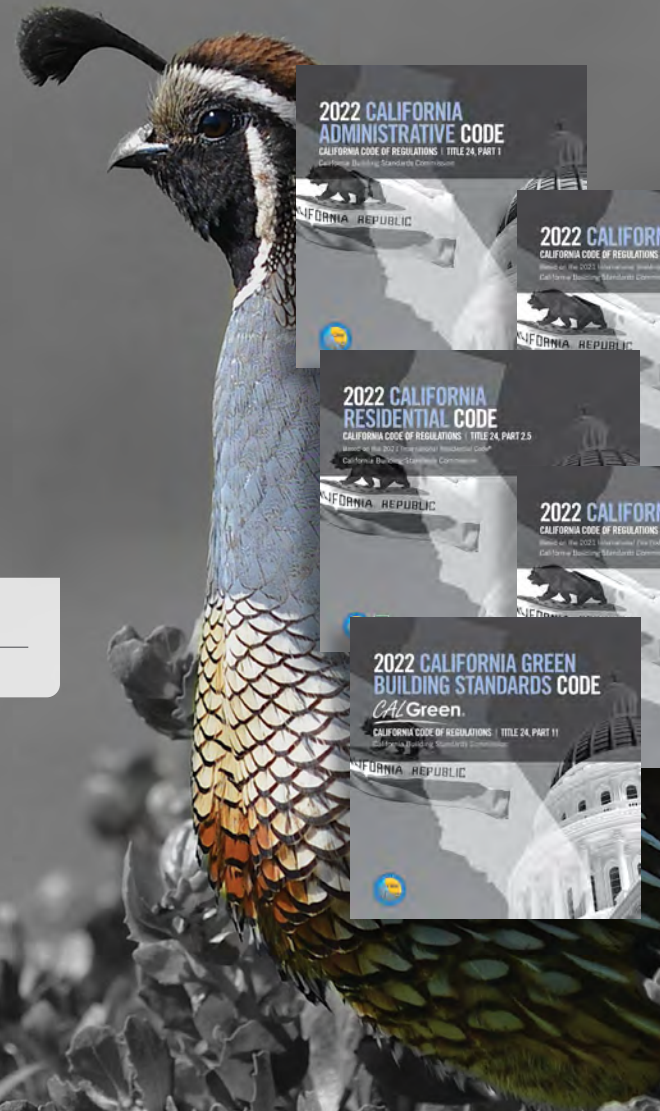


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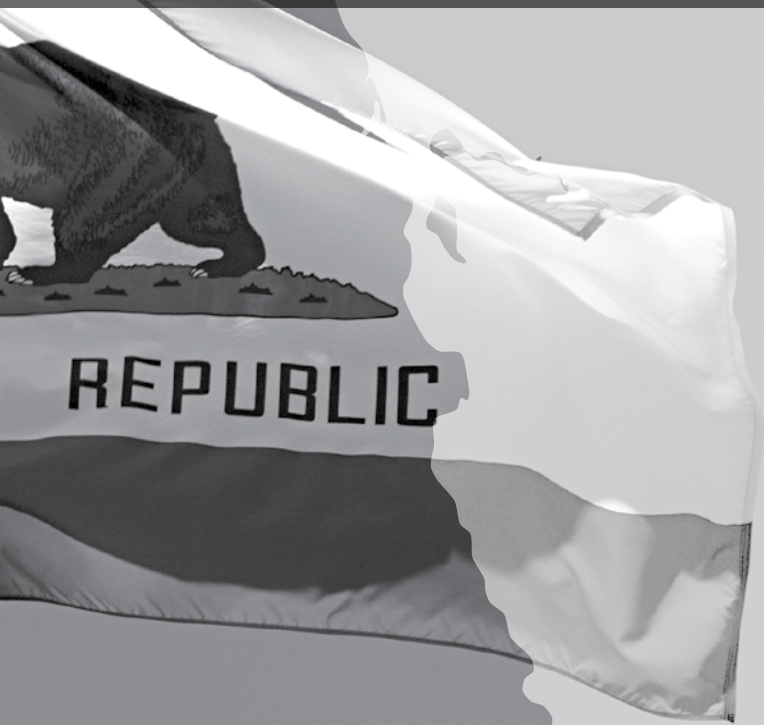
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2022 CALIFORNIA ADMINISTRATIVE CODE

CALIFORNIA CODE OF REGULATIONS | TITLE 24, PART 1

California Building Standards Commission



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2022 CALIFORNIA ADMINISTRATIVE CODE

CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 1

California Building Standards Commission



See the History Note
Appendices for effective dates.

For Errata and Supplement effective
dates see the History Note Appendix

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PREFACE

This document is Part 1 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Administrative Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

Secretary Yolanda Richardson – Chair

Rajesh Patel – Vice-Chair

Erick Mikiten

Elley Klausbruckner

Aaron Stockwell

Juvilyn Alegre

Peter Santillan

Kent Sasaki

Laura Rambin

Mia Marvelli – Executive Director

Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page v.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073
Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916
State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300
Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312
Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200
Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100
Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210
Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041
Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188
Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220
Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov
Meat & Poultry Packing Plant Standards
Rendering & Collection Center Standards (916) 900-5004
Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356
Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks
(916) 445-3338
Factory-Built Housing, Manufactured Housing &
Commercial Modular
Mobilehome—Permits & Inspections
Northern Region—(916) 255-2501
Southern Region—(951) 782-4431
(800) 952-8356
Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661
Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards
Essential Services Building Standards
Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development

AKA: California Department of Health Care

Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300
Hospital Standards
Skilled Nursing Facility Standards &
Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800
Code Development and Analysis
Fire Safety Standards

HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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CHAPTER 1

ADMINISTRATIVE REGULATIONS OF THE CALIFORNIA BUILDING STANDARDS COMMISSION

ARTICLE 1 GENERAL

1-101. Abbreviations. The following abbreviations shall apply to Title 24, California Code of Regulations. Abbreviations may also be provided in each of the other 12 parts of Title 24. If an abbreviation in this section conflicts with an abbreviation within another part of Title 24, the abbreviation reference in the other part shall prevail within that part.

Note: For information regarding the code provisions adopted for a state agency and the application of such code provisions, see the agency administrative chapters in the appropriate parts of Title 24, *California Code of Regulations*.

AGR	Department of Food and Agriculture	DSA-SS	Identifies code provisions by the Division of the State Architect-Structural Safety
BSC	Identifies code provisions by the Building Standards Commission	DSA-SS/CC	Identifies provisions by the Division of the State Architect-Structural Safety, applicable to Community Colleges as specified
BSC-CG	Identifies the California Green Building Standards Code (CALGreen) provisions by BSC	DSA-AC	Identifies code provisions by the Division of the State Architect-Access Compliance
BSCC	Identifies code provisions by the Board of State and Community Corrections	DOE	Department of Education
CA	Department of Consumer Affairs	DOT	Department of Transportation
CALGreen	California Green Building Standards Code (CALGreen), Part 11 of Title 24	HCD	Housing and Community Development
CBC	<i>California Building Code</i> (Part 2 of Title 24)	HCD 1	Identifies code provisions by HCD
CCR	California Code of Regulations	HCD 2	Identifies code provisions by HCD
CEBC	<i>California Existing Building Code</i> (Part 10 of Title 24)	HCD 1AC	Identifies Housing Accessibility code provisions by HCD
CEC	<i>California Electrical Code</i> (Part 3 of Title 24)	IBC	<i>International Building Code</i> [®]
CEC	<i>California Energy Code</i> (Part 6 of Title 24)	IFC	<i>International Fire Code</i> [®]
CEC	<i>California Energy Commission</i>	IEBC	<i>International Existing Building Code</i> [®]
CFC	<i>California Fire Code</i>	IRC	<i>International Residential Code</i> [®]
CHBC	<i>California Historical Building Code</i> (Part 8 of Title 24)	NEC	<i>National Electrical Code</i> [®]
CMC	<i>California Mechanical Code</i> (Part 4 of Title 24)	NFPA	National Fire Protection Association
CPC	<i>California Plumbing Code</i> (Part 5 of Title 24)	OHP	Office of Historical Preservation
CRC	<i>California Residential Code</i> (Part 2.5 of Title 24)	OSHPD	Office of Statewide Health Planning and Development
CRSC	<i>California Referenced Standards Code</i> (Part 12 of Title 24)	OSHPD 1 and 1R	Identifies code provisions by OSHPD
DPH	Identifies code provisions by the Department of Public Health	OSHPD 2	Identifies code provisions by OSHPD
DWR	Identifies code provisions by the Department of Water Resources	OSHPD 3	Identifies code provisions by OSHPD
DSA	Division of the State Architect, a division within the Department of General Services	OSHPD 4	Identifies code provisions by OSHPD
		OSHPD 5	Identifies code provisions by OSHPD
		SFM	Identifies code provisions by the Office of the State Fire Marshal
		SHBSB	Identifies code provisions by the State Historical Building Safety Board
		SL	Identifies code provisions by the State Librarian
		SLC	Identifies code provisions by the State Lands Commission
		UBC [™]	<i>Uniform Building Code</i> ; the UBC is no longer published or adopted in the current edition of Title 24

UBC STDS *Uniform Building Code Standards*; the UBC STDS is no longer published, but relevant standards are referenced in the CEBC

UFC *Uniform Fire Code*; the UFC is no longer published or adopted in the current edition of Title 24

UHC *Uniform Housing Code*; adopted by HCD in Chapter 1 of Title 25

UMC *Uniform Mechanical Code*[®]

UPC *Uniform Plumbing Code*[®]

Authority: Government Code Section 11000, and Health and Safety Code Sections 18931 (f) and 18940.5.

Reference: Government Code Section 11000, and Health and Safety Code Sections 18931 (d) and 18940.5.

1-103. Definitions. The following definitions shall apply to this Chapter 1, of Part 1, of Title 24, California Code of Regulations. Definitions may also be provided in each of the other 12 parts of Title 24. If a definition in this section conflicts with a definition within another part of Title 24, the definition reference in the other part shall prevail within that part.

ADOPTING AGENCY (or state adopting agency). An agency of state government with authority in law to develop and adopt building standards for approval and publication in Title 24, California Code of Regulations, by the Commission. An adopting agency has authority to conduct public hearings aside from the public hearings conducted by the Commission. See Proposing Agency.

APPEAL. An appeal to the Commission, as provided and limited by Health and Safety Code Sections 18945 through 18949, by any person adversely affected by the application of an existing building standard or administrative regulation in Title 24, by a state agency or local agency.

BUILDING STANDARDS ADMINISTRATION SPECIAL REVOLVING FUND (the Fund). The Fund established in the State Treasury to receive funds submitted by the Commission pursuant to the provisions of Health and Safety Code Section 18931.6 and Article 5.

CALGreen. The California Green Building Standards in Part 11 of Title 24, California Code of Regulations.

CODE ADVISORY COMMITTEE. An advisory panel or body appointed to advise the Commission with respect to building standards as authorized by Health and Safety Code Section 18927.

CODE CHANGE (proposed provision). A proposed addition, amendment, repeal or adoption of a building standard as defined by Health and Safety Code Section 18909, or of an administrative regulation of Title 24.

CODE CHANGE SUBMITTAL (rulemaking file). The rulemaking file submitted by a state proposing agency, which includes the proposed code change(s) or provision(s) for Title 24, along with justification and all other required documents, submitted to the Commission by a proposing agency.

COMMISSION. The California Building Standards Commission established under Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

DEPARTMENT. The Department of Housing and Community Development.

ENFORCING AGENCY (or Enforcement Agency). An agency, board, commission, department, division, office or individual assigned by law or ordinance as being responsible for the enforcement of building standards.

EXECUTIVE DIRECTOR. The Chief Executive appointed by the California Building Standards Commission pursuant to Health and Safety Code Section 18925, to carry out the duties assigned by the California Building Standards Commission as designated in Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

FEES, FRACTIONS THEREOF. Fee increments for individual building permit values less than \$100,000 as described in Article 5, Section 1-505 and Table 1-505.

JUSTIFICATION. An initial statement of reasons and the information needed to complete a notice of proposed action, including a determination as to the effect of the code change on housing costs.

NOTICE OF PROPOSED ACTION. For the purposes of this chapter is synonymous with the term Notice of Proposed Building Standard.

OFFICE. The Office of the State Fire Marshal.

PETITION. A written submittal to the Commission or a state adopting or proposing agency by any local government agency, firm or member of the public for the purpose of proposing a new building standard or administrative regulation in Title 24, or the amendment or repeal of an existing building standard or administrative regulation in Title 24 that is currently effective.

PROPOSING AGENCY (or state proposing agency). A state agency having authority and responsibility to propose a building standard for adoption by the Commission and publication in Title 24, California Code of Regulations. A proposing agency does not have authority to conduct public hearings for the adoption of building standards. See Adopting Agency.

PUBLIC UTILITY. The California Public Utilities Commission (PUC); or which would otherwise be regulated by the PUC but are exempted by municipal charter.

SPECIAL CODE ADVISORY COMMITTEE. An ad hoc committee established by the Commission, when necessary, to advise the Commission on a subject in the code needing extensive revision or on a complex subject which needs to be regulated or to perform a review of a proposed code change that warrants special technical review.

STATE AGENCY REPRESENTATIVE(S). For the purposes of this chapter means representative(s) of state proposing or adopting agencies.

TECHNICAL REVIEW. A review of a proposed code change and its justification conducted pursuant to Health and Safety Code Section 18930 (c), (d), (e), (f) to ensure

that a code change is justified in terms of nine-point criteria of Health and Safety Code Section 18930 (a).

TITLE 24. The 24th title within the California Code of Regulations, also referred to as the California Building Standards Code. Title 24 is reserved for building standards and administrative regulations to implement building standards approved and published, or caused to be published, by the California Building Standards Commission.

Authority: Government Code 11000, and Health and Safety Code Sections 18929.1, 18931(f) and 18949.6.

Reference: Government Code 11000, and Health and Safety Code Sections 18927, 18929–18932, 18934, 18935, 18936, 18949.1, 18949.2, 18949.3, 18949.5 and 18949.6.

1-105. Use of Commission indicia.

(a) Other than the Commission, no person, firm, agency or organization shall copy, duplicate, reprint or otherwise use the indicia of the Commission without the express written approval of the Commission. For the purposes of this section, the Commission’s indicia shall include but not be limited to any logo, symbol or emblem used by the Commission to identify codes, standards, bulletins and other documents or properties as being issued, adopted, approved, published or maintained by the Commission.

(b) Requests for approval to copy, duplicate, reprint or otherwise use the indicia of the Commission shall be in writing and be submitted to the Executive Director, California Building Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, California 95833. The address should be confirmed at the Commission’s website: www.dgs.ca.gov/bsc. Requests shall include the identification of the intended document or material that is to include the indicium or indicia of the Commission, and the time frame for the proposed usage.

(c) The Executive Director, or designee, shall provide a written response to requests received pursuant to subsection (b). Approvals of indicia usage may include limitations to a specific usage, type of document or material, and/or time frame. Denial of indicia usage shall include the reasoning for the denial. The Commission shall consider reasonably corrected resubmittals.

Authority: Health and Safety Code Section 18931(f).

Reference: Health and Safety Code Section 18931(f).

ARTICLE 2

DUTIES AND RESPONSIBILITIES OF THE BUILDING STANDARDS COMMISSION, THE EXECUTIVE DIRECTOR AND COMMISSION PERSONNEL

1-201. Duties.

(a) **Commission duties.** The Commission shall perform all functions relating to the adoption and publication of the California Building Standards Code in Title 24 of the California Code of Regulations prescribed by the California Building Standards Law in Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

(b) **Executive Director duties.** The Executive Director shall be the primary individual responsible for implementing the will of the Commission, and shall have the authority to:

1. Recommend to the Commission policies under which the office of the Commission will operate.
2. Interpret and implement the policies of the Commission.
3. Provide the administrative direction for the day-to-day work of the Commission.
4. Manage the technical and support staff of the Commission.
5. Represent the Commission before the Legislature.
6. Review and approve or disapprove agencies’ public notices for proposed building standards per Sections 11346.4 and 11346.5 of the Government Code.
7. Ensure that state agencies comply with Health and Safety Code Section 18930 and Government Code Section 11340 et seq. (as applicable), when adopting building standards, prior to submission to the Commission.
8. Negotiate and execute contractual agreements necessary to carry out the mission of the Commission.
9. Manage the Commission’s appeal and petition process.
10. Represent the Commission to all levels of state and local government, and with the private sector.
11. Perform other duties as required by the Commission and state statute(s).

Authority: Health and Safety Code Section 18931.

Reference: Health and Safety Code Sections 18925 and 18931.

1-203. Development of green building standards.

(a) The Commission shall adopt, approve, codify, update and publish green building standards for occupancies that are not under the explicit authority of another state agency. The Commission also may review and comment on proposals and proposed standards developed by other agencies in order to reduce or eliminate ambiguities or conflicts.

(b) A list of agencies with specific authority to propose and/or adopt building standards are identified in Title 24, Part 2, the *California Building Code*, Chapter 1, Division 1. The Commission shall work with these agencies to coordinate the adoption of green building standards for residential and nonresidential occupancies.

(c) In developing green building standards, the Commission shall consult with the state entities it finds to be appropriate for specific standards including, but not limited to, the following state agencies:

1. Department of Resources Recycling and Recovery
2. California Energy Commission
3. California Air Resources Board
4. California Department of Water Resources
5. California Department of Transportation
6. California Department of General Services
7. California Department of Public Health
8. Office of State Fire Marshal

(d) The Commission also shall consult with representatives from each of the following:

1. Environmental advocacy groups
2. Interested local government and code enforcement entities
3. Building construction and design industries
4. Interested public parties

(e) The Commission may consult with and seek input from the entities and representatives identified in subsections (c) and (d) either by written comment or in a meeting format and shall consider all input provided during the development of the green building standards which is relevant to specific standards. The Commission shall provide written responses to formal comments received during the public comment period for any proposed green building standards.

(f) See Section 1-404 for requirements concerning state agency participation in the development of green building standards.

Authority: Health and Safety Code Sections 18909(c), 18929, 18930.5, 18931.6 and 18931.7.

Reference(s): Health and Safety Code Sections 18930.5, 18931.6 and 18931.7.

1-209. Code advisory committees.

(a) **Standing code advisory committees.** The Commission shall establish the following standing code advisory committees.

1. Accessibility
2. Plumbing, Electrical, Mechanical and Energy
3. Building, Fire and Other Regulations
4. Structural Design/Lateral Forces
5. Health Facilities
6. Green Building

(b) **Special code advisory committee.** The Commission may establish one or more special code advisory committees when it determines that a subject in the code needs to be extensively revised or that a complex subject which needs to be regulated is not covered or that the content of a proposed code change warrants special technical review.

(c) **Quorum.** A majority of the members of the code advisory committee(s) shall constitute a quorum for the transaction of business. A majority of the members present shall constitute a quorum for determining the outcome of a vote.

(d) **Members.** The code advisory committees shall be limited to a maximum of nine voting members, appointed by the Commission for one triennial code adoption cycle (3 years). The Commission can extend the term beyond 3 years if deemed necessary, and members shall hold appointments at the pleasure of the Commission. The appointments shall be made from individuals knowledgeable in the building standards or general subjects assigned to the specific committee. Members shall be solicited by the Commission based on the representations listed in this section. However, when there are no volunteers for a specific representation following a 30-day advertisement of an available committee position, the

Commission may make other appointments as deemed necessary to maintain the expertise and balance of a committee:

1. **Accessibility.** The Commission shall solicit nominations from:

A. Ex-Officio Member(s)

- (1) State Agency Representative(s)

B. Voting Member(s)

- (1) Disability Access Advocate Knowledgeable in Visually Impaired
- (2) Disability Access Advocate Knowledgeable in Hearing Impaired
- (3) Disability Access Advocate Knowledgeable in Mobility Impaired
- (4) Disability Access Advocate Knowledgeable in Environmental Health Network or Other Cognitively Impaired
- (5) Local Government Building Official¹
- (6) Construction Industry
- (7) Architect
- (8) Fire Official¹
- (9) Public Member

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2. **Plumbing, electrical, mechanical and energy.** The Commission shall solicit nominations from:

A. Ex-Officio Member(s)

- (1) State Agency Representative(s)

B. Voting Member(s)

- (1) Local Government Building Official¹
- (2) Environmental/Energy Organization
- (3) Construction Industry
- (4) Architect
- (5) Fire Official¹
- (6) Public Member or Local Government Water Efficiency Official¹
- (7) Plumbing Inspector
- (8) Mechanical Engineer
- (9) Electrical Engineer or Electrical Inspector

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3. **Building, fire and other.** The Commission shall solicit nominations from:

A. Ex-Officio Member(s)

- (1) State Agency Representative(s)

B. Voting Member(s)

- (1) Local Government Building Official¹
- (2) Registered Fire Protection Engineer
- (3) Construction Industry
- (4) Architect
- (5) Commercial Building Industry
- (6) Fire Official¹

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- (7) Disability Access Advocate
- (8) Public Member
- 4. **Structural design/lateral forces.** The Commission shall solicit nominations from:
 - A. Ex-Officio Member(s)
 - (1) State Agency Representative
 - B. Voting Member(s)
 - (1) Three (3) Structural Engineers
 - (2) Architect
 - (3) General Contractor
 - (4) Local Government Building Official¹
 - (5) Public Member
- 5. **Health facilities.** The Commission shall solicit nominations from:
 - A. Ex-Officio Member(s)
 - (1) State Agency Representative(s)
 - B. Voting Member(s)
 - (1) Acute Care Hospital Representative
 - (2) Skilled Nursing Facility Representative
 - (3) Architect
 - (4) General Contractor
 - (5) Mechanical Engineer
 - (6) Electrical Engineer or Electrical Inspector
 - (7) Fire Protection Engineer
 - (8) Local Government Building Official¹
 - (9) Primary Care or Specialty Clinic Representative
- 6. **Green building.** The Commission shall solicit nominations from:
 - A. Ex-Officio Member(s)
 - (1) State Agency Representative(s)
 - B. Voting Member(s)
 - (1) Residential Construction Industry Representative
 - (2) Commercial Building Industry Representatives
 - (3) Architect
 - (4) Environmental Organization Representative
 - (5) Local Government Building Official¹
 - (6) Public Member or Local Government Water Efficiency Official¹
 - (7) Fire Official¹
 - (8) Mechanical Engineer or Energy/Building Performance Specialist
 - (9) Electrical Engineer, Electrical Inspector or Energy/Building Performance Specialist

1. The Local Government Building Official, Local Government Water Efficiency Official and Fire Official positions may be filled by a consultant authorized to represent the local agency providing the consultant serves in the official capacity of a full-time building, water efficiency or fire official for a single city, county or city and county local government. (Footnote shall apply to each Local Government Building Official, Local Government Water Efficiency Official and Fire Official position on every committee).

Section 1-211. Application for code advisory committee appointment.

(a) **Application period.** When advertising a vacancy on a Code Advisory Committee, the Commission may establish an application period with a closing date and may, at its discretion, consider applications received after the closing date.

(b) **Application required.** Persons desiring appointment to a position on a Code Advisory Committee must submit the application to the Commission as required by this section. A separate application is required for each advertised vacancy on a Code Advisory Committee. The Commission will not maintain applications on file for future consideration.

(c) **Application form.** For each Code Advisory Committee vacancy, a completed *Application for Code Advisory Committee Appointment*, form BSC-7, shall be submitted to the office of the Executive Director, California Building Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833. The current address may be verified at the Commission’s website (www.dgs.ca.gov/bsc). The application form is available from the Commission or may be obtained on the Commission’s website during an open Code Advisory Committee application period.

The application shall be accompanied by a resume and may be further supported by attachments including letters of support or recommendation and other materials demonstrating expertise and knowledge applicable to the Code Advisory Committee position.

(d) **Application fee.** There is no application fee.

(e) **Selection decision.** The Commission will consider applications and make selections based on qualifications applicable to the Code Advisory Committee vacancy. All decisions by the Commission regarding appointments to Code Advisory Committees are final and are not subject to appeal.

(f) **Notice of appointment.** The Executive Director, or their designee, shall provide written notice to applicants selected by the Commission for appointment to a Code Advisory Committee. Written notice shall also be provided to all applicants not selected for appointment to a Code Advisory Committee.

Authority: Health and Safety Code Sections 18909(c), 18929, 18930.5, 18949.6 and 18931(f).

Reference: Health and Safety Code Sections 18927, 18929, 18930.5, 18931(f), 18934, 18936 and 18949.6.

**ARTICLE 3
APPEALS AND PETITION PROCEDURES**

1-301. Appeals and petitions.

(a) The public may submit appeals and petitions to the Commission as prescribed in this Article.

(b) Appeals and petitions concerning building standards that are not in effect at the time of submission will not be accepted by the Commission. An appeal or petition submitted on a proposed, approved and/or adopted building standard of Title 24, outside of its effective date, shall be considered invalid and returned to the submitter in accordance with this article.

(c) An appeal or petition, as defined in Section 1-103 of this chapter, is not the means to support or oppose a proposed, approved and/or adopted building standard for publication in Title 24, prior to its effective date. To provide comment on a proposed building standard, see Section 1-413 in this chapter.

(d) The Commission may accept appeals relating to actions and decisions by state and local agencies to enforce building standards, but may only make recommendations for reconsideration. The Commission has no authority to overturn a decision by a state or local agency when the matter is within the jurisdiction of that state or local agency.

Authority: Health and Safety Code Sections 18931, 18945 and 18946.

Reference: Health and Safety Code Sections 18931, 18945 and 18946.

1-303. Scope of appeals and types of appellants. Appeals to the Commission and the matters which can be appealed are as follows:

(a) An appeal may be submitted by any person adversely affected by the administration of building standards or administrative regulations of Title 24, or the enforcement or the lack of enforcement of Title 24, by any state agency as prescribed in Health and Safety Code Section 18945(a) and this article.

(b) An appeal may be submitted by any person adversely affected by the enforcement of Title 24 by a local enforcement agency, in the company of the local enforcement agency, as prescribed in Health and Safety Code Section 18945(b) and this article. Joint appeals must have statewide significance.

(c) An appeal may be filed by any person, including a state or local agency adversely affected by an apparent conflict, duplication or overlap of any current Title 24 provision, or any other matter of statewide significance relating to the application of Title 24.

(d) When the basis of an appeal is the action of a state agency other than the Commission, the appellant must obtain a final determination from the state agency in question relating to the issue under appeal before the Commission will hear the appeal.

Exception: An apparent conflict, duplication or overlap in other available state appeals procedures or within the regulations or code.

Authority: Health and Safety Code Sections 18931, 18945 and 18946.

Reference: Health and Safety Code Sections 18931, 18945 and 18946.

1-305. Time limitations for appeals.

Appeals will be accepted by the Commission only within six (6) months of when the act, interpretation, decision or practice complained of occurred.

Exception: The Commission, at its discretion, may accept and act on an appeal when more than six (6) months have passed if special circumstances are found to exist.

Authority: Health and Safety Code Section 18931.

Reference: Health and Safety Code Section 18931.

1-307. Appeal form and filing fee.

(a) An appeal shall be submitted using Appeal Form BSC-33, which is available on the Commission’s website, or by contacting the Commission’s office by telephone at (916) 263-0916, or by email (cbcs@dgs.ca.gov). The form contains instructions on providing the necessary information and the required documents, including but not limited to:

1. The specific regulation, rules, interpretation or decision of any state agency respecting the administration of any building standard being appealed.
2. The dates of any act, interpretation or decision of any state agency related to the complaint.
3. The nature of any act, interpretation or decision of any state agency related to the complaint.
4. The reasons for the appeal.
5. Documentation of the official action of the applicable state agency with respect to the agency’s final determination on the issue.
6. Identification of witnesses, experts and other representatives of the appellant.

(b) The appeal shall be filed by mail with the Executive Director, California Building Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, California 95833. The address should be confirmed at the Commission’s website (www.dgs.ca.gov/bsc).

(c) Filing Fee: Health and Safety Code Section 18949 requires the Commission to recover the cost of administrating appeals. Accordingly, a nonrefundable fee of \$450.00 shall accompany the submitted appeal form. In addition, any and all costs for an administrative law judge or costs related to a hearing before the appeals subcommittee will be the responsibility of the appellants.

Authority: Health and Safety Code Sections 18931 and 18945.

Reference: Health and Safety Code Sections 18931, 18945 and 18949.

1-309. Receipt and processing appeals.

(a) Receipt of any appeal shall be acknowledged in writing by the Executive Director, or their designee, within 45 days of receipt, advising the appellant and any state or local agency party to the appeal, of the acceptance or rejection of the appeal, as filed, or the need for additional information to make a determination. The reply shall also set forth the planned action of the Commission in response to an accepted appeal, together with reasons for the proposed actions.

(b) If the Executive Director determines that additional information is needed in order to process the appeal and make a determination, the Executive Director may request the additional information in the written response required by subsection (a), and defer action on the appeal until the additional information is received. If the Executive Director requests additional information, the appellant shall have 30 days from the date of the Executive Director’s request to submit the information. If the requested information is not received within 30 days, the Executive Director may treat the appeal as

having been abandoned or may, upon written notice to the appellant and any state or local agency as a party to the appeal, process the appeal based on the information available. Upon written request, the Executive Director may for good cause, extend the 30-day period by one additional 30-day period.

(c) Following the acceptance of an appeal, the Executive Director and Chair of the Commission’s Appeals Committee, as appointed by the Chair of the Commission, shall, acting together, designate a hearing authority by determining whether the appeal should be heard by the Appeals Committee, the full Commission, a member of the Commission designated as hearing officer, or by a hearing officer appointed by the Office of Administrative Hearings.

(d) Within 15 days of determining the hearing authority, and no less than 15 days prior to the appeal hearing date, the Executive Director, or their designee, shall provide to the appellant and any state or local agency as a party to the appeal, written notice identifying the hearing authority, procedures, and when possible the scheduled hearing date, time and location.

Authority: Health and Safety Code Sections 18931 and 18945.

Reference: Health and Safety Code Sections 18931, 18945 and 18946.

1-311. Appeal hearing procedures.

(a) When it is determined pursuant to subsection 1-309(c) that the appeal shall be heard by the Commission’s Appeals Committee or a member of the Commission appointed as the hearing officer, the following provisions shall apply:

1. The Executive Director shall provide written notice of the date, time and location of hearing to interested parties, as provided in subsection 1-309(d), and may invite experts or other witnesses as necessary for the hearing.
2. The Appeals Committee or the member of the Commission appointed as the hearing officer, shall not be bound by the rules of evidence or procedure applicable in the courts. Appellant, appellant’s witnesses and any other interested persons may present testimony, argument and/or documentary material concerning the matter(s) under consideration.
3. The Appeals Committee or the member of the Commission appointed as the hearing officer shall prepare their finding(s) and decision within 30 days after the appeal hearing.
4. The Executive Director shall, in writing, advise the appellant, any state or local agency as a party to the appeal, and the Commission, of the Appeals Committee or the member of the Commission appointed as the hearing officer decision within 15 days from the date of the decision.
5. When an appeal is heard by the Appeals Committee or the member of the Commission appointed as the hearing officer, either party may request a reconsideration of the decision by the Commission. The request must be submitted to the Executive Director in writing no more than 45 days after the date the original decision by the Appeals Committee or member of the Commission appointed as the hearing officer is made.

6. Reconsideration by the Commission shall be conducted in accordance with subsection 1-311(b), and based upon the record of the appeal hearing and additional information or testimony that is specifically requested by the Commission.

7. Notwithstanding the foregoing, the appeal may be withdrawn at any time by the appellant upon written notice to the Executive Director. Upon withdrawal, no further proceeding as specified above shall take place. The withdrawal of the appeal shall be accepted with or without prejudice, as determined by the Commission’s Appeals Committee or the member of the Commission appointed as the hearing officer.

(b) When it is determined pursuant to subsection 1-309(c) that an appeal shall be heard by the Commission, or pursuant to subsection 1-311(a) 5 that a reconsideration hearing is to be conducted by the Commission, the following provisions shall apply:

1. An appeal or request for reconsideration shall be acted on by the Commission during the next regularly scheduled public Commission meeting, or within 180 days, after the date the appeal or request for reconsideration is received by the Executive Director.
2. The Executive Director shall provide written notice of the time, date and location of the hearing to interested parties, as provided in subsection 1-309(d), and invite expert or other witnesses as necessary for the hearing.
3. The Commission shall not be bound by the rules of evidence or procedure applicable in the courts. The hearing shall be conducted according to the Commission’s own rules, accepting evidence as it requires, and chaired by its regular Chairperson. Appellant and other interested parties may present relevant testimony, argument or documentary material as acceptable to the Commission.
4. The Commission shall make a decision on the appeal at an open meeting thereof, provided that the matter may be continued or taken under advisement for decision at a later meeting of the Commission, or re-referred to the Appeals Committee for further consideration and report to the Commission. No Commissioner may cast a vote on the determination of an appeal unless the Commissioner was present at the hearing held for appeal.
5. Notwithstanding the foregoing, the appeal may be withdrawn at any time by the appellant upon written notice to the Executive Director. Upon withdrawal, no further proceedings as specified above shall take place. The withdrawal of the appeal shall be accepted with or without prejudice, as determined by the Commission.
6. The Executive Director shall, in writing, advise the appellant, and any state or local agency as a party to the appeal, of the decision of the Commission within 15 days from the date of the official Commission decision.

(c) The Commission may elect, pursuant to subsection 1-309(c), to refer the appealing parties to a hearing officer appointed by the Office of Administrative Hearings. When such referral is made to the Office of Administrative Hear-

ings, the hearing procedures and requirements shall be conducted as prescribed in Health and Safety Code Section 18946 and to the applicable regulations in California Code of Regulations, Title 1, Division 2.

(d) Action by the Commission on the appeal of a building standards issue within the authority of the Commission shall exhaust the administrative relief of the appellant.

Authority: Health and Safety Code Sections 18931, 18945 and 18946.

Reference: Health and Safety Code Sections 18931, 18945 and 18946 and Government Code Section 13959.

1-313. Petitions.

(a) Any local governmental agency, firm or member of the public may petition either the Commission or the authoritative agency for the proposal, adoption, amendment or repeal of any building standard or administrative regulation in Title 24 of the California Code of Regulations.

(b) Petitions shall be submitted to the Commission using Petition Form BSC-30, available on the Commission’s website (www.dgs.ca.gov/bsc). The form contains instructions as to the information to be provided and documents to accompany the petition form.

(c) Petitions shall be filed by mail with the Executive Director at: CALIFORNIA BUILDING STANDARDS COMMISSION, 2525 Natomas Park Drive, Suite 130, Sacramento, California 95833. The address should be confirmed at the Commission’s website (www.dgs.ca.gov/bsc).

(d) The Commission may refer received petitions to the state agency, or multiple agencies, having specific jurisdiction for the subject of the adopted building standard or for the subject of the proposed building standard as proposed by the petitioner. Except as provided in Section 1-329 of this chapter, a state agency receiving a petition referred by the Commission shall process the petition as required by this article, including the reporting of actions and decisions by the agency to the Commission.

(e) Petitions are not to be used to address matters relating to a currently proposed building standard or an adopted building standard prior to its effective date. Any concerns relating to currently proposed building standards should be brought forward during the public comment period designated for the proposed building standard.

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Health and Safety Code Sections 18931 and 18949.6.

1-315. Criteria for petition. A petition for the adoption, amendment or repeal of a state building standard must meet the following criteria:

(a) The subject issue must have statewide significance and must have implications for a whole category of projects or a broad range of project types, and:

(b) The rationale for the petition must take the form of at least one of the following criteria:

1. A current building standard conflicts with pertinent statute(s) and/or regulation(s). To substantiate this criterion, the petitioner must cite the subject building standard and the conflicting statute(s) and/or regulation(s),

and provide a clear written description of why the two are inconsistent.

2. Compliance with a current building standard is routinely impossible or onerous. To substantiate this criterion, the petitioner must cite the current building standard, present written or photographic evidence of the difficulty in complying with it, and clearly show that the problem is common or potentially common to many different projects or project types in many different circumstances. This criterion shall not be used to justify a petition for the repeal or amendment of a current building standard that poses difficulty to a single project.
3. A current building standard is inefficient or ineffective. To substantiate this criterion, the petitioner must cite the subject building standard, provide clear and concise written or photographic evidence of its ineffectiveness or inefficiency, describe a proposed alternative and provide clear and convincing written or photographic evidence that it is more efficient or effective.
4. A current building standard is obsolete. To substantiate this criterion, the petitioner must show at least one of the following facts:
 - A. A material or product specified in the building standard is not available, or
 - B. There is no statute authorizing the subject building standard, or
 - C. Significant developments in procedures, materials or other issues subject to the building standard have created a need for amendment or deletion of the building standard; that current state statutes permit amendment or deletion of the building standards; and that the building standard has the effect of prohibiting the use of a material or procedure that has demonstrated satisfactory performance and meets the intended purpose of building standards.
5. There is a need for a new building standard. To substantiate this criterion, the petitioner must provide a clear written description of the proposed building standard, explain why it is necessary and cite the statute(s) that require or authorize the new building standard.

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Health and Safety Code Sections 18931 and 18949.6.

1-317. Emergency petition.

(a) A petitioner may assert the petition requires immediate action because there is potential imminent danger to public health, safety or welfare. To substantiate the existence of potential imminent danger, the petitioner must include in the petition a written description of the specific facts showing the need for immediate action.

(b) If the emergency petition is approved by the Commission and if the petition is accepted pursuant to this article, the proposing agency or adopting agency shall develop and/or adopt new or amended building standards necessary to satisfy

the cause for the petition. The new or amended building standards shall be proposed and adopted as emergency building standards as permitted by Health and Safety Code Sections 18934.8 and 18937, and as provided for in section 1-419 of this chapter.

Authority: Health and Safety Code Sections 18931, 18934.8, 18937 and 18949.6.

Reference: Health and Safety Code Sections 18931, 18934.8, 18937 and 18949.6.

1-319. Petition processing by the Commission.

(a) Within 45 days after the date of receiving a petition, the Commission shall determine whether the petition meets the requirements of this article for petitions and provide the petitioner written notification on the Commission’s determination and/or related action(s).

(b) If the Commission determines that the petition does not meet the requirements of this article for petitions, the petition shall be returned to the petitioner without action but with written notification including itemization of the missing or incomplete items. The Commission shall retain a copy of the petition being returned to the petitioner in accordance with subparagraph (f).

(c) If the Commission determines that the petition meets the requirements of this article for petitions and the subject matter of the petition is within the Commission’s jurisdiction provided in statute, the Commission shall provide the petitioner written notification of the acceptance of the petition and planned action. The Commission shall act on the accepted petition during the next regularly scheduled code adoption cycle.

(d) If the Commission determines the subject matter of a petition is within the specific jurisdiction of another proposing or adopting agency, the Commission shall forward the complete petition to that agency for its review and determination. The forwarded petition shall be accompanied by a copy of the Commission’s written notification to the petitioner, which shall indicate the petition has been forwarded to the identified proposing or adopting agency having jurisdiction for its review and determination.

(e) Upon receipt of a petition forwarded by the Commission, the proposing or adopting agency shall act in accordance with Section 1-321. If a proposing or adopting agency disagrees with the Commission’s determination in forwarding a petition to its agency, and thus sends the forwarded petition back to the Commission, the Commission shall return the petition to the petitioner, without action, within 30 days of receipt of the petition returned by the proposing or adopting agency, in accordance with the procedures provided in this section.

(f) The Commission shall maintain records relating to the submittal, status and correspondence of petitions received by the Commission.

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Health and Safety Code Sections 18931 and 18949.6.

1-321. Petition processing by proposing or adopting agencies. Upon receipt of a petition forwarded by the Commission, or a petition received directly from a petitioner, the

proposing or adopting agency shall be responsible for the following duties:

(a) If the proposing or adopting agency receives a forwarded petition from the Commission but disagrees with the Commission’s determination that a petition is complete, or if the proposing or adopting agency believes the petition is in the jurisdiction of a different agency, the proposing or adopting agency shall notify the Commission in writing within 45 days after the date of receiving the petition. In notifying the Commission, the agency shall include an itemization of the missing or incomplete items and/or reasons why the petition is not within the proposing or adopting agency’s authority as provided in statute.

(b) If the proposing or adopting agency determines that a received petition, which has not been forwarded by the Commission, does not meet the requirements of this article for petitions, the agency shall, within 45 days after the date of receiving the petition, provide the petitioner written notification of the determination with itemization of the missing or incomplete items. The agency shall provide the Commission a copy of the notification at the time the notification is sent to the petitioner.

(c) If the proposing or adopting agency determines that it has jurisdiction and that a received petition is complete, it shall take the following action(s) as appropriate, communicating with the petitioner and Commission, within the noted time lines:

1. The agency may deny or accept a petition in part and may grant other relief or take other action as it may determine to be warranted by the petition and shall notify the petitioner and Commission in writing of the action.
2. If the agency denies the petition for cause pursuant to Section 1-323 of this article [Criteria for denying a petition], it shall do so in writing within 45 days after the date of receiving the petition from the petitioner, or the referral by the Commission.
3. If the agency accepts the petition, it shall notify the petitioner and Commission in writing within 45 days after the date of receiving the petition. For the purposes of this section, accepting the petition indicates that the agency believes the issue(s) merit(s) proceeding to the development of a code change submittal as prescribed in this chapter.
4. If the accepted petition contains an emergency clause, the agency shall also rule on the existence of an emergency. If the agency concurs that an emergency exists, it shall schedule code development and begin adoption procedures on an emergency basis in accordance with section 1-419 of this chapter. The agency shall notify the Executive Director of its intent to commence rulemaking pursuant to Health and Safety Code Section 18926(b).

Authority: Health and Safety Code Sections 18931, 18949.1, 18949.2, 18949.3, 18949.5 and 8949.6.

Reference: Health and Safety Code Sections 18926, 18931 and 18949.6.

1-323. Criteria for denying a petition. The Commission, or other proposing or adopting agency, whichever is processing a petition, may deny a petition for cause using at least one of the following criteria:

(a) The subject building standard is already scheduled for review at the next regular triennial or other scheduled adoption. To substantiate this criterion, the Commission or other agency shall include in its written denial a schedule for the planned review. Alternatively, the Commission or other agency may approve a petition but defer its implementation until the next scheduled adoption.

(b) The issues cited by the petitioner are factually incorrect. To substantiate this criterion, the Commission or other agency shall identify in its written denial the incorrect facts.

(c) The issues cited by the petitioner are not within the state’s jurisdiction. To substantiate this criterion, the Commission or agency shall show in its written denial why the issues are outside its jurisdiction.

(d) The issues cited by the petitioner have been raised and answered through another petition or during the previous rulemaking. To substantiate this criterion, the Commission or agency shall include with its written denial a copy of the previous petition and its response or the pertinent rulemaking file information.

Note: If new facts or substantiating data, pertinent to a petition, are provided, this criterion shall not be grounds for denying a petition.

(e) Resolving the issues raised by the petitioner would compromise the agency’s ability to carry out its legal mandate. To substantiate this criterion, the Commission or agency shall include with its denial the specific ways in which its legal mandate would be compromised.

(f) The building standard proposed by the petitioner would do any of the following:

1. Create unnecessary hardship or expense
2. Inappropriately exclude materials, equipment or brands
3. Include only specific brands
4. Conflict with federal or state laws or regulations or existing building standards
5. Be otherwise without merit and public benefit

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Health and Safety Code Sections 18931 and 18949.6.

1-325. Reconsideration of denied petition.

(a) A petitioner may request reconsideration of any part or all of a decision of any proposing or adopting agency or the Commission on any denied petition.

(b) The request shall be submitted in accordance with the following:

1. Petition procedures of this article.
2. Include the reason(s) why the decision to deny the petition should be reconsidered.

3. Is submitted to and received by the agency having authority that denied the petition no later than the close of business on the 60th day after the date of the decision involved.

(c) The agency’s or Commission’s reconsideration of any matter relating to a petition shall be subject to the provisions of this article.

Authority: Health and Safety Code Sections 18931, 18945, and 18949.6.

Reference: Health and Safety Code Sections 18931, 18945, and 18949.6.

1-327. Reconsideration by the Commission.

(a) The Commission shall have no authority to reevaluate or reverse the decisions on petitions made by a proposing agency or adopting agency when the subject of the petition is within the specific jurisdiction of the proposing agency or adopting agency.

(b) Requests for the reconsideration of a decision by the Commission shall meet the requirements of Section 1-325 of this article.

(c) Should the Commission reverse its previous decision made on a petition, the petition shall be considered accepted and a rulemaking process shall begin as provided in this chapter.

Authority: Health and Safety Code Sections 18931, 18945, and 18949.6.

Reference: Health and Safety Code Sections 18931, 18945, and 18949.6.

1-329. Substitution of or supplementation by agency procedures.

(a) The provisions of this article pertaining to petitions shall not apply when an agency notifies the Commission that a petition process is mandated by specific statutes in addition to Government Code Sections 11340.6 and 11340.7, and/or that it has adopted its own regulations or procedures complying with Government Code Sections 11340.6 and 11340.7, and that it has notified the public of the existence of these statutes, regulations or procedures. Notification to the Commission shall consist of a written copy of the statutes, regulations or procedures and a description of the methods used to make the public aware of their existence. Upon receiving notification, the Commission shall exclude the agency from compliance with this article pertaining to petitions. If the Commission receives a petition pertaining to an excluded agency’s jurisdiction, the Commission shall forward the petition without undertaking any of the duties prescribed by this article pertaining to petitions directly to the agency and shall notify the petitioner of that fact.

(b) These regulations are not intended to be the sole means by which the proposing agency or adopting agencies and the interested public can raise, discuss and resolve issues pertaining to building standards. Agency procedures such as public participation meetings, advisory committees, written and verbal correspondence between members of the public and agency personnel, and other methods are considered alternatives that may be chosen by a member of the public instead of or in addition to the petition procedures described in this article.

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Health and Safety Code Sections 18931 and 18949.6.

**ARTICLE 4
RULEMAKING FOR THE
ADOPTION OF BUILDING STANDARDS**

1-401. Purpose. This article establishes basic minimum procedural requirements for a code adoption cycle for proposing agencies to ensure adequate public participation in the development of building standards, to ensure adequate technical review and adequate time for technical review by code advisory committees and to ensure adequate notice to the public of compiled code change submittals prior to adoption by the Commission.

1-403. Public participation.

(a) **Precycle public participation.** Every state agency with authority to propose or adopt building standards shall develop proposed building standards in a manner to ensure public participation. Methods for ensuring public participation may include but are not limited to the following:

1. Identify and maintain a listing of all interested groups or persons affected by building standards of the type within the jurisdiction of the agency.
2. Prior to commencing the development of proposed building standards, notify all interested groups and persons that building standards are to be developed, and solicit suggestions and a means for participation.
3. Conduct workshops to solicit input where the proposals are complex or large in number and cannot easily be reviewed during the comment period.
4. Make available draft proposals to interested groups or persons expressing interest.
5. Establish a procedure to provide interested groups or persons the opportunity to advise the agency of the impact of the proposed standards.

(b) **Written public comments.** The public may submit written comments in support or opposition to proposed building standards or proposed repeal of existing building standards. The written comment may be provided at a public meeting of a code advisory committee, and at any public meeting or hearing by the Commission conducted for the purpose of considering building standards published or proposed to be published in Title 24 of the California Code of Regulations, and during any public comment period announced by an issued Notice of Proposed Action or agenda. See Section 1-413 for additional information.

(c) **Oral public comments.** The public may provide oral comment in support or opposition to proposed building standards and the proposed repeal of existing building standards during a public meeting of a code advisory committee, or during any public meeting or hearing of the Commission conducted for the purpose of considering building standards published or proposed to be published in Title 24, California Code of Regulations.

Authority: Health and Safety Code Sections 18929.1 and 18934.

Reference: Government Code Section 11346.45, Health and Safety Code Sections 18929.1 and 18934.

1-404. State agency participation for green building standards. The Commission and other state agencies that propose green building standards shall allow for input by other state agencies that have expertise in green building subject areas but do not have the statutory authority to propose green building standards. The process for making recommended changes to proposing state agencies shall align with an 18-month code adoption cycle (triennial or intervening) and the proposing state agency’s rulemaking schedule as follows:

(a) **Timing for submittal.** The timing for receipt of recommended changes shall be determined by the state agency that has statutory authority to propose green building standards for a specific occupancy. Pursuant to 1-403(a)(2), prior to commencing the development of proposed building standards, proposing state agencies shall notify all interested parties that building standards are to be developed, and solicit suggestions and a means for participation.

(b) **Mandatory or voluntary standards.** The state agency recommending changes shall specify whether the recommended changes are intended to be mandatory or voluntary green building standards, and shall indicate, to the extent possible, if a recommended voluntary green building measure should be considered for possible adoption as a mandatory measure within the two subsequent adoption cycles. The proposing state agency shall determine if a recommended green building standard will be proposed as a mandatory or voluntary measure.

(c) **Submittal documents.** Submittal documents shall be submitted as a complete package and shall include, but are not limited to, all of the following:

1. Recommended regulatory text for new green building standards or revisions to existing green building standards, in strikeout/underline format;
2. Rationale that clearly explains the specific purpose and the need for the changes including the basis for recommending that the items be considered for adoption as mandatory or voluntary green building standards;
3. Fiscal and economic analysis and supporting documentation in a format specified by the proposing state agency, which shall include the cost of compliance;
4. Verifiable and appropriate technical analysis, data or other information in support of the recommended changes including information on product availability. Data or information shall include, but is not limited to, copies of reports, findings, data relied upon or other materials and analyses;
5. Certification by the state agency suggesting the recommended changes that the content of the aforementioned submittal documents are true and accurate; and
6. Any additional information as requested by the proposing state agency.

(d) **Availability to the public.** The proposing state agency, in complying with the provisions of Section 1-403 and having determined to propose the recommended changes as building standards, shall make the proposals

available to interested groups, persons expressing interest, and the public pursuant to Government Code §§11346.45 and 11347.1.

(e) **State agency declines to proceed.** The proposing state agency may decline to proceed with recommended changes from the suggesting state agency with expertise in green building subject areas due to any of, including but not limited to, the following circumstances:

1. Recommended changes conflict with the proposing state agency’s mission, stated goals and/or other mission critical program requirements;
2. The suggesting state agency has failed to provide the submittal documents as required;
3. The suggesting state agency provides data, analysis or information that is flawed or otherwise determined by the proposing state agency to be unusable in-whole or in-part;
4. The suggesting state agency fails to provide a complete package of submittal documents within the timeframe directed by the proposing state agency in order to appropriately advance the suggested changes during the subject rulemaking cycle; and
5. Any other reason as determined by the proposing state agency.

(f) **Rulemaking participation.** When the proposing state agency determines that it will accept and advance a recommended change submitted by a state agency with expertise in green building subject areas during a rulemaking code adoption cycle, the state agency that submitted the recommended change shall be notified in writing of the acceptance within 30 days of receipt of the submittal documents.

The written notification of receipt of submittal documents shall identify any assistance the proposing state agency may require from the suggesting state agency during the rulemaking process. This may include, but is not limited to contributions and participation in pre-cycle workshops or focus group meetings, development of proposed express terms and statement of reasons, providing research or documentation needed to support the suggested changes and comply with the requirements of the initial statement of reasons, and the State of California Department of Finance Economic and Fiscal Impact Statement (Std. 399), code advisory committee presentations, and/or presenting the proposed code change before the Commission. The proposing state agency may request other documentation as necessary to comply with the rulemaking process.

Authority: Health and Safety Code Sections 18929.1, 18930.5 and 18934.

Reference: Government Code Section 11346.45, Health and Safety Code Sections 18929.1, 18930.5 and 18934.

1-405. State adopting agency hearing date. State adopting agencies planning to conduct hearings relative to building standards shall, prior to giving public notice, acquire the written approval of the Commission as to the date, time and place of the hearing(s). The approval may be in the form of the Commission’s approval of the proposed Notice of Proposed Action submitted by an adopting agency, when the date, time

and place for the hearing is included in the proposed Notice of Proposed Action.

Authority: Health and Safety Code Sections 18931 and 18935.

Reference: Health and Safety Code Sections 18931 and 18935.

1-406. Commencement of rulemaking.

(a) In order to effectively administer the Triennial and Intervening Code Adoption Cycles, the Commission shall establish deadlines for state adopting agency and state proposing agency submittals of rulemaking files of adopted or proposed building standards for publication in Title 24, California Code of Regulations.

(b) The Commission shall notify state adopting agencies and state proposing agencies in writing of the deadlines for acceptance of rulemaking files a minimum of 180 days prior to the deadline. State adopting agencies and state proposing agencies shall submit rulemaking files as specified in this article to the Commission on or before the deadline for acceptance specified in the written notice.

Authority: Health and Safety Code Sections 18929.1 and 18930.

Reference: Health and Safety Code Sections 18930, 18931 and 18933.

1-407. Initial rulemaking file submittals by a state proposing agency.

(a) State proposing agencies developing building standards, or administrative regulations to support building standards, to be published in Title 24, shall prepare a rulemaking file for submittal to the office of the Commission, which shall comply with Article 5 (commencing with Section 11346) of Chapter 3.5 of Part 1 of Division 3 of Title 2 of the Government Code. The Notice of Proposed Action required by this section shall be approved by the Commission prior to any official notice to conduct a hearing or comment period regarding the proposed rulemaking.

Note: Current forms, templates, and checklists for developing rulemakings are available from the Commission to assist state proposing and adopting agencies. These are provided in order to help ensure that the state agencies’ rulemaking documents comply with specific requirements for content, completeness, statutory authority and reference and numerous other requirements.

(b) File content. The initial rulemaking file submitted to the Commission shall include the following:

1. One (1) original Building Standards Face Sheet (BSC-1), with the wet signature of the agency director or designee.
2. One (1) copy of the Notice of Proposed Action. The Notice of Proposed Action shall be complete except for the public comment period portion. The public comment period will be determined by the Commission staff.
3. Two (2) copies of the Initial Express Terms showing the proposed building standards or amendments to existing building standards in strikeout/underline format. The language, including numbering and punctuation, of proposed new building standards or amendments to existing building standards shall be shown underlined. Proposed deletions of existing building standards shall be shown in strikeout type. Existing building standards to remain

without amendment shall be shown without underlining or strikeout or other highlighting.

4. Two (2) copies of the Initial Statement of Reasons for proposing the adoption, amendment, or repeal of a regulation.
5. One (1) copy of the Department of Finance Economic and Fiscal Impact Statement (STD. 399). Wet signatures are not required on STD. 399 until final submittal of the rulemaking file.
6. Two (2) copies of the written Nine-Point Criteria Analysis substantiating compliance with Health and Safety Code Section 18930.
7. One (1) electronic file copy of each of the above documents listed under subsection 1-407(b), which shall be suitable for immediate placement on the Commission’s website (www.dgs.ca.gov/bsc) for public viewing. Items 2, 3, 4 and 6 listed under this section shall be in compliance with the Web Content Accessibility Guidelines 2.0, or a subsequent version, published by the Web Accessibility Initiative of the World Wide Web Consortium at a minimum Level AA success criteria. [See Government Code Section 11546.7(a).]

(c) Upon approval of the Notice of Proposed Action for building standards, the Executive Director will forward the approved Notice of Proposed Action to the Office of Administrative Law for the sole purpose of publication in the California Regulatory Notice Register before the start of the public comment period, and return an approved copy to the proposing agency. If a Notice of Proposed Action is found to be incomplete or incorrect by Commission staff, the Executive Director shall return it to the proposing agency within 10 days with a written listing of the found deficiencies to enable the agency to make corrections for resubmittal to the Commission.

1. Any Notice of Proposed Action not acted upon within 20 days by the Commission staff shall be considered approved and may be published in the California Regulatory Notice Register.

Authority: Government Code Sections 11346–11348 and Health and Safety Code Sections 18930, 18931, 18935 and 18949.6.

Reference: Government Code Section 11546.7(a) and Health and Safety Code Sections 18930, 18931, 18935 and 18949.6.

1-408. Certification of delegation of authority.

(a) Whenever a certification is required by this article, it shall be made by the head of the state agency that is proposing, adopting, amending or repealing building standards or administrative regulations, or by a designee of the agency head. The certification and delegation shall be in writing.

(b) The certification wet signature required on the Notice/Submission Face Sheet (BSC-1) by Sections 1-407(b)1, 1-415(a)1, and 1-419(b)1 and the certification wet signature required on the Department of Finance Economic and Fiscal Impact Statement (STD. 399) required by Section 1-415(a)7 shall be made by the agency director, or their designee, of the agency proposing or adopting the building standards. A written delegation identifying the agency’s authorized signatory designee(s) shall be submitted prior to or with the rulemaking

file(s) when the Notice/Submission Face Sheet (BSC-1) is signed by other than the agency director.

Authority: Government Code Sections 11340 et seq., and Health and Safety Code Sections 18929.1, 18930, 18931, 18934, 18935 and 18949.6.

Reference: Government Code Sections 11340 et seq., and Health and Safety Code Sections 18929.1, 18930, 18931, 18934, 18935 and 18949.6.

1-409. Code advisory committee review.

(a) Prior to conducting any hearing or public comment period as part of the rulemaking proceeding required by the Administrative Procedure Act, the Commission shall assign an initial rulemaking file, received on or before the deadline established under Section 1-406 of this article, to one or more code advisory committees specifically knowledgeable in the building standard being proposed and schedule the submittal for a noticed public hearing to ensure adequate opportunity for public participation and technical review.

(b) A state proposing agency responsible for developing an initial rulemaking file shall attend the code advisory committee meeting to present its proposal, and be prepared to respond to committee comments and questions.

(c) **Code advisory committee reviews.** A code advisory committee shall conduct a public hearing to perform a technical review of all initial rulemaking files assigned to it by the Commission. A code advisory committee meeting shall be scheduled by the Commission and shall be open to the public.

(d) **Code advisory committee meeting notice.** The location, date and time of a code advisory committee meeting shall be noticed by the Commission and conducted in accordance with the Bagley-Keene Open Meeting Act (Gov. Code, §§ 11120–11132.).

(e) **Code advisory committee recommendations.** A code advisory committee shall make a recommendation on each proposed provision within the initial rulemaking file. A recommendation other than “approve” shall include a substantiating reason based on the Nine-Point Criteria in Health and Safety Code Section 18930. The recommendations to the Commission shall be based on one of the following and shall become part of the rulemaking file:

1. **Approve.** Approval of a proposed provision as submitted.
2. **Disapprove.** A proposed provision does not meet one or more specified criteria of Health and Safety Code Section 18930.
3. **Further study required.** A proposed provision has merit but does not meet one or more specified criteria of Health and Safety Code Section 18930. The proposed provision requires further study by the proposing agency. Upon further study, the proposing agency may resubmit the proposed provision for a comment period in the current cycle. The committee may recommend that the proposing agency submit the proposed provision in the next code adoption cycle after further study, or, if the matter can be resolved in time, submit the proposed provision for a comment period in the current cycle.
4. **Approve as amended.** Approval as amended of a proposed provision, as suggested by the committee for organization, cross-referencing, clarity and editorial

improvements or as amended and submitted for committee review by the agency. Modifications are justified in terms of Health and Safety Code Section 18930.

(f) **Code advisory committee reports.** The code advisory committee report of recommendations to the Commission shall be made available to the public for review and comment and be included in the Commission’s rulemaking file.

(g) **State proposing agency action.** State proposing agencies shall address each code advisory committee recommendation in the revised Initial Statement of Reasons by explaining what, if any, action was taken or not taken to address the recommendation.

Authority: Health and Safety Code Sections 18931 and 18935.

Reference: Health and Safety Code Sections 18931 and 18935.

1-411. Public comment rulemaking file submitted by a state proposing agency.

(a) Public comment periods, including 45-day and 15-day periods, shall be conducted according to Article 5 (commencing with Section 11346) of Chapter 3.5 of Part 1 of Division 3 of Title 2 of the Government Code.

(b) State proposing agencies shall submit rulemaking files to the Commission on or before the deadline established by the Commission, in preparation for the 45-day public comment period.

Note: Current forms, templates, and checklists for developing rulemakings are available from the Commission to assist state proposing and adopting agencies. These are provided in order to help ensure that the state agencies’ rulemaking documents comply with specific requirements for content, completeness, statutory authority and reference and numerous other requirements.

(c) File content. The rulemaking file shall include the following items.

1. One (1) copy of the Notice of Proposed Action.
2. Two (2) copies of the 45-Day Express Terms, including any amendments made to address code advisory committee recommendations.
3. Two (2) copies of the Initial Statement of Reasons, including explanations of any revisions suggested in the 45-Day Express Terms to address code advisory committee recommendations.
4. All other items required by Section 1-407 that have been amended since the initial rulemaking file was submitted for Code Advisory Committee review.
5. One (1) electronic file copy of each document submitted, which shall be suitable for immediate placement on the Commission’s website (www.dgs.ca.gov/bsc) for public viewing. Items 1, 2, 3 and 4 (Nine-Point Criteria Analysis only) listed under this section shall be in compliance with the Web Content Accessibility Guidelines 2.0, or a subsequent version, published by the Web Accessibility Initiative of the World Wide Web Consortium at a minimum Level AA success criteria. [See Government Code Section 11546.7(a).]

(d) In coordination with the Commission, and with the Commission’s approval of the submitted rulemaking file

items, a state proposing agency shall perform the following to carry out the public comment periods:

1. Verify the rulemaking items submitted by the state proposing agency are posted and available to the public on the Commission’s website (www.dgs.ca.gov/bsc).
2. Distribute the Notice of Proposed Action to the parties on record with the state proposing agency that have requested to receive proposed rulemaking documents.
3. Provide printed or electronic files of the rulemaking documents described in the Notice of Proposed Action, if requested.
4. Maintain all written public comments received during the public comment periods in preparation for developing the final rulemaking file for submittal to the Commission for adoption.
5. Public comments received by a state proposing agency shall be forwarded to the Commission.

(e) Coordinate with the Commission should it be necessary to conduct additional 45-day and/or 15-day public comment periods.

Authority: Government Code Section 11346 et seq. and Health and Safety Code Sections 18929.1, 18930, 18934, 18935 and 18949.6.

Reference: Government Code Sections 11346 et seq. and 11546.7(a) and Health and Safety Code Sections 18929.1, 18930, 18934, 18935 and 18949.6.

1-413. Public comments and related actions.

(a) Anyone wishing to provide written or oral comment on a recommendation of the code advisory committee(s) and/or on a proposed building standard or the repeal of an existing building standard may do so in accordance with this section. The Commission, or state proposing agency, shall consider public comments received during a public comment period announced by a Notice of Proposed Action.

(b) When no public hearing is scheduled as part of a public comment period, a public hearing may be requested. Upon written request received, no later than 15 days prior to the close of the public comment period, a public hearing pursuant to Government Code Section 11346.8 shall be held by the Commission when the Commission is the proposing agency, or state proposing agency responsible for the proposal, to receive comment on the proposed building standard or repeal of an existing building standard, its justification or code advisory committee recommendations. At the hearing statements, arguments, or comments, either oral or in writing, or both, shall be permitted.

(c) A written or oral public comment submitted pursuant to this section shall refer to a specific recommendation made by a code advisory committee on a proposed building standard or repeal of an existing building standard. The public comment shall clearly indicate the action desired and include a substantiating reason for the desired action based on the Nine-Point Criteria in Health and Safety Code Section 18930.

(d) The Commission shall make available to the public upon request a record of written and oral comments received at the Commission office, or during code advisory committee meetings and meetings and hearings by the Commission, and during public comment periods, in regard to a proposed

building standard or the proposed repeal of an existing building standard.

(e) The Commission and/or state proposing agency, whichever is appropriate, shall consider the comments received during a code advisory committee meeting and during a public comment period from the public pursuant to this section. Any amendments to the proposed building standard or proposed repeal of an existing building standard as a result of the public comment and determinations shall be explained in the Final Statement of Reasons.

(f) Following all public comment periods for a proposed building standard or proposed repeal of an existing building standard, the Commission will conduct a public meeting to consider the approval or adoption of the proposal.

Note: The Commission provides a suggested public comment form at the Commission's website - dgs.ca.gov/BSC

No new issues will be raised before the Commission that were not included in the record of comments.

Items not challenged but affected as a result of an action on another item may also be considered at the Commission meeting to eliminate conflict, duplication or overlap.

Authority: Government Code Section 11346 et seq. and Health and Safety Code Sections 18929.1, 18930, 18934 and 18935.

Reference: Government Code Section 11346 et seq. and Health and Safety Code Sections 18929.1, 18930, 18934 and 18935.

1-415. Final rulemaking file by state proposing agencies.

(a) After any hearings and the close of all public comment periods a final rulemaking file shall be submitted to the Commission with all rulemaking documents complete and ready for the Commission's public meeting to consider adoption. Forms, templates, and checklists are available from the Commission. Each final rulemaking file shall be organized and indexed to identify the following items required for inclusion:

1. One (1) original Building Standards Face Sheet (BSC-1) with the wet signature of the agency director or designee.
2. One (1) copy of the Notice of Proposed Action.
3. One (1) copy of the Informative Digest.
4. One (1) copy of the Initial Statement of Reasons.
5. One (1) copy of the Final Express Terms to illustrate the final proposed building standards.
6. One (1) copy of the Finding of Emergency Statement (submitted only with Emergency Building Standards). Also see Section 1-419 of this article.
7. One (1) copy of the Department of Finance Economic and Fiscal Impact Statement (STD. 399) containing all required wet signatures as appropriate, together with fiscal analysis prepared by the submitting Agency.
8. One (1) copy of the written transcript or recorded minutes of any public hearings.
9. One (1) copy of each exhibit submitted or written comment received at any public hearing conducted by the agency and a transcript of any oral comments received.

10. One (1) copy of each written comment received during public comment period(s), and a memo attesting to the 45-day public availability period.
11. One (1) copy of the Final Statement of Reasons and any studies, surveys or documents used to support the rationale for the proposed building standard(s).
12. One (1) copy of the Updated Informative Digest.
13. One (1) copy of the proposed standards with any post hearing changes indicated, and a memo attesting to the 15-day public availability period (if applicable).
14. One (1) original Certification of Close and Complete of the Rulemaking File with the wet signature of the agency director or designee.
15. One (1) copy of the written Nine-Point Criteria Analysis, which shall justify the approval of the building standard(s) in terms of the criteria as set forth in the State Building Standards Law, Part 2.5, Division 13, Section 18930 et seq., of the Health and Safety Code.
16. One (1) copy of the Certification of Compliance, which is required to make emergency building standards permanent (submitted only with Emergency Building Standards during certifying rulemaking).
17. One (1) copy of a written statement confirming that the state agency complied with the provisions of Government Code Section 11346.4(a)(1) through (4) regarding the mailing of notice of proposed action at least 45 days prior to public hearing and close of the public comment period. The statement shall include the date upon which the notice was mailed. This section is not intended to require an agency to provide a copy of its mailing list to support the statement.
18. One (1) electronic file copy of each of the above documents listed under this section. The electronic files shall be suitable for immediate placement on the Commission's website for public viewing. Items 4 through 6, 11 through 13, and 15 listed under this section shall be in compliance with the Web Content Accessibility Guidelines 2.0, or a subsequent version, published by the Web Accessibility Initiative of the World Wide Web Consortium at a minimum Level AA success criteria. [See Government Code Section 11546.7(a).]

(b) The proposed building standards shall be submitted in the strikeout/underline format. If the proposed building standards amend existing building standards, all deletions must be shown in strikeout type and all additions, including punctuation, must be underlined. The provisions of this section may be waived by the Executive Director through written notification to the adopting agency.

Authority: Health and Safety Code Sections 18931 and 18949.6.

Reference: Government Code Section 11546.7(a) and Health and Safety Code Sections 18931 and 18949.6.

1-417. Final actions by the Commission and proposing agency.

(a) Following the close of the public comment period, and any public hearing, the Commission shall take one of the fol-

lowing actions on each received final rulemaking file proposing to adopt new, repeal, or amend building standards.

1. **Approve.** The Commission approves a proposed code change as submitted. The change is justified in terms of Health and Safety Code Section 18930.
2. **Disapprove.** The Commission disapproves a proposed code change as not justified in terms of Health and Safety Code Section 18930.
3. **Further study required.** The Commission finds that a proposed code change has merit but does not meet specified criteria of Health and Safety Code Section 18930. The change requires further study and justification by the proposing agency. The proposed code change may be submitted in a future code adoption cycle with further study and justification.
4. **Approve as amended.** The Commission approves a proposed code change as modified by the proposing Agency Director or authorized representative in accordance with an approved written delegation order. No modification shall be made that materially alters a requirement, right, responsibility, condition or prescription in the text made available to the public for comment in accordance with this chapter. The proposing agency shall justify the modification pursuant to Health and Safety Code Section 18930 in an amended justification consistent with the approval action submitted to the Commission within 15 days. Failure to submit the amended justification within that time is cause for disapproval.

(b) **Withdrawal.** A proposing agency may withdraw a proposed code change as determined appropriate at any time during the rulemaking process.

Authority: Health and Safety Code Sections 18929.1, 18949.6 and 18931(f).

Reference: Health and Safety Code Sections 18927, 18929 through 18932, 18934, 18935, 18936, 18949.1, 18949.2, 18949.3, 18949.5 and 18949.6.

1-419. Emergency building standards.

(a) Emergency building standards may be developed and acted on as provided in Health and Safety Code Sections 18937 through 18938 and other referenced or applicable provisions of California Building Standards Law (HS. Code, § 18901 et seq.) and the Administrative Procedure Act (Gov. Code, § 11340 et seq.). Emergency building standards shall be acted on within 30 days and shall not be effective until approved by the Commission and filed with the Secretary of State.

(b) Rulemaking files for emergency building standards submitted to the Commission for consideration shall include each of the following:

1. One (1) original Building Standards Face Sheet (BSC-1), with the wet signature of the agency director or designee.
2. Two (2) copies of the Finding of Emergency satisfying requirements of Government Code Section 11346.1.
3. Two (2) copies of the Express Terms illustrating the proposed emergency building standards.
4. Two (2) copies of the written Nine-Point Criteria Analysis substantiating compliance with Health and Safety Code Section 18930.

5. Any supporting documentation on which the proposed emergency building standards are based.

6. One (1) electronic file copy of each of the above documents listed under subsection 1-419(b). The electronic documents shall be suitable for immediate placement on the Commission’s website for public viewing. Items 2 through 5 listed under this subsection shall be in compliance with the Web Content Accessibility Guidelines 2.0, or a subsequent version, published by the Web Accessibility Initiative of the World Wide Web Consortium at a minimum Level AA success criteria. [See Government Code Section 11546.7(a).]

(c) The Commission shall make a ruling on the state agency’s Finding of Emergency as to its compliance with Government Code Section 11346.1. If the Finding of Emergency is approved, the Commission shall consider the proposed emergency building standard and make a ruling to approve, disapprove, further study required, or approve as amended, consistent with Section 1-417(a) of this article.

(d) The Commission shall file approved emergency building standards with the Secretary of State at the earliest possible date following approval. Following the filing with the Secretary of State for an adopted emergency building standard, the Commission shall notify the affected state agency in writing of the filing date of the emergency building standard.

(e) Following the initial adoption of emergency building standards and if determined appropriate, the state agency responsible for the emergency building standards shall proceed to complete the certifying rulemaking process to make the emergency building standards permanent within 180 days in accordance with Government Code Section 11346.1 and Health and Safety Code Section 18938. Rulemaking files submitted to the Commission for certifying rulemaking shall include all applicable documents required by Section 1-415 of this article.

(f) Readoption of an emergency building standard pursuant to Government Code Section 11346.1(h) requires sending a notice of proposed action pursuant to Government Code Section 11346.1(a)(2).

In addition to fulfilling the requirements for submission of building standard actions described in this section and Sections 1-407, 1-411, 1-415 and 1-420 of this article, as applicable, a state proposing or adopting agency requesting approval for readoption of an emergency building standard shall provide the following:

1. A written statement providing specific facts demonstrating by substantial evidence that the agency has made substantial progress and proceeded with diligence to comply with Government Code Section 11346.1(e); and either
2. A statement that the emergency circumstances are unchanged since the initial adoption or prior readoption; or
3. An updated finding of emergency required by Government Code Section 11346.1(b) to reflect circumstances that have changed since the initial adoption or readoption.

(g) Rulemaking files for readoption of emergency building standards submitted to the Commission for consideration shall include each of the following:

1. One (1) original Building Standards Notice/Submission Face Sheet (BSC-1), with the wet signature of the agency director or designee.
2. Two (2) copies of the Finding of Emergency previously approved by the Commission satisfying requirements of Government Code Section 11346.1 of this article.
3. Two (2) copies of the statement relative to substantial progress, and the statement that the emergency remains unchanged or an updated finding of emergency, as appropriate. The statements and updated finding shall incorporate the provisions of Section 1-419(f) of this article.
4. Two (2) copies of the Express Terms illustrating the approved/adopted emergency building standards.
5. Two (2) copies of the written Nine-Point Criteria Analysis substantiating compliance with Health and Safety Code Section 18930.
6. Any supporting documentation on which the approved/adopted emergency building standards are based.
7. One (1) electronic file copy of each of the above documents listed under subsection 1-419(g). The electronic documents shall be suitable for immediate placement on the Commission's website for public viewing. Items 2 through 6 listed under this subsection shall be in compliance with the Web Content Accessibility Guidelines 2.0, or a subsequent version, published by the Web Accessibility Initiative of the World Wide Web Consortium at a minimum Level AA success criteria. [See Government Code Section 11546.7(a).]

Authority: Government Code Sections 11346.1 and 11346.5 and Health and Safety Code Sections 18930, 18937 and 18949.6.

Reference: Government Code Sections 11346.1, 11346.5 and 11546.7(a) and Health and Safety Code Sections 18913, 18930, 18935, 18937, 18938 and 18949.6.

1-420. State adopting agency submittals.

(a) All building standards and emergency building standards adopted by a state adopting agency must be approved by the Commission prior to codification pursuant to Health and Safety Code Section 18930. The submitted rulemaking file for approval shall satisfy all applicable provisions of the Administrative Procedure Act (Gov. Code, § 11340 et seq.).

(b) In accordance with Health and Safety Code Section 18935, the notice of proposed action and the initial statement of reasons shall be submitted to the Commission for review. The notice and the initial statement of reasons shall be submitted a minimum of 45 days in advance of the state adopting agency beginning its initial 45-day public comment period. Along with the notice and initial statement of reasons, the adopting agency shall include its initial express terms for review by the Commission.

After review and determination that the notice of proposed action and initial statement of reasons are in compliance with Article 5 of Chapter 3.5 of Part 1 of Division 3 of Title 2 of the Government Code, the Commission shall approve the

documents and notify the state adopting agency in writing within 5 calendar days of the approval. The Commission shall submit the notice of proposed action to the Office of Administrative Law (OAL) for publication in its California Regulatory Notice Register pursuant to OAL's procedures.

(c) The submitted rulemaking files for adopted building standards and emergency building standards shall contain and comply with the applicable related provisions in Sections 1-415 and 1-419 of this article, as appropriate.

After any hearings, the close of all public comment periods and the state adopting agency receiving approval from its commission, board or other approving body, a final rulemaking file shall be submitted to the Commission. The final rulemaking file shall consist of Items 1 through 17 of Section 1-415 of this article. Each final rulemaking file shall be organized and indexed to identify all items comprising the final rulemaking file.

(d) A representative of the submitting state adopting agency shall be present at the Commission's public meeting at which approval will be considered. The representative shall do the following:

1. Summarize the adopted building standards or emergency building standards.
2. Summarize the agency's activities to satisfy requirements for rulemaking.
3. Respond to any questions by the Commission.

Authority: Government Code Section 11346 et seq., and Health and Safety Code Sections 18930 and 18949.6.

Reference: Government Code Section 11346 et seq., and Health and Safety Code Sections 18930, 18935, 18937 and 18949.6.

1-421. Change without regulatory effect.

(a) Notwithstanding the rulemaking procedures specified in Article 4 of this chapter, a proposing or adopting agency may add to, revise or delete text published in Title 24 of the California Code of Regulations, with the approval of the Commission, when the change has no regulatory effect as provided in this section.

(b) A proposing or adopting agency acting pursuant to this section on provisions of Title 24 that are also adopted by other state agencies, shall obtain the written concurrence of the other agencies in regard to the change without regulatory effect.

(c) A change without regulatory effect is a change to the provisions of Title 24 that does not impose any new requirement for the design or construction of buildings and associated structures and equipment. A change without regulatory effect may include, but is not limited to:

1. Renumbering, reordering or relocating a regulatory provision;
2. Deleting a regulatory provision for which all statutory or constitutional authority has been repealed;
3. Deleting a regulatory provision held invalid in a judgment that has become final, entered by a California court of competent jurisdiction, a United States District Court located in the State of California, the United States Court of Appeals for the Ninth Circuit, or the United States Supreme Court; however, the Commis-

sion shall not approve any proposed change without regulatory effect if the change is based on a superior court decision which invalidated the regulatory provision solely on the grounds that the underlying statute was unconstitutional;

4. Revising structure, syntax, cross-reference, grammar or punctuation;
5. Changing an “authority” or “reference” citation for a regulation; and
6. Making a regulatory provision consistent with a changed California statute if both of the following conditions are met:

- (A) The regulatory provision is inconsistent with and superseded by the changed statute, and
- (B) The state adopting agency or state proposing agency has no discretion to adopt a change which differs in substance from the one chosen.

(d) The rulemaking file for a change without regulatory effect to be submitted to the Commission for adoption or approval, and publication in Title 24 shall include the following:

1. A completed Building Standards Face Sheet (BSC-1) as required by Section 1-415 of this chapter; and
2. Express Terms illustrating the change in the form required by Section 1-415 of this chapter; and
3. A written statement for each section explaining how the change meets the requirements of Subsection (c) above; and
4. Pursuant to Subsection (b) above, a written statement by each state Agency that has adopted the provision being changed, concurring with the regulatory change. All such statements shall be signed by a duly authorized representative of the Agency.

(e) The Commission shall make a determination regarding a change submitted pursuant this section within thirty (30) days of its receipt. Within ten (10) days of making a determination, the Commission shall send written notification of the determination to the agency that submitted the change when:

1. The Commission determines that the submitted change meets the requirements of this section for a change without regulatory effect, the regulatory change shall be filed with the Secretary of State and the Commission shall publish the change in Title 24, California Code of Regulations.
2. The Commission determines that the submitted change does not meet the requirements of this section for a change without regulatory effect, or does not comply with the rulemaking requirements of this section, the written determination by the Commission shall provide sufficient itemization of the deficiencies. The agency may correct the rulemaking file for reconsideration by the Commission, or begin proceeding with a regulatory action pursuant to Article 4 of this chapter.

(f) An adoption or approval by the Commission of a change without regulatory effect shall be effective 30 days after filing with the Secretary of State. Health and Safety

Code Section 18938(c) establishes the effective date as being 30 days after filing the amendment or repeal by the Commission with the Secretary of State.

Authority: Health and Safety Code Sections 18929.1, 18930, 18931(f) and 18946.6.

Reference: Health and Safety Code Sections 18929.1, 18930, 18931(f) and 18946.6.

**ARTICLE 5
CITY, COUNTY, AND CITY AND COUNTY
BUILDING PERMIT FEES**

1-501. Purpose. This article establishes regulations for implementation of Health and Safety Code Sections 18931.6 and 18931.7, to require a surcharge on building permits in order to provide funds, upon appropriation, for the California Building Standards Commission, Department of Housing and Community Development and Office of the State Fire Marshal to use in carrying out the provisions of California Building Standards Law and of State Housing Law relating to building standards, with emphasis placed on the adoption, publication and educational efforts associated with green building standards. The fees are to be collected by cities, counties, and cities and counties and transmitted to the California Building Standards Commission. The fees are based on building permit valuation.

1-503. Definitions. The following terms are defined in Section 1-103. Definitions of this Chapter:

- Building Standards Administration Special Revolving Fund (the Fund).**
- Department.**
- Fees, fractions thereof.**
- Office.**

1-505. Fee assessment.

(a) Fees shall be levied on building permits required for all disciplines covered by Title 24, including, but not limited to, building, electrical, mechanical and plumbing, and for which a valuation is made.

(b) Fees are assessed at a rate of \$4 per \$100,000, or fractions thereof, of each building permit valuation, but not less than \$1 per permit, as shown in Table 1-505:

**TABLE 1-505
BUILDING PERMIT VALUATION FEE**

BUILDING PERMIT VALUATION	FEE
\$1 – \$25,000	\$1
\$25,000.01 – \$50,000	\$2
\$50,000.01 – \$75,000	\$3
\$75,000.01 – \$100,000	\$4
Every \$25,000 or fraction thereof above \$100,000	Add \$1

1. Cities, counties, and cities and counties may retain up to ten percent (10%) of the fees for related administrative costs, code enforcement, and education as permitted by Health and Safety Code Section 18931.6.
2. When a building permit is issued and no valuation is made, the city, county, or city and county may exempt that permit from fee assessment.

(c) The Commission may reduce the rate of the fee by regulation upon determination that a lesser fee is sufficient to carry out the programs of the Commission, the Department and the Office. The Commission may establish a termination date or duration for the fee reduction period.

Authority: Government Code Section 11346 et seq. and Health and Safety Code Sections 18930.5, 18931(f), 18931.6, 18931.7 and 18949.6.

Reference: Government Code Section 11346 et seq. and Health and Safety Code Sections 18930.5, 18931(f), 18931.6, 18931.7 and 18949.6.

1-507. Fee collection.

(a) Cities, counties, and cities and counties shall submit fees each quarter, commencing with the quarter beginning January 1 and ending March 31, 2009, due on the 15th day of the following month.

1. Each quarter, a city, county, and city and county shall submit a completed Fee Report Form (BSC-2) and payment to the California Building Standards Commission for the fees collected that quarter.

2. A Contact Information Form (BSC-3) shall accompany the Fee Report Form and payment only when contact information changes. Such changes include the city, county, or city and county address, telephone number(s), office or department contact, and/or building official.

3. For a check payment, the check shall be mailed together with the certified quarterly Fee Report Form (BSC-2) and Contact Information Form as appropriate, to the California Building Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833. For an electronic payment (see Note), the payment receipt shall be emailed together with the certified quarterly Fee Report Form (BSC-2), and Contact Information Form as appropriate, to BSASRF_Fee@dgs.ca.gov.

Note: Only the CBSC-approved electronic payment platform shall be used for electronic payments. Forms, a detailed guidebook and information regarding the electronic payment platform are available at the Commission's Building Permit Fee webpage - dgs.ca.gov/BSC/BSASRF---The-Building-Permit-Fee.

(b) The Commission shall deposit the moneys collected into the Building Standards Administration Special Revolving Fund for use, upon appropriation, by the Commission, the Department, and the Office as specified in Section 1-501.

Authority: Health and Safety Code Sections 18909(c), 18929, 18930.5, 18931.6, 18931.7 and 18949.6.

Reference: Health and Safety Code Sections 18930.5, 18931.6 and 18931.7.

1-509. Request for refund of fees.

(a) When a city, county or city and county determines that excess fees were paid in error due to a miscalculation, a written request for refund may be filed with the California Building Standards Commission, 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833. The request for refund shall be submitted with all of the following:

1. A detailed summary describing the circumstances surrounding the miscalculation that occurred regarding the incorrect submission of fees;

2. Documentation that demonstrates how the amount error occurred, and showing the correct amount;
3. Written certification that the refund amount is accurate and true.

(b) Receipt of a request for refund of fees shall be acknowledged by the California Building Standards Commission in writing within 45 days of receipt. The acknowledgement shall include whether additional supporting documentation is required in order to verify the refund amount.

(c) Should a city, county, or city and county be delinquent in any past quarterly fee submissions, the past due quarterly fee reports and respective payments shall be made current prior to resolution regarding a refund.

Authority: Health and Safety Code Sections 18909(c), 18929, 18930.5, 18931.6, 18931.7 and 18949.6.

Reference: Health and Safety Code Sections 18930.5, 18931.6 and 18931.7.

HISTORY NOTE APPENDIX FOR CHAPTER 1

Administrative Regulations for the California Building Standards Commission California Code of Regulations, Title 24, Part 1

HISTORY:

> The history notes for prior changes remain within the text of this code.

1. (BSC 1/89) Regular order by the California Building Standards Commission to amend Section 1-601, Part 1, Title 24, California Code of Regulations. Filed with the Secretary of State April 1990; effective April 17, 1990. Approved as a regular order by the California Building Standards Commission on April 16, 1990.
2. (BSC 2/92) Regular order by the California Building Standards Commission to adopt Section 1-901, Part 1, Title 24, California Code of Regulations. Filed with the Secretary of State February 10, 1994; effective March 12, 1994. Approved by the Office of Administrative Law on February 10, 1994.
3. (BSC 2/93) Regular order by the California Building Standards Commission to Amend Sections 1-402, 1-501, 1-603, 1-604, 1-801 and 1-802, 1-803, 1-804, 1-805, 1-806, 1-807, 1-808, 1-809, Part 1, Title 24, California Code of Regulations. Approved by Office of Administrative Law on January 27, 1995; filed at the Secretary of State on January 27, 1995; effective 30 days thereafter, which will be February 26, 1995. Publication date April 24, 1995.
4. (BSC 02/08) Article 1-9, Code Adoption Process. Amend Section 1-902 and add new Article 1-10, City, County, and City and County Building Permit Fees. Effective June 21, 2009.
5. (BSC 07/09) Supplement adding Section 1-1004 Development of Standards to Chapter 1. Effective on January 1, 2011.
6. (BSC 03/10) Repeal, amend and reformat Chapter 1 of the 2010 California Administrative Code, CCR Title 24, Part 1, effective on August 28, 2011.
7. (BSC 05/10) Add new Section 1-105 to Article 1 Use of Commission Indicia, effective on November 20, 2011.
8. (BSC 02/12) Amend Chapter 1, Article 1, Sections 1-101, 1-105, Article 2, Sections 1-201, 1-207, 1-209, 1-211, Article 4, Sections 4-411, 1-421, Article 5, Section 1-503. Approved by the California Building Standards Commission on January 23, 2013, filed with Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.
9. Errata to correct editorial errors within the preface and Chapter 1 of this code. Effective January 1, 2014.
10. (BSC 01/13) 2013 Intervening Cycle Supplement. Amendments and corrections to Article 1, Sections 1-101, 1-105 add website reference; Article 2, Sections 1-203 correct title of Commission, 1-209, 1-211 correct website references; Article 3, Section 1-307 correct title of Commission and add website reference; Article 4, Sections 1-407 correct grammatical editorial errors and add website reference, 1-413, 1-415, 1-415(a)4 clarify actions taken following public comment periods and clarify the application of “Approve as Amended,” 1-419 clarify availability of rulemaking documents and add website reference, 1-421 clarify grammatical errors; Article 5, Sections 1-503, 1-505, 1-507 correct grammatical errors, clarify fee collection forms and add website reference. Approved by the California Building Standards Commission on July 22, 2014, filed with the Secretary of State on July 30, 2014, effective August 30, 2014.
11. (BSC 01/15) Amend Chapter 1, Article 1, Sections 1-101, 1-103; Article 2, Sections 1-205, 1-207, 1-209, Article 4, 1-404, Article 5, Section 1-509. Approved by the California Building Standards Commission on December 16, 2015, filed with the Secretary of State on December 21, 2015, and effective 30 days after filing with Secretary of State.
12. Errata to correct editorial errors within the preface as well as throughout various chapters in this code. Effective January 1, 2017.
13. (BSC 01/16) 2016 Intervening Cycle Supplement adopted by the California Building Standards Commission on June 20, 2017, filed with the Secretary of State on August 17, 2017, effective 30 days after filing.
14. (BSC 01/18) 2018 Triennial Code Adoption Cycle Amend Chapter 1, Article 1, Sections 1-101, 1-103; Article 2, Section 1-211; Article 3, Sections 1-309, 1-311, 1-313, 1-317, 1-321; Article 4, Sections 1-407, 1-411, 1-415, 1-419, 1-420 and 1-421. Added to Chapter 1, Article 4, new Section 1-408. Approved by the California Building Standards Commission on December 5, 2018, filed with the Secretary of State on December 7, 2018, and effective 30 days after filing with the Secretary of State pursuant to California Health and Safety Code, Section 18938.
15. Erratum to correct editorial errors in Chapter 1, Article 2: effective January 1, 2020.
16. 2019 Intervening Cycle Update (BSC 01/19) Adoption of amendments to the 2019 California Administrative Code (CAC). Approved by the California Building Standards Commission on August 13, 2020, published on January 1, 2021, effective 30 days after filing with Secretary of State.
17. (BSC 04/21) Amend Chapter 1, Article 2, Section 1-209, Article 4, Section 1-407, 1-411, 1-415, 1-419, Article 5, Section 1-507. Approved by the California Building Standards Commission on January 18, 2022, filed with the Secretary of State on February 2, 2022, and effective 30 days after filing with Secretary of State.

CHAPTER 2

ADMINISTRATIVE REGULATIONS FOR THE DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT (HCD)

ARTICLE 2-1 GREEN BUILDING STANDARDS

2-101. Scope. The Department of Housing and Community (HCD) shall develop and propose for adoption to the California Building Standards Commission green building standards related to methods, materials or processes not under the authority of another state agency. HCD also may review and comment on proposals and proposed standards developed by other agencies in order to reduce or eliminate ambiguities or conflicts with HCD's residential standards or authority. The green building standards developed and proposed by HCD would be applicable for residential occupancies including, but not limited to, hotels, motels, lodging houses, apartment houses, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities. The administrative procedures for developing and proposing those standards shall be consistent with this article.

2-102. Development of standards.

(a) In developing green building standards, the Department of Housing and Community Development shall consult with state entities appropriate for specific standards including, but not limited to, the following state agencies:

1. The California Department of Resource Recycling and Recovery
2. The California Energy Resources Conservation and Development Commission
3. The California Air Resources Board
4. The California Department of Water Resources
5. The California Department of Transportation
6. The California Department of General Services
7. The California Department of Public Health
8. Office of the State Fire Marshal

(b) HCD also shall consult with representatives from each of the following:

1. Environmental advocacy groups
2. Interested city, county, or city and county government and code enforcement entities
3. The building construction and design industry
4. Interested public parties

(c) HCD may consult with and seek input from the entities and representatives identified in subsections (a) and (b) either by written comment or in a meeting format and shall consider

all input provided during the development of the green building standards which is relevant to specific standards. HCD shall provide written responses to formal comments received during the public comment period for any proposed green building standard.

Authority: Health and Safety Code Sections 17921, 17922 and 19990.

Reference: Health and Safety Code Sections 17000 through 17060, 17910 through 17990 and 19960 through 19997.

HISTORY NOTE APPENDIX FOR CHAPTER 2
Administrative Regulations for the
Department of Housing and Community Development
California Code of Regulations, Title 24, Part 1

HISTORY:

- > The history notes for prior changes remain within the text of this code.
 - 1. (HCD 05/09) Adoption of administrative provisions for green building code development in Part 1. Effective on February 13, 2010.

CHAPTER 3
ADMINISTRATIVE REGULATIONS
FOR THE OFFICE OF THE STATE FIRE MARSHAL (SFM)

ARTICLE 3-1
GENERAL PROVISIONS

3-101. Purpose. The State Fire Marshal shall prepare and adopt building standards in the California Building Standards Code relating to fire and panic safety. The State Fire Marshal shall enforce these regulations in all state-owned buildings, specified state-occupied buildings, and state institutions. Facilities constructed or altered pursuant to these regulations shall be in compliance with the California Code of Regulations, Title 24 related to the design aspects of the fire and life safety (FLS) elements, components and systems.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

Reference - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

3-102. Scope. Title 24, California Code of Regulations (C.C.R.), known as the California Building Standards Code, designates building regulations that are applicable to the fire and life safety portions of the design, construction, reconstruction, rehabilitation, alteration or addition to any state-owned building, specified state-occupied buildings, and state institutions as defined in Article 3-2 Definitions. The term “specified state-occupied buildings” shall include all buildings, structures, appurtenances and related systems or facilities as defined in Section 13108 and Section 13146 of the Health and Safety Code, authorizing the Office of the State Fire Marshal (SFM) to carry out the functions and duties related to plan check, construction, use and inspections of the construction of state-owned buildings, specified state-occupied buildings, and state institutions.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

Reference - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

3-103. Authority for enforcement of regulations. All duties and functions that relate to the fire and life safety aspects of state-owned buildings, specified state-occupied buildings, and state institutions construction plan checking, and inspections have been vested by law in the Office of the State Fire Marshal.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

Reference - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

3-104. Application of building standards. Building standards applicable to state-owned buildings, specified state-occupied buildings, and state institutions are set forth in Parts 1, 2, 2.5, 3, 4, 5, 6, 8, 9, 10, 11 and 12, Title 24, C.C.R., and have been adopted as minimum design and construction standards upon which to base the approval of plans and specifications. These regulations shall not be construed to prevent the use of higher design standards or to restrict the use of new or

innovative design or construction techniques. Where the designer desires to use innovative design or construction techniques not addressed in these regulations it shall be necessary to submit for review and approval information including computations, test data and recommendations covering the design in question. The designer shall confer with the SFM concerning the applicability of these innovative design or construction techniques to construction of state-owned, specified state-occupied, and state institutions prior to the submittal of plans and specifications. SFM must be satisfied that the degree of safety achieved by these innovative design and construction techniques is at least equivalent to that achieved by the regulations. The determination of the equivalency of the degree of safety shall be the responsibility of SFM.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

Reference - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

3-105. Approval of construction, reconstruction, rehabilitation, alteration of or addition to any state-owned, specified state-occupied, and state institutions. Plans and specifications for any new state building or for the reconstruction, rehabilitation, alteration or addition to state buildings shall be submitted to SFM for approval as required by and in accordance with Health and Safety Code Sections 13108 through 13146.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

Reference - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921

ARTICLE 3-2
DEFINITIONS

PLANS. “Plans” as used in these regulations shall mean the drawings associated with the project, such as, but not limited to, specifications, vicinity maps, site plans, foundation plans, floor plans, ceiling plans, roof plans, cross-sections, interior elevations, exterior elevations and details that are used in conjunction with the project specifications, and that are necessary to accomplish construction in conformance with the requirements of the Health and Safety Code Section 13108.

SPECIAL INSPECTOR. A Special Inspector shall mean any person duly approved by the State Fire Marshal to perform construction inspections for a project.

SPECIFICATIONS. “Specifications” as used in these regulations shall mean the written document that is used in conjunction with the project plans to establish the job conditions, the quality and quantity of construction materials used in the project and the quality of workmanship required to accom-

plish the construction in conformance with the provisions of this Code.

SPECIFIED STATE-OCCUPIED BUILDINGS. Any building, structure or area that meets any of the following criteria:

1. A building where the state has contracted into a build-to-suit lease.
2. A courthouse holding facility or trial court with a detention area.
3. A building used by the Department of Corrections and Rehabilitation (CDCR) as a community correctional reentry center.
4. 100% state occupied.
5. State-occupied areas in a state-leased building that is a high-rise and is 75 percent of the net area floor space or more occupied by state entities.
6. State-occupied areas in a building that contains 5,000 square feet or more space of state-leased Group H or Group L occupancy.
7. A state-leased building with facilities with the primary purpose of housing state records and/or state artifacts of historical significance.
8. Properties leased by California State University (CSU) or University of California (UC).
9. State institutions and their real property.
10. CAL FIRE occupied areas in leased buildings.
11. State-leased facilities where the governing body's fire protection services rely on an all-volunteer fire department.

Except as provided in Items 1 through 11, buildings shall become the responsibility of the local jurisdiction.

Authority - Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921.

Reference - Health and Safety Code Sections 13108, 13143, 13145, 13146, 16022.5 and 17921.

STATE-OWNED BUILDING. A state-owned building shall mean any building owned by the state or a political subdivision thereof. A building or real property that is owned by or deeded to the state.

Authority: Health and Safety Code Sections 13108, 13108.5, 13114, 13143, 13143.2, 13143.6, 13145, 13146, 13210, 13211, 16022.5, 17921, 18949.2, Government Code Section 51189, Public Education Code 17074.50.

Reference(s): Health and Safety Code Sections 13108, 13143, 13145, 13146, 13211, 16022.5, 17921, 18949.2, Government Code Sections 51176, 51177, 51178 and 51179, Public Resources Code Sections 4201 through 4204.

HISTORY NOTE APPENDIX FOR CHAPTER 3

Administrative Regulations for the Office of the State Fire Marshal California Code of Regulations, Title 24, Part 1

HISTORY:

The history notes for prior changes remain within the text of this code.

1. (SFM 03/21) Adoption of administrative provisions in Chapter 3, Part 1. Approved by the California Building Standards Commission on January 18, 2022, filed with the Secretary of State on February 2, 2022, and effective on January 1, 2023.

CHAPTER 4

ADMINISTRATIVE REGULATIONS FOR THE DIVISION OF THE STATE ARCHITECT—STRUCTURAL SAFETY (DSA-SS)

ARTICLE 1 ESSENTIAL SERVICES BUILDINGS

4-201. Purpose. Essential services buildings constructed pursuant to these rules and regulations shall be designed and constructed to resist gravity forces, to minimize fire hazards and to resist, insofar as practical, the forces generated by winds and major earthquakes of the intensity and severity of the strongest anticipated at the building site without catastrophic collapse, but may experience some repairable architectural or structural damage. An essential services building as designed and constructed shall be capable of providing essential services to the public after a disaster. In addition, the equipment and other accessories that are necessary for the continued functioning of the essential services operation shall be anchored and braced to resist earthquake forces.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-202. Scope. These regulations apply to the administrative procedures concerning the construction, reconstruction, alteration of or addition to any essential services building under the jurisdiction of a city, city and county, county (including special fire districts) or the State of California.

When the enforcement agency is the Division of the State Architect (DSA) all parts of the *California Building Standards Code*, as contained in Title 24 of the California Code of Regulations and adopted by that agency designate the building regulations that shall apply to an essential services building. The term “essential services building” shall include all buildings, structures, appurtenances and related systems or facilities as defined in Section 4-207.

These rules and regulations establish reasonable standards and minimum requirements for the design and construction of an essential services building. An essential services building shall also be designed and constructed to conform to the regulations adopted by the California State Fire Marshal in Title 24, CCR, for the particular occupancy concerned.

When the enforcement agency is a local agency, the locally adopted editions of the model codes and the administrative regulations contained in Part 1 (Sections 4-201 through 4-222 and 4-243 through 4-249) Title 24, California Code of Regulations (CCR) designate the building regulations that shall apply to an essential services building. The term “essential services building” shall include all buildings, structures, appurtenances and related systems or facilities as defined in Section 4-207.

If the building standards and regulations adopted by the city, city and county or county agency responsible for building safety are more restrictive than those adopted in the applicable sections of Title 24, CCR, then the local building standards and regulations shall govern within its jurisdiction.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-203. Interpretation. No regulation shall be construed to deprive the enforcing agency of its right to exercise the powers conferred upon it by law or limit the enforcing agency in such enforcement as is necessary to secure the safety of construction as required in the Essential Services Seismic Safety Act (see “Act,” Section 4-207.)

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-204. Delegation of authority. Any powers, duties and responsibilities pursuant to carrying out the provisions of the Essential Services Buildings Seismic Safety Act for the State Architect may be delegated by the State Architect to the Chief Structural Engineer, Division of the State Architect, subject to the direction of the State Architect.

Those powers, duties and responsibilities so delegated may include the observation of the implementation and administration of the Act, the adoption in consultation with local jurisdictions of the regulations necessary for carrying out the provisions of the Act, providing advice and assistance to local jurisdictions in matters concerning the Act or these regulations and acting as an appeals agency relative to the administration of the Act.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16022.

4-205. Application of building standards. Building standards are set forth in Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12 of Title 24, CCR, and have been adopted as a basis for the approval of plans and specifications. These regulations shall not be construed to prevent the use of higher design standards nor to restrict the use of new or innovative design or construction techniques.

Where the designer desires to use innovative design or construction techniques not addressed in these regulations, it shall be necessary to submit for review and approval information including computations, test data and recommendations covering the design in question. The Division of the State Architect or local enforcement agency must be satisfied that the degree of safety achieved is equivalent to that achieved by the standards contained in Title 24, CCR. The enforcement agency review and approval of the innovative design or construction techniques shall precede the submission of plans and specifications utilizing these techniques.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-206. Approval of new essential services buildings. Plans and specifications shall be submitted to the appropriate enforcement agency for every new owned or leased essential services building before the plans are adopted by the governing board, authority, owner, corporation or other agency proposing to construct any essential services building.

Before any agency may convert an existing building into an essential services building, that agency shall submit plans

and specifications for the alteration of the building to the appropriate enforcement agency for approval. The plans shall provide for the alterations necessary for compliance with the requirements of these rules and regulations.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16011.

4-207. Definitions. The words defined in this section shall have the meaning stated therein throughout the rules and regulations contained in Part 1 (Administrative), Title 24, CCR.

ACT shall mean the Essential Services Buildings Seismic Safety Act of 1986, Sections 16000-16023, inclusive, of the Health and Safety Code.

ADDITION shall mean an increase in floor area or volume of enclosed space that is physically attached to an existing building by connections that are required for transmitting vertical or horizontal loads between the addition and the existing structure. The area exemption in Section 16010 of the Act does not apply to additions to essential services buildings when the total area of the existing building and the addition exceeds 2,000 square feet. An “addition” that is not required to be physically attached either for its own support or for support of the existing building shall be separated as required by Part 2, Title 24, CCR, and shall be deemed to be the construction of a new essential services building.

ALTERATION shall mean changes within an existing building as defined in Part 2, Title 24, CCR. Alterations to existing essential services buildings shall conform to the requirements of Title 24, CCR. Major alterations will be permitted, provided the entire essential services building as modified, including the structural alterations or additions, conforms to the requirements of Title 24, CCR, if the area of the existing building, including additions, exceeds 2,000 square feet.

APPROVED PLANS AND SPECIFICATIONS shall mean plans, specifications, addenda and construction change documents that have been duly approved by the appropriate enforcement agency pursuant to Sections 16013 and 16016 of the Health and Safety Code and that are identified by a stamp bearing the name of the enforcement agency, the identification number, the date and the signature of the qualified reviewer as required in Section 16011 of the Act.

COMPLYING BUILDING shall mean a building that has been constructed or reconstructed in accordance with these rules and regulations.

CONSTRUCTION CHANGE DOCUMENT shall mean a construction document submitted by the responsible project architect or registered engineer and approved by DSA depicting a change to the approved plans and/or specifications after the construction contract has been let.

DIVISION OF THE STATE ARCHITECT, or **DIVISION** or the initials DSA shall mean the Division of the State Architect in the Department of General Services, State of California.

ENFORCEMENT AGENCY shall mean the Division of the State Architect for state-owned or state-leased buildings and shall mean the enforcement agency of any city, county or city and county having jurisdiction over locally owned or locally leased essential services facilities.

ESSENTIAL SERVICES BUILDING means any building, or any building a portion of which is used or designed to be used as a fire station, police station, emergency operations center, California Highway Patrol office, sheriff’s office or emergency communication dispatch center.

EQUIPMENT shall mean all new or replacement equipment installed in any new or existing owned or leased building that is required for the functioning of the essential services operation. The installation of such equipment shall meet the support, bracing and anchorage requirements of Title 24, CCR. The area exemption in Section 16010 of the Act does not apply to the anchorage or bracing of equipment necessary to the operation of the essential services function.

FIRE STATION shall mean any building that contains the operational facilities, fire suppression, alarm and communications equipment necessary to respond to fire emergencies.

MAINTENANCE shall mean and include ordinary upkeep or repair work such as replacement in kind, repainting, replastering and reroofing.

NEW ESSENTIAL SERVICES BUILDING shall mean any newly erected essential services building or any existing building converted to essential services use subsequent to the effective date of the Act regardless of whether the building is owned or leased by the public agency. Existing buildings housing essential services facilities owned or leased by the state, a city, a city and county or a county prior to the effective date of the Act are exempt from these regulations. When a portion of a building is to be utilized for an essential services operation, the area so utilized and the utilities systems and components servicing the area shall be constructed according to these rules and regulations and shall be separated or protected from damage due to failures of other portions of the structure to the extent determined by the enforcement agency to insure continued functioning after an earthquake or other disaster. Ancillary buildings and facilities related to the essential services building function may be exempt from these regulations if the enforcement agency determines that such buildings and facilities are not necessary to the functioning of the essential services operation after an earthquake or other disaster.

NONSTRUCTURAL ALTERATIONS shall mean only such alterations that do not affect the safety of the essential services building and do not change, in any manner, its structural elements.

OWNER for the purposes of these regulations shall mean the public agency responsible for the essential services functions performed under its authority within an essential services building. The owner is responsible for applying for and obtaining the approvals and certifications required by these regulations.

PLANS as used in these regulations shall mean the drawings associated with the project such as, but not limited to, vicinity maps, site plans, foundation plans, floor plans, ceiling plans, roof plans, cross-sections, interior elevations, exterior elevations and details that are used in conjunction with the project specifications and that are necessary to accomplish construction in conformance with the requirements of the Act.

POLICE STATION shall mean any building that contains the operational facilities and the alarm and communications equipment necessary to respond to police emergencies. This definition shall include the offices of local police departments, county sheriffs, California Highway Patrol and all offices necessary to the functioning of the essential services operation after an earthquake or other disaster.

PROJECT INSPECTOR shall mean any individual duly approved by the enforcement agency as the on-site inspector for a particular project. The project inspector shall be employed and paid by the owner and shall act under the general direction of the architect or registered engineer in general responsible charge of the project and under the supervision of the enforcement agency. The project inspector shall be responsible for inspecting all work included in the construction contract, except for work that must be inspected by an approved special inspector. (See Section 4-211 (c) for special inspection.)

RECONSTRUCTION is the repair of damage to an existing complying essential services building or an alteration of an existing noncomplying building to bring it into conformance with the safety standards established by these regulations for essential services buildings.

REGISTERED ENGINEER as used in these regulations shall mean a structural engineer, civil engineer, mechanical engineer or electrical engineer holding a valid certificate under Chapter 7, Division 3, of the *California Business and Professions Code*.

SPECIFICATIONS as used in these regulations shall mean the written document that is used in conjunction with the project plans to establish the job conditions, the quality and quantity of construction materials used in the project and the quality of workmanship required to accomplish the construction in conformance with the provisions of the Act.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16003, 16011, 16018 and 16019.

4-208. Application for approval of drawings and specifications.

(a) Before adopting plans and specifications, the agency responsible for the essential services function shall submit an application to the appropriate enforcing agency for written approval of said plans and specifications except where the new construction is a Type V or Type II-B one-story structure that contains 2000 square feet or less of floor area and is not located in a special studies zone as defined in Section 2622 of the Public Resources Code.

(b) An architect, structural engineer or civil engineer may act as the agent for the essential services agency when filing the application for approval of plans and specifications.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16010, 16011 and 16015.

4-209. Designation of responsibilities.

(a) **General responsible charge.** For every essential services building project there shall be an architect, structural engineer or civil engineer in general responsible charge of plans, specifications and observation of construction, except

that plans, specifications and observation of construction may be under the responsible charge of a registered mechanical or electrical engineer for work involving only those respective branches of engineering. A project may be divided into parts, provided that each part is clearly defined by a building or similar distinct unit. The part, so defined, shall include all portions and utility systems or facilities necessary to the complete functioning of that part. Separate assignments of general responsible charge may be made for the parts.

(b) **Delegation of responsibility.** The architect, structural engineer or civil engineer in general responsible charge may delegate responsibility for any portion of the work to, or may employ, or retain other architects, structural engineers or civil engineers. Registered mechanical and electrical engineers may be delegated responsibility for the mechanical and electrical portions of the work, respectively.

(c) **Evidence of responsibility.** The stamp and signature of the architect or registered engineer on a plan, specification or other document shall be deemed evidence that full responsibility is assumed by the signator for the work shown thereon, including also those portions of the accompanying computations, specifications or plans that pertain to such work.

(d) **Alternates.** The applicant, or the architect or registered engineer having general or delegated responsibility, may name one or more persons to act as alternate(s) for the design and/or observations of the work of construction, provided such persons are architects or registered engineers who themselves are qualified under these regulations to assume the responsibility assigned.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16011, 16012 and 16015.

4-210. Plans, specifications, computations and other data.

(a) **General.** When an application is filed, it shall be accompanied by the required number of complete sets of the plans and specifications, the complete structural design calculations, site data and a fee as established by the enforcement agency.

(b) **Plans.** Plans shall show the use or occupancy of all parts of the essential services buildings and shall give such other information as may be required to indicate the nature of the work proposed and to show compliance with the act and these regulations. The drawings shall be legible and sufficiently detailed and cross-referenced to show clearly the pertinent features of the construction, and shall have sufficient dimensions to be readily interpreted. Where a project includes several buildings, the plans for each shall be drawn independently except that details common to all need not be repeated. Submitted plans and specifications that are obviously incomplete or incorrect shall be returned to the architect or registered engineer in general responsible charge with a request for compliance with these regulations before checking is begun or resumed by the enforcement agency.

(c) **Specifications.** Specifications shall completely set forth the requirements for the various types of materials that will enter into the permanent construction and shall describe the methods not covered in the technical regulations that are

to be used to obtain the required quality of the work shown on the plans.

(d) **Design computations.** Computations, stress diagrams and other pertinent data shall accompany the plans and specifications and shall be sufficiently complete so that calculations for individual structural members can be readily interpreted. The computations shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the proposed essential services building will resist vertical loads and horizontal forces. The computations shall be sufficiently complete to establish that the structure will resist the loads and forces prescribed in Part 2, Title 24, CCR. Assumed safe bearing pressures on soils and specified strengths of concrete shall be given in the computations and noted on the plans. Where unusual conditions occur, such additional data as are pertinent to the work shall be submitted.

(e) **Site data.** Site data for all essential services buildings covered by these regulations shall include a soil investigation report providing information on subsurface site work and laboratory testing, an evaluation of site soil conditions, a recommendation for the type of foundation to be used and an allowable design value for the soil bearing capacity. For all essential services building sites not exempted from the provisions of the Act, a geologic and earthquake hazard report including an evaluation of both known and potentially active local and regional fault systems, slope stability, liquefaction potential and other hazards shall be prepared by competent persons and submitted with the application, plans and specifications. All or parts of the geologic and earthquake hazard investigation and report may be waived by the enforcement agency when in the judgment of the enforcement agency those requirements are unnecessary and would not be beneficial to public safety.

(f) **Signatures required.** All plans and specifications submitted for approval shall bear the stamp and signature of the architect or professional engineer in general responsible charge of design. When responsibility for a portion of the work has been delegated, the plans and specifications covering that portion of design shall also bear the stamp and signature of the responsible registered engineer or architect.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16011, 16012, 16013 and 16014.

4-211. Observation and inspection of construction.

(a) **Observation by architect or registered engineer.** The Act provides that the observation of the work of construction, reconstruction, alteration or addition shall be under the general responsible charge of an architect, structural engineer, civil engineer or, under certain conditions, a registered mechanical or electrical engineer for work involving only those respective branches of engineering. A geotechnical engineer shall provide the observation for placement of fills and shall submit a verified report attesting to the compliance of the engineered fill.

(b) **Inspection by project inspector.** The owner must provide for and require competent, adequate and continuous inspection of all construction work by a project inspector

approved for each individual project by the enforcement agency. The project inspector so approved shall cooperate with the architect or registered engineer in general responsible charge of the observation of the work of construction to ensure compliance with the approved drawings and specifications. The project inspector shall request interpretations and clarifications of the approved contract drawings and specifications when necessary from the responsible architect or registered engineer.

For every project there shall be a project inspector who shall have personal knowledge as defined in Section 16021 of the Health and Safety Code of all work done on the project or its parts. On large projects adequate inspection may require the employment of one or more approved assistant inspectors. The employment of special inspectors or assistant inspectors shall not be construed as relieving the project inspector of his/her duties and responsibilities under Sections 4-214 and 4-219 of these regulations. The project inspector shall, under the direction of the architect or engineer, be responsible for monitoring the work of the special inspectors and testing laboratories to ensure that the special inspection and testing program is satisfactorily completed.

No work shall be carried out except under the inspection of the project inspector approved by the enforcement agency. The project inspector shall have had at least three years equivalent experience in construction work of a type similar to that for which he/she is proposed as inspector, shall have a thorough knowledge of building materials and shall be able to read and interpret plans and specifications.

The cost of project inspection shall be paid for by the owner (see "Project Inspector" definition in Section 4-207).

(c) **Special inspection.** Special inspection by inspectors specially approved by the enforcement agency may be required for masonry construction, glued laminated timber fabrication, wood framing using timber connectors, concrete batching, shotcrete, prestressed concrete, structural steel fabrication, high-strength steel bolt installations, welding, pile driving, electrical work or mechanical work. The cost of all special inspectors required by this section shall be paid for by the owner.

The project inspector may perform special inspections if the project inspector has been specially approved for such purposes and has the time available to complete the special inspections in addition to project inspection work.

The detailed inspection of all work covered by this section is the responsibility of the project inspector when special inspection is not provided. The enforcement agency may require special inspection for shop fabrication procedures that preclude the complete inspection of the work after assembly. The enforcement agency may require special inspection at the site in addition to those listed above if found necessary because of the special use of material or methods of construction.

Approved special inspectors shall submit verified reports as required by Section 4-214, for the special work covered. Special inspectors shall periodically submit reports of inspections to the enforcement agency, the architect, the registered engineer responsible for the observation of structural work

and the project inspector. Construction work that the special inspector finds not to be in compliance with the approved plans and specifications, and that is not immediately corrected upon notifying the contractor, shall be reported immediately to the project inspector, the enforcement agency, the architect and the registered engineer responsible for observation of the structural work.

Authority: Health and Safety Code Sections 16017 and 16022.

Reference: Health and Safety Code Sections 16015, 16017, 16020 and 16021.

4-212. Supervision of construction by the enforcement agency. During the construction, reconstruction, repair, alteration of or addition to any essential services building, the enforcement agency as provided in the Act, shall make such site visits and observations as in its judgment is necessary or proper for enforcement of the Act and the protection of the safety of the occupants of the building and the public. If at any time as the work progresses it is found that modifications or changes are necessary to achieve compliance with building standards, the enforcement agency shall direct the architect or registered engineer in general responsible charge to prepare and submit documents covering such modifications or changes for the review and approval of the enforcement agency.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16001, 16009 and 16020.

4-213. Tests.

(a) **General.** Tests of materials are required as set forth in the approved plans and specifications and in Part 2, Title 24, CCR. Where job conditions warrant, the architect or registered engineer may waive certain tests with the approval of the enforcement agency. A list of all required tests of materials and of all required special inspections shall be prepared and submitted by the architect, structural engineer, or civil engineer in general responsible charge of the project at the time the plans and specifications are stamped for identification by the enforcement agency.

(b) **Test sampling.** Test samples or specimens of material for testing may be taken by the architect or registered engineer, the architect’s or engineer’s representative, the project inspector or a representative of the testing agency. In no case shall the contractor, his employee or a vendor select the samples or specimens.

(c) **Test reports.** One copy of all test reports shall be forwarded by the testing agency to the enforcement agency, the architect, the registered engineer responsible for observation of the structural work and the project inspector. Such reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or unsatisfactory. Records of special sampling operations shall also be reported. The reports shall show that the material or materials were sampled and tested in accordance with the requirements of these regulations and with the approved plans and specifications. In the case of masonry or concrete, test reports shall show the specified design strength. Test reports shall also state whether or not the material or materials tested comply with the requirements of the approved plans and specifications.

(d) **Verification of test reports.** Each testing agency shall submit to the enforcement agency a verified report,

covering all tests and inspections that were required to be performed as of the date that work on the project is suspended or the services of the testing laboratory are terminated, and at the completion of the project, covering all of required tests and inspections. The verified report shall be signed, under penalty of perjury, by the professional engineer charged with engineering managerial responsibility for the laboratory. The verified report shall indicate that all tests and inspections were made as required by the approved plans and specifications, and shall list any noncompliant tests or inspections that have not been resolved by the date of the verified report. In the event that not all required tests or inspections were made by the laboratory making this verified report, those tests and inspections not made shall be listed on the verified report.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16020 and 16021.

4-214. Verified reports. Sections 16020 and 16021 of the Act require that from time to time as the work of construction progresses, the architect or registered engineer in charge of observation of the work, each architect or registered engineer delegated responsibility for observation of a portion of the work, the project inspector, approved special inspectors and the contractor shall each make and sign under penalty of perjury, a duly verified report to the enforcement agency upon a prescribed form or forms, showing that of his or her own personal knowledge the work during the period covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved plans and specifications, and setting forth such detailed statement of fact as shall be required.

The term “personal knowledge” as applied to an architect or registered engineer means the personal knowledge that is obtained from periodic visits of reasonable frequency to the project site for the purpose of general observation of the work, and that is obtained from the reporting of others on the progress of the work, testing of materials, inspection and superintendence of the work. The exercise of reasonable diligence to obtain the facts is required.

The term “personal knowledge” as applied to an inspector means the actual personal knowledge that is obtained from the inspector’s personal continuous inspection of the work in all stages of its progress. For work performed away from the site, the project inspector may obtain personal knowledge from the reporting of testing or special inspection of materials and workmanship for compliance with approved plans, specifications and applicable standards. The exercise of reasonable diligence to obtain the facts is required.

The term “personal knowledge” as applied to the contractor means the personal knowledge gained from constructing the building. The exercise of reasonable diligence to obtain the facts is required.

See Article 2, Section 4-240 and Article 3, Section 4-249 for the reporting requirements to state and local enforcement agencies, respectively.

Authority: Health and Safety Code Sections 16020, 16021 and 16022.

Reference: Health and Safety Code Sections 16020 and 16021.

4-215. Changes in the approved drawings and specifications.

(a) **General.** All work shall be executed in accordance with the approved plans and specifications except where documents authorizing changes have been submitted by the responsible architect or registered engineer to the enforcement agency for review and approval. These documents shall describe the authorized changes, show the increase or decrease in the contract cost involved and shall contain the signatures of the responsible architect or registered engineer and the owner and shall bear the approval stamp of the enforcement agency.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16011, 16013 and 16015.

4-216. Final certification of compliance. The certification of compliance for the essential services building shall be issued by the enforcement agency when the project has been completed in accordance with the requirements as to safety of design and construction with Sections 16000-16023 of the Health and Safety Code (Essential Services Buildings Seismic Safety Act) and with the requirements of these regulations. The certification of compliance will be evidenced by a letter or a certificate of occupancy each of which shall contain a statement that the building design and review and the work of construction have been completed in accordance with the requirements of Sections 16000 through 16023 of the Health and Safety Code and of Part 1, Title 24, CCR. The certificate of compliance will be directed to the owner of the essential services building.

Local enforcement agencies shall forward one copy of the certification of compliance to the DSA Headquarters Office in Sacramento.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009 and 16022.

4-217. Duties of the architect and registered engineers.

(a) **General.** The architect or registered engineer is responsible to the owner and to the enforcement agency to see that the completed work conforms in every material respect to these regulations and the approved plans and specifications. The architect or registered engineer may, if so authorized, act as agent for the owner in completing and submitting the application to the enforcement agency.

The architect or registered engineer, in no way, is relieved of any responsibility by the activities of the enforcement agency in the performance of its duties.

(b) **General responsible charge.** The architect or registered engineer in general responsible charge shall advise the owner in regard to filing of the application for approval of plans, the selection of a project inspector and the selection of a testing laboratory. The architect or registered engineer shall prepare the plans, specifications, design computations and other data and shall prepare documents authorizing changes in the approved drawings and specifications when so directed by the owner or as required by conditions on the project. The architect or registered engineer shall make, or cause to be made, the corrections required on the various documents to

comply with the requirements of these regulations and shall provide the project inspector and testing agency with a complete set of stamped plans, specifications and documents authorizing changes.

The enforcement agency directs all technical correspondence to the architect or registered engineer in general responsible charge of the project.

(c) **Architect or engineer verified reports.** All architects and registered engineers having responsibility for observation of the work of construction shall maintain such personal contact with the project as is necessary to assure themselves of compliance in every material respect with the approved plans and specifications and shall submit verified reports to the enforcement agency as required in Section 4-214. The architect or registered engineer in general responsible charge shall be responsible for the timely submittal of the required verified reports from the project inspector, the contractor and any other architects or engineers who have been delegated responsibility for observation of the work.

(d) **Testing program.** The architect or registered engineer in general responsible charge shall establish the extent of the testing of materials consistent with the needs of the particular project and shall issue specific instructions to the testing agency. The architect or registered engineer shall also notify the enforcement agency as to the disposition of materials noted on laboratory reports as not conforming to the approved plans and specifications.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16015 and 16020.

4-218. Duties of the mechanical and electrical engineers.

The architect, structural engineer or civil engineer in general responsible charge retains overall responsibility for the mechanical and electrical portions of the work when the design responsibility for that work has been delegated and the plans have been prepared by registered mechanical and electrical engineers.

Where plans, specifications and estimates for alterations or repairs only involve mechanical or electrical work, said plans, specifications and estimates may be prepared and the work of construction observed by a registered mechanical or electrical engineer, respectively, who shall be in general responsible charge.

The mechanical or electrical engineer shall fulfill the duties outlined in Section 4-217 when assuming general responsible charge and shall submit verified reports as required in Section 4-214. When accepting delegated responsibility, the mechanical or electrical engineer shall comply with the requirements of Sections 4-209 and 4-210 insofar as these may relate to the delegated work.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16015.

4-219. Duties of the project inspector.

(a) **General.** The project inspector shall act under the general direction of the architect or registered engineer and under the supervision of the enforcement agency.

(b) **Duties.** The general duties of the project inspector in fulfilling project inspection responsibilities are as follows:

1. **Continuous inspection requirements.** The project inspector must have actual personal knowledge obtained by personal and continuous inspection of the work of construction in all stages of its progress that the requirements of the approved plans and specifications are being executed.

Continuous inspection means complete inspection of every part of the work. Work, such as concrete work or masonry work that can be inspected only as it is placed, shall require the constant presence of the project inspector. Other types of work that can be completely inspected after the work is installed may be carried on while the project inspector is not present. In any case, the project inspector must personally inspect every part of the work. In no case shall the project inspector have or assume any duties that will prevent him or her from providing continuous inspection.

The project inspector may obtain personal knowledge of the work of construction, either on-site or off-site, from the inspections performed by special inspectors or approved assistant inspectors and from the reporting of others on testing and inspection of materials and workmanship for compliance with the plans, specifications and applicable standards. The exercise of reasonable diligence to obtain the facts shall be required.

2. **Relations with the architect or engineer.** The project inspector shall work under the general direction of the architect or registered engineer. Any uncertainties in the inspector's comprehension of the plans and specifications shall be reported promptly to the architect or registered engineer for his/her interpretation and instructions. In no case shall the instructions of the architect or registered engineer be construed to cause work to be done that is not in conformity with the approved plans, specifications and documents authorizing changes.
3. **Job file.** The project inspector shall keep a file of approved plans and specifications (including all approved documents authorizing changes) on the job at all times.
4. **Construction procedure records.** The project inspector shall keep a record of certain construction procedures including, but not limited to the following:
 - A. Concrete pouring operations. The records show the time and date of placing concrete and the time and date of removal of forms in each portion of the structure.
 - B. Welding operations. The record shall include identification marks of welders, lists of defective welds, manner of correction of defects, etc.
 - C. Penetration under the last ten (10) blows for each pile when piles are driven for foundations.

All such records of construction procedures shall be kept on the job until the completion of the work. These

records shall be made a part of the permanent records of the owner.

5. **Deviations.** The project inspector shall notify the contractor, in writing, of any deviations from the approved plans and specifications that are not immediately corrected by the contractor when brought to the contractor's attention. Copies of such notice shall be forwarded immediately to the architect or registered engineer and to the enforcement agency.

Failure on the part of the project inspector to notify the contractor of deviations from the approved plans and specifications shall in no way relieve the contractor of any responsibility to complete the work covered by his or her contract in accordance with the approved plans and specifications and all laws and regulations.

6. **Verified reports.** The project inspector shall submit to the enforcement agency verified reports as required in Section 4-214.

(c) **Violations.** Failure, refusal or neglect on the part of the project inspector to notify the contractor of any work that does not comply with the requirements of the approved plans and specifications, or failure, refusal or neglect to report immediately, in writing any such violation to the architect or registered engineer, to the owner and to the enforcement agency shall constitute a violation of the Act and shall be cause for the enforcement agency to take action, which may result in withdrawal of the inspector's approval.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16017 and 16021.

4-220. Duties of the contractor.

(a) **Responsibilities.** It is the duty of the contractor to complete the work covered by his or her contract in accordance with the approved plans and specifications therefore. The contractor in no way is relieved of any responsibility by the activities of the architect, registered engineer, project inspector or the enforcement agency in the performance of their duties.

(b) **Performance of the work.** The contractor shall study carefully the approved plans and specifications and shall plan his schedule of operations well ahead of time. If at any time it is discovered the work is being done that is not in accordance with the approved plans and specifications, the contractor shall correct the work immediately.

All inconsistencies or items that appear to be in error in the plans and specifications shall be promptly called to the attention of the architect or registered engineer, through the project inspector, for interpretation or correction. In no case, however, shall the instruction of the architect or registered engineer be construed to cause work to be done that is not in conformity with the approved plans, specifications, construction change documents and standards.

The contractor must notify the project inspector, in advance, of the commencement of construction of each and every aspect of the work.

(c) **Verified reports.** The contractor shall make and submit to the enforcement agency from time to time, verified reports as required in Section 4-214.

If work on the building is being done by independent contractors having contracts with the owner, verified reports shall be submitted by each contractor regardless of the type of work involved.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16021.

4-221. Records. DSA shall maintain a record of the approved plans, specifications, addenda, construction change documents and letters of certification for state-owned or state-leased essential services buildings that have been certified as complying with the provisions of the Act. DSA shall also maintain a record of the letters of compliance for essential services buildings built under the jurisdiction of local enforcement agencies that have been submitted to DSA by those agencies.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16022.

4-222. Advisory board.

(a) **General.** The State Architect may appoint an advisory board whose duty it is to serve in an advisory capacity to DSA in connection with administrative matters and with reference to regulations and requirements pertaining to the administration of the Act. This board shall also act as a board of review to which appeal can be made by owners, architects, engineers or other interested parties in case of disagreement with the interpretation by the local enforcement agencies and/or local appeals board of the Essential Services Buildings Seismic Safety Act or the regulations adopted pursuant thereto. For state agencies, the Advisory Board shall act as an appeals board for disagreements with the rulings, decisions, interpretations or acts of DSA.

(b) **Membership.** The said board shall consist of nine members appointed by the State Architect and four ex-officio members who are: State Architect, the Chief Structural Engineer of DSA, the California State Fire Marshal, the Executive Director of the Building Standards Commission and the Chairman of the Seismic Safety Commission. The ex-officio board members may appoint alternates to serve on the board as their representatives. Of the appointive members, one shall be an architect, one shall be a structural engineer, one shall be a civil engineer, one shall be a mechanical engineer or an electrical engineer, one shall be a representative of the League of California Cities, one shall be a representative of the County Supervisors Association, one shall be a representative of the California Building Officials, one shall be a representative of the California Fire Chiefs Association and one shall be a representative of a law enforcement agency. The appointive members shall serve at the pleasure of the State Architect. The State Architect will select appointive members from nominations solicited from the California Council, American Institute of Architects, the Structural Engineers Association of California, the Consulting Engineers and Land Surveyors Association of California, the California Building Officials, the League of California Cities, the County Supervisors Association, the California Peace Officers Association and from the California Fire Chiefs Association. The State Architect may also appoint additional ex-officio members. Ex-officio members are not entitled to vote in board actions.

(c) **Meetings.** The board shall elect its own chairperson and vice-chairperson and shall convene upon the call of the chairperson or the State Architect whenever it may be necessary in the chairperson’s or State Architect’s judgment for the board to meet. The board shall adopt such rules of procedure as are necessary to enable it to perform the obligations delegated to it. The chairperson of the board shall at his or her discretion or upon the instruction of the board designate subcommittees to study and report back to the board on any technical subject or matter for which an independent study is desired or regarding appeals that are made to the board from interpretations of the enforcement agencies. The board members will be reimbursed for their reasonable expenses in attending meetings but shall receive no compensation for their services.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16022.

**ARTICLE 2
STATE BUILDINGS**

4-223. General. The provisions of Article 1 and Article 2 of these regulations shall apply to state-owned or state-leased essential services buildings. Article 2 requirements do not apply to essential services buildings under the jurisdiction of local enforcement agencies.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-224. Application for DSA approval of drawings and specifications.

(a) The written approval of drawings and specifications shall consist of a letter issued by DSA when the procedures of Section 4-229 of these regulations are completed.

(b) The agency responsible for the essential services function shall submit an application, for the approval of drawings and specifications to DSA. A separate application shall be submitted for each essential services building or group of buildings on each site. Applications shall be submitted to DSA on Form DSA-1, Application for Approval of Plans and Specifications. DSA forms are available on the Internet at www.dgs.ca.gov/dsa, or at any of the DSA regional offices.

(c) The application shall contain a project name and location of the essential services building or buildings, the name of the architect or registered engineer in general responsible charge of the work, the names of the architects or registered engineers who have been delegated responsibility for portions of the work (see Section 4-209), the estimated cost of the project and all such other information as is requested on Form DSA-1 Application for Approval of Plans and Specifications.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16001 and 16011.

4-225. Designation of responsibility. In addition to the requirements of Section 4-209, Article 1 of these regulations, the following provisions shall apply;

(a) **Delegation of responsibility.** The architect, structural engineer or civil engineer in general responsible charge shall employ or retain, under his/her supervision, registered

mechanical and electrical engineers to design and observe the construction of the mechanical and electrical portions of the work when these elements are significant to the safety of the building or its occupants or the continuing functioning of the building. The requirement for observation of construction of the mechanical and electrical portions of the work by the mechanical and electrical engineers may be waived where the mechanical and electrical elements are not considered to be significant to the safety of the building or its occupants or its continuing functioning and when special mechanical and electrical inspection in accordance with Section 4-211 is provided.

No delegation to or employment or retention of others shall be construed as relieving the architect, structural engineer or civil engineer in general responsible charge of his/her rights, duties and responsibilities under Section 16015 of the Act and Section 4-217 of these regulations.

(b) **Assumption of responsibility.** The architect, structural engineer or civil engineer who submits for approval plans and specifications for any project or any portion of any project that have been prepared by others shall assume responsibility for the safety of design of the completed construction and for the interpretation of and any necessary amplification of the plans and specifications of the project. He/she shall stamp and sign all plans submitted for approval to indicate his/her assumption of responsibility or may, in lieu thereof, stamp and sign, and submit plans prepared under his/her own charge. (See Section 4-210 for other signatures.) When an architect, structural engineer or civil engineer accepts the responsibility for completion of a project or a portion of a project relinquished by another, that architect, structural engineer or civil engineer thereby assumes responsibility as follows:

1. If the relinquishment occurs prior to the completion of the design documents, all responsibility shall be assumed. [See Section 4-225 (c) for the procedure.]
2. If the relinquishment occurs after the design drawings and specifications have been completed and approved by the enforcement agency, the assuming architect or registered engineer shall be responsible for the construction of the project in accordance with the design of the relinquishing architect or engineer. The assuming architect or registered engineer shall assume responsibility for the interpretation of and any necessary amplification of the plans and specifications and shall stamp and sign any such documents prepared for that purpose.

(c) **Acceptance of responsibility.** The assumption of general responsible charge or of delegated responsibility shall be clearly outlined, accepted and approved by the parties concerned including the owner. The enforcement agency shall be notified when any change is made in the individuals in general responsible charge or delegated responsible charge.

Form DSA-1, Application for Approval of Plans and Specifications, provides for the delegation of responsibility, but for unusual cases, or for changes in responsibility taking place after the plans have been submitted for approval, the delegation of responsibility, acceptances and approvals

thereof, shall be submitted in letter form, which shall include an indication that the owner has been notified.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16011 and 16015.

4-226. Alternates in general responsible charge or delegated responsible charge. Alternates may be named on Form DSA-1, Application for Approval of Plans and Specifications, or in letter form. Letter forms shall be submitted to DSA prior to performance of work by the alternate and shall include an indication that the owner has been notified.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16015.

4-227. Estimate of cost. Estimates of cost shall be based on the cost of construction prevailing at the time the plans and specifications for the project are submitted to DSA. The estimated cost of a project shall be increased as necessary to include the estimated cost of every alternate building or portion thereof shown on the plans and specifications as if each alternate building and portion were to be constructed separately and simultaneously.

When a contract amount, or the cumulative total of two or more contract amounts, exceeds the estimated cost by more than 30 percent, the estimated cost shall be revised. An additional fee based on the contract amount shall be paid before proceeding with the work. When the actual cost of constructing all the work shown on the approved plans is less than 70 percent of the estimated cost, a refund of overpaid fees may be claimed. (See Section 4-232 for actual cost.)

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009 and 16011.

4-228. Procedure for approval of application and voidance of application.

(a) **General.** After DSA has completed its review of the documents submitted with the application, the checked prints of the plans and specifications with the requests for corrections and/or additional information noted thereon shall be returned to the responsible architect or registered engineer. When plans and/or specifications require extensive corrections, a corrected set of prints of the plans and specifications shall be submitted for review if requested by DSA.

When the requested corrections have been made and/or the additional information as requested has been provided by the responsible architect or registered engineer, an employee representative of the architect or registered engineer shall return the check set of plans and specifications along with the original plan tracings, the corrected specification pages and specification master cover sheet to DSA for backchecking. The backcheck is a comparison of the corrected plans and specifications with the check set of plans and specifications and shall be accomplished either by a conference at the DSA office between the architect or registered engineer or his/her employee representative and the checking engineer or by mail in the case of minor corrections to which all parties have agreed.

Changes in plans and specifications, other than changes necessary for correction, made after submission for approval shall be brought to the attention of DSA in writing or by sub-

mission of revised plans identifying those changes clearly at the time of back-checking. Failure to give such notice may result in the voidance of any subsequent approval given to the plans and specifications.

All requested corrections shall be made, additional requested information furnished or original designs justified and a list of materials to be tested and special inspections to be made shall be supplied to DSA at the time of backcheck. When DSA deems that the corrected plans and specifications comply with these regulations and all parts of Title 24, CCR, that pertain to essential services building construction, DSA shall place its stamp of identification on the reproducible sheets of drawings and master cover sheet of the specifications. This stamp is affixed for purposes of identification only and shall not be construed as authorization to let the construction contracts.

One set of prints of the stamped plans and specifications shall be submitted to DSA. The submittal of the stamped prints of the plans and specifications is required before DSA will issue the written notice of approval of the application.

(b) **Approval of the application.** DSA shall issue to the owner of the essential services building a letter approving the application for the project upon receipt of the stamped copies of the approved plans and specifications. This letter shall constitute the approval of drawings and specifications as required by Section 16016 of the Health and Safety Code. No construction or fabrication work on an essential services building project shall commence until this approval in writing has been obtained.

DSA will retain one set of the stamped plans and specifications and other pertinent project information in its files as a permanent record of the compliance of the approved project documents.

(c) **Voidance of the application.** Any change, erasure, alteration or modification of any plans or specifications bearing the identification stamp of DSA may result in voidance of the approval of the application. However, the “written approval of plans” may be extended by DSA to include revised plans and specifications after documents are submitted for review and approved. (See Section 4-233 for revised plans and Section 4-215 for addenda and construction change documents.)

The procedures leading to written approval of plans shall be carried to conclusion without suspension or unnecessary delay. The application shall be void where either (1) prints from corrected plans or corrected original plans are not filed for backcheck and the backcheck is not completed within six months after the date of return of the checked plans to the architect or registered engineer, or (2) prints of the stamped plans and one set of the stamped specifications are not submitted to DSA files within two months after the date shown on the stamp of identification.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16011 and 16013.

4-229. Deferred approvals. Where a portion of the construction cannot be adequately detailed on the approved plans because of variations in product design and manufacture, the

approval of plans for such portion, when specifically accepted by the enforcement agency, may be deferred until the material suppliers are selected provided the following conditions are met:

- (a) The project plans clearly indicate that a deferred approval by the enforcement agency prior to the fabrication and installation is required for the indicated portions of the work.
- (b) The project plans and specifications adequately describe the performance and loading criteria for such work.
- (c) An architect or registered engineer stamps and signs the plans and specifications for the deferred approval items. The architect or engineer in general responsible charge of the design of the project shall submit the plans and specifications for the deferred approval item to the enforcement agency, with notation indicating that the deferred approval documents have been found to be in general conformance with the design of the building.
- (d) Deferred approval shall not apply to the requirements of Section 4-210 (b), (c) and (d) with regard to the vertical and lateral load resisting systems and elements of the building. The plans, details, specifications and computations for the structural portions of the building shall provide sufficient information to permit a complete review when the project is submitted.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16011, 16012, 16013 and 16014.

4-230. Withdrawal of application. If a request is made by the owner of an essential services building for cancellation of the application and return of the plans and specifications, together with the fee paid, it will be granted only when the review of plans and specifications has not actually started. If the review of the plans and specifications has started, 30 percent of the paid fee will be refunded or applied to a new application for the same project.

No refund will be allowed for projects upon which only the minimum fee has been paid. No refund will be allowed after a contract has been let for any portion of the work except as provided in Section 4-228.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16009.

4-231. Fees. The filing fee required by DSA to accompany the submittal of project plans and specifications for essential services buildings shall be one and one-half percent (1.5%) of the first \$1,000,000 of estimated cost and one and one-quarter percent (1.25%) of the excess of the estimated cost over \$1,000,000 except that the minimum filing fee for any project shall be \$250.

The words “filing fee” mean the fee that must accompany the application and the words “further fee” mean the fee that shall be paid to DSA if the actual cost exceeds the estimated cost by more than 5 percent.

The application for an essential services building is considered received when it, accompanied by the plans and specifications, structural design computations, site data and filing fee has been received by DSA and an application number has been assigned.

An Essential Services Building Account is hereby established in the Architecture Public Fund for the purpose of crediting the application fees paid by state agencies into the state treasury.

Authority: Health and Safety Code Sections 16022 and 16023.

Reference: Health and Safety Code Sections 16006, 16007 and 16009.

4-232. Project cost. For purposes of determining fees, both the estimated and actual costs of the project shall be the total outlay for all work included in the approved plans and specifications (exclusive of fees paid, but not recovered, for architectural engineering, inspection and testing services) regardless of whether the funds are provided by the state, local government authorities or agencies, or by private groups or individuals. In the event a building is converted to essential services building use, the cost shall include the value of the building. If work is done in portions, the actual cost shall be determined at the completion of each contract.

The estimated cost and the fee based thereon shall not be amended after plan check has started except as provided by Section 4-227 or for a permissible increase in the scope of the project. The scope of the project shall not be amended after bids for all or part of the project are opened. No portion of the fee can be returned after checking has started except as provided by Sections 4-227 and 4-230.

Actual project cost shall include all items that are normally considered to be contractor's operation costs such as owner furnished labor and materials, bond insurance and use of owner's facilities and shall not be reduced by chargebacks such as those for testing, inspection or overrun of contract time. All fees and/or reimbursable charges paid the construction managers shall be included in the actual cost of construction. When the contract for the work includes items not otherwise subject to the approval of DSA and not included in the approved plans and specifications, the actual cost shall include this work unless such costs are segregated bid items or by separately priced items of change orders, or by certified copy of a subcontractor's bid. Such segregation shall not be made by contract price breakdown or estimates.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009 and 16011.

4-233. Revisions of plans and specifications.

(a) **General.** No additional fee is charged upon submission of revisions to the approved plans and specifications, provided that the entire matter is actually one transaction having to do with the same essential services building and the revisions do not require substantial review for safety of design. If the original plans are abandoned and the plans and specifications submitted in lieu thereof are in fact for a new project rather than an identical building or where a modified set of plans is for an essentially different structural concept, it is necessary that a new application be filed and fee paid. This is

regardless of the fact that the building may have the same name, be of the same general size and be situated at the same location as the essential services building for which the original application was submitted.

(b) **Addenda.** Changes or alterations of the approved plans or specifications prior to letting a construction contract for the work involved shall be made by means of addenda. Addenda shall be stamped and signed by the architect or registered engineer in general responsible charge of preparation of the plans and specifications, and by the architect or registered engineer delegated responsibility for the portion affected by the addenda. Addenda shall be submitted to DSA for review and approval and as such become part of the approved contract documents.

(c) **Construction change documents.** Changes or alterations of the approved plans or specifications after a contract for the work has been let shall be made by means of construction change documents. Construction change documents shall state the reason for the change and shall be accompanied by supplementary drawings and calculations where necessary. All construction change documents shall be stamped and signed by the architect or registered engineer in general responsible charge of the work of construction of the project, and by the architect or registered engineer delegated responsibility for observation of the portion of the work of construction affected by the construction change documents. Construction change documents shall be submitted to DSA for review and approval and as such become part of the approved contract documents.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16009.

4-234. Billing for further fees. The owner shall be billed for further fees upon completion of the project or portion thereof if fee is due. Claims for refunds of five dollars or less due to errors in cost reporting or fee computation shall be made within six months from the date of filing.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16009.

4-235. Time of beginning construction and partial construction. Construction work whether for a new essential services building, or for a reconstruction, alteration or addition project for an essential services building, shall not be commenced, and no contract shall be let until the owner has applied for and obtained from DSA the required written approval of plans and specifications. Construction of all work shown in the approved plans and specifications shall be commenced within one year after the approval of the application; otherwise the approval of the part not commenced shall be void unless DSA has been notified and an extension of the approval has been granted. DSA may require that the plans and specifications be revised to meet its current regulations before a renewal of the voided approval is granted. Renewal shall not be granted after a period of four years beyond the date of the application approval.

State agencies may complete all work or proceed with construction of any part of the work included in the approved

plans and specifications with the intent of completing the work later.

All work done and materials used and installed must be in accordance with and in conformity to the approved plans and specifications. DSA shall be notified whenever work is being carried on and failure to give such notice may result in voidance of the approval of the plans and specifications.

An uncompleted building shall not be construed as having been constructed under the provisions of the Essential Services Building Seismic Safety Act.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16016.

4-236. Notice of start of construction. The architect or registered engineer responsible for the project shall give DSA written notification before construction is to be started. As soon as a contract has been let, the architect or registered engineer shall furnish to DSA on Form DSA-102, Contract Information, the name of the contractor, the contract price and the date of starting of construction. DSA forms are available on the Internet at www.dgs.ca.gov/dsa, or at any of the DSA regional offices.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16016.

4-237. Notice of suspension of construction. DSA shall be notified by the project inspector when (1) the construction is suspended for more than two weeks or (2) the construction is suspended or abandoned for any reason for a continuous period of one year following its commencement at which time the approval of DSA becomes void. DSA may reinstate the approval upon the request of the owner.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16009.

4-237.1 Stop work order.

(a) Whenever DSA finds any construction work being performed in a manner contrary to the provisions of this code and that would compromise the structural integrity of the building, the Department of General Services, State of California, is authorized to issue a stop work order.

(b) The stop work order shall be in writing and shall be given to the owner of the property involved, or to the owner's agent, or to the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

(c) Any person who continues working the cited work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16017.5.

4-238. Application for approval of project inspectors, assistant inspectors and special inspectors. For each essential services building project, an Inspector's Qualification Record, Form DSA-5, shall be submitted for the proposed

project inspector, a proposed assistant inspector, and may be required by DSA to be submitted for a proposed special inspector. The proposed project inspector and any proposed assistant inspector shall be interviewed by the architect or registered engineer in general responsible charge of the project to determine his/her qualifications. The architect or registered engineer shall recommend to DSA the approval of the inspector based upon his/her determination of the competency of the candidate to perform the inspection work. Unless otherwise directed by the enforcing agency, special inspection reports shall be in accordance with Section 4-211(c) and submitted in a timely fashion as determined by the enforcing agency; special inspection reports indicating nonconformance shall be immediately submitted to the enforcing agency, the owner, the project inspector, the contractor, and the architect or registered engineer.

Form DSA-5 for the proposed inspector, with the signatures of the architect or registered engineer and the owner, shall be submitted to DSA for review and approval. In addition to the information supplied on the qualification record, DSA may require a personal interview with the proposed inspector, which may include oral and written examinations concerning inspection and testing procedures.

The submittal of the Inspector's Qualification Record for the project inspector shall be made a minimum of 10 days prior to the start of construction on the project. The submittal of the Inspector's Qualification Record for an assistant inspector, or when required for a special inspector, shall be made a minimum of 10 days prior to the use of the assistant inspector or special inspector on the project. DSA forms are available on the Internet at www.dgs.ca.gov/dsa, or at any of the DSA regional offices.

Authority: Health and Safety Code Sections 16017 and 16022.

Reference: Health and Safety Code Sections 16017 and 16021.

4-239. Tests. In addition to the requirements of Section 4-213, Article 1 of these regulations, the following provisions shall apply:

(a) **Performance of tests.** The owner, with the recommendation of the architect or registered engineer shall select a qualified testing laboratory to conduct the tests. Sampling, preparation of samples and tests shall be in accordance with the standards as provided in the approved plans and specifications and in the applicable building regulations. Unless otherwise directed by the enforcing agency, test reports shall be in accordance with Section 4-213 and submitted in a timely fashion as determined by the enforcing agency. Where a sample has failed to pass the required tests, the test lab shall report immediately the deficiency to the enforcing agency, the owner, the project inspector, the contractor and the architect or registered engineer. The architect or registered engineer, subject to the approval of the enforcement agency, may permit retest of the sampled material.

(b) **Payments.** The owner shall pay for all tests. When in the opinion of the architect or registered engineer additional tests are required because of the manner in which the contractor executes his work, such tests shall be paid for by the owner but the amount paid may be collected from the con-

tractor. Examples of such tests are: Tests of materials substituted for previously approved materials, retests made necessary by the failure of materials to comply with the requirements of the specifications and load tests necessary because certain portions of the structure have not fully met specification or plan requirements.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16020 and 16021.

4-240. Required filing of verified reports. Project inspectors, approved special inspectors and contractors shall file verified reports on Form DSA-6. Architects and engineers shall file verified reports on Form DSA-6A/E. DSA forms are available on the Internet at www.dgs.ca.gov/dsa, or at any of the DSA regional offices.

Verified reports shall be filed with DSA as follows:

- (a) By each contractor having a contract with the owner, at the completion of the contract.
- (b) By the architect, registered engineers, project inspector and approved special inspectors at the completion of the essential services building.
- (c) By the architect, registered engineers, project inspector and contractor at the suspension of all work for a period of more than one month.
- (d) By the architect, registered engineer, project inspector, approved special inspector or contractor whose services in connection with the project have been terminated for any reason.
- (e) At any time a verified report is requested by DSA.

Authority: Health and Safety Code Sections 16020, 16021 and 16022.

Reference: Health and Safety Code Sections 16020, 16021 and 16022.

4-241. Project inspector's semimonthly reports. In addition to the verified reports required in Section 4-214, the project inspector shall make semimonthly reports of the progress of construction to the architect or registered engineer in general responsible charge. A copy of each such report shall be sent to the owner, the architect or engineer in general responsible charge and DSA. Semimonthly reports shall state the name, location and owner of the essential services building and shall contain the application number and file number of the project for identification purposes. The reports shall include a list of official visitors to the project and whom they represent, a brief statement of the work done, instructions received from the architect or registered engineer during the period covered by the report and pertinent information regarding any unusual conditions or questions that may have arisen at the job. Forms are not provided by DSA for semimonthly reports. Failure to comply with this section will be cause for withdrawal of the approval of the project inspector.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16017.

4-242. Notifications by the project inspector. The project inspector shall notify DSA at the following times:

- (a) When construction work on the project is started, or restarted, if previously suspended per Item (d) below.

(b) At least 48 hours in advance of the time when foundation trenches will be complete and ready for footing forms.

(c) At least 48 hours in advance of the first placement of foundation concrete and 24 hours in advance of any subsequent and significant concrete placement.

(d) When all work on the project is suspended for a period of more than two weeks.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16017.

ARTICLE 3 LOCAL BUILDINGS

4-243. General.

(a) The provisions of Article 1 and Article 3 of these regulations shall apply to essential services buildings owned or leased by a city, county or county or a special fire district within these jurisdictions. The Division of the State Architect shall observe the implementation and administration of the provisions of the Essential Services Buildings Seismic Safety Act and these regulations pertaining to local jurisdictions under the authority granted in the Act.

(b) Local jurisdictions shall establish such administrative procedures as they deem necessary and proper for the enforcement of the provisions of the Act so long as those procedures do not conflict with the requirements of Articles 1 and 3 of these regulations. The enforcement of these regulations is the responsibility of an authorized official of the local enforcement agency.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16001.

4-244. Approval of drawings and specifications.

(a) The required written approval of drawings and specifications may consist of either a building permit or other document as established by the enforcing agency.

(b) Written notification by the local enforcement agency to DSA shall be required when the written approval of the drawings and specifications is issued by the local enforcement agency. The written notification shall contain a project name and location for the essential services building, the name of the architect or registered engineer in general responsible charge of the work, the estimated cost of the project, the name of the qualified plan reviewer (the licensed architect or registered engineer responsible for the design review) and if available the name of the project inspector. The written notification shall also include a statement signed by an official of the enforcement agency that the plans and specifications and the review thereof has been accomplished in compliance with the provisions of the Act and of these regulations.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16001 and 16011.

4-245. Voidance of application. Any change, erasure, alteration or modification of any plans or specifications bearing the identification or approval stamp of the enforcement agency may result in voidance of the approval of the applica-

tion. However, the “written approval of the plans” may be extended by the enforcement agency to include revised plans and specifications after documents are submitted for review and approved.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Sections 16009, 16011 and 16013.

4-246. Time of beginning of construction and partial construction. Construction work whether for a new essential services building, or for a reconstruction, alteration or addition project for an essential services building, shall not be commenced nor shall any contract be let until the owner has applied for and obtained from the enforcement agency the required written approval of plans and specifications.

All work done and materials used and installed must be in accordance with and in conformity to the approved plans and specifications. The enforcement agency shall be notified whenever work is being carried on and failure to give such notice may result in voidance of the approval of the plans and specifications.

An uncompleted building shall not be considered as having been constructed under the provisions of the Essential Services Buildings Seismic Safety Act.

Authority: Health and Safety Code Section 16002.

Reference: Health and Safety Code Section 16016.

4-247. Notice of start of construction. The architect or registered engineer responsible for the project shall give written notification to the enforcement agency before construction is to be started. The architect or registered engineer shall furnish the name of the contractor, the contract price and the date of starting of construction.

Authority: Health and Safety Code Section 16022.

Reference: Health and Safety Code Section 16016.

4-248. Approval of the project inspector, assistant inspector and special inspectors by the enforcement agency.

(a) The enforcement agency shall review, for each individual project, the qualifications of the project inspector, any assistant inspector, and special inspectors proposed for an essential services buildings projects to determine the inspector’s competency to do the inspection required for that particular project. The qualification review shall include, for the project inspector and any assistant inspector, an appraisal of the candidate’s education and experience and a personal interview, which may include a written examination if deemed appropriate by the enforcement agency.

(b) The approval of the project inspector by the enforcement agency shall include information to the project inspector of the “personal knowledge” provisions of the Act and of the additional requirement that the project inspector shall not assume other duties that would preclude the inspector from obtaining personal knowledge required of all work of construction.

(c) Representatives of the enforcement agency shall from time to time visit the construction site to observe the work of construction and to monitor the performance of the project inspector. The construction work is subject to any inspections required by the enforcement agency.

Authority: Health and Safety Code Sections 16017 and 16022.

Reference: Health and Safety Code Sections 16017 and 16021.

4-249. Verified reports. The verified reports required by the Act to be filed by any architects, engineers, inspectors and contractors having responsibility for all or any portion of the construction work of the project shall be filed on a form prescribed by the enforcement agency. Original manual signatures of the architect, engineer, inspector and contractor are required on the verified report. Refer to Section 4-214 of these regulations for verified report requirements.

Authority: Health and Safety Code Sections 16020, 16021 and 16022.

Reference: Health and Safety Code Sections 16020 and 16021.

GROUP 1

SAFETY OF CONSTRUCTION OF PUBLIC SCHOOLS

ARTICLE 1 GENERAL PROVISIONS

4-301. Purpose. School buildings constructed pursuant to these regulations are expected to resist earthquake forces generated by major earthquakes of the intensity and severity of the strongest experienced in California without catastrophic collapse, but may experience some reparable architectural or structural damage.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

HISTORY:

1. Repealer of Group 1, Articles 1-6 (§§ 1-80) and new Group 1, Articles 1-5 (§§ 1-6, 8, 10, 10.5, 11-14, 16-26, 26.1, 26.2, 26.5-26.9, 27-40, 50, 51, 60, 61, 62, 80 and Appendix), filed 11-1-66; effective thirtieth day thereafter (Register 66, No. 38). For history of former sections see Registers 53, Nos. 15, 18; 54, No. 24; 55, No. 12; 56, No. 10; 59, No. 14; 60, Nos. 8, 16; 61, No. 19; 64, No. 13.
2. Amendment filed 6-29-76 as an emergency; designated effective 7-1-76 (Register 76, No. 27).
3. Certificate of Compliance filed 10-15-76 (Register 76, No. 42).
4. Amendment of NOTE filed 6-19-79; effective thirtieth day thereafter (Register 79, No. 25).
5. Repealer filed 9-24-82 by OAL pursuant to Government Code Section 11349.7 (j); effective thirtieth day thereafter (Register 82, No. 39).
6. Repealer of Group 1 (Articles 1-5, Sections 2-80, not consecutive) and new Group 1 (Articles 1-9, Sections 1-55, not consecutive and Appendix) filed 9-8-83; effective 9-15-83 pursuant to Government Code Section 11346.2 (d) (Register 83, No. 40). For prior history, see Registers 79, No. 25; 77, No. 40; 76, No. 42; 76, No. 27; and 74, No. 38.
7. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-301, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-302. Scope.

(a) **General.** Part 2, Title 24, California Code of Regulations (C.C.R.), also known as the California Building Code, and Part 10, C.C.R., also known as the California Existing Building Code, designate the structural building regulations that shall apply to the design, construction, reconstruction, rehabilitation, alteration of or addition to any school building as defined in Sections 17283 and 81130.5 of the Education Code. The term “school building” shall include all buildings, structures, appurtenances and related systems or facilities as defined in Section 4-314.

These regulations establish reasonable standards and minimum requirements for the structural integrity of public school buildings to resist, insofar as practicable, the forces of gravity, wind and earthquake for the protection of life and property.

The design and construction of the mechanical and electrical systems in school buildings shall conform to the applicable building regulations in Title 24, C.C.R.

Further, the design and construction of school buildings shall comply with the regulations adopted by the Division of the State Architect/Access Compliance (DSA-AC) and the Office of the California State Fire Marshal for the particular occupancies concerned. (See Title 24, C.C.R.)

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

(b) **Emergency buildings.** Installation of relocatable school buildings, used or designed to be used for school purposes following disasters such as earthquakes, fires, floods or unanticipated emergency classroom needs require approval by DSA. DSA has determined that compliance with the strict letter of the regulations may be impractical in these circumstances. The modifications to the regulations granted by DSA are as indicated here and are recorded and entered in the files of DSA in accordance with Section 4-304.

Emergency relocatable buildings must meet all the requirements of regulations with the following modifications and limitations:

1. The building is a one-story relocatable building no greater than 2,160 square feet in area.
2. Documentation is provided indicating the construction of the building superstructure is DSA certified in accordance with Section 4-339.
3. A foundation system is provided that has been accepted by DSA.
4. Observation and inspection of construction shall be in compliance with Section 4-333.
5. Verified reports shall be prepared and provided in compliance with Section 4-336.
6. DSA must be notified immediately by the district of the emergency need and the intent to use this section.
7. Within 14 days following the installation of these emergency buildings, the school district will notify DSA of the extent of the damage to their permanent school buildings or extent of emergency need and the number of emergency buildings installed to house displaced students.
8. Within 60 days following installation of these emergency buildings, the design professional representing the school district shall provide DSA with a complete project submittal in compliance with Article 3 of these regulations.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17282 and 17298.

HISTORY:

1. Editorial correction of printing error (Register 83, No. 45).
2. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-302, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

* The reorganization of Group 1 is printed as a repealer and adoption for clarity.

- (DSA/SS 2/95) Regular order by the Division of the State Architect/ Structural Safety Section to amend Section 4-302(b). Filed with the Secretary of State on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

4-303. Delegation of authority. All powers, duties, responsibilities pursuant to carrying out the provisions of the Field Act vested by law in the Department of General Services have been delegated by the Department to the State Architect.

Authority: Education Code Sections 17310 and 81142.

Reference: Government Code Section 14607.

4-304. Alternate materials and methods of construction and modifications. The provisions of these regulations are not intended to prevent the use of any material or method of construction not specifically prescribed by these regulations, provided any alternate has been approved and its use authorized by DSA.

DSA may approve any such alternate, provided DSA finds that the proposed design is satisfactory and complies with the provisions of these regulations and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in these regulations in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation.

DSA shall require that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding its use. The details of any action granting acceptance of an alternate shall be recorded and entered in the files of DSA.

When there are practical difficulties involved in carrying out the provisions of these regulations, DSA may grant modifications for individual cases. DSA shall first find that a special individual reason makes the strict letter of these regulations impractical and that the modification is in conformance with the intent and purpose of these regulations and that such modification does not lessen any fire protection requirements or any degree of structural integrity. The details of any action granting modifications shall be recorded and entered in the files of DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

HISTORY:

- (OSA/SS 1/92) Regular order by the Office of the State Architect/ Structural Safety Section to amend Section 4-304, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-305. Application of building standards. Building standards applicable to public school buildings are set forth in Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, Title 24, C.C.R., and have been adopted as minimum design and construction standards upon which to base the approval of plans and specifications. These regulations shall not be construed to prevent the use of higher design standards nor to restrict the use of new or innovative design or construction techniques.

Where the designer desires to use innovative design or construction techniques not addressed in these regulations it shall be necessary to submit for review and approval information including computations, test data and recommendations covering the design in question. The designer shall confer

with DSA concerning the applicability of these innovative design or construction techniques to school building construction prior to the submittal of plans and specifications.

DSA must be satisfied that the degree of safety achieved by these innovative design and construction techniques is at least equivalent to that achieved by the regulations. This requirement shall apply to all buildings proposed for public school use for educational purposes as defined in these regulations. The proposed use of archaic building materials and structural systems such as those desired to be retained in buildings that have been designated as historically important shall be included in this provision. The determination of the equivalency of the degree of safety shall be the responsibility of DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

HISTORY:

- (OSA/SS 1/92) Regular order by the Office of the State Architect/ Structural Safety Section to amend Section 4-305, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-306. Approval of new school buildings, rehabilitation of school buildings and additions to school buildings. Plans and specifications for any new school building or the rehabilitation of or addition to any school building, regardless of cost, shall be submitted to DSA for approval in accordance with Section 4-315.

All new construction work that is part of an addition project shall comply with currently effective regulations. Existing school buildings for which an addition project is proposed shall be retrofitted when required by Section 4-309(c).

Before the school board may award a contract or commence construction work for the rehabilitation of a structure already owned (including those pre-1933 buildings not retrofitted or subsequently abandoned for school use under the provisions of the Garrison Act), or an existing building that has been purchased or leased, into a school building, the school board shall submit application and plans of the building to DSA for approval. The plans shall provide for the retrofit necessary for full compliance with the requirements of currently effective regulations. Refer to Section 4-307 for rehabilitation of an existing nonconforming building for use as a school building.

When a structural rehabilitation of an existing school building is required by Section 4-309(c) and DSA, the school board shall submit to DSA, prior to submittal of project application, a pre-application for the rehabilitation project, fees in accordance with Section 4-326, and an Evaluation and Design Criteria Report for approval. If the school board voluntarily elects to rehabilitate an existing school building to full compliance with the code, then a pre-application may be required by DSA. The report shall propose the methodologies for evaluation and design, and determination of acceptance criteria for nonconforming construction, and shall propose the material testing and condition assessment requirements for the rehabilitation. The approved Evaluation and Design Criteria Report shall establish the criteria for the evaluation and design to be used by the project design professionals and

the material testing and condition assessment requirements. The seismic evaluation and retrofit design shall comply with the provisions of Sections 317 through 323, Part 10, Title 24, C.C.R.

The relocation or moving of an existing school building within the same school district or from one school district to another regardless of cost requires approval by DSA. (See Section 4-314 for definition of “relocation.”)

The provisions of this section shall not apply to a “temporary-use building community college.” (See Section 4-314 for definitions of “new school building” and “temporary-use building community college.”)

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-306, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-307. Rehabilitation of an existing nonconforming building for use as a school building.

(a) An existing nonconforming building rehabilitated for use as a school building is considered, for the purpose of the application of Title 24, to be a new school building. Plans and specifications for rehabilitation of any existing nonconforming building, or portion thereof, for use as a school building shall provide for the retrofit necessary for compliance with the health and safety standards contained in Title 24, C. C. R., currently effective edition. Existing materials or systems not specifically prescribed in current safety standards are permitted to be evaluated for equivalency and approved in accordance with Section 4-304. The seismic evaluation and retrofit design shall comply with the provisions of Sections 317 through 323, Part 10, Title 24, C. C. R.

(b) A site that is currently not an existing school site, on which one or more existing nonconforming buildings are rehabilitated for use as school building(s), is considered to be a new school site for the purpose of the application of Title 24. Any building on a new school site that is not rehabilitated and approved as a school building shall not be used for school purposes and shall be subject to the provisions of Section 4-310.

(c) Prior to submittal of a project application for the rehabilitation of an existing nonconforming building, the school board shall submit to DSA a pre-application for the rehabilitation project, fees in accordance with Section 4-326, and an Evaluation and Design Criteria Report for approval. The report shall propose the methodologies for evaluation and design, and determination of acceptance criteria for nonconforming construction; and shall propose the material testing and condition assessment requirements for the rehabilitation. The approved Evaluation and Design Criteria Report establishes the criteria for the evaluation and design to be used by the project design professionals, and the material testing and condition assessment requirements.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

4-308. Reconstruction or alteration projects not in excess of \$100,000 in cost. Projects involving only reconstruction or alterations whose estimated costs do not exceed \$100,000 do not require approval by DSA, but such approval can be obtained at the request of the school board and by compliance with these regulations. The cost of work classified as maintenance as defined in Section 4-314 shall not be considered for purposes of this section. The regulations of the Division of the State Architect/Access Compliance and of the California State Fire Marshal may apply to any project, including maintenance, regardless of cost. See Section 4-302.

In authorizing and completing the design and construction of projects with an estimated cost below \$100,000 as described in this section, the school board assumes responsibility for employing an architect or a registered engineer to prepare the plans and specifications and for adequate inspection of the materials and work of construction to ensure compliance with the currently effective provisions of Title 24, C.C.R.

The dollar amount cited in this section shall be increased on an annual basis, according to an inflationary index governing construction costs that is selected and recognized by the Division of the State Architect. This annually adjusted dollar amount shall be published by DSA and made available to school boards and the public.

School construction projects shall not be subdivided for the purpose of evading the cost limitations of this section.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17295, 81130 and 81133.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-308, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.
2. (DSA/SS 9/96) 1996 Annual Code Adoption Cycle will amend Section 4-308, of Part 1, Title 24, C.C.R. Filed with the Secretary of State on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.

4-309. Reconstruction or alteration projects in excess of \$100,000 in cost.

(a) **General.** Plans and specifications for any reconstruction or alteration project exceeding \$100,000 in cost shall be submitted to DSA for approval in accordance with Section 4-315, except as provided within this section. The cost of work classified as maintenance as defined in Section 4-314 shall not be considered for purposes of this section.

The dollar amounts cited in this section shall be increased on an annual basis, according to an inflationary index governing construction costs that is selected and recognized by DSA. This annually adjusted dollar amount shall be published by DSA and made available to school boards and the public.

School construction projects shall not be subdivided for the purpose of evading the cost limitations of this section.

All new construction work that is part of a reconstruction or alteration project shall comply with currently effective reg-

ulations for design and construction, where not otherwise regulated in this section.

Exception: Fire damage repair may be accomplished utilizing the approved plans and specifications for the original construction work. All regulations and standards in effect at the time of approval shall be complied with except that the testing and inspection requirements of current regulations shall apply to the reconstruction work. Minor modifications to the original approved plans may be made, subject to the approval of DSA, provided that they do not reduce the structural capacity of the building.

All modifications affecting the existing structural elements carrying gravity load shall comply with Section 503.3, Part 10, Title 24, C.C.R.

Where any modifications to an existing school building results in an increase to the seismic or wind forces in any lateral force-resisting structural component by more than 10 percent, or decrease the capacity or stiffness of any lateral force resisting structural component by more than 5 percent, cumulative since the original construction, then those affected components shall be made to comply with Section 319.1 or 317.7, Part 10, Title 24, C.C.R and Section 1609A, Part 2, Title 24, C.C.R. Only the affected components need be strengthened unless a rehabilitation is required for the entire building per Section 4-309(c). The capacity or stiffness of the lateral force-resisting structural component may include past strengthening that was approved and certified by DSA as the basis for the percentage comparison.

Voluntary lateral force-resisting system modifications may be used where permitted in Section 4-309(d).

When the estimated cost of a reconstruction or alteration project exceeds \$100,000 but does not exceed \$225,000, and a licensed structural engineer determines that the project does not include any work of a structural nature, approval of the project plans and specifications by DSA is not required, provided the following three items are completed:

1. The structural engineer shall submit a written statement to DSA, indicating that the project does not contain any work of a structural nature.
2. The design professional in general responsible charge of the project shall certify, in writing, that the plans and specifications for the project meet any applicable fire and life-safety standards, and do not specify any work of construction that is regulated by the accessibility standards of Title 24. This certification shall be submitted to DSA, and shall bear the stamp and signature of the design professional.
3. Within 10 days of the completion of the project, a DSA certified project inspector shall sign and submit to DSA a verified report on a form prescribed by DSA, indicating that the project was completed in conformance with the plans and specifications.

(b) **Existing noncomplying, nonstructural elements.** Existing noncomplying, nonstructural elements discovered during the design or construction of a reconstruction, alteration or addition to an existing complying school building

and directly affected by the work of construction shall be corrected to comply with the bracing and anchorage requirements of currently effective regulations.

(c) **Required rehabilitation.** Existing school buildings for which a reconstruction, alteration or addition project is proposed shall be evaluated and retrofitted as required to comply with currently effective regulations applicable to the rehabilitation of structural systems per Section 4-306, including wind and seismic force requirements, when any of the following conditions occur:

1. When the cost of the reconstruction, alteration, or addition project exceeds 50 percent of the replacement value of the existing building. Air-conditioning equipment and insulation materials costs, including installation, need not be included in the percentage of replacement value calculation. For the purposes of this section, the cost of the reconstruction, alteration or addition project need not include the cost of voluntary lateral force-resisting system modifications in accordance with Section 4-309(d), except the cost shall be included when the structure is located in a fault hazard zone and a geologic hazard report demonstrates that the structure is located within 50 feet of the trace of an active fault as defined in Section 4-317(e).
2. When the cost of the reconstruction, alterations or addition project does not exceed 50 percent of the replacement value of the existing building, and the proposed work results in any of the following:
 - A. An increase in the effective seismic weight, or wind force due to increase in surface area exposed to wind, in any story by more than 10 percent, cumulative since the original construction.
 - B. A reduction in the lateral-force-resisting capacity or stiffness of any story in any one direction by more than 10 percent, cumulative since the original construction. For the purposes of evaluating the strength or stiffness reduction, any new strengthening as part of the project shall not be included. The capacity or stiffness of the lateral-force-resisting system may include past strengthening that was approved and certified by DSA as the basis for the percentage comparison.
 - C. A structural irregularity that is prohibited in ASCE 7 Section 12.3.3.1 and Section 1617A.1.10, Part 2.
3. When a change of occupancy results in a structure being reclassified to a higher risk category.

(d) **Voluntary lateral force-resisting system modifications.** Alterations to existing structural components or additions of new structural components that do not exceed the limitations of Section 4-309(c)2 for required rehabilitation and are initiated for the purpose of increasing the strength or stiffness of the lateral force-resisting system of an existing structure are permitted to be evaluated and designed in accordance with Section 317.11 of Part 10, Title 24, C.C.R. and Section 1609A, Part 2, Title 24, C.C.R. for voluntary lateral force-resisting system modifications.

(e) When building damage due to an earthquake or wind is repaired, all portions of the building associated to this damage shall be retrofitted to comply with currently effective regulations.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17295, 81130 and 81133.

HISTORY:

1. New section filed 2-28-86; effective 30th day thereafter (Register 86, No. 9).
2. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-309, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-310. School garages, warehouses, storage and similar buildings, dwellings for employees and miscellaneous structures. The Act does not apply to buildings or structures constructed by a school district for the purpose of, and used solely for, housing, buses and minor mechanical equipment or for nonschool use where such buildings or structures do not provide facilities for either pupils or teachers and are not intended to be entered by them as such for school purposes. Similarly, the Act does not apply to dwellings for employees or to district-wide administrative buildings on sites separate from school sites, which are not to be used or entered by pupils or teachers, for school purposes. DSA approval for accessibility is required in accordance with Section 5-101. Approvals from other agencies may also be required. Such buildings or structures shall not be used for school purposes.

The Act does not apply to school-based health centers, social services or support services qualifying under the provisions of Education Code, Section 17296, housed in stand-alone buildings located on school property that are not to be used for school purposes. Approvals from other agencies will be required for these facilities. Proof of qualification and a copy of the building permit from the local building official will be required to be provided to DSA prior to start of construction.

It shall be the responsibility of the school board to take all necessary measures and precautions to prevent such use and to prevent injuries to pupils or teachers on school grounds as a result of collapse of such buildings or structures. Any such building excluded from the provisions of these regulations shall be posted with a sign pursuant to Sections 17368 and 81160 of the Education Code.

In authorizing and completing the design and construction of district-owned buildings as described in this section, the school board assumes responsibility for employing appropriately licensed architects or registered engineers to prepare the plans and specifications and for adequate inspection of the materials and work of construction to ensure compliance with the provisions of Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, Title 24, C.C.R., as adopted by the Building Standards Commission.

For these cases DSA requires that a resolution be passed by the school board stating that the building or structure shall not be used for school purposes and that no pupils or teachers, as such, will be permitted to use or enter the said building for said purposes or be subjected to a hazard result-

ing from its collapse. A copy of the resolution shall be submitted to DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17296, 17368, 81130 and 81160.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-310, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-311. Condemnation. DSA has no authority under the Act to order the closing of any school building. However, if requested by the school district or on DSA's own volition, DSA shall examine and report on the safety of structural aspects of any school building that appear to be deficient. The report shall state in writing to the school board whether or not the investigated structural aspects of the building are in compliance with the code in effect at the time of construction, and shall also state whether or not the building is safe for school use. (See Sections 4-345 and 4-346.)

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17311 and 81143.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-311, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-312. Demolition. Demolition is the entire razing or destruction of a school building or a school building unit. It is not necessary to secure the approval of DSA for such demolition. It is the responsibility of the school board to notify DSA of such demolition.

Approval by DSA is required for any partial demolition of existing buildings or any demolition that is part of a reconstruction, rehabilitation, alteration or addition.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17310 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-312, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 2 DEFINITIONS

4-313. General. The words defined in Section 4-314 shall have the meaning stated therein throughout the regulations contained in Part 1, Section 4-300, et seq, Title 24, C.C.R.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17283, 81130, 81130.5 and 81529.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-313, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-314. Definitions.

ACT shall mean the Field Act, Sections 17280-17316 and 81130-81147, inclusive of the Education Code.

ADDITION as that term is used in these regulations shall mean an increase in permanently constructed floor area or volume of enclosed space placed immediately adjacent to or above and sharing use with an existing certified building. The addition may be of the same occupancy or a different occupancy and may be either structurally attached or structurally detached from the existing building. An existing building with an existing expansion joint, indicating that it was previously added on to at one time in the past, is considered one single building.

ALTERATION shall mean any construction or renovation to an existing certified building other than reconstruction, rehabilitation, or addition. The relocation or moving of an existing certified school building is considered to be a relocation, not an alteration, requiring filing of the plans and specifications with, and certification by, DSA.

APPROVED PLANS AND SPECIFICATIONS as used in these regulations shall mean plans, specifications, addenda, construction changes and other documents that have been duly approved by DSA pursuant to Sections 17295 and 81133 of the Education Code. The plans and specifications shall be identified by a stamp bearing the name "Division of the State Architect," the application number, initials of the plan reviewers and date of stamping. The written approval as required by Section 17297, Education Code, shall not be issued until a copy of plans and specifications bearing DSA's identification stamp is on file at the DSA.

ARCHITECT shall mean a certified architect holding a valid license under Chapter 3, Division 3, of the *California Business and Professions Code*.

CERTIFIED BUILDING shall mean a building that was constructed or reconstructed in accordance with Article 3 or 7 commencing with Sections 17280 and 81130, respectively, of the Education Code and with the regulations in effect at the time of their certification.

CONSTRUCTION CHANGE DOCUMENT shall mean a construction document submitted by the responsible project architect or registered engineer and approved by DSA depicting a change to the approved plans and/or specifications after the construction contract has been let.

DIVISION OF THE STATE ARCHITECT or **DIVISION**, or initials **DSA**, shall mean the Division of the State Architect in the Department of General Services, State of California. Approval, disapproval, orders and certificates of compliance shall be issued directly by the State Architect who shall act for the Department of General Services in carrying out the provisions of the Act.

GARRISON ACT (1939), Sections 17280–17316 and 81160–81192 of the Education Code, as amended, prescribes the actions to be taken by school board members to preclude personal liability for the continued use of unsafe school buildings.

GEOTECHNICAL ENGINEER shall mean a professional engineer holding a certificate to use the title geotechnical engineer, soil engineer or soils engineer under the law regulating

the practice of civil engineering comprising Chapter 7 of Division 3, of the *California Business and Professions Code*.

INSPECTOR shall mean any person duly approved by DSA to perform construction inspection for a particular project. (See Sections 4-333 and 4-342.)

MAINTENANCE shall mean and include ordinary upkeep or repair work such as replacements in kind, repainting, replastering and reroofing. Reroofing shall be limited to one additional application and shall include an examination of the structural elements of the roof, walls, ceilings and all other elements that may have suffered deterioration from moisture resulting from roof leaks. Maintenance shall not include work, other than repainting, on structural framing nor include the replacement of large mechanical, electrical or plumbing units or systems.

NEW SCHOOL BUILDING shall mean any newly erected school building and/or existing owned, leased or purchased building converted to school use and certified by DSA.

NONCONFORMING BUILDING is a building that has not been certified by DSA as a school building.

NONSTRUCTURAL ALTERATIONS shall mean only such alterations as do not affect the structural safety of the school building and that do not change, in any manner, its structural elements.

OFFSITE LOCATION is a building designated by the governing board to be used for less than full-time instruction in educational programs that require such offsite facilities in order to fulfill the objectives of the programs. Such designated buildings shall not be located on, or adjacent to, a school site and its primary use shall be for other than public school purposes. The designation of off-site location is subject to review by DSA. (See Education Code Section 81529.)

PLANS as used in these regulations shall mean the drawings associated with the project such as, but not limited to, vicinity maps, site plans, foundation plans, floor plans, ceiling plans, roof plans, cross sections, interior elevations, exterior elevations and details.

PROFESSIONAL ENGINEER as used in these regulations shall mean an engineer holding a valid certificate under Chapter 7, Division 3, of the *California Business and Professions Code*, in the branch of engineering that is applicable.

PUPILS as used in these regulations shall mean persons who are performing a required activity or entering a building by virtue of being a pupil enrolled in an elementary or secondary school district or a community college district.

RECONSTRUCTION is the repair of damage to an existing certified school building.

REGISTERED ENGINEER as used in these regulations shall mean a structural engineer or a professional engineer as defined in this section.

REHABILITATION is the evaluation and resulting retrofit of an existing nonconforming building or a school building conforming to earlier code requirements to bring the building, or portion thereof, into conformance with the safety standards of the currently effective regulations, Parts 2, 3, 4, 5, 6, 8, 9, 10, 11 and 12, Title 24, C. C. R.

RELOCATABLE BUILDING is any building with an integral floor structure that is capable of being readily

moved. (See Education Code Section 17350.) Relocatable buildings that are to be placed on substandard foundations not complying with the requirements of Part 2, Title 24, C.C.R., require a statement from the school district stating that the durability requirements for those foundations may be waived and acknowledging the temporary nature of the foundations.

RELOCATION shall mean the physical moving of any certified building either as a single unit or in parts from its original location to a new location on the same campus or on a different campus. Relocation of a building requires the approval of DSA.

RETROFIT is the construction of any new element or system, or the alteration of any existing element or system required for the rehabilitation of the building.

SCHOOL BOARD shall mean and include district Boards of Trustees, city or county Boards of Education and other appropriate authorities for which any school building used or designed to be used for elementary or secondary school or community college purposes is to be constructed, reconstructed, altered or added to by the state, or by any county, city, city and county, or other political subdivision, or by any school or community college district of any kind or character within the state, or by the United States government, or any agency thereof.

SCHOOL BUILDING as defined in Sections 17283 and 81130.5 of the Act is interpreted to include all structure and utility systems or facilities necessary to the complete functioning of the structures, used or designed to be used for instructional purposes, or intended to be entered by pupils or teachers for school purposes, or structures operated as school units, the failure of which would endanger pupils or teachers on school grounds or in school buildings. (See Section 4-310 for teacher residences.) “School Building” is also defined to include dwellings, including utility systems or facilities necessary to the complete functioning of the dwellings, used by pupils, teachers and school employees that are part of a campus where the primary use is for school purposes.

The following are not considered to be school buildings but may be submitted separately or may be included in the plans and specifications for a school building project and will be checked under the provisions of the Act if submitted by the school district: one-story buildings not over 250 square feet in area when used exclusively as accessory facilities to athletic fields (equipment storage, toilets, snack bars, ticket booths, etc.); greenhouses, barns and materials or equipment storage sheds, used exclusively for plant or animal production or protection and not used for classroom instruction (small groups of pupils and teachers may enter these structures for short periods of time); lighting poles less than 35 feet above the grade, antenna towers less than 35 feet above the grade; retaining walls less than 4 feet above the top of foundations and not supporting a surcharge, concrete or masonry fences less than 6 feet above adjacent grade, ballwalls or yard walls less than 6 feet above adjacent grade; signs, scoreboards or solid-clad fences less than 8 feet above adjacent grade; bleachers and grandstands five rows of seats or less above grade; playground equip-

ment; flagpoles less than 35 feet above grade; open-mesh fences and baseball backstops and temporary-use community college buildings as defined below. For work described in this paragraph that is not submitted to DSA for approval under the Act, the school board assumes responsibility for employing appropriately licensed architects or registered engineers to prepare the plans and specifications and for adequate inspection of the materials and work of construction to ensure compliance with the provisions of Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, Title 24, C.C.R., as adopted by the Building Standards Commission.

Buildings and other structures constructed by students that upon completion of construction will not be used for school purposes and will not be entered by pupils or teachers are not considered school buildings and shall not be checked under the provisions of the Act. These student-constructed buildings shall not remain at the school site more than 90 days following completion, unless the building meets all the requirements of Section 4-310.

“School Building” in a complex operated by the state for correctional or forestry purposes shall include only those structures used or designed to be used for elementary or secondary school instruction or community college instruction. Living units, dining areas, administration buildings or structures used for support services in such correctional or forestry complexes shall not be considered school buildings for purposes of Field Act requirements.

SCHOOL DISTRICT as used in these regulations shall mean a Kindergarten through 12th grade school district of any kind or character within the state, a community college district of any kind or character within the state, a county office of education, elementary or secondary school operated by the United States government, or any agency thereof, and any elementary or secondary school administered directly by the State Department of Education.

STRUCTURAL ENGINEER as used in these regulations shall mean a professional engineer holding a valid certificate to use the title structural engineer under the law regulating the practice of civil engineering comprising Chapter 7 of Division 3 of the Business and Professions Code, relating to professional engineers.

TEACHERS as used in these regulations shall mean persons who are performing a required activity or entering a building by virtue of being teachers employed by an elementary or secondary school district or a community college district.

TEMPORARY-USE BUILDING COMMUNITY COLLEGE is any community college building for which the intended use by the school district at the time of entering into a lease contract or agreement is not for more than three years from the date of first occupancy.

TEMPORARY-USE BUILDING K-12 is any temporary school buildings, other than those for community colleges, used or designed to be used for school purposes following disasters such as earthquakes, fires and floods, unanticipated emergency classroom needs or during modernization projects, for which repairs are in progress. The use of such buildings is limited to a maximum of three years.

WAIVER OF DURABILITY refers to a waiver, as may be requested by the school district, of certain durability requirements of Part 2, Title 24 for foundations of relocatable buildings.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17283, 17405, 81130, 81130.5 and 81529.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-314, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 3

APPROVAL OF DRAWINGS AND SPECIFICATIONS

4-315. Application for approval of drawings and specifications.

(a) **General.** Before awarding a contract or commencing with construction of a school building project, the school board shall submit an application to the Division of the State Architect and obtain written approval of the plans and specifications for any of the following:

1. The construction of any new school building, or rehabilitation of or addition to any existing school building. School building is defined in Section 4-314.
2. The reconstruction or alteration of an existing school building if the estimated cost exceeds \$100,000. (See Sections 4-308 and 4-309.)
3. The lease or purchase of any relocatable building except where occupied as a temporary-use community college building.

Exception: The school board may award a contract and commence construction of a “relocatable building” for emergency housing in compliance with 4-302(b).

4. The rehabilitation of a nonschool building to use as a “school building.” (See Sections 4-306 and 4-307.)

It is not necessary to secure approval for maintenance work on school buildings, in accordance with Sections 4-308 and 4-309. See Section 4-314 for the definition of “maintenance.”

(b) **Filing.** A separate application shall be submitted to DSA for each school building or group of school buildings on each school site. The application shall be submitted on a form prescribed by DSA. The application shall contain a project name for the school building or group of buildings, the name of the architect or registered engineer in general responsible charge of the work, the names of the architects or registered engineers who have been delegated responsibility for portions of the work (see Section 4-316), the estimated cost of the project and all such other information as is requested thereon.

(c) **Delayed filing.** In case the plans and specifications for the reconstruction or alteration of any school building have not been submitted to DSA under the assumption that the cost will not exceed \$100,000, the school board shall, if the bids that are received indicate that the cost will be in excess

of \$100,000, delay letting a contract until such time as the plans and specifications have been submitted and the approval by DSA obtained. The contract or contracts, when made, shall be based on the duly approved plans and specifications.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17297, 17302, 81133 and 81138.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-315, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-316. Designation of responsibilities.

(a) **General responsible charge.** For every project there shall be an architect or structural engineer in general responsible charge of the preparation of the plans, specifications and observation of the work of construction.

Exception: Where the plans, specifications or work of construction do not involve architectural or structural work or changes, the said plans, specifications and observation of the work of construction may be under the responsible charge of a professional engineer qualified to perform services and registered in that branch of engineering applicable to the work.

A project may be divided into parts, provided that each part is clearly defined by a building or similar distinct unit. The part, so defined, shall include all portions and utility systems or facilities necessary to the complete functioning of that part.

(b) **Delegation of responsibility.** The architect or structural engineer in general responsible charge may delegate responsibility for any portion of the preparation of the plans, specifications and observation of the work of construction, or may employ or retain, other architects or registered engineers. No delegation to, or employment or retention of others shall be construed as relieving the architect or structural engineer in general responsible charge of his or her rights, duties and responsibilities under Sections 17302 and 81138 of the Education Code and Sections 4-336, 4-341 and 4-344 of these regulations.

Subject to the provisions of the immediately precedent sentence, the architect or structural engineer in general responsible charge may employ or retain, under his or her supervision, professional engineers registered in the applicable branches of engineering to design and observe the construction, including the making of verified reports (see Section 4-336).

(c) **Assumption of responsibility.** The architect or registered engineer who has been delegated responsibility becomes the “responsible design professional” for that delegated portion of the work. Any design professional delegated responsibility for any portion of the work shall perform the duties prescribed in Section 4-341(c). Any design professional delegated responsibility for any portion of the observation of construction shall perform the duties prescribed in Section 4-341(f).

When an architect or registered engineer accepts the responsibility for completion of a project or portion of a proj-

ect started by another, that architect or registered engineer thereby assumes responsibility as follows:

1. If the change in responsibility occurs prior to the approval of the design documents, all responsibility shall be assumed. (See first paragraph of this subsection for procedure.)
2. If the change in responsibility occurs after the design drawings and specifications have been approved by DSA, the assuming architect or registered engineer shall be responsible for the construction of the project in accordance with the design of the previous architect or engineer. The assuming architect or registered engineer shall assume responsibility for the interpretation of and any necessary amplification of the plans and specifications and shall stamp and sign any such documents prepared for that purpose.

(d) **Acceptance of responsibility.** The assumption of general responsible charge or of delegated responsibility shall be established by the following:

1. Acceptance as architect or registered engineer in general responsible charge for the preparation of the plans, specifications and observation of the work of construction shall be reported using the form(s) prescribed by DSA.
2. Acceptance as the responsible design professional to whom portions of the preparation of the plans and specifications has been delegated shall be reported using form(s) prescribed by DSA.
3. Acceptance as the responsible design professional to whom portions of the observation of work of construction has been delegated shall be reported using form(s) prescribed by DSA. Any change in the assumption of the general responsible charge or of delegated responsibility shall be reported using the form(s) prescribed by DSA. If no form is available for a specific delegation or change, the delegation of responsibility shall be reported in letter form, which shall include an indication that the school board has been notified.

(e) **Alternates.** The applicant, or the architect or registered engineer having general or delegated responsibility, may name one or more persons to act as alternate(s) for the design and/or observation of the work of construction, provided such persons are architects or registered engineers who themselves are qualified under these rules and regulations to assume the responsibility assigned.

Alternates shall be named on a form prescribed by DSA, or if no form is available, reported in letter form. Letters or forms shall be submitted to DSA prior to performance of work by the alternate and shall include an indication that the school board has been notified.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17302 and 81138.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-316, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-317. Plans, specifications, calculations and other data.

(a) **General.** An application for approval of plans and specifications shall be filed with DSA, and the plans and specifications, design calculations, site data and a fee payment calculated on the estimated cost shall be submitted in accordance with procedures established by DSA. The plans and specifications shall include the construction documents required by Section 5-103 of Title 24, Part 1, California Code of Regulations. (See Section 4-320.)

Exception: DSA may require than an application for projects using the collaborative process for project review per Education Code Section 17319 or 81133.1 be accompanied by the filing fees per Sections 4-320 and 5-104. The deadline for submittal of completed plans, specifications and supporting documentation shall be determined by DSA in consultation with the applicant, and shall not exceed 18 months from the application date. Failure to comply with the established deadline may result in voidance of the application.

Plans and specifications that when submitted are determined, through initial plan check, by DSA to be incomplete or incorrect, shall be returned to the architect or engineer in general responsible charge with a request for compliance with these regulations before detailed plan checking commences.

(b) **Plans.** Plans shall designate the use or occupancy of all parts of the school buildings and shall give such other information as may be required to indicate the nature of the work proposed and to show compliance with the act and these regulations. The plans shall be legible and sufficiently detailed and cross-referenced to show clearly the pertinent features of the construction, and shall have sufficient dimensions to be readily interpreted. Where a project includes several school buildings, the plans for each shall be drawn independently except that details common to all need not be repeated.

The architect or engineer in general responsible charge or the professional engineer delegated responsibility for the design of the structural system of the project shall design and detail the anchorage and bracing of nonstructural elements. The details for the bracing and anchorage of nonstructural elements shall be shown and cross-referenced on the drawings.

(c) **Specifications.** Specifications shall completely set forth the requirements for the various types of materials that will enter into permanent construction and shall describe the methods not covered in the technical regulations that are to be used to obtain the required quality of the work shown on the plans as described in the specifications.

Due to the difficulty of anticipating every unsatisfactory condition that might be found in existing construction where addition, alteration, rehabilitation or reconstruction work is proposed, the following clause or one of similar meaning shall be included in the specifications:

“Should any existing conditions such as deterioration or noncomplying construction be discovered that is not covered by the DSA approved documents wherein the finished work will not comply with Title 24, California Code

of Regulations, a construction change document, or a separate set of plans and specifications, detailing and specifying the required repair work shall be submitted to and approved by DSA before proceeding with the repair work.”

(d) **Design calculations.** Calculations, stress diagrams and other pertinent data shall accompany the plans and specifications and shall be sufficiently complete so that capacities for individual structural members and their connections can be verified without additional calculations. All assumptions used in the calculations and their bases shall be stated. The calculations shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the proposed school building will resist vertical loads and horizontal forces.

The calculations shall be sufficiently complete to establish that the structure will resist the loads and forces prescribed in Part 2, Title 24, C.C.R. Assumed safe bearing pressures on soils and specified strengths of concrete shall be given in calculations and noted on plans. Where unusual conditions occur, such additional data as are pertinent to the work shall be submitted.

(e) **Site data.** Site data for all school sites shall include a geotechnical engineering report including subsurface site work, laboratory testing, an evaluation of site soil conditions, a recommendation for the type of foundations to be used and an allowable design value for the soil-bearing capacity.

A geologic and earthquake hazard report shall be submitted with the application for all new school sites, and for all construction on existing school sites located in a Seismic Hazard Zone, an Alquist-Priolo Earthquake Fault Zone, or in a seismic hazard zone designated in the Safety Element of a Local General Plan. DSA may require a geologic and earthquake hazard study for any construction on a school site outside of the boundaries of any geologic hazard zone where a potential geologic hazard has been previously identified.

Reports shall be prepared, and signed by a California-certified engineering geologist and a California-registered geotechnical engineer. Geologic hazard reports shall include an evaluation of the potential for damage due to flooding.

No school building shall be constructed, rehabilitated, reconstructed or relocated within 50 feet of the trace of an active fault that has experienced surface displacement within Holocene time (approximately 11,000 years).

(f) **Estimates of cost.** Estimates of cost shall be based on the cost prevailing at the time the plans and specifications are submitted to DSA. The estimated cost of a project shall be increased as necessary to include the estimated cost of every alternate building or portion thereof shown on the plans or specifications as if each alternate building and portion were to be constructed separately and simultaneously.

For projects using the collaborative process for project review per Education Code Section 17319 or 81133.1, the estimated cost of the project shall be based on the cost prevailing at the time that the application is submitted. Upon submittal of complete plans and specifications, DSA may require the applicant to revise the estimated cost based on

prevailing costs at that time. If the estimated cost has increased, the applicant shall submit additional filing fees based on the revised estimated cost.

When a contract amount, or the cumulative total of two or more contract amounts, exceeds the estimated cost by more than 30 percent, the estimated cost may be revised. An additional fee, if required, based on the revised estimated cost of the revision shall be paid before proceeding with the work. When the actual cost of constructing all the work shown on the approved plans is less than 70 percent of the estimated cost, a refund of overpaid fees may be claimed. (See Section 4-322 for actual cost and Section 4-325 for billing for further fees.)

(g) **Deferred submittals.** Only where a portion of the construction cannot be adequately detailed on the approved plans because of variations in product design and/or manufacturer, the approval of plans for such portion, when specifically accepted by DSA, may be deferred until the material suppliers are selected, provided the following conditions are met:

1. The project plans clearly indicate that DSA approval of the deferred submittal is required for the indicated portions of the work prior to fabrication and installation.
2. The project plans and specifications adequately describe the performance and loading criteria for such work.
3. A California licensed architect or California registered engineer stamps and signs the plans and specifications for the deferred submittal item. The architect or engineer in general responsible charge of the design of the project shall submit the plans and specifications for the deferred submittal item to DSA, with notation indicating that the deferred submittal documents have been found to be in general conformance with the design of the building.
4. Fabrication of deferred submittal items shall not begin without first obtaining the approval of deferred portions of the plans and specifications by DSA.

(h) **Signatures required.** The original signature sheet for the specifications and all plans, submitted for approval shall bear the stamp and signature of the architect or professional engineer in general responsible charge of the design of the project.

When responsibility for a portion of the work has been delegated, the plans and the original cover sheet for the specifications covering that portion of the design shall bear the signature and stamp of the responsible professional engineer or architect to whom the work has been delegated as well as that of the architect or engineer in general responsible charge. As an option, the architect or engineer in general responsible charge may sign the documents with notation indicating that the documents have been coordinated with the design documents and found to be in general conformance with the design.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17299, 17212, 17212.5, 17319, 81133.1, 81135 and 81033.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-317, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-318. Procedure for approval of application and voidance of application.

(a) **General.** After DSA has completed its check of the documents submitted with the application, the checked prints of the plans and specifications, with the items marked for corrections and/or requests for additional information noted thereon, shall be returned to the architect or registered engineer in general responsible charge. When plans and/or specifications require extensive corrections, a corrected set of prints of the plans and specifications shall be submitted for review if requested by DSA.

When the requested corrections have been made and/or the additional information has been provided by the architect or registered engineer in general responsible charge, an employee representative shall return the check set of plans and specifications along with the original plan tracings, the corrected specification pages and specification master cover sheet to DSA for backchecking. The backcheck is a comparison of the corrected plans and specifications with the check set of plans and specifications and shall be accomplished by either a conference between a knowledgeable employee representative or the architect or registered engineer in general responsible charge and the checking engineer, or by mail in the case of minor corrections to which all parties have agreed.

Changes in plans and specifications, other than changes necessary for correction, made after submission for approval, shall be brought to the attention of DSA in writing or by submission of revised plans identifying those changes clearly at the time of back-checking. Failure to give such notice may result in the voidance of any subsequent approval given to the plans and specifications.

All requested corrections shall be made, additional requested information furnished or original design justified prior to or at the time of the backcheck. When DSA deems that the corrected plans and specifications comply with these regulations and those parts of Title 24, CCR, that pertain to public school construction, DSA shall place its stamp on the reproducible sheets of drawings and master cover sheet of the specifications. The stamped drawings and specifications will be temporarily retained by DSA so that a record set can be created. DSA may direct the school district to create portions of the record set, and DSA may charge a fee to the school district to recover the costs of creating the record set.

(b) **Approval of application.** DSA shall issue to the school district written approval of the application for the project within five working days of stamping the approved plans and specifications. This written approval shall constitute the “written approval of the plans, as to safety of design and construction” required by Sections 17297 and 81134, Education Code, before letting a contract for any construction. (See Section 4-330 for construction time limitations.)

(c) **Voidance of application.** Any change, erasure, alteration or modification of any plans or specification bearing the stamp of DSA may result in voidance of the approval of the

application. However, the “written approval of plans” may be extended by DSA to include revised plans and specifications after documents are submitted for review and approved. (See Section 4-323 for revised plans and Section 4-338 for addenda and construction changes.)

The procedures leading to written approval of plans shall be carried to conclusion without suspension or unnecessary delay. At the discretion of DSA, the entire application may be voided where either (1) prints from corrected plans or corrected original plans are not filed for backcheck within 6 months after the date of return of checked plans to the architect or engineer, or (2) at the discretion of DSA, any remaining unapproved increment(s) of the application may be voided when more than six months have elapsed since the last approval of an increment has been issued, and subsequent incremental plans and specifications have not been received by DSA for checking.

For voided applications, upon request by the school district, 30 percent of the total structural portion of the fee will be refunded; however, no refund will be allowed for projects upon which only the minimum fee has been paid, or upon which only an increment was voided.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17297, 17307, 81133 and 81134.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-318, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-319. Withdrawal of application. If a request is made by the school board for the cancellation or withdrawal of the application and return of the plans and specifications, together with the paid fee, it will be granted only when the check of plans and specifications has not actually started. If the checking of plans and specifications has started, 30 percent of the total structural fee will be refunded or applied to a new application for the same project.

No refund will be allowed for projects upon which only the minimum fee has been paid. No refund will be allowed after a contract has been let for any portion of the work except as provided by Section 4-317(f).

For projects using the collaborative process for project review per Education Code Section 17319 or 81133.1, if the project is voided by DSA or a request by the applicant is made to withdraw the application prior to submittal of completed plans and specifications, filing fees minus costs incurred by DSA will be refunded.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17300, 81133 and 81136.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-319, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 4 FEES

4-320. Application fees. The fees required by Sections 17300 and 81136 of the Education Code shall be in accordance with Section 4-321. The fee schedule in effect at the time of filing shall apply throughout the duration of such application. A list of prior fee schedules is available upon request from DSA. The words “filing fee” mean the fee that shall accompany the application, or as corrected pursuant to Section 4-317(f), and the words “further fee” mean the fee that shall be paid to DSA if the actual cost exceeds the estimated cost by more than 5 percent. The application is considered to be received when it, accompanied by the plans and specifications, structural design computations, other required documents and filing fee, has been received by DSA, and the application number assigned.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17300 and 81133.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-320, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-321. Fee Schedule 11. The filing fee for projects shall be a maximum of 1.25 percent of the first \$1,000,000 of estimated cost and a maximum of 1.0 percent on the excess of the estimated cost over \$1,000,000, except that the minimum fee in any case shall be \$250.00. The maximum percentages may be subject to adjustment through enforcement agency policy in accordance with the Education Code.

If the actual cost exceeds the estimated cost by more than 5 percent, the further fee for such projects shall be equal to the difference between the filing fee paid and the amount computed under Fee Schedule 11 on the actual cost, the actual cost being determined according to Section 4-322.

Authority: Education Code Sections 17300, 17301, 17310, 81133 and 81142.

Reference: Education Code Sections 17280, 17300, 81130, 81133 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-321.1, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.
2. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-321.2, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-322. Project cost. For purposes of determining fees, both the estimated and actual costs of the project shall be the total outlay for all work included in the approved plans and specifications (exclusive of fees paid, but not recovered, for architectural, engineering, inspection and testing services) regardless of whether the funds are provided by the school district, by other public or private agencies or by individuals. The cost shall include any moving or relocation. In the event a building is converted to school use (see Section 4-306) the cost shall include the current replacement cost of the build-

ing. The current replacement cost shall be computed by multiplying an appropriate square foot cost by the total square foot area of the building being converted to school use. If work is done in portions the actual cost shall be determined at the completion of each contract. (See Section 4-325.)

The estimated cost and the fee based thereon shall not be amended after plan check has started except as provided by Section 4-317(f) or for permissible increase in scope of project. The scope of a project shall not be amended after bids for all or part of the project are opened. No portion of the fee can be returned after checking has been started except as provided by Sections 4-317(f) and 4-319.

Actual cost shall include all items that are normally considered to be contractor’s operation costs such as district-furnished labor and materials, bond, insurance and use of district facilities, and shall not be reduced by charge-backs such as those for testing, inspection or overrun of contract time. All fees and/or reimbursable charges paid to construction managers for performance of construction work shall be included in the actual cost of construction. When the contract for the work includes items not otherwise subject to the approval of DSA and not included in the approved plans and specifications the actual cost shall include this work unless such costs are segregated by separate bid items or by separately priced items of change orders, or by a certified copy of a subcontractor’s bid. Such segregation shall not be made by contract price breakdown or estimates. An hourly fee may be charged to the school district for the review of bid alternates.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17300 and 81133.

HISTORY:

1. Editorial correction of printing error (Register 83, No. 45).
2. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-322, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-323. Revisions of plans and specifications. Revisions are changes to the DSA approved plans or specifications made after DSA approval. Revisions shall be submitted to and approved by DSA.

An hourly fee may be charged to the school district for the review of revisions to approved plans and specifications in accordance with the published rates and collection procedures established by DSA.

If determined by the enforcement agency that the original plans that add buildings to the project scope are abandoned and the plans and specifications submitted in lieu thereof are for a new project rather than for an identical building, or a modified set of plans is for an essentially different structural concept, then it is necessary that a new application be filed and fee paid. This is regardless of the fact that the school building may have the same name, be of the same general size and be situated at the same location as the school building for which the original application was made.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17300 and 81133.

4-324. Examples and explanations of fee computation.

(a) Filing fee to accompany application.

Filing Fee under Schedule 11		
Estimated Cost \$8,000		
1.25% × \$8,000	=	\$100.00
Filing Fee is the minimum charge		\$250.00
Filing Fee under Schedule 11		
Estimated Cost: \$925,000.00		
1.25% × \$925,000	=	\$11,562.50
Filing Fee under Schedule 11		
Estimated Cost: \$1,260,000.00		
1.25% × \$1,000,000	=	\$12,500.00
1.0% × \$260,000	=	<u>2,600.00</u>
		\$15,100.00
Corrected Estimate under Schedule 11		
Estimated Cost on Application: \$925,000.00		
1.25% × \$925,000	=	\$11,562.00
1st Contract		700,000.00
2nd Contract		<u>525,000.00</u>
		\$1,225,000.00
(Exceeds \$925,000 by more than 30%)		
Corrected Estimated Cost: \$1,225,000.00*		
1.25% × \$1,000,000	=	\$12,500.00
1.0% × 225,000	=	<u>2,250.00</u>
		\$14,750.00
Fee previously paid		\$11,562.00
Corrected filing fee due		\$3,188.00

(b) Further fees where the actual cost exceeds the estimated or corrected estimated cost by more than 5 percent.

Further Fee under Schedule 11		
Corrected Estimated Cost: \$1,225,000*		
Actual Cost \$1,352,740.50		
1.25% × \$1,000,000.00	=	\$12,500.00
1.0% × 352,740.50	=	<u>3,527.41</u>
		\$16,027.41
Filing Fee Paid		
1.25% × \$1,000,000	=	\$12,500.00
1.0% × 225,000	=	<u>2,250.00</u>
		\$14,750.00
Further Fee	=	\$ 1,277.41

*The corrected estimated cost could be more than the sum of contracts if all work called for on plans is not yet under contract.

Authority: Education Code Sections 17300, 17301, 17310, 81133 and 81142.

Reference: Education Code Sections 17300, 17301 and 81133.

HISTORY:

- (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-324, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-325. Billing for further fees. The school district shall be billed for further fees upon completion of the project or portion thereof if fee is due. Claims for refunds due to errors in cost reporting or fee computation shall be made within six months from date of billing.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17300 and 81133.

4-326. Fees for approval of an evaluation and design criteria report for rehabilitation of an existing nonconforming building for use as a school building. A retainer fee of \$2,000.00 shall be required with submittal of the pre-application for a rehabilitation project in accordance with Section 4-307(c). Fees incurred in excess of the retainer fee for DSA review of the Evaluation and Design Criteria Report shall be based on the established hourly billing rate of the Department. Prior to approval of the Evaluation and Design Criteria Report, any additional fees incurred by DSA shall be fully paid. Any unused portion of the retainer fees shall be returned to the school district.

Authority: Education Code Section 17310.

Reference: Education Code Section 17280.5.

HISTORY:

- (DSA/SS (EF 02/03) Emergency adoption/approval of administrative and procedural requirements for the adaptive reuse of existing buildings for public school use; CCR Title 24, Part 1. Approved as emergency by the California Building Standards Commission on May 14, 2003, and filed with the Secretary of State on May 15, 2003. Effective May 15, 2003.

4-327. Fees for DSA review prior to application filing. An hourly fee may be charged to the school district for the review of draft drawings and specifications or consultations with DSA during project development, as requested by the school district and in accordance with the published rates and collection procedures established by DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17319 and 81133.1.

4-328. Fees for DSA certification of construction. A fee may be charged to the school district for the review and processing of all required documents submitted for the issuance of certification in accordance with the published rates and collection procedures established by DSA.

Authority: Education Code Sections 17310, 17315, 81142 and 81147.

Reference: Education Code Sections 17315(c) and 81147(c).

**ARTICLE 5
CERTIFICATION OF CONSTRUCTION**

4-330. Time of beginning construction and partial construction. Construction work, whether for a new school building, reconstruction, rehabilitation, alteration or addition, shall not be commenced, and no contract shall be let until the school board has applied for and obtained from DSA written approval of plans and specifications. Construction for each school building shall be commenced within four years after the approval of the plans; otherwise, the approval is void for those school buildings that have not commenced construction.

Exception: DSA may withdraw approval or institute post-approval requirements as necessary to address life safety concerns due to information received after approval of plans and before commencement of construction.

The school board may complete all work or proceed with the construction of any part of the work included in the approved plans and specifications with the intent of completing the work later. All work done and materials used and

installed must be in accordance with and in conformity to the approved plans and specifications.

An uncompleted building shall not be considered as having been constructed under the provisions of Article 3 or 7 commencing with Sections 17280 and 81130 of the Education Code, respectively. Section 17372 of the Education Code restricts the use of such a building.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17297, 17307, 17372 and 81130.

4-331. Notice to DSA at start of construction. The architect or registered engineer responsible for the project or the school district shall promptly notify DSA of the start of construction using forms and procedures specified by DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17295, 81130 and 81133.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/ Structural Safety Section to amend Section 4-331, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-332. Notice of suspension of construction.

(a) When construction is suspended for more than one month, the project inspector shall notify DSA [see Section 4-336(c)3].

(b) If all construction is suspended or abandoned for any reason for a continuous period of one year following its commencement, the approval of DSA shall become void. DSA may reinstate the approval on the request of the school board.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17310 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/ Structural Safety Section to amend Section 4-332, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-333. Observation and inspection of construction.

(a) **Observation by architect or registered engineer.** The Act requires that the observation of the work of construction, reconstruction, rehabilitation, alteration or addition shall be under the general responsible charge of an architect, structural engineer, or under certain conditions a professional engineer registered in that branch of engineering applicable to the work. (See Section 4-316.)

The responsible geotechnical engineer, or his or her qualified representative, shall perform all testing and special inspection of all earth materials, the placement and compaction of engineered fills, and the geotechnical aspects of foundations, retaining walls and foundation anchors. The responsible geotechnical engineer shall submit verified reports in accordance with Section 4-336 and Title 24, Part 2, Section 1704A.7.1.

(b) **Inspection by a project inspector.** The school board must provide for and require competent, adequate and continuous inspection by an inspector satisfactory to the architect or registered engineer in general responsible charge of observation of the work of construction; to any registered structural

engineer delegated responsibility for a portion of the work; and to DSA.

1. The cost of project inspection shall be paid for by the school board. An inspector shall not have any current employment relationship with any entity that is a contracting party for the construction or any entity providing any services for the school district except for services directly related to project inspection.
2. Project inspectors are prohibited from any activities involving the actual performance of construction, or the scheduling, coordination or supervision of construction contractors for the project.
3. For every project there shall be a project inspector who shall have personal knowledge as defined in Sections 17309 and 81141 of the Education Code of all work done on the project or its parts as defined in Section 4-316. No work shall be carried on except under the inspection of an inspector approved by DSA. On large projects adequate inspection may require the employment of one or more approved assistant inspectors in accordance with Section 4-333(d). The employment of special inspectors or assistant inspectors shall not be construed as relieving the project inspector of his or her duties and responsibilities under Sections 17309 and 81141 of the Education Code and Sections 4-336 and 4-342 of these regulations.
4. The project inspector shall be capable of performing all essential functions of the job.
5. The project inspector and any assistant inspector must be approved by DSA for each individual project. Prior to being eligible for approval, any project inspector or any assistant inspector shall establish, to the satisfaction of DSA that he or she:
 - A. is appropriately certified by DSA, per Section 4-333.1; and
 - B. has adequate knowledge and experience to perform the required duties for the project. He or she shall have at least three years experience in inspection or construction work on building projects of a type similar to the project. For newly certified inspectors without prior DSA project inspection experience, attendance of DSA-specified training is required; and
 - C. will provide sufficient time on the project to fulfill all inspection responsibilities required by these regulations.
6. An approved project inspector may be replaced in accordance with the process outlined in Section 4-341(d). The school district shall ensure that a replacement inspector is provided prior to continuation of construction work. DSA may withhold approval of the replacement inspector until a verified report by the previous project inspector is submitted in accordance with Section 4-336(c)5.
7. DSA may withdraw the inspector's approval for the project due to failure of project inspector to comply with the requirements contained in Section 4-342(b).

DSA shall communicate the withdrawal of the project inspector's approval in writing to the school district and the architect or registered engineer in general responsible charge. The school district shall ensure that a replacement inspector is provided prior to continuation of construction work.

8. The project inspector may perform special inspections if the project inspector has been specially approved by DSA for such purpose and has the time available to complete the special inspections in addition to project inspection work.
9. The detailed inspection of all work, as specified in Section 4-335(f), is the responsibility of the project inspector when a special inspector is not provided.

(c) **Special inspection.** Special inspection by qualified inspectors shall be in accordance with Title 24, Part 2, Chapter 17A.

DSA may require special inspectors for types of construction in addition to those listed in Chapter 17A, Title 24, Part 2 if found necessary because of the special use of materials or methods of construction.

(d) **Assistant inspectors.** Assistant inspectors are approved by DSA to assist the project inspector with the inspection of one or more aspects of the construction. Assistant inspectors must work under the supervision of a Class 1 or 2 certified project inspector.

1. On large projects DSA may require the employment of assistant inspectors when the project inspector is not able to provide continuous inspection of all aspects of the construction in a timely manner. When assistant inspectors are required by DSA the project inspector shall remain on-site providing supervision of all assistants during all construction.
2. All assistant inspectors must be approved by DSA prior to performing any inspection work in accordance with Section 4-341(d). Prior to being approved by DSA as an assistant inspector the individual must satisfy all of the following requirements:
 - A. Be certified as a Class 1, Class 2, Class 3 or Class 4 inspector in accordance with Section 4-333.1.
 - B. Must possess adequate experience for the type of construction that the assistant will be assigned to inspect.
 - C. Document at least three years of experience in the types of construction that the assistant will inspect. Experience must be obtained in construction or inspection of buildings similar to the buildings for which the individual is applying.
3. The assistant inspector shall establish, to the satisfaction of DSA that he or she meets all of the requirements established in Section 4-333(b)5.
4. Failure of the assistant inspector to perform any of the duties specified in these regulations may be cause for DSA to take action as outlined in Section 4-342(d).

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17309, 17311, 81130, 81138, 81141 and 81143.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-333, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.
2. (DSA/SS 2/95) Regular order by the Division of the State Architect/Structural Safety Section to amend Section 4-333. Filed with the Secretary of State on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

4-333.1. Project inspector certification. To become a DSA certified project inspector, an applicant must qualify for and successfully complete a written examination administered by DSA. The examination measures the applicant's ability to read and comprehend construction documents associated with performing inspections as well as the construction, inspection and testing requirements of the *California Building Standards Code*. Examinations are given in three classes.

1. A Class 1 certified inspector may be approved to inspect any project.
2. A Class 2 certified inspector may be approved to inspect any project, except a project containing one or more new structures or additions with a primary lateral force resisting system of steel, masonry or concrete.
3. A Class 3 certified inspector may be approved to inspect projects containing alterations to approved buildings, site placement of relocatable buildings and construction of minor structures.
4. Though an examination is no longer offered for Class 4, a Class 4 certified inspector may be approved to inspect projects containing site placement of relocatable buildings and associated site work.

To qualify for an examination, an applicant shall possess a high school diploma or equivalent, and shall meet the following minimum qualifications for the classification. Alternative qualifications consistent with those noted herein may be considered by DSA. Possession of a valid California registration as a civil or structural engineer or a valid California license as an architect, and one year qualifying experience in construction observation of buildings or structures as a civil or structural engineer or architect will qualify for any classification.

(a) For Class 1 inspector exam, one of the following:

1. Four years of experience as a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection, with a valid certification as a commercial combination building inspector by a state- or nationally-recognized organization, as accepted by DSA, on:

A. new building public school construction projects subject to the requirements of Education Code Section 17280 or 81130 consistent with the DSA Class 1 or 2 project classification and these regulations; and/or,

- B. construction of new hospital buildings as defined by Health and Safety Code Section 129725; or,
- C. building projects of Type I or II construction.

Exception: Possession of a valid California registration as a mechanical or electrical engineer responsible for the design and/or construction of respective building systems may be substituted for two years of required experience. Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience.

- 2. Four years of qualifying experience as the lead project construction superintendent on:

- A. new building public school construction projects subject to the requirements of Education Code Section 17280 or 81130 consistent with the DSA Class 1 or 2 project classification and these regulations; and/or,
- B. construction of new hospital buildings as defined by Health and Safety Code Section 129725; or,
- C. building projects of Type I or II construction.

Exception: Possession of a valid California registration as a mechanical or electrical engineer responsible for the design and/or construction of respective building systems may be substituted for two years of required experience. Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience.

- 3. Two years of qualifying experience as a DSA certified Class 2 project inspector,
- 4. Possession of certification as a DSA Class 2 project inspector with one year minimum qualifying experience as a DSA Class 2 project inspector and any combination of three years of qualifying experience on projects consistent with the DSA Class 1 or 2 project classification as:
 - A. an assistant project inspector; or
 - B. a special inspector (inspecting steel, concrete or masonry construction with a valid certification from a state- or nationally-recognized organization, as accepted by DSA). (Note: special inspector experience may be substituted on a month-for-month basis up to a maximum of one year); or

- C. a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection (with a valid certification as a commercial combination building inspector by a state or nationally-recognized organization, as accepted by DSA); or

- D. a lead project construction superintendent or construction experience as a journeyman or equivalent limited to working in the carpentry, steel, concrete or masonry trades (note: journeyman or equivalent experience may be substituted on a month-for-month basis up to a maximum of one year); or,

- 5. Possession of certification as a DSA Class 3 project inspector with three years minimum qualifying experience as a DSA Class 3 project inspector and any combination of three years of qualifying experience on projects consistent with the DSA Class 1 or 2 project classification as:

- A. an assistant project inspector; or
- B. a special inspector (inspecting steel, concrete or masonry construction with a valid certification from a state- or nationally-recognized organization, as accepted by DSA). (Note: special inspector experience may be substituted on a month-for-month basis up to a maximum of one year); or

- C. a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection (with a valid certification as a commercial combination building inspector by a state or nationally-recognized organization, as accepted by DSA); or

- D. a lead project construction superintendent or construction experience as a journeyman or equivalent limited to working in the carpentry, steel, concrete or masonry trades. (Note: journeyman or equivalent experience may be substituted on a month-for-month basis up to a maximum of one year.)

- 6. Possession of certification as a DSA Class 3 project inspector with one year minimum qualifying experience as a DSA Class 3 project inspector and ten years of relevant construction experience, including four years as a journeyman or equivalent experience level, limited to working in the carpentry, steel, concrete or masonry trades on construction projects consistent with the DSA Class 1 or 2 project classification.

Exception: Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for the required journeyman or equivalent experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for two years of required journeyman or equivalent experience. Completed coursework in architecture, engineering, building

inspection and/or construction may be substituted on a month-for-month basis up to a maximum of one year of required journeyman or equivalent experience.

(b) For Class 2 inspector exam, one of the following:

Exception: DSA may allow an applicant lacking years of experience, up to a maximum of one year, in the minimum qualifications options below to sit for the Class 2 examination. However, upon successful completion of the exam, the applicant shall not be granted certification until all requirements for one of the minimum qualifications options are completely satisfied. The applicant must obtain their last year of required experience within three calendar years of the administration date of the examination passed.

1. Three years of experience as a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection, with a valid certification as a commercial combination building inspector by a state or nationally-recognized organization, as accepted by DSA, or five years of experience in the same role with a valid certification as a commercial building inspector or residential combination building inspector by a state or nationally-recognized organization, as accepted by DSA on:

A. new building public school construction projects subject to the requirements of Education Code Sections 17280 or 81130 consistent with the DSA Class 1 or 2 project classification and these regulations; and/or

B. construction of new hospital buildings as defined by Section 129725 of the Health and Safety Code; or

C. building projects of Type I, II, III or IV construction; or

Exception: Possession of a valid California registration as a mechanical or electrical engineer responsible for the design and/or construction of respective building systems, may be substituted for two years of required experience. Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience.

2. Three years of qualifying experience as the lead project construction superintendent on:

A. new building public school construction projects subject to the requirements of Education Code Sections 17280 or 81130, and these regulations; and/or

B. construction of new hospital buildings as defined by Section 129725 of the Health and Safety Code; or

C. building projects of Type I, II, III, or IV construction; or

D. building construction consistent with the DSA Class 1 or 2 project classification; or,

Exception: Possession of a valid California registration as a mechanical or electrical engineer responsible for the design and/or construction of respective building systems may be substituted for two years of required experience. Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience.

3. Two years of qualifying experience as a DSA certified Class 3 project inspector.

4. Possession of certification as a DSA Class 3 project inspector with one year minimum qualifying experience as a DSA Class 3 project inspector and any combination of two years of qualifying experience on projects consistent with the DSA Class 1 or 2 project classification as:

A. an assistant project inspector; or

B. a special inspector (inspecting steel, concrete or masonry construction with a valid certification from a state- or nationally-recognized organization, as accepted by DSA). (Note: special inspector experience may be substituted on a month-for-month basis up to a maximum of one year); or

C. a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection (with a valid certification as a commercial building inspector or residential combination inspector by a state- or nationally-recognized organization, as accepted by DSA); or

D. a lead project construction superintendent or construction experience as a journeyman or equivalent limited to working in the carpentry, steel, concrete or masonry trades (note: journeyman or equivalent experience may be substituted on a month-for-month basis up to a maximum of one year); or,

5. Eight years of relevant construction experience, including three years as a journeyman or equivalent, limited to working in carpentry, steel, concrete or masonry trades on construction projects consistent with the DSA Class 1 or 2 project classification.

Exception: Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for the

required journeyman or equivalent experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for two years of required journeyman or equivalent experience. Completed coursework in architecture, engineering, building inspection and/or construction may be substituted on a month-for-month basis up to a maximum of one year of required journeyman or equivalent experience.

6. Possession of at least two valid special inspector certifications in steel, concrete, or masonry and eight years of special inspector experience (inspecting steel, concrete or masonry construction). No more than three years of a single type (related to steel, concrete, or masonry) of special inspection experience can be used.

(c) For the Class 3 inspector exam, one of the following:

Exceptions:

- i. DSA may allow an applicant lacking years of experience, up to a maximum of one year, in the minimum qualifications options below to sit for the Class 3 examination. However, upon successful completion of the exam, the applicant shall not be granted certification until all requirements for one of the minimum qualifications options are completely satisfied. The applicant must obtain their last year of required experience within three calendar years of the administration date of the examination passed.
 - ii. Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may sit for the Class 3 examination. However, upon successful completion of the exam, the applicant shall not be granted certification until all requirements for one of the minimum qualifications options are completely satisfied. The applicant must obtain their last year of required experience within three calendar years of the administration date of the examination passed.
1. Two years of experience as an architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection of building construction or construction consistent with the DSA Class 1, 2 or 3 project classification with a valid certification as a residential combination or commercial building inspector by a state- or nationally-recognized organization, as accepted by DSA.

Exception: Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience; or,

2. Possession of a valid California registration as a mechanical or electrical engineer and one year qualifying experience in construction observation of building systems; or,
3. Two years of qualifying experience as the lead project construction superintendent working on building projects or projects consistent with the DSA Class 1, 2 or 3 project classification.

Exception: Possession of a baccalaureate or higher in architecture, engineering, building inspection and/or construction may be substituted for one year of required experience. Possession of an associate's degree in architecture, engineering, building inspection and/or construction may be substituted for six months of required experience. Experience may be substituted with completed college coursework in architecture, engineering, building inspection and/or construction on a month-for-month basis for a maximum of six months; or,

4. Two years of qualifying experience as a DSA certified Class 4 project inspector.
5. Possession of certification as a DSA Class 4 project inspector with one year minimum qualifying experience as a DSA Class 4 project inspector and any combination of one year of qualifying experience on building projects or projects consistent with the DSA Class 1, 2 or 3 project classification as:
 - A. an assistant project inspector; or
 - B. a special inspector (inspecting steel, concrete or masonry construction with a valid certification from a state- or nationally-recognized organization, as accepted by DSA); or
 - C. a nonlicensed or nonregistered architect's, engineer's, owner's, or local building official's representative in building code-enforcement inspection (with a valid certification as a commercial building inspector or residential combination inspector by a state or nationally-recognized organization, as accepted by DSA); or
 - D. a journeyman or equivalent limited to working in the carpentry, steel, concrete or masonry trades.

Exception: Possession of a baccalaureate or higher, associate's degree, or completed college coursework in architecture, engineering, building inspection and/or construction may be substituted as part of the combined (i.e., non-Class 4) experience on a month-for-month basis up to a maximum of one year; or,

6. Six years of relevant construction experience, including two years as a journeyman or equivalent experience level, limited to working in the carpentry, steel, concrete or masonry trades on building construction projects consistent with the DSA Class 1, 2 or 3 project classification.

Exception: Two years of journeyman or equivalent experience may be substituted with possession of a baccalaureate or higher. One year of journeyman or equivalent experience may be substituted with possession of an associate's degree. Journeyman or equivalent experience may be substituted with or completed college coursework in architecture, engineering, building inspection and/or construction on a month-for-month basis for up to a maximum of six months.

7. Possession of at least two valid special inspector certifications in steel, concrete, or masonry and four years of special inspector experience (inspecting steel, concrete or masonry construction). No more than two years of a single type (related to steel, concrete, or masonry) of special inspection experience can be used.

An applicant for the certification examination or an inspector possessing a valid certificate issued by DSA, shall file changes of name, mailing address, email address or telephone number with the DSA headquarters office within 10 working days of that change. The information filed shall include the new and former name, mailing address, email address or telephone number.

Certification will be valid for a period of four years unless revoked in accordance with Section 4-342(d) or upgraded by achieving certification in a different class. Certification may be renewed by passing a recertification examination and attending DSA training classes that may include applicable continuing education courses acceptable to DSA that are presented by other entities acceptable to DSA.

DSA may charge an examination fee and training fee to recover reasonable costs.

An applicant for either the certification or recertification examination shall conduct his or her self during the examination in an ethical manner, with honesty and consideration for other examinees, shall not reveal examination contents with anyone during or after the examination, shall not falsify documents required for examination entrance and shall comply with published rules of the examination. Noncompliance may result in immediate expulsion from the examination without passage of any or all parts, forfeiture of fees, required payment of fines and other costs incurred by DSA in addressing the noncompliance, and nonentry to future certification or recertification examinations. Noncompliance by certified inspectors attempting to elevate their inspector classification may be cause for DSA to take disciplinary action in accordance with Section 4-342(d).

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17311 and 81143.

4-334. Supervision by the Division of the State Architect. During construction, reconstruction, rehabilitation, repair, alteration of, or addition to any school building, DSA, as provided by the Act, shall make such site visits as in its judgment are necessary for proper enforcement of the Act and the protection of the safety of the pupils, the teachers and the public. If at any time as the work progresses, prior to the issuance of the certification of compliance it is found that modifications or changes are necessary to secure safety or to comply with

code requirements, DSA shall notify the architect or registered engineer in general responsible charge, the contractor and the school district of the necessity for such modifications or changes.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17311 and 81143.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-334, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-334.1. Stop work order.

(a) Whenever DSA finds any construction work being performed in a manner contrary to the provisions of this code and that would compromise the structural integrity of the building, the Department of General Services, State of California, is authorized to issue a stop work order.

(b) The stop work order shall be in writing and shall be given to the owner of the property involved, or the owner's agent, or the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

(c) Any person who continues working on the cited work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17307.5 and 81133.5.

4-335. Structural tests and special inspections.

(a) **General.** Structural tests and special inspections are required as set forth in these regulations and Part 2 of Title 24, C.C.R.

Whenever there is insufficient evidence of compliance with any of the provisions of Title 24, C.C.R., or evidence that any material or construction does not conform to the requirements of Title 24, C.C.R., DSA may require tests/inspections as proof of compliance to be made at no expense to DSA.

Test/inspection methods shall be as specified by Title 24, C.C.R. and by applicable referenced standards, as listed in Chapter 35 of Part 2 of Title 24, C.C.R. If there are no recognized and accepted test/inspection methods, the responsible architect or structural engineer shall submit written alternate test/inspection procedures for review and acceptance by DSA.

The school board shall, with the advice of the architect or registered engineer in general responsible charge, select the laboratory of record, acceptable to DSA in accordance with Section 4-335.1, to conduct all required tests for the project, and special inspections that are contracted to the laboratory of record. The laboratory of record shall be directly employed by the school board and not be in the employ of any other agency or individual.

All tests shall be made by a laboratory acceptable to DSA, as described in Section 4-335.1. Where job conditions warrant, the architect or registered engineer in general responsible charge may waive certain tests with the approval of DSA. The responsible architect or structural engineer shall prepare a statement of structural tests and special inspections, obtain DSA approval and provide a copy of the approved statement of structural tests and special inspections to the laboratory of record and the project inspector prior to the start of construction.

(b) **Payments.** The school board shall pay for all tests/inspections, but if so specified the amount or a portion thereof may be collected from the contractor by the school board. When in the opinion of the architect or registered engineer, additional tests/inspections are required because of the manner in which the contractor executes his or her work, such tests/inspections shall be paid for by the schoolboard, but if so specified the amount paid may be collected from the contractor by the school board. Examples of such tests/inspection are: tests of material substituted for previously accepted materials, retests or re-inspections made necessary by the failure of material to comply with the requirements of the approved construction documents and specifications, and load tests necessary because certain portions of the structure have not fully met specification or plan requirements.

(c) **Sampling and testing of materials.** Samples or specimens of material for testing shall be taken by a qualified representative of the laboratory of record. For a minor scope of work, the project inspector may, if qualified and other duties permit, be authorized in writing by DSA to obtain, handle, prepare, protect, transport and/or store test specimens.

In general, samples may be selected at random; however, if there is reason to believe that specific materials may be defective, sample locations may be selected by the project inspector, responsible architect or structural engineer or DSA representative. In no case shall the contractor or vendor select the sample location or obtain specimens.

Obtaining, handling, preparing, protecting, transporting or storing of samples and testing shall be in accordance with the standards as provided for in the approved plans, specifications and in the applicable building regulations.

In cases where a tested sample has failed to meet the requirements of the DSA approved documents, the responsible architect or structural engineer, subject to the approval of DSA, may permit retest of the material or in-place work.

(d) **Test reporting requirements.**

1. The laboratory of record shall complete detailed test reports outlining all structural material tests. Report format shall be as prescribed by DSA.
2. Reports shall include all tests made, regardless of whether such tests indicate that the material is satisfactory or nonconforming.
3. The reports shall clearly state that the material or materials were sampled and tested in accordance with the requirements of these regulations and the approved plans and specifications. Reports shall also clearly state whether or not the material or materials tested met the requirements of the DSA approved documents.

4. All reports of tests performed on-site shall be submitted to the project inspector within one work day of the day the tests were performed.

5. Within 7 calendar days of the date of any material test, the laboratory of record shall submit all such test reports to the design professional in general responsible charge, the structural engineer, the project inspector, the contractor and the school district. The laboratory of record shall provide test reports to DSA when requested.

6. Reports of material tests not conforming with the requirements of the DSA approved documents shall be forwarded immediately to DSA, the design professional in general responsible charge, the structural engineer, the project inspector, the contractor and the school district.

(e) **Verified reports by the laboratory of record.** The laboratory of record shall submit a verified report to DSA, and provide a copy to the architect or registered engineer in general responsible charge, the school board and the project inspector, covering all of the tests and special inspections that were required to be made by that laboratory. Such report shall be furnished within 14 days of the completion of the testing/special inspection program, whenever required by DSA, or any time that work on the project is suspended, or services of the laboratory of record are terminated. The report shall cover the tests and special inspections completed at that time.

The verified report shall be signed, under penalty of perjury, by the California registered civil engineer charged with engineering managerial responsibility for the laboratory of record. The verified report shall state that the structural tests and special inspections required by the DSA approved documents were made. The report shall include a list of any non-compliant material or inspected work that has not been resolved by the date of the verified report. Any required tests or special inspection work that was not conducted by the laboratory of record shall be listed on the verified report, with an explanation why they were not performed.

(f) **Special inspection.** A special inspector shall not be less than 25 years of age, shall have had at least three years of experience in construction work or special inspection work on one or more projects similar to the project for which the inspector is applying, shall have a thorough knowledge of the building materials of his or her specialty and shall be able to read and interpret plans and specifications.

DSA may require evidence of the proposed special inspector's knowledge and experience by requiring proof of valid certification, as appropriate, from national, regional, or state authorities and/or by successful completion of a written and/or oral examination by the applicant before approval is granted. DSA may charge a fee to administer such examinations. DSA will maintain a list of special inspectors who have successfully completed an examination by DSA, and continued eligibility to remain on that list will be dependent on demonstrated acceptable performance of duties assigned and/or attendance at continuing education classes.

1. Special inspectors shall be employed by the laboratory of record or contract individually and directly with the school board.

A. Special inspectors employed by laboratory of record.

Assignment to a project: Special inspectors employed by the laboratory of record, under the supervision of the laboratory's engineering manager, do not require DSA project specific approval.

Supervision: Supervision of special inspectors employed by the laboratory of record shall be provided by the engineering manager, whose supervision duties shall include but are not limited to the following tasks:

- (i) Providing oversight and responsible control of special inspection services and associated report documents.
- (ii) Verifying that special inspectors meet all employment requirements and possess the training, education, technical knowledge, experience and/or certifications necessary to perform the duties assigned. The engineering manager shall also ensure that records of relevant certifications, qualifications, training and experience of inspection personnel are maintained at the laboratory facility and made available upon request to DSA.
- (iii) Verifying that special inspectors conduct the required field-related services in strict accordance with DSA approved documents and applicable standards.
- (iv) Monitoring special inspection activities to assure that the qualified special inspector is performing his or her duties as required.
- (v) Verifying that special inspectors properly document their activities, and that reports and logs are prepared and distributed in accordance with these regulations.

B. Special inspectors who contract individually and directly with the school board.

Approval for a project: The school board, or architect or registered engineer in general responsible charge shall secure DSA approval for special inspectors as required prior to commencement of work for which special inspection is required.

Supervision: The duties of the architect or registered engineer in general responsible charge in directing the special inspector shall include but are not limited to the following tasks:

- (i) Verifying that special inspectors possess the training, education and/or certifications necessary to perform the duties assigned.
- (ii) Verifying that special inspectors conduct the required special inspection services in strict accordance with DSA approved documents and applicable standards.
- (iii) Monitoring special inspection activities to assure that the qualified special inspector is performing his or her duties as required.

(iv) Verifying that special inspectors properly document their activities, and that reports and logs are prepared and distributed in accordance with these regulations.

(v) Verifying that all special inspectors working under the direction of the design professional have filed verified reports as prescribed by Section 4-336(c), and that all code-required special inspections were completed.

2. The acceptance or approval of special inspectors may be withdrawn by DSA if the special inspector fails to comply with any part of these regulations or the applicable inspection-related referenced standards on the approved plans and specification.

3. The duties of the special inspector shall include but are not limited to the following:

A. Review and comprehend all applicable DSA approved construction documents, shop drawings, requirements of applicable code and code referenced standards.

B. Perform the inspections in conformance with the requirements of the DSA approved documents, applicable code and code referenced standards.

C. Verify whether or not the work conforms to the requirements of the DSA approved documents, applicable code and code referenced standards.

D. The special inspector shall not accept any deviation from the DSA approved documents unless the revision has been approved by DSA.

E. Report in writing immediately any work that the special inspector deems nonconforming, and that is not immediately corrected upon notifying the contractor. Submit the report to the project inspector, DSA, the, architect or registered engineer in general responsible charge, the structural engineer delegated responsible charge for observation of construction, the contractor and the school district.

F. Complete and submit all required reports, as set forth in sub-section 4 below.

G. Special inspectors who contract individually and directly with the school district shall maintain records of all special inspections on a job-by-job basis for at least six (6) years, and shall make such records available to the school district, design professional in responsible charge and DSA upon request. Such records shall include all special inspection reports, noted deficiencies and dates of resolution of such deficiencies, verified reports, photographs, and such other information as may be appropriate to establish the sufficiency of the inspection program.

4. Inspection reporting requirements:

A. **Special inspector daily reports.** Special inspectors shall prepare detailed daily inspection reports outlining the work inspected and shall forward a copy of

the report to the project inspector within one day of the day the inspections were performed.

Reports indicating materials or workmanship found to be nonconforming with the requirements of the DSA approved documents shall be forwarded immediately to the project inspector, DSA, the architect or registered engineer in general responsible charge, the structural engineer delegated responsible charge for observation of construction, the contractor and the school district.

Within 7 days of the date of any special inspection, the special inspector shall submit copies of all daily reports to the school district, the architect or registered engineer in general responsible charge, the structural engineer delegated responsible charge for observation of construction, the contractor and the project inspector. The special inspector shall provide daily reports to DSA when requested.

Report format shall be as prescribed by DSA. Reports shall clearly state whether the work was inspected in accordance with the requirements of the DSA approved documents for the project. Reports shall also clearly state whether the work inspected met the requirements of the DSA approved documents. Reports shall include all special inspections made regardless of whether such inspections indicate that the work is satisfactory or nonconforming.

B. Special inspector verified report. Each special inspector who contracts individually and directly with the school board shall complete a verified report, as required by Section 4-336, and submit it to DSA, the architect or registered engineer in general responsible charge, the structural engineer delegated responsible charge for observation of construction, the school board and the project inspector. Such report shall be furnished within 14 days of the conclusion of work requiring special inspection, whenever required by DSA, or any time that work on the project is suspended, or services of the special inspector are terminated. The report shall cover the special inspection work completed at that time.

The verified report shall indicate that all special inspections were made as required by the approved plans and specifications, and shall list any noncompliant work that has not been resolved by the date of the verified report. Any required special inspections that were not conducted by the special inspector shall be listed on the verified report, with an explanation.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17309 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-335, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-335.1. DSA Laboratory Evaluation and Acceptance program.

(a) **General.** Laboratories conducting any special inspection, testing, or obtaining, handling, preparing, protecting, transporting or storing of samples must be accepted by the DSA Laboratory Evaluation and Acceptance (LEA) program. A laboratory may apply for DSA acceptance by submitting an application on a form prescribed by DSA, along with supporting documentation, to DSA. Upon receipt of a valid application, DSA shall evaluate the laboratory to verify that requirements of these regulations are met and that engineering managerial and supervisory staff are familiar with Title 24, C.C.R. requirements pertinent to materials testing and special inspection.

A letter of acceptance by DSA shall be issued to the laboratory and shall state that the laboratory has demonstrated that it has met the criteria established by DSA for performance of material testing and special inspection of work under DSA jurisdiction. A list of accepted LEA laboratories showing the types of tests and inspections for which they have been approved shall be posted on the DSA website.

(b) To qualify for acceptance, a laboratory shall comply with the following requirements:

1. **Qualification criteria.** The laboratory shall obtain and maintain accreditation for ASTM E329-11: *Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection*, through required evaluation and accreditation as described below.

Other nationally recognized evaluation services or accreditation bodies, equivalent to those indicated below, may be accepted by DSA with prior approval.

- A. The laboratory shall receive on-site assessments and quality system evaluations by the American Association of State Highway and Transportation Officials (AASHTO) re:source and/or the Cement and Concrete Reference Laboratory (CCRL).
- B. The laboratory shall maintain accreditation from the AASHTO Accreditation Program (AAP).

In addition, the laboratory must maintain accreditation for the following standards, as applicable: ASTM C1077 (Aggregate), ASTM C1077 (Concrete), ASTM C1093 (Masonry) and ASTM D3740 (Soil).

The laboratory shall maintain participation in applicable AASHTO re:source and CCRL proficiency sample programs.

The laboratory must authorize the release of accreditation, assessment and proficiency sample testing information to DSA.

2. **Laboratory structure.** Each laboratory facility shall employ a full-time engineering manager who is a State of California registered civil engineer. The engineering manager shall possess a minimum of 5 years of relevant experience in the inspection and testing industry and hold a management position in the company. All test-

ing and special inspection services shall be performed under the engineering manager's general supervision. The engineering manager shall be responsible for ensuring that all technicians and special inspectors employed by the laboratory are appropriately trained, qualified and certified in their area of expertise. The engineering manager may not be employed by any other DSA accepted laboratory that provides special inspection or testing services on DSA regulated projects. Administration and business practices of the laboratory shall comply with all relevant California State and Federal laws.

3. **Supervision.** Supervision by the engineering manager shall include but is not limited to the following tasks:
 - A. Providing oversight and responsible control of all field and laboratory testing services, special inspection services and associated report documents.
 - B. Verifying that technicians and special inspectors meet all employment requirements and possess the training, education and/or certifications necessary to perform the duties assigned.
 - C. Verifying that qualified technicians and special inspectors conduct the required laboratory and field-related services in strict accordance with DSA approved documents and applicable standards.
 - D. On-site monitoring of the special inspection activities to assure that the qualified special inspector is performing his or her duties as required. Frequency of the visits shall be determined by the engineering manager, who shall consider the size and complexity of the project.
 - E. Verifying that special inspectors properly document their activities, and that reports and logs are prepared and distributed in accordance with these regulations.
4. **Limitation of duties.** LEA laboratory activities are specifically limited to those tests/special inspections for which the laboratory has been approved and for which it has satisfied the requirements set forth in these regulations. No laboratory shall conduct any test or special inspections for which the laboratory is not qualified or approved by DSA to perform. The laboratory of record may subcontract tests/special inspections for which it is not approved to another LEA accepted laboratory possessing that approval.
5. **Equipment and tools.** A DSA accepted laboratory shall have adequate facilities, equipment, personnel expertise and technical references to permit the performance of testing and special inspections in compliance with applicable national standards and regulations. The laboratory shall possess and maintain all tools and equipment required to perform the specific tests and special inspections for which it is approved. Such tools and equipment shall be maintained and calibrated periodically in accordance with applicable nationally accepted standards.

6. **Documentation.** A laboratory shall maintain records of all tests and special inspections on a job-by-job basis for at least six (6) years, and shall make such records available to the school board, design professional in responsible charge and DSA upon request. Such records shall include all laboratory test reports, special inspection reports, noted deficiencies and dates of resolution of such deficiencies, verified reports, photographs, and such other information as may be appropriate to establish the sufficiency of the testing/special inspection program.

The laboratory's engineering manager shall review test and special inspection reports and progress reports for conformance of inspected work with the approved plans, specifications and workmanship provisions of the California Building Code (CBC) and referenced standards. Such supervision and control shall be evidenced by the engineering manager's signature and seal on the verified reports required by these regulations.

7. **Obligation to avoid conflict of interest.** Laboratories shall not engage in any activities that may conflict with their objective judgment and integrity, including but not limited to having a financial and/or other interest in the construction, installation, manufacture or maintenance of structures or components that they inspect, test, verify, or certify.
8. **Evaluations.** The qualifications and capabilities of testing laboratories statewide are subject to evaluation by DSA LEA program personnel. Evaluations occur upon application for initial acceptance, application for renewal, a change in responsible engineering manager, laboratory location, supervisory personnel, and company name and/or services. Evaluations may include but are not limited to a review of the application submitted, consultation with the engineering manager as well as an on-site examination/evaluation of the quality system, equipment, personnel and records.
9. **Audits.** The operations of a DSA accepted laboratory may be subject to audit by DSA. Audits may occur upon receipt of complaints or evidence of failure by the laboratory to meet the requirements of these regulations. Audits may include but are not limited to the following: review of LEA program records, project specific records, on-site examination of equipment, and records of special inspection and testing services. An audit may result in a requirement that the laboratory be re-evaluated.
10. **Obligation to cooperate with inquiries.** All accepted laboratories shall cooperate in any investigation by DSA into the activities at any school project site or fabricating/manufacturing facility for which they have provided special inspection and/or testing services and shall provide prompt, accurate and complete responses to reasonable inquiries by DSA and other appropriate individuals or agencies.

(c) **Duration of LEA laboratory acceptance.** Acceptance will remain valid for a period of four years unless approval is

withdrawn for failure to comply with the requirements of these regulations. Examples of such failure include, but are not limited to:

1. Making changes in engineering management, supervisory personnel, laboratory location, major equipment, or other key factors without prior notification to the DSA LEA program.
2. Failing to have the laboratory facility evaluated and accredited as outlined in Section 335(b)1, as applicable to services offered.
3. Reporting that materials and/or workmanship meet the requirements of DSA approved documents when they do not.
4. Failing to sample, handle and/or test materials as required by the approved documents, code and referenced standards.
5. Utilizing technicians or special inspectors that do not meet the qualification and/or certification requirements.
6. Failing to adequately supervise technicians and/or special inspectors.
7. Failing to comply with any of the other requirements of these regulations or the DSA approved documents for a project.

(d) **Fees for testing laboratory evaluation.** DSA may charge a fee to cover the costs of evaluating and re-evaluating the laboratory. DSA reserves the right to visit, audit and observe the laboratories.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17309 and 81141.

4-336. Verified reports.

(a) **General.** As the work of construction progresses, the architect or registered engineer in general responsible charge of observation of construction of the work, each architect or registered engineer delegated responsibility for a portion of observation of construction of the work, the project inspector, the geotechnical engineer, the laboratory of record, approved special inspectors contracting individually and directly with the school board, and the contractor shall each make and sign under penalty of perjury, a duly verified report to DSA and provide a copy of the same report to the project inspector. The verified report shall be made upon a prescribed form or forms attesting that of his or her own personal knowledge the work during the period covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved plans and specifications, and setting forth such detailed statements of fact as shall be required.

The term “personal knowledge” as applied to an architect or registered engineer means the personal knowledge that is obtained from periodic visits of reasonable frequency to the project site for the purpose of general observation of the work, and that is obtained from the reporting of others on the progress of the work, testing of materials, inspection and superintendence of the work. The exercise of reasonable diligence to obtain the facts is required.

The term “personal knowledge” as applied to the project inspector means the actual personal knowledge that is obtained from the inspector’s personal continuous inspection of the work in all stages of its progress. For work performed away from the site, the project inspector may obtain personal knowledge from the reporting of testing or special inspection of materials and workmanship for compliance with approved plans, specifications and applicable standards. The exercise of reasonable diligence to obtain the facts is required.

The term “personal knowledge” as applied to a special inspector means the actual personal knowledge that is obtained from the inspector’s personal inspection of the work assigned. The verified report shall clearly describe the work assigned to each individual special inspector. The exercise of reasonable diligence to obtain the facts is required.

The term “personal knowledge” as applied to the contractor means the personal knowledge gained from constructing the building. The exercise of reasonable diligence to obtain the facts is required.

(b) **Verified report form.** Verified reports shall be made on specific forms prescribed by DSA.

(c) **Required filing.** Verified reports shall be made as follows:

1. By each contractor having a contract with the school board, at the completion of the contract.
2. By the architect, registered engineers and project inspector at the completion of construction as determined acceptable to DSA.
3. By the architect, registered engineers, engineering manager of the laboratory of record, as required by Section 4-335(e), project inspector, and approved special inspectors contracting individually and directly with the school board, at the suspension of all work for a period of more than one month and at identified milestones of completed construction prescribed by DSA.
4. By the project inspector when any building included in the scope of the project is occupied or re-occupied.
5. By any of the following, whenever their services in connection with the project have been terminated for any reason: the architect or registered engineer in general responsible charge, engineering manager of the laboratory of record, project inspector, approved special inspector contracting individually and directly with the school board, or the contractor.
6. By the responsible geotechnical engineer, as required by Section 4-333(a), upon completion of his or her duties.
7. By the engineering manager of the laboratory of record, as required by Section 4-335(e), at the completion of the testing program.
8. By the approved special inspector contracting individually and directly with the school board at the conclusion of work requiring special inspection.

9. By any party listed above at any time a verified report is requested by DSA.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17309 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-336, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-337. Semimonthly reports. In addition to the verified reports (Section 4-336) the project inspector shall make semi-monthly reports of the progress of construction to the architect or registered engineer in general responsible charge and the structural engineer if delegated to observe the structural portion of the construction. A copy of each such report shall be sent to the school board and DSA, and a copy kept in the project inspector's job file.

Semimonthly reports shall state the name of the building, the school and the school district, and give the file and application number. The reports shall include a list of official visitors to the project and whom they represent, a brief statement of the work done, instructions received from the architect or registered engineer during the period covered by the report and pertinent information regarding any unusual conditions or questions that may have arisen at the job. The semimonthly report shall include problems or noncomplying conditions that have occurred on the project and how they were resolved or brought into compliance. Failure to comply with this section, in a timely manner, may be cause for DSA to withdraw approval of the inspector.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17309, 17310, 81130, 81141 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-337, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-338. Addenda and construction changes.

(a) **General.** Work shall be executed in accordance with the approved plans, addenda and construction change documents. Changes in the plans and specifications shall be made by addenda or construction change documents approved by DSA. [See Section 4-318(b).]

(b) **Addenda.** Changes of the approved plans or specifications made during the bidding phase and prior to letting a construction contract for the work involved shall be made by means of addenda. Addenda for changes to the structural, accessibility or fire-life safety portions of the project shall be submitted to and approved by DSA prior to commencement of the work shown thereon. Addenda shall refer to the portions of the approved plans and specifications being changed; clearly describe the work to be accomplished; and, where necessary, be accompanied by supplementary drawings, technical data and calculations. Addenda shall be numbered sequentially for easy reference. All addenda shall be stamped

and signed by the architect or registered engineer in general responsible charge.

If required by DSA, all other addenda shall be submitted to the DSA for concurrence that they do not contain changes to the structural, accessibility and/or fire-life safety portions of the project.

(c) **Construction changes.** Changes of the approved plans or specifications after a contract for the work has been let shall be made by means of construction change documents. Construction change documents for changes to the structural, accessibility or fire-life safety portions of the project shall be submitted to and approved by DSA prior to commencement of the work shown thereon. Construction change documents shall refer to the portions of the approved plans and specifications being changed; clearly describe the work to be accomplished; and, where necessary, be accompanied by supplementary drawings, technical data and calculations. Construction change documents shall be numbered sequentially for easy reference. All construction change documents shall be stamped and signed by the architect or engineer in general responsible charge, or by the architect or registered engineer delegated responsibility for the portion of the work of construction affected by the change.

If required by DSA, all other construction change documents shall be submitted to the DSA for concurrence that they do not contain changes to the structural, accessibility and/or fire-life safety portions of the project.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17927 and 81134.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-338, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-339. Final certification of construction. The certification of compliance by DSA for public school building projects will be issued when the work has been completed in accordance with the requirements as to safety of design and construction of Sections 17280-17316 and 81130-81147 of the Education Code. The final certification of compliance will not be issued until the school board has filed a notice of completion and has filed a statement of final actual project cost as identified in Section 4-322, and has paid all required fees to the Department of General Services.

The certification by DSA may be evidenced either by letter or by certificate. A certificate of compliance will, in general, be issued only for large new projects where the board may desire to display such certificate in a conspicuous place. The letter or certificate of compliance will be directed to the school board.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17310 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-339, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 6 DUTIES UNDER THE ACT

4-341. Duties of the architect, structural engineer or professional engineer.

(a) **General.** The architect or registered engineer in general responsible charge is responsible to the school board and to DSA to see that the completed work conforms in every material respect to these regulations and to the approved plans and specifications. (See Section 4-316.) The architect or registered engineer in general responsible charge may, if so authorized, act as agent for the school board in completing and submitting the application for approval of plans and specifications to DSA. (See Section 4-315.)

The architect or registered engineer in general responsible charge in no way is relieved of any responsibility by the activities of DSA in the performance of its duties.

(b) **General responsible charge.** The architect, structural engineer or professional engineer in general responsible charge shall advise the school board in regard to filing of the application for approval of plans, the selection of an inspector and the selection of a testing laboratory. The architect or registered engineer in general responsible charge shall prepare plans, specifications, design calculations and other data and shall prepare addenda and construction change documents authorized by the school board and as required by conditions on the project.

The architect or registered engineer in general responsible charge shall make, or cause to be made, the corrections required on the various documents to comply with the requirements of these regulations. The architect or registered engineer in general responsible charge shall perform general observation of the work of construction, interpret the approved drawings and specifications and shall provide the project inspector and testing facility with a complete set of stamped plans, specifications, addenda and construction change documents prior to the start of construction.

In general, DSA directs all technical correspondence to the architect or registered engineer in general responsible charge of the project.

(c) **Delegated responsibility.** An architect or registered engineer to whom responsibility has been delegated shall, under the general direction of the architect or registered engineer in general responsible charge, prepare plans, specifications, calculations and other data, and make corrections on these documents as required to comply with these regulations. Such architect or registered engineer shall consult with the architect or registered engineer in general responsible charge in the preparation of addenda, deferred submittals and construction change documents and the selection of inspectors and the testing facility. The architect or registered engineer to whom responsibility has been delegated shall provide evidence of his or her responsibility for the documents that affect his or her portion of the work and are presented to DSA for approval by his or her stamp and signature thereon.

(d) **Approval of inspectors.** The school district or architect or registered engineer in general responsible charge shall obtain DSA approval for a project inspector, an assistant

inspector and a replacement inspector, if any, prior to commencement or continuation of construction work, as applicable, in accordance with the project inspector approval process specified by DSA. The following shall be submitted to DSA:

1. The name of the person proposed as project inspector of the work, together with an outline of his or her experience and pertinent qualifications on a form prescribed by DSA, in accordance with the project inspector approval process specified by DSA.

DSA inspector approval is contingent upon the inspector providing adequate time to satisfy continuous inspection requirements per 4-342(b)1. The proposed project inspector's concurrent workload shall be included in the inspector's submittal forms for project approval. If DSA determines the inspector's cumulative workload appears excessive and may hinder continuous inspection required per Section 4-342(b)1, DSA may require the inspector to justify that sufficient time will be spent on the project.

2. The name of any proposed assistant inspector together with an outline of his or her experience and pertinent qualifications on a form prescribed by DSA, in accordance with the project inspector approval process specified by DSA.
3. The name of any special inspector to be used, in accordance with Section 4-335(f)1(B).
4. When a replacement project inspector is retained, the name of the person proposed as the new project inspector, together with an outline of his or her experience and pertinent qualifications on a form prescribed by DSA.

The architect or registered engineer in general responsible charge shall provide general direction of the work of the project inspector and shall immediately notify the school board and DSA in writing if the project inspector is found to be unable or unwilling to perform such duties properly. This notification shall include a statement as to whether the architect or engineer is recommending that the school board terminate the inspector's employment. Prior to termination, the school district shall confer with DSA and provide the basis for the termination, and the architect or structural engineer in general responsible charge shall obtain DSA approval of a replacement project inspector. No work on the project may proceed until a new project inspector has been approved by DSA. Upon completion of a terminating verified report, the inspector's duties and responsibilities for the project are ended.

In view of the architect or engineer's responsibilities for directing the activities of the inspector, such architect or registered engineer in general responsible charge shall review and evaluate the inspector's qualifications before recommending the approval of the inspector to DSA.

(e) **Report of contract.** The architect or registered engineer in general responsible charge or the school board shall report contract information and time of starting work to DSA. (See Section 4-331.)

(f) **Architect or engineer verified reports.** The architect or registered engineer in general responsible charge and all architects and registered engineers delegated responsibility

for observation of the work of construction shall observe the work of construction of his or her portion of the project; when delegated, consult with the design professional in general responsible charge in the interpretation of the approved drawings and specifications; and shall maintain such personal contact with the project as is necessary to assure themselves of compliance in every material respect with the approved plans and specifications. Personal contact shall include visits to the project site by the architect, engineer or their qualified representative to observe the construction. The architect or registered engineer in general responsible charge and each architect or engineer delegated responsibility for observations of the work of construction shall submit verified reports to DSA and provide a copy to the project inspector as required by Section 4-336. The architect or registered engineer in general responsible charge shall also require that verified reports from the project inspector, special inspectors, testing facility, the geotechnical engineer, contractors and the other architects and engineers are submitted as required.

(g) Structural tests and special inspection program.

The architect or registered engineer in general responsible charge shall establish the extent of the structural tests and special inspection program consistent with the needs of the particular project (see Section 4-335) and shall issue specific instructions to the testing facility and special inspectors prior to start of construction. He or she shall also notify DSA as to the disposition of materials noted on laboratory testing, and/or special inspection, reports as not conforming to the DSA approved documents.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17302, 17309, 17310, 81138, 81141 and 81142.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-341, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-342. Duties of the project inspector.

(a) **General.** The project inspector shall act under the direction of the architect or registered engineer in general responsible charge. The project inspector is also subject to supervision by DSA.

(b) **Duties.** The general duties of the project inspector in fulfilling his or her responsibilities are as follows:

1. **Continuous inspection requirement.** The project inspector must have actual personal knowledge, obtained by personal and continuous inspection of the work of construction in all stages of its progress, that the requirements of the approved plans and specifications are being completely executed.

Continuous inspection means complete inspection of every part of the work. Work, such as concrete work or masonry work that can be inspected only as it is placed, shall require the constant presence of the inspector. Other types of work that can be completely inspected after the work is installed may be carried on while the inspector is not present. In any case, the inspector must personally inspect every part of the work. In no case

shall the inspector have or assume any duties that will prevent the inspector from giving continuous inspection. DSA may require verification from the project inspector of time spent at the construction site during all phases of the work. The project inspector may obtain personal knowledge of the work of construction, either on-site or off-site, performed under the inspection of special inspectors and/or assistant inspectors (Section 4-333). The project inspector may obtain personal knowledge that materials used in the construction conform to the DSA approved documents by verifying test reports performed by DSA accepted testing facilities, verifying materials certifications shipped with the materials, or other means as specified in the DSA approved documents and referenced codes and standards. The project inspector shall verify that special inspectors possess valid certifications for the work being inspected. The project inspector shall be responsible for monitoring the work of the special inspectors and testing laboratories to ensure that the testing program is satisfactorily completed. The project inspector shall be responsible for supervising the work of all assistant inspectors in accordance with Section 4-333(d). The exercise of reasonable diligence to obtain the facts shall be required.

2. **Relations with architect or engineer.** Any uncertainties in the inspector's comprehension of the plans and specifications or inconsistencies or seeming errors in the approved construction documents shall be reported promptly to the architect or registered engineer in general responsible charge for interpretation and instructions. In no case shall the instruction of the architect or registered engineer be construed to cause work to be done that is not in conformity with the DSA approved documents.
3. **Job file.** The project inspector shall keep and maintain a file on the job at all times with all of the following:
 - A. DSA approved plans and specifications including DSA approved addenda and all construction change documents.
 - B. Applicable parts of the edition of Title 24, C.C.R., referred to in the plans and specifications, and any pertinent referenced standards.
 - C. DSA approved statement of structural tests and special inspections.
 - D. Copies of project inspector's semi-monthly reports.
 - E. Copies of all deviation notices and a log of all deviation notices. The log shall reference all applicable details and specification sections related to nonconforming materials and workmanship including construction change documents, addenda and deferred submittals. The log shall describe all corrective actions taken whether performed in accordance with DSA approved documents or not, the current status of each deviation issue and the resolution for each issue.
 - F. Log documenting all significant communications with the design professionals, contractors, DSA representatives and other persons involved in the project. Significant communications include, but are not limited to, interpretations, clarifications or directions

from the design professionals, issues identified by DSA representatives, directives from the school district and start notices from the contractor.

- G. Laboratory tests and inspection reports.
- H. Contractor's request for information (RFI) and responses to the RFIs.
- I. Interpretations and clarifications from the design professional in general responsible charge.
- J. Special inspection reports.
- K. Concrete placing operation records showing the time and date of placing concrete and the time and date of removal of forms in each portion of the structure.
- L. Welding operation records including identification marks of welders, lists of defective welds, manner of correction of defects, etc.
- M. Pile driving operation records including penetration under the last 10 blows for each pile when piles are driven for foundations.
- N. Verified reports for all persons required by this code to file verified reports.
- O. Any other applicable documents required to provide a complete record of construction.

The job file shall be kept on the job site until the completion of the project and shall be readily accessible to DSA personnel during site visits. A copy of the job file shall be made available to DSA upon request. The job file, with the exception of building codes and reference standards, shall be made a part of the permanent school district records.

- 4. **Project inspector's semimonthly reports.** The project inspector shall keep the architect or registered engineer in general responsible charge thoroughly informed as to the progress of the work by making semimonthly reports in writing as required in Section 4-337.
- 5. **Notifications to DSA.** The project inspectors shall notify DSA at the following times:
 - A. When construction work on the project is started, or restarted if previously suspended per Item D below.
 - B. At least 48 hours in advance of the time when foundation trenches will be complete, ready for footing forms.
 - C. At least 48 hours in advance of the first placement of foundation concrete and first grout placement for masonry construction and, when requested by the enforcement agency, 24 hours in advance of any subsequent and significant concrete placement, or grout placement for masonry construction.
 - D. When all work on the project is suspended for a period of more than one month.
 - E. By email at least 48 hours prior to scheduled work covering up uncorrected deviations.
- 6. **Deviations.** The project inspector shall notify the contractor, in writing, of any deviations from the approved plans and specifications that are not immediately cor-

rected by the contractor when brought to the contractor's attention. Copies of such notice shall be forwarded immediately to the architect or registered engineer, and to DSA.

Failure on the part of the project inspector to notify the contractor of deviations from the approved plans and specifications shall in no way relieve the contractor of any responsibility to complete the work covered by his or her contract in accordance with the approved plans and specifications and all laws and regulations.

- 7. **Inspector verified report.** The project inspector shall make and submit directly to DSA verified reports (see Section 4-336). The project inspector shall prepare and deliver to DSA detailed statements of fact regarding materials, operations, etc., when requested.
- 8. **Performance of duties.** The inspector shall perform all duties and render all services with honesty. Inspectors who fail to carry out their duties in an ethical manner or who engage in illegal activities may be subject to disciplinary action as defined in Section 4-342(d).

(c) **Violations.** Failure, refusal or neglect on the part of an inspector to notify the contractor of any work that does not comply with the requirements of the approved plans and specifications, or failure, refusal or neglect to report immediately, in writing, any such violation to the architect or registered engineer, to the school board and to DSA shall constitute a violation of the Act and shall be cause for DSA to take action that may result in the withdrawal of the inspector's approval. The State Architect or designee may take appropriate action as described in Section 4-342(d) when any of the following conditions exist:

- 1. The inspector has failed to fulfill any of the relevant requirements of this code.
- 2. The inspector has been convicted of a crime considered to be substantially related to the qualifications, functions or duties of an inspector in a manner consistent with the public health, safety or welfare.

(d) **Disciplinary actions.** Failure to satisfactorily perform inspector duties identified in this code may be cause for DSA to take action(s) that include but are not limited to the following:

- 1. Requiring the inspector to meet with DSA in the regional office for counseling.
- 2. Requiring the inspector to attend training classes.
- 3. Withdrawal of the inspector's approval for the project.
- 4. Downgrading of the inspector's class of certification.
- 5. Suspension of the inspector's certification.
- 6. Withdrawal of the inspector's certification.

(e) **Notice of disciplinary actions.** Notice of disciplinary action shall specify the grounds for the actions taken.

(f) **Criteria for reinstatement.** When considering reversal of any disciplinary action taken pursuant to Section 4-342(d), the State Architect or designee evaluating the reinstatement of an inspector's approval for a project, or certification, may consider the following criteria:

- 1. Nature and severity of the act(s) or offense(s).

2. The time that has elapsed since the commission of the act(s) or offense(s).
3. If applicable, evidence of expungement proceedings pursuant to Section 1203.4 of the Penal Code.

(g) Filing an appeal.

1. The State Architect or his/her designee has the discretion to immediately order that approval of a project inspector for a project, or certification, be temporarily invalidated or to seek additional information, pending a final determination by the State Architect or his/her designee pursuant to Section 4-342(c). The decision to temporarily invalidate approval of a project inspector for a project, or certification, will be made on a case by case basis, as necessary to ensure public health, safety and welfare.
2. The State Architect or his/her designee shall provide the appellant with written notice that their approval for a project, or certification, has been temporarily invalidated as of a specific date or is subject to suspension or denial pursuant to Section 4-342(d), pending a final determination. The written notice shall include the reasons for the action being taken or investigated, as applicable, and provide a summary of the facts and allegations. Service of the written notice of the proposed action shall be confirmed by certified mail.
3. Written notice of the final determination by the State Architect or his/her designee shall be confirmed by certified mail within 60 days from the initial written notification. The time to render his/her determination may be extended an additional 30 days, as necessary to consider any additional supporting documentation provided to the State Architect relevant to the issue being investigated.
4. An appeal of an action by the State Architect or his/her designee to suspend approval of a project inspector for a project, or certification, or to deny renewal of a certification must be filed in writing with DSA within 60 days of the date posted on the certified service of the written notice of the final determination from the State Architect. Unless a hearing is specifically requested as provided in Section 4-342(g)6 the appeal will be based on an analysis of the materials available.
5. Within 60 days from the date of receipt of the appeal the State Architect or his/her designee shall render his/her determination on the appeal. The time to render the determination may be extended an additional 30 days, as necessary to conclude any research or investigation required, at the discretion of the State Architect or his/her designee.
6. Should an individual submit a written request for a hearing, the State Architect may designate an appropriate hearing officer to conduct the hearing. Written notice of the date and time of the hearing and the reasons for the action being taken or investigated, as applicable, shall be provided to the appellant. The hearing shall be limited in scope to the actions stated in the written notice. The appellant may bring a representative of his/her choice.

7. The appellant shall be notified in writing of the determination made by State Architect or his/her designee regarding the appeal. Service of the written notice of the decision shall be confirmed by certified mail.
8. Any appeal of a decision rendered by the State Architect or his/her designee to rescind approval for a project or certification may be appealed to the Superior Court.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17309, 17311, 81141 and 81143.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-342, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-343. Duties of the contractor.

(a) **Responsibilities.** It is the duty of the contractor to complete the work covered by his or her contract in accordance with the approved plans and specifications thereof. The contractor in no way is relieved of any responsibility by the activities of the architect, engineer, inspector or DSA in the performance of such duties.

(b) **Performance of the work.** The contractor shall carefully study the approved plans and specifications and shall plan a schedule of operations well ahead of time. If at any time it is discovered that work is being done that is not in accordance with the approved plans and specifications, the contractor shall correct the work immediately.

All inconsistencies or items that appear to be in error in the approved plans and specifications shall be promptly called to the attention of the architect or registered engineer, through the inspector, for interpretation or correction. In no case, however, shall the instruction of the architect or registered engineer be construed to cause work to be done that is not in conformity with the approved plans, specifications and construction change documents.

The contractor must notify the project inspector, in writing, of the commencement of construction of each and every aspect of the work at least 48 hours in advance.

The contractor must notify the inspector of the completion of each aspect of the work.

(c) **Contractor verified reports.** The contractor shall make and submit to DSA from time to time, verified reports as required in Section 4-336.

If work on the building is being done by independent contractors, having contracts with the school board, verified reports shall be submitted by each contractor regardless of the type of work involved.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17309, 81130 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-343, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-344. Duties of mechanical and electrical engineers. The architect or structural engineer in general responsible charge is responsible for the designs prepared by the mechanical and electrical engineers, except that where plans, specifications and estimates for alterations or repairs do not involve architectural or structural changes said plans, specifications and estimates may be prepared and work of construction may be observed by a professional engineer in general responsible charge who is duly qualified to perform such services and who holds a valid certificate under Chapter 7 of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications, and estimates and work of construction are applicable.

The mechanical or electrical engineer shall fulfill the duties outlined in Section 4-341 when assuming general responsible charge and shall submit verified reports as required in Section 4-336. When accepting delegated responsibility he or she shall comply with the requirements of Sections 4-336 and 4-341 insofar as these may relate to the work delegated to him or her.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17302, 17309, 81133, 81138 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-344, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 7 EXAMINATION AND REPORT OF EXISTING BUILDINGS

4-345. Request for examination.

(a) **Examination and report requested of DSA by the school district.** Upon written request by the governing board of any school district or by at least 10 percent of the parents having pupils enrolled in any school district as certified to by the county superintendent of schools, DSA shall make an examination and report on the structural condition of any school building of the district. DSA must report whether or not each building examined is substantially compliant with applicable code provisions. Whether or not such examination is requested of DSA is entirely optional with the school district or parents concerned, and consequently, in making such examination and report DSA acts as the agent of the school district to whom DSA makes its report and by whom it is guided in determining the extent and character of the examination made.

DSA may prescribe a form, which shall be filled out by the applicant, supplying such information as is available.

DSA is not authorized to prepare plans or make estimates of the cost necessary to make such repairs to the building or buildings as are necessary to meet structural safety standards. (See Sections 17367 and 81162 of the Education Code.)

(b) **Examination and report by school district's structural engineer.** The school district may retain a structural engineer, at the school district's expense, to examine and report on the structural condition of any school building of the dis-

trict. The structural engineer shall consult with DSA for guidance as to the standard of safety to which the structural condition must measure. The structural engineer must report on whether or not each of the buildings examined is safe or unsafe for school use, and whether or not each of the buildings is substantially compliant with applicable code requirements as required by DSA under Section 4-345(a) above.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17313 and 81162.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-345, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-346. Cost of examinations done by DSA. Upon completion of the examination by DSA and the submission of the report thereof to the school board, DSA shall submit a statement of the actual expense involved in the examination and preparation of report. Payment by the school board shall be made to DSA upon receipt of the statement of expense involved unless waived by DSA upon recommendation of the state superintendent of public instruction.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17313 and 81145.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-346, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 8 DOCUMENTS AND RECORDS

4-350. Records. The records retained by DSA pertaining to the supervision of the construction of school buildings by DSA are public documents and are open to inspection during office hours. Documents shall not be taken from the custody of DSA except as required by law.

Examination reports prepared under the provisions of Sections 17313 and 81162 of the Act (See Section 4-345) are considered to be the property of the school board. Inquiries regarding examination reports shall be referred to the school board concerned.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17315, 81133 and 81147; and Health and Safety Code Sections 19850 through 19853.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-350, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-351. Location of records. A file of school building plans, specifications and documents for currently active school projects in each of four regions of the state is maintained in the respective DSA regional office: Oakland (Region I), Sacramento (Region II), Los Angeles (Region III) and San Diego (Region IV). Completed or certified project records including plans and specifications are stored in the State Records Cen-

ter in Sacramento or in electronic format at the regional offices.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17299, 17309, 81133, 81135 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-351, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

4-352. Submission of documents.

(a) **Application.** Applications for approval of plans and specifications shall be submitted to the DSA regional office serving the project location unless specific approval for submittal elsewhere is given by the State Architect. Processing shall be completed by the receiving office but portions of the work may be reassigned.

(b) **Construction documents.** All documents such as notices in accordance with Sections 4-331 and 4-332, qualification records in accordance with Sections 4-333 and 4-341, test reports in accordance with Section 4-335, special inspection reports in accordance with Section 4-335, verified reports in accordance with Section 4-336, and semimonthly reports in accordance with Section 4-337 shall be submitted to the appropriate DSA regional office according to location of the project.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17295, 17299, 17309, 81133, 81135 and 81141.

HISTORY:

1. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-352, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

ARTICLE 9

STATE ADVISORY BOARD TO THE DIVISION OF THE STATE ARCHITECT FOR THE FIELD ACT

4-355. Advisory board.

(a) **General.** The State Architect may appoint an advisory board whose duty it is to serve in an advisory capacity to DSA in connection with technical or structural matters and with reference to regulations and requirements pertaining to the administration of the Act. This board shall also act as a board of review relating to enforcement of Title 24 for building projects under the jurisdiction of DSA.

(b) **Membership.** The board shall consist of 17 members appointed by the State Architect. Of the appointive members: two shall be structural engineers; two shall be architects; one shall be a geotechnical engineer; one shall be a general contractor; one shall be a local building official; one shall be an electrical engineer; one shall be a mechanical engineer; two shall be school district personnel; one shall be a project inspector; one shall be a fire and panic safety representative; one shall represent the field of accessibility compliance; one

shall represent community colleges personnel; and two shall be members of the general public.

Each member shall be appointed for a term of four years and shall hold office until the appointment and qualification of his or her successor or until one year has elapsed since the expiration of the term for which he or she was appointed, whichever first occurs. No person shall serve as a member of the board for more than two consecutive terms. The State Architect may remove any member of the board for neglect of duty or other just cause. All appointed board members may vote.

The State Architect may also appoint up to three additional ex officio members. State Architect-appointed ex officio members may continue to serve until appointment of their successors by the State Architect. Appointed ex officio members may vote.

Appointive members, except for the public members and the appointed ex officio members, shall be qualified by close connection with public school and state building design and construction. They shall be appointed from nominees recommended by the governing bodies of California-based professional organizations representing school districts, architects, engineers, construction inspectors, construction managers, consultants and facility planners, contractors, building officials and fire and panic safety representatives.

There shall be eight state representative members of the board, who shall be: the State Architect; the State Geologist; the Executive Director of the California Seismic Safety Commission; the State Superintendent of Public Instruction; the Chancellor, California Community Colleges; the Director of the Office of Statewide Health Planning and Development; the Deputy Director of the Department of General Services, Real Estate Services Division; and, the State Fire Marshal; or their officially designated representatives. These members are not entitled to vote.

(c) **Meetings.** The board shall elect its own chairperson and vice chairperson and shall convene upon the call of the chairperson or the State Architect whenever it may be necessary in his or her judgment for the board to meet. The board shall adopt such rules of procedure as are necessary to enable it to perform the obligations delegated to it. The chairperson of the board shall at his or her discretion or upon instructions from the board designate subcommittees to study and report back to the board any technical subject or matter regarding which an independent review or further study is desired or regarding which appeal is made to the board from decisions or rulings of the office. The board members will be reimbursed from the fund defined in Sections 17301 and 81137 of the Act for their reasonable actual expenses in attending meetings, but shall receive no compensation for their services.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17310 and 81142.

HISTORY:

1. Editorial renumbering of Article 5 to Article 9 to correct printing error (Register 83, No. 45).
2. (OSA/SS 1/92) Regular order by the Office of the State Architect/Structural Safety Section to amend Section 4-355, Part 1, Title 24, C.C.R. Filed with the Secretary of State on December 15, 1992; effective July 1, 1993. Approved by the California Building Standards Commission on December 9, 1992.

GROUP 2

SAFETY OF CONSTRUCTION OF PUBLIC SCHOOLS: FIRE AND LIFE SAFETY

ARTICLE 1 GENERAL PROVISIONS

4-401. Purpose. These regulations implement Section 14963 of the Government Code to ensure that elementary, secondary or community college buildings and facilities constructed or altered pursuant to these regulations are in compliance with the California Code of Regulations, Title 24 related to the design aspects of the Fire and Life Safety (FLS) elements, components and systems.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963.

4-402. Scope. Title 24, California Code of Regulations (C.C.R.) parts 2, 3, 4, 5 and 9; known as the California Building Code, designate building regulations that are applicable to the Fire and Life Safety portions of the design, construction, reconstruction, rehabilitation, alteration of or addition to any school building as defined in Sections 17283 and 81050 of the Education Code. The term “school building” shall include all buildings, structures, appurtenances and related systems or facilities as defined in Section 4-314. Section 14963, Government Code, authorizes the Division of the State Architect (DSA) to carry out the functions and duties related to plan check and inspections of the construction of school buildings.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963. Education Code Sections 17283 and 81050.

4-403. Authority for enforcement of regulations. All duties and functions that relate to the Fire and Life Safety aspects of school construction plan checking and inspections have been vested by law in the Division of the State Architect.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963.

4-404. Alternate materials and methods of construction and modifications. The provisions of these regulations are not intended to prevent the use of any material or method of construction not specifically prescribed by these regulations, provided any alternate has been approved and its use authorized by DSA or the State Fire Marshal.

DSA may approve any such alternate, provided DSA finds that the proposed design is satisfactory and complies with the provisions of these regulations and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in these regulations in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation.

DSA shall require that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding its use. The details of any action granting acceptance of an alternate shall be recorded and entered in the files of DSA.

When there are practical difficulties involved in carrying out the provisions of these regulations, DSA may grant modifications for individual cases. DSA shall first find that a special individual reason makes the strict letter of these regulations impractical, that the modification is in conformance with the intent and purpose of these regulations, and that such modification does not lessen any fire protection requirements, accessibility or degree of structural integrity. The details of any action granting modifications shall be recorded and entered in the files of DSA.

Authority: Education Code Sections 17310 and 81142. Government Code Section 14963.

Reference: Education Code Sections 17280 and 81130. Government Code Section 14963.

4-405. Application of building standards. Building standards applicable to public school buildings are set forth in Parts 2, 3, 4, 5, 6, 9, 11 and 12, Title 24, C.C.R., and have been adopted as minimum design and construction standards upon which to base the approval of plans and specifications. These regulations shall not be construed to prevent the use of higher design standards or to restrict the use of new or innovative design or construction techniques.

Where the designer desires to use innovative design or construction techniques not addressed in these regulations it shall be necessary to submit for review and approval information including computations, test data and recommendations covering the design in question. The designer shall confer with DSA concerning the applicability of these innovative design or construction techniques to school building construction prior to the submittal of plans and specifications.

DSA must be satisfied that the degree of safety achieved by these innovative design and construction techniques is at least equivalent to that achieved by the regulations. The determination of the equivalency of the degree of safety shall be the responsibility of DSA.

Authority: Education Code Sections 17310 and 81142. Government Code Section 14963.

Reference: Education Code Sections 17280 and 81130. Government Code Section 14963.

4-406. Approval of construction, reconstruction, rehabilitation, alteration of or addition to any school buildings. Plans and specifications for any new school building or for the reconstruction, rehabilitation, alteration of or addition to school buildings shall be submitted to DSA for approval as required by and in accordance with Sections 4-306 through 4-310. This approval shall include Fire and Life Safety.

Authority: Government Code Section 14963. Education Code Sections 17310 and 81142.

Reference: Government Code Section 14963. Health and Safety Code Section 13143. Education Code Sections 17280, 17295, 81130 and 81133.

ARTICLE 2 DEFINITIONS

4-410. General. The words defined in Sections 4-314 and 4-411 shall have the meaning stated therein throughout the regulations contained in Part 1, Section 4-400, et seq, Title 24, C.C.R.

Authority: Education Code Sections 17310 and 81142. Government Code Section 14963.

Reference: Education Code Sections 17283, 81130, 81050 and 81529.

4-411. Definitions.

DIVISION OF THE STATE ARCHITECT or DIVISION, or initials **DSA**, shall mean the Division of the State Architect in the Department of General Services, State of California.

INSPECTOR shall mean any person duly approved by DSA to perform construction inspection for a particular project. (See Sections 4-333 and 4-342.)

Authority: Education Code Sections 17310 and 81142. Government Code Section 14963.

Reference: Education Code Sections 17280, 17283, 17405, 81130, 81050 and 81529. Health and Safety Code Section 13143.

ARTICLE 3 APPROVAL OF DRAWINGS AND SPECIFICATIONS

4-415. Application for approval of drawings and specifications. Before awarding a contract or commencing with construction of a school building project, the school board shall submit an application to the Division of the State Architect and obtain written approval of the plans and specifications as required by and in accordance with Sections 4-315 through 4-319.

Authority: Education Code Sections 17310 and 81142. Government Code Section 14963.

Reference: Education Code Sections 17280 and 81130. Government Code Section 14963.

ARTICLE 4 FEES

4-420. Fees.

(a) The filing fee for projects shall be:

- three-tenths of one percent (0.3%) of the first \$1,000,000 of the estimated project cost; plus
- two-tenths of one percent (0.2%) of the project cost greater than \$1,000,000 up to and including \$5,000,000; plus
- one-tenth of one percent (0.1%) of the project cost greater than \$5,000,000 up to and including \$25,000,000; plus
- five one-hundredths of one percent (0.05%) of the project cost greater than \$25,000,000 up to and including \$100,000,000; plus
- one one-hundredth of one percent (0.01%) of the project cost above \$100,000,000;
- except that the minimum fee in any case shall be \$300.00.

Examples of filing fee to accompany application:

(1) Estimated project cost = \$40,000		
0.3% x \$40,000	=	\$ 120.00
Filing fee is the minimum charge	=	\$ 300.00
(2) Estimated project cost = \$925,000		
0.3% x \$925,000	=	<u>\$2,775.00</u>
Filing fee	=	<u>\$2,775.00</u>
(3) Estimated project cost = \$3,840,000		
0.3% x \$1,000,000	=	\$3,000.00
0.2% x \$2,840,000	=	<u>\$5,680.00</u>
Filing fee	=	<u>\$8,680.00</u>
(4) Estimated project cost = \$7,260,000		
0.3% x \$1,000,000	=	\$3,000.00
0.2% x \$4,000,000	=	\$8,000.00
0.1% x \$2,260,000	=	<u>\$2,260.00</u>
Filing fee	=	<u>\$13,260.00</u>
(5) Estimated project cost = \$26,500,000		
0.3% x \$1,000,000	=	\$3,000.00
0.2% x \$4,000,000	=	\$8,000.00
0.1% x \$20,000,000	=	\$20,000.00
0.05% x \$1,500,000	=	<u>\$750.00</u>
Filing fee	=	<u>\$31,750.00</u>

(b) The fee schedule in effect at the time of filing shall apply throughout the duration of such application.

(c) When the actual project cost exceeds the estimated cost, a further fee for such projects shall become due and shall be equal to the difference between the filing fee paid and the amount computed under the schedule above using the actual cost of the project. The actual project cost shall be determined as directed in Section 4-421 and billed according to Section 4-423.

(d) If the applicant requests the cancellation or withdrawal of the application and return of the plans and specifications and filing fee, this shall be granted unless the review has begun. No portion of the filing fee can be returned after the review has started.

(e) Beginning in July 2015, and within every four years thereafter, the State Architect shall review the fee schedule and make a written determination whether the fees are sufficient to fund the programs.

(i) If the State Architect determines that a lesser amount is sufficient to maintain the programs, the fees may be reduced for a period up to four years.

(ii) If the State Architect determines that a greater amount is necessary to maintain the programs utilizing these funds, the State Architect shall propose a fee schedule increase.

Authority: Education Code Sections 17300 and 17301.

Reference: Government Code Section 14963. Health and Safety Code Section 13138.

4-421. Project cost. For purposes of determining the fees, project costs shall be determined as defined by and in accordance with Section 4-322.

Authority: Education Code Sections 17300 and 17301.

Reference: Government Code Section 14963. Education Code Sections 17300(a) and 81133(c)(6). Health and Safety Code Section 13143.

4-422. Revision of plans and specifications.

(a) Revisions are changes to plans or specifications made after DSA approval. Revisions shall be submitted to and approved by DSA.

(b) An hourly fee may be charged to the applicant for the review of revisions to approved plans and specifications.

Authority: Education Code Sections 17300 and 17301.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

4-423. Billing for further fees. The school district shall be billed for further fees upon completion of the project or portion thereof if fee is due. Claims for refunds of \$5.00 or less due to errors in cost reporting or fee computation shall be made within six months from date of billing.

Authority: Education Code Sections 17300 and 17301.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

4-424. Fees for DSA review prior to application filing. An hourly fee may be charged to the school district for the review of draft drawings and specifications or consultations with DSA during project development, as requested by the school district.

Authority: Education Code Sections 17300 and 17301.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

**ARTICLE 5
CERTIFICATION OF CONSTRUCTION**

4-430. General. Certification of construction shall be in accordance Chapter 4, Group 1, Article 5 as follows:

(a) Time of beginning construction and partial construction: Section 4-330.

(b) Notice to DSA at start of construction: Section 4-331.

(c) Notice of suspension of construction: Section 4-332.

(d) Observation and inspection of construction: Section 4-333.

(e) Project inspector certification: Section 4-333.1.

(f) Verified Reports: Section 4-336.

(g) Semimonthly reports: Section 4-337.

(h) Addenda and construction changes: Section 4-338.

(i) Final certification of construction: Section 4-339.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

4-431. Supervision by the Division of the State Architect. During construction, reconstruction, rehabilitation, repair, alteration of, or addition to any school building, DSA shall make such visits as in its judgment are necessary for proper enforcement of these regulations and the protection of the safety of the pupils, the teachers and the public. If at any time as the work progresses, prior to issuance of the certification of compliance, it is found that modifications or changes are necessary to secure safety or to comply with code require-

ments, DSA shall notify the responsible architect or responsible structural engineer and the school district of the necessity for such modifications or changes.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

4-432. Stop work order.

(a) Whenever DSA finds any work regulated by this code being performed in a manner contrary to the provisions of this code, including the applicable standards, DSA is authorized to issue a stop work order.

(b) The stop work order shall be in writing and shall be given to the owner of the property involved, or the owner's agent, or the person doing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order, and the conditions under which the cited work will be permitted to resume.

(c) Any person who continues working in the cited work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to penalties as prescribed by law.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963.

**ARTICLE 6
DUTIES**

4-435. General. Duties of the various individuals involved in the design and construction shall be in accordance with Chapter 4 Group 1 Article 6 Sections 4-341 through 4-344.

Authority: Government Code Section 14963.

Reference: Government Code Section 14963. Health and Safety Code Section 13143.

HISTORY:

1. (DSASS 01/13) Supplement to add a new Group 2 "Safety of Construction of Public Schools: Fire and Life Safety," Article 1, Section 4-401, 4-402, 4-403, 4-404, 4-405, & 4-406; Article 2, Section 4-410 & 4-411; Article 3, Section 4-415; Article 4, Section 4-420, 4-421, 4-422, 4-423, & 4-424; Article 5, Section 4-430, 4-431, & 4-432; Article 6, Section 4-435. Approved by the California Building Standards Commission on October 21, 2014, filed with Secretary of State on October 27, 2014, effective November 27, 2014

GROUP 3

SUSTAINABLE CONSTRUCTION OF PUBLIC SCHOOLS AND COMMUNITY COLLEGES: OUTDOOR WATER USE

ARTICLE 1 GENERAL PROVISIONS

4-501. Purpose. These regulations implement sections of the Education Code to ensure that elementary, secondary, or community college buildings and facilities constructed or altered pursuant to these regulations are in compliance with the California Code of Regulations (C.C.R.), Title 24 related to the design aspects of sustainable building elements, components and systems specifically irrigation systems for landscape areas.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 81130 and 81142.

4-502. Scope. California Code of Regulations, Title 24, Part 11; known as the “CALGreen Code”, designates building regulations that are applicable to the Green Building Standards portions of the design, construction, or addition to any school building as defined in Sections 17283 and 81131 of the Education Code.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

ARTICLE 2 DEFINITIONS

4-506. General. The definition(s) in Sections 4-507 shall have the meaning stated therein throughout the regulations contained in Part 1, Chapter 4, Group 3, et seq, Title 24, C.C.R.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17283, 81130, 81131 and 81529.

4-507. Definitions.

SELF-CERTIFICATION shall mean a registered architect, landscape architect or civil engineer in general responsible charge prepares a set of construction documents that comply with the California Code of Regulations (C.C.R.), Title 24 or other referenced regulations, and provides their signature ensuring that the construction documents and related reports meet or exceed the code requirements.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280, 17283, 17405, 81130, 81131 and 81529.

ARTICLE 3 APPLICATION FOR VERIFICATION OF SELF-CERTIFICATION OF DRAWINGS AND SPECIFICATIONS

4-508. Plans, specifications and other data. When an application for review of the self-certification of compliance with the Outdoor Water Use regulations is filed, it shall be accompanied by a site landscape area location plan and set of plans and specifications.

Plans, specifications or self-certification forms that, when submitted, are determined by DSA to be incomplete or incorrect, shall be returned to the architect, landscape architect, or civil engineer in general responsible charge with a request for additional information or revisions.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

4-509. Application for self-certified drawings and specifications. The irrigation plans and specifications shall meet the California Code of Regulations, Title 24, Part 11 (CALGreen Code), Section 5.304 requirements for outdoor water use adopted by DSA-SS. The architect, landscape architect, or civil engineer in general responsible charge shall self-certify that the project’s landscape planting and irrigation design is compliant with the current version of the Model Water Efficient Landscape Ordinance (MWELO) per Section 5.304 requirements for outdoor water use adopted by DSA-SS of the CALGreen Code and built in accordance to these regulations. All related drawings and specifications must display their registration seal and signature.

Before commencing with construction of a landscape irrigation project and any associated buildings, the architect, landscape architect or civil engineer in general responsible charge shall submit to DSA for approval the documentation prescribed by the DSA certifying that the landscape irrigation design complies with the Outdoor Water Use regulations, and that periodic site observations during construction will occur to ensure the landscape planting and irrigation work is completed in accordance with the requirements of the CALGreen Section 5.304 requirements for outdoor water use adopted by DSA-SS.

Authority: Education Code Sections 17310 and 81142.

Reference: Education Code Sections 17280 and 81130.

HISTORY NOTE APPENDIX FOR CHAPTER 4

Administrative Regulations for the Division of State Architect, Structural Safety California Code of Regulations, Title 24, Part 1

HISTORY:

> The history notes for prior changes remain within the text of this code.

1. (DSA-SS 1/02) Chapter 4, Section 4-309. Reconstruction or Alternation Projects in Excess of \$25,000 in Cost. Approved by the Building Standards Commission on May 14, 2003 and effective 180 days after publication.
2. (DSA-SS EF 02/03) Emergency adoption/approval of technical design and construction building standards for the adaptive reuse of existing building public school use; C.C.R., Title 24, Part 1. Approved by the California Building Standards Commission on May 14, 2003 and filed with Secretary of State on May 15, 2003. Effective May 15, 2003.
3. (DSA-SS EF 04/03) Emergency re-adoption/re-approval of technical design and construction building standards for the adaptive reuse of existing building public school use; C.C.R., Title 24, Part 1. Approved by the California Building Standards Commission on July 16, 2003 and filed with Secretary of State on September 10, 2003. Effective September 10, 2003.
4. (DSA-SS EF 04/03) Emergency re-adoption/re-approval of technical design and construction building standards for the adaptive reuse of existing building public school use; C.C.R., Title 24, Part 1. Approved as permanent by the California Building Standards Commission on January 7, 2004 and filed with the Secretary of State on January 8, 2004. Effective January 8, 2004.
5. (DSA-SS 03/06) Editorial amendments to administrative standards for public elementary and secondary schools and community colleges that correlate with DSA-SS adoption of the 2006 *California Building Code* into Part 2 of Title 24. Effective January 1, 2008.
6. (DSA-SS EF 01/09) Modification to project renewal timeframes. Approved by the commission January 22, 2009 and filed with the Secretary of State on January 26, 2009 with an effective date of January 26, 2009.
7. Erratum to correct editorial errors in preface and Chapter 4.
8. (DSA-SS EF 02/10) Emergency rulemaking to amend Articles 2 through 6, Part 1 Title 24, Chapter 4, effective on August 17, 2010, approved as permanent on January 19, 2011.
9. (DSA-SS 01/12) Amend Chapter 4, Article 1, Section 4-302, 4-305, 4-306, 4-307, 4-309, 4-310, Article 2, Section 4-314, Article 3, Section 4-315, 4-316, 4-317, Article 4, Section 4-320, 4-323, 4-324, 4-325, 4-326, 4-327, Article 5, Section 4-330, 4-331, 4-332, 4-333, 4-335, 4-336, 4-337, 4-339, Article 6, Section 4-341, 4-342, 4-343, Article 7, Section 4-345, Article 8, Section 4-350, 4-352, Article 9, Section 4-355. Approved by the California Building Standards Commission on January 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.
10. Rulemaking file number DSA-SS EF 03/15: Emergency rulemaking added Group 3, Articles 1 through 4, to Part 1 Title 24, Chapter 4. It was originally approved by the Commission July 21, 2015 and effective upon filing with Secretary of State on July 23, 2015. An emergency supplement was not issued for the initial emergency building standards but was provided in Building Standards Commission Information Bulletin 15-03, dated July 24, 2015, which is now superseded. The rulemaking was made permanent pursuant to Government Code Sections 11346.2 to 11347.3. The supplement provides emergency building standards that were adopted by the Building Standards Commission on January 20, 2016, and filed with Secretary of State on January 26, 2016.
11. (DSA-SS 01/15) Amend Chapter 4, Article 1: Section 4-205, 4-207, 4-208, 4-210, 4-211, 4-219, 4-220, 4-221; Article 2: Section 4-236; Group 1, Article 1: Section 4-302, 4-305, 4-306, 4-307, 4-309, 4-310, Article 2: Section 4-313, 4-314, Article 3: Section 4-315, 4-316, 4-317, 4-318, 4-319; Article 4: Section 4-320, 4-321, 4-323, 4-324, 4-325; Article 5: Section 4-333, 4-333.1, 4-334, 4-335, 4-335.1, 4-336, 4-338; Article 6: Section 4-341, 4-342, 4-343, 4-345; Article 8, Section 4-350; Group 2, Article 1: Section 4-401, 4-402; Article 2: Section 4-410, 4-411; Article 5: Section 4-430; Article 6: Section 4-435, Approved by the California Building Standards Commission on December 16, 2015, filed with the Secretary of State on December 21, 2015, and effective 30 days after filing with Secretary of State.
12. Errata to correct editorial errors within Chapter 4 in this code. Effective January 1, 2017.
13. 2016 Intervening Cycle Supplement (DSA-SS/CC 01/16) adopted by the California Building Standards Commission on June 20, 2017, filed with the Secretary of State on August 17, 2017, effective thirty days after filing.
14. 2018 Triennial Code Adoption Cycle (DSA-SS/CC 01/18) Amend Chapter 4, Article 2, Sections 4-228, 4-238 and 4-239; Group 1, Article 1, Sections 4-30, 24-306, 4-309; Article 2, Section 4-314; Article 3, Section 4-315; Article 4, Sections 4-321, 4-324 and 4-328; Article 5, Section 4-333.1; Article 6, Section 4-341 and Article 8, Section 4-352. Approved by the California Building Standards Commission on December 4, 2018,

filed with the Secretary of State on December 7, 2018, and effective 30 days after filing with the Secretary of State pursuant to *California Health and Safety Code* Section 18938.

15. Erratum to correct editorial errors in Chapter 4, Section 4-333 and to correct History Note format: effective January 1, 2020.
16. 2019 Intervening Cycle Update (DSA-SS/CC 01/19) Adoption of amendments to the 2019 California Administrative Code (CAC). Approved by the California Building Standards Commission on August 13, 2020, published on January 1, 2021, effective 30 days after filing with Secretary of State.
17. (DSA-SS/CC 04/21) Amend Chapter 4, Group 1, Article 1, Section 4-309, Article 3, Section 4-316, Article 5, Sections 4-330, 4-335, 4-335.1, Group 3, Article 3, Sections 4-508, 4-509. Repeal Chapter 4, Group 3, Article 4. Approved by the California Building Standards Commission on January 18, 2022, filed with the Secretary of State on February 2, 2022, and effective 30 days after filing with Secretary of State.

CHAPTER 5

ACCESS TO PUBLIC BUILDINGS BY PERSONS WITH DISABILITIES

ARTICLE 1 COMPLIANCE PROCEDURES

5-101. Purpose. These regulations implement Sections 4450 et seq. of the Government Code to ensure that where state funds are utilized for the construction or alteration of any public building or facility or where the funds of counties, municipalities or other political subdivisions are utilized for the construction or alteration of elementary, secondary or community college buildings and facilities that the plans and specifications for such buildings and facilities are reviewed by the Division of the State Architect (DSA) and certified to be in compliance with California law requiring access for persons with disabilities prior to a contract being awarded.

Authority: Government Code Sections 4450, 4453 and 4454.

Reference: Government Code Section 4454.

HISTORY:

1. New Group 2 (§§81 through 86) filed 3-5-71 as an emergency; effective on filing. Certificate of Compliance included (Register 71, No. 10). For history of former Group 2 see Register 66, No. 38.
2. Amendment filed 11-24-78; designated effective 1-1-79 (Register 78, No. 47).

5-102. General. For the purpose of assuring compliance with minimum requirements for accessibility by persons with disabilities, the governmental agency controlling the appropriation from which the project is funded shall submit an application, together with plans and full, complete and accurate specifications and filing fee, to the State Architect. The DSA will process the documents. Written approval shall be obtained prior to award of a construction contract.

Authority: Government Code Section 4453.

Reference: Government Code Section 4454.

HISTORY:

1. Amendment filed 11-24-78; designated effective 1-1-79 (Register 78, No. 47).

5-103. Application. For each project to be reviewed and certified, a separate application (Form DSA-1) shall be submitted to the DSA. The application shall be accompanied by a complete set of project plans and specifications and an appropriate filing fee (see Section 5-104).

The above documents shall be submitted to the DSA regional offices serving the project location unless specific approval for submittal elsewhere is given by the State Architect.

The application shall be considered received when all the required documents and fees have been received by the office and the application number assigned.

The documents submitted for review and used for certification shall be retained by the DSA.

Authority: Government Code Section 4454.

Reference: Government Code Section 4454.

HISTORY:

1. Amendment filed 11-24-78; designated effective 1-1-79 (Register 78, No. 47). For prior history, see Register 76, No. 25.

2. Renumbering and amendment of former Section 83 to Section 83.1 filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2(d) (Register 84, No. 35).
3. Erratum to reflect locations of offices.

5-104. Fees.

(a) The filing fee for projects under applications received on or after March 1, 2013, shall be *five-tenths* of one percent (0.5%) of the first \$500,000.00 of the estimated project cost plus *twenty-five one-hundredths* of one percent (0.25%) of the project cost greater than \$500,000.00 up to and including \$2,000,000.00 plus *one-tenth* of one percent (0.1%) of the excess of the estimated project cost over \$2,000,000.00, except that the minimum fee in any case shall be \$500.00.

Example of filing fee to accompany application:

Estimated project cost = \$250,000.00		
.005 × \$250,000.00	=	\$1,250.00
Estimated project cost = \$1,500,000.00		
.005 × \$500,000.00	=	\$2,500.00
.0025 × \$1,000,000.00	=	2,500.00
		\$5,000.00
Estimated project cost = \$5,000,000.00		
.005 × \$500,000.00	=	\$2,500.00
.0025 × \$1,500,000.00	=	3,750.00
.001 × \$3,000,000.00	=	3,000.00
		\$9,250.00

(b) The fee schedule in effect at the time of filing shall apply throughout the duration of such application.

(c) When the actual project cost exceeds the estimated cost a further fee for such projects shall become due and shall be equal to the difference between the filing fee paid and the amount computed under the schedule above using the actual cost of the project. The actual project cost shall be determined as directed in Section 5-105 and billed according to Section 5-107.

(d) If the applicant requests the cancellation or withdrawal of the application and return of the plans and specifications and filing fee, this shall be granted unless the review has begun. No portion of the filing fee can be returned after the review has started.

(e) Beginning in July 2009, with a review in 2011 and within every four years thereafter, the State Architect shall review the fee schedule and make a written determination whether the fees are sufficient to fund the programs.

(i) If the State Architect determines that a lesser amount is sufficient to maintain the programs, the fees may be reduced for a period up to four years.

(ii) If the State Architect determines that a greater amount is necessary to maintain the programs utilizing these funds, the State Architect shall propose a fee schedule increase.

Authority: Government Code Section 4453.

Reference: Government Code Section 4454.

HISTORY:

1. New section filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2(d) (Register 84, No. 35).
2. (OSA/AC-A 1/89) Editorial transfer from CCR, Title 21 to Title 24 11-1-89.
3. (OSA/AC-A 2/89) Amend CCR, Title 24, Part 1, Sec. 5-104 (a) (b), effective 1-1-90. Approved by Building Standards Commission 10-30-89.
4. (OSA/AC EF 1/92) Emergency order by the Office of the State Architect/Access Compliance to amend Section 5-104 (a), Part 1, Title 24, California Code of Regulations. Filed as an emergency order with the secretary of state February 25, 1992; effective March 1, 1992. Approved as an emergency by the California Building Standards Commission on February 24, 1992.
5. (OSA/AC EF 1/92) Emergency order by the Office of the State Architect/Access Compliance to amend Section 5-104 (a), Part 1, Title 24, California Code of Regulations; approved by the California Building Standards Commission on February 24, 1992; filed as an emergency order with the secretary of state February 25, 1992, and effective March 1, 1992, has lapsed. No action was taken by the OSA/AC to make these regulations permanent; therefore, the initial regulations are back in effect as of June 29, 1992.

5-105. Project cost. For purposes of determining the fees, both the estimated and actual project cost shall be the cost for the total outlay contemplated for all work included in the certified plans and specifications. The term “project” shall be defined as all buildings and other structures, together with the development of the site, but in the event the plans and specifications submitted with the application do not provide for the construction of, addition or alteration to a building or structure, then it shall be for the site development proposed in the application.

The actual project cost shall include all items that are normally considered to be contractors operation costs. Addenda or change order items that increase the contract amount shall be included in the final actual project cost computation.

All fees and/or reimbursable charges paid the construction managers shall be included in the actual project cost. When the contract for the work includes items not otherwise subject to the approval of the office and not included in the approved plans and specifications the actual cost shall include this work unless such costs are segregated by separate bid items or by separately priced items of change orders, or by a certified copy of the subcontractor's bid. Such segregation shall not be made by contract price breakdown or estimates.

Authority: Government Code Section 4454.

Reference: Government Code Section 4454.

HISTORY:

1. New section filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2 (d) (Register 84, No. 35).

5-106. Revision of plans and specifications. Revisions are changes to plans or specifications made after DSA approval. Revisions shall be submitted to and approved by DSA.

An hourly fee may be charged to the applicant for the review of revisions to approved plans and specifications.

If the original plans are abandoned and the plans and specifications submitted in lieu thereof are in fact for a new project rather than an identical project, or where a modified set of plans is for an essentially different concept, it is necessary that a new application be filed and a fee paid. This is regardless of the fact that the project may have the same name, be of

the same general size and be situated at the same location as the project for which the original application was made.

Authority: Government Code Section 4454.

Reference: Government Code Section 4454.

HISTORY:

1. New section filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2(d) (Register 84, No. 35).

5-107. Billing for further fees. For public school projects the DSA shall determine whether or not further fees are due and shall bill the district for such further fees.

For projects other than public schools, the applicant or owner shall submit to the office a report verifying the actual project cost within 90 days after the completion of the project. This actual project cost shall be the basis for the further fee computation. The accuracy and timely submission of this actual project cost report shall be the responsibility of the owner or his designated agent. The owner shall be billed for further fees upon completion of the project or portion thereof if fee is due.

Authority: Government Code Section 4454.

Reference: Government Code Section 4454.

HISTORY:

1. New section filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2 (d) (Register 84, No. 35).

5-108. Refunds. Claims for refunds of five dollars or less due to errors in cost reporting or fee computation shall be made within one year from the date of payment.

Authority: Government Code Section 4454.

Reference: Government Code Section 4454.

HISTORY:

1. New section filed 8-30-84; effective upon filing pursuant to Government Code Section 11346.2(d) (Register 84, No. 35).

5-109. Review of plans and specifications. The DSA will review the submitted documents to ensure that the requirements cited in Article 1 are fully met.

Authority: Government Code Section 4453.

Reference: Government Code Section 4454.

HISTORY:

1. Amendment filed 11-24-78; designated effective 1-1-79 (Register 78, No. 47).

5-110. Written approval.

(a) **Approval obtained.** Upon completion of review, DSA will return to the awarding authority a written approval, if the documents comply with the requirements. This approval of the application constitutes the “written approval” required by Section 4454 of the Government Code. No changes or revisions shall be made following written approval that affect access compliance items unless such changes or revisions are submitted to the DSA for approval.

(b) **Approval denied.** If the documents fail to meet the requirements of these regulations, DSA will return to the awarding authority the plans with corrections noted thereon together with instructions for resubmittal of the plans and specifications. The corrected plans are the property of the Division of the State Architect and shall be returned within six months or the application will be void. No valid construction contract may be awarded before written approval is obtained.

(c) **Unauthorized deviations.** In the event that there is an unauthorized deviation from the requirements of these regulations with respect to the standards specified, the same shall be rectified by full compliance therewith within ninety (90) days after discovery of such deviation.

(d) **Notification.** Where the State Architect is the enforcement authority and any project is proposed to be approved and such approval action would deny accessibility either required by Sections 4450 and 4458, inclusive, of the Government Code to persons with disabilities, or by reason of an equivalent facilitation exception granted pursuant to Section 4451 of the Government Code, the State Architect shall notify affected persons with disabilities or organizations and others who have made written requests to be informed as to such proposals under consideration.

Authority: Government Code Sections 4450 and 4460 and Health and Safety Code Section 18949.

Reference: Government Code Section 4460.

HISTORY:

1. Amendment filed 11-24-78; designated effective 1-1-79 (Register 78, No. 47).
2. New subsection (d) filed 3-6-81 as an emergency; effective upon filing (Register 81, No. 10). A Certificate of Compliance must be transmitted to OAL within 120 days or emergency language will be repealed on 7-4-81.
3. Order of Repeal of 3-6-81 emergency order filed 3-13-81 by OAL pursuant to Government Code Section 11349.6 (Register 81, No. 11).
4. New subsection (d) filed 7-28-82; effective thirtieth day (Register 82, No. 31).
5. Amendment of subsection (a) filed 7-17-85; effective thirtieth day thereafter (Register 85, No. 29).

5-111. General requirements. General requirements and building standards are located in Title 24, Part 2.

**ARTICLE 2
DIVISION OF THE STATE ARCHITECT—
ACCESS COMPLIANCE PROCESSING
PRODUCT APPROVALS
January 1, 2001**

Detectable warning products and directional surfaces installed after January 1, 2001 shall be evaluated by an independent entity, selected by the Department of General Services, Division of the State Architect, Access Compliance, for all occupancies, including transportation and other outdoor environments, except that when products and surfaces are for use in residential housing, evaluation shall be in consultation with the Department of Housing and Community Development. See Government Code Section 4460.

5-201. Processing independent entity evaluation approvals (IEEA). Independent Entity Evaluation Approvals shall be registered in the Division of the State Architect (DSA) headquarters office.

To maintain a central file for all IEEA and to operate within the current DSA program, certain administration and all accounting shall be performed at the DSA headquarters office under the direction of the Principal Architect.

5-202. IEEA application procedure.

1. Upon receipt of an IEEA application, send the application fee and a copy of the application to the DSA headquarters office, attention: Access Compliance.
2. A paper file will be created for each IEEA, which will initially include a copy of the application and the application fee. Headquarters personnel will then file the product, manufacturer and registration information, creating an IEEA number.
3. The application fee will be given to the headquarters' cashier for deposit.

5-203. IEEA acceptance procedure.

1. Prior to issuing IEEA acceptance, it is required that all fees be paid. If fees are due, please contact the manufacturer for payment and forward the payment to the DSA headquarters office, along with the request for the additional payment.
2. The fee, if any, will be given to the headquarters' cashier for filing and deposit.
3. The acceptance letter will be retained at DSA headquarters, Access Compliance. A copy of the status approval letter will be returned to the applicant.
4. Headquarters' personnel will register, prepare and distribute all necessary copies of the acceptance letter. The original file shall be maintained at headquarters.

5-204. Accounting of IEEA. Income for IEEA will be earned in the month in which they are banked. This money will be applied to Disability Access Account for deposit.

5-205. Contacts for questions.

1. IEEA Contact—DSA headquarters, attention: Access Compliance, IEEA Program.
2. Headquarters Administration Contact—DSA headquarters, attention: Access Compliance, IEEA Program.
3. Headquarters Accounting Contact—DSA headquarters, Accounting.

Authority: Government Code Sections 4450, 4460 and Health and Safety Code Section 18949.1.

Reference: Government Code Section 4460.

**ARTICLE 3
ACCEPTANCE OF DETECTABLE WARNING
AND DIRECTIONAL SURFACE PRODUCTS FOR
MANUFACTURERS AND DESIGN PROFESSIONALS
January 1, 2001**

Detectable warning products and directional surfaces installed after January 1, 2001 shall be evaluated by an independent entity, selected by the Department of General Services, Division of the State Architect, Access Compliance, for all occupancies, including transportation and other outdoor environments, except that when products and surfaces are for use in residential housing, evaluation shall be in consultation with the Department of Housing and Community Development. See Government Code Section 4460.

5-301. Division of the State Architect, Access Compliance, acceptance of product. The procedure for the DSA-AC acceptance of manufactured products is detailed in this article.

ACCESS TO PUBLIC BUILDINGS BY PERSONS WITH DISABILITIES

All products require prior evaluation by a recognized evaluation agency that has a program specifically intended for such purposes. DSA-AC shall review the evaluation report for compliance with related and appropriate national standards and Title 24 requirements.

5-301.1. Product submittal. Products must meet the requirements of Section 5-301.

5-301.2. Division of the State Architect, Access Compliance, products exempt from evaluation by a recognized agency. No products can be approved for use that do not require evaluation by a recognized evaluation agency.

5-301.3. Products evaluated by recognized state and city agencies. No products can be approved by any state and city agencies for use that do not require evaluation by a recognized evaluation agency.

5-301.4. Products evaluated by a recognized evaluation agency. Products must have, as a minimum, an approved report published by a nationally recognized evaluation agency. Without an evaluation report, the applicant will be required to obtain such a report or will be denied acceptance on DSA-AC projects. The report and its evaluation criteria may be reviewed for compliance with national standards.

5-301.5. Development of DSA acceptance criteria. Development of new DSA-AC acceptance criteria shall be based on acceptance criteria from a recognized evaluation agency.

5-301.6. Marking. Each detectable warning and directional surface product shall be provided with:

1. Label indicating the DSA label number,
2. Manufacturer's product number, and
3. Product approval expiration date.

Authority: Government Code Sections 4450 and 4460 and Health and Safety Code Section 18949.1.

Reference: Government Code Section 4460.

ARTICLE 4 APPLICATION FOR INDEPENDENT ENTITY EVALUATION APPROVAL (IEEA)

5-401. Application for IEEA. The following form must be filed in duplicate:

HISTORY NOTE APPENDIX FOR CHAPTER 5

Administrative Regulations for the Division of State Architect, Access Compliance California Code of Regulations, Title 24, Part 1

HISTORY:

- > The history notes for prior changes remain within the text of this code.
 1. (DSA-AC 2/01) Adoption of detectable warning products and standards, Chapter 5, Articles 2, 3 and 4. Approved by the California Building Standards Commission on November 28, 2001. Filed with the Secretary of State on March 1, 2002, effective April 2, 2002.
 2. (DSA-AC 05/04) Changes without regulatory effect to addresses in Section 5-103 and an acronym in Section 5-202. Filed with Secretary of State on June 28, 2006 and effective 30th day after filing with Secretary of State.
 3. (DSA-AC 03/06) Repeal of duplicate provisions and editorial and formatting amendments to administrative standards for implementing facility access in conformance with California Law and federally recognized accessibility standards. Effective January 1, 2008.
 4. (DSA-AC 04/09) Revisions to Section 5-104, Fees, by State and Consumer Services Agency on behalf of the Division of State Architect-Access Compliance. Effective February 13, 2010.
 5. (DSA-AC 02/12) Amend Chapter 5, Section 5-104 and 5-106. Approved by the California Building Standards Commission on January 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.
 6. Erratum to correct History Note format in Chapter 5: effective January 1, 2020.
 7. (DSA-SS/CC 04/21) Amend Chapter 5, Article 1, Section 5-103. Approved by the California Building Standards Commission on January 18, 2022, filed with the Secretary of State on February 2, 2022, and effective 30 days after filing with Secretary of State.

CHAPTER 6

SEISMIC EVALUATION PROCEDURES FOR HOSPITAL BUILDINGS

ADMINISTRATIVE REGULATIONS FOR THE OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT (OSHPD)

ARTICLE 1 DEFINITIONS AND REQUIREMENTS

1.0 Scope. The regulations in this article shall apply to the administrative procedures necessary to implement the seismic retrofit requirements of the Alfred E. Alquist Hospital Facilities Seismic Safety Act of 1983.

1.1 Application. The regulations shall apply to all general acute care hospital facilities as defined in Section 1.2 of these regulations.

1.2 Definitions. Unless otherwise stated, the words and phrases defined in this section shall have the meaning stated therein throughout Chapter 6, Part 1, Title 24.

ADMINISTRATIVE EXTENSION means an extension not to exceed two years granted while the hospital's application for an extension pursuant to Section 1.5.2 Item 8 is being reviewed by the Office.

ALTERNATIVE ANALYSIS means a complete seismic analysis using methodology approved in advance by the Office and meeting the criteria of Article 2, Section 2.7 of these regulations.

BULK MEDICAL GAS SYSTEM means an assembly of fixed equipment such as storage containers, pressure regulators, pressure relief devices, vaporizers, manifolds and interconnecting piping that has a capacity of more than 20,000 cubic feet (NTP) of cryogenic medical gas.

COMMUNICATIONS SYSTEM means the assembly of equipment such as telephone switchgear, computers, batteries, radios, microwave communications systems, towers and antennas that provide essential internal and external communication links.

COMPLETE STRUCTURAL DAMAGE means a significant portion of the structural elements have exceeded their ultimate capacities for some critical structural elements or connections have failed, resulting in dangerous permanent lateral displacement, partial collapse or collapse of the entire building. A Complete Structural Damage would be a loss of 100% of the building's replacement cost.

CONFORMING BUILDING means a building originally constructed in compliance with the requirements of the 1973 or subsequent edition of the *California Building Code* or classified as *SPC-4D*, as defined in this section.

CRITICAL CARE AREA means those special care units, intensive care units, coronary care units, angiography laboratories, cardiac catheterization laboratories, delivery rooms, emergency rooms, operating rooms, postoperative recovery rooms and similar areas in which patients are intended to be subjected to invasive procedures and connected to line-operated, electromedical devices.

CRITICAL COMMUNITY PROVIDER means hospitals determined to be critical to community access to healthcare, as determined in Section 1.5.2 Item 8.5.

DAMAGE CONTROL STRUCTURAL PERFORMANCE CATEGORY is a performance category that has been demonstrated either by analysis or retrofit to satisfy the requirements of Section 1.4.5.1.3 and the *California Existing Building Code (CEBC)* Sections 303A.3.4.5, 501A.3.1 and 501A.3.2 or equivalent provisions in later editions of the *CEBC*. Buildings satisfying this structural performance standard shall be deemed to satisfy the requirements of the *Structural Performance Category SPC-4D*.

EMERGENCY POWER SUPPLY (EPS) means the source of electric power including all related electrical and mechanical components of the proper size or capacity, or both, required for the generation of the required electrical power at the EPS output terminals. For rotary energy converters, components of an EPS include the prime mover, cooling system, generator, excitation system, starting system, control system, fuel system and lube system (if required).

ESSENTIAL ELECTRICAL SYSTEMS means a system as defined in the *California Electrical Code*, Article 517 "Health Care Facilities," Chapter 5, Part 3 of Title 24.

FIRE ALARM SYSTEM means a system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal initiating devices and to initiate appropriate response to those signals.

FUNCTIONAL CONTIGUOUS GROUPING means a group of hospital buildings, each of which contains the primary source of one or more basic service that are operationally interconnected in a manner acceptable to the Department of Health Services.

GENERAL ACUTE CARE HOSPITAL as used in Chapter 6, Part 1 means a hospital building as defined in Section 129725 of the Health and Safety Code and that is also licensed pursuant to subdivision (a) of Section 1250 of the Health and Safety Code, but does not include these buildings if the beds licensed pursuant to subdivision (a) of Section 1250 of the Health and Safety Code, as of January 1, 1995, comprise 10 percent or less of the total licensed beds of the total physical plant, and does not include facilities owned or operated, or both, by the Department of Corrections. It also precludes hospital buildings that may be licensed under the above mentioned code sections, but provide skilled nursing or acute psychiatric services only.

HOSPITAL EQUIPMENT means equipment permanently attached to the building utility services such as surgical, morgue, and recovery room fixtures, radiology equipment,

medical gas containers, food service fixtures, essential laboratory equipment, TV supports, etc.

HYBRID STRUCTURE means a structure consisting of an original and one or more additions, constructed at different times, and with lateral-force-resisting systems of different types, or constructed with differing materials or a different design approach. The original building and additions are interconnected and not seismically isolated.

NONCONFORMING BUILDING means any building that is not a conforming building.

NONSTRUCTURAL PERFORMANCE CATEGORY (NPC) means a measure of the probable seismic performance of building contents and nonstructural systems critical to providing basic services to inpatients and the public following an earthquake, as defined in Article 11, Table 11.1 of these regulations.

NONSTRUCTURAL PERFORMANCE CATEGORY NPC-4D is a performance category assigned to existing hospital buildings not designed and constructed under a building permit issued by OSHPD that have been evaluated and or retrofitted to satisfy the requirements of NPC 4D for one of the Levels defined in Article 11, Table 11.1 Nonstructural Performance Categories. Level 1 being the minimum level of seismic compliance and Level 3 being the highest level of compliance required for continued operation beyond 2030.

PATIENT ORIGIN REGION is a geographic area bounded by the same U.S. Postal Service five-digit Zip Code. For the purposes of determining the hospital service area the patient origin region may be referred to as “region.”

PRIMARY SOURCE means that building or portion of a building identified by the hospital as housing the main or principal source of a basic hospital service, serving the greatest number of patients, providing the greatest number of patient beds, or having the largest/greatest floor space of the specified basic service. The hospital may submit data to substantiate the primary source through alternative criteria if different than above.

PRINCIPAL HORIZONTAL DIRECTIONS means the two predominant orthogonal translational modes of vibration with the lowest frequency.

PROBABILITY OF COLLAPSE means the fraction of building that is expected to collapse given that the ground motions defined in Section 1.4.5.1.2.1.4 occur at the building site.

REBUILD PLAN means a plan to meet seismic standards primarily by constructing a new conforming SPC-5 building for use in lieu of an SPC-1 building.

REGION see definition for “patient origin region.”

REMOVAL PLAN means a plan to meet seismic standards primarily by removing acute care services or beds from the hospital’s license.

REPLACEMENT PLAN means a plan to meet seismic standards primarily by relocating acute care services or beds from nonconforming buildings into a conforming building.

RETROFIT PLAN means a plan to meet seismic standards primarily by modifying the building in a manner that brings the building up to SPC-2, SPC-4D, or SPC-5 standards.

SIGNIFICANT STRUCTURAL DEFICIENCY means an attribute of the structure considered to be significant with respect to Probability of Collapse.

SLENDER SEISMIC RESISTING SYSTEM means any vertical system for resisting lateral forces, such as walls, braced frames or moment frames, with a height to width ratio greater than four for the minimum horizontal dimension at any height.

STRUCTURAL PERFORMANCE CATEGORY (SPC) means a measure of the probable seismic performance of building structural systems and risk to life posed by a building subject to an earthquake, as defined in Article 2, Table 2.5.3 of these regulations.

STRUCTURAL PERFORMANCE CATEGORY SPC-4D is a performance category assigned to previously nonconforming hospital buildings that have been demonstrated either by analysis or retrofit to be equivalent to the minimum prescriptive requirements of the 1979 Uniform Building Code (UBC 1979) including the California amendments, hereafter called the 1980 CBC, in accordance with Section 1.4.5.1.3 and the California Existing Building Code Sections 303A.3.4.5, 501A.3.1 and 501A.3.2.

1.3 Seismic evaluation. All general acute care hospital owners shall perform a seismic evaluation on each hospital building in accordance with the Seismic Evaluation Procedures as specified in Articles 2 through 11 of these regulations. By January 1, 2001, hospital owners shall submit the results of the seismic evaluation to the Office for review and approval. By completing this seismic evaluation, a hospital facility can determine its respective seismic performance categories for both the Structural Performance Category (SPC) and the Nonstructural Performance Category (NPC) in accordance with Articles 2 and 11 of these regulations.

Exception: The Structural Performance Category of SPC-4D shall be established in accordance with Section 1.4.5.1.3 and the California Existing Building Code (CEBC) Sections 303A.3.4.5, 501A.3.1 and 501A.3.2 or equivalent provisions in later editions of the CEBC.

1.3.1 Seismic evaluation submittal. Hospital owners shall submit the seismic evaluation report to the Office by January 1, 2001. There are no provisions for submittal of the evaluation report after this date, except as provided in Section 1.4.5.1.2. The hospital owners shall submit the evaluation report in accordance with Section 7-113, “Application for Plan Report or Seismic Compliance Extension Review” and Section 7-133, “Fees” of Article 3, Chapter 7, Part 1, Title 24.

Exceptions:

1. Any hospital facility owner whose building is exempted from the structural evaluation in accordance with Section 2.0.1.2 shall not be required to submit a structural evaluation report as specified in Section 1.3.3. In lieu of the structural evaluation report, hospital owners shall submit the matrix of construction information for the specified build-

ing(s) as noted in Section 1.3.4.6 to the Office by January 1, 2001;

2. Any hospital facility owner whose building is exempted from the nonstructural seismic evaluation in accordance with Section 11.0.1.2 shall not be required to submit a nonstructural evaluation report as specified in Section 1.3.4. In lieu of the nonstructural evaluation report, hospital owners shall submit the matrix of construction information for the specified building(s) as noted in Section 1.3.4.6 to the Office by January 1, 2001.

1.3.2 Seismic evaluation format. The evaluation shall consist of the Structural Evaluation and the Nonstructural Evaluation Reports. The reports shall be prepared in conformance with Part 1, Chapter 7, Title 24 and these regulations and prepared as follows:

1. Reports shall be submitted in an 8½" x 11" format;
2. All site, architectural, and engineering plans shall be formatted on 11- by 17-inch sheets (folded to 8½ by 11 inches);
3. Larger sheets, if required to clearly describe the requested information, shall be appended to the reports; and
4. Other supporting documents in addition to those meeting the minimum requirements of Sections 1.3.3 and 1.3.4 may be appended to the reports.

1.3.3 Structural evaluation report. The structural evaluation report shall include the following elements:

1. A description of the building, including photographs of the building, and sketches of the lateral force resisting system;
2. The "General Sets of Evaluation Statements" from the Appendix;
3. A synopsis of the investigation and supporting calculations that were made;
4. A list of the deficiencies requiring remediation to change statement responses from false to true; and
5. The SPC for the building, with comments on the relative importance of the deficiencies.

1.3.4 Nonstructural evaluation report. The nonstructural evaluation report shall include the following elements:

1. A written description of the evaluation methods and procedures conducted in conformance with Article 11 of these regulations for the determination of the facilities existing compliance. The description shall include the systems and components required for the planned level of nonstructural performance as identified in Table 11.1;

Exceptions:

1. Additional evaluations as in accordance with Section 11.01.3 will be required for any hospital owner electing to obtain a higher NPC at a future date consistent with an approved compliance plan;

2. A complete nonstructural evaluation up to NPC 5 is required prior to the hospital owner selling or leasing the hospital to another party.
2. Provide single line diagrammatic plans (site plan and floor plans) of the following:

2.1. Location of the following areas/spaces:

- (a) Central supply areas;
- (b) Clinical laboratory service spaces;
- (c) Critical care areas;
- (d) Pharmaceutical service spaces;
- (e) Radiological service spaces; and
- (f) Sterile supply areas.

2.2. Diagrammatic or narrative descriptions of the following major building systems where deficiencies are identified that are within the scope of the evaluation, including primary source location or point(s) of entry into the building and major distribution routes of each utility or system.

(a) Mechanical systems including:

- i. Air supply equipment, piping, controls and ducting;
- ii. Air exhaust equipment and ducting;
- iii. Steam and hot water piping systems, including boilers, piping systems, valving and components; and
- iv. Elevators selected to provide service to patient, surgical, obstetrical and ground floors.

(b) Plumbing systems including:

- i. Domestic water supply system, including heating equipment, valving, storage facilities and piping;
- ii. Medical gas supply system, including storage facilities, manifolding and piping;
- iii. Fire protection system, including sprinkler systems, wet and dry standpipes, piping systems and other fire suppression systems; and
- iv. Sanitary drainage system, including storage facilities and piping.

(c) Electrical systems, including:

- i. Essential electrical system, including emergency fuel storage;
- ii. Internal communication systems;
- iii. External communication systems;
- iv. Fire alarm systems; and
- v. Elevators selected to provide service to patient, surgical, obstetrical and ground floors.

SEISMIC EVALUATION PROCEDURES FOR HOSPITAL BUILDINGS

BUILDING NAME/ DESIGNATION	OSHPD (or local building) permit date/ number	GOVERNING BUILDING CODE	CONSTRUCTION COMPLETION DATE	BUILDING TYPE (per Section 2.2.3)	SPC	NPC

3. A synopsis of the evaluation and all the calculations used in the course of the evaluation for the planned level of nonstructural performance;
4. A list of the deficiencies identified in the course of the evaluation for the planned level of nonstructural performance;
5. Provide an 11- by 17-inch scaled Site Plan which identifies the boundaries of the facility property, locates all buildings, roadways, parking and other significant site features and improvements. Identify boundaries between buildings which were constructed at different times. For all buildings, note the names of the buildings and date of each related building permit. Provide the SPC and NPC for all buildings.
6. Provide the following matrix of construction information for each building of the facility under the acute care license, include the Structural Performance Category (SPC) and Nonstructural Performance Category (NPC) for all hospital buildings (see Tables 2.5.3 and 11.1). Identify each building addition separately. For buildings constructed, reconstructed or remodeled under a building permit issued by the Office, provide the OSHPD application number and the date of the initial submittal.

1.4 Compliance plans. A compliance plan shall be prepared and submitted for each building subject to these regulations. All general acute care hospital owners shall formulate a compliance plan which shall indicate the facility’s intent to do any of the following:

1. Building retrofit for compliance with these regulations for continued acute care operation beyond 2030;
2. Partial retrofit for initial compliance, with closure or replacement expected by 2002, 2008, 2013 or 2030;
3. Removal from acute care service with conversion to nonacute care health facility use; or
4. No action, building to be closed, demolished or replaced.

This plan must clearly indicate the actions to be taken by the facility and must be in accordance with the timeframes set forth in Article 2 (Structural Performance Category-“SPC”) and Article 11 (Nonstructural Performance Category-“NPC”) of the Seismic Evaluation Procedure regulations.

1.4.1 Preparation of the compliance plan. The Compliance Plan shall be prepared and submitted in conformance with these regulations in the following format:

1. Compliance Plans shall be submitted in an 8½- by 11-inch format;

2. All site, architectural, and engineering plans shall be formatted on 11- by 17-inch sheets (folded to 8½ by 11 inches);
3. Larger sheets, if required to clearly describe the requested information, shall be appended to the compliance plan; and
4. Other supporting documents in addition to those meeting the minimum requirements of Section 1.4.4 may be appended to the compliance plan.

1.4.2 Compliance plan submittal. Hospital owners shall submit the compliance plan to the Office by January 1, 2001, unless the owner requests an extension pursuant to Section 1.4.3. The hospital owners shall submit the compliance plan in accordance with Section 7-113, “Application for Plan or Report Review” and Section 7-133, “Fees” of Article 3, Chapter 7, Part 1, Title 24.

1.4.3 Compliance plan submittal extension. Hospital owners may request an extension from the Office for submission of the compliance plan. Any hospital owner requesting an extension for submittal of the compliance plan shall make such request in writing to the Office up to 180 days prior to, but no later than January 1, 2001. The compliance plan must be submitted no later than January 1, 2002. All hospital owners requesting an extension for submittal of the compliance plan shall certify to OSHPD that all hospital buildings continuing acute care operation beyond January 1, 2002 meet the standards of NPC 2 by January 1, 2002.

1.4.4 Compliance plan requirements. Each compliance plan shall contain the following elements:

1. An Existing Site/Campus Description;
2. A Compliance Plan Description;
3. A Compliance Site Plan;
4. A Compliance Plan Schedule; and
5. An Existing and Planned Buildings Matrix.

1.4.4.1 Existing site/campus description. If the compliance plan is submitted separately from the seismic evaluation, it will be necessary to resubmit the information as specified in Section 1.3.4.5, of the Nonstructural Evaluation Report.

1.4.4.2 Compliance plan description. Provide a comprehensive narrative description of the Compliance Plan, including the projected schedule for compliance.

1.4.4.3 Compliance site plan. Provide Compliance Site Plans, indicating the configuration of the facility at the 2008 and 2030 milestones. The plans shall indicate conforming and nonconforming buildings and identify the final configuration of the facility at each milestone, after completion of compliance measures.

1.4.4.4 Compliance plan schedule. Provide a bar graph schedule which describes the schedule for compliance with the SPC and NPC seismic performance categories, indicating the schedule of the following major phases of the plan:

1. Obtain a geotechnical report (if necessary);
2. Architecture and engineering design/construction document preparation;
3. Local approvals;
4. Office review, approval and permitting;

BUILDING NAME/ DESIGNATION	BUILDING TYPE (per Section 2.2.3)	SPC existing	SPC planned	NPC existing	NPC planned

5. Approval of Department of Health Services Licensing and Certification, and any other required licensing;
6. Permanent relocation of acute care services to other buildings or facilities (identify services affected);
7. Temporary/interim relocation of acute care services to other buildings including the duration of the approved program flexibility plan pursuant to Health and Safety Code Section 1276.05;
8. Construction period; and
9. Beneficial occupancy.

1.4.4.5 Existing and planned buildings matrix. Provide the following matrix of construction information for each building of the facility under the acute care license, include the Structural Performance Category (SPC) and Nonstructural Performance Category (NPC) for all hospital buildings (see Tables 2.5.3 and 11.1). Identify each building addition separately.

1.4.5 Compliance plan update/change notification. Should a hospital owner change an approved Compliance Plan, the hospital shall document any changes and submit for review and approval to the Office an amended Compliance Plan. Changes are defined as alterations to the planned level of seismic performance or compliance schedule. Submittal of an amended compliance plan shall require a hospital owner to comply with one or more of the following provisions, if applicable:

1. A hospital owner shall submit to the Department of Health Services’ Seismic Safety Unit (DHS) an Office-approved compliance plan that includes interim relocation of general acute care services in accordance with a program flexibility plan pursuant to Health and Safety Code Section 1276.05. This submittal by the hospital owner to DHS shall occur within 30 days of the Office’s approval.
2. A hospital owner shall comply with the requirements of Section 1.5.2, “Delay in Compliance” for any amended compliance plan.

3. A hospital owner amending a compliance plan to attain a higher NPC level will perform a nonstructural evaluation of the systems and components required for the planned level of nonstructural performance identified in Table 11.1, “Nonstructural Performance Categories.”

1.4.5.1 Change in seismic performance category. The SPC or NPC for a hospital building may be changed by the Office from the initial determination in Section 1.3.3 or 1.3.4, provided the building has been modified to comply with the requirements of the *California Existing Building Code* (Part 10 of Title 24) for the specified SPC or NPC. *The SPC of a hospital building shall also be permitted to be changed on the basis of the following:*

1. Collapse probability assessments in accordance with Section 1.4.5.1.2; or
2. Analysis or retrofit in accordance with Section 1.4.5.1.3.

1.4.5.1.1 The SPC or NPC for a hospital building may be in accordance with by the Office from the initial determination made per Sections 2.0.1.2.3 or 11.0.1.2.1 upon the following:

1. A Seismic Evaluation Report shall be submitted and approved which shall include either or both of the following:
 - 1.1. A structural evaluation report in accordance with Section 1.3.3;
 - 1.2. A nonstructural evaluation report in accordance with Section 1.3.4.

Exception: To change an NPC 1 hospital building to an NPC 2 under this section, the nonstructural evaluation may be limited in scope to the systems and equipment specified in Section 11.2.1.

2. The building has been modified to comply with the requirements of the *California Existing Building Code* (Part 10 of Title 24) for the specified SPC or NPC.

1.4.5.1.2 Hospital buildings with an SPC 1 rating, may be reclassified to SPC 2 by the Office, pursuant to Table 2.5.3, on the basis of a collapse probability assessment in accordance with Section 1.4.5.1.2 Item 1 provided the hospital buildings received an extension to the January 1, 2008, compliance deadline in accordance with Section 1.5.2.

Exception: Hospital buildings with the potential for surface fault rupture and surface displacement at the building site (Section 9.3.3) *are not eligible for reclassification.*

1. Hospital buildings with SPC 1 rating may be reclassified as follows:
 - a) The Office shall issue a written notice to the hospital owners informing them that they may be eligible for reclassification of their SPC 1 buildings as permitted by this section.
 - b) For an SPC-1 building to be considered for reclassification to the SPC-2 rating, the hospital owner shall request a collapse probability assessment. The request shall include at a minimum the information and documents specified in Section 1.8.

1.4.5.1.2.1 Upon assessment of the collapse probability of the SPC-1 building, the Office shall notify the hospital owner in writing the final SPC rating of the subject building.

Every building with collapse probability more than 0.75 percent, but less than or equal to 1.20 percent, shall be altered, repaired or seismically retrofitted to mitigate any deficiencies identified in accordance with Article 10 Sections 10.1.1.1, 10.1.2.2, 10.1.6 and 10.1.7 of this chapter (as part of the complete seismic evaluation in accordance with Section 1.3.3) by January 1, 2015. Hospitals not meeting the deadline set by this section shall not be issued a building permit for any noncompliant building except those required for seismic compliance in accordance with the *California Administrative Code* (Chapter 6), maintenance, and emergency repairs until the building permit required by this section is issued.

1.4.5.1.2.2 When the collapse probability assessment by the Office results in the building remaining in SPC 1, further evaluation may be provided by the hospital owner in accordance with Section 2.7 in order to substantiate a higher SPC rating.

1.4.5.1.3 *Nonconforming hospital buildings shall be permitted to be reclassified to SPC-4D, pursuant to Table 2.5.3, in accordance with the CEBC Sections 303A.3.4.5, 501A.3.1 and 501A.3.2 or equivalent provisions in later editions of the CEBC.*

Exceptions: *Hospital buildings with the following deficiencies are not eligible for reclassification to SPC-4D:*

1. *Hospital buildings with the potential for surface fault rupture and surface displacement at the building site (Section 9.3.3).*
2. *Unreinforced Masonry shear wall buildings (Section 5.4), and*
3. *Precast Concrete buildings (Sections 4.4, 5.2 & 7.4).*

1.4.5.1.4 Except as provided in Section 1.4.5.1.5, a nonconforming hospital building that does not meet the structural and nonstructural requirements of Table 2.5.3 and Table 11-1 shall not provide acute care services or beds after the compliance deadlines set forth in Section 1.5.1. After these deadlines, the following shall apply.

1. A nonconforming hospital building used as a hospital outpatient clinical services building shall not be classified as a hospital building. It shall comply with the provisions of Health and Safety Code Section 129725. It shall not be subject to the requirements of Title 24, Part 1, Chapter 6.
2. A nonconforming hospital building used as an acute psychiatric hospital or multistory skilled nursing facility or intermediate care facility shall be classified as a hospital building. However, it shall not be subject to the requirements of Title 24, Part 1, Chapter 6.
3. A nonconforming hospital building used as a single-story wood frame or light steel frame skilled nursing facility or intermediate care facility shall not be classified as a hospital building, and shall not be subject to the requirements of Title 24, Part 1, Chapter 6.

4. A nonconforming hospital building used for purposes other than those listed above shall not be classified as a hospital building; shall not be licensed pursuant to Health and Safety Code Section 1250(a); shall not be subject to the requirements of Title 24, Part 1, Chapter 6; and shall not be under the jurisdiction of the Office.

1.4.5.1.5 A hospital building from which acute care services and beds have been removed *or a nonconforming hospital building without SPC or NPC rating* shall not provide *general acute care* services unless it has been modified to comply with the requirements of *SPC-4D* or SPC 5 and NPC 4, NPC 4D or NPC 5. Prior to use for acute care service, the SPC and/or NPC of the hospital building shall be changed in accordance with Section 1.4.5.1.1 *or 1.4.5.1.3*.

1.5 Compliance requirements. All general acute care hospital owners shall comply with the seismic performance categories, both SPCs and NPCs, established in the seismic evaluation procedures, Articles 2 and 11 and set forth in Tables 2.5.3 and 11.1, respectively.

1.5.1 Compliance deadlines.

1. Before January 1, 2020, the owner of an acute care inpatient hospital where buildings are rated SPC 1 or SPC 2; or where the NPC rating is less than 5, shall submit to the Office an attestation that the board of directors of that hospital is aware that the hospital building is required to meet the January 1, 2030, deadline for substantial compliance with those regulations and standards.
2. After January 1, 2020, any general acute care hospital building which continues acute care operation must, at a minimum, meet the nonstructural requirements of NPC 2, as defined in Article 11, Table 11.1 or shall no longer be granted a building permit for construction work in such building except those required for seismic compliance in accordance with the *California Administrative Code* (Chapter 6), maintenance, and emergency repairs.
3. After January 1, 2030, any general acute care hospital building which continues acute care operation must, at a minimum, meet the structural requirements of SPC 3, 4, 4D or 5, as defined in Article 2, Table 2.5.3 and the nonstructural requirements of NPC 5, as defined in Article 11, Table 11.1 or shall no longer provide acute care services.

1.5.2 Delay in compliance.

1. **Requirements for NPC.** For any general acute care hospital located in Seismic Design Category D, as defined by Section 1613A of the 2013 *California Building Code*:
 - 1.1. By January 1, 2024, the hospital owner shall submit to the Office a complete nonstructural evaluation up to NPC 4 or 4D and NPC 5, for each building.
 - 1.2. By January 1, 2026, the hospital owner shall submit to the Office construction documents for NPC 4 or 4D and NPC 5 compliance that are

deemed ready for review by the Office, for each building that will continue to provide acute care services beyond January 1, 2030.

- 1.3. By January 1, 2028, the hospital owner shall obtain a building permit to begin construction, for NPC 4 or 4D and NPC 5 compliance of each building that the owner intends to use as a general acute care hospital building after January 1, 2030. Hospitals not meeting the January 1, 2028 deadline set by this section shall not be issued a building permit for any noncompliant building except those required for seismic compliance in accordance with the California Administrative Code (Chapter 6), maintenance, and emergency repairs until the building permit required by this section is issued.

Exception: If the hospital has obtained an extension for SPC compliance, the NPC compliance deadlines shall coincide with the approved SPC extension deadlines and the requirements of Sections 1.5.2 shall be deemed to be satisfied.

- 1.4. After January 1, 2028, buildings with an NPC rating less than 4, all remodels/renovations, or other construction work, shall include anchorage and/or bracing of all equipment and services within the boundary of the scope of work that is not in compliance with NPC 4.

Exception 1: Remodels/renovations, or other construction work, that remove a room or space from service use or occupancy for less than 24 hours.

Exception 2: Where 20 percent or less of the affected existing construction, such as ceilings, walls, and ducts, but independent of finishes, is removed to access equipment and services for anchorage/bracing may be reinstalled as it pre-existed prior to the NPC work, as long as it was in compliance with the code at the time it was installed/constructed.

Exception 3: Buildings that have been removed from general acute care service, or have projects to remove the building from acute care services by 2030.

- 1.5. Any general acute care hospital building (located in Seismic Design Category D or F) granted an extension up to January 1, 2020 or beyond is deemed to comply with the terms of the extension if all of the following conditions are met:

- 1.5.1. The hospital meets the anchorage and bracing requirements for NPC 2.

- 1.5.2. The building is upgraded to NPC 3 in accordance with the compliance timeframes specified in Table 11.1.

Exception: The building is SPC-2, the method of compliance is to remove the building from general acute care service by 2030, and no SPC-4D projects have been submitted to the Office.

2. Requirements for SPC.

1. Extension until January 1, 2020. Any SPC-1 general acute care hospital building that has received an extension to the January 1, 2008, deadline for both the structural and nonstructural requirements may receive an additional extension of up to seven years to the January 1, 2013, deadline for both the structural and nonstructural requirements.

- 1.1. For an SPC-1 building to be eligible for this extension, all of the following conditions must be met:

- (a) The hospital owner requesting an extension for an SPC-1 building in accordance with this section, must submit to the Office no later than March 31, 2012, the following:
- (i) An application for extension accompanied by a letter of intent stating whether the hospital intends to rebuild, replace or retrofit the building, or remove all general acute care beds and services from the building.
 - (ii) A facility site plan identifying the SPC-1 hospital building for which the extension is being requested by name and OSHPD assigned building number.
 - (iii) A chart or a bar graph schedule which describes the necessary amount of time and schedule to complete the construction for the subject building in order to achieve the targeted building resolution stipulated in the letter of intent pursuant to Section 1.5.2 Item 2.1.1(a)(i). The chart shall indicate all major milestones required for the implementation of the construction plan.
 - (iv) A narrative description and supporting documentation demonstrating how the hospital intends to meet the requested deadline and why the requested extension is necessary.
 - (v) When applicable, a narrative description and supporting documentation demonstrating community access to

essential hospital services as specified in Section 1.5.2 Item 2.1.5.

- (vi) When applicable, a narrative description and supporting documentation demonstrating the hospital owner's financial hardship to meet the milestones specified in Section 1.5.2 Items 2.1.6.
 - (vii) Information on the type of use/ occupancy of the SPC-1 building by listing the type of services currently delivered in the building.
- (b) The hospital owner submits to the Office, no later than September 30, 2012, an application and required documents ready for review seeking collapse probability assessment for its SPC-1 building in accordance with Section 1.8.2.
 - (c) The hospital owner submits to the Office, no later than January 1, 2015, construction documents ready for review consistent with the letter of intent and the schedule submitted pursuant to Section 1.5.2 Items 2.1.1(a)(i) and (iii). The construction documents shall be accompanied by a financial capacity report. The financial capacity report shall demonstrate the hospital owner's financial capacity to implement the construction plans submitted pursuant to this subsection.
 - (d) The hospital owner receives a building permit consistent with the letter of intent and the schedule submitted pursuant to Section 1.5.2 Items 2.1.1(a)(i) and (iii) no later than July 1, 2018.
- 1.2. A hospital may demonstrate that it has complied with the requirements of their compliance schedule if they received confirmation of compliance from the Office by the end of their extension date.
- 1.3. Extensions to the January 1, 2013 compliance deadline.
- 1.3.1. The maximum permitted extension for a hospital building is the greater extension time allowed based on consideration of the structural integrity of the building as determined by the Risk-Based Extension in Section 1.5.2. Item 8.4, the access to essential hospital services as determined in Section 1.5.2 Item 8.5 and the Financial Hardship as determined by Section 1.5.2 Item 8.6. In no event shall the maximum permitted extension exceed seven years or the amount of time reasonably required to complete the construction described in Section 1.5.2 Item 2.1.1(a), whichever is less.
 - 1.3.2. Upon acceptance of the application for extension and all submittal documentation

required in Section 1.5.2 Item 8.1(a) an SPC-1 building may be granted an Administrative Extension by the Office.

1.4. Risk-Based Extension. The risk-based extension is based on the seismic risk coefficient.

- (a) The seismic risk coefficient posed by a building, P , shall be determined by:

$$P = H \times E$$

Where:

H = the value of the collapse probability in percent, as determined by the requirements of Section 1.8; and,

E = the Exposure Factor, based on the presence of Basic and Supplemental Services, as defined in Part 2, Title 24, Section 1224.3.

The Exposure Factor E shall be taken as:

$E = 0.5$ where the building houses only storage spaces, central sterile supply spaces, and/or utility plant spaces.

$E = 0.7$ where the building houses only clinical laboratory, pharmaceutical, dietetic and/or support services spaces, or nonpatient care building which is contiguous to and provides egress or structural support to an acute care hospital building(s).

$E = 1.0$ where the building houses any other Basic and/or Supplementary Service spaces.

Where a building contains more than one Basic and/or Supplementary Service space, the largest value of E shall apply.

- (b) The Risk-Based Extension is determined by the seismic risk coefficient, P :
 - i. Where $P \leq 3.0\%$, the Risk-Based Extension for the building shall not exceed seven years.
 - ii. Where $P > 3.0\%$ but $P \leq 5.0\%$, the Risk-Based Extension for the building shall not exceed five years.
 - iii. Where $P > 5.0\%$, the Risk-Based Extension for the building shall not exceed two years.
 - iv. Regardless of the seismic coefficient, P , the Risk-Based Extension for any building straddling an Active Fault shall not exceed two years.

1.5. Community access to essential hospital services. The potential effect of closure of the hospital building on community access to essential hospital services shall be evaluated. A building at a hospital defined as a Critical Community Provider in accor-

dance with this Section is eligible for a Maximum Permitted Extension of up to seven years. The hospital may be classified as a Critical Community Provider if it meets the requirements of Section 1.5.2 Items 2.1.5(a), 2.1.5(b), 2.1.5(c), 2.1.5(d) or 2.1.5(e):

- (a) The hospital meets the requirements of (i) or (ii) below:
 - i. Certified as a Sole Community Hospital, Critical Access Hospital, or Rural Referral Center by the Department of Health and Human Service Centers for Medicare & Medicaid Services.
 - ii. Disproportionate Share Hospital. For purposes of this section a hospital is deemed to be a disproportionate share hospital if it meets the eligibility requirements of the Welfare and Institutions Code, Section 14105.98 for at least two years during the five most current years prior to application for an extension.
- (b) The hospital provides care for uninsured/underinsured populations. To qualify, the hospital must meet or exceed all of the following minimum thresholds:
 - i. 10 percent Medicaid Discharges.
 - ii. 10 percent Medicaid Emergency Department visits.
 - iii. 10 percent Uninsured Emergency Department visits.
 - iv. Inpatient Occupancy rate of the hospital general acute licensed beds greater than 50 percent.
- (c) The hospital is a critical service provider of any of the following specialized medical care within its service area as defined in Section 1.5.2 Item 2.1.5(f):
 - i. Trauma Center as defined by CCR – Title 22, Division 9, Section 100248.
 - ii. Children’s Hospital as defined by the Welfare and Institutions Code, Section 10727.
 - iii. Burn Unit as defined by CCR – Title 22, Division 5, Section 70421.
 - iv. Emergency department provides 10 percent or more of the total Emergency Treatment Stations.
 - v. A hospital in which its service area has an average number of patient beds/1000 population below 1.5.
- (d) The hospital provides more than 20 percent of the licensed acute care beds in the hospitals’ service area as defined in Section 1.5.2 Item 2.1.5(f).

- (e) A tertiary or specialty hospital dedicated to specific sub-specialty care with volumes in excess of 50 percent of total annual discharges within the county in which the hospital is located.
- (f) Hospital Service Area. The total geographic area comprised by the sum of all patient origin regions that significantly contribute to the inpatient population of the subject hospital. For the purposes of determining the hospital service area, conditions (i) and (ii) listed below shall be satisfied:
 - (i) The number of regions considered shall include all the regions with a relative hospital ratio of inpatient discharges per region greater than 5 percent of the total hospital inpatient discharges. “Relative hospital ratio of inpatient discharges per region” means the number of hospital patients discharged in a region by the subject hospital in relation to the total hospital patients discharged for the same region by all hospitals.
 - (ii) The number of regions considered shall include all the regions with a hospital ratio of inpatient discharges per region that cumulatively account for at least 70 percent of the total hospital patient discharges. “Hospital ratio of inpatient discharges per region” means the number of hospital patients discharged in a region by the subject hospital in relation to the total patients discharged by the subject hospital.

The data utilized to determine community access to essential hospital services shall be based on the hospital’s most current fiscal reporting information filed with the Office or on the hospital’s fiscal reporting information filed with the Office for any of the most current three years.

- 1.6. Financial Hardship. Evaluation of financial hardship shall be determined on a hospital-by-hospital basis. A building at a hospital that meets the financial hardship criteria of this section is eligible for a Maximum Permitted Extension of up to seven years. A hospital may be determined to have financial hardship if it meets at least one of the following requirements:
- (a) Financial performance. The hospital meets all of the following thresholds:
 - i. Negative operating margin for the hospital for at least two years during the five years prior to application for an extension.
 - ii. Days Cash-on-Hand less than 60.
 - iii. Current Ratio less than 1.5

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- (b) The hospital has a bond rating based on the following table:

**TABLE 1.5.2.8.6
BOND RATING GRADES**

CREDIT RISK	MOODY'S	STANDARD AND POOR'S	FITCH RATINGS
Medium	Baa	BBB	BBB
Lower Medium	Ba	BB	BB
Lower Grade	B	B	B
Poor Grade	Caa	CCC	CCC
Speculative	Ca	CC	CC
No Payments/Bankruptcy	C	D	D
In Default	C	D	D

- (c) For public hospitals, voters rejected the most recent bond issue specifically related to seismic compliance construction work at the facility.

The data utilized to determine financial hardship shall be based on the hospital owner's most current fiscal reporting information filed with the Office or on the hospital owner's fiscal reporting information filled with the Office for any of the most current three years unless noted otherwise in subsection (a) above.

- 1.7. Extension Adjustments. A hospital may request an extension adjustment necessary to complete the construction for the building granted an extension pursuant to Section 1.5.2 Item 2. In order for this request to be considered, the hospital owner shall notify the Office in writing as soon as practicable, but in no event later than six months after the hospital owner discovered the change of circumstances. The request shall include at a minimum all of the following:
 - (a) The length/duration of the additional extension time adjustment, but in no event the total extension including the adjustment shall exceed the period specified in Section 1.5.2 Item 2.
 - (b) The name and OSHPD assigned number for the hospital building requiring the extension adjustment.
 - (c) A narrative description and data supporting the discovered change of circumstances in completing the construction for the building granted an extension pursuant to Section 1.5.2 Item 2.
 - (d) An amended bar graph schedule required by Section 1.5.2 Item 2.1.1(a)(iii).

- 1.8. Extension Revocation/Termination. An extension for any hospital building granted pursuant to Sec-

tion 1.5.2 Item 2 may be revoked or terminated based on the following:

- (a) The Office determines that any information submitted pursuant to this section was falsified; or
- (b) The hospital failed to meet a milestone set forth in Sections 1.5.2 Item 2.1.1(a)(iii); or
- (c) Where the work of construction is abandoned or suspended for a period of at least six months, unless the hospital demonstrates in a publicly available document that the abandonment or suspension was caused by factors beyond its control.

2. Additional extension beyond January 1, 2020.

2.1. The Office may grant the hospital owner an additional extension to the January 1, 2020 seismic compliance deadline for each SPC 1 building where all the following conditions are met:

- (a) An extension was previously granted pursuant to California Health and Safety Code, Section 130060(g) or Section 130061.5(b).
- (b) A prior compliance plan corresponding to a replacement, retrofit or rebuild project was submitted to the Office by January 1, 2018.
- (c) The application for an extension is submitted by the owner on a form provided by the Office, and received by the Office no later than April 1, 2019.
- (d) The application, one per building, shall identify the seismic compliance method chosen based on a replacement, retrofit or rebuild plan as defined in definitions Section 1.2 of this chapter, for addressing the acute care functions in the SPC-1 building.
- (e) Documentation of facts necessary in determining the maximum length of the extension that may be granted in accordance with subsection 2.1.1 shall be submitted with the application.

2.1.1. Maximum length of Extension. The Office shall not grant an extension that exceeds the amount of time needed by the owner to come into compliance. The length of the extension to be granted shall be based upon a showing by the owner of the facts necessitating the additional time. It shall include a review of the plan and all the documentation submitted in the application for the extension, and shall permit only that additional time necessary to allow the owner to deal with compliance plan issues that cannot be fully met without the extension.

2.1.2. Extension for Replacement or Retrofit Plan where Construction has not Started. For an extension request based on a replacement plan or retrofit plan, final seismic compliance shall be achieved, a certificate of occupancy or construction final shall be obtained by July 1, 2022 and the following conditions shall apply:

1. Application submitted shall contain an extension schedule that identifies:
 - a. The maximum extension time requested, but no later than July 1, 2022.
 - b. Date when building permit will be obtained.
 - c. Date the hospital will begin construction.
2. A construction schedule shall be submitted within 15 calendar days of obtaining a building permit. The construction schedule shall identify a minimum of two major milestones acceptable to the office that will be used as a basis for determining whether the hospital is making adequate progress. Major milestones identified in the construction schedule shall be chosen such that they are easily verifiable by the Office.
3. Obtain a building permit.
4. Start construction.

Compliance with the requirements in (1 through 4) above shall be achieved no later than April 1, 2020.

2.1.3. Extension for Rebuild Plan where Construction has not Started. For an extension requested based on a rebuild plan, final seismic compliance shall be achieved, a certificate of occupancy shall be obtained by January 1, 2025 and the following shall apply:

1. Application submitted, shall contain an extension schedule that identifies:
 - a. The maximum time request for the extension, but no later than January 1, 2025.
 - b. Date of submission of the rebuild project deemed ready for review to the Office, but no later than July 1, 2020

c. Date when building permit will be obtained.

d. Date the hospital will begin construction.

2. Submission of the rebuild project deemed ready for review to the Office shall occur no later than July 1, 2020.
3. A construction schedule submitted within 15 calendar days of obtaining a building permit. The construction schedule shall identify a minimum of two major milestones acceptable to the office that will be used as a basis for determining whether the hospital is making adequate progress. Major milestones identified in the construction schedule shall be chosen such that they are easily verifiable by the Office.
4. Obtain a building permit.
5. Start construction.

Compliance with the requirements in 3) through 5) above shall be achieved no later than January 1, 2022.

2.1.4. Extension where Construction has Started. For a hospital building that has previously submitted to the Office a retrofit, replace or rebuild project for which a retrofit, replace or rebuild project was previously submitted to the Office and is under construction, the application for an extension shall contain all the following:

1. The method of compliance with the requested extension which shall be no later than July 1, 2022 for retrofit or replace plan and January 1, 2025 for rebuild plan. The application shall include the facts necessitating the additional time.
2. The project number under which the construction has commenced and is continuing.
3. A revised construction schedule to reflect the extension being requested and at least two major milestones shall be identified. Major milestones shall be chosen such that they are easily verifiable by the Office.

2.2. Quarterly Status Reports. A hospital granted an extension pursuant to this section shall provide a quarterly status report in a form required by the

Office, consistent with their extension/construction schedule. The first report is due on July 1, 2019, and subsequent status reports shall be due every October 1, January 1, April 1, and July 1 until seismic compliance is achieved. Each quarterly report shall contain the cumulative progress made towards meeting the dates in the extension and the construction schedules, current to 15 calendar days before the report is due. The report may be submitted to the Office no more than 15 calendar days before the due date.

- 2.3. Fines for Failure to Comply. Failure to comply with the dates for plan submission, construction schedule submission, obtain a building permit, to begin construction identified and accepted by the Office in the extension schedule or the major milestone dates identified and accepted by the Office in the construction schedule shall result in the assessment of a fine of five thousand dollars (\$5,000) per calendar day until the requirements or milestones, respectively, are met. The Office shall not issue a construction final or certificate of occupancy for the building until all assessed penalties accrued pursuant to this section have been paid in full or, if an appeal is pending, have been posted subject to resolution of the appeal.
- 2.4. Adjustments to Schedules. The Office may grant an adjustment as necessary to deal with contractor, labor, material delays, with acts of God, or with governmental entitlements, experienced by the hospital. The hospital shall submit the reason for the delay along with substantiating documents, a revised construction schedule and identify at least two new major milestones consistent with the adjustment. Requests for adjustments shall be made with the Office as soon as the reasons for the delay are known but no less than 30 calendar days before any upcoming affected extension schedule or construction milestone date.

Failure to comply with the revised construction schedule or meet any of the major milestones shall result in penalties as specified in subsection 2.3. The adjustment shall not exceed the corresponding final seismic compliance date of July 1, 2022 for a replacement plan or retrofit plan and January 1, 2025 for a rebuild plan.

1.6 Dispute resolution/appeals process. Dispute resolution and appeals shall be in conformance with Article 5, Chapter 7, Part 1 of Title 24.

1.7 Notification from OSHPD.

1. The Office shall issue written notices of compliance to all hospital owners that have attained the minimum required SPC and NPC performance levels by the required seismic compliance dates or extension dates granted by the Office;
2. The Office shall issue written notices of violation to all hospital owners that are not in compliance with the minimum SPC and NPC performance levels by the required seismic compliance dates or extension dates granted by the Office; and
3. The Office shall notify the State Department of Health Services of the hospital owners which have received a written notice of violation for failure to comply with these regulations.

1.8 Collapse probability assessment. Hospital owners may request a collapse probability assessment to reclassify buildings with an SPC-1 rating to SPC-2 in accordance with Section 1.4.5.1.2, or be used to determine eligibility for an extension in accordance with Section 1.5.2 Item 8.

1.8.1 The collapse probability assessment by the Office shall be determined using the following:

1. Multi-Hazard Loss Estimation Methodology, Earthquake Module (HAZUS-MH) developed by the Federal Emergency Management Agency (FEMA)/National Institute of Building Sciences (NIBS).
2. Building specific input parameters required by the Advanced Engineering Building Module (AEBM) of the HAZUS methodology shall be obtained from Appendix H to Chapter 6.
3. Modifications by the Office to the AEBM input parameters are hereby adopted as shown in Appendix H to Chapter 6, which are based on the following:
 - a) Building type
 - b) Building height and number of stories
 - c) Building age
 - d) Significant Structural Deficiencies listed in Section 1.8.2 Item 2.
4. Site seismicity parameters adjusted for soil type, as determined by the Office, shall be the lesser of:
 - a) Deterministic ground motion due to the maximum magnitude earthquake event on the controlling fault system.
 - b) Probabilistic ground motion having 10 percent probability of being exceeded in 50 years.

1.8.2 The collapse probability assessment for SPC-1 buildings shall be based on the following building information, parameters and documents:

1. A complete seismic evaluation of the building pursuant to Section 1.3.3.

Exception: Hospital owners who had submitted a complete structural evaluation report in compliance with Section 1.3.3, that is deemed to be complete by the Office, need not resubmit.
2. A supplemental evaluation report prepared by a California registered structural engineer that identifies the existence or absence of the building structural Lateral Force Resisting System (LFRS) properties and Significant Structural Deficiencies listed below:

- a. Age: Year of the *California Building Code* (CBC) used for the original building design.

Exception: For pre-1933 buildings, the design year shall be reported.

- b. Materials Tests: Office approved materials test results based on test plan preapproved by the Office (Section 2.1.2).
- c. Load path (Section 3.1)
- d. Mass irregularity (Section 3.3.4).
- e. Vertical discontinuity (Section 3.3.5).
- f. Adjacent buildings (Section 3.4).
- g. Short captive column (Section 3.6).
- h. Material deterioration (Section 3.7).
- i. Weak columns (Sections 4.2.8 and 4.3.6).
- j. Wall anchorage (Section 8.2).
- k. Redundancy (Section 3.2).
- l. Weak story irregularity (Section 3.3.1).
- m. Soft story irregularity (Section 3.3.2).
- n. Torsional irregularity (Section 3.3.6).
- o. Deflection incompatibility (Section 3.5).
- p. Cripple walls (Section 5.6.4).
- q. Openings (in diaphragm) at shear walls (Section 7.1.4).
- r. Topping slab missing (Sections 7.3 and 7.4) or the building type (structural system) is of lift slab construction.
- s. URM wall height to thickness ratio (Section 5.4.3).
- t. URM Parapets (Section 10.1.6).

This supplemental evaluation report shall include supporting documentation including existing construction drawings or reconstructed as-builts (Section 2.1.2) relating to the existence or absence of the Significant Structural Deficiencies listed above including calculations, where required, for review and acceptance by the Office, unless they are included in the complete structural evaluation.

- 3. Building systems shall be classified as to their Model Building Type in accordance with Table 1.8. For buildings with multiple building types, all types shall be listed. The building type resulting in the maximum collapse probability will be utilized by the Office to determine eligibility for reclassification.
- 4. Building height and number of stories above and below the seismic base shall be specified.
- 5. For SPC-1 buildings where the potential for surface fault rupture and surface displacement at the building site is present as determined by Section 9.3, a supplemental geologic hazards report prepared by a California registered engineering geologist/seismologist is required to address the following:
 - a. A site plan showing diagrammatically the location of the building footprint, the surface trace or traces of potential surface fault rupture.
 - b. The expected surface displacement during a rupture event.

TABLE 1.8—MODEL BUILDING TYPE

MODEL BUILDING TYPE (MBT)	DESCRIPTION
W1	Wood, Light Frame (≤ 5,000 sq ft)
W2	Wood, greater than 5,000 sq ft
S1	Steel Moment Frame
S2	Steel Braced Frame
S3	Steel Light Frame
S4	Steel Frame with Cast-In Place Concrete Shear Walls
S5	Steel Frame with Unreinforced Masonry Infill Walls
C1	Concrete Moment Frame
C2	Concrete Shear Walls
C3	Concrete Frame with Unreinforced Masonry Infill Walls
PC1	Precast Concrete Tilt-Up Walls
PC2	Precast Concrete Frames with Concrete Shear Walls
RM1	Reinforced-Masonry Bearing Walls with Flexible Diaphragms
RM2	Reinforced-Masonry Bearing Walls with Rigid Diaphragms
URM	Unreinforced-Masonry Bearing Walls
MH	Manufactured Housing

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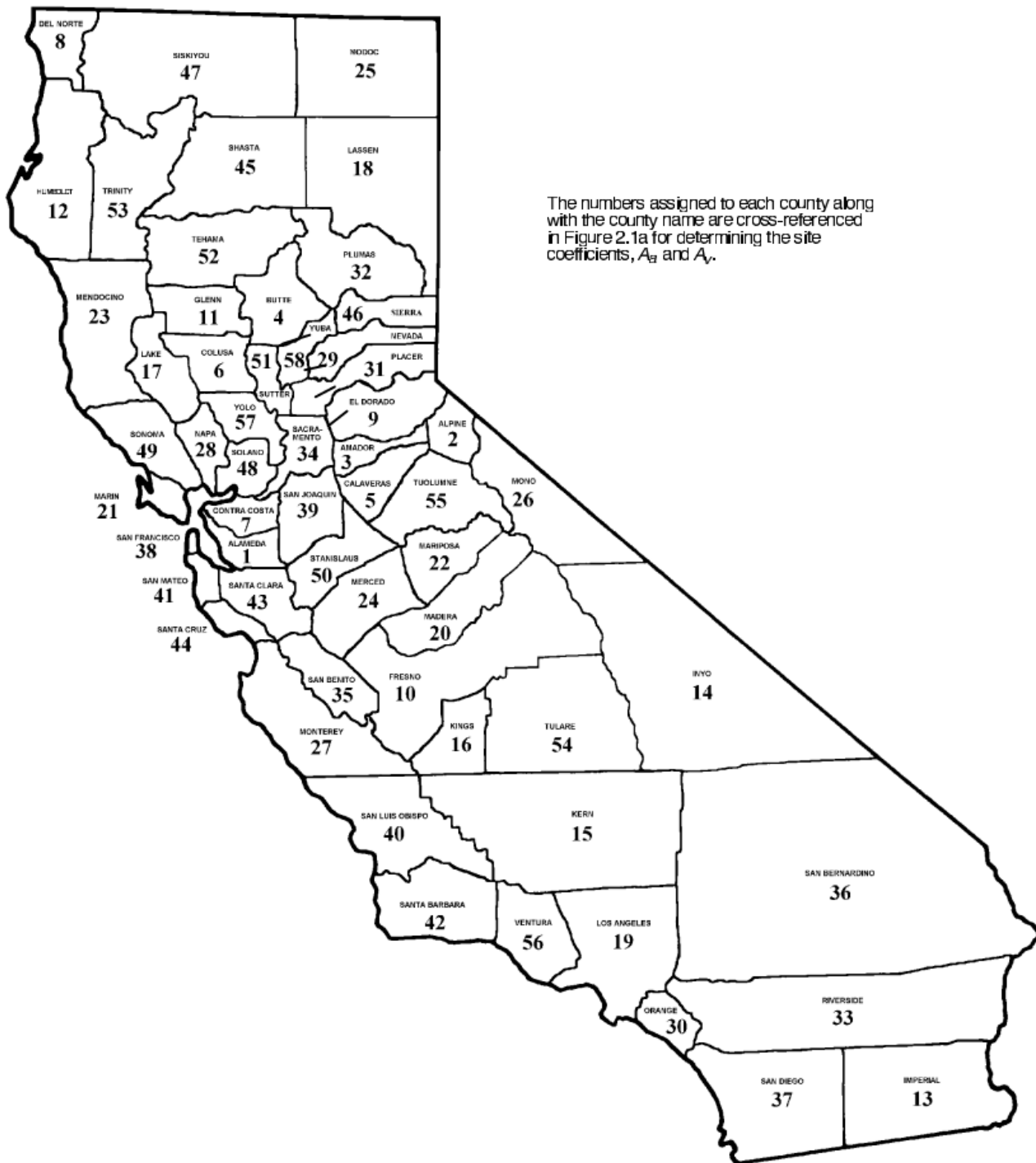


FIGURE 2.1

ARTICLE 2 PROCEDURES FOR STRUCTURAL EVALUATION OF BUILDINGS

2.0 General.

2.0.1 Structural evaluation procedure.

1. The structural evaluation process shall include the following steps:
 - 1.1 Site visit and data collection;
 - 1.2 Identification of building type;
 - 1.3 Completion of evaluation statements in appendix;
 - 1.4 Follow-up field work, if required;
 - 1.5 Follow-up analysis for “False” evaluation statements;
 - 1.6 Final evaluation for the building;
 - 1.7 Preparation of the evaluation report; and
 - 1.8 Submittal of evaluation report to OSHPD.
2. A general acute care hospital facility building may be exempted from a structural evaluation upon submittal of a written statement by the hospital owner to OSHPD certifying the following conditions:
 - 2.1 A conforming building as defined in Article 1, Section 1.2, may be placed into SPC 5 in accordance with Table 2.5.3 under the following circumstances:
 - (a) The building was designed and constructed to the 1989 or later edition of Part 2, Title 24, and
 - (b) If any portion of the structure, except for the penthouse, is of steel moment resisting frame construction (Building Type 3, or Building Type 4 or 6 with dual lateral system, as defined in Section 2.2.3) and the building permit was issued after October 25, 1994.
 - 2.2 All other conforming buildings as defined in Article 1, Section 1.2, may be placed into SPC 4 in accordance with Table 2.5.3, except those required by Section 4.2.10 to be placed in SPC 3 in accordance with Table 2.5.3, without the need for any structural evaluation.
 - 2.3 Nonconforming buildings as defined in Article 1, Section 1.2 may be placed into SPC 1 in accordance with Table 2.5.3 without any structural evaluation.

2.1 Site visit, evaluation and data collection procedures.

2.1.1 Site visit and evaluation.

1. The evaluator shall visit the building to observe and record the type, nature and physical condition of the structure.
2. The evaluator shall review an *Engineering Geological Report* on site geologic and seismic conditions. The report shall be prepared in accordance with Title 24, Sec-

tion 1634A of 1995 *California Building Code* (CBC) or equivalent provision in later version of the CBC.

Exceptions:

1. Reports are not required for one-story, wood-frame and light steel-frame buildings of Type II or Type V construction and 4,000 square feet or less in floor area;
2. A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found by the Office to be currently appropriate.
3. Establish the following *site and soil parameters*:
 - a. The value of the effective peak acceleration coefficient (A_a) from Figure 2.1 and 2.1a;
 - b. The value of the effective peak velocity-related acceleration coefficient (A_v) from Figure 2.1 and 2.1a;
 - c. The soil profile type (S_1 , S_2 , S_3 or S_4) derived from the geotechnical report or from Table 2.1;
 - d. The site coefficient, (S), from Table 2.1; and
 - e. The ground motion parameters and near field effects in strong ground shaking required for the evaluation of welded steel moment frame structures in accordance with Sections 4.2.0.1, 4.2.0.2 and 4.2.10.
4. Assemble building design data including:
 - a. Construction drawings, specifications and calculations for the original building (Note: when reviewing and making use of existing analyses and structural member checks, the evaluator shall assess and report the basis of the earlier work);
 - b. All drawings, specifications and calculations for remodeling work; and
 - c. Material tests and inspection reports for nonconforming buildings. If the original drawings are available, but material test and inspection reports are not available, perform the testing program as specified in Section 2.1.2.2.

If structural drawings are not available, the site visit and evaluation shall be performed as described in Section 2.1.1.5, and structural data shall be collected using the procedures in Sections 2.1.2.1 and 2.1.2.2.
5. During the site visit, the evaluator shall:
 - a. Verify existing data;

- b. Develop other needed data (e.g., measure and sketch building as outlined in Section 2.1.2);
 - c. Verify the vertical and lateral systems;
 - d. Check the condition of the building; and
 - e. Identify special conditions, anomalies and oddities.
6. Review other data available such as assessments of building performance following past earthquakes.
 7. Prepare a summary of the data using an OSHPD- approved format.
 8. Perform the evaluation using the procedures in Sections 2.2 through 2.5.
 9. Prepare a report of the findings of the evaluation using an OSHPD-approved format.

2.1.2 Data collection. Building information pertinent to a structure’s seismic performance, including condition, configuration, detailing, material strengths and foundation type, shall be obtained in accordance with this section, and documented on drawings and/or sketches that shall be included with the structural calculations.

Exception: Materials testing is not required for reclassification by the collapse probability assessment option as permitted by Section 1.4.5.1.2, where nonavailability of materials test is identified as a deficiency in accordance with Section 1.8.2.2(b).

2.1.2.1 Building characteristics. Characteristics of the building relevant to its seismic performance shall be obtained for use in the building evaluation. This shall include current information on the building’s condition, configuration, material strengths, detailing and foundation type. This data shall be obtained from:

1. Review of construction documents;
2. Destructive and nondestructive testing and examination of selected building components; and
3. Field observation of exposed conditions *to verify that field conditions substantially match the construction documents in accordance with data collection requirements in the California Existing Building Code Section*

303A.3.5.3, or equivalent provisions in later editions of the CEBC.

The characteristics of the building shall be established, including identification of the gravity- and lateral-load-carrying systems. The effective lateral-load carrying system may include structural and nonstructural elements that will participate in providing lateral resistance, although these elements may not have intended to provide lateral resistance. The load path shall be identified, taking into account the effects of any modifications, alterations or additions.

The owner or the owner’s authorized agent shall submit the following to the office for review and approval:

1. Complete set of construction documents.
2. Field test report(s) in accordance with Section 2.1.2.2.
3. Field observation report, which shall verify that field conditions substantially match the construction documents.

2.1.2.1.1 Nonconforming buildings without construction documents. Where the available construction documents do not provide sufficient detail to characterize the structure, the evaluation may be based on field surveys, summarized in as-built drawings. These drawings must depict building dimensions, component sizes, reinforcing information (for concrete and masonry elements), connection details, footing information, and the proximity of neighboring structures. All parts of the building that may contribute to the seismic resistance or that may be affected by the seismic response of the structure must be identified. The field survey shall establish the physical existence of the structural members, and identify critical load bearing members, transfer mechanisms, and connections. The survey shall include information on the structural elements and connector materials and details. Performing the field survey will entail removal of fireproofing or concrete encasement at critical locations to permit direct visual inspection and measurement of elements and connections. Nondestructive techniques such as radiographic, electromagnetic and other methods may be used to supplement destructive techniques.

1. **Steel elements.** Steel elements shall be classified by structural member type (e.g., rolled or build-up, material grade, and general properties). The survey shall note the presence of degradation or indications of plastic deformation, integrity of surface coatings, and signs of any past movement. For degraded elements, the lost

TABLE 2.1—SOIL PROFILE TYPES AND SITE COEFFICIENTS

SOIL PROFILE TYPE	PROFILE WITH	SITE COEFFICIENT, S
S1	Rock of any characteristic, either shalelike or crystalline in nature. Such material may be characterized by a shear wave velocity greater than 2,500 feet per second or by other appropriate means of classification.	1.0
	or	
	Stiff soil conditions where the soil depth is less than 200 feet and the soil types overlying rock are stable deposits of sands, gravels or stiff clays.	
S2	Deep cohesionless or stiff clay conditions, including sites where the soil depth exceeds 200 feet and the soil types overlying rock are stable deposits of sands, gravels or stiff clays.	1.2
S3	Soft- to medium-stiff clays and sands characterized by 30 feet or more of soft- to medium-stiff clays with or without intervening layers of sand or other cohesionless soils.	1.5
S4	More than 70 feet of soft clays or silts characterized by a shear wave velocity less than 400 feet per second.	2.0

material thickness and reduction of cross-sectional area and moment of inertia shall be determined. Visual inspection of welds shall be per American Welding Society D1.1, "Structural Welding Code-Steel." Structural bolts shall be verified to be in proper configuration and tightened as required in the AISC Steel Construction Manual. Rivets shall also be verified to be in proper configuration and in full contact, with "hammer sounding" conducted on random rivets to ensure they are functional. Nondestructive testing methods, such as dye penetrant and magnetic particle testing, acoustic emission, radiography and ultrasound shall be used when visual inspection identifies degradation or when a particular element or connection is critical to seismic resistance and requires further verification. For buildings in which archaic cast and wrought irons are employed, additional investigations to confirm ductility and impact resistance shall be conducted.

- 2. Concrete elements.** The configuration and dimensions of primary and secondary structural elements shall be established. The configuration and condition of reinforcing steel shall be assessed, through removal of con-

crete cover and direct visual inspection, and through nondestructive inspection using electromagnetic, radiographic and other methods. Critical parameters of the reinforcing system, such as lap splice length, presence of hooks, development within concrete, degree of corrosion and integrity of the construction shall be established in sufficient detail to perform the structural evaluation.

- 3. Masonry elements.** The configuration and dimensions of masonry elements shall be established. The configuration and condition of reinforcing steel shall be assessed, through removal of masonry cover and direct visual inspection, and through nondestructive inspection using electromagnetic, radiographic and other methods. Critical parameters of the reinforcing system, such as lap splice length, presence of hooks, development within concrete, degree of corrosion and integrity of the construction shall be established in sufficient detail to perform the structural evaluation.
- 4. Wood elements.** The configuration and dimensions of wood elements; the connections between wood elements; and the connections between wood and other

FIGURE 2.1a—EFFECTIVE PEAK ACCELERATION COEFFICIENT (A_a) AND EFFECTIVE PEAK VELOCITY COEFFICIENT (A_v) FOR CALIFORNIA

No.	County	EPA A_a	EPV A_v	No.	County	EPA A_a	EPV A_v
1	Alameda	0.40	0.40	30	Orange	0.40	0.40
2	Alpine	0.20	0.20	31	Placer	0.20	0.20
3	Amador	0.20	0.20	32	Plumas	0.20	0.20
4	Butte	0.20	0.20	33	Riverside	0.40	0.40
5	Calaveras	0.20	0.20	34	Sacramento	0.20	0.30
6	Colusa	0.20	0.30	35	San Benito	0.40	0.40
7	Contra Costa	0.40	0.40	36	San Bernardino	0.40	0.40
8	Del Norte	0.20	0.20	37	San Diego	0.40	0.40
9	El Dorado	0.20	0.20	38	San Francisco	0.40	0.40
10	Fresno	0.40	0.40	39	San Joaquin	0.30	0.30
11	Glenn	0.20	0.20	40	San Luis Obispo	0.40	0.40
12	Humboldt	0.20	0.30	41	San Mateo	0.40	0.40
13	Imperial	0.40	0.40	42	Santa Barbara	0.40	0.40
14	Inyo	0.40	0.40	43	Santa Clara	0.40	0.40
15	Kern	0.40	0.40	44	Santa Cruz	0.40	0.40
16	Kings	0.40	0.40	45	Shasta	0.20	0.20
17	Lake	0.30	0.30	46	Sierra	0.20	0.20
18	Lassen	0.20	0.20	47	Siskiyou	0.20	0.20
19	Los Angeles	0.40	0.40	48	Solano	0.40	0.40
20	Madera	0.20	0.30	49	Sonoma	0.40	0.40
21	Marin	0.40	0.40	50	Stanislaus	0.40	0.40
22	Mariposa	0.20	0.20	51	Sutter	0.20	0.20
23	Mendocino	0.40	0.40	52	Tehama	0.20	0.20
24	Merced	0.40	0.40	53	Trinity	0.20	0.30
25	Modoc	0.20	0.20	54	Tulare	0.40	0.40
26	Mono	0.40	0.40	55	Tuolumne	0.20	0.20
27	Monterey	0.40	0.40	56	Ventura	0.40	0.40
28	Napa	0.40	0.40	57	Yolo	0.20	0.30
29	Nevada	0.20	0.20	58	Yuba	0.20	0.20

structural components or elements such as concrete or masonry walls shall be established. The configuration and condition of wood members, including size, type, grade, condition and quality shall be assessed, through removal of finish materials, and examination of unfinished areas such as attics, crawl spaces and basements. Critical connections and elements shall be visually inspected, using invasive procedures or removal of finishes where necessary. For shear walls, select locations shall be exposed to allow evaluation of sheathing material, nail size, spacing and installation (e.g., overdriven or nails that miss or split the framing members). The base connections of shear resisting elements shall be inspected and evaluated for their adequacy to connect the base of the structure to the foundation or structure below.

5. **Foundation elements.** In the absence of dependable construction drawings, determination of the size and detailing of the foundation system requires invasive procedures. The evaluator shall select representative footings for exposure to establish footing size and depth. Conservative assumptions regarding the reinforcement may be made considering code requirements and local practice at the time of the design. In the absence of evidence to the contrary, it may be assumed that the foundation elements were adequately designed to resist actual gravity loads to which the building has been subjected.

2.1.2.2 Material properties. The building evaluation shall be based on the strength and deformation properties of the existing materials and components. The strength of existing components shall be calculated using data on their configuration, obtained from the original construction documents, supplemented by field observations and the test values of material properties. Where such effects may have a deleterious effect on component or structural behavior, allowances shall be made for the likely effects of strain hardening or degradation. Test values may be obtained from samples extracted from the structure, or from original materials and compliance certificates. The Office will determine the adequacy of the *test results based upon the approved material testing program.*

The materials testing program shall require approval by the Office prior to testing. Prior to performing destructive materials test and nondestructive tests requiring modification to existing conditions, the owner or the owner's authorized agent shall obtain a building permit.

The materials testing shall be in accordance with the California Existing Building Code Section 303A.3.5.3, or equivalent provisions in later editions of the CEBC.

2.1.2.2.1 Nonconforming buildings with construction documents. The material properties for nonconforming buildings for which original construction documents of sufficient detail are available shall be confirmed by testing or from acceptable original materials and compliance certificates. If original materials and compliance certificates are available, they must provide the information specified in Items 1 through 4 of this section to be considered acceptable.

1. **Steel elements.** The following properties are required for each member type (e.g., beams, columns, braces) and each steel grade used in the structure:

- a) Ultimate tensile and yield capacities;
- b) Modulus of elasticity; and
- c) Deformation characteristics including mode of failure.

2. **Concrete elements.** The following material properties are required for each member type (e.g., beams, columns, walls) in the structure:

- a) Concrete compressive strength;
- b) Concrete unit weight;
- c) Concrete modulus of elasticity;
- d) Reinforcing steel tensile yield point;
- e) Reinforcing steel modulus of elasticity;
- f) Reinforcing steel chemical composition and carbon equivalent; and
- g) Reinforcing steel surface deformations.

3. **Masonry elements.** The following material properties are required for each type of masonry in the structure:

- a) Masonry compressive strength;
- b) Masonry unit weight;
- c) Masonry modulus of elasticity;
- d) Reinforcing steel tensile yield point;
- e) Reinforcing steel modulus of elasticity;
- f) Reinforcing steel chemical composition and carbon equivalent; and
- g) Reinforcing steel surface deformations.

4. **Wood elements.** The following material properties are required for each type of wood element in the structure:

- a) Identification of Wood Species, and
- b) Grade Material. (Note: This may be established by visual inspection or stamped labels on the element.)

2.1.2.2.2 Nonconforming buildings without construction documents. The material properties for nonconforming buildings for which original construction documents of sufficient detail are unavailable shall be confirmed by testing. The number and location of tests shall be selected so as to provide sufficient information to adequately define the existing condition of materials in the building. The evaluator shall determine the number and location of tests. The test locations shall be located throughout the entire building in those components which provide the primary path of lateral force resistance.

2.2 Selection and use of evaluation statements.

2.2.1 Identification of building type. The evaluator shall determine the building type using the following procedure:

1. Identify the lateral-force-resisting system using text and drawings, including whatever components are available and effective to constitute a system. Prepare floor and roof plans, and elevations and sketches of the lateral-force-resisting system.
2. Select one or more of the 15 common building types which best characterize the structure (see Sections 2.2.2 and 2.2.3 below). Structures with multiple lateral force

resisting systems (different lateral systems in orthogonal directions, or structures where the system changes from level to level) may require the use of two or more building types. In the case of hybrid structures or other buildings that cannot be adequately classified using the 15 building types, the alternative analysis procedure shall be used, or the building shall be placed in SPC “1.”

3. Reproduce from the Appendix the list of evaluation statements. These statements shall be used for all types of buildings. Some statements on the list may not be appropriate. These statements may be marked “NA” as “not applicable.” The Appendix also contains the set of evaluation statements that address foundations and geologic site hazards, and nonstructural elements.

2.2.2 Using the general procedure. The general procedure involving use of the set of evaluation statements presented in the Appendix consists of the following steps:

1. Evaluate the basic building system according to the evaluation statements in Article 3;
2. Evaluate the vertical systems resisting lateral forces according to Article 4 (moment frames), Article 5 (shear walls) or Article 6 (braced frames) as appropriate. For buildings with a combination of vertical systems, each system in the building must be evaluated;
3. Evaluate the diaphragm or horizontal bracing system according to Article 7;
4. Evaluate the structural connections according to Article 8;
5. Evaluate the foundation and possible geologic site hazards according to Article 9;
6. Evaluate the nonstructural elements that involve immediate life-safety issues according to Article 10; and
7. Evaluate the critical nonstructural components and systems according to Article 11.

If a statement is found to be true, the condition being evaluated is acceptable according to the criteria of these regulations, and the issue may be set aside. If a statement is found to be false, a condition exists that needs to be addressed further, using the specified analysis procedures. Analysis procedures are given in Section 2.4. Each statement includes a reference to a particular section in Articles 3 through 10 where additional procedures for the resolution of the issues are given. The evaluator shall assemble the list of deficiencies and the results of the analysis and proceed to the final evaluation in Section 2.5.

2.2.3 Common building types. The evaluator shall determine the type(s) of building being evaluated, choosing from among the following 15 common types:

1. **Building Type 1—Wood, light frame.** These buildings are typically small structures of one or more stories. The essential structural character of this type is repetitive framing by wood joists on wood studs. Loads are light and spans are small. These buildings may have relatively heavy chimneys and may be partially or fully covered with veneer. Lateral loads are transferred by diaphragms to shear walls. The diaphragms are roof panels and floors. Shear walls are exterior walls sheathed with plank siding, stucco, plywood, gypsum

board, particle board or fiberboard. Interior partitions are sheathed with plaster or gypsum board.

2. **Building Type 2—Wood, commercial and industrial.** These are buildings with a floor area of 5,000 square feet or more and with few, if any, interior bearing walls. The essential structural character is framing by beams on columns. The beams may be glulam beams, steel beams or trusses. Lateral forces usually are resisted by wood diaphragms and exterior walls sheathed with plywood, stucco, plaster or other paneling. The walls may have rod bracing. Large exterior wall openings often require post-and-beam framing. Lateral force resistance on those lines may be achieved with steel rigid frames or diagonal bracing.
3. **Building Type 3—Steel moment frame.** These buildings have a frame of steel columns and beams. Lateral forces are resisted by the development of flexural forces in the beams and columns. In some cases, the beam-column connections have very small moment resisting capacity but, in other cases, the connections of some of the beams and columns were designed to fully develop the member capacities. Lateral loads are transferred by diaphragms to moment resisting frames. The diaphragms can be of almost any material. The frames develop their stiffness by full or partial moment connections. The frames can be located almost anywhere in the building. Usually the columns have their strong directions oriented so that some columns act primarily in one direction while the others act in the other direction, and the frames consist of lines of strong columns and their intervening beams.
4. **Building Type 4—Steel braced frame.** These buildings are similar to Type 3 buildings except that the vertical components of the lateral-force-resisting system are braced frames rather than moment frames.
5. **Building Type 5—Steel light frame.** These buildings are pre-engineered and prefabricated with transverse rigid frames. The roof and walls consist of lightweight panels. The frames are built in segments and assembled in the field with bolted joints. Lateral loads in the transverse direction are resisted by the rigid frames with loads distributed to them by shear elements. Loads in the longitudinal direction are resisted entirely by shear elements. The shear elements can be either the roof and wall sheathing panels, an independent system of tension-only rod bracing, or a combination of panels and bracing.
6. **Building Type 6—Steel frame with concrete shear walls.** The shear walls in these buildings are cast-in-place concrete and may be bearing walls. The steel frame is designed for vertical loads only. Lateral loads are transferred by diaphragms of almost any material to the shear walls. The steel frame may provide a secondary lateral-force-resisting system depending on the stiffness of the frame and the moment capacity of the beam-column connections. In “dual” systems, the steel moment frames are designed to work together with the concrete shear walls in proportion to their relative rigidities. In this case, the walls would be evaluated

under this building type and the frames would be evaluated under Type 3, Steel Moment Frames.

7. **Building Type 7—Steel frame with infill shear walls.** This is one of the older type of buildings. The infill walls usually are offset from the exterior frame members, wrap around them, and present a smooth masonry exterior with no indication of the frame. Solidly infilled masonry panels act as a diagonal compression strut between the intersections of the moment frame. If the walls do not fully engage the frame members (i.e., lie in the same plane), the diagonal compression struts will not develop. The peak strength of the diagonal strut is determined by the tensile stress capacity of the masonry panel. The post-cracking strength is determined by an analysis of a moment frame that is partially restrained by the cracked infill. The analysis shall be based on published research and shall treat the system as a composite of a frame and the infill. An analysis that attempts to treat the system as a frame and shear wall is not permitted.
8. **Building Type 8—Concrete moment frame.** These buildings are similar to Type 3 buildings except that the frames are of concrete. There is a large variety of frame systems. Older buildings may have frame beams that have broad shallow cross sections or are simply the column strips of flat-slabs.
9. **Building Type 9—Concrete shear walls.** The vertical components of the lateral-force-resisting system in these buildings are concrete shear walls that are usually bearing walls. In older buildings, the walls often are quite extensive and the wall stresses are low but reinforcing is light. Remodeling that entailed adding or enlarging the openings for windows and doors may critically alter the strength of the modified walls. In newer buildings, the shear walls often are limited in extent, generating the need for boundary members and additional design consideration of overturning forces.
10. **Building Type 10—Concrete frame with infill shear walls.** These buildings are similar to Type 7 buildings except that the frame is of reinforced concrete. The analysis of this building is similar to that recommended for Type 7 except that the shear strength of the concrete columns, after cracking of the infill, may limit the semiductile behavior of the system. Research that is specific to confinement of the infill by reinforced concrete frames shall be used for the analysis.
11. **Building Type 11—Precast/tilt-up concrete walls with lightweight flexible diaphragm.** These buildings have a wood or metal deck roof diaphragm that distributes lateral forces to precast concrete shear walls. The walls are thin but relatively heavy while the roofs are relatively light. Tilt-up buildings often have more than one story. Walls can have numerous openings for doors and windows of such size that the wall behaves more like a frame than a shear wall.
12. **Building Type 12—Precast concrete frames with concrete shear walls.** These buildings contain floor and roof diaphragms typically composed of precast concrete elements with or without cast-in-place con-

crete topping slabs. The diaphragms are supported by precast concrete girders and columns. The girders often bear on column corbels. Closure strips between precast floor elements and beam-column joints usually are cast-in-place concrete. Welded steel inserts often are used to interconnect precast elements. Lateral loads are resisted by precast or cast-in-place concrete shear walls.

13. **Building Type 13—Reinforced masonry bearing walls with wood or metal deck diaphragms.** These buildings have perimeter bearing walls of reinforced brick or concrete-block masonry. These walls are the vertical elements in the lateral-force-resisting system. The floors and roofs are framed either with wood joists and beams with plywood or straight or diagonal sheathing or with steel beams with metal deck with or without a concrete fill. Wood floor framing is supported by interior wood posts or steel columns; steel beams are supported by steel columns.
14. **Building Type 14—Reinforced masonry bearing walls with precast concrete diaphragms.** These buildings have bearing walls similar to those of Type 13 buildings, but the roof and floors are composed of precast concrete elements such as planks or tee-beams, and the precast roof and floor elements are supported on interior beams and columns of steel or concrete (cast-in-place or precast). The precast horizontal elements may have a cast-in-place topping.
15. **Building Type 15—Unreinforced masonry (URM) bearing wall buildings.** These buildings include structural elements that vary depending on the building's age and, to a lesser extent, its geographic location. In buildings built before 1900, the majority of floor and roof construction consists of wood sheathing supported by wood subframing. In large multi-story buildings, the floors are cast-in-place concrete supported by the unreinforced masonry walls and/or steel or concrete interior framing. In buildings built after 1950, unreinforced masonry buildings with wood floors usually have plywood rather than board sheathing. The perimeter walls, and possibly some interior walls, are unreinforced masonry. The walls may or may not be anchored to the diaphragms. Ties between the walls and diaphragms are more common for the bearing walls than for walls that are parallel to the floor framing. Unreinforced masonry bearing wall buildings (TYPE 15) shall be assigned to SPC 1. No further analysis is required.

2.3 Follow-up field work. The first assessment of the evaluation statements may indicate a need for more information about the building. The evaluator shall make additional site visits, performing the necessary surveys and tests to complete the evaluation.

2.4 Analysis of the building. The general requirements for building analysis (including the determination of force level, horizontal distribution of lateral forces, accidental torsion, interstory drift and overturning) are summarized in this section. For cases where dynamic analysis is required, the general requirements are given in Section 2.4.10.

2.4.1 Scope of analysis. When an evaluation statement is false and requires further analysis, the evaluator shall provide appropriate analyses that will cover the statement requirements. For the analysis, the evaluator will:

1. Calculate the building weights;
2. Calculate the building period;
3. Calculate the lateral force on the building;
4. Distribute the lateral force over the height of the building;
5. Calculate the story shears and overturning moments;
6. Distribute the story shears to the vertical resisting elements in proportion to their relative stiffness;
7. Examine the individual elements as required by the evaluation statements:
 - a. Load and reaction diagrams for diaphragms and for the vertical resisting elements;
 - b. Shearing stresses and chord forces in the diaphragm;
 - c. Vertical components (walls and frames) and find the story deflections, member forces and deflections; and
 - d. Total forces or deflections according to the specified load combinations.

For moment frames consisting of beams and columns, the distribution of story shears to the vertical lateral-force-resisting elements in that story may be in proportion to their relative stiffness. In multistory frame-shear wall structures or in structures where the vertical resisting elements have significantly different lateral stiffnesses, or where the stiffnesses of the vertical resisting elements change significantly over the height of the structure, an analysis of the entire structure under the prescribed lateral loads shall be performed.

2.4.2 Demand. All building components evaluated shall resist the effects of the seismic forces prescribed herein and the effects of gravity loadings from dead, floor live and snow loads. The following load combinations shall be used:

$$Q = 1.1 Q_D + Q_L + Q_S \pm Q_E \quad (2-1)$$

or

$$Q = 0.9Q_D \pm Q_E \quad (2-2)$$

where:

- Q = the effect of the combined loads.
- Q_D = the effect of dead load.
- Q_E = the effect of seismic forces.
- Q_L = the effective live load is equal to 25 percent of the unreduced design live load but not less than the actual live load.
- Q_S = the effective snow load is equal to either 70 percent of the full design snow load or, where conditions warrant and are approved by OSHPD, not less than 20 percent of the full design snow load except that, where the design snow load is less than 30 pounds per square foot, no part of the load need be included in seismic loading.

The seismic portion of the demand (Q_E) is obtained from analysis of the building using the seismic base shear (V) from Equation 2-3.

2.4.3 Seismic analysis of the building.

2.4.3.1 Base shear. The seismic base shear determined from Equation 2-3 is the basic seismic demand on the building. Element forces and deflections obtained from analysis based on this demand are the element demands (Q_E) to be used in the load combinations of Equations 2-1 and 2-2. The demands are modified in some cases as discussed in Section 2.4.11.

The seismic base shear (V) in a given direction shall be determined as follows:

$$V = C_s W \quad (2-3)$$

where:

C_s = the seismic design coefficient determined by Equation 2-4 or 2-5.

W = the total dead load and applicable portions of the following:

- In storage and warehouse occupancies, a minimum of 25 percent of the floor live;
- Where an allowance for partition load is included in the floor load design, the actual partition weight or a minimum weight of 10 psf of floor area, whichever is greater;
- Total operating weight of all permanent equipment; and
- The effective snow load as defined in Section 2.4.2.

The seismic coefficient (C_s) for existing buildings shall be determined as follows:

$$C_s = 0.67 \left(\frac{1.2A_v S}{RT^{2/3}} \right) = \frac{0.80A_v S}{RT^{2/3}} \quad (2-4)$$

where:

A_v = the peak velocity-related acceleration coefficient given in Figures 2.1 and 2.1a.

R = a response modification coefficient from Table 2.4.3.1.

S = the site coefficient given in Table 2.1. In locations where the soil properties are not known in sufficient detail to determine the Soil Profile Type S_3 shall be used. Soil Profile Type S_4 need not be assumed unless OSHPD determines that Soil Profile Type S_4 may be present at the site, or in the event the Soil Profile Type S_4 is established by the geotechnical engineer.

T = the fundamental period of the building.

The value of C_s need not be greater than:

$$C_s = 0.85 \left(\frac{2.5A_a}{R} \right) = \frac{2.12A_a}{R} \quad (2-5)$$

where:

A_a = the effective peak acceleration coefficient given in Figures 2.1 and 2.1a.

TABLE 2.4.3.1—RESPONSE COEFFICIENTS¹

R	C _d	SYSTEM
Bearing wall systems		
6.5	4	Light-framed walls with shear panels
4.5	4	Reinforced concrete shear walls
3.5	3	Reinforced masonry shear walls
4	3.5	Concentrically braced frames
1.25	1.25	Unreinforced masonry shear walls
Building frame systems		
8	4	Eccentrically braced frames, moment-resisting connections at columns away from link
7	4	Eccentrically braced frames, nonmoment-resisting connections at columns away from link
7	4.5	Light-framed walls with shear panels
5	4.5	Concentrically braced frames
5.5	5	Reinforced concrete shear walls
4.5	4	Reinforced masonry shear walls
3.5	3	Tension-only braced frames
1.5	1.5	Unreinforced masonry shear walls
Moment-resisting frame system		
8	5.5	Special moment frames of steel
8	5.5	Special moment frames of reinforced concrete
4	3.5	Intermediate moment frames of reinforced concrete
4.5	4	Ordinary moment frames of steel
2	2	Ordinary moment frames of reinforced concrete
Dual system with a special moment frame capable of resisting at least 25 percent of prescribed seismic forces.		
Complementary seismic-resisting elements		
8	4	Eccentrically braced frames, moment-resisting connections at columns away from link
7	4	Eccentrically braced frames, nonmoment-resisting connections at columns away from link
6	5	Concentrically braced frames
8	6.5	Reinforced concrete shear walls
6.5	5.5	Reinforced masonry shear walls
8	5	Wood sheathed shear panels
Dual system with an intermediate moment frame of reinforced concrete or an ordinary moment frame of steel capable of resisting at least 25 percent of prescribed seismic forces.		
Complementary seismic-resisting elements		
5	4.5	Concentrically braced frames
6	5	Reinforced concrete shear walls
5	4.5	Reinforced masonry shear walls
7	4.5	Wood sheathed shear panels
Inverted pendulum structures		
2.5	2.5	Special moment frames of structural steel
2.5	2.5	Special moment frames of reinforced concrete
1.25	1.25	Ordinary moment frames of structural steel

1. Some building systems such as precast moment resisting frames are not listed in Table 2.4.3.1. When an unlisted building system must be evaluated, the evaluator shall perform an alternate analysis per Section 2.7 or place the building in SPC 1.

TABLE 2.4.3.2—COEFFICIENT FOR UPPER LIMIT ON CALCULATED PERIOD

A _v	C _a
0.4	1.2
0.3	1.3
0.2	1.4

2.4.3.2 Period. For use in Equation 2-4, the value of *T* shall be calculated using one of the following methods:

Method 1. The value of *T* may be taken to be equal to the approximate fundamental period of the building (*T_a*) determined as follows:

- a. For buildings in which the lateral-force-resisting system consists of moment-resisting frames capable of resisting 100 percent of the required lateral force and such frames are not enclosed or adjoined by more rigid components tending to prevent the frames from deflecting when subjected to seismic forces:

$$T_a = C_T h_n^{3/4} \tag{2-6a}$$

where:

C_T = 0.035 for steel frames.

C_T = 0.030 for concrete frames.

h_n = the height in feet above the base to the highest level of the building.

- b. As an alternate for concrete and steel moment-resisting-frame buildings of 12 stories or fewer with a minimum story height of 10 feet, the equation *T_a* = 0.10*N*, where *N* = the number of stories, may be used in lieu of Equation 2-6a.

- c. For all other buildings,

$$T_a = \frac{0.05 h_n}{\sqrt{L}} \tag{2-6b}$$

where:

L = the overall length (in feet) of the building at the base in the direction under consideration.

Method 2. The fundamental period *T* may be estimated using the structural properties and deformational characteristics of the resisting elements in a properly substantiated analysis. This requirement may be satisfied by using the following equation:

$$T = 2\pi \sqrt{\frac{\sum(w_i d_i^2)}{g \sum(f_i d_i)}} \tag{2-7}$$

The values of *f_i* represent any lateral force, associated with weights *w_i*, distributed approximately in accordance with the principles of Equations 2-8, 2-9 and 2-10 or any other rational distribution. The elastic deflections, *d_i*, should be calculated using the applied lateral forces, *f_i*. The period used for computation of *C_s* shall not exceed *C_aT_a*, where *C_a* is given in Table 2.4.3.2.

2.4.3.3 Direction of seismic forces. Assume that seismic forces will come from any horizontal direction. The forces may be assumed to act nonconcurrently in the direction of each principal axis of the structure except as discussed in Section 2.4.3.5.

2.4.3.4 Uplift. The beneficial effects of uplift at the foundation soil level may be considered, using the alternative analysis procedure.

2.4.3.5 Orthogonal effects. The critical load effect due to direction of application of seismic forces on the building may be assumed to be satisfied if components and their foundations are designed for the following combination of prescribed loads: 100 percent of the forces for one direction plus 30 percent of the forces for the perpendicular direction. The combination requiring the maximum component strength should be used.

Exception: Diaphragms and components of the seismic resisting system utilized in only one of the two orthogonal directions need not be designed for the combined effects.

2.4.3.6 Combinations of structural systems. When combinations of structural systems are incorporated into the same structure, the following requirements shall be satisfied:

1. Vertical combinations.

- 1.1 Structures not having the same structural system throughout their height shall be evaluated using the dynamic lateral force procedure.

Exceptions:

1. Structures five stories or less without stiffness and strength irregularities may be evaluated using the equivalent lateral force procedures; and
 2. Structures conforming to Section 2.4.3.6.2, below.
- 1.2 A two-stage analysis may be used if a structure contains a relatively rigid base supporting a flexible upper portion and both portions considered separately can be classified as regular structures. The rigid base shall have a calculated natural period in each direction of not more than 0.06 seconds. The periods shall be evaluated using Eq. 2-7, or its equivalent, considering the total mass of the flexible upper portion concentrated at the top of the rigid base. The flexible upper portion shall be evaluated as a separate structure supported laterally by the rigid base. The rigid base shall be evaluated as a separate structure. The reactions of the flexible upper portion shall be applied at the top of the rigid base, amplified by the ratio of the R and C_d factors of the superstructure divided by those for the base structure. The values of R and C_d for the base structure shall be greater than or equal to those used for the superstructure. The total lateral force on the base shall include the forces determined for the base itself.

- 2. Combinations along different axes.** If a building has a bearing wall system in only one direction, the value of R used for systems in the other direction shall not be greater than that used for the bearing wall system.

2.4.3.7 Vertical distribution of forces. The lateral force (F_x), induced at any level, shall be determined as follows:

$$F_x = C_{vx} V \quad (2-8)$$

and

$$C_{vx} = \frac{w_x h_x^k}{\sum_{i=1}^n w_i h_i^k} \quad (2-9)$$

where:

C_{vx} = vertical distribution factor.

h_i and

h_x = the height (feet) from the base to Level I or x .

k = an exponent related to the building period as follows:

For buildings having a period of 0.5 second or less, $k = 1$.

For buildings having a period of 2.5 seconds or more, $k = 2$.

For buildings having a period between 0.5 and 2.5 seconds, k may be taken as 2 or may be determined by linear interpolation between 1 and 2.

V = total design lateral force or shear at the base of the building.

w_i and

w_x = the portion of the total gravity load of the building (W) located or assigned to Level I or x .

2.4.3.8 Horizontal distribution of shear. The story shear, (V_x), shall be distributed to the various vertical elements of the lateral-force-resisting system in proportion to their rigidities, considering the rigidity of the diaphragm.

2.4.3.9 Horizontal torsional moments. The increased shears resulting from horizontal torsion where diaphragms have the capability to transmit that torsion shall be evaluated. The accidental torsional moment shall be determined assuming displacements of the centers of mass each way from their calculated locations. The minimum assumed displacement of the center of mass at each level shall be five percent of the dimension at that level measured perpendicular to the direction of the applied force. For each element, the most severe loading shall be considered.

2.4.3.10 Overturning. Every structure shall be capable of resisting the overturning effects caused by earthquake forces specified. At any level, the overturning moments to be resisted shall be estimated using those seismic forces (F_i and F_x) that act on levels above the level under consideration. At any level, the incremental changes of the overturning moment shall be distributed to the various resisting elements in the same proportion as distribution of the horizontal shears to those elements. The foundations of buildings (but not the connection of the building to the foundation), except inverted pendulum structures, shall be evaluated for the foundation overturning design moment (M_f) at the foundation-soil interface determined using the overturning moment at the base with an overturning moment reduction factor of 0.75.

2.4.3.11 P-delta effects. The resulting member forces and moments and the story drifts induced by P -delta effects shall be considered in the evaluation of overall structural frame

stability. *P*-delta need not be considered if the drift satisfies the “Quick Check for Drift” given in Section 2.4.7.

2.4.3.12 Foundations. The foundation shall be capable of transmitting the base shear and the overturning forces defined in this article from the structure into the supporting soil. The short-term dynamic nature of the loads may be taken into account in establishing the soil properties.

2.4.3.12.1 Soil capacities. The capacity of the foundation soil in bearing or the capacity of the soil interface between pile, pier or caisson and the soil shall be sufficient to support the structure with all prescribed loads, other than earthquake forces, taking due account of the settlement that the structure is capable of withstanding. For the load combination including earthquake, the soil capacities must be sufficient to resist loads at acceptable strains considering both the short time of loading and the dynamic properties of the soil. Allowable soil capacities multiplied by a factor of 2.0 may be used, except that values for sliding friction may not be increased.

2.4.3.12.2 Structural materials. The strength of concrete foundation components subjected to seismic forces alone or in combination with other prescribed loads and their detailing requirements shall be determined from the provisions of ACI 318. Reductions to foundation component capacities shall be made where components do not meet the requirements of ACI 318.

2.4.4 Deformation and drift. When deformations and drift limits need to be checked, such as for frames failing the “Quick Check of Drift” and slender seismic resisting systems of any type, compute the elastic deformations caused by the required forces and then multiply by the factor *C_d* to determine the total deformations. Interstory drifts shall not exceed 0.0133*h_{xx}*, where *h_{xx}* is the story height below level *x*. For purposes of this drift analysis only, it is permissible to use the computed fundamental period (*T*) of the building without the upper bound limitation specified in Section 2.4.3.2 when determining drift level seismic design forces.

2.4.5 Demand on diaphragms. The deflection in the plane of the diaphragm shall not exceed the permissible deflection of

the attached elements as determined by the evaluator. Permissible deflection permits the attached element to maintain its structural integrity under the individual loading and continue to support the prescribed loads without endangering the occupants of the building.

Floor and roof diaphragms shall be designed to resist a minimum force equal to 0.5*A_v* times the weight of the diaphragm and other elements attached to the building plus the portion of the seismic shear force at that level, (*V_x*), required to be transferred to the components of the vertical seismic-resisting system because of offsets or changes in stiffness of the vertical components above and below the diaphragm.

Diaphragms shall provide for both the shear and bending stresses resulting from these forces. Diaphragms shall have ties or struts to distribute the wall anchorage forces into the diaphragm as prescribed in Section 3.6.4 of the 1994 *NEHRP Recommended Provisions*.

2.4.6 Demand on parts and portions of the building. Parts and portions of structures and permanent nonstructural components and equipment supported by a structure and their attachments, as identified in the building evaluation procedures, shall be evaluated to verify that they are capable of resisting the seismic forces specified below. All attachments or appendages, including anchorages and required bracing, shall be evaluated for seismic forces. Nonrigid equipment, the structural failure of which would cause a life-safety hazard, also shall be evaluated.

Each element or component evaluated shall be capable of resisting a total lateral seismic force, *F_p*, where:

$$F_p = 0.67(A_v C_c W_c) \tag{2-10}$$

where:

A_v = the velocity-related acceleration coefficient given in Figures 2.1 and 2.1a.

C_c = a coefficient given in Table 2.4.6.

W_c = the weight of the element or component.

The NPC of the building shall be determined using the procedures in Article 11.

TABLE 2.4.6—SEISMIC COEFFICIENT, *C_c*

		<i>C_c</i>
Parts of structure	Walls:	
	Unbraced (cantilevered parapets and walls)	2.4
	Other exterior walls at and above the ground floor	0.9
	All interior bearing and nonbearing walls and partitions	0.9
	Masonry or concrete fences over 6 feet high	0.9
	Penthouse (except where framed by an extension of the building frame)	0.9
	Connections for prefabricated structural elements other than walls with force applied at the center of gravity	0.9
Nonstructural components	Exterior and interior ornamentations and appendages	2.4
	Chimneys, stacks, trussed towers and tanks:	
	Supported on or projecting as an unbraced cantilever above the roof more than one-half its total height	2.4
	All others including those supported below the roof with unbraced projection above the roof less than one-half its height or braced or guyed to the structural frame at or above its center of mass	0.9
	Mechanical, plumbing and electrical equipment	0.9
	Anchorage for suspended ceilings and light fixtures	0.9

2.4.7 Quick checks of strength and stiffness. Evaluation statements may require quick check estimates of the strength and stiffness of the building.

To check the average shear stress or drift for upper stories in addition to the first story, the story shear for an upper story may be approximated as follows:

$$v_j = \left(\frac{n+j}{n+1} \right) \left(\frac{W_j}{W} \right) 1.2V \quad (2-11)$$

where:

- j = number of story level under consideration.
- n = total number of stories above ground level.
- V = base shear from Equation 2-3.
- V_j = maximum story shear at story Level j .
- W = total seismic dead load.
- W_j = total seismic dead load of all stories above Level j (see Section 2.4.1).

2.4.7.1 Story drift for moment frames. The following equation for the drift ratio is applicable only to regular, multistory, multibay frames with columns continuous top and bottom:

$$DR = \left(\frac{k_b + k_c}{K_b \bullet K_c} \right) \left(\frac{h}{12E} \right) V_c C_d \quad (2-12)$$

where:

- C_d = deflection amplification factor from Table 2.4.3.1.
- DR = drift ratio = interstory displacement divided by interstory height.
- E = modulus of elasticity (ksi).
- h = story height (in.).
- I = moment of inertia (in.⁴).
- k_b = I/L for the beam.
- k_c = I/h for the column.
- L = center-to-center length (in.).
- V_c = shear in the column (kips).

For reinforced concrete frames, use appropriate cracked section properties pursuant to ACI 318-95 or later. For other configurations of frames, compute the drift ratio from the principles of structural mechanics.

2.4.7.2 Shearing stress in concrete frame columns. The equation for a quick estimate of the average shearing stress, (v_{avg}), in the columns of concrete frames is as follows:

$$v_{avg} = \left(\frac{n_c}{N_c - n_f} \right) \left(\frac{V_j}{A_c} \right) \quad (2-13)$$

where:

- A_c = summation of the cross-sectional area of all columns in the story under consideration.
- n_c = total number of columns.
- n_f = total number of frames in the direction of loading.
- V_j = story shear from Equation 2-11.

Equation 2-13 assumes that nearly all of the columns in the frame have similar stiffness. For other configurations of frames, compute the shear stress in the concrete columns from the principles of structural mechanics.

2.4.7.3 Shearing stress in shear walls. The equation for a quick estimate of the average wall shear stress (v_{avg}) is as follows:

$$v_{avg} = \frac{V_j}{A_w} \quad (2-14)$$

where:

- A_w = summation of the horizontal cross-sectional area of all shear walls in the direction of loading. The wall area shall be reduced by the area of any openings. For masonry walls, use the net area. For wood-framed walls, use the length rather than the area.
- V_j = story shear at the level under consideration determined from Equation 2-11.

The allowable stresses for the various types of shear wall building are given in Section 5.1 for concrete shear walls, Section 5.3 for reinforced masonry shear walls, Section 5.4 for unreinforced masonry shear walls and Section 5.6 for wood shear walls.

2.4.7.4 Diagonal bracing. The equation for a quick estimate of the average axial stress in the diagonal bracing (f_{br}) is as follows:

$$f_{br} = \left(\frac{V_j}{sN_{br}} \right) \left(\frac{L_{br}}{A_{br}} \right) \quad (2-15)$$

where:

- A_{br} = the average area of a diagonal brace (in.²).
- L_{br} = average length of the braces (ft).
- N_{br} = number of braces in tension and compression if the braces are designed for compression; if not, use the number of braces in tension, if the braces are not designed for compression.
- s = average span length of braced spans (ft).
- V_j = maximum story shear at each level (kips).

2.4.8 Procedure for evaluating unreinforced masonry bearing wall buildings. Unreinforced masonry bearing wall buildings shall automatically be placed in SPC 1.

2.4.9 Element capacities. Calculate element capacities on the ultimate-strength basis of the 1994 *NEHRP Recommended Provisions*.

When calculating capacities of deteriorated or damaged elements, the evaluator shall make appropriate reductions in the material strength, the section properties and any other aspects of the capacity affected by the deterioration.

2.4.9.1 Wood. The basic document is Chapter 9 of the 1994 *NEHRP Recommended Provisions*, as modified in Section 5.6 of these regulations.

2.4.9.2 Steel. The basic document is Chapter 5 of the 1994 *NEHRP Recommended Provisions*, as modified in Articles 4 and 6 of these regulations.

2.4.9.3 Concrete. The basic document is ACI 318-89. Because this document is on an ultimate-strength basis, the 1994 *NEHRP Recommended Provisions* specifies special load factors that include the factor of 1.0 for earthquake effects (see Equations 2-1 and 2-2).

2.4.9.4 Masonry. The basic document is Chapter 8 of the 1994 *NEHRP Recommended Provisions*, as modified in Article 5 of these regulations.

2.4.10 Dynamic analysis. Unless otherwise noted, the procedures given in Articles 3 through 10 use the equivalent lateral force procedure. The use of a dynamic analysis procedure is required for the following:

- 1) Buildings 240 feet or more in height;
- 2) Buildings with vertical irregularities caused by significant mass or geometric irregularities;
- 3) Buildings where the distribution of the lateral forces departs from that assumed in the equivalent lateral force procedure; and
- 4) Where required by the evaluation statements in Articles 3 through 10.

Dynamic analysis procedures shall conform to the criteria established in this section. The analysis shall be based on an appropriate ground motion representation as specified in this section and shall be performed using accepted principles of dynamics. Structures that are evaluated in accordance with this section shall comply with all other applicable requirements.

2.4.10.1 Ground motion. The ground motion representation shall be an elastic response spectra developed for mean values for the specific site, in accordance with the procedures in Title 24, Section 1629A.2 of 1995 *California Building Code* (CBC) or equivalent provision in later version of the CBC.

2.4.10.2 Mathematical model. A mathematical model of the physical structure shall represent the spatial distribution of the mass and stiffness of the structure to calculate the significant features of its dynamic response. A three-dimensional model shall be used when the dynamic analysis involves a structure with an irregular plan configuration and rigid or semirigid diaphragms.

2.4.10.3 Analysis procedure.

2.4.10.3.1 Response spectrum analysis. An elastic dynamic analysis of a structure shall use the peak dynamic response of all modes having a significant contribution to total structural response. This requirement may be satisfied by demonstrating that for the modes considered, at least 90% of the participating mass of the structure is included in the calculation of response in each principal horizontal direction. Peak modal responses are calculated using the ordinates of the appropriate response spectrum curve that corresponds to the modal periods. Maximum modal contributions shall be combined in a statistical manner using recognized combination methods to obtain an approximate total structural response.

2.4.10.3.2 Scaling of results. When the base shear for a given direction is less than that required by the equivalent lateral

force procedure, the base shear shall be increased to the value prescribed in that procedure. All corresponding response parameters, including deflections, member forces and moments, shall be increased proportionately.

When the base shear for a given direction is greater than that required by the equivalent lateral force procedure, the base shear may be decreased to the value prescribed in that procedure. All corresponding response parameters, including deflections, member forces, and moments, may be decreased proportionately.

2.4.10.3.3 Post-yield analyses. Post-yield analyses of a simplified model of the building may be made to estimate the nonlinear displacements of the structural system. If the analysis is made with a two-dimensional planar model, the additive torsional displacement shall be established through methods that are equivalent to those used for response spectra analyses.

The displacements or rotations of structural members estimated by the post-yield analysis shall be compared with relevant experimental data to determine the adequacy of the member or system.

2.4.10.4 Torsion. The analysis shall account for torsional effects, including accidental torsional effects, as prescribed in Section 2.4.3.9. Where three-dimensional models are used for analysis, effects of accidental torsion shall be accounted for by appropriate adjustments in the model such as adjustment of mass locations or by equivalent static procedures such as provided in Section 2.4.3.9.

2.4.11 Acceptance criteria. The elements to be analyzed are specified in the procedures given in Articles 3 through 10. The total demand, Q , is calculated by Equation 2-1 or 2-2 as modified below. The capacity, C , is calculated according to the procedures of Section 2.4.9. The basic acceptance criterion is:

$$Q \leq C \quad (2-17)$$

Where elements or portions of a lateral force resisting system are expected to behave in a less ductile manner than the system as a whole, the term Q_E in Equation 2-1 or 2-2 shall be modified or special calculations be made to account for the different failure modes of the various elements. Modification of Q_E and special calculation procedures and when they shall be used, are described in Articles 3 through 8.

If all significant elements meet the basic acceptance criteria as specified herein, no further analysis is needed.

2.4.12 Assessment of element deficiencies. The result of the checks specified in Articles 3 through 10 will show whether or not the elements meet the requirements of the 1994 *NEHRP Recommended Provisions* as modified herein.

For those elements not meeting the specified acceptance criteria, the relative hazard or seriousness of the deficiencies shall be assessed. Deficiencies shall be ranked according to:

- 1) Degrees of "overstress" (both total and seismic);
- 2) Element importance in the load path; and
- 3) Building, ductile and element stability.

2.5 Final evaluation.

2.5.1 Review the statements and responses. Upon completion of the analysis and field work, the evaluator shall review the evaluation statements and the responses to the statements to ensure that all of the concerns have been addressed.

2.5.2 Assemble and review the results of the procedures. Upon completion of the procedures given in Articles 3 through 10, the evaluator shall assemble and review the results.

2.5.2.1 Q versus C . The criterion $Q \leq C$ is an indication of whether an element meets the requirements of the 1994 *NEHRP Recommended Provisions* as modified for these regulations. However, because Q involves gravity effects, the ratio of Q to C for an element must be considered in light of the seismic demand versus capacity in order to fully determine the seriousness of the earthquake hazard.

2.5.2.2 D_E/C_E ratios. The severity of the deficiencies shall be assessed by listing the D_E/C_E ratios in descending order. The element with the largest value is the weakest link in the building. If the element can fail without jeopardizing the building, then the SPC may be based upon the element with the next lower ratio, and so on. Failure of an element will not jeopardize the building provided an alternate load path (neglecting the failed element) exists, and the vertical and lateral stability of the structure, or portions of the structure, is not impaired. The presence of an element with a D_E/C_E greater than one, where failure of that element will jeopardize the stability of the building or element, requires that nonconforming buildings be placed in SPC 1. For conforming buildings, see the appropriate evaluation statement.

2.5.2.3 Qualitative issues. Some of the procedures identify specific deficiencies without any calculation. These deficiencies will automatically place buildings in SPC 1, 3 or 4.

2.5.3 Final evaluation. The final evaluation will place the building in the appropriate the SPC (Table 2.5.3), based on a review of the qualitative and quantitative results of the procedures and the list of deficiencies. In general, an unmitigated “false” answer to an evaluation statement will lower the SPC of the Building. A “false” evaluation statement may be considered mitigated if the building, element or component is justified using the procedure outlined in the evaluation statement, or the effects of the condition are incorporated in the overall evaluation, as described in Section 2.5.2.2. Alternatively, the SPC rating of a building may be assigned by the Office on the basis of a collapse probability assessment performed in accordance with Section 1.4.5.1.2.

2.5.3.1 Conforming buildings. Conforming buildings, other than those of welded steel moment frame construction (Building Type 3 and possibly Building Types 4 and 6, if a dual system is present), without any unmitigated “false” evaluation statements shall be placed in SPC 5. Other conforming buildings shall be placed in the lowest SPC directed by the evaluation statements.

2.5.3.2 Nonconforming buildings. An unmitigated “False” answer to any evaluation statement shall result in nonconforming buildings being placed in SPC 1, unless directed otherwise by the procedures for that particular evaluation statement. All other nonconforming buildings shall be placed in SPC 2.

TABLE 2.5.3—STRUCTURAL PERFORMANCE CATEGORIES (SPC)

SPC	DESCRIPTION
SPC 1	Buildings posing significant risk of collapse and a danger to the public. These buildings must be brought up to the SPC 2 level by January 1, 2008, or be removed from acute care service. Where the Office has performed a collapse probability assessment, buildings with Probability of Collapse greater than 1.20% shall be placed in this category.
SPC 2	Buildings in compliance with the pre-1973 <i>California Building Standards Code</i> or other applicable standards, but not in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act. These buildings do not significantly jeopardize life, but may not be repairable or functional following strong ground motion. These buildings must be brought into compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, its regulations or its retrofit provisions by January 1, 2030, or be removed from acute care service. Where the Office has performed a collapse probability assessment, buildings with Probability of Collapse less than or equal to 1.20% shall be placed in this category.
SPC 3	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, utilizing steel moment-resisting frames in regions of high seismicity as defined in Section 4.2.10 and constructed under a permit issued prior to October 25, 1994. These buildings may experience structural damage which does not significantly jeopardize life, but may not be repairable or functional following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used to January 1, 2030, and beyond.
SPC 4	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, but may experience structural damage which may inhibit ability to provide services to the public following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used to January 1, 2030, and beyond.
SPC-4D	<i>Nonconforming hospital buildings satisfying the requirements of Section 1.4.5.1.3 and the California Existing Building Code Sections 303A.3.4.5, 501A.3.1 and 501.A.3.2 or equivalent provisions in later editions of the CEBC.</i> These buildings may experience structural damage which may inhibit ability to provide services to the public following strong ground motion. These buildings may be used to January 1, 2030 and beyond.
SPC 5	Buildings in compliance with the structural provisions of the Alquist Hospital Facilities Seismic Safety Act, and reasonably capable of providing services to the public following strong ground motion. Buildings in this category will have been constructed or reconstructed under a building permit obtained through OSHPD. These buildings may be used without restriction to January 1, 2030, and beyond.

2.6 The final report. The report shall include the following elements:

1. A description of the building, including photographs, and sketches of the lateral-force-resisting system using an OSHPD approved format;
2. The set of statements from the Appendix, with a synopsis of the investigation and supporting calculations that were made;
3. A list of the deficiencies that must be remedied in order to change statement responses from false to true;
4. The SPC for the building, with comments on the relative importance of the deficiencies; and
5. The NPC for the building.

2.7 Alternative analysis. The owner of a building may elect to perform an Alternative Analysis, to evaluate a structure in more detail than that provided by the evaluation procedures specified in these regulations. The methodology of an Alternative Analysis must be approved in advance by OSHPD, and shall meet the following criteria:

1. Data collection on the structure and site conditions shall be performed in accordance with the appropriate Sections of Article 2 of these regulations. Depending upon the type of analysis to be performed, additional data regarding the as built condition and material properties may be required;
2. The analysis of the structure shall determine the distribution of strength and deformation demands produced by the design ground shaking and other seismic hazards. The analysis shall address seismic demands and capacities to resist these demands for all elements in the structure that either:
 - Are essential to the lateral stability of the structure (primary elements); or
 - Are essential to the vertical load-carrying integrity of the building.
3. The analysis procedure may consist of a linear or non-linear analysis. The analytical methods and acceptance criteria shall conform to *Chapters 3A, 4A and 5A of the California Existing Building Code*.

ARTICLE 3 PROCEDURES FOR BUILDING SYSTEMS

3.0 Introduction. This article sets forth general requirements that apply to all buildings: load path, redundancy, configuration, adjacent buildings and the condition of the materials.

3.1 Load path. The structure contains a complete load path for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The load path is the most essential requirement for a building. There must be a lateral-force-resisting system that forms a load path between the foundation and all diaphragm levels

and that ties all of the portions of the building together. The load path must be complete and sufficiently strong.

3.2 Redundancy. The structure will remain laterally stable after the failure of any single element.

Check whether stability of the structure depends on a single element. If the failure of a single element (member or connection) will result in loss of lateral stability, the element shall be checked for adequacy using an amplification factor of $C_d/2$, but not less than 1.5. *P*-delta effects shall be included in this check.

3.3 Configuration. Vertical irregularities are defined in terms of discontinuities of strength, stiffness, geometry and mass.

Horizontal irregularities involve the horizontal distribution of lateral forces to the resisting frames or shear walls. Irregularities in the shape of the diaphragm itself (i.e., diaphragms that are L-shaped or have notches) are covered in Article 7.

3.3.1 Weak story. Visual observation or a Quick Check indicates that there are no significant strength discontinuities in any of the vertical elements in the lateral-force-resisting system; the story strength at any story is not less than 80 percent of the strength of the story above.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check story strengths individually. Where a weak story exists, the resisting elements shall be checked; include *P*-delta effects and inelastic demand. To compensate for the concentration of inelastic action where the story strength of the weak story is less than 65 percent of the story above, amplify the design forces in the weak story by the factor $C_d/2$, but not less than 1.5. Conforming buildings which fail this check shall be placed in SPC 4.

3.3.2 Soft story. Visual observation or a Quick Check indicates that there are no significant stiffness discontinuities in any of the vertical elements in the lateral-force-resisting system; the lateral stiffness of a story is not less than 70 percent of that in the story above or less than 80 percent of the average stiffness of the three stories above.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the stiffness of certain portions of the building. Where a soft story condition is indicated, the stiffness of the building shall be calculated story by story, in order to determine whether a story falls within the definition of a soft story. Where a soft story exists, the resisting elements shall be checked; include *P*-delta effects. For buildings more than 65 feet or five stories tall, a dynamic analysis shall be performed to compute the distribution of seismic forces.

3.3.3 Geometry. There are no significant geometrical irregularities; there are no setbacks (i.e., no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to the adjacent stories).

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator

may consider this condition as mitigated, and no calculations are necessary. Where geometric irregularities exist, a dynamic analysis shall be performed to compute the vertical distribution of seismic forces.

3.3.4 Mass. There are no significant mass irregularities; there is no change of effective mass of more than 50 percent from one story to the next, excluding light roofs.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the distribution of mass in the building. The effective mass is the real mass consisting of the dead weight of the floor plus the actual weights of partitions and equipment. Where mass irregularities exist, a dynamic analysis shall be performed to compute the vertical distribution of seismic forces.

3.3.5 Vertical discontinuities. All shear walls, infilled walls and frames are continuous to the foundation.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The primary deficiency is in the strength of the columns that support the wall or frame. The secondary deficiency is in the strength of the connecting strut or diaphragm. Conforming buildings which fail these checks shall be placed in SPC 4.

Procedure for columns: Check the columns that support the upper vertical lateral load-resisting element for their capacity to support the gravity loads plus the overturning forces. The overturning forces shall be based on the design forces amplified by the factor $C_d/2$, but not less than 1.5, or on the capacity of the vertical lateral load-resisting element to resist lateral force if this is greater. The column check shall include P -delta effects.

Procedure for strut or diaphragm: Check the strut or diaphragm for its ability to transfer the load from the discontinuous element to the lower resisting element.

3.3.6 Torsion. The lateral-force-resisting elements form a well-balanced system that is not subject to significant torsion. Significant torsion will be taken as any condition where the distance between the story center of rigidity and the story center of mass is greater than 20 percent of the width of the structure in either major plan dimension.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. One deficiency is in the layout and the strengths and stiffness of the walls and frames of the lateral-force-resisting system. Another deficiency is in the strength of columns that are not part of the lateral-force-resisting system but are forced to undergo displacements due to the rotation of the diaphragm. Verify the adequacy of the system by analyzing the torsional response using procedures that are appropriate for the relative rigidities of the diaphragms and the vertical resisting elements. Calculate the maximum story drift (the average building drift plus the additional displacement due to torsion). Verify that all vertical load-carrying ele-

ments can maintain their load-carrying ability under the expected drifts. When checking columns, include P -delta effects and consider inelastic demand. Conforming buildings which fail this check shall be placed in SPC 4.

3.4 Adjacent buildings. There is no immediately adjacent structure that is less than half as tall or has floors/levels that do not match those of the building being evaluated. A neighboring structure is considered to be “immediately adjacent” if it is within 2 inches times the number of stories away from the building being evaluated.

The deficiency is the distance between the buildings. Report the condition as a hazard. Where both buildings are designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated. Other conforming buildings which fail these checks shall be placed in SPC 4.

3.5 Deflection incompatibility. Column and beam assemblies that are not part of the lateral-force-resisting system (i.e., gravity load-resisting frames) are capable of accommodating imposed building drifts, including amplified drift caused by diaphragm deflections, without loss of vertical load-carrying capacity.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the ductility of the vertical load-carrying system. Calculate the expected drifts using the procedures in Section 2.4.4. Use net section properties for all reinforced concrete elements in the lateral-force-resisting system. Include the lateral displacements due to diaphragm deflections, using the diaphragm loading computed in Section 2.4.6. Evaluate the capacity of the nonlateral-force-resisting columns and beam assemblies to undergo the combined drift, considering moment-axial force interaction and column shear.

3.6 Short “captive” columns. There are no columns with height-to-depth ratios less than 75 percent of the nominal height-to-depth ratios of the typical columns at that level.

The deficiency is in the tendency of short captive columns to attract high shear forces because of their high stiffness relative to adjacent elements. Calculate the story drift, and determine the shear demand (V_e) in the short column caused by the drift ($V_e = 2M/L$). The ratio of V_e/V_n shall be less than one, where V_n is the column nominal shear capacity computed in accordance with ACI criteria. Conforming buildings which fail these checks shall be placed in SPC 4.

3.7 Evaluation of materials and conditions.

3.7.1 Deterioration of wood. None of the wood members shows signs of decay, shrinkage, splitting, fire damage or sagging, and none of the metal accessories is deteriorated, broken or loose.

The deficiency is in the capacity of the deteriorated elements. Determine the cause and extent of damage. Identify the lateral-force-resisting system and determine the consequences of the damage to the system. The system shall be judged adequate if it can perform with the damaged elements. Check the structural systems with appropriate reductions in member properties.

3.7.2 Overdriven nails. There is no evidence of overdriven nails in the shear walls or diaphragms.

The deficiency is in the capacity of the fasteners. Check the wall demand and capacity, using reduced strength due to overdriven fasteners.

3.7.3 Deterioration of steel. There is no significant visible rusting, corrosion or other deterioration in any of the steel elements in the vertical- or lateral-force-resisting systems.

The deficiency is the reduction in cross-section of the elements. Check the structural systems with appropriate reductions in member properties. See Article 4 for inspection requirements for welded steel moment-resisting frame structures.

3.7.4 Deterioration of concrete. There is no visible deterioration of concrete or reinforcing steel in any of the frame elements.

The deficiency is the reduction in member properties. Check the structural systems with appropriate reductions in member capacities.

3.7.5 Post-tensioning anchors. There is no evidence of corrosion or spalling in the vicinity of post-tensioning or end fittings. Coil anchors have not been used.

The deficiency is the reduced area of the prestress strands and, with coil anchors, the ability of the anchorage to maintain its grip under cyclic loading. Inspect a sample of the concrete in the area of the anchorage to determine its condition. Determine the cause and extent of the deterioration. Consider the effects of anchorage failure on the vertical and lateral load-carrying capacity of the structure.

3.7.6 Concrete wall cracks. All diagonal cracks in the wall elements are 1.0 mm or less in width, are in isolated locations and do not form an X pattern.

The deficiency is the reduced capacity of the wall. Determine the cause and extent of the cracking. Check the structural systems with reduced wall capacity.

3.7.7 Cracks in boundary columns. There are no diagonal cracks wider than 1.0 mm in concrete columns that encase the masonry infills.

The deficiency is the reduced capacity of the wall. Evaluate the wall with limited capacity assigned to the deteriorated elements. Determine the cause and extent of the damage.

3.7.8 Precast concrete walls. There is no significant visible deterioration of concrete or reinforcing steel or evidence of distress, especially at the connections.

The deficiency is in the strength of the connections. Determine the cause and extent of distress and check the structural systems with appropriate reductions in capacity.

3.7.9 Masonry joints. The mortar cannot be easily scraped away from the joints by hand with a metal tool, and there are no significant areas of eroded mortar.

The deficiency is in the strength of the wall. Check the adequacy of the walls with the strength determined by tests.

This evaluation statement also applies to masonry veneers present on the exterior or interior walls of the building.

3.7.10 Masonry units. There is no visible deterioration of large areas of masonry units.

The deficiency is in the strength of the units. Determine the cause and extent of deterioration and use reduced capacity in determining the adequacy of the units.

3.7.11 Cracks in infill walls. There are no diagonal cracks in the infilled walls that extend throughout a panel or are greater than 1.0 mm wide.

The deficiency is the reduced capacity of the wall. Determine the cause and extent of the cracking. If appropriate, check the structural systems with reduced wall capacity.

ARTICLE 4 PROCEDURES FOR MOMENT-RESISTING SYSTEMS

4.0 Introduction. Moment frames develop their resistance to lateral forces through the flexural strength and continuity of beam and column elements. Moment frames may be classified as special, intermediate and ordinary frames.

For evaluations using these regulations, it is not necessary to determine the type of frame in the building. The issues are addressed by appropriate acceptance criteria in the specified procedures. For determination of element capacities, see Article 2, Section 2.4.9.

4.1 Frames with infill walls.

4.1.1 Interfering walls. All infill walls placed in moment frames are isolated from structural elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is an inappropriate connection of the wall to the frame. Evaluate the relative strength and stiffness of the walls and frames, considering the nature and size of the joint or connection between the wall and the frame. If the strength of the walls is not commensurate with the stiffness, the building should be treated as Type 7 or Type 10 (Article 2, Section 2.2.3 "Common Building Types"), a frame with infill walls. If the infill walls do not extend the full story height and are not properly isolated from the frame columns, evaluate the column shear demand and capacity, based on a column height equal to the clear distance from the top of the wall to the bottom of the slab or beam above, amplifying the design forces in the short column by $C_d/2$, but not less than 1.5. The shear demand need not exceed the shear capacity corresponding to flexural capacity of the column, based on a column height equal to the clear distance from the top of the wall to the bottom of the slab or beam above.

4.2 Steel moment frames. Welded steel moment frames may be subject to detailed frame joint evaluation requirements, as outlined in this section. The purpose of this joint evaluation is to determine if the building has experienced joint damage in strong ground shaking.

4.2.0.1 Preliminary screening. All welded steel moment frame structures shall undergo a detailed frame joint evaluation if the building is located at a site that has experienced the following:

1. An earthquake of magnitude greater than or equal to 6.5 that produced ground motion in excess of 0.20 g; or
2. An earthquake that generated ground motion in excess of 0.30 g.

The ground motion estimates shall be based on actual instrumental recordings in the vicinity of the building. When such ground motion records are not available, ground motion estimates may be based on empirical or analytical techniques. All ground motion estimates shall reflect the site-specific soil conditions.

4.2.0.2 Additional indicators. A detailed frame joint evaluation of the building shall be performed if any of the following apply:

1. Significant structural damage is observed in one or more welded steel moment frame structures located within 1 km of the building on sites with similar, or more firm, soil properties;
2. An earthquake having a magnitude of 6.5 or greater, where the structure is located within 5 km of the trace of a surface rupture or within the vertical projection of the rupture area when no surface rupture has occurred;
3. Significant architectural or structural damage has been observed in the building following an earthquake; or
4. Entry to the building has been limited by the building official because of earthquake damage, regardless of the type or nature of the damage.

4.2.0.3 Connection inspections. Detailed frame joint evaluations shall be performed in accordance with the procedures in the *Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frame Structures*, FEMA 267, August 1995.

4.2.1 Drift check. The building satisfies the Quick Check of the frame drift.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check drift using the procedures in Section 2.4.7.1 against the prescribed limit. If the drift exceeds the limiting drift at any story level, the structure shall be evaluated with full-frame analysis using the anticipated distribution of lateral forces to the moment-resisting frames and including P-delta effects. Check the other statements using the demand from this analysis.

4.2.2 Compact members. All moment-frame elements meet the compact section requirements of the basic AISC documents.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the member capacities. Check member capacities, using member demands obtained from a frame analysis. Calculate member capacities using appropriate criteria for

noncompact sections. Check the member capacities using appropriate R values (e.g., noncompact members require use of the R value for ordinary frames).

4.2.3 Beam penetrations. All openings in frame-beam webs have a depth less than one-fourth of the beam depth and are located in the center half of the beams.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the shear capacity of the beam. Check that the shear capacity of the beam is sufficient to develop the flexural plastic hinge. If the shear capacity is insufficient to develop the flexural capacity of the member, use the R value for ordinary frames.

4.2.4 Moment connections. All beam-column connections in the lateral-force-resisting moment frame have full-penetration flange welds and a bolted or welded web connection.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection. Check the connection on the basis of its strength. Check the member capacities using appropriate R values. Connections that do not develop the flexural capacity of the member require use of the R value for ordinary frames.

4.2.5 Column splices. All column splice details of the moment-resisting frames include connection of both flanges and the web.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the bolts or welds in the connection. Check the adequacy of the splice connection for all gravity and seismic loads. Amplify the seismic load for partial-penetration welded splices by the factor $C_d/2$.

4.2.6 Joint webs. All web thicknesses within joints of moment-resisting frames meet AISC criteria for web shear.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the web. Calculate the joint shear capacity using formulas given in the AISC provisions and compare it to the demand from an equivalent lateral force analysis or the average column shear, V_c , calculated for the Quick Check for drift.

4.2.7 Girder flange continuity plates. There are girder flange continuity plates at joints.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the joint. Check joints without such plates using AISC provisions, using the R value for ordinary frames.

4.2.8 Strong column/weak beam. At least one half of the joints in each story are strong column/weak beam (33 percent on every line of moment frame). Roof joints need not be considered.

The deficiency is excessive ductility demand and displacement in a single story. Compare beam and column moment

capacities, including the effect of axial force. The evaluator may consider this condition mitigated if the joints in the building meet the provisions of Section 2710(g)5 of the 1992 edition of Part 2, Title 24. Conforming buildings which do not meet those provisions shall be placed in SPC 4.

4.2.9 Out-of-plane bracing. Beam-column joints are braced out-of-plane.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the stability of the beam-column joint. Verify the joint bracing by visual observation.

4.2.10 Pre-Northridge earthquake welded moment frame joints. Welded steel moment frame beam-column joints are designed and constructed in accordance with recommendations in FEMA 267, *Interim Guidelines: Evaluation, Repair, Modification and Design of Welded Steel Moment Frame Structures*, August 1995.

For buildings constructed under permit issued after October 25, 1994, the evaluator may consider this condition as mitigated. The deficiency is in the ductility of the beam-column joint. The following procedures shall be used for categorizing buildings with welded steel moment frame joints.

Procedure for conforming buildings: Conforming buildings located in Seismic Zone 4 of 1995 *California Building Code* (CBC) or later version of the CBC, within a zone designated as being potentially subject to near field effects in strong ground shaking, shall be placed in SPC 3.

All other conforming buildings shall be placed in SPC 4.

Procedure for nonconforming buildings: Nonconforming buildings shall be placed in SPC 2.

4.3 Concrete moment frames. The details covered in evaluation statements in Sections 4.3.4 through 4.3.14 will be found in frames that have been designed and detailed for ductile behavior. If any one detail is not present, the frames are not considered to meet life-safety goals, and nonconforming buildings shall be placed in SPC 1. For conforming buildings, see the appropriate evaluation statement. For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the building may assume “true” responses to all evaluation statements in this section.

4.3.1 Shearing stress check. The building satisfies the Quick Check of the average shearing stress in the columns.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Perform a quick estimation of the average shearing stress in the columns according to the procedure specified in Section 2.4.7.2. If the average column shear stress is greater than 60 psi, a more detailed evaluation of the structure shall be performed. This evaluation shall employ a more accurate estimation of the level and distribution of the lateral loads; use the procedures outlined in Section 2.4.

4.3.2 Drift check. The building satisfies the Quick Check of story drift.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary.

Check drift using the procedures in Section 2.4.7.1 against the prescribed limit. If the drift exceeds the limiting drift at any story level, the structure shall be evaluated with full-frame analysis using the anticipated distribution of lateral forces to the moment-resisting frames and including *P*-delta effects as found in Section 2.4.1. Check the other statements using the demand from this analysis.

4.3.3 Prestressed frame elements. The lateral-load-resisting frames do not include any prestressed or post-tensioned elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the frames during inelastic straining. Check the capacity of the members and joints using all of the mild steel reinforcing that is available and bonded prestressing when appropriate. The *R* value used for evaluation shall reflect the ductility and damping of the system. Where better information is not available, multiply the *R* value selected on the basis of mild reinforcement by 0.75 to account for the effect of prestressing.

4.3.4 Joint eccentricity. There are no eccentricities larger than 20 percent of the smallest column plan dimension between girder and column centerlines.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the frame, either the members or the joints or both. Evaluate the frames considering the additional shear stresses caused by the joint torsion.

4.3.5 No shear failures. The shear capacity of frame members is greater than the moment capacity.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is inadequate shear capacity in the columns or beams. Compare V_e with the member shear capacity, ϕV_n , calculated in accordance with ACI 318 Appendix. The ratio $V_e / \phi V_n$ shall be less than or equal to 1.0.

4.3.6 Strong column/weak beam. The moment capacity of the columns is greater than that of the beams.

The deficiency is in column capacity. Compare the sum of the beam moment capacities to that of the column capacities. Include the participation of the slab in the beam capacities. The moment capacity to be compared is the plastic moment, M_{pr} . The ratio of the sum of the M_{pr} for the columns to the sum of the M_{pr} for the beams is required to be not less than 1.2. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

4.3.7 Stirrup and tie hooks. The beam stirrups and column ties are anchored into the member cores with hooks of 135 degrees or more.

The deficiency is in the shear resistance and confinement of the member. Determine if beam stirrups and column ties are appropriately anchored into member cores with hooks of 135 degrees or more. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

4.3.8 Column-tie spacing. Frame columns have ties spaced at $d/4$ or less throughout their length and at $8 d_b$, or less at all potential plastic hinge regions.

The deficiency is in the shear capacity of the column. Report this condition as a deficiency. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

4.3.9 Column-bar splices. All column bar lap splice lengths are greater than $35 d_b$, long and are enclosed by ties spaced at $8 d_b$, or less.

The deficiency is in the strength and ductility of the column. Compare the splice length provided with that required by Sections 12.2 and 12.15 of the ACI 318 provisions. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

4.3.10 Beam bars. At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25 percent of the steel provided at the joints for either positive or negative moment is continuous throughout the members.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength and ductility of the beam. Determine if the required beam bars are present. For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary.

4.3.11 Beam-bar splices. The lap splices for longitudinal beam reinforcing are located within the center half of the member lengths and not in the vicinity of potential plastic hinges.

The deficiency is in the strength and ductility of the beam. Determine if the beam bar splices are detailed and located such that the yield capacity of the beam can be developed. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

4.3.12 Stirrup spacing. All beams have stirrups spaced at $d/2$ or less throughout their length and at $8 d_b$, or less at potential hinge locations.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength and ductility of the beam. Determine if the stirrups meet the specified spacing requirements, such that the yield capacity of the beam can be developed.

4.3.13 Beam truss bars. Bent-up longitudinal steel is not used for shear reinforcement.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength and ductility of the beam. Determine if bent-up shear reinforcement is present. If present, check the shear capacity of the element ignoring the effects of the bent-up longitudinal bars.

4.3.14 Joint reinforcing. Column ties extend at their typical spacing through all beam-column joints at exterior columns.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations

are necessary. The deficiency is in the strength and ductility of the beam-column joint. Calculate the joint capacity, V_e , and the joint shear, V_j . The joint shear is calculated at a horizontal section at mid-height of the joint. The horizontal shear at the critical section is obtained from summation of horizontal forces in a free-body diagram of the upper half of the joint as $V_j = (T_l + T_r) - V_e$ where T_l and T_r , the forces in the flexural tensile reinforcement in the beams on the left and right sides of the joint, respectively, are calculated assuming a steel stress equal to $1.25 f_y$. See Figure 4.3.14 for computation of V_e . The ratio V_j/V_e shall be less than or equal to 1. Conforming buildings which do not meet this criteria shall be placed in SPC 4.

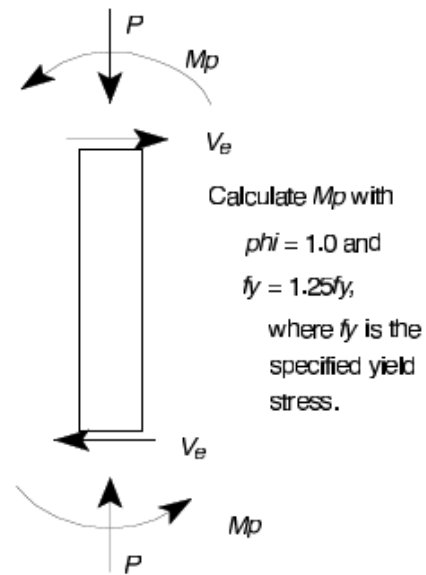


FIGURE 4.3.14
 M_{pr} and V_e

4.3.15 Flat slab frames. The system is not a frame consisting of columns and a flat slab/plate without beams.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. Perform a detailed analysis, or assign the building to SPC 1.

4.4 Precast concrete moment frames.

4.4.1 Precast frames. The lateral loads are not resisted by precast concrete frame elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connections. Check the adequacy of the precast frames. Where lateral movement will cause strength capacities to be first exceeded at connections, use $R = C_d = 1.5$ unless there is information on connection behavior that justifies higher values. Where all yielding occurs within members, use the R -value for the appropriate cast-in-place frame.

4.4.2 Precast connections. For buildings with concrete shear walls, the connection between precast frame elements such as chords, ties and collectors in the lateral-force-resisting system can develop the capacity of the connected members.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connections. Analyze the connections. Determine where connection failures would be brittle (e.g., pull-out of an embedded item would occur before yield of a mild steel element). Analyze structure for stability assuming that these brittle connections have failed or are not capable of transmitting forces, or check such connections for seismic force amplified by factor $C_d/2$, but not less than 1.5. For shear capacity, refer to Section 4.3. For flexure, find the path of forces from the element through the connection into the other element.

4.5 Frames not part of the lateral-force-resisting system. This section deals with frames that were not designed to be part of the lateral-force-resisting system. These are basic structural frames of steel or concrete that are designed for gravity loads with shear walls, bracing or moment frames providing the resistance to lateral forces.

If the primary lateral-force-resisting system consists of concrete walls (infilled in steel frames or monolithic in concrete frames), the building shall be treated as a concrete shear wall building (Type 6) with the frame columns as boundary elements. If the walls are masonry infills, the frames shall be treated as steel or concrete frames with infill walls of masonry (Type 7 or 10). Buildings with steel braces shall be treated as braced frame systems (Type 4). The principal deficiency identified in this section is loss of vertical-load-carrying capacity due to excessive deformations.

The analysis must include the deformations imposed by the infill walls, and the consequences of the failure of such walls.

4.5.1 Complete frames. The steel or concrete frames form a complete vertical load-carrying system.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check the shear walls or braced frames, including the effects of all dead and live loads, and note that the R values for buildings without a complete vertical load-carrying space frame are different from those for complete frame buildings. For wall systems, the frame is considered incomplete if the beams end at the edge of a shear wall that has no boundary columns or, if there are such columns, the beams do not continue across in the plane of the wall. For chevron-braced frame systems, the frame is considered incomplete if the beam in the brace frame cannot carry the design dead and live loads without the presence of the braces.

ARTICLE 5 PROCEDURES FOR SHEAR WALLS

5.0 Introduction. Shear walls have two aspects: carrying in-plane shear when the earthquake direction under consideration is parallel to the wall and resisting out-of-plane forces when the earthquake direction under consideration is perpen-

dicular to the wall. The in-plane effects are covered in this article. Out-of-plane effects are covered in Article 8. All walls not structurally isolated are assumed to act as shear walls that will participate in resisting lateral forces up to their capacity.

5.1 Concrete shear walls.

5.1.1 Shearing stress check. The building satisfies the Quick Check of the shearing stress in the shear walls.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Generate the lateral loads using the Quick Check procedure of Section 2.4.7.3. If v_{avg} is greater than 50 psi (or square root of f'_c if f'_c is known), a more detailed evaluation of the structure shall be performed. This evaluation shall employ a more accurate estimation of the level and distribution of the lateral loads, using the analysis procedures in Article 2.

5.1.2 Overturning. All shear walls have h_w/l_w ratios less than 4 to 1.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the required resistance to overturning moments. Calculate the resistance to the required overturning moments. The overturning resistance shall include the resistance contributed by wall flanges, friction on piling, earth over foundations, and floor and roof weights supported by the wall. The calculated resistance shall be greater than 0.75 times the base moment of the shear wall. The overturning resistance moment may be taken as the righting moment about an edge of the footing or the wall flexural capacity, whichever is less.

5.1.3 Coupling beams. The stirrups in all coupling beams are spaced at $d/2$ or less and are anchored into the core with hooks of 135 degrees or more.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the coupling beams. Assume that the beams yield. Calculate their end-moment capacity based either on flexural yield or shear capacity, whichever is lower. The coupling beam moment capacity should include the contribution of a reasonable portion of the adjacent floor slab reinforcement when this reinforcement is in tension. Analyze the walls as independent walls with these restoring moments or shears helping to stabilize the walls. Check the stability of the wall and the stresses in the vertical boundaries. Conforming buildings which fail this check shall be placed in SPC 4, and no calculations are necessary.

5.1.4 Column splices. Steel column splice details in shear wall boundary elements can develop the tensile strength of the column.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the splice in the boundary column. Determine the maximum tensile column load in each case and verify the adequacy of the splice to resist this load, including gravity loads. Check the adequacy of the splice

connection for all gravity and seismic loads. Amplify the seismic load for partial-penetration welded splices by the factor $C_d/2$, but not less than 1.5, when the seismic load produces tension at the splice.

5.1.5 Wall connections. There is positive connection between the shear walls and the steel beams and columns.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the adequacy of the connections between the shear wall and the beams and columns that are its boundary elements. Calculate the effective overturning demand for the walls and check the adequacy of the shear transfer to the steel elements. A value for shear friction between steel and concrete shall be included only if the steel element is completely encased with reinforced concrete.

5.1.6 Confinement reinforcing. For shear walls with h_w/l_w greater than 2.0, the boundary elements are confined with spirals or ties with spacing less than $8d_b$.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the ductility of the vertical boundary elements that are required to resist large axial forces. Check the need for boundary elements, per ACI 318. Where boundary elements are required but not provided, amplify the seismic forces for the entire structure by the factor 1.25 (and use $0.8C_d$ for drift calculation). Conforming buildings which fail this evaluation statement shall be placed in SPC 4, and no calculations are necessary.

5.1.7 Reinforcing steel. The total reinforcing steel for concrete walls is greater than 0.0025 times the gross area of the wall along both the longitudinal and transverse axes and the maximum spacing of reinforcing steel is 18 inches.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the quantity of reinforcing in the wall. Calculate the capacity of the walls with the reinforcing that is provided, but amplify the seismic forces by the factor 1.25 (and use $0.8C_d$ for drift calculation). Where the reinforcing in the wall is less than 0.0015 times the gross area of the wall along the longitudinal or transverse axis, or if the reinforcing steel spacing exceeds 18 inches, the contribution of the wall to lateral strength and stiffness of the building shall be ignored and, if it is a bearing wall, the building shall be placed in SPC 1.

5.1.8 Reinforcing at openings. There is special wall reinforcement around all openings.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the reinforcing in the piers and spandrels. Determine the capacity of the spandrels and piers considering all available reinforcing steel that crosses the critical sections.

5.2 Precast concrete shear walls. Shear walls of precast concrete are in segments that are tied together, but the connections may be of a brittle type. Connections adequate for design level forces may not be capable of developing the

yield level capacity of the panels. The effects of the precast panel connections on the other evaluation statements concerned with wall elements shall be considered. The deficiency is in the quality and ductility of the connections.

5.2.1 Panel-to-panel connections. Adjacent wall panels are not connected by welded steel inserts.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the inserts. Check the welded inserts. Determine where connection failures would be brittle (e.g., pull-out of an embedded item would occur before yield of a mild steel element). Analyze structure for stability assuming that these brittle connections have failed or are not capable of transmitting forces or check such connections for seismic force amplified by the factor $C_d/2$, but not less than 1.5.

5.2.2 Wall openings. Openings constitute less than 75 percent of the length of any perimeter wall with the wall piers having h_w/l_w ratios of less than 2.0.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency may be in the strength of the panel connections or may be that the reinforced concrete elements actually behave like a moment frame and should be evaluated as such. Check the elements in the precast shear wall system. When large open areas exist, check the transfer of shear between the diaphragm and the wall. Compare the lateral displacements of the wall due to shear and flexure. If more than 50 percent of the total lateral displacement is due to flexure, or if the width of the wall piers is less than five times the thickness, analyze the wall as a moment frame.

5.2.3 Collectors. Wall elements with openings larger than a typical panel at a building corner are connected to the remainder of the wall with collector reinforcing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the configuration of the wall or the diaphragm. Find an adequately strong path of forces. If none is found, report this as a deficiency.

5.3 Reinforced masonry shear walls.

5.3.1 Shearing stress check. The building satisfies the Quick Check of the shearing stress in the reinforced masonry shear walls.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Generate the lateral loads using the Quick Check procedure of Section 2.4.7.3. If v_{avg} is greater than 15 psi, a more detailed evaluation of the structure shall be performed. This evaluation shall employ a more accurate estimation of the level and distribution of the lateral loads, using the analysis procedures in Article 2.

5.3.2 Reinforcing. The total vertical and horizontal reinforcing steel in reinforced masonry walls is greater than 0.002 times the gross area of the wall with a minimum of 0.0007 in either of the two directions, the spacing of reinforcing steel is

less than 48 inches and all vertical bars extend to the top of the walls.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. If the quantity of wall reinforcing is less than the specified amounts, report this condition as a deficiency.

5.3.3 Reinforcing at openings. All wall openings that interrupt rebar have trim reinforcing on all sides.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the lack of reinforcing at the end of wall elements adjacent to openings and at the corners of walls. Check the wall using only the length of piers between reinforcing steel.

5.4 Unreinforced masonry shear walls. Unreinforced masonry bearing wall buildings are automatically classified as SPC 1, unless reclassification is permitted in accordance with Section 1.4.5.1.2. The following provisions apply to unreinforced masonry shear wall structures that also possess a complete vertical load-carrying space frame.

5.4.1 Shearing stress check.

The building satisfies the Quick Check of the shearing stress in the unreinforced masonry shear walls.

Generate the lateral loads using the Quick Check procedure of Section 2.4.7.3. The allowable stress (on the gross area) for solid brick masonry is 10 psi; for hollow unit masonry, 6 psi; and for grouted block masonry, 12.5 psi. If v_{avg} is greater than the allowable stress, an Alternative Analysis of the structure shall be performed, or the building shall be placed in SPC 1.

5.4.2 Masonry lay-up.

Filled collar joints of multiwythe masonry walls have negligible voids.

The deficiency is in the lay-up of the wall that left voids between the wythes. Investigate the lay-up. This can be done when masonry units are removed for strength tests. If voids are present, report this condition as a deficiency.

5.4.3 Proportions. The height/thickness ratio of the wall panels is as follows:

One-story building $h_w/t < 15$

Multistory building

Top story $h_w/t < 9$

Other stories $h_w/t < 13$

The deficiency is in the out-of-plane strength of the wall. Check the out-of-plane demand using the procedure for parts and portions of a building given in Section 2.4.6.

5.5 Unreinforced masonry infill walls in frames.

5.5.1 Proportions. The height/thickness ratio of the wall panels is as follows:

One-story building $h_w/t < 14$

Multistory building

Top story $h_w/t < 9$

Other stories $h_w/t < 20$

The deficiency is in the out-of-plane strength of the wall. Check the out-of-plane demand using the procedure for parts and portions of a building given in Section 2.4.6.

5.5.2 Solid walls. The infill walls are not of cavity construction.

The deficiency is in the out-of-plane strength of the wall. If infill walls are of cavity construction, report this as a deficiency.

5.5.3 Infill walls. The infill walls are continuous to the soffits of the frame beams.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the columns. Check the shear capacity of the columns to develop opposing yield moments at top and bottom of the short free height or to resist required force amplified by the factor $C_d/2$, but not less than 1.5.

5.5.4 Wall connections. All infill panels are constructed to encompass the frames around their entire perimeter.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the connection of the infill panel to the frame. Determine the panel edge condition from available drawings or from field investigation. If the panels are not properly connected to the frame, report this condition as a deficiency.

5.6 Walls in wood frame buildings.

5.6.1 Shearing stress check. The building satisfies the Quick Check of the shearing stress in wood shear walls.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Generate the lateral loads using the Quick Check procedure of Section 2.4.7.3 and compare to 400 pounds per foot of plywood wall or 50 pounds per foot of walls composed of gypsum board or other materials. If v_{avg} is greater than these values, a more detailed evaluation of the structure shall be performed. This evaluation shall employ a more accurate estimation of the level and distribution of the lateral loads using the analysis procedures in Article 2.

5.6.2 Openings. Walls with garage doors or other large openings are braced with plywood shear walls or are supported by adjacent construction through substantial positive ties.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the lateral-force-resisting system. Check the ability of the walls and diaphragms to control, through torsional capacity, displacements at walls with large openings. Check that the diaphragm is a complete system with chords and collectors provided to deliver the lateral loads as required.

5.6.3 Wall requirements. All walls supporting tributary area of 24 to 100 square feet per foot of wall are plywood sheathed with proper nailing or rod braced and have a height-to-depth (H/D) ratio of 1 to 1 or less or have properly detailed and constructed hold-downs.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall and/or in hold-downs

to resist overturning forces. Check the walls using floor areas tributary to the walls. Check all portions of the load path to ensure proper force transfer.

5.6.4 Cripple walls. All exterior cripple walls below the first floor level are braced to the foundation with shear elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the shear strength of the cripple walls. Check all exterior cripple walls below the first floor level to ensure that they are braced to the foundation with shear elements.

5.6.5 Narrow shear walls. Narrow wood shear walls with an aspect ratio greater than 2 to 1 do not resist forces developed in the building.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the narrow walls. Determine the shear capacity of the wall and related overturning demand. This shear capacity and related overturning must be transferred to the foundation within allowable stresses.

5.6.6 Stucco (exterior plaster) shear walls. Multistory buildings do not rely on exterior stucco walls as the primary lateral-force-resisting system.

The deficiency is in the strength of the stucco walls. Inspect stucco-clad buildings to determine if there is a lateral system such as plywood or diagonal sheathing at all but the top floor. Where exterior plaster is present, verify that the wire reinforcing is attached directly to the wall framing and the wire is completely embedded into the plaster material. Conforming buildings which fail this check shall be placed into SPC 4.

5.6.7 Plaster or gypsum wallboard shear walls. Interior plaster or gypsum wallboard is not being used for shear walls in buildings over one story in height.

The deficiency is in the strength of the walls. Determine if there is a lateral system such as plywood or diagonal sheathing at all but the top floor. Multistory buildings shall not rely on interior plaster or gypsum wallboard walls as the primary lateral-force-resisting system. Conforming buildings which fail this check shall be placed into SPC 4.

ARTICLE 6 PROCEDURES FOR BRACED FRAMES

6.0 Introduction. Braced frames develop their resistance to lateral forces by the bracing action of diagonal members. The braces induce forces in the associated beams and columns so that all work together like a truss with all members subjected to stresses that are primarily axial.

A **concentrically braced frame** has minor eccentricities in the joints of the frame that are accounted for in the design.

An **eccentrically braced frame** has elements that are strictly controlled to combine a stiffening effect due to the

diagonal braces with yielding in the link beams. Eccentrically braced frames are present only in conforming buildings.

6.1 Concentrically braced frames.

6.1.1 Stress check. The building satisfies the Quick Check of the stress in the diagonals.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Calculate the average axial stress in the diagonals using the procedures of Section 2.4.7.4. Increase the calculated stress to account for torsion, based on the amount of torsion (Section 3.3.6) present and the distance between braced frames. If the average stress exceeds 30 ksi, an accurate analysis of the stresses on the bracing elements shall be performed.

6.1.2 Stiffness of diagonals. All diagonal elements required to carry compression have Kl/r ratios less than 120.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the stiffness of the diagonals. Check the bracing elements, amplifying the seismic force by the factor 1.25.

6.1.3 Tension-only braces. Tension-only braces are not used as the primary diagonal bracing elements in structures over two stories in height.

The deficiency is in the strength of the braces. Check the braces. If they are tension-only, and the building is over two stories in height, place the building in SPC 1. Tension-only bracing of small penthouse structures may be reviewed using the procedures in Section 2.4.6. Conforming buildings which fail this check shall be placed in SPC 4.

6.1.4 Chevron bracing. The bracing system does not include chevron-, V-, or K-braced bays.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check all elements in the braced frames. For chevron- and V-braced frames, the beam shall be a single element that can carry the gravity loads without the intermediate support of the braces. Check the adequacy of the beam for the seismic forces amplified by $C_d/2$, but not less than 1.5. Consider the effect of buckling of a leg of chevron-bracing or V-bracing, including the continuity, strength, and bracing of the beams and the ability of the connection to permit buckling of the brace while not destroying the capacity for repeated cycles of loading. If K-bracing is used in buildings over two stories, amplify the seismic forces in the bracing and columns by the factor $C_d/2$, but not less than 1.5.

6.1.5 Concentric joints. All the diagonal braces frame into the beam-column joints concentrically.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the joints. Evaluate the consequence of the eccentricity on the member required to resist it. Evaluate the shear, bending and axial force requirements at the locations of eccentricities.

6.1.6 Connection strength. All the brace connections are able to develop the yield capacity of the diagonals.

The deficiency is in the strength of the connections. Check the connection strength. Use a demand value that develops the tensile capacity of the brace or is 1.25 times the required seismic force. If connections in a conforming building cannot develop the yield capacity of the brace and do not meet the requirements of Part 2, Title 24, Section 2211A.9.3 of 1995 *California Building Code* (CBC) or equivalent provision in later version of the CBC, the building shall be placed in SPC 4.

6.1.7 Column splices. All column splice details of the braced frames can develop the column yield capacity.

The deficiency is in the strength of the splice. Calculate the adequacy of the splice connection for all expected forces including gravity loads. Amplify the seismic load for partial penetration welded splices by the factor $C_d/2$ when the seismic load produces tension at the splice. If the column splice details in a conforming building cannot develop the yield capacity of the column and do not meet the requirements of Part 2, Title 24, Section 2211A.9.5 of 1995 *California Building Code* (CBC) or equivalent provision in later version of the CBC, the building shall be placed in SPC 4.

6.1.8 Concrete braced frames. None of the braces in the framing system are of reinforced concrete construction.

The deficiency is in the ductility of the braced frame. Report this condition as a deficiency, and place nonconforming buildings in SPC 1. Place conforming buildings in SPC 4.

6.2 Eccentrically braced frames.

6.2.1 Link beam location. The link beams are not connected to the columns.

The deficiency is in the ductility of the link beam-column connection. Report this condition and place the building in SPC 4.

ARTICLE 7 PROCEDURES FOR DIAPHRAGMS

7.0 Introduction. The diaphragm is the horizontal subsystem that distributes lateral load to the vertical subsystems (walls and frames) and that provides lateral support for walls and parapets.

7.1 Diaphragms. Diaphragms are treated as horizontal beams. The floor (or roof), which is analogous to the web of a wide-flange beam, is assumed to carry the shear; the edge of the floor (or roof) or a spandrel, which is analogous to the flange, is assumed to carry the flexural stress.

7.1.1 Plan irregularities. There is significant tensile capacity at reentrant corners or other locations of plan irregularities.

For buildings designed and constructed in accordance with the 1989 or later editions of Part 2, Title 24, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm in the vicinity of corners. Evaluate the chord/collector requirements at the reentrant corners and other locations

of plan irregularities by applying the maximum of the diaphragm force and the calculated story force to a model of the isolated diaphragm. All elements that can contribute to the tensile capacity at the reentrant corner may be included with appropriate consideration given to gravity load stresses. Conforming buildings which fail this check shall be placed in SPC 4.

7.1.2 Cross ties. There are continuous cross ties between diaphragm chords.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the adequacy of the path for wall anchorage forces into the diaphragm. A cross tie is a beam or girder that spans the width of the diaphragm, accumulates the wall loads and transfers them, over the full depth of the diaphragms, into the next bay and on to the nearest shear wall or frame. Calculate the wall anchorage forces according to Section 2.4.5, and check that these forces can be developed, element by element, in the diaphragm.

7.1.3 Reinforcing at openings. There is reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm in the vicinity of the openings. Check the adequacy of the diaphragm to transfer stresses around the opening.

7.1.4 Openings at shear walls. Diaphragm openings immediately adjacent to the shear walls constitute less than 25 percent of the wall length, and the available length appears sufficient.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the length of diaphragm needed to transfer shear to the wall or frame and to provide lateral support for the wall or frame.

Procedure for diaphragm shear: Verify that there is a path of forces and sufficient strength to deliver the diaphragm shear to the shear wall. The diaphragm shear is the demand.

Procedure for lateral support of the wall: Treat the wall as a portion of the building using F_p as the demand.

7.1.5 Openings at braced frames. Diaphragm openings immediately adjacent to the braced frames extend less than 25 percent of the length of the bracing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is similar to that described above for openings at shear walls.

Procedure for diaphragm shear: Verify that there is a path of forces and sufficient strength to deliver the diaphragm shear to the braced frame. The diaphragm shear is the seismic demand.

Procedure for lateral support of the frame: Treat the frame as a portion of the building using F_p as the demand.

7.1.6 Openings at exterior masonry shear walls. Diaphragm openings immediately adjacent to exterior masonry walls are no more than 8 feet long.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is similar to that described above for openings at shear walls.

Procedure for diaphragm shear: Verify that there is a path of forces and sufficient strength to deliver the diaphragm shear to the shear wall. The diaphragm shear is the demand.

Procedure for lateral support of the wall: Treat the wall as a portion of the building using F_p as the demand.

7.2 Wood diaphragms.

7.2.1 Sheathing. None of the diaphragms consist of straight sheathing or have a span/depth ratio greater than 2 to 1.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm. Analyze the wood diaphragm using the procedure given in Chapter 9 of the 1994 *NEHRP Recommended Provisions*.

7.2.2 Spans. All diaphragms with spans greater than 24 feet have plywood or diagonal sheathing. Structures in Building Type 2 may have rod-braced systems.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength and stiffness of the diaphragm. Evaluate the diaphragm stresses using the procedure given in Chapter 9 of the 1994 *NEHRP Recommended Provisions*. Also evaluate the deflections. A maximum displacement of 3 inches shall be acceptable. For horizontal bracing systems, see Section 7.5.

7.2.3 Unblocked diaphragms. Unblocked wood panel diaphragms consist of horizontal spans of less than 40 feet and have span/depth ratios less than or equal to 3 to 1.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm. Analyze the diaphragm using the 1994 *NEHRP Recommended Provisions* requirements for unblocked diaphragms.

7.2.4 Span/depth ratio. If the span/depth ratios of wood diaphragms are greater than 3 to 1, there are nonstructural walls connected to all diaphragm levels at less than 40-foot spacing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the stiffness of the diaphragm. Analyze the wood diaphragm using the procedures given in Chapter 9 of the 1994 *NEHRP Recommended Provisions*.

7.2.5 Diaphragm continuity. None of the diaphragms are composed of split-level floors or, in wood commercial or industrial buildings, have expansion joints.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The

deficiency is in the strength of the diaphragm. Evaluate the building with proper recognition of the effects of the discontinuities.

7.2.6 Chord continuity. All chord elements are continuous, regardless of changes in roof elevation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is the lack of a chord. Report the lack of a chord as a deficiency.

7.3 Metal deck diaphragms. Allowable values of metal deck diaphragms may be obtained from the manufacturer's approved data. The evaluator shall consider conditions that can weaken the diaphragm (i.e., troughs, gutters and recesses that have the effect of reducing the system to the bare deck or of creating a joint).

7.3.1 Deck topping. All metal deck roofs have a reinforced concrete topping slab.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm. Evaluate the bare metal deck diaphragm using the procedure given in the 1994 *NEHRP Recommended Provisions* requirements.

7.3.2 Untopped diaphragms. Untopped metal deck diaphragms consist of horizontal spans of less than 40 feet and have span/depth ratios less than or equal to 3 to 1.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the diaphragm. Analyze the diaphragm using the procedure given in the 1994 *NEHRP Recommended Provisions* requirements.

7.4 Precast concrete diaphragms. Evaluation of precast concrete diaphragms and the connections between precast elements shall consider eccentricities, adequacy of welds and length of embedded bars. If a topping slab is provided, it shall be assumed to resist all of the shear.

7.4.1 Topping slab. Precast concrete diaphragm elements are interconnected by a reinforced concrete topping slab.

The deficiency is in the ability to transfer shear from one element to another. Check the slab element interconnection and check the lateral load capacity of the vertical elements that resist horizontal force. Where the capacity of the diaphragm is less than 150 percent of the sum of the load capacities of the vertical elements and where connections can allow the diaphragm to fail in a brittle manner, the R values used in computing the seismic demand shall be consistent with those for brittle systems (not to exceed $R = 2$). Conforming buildings without a reinforced concrete topping slab shall be placed in SPC 4.

7.4.2 Continuity of topping slab. The topping slab continues uninterrupted through the interior walls and into the exterior walls or is provided with dowels with a total area equal to the topping slab reinforcing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The

deficiency is the abrupt loss of strength where the topping slab is interrupted. Evaluate the tension and shear demand due to diaphragm forces, including collector requirements, perpendicular-to-wall loads, or chord forces at re-entrant corners.

7.5 Horizontal bracing. Horizontal bracing forms a complete system of adequate capacity.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is an incomplete or inadequate horizontal bracing system. Evaluate the horizontal bracing system for completeness of the system and its ability to gather all tributary forces and deliver them to the walls or frames.

7.6 Other systems. The diaphragm system does not include thin planks and/or toppings of gypsum.

The deficiency is the inadequate capacity of the diaphragm. Conforming buildings with this condition shall be placed in SPC 4.

ARTICLE 8 PROCEDURES FOR CONNECTIONS

8.0 Introduction. The connections evaluated in this article are connections between:

- Framing members and walls;
- Diaphragms and walls or frames; and
- Walls or frames and foundations.

Connections between other structural members are discussed in the appropriate article.

8.1 Connection concerns. The evaluation of these specific connections involves review of:

- Lateral support of walls that are perpendicular to the direction of the earthquake (“normal walls”);
- Transfer of shear from diaphragms to shear walls and frames that are parallel to the direction of the earthquake;
- Anchorage of walls and columns to the foundations; and
- Interconnection of elements where failure of connections would jeopardize the system.

8.2 Anchorage for normal forces.

8.2.1 Wood ledgers. The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall-to-diaphragm connection. Report this condition as a deficiency.

8.2.2 Wall anchorage. Exterior concrete or masonry walls are anchored to each of the diaphragm levels for out-of-plane loads.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall-to-diaphragm connec-

tions. Check that the anchor provides a direct, positive connection between the wall and the diaphragm for forces perpendicular to the face of the wall. Evaluate the wall anchorage, treating the wall as a portion of the building, with F_p as the demand.

8.2.3 Masonry wall anchors. Wall anchorage connections are steel anchors or straps that are developed into the diaphragm.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall anchors. Evaluate the wall anchorage, treating the wall as a portion of the building, with F_p as the demand.

8.2.4 Anchor spacing. The anchors from the floor and roof systems into exterior masonry walls are spaced at 4 feet or less.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall anchors. Evaluate the wall anchors, treating the wall as a portion of the building, with F_p as the demand.

8.2.5 Tilt-up walls. Precast bearing walls are connected to the diaphragms for out-of-plane loads; steel anchors or straps are embedded in the walls and developed into the diaphragm.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the wall anchors. Evaluate the wall anchorage, treating the load as a portion of the building, with F_p as the demand. Check the load path between the wall anchors and the diaphragm cross tie.

8.2.6 Panel-diaphragm connections. There are at least two anchors from each precast wall panel into the diaphragm elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the number of anchors. Report this condition as a deficiency.

8.2.7 Inadequate stiffness of wall anchors. Anchors of walls to wood structural elements are installed taut and are stiff enough to prevent movement between the wall and roof.

The deficiency is in the ability of the wall anchor to prevent separations between the wall and roof sheathing that may result in out-of-plane failure of the ledger support. Inspect all anchors to see that they do not have twists, kinks, offsets, or are otherwise installed so that some movement is required before the anchor becomes effective, and that this condition may lead to cross grain bending in the ledger. Conforming buildings which fail this check shall be placed in SPC 4.

8.3 Shear transfer.

8.3.1 Transfer to shear walls. Diaphragms have sufficient capacity and are connected for transfer of loads to the shear walls.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The

deficiency is in the capacity of the connection to transfer shear. Verify the adequacy of the available diaphragm capacity.

8.3.2 Transfer to steel frames. The method used to transfer diaphragm shears to the steel frames is approved for use under lateral loads.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the capacity of the connection to transfer shear. Evaluate the capacity of the load-transfer mechanism provided, using AISC design methods or approved manufacturer's data. Compare this capacity to the assumed lateral force distribution.

8.3.3 Topping slab to walls and frames. Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doweled into the shear wall or frame elements.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the capacity of the connection to transfer shear. Evaluate the capacity of the load-transfer mechanism provided. Compare this capacity to the assumed lateral force distribution.

8.4 Vertical components to foundations.

8.4.1 Steel columns. The columns in lateral-force-resisting frames are substantially anchored to the building foundation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the frame and the foundation. Report this condition as a deficiency.

8.4.2 Concrete columns. All longitudinal column steel is doweled into the foundation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the column and the foundation. Report this condition as a deficiency.

8.4.3 Wood posts. There is positive connection of wood posts to the foundation and the elements being supported.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the post and the foundation. Report this condition as a deficiency.

8.4.4 Wall reinforcing. All vertical wall reinforcing is doweled into the foundation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the wall and the foundation. Report this condition as a deficiency.

8.4.5 Shear-wall-boundary columns. The shear-wall columns are substantially anchored to the building foundation.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the

shear-wall columns and the foundation. Report this condition as a deficiency.

8.4.6 Wall panels. The wall panels are connected to the foundation and/or ground floor slab with dowels equal to the vertical panel reinforcing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the wall panel and the foundation. Report this condition as a deficiency.

8.4.7 Wood sills. All wall elements are bolted to the foundation sill at 6-foot spacing or less with proper edge and end distances for concrete and wood.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is in the strength of the connection between the wood sill and the foundation. Report this condition as a deficiency.

8.5 Interconnection of elements.

8.5.1 Girders. Girders supported by walls or pilasters have special ties to secure the anchor bolts.

The deficiency is in the strength of the pilaster at the girder anchorage. Report this condition as a deficiency. Conforming buildings that fail this check shall be placed in SPC 4.

8.5.2 Corbel bearing. If the frame girders bear on column corbels, the length of bearing is greater than 3 inches.

The deficiency is in the length of bearing. Calculate the inter-story drift. Judge the adequacy of the connections to retain their vertical load-carrying integrity at a maximum drift estimated to be equal to the drift calculated with the unreduced demand. Conforming buildings that fail this check shall be placed in SPC 4.

8.5.3 Corbel connections. The frame girders are not supported on corbels with welded elements.

The deficiency is in the strength of the connection. Check all welded connections that transfer lateral loads or are subject to frame action. Determine where connection failures would be brittle (e.g., pull-out of embedded item would occur before yield of mild steel element). Analyze structure for capacity without such connections or check such connections for seismic force amplified by factor $C_d/2$, but not less than 1.5. For connections that can allow the diaphragm to fail in a brittle manner, the R values used in computing the seismic demand shall be consistent with those for brittle systems (not to exceed $R = 2$). Conforming buildings that fail this check shall be placed in SPC 4.

8.6 Roof decking.

8.6.1 Light-gage metal, plastic or cementitious roof panels. All light-gage metal, plastic or cementitious roof panels are properly connected to the roof framing at not more than 12 inches on center.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is the lack of connection of sufficient strength between the roof panels and the framing elements. Report this condition as a deficiency.

8.6.2 Wall panels. All wall panels (metal, fiberglass or cementitious) are properly connected to the framing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is the lack of connections of sufficient strength (to prevent a falling hazard) and flexibility (to allow for the relative displacements between the panel and the supporting frame). Report this condition as a deficiency.

ARTICLE 9 PROCEDURES FOR FOUNDATIONS AND GEOLOGIC SITE HAZARDS

9.0 Introduction. The seismic evaluation of an existing building shall include an examination of the building foundation, an assessment of the capability of the soil beneath the foundation to withstand the forces applied during an earthquake and an evaluation of any nearby geologic hazards that may affect the stability of the foundation.

9.1 Condition of foundations.

9.1.1 Foundation performance. The structure does not show evidence of excessive foundation movement such as settlement or heave that would affect its integrity or strength.

The deficiency is reduction of the integrity and strength of foundation elements by cracking, yielding, tipping or buckling of the foundation. Visually examine lower level walls, partitions, grade beams, visible footings, pile caps and the like for cracking, yielding, buckling and out-of-level conditions. Report evidence of movement as a deficiency.

9.1.2 Deterioration. There is no evidence that foundation elements have deteriorated due to corrosion, sulphate attack, material breakdown or other reasons in a manner that would affect the integrity or strength of the structure.

The deficiency is weakening of the foundation due to deterioration, with the same consequences as discussed in Section 9.1.1. Determine if there is historical evidence in the local area of deterioration of the particular type of foundation elements in the building where site conditions are similar. Examine the visible foundation elements for evidence of loss of support as specified in Section 9.1.1.

9.2 Capacity of foundations.

9.2.1 Overturning. The ratio of the effective horizontal dimension, at the foundation level of the seismic-resisting system, to the building height (base/height) exceeds $1.4 A_v$.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is the concentration of seismic inertial response into narrow elements by the seismic-resisting system, which may overcome the ability of the foundation elements, either structure or soil, to provide adequate resistance. For shallow foundations, evaluate the shear and moment capacity of the foundation elements for adequacy to resist calculated seismic forces. Evaluate the vertical bearing pressure of the soil under seismic loading conditions due to the total gravity and overturning loads and compare to two times the allowable static-bearing pressure. For deep foundations, evaluate the ultimate vertical capacity of the pile or pier under seismic loads. Com-

pare the foundation capacity to the gravity loads plus the overturning loads.

9.2.2 Ties between foundation elements. Foundation ties adequate for seismic forces exist where footings, piles and piers are not restrained by beams, slabs, or competent soils or rock.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is the possibility of significant differential lateral deformations of the foundations. Evaluate the lateral restraint to seismic forces provided by the foundation materials or the structural ties. For shallow foundations, evaluate the horizontal capacity of the foundation soils under seismic loading conditions (the lateral resistance of the footings due to passive resistance on affected sides of the footings plus the friction on the base of the footings) and compare to the base shear of the building. In the evaluation of base friction, consideration shall be given to the effect of the vertical component of ground motion.

9.2.3 Load path at pile caps. The pile caps are capable of transferring overturning and lateral forces between the structure and individual piles in the pile cap.

The deficiency is insufficient capacity of the pile cap to transfer seismic forces from the superstructure to the individual piles. Check the moment and shear capacity to transfer uplift and lateral forces from the point of application on the pile cap to each pile. Conforming buildings which fail this check shall be placed in SPC 4.

9.2.4 Lateral force on deep foundations. Piles and piers are capable of transferring the lateral forces between the structure and the soil.

The deficiencies include inadequate flexural strength and ductility of piles or piers at the connection to the cap and the upper portion of the pile. Compare the maximum lateral resistance of soil against piles or piers and caps against the demand. For concrete piles, check for a minimal amount of longitudinal reinforcement in the upper portion of piles or piers and for hoops or ties immediately beneath the caps. Also check for confining transverse reinforcement wherever bending moments might be high, including changes in soil stiffness. Conforming buildings which fail this check shall be placed in SPC 4.

9.2.5 Pole buildings. Pole foundations have adequate embedment.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. The deficiency is inadequate strength of the pole foundation. Check lateral force resistance of embedded poles using conventional procedures, comparing with conventional allowable pressures times 1.5.

9.2.6 Sloping sites. The grade difference from one side of the building to another does not exceed one-half story.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. If this statement is false, include the horizontal force due to the grade difference, appropriately modified for seismic motions,

with the seismic inertial force when checking sliding stability and the lateral-force-resisting system below grade.

9.3 Geologic site hazards. This section addresses geologic and local site conditions that can lead to building structural damage and threaten life safety in an earthquake. In the seismic evaluation of buildings for life-safety considerations, it will be necessary to investigate the site to establish that there are no geologic site hazards present or, if they are present, that their threat is not significant or is mitigated by the design. Requirements for engineering geologic reports are given in Section 2.1.2.

9.3.1 Liquefaction. Liquefaction susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 feet under the building.

The deficiency is the potential for liquefaction that will result in vertical settlement and potential loss of foundation support for spread footings, or for lateral spreading of liquefied soils that can occur on nearly flat slopes and be detrimental to the foundation system. Evaluate the liquefaction potential and consequences of vertical settlement or lateral movement of the foundations. Conforming buildings which fail this check shall be placed in SPC 4.

9.3.2 Slope failure. The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating small predicted movements without failure.

Evaluate the likely movements associated with seismically induced slope failures beneath, above or adjacent to the building and their effect on the structural integrity of the building. Conforming buildings which fail this check shall be placed in SPC 4.

9.3.3 Surface fault rupture. Surface fault rupture and surface displacement at the building site are not anticipated.

Evaluate the proximity of known active faults to the building. If the potential for surface fault rupture and surface displacement at the building site is present, nonconforming buildings shall be placed in SPC 1. Conforming buildings which fail this check shall be placed in SPC 4.

ARTICLE 10

EVALUATION OF ELEMENTS THAT ARE NOT PART OF THE LATERAL-FORCE-RESISTING SYSTEM

10.0 Introduction. This article sets forth general requirements that apply to nonstructural elements related to life-safety issues. Article 11 addresses evaluation of critical nonstructural systems needed for continued hospital function following an earthquake, and assignment of buildings to Nonstructural Performance Categories.

The evaluation statements discussed in this article (and listed in the appendix) deal with life-safety concerns. Some of the statements can be answered directly. For others, further investigation will be required in accordance with evaluation procedures indicated in other articles of these regulations using seismic forces indicated in Section 2.4.6 and the appropriate C_c seismic coefficient given in Table 2.4.3.1. Also, the

materials used in the nonstructural element and its connections must be considered.

10.1 Nonstructural walls. The term "nonstructural walls" refers to walls that are not part of the load-carrying system, but may become load bearing upon attachment and interaction with other elements. Evaluation must be made to determine if they are capable of resisting seismic forces required by Section 2.4.6 as well as the other requirements of these regulations.

10.1.1 Partitions.

10.1.1.1 Masonry partitions. There are no unbraced unreinforced masonry or hollow clay tile partitions in critical care areas, clinical laboratory service spaces, pharmaceutical service spaces, radiological service spaces, central and sterile supply areas, exit corridors, elevator shafts or stairwells.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check for the presence of support angles at floor and roof, and for spaces at the sides and top of the wall to provide for interaction of the structural system.

10.1.1.2 Structural separations. At structural separations, partitions in exit corridors have seismic or control joints.

Check that seismic and/or control joints have been provided at structural separations. Conforming buildings that fail this check shall be placed in SPC 4.

10.1.1.3 Partition bracing. In exit corridors, the tops of partitions that extend only to the ceiling line have lateral bracing.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Partitions extending only to ceilings may overturn or buckle due to the lack of bracing.

10.1.2 Cladding and veneer. For conforming buildings, the evaluator may consider these conditions as mitigated, and no calculations are necessary. Exterior wall panels or cladding can fall if their connections to the building frames have insufficient strength and/or ductility.

10.1.2.1 Masonry veneer. Masonry veneer is connected to the back-up with corrosion-resistant ties spaced 24 inches on center maximum with at least one tie for every $2\frac{2}{3}$ square feet.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check for the presence of the required ties.

10.1.2.2 Cladding panels in moment frame buildings. For moment frame buildings of steel or concrete, panels are isolated from the structural frame to absorb predicted interstory drift without collapse.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check the ability of the cladding panels and their connections to tolerate the story drift computed in Section 2.4.4 without an anchorage failure.

10.1.2.3 Cladding panel connections. Where bearing connections are required, there are at least two bearing connections for each cladding panel and there are at least four

connections for each cladding panel capable of resisting out-of-plane forces.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Verify that an adequate number of the appropriate connection types are present for each cladding panel.

10.1.2.4 Cladding panel condition. Cladding panel connections appear to be installed properly. No connection element is severely deteriorated or corroded. There is no cracking in the panel materials indicative of substantial structural distress. There is no substantial damage to exterior cladding due to water leakage. There is no substantial damage to exterior wall cladding due to temperature movements.

Substantial deterioration can lead to loss of cladding elements or panels. Exterior walls shall be checked for deterioration. Damage due to corrosion, rotting, freezing or erosion can be concealed within the wall. Probe into the wall space, if necessary, for signs of water leakage at vulnerable interior spaces (e.g., around windows and at floor areas). Check elements that tie cladding to the backup structure and that tie the back-up structure to floor and roof slabs. Check exterior walls for cracking due to thermal movements. Check the cladding systems with appropriate reductions in member capacities. Conforming buildings that fail this check shall be placed in SPC 4.

10.1.3 Metal stud back-up systems.

10.1.3.1 General. Additional steel studs frame window and door openings. Corrosion of veneer ties, tie screws, studs and stud tracks is minimal. Stud tracks are adequately fastened to the structural frame.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Verify that adequate framing has been provided around openings in the exterior walls. Check the cladding systems with appropriate reductions in member capacities. Check the adequacy of the connection to the structural frame using the forces specified in Section 2.4.6.

10.1.3.2 Masonry veneer with stud back-up. Masonry veneer more than 30 feet above the ground is supported by shelf angles or other elements at each floor level. Masonry veneer is adequately anchored to the back-up at locations of through-wall flashing. Masonry veneer is connected to the back-up with corrosion-resistant ties spaced 24 inches on center maximum and with at least one tie for every $2\frac{2}{3}$ square feet.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check that adequate supports and ties are provided.

10.1.4 Masonry veneer with concrete block back-up.

10.1.4.1 General. The concrete block back-up qualifies as reinforced masonry.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Verify that the concrete block back-up meets the requirements of Sections 5.3.2 and 5.3.3.

10.1.4.2 Masonry veneer support. Masonry veneer more than 30 feet above the ground is supported by shelf angles or other elements at each floor level. Masonry veneer is ade-

quately anchored to the back-up at locations of through-wall flashing. Masonry veneer is connected to the back-up with corrosion-resistant ties spaced 24 inches on center maximum and with at least one tie for every $2\frac{2}{3}$ square feet. The concrete block back-up is positively anchored to the structural frame at 4-foot maximum intervals along the floors and roofs.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check that adequate supports and ties are provided.

10.1.5 Other veneer/panel systems.

10.1.5.1 Thin stone veneer panels. Stone anchorages are adequate for computed loads.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. There are no visible cracks or weak veins in the stone. Check the adequacy of the connection to the stone anchorage using the forces specified in Section 2.4.6.

10.1.5.2 Wood/aggregate panels. There is no visible deterioration of screws or wood at panel attachment points.

The deficiency is in the strength of the connections. Determine the cause and extent of distress and check the attachment of the panels with appropriate reductions in capacity. Conforming buildings that fail this check shall be placed in SPC 4.

10.1.6 Parapets, cornices, ornamentation and appendages.

There are no laterally unsupported unreinforced masonry parapets or cornices above the highest anchorage level with height/thickness ratios greater than 1.5. Concrete parapets with height/thickness ratios greater than 1.5 have vertical reinforcement. Cornices, parapets, signs and other appendages that extend above the highest anchorage level or cantilever from exterior wall faces and other exterior wall ornamentation are reinforced and well anchored to the structural system.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. If any of these items are of insufficient strength and/or are not securely attached to the structural elements, they may break off and fall, becoming significant life-safety hazards. Check the adequacy of these items using the forces specified in Section 2.4.6. The maximum height of an unbraced URM parapet shall be determined based on the height dimension measured above the lower of either the level of tension anchors or roof sheathing to the top of the wall parapet. The minimum height of a parapet above the wall anchor should be 12 inches.

Exception: If a reinforced concrete beam is provided at the top of the wall, the minimum height above the wall anchor may be 6 inches.

10.1.7 Means of egress. Canopies are anchored and braced to prevent collapse and blockage of building exits.

For conforming buildings, the evaluator may consider this condition as mitigated, and no calculations are necessary. Check canopies for the forces specified in Section 2.4.6.

**ARTICLE 11
EVALUATION OF CRITICAL
NONSTRUCTURAL COMPONENTS AND SYSTEMS**

11.0 Introduction. This article covers nonstructural components and systems critical to patient care.

11.01 Nonstructural evaluation procedure.

1. The nonstructural performance evaluation shall examine the respective critical nonstructural systems and elements for the planned NPC as specified in Table 11.1, "Nonstructural Performance Categories." The nonstructural evaluation process shall include the following steps:
 1. Site visit and data collection;
 2. Identification of building SPC;
 3. Identification of critical nonstructural systems for the planned NPC;
 4. Identification of critical care services housed in the building;
 5. Final evaluation for the critical nonstructural elements and systems for the planned NPC;
 6. Preparation of evaluation report; and
 7. Submittal of evaluation report to OSHPD.
2. A general acute care hospital facility may be exempted from a nonstructural evaluation upon submittal of a written statement by the hospital owner to OSHPD certifying the following conditions:
 1. The building is designated "NPC 1" in conformance with Table 11.1 "Nonstructural Performance Categories," or
 2. The building is designated "NPC 4" in conformance with Table 11.1 "Nonstructural Performance Categories" and provided:
 - a) The building was designed and constructed under a building permit issued by OSHPD;
 - b) All subsequent repairs, remodels, additions and alterations were performed under a permit issued by OSHPD, and
 - c) Fire sprinkler systems have been retrofitted in conformance with Table 11.1, "Nonstructural Performance Categories."
 3. If a hospital owner elects to obtain a higher NPC at a future date, additional nonstructural evaluations as specified in Section 11.01.1 will be required.

Exception: An engineering report may be submitted to the Office in lieu of the NPC 2 evaluation report required by Section 1.4.5.1.1 for nonstructural upgrades from NPC 1 to NPC 2, The engineering report shall comply with the following minimum requirements:

1. The report shall be stamped and signed by a California licensed structural engineer certifying, in a form acceptable to the Office, compliance with the requirements of NPC 2.

2. The report shall state that the systems and equipment listed in Table 11.1 for NPC 2 compliance either comply with or have been modified to comply with the requirements of Chapter 16A, 1995 *California Building Code* or equivalent provision in later version of the CBC.
3. The report shall state what specific deficiencies have been addressed in the NPC 2 upgrade projects, and provide OSHPD project numbers for these projects.
4. The report shall state that the corrective work required for NPC 2 compliance has been completed under permits issued by OSHPD.

If the hospital owner or governing body has already submitted a revised or new NPC 2 evaluation report, and the Office has reviewed and made comments on this report, the engineering report shall include a statement that all comments pertaining to NPC 2 compliance in the OSHPD review have been resolved.

4. If a hospital owner sells or leases the hospital to another party, a complete nonstructural evaluation and list of all nonstructural deficiencies to achieve NPC 5 shall be submitted to the Office prior to the completion of the sale or lease.

11.1 Nonstructural performance categories. Each building shall be assigned a Nonstructural Performance Category (NPC), based upon the degree of anchorage and bracing of selected nonstructural elements and systems. This includes architectural, mechanical, electrical and hospital equipment in addition to associated conduit, ductwork, piping and machinery. NPCs are defined in Table 11.1.

11.1.1 Site visit and evaluation. The evaluator shall:

1. Visit the building to observe and record the type, nature and physical condition of the nonstructural elements and systems for the planned NPC;
2. Note the SPC of the buildings based on procedures followed in Article 2;
3. Assemble building design data including:
 - a. Construction drawings, specifications and calculations, and
 - b. All drawings, specifications and calculations for remodeling work.
4. During the visit, the evaluator shall:
 - a. Verify existing data;
 - b. Develop other needed data (e.g., measure and sketch building if necessary);
 - c. Verify the critical nonstructural systems of the planned NPC;
 - d. Verify the critical care areas/services; and
 - e. Identify special conditions which may impact the nonstructural systems or endanger the function of the critical care areas/services.

TABLE 11.1—NONSTRUCTURAL PERFORMANCE CATEGORIES

TIMEFRAMES	NONSTRUCTURAL PERFORMANCE CATEGORY ¹	DESCRIPTION
	NPC 1	Buildings with equipment and systems not meeting the bracing and anchorage requirements of any other NPC.
January 1, 2002	NPC 2	The following systems are braced or anchored in accordance with Part 2, Title 24: ¹ <ul style="list-style-type: none"> • communications systems, • emergency power supply, • bulk medical gas systems, • fire alarm systems and • emergency lighting equipment and signs in the means of egress.
January 1, 2024 (SDC F), January 1, 2030 (SDC D),	NPC 3	The building meets the criteria for NPC “2” and in critical care areas, clinical laboratory service spaces, pharmaceutical service spaces, radiological service spaces, and central and sterile supply areas, the following components meet the bracing and anchorage requirements of Part 2, Title 24: ² <ul style="list-style-type: none"> • “Nonstructural components,” listed in the 1995 CBC, Part 2, Title 24, Table 16A-0. <p>Exceptions:</p> <ol style="list-style-type: none"> 1. Lateral bracing of suspended ceiling systems may be omitted in rooms with a floor area less than 300 square feet, provided the room is not an intensive care or coronary care unit patient room, angiography laboratory, cardiac catheterization laboratory, delivery room, operating room or post-operative recovery room. For rooms with a floor area greater than 300 square feet, OSHPD pre-approved standard details may be used. 2. Wall or floor-mounted cabinets, shelves, shelving units, file cabinets, and/or storage racks and rolling carts, unless these components are in a location where they could fall, collapse, or fail in the patient care vicinity as defined in Article 517.2 of the CEC, or could block a required means of egress. <ul style="list-style-type: none"> • “Equipment,” as listed in the 1995 CBC, Part 2, Title 24, Table 16A-0, “Equipment,” including equipment in the physical plant that service these areas. <p>Exceptions:</p> <ol style="list-style-type: none"> 1. Seismic restraints need not be provided for cable trays, conduit and HVAC ducting. Seismic restraints may be omitted from piping systems, provided that an approved method of preventing release of the contents of the piping system in the event of a break is provided. 2. Elevator(s) need not comply with these requirements. 3. Tanks and vessels are connected to the building systems with flexible connectors capable of accommodating a minimum of 12 inches of movement in any direction and not be dislodged from supports. <ul style="list-style-type: none"> • Fire sprinkler systems comply with the bracing and anchorage requirements of NFPA 13, 1994 edition, or subsequent applicable standards.
January 1, 2030	NPC 4D Levels 1, 2, or 3	The building meets the criteria for NPC “3,” and for systems listed in Levels 1 to 3 below, meets the bracing and anchorage requirements of Part 2, Title 24. ² <ol style="list-style-type: none"> 1. Level 1 includes all systems and equipment required to comply with NPC-3. An Operational Plan to repair and bring all systems and services back online, or to provide them in an alternative manner, is filed with the Office in accordance with Section 11.2.3. 2. Level 2 includes Level 1 and all services and utilities from the source to Level 1 areas necessary to accommodate continuation of operations after an event. These services are anchored and braced, and shall include elevator(s) selected to provide service to patient, surgical, obstetrical, and ground floors during interruption of normal power needed, to meet the structural requirements of Part 2, Title 24. An Operational Plan to repair and bring all other systems and services back online, or to provide them in an alternative manner, is filed with the Office in accordance with Section 11.2.3. 3. Level 3 includes Level 2, and all systems and equipment are anchored and braced so that additional services, as determined by the hospital in its Operational Plan, are functional and available to the public after a seismic event. The Operational Plan to repair and bring all other systems and services back online, or to provide them in an alternative manner, is filed with the Office in accordance with Section 11.2.3.
January 1, 2030	NPC 4	The building meets the criteria for NPC “3” and all architectural, mechanical, electrical systems, components and equipment, and hospital equipment including all elevator(s) meet the bracing and anchorage requirements of Part 2, Title 24. ² This category is for classification purposes of the Office of Emergency Services.
January 1, 2030	NPC 5	The building meets the criteria for NPC “4” or NPC “4D” and onsite supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours emergency operations, are integrated into the building plumbing systems in accordance with the <i>California Plumbing Code</i> . An onsite emergency system as defined in the <i>California Electrical Code</i> is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.

1. For the purpose of NPC 2 and NPC 5, all enumerated items within Table 11.1 shall meet the requirements of Section 1632A of 2001 *California Building Code* (CBC) or equivalent provision in later version of the CBC by the specified timeframe as indicated by their respective NPC.
2. For the purposes of NPC 3 and NPC 4 or NPC 4D in SPC 2, SPC 3, SPC 4 or SPC 4D, buildings, all enumerated items within Table 11.1 shall meet the requirements of the 1998 CBC, Section 1630B or equivalent provision in later version of the CBC, by the specified timeframe. The adequacy of anchorage and bracing may be limited to the connection of the component or equipment to the support when the total reaction at the point of support (including the application of F_p) less than or equal to the following limits:
 1. 250 pounds for components or equipment attached to light frame walls. For the purposes of this requirement, the sum of the absolute value of all reactions due to component loads on a single stud shall not exceed 250 pounds.
 2. 1,000 pounds for components or equipment attached to roofs, or walls of reinforced concrete or masonry construction.
 3. 2,000 pounds for components or equipment attached to floors or slabs-on-grade.

Exception: If the anchorage or bracing is configured in a manner that results in significant torsion on a supporting structural element, the effects of the nonstructural reaction force on the structural element shall be considered in the anchorage design.

If drawings are not available, the site visit and evaluation shall be performed as described in this section.

5. Review other data available such as assessments of building performance and function following past earthquakes;
6. Prepare a summary of data using an OSHPD approved format;
7. Perform the evaluation using the procedures in Section 11.2; and
8. Prepare a report of the findings of the evaluation using an OSHPD approved format.

11.2 Evaluation of buildings. Conforming and nonconforming buildings shall be placed in an NPC based upon the degree of anchorage and bracing for those systems and equipment specified in Table 11.1. The scope of the nonstructural evaluation may be limited to the nonstructural systems and elements specified in Table 11.1 for the planned NPC. Buildings which do not meet the requirements for NPC 2 as defined in Table 11.1 shall be placed in NPC 1.

11.2.1 Evaluation procedures for NPC 2. The following steps shall determine if the building meets the criteria for NPC 2:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 as specified in Table 11.1;
- b) Conduct an inventory of components and equipment, noting whether the items are anchored or braced;
- c) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or
 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five-digit project number on the approval that begins with the "H" prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.1(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 2.

Installation is defined as that which shows the size and type of material for all components of the system,

including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- d) If the components and equipment inventoried in 11.2.1(b) is anchored or braced, but does not meet the requirements of Section 11.2.1(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete or wood determined by approved tests; and
- e) If any of the items inventoried in 11.2.1(b) are unanchored or inadequately braced as determined by Section 11.2.1(d), the building shall be placed in NPC 1.

11.2.2 Evaluation procedures for NPC 3. The following steps shall determine if the building meets the criteria for NPC 3:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 and NPC 3;
- b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 3, noting whether the components and equipment are anchored or braced;
- c) Determine the level of NPC 3 conformance desired.
 1. Buildings classified as SPC 1 or SPC 2 are permitted to meet the NPC 3 performance level. See also Section 11.2.3(c).
 2. Buildings classified as SPC 3 or higher must meet the NPC 3 performance level.
- d) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or
 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five-digit project number on the approval stamp that begins with an "H" prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.2(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 2 and NPC 3.

Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- e) If the components and equipment inventoried in 11.2.2(b) are anchored or braced, but do not meet the requirements of Section 11.2.2(d), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1 for NPC 3. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete, or wood determined by approved tests.
- f) If any of the items inventoried in 11.2.2(b) are inadequately anchored or braced, as determined by Section 11.2.2(d), the building shall be placed in NPC 2.

11.2.3 Evaluation procedures for NPC 4 and NPC 4D. The following steps shall be followed to determine if the building meets the criteria for NPC 4 or NPC 4D:

- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 through NPC 4 or NPC 4D;
- b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 2 through NPC 4 or NPC 4D, noting whether the components and equipment are anchored or braced;
- c) Determine if the anchorage or bracing of the identified components and equipment complies with one of the following conditions:
 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24. Installation or retrofit of components that were designed to meet NPC 3R requirements must be shown to meet the anchorage and bracing requirements of the *California Building Code* for NPC 3. Buildings where the components designed to meet NPC 3R requirements that do not meet the anchorage and bracing requirements for NPC 3 shall be retrofitted to meet those requirements; or
 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five-digit project number on the approval stamp that begins with an “H” prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demon-

strated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.3(a) shows it to be constructed in reasonable conformity with these drawings.

Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 4 or NPC 4D.

Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.

- d) If the components and equipment inventoried in 11.2.3(b) are anchored or braced, but do not meet the requirements of Section 11.2.3(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete or wood determined by approved tests; and
- e) If any of the items inventoried in 11.2.3(b) is unanchored or inadequately braced as determined by Section 11.2.3(d), the building shall be placed in NPC 3.
- f) Nonstructural Performance Category 4D Operational Plan (Operational Plan) for Levels 1, 2, and 3 areas required for continuous operations. For minimum compliance with NPC 4D the facility must prepare an owner-approved Operational Plan specifying how it will repair nonstructural damage and bring systems and services back on line, or provide them in an alternative manner to accommodate continuation of critical care operations. This plan may include any other units or departments that hospitals may wish to keep operational for a minimum of 72 hours after a seismic event or other natural or human-made disaster. The Operational Plan shall be filed with the Office and shall include an executive summary, a detailed narrative of management of utilities, provisions, sustainability, and alternate means. The Operational Plan shall include, but is not limited to, the following topics for each unit or service that is not in compliance with NPC 4:

1. LEVEL 1 AREAS

- i. As-built plans, schematic, or other means showing the routing for all utilities serving the areas from their source to the areas they serve.
- ii. Materials on hand to make necessary repairs to these systems in the event of failure, breakage, or other causes of nonoperational status.
- iii. Prioritize the restoration of the essential electrical system.

- iv. Facility has a plan to maintain the areas in operation, including all necessary utilities and equipment for functionality.
 - v. An arrangement is in place to transfer the services in the event the hospital's services are not operational or cannot be made operational immediately.
- 2. CENTRAL AND STERILE SUPPLIES** – Facility has a means to obtain additional medical equipment and supplies for the areas in the event in-house central or sterile supplies storage is damaged or unusable.
- 3. DIETARY** – Facility has a means to obtain food service for the areas in the event in-house dietary is damaged or unusable.
- 4. PHARMACEUTICAL SERVICES** – Facility has means to obtain pharmaceutical services for the areas in the event in-house pharmaceutical services are damaged or unusable.
- 5. EMERGENCY POWER**
- i. Reliable emergency power generating capacity for the areas is provided.
 - ii. Emergency power is adequate to provide for all essential services for 72 hours of continuous, full-load demand before replenishment is needed.
 - iii. Facility has a means for emergency fuel replenishment.
 - iv. Facility has a means of providing essential electrical power in the event of its generator(s) failure.
 - v. Stat Lab and blood bank have been identified as essential services.
- 6. WATER SUPPLY** – Facility has a means to obtain water service for the areas in the event normal water service is not available.
- 7. MEDICAL GASES** – Facility has a means to obtain medical gases for areas in the event normal medical gas systems and supplies are not available.
- 8. VENTILATION**
- i. Facility can isolate and shut down Heating, Ventilation, and Air Conditioning (HVAC) system zones in an emergency.
 - ii. Guidelines are in place for emergency shutdown.
 - iii. Sections of the facility can be isolated.
 - iv. Individuals are identified who have authority for ordering HVAC shutdown 24/7.
 - v. Air intakes are protected from tampering.
 - vi. Facilities and Engineering staff have knowledge of HVAC zones and shutdown procedures.
- vii. Facility maintains adequate emergency supplies of filters for HVAC systems.
- 9. WASTE DISPOSAL**
- i. Procedures for management and disposal of an increased volume of contaminated wastes, goods, and fluids for 72 hours are in place.
- g) **Operational Plan update/change notification.** The hospital shall document any changes and file the revised plan with the Office.
- 11.2.4 Evaluation procedures for NPC 5.** The following steps shall determine if the building meets the criteria for NPC 5:
- a) Identify the specific nonstructural components and equipment that are subject to the requirements of NPC 2 through NPC 5;
 - b) Conduct an inventory of components and equipment specified in Table 11.1, NPC 2 through NPC 5, noting whether the components and equipment are anchored or braced;
 - c) Determine if the anchorage or bracing of the identified components and equipment complies with the following conditions:
 - 1. Installed under a permit issued by OSHPD. Drawings showing the installation and bearing an OSHPD approval stamp are required to show that the installation conforms to Part 2, Title 24; or
 - 2. Reviewed and approved by the Department of General Services, Office of Architecture and Construction, Structural Safety Section. Drawings showing: a) the installation; b) bear an Office of Architecture and Construction, Structural Safety Section approval stamp; and c) a five-digit project number on the approval stamp that begins with an “H” prefix, are required to demonstrate that the installation conforms to Part 2, Title 24. It shall also be demonstrated by a written report submitted by the structural engineer, acceptable to the enforcement agency, that an investigation of the anchorage and bracing of components and equipment identified in Section 11.2.4(a) shows it to be constructed in reasonable conformity with these drawings.
- Anchorage and bracing of elements that comply with either of these conditions are considered to meet the requirements of NPC 5.
- Installation is defined as that which shows the size and type of material for all components of the system including the anchor or fastener manufacturer (if proprietary), type, total number and embedment if connected to structural concrete, masonry or wood.
- d) If the components and equipment inventoried in 11.2.4(b) are anchored or braced, but do not meet the

requirements of Section 11.2.4(c), determine if the bracing and anchorage is sufficient to meet the code requirements specified in Table 11.1. The bracing capacity shall be determined by calculations based upon information shown in the construction documents. If these documents are incomplete or unavailable, the evaluation shall be based on the as-built conditions, with the capacity of fasteners to masonry, concrete or wood determined by approved tests; and

- e) If any of the items inventoried in 11.2.4(b) is inadequately anchored or braced as determined by Section 11.2.4(d), the building shall be placed in the appropriate NPC category in accordance with Table 11.1.

11.3 Testing requirements for evaluating the performance of existing mechanical fasteners. A testing program shall be instituted to determine the capacity of mechanical fasteners used to anchor nonstructural components including the bracing of pipes, ducts and conduit, and the attachment of equipment and other components listed in the 1995 CBC, Part 2, Title 24, Table 16A-0. Anchors shall be categorized as either seismic bracing of pipes ducts or conduit or equipment and other component anchors.

11.3.1 Anchors used in the seismic bracing of pipes, ducts or conduit. For anchors used in the seismic bracing of pipes, ducts or conduit, the following shall apply:

1. Twenty percent of the anchors (20 minimum) of a given size and type (wedge, shell and sleeve for expansion bolts), at each level of the structure shall be tension tested to three times the maximum calculated design load specified in Section 1630B of 1998 *California Building Code* (CBC) or equivalent provision in later version of the CBC but not less than 500 pounds. A minimum of one anchor in any 4-bolt group shall be tested assuming an equal distribution of the calculated force to the bolt group. One-quarter ($1/4$)-inch diameter anchors need not be tested. Where none of the anchors in the group have calculated tension, testing shall consist of torque testing.

Exception: Internally threaded anchors, such as shell-type anchors, shall be tested to four times the maximum calculated design loads. Attachment hardware shall be shimmed or removed prior to testing so that it does not prevent the possible withdrawal of the anchor.

2. If an anchor fails the tension test, 20 anchors, installed by the same trade, in the immediate vicinity of the failed anchor shall be tested prior to resuming to a 20 percent sampling rate for testing.

11.3.2 Anchors used in the attachment of equipment and other components. For anchors used in the attachment of equipment and other components listed in the 1995 CBC, Part 2, Title 24, Table 16A-0, the following shall apply:

1. A minimum of one anchor of a given size shall be tension tested for each piece of equipment or other component under consideration. Where the number of anchors

for the piece of equipment or component exceeds four, a minimum of 20 percent of the anchors shall be tension tested. Where none of the anchors in the group have calculated tension, testing shall consist of torque testing.

2. The tension test load shall be three times the maximum tension force calculated for an anchor in the attachment group using the design loads specified in Section 1630B of 1998 *California Building Code* (CBC) or equivalent provision in later version of the CBC or 500 pounds minimum. One-quarter ($1/4$)-inch diameter anchors need not be tested.

Exception: Internally threaded anchors, such as shell type anchors, shall be tested to four times the maximum calculated design loads. Attachment hardware shall be shimmed or removed prior to testing so that it does not prevent the possible withdrawal of the anchor.

3. If a single anchor fails, all anchors in the attachment group shall be tested. If two or more anchors fail, the component shall be retrofitted for the forces as for new construction.

11.3.3 Tension testing procedure.

1. Testing of anchors shall be accomplished by the application of externally applied direct tension force to the anchor. The testing apparatus shall not restrict the probable shear cone failure surface of the concrete or masonry.
2. Torque testing is not permitted in lieu of tension testing unless specifically allowed in these provisions.
3. A failure is defined when the tension load on the anchor produces a slip of $1/8$ inch, a shear cone failure in the concrete or masonry, concrete splitting, or fracture of the steel anchor itself prior to attaining the test load value.

Exception: For internally threaded anchors, the allowable slip shall not exceed $1/16$ inch.

11.3.4 Alternate test criteria. In lieu of testing in accordance with Section 11.3.1 or 11.3.2, a test load may be established by the evaluating engineer. The allowable load that the anchor can resist shall be determined by dividing the test load by the appropriate factors noted in Section 11.3.1 or 11.3.2. No one-third increase is permitted for seismic or wind loads.

11.3.5 Allowable shear loads. Allowable shear loads on anchors shall be determined by either of the following:

1. Shear values listed in Table 19B-E of 1998 *California Building Code* (CBC) or equivalent provision in later version of the CBC, or
2. Shear values shall be obtained by analysis using Strength Design of Anchorage to Concrete, Section A.6, published by the Portland Cement Association, 1999, with the specified reduction coefficient(s) to convert the "strength" values to allowable stress design values of 1.7.

APPENDIX

GENERAL SETS OF EVALUATION STATEMENTS

EVALUATION STATEMENTS FOR THE BASIC BUILDING SYSTEM

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

Building System

- T F** **LOAD PATH:** The structure contains a complete load path for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Section 3.1)
- T F** **REDUNDANCY:** The structure will remain laterally stable after the failure of any single element. (Section 3.2)

Configuration

- T F NA** **WEAK STORY:** Visual observation or a Quick Check indicates that there are no significant strength discontinuities in any of the vertical elements in the lateral-force-resisting system; the story strength at any story is not less than 80 percent of the strength of the story above. (Section 3.3.1)
- T F NA** **SOFT STORY:** Visual observation or a Quick Check indicates that there are no significant stiffness discontinuities in any of the vertical elements in the lateral-force-resisting system; the lateral stiffness of a story is not less than 70 percent of that in the story above or less than 80 percent of the average stiffness of the three stories above. (Section 3.3.2)
- T F NA** **GEOMETRY:** There are no significant geometrical irregularities; there are no setbacks (i.e., no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to the adjacent stories). (Section 3.3.3)
- T F NA** **MASS:** There are no significant mass irregularities; there is no change of effective mass of more than 50 percent from one story to the next, excluding light roofs. (Section 3.3.4)
- T F NA** **VERTICAL DISCONTINUITIES:** All shear walls, infilled walls and frames are continuous to the foundation. (Section 3.3.5)
- T F** **TORSION:** The lateral-force-resisting elements form a well-balanced system that is not subject to significant torsion. Significant torsion will be taken as any condition where the distance between the story center of rigidity and the story center of mass is greater than 20 percent of the width of the structure in either major plan dimension. (Section 3.3.6)

Adjacent buildings

- T F** **ADJACENT BUILDINGS:** There is no immediately adjacent structure that is less than half as tall or has floors/levels that do not match those of the building being evaluated. A neighboring structure is considered “immediately adjacent” if it is within 2 inches times the number of stories away from the building being evaluated. (Section 3.4)

Deflection incompatibility

- T F** **DEFLECTION INCOMPATIBILITY:** Column and beam assemblies that are not part of the lateral-force-resisting system (i.e., gravity load-resisting frames) are capable of accommodating imposed building drifts, including amplified drift caused by diaphragm deflections, without loss of vertical load-carrying capacity. (Section 3.5)

Short “captive” columns

- T F** **SHORT “CAPTIVE” COLUMNS:** There are no columns with height-to-depth ratios less than 75 percent of the nominal height-to-depth ratios of the typical columns at that level. (Section 3.6)

Materials and conditions

- T F NA** **DETERIORATION OF WOOD:** None of the wood members shows signs of decay, shrinkage, splitting, fire damage or sagging, and none of the metal accessories is deteriorated, broken or loose. (Section 3.7.1)
- T F NA** **OVERDRIVEN NAILS:** There is no evidence of overdriven nails in the shear walls or diaphragms. (Section 3.7.2)
- T F NA** **DETERIORATION OF STEEL:** There is no significant visible rusting, corrosion or other deterioration in any of the steel elements in the vertical- or lateral-force-resisting system. (Section 3.7.3)
- T F NA** **DETERIORATION OF CONCRETE:** There is no visible deterioration of concrete or reinforcing steel in any of the frame elements. (Section 3.7.4)
- T F NA** **POST-TENSIONING ANCHORS:** There is no evidence of corrosion or spalling in the vicinity of post-tensioning or end fittings. Coil anchors have not been used. (Section 3.7.5)
- T F NA** **CONCRETE WALL CRACKS:** All diagonal cracks in the wall elements are 1.0 mm or less in width, are in isolated locations, and do not form an X pattern. (Section 3.7.6)
- T F NA** **CRACKS IN BOUNDARY COLUMNS:** There are no diagonal cracks wider than 1.0 mm in concrete columns that encase the masonry infills. (Section 3.7.7)
- T F NA** **PRECAST CONCRETE WALLS:** There is no significant visible deterioration of concrete or reinforcing steel or evidence of distress, especially at the connections. (Section 3.7.8)
- T F NA** **MASONRY JOINTS:** The mortar cannot be easily scraped away from the joints by hand with a metal tool, and there are no significant areas of eroded mortar. (Section 3.7.9)
- T F NA** **MASONRY UNITS:** There is no visible deterioration of large areas of masonry units. (Section 3.7.10)
- T F NA** **CRACKS IN INFILL WALLS:** There are no diagonal cracks in the infilled walls that extend throughout a panel or are greater than 1.0 mm wide. (Section 3.7.11)

EVALUATION STATEMENTS FOR VERTICAL SYSTEMS RESISTING LATERAL FORCES

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

MOMENT FRAMES
Frames with infill walls

T F NA INTERFERING WALLS: All infill walls placed in the moment frames are isolated from the structural elements. (Section 4.1.1)

Steel moment frames

T F NA DRIFT CHECK: The building satisfies the Quick Check of the frame drift. (Section 4.2.1)

T F NA COMPACT MEMBERS: All moment frame elements meet the compact section requirements of the basic AISC documents. (Section 4.2.2)

T F NA BEAM PENETRATIONS: All openings in frame-beam webs have a depth less than one fourth of the beam depth and are located in the center half of the frame beams. (Section 4.2.3)

T F NA MOMENT CONNECTIONS: All beam-column connections in the lateral-force-resisting moment frame have full-penetration flange welds and a bolted or welded web connection. (Section 4.2.4)

T F NA COLUMN SPLICES: All column splice details of the moment-resisting frames include connection of both flanges and the web. (Section 4.2.5)

T F NA JOINT WEBS: All web thicknesses within joints of moment-resisting frames meet the AISC criteria for web shear. (Section 4.2.6)

T F NA GIRDER FLANGE CONTINUITY PLATES: There are girder flange continuity plates at joints. (Section 4.2.7)

T F NA STRONG COLUMN/WEAK BEAM: At least one half of the joints are strong column/weak beam (33 percent on every line of moment frame). Roof joints need not be considered. (Section 4.2.8)

T F NA OUT-OF-PLANE BRACING: Beam-column joints are braced out-of-plane. (Section 4.2.9)

T F NA PRE-NORTHBRIDGE EARTHQUAKE WELDED MOMENT FRAME JOINTS: Welded steel moment frame beam-column joints are designed and constructed in accordance with recommendations in FEMA 267, Interim Guidelines: Evaluation, Repair, Modification, and Design of Welded Steel Moment Frame Structures, August 1995. (Section 4.2.10)

Concrete moment frames

T F NA SHEARING STRESS CHECK: The building satisfies the Quick Check of the average shearing stress in the columns. (Section 4.3.1)

T F NA DRIFT CHECK: The building satisfies the Quick Check of story drift. (Section 4.3.2)

T F NA PRESTRESSED FRAME ELEMENTS: The lateral-load-resisting frames do not include any pre-stressed or post-tensioned elements. (Section 4.3.3)

T F NA JOINT ECCENTRICITY: There are no eccentricities larger than 20 percent of the smallest column plan dimension between girder and column center-lines. (Section 4.3.4)

T F NA NO SHEAR FAILURES: The shear capacity of frame members is greater than the moment capacity. (Section 4.3.5)

T F NA STRONG COLUMN/WEAK BEAM: The moment capacity of the columns appears to be greater than that of the beams. (Section 4.3.6)

T F NA STIRRUP AND TIE HOOKS: The beam stirrups and column ties are anchored into the member cores with hooks of 135 degrees or more. (Section 4.3.7)

T F NA COLUMN-TIE SPACING: Frame columns have ties spaced at $d/4$ or less throughout their length and at $8d_b$, or less at all potential plastic hinge regions. (Section 4.3.8)

T F NA COLUMN-BAR SPLICES: All column bar lap splice lengths are greater than $35d_b$, long and are enclosed by ties spaced at $8d_b$, or less. (Section 4.3.9)

T F NA BEAM BARS: At least two longitudinal top and two longitudinal bottom bars extend continuously throughout the length of each frame beam. At least 25 percent of the steel provided at the joints for either positive or negative moment is continuous throughout the members. (Section 4.3.10)

T F NA BEAM-BAR SPLICES: The lap splices for the longitudinal beam reinforcing are located within the center half of the member lengths or in the vicinity of potential plastic hinges. (Section 4.3.11)

T F NA STIRRUP SPACING: All beams have stirrups spaced at $d/2$ or less throughout their length and at $8d_b$, or less at potential hinge locations. (Section 4.3.12)

T F NA BEAM TRUSS BARS: Bent-up longitudinal steel is not used for shear reinforcement. (Section 4.3.13)

T F NA JOINT REINFORCING: Column ties extend at their typical spacing through all beam-column joints at exterior columns. (Section 4.3.14)

T F NA FLAT SLAB FRAMES: The system is not a frame consisting of a flat slab/plate without beams. (Section 4.3.15)

Precast concrete moment frames

T F NA PRECAST FRAMES: The lateral loads are not resisted by precast concrete frame elements. (Section 4.4.1)

T F NA PRECAST CONNECTIONS: For buildings with concrete shear walls, the connection between precast frame elements such as chords, ties and collectors in the lateral-force-resisting system can develop the capacity of the connected members. (Section 4.4.2)

Frames not part of the lateral-force-resisting system

T F NA COMPLETE FRAMES: The steel or concrete frames form a complete vertical load-carrying system. (Section 4.5.1)

SHEAR WALLS

Concrete shear walls

- T F NA** SHEARING STRESS CHECK: The building satisfies the Quick Check of the shearing stress in the shear walls. (Section 5.1.1)
- T F NA** OVERTURNING: All shear walls have h_w/l_w ratios less than 4 to 1. (Section 5.1.2)
- T F NA** COUPLING BEAMS: The stirrups in all coupling beams are spaced at $d/2$ or less and are anchored into the core with hooks of 135 degrees or more. (Section 5.1.3)
- T F NA** COLUMN SPLICES: Steel column splice details in shear wall boundary elements can develop the tensile strength of the column. (Section 5.1.4)
- T F NA** WALL CONNECTIONS: There is positive connection between the shear walls and the steel beams and columns. (Section 5.1.5)
- T F NA** CONFINEMENT REINFORCING: For shear walls with h_w/l_w greater than 2.0, the boundary elements are confined with spirals or ties with spacing less than $8d_b$. (Section 5.1.6)
- T F NA** REINFORCING STEEL: The area of reinforcing steel for concrete walls is greater than 0.0025 times the gross area of the wall along both the longitudinal and transverse axes and the maximum spacing of reinforcing steel is 18 inches. (Section 5.1.7)
- T F NA** REINFORCING AT OPENINGS: There is special wall reinforcement around all openings. (Section 5.1.8)

Precast concrete shear walls

- T F NA** PANEL-TO-PANEL CONNECTIONS: Adjacent wall panels are not connected by welded steel inserts. (Section 5.2.1)
- T F NA** WALL OPENINGS: Openings constitute less than 75 percent of the length of any perimeter wall with the wall piers having h_w/l_w ratios of less than 2.0. (Section 5.2.2)
- T F NA** COLLECTORS: Wall elements with openings larger than a typical panel at a building corner are connected to the remainder of the wall with collector reinforcing. (Section 5.2.3)

Reinforced masonry shear walls

- T F NA** SHEARING STRESS CHECK: The building satisfies the Quick Check of the shearing stress in the unreinforced masonry shear walls. (Section 5.4.1)
- T F NA** REINFORCING: The total vertical and horizontal reinforcing steel in reinforced masonry walls is greater than 0.002 times the gross area of the wall with a minimum of 0.0007 in either of the two directions, the spacing of reinforcing steel is less than 48 inches and all vertical bars extend to the top of the walls. (Section 5.4.2)
- T F NA** REINFORCING AT OPENINGS: There is special wall reinforcement around all openings. (Section 5.1.8)

Unreinforced masonry shear walls

- T F NA** SHEARING STRESS CHECK: The building satisfies the Quick Check of the shearing stress in the unreinforced masonry shear walls. (Section 5.4.1)
- T F NA** MASONRY LAY-UP: Filled collar joints of multiwythe masonry walls have negligible voids. (Section 5.4.2)

Infill walls in frames

- T F NA** PROPORTIONS: The height/thickness ratio of the wall is as follows: (Section 5.4.3)
- One-story building $h_w/t < 15$
- Multistory building
- Top story $h_w/t < 9$
- Other stories $h_w/t < 13$
- T F NA** SOLID WALLS: The infill walls are not of cavity construction. (Section 5.5.2)
- T F NA** CONTINUOUS WALLS: The infill walls are continuous to the soffits of the frame beams. (Section 5.5.3)
- T F NA** WALL CONNECTIONS: All infill panels are constructed to encompass the frames around their entire perimeter. (Section 5.5.4)

Walls in wood-frame buildings

- T F NA** SHEARING STRESS CHECK: The building satisfies the Quick Check of the shearing stress in the wood shear walls. (Section 5.6.1)
- T F NA** OPENINGS: Walls with garage doors or other large openings are braced with plywood shear walls or are supported by adjacent construction through substantial positive ties. (Section 5.6.2)
- T F NA** WALL REQUIREMENTS: All walls supporting tributary area of 24 to 100 square feet per foot of wall are plywood sheathed with proper nailing, or rod braced and have a height-to-depth (H/D) ratio of 1 to 1 or less, or have properly detailed and constructed hold downs. (Section 5.6.3)
- T F NA** CRIPPLE WALLS: All exterior cripple walls below the first floor level are braced to the foundation with shear elements. (Section 5.6.4)
- T F NA** NARROW SHEAR WALLS: Narrow wood shear walls with an aspect ratio greater than 2 to 1 do not resist forces developed in the building. (Section 5.6.5)
- T F NA** STUCCO (EXTERIOR PLASTER) SHEAR WALLS: Multistory buildings do not rely on exterior stucco walls as the primary lateral-force-resisting system. (Section 5.6.6)
- T F NA** PLASTER OR GYPSUM WALLBOARD SHEAR WALLS: Interior plaster or gypsum wallboard is not being used for shear walls in buildings over one story in height. (Section 5.6.7)

BRACED FRAMES
Concentric braced frames

- T F NA** STRESS CHECK: The building satisfies the Quick Check of the stress in the diagonals. (Section 6.1.1)
- T F NA** STIFFNESS OF DIAGONALS: All diagonal elements required to carry compression have K/r ratios less than 120. (Section 6.1.2)
- T F NA** TENSION-ONLY BRACES: Tension-only braces are not used as the primary diagonal bracing elements in structures over two stories in height. (Section 6.1.3)
- T F NA** CHEVRON BRACING: The bracing system does not include chevron-, V- or K-braced bays. (Section 6.1.4)
- T F NA** CONCENTRIC JOINTS: All the diagonal braces frame into the beam-column joints concentrically. (Section 6.1.5)
- T F NA** CONNECTION STRENGTH: All the brace connections are able to develop the yield capacity of the diagonals. (Section 6.1.6)
- T F NA** COLUMN SPLICES: All column splice details of the braced frames can develop the column yield capacity. (Section 6.1.7)
- T F NA** CONCRETE BRACED FRAMES: None of the braces in the framing system are of reinforced concrete construction. (Section 6.1.8)

Eccentric braced frames

- T F NA** LINK BEAM LOCATION: The link beams are not connected to the columns. (Section 6.2.1)

EVALUATION STATEMENTS FOR DIAPHRAGMS

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

General

- T F NA** PLAN IRREGULARITIES: There is significant tensile capacity at reentrant corners or other locations of plan irregularities. (Section 7.1.1)
- T F NA** CROSS TIES: There are continuous cross ties between diaphragm chords. (Section 7.1.2)
- T F NA** REINFORCING AT OPENINGS: There is reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. (Section 7.1.3)
- T F NA** OPENINGS AT SHEAR WALLS: Diaphragm openings immediately adjacent to the shear walls constitute less than 25 percent of the wall length, and the available length appears sufficient. (Section 7.1.4)
- T F NA** OPENINGS AT BRACED FRAMES: Diaphragm openings immediately adjacent to the braced frames extend less than 25 percent of the length of the bracing. (Section 7.1.5)
- T F NA** OPENINGS AT EXTERIOR MASONRY SHEAR WALLS: Diaphragm openings immediately adjacent to exterior masonry walls are no more than 8 feet long. (Section 7.1.6)

Wood diaphragms

- T F NA** SHEATHING: None of the diaphragms consist of straight sheathing or have span/depth ratios greater than 2 to 1. (Section 7.2.1)
- T F NA** SPANS: All diaphragms with spans greater than 24 feet have plywood or diagonal sheathing. Structures in Building Type 2 may have rod-braced systems. (Section 7.2.2)
- T F NA** UNBLOCKED DIAPHRAGMS: Unblocked wood panel diaphragms consist of horizontal spans of less than 40 feet and have span/depth ratios less than or equal to 3 to 1. (Section 7.2.3)
- T F NA** SPAN/DEPTH RATIO: If the span/depth ratios of wood diaphragms are greater than 3 to 1, there are nonstructural walls connected to all diaphragm levels at less than 40-foot spacing. (Section 7.2.4)
- T F NA** DIAPHRAGM CONTINUITY: None of the diaphragms are composed of split-level floors or, in wood commercial or industrial buildings, have expansion joints. (Section 7.2.5)
- T F NA** CHORD CONTINUITY: All chord elements are continuous, regardless of changes in roof elevation. (Section 7.2.6)

Metal deck diaphragms

- T F NA** DECK TOPPING: All metal deck roofs have a reinforced concrete topping slab. (Section 7.3.1)
- T F NA** UNTOPPED DIAPHRAGMS: Untapped metal deck diaphragms consist of horizontal spans of less than 40 feet and have span/depth ratios less than or equal to 3 to 1. (Section 7.3.2)

Precast concrete diaphragms

- T F NA** TOPPING SLAB: Precast concrete diaphragm elements are interconnected by a reinforced concrete topping slab. (Section 7.4.1)
- T F NA** CONTINUITY OF TOPPING SLAB: The topping slab continues uninterrupted through the interior walls and into the exterior walls or is provided with dowels with a total area equal to the topping slab reinforcing. (Section 7.4.2)

Horizontal bracing

- T F NA** HORIZONTAL BRACING: Horizontal bracing forms a complete system of adequate capacity. (Section 7.5.1)

Other systems

- T F NA** OTHER SYSTEMS: The diaphragm system does not include thin planks and/or toppings of gypsum. (Section 7.6.1)

EVALUATION STATEMENTS FOR STRUCTURAL CONNECTIONS

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

Anchorage for normal forces

- T F NA** WOOD LEDGERS: The connection between the wall panels and the diaphragm does not induce cross-grain bending or tension in the wood ledgers. (Section 8.2.1)
- T F NA** WALL ANCHORAGE: The exterior concrete or masonry walls are anchored to each of the diaphragm levels for out-of-plane loads. (Section 8.2.2)
- T F NA** MASONRY WALL ANCHORS: Wall anchorage connections are steel anchors or straps that are developed into the diaphragm. (Section 8.2.3)
- T F NA** ANCHOR SPACING: The anchors from the floor and roof systems into exterior masonry walls are spaced at 4 feet or less. (Section 8.2.4)
- T F NA** TILT-UP WALLS: Precast-bearing walls are connected to the diaphragms for out-of-plane loads; steel anchors or straps are embedded in the walls and developed into the diaphragm. (Section 8.2.5)
- T F NA** PANEL-DIAPHRAGM CONNECTION: There are at least two anchors from each precast wall panel into the diaphragm elements. (Section 8.2.6)
- T F NA** INADEQUATE STIFFNESS OF WALL ANCHORS: Anchors of walls to wood structural elements are installed taut and are stiff enough to prevent movement between the wall and roof. (Section 8.2.7)

Shear transfer

- T F NA** TRANSFER TO SHEAR WALLS: Diaphragms are reinforced and connected for transfer of loads to the shear walls. (Section 8.3.1)
- T F NA** TRANSFER TO STEEL FRAMES: The method used to transfer diaphragm shears to the steel frames is approved for use under lateral loads. (Section 8.3.2)
- T F NA** TOPPING SLAB TO WALLS AND FRAMES: Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements are doveled into the shear wall or frame elements. (Section 8.3.3)

Vertical components

- T F NA** STEEL COLUMNS: The columns in the lateral-force-resisting frames are substantially anchored to the building foundation. (Section 8.4.1)
- T F NA** CONCRETE COLUMNS: All longitudinal column steel is doveled into the foundation. (Section 8.4.2)
- T F NA** WOOD POSTS: There is positive connection of wood posts to the foundation and the elements being supported. (Section 8.4.3)
- T F NA** WALL REINFORCING: All vertical wall reinforcing is doveled into the foundation. (Section 8.4.4)
- T F NA** SHEAR-WALL-BOUNDARY COLUMNS: The shear wall columns are substantially anchored to the building foundation. (Section 8.4.5)
- T F NA** WALL PANELS: The wall panels are connected to the foundation and/or ground floor slab with dowels equal to the vertical panel reinforcing. (Section 8.4.6)
- T F NA** WOOD SILLS: All wall elements are bolted to the foundation sill at 6-foot spacing or less with proper edge distance for concrete and wood. (Section 8.4.7)

Interconnection of elements

- T F NA** GIRDERS: Girders are supported by walls, or pilasters have special ties to secure the anchor bolts. (Section 8.5.1)
- T F NA** CORBEL BEARING: If the frame girders bear on column corbels, the length of bearing is greater than 3 inches. (Section 8.5.2)
- T F NA** CORBEL CONNECTIONS: The frame girders are not supported on corbels with welded elements. (Section 8.5.3)

Roof decking

- T F NA** LIGHT-GAGE METAL, PLASTIC OR CEMENTITIOUS ROOF PANELS: All light-gage metal, plastic or cementitious roof panels are properly connected to the roof framing at not more than 12 inches on center. (Section 8.6.1)
- T F NA** WALL PANELS: All wall panels (metal, fiberglass or cementitious) are properly connected to the wall framing. (Section 8.6.2)

EVALUATION STATEMENTS FOR FOUNDATIONS AND GEOLOGIC SITE HAZARDS

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

Condition of foundations

- T F** FOUNDATION PERFORMANCE: The structure does not show evidence of excessive foundation movement such as settlement or heave that would affect its integrity or strength. (Section 9.1.1)
- T F** DETERIORATION: There is no evidence that foundation elements have deteriorated due to corrosion, sulphate attack, material breakdown or other reasons in a manner that would affect the integrity or strength of the structure. (Section 9.1.2)

Capacity of foundations

- T F** OVERTURNING: The ratio of the effective horizontal dimension, at the foundation level of the seismic-resisting system to the building height (base/height) exceeds 1.4AV. (Section 9.2.1)
- T F** TIES BETWEEN FOUNDATION ELEMENTS: Foundation ties adequate for seismic forces exist where footings, piles and piers are not restrained by beams, slabs or competent soils or rock. (Section 9.2.2)
- T F NA** LOAD PATH AT PILE CAPS: The pile caps are capable of transferring overturning and lateral forces between the structure and individual piles in the pile cap. (Section 9.2.3)
- T F NA** LATERAL FORCE ON DEEP FOUNDATIONS: Piles and piers are capable of transferring the lateral forces between the structure and the soil. (Section 9.2.4)
- T F NA** POLE BUILDINGS: Pole foundations have adequate embedment. (Section 9.2.5)

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T F NA SLOPING SITES: The grade difference from one side of the building to another does not exceed one-half story. (Section 9.2.6)

Geologic site hazards

T F NA LIQUEFACTION: Liquefaction-susceptible, saturated, loose granular soils that could jeopardize the building's seismic performance do not exist in the foundation soils at depths within 50 feet under the building. (Section 9.3.1)

T F SLOPE FAILURE: The building site is sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or is capable of accommodating small, predicted movements without failure. (Section 9.3.2)

T F SURFACE FAULT RUPTURE: Surface fault rupture and surface displacement at the building site are not anticipated. (Section 9.3.3)

EVALUATION STATEMENTS FOR ELEMENTS THAT ARE NOT PART OF THE LATERAL-FORCE-RESISTING SYSTEM

Address the following evaluation statements, marking each either true (T), false (F) or not applicable (N/A). Statements that are found to be true identify issues that are acceptable according to the criteria of these regulations; statements that are found to be false identify issues that need investigation. For guidance in the investigation, refer to the section number indicated in parentheses at the end of the statement.

NONSTRUCTURAL WALLS

Partitions

T F NA MASONRY PARTITIONS: There are no unbraced unreinforced masonry or hollow clay tile partitions in critical care areas, clinical laboratory service spaces, pharmaceutical service spaces, radiological service spaces, and central and sterile supply areas, exit corridors, elevator shafts or stairwells. (Section 10.1.1.1)

T F NA STRUCTURAL SEPARATIONS: At structural separations, partitions in exit corridors have seismic or control joints. (Section 10.1.1.2)

T F NA PARTITION BRACING: In exit corridors, the tops of partitions that extend only to the ceiling line have lateral bracing. (Section 10.1.1.3)

Cladding and veneer

T F NA MASONRY VENEER: Masonry veneer is connected to the back-up with corrosion-resistant ties spaced 24 inches on center maximum with at least one tie for every $2\frac{2}{3}$ square feet. (Section 10.1.2.1)

T F NA CLADDING PANELS IN MOMENT FRAME BUILDINGS: For moment frame buildings of steel or concrete, panels are isolated from the structural frame to absorb predicted interstory drift without collapse. (Section 10.1.2.2)

T F NA CLADDING PANEL CONNECTIONS: Where bearing connections are required, there are at least two bearing connections for each cladding panel, and there are at least four connections for each cladding panel capable of resisting out-of-plane forces. (Section 10.1.2.3)

T F NA CLADDING PANEL CONDITION: Cladding panel connections appear to be installed properly. No connection element is severely deteriorated or corroded. There is no cracking in the panel materials indicative of substantial structural distress. There is no substantial damage to exterior cladding due to water leakage. There is no substantial damage to exterior wall cladding due to temperature movements. (Section 10.1.2.4)

Metal stud back-up systems

T F NA GENERAL: Additional steel studs frame window and door openings. Corrosion of veneer ties, tie screws, studs and stud tracks is minimal. Stud tracks are adequately fastened to the structural frame. (Section 10.1.3.1)

T F NA MASONRY VENEER WITH STUD BACK-UP: Masonry veneer more than 30 feet above the ground is supported by shelf angles or other elements at each floor level. Masonry veneer is adequately anchored to the back-up at locations of through-wall flashing. Masonry veneer is connected to the backup with corrosion-resistant ties spaced 24 inches on center maximum and with at least one tie for every $2\frac{2}{3}$ square feet. (Section 10.1.3.2)

T F NA MASONRY VENEER WITH CONCRETE BLOCK BACK-UP—GENERAL: The concrete block back-up qualifies as reinforced masonry. (Section 10.1.4.1)

T F NA MASONRY VENEER SUPPORT: Masonry veneer more than 30 feet above the ground is supported by shelf angles or other elements at each floor level. Masonry veneer is adequately anchored to the back-up at locations of through-wall flashing. Masonry veneer is connected to the back-up with corrosion-resistant ties spaced 24 inches on center maximum and with at least one tie for every $2\frac{2}{3}$ square feet. The concrete block back-up is positively anchored to the structural frame at 4-foot maximum intervals along the floors and roofs. (Section 10.1.4.2)

Other veneer/panel systems

T F NA THIN STONE VENEER PANELS: Stone anchorages are adequate for computed loads. (Section 10.1.5.1)

T F NA WOOD/AGGREGATE PANELS: There is no visible deterioration of screws or wood at panel attachment points. (Section 10.1.5.2)

Parapets, cornices, ornamentation and appendages

T F NA PARAPETS, CORNICES, ORNAMENTATION AND APPENDAGES: There are no laterally unsupported unreinforced masonry parapets or cornices above the highest anchorage level with height/thickness ratios greater than 1.5. Concrete parapets with height/thickness ratios greater than 1.5 have vertical reinforcement. Cornices, parapets, signs and other appendages that extend above the highest anchorage level or cantilever from exterior wall faces and other exterior wall ornamentation are reinforced and well anchored to the structural system. (Section 10.1.6)

T F NA MEANS OF EGRESS: Canopies are anchored and braced to prevent collapse and blockage of building exits. (Section 10.1.7)

APPENDIX H TO CHAPTER 6 HAZUS AEBM REGULATIONS

6-A1 HAZUS AEBM technology. The Federal Emergency Management Agency (FEMA)/National Institute of Building Sciences (NIBS) Multi-Hazard Loss Estimation Technology (HAZUS-MH MR2) and, specifically, the HAZUS Advanced Engineering Building Module (AEBM) are used by the Office with building-specific parameters, described in this appendix, to evaluate the Probability of Collapse of SPC-1 buildings.

6-A2 Probability of collapse. The Probability of Collapse, P[COL], is calculated by Equation (A6-1):

$$P[\text{COL}] = P[\text{COL}|\text{STR}_5] \times P[\text{STR}_5] \quad (\text{A6-1})$$

where:

P[COL|STR₅] = collapse factor of the HAZUS AEBM, as modified herein, and

P[STR₅] = probability of Complete Structural Damage, based on HAZUS AEBM methods and parameters, as modified herein.

6-A3 Building-specific properties. Building-specific properties are based on the building type (structural system), or Model Building Type (MBT), building height (number of stories above seismic base), building age (pre-1933, 1933–1961 or post-1961 design vintage), availability of materials testing data, and Significant Structural Deficiencies.

Table A6-1 lists Significant Structural Deficiencies. Table A6-1 includes older buildings (pre-1933 buildings) and buildings that do not have available materials test data, and treats these conditions as Significant Structural Deficiencies.

SPC-1 buildings with no Significant Structural Deficiencies are evaluated using “Baseline” values of building-specific properties. SPC-1 buildings with one or more Significant Structural Deficiencies are evaluated using Sub-Baseline (SubBase), or Ultra-Sub-Baseline (USB) building-specific properties, as specified in Table A6-1.

Building-specific properties include parameters related to (1) building capacity, (2) building response, (3) Complete Structural Damage, and (4) building collapse. Appendix H Sections 6-A4 through 6-A7 define the parameters of interest related to building capacity, building response, Complete Structural Damage, and building collapse, respectively, and specify appropriate values of these parameters.

6-A4. Building capacity. Building-specific capacity properties of interest include the yield capacity control point (D_y , A_y) and the ultimate capacity control point (D_u , A_u), as calculated by Equations (A6-2 through A6-5, respectively):

$$A_y = C_s \cdot \gamma / \alpha_1 \quad (\text{A6-2})$$

$$D_y = 9.8 \cdot A_y \cdot T_e^2 \quad (\text{A6-3})$$

$$A_u = \lambda \cdot A_y \quad (\text{A6-4})$$

$$D_u = \lambda \cdot \mu \cdot D_y \quad (\text{A6-5})$$

where:

C_s = seismic design coefficient — values of C_s are given in Tables A6-2a and A6-2b, respectively,

α_1 = modal weight factor, Alpha 1 — values of α_1 are given in Table A6-4,

T_e = elastic period, in seconds — values of T_e are given in Table A6-3,

γ = yield strength factor, Gamma — values of γ are given in Table A6-5,

λ = “overstrength” factor, Lambda — values of λ are given in Table A6-5, and

μ = “ductility” factor, Mu — values of μ are given in Table A6-6.

6-A5 Building response. Building-specific response parameters of interest include the elastic damping factor, β_E , and the degradation factor, Kappa. Values of β_E are given in Table A6-7 and values of the Kappa factor are given in Table A6-8.

6-A-6 Complete structural damage. Building-specific damage parameters of interest include the median spectral displacement of the Complete Structural Damage state, S_{dC} , and the associated lognormal standard deviation (Beta) factor, β_C . Values of β_C are given in Table A6-11. Median spectral displacement at the Complete Structural Damage state, S_{dC} , is calculated using Equation (A6-6):

$$S_{dC} = \Delta_C \cdot H_R \cdot \alpha_2 / \alpha_3 \quad (\text{A6-6})$$

where:

Δ_C = interstory drift ratio (of the story with maximum drift) at the threshold of Complete Structural Damage — values of Δ_C are given in Table A6-9,

H_R = height of building at the roof level, in inches — default values of H_R are given in Table A6-3 as a function of the number of stories above grade,

α_2 = modal height factor, Alpha 2 — values of α_2 are given in Table A6-4, and

α_3 = modal shape factor, Alpha 3, relating maximum-story drift and roof drift, values of α_3 are given in Table A6-10.

6-A-7 Building collapse. Building-specific values of the collapse factor, P[COL|STR₅], that describe the fraction of the building likely to be collapsed given that the building has reached the Complete Structural Damage state, STR₅, are given in Table A6-12.

TABLE A6-1—SIGNIFICANT STRUCTURAL DEFICIENCY MATRIX

SIGNIFICANT STRUCTURAL DEFICIENCY/CONDITION ¹	CAPACITY		RESPONSE		STRUCTURAL DAMAGE - COMPLETE DAMAGE STATE						COLLAPSE	
	Over-Strength		Duration		Fragility Curve Median ⁴				Fragility Curve Variability - Beta Factor (β_c)		Collapse Factor (P[COL : STR _c])	
	Gamma and Lambda Factors		Degradation (Kappa) Factor		Maximum Story Drift Ratio (Δ_c)		Mode Shape (Alpha 3) Factor					
	SubBase	USB	SubBase	USB ⁵	SubBase	USB	SubBase	USB ⁶	SubBase	USB ⁵	SubBase	USB ⁶
Age (Pre-1933 buildings)	X	X ⁷										
Materials Testing (None)	X								X			
No Redundancy									X		X	X ⁶
Weak Story Irregularity					X		X	X ⁶			X	X ⁶
Soft Story Irregularity					X		X	X ⁶			X	X ⁶
Mass Irregularity					X							
Vertical Discontinuity	X				X							
Torsional Irregularity						X					X	X ⁶
Deflection Incompatibility ²					X				X		X	X ⁶
Short Column ³	X					X						
Wood Deterioration		X	X									
Steel Deterioration		X	X									
Concrete Deterioration		X	X									
Weak Column-Steel	X				X							
Weak Column-Concrete	X		X		X							
No Cripple Wall Bracing					X		X	X ⁶			X	X ⁶
Topping Slab	X		X						X		X	X ⁶
Inadequate Wall Anchorage/Parapet Bracing		X							X			
Load Path/Diaphragm Openings									X		X	X ⁶
URM Wall Thickness Ratio											X	X ⁶

1. Sub-Baseline (SubBase) and Ultra-Sub-Baseline (USB) properties are based on one, or more, significant structural deficiencies.
2. The Deflection Incompatibility structural deficiency applies only to concrete systems (C1, C2 and C3).
3. The Short Column structural deficiency applies only to concrete and masonry systems (C1, C2, C3, RM1 and RM2).
4. Effects of deficiencies related to drift and mode shape limited to a combined factor of 5 reduction in Complete median (of HAZUS default value).
5. Grey shading indicates USB performance is not defined/used for deficiencies related to degradation (kappa) and fragility curve (beta) factors.
6. USB performance required for systems with multiple, SubBase deficiencies related to either the mode shape (Alpha 3) factor or the collapse rate.
7. USB performance required for pre-1933 buildings with other over-strength-related deficiencies (else use SubBase performance for pre-1933 buildings).

TABLE A6-2a—SEISMIC DESIGN COEFFICIENT, C_s UBC SEISMIC ZONE 4

NO. OF STORIES	Seismic Design Coefficient, C_s - UBC Seismic Zone 4 Locations (Zone 3 of older editions of the UBC)					
	Structural System (MBT)					
	S1 and C1		S2, S3, S4, S5, C2 and C3 (MH)		W1, W2, PC1, PC2, RM1, RM2, URM	
	Post-61	Pre-61	Post-61	Pre-61	Post-61	Pre-61
1	0.072	0.109	0.100	0.109	0.133	0.109
2	0.057	0.092	0.100	0.092	0.133	0.092
3	0.050	0.080	0.086	0.080	0.114	0.080
4	0.045	0.071	0.078	0.071	0.104	0.071
5	0.042	0.063	0.073	0.063	0.098	0.063
6	0.040	0.057	0.069	0.057	0.092	0.057
7	0.038	0.052	0.066	0.052	0.088	0.052
8	0.036	0.048	0.064	0.048	0.085	0.048
9	0.035	0.044	0.062	0.044	0.082	0.044
10	0.034	0.041	0.060	0.041	0.080	0.041
11	0.032	0.039	0.058	0.039	0.078	0.039
12	0.032	0.036	0.057	0.036	0.076	0.036
13	0.031	0.034	0.056	0.034	0.074	0.034
14	0.030	0.032	0.055	0.032	0.073	0.032
15	0.029	0.031	0.054	0.031	0.072	0.031
16	0.029	0.029	0.053	0.029	0.070	0.029
17	0.028	0.028	0.052	0.028	0.069	0.028
18	0.028	0.027	0.051	0.027	0.068	0.027
19	0.027	0.026	0.051	0.026	0.067	0.026
> = 20	0.027	0.024	0.050	0.039	0.067	0.024

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TABLE A6-2b—SEISMIC DESIGN COEFFICIENT, C_s UBC SEISMIC ZONE 3

NO. OF STORIES	Seismic Design Coefficient, C_s - UBC Seismic Zone 3 Locations (Zone 2 of older editions of the UBC)					
	Structural System (MBT)					
	S1 and C1		S2, S3, S4, S5, C2 and C3 (MH)		W1, W2, PC1, PC2, RM1, RM2, URM	
	Post-61	Pre-61	Post-61	Pre-61	Post-61	Pre-61
1	0.036	0.055	0.050	0.055	0.066	0.055
2	0.028	0.046	0.050	0.046	0.066	0.046
3	0.025	0.040	0.043	0.040	0.057	0.040
4	0.023	0.035	0.039	0.035	0.052	0.035
5	0.021	0.032	0.037	0.032	0.049	0.032
6	0.020	0.029	0.035	0.029	0.046	0.029
7	0.019	0.026	0.033	0.026	0.044	0.026
8	0.018	0.024	0.032	0.024	0.043	0.024
9	0.017	0.022	0.031	0.022	0.041	0.022
10	0.017	0.021	0.030	0.021	0.040	0.021
11	0.016	0.019	0.029	0.019	0.039	0.019
12	0.016	0.018	0.029	0.018	0.038	0.018
13	0.015	0.017	0.028	0.017	0.037	0.017
14	0.015	0.016	0.027	0.016	0.036	0.016
15	0.014	0.015	0.027	0.015	0.036	0.015
16	0.014	0.015	0.026	0.015	0.035	0.015
17	0.014	0.014	0.026	0.014	0.035	0.014
18	0.014	0.013	0.026	0.013	0.034	0.013
19	0.014	0.013	0.025	0.013	0.034	0.013
> = 20	0.013	0.012	0.025	0.012	0.033	0.012

TABLE A6-3—DEFAULT BUILDING HEIGHTS AND ELASTIC PERIODS

NO. OF STORIES	DEFAULT BUILDING HEIGHT, H _R , AND ELASTIC PERIOD, T _e , PROPERTIES													
	Structural System (MBT)													
	W1 AND W2 (MH)		S1		C1		S2		S4 AND S5		C2, C3, PC2, RM1, RM2, URM		S3 AND PC1	
	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)	H _R (ft)	T _e (sec)
1	14	0.35	14	0.40	12	0.40	14	0.40	14	0.35	12	0.35	15	0.35
2	24	0.38	24	0.50	20	0.40	24	0.43	24	0.35	20	0.35	25	0.39
3	34	0.49	36	0.69	30	0.48	36	0.59	36	0.44	30	0.39	35	0.50
4	44	0.60	48	0.87	40	0.62	48	0.73	48	0.55	40	0.48		
5	54	0.70	60	1.04	50	0.76	60	0.86	60	0.65	50	0.57		
6			72	1.20	60	0.89	72	0.99	72	0.74	60	0.65		
7			84	1.36	70	1.03	84	1.11	84	0.84	70	0.73		
8			96	1.51	80	0.16	96	1.22	96	0.92	80	0.81		
9			108	1.66	90	1.29	108	1.34	108	1.01	90	0.88		
10			120	1.81	100	1.41	120	1.45	120	1.09	100	0.95		
11			132	1.95	110	1.54	132	1.55	132	1.17	110	1.02		
12			144	2.09	120	1.67	144	1.66	144	1.25	120	1.09		
13			156	2.23	130	1.79	156	1.76	156	1.33	130	1.16		
14			168	2.36	140	1.91	168	1.86	168	1.40	140	1.23		
15			180	2.50	150	2.04	180	1.96	180	1.48	150	1.29		
16			192	2.63	160	2.16	192	2.06	192	1.55	160	1.35		
17			204	2.76	170	2.28	204	2.15	204	1.62	170	1.42		
18			216	2.89	180	2.40	216	2.25	216	1.70	180	1.48		
19			228	3.02	190	2.52	228	2.34	228	1.77	190	1.54		
> = 20			240	3.14	200	2.64	240	2.43	240	1.84	200	1.60		

TABLE A6-4—ALPHA 1 AND ALPHA 2, MODAL FACTORS

NO. OF STORIES	ALPHA 1 (α ₁) - MODAL WEIGHT FACTOR				ALPHA 2 (α ₂) - MODAL HEIGHT FACTOR	
	Structural System (MBT)					
	S1 and C1	W1, W2, S2, S3, S4, C2, C3, PC2, RM1 and RM2	PC1 and URM	MH	MH	All Systems (except MH)
1	0.75	0.8	0.75	1.00	1.00	0.75
2	0.75	0.8	0.75			0.75
3	0.75	0.8	0.75			0.75
4	0.75	0.8				0.75
5	0.75	0.8				0.75
6	0.73	0.79				0.72
7	0.71	0.78				0.69
8	0.69	0.77				0.66
9	0.67	0.76				0.63
10	0.65	0.75				0.60
11	0.65	0.75				0.60
12	0.65	0.75				0.60
13	0.65	0.75				0.60
14	0.65	0.75				0.60
> =15	0.65	0.75				0.60

TABLE A6-5—LAMBDA FACTOR

NO. OF STORIES	Gamma Factor (γ)	LAMBDA FACTOR (λ)														
		Baseline Performance					SubBase Performance					USB Performance				
		Structural System (MBT)					Structural System (MBT)					Structural System (MBT)				
		W1, S1, C1	W2, C2	S4, C3	Other MBT	PC1, URM	W1, S1, C1	W2, C2	S4 C3	Other MBT	PC1, URM	W1, S1, C1	W2, C2	S4 C3	Other MBT	PC1, URM
1	2.70	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
2	2.50	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
3	2.25	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
4	2.00	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
5	1.88	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
6	1.80	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
7	1.75	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
8	1.71	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
9	1.69	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
10	1.67	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
11	1.65	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
12	1.65	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
13	1.65	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
14	1.65	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17
> = 15	1.65	2.00	2.00	1.83	1.67	1.33	1.75	1.75	1.63	1.50	1.25	1.50	1.50	1.42	1.33	1.17

TABLE A6-6—DUCTILITY FACTOR M_u

NO. OF STORIES	M_u (μ) FACTOR (All Systems)
1	6.00
2	6.00
3	4.94
4	4.41
5	4.07
6	3.82
7	3.63
8	3.48
9	3.35
10	3.24
11	3.15
12	3.07
13	3.00
14	3.00
> = 15	3.00

TABLE A6-7—ELASTIC DAMPING

STRUCTURAL SYSTEM (MBT)	β_E ELASTIC DAMPING (% of Critical)
S1, S2, S3 and S4	5
C1, C2, PC1 and PC2	7
RM1 and RM2	7
C3 and S5	7
W1 and W2	10

TABLE A6-8—DEGRADATION KAPPA FACTORS

SCENARIO EARTHQUAKE CRITERIA		DEGRADATION (Kappa) FACTORS - (K_S , K_M and K_L)			
Minimum Distance Site to Fault ¹ (km)	Maximum Magnitude ²	Baseline Performance		SubBase Performance	
		Post-61	Pre-1961	Post-61	Pre-1961
< 5	All	0.8	0.7	0.6	0.5
5 - 10	$M_{max} \leq 6.5$	0.8	0.7	0.6	0.5
5 - 10	$M_{max} > 6.5$	0.7	0.6	0.5	0.4
10 - 25	$M_{max} \leq 6.5$	0.7	0.6	0.5	0.4
10 - 25	$7.0 \geq M_{max} > 6.5$	0.6	0.5	0.4	0.3
10 - 25	$M_{max} < 7.0$	0.5	0.4	0.3	0.2
25 - 50	$M_{max} \leq 7.0$	0.5	0.4	0.3	0.2
25 - 50	$M_{max} > 7.0$	0.4	0.3	0.2	0.1
> 50	All	0.4	0.3	0.2	0.1

1. Minimum distance to the fault that controls 1-second period ground motions at the building site.
2. Maximum magnitude (M_{max}) of fault that controls 1-second ground motions at the building site.

TABLE A6-9—INTERSTORY DRIFT RATIO — MEDIAN COMPLETE STRUCTURAL DAMAGE

STRUCTURAL SYSTEM (MBT)	INTERSTORY DRIFT RATIO (max story) - MEDIAN COMPLETE STRUCTURAL DAMAGE (DC)					
	Baseline Performance		SubBase Performance		USB Performance	
	Post-61	Pre-61	Post-61	Pre-61	Post-61	Pre-61
W1 and W2 (MH)	0.075	0.075	0.060	0.060	0.038	0.038
S1, C1, S2 and C2	0.060	0.050	0.050	0.040	0.030	0.025
S3, S4, PC1, PC2, RM1 and RM2	0.053	0.044	0.044	0.035	0.027	0.022
S5, C3 and URM		0.035		0.028		0.018

TABLE A6-10—ALPHA 3 (α_3) MODAL SHAPE FACTOR

No. of Stories	ALPHA 3 (α_3) MODAL SHAPE FACTOR - RATION OF MAXIMUM INTERSTORY DRIFT TO AVERAGE INTERSTORY DRIFT								
	When Combined with Baseline Interstory Drift Ratios (Table A6-9)			When Combined with SubBase Interstory Drift Ratios (Table A6-9)			When Combined with USB Interstory Drift Ratios (Table A6-9)		
	Baseline Performance	SubBase Performance	USB Performance	Baseline Performance	SubBase Performance	USB Performance	Baseline Performance	SubBase Performance	USB Performance
1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2	1.21	1.62	2.03	1.21	1.62	2.03	1.21	1.62	2.03
3	1.35	2.04	2.73	1.35	2.04	2.73	1.35	2.04	2.50
4	1.45	2.36	3.27	1.45	2.36	3.27	1.45	2.36	2.50
5	1.54	2.63	3.72	1.54	2.63	3.72	1.54	2.50	2.50
6	1.62	2.87	4.11	1.62	2.87	4.00	1.62	2.50	2.50
7	1.69	3.07	4.46	1.69	3.07	4.00	1.69	2.50	2.50
8	1.75	3.26	4.77	1.75	3.26	4.00	1.75	2.50	2.50
9	1.81	3.43	5.00	1.81	3.43	4.00	1.81	2.50	2.50
10	1.86	3.59	5.00	1.86	3.59	4.00	1.86	2.50	2.50
11	1.91	3.73	5.00	1.91	3.73	4.00	1.91	2.50	2.50
12	1.96	3.87	5.00	1.96	3.87	4.00	1.96	2.50	2.50
13	2.00	4.00	5.00	2.00	4.00	4.00	2.00	2.50	2.50
14	2.04	4.12	5.00	2.04	4.00	4.00	2.04	2.50	2.50
> = 15	2.08	4.23	5.00	2.08	4.00	4.00	2.08	2.50	2.50

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TABLE A6-11—LOGNORMAL STANDARD DEVIATION (BETA) VALUES — COMPLETE STRUCTURAL DAMAGE

NO. OF STORIES	LOGNORMAL STANDARD DEVIATION (BETA) VALUES — COMPLETE STRUCTURAL DAMAGE (β_c)			
	Baseline Performance		SubBase Performance	
	Post-61	Pre-61	Post-61	Pre-61
1	0.85	0.90	0.95	1.00
2	0.85	0.90	0.95	1.00
3	0.85	0.90	0.95	1.00
4	0.84	0.89	0.94	0.99
5	0.83	0.88	0.93	0.98
6	0.82	0.87	0.92	0.97
7	0.81	0.86	0.91	0.96
8	0.80	0.85	0.90	0.95
9	0.79	0.84	0.89	0.94
10	0.78	0.83	0.88	0.93
11	0.77	0.82	0.87	0.92
12	0.76	0.81	0.86	0.91
13	0.75	0.80	0.85	0.90
14	0.75	0.80	0.85	0.90
> =15	0.75	0.80	0.85	0.90

TABLE A6-12—COLLAPSE FACTOR

STRUCTURAL SYSTEM (MBT)	COLLAPSE FACTOR - LIKELIHOOD OF COLLAPSE GIVEN COMPLETE STRUCTURAL DAMAGE - P[COL STR _c]		
	Baseline Performance	SubBase Performance	USB Performance
W1 and W2	0.05	0.10	0.20
S1, S2, S3, S4 and S5	0.08	0.15	0.30
C1, C2 and C3	0.13	0.25	0.50
RM1 and RM2	0.13	0.25	0.50
PC1 and PC2	0.15	0.30	0.60

HISTORY NOTE APPENDIX FOR CHAPTER 6

Administrative Regulations for the Office of Statewide Health Planning and Development California Code of Regulations, Title 24, Part 1

HISTORY:

- > The history notes for prior changes remain within the text of this code.
1. (OSHPD 1/96) Adoption of Chapter 6, Seismic Evaluation Procedures for Hospital Buildings, Part 1, Title 24, C.C.R. Filed with the secretary of state on April 8, 1997, effective April 8, 1997. Approved by the California Building Standards Commission on February 6, 1997.
 2. (OSHPD 1/97) New Article 1-Definitions and Requirements based on SB 1953. Approved by the California Building Standards Commission on March 18, 1998. Filed with the Secretary of State on March 25, 1998, effective March 25, 1998.
 3. (BSC 2/99) Article 1-7, Conflict of Interest Code. Amend Section 1-701. Approved by the Fair Political Practices Committee on October 29, 1999. Filed with the Secretary of State on December 31, 1999, effective January 30, 2000.
 4. (OSHPD EF 1/00) Part 1, Chapter 6, Articles 1, 10, 11 and Appendix. Approved as submitted by the California Building Standards Commission on February 28, 2000. Filed with the Secretary of State on March 3, 2000, effective March 3, 2000. Permanent approval by California Building Standards Commission on May 24, 2000. Certification of Compliance filed with Secretary of State May 26, 2000.
 5. (OSHPD EF 2/00) Part 1, Amend Chapter 6, Articles 1, 2, 10 and 11. Emergency approval by the California Building Standards Commission on May 24, 2000. Filed with the Secretary of State on May 26, 2000, effective May 26, 2000. Permanent approval by California Building Standards Commission September 20, 2000. Certification of Compliance filed with Secretary of State November 15, 2000.
 6. (OSHPD EF 5/01) Emergency adoption of amendments to hospital seismic safety evaluation regulations contained in Title 24, C.C.R., Part 1, Chapter 6. Approved by the California Building Standards Commission on November 28, 2001. Filed with the Secretary of State on December 4, 2001, effective December 4, 2001.
 7. (OSHPD EF 01/02) Amend Chapter 6 and 7 of Part 1. Approved as emergency by the California Building Standards Commission on January 15, 2003, and filed with the Secretary of State on January 16, 2003. Effective January 16, 2003.
 8. (OSHPD EF 01/02) Amend Chapters 6 and 7 of Part 1. Approved as permanent emergency by the California Building Standards Commission. Permanent approval on May 14, 2003. Certification of Compliance filed with the Secretary of State on May 15, 2003. Effective January 16, 2003.
 9. (OSHPD EF 01/05) Amend Part 1, Chapter 6, Article 11 and Table 11.1. Approved as emergency by the California Building Standards Commission on December 13, 2005. Filed with the Secretary of State on December 14, 2005 with an effective date of December 14, 2005.
 10. (OSHPD EF 01/05) Amend Part 1, Chapter 6, Article 11 and Table 11.1. Re-adopted/approved as emergency by the California Building Standards Commission on March 22, 2006. Filed with the Secretary of State on March 30, 2006 with an effective date of March 30, 2006.
 11. (OSHPD 01/04) Amend Article 1 for nonconforming hospital buildings. Filed with Secretary of State on May 23, 2006, and effective on the 30th day after filing with the Secretary of State.
 12. (OSHPD EF 01/05) Amend Title 24, Part 1, Chapter 6, Article 11 and Table 11.1. The language for the permanent rule will remain effective and unchanged from the readoption/approval of Emergency Finding (OSHPD EF 01/05) Supplement dated May 30, 2006. Approved as permanent by the California Building Standards Commission on July 27, 2006 and filed with the Secretary of State on July 28, 2006.
 13. (OSHPD EF 01/07) Amend Title 24, Part 1, Chapter 6, Article 1, Article 2, Article 4, Article 6, Article 11, Table 11.1. Approved by the California Building Standards Commission on July 19, 2007. Filed with the Secretary of State July 20, 2007, effective January 1, 2008.
 14. (OSHPD EF 01-07) Amend Title 24, Part 1, Chapter 6, Article 1, Article 2, Article 4, Article 6, Article 11 and Table 11.1. Approved by the California Building Standards Commission on July 19, 2007. Filed with the Secretary of State on July 20, 2007, effective January 1, 2008. It was approved as permanent by the California Building Standards Commission on May 21, 2008 and filed with the Secretary of State on May 23, 2008.
 15. (OSHPD EF 02/07) Amend Title 24, Part 1, Chapter 6, definitions added and Chapter amended throughout with a new Appendix H to Chapter 6. Approved as an emergency regulation by the California Building Standards Commission on November 14, 2007, filed with the Secretary of State on November 29, 2007. Effective November 29, 2007. It was approved as permanent by the California Building Standards Commission on May 21, 2008 and filed with the Secretary of State on May 23, 2008.
 16. (OSHPD 08/09) Amend Title 24, Part 1, Chapter 6 with amendments throughout. Effective on February 13, 2010.
 17. (OSHPD EF 01/10) Amend Title 24, Part 1, Chapter 6 with updates to HAZUS standards pursuant to SB 499

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(Chapter 601, Statutes of 2009). Effective on February 13, 2010.

18. (OSHPD 02/10) Amend Article 1, Title 24, Chapter 6, effective on August 28, 2011.
19. (OSHPD 01/12 and OSHPD 03/12) Amend Chapter 6, Seismic Evaluation Procedures for Hospital Buildings. Approved by the California Building Standards Commission on January 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.
20. (OSHPD 04/15) Amend Chapter 6, Seismic Evaluation Procedures for Hospital Buildings. Article 1: Section 1.2, 1.3, 1.4.5.1, 1.4.5.1.1, 1.4.5.1.2, 1.4.5.1.3, 1.4.5.1.4, 1.4.5.1.5, 1.5.1, 2.1.2, 2.1.2.1, 2.1.2.2, 2.7, Table 2.5.3, 11.2.2. Approved by the California Building Standards Commission on December 16, 2015, filed with the Secretary of State on December 21, 2015, and effective 30 days after filing with the Secretary of State.
21. 2018 Triennial Code Adoption Cycle (OSHPD 01/18) Amend Chapter 6, Article 1, Sections 1.2, 1.3, 1.4.5.1, 1.4.5.1.1, 1.4.5.1.3, 1.4.5.1.5, 1.5.1 and 1.5.2; Article 2, Sections 2.1.2.1, 2.1.2.2, Table 2.5.3 and 2.7; Article 11, Table 11.1, Sections 11.2.2, 11.2.3 and 11.2.4. Approved by the California Building Standards Commission on December 4, 2018, filed with the Secretary of State on December 7, 2018, and effective 180 days after filing with the Secretary of State pursuant to *California Health and Safety Code*, Section 18938.
22. 2019 Intervening Cycle Update (OSHPD 01/19) Adoption of amendments to the 2019 California Administrative Code (CAC). Approved by the California Building Standards Commission on July 13, 2020, published on January 1, 2021, effective 30 days after filing with Secretary of State.

CHAPTER 7

SAFETY STANDARDS FOR HEALTH FACILITIES

ARTICLE 1 GENERAL

7-101. Scope. The regulations in this part shall apply to the administrative procedures necessary to implement the Alfred E. Alquist Act of 1983 and to comply with State Building Standards Law.

Section 129680, Health and Safety Code, authorizes the OSHPD to enforce and amend the *California Building Standards Code* for the safety of hospitals, skilled nursing facilities and intermediate care facilities.

Unless otherwise stated, all references to sections of statute are sections found in the Health and Safety Code.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-101. Filed with the secretary of state on August 14, 1996, becomes effective September 18, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-103. Jurisdiction. The following are within the jurisdiction of Office of Statewide Health Planning and Development:

(a) For development of regulations in the *California Building Standards Code* and enforcement thereof.

1. Hospital buildings as defined by Section 129725, Health and Safety Code. Correctional Treatment Centers shall certify to the Office in compliance with Section 7-156.
2. Skilled nursing facilities as specified in paragraphs (2) and (3) of subdivision (b) of Section 129725, Health and Safety Code.
3. Intermediate care facilities as specified in paragraphs (2) and (3) of subdivision (b) of Section 129725, Health and Safety Code.

(b) For development of regulations in the *California Building Standards Code*.

1. Clinics, as defined by Section 1200 and 129725 (b) (1), Health and Safety Code, are under the jurisdiction of the local building official for enforcement, except as otherwise specified in Article 21, Section 7-2104 (d) of this chapter.

Exception: When licensed under an acute care hospital and serving more than 25 percent inpatients pursuant to Sections 129725 (b) (1) and 129730, Health and Safety Code, the Office shall retain jurisdiction for enforcement.

2. Correctional Treatment Centers, as defined by Section 129725 (b) 6, 7 (A) or 7 (B), Health and Safety Code, operated by or to be operated by a law enforcement agency of a city, county or a city and county are under the jurisdiction of the local enforcing agency for enforcement.

Correctional Treatment Centers shall certify to the Office in compliance with Section 7-156.

(c) For hospital buildings, skilled nursing facilities and intermediate care facilities, the Office shall also enforce the regulations of the *California Building Standards Code* as adopted by the California Energy Commission, the Office of the State Fire Marshal and the Division of the State Architect/ Access Compliance Section, for Energy Conservation, fire and life safety and accessibility compliance for persons with disabilities, respectively.

Correctional Treatment Centers shall certify to the Office in compliance with Section 7-156.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-103. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD 2/96) 1996 Annual Code Adoption Cycle will amend Section 7-103, of Part 1, Title 24, C.C.R. Filed with the secretary of state on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.

7-104. Alternate method of compliance. The provisions of the *California Building Standards Code* (CBSC) are not intended to prevent the use of any alternate method of compliance not specifically prescribed by the CBSC, provided written approval for such alternate method has been granted by the Office. Alternate methods include Alternate Means of Protection, Alternate Method of Compliance, Alternative System, designs required by regulations to be specifically approved by the enforcing agency, and Program Flexibility. A written request shall be submitted to the Office with an Alternate Method of Compliance form provided by the Office and supporting documentation as necessary to assist the Office in its review. The written request shall include substantiating evidence in support of the alternate. If the request is submitted prior to the submittal of construction documents, an Application for Plan Review form must also be submitted with a fee pursuant to Section 7-133 (a) 3. A request approved by the Office shall be limited to the specific request and shall not be construed as establishing a precedent for any future requests. The provisions of the following sections must also be met: Section 104.11 and Section 1224.2, *California Building Code*; Article 90.4, *California Electrical Code*; Section 105.0, *California Mechanical Code*; Section 301.4, *California Plumbing Code*; and Section 1.11.2.4, *California Fire Code*.

7-105. Authority. (Deleted)

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to delete Section 7-105. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-107. Interpretation. No regulation shall be construed to deprive the Office of its right to exercise the powers conferred upon it by law, or to limit the Office in such enforcement as is necessary to secure safety of construction, as required by Division 107, Chapter 7 (commencing with Section 129675), Health and Safety Code.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

7-109. Application of regulations.

(a) Except as otherwise provided, these regulations and all applicable parts of the *California Building Standards Code* shall be the basis for design, plan review and observation of construction of hospital buildings, skilled nursing facilities and intermediate care facilities.

(b) Deleted.

(c) Additions, structural repairs or alterations to existing health facilities shall be made in accordance with the provisions of Part 2, Title 24, California Code of Regulations, *California Building Standards Code*.

(d) Before any health facility not previously licensed under Section 1250 of the Health and Safety Code can be licensed and used as a health facility, the applicant shall provide substantiating documentation from a structural engineer that the building is in full conformance with the requirements of the *California Building Standards Code* for new buildings; if not, the building shall be reconstructed to conform to the requirements of the *California Building Standards Code*.

(e) Routine maintenance and repairs shall not require prior approval by the Office but shall be performed in compliance with the applicable provisions of the *California Building Standards Code*.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-109. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

ARTICLE 2 DEFINITIONS

Unless otherwise stated, the words and phrases defined in this article shall have the meaning stated therein throughout Chapter 7, Part 1, Title 24.

7-111. Definitions.

ACTUAL CONSTRUCTION COST means the cost of all portions of a project to construct the work as shown on the approved construction documents and as necessary to comply with the *California Building Standards Code*, generally based upon the sum of the construction contract(s), when applicable, and other direct construction costs, including but not limited to mobilization, general and special conditions, supervision and management, overhead, markups and profit, demolition, building pad construction (including but not limited to grading, soil remediation, excavation, trenching,

retaining, shoring, etc.), temporary construction and barriers, materials, supplies, machinery, construction equipment, labor cost or the wages paid to the workers doing the work, etc., as certified by the hospital governing board or authority. Construction cost does not include the compensation paid to the designer(s), inspector(s), plan review and building permit, the cost of the land, rights-of-way, work outside the scope of OSHPD's jurisdiction, mobile equipment and furnishings, or other costs which are defined in the contract documents as not a part of the work. Work requiring a plan approval and/or building permit issued by the Office which is identified as not in the scope of the work and/or not in contract (NIC) shall be performed under a separate building permit.

ADDITION means any work which increases the floor or roof area or the volume of enclosed space of an existing building.

ALTERATION means any change in an existing building which does not increase and may decrease the floor or roof area or the volume of enclosed space.

ALTERNATE METHOD OF COMPLIANCE means the approved use of an alternative material, method of construction, device or design to comply with an architectural, electrical, mechanical or plumbing regulation.

ALTERNATE MEANS OF PROTECTION means the approved use of an alternative material, assembly or method of construction to comply with a fire and life safety regulation pursuant to Section 111.2.4, California Chapter 1, *California Fire Code*.

ALTERNATIVE SYSTEM means the approved use of an alternative material, design or method of construction to comply with a structural regulation.

APPLICATION means any review, evaluation, or process for which the Office has established an application, filing fee, and/or review/process fee, in accordance with its authority in the *California Health and Safety Code*.

APPROVED CONSTRUCTION DOCUMENTS means all plans, specifications, amended construction documents and deferred submittals that have the written approval of the Office. The identification stamp of the Office shall not be construed to mean the written approval of plans required by Section 7-113.

ARCHITECT means a person licensed as an architect under Chapter 3 (commencing with Section 5500), Division 3, the California Business and Professions Code.

ASSIGNMENT means the project scope of services, expected results, completion time and the monetary limitation for the services.

ASSOCIATED STRUCTURAL ALTERATIONS means any change affecting existing structural elements or requiring new structural elements for vertical or lateral support of an otherwise nonstructural alteration.

CANDIDATE means an applicant who is accepted by the Office as eligible to participate in a Hospital Inspector Certification Examination pursuant to the qualification criteria described in these regulations.

CIVIL ENGINEER means a person licensed as a civil engineer under Chapter 7 (commencing with Section 6700), Division 3, the California Business and Professions Code.

CONFORMING BUILDING means a building originally constructed in compliance with the requirements of the 1973 or subsequent edition of the *California Building Code* or classified as SPC-4D, as defined in Chapter 6 of this code.

CONSTRUCTION means any construction, reconstruction or alteration of, or addition or repair to any health facility.

DEFERRED SUBMITTALS see Section 7-126.

DIRECTOR means the Director of the Office of Statewide Health Planning and Development or the Director's designee authorized to act in his or her behalf.

ELECTRICAL ENGINEER means a person licensed as an electrical engineer under Chapter 7 (commencing with Section 6700), Division 3, the California Business and Professions Code.

EMERGENCY REPAIR [OSHPD 1, 2, 3 & 5] Repair to, or replacement of, an element of a building, structure, utility system, or equipment that is essential to the continued safe occupation and operation of a facility. May include repairs needed after a disaster.

ENGINEERING GEOLOGIST means a person certified as an engineering geologist under Chapter 12.5 (commencing with Section 7800), Division 3, the California Business and Professions Code, in that branch of engineering which is applicable.

ESTIMATED CONSTRUCTION COST means the cost estimate of actual construction cost proposed by an applicant for a construction project within the Office's jurisdiction.

FEE means the fees authorized in the *California Health and Safety Code*, and the *California Building Standards Code*.

FIRM includes any qualified corporation, legal entity, architect or engineer.

FREESTANDING as applied to structures that are adjacent to a licensed hospital building means a structure that meets the following criteria:

1. Structural separation shall comply with the applicable provisions of the *California Building Code*.
2. Fire-resistance-rated construction separations shall comply with the applicable provisions of the *California Building Code*.
3. Buildings on the same lot shall comply with the height and area limitations of the *California Building Code*.

HEALTH FACILITY as used in this part and all applicable parts of the *California Building Standards Code* means any health facility licensed pursuant to Section 1250 of the Health and Safety Code under the jurisdiction of the Office.

(a) Hospital building includes:

1. **HOSPITAL BUILDING** as used in this part and other applicable parts of the *California Building Standards Code* means any building used for a health facility of a type required to be licensed pursuant to Section 1250 of the Health and Safety Code.
2. Except as provided in paragraph (7) of subdivision (b), hospital building includes a correctional treatment cen-

ter, as defined in subdivision (j) of Section 1250, the construction of which was completed on or after March 7, 1973.

(b) **HOSPITAL BUILDING** does not include any of the following:

1. Any building in which outpatient clinical services of a health facility licensed pursuant to Section 1250 are provided that is freestanding from a building in which hospital services are provided. If any one or more outpatient clinical services in the building provide services to inpatients, the building shall not be included as a "hospital building" if those services provided to inpatients represent no more than 25 percent of the total outpatient visits provided at the building. Hospitals shall maintain on an ongoing basis, data on the patients receiving services in these buildings, including the number of patients seen, categorized by their inpatient or outpatient status. Hospitals shall submit this data annually to the Department of Public Health.
2. Any building used, or designed to be used, for a skilled nursing facility or intermediate care facility, if the building is of single-story, wood-frame or light steel frame construction.
3. Any building of single-story, wood-frame or light steel frame construction in which only skilled nursing or intermediate care services are provided if the building is separated from a building housing other patients of the health facility receiving higher levels of care.
4. Any freestanding structures of a chemical dependency recovery hospital exempted under the provisions of subdivision (c) of Section 1275.2.
5. Any building licensed to be used as an intermediate care facility/developmentally disabled habilitative with six beds or less and any intermediate care facility/developmentally disabled habilitative of 7 to 15 beds that is a single-story, wood-frame or light-steel frame building.
6. Any building subject to licensure as a correctional treatment center, as defined in subdivision (j) of Section 1250, the construction which was completed prior to March 7, 1973.
7.
 - A. Any building that meets the definition of a correctional treatment center pursuant to subdivision (j) of Section 1250, for which the final design documents were completed or the construction of which was begun prior to January 1, 1994, operated by or to be operated by the Department of Corrections, the Department of the Youth Authority, or by a law enforcement agency of a city, county, or a city and county.
 - B. In the case of reconstruction, alteration, or addition to the facilities identified in this paragraph, and paragraph (6) or any other building subject to licensure as a general acute care hospital, acute psychiatric hospital, correctional treatment center, or nursing facility, as defined in subdivisions (a), (b), (j) and (k) of Section 1250, operated or to be operated by the Department of Corrections, the Department of

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the Youth Authority, or by a law enforcement agency of city, a county, or city and county, only the reconstruction, alteration, or addition, itself, and not the building as a whole, nor any other aspect thereof, shall be required to comply with this chapter or the regulations adopted pursuant thereto.

HOSPITAL BUILDING SAFETY BOARD means the Board which shall advise the Director and, notwithstanding Health and Safety Code Section 13142.6 and except as provided in Section 18945, shall act as a board of appeals in all matters relating to the administration and enforcement of building standards relating to the design, construction, alteration and seismic safety of hospital building projects submitted to the Office pursuant to this chapter.

Further, notwithstanding Section 13142.6, the Board shall act as the board of appeals in matters relating to all fire and panic safety regulations and alternate means of protection determinations for hospital building projects submitted to the Office pursuant to this chapter.

The Board shall consist of 16 members appointed by the Director of the Office. Of the appointive members, two shall be structural engineers, two shall be architects, one shall be an engineering geologist, one shall be a geotechnical engineer, one shall be a mechanical engineer, one shall be an electrical engineer, one shall be a hospital facilities manager, one shall be a local building official, one shall be a general contractor, one shall be a fire and panic safety representative, one shall be a hospital inspector of record and three shall be members of the general public.

There shall be six ex officio members of the Board, who shall be the Director of the Office, the State Fire Marshal, the State Geologist, the Executive Director of the California Building Standards Commission, the State Director of Health Services, and the Deputy Director of the Facilities Development Division in the Office, or their officially designated representatives.

HOSPITAL INSPECTOR means an individual who has passed the OSHPD certification examination and possesses a valid Hospital Inspector Certificate (or Construction Inspector for Health Facilities Certificate) issued by the Office.

HOSPITAL INSPECTOR OF RECORD (IOR) means an individual who is:

- (a) An OSHPD certified Hospital Inspector, pursuant to the provisions of these regulations and
- (b) Employed by the hospital governing board or authority and
- (c) Approved by the architect and/or engineer in responsible charge and the Office as being satisfactory to inspect a specified construction project.

INTEGRATED REVIEW is the process that engages the Office, at its sole discretion, early in the project design and continues through the development and submission of documents during the design phases of conceptualization, criteria design, detailed design, implementation documents, office review, and final plan approval. Within each phase, milestones are established for specific, agreed-upon points in time where segments of the design/building system are completely designed and/or defined in their entirety. The Office provides

an agreed-upon level of review that allows for written conditional acceptance of these elements and/or systems.

LICENSE means the basic document issued by the Department of Health Services permitting the operation of a health facility under the provisions of Title 22, California Code of Regulations, Division 5.

LOCAL GOVERNMENT ENTITY means a building department of a city, city and county, or county.

MAINTENANCE [OSHPD 1, 2, 3 & 5] The routinely recurring work required to keep a facility (plant, building, structure, utility system, etc.) in such condition that it may be continuously utilized, at its original or designed capacity and efficiency, for its intended purpose. Actions necessary for retaining or restoring an existing element or component of a building, piece of equipment, machine, or system to the specified operable condition to achieve its maximum useful life, including corrective maintenance and preventative maintenance.

MANAGED PROJECT means a project where schedules and deadlines relating to plan review and construction are negotiated between the Office and the governing board or authority of the health facility or their designated representative. Managed projects include, but are not limited to, projects approved by the Office for integrated review, as described in Section 7-130, or incremental review, as described in Section 7-131.

MATERIALLY ALTER as applied to construction projects or approved construction documents means any change, alteration or modification, as determined by the Office, that alters the scope of a project, could cause the project to be in non-compliance with the *California Building Standards Code*, or causes an unreasonable risk to the health and safety of patients, staff or the public.

MECHANICAL ENGINEER means a person licensed as a mechanical engineer under Chapter 7 (commencing with Section 6700), Division 3, the California Business and Professions Code.

MINORITY, WOMEN AND DISABLED VETERAN BUSINESS ENTERPRISE shall have the respective meanings set forth in Section 10115.1 of the Public Contract Code.

NONCONFORMING BUILDING means any building that is not a conforming building.

NONSTRUCTURAL ALTERATION means any alteration which neither affects existing structural elements nor requires new structural elements for vertical or lateral support and which does not increase the lateral force in any story by more than five percent.

OFFICE means the Facilities Development Division within the Office of Statewide Health Planning and Development.

PRIMARY GRAVITY LOAD RESISTING SYSTEM (PGLRS) means assembly of structural elements in the building that resists gravity loads, including floor and roof beams/girders supporting gravity loads or any other members designed to support significant gravity loads. Foundations supporting loads from the PGLRS shall be considered part of the PGLRS.

PROGRAM FLEXIBILITY means the approved use of an alternate space utilization, new concepts of design, treatment techniques or alternate finish materials. Program flexibility requests must be reviewed by the Department of Public Health and the Office, or other authority having jurisdiction.

RECONSTRUCTION means the rebuilding of any “existing building” to bring it into full compliance with these regulations and all applicable parts of the *California Building Standards Code*.

SEISMIC FORCE RESISTING SYSTEM (SFRS) means assembly of structural elements in the building that resists seismic loads, including struts, collectors, chords, diaphragms and trusses. Foundations supporting loads from the SFRS shall be considered part of the SFRS.

SIGN, SIGNED, SIGNATURE, SIGNATURES means to affix an individual’s signature by manual, electronic or mechanical methods. Manual method includes, but is not limited to, a pen and ink signature. Electronic method includes, but is not limited to, scanned signature images embedded in construction documents, faxes or other electronic document files. Mechanical method includes, but is not limited to, rubber stamp signature.

SITE DATA means reports of investigation into geology, earthquake ground motion and geotechnical aspects of the site of a health facility construction project.

SMALL BUSINESS means a firm that complies with the provisions of Government Code Section 14837.

START OF CONSTRUCTION [OSHPD 1, 1R, 2, 4 & 5] is the date the actual physical work, demolition, construction, repair, reconstruction, rehabilitation, addition, placement, preparation of the site for the first placement of permanent construction of a building such as the trenching for foundations or utilities, or other improvements or offsite component preparation as shown on the approved construction documents begins.

STRUCTURAL ELEMENTS means floor or roof diaphragms, decking, joists, slabs, beams or girders; columns; bearing walls; retaining walls; masonry or concrete nonbearing walls exceeding one story in height; foundations; shear walls or other lateral force resisting members; and any other elements necessary to the vertical and lateral strength or stability of either the building as a whole or any of its parts including connections between such elements.

STRUCTURAL ENGINEER means a person licensed as a structural engineer under Chapter 7 (commencing with Section 6700), Division 3, the California Business and Professions Code.

STRUCTURAL REPAIRS means any change affecting existing or requiring new structural elements primarily intended to correct the effects of deterioration or impending or actual failure, regardless of cause.

SUBSTANTIAL COMPLIANCE means a stage of a construction or building project, or a designated portion of the project, that is sufficiently complete in accordance with the approved construction plans and the California Building Standards Code such that the owner may use or occupy the building project, or designated portion thereof, for the intended purpose.

VOLUNTARY STRUCTURAL ALTERATION means any alteration of existing structural elements or provision of new structural elements which is not necessary for vertical or lateral support of other work and is initiated by the applicant primarily for the purpose of increasing the vertical or lateral load carrying strength or stiffness of an existing building.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-111. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD 1/96) 1996 Annual Code Adoption Cycle will amend Section 7-111, of Part 1, Title 24, C.C.R. Filed with the secretary of state on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.
3. (OSHPD/EF 1/92) Emergency order by the Office of Statewide Health Planning and Development to amend Sections 7-111 and 7-191, Part 1, Title 24, California Code of Regulations. Filed as an emergency order with the secretary of state September 1, 1992; effective September 1, 1992. Approved as an emergency by the California Building Standards Commission on August 27, 1992.
4. (OSHPD/EF 1/92, permanent) Emergency order by the Office of Statewide Health Planning and Development to amend Sections 7-111 and 7-191, Part 1, Title 24, California Code of Regulations. Filed as a permanent order with the secretary of state on March 9, 1993; effective March 9, 1993. Approved as a permanent order by the California Building Standards Commission on March 5, 1993.

**ARTICLE 3
APPROVAL OF CONSTRUCTION DOCUMENTS**

7-113. Application for plan, report or seismic compliance extension review.

(a) Except as otherwise provided in this part, before commencing construction or alteration of any health facility, the governing board or authority thereof shall submit an application for plan review to the Office, and shall obtain the written approval thereof by the Office describing the scope of work included and any special conditions under which approval is given.

1. The application shall contain a definite identifying name for the health facility, the name of the architect or engineer who is in responsible charge of the work, pursuant to Section 7-115 (a), the names of the delegated architects or engineers responsible for the preparation of portions of the work pursuant to Section 7-115(a)3, the estimated cost of the project and all such other information required for completion of the application. The architect or engineer in responsible charge or having delegated responsibility may name one or more persons to act as an alternate(s), provided such persons are architects or engineers qualified under these regulations to assume the responsibility assigned.
2. Submission of documents to the Office may be in three consecutive stages:
 - A. Geotechnical Review: One application for plan review and, when applicable, three copies of the site data must be attached. Plans may be submitted electronically in a format acceptable to the Office.
 - B. Preliminary Review: Submit drawings electronically or provide two paper copies of reports or pre-

liminary plans and preliminary annotated specifications. If providing paper copies, plans/drawings size shall not exceed 36 × 48 inches, and bundled sets of plans/drawings shall not exceed 40 lbs in weight. Plans may be submitted electronically in a format acceptable to the Office.

- C. Final Review: Submit drawings electronically or provide two paper copies of final construction documents and reports. If providing paper copies, plans/drawings size shall not exceed 36 × 48 inches, and bundled sets of plans/drawings shall not exceed 40 lbs in weight. Plans may be submitted electronically in a format acceptable to the Office.

(b) Application for seismic compliance extension requires submission of OSHPD Application Form #OSHPD-384, “Application for 2008 Extension/Delay in Compliance.” The submittal must comply with the applicable requirements of Chapter 6, Article 1, Section 1.5.2 “Delay in Compliance.”

(c) For every project there shall be an architect or engineer in responsible charge of reviewing and coordinating all submittals, except as set forth in Section 7-115(c).

1. A project may be divided into parts, provided that each part is clearly defined by a building or similar distinct unit. The part, so defined, shall include all portions and utility systems or facilities necessary to the complete functioning of that part. Separate assignments of the delegated architects or engineers pursuant to Section 7-115(a)3 may be made for the parts. Incremental projects pursuant to Section 7-131 shall consist of only one building.

(d) The assignment of the delegated architect or engineer pursuant to Section 7-115 (a) 3 and the responsibility for the preparation of construction documents and the administration of the work of construction for portions of the work shall be clearly designated on the application for approval of reports or construction documents.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-113. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-115. Preparation of construction documents and reports.

(a) All construction documents or reports, except as provided in (c) below shall be prepared under an architect or engineer in responsible charge. Prior to submittal to the office, the architect or engineer in responsible charge for a project shall sign every sheet of the drawings, and the title sheet, cover sheet or signature sheet of specifications and reports. A notation may be provided on the drawings indicating the architect’s or engineer’s role in preparing and reviewing the documents. Plans/drawings submitted to the office shall not exceed the size and weight described in Section 7-113(a)(2).

1. Except as provided in paragraph 2 below, the architect or engineer in responsible charge of the work shall be an architect or structural engineer.

2. For the purposes of this section, a mechanical, electrical or civil engineer may be the engineer in responsible charge of alteration or repair projects that do not affect architectural or structural conditions, and where the work is predominantly of the kind normally performed by mechanical, electrical or civil engineers.

3. The architect or engineer in responsible charge may delegate the preparation of construction documents and administration of the work of construction for designated portions of the work to other architects and/or engineers as provided in (b) below. Preparation of portions of the work by others shall not be construed as relieving the architect or engineer in responsible charge of his rights, duties and responsibilities under Section 129805 of the Health and Safety Code.

(b) Architects or engineers licensed in the appropriate branch of engineering, may be responsible for the preparation of construction documents and administration of the work of construction as permitted by their license, and as provided below. Architects and engineers shall sign and affix their professional stamp to all construction documents or reports that are prepared under their charge. All construction documents shall be signed and stamped prior to issuance of a building permit.

1. The structural construction documents or reports shall be prepared by a structural engineer.
2. A mechanical or electrical engineer may prepare construction documents or reports for projects where the work is predominately of the kind normally prepared by mechanical or electrical engineers.
3. A civil engineer may prepare construction documents or reports for the anchorage and bracing of nonstructural equipment.

(c) A licensed specialty contractor may prepare construction documents and may administer the work of construction for health facility construction projects, subject to the following conditions:

1. The work is performed and supervised by the licensed specialty contractor who prepares the construction documents,
2. The work is not ordinarily within the standard practice of architecture and engineering,
3. The project is not a component of a project prepared pursuant to 7-115(a) and (b),
4. The contractor responsible for the design and installation shall also be the person responsible for the filing of reports, pursuant to Section 7-151,
5. The contractor shall provide with the application for plan review to the Office a written and signed statement stating that he or she is licensed, the number of the license, and that the license is in full force and effect, and
6. The work is limited to one of the following types of projects:
 - A. Fire protection systems where none of the fire sprinkler system piping exceeds 2½ inches (63.5 mm) in diameter.
 - B. Low voltage systems not in excess of 91 volts. These systems include, but are not limited to, telephone,

sound, cable television, closed circuit video, nurse call systems and power limited fire alarm systems.

C. Roofing contractor performing reroofing where minimum $\frac{1}{4}$ inch (6.4 mm) on 12 inch (305 mm) roof slopes are existing and any roof mounted equipment needing remounting does not exceed 400 pounds.

D. Insulation and acoustic media not involving the removal or penetration of fire-rated walls, or ceiling and roof assemblies.

(d) The specification and use of preapprovals does not preempt the plan approval and building permit process. Construction documents using preapprovals shall be submitted to the Office for review and approval and issuance of a building permit prior to the start of construction.

1. The registered design professional, in conjunction with the registered design professional in responsible charge, listed on the plan review application or the building permit application, shall review all qualities, features, and/or properties to ensure code compliance, appropriate integration with other building systems, and proper design for the project-specific conditions and installation. Stamping and signing of construction documents as required in subsection (a) and (b) shall be for this purpose only.
2. When preapprovals are used, they shall be incorporated into the construction documents. Incorporation by reference only is not permitted. Preapprovals must be incorporated without any modification. This subsection shall not apply if modifications are made to the preapproved details.
3. Preapprovals submitted after the construction documents have been approved and a building permit has been issued shall be incorporated into the construction documents in accordance with Section 7-153.
4. The use of preapproved details must strictly comply with all manufacturer's instructions, conditions, special requirements, etc., which are a part of the preapproval.
5. Conditions not covered by a preapproval shall be substantiated with calculations, drawings, specifications, etc., stamped and signed by the registered design professional and signed by the registered design professional in responsible charge listed on the plan review application or building permit application and must be submitted to the OSHPD for review and approval prior to construction.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-115. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-117. Site data.

(a) The site data reports shall be required for all proposed construction except:

1. As provided in Part 2, Title 24.

2. One-story, wood-frame or light steel frame buildings of Type II or V construction and 4,000 square feet or less in floor area not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan.
3. Nonstructural alterations.
4. Structural repairs for other than earthquake damage.
5. Incidental structural additions or alterations.

(b) Three copies of site data reports shall be furnished to the Office for review and evaluation prior to the submittal of the project documents for final plan review. Site data reports shall comply with the requirements of these regulations and Part 2, Title 24. Upon the determination that the investigation of the site and the reporting of the findings was adequate for the design of the project, the Office will issue a letter stating the site data reports are acceptable.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7.117. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-118. Building energy efficiency program. Healthcare facility projects that consist of a newly constructed building or an addition that increases floor area and conditioned volume requires compliance with Title 24, Part 6, *California Energy Code*.

7-119. Functional program.

(a) **General.**

1. **Functional program requirement.** The owner or legal entity responsible for the outcome of the proposed health care facility design and construction project shall be responsible for providing a functional program to the project's architect/engineer and to the Office. The requirement applies to all scopes and disciplines of the project that affect patient care directly or indirectly, by means of new construction, additions, or modifications to specific hospital departmental functions which form an integral part of the facility. Projects that only involve equipment replacement, fire safety upgrades, or renovations that will not change the occupancy, function, or use of existing space shall not require a functional program.

2. **Functional program purpose.**

- A. An owner-approved functional program shall be made available for use by the design professional(s) in the development of project design and construction documents, and shall be submitted to the Office, at the time of application for plan review, to serve as a reference for the review of the application documents.
- B. Revisions to the functional program shall be documented and a final updated version shall be submitted to the Office prior to approval of the construction documents.

C. The facility is encouraged to retain the functional program with other design data to facilitate future alterations, additions, and program changes.

3. Nomenclature in the functional program.

A. The names for spaces and departments used in the functional program shall be consistent with those used in the *California Building Code*. If acronyms are used, they should be defined clearly.

B. The names and spaces indicated in the functional program shall also be consistent with those used on submitted floor plans.

(b) **Functional program executive summary.** An executive summary of the key elements of the functional program shall be provided and, at a minimum, shall include the following narrative:

1. Purpose of the project.

A. The narrative shall describe the services to be provided, expanded, or eliminated by the proposed project.

B. The narrative shall describe the intent of the project and how the proposed modifications will address the intent.

2. Project type and size.

A. The type of health care facility(ies) proposed for the project shall be identified as defined by the *California Building Code*.

B. Project size in square footage (new construction and renovation) and number of stories shall be provided.

3. Construction type/occupancy and building systems.

A. **New construction.** If the proposed project is new construction that is not dependent on or attached to an existing structure, the following shall be included:

- (1) A description of construction type(s) for the proposed project.
- (2) A description of proposed occupancy(ies) and, if applicable, existing occupancy(ies).
- (3) A description of proposed engineering systems.
- (4) A description of proposed fire protection systems.

B. **Renovation.** For a project that is a renovation of, or addition to, an existing building, the following shall be included in the project narrative:

- (1) A description of the existing construction type and the construction type for any proposed renovations or additions shall be described.
- (2) A general description of existing engineering systems serving the area of the building affected by the proposed project and how these systems will be modified, extended, augmented, or replaced by the proposed project.
- (3) A general description of existing fire protection systems serving the area of the building affected by the proposed project and how these systems

will be modified, extended, augmented, or replaced by the proposed project.

(c) **Functional program content.** The functional program for the project shall include the following:

1. **Purpose of the project.** The physical, environmental, or operational factors, or combination thereof, driving the need for the project and how the completed project will address these issues shall be described.

2. Project components and scope.

A. The department(s) affected by the project shall be identified.

B. The services and project components required for the completed project to function as intended shall be described.

3. **Indirect support functions.** The increased (or decreased) demands throughout, workloads, staffing requirements, etc., imposed on support functions affected by the project shall be described. (These functions may or may not reside adjacent to or in the same building or facility with the project.)

4. **Operational requirements.** The operational requirements, which include but are not limited to the following, shall be described:

A. Projected operational use and demand loading for affected departments and/or project components.

B. Relevant operational circulation patterns, including staff, family/visitor, and materials movement.

C. Departmental operational relationships and required agencies

5. **Environment of care requirements.** The functional program shall describe the functional requirements and relationships between the following environment of care components and key elements of the physical environment:

A. **Delivery of care model (concepts).** This shall include:

- (1) A description of the delivery of care model, including any unique features.
- (2) A description of the physical elements and key functional relationships necessary to support the intended delivery of care model.

B. **Patients, visitors, physicians, and staff accommodation and flow.** Design criteria for the following shall be described:

- (1) The physical environment necessary to accommodate facility users and administration of the delivery of care model.
- (2) The physical environment (including travel paths, desired amenities and separation of users and workflow) necessary to create operational efficiencies and facilitate ease of use by patients, families, visitors, staff, and physicians.

C. **Building infrastructure and systems design criteria.** Design criteria for the physical environment necessary to support organizational, technological,

and building systems that facilitate the delivery of care model shall be described.

D. Physical environment. Descriptions of and/or design criteria for the following shall be provided:

- (1) Light and views – How the use and availability of natural light, illumination, and views are to be considered in the design of the physical environment.
- (2) Wayfinding.
- (3) Control of environment – How, by what means, and to what extent users of the finished project are able to control their environment.
- (4) Privacy and confidentiality – How the privacy and confidentiality of the users of the finished project are to be protected.
- (5) Security – How the safety and security of patients or residents, staff, and visitors shall be addressed in the overall planning of the facility consistent with the functional program.
- (6) Architectural details, surfaces, and furnishing characteristics and criteria.
- (7) Cultural responsiveness – How the project addresses and/or responds to local or regional cultural considerations.
- (8) Views of, and access to, nature.

6. Architectural space and equipment requirements.

A. Space list.

- (1) The functional program shall contain a list organized by department or other appropriate functional unit that shows each room in the proposed project, indicating its size by gross floor area and clear floor area.
- (2) The space list shall indicate the spaces to which the following components, if required, are assigned:
 - (a) Fixed and movable medical equipment.
 - (b) Furnishings and fixtures.
 - (c) Technology provisions.

B. Area.

- (1) Gross floor area for the project shall be aggregated by department, and appropriate multiplying factors shall be applied to reflect circulation and wall thicknesses within the department or functional area. This result shall be referred to as department gross square footage (DGSF).
- (2) DGSF for the project shall be aggregated, and appropriate multiplying factors shall be applied to reflect inter-departmental circulation, exterior wall thickness, engineering spaces, general storage spaces, vertical circulation, and any other areas not included within the intra-department calculations. This result shall be referred to as building gross square footage (BGSF) and shall reflect the overall size of the project.

7. Technology requirements. Technology systems for the project shall be identified to serve as a basis for project coordination and budgeting.

- A. Any technology systems integration strategy shall be defined.
- B. Department and room specific detail for system and device deployment shall be developed.

8. Short- and long-term planning considerations. A statement addressing accommodations for the following, as appropriate for the project shall be included:

- A. Future growth.
- B. Impact on existing adjacent facilities.
- C. Impact on existing operations and departments.
- D. Flexibility.

9. Patient safety risk assessment. Projects associated with acute psychiatric hospitals, acute psychiatric nursing units in general acute-care hospitals, and special treatment program service units in skilled nursing facilities shall include a Patient Safety Risk Assessment. At a minimum, a Behavioral and Mental Health Risk Assessment shall be addressed as part of the Patient Safety Risk Assessment. The Patient Safety Risk Assessment shall be subject to review and approval by the California Department of Public Health.

A. Behavioral and mental health risk assessment. A Behavioral and Mental Health Risk Assessment shall be prepared for all acute psychiatric hospitals, psychiatric nursing units within general acute-care hospitals, and special treatment program units in skilled nursing facilities. The risk assessment shall include evaluation of the population at risk and the nature and scope of the project, taking into account the model of care and operational considerations, and proposed built environment solutions to mitigate potential risks and hazards.

B. Behavioral and mental health elements (psychiatric patient injury and suicide prevention). The safety risk assessment report shall identify areas that will serve patients at risk of mental health injury and suicide.

C. Behavioral and mental health response.

- (1) The safety risk assessment team shall identify mitigating features for the identified at-risk locations.
- (2) The design of behavioral and mental health patient care settings shall address the need for a safe treatment environment for those who may present unique challenges and risks as a result of their mental condition.
 - (i) The patient environment shall be designed to protect the privacy, dignity, and health of patients and address the potential risks related to patient elopement; and harm to self, to others, and to the environment.

SAFETY STANDARDS FOR HEALTH FACILITIES

- (ii) The design of behavioral/mental health patient areas shall accommodate the need for clinical and security resources.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675-129998.

Informational Note: Behavioral and mental health risk should be determined through simultaneous consideration of the inherent danger of any individual environmental feature because of patient profile and acuity, the anticipated level of staff supervision for each area, and space visibility and supervision.

The governing body should develop a detailed assessment of the level of risk for each program area where mental health patients will be served (e.g., emergency department, nursing units). Refer to Appendix Table A1.2-a Safety Risk Assessment Team Member Expertise of the *Guidelines for Design and Construction of Hospitals and Outpatient Facilities* published by The Facility Guidelines Institute for areas of expertise needed on the behavioral and mental health assessment team.

Each area should be evaluated to identify the architectural details, surfaces, and furnishings and exposed mechanical and electrical devices and components to be addressed in the risk assessment. Examples of areas to be included in a mental health risk assessment include the following:

Highest Level of Risk

1. Seclusion rooms (where patient acuity poses an increased risk).
2. Patient bedrooms and toilet rooms (areas where patients spend long periods of time out of direct supervision of the staff).
3. Psychiatric emergency department (comprehensive psychiatric emergency program) and area under good supervision but dealing with unpredictable patients under initial evaluation and often under heavy medication.

Moderate Level of Risk

1. Activity spaces, group rooms, and treatment spaces (supervised with good visibility).
2. Dining rooms and recreation spaces, both indoor and outdoor.
3. Corridors (always visible).

Lowest Level of Risk

1. Exam rooms, private offices, and conciliation rooms (always supervised).
2. Staff and support areas (not accessible by patients).

Other information that could be considered can be found in *Patient Safety Standards, Materials and Systems Guidelines* published by the New York State Office of Mental Health, and the *Design Guide for the Built Environment of Behavioral Health Facilities* distributed by The Facility Guidelines Institute.

7-121. Presubmittal meeting.

(a) A presubmittal meeting between the Office and the design professionals is required for construction or alteration projects for hospital buildings and buildings described in paragraphs (2) and (3) of Subdivision (b) of Section 129725 of the Health and Safety Code with estimated construction costs of twenty million dollars (\$20,000,000) or more. The presubmittal meeting shall be held prior to the submittal of preliminary plans and specifications or final construction documents. Prior to scheduling a presubmittal meeting, the architect or engineer in responsible charge shall submit the following information to the Office:

1. Meeting agenda listing major points of discussion.
2. New and if applicable, existing floor plans.
3. Description and scope of the project.
4. Functional Program as described in Section 7-119.
5. Description of structural systems—vertical, lateral, foundation, etc.

6. Alternate method of compliance and program flexibility issues.
7. Type of construction.
8. Occupancy—existing and proposed, with justification.
9. Accessibility considerations, including path of travel.
10. Preliminary means of egress plan.
11. Architectural, structural, mechanical, plumbing, electrical, and fire and life safety issues.

(b) The architect or engineer in responsible charge shall record all resolutions of substantive issues in a letter of understanding that shall be submitted to the Office for acceptance prior to the submittal of final construction documents. The letter of understanding shall be based on the assumptions presented at the presubmittal meeting. Subsequent changes in design, program requirements, project delivery, or other unforeseen issues may necessitate modifications to the letter of understanding.

(c) **Integrated review.** A request for Integrated Review (IR) must be submitted to the Office in writing, prior to the presubmittal meeting being scheduled. In addition to the items listed in Section 7-121 (a), for IR projects, the architect or engineer in responsible charge shall submit the following information to the Office:

1. Complete project schedule.
2. Proposed review matrix outlining all phases, milestones, increments, and segments for the project.
3. Initial draft of the Integrated Review Plan (IRP) proposed, defining roles and accountability of the participants.

Authority: Health and Safety Code Section 18929 and 129675–130070

Reference: Health and Safety Code Section 129850

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-121. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-123. Preliminary plans and specifications.

(a) The governing board or authority or their designated representative may submit preliminary plans and preliminary annotated specifications to the Office for review prior to submittal of the final construction documents.

(b) The Office's review of the preliminary plans and outline specifications shall be limited to the content of the preliminary plans and outline specifications submitted. A copy of the marked-up preliminary plans and outline specifications or of the approved preliminary plans and outline specifications shall accompany the submittal of the final construction documents.

Authority: Health and Safety Code Section 18929 and 129675–130070

Reference: Health and Safety Code Section 129850

7-125. Final review of construction documents.

(a) Final construction documents shall be submitted in accordance with Section 107, Part 2. Title 24. Final construction documents that are incomplete shall be returned to the

applicant for completion prior to acceptance by the Office for plan review.

(b) Local government entity zoning approvals or clearances shall be furnished to the Office, when applicable, prior to approval of the final construction documents by the Office.

(c) When the Office finds items on the final construction documents that do not comply with these regulations and/or applicable sections of the *California Building Standards Code*, the noncomplying items shall be noted in writing with a proper code citation. The marked-up set of construction documents will be returned to the architect or engineer in responsible charge. A set of prints from corrected construction documents shall be filed for backcheck when the original check or subsequent backchecks(s) indicates that extensive changes are necessary. Where necessary corrections are of a minor nature, corrected original construction documents may be filed for backcheck. The architect or engineer in responsible charge must provide a written response to all comments made by the Office. The written response must include a description and a location of the corrections made to the construction documents. The written response may be provided as a letter, or may be provided as responses written directly on the marked-up set of drawings. Changes in construction documents, other than changes necessary for correction, made after submission for approval, shall be brought to the attention of the Office in writing or by submission of revised construction documents identifying those changes. Failure to give such notice voids any subsequent approval given to the construction documents.

(d) The Office's approval of the final construction documents shall be in accordance with Section 107.3.1, Part 2, Title 24.

(e) **Changes in scope.** Changes to the scope of the original project shall be required to be submitted as a separate project.

Exception: At the discretion of the Office, changes in scope may be allowed in the original project. The Office may require the documents to be reviewed as an examination subject to fees required by Section 7-133(q)(3).

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHDP 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-125. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHDP 7/96) 1996 Annual Code Adoption Cycle will amend Section 7-125, of Part 1, Title 24, C.C.R. Filed with the secretary of state on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.

7-126. Deferred submittals.

(a) **Conditions.** Where a portion of the design cannot be fully detailed on the approved construction document because of variations in product design and manufacture, the approval of the construction documents for such portion may be deferred until the material suppliers are selected under the following conditions:

1. The construction documents clearly describe the deferred submittals that shall be approved by the Office

prior to fabrication and installation for the indicated portions of the work.

2. The construction documents fully describe the performance and loading criteria for such work.
3. After the construction documents are approved and within 30 calendar days after commencement of construction, the architect or engineer in responsible charge shall submit a schedule to the Office indicating when the deferred submittals will be submitted to the Office for review.

Exception: Seismic Force Resisting System (SFRS), Primary Gravity Load Resisting System (PGLRS) and stairs shall not be deferred.

(b) **Submittal process and notation.** Submittal documents for deferred submittal items shall be submitted to the architect or engineer to whom responsibility has been delegated for preparation of construction documents, as listed on the application, for review prior to submittal to the Office. The architect or engineer to whom responsibility has been delegated for preparation of construction documents, as listed on the application, shall review and forward submittal documents for deferred submittal items to the Office with a notation indicating that the deferred submittal documents have been reviewed and that they have been found to be in general conformance with the design of the project.

(c) **Stamping and signing.** Stamping and signing of deferred submittals shall comply with Section 7-115(a) and (b).

(d) **Fabrication and installation.** The deferred submittal items shall not be fabricated or installed until their design and submittal documents have been approved by the Office.

(e) **Limitations.** The Office shall have sole discretion as to the portions of the design that may be deferred.

7-127. Projects exempt from plan review process.

(a) The Office may exempt from the plan review process construction or alteration projects for hospitals, skilled nursing facilities and intermediate care facilities, if the project meets the following criteria:

1. The estimated construction cost is \$50,000 or less. For the purpose of determining eligibility for exemption from the plan review process, the estimated construction cost excludes imaging equipment costs; design fees; inspection fees; off-site work; and fixed equipment costs, including but not limited to sterilizers, chillers and boilers.
2. The construction documents are stamped and signed pursuant to Section 7-115(a) and (b).
3. The entire project or an element of the project shall not pose a clear and significant risk to the health and safety of the patients, staff or public.

(b) Projects subdivided into smaller projects for the purpose of evading the cost limitation requirement shall not be exempt from the plan review process. (c) All requirements of Article 4, Construction must be met, except Section 7-135(a)1.

7-128. Work performed without a permit.

(a) **Compliance examination.** Construction or alteration of any health facility, governed under these regulations, per-

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formed without the benefit of review, permitting, and/or observation by the Office when review, permitting and/or observation is required, and without the exemption by the Office provided for in Section 7-127, shall be subject to examination by the Office to assess relevant code compliance.

1. Whenever it is necessary to make an inspection to enforce any applicable provision of the *California Building Standards Code* or the Alfred E. Alquist Hospital Facilities Seismic Safety Act, or the Office, or its authorized representative, has reasonable cause to believe that there exists in any building or upon any premises any condition or violation of any applicable building standards that makes the building or premises unsafe, dangerous, or hazardous, the Office or its authorized representatives may enter the building or premises at any reasonable time for the purpose of inspection and examination authorized by this chapter.
2. Examination by the Office may include, but is not limited to:
 - A. Review of existing plans;
 - B. Site visit(s) as necessary to assess the extent of unpermitted work;
 - C. Inspection of work for the purpose of determining compliance including destructive demolition as necessary in accordance with *California Building Code* Section 110.1 including the removal and/or replacement of any material required to allow inspection, and potentially destructive testing needed to demonstrate compliance with the *California Existing Building Code*; and
 - D. Participation in a predesign conference with architects/engineers to resolve code issues relevant to the corrective or remedial work necessary.

(b) **Plan review.** Construction or alteration of any health facility, governed under these regulations, performed without the benefit of review, permitting and/or observation by the Office, and construction or alteration found in violation of any applicable section of the *California Building Standards Code* during examination, shall be brought into compliance with the current enforceable edition of the *California Building Standards Code*. Application for Office review of construction documents and reports for the construction or alteration and corrective work necessary to remedy any violations, unsafe, dangerous, or hazardous conditions shall be made in accordance with Sections 7-113 through 7-126. The construction documents and reports shall be prepared under an architect or engineer in responsible charge pursuant to Section 7-115 and shall clearly and separately delineate the following:

1. Portions of the building or structure that existed prior to the unpermitted construction or alteration;
2. The unpermitted construction or alteration work that is proposed to remain, including all associated dimensions, assemblies, specifications and details; and
3. New corrective or remedial work necessary to bring the unpermitted construction or alteration work into compliance with all applicable parts of the current *California Building Standards Code*.

(c) **Construction observation.** The construction, inspection and observation of any construction or alteration of any health facility, governed under these regulations, previously performed without the benefit of review, permitting, and/or observation, and of any new corrective or remedial work deemed necessary by the Office, shall be in accordance with Article 4 of this Chapter. The Office shall make such observation as in its judgment is necessary or proper for the enforcement of these regulations and all applicable parts of the *California Building Standards Code*. Any violations found in existing, previously constructed or altered, or new corrective or remedial work shall be corrected as required under *California Building Code* Section 110.6.

(d) **Fees.** Fees associated with compliance examination, plan review and field observation shall be in accordance with the following:

1. The fee for examination shall be the Office's actual costs associated with:
 - A. Field investigation and Office support as described in Section 7-128(a)2; and
 - B. Legal and administrative costs associated with documentation and reporting of violations of licensing statutes and/or pursuing claims of misconduct with the relative Departments and Boards, including but not limited to:
 - 1) The California Department of Public Health;
 - 2) The California Architects Board;
 - 3) The Board for Professional Engineers, Land Surveyors, and Geologists; and
 - 4) The Contractors State License Board.
2. A separate, additional, fee for plan review described in Section 7-128(b) and field observation described in Section 7-128(c) shall be based on the estimated cost of construction as specified below:
 - A. The fee for hospital buildings is 2.0 percent of the estimated construction cost. <
 - B. The fee for skilled nursing and intermediate care facilities, as defined in Subdivision (c), (d), (e) or (g) of Section 1250, Health and Safety Code, is 1.5 percent of the estimated construction cost. <
 - C. The estimated construction cost for a project shall be determined as described in Section 7-133(a)4 and shall include the value of the previously unpermitted construction, or alteration, plus the value of any new corrective and remedial work.
 - D. The final approval of the work shall be in accordance with Section 7-133 (a) 7.

(e) **Occupancy.** Upon determination that construction or alteration of any health facility, governed under these regulations, has occurred without the benefit of review, permitting, and/or observation by the Office, and without the exemption by the Office provided for in Section 7-127, the Office may order the area of construction or alteration to be vacated and remain unoccupied, or that the current certificate of occupancy for the building be revoked under *California Building Code* Section 111.4, until the Office provides a certificate of

occupancy upon the completion of all field observation and final construction inspection of the construction or alteration, and associated corrective and remedial work.

Authority: Health and Safety Code Sections 18929 and 129765 -130070.

Reference: Health and Safety Code Section 129850.

7-129. Time limitations.

(a) Final construction documents shall be submitted to the Office within one year of the date of the Office's report on preliminary plans and outline specifications or the application shall become void unless an extension has been requested and approved. The architect or engineer in responsible charge may request one extension of up to 180 calendar days; however, the Office may require that the construction documents meet current regulations. The extension must be requested in writing and justifiable cause demonstrated.

(b) The procedures leading to obtaining written approval of final construction documents shall be carried to conclusion without suspension or unnecessary delay. Unless an extension has been approved by the Office, the application shall become void when paragraph 1, 2 or 3 occurs:

1. If project actual construction cost is \$500,000 or less and construction documents are not filed for backcheck within 45 calendar days after the date of return of checked construction documents to the architect or engineer in responsible charge. Backcheck submittals that do not contain a written response to all comments in accordance with Section 7-125(c) shall not be considered an official submittal to the Office. The architect or engineer in responsible charge may request one extension of up to 45 calendar days; however, the Office may require the construction documents be revised to meet current regulations. The extension must be requested in writing and justifiable cause demonstrated.
2. If project actual construction cost is greater than \$500,000 and construction documents are not filed for backcheck within 90 calendar days after the date of return of checked construction documents to the architect or engineer in responsible charge. Backcheck submittals that do not contain a written response to all comments in accordance with Section 7-125 (c) shall not be considered an official submittal to the Office. The architect or engineer in responsible charge may request one extension of up to 90 calendar days; however, the Office may require the construction documents be revised to meet current regulations. The extension must be requested in writing and justifiable cause demonstrated.
3. A set of stamped construction documents are not submitted to the Office within 45 calendar days after the date shown with the identification stamp by the Office.

(c) Construction, in accordance with the approved construction documents, shall commence within one year after obtaining the written approval of construction documents, or this approval shall become void. Prior to the approval becoming void, the applicant may apply for one extension of up to one year. The Office may require that the construction documents be revised to meet current regulations before granting

an extension. The extensions must be requested in writing and justifiable cause demonstrated.

(d) If the work of construction is suspended or abandoned for any reason for a period of one year following its commencement, the Office's approval shall become void. Prior to the approval becoming void, the applicant may apply for one extension of up to one year. The Office may require that the construction documents be revised to meet current regulations before granting an extension. The extensions must be requested in writing and justifiable cause demonstrated. For the purpose of building permit time limitation, a project shall be considered abandoned when the work of construction, if any, performed during any twelve-month period does not result in a minimum of ten percent increase in the overall percentage of construction work for the project based on either its scope or cost and no extension for time has been approved by the office.

Exception: The time limitations and deadlines specified in Section 7-129 (a) and (b) shall not apply to managed projects as defined in Section 7-111. This includes, but is not limited to, projects approved for integrated review, as described in Section 7-130, or incremental review, as described in Section 7-131.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-129. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-130. Integrated submittal, review and approval.

The Office, at its sole discretion, may enter into a written agreement with the hospital governing board or authority for the integrated submittal, review and approval of construction documents.

7-131. Incremental design, bidding and construction.

(a) In accordance with Section 107.3.3, Part 2, Title 24, the Office is authorized to review and approve construction documents and issue a permit for increments of a building or structure prior to the construction documents for the entire building or structure have been submitted and approved, provided that adequate information and detailed statements have been filed complying with pertinent requirements of applicable codes. For other regulations pertaining to incremental design, bidding and construction, see Section 107.3.3, Part 2, Title 24.

(b) Increments shall be limited to complete phases of construction, such as demolition, site work and utilities, foundations and basement walls, structural framing, architectural work, mechanical work, electrical work, etc. A master plan identifying the work to be completed in each increment, an estimated cost for each increment, and a chart showing the proposed coordination of the design, bidding and construction schedules, state and local plan review times, and estimated completion and occupancy of the project shall be submitted with the first increment.

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(c) The incremental submittals and construction shall be continuous to conclusion without suspension or unnecessary delay unless specifically approved by the Office.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-131. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-132. Design/build method.

Projects prepared under the design/build delivery method shall comply with all applicable requirements of Title 24, Part 1, California Administrative Code including but not limited to Sections 7-115, 7-141, 7-143, 7-144, 7-145, 7-149, 7-151, 7-153 and 7-155.

Authority: Health and Safety Code Section 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-133. Fees.

(a) **Plan review and field observation.** The fee for plan review and field observation shall be based on the estimated cost of construction as specified below. If the actual construction cost for a hospital or skilled nursing facility project exceeds the estimated construction cost by more than five percent (5%), a further fee shall be paid to the Office, based on the applicable schedule specified in (a) (1) or (2) and computed on the amount by which the actual cost exceeds the estimated cost.

1. The fee for hospital construction projects with an estimated construction cost of \$250,000 or more is 1.64 percent of the estimated construction cost.
 - A. For projects under \$250,000, the fee is 2.0 percent of the estimated construction cost.
 - B. The Office shall charge actual costs for review and approval of seismic evaluations and compliance plans prepared pursuant to Article 8, Chapter 1, Part 7, Division 107, (commencing with Section 130000) of the Health and Safety Code. Total cost paid for these review services shall be nonrefundable.
2. The fee for skilled nursing and intermediate care facilities, as defined in Subdivision (c), (d), (e) or (g) of Section 1250, Health and Safety Code, is 1.5 percent of the estimated construction cost.
3. The minimum filing fee shall be \$250.00. This filing fee is nonrefundable.
4. The estimated construction cost for a project shall be determined as follows:
 - A. An applicant shall submit the estimated cost of construction for a project as part of the project application. Applicants for projects with an estimated construction cost greater than \$20 million, and any others as requested by the Office, shall submit justification of the estimated construction costs as part of the project application.

B. In the event that the Office believes that a project's estimated construction cost may be inaccurate or undervalued, the Office may request that the applicant provide supplemental documentation to substantiate the estimated construction cost. The documentation may include, but is not limited to, design estimates, construction contracts, bid estimates, and/or budget estimates.

C. If, upon review, the Office determines that reasonable grounds exist to find that the estimated construction cost is underestimated or undervalued, the Office will provide the applicant in question an opportunity to participate in a formal conference and/or present additional evidence before a final determination as to the validity of the estimated construction cost is made.

D. The Office will make a final determination as to the validity of the estimated construction cost after considering all of the evidence on record, including the formal conference and/or any supplemental documentation provided by the applicant.

E. In the event the Office makes a final determination that the estimated construction cost is underestimated or undervalued, the Office may deem the application incomplete and deny the project application until the applicant either: (a) revises the estimated construction cost to the Office's reasonable satisfaction, or (b) produces further documentation to substantiate the estimated construction cost to the Office's reasonable satisfaction. A notice of denial will be provided to the applicant in writing and may be appealed to a Hearing Officer consistent with Article 5.5.

5. Upon receipt of an application, the Office will calculate the fee for the proposed project or process and send an invoice to the applicant for the required fee amount. Payment is due within thirty (30) days of receipt of the invoice. A project application is incomplete until payment in full is received by the Office for the invoiced fee amount.

6. The Office may, but is not required to, provide plan review, field observation and other services for projects or processes with incomplete applications. The Office may, at its discretion, cease work on any project or process until the relevant application is deemed complete. The Office may, at its discretion, prioritize projects or processes with complete applications before projects or processes with incomplete applications, and may allocate resources for the plan review or process based upon the date that each respective application is deemed complete.

If the Office, as a courtesy, provides plan review, field observation or other services for a project or process with an incomplete application, it shall not be deemed a waiver of the Office's right to: (a) cease or postpone work on the project or process in question at a future date; (b) cease or postpone work on other projects or processes with incomplete applications until the

applications in question are deemed complete; and/or (c) pursue any and all legal remedies for collection of monies owed.

7. Upon completion of all work in accordance with the approved construction documents and receipt of all required verified compliance reports and testing and inspection reports, the Office will grant final approval of the work when all remaining fees based on the actual construction cost, if any, have been paid to the Office. The actual construction cost for a project shall be determined as follows:
 - A. The hospital governing board or authority shall submit the actual construction cost for a project as part of the final approval of the work.
 - B. In the event that the Office believes that a project's actual construction cost may be understated, the Office may request that the hospital governing board or authority provide supplemental documentation to substantiate the actual construction cost. This supplemental information may include, but is not limited to, executed construction contracts, paid invoices, approved change orders, cancelled checks, etc.
 - C. If, upon review of the supplemental information, the Office determines that reasonable grounds exist to find that the actual construction cost is understated, the Office may provide the hospital governing board or authority in question an opportunity to participate in a formal conference and/or present additional evidence before a final determination as to the validity of the actual construction cost is made.
 - D. The Office will make a final determination as to the validity of the actual construction cost after considering all of the evidence on record, including the formal conference and/or any supplemental information provided by the hospital governing board or authority.
 - E. In the event that the Office makes a final determination that the actual construction cost is understated, the Office may deem the project as noncompliant with the Alfred E. Alquist Hospital Facilities Seismic Safety Act until the hospital governing board or authority either: (a) revises the actual construction cost to the Office's reasonable satisfaction, or (b) produces further supplemental information to substantiate the actual construction cost to the Office's reasonable satisfaction. A notice of denial will be provided to the hospital governing board or authority in writing and may be appealed to a Hearing Officer consistent with Article 5.5.

The Office may, but is not required to, provide a final construction inspection, field observation, issue a certificate of occupancy or other services for projects or processes for which all fees have not been paid. The Office may, at its discretion, cease work on any project or process until all remaining fees have been paid to the Office's satisfaction in accordance with Section 7-155. The Office may, at its discretion, prioritize projects or

processes for which all remaining fees have been paid, before projects or processes for which outstanding fees are owed the Office and may allocate resources for its services based upon the date that all outstanding fees for each respective project or process has been paid to the Office's satisfaction.

If the Office, as a courtesy, provides a final construction inspection, field observation, certificate of occupancy, or other services for a project or process for which remaining fees have not been paid, it shall not be deemed a waiver of the Office's right to: (a) cease or postpone work on the project or process in question at a future date; (b) cease or postpone work on other projects or processes in noncompliance until the remaining fees have been paid to the Office's satisfaction; and/or (c) pursue any and all legal remedies for collection of monies owed.

(b) The fee for submitting an amended seismic evaluation report or compliance plan is \$250. The fee for review and approval of the amended report or compliance plan shall be subject to Section 7-133(a)1A above.

(c) The fee for submitting an application for extension to seismic compliance is \$250. The fee for review and approval or granting of a seismic extension shall be subject to Section 7-133(a)1A above.

(d) **Preliminary review.** The fee for review of preliminary plans and outline specifications pursuant to Section 7-121 is 10 percent of the fee indicated in Section 7-133(a) and shall be due upon the submission of preliminary plans and outline specifications. The preliminary review fee is nonrefundable and shall be deducted from the application fee specified in Section 7-133(a).

(e) **Incremental projects.** The fee for incremental projects pursuant to Section 7-131 is based upon the estimated construction cost of each increment, as calculated in accordance with Section 7-133(a), and shall be due upon the first submission of the construction documents of each construction increment. The final fee shall be based upon the determination of the final actual construction cost of all increments in accordance with Section 7-133(a).

(f) **Annual permit for hospital projects.** A hospital may choose to apply for an annual permit for one or more small projects of \$50,000 or less in cumulative total estimated construction cost. The annual permit is applicable to only the project(s) submitted within the state's fiscal year in which the Office issues the annual permit. An application filing fee of \$500.00 is due upon submittal of the annual permit and is in lieu of an application filing fee specified in (a) of this Section.

(g) **Annual permit for skilled nursing facility projects.** A skilled nursing facility may choose to apply for an annual permit for one or more small projects of \$25,000 or less in cumulative total estimated construction cost. The annual permit is applicable to only the project(s) submitted within the state's fiscal year in which the Office issues the annual permit. An application filing fee of \$250.00 is due upon submittal of the annual permit and is in lieu of an application filing fee, as specified in (a) of this Section.

(h) Integrated review submittal.

1. The fee for integrated review and approval pursuant to Section 7-130 shall be 1.95 percent of the estimated construction cost as calculated in accordance with Section 7-133(a) 4 through 7. A nonrefundable fee of 10 percent of the fee shall be due upon approval of the written agreement and shall be deducted from the application fee specified in Section 7-133(a) or fees pursuant to Section 7-133(e) for incremental reviews.

(i) Geotechnical/Geohazard reports. The fee for review of a geotechnical/geohazard report shall be \$5,000.00.

(j) Deferral of fee payment for disaster-related projects.

1. A health facility may request to defer payment of the filing fee, as described in this section, for up to one year, for a construction or alteration project to repair damage resulting from an event which the governor has declared as a disaster. The request for payment deferral must be submitted to the Office, in writing, and accompany the application for plan review. The request may be on a form, as provided by the Office, or other written format and shall identify the facility name, project number, estimated construction cost and shall certify to the following:

- A. The repair project is necessary due to damage sustained by the [name of the specified event] which was declared to be a disaster by the governor on [date of the declaration].
- B. The facility cannot presently afford to pay the filing fee.
- C. On [date of application], the health facility applied for federal disaster relief from the Federal Emergency Agency (FEMA) with respect to the disaster identified in this request.
- D. The facility expects to receive financial assistance within one year of the date of the application for disaster relief.

Payment deferral requests shall be signed by the health facility's chief executive officer or chief financial officer.

2. Within ten business days of receipt of a facility's payment deferral request, the facility will be given written notice by the deputy director either approving or denying the deferral of the project plan review fee. Incomplete requests will be returned to the facility by facsimile within five business days, accompanied by a statement describing what is needed for the request to be complete.
3. If the deferral request is denied by the deputy director, the health facility may appeal this decision to the director of the Office. The appellant must submit a written appeal to the Office within ten business days of receipt of the denial. If an appeal is not received by the Office within the ten business days, the project will be returned to the health facility as incomplete.
4. The plan review fees deferred under this section shall be due and paid in full by the applicant facility within one year from the date of the Office's approval of the

project plans. Failure to submit the deferred fee payment will result in an offset against any amount owed by the state to the health facility.

(k) Seismic examination. The Office shall charge actual costs for the seismic examination of the condition of a hospital building upon written request to the Office by the governing board or authority of any hospital, pursuant to Section 129835 of the Health and Safety Code. In addition, the minimum filing fee of \$250.00 shall apply to each application pursuant to Health and Safety Code Section 129785(a). The total cost paid for these services shall be nonrefundable.

(l) OSHPD Special Seismic Certification preapproval (OSP). The Office shall charge for actual review time of new and renewal OSPs at prevailing hourly rates applicable for the review personnel. In addition, the minimum filing fee of \$250.00 shall apply to each new and renewal application, pursuant to Section 129785(a) of the Health and Safety Code. The total cost paid for these services shall be nonrefundable.

(m) OSHPD Preapproval of Manufacturer's Certification (OPM). The Office shall charge for actual review time of the OPM at prevailing hourly rates applicable for the review personnel, pursuant to Section 129895 of the Health and Safety Code. In addition, the minimum filing fee of \$250.00 shall apply to each new and renewal application, pursuant to Section 129785(a) of the Health and Safety Code. The total cost paid for these services shall be nonrefundable.

(n) Work performed without a permit. Fees associated with examination, plan review, and construction observation for construction or alteration of any health facility, governed under these regulations, performed without the benefit of review, permitting, and/or observation by the Office, and without the exemption by the Office provided for in Section 7-127, shall be determined in accordance with Section 7-128(d).

(o) SPC-1 hospital building seismic compliance extensions. The Office shall charge actual costs to cover the review and verification of the extension documents submitted, pursuant to Section 130060(g) of the Health and Safety Code. The total cost paid for these services shall be nonrefundable.

(p) Alternate Method of Compliance. The fee for an Alternate Method of Compliance/Protection (AMC) application is \$250.00. In addition, the Office shall charge actual costs for review of AMCs involving examination on the condition of any hospital building, including but not limited to review for equivalency to the California Building Standards Code. The total cost paid for these services shall be nonrefundable.

(q) Amended construction documents. The fee for submittal and review of Amended Construction Documents shall be as follows:

1. **Additional costs.** The minimum filing fee for Amended Construction Documents which result in additional construction costs shall be \$250.00.
2. **Cost reductions.** The minimum filing fee for Amended Construction Documents with cost reductions or no cost shall be \$500.00.
3. **Review by examination.** The filing fee for Amended Construction Documents with a change in scope, as defined in Section 7-153(d) exception, shall be \$250.00.

In addition, the Office shall charge actual costs associated with the examination and review of such documents.

The filing fees established in this subsection are nonrefundable.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129785 and 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-133. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD/EF 1/91) Emergency order by the Office of Statewide Health Planning and Development to amend Section 7-133, Part 1, Title 24, California Code of Regulations. Filed as an emergency order with the secretary of state September 25, 1991; effective September 25, 1991. Approved as an emergency by the California Building Standards Commission on September 20, 1991.
3. (OSHPD/EF 1/91) Permanent order by the Office of Statewide Health Planning and Development to amend Section 7-133, Part 1, Title 24, California Code of Regulations. Filed as a permanent order with the secretary of state February 25, 1992; effective September 25, 1991. Approved as an emergency by the California Building Standards Commission on February 24, 1992.

7-134. Fee refund

(a) Upon written request from the applicant, a fee refund may be issued pursuant to this section.

1. The written refund request must be submitted to the Office within:
 - a. One year from the date that a Certificate of Occupancy or a Certificate of Substantial Compliance is issued by the office,
 - b. One year from the date the project is withdrawn by the applicant, or
 - c. One year from the date when an application may become void, based on the requirements of Section 7-129, Time Limitations for Approval.
2. No refund shall be issued before the date the project is closed or withdrawn or the application is voided.
3. If delinquent fees are owed to the Office for any health facility construction project at the subject facility, no refund shall be issued until the delinquent fees are paid.
4. Refunds, pursuant to Section 7-134, shall be exclusive of the \$250 filing fee.
5. Refunds shall be calculated pursuant to Sections 7-134 (b) or (c).

(b) Refunds for projects that are completed. If the estimated construction cost of a project exceeds the actual construction cost by more than five percent (5%), the excess portion of the fees paid pursuant to Section 7-133(a)(1) or (2) shall be refunded to the applicant health facility. The refund amount shall be computed based on the amount by which the estimated cost exceeds the actual construction cost.

Exception: The Office will not issue a refund if the applicant did not complete construction of at least 75% of the square footage included in the original approved construction documents for the project, or if the applicant reduces

the scope of the project shown on the original approved plans by more than 25%.

(c) Refunds for projects that are withdrawn or cancelled. A portion of the fees paid to the Office, pursuant to Section 7-133, may be refunded to the applicant under the following specified circumstances:

1. If the applicant withdraws a project prior to commencement of plan review, the total fee, exclusive of the \$250 filing fee, shall be refunded to the applicant.
2. If the applicant withdraws a project after commencement of plan review and prior to commencement of construction, 30% of the fee submitted for that project shall be refunded to the applicant.
3. If the applicant cancels a project after commencement of construction, the Office shall not issue a refund.
4. If a project submitted under an annual permit is withdrawn by the applicant, the \$250 filing fee shall not be refunded by the Office.
5. If fees are paid for a project that is determined by the Office to be exempt from the plan review process or otherwise not reviewable under the Office's jurisdiction, the total fee, exclusive of the \$250 filing fee, shall be refunded to the applicant.

(d) If the applicant is able to demonstrate extraordinary circumstances, the Director of the Office may authorize refunds in addition to those specified above.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129785.

ARTICLE 4 CONSTRUCTION

7-135. Time of beginning construction.

(a) Construction shall not commence until the health facility has applied for and obtained from the Office:

1. Written approval of the construction documents.
2. A building permit.
3. Written approval of the testing, inspection and observation program.
4. Written approval of the inspector of record for the project pursuant to Section 7-212(a).

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-135. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-137. Notice of start of construction.

(a) As soon as a contract has been awarded, the governing board or authority of the health facility shall provide to the Office, on a form provided by the Office, the following:

1. Name and address of the contractor.
2. Contract price.

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3. Date on which contract was awarded.
4. Date of construction start.

Authority: Health and Safety Code Sections 127015, 129785 and 129850; and Government Code, Section 11152.

Reference: Health and Safety Code Section 129785.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-137. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-139. Notice of suspension of construction.

(a) When construction is suspended for more than two weeks, the governing board or authority of the hospital shall notify the Office in writing.

(b) If the work of construction is suspended or abandoned for any reason for a period of one year following its commencement, the Office's approval shall become void. The Office may reinstate the approval as described in Section 7-129(c).

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-139. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-141. Administration of construction.

(a) The administration of the work of construction, including the testing, inspection and observation program, shall be under the responsible charge of an architect and structural engineer. When a structural engineer is not substantially involved, the architect shall be solely responsible. Where neither structural nor architectural elements are substantially involved, a mechanical or electrical engineer registered in the branch of engineering most applicable to the project may be in responsible charge.

(b) All architects and engineers to whom responsibility has been delegated for preparation of construction documents as listed on the application shall observe the work of construction for their portion of the project. They shall consult with the architect or engineer in responsible charge in the interpretation of the approved construction documents, the preparation of changes to the approved construction documents and deferred submittals and the selection of approved agencies.

(c) The architect or engineer in responsible charge or having delegated responsibility may name one or more persons to act as alternate(s) for observation of the work of construction provided such persons are architects or engineers qualified under these regulations to assume the responsibility assigned.

(d) The architect and/or engineer in responsible charge of the work shall prepare and administer a testing, inspection and observation program which shall be submitted to the Office for approval prior to the issuance of the building permit.

(e) The testing program shall identify materials and tests to be performed on the project. The approved agency and/or individual(s) to perform each of the required tests shall also be identified. The testing program shall include, at a minimum, those tests required by applicable sections of the *California Building Standards Code*.

(f) The inspection program shall include a completed application for inspector(s) of record for the project. If a project has more than one inspector of record, the distribution of responsibilities for the work shall be clearly identified for each inspector of record.

(g) The inspection program shall also identify all special inspections to be performed on the project along with approved agency and the individual(s) to perform the inspections. The special inspections shall include, at a minimum, those special inspections required by applicable sections of the *California Building Standards Code*.

(h) The observation program shall identify each design professional that must, through personal knowledge as defined in Section 7-151, verify that the work is in compliance with the approved construction documents.

(i) The design professionals, contractor or owner/builder, approved agency, and the inspector(s) of record shall verify that the work is in compliance with the approved construction documents in accordance with the requirements for personal knowledge as it applies to each participant. The program shall give specific intervals or project milestones at which site reporting is to occur for each affected participant. Each required observation report shall be documented by a Verified Compliance Report form prepared by each participant and submitted to the Office.

(j) The Testing Inspection and Observation (TIO) program shall specify the manner, frequency, duration and reporting of the testing, inspection, and observation of work performed away from the site.

(k) The testing, inspection and observation program shall include samples of test and inspection reports and provide time limits for the submission of reports.

Exception: Samples of test and inspection reports shall not be required when tests and special inspections are performed by an OSHPD Preapproved Agency (OPAA).

(l) All completed test and inspection reports shall be submitted to the inspector of record, the owner and the architect or engineer in responsible charge by the author of the report.

(m) Changes to the testing, inspection and observation program made subsequent to approval by the office shall be submitted to the office in accordance with Section 7-153.

Authority: Health and Safety Code Sections 129825 and 129675-130070.

Reference: Health and Safety Code Sections 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-141. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-143. Responsibility of the contractor.

(a) The contractor shall complete the work in accordance with the approved construction documents. The contractor shall not be relieved of any responsibility by the activities of the architect, engineer, inspector or the Office in the performance of their duties.

(b) The contractor shall submit verified compliance reports to the Office in accordance with Section 7-151.

(c) Where no general contractor is involved, the governing body or authority of a health facility shall designate an agent who shall be responsible for the construction of the project in accordance with the approved contract documents and such agent shall submit the verified reports to the Office.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-143. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-144. Inspection.

(a) The hospital governing board or authority shall provide for competent, adequate and continuous inspection by one or more Inspector(s) of Record (IOR) satisfactory to the architect or structural engineer or both, in responsible charge of the work, or the engineer in responsible charge of the work and the Office.

(b) When the hospital governing board or authority proposes more than one IOR for a construction project, a lead IOR shall be identified to coordinate construction inspection and communication with the Office.

(c) IOR(s) for a hospital construction project shall be approved by the Office in accordance with the provisions of Section 7-212.

Authority: Health and Safety Code Sections 18929 and 129675 - 130070.

Reference: Health and Safety Code Section 129825.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-144. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD 1/96) 1996 Annual Code Adoption Cycle will amend Section 7-144, of Part 1, Title 24, C.C.R. Filed with the secretary of state on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.

7-145. Continuous inspection of the work.

(a) The general duties of the IOR shall be as follows:

1. The IOR shall have personal knowledge, obtained by continuous inspection of all parts of the work of construction in all stages of its progress to ensure that the work is in accordance with the approved construction documents.
2. Continuous inspection means complete inspection of every part of the work. Work, such as concrete or masonry work which can be inspected only as it is placed or assembled, shall require the constant presence

of the IOR. Other types of work which can be completely inspected after the work is installed may be carried on while the IOR is not present. In no case shall the IOR have or assume any duties which will prevent continuous inspection.

3. The IOR shall work under the direction of the architect or engineer in responsible charge. All inconsistencies or seeming errors in the approved construction documents shall be reported promptly to the architect or engineer in responsible charge for interpretation and instructions. In no case, however, shall the instructions of the architect or engineer in responsible charge be construed to cause work to be done which is not in conformity with the approved construction documents.

4. The IOR shall maintain a file of approved construction documents on the job at all times including all reports of tests and inspections required by the construction documents and shall immediately return any unapproved documents to the architect or engineer in responsible charge for proper action. The IOR shall also maintain on the job at all times, all codes and regulations referred to in the approved construction documents.

5. The IOR shall notify the Office in writing:

- A. When the work is started or resumed on the project.
- B. At least 48 hours in advance of the time when foundation trenches will be complete, ready for footing forms.
- C. At least 48 hours in advance of the first placing of concrete.
- D. When work has been suspended for a period of more than two weeks.

6. The IOR(s) shall maintain field records of construction progress for each day or any portion of a day that they are present at the project site location. The field record shall state the time of arrival, time of departure, a summary of work in progress and noted deficiencies in the construction or deviations from the approved construction documents. The field record shall document the time and date of all significant correspondence with the contractor regarding incomplete work, potential deficiencies or deviations which require the contractor's attention and could potentially affect the timely and compliant completion of the project. This field record shall document the date, time and method of correction for any noted deficiencies or deviations. In addition, this record shall contain the following as applicable:

- A. Copies of all certificates, tags, marks or other evidence of material properties and/or manufactured components as required by the California Building Standards Code.
- B. The time and date of placing concrete; time and date of removal of forms and shoring in each portion of the structure; location of defective concrete; and time, date and method of correction of defects.

C. Identification marks of welders, lists of defective welds, and manner of correction of defects and other related events.

D. A list of test reports of all nonconforming materials or defective workmanship and shall indicate the corrective actions taken.

E. The names and certificate numbers (when applicable) of all special inspectors who perform work both on- and off-site.

F. When driven piles are used for foundations, the location, length and penetration under the last ten blows for each pile. It shall also include a description of the characteristics of the pile driving equipment.

G. The log of changes to the work prepared by the architect or engineer in responsible charge required by Section 7-153(e).

7. Field records may be kept electronically. All field records of construction progress shall be retained on the job until the completion of the work and shall, upon request, be made available to the Office, the architect or engineer in responsible charge and the owner. Electronic records may be retained off-site if made available during on-site and remote review of documents. Upon completion of the project, these original field records shall be submitted to the hospital governing board or authority.

(b) The IOR shall notify the contractor, in writing, of any deviations from the approved construction documents or new construction not in compliance with the *California Building Standards Code*, which have not been immediately corrected by the contractor. Copies of such notice shall be forwarded immediately to the architect or engineer in responsible charge, owner and to the Office.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-145. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-147. Observation by the Office.

(a) During the construction, of any health facility, the Office shall make such observation as in its judgment is necessary or proper for the enforcement of these regulations and all applicable parts of the *California Building Standards Code*.

Whenever the Office finds a violation of these regulations and/or applicable parts of the *California Building Standards Code* that requires correction, the citation of the violation shall be issued to the hospital governing board or authority in writing and shall include a proper reference to the regulation or statute being violated.

Authority: Health and Safety Code Sections 127015, 129825 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-147. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-149. Tests.

(a) Pursuant to Section 7-141, the architect or engineer in responsible charge shall establish and administer the testing program. Where job conditions warrant, the architect and/or engineer may waive certain specified tests contingent upon the approval of the Office. The Office shall be notified as to the disposition of materials noted on laboratory reports. One copy of all test reports shall be forwarded to the inspector of record, owner and the architect or engineer in responsible charge by the testing agency. The reports shall state definitely whether the material tested complies with the approved construction documents.

(b) The governing board or authority of a health facility shall select an approved agency to conduct the tests. The selected approved agency shall be acceptable to the architect or engineer in responsible charge. The governing board or authority shall pay for all tests.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-149. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-151. Verified compliance reports.

(a) In accordance with Section 7-151(f), or when required by the Office, the architect(s), engineers(s), inspector(s) of record (IORs), approved agency, special inspector(s) and contractor or owner/builder shall each submit to the Office a verified compliance report, with their signature and based on their own personal knowledge, as defined by this section. The report shall:

1. Verify that the work during the period, or a portion of the work, covered by the report has been performed and materials used and installed are in accordance with the construction documents.
2. Set forth detailed statements of fact as are required by the Office.

(b) Personal knowledge as applied to the licensed architect or engineer or both, shall be in accordance with Health and Safety Code (H&SC) Section 129830. Knowledge that is obtained from the reporting of others as referred to in this H&SC section applies to individuals who have personal knowledge for the specific project.

(c) Personal knowledge as applied to the IOR, shall be in accordance with Health and Safety Code (H&SC) Section 129830 as applied to the inspector. Knowledge that is obtained from the reporting of others as referred to in this H&SC section applies to individuals who have personal knowledge for the specific project.

(d) Personal knowledge as applied to the contractor, shall be in accordance with Health and Safety Code (H&SC) Section 129830 as applied to the contractor.

(e) Personal knowledge, as applied to the approved agency, means the knowledge that is obtained from testing, special inspections and reports prepared in accordance with the CBC Section 1704.2.4 or 1704A.2.4 and these regulations.

(f) Verified compliance reports shall be submitted to the Office at the intervals or stages of the work as stated in the approved testing, inspection and observation program. In no case shall the submittal of verified compliance reports be less than:

1. One copy prepared and signed by each required participant or discipline at the completion of the work.
2. One copy prepared and signed by any participant or discipline at any time a special verified compliance report is required by the Office.

(g) The architect or engineer in responsible charge of the work shall be responsible for ensuring all required verified compliance reports are submitted to the Office.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-151. Filed with the secretary of state on August 4, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-152. Replacement of an architect, engineer, inspector of record, approved agency, special inspector or contractor.

(a) When replacing any of the listed individuals and/or approved agency the following shall be submitted to the Office:

1. Prior to plan approval
 - A. Revised application(s) listing the new responsible individual(s) and/or approved agency.
2. Following construction document approval
 - A. Revised application(s) listing the new responsible individual(s) and/or approved agency.
 - B. An initial report, prepared by the new responsible individual(s) and/or approved agency, based on field observation(s) that the work performed and materials used and installed to date are in accordance with the project's construction documents. Any observed issues of nonconformance shall be listed in the report. The new individual(s) and/or approved agency shall be responsible for verification of project compliance, pursuant to Section 7-151, for the remainder of the project.
 - C. A final verified report from the individual(s) and/or approved agency being replaced.

Exception to (C): In the event that the individual(s) and/or approved agency being replaced refuse to, or cannot provide a final verified

report, the owner shall submit a letter to the Office verifying that the work performed and materials used and installed are in accordance with the project's construction documents. The letter shall also list the reason the verified report could not be obtained.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-153. Changes to the approved work.

(a) **Changes in the work.** Work shall be executed in substantial conformance with the construction documents approved by the Office. Changes in the work shall be made by amended construction documents approved by the Office. Changes in the work include, but are not limited to, the following: Correction of errors in design and/or construction to bring the construction documents and/or construction into compliance with applicable codes; change(s) in the scope of the work; and additional work required because of discovered conditions. Only changes that materially alter the work shall be submitted to the Office for review and approval as amended construction documents.

1. **Amended construction documents.** Changes or alterations of the approved construction documents shall be made by means of amended construction documents. Amended construction documents shall be submitted with a form provided by the Office and shall state the reason for the change and show the estimated or actual addition to or deduction from the current, estimated or actual, contract amount. The form shall be signed by the architect or engineer, or delegated architect or engineer as allowed by Section 7-115, and shall be accompanied by supplementary construction documents, when necessary. The construction documents shall be stamped and signed pursuant to Section 7-115. All changes shall be clearly described. An electronic copy or two paper copies of the form and construction documents shall be submitted for review and approval by the Office. All amended construction documents shall be approved by the Office prior to installation of the work.

2. **Emergencies.** Emergency changes in the work relating to the safety of persons at the construction site may be made immediately. Such emergency changes shall be documented by subsequent amended construction documents and may require modification to comply with these regulations.

(b) **Changes that do not materially alter the work.** The following types of changes in the work do not materially alter the work and do not require the submission of amended construction documents to the Office:

1. Clarification and interpretation of plans and specifications by the responsible design professional.

Note: If calculations by the structural engineer in responsible charge, or by the delegated structural engineer, are necessary to determine structural or nonstructural adequacy, an amended construction

document submittal must be made to the Office for review.

2. Construction means and methods, such as construction sequencing, coordination of the work, and methods of assembly/construction. Construction means and methods do not include work that would require Alternate Method of Compliance or an Alternate Means of Protection.

Note: Temporary construction, such as temporary exiting, temporary air handlers, temporary bulk oxygen tanks, or temporary shoring supporting an occupied building under Office jurisdiction are not considered means and methods and thus would require a separate permit or the submittal of an amended construction document to the Office for review.

3. Substitution of equipment, products, or materials. The equipment, product or material substituted must be code compliant; perform the same function as the equipment, product, or material that it is replacing; must not increase the mechanical or electrical loads to the building systems; must not increase loads to lateral or gravity load-bearing structural frame members; and must meet the design requirements for the project.

Note: Changing from one kind of equipment, product or material to another, such as changing from drilled-in concrete anchors to concrete screw anchors or changing the top-of-wall fire-resistive material/design are not considered substitutions and require the submittal of an amended construction document to the Office for review. If calculations by a structural engineer are necessary to determine structural or nonstructural adequacy, an amended construction document must be submitted to the Office for review.

4. New details that are based on other approved details, in whole or in part, including referenced standards or pre-approved details. Reference to the approved details must be shown.
5. Final routing configurations of ducts, conduits, pipes, etc., where these are shown diagrammatically on the approved plans.

Note: Submittal of an amended construction document will be required when additional fire/smoke dampers, non pre-approved seismic fittings, or specially engineered braces or hangers are necessary to accommodate the final configuration or routing.

6. Dimensional changes to rooms that do not affect code required minimum dimensions, fixed dimensions, minimum room or space requirements and required clearances.

Note: Applicable code sections and minimum dimension and space requirements must be shown on plans for confirmation by Office field staff.

7. Relocation of doors, windows, electrical switches and outlets, plumbing fixtures, etc., that do not require additional changes to the work to make the relocation code compliant.

8. Relocation or reconfiguration of cabinetry that does not affect code required minimum dimensions and clearances, minimum room or space requirements, or minimum storage requirements. Such cabinetry reconfiguration shall not increase loads to supporting members, such as wall studs and ceiling framing.

Note: Applicable code sections and minimum dimensions and space requirements must be shown on plans for confirmation by Office field staff.

If the architect or engineer in responsible charge of a project determines that changes to the approved construction documents are necessary that do not materially alter the work, all such changes shall be stamped and signed by the appropriate design professional(s) pursuant to Section 7-115. All changes in the work are subject to concurrence of the Office field staff as to whether or not the change materially alters the work.

(c) **Code compliance.** Changes in the work that do not require amended construction documents shall not be deemed to grant authorization for any work to be done in violation of the provisions of any applicable code.

(d) **Changes in scope.** Amended construction documents that change the scope of the original project shall be required to be submitted as a separate project.

Exception: At the discretion of the Office, changes in scope may be submitted as amended construction documents. The Office may require the documents to be reviewed as an examination subject to fees required by Section 7-133(q)(3).

(e) **Documentation of changes.** The architect or engineer in responsible charge shall maintain a log of all changes to the work of construction. The log shall indicate whether the Office has made a determination as to whether each change materially alters the work, the date such determination was made, and the name of the Office staff who made the determination. The log shall be maintained on the project site as part of the inspector's field records.

Authority: Health and Safety Code Sections 18929 and 129675-130070.

Reference: Health and Safety Code Sections 129850.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-153. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD 7/96) 1996 Annual Code Adoption Cycle will amend Section 7-153, of Part 1, Title 24, C.C.R. Filed with the secretary of state on February 19, 1997; effective March 21, 1997. Approved by the California Building Standards Commission on February 6, 1997.

7-155. Final approval of the work.

(a) The Office shall schedule a final state agency inspection of the work subsequent to the receipt of the responsible

architect's or engineer's statement that the contract is performed or substantially performed.

(b) The final approval of the construction shall be issued by the Office when:

1. All work has been completed in accordance with the approved construction documents.
2. The required verified compliance reports and test and inspection reports have been filed with the Office.
3. All remaining fees have been paid to the Office.

(c) Final approval shall be confirmed by a letter sent to the Department of Public Health with a copy to the applicant. The letter shall state that the work has been constructed in accordance with the *California Building Standards Code*, Title 24, California Code of Regulations.

Authority: Health and Safety Code Sections 127015 and 129850.

Reference: Health and Safety Code Sections 129675–129998.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-155. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

7-156. Certification of correctional treatment centers.

(a) Construction documents prepared by or under the supervision of the Department of Corrections and Rehabilitation for the new construction, reconstruction, alteration or addition of any hospital building and/ or correctional treatment center, as defined in Section 1250, Health and Safety Code, or any building specified in Section 129875, Health and Safety Code shall be certified to the Office by the Department of Corrections and Rehabilitation. Construction documents and construction of these facilities shall be in full compliance with all applicable building standards including, but not limited to, architectural, structural, mechanical, plumbing, electrical, and fire and life safety.

The Department of Corrections and Rehabilitation shall use a secondary peer review procedure to review the design of new construction, reconstruction, alteration or addition in order to ensure that the construction documents are in compliance with the building standards of Title 24, Parts 2, 3, 4, 5 and 9. The secondary peer review shall be performed by a California licensed architect, structural engineer, mechanical engineer and electrical engineer, as applicable.

Upon completion of construction, a written certification signed by the Director or designee of the Department of Corrections and Rehabilitation shall be submitted to the Office and shall include:

1. Description of the project scope;
2. Certification that construction documents and construction are in full compliance with all applicable building standards of Title 24, Parts 2, 3, 4, 5 and 9;
3. Certification that a secondary peer review has been completed and the peer review indicates that the design for new construction, reconstruction, alteration or addition to the facility adheres to all building standards of Title 24, Parts 2, 3, 4, 5 and 9;

4. Certification that construction inspection was performed by a competent on-site inspector and that all work was completed in accordance with the complying construction documents; and

5. Attachments which include the final as-built construction documents.

(b) Construction documents prepared by or under the supervision of a city, county or city and county law enforcement agency for the new construction, reconstruction, alteration or addition of any hospital building and/or correctional treatment center, as defined in Section 1250, Health and Safety Code, or any building specified in Section 129875, Health and Safety Code shall be certified to the Office by the law enforcement agency. Construction documents and construction of these facilities shall be in full compliance with all applicable building standards including, but not limited to, architectural, structural, mechanical, plumbing, electrical and fire and life safety.

Upon completion of construction a written certification signed by the law enforcement agency head or designee shall be submitted to the Office and shall include:

1. Description of the project scope;
2. Certification that construction documents and construction are in full compliance with all applicable building standards of Title 24, Parts 2, 3, 4, 5 and 9; and
3. Attachments which include the final as-built construction documents.

Authority: Health and Safety Code Sections 1275, 127010, 127015, 129790 and 129850.

Reference: Health and Safety Code Section 15076.

HISTORY:

1. (OSHPD 2/96) 1996 Annual Code Adoption Cycle will add Section 7-156, of Part 1, Title 24, C.C.R. Filed with the secretary of state on March 4, 1997; effective April 3, 1997. Approved by the California Building Standards Commission on February 6, 1997.

7-157. Records. (Deleted)

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to delete Section 7-157. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

**ARTICLE 5
APPEALS TO THE HOSPITAL
BUILDING SAFETY BOARD**

7-159. Grounds for appeal.

(a) The Hospital Building Safety Board shall act as a board of appeals in the following:

1. All matters relating to the administration and enforcement of building standards relating to the design, construction, alteration and seismic safety of health facility projects submitted to the Office pursuant to the Health and Safety Code, notwithstanding Health and Safety Code Section 13142.6 and except as provided in Health and Safety Code Section 18945.
2. Matters relating to all fire and panic safety regulations and alternate means of protection determinations for health facility projects submitted to the Office pursuant

to the Health and Safety Code, notwithstanding Health and Safety Code Section 13142.6.

3. Explicitly enumerated matters identified in Health and Safety Code Sections 130060, 130061, and 130064 of the Health and Safety Code.

Only those matters identified in this section shall be appealable to the Hospital Building Safety Board. An appeal pursuant to this section may be made only by the current or prospective licensee of a health facility or their authorized agent, hereafter known as the appellant.

(b) Appeals made pursuant to this section shall be considered by the Hospital Building Safety Board only following the completion of the Comment and Process Review, held in accordance with Section 7-161.

7-161. Comment and Process Review (CPR).

(a) **First Level Review.** In the event that the appellant disagrees with a ruling, order, decision or act of the Office in a matter listed in Section 7-159(a), the appellant must first seek to resolve the issue informally with the original decision maker.

(b) **Second Level Review.** In the event that the appellant disagrees with a ruling, order, decision or act of the Office following First Level Review as described in (a) of this section, the appellant may submit a request for Second Level Review to the immediate supervisor of the original decision maker. A request for Second Level Review must be submitted in writing within ten (10) calendar days of issuance of the initial ruling, order, decision or act, and must include the following:

1. The name, mailing or e-mail address, and telephone number of appellant;
2. Identification of the specific ruling, order, decision or act to be reviewed;
3. The reason for the requested review;
4. Specific aspects of the decision with which the appellant disagrees and a proposal of alternatives the appellant would like for the reviewer to consider; and
5. Copies of any documents or data the appellant believes support the appellant's case or that the appellant believes would assist the reviewer.

(c) **Third Level Review.** In the event that the appellant disagrees with a determination made pursuant to (b) of this section, or in the event that the Second Level Reviewer does not issue to the appellant a response to the request for Second Level Review within ten (10) calendar days of submission of the request, the appellant may submit a request for Third Level Review by submitting in writing the information described in Section 7-161(b)(1)–(5) to the Deputy Division Chief.

(d) **Fourth Level Review.** In the event that the appellant disagrees with a determination made pursuant to (c) of this section, or in the event that the Third Level Reviewer does not issue to the appellant a response to the request for Third Level Review within ten (10) calendar days of submission of the request, the appellant may submit a request for Fourth Level Review by submitting in writing the information

described in Section 7-161(b)(1)–(5) to the Deputy Director. The Deputy Director shall provide the appellant with the written notice of his or her final determination.

(e) In the event that the appellant disagrees with the final determination of the Deputy Director pursuant to (d) of this section, or in the event that the Deputy Director does not issue to the appellant a response to the request for Fourth Level Review within ten (10) calendar days of submission of the request, appellant may request a formal hearing before the Hospital Building Safety Board pursuant to Section 7-163.

7-163. Formal hearing request.

Consistent with Section 7-159 and upon completion of the Comment Process Review procedure identified in Section 7-161, the appellant may appeal the final determination of the Deputy Director to the Hospital Building Safety Board. To request a formal hearing, the appellant shall submit a written request for appeal containing the information described in Section 7-161(b)(1)–(5) to the Hospital Building Safety Board through the Office within fifteen (15) calendar days of issuance of the Deputy Director's final determination pursuant to Section 7-161(d). Any request for appeal received by the Office more than fifteen (15) calendar days after issuance of the Deputy Director's final determination pursuant to Section 7-161(d) may be considered at the discretion of the Office.

7-165. Formal hearing.

(a) The Hospital Building Safety Board shall act as the hearing body for appeals submitted pursuant to Section 7-163 and shall conduct a public hearing on the appeal.

(b) The Chair of the Hospital Building Safety Board shall call a hearing on an appeal. The hearing shall be convened at a location selected by the Chair.

(c) The hearing shall be held within forty-five (45) calendar days of receipt by the Office of the written request for appeal described in Section 7-163. The parties to the appeal shall be notified in writing of the time and place of the hearing within fifteen (15) calendar days of receipt by the Office of the request for appeal.

(d) At least three (3) voting members of the Board shall be present at the hearing. The decision shall bear the endorsement of a simple majority of the Board members present.

(e) The proceedings shall be recorded. Transcripts shall be made available to anyone making a request therefor upon deposit with the Hospital Building Safety Board of the amount of money which the Office has determined necessary to cover the costs of transcript preparation.

(f) The appellant may, at his or her own expense, arrange for stenographic recording and transcription of the hearings.

7-167. Rights of the appellant.

The appellant shall have the right to counsel, to submit documentary evidence and exhibits, to present and rebut evidence, to have witnesses appear and testify, and to question representatives of the Office and other witnesses presenting testi-

mony or documents in the hearing. These rights shall be executed by the appellant at the appellant's own expense.

7-169. Appeal hearing procedure.

(a) An appeal hearing conducted by the Hospital Building Safety Board shall not be conducted in accordance with strict rules of evidence or courtroom procedure. During the hearing, the Chair may accept into the record without formal proof any generally accepted technical or scientific matter related to seismic, architectural, structural, mechanical, electrical, fire and life safety or health facilities. Hearsay evidence may be allowed for the purpose of supplementing or explaining other evidence, but shall not be sufficient by itself to support the findings.

(b) The Chair of the hearing shall determine the order of witnesses and presentation and introduction of documents, evidence and exhibits into the record of the hearing. The Chair may impose reasonable time limits, rule on admissibility of evidence, maintain decorum in the hearings, call recesses and rule on continuation of the hearings.

(c) The Chair may request counsel from the Office for advice on points of law.

(d) Prior to closing of the hearing, the Chair shall announce the decision of the Board.

7-171. Decision on appeal.

(a) A decision on an appeal heard by the Hospital Building Safety Board shall be reached as follows:

1. The Board shall render a decision prior to the closing of the hearing.
2. The Board may affirm, reverse or amend the ruling, order, decision or act being appealed.
3. Decision of the Hospital Building Safety Board shall become effective immediately upon their announcements by the Chair of the Board, unless otherwise specified by the Chair.

(b) The decision of the Board shall be provided in writing to the parties within fifteen (15) calendar days of the formal hearing held pursuant to Section 7-165.

(c) If less than a quorum of the voting members of the Board were present for the formal hearing held pursuant to Section 7-165, the appellant may appeal the written decision for hearing at the next regularly scheduled meeting of the Hospital Building Safety Board. The appellant shall submit a written request for such an appeal to the Hospital Building Safety Board through the Office no later than ten (10) days after the Board issues the written decision pursuant to Section 7-171(b). The appeal shall be heard at the next regularly scheduled meeting of the Hospital Building Safety Board, but not less than twenty (20) days after receipt of the request.

Authority: Health and Safety Code Sections 18929 and 129675-130070.

Reference: Health and Safety Code Section 129955.

HISTORY:

- I. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-171. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.

**ARTICLE 5.5
APPEALS TO A HEARING OFFICER**

7-173. Grounds for appeal.

(a) A hearing officer selected by the Director of the Office shall hear appeals in only the following:

1. Underestimation, undervaluation, or understatement of construction costs pursuant to Section 7-133(a)(4)(E) and Section 7-133(a)(7)(E).
2. Inspector of Record certification suspension or revocation pursuant to Section 7-214(d).

(b) An appeal pursuant to subsection (a) may be made only by one of the following:

1. In the case of a dispute regarding underestimation, undervaluation, or understatement of construction costs, the current or prospective licensee of a health facility or their authorized agent.
2. In the case of a dispute regarding Inspector of Record certification suspension or revocation pursuant to Section 7-214(d), only an Inspector of Record whose certification has been suspended or revoked pursuant to Section 7-214(d).

7-175. Formal hearing request.

(a) Consistent with Section 7-173, the appellant may appeal a final ruling, order, decision or act of the Office to a hearing officer. The appellant must submit a request for a formal hearing in writing to the Office within fifteen (15) calendar days of issuance of the written result of the formal conference and must contain the following:

1. The name, mailing or e-mail address, and telephone number of appellant;
2. Identification of the specific ruling, order, decision or act to be reviewed;
3. The reason for the requested review;
4. Specific aspects of the decision with which the appellant disagrees and a proposal of alternatives the appellant would like the reviewer to consider; and
5. Copies of any documents or data the appellant believes support the appellant's case or that the appellant believes would assist the reviewer.

(b) All appeals submitted after fifteen (15) calendar days of issuance of the result of the formal conference shall be considered only at the discretion of the Office.

7-177. Formal hearing.

(a) A hearing officer selected by the Director of the Office shall act as the sole adjudicator for an appeal pursuant to Article 5.5 and shall conduct a hearing on the appeal.

(b) The hearing officer shall call a hearing on an appeal. The hearing shall be convened at either the Sacramento or the Los Angeles location of the Office.

(c) The hearing shall be held within thirty (30) calendar days of issuance of the written request for formal hearing pursuant to Section 7-175. The parties to the appeal shall be noti-

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fied in writing of the time and place of the hearing within fifteen (15) calendar days of receipt by the Office of the written request for formal hearing.

(d) The decision shall reflect the judgment of the hearing officer selected to hear the appeal.

7-179. Rights of the appellant.

The appellant shall have the right to counsel, to submit documentary evidence and exhibits to present and rebut evidence, to have witnesses appear and testify, and to question representatives of the Office and other witnesses presenting testimony or documents in the hearing. These rights shall be executed by the appellant at the appellant's own expense.

7-181. Appeal hearing procedure.

(a) An appeal hearing conducted by the hearing officer shall not be conducted in accordance with strict rules of evidence or courtroom procedure. During the hearing, the hearing officer may accept into the record without formal proof any generally accepted technical, supportive, or validating matter related to the issue.

(b) The hearing officer shall determine the order of witnesses and presentation and introduction of documents, evidence and exhibits into the record of the hearing. The hearing officer may impose reasonable time limits, rule on admissibility of evidence, maintain decorum in the hearings, call recesses and rule on the continuation of the hearings.

(c) The hearing officer may request counsel from the Office for advice on points of law.

(d) The hearing officer shall adjourn the appeal hearing after both the appellant and the Office have had an opportunity to present and rebut evidence.

7-183. Decision on appeal.

A decision on an appeal heard by a hearing officer shall be reached as follows:

(a) The hearing officer shall issue a written decision to the appellant within fifteen (15) calendar days of adjournment of the appeal hearing.

(b) The hearing officer may affirm, reverse or amend the ruling, order, decision or act being appealed.

(c) Decisions of a hearing officer made pursuant to this section shall be final and binding and shall become effective immediately upon issuance of a written decision by that hearing officer unless otherwise specified by that hearing officer.

Authority: Health and Safety Code Sections 18929 and 129675-130070.

Reference: Health and Safety Code Section 129850 and 129935-129955.

ARTICLE 6 CONTRACTS

7-191. Contract qualification criteria.

(a) Individuals performing services under contracts entered into with the Office pursuant to Health and Safety Code, Section 129855 shall meet the following qualifications.

1. Plan reviews shall be performed only by architects or engineers validly certified under Division 3 of the Business and Professions Code as follows:

A. **Selection criteria.** The director shall establish selection criteria which will comprise the basis for the selection of eligible firms or local government entities to independently perform the required architectural and engineering services. The criteria will include such factors as:

- (1) Professional experience in performing services of similar nature.
- (2) Knowledge of applicable codes, regulations and technology associated with the services required.
- (3) Quality and relevance of recently completed or ongoing work.
- (4) Reliability, continuity and proximity of firm or local government entity to the Office.
- (5) Demonstrated competence.
- (6) Staffing capability.
- (7) Education and experience of key personnel to be assigned.
- (8) Current workload and ability to meet review deadlines according to schedule.
- (9) Other technical factors the director deems relevant to the specific service to be performed.

These factors shall be weighed by the director according to the nature of the proposed project or service, the complexity and special requirements of the specific services and the needs of the Office.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.

Reference: Government Code Sections 4526 and 4527.

B. Announcement.

- (1) A statewide announcement of specific services sought from firms shall be published in the California State Contracts Register, in accordance with the Government Code (commencing with Section 14825), and whenever possible, in the publications of the respective professional societies. Failure of any professional society to publish the announcement shall not invalidate any contract. Services sought from the local government entities are exempt from advertising in the California State Contracts Register pursuant to standard State of California operating procedures.
- (2) The announcement for each proposed project or service shall include, at a minimum, a brief description of the project or services required, location, duration, submittal requirements, contact person for the Office, and the final response date for receipt of statements from firms of their demonstrated competence and professional qualifications.

- (3) The director shall identify potentially qualified minority, women and disabled veteran business enterprises and small businesses interested in contracting with the Office, and shall provide copies of announcements to those businesses that have indicated an interest in receiving the announcements. Failure of the director to send a copy of an announcement to any business shall not invalidate any contract.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.

Reference: Government Code Sections 4526 and 4527.

C. Selection of qualified firms.

- (1) After the expiration of the final response date in the published announcement, the director shall review and evaluate the written responses to the announcement, using the selection criteria contained in Section 7-191(a)1A, and rank, in order of qualifications, the firms determined as eligible to perform the required services.
- (2) The director shall conduct discussions with at least the three most eligible firms, or a lesser number if fewer than three eligible firms have responded, to further expand on those qualifications and experience required to perform the services sought. From the firms with which discussions are held, the director shall select, in order of qualification, not less than three firms, or lesser number if fewer than three eligible firms responded, deemed to be the most highly qualified to perform the required services.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.

Reference: Government Code Sections 4526 and 4527.

D. Selection of qualified local government entities.

- (1) For specific services to be performed by local government entities, the director shall solicit, review and evaluate the qualifications of the local government entities using the selection criteria contained in Section 7-191(a)1A.
- (2) The director shall select, in order of qualification, those local government entities deemed to be the most highly qualified to perform the required services.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.

Reference: Government Code Sections 4526 and 4528.

E. Estimate of value of services.

- (1) Before entering into fee negotiations with any firm or local government entity selected pursuant to Section 7-191(a)1C(2) or D, the Office shall prepare an estimate of the value of the proposed services based on accepted billable rates for comparable services.
- (2) At any time the director determines the Office's estimate to be unrealistic, the director shall require the estimate to be reevaluated and, if deemed necessary, modified. If the director

modifies an estimate, negotiations will resume with the best qualified firm or local government entity.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129855 and Government Code Section 4526.

F. Fee negotiation with firms.

- (1) The director shall ask firms selected pursuant to Section 7-191(a)1C(2) to submit a fee schedule of hourly billable rates. The director shall then attempt to negotiate hourly billable rates determined to be fair and reasonable with the firms, beginning with the best qualified and continuing with the remaining firms, in order of qualifications.
 - (i) The firm negotiating with the director shall be given two opportunities to respond to the Office's request to meet the fair and reasonable estimate for hourly billable rates for the contract services;
 - (ii) The firm must respond within 7 business days to each request by the Office for a new estimate which either meets or does not exceed by more than 10 percent the Office's fair and reasonable estimate for hourly billable rates; and
 - (iii) If after the second attempt, the firm is nonresponsive or a satisfactory hourly billable rate cannot be negotiated, the director shall terminate negotiations with that firm.
- (2) After successful negotiations, a retainer contract will be executed with the firm. There may be multiple contracts awarded and each shall specify a contract period and monetary limitation. Work shall commence only upon execution of an assignment. Assignments will be negotiated pursuant to Section 7-191(a)1G.
- (3) For firms selected pursuant to Section 7-191(a)1C(2) to provide services for a specific project where the scope of work is extremely complex or unusual, fee negotiations will proceed in accordance with Section 7-191(a)1G.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129855 and Government Code Sections 4526 and 4528.

G. Services negotiations with firms.

- (1) From among the firms selected in Section 7-191(a)1C(2), as most highly qualified to perform services required, the director shall attempt to negotiate a satisfactory assignment or contract with the best qualified firm at a compensation which the Office determines to be fair and reasonable.
 - (i) The firm negotiating with the director shall be given two opportunities to respond to the Office's request to meet

the fair and reasonable estimate for assignment or contract services;

- (ii) The firm must respond within 7 business days to each request by the Office for a new estimate which either meets or does not exceed by 10 percent the Office’s fair and reasonable estimate;
 - (iii) If after the second attempt, the firm is nonresponsive or a satisfactory rate cannot be negotiated, the director shall terminate negotiations with that firm; and
 - (iv) Negotiations with the next best-qualified firm shall commence.
- (2) The director shall continue the negotiation process with the remaining qualified firms, if any, in order of qualifications, until a satisfactory assignment or contract is reached. If unable to negotiate a satisfactory assignment or contract with any of the qualified firms, the director shall abandon the negotiation process for the required services.

Authority: Health and Safety Code Sections 18929 and 129675–130070.
Reference: Health and Safety Code Section 129855 and Government Code Sections 4526 and 4528.

H. Fee and services negotiation with local government entities.

- (1) From among the local government entities selected in Section 7-191(a)1D(2), as most highly qualified to perform services required, the director shall attempt to negotiate a satisfactory contract with the best qualified local government entity at a compensation which the Office determines to be fair and reasonable.
- (2) If the director is unable to negotiate a satisfactory contract with the best qualified local government entity at a compensation which is determined to be fair and reasonable, negotiations with that local government entity shall be terminated and negotiations undertaken with the second best qualified local government entity. If unable to negotiate a satisfactory contract with the second best qualified local government entity at a compensation which the Office determines is fair and reasonable, negotiations with that local government entity shall be terminated and negotiations undertaken with the third best qualified local government entity. If unable to negotiate a satisfactory contract with the third best qualified local government entity at a compensation which the Office determines is fair and reasonable, negotiations with that local government entity shall be terminated.

The director shall continue the negotiation process with the remaining qualified local government entities, if any, in order of qualifications, until a satisfactory contract is reached. If

unable to negotiate a satisfactory contract with any of the qualified local government entities, the director shall abandon the negotiation process for the required services.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.
Reference: Government Code Sections 4526 and 4528.

- I. **Amendments.** When the director determines that a change in the assignment or contract is necessary during the performance of the services, the parties may, by mutual consent, in writing, agree to modifications, additions or deletions in the general terms, conditions and specifications for the services involved, with an appropriate adjustment in the firm’s or local government entity’s compensation, if necessary.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.
Reference: Government Code Sections 4526 and 4528.

- J. **Contracting in phases.** When the director determines it is necessary or desirable for a project to be performed in separate phases, increments or stages due to a change in design or scope of work, the director may negotiate compensation for the initial phase, increment or stage of the services required; provided, however, the director first determines that the firm selected is best qualified to perform the entire project. The assignment shall include a provision that the Office may, at its option, utilize the firm to perform other phases, increments or stages of the services under terms which the Office determines to be fair and reasonable, to be later negotiated and included in a mutual written agreement. In the event that the Office exercises its option under the contract to utilize the firm to perform other phases, increments or stages of the project, the procedures of this article regarding estimates of value of services and negotiation shall be followed.

Authority: Health and Safety Code Sections 18929 and 129675–130070.
Reference: Health and Safety Code Section 129855 and Government Code Sections 4526 and 4528.

- K. **Statewide participation goals.** In the negotiation of a satisfactory contract as provided in Section 7-191 (a)1F and G, qualified firm(s) must meet the statewide participation goals for minority, women and disabled veteran business enterprises or demonstrate that a good faith effort was made to meet them. The best qualified firm shall comply with the statewide participation goals or demonstrate a good faith effort as required by the regulations contained in Title 2, California Code of Regulations, Sections 1896.61-1896.67 and 1896.90–1896.96.

Authority: Government Code Section 4526; Public Contract Code Section 10115.3.
Reference: Government Code Section 4528; Public Contract Code Sections 10115, 10115.1, 10115.2 and 10115.3.

L. Emergency. When the director makes a finding that the public health, safety or welfare would be adversely affected in a significant way because insufficient time exists within which to implement the foregoing procedure to secure necessary services, the director may negotiate a contract for such services without the necessity of following such procedure, or any part thereof.

Authority: Health and Safety Code Sections 129850, 129855 and 18949.3; Government Code Section 4526.

Reference: Government Code Section 4526.

M. Unlawful considerations. Each contract shall include a provision by which the firm or local government entity warrants that the contract was not obtained or secured through rebates, kickbacks or other unlawful considerations either promised or paid to any Office employee. Failure to adhere to this warranty may be cause for contract termination and recovery of damages under the rights and remedies due the Office under the default provision of the contract.

Authority: Government Code Section 4526.

Reference: Government Code Section 4526.

N. Prohibited relationships. No Office employee who participates in the evaluation or selection process leading to award of a contract shall have a relationship with any of the firms or local government entity seeking that contract, if that relationship is subject to the prohibition of Government Code Section 87100.

Authority: Government Code Section 4526.

Reference: Government Code Sections 4526, 87100 and 87102.

HISTORY:

1. (OSHPD 2/95) Regular order by the Office of Statewide Health Planning and Development to amend Section 7-191. Filed with the secretary of state on August 14, 1996, becomes effective September 13, 1996. Approved by the California Building Standards Commission on March 19, 1996.
2. (OSHPD/EF 1/92) Emergency order by the Office of Statewide Health Planning and Development to amend Sections 7-111 and 7-191, Part 1, Title 24, California Code of Regulations. Filed as an emergency order with the secretary of state September 1, 1992; effective September 1, 1992. Approved as an emergency by the California Building Standards Commission on August 27, 1992.
3. (OSHPD/EF 1/92, permanent) Emergency order by the Office of Statewide Health Planning and Development to amend Sections 7-111 and 7-191, Part 1, Title 24, California Code of Regulations. Filed as a permanent order with the secretary of state on March 9, 1993; effective March 9, 1993. Approved as a permanent order by the California Building Standards Commission on March 5, 1993.

**ARTICLE 7
TESTING AND INSPECTION**

Testing and inspection requirements are found in the *California Building Standards Code*.

**ARTICLE 8
CALIFORNIA BUILDING STANDARDS**

Architectural, mechanical, electrical, structural, and fire and life safety and accessibility standards are found in the *California Building Standards Code*.

**ARTICLE 19
CERTIFICATION AND APPROVAL
OF HOSPITAL INSPECTORS**

7-200. Administration of hospital inspector examination and certification.

(a) The Office shall test and certify inspectors in one or more of the following classes:

1. Class “A” Hospital Inspector may inspect all areas of construction, including: architectural, mechanical, plumbing, electrical, fire and life safety, and structural elements.
2. Class “B” Hospital Inspector may inspect only the following areas of construction: architectural, mechanical, plumbing, electrical, fire and life safety, and anchorage of nonstructural elements.
3. Class “C” Hospital Inspector may inspect one or more areas of construction specialty, including but not limited to the areas listed in Section 7-204(c)1, but may not inspect the complete scope of construction authorized for “A” or “B” inspectors.

(b) In order to be certified in and perform the scope of responsibilities of a hospital inspector as specified in paragraph (a) (1), (2) or (3), an individual must be successful in the examination for that classification.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129825.

7-201. Contact with office. All correspondence, applications and remittances related to the certification or recertification of Hospital Inspector shall be directed to the Office of Statewide Health Planning and Development, Facilities Development Division, Hospital Inspector Certification Program.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-202. Filing change of name, address or telephone number. An applicant for the certification examination or a Hospital Inspector possessing a valid certificate issued by the Office, shall file name, mailing address or telephone number changes with the Office in Sacramento within 10 working days of that change. The information filed shall include both the new and former name, mailing address or telephone number.

Authority: Health and Safety Code Sections 1275, 127010, 127015, 129680 and 129825.

Reference: Health and Safety Code Sections 129680 and 129825.

7-203. Applying for the certification examination.

(a) An applicant may apply for the Hospital Inspector Certification Exam by submitting, to the Office, the following items prior to the final filing date announced for a scheduled exam:

1. A completed application, provided by the Office, shall be submitted to the Office in Sacramento and shall include the exam title, preferred examination location, applicant's name, mailing address and telephone number. An application for an examination is valid for one year commencing with the first available examination date. If applicant has not taken an exam within that

one-year period, a new application and exam fee must be submitted to participate in a future exam.

2. Certificates or transcripts indicating educational courses completed by the applicant which relate to the minimum qualifying requirements stated in Section 7-204.
3. Work verification form or letter from current and/or previous employer(s) regarding any job which meets the minimum qualifications for the certification examination and which includes the applicant's name, dates of employment, job description and employer's signature.
4. An "Application Review Fee" in the amount specified on a certification examination announcement for a scheduled exam and pursuant to Section 7-206.

(b) Incomplete submittals may be rejected by the Office. The application, documents and fees will be returned to the applicant with a statement of reason for nonacceptance.

(c) Upon review, verification and evaluation of the applicant's qualifications, the Office will notify the applicant, in writing, of eligibility or ineligibility for entrance to the requested certification examination.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-204. Minimum qualification for examination.

An applicant must meet the following criteria to be eligible to participate in the certification examination for a Class "A," "B," or "C" Hospital Inspector.

(a) Minimum qualifications for Class "A" Hospital Inspector Exam:

1. High school graduation or the equivalent and six years experience involving building projects of Type I or II construction as an architect's, engineer's, owner's, local building official's or general contractor's representative in technical inspection of major structural and nonstructural systems and components of buildings. [Note: Experience in subsection (a)1 may be substituted with college education with major work in architecture, engineering, building inspection and/or construction on a year-for-year basis for a maximum of two years.]; or
2. Possess a valid California registration/license as a mechanical, electrical, or civil engineer and two years experience involving building projects of Type I or II construction as an architect's, engineer's, owner's, local building official's or general contractor's representative in technical inspection of major structural and nonstructural systems and components of buildings; or
3. Two years of satisfactory performance as a Class "B" Hospital Inspector of Record on hospital projects of significant scope and complexity as determined by OSHPD; or
4. Possess a valid California registration/license as a structural engineer or a valid California license as an architect.

(b) Minimum qualifications for Class "B" Hospital Inspector Exam:

1. High school graduation or the equivalent and four years experience involving building projects of Type I or II construction as an architect's, engineer's, owner's, local building official's or general contractor's representative in technical inspection of major structural and nonstructural systems and components of buildings. [Note: Experience in subsection (b)1 may be substituted with college education with major work in architecture, engineering, building inspection and/or construction on a year-for-year basis for a maximum of two years.]; or
2. Possess a valid California registration/license as a civil engineer and two years experience involving building projects of Type I or II construction as an architect's, engineer's, owner's, local building official's or general contractor's representative in technical inspection of more than one major structural or nonstructural system of buildings (structural, mechanical, electrical or plumbing); or
3. Possess a valid California registration/license as a structural, mechanical or electrical engineer, or a valid California license as an architect; or
4. High school graduation or the equivalent, two years' experience involving building projects of Type I or II construction as an architect's, engineer's, owner's, local building official's or general contractor's representative in technical inspection of major structural and nonstructural systems and components of buildings, and possession of valid certification in all of the following four categories:
 - International Code Council (ICC) certification as a California Commercial Building Inspector (I1),
 - International Code Council (ICC) certification as a California Commercial Electrical Inspector (I2),
 - International Association of Plumbing and Mechanical Officials (IAPMO) certification as a California Plumbing Inspector,
 - International Association of Plumbing and Mechanical Officials (IAPMO) certification as a California Mechanical Inspector.

(c) Minimum qualifications for Class "C" Hospital Inspector Exam:

1. High school graduation or the equivalent and four years experience involving commercial or institutional building projects as the representative in testing, inspection or observation of construction for an architect, engineer, owner, local building official, local fire authority, testing lab, specialty contractor or general contractor and must possess valid certification issued by an organization specified in 4 below.

[Note: Experience in subsection (c)(1) may be substituted with college education with major work in architecture, engineering, building inspection and/or construction on a year-for-year basis for a maximum of two years.]; or

2. Possess a valid California registration/license as an engineer and two years experience involving building projects as an architect's, engineer's, owner's, local building official's, local fire authority's, specialty contractor's or general contractor's representative in testing inspection or observation of construction and must possess at least one valid certificate issued by an organization that is listed or described in (c)(4); or
3. Possess a valid California registration/license as a civil, mechanical or electrical engineer, or a valid California license as an architect and must possess at least one valid certificate issued by an organization specified in (4).
4. In addition to the experience requirements described in (c)1, 2 or 3 above, the applicant must have certification corresponding to the Class C certification sought as follows:

Accessibility – Division of the State Architect Certification as a Certified Access Specialist (CASp)

Anchorage/Bracing of Nonstructural Components – Certification to be administered by the Office

Electrical – International Code Council (ICC) certification as a California Commercial Electrical Inspector (I2)

Fire Alarm – National Institute for the Certification of Engineering Technologies (NICET) certification in “Fire Alarm Systems, Level III” or International Code Council (ICC) certification as a Commercial Fire Alarm Inspector (I2)

Fire Resistive Construction – International Code Council (ICC) certification as a California Commercial Building Inspector (I1)

Framing and Drywall – International Code Council (ICC) certification as a California Commercial Building Inspector (I1)

Inspection and Testing of Water Based Systems – National Institute for the Certification of Engineering Technologies (NICET) certification in “Inspection and Testing of Water Based Systems, Level III”

Mechanical – International Association of Plumbing and Mechanical Officials (IAPMO) certification as a California Mechanical Inspector

Medical Gas Systems – National Inspection Testing Certification (NITC) Certification as Medical Gas Inspector 6020

Plumbing – International Association of Plumbing and Mechanical Officials (IAPMO) certification as a California Plumbing Inspector

Roofing – International Code Council (ICC) certification as a California Commercial Building Inspector (I1)

In addition to the certifications listed, the Office, at its sole discretion, may accept equivalent certification by other state- or nationally-recognized organizations.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129825.

7-206. Fees.

(a) Fees required pursuant to subsection (b), shall be transmitted by credit card, money order, cashier check, certified check or personal check, and payable to the Office of State-wide Health Planning and Development.

(b) The prescribed fees relative to the Hospital Inspector Certification Program shall be specifically charged to the applicant to recover reasonable costs of administering the certification program. Fees shall be charged as follows:

Application review	\$100.00 (nonrefundable)
Exam for Class “A” Inspector Certification	\$300.00
Exam for Class “B” Inspector Certification	300.00
Exam for Class “C” Inspector Certification	100.00 (for each specialty certificate)
Recertification exam	100.00
Delinquency fee	100.00
Duplicate certificate	25.00

(c) An application review fee must accompany an application for a certification examination. This fee is nonrefundable.

(d) An exam fee shall be submitted by an applicant for a specified examination prior to participation in the examination.

(e) An applicant shall forfeit the exam fee if the applicant fails to appear for any portion of the exam for which the applicant is scheduled.

(f) If the Office has a need to reschedule an exam, a qualified applicant who has submitted the exam fee prior to the reschedule will be either reimbursed or credited for the exam fee amount.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129825.

7-207. Examination for certification.

(a) Prior to receiving certification, the candidate shall take and pass an examination administered by the Office.

(b) The scope of the written certification examinations is as follows:

1. The examinations for Class “A” and “B” Hospital Inspectors will measure the applicant’s ability to read and understand construction documents; ability to identify and understand the application of various *California Building Standards Code* requirements; knowledge of appropriate inspector duties and ability to communicate in writing. The test will be divided into sections covering the following code enforcement areas of construction inspection, where applicable: structural, architectural, mechanical, electrical, fire and life safety, and administrative.
2. The examination for Class “C” Hospital Inspectors will measure the applicant’s ability to identify and understand the application of various *California Building Standards Code* requirements; knowledge of appropriate inspector duties and ability to communicate in writing. The candidate’s inspection certification, pursuant to Section 7-204(c)(1) above, may be substituted for the technical aspect of the written certification examination for Class “C” Hospital Inspector.

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(c) In order to be successful in the Class “A,” “B” or “C” certification exam, a candidate must obtain a passing score in each section of the written exam.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-208. Conduct relative to the examination.

(a) An applicant or candidate who participates in any of the following acts before, during or after the administration of the examination, shall be disqualified by the Office and not be eligible for certification. The applicant shall not:

1. Violate any rules of the examination.
2. Bring unauthorized reference material or electronic device(s) into the examination room.
3. Copy any portion of the exam.
4. Participate in collusion regarding the exam.
5. Disclose the contents of the examination questions to anyone other than a person authorized by the Office.
6. Solicit, accept or compile information regarding the contents of the examination.
7. Falsify documents required for exam entrance.

(b) If an applicant is disqualified from the exam, it shall result in denial of the application and forfeiture of fees submitted to the Office as specified in Section 7-206.

(c) An applicant or candidate who is disqualified from an examination may not participate in an examination or reexamination for a period of time as determined by the Office, but not less than one year from the date of disqualification.

(d) An applicant, candidate or certified hospital inspector who is determined to have violated any of the provisions of Section 7-208(a) may be subject to suspension or revocation of certification in accordance with Section 7-214.

Authority: Health and Safety Code Sections 1275, 127010, 127015, 129680 and 129825.

Reference: Health and Safety Code Sections 129680 and 129825.

7-209. Reexamination.

(a) A candidate who has failed an examination may participate in a reexamination no sooner than six months from the exam previously taken by the candidate. In order to participate in a reexamination, the candidate must submit an application for a reexamination accompanied by the examination fee pursuant to Section 7-206.

(b) An applicant or candidate who is disqualified from an examination may not participate in an examination or reexamination for a period as determined by the Office, but not less than a period of one year from the date of disqualification.

(c) The applicant may refile for an examination by submitting an application, documents and fees pursuant to Sections 7-203 and 7-206.

(d) A candidate who passes all sections of the Class “A” or “B” exam except one, may retest in only that section. Failure to achieve a passing score on the retested section will be considered failure of the entire exam. The candidate may apply to retake the complete exam pursuant to subsections (a) and (b).

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-210. Issuance of certification.

(a) If a candidate is successful in the certification or recertification examination, a certificate will be issued to the Hospital Inspector by the Office. Certificates will expire three years from the date of issuance with the following exception:

1. Certification may be revoked or suspended pursuant to Section 7-214.

(b) A duplicate certificate will be granted to a Hospital Inspector for replacement of an original certificate that is lost, destroyed or mutilated upon written request and payment of the duplication fee, as required in Section 7-206.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129825.

7-211. Renewal of a hospital inspector certificate.

(a) A Hospital Inspector shall participate in a written recertification exam prior to the expiration of the certification in order to renew and maintain valid certification.

(b) To be eligible for the recertification exam, a Hospital Inspector shall maintain all certifications and prerequisites required to qualify for certification as specified in Section 7-204; and

1. Possess a valid unexpired Hospital Inspector Certificate or an expired certificate that meets the delinquency criteria in subsection (c).
2. Complete a seminar conducted, sponsored, or cosponsored by the Office within the three-year certification period.
3. Submit a recertification exam fee pursuant to Section 7-206.

(c) Expired certification may be reinstated after the expiration date, but within six months past that date. The Hospital Inspector will be required to pay a delinquency fee, pursuant to Section 7-206, in order to reinstate certification during the six-month delinquency period. If an inspector fails to reinstate certification within this time frame, the inspector will be required to pass a certification exam to obtain new certification as a Hospital Inspector.

(d) If a Hospital Inspector fails the recertification exam a re-test may be offered by the Office. If a retest is offered, the Hospital Inspector will be required to pay the recertification exam fee again for the retest. The inspector must meet the requirements of provision (b) to maintain a valid certificate.

(e) If a Hospital Inspector fails the recertification exam, the inspector must meet the requirements of provision (b) to maintain a valid certificate.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

7-212. Approval of hospital inspector of record for construction projects.

(a) It is incumbent upon the hospital governing board or authority and the architect or structural engineer, or both, in responsible charge of the work, or the engineer in responsible charge of the work, to select the appropriate inspector(s) for a project. The hospital governing board or authority shall submit to the Office an application for each Hospital Inspector of

Record proposed to perform construction inspection on a specified hospital construction project. The hospital governing board or authority shall obtain Office approval of proposed Hospital Inspector(s) of Record prior to commencement of the hospital construction project in accordance with Section 7-135.

(b) The Office shall not approve a proposed Hospital Inspector of Record for a specified hospital construction project if the Office determines one of the following:

1. The Hospital Inspector of Record applicant does not hold a valid Hospital Inspector certificate pursuant to the provisions of these regulations.
2. The Hospital Inspector is not appropriately certified in the class of inspection required for the scope of the construction project. The Class “C” inspector does not possess a current certificate for the area of inspection proposed in accordance with Section 7-204(c)l.
3. The Hospital Inspector is a former Office employee pursuant to subsection (c) and is within the one year restriction period governing the Office’s approval of an inspector.
4. The Hospital Inspector is committed to a workload outside the specified hospital construction project and is unable to allot adequate time to perform the work on the specified construction project, as determined by the process set forth in subsection (d).
5. The Hospital Inspector is the architect or engineer in responsible charge of the work for the construction project specified on the Hospital Inspector of Record application.

Exception: The Office may approve the architect or engineer in responsible charge of the work, when in the determination of the Office: (A) the project scope, duration and complexity do not merit a separate individual to serve as the Hospital Inspector of Record, and (B) the ability of the Office to obtain accurate and impartial inspection will not be jeopardized.

(c) A former employee of the Office who performed field inspections/observations or supervised staff performing field inspections/observations during employment with the Office shall not be approved for a project by the Office as a Hospital Inspector of Record within one year from the effective date of separation from the Office.

(d) When the Office determines that the cumulative workload of a Hospital Inspector of Record applicant appears excessive and may hinder competent and adequate inspection of a specified hospital construction project, the Office may request that the Hospital Inspector of Record applicant submit a written plan including a work schedule and indicating a means to perform inspection on the specified hospital construction project.

The Office will consider specific work-related factors when reviewing the Hospital Inspector’s work schedule to determine approval, pursuant to subsection (b)4. These work-related factors are limited to the following:

1. The geographic location of current work sites,
2. The scope of current projects,

3. The current phase of each project, and
4. The number of current projects.

(e) When an inspector is approved by the Office, written notification will be sent to the hospital governing board or authority; the architect and/or engineer in responsible charge of the construction project; and the inspector of record applicant. The inspector must be in possession of this approval notice prior to commencement of construction.

(f) A Hospital Inspector of Record who has been approved by the Office must maintain valid certification throughout the term of the specified project in order to remain a Hospital Inspector of Record on the project. The Office shall rescind approval of a Hospital Inspector of Record on a project if the inspector does not comply with this provision.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129825.

7-213. Monitoring of the hospital inspector of record’s performance. When the Office determines that a Hospital Inspector of Record has violated a provision of these regulations or that the inspector is not competently or adequately providing inspection of a facility to ensure the hospital construction is in compliance with the construction documents, the Office will notify that inspector, the hospital governing board or authority, and the architect and/or engineer in responsible charge. The written notification will include the Office’s findings, reference to the statute and/or regulation being violated, and statement of the Office’s intent to issue a “stop work” order unless the violation ceases and is rectified immediately.

Authority: Health and Safety Code Sections 1275, 127010, 127015, 129680 and 129825.

Reference: Health and Safety Code Sections 129680, 129825 and 129998.

7-214. Suspension or revocation of certification.

(a) A hospital inspector of record certification, issued by the Office, may be suspended or revoked, as determined by the Office. A certification may be suspended or revoked if: (1) the Office determines that one or more grounds for suspension/revocation exist and the immediate suspension of a certification is necessary for health and safety reasons, or (2) the Office determines that reasonable grounds exist for the suspension/revocation of a certification based upon the evidence presented.

(b) **Grounds for suspension and/or revocation.** The Office or third parties may propose the suspension/revocation of a certification to the Office based on evidence of a certificate holder’s (1) incompetent inspection(s); (2) inadequate inspection(s); (3) misrepresentation(s); (4) misconduct; and/or (5) violation(s) of these regulations.

(c) **Process for suspension and/or revocation.** The Office shall investigate the alleged inappropriate activity, as identified in Section 7-214(b), of the certificate holder, gather evidence related to the incident(s) in question, and interview witnesses, if appropriate. Based upon consideration of the evidence presented, the Office shall determine whether or not reasonable grounds exist for the suspension/revocation of certification.

In the event that the Office determines that reasonable grounds exist for suspension/revocation, the Office will

notify the certificate holder in writing. The notice shall provide the certificate holder with an opportunity to participate in a formal conference and/or present additional evidence before a final determination is made. The Office must receive a written request for a formal conference and/or additional evidence from the certificate holder within 15 calendar days of the issuance of notice. If the Office does not receive a timely request for a formal conference, the Office may issue a final determination as to the suspension/revocation.

A formal conference may be conducted in person or by telephone. The Office shall make a final determination as to the suspension/revocation after considering all the evidence on record, including the formal conference and/or any additional information submitted by the certificate holder. Written notification of the Office's final determination will be provided to the certificate holder within 15 calendar days of the formal conference, if applicable.

(d) **Suspension** is appropriate when the Office determines any of the following: (1) a certificate holder negligently or incompetently commits an act amounting to one or more grounds for suspension identified in Section 7-214(b); (2) the evidence demonstrates solitary, limited or isolated incident(s) rather than a course of negligent/incompetent conduct on the part of the certificate holder in question; and/or (3) other factors, including but not limited to mitigating circumstances or facts relating to the certificate holder's course of conduct, support the suspension of the certification in lieu of revocation.

A certification may be suspended for a minimum of one month to a maximum of six months. The duration of suspension will be determined by the Office upon consideration of all of the evidence on record, and account for the severity of the action(s) constituting grounds for suspension.

(e) **Revocation** is appropriate when the Office determines any of the following: (1) a certificate holder knowingly, willfully or with gross negligence commits an act amounting to one or more grounds for revocation identified in Section 7-214(b); (2) the evidence demonstrates a course of actionable conduct and/or a history of repeated or continuous deviations from the general standard of care in the inspection industry; and/or (3) the Office determines that other factors, including but not limited to damages to third parties or facts related to the certificate holder's course of conduct, justify the revocation of the certification in lieu of suspension.

A certification, once revoked, is no longer valid and may not be renewed pursuant to Section 7-211. In the event that a certificate holder has his or her hospital inspector certification revoked consistent with this Section, he or she may not apply for a new certification for a period of three years from the date of the Office's final written determination identified in Section 7-214(c).

(f) **Appeal.** A final written determination of the Office related to the suspension and/or revocation of a certificate may be appealed by the certificate holder pursuant to Article 5.5 of these regulations.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129850.

ARTICLE 20 REPAIR OF DAMAGE AFTER AN EMERGENCY

7-300. Plan review and approval.

(a) All repair projects are subject to prior plan review, plan approval and construction permit by the Office except as noted in subsection (b).

(b) For emergency repairs carried out without the Office plan review and permit the aftermath of an emergency, an application for plan review must be submitted with construction documents, fees and a letter of transmittal stating the reasons for emergency repairs. Photographs, if available, and reports of damage and repairs should also be submitted with the application. Additional repairs may be required if the emergency repairs do not comply with the code. For alternate fee payment methodology, see Section 129787 of the Health and Safety Code.

(c) Plan reviews for emergency damage repairs will be performed on a priority basis. The application for plan review should clearly state that the scope of the project is to repair the damage from the emergency. Where possible, reviews will be made over the counter.

(d) Plan review fees shall be payable for all damage repair projects in accordance with the following:

1. 1.64 percent of estimated construction costs for hospitals.
2. 1.50 percent of estimated construction cost for skilled nursing facilities (SNF) or intermediate care facilities (ICF).
3. For alternate fee payment methodology, see Section 129787 of the Health and Safety Code.
4. An examination fee where review of existing plans is required. The fee will be calculated on a time and material basis at the prevailing hourly rates applicable for the review personnel.

(e) Office recommends predesign conference with architects/engineers to resolve code issues relevant to the repair projects.

Authority: Health and Safety Code Section 129850.

Reference: Health and Safety Code Sections 129785, 129787 and 129820.

7-301. Appeals. The Hospital Building Safety Board shall act as a board of appeals with regard to disagreements between the Office and hospital/SNF/ICF authorities on interpreting the repair policy or the establishment of the degree of damage. (Section 7-159 of Administrative Regulations for the Office)

Authority: Health and Safety Code Section 129850.

Reference: Health and Safety Code Section 129925.

7-305. All buildings.

Where the repairs to damage caused by an emergency are required, facilities may reopen, after temporary repairs, for a limited period of time subject to the following.

1. **Temporary repairs:** The hazard resulting from damage to the facility is abated and the facility is at least restored to its pre-emergency condition or its equivalent.

2. **Permanent repairs/retrofit:** The owner successfully negotiates with the Office a time bound plan for the permanent repairs/retrofit of the damaged facilities required by these regulations.

Authority: Health and Safety Code Section 129850.

Reference: Health and Safety Code Sections 129725 and 129820.

HISTORY:

1. (OSHPD/EF 1/95) Emergency order by the Office of Statewide Health Planning and Development to add Sections 7-300 through 7-305, Part 1, Title 24, California Code of Regulations. Filed as an emergency order with the secretary of state on September 8, 1995; effective September 8, 1995. Approved as an emergency by the California Building Standards Commission on September 7, 1995.
2. (OSHPD/EF 1/95, permanent) Emergency order by the Office of Statewide Health Planning and Development to add Sections 7-300 through 7-305, Part 1, Title 24, California Code of Regulations. Filed as a permanent order with the secretary of state on November 30, 1995. Since there were no changes, effective date remains September 8, 1995.

**ARTICLE 21
PLAN REVIEW, BUILDING INSPECTION AND
CERTIFICATION OF SURGICAL CLINICS,
CHRONIC DIALYSIS CLINICS AND
OUTPATIENT SERVICES CLINICS**

7-2100. Scope of responsibilities.

(a) Except as otherwise provided in these regulations, a city or county building jurisdiction shall be responsible for plan review and building inspection of new construction or alteration of clinic facilities specified in 7-2100(a)(1), (2), (3) and (4) and shall also provide certification that the clinic facilities identified in 7-2100(a)(1), (2) and (3) are in conformance with the applicable clinic provisions in the latest edition of the *California Building Standards Code*. For clinic facilities identified in 7-2100(a)(1), (2) or (3), construction or alteration shall include buildings converted to the specific purpose.

1. Surgical clinic as defined in Health and Safety Code, Section 1204(b)(1).
2. Chronic dialysis clinic as defined in Health and Safety Code, Section 1204(b)(2).
3. Surgical and/or chronic dialysis clinic building which is freestanding from a building where hospital services are provided and as defined in Health and Safety Code, Section 129725(b)(1).
4. Any building where hospital outpatient clinical services are provided that is freestanding from a hospital building, as defined in Health and Safety Code, Section 129725(a), except those buildings identified in 7-2100(a)(3).

(b) The city or county shall not establish or apply building standards for the construction or alteration of hospital licensed freestanding clinics, as described in Section 7-2100(a)(3) and (4), which are more restrictive or comprehensive than comparable building standards established or applied to clinic facilities which are not hospital licensed pursuant to Health and Safety Code, Chapter 1 (commencing with Section 1200) of Division 2.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129885.

7-2101. Surgical clinic and chronic dialysis clinic project submittal to the local building jurisdiction.

(a) The governing authority or owner of a clinic, as described in Section 7-2100(a)1 and 2, shall submit construction plans to the city or county, as applicable, for plan review, building inspection and certification. Certification by the local building jurisdiction shall indicate that the project clinic is in conformance with the applicable clinic provisions in the latest edition of the *California Building Standards Code*.

Exception: Notwithstanding Section 7-2100(a)(1) and (2), the governing authority or owner may request the Office to perform the plan review and certification, pursuant to Section 7-2102.

(b) Upon the clinic's initial submittal of project plans, the city or county shall advise the governing authority or owner, in writing, of its decision that plan review services will either include certification or not include certification.

(c) If the city or county indicates to the governing authority or owner that it will include certification with plan review of the specified clinic project, the city or county shall:

1. Review plans to all applicable provisions in the latest edition of the *California Building Standards Code* and;
2. Provide written certification to the applicant within 30 days of completion of construction that the applicable clinic provisions have been met.

(d) If the city or county indicates to the applicant that it will not include certification with plan review of the specified clinic project, the city or county shall review the plans to the provisions of the latest edition of the *California Building Standards Code*, excluding the clinic provisions. The governing authority or owner shall also submit the following items to the Office:

1. A completed application and construction documents for the clinic project, pursuant to Section 7-113, and;
2. A fee, pursuant to Section 7-2106.

(e) The Office shall review the construction documents to determine whether or not the clinic project meets the applicable clinic provisions in the latest edition of the *California Building Standards Code*.

(f) Upon completion of plan review and receipt of all applicable fees, the Office shall provide the clinic applicant with written certification that the project construction documents meet the clinic provisions in the latest edition of the *California Building Standards Code*.

(g) Building construction inspection for the clinic project shall be performed by the local jurisdiction.

7-2102. Request for the office to provide plan review for surgical clinics and chronic dialysis clinics.

(a) If the governing authority or owner of a clinic, as described in Section 7-2100(a)(1) or (2), elects to request the Office to provide plan review services for a clinic project, in lieu of the city or county, the request shall be submitted to the Office in writing. The Office will consult with the applicable local building jurisdiction prior to acceptance or nonacceptance.

tance of the plan review request and subsequently notify the clinic, in writing, of its decision.

(b) If the Office agrees to provide plan review and certification services for the governing authority or owner, the applicant shall submit the following items to the Office:

1. A completed application and design construction documents for the clinic project, pursuant to Section 7-113, and;
2. A fee, pursuant to Section 7-2106.

(c) The Office shall review the plans to all applicable provisions in the latest edition of the *California Building Standards Code*.

(d) Upon completion of plan review and receipt of all applicable fees, the Office shall provide the applicant with written certification that the project construction documents meet the applicable clinic provisions in the latest edition of the *California Building Standards Code*.

(e) Building construction inspection for the project clinic shall be performed by the local building jurisdiction. Therefore, the governing authority or owner shall submit to the city or county applicable project documents required for these building inspection services.

7-2103. Hospital outpatient services clinic project submittal to local building jurisdiction.

(a) The hospital governing authority or owner of a freestanding outpatient services clinic, as described in Section 7-2100(a)(3) or (4), shall submit construction plans to the city or county, as applicable, for plan review and building inspection, pursuant to this section or may request the Office to perform plan review and building inspection, pursuant to Section 7-2104. Certification by the local building jurisdiction that the project clinic is in conformance with the applicable clinic provisions in the latest edition of the *California Building Standards Code* is also required for clinics described in 7-2100(a)(3).

(b) If the hospital governing authority or owner of a clinic, as described in Section 7-2100(a)(3), initially submits clinic plans to the city or county for plan review, the city or county shall respond to the clinic owner, in writing, stating its decision of whether or not the plan review will include certification.

(c) If the city or county indicates to the hospital governing authority or owner that it will include certification with plan review of the specified clinic project, the city or county shall:

1. Review plans to all applicable provisions in the latest edition of the *California Building Standards Code* and;
2. Provide written certification to the applicant within 30 days of completion of construction that the applicable clinic provisions have been met.

(d) If the city or county indicates to the hospital governing authority or owner that it will not include certification with plan review of the specified clinic project, the city or county shall review the plans to the provisions of the latest edition of the *California Building Standards Code*, excluding the clinic

provisions. The applicant shall also submit the following items to the Office:

1. A completed application, construction documents for the clinic project, pursuant to Section 7-113, and;
2. A fee, pursuant to Section 7-2106.

(e) The Office shall review the construction documents for certification to determine whether or not the clinic project meets the applicable clinic provisions in the latest edition of the *California Building Standards Code*.

(f) Upon completion of plan review and receipt of all applicable fees, the Office shall provide the clinic applicant with certification that the project construction documents meet the applicable clinic provisions in the latest edition of the *California Building Standards Code*.

(g) Building construction inspection for the project clinic shall be performed by the local building jurisdiction.

7-2104. Plan review and building inspection by the office for hospital outpatient services clinics.

(a) The hospital governing authority, as described in Section 7-2100(a)(3) or (4), may request that the Office perform plan review and building inspection for a clinic project, in lieu of the city or county performing these services. This request shall be submitted to the Office in writing.

(b) The Office shall perform the requested plan review and building inspection services when the hospital governing authority submits the following items to the Office:

1. A completed application, construction documents for the clinic project, pursuant to Section 7-113; and
2. A fee, pursuant to Section 7-2106.

(c) For clinic facilities described in Section 7-2100(a)(3), upon completion of the building construction and receipt of all applicable fees, the Office will provide certification that the construction documents and construction comply with the applicable provisions in the *California Building Standards Code*.

(d) A clinic building which has been accepted by the Office, pursuant to paragraph (a) of this section, shall remain under the jurisdiction of the Office for plan review and building inspection of any subsequent alterations, unless the hospital governing authority or owner submits written notification to the Office, requesting the applicable city or county building jurisdiction to conduct plan review and building inspection for subsequent construction projects of the specified clinic.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129885.

7-2105. “Hospital Building” designation of a freestanding hospital-owned clinic.

(a) A building which is under the Office’s jurisdiction, pursuant to Section 7-2104(d) may be designated as a “hospital building” by the hospital governing authority or owner under the following conditions:

1. The hospital governing authority or owner submits written notification to the Office indicating the determi-

nation to designate the building as a “hospital building” and;

2. The subject building remains under the jurisdiction of the Office for plan review and building inspection.

(b) A building designated as a “hospital building,” pursuant to Section 7-2105(a), shall be reviewed and inspected to verify compliance with the standards and requirements for a hospital building, as defined in Health and Safety Code, Part 7, Chapter 1, (commencing with Section 129675).

7-2106. Fees for review of specified clinics.

(a) Fees for plan review services of clinic buildings described in Section 7-2100(a)1, 2 and 3, shall be in an amount not to exceed the actual cost of performing the services.

Exception: When the Office accepts a request from the hospital governing authority or owner to perform plan review and building inspection services for those buildings described in Section 7-2100(a)3, the fee requirements of Section 7-133(a)(1) which apply to hospital buildings shall also apply to the project building.

(b) When the Office accepts a request from the hospital governing authority or owner to perform plan review and building inspection services for those buildings described in Section 7-2100(a)(4), the fee requirements of Section 7-133 (a) (1) which apply to hospital buildings shall also apply to the project building.

(c) Fees shall be paid as follows:

1. A nonrefundable filing fee of \$250.00 shall accompany the application for plan review. This filing fee will be applied toward the total fees due for the project.
2. After a preliminary review of the required documents received and determination of the services to be performed, the Office will provide an estimate of the total review fee due based on costs to be incurred.
3. The applicant shall submit payment of the estimated fee prior to start of the plan review and building inspection services.
4. If during the review/inspection process it appears that actual costs will exceed the estimate by more than five percent (5%), the applicant will be informed that additional fees, not to exceed the actual cost will be due and payable immediately upon project completion.
5. All applicable fees for a completed project shall be paid prior to certification by the Office.

Authority: Health and Safety Code Sections 18929 and 129675–130070.

Reference: Health and Safety Code Section 129885.

7-2107. Fee refund.

(a) Upon written request from the applicant, a fee refund may be issued pursuant to this section.

1. The written request must be submitted to the office within:
 - a. One year of the date of written certification of compliance with the applicable clinic provisions.

b. One year of the date the project is withdrawn by the applicant.

c. The time limits specified in Section 7-134 for building(s) as described in Section 7-2104.

2. No refund shall be issued before written certification is provided, or the project is withdrawn or closed.

3. Refunds shall be exclusive of the \$250 filing fee.

4. Refunds shall be calculated pursuant to Section 7-2107(b), (c) or (d).

(b) Fees paid for a project, involving a building(s) as described in Section 7-2100(a)(1), (2) or (3), which exceed the actual cost for performing plan review and inspection services by more than five percent (5%), shall be refunded by the Office.

Exception: Refunds for building(s) described in Section 7-2104 shall be calculated pursuant to the applicable requirements of Section 7-134.

(c) If an applicant withdraws a project that has been submitted to the Office for plan review of a building(s), as described in Section 7-2100(a)(1), (2) or (3), the unexpended balance of fees paid to the Office for actual cost of plan review services provided shall be refunded to the applicant.

Exception: Refunds for building(s) described in Section 7-2104 shall be calculated pursuant to the applicable requirements of Section 7-134.

(d) If an applicant requests a refund of fees for a project that has been submitted to the Office for plan review and building inspection, as described in Section 7-2100(a)(4), a fee may be refunded to the applicant pursuant to the applicable requirements of Section 7-134.

Authority: Health and Safety Code Sections 1226, 18929 and 129675–130070.

Reference: Health and Safety Code Section 129885.

HISTORY NOTE APPENDIX FOR CHAPTER 7

Administrative Regulations for the Office of Statewide Health Planning and Development California Code of Regulations, Title 24, Part 1

HISTORY:

> The history notes for prior changes remain within the text of this code.

1. (OSHPD 1/97) Regular order by the Office of Statewide Health and Planning and Development to amend Chapters 6 and 7 as a result of SB 1953. Filed at the secretary of state on March 25, 1998; effective March 25, 1998. Approved by the California Building Standards Commission on March 18, 1998.
2. (OSHPD-EF 1/98) Emergency order by the Office of Statewide Health Planning and Development to adopt administrative regulations specific to Hospital Inspector Citizenship/Alien Certification. Filed at the secretary of state on March 25, 1998; effective March 25, 1998. Approved by the California Building Standards Commission on March 18, 1998.
3. BSC 1997 Triennial Code Adoption Cycle (OSHPD 1/97, OSHPD 2/97, OSHPD 3/97). Approved by the California Building Standards Commission on May 6, 1998. Filed at the secretary of state's office on September 29, 1998, effective October 29, 1998.
4. Erratum to correct printing errors. Correction to Section 7-101 to change the date of the Alfred E. Alquist Act to 1983. Correction of grammatical error in Section 7-111. Publication date February 15, 2001.
5. (OSHPD 9/99) Testing, Inspection, and Observation Program. Various sections in Chapter 7. Approved as submitted by the California Building Standards Commission on May 24, 2000. Filed with the Secretary of State on June 8, 2000, effective July 7, 2000.
6. (OSHPD 10/99) Filing Fee/Personal Knowledge Verified Reports. Amend Sections 7-103, 7-111, 7-113, 7-133, 7-151. Approved as submitted by the California Building Standards Commission on May 24, 2000. Filed with the Secretary of State on June 8, 2000, effective July 7, 2000.
7. (OSHPD 3/99) Class C Hospital Inspector. Amend Sections 7-200, 7-204, 7-206. Approved as submitted by the California Building Standards Commission on May 24, 2000. Filed with the Secretary of State on June 8, 2000, effective July 7, 2000.
8. (OSHPD 01/01) 7-115 Preparation of Plans and Specifications. 7-152 Supplantation of an Architect, Engineer or Inspector of Record, Special Inspector or Contractor. Approved as submitted by the California Building Standards Commission on September 25, 2001. Files with the Secretary of State on November 6, 2001, effective December 6, 2001.
9. October 1, 2002 Errata adding Number 8 above.
10. (OSHPD EF 01/02) Amend Chapter 6 and 7 of Part 1. Approved as emergency by the California Building Standards Commission on January 15, 2003, and filed with the Secretary of State on January 16, 2003. Effective January 16, 2003.
11. (OSHPD 4/02) Chapter 7, amend various sections. Safety Standards for Health Facilities. Article 3, Section 7-125, Final Review of Plans and Specification. Article 3, Section 7-129, Time Limitations for Approval. Article 4, Section 7-135, Time of Beginning Construction. Article 4, Section 7-141, Administration of Construction. Article 4, Section 7-155, Final Approval of the Work. Article 19, Section 7-203, Applying for the Certification Examination. Article 21, Section 7-2100 through 7-2106, Scope of Responsibilities. Approved by the Building Standards Commission on May 14, 2003 and effective June 13, 2003.
12. (OSHPD EF 01/02) Amend Chapters 6 and 7 of Part 1. Approved as permanent emergency by the California Building Standards Commission. Permanent approval on May 14, 2003. Certification of Compliance filed with the Secretary of State on May 15, 2003. Effective January 16, 2003.
13. (OSHPD 01/04) Amend Chapter 6, Article 1 for change in Seismic Performance Category nonconforming building. Amend Chapter 7, Article 3 for plan review, Article 4 for construction inspection, Article 5 for appeals to the Hospital Building Safety Board, Article 6 for contract services, Article 19 for certification of hospital inspectors, and Article 21 for fees for review of specified clinics. Filed with Secretary of State on May 23, 2006, and effective on the 30th day of filing with the Secretary of State.
14. (OSHPD 01/06) Amendments to administrative standards for the review and construction of health facilities: preparation of plans and specifications, Hospital Inspector certification, and plan review and inspection of outpatient clinics. Filed with the Secretary of State on February 15, 2007, and effective 30 days thereafter.
15. (OSHPD EF 01/07) Amend Title 24, Part 1, Chapter 7, Article 1, Article 2, Article 3, Article 20. Approved by the California Building Standards Commission on July 19, 2007. Filed with the Secretary of State on July 20, 2007, effective on January 1, 2008.
16. (OSHPD 01/07) Amend Chapter 7, Safety Standards for Health Facilities. Approved by the California Building Standards Commission on July 17, 2008. Filed with the Secretary of State on July 18, 2008, and effective 30 days thereafter.
17. (OSHPD 04/09) Amend Chapter 7, Safety Standards for Health Facilities. Effective on February 13, 2010.
18. (OSHPD EF 01/10) Amend Chapter 7 with HAZUS updates pursuant to SB 499 (Chapter 601, Statutes of 2009). Effective on February 13, 2010.

19. (OSHPD 01/10) Amend Article 1, Title 24, Chapter 7, Article 7-111, effective on August 28, 2011.
20. (OSHPD 02/12 and OSHPD 03/12) Amend Chapter 7, Safety Standards for Health Facilities. Approved by the California Building Standards Commission on January 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.
21. (OSHPD 01/15) Amend Chapter 7, Safety Standards for Health Facilities: Article 2: Section 7-111; Article 3: Section 7-131, 7-133; Article 4: Section 7-141, 7-144, 7-149, 7-153; Article 5: Section 7-159, 7-161, 7-165, 7-167, 7-169, 7-171; Article 5.5: Section 7-173, 7-175, 7-177, 7-181, Article 19: Section 7-214, 7-215. Approved by the California Building Standards Commission on December 16, 2015, and effective 30 days after filing with Secretary of State.
22. Errata to correct editorial errors within Chapter 7 in this code. Effective January 1, 2017.
23. 2016 Intervening Cycle Supplement (OSHPD 01/16) adopted by the California Building Standards Commission on June 20, 2017, filed with the Secretary of State on August 17, 2017, effective thirty days after filing.
24. 2018 Triennial Code Adoption Cycle (OSHPD 01/18) Amend Chapter 7, Article 1, Section 7-103; Article 2, Section 7-111; Article 3, Sections 7-115 and 7-128; Article 4, Sections 7-141, 7-144, 7-145, 7-149, 7-151, 7-152, 7-153 and 7-155; Article 5, Sections 7-165 and 7-171; Article 19, Sections 7-204, 7-207, 7-208, 7-209 and 7-211; Added to Chapter 7, Article 3, new Section 7-118. Approved by the California Building Standards Commission on December 4, 2018, filed with the Secretary of State on December 7, 2018, and effective 180 days after publication pursuant to *California Health and Safety Code*, Section 18938.
25. Erratum to correct editorial errors in Chapter 7, Section 7-144(a): effective January 1, 2020.
26. 2019 Intervening Cycle Update (OSHPD 01/19) Adoption of amendments to the 2019 California Administrative Code (CAC). Approved by the California Building Standards Commission on July 13, 2020, published on January 1, 2021, effective 30 days after filing with Secretary of State.
27. (OSHPD 03/21) Amend Chapter 7, Article 2, Section 7-111, Article 3, Sections 7-113, 7-121, 7-123, 7-128, 7-129, 7-130, 7-133, Article 4, Sections 7-144, 7-145, 7-153, Article 19, Section 7-201. Approved by the California Building Standards Commission on January 18, 2022, filed with the Secretary of State on February 2, 2022, and effective 30 days after filing with Secretary of State.

CHAPTER 8

ADMINISTRATIVE REGULATIONS FOR THE CALIFORNIA DEPARTMENT OF PUBLIC HEALTH (CDPH)

ARTICLE 1 PUBLIC SWIMMING POOLS

8-100. Plans and specifications.

(a) A person proposing to construct, reconstruct or alter a swimming pool or auxiliary structure or equipment shall submit legible plans and specifications to the enforcing agent for review and written approval prior to commencing the work and in advance of the issuance of any building, plumbing or electrical permit.

(b) Plans submitted for approval pursuant to this section shall be drawn to a scale of 1 centimeter equals 0.48 meters ($\frac{1}{4}$ inch equals 1 foot), except that plans for spa pools shall be drawn to a scale of 1 centimeter equals 0.12 meters (1 inch equals 1 foot).

(c) The enforcing agent may require the submission of such additional information as may be required to determine the compliance of plans and specifications submitted for approval.

(d) Within 30 days of the receipt of plans and specifications, the enforcing agent shall notify the person submitting the plans and specifications of their approval or disapproval.

Authority: Health and Safety Code Sections 116050 and 131200.

Reference: Health and Safety Code Sections 116035 and 116050.

8-101. Construction.

(a) Swimming pools shall be constructed, reconstructed or altered in compliance with plans approved pursuant to Section 8-100, unless written approval of variance from such plans is obtained from the enforcing agent.

(b) Swimming pools shall conform to the requirements of Chapter 31B, Part 2, Title 24, California Code of Regulations.

Authority: Health and Safety Code Sections 116050 and 131200.

Reference: Health and Safety Code Sections 116035 and 116050.

ARTICLE 2 RETAIL FOOD FACILITIES

8-200. Adoption of the most recent edition of the *California Mechanical Code*. Chapter 5, Part 4, Title 24, California Code of Regulations, shall be the commercial hood and kitchen ventilation standards for retail food facilities as defined in Title 17, California Code of Regulations, Section 12100(a).

Authority: Health and Safety Code Sections 100275 and 113705.

Reference: Health and Safety Code Sections 113715, 114149.1 and 114419.2.

HISTORY:

1. New Article 10.4 (Sections 13670-13671) filed 9-18-80; effective thirtieth day thereafter (Register 80, No. 38).

8-201. Building plan approval.

(a) Building plans for new construction or remodeling of kitchen ventilation systems in retail food establishments shall be submitted for review and approval to either the local health officer or a duly authorized registered environmental health specialist.

(b) Construction or installation shall not begin without prior written approval that the building plan complies with the requirements of Section 8-200.

Authority: Health and Safety Code Sections 100275 and 113705.

Reference: Health and Safety Code Section 114380.

ARTICLE 3 ORGANIZED CAMPS

8-300. Building structures.

(a) Plans and specifications shall be approved by the local enforcing agency prior to start of any construction.

(b) Every building or structure shall be designed and constructed in accordance with the *California Building Code*, Part 2, Title 24, California Code of Regulations and Section 19150 of the Health and Safety Code.

(c) Every building or structure shall be inspected during its construction. Upon completion of construction, the person, firm or corporation responsible for its design, shall certify in writing to the local enforcing agency that the building or structure was, in fact, constructed in accordance with the approved plans and specifications therefor.

(d) Nothing in this section shall prohibit the Department of Health Services or local enforcing agency, from contracting with the Office of the State Architect of the Department of General Services or any private or other governmental agency for the review of design and performance of inspection of construction of camp buildings and structures, in accordance with the provisions of this section.

Authority: Health and Safety Code Sections 208 and 18897.2.

Reference: Health and Safety Code Sections 18897.2 and 18944(a).

HISTORY:

1. Amendment filed 3-5-71; effective thirtieth day thereafter. Approved by State Building Standards Commission 2-26-71 (Register 71, No. 10).
2. Amendment filed 11-28-80; effective thirtieth day thereafter (Register 80, No. 48).
3. Amendment filed 4-28-86; effective thirtieth day thereafter (Register 86, No. 18).

ARTICLE 4 HOSPITALS

8-400. Alterations to existing buildings or new construction.

(a) Alterations to existing buildings licensed as hospitals or new constructions shall be in conformance with Chapter 4A, Part 2, Title 24, California Code of Regulations.

(b) Hospitals licensed and in operation prior to the effective date of changes in these regulations shall not be required to institute corrective alterations or construction to comply with such changes except where specifically required or where the Department determines that a definite hazard to health and safety exists. Any hospital for which preliminary or working drawings and specifications have been approved by the Department prior to the effective date of changes to these regulations shall not be required to comply with such changes provided substantial, actual construction is commenced within one year after the effective date of such changes.

8-401. Application for architectural plan review.

(a) Drawings and specifications for alterations to existing buildings or new construction shall be submitted to the Department for approval and shall be accompanied by an application for plan review on forms furnished by the Department. The application shall:

1. Identify and describe the work to be covered by the plan review for which the application is made.
2. Describe the land on which the proposed work is to be done, by lot, block, tract or house and street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Show the present and proposed use or occupancy of all parts of the building or buildings.
4. State the number of square meters (feet) of floor area involved in new construction and in alterations.
5. Give such other information as may be required by the Department for unusual design circumstances.
6. Be signed by the person designing the work or the owner of the work.

(b) The application for plan review shall also include a written statement that a description of the proposed work has been submitted to the Area Comprehensive Health Planning Agency approved by the State Advisory Health Council pursuant to Section 437.7 of the Health and Safety Code.

ARTICLE 5 ACUTE PSYCHIATRIC HOSPITALS

8-500. Alterations to existing buildings or new construction.

(a) Alterations to existing buildings licensed as hospitals or new construction shall be in conformance with Chapter 4A, Part 2, Title 24, California Code of Regulations.

(b) Hospitals licensed and in operation prior to the effective date of changes in these regulations shall not be required

to institute corrective alterations or construction to comply with such changes except where specifically required or where the Department determines that a definite hazard to health and safety exists. Any hospital for which preliminary or working drawings and specifications have been approved by the Department prior to the effective date of changes to these regulations shall not be required to comply with such changes provided substantial, actual construction is commenced within one year after the effective date of such changes.

8-501. Application for plan review.

(a) Drawings and specifications for alterations to existing buildings or new construction shall be submitted to the Department for approval and shall be accompanied by an application for plan review on forms furnished by the Department. The application shall:

1. Identify and describe the work to be covered by the plan review for which the application is made.
2. Describe the land on which the proposed work is to be done, by lot, block, tract or house and street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Show the present and proposed use or occupancy of all parts of the building or buildings.
4. State the number of square meters (square feet) of floor area involved in new construction and in alterations.
5. Give such other information as may be required by the Department for unusual design circumstances.
6. Be signed by the person designing the work or the owner of the work.

(b) The application for plan review shall also include a written statement that a description of the proposed work has been submitted to the Area Comprehensive Health Planning Agency approved by the State Advisory Health Council pursuant to Section 437.7 of the Health and Safety Code.

ARTICLE 6 SKILLED NURSING

8-600. Alterations to existing buildings or new construction.

(a) Alterations to existing buildings licensed as skilled nursing facilities or new construction shall be in conformance with Chapter 4A, Part 2, Title 24, California Code of Regulations and requirements of the State Fire Marshal.

(b) Facilities licensed and in operation prior to the effective date of changes in construction regulations shall not be required to institute corrective alterations or construction to comply with such new requirements except where specifically required or where the Department determined in writing that a definite hazard to health and safety exists. Any facility for which preliminary or working drawings and specifications have been approved by the Department prior to the effective date of changes to construction regulations shall not be required to comply with such new requirements provided

substantial actual construction is commenced within one year of the effective date of such new requirements.

(c) All facilities shall maintain in operating condition all buildings, fixtures and spaces in the numbers and types as specified in the construction requirements under which the facility or unit was first licensed.

Authority: Health and Safety Code Sections 208(a) and 1275.

Reference: Health and Safety Code Section 1276.

ARTICLE 7 INTERMEDIATE CARE FACILITIES

8-700. Safety, zoning and building clearance.

(a) Architectural plans shall not be approved and a license shall not be originally issued to any intermediate care facility which does not conform to these requirements or other state requirements on seismic safety, fire and life safety, and environmental impact, and to local fire safety, zoning and building ordinances, evidence of which shall be presented in writing to the Department.

(b) It shall be the responsibility of the licensee to maintain the intermediate care facility in a safe structural condition. If the Department determines in a written report submitted to the licensee that an evaluation of the structural condition of an intermediate care facility building is necessary, the licensee may be required to submit a report by a licensed structural engineer which shall establish a basis for eliminating or correcting the structural conditions which may be hazardous to occupants.

(c) The facility shall meet the seismic safety requirements, if any, prescribed by Section 15001 of the Health and Safety Code.

8-701. Alterations to existing buildings or new construction.

(a) Alterations to existing buildings licensed as intermediate care facilities or new construction shall be in conformance with Chapter 4A, Part 2, Title 24, California Code of Regulations.

(b) Intermediate care facilities licensed and in operation prior to the effective date of changes in construction regulations shall not be required to institute corrective alterations or construction to comply with such new requirements except where specifically required or where the Department determines that a definite hazard to health and safety exists. Any intermediate care facility for which preliminary or working drawings and specifications have been approved by the Department prior to the effective date of changes to construction regulations shall not be required to comply with such new requirements provided substantial actual construction is commenced within one year of the effective date of such new requirements.

(c) All intermediate care facilities shall maintain in operating condition all buildings, fixtures and spaces in the numbers and types as specified in the construction requirements under which the intermediate care facility or unit was first licensed.

8-702. Application for plan review.

(a) Drawings and specifications for alterations to existing buildings or new construction shall be submitted to the Department for approval and shall be accompanied by an application for plan review on forms furnished by the Department. The application shall:

1. Identify and describe the work to be covered by the plan review for which the application is made.
2. Describe the land on which the proposed work is to be done, by lot, block, tract or house and street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Show the present and proposed use or occupancy of all parts of the building or buildings.
4. State the number of square meters (square feet) of floor area involved in new construction and in alterations.
5. Give such other information as may be required by the Department for unusual design circumstances.
6. Be signed by the person designing the work or the owner of the work.

(b) The application for plan review shall also include a written statement that a description of the proposed work has been submitted to the Area Comprehensive Health Planning Agency approved by the State Advisory Health Council pursuant to Section 437.7 of the Health and Safety Code.

ARTICLE 8 INTERMEDIATE CARE FACILITIES FOR THE DEVELOPMENTALLY DISABLED

8-800. Alterations to existing buildings or new construction.

(a) Alterations to existing buildings licensed as intermediate care facilities for the developmentally disabled or new construction shall be in conformance with Chapter 4A, Part 2, Title 24, California Code of Regulations.

(b) Facilities licensed or exempt from licensure and in operation prior to the effective date of changes in construction regulations shall not be required to institute corrective alterations or construction to comply with such new requirements except where specifically required or where the Department determines in writing that a definite hazard to health and safety exists. Any facility for which preliminary or working drawings and specifications have been approved by the Department prior to the effective date of changes to construction regulations shall not be required to comply with such new requirements provided substantial actual construction is commenced within one year of the effective date of such new requirements.

(c) All facilities shall maintain in operating condition all buildings, fixtures and spaces in the numbers and types as specified in the construction requirements under which the facility or unit was first licensed.

Authority: Health and Safety Code Section 208(a).

Reference: Health and Safety Code Sections 1276 and 15007.

8-801. Application for plan review. Drawings and specifications for alterations to existing buildings or new construction shall be submitted to the Department for approval and shall be accompanied by an application for plan review on forms furnished by the Department. The application shall meet the requirements of California Code of Regulations, Title 22, Division 7, Chapter 6, Article 1, Sections 93001 through 93019.

Authority: Health and Safety Code Section 208(a).

Reference: Health and Safety Code Sections 1276 and 15007.

HISTORY NOTE APPENDIX FOR CHAPTER 8

Administrative Regulations for the California Department of Public Health (CDPH) California Code of Regulations, Title 24, Part 1

HISTORY:

- > The history notes for prior changes remain within the text of this code.
 1. (CDPH 01/14) 2013 Intervening Cycle Supplement. Change without Regulatory Effect, Article 1, Swimming Pools and Article 2, Retail Food Facilities. Approved by the California Building Standards Commission on October 21, 2014, filed with Secretary of State on October 27, 2014, effective November 27, 2014.
 2. Erratum to correct Chapter 8 History Note format: effective January 1, 2020.

CHAPTER 9

**ADMINISTRATIVE REGULATIONS FOR THE OCCUPATIONAL
SAFETY AND HEALTH STANDARDS BOARD (OSHA)**

(RESERVED)

CHAPTER 10

ADMINISTRATIVE REGULATIONS FOR THE CALIFORNIA ENERGY COMMISSION (CEC)

ARTICLE 1 ENERGY BUILDING REGULATIONS

10-101. Scope.

(a) This article contains administrative regulations relating to the energy building regulations in Title 24, Part 6. This article applies to all residential and nonresidential buildings.

(b) Nothing in this article lessens any necessary qualifications or responsibilities of licensed or registered building professionals or other designers or builders, or the duties of enforcement agencies, that exist under state or local law.

(c) If any provision of the regulations in this article or the Building Energy Efficiency Standards, Title 24, Part 6, of the California Code of Regulations is found invalid by a court of competent jurisdiction, the remainder of these regulations shall remain in effect.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25402 and 25402.1, Public Resources Code.

HISTORY:

1. New Article 1 (Section 1401) filed 5-3-76; effective thirtieth day thereafter (Register 76, No. 19).
2. Amendment filed 8-17-77; designated effective 3-11-78 (Register 77, No. 34).
3. Repealer of Article 1 (Section 1401) and new Article 1 (Sections 1401-1408, not consecutive) filed 12-9-81; designated effective 7-1-82 (Register 81, No. 50).
4. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).

10-102. Definitions. In this article the following definitions apply:

ACCEPTANCE REQUIREMENTS are “acceptance requirements for code compliance” as defined in Section 100.1(b) of Part 6.

ACCEPTANCE TEST TECHNICIAN (ATT) is a Field Technician as defined in Section 10-102 who is certified by an authorized Acceptance Test Technician Certification Provider to perform acceptance testing of either lighting controls or mechanical systems pursuant to the requirements of Sections 10-103.1 or 10-103.2, respectively. ATTs are authorized to perform only those acceptance tests for which they are certified by an ATTCP; ATTs certified to perform acceptance testing of lighting controls are sometimes referred to as “lighting control ATTs,” and ATTs certified to perform acceptance testing of mechanical systems are sometimes referred to as “mechanical ATTs.” (See “Field Technician” and “Acceptance Test Technician Certification Provider.”)

ACCEPTANCE TEST EMPLOYER (ATE) is a person or entity who employs an Acceptance Test Technician and is certified by an authorized Acceptance Test Technician Certification Provider pursuant to the requirements of Sections 10-103.1 or 10-103.2. ATEs are authorized to employ only those

ATTs for which they are certified by an ATTCP; ATEs certified to employ ATTs that perform acceptance testing of lighting controls are sometimes referred to as “lighting control ATEs,” and ATEs certified to employ ATTs that perform acceptance testing of mechanical systems are sometimes referred to as “mechanical ATEs.” (See “Acceptance Test Technician” and “Acceptance Test Technician Certification Provider.”)

ACCEPTANCE TEST TECHNICIAN CERTIFICATION PROVIDER (ATTCP) is an agency, organization or entity approved by the Energy Commission to train, certify and oversee ATTs and ATEs relating to either lighting controls or mechanical systems according to the requirements of Sections 10-103.1 or 10-103.2, respectively. ATTCPs are authorized to certify only those ATTs and ATEs for which they are approved by the Energy Commission; ATTCPs approved to certify ATTs and ATEs relating to the acceptance testing of lighting controls are sometimes referred to as “lighting control ATTCPs,” and ATTCPs approved to certify ATTs and ATEs relating to the acceptance testing of mechanical systems are sometimes referred to as “mechanical ATTCPs.” (See “Acceptance Test Technician” and “Acceptance Test Employer.”)

NOTE: Authority cited: Sections 25402, 25402.1 and 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

ACM means **ALTERNATIVE CALCULATION METHOD** and are compliance software, or alternative component packages, or exceptional methods approved by the Commission under Section 10-109. ACMs are also referred to as Compliance Software.

ACM APPROVAL MANUALS are the documents establishing the requirements for Energy Commission approval of Compliance Software used to demonstrate compliance with the Building Energy Efficiency Standards for Residential and Nonresidential Buildings currently adopted by the Energy Commission.

ACM REFERENCE MANUAL is the document establishing the procedures required to implement Sections 140.1 and 150.1 of Title 24, Part 6 of the California Code of Regulations in Compliance Software.

ADDITIONALITY is a property of solar offsets whereby the offset causes additional benefits beyond what would occur as a result of all other actions, and which would exclusively benefit the building or property for which the offset substitutes for compliance obligations that would otherwise be required for that building or property, and those benefits would not ever be transferred to other buildings or property.

ALTERNATIVE COMPONENT PACKAGE is a set of building measures whose aggregate calculated energy use is less than or equal to the maximum allowed Energy Budget.

APPLIANCE EFFICIENCY REGULATIONS are the regulations in Title 20, Section 1601 et seq. of the California Code of Regulations.

APPROVED CALCULATION METHOD is compliance software, or alternative component packages, or exceptional methods approved under Section 10-109.

BUILDING ENERGY EFFICIENCY STANDARDS are those regulations contained in Title 24, Part 6 of the California Code of Regulations.

BUILDING PERMIT is an electrical, plumbing, mechanical, building or other permit or approval, that is issued by an enforcement agency, and that authorizes any construction that is subject to Part 6.

CALIFORNIA ENERGY COMMISSION is the California State Energy Resources Conservation and Development Commission.

COMMISSION is the State Energy Resources Conservation and Development Commission.

COMPLEX MECHANICAL SYSTEM is defined here for the purposes of complying with the Design Phase Review component of Section 10-103(a)1. Complex Mechanical Systems are systems that include 1) fan systems each serving multiple thermostatically controlled zones, or 2) built-up air handler systems (non-unitary or nonpackaged HVAC equipment), or 3) hydronic or steam heating systems, or 4) hydronic cooling systems. Complex systems are NOT the following: unitary or packaged equipment listed in Tables 112-A, 112-B, 112-C and 112-E that each serve one zone, or two-pipe, heating only systems serving one or more zones.

COMPLIANCE APPROACH is any one of the allowable methods by which the design and construction of a building may be demonstrated to be in compliance with Part 6. The compliance approaches are the performance compliance approach and the prescriptive compliance approach. The requirements for each compliance approach are set forth in Section 100.0(e)2 of Part 6.

COMPLIANCE DATA EXCHANGE FILE is an Extensible Markup Language (XML) file that contains compliance data used to populate a compliance document. The Compliance Data Exchange File is part of the Compliance Registration Package.

COMPLIANCE DOCUMENT is any of the documents specified in Section 10-103(a) utilized to demonstrate compliance with Part 6 (i.e., Certificate of Compliance, Certificate of Installation, Certificate of Acceptance and Certificate of Verification).

COMPLIANCE REGISTRATION PACKAGE means digitally signed or encrypted digital data that is transmitted to or from a data registry that contains the data required for registering a compliance document with a data registry, including the compliance data exchange file. A commonly used method is the Zip file format, a data compression and archiving specification that is in the public domain. Files

transmitted to or from a data registry using the Zip file format shall be password protected as described in JA7.6.3.2.7.

COMPLIANCE SOFTWARE is software that has been approved pursuant to Section 10-109 of Part 1.

CONDITIONED FLOOR AREA is the “conditioned floor area” as defined in Section 100.1(b) of Part 6.

CRRC-1 is the Cool Roof Rating Council document entitled “Product Rating Program.”

DATA REGISTRY is a web service with a user interface and database maintained by a Registration Provider that complies with the applicable requirements in Reference Joint Appendix JA7, with guidance from the Data Registry Requirements Manual, and provides for registration of residential or nonresidential compliance documentation used for demonstrating compliance with Part 6.

RESIDENTIAL DATA REGISTRY is a data registry that is maintained by a HERS Provider that provides for registration, when required by Part 6 of all residential compliance documentation and the nonresidential Certificate of Verification, and complies with the data maintenance requirements of Title 20, Chapter 4, Article 8, Section 1670 et seq.

NONRESIDENTIAL DATA REGISTRY is a data registry that is maintained by a Registration Provider approved by the Commission that provides for registration, when required by Part 6 of all nonresidential compliance documentation, excluding all Certificates of Acceptance recorded by an acceptance test technician certification provider (Sections 10-103.1 and 10-103.2). However, nonresidential data registries may not provide for registration of nonresidential Certificates of Verification.

DATA REGISTRY REQUIREMENTS MANUAL is a document that provides additional detailed guidance regarding the functional and technical aspects of the data registry requirements given in Joint Appendix JA7.

DOCUMENTATION AUTHOR is a person who prepares a Title 24 Part 6 compliance document that must subsequently be reviewed and signed by a responsible person in order to certify compliance with Part 6.

ENERGY BUDGET is the “energy budget” as defined in Section 100.1(b) of Part 6.

ENERGY COMMISSION is the California State Energy Resources Conservation and Development Commission.

ENFORCEMENT AGENCY is the city, county or state agency responsible for issuing a building permit.

EXCEPTIONAL METHOD is a method for estimating the energy performance of building features that cannot be adequately modeled using existing Compliance Software and that is approved by the Executive Director.

EXECUTIVE DIRECTOR is the Executive Director of the Commission.

FIELD TECHNICIAN is a person who performs acceptance tests in accordance with the specifications in Reference Nonresidential Appendix NA7, and reports the results of the

acceptance tests on the Certificate of Acceptance in accordance with the requirements of Section 10-103(a)4.

HERS is the California Home Energy Rating System as described in Title 20, Chapter 4, Article 8, Section 1670.

HERS PROVIDER is an organization that administers a home energy rating system as described in Title 20, Chapter 4, Article 8, Section 1670.

HERS PROVIDER DATA REGISTRY is a data registry maintained by a HERS provider in compliance with requirements per Title 20, Chapter 4, Article 8, Section 1670 et seq.

HERS RATER is a person who has been trained, tested and certified by a HERS Provider to perform the field verification and diagnostic testing required for demonstrating compliance with the Part 6 as described in Title 20, Chapter 4, Article 8, Section 1670(i).

HVAC SYSTEM is the “HVAC system” as defined in Section 100.1(b) of Part 6.

MANUFACTURED DEVICE is the “manufactured device” as defined in Section 100.1(b) of Part 6.

NFRC 100 is the National Fenestration Rating Council document entitled “NFRC 100: Procedure for Determining Fenestration Product *U*-factors” (2017). NFRC 100 includes procedures for the Component Modeling Approach (CMA) and site built fenestration formerly included in a separate document, NFRC 100-SB.

NFRC 200 is the National Fenestration Rating Council document entitled “NFRC 200: Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence” (2017).

NFRC 202 is the National Fenestration Rating Council document entitled “NFRC 202: Procedures for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence” (2017).

NFRC 203 is the National Fenestration Rating Council document entitled “NFRC 203: Procedure for Determining Visible Transmittance of Tubular Daylighting Devices” (2017).

NFRC 400 is the National Fenestration Rating Council document entitled “NFRC 400: Procedure for Determining Fenestration Product Air Leakage” (2017).

PART 6 is Title 24, Part 6 of the California Code of Regulations.

PUBLIC ADVISER is the Public Adviser of the Commission.

R-VALUE is the measure of the thermal resistance of insulation or any material or building component expressed in ft² - hr-°F/Btu.

RECORD DRAWINGS are drawings that document the as-installed location and performance data on all lighting and space conditioning system components, devices, appliances and equipment, including but not limited to wiring sequences, control sequences, duct and pipe distribution system layout and sizes, space conditioning system terminal device layout and air flow rates, hydronic system and flow rates, and connections for the space conditioning system. Record drawings are sometimes referred to as “as built” drawings.

REFERENCE APPENDICES is the support document for the Building Energy Efficiency Standards and the ACM Approval Manuals. The document consists of three sections: the Reference Joint Appendices (JA), the Reference Residential Appendices (RA) and the Reference Nonresidential Appendices (NA) currently adopted by the Energy Commission.

REFERENCE JOINT APPENDICES are the Reference Joint Appendices currently adopted by the Energy Commission.

REFERENCE NONRESIDENTIAL APPENDICES are the Reference Nonresidential Appendices currently adopted by the Energy Commission.

REFERENCE RESIDENTIAL APPENDICES are the Reference Residential Appendices currently adopted by the Energy Commission.

REGISTERED COMPLIANCE DOCUMENT is a compliance document that has been submitted to a residential or nonresidential data registry for retention, been verified as valid with an XML schema approved by the Commission, and gone through the registration process so that the registered document displays all applicable electronic signatures as well as the Registration Provider's digital certificate and the document's unique registration number. The image of the registered document is accessible for printing or viewing by authorized users of the data registry. The registered document's unique visible registration number is appended onto the document image by the data registry.

REGISTRATION PROVIDER is an organization that administers a data registry service that conforms to the requirements in Reference Joint Appendix JA7.

STANDARD DESIGN BUILDING is a “Standard Design Building” as defined in Section 100.1(b) of Part 6.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25402 and 25402.1, Public Resources Code.

HISTORY:

1. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
2. Amendment filed 12-4-86; effective thirtieth day thereafter (Register 87, No. 1).
3. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-102, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.
4. (CEC 1/94) Regular order by the California Energy Commission to amend Section 10-102, Part 6, Title 24, California Code of Regulations. Filed with the secretary of state May 24, 1995; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on May 23, 1995.

10-103. Permit, certificate, informational and enforcement requirements for designers, installers, builders, manufacturers and suppliers.

(a) **Documentation.** For all buildings other than healthcare facilities, the following documentation is required to demonstrate compliance with Part 6. This documentation shall meet the requirements of Section 10-103(a) or alternatives

approved by the Executive Director. Healthcare facilities shall instead comply with the applicable provisions of Chapter 7.

1. **Certificate of Compliance.** For all buildings, the Certificate of Compliance described in Section 10-103 shall be signed by the person who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the building design (*responsible person*); and submitted in accordance with Sections 10-103(a)1 and 10-103(a)2 to certify conformance with Part 6. If more than one person has responsibility for the building design, each person shall sign the Certificate of Compliance document(s) applicable to that portion of the design for which the person is responsible. Alternatively, the person with chief responsibility for the building design shall prepare and sign the Certificate of Compliance document(s) for the entire building design. Subject to the requirements of Sections 10-103(a)1 and 10-103(a)2, persons who prepare Certificate of Compliance documents (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. In accordance with applicable requirements of 10-103(a)1, the signatures provided by *responsible persons* and *documentation authors* shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

For all nonresidential buildings, the Design Review Kickoff Certificate(s) of Compliance and the Construction Document Design Review Checklist Certificate(s) of Compliance shall be reviewed and signed by a licensed professional engineer or licensed architect, or a licensed contractor representing services performed by or under the direct supervision of a licensed engineer or architect, as specified in the provisions of Division 3 of the Business and Professions Code. For buildings less than 10,000 square feet, this signer may be the engineer or architect of record. For buildings greater than 10,000 square feet but less than 50,000 square feet, this signer shall be a qualified in-house engineer or architect with no other project involvement or a third-party engineer, architect or contractor. For buildings greater than 50,000 square feet and all buildings with complex mechanical systems serving more than 10,000 square feet, this signer shall be a third-party engineer, architect or contractor.

- A. All Certificate of Compliance documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the energy features, performance specifications, materials, components and manufactured devices required for compliance with Part 6.
- ii. Identify the building project name and location. The building project name and location

identification on the Certificate of Compliance shall be consistent with the building project name and location identification given on the other applicable building design plans and specifications submitted to the enforcement agency for approval with the building permit application.

- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)1 requires the document to be registered.
- iv. Include a declaration statement to the effect that the building energy features, performance specifications, materials, components and manufactured devices for the building design identified on the Certificate of Compliance indicate the building is in compliance with the requirements of Title 24, Parts 1 and 6, and the building design features identified on the Certificate of Compliance are consistent with the building design features identified on the other applicable compliance documents, worksheets, calculations, plans and specifications submitted to the enforcement agency for approval with the building permit application.
- v. Be signed by the *documentation author* to certify the documentation is accurate and complete. When document registration is required by Section 10-103(a)1, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the *responsible person* eligible under Division 3 of the Business and Professions Code to accept responsibility for the design to certify conformance with Part 6. When document registration is required by Section 10-103(a)1, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.

- B. For all low-rise residential buildings for which compliance requires HERS field verification, the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) and their associated Compliance Registration Packages for registration and retention to a HERS provider data registry in compliance with Title 20, Chapter 4, Article 8, Section 1670 et seq. The submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Compliance documents and their associated Compliance Registration Packages

that are registered and retained by a HERS provider data registry shall also be automatically transmitted by the data registry in compliance with Title 20, Chapter 4, Article 8, Section 1670 et seq, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

- C. For alterations to existing residential buildings for which HERS field verification is not required, including but not limited to water heater and window replacements, and for additions to existing residential buildings that are less than 300 square feet for which HERS field verification is not required, the enforcement agencies may at their discretion not require any Certificate of Compliance documentation, or may develop simplified Certificate of Compliance documentation for demonstrating compliance with the Standards.

Exemptions from submitting compliance documentation shall not be deemed to grant authorization for any work to be done in any manner in violation of this code or other provisions of law.

- D. Contingent upon approval of data registry(s) by the Commission, all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6 the person(s) responsible for the Certificate(s) of Compliance shall submit the Certificate(s) and their associated Compliance Registration Packages for registration and retention to a data registry approved by the Commission. The submittals to the approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Compliance documents and their associated Compliance Registration Packages that are registered and retained by an approved data registry shall also be automatically transmitted by the data registry to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

- 2. **Application for a building permit.** Each application for a building permit subject to Part 6 shall contain at least one copy of the documents specified in Sections 10-103(a)2A, 10-103(a)2B and 10-103(a)2C.

- A. For all newly constructed buildings, additions, alterations or repairs regulated by Part 6 the applicant shall submit the applicable Certificate(s) of Compliance to the enforcement agency for approval. The certificate(s) shall conform to the requirements of Section 10-103(a)1, and shall be approved by the local enforcement agency, in accordance with all applicable requirements of Section 10-103(d), by stamp or authorized signature prior to issuance of a building permit. A copy of the Certificate(s) of Compliance shall be included with the documenta-

tion the builder provides to the building owner at occupancy as specified in Section 10-103(b).

For alterations to existing residential buildings for which HERS field verification is required, and when the enforcement agency does not require building design plans to be submitted with the application for a building permit, the applicable Certificate of Compliance documentation specified in Section 10-103(a)1 is not required to be approved by the enforcement agency prior to issuance of a building permit, but shall be approved by the enforcement agency prior to final inspection of the dwelling unit, and shall be made available to the enforcement agency for all applicable inspections, or made available for viewing on an approved data registry.

When the enforcement agency requires building design plans to be submitted with the application for a building permit, the applicable Certificate of Compliance documents shall be incorporated into the building design plans. When Section 10-103(a)1 requires document registration, the certificate(s) that are incorporated into the building design plans shall be copies of the registered Certificate of Compliance documents from a HERS provider data registry, or a data registry approved by the Commission.

- B. When the enforcement agency requires building design plans and specifications to be submitted with the application for a building permit, the plans shall conform to the specifications for the features, materials, components and manufactured devices identified on the Certificate(s) of Compliance, and shall conform to all other applicable requirements of Part 6. Plans and specifications shall be submitted to the enforcement agency for any other feature, material, component or manufactured device that Part 6 requires be indicated on the building design plans and specifications. Plans and specifications submitted with each application for a building permit for nonresidential buildings, high-rise residential buildings and hotels and motels shall provide acceptance requirements for code compliance of each feature, material, component or manufactured device when acceptance requirements are required under Part 6. Plans and specifications for nonresidential buildings, high-rise residential buildings and hotels and motels shall require, and indicate with a prominent note on the plans, that within 90 days after the Enforcement Agency issues a permanent final occupancy permit, record drawings be provided to the building owner.

For all buildings, if the specification for a building design feature, material, component or manufactured device is changed before final construction or installation, such that the building may no longer comply with Part 6 the building must be brought back into compliance, and so indicated on amended plans, specifications, and Certificate(s) of Compliance that shall be submitted to the enforcement agency for approval. Such characteristics shall

include the efficiency (or other characteristic regulated by Part 6) of each building design feature, material, component or device.

- C. The enforcement agency shall have the authority to require submittal of any supportive documentation that was used to generate the Certificate(s) of Compliance, including but not limited to the electronic input file for the compliance software tool that was used to generate performance method Certificate(s) of Compliance; or any other supportive documentation that is necessary to demonstrate that the building design conforms to the requirements of Part 6.
3. **Certificate of Installation.** For all buildings, the person in charge of the construction or installation, who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the construction or installation of features, materials, components or manufactured devices regulated by Part 6 or the Appliance Efficiency Regulations (*responsible person*) shall sign and submit Certificate of Installation documentation as specified in Section 10-103(a)3 to certify conformance with Part 6. If more than one person has responsibility for the construction or installation, each person shall sign and submit the Certificate of Installation documentation applicable to the portion of the construction or installation for which they are responsible; alternatively, the person with chief responsibility for the construction or installation shall sign and submit the Certificate of Installation documentation for the entire construction or installation scope of work for the project. Subject to the requirements of Section 10-103(a)3, persons who prepare Certificate of Installation documentation (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. In accordance with applicable requirements of 10-103(a)3, the signatures provided by *responsible persons* and *documentation authors* shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

A. **Delegation of Signature Authority.** Except where prohibited by law, including but not limited to any requirements under Division 3 of the Business and Professions Code, the *Responsible Person* may delegate signature authority to third parties (*Authorized Representatives*) provided that there is a written agreement:

- i. Between the *Responsible Person* and the person to be designated as the *Authorized Representative*.
- ii. Specifying that the *Authorized Representative* may sign Certificates of Installation on behalf of the *Responsible Person*.
- iii. Specifying that the legal responsibility for construction or installation in the applicable classification for the scope of work specified

on the Certificate of Installation document(s) remains with the *Responsible Person*.

- iv. That is signed by both the *Responsible Person* and the *Authorized Representative*.
- v. That is retained by the HERS Provider to which all compliance documents are submitted for the building to which the Certificate of Installation documentation pertains.
- vi. That is maintained in the HERS Provider Data Registry such that it is accessible for verification by, included but not limited to, the Energy Commission and enforcement agencies.

B. **Format.** All Certificate of Installation documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the features, materials, components, manufactured devices and system performance diagnostic results required to demonstrate compliance with Part 6 and the Appliance Efficiency Regulations.
- ii. State the number of the building permit under which the construction or installation was performed.
- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)3 requires the document to be registered.
- iv. Include a declaration statement indicating that the constructed or installed features, materials, components or manufactured devices (the installation) identified on the Certificate of Installation conform to all applicable codes and regulations, and the installation conforms to the requirements given on the plans and specifications approved by the enforcement agency.
- v. Be signed by the documentation author to certify the documentation is accurate and complete. When document registration is required by Section 10-103(a)3, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- vi. Be signed by the *Responsible Person* eligible under Division 3 of the Business and Professions Code to accept responsibility for construction or installation in the applicable classification for the scope of work specified on the Certificate of Installation document(s), or shall be signed by their *Authorized Representative*. When document registration is required by Section 10-103(a)3, the signature shall be an electronic signature on an elec-

tronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.

C. For all low-rise residential buildings, the person(s) responsible for the Certificate(s) of Installation, or their *Authorized Representative(s)*, shall submit the following Certificate of Installation documentation and their associated Compliance Registration Packages that are applicable to the building to a HERS provider data registry for registration and retention in accordance with Title 20, Chapter 4, Article 8, Section 1670 et seq. and procedures specified in Reference Residential Appendix RA2:

- i. All Certificates of Installation for which compliance requires HERS field verification.
- ii. All other Certificates of Installation, except those exempted by the Energy Commission.

The submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Installation documents and their associated Compliance Registration Packages that are registered and retained by a HERS provider data registry in compliance with Title 20, Chapter 4, Article 8, Section 1670 et seq. shall also be automatically transmitted by the data registry to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

D. For alterations to existing residential buildings for which HERS field verification is not required, including but not limited to water heater and window replacements, and for additions to existing residential buildings that are less than 300 square feet for which HERS field verification is not required, the enforcement agencies may at their discretion not require any Certificate of Installation documentation, or may develop simplified Certificate of Installation documentation for demonstrating compliance with the Standards.

Exemptions from submitting compliance documentation shall not be deemed to grant authorization for any work to be done in any manner in violation of this code or other provisions of law.

E. Contingent upon approval of data registry(s) by the Commission, all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6 the person(s) responsible for the Certificate(s) of Installation, except those documents exempted by the Energy Commission, shall submit the Certificate(s) and their associated

Compliance Registration Packages for registration and retention to a data registry approved by the Commission. The submittals to the approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Installation documents and their associated Compliance Registration Packages that are registered and retained by an approved data registry shall also be automatically transmitted by the data registry to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

F. **Availability.** For all buildings, a copy of the Certificate(s) of Installation shall be posted, or made available with the building permit(s) issued for the building, or made available for viewing on an approved data registry, and shall be made available to the enforcement agency for all applicable inspections. When document registration is required by Section 10-103(a)3, registered copies of the Certificate(s) of Installation from a HERS provider data registry or a data registry approved by the Commission shall be posted or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the Certificate(s) of Installation to be posted upon completion of that portion. A copy of the Certificate(s) of Installation shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

4. **Certificate of Acceptance.** For all nonresidential buildings, high-rise residential buildings and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6 the person in charge of the acceptance testing, who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the applicable scope of system design, or construction, or installation of features, materials, components or manufactured devices regulated by Part 6 or the Appliance Efficiency Regulations (*responsible person*), shall sign and submit all applicable Certificate of Acceptance documentation in accordance with Section 10-103(a)4 and Reference Nonresidential Appendix NA7 to certify conformance with Part 6. If more than one person has responsibility for the acceptance testing, each person shall sign and submit the Certificate of Acceptance documentation applicable to the portion of the construction or installation for which they are responsible; alternatively, the

person with chief responsibility for the system design, construction or installation shall sign and submit the Certificate of Acceptance documentation for the entire construction or installation scope of work for the project. Subject to the requirements of Section 10-103(a)4, persons who prepare Certificate of Acceptance documentation (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. Persons who perform acceptance test procedures in accordance with the specifications in Reference Nonresidential Appendix NA7, and report the results of the acceptance tests on the Certificate of Acceptance (*field technicians*) shall sign a declaration statement on the documents they submit to certify the information provided on the documentation is true and correct. In accordance with applicable requirements of Section 10-103(a)4, the signatures provided by *responsible persons*, *field technicians* and *documentation authors* shall be original signatures on paper documents or electronic signatures on electronic documents conforming to the electronic signature specifications in Reference Joint Appendix JA7.

A. All Certificate of Acceptance documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the features, materials, components, manufactured devices and system performance diagnostic results required to demonstrate compliance with the acceptance requirements to which the applicant must conform as indicated in the plans and specifications submitted under Section 10-103(a)2, and as specified in Reference Nonresidential Appendix NA7.
- ii. State the number of the building permit under which the construction or installation was performed.
- iii. Display the unique registration number assigned by the data registry if Section 10-103(a)4 requires the document to be registered.
- iv. Include a declaration statement indicating that the features, materials, components or manufactured devices identified on the Certificate of Acceptance conform to the applicable acceptance requirements as indicated in the plans and specifications submitted under Section 10-103(a), and with applicable acceptance requirements and procedures specified in the Reference Nonresidential Appendix NA7, and confirms that Certificate(s) of Installation described in Section 10-103(a)3 has been completed and is posted or made available

with the building permit(s) issued for the building, or made available for viewing on an approved data registry.

- v. Be signed by the *documentation author* to certify the documentation is accurate and complete. When document registration is required by Section 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
 - vi. Be signed by the *field technician* who performed the acceptance test procedures and reported the results on the Certificate of Acceptance. When document registration is required by Section 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
 - vii. Be signed by the *responsible person* in charge of the acceptance testing who is eligible under Division 3 of the Business and Professions Code to accept responsibility for the system design, construction or installation in the applicable classification for the scope of work identified on the Certificate of Acceptance, or shall be signed by their authorized representative. When document registration is required by Section 10-103(a)4, the signature shall be an electronic signature on an electronic document in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- B. Contingent upon approval of data registry(s) by the Commission, all nonresidential buildings, high-rise residential buildings, and hotels and motels, when designated to allow use of an occupancy group or type regulated by Part 6 the person(s) responsible for the Certificate(s) of Acceptance shall submit the Certificate(s) and their associated Compliance Registration Packages for registration and retention to a data registry approved by the Commission, excluding all Certificates of Acceptance recorded by an acceptance test technician certification provider (Sections 10-103.1 and 10-103.2). The submittals to the approved data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Acceptance documents and their associated Compliance Registration Packages that are registered and retained by an approved data registry shall also be automatically transmitted by

the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

- > C. A copy of the Certificate(s) of Acceptance shall be posted, or made available with the building permit(s) issued for the building, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the Certificate(s) of Acceptance to be posted upon completion of that portion. A copy of the Certificate(s) of Acceptance shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

5. **Certificate of Field Verification and Diagnostic Testing (Certificate of Verification).** For all buildings for which compliance requires HERS field verification, a certified HERS Rater shall conduct all required HERS field verification and diagnostic testing in accordance with applicable procedures specified in Reference Appendices RA2, RA3, NA1 and NA2. All applicable Certificates of Verification documentation shall be completed, signed and submitted by the certified HERS Rater who performed the field verification and diagnostic testing services (*responsible person*) in accordance with the requirements of Section 10-103(a)5, and Reference Appendices RA2 and NA1, to certify conformance with Part 6. If more than one rater has responsibility for the HERS verification for the building, each rater shall sign and submit the Certificate of Verification documentation applicable to the portion of the building for which they are responsible. Subject to the requirements of Section 10-103(a)5, persons who prepare Certificate of Verification documentation (*documentation authors*) shall sign a declaration statement on the documents they prepare to certify the information provided on the documentation is accurate and complete. The signatures provided by *responsible persons* and *documentation authors* shall be electronic signatures on electronic documents.

A. **Format.** All Certificate of Verification documentation shall conform to a format and informational order and content approved by the Energy Commission.

These documents shall:

- i. Identify the installed features, materials, components, manufactured devices or system performance diagnostic results that require HERS verification for compliance with Part 6 as specified on the Certificate(s) of Compliance for the building.
- ii. State the number of the building permit under which the construction or installation was performed.

- iii. Display the unique registration number assigned by the HERS provider data registry, and provide any additional information required by Reference Appendices RA2, RA3, NA1 and NA2.
 - iv. Include a declaration statement indicating that the installed features, materials, components or manufactured devices requiring HERS verification conform to the applicable requirements in Reference Appendices RA2, RA3, NA1, NA2, and the requirements specified on the Certificate(s) of Compliance approved by the local enforcement agency, and confirms the same features, materials, components or manufactured devices are identified on the applicable Certificate(s) of Installation signed and submitted by the person(s) responsible for the construction or installation as described in Section 10-103(a)3.
 - v. Be signed by the *documentation author* to certify the documentation is accurate and complete. The signatures shall be electronic signatures on electronic documents in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
 - vi. Be signed by the HERS Rater who performed the field verification and diagnostic testing services (*responsible person*). The signatures shall be electronic signatures on electronic documents in accordance with the electronic signature specifications in Reference Joint Appendix JA7.
- B. For all buildings for which compliance requires HERS field verification, the certified HERS Rater responsible for the Certificate(s) of Verification shall submit the Certificates and their associated Compliance Registration Packages for registration and retention to a HERS provider data registry in accordance with the applicable procedures in Reference Appendices RA2 and NA1, and in compliance with Title 20, Chapter 4, Article 8, Section 1670 et seq.

The submittals to the HERS provider data registry shall be made electronically in accordance with the specifications in Reference Joint Appendix JA7.

Contingent upon availability and approval of an electronic document repository by the Executive Director, Certificate of Verification documents and their associated Compliance Registration Packages that are registered and retained by a HERS provider data registry in accordance with Title 20, Chapter 4, Article 8, Section 1670 et seq. shall also be automatically transmitted by the data registry, to an electronic document repository for retention in accordance with the specifications in Reference Joint Appendix JA7.

C. **Availability.** For all buildings, a copy of the registered Certificate(s) of Verification shall be posted, or made available with the building permit(s) issued

for the building, or made available for viewing on an approved data registry, and shall be made available to the enforcement agency for all applicable inspections. If construction on any portion of the building subject to Part 6 will be impossible to inspect because of subsequent construction, the enforcement agency may require the Certificate(s) of Verification to be posted upon completion of that portion. A copy of the registered Certificate(s) of Verification shall be included with the documentation the builder provides to the building owner at occupancy as specified in Section 10-103(b).

Exception to Section 10-103(a): Enforcing agencies may exempt nonresidential buildings that have no more than 1,000 square feet of conditioned floor area in the entire building and an occupant load of 49 persons or less from the documentation requirements of Section 10-103(a), provided a statement of compliance with Part 6 is submitted and signed by a licensed engineer or the licensed architect with chief responsibility for the design.

(b) Compliance, operating, maintenance and ventilation information to be provided by builder.

1. Compliance information.

A. For low-rise residential buildings, at final inspection, the enforcement agency shall require the builder to leave in the building, copies of the completed, signed and submitted compliance documents for the building owner at occupancy. For low-rise residential buildings, such information shall, at a minimum, include copies of all Certificate of Compliance, Certificate of Installation and Certificate of Verification documentation submitted. These documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).

B. For nonresidential buildings, high-rise residential buildings and hotels and motels, at final inspection, the enforcement agency shall require the builder to leave in the building, copies of the completed, signed and submitted compliance documents for the building owner at occupancy. For nonresidential buildings, high-rise residential buildings and hotels and motels, such information shall include copies of all Certificate of Compliance, Certificate of Installation, Certificate of Acceptance and Certificate of Verification documentation submitted. These documents shall be in paper or electronic format and shall conform to the applicable requirements of Section 10-103(a).

2. Operating information. At final inspection, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, operating information for all applicable features, materials, components and mechanical devices installed in the building. Operating information shall include instructions on how to operate the features, materials, components and mechanical devices correctly and efficiently. The instructions shall be consis-

tent with specifications set forth by the Executive Director. For low-rise residential buildings, such information shall be contained in a folder or manual which provides all information specified in Section 10-103(b). This operating information shall be in paper or electronic format.

For dwelling units, buildings or tenant spaces that are not individually owned and operated, or are centrally operated, such information shall be provided to the person(s) responsible for operating the feature, material, component or mechanical device installed in the building. This operating information shall be in paper or electronic format.

3. Maintenance information. At final inspection, the enforcement agency shall require the builder to leave in the building, for the building owner at occupancy, maintenance information for all features, materials, components and manufactured devices that require routine maintenance for efficient operation. Required routine maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title and/or publication number, the operation and maintenance manual for that particular model and type of feature, material, component or manufactured device. For low-rise residential buildings, this information shall include a schedule of all interior luminaires and lamps installed to comply with Section 150.0(k).

For dwelling units, buildings or tenant spaces that are not individually owned and operated or are centrally operated, such information shall be provided to the person(s) responsible for maintaining the feature, material, component or mechanical device installed in the building. This information shall be in paper or electronic format.

4. Ventilation information.

A. For low-rise and high-rise residential buildings, the enforcement agency shall require the builder to leave the following information in the building, for the building owner at occupancy:

i. A description of the quantities of outdoor air that the whole-dwelling unit ventilation system(s) are designed to provide to the building's conditioned space, and instructions for proper operation and maintenance of the ventilation system.

ii. Instructions for proper operation and maintenance of local exhaust systems, including instructions for conditions for which any occupant-controlled systems such as kitchen range hoods and bathroom exhaust fans should be used.

iii. For systems in buildings or tenant spaces that are not individually owned and operated by the dwelling unit occupants, the building's owner or their representative shall provide a copy of the ventilation system information to dwelling occupants at the beginning of their occupancy. For systems in buildings or tenant spaces that are cen-

trally operated, all applicable ventilation system information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component or mechanical ventilation device installed in the building. This information shall be in paper or electronic format.

B. For nonresidential buildings, and hotels and motels, the enforcement agency shall require the builder to provide the building owner at occupancy a description of the quantities of outdoor and recirculated air that the ventilation systems are designed to provide to each area. For buildings or tenant spaces that are not individually owned and operated or are centrally operated, such information shall be provided to the person(s) responsible for operating and maintaining the feature, material, component or mechanical device installed in the building. This information shall be in paper or electronic format.

(c) **Equipment information to be provided by manufacturer or supplier.** The manufacturer or supplier of any manufactured device shall, upon request, provide to building designers and installers information about the device. The information shall include the efficiency (and other characteristics regulated by Part 6). This information shall be in paper or electronic format.

(d) **Enforcement agency requirements.**

1. **Permits.** An enforcement agency shall not issue a building permit for any construction unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 that are in effect on the date the building permit was applied for. The enforcement agency determination shall confirm that the documentation requirements of Sections 10-103(a)1 and 10-103(a)2 have been met.

If a building permit has been previously issued, there has been no construction under the permit, and the permit has expired, the enforcement agency shall not issue a new permit unless the enforcement agency determines in writing that the construction is designed to comply with the requirements of Part 6 in effect on the date the new permit is applied for. The enforcement agency determination shall confirm that the documentation requirements of Sections 10-103(a)1 and 10-103(a)2 have been met.

“Determines in writing” includes, but is not limited to, approval of a building permit with a stamp normally used by the enforcement agency.

2. **Inspection.** The enforcement agency shall inspect newly constructed buildings and additions, and alterations to existing buildings to determine whether the construction or installation is consistent with the agency's approved plans and specifications, and complies with Part 6. Final certificate of occupancy shall not be issued until such consistency and compliance is verified. For Occupancy Group R-3,

final inspection shall not be complete until such consistency and compliance is verified.

Such verification shall include determination that:

A. All installed features, materials, components or manufactured devices, regulated by the Appliance Efficiency Regulations or Part 6 are indicated, when applicable, on the Certificate(s) of Installation, Certificate(s) of Acceptance and Certificate(s) of Verification, and are consistent with such features, materials, components or manufactured devices given in the plans and specifications and the Certificate(s) of Compliance approved by the local enforcement agency.

B. All required Certificates of Installation are posted, or made available with the building permit(s) issued for the building, or made available for viewing on an approved data registry, and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Installation conform to the specifications of Section 10-103(a)3.

C. All required Certificates of Acceptance are posted, or made available with the building permit(s) issued for the building and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Acceptance conform to the specifications of Section 10-103(a)4.

D. All required Certificates of Verification are posted, or made available with the building permit(s) issued for the building, or made available for viewing on an approved data registry, and are made available to the enforcement agency for all applicable inspections, and that all required Certificates of Verification conform to the specifications of Section 10-103(a)5.

Authority: Section 25402, Public Resources Code.

Reference: Section 25402, Public Resources Code.

HISTORY:

1. Amendment of subsection (e) filed 1-19-84; effective thirtieth day thereafter (Register 84, No. 3).
2. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
3. Editorial correction of subsection (b) filed 2-5-85; effective upon filing pursuant to Government Code Section 11346.2 (d) (Register 85, No. 6).
4. Amendment of subsection (a) filed 12-4-86; effective thirtieth day thereafter (Register 87, No. 1).
5. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-103, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.
6. (CEC 2/94) Regular order by the California Energy Commission to amend Section 10-103 (a) 1, 2, 3 and 4; (b) 1, 2 and 3; (d) 2, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state May 24, 1995; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on May 23, 1995.

10-103.1. Nonresidential lighting controls acceptance test training and certification.

(a) **Scope.** The requirements of this section apply to Acceptance Test Technicians (ATTs) and Acceptance Test Employers (ATEs), and Acceptance Test Technician Certification Providers (ATTCPs) that perform work relating to the acceptance testing of nonresidential lighting systems and controls.

(b) **Industry certification threshold.** ATT and ATE certification requirements shall take effect when the Energy Commission finds that each of the following conditions are met. Until such time that Sections 10-103.1(b)1 and 10-103.1(b)2 are met, or if, subsequent to being met, they cease to be maintained, Field Technicians may complete acceptance testing as specified in Part 6, Sections 130.4 and 160.5(e) without meeting the certification requirements specified in Part 1, Section 10-103.1.

1. **Number of certified ATTs.** There shall be no less than 300 ATTs certified to perform the lighting acceptance tests in Building Energy Efficiency Standards, Sections 130.4 and 160.5(e). The number of certified ATTs shall be submitted to the Energy Commission in the annual reports prepared by ATTCPs, as specified in Section 10-103.1(d)1.

2. **Industry coverage by ATTCPs.** The ATTCPs approved by the Energy Commission, in their entirety, shall provide reasonable access to certification to the following industry groups: electrical contractors, certified general electricians, licensed architects, professional engineers, controls installation and startup contractors and certified commissioning professionals who have verifiable training, experience and expertise in lighting controls and electrical systems. The Energy Commission will determine whether reasonable access to certification is provided by considering factors such as certification costs commensurate with the complexity of the training being provided, certification marketing materials, prequalification criteria, class location and availability, and curriculum.

(c) **Qualifications and approval of ATTCPs.** ATTCPs shall submit a written application to the Energy Commission with a summary and the related background documents to explain how the following criteria and procedures have been met:

1. **Organizational Structure.** ATTCPs shall provide written explanations of the organization type, by-laws and ownership structure. ATTCPs shall explain in writing how their certification program meets the qualification requirements of Title 24, Part 1, Section 10-103.1(c). ATTCPs shall explain in their application to the Energy Commission their organizational structure and their procedures for independent oversight, quality assurance, supervision and support of the acceptance test training and certification processes.

2. **Certification of ATEs.** The ATTCPs shall provide written explanations of their certification and oversight

of ATEs. This explanation shall document how the ATTCP ensures that ATEs are providing quality control and appropriate supervision and support for their ATTs.

A. **Recertification.** The ATTCP shall recertify all ATEs prior to the implementation of each adopted update to the Building Energy Efficiency Standards as these updates affect the acceptance test requirements. Recertification requirements and procedures shall only apply to those specific elements that are new or modified in future updates to Building Energy Efficiency Standards.

3. **Training and Certification Procedures.** ATTCPs shall include with their application a complete copy of all training and testing procedures, manuals, handbooks and materials. ATTCPs shall explain in writing how their training and certification procedures include, but are not limited to, the following:

A. **Training scope.** The scope of the training shall include both hands-on experience and theoretical training to certify competency in the technologies and skills necessary to perform the acceptance tests.

B. **ATT training.**

(i) **Curricula.** ATTCP training curricula for ATTs shall include, but not be limited to, the analysis, theory and practical application of the following:

- a. Lamp and ballast systems;
- b. Line voltage switching controls;
- c. Low voltage switching controls;
- d. Dimming controls;
- e. Occupancy sensors;
- f. Photosensors;
- g. Demand responsive signal inputs to lighting control systems;
- h. Building Energy Efficiency Standards required lighting control systems;
- i. Building Energy Efficiency Standards required lighting control system-specific analytical/problem solving skills;
- j. Integration of mechanical and electrical systems for Building Energy Efficiency Standards required lighting control installation and commissioning;
- k. Safety procedures for low-voltage retrofits (< 50 volts) to control line voltage systems (120 to 480 volts);
- l. Accurate and effective tuning, calibration and programming of Building Energy Efficiency Standards required lighting control systems;
- m. Measurement of illuminance according to the Illuminating Engineering Society's

measurement procedures as provided in the IES Lighting Handbook, 10th Edition, 2011;

- n. Building Energy Efficiency Standards lighting controls acceptance testing procedures; and
 - o. Building Energy Efficiency Standards acceptance testing compliance documentation for lighting controls.
- ii. **Hands-on training.** The ATTCP shall describe in its application the design and technical specifications of the laboratory boards, equipment and other elements that will be used to meet the hands-on requirements of the training and certification.
 - iii. **Prequalification.** Participation in the certification program shall be limited to persons who have at least three years of professional experience and expertise in lighting controls and electrical systems as determined by the Lighting Controls ATTCPs.

NOTE: ATTCPs may specify additional qualifications for participation in their programs, such as limiting participation to persons that are not currently listed as “decertified” by another ATTCP.

- iv. **Instructor to Trainee Ratio.** The ATTCP shall document in its application to the Energy Commission why its instructor to trainee ratio is sufficient to ensure the integrity and efficacy of the curriculum and program based on industry standards and other relevant information.
- v. **Tests.** The ATTCP shall describe the written and practical tests used to demonstrate each certification applicant’s competence in all specified subjects. The ATTCPs shall retain all results of these tests for five years from the date of the test.
- vi. **Recertification.** The ATTCP shall recertify all ATTs prior to the implementation of each adopted update to the Building Energy Efficiency Standards when these updates affect the acceptance test requirements. Recertification requirements and procedures shall only apply to those specific elements that are new or modified in future updates to Building Energy Efficiency Standards. The ATTCP shall develop recertification training curricula for ATTs consistent with training requirements in Sections 10-103.1(c)3A and 10-103.1(c)3B, and shall submit the proposed recertification training curricula to the Energy Commission for review and approval in the update report required under Section 10-103.1(d)2.

C. ATE Training. Training for ATEs shall consist of a single class or webinar consisting of at least four hours of instruction that covers the scope and pro-

cess of the acceptance tests in Building Energy Efficiency Standards, Sections 130.4 and 160.5(e).

- D. **Complaint procedures.** The ATTCPs shall describe in their applications to the Energy Commission procedures for accepting and addressing complaints regarding the performance of any ATT or ATE certified by the ATTCP, and explain how building departments and the public will be notified of these proceedings.
- E. **Decertification procedures.** The ATTCPs shall describe in its applications to the Energy Commission procedures for revoking their certification of ATTs and ATEs based upon poor quality or ineffective work, failure to perform acceptance tests, falsification of documents, failure to comply with the documentation requirements of these regulations or other specified actions that justify decertification. The ATTCP shall also describe its general procedures for decertified ATTs or ATEs seeking to regain their certification status, including eligibility requirements for recertification (if any).
- F. **Quality Assurance and Accountability.** The ATTCP shall describe in its application to the Energy Commission its procedures for conducting quality assurance and accountability activities, including but not limited to the following:
 - i. The ATTCP shall include quality assurance and accountability measures, including but not limited to independent oversight of the certification materials, processes and procedures, visits to building sites where certified technicians are completing acceptance tests, certification process evaluations, building department surveys to determine acceptance testing effectiveness, and expert review of the training curricula developed for Building Energy Efficiency Standards, Sections 130.4 and 160.5(e).
 - ii. The ATTCP shall review a random sample of no less than 1 percent of each ATT’s completed compliance forms, and shall perform randomly selected on-site audits of no less than 1 percent of each ATT’s completed acceptance tests. Independent oversight may be demonstrated by accreditation under the ISO/IEC 17024 standard.
- G. **Certification identification number and verification of ATT and ATE certification status.** The ATTCP shall describe in its application to the Energy Commission its procedures for recording, tracking and communicating certification status, including but not limited to the following:
 - i. Upon certification of an ATT or ATE, the ATTCP shall issue a unique certification identification number to the ATT or ATE.
 - ii. The ATTCP shall maintain an accurate public record of the certification status for all ATTs

and ATEs that the ATTCP has certified, including any ATTs or ATEs who have been decertified as specified in Section 10-103.1(c)3E.

- iii. The ATTCP shall provide verification of current ATT certification status upon request to authorized document Registration Provider personnel or enforcement agency personnel to determine the ATT's eligibility to sign Certificate of Acceptance documentation according to all applicable requirements in Sections 10-103.1, 10-102, 10-103(a)4, and the Reference Joint Appendix JA7.

H. Electronic database system. The ATTCP shall maintain, or by suitable contractual requirements cause to be maintained, an electronic database system approved by the Energy Commission. The electronic database system shall be capable of all the following:

- i. Support all activities for the ATTCP to comply with its quality assurance program as required by Section 10-103.1(c)3F.
- ii. For no less than five years, record and preserve all certificates of acceptance offered for certification by the ATTCP and as performed by its own certified ATTs.
- iii. Allow the transmission of electronic copies of each completed certificate of acceptance to the ATT that performed the test, the ATE associated with that ATT or both.
 - a. Each page of each certificate of acceptance shall bear the logo of the ATTCP or other identifying insignia as approved by the Energy Commission.
 - b. The electronic copy shall be capable of being printed.
 - c. The ATTCP may apply to the Energy Commission for approval to use alternative compliance documents that differ from those approved for use by the Energy Commission but must demonstrate that these alternative compliance documents do not differ in format, informational order or content from approved compliance documents.
- iv. Provide a means of verifying any certificate of acceptance to the enforcement agency having jurisdiction as identified on the certificate of acceptance.
- v. Provide the Energy Commission with any of the following project data or documents upon request: project address, permit numbers, acceptance test technician and acceptance test employee certification numbers, certificates of acceptance, compliance forms, installation forms and record of quality assurance review. The Energy Commission may adopt an Appli-

cation Programming Interface (API) for providing data electronically. Within one year of development of an API, the ATTCP's electronic database system shall have the ability to transfer project data to the Energy Commission through the API upon completion of the project or at established intervals no longer than monthly.

I. Compliance document recording and repository reporting requirement.

- i. The ATTCP shall record all certificates of compliance [Section 10-103(a)1], certificates of installation [Section 10-103(a)3] and certificates of acceptance [Section 10-103(a)4] associated with any acceptance test specified in Part 6, Sections 130.4 and 160.5(e).
- ii. Contingent upon Energy Commission approval of the threshold [Section 10-103.1(b)] and upon availability and approval of an electronic document repository by the Executive Director, the ATTCP shall submit monthly data transfer packets to the Energy Commission to an electronic document repository for retention consistent with Energy Commission instructions.

(d) Requirements for ATTCPs to provide regular reports. The ATTCP shall provide the following regular reports to the Energy Commission:

1. Annual Report. The ATTCP shall provide an annual report to the Energy Commission that includes the following:

- A. A summary of the certification services provided over the reporting period, including the total number of Acceptance Test Technicians and Employers certified by the ATTCP during the reporting period and to date.
- B. A summary of all actions taken against any ATT or ATE as a result of the complaint or quality assurance procedures described by the ATTCP as required under Section 10-103.1(c)3D and 10-103.1(c)3F.
- C. A summary of the quality assurance and accountability activities conducted over the reporting period, including the compliance forms reviewed and the on-site audits performed as required under Section 10-103.1(c)3Fii during the reporting period and to date.
- D. A summary of the number and type of acceptance tests performed in each local jurisdiction over the reporting period and to date.
- E. A signed certification to the Energy Commission that the ATTCP continues to meet the requirements of Section 10-103.1.

2. Update Report. The ATTCP shall have no less than six months following the adoption of an update to the Building Energy Efficiency Standards to prepare an Update Report. The ATTCP shall submit an Update

Report to the Energy Commission no less than six months prior to the effective date of any newly adopted update to the Building Energy Efficiency Standards. The ATTCP shall report to the Energy Commission what application amendments are proposed, to address changes to the Building Energy Efficiency Standards or to ensure training is reflective of the variety of lighting controls that are currently encountered in the field. All required update reports shall contain a signed certification that the ATTCP continues to meet the requirements of Section 10-103.1. Update reports shall be approved through the Amendment Process provided under Section 10-103.1(f).

All required reports shall contain a signed certification that the ATTCP has met all requirements for this program.

(e) **Application review and determination.** The Energy Commission shall review ATTCP applications according to the criteria and procedures in Section 10-103.1(c) to determine if such providers meet the specified requirements for providing acceptance testing certification services.

1. Energy Commission staff will review and validate all information received on ATTCP applications, and determine whether the application is complete and contains sufficient information to be evaluated by staff. Complete applications shall be evaluated by staff based on their contents.
2. The Executive Director may require that the applicant provide additional information as required by staff to fully evaluate the ATTCP application.
3. The Executive Director shall provide a copy of the staff evaluation to interested persons and provide a reasonable opportunity for public comment.
4. The Executive Director shall issue a written recommendation that the Energy Commission designate the applicant as an authorized ATTCP or deny the application.
5. The Energy Commission shall make a final decision on the application at a publicly-noticed hearing.

(f) **Amendment Process.**

The ATTCP may amend a submitted or approved application, as follows:

1. **Amendment Scope.**

A. **Nonsubstantive Changes.** A nonsubstantive change is a change that does not substantively alter the requirements of the application materials for the ATTCP, ATT or ATE. For amendments making only nonsubstantive changes, the ATTCP shall submit the following:

- i. A letter describing the change to the Energy Commission as an addendum to the application;
- ii. A replacement copy of the affected sections of the ATTCP application with the changes incorporated; and

- iii. A copy of the affected sections of the ATTCP application showing the changes in underline and strikeout format.

B. **Substantive Changes.** A substantive change is a change that substantively alters the requirements of the application materials for the ATTCP, ATT or ATE. For amendments making any substantive changes, the ATTCP shall submit the following:

- i. A document describing the scope of the change to the application, the reason for the change and the potential impact to the ATTCP, ATT and ATE as an addendum to the application;
- ii. A replacement copy of the affected sections of the ATTCP application with the changes incorporated; and
- iii. A copy of the affected sections of the ATTCP application showing the changes in underline and strikeout format.

2. **Amendment Review.** Amendments submitted prior to approval of an ATTCP application shall be included in the application's Application Review and Determination process specified in Section 10-103.1(e).

Amendments submitted after approval of an ATTCP's application that contain only nonsubstantive changes shall be reviewed by the Executive Director for consistency with Section 10-103.1. Amendments determined to be consistent with this section shall be incorporated into the approval as errata.

Amendments submitted after approval of an ATTCP's application that contain any substantive changes shall be subject to the Application Review and Determination process specified in Section 10-103.1(e). If the Energy Commission finds that the amended application does not meet the requirements of Section 10-103.1, then the ATTCP shall either abide by the terms of their previously approved application or have their approval suspended.

(g) **Review by the Energy Commission.** If the Energy Commission determines there is a violation of these regulations or that an ATTCP is no longer providing adequate certification services, the Energy Commission may revoke the authorization of the ATTCP pursuant to Section 1230 et seq. of Title 20 of the California Code of Regulations.

Authority: Sections 25402, 25402.1, 25213, Public Resources Code.

References: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

10-103.2. Nonresidential mechanical acceptance test training and certification.

(a) **Scope.** The requirements of this section apply to Acceptance Test Technicians (ATTs), Acceptance Test Employers (ATEs) and Acceptance Test Technician Certification Providers (ATTCPs) that perform work relating to the acceptance testing of nonresidential mechanical systems and controls.

(b) **Industry Certification Threshold.** ATT and ATE certification requirements shall take effect when the Energy Commission finds that each of the following conditions are

met. Until such time that Sections 10-103.2(b)1 and 10-103.2(b)2 are met, or if, subsequent to being met, they cease to be maintained, Field Technicians may complete acceptance testing as specified in Sections 120.5 and 160.3(d) without completing certification requirements specified in Part 1, Section 10-103.2.

1. **Number of Certified ATTs.**

A. There shall be no less than 300 ATTs certified to perform the complete set of mechanical acceptance tests in Building Energy Efficiency Standards, Sections 120.5 and 160.3(d), except as provided in Subsection 10-103.2(b)1B. The number of certified ATTs shall be submitted to the Energy Commission in the annual reports prepared by ATTCPs, as specified in Section 10-103.2(d)1.

B. If there are less than 300 ATTs certified to perform all of the acceptance tests in Building Energy Efficiency Standards, Sections 120.5 and 160.3(d), then there shall be at least 300 ATTs certified to complete the following tests:

- i. NA7.5.1 Outdoor Air Ventilation Systems
- ii. NA7.5.2 Constant Volume, Single Zone Unitary Air Conditioners and Heat Pumps
- iii. NA7.5.4 Air Economizer Controls
- iv. NA7.5.5 Demand Control Ventilation Systems
- v. NA 7.5.6 Supply Fan Variable Flow Controls
- vi. NA7.5.7, NA7.5.9 Hydronic System Variable Flow Controls
- vii. NA7.5.10 Automatic Demand Shed Controls

2. **Industry coverage by ATTCPs.** ATTCPs approved by the Energy Commission, in their entirety, provide reasonable access to certification to the following industry groups: professional engineers, licensed architects, HVAC installers, mechanical contractors, Testing and Balancing (TAB) certified technicians, controls installation and startup contractors and certified commissioning professionals who have verifiable training, experience and expertise in HVAC systems. The Energy Commission will determine reasonable access by considering factors such as certification costs commensurate with the complexity of the training being provided, certification marketing materials, prequalification criteria, class availability and curriculum.

(c) **Qualifications and approval of ATTCPs.** ATTCPs shall submit a written application to the Energy Commission with a summary and the necessary background documents to explain how the following criteria and procedures have been met:

1. **Organizational Structure.** ATTCPs shall provide written explanations of the organization type, by-laws and ownership structure. ATTCPs shall explain in writing how their certification program meets the qualifications of Building Energy Efficiency Standards, Section 10-103.2(c). ATTCPs shall explain in their application to the Energy Commission their organizational structure and their procedures for independent oversight,

quality assurance, supervision and support of the acceptance test training and certification processes.

2. **Certification of ATEs.** The ATTCPs shall provide written explanations of their certification and oversight of ATEs. This explanation shall document how the ATTCP ensures that ATEs are providing quality control and appropriate supervision and support for their ATTs.

A. **Recertification.** The ATTCP shall recertify all ATEs prior to the implementation of each adopted update to the Building Energy Efficiency Standards as these updates affect the acceptance test requirements. Recertification requirements and procedures shall only apply to those specific elements that are new or modified in future updates to Building Energy Efficiency Standards.

3. **Requirements for Applicant ATTCPs to Document Training and Certification Procedures.** ATTCPs shall include with their application a complete copy of all training and testing procedures, manuals, handbooks and materials. ATTCPs shall explain in writing how their training and certification procedures include, but are not limited to, the following:

A. **Training Scope.** The scope of the training shall include both hands-on experience and theoretical training to certify competency in the technologies and skills necessary to perform the acceptance tests.

B. **ATT Training.**

i. **Curricula.** ATTCP training curricula for ATTs shall include, but not be limited to, the analysis, theory and practical application of the following:

- a. Constant volume system controls;
- b. Variable volume system controls;
- c. Air-side economizers;
- d. Air distribution system leakage;
- e. Demand controlled ventilation with CO₂ sensors;
- f. Demand controlled ventilation with occupancy sensors;
- g. Automatic demand shed controls;
- h. Hydronic valve leakage;
- i. Hydronic system variable flow controls;
- j. Supply air temperature reset controls;
- k. Condenser water temperature reset controls;
- l. Outdoor air ventilation systems;
- m. Supply fan variable flow controls;
- n. Boiler and chiller isolation controls;
- o. Fault detection and diagnostics for packaged direct-expansion units;
- p. Automatic fault detection and diagnostics for air handling units and zone terminal units;

- q. Distributed energy storage direct-expansion air conditioning systems;
 - r. Thermal energy storage systems;
 - s. Building Energy Efficiency Standards mechanical acceptance testing procedures; and
 - t. Building Energy Efficiency Standards acceptance testing compliance documentation for mechanical systems.
- ii. **Hands-on training.** The ATTCP shall describe in its application the design and technical specifications of the laboratory boards, equipment and other elements that will be used to meet the hands-on requirements of the training and certification.
 - iii. **Prequalification.** Participation in the certification program shall be limited to persons who have at least three years of professional experience and expertise in mechanical controls and systems as determined by the Mechanical ATTCPs.
NOTE: ATTCPs may specify additional qualifications for participation in their programs, such as limiting participation to persons that are not currently listed as “decertified” by another ATTCP.
 - iv. **Instructor to Trainee Ratio.** The ATTCP shall document in its application to the Energy Commission why its instructor to trainee ratio is sufficient to ensure the integrity and efficacy of the curriculum and program based on industry standards and other relevant information.
 - v. **Tests.** The ATTCP shall describe the written and practical tests used to demonstrate each certification applicant’s competence in all specified subjects. The ATTCPs shall retain all results of these tests for five years from the date of the test.
 - vi. **Recertification.** The ATTCP shall recertify all ATTs prior to the implementation of each adopted update to the Building Energy Efficiency Standards as these updates affect the acceptance test requirements. Recertification requirements and procedures shall only apply to those specific elements that are new or modified in future updates to Building Energy Efficiency Standards.

C. **ATE.** Training for ATEs shall consist of a single class or webinar consisting of at least four hours of instruction that covers the scope and process of the acceptance tests in Building Energy Efficiency Standards, Sections 120.5 and 160.3(d).

D. **Complaint procedures.** Procedures described in writing for notifying building departments and the public that the ATTCP will accept complaints regarding the performance of any certified ATT or ATE, and procedures for how the ATTCP will address these complaints.

E. **Decertification Procedures.** The ATTCP shall describe in its application to the Energy Commission procedures for revoking their certification of ATT and ATEs based upon poor quality or ineffective work, failure to perform acceptance tests, falsification of documents, failure to comply with the documentation requirements of these regulations or other specified actions that justify decertification. The ATTCP shall also describe its general procedures for decertified ATTs or ATEs seeking to regain their certification status, including eligibility requirements for recertification (if any).

F. **Quality Assurance and Accountability.** The ATTCP shall describe in its applications to the Energy Commission procedures for conducting quality assurance and accountability activities, including but not limited to the following:

- i. The ATTCPs shall include quality assurance and accountability measures, including but not limited to independent oversight of the certification materials, processes and procedures, visits to building sites where certified technicians are completing acceptance tests, certification process evaluations, building department surveys to determine acceptance testing effectiveness, and expert review of the training curricula developed for Building Energy Efficiency Standards, Sections 120.5 and 160.3(d).
- ii. The ATTCP shall review a random sample of no less than 1 percent of each ATT’s completed compliance forms. The ATTCP shall also randomly select and shadow audit no less than 1 percent of each ATE’s overseen projects, following the assigned ATT and observing their performance on the job site. Independent oversight may be demonstrated by accreditation under the ISO/IEC 17024 standard.

G. **Certification Identification Number and Verification of ATT and ATE Certification Status.** The ATTCP shall describe in its applications to the Energy Commission procedures for recording, tracking and communicating certification status, including but not limited to the following:

- i. Upon certification of an ATT or ATE, the ATTCP shall issue a unique certification identification number to the ATT or ATE.
- ii. The ATTCP shall maintain an accurate public record of the certification status for all ATTs and ATEs that the ATTCP has certified, including any ATTs or ATEs who have been decertified as specified in 10-103.2(c)3E.
- iii. The ATTCP shall provide verification of current ATT certification status upon request to authorized document Registration Provider personnel or enforcement agency personnel to

determine the ATT's eligibility to sign Certificate of Acceptance documentation according to all applicable requirements in Sections 10-103.2, 10-102, 10-103(a)4, and Reference Joint Appendix JA7.

H. Electronic Database System. The ATTCP shall maintain, or by suitable contractual requirements cause to be maintained, an electronic database system approved by the Energy Commission. The electronic database system shall be capable of all the following:

- i. Support all activities for the ATTCP to comply with its quality assurance program as required by Section 10-103.2(c)3F.
- ii. For no less than five years, record and preserve all certificates of acceptance offered for certification by the ATTCP and as performed by its own certified ATTs.
- iii. Allow the transmission of electronic copies of each completed certificate of acceptance to the ATT that performed the test, the ATE associated with that ATT or both.
 - a. Each page of each certificate of acceptance shall bear the logo of the ATTCP or other identifying insignia as approved by the Energy Commission.
 - b. The electronic copy shall be capable of being printed.
 - c. The ATTCP may apply to the Energy Commission for approval to use alternative compliance documents that differ from those approved for use by the Energy Commission but must demonstrate that these alternative compliance documents do not differ in format, informational order or content from approved compliance documents.
- iv. Provide a means of verifying any certificate of acceptance to the enforcement agency having jurisdiction as identified on the certificate of acceptance.
- v. Provide the Energy Commission with any of the following project data or documents upon request: project address, permit numbers, acceptance test technician and acceptance test employee certification numbers, certificates of acceptance, compliance forms, installation forms and record of quality assurance review. The Energy Commission may adopt an Application Programming Interface (API) for providing data electronically. Within one year of development of an API, the ATTCP's electronic database system shall have the ability to transfer project data to the Energy Commission through the API upon completion of the project or at established intervals no longer than monthly.

I. Compliance Document Recording and Repository Reporting Requirement:

- i. The ATTCP shall record all certificates of compliance [Section 10-103(a)1], certificates of installation [Section 10-103(a)3], and certificates of acceptance [Section 10-103(a)4] associated with any acceptance test specified in Part 6, Sections 120.5 and 160.3(d).
- ii. Contingent upon Energy Commission approval of the threshold [Section 10-103.2(b)] and upon availability and approval of an electronic document repository by the Executive Director, the ATTCP shall submit monthly data transfer packets to the Energy Commission to an electronic document repository for retention consistent with Energy Commission instructions.

(d) Requirements for ATTCPs to provide regular reports. The ATTCP shall provide the following regular reports to the Energy Commission:

1. **Annual Report.** The ATTCP shall provide an annual report to the Energy Commission that includes the following:
 - A. A summary of the certification services provided over the reporting period, including the total number of Acceptance Test Technicians and Employers certified by the agency during the reporting period and to date.
 - B. A summary of all actions taken against any ATT or ATE as a result of the complaint or quality assurance procedures described by the ATTCP as required under Section 10-103.2(c)3D and 10-103.2(c)3F. <
 - C. A summary of the quality assurance and accountability activities conducted over the reporting period, including the compliance forms reviewed and the on-site audits performed as required under Section 10-103.2(c)3F(ii) during the reporting period and to date. <
 - D. A summary of the number and type of acceptance tests performed in each local jurisdiction over the reporting period and to date.
 - E. A signed certification to the Energy Commission that the ATTCP continues to meet the requirements of Section 10-103.2.
2. **Update Report.** The ATTCP shall have no less than six months following the adoption of an update to the Building Energy Efficiency Standards to prepare an Update Report. The ATTCP shall submit an Update Report to the Energy Commission no less than six months prior to the effective date of any newly adopted update to the Building Energy Efficiency Standards. The ATTCP shall report to the Energy Commission what application amendments are proposed to address changes to the Building Energy Efficiency Standards or to ensure training is reflective of the variety of mechanical equipment and systems currently encountered in the field. All required update reports shall contain a signed certification that the ATTCP continues to meet

all the requirements of Section 10-103.2(c). Update reports shall be approved through the Amendment Process provided under Section 10-103.2(f).

All required reports shall contain a signed certification that the ATTCP has met all requirements for this program.

(e) **Application Review and Determination.** The Energy Commission shall review ATTCP applications according to the criteria and procedures in Section 10-103.2(c) to determine if such providers meet the specified requirements for providing acceptance testing certification services.

1. Energy Commission staff will review and validate all information received on ATTCP applications, and determine whether the application is complete and contains sufficient information to be evaluated by staff. Complete applications shall be evaluated by staff based on their contents.
2. The Executive Director may require that the applicant provide additional information as required by staff to fully evaluate the ATTCP application.
3. The Executive Director shall provide a copy of the staff evaluation to interested persons and provide an opportunity for public comment.
4. The Executive Director shall issue a written recommendation that the Energy Commission designate the applicant as an authorized ATTCP or deny the Provider application.
5. The Energy Commission shall make a final decision on the application at a publicly-noticed hearing.

(f) **Amendment Process.**

The ATTCP may amend a submitted or approved application, as follows:

1. **Amendment Scope.**

A. **Nonsubstantive Changes.** A nonsubstantive change is a change that does not substantively alter the requirements of the application materials for the ATTCP, ATT or ATE. For amendments making only nonsubstantive changes, the ATTCP shall submit the following:

- i. a letter describing the change to the Energy Commission as an addendum to the application;
- ii. A replacement copy of the affected sections of the ATTCP application with the changes incorporated; and
- iii. A copy of the affected sections of the ATTCP application showing the changes in underline and strikeout format.

B. **Substantive Changes.** A substantive change is a change that substantively alters the requirements of the application materials for the ATTCP, ATT or ATE. For amendments making any substantive changes, the ATTCP shall submit the following:

- i. A document describing the scope of the change to the application, the reason for the

change and the potential impact to the ATTCP, ATT and ATE as an addendum to the application;

- ii. A replacement copy of the affected sections of the ATTCP application with the changes incorporated; and
 - iii. A copy of the affected sections of the ATTCP application showing the changes in underline and strikeout format.
2. **Amendment Review.** Amendments submitted prior to approval of an ATTCP application shall be included in the application's Application Review and Determination process specified in Section 10-103.2(e).

Amendments submitted after approval of an ATTCP's application that contain only nonsubstantive changes shall be reviewed by the Executive Director for consistency with Section 10-103.2. Amendments determined to be consistent with this section shall be incorporated into the approval as errata.

Amendments submitted after approval of an ATTCP's application that contain any substantive changes shall be subject to the Application Review and Determination process specified in Section 10-103.2(e). If the Energy Commission finds that the amended application does not meet the requirements of Section 10-103.2, then the ATTCP shall either abide by the terms of their previously approved application or have their approval suspended.

(g) **Review by the Energy Commission.** If the Energy Commission determines there is a violation of these regulations or that an ATTCP is no longer providing adequate certification services, the Energy Commission may revoke the authorization of the ATTCP pursuant to Section 1230 et seq. of Title 20 of the California Code of Regulations.

Authority: Sections 25402, 25402.1, 25213, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8, 25910 and 25943, Public Resources Code.

10-104. Exceptional designs.

Note: See Section 10-109 for approval of calculation methods and Alternative Component Packages.

(a) **Requirements.** If a building permit applicant proposes to use a performance compliance approach, and the building designs cannot be adequately modeled by an approved calculation method, an applicant shall be granted a building permit if the Commission finds:

1. That the design cannot be adequately modeled with an approved calculation method;
2. Using an alternative evaluation technique, that the design complies with Part 6; and
3. That the enforcement agency has determined that the design complies with all other legal requirements.

(b) **Applications.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:

1. A copy of the plans and documentation required by Section 10-103(a)2;

2. A statement explaining why meeting the energy budget cannot be demonstrated using an approved calculation method;
3. Documentation from the enforcement agency stating that:
 - A. Meeting the energy budget requirements cannot be demonstrated using an approved calculation method; and
 - B. The design complies with all other legal requirements; and
4. A detailed evaluation of the energy consumption of the proposed building and the building's materials, components and manufactured devices proposed to be installed to meet the requirements of Part 6 using an alternative evaluation technique. The evaluation shall include a copy of the technique, instructions for its use, a list of all input data and all other information required to replicate the results.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

HISTORY:

1. New section filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
2. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-104, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-105. Enforcement by the Commission.

(a) **Where there is no local enforcement agency.** Before new construction may begin in an area where there is no local enforcement agency, the Executive Director shall determine in writing that the building design conforms to the requirements of Part 6. The person proposing to construct the building shall submit the information described in Sections 10-103(a)1 and 10-103(a)2 to the Executive Director when such a determination is sought.

(b) **Where building construction is under the jurisdiction of a state agency.** Pursuant to Public Resources Code Section 25402.1(g)(5), no construction of any state building shall commence until the Department of General Services or the state agency that otherwise has jurisdiction over the property determines that the construction is designed to comply with the requirements of Part 6, and confirms that the documentation requirements of Sections 10-103(a)1 and 10-103(a)2 have been met and that the plans indicate the features and performance specifications needed to comply with Part 6. The responsible state agency shall notify the Commission's Executive Director of its determination.

(c) **Where the enforcement agency fails to enforce.** If an enforcement agency fails to enforce the requirements of this article or of Part 6 the Commission, after furnishing 10 days written notice, may condition building permit issuance on submission of the information described in Sections 10-103(a)1 and 10-103(a)2 to the Executive Director and on his

or her written determination that proposed construction conforms to the requirements of Part 6.

Authority: Code Section 25402.1, Public Resources Code.

Reference: Section 25402.1, Public Resources Code.

HISTORY:

1. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
2. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-105, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-106. Locally adopted energy standards.

(a) **Requirements.** Local governmental agencies may adopt and enforce energy standards for newly constructed buildings, additions, alterations and repairs to existing buildings provided the following two requirements are met prior to any enforcement of the standards:

1. A determination that the standards are cost effective is adopted by the local agency at a public meeting and subsequently filed with the Energy Commission; and
2. The Energy Commission finds that the standards will require buildings to be designed to consume less energy than permitted by Title 24, Part 6.

(b) **Documentation application.** Local governmental agencies wishing to enforce energy standards subject to Section 10-106(a) shall submit an application with the following materials to the Executive Director:

1. The proposed energy standards;
2. The local governmental agency's findings and supporting analyses on the energy savings and cost effectiveness of the proposed energy standards;
3. A statement or finding by the local governmental agency that the proposed energy standards will require buildings to be designed to consume less energy than permitted by Part 6; and
4. Any findings, determinations, declarations or reports, including any negative declaration or environmental impact report, required pursuant to the California Environmental Quality Act, Public Resources Code Section 21000 et seq.

Authority: Section 25402.1, Public Resources Code.

Reference: Section 21080.4, 21153, 23402.1, Public Resources Code.

HISTORY:

1. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
2. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-106, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-107. Interpretations.

(a) The Commission may make a written determination as to the applicability or interpretation of any provision of this article or of Part 6 upon written application, if a dispute con-

cerning a provision arises between an applicant for a building permit and the enforcement agency, and the dispute has been heard by the local board of permit appeals or other highest local review body. Notice of any such appeal, including a summary of the dispute and the section of the regulations involved, shall if possible be sent to the Commission by the enforcing agency 15 days before the appeal is heard, and the result of the appeal shall be sent to the Commission within 15 days after the decision is made. Either party to the dispute may apply for a determination but shall concurrently deliver a copy of the application to the other party. The determinations are binding on the parties.

(b) The Executive Director may, upon request, give written advice concerning the meaning of any provision of this article or of Part 6. Such advice is not binding on any person.

Authority: Section 25402.1, Public Resources Code.

Reference: Sections 25402.1 and 25218.5, Public Resources Code.

HISTORY:

1. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
2. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-107, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-108. Exemption.

(a) **Requirements.** The Commission may exempt any building from any provision of Part 6 if it finds that:

1. Substantial funds had been expended in good faith on planning, designing, architecture or engineering of the building before the adoption date of the provision; and
2. Compliance with the requirements of the provision would be impossible without both substantial delays and substantial increases in costs of construction above the reasonable costs of the measures required to comply with the provision.

(b) **Application.** The applicant shall submit four copies of a signed application with the following materials to the Executive Director:

1. A summary of the claimant’s contracts for the project;
2. A summary of internal financial reports on the project;
3. Dated schedules of design activities; and
4. A progress report on project completion.

Authority: Section 25402.1, Public Resources Code.

Reference: Section 25402.1, Public Resources Code.

HISTORY:

1. Amendment filed 8-11-83; effective thirtieth day thereafter (Register 83, No. 33).
2. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
3. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-108, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-109. Compliance software, alternative component packages, exceptional methods, data registries and related external digital data sources, alternative residential field verification protocols, electronic document repositories, photovoltaic and battery storage system requirement determinations.

(a) **Compliance software, alternative component packages, exceptional methods, data registries and related data input software, alternative residential field verification protocols or electronic document repositories** must be approved by the Commission in order to be used to demonstrate compliance with Part 6.

(b) **Application.** Applications for approval of compliance software, alternative component packages, exceptional methods, data registries and related data input software, and alternative field verification protocols must be made as follows:

1. An applicant shall submit four copies of a signed application form specified by the Executive Director.
2. The application shall include the following materials:
 - A. A description of the functional or analytical capabilities of the compliance software, alternative component package, calculation method, exceptional method, data registry or related data input software, and alternative field verification protocols; and
 - B. A demonstration that the criteria in Section 10-109 are met; and
 - C. An initial fee of one thousand dollars (\$1,000). The total fee shall cover the Commission’s cost of reviewing and analyzing the application. Within 75 days of receipt of an application, the Commission will provide an estimate of the total maximum cost to review and analyze the application and make a determination as to the completeness of the application. Consideration of the application will be delayed until the applicant submits requested additional information. After the Commission determines the total cost, if the cost exceeds the initial fee, the Commission shall assess an additional fee to cover the total cost. If the actual cost is less than the initial, or any estimated maximum, fee the Commission shall refund the difference to the applicant.

(c) **Compliance software.**

1. **Public domain computer programs.** In addition to the public domain computer programs that are approved pursuant to Public Resources Code Section 25402.1, the Commission may, upon written application or its own motion, approve additional public domain computer programs that may be used to demonstrate that proposed building designs meet energy budgets.
 - A. The Commission shall ensure that users’ manuals or guides for each approved program are available.

B. The Commission shall approve a program only if it predicts energy consumption substantially equivalent to that predicted by the above-referenced public domain computer program, when it models building designs or features.

2. **Alternative calculation methods (all occupancies).**

The Commission may approve nonpublic domain computer programs as an alternative calculation method, that building permit applicants may then use to demonstrate compliance with the performance standards (energy budgets) in Part 6. In addition to the application requirements of subdivision (b) above, an application for approval of compliance software must include documentation demonstrating, that the compliance software meets the requirements, specifications and criteria set forth in the Residential or Nonresidential ACM Approval Manual, as appropriate.

Note: Copies of the ACM Approval Manuals may be obtained from the Commission’s website at: www.energy.ca.gov/title24.

(d) **Alternative component packages.** In addition to the application requirements of subdivision (b) above, an application for approval of an alternative component package must include documentation that demonstrates that the package:

1. Will meet the applicable energy budgets; and
2. Is likely to apply to a significant percentage of newly constructed buildings or to a significant segment of the building construction and design community.

(e) **Exceptional methods.** The Commission may approve an exceptional method that analyzes a design, material or device that cannot be adequately modeled using the public domain computer programs. Applications for approval of exceptional methods shall include all information needed to verify the method’s accuracy.

(f) **Commission action.** The Commission may take the following actions on an application submitted pursuant to this section:

1. Approve the application unconditionally;
2. Restrict approval to specified occupancies, designs, materials or devices; or
3. Reject the application.

(g) **Resubmittal.** An applicant may resubmit a rejected application or may request modification of a restricted approval. Such application shall include the information required pursuant to this section, and, if applicable, shall indicate how the proposed compliance software, alternative component package, exceptional method, data registry or related data input software has been changed to enhance its accuracy or capabilities.

1. Modification. Whenever an approved compliance software, alternative component package, exceptional method, data registry or related data input software is changed in any way, it must be resubmitted under this section for approval.
2. The Commission may modify or withdraw approval of compliance software, an alternative component pack-

age, an exceptional method, or a data registry or related data input software based on its approval of other programs, methods, registries or data input software that are more suitable.

(h) In addition to the procedures and protocols identified in the Alternative Calculation Method Approval Manuals and the Reference Appendices, the Commission may authorize alternative procedures or protocols that demonstrate compliance with Part 6.

(i) **Data registries and related external digital data sources, and electronic document repositories.**

1. Data registries and related external digital data sources.

Data registries and related external digital data sources shall conform to the requirements specified in Reference Joint Appendix JA7.

A. The Commission may approve residential data registries that provide for registration and retention of compliance documents and their associated Compliance Registration Packages when required by Part 6 of all residential compliance documentation and the nonresidential Certificates of Verification.

B. Nonresidential data registry approval thresholds.

- i. The Commission may approve nonresidential data registries that provide for registration and retention of compliance documents and their associated Compliance Registration Packages when required by Part 6 of all nonresidential compliance documentation, excluding all Certificates of Acceptance recorded by an acceptance test technician certification provider (Sections 10-103.1 and 10-103.2). However, nonresidential data registries may not provide for registration of nonresidential Certificates of Verification.
- ii. As a prerequisite to reviewing and/or approving nonresidential data registries for use, on or after January 1, 2023, the Commission shall first make all of the following findings:
 - a. The Commission has approved data schema capable of utilization in the development of any nonresidential data registry.
 - b. The Commission will not lose access to information necessary to support the enforcement and development of current and future building code cycles.
- iii. The procedures for consideration and approval of applications enumerated in Section 10-110 shall not apply to applications for nonresidential data registries until the Commission makes the findings specified in Section 10-109(i)1Bii.
- iv. Nothing in this or any other section, including Section 10-110, shall be construed as requiring the Commission to make the findings specified in Section 10-109(i)1Bii by any set date, regardless of pending applications.

v. The Registration Provider shall only use data schema approved by the Commission in a nonresidential data registry.

C. The Commission may approve external digital data sources used for data input to various data registries for registering, when required by Part 6 residential or nonresidential compliance documentation.

2. Electronic document repositories.

A. The Commission may approve electronic document repositories that retain for the Commission electronic compliance documentation and their associated Compliance Registration Packages generated by residential and nonresidential data registries when registration is required by Part 6.

(j) **Alternative residential field verification protocols.**

Alternative residential field verification protocols shall comply with the application requirements of Section 10-109(b) and any applicable requirements of Reference Residential Appendices RA1.

(k) **Photovoltaic system and battery storage system requirement determinations.**

The Commission may, upon written application or its own motion, determine that the photovoltaic or battery storage requirements in Section 150.1(a)3, Section 140.0(c), Section 170.0(a)3 shall not apply, if the Commission finds that the implementation of public agency rules regarding utility system costs and revenue requirements, compensation for customer-owned generation, interconnection fees or other factors causes the Commission's cost effectiveness conclusions, made pursuant to Public Resources Code 25402(b)(3), to not hold for particular buildings.

Applications shall include full information regarding the differences between public agency rules and Energy Commission cost effectiveness determinations, including all information requested by the Commission to enable full review of the application. Applications shall also include specific recommended limitations to the scope of the determination that is requested, and specific eligibility criteria to determine what buildings would qualify for the determination. Applications from public agencies shall be submitted to the Energy Commission only after public review within the jurisdiction of the public entity or service area of the utility.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25402 and 25402.1, Public Resources Code.

HISTORY:

1. New section filed 12-9-81; designated effective 1-15-82 (Register 81, No. 50).
2. Amendment filed 8-11-83; effective thirtieth day thereafter (Register 83, No. 33).
3. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
4. Amendment of subsections (b), (d) and (e) filed 12-4-86; effective thirtieth day thereafter (Register 87, No. 1).
5. Change without regulatory effect of subsection (d) filed 4-5-88; operative 5-5-88 (Register 88, No. 17).

6. Amendment of subsections (b) and (d) filed 1-20-89; operative 2-19-89 (Register 89, No. 4).

7. (CEC 1/92) Regular order by the California Energy Commission to amend Section 10-109, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state June 12, 1992; publication date July 15, 1992; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on June 8, 1992.

10-110. Procedures for consideration of applications under Sections 10-104, 10-106, 10-108 and 10-109.

(a) Within 75 days of receipt of an application, the Executive Director shall determine if the application is complete with all the supporting information required pursuant to Sections 10-104, 10-106, 10-108 or 10-109 (the complete application package).

(b) Once the application is determined to be complete, the Executive Director shall make the complete application package available to interested parties for review and comment. Comments from interested parties must be submitted within a time period set by the Executive Director, which shall be no less than 15 and no greater than 60 days after the complete application package is made available.

(c) Within 75 days of the date the application is determined to be complete, the Executive Director may request any additional information needed to evaluate the application. Consideration of the application will be delayed until the applicant submits the requested additional information.

(d) Within 75 days of the date the application is determined to be complete, the Executive Director may convene a workshop to gather additional information from the applicant and other interested parties. Interested parties will have 15 days after the workshop to submit additional comments or information regarding the application.

(e) Within 90 days of the date the application is determined to be complete, or within 30 days after receipt of complete additional information requested under Section 10-110(c) or within 60 days after the receipt of additional information submitted by interested parties under Section 10-110(d), whichever is later, the Executive Director shall submit to the Commission a written recommendation on the application.

(f) The complete application package, any additional information considered by the Executive Director, and the Executive Director's recommendation shall be placed on the consent calendar and considered at the next business meeting after submission of the recommendation. The matter may be removed from the consent calendar at the request of any person.

(g) The Executive Director may charge a fee to recover the costs of processing and reviewing applications, with the exception of Section 10-106 applications.

(h) All applicants have the burden of proof to establish that their applications should be granted.

Authority: Section 25402.1, Public Resources Code.

Reference: Section 25402.1, Public Resources Code.

HISTORY:

1. New section filed 12-9-81; designated effective 1-15-82 (Register 81, No. 50).

2. Amendment filed 12-27-84; designated effective 1-1-85 pursuant to Government Code Section 11346.2 (d) (Register 84, No. 52).
3. Amendment filed 12-4-86; effective thirtieth day thereafter (Register 87, No. 1).

10-111. Certification and labeling of fenestration product and exterior door *U*-factors, solar heat gain coefficients, visible transmittance and air leakage. This section establishes rules for implementing labeling and certification requirements relating to *U*-factors, solar heat gain coefficients (SHGCs), visible transmittance (VT) and air leakage for fenestration products and exterior doors under Section 110.6(a) of Part 6. This section also provides for designation of the National Fenestration Rating Council (NFRC) as the supervisory entity responsible for administering the state’s certification program for fenestration products and exterior doors, provided NFRC meets specified criteria.

(a) Labeling requirements.

1. Temporary labels.

- A. Every manufactured fenestration product and exterior door shall have attached to it a clearly visible temporary label that lists the *U*-factor, the solar heat gain coefficient (SHGC) and Visible Transmittance (VT) and that certifies compliance with the air leakage requirements of Section 110.6(a)1. Temporary labels for manufactured fenestration products and exterior doors are to incorporate the values determined by Section 10-111(a)1B and shall comply with the labeling requirements of NFRC 700. No other values for *U*-factor, SHGC, VT and Air Leakage are allowed on the temporary label attached to the manufactured fenestration product or exterior door. Component Modeling Approach (CMA) and site-built fenestration products shall have an NFRC label certificate that lists the *U*-factor, the Solar Heat Gain Coefficient (SHGC) and the Visible Transmittance (VT) and shall comply with the labeling requirements of NFRC 705 for the Computer Modeling Approach or NFRC 700 for site-built fenestration products.
- B. *U*-factor, SHGC, VT and Air Leakage shall be determined by either:
 - i. Fenestration products and exterior doors rated and certified using NFRC 100, NFRC 200, NFRC 202, NFRC 203 or NFRC 400 Rating Procedures. The manufacturer shall stipulate that the ratings were determined in accordance with applicable NFRC procedures. For manufactured fenestration products and exterior doors, a temporary label certificate approved by the supervisory entity (NFRC) meets the requirements of this section. For component modeling and site-built fenestration products, a label certificate approved by the supervisory entity (NFRC) meets the requirements of this section.
 - ii. For manufactured or site-built fenestration products and exterior doors not rated by NFRC, a temporary label with the words “CEC Default *U*-factor,” followed by the appropriate default *U*-factor specified in Section 110.6(a)2 and with

the words “CEC Default SHGC,” followed by the appropriate default SHGC specified in Section 110.6(a)3 and with the words “CEC Default VT,” followed by the appropriate VT as specified in Section 110.6(a)4, meets the requirements of this Subsection B.

C. Temporary labels shall also certify that the manufactured fenestration product or exterior door complies with the air leakage requirements of Section 110.6(a)1 of the Standards.

2. **Permanent labels.** Rated products shall have a permanent label consistent with their rating and certification that is either a stand-alone label, an extension or tab of an existing permanent certification label being used by the manufacturer/responsible party, or series of marks or etchings on the product. The permanent label coupled with observable product characteristics, shall be usable to trace the product to certification information on file with the supervisory entity or to a directory of certified products, published by the supervisory entity. For CMA and site-built fenestration products, a label certificate approved by the supervisory entity meets the requirements of this section.

Exception to Section 10-111(a): Field-fabricated fenestration products.

(b) Certification requirements.

1. **Certification to default ratings.** The manufacturer shall certify on the Default Label that the product’s *U*-factor, SHGC and VT meets the default criteria in Sections 110.6(a)2, 110.6(a)3 and 110.6(a)4; and
 - A. A temporary label, affixed to the product, that meets the requirements of Section 10-111(a)1B meets this requirement.
 - B. If the product claims the default *U*-factor for a thermal break product, the manufacturer shall also certify on the label that the product meets the thermal-break product criteria, specified on the default table, on which the default value is based. Placing the terms “Meets Thermal Break Default Criteria” on the default temporary label or default label certificate meets this requirement.
2. **Certification to NFRC Rating Procedure.** If a product’s *U*-factor, SHGC or VT is based on the NFRC Rating Procedure, the *U*-factor, SHGC or VT shall be certified by the manufacturer according to the procedures of an independent certifying organization approved by the Commission.
 - A. A temporary label, affixed to the product or label certificate for CMA and site-built fenestration, meeting the requirements of Section 10-111(a) certified by the independent certifying organization complies with this requirement.
 - B. An “independent certifying organization approved by the Commission” means any organization authorized by the supervisory entity to certify *U*-factor ratings, Solar Heat Gain Coefficient and Visible Transmittance ratings in accordance with the NFRC

Rating Procedure. If the Commission designates the NFRC as the supervisory entity, any independent certification and Inspection Agency (IA) licensed by NFRC shall be deemed to be an “independent certifying organization approved by the Commission.”

- C. The “supervisory entity” means the NFRC, except as provided in Section 10-111(c)1.

Exception to Section 10-111(b): Field-fabricated fenestration products.

(c) **Designation of supervisory entity.** The NFRC shall be the supervisory entity to administer the certification program relating to *U*-factors, SHGC and VT ratings for fenestration products and exterior doors, provided the Commission determines that the NFRC meets the criteria in Section 10-111(d).

1. The Commission may consider designating a supervisory entity other than NFRC only if the Commission determines that the NFRC cannot meet the criteria in Section 10-111(d). Such other supervisory entity shall meet the criteria in Section 10-111(d) prior to being designated.
2. The Commission shall periodically review, at least annually, the structure and operations of the supervisory entity to ensure continuing compliance with the criteria in Section 10-111(d).

(d) **Criteria for supervisory entity.**

1. Membership in the entity shall be open on a nondiscriminatory basis to any person or organization that has an interest in uniform thermal performance ratings for fenestration products and exterior doors, including, but not limited to, members of the fenestration industry, glazing infill industry, building industry, design professionals, specifiers, utilities, government agencies and public interest organizations. The membership shall be composed of a broad cross section of those interested in uniform thermal performance ratings for fenestration products.
2. The governing body of the entity shall reflect a reasonable cross section of the interests represented by the membership.
3. The entity shall maintain a program of oversight of product manufacturers, laboratories and independent certifying organizations that ensures uniform application of the NFRC Rating Procedures, labeling and certification, and such other rating procedures for other factors affecting energy performance as the NFRC and the Commission may adopt.
4. The entity shall require manufacturers and independent certifying organizations within its program to use laboratories accredited by the supervisory entity to perform simulations and tests under the NFRC Rating Procedure or by an NFRC Approved Calculation Entity (ACE) under the Component Modeling Approach (CMA) Product Certification Program (PCP).
5. The entity shall maintain appropriate guidelines for testing and simulation laboratories, manufacturers and certifying agencies, including requirements for adequate:
 - A. Possession and calibration of equipment;

- B. Education, competence and training of personnel;
- C. Quality control;
- D. Record keeping and reporting;
- E. Periodic review (including, but not limited to, blind testing by laboratories; inspections of products; and inspections of laboratories, manufacturing facilities and certifying agencies);
- F. Challenges to certified ratings; and
- G. Guidelines to maintain the integrity of the program, including, but not limited to, provisions to avoid conflicts of interest within the rating and certification process.

6. The entity shall be a nonprofit organization and shall maintain reasonable, nondiscriminatory fee schedules for the services it provides and shall make its fee schedules, the financial information on which fees are based, and financial statements available to its members for inspection.
7. The entity shall provide hearing processes that give laboratories, manufacturers and certifying agencies a fair review of decisions that adversely affect them.
8. The entity shall maintain a certification policy committee whose procedures are designed to avoid conflicts of interest in deciding appeals, resolving disputes and setting policy for the certifying organizations within its program.
9. The entity shall publish at least annually a directory of products certified and decertified within its program.
10. The entity itself shall be free from conflict-of-interest ties or to undue influence from any particular manufacturing interest(s), testing or simulation lab(s), or independent certifying organization(s).
11. The entity shall provide or authorize the use of labels and label certificates for Component Modeling Approach and site-built fenestration products that can be used to meet the requirements of Sections 110.6(a)2, 110.6(a)3 and 110.6(a)4, and this section.
12. The entity’s certification program shall allow for multiple participants in each aspect of the program to provide for competition between manufacturers, testing labs, simulation labs and independent certifying organizations.

(e) **Certification for other factors.** Nothing in this section shall preclude any entity, whether associated with a *U*-factor, SHGC or VT certification program or not, from providing certification services relating to factors other than *U*-factors, SHGCs and VTs for fenestration products and exterior doors.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

HISTORY:

1. (CEC/2/92) Regular order by the California Energy Commission to adopt Section 10-111, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state August 10, 1993; effective 30 days thereafter (September 9, 1993). Approved as a regular order by the California Building Standards Commission on August 2, 1993.

2. (CEC 2/94) Regular order by the California Energy Commission to amend Section 10-111 (a) 1 B, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state August 24, 1993; effective 30 days thereafter. Approved as a regular order by the California Building Standards Commission on August 2, 1995.

10-112. Criteria for default tables.

(a) The Commission shall maintain tables of default *U*-factors and SHGCs for use as an alternative to *U*-factors and SHGCs derived based on the NFRC Rating Procedure. The default values shall meet the following criteria:

1. The values shall be derived from simulations of products using the same computer simulation program(s) used in the NFRC Rating Procedure.
2. The default values shall be set so that they do not provide to any significant number of products a lower *U*-factor or SHGC than those products would obtain if they were rated using the full NFRC Rating Procedure.

(b) The Commission shall periodically review and revise the default tables as necessary to ensure that the criteria are met.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

HISTORY:

1. (CEC/2/92) Regular order by the California Energy Commission to adopt Section 10-112, Part 1, Title 24, California Code of Regulations. Filed with the secretary of state August 10, 1993; effective 30 days thereafter (September 9, 1993). Approved as a regular order by the California Building Standards Commission on August 2, 1993.

10-113. Rating and labeling of roofing product reflectance and emittance. This section establishes rules for implementing labeling and rating requirements relating to reflectance and emittance for roofing products for showing compliance with Sections 140.1, 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)1H and 150.2(b)2 of Title 24, California Code of Regulations, Part 6. This section also provides for designation of the Cool Roof Rating Council (CRRC) as the supervisory entity responsible for administering the state’s rating program for roofing products, provided CRRC meets specified criteria.

(a) **Labeling requirements.** Every roofing product installed in construction to take compliance credit or meet the Prescriptive requirements for reflectance and emittance under Sections 140.1, 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)1H or 150.2(b)2 shall have a clearly visible packaging label that lists the emittance and the initial and 3-year aged solar reflectance, or a CRRC Rapid Rating for solar reflectance, tested in accordance with CRRC-1.

Packaging for liquid-applied roof coatings shall state the product meets the requirements specified in Section 110.8(i)4.

(b) **Certification requirements.** Every roofing product installed in construction to take compliance credit or meet the Prescriptive requirements for reflectance and emittance under Sections 140.1, 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)1H or 150.2(b)2 shall be rated by CRRC or another supervisory entity approved by the Commission pursuant to Section 10-113(c).

(c) **Designation of supervisory entity.** The CRRC shall be the supervisory entity to administer the rating program

relating to reflectance and emittance ratings for roofing products, provided the Commission determines that the CRRC meets the criteria in Section 10-113(d).

1. The Commission may consider designating a supervisory entity other than CRRC if the Commission determines that the CRRC is not meeting the criteria in Section 10-113(d). Such other supervisory entity shall meet the criteria in Section 10-113(d) prior to being designated.
2. The Commission shall periodically review, at least annually, the structure and operations of the supervisory entity to ensure continuing compliance with the criteria in Section 10-113(d). The supervisory entity shall provide an annual report to the Commission explaining all of the measures it has taken to comply with the criteria in Section 10-113(d).

(d) Criteria for supervisory entity.

1. Membership in the entity shall be open on a nondiscriminatory basis to any person or organization that has an interest in uniform performance ratings for roofing products, including, but not limited to, members of the roofing industry, building industry, design professionals, specifiers, utilities, government agencies and public interest organizations. The membership shall be composed of a broad cross section of those interested in uniform thermal performance ratings for roofing products.
2. The governing body of the entity shall reflect a reasonable cross section of the interests represented by the membership.
3. The entity shall maintain a program of oversight of product manufacturers, laboratories and independent certifying organizations that ensures uniform application of the CRRC testing and rating procedures, labeling and rating, and such other rating procedures for other factors that improves the accuracy of properties of roofing products affecting energy performance as the CRRC and the Commission may adopt.
4. The entity shall require manufacturers and independent certifying organizations within its program to use only laboratories accredited by the supervisory entity to perform tests in accordance with CRRC-1.
5. The entity shall maintain appropriate guidelines for testing laboratories and manufacturers, including requirements for adequate:
 - A. Possession and calibration of equipment;
 - B. Education, competence and training of personnel;
 - C. Quality control;
 - D. Record keeping and reporting;
 - E. Periodic review including, but not limited to, blind testing by laboratories; inspections of products; and inspections of laboratories, and manufacturing facilities;
 - F. Challenges to ratings; and

- G. Guidelines to maintain the integrity of the program, including, but not limited to, provisions to avoid conflicts of interest within the rating process.
- 6. The entity shall be a nonprofit organization and shall maintain reasonable, nondiscriminatory fee schedules for the services it provides, and shall make its fee schedules, the financial information on which fees are based and financial statements available to its members for inspection.
- 7. The entity shall provide hearing processes that give laboratories, manufacturers and certifying agencies a fair review of decisions that adversely affect them.
- 8. The entity shall maintain a policy committee or similar body whose procedures are designed to avoid conflicts of interest in deciding appeals, resolving disputes and setting policy for the certifying organizations in its program.
- 9. The entity shall publish at least annually a directory of rated products and products that are no longer rated by the CRRC.
- 10. The entity itself shall be free from conflict-of-interest ties or to undue influence from any particular roofing product manufacturing interest(s), testing or independent certifying organization(s).
- 11. The entity shall provide or authorize the use of labels that can be used to meet the requirements for showing compliance with the requirements of Sections 140.1, 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)11 and 150.2(b)2, and this section.
- 12. The entity’s rating program shall allow for multiple participants in each aspect of the program to provide for competition between manufacturers and between testing labs.

Authority: Sections 25402 and 25402.1, Public Resources Code.
Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

10-114. Determination of outdoor lighting zones and administrative rules for use. This section establishes rules for implementing outdoor lighting zones to show compliance with Section 140.7 of Title 24, California Code of Regulations, Part 6.

**TABLE 10-114-A
 LIGHTING ZONE CHARACTERISTICS AND RULES FOR AMENDMENTS BY LOCAL JURISDICTIONS**

ZONE	AMBIENT ILLUMINATION	STATEWIDE DEFAULT LOCATION	MOVING UP TO HIGHER ZONES	MOVING DOWN TO LOWER ZONES
LZ0	Very Low	Undeveloped areas of government designated parks, recreation areas and wildlife preserves.	Undeveloped areas of government designated parks, recreation areas and wildlife preserves can be designated as LZ1 or LZ2 if they are contained within such a zone.	Not applicable.
LZ1	Low	Rural areas, as defined by the 2010 U.S. Census. These areas include: single or dual family residential areas, parks, and agricultural zone districts, developed portion of government designated parks, recreation areas and wildlife preserves. Those that are wholly contained within a higher lighting zone may be considered by the local government as part of that lighting zone.	Developed portion of a government designated park, recreation area or wildlife preserve, can be designated as LZ2 or LZ3 if they are contained within such a zone. Retail stores, located in a residential neighborhood, and rural town centers, as defined by the 2010 U.S. Census, can be designated as LZ2 if the business operates during hours of darkness.	Not applicable.
LZ2	Moderate	Urban clusters, as defined by the 2010 U.S. Census. The following building types may occur here: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.	Special districts within a default LZ2 zone may be designated as LZ3 or LZ4 by a local jurisdiction. Examples include special commercial districts or areas with special security considerations located within a mixed-use residential area or city center.	Special districts may be designated as LZ1 by the local jurisdiction, without any size limits.
LZ3	Moderately High	Urban areas, as defined by the 2010 U.S. Census. The following building types may occur here: multifamily housing, mixed use residential neighborhoods, religious facilities, schools, and light commercial business districts or industrial zoning districts.	Special districts within a default LZ3 may be designated as LZ4 by local jurisdiction for high-intensity nighttime use, such as entertainment or commercial districts or areas with special security considerations requiring very high light levels.	Special districts may be designated as LZ1 or LZ2 by the local jurisdiction, without any size limits.
LZ4	High	None.	Not applicable.	Not applicable.

(a) **Lighting zones.** Exterior lighting allowances in California vary by Lighting Zones (LZ).

(b) **Lighting zone characteristics.** Table 10-114-A specifies the relative ambient illumination level and the statewide default location for each lighting zone.

(c) **Amending the lighting zone designation.** A local jurisdiction may officially adopt changes to the lighting zone designation of an area by following a public process that allows for formal public notification, review and comment about the proposed change. The local jurisdiction may determine areas where Lighting Zone 4 is applicable and may increase or decrease the lighting zones for areas that are in State Default Lighting Zones 1, 2 and 3, as specified in Table 10-114-A.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

10-115. Community shared solar electric generation system or community shared battery storage system compliance option for onsite solar electric generation or battery storage requirements.

(a) **Community shared solar electric generation system or battery storage system offset.** If approved by the commission, a community shared solar system, other community shared renewable system, community shared battery storage system or combination of the aforementioned systems (hereinafter referred to as a community shared solar or battery storage system) may be used as a compliance option to partially or totally meet the on-site solar electric generation system and/or battery storage system that is otherwise required by Section 140.0(c), 150.1(a)3 or 170.0(a)3 of Title 24, California Code of Regulations, Part 6. To be approved, the community shared solar electric generation or community shared battery storage system must demonstrate, to the Commission’s satisfaction, that all the following requirements will be met:

1. **Enforcement agency.** The community shared solar electric generation system and/or community shared battery storage system shall be installed and available for enforcement agency site inspection, no later than the point in time the enforcement agency must physically verify compliance of the building, which would otherwise be required to have an on-site solar electric generation and/or battery storage system, and shall not cause delay in the process of enforcement agency review and approval of that building. The enforcement agency shall have jurisdiction and facilitated access to make site inspections. All documentation for the community solar electric generation system and/or community solar battery storage system that is required to demonstrate compliance for the building shall be completed prior to building permit application.
2. **Energy performance.** The community shared solar electric generation system and/or commu-

nity shared battery storage system shall be demonstrated to provide the same or better energy performance equal to the partial or total compliance with the energy performance of the on-site solar electric generation and/or battery storage system that would otherwise have been required for the building, computed by compliance software certified for use by the Commission.

3. **Participating building energy savings benefits.**

The community shared solar electric generation system and/or community shared battery storage system shall provide energy saving benefits directly to the building. The energy savings benefits allocated to the building shall be in the form of:

- A. actual reductions in the energy consumption of the participating building;
- B. energy reduction credits that will result in virtual reductions in the building’s energy consumption that is subject to energy bill payments; or
- C. payments to the building that will have an equivalent effect as energy bill reductions.

The reduction in the building’s energy bill resulting from A, B or C above shall be greater than the added cost to the building resulting from the building’s share in the community shared solar and/or battery storage system.

4. **Durability, Participation and building opt-out.**

A. **Durability.** The community shared solar electric generation system and/or community shared battery storage system shall be designed and installed to provide the energy savings benefits to the participating building(s) specified in Section 10-115(a)3 for a period of no less than 20 years.

B. **Participation.** The Administrator(s) approved by the Energy Commission pursuant to Section 10-115(b)1 shall ensure that all participating buildings, which use the community shared solar and/or community shared battery storage system to comply with Section 140.0(c), 150.1(a)3 or 170.0(a)3, remain participating buildings for no less than a 20-year period (“Participation Period”), regardless of who owns or occupies the participating building, unless the building owner discontinues participation after causing the on-site solar electric generation system to be installed and interconnected pursuant to the Opt-Out Requirements. For purposes of this Section, “Opt-Out Requirements” shall mean installation and interconnection of an on-site solar electric generation system that meets or exceeds the requirements of Section 140.0(c), 150.1(a)3 or

170.0(a)3 in effect at the time the builder applied for the original building permit for the participating building. To demonstrate compliance, the Administrator shall require either of the following:

- i. **Equitable servitude.** As a condition for a building to participate, participating builders shall impose an equitable servitude through a properly recorded declaration of covenants, conditions and restrictions (“CC&Rs”) or other properly recorded covenant, deed restriction or other legally binding method referenced in each deed transferring title for each participating building. This equitable servitude shall run with the land and obligate the original owner(s)/tenant(s) and all subsequent owner(s)/tenant(s) of the participating building to maintain the building’s participation in the community shared solar and/or community shared battery storage system for the Participation Period, or ensure installation and interconnection of an on-site solar electric generation system that satisfies the Opt-Out Requirements. The equitable servitude shall specify that in order to discontinue participation in the community shared solar and/or battery system, the building owner must satisfy the Opt-Out Requirements. The builder shall ensure that the equitable servitude provides the Administrator approved by the Commission the right to enforce the above provisions. The equitable servitude shall remain in force for a period of 20 years from the date of first participation of the building in the community shared solar and/or battery system. The equitable servitude shall not be revocable. The equitable servitude shall be delivered to all responsible parties through transfer disclosure statements.
- ii. **Other system.** The Commission may approve another program, structure or system by which an Administrator (or other entity approved by the Commission) ensures the requirements of this Section 10-115(a)4B will be satisfied for a Participation Period of no less than 20 years.

C. Compliance documentation. The Administrator shall maintain record(s) of the compliance documentation that determined the requirements for the on-site solar electric generation system and/or battery storage system to comply with the standards in effect at the time the builder applied for the original building permit, and which estab-

lishes participants’ obligations to meet the Opt-Out Requirements. The Administrator shall provide a copy of this compliance documentation upon a participating building owner’s request, to every new owner of a participating building when the Administrator is notified that title has transferred, and to any participating building owner who requests to Opt-Out.

D. Building opt-out. At any time during the Participation Period, a participating building owner shall have the option to discontinue the participation of the building in the community shared solar and/or battery storage system (“Opt-Out”) if the building satisfies the Opt-Out Requirements.

- i. Prior to Opt-Out, the building owner shall demonstrate that they have installed such an on-site solar electric generation system and met the Opt-Out Requirements by providing documentation from the installer of the on-site solar system or an attestation of the building owner with supporting documentation.

The building owner shall be responsible for all costs associated with documenting that the on-site solar generation system satisfies the Opt-Out Requirements.

- ii. Upon receiving documentation regarding Opt-Out from a building owner, the Administrator shall compare the documentation to the compliance documentation specified in Section 10-115(a)4C and confirm whether, based on the documentation, the installed solar system meets or exceeds the Opt-Out Requirements. Within 30 days of a building owner providing documentation, the Administrator shall provide written confirmation to the building owner whether, based on the Administrator’s review of that documentation, the on-site solar generation system satisfies the Opt-Out Requirements. The Administrator may, at its discretion, verify the documentation through a physical inspection. The Administrator shall maintain record of the documentation that demonstrates and confirms the on-site solar generation system met the Opt-Out requirements for the remainder of the Participation Period.
- iii. Upon a building owner’s exercise of the Opt-Out, all costs and benefits associated with participation in the community shared solar and/or battery storage system shall cease. If any balance of costs or benefits is owed to either party at the time of Opt-Out, such balance shall be paid to that party.

iv. The Administrator [or other entity approved by the Commission pursuant to Section 10-115(a)4Bii] shall not impose any penalty related to a participating building's Opt-Out, or charge participants for recuperation of unrealized revenue that would have been expected to accrue beyond the end of participation. If the Administrator (or other entity approved by the Commission) plans to charge any other fees at the time of building Opt-Out, the Application for Commission Approval shall explain the purpose of those fees.

5. **Additionality.** The community shared solar electric generation system and/or community shared battery storage system shall provide the energy savings benefits specified in Section 10-115(a)3 exclusively to the participating building(s). Those energy savings benefits shall in no way be attributed to other purposes or transferred to other buildings or property.

A. The participating building(s) shall be served primarily by renewable resources developed specifically for the community solar electric generation system.

B. Other renewable resources may be used when participating buildings are permitted before the renewable resources developed for the program start operating or after they cease operating. During these times, other renewable resources may be used to meet the requirements of Section 10-115(a)4 for each participating building.

C. The renewable resources, including those developed primarily to serve participating buildings and those utilized to serve participating buildings during the time periods described in Section 10-115(a)5B for the purpose of meeting the requirements of Section 10-115(a)4, shall meet the following requirement:

i. For each renewable resource used to serve participating buildings, bundled Renewable Energy Credits (RECs), which satisfy the criteria of Portfolio Content Category 1, shall be retired and tracked in the Western Renewable Energy Generation Information System (WREGIS) on the behalf of program participants, to ensure that they will not be allocated to or used for any other purpose, including Renewable Performance Standard (RPS) compliance, resale of RECs or renewable generation to any other person or entity, or any other mandatory or voluntary renewable electricity program requirement or claim.

D. Renewable resources developed to serve participating buildings may also be used to serve other loads when there is excess generation beyond what is needed to serve participating buildings. Any excess generation used for such other loads shall be isolated from the generation serving participating buildings, and shall not result in violation of Section 10-115(a)5C.

6. **Location.** The community shared solar electric generation system and/or community shared battery storage system shall be located on a distribution system of the load serving entity providing service to the participating buildings.

7. **Size.** The community shared solar electric generation system and/or community shared battery storage system shall not be served by any individual source larger than 20 MW.

8. **Accountability and recordkeeping.** Applicants for Commission approval of community shared solar electric generation systems and/or community shared battery storage systems shall be accountable to all parties who relied on these systems for partial or total compliance with the on-site solar electric generation and/or battery storage system that would otherwise be required, including but not limited to builders of the buildings, owners of the buildings, enforcement agencies and the Commission.

A. Each year beginning twelve months after initial approval, the Administrator shall provide to the Commission a report demonstrating the previous year's compliance with each requirement of Section 10-115.

B. Recordkeeping regarding compliance with the requirements in Section 10-115(a) shall be maintained over the period of time specified in Section 10-115(a)4 for each building for which the community shared solar electric generation or battery storage system is used to demonstrate partial or total compliance. Access to these records shall be provided to any entity approved by the Commission for auditing compliance with these requirements.

(b) **Application for commission approval.** Any entity may apply to the Commission for approval to administer a community shared solar electric generation or community shared battery storage system to provide partial or total compliance with the on-site solar electric generation system and/or battery storage system required by Section 150.1 of Title 24, California Code of Regulations, Part 6. Once approved, the entity shall be the Administrator of the community shared solar electric generation or community shared battery storage system.

1. The application shall demonstrate to the Commission's satisfaction that each of the require-

ments specified in Section 10-115(a) will be met and shall include detailed explanation of the actions that will be taken by the applicant to ensure that each requirement is met over the period of time specified in Section 10-115(a)4 for each building for which a partial or total offset is used to demonstrate compliance.

2. All applicants have the burden of proof to establish that their application should be granted.
3. Applications from public agencies shall be submitted to the Energy Commission only after public review through at least one public meeting within the jurisdiction of the public entity or service area of the load-serving entity and adoption by the public agency. The Commission shall have the authority to not approve any application that the Commission determines to be inconsistent with the requirements of Section 10-115.

Within 45 days of receiving a request for review, the Commission shall issue a written decision affirming or modifying the Executive Director's determination. If the Commission does not issue a written decision within 45 days, the request for review shall be deemed denied. The Administrator shall have the burden of proof to establish that its revised application should be approved.

Authority: Sections 25402 and 25402.1, Public Resources Code.

Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, Public Resources Code.

(c) Executive director approval of revised applications.

The Administrator of an approved community shared solar electric generation system and/or community shared battery storage system shall submit a revised application demonstrating compliance with the Section 10-115 requirements to the Executive Director for approval, when:

1. A new renewable resource is proposed to be added to a community shared solar electric generation system and/or community shared battery storage system, and/or
2. The Commission modifies the requirements of Section 10-115 in a building standards rulemaking. Such modified requirements would not apply retroactively to the buildings for which building permit applications are submitted prior to the effective date of the modified standards or to the continued use of previously approved renewable resources developed to serve a community shared solar electric generation system and/or community shared battery storage system.

Within 60 days of receiving a revised application, the Executive Director may either approve the revised application by letter if the Executive Director concludes that the requirements of Section 10-115 will be met, request the Administrator to resubmit their revised application with changes, or disapprove the application. If the Executive Director disapproves the application, the applicant may request that the Commission review the Executive Director's determination. The petition must be filed in writing in accordance with Title 20, California Code of Regulations, Section 1208 within 15 days of the date of the filing of the Executive Director's determination and must state the basis for requesting review of the Executive Director's determination.

HISTORY NOTE APPENDIX FOR CHAPTER 10

Administrative Regulations for the California Energy Commission California Code of Regulations, Title 24, Part 1

HISTORY:

> The history notes for prior changes remain within the text of this code.

1. (CEC 1/97) Regular order by the California Energy Commission to amend Article 1, 1998 Energy Efficiency Standards. Filed with the secretary of state on December 3, 1997; effective January 22, 1998. Approved by the California Building Standards Commission on November 18, 1997.
2. (CEC-EF 1/01) Emergency adoption of AB 970 energy efficiency standards for residential and nonresidential buildings; CCR, Title 24, Parts 1 and 6. Approved by the California Building Standards Commission on January 31, 2001, and filed with the secretary of state on February 2, 2001, effective June 1, 2001.
Exception: Building energy efficiency standards compliance documentation submitted prior to June 1, 2001, using the Multiple Orientation Alternative to Section 151(c) shall be used to determine compliance through December 31, 2001.
3. (CEC 03/02) Approval of energy efficiency standards, which adopt by reference the National Fenestration Rating Council's (NFRC) 2002 window rating and labeling procedures; CCR, Title 24, Parts 1 and 6. Approved by the California Building Standards Commission on May 14, 2003, and filed with the Secretary of State on May 16, 2003. Effective June 14, 2003.
4. (CEC 01/03) 2005 building energy efficiency standards approved by the California Building Standards Commission on July 21, 2004, for publication in California Code of Regulations, Title 24, Parts 1 and 6; filed with the Secretary of State September 24, 2004; published April 1, 2005; effective October 1, 2005.
5. (CEC 01/07) Update of 2007 building energy efficiency standards in response to AB 32 (Nuñez, Chap. 488, Stats. of 2006) and SB 1 (Murray, Chap. 132, Stats. of 2006), approved by the California Building Standards Commission on September 11, 2008; filed with the Secretary of State September 12, 2008; effective 30 days after filing with the Secretary of State [Health and Safety Code §18938(c)].
6. Erratum to change the effective date of the supplement published on January 1, 2009, from August 1, 2009, to January 1, 2010.
7. (CEC 01/12 & 02/12) Updates to the administrative provisions for the California Energy Commission - Chapter 10, Sections 10-102, 10-103, 10-103A, 10-103B, 10-104, 10-105, 10-106, 10-107, 10-109, 10-110, 10-111, 10-112, 10-113 and 10-114, Approved by the California Building Standards Commission on Jan-

uary 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.

8. (CEC 01/12) A delayed effective date for the energy based provisions within the 2013 California Administrative Code was approved at the April 22, 2014 California Building Standards Commission meeting. The new effective date for these provisions is July 1, 2014.
9. (CEC 02/15) Updates to the administrative provisions for the California Energy Commission - Chapter 10, Sections 10-101, 10-102, 10-103, 10-105, 10-106, 10-108, 10-109, 10-111, 10-113 and 10-114. Approved by the California Building Standards Commission on January 19, 2016, filed with the Secretary of State on January 26, 2016, and effective 30 days after filing with Secretary of State.
10. 2018 Triennial Code Adoption Cycle (CEC 02/18) Amend Chapter 10, Article 1, Section 10-102, 10-103, 10-103.1, 10-103.2, 10-106, 10-109, 10-110, 10-111, 10-113; Added to Chapter 10, Article 1, Section 10-115. Approved by the California Building Standards Commission on December 5, 2018, filed with the Secretary of State on December 7, 2018, and effective 30 days after filing with the Secretary of State pursuant to *California Health and Safety Code*, Section 18938.
11. Erratum to correct History Note format in Chapter 10: effective January 1, 2020.
12. (CEC 04/21) Amend Chapter 10, Article 1, Sections 10-102, 10-103, 10-103.1, 10-103.2, 10-109, 10-114, 10-115. Approved by the California Building Standards Commission on December 14, 2022, filed with the Secretary of State on January 6, 2022, and effective on January 1, 2023.

CHAPTER 11

**ADMINISTRATIVE REGULATIONS FOR THE
DEPARTMENT OF FOOD AND AGRICULTURE (AGR)**

(RESERVED)

CHAPTER 12
ADMINISTRATIVE REGULATIONS
FOR THE DEPARTMENT OF YOUTH AUTHORITY (YA)

(RESERVED)

CHAPTER 13

ADMINISTRATIVE REGULATIONS FOR THE BOARD OF STATE AND COMMUNITY CORRECTIONS (BSCC)

ARTICLE 1 MINIMUM STANDARDS FOR LOCAL DETENTION FACILITIES

13-101. County correctional facility capital expenditure fund.

(a) **Definitions.** The following words when used in this subchapter shall have the meaning hereafter ascribed to them, unless the context of their use clearly requires a different meaning.

BOARD means Board of State and Community Corrections.

COUNTY CORRECTIONAL FACILITY CAPITAL EXPENDITURE FUND means moneys received from the sale of State of California General Obligation Bonds as authorized by the County Correctional Facility Capital Expenditure Bond Act of 1986.

CONTRACT means the written agreement and any amendments thereto between the State Board and a county in which the terms, provisions and conditions governing the funds are stated.

(b) Fund award conditions.

1. Prior to entering into a contract with a county, the Board shall ensure that the county is ready to proceed with construction. A county shall be deemed ready to proceed with construction when it has done all of the following:
 - A. Received approval by the State Fire Marshal for compliance with fire safety regulations in the plans, specifications and working drawings for the facility to be constructed.
 - B. Received approval for compliance with minimum jail standards by the Board as described in Title 15, Chapter 1, Subchapter 2, Sections 546 and 548.
 - C. Met all other requirements contained in Title 15, Chapter 1, Subchapter 2, Section 544.

(c) Preparation of architectural drawings and specifications.

1. Architectural drawings and specifications shall be submitted to the Board by dates and in a manner prescribed by the Board.
2. After review of the drawings and specifications, the Board shall notify the county, in writing, of any major deficiencies. Deficiencies may be identified as either failures to comply with minimum jail standards, or as design features which will pose serious operational or management problems if uncorrected even though no minimum jail standards are violated.

3. Deficiencies in compliance with minimum jail standards shall be corrected by the county prior to advertising for bids.
4. At least 30 days prior to entering into a contract with the county, the Board shall inform the sheriff and the board of supervisors in writing of other design deficiencies posing serious operational or management problems.
5. At the time the county submits its final architectural plans and specifications for review and approval, it shall also submit a preliminary staffing plan for the proposed facility, along with an analysis of other anticipated operating costs for the facility, which have been reviewed and approved by the board of supervisors in a public hearing. The sheriff shall review the staffing plan and operating cost analysis, and his written comments shall accompany this submittal. At a minimum, this plan shall include the following:
 - A. Transition team program statement and costs.
 - B. Staffing requirements under the proposed design capacity.
 - C. Shift and post identification of staff for the proposed facility, delineated by custody and support staff.
 - D. Analysis of 30-year life cycle operating costs and maintenance and energy costs for the proposed facility.
 - E. Identification of, and revenue sources for, additional funds needed to support the staffing levels and operating costs for the proposed facility.

(d) Variance.

1. The Board may grant a variance from any Board requirement contained herein for good and sufficient reason. Such a variance may be granted by the Board only upon the written application therefore and documentation thereof. The request for a variance shall contain the following:
 - A. Name and address of requestor.
 - B. The specific requirement for which variance is being requested.
 - C. The supporting reasons for a variance request.
 - D. A copy of the variance request shall be sent to the Board by requestor. The staff shall summarize the issues involved and cause the matter to be placed on a Board meeting agenda in an expeditious manner. The requestor will be given an opportunity to be heard by the Board for the purpose of presenting oral argument in support of its request for a variance.

(e) **Project modifications.**

1. Project modifications which are proposed after a contract is signed which (1) substantially alter the design or scope of the project, (2) substantially alter the design, location, size, capacity or quality of major items or equipment, or (3) increase the amount of state funds needed to complete the project, require prior written approval of the Board.
2. Construction change orders which propose a substantial increase in jail capacity or a substantial change in project concept or cost require prior written approval of the Board. Other change orders will not require prior approval. Summaries of all change orders shall be submitted to the Board monthly in a format approved by the Board.

Note: See also Title 15, Chapter 1, Subchapter 2, Section 568.

(f) **Purpose.** The appeal hearing procedures are intended to provide a review concerning the application and enforcement of standards and regulations governing the administration of the County Correctional Facility Capital Expenditure Fund. A county may appeal on the basis of alleged misapplication, capricious enforcement of regulations, or substantial differences of opinion as may occur concerning the proper application of regulations or procedures.

(g) **Definitions applying to appeal procedures.** For purpose of this article, the following definitions shall apply:

APPEAL HEARING means an administrative procedure providing an appellant with an opportunity to present the facts of the appeal for a formal decision concerning matters raised pursuant to the purposes set forth in subsection (f), above.

APPELLANT means a county which files a request for an appeal hearing.

EXECUTIVE OFFICER means the Executive Officer of the Board.

REQUEST FOR APPEAL HEARING means a clear written expression of dissatisfaction about a procedure or action taken and a request for a hearing on the matter and filed with the Executive Officer of the Board.

FILING DATE means the date a request for an appeal hearing is received by the Executive Officer of the Board.

AUTHORIZED REPRESENTATIVE means an individual authorized by the appellant to act as his/her representative in any or all aspects of the hearing.

HEARING PANEL means a panel comprised of three members of the Board who shall be selected by the chairperson at the time the appeal is filed. A fourth member may be designated as an alternate. Members designated to the hearing panel shall not be employed by or be residents of the county submitting the appeal nor shall they be employed by any other county that has a funded project or is seeking funds.

PROPOSED DECISION means a written recommendation from the hearing panel/hearing officer to the full Board containing a summary of facts and a recommended decision on the appeal.

NOTICE OF DECISION means a written recommendation from the hearing panel/hearing officer to the full Board containing a summary of facts and a recommended decision on the appeal.

(h) **Request for appeal hearing by Board.**

1. If a county is dissatisfied with an action of the Board staff, it may file a request for an appeal hearing with the Board. Such appeal shall be filed within 30 calendar days of the notification of the action with which the county is dissatisfied.
2. The request shall be in writing and:
 - A. Shall state the basis for the dissatisfaction.
 - B. Shall state the action being requested of the Board.
 - C. Shall include as attachments any correspondence related to the appeal with and from the Executive Officer.

(i) **Board hearing procedures.**

1. The hearing shall be conducted by a hearing panel designated by the Chairperson of the Board at a reasonable time, date and place, but not later than 21 days after the filing of the request for hearing with the Board, unless delayed for good cause. The Board shall mail or deliver to the appellant or authorized representative a written notice of the time and place of hearing not less than 7 days prior to the hearing.
2. The procedural time requirements may be waived with mutual written consent of the parties involved.
3. Appeal hearing matters shall be set for hearing, heard and disposed of by a notice of decision within 60 days from the date of the request for appeal hearing, except in those cases where the appellant withdraws or abandons the request for hearing or the matter is continued for what is determined by the hearing panel to be good cause.
4. An appellant may waive a personal hearing before the hearing panel and under such circumstances, the hearing panel shall consider the written information submitted by the appellant and other relevant information as may be deemed appropriate.
5. The hearing is not formal in nature. Pertinent and relevant information, whether written or oral, will be accepted. Hearings will be tape recorded.
6. After the hearing has been completed, the hearing panel shall submit a proposed decision in writing to the Board at its next regular public meeting.

(j) **State Board decision.**

1. The Board, after receiving the proposed decision, may:
 - A. Adopt the proposed decision.
 - B. Decide the matter on the record with or without taking additional evidence, or
 - C. Order a further hearing to be conducted if additional information is needed to decide the issue.
2. After the hearing panel's proposed decision is adopted, or an alternate decision is rendered by the Board, or

notice of new hearing ordered, notice of decision or other such actions shall be mailed or otherwise delivered by the Board to the appellant.

3. The record of the testimony, exhibits, all papers and requests filed in the proceedings and the hearing panel's proposed decision, shall constitute the exclusive record for decision and shall be available to the appellant at any reasonable time for one year after the date of the Board's notice of decision in the case.
4. The decision of the Board shall be final.

Note: Amendments to Section 13-102 effective November 25, 1993.

13-102. Minimum standards for local detention facilities.

(a) **Definitions.** The following definitions shall apply:

ADMINISTERING MEDICATION, as it relates to managing legally obtained drugs, means the act by which a single dose of medication is given to a patient. The single dose of medication may be taken either from stock (undispensed) or dispensed supplies.

ADMINISTRATIVE SEGREGATION means the physical separation of different types of inmates from each other as specified in Penal Code Sections 4001 and 4002, and Section 1053 of Title 15, C.C.R. Administrative segregation is accomplished to provide that level of control and security necessary for good management and the protection of staff and inmates.

ALTERNATE MEANS OF COMPLIANCE means a process for meeting or exceeding standards in an innovative way, after a pilot project evaluation, approved by the Corrections Standards Authority pursuant to an application.

AVERAGE DAILY POPULATION means the average number of inmates housed daily during the last fiscal year.

BOARD OF STATE AND COMMUNITY CORRECTIONS means the Board of State and Community Corrections, whose board acts by and through its executive director, deputy directors and field representatives.

CLINICAL EVALUATION means an assessment of a person's physical and/or mental health condition conducted by licensed health personnel operating within recognized scope of practice specific to their profession and authorized by a supervising physician or psychiatrist.

CONCEPT DRAWINGS means, with respect to a design-build project, any drawings or architectural renderings that may be prepared, in addition to performance criteria, in such detail as the agency determines necessary to sufficiently describe the agency's needs.

CONTACT means any physical or sustained sight or sound contact between juveniles in detention and incarcerated adults. Sight contact is clear visual contact between adult inmates and juveniles within close proximity to each other. Sound contact is direct oral communication between adult inmates and juvenile offenders.

COURT HOLDING FACILITY means a local detention facility constructed within a court building after January 1, 1978, used for the confinement of persons solely for the pur-

pose of a court appearance for a period not to exceed 12 hours.

CUSTODIAL PERSONNEL means those officers with the rank of deputy, correctional officer, patrol persons or other equivalent sworn or civilian rank whose duties include the supervision of inmates.

DELIVERING MEDICATION, as it relates to managing legally obtained drugs, means the act of providing one or more doses of a prescribed and dispensed medication to a patient.

DESIGN-BID-BUILD means a construction procurement process independent of the design process and in which the construction of a project is procured based on completed construction documents.

DESIGN-BUILD means a construction procurement process in which both the design and construction of a project are procured from a single entity.

DEVELOPMENTALLY DISABLED means those persons who have a disability which originates before an individual attains age 18, continues, or can be expected to continue indefinitely, and constitutes a substantial disability for that individual. This term includes mental retardation, cerebral palsy, epilepsy and autism, as well as disabling conditions found to be closely related to mental retardation or to require treatment similar to that required for mentally retarded individuals.

DIRECT VISUAL OBSERVATION means direct personal view of the inmate in the context of his/her surroundings without the aid of audio/video equipment. Audio/video monitoring may supplement but not substitute for direct visual observation.

DISCIPLINARY ISOLATION means that punishment status assigned an inmate as the result of violating facility rules and which consists of confinement in a cell or housing unit separate from regular jail inmates.

DISPENSING, as it relates to managing legally obtained drugs, means the interpretation of the prescription order, the preparation, repackaging and labeling of the drug based upon a prescription from a physician, dentist or other prescriber authorized by law.

DISPOSAL, as it relates to managing legally obtained drugs, means the destruction of medication or its return to the manufacturer or supplier.

EMERGENCY means any significant disruption of normal facility procedure, policies or activities caused by a riot, fire, earthquake, attack, strike or other emergent condition.

EMERGENCY MEDICAL SITUATIONS means those situations where immediate services are required for the alleviation of severe pain, or immediate diagnosis and treatment of unforeseeable medical conditions are required, if such conditions would lead to serious disability or death if not immediately diagnosed and treated.

EXERCISE means activity that requires physical exertion of the large muscle group.

FACILITY/SYSTEM ADMINISTRATOR means the sheriff, chief of police, chief probation officer or other offi-

cial charged by law with the administration of a local detention facility/system.

FACILITY MANAGER means the jail commander, camp superintendent or other comparable employee who has been delegated the responsibility for operating a local detention facility by a facility administrator.

FACILITY WATCH COMMANDER means the individual designated by the facility manager to make operational decisions during his/her tour of duty.

HEALTH AUTHORITY means that individual or agency that is designated with responsibility for health care policy pursuant to a written agreement, contract or job description. The health authority may be a physician, an individual or a health agency. In those instances where medical and mental health services are provided by separate entities, decisions regarding mental health services shall be made in cooperation with the mental health director. When this authority is other than a physician, final clinical decisions rest with a single designated responsible physician.

HEALTH CARE means medical, mental health and dental services.

JAIL, as used in Article 8, means a Type II or III facility as defined in the “Minimum Standards for Local Detention Facilities.”

LABELING, as it relates to managing legally obtained drugs, means the act of preparing and affixing an appropriate label to a medication container.

LAW ENFORCEMENT FACILITY means a building that contains a Type I Jail or Temporary Holding Facility or Lockup. It does not include a Type II or III jail, which has the purpose of detaining adults, charged with criminal law violations while awaiting trial or sentenced adult criminal offenders.

LEGEND DRUGS are any drugs defined as “dangerous drugs” under Chapter 9, Division 2, Section 4211 of the *California Business and Professions Code*. These drugs bear the legend, “Caution Federal Law Prohibits Dispensing without a Prescription.” The Food and Drug Administration (FDA) has determined, because of toxicity or other potentially harmful effects, that these drugs are not safe for use except under the supervision of a health care practitioner licensed by law to prescribe legend drugs.

LIVING AREAS means those areas of a facility utilized for the day-to-day housing and activities of inmates. These areas do not include special use cells such as sobering, safety, and holding or staging cells normally located in receiving areas.

LOCAL DETENTION FACILITY means any city, county, city and county, or regional jail, camp, court holding facility or other correctional facility, whether publicly or privately operated, used for confinement of adults or of both adults and minors, but does not include that portion of a facility for confinement of both adults and minors which is devoted only to the confinement of minors.

LOCAL DETENTION SYSTEM means all of the local detention facilities that are under the jurisdiction of a city, county or combination thereof, whether publicly or privately

operated. Nothing in the standards are to be construed as creating enabling language to broaden or restrict privatization of local detention facilities beyond that which is contained in other statute.

LOCAL HEALTH OFFICER means that licensed physician who is appointed pursuant to Health and Safety Code Section 101000 to carry out duly authorized orders and statutes related to public health within their jurisdiction.

LOCKUP means a locked room or secure enclosure under the control of a peace officer or custodial officer that is primarily used for the temporary confinement of adults who have recently been arrested; sentenced prisoners who are inmate workers may reside in the facility to carry out appropriate work.

MAY. “May” is permissive; “shall” is mandatory.

MENTAL HEALTH DIRECTOR means that individual who is designated by contract, written agreement or job description, to have administrative responsibility for the facility or system mental health program.

NONSECURE CUSTODY means that a minor’s freedom of movement in a law enforcement facility is controlled by the staff of the facility; and

- (1) the minor is under constant direct visual observation by the staff;
- (2) the minor is not locked in a room or enclosure; and,
- (3) the minor is not physically secured to a cuffing rail or other stationary object.

NONSENTENCED INMATE means an inmate with any pending local charges or one who is being held solely for charges pending in another jurisdiction.

OVER-THE-COUNTER (OTC) DRUGS, as it relates to managing legally obtained drugs, are medications which do not require a prescription (nonlegend).

PEOPLE WITH DISABILITIES includes, but is not limited to, persons with a physical or mental impairment that substantially limits one or more of their major life activities or those persons with a record of such impairment or perceived impairment that does not include substance use disorders resulting from current illegal use of a controlled substance.

PERFORMANCE CRITERIA means, with respect to a design-build project, the information that fully describes the scope of the proposed project and includes, but is not limited to, the size, type and design character of the buildings and site; the required form, fit, function, operational requirements and quality of design, materials, equipment and workmanship; and any other information deemed necessary to sufficiently describe the agency’s needs; including documents prepared pursuant to paragraph (1) of subdivision (d) of Section 20133 of the Public Contract Code.

PILOT PROJECT means an initial short-term method to test or apply an innovation or concept related to the operation, management or design of a local detention facility pursuant to application to, and approval by, the Corrections Standards Authority.

PRELIMINARY DRAWINGS means, with respect to a design-build project, a site plan, architectural floor plans, elevations, outline specifications and a cost estimate for each utility, site development, conversion and remodeling project. The drawings shall be sufficiently descriptive to accurately convey the location, scope, cost and the nature of the improvement being proposed.

PROCUREMENT, as it relates to managing legally obtained drugs, means the system for ordering and obtaining medications for facility stock.

PSYCHOTROPIC MEDICATION means any medication prescribed for the treatment of symptoms of psychoses and other mental and emotional disorders.

RATED CAPACITY means the number of inmate occupants for which a facility's single- and double-occupancy cells, or dormitories, except those dedicated for medical or disciplinary isolation housing, were planned and designed in conformity to the standards and requirements contained herein and in Title 15, C.C.R.

REGIONAL CENTER FOR DEVELOPMENTALLY DISABLED means those private agencies throughout the state, funded through the Department of Developmental Services which assure provision of services to persons with developmental disabilities. Such centers will be referred to as regional centers in these regulations.

REMODEL means to alter the facility structure by adding, deleting or moving any of the building's components, thereby affecting any of the spaces specified in Title 24, Section 1231.

REPACKAGING, as it relates to managing legally obtained drugs, means the transferring of medications from the original manufacturer's container to another properly labeled container.

REPAIR means to restore to original condition or replace with like-in-kind.

SAFETY CHECKS means direct, visual observation performed at random intervals within timeframes prescribed in these regulations to provide for the health and welfare of inmates.

SECURE CUSTODY means that a minor being held in temporary custody in a law enforcement facility is locked in a room or enclosure and/or physically secured to a cuffing rail or other stationary object.

SECURITY GLAZING means a glass/polycarbonate composite glazing material designed for use in detention facility doors and windows and intended to withstand measurable, complex loads from deliberate and sustained attacks in a detention environment.

SENTENCED INMATE means an inmate that is sentenced on all local charges.

SHALL is mandatory; "may" is permissive.

SOBERING CELL as referenced in Section 1056, refers to an initial "sobering up" place for arrestees who are sufficiently intoxicated from any substance to require a protected environment to prevent injury by falling or victimization by other inmates.

STORAGE, as it relates to legally obtained drugs, means the controlled physical environment used for the safekeeping and accounting of medications.

SUPERVISION IN A LAW ENFORCEMENT FACILITY means that a minor is being directly observed by the responsible individual in the facility to the extent that immediate intervention or other required action is possible.

SUPERVISORY CUSTODIAL PERSONNEL means those staff members whose duties include direct supervision of custodial personnel.

TEMPORARY CUSTODY means that the minor is not at liberty to leave the law enforcement facility.

TEMPORARY HOLDING FACILITY means a local detention facility constructed after January 1, 1978, used for the confinement of persons for 24 hours or less pending release, transfer to another facility or appearance in court.

TYPE I FACILITY means a local detention facility used for the detention of persons, for not more than 96 hours, excluding holidays, after booking. Such a Type I facility may also detain persons on court order either for their own safekeeping or sentenced to a city jail as an inmate worker, and may house inmate workers sentenced to the county jail provided such placement in the facility is made on a voluntary basis on the part of the inmate. As used in this section, an inmate worker is defined as a person assigned to perform designated tasks outside of his/her cell or dormitory, pursuant to the written policy of the facility, for a minimum of four hours each day on a five-day scheduled work week.

TYPE II FACILITY means a local detention facility used for the detention of persons pending arraignment, during trial and upon a sentence of commitment.

TYPE III FACILITY means a local detention facility used only for the detention of convicted and sentenced persons.

TYPE IV FACILITY means a local detention facility or portion thereof designated for the housing of inmates eligible under Penal Code Section 1208 for work/education furlough and/or other programs involving inmate access into the community.

WORKING DRAWINGS means, with respect to a design-build project, a complete set of plans and specifications showing and describing all phases of a project, architectural, structural, mechanical, electrical, civil engineering and landscaping systems to the degree necessary for the purpose of accurate bidding by contractors and for the use of artisans in constructing the project.

(b) **Exclusions.** Title 24 of the California Code of Regulations, Sections 13-102 and 2-1013 which pertain to planning and design of detention facilities shall be applicable to facilities for which architectural drawings have been submitted to the Board for review. These requirements shall not be applicable to facilities which were constructed in conformance with the standards of the Board in effect at the time of initial architectural planning. When any facility, designed and constructed under earlier standards, can comply with a more recently adopted requirement, the least-restrictive regulation shall apply.

If, in the course of inspection of local detention facilities, the Board determines that a facility planned or built prior to these regulations does not meet the appropriate, applicable standards in effect at the time of initial architectural planning, the local governing body shall submit to the Board for their approval within one year of such inspection a plan for causing that facility to meet current standards. Such a plan shall include the specific building areas which need to be remodeled and/or constructed, a definite time period over which the proposed modifications are planned and a cost estimate including a description of the method of financing.

(c) Initial planning for a local detention facility.

1. **Letter of intent.** A city, county, city and county, or any combination thereof which has an intent to build or remodel any local detention facility shall immediately file a letter of intent with the Board.
2. **Needs assessment study.** Any city, county, city and county, or region intending to construct a new Type I, II, III or IV facility or add 25 or more beds to an existing facility shall complete a needs assessment study. One copy of the needs assessment study shall be submitted to the Board prior to contracting for plans and specifications.

The needs assessment shall include, but not be limited to, a description of:

- A. The elements of the system;
 - B. The department's operational and design philosophy;
 - C. The current inmate population;
 - D. The classification system;
 - E. Program needs, including planned academic programs to include special education programs and an analysis of performance in using programs that can reduce secure facility requirements;
 - F. An analysis of the local trends and characteristics which influence planning assumptions about future corrections' systems change, including population projections, current and projected inmate populations, and program costs based on continuation of current policies and projections of alternative policies or programs on inmate population growth and program costs;
 - G. The adequacy of staffing levels;
 - H. The ability to provide visual supervision;
 - I. The adequacy of record keeping;
 - J. A history of the system's compliance with standards; and
 - K. Any unresolved issues.
3. **Operational program statement.** Unless the construction or remodeling is of a minor nature, not affecting the capacity or flow of the facility, an operational program statement shall be developed by the facility administrator and submitted to the Board for the purpose of providing the basis upon which architectural plans are drawn. The operational program statement must be

submitted with the schematic architectural plans required by Section 13-102 (c) 5 of these regulations for design-bid-build construction projects. The operational program statement must be submitted with the performance criteria or performance criteria and concept drawings for design-build construction projects. The operational program statement must include a description of the following:

- A. Intended capacity of facility.
 - B. Security and classification of inmates to be housed.
 - C. Inmate movement within the facility and entry and exit from security areas.
 - D. Food preparation and serving.
 - E. Staffing.
 - F. Booking.
 - G. Visiting and attorney reviews.
 - H. Exercise.
 - I. Programs.
 - J. Medical services, including the management of communicable diseases.
 - K. Cleaning and/or laundering.
 - L. Inmate segregation as specified in Penal Code Sections 4001 and 4002 and Article 5 of Title 15, C.C.R.
 - M. Court holding and inmate movement.
 - N. Mental health services.
 - O. Facilities for jail administration and operations staff.
 - P. Staff to staff communications system.
 - Q. Management of disruptive inmates.
 - R. Management and placement of persons with disabilities, with provisions for wheelchairs, gurney access and for evacuation during emergencies.
 - S. Architectural treatment of space relative to preventing suicides by inmates.
 - T. Method of implementing Penal Code Section 4030 relating to the holding of misdemeanor arrestees.
 - U. Intended type of facility.
 - V. Sobering cell(s) as referenced by Title 15, Section 1056, with the ability to segregate.
 - W. Safety cell(s) as referenced by Title 15, Section 1055.
 - X. If minors describe how to enter the security area for processing and/or secure custody or housing, how will movement within the facility and entry and exit from security areas be accomplished pursuant to separation requirements of Welfare and Institutions Code Section 208(a) and Section 1144 of these regulations.
4. **Type III and Type IV facilities in existing buildings.** Wherever a city, county or combination thereof,

intends to establish a Type III or Type IV facility in an existing building or buildings, notice shall be given to the Board whose staff shall complete a survey to determine capacity of such buildings and shall make recommendations for necessary modifications. The proposing local government shall secure the appropriate clearance from the health authority, building official and State Fire Marshal.

5. **Submittal of plans and specifications.** All plans and specifications shall be submitted to the Board in compliance with Penal Code Section 6029.

1. For design-bid-build projects, one set of plans and specifications shall be submitted at the schematic design phase, at the design development phase and the construction document phase.
2. For design-build projects, one set of performance criteria or performance criteria and concept drawings shall be submitted before the county issues a request for proposals for the services of a design-build entity. One set of construction document drawings shall be submitted. Board staff shall respond in writing indicating compliance or non-compliance with these regulations.

6. **Design requirements.**

- A. The design of a local detention facility shall comply with provisions of California Code of Regulations, Title 24, Part 2, Section 1231.
- B. The design of a Type I, Type II, Type III or Type IV facility, shall provide the following:

- (1) **Fire safety.** The provisions of Title 19 and Title 24, Part 2 as they relate to detention facilities shall be incorporated into the facility design.
- (2) **Suicide hazards.** Architectural plans shall be reviewed by the Board for the purpose of reducing hazards posed by fixtures and equipment which could be used for an act of suicide by an inmate. The facility design shall avoid any surfaces, edges, fixtures or fittings that can provide an attachment for self-inflicted injury. The following features shall be incorporated in the design of temporary holding cells, temporary staging cells sobering cells, safety cells, single occupancy cells and any other area where an inmate may be left alone:
 - a. plumbing shall not be exposed. Operation of control valves shall use flush buttons or similar. The drinking fountain bubbler shall be without curved projections;
 - b. towel holders shall be ball-in-socket or indented clasp, not pull-down hooks or bars;
 - c. supply and return grilles and any other vent or security cover shall have openings no greater than $\frac{3}{16}$ inch or have 16-mesh per square inch;

- d. beds, desk surfaces and shelves shall have no sharp edges and be configured to prevent attachment;
- e. light fixtures shall be tamper resistant;
- f. fixtures such as mirrors shall be mounted using tamper-resistant fasteners; and
- g. fire sprinkler heads inside rooms shall be designed to prevent attachment.
- h. telephone cords shall be at a length that reduces the potential for use as a ligature.

(3) **Health and sanitation.** Provisions of Subchapter 4, Title 15, California Code of Regulations, and of the California Retail Food Code as they relate to detention facilities shall be incorporated into the facility design.

(4) **Single- and/or double-occupancy cells.** In any local detention system, the number of single- and/or double-occupancy cells shall be that number, determined by the facility/system administrator in conjunction with the Board, necessary to safely manage the population of the facility/system based on a comprehensive needs assessment which accounts for those inmates projected to be:

- a. administrative segregation cases,
- b. persons with disabilities,
- c. custodial problems and/or
- d. likely to need individual housing for other specific reasons as determined by the facility/system administration.

The total number of single- and/or double-occupancy cells shall not be less than 10 percent of the system's Corrections Standards Authority rated capacity. The local detention facility/ system shall comply with all other design requirements contained in these regulations.

(5) **Staff and inmate safety.** Facilities shall be designed and/or equipped in such a manner that staff and inmates have the ability to summon immediate assistance in the event of an incident or an emergency.

(6) **Heating and cooling.** Provision shall be made to maintain a living environment in accordance with the heating, ventilating and air conditioning requirements of Parts 2 and 4, and the energy conservation requirements of Part 6, Title 24, California Code of Regulations.

(7) **Acoustics.** Housing areas shall be designed and constructed so that the average noise level does not exceed 70 decibels during periods of activity and 45 decibels during sleeping hours.

(8) **Living areas.** Living areas shall be separated from the area for reception and booking.

(9) **Spaces for persons with disabilities.**

- a. Spaces within the security perimeter such as day rooms and activity areas shall be located such that persons with disabilities will not be excluded from participating in any program for which he or she would otherwise be eligible. Accessible showers for inmates with disabilities shall be available.
- b. All spaces of a local detention facility shall comply with the applicable chapters of Title 24, Part 2 of the California Code of Regulations.

- (10) **Security.** The design should facilitate security and supervision appropriate to the level of inmate custody including consideration of design and space as it relates to the prevention of sexual abuse and harassment.
- (11) **Glazing.** Internal and external facility glazing shall be appropriate to the security level of the detention area or room.
- (12) **Hair care space.** Space and suitable equipment must be provided in all Type II or Type III facilities for men’s haircutting and/or female hair-dressing.
- (13) Floor drains shall be provided where operationally and mechanically appropriate.
- (14) A sewage system design capable of addressing items that could potentially impact waste water systems.
- (15) Medical/mental health care housing shall be designed in consultation with the health authority. Medical/mental health areas may contain other than single occupancy rooms.

C. The design of a Court Holding or Temporary Holding facility must include and comply with the following subsections of Section 13-102(c)6B: (1), (2), (3), (5), (6), (7), (9), (10) and (13). Court holding facilities shall have separate paths of travel for inmates from those used by the public.

7. **Pilot projects.** The pilot project is the short-term method used by a local detention facility/system, approved by the Board, to evaluate innovative programs, operations or concepts which meet or exceed the intent of these regulations.

The Board may, upon application of a city, county, or city and county, grant pilot project status to a program, operational innovation or new concept related to the operation and management of a local detention facility. An application for a pilot project shall include, at a minimum, the following information:

- A. The regulations which the pilot project will affect.
- B. Review of case law, including any lawsuits brought against the applicant’s local detention facility, pertinent to the proposal.

- C. The applicant’s history of compliance of noncompliance with standards.
- D. A summary of the “totality of conditions” in the facility or facilities, including but limited to:
 - (1) Program activities, exercise and recreation;
 - (2) Adequacy of supervision;
 - (3) Types of inmates affected; and,
 - (4) Inmate classification procedures.
- E. A statement of the goals the pilot project is intended to achieve, the reasons a pilot project is necessary and why the particular approach was selected.
- F. The projected costs of the pilot project and projected cost savings to the city, county, city and county, if any.
- G. A plan for developing and implementing the pilot project, including a time line where appropriate.
- H. A statement of how the overall goal of providing safety to staff and inmates will be achieved.

The Board shall consider applications for pilot projects based on the relevance and appropriateness of the proposed project, the completeness of the information provided in the application and staff recommendations.

Within 10 working days of receipt of the application, Board staff will notify the applicant, in writing, that the application is complete and accepted for filing, or that the application is being returned as deficient and identifying what specific additional information is needed. This does not preclude the Board members from requesting additional information necessary to make a determination that the pilot project proposed actually meets or exceeds the intent of the regulations at the time of the hearing. When complete, the application will be placed on the agenda for the Board’s consideration at a regularly scheduled meeting. The written notification from the Board to the applicant shall also include the date, time and location of the meeting at which the application will be considered. (The Board meeting schedule for the current calendar year is available through its office in Sacramento.)

When an application for a pilot project is approved by the Board, the Board staff shall notify the applicant, in writing within 10 working days of the meeting, of any conditions included in the approval and the time period for the pilot project. Regular progress reports and evaluative data on the success of the pilot project in meeting its goals shall be provided to the Board. If disapproved, the applicant shall be notified in writing, within 10 working days of the meeting, the reasons for said disapproval. This application approval process may take up to 90 days from the date of receipt of a complete application.

Pilot project status granted by the Board shall not exceed twelve months after its approval date. When deemed to be in the best interest of the application, the Board may extend the expiration date for up to an additional twelve months. Once a

city, county, or city and county successfully completes the pilot project evaluation period and desires to continue with the program, it may apply for an alternate means of compliance as described in Section 13-102(c)8 of these regulations.

8. **Alternate means of compliance.** The alternate means of compliance is the long-term method used by a local detention facility/system, approved by the Board, to encourage responsible innovation and creativity in the operation of California's local detention facilities. The Board may, upon application of a city, county, or city and county, consider alternate means of compliance with these regulations after the pilot project process has been successfully evaluated [as defined in Section 13-102(c)7]. The city, county, or city and county must present the completed application to the Board no later than 30 days prior to the expiration of its pilot project.

Applications for alternate means of compliance must meet the spirit and intent of improving jail management, shall be equal to or exceed the existing standard(s) and shall include reporting and evaluation components. An application for alternate means of compliance shall include, at a minimum, the following information:

- A. Review of case law, including any lawsuits brought against the applicant local detention facility, pertinent to the proposal.
- B. The applicant's history of compliance or noncompliance with standards.
- C. A summary of the "totality of conditions" in the facility or facilities, including but not limited to:
 - (1) Program activities, exercise and recreation;
 - (2) Adequacy of supervision;
 - (3) Types of inmates affected; and
 - (4) Inmate classification procedures.
- D. A statement of the problem the alternate means of compliance is intended to solve, how the alternative will contribute to a solution of the problem and why it is considered an effective solution.
- E. The projected costs of the alternative and projected cost savings to the city, county, city and county, if any.
- F. A plan for developing and implementing the alternative, including a time line where appropriate.
- G. A statement of how the overall goal of providing safety to staff and inmates was achieved during the pilot project evaluation phase [Section 13-102(c)7].

The Board shall consider applications for alternate means of compliance based on the relevance and appropriateness of the proposed alternative, the completeness of the information provided in the application, the experiences of the jurisdiction during the pilot project, and staff recommendations.

Within 10 working days of receipt of the application, Board staff will notify the applicant, in writing, that the application is complete and accepted for fil-

ing, or that the application is being returned as deficient and identifying what specific additional information is needed. This does not preclude the Board members from requesting additional information necessary to make a determination that the alternate means of compliance proposed meets or exceeds the intent of these regulations at the time of the hearing. When complete, the application will be placed on the agenda for the Board's consideration at a regularly scheduled meeting.

The written notification from the Board to the applicant shall also include the date, time and location of the meeting at which the application will be considered. (The Board meeting schedule for the current calendar year is available through its office in Sacramento.)

When an application for an alternate means of compliance is approved by the Board, Board staff shall notify the applicant, in writing within 10 working days of the meeting, of any conditions included in the approval and the time period for which the alternate means of compliance shall be permitted. The Board may require regular progress reports and evaluative data as to the success of the alternate means of compliance. If disapproved, the applicant shall be notified in writing, within 10 working days of the meeting, the reasons for said disapproval. This application approval process may take up to 90 days from the date of receipt of a complete application.

The Board may revise the minimum jail standards during the next biennial review (reference Penal Code Section 6030) based on data and information obtained during the alternate means of compliance process. If, however, the alternate means of compliance does not have universal application, a city, county, city and county, may continue to operate under this status as long as they meet the terms of this regulation.

**ARTICLE 2
MINIMUM STANDARDS FOR JUVENILE FACILITIES**

13-201. Minimum standards for juvenile facilities.

(a) **Definitions.** The following definitions shall apply:

ADMINISTERING MEDICATION, as it relates to pharmaceutical management, means the act by which a single dose of medication is given to a patient by licensed health care staff. The single dose of medication may be taken either from stock (undispensed) or dispensed supplies.

ALTERNATE MEANS OF COMPLIANCE means a process for meeting or exceeding the intent of the standards in an innovative way as approved by the Board pursuant to an application.

APPEAL HEARING means an administrative procedure providing an appellant with an opportunity to present the facts of the appeal for the formal decision concerning matters raised pursuant to the purposes set forth in these regulations.

Such hearing may be conducted using oral and/or written testimony as specified by the Executive Director of the Board.

APPELLANT means a county or city which files a request for an appeal hearing.

AUTHORIZED AND REPRESENTATIVE means an individual authorized by the appellant to act as its representative in any or all aspects of the hearing.

BOARD means the Board of State and Community Corrections, which acts by and through its executive director, deputy directors and field representatives.

CAMP means a juvenile camp, ranch, forestry camp or boot camp established in accordance with Section 881 of the Welfare and Institutions Code, to which youth made wards of the court on the grounds of fitting the description in Section 602 of the Welfare and Institutions Code may be committed.

CELL EXTRACTION means the forceful removal of a youth from a room.

CLERGY means persons ordained for religious duties.

COMMITTED means placed in a jail or juvenile facility pursuant to a court order for a specific period of time, independent of, or in connection with, other sentencing alternatives.

CONCEPT DRAWINGS means, with respect to a design-build project, any drawings or architectural renderings that may be prepared, in addition to performance criteria, in such detail as the agency determines necessary to sufficiently describe the agency's needs.

CONTRABAND is any object, writing or substance, the possession of which would constitute a crime under the laws of the State of California, pose a danger within a juvenile facility or would interfere with the orderly day-to-day operation of a juvenile facility, or violate facility rules.

CONTROL ROOM is a continuously staffed secure area within the facility that contains staff responsible for safety, security, emergency response, communication, electronics and movement.

COURT HOLDING FACILITY FOR MINORS means a local detention facility constructed within a court building used for the confinement of minors or minors and adults for the purpose of a court appearance, for a period not to exceed 12 hours.

DELIVERING MEDICATION, as it relates to pharmaceutical management, means the act of providing one or more doses of a prescribed and dispensed medication to a youth.

DESIGN-BID-BUILD means a construction procurement process independent of the design process and in which the construction of a project is procured based on completed construction documents.

DESIGN-BUILD means a construction procurement process in which both the design and construction of a project are procured from a single entity.

DEVELOPMENTALLY DISABLED means those persons who have a disability which originates before an individual attains age 18, continues, or can be expected to continue indefinitely, and constitutes a substantial disability for that

individual. This term includes mental retardation, cerebral palsy, epilepsy and autism, as well as disabling conditions found to be closely related to mental retardation or to require treatment similar to that required for mentally retarded individuals.

DIRECT VISUAL OBSERVATION means staff must personally see youth's movement and/or skin. Audio/video monitoring may supplement but not substitute for direct visual observation.

DIRECT VISUAL SUPERVISION means staff constantly in the presence of the youth. Audio/video monitoring may supplement but not substitute for direct visual supervision.

DISPENSING, as it relates to pharmaceutical management, means the interpretation of the prescription order, the preparation, repackaging and labeling of the drug based upon a prescription from a physician, dentist or other prescriber authorized by law.

DISPOSAL, as it relates to pharmaceutical management, means the destruction of medication or its return to the manufacturer or supplier.

DNA or Deoxyribonucleic acid means a chromosomal double stranded molecule that exists in each living cell. DNA determines an individual's hereditary characteristics and can be used to distinguish and identify an individual from another person. This becomes critical when blood, hair, skin or any other part of the body is used to prove one's involvement or lack of involvement in a crime scene.

EMERGENCY means a significant disruption of normal facility procedure, policy or operation caused by civil disorder, single incident of mass arrest of juveniles and natural disasters such as flood, fire or earthquake; and which requires immediate action to avert death or injury and to maintain security.

EXECUTIVE DIRECTOR means the Executive Director of the Board.

EXERCISE means an activity that requires physical exertion of the large muscle groups.

EXIGENT means an urgent and unanticipated event that requires immediate action.

FACILITY ADMINISTRATOR means Chief Probation Officer, Sheriff, Marshal, Chief of Police or other official charged by law with administration of the facility.

FACILITY MANAGER means director, superintendent, police or sheriff commander or other person in charge of the day-to-day operation of a facility holding youth.

FILING DATE means the date a request for an appeal hearing is received by the Executive Director or the Board.

504 PLAN means a written educational plan developed by a group of educators, administrators, parents and other relevant participants that addresses the needs of a student with a physical or mental impairment which may substantially limit major life activities, including caring for one's self, walking, seeing, hearing, speaking, breathing, working, performing manual tasks and learning as defined under Section 504.

FURLOUGH means the conditional or temporary release of a youth from the facility.

GENDER EXPRESSION means the manner in which a person expresses his or her gender through clothing, appearance, behavior, speech, etc.

GENDER IDENTITY means a person's sense of identification with either the male or female self.

GROUP PUNISHMENT means a group of uninvolved youth is disciplined due to the actions of one or more youth.

HEALTH ADMINISTRATOR means that individual or agency that is designated with responsibility for health care policy pursuant to a written agreement, contract or job description. The health administrator may be a physician, an individual or a health agency. In those instances where medical and mental health services are provided by separate entities, decisions regarding mental health services shall be made in cooperation with the mental health director. When the administrator is other than a physician, final clinical judgment rests with a designated responsible physician.

HEALTH CARE means medical, mental health and dental services.

HEALTH CARE CLEARANCE means a nonconfidential statement which indicates to child supervision staff that there are no health contraindications to a youth being admitted to a facility and specifies any limitations to full program participation.

HEARING PANEL means a panel comprised of three members of the Board who shall be selected by the Chairman at the time an appeal is filed. A fourth member may be designated as alternate. Members designated to the hearing panel shall not be employed by or citizens of the county or city submitting an appeal.

INDIVIDUAL EDUCATION PROGRAM (IEP) means a written statement for each individual with exceptional needs that is developed, reviewed and revised in a meeting in accordance with Education Code Section 56345 and applicable federal laws and regulation.

JUVENILE FACILITY means a juvenile hall, ranch or camp, forestry camp, regional youth education facility, boot camp or special-purpose juvenile hall.

JUVENILE HALL means a county facility designed for the reception and temporary care of youth detained in accordance with the provisions of this subchapter and the juvenile court law.

LABELING, as it relates to pharmaceutical management, means the act of preparing and affixing an appropriate label to a medication container.

LEGEND DRUGS are any drugs defined as "dangerous drugs" under Chapter 9, Division 2, Section 4211 of the California Business and Professions Code. These drugs bear the legend, "Caution Federal Law Prohibits Dispensing Without a Prescription." The Food and Drug Administration (FDA) has determined, because of toxicity or other potentially harmful effects, that these drugs are not safe for use except under the supervision of a health care practitioner licensed by law to prescribe legend drugs.

LIVING UNIT shall be a self-contained unit containing locked sleeping rooms, single and double occupancy sleeping rooms or dormitories, dayroom space, water closets, wash basins, drinking fountains and showers commensurate to the number of youth housed. A living unit shall not be divided in any way that hinders direct access, supervision or immediate intervention or other action if needed.

LOCAL HEALTH OFFICER means that licensed physician who is appointed by the Board of Supervisors pursuant to Health and Safety Code Section 101000 to carry out duly authorized orders and statutes related to public health within his/her jurisdiction.

MAXIMUM CAPACITY means the number of youth that can be housed at any one time in a juvenile hall, camp, ranch, home, forestry camp, regional youth education facility or boot camp in accordance with provisions in this subchapter.

MENTAL HEALTH DIRECTOR means that individual who is designated by contract, written agreement or job description to have administrative responsibility for the mental health program. The health administrator shall work in cooperation with the mental health director to develop and implement mental health policies and procedures.

MINOR means a person under 18 years of age and includes those persons whose cases are under the jurisdiction of the adult criminal court.

NONSCHOOL DAY means a day when school is not in operation. It also applies when an individual youth is not enrolled in school and is not required to be in attendance.

NOTICE OF DECISION means a written statement by the Executive Director of the Board which contains the formal decision of the Executive Director of the Board and the reason for that decision.

ON-SITE HEALTH CARE STAFF means licensed, certified or registered health care personnel who provide regularly scheduled health care services at the facility pursuant to a contract, written agreement or job description. It does not extend to emergency medical personnel or other health care personnel who may be on site to respond to an emergency or an unusual situation.

OVER-THE-COUNTER (OTC) DRUGS, as it relates to pharmaceutical management, are medications which do not require a prescription (nonlegend).

PERFORMANCE CRITERIA means, with respect to a design-build project, the information that fully describes the scope of the proposed project and includes, but is not limited to, the size, type and design character of the buildings and site; the required form, fit, function, operational requirements and quality of design, materials, equipment and workmanship; and any other information deemed necessary to sufficiently describe the agency's needs; including documents prepared pursuant to paragraph (1) of subdivision (d) of Section 20133 of the Public Contract Code.

PILOT PROJECT means an initial short-term method to test or apply an innovation or concept related to the operation, management or design of a juvenile facility, jail or lockup pursuant to an application to, and approval by, the Board.

PODULAR DESIGN means a design concept for detention facilities in which housing cells, dormitories or sleeping rooms are positioned around the perimeter of a common day-room, forming a housing/living unit. Generally, the majority of services for each housing/living unit (such as dining, medical exam/sick call, programming, school, etc.) occur in specified locations within the unit.

PRIMARY RESPONSIBILITY is the ability of a child supervision staff member to independently supervise one or more youth.

PROCUREMENT, as it relates to pharmaceutical management, means the system for ordering and obtaining medications for facility stock.

PROPOSED DECISION means a written recommendation from the hearing panel/hearing officer to the full Board containing a summary of facts and a recommended decision on an appeal.

PROSTHESES means artificial devices to replace missing body parts or to compensate for defective bodily function. Prostheses are distinguished from slings, crutches or other similar assistive devices.

PSYCHOTROPIC MEDICATION means those drugs that are used to treat psychiatric symptoms. Drugs used to reduce the toxic side effects of psychotropic medications are not included.

RECREATION means activities that occupy the attention and offer the opportunity for relaxation. Such activities may include ping-pong, TV, reading, board games and letter writing.

REGIONAL FACILITY means a facility serving two or more counties bound together by a memorandum of understanding or a joint powers agreement identifying the terms, conditions, rights, responsibilities and financial obligation of all parties.

REMODELING means to alter the facility structure by adding, deleting or moving any of the buildings components, thereby affecting any of the spaces specified in Title 24, Section 1230.

REPACKAGING, as it relates to pharmaceutical management, means transferring medications from the original manufacturer's container to another properly labeled container.

REQUEST FOR APPEAL HEARING means a clear written expression of dissatisfaction about a procedure or action taken, requesting a hearing on the matter, and filed with the Executive Director of the Board.

RESPONSIBLE PHYSICIAN means that physician who is appropriately licensed by the state and is designated by contract, written agreement or job description to have responsibility for policy development in medical, dental and mental health matters involving clinical judgments. The responsible physician may also be the health administrator.

SECURITY GLAZING means a glass/polycarbonate composite glazing material designed for use in detention facility doors and windows and intended to withstand measurable, complex loads from deliberate and sustained attacks in a detention environment.

SEPARATION means limiting a youth's participation in regular programming for a specific purpose.

SEXUAL ORIENTATION means a person's emotional, romantic and sexual attraction for members of the same, opposite or both sexes.

SHALL is mandatory; "may" is permissive.

SPECIAL-PURPOSE JUVENILE HALL means a county facility used for the temporary confinement of a youth, not to exceed 96 hours, prior to transfer to a full service juvenile facility or release.

SPECIAL VISITS mean visits by persons that may not be parents or guardians, as outlined in Section 1374 of these regulations, and may include mentors, extended family members, role models and spouses.

STATUS OFFENDER means a youth alleged or adjudged to be a person described in Section 601 of the Welfare and Institutions Code.

STORAGE, as it relates to pharmaceutical management, means the controlled physical environment used for the safe-keeping and accounting of medications.

SUPERVISORY STAFF means a staff person whose primary duties may include, but are not limited to, scheduling and evaluating subordinate staff, providing on-the-job training, making recommendations for promotion, hiring and discharge of subordinate staff, recommending disciplinary actions and overseeing subordinate staff work. Supervisory staff shall not be included in the youth to supervision staff ratio, although some of their duties could include the periodic supervision of youth.

TRANSGENDER YOUTH means a youth whose gender identity does not correspond with his or her anatomical sex.

USE OF FORCE means an immediate means of overcoming resistance and to control the threat of imminent harm to self or others.

VOYEURISM means an invasion of privacy of a youth by staff for reasons unrelated to official duties, such as peering at a youth who is using a toilet in his or her room to perform bodily functions; requiring a youth to expose his or her buttocks, genitals, or breasts; or taking images of all or part of a youth's naked body or of a youth performing bodily functions. Exception would include exigent circumstances or when such viewing is incidental to routine room safety checks.

YOUTH means any person who is in the custody of the juvenile facility. This person may be a minor under the age of 18 or a person over 18 years of age. This includes persons whose cases are under the jurisdiction of the juvenile court and persons whose cases are under the jurisdiction of the adult court.

YOUTH SUPERVISION STAFF means juvenile facility employee, whose duty is primarily the supervision of youth. Administrative, supervisory, food services, janitorial or other auxiliary staff is not considered child supervision staff.

(b) **Exclusions.** Title 24 of the California Code of Regulations, Sections 13-201 and 1230, which pertain to planning and design of juvenile facilities, shall be applicable to facilities for which architectural drawings have been submitted to

the Board for review. These requirements shall not be applicable to facilities that were constructed in conformance with the standards of the Department of the Youth Authority or the Board in effect at the time of initial architectural planning. However, an existing juvenile facility built in accordance with construction standards in effect at the time of construction shall be considered as being in compliance with the provisions of this article unless the condition of the structure is determined by the facility administrator or other appropriate authority to be dangerous to life, health or welfare of youth. When any facility, designed and constructed under earlier standards, can comply with a more recently adopted requirement, the least restrictive regulation shall apply.

If, in the course of inspection of local juvenile facilities, the Board determines that a facility planned or built prior to these regulations does not meet the appropriate, applicable standards in effect at the time of initial architectural planning, the local governing body shall submit to the Board for their approval within one year of such inspection a plan for causing that facility to meet current standards. Such a plan shall include the specific building areas that need to be remodeled and/or constructed, a definite time period over which the proposed modifications are planned and a cost estimate including a description of the method of financing.

(c) **Initial planning for a local juvenile facility.**

1. **Letter of intent.** A county, city, city and county or regional juvenile facility that intends to build or remodel any local juvenile facility shall file a letter of intent with the Board.

2. **Needs assessment.** Any county, city, city and county, or regional juvenile facility intending to construct a new juvenile facility, or expand the rated capacity of the current facility, shall complete a needs assessment. One copy of the needs assessment shall be submitted to the Board prior to submitting plans and specifications. There are two types of needs assessments:

A. **Comprehensive Needs Assessment.** The Comprehensive Needs Assessment shall include:

- (1) A description of the elements of the system;
- (2) A description of the department's management philosophy/process;
- (3) A description of the current youth population;
- (4) A description of the classification system;
- (5) A description of the program needs, including planned academic programs and special education programs, and an analysis of performance in using programs which can reduce secure facility requirements;
- (6) An analysis of the corrections' system trends and characteristics which influence planning assumptions about future change, including: population projections, technological trends and advancements, projections of youth population and program costs based on continuation of current policies, and projections of the

impact of alternative policies or programs on youth population growth and program costs;

- (7) A history of the system's compliance with standards, including the adequacy of staffing levels and the ability to provide visual supervision;
- (8) A history of the adequacy of record keeping;
- (9) The ability to provide confidential interviews and medical exams; and;
- (10) A discussion of unresolved issues.

B. **Targeted Needs Assessment.**

- (1) For expansion of an existing facility, a targeted needs assessment may be submitted if a comprehensive needs assessment has been submitted and accepted by the Board within 5 years.
- (2) The Targeted Needs Assessment shall include any update and/or changes to the previous Comprehensive Needs Assessment and provide information affirming its validity and accuracy.

3. **Operational program statement.** Unless the construction or remodeling is of a minor nature, not affecting the capacity or flow of the facility, an operational program statement shall be developed by the facility administrator and submitted to the Board for the purpose of providing the basis upon which architectural plans are drawn. The operational program statement must be submitted with the schematic architectural plans required by Section 13-201 (c) 5 of these regulations for design-bid-build construction projects. The operational program statement must be submitted with the performance criteria or performance criteria and concept drawings for design-build construction projects. The operational program statement must include a description of the following:

- A. Intended capacity of facility;
- B. Security and classification of youth to be housed;
- C. Movement within the facility and entry and exit from secure areas;
- D. Food preparation and serving;
- E. Staffing;
- F. Booking;
- G. Visiting and attorney interviews;
- H. Exercise;
- I. Programs;
- J. Medical services, including the management of communicable diseases;
- K. Cleaning and/or laundering;
- L. Segregation of youth;
- M. Court holding and movement;
- N. Mental health services;

- O. Facilities for administration and operations staff;
- P. Staff to staff communications system;
- Q. Management of disruptive youth;
- R. Management of youth with disabilities, with provisions for wheelchairs, gurney access and for evacuation during emergencies;
- S. Architectural treatment of space relative to preventing suicides by youth;
- T. Method of implementing *California Penal Code* Section 4030 relating to the holding of offenders requiring incarceration without the necessity of unjustified strip searches; and
- U. School programs.

4. **Facilities in existing buildings.** Wherever county, city, city and county, or regional juvenile facility intends to establish a juvenile facility in an existing building or buildings, notice shall be given to the Board whose staff shall complete a survey to determine capacity of such buildings and shall make recommendations for necessary modifications. The proposing local government shall secure the appropriate clearance from the health authority, building official and State Fire Marshal.

5. **Submittal of plans and specifications.** All plans and specifications shall be submitted to the Board in compliance with Penal Code Section 6029.

- (1) For design-bid-build projects, one set of plans and specifications shall be submitted at the schematic design stage, at the design development stage and construction document phase.
- (2) For design-build projects, one set of performance criteria or performance criteria and concept drawings shall be submitted before the county issues a request for proposals for the services of a design-build entity. One set of construction document drawings shall be submitted. Board staff shall respond in writing indicating compliance or non-compliance with these regulations.

6. **Design requirements.**

A. The design of a local juvenile facility shall comply with provisions of California Code of Regulations, Title 24, Part 2, Section 1230.

B. The design of a juvenile facility shall address the following:

- 1. **Fire safety.** The provisions of Title 19 and Title 24 as adopted by the State Fire Marshal as they relate to juvenile facilities shall be incorporated into the facility design.
- 2. **Suicide hazards.** Architectural plans shall be reviewed by the Board for the purpose of reducing hazards posed by fixtures and equipment which could be used for an act of suicide by a youth. The facility design shall avoid any surfaces, edges, fixtures, or fittings that can provide an attachment for hanging or other opportunity for self-inflicted

injury. The following features shall be incorporated in the design of sleeping rooms, bathrooms and any other area where a juvenile may be left alone:

- a. Plumbing shall not be exposed. Operation of control valves shall use flush buttons or similar. Drinking water spout, if any, shall be without curved projections;
- b. Towel holders shall be ball-in-socket or indented clasp, not pull-down hooks or bars;
- c. Supply and return grilles and any other vent or security cover shall have openings no greater than $\frac{3}{16}$ inch or have 16-mesh per square inch;
- d. Beds, desk surfaces and shelves shall have no sharp edges and shall be configured to prevent attachment;
- e. Light fixtures shall be tamper resistant;
- f. Fixtures such as mirrors shall be mounted using tamper-resistant fasteners;
- g. Fire sprinkler heads inside rooms shall be designed to prevent attachment; and
- h. Telephone cords shall be at a length that reduces the potential for use as a ligature.

3. **Health and sanitation.** Provisions of Subchapter 5, Title 15, California Code of Regulations, and of the California Retail Food Code (CalCode) as they relate to juvenile facilities shall be incorporated into the facility design.

4. When adding new sleeping rooms to a juvenile hall, not less than 10 percent of them shall be single occupancy, unless the juvenile hall can demonstrate that its current number of single occupancy rooms will equal at least 10 percent of the new rated capacity. In addition, single or double occupancy rooms shall be that number, determined by the facility administrator, necessary to safely manage the population of the facility based on a comprehensive needs assessment which accounts for youth projected to be:

- a. Mentally disordered,
- b. Custodial problems and/or
- c. Likely to need individual housing for other specific reasons as determined by the facility administration.

The total number of single or double occupancy rooms shall be identified.

5. **Staff and safety.** Facilities shall be designed and/ or equipped in such a manner that staff and youth have the ability to summon immediate assistance in the event of an incident or an emergency.

6. **Heating and cooling.** Provision shall be made to maintain a generally accepted living environment and meet the requirements of Parts 1 (*California Administrative Code*), 2 (*California Building Code*) and 4 (*California Mechanical Code*).

7. **Acoustics.** Dayroom areas shall be designed and constructed so that the noise level does not exceed 70 decibels and a reverberation time less than 1.5 seconds. Sleeping areas shall have a noise level no higher than 45 decibels and a reverberation time less than 1.5 seconds. The heating, ventilating and air conditioning noise level shall be no higher than 45 decibels in sleeping areas and classrooms.
8. **Spaces for the disabled.**
 - a. Other space within the security perimeter such as dayroom and activity areas shall be located such that a disabled youth will not be excluded from participating in any program for which they would otherwise be eligible. An accessible shower for disabled youth shall be available.
 - b. All spaces of a local juvenile facility shall comply with the applicable chapters of Title 24, Part 2 of the California Code of Regulations.
9. **Security.** Facility design shall provide security and supervision appropriate to the classification level of youth in custody including consideration of design space as it relates to the prevention of sexual abuse, assault and harassment.
 - a. The facility perimeter shall be controlled by appropriate means to ensure that youth remain within the perimeter and shall be designed to prevent access by the general public without proper authorization.
 - b. Security glazing shall be used where it defines the secure perimeter of buildings. It shall also be used at appropriate interior locations to ensure a secure and safe environment for youth and staff.
10. **Medical/mental health care housing and treatment space.** There shall be some means to provide health care and housing and treatment of ill and/or infirm youth. When the operational program statement for a facility indicates that medical care housing is needed, such housing must provide lockable storage space for medical instruments and must be located within the security area of the facility accessible to both female and male youth, but not in the living area of either. Treatment spaces and the medical care housing unit shall be designed in consultation with the health authority. If negative pressure isolation rooms are being planned, they shall be designed to the community standard. Medical/mental health areas may contain other than single occupancy rooms.
11. A sewage system design capable of addressing items that could potentially impact waste water systems.
12. Floor drains shall be provided where operationally and mechanically appropriate.
7. **Pilot project.** A pilot project is the short-term method used by a local juvenile facility/system approved by the Board to evaluate innovative programs, operations or

concepts which may not comply with the regulations but meet or exceed the intent of these regulations.

The Board may, upon application of a city, county, or city and county, grant pilot project status to a program, operational innovation or new concept related to the operation and management of a local juvenile facility. An application for a pilot project shall include, at a minimum, the following information:

- (a) The regulations that the pilot project shall affect;
- (b) Any lawsuits brought against the applicant local juvenile facility, pertinent to the proposal;
- (c) A summary of the “totality of conditions” in the facility or facilities, including but not limited to
 1. Program activities, exercise and recreation,
 2. Adequacy of supervision,
 3. Types of youth affected and
 4. Classification procedures.
- (d) A statement of the goals the pilot project is intended to achieve, the reasons a pilot project is necessary and why the particular approach was selected;
- (e) The projected costs of the pilot project and projected cost savings to the city, county, or city and county, if any;
- (f) A plan for developing and implementing the pilot project including a time line where appropriate; and
- (g) A statement of how the overall goal of providing safety to staff and youth shall be achieved.

The Board may consider applications for pilot projects based on the relevance and appropriateness of the proposed project, the applicant’s history of compliance/noncompliance with regulations, the completeness of the information provided in the application and staff recommendations.

Within 10 working days of receipt of the application, Board staff shall notify the applicant, in writing, that the application is complete and accepted for filing, or that the application is being returned as deficient and identifying what specific additional information is needed. This does not preclude the Board members from requesting additional information necessary to make a determination that the pilot project proposed actually meets or exceeds the intent of these regulations at the time of the hearing. When complete, the application shall be placed on the agenda for the Board’s consideration at a regularly scheduled meeting. The written notification from the Board to the applicant shall also include the date, time and location of the meeting at which the application shall be considered.

When an application for a pilot project is approved by the Board, Board staff shall notify the applicant, in writing within 10 working days of the meeting, of any conditions included in the approval and the time period for the pilot project. Regular progress reports and evaluative data on the success of the pilot project in meeting its goals shall be provided to the Board. The Board may extend time limits for pilot projects for good and proper purpose.

If disapproved, the applicant shall be notified in writing, within 10 working days of the meeting, the reasons for said disapproval. This application approval process may take up to 90 days from the date of receipt of a complete application.

Pilot project status granted by the Board shall not exceed 12 months after its approval date. When deemed to be in the best interest of the applicant, the Board may extend the expiration date. Once a city, county, or city and county successfully completes the pilot project evaluation period and desires to continue with the program, it may apply for an alternate means of compliance. The pilot project shall be granted an automatic extension of time to operate the project pending the Board consideration of an alternate means of compliance.

8. **Alternate means of compliance.** An alternate means of compliance is the long-term method used by a local juvenile facility/system, approved by the Board, to encourage responsible innovation and creativity in the operation of California’s local juvenile facilities. The Board may, upon application of a city, county, or city and county, consider alternate means of compliance with these regulations either after the pilot project process has been successfully evaluated or upon direct application to the Board. The city, county, or city and county shall present the completed application to the Board no later than 30 days prior to the expiration of its pilot project, if needed.

Applications for alternate means of compliance shall meet the spirit and intent of improving facility management, shall enhance, be equal to, or exceed the intent of, existing standard(s), and shall include reporting and evaluation components. An application for alternate means of compliance shall include, at a minimum, the following information:

- (a) Any lawsuits brought against the applicant local facility, pertinent to the proposal;
- (b) A summary of the “totality of conditions” in the facility or facilities, including but not limited to:
 - 1. Program activities, exercise and recreation;
 - 2. Adequacy of supervision;
 - 3. Types of youth affected; and
 - 4. Classification procedures.
- (c) A statement of the problem the alternate means of compliance is intended to solve, how the alternative shall contribute to a solution of the problem and why it is considered an effective solution;
- (d) The projected costs of the alternative and projected cost savings to the city, county, or city and county, if any;
- (e) A plan for developing and implementing the alternative, including a time line where appropriate; and
- (f) A statement of how the overall goal of providing safety to staff and youth was or would be achieved during the pilot project evaluation phase.

- (g) When remodeling, a statement which indicates that the alternate means of compliance will provide an enhanced compliance with current regulations, if full compliance cannot be achieved.

The Board may consider applications for alternate means of compliance based on the relevance and appropriateness of the proposed alternative, the applicant’s history of compliance/noncompliance with regulations, the completeness of the information provided in the application, the experiences of the jurisdiction during the pilot project, if applicable, and staff recommendations.

Within 10 working days of receipt of the application, Board staff shall notify the applicant, in writing, that the application is complete and accepted for filing, or that the application is being returned as deficient and identifying what specific additional information is needed. This does not preclude the Board members from requesting additional information necessary to make a determination that the alternate means of compliance proposed meets or exceeds the intent of these regulations at the time of the hearing. When complete, the application shall be placed on the agenda for the Board’s consideration at a regularly scheduled meeting. The written notification from the Board to the applicant shall also include the date, time and location of the meeting at which the application shall be considered.

When an application for an alternate means of compliance is approved by the Board, Board staff shall notify the applicant, in writing, within 10 working days of the meeting, of any conditions included in the approval and the time period for which the alternate means of compliance shall be permitted. Regular progress reports and evaluative data as to the success of the alternate means of compliance shall be submitted by the applicant. If disapproved, the applicant shall be notified in writing, within 10 working days of the meeting, the reasons for said disapproval. This application approval process may take up to 90 days from the date of receipt of a complete application.

The Board may revise the minimum standards during the next biennial review based on data and information obtained during the alternate means of compliance process. If, however, the alternate means of compliance does not have universal application, a city, county, or city and county may continue to operate under this status as long as they meet the terms of this regulation.

HISTORY:

- 1. (BOC 1/96) Regular order by the Board of Corrections to add Article 2, to Part 1, Title 24, C.C.R. Filed with the secretary of state on February 19, 1997; effective March 21, 1997. Approved as a regular order by the California Building Standards Commission on February 6, 1997.

Note: Authority cited: Sections 210 and 885, Welfare and Institutions Code; and Assembly Bill 1397, Chapter 12, Statutes of 1996. Reference: Section 209, Welfare and Institutions Code; 1995-96 Budget Act, Chapter 303, Item Number 5430-001-001, Statutes of 1995; Assembly Bill 904, Chapter 304, Statutes of 1995; and Assembly Bill 1397, Chapter 12, Statutes of 1996.

HISTORY NOTE APPENDIX FOR CHAPTER 13
Administrative Regulations for the
Board of State and Community Corrections
California Code of Regulations, Title 24, Part 1

HISTORY:

> The history notes for prior changes remain within the text of this code.

1. (BOC 1/97) Regular order by the Board of Corrections to amend their administrative regulations pertaining to Local Detention Facilities. Filed with the secretary of state on March 25, 1998; effective April 24, 1998. Approved by the California Building Standards Commission on March 18, 1998.

2. January 2, 2003 Supplement approved by the California Building Standards Commission on January 31, 2001, Filed with the Secretary of State on February 2, 2001, published January 1, 2003, and effective July 1, 2003:

Section 13-102(a)5 — Revise “. . . Executive Officer . . .” to read “. . . Executive Director . . .”.

Section 13-102(a)9 — Revise “Detoxification cell” to read “Sobering cell”.

Section 13-102(a)24 — Revise “. . . as detoxification, safety, . . .” to read “. . . as sobering, safety, . . .”.

Following Section 13-102(a)18, insert a new Section 13-102(a)19. Renumber Sections 13-102(a)29 and 13-102(a)30 as Section 13-102(a)30 and 13-102(a)31 respectively.

Following renumbered Section 13-102(a)31, insert a new Section 13-102(a)32. Renumber Sections 13-102(a)31 through 13-102(a)35 two numbers higher.

Following renumbered Section 13-102(a)37, insert a new Section 13-102(a)38. Renumber Section 13-102(a)36 as 13-102(a)39.

Following renumbered Section 13-102(a)39, insert a new Section 13-102(a)40. Renumber Sections 13-102(a)37 through 13-102(a)46 four numbers higher.

(All of the following references for Section 13-102 et seq. use the revised Section numbers.)

Section 13-102(c)2 — At the end of the first paragraph delete the words “The needs assessment study shall include:” and items A. through F. Insert new lead provision and items (a) through (k).

Section 13-102(c)3.R — Revise “disabled inmates” to “persons with disabilities.”

Section 13-102(c)3.T — Revise “Section 4465.5” to “Section 4030.”

Section 13-102(c)3.V — Revise “Detoxification Cell(s)” to “Sobering cell(s).”

Section 13-102(c)6.B.(2) — In the tenth line, revise “detoxification cells” to “sobering cells.”

Section 13-102(c)6.B.(4)a — Revise “mentally disordered” to “persons with disabilities.”

Section 13-102(c)6.B.(4)d — Delete the words “The needs assessment study shall include, but not be limited to, a description of:” and delete the items a. through j. immediately below.

Section 13-102(c)6.B.(9) — Revise the title to “Spaces for persons with disabilities.”

Section 13-102(c)6.B.(9)a — Revise the definition to read “A cell or room for an inmate with a disability using a wheelchair must have an appropriate entry and a toilet, washbasin and drinking fountain which the inmate can use without personal assistance.”

Section 13-102(c)6.B.(9)b — Revise “. . . disabled inmate . . .” to “. . . persons with disabilities . . .”; and revise the last sentence to read “Accessible showers for inmates with disabilities shall be available.”

Following Section 13-102(c)6.B.(10) insert a new Section 13-102(c)6.B.(11) and renumber the existing Section 13-102(c)6.B.(11) to Section 13-102(c)6.B.(12).

Following the newly renumbered Section 13-102(c)6.B.(12), insert new Sections 13-102(c)6.B.(13) and 13-102(c)6.B.(14).

Section 13-102(c)6.C — Revise the fourth line to read “. . . (6), (7), (9), (10) and (12). Court holding . . .”

Section 13-201(a)2 — Revise the second line to read “. . . in an innovative way as approved by . . .”.

Section 13-201(a)3 — Revise “. . . Executive Officer . . .” to “. . . Executive Director . . .”.

Section 13-201(a)5 — Replace “. . . his or her . . .” with “. . . its . . .”.

Section 13-201(a)6 — Replace “. . . officer . . .” with “. . . director . . .”.

Section 13-201(a)7 — Revise “. . . Section 880 of the California Welfare and Institutions Code . . .” to read “. . . Section 881 of the Welfare and Institutions Code, . . .”; and revise “. . . Section 602 of the California Welfare and Institutions Code. . .” to read “. . . Section 602 of the Welfare and Institutions Code . . .”.

Section 13-201(a)8 — In the last line, replace “. . . are . . .” with “. . . is . . .”.

Section 13-201(a)9 — Revise “. . . means sentenced to a jail . . .” to read “. . . means placed in a jail . . .”.

Section 13-201(a)15 — Revise “. . . an I.Q. of 70 or lower . . .” to read “. . . an I.Q. of 69 or lower . . .”.

Insert a new Section 13-201(a)16 and renumber the existing Sections 13-201(a)16 thru 13- thru 13-13-201(a)51 one number higher.

(The following references use the revised Section numbers.)

Section 13-201(a)17—In the last line, replace “. . . observation . . .” with “. . . supervision . . .”.

Section 13-201(a)21 — Revise “. . . Executive Officer . . .” to “. . . Executive Director . . .”.

Section 13-201(a)24 — Revise “. . . Executive Officer or . . .” to “. . . Executive Director of . . .”.

Section 13-201(a)27 — Revise “. . . contraindications to minors being . . .” to read “. . . contraindications to a minor being . . .”.

Section 13-201(a)28 — In the third and last lines, revise “. . . the appeal . . .” to read “. . . an appeal . . .”.

Section 13-201(a)31 — Revise the second line to read “. . . forestry camp, regional youth educational facility, boot camp or . . .”.

Section 13-201(a)32 — In the last line, revise “. . . article . . .” to read “. . . subchapter . . .”.

Section 13-201(a)34 — Revise the first and second lines to read “. . . means a building that contains a Type I or Temporary Holding Facility. It does not include . . .”.

Section 13-201(a)35 — In the fifth line, add a “,” after the word “determined” and in the sixth line add a “,” after the word “effects.”

Section 13-201(a)37 — In the third line revise “. . . sleeping rooms and/or dormitories . . .” to read “. . . sleeping rooms or dormitories . . .”.

Section 13-201(a)38 — In the last line, revise “. . . their jurisdiction.” to read “. . . his/her jurisdiction.”

Section 13-201(a)39 — In the second line change “. . . which . . .” to “. . . that . . .”; and at the end of the Section add “Lockups are Type I or Temporary Holding Facilities as defined in the ‘Minimum Standards for Local Detention Facilities’.”

Section 13-201(a)40 — Revise “. . . minors authorized to be housed . . .” to “. . . minors that can be housed . . .”; and revise “. . . forestry camp or boot camp . . .” to read “. . . forestry camp, regional youth education facility, or boot camp . . .”; and in the last line, replace “article” with “subchapter.”

Section 13-201(a)41 — Revise last line to read “. . . administrative responsibility for the mental health program.”

Section 13-201(a)42 — Capitalize Minimum Standards for Local Detention Facilities and after “. . . Subchapter 4, . . .” add “Section 1000 et seq.”

Section 13-201(a)43 — In the last line omit the word “California.”

Section 13-201(a)44B — Add a “,” after “and.”

Section 13-201(a)45 — Revise “. . . Executive Officer . . .” to “. . . Executive Director . . .”

Section 13-201(a)46 — Revise the third line to read “. . . pursuant to a contract, . . .”.

Section 13-201(a)48 — Revise the third line to read “. . . pursuant to an application . . .”.

Section 13-201(a)50 — Revise the last line to read “. . . on an appeal.”

Insert a new Section 13-201(a)53 and renumber existing Sections 13-201(a)52 thru 13-201(a)64 two numbers higher.

(The following references use the revised Section numbers.)

Section 13-201(a)54 — Revise the last line to read “. . . specified in Title 24 Section 460A.”

Section 13-201(a)56 — Revise “. . . Executive Officer or . . .” to “. . . Executive Director of . . .”.

Section 13-201(a)57 — In the last line change “. . . authority.” to “. . . administrator.”

Section 13-201(a)60 — Revise the second line to read “. . . of a minor, not to exceed 96 hours, . . .”.

Section 13-201(a)61 — Omit the word “. . . California . . .” from the second line.

Section 13-201(a)63 — Revise the first line to read “Supervision in a law enforcement facility means . . .”; and revise the second line to read “. . . is being directly observed by the . . .”.

Section 13-201(b) — Revise the seventh line to read “. . . Youth Authority of the Board of Corrections in effect . . .”.

Section 13-201(c)1 — Revise the first line to read “. . . or regional juvenile facility . . .”.

Section 13-201(c)2 — Revise the second line to read “. . . or regional juvenile facility . . .”; and revise the third line to read “. . . facility, or expand the rated capacity of the current facility shall complete . . .”; and replace existing items A through E with new items A through J.

Section 13-201(c)3 — In item R revise the first line to read “Management of minors with disabilities with provisions . . .”; and in item S omit “and,” from the last line; and in item T revise “Section 4465.5” to “Section 4030” and add “; and,” to the last line; and insert a new item U.

Section 13-201(c)4 — Revise the second line to read “. . . county, or regional juvenile facility. . .”.

Section 13-201(c)6B — Revise the first line to read “. . . facility shall address the . . .”.

Section 13-201(c)6B(3) — Revise “. . . Subchapter 4 . . .” to read “. . . Subchapter 5 . . .”.

Section 13-201(c)6B(4) — Insert new language before “single or double occupancy . . .”; and omit the heading “The needs assessment shall include but not be limited to a description of:” along with the items a. through k. below it.

Section 13-201(c)6B(8)a. — Revise the definitions to read “A room for a minor with a disability requiring a wheelchair, must have an appropriate entry and a toilet, washbasin and drinking fountain which the minor can utilize without personal assistance.”

Section 13-201(c)6B(10) — Revise the title to read “. . . health care housing and treatment space.”; and revise the

second line to read “. . . housing and treatment of ill . . .”; and revise the tenth line to read “... Treatment spaces and the medical care housing. . .”.

Section 13-201(c)8 — Revise the second line of the second paragraph to read “. . . compliance shall enhance, be equal to, or . . .”; and insert a new item (g).

3. (BOC 01/02) Approval of minimum standards for local facilities, CCR, Title 24, Part 1. Approved by the California Building Standards Commission on July 16, 2003, and filed with the Secretary of State on July 18, 2003. Effective August 17, 2003.

4. (BOC 01/04) Part 1, Chapter 13, Sections 13-102(a); 13-102(c)1; 13-102(c)3; 13-102(c)6; 13-102(c)7; 13-102(c)8.

13-102(a) — Definitions. Add a definition for “Contact,” “Inmate worker,” “Jail,” “Law enforcement facility,” “Lockup,” “Nonsecure custody,” “Secure detention,” “Supervision in law enforcement facility,” “Temporary custody” and “Exercise.”

Revise “health authority” for clarity. Revise “local detention facility” to add the term “and minors” for clarity.

The term “herein” and “CCR” were deleted from the definition of “rated capacity.”

Revise “managerial custodial personnel” for clarity.

Add new definition for “security glazing” to help define the adult regulation requirements.

The term “his or her” is being replaced with the term “his/her” in the definition of “Type I Facility.”

13-102(c)1 — Letter of Intent + Revise regulation to provide consistent terminology when referring to a “city,” “county” or “city and county.”

13-102(c)3 — Program Statement — Retitled regulation to include “Operational” in the title heading to read as follows: “Operational Program Statement.”

13-102(c)6 — Design Requirements — This modification will require floor drains to be added to hair care spaces.

13-102(c)7 — Pilot Projects — Replaces existing text in Title 24 with language from Title 15.

13-102(c)8 — Alternate Means of Compliance — Describes the process for applying, monitoring and approving alternate means of compliance.

5. (CSA 01/06) Part 1, Chapter 13, 13-201. Approved by the California Building Standards Commission on July 17, 2008, filed with the Secretary of State on October 21, 2008, and effective 30 days after filing with the Secretary of State.

6. (CSA 01/10) Part 1, Chapter 13, 13-102. Approved by the California Building Standards Commission on October 19, 2011, filed with the Secretary of State on October 21, 2011, and effective 30 days after filing with the Secretary of State.

13-102(a) — Definitions. Add a definition for “Corrections Standards Authority,” “Clinical Evaluation,” “Con-

cept Drawings,” “Design-Bid-Build,” “Design-Build,” “Facility Watch Commander,” “Performance Criteria,” “Preliminary Drawings,” “May” and “Working Drawings.”

Modify definitions of “Law Enforcement Facility,” “Local Detention System,” “Rated Capacity,” “Remodel,” “Safety Checks” and “Secure Custody.”

Delete the following definitions: “Inmate Worker,” “Licensed Health Personnel” and “Manager, Custody Personnel.”

13-102(b) — In all locations showing “Board,” replace with “Corrections Standards Authority.”

13-102(c)3 — Amend text and add new item x

13-102(c)5 — Amend section to show two items.

13-102(c)6 — Amend text to add new item ‘h’ and modify existing item ‘c’.

13-102(c)6 — Revise item 14 and add new item 15.

13-102(c)8 — Add new text to end of section.

7. (CSA 01/12) Renamed as the Board of State and Community Corrections (BSCC).

Chapter 13, Section 13-201(a) Approved by the California Building Standards Commission on January 23, 2013, filed with the Secretary of State on January 28, 2013, and effective 30 days after filing with Secretary of State.

13-201(a) – Definitions. Change all “Correction Standards Authority” phrases and “CSA” acronyms to “Board.” Change all “minor” and “minor’s” phrases to “youth” where occurs.

Add new definitions as follows: “Clergy,” “Concept Drawings,” “Design-Bid-Build,” “Design-Build,” “Exigent,” “Gender Identity,” “Non-School Day,” “Performance Criteria,” “Separation,” “Sexual Orientation,” “Special Visits,” “Transgender Youth.”

Modify existing definitions as follows: “Contraband” – added to the last sentence “or violate facility rules.” “DNA” – Corrected the spelling of “Deoxyribonucleic.” “504 Plan” – Strike language referring to Federal Rehab. Act of 1973 and added clarification language. Revised the entire definition of “Individual Education Program (IEP)” – Added reference to Education Code and clarification language.

“Living Unit” – Strike “by any permanent or temporary barrier” and add “in any way.” Change title of “New Generation Design” to the new title of “Podular Design.”

Remove the following definitions: “Intensive Supervision Unit,” “Licensed Health Care Personnel,” and “Minimum Standards for Local Detention Facilities.”

Modify “Use of Force” – sub-section 3. Operational program statement, added clarifying language regarding design- build construction projects and the operational program needs. Sub-Section 5. Submittal of plans and specifications, clarifying language. Sub-section 6. Design requirements, added ref. to Title 24 and the State Fire Marshal for sub-number 1. Fire safety and added clarify-

ing language in items 'c' and 'h.' Sub-number 3. Health and sanitation, ref. to Retail Food Code was added. Sub-number 6. Heating and cooling, clarifying language and removed ref. to Part 6 Energy Code. Sub-number 11. A new sentence was added regarding sewage system design.

8. 2016 Intervening Cycle Supplement (BSCC 01/16) adopted by the California Building Standards Commission on June 20, 2017, filed with the Secretary of State on August 17, 2017, effective thirty days after filing.
9. Erratum to correct editorial corrections to Chapter 13, Section 13-201(c)(2)(A): effective January 1, 2020.

CHAPTER 14
ADMINISTRATIVE REGULATIONS
FOR THE DEPARTMENT OF EDUCATION (DOE)

(RESERVED)

CHAPTER 15.1
ADMINISTRATIVE REGULATIONS FOR THE DEPARTMENT OF
CONSUMER AFFAIRS (CA) BOARD OF ACCOUNTANCY
(RESERVED)

CHAPTER 15.2
ACUPUNCTURE EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.3
DIVISION OF ALLIED HEALTH PROFESSIONS
(RESERVED)

CHAPTER 15.4
BOARD OF ARCHITECTURAL EXAMINERS
(RESERVED)

CHAPTER 15.5
ATHLETIC COMMISSION
(RESERVED)

CHAPTER 15.6
AUCTIONEER COMMISSION
(RESERVED)

CHAPTER 15.7
BUREAU OF AUTOMOTIVE REPAIR
(RESERVED)

CHAPTER 15.8
BOARD OF BARBER EXAMINERS
(RESERVED)

CHAPTER 15.9
BOARD OF BEHAVIORAL SCIENCE EXAMINERS
(RESERVED)

CHAPTER 15.10
CEMETERY BOARD
(RESERVED)

CHAPTER 15.11
BUREAU OF COLLECTION AND INVESTIGATIVE SERVICES
(RESERVED)

CHAPTER 15.12
CONTRACTORS' STATE LICENSE BOARD
(RESERVED)

CHAPTER 15.13
BOARD OF COSMETOLOGY
(RESERVED)

CHAPTER 15.14
BOARD OF DENTAL EXAMINERS
(RESERVED)

CHAPTER 15.15
BUREAU OF ELECTRONIC AND APPLIANCE REPAIR
(RESERVED)

CHAPTER 15.16
BOARD OF FUNERAL DIRECTORS AND EMBALMERS
(RESERVED)

CHAPTER 15.17
BOARD OF REGISTRATION FOR GEOLOGISTS
AND GEOPHYSICISTS
(RESERVED)

CHAPTER 15.18
BOARD OF GUIDE DOGS FOR THE BLIND
(RESERVED)

CHAPTER 15.19
HEARING AID DISPENSERS EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.20
BUREAU OF HOME FURNISHINGS
(RESERVED)

CHAPTER 15.21
BOARD OF LANDSCAPE ARCHITECTS
(RESERVED)

CHAPTER 15.22
BOARD OF MEDICAL QUALITY ASSURANCE
(RESERVED)

CHAPTER 15.23
BOARD OF NURSING HOME ADMINISTRATORS
(RESERVED)

CHAPTER 15.24
BOARD OF OPTOMETRY
(RESERVED)

CHAPTER 15.25
BUREAU OF PERSONNEL SERVICES
(RESERVED)

CHAPTER 15.26
BOARD OF PHARMACY
(RESERVED)

CHAPTER 15.27
PHYSICAL THERAPY EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.28
PHYSICIAN'S ASSISTANT EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.29
BOARD OF PODIATRIC MEDICINE
(RESERVED)

CHAPTER 15.30
BOARD OF POLYGRAPH EXAMINERS
(RESERVED)

CHAPTER 15.31
BOARD OF PROFESSIONAL ENGINEERS
(RESERVED)

CHAPTER 15.32
PSYCHOLOGY EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.33
BOARD OF REGISTERED NURSES
(RESERVED)

CHAPTER 15.34
RESPIRATORY CARE EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.35
BOARD OF CERTIFIED SHORTHAND REPORTERS
(RESERVED)

CHAPTER 15.36
SPEECH PATHOLOGY AND AUDIOLOGY EXAMINING COMMITTEE
(RESERVED)

CHAPTER 15.37
STRUCTURAL PEST CONTROL BOARD
(RESERVED)

CHAPTER 15.38
TAX PREPARERS PROGRAM
(RESERVED)

CHAPTER 15.39
BOARD OF EXAMINERS IN VETERINARY MEDICINE
(RESERVED)

CHAPTER 15.40
BOARD OF VOCATIONAL NURSE
AND PSYCHIATRIC TECHNICIAN EXAMINERS
(RESERVED)

CHAPTER 16

CALIFORNIA STATE LIBRARY

ARTICLE 1 SCOPE

16-101. Application. These regulations apply to public library projects for which funds have been granted under the Library Construction and Renovation Bond Act of 1988, Proposition 85 (1988), Education Code Sections 19950-19981.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957 and 19961.

ARTICLE 2 DEFINITIONS

16-201. Definitions. In this chapter, the following definitions apply:

PROJECT means the construction or renovation project for which an application has been approved by the Board.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957 and 19961 (c).

BOND ACT means the California Library Construction and Renovation Bond Act of 1988, Proposition 85 (1988), Education Code Sections 19950-19981.

Authority: Education Code Section 19960.

Reference: Education Code Section 19950.

BOARD means the California Library Construction and Renovation Board.

Authority: Education Code Section 19960.

Reference: Education Code Section 19952 (c).

FACILITY means a building used for public library service and operated or intended to be operated by a jurisdiction under authority of an Education Code provision to provide public library service. The owner of a facility may be a jurisdiction other than the operator of the facility.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

INITIATOR means a description of a proposed change order together with a request for a cost estimate for the change order, prepared for transmission to the contractor by the project architect or similar official representing the owner. An “initiator” is sometimes referred to as a “bulletin.”

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957, 19962 and 19965.

STATE LIBRARIAN means the State Librarian or a duly authorized representative of the State Librarian.

Authority: Education Code Section 19960.

Reference: Education Code Section 19960.

ARTICLE 3 ADMINISTRATION AND ENFORCEMENT

16-301. Local responsibility for plan checking and inspection. The local building official of the jurisdiction responsible

for the site upon which the facility is located is responsible for routine plan checking and on-site inspections for compliance with local building codes, regulations and requirements.

Authority: Education Code Section 19960.

Reference: Education Code Section 19958 (b).

16-302. Required submissions to the state librarian before putting a project to bid.

(a) No project shall receive Bond Act funds if it has been put to bid before the State Librarian has reviewed and approved, in sequence, the following submissions of design and fiscal documents:

1. The building program, schematic designs and outline specifications, and a current project budget.
2. Preliminary plans and specifications (also known as 100 percent design development documents), and a current project budget.
3. Working drawings and specifications and contract language (also known as construction documents or contract documents), and a current project budget. This submission shall be prior to the local plan check.
4. Any revisions to the approved set of schematic designs, preliminary plans, or any revisions to the approved set of working drawings, specifications and contract clauses, including any resulting from the local plan check if they affect library operations or project scope.

(b) Projects which, at the time of approval of their application by the Board, have completed any of the design documents in the preceding subsection, shall after approval of the application submit the building program and the most current set of design documents to the State Librarian for the required review, in the number of copies specified by the State Librarian. Earlier versions need not be submitted.

Authority: Education Code Section 19960.

Reference: Education Code Section 19960.

Exception: Submission requirements shall differ from those in the preceding section for the designs of the following projects:

1. Projects solely for energy conservation shall submit an energy audit by a qualified engineer or architect, instead of a building program.
2. Projects whose total cost is less than \$200,000, including any contiguous work not included in the approved project, shall omit the submission of the preliminary plans and specifications.
3. Projects governed by this section shall provide all other required submissions.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-303. Notification of submission dates. Grantees shall periodically provide the State Librarian an amended schedule of dates when the required initial submissions of building

programs and schematic, preliminary and working drawings will be made. Submissions received within twenty-two (22) working days of the date specified on the most recent amended schedule received from the grantee at least thirty (30) working days prior to the submission shall be reviewed within the time periods specified in this Article.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957 and 19960.

16-304. Time period for review of submissions prior to bid.

(a) The State Librarian shall review:

1. The initial submission of building programs, schematic drawings and outline specifications, and current project budget within fifteen (15) working days after receipt.
2. The initial submission of preliminary plans and specifications, and current project budget within fifteen (15) working days after receipt.
3. The initial submission of working drawings, specifications and contract clauses within thirty (30) working days after receipt.

(b) The State Librarian shall approve any required resubmissions or any changes to approved designs and documents prior to bid, within five (5) working days after receipt.

(c) If the submission is received more than twenty-two (22) working days earlier or later than the date specified on the most recent amended schedule received from the grantee at least thirty (30) working days prior to the submission, the State Librarian may extend the review period for that submission by ten (10) working days.

(d) Following the time period for review, the State Librarian shall either approve the submission or notify the submitter of the deficiencies that are to be corrected. If the State Librarian does neither, the submission is approved as submitted.

Authority: Education Code Section 19960.

Reference: Education Code Section 19960.

16-305. Change orders.

(a) Following local award of the construction contract for the project, the grantee shall submit to the State Librarian a copy of each initiator, regardless of its nature, no later than the same time it is forwarded to the contractor.

(b) The State Librarian shall, within three working days of receipt of the initiator, review all initiators that if issued as change orders would:

1. Affect library operations, including but not limited to work that affects the location or number of any bookstacks, storage shelving, doorways or direction of swing of doors, paths of travel and circulation, access to any library equipment, materials and services, or use of spaces. Any such initiators shall be accompanied by a statement by the local library director describing how the change will be accommodated in the operational program following completion of the construction; or,

2. Change the scope of the project, including the project budget if the change would reduce the local contribution to the project.

(c) Upon receipt of any initiator requiring review in accordance with the preceding subsection, the State Librarian shall:

1. Approve the change order; or,
2. Return the initiator for resubmission, for a specified reason, in which case the resubmission will be reviewed within three days of its receipt; or,
3. Notify the submitter that an additional period not to exceed five days will be required to gather specified additional information. No further additional time shall be taken for this reason.

(d) If the State Librarian does not act in accordance with the preceding subsection, the change order may be issued as submitted.

(e) All other change orders may be issued without the State Librarian’s approval.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957, 19962 and 19965.

16-306. Review of building programs, schematic designs, specifications and budget. The State Librarian shall review and approve building programs, schematic designs, outline specifications and the current project budget to ensure that:

(a) The building program conforms to general principles of library planning as included in Nolan Lushington, *Libraries Designed for Users* (1979); Raymond Holt, *Wisconsin Library Building Handbook* (1978); Aaron Cohen, *Designing and Space Planning for Libraries* (1979), or similar standard public library planning works, and as supplemented by subsequent standard journal literature on changing concepts of library service.

(b) The schematic designs and outline specifications appropriately interpret the building program, provide functional arrangements and a practical design.

(c) The current project budget is appropriate to the approved program and to the schematic designs and outline specifications.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-307. Review of preliminary plans, specifications and budget. The State Librarian shall review and approve preliminary plans and specifications and the current project budget to ensure that:

(a) The preliminary plans carry out the approved schematic design concepts without significant change.

(b) The support systems are appropriate to meet program requirements, accessible and reasonably laid out.

(c) There are no obvious code compliance problems.

(d) The current project budget is appropriate to the approved program and to the preliminary designs.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-308. Review of working drawings, specifications, budget and contract language. The State Librarian shall review and approve working drawings and specifications, the current project budget, and contract language to ensure that:

(a) The systems and design are compatible with the programmatic needs of the library and the requirements of the State Building Code.

(b) The design reflects prudent principles of public works buildings design and good construction practice.

(c) The systems in the design documents are well coordinated.

(d) The current project budget is appropriate to the approved program and to the working drawing designs.

(e) The construction contract provides for all relevant requirements of the Bond Act, of the regulations adopted under authority of Education Code Section 19960, and of the project documents.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-309. Arbitration if fail to agree on comments.

(a) If the grantee and the State Librarian cannot agree on disposition of comments by the State Librarian at any of the reviews by the State Librarian, the State Librarian shall provide to the grantee a list of three experts qualified in the appropriate discipline. The experts shall not have previously been involved with the project. The grantee shall choose one of them to decide the issue, and shall pay the expert's costs and customary fees. The expert's decision shall be binding on both parties.

(b) If the issue relates to code interpretation, its disposition shall use the jurisdiction's local code appeals process.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-310. Bookstacks.

(a) No bookstacks may be installed, remodeled or moved until the State Librarian has reviewed and approved in sequence the following:

1. Specifications for the bookstacks, which implement the standards in Part 2 of the State Building Code, and
2. The local review of the contractor's calculations showing that the installation meets the specification.

This requirement applies to bookstacks to be installed, remodeled or moved in any project receiving Bond Act funds. It also applies both to bookstacks included in the local construction contract and to bookstacks contracted for separately from the local construction contract, but installed within one year of the completion of the local construction contract.

(b) The grantee or its successor in interest shall ensure that any bookstacks installed, moved or remodeled in any project during the twenty (20) years following acceptance of the project by the local jurisdiction having title to the facility conform to the specifications for library bookstacks in the

State Building Code applicable to the project at the time of project completion.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957 (f) and 19967 (a).

16-311. Floor loads. If any floor areas in a project are adjacent to bookstacks and are potentially available for future installation of bookstacks, even if not originally so intended, those areas shall conform to the same floor load standards as required for the book-stacks.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-312. Remodeling.

(a) Remodeling and renovation of public library facilities constructed prior to 1973 shall conform to the *Uniform Building Code* requirements for remodeling, except that:

1. Remodeling and renovation of facilities classified as qualified historical buildings or structures under Health and Safety Code Section 18955 shall meet the requirements of the *State Historical Building Code* instead of the requirements of the *Uniform Building Code*.
2. Remodeling or renovation projects that include unreinforced masonry shall conform to Chapter 1 of the Appendix to the *Uniform Code for Building Conservation*, 1987. If a jurisdiction with a remodeling or renovation project that includes unreinforced masonry has adopted a local earthquake hazard mitigation program that requires strengthening such structures, the jurisdiction may instead follow its local program.

(b) Remodeling and renovation of public library facilities constructed in 1973 or later, or parts of public library facilities, shall for the facility, or each respective part of a facility, conform to the codes in effect at the time of original construction for the facility or for the respective part. If the remodeling and renovation is for a facility that had previously been remodeled, or for one or more parts that had previously been remodeled, and such previous remodeling required that the facility or respective parts of the facility were brought up to the code in effect at the time of previous remodeling, then the remodeling funded by Bond Act moneys shall conform to the code in effect at the time of previous remodeling rather than the code in effect at the time of original construction of the respective parts of the facility.

Authority: Education Code Section 19960.

Reference: Education Code Section 19957.

16-313. Access to construction and records. The grantee shall provide the State Librarian reasonable access to the construction site and to project records.

Authority: Education Code Section 19960.

Reference: Education Code Section 19960.

ARTICLE 4 FEES

16-401. Project administration fee.

(a) For purposes of this section, "project cost" means the entire cost of a project, paid by state and local funds com-

bined, including the cost of bookstacks whether or not in the construction contract, and of furnishings if credited under Education Code Section 19962 (d), but excluding the cost of land acquired under Education Code Section 19957 (b) or the value of land donated or otherwise acquired and credited to the project under Education Code Section 19962 (c).

(b) The State Librarian may charge a project administration fee for each project of one-half of one percent (.5%) of project cost.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957, 19960 and 19962.

16-402. Allowable fees and costs as allowable bond act costs. Any fees or costs authorized in this Division, including work required to meet Title 24 requirements, may be included in Bond Act project costs. Costs of resolving a code interpretation dispute with the local building official may not be included in Bond Act costs.

Authority: Education Code Section 19960.

Reference: Education Code Sections 19957 (g) and 19958 (b) (4).

HISTORY:

1. (DOE-A 1/89) Adopt CCR, Title 24, Part 1, Chapter 16, effective 12-1-89. Approved by the Building Standards Commission 10-30-89.

**ARTICLE 5
CALIFORNIA READING AND LITERACY
IMPROVEMENT AND PUBLIC LIBRARY
CONSTRUCTION AND RENOVATION
BOND ACT OF 2000**

Article 5.1. Scope.

16-510. Applicability. These regulations apply to public library projects for which funds have been granted under the California Reading and Literacy Improvement and Library Construction and Renovation Bond Act of 2000. Education Code Sections 19985-20011.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989 and 19993.

Article 5.2. Definitions.

16-520. Definitions. In this chapter, the following definitions apply:

ADDENDUM—a description of a proposed change to the approved plans or specifications prior to bid for construction.

ADDITION—a project that increases the floor area of enclosed space of an existing building. Addition also means expansion.

ARCHITECT—an architect holding a valid license under Chapter 3, Division 3, of the California Business and Professions Code.

ASSIGNABLE SQUARE FOOTAGE—the usable space within the defining walls of the building assigned to furniture and equipment but does not include any nonassignable space.

BOARD—the California Public Library Construction and Renovation Board.

BOND ACT—the California Reading and Literacy Improvement and Public Library Construction and Renovation Bond Act of 2000, Education Code, Sections 19985-20011.

BUILDING CODE—the *California Building Standards Code*, Title 24, California Code of Regulations.

CHANGE ORDER—a description of a proposed change, together with a cost estimate for the change order, prepared for transmission from the contractor to the project architect or similar official representing the owner.

CONSTRUCTION COST ESTIMATOR—an individual who has had responsibility for five or more construction project cost estimates in excess of \$1,000,000 each within the previous 10 years prior to the Board’s application deadline.

CONSTRUCTION SPECIFICATIONS INSTITUTE, or CSI—a technical association providing product and specification information to its members.

DESIGN DOCUMENTS—plans, specifications and all other documents appropriate for the design phase of a project.

DIVISION OF THE STATE ARCHITECT, or DSA—the Division of the State Architect, Department of General Services, State of California.

FACILITY—a building used for public library service and operated or intended to be operated by a local jurisdiction to provide public library service. The owner of a facility may be a jurisdiction other than the operator of the facility.

FENESTRATION—the arrangement, proportioning and design of exterior and interior windows, clerestories, skylights, window walls and doors in a building.

GROSS SQUARE FOOTAGE—the entire area of the building interior including the exterior wall thickness. The total of the assignable square footage and the nonassignable square footage equals the gross square footage.

LIBRARY BUILDING PROGRAM—the planning document that describes the space requirements and all other general building considerations required for the design of a public library building.

NONASSIGNABLE SPACE—utility areas of a building required for the function of the building, including stairways; elevators; corridors and interior walkways; public lobbies; restrooms; duct shafts; mechanical rooms; electrical closets; telecommunications closets for voice, data, electrical, security and fire systems; janitor’s closets; fireplaces; interior and exterior wall thickness; and exterior amenities that are part of the building but not enclosed, such as loading docks and covered patios, porches and walkways.

PLANS—the architectural and engineering drawings associated with a project such as, but not limited to, vicinity maps, site plans, foundation plans, floor plans, reflected ceiling plans, roof plans, cross sections, interior elevations, exterior elevations and details.

PROFESSIONAL ENGINEER—an engineer holding a valid certificate under Chapter 7, Division 3, of the California Business and Professions Code, in that branch of engineering that is applicable.

PROJECT—the construction, renovation and/or addition project for which an application has been awarded a grant by the Board.

READERS' SEATS—all seating in the library available for the public of all ages to use while reading print materials (i.e., lounge seating, benches, floor cushions, seating at tables, carrels and study counters). Readers' seats do not include technology workstations.

REMODELING, REHABILITATION AND RENOVATION—a construction change within, or to, an existing building.

STATE LIBRARIAN—the California State Librarian or a duly authorized representative of the State Librarian.

STATE LIBRARY—the California State Library.

STATE LIBRARY PLANS REVIEW FORM—the form used by California State Library staff to comment on each design phase plan submittal. (See Appendix.)

TECHNOLOGY WORKSTATIONS—workstations in the library of any form (e.g., tables, carrels, counters, office systems) available for the public of all ages to use while operating any kind of library provided electronic or audiovisual technology [i.e., personal computers, computer terminals, online public access computers (OPAC's), audio and video units, ADA adaptive technology and microform readers].

Authority: Education Code Section 19992.

Reference: Education Code Sections 19985, 19986(c), 19989, 19992, 19995 and 19997.

Article 5.3 Administration and enforcement. All library bond act projects.

16-530. Local responsibility for permitting, plan checking and construction inspections.

Local building official responsibilities. The local building official of the jurisdiction responsible for the site upon which the facility is located is responsible for routine plan checking and on-site inspections for compliance with state and local building codes, regulations and requirements.

Authority: Education Code Section 19992.

Reference: Education Code Section 19992.

Article 5.4. Administration and enforcement. All library bond act projects, including all joint use projects.

16-540. Required submission to the State Librarian before putting a project to bid.

(a) **State Librarian review and accept before bid.** No project awarded Library Bond Act funds shall be put to bid before the State Librarian has reviewed and accepted, in sequence, the submissions of design documents and final cost estimate as set forth in Section 16-542.

(b) **Projects that have completed any of the design documents at grant award not required to submit earlier versions.** Projects that, at the time of approval of their application by the Board, have completed any of the design documents in Section 16-542 shall, after grant award, submit a copy of the final library building program and the most current set of design documents to the State Librarian for the required review. Earlier versions need not be submitted.

Authority: Education Code Section 19992.

Reference: Education Code Section 19993.

16-541. Timetable for architectural and engineering plans and specifications review and acceptance.

(a) **Conceptual plans and outline specifications review.** Conceptual plans shall be returned to the grant recipient within 15 working days after the grant award by the Board.

(b) **State Librarian plans review.** The State Librarian shall review and accept:

1. **Schematic design plans and specifications review.** The review period for schematic documents [See Section 16-542(h)] is 15 working days after receipt.
2. **Design development plans and specifications review.** The review period for design development documents [See Section 16-542(i)] is 21 working days after receipt.
3. **Construction documents and specifications review.** The review period for construction documents [see Section 16-542(j)] is 30 working days after receipt.
4. **Final review of construction documents.** The review period for final construction documents [see Section 16-542(k)], before going to bid, is five working days after receipt. Final review shall occur after all local jurisdictional approvals have been obtained.

(c) **Revision to previously accepted set of design documents.** The State Librarian shall review and accept, within 10 working days after receipt, any revisions to a previously accepted set of design documents, including any revisions resulting from the local plan check, that affect the following:

1. **Alter use of space.** Alter the proposed use of all or part of the library building;
2. **Change square footage of space.** Change the square footage by 10 percent or more of a building space identified in the grant recipient's building program, and in the most recently accepted set of design documents;
3. **Decrease library components.** Decrease the number of collections, readers seats, technology workstations, staff workstations and offices, meeting room seating by more than 10 percent;
4. **Change in building systems with negative impacts.** Change the lighting, power or data distribution systems in a manner that negatively impacts the use of the building, furniture and equipment by the public or staff;
5. **Modify access compliance.** Modify access compliance from most recently accepted set of design documents;
6. **Functional layout.** Change the layout of the library furniture and equipment in a way that negatively affects the functional operation of the facility as a library.

(d) **State Librarian acceptance.** Following the time period for review, the State Librarian shall either accept or notify the grant recipient of the deficiencies that are to be corrected. If the State Librarian does neither, the submission is accepted as submitted.

(e) **Plans and specifications submittal review period extension.** The State Librarian may extend the plans review period up to 15 additional working days if potential design or construction defects are identified in the plans and specifica-

tions. A letter of notification of the additional 15 working day review period will be sent to the grant recipient.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989 and 19993.

16-542. Submittal requirements for architectural and engineering plans and specifications review and acceptance.

(a) **Address for plans submittal.** The address for plans submittal shall be:

Library Bond Act Manager
Office of Library Construction
California State Library
1029 J Street, Suite 400
Sacramento, CA 95814-2825

(b) **State Librarian review and acceptance of architectural and engineering plans.** The State Librarian shall review and accept, in sequence, the final library building program, the architectural and engineering plans, and the construction cost estimates. For each submittal of schematic plans, design development plans and construction documents, the grant recipient shall submit to the California State Library, the following:

1. Number of sets of plans required. Four sets of plans and specifications; and
2. One copy of all supporting documents required. One copy of all other documentation as designated in this section for each design phase.

(c) **Sheet numbering.** All plan sheets shall be identified by a sheet number and shall be cross-referenced. Sheet numbers shall also correspond to a sheet index on the title sheet.

(d) **Preliminary, detailed and final construction cost estimates.** An independent, professional construction cost estimator who is not an employee of the grant recipient or library service provider shall provide the preliminary construction cost estimate for the schematic design plans and specifications review, the detailed construction cost estimate for the design development plans and specifications review, and the final construction cost estimate for the construction documents and specifications review. All estimates shall be priced out at the current market conditions prevailing at the time the plans and specifications are submitted to the State Library.

(e) **Incomplete submittals.** If the State Library determines that any design plan submittal is incomplete or incorrect, the grant recipient will be notified of the missing or incorrect documents within five days of receipt of the submittal. The time period for State Librarian review will not begin until the missing or corrected documents are submitted to the State Library.

(f) **State Library plans review form.** In response to any design phase review, State Library comments shall be documented on a State Library Plans Review Form (see Appendix) and returned to the grant recipient. The grant recipient shall address each State Library comment on the plans or specifications, making appropriate changes and noting on the State Library Plans Review Form each change made and where it can be found on the drawings or in the specifications. The grant

recipient shall return one copy of this revised form to the State Library at the next required design phase submittal.

(g) **Conceptual plans and outline specifications review.** Conceptual plans and outline specifications previously submitted with an application shall be sent with State Library comments to the grant recipient. The grant recipient shall incorporate these comments into the schematic design plans and specifications.

(h) **Schematic design plans and specifications review.** The grant recipient shall provide the following:

1. **Final library building program.** A final library building program.
2. **Preliminary code information.** Preliminary code information documented on the title sheet of drawings including occupancy, construction type, site and building access, any applicable seismic and energy provisions, planning and environmental compliance information, and any other code applications to specific project conditions.
3. **Site plan.** A site plan showing the library building, parking (including number of spaces and location of accessible parking), and trees or other features that must remain in their original locations, and access drives as well as any anticipated future expansion of the building and parking. The site plan shall have a north arrow. Property lines shall be shown clearly as determined by the boundary survey completed as part of the grant application.
4. **Floor plans.** Floor plans of the spaces listed in the library building program and identified by the area/space name assigned in the library building program. Show all columns and identify all functional areas, including all nonassignable spaces.
5. **Furniture and equipment plan.** A furniture and equipment plan that identifies all furniture and equipment based on the library building program. The furniture and equipment plan shall be a computer-generated drawing, drawn to scale. Show all columns and coordinate with the floor plan. Show critical dimensions for the following: overall dimensions, dimensions between columns, dimensions for exiting and access compliance, and other dimensions that demonstrate the required quantity of furniture and equipment will fit into the proposed building, and allow for full code compliance and functioning of the facility.
6. **Assignable square footage tabulation.** A tabulation of the assignable square footage for each area called for in the final library building program compared to the assignable square footage shown on the floor plan.
7. **Collection tabulation.** A tabulation of the number of books, magazines and audiovisual materials called for in the library building program compared to the number of books, magazines and audiovisual materials that can be housed given the proposed furniture and equipment plan. The tabulation shall also provide the conversion factors utilized (books per double-faced unit, or books per linear foot).

8. **Technology workstations tabulation.** A tabulation of the number of technology workstations by area called for in the library building program compared to the number of technology workstations shown on the furniture and equipment plan.
9. **Readers' seats tabulation.** A tabulation of the number of readers' seats by area called for in the library building program compared to the number of readers' seats shown on the furniture and equipment plan.
10. **Exterior elevations.** Elevations of all four sides of the building showing general locations of openings, roof lines and grade lines.
11. **Roof plan.** A roof plan showing roofing material, roof slope and direction of slope; roof overhangs and major elements and their relationship to the exterior wall of the building.
12. **Building sections.** Two sections through the building, one longitudinal and one latitudinal.
13. **Engineering plans and specifications.**
 - A. **Civil.** On-site and off-site utilities, fire protection, drainage, paving and grading.
 - B. **Structural.** Basic structural materials and systems, analyses and development of design solutions.
 - C. **Mechanical.** Energy source, heating, ventilating and air conditioning (HVAC), conservation, plumbing, fire protection and security systems.
 - D. **Electrical.** Power, data, communication, lighting, fire and security systems, and general space requirements.
 - E. **Landscape.** Conceptual design solutions for land forms, lawns and plantings based on program requirements, physical site characteristics, design and environmental objectives.
14. **Outline specifications.** Outline specifications describing the type and quality of building systems, basic components, and components unique to the project. Outline specifications for the engineering disciplines listed in Item 13, "Engineering plans and specifications" shall be included.
15. **Preliminary construction cost estimate.** A preliminary construction cost estimate consisting of a projected cost for the construction project based on the most recent schematic design studies, current and historic area, volume or other unit costs. The estimate shall include an assemblies (or CSI format) estimate summary.
 - (i) **Design development plans and specifications review.** The grant recipient shall provide the following:
 1. **Site plan.** A site plan showing all buildings dimensioned from adjacent structures or other critical site features, datum elevations at all entries, street lines and grades, property lines, required setbacks, easements, parking, sidewalks, preliminary site and exterior building lighting scheme with identification of fixture types, and routing of sewer, water, gas and other utilities, and site detailing showing typical external elements.
2. **Floor plans.** Floor plans showing complete functional layout, room designations, all major dimensions, all critical dimensions and all columns.
3. **Exterior elevations.** Elevations showing full-height facades, type and extent of exterior finishes, all openings including fenestration and overall vertical building heights related to established building datum. Indicate treatment of visible mechanical equipment and abutting topography and grade relationship.
4. **Roof plan.** A roof plan delineating roofing materials, direction and slope of roof; relationship of exterior wall to roof, overhangs and covered areas; mechanical equipment areas and screening; and location and major dimensions for major roof elements.
5. **Building sections.** Two building sections (one longitudinal and one latitudinal) showing the overall building solution with typical wall construction, foundation, parapet design, insulation methods, window, mechanical penetrations impact, relationship of various levels, floor to ceiling heights, and ceiling height and book-stack height coordination anticipating code-compliant fire sprinkler installation.
6. **Details.** Detail sheets showing key conditions, such as window and frame types, frame and door types, typical wall types and nontypical design-related detailing.
7. **Interior elevations.** Interior elevations showing typical and special spaces, and any built-in cabinetry or counter items. These drawings shall be of pre-final quality adequate to convey design intent. Basic dimensions shall be delineated, along with casework, counters and other built-ins, with heights and depths shown.
8. **Reflected ceiling plan.** Reflected ceiling plan integrated to show structural, mechanical and electrical impacts, including low voltage systems; e.g., security, audiovisual and public address system speakers.
9. **Schedules.** Schedules are to be nonrepetitive and comprehensive with keying to floor plans and elevations; pre-final interior finishes, frame and door, window and glazing, and preliminary hardware.
10. **Furniture, furnishings and equipment plan.** Furniture, furnishings and equipment plan with any special interior design features. Preliminary documentation of materials, finishes and colors.
11. **Signage schedule and plan.** Signage schedule and plan indicating the size, type and nomenclature of all interior signs.
12. **Assignable square footage comparison.** A tabulation of the assignable square footage for each area called for in the final library building program compared to the assignable square footage shown on the floor plan. Any changes from the accepted schematic plans shall be highlighted.
13. **Engineering plans and specifications.**
 - A. **Civil.** Grading, drainage and preliminary details for on-site and off-site work.

- B. **Structural.** Basic structural system and dimensions, structural and foundation design criteria, and preliminary sizing of major structural components.
- C. **Mechanical.** Preliminary equipment and duct layout, approximate equipment sizes and capacities, required space for equipment, chases and clearance coordination with structural, acoustical and energy conservation measures and visual impacts.
- D. **Plumbing.** Preliminary plumbing lines routing within the building, point of entry of water, gas, storm drains, and sewer to building and preliminary details.
- E. **Electrical.** Electrical site plan. Preliminary lighting plan and fixture schedule, single line diagram, preliminary power, data, and communication plans, security and fire alarm plans, and low-voltage plans.
- (1) **Lighting system plan.** Lighting system plan overlaid on the furnishings, equipment and signage plan. Show all sources of artificial illumination with a legend that indicates the type of light fixture.
 - (2) **Catalog “cut” sheets.** Catalog “cut” sheets for each lighting fixture showing the fixture configuration, type and lens. The cut sheets must be keyed to the legend on the plans for quick identification.
 - (3) **Electrical and data distribution systems plan.** Electrical and data distribution systems plan overlaid on the furnishings, equipment and signage plan. Show all service panel boards, power outlets, telephone, data communication outlets and audiovisual outlets with a legend that indicates the type of outlets. Also include locations of book detection gates and security system components (surveillance cameras, motion and glass break detectors, magnetic door contacts and card access system readers), and public address system speaker locations.
- F. **Landscape.** Preliminary planting and irrigation plans with preliminary details.
14. **Draft specifications.** Draft specifications including comprehensive, abbreviated descriptions of size, character and quality of methods, materials and systems. Coordinate specifications with the drawings. Use Construction Specifications Institute (CSI) format with applicable section numbers. Include all engineering specifications, and special or supplementary conditions specific to the project.
15. **Detailed construction cost estimate.** A detailed construction cost estimate and summary shall be prepared updating and refining the preliminary construction cost estimate of the project. The following shall be shown:
- (1) a breakdown for each major area of construction work in CSI format; (2) all estimates shall include individual item unit costs (materials, labor and equipment); quantities and total quantity costs; (3) sales tax; general

contractor’s construction indirects (general conditions, overhead and profit); subcontractor’s mark-ups shall be listed separately; (4) the estimate shall separate the project’s building costs from site and utilities costs.

(j) **Construction documents and specifications review.** The grant recipient shall provide the following:

1. **Complete set of construction documents.** A complete set of construction documents including all drawings, and specifications, structural calculations and energy load calculations in accordance with the Building Code; and contract language, along with all other documentation required as part of the bid package. All building systems must be delineated fully to illustrate their proposed scope and functions.
2. **Final construction cost estimate.** A detailed final construction cost estimate and summary shall be prepared in CSI format, updating and refining the detailed construction cost estimate, including: (1) individual line items, unit costs (materials, labor and equipment); quantities and total quantity costs; (2) sales tax; general contractor’s construction indirects (general conditions, overhead and profit); subcontractor’s mark-ups shall be listed separately; and (3) the estimate shall separate the project’s building costs from site and utilities costs.

(k) **Final review of construction documents.** Once the State Librarian has accepted the construction documents and all the local code compliance reviews have been completed, the grant recipient shall send to the State Library one final copy of stamped and signed plans and specifications, which will be used by contractors when providing their bids. All sheets of the plans shall be signed, as well as the specifications cover by the architect or appropriate engineer.

(l) **Access compliance.** Grant recipient, upon receipt of DSA approval, shall provide documentation of DSA Access Compliance approval for the project to the State Librarian. (See Access Compliance by the Division of the State Architect authority as cited in Government Code, Section 4450 et. seq., and the compliance procedures found in *California Building Standards Code*, Title 24, Code of Regulations, Part 1, Sections 5-101 et. seq.)

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989 and 19993.

16-543. Bookstacks.

(a) **Bookstack installation acceptance.** No bookstacks may be installed, remodeled or moved until the State Librarian has reviewed and accepted in sequence the following:

1. **Specifications for the bookstacks.** Specifications for the bookstacks, which implement the standards in Volume 2 of the *California Building Code*; and
2. **Local review and approval of bookstack installation.** The local review and approval of the bookstack contractor’s calculations showing that the installation meets the specification.

(b) **Requirement for bookstacks installed at a later date.** The requirement in Section 16-543(a) applies to bookstacks to be installed, remodeled or moved in any project receiving Library Bond Act funds. It also applies both to

bookstacks included in the local construction contract and to bookstacks contracted for separately from the local construction contract, but installed within one year of the completion of the local construction contract.

(c) **Bookstack installation must meet specifications for 40 years.** The grant recipient or its successor in interest shall ensure that any bookstacks installed, moved or remodeled in any project during the 40 years following acceptance of the project by the local jurisdiction having title to the facility conform to the specifications for library bookstacks in the *California Building Code*.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989 and 19999(a).

16-544. Floor loads.

(a) **Standards for floor loads.** Implement the standards in Volume 2 of the *California Building Code*.

(b) **Floor load for adjacent areas to bookstacks.** If any floor areas in a project are adjacent to bookstacks and the bookstacks may expand to these adjacent areas, even if not originally so intended, those areas shall conform to the same floor load standards as required for the bookstacks. (Refer to *California Building Code*, Volume 2.)

Authority: Education Code Section 19992.

Reference: Education Code Section 19989.

16-545. Renovations.

(a) **Public library renovation requirements.** Renovation of public library facilities shall conform to the *California Building Standards Code*, Title 24, California Code of Regulations requirements for renovation, except that:

1. **Renovation projects—*California Historical Building Code*.** Renovation of facilities classified as qualified historical buildings or structures under Health and Safety Code Section 18955 shall meet the requirements of the *California Historical Building Code* (Part 8) instead of the requirements of the California Building Standards Code, Title 24, *California Code of Regulations*.
2. **Renovation projects—*California Code for Building Conservation*.** Renovation projects that include unreinforced masonry shall conform to Part 10 of the *California Building Standards Code*, the *California Code for Building Conservation*.

Authority: Education Code Section 19992.

Reference: Education Code Section 19989.

16-546. State Librarian acceptance of addenda and change orders.

(a) **Changes in accepted plans.** Changes of the accepted plans or specifications shall be made by means of an addendum or change order sent to the address specified in Section 16-542(a).

(b) **Addendum and change order types requiring State Librarian review.** A grant recipient shall submit to the State Librarian for review and acceptance addenda or change orders that would:

1. **Alter use of space.** Alter the proposed use of all or part of the library building;

2. **Change square footage of space.** Change the square footage by 10 percent or more of a building space identified in the grant recipient's building program, and in the final construction documents accepted by the State Librarian;

3. **Decrease library components.** Decrease the number of collections, readers' seats, technology workstations, staff workstations and offices, meeting room seating by more than 10 percent;

4. **Change in building systems with negative impacts.** Change the lighting, power or data distribution systems in a manner that negatively impacts the use of the building, furniture and equipment by the public or staff.

5. **Modify access compliance.** Modify access compliance from what was approved by Division of State Architect's Access Compliance unit.

(c) **Addendum and change order requirements.** Addenda and change orders shall state the reason for the change and the scope of work to be provided, and where necessary, supplementary drawings shall be furnished to clearly describe the change.

(d) **Acceptance of addenda or change orders.** Upon receipt of any addenda or change orders requiring review in accordance with the preceding subsections, the State Librarian shall, within three working days of receipt, review and:

1. **Accept.** Accept the addendum or change order; or
2. **Return for resubmission.** Return the addendum or change order, stating the reasons why it was not accepted, for revision or additional justification and resubmission.

(e) **Addenda or change orders issued as submitted.** If the State Librarian has not accepted or returned the addendum or change order within three working days, the addendum or change order may be issued as submitted.

(f) **All other project addenda and change orders.** All addenda or change orders not covered by Section 16-546(b) shall be issued without the State Librarian's review and acceptance.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989, 19995 and 19997.

16-547. State Access to construction and records.

Access to construction site and project records. The grant recipient shall provide the State Librarian reasonable access to the construction site and to project records.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19992 and 19993.

Article 5.5. Fees.

16-550. Allowable fees and costs as allowable bond act costs.

Allowable project fees and costs. Any fees or costs authorized in these regulations pursuant to the Library Bond Act, including work required to meet *California Building Standards Code* requirements, may be included as eligible Library Bond Act project costs.

Authority: Education Code Section 19992.

Reference: Education Code Sections 19989 and 19990.

**APPENDIX
STATE LIBRARY PLANS REVIEW FORM**

CALIFORNIA STATE LIBRARY
Office of Library Construction
1029 J Street, Suite 400
Sacramento, CA 95814

PAGE ____ OF ____

Facsimile: (916) 445-9200

E-mail: _____

Contact: _____

CONCEPTUAL

SCHEMATICS

DESIGN DEVELOPMENT

CONSTRUCTION DOCUMENTS

PROJECT NAME: _____

PROJECT LOCATION: _____

STATE LIBRARY PROJECT NO: _____

#	REVIEW COMMENT	ACTION TAKEN	DATE

APPENDIX
STATE LIBRARY PLANS REVIEW FORM (Continued)

CALIFORNIA STATE LIBRARY
Office of Library Construction
1029 J Street, Suite 400
Sacramento, CA 95814

PAGE ____ OF ____

Facsimile: (916) 445-9200
E-mail: _____
Contact: _____

#	REVIEW COMMENT	ACTION TAKEN	DATE

HISTORY NOTE APPENDIX FOR CHAPTER 16

Administrative Regulations for the State Librarian California Code of Regulations, Title 24, Part 1

HISTORY:

- > The history notes for prior changes remain within the text of this code.
 1. (SL 1/01) Part 1, Chapter 16, Article 5. Approved by the Building Standards Commission on November 28, 2001. Filed with the Secretary of State on December 4, 2001, effective January 3, 2002. Add Article 5 to Chapter 16 pertaining to the libraries funded pursuant to the Public Library Construction and Renovation Bond Act of 2000.
 2. Erratum to correct History Note format in Chapter 16: effective January 1, 2020.



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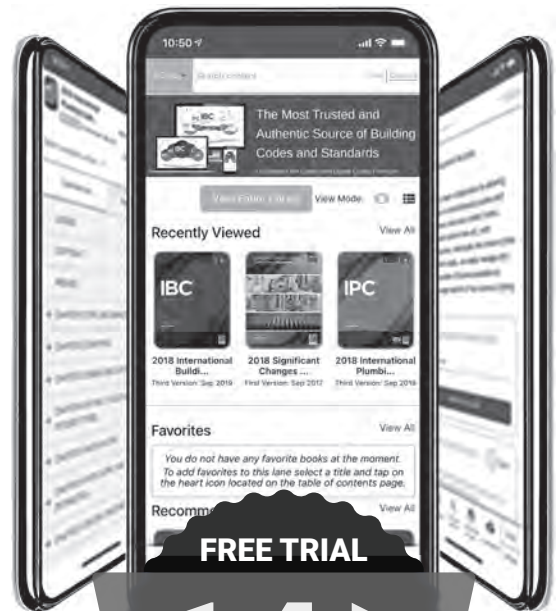
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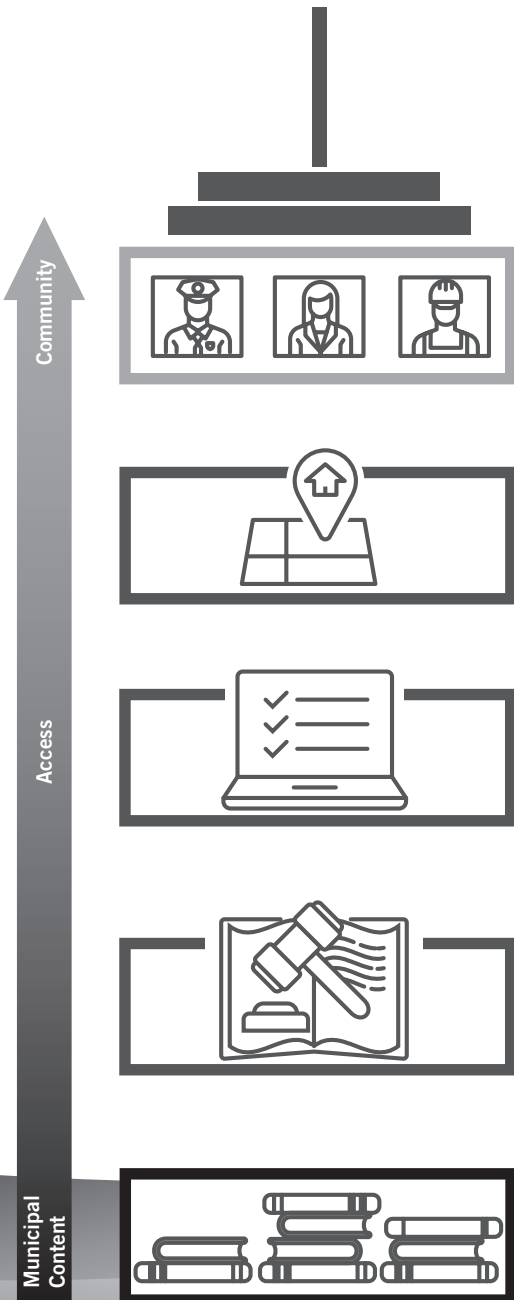


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2022 CALIFORNIA BUILDING CODE

CALIFORNIA CODE OF REGULATIONS | TITLE 24, PART 2, VOLUME 1 OF 2

Based on the 2021 International Building Code®
California Building Standards Commission



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2022 CALIFORNIA BUILDING CODE

CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 2, VOLUME 1 OF 2

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California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is Part 2 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

Secretary Yolanda Richardson – Chair

Rajesh Patel – Vice-Chair

Erick Mikiten

Elley Klausbruckner

Aaron Stockwell

Juvilyn Alegre

Peter Santillan

Kent Sasaki

Laura Rambin

Mia Marvelli – Executive Director

Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page iv.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073

Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916

State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300

Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312

Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards (916) 900-5004

Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356

Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661

Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,

Restoration or Relocation Standards

Office of Statewide Health Planning and Development

**AKA: California Department of Health Care Access and
Information (HCAI)**

www.hcai.ca.gov (916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800

Code Development and Analysis

Fire Safety Standards

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

Legend of Acronyms of Adopting State Agencies

BSC	California Building Standards Commission (see Section 1.2)
BSC-CG	California Building Standards Commission-CALGreen (see Section 1.2.2)
BSCC	Board of State and Community Corrections (see Section 1.3)
SFM	Office of the State Fire Marshal (see Section 1.11)
HCD 1	Department of Housing and Community Development (see Section 1.8.2.1.1)
HCD 2	Department of Housing and Community Development (see Section 1.8.2.1.3)
HCD 1/AC	Department of Housing and Community Development (see Section 1.8.2.1.2)
DSA-AC	Division of the State Architect-Access Compliance (see Section 1.9.1)
DSA-SS	Division of the State Architect-Structural Safety (see Section 1.9.2)
DSA-SS/CC	Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)
OSHPD 1	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 1R	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 2	Office of Statewide Health Planning and Development (see Section 1.10.2)
OSHPD 3	Office of Statewide Health Planning and Development (see Section 1.10.3)
OSHPD 4	Office of Statewide Health Planning and Development (see Section 1.10.4)
OSHPD 5	Office of Statewide Health Planning and Development (see Section 1.10.5)
DPH	Department of Public Health (see Section 1.7)
AGR	Department of Food and Agriculture (see Section 1.6)
CEC	California Energy Commission (see Section 100 in Part 6, the California Energy Code)
CA	Department of Consumer Affairs (see Section 1.4): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Household Goods & Services Structural Pest Control Board (SPCB)
SL	State Library (see Section 1.12)
SLC	State Lands Commission (see Section 1.14)
DWR	Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages vii and viii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency’s statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies’ adoption as follows:

Adopt the entire IBC chapter without state amendments.

If there is an “X” under a particular state agency’s acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user. See Chapter 1 for state agency authority and building applications.)

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter			X																			
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter/Section																						

Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an “X” in the column, by that particular section, under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter 1																						
202			X																			

Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below					X	X		S	A	M	P	L	E									
Chapter 1																						
202					X	X		S	A	M	P	L	E									
202					X	X			C	O	N	T.										
203					X	X																
203					X	X																

Marginal Markings

Symbols in the margin indicate the status of code changes as follows:

- || This symbol indicates that a change has been made to a California amendment.
- > This symbol indicates deletion of California amendment language.
- | This symbol indicates that a change has been made to International Code Council model language.
- ➔ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2018 edition of the *International Building Code*.

2021 LOCATION	2018 LOCATION
508.5–508.5.11	419.1–419.9
904.12	904.14
904.13	904.12
904.14	904.13
1010.2	1010.1.9
1010.2.1	1010.1.9.6
1010.2.2	1010.1.9.1
1010.2.3	1010.1.9.2
1010.2.4	1010.1.9.4
1010.2.5	1010.1.9.5
1010.2.6	1010.1.9.6.1
1010.2.7	1010.1.9.12
1010.2.8	1010.1.4.4
1010.2.9	1010.1.10
1010.2.9.3	1010.1.10.1
1010.2.9.4	1010.1.10.2
1010.2.10	1010.1.9.3
1010.2.11	1010.1.9.10
1010.2.12	1010.1.9.9
1010.2.13	1010.1.9.8
1010.2.13.1	1010.1.9.8.1
1010.2.14	1010.1.9.7
1010.2.15	1010.1.9.11
1010.3	1010.1.4
1010.3.1	1010.1.4.1
Table 1010.3.1(1)	Table 1010.1.4.1(1)
Table 1010.3.1(2)	Table 1010.1.4.1(2)
1010.3.1.1	1010.1.4.1.1
1010.3.1.2	1010.1.4.1.2
1010.3.2	1010.1.4.2
1010.3.3	1010.1.4.3
1029.1	1028.4
1029.2	1028.4.2
1029.3	1028.4.2

(continued)

RELOCATIONS—continued

2021 LOCATION	2018 LOCATION
1107.3	1109.14
1110.14	1109.12.1
1605.2	605.3.2
1607.14.2.2	1607.13.3
1607.14.4.3	1607.13.5.2.1
2304.12.2.6	2304.12.3
2304.12.2.6.1	2304.12.3.1
2304.12.2.7	2304.12.4
2304.12.2.8	2304.12.5
3301.2.1	1511.2

Coordination of the International Codes

The coordination of technical provisions is one of the strengths of the ICC family of model codes. The codes can be used as a complete set of complementary documents, which will provide users with full integration and coordination of technical provisions. Individual codes can also be used in subsets or as stand-alone documents. To make sure that each individual code is as complete as possible, some technical provisions that are relevant to more than one subject area are duplicated in some of the model codes. This allows users maximum flexibility in their application of the I-Codes.

Maintenance

The *International Building Code* is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate.

The ICC Code Development Process reflects principles of openness, transparency, balance, due process and consensus, the principles embodied in OMB Circular A-119, which governs the federal government's use of private-sector standards. The ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the ICC's cloud-based app, cdp-Access[®]. A broad cross section of interests are represented in the ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC's important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- American Institute of Architects (AIA)
- National Association of Home Builders (NAHB)
- National Association of State Fire Marshals (NASFM)

The code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the International Code Council.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. The ICC does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

As mentioned in the preceding material, in each code development cycle, code change proposals to this code are considered at the Committee Action Hearings by 11 different code development committees.

Code change proposals to sections of the code that are preceded by a bracketed letter designation, such as [A], will be considered by a committee other than the building code committee listed for the chapter or appendix on the preceding page. For example, proposed code changes to Section [F] 307.1.1 will be considered by the International Fire Code Development Committee during the Committee Action Hearing in the 2021 (Group A) code development cycle.

The bracketed letter designations for committees responsible for portions of this code are as follows:

- [A] = Administrative Code Development Committee
- [BE] = IBC—Egress Code Development Committee
- [BF] = IBC—Fire Safety Code Development Committee
- [BG] = IBC—General Code Development Committee
- [BS] = IBC—Structural Code Development Committee
- [E] = International Commercial Energy Conservation Code Development Committee or International Residential Energy Conservation Code Development Committee
- [EB] = International Existing Building Code Development Committee
- [F] = International Fire Code Development Committee
- [FG] = International Fuel Gas Code Development Committee
- [M] = International Mechanical Code Development Committee
- [P] = International Plumbing Code Development Committee

For the development of the 2024 edition of the I-Codes, there will be two groups of code development committees and they will meet in separate years, as shown in the following Code Development Hearings Table.

Code change proposals submitted for code sections that have a letter designation in front of them will be heard by the respective committee responsible for such code sections. Because different committees hold Committee Action Hearings in different years, proposals for the IBC will be heard by committees in both the 2021 (Group A) and the 2022 (Group B) code development cycles.

For instance, every section of Chapter 16 is the responsibility of the IBC—Structural Code Development Committee. As noted in the preceding table, that committee will hold its Committee Action Hearings in 2022 to consider code change proposals for the chapters for which it is responsible. Therefore any proposals received for Chapter 16 of this code will be assigned to the IBC—Structural Code Development Committee and will be considered in 2022, during the Group B code change cycle.

It is very important that anyone submitting code change proposals understands which code development committee is responsible for the section of the code that is the subject of the code change proposal. For further information on the Code Development Committee responsibilities, please visit the ICC website at www.iccsafe.org/current-code-development-cycle.

CODE DEVELOPMENT HEARINGS

Group A Codes (Heard in 2021, Code Change Proposals Deadline: January 11, 2021)	Group B Codes (Heard in 2022, Code Change Proposals Deadline: January 10, 2022)
International Building Code – Egress (Chapters 10, 11, Appendix E) – Fire Safety (Chapters 7, 8, 9, 14, 26) – General (Chapters 2–6, 12, 27–33, Appendices A, B, C, D, K, N)	Administrative Provisions (Chapter 1 of all codes except IECC, IRC and IgCC; IBC Appendix O; the appendices titled “Board of Appeals” for all codes except IECC, IRC, IgCC, ICCPC and IZC; administrative updates to currently referenced standards; and designated definitions)
International Fire Code	International Building Code – Structural (Chapters 15–25, Appendices F, G, H, I, J, L, M)
International Fuel Gas Code	International Existing Building Code
International Mechanical Code	International Energy Conservation Code—Commercial
International Plumbing Code	International Energy Conservation Code—Residential – IECC—Residential – IRC—Energy (Chapter 11)
International Property Maintenance Code	International Green Construction Code (Chapter 1)
International Private Sewage Disposal Code	International Residential Code – IRC—Building (Chapters 1–10, Appendices AE, AF, AH, AJ, AK, AL, AM, AO, AQ, AR, AS, AT, AU, AV, AW)
International Residential Code – IRC—Mechanical (Chapters 12–23) – IRC—Plumbing (Chapters 25–33, Appendices AG, AI, AN, AP)	
International Swimming Pool and Spa Code	
International Wildland-Urban Interface Code	
International Zoning Code	

Note: Proposed changes to the ICCPC will be heard by the code development committee noted in brackets [] in the text of the ICCPC.

Effective Use of the International Building Code

The IBC is a model code that provides minimum requirements to safeguard the public health, safety and general welfare of the occupants of new and existing buildings and structures. The IBC is fully compatible with the ICC family of codes, including: the IECC, IEBC, IFC, IFGC, IgCC, IMC, IPC, IPSDC, IPMC, IRC, ISPSC, IWUIC, IZC and ICCPC.

The IBC addresses structural strength, means of egress, sanitation, adequate lighting and ventilation, accessibility, energy conservation and life safety in regard to new and existing buildings, facilities and systems. The codes are promulgated on a 3-year cycle to allow for new construction methods and technologies to be incorporated into the codes. Alternative materials, designs and methods not specifically addressed in the code can be approved by the building official where the proposed materials, designs or methods comply with the intent of the provisions of the code (see Section 104.11).

The IBC applies to all occupancies, including one- and two-family dwellings and townhouses that are not within the scope of the IRC. The IRC is referenced for coverage of detached one- and two-family dwellings and townhouses as defined in the exception to Section 101.2 and the definition for “Townhouse” in Chapter 2. The IRC can also be used for the construction of live/work units (as defined in Section 508.5) and small bed and breakfast-style hotels where there are five or fewer guest rooms and the hotel is owner occupied. The IBC applies to all types of buildings and structures unless exempted. Work exempted from permits is listed in Section 105.2.

ARRANGEMENT AND FORMAT OF THE 2021 IBC

Before applying the requirements of the IBC, it is beneficial to understand its arrangement and format. The IBC, like other codes published by ICC, is arranged and organized to follow sequential steps that generally occur during a plan review or inspection.

The following table shows how the IBC is divided. The three tables following that show IBC requirements that are correlated with other I-Codes. Lastly, the ensuing chapter-by-chapter synopsis details the scope and intent of the provisions of the IBC.

CHAPTER TOPICS

Chapters	Subjects
1–2	Administration and definitions
3	Use and occupancy classifications
4, 31	Special requirements for specific occupancies or elements
5–6	Height and area limitations based on type of construction
7–9	Fire resistance and protection requirements
10	Requirements for evacuation
11	Specific requirements to allow use and access to a building for persons with disabilities
12–13, 27–30	Building systems, such as lighting, HVAC, plumbing fixtures, elevators
14–26	Structural components—performance and stability
32	Encroachment outside of property lines
33	Safeguards during construction
35	Referenced standards
Appendices A–O	Appendices

IFC Correlated Topics

The IBC requirements for hazardous materials, fire-resistance-rated construction, interior finish, fire protection systems, means of egress, emergency and standby power, and temporary structures are directly correlated with the requirements of the IFC. The following table shows chapters/sections of the IBC that are correlated with the IFC:

IBC/IFC CORRELATED TOPICS

IBC Chapter/Section	IFC Chapter/Section	Subject
Sections 307, 414, 415	Chapters 50–67	Hazardous materials and Group H requirements
Chapter 7	Chapter 7	Fire-resistance-rated construction (fire and smoke protection features in the IFC)
Chapter 8	Chapter 8	Interior finish, decorative materials and furnishings
Chapter 9	Chapter 9	Fire protection systems
Chapter 10	Chapter 10	Means of egress
Chapter 27	Section 604	Standby and emergency power
Section 3103	Chapter 31	Temporary structures

IMC Correlated Topics

The IBC requirements for smoke control systems, and smoke and fire dampers are directly correlated to the requirements of the IMC. IBC Chapter 28 is a reference to the IMC and the IFGC for chimneys, fireplaces and barbecues, and all aspects of mechanical systems. The following table shows chapters/sections of the IBC that are correlated with the IMC:

IBC/IMC CORRELATED TOPICS		
IBC Chapter/Section	IMC Chapter/Section	Subject
Section 717	Section 607	Smoke and fire dampers
Section 909	Section 513	Smoke control

IPC Correlated Topics

The IBC requirements for plumbing fixtures and toilet rooms are directly correlated to the requirements of the IPC. The following table shows chapters/sections of the IBC that are correlated with the IPC:

IBC/IPC CORRELATED TOPICS		
IBC Chapter/Section	IPC Chapter/Section	Subject
Chapter 29	Chapters 3 & 4	Plumbing fixtures and facilities

Chapter 1 Scope and Administration

Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts, Part 1— Scope and Application (Sections 101-102) and Part 2—Administration and Enforcement (Sections 103-116). Section 101 identifies which buildings and structures come under its purview and references other I-Codes as applicable. Standards and codes are scoped to the extent referenced (see Section 102.4).

The building code is intended to be adopted as a legally enforceable document and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the building official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

Chapter 2 Definitions

All terms that are defined in the code are listed alphabetically in Chapter 2. While a defined term may be used in one chapter or another, the meaning provided in Chapter 2 is applicable throughout the code.

Where understanding a term's definition is especially key to or necessary for understanding a particular code provision, the term is shown in italics. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code is provided.

Chapter 3 Occupancy Classification and Use

Chapter 3 provides for the classification of buildings, structures and parts thereof based on the purpose or purposes for which they are used. Section 302 identifies the groups into which all buildings, structures and parts thereof must be classified. Sections 303 through 312 identify the occupancy characteristics of each group classification. In some sections, specific group classifications having requirements in common are collectively organized such that one term applies to all. For example, Groups A-1, A-2, A-3, A-4 and A-5 are individual groups for assembly-type buildings. The general term “Group A,” however, includes each of these individual groups. Other groups include Business (B), Educational (E), Factory (F-1, F-2), High Hazard (H-1, H-2, H-3, H-4, H-5), Institutional (I-1, I-2, I-3, I-4), Mercantile (M), Residential (R-1, R-2, R-3, R-4), Storage (S-1, S-2) and Utility (U). In some occupancies, the smaller number means a higher hazard, but that is not always the case.

Defining the use of the buildings is very important as it sets the tone for the remaining chapters of the code. Occupancy works with the height, area and construction type requirements in Chapters 5 and 6, as well as the special provisions in Chapter 4, to determine “equivalent risk,” or providing a reasonable level of protection or life safety for building occupants. The determination of equivalent risk involves three interdependent considerations: (1) the level of fire hazard associated with the specific occupancy of the facility; (2) the reduction of fire hazard by limiting the floor area and the height of the building based on the fuel load (combustible contents and burnable building components); and (3) the level of overall fire resistance provided by the type of construction used for the building. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type.

Occupancy classification also plays a key part in organizing and prescribing the appropriate protection measures. As such, threshold requirements for fire protection and means of egress systems are based on occupancy classification (see Chapters 9 and 10). Other sections of the code also contain requirements respective to the classification of building groups. For example, Section 706 specifies requirements for fire wall fire-resistance ratings that are tied to the occupancy classification of a building and Section 803.11 contains interior finish requirements that are dependent upon the occupancy classification. The use of the space, rather than the occupancy of the building, is utilized for determining occupant loading (Section 1004) and live loading (Section 1607).

Over the useful life of a building, the activities in the building will evolve and change. Where the provisions of the code address uses differently, moving from one activity to another or from one level of activity to another is, by definition, a change of occupancy. The new occupancy must be in compliance with the applicable provisions.

Chapter 4 Special Detailed Requirements Based on Occupancy and Use

Chapter 4 contains the requirements for protecting special uses and occupancies, which are supplemental to the remainder of the code. Chapter 4 contains provisions that may alter requirements found elsewhere in the code; however, the general requirements of the code still apply unless modified within the chapter. For example, the height and area limitations established in Chapter 5 apply to all special occupancies unless Chapter 4 contains height and area limitations. In this case, the limitations in Chapter 4 supersede those in other sections. An example of this is the height and area limitations for open parking garages given in Section 406.5.4, which supersede the limitations given in Sections 504 and 506.

In some instances, it may not be necessary to apply the provisions of Chapter 4. For example, if a covered mall building complies with the provisions of the code for Group M, Section 402 does not apply; however, other sections that address a use, process or operation must be applied to that specific occupancy, such as stages and platforms, special amusement buildings and hazardous materials (Sections 410, 411 and 414).

The chapter includes requirements for buildings and conditions that apply to one or more groups, such as high-rise buildings, underground buildings or atriums. Special uses may also imply specific occupancies and operations, such as for Group H, hazardous materials, application of flammable finishes, drying rooms, organic coatings and combustible storage or hydrogen fuel gas rooms, all of which are coordinated with the IFC. Unique consideration is taken for special use areas, such as covered mall buildings, motor-vehicle-related occupancies, special amusement buildings and aircraft-related occupancies. Special facilities within other occupancies are considered, such as stages and platforms, motion picture projection rooms, children’s play structures and storm shelters. Finally, in order that the overall package of protection features can be easily understood, unique considerations for specific occupancies are addressed: Groups I-1, I-2, I-3, R-1, R-2, R-3 and R-4; and ambulatory care facilities and live/work units.

Chapter 5 General Building Heights and Areas

Chapter 5 contains the provisions that regulate the minimum type of construction for area limits and height limits based on the occupancy of the building. Height and area increases (including allowances for basements, mezzanines and equipment platforms) are permitted based on open frontage for fire department access, separation and the type of sprinkler protection provided (Sections 503-506, 510). These thresholds are reduced for buildings over three stories in height in accordance with Sections 506.2.1 and 506.2.2. Provisions include the protection and/or separation of incidental uses (Table 509.1), accessory occupancies (Section 508.2) and mixed uses in the same building (Sections 506.2.2, 508.3, 508.4 and 510). Unlimited area buildings are permitted in certain occupancies when they meet special provisions (Section 507). Live/work units are provided for in Section 508.5.

Tables 504.3, 504.4 and 506.2 are the keystones in setting thresholds for building size based on the building's use and the materials with which it is constructed. If one then looks at Tables 504.3, 504.4 and 506.2, the relationship among group classification, allowable heights and areas and types of construction becomes apparent. Respective to each group classification, the greater the fire-resistance rating of structural elements, as represented by the type of construction, the greater the floor area and height allowances. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type. Starting in the 2015 edition, the table that once contained both height and area has been separated and these three new tables address the topics individually. In addition, the tables list criteria for buildings with and without automatic sprinkler systems.

Chapter 6 Types of Construction

The interdependence of these fire safety considerations can be seen by first looking at Tables 601 and 705.5, which show the fire-resistance ratings of the principal structural elements comprising a building in relation to the five classifications for types of construction. Type I construction is the classification that generally requires the highest fire-resistance ratings for structural elements, whereas Type V construction, which is designated as a combustible type of construction, generally requires the least amount of fire-resistance-rated structural elements. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type. Section 603 includes a list of combustible elements that can be part of a non-combustible building (Types I and II construction).

Chapter 7 Fire and Smoke Protection Features

The provisions of Chapter 7 present the fundamental concepts of fire performance that all buildings are expected to achieve in some form. This chapter identifies the acceptable materials, techniques and methods by which proposed construction can be designed and evaluated against to determine a building's ability to limit the impact of fire. The fire-resistance-rated construction requirements within Chapter 7 provide passive resistance to the spread and effects of fire. Types of separations addressed include fire walls, fire barriers, fire partitions, horizontal assemblies, smoke barriers and smoke partitions. A fire produces heat that can weaken structural components and smoke products that cause property damage and place occupants at risk. The requirements of Chapter 7 work in unison with height and area requirements (Chapter 5), active fire detection and suppression systems (Chapter 9) and occupant egress requirements (Chapter 10) to contain a fire should it occur while helping ensure occupants are able to safely exit.

Chapter 7A Materials and Construction Methods for Exterior Wildfire Exposure

The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface (WUI) Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

Chapter 8 Interior Finishes

This chapter contains the performance requirements for controlling fire growth within buildings by restricting interior finish and decorative materials. Past fire experience has shown that interior fin-

ish and decorative materials are key elements in the development and spread of fire. The provisions of Chapter 8 require materials used as interior finishes and decorations to meet certain flame-spread index or flame-propagation criteria based on the relative fire hazard associated with the occupancy. As smoke is also a hazard associated with fire, this chapter contains limits on the smoke development characteristics of interior finishes. The performance of the material is evaluated based on test standards.

Chapter 9 Fire Protection and Life Safety Systems

Chapter 9 prescribes the minimum requirements for active systems of fire protection equipment to perform the following functions: detect a fire; alert the occupants or fire department of a fire emergency; and control smoke and control or extinguish the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the IFC; however, the IFC Chapter 9 also contains periodic testing criteria that are not contained in the IBC. In addition, the special fire protection system requirements based on use and occupancy found in IBC Chapter 4 are duplicated in IFC Chapter 9 as a user convenience.

Chapter 10 Means of Egress

The general criteria set forth in Chapter 10 regulating the design of the means of egress are established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system (i.e., exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics also are specified for the components that will permit their safe use without special knowledge or effort. The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Chapter 10 of the IBC is duplicated in Chapter 10 of the IFC; however, the IFC contains one additional section on the means of egress system in existing buildings.

Chapter 11A - Housing Accessibility and/or Chapter 11B - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing

Verify compliance with accessibility provisions. In order to be considered as accessible, buildings and their individual elements must comply with the applicable scoping and technical provisions of Chapter 11A and/or Chapter 11B.

Chapter 12 Interior Environment

Chapter 12 provides minimum standards for the interior environment of a building. The standards address the minimum sizes of spaces, minimum temperature levels, and minimum light and ventilation levels. The collection of requirements addresses limiting sound transmission through walls, ventilation of attic spaces and under floor spaces (crawl spaces). Finally, the chapter provides minimum standards for toilet and bathroom construction, including privacy shielding and standards for walls, partitions and floors to resist water intrusion and damage.

Chapter 13 Energy Efficiency

Refer to California Energy Code, Title 24, Part 6.

Chapter 14 Exterior Walls

This chapter addresses requirements for exterior walls of buildings. Minimum standards for wall covering materials, installation of wall coverings and the ability of the wall to provide weather protection are provided. This chapter also requires exterior walls that are close to lot lines, or that are bearing walls for certain types of construction, to comply with the minimum fire-resistance ratings specified in Chapters 6 and 7. The installation of each type of wall covering, be it wood, masonry, vinyl, metal composite material or an exterior insulation and finish system, is critical to its long-term performance in protecting the interior of the building from the elements and the spread of fire. Limitations on the use of combustible materials on exterior building elements such as balconies, eaves, decks and architectural trim are also addressed in this chapter.

Chapter 15 Roof Assemblies and Rooftop Structures

Chapter 15 provides standards for both roof assemblies and structures that sit on top of the roofs of buildings. The criteria address roof construction and covering, including the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is prescriptive in nature and is based on decades of experience with various traditional materials, but it also addresses newer products such as photovoltaic shingles. These prescriptive rules are very important for satisfying performance of one type of roof covering or another. Section 1511 addresses rooftop structures, including penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.

Chapter 16 Structural Design

Chapter 16 prescribes minimum structural loading requirements for use in the design and construction of buildings and structural components. It includes minimum design loads, assignment of risk categories and permitted design methodologies. Standards are provided for minimum design loads (live, dead, snow, wind, rain, flood, ice and earthquake as well as the required load combinations). The application of these loads and adherence to the serviceability criteria will enhance the protection of life and property. The chapter references and relies on many nationally recognized design standards. A key standard is the American Society of Civil Engineers' *Minimum Design Loads for Buildings and Other Structures* (ASCE 7). Structural design must address the conditions of the site and location. Therefore, maps are provided of rainfall, seismic, snow and wind criteria in different regions.

Chapter 17 Special Inspections and Tests

Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, labeling materials and assemblies and special inspection of structural assemblies. This chapter expands on the inspections of Chapter 1 by requiring special inspection where indicated and, in some cases, structural observation. It also spells out additional responsibilities for the owner, contractor, design professionals and special inspectors. Proper assembly of structural components, proper quality of materials used and proper application of materials are essential to ensuring that a building, once constructed, complies with the structural and fire-resistance minimums of the code and the approved design. To determine this compliance often requires continuous or frequent inspection and testing. Chapter 17 establishes standards for special inspection, testing and reporting of the work to the building official.

Chapter 18 Soils and Foundations

Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads from the structure above. This chapter includes requirements for soils investigation and site preparation for receiving a foundation, including the allowed load-bearing values for soils and for protecting the foundation from water intrusion. Section 1808 addresses the basic requirements for all foundation types. Later sections address foundation requirements that are specific to shallow foundations and deep foundations. Due care must be exercised in the planning and design of foundation systems based on obtaining sufficient soils information, the use of accepted engineering procedures, experience and good technical judgment.

Chapter 19 Concrete

This chapter provides minimum accepted practices for the design and construction of buildings and structural components using concrete—both plain and reinforced. Chapter 19 relies primarily on the reference to American Concrete Institute (ACI) 318, *Building Code Requirements for Structural Concrete*. This chapter also includes references to additional standards. Structural concrete must be designed and constructed to comply with this code and all listed standards. There are specific sections of the chapter addressing concrete slabs, anchorage to concrete and shotcrete. Because of the variable properties of material and numerous design and construction options available in the uses of concrete, due care and control throughout the construction process is necessary.

Chapter 20 Aluminum

Chapter 20 contains standards for the use of aluminum in building construction. Only the structural applications of aluminum are addressed. This chapter does not address the use of aluminum in specialty products such as storefront or window framing or architectural hardware. The use of aluminum in heating, ventilating or air-conditioning systems is addressed in the IMC. This chapter references national standards from the Aluminum Association for use of aluminum in building construction, AA ASM 35, *Aluminum Sheet Metal Work in Building Construction*, and AA ADM, *Aluminum Design Manual*. By utilizing the standards set forth, a proper application of this material can be obtained.

Chapter 21 Masonry

This chapter provides comprehensive and practical requirements for masonry construction. The provisions of Chapter 21 require minimum accepted practices and the use of standards for the design and construction of masonry structures. The provisions address: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; and required details of construction, including the execution of construction. Masonry design methodologies including allowable stress design, strength design and empirical design are covered by provisions of this chapter. Also addressed are masonry fireplaces and chimneys, masonry heaters and glass unit masonry. Fire-resistant construction using masonry is also required to comply with Chapter 7. Masonry foundations are also subject to the requirements of Chapter 18.

Chapter 22 Steel

Chapter 22 provides the requirements necessary for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. This chapter specifies appropriate design and construction standards for these types of structures. It also provides a road map of the applicable technical requirements for steel structures. Because steel is a noncombustible building material, it is commonly associated with Types I and II construction; however, it is permitted to be used in all types of construction. Chapter 22 requires that the design and use of steel materials be in accordance with the specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.

Chapter 23 Wood

This chapter provides minimum requirements for the design of buildings and structures that use wood and wood-based products. The chapter is organized around three design methodologies: allowable stress design (ASD), load and resistance factor design (LRFD) and conventional light-frame construction. Included in this chapter are references to design and manufacturing standards for various wood and wood-based products; general construction requirements; design criteria for lateral force-resisting systems and specific requirements for the application of the three design methods. In general, only Type III, IV or V buildings may be constructed of wood.

Chapter 24 Glass and Glazing

This chapter establishes regulations for glass and glazing that, when installed in buildings and structures, are subjected to wind, snow and dead loads. Engineering and design requirements are included in the chapter. Additional structural requirements are found in Chapter 16. Another concern of this chapter is glass and glazing used in areas where it is likely to be impacted by the occupants. Section 2406 identifies hazardous locations where glazing installed must either be safety glazing or blocked to prevent human impact. Safety glazing must meet stringent standards and be appropriately marked or identified. Additional requirements are provided for glass and glazing in guards, handrails, elevator hoistways and elevator cars, as well as in athletic facilities.

Chapter 25 Gypsum Board, Gypsum Panel Products and Plaster

Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum board, gypsum panel products and plaster. It also addresses reinforced gypsum concrete. These represent the most common interior and exterior finish materials in the building industry. This chapter primarily addresses quality-control-related issues with regard to material specifications and installation requirements. Most products are manufactured under the control of industry standards. The building official or inspector primarily needs to verify that the appropriate product is used and properly installed for the intended use and location. While often simply used as wall and ceiling coverings, proper design and application are necessary to provide weather resistance and required fire protection for both structural and nonstructural building components.

Chapter 26 Plastic

The use of plastics in building construction and components is addressed in Chapter 26. This chapter provides standards addressing foam plastic insulation, foam plastics used as interior finish and trim, and other plastic veneers used on the inside or outside of a building. Plastic siding is regulated by Chapter 14. Sections 2606 through 2611 address the use of light-transmitting plastics in various configurations such as walls, roof panels, skylights, signs and as glazing. Requirements for the use of fiber-reinforced polymers, fiberglass-reinforced polymers and reflective plastic core insulation are also contained in this chapter. Additionally, requirements specific to the use of wood-plastic composites and plastic lumber are contained in this chapter. Some plastics exhibit rapid flame spread and heavy smoke density characteristics when exposed to fire. Exposure to the heat generated by a fire can cause some plastics to deform, which can affect their performance. The requirements and limitations of this chapter are necessary to control the use of plastic and foam plastic products such that they do not compromise the safety of building occupants.

Chapter 27 Electrical

Since electrical systems and components are an integral part of almost all structures, it is necessary for the code to address the installation of such systems. For this purpose, Chapter 27 references the National Electrical Code (NEC). In addition, Section 2702 addresses emergency and standby power requirements. Such systems must comply with the *IFC* and referenced standards. This section also provides references to the various code sections requiring emergency and standby power, such as high-rise buildings and buildings containing hazardous materials.

Chapter 28 Mechanical Systems

Nearly all buildings will include mechanical systems. This chapter provides references to the IMC and the IFGC for the design and installation of mechanical systems. In addition, Chapter 21 of this code is referenced for masonry chimneys, fireplaces and barbecues.

Chapter 29 Plumbing Systems

Chapter 29 regulates the minimum number of plumbing fixtures that must be provided for every type of building. This chapter also regulates the location of the required fixtures in various types of buildings. This section requires separate facilities for males and females except for certain types of small occupancies. The regulations in this chapter come directly from Chapters 3 and 4 of the IPC.

Chapter 30 Elevators and Conveying Systems

Chapter 30 provides standards for the installation of elevators into buildings. Referenced standards provide the requirements for the elevator system and mechanisms. Detailed standards are provided in the chapter for hoistway enclosures, machine rooms and requirements for sizing of elevators. Beginning in the 2015 edition of this code, the elevator lobby requirements were moved from Chapter 7 to Chapter 30 to pull all the elevator-related construction requirements together. New provisions were added in the 2009 edition for fire service access elevators required in high-rise buildings and for the optional choice of occupant evacuation elevators (see Section 403).

Chapter 31 Special Construction

Chapter 31 contains a collection of regulations for a variety of unique structures and architectural features. Pedestrian walkways and tunnels connecting two buildings are addressed in Section 3104. Membrane and air-supported structures are addressed by Section 3102. Safeguards for swimming pool safety are addressed by way of reference to the ISPSA in Section 3109. Standards for temporary structures, including permit requirements, are provided in Section 3103. Structures as varied as awnings, marquees, signs, telecommunication and broadcast towers and automatic vehicular gates are also addressed (see Sections 3105 through 3108 and 3110).

Chapter 31A Systems for Window Cleaning or Exterior Building Maintenance

Chapter 31B Public Pools

Chapter 31C Radiation

Chapter 31D Food Establishments

Chapter 31E Reserved

Chapter 31F Marine Oil Terminals

Chapter 32 Encroachments into the Public Right-of-way

Buildings and structures from time to time are designed to extend over a property line and into the public right-of-way. Local regulations outside of the building code usually set limits to such encroachments, and such regulations take precedence over the provisions of this chapter. Standards are provided for encroachments below grade for structural support, vaults and areaways. Encroachments

above grade are divided into below 8 feet, 8 feet to 15 feet, and above 15 feet, because of headroom and vehicular height issues. This includes steps, columns, awnings, canopies, marquees, signs, windows and balconies. Similar architectural features above grade are also addressed. Pedestrian walkways must also comply with Chapter 31.

Chapter 33 Safeguards During Construction

Chapter 33 provides safety requirements during construction and demolition of buildings and structures. These requirements are intended to protect the public from injury and adjoining property from damage. In addition the chapter provides for the progressive installation and operation of exit stairways and standpipe systems during construction.

Chapter 34 Reserved

During the 2015 code change cycle the membership voted to delete Chapter 34, Existing Structures, from this code and reference the IEBC. The provisions that were in Chapter 34 appear in the IEBC. Former Sections 3402 through 3411 appear as IEBC Chapter 4 and Section 3412 as Chapter 14.

Chapter 35 Referenced Standards

The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 35 contains a comprehensive list of all standards that are referenced in the code, including the appendices. The standards are part of the code to the extent of the reference to the standard (see Section 102.4). Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the building official, contractor, designer and owner.

Chapter 35 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based upon the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

Appendices

Appendices are provided in the IBC to offer optional or supplemental criteria to the provisions in the main chapters of the code. Appendices provide additional information for administration of the Department of Building Safety as well as standards not typically administered by all building departments. Appendices have the same force and effect as the first 35 chapters of the IBC only when explicitly adopted by the jurisdiction.

Appendix A Employee Qualifications

Effective administration and enforcement of the family of International Codes depends on the training and expertise of the personnel employed by the jurisdiction and their knowledge of the codes. Section 103 of the code establishes the Department of Building Safety and calls for the appointment of a building official and deputies such as plans examiners and inspectors. Appendix A provides standards for experience, training and certification for the building official and the other staff mentioned in Chapter 1.

Appendix B Board of Appeals

Section 113 requires the establishment of a board of appeals to hear appeals regarding determinations made by the building official. Appendix B provides qualification standards for members of the board as well as operational procedures of such board.

Appendix C Group U—Agricultural Buildings

Appendix C provides a more liberal set of standards for the construction of agricultural buildings, rather than strictly following the utility building provision, reflective of their specific usage and limited occupant load. The provisions of this appendix, when adopted, allow reasonable heights and areas commensurate with the risk of agricultural buildings.

Appendix D Fire Districts

Fire districts have been a tool used to limit conflagration hazards in areas of a city with intense and concentrated development. More frequently used under the model codes that preceded the IBC, this appendix is provided to allow jurisdictions to continue the designation and use of fire districts. Fire district standards restrict certain occupancies within the district, as well as setting higher minimum construction standards.

Appendix E *Reserved*

Appendix F Rodentproofing

The provisions of this appendix are minimum mechanical methods to prevent the entry of rodents into a building. These standards, when used in conjunction with cleanliness and maintenance programs, can significantly reduce the potential of rodents invading a building.

Appendix G Flood-resistant Construction

Appendix G is intended to fulfill the flood-plain management and administrative requirements of the National Flood Insurance Program (NFIP) that are not included in the code. Communities that adopt the IBC and Appendix G will meet the minimum requirements of NFIP as set forth in Title 44 of the Code of Federal Regulations.

Appendix H Signs

Appendix H gathers in one place the various code standards that regulate the construction and protection of outdoor signs. Whenever possible, this appendix provides standards in performance language, thus allowing the widest possible application.

Appendix I Patio Covers

Appendix I provides standards applicable to the construction and use of patio covers. It is limited in application to patio covers accessory to dwelling units. Covers of patios and other outdoor areas associated with restaurants, mercantile buildings, offices, nursing homes or other nondwelling occupancies would be subject to standards in the main code and not this appendix.

Appendix J Grading

Appendix J provides standards for the grading of properties. This appendix also provides standards for administration and enforcement of a grading program including permit and inspection requirements. Appendix J was originally developed in the 1960s and used for many years in jurisdictions throughout the western United States. It is intended to provide consistent and uniform code requirements anywhere grading is considered an issue.

Appendix K *Group R-3 and Group R-3.1 Occupancies Protected by the Facilities of the Central Valley Flood Protection Plan*

Appendix K provides provisions applicable to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612 of Group R-3 and R-3.1 located in areas protected by the facilities of the Central Valley Flood Protection Plan.

Appendix L Earthquake Recording Instrumentation

The purpose of this appendix is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the IBC.

Appendix M Tsunami-Generated Flood Hazards

Addressing a tsunami risk for all types of construction in a tsunami hazard zone through building code requirements would typically not be cost effective, making tsunami-resistant construction impractical at an individual building level. However, this appendix does allow the adoption and enforcement of requirements for tsunami hazard zones that regulate the presence of high-risk or high-hazard structures.

Appendix N Replicable Buildings

Many jurisdictions have recognized the need for some form of expedited review process for replicable buildings. By codifying the approach contained in the ICC G1-2010 *Guideline for Replicable Buildings*, this appendix provides jurisdictions with a means of incorporating replicable building requirements into their building code adoption process. The intent is to streamline the plan review process at the local level by removing redundant reviews.

Appendix O Performance-based Application

Appendix O provides an optional design, review and approval framework for use by the building official. It simply extracts the relevant administrative provisions from the ICCPC into a more concise, usable appendix format for a jurisdiction confronted with such a need. Typical uses would include cases of alternate methods in Chapter 1 and select areas of the code that require a rational analysis, such as Section 909.

Appendix P *Emergency Housing*

This appendix shall be applicable to emergency housing and emergency housing facilities. Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and assembled in accordance with this appendix shall be occupied only during declaration of state of emergency, local emergency or shelter crises. Buildings and structures constructed in accordance with the California Building Code, used as emergency housing, shall be permitted to be permanently occupied.

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 1 – SCOPE AND ADMINISTRATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Chapter / Section																						
Division I – California Administration																						
1.1	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
1.2	X		X																			
1.2.3	X						X															
1.3			X												X							
1.4			X																	X		
1.5 (Reserved)			X																			
1.6			X														X					
1.7			X													X						
1.8			X	X	X	X																
1.9			X																			
1.9.1 – 1.9.1.8							X															
1.9.2								X	X													
1.9.2.1								X														
1.9.2.2									X													
1.10			X																			
1.10.1										X	X											
1.10.2												X										
1.10.3													X									
1.10.4														X								
1.10.5 – 1.10.5.3															X							
1.11			X																			
1.12			X																		X	
1.13 (Reserved)																		X				
1.14																						X
Division II – Scope and Administration																						
101.1 – 101.4.5							X			X	X	X	X	X	X							
101.4.7										X	X	X		X	X							
102.1							X	X	X	X	X	X	X	X	X							
102.2 – 102.4							X	X	X	X	X	X	X	X	X							
102.4.1							X	X														
102.4.3							X	X	X	X	X	X	X	X	X							
102.4.4							X	X	X	X	X	X	X	X	X							
102.5							X	X	X	X	X	X	X	X	X							
102.6 – 104.1										X	X	X	X	X	X							
104.2 – 104.4										X	X	X	X	X	X							
104.5 – 104.8										X	X	X	X	X	X							
104.9							X	X	X	X	X	X	X	X	X							

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 1 – SCOPE AND ADMINISTRATION—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X
Chapter / Section																						
Division II – <i>Scope and Administration</i> -cont'd																						
104.10								X	X	X	X	X	X	X								
104.11							X	X	X	X	X		X	X								
104.11.1 – 104.11.2										X	X	X	X	X								
104.11.3										X	X	X		X	X							
104.11.4										X				X								
105.1										X	X	X	X	X	X							
105.1.1 – 105.2										X	X	X	X	X	X							
105.2 Building: 1-13			X	X	X																	
105.2.1 – 105.2.2			X							X	X	X	X	X	X							
105.2.3										X	X	X	X	X	X							
105.3 – 105.3.1			X							X	X	X	X	X	X							
105.3.2										X	X	X		X	X							
105.4			X							X	X	X	X	X	X							
105.5										X	X	X	X	X	X							
105.5.1	X																					
105.6 – 105.7			X							X	X	X	X	X	X							
106.1			X					X	X	X	X	X	X	X	X							
106.1.1										X	X	X		X	X							
106.1.2								X	X													
106.2 – 106.3			X							X	X	X	X	X	X							
107.1			X	X	X					X	X	X	X	X	X							
107.2			X							X	X	X	X	X	X							
107.2.1			X	X	X					X	X	X		X								
107.2.3			X	X	X																	
107.2.4			X	X	X																	
107.2.5			X	X	X			X	X													
107.2.6			X	X	X																	
107.2.6.1				X	X																	
107.2.7			X	X	X																	
107.3			X							X	X	X	X	X	X							
107.3.4.1										X	X	X		X	X							
107.4			X																			
107.5			X							X	X	X	X	X	X							
108.1 – 108.4			X							X	X	X	X	X	X							
109										X	X	X	X	X	X							
110.1 – 110.3			X							X	X	X	X	X	X							
110.3.1 – 110.3.3				X	X					X	X	X	X	X	X							
110.3.4 – 110.3.7			X	X	X					X	X	X	X	X	X							

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 1 – SCOPE AND ADMINISTRATION—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X	X
Chapter / Section																							
Division II – <i>Scope and Administration</i> -cont'd																							
110.3.4.1				X																			
110.3.5	X		X	X	X			X	X														
110.3.6				X	X																		
110.3.7				X	X			X	X														
110.3.8				X	X																		
110.3.9 – 110.3.11			X	X	X					X	X	X	X	X	X								
110.3.11.1				X	X																		
110.3.12 – 110.3.12.1				X	X																		
110.3.12.2				X	X																		
110.4 – 110.6			X							X	X	X	X	X	X								
111.1			X							X	X	X	X	X	X								
111.2			X				X			X	X	X	X	X	X								
111.3 – 111.4			X							X	X	X	X	X	X								
112			X							X	X	X	X	X	X								
113										X	X	X	X	X	X								
114.1 – 114.2			X							X	X	X	X	X	X								
114.2 – 114.3										X	X	X	X	X	X								
115 - 116			X							X	X	X	X	X	X								

The state agency does not adopt sections identified by the following symbol: †
The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 1
SCOPE AND ADMINISTRATION
DIVISION I
CALIFORNIA ADMINISTRATION

SECTION 1.1
GENERAL

1.1.1 Title. *These regulations shall be known as the California Building Code, may be cited as such and will be referred to herein as “this code.” The California Building Code is Part 2 of thirteen parts of the official compilation and publication of the adoption, amendment and repeal of building regulations to the California Code of Regulations, Title 24, also referred to as the California Building Standards Code.*

1.1.2 *This part incorporates by adoption the 2021 International Building Code of the International Code Council with necessary California amendments.*

1.1.2 Purpose. *The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation and energy conservation; safety to life and property from fire and other hazards attributed to the built environment; and to provide safety to fire fighters and emergency responders during emergency operations.*

1.1.3 Scope. *The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout the State of California.*

1.1.3.1 Nonstate-regulated buildings, structures and applications. *Except as modified by local ordinance pursuant to Section 1.1.8, the following standards in the California Code of Regulations, Title 24, Parts 2, 2.5, 3, 4, 5, 6, 9, 10 and 11 shall apply to all occupancies and applications not regulated by a state agency.*

1.1.3.2 State-regulated buildings, structures and applications. *The model code, state amendments to the model code and/or state amendments where there are no relevant model code provisions shall apply to the following buildings, structures and applications regulated by state agencies as specified in Sections 1.2 through 1.14, except where modified by local ordinance pursuant to Section 1.1.8. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.*

Note: *See “How to Distinguish Between Model Code Language and California Amendments” in the front of the code.*

1. *State-owned buildings, including buildings constructed by the Trustees of the California State*

University, and to the extent permitted by California laws, buildings designed and constructed by the Regents of the University of California, and regulated by the Building Standards Commission. See Section 1.2 for additional scope provisions.

2. *Local detention facilities regulated by the Board of State and Community Corrections. See Section 1.3 for additional scope provisions.*
3. *Barbering, cosmetology or electrolysis establishments, acupuncture offices, pharmacies, veterinary facilities and structural pest control locations regulated by the Department of Consumer Affairs. See Section 1.4 for additional scope provisions.*
4. *Section 1.5 reserved for the California Energy Commission.*
5. *Dairies and places of meat inspection regulated by the Department of Food and Agriculture. See Section 1.6 for additional scope provisions.*
6. *Organized camps, laboratory animal quarters, public swimming pools, radiation protection, commissaries serving mobile food preparation vehicles and wild animal quarantine facilities regulated by the Department of Public Health. See Section 1.7 for additional scope provisions.*
7. *Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities. See Section 1.8.2.1.1 for additional scope provisions.*
8. *Accommodations for persons with disabilities in buildings containing newly constructed covered multifamily dwellings, new common use areas serving existing covered multifamily dwellings, additions to existing buildings where the addition alone meets the definition of covered multifamily dwellings, and new common-use areas serving new covered multifamily dwellings, which are regulated by the Department of Housing and Community Development. See Section 1.8.2.1.2 for additional scope provisions.*
9. *Permanent buildings and permanent accessory buildings or structures constructed within mobile-home parks and special occupancy parks regulated by the Department of Housing and Community Development. See Section 1.8.2.1.3 for additional scope provisions.*

- 10. Accommodations for persons with disabilities regulated by the Division of the State Architect. See Section 1.9.1 for additional scope provisions.
- 11. Public elementary and secondary schools, community college buildings and state-owned or state-leased essential service buildings regulated by the Division of the State Architect. See Section 1.9.2 for additional scope provisions.
- 12. Qualified historical buildings and structures and their associated sites regulated by the State Historical Building Safety Board with the Division of the State Architect. See Section 1.9.3 for additional scope provisions.
- 13. General acute care hospitals, acute psychiatric hospitals, skilled nursing and/or intermediate care facilities, clinics licensed by the Department of Public Health and correctional treatment centers regulated by the Office of Statewide Health Planning and Development. See Section 1.10 for additional scope provisions.
- 14. Applications regulated by the Office of the State Fire Marshal include, but are not limited to, the following in accordance with Section 1.11:
 - 14.1. Buildings or structures used or intended for use as an:
 - 1. Asylum, jail, prison
 - 2. Mental hospital, hospital, home for the elderly, children's nursery, children's home or institution, school or any similar occupancy of any capacity
 - 3. Theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education
 - 4. Small family day-care homes, large family day-care homes, residential facilities and residential facilities for the elderly, residential care facilities
 - 5. State institutions or other state-owned or state-occupied buildings
 - 6. High rise structures
 - 7. Motion picture production studios
 - 8. Organized camps
 - 9. Residential structures
 - 14.2. Tents, awnings or other fabric enclosures used in connection with any occupancy
 - 14.3. Fire alarm devices, equipment and systems in connection with any occupancy
 - 14.4. Hazardous materials, flammable and combustible liquids

14.5. Public school automatic fire detection, alarm and sprinkler systems

14.6. Wildland-urban interface fire areas

- 15. Public libraries constructed and renovated using funds from the California Library Construction and Renovation Bond Act of 1988 and regulated by the State Librarian. See Section 1.12 for additional scope provisions.
- 16. Section 1.13 reserved for the Department of Water Resources.
- 17. For applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, outdoor environments and uses shall be classified according to accessibility uses described in Chapter 11B.
- 18. Marine Oil Terminals regulated by the California State Lands Commission. See Section 1.14 for additional scope provisions.

1.1.4 Appendices. Provisions contained in the appendices of this code shall not apply unless specifically adopted by a state agency or adopted by a local enforcing agency in compliance with Health and Safety Code Section 18901 et. seq. for Building Standards Law, Health and Safety Code Section 17950 for State Housing Law and Health and Safety Code Section 13869.7 for Fire Protection Districts. See Section 1.1.8 of this code.

1.1.5 Referenced codes. The codes, standards and publications adopted and set forth in this code, including other codes, standards and publications referred to therein are, by title and date of publication, hereby adopted as standard reference documents of this code. When this code does not specifically cover any subject related to building design and construction, recognized architectural or engineering practices shall be employed. The National Fire Codes, standards and the Fire Protection Handbook of the National Fire Protection Association are permitted to be used as authoritative guides in determining recognized fire prevention engineering practices.

1.1.6 Nonbuilding standards, orders and regulations. Requirements contained in the California Building Code, or in any other referenced standard, code or document, which are not building standards as defined in Health and Safety Code Section 18909, shall not be construed as part of the provisions of this code. For nonbuilding standards, orders and regulations, see other titles of the California Code of Regulations.

1.1.7 Order of precedence and use.

1.1.7.1 Differences. In the event of any differences between these building standards and the standard reference documents, the text of these building standards shall govern.

1.1.7.2 Specific provisions. Where a specific provision varies from a general provision, the specific provision shall apply.

1.1.7.3 Conflicts. When the requirements of this code conflict with the requirements of any other part of the Califor-

nia Building Standards Code, Title 24, the most restrictive requirements shall prevail.

1.1.7.3.1 Detached one- and two-family dwellings. Detached one- and two-family dwellings, lodging houses, live/work units, townhouses not more than three stories above grade plane in height with a separate means of egress, and their accessory structures, may be designed and constructed in accordance with this code or the California Residential Code, but not both, unless the proposed structure(s) or element(s) exceed the design limitations established in the California Residential Code, and the code user is specifically directed by the California Residential Code to use this code.

1.1.8 City, county, or city and county amendments, additions or deletions. The provisions of this code do not limit the authority of city, county, or city and county governments to establish more restrictive and reasonably necessary differences to the provisions contained in this code pursuant to complying with Section 1.1.8.1. The effective date of amendments, additions or deletions to this code by a city, county, or city and county filed pursuant to Section 1.1.8.1 shall be the date filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with Health and Safety Code Section 18941.5 for Building Standards Law, Health and Safety Code Section 17958 for State Housing Law or Health and Safety Code Section 13869.7 for Fire Protection Districts.

1.1.8.1 Findings and filings.

1. The city, county, or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geological conditions.

Exception: Hazardous building ordinances and programs mitigating unreinforced masonry buildings.

2. The city, county, or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties, and fire departments shall file the amendments, additions or deletions, and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.

3. Findings prepared by fire protection districts shall be ratified by the local city, county or city and county and filed with the California Department of Housing and Community Development, Division of Codes and Standards, P.O. Box 278180, Sacramento, CA 95827-8180 or 9342 Tech Center Drive, Suite 500, Sacramento, CA 95826-2582.

1.1.8.2 Locally adopted energy standards—California Energy Code, Part 6.

In addition to the provisions of Section 1.1.8.1 of this part, the provisions of this section shall apply to a city,

county, and cities and counties adopting local energy standards applicable to buildings and structures subject to the California Energy Code, Part 6.

Applicable provisions of Public Resources Code Section 25402.1(h)(2) and applicable provisions of Section 10-106, Chapter 10 of the California Administrative Code, Part 1 apply to locally adopted energy standards amending the California Energy Code, Part 6.

1.1.9 Effective date of this code. Only those standards approved by the California Building Standards Commission that are effective at the time an application for building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the History Note page of this code.

Exceptions:

(1) [HCD 1 & HCD 2] Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.

(2) [HCD 1 & HCD 2] Plans approved by the Department of Housing and Community Development or a Department-approved design approval agency for factory-built housing as defined by Health and Safety Code Section 19971. Approved plans, pursuant to the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, Article 3, Section 3037 remain valid for a period of 36 months from the date of plan approval.

1.1.10 Availability of codes. At least one complete copy each of Titles 8, 19, 20, 24 and 25 with all revisions shall be maintained in the office of the building official responsible for the administration and enforcement of this code. Each state department concerned and each city, county, or city and county shall have an up-to-date copy of the code available for public inspection. See Health and Safety Code Section 18942(e)(1) and (2).

1.1.11 Format. This part fundamentally adopts the International Building Code by reference on a chapter-by-chapter basis. When a specific chapter of the International Building Code is not printed in the code and is marked “Reserved”, such chapter of the International Building Code is not adopted as a portion of this code. When a specific chapter of the International Building Code is marked “Not adopted by the State of California” but appears in the code, it may be available for adoption by local ordinance.

Note: Matrix Adoption Tables at the front of each chapter may aid the code user in determining which chapter or sections within a chapter are applicable to buildings under the authority of a specific state agency, but they are not to be considered regulatory.

1.1.12 Validity. If any chapter, section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, contrary to statute, exceeding the authority of the state as stipulated by statutes or otherwise inoperative, such decision shall not affect the validity of the remaining portion of this code.

SECTION 1.2 BUILDING STANDARDS COMMISSION

1.2.1 BSC. *Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.*

1. State buildings for all occupancies.

Application—State buildings (all occupancies), including buildings constructed by the Trustees of the California State University (CSU) and the Regents of the University of California (UC) where no state agency has the authority to adopt building standards applicable to such buildings.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 18934.5.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

2. University of California, California State Universities and California Community Colleges.

Application—Standards for lighting for parking lots and primary campus walkways at the University of California, California State Universities and California Community Colleges.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Government Code Section 14617.

Reference—Government Code Section 14617.

3. Existing state-owned buildings, including those owned by the University of California and by the California State University.

Application—Building seismic retrofit standards including abating falling hazards of structural and nonstructural components and strengthening of building structures. See also Division of the State Architect.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 16600.

Reference—Health and Safety Code Sections 16600 through 16604.

4. Unreinforced masonry-bearing wall buildings.

Application—Minimum seismic strengthening standards for buildings specified in Appendix Chapter A1 of the California Existing Building Code, except for buildings subject to building standards adopted pursuant to Health and Safety Code (commencing) with Section 17910.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 18934.7.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

1.2.1.1 State building. For purposes of this code, a “state building” is a structure for which a state agency or state entity has authority to construct, alter, enlarge, replace, repair or demolish.

1.2.1.2 Enforcement. [CSU, UC, Judicial Council and California Department of Corrections and Rehabilitation] State agencies or state entities authorized to construct state buildings may appoint a building official who is responsible to the agency for enforcement of the provisions of the California Building Standards Code.

Exception: State buildings regulated by other sections of this code remain the enforcement responsibility of the designated entities.

1.2.1.3 Enforcement. Reserved for DGS.

1.2.1.4 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym **BSC**.

1.2.2 BSC-CG. *Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.*

1. Green buildings standards for nonresidential occupancies.

Application—All occupancies where no state agency has the authority to adopt green building standards applicable to those occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Sections 18930.5(a), 18938 and 18940.5.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

2. Graywater systems for nonresidential occupancies.

Application—The construction, installation and alteration of graywater systems for indoor and outdoor uses in nonresidential occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 18941.8.

Reference—Health and Safety Code Section 18941.8.

1.2.2.1 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym **BSC-CG**.

1.2.3 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of

construction shall be approved where the building official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

1.2.3.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1.2.3.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

**SECTION 1.3
BOARD OF STATE AND
COMMUNITY CORRECTIONS**

1.3.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Local detention facilities.

Enforcing agency—Board of State and Community Corrections.

Authority cited—Penal Code Section 6030; Welfare and Institutions Code Sections 207.1, 210 and 885.

Reference—Penal Code Section 6030; Welfare and Institutions Code Sections 207.1, 210 and 885.

1.3.2 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym BSCC.

**SECTION 1.4
DEPARTMENT OF CONSUMER AFFAIRS**

1.4.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

1. Board of Barbering and Cosmetology.

Application—Any establishment or mobile unit where barbering, cosmetology or electrolysis is being performed.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Business and Professions Code Section 7312.

Reference—Business and Professions Code Sections 7303, 7303.1, 7312 and 7313.

2. Acupuncture Board.

Application—Acupuncture offices.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Business and Professions Code Section 4933.

Reference—Business and Professions Code Sections 4928, 4928.1 and 4933.

3. Board of Pharmacy.

Application—Pharmacies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Business and Professions Code Section 4005.

Reference—Business and Professions Code Sections 4005, 4127.7 and 4201.

4. Veterinary Medical Board.

Application—Veterinary facilities.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Business and Professions Code Section 4808.

Reference—Business and Professions Code Sections 4800, 4800.1, 4808 and 4809.5.

5. Structural Pest Control Board.

Application—Structural pest control locations.

Enforcing agency—Structural Pest Control Board.

Authority cited—Business and Professions Code Section 8525.

Reference—Business and Professions Code Sections 8520, 8520.1 and 8525.

1.4.2 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym CA.

**SECTION 1.5
Reserved**

**SECTION 1.6
DEPARTMENT OF FOOD AND AGRICULTURE**

1.6.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Dairies and places of meat and poultry inspection.

Enforcing agency—Department of Food and Agriculture.

Authority cited—Food and Agricultural Code Sections 18735, 18960, 19384, 33481 and 33731.

Reference—Food and Agricultural Code Sections 18735, 18960, 19384, 33481 and 33731.

1.6.2 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym AGR.

SECTION 1.7

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

1.7.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

California Department of Public Health

Application—Organized camps, laboratory animal quarters, public swimming pools, radiation protection and producing facilities, commissaries serving mobile food preparation vehicles, wild animal quarantine facilities, shellfish facilities and food establishments.

Enforcing agency—The California Department of Public Health and the local health agencies.

Authority cited—Health and Safety Code Sections 1660, 18897.2, 110065, 112165, 113710, 114304, 115061, 116050, 121795 and 131200.

Reference—Health and Safety Code Sections 1650, 1660, 18897.2, 18897.4, 18897.7, 100150, 110065, 113705, 113710, 114825, 114965, 115061, 116050, 116503, 112165, 121795 and 131200.

1.7.2 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym DPH.

SECTION 1.8

DEPARTMENT OF HOUSING AND COMMUNITY DEVELOPMENT

1.8.1 Purpose. The purpose of this code is to establish the minimum requirements necessary to protect the health, safety and general welfare of the occupants and the public by governing accessibility, erection, construction, reconstruction, enlargement, conversion, alteration, repair, moving, removal, demolition, occupancy, use, height, court, area, sanitation, ventilation, maintenance and safety to life and property from fire and other hazards attributed to the built environment.

SECTION 1.8.2

AUTHORITY AND ABBREVIATIONS

1.8.2.1 General. The Department of Housing and Community Development is authorized by law to promulgate and adopt building standards and regulations for several types

of building applications. The applications under the authority of the Department of Housing and Community Development are listed in Sections 1.8.2.1.1 through 1.8.2.1.3.

Note: See the California Residential Code for detached one- and two-family dwellings and townhouses.

1.8.2.1.1 Housing construction.

Application—Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities including accessory buildings, facilities and uses thereto. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 1.”

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17922.15, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Business and Professions Code Division 5; Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 832, 1101.4, 1101.5, 1954.201, 1954.202 and 5551; and Government Code Sections 8698.4, 12955.1 and 12955.1.1. California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.2 Housing accessibility.

Application—Covered multifamily dwellings as defined in Chapter 2 including, but not limited to, lodging houses, dormitories, timeshares, condominiums, shelters for homeless persons, congregate residences, apartments, dwellings, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities.

Sections of this code identified by the abbreviation “HCD 1-AC” require specific accommodations for persons with disabilities as defined in Chapter 2. The application of such provisions shall be in conjunction with other requirements of this code and apply only to newly constructed covered multifamily dwellings as defined in Chapter 2. “HCD 1-AC” applications include, but are not limited to, the following:

1. All newly constructed covered multifamily dwellings as defined in Chapter 2.
2. New common use areas as defined in Chapter 2, serving existing covered multifamily dwellings.

- 3. Additions to existing buildings, where the addition alone meets the definition of covered multifamily dwellings as defined in Chapter 2.
- 4. New common use areas serving new covered multifamily dwellings.
- 5. Where any portion of a building’s exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of Chapter 11A.

“HCD 1-AC” building standards generally do not apply to public use areas or public accommodations such as hotels and motels, and public housing. Public use areas, public accommodations and public housing, as defined in Chapter 2, are subject to the Division of the State Architect (DSA-AC) in Chapter 11B, and are referenced in Section 1.9.1.

Newly constructed covered multifamily dwellings, which can also be defined as public housing, shall be subject to the requirements of Chapter 11A and Chapter 11B.

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Sections 12955.1 and 12955.1.1.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 1101.4, 1101.5, 1954.201 and 1954.202; and Government Code Sections 12955.1 and 12955.1.1. California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.3 Permanent buildings in mobilehome parks and special occupancy parks.

Application—Permanent buildings, and permanent accessory buildings or structures, constructed within mobilehome parks and special occupancy parks that are under the control and ownership of the park operator. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 2.”

Enforcing agency—The Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and Safety Code, Division 13, Part 2.1 commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3 commencing with Section 18860 for special occupancy parks.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17922.15, 17926, 17927, 17928, 17958.12, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1 through 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 1101.4, 1101.5 and 1954.201; and Government Code Sections 12955.1 and 12955.1.1. California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607; and Title 25, Sections 1042 and 2042.

**SECTION 1.8.3
LOCAL ENFORCING AGENCY**

1.8.3.1 Duties and powers. The building department of every city, county, or city and county, shall enforce all the provisions of law, this code and the other rules and regulations promulgated by the Department of Housing and Community Development pertaining to the installation, erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

The provisions regulating the erection and construction of dwellings and appurtenant structures shall not apply to existing structures as to which construction is commenced or approved prior to the effective date of these regulations. Requirements relating to use, maintenance and occupancy shall apply to all dwellings and appurtenant structures approved for construction or constructed before or after the effective date of this code.

For additional information regarding the use and occupancy of existing buildings and appurtenant structures, see California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Article 1, Section 1.

For additional requirements regarding additions, alterations or repairs to existing buildings and appurtenant structures, see the California Existing Building Code.

1.8.3.2 Laws, rules and regulations. Other than the building standards contained in this code, and notwithstanding other provisions of law, the statutory authority and location of the laws, rules and regulations to be enforced by local enforcing agencies are listed by statute in Sections 1.8.3.2.1 through 1.8.3.2.5 below:

1.8.3.2.1 State Housing Law. Refer to the State Housing Law, California Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1, for the erection, construction, reconstruction, movement, enlargement,

conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

1.8.3.2.2 Mobilehome Parks Act. Refer to the Mobilehome Parks Act, California Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000 for mobilehome park administrative and enforcement authority, permits, plans, fees, violations, inspections and penalties both within and outside mobilehome parks.

Exception: Mobilehome parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.3 Special Occupancy Parks Act. Refer to the Special Occupancy Parks Act, California Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000 for special occupancy park administrative and enforcement authority, permits, fees, violations, inspections and penalties both within and outside of special occupancy parks.

Exception: Special occupancy parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.4 Employee Housing Act. Refer to the Employee Housing Act, California Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600 for employee housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

1.8.3.2.5 Factory-Built Housing Law. Refer to the Factory-Built Housing Law, California Health and Safety Code, Division 13, Part 6 commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000 for factory-built housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

SECTION 1.8.4 PERMITS, FEES, APPLICATIONS AND INSPECTIONS

1.8.4.1 Permits. A written construction permit shall be obtained from the enforcing agency prior to the erection, construction, reconstruction, installation, moving or alteration of any building or structure.

Exceptions:

1. Work exempt from permits as specified in Chapter 1, Division II, Scope and Administration, Section 105.2.
2. Changes, alterations or repairs of a minor nature not affecting structural features, egress, sanitation, safety or accessibility as determined by the enforcing agency.

3. Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.

Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of other provisions of law or this code.

1.8.4.2 Fees. Subject to other provisions of law, the governing body of any city, county, or city and county, may prescribe fees to defray the cost of enforcement of rules and regulations promulgated by the Department of Housing and Community Development. The amount of the fees shall not exceed the amount reasonably necessary to administer or process permits, certificates, forms or other documents, or to defray the costs of enforcement. For additional information, see the State Housing Law, Health and Safety Code, Division 13, Part 1.5, Section 17951 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, Article 3, commencing with Section 6.

1.8.4.3 Plan review and time limitations. Subject to other provisions of law, provisions related to plan checking, prohibition of excessive delays and contracting with or employment of private parties to perform plan checking are set forth in the State Housing Law, Health and Safety Code Section 17960.1, and for employee housing, in Health and Safety Code Section 17021.

1.8.4.3.1 Retention of plans. The building department of every city, county, or city and county shall maintain an official copy, microfilm, electronic or other type of photographic copy of the plans of every building, during the life of the building, for which the department issued a building permit.

Exceptions:

1. Single or multiple dwellings not more than two stories and basement in height.
2. Garages and other structures appurtenant to buildings listed in Exception 1.
3. Farm or ranch buildings appurtenant to buildings listed in Exception 1.
4. Any one-story building where the span between bearing walls does not exceed 25 feet (7620 mm), except a steel frame or concrete building.

All plans for common interest developments as defined in Section 4100 of the California Civil Code shall be retained. For additional information regarding plan retention and reproduction of plans by an enforcing agency, see Health and Safety Code Sections 19850 through 19852.

1.8.4.4 Inspections. Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or other regulations of the Department of Housing and Community Development. Required inspections are listed in Chapter 1, Division II, Scope and Administration, Sections 110.3.1, 110.3.2, 110.3.3, 110.3.4, 110.3.4.1, 110.3.5, 110.3.6, 110.3.7, 110.3.9, 110.3.10, 110.3.11, 110.3.11.1 and 110.3.11.2.

SECTION 1.8.5 RIGHT OF ENTRY FOR ENFORCEMENT

1.8.5.1 General. Subject to other provisions of law, officers and agents of the enforcing agency may enter and inspect public and private properties to secure compliance with the rules and regulations promulgated by the Department of Housing and Community Development. For limitations and additional information regarding enforcement, see the following:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

SECTION 1.8.6 LOCAL MODIFICATION BY ORDINANCE OR REGULATION

1.8.6.1 General. Subject to other provisions of law, a city, county, or city and county may make changes to the provisions adopted by the Department of Housing and Community Development. If any city, county, or city and county does not amend, add or repeal by local ordinances or regulations the provisions published in this code or other regulations promulgated by the Department of Housing and Community Development, those provisions shall be applicable and shall become effective 180 days after publication by the California Building Standards Commission. Amendments, additions and deletions to this code adopted by a city, county, or city and county pursuant to California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, together with all applicable portions of this code, shall also become effective 180

days after publication of the California Building Standards Code by the California Building Standards Commission.

1.8.6.2 Findings, filings and rejections of local modifications. Prior to making any modifications or establishing more restrictive building standards, the governing body shall make express findings and filings, as required by California Health and Safety Code Section 17958.7, showing that such modifications are reasonably necessary due to local climatic, geological or topographical conditions. No modification shall become effective or operative unless the following requirements are met:

1. The express findings shall be made available as a public record.
2. A copy of the modification and express finding, each document marked to cross-reference the other, shall be filed with the California Building Standards Commission for a city, county, or city and county and with the Department of Housing and Community Development for fire protection districts.
3. The California Building Standards Commission has not rejected the modification or change.

Nothing in this section shall limit the authority of fire protection districts pursuant to California Health and Safety Code Section 13869.7(a).

SECTION 1.8.7 ALTERNATE MATERIALS, DESIGNS, TESTS AND METHODS OF CONSTRUCTION

1.8.7.1 General. The provisions of this code, as adopted by the Department of Housing and Community Development, are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, design or method of construction not specifically prescribed by this code. Consideration and approval of alternates shall comply with Section 1.8.7.2 for local building departments and Section 1.8.7.3 for the Department of Housing and Community Development.

1.8.7.2 Local building departments. The building department of any city, county, or city and county may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses, dwellings or accessory structures, except for the following:

1. Structures located in mobilehome parks as defined in California Health and Safety Code Section 18214.
2. Structures located in special occupancy parks as defined in California Health and Safety Code Section 18862.43.
3. Factory-built housing as defined in California Health and Safety Code Section 19971.

1.8.7.2.1 Approval of alternates. The consideration and approval of alternates by a local building department shall comply with the following procedures and limitations:

1. The approval shall be granted on a case-by-case basis.

2. Evidence shall be submitted to substantiate claims that the proposed alternate, in performance, safety and protection of life and health, conforms to, or is at least equivalent to, the standards contained in this code and other rules and regulations promulgated by the Department of Housing and Community Development.
3. The local building department may require tests performed by an approved testing agency at the expense of the owner or owner's agent as proof of compliance.
4. If the proposed alternate is related to accessibility in covered multifamily dwellings or in facilities serving covered multifamily dwellings as defined in Chapter 2, the proposed alternate must also meet the threshold set for equivalent facilitation as defined in Chapter 2.

For additional information regarding approval of alternates by a building department pursuant to the State Housing Law, see California Health and Safety Code Section 17951(e) and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

1.8.7.3 Department of Housing and Community Development. The Department of Housing and Community Development may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal or demolition of apartments, condominiums, hotels, motels, lodging houses, dwellings or an accessory thereto and permanent buildings in mobilehome parks and special occupancy parks. The consideration and approval of alternates shall comply with the following:

1. The department may require tests at the expense of the owner or owner's agent to substantiate compliance with the California Building Standards Code.
2. The approved alternate shall, for its intended purpose, be at least equivalent in performance and safety to the materials, designs, tests or methods of construction prescribed by this code.

SECTION 1.8.8 APPEALS BOARD

1.8.8.1 General. Every city, county, or city and county shall establish a process to hear and decide appeals of orders, decisions and determinations made by the enforcing agency relative to the application and interpretation of this code and other regulations governing construction, use, maintenance and change of occupancy. The governing body of any city, county, or city and county may establish a local appeals board and a housing appeals board to serve this purpose. Members of the appeals board(s) shall not be employees of the enforcing agency and shall be knowledgeable in the applicable building codes, regulations and ordinances as determined by the governing body of the city, county, or city and county.

Where no such appeals boards or agencies have been established, the governing body of the city, county, or city

and county shall serve as the local appeals board or housing appeals board as specified in California Health and Safety Code Sections 17920.5 and 17920.6.

1.8.8.2 Definitions. The following terms shall for the purposes of this section have the meaning shown.

HOUSING APPEALS BOARD. The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the requirements of the city, county, or city and county relating to the use, maintenance and change of occupancy of buildings and structures, including requirements governing alteration, additions, repair, demolition and moving. In any area in which there is no such board or agency, "Housing appeals board" means the local appeals board having jurisdiction over the area.

LOCAL APPEALS BOARD. The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the building requirements of the city, county, or city and county. In any area in which there is no such board or agency, "Local appeals board" means the governing body of the city, county, or city and county having jurisdiction over the area.

1.8.8.3 Appeals. Except as otherwise provided in law, any person, firm or corporation adversely affected by a decision, order or determination by a city, county, or city and county relating to the application of building standards published in the California Building Standards Code, or any other applicable rule or regulation adopted by the Department of Housing and Community Development, or any lawfully enacted ordinance by a city, county, or city and county, may appeal the issue for resolution to the local appeals board or housing appeals board as appropriate.

The local appeals board shall hear appeals relating to new building construction and the housing appeals board shall hear appeals relating to existing buildings.

SECTION 1.8.9 UNSAFE BUILDINGS OR STRUCTURES

1.8.9.1 Authority to enforce. Subject to other provisions of law, the administration, enforcement, actions, proceedings, abatement, violations and penalties for unsafe buildings and structures are contained in the following statutes and regulations:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1. For enforcement related to accessory dwelling units, see Section 17980.12 operative until January 1, 2035.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of

Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.

3. *For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.*
4. *For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.*
5. *For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.*

1.8.9.2 Actions and proceedings. *Subject to other provisions of law, punishments, penalties and fines for violations of building standards are contained in the following statutes and regulations:*

1. *For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.*
2. *For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.*
3. *For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.*
4. *For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.*
5. *For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.*

SECTION 1.8.10 OTHER BUILDING REGULATIONS

1.8.10.1 Existing structures. *Notwithstanding other provisions of law, the replacement, retention and extension of original materials and the use of original methods of construction for any existing building or accessory structure, or portions thereof, shall be permitted in accordance with the provisions of this code and the California Existing Building Code, as adopted by the Department of Housing and Community Development. For additional information, see California Health and Safety Code, Sections 17912, 17920.3, 17922 and 17958.8.*

1.8.10.2 Moved structures. *Subject to the requirements of California Health and Safety Code Sections 17922, 17922.3 and 17958.9, local ordinances or regulations relating to a moved residential building or accessory structure thereto, shall permit the replacement, retention and extension of original materials and the use of original methods of construction so long as the structure does not become or continue to be a substandard building.*

SECTION 1.9 DIVISION OF THE STATE ARCHITECT

1.9.1 Division of the State Architect—Access Compliance.

General. *The purpose of this code is to ensure that barrier-free design is incorporated in all buildings, facilities, site work and other improvements to which this code applies in compliance with state law to ensure that these improvements are accessible to and usable by persons with disabilities. Additions, alterations and structural repairs in all buildings and facilities shall comply with these provisions for new buildings, except as otherwise provided and specified herein.*

The provisions of these regulations shall apply to any portable buildings leased or owned by a school district, and shall also apply to temporary and emergency buildings and facilities. Temporary buildings and facilities are not of permanent construction but are extensively used or are essential for public use for a period of time. Examples of temporary buildings or facilities covered include, but are not limited to: reviewing stands, temporary classrooms, bleacher areas, exhibit areas, temporary banking facilities, temporary health screening services or temporary safe pedestrian passageways around a construction site.

In addition, to incorporate standards at least as restrictive as those required by the federal government for barrier-free design under (1) Title III (Public Accommodations and Commercial Facilities), Subpart D (New Construction and Alteration) (see 28 C.F.R., Part 36), and (2) Title II (Public Entities), Section 35.151 (New Construction and Alterations) (see 28 C.F.R., Part 35) both from the Americans with Disabilities Act of 1990, 2004 Americans with Disabilities Act Accessibility Guidelines, as adopted by the U.S. Department of Justice (see 36 C.F.R. Part 1191, Appendices B and D), and (3) under the Fair Housing Amendments Act of 1988.

Some of these regulations may be more stringent than state law in order to meet the federal requirement.

1.9.1.1 Application. See Government Code commencing with Section 4450.

Publicly funded buildings, structures, sidewalks, curbs and related facilities shall be accessible to and usable by persons with disabilities as follows:

1.9.1.1.1 All buildings, structures, sidewalks, curbs and related facilities constructed in the state by the use of state, county or municipal funds, or the funds of any political subdivision of the state. For public housing see Section 1.9.1.3.

1.9.1.1.2 All buildings, structures and facilities that are leased, rented, contracted, sublet or hired by any municipal, county or state division of government, or by a special district. For public housing see Section 1.9.1.3.

1.9.1.1.3 All existing publicly funded buildings and facilities when alterations, structural repairs or additions are made to such buildings or facilities. For detailed requirements on existing buildings, see Chapter 11B, Division 2, Section 11B-202. For public housing see Section 1.9.1.3.

1.9.1.1.4 With respect to buildings, structures, sidewalks, curbs and related facilities not requiring a building permit, building standards published in the California Building Standards Code relating to access for persons with disabilities and other regulations adopted pursuant to Government Code Section 4450, and in effect at the time construction is commenced, shall be applicable.

1.9.1.2 Application. See Health and Safety Code commencing with Section 19952.

All privately funded public accommodations, as defined, and commercial facilities, as defined, shall be accessible to persons with disabilities as follows:

Exception: Certain types of privately funded multistory buildings do not require installation of an elevator to provide access above and below the first floor. See Chapter 11B.

1.9.1.2.1 Any building, structure, facility, complex or improved area, or portions thereof, which are used by the general public.

1.9.1.2.2 Any sanitary facilities which are made available for the public, clients or employees in such accommodations or facilities.

1.9.1.2.3 Any curb or sidewalk intended for public use that is constructed in this state with private funds.

1.9.1.2.4 All existing privately funded public accommodations when alterations, structural repairs or additions are made to such public accommodations as set forth under Chapter 11B.

1.9.1.3 Application—Public housing. See Government Code Section 12955.1(c) and the definition for public housing in Chapter 2.

1.9.1.4 Enforcing agency.

1.9.1.4.1 The director of the Department of General Services where state funds are utilized for any project or where funds of counties, municipalities or other political subdivisions are utilized for the construction of elementary, secondary or community college projects.

1.9.1.4.2 The governing bodies where funds of counties, municipalities or other political subdivisions are utilized except as otherwise provided above.

1.9.1.4.3 The building department of every city, county or city and county within the territorial area of its city, county or city and county, where private funds are utilized. “Building department” means the department, bureau or officer charged with the enforcement of laws or ordinances regulating the erection or construction, or both the erection and construction, of buildings.

1.9.1.5 Special conditions for persons with disabilities requiring appeals action ratification. Whenever reference is made in these regulations to this section, the findings and determinations required to be rendered by the local enforcing agency shall be subject to ratification through an appeals process.

1.9.1.6 Authority cited—Government Code Section 4450.

1.9.1.7 Reference cited—Government Code Sections 4450 through 4461 and 12955.1(c) and Health and Safety Code Sections 18949.1, 19952 through 19959.

1.9.1.8 Adopting agency identification. The provisions of this code applicable to buildings identified in this Subsection 1.9.1 will be identified in the Matrix Adoption Tables under the acronym DSA-AC.

1.9.2 Division of the State Architect—Structural Safety.

1.9.2.1 DSA-SS Division of the State Architect-Structural Safety.

Application—Public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

Enforcing agency—The Division of the State Architect—Structural Safety (DSA-SS) has been delegated the responsibility and authority by the Department of General Services to review and approve the design and observe the construction of public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

Authority cited—Education Code Sections 17310 and 81142 and Health and Safety Code Section 16022.

Reference—Education Code Sections 17280 through 17317, and 81130 through 81147 and Health and Safety Code Sections 16000 through 16023.

1.9.2.1.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations:

- 1.1. Sections 4-301 through 4-355, Group 1, and Sections 4-401 through 4-435, Group 2, Chapter 4 for public elementary and secondary schools and community colleges.

1.2. Sections 4-201 through 4-249, Chapter 4, for state-owned or state-leased essential services buildings.

2. **Title 24, Part 2, California Code of Regulations:** [applies to public elementary and secondary schools, community colleges and state-owned or state-leased essential services building(s)]:

2.1. Sections 1.1 and 1.9.2.1 of Chapter 1, Division I.

2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 104.9, 104.10, 104.11, 106.1, 107.2.5 and 110.3.6 of Chapter 1, Division II.

1.9.2.1.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, California Code of Regulations, for school buildings, community colleges and state-owned or state-leased essential service buildings.

The provisions of Title 24, Part 2, as adopted and amended by the Division of the State Architect—Structural Safety, shall apply to the applications listed in Section 1.9.2.1.

The Division of the State Architect—Structural Safety adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33 and 35.

1.9.2.1.3 Amendments. Division of the State Architect—Structural Safety amendments in this code appear preceded with the acronym [DSA-SS].

Exception: Chapters 16A, 17A, 18A, 19A, 21A and 22A—Amendments appearing in these chapters without an acronym have been co-adopted by DSA-SS and OSHPD.

1.9.2.1.4 Reference to other chapters. Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21 and 22, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A shall apply instead.

1.9.2.2 DSA-SS/CC Division of the State Architect—Structural Safety/Community Colleges

Application—Community Colleges. The Division of the State Architect has been delegated the authority by the Department of General Services to promulgate alternate building standards for application to community colleges, which a community college may elect to use in lieu of standards promulgated by DSA-SS in accordance with Section 1.9.2.1.

Enforcing agency—Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC)

The Division of the State Architect has been delegated the authority by the Department of General Services to review and approve the design and oversee construction of community colleges electing to use the alternative building standards as provided in this section.

Authority cited—Education Code Section 81053.

Reference—Education Code Sections 81052, 81053 and 81130 through 81147.

1.9.2.2.1 Applicable administrative standards.

1. **Title 24, Part 1, California Code of Regulations:**

1.1. Sections 4-301 through 4-355, Group 1, and Sections 4-401 through 4-435, Group 2, Chapter 4.

2. **Title 24, Part 2, California Code of Regulations:**

2.1. Sections 1.1 and 1.9.2 of Chapter 1, Division I.

2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 104.9, 104.10, 104.11, 106.1, 107.2.5 and 110.3.6 of Chapter 1, Division II.

1.9.2.2.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, California Code of Regulations.

The Division of the State Architect—Structural Safety/Community Colleges [DSA-SS/CC] adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17A, 18A, 19, 20, 21, 22, 23, 24, 25, 26, 30, 31, 32, 33 and 35.

1.9.2.2.3 Amendments. Division of the State Architect—Structural Safety/Community Colleges amendments in this code appear preceded with the acronym [DSA-SS/CC].

Exception: Chapters 17A, and 18A—Amendments appearing in these chapters without an acronym have been co-adopted by DSA-SS, DSA-SS/CC and OSHPD.

1.9.2.2.4 Reference to other chapters. Where reference is made within this code to sections in Chapters 17 and 18, the respective sections in Chapters 17A and 18A shall apply instead.

SECTION 1.10 OFFICE OF STATEWIDE HEALTH PLANNING AND DEVELOPMENT

1.10.1 OSHPD 1 and OSHPD 1R. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—[OSHPD 1] General acute care hospital buildings. [OSHPD 1R] Nonconforming hospital SPC or freestanding buildings that have been removed from acute-care service.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above stated facility types.

1.10.1.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapters 6 and 7.

2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.1.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.1.

OSHPD 1 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33, 35 and Appendix L.

OSHPD 1R adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 30, 31, 32, 33 and 35.

1.10.1.3 Identification of amendments. For applications listed in Section 1.10.1, amendments appear in this code preceded with the acronym [OSHPD 1], unless the entire chapter is applicable. For nonconforming hospital buildings removed from acute-care service, amendments are preceded with the acronym [OSHPD 1R].

1.10.1.4 Reference to other chapters. Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21 and 22, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A shall apply instead for hospital buildings under OSHPD 1.

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 19958, 127010, 127015, 129680, 1275 and 129675 through 130070.

1.10.2 OSHPD 2, 2A and 2B. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—[OSHPD 2A] Skilled nursing facility and intermediate care facility buildings of single-story, wood-frame or light steel frame construction or buildings of single-story, wood-frame or light steel frame construction where only skilled nursing or intermediate care services are provided if the building is separated from a building housing other patients of the health facility receiving higher levels of care. [OSHPD 2B] Skilled nursing facility and intermediate care facility buildings of all other types. [OSHPD 2] The OSHPD 2 designation applies to both 2A and 2B.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility type.

1.10.2.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.

2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.2.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.2.

OSHPD 2 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 30, 31, 32, 33 and 35.

1.10.2.3 Identification of amendments. For applications listed in Section 1.10.2, amendments appear in this code preceded with the acronym [OSHPD 2].

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 127010, 127015, 1275 and 129680.

1.10.3 OSHPD 3. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Licensed clinics and any freestanding building under a hospital license where outpatient clinical services are provided.

Enforcing agency—Local building department.

1.10.3.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.

2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.3.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.3.

OSHPD 3 adopts the following building standards in Title 24, Part 2:

Chapter 12.

1.10.3.3 Identification of amendments. For applications listed in Section 1.10.3, amendments appear in this code without the acronym [OSHPD 3]. Adoptions are shown in the adoption matrix.

Authority—Health and Safety Code Sections 127010, 127015 and 1226.

References—Health and Safety Code Sections 127010, 127015, 129885 and 1226, Government Code Section 54350 and State Constitution Article 11, Section 7.

1.10.4 OSHPD 4. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Correctional treatment centers.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

1.10.4.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.4.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.4.

OSHPD 4 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16A, 17A, 18A, 19A, 20, 21A, 22A, 23, 24, 25, 26, 30, 31, 32, 33, 35 and Appendix L.

1.10.4.3 Identification of amendments. For applications listed in Section 1.10.4, amendments appear in this code preceded with the acronym [OSHPD 4], unless the entire chapter is applicable.

1.10.4.4 Reference to other chapters. Where reference is made within this code to sections in Chapters 16, 17, 18, 19, 21 and 22, the respective sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A shall apply instead.

Authority—Health and Safety Code Sections 127010, 127015 and 129790.

References—Health and Safety Code Sections 127010, 127015, 1275 and 129675 through 130070.

1.10.5 OSHPD 5. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Acute psychiatric hospital buildings.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect – Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility type.

1.10.5.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.5.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provision of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.5.

OSHPD 5 adopts the following building standards in Title 24, Part 2:

Chapters 2 through 10, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 30, 32 and 33.

1.10.5.3 Identification of amendments. For applications listed in Section 1.10.5, amendments appear in this code preceded with the acronym [OSHPD 5].

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 127010, 127015, 129680, 1275 and 129675 through 130070.

SECTION 1.11

OFFICE OF THE STATE FIRE MARSHAL

1.11.1 SFM—Office of the State Fire Marshal. Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application:

Institutional, educational or any similar occupancy. Any building or structure used or intended for use as an asylum, jail, prison, mental hospital, hospital, sanitarium, home for the elderly, children’s nursery, children’s home or institution, school or any similar occupancy of any capacity.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Assembly or similar place of assemblage. Any theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Small family day-care homes.

Authority cited—Health and Safety Code Sections 1597.45, 1597.54, 13143 and 17921.

Reference—Health and Safety Code Section 13143.

Large family day-care homes.

Authority cited—Health and Safety Code Sections 1597.46, 1597.54 and 17921.

Reference—Health and Safety Code Section 13143.

Residential facilities and residential facilities for the elderly.

Authority cited—Health and Safety Code Section 13133.

Reference—Health and Safety Code Section 13143.

Any state institution or other state-owned or specified state-occupied building.

Specified state-occupied buildings. Any building, structure or area that meets any of the following criteria:

1. A building where the state has contracted into a build-to-suit lease.
2. A courthouse holding facility or trial court with a detention area.
3. A building used by the Department of Corrections and Rehabilitation CDCR) as a community correctional reentry center.
4. 100 percent state occupied.
5. State-occupied areas in a state-leased building that is a high-rise and is 75 percent of the net area floor space or more occupied by state entities.
6. State-occupied areas in a building that contains 5,000 square feet (465 m²) or more space of state-leased Group H or Group L occupancy.
7. A state-leased building with facilities with the primary purpose of housing state records and/or state artifacts of historical significance.
8. Properties leased by California State University (CSU) or University of California (UC).
9. State institutions and their real property.
10. CAL FIRE occupied areas in leased buildings.
11. State-leased facilities where the governing body's fire protection services rely on an all-volunteer fire department.

Except as provided in Items 1 through 11, buildings shall become the responsibility of the local jurisdiction.

Authority cited—Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921.

Reference—Health and Safety Code Sections 13108, 13143, 13145, 13146, 16022.5 and 17921.

High-Rise structures.

Authority cited—Health and Safety Code Section 13211.

Reference—Health and Safety Code Section 13143.

Motion picture production studios.

Authority cited—Health and Safety Code Section 13143.1.

Reference—Health and Safety Code Section 13143.

Organized camps.

Authority cited—Health and Safety Code Section 18897.3.

Reference—Health and Safety Code Section 13143.

Residential. All hotels, motels, lodging houses, apartment houses and dwellings, including congregate residences and buildings and structures accessory thereto.

Multiple-story structures existing on January 1, 1975, let for human habitation, including and limited to, hotels, motels and apartment houses, less than 75 feet (22 860 mm) above the lowest floor level having building access, wherein rooms used for sleeping are let above the ground floor.

Authority cited—Health and Safety Code Sections 13143.2 and 17921.

Reference—Health and Safety Code Section 13143.

Residential care facilities. Certified family care homes, out-of-home placement facilities, halfway houses, drug and/or alcohol rehabilitation facilities and any building or structure used or intended for use as a home or institution for the housing of any person of any age when such person is referred to or placed within such home or institution for protective social care and supervision services by any governmental agency.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Tents, awnings or other fabric enclosures used in connection with any occupancy.

Authority cited—Health and Safety Code Section 13116.

Reference—Health and Safety Code Section 13143.

Fire alarm devices, equipment and systems in connection with any occupancy.

Authority cited—Health and Safety Code Section 13114.

Reference—Health and Safety Code Section 13143.

Hazardous materials.

Authority cited—Health and Safety Code Section 13143.9.

Reference—Health and Safety Code Section 13143.

Flammable and combustible liquids.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Public School Automatic Fire Detection, Alarm and Sprinkler Systems.

Authority cited—Health and Safety Code Section 13143 and California Education Code Article 7.5, Sections 17074.50, 17074.52 and 17074.54.

Reference—Government Code Section 11152.5, Health and Safety Code Section 13143 and California Education Code Chapter 12.5, Leroy F. Greene School Facilities Act of 1998, Article 1.

Wildland-Urban Interface Fire Area.

Authority cited—Health and Safety Code Sections 13143, 13108.5(a) and 18949.2(b) and (c) and Government Code Section 51189.

Reference—Health and Safety Code Sections 13143, Government Code Sections 51176, 51177, 51178 and 51179 and Public Resources Code Sections 4201 through 4204.

1.11.1.1 Adopting agency identification. *The provisions of this code applicable to buildings identified in this Sub-section 1.11.1 will be identified in the Matrix Adoption Tables under the acronym SFM.*

1.11.2 Duties and powers of the enforcing agency.

1.11.2.1 Enforcement.

1.11.2.1.1 *The responsibility for enforcement of building standards adopted by the State Fire Marshal and published in the California Building Standards Code relating to fire and panic safety and other regulations of the State Fire Marshal shall, except as provided in Section 1.11.2.1.2, be as follows:*

1. *The city, county or city and county with jurisdiction in the area affected by the standard or regulation shall delegate the enforcement of the building standards relating to fire and panic safety and other regulations of the State Fire Marshal as they relate to Group R-3 occupancies, as described in Section 310.1 of Part 2 of the California Building Standards Code, to either of the following:*
 - 1.1. *The chief of the fire authority of the city, county or city and county, or an authorized representative.*
 - 1.2. *The chief building official of the city, county or city and county, or an authorized representative.*
2. *The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.*
3. *The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.*
4. *The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.*
5. *Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.*

1.11.2.1.2 *Pursuant to Health and Safety Code Section 13108, and except as otherwise provided in this section, building standards adopted by the State Fire Marshal published in the California Building Standards Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings and state institutions throughout the state. Upon the written request of the chief fire*

official of any city, county or fire protection district, the State Fire Marshal may authorize such chief fire official and his or her authorized representatives, in their geographical area of responsibility, to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.

Pursuant to Health and Safety Code Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

1.11.2.1.3 *Pursuant to Health and Safety Code Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than \$100.00 or more than \$500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.*

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

1.11.2.2 Right of entry. *The fire chief of any city, county or fire protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of preparing a fire suppression preplanning program or for the purpose of investigating any fire in a state-occupied building.*

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department

or fire protection district and his or her authorized representatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

1.11.2.3 More restrictive fire and panic safety building standards.

1.11.2.3.1 Any fire protection district organized pursuant to Health and Safety Code Part 2.7 (commencing with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to Section 1.1.8.1.

1.11.2.3.2 Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 1.11.2.3.1, to the city, county, or city and county where the ordinance will apply. The city, county, or city and county may provide the district with written comments, which shall become part of the fire protection district's public hearing record.

1.11.2.3.3 The fire protection district shall transmit the adopted ordinance to the city, county, or city and county where the ordinance will apply. The legislative body of the city, county, or city and county may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county, or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county or city and county shall file a copy of the findings of the district, and any findings of the city, county, or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 1.1.8.1(3).

1.11.2.4 Request for alternate means of protection. Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall

be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in Title 19, California Code of Regulation, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

1.11.2.5 Appeals. When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.

1.11.3 Construction documents.

1.11.3.1 Public schools. Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.

1.11.3.2 Movable walls and partitions. Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.

1.11.3.3 New construction high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.
2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to

perform such services. Administration of the work of construction shall be under the charge of the responsible architect or engineer except that where plans and specifications involve alterations or repairs, such work of construction may be administered by an engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 65700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications and estimates and work of construction are applicable.

This section shall not be construed as preventing the design of fire-extinguishing systems by persons holding a C-16 license issued pursuant to Division 3, Chapter 9, Business and Professions Code. In such instances, however, the responsibility charge of this section shall prevail.

1.11.3.4 Existing high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required by California Fire Code Chapter 11 and California Existing Building Code for existing high-rise buildings. Such plans or specifications shall be submitted to the enforcing agency having jurisdiction.
2. When new construction is required to conform with the provisions of these regulations, complete plans or specifications, or both, shall be prepared in accordance with the provisions of this subsection. As used in this section, "new construction" is not intended to include repairs, replacements or minor alterations which do not disrupt or appreciably add to or affect the structural aspects of the building.

1.11.3.5 Retention of plans. Refer to Building Standards Law, Health and Safety Code Sections 19850 and 19851 for permanent retention of plans.

1.11.4 Fees.

1.11.4.1 Other fees. Pursuant to Health and Safety Code Section 13146.2, a city, county or district which inspects a hotel, motel, lodging house or apartment house may charge and collect a fee for the inspection from the owner of the structure in an amount, as determined by the city, county or district, sufficient to pay its costs of that inspection.

1.11.4.2 Large family day-care. Pursuant to Health and Safety Code Section 1597.46, Large Family Day-Care Homes, the local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process.

1.11.4.3 High-Rise. Pursuant to Health and Safety Code Section 13217, High-Rise Structure Inspection: Fees and costs, a local agency which inspects a high-rise structure pursuant to Health and Safety Code Section 13217 may charge and collect a fee for the inspection from the owner of the high-rise structure in an amount, as determined by the local agency, sufficient to pay its costs of that inspection.

1.11.4.4 Fire clearance preinspection. Pursuant to Health and Safety Code Section 13235, Fire Clearance Preinspection, fee, upon receipt of a request from a prospective licensee of a community care facility, as defined in Section 1502, of a residential care facility for the elderly, as defined in Section 1569.2, or of a child day care facility, as defined in Section 1596.750, the local fire enforcing agency, as defined in Section 13244, or State Fire Marshal, whichever has primary jurisdiction, shall conduct a preinspection of the facility prior to the final fire clearance approval. At the time of the preinspection, the primary fire enforcing agency shall price consultation and interpretation of the fire safety regulations and shall notify the prospective licensee of the facility in writing of the specific fire safety regulations which shall be enforced in order to obtain fire clearance approval. A fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility.

1.11.4.5 Care facilities. The primary fire enforcing agency shall complete the final fire clearance inspection for a community care facility, residential care facility for the elderly, or child day care facility within 30 days of receipt of the request for the final inspection, or as of the date the prospective facility requests the final preclearance inspection by the State Department of Social Services, whichever is later.

Pursuant to Health and Safety Code Section 13235, a preinspection fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility.

Pursuant to Health and Safety Code Section 13131.5, a reasonable final inspection fee, not to exceed the actual cost of inspection services necessary to complete a final inspection may be charged for occupancies classified as residential care facilities for the elderly (RCFE).

Pursuant to Health and Safety Code Section 1569.84, neither the State Fire Marshal nor any local public entity shall charge any fee for enforcing fire inspection regulations pursuant to state law or regulation or local ordinance, with respect to residential care facilities for the elderly (RCFE) which service six or fewer persons.

1.11.4.6 Requests of the Office of the State Fire Marshal. Whenever a local authority having jurisdiction requests that the State Fire Marshal perform plan review and/or inspection services related to a building permit, the applicable fees for such shall be payable to the Office of the State Fire Marshal.

1.11.5 Inspections. Work performed subject to the provisions of this code shall comply with the inspection requirements of Sections 110.1, 110.3, 110.3.4, 110.3.5, 110.3.6, 110.3.8, 110.3.9, 110.3.10, 110.5 and 110.6 as adopted by the Office of the State Fire Marshal.

1.11.5.1 Existing Group I-1 or R occupancies. Licensed 24-hour care in a Group I-1 or R occupancy in existence and originally classified under previously adopted state codes shall be reinspected under the appropriate previous code, provided there is no change in the use or character which would place the facility in a different occupancy group.

SCOPE AND ADMINISTRATION

1.11.6 Certificate of Occupancy. A Certificate of Occupancy shall be issued as specified in Section 111.

Exception: Certificates of occupancy are not required for work exempt from permits in accordance with Section 105.2 of the California Building Code.

1.11.7 Temporary structures and uses. See Section 108.

1.11.8 Service utilities. See Section 112.

1.11.9 Stop work order. See Section 115.

1.11.10 Unsafe buildings, structures and equipment. See Section 116.

1.11.11 Adopting Agency Identification. The provisions of this code applicable to buildings identified in this Section 1.11 will be identified in the Matrix Adoption Tables under the acronym SFM.

SECTION 1.12 STATE LIBRARIAN

1.12.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Public library construction and renovation using funds from the California Library Construction and Renovation Bond Act of 1988.

Enforcing agency—State librarian.

Authority cited—Education Code Sections 19950 through 19981.

Reference—Education Code Sections 19950 through 19981.

SECTION 1.13 DEPARTMENT OF WATER RESOURCES Reserved

SECTION 1.14 CALIFORNIA STATE LANDS COMMISSION

1.14.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Marine oil terminals.

Enforcing agency—California State Lands Commission.

Authority cited—Public Resources Code Section 8755.

Reference—Public Resources Code Section 8755.

DIVISION II

SCOPE AND ADMINISTRATION

User notes:

About this chapter: Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts: Part 1—Scope and Application (Sections 101–102) and Part 2—Administration and Enforcement (Sections 103–116). Section 101 identifies which buildings and structures come under its purview and references other I-Codes as applicable. Standards and codes are scoped to the extent referenced (see Section 102.4).

This code is intended to be adopted as a legally enforceable document and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner. Chapter 1 is largely concerned with maintaining “due process of law” in enforcing the building performance criteria contained in the body of the code.

Code development reminder: Code change proposals to this chapter will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

Note: Sections adopted or amended by state agencies are specifically indicated by an agency banner.

PART 1—SCOPE AND APPLICATION

SECTION 101 SCOPE AND GENERAL REQUIREMENTS

[A] **101.1 Title.** These regulations shall be known as the *Building Code* of [NAME OF JURISDICTION], hereinafter referred to as “this code.”

[A] **101.2 Scope.** The provisions of this code shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

Exception: Detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above *grade plane* in height, shall comply with this code or the *California Residential Code*.

[A] **101.2.1 Appendices.** Provisions in the appendices shall not apply unless specifically adopted.

[A] **101.3 Purpose.** The purpose of this code is to establish the minimum requirements to provide a reasonable level of safety, health and general welfare through structural strength, means of egress, stability, sanitation, light and ventilation, energy conservation, and for providing a reasonable level of life safety and property protection from the hazards of fire, explosion or dangerous conditions, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

[A] **101.4 Referenced codes.** The other codes specified in Sections 101.4.1 through 101.4.7 and referenced elsewhere in this code shall be considered to be part of the requirements of this code to the prescribed extent of each such reference.

[A] **101.4.1 Gas.** The provisions of the *California Mechanical Code* shall apply to the installation of gas

pipng from the point of delivery, gas appliances and related accessories as covered in this code. These requirements apply to gas piping systems extending from the point of delivery to the inlet connections of appliances and the installation and operation of residential and commercial gas appliances and related accessories.

[A] **101.4.2 Mechanical.** The provisions of the *California Mechanical Code* shall apply to the installation, alterations, repairs and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

[A] **101.4.3 Plumbing.** The provisions of the *California Plumbing Code* shall apply to the installation, *alteration, repair* and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances, and where connected to a water or sewage system and all aspects of a medical gas system. The provisions of the *California Plumbing Code* shall apply to private sewage disposal systems.

[A] **101.4.4 Property maintenance.** The provisions of the *California Existing Building Code* shall apply to existing structures and premises; equipment and facilities; light, ventilation, space heating, sanitation, life and fire safety hazards; responsibilities of owners, operators and occupants; and occupancy of existing premises and structures.

[A] **101.4.5 Fire prevention.** The provisions of the *California Fire Code* shall apply to matters affecting or relating to structures, processes and premises from the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices; from conditions hazardous to life, property or public welfare in the occupancy of structures or premises; and from the construction, extension, repair, alteration or removal of fire suppression, automatic sprinkler systems and alarm systems or fire hazards in the structure or on the premises from occupancy or operation.

[A] **101.4.6 Energy.** The provisions of the *California Energy Code* shall apply to all matters governing the design and construction of buildings for energy efficiency.

[A] **101.4.7 Existing buildings.** The provisions of the *California Existing Building Code* shall apply to matters governing the repair, alteration, change of occupancy, addition to and relocation of existing buildings.

[OSHPD 1] *The provisions of Chapters 2A, 3A, 4A and 5A of the California Existing Building Code shall apply to all matters governing the repairs, alterations, change of occupancy, additions and relocation of existing structures and portions thereof under OSHPD jurisdiction. All references to Chapters 3, 4 and 5 of the California Existing Building Code shall be replaced by equivalent provisions in Chapters 3A, 4A and 5A.*

[OSHPD 1R, 2, 4 & 5] *The provisions of the California Existing Building Code, Chapters 2, 3, 4 and 5 shall apply to all matters governing the repairs, alterations, change of occupancy, additions and relocation of existing structures and portions thereof under OSHPD jurisdiction.*

SECTION 102 APPLICABILITY

[A] **102.1 General.** Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[A] **102.2 Other laws.** The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

[A] **102.3 Application of references.** References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

[A] **102.4 Referenced codes and standards.** The codes and standards referenced in this code shall be considered to be part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 through 102.4.4.

[A] **102.4.1 Conflicts.** Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

[A] **102.4.2 Provisions in referenced codes and standards.** Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code or the *California Codes* specified in Section 101.4, the provisions of this code or the *California Codes* specified in Section 101.4, as applicable, shall take precedence over the provisions in the referenced code or standard.

102.4.3 Code references. [OSHPD 1, 1R, 2, 3, 4, & 5, DSA-SS & DSA-SS/CC] *All reference to International*

Codes or other similar codes in referenced standards shall be replaced by equivalent provisions in the California Building Standards Codes.

102.4.4 Reference in standards. [OSHPD 1, 1R, 2, 3, 4, & 5, DSA-SS & DSA-SS/CC] *All references listed in reference standards shall be replaced by referenced standards listed in Chapter 35 of this code, where applicable, and shall include all amendments to the reference standards in this code.*

[A] **102.5 Partial invalidity.** In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

[A] **102.6 Existing structures.** The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as otherwise specifically provided in this code, the *California Existing Building Code* or the *California Fire Code*.

[A] **102.6.1 Buildings not previously occupied.** A building or portion of a building that has not been previously occupied or used for its intended purpose in accordance with the laws in existence at the time of its completion shall comply with the provisions of this code or the *California Residential Code*, as applicable, for new construction or with any current permit for such occupancy.

[A] **102.6.2 Buildings previously occupied.** The legal occupancy of any building existing on the date of adoption of this code shall be permitted to continue without change, except as otherwise specifically provided in this code, the *California Fire Code* or *California Existing Building Code*, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION 103 CODE COMPLIANCE AGENCY

[A] **103.1 Creation of enforcement agency.** The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the building official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] **103.2 Appointment.** The building official shall be appointed by the chief appointing authority of the jurisdiction.

[A] **103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the building official.

SECTION 104 DUTIES AND POWERS OF BUILDING OFFICIAL

[A] 104.1 General. The building official is hereby authorized and directed to enforce the provisions of this code. The building official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.

[A] 104.2 Applications and permits. The building official shall receive applications, review construction documents and issue permits for the erection, and alteration, demolition and moving of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

[A] 104.2.1 Determination of substantially improved or substantially damaged existing buildings and structures in flood hazard areas. For applications for reconstruction, rehabilitation, repair, alteration, addition or other improvement of existing buildings or structures located in flood hazard areas, the building official shall determine if the proposed work constitutes substantial improvement or repair of substantial damage. Where the building official determines that the proposed work constitutes substantial improvement or repair of substantial damage, and where required by this code, the building official shall require the building to meet the requirements of Section 1612 or Section R322 of the *California Residential Code*, as applicable.

[A] 104.3 Notices and orders. The building official shall issue necessary notices or orders to ensure compliance with this code.

[A] 104.4 Inspections. The building official shall make the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report on unusual technical issues that arise, subject to the approval of the appointing authority.

[A] 104.5 Identification. The building official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

[A] 104.6 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in a structure or on a premises a condition that is contrary to or in violation of this code that makes the structure or premises unsafe, dangerous or hazardous, the building official is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises is unoccupied, the building official shall first make a reasonable effort to

locate the owner or other person having charge or control of the structure or premises and request entry. If entry is refused, the building official shall have recourse to the remedies provided by law to secure entry.

[A] 104.7 Department records. The building official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for retention of public records.

[A] 104.8 Liability. The building official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be civilly or criminally rendered liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

[A] 104.8.1 Legal defense. Any suit or criminal complaint instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representatives of the jurisdiction until the final termination of the proceedings. The building official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

[A] 104.9 Approved materials and equipment. Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

[A] 104.9.1 Used materials and equipment. Materials that are reused shall comply with the requirements of this code for new materials. Used equipment and devices shall not be reused unless approved by the building official.

[A] 104.10 Modifications. Where there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, upon application of the owner or the owner's authorized agent, provided that the building official shall first find that special individual reason makes the strict letter of this code impractical, the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, accessibility, life and fire safety or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.

[A] 104.10.1 Flood hazard areas. The building official shall not grant modifications to any provision required in flood hazard areas as established by Section 1612.3 unless a determination has been made that:

1. A showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section 1612 inappropriate.

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2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. A determination that the variance is the minimum necessary to afford relief, considering the flood hazard.
5. Submission to the applicant of written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation, and stating that construction below the design flood elevation increases risks to life and property.

[A] 104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed alternative meets all of the following:

1. The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of this code,
2. The material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code as it pertains to the following:
 - 2.1. Quality.
 - 2.2. Strength.
 - 2.3. Effectiveness.
 - 2.4. Fire resistance.
 - 2.5. Durability.
 - 2.6. Safety.

Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

[DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] Alternative system shall satisfy ASCE 7 Section 1.3, unless more restrictive requirements are established by this code for an equivalent system.

[DSA-SS, DSA-SS/CC] Alternative systems shall also satisfy the California Administrative Code, Section 4-304.

[OSHPD 1, 1R, 2, 4 & 5] Alternative systems shall also satisfy the California Administrative Code, Section 7-104.

[A] 104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assem-

blies not specifically provided for in this code, shall consist of valid research reports from approved sources.

[A] 104.11.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

104.11.3 Peer review. [OSHPD 1, 1R, 2, 4 & 5] When peer review is required for new or existing buildings, it shall be performed pursuant to Section 1617A.1.41.

104.11.4 Earthquake monitoring instruments. [OSHPD 1 & 4] The enforcement agency may require earthquake monitoring instruments for any building that receives approval of an alternative system for the Lateral Force Resisting System (LFRS). There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent. A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval.

The instruments shall be interconnected for common start and common timing. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating "MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT" shall be posted in a conspicuous location.

The Owner of the building shall be responsible for the implementation of the instrumentation program. Maintenance and service of the instruments shall be in accordance with Appendix L, Section 1.101.3 of Part 2, Volume 2 of the California Building Code.

SECTION 105 PERMITS

[A] 105.1 Required. Any owner or owner's authorized agent who intends to construct, enlarge, alter, repair, move, demolish or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be performed, shall first make application to the building official and obtain the required permit.

[A] 105.1.1 Annual permit. Instead of an individual permit for each alteration to an already approved electrical, gas, mechanical or plumbing installation, the building official is authorized to issue an annual permit upon application therefor to any person, firm or corporation regularly

employing one or more qualified tradespersons in the building, structure or on the premises owned or operated by the applicant for the permit.

[A] 105.1.2 Annual permit records. The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The building official shall have access to such records at all times or such records shall be filed with the building official as designated.

[A] 105.2 Work exempt from permit. Exemptions from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Permits shall not be required for the following:

Building:

1. One-story detached accessory structures used as tool and storage sheds, playhouses and similar uses, provided that the floor area *does not exceed* 120 square feet (11.15 m²). *It is permissible that these structures still be regulated by Section 710A, despite exemption from permit.*
2. Fences not over 7 feet (2134 mm) high.
3. Oil derricks.
4. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge or impounding Class I, II or IIIA liquids.
5. Water tanks supported directly on grade if the capacity is not greater than 5,000 gallons (18 925 L) and the ratio of height to diameter or width is not greater than 2:1.
6. Sidewalks and driveways not more than 30 inches (762 mm) above adjacent grade, and not over any basement or story below and are not part of an accessible route.
7. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
8. Temporary motion picture, television and theater stage sets and scenery.
9. Prefabricated swimming pools accessory to a Group R-3 occupancy that are less than 24 inches (610 mm) deep, are not greater than 5,000 gallons (18 925 L) and are installed entirely above ground.
10. Shade cloth structures constructed for nursery or agricultural purposes, not including service systems.
11. Swings and other playground equipment accessory to detached one- and two-family dwellings.
12. Window awnings in Group R-3 and U occupancies, supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.

13. Nonfixed and movable fixtures, cases, racks, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

1. **Repairs and maintenance:** Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.
2. **Radio and television transmitting stations:** The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for a power supply and the installations of towers and antennas.
3. **Temporary testing systems:** A *permit* shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (0.75 kW) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe, provided, however, that if any concealed trap, drain pipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a permit shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures and the removal and reinstallation of water closets, provided that such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

[A] 105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency situation, the permit application shall be submitted

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within the next working business day to the building official.

[A] 105.2.2 Public service agencies. A permit shall not be required for the installation, alteration or repair of generation, transmission, distribution or metering or other related equipment that is under the ownership and control of public service agencies by established right.

[A] 105.3 Application for permit. To obtain a permit, the applicant shall first file an application therefor in writing on a form furnished by the department of building safety for that purpose. Such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use and occupancy for which the proposed work is intended.
4. Be accompanied by construction documents and other information as required in Section 107.
5. State the valuation of the proposed work.
6. Be signed by the applicant, or the applicant's authorized agent.
7. Give such other data and information as required by the building official.

[A] 105.3.1 Action on application. The building official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing, stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable.

[A] 105.3.2 Time limitation of application. An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued; except that the building official is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated. *[OSHDP 1, 1R, 2, 4 & 5] Time limitation shall be in accordance with the California Administrative Code, Chapter 7, Section 7-129.*

[A] 105.4 Validity of permit. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building offi-

cial from requiring the correction of errors in the construction documents and other data. The building official is authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.

[A] 105.5 Expiration. Every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 180 days after its issuance, or if the work authorized on the site by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

105.5.1 Expiration. [BSC] On or after January 1, 2019, every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 12 months after its issuance, or if the work authorized on the site by such permit is suspended or abandoned for a period of 12 months after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. (See Health and Safety Code Section 18938.5 and 18938.6.)

[A] 105.6 Suspension or revocation. The building official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or regulation or any of the provisions of this code.

[A] 105.7 Placement of permit. The building permit or copy shall be kept on the site of the work until the completion of the project.

SECTION 106 FLOOR AND ROOF DESIGN LOADS

[A] 106.1 Live loads posted. In commercial, *institutional* or industrial buildings, for each floor or portion thereof designed for live loads exceeding 50 psf (2.40 kN/m²), such design live loads shall be conspicuously posted by the owner or the owner's authorized agent in that part of each story in which they apply, using durable signs. It shall be unlawful to remove or deface such notices. *[DSA-SS, DSA-SS/CC] These posting requirements also apply to school and state-owned essential services buildings as regulated by DSA.*

106.1.1 Snow load posting. [OSHDP 1, 1R, 2, 4 & 5] Snow loads used in design shall be posted as for live loads.

106.1.2 Snow load posting. [DSA-SS, DSA-SS/CC] When design snow loads at exterior balconies, decks and other elevated walking surfaces exceed 50 psf, the design snow loads shall be posted as for live loads. When design roof (not ground) snow loads exceed 20 psf, the roof design snow loads for each roof level of the building shall similarly be conspicuously posted with signs stating the maximum design roof snow loads.

[A] **106.2 Issuance of certificate of occupancy.** A certificate of occupancy required by Section 111 shall not be issued until the floor load signs, required by Section 106.1, have been installed.

[A] **106.3 Restrictions on loading.** It shall be unlawful to place, or cause or permit to be placed, on any floor or roof of a building, structure or portion thereof, a load greater than is permitted by this code.

SECTION 107 CONSTRUCTION DOCUMENTS

[A] **107.1 General.** Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted in two or more sets, or in a digital format where allowed by the building official, with each permit application. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

[A] **107.2 Construction documents.** Construction documents shall be in accordance with Sections 107.2.1 through 107.2.8.

[A] **107.2.1 Information on construction documents.** Construction documents shall be dimensioned and drawn on suitable material. Electronic media documents are permitted to be submitted where approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.

[A] **107.2.2 Fire protection system shop drawings.** Shop drawings for the fire protection systems shall be submitted to indicate conformance to this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

[A] **107.2.3 Means of egress.** The construction documents shall show in sufficient detail the location, construction, size and character of all portions of the means of egress including the path of the exit discharge to the public way in compliance with the provisions of this code. In other than occupancies in Groups R-2, R-3, and I-1, the construction documents shall designate the number of occupants to be accommodated on every floor, and in all rooms and spaces.

[A] **107.2.4 Exterior wall envelope.** Construction documents for all buildings shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope as required, including flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive barrier and details around openings.

The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system that was tested, where applicable, as well as the test procedure used.

[A] **107.2.5 Exterior balconies and elevated walking surfaces.** Where balconies or other elevated walking surfaces have weather-exposed surfaces, and the structural framing is protected by an impervious moisture barrier, the construction documents shall include details for all elements of the impervious moisture barrier system. The construction documents shall include manufacturer's installation instructions.

[A] **107.2.6 Site plan.** The construction documents submitted with the application for permit shall be accompanied by a site plan showing to scale the size and location of new construction and existing structures on the site, distances from lot lines, the established street grades and the proposed finished grades and, as applicable, flood hazard areas, floodways, and design flood elevations; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify the requirement for a site plan where the application for permit is for alteration or repair or where otherwise warranted.

[A] **107.2.6.1 Design flood elevations.** Where design flood elevations are not specified, they shall be established in accordance with Section 1612.3.1.

[A] **107.2.7 Structural information.** The construction documents shall provide the information specified in Section 1603.

107.2.8 Relocatable buildings. Construction documents for relocatable buildings shall comply with Section 3112.

[A] **107.3 Examination of documents.** The building official shall examine or cause to be examined the accompanying submittal documents and shall ascertain by such examinations whether the construction indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

[A] **107.3.1 Approval of construction documents.** When the building official issues a permit, the construction documents shall be approved, in writing or by stamp, as

“Reviewed for Code Compliance.” One set of construction documents so reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work and shall be open to inspection by the building official or a duly authorized representative.

[A] 107.3.2 Previous approvals. This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

[A] 107.3.3 Phased approval. The building official is authorized to issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such permit for the foundation or other parts of a building or structure shall proceed at the holder’s own risk with the building operation and without assurance that a permit for the entire structure will be granted.

[A] 107.3.4 Design professional in responsible charge. Where it is required that documents be prepared by a registered design professional, the building official shall be authorized to require the owner or the owner’s authorized agent to engage and designate on the building permit application a registered design professional who shall act as the registered design professional in responsible charge. If the circumstances require, the owner or the owner’s authorized agent shall designate a substitute registered design professional in responsible charge who shall perform the duties required of the original registered design professional in responsible charge. The building official shall be notified in writing by the owner or the owner’s authorized agent if the registered design professional in responsible charge is changed or is unable to continue to perform the duties.

The registered design professional in responsible charge shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building.

[A] 107.3.4.1 Deferred submittals. Deferral of any submittal items shall have the prior approval of the building official. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the building official.

Documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the building official with a notation indicating that the deferred submittal documents have been reviewed and found to be in general conformance to the design of the building. The deferred submittal items

shall not be installed until the deferred submittal documents have been approved by the building official. *[OSHPD 1, 1R, 2, 4 & 5] Deferred submittals shall be in accordance with the California Administrative Code, Chapter 7, Section 7-126.*

[A] 107.4 Amended construction documents. Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

[A] 107.5 Retention of construction documents. One set of approved construction documents shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.

**SECTION 108
TEMPORARY STRUCTURES AND USES**

[A] 108.1 General. The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

[A] 108.2 Conformance. Temporary structures and uses shall comply with the requirements in Section 3103.

[A] 108.3 Temporary power. The building official is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in NFPA 70.

[A] 108.4 Termination of approval. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

**SECTION 109
FEES**

[A] 109.1 Payment of fees. A permit shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

[A] 109.2 Schedule of permit fees. Where a permit is required, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] 109.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall reflect the total value of work, including materials and labor, for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the building official, the valuation is underestimated on the application, the permit

shall be denied, unless the applicant can show detailed estimates to meet the approval of the building official. Final building permit valuation shall be set by the building official.

[A] 109.4 Work commencing before permit issuance. Any person who commences any work before obtaining the necessary permits shall be subject to a fee established by the building official that shall be in addition to the required permit fees.

[A] 109.5 Related fees. The payment of the fee for the construction, alteration, removal or demolition for work done in connection to or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

[A] 109.6 Refunds. The building official is authorized to establish a refund policy.

SECTION 110 INSPECTIONS

[A] 110.1 General. Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain visible and able to be accessed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the owner or the owner's authorized agent to cause the work to remain visible and able to be accessed for inspection purposes. Neither the building official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

[A] 110.2 Preliminary inspection. Before issuing a permit, the building official is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

[A] 110.3 Required inspections. The building official, upon notification, shall make the inspections set forth in Sections 110.3.1 through 110.3.12.

[A] 110.3.1 Footing and foundation inspection. Footing and foundation inspections shall be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete is ready mixed in accordance with ASTM C94, the concrete need not be on the job.

[A] 110.3.2 Concrete slab and under-floor inspection. Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place, but before any concrete is placed or floor sheathing installed, including the subfloor.

[A] 110.3.3 Lowest floor elevation. In flood hazard areas, upon placement of the lowest floor, including the basement, and prior to further vertical construction, the elevation certification required in Section 1612.4 or the *California Residential Code*, as applicable, shall be submitted to the building official.

[A] 110.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, all framing, fire-blocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.

110.3.4.1 [HCD 1] Moisture content verification. *Moisture content of framing members shall be verified in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

[A] 110.3.5 Types IV-A, IV-B and IV-C connection protection inspection. In buildings of Types IV-A, IV-B and IV-C construction, where connection fire-resistance ratings are provided by wood cover calculated to meet the requirements of Section 2304.10.1, inspection of the wood cover shall be made after the cover is installed, but before any other coverings or finishes are installed.

[A] 110.3.6 Lath, gypsum board and gypsum panel product inspection. Lath, gypsum board and gypsum panel product inspections shall be made after lathing, gypsum board and gypsum panel products, interior and exterior, are in place, but before any plastering is applied or gypsum board and gypsum panel product joints and fasteners are taped and finished.

Exception: Gypsum board and gypsum panel products that are not part of a fire-resistance-rated assembly or a shear assembly.

[A] 110.3.7 Weather-exposed balcony and walking surface waterproofing. Where balconies or other elevated walking surfaces have weather-exposed surfaces, and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and approved.

Exception: Where special inspections are provided in accordance with Section 1705.1.1, Item 3.

[A] 110.3.8 Fire- and smoke-resistant penetrations. Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and approved.

[A] 110.3.9 Energy efficiency inspections. Inspections shall be made to determine compliance with Chapter 13 and shall include, but not be limited to, inspections for: envelope insulation R- and U-values, fenestration U-value, duct system R-value, and HVAC and water-heating equipment efficiency.

[A] 110.3.10 Other inspections. In addition to the inspections specified in Sections 110.3.1 through 110.3.9, the building official is authorized to make or require other inspections of any construction work to ascertain compli-

ance with the provisions of this code and other laws that are enforced by the department of building safety.

[A] **110.3.11 Special inspections.** For special inspections, see Chapter 17.

[A] **110.3.12 Final inspection.** The final inspection shall be made after all work required by the building permit is completed.

[A] **110.3.12.1 Flood hazard documentation.** If located in a flood hazard area, documentation of the elevation of the lowest floor as required in Section 1612.4 shall be submitted to the building official prior to the final inspection.

110.3.12.2 [HCD 1] Operation and maintenance manual. *At the time of final inspection, a manual, compact disc, web-based reference or other media acceptable to the enforcing agency shall be placed in the building in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.*

[A] **110.4 Inspection agencies.** The building official is authorized to accept reports of approved inspection agencies, provided that such agencies satisfy the requirements as to qualifications and reliability.

[A] **110.5 Inspection requests.** It shall be the duty of the holder of the building permit or their duly authorized agent to notify the building official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

[A] **110.6 Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or the permit holder's agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

SECTION 111 CERTIFICATE OF OCCUPANCY

[A] **111.1 Change of occupancy.** A building or structure shall not be used or occupied in whole or in part, and a change of occupancy of a building or structure or portion thereof shall not be made, until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid.

Exception: Certificates of occupancy are not required for work exempt from permits in accordance with Section 105.2.

[A] **111.2 Certificate issued.** After the building official inspects the building or structure and does not find violations

of the provisions of this code or other laws that are enforced by the department, the building official shall issue a certificate of occupancy that contains the following:

1. The permit number.
2. The address of the structure.
3. The name and address of the owner or the owner's authorized agent.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code.
6. The name of the building official.
7. The edition of the code under which the permit was issued.
8. The use and occupancy, in accordance with the provisions of Chapter 3.
9. The type of construction as defined in Chapter 6.
10. The design occupant load.
11. Where an automatic sprinkler system is provided, whether the sprinkler system is required.
12. Any special stipulations and conditions of the building permit.

[A] **111.3 Temporary occupancy.** The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.

[A] **111.4 Revocation.** The building official is authorized to suspend or revoke a certificate of occupancy or completion issued under the provisions of this code, in writing, wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of the provisions of this code or other ordinance of the jurisdiction.

SECTION 112 SERVICE UTILITIES

[A] **112.1 Connection of service utilities.** A person shall not make connections from a utility, a source of energy, fuel, or power, or a water system or sewer system to any building or system that is regulated by this code for which a permit is required, until approved by the building official.

[A] **112.2 Temporary connection.** The building official shall have the authority to authorize the temporary connection of the building or system to the utility, the source of energy, fuel, or power, or the water system or sewer system for the purpose of testing systems or for use under a temporary approval.

[A] **112.3 Authority to disconnect service utilities.** The building official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards

in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section 112.1 or 112.2. The building official shall notify the serving utility, and wherever possible the owner or the owner's authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner or the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

SECTION 113 MEANS OF APPEALS

[A] 113.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the building official.

[A] 113.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] 113.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

[A] 113.4 Administration. The building official shall take immediate action in accordance with the decision of the board.

SECTION 114 VIOLATIONS

[A] 114.1 Unlawful acts. It shall be unlawful for any person, firm or corporation to erect, construct, alter, extend, repair, move, remove, demolish or occupy any building, structure or equipment regulated by this code, or cause same to be done, in conflict with or in violation of any of the provisions of this code.

[A] 114.2 Notice of violation. The building official is authorized to serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, moving, removal, demolition or occupancy of a building or structure in violation of the provisions of this code, or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

[A] 114.3 Prosecution of violation. If the notice of violation is not complied with promptly, the building official is authorized to request the legal counsel of the jurisdiction to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation, or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant thereto.

[A] 114.4 Violation penalties. Any person who violates a provision of this code or fails to comply with any of the requirements thereof or who erects, constructs, alters or repairs a building or structure in violation of the approved construction documents or directive of the building official, or of a permit or certificate issued under the provisions of this code, shall be subject to penalties as prescribed by law.

SECTION 115 STOP WORK ORDER

[A] 115.1 Authority. Where the building official finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the building official is authorized to issue a stop work order.

[A] 115.2 Issuance. The stop work order shall be in writing and shall be given to the owner of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume.

[A] 115.3 Emergencies. Where an emergency exists, the building official shall not be required to give a written notice prior to stopping the work.

[A] 115.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the authority having jurisdiction.

SECTION 116 UNSAFE STRUCTURES AND EQUIPMENT

[A] 116.1 Unsafe conditions. Structures or existing equipment that are or hereafter become unsafe, insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or that constitute a fire hazard, or are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe, as the building official deems necessary and as provided for in this section. A vacant structure that is not secured against unauthorized entry shall be deemed unsafe.

[A] 116.2 Record. The building official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.

SCOPE AND ADMINISTRATION

[A] **116.3 Notice.** If an unsafe condition is found, the building official shall serve on the owner of the structure, or the owner's authorized agent, a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or that requires the unsafe structure to be demolished within a stipulated time. Such notice shall require the person thus notified to declare immediately to the building official acceptance or rejection of the terms of the order.

[A] **116.4 Method of service.** Such notice shall be deemed properly served where a copy thereof is served in accordance with one of the following methods:

1. A copy is delivered to the owner personally.
2. A copy is sent by certified or registered mail addressed to the owner at the last known address with the return receipt requested.
3. A copy is delivered in any other manner as prescribed by local law.

If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner on the owner's authorized agent shall constitute service of notice on the owner.

[A] **116.5 Restoration or abatement.** Where the structure or equipment determined to be unsafe by the building official is restored to a safe condition, the owner, the owner's authorized agent, operator or occupant of a structure, premises or equipment deemed unsafe by the building official shall abate or cause to be abated or corrected such unsafe conditions either by repair, rehabilitation, demolition or other approved corrective action. To the extent that repairs, alterations or additions are made or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions and change of occupancy shall comply with the requirements of the *California Existing Building Code*.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
201.3			X	X	X	X																
201.4			X																			
202			X	X	X	X																
Access Aisle							X															
Accessibility				X	X	X	X															
Accessibility Function Button							X															
Accessible				X	X	X	X															
Accessible Element							X															
Accessible Means of Egress							X															
Accessible Route				X	X	X	X															
Accessible Space				X	X	X	X															
Accessible Unit				†	†	†																
Accessory Dwelling Unit				X	X																	
Active Earthquake Fault								X	X	X					X							
Active Equipment/Component								X	X	X	X	X		X	X							
Adaptable							X															
Adaptable Dwelling Unit						X																
Addition (2nd paragraph only)							X															
Adjusted Construction Cost							X															
Administrative Authority							X															
Adult Changing Facility							X															
Aged Home or Institution			X																			
Aisle (2nd paragraph only)							X															
Alteration							X															
Alternative System										X	X	X		X	X							
Amusement Attraction							X															
Amusement Ride							X															
Amusement Ride Seat							X															
ANSI							X															
Approved (with notes)			X	X	X	X																
Approved (2nd paragraph only) (w/o notes)							X															
Approved Agency				X	X			X	X													
Approved Listing Agency				X	X																	
Approved Testing Agency				X	X		X			X	X	X		X	X							
Area of Refuge							X															
Area of Sport Activity							X															
Assembly Area							X															
Assistive Device						X																
Assistive Listening System (ALS)							X															
Automatic Door				X	X	X	X															
Automatic Teller Machine (ATM)							X															
Auxiliary Area																X						

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
<i>Backwash</i>																X						
<i>Base</i>								X	X	X				X								
<i>Bather</i>																X						
<i>Bathroom</i>						X	X															
<i>Bedridden Person</i>			X																			
<i>Blended Transition</i>							X															
<i>Boarding Pier</i>							X															
<i>Boat Launch Ramp</i>							X															
<i>Boat Slip</i>							X															
<i>Bottle-Filling Station</i>							X															
<i>Building</i>			X																			
<i>Building (with exception)</i>				X	X	X																
<i>Building (w/o notes)</i>							X															
<i>Building Entrance on an Accessible Route</i>						X																
<i>Building, Existing</i>				X	X																	
<i>Building Official</i>							X															
<i>Care and Supervision</i>			X																			
<i>Care Suite</i>			X																			
<i>Carriage Unit</i>						X																
<i>Catastrophically Injured</i>			X																			
<i>Catch Pool</i>							X															
<i>CCR</i>							X															
<i>CDF Director</i>			X																			
<i>Cell</i>			X																			
<i>Cell Complex</i>			X																			
<i>Cell Tiers</i>			X																			
<i>Cellular Concrete</i>				X	X																	
<i>Central Control Building</i>			X																			
<i>Characters</i>				X	X	X	X															
<i>Charter School</i>			X																			
<i>Child Care</i>			X																			
<i>Child-Care Center</i>			X																			
<i>Child or Children</i>			X																			
<i>Children’s Use</i>							X															
<i>Chronically Ill</i>			X																			
<i>Circulation Path</i>							X															
<i>Clean Pool Water</i>																X						
<i>Clear</i>							X															
<i>Clear Floor Space</i>						X	X															
<i>Clear Pool Water</i>																X						
<i>Climate Zone</i>																		X				
<i>Clinic, Outpatient</i>			X																			
<i>Closed-Circuit Telephone</i>							X															
<i>Commercial Facilities</i>							X															
<i>Commercial Place of Public Amusement</i>							X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X	X							
Adopt only those sections that are listed below							X									X	X					
Chapter / Section																						
Common Use				†	†	†	X															
Common Use Areas			†			X																
Community Care Facility			X																			
Community Correctional Reentry Centers			X																			
Comply With							X															
Concrete, Cellular				X	X	X																
Congregate Living Health Facility (CLHF)			X																			
Congregate Residence			X			X																
Control Room			X																			
Correctional Hospitals			X																			
Correctional Medical or Mental Health Housing Suite			X																			
Correctional Mental Health Facilities			X																			
Correctional Nursing Facilities			X																			
Correctional Treatment Centers			X																			
Corrosion Resistant																	X					
Courthouse Holding Facility			X																			
Courtroom Dock			X																			
Covered Multifamily Dwellings						X																
Cross Slope						X	X															
Curb Cut				X	X	X	X															
Curb Ramp				X	X	X	X															
Custody Station			X																			
Day-Care			X																			
Day-Care Home, Family			X																			
Day-Care Home, Large Family			X																			
Day-Care Home, Small Family			X																			
Day Room			X																			
Deck																	X					
Department				X	X																	
Designated Public Transportation							X															
Destination-Oriented Elevator							X															
Detached Single-Family Dwelling				X	X																	
Detectable Warning				X	X	X	X															
Detention Elevator			X																			
Detention Program Suite			X																			
Detention Treatment Room			X																			
Detoxification Facilities			X																			
Directional Sign				X	X		X															
Disability							X															
Distance from Active Earthquake Fault								X	X	X					X							

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X	X							
Adopt only those sections that are listed below							X									X	X					
Chapter / Section																						
<i>District Agricultural Associations</i>							X															
<i>Dormitory</i>			X				X															
<i>Dormitory</i>			X																			
<i>Drain</i>																X						
<i>Drive Aisle</i>							X															
<i>Drive-up Electric Vehicle Charging Station</i>							X															
<i>Driveway</i>							X															
<i>Dwelling Unit</i>						X																
<i>Effective Particle Size</i>																X						
<i>Efficiency Dwelling Unit</i>				X																		
<i>Electric Vehicle</i>			X																			
<i>Electric Vehicle (EV)</i>							X															
<i>Electric Vehicle (EV) Charger</i>							X															
<i>Electric Vehicle Charging Space (EV Space)</i>							X															
<i>Electric Vehicle Charging Station (EVCS)</i>							X															
<i>Electric Vehicle (EV) Connector</i>							X															
<i>Element</i>							X															
<i>Elevated Play Component</i>							X															
<i>Elevator, Passenger</i>				X	X		X															
<i>Employee Work Area</i>							X															
<i>Enforcement</i>				X	X																	
<i>Enforcement Agent</i>								X	X	X	X	X	X	X	X							
<i>Enforcing Agency</i>			X	X	X		X			X	X	X	X	X	X		X					
<i>Entrance</i>				X	X	X	X															
<i>Equipment</i>								X	X	X	X	X	X	X								
<i>Countertop Equipment</i>								X	X	X	X	X	X	X								
<i>Essential Equipment</i>								X	X	X	X	X	X	X								
<i>Fixed Equipment</i>								X	X	X	X	X	X	X								
<i>Interim Equipment</i>										X	X	X	X	X								
<i>Mobile Equipment</i>								X	X	X	X	X	X	X								
<i>Movable Equipment</i>								X	X	X	X	X	X	X								
<i>Other Equipment</i>								X	X	X	X	X	X	X								
<i>Temporary Equipment</i>										X	X	X	X	X								
<i>Equipment Area</i>																X						
<i>Equivalent Facilitation</i>						X	X															
<i>Existing Building or Facility</i>							X															
<i>Exit</i>							X															
<i>Exterior Covering</i>			X																			
<i>Facility</i>							X															
<i>Family</i>				X																		
<i>Fire Appliance</i>			X																			
<i>Fire Hazard Severity Zones</i>			X																			
<i>Fire Protection Plan</i>			X																			
<i>Fire-Retardant Treated Wood</i>			X																			
<i>Fire-Smoke Barrier</i>			X																			
<i>Fireworks</i>			X																			

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
<i>Freestanding Acute Psychiatric Building (APB)</i>															X							
<i>Freestanding Skilled Nursing Building (SNB)</i>												X										
<i>Full-Time Care</i>			X																			
<i>Functional Area</i>							X															
<i>Gangway</i>							X															
<i>Gas Detection System</i>			X																			
<i>General Acute Care Building (GAC Building)</i>										X												
<i>Golf Car Passage</i>							X															
<i>Grab Bar</i>					X	X																
<i>Grade (Adjacent Ground Elevation)</i>					X	X																
<i>Grade Break</i>						X																
<i>Ground Floor</i>					X	X																
<i>Ground Level Play Component</i>						X																
<i>Group Home</i>			X																			
<i>Guard (or Guardrail)</i>				X	X	X	X															
<i>Hall Call Console</i>							X															
<i>Handrail</i>							X															
<i>Handwashing Fixture</i>										X		X	X	X								
<i>Hazardous Substance</i>			X																			
<i>Health Care Provider</i>							X															
<i>High-Rise Building</i>			X																			
<i>High-Rise Building Access</i>			X																			
<i>Historic Buildings</i>							X															
<i>Holding Facility</i>			X																			
<i>Hospitals and Psychiatric Hospitals</i>			X																			
<i>Hotel or Motel</i>				X	X																	
<i>Housing at a Place of Education</i>						X	X															
<i>Housing Pod</i>			X																			
<i>Housing Unit</i>			X																			
<i>HPM</i>			X																			
<i>If, If... Then</i>							X															
<i>Ignition-Resistant Material</i>			X																			
<i>Infant</i>			X																			
<i>Inflatable Amusement Device</i>			X																			
<i>Inlet</i>																						
<i>Intake and Release Areas</i>			X																			
<i>Intended to be occupied as a Residence</i>				†	†	†																
<i>International Symbol of Accessibility</i>						X	X															
<i>Irregular Structure</i>							X	X	X					X								
<i>Key Station</i>							X															
<i>Kick Plate</i>				X	X	X	X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
<i>Kitchen or Kitchenette</i>							X															
Labeled				X	X																	
Laboratory			X																			
Laboratory Suite			X																			
Ladder																X						
Lavatory						X	X															
Level Area						X																
Licensing Agency										X	X	X	X	X	X							
Lift, Platform (Wheelchair)						X																
Liquid Tight Floor			X																			
Listed			X	X	X																	
Listing Agency				X	X																	
Live/Work Unit				X																		
Lobby			X	X	X																	
Local Agency Very High Fire Hazard Severity Zone			X																			
Lodging House				X		X																
Log Wall Construction			X																			
Mail Boxes							X															
Major Structural Alterations, Additions or Repairs										X				X								
Marked Crossing				X	X	X	X															
May							X															
Medical Pool																X						
Mezzanine							X															
Minor Structural Alteration, Additions or Repairs										X				X								
Monolithic										X	X	X	X	X	X							
Monolithic Ceiling										X	X	X	X	X	X							
Motel				X	X																	
Motion Picture and Television Production Studio Sound Stage, Approved Production Facilities and Production Locations			X																			
Multi-bedroom Housing Unit							X															
Multilevel Assembly Seating				†	†	†																
Multistory Dwelling Unit						X																
Multistory Unit				†	†	†																
Newly Constructed						X																
Next Generation Attenuation West 2 (NGA W2)								X	X	X				X								
NFPA							X															
Non-General Acute Care Building (Non-GAC Building)											X											
Nonambulatory Persons			X																			
Noncombustible			X																			
Nonpatient-care Suite			X																			

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X	X							
Adopt only those sections that are listed below							X									X	X					
Chapter / Section																						
<i>Normal</i>				X	X																	
<i>Nosing</i>							X															
<i>NPC 1, NPC 2, NPC 3/NPC 3R, NPC 4 and NPC 5</i>										X												
<i>Nursing Homes</i>			X																			
<i>Occupant Load</i>							X															
<i>Occupiable Space</i>							X															
<i>Open Riser</i>				X	X	X	X															
<i>Operable Part</i>				X	X	X	X															
<i>Organized Camps</i>			X																			
<i>Overflow System</i>																	X					
<i>Passage Door</i>						X																
<i>Passenger Elevator</i>				X	X		X															
<i>Passive Solar Energy Collector</i>				X	X																	
<i>Path of Travel</i>							X															
<i>Pedestrian</i>						X	X															
<i>Pedestrian Way</i>				X	X	X	X															
<i>Peer Review</i>										X	X	X		X	X							
<i>Periodic Special Inspection</i>								X	X													
<i>Permanent</i>							X															
<i>Permanent Portable Building</i>			X																			
<i>Permit</i>							X															
<i>Persons with Disabilities</i>						X																
<i>Persons with Intellectual Disabilities, Profoundly or Severely</i>			X																			
<i>Photovoltaic (PV) Panel System, Ground Mounted</i>			X																			
<i>Photovoltaic (PV) Support Structure, Elevated</i>			X																			
<i>Pictogram</i>				X	X	X	X															
<i>Place of Public Accommodation</i>				X	X	X	X															
<i>Platform</i>							X															
<i>Platform (Wheelchair) Lift</i>				X	X	X	X															
<i>Play Area</i>							X															
<i>Play Component</i>							X															
<i>Point-of-Sale Device</i>							X															
<i>Pool</i>																	X					
<i>Pool User</i>																	X					
<i>Pool Volume</i>																	X					
<i>Powder Room</i>				X	X	X	X															
<i>Power-Assisted Door</i>							X															
<i>Primary Entry</i>						X																
<i>Primary-Entry Level</i>						X																
<i>Private Building or Facility</i>							X															
<i>Private Pool</i>																	X					
<i>Professional Office of a Health Care Provider</i>							X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
<i>Project Inspector</i>								X	X													
<i>Protective Social Care Facility</i>			X																			
<i>Public Building or Facility</i>							X															
<i>Public Entity</i>						X	X															
<i>Public Entrance</i>							X															
<i>Public Housing</i>						X	X															
<i>Public Pool</i>																	X					
<i>Public Use</i>							X															
<i>Public-Use Areas</i>						X	X															
<i>Public Way</i>							X															
<i>Qualified Historic Building or Facility</i>							X															
<i>Quality Assurance (QA)</i>								X	X	X	X	X		X	X							
<i>Quality Control (QC)</i>								X	X	X	X	X		X	X							
<i>Raftertail</i>			X																			
<i>Ramp</i>							X															
<i>Reasonable Portion</i>							X															
<i>Recessed Steps</i>																	X					
<i>Recessed Treads</i>																	X					
<i>Recirculation System</i>																	X					
<i>Recommend</i>				X	X		X															
<i>Relocatable Building (Public School)</i>			X					X	X													
<i>Remodeling</i>							X															
<i>Removed from Acute Care Service</i>											X											
<i>Repair</i>							X															
<i>Residential Care Facility for the Chronically III (RCF/CI)</i>			X																			
<i>Residential Care Facility for the Elderly (RCFE)</i>			X																			
<i>Residential Dwelling Unit</i>							X															
<i>Residential Facility (RF)</i>			X																			
<i>Restraint</i>			X																			
<i>Restricted Area</i>										X	X	X	X	X								
<i>Restricted Entrance</i>							X															
<i>Retrofit</i>								X	X	X			X									
<i>Riser</i>				X	X	X	X							X								
<i>Roof Eave</i>			X																			
<i>Roof Eave Soffit</i>			X																			
<i>Rugged Equipment</i>								X	X													
<i>Running Slope</i>				X	X	X	X															
<i>Sanitary Facility</i>				X		X																
<i>Secure Interview Rooms</i>			X																			
<i>Self-Service Storage</i>				†	†	†	X															
<i>Service Entrance</i>							X															
<i>Shall</i>							X															
<i>Shallow Pool</i>																	X					

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHDPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
<i>Shopping Center (or Shopping Mall)</i>							X															
<i>Should</i>				X	X		X															
<i>Sidewalk</i>				X	X	X	X															
<i>Sign</i>						X	X															
<i>Significant Loss of Function</i>								X	X	X				X								
<i>Single-Accommodation Sanitary Facility</i>						X																
<i>Sink</i>						X	X															
<i>Site</i>							X															
<i>Site Development</i>						X																
<i>Sleeping Accommodations</i>				X	X	X	X															
<i>Slip Resistant</i>																	X					
<i>Slope</i>						X																
<i>Small Management Yard</i>			X																			
<i>Soft Contained Play Structure</i>							X															
<i>Space</i>				X	X	X	X															
<i>SPC 1, SPC 2, SPC 3, SPC 4D and SPC 5</i>										X												
<i>SPC Building</i>										X	X											
<i>Special Inspection</i>								X	X													
<i>Special Amusement Area</i>			X																			
<i>Specified Public Transportation</i>							X															
<i>Stage</i>							X															
<i>Stair</i>							X															
<i>Stairs</i>																	X					
<i>Stairway</i>							X															
<i>State-Owned/Leased Building</i>			X																			
<i>State Responsibility Area</i>			X																			
<i>Step</i>																	X					
<i>Steps, Recessed Steps, Ladders and Recessed Treads</i>																	X					
<i>Story (2nd paragraph only)</i>							X															
<i>Structural Frame</i>							X															
<i>Structure</i>							X															
<i>Sub-Component</i>										X	X	X		X	X							
<i>Surface Mounted Component</i>										X	X	X		X	X							
<i>Tactile</i>				X	X	X	X															
<i>Tactile Sign</i>				X	X	X	X															
<i>Technically Infeasible</i>							X															
<i>Teeing Ground</i>							X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X	X	X								
Adopt only those sections that are listed below							X								X	X						
Chapter / Section																						
Temporary							X															
Temporary Holding Cell, Room or Area.			X												X							
Temporary Holding Facility			X																			
Tenable Environment			X																			
Terminally Ill			X																			
Testing Agency				X	X																	
Text Telephone						X	X															
Toddler			X																			
Torque-Controlled Post-Installed Anchor								X	X	X	X	X		X	X							
Transfer Device							X															
Transient Lodging				X	X	X	X															
Transit Boarding Platform							X															
Transition Plate							X															
Tread				X	X	X																
Treatment of Water																X						
TTY						X	X															
Turnover Time																X						
Type A Unit				†	†	†																
Type B Unit				†	†	†																
Uniformity Coefficient																X						
Unreasonable Hardship				X	X	X	X															
Use Zone							X															
Valuation Threshold							X															
Variable Message Signs (VMS)							X															
Variable Message Sign (VMS) Characters							X															
Vehicular or Pedestrian Arrival Points						X																
Vehicular Way						X	X															
Waiting Room			X																			
Walk						X	X															
Waterline																X						
Wet Bar							X															
Wheelchair						X	X															
Wheelchair Space							X															
Wildfire			X																			
Wildfire Exposure			X																			
Wildland-Urban Interface Fire Area			X																			
Winery Caves			X																			
Work Area Equipment							X															
Workstation (2nd paragraph only)							X															

The state agency does not adopt sections identified by the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 2

DEFINITIONS

User notes:

About this chapter: Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purposes of the code.

Code development reminder: Code change proposals to sections preceded by the designation [A] or [BS] will be considered by one of the code development committees meeting during the 2022 (Group B) Code Development Cycle.

SECTION 201 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *California Energy Code*, *California Existing Building Code*, *California Fire Code*, *California Green Building Standards Code*, *California Electrical Code*, *California Mechanical Code* or *California Plumbing Code*, such terms shall have the meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies. Webster's Third New International Dictionary of the English Language, Unabridged, shall be considered as providing ordinarily accepted meanings.

SECTION 202 DEFINITIONS

[BG] 24-HOUR BASIS. The actual time that a person is an occupant within a facility for the purpose of receiving care. It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

[BS] AAC MASONRY. Masonry made of autoclaved aerated concrete (AAC) units, manufactured without internal reinforcement and bonded together using thin- or thick-bed mortar.

> **ACCESS AISLE.** [DSA-AC] An accessible space adjacent to
|| or between vehicle spaces that provides clearances in compliance with this code.

ACCESSIBILITY. [DSA-AC & HCD 1-AC] The combination of various elements in a building, facility, site or area, or portion thereof which allows access, circulation and the full use of the building and facilities by persons with disabilities in compliance with this code.

ACCESSIBILITY FUNCTION BUTTON. [DSA-AC] A button on an elevator hall call console in a destination-oriented elevator system that when pressed will activate a series of visual and verbal prompts and announcements providing instruction regarding hall call console operation and direction to an assigned elevator.

ACCESSIBLE. [DSA-AC & HCD 1-AC] A site, building, facility, or portion thereof that is approachable and usable by persons with disabilities in compliance with this code.

ACCESSIBLE ELEMENT. [DSA-AC] An element specified by the regulations adopted by the Division of the State Architect-Access Compliance.

[BE] ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

ACCESSIBLE ROUTE. [DSA-AC & HCD 1-AC] A continuous unobstructed path connecting accessible elements and spaces of an accessible site, building or facility that can be negotiated by a person with a disability using a wheelchair, and that is also safe for and usable by persons with other disabilities. Interior accessible routes may include corridors, hallways, floors, ramps, elevators and lifts. Exterior accessible routes may include parking access aisles, curb ramps, crosswalks at vehicular ways, walks, ramps and lifts.

ACCESSIBLE SPACE. [DSA-AC & HCD 1-AC] A space that complies with the accessibility provisions of this code.

[BE] ACCESSIBLE UNIT. A dwelling unit or sleeping unit that complies with this code and the provisions for Accessible units in ICC A117.1.

ACCESSORY DWELLING UNIT. [HCD 1 & HCD 2] An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. Accessory dwelling units shall include permanent provisions for living, sleeping, eating, cooking and sanitation on the same parcel as the single-family or multifamily dwelling is or will be situated. (See Government Code Section 65852.2)

DEFINITIONS

[BS] ACCREDITATION BODY. An approved, third-party organization that is independent of the grading and inspection agencies, and the lumber mills, and that initially accredits and subsequently monitors, on a continuing basis, the competency and performance of a grading or inspection agency related to carrying out specific tasks.

ACTIVE EARTHQUAKE FAULT. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] *A fault that has been the source of earthquakes or is recognized as a potential source of earthquakes, including those that have exhibited surface displacement within Holocene time (about 11,000 years) as determined by California Geological Survey (CGS) under the Alquist-Priolo Earthquake Fault Zoning Act, those included as type A or type B faults for the U.S. Geological Survey (USGS) National Seismic Hazard Maps, and faults considered to have been active in Holocene time by any authoritative source, federal, state or local governmental agency.*

ACTIVE EQUIPMENT/COMPONENT. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *Equipment/Component containing moving or rotating parts, electrical parts such as switches or relays, or other internal components that are sensitive to earthquake forces and critical to the function of the equipment.*

ADAPTABLE. [DSA-AC] *Capable of being readily modified and made accessible.*

ADAPTABLE DWELLING UNIT. [HCD 1-AC] *An accessible dwelling unit within a covered multifamily building as designed with elements and spaces allowing the dwelling unit to be adapted or adjusted to accommodate the user. See Chapter 11A, Division IV.*

[A] ADDITION. An extension or increase in floor area, number of stories or height of a building or structure. [DSA-AC] *An expansion, extension or increase in the gross floor area or height of a building or facility.*

[BS] ADHERED MASONRY VENEER. Veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

ADJUSTED CONSTRUCTION COST. [DSA-AC] *All costs directly related to the construction of a project, including labor, material, equipment, services, utilities, contractor financing, contractor overhead and profit, and construction management costs. The costs shall not be reduced by the value of components, assemblies, building equipment or construction not directly associated with accessibility or usability. The adjusted construction cost shall not include: project management fees and expenses, architectural and engineering fees, testing and inspection fees, and utility connection or service district fees.*

ADMINISTRATIVE AUTHORITY. [DSA-AC] *A governmental agency that adopts or enforces regulations and guidelines for the design, construction or alteration of buildings and facilities.*

[BS] ADOBE CONSTRUCTION. Construction in which the exterior load-bearing and nonload-bearing walls and partitions are of unfired clay masonry units, and floors, roofs and

interior framing are wholly or partly of wood or other approved materials.

Adobe, stabilized. Unfired clay masonry units to which admixtures, such as emulsified asphalt, are added during the manufacturing process to limit the units' water absorption so as to increase their durability.

Adobe, unstabilized. Unfired clay masonry units that do not meet the definition of "Adobe, stabilized."

ADULT CHANGING FACILITY. *A facility that is for use by persons with disabilities who need assistance with personal hygiene.*

[F] AEROSOL CONTAINER. A metal can or plastic container up to a maximum size of 33.8 fluid ounces (1000 ml), or a glass bottle up to a maximum size of 4 fluid ounces (118 ml), designed and intended to dispense an aerosol.

[F] AEROSOL PRODUCT. A combination of a container, a propellant and a material that is dispensed. Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2 or Level 3.

Level 1 aerosol products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

Level 2 aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 aerosol products. Those with a total chemical heat of combustion that is greater than 13,000 Btu/lb (30 kJ/g).

AGED HOME OR INSTITUTION. *A facility used for the housing of persons 65 years of age or older in need of care and supervision. (See definition of "care and supervision")*

[BS] AGGREGATE. In roofing, crushed stone, crushed slag or water-worn gravel used for surfacing for roof coverings.

[BG] AGRICULTURAL BUILDING. A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

[BF] AIR-IMPERMEABLE INSULATION. An insulation having an air permeance equal to or less than $0.02 \text{ l/s} \times \text{m}^2$ at 75 pa pressure differential tested in accordance with ASTM E283 or ASTM E2178.

[BG] AIR-INFLATED STRUCTURE. A structure that uses air-pressurized membrane beams, arches or other elements to enclose space. Occupants of such a structure do not occupy the pressurized area used to support the structure.

[BG] AIR-SUPPORTED STRUCTURE. A structure wherein the shape of the structure is attained by air pressure and occupants of the structure are within the elevated pressure area. Air-supported structures are of two basic types:

Double skin. Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an

airspace which serves for insulation, acoustic, aesthetic or similar purposes.

Single skin. Where there is only the single outer skin and the air pressure is directly against that skin.

[BE] AISLE. An unenclosed exit access component that defines and provides a path of egress travel. *[DSA-AC] A circulation path between objects such as seats, tables, merchandise, equipment, displays, shelves, desks, etc., that provides clearances in compliance with this code.*

[BE] AISLE ACCESSWAY. That portion of an exit access that leads to an aisle.

[F] ALARM NOTIFICATION APPLIANCE. A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof.

[F] ALARM SIGNAL. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

[F] ALARM VERIFICATION FEATURE. A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

[BS] ALLOWABLE STRESS DESIGN. A method of proportioning structural members, such that elastically computed stresses produced in the members by nominal loads do not exceed specified allowable stresses (also called “working stress design”).

[A] ALTERATION. Any construction or renovation to an existing structure other than repair or addition. *[DSA-AC] A change, addition or modification in construction, change in occupancy or use, or structural repair to an existing building or facility. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historic restoration, resurfacing of circulation paths or vehicular ways, changes or rearrangement of the structural parts or elements, and changes or rearrangement in the plan configuration of walls and full-height partitions. Normal maintenance, reroofing, painting or wallpapering, or changes to mechanical and electrical systems are not alterations unless they affect the usability of the building or facility.*

[BE] ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

ALTERNATIVE SYSTEM. *[OSHPD 1, IR, 2, 4 & 5] Alternative materials, design and methods of construction in accordance with Section 104.11, Section 11.1.4 of ASCE 7 or structural design criteria as approved by the enforcement agency.*

[BG] AMBULATORY CARE FACILITY. Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than 24-hour basis to persons

who are rendered incapable of self-preservation by the services provided or staff has accepted responsibility for care recipients already incapable.

AMUSEMENT ATTRACTION. *[DSA-AC] Any facility, or portion of a facility, located within an amusement park or theme park which provides amusement without the use of an amusement device. Amusement attractions include, but are not limited to, fun houses, barrels and other attractions without seats.*

AMUSEMENT RIDE. *[DSA-AC] A system that moves persons through a fixed course within a defined area for the purpose of amusement.*

AMUSEMENT RIDE SEAT. *[DSA-AC] A seat that is built-in or mechanically fastened to an amusement ride intended to be occupied by one or more passengers.*

[BG] ANCHOR BUILDING. An exterior perimeter building of a group other than H having direct access to a covered or open mall building but having required means of egress independent of the mall.

[BS] ANCHORED MASONRY VENEER. Veneer secured with approved mechanical fasteners to an approved backing.

[BF] ANNULAR SPACE. The opening around the penetrating item.

[F] ANNUNCIATOR. A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

ANSI. *[DSA-AC] The American National Standards Institute.*

[A] APPROVED. Acceptable to the building official or enforcing agency.

[HCD 1, HCD 2 & DSA-AC] “Approved” means meeting the approval of the enforcing agency, except as otherwise provided by law, when used in connection with any system, material, type of construction, fixture or appliance as the result of investigations and tests conducted by the agency, or by reason of accepted principles or tests by national authorities or technical, health or scientific organizations or agencies.

Notes: [HCD 1 & HCD 2]

1. See Health and Safety Code Section 17920 for “Approved” as applied to residential construction and buildings or structures accessory thereto, as referenced in Section 1.8.2.1.1.
2. See Health and Safety Code Section 17921.1 for “Approved” as applied to the use of hotplates in residential construction referenced in Section 1.8.2.1.1.
3. See Health and Safety Code Section 19966 for “Approved” as applied to factory-built housing as referenced in Section 1.8.3.2.5.
4. See Health and Safety Code Section 18201 for “Approved” as applied to mobilehome parks as referenced in Section 1.8.2.1.3.
5. See Health and Safety Code Section 18862.1 for “Approved” as applied to special occupancy parks as referenced in Section 1.8.2.1.3.

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[A] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification where such agency has been approved by the building official.

[HCD 1 & HCD 2] “Approved agency” shall mean “Listing agency” and “Testing agency.”

[DSA-SS, DSA-SS/CC] This term is synonymous with “laboratory of record” as referenced in Section 4-335 of the California Administrative Code.

[BS] APPROVED FABRICATOR. An established and qualified person, firm or corporation approved by the building official pursuant to Chapter 17 of this code.

APPROVED LISTING AGENCY. *[HCD 1 & HCD 2] Any agency approved by the enforcing agency, unless otherwise provided by law, which is in the business of listing and labeling and which makes available at least an annual published report of such listings in which specific information is included that the product has been tested to recognized standards and found to comply.*

[A] APPROVED SOURCE. An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

APPROVED TESTING AGENCY. *[HCD 1, HCD 2, DSA-AC & OSHPD 1, IR, 2, 4 & 5] Any agency, which is determined by the enforcing agency, except as otherwise provided by law, to have adequate personnel and expertise to carry out the testing of systems, materials, types of construction, fixtures or appliances.*

[BS] AREA (for masonry).

Gross cross-sectional. The area delineated by the out-to-out specified dimensions of masonry in the plane under consideration.

Net cross-sectional. The area of masonry units, grout and mortar crossed by the plane under consideration based on out-to-out specified dimensions.

[BG] AREA, BUILDING. The area included within surrounding exterior walls, or exterior walls and fire walls, exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

[BE] AREA OF REFUGE. An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

[BE] AREA OF SPORT ACTIVITY. That portion of an indoor or outdoor space where the play or practice of a sport occurs.

[BG] AREAWAY. A subsurface space adjacent to a building open at the top or protected at the top by a grating or guard.

ASSEMBLY AREA. *[DSA-AC] A building or facility, or portion thereof, used for the purpose of entertainment, educational or civic gatherings, or similar purposes. For the purposes of these requirements, assembly areas include, but are not limited to, classrooms, lecture halls, courtrooms, public meeting*

rooms, public hearing rooms, legislative chambers, motion picture houses, auditoria, theaters, playhouses, dinner theaters, concert halls, centers for the performing arts, amphitheaters, arenas, stadiums, grandstands or convention centers.

ASSEMBLY SEATING, MULTILEVEL. See “Multilevel assembly seating.”

ASSISTIVE DEVICE. *[HCD 1-AC] An aid, tool or instrument used by persons with disabilities to assist in activities of daily living.*

ASSISTIVE LISTENING SYSTEM (ALS). *[DSA-AC] An amplification system utilizing transmitters, receivers and coupling devices to bypass the acoustical space between a sound source and a listener by means of induction loop, radio frequency, infrared or direct-wired equipment.*

[BG] ATRIUM. A vertical space that is closed at the top, connecting two or more stories in Group I-2 and I-3 occupancies or three or more stories in all other occupancies.

[BG] ATTIC. The space between the ceiling framing of the top story and the underside of the roof.

[F] AUDIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of hearing.

[F] AUTOMATIC. As applied to fire protection devices, a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or combustion products.

AUTOMATIC DOOR. *A door equipped with a power-operated mechanism and controls that open and close the door automatically upon receipt of a momentary actuating signal. The switch that begins the automatic cycle may be a photo-electric device, floor mat or manual switch.*

[F] AUTOMATIC FIRE-EXTINGUISHING SYSTEM. An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

[F] AUTOMATIC SMOKE DETECTION SYSTEM. A fire alarm system that has initiation devices that utilize smoke detectors for protection of an area such as a room or space with detectors to provide early warning of fire.

[F] AUTOMATIC SPRINKLER SYSTEM. An automatic sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

AUTOMATIC TELLER MACHINE (ATM). *[DSA-AC] Any electronic information processing device that accepts or dispenses cash in connection with a credit, deposit or convenience account. The term does not include devices used solely to facilitate check guarantees or check authorizations, or which are used in connection with the acceptance or dispensing of cash on a person-to-person basis, such as by a store cashier.*

[F] AUTOMATIC WATER MIST SYSTEM. A system consisting of a water supply, a pressure source and a distribution piping system with attached nozzles, which, at or above a minimum operating pressure, defined by its listing, discharges water in fine droplets meeting the requirements of NFPA 750 for the purpose of the control, suppression or extinguishment of a fire. Such systems include wet-pipe, dry-pipe and pre-action types. The systems are designed as engineered, pre-engineered, local-application or total flooding systems.

[F] AUTOMATIC WATER MIST SYSTEM. A system consisting of a water supply, a pressure source and a distribution piping system with attached nozzles, which, at or above a minimum operating pressure defined by its listing, discharges water in fine droplets meeting the requirements of NFPA 750 for the purpose of the control, suppression or extinguishment of a fire. Such systems include wet-pipe, dry-pipe and pre-action types. The systems are designed as engineered, preengineered, local-application or total-flooding systems.

AUXILIARY AREA. A public dressing, locker, shower or toilet area or building space intended to be used by bathers.

[F] AVERAGE AMBIENT SOUND LEVEL. The root mean square, A-weighted sound pressure level measured over a 24-hour period, or the time any person is present, whichever time period is less.

[BG] AWNING. An architectural projection that provides weather protection, identity or decoration and is partially or wholly supported by the building to which it is attached. An awning is composed of a lightweight frame structure over which a covering is attached.

[BF] BACKING. The wall or surface to which the veneer is secured.

BACKWASH. Is the process of thoroughly cleansing the filter media and/or elements and the contents of the filter vessel.

[BE] BALANCED DOOR. A door equipped with double-pivoted hardware so designed as to cause a semicounterbalanced swing action when opening.

[F] BALED COTTON. A natural seed fiber wrapped in and secured with industry accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).

[F] BALED COTTON, DENSELY PACKED. Cotton made into banded bales with a packing density of not less than 22 pounds per cubic foot (360 kg/m³), and dimensions complying with the following: a length of 55 inches (1397 mm), a width of 21 inches (533.4 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).

[BS] BALLAST. In roofing, ballast comes in the form of large stones or paver systems or light-weight interlocking paver systems and is used to provide uplift resistance for roofing systems that are not adhered or mechanically attached to the roof deck.

[F] BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

Artificial barricade. An artificial mound or revetment a minimum thickness of 3 feet (914 mm).

Natural barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

BASE. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] See ASCE 7.

[BS] BASE FLOOD. The flood having a 1-percent chance of being equaled or exceeded in any given year.

[BS] BASE FLOOD ELEVATION. The elevation of the base flood, including wave height, relative to the National Geodetic Vertical Datum (NGVD), North American Vertical Datum (NAVD) or other datum specified on the *Flood Insurance Rate Map* (FIRM).

[BG] BASEMENT. A story that is not a story above grade plane (see “Story above grade plane”). This definition of “Basement” does not apply to the provisions of Section 1612 for flood loads.

[BS] BASEMENT (for flood loads). The portion of a building having its floor subgrade (below ground level) on all sides. This definition of “Basement” is limited in application to the provisions of Section 1612.

BATHER. A person using a pool and adjoining deck areas for the purpose of water sports such as diving, swimming, wading or related activities.

BATHROOM. For the purposes of Chapters 11A and 11B, a room which includes a water closet (toilet), a lavatory and a bathtub and/or a shower. It does not include single-fixture facilities or those with only a water closet and lavatory. It does include a compartmented bathroom. A compartmented bathroom is one in which the fixtures are distributed among interconnected rooms. A compartmented bathroom is considered a single unit and is subject to the requirements of Chapters 11A and 11B.

[BS] BEARING WALL STRUCTURE. A building or other structure in which vertical loads from floors and roofs are primarily supported by walls.

[BS] BED JOINT. The horizontal layer of mortar on which a masonry unit is laid.

BEDRIDDEN PERSON. A person, requiring assistance in turning and repositioning in bed, or being unable to independently transfer to and from bed, except in facilities with appropriate and sufficient care staff, mechanical devices if necessary, and safety precautions as determined in Title 22 regulations, by the Director of Social Services or his or her designated representative. Persons who are unable to inde-

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pendently transfer to and from bed, but who do not need assistance to turn or reposition in bed, shall be considered nonambulatory.

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of persons with developmental disabilities, in consultation with the Director of Developmental Services or his or her designated representative.

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of all other persons with disabilities who are not developmentally disabled.

[BE] BLEACHERS. Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Grandstand”).

BLENDED TRANSITION. [DSA-AC] A raised pedestrian crossing, depressed corner or similar connection that has a grade of 5 percent or less between a circulation path at the level of the sidewalk or walk and the level of a vehicular way.

[BG] BOARDING HOUSE. A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

BOARDING PIER. [DSA-AC] A portion of a pier where a boat is temporarily secured for the purpose of embarking or disembarking.

BOAT LAUNCH RAMP. [DSA-AC] A sloped surface designed for launching and retrieving trailed boats and other water craft to and from a body of water.

BOAT SLIP. [DSA-AC] That portion of a pier, main pier, finger pier or float where a boat is moored for the purpose of berthing, embarking or disembarking.

[F] BOILING POINT. The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch (psia) (101 kPa) or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D86 shall be used as the boiling point of the liquid.

BOTTLE-FILLING STATION. A fixture that is designed and intended for filling personal use drinking water bottles or containers. Such fixtures can be separate from or integral to a drinking fountain.

[BS] BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

[BS] BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel’s length meets the requirements of its particular bracing method and contributes toward the total amount of bracing required along its braced wall line.

[BE] BREAKOUT. For revolving doors, a process whereby wings or door panels can be pushed open manually for means of egress travel.

[BS] BRICK.

Calcium silicate (sand lime brick). A pressed and subsequently autoclaved unit that consists of sand and lime, with or without the inclusion of other materials.

Clay or shale. A solid or hollow masonry unit of clay or shale, usually formed into a rectangular prism, then burned or fired in a kiln; brick is a ceramic product.

Concrete. A concrete masonry unit made from Portland cement, water, and suitable aggregates, with or without the inclusion of other materials.

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any occupancy.

Exception: [HCD 1, HCD 2 & HCD 1-AC] For applications listed in Section 1.8.2 regulated by the Department of Housing and Community Development, “Building” shall not include the following:

1. Any mobilehome as defined in Health and Safety Code Section 18008.
2. Any manufactured home as defined in Health and Safety Code Section 18007.
3. Any commercial modular as defined in Health and Safety Code Section 18001.8 or any special purpose commercial modular as defined in Section 18012.5.
4. Any recreational vehicle as defined in Health and Safety Code Section 18010.
5. Any multifamily manufactured home as defined in Health and Safety Code Section 18008.7.

For additional information, see Health and Safety Code Section 18908.

Note: Building shall have the same meaning as defined in Health and Safety Code Sections 17920 and 18908 for the applications specified in Section 1.11. | |

BUILDING AREA. See “Area, building.”

[BG] BUILDING ELEMENT. A fundamental component of building construction, specified in TABLE 601, which may or may not be of fire-resistance-rated construction and is constructed of materials based on the building type of construction.

BUILDING ENTRANCE ON AN ACCESSIBLE ROUTE. [HCD 1-AC] An accessible entrance to a building that is connected by an accessible route to public transportation stops, to parking or passenger loading zones, or to public streets or sidewalks, if available.

BUILDING, EXISTING. [HCD 1 & HCD 2] A building erected prior to the adoption of this code, or one for which a legal building permit has been issued.

BUILDING HEIGHT. See “Height, building.”

[BG] BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[A] BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

[BS] BUILDING-INTEGRATED PHOTOVOLTAIC (BIPV) PRODUCT. A building product that incorporates photovoltaic modules and functions as a component of the building envelope.

[BS] BUILDING-INTEGRATED PHOTOVOLTAIC ROOF PANEL (BIPV ROOF PANEL). A photovoltaic panel that functions as a component of the building envelope.

[BS] BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

[BG] CANOPY. A permanent structure or architectural projection of rigid construction over which a covering is attached that provides weather protection, identity or decoration. A canopy is permitted to be structurally independent or supported by attachment to a building on one or more sides.

[F] CAPACITOR ENERGY STORAGE SYSTEM. A stationary, rechargeable energy storage system consisting of capacitors, chargers, controls and associated electrical equipment designed to provide electrical power to a building or facility. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.

[F] CARBON DIOXIDE EXTINGUISHING SYSTEMS. A system supplying carbon dioxide (CO₂) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

[F] CARBON MONOXIDE ALARM. A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

[F] CARBON MONOXIDE DETECTOR. A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

CARE AND SUPERVISION. *Any one or more of the following activities provided by a person or facility to meet the needs of the clients:*

1. Assistance in dressing, grooming, bathing and other personal hygiene.
2. Assistance with taking medication.
3. Central storing and/or distribution of medications.
4. Arrangement of and assistance with medical and dental care.
5. Maintenance of house rules for the protection of clients.
6. Supervision of client schedules and activities.
7. Maintenance and/or supervision of client cash resources or property.

8. Monitoring food intake or special diets.

9. Providing basic services required by applicable law and regulation to be provided by the licensee in order to obtain and maintain a community-care facility license.

[BG] CARE SUITE. In Group I-2 or I-2.1 occupancies, a group of treatment rooms, care recipient sleeping rooms and the support rooms or spaces and circulation space within the suite where staff are in attendance for supervision of all care recipients within the suite, and the suite is in compliance with the requirements of Section 407.4.4.

CARRIAGE UNIT. *[HCD 1-AC] A dwelling unit with living space on one or more floors immediately above a Group U, private garage or garages. The footprint of the garage or garages is used as the footprint for the remaining floor or floors of the units above and the garage level contains no habitable space.*

Note: *Dwelling units located over a common garage shall not be considered carriage units.*

[BS] CAST STONE. A building stone manufactured from Portland cement concrete precast and used as a trim, veneer or facing on or in buildings or structures.

CATASTROPHICALLY INJURED. *As termed, means a person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined by the Department of Health Services Certification and Licensing that active rehabilitation would be beneficial.*

CATCH POOL. *[DSA-AC] A pool or designated section of a pool used as a terminus for water slide flumes.*

CCR. *[DSA-AC] The California Code of Regulations.*

CDCR. *California Department of Corrections and Rehabilitation.*

CDF DIRECTOR. *[SFM] (See Chapter 7A, Section 702A for defined term.)*

[F] CEILING LIMIT. The maximum concentration of an airborne contaminant to which one may be exposed. The ceiling limits utilized are those published in DOL 29 CFR Part 1910.1000. The ceiling Recommended Exposure Limit (REL-C) concentrations published by the US National Institute for Occupational Safety and Health (NIOSH), Threshold Limit Value—Ceiling (TLV-C) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), Ceiling Workplace Environmental Exposure Level (WEEL-Ceiling) Guides published by the American Industrial Hygiene Association (AIHA), and other approved, consistent measures are allowed as surrogates for hazardous substances not listed in DOL 29 CFR Part 1910.1000.

[BF] CEILING RADIATION DAMPER. A listed device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening. Ceiling radiation dampers include air terminal units, ceiling dampers and ceiling air diffusers. Ceiling radiation dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems

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that continue to operate during a fire. A dynamic ceiling radiation damper is tested and rated for closure under elevated temperature airflow.

CELL (Detention or correctional facility). [SFM] A sleeping or housing unit in a detention or correctional facility for the confinement of not more than two inmates or prisoners.

[BG] CELL (Group I-3 occupancy). A room within a housing unit in a detention or correctional facility used to confine inmates or prisoners.

[BS] CELL (masonry). A void space having a gross cross-sectional area greater than $1\frac{1}{2}$ square inches (967 mm²).

CELL COMPLEX. A cluster or group of cells or dormitories in a jail, prison or other detention facility, together with rooms used for accessory purposes, all of which open into the cell complex, and are used for functions such as dining, counseling, exercise, classrooms, sick call, visiting, storage, staff offices, control rooms or similar functions, and interconnecting corridors all within the cell complex.

[BG] CELL TIER. Levels of cells vertically stacked above one another within a housing unit.

CELL TIERS. Cells, dormitories and accessory spaces. Cell tiers are located one level above the other and do not exceed two levels per floor. A cell tier shall not be considered a story or mezzanine. The aggregate area of a tier within a housing pod shall not be greater than one-third of the floor area of that pod when supported by non-rated construction, and shall be no greater than two-thirds of the floor area of the pod when the tier floor and supporting elements meet the fire rating requirements of a floor.

CELLULAR CONCRETE. [HCD 1 & HCD 2] A lightweight product consisting of Portland cement and selected gas-forming chemicals or foaming agents which create homogeneous voids in the hardened concrete.

[BS] CEMENT PLASTER. A mixture of Portland or blended cement, Portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this code.

CENTRAL CONTROL BUILDING. A secure building within a prison where the fire and life safety systems, communication systems, security systems and exterior lighting systems are monitored and where security operations necessitate the remote locking of required means of egress or at the door with a key to maintain a high security area

[BF] CERAMIC FIBER BLANKET. A high-temperature mineral wool insulation material made of alumina-silica ceramic or calcium magnesium silicate soluble fibers and weighing 4 to 10 pounds per cubic foot (pcf) (64 to 160 kg/m³).

[BS] CERTIFICATE OF COMPLIANCE. A certificate stating that materials and products meet specified standards or that work was done in compliance with approved construction documents.

[A] CHANGE OF OCCUPANCY. Either of the following shall be considered as a change of occupancy where this code requires a greater degree of safety, accessibility, structural

strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

CHARACTERS. Letters, numbers, punctuation marks and typographic symbols.

CHARTER SCHOOL. A public school providing instruction from kindergarten through 12th grade, established pursuant to Education Code, Title 2, Division 4, Part 26.8, Section 47600, et seq.

CHILD-CARE. For the purposes of these regulations, means the care of children during any period of a 24-hour day where permanent sleeping accommodations are not provided. The time-period shall not be more than 24 hours.

Note: "Child care" shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

CHILD-CARE CENTER. Any facility of any capacity other than a large or small family day-care home as defined in these regulations in which less than 24-hour-per-day nonmedical supervision is provided for children in a group setting.

CHILD OR CHILDREN. A person or persons under the age of 18 years.

CHILDREN'S USE. [DSA-AC] Describes spaces and elements specifically designed for use primarily by people 12 years old and younger.

[M] CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outdoor atmosphere.

Factory-built chimney. A listed and labeled chimney composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones, or concrete.

Metal chimney. A field-constructed chimney of metal.

[M] CHIMNEY TYPES.

High-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, high-heat appliances producing combustion gases in excess of 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.3).

Low-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, low-heat appliances producing combustion gases not in excess of 1,000°F (538°C) under normal operating conditions, but capable of producing combustion gases of 1,400°F (760°C) during intermittent forces firing for peri-

ods up to 1 hour. Temperatures shall be measured at the appliance flue outlet.

Masonry type. A field-constructed chimney of solid masonry units or stones.

Medium-heat appliance type. An approved chimney for removing the products of combustion from fuel-burning, medium-heat appliances producing combustion gases not exceeding 2,000°F (1093°C) measured at the appliance flue outlet (see Section 2113.11.2).

CHRONICALLY ILL. See “Terminally ill.”

[BE] CIRCULATION PATH. An exterior or interior way of passage from one place to another for pedestrians. *[DSA-AC] An exterior or interior way of passage provided for pedestrian travel, including but not limited to, walks, sidewalks, hallways, courtyards, elevators, platform lifts, ramps, stairways and landings.*

[F] CLEAN AGENT. Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon vaporation.

CLEAN POOL WATER. *Is a pool water that is free of dirt, oils, scum, algae, floating materials or other visible organic and inorganic materials that would sully the water.*

CLEAR. *[DSA-AC] Unobstructed.*

CLEAR FLOOR SPACE. *[DSA-AC & HCD 1-AC] The minimum unobstructed floor or ground space required to accommodate a single, stationary wheelchair and occupant.*

CLEAR POOL WATER. *Pool water that is free from cloudiness and is transparent.*

[BF] CLIMATE ZONE. A geographical region that has been assigned climatic criteria as specified in Chapters 3 [CE] and 3 [RE] of the *International Energy Conservation Code (IECC)* or, for California Energy Code provisions, *Figure 100. 1-A of the California Energy Code.*

[BG] CLINIC, OUTPATIENT. Buildings or portions thereof used to provide medical care on less than a 24-hour basis to persons who are not *classified as nonambulatory or bedridden* or rendered incapable of self-preservation by the services provided.

CLOSED-CIRCUIT TELEPHONE. *[DSA-AC] A telephone with a dedicated line such as a house phone, courtesy phone or phone that must be used to gain entry to a facility.*

[F] CLOSED SYSTEM. The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of compressed gases. Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

[BS] COASTAL A ZONE. Area within a special flood hazard area, landward of a V zone or landward of an open coast without mapped coastal high-hazard areas. In a coastal A zone, the principal source of flooding must be astronomical tides, storm surges, seiches or tsunamis, not riverine

flooding. During the base flood conditions, the potential for breaking wave height shall be greater than or equal to 1½ feet (457 mm). The inland limit of the *coastal A zone* is (a) the *Limit of Moderate Wave Action* if delineated on a FIRM, or (b) designated by the authority having jurisdiction.

[BS] COASTAL HIGH-HAZARD AREA. Area within the special flood hazard area extending from offshore to the inland limit of a primary dune along an open coast and any other area that is subject to high-velocity wave action from storms or seismic sources, and shown on a *Flood Insurance Rate Map* (FIRM) or other flood hazard map as velocity Zone V, VO, VE or V1-30.

[BS] COLLAR JOINT. Vertical longitudinal space between wythes of masonry or between masonry wythe and backup construction that is permitted to be filled with mortar or grout.

[BS] COLLECTOR. A horizontal diaphragm element parallel and in line with the applied force that collects and transfers diaphragm shear forces to the vertical elements of the lateral force-resisting system or distributes forces within the diaphragm, or both.

[BF] COMBINATION FIRE/SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

[BS] COMBINED PILE RAFT. A geotechnical composite construction that combines the bearing effect of both foundation elements, raft and piles, by taking into account interactions between the foundation elements and the subsoil.

[F] COMBUSTIBLE DUST. Finely divided solid material that is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a US No. 40 standard sieve.

[F] COMBUSTIBLE FIBERS. Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials. This definition does not include densely packed baled cotton.

[F] COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

The category of combustible liquids does not include compressed gases or cryogenic fluids or liquids that do not have a fire point when tested in accordance with ASTM D92.

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having a closed cup flash point at or above 200°F (93°C).

DEFINITIONS

COMMERCIAL FACILITIES [DSA-AC]. Facilities whose operations will affect commerce and are intended for non-residential use by a private entity. Commercial facilities shall not include (1) facilities that are covered or expressly exempted from coverage under the Fair Housing Act of 1968, as amended (42 U.S.C. 3601 - 3631); (2) aircraft; or (3) railroad locomotives, railroad freight cars, railroad cabooses, commuter or intercity passenger rail cars (including coaches, dining cars, sleeping cars, lounge cars and food service cars), any other railroad cars described in Section 242 of the Americans With Disabilities Act or covered under Title II of the Americans With Disabilities Act, or railroad rights-of-way. For purposes of this definition, “rail” and “railroad” have the meaning given the term “railroad” in Section 202(e) of the Federal Railroad Safety Act of 1970 (45 U.S.C. 431(e)).

[F] COMMERCIAL MOTOR VEHICLE. A motor vehicle used to transport passengers or property where the motor vehicle meets one of the following:

1. Has a gross vehicle weight rating of 10,000 pounds (4540 kg) or more.
2. Is designed to transport 16 or more passengers, including the driver.

COMMERCIAL PLACE OF PUBLIC AMUSEMENT. [DSA-AC] An auditorium, convention center, cultural complex, exhibition hall, permanent amusement park, sports arena, theater or movie house for which the maximum occupancy is 2,500 or more for the facility. Cultural complexes include but are not limited to art galleries, symphony, concert halls and museums. A commercial place of public amusement does not include any public or private higher education facility or district agricultural associations.

[BE] COMMON PATH OF EGRESS TRAVEL. That portion of exit access travel distance measured from the most remote point of each room, area or space to that point where the occupants have separate and distinct access to two exits or exit access doorways.

COMMON USE. Interior or exterior circulation paths, rooms, spaces or elements that are not for public use and are made available for the shared use of two or more people.

COMMON USE AREAS. [HCD 1-AC] Private use areas within multifamily residential facilities where the use of these areas is limited exclusively to owners, residents and their guests. The areas may be defined as rooms or spaces or elements inside or outside of a building.

COMMUNITY CARE FACILITY. Any facility, place or building that is maintained and operated to provide nonmedical residential care, day treatment, adult day care or agency services for children, adults, or children and adults, including, but not limited to, the physically handicapped, mentally impaired, incompetent persons, and abused or neglected children, and includes but is not limited to the following as defined in Health and Safety Code Section 1502:

1. Residential facility
2. Adult day program
3. Therapeutic day services facility

4. Social rehabilitation facility
5. Community treatment facility
6. Full-service adoption agency
7. Transitional shelter care facility
8. Transitional housing placement facility

COMMUNITY CORRECTIONAL REENTRY CENTERS—CALIFORNIA DEPARTMENT OF CORRECTIONS AND REHABILITATION [CDCR]. Community-located facilities that provide housing and transitional rehabilitative or community-based programing services for ambulatory inmates. CDCR Program services assist with substance use disorder treatment, employment, education, family reunification and social support. Program participants remain under the jurisdiction of CDCR, are monitored by CDCR staff and supervised by CDCR approved/contracted program providers 24/7. The facilities include residential living, food services, administrative and program functional spaces in a non-licensed 24 hr. facility.

COMPLY WITH. [DSA-AC] Comply with means to meet one or more provisions of this code.

[F] COMPRESSED GAS. A material or mixture of materials that meets both of the following:

1. Is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure.
2. Has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68°F (20°C).
3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

[BS] CONCRETE.

Carbonate aggregate. Concrete made with aggregates consisting mainly of calcium or magnesium carbonate, such as limestone or dolomite, and containing 40 percent or less quartz, chert or flint.

Cellular. [HCD 1 & HCD 2] See “Cellular Concrete.”

Cellular. A lightweight insulating concrete made by mixing a preformed foam with Portland cement slurry and having a dry unit weight of approximately 30 pcf (480 kg/m³).

Lightweight aggregate. Concrete made with aggregates of expanded clay, shale, slag or slate or sintered fly ash or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and weighing 85 to 115 pcf (1360 to 1840 kg/m³).

Perlite. A lightweight insulating concrete having a dry unit weight of approximately 30 pcf (480 kg/m³) made with perlite concrete aggregate. Perlite aggregate is produced from a volcanic rock which, when heated, expands to form a glass-like material of cellular structure.

Sand-lightweight. Concrete made with a combination of expanded clay, shale, slag, slate, sintered fly ash, or any natural lightweight aggregate meeting ASTM C330 and possessing equivalent fire-resistance properties and natural sand. Its unit weight is generally between 105 and 120 pcf (1680 and 1920 kg/m³).

Siliceous aggregate. Concrete made with normal-weight aggregates consisting mainly of silica or compounds other than calcium or magnesium carbonate, which contains more than 40-percent quartz, chert or flint.

Vermiculite. A light weight insulating concrete made with vermiculite concrete aggregate which is laminated micaceous material produced by expanding the ore at high temperatures. When added to a Portland cement slurry the resulting concrete has a dry unit weight of approximately 30 pcf (480 kg/m³).

➔ CONGREGATE LIVING HEALTH FACILITY (CLHF).

As defined in Health and Safety Code Section 1250.

- (1) A residential home with a capacity, except as provided in paragraph (4), of no more than 18 beds, that provides inpatient care, including the following basic services: medical supervision, 24-hour skilled nursing and supportive care, pharmacy, dietary, social, recreational, and at least one type of service specified in paragraph (2). The primary need of congregate living health facility residents shall be for availability of skilled nursing care on a recurring, intermittent, extended, or continuous basis. This care is generally less intense than that provided in general acute care hospitals but more intense than that provided in skilled nursing facilities.
- (2) Congregate living health facilities shall provide one of the following services:
 - (A) Services for persons who are mentally alert, persons with physical disabilities, who may be ventilator dependent.
 - (B) Services for persons who have a diagnosis of terminal illness, a diagnosis of a life-threatening illness, or both. Terminal illness means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon. A "life-threatening illness" means the individual has an illness that can lead to a possibility of a termination of life

within five years or less as stated in writing by his or her attending physician and surgeon.

- (C) Services for persons who are catastrophically and severely disabled. A person who is catastrophically and severely disabled means a person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined that active rehabilitation would be beneficial and to whom these services are being provided. Services offered by a congregate living health facility to a person who is catastrophically disabled shall include, but not be limited to, speech, physical, and occupational therapy.
- (3) A congregate living health facility license shall specify which of the types of persons described in paragraph (2) to whom a facility is licensed to provide services.
- (4)
 - (A) A facility operated by a city and county for the purposes of delivering services under this section may have a capacity of 59 beds.
 - (B) A congregate living health facility not operated by a city and county servicing persons who are terminally ill, persons who have been diagnosed with a life-threatening illness, or both, that is located in a county with a population of 500,000 or more persons, or located in a county of the 16th class pursuant to Section 28020 of the Government Code, may have not more than 25 beds for the purpose of serving persons who are terminally ill.
 - (C) A congregate living health facility not operated by a city and county servicing persons who are catastrophically and severely disabled, as defined in subparagraph (C) of paragraph (1) that is located in a county of 500,000 or more persons may have not more than 12 beds for the purpose of serving persons who are catastrophically and severely disabled.
- (5) A congregate living health facility shall have a noninstitutional, homelike environment.

CONGREGATE RESIDENCE. Any building or portion thereof that contains facilities for living, sleeping and sanitation, as required by this code, and may include facilities for eating and cooking, for occupancy by other than a family. A congregate residence may be a shelter, convent, monastery, dormitory, fraternity or sorority house, but does not include jails, hospitals, nursing homes, hotels or lodging houses.

[F] CONSTANTLY ATTENDED LOCATION. A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.

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[A] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit.

[BG] CONSTRUCTION TYPES. See Section 602.

Type I. See Section 602.2.

Type II. See Section 602.2.

Type III. See Section 602.3.

Type IV. See Section 602.4.

Type V. See Section 602.5.

[BF] CONTINUOUS INSULATION (ci). Insulating material that is continuous across all structural members without thermal bridges other than fasteners and service openings. It is installed on the interior or exterior, or is integral to any opaque surface of the building envelope.

[F] CONTROL AREA. Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See the definition of “*Outdoor control area*” in the *California Fire Code*.

CONTROL ROOM. A room that has staff that provides direct supervision of one or more cell tiers, pods, dormitories, housing units, sally ports, central holding areas, individual holding cells within central holding areas, as well as any number of courtroom holding cells and arraignment docks, and may have fire and personal alarm annunciation, ability to open and close doors, communicate with Central Control and monitor activities inside the area of control and the space immediately outside the Control Room’s zone of influence.

[BS] CONTROLLED LOW-STRENGTH MATERIAL. A self-compacted, cementitious material used primarily as a backfill in place of compacted fill.

[BS] CONVENTIONAL LIGHT-FRAME CONSTRUCTION. Construction whose primary structural elements are formed by a system of repetitive wood-framing members. See Section 2308 for conventional light-frame construction provisions.

[BG] CORNICE. A projecting horizontal molded element located at or near the top of an architectural feature.

CORRECTIONAL HOSPITALS. Facilities that provide care and treatment for medical, psychiatric, obstetrical or surgical treatment of care recipients that are incapable of self-preservation within a detention facility such as a prison or jail.

CORRECTIONAL MEDICAL OR MENTAL HEALTH HOUSING SUITE. Within a state prison, correctional treatment facility, local detention facility or juvenile facility, a correctional medical or mental health housing suite shall be a group of patient rooms or cells and support spaces, including nurse stations, located around shared circulation.

CORRECTIONAL MENTAL HEALTH FACILITIES. Facilities that provide care and treatment for psychiatric treatment of care recipients that are incapable of self-preservation within a detention facility such as a prison or jail.

CORRECTIONAL NURSING FACILITIES. Facilities that provide care, including both intermediate care facilities and skilled nursing facilities, where any of the persons are incapable of self-preservation or classified as non-ambulatory or bedridden within a detention facility such as a prison or jail.

CORRECTIONAL TREATMENT CENTERS. Facilities that provide emergency and acute care and treatment for medical, psychiatric, obstetrical or surgical treatment of care recipients that are incapable of self-preservation within a detention facility such as a prison or jail.

[BE] CORRIDOR. An enclosed exit access component that defines and provides a path of egress travel.

CORRIDOR, OPEN-ENDED. See “*Open-ended corridor*.”

[BF] CORRIDOR DAMPER. A listed device intended for use where air ducts penetrate or terminate at horizontal openings in the ceilings of fire-resistance-rated corridors, where the corridor ceiling is permitted to be constructed as required for the corridor walls.

[BS] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties when exposed to its environment.

CORROSION RESISTANT. Capable of maintaining original surface characteristics under the prolonged influence of the use environment.

[F] CORROSIVE. A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR, Part 173.137, such chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.

[BG] COURT. An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior building walls or other enclosing devices.

COURTHOUSE HOLDING FACILITY. [SFM] A room, cell, cell complex or building for the confinement of persons for the purpose of a court appearance for a period not to exceed 12 hours.

COURTROOM DOCK. An area within a courtroom where persons may be restrained and are awaiting court proceedings.

[BG] COVERED MALL BUILDING. A single building enclosing a number of tenants and occupants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices and other similar uses wherein two or more tenants have a main entrance into one or more malls. Anchor buildings shall not be considered as a part of the covered mall building. The term “covered mall building” shall include open mall buildings as defined below.

Mall. A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other. The term “mall” shall include open malls as defined below.

Open mall. An unroofed common pedestrian way serving a number of tenants not exceeding three levels. Circulation at levels above grade shall be permitted to include open exterior balconies leading to exits discharging at grade.

Open mall building. Several structures housing a number of tenants, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses, wherein two or more tenants have a main entrance into one or more open malls. Anchor buildings are not considered as a part of the open mall building.

COVERED MULTIFAMILY DWELLINGS. [HCD 1-AC] *“Covered multifamily dwellings” means either of the following:*

1. *Buildings that consist of at least four condominium dwelling units or at least three apartment dwelling units if the buildings have at least one elevator.*
2. *The ground floor dwelling units in buildings that consist of at least four condominium dwelling units or at least three apartment dwelling units if the building does not have an elevator.*

Covered multifamily dwellings include dwellings listed in Section 1102A.1. For purposes of this definition, dwelling units within a single structure separated by firewalls do not constitute separate buildings.

[BS] CRIPPLE WALL. A framed stud wall extending from the top of the foundation to the underside of floor framing for the lowest occupied floor level.

[F] CRITICAL CIRCUIT. A circuit that requires continuous operation to ensure safety of the structure and occupants.

[BS] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element.

CROSS SLOPE. *The slope that is perpendicular to the direction of travel.*

[F] CRYOGENIC FLUID. A liquid having a boiling point lower than -150°F (-101°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101 kPa).

CURB CUT. *An interruption of a curb at a pedestrian way, which separates surfaces that are substantially at the same elevation.*

CURB RAMP. *A sloping prepared surface, intended for pedestrian traffic, which provides access between a walk or sidewalk and a surface located above or below an adjacent curb face.*

[BG] CUSTODIAL CARE. Assistance with day-to-day living tasks; such as assistance with cooking, taking medication, bathing, using toilet facilities and other tasks of daily living. Custodial care includes persons receiving care who have the ability to respond to emergency situations and evacuate at a slower rate and/or who have mental and psychiatric complications.

CUSTODY STATION. *A desk or platform staffed by one or more custody officers whose purpose is to supervise those in custody.*

[BS] DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAMPER. See “Ceiling radiation damper,” “Combination fire/smoke damper,” “Corridor damper,” “Fire damper” and “Smoke damper.”

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgment of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine, or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake, or other environmental loads when such loads are imminent.

[F] DAY BOX. A portable magazine designed to hold explosive materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56 of the *California Fire Code*.

DAY-CARE. *For the purposes of these regulations, means the care of persons during any period of a 24-hour day where permanent sleeping accommodations are not provided. The time period shall not be more than 24 hours.*

Note: “Day-care” shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

DAY-CARE HOME, FAMILY. *A home that regularly provides care, protection and supervision for 14 or fewer children, in the provider’s own home, for periods of less than 24 hours per day, while the parents or guardians are away, and is either a large family day-care home or a small family day-care home.*

DAY-CARE HOME, LARGE FAMILY. *A provider’s own home which is licensed to provide day care for periods less than 24 hours per day for nine to 14 persons, including children under the age of 10 years who reside at the home.*

DAY-CARE HOME, SMALL FAMILY. *A home which provides family day-care to eight or fewer children, including children under the age of 10 years who reside at the home, in the provider’s own home, for periods of less than 24 hours per day. Small family day-care homes are exempted from state fire and life safety regulations other than those state and local standards applicable to Group R-3 occupancies. (See Health and Safety Code, Section 13143 (b).)*

DAY ROOM. *A room which is adjacent to a cell, or cell tier, or dormitory and which is used as a dining, exercise or other activity room for inmates.*

[BS] DEAD LOAD. The weight of materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions,

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finishes, cladding and other similarly incorporated architectural and structural items, and the weight of fixed service equipment, including cranes and material handling systems.

DECK. *Is an area surrounding a pool which is specifically constructed or installed for use by bathers.*

[BS] DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

[F] DECORATIVE MATERIALS. All materials applied over the building interior finish for decorative, acoustical or other effect including, but not limited to, curtains, draperies, fabrics and streamers; and all other materials utilized for decorative effect including, but not limited to, bulletin boards, artwork, posters, photographs, batting, cloth, cotton, hay, stalks, straw, vines, leaves, trees, moss and similar items, foam plastics and materials containing foam plastics. Decorative materials do not include wall coverings, ceiling coverings, floor coverings, ordinary window shades, interior finish and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

[BS] DEEP FOUNDATION. A deep foundation is a foundation element that does not satisfy the definition of a shallow foundation.

[BE] DEFEND-IN-PLACE. A method of emergency response that engages building components and trained staff to provide occupant safety during an emergency. Emergency response involves remaining in place, relocating within the building, or both, without evacuating the building.

[A] DEFERRED SUBMITTAL. Those portions of the design that are not submitted at the time of the application and that are to be submitted to the building official within a specified period.

[F] DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

[BF] DELAYED-ACTION CLOSER. A self-closing device that incorporates a delay prior to the initiation of closing. Delayed-action closers are mechanical devices with an adjustable delay.

[F] DELUGE SYSTEM. A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

DEPARTMENT. *[HCD 1 & HCD 2] The Department of Housing and Community Development.*

[BS] DESIGN EARTHQUAKE GROUND MOTION. The earthquake ground motion that buildings and structures are specifically proportioned to resist in Section 1613.

[BS] DESIGN FLOOD. The flood associated with the greater of the following two areas:

1. Area with a flood plain subject to a 1-percent or greater chance of flooding in any year.
2. Area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

[BS] DESIGN FLOOD ELEVATION. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation shall be the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 2 feet (610 mm).

DESIGN PROFESSIONAL, REGISTERED. See "*Registered design professional.*"

DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE, REGISTERED. See "*Registered design professional in responsible charge.*"

[BS] DESIGN STRENGTH. The product of the nominal strength and a resistance factor (or strength reduction factor).

DESIGNATED PUBLIC TRANSPORTATION. *[DSA-AC] Transportation provided by a public entity (other than public school transportation) by bus, rail or other conveyance (other than transportation by aircraft or intercity or commuter rail transportation) that provides the general public with general or special service, including charter service, on a regular and continuing basis.*

[BS] DESIGNATED SEISMIC SYSTEM. Those nonstructural components that require design in accordance with Chapter 13 of ASCE 7 and for which the component importance factor, I_p , is greater than 1 in accordance with Section 13.1.3 of ASCE 7.

DESTINATION-ORIENTED ELEVATOR. *[DSA-AC] Destination-oriented elevators are operated by the user selecting a destination floor at a hall call console located at or near an elevator landing. The destination-oriented elevator system then assigns an elevator car which transports the user to the selected destination floor. Destination-oriented elevators do not provide floor selection within elevator cars.*

[F] DETACHED BUILDING. A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures.

DETACHED SINGLE-FAMILY DWELLING. *[HCD 1 & HCD 2] Any single-family dwelling which is separated (detached) from adjacent buildings.*

[BS] DETAILED PLAIN CONCRETE STRUCTURAL WALL. See Section 1905.1.1.

DETECTABLE WARNING. *A standardized surface feature built in or applied to walking surfaces or other elements to warn persons with visual impairments of hazards on a circulation path.*

[F] DETECTOR, HEAT. A fire detector that senses heat—either abnormally high temperature or rate of rise, or both.

DETENTION ELEVATOR. [SFM] *Detention elevator shall mean an elevator which moves in-custody individuals within a secure and restrained environment.*

DETENTION PROGRAM SUITE. *Within a state prison, correctional treatment facility, local detention facility or juvenile facility, a detention program suite shall be a group of program related spaces, not classified as group F uses, located around shared circulation.*

DETENTION TREATMENT ROOM. [SFM] *Detention treatment room shall mean a lockable room or rooms within Group I-3 occupancies used for recreational therapy, group rooms, interdisciplinary treatment team rooms and interview rooms not classified solely as a Group I-2 occupancy.*

[F] DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

[BG] DETOXIFICATION FACILITIES. Facilities that provide treatment for substance abuse, serving care recipients who are incapable of self-preservation or classified as non-ambulatory or who are harmful to themselves or others.

[BS] DIAPHRAGM. A horizontal or sloped system acting to transmit lateral forces to vertical elements of the lateral force-resisting system. When the term “diaphragm” is used, it shall include horizontal bracing systems.

Diaphragm, blocked. In light-frame construction, a diaphragm in which all sheathing edges not occurring on a framing member are supported on and fastened to blocking.

Diaphragm boundary. In light-frame construction, a location where shear is transferred into or out of the diaphragm sheathing. Transfer is either to a boundary element or to another force-resisting element.

Diaphragm chord. A diaphragm boundary element perpendicular to the applied load that is assumed to take axial stresses due to the diaphragm moment.

Diaphragm, unblocked. A diaphragm that has edge nailing at supporting members only. Blocking between supporting structural members at panel edges is not included. Diaphragm panels are field nailed to supporting members.

[BS] DIMENSIONS. This definition applies only to Chapter 21.

Nominal. The specified dimension plus an allowance for the joints with which the units are to be laid. Nominal dimensions are usually stated in whole numbers. Thickness is given first, followed by height and then length.

Specified. Dimensions specified for the manufacture or construction of a unit, joint or element.

[BE] DIRECT ACCESS. A path of travel from a space to an immediately adjacent space through an opening in the common wall between the two spaces.

DIRECTIONAL SIGN. [DSA-AC, HCD 1 & HCD 2] *A publicly displayed notice which indicates by use of words or symbols a recommended direction or route of travel.*

DISABILITY. [DSA-AC] *Disability is (1) a physical or mental impairment that limits one or more of the major life activities of an individual, (2) a record of such an impairment, or (3) being regarded as having such an impairment.*

[F] DISPENSING. The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

DISTANCE FROM AN ACTIVE EARTHQUAKE FAULT. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] *Distance measured from the nearest point of the building to the closest edge of an Alquist-Priolo Earthquake fault zone for an active fault, if such a map exists, or to the closest mapped splay of the fault.*

DISTRICT AGRICULTURAL ASSOCIATIONS. *Those associations regulated by the California Food and Agricultural Code, Division 3, Part 3.*

DOOR, BALANCED. See “Balanced door.”

DOOR, LOW-ENERGY POWER-OPERATED. See “Low-energy power-operated door.”

DOOR, POWER-ASSISTED. See “Power-assisted door.”

DOOR, POWER-OPERATED. See “Power-operated door.”

DOORWAY, EXIT ACCESS. See “Exit access doorway.”

[BG] DORMITORY. A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses. [SFM] *For Group I-3 occupancies “Dormitory” is an area occupied by no less than three inmates.*

[BF] DRAFTSTOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

DRAG STRUT. See “Collector.”

DRAIN. *A fitting or fixture, usually at or near the bottom of a pool, through which water leaves the pool normally to the recirculation pump.*

[BS] DRILLED SHAFT. A cast-in-place deep foundation element, also referred to as a caisson, drilled pier or bored pile, constructed by drilling a hole (with or without permanent casing or drilling fluid) into soil or rock and filling it with fluid concrete after the drilling equipment is removed.

Socketed drilled shaft. A drilled shaft with a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock.

DRIVE AISLE. *A vehicular way provided within a parking facility that connects vehicular entrances, parking stalls, electric vehicle charging stations, passenger loading zones and vehicular exits.*

DRIVE-UP ELECTRIC VEHICLE CHARGING STATION. *An electric vehicle charging station in which use is limited to 30 minutes maximum and is provided at a location*

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where the electric vehicle approaches in the forward direction, stops in the vehicle space, charges the vehicle and proceeds forward to depart the vehicle space. The arrangement of a drive-up electric vehicle charger and its associated vehicle space is similar to a gasoline filling station island.

DRIVEWAY. A vehicular way providing access between a public way and a building, parking facility, or other off-street area. A driveway may provide access to drive aisles in a parking facility.

[BS] DRY FLOODPROOFING. A combination of design modifications that results in a building or structure, including the attendant utilities and equipment and sanitary facilities, being water tight with walls substantially impermeable to the passage of water and with structural components having the capacity to resist loads as identified in ASCE 7.

[F] DRY-CHEMICAL EXTINGUISHING AGENT. A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

[A] DWELLING. A building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

[A] DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation. **[HCD 1-AC]** For the purposes of Chapter 11A, a single unit of residence for a family of one or more persons. Examples of dwelling units covered by Chapter 11A include condominiums, an apartment unit within an apartment building, and other types of dwellings in which sleeping accommodations are provided but toileting or cooking facilities are shared by occupants of more than one room or portion of the dwelling. Examples of the latter include dormitory rooms and sleeping accommodations in shelters intended for occupancy as residences for homeless persons.

[BG] DWELLING UNIT, EFFICIENCY. A dwelling unit where all permanent provisions for living, sleeping, eating and cooking are contained in a single room.

DWELLING UNIT OR SLEEPING UNIT, MULTISTORY. See “Multistory unit.”

EFFECTIVE PARTICLE SIZE. The theoretical size of a sieve in mm that will pass 10 percent by weight of sand.

EFFICIENCY DWELLING UNIT. **[HCD 1]** A dwelling unit constructed in accordance with Health and Safety Code Section 17958.1 or the California Building Code Section 1208.4.

[BE] EGRESS COURT. A court or yard which provides access to a public way for one or more exits.

ELECTRIC VEHICLE (EV). **[DSA-AC & SFM]** An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehi-

cles, electric motorcycles and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array or other source of electric current. Plug-in hybrid electric vehicles (PHEV) are considered electric vehicles. For the purpose of this code, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not included.

ELECTRIC VEHICLE (EV) CHARGER. Off-board charging equipment used to charge an electric vehicle.

ELECTRIC VEHICLE CHARGING SPACE (EV Space). A space intended for charging electric vehicles.

ELECTRIC VEHICLE CHARGING STATION (EVCS). One or more electric vehicle charging spaces served by an electric vehicle charger or other charging equipment. Where a multiport electric vehicle charger can simultaneously charge more than one vehicle, the number of electric vehicle charging stations shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

ELECTRIC VEHICLE (EV) CONNECTOR. A device that, when electrically coupled (conductive or inductive) to an electric vehicle inlet, establishes an electrical connection to the electric vehicle for the purpose of power transfer and information exchange. This device is part of the electric vehicle coupler.

[BG] ELECTRIC VEHICLE CHARGING STATION. One or more vehicle spaces served by an electric vehicle charging system.

[BF] ELECTRICAL CIRCUIT PROTECTIVE SYSTEM. A specific construction of devices, materials, or coatings installed as a fire-resistive barrier system applied to electrical system components, such as cable trays, conduits and other raceways, open run cables and conductors, cables, and conductors.

ELEMENT. **[DSA-AC]** An architectural or mechanical component of a building, facility, space or site.

ELEVATED PLAY COMPONENT. **[DSA-AC]** A play component that is approached above or below grade and that is part of a composite play structure consisting of two or more play components attached or functionally linked to create an integrated unit providing more than one play activity.

[F] ELEVATOR GROUP. A grouping of elevators in a building located adjacent or directly across from one another that responds to common hall call buttons.

ELEVATOR, PASSENGER. **[HCD 1 & HCD 2]** See “PASSENGER ELEVATOR.” **[DSA-AC]** An elevator used primarily to carry passengers.

[F] EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving hazardous materials.

[F] EMERGENCY CONTROL STATION. An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

[F] EMERGENCY POWER SYSTEM. A source of automatic electric power of a required capacity and duration to operate required life safety, fire alarm, detection and ventilation systems in the event of a failure of the primary power. Emergency power systems are required for electrical loads where interruption of the primary power could result in loss of human life or serious injuries.

[F] EMERGENCY VOICE/ALARM COMMUNICATIONS. Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

[BF] EMITTANCE. The ratio of radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

[BE] EMPLOYEE WORK AREA. All or any portion of a space used only by employees and only for work. Corridors, toilet rooms, kitchenettes and break rooms are not employee work areas.

ENFORCEMENT. [HCD 1 & HCD 2] *The applicable section of the Health and Safety Code is repeated here for clarity and reads as follows:*

Section 17920. "Enforcement" means diligent effort to secure compliance, including review of plans and permit applications, response to complaints, citation of violations and other legal process. Except as otherwise provided in this part, "enforcement" may, but need not, include inspections of existing buildings on which no complaint or permit application has been filed, and effort to secure compliance as to these existing buildings.

ENFORCEMENT AGENT. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] *That individual within the agency or organization charged with responsibility for agency or organization compliance with the requirements of this Code. Used interchangeably with Building Official and Code Official.*

ENFORCING AGENCY. [DSA-AC, HCD 1 & HCD 2] *The designated department or agency as specified by statute or regulation.*

[BS] ENGINEERED WOOD RIM BOARD. A full-depth structural composite lumber, wood structural panel, structural glued laminated timber or prefabricated wood I-joist member designed to transfer horizontal (shear) and vertical (compression) loads, provide attachment for diaphragm sheathing, siding and exterior deck ledgers, and provide lateral support at the ends of floor or roof joists or rafters.

ENTRANCE. *Any access point to a building or portion of a building or facility used for the purpose of entering. An entrance includes the approach walk, the vertical access leading to the entrance platform, the entrance platform itself, vestibule if provided, the entry door or gate, and the hardware of the entry door or gate.*

ENTRANCE, PUBLIC. See "Public entrance."

ENTRANCE, RESTRICTED. See "Restricted entrance."

ENTRANCE, SERVICE. See "Service entrance."

EQUIPMENT. [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *Equipment as used in this part and all applicable parts of the California Building Standards Code shall be classified as fixed equipment, mobile, movable, countertop, interim, temporary or other equipment.*

(1) **COUNTERTOP EQUIPMENT** [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *means equipment that typically remains on countertop, work bench, shelf or support other than the floor during its service life.*

(2) **ESSENTIAL EQUIPMENT** [OSHPD 1, 2, 4 & 5] *means equipment whose failure will significantly impair operations during or after a disaster. The facility shall determine which equipment is essential. Essential equipment shall also include equipment that is required to provide the eight basic services of the hospital as defined in Section 1224.3.*

ESSENTIAL EQUIPMENT [DSA-SS, DSA-SS/CC] *means equipment whose failure will significantly impair operations during or after a disaster for emergency preparedness, communications and operations centers, and other facilities required for emergency response of state-owned essential services buildings, as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207, and all structures required for their continuous operation or access/egress.*

(3) **FIXED EQUIPMENT** [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *means equipment that is directly attached to the building or directly connected to a service distribution system/utility and that typically remains in one fixed location during its service life or use.*

(4) **INTERIM EQUIPMENT** [OSHPD 1, 2, 4 & 5] *means temporary equipment that will be in use greater than 180 days but only for the duration of the construction project that it is related to.*

(5) **MOBILE EQUIPMENT** [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *means equipment, with or without wheels or rollers, that is typically used in a different location than where it is stored and moved from one location in the building to another during ordinary use.*

(6) **MOVABLE EQUIPMENT** [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *means equipment that is directly attached to the building and/or directly connected to a service distribution system/utility, with or without wheels or rollers, that typically remains in one fixed location during its service life or use, but is required to be periodically moved to facilitate cleaning or maintenance.*

(7) **OTHER EQUIPMENT** [DSA-SS, DSA-SS/CC, OSHPD 1, 2, 4 & 5] *means equipment that is not directly connected to a building service distribution system, with or without wheels or rollers, and is typically used at a single location during its service life.*

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(8) **TEMPORARY EQUIPMENT [OSHPD 1, 2, 4 & 5]** means fixed, movable, countertop or other equipment that is used during replacement, maintenance or repair for a time of service as defined in Section 108.

EQUIPMENT AREA. An area used for pool recirculation and purification equipment and related piping appurtenances.

[BG] EQUIPMENT PLATFORM. An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairways, alternating tread devices and ladders necessary to access the platform (see Section 505.3).

EQUIVALENT FACILITATION. The use of designs, products or technologies as alternatives to those prescribed, resulting in substantially equivalent or greater accessibility and usability.

Note: In determining equivalent facilitation, consideration shall be given to means that provide for the maximum independence of persons with disabilities while presenting the least risk of harm, injury or other hazard to such persons or others.

[BS] ESSENTIAL FACILITIES. Buildings and other structures that are intended to remain operational in the event of extreme environmental loading from flood, wind, snow or earthquakes.

[F] EXHAUSTED ENCLOSURE. An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

[A] EXISTING BUILDING. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

EXISTING BUILDING OR FACILITY. [DSA-AC] A facility in existence on any given date, without regard to whether the facility may also be considered newly constructed or altered under this code.

[BS] EXISTING STRUCTURE. A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

[BE] EXIT. That portion of a means of egress system between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of exit discharge, interior exit stairways and ramps, exit passageways, exterior exit stairways and ramps and horizontal exits.

EXIT, HORIZONTAL. See “Horizontal exit.”

[BE] EXIT ACCESS. That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

[BE] EXIT ACCESS DOORWAY. A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, corridor, exit access stairway or ramp.

[BE] EXIT ACCESS RAMP. A ramp within the exit access portion of the means of egress system.

[BE] EXIT ACCESS STAIRWAY. A stairway within the exit access portion of the means of egress system.

[BE] EXIT DISCHARGE. That portion of a means of egress system between the termination of an exit and a public way.

[BE] EXIT DISCHARGE, LEVEL OF. The story at the point at which an exit terminates and an exit discharge begins.

[BE] EXIT PASSAGEWAY. An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to an exit or to the exit discharge.

[BF] EXPANDED VINYL WALL COVERING. Wall covering consisting of a woven textile backing, an expanded vinyl base coat layer and a nonexpanded vinyl skin coat. The expanded base coat layer is a homogeneous vinyl layer that contains a blowing agent. During processing, the blowing agent decomposes, causing this layer to expand by forming closed cells. The total thickness of the wall covering is approximately 0.055 inch to 0.070 inch (1.4 mm to 1.78 mm).

[F] EXPLOSION. An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, deflagration or detonation, decomposition of molecules and runaway polymerization (usually detonations).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

[F] EXPLOSIVE. A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to: dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord, and igniters. The term “explosive” includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive other than consumer fireworks, 1.4G by the hazardous materials regulations of DOTn 49 CFR Parts 100-185.

High explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap when unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explosives include, but are not limited to: black powder; safety fuse; igniters; igniter cord; fuse lighters; fireworks; and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable

discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

UN/DOtn Class 1 explosives. The former classification system used by DOtn included the terms “high” and “low” explosives as defined herein. The following terms further define explosives under the current system applied by DOtn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (i.e., the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire *load* instantaneously.

Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5. Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard, but that are so insensitive there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

EXTERIOR COVERING. [SFM] (See Chapter 7A, Section 702A for defined term.)

[BE] EXTERIOR EXIT RAMP. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and is open to yards, courts or public ways.

[BE] EXTERIOR EXIT STAIRWAY. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and is open to yards, courts or public ways.

[BF] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS). EIFS are nonstructural, nonload-bearing, exterior wall cladding systems that consist of an insulation

board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat and a textured protective finish coat.

[BF] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE. An EIFS that incorporates a means of drainage applied over a water-resistive barrier.

[BF] EXTERIOR SURFACES. Weather-exposed surfaces.

[BF] EXTERIOR WALL. A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

[BF] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, fascias, gutters and leaders.

[BF] EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall covering materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

[BF] F RATING. The time period that the through-penetration firestop system or perimeter fire containment system limits the spread of fire through the penetration or void.

[BF] FABRIC PARTITION. A partition consisting of a finished surface made of fabric, without a continuous rigid backing, that is directly attached to a framing system in which the vertical framing members are spaced greater than 4 feet (1219 mm) on center.

[BS] FABRICATED ITEM. Structural, load-bearing or lateral load-resisting members or assemblies consisting of materials assembled prior to installation in a building or structure, or subjected to operations such as heat treatment, thermal cutting, cold working or reforming after manufacture and prior to installation in a building or structure. Materials produced in accordance with standards referenced by this code, such as rolled structural steel shapes, steel reinforcing bars, masonry units and wood structural panels, or in accordance with a referenced standard that provides requirements for quality control done under the supervision of a third-party quality control agency, are not “fabricated items.”

[F] FABRICATION AREA. An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

[A] FACILITY. All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site. [DSA-AC] All or any portion of buildings, structures, site improvements, elements, and pedestrian routes or vehicular ways located on a site.

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[BS] FACTORED LOAD. The product of a nominal load and a load factor.

FAMILY. [HCD 1] *An individual or two or more persons who are related by blood or marriage; or otherwise live together in a dwelling unit.*

[BS] FENESTRATION. Products classified as either vertical fenestration or skylights and sloped glazing, installed in such a manner as to preserve the weather-resistant barrier of the wall or roof in which they are installed. Fenestration includes products with glass or other transparent or translucent materials.

[BS] FENESTRATION, VERTICAL. Windows that are fixed or movable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors installed in a wall at less than 15 degrees from the vertical.

[BS] FIBERBOARD. A fibrous, homogeneous panel made from lignocellulosic fibers (usually wood or cane) and having a density of less than 31 pounds per cubic foot (pcf) (497 kg/m³) but more than 10 pcf (160 kg/m³).

[BS] FIBER-CEMENT (BACKER BOARD, SIDING, SOFFIT, TRIM AND UNDERLAYMENT) PRODUCTS. Manufactured thin section composites of hydraulic cementitious matrices and discrete nonasbestos fibers.

[BF] FIBER-REINFORCED POLYMER. A polymeric composite material consisting of reinforcement fibers, such as glass, impregnated with a fiber-binding polymer which is then molded and hardened. Fiber-reinforced polymers are permitted to contain cores laminated between fiber-reinforced polymer facings.

FIELD NAILING. See “Nailing, field.”

FIRE ALARM BOX, MANUAL. See “Manual fire alarm box.”

[F] FIRE ALARM CONTROL UNIT. A system component that receives inputs from automatic and manual fire alarm devices and may be capable of supplying power to detection devices and transponders or off-premises transmitters. The control unit may be capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

[F] FIRE ALARM SIGNAL. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch or other device whose activation is indicative of the presence of a fire or fire signature.

[F] FIRE ALARM SYSTEM. A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

FIRE APPLIANCE. [SFM] *The apparatus or equipment provided or installed for use in the event of an emergency.*

[BF] FIRE AREA. The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building. Areas of the building not

provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

[BF] FIRE BARRIER. A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

[F] FIRE COMMAND CENTER. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the systems can be manually controlled.

[BF] FIRE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon detection of heat and resist the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

[F] FIRE DETECTOR, AUTOMATIC. A device designed to detect the presence of a fire signature and to initiate action.

[BF] FIRE DOOR. The door component of a fire door assembly.

[BF] FIRE DOOR ASSEMBLY. Any combination of a fire door, frame, hardware and other accessories that together provide a specific degree of fire protection to the opening.

FIRE DOOR ASSEMBLY, FLOOR. See “Floor fire door assembly.”

[BF] FIRE EXIT HARDWARE. Panic hardware that is listed for use on fire door assemblies.

FIRE HAZARD SEVERITY ZONES. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

[F] FIRE LANE. A road or other passageway developed to allow the passage of fire apparatus. A fire lane is not necessarily intended for vehicular traffic other than fire apparatus.

[BF] FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

FIRE PROTECTION PLAN. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

[BF] FIRE PROTECTION RATING. The period of time that an opening protective will maintain the ability to confine a fire as determined by tests specified in Section 716. Ratings are stated in hours or minutes.

[F] FIRE PROTECTION SYSTEM. Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

[BF] FIRE PROTECTIVE CURTAIN ASSEMBLY. An assembly consisting of a fabric curtain, a bottom bar, guides, a coil, and an operating and closing system.

[BF] FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

[F] FIRE SAFETY FUNCTIONS. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of harmful effects of fire.

[BF] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. The closest interior lot line.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings on the lot.

The distance shall be measured at right angles from the face of the wall.

FIRE-SMOKE BARRIER. [SFM] *A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained in accordance with Section 707 and that is designed and constructed to restrict the movement of smoke in accordance with Section 710.*

[BF] FIRE WALL. A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

[BF] FIRE WINDOW ASSEMBLY. A window constructed and glazed to give protection against the passage of fire.

[BF] FIREBLOCKING. Building materials, or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

[M] FIREPLACE. A hearth and fire chamber or similar prepared place in which a fire may be made and which is built in conjunction with a chimney.

[BS] FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

[BF] FIRE-RATED GLAZING. Glazing with either a fire protection rating or a fire-resistance rating.

[BF] FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

[BF] FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with either ASTM E1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

[BS] FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface-burning characteristics and resist propagation of fire.

FIRE-RETARDANT TREATED WOOD. [SFM] *See Section 2303.2.*

FIRESTOP, MEMBRANE-PENETRATION. See “Membrane-penetration firestop.”

FIRESTOP, PENETRATION. See “Penetration firestop.”

FIRESTOP SYSTEM, THROUGH-PENETRATION. See “Through-penetration firestop system.”

[F] FIREWORKS. Any composition or device for the purpose of producing a visible or audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks.

Fireworks, 1.3G. Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition, and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as fireworks, UN0335 by the DOTn.

Note: Fireworks shall have the same meaning as defined in Health and Safety Code Section 12511 and 12512 which has been reprinted as follows:

12511. “Fireworks” means any device containing chemical elements and chemical compounds capable of burning independently of the oxygen of the atmosphere and producing audible, visual, mechanical or thermal effects which are useful as pyrotechnic devices or for entertainment.

The term “fireworks” includes, but is not limited to, devices designated by the manufacturer as fireworks, torpedoes, skyrockets, roman candles, rockets, Daygo bombs, sparklers, party poppers, paper caps, chasers, fountains, smoke sparks, aerial bombs and fireworks kits.

12512. “Fireworks kit” means any assembly of materials or explosive substances, which is designed and intended by the seller to be assembled by the person receiving such material or explosive substance and when so assembled would come within the definition of fireworks in Section 12511.

Fireworks, 1.4G. Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion or deflagration that complies with the construction, chemical composition and labeling regulations of the DOTn for fireworks, UN0336, and the US Consumer Product Safety Commission (CPSC) as set forth in CPSC 16 CFR: Parts 1500 and 1507.

[BG] FIXED BASE OPERATOR (FBO). A commercial business granted the right by the airport sponsor to operate on an airport and provide aeronautical services, such as fueling, hangaring, tie-down and parking, aircraft rental, aircraft maintenance and flight instruction.

[BE] FIXED SEATING. Furniture or fixture designed and installed for the use of sitting and secured in place including bench-type seats and seats with or without backs or armrests.

[BF] FLAME SPREAD. The propagation of flame over a surface.

DEFINITIONS

[BF] FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.

[F] FLAMMABLE GAS. A material that is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)], which also meets one of the following:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air.
2. Has a flammable range at 14.7 psia (101 kPa) with air of at least 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E681.

[F] FLAMMABLE LIQUEFIED GAS. A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

[F] FLAMMABLE LIQUID. A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

Class IA. Liquids having a flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C). The category of flammable liquids does not include compressed gases or cryogenic fluids, or liquids that do not have a fire point when tested in accordance with ASTM D92.

[F] FLAMMABLE MATERIAL. A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

[F] FLAMMABLE SOLID. A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption or moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR; Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.1 inch (2.5 mm) per second along its major axis.

[F] FLAMMABLE VAPORS OR FUMES. The concentration of flammable constituents in air that exceeds 25 percent of their lower flammable limit (LFL).

[F] FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of

a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D56, ASTM D93 or ASTM D3278.

[BE] FLIGHT. A continuous run of rectangular treads, winders or combination thereof from one landing to another.

FLOOD, DESIGN. See “Design flood.”

[BS] FLOOD DAMAGE-RESISTANT MATERIALS. Any construction material capable of withstanding direct and prolonged contact with floodwaters without sustaining any damage that requires more than cosmetic repair.

FLOOD ELEVATION, DESIGN. See “Design flood elevation.”

[BS] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year.
2. The area designated as a flood hazard area on a community’s flood hazard map, or otherwise legally designated.

FLOOD HAZARD AREAS, SPECIAL. See “Special flood hazard area.”

[BS] FLOOD INSURANCE RATE MAP (FIRM). An official map of a community on which the Federal Emergency Management Agency (FEMA) has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

[BS] FLOOD INSURANCE STUDY. The official report provided by the Federal Emergency Management Agency containing the *Flood Insurance Rate Map* (FIRM), the *Flood Boundary and Floodway Map* (FBFM), the water surface elevation of the base flood and supporting technical data.

[BS] FLOOD or FLOODING. A general and temporary condition of partial or complete inundation of normally dry land from:

1. The overflow of inland or tidal waters.
2. The unusual and rapid accumulation or runoff of surface waters from any source.

[BS] FLOODWAY. The channel of the river, creek or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

[BE] FLOOR AREA, GROSS. The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, ramps, closets, the thickness of interior walls, columns or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings or interior courts.

[BE] FLOOR AREA, NET. The actual occupied area not including unoccupied accessory areas such as corridors, stairways, ramps, toilet rooms, mechanical rooms and closets.

[BF] FLOOR FIRE DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories installed in a horizontal plane, which together provide a specific degree of fire protection to a through-opening in a fire-resistance-rated floor (see Section 712.1.13.1).

[BF] FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m³).

[F] FOAM-EXTINGUISHING SYSTEM. A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

[BE] FOLDING AND TELESCOPIC SEATING. Tiered seating having an overall shape and size that is capable of being reduced for purposes of moving or storing and is not a building element.

[BG] FOOD COURT. A public seating area located in the mall that serves adjacent food preparation tenant spaces.

[BG] FOSTER CARE FACILITIES. Facilities that provide care to more than five children, 2½ years of age or less.

[BS] FOUNDATION PIER. This definition applies only to Chapter 21.

An isolated vertical foundation member whose horizontal dimension measured at right angles to its thickness does not exceed three times its thickness and whose height is equal to or less than four times its thickness.

[BS] FRAME STRUCTURE. A building or other structure in which vertical loads from floors and roofs are primarily supported by columns.

FREESTANDING ACUTE PSYCHIATRIC BUILDING (APB). *[OSHPD 5] A freestanding building, as defined in the California Administrative Code Section 7-111, that provides 24-hour inpatient Acute Psychiatric Services as defined in the Health and Safety Code (H&SC) Section 1250(b) or as special services in accordance with H&SC Section 1255(a)(5) of a general acute care hospital defined in H&SC Section 1250(a) and all structures, equipment and services required for their operation or access/egress.*

FREESTANDING SKILLED NURSING BUILDING (SNB). *[OSHPD 2] A freestanding building, as defined in the California Administrative Code Section 7-111, that provides skilled nursing and/or intermediate care as defined in the Health and Safety Code Section 1250(c) or (d), and all structures, equipment and services required for their operation or access/egress.*

[F] FUEL CELL POWER SYSTEM, STATIONARY. A stationary energy-generation system that converts the chemical energy of a fuel and oxidant to electric energy (DC or AC electricity) by an electrochemical process.

Field-fabricated fuel cell power system. A stationary fuel cell power system that is assembled at the job site and is not a preengineered or prepackaged factory-assembled fuel cell power system.

Preengineered fuel cell power system. A stationary fuel cell power system consisting of components and modules that are produced in a factory and shipped to the job site for assembly.

Prepackaged fuel cell power system. A stationary fuel cell power system that is factory assembled as a single, complete unit and shipped as a complete unit for installation at the job site.

FULL-TIME CARE. *Shall mean the establishment and routine care of persons on an hourly, daily, weekly, monthly, yearly or permanent basis, whether for 24-hours per day or less, and where sleeping accommodations are provided.*

FUNCTIONAL AREA. *[DSA-AC] A room, space or area intended or designated for a group of related activities or processes.*

[BS] GABLE. The triangular portion of a wall beneath the end of a dual-slope, pitched, or mono-slope roof or portion thereof and above the top plates of the story or level of the ceiling below.

[BE] GAMING. To deal, operate, carry on, conduct, maintain or expose for play any game played with cards, dice, equipment or any mechanical, electromechanical or electronic device or machine for money, property, checks, credit or any representative of value except where occurring at private home or operated by a charitable or educational organization.

[BE] GAMING AREA. Single or multiple areas of a building or facility where gaming machines or tables are present and gaming occurs, including but not limited to, primary casino gaming areas, VIP gaming areas, high-roller gaming areas, bar tops, lobbies, dedicated rooms or spaces such as in retail or restaurant establishments, sports books and tournament areas.

[BE] GAMING MACHINE TYPE. Categorization of gaming machines per type of game played on them, including, but not limited to, slot machines, video poker and video keno.

[BE] GAMING TABLE TYPE. Categorization of gaming tables per the type of game played on them, including, but not limited to, baccarat, bingo, blackjack/21, craps, pai gow, poker, roulette.

GANGWAY. *[DSA-AC] A variable-sloped pedestrian walkway that links a fixed structure or land with a floating structure. Gangways that connect to vessels are not addressed by this code.*

[F] GAS CABINET. A fully enclosed, ventilated noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.

[F] GAS DETECTION SYSTEM. A system or portion of a combination system that utilizes one or more stationary sensors to detect the presence of a specified gas at a specified concentration and initiate one or more responses required by this code, such as notifying a responsible person, activating an alarm signal, or activating or deactivating equipment. A self-contained gas detection and alarm device is not classified as a gas detection system.

DEFINITIONS

[F] GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

[F] GASEOUS HYDROGEN SYSTEM. An assembly of piping, devices and apparatus designed to generate, store, contain, distribute or transport a nontoxic, gaseous hydrogen-containing mixture having not less than 95-percent hydrogen gas by volume and not more than 1-percent oxygen by volume. Gaseous hydrogen systems consist of items such as compressed gas containers, reactors and appurtenances, including pressure regulators, pressure relief devices, manifolds, pumps, compressors and interconnecting piping and tubing and controls.

GENERAL ACUTE CARE BUILDING (GAC Building). *[OSHPD 1] Hospital buildings as defined in the California Administrative Code Section 7-111 and all structures, equipment and services required for their continuous operation or access/egress.*

[BF] GLASS FIBERBOARD. Fibrous glass roof insulation consisting of inorganic glass fibers formed into rigid boards using a binder. The board has a top surface faced with asphalt and kraft reinforced with glass fiber.

[BS] GLASS MAT GYPSUM PANEL. A gypsum panel consisting of a noncombustible core primarily of gypsum, surfaced with glass mat partially or completely embedded in the core.

GOLF CAR PASSAGE. *[DSA-AC] A continuous passage on which a motorized golf car can operate.*

GRAB BAR. *[DSA-AC & HCD 1-AC] A bar for the purpose of being grasped by the hand for support.*

GRADE (Adjacent Ground Elevation). *[DSA-AC & HCD 1-AC] The lowest point of elevation of the finished surface of the ground, paving or sidewalk within the area between the building and the property line or, when the property line is more than 5 feet (1524 mm) from the building, between the building and a line 5 feet (1524 mm) from the building. See Health and Safety Code Section 19955.3(d).*

GRADE BREAK. *[DSA-AC] The line where two surface planes with different slopes meet.*

[BS] GRADE (LUMBER). The classification of lumber in regard to strength and utility in accordance with American Softwood Lumber Standard DOC PS 20 and the grading rules of an approved lumber rules-writing agency.

[BE] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An emergency escape and rescue opening located such that the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

[BG] GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

GRADE PLANE, STORY ABOVE. See “Story above grade plane.”

[BE] GRANDSTAND. Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Bleachers”).

[BG] GREENHOUSE. A structure or thermally isolated area of a building that maintains a specialized sunlit environment used for and essential to the cultivation, protection or maintenance of plants.

[BG] GROSS LEASABLE AREA. The total floor area designed for tenant occupancy and exclusive use. The area of tenant occupancy is measured from the centerlines of joint partitions to the outside of the tenant walls. All tenant areas, including areas used for storage, shall be included in calculating gross leasable area.

GROUND FLOOR. *The floor of a building with a building entrance on an accessible route. A building may have one or more ground floors.*

GROUND LEVEL PLAY COMPONENT. *[DSA-AC] A play component that is approached and exited at the ground level.*

[BG] GROUP HOME. *Group Home means a facility which provides 24-hour care and supervision to children, provides services specified in this chapter to a specific client group, and maintains a structured environment, with such services provided at least in part by staff employed by the licensee. The care and supervision provided by a group home shall be nonmedical except as permitted by Welfare and Institutions Code Section 17736(b). Since small family and foster family homes, by definition, care for six or fewer children only, any facility providing 24-hour care for seven or more children must be licensed as a group home.*

[BE] GUARD [DSA-AC, HCD 1, HCD 2 & HCD 1-AC] OR GUARDRAIL. A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

[BG] GUESTROOM. A room used or intended to be used by one or more guests for living or sleeping purposes.

[BS] GYPSUM BOARD. The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing.

[BS] GYPSUM PANEL PRODUCT. The general name for a family of sheet products consisting essentially of gypsum complying with the standards specified in Table 2506.2 and Table 2507.2, and Chapter 35. Gypsum board and glass mat gypsum panels are examples of gypsum panel products.

[BS] GYPSUM PLASTER. A mixture of calcined gypsum or calcined gypsum and lime and aggregate and other approved materials as specified in this code.

[BS] GYPSUM SHEATHING. Gypsum panel products specifically manufactured with enhanced water resistance for use as a substrate for exterior surface materials.

[BS] GYPSUM VENEER PLASTER. Gypsum plaster applied to an approved base in one or more coats normally not exceeding $\frac{1}{4}$ inch (6.4 mm) in total thickness.

[BS] GYPSUM WALLBOARD. A gypsum board used primarily as an interior surfacing for building structures.

[BG] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

HALL CALL CONSOLE. *[DSA-AC] An elevator call user interface exclusive to a destination-oriented elevator system that requires the user to select a destination floor prior to entering the elevator car.*

[F] HALOGENATED EXTINGUISHING SYSTEM. A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

[F] HANDLING. The deliberate transport by any means to a point of storage or use.

[BE] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

HANDWASHING FIXTURE. *Refer to the California Plumbing Code, Section 210.0.*

HANDWASHING FIXTURE. *[OSHDP 1, 2, 3, 4 & 5] A lavatory provided in patient rooms, nurse stations and other patient care areas intended for staff hygiene and infection control. These special-use lavatories are an element of a handwashing station as defined in Section 1224.3. Refer to the California Plumbing Code Section 210.0 definition for additional requirements associated with handwashing fixtures.*

[BS] HARDBOARD. A fibrous-felted, homogeneous panel made from lignocellulosic fibers consolidated under heat and pressure in a hot press to a density not less than 31 pcf (497 kg/m³).

HARDWARE. See “Fire exit hardware” and “Panic hardware.”

[F] HAZARDOUS MATERIALS. Those chemicals or substances that are physical hazards or health hazards as classified in Section 307 and the *California Fire Code*, whether the materials are in usable or waste condition.

[F] HAZARDOUS PRODUCTION MATERIAL (HPM). A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by the *California Electrical Code* and which is used directly in research, laboratory or production processes which have as their end product materials that are not hazardous.

HAZARDOUS SUBSTANCE. *[SFM] Hazardous Substance is a substance which, by reason of being explosive, flammable, toxic, poisonous, corrosive, oxidizing, irritant or otherwise harmful, is likely to cause injury.*

[BS] HEAD JOINT. Vertical mortar joint placed between masonry units within the wythe at the time the masonry units are laid.

HEALTH CARE PROVIDER. *[DSA-AC] See “Professional Office of a Health Care Provider”*

[F] HEALTH HAZARD. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic or highly toxic, and corrosive.

HEAT DETECTOR. See “Detector, heat.”

[BG] HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

[BS] HELICAL PILE. Manufactured steel deep foundation element consisting of a central shaft and one or more helical bearing plates. A helical pile is installed by rotating it into the ground. Each helical bearing plate is formed into a screw thread with a uniform defined pitch.

[F] HELIPAD. A structural surface that is used for the landing, taking off, taxiing and parking of helicopters.

[F] HELIPORT. An area of land or water or a structural surface that is used, or intended for use, for the landing and taking off of helicopters, and any appurtenant areas that are used, or intended for use, for heliport buildings or other heliport facilities.

[F] HELISTOP. The same as “heliport,” except that no fueling, defueling, maintenance, repairs or storage of helicopters is permitted.

[F] HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration that falls within any of the following categories:

1. A chemical that has a median lethal dose (LD₅₀) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD₅₀) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC₅₀) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categorization of this type of material shall be performed by experienced, technically competent persons.

[BF] HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL). Panels consisting of layers of cellulose fibrous material impregnated with thermosetting resins and bonded together by a high-pressure process to form a homogeneous nonporous core suitable for exterior use.

DEFINITIONS

[BF] HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATE (HPL) SYSTEM. An exterior wall covering fabricated using HPL in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

[BG] HIGH-RISE BUILDING. *In other than Group I-2 occupancies “high-rise buildings” as used in this code:*

Existing high-rise structure. *A high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.*

High-rise structure. *Every building of any type of construction or occupancy having floors used for human occupancy located more than 75 feet above the lowest floor level having building access (see Section 403), except buildings used as hospitals as defined in Health and Safety Code Section 1250.*

New high-rise building. *A high-rise structure, the construction of which is commenced on or after July 1, 1974. For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Unless all provisions of this section have been met, the construction of such buildings shall commence on or before January 1, 1976.*

New high-rise structure. *A high-rise structure, the construction of which is commenced on or after July 1, 1974.*

HIGH-RISE BUILDING ACCESS. *An exterior door opening conforming to all of the following:*

1. Suitable and available for fire department use.
2. Located not more than 2 feet (610 mm) above the adjacent ground level.
3. Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.
4. Designed to permit penetration through the use of fire department forcible-entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.

[A] HISTORIC BUILDINGS. Any building or structure that is one or more of the following:

1. Listed or certified as eligible for listing by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a National Register, state designated or locally designated historic district.

[DSA-AC] *See “Qualified historical building or property,” C.C.R., Title 24, Part 8.*

HOLDING FACILITY. *A detention or correctional facility or area where inmates, staff and public are not housed but are restrained.*

[BF] HORIZONTAL ASSEMBLY. A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

[BE] HORIZONTAL EXIT. An exit component consisting of fire-resistance-rated construction and opening protectives intended to compartmentalize portions of a building thereby creating refuge areas that afford safety from the fire and smoke from the area of fire origin.

[BG] HOSPITALS AND PSYCHIATRIC HOSPITALS. Facilities that provide care or treatment for the medical, psychiatric, obstetrical, or surgical treatment of care recipients who are incapable of self-preservation or classified as nonambulatory or bedridden.

HOTEL OR MOTEL. **[HCD 1 & HCD 2]** *Any building containing six or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests.*

HOUSING AT A PLACE OF EDUCATION. *Housing operated by or on behalf of an elementary, secondary, undergraduate or postgraduate school, or other place of education, including dormitories, suites, apartments or other places of residence.*

HOUSING POD. *A section of a housing unit designed to segregate different populations. Housing Pods contain sleeping areas, dayroom space, showers, toilet facilities and support space.*

HOUSING UNIT. A building or portion of a building intended to lodge inmates on a 24-hour basis where accommodations are provided for sleeping and other inmate support areas. A Housing Unit may contain one or more housing pods.

HPM. See “Hazardous Production Material.”

[F] HPM ROOM. A room used in conjunction with or serving a Group H-5 occupancy, where HPM is stored or used and which is classified as a Group H-2, H-3 or H-4 occupancy.

[BS] HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes defined as:

1. The US Atlantic Ocean and Gulf of Mexico coasts where the basic design wind speed, V, for Risk Category II buildings is greater than 115 mph (51.4 m/s);
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

[F] HYDROGEN FUEL GAS ROOM. A room or space that is intended exclusively to house a gaseous hydrogen system.

[BS] ICE-SENSITIVE STRUCTURE. A structure for which the effect of an atmospheric ice load governs the design of a structure or portion thereof. This includes, but is not limited to, lattice structures, guyed masts, overhead lines, light suspension and cable-stayed bridges, aerial cable systems (e.g., for ski lifts or logging operations), amusement rides, open catwalks and platforms, flagpoles and signs.

IF, IF . . . THEN. **[DSA-AC]** *The terms “if” and “if . . . then” denote a specification that applies only when the conditions described are present.*

IGNITION-RESISTANT MATERIAL. **[SFM]** *(See Chapter 7A, Section 702A for defined term.)*

[F] IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of airborne contaminants which poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppmv/v) or milligrams per cubic meter (mg/m³). If adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the building official shall make such determination.

[BS] IMPACT LOAD. The load resulting from moving machinery, elevators, cranes, vehicles and other similar forces and kinetic loads, pressure and possible surcharge from fixed or moving loads.

[BS] IMPACT PROTECTIVE SYSTEM. Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached or locked over exterior glazing.

[BG] INCAPABLE OF SELF-PRESERVATION. Persons who, because of age, physical limitations, mental limitations, chemical dependency or medical treatment, cannot respond as an individual to an emergency situation.

[F] INCOMPATIBLE MATERIALS. Materials that, when mixed, have the potential to react in a manner that generates heat, fumes, gases or byproducts which are hazardous to life or property.

[BS] INDIVIDUAL TRUSS MEMBER. A truss chord or truss web.

[F] INERT GAS. A gas that is capable of reacting with other materials only under abnormal conditions such as high temperatures, pressures and similar extrinsic physical forces. Within the context of the code, inert gases do not exhibit either physical or health hazard properties as defined (other than acting as a simple asphyxiant) or hazard properties other than those of a compressed gas. Some of the more common inert gases include argon, helium, krypton, neon, nitrogen and xenon.

INFANT. *Any child who because of age only, is unable to walk and requires the aid of another person to evacuate the building. In no case shall the term "infant" mean a child 2 years of age or older.*

INFLATABLE AMUSEMENT DEVICE. *A device made of flexible fabric or other combustible materials that is inflated by one or more air-blowers providing internal air pressure to maintain its shape. Such a device is designed for recreational activities that allow occupants to bounce, climb, slide, negotiate an obstacle course or participate in interactive play.*

[F] INITIATING DEVICE. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box or supervisory switch.

INLET. *A fitting or fixture through which circulation water enters the pool.*

[BF] INSULATING SHEATHING. A rigid panel or board insulation material having a thermal resistance of not less than R-2 of the core material with properties suitable for use on walls, floors, roofs or foundations.

INTAKE AND RELEASE AREAS. *A temporary holding suite where detained and/or incarcerated individuals are received and processed into a facility or are released from the facility. The suite may contain holding cells, sobering and safety cells, medical examination space, interview rooms, property storage and staff work areas.*

[BE] INTENDED TO BE OCCUPIED AS A RESIDENCE. This refers to a dwelling unit or sleeping unit that can or will be used all or part of the time as the occupant's place of abode.

[BE] INTERIOR EXIT RAMP. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

[BE] INTERIOR EXIT STAIRWAY. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

[BF] INTERIOR FINISH. Interior finish includes interior wall and ceiling finish and interior floor finish.

[BF] INTERIOR FLOOR FINISH. The exposed floor surfaces of buildings including coverings applied over a finished floor or stair, including risers.

[BF] INTERIOR FLOOR-WALL BASE. Interior floor finish trim used to provide a functional or decorative border at the intersection of walls and floors.

[BF] INTERIOR SURFACES. Surfaces other than weather exposed surfaces.

[BF] INTERIOR WALL AND CEILING FINISH. The exposed interior surfaces of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

[BS] INTERLAYMENT. A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake roof covering.

INTERNATIONAL SYMBOL OF ACCESSIBILITY. *The symbol adopted by Rehabilitation International's 11th World Congress for the purpose of indicating that buildings and facilities are accessible to persons with disabilities.*

[BS] INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

DEFINITIONS

[BF] INTUMESCENT FIRE-RESISTANT COATINGS. Thin film liquid mixture applied to substrates by brush, roller, spray or trowel which expands into a protective foamed layer to provide fire-resistant protection of the substrates when exposed to flame or intense heat.

IRREGULAR STRUCTURE. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] A structure designed as having one or more plan or vertical irregularities per ASCE 7 Section 12.3.

[BS] JOINT. The opening in or between adjacent assemblies that is created due to building tolerances, or is designed to allow independent movement of the building in any plane caused by thermal, seismic, wind or any other loading.

[A] JURISDICTION. The governmental unit that has adopted this code.

KEY STATION. [DSA-AC] Certain rapid and light rail stations, and commuter rail stations, as defined under criteria established by the Department of Transportation in 49 CFR 37.47 and 49 CFR 37.51, respectively.

KICK PLATE. An abrasion-resistant plate affixed to the bottom portion of a door to prevent a trap condition and protect its surface.

KITCHEN OR KITCHENETTE. [DSA-AC] A room, space or area with equipment for the preparation and cooking of food.

[BF] L RATING. The air leakage rating of a through penetration firestop system or a fire-resistant joint system when tested in accordance with UL 1479 or UL 2079, respectively.

[A] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material and the name and identification of an approved agency, and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency (see Section 1703.5, “Manufacturer’s designation” and “Mark”).

[A] LABELED. Equipment, materials or products to which has been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of the above-labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose. [HCD 1 & HCD 2] “Labeled” means equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, approved by the Department, that maintains a periodic inspection program of production of labeled products, installations, equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

LABORATORY. [SFM] A room, building or area where the use and storage of hazardous materials are utilized for testing, analysis, instruction, research or developmental activities.

LABORATORY SUITE. [SFM] A laboratory suite is a Group L Occupancy space within a building or structure, which may include multiple laboratories, offices, storage, equipment rooms or similar support functions, where the aggregate quantities of hazardous materials stored and used do not exceed the quantities set forth in Table 453.7.2.1 (see Section 453).

LADDER. A series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.

LAVATORY. A fixed bowl or basin with running water and drainpipe, as in a toilet or bathing facility, for washing or bathing purposes. (As differentiated from the definition of “Sink”.)

LEVEL AREA. [HCD 1-AC] A specified surface that does not have a slope in any direction exceeding $\frac{1}{4}$ inch (6.4 mm) in 1 foot (305 mm) from the horizontal (2.083-percent gradient).

LEVEL OF EXIT DISCHARGE. See “Exit discharge, level of.”

LICENSING AGENCY. [OSHPD 1, 1R, 2, 3, 4 & 5] (See Chapter 12, Section 1224.3 for defined term.)

[F] LIFE SAFETY SYSTEMS. Systems, devices and equipment that enhance or facilitate evacuation, smoke control, compartmentation and isolation.

LIFT, PLATFORM (WHEELCHAIR). [HCD 1-AC] See “Platform (Wheelchair) Lift”.

[BF] LIGHT-DIFFUSING SYSTEM. Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

[BS] LIGHT-FRAME CONSTRUCTION. Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

[BF] LIGHT-TRANSMITTING PLASTIC ROOF PANELS. Structural plastic panels other than skylights that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

[BF] LIGHT-TRANSMITTING PLASTIC WALL PANELS. Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in exterior walls.

[BS] LIMIT OF MODERATE WAVE ACTION. Line shown on FIRMs to indicate the inland limit of the $1\frac{1}{2}$ -foot (457 mm) breaking wave height during the base flood.

[BS] LIMIT STATE. A condition beyond which a structure or member becomes unfit for service and is judged to be no longer useful for its intended function (serviceability limit state) or to be unsafe (strength limit state).

[F] LIQUID. A material that has a melting point that is equal to or less than 68°F (20°C) and a boiling point that is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). When not otherwise identified, the term “liquid” includes both flammable and combustible liquids.

[F] LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

LIQUIDTIGHT FLOOR. [SFM] *A nonpermeable barrier capable of containing hazardous material liquids without degradation.*

[F] LIQUID USE, DISPENSING AND MIXING ROOM. A room in which Class I, II and IIIA flammable or combustible liquids are used, dispensed or mixed in open containers.

[A] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

[HCD 1 & HCD 2] “Listed” means all products that appear in a list published by an approved testing or listing agency. For additional information, see Health and Safety Code Section 17920(h).

[SFM] For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, “listed” shall also mean equipment or materials accepted by the state fire marshal as conforming to the provisions of the State Fire Marshal’s regulations and which are included in a list published by the State Fire Marshal.

LISTING AGENCY. [HCD 1 & HCD 2] *An agency approved by the department that is in the business of listing and labeling products, materials, equipment and installations tested by an approved testing agency, and that maintains a periodic inspection program on current production of listed products, equipment and installations, and that, at least annually, makes available a published report of these listings. For additional information, see Health and Safety Code Section 17920(i).*

[BS] LIVE LOAD. A load produced by the use and occupancy of the building or other structure that does not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

[BS] LIVE LOAD, ROOF. A load on a roof produced:

1. During maintenance by workers, equipment and materials; or
2. During the life of the structure by movable objects such as planters or other similar small decorative appurtenances that are not occupancy related.

[BG] LIVE/WORK UNIT. A dwelling unit or sleeping unit in which a significant portion of the space includes a nonresidential use that is operated by the tenant or building owner.

[BS] LOAD AND RESISTANCE FACTOR DESIGN (LRFD). A method of proportioning structural members and their connections using load and resistance factors such that no applicable limit state is reached when the structure is subjected to appropriate load combinations. The term “LRFD” is used in the design of steel and wood structures.

[BS] LOAD EFFECTS. Forces and deformations produced in structural members by the applied loads.

[BS] LOAD FACTOR. A factor that accounts for deviations of the actual load from the nominal load, for uncertainties in the analysis that transforms the load into a load effect, and for the probability that more than one extreme load will occur simultaneously.

[BS] LOADS. Forces or other actions that result from the weight of building materials, occupants and their possessions, environmental effects, differential movement and restrained dimensional changes. Permanent loads are those loads in which variations over time are rare or of small magnitude, such as dead loads. All other loads are variable loads (see “Nominal loads”).

LOBBY. [SFM, HCD 1 & HCD 2] *An area not defined as a waiting room at the entrance of a building through which persons must pass.*

LOCAL AGENCY VERY HIGH FIRE HAZARD SEVERITY ZONE. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

LODGING HOUSE. [HCD 1 & HCD 1-AC] *Any building or portion thereof containing not more than five guest rooms where rent is paid in money, goods, labor or otherwise, and that is occupied by the proprietor as the residence of such proprietor.*

LOG WALL CONSTRUCTION. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

[A] LOT. A portion or parcel of land considered as a unit.

[A] LOT LINE. A line dividing one lot from another, or from a street or any public place.

[BE] LOW-ENERGY POWER-OPERATED DOOR. A swinging, sliding or folding door that opens automatically upon an action by a pedestrian such as pressing a push plate or waving a hand in front of a sensor. The door closes automatically, and operates with decreased forces and decreased speeds (see “Power-assisted door” and “Power-operated door”).

[F] LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as “LEL” or “lower explosive limit.”

[BS] LOWEST FLOOR. The lowest floor of the lowest enclosed area, including basement, but excluding any unfinished or flood-resistant enclosure, usable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the structure in violation of Section 1612.

DEFINITIONS

MAIL BOXES. [DSA-AC] *Receptacles for the receipt of documents, packages or other deliverable matter. Mail boxes include, but are not limited to, post office boxes and receptacles provided by commercial mail-receiving agencies, apartment facilities or schools.*

[BS] MAIN WINDFORCE-RESISTING SYSTEM. An assemblage of structural elements assigned to provide support and stability for the overall structure. The system generally receives wind loading from more than one surface.

MAJOR STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS. [OSHPD 1 & 4] Refer to Chapter 2 of the California Existing Building Code.

MALL BUILDING, COVERED and MALL BUILDING, OPEN. See “Covered mall building.”

[F] MANUAL FIRE ALARM BOX. A manually operated device used to initiate an alarm signal.

[A] MANUFACTURER’S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules (see “Label” and “Mark”).

[A] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material (see “Label” and “Manufacturer’s designation”).

MARKED CROSSING. *A crosswalk or other identified path intended for pedestrian use in crossing a vehicular way.*

[BG] MARQUEE. A canopy that has a top surface which is sloped less than 25 degrees from the horizontal and is located less than 10 feet (3048 mm) from operable openings above or adjacent to the level of the marquee.

[BS] MASONRY. A built-up construction or combination of building units or materials of clay, shale, concrete, glass, gypsum, stone or other approved units bonded together with or without mortar or grout or other accepted methods of joining.

Glass unit masonry. Masonry composed of glass units bonded by mortar.

Plain masonry. Masonry in which the tensile resistance of the masonry is taken into consideration and the effects of stresses in reinforcement are neglected.

Reinforced masonry. Masonry construction in which reinforcement acting in conjunction with the masonry is used to resist forces.

Solid masonry. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

Unreinforced (plain) masonry. Masonry in which the tensile resistance of masonry is taken into consideration and the resistance of the reinforcing steel, if present, is neglected.

[BS] MASONRY UNIT. Brick, tile, stone, glass block or concrete block conforming to the requirements specified in Section 2103.

Hollow. A masonry unit whose net cross-sectional area in any plane parallel to the load-bearing surface is less than 75 percent of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit whose net cross-sectional area in every plane parallel to the load-bearing surface is 75 percent or more of its gross cross-sectional area measured in the same plane.

[BG] MASS TIMBER. Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction.

[BF] MASTIC FIRE-RESISTANT COATINGS. Liquid mixture applied to a substrate by brush, roller, spray or trowel that provides fire-resistant protection of a substrate when exposed to flame or intense heat.

MAY. [DSA-AC] *May denotes an option or alternative.*

[BE] MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

[BF] MECHANICAL EQUIPMENT SCREEN. A roof-top structure, not covered by a roof, used to aesthetically conceal plumbing, electrical or mechanical equipment from view.

[BG] MECHANICAL-ACCESS OPEN PARKING GARAGES. Open parking garages employing parking machines, lifts, elevators or other mechanical devices for vehicles moving from and to street level and in which public occupancy is prohibited above the street level.

[BG] MEDICAL CARE. Care involving medical or surgical procedures, nursing or for psychiatric purposes.

MEDICAL POOL. *A special-purpose pool used by a state-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.*

[BF] MEMBRANE PENETRATION. A breach in one side of a floor-ceiling, roof-ceiling or wall assembly to accommodate an item installed into or passing through the breach.

[BG] MEMBRANE-COVERED CABLE STRUCTURE. A nonpressurized structure in which a mast and cable system provides support and tension to the membrane weather barrier and the membrane imparts stability to the structure.

[BG] MEMBRANE-COVERED FRAME STRUCTURE. A nonpressurized building wherein the structure is composed of a rigid framework to support a tensioned membrane which provides the weather barrier.

[BF] MEMBRANE-PENETRATION FIRESTOP. A material, device or construction installed to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

[BF] MEMBRANE-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly, one or more penetrating items installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time.

[BE] MERCHANDISE PAD. A merchandise pad is an area for display of merchandise surrounded by aisles, permanent fixtures or walls. Merchandise pads contain elements such as nonfixed and movable fixtures, cases, racks, counters and partitions as indicated in Section 105.2 from which customers browse or shop.

[BF] METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a solid plastic core.

[BF] METAL COMPOSITE MATERIAL (MCM) SYSTEM. An exterior wall covering fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

[BS] METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m²) per sheet.

[BS] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.279 m²) per sheet.

[BG] MEZZANINE. An intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505. *[DSA-AC] An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located. Mezzanines have sufficient elevation that space for human occupancy can be provided on the floor below.*

[BS] MICROPILE. A micropile is a bored, grouted-in-place deep foundation element that develops its load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock.

[BF] MINERAL BOARD. A rigid felted thermal insulation board consisting of either felted mineral fiber or cellular beads of expanded aggregate formed into flat rectangular units.

[BF] MINERAL FIBER. Insulation composed principally of fibers manufactured from rock, slag or glass, with or without binders.

[BF] MINERAL WOOL. Synthetic vitreous fiber insulation made by melting predominately igneous rock or furnace slag, and other inorganic materials, and then physically forming the melt into fibers.

MINOR STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS. *[OSHPD 1 & 4] Refer to Chapter 2 of the California Existing Building Code.*

[BS] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

MONOLITHIC. *[OSHPD 1, 1R, 2, 3, 4 & 5] (See Chapter 12, Section 1224.3 for defined term.)*

MONOLITHIC CEILING. *[OSHPD 1, 1R, 2, 3, 4 & 5] (See Chapter 12, Section 1224.3 for defined term.)*

[BS] MORTAR. A mixture consisting of cementitious materials, fine aggregates, water, with or without admixtures, that is used to construct unit masonry assemblies.

[BS] MORTAR, SURFACE-BONDING. A mixture to bond concrete masonry units that contains hydraulic cement, glass fiber reinforcement with or without inorganic fillers or organic modifiers and water.

MOTEL. *[HCD 1 & HCD 2] See “Hotel” or “Motel.”*

MOTION PICTURE AND TELEVISION PRODUCTION STUDIO SOUND STAGES, APPROVED PRODUCTION FACILITIES AND PRODUCTION LOCATIONS. *See Chapter 48, California Fire Code.*

MULTI-BEDROOM HOUSING UNIT. *[DSA-AC] A housing unit, intended for use by students at a place of education, with a kitchen and/or toilet and bathing rooms within the unit, such as an apartment or dormitory. Multi-bedroom housing units are separate from one another and from common use spaces within a building.*

[BE] MULTILEVEL ASSEMBLY SEATING. Seating that is arranged in distinct levels where each level is composed of either multiple rows, or a single row of box seats accessed from a separate level.

[F] MULTIPLE-STATION ALARM DEVICE. Two or more single-station alarm devices that can be interconnected such that actuation of one causes all integral or separate audible alarms to operate. A multiple-station alarm device can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

[F] MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes the appropriate alarm signal to operate in all interconnected alarms.

MULTISTORY DWELLING UNIT. *[HCD 1-AC] A dwelling unit with finished living space located on one floor and the floor or floors immediately above or below it.*

[BE] MULTISTORY UNIT. A dwelling unit or sleeping unit with habitable space located on more than one story.

[BF] NAILABLE SUBSTRATE. A product or material such as framing, sheathing or furring, composed of wood, wood-based materials or other materials providing equivalent fastener withdrawal resistance.

[BS] NAILING, BOUNDARY. A special nailing pattern required by design at the boundaries of diaphragms.

[BS] NAILING, EDGE. A special nailing pattern required by design at the edges of each panel within the assembly of a diaphragm or shear wall.

[BS] NAILING, FIELD. Nailing required between the sheathing panels and framing members at locations other than boundary nailing and edge nailing.

DEFINITIONS

[BS] NATURALLY DURABLE WOOD. The heartwood of the following species except for the occasional piece with corner sapwood, provided 90 percent or more of the width of each side on which it occurs is heartwood.

Decay resistant. Redwood, cedar, black locust and black walnut.

Termite resistant. Redwood, Alaska yellow cedar, Eastern red cedar and Western red cedar.

NEWLY CONSTRUCTED. [HCD 1-AC] A building that has never before been used or occupied for any purpose.

NEXT GENERATION ATTENUATION WEST 2 (NGA WEST 2). [DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Attenuation relations used for the 2014 United States Geological Survey (USGS) seismic hazards maps (for the Western United States) or their equivalent as determined by the enforcement agency.

NFPA. [DSA-AC] The National Fire Protection Association.

[BS] NOMINAL LOADS. The magnitudes of the loads specified in Chapter 16 (dead, live, soil, wind, snow, rain, flood and earthquake).

[BS] NOMINAL SIZE (LUMBER). The commercial size designation of width and depth, in standard sawn lumber and glued-laminated lumber grades; somewhat larger than the standard net size of dressed lumber, in accordance with DOCPS 20 for sawn lumber and with the ANSI/AWC NDS for glued-laminated lumber.

NON-GENERAL ACUTE CARE BUILDING (Non-GAC Building). [OSHPD 1R] A non-freestanding SPC building, which is removed from general acute care services in accordance with the Section 309A of the California Existing Building Code that remains under OSHPD jurisdiction as part of an OSHPD 1 Hospital building.

NONAMBULATORY PERSONS. Persons unable to leave a building unassisted under emergency conditions. It includes, but is not limited to, persons who depend on mechanical aids such as crutches, walkers and wheelchairs and any person who is unable to physically and mentally respond to a sensory signal approved by the state fire marshal or an oral instruction relating to fire danger.

The determination of ambulatory or nonambulatory status of persons with developmental disabilities shall be made by the Director of Social Services or his or her designated representative, in consultation with the director of Developmental Services or his or her designated representative. The determination of ambulatory or nonambulatory status of all other disabled persons placed after January 1, 1984, who are not developmentally disabled shall be made by the Director of Social Services or his or her designated representative.

NONCOMBUSTIBLE. [SFM] Noncombustible as applied to building construction material means a material which, in the form in which it is used, is either one of the following:

1. Material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E136 shall be considered noncombustible.
2. Material having a structural base of noncombustible material as defined in Item 1 above, with a surfacing

material not over $\frac{1}{8}$ inch (3.2 mm) thick which has a flame-spread index of 50 or less.

“Noncombustible” does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread index, beyond the limits herein established, through the effects of age, moisture or other atmospheric condition.

[BG] NONCOMBUSTIBLE MEMBRANE STRUCTURE. A membrane structure in which the membrane and all component parts of the structure are noncombustible.

NONPATIENT-CARE SUITE. In Group I-2 or I-2.1 occupancies, a group of rooms or spaces within a suite for use as administrative, business and professional offices.

[BS] NONSTRUCTURAL CONCRETE. Any element made of plain or reinforced concrete that is not part of a structural system required to transfer either gravity or lateral loads to the ground.

NORMAL. [HCD 1 & HCD 2] Conforming to a pattern or standard regarded as usual or typical.

[F] NORMAL TEMPERATURE AND PRESSURE (NTP). A temperature of 70°F (21°C) and a pressure of 1 atmosphere [14.7 psia (101 kPa)].

[BE] NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

NOTIFICATION ZONE. See “Zone, notification.”

NPC 1, NPC 2, NPC 3/NPC 3R, NPC 4 and NPC 5. [OSHPD 1] Building nonstructural performance categories for Hospital Buildings defined in Table 11.1 of California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

[F] NUISANCE ALARM. An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

[BG] NURSING HOMES. Facilities that provide care, including both intermediate care facilities and skilled nursing facilities where any of the persons are incapable of self-preservation or classified as nonambulatory or bedridden.

[BE] OCCUPANT LOAD. The number of persons for which the means of egress of a building or portion thereof is designed.

[BG] OCCUPIABLE SPACE. A room or enclosed space designed for human occupancy in which individuals congregate for amusement, educational or similar purposes or in which occupants are engaged at labor, and which is equipped with means of egress and light and ventilation facilities meeting the requirements of this code.

[BG] OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in Section 406.5.2 on two or more sides that is used for the parking or storage of private motor vehicles as described in Section 406.5.3.

OPEN RISER. The space between two adjacent stair treads not closed by a riser.

[F] OPEN SYSTEM. The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

[BE] OPEN-AIR ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure and is open to the atmosphere.

[BE] OPEN-ENDED CORRIDOR. An interior corridor that is open on each end and connects to an exterior stairway or ramp at each end with no intervening doors or separation from the corridor.

[BF] OPENING PROTECTIVE. A fire door assembly, fire shutter assembly, fire window assembly or glass-block assembly in a fire-resistance-rated wall or partition.

OPERABLE PART. *A component of an element used to insert or withdraw objects, or to activate, deactivate or adjust the element.*

[F] OPERATING BUILDING. A building occupied in conjunction with the manufacture, transportation or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

[BS] ORDINARY PRECAST STRUCTURAL WALL. See Section 1905.1.1.

[BS] ORDINARY REINFORCED CONCRETE STRUCTURAL WALL. See Section 1905.1.1.

[BS] ORDINARY STRUCTURAL PLAIN CONCRETE WALL. See Section 1905.1.1.

[F] ORGANIC PEROXIDE. An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can pose an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

Class I. Those formulations that are capable of deflagration but not detonation.

Class II. Those formulations that burn very rapidly and that pose a moderate reactivity hazard.

Class III. Those formulations that burn rapidly and that pose a moderate reactivity hazard.

Class IV. Those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high explosion hazard through rapid explosive decomposition.

ORGANIZED CAMPS. See Section 450, Group C Occupancy.

[BS] ORTHOGONAL. To be in two horizontal directions, at 90 degrees (1.57 rad) to each other.

[BS] OTHER STRUCTURES. This definition applies only to Chapters 16 through 23.

Structures, other than buildings, for which loads are specified in Chapter 16.

OUTPATIENT CLINIC. See “Clinic, outpatient.”

OVERFLOW SYSTEM. *The system which includes perimeter-type overflow gutters, surface skimmers, surge or collector tanks, other surface water collective system components and their interconnecting piping.*

[A] OWNER. Any person, agent, operator, entity, firm or corporation having any legal or equitable interest in the property; or recorded in the official records of the state, county or municipality as holding an interest or title to the property; or otherwise having possession or control of the property, including the guardian of the estate of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court.

[F] OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and, if heated or contaminated, can result in vigorous self-sustained decomposition.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Additionally, the oxidizer causes a severe increase in the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes in contact.

Class 2. An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes in contact.

Class 1. An oxidizer that does not moderately increase the burning rate of combustible materials.

[F] OXIDIZING GAS. A gas that can support and accelerate combustion of other materials more than air does.

[BS] PANEL (PART OF A STRUCTURE). The section of a floor, wall or roof comprised between the supporting frame of two adjacent rows of columns and girders or column bands of floor or roof construction.

[BE] PANIC HARDWARE. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel. See “Fire exit hardware.”

[BS] PARTICLEBOARD. A generic term for a panel primarily composed of cellulosic materials (usually wood), generally in the form of discrete pieces or particles, as distinguished from fibers. The cellulosic material is combined with

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synthetic resin or other suitable bonding system by a process in which the interparticle bond is created by the bonding system under heat and pressure.

PASSAGE DOOR. [HCD 1-AC] A door other than an exit door through which persons may traverse.

PASSENGER ELEVATOR. [DSA-AC] See “Elevator, Passenger”

PASSENGER ELEVATOR. [HCD 1 & HCD 2] An elevator used primarily to carry passengers. For additional information, see California Code of Regulations, Title 8, Division 1, Chapter 4.

PASSIVE SOLAR ENERGY COLLECTOR. [HCD 1 & HCD 2] Uses architectural components, rather than mechanical components, to provide heating or cooling for a building interior.

PATH OF TRAVEL. [DSA-AC] An identifiable accessible route within an existing site, building or facility by means of which a particular area may be approached, entered and exited, and which connects a particular area with an exterior approach (including sidewalks, streets and parking areas), an entrance to the facility, and other parts of the facility. When alterations, structural repairs or additions are made to existing buildings or facilities, the term “path of travel” also includes the toilet and bathing facilities, telephones, drinking fountains and signs serving the area of work.

PEDESTRIAN. An individual who moves in walking areas with or without the use of walking assistive devices such as crutches, leg braces, wheelchairs, white cane, service animal, etc.

PEDESTRIAN WAY. A route by which a pedestrian may pass.

PEER REVIEW. [OSHPD 1, 1R, 2, 4 & 5] Peer review refers to the procedure contained in California Building Code Section 1617A.1.41.

[BF] PENETRATION FIRESTOP. A through-penetration firestop or a membrane-penetration firestop.

[BG] PENTHOUSE. An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, stairways, and vertical shaft openings.

[BS] PERFORMANCE CATEGORY. A designation of wood structural panels as related to the panel performance used in Chapter 23.

[BF] PERIMETER FIRE CONTAINMENT SYSTEM. An assemblage of specific materials or products that is designed to resist for a prescribed period of time the passage of fire through voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies.

PERIODIC SPECIAL INSPECTION. [DSA-SS, DSA-SS/CC] Special inspection by the special inspector who is intermittently present where the work to be inspected has been or is being performed and at the completion of the work.

PERMANENT. [DSA-AC] Facilities which, are intended to be used for periods longer than those designated in this code under the definition of “Temporary.”

[BS] PERMANENT INDIVIDUAL TRUSS MEMBER DIAGONAL BRACING (PITMDB). Structural member or assembly intended to permanently stabilize the PITMRs.

[BS] PERMANENT INDIVIDUAL TRUSS MEMBER RESTRAINT (PITMR). Restraint that is used to prevent local buckling of an individual truss chord or web member because of the axial forces in the individual truss member.

PERMANENT PORTABLE BUILDING. [SFM] A portable building that is used to serve or house students and is certified as a permanent building on a new public school campus by the public school administration shall comply with the requirements of new campus buildings.

[A] PERMIT. An official document or certificate issued by the building official that authorizes performance of a specified activity.

[A] PERSON. An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

[BG] PERSONAL CARE SERVICE. The care of persons who do not require medical care. Personal care involves responsibility for the safety of the persons while inside the building

PERSONS WITH DISABILITIES. [HCD 1-AC] For purposes of Chapter 11A, “Persons with disabilities” includes, but is not limited to, any physical or mental disability as defined in Government Code Section 12926.

PERSONS WITH INTELLECTUAL DISABILITIES, PROFOUNDLY OR SEVERELY. Shall mean any persons with intellectual disabilities who is unable to evacuate a building unassisted during emergency conditions.

Note: The determination as to such incapacity shall be made by the Director of the State Department of Public Health or his or her designated representative pursuant to Health and Safety Code Section 13131.3.

[BE] PHOTOLUMINESCENT. Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

[BS] PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of tracker, designed to generate DC power when exposed to sunlight.

[BS] PHOTOVOLTAIC PANEL. A collection of modules mechanically fastened together, wired and designed to provide a field-installable unit.

[BS] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels, that converts solar radiation into electricity, including rack support systems.

PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND-MOUNTED. An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.

PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED. An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.

[BS] PHOTOVOLTAIC SHINGLES. A roof covering resembling shingles that incorporates photovoltaic modules.

[F] PHYSICAL HAZARD. A chemical for which there is evidence that it is a combustible liquid, cryogenic fluid, explosive, flammable (solid, liquid or gas), organic peroxide (solid or liquid), oxidizer (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).

[F] PHYSIOLOGICAL WARNING THRESHOLD LEVEL. A concentration of airborne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³), that represents the concentration at which persons can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological response. When used in conjunction with the permissible exposure limit (PEL) the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of “Permissible exposure limit (PEL)” in the California Fire Code.

PICTOGRAM. A pictorial symbol that represents activities, facilities or concepts.

PLACE OF PUBLIC ACCOMMODATION. A facility operated by a private entity whose operations affect commerce and fall within at least one of the following categories:

- (1) Place of lodging, except for an establishment located within a facility that contains not more than five rooms for rent or hire and that actually is occupied by the proprietor of the establishment as the residence of the proprietor. For purposes of this code, a facility is a “place of lodging” if it is
 - (i) An inn, hotel or motel; or
 - (ii) A facility that
 - (A) Provides guest rooms for sleeping for stays that primarily are short-term in nature (generally 30 days or less) where the occupant does not have the right to return to a specific room or unit after the conclusion of his or her stay; and
 - (B) Provides guest rooms under conditions and with amenities similar to a hotel, motel or inn, including the following:
 - (1) On- or off-site management and reservations service;
 - (2) Rooms available on a walk-up or call-in basis;
 - (3) Availability of housekeeping or linen service; and
 - (4) Acceptance of reservations for a guest room type without guaranteeing a

particular unit or room until check-in, and without a prior lease or security deposit.

- (2) A restaurant, bar or other establishment serving food or drink;
- (3) A motion picture house, theater, concert hall, stadium or other place of exhibition or entertainment;
- (4) An auditorium, convention center, lecture hall or other place of public gathering;
- (5) A bakery, grocery store, clothing store, hardware store, shopping center or other sales or rental establishment;
- (6) A laundromat, dry-cleaner, bank, barber shop, beauty shop, travel service, shoe repair service, funeral parlor, gas station, office of an accountant or lawyer, pharmacy, insurance office, professional office of a health care provider, hospital or other service establishment;
- (7) A terminal, depot or other station used for specified public transportation;
- (8) A museum, library, gallery or other place of public display or collection;
- (9) A park, zoo, amusement park or other place of recreation;
- (10) A nursery, elementary, secondary, undergraduate or postgraduate private school, or other place of education;
- (11) A day-care center, senior citizen center, homeless shelter, food bank, adoption agency or other social service center establishment;
- (12) A gymnasium, health spa, bowling alley, golf course or other place of exercise or recreation;
- (13) A religious facility;
- (14) An office building; and
- (15) A public curb or sidewalk.

PLACE OF RELIGIOUS WORSHIP. See “Religious worship, place of.”

[BF] PLASTIC COMPOSITE. A generic designation that refers to wood/plastic composites, plastic lumber and similar materials.

[BF] PLASTIC GLAZING. Plastic materials that are glazed or set in a frame or sash or are otherwise supported.

[BF] PLASTIC LUMBER. A manufactured product made primarily of plastic materials (filled or unfilled) which is generally rectangular in cross section.

[BG] PLATFORM. A raised area within a building used for worship, the presentation of music, plays or other entertainment; the head table for special guests; the raised area for lecturers and speakers; boxing and wrestling rings; theater-in-the-round stages; and similar purposes wherein, other than horizontal sliding curtains, there are no overhead hanging curtains, drops, scenery or stage effects other than lighting and sound. A temporary platform is one installed for not more than 30 days.

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PLATFORM (WHEELCHAIR) LIFT. A hoisting and lowering mechanism equipped with a car or platform or support that serves two landings of a building or structure and is designed to carry a passenger or passengers and/or luggage or other material a vertical distance as may be allowed.

PLAY AREA. [DSA-AC] A portion of a site containing play components designed and constructed for children.

PLAY COMPONENT. [DSA-AC] An element intended to generate specific opportunities for play, socialization or learning. Play components are manufactured or natural; and are stand-alone or part of a composite play structure.

[BG] PLAY STRUCTURE. A structure composed of one or more components, where the user enters a play environment.

POINT-OF-SALE DEVICE. [DSA-AC] A device used for the purchase of a good or service where a personal identification number (PIN), zip code or signature is required.

[BF] POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, which in some cases contains fillers or reinforcements, that is used to clad exterior walls of buildings.

POOL. A constructed or prefabricated artificial basin, chamber or tank intended to be used primarily by bathers, and not for cleaning of the body or for individual therapeutic use.

POOL USER. A person using a pool and ancillary facilities for the purpose of water activities such as diving, swimming or wading.

POOL VOLUME. The amount of water expressed in gallons (liters) that a pool holds when filled.

[BS] PORCELAIN TILE. Ceramic tile having an absorption of 0.5 percent or less in accordance with Table 10 of ANSI A137.1, or Tables 4 or 5 of ANSI A137.3.

[BS] POSITIVE ROOF DRAINAGE. A design that accounts for deflections from all design loads and has sufficient additional slope to ensure that drainage of the roof occurs within 48 hours of precipitation.

POWDER ROOM. A room containing a water closet (toilet) and a lavatory, and which is not defined as a bathroom.

POWER-ASSISTED DOOR. [DSA-AC] A door used for human passage with a mechanism that helps to open the door, or relieves the opening resistance of a door, upon the activation of a switch or a continued force applied to the door itself.

[BE] POWER-ASSISTED DOOR. Swinging door which opens by reduced pushing or pulling force on the door-operating hardware. The door closes automatically after the pushing or pulling force is released and functions with decreased forces. See “Low-energy power-operated door” and “Power-operated door.”

[BE] POWER-OPERATED DOOR. Swinging, sliding, or folding door which opens automatically when approached by a pedestrian or opens automatically upon an action by a pedestrian. The door closes automatically and includes provisions such as presence sensors to prevent entrapment. See “Low energy power-operated door” and “Power-assisted door.”

[BS] PREFABRICATED WOOD I-JOIST. Structural member manufactured using sawn or structural composite lumber flanges and wood structural panel webs bonded together with exterior exposure adhesives, which forms an “I” cross-sectional shape.

[BS] PRESERVATIVE-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced susceptibility to damage by fungi, insects or marine borers.

[BS] PRESTRESSED MASONRY. Masonry in which internal stresses have been introduced to counteract potential tensile stresses in masonry resulting from applied loads.

PRIMARY ENTRY. [HCD 1-AC] The principal entrance through which most people enter the building, as designated by the building official.

PRIMARY ENTRY LEVEL. [HCD 1-AC] The floor or level of the building on which the primary entry is located.

[BG] PRIMARY STRUCTURAL FRAME. The primary structural frame shall include all of the following structural members:

1. The columns.
2. Structural members having direct connections to the columns, including girders, beams, trusses and spandrels.
3. Members of the floor construction and roof construction having direct connections to the columns.
4. Members that are essential to the vertical stability of the primary structural frame under gravity loading.

PRIVATE BUILDING OR FACILITY. [DSA-AC] A place of public accommodation or a commercial building or facility subject to Chapter 1, Section 1.9.1.2.

[BG] PRIVATE GARAGE. A building or portion of a building in which motor vehicles used by the owner or tenants of the building or buildings on the premises are stored or kept, without provisions for repairing or servicing such vehicles for profit.

PRIVATE POOL. Any constructed pool, permanent or portable, that is intended for noncommercial use as a swimming pool by not more than three owner families and their guests.

Note: A single-family residence is a Group R, Division 3 occupancy.

PROFESSIONAL OFFICE OF A HEALTH CARE PROVIDER. [DSA-AC] A location where a person or entity, regulated by the State to provide professional services related to the physical or mental health of an individual, makes such services available to the public. The facility housing the professional office of a health care provider only includes floor levels housing at least one health care provider, or any floor level designed or intended for use by at least one health care provider.

PROJECT INSPECTOR. [DSA-SS, DSA-SS/CC] The person approved to provide inspection in accordance with the California Administrative Code, Section 4-333(b). The term “project inspector” is synonymous with “inspector of record.”

[BG] PROSCENIUM WALL. The wall that separates the stage from the auditorium or assembly seating area.

PROTECTIVE SOCIAL CARE FACILITY. [SFM] A facility housing persons, who are referred, placed or caused to be placed in the facility, by any governmental agency and for whom the services, or a portion thereof, are paid for by any governmental agency. These occupancies shall include, but are not limited to, those commonly referred to as “assisted living facilities,” “social rehabilitation facilities,” “certified family care homes,” “out-of-home placement facilities,” and “halfway houses.”

PSYCHIATRIC HOSPITALS. See “Hospitals and psychiatric hospitals.”

PUBLIC BUILDING OR FACILITY. [DSA-AC] A building or facility or portion of a building or facility designed, constructed, or altered by, on behalf of, or for the use of a public entity subject to Chapter 1, Section 1.9.1.1.

PUBLIC ENTITY. Any state or local government; any department, agency, special-purpose district, or other instrumentality of a state or local government.

[BE] PUBLIC ENTRANCE. An entrance that is not a service entrance or a restricted entrance.

PUBLIC HOUSING. [DSA-AC & HCD 1-AC] Housing facilities constructed or altered by, for, or on behalf of a public entity, or constructed or altered as part of a public entity’s program to provide housing pursuant to United States Code of Federal Regulations, 28 CFR Part 35, Section 35.102(a), including but not limited to the following:

1. One- or two-family dwelling units or congregate residences;
2. Buildings or complexes with three or more residential dwelling units;
3. Homeless shelters, group homes, halfway houses and similar social service establishments;
4. Transient lodging, such as hotels, motels, hostels and other facilities providing accommodations of a short-term nature of not more than 30 days duration;
5. Housing at a place of education, such as housing on or serving a public school, public college or public university.

Note: A public entity’s program to provide housing may include but is not limited to: the allocation of local, state or federal financial assistance, Community Development Block Grants, Low Income Housing Tax Credits, the California Multifamily Housing Program, loan agreements and housing bonds. Examples that are not considered a public entity’s program to provide housing may include but are not limited to: density bonuses, the receipt of public funds for the installation of energy efficiency features, seismic strengthening, water conservation and fire safety features. For additional information see “Guide to Public Housing Regulated in Chapter 11B of the California Building Code” and the “California Access Compliance Advisory Reference Manual” available on the Division of the State Architect’s website.

PUBLIC POOL. A pool other than a private pool.

PUBLIC USE. [DSA-AC] Interior or exterior rooms, spaces or elements that are made available to the public. Public use may be provided at a building or facility that is privately or publicly owned. Private interior or exterior rooms, spaces or elements associated with a residential dwelling unit provided by a public housing program or in a public housing facility are not public use areas and shall not be required to be made available to the public.

[A] PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

[BE] PUBLIC-USE AREAS. Interior or exterior rooms or spaces of a building or facility that are made available to the general public and do not include common use areas. Public use areas may be provided at a building or facility that is privately or publicly owned.

[F] PYROPHORIC. A chemical with an auto-ignition temperature in air, at or below a temperature of 130°F (54.4°C).

[F] PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

QUALIFIED HISTORIC BUILDING OR FACILITY. [DSA-AC] A building or facility that is listed in or eligible for listing in the National Register of Historic Places, or designated as historic under an appropriate State or local law. See C.C.R. Title 24, Part 8.

QUALITY ASSURANCE (QA). [DSA-SS, DSA-SS/CC, OSHPD 1R, 1, 2, 4 & 5] Special inspections and testing provided by an approved agency employed by the Owner. Project specific testing required by approved construction documents shall be performed by the approved agency responsible for Quality Assurance (QA), unless approved otherwise by the building official.

QUALITY CONTROL (QC). [DSA-SS, DSA-SS/CC, OSHPD 1R, 1, 2, 4 & 5] Inspections and materials/functionality testing provided by the fabricator, erector, manufacturer or other responsible contractor as applicable.

[BF] RADIANT BARRIER. A material having a low-emittance surface of 0.1 or less installed in building assemblies.

RAFTERTAIL. [SFM] (See Chapter 7A, Section 702A for defined term.)

[BE] RAMP. A walking surface that has a running slope steeper than one unit vertical in 20 units horizontal (5-percent slope).

RAMP, EXIT ACCESS. See “Exit access ramp.”

RAMP, EXTERIOR EXIT. See “Exterior exit ramp.”

RAMP, INTERIOR EXIT. See “Interior exit ramp.”

[BG] RAMP-ACCESS OPEN PARKING GARAGES. Open parking garages employing a series of continuously rising floors or a series of interconnecting ramps between floors permitting the movement of vehicles under their own power from and to the street level.

DEFINITIONS

REASONABLE PORTION. [DSA-AC] *That segment of a building, facility, area, space or condition, which would normally be necessary if the activity therein is to be accessible by persons with disabilities.*

RECESSED STEPS. *A riser/tread or series of risers/treads extending down into the deck with the bottom riser or tread terminating at the pool wall (thus creating a “stairwell”).*

RECESSED TREADS. *A series of vertically spaced cavities in the pool wall creating tread areas for step holes.*

RECIRCULATION SYSTEM. *The interconnected system traversed by the recirculated water from the pool until it is returned to the pool, i.e., from the pool through the collector or surge tank, recirculation pump, filters, chemical treatment and heater (if provided), and returned to the pool.*

RECOMMEND. [DSA-AC, HCD 1 & HCD 2] *Does not require mandatory acceptance, but identifies a suggested action that shall be considered for the purpose of providing a greater degree of accessibility to persons with disabilities.*

[A] RECORD DRAWINGS. Drawings (“as built”) that document the location of all devices, appliances, wiring sequences, wiring methods and connections of the components of a fire alarm system as installed.

[BF] REFLECTIVE PLASTIC CORE INSULATION. An insulation material packaged in rolls, that is less than 1/2 inch (12.7 mm) thick, with not less than one exterior low-emittance surface (0.1 or less) and a core material containing voids or cells.

[A] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A registered design professional engaged by the owner or the owner’s authorized agent to review and coordinate certain aspects of the project, as determined by the building official, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

[BG] RELIGIOUS WORSHIP, PLACE OF. A building or portion thereof intended for the performance of religious services.

[A] RELOCATABLE BUILDING. A partially or completely assembled building constructed and designed to be reused multiple times and transported to different building sites.

RELOCATABLE BUILDING (PUBLIC SCHOOL). *Any building with an integral floor structure which is capable of being readily moved. (See Education Code Section 17350.) Relocatable buildings that are to be placed on substandard foundations not complying with the requirements of Part 2, Title 24, C.C.R., require a statement from the school district stating that the durability requirements for those foundations may be waived and acknowledging the temporary nature of the foundations.*

REMODELING. [DSA-AC] *See “Alteration.”*

REMOVED FROM ACUTE CARE SERVICE. [OSHPD IR] *Buildings that previously provided basic and/or supplemental services, as defined in Section 1224.3 that have been removed from acute care service in compliance with Part 10 California Existing Building Code Chapter 3A through a project approved by OSHPD, and remain under the jurisdiction of OSHPD.*

[A] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

[BG] REPAIR GARAGE. A building, structure or portion thereof used for servicing or repairing motor vehicles.

[BS] REROOFING. The process of recovering or replacing an existing roof covering. See “Roof recover” and “Roof replacement.”

[BG] RESIDENTIAL AIRCRAFT HANGAR. An accessory building less than 2,000 square feet (186 m²) and 20 feet (6096 mm) in building height constructed on a one- or two-family property where aircraft are stored. Such use will be considered as a residential accessory use incidental to the dwelling.

RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI). *As termed, means a housing arrangement with a maximum capacity of 25 residents that provides a range of services to residents who have chronic, life-threatening illnesses.*

RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE). *As defined in Health and Safety Code Section 1569.2, shall mean a facility with a housing arrangement chosen voluntarily by persons 60 years of age or over, or their authorized representative, where varying levels and intensities of care and supervision, protective supervision or personal care are provided, based on their varying needs, as determined in order to be admitted and to remain in the facility. Persons under 60 years of age with compatible needs, as determined by the Department of Social Services in regulations, may be allowed to be admitted or retained in a residential-care facility for the elderly.*

Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to Group R-2.1, Occupancies classified as residential facilities (RF) and residential-care facilities for the elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for residential-care facilities for the elderly.

RESIDENTIAL DWELLING UNIT. [DSA-AC] A unit intended to be used as a residence that is primarily long-term in nature. Residential dwelling units do not include transient lodging, inpatient medical care, licensed long-term care, and detention or correctional facilities.

RESIDENTIAL FACILITY (RF). As defined in Section 1502 of the Health and Safety Code, shall mean any family home, group care facility or similar facility determined by the director of Social Services, for 24-hour nonmedical care of persons in need of personal services, supervision or assistance essential for sustaining the activities of daily living or for the protection of the individual. Such facilities include small family homes and social rehabilitation facilities.

Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to Group R Occupancies classified as residential facilities (RF) and residential-care facilities for the elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for residential-care facilities for the elderly.

[BS] RESISTANCE FACTOR. A factor that accounts for deviations of the actual strength from the nominal strength and the manner and consequences of failure (also called “strength reduction factor”).

RESTRAINT. [SFM] The physical retention of a person within a room, cell or cell block, holding cells, temporary holding cell, rooms or area, holding facility, secure interview rooms, courthouse holding facilities, courtroom docks, or similar buildings or portions thereof by any means, or within the exterior walls of a building by means of locked doors inoperable by the person restrained. Restraint shall also mean the physical binding, strapping or similar restriction of any person in a chair, walker, bed or other contrivance for the purpose of deliberately restricting the free movement of ambulatory persons.

Restraint shall not be construed to include nonambulatory persons nor shall it include the use of bandage material, strip sheeting or other fabrics or materials (soft ties) used to restrain persons in hospital-type beds or wheelchairs to prevent injury, provided an approved method of quick release is maintained.

Facilities employing the use of soft ties, however, shall be classified as a building used to house nonambulatory persons. Restraint shall not be practiced in licensed facilities classified as Group R-2.1, R-3.1 and R-4 occupancies unless constructed as a Group I-3 occupancy. For Group I-3 Occupancies see Section 408.1.1.

RESTRICTED AREA. [OSHPD 1, 2, 3, 4 & 5] (See Chapter 12, Section 1224.3 for defined term.)

[BE] RESTRICTED ENTRANCE. An entrance that is made available for common use on a controlled basis, but not public use, and that is not a service entrance.

[BG] RETRACTABLE AWNING. A retractable awning is a cover with a frame that retracts against a building or other structure to which it is entirely supported.

RETROFIT. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] The construction of any new element or system, or the alteration of any existing element or system required to bring an existing building, or portion thereof, conforming to earlier code requirements, into conformance with standards of the currently effective California Building Standards Code.

RISER. The upright part between two adjacent stair treads, between either an upper or lower landing and an adjacent stair tread, or between two adjacent landings.

[BS] RISK CATEGORY. A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance.

[BS] RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_r) GROUND MOTION RESPONSE ACCELERATIONS. The most severe earthquake effects considered by this code, determined for the orientation that results in the largest maximum response to horizontal ground motions and with adjustment for targeted risk.

[BS] ROOF ASSEMBLY (For application to Chapter 15 only). A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly can include an underlayment, a thermal barrier, insulation or a vapor retarder.

[BS] ROOF COATING. A fluid-applied, adhered coating used for roof maintenance or roof repair, or as a component of a roof covering system or roof assembly.

[BS] ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See “Roof assembly.”

[BS] ROOF DECK. The flat or sloped surface constructed on top of the exterior walls of a building or other supports for the purpose of enclosing the story below, or sheltering an area, to protect it from the elements, not including its supporting members or vertical supports.

ROOF DRAINAGE, POSITIVE. See “Positive roof drainage.”

ROOF EAVE. [SFM] (See Chapter 7A, Section 702A for defined term.)

ROOF EAVE SOFFIT. [SFM] (See Chapter 7A, Section 702A for defined term.)

[BS] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[BS] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of correcting damage or restoring pre-damage condition.

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[BS] ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

[BG] ROOF VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

[BG] ROOFTOP STRUCTURE. A structure erected on top of the roof deck or on top of any part of a building.

RUGGED EQUIPMENT. *[DSA-SS, DSA-SS/CC] Rugged equipment refers to an amplexness of construction that gives such equipment the ability to survive earthquake strong motions without significant loss of function.*

[BS] RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset at least one-quarter the unit length.

RUNNING SLOPE. *The slope that is parallel to the direction of travel. (As differentiated from the definition of "Cross Slope.")*

[BG] SALLYPORT. A security vestibule with two or more doors or gates where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door or gate at a time.

SANITARY FACILITY. *[HCD 1 & HCD 1-AC] Any single water closet, urinal, lavatory, bathtub or shower, or a combination thereof, together with the room or space in which they are housed.*

[BE] SCISSOR STAIRWAY. Two interlocking stairways providing two separate paths of egress located within one exit enclosure.

[BS] SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

[BG] SECONDARY STRUCTURAL MEMBERS. The following structural members shall be considered secondary members and not part of the primary structural frame:

1. Structural members not having direct connections to the columns.
2. Members of the floor construction and roof construction not having direct connections to the columns.
3. Bracing members that are not designated as part of a primary structural frame or bearing wall.

SECURE INTERVIEW ROOMS. *A lockable room used to hold and interview detainees for further processing.*

[BS] SEISMIC DESIGN CATEGORY. A classification assigned to a structure based on its risk category and the severity of the design earthquake ground motion at the site.

[BS] SEISMIC FORCE-RESISTING SYSTEM. That part of the structural system that has been considered in the design to provide the required resistance to the prescribed seismic forces.

[BF] SELF-CLOSING. As applied to a fire door or other opening protective, means equipped with a device that will ensure closing after having been opened.

[BE] SELF-LUMINOUS. Illuminated by a self-contained power source, other than batteries, and operated independently of external power sources.

SELF-PRESERVATION, INCAPABLE OF. See "Incapable of self-preservation."

[BG] SELF-SERVICE STORAGE FACILITY. Real property designed and used for the purpose of renting or leasing individual storage spaces to customers for the purpose of storing and removing personal property on a self-service basis.

SELF-SERVICE STORAGE. *[DSA-AC] Building or facility designed and used for the purpose of renting or leasing individual storage spaces to customers for the purpose of storing and removing personal property on a self-service basis.*

[F] SERVICE CORRIDOR. A fully enclosed passage used for transporting HPM and purposes other than required means of egress.

[BE] SERVICE ENTRANCE. An entrance intended primarily for delivery of goods or services.

[BF] SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and roof.

[BF] SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SHALL. *[DSA-AC] Denotes a mandatory specification or requirement.*

[BS] SHALLOW FOUNDATION. A shallow foundation is an individual or strip footing, a mat foundation, a slab-on-grade foundation or a similar foundation element.

SHALLOW POOL. *A pool that has a maximum depth of less than 6 feet (1829 mm).*

[BS] SHEAR WALL. This definition applies only to Chapter 23.

A wall designed to resist lateral forces parallel to the plane of a wall.

Shear wall, perforated. A wood structural panel sheathed wall with openings, that has not been specifically designed and detailed for force transfer around openings.

Shear wall segment, perforated. A section of shear wall with full-height sheathing that meets the height-to-width ratio limits of Section 4.3.4 of AWC SDPWS.

[BS] SHINGLE FASHION. A method of installing roof or wall coverings, water-resistive barriers, flashing or other building components such that upper layers of material are placed overlapping lower layers of material to provide for drainage via gravity and moisture control.

SHOPPING CENTER (OR SHOPPING MALL). *[DSA-AC] One or more sales or rental establishments or stores. A shopping center may include a series of buildings on a common site, connected by a common pedestrian access route on, above or below the ground floor, that is either under common ownership or common control or developed either as one project or as a series of related projects. For the purposes of this section, "shopping center" or "shopping mall" includes a covered mall building.*

SHOULD. [HCD 1 & HCD 2] See “Recommend.”

SIDEWALK. A surfaced pedestrian way contiguous to a street used by the public. (As differentiated from the definition of “Walk.”)

SIGN. (HCD 1-AC, DSA-AC) An element composed of displayed textual, verbal, symbolic, tactile and/or pictorial information.

SIGNIFICANT LOSS OF FUNCTION. [DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Significant loss of function for equipment or components means the equipment or component cannot be restored to its original function by competent technicians after a design earthquake because the equipment or component require parts that are not normally stocked by the owner or not readily available.

SINGLE-ACCOMMODATION SANITARY FACILITY. [HCD 1-AC] A room that has not more than one of each type of sanitary fixture, is intended for use by only one person at a time, has no partition around the toilet, and has a door that can be locked on the inside by the room occupant.

[BS] SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

[F] SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

SINK. A fixed bowl or basin with running water and drain-pipe, as in a kitchen or laundry, for washing dishes, clothing, etc. (As differentiated from the definition of “Lavatory.”)

[BG] SITE. A parcel of land bounded by a lot line or a designated portion of a public right-of-way.

[BS] SITE CLASS. A classification assigned to a site based on the types of soils present and their engineering properties as defined in Section 1613.2.2.

[BS] SITE COEFFICIENTS. The values of F_a and F_v indicated in Table 1613.2.3(1) and Table 1613.2.3(2), respectively.

SITE DEVELOPMENT. [HCD 1-AC] “On-site” and “off-site” work, including, but not limited to, walks, sidewalks, ramps, curbs, curb ramps, parking facilities, stairs, planting areas, pools, promenades, exterior gathering or assembly areas and raised or depressed paved areas.

[BG] SITE-FABRICATED STRETCH SYSTEM. A system, fabricated on site and intended for acoustical, tackable or aesthetic purposes, that is composed of three elements:

1. A frame (constructed of plastic, wood, metal or other material) used to hold fabric in place.
2. A core material (infill, with the correct properties for the application).
3. An outside layer, composed of a textile, fabric or vinyl, that is stretched taut and held in place by tension or mechanical fasteners via the frame.

[BS] SKYLIGHT, UNIT. A factory-assembled, glazed fenestration unit, containing one panel of glazing material that allows for natural lighting through an opening in the roof assembly while preserving the weather-resistant barrier of the roof.

[BS] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Unit skylights, tubular daylighting devices, glazing materials, solariums, sunrooms, roofs and sloped walls are included in this definition.

SLEEPING ACCOMMODATIONS. Rooms intended and designed for sleeping.

[A] SLEEPING UNIT. A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

SLIP RESISTANT. A rough finish that is not abrasive to the bare foot.

SLOPE. [HCD 1-AC] The relative steepness of the land between two points and is calculated as follows:

The horizontal distance and elevation change between the two points (e.g., an entrance and a passenger loading zone). The difference in elevation is divided by the distance and the resulting fraction is multiplied by 100 to obtain the percentage of slope.

For example: if a principal entrance is 10 feet (3048 mm) from a passenger loading zone, and the principal entrance is raised 1 foot (305 mm) higher than the passenger loading zone, then the slope is $\frac{1}{10} \times 100 = 10$ percent.

SMALL MANAGEMENT YARD. An exterior exercise yard within a Group I-3 prison used for inmate exercise for a maximum of 2 hours per day, constructed in accordance with Section 408.15.

[F] SMOKE ALARM. A single- or multiple-station alarm responsive to smoke. See “Multiple-station smoke alarm” and “Single-station smoke alarm.”

[BF] SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

[BG] SMOKE COMPARTMENT. A space within a building separated from other interior areas of the building by smoke barriers, including interior walls and horizontal assemblies.

[BF] SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

[F] SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion.

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[BF] SMOKE PARTITION. A wall assembly that extends from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

[BF] SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84.

[BF] SMOKEPROOF ENCLOSURE. An exit stairway or ramp designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.

[BE] SMOKE-PROTECTED ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure for a specified design time by means of passive design or by mechanical ventilation.

[BG] SOFT CONTAINED PLAY EQUIPMENT STRUCTURE. A play structure containing one or more components where the user enters a play environment that utilizes pliable materials.

SOFT CONTAINED PLAY STRUCTURE. [DSA-AC] A play structure made up of one or more play components where the user enters a fully enclosed play environment that utilizes pliable materials, such as plastic, netting or fabric.

[F] SOLID. A material that has a melting point, decomposes or sublimates at a temperature greater than 68°F (20°C).

SPACE. A definable area, such as a room, toilet room, hall, assembly area, entrance, storage room, alcove, courtyard or lobby.

SPC 1, SPC 2, SPC 3, SPC 4, SPC 4D and SPC 5. [OSHPD 1] Building structural performance categories for Hospital Buildings defined in Table 2.5.3 of California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

SPC BUILDING. [OSHPD 1 and 1R] Means a structure with an independent vertical and lateral force-resisting system (LFRS) and a distinct building structural performance category assigned by OSHPD.

SPECIAL AMUSEMENT AREA. A special amusement area is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and is arranged in a manner that:

1. Makes the means of egress path not readily apparent due to visual or audio distractions, or
2. Intentionally confounds identification of the means of egress path, or
3. Otherwise makes the means of egress path not readily available because of the nature of the attraction or mode of conveyance through the special amusement area, building, structure or portion thereof.

[BG] SPECIAL EVENT STRUCTURE. Any ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower or similar structure supporting entertainment-related equipment or signage.

[BS] SPECIAL FLOOD HAZARD AREA. The land area subject to flood hazards and shown on a *Flood Insurance Rate Map* or other flood hazard map as Zone A, AE, A1-30, A99, AR, AO, AH, V, VO, VE or V1-30.

[BS] SPECIAL INSPECTION. Inspection of construction requiring the expertise of an approved special inspector in order to ensure compliance with this code and the approved construction documents.

Continuous special inspection. Special inspection by the special inspector who is present continuously when and where the work to be inspected is being performed.

Periodic special inspection. [DSA-SS, DSA-SS/CC] Special inspection by the special inspector who is intermittently present where the work has been or is being performed and at the completion of the work.

[BS] SPECIAL INSPECTOR. A qualified person employed or retained by an approved agency and approved by the building official as having the competence necessary to inspect a particular type of construction requiring special inspection.

[BS] SPECIFIED COMPRESSIVE STRENGTH OF MASONRY, f'_m . Minimum compressive strength, expressed as force per unit of net cross-sectional area, required of the masonry used in construction by the approved construction documents, and upon which the project design is based. Whenever the quantity f'_m is under the radical sign, the square root of numerical value only is intended and the result has units of pounds per square inch (psi) (MPa).

SPECIFIED PUBLIC TRANSPORTATION. [DSA-AC] Transportation by bus, rail or any other conveyance (other than aircraft) provided by a private entity to the general public, with general or special service (including charter service) on a regular and continuing basis.

[BF] SPLICE. The result of a factory and/or field method of joining or connecting two or more lengths of a fire-resistant joint system into a continuous entity.

SPORT ACTIVITY, AREA OF. See “Area of sport activity.”

[F] SPRAY ROOM. A room designed to accommodate spraying operations.

[BF] SPRAY-APPLIED FOAM PLASTIC. Single- and multiple-component, spray-applied foam plastic insulation used in nonstructural applications that are installed at locations wherein the material is applied in a liquid or frothed state, permitted to free rise and cure in situ.

[BF] SPRAYED FIRE-RESISTANT MATERIALS. Cementitious or fibrous materials that are sprayed to provide fire-resistant protection of the substrates.

[BG] STAGE. A space within a building utilized for entertainment or presentations, which includes overhead hanging curtains, drops, scenery or stage effects other than lighting and sound.

[BE] STAIR. A change in elevation, consisting of one or more risers.

STAIRS. A series of two or more steps.

[BE] STAIRWAY. One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

STAIRWAY, EXIT ACCESS. See “Exit access stairway.”

STAIRWAY, EXTERIOR EXIT. See “Exterior exit stairway.”

STAIRWAY, INTERIOR EXIT. See “Interior exit stairway.”

STAIRWAY, SCISSOR. See “Scissor stairway.”

[BE] STAIRWAY, SPIRAL. A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

[F] STANDBY POWER SYSTEM. A source of automatic electric power of a required capacity and duration to operate required building, hazardous materials or ventilation systems in the event of a failure of the primary power. Standby power systems are required for electrical loads where interruption of the primary power could create hazards or hamper rescue or fire-fighting operations.

[F] STANDPIPE, TYPES OF. Standpipe types are as follows:

Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to meet the system demand.

Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but does not have a water supply capable of delivering the system demand attached to the system. Manual-wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to meet the system demand.

Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

[F] STANDPIPE SYSTEM, CLASSES OF. Standpipe classes are as follows:

Class I system. A system providing 2½-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

Class II system. A system providing 1½-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Class III system. A system providing 1½-inch (38 mm) hose stations to supply water for use by building occupants and 2½-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

STATE-OWNED/LEASED BUILDING. *[SFM] State-Owned/Leased Building is a building or portion of a building that is owned, leased or rented by the state. State-leased buildings shall include all required exits to a public way serving such leased area or space. Portions of state-leased buildings that are not leased or rented by the state shall not be included within the scope of this section unless such portions present an exposure hazard to the state-leased area or space.*

STATE RESPONSIBILITY AREA. *[SFM] (See Chapter 7A, Section 702A for definition of term.)*

[BS] STEEL CONSTRUCTION, COLD-FORMED. That type of construction made up entirely or in part of steel structural members cold formed to shape from sheet or strip steel such as roof deck, floor and wall panels, studs, floor joists, roof joists and other structural elements.

[BS] STEEL ELEMENT, STRUCTURAL. Any steel structural member of a building or structure consisting of rolled shapes, pipe, hollow structural sections, plates, bars, sheets, rods or steel castings other than cold-formed steel or steel joist members.

[BS] STEEL JOIST. Any steel structural member of a building or structure made of hot-rolled or cold-formed solid or open-web sections, or riveted or welded bars, strip or sheet steel members, or slotted and expanded, or otherwise deformed rolled sections.

[BF] STEEP SLOPE. A roof slope 2 units vertical in 12 units horizontal (17-percent slope) or greater.

STEP. *A riser and tread.*

STEPS, RECESSED STEPS, LADDERS AND RECESSED TREADS. *Those means of entry and exit to and from the pool which may be used in conjunction with each other.*

[BS] STONE MASONRY. Masonry composed of field, quarried or cast stone units bonded by mortar.

[F] STORAGE, HAZARDOUS MATERIALS. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

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[BS] STORAGE RACKS, STEEL. Cold-formed or hot-rolled steel structural members which are formed into steel storage racks, including pallet storage racks, movable-shelf racks, rack-supported systems, automated storage and retrieval systems (stacker racks), push-back racks, pallet-flow racks, case-flow racks, pick modules and rack-supported platforms. Other types of racks, such as drive-in or drive-through racks, cantilever racks, portable racks or racks made of materials other than steel, are not considered storage racks for the purpose of this code.

[BS] STORAGE RACKS, STEEL CANTILEVERED. A framework or assemblage composed of cold-formed or hot-rolled steel structural members, primarily in the form of vertical columns, extended bases, horizontal arms projecting from the faces of the columns, and longitudinal (down-aisle) bracing between columns. There may be shelf beams between the arms, depending on the products being stored; this definition does not include other types of racks such as pallet storage racks, drive-in racks, drive-through racks, or racks made of materials other than steel.

[BG] STORM SHELTER. A building, structure or portions thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

Community storm shelter. A storm shelter not defined as a “Residential storm shelter.”

Residential storm shelter. A storm shelter serving occupants of dwelling units and having an occupant load not exceeding 16 persons.

[BG] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (see “Basement,” “Building height,” “Grade plane” and “Mezzanine”). A story is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

[DSA-AC] *That portion of a building or facility designed for human occupancy included between the upper surface of a floor and upper surface of the floor or roof next above. A story containing one or more mezzanines has more than one floor level. If the finished floor level directly above a basement or unused under-floor space is more than six feet (1829 mm) above grade for more than 50 percent of the total perimeter or is more than 12 feet (3658 mm) above grade at any point, the basement or unused under-floor space shall be considered as a story.*

[BG] STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet (1829 mm) above grade plane; or
2. More than 12 feet (3658 mm) above the finished ground level at any point.

[BS] STRENGTH. This term is defined two ways, the first for use in Chapter 16 and the second for use in Chapter 21.

For Chapter 16:

Nominal strength. The capacity of a structure or member to resist the effects of loads, as determined by computations using specified material strengths and dimensions and equations derived from accepted principles of structural mechanics or by field tests or laboratory tests of scaled models, allowing for modeling effects and differences between laboratory and field conditions.

Required strength. Strength of a member, cross section or connection required to resist factored loads or related internal moments and forces in such combinations as stipulated by these provisions.

Strength design. A method of proportioning structural members such that the computed forces produced in the members by factored loads do not exceed the member design strength [also called “load and resistance factor design” (LRFD)]. The term “strength design” is used in the design of concrete and masonry structural elements.

For Chapter 21:

Design strength. Nominal strength multiplied by a strength reduction factor.

Nominal strength. Strength of a member or cross section calculated in accordance with these provisions before application of any strength-reduction factors.

Required strength. Strength of a member or cross section required to resist factored loads.

[BS] STRUCTURAL COMPOSITE LUMBER. Structural member manufactured using wood elements bonded together with exterior adhesives. Examples of structural composite lumber are:

Laminated strand lumber (LSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths not less than 150 times the least dimension of the wood strand elements.

Laminated veneer lumber (LVL). A composite of wood veneer sheet elements with wood fibers primarily oriented along the length of the member, where the veneer element thicknesses are 0.25 inches (6.4 mm) or less.

Oriented strand lumber (OSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inches (2.54 mm) or less and their average lengths not less than 75 times and less than 150 times the least dimension of the strand elements.

Parallel strand lumber (PSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member where the least dimension of the

wood strand elements is 0.25 inches (6.4 mm) or less and their average lengths not less than 300 times the least dimension of the wood strand elements.

STRUCTURAL FRAME. [DSA-AC] *The columns and the girders, beams and trusses having direct connections to the columns and all other members that are essential to the stability of the building or facility as a whole.*

[BS] STRUCTURAL GLUED-LAMINATED TIMBER. An engineered, stress-rated product of a timber laminating plant, composed of assemblies of specially selected and prepared wood laminations in which the grain of all laminations is approximately parallel longitudinally and the laminations are bonded with adhesives.

[BS] STRUCTURAL OBSERVATION. The visual observation of the structural system by a registered design professional for general conformance to the approved construction documents.

[A] STRUCTURE. That which is built or constructed.

SUB-COMPONENT. [OSHDP 1, 1R, 2, 4 & 5] *A portion of an equipment or component that is uniquely identified by a part number (also known as model number or identification number).*

[BS] SUBSTANTIAL DAMAGE. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[BS] SUBSTANTIAL IMPROVEMENT. Any repair, reconstruction, rehabilitation, alteration, addition or other improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to assure safe living conditions.
2. Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a historic structure.

[BG] SUNROOM. A one-story structure attached to a building with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

[F] SUPERVISING STATION. A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

[F] SUPERVISORY SERVICE. The service required to monitor performance of guard tours and the operative condition of fixed suppression systems or other systems for the protection of life and property.

[F] SUPERVISORY SIGNAL. A signal indicating the need of action in connection with the supervision of guard tours, the fire suppression systems or equipment or the maintenance features of related systems.

[F] SUPERVISORY SIGNAL-INITIATING DEVICE. An initiation device, such as a valve supervisory switch, water-level indicator or low-air pressure switch on a dry-pipe sprinkler system, whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system, or a need for action in connection with guard tours, fire suppression systems or equipment or maintenance features of related systems.

SURFACE MOUNTED COMPONENT. [OSHDP 1, 1R, 2, 4 & 5] *As referenced in CBC Section 1705A.13.3.1 Exceptions, a component directly attached to only one continuous flat surface of wall, floor or roof, without supports. Surface mounted components are directly attached to a surface by attachments (without any supports) and are not rigidly connected to anything else (e. g., distribution system, other components).*

[BS] SUSCEPTIBLE BAY. A roof or portion thereof with either of the following:

1. A slope less than $\frac{1}{4}$ -inch per foot (0.0208 rad).
2. On which water is impounded, in whole or in part, and the secondary drainage system is functional but the primary drainage system is blocked.

A roof surface with a slope of $\frac{1}{4}$ -inch per foot (0.0208 rad) or greater towards points of free drainage is not a susceptible bay.

[BG] SWIMMING POOL. Any structure intended for swimming, recreational bathing or wading that contains water over 24 inches (610 mm) deep. This includes in-ground, above-ground and on-ground pools; hot tubs; spas and fixed-in-place wading pools.

[BF] T RATING. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E814 or UL 1479.

TACTILE. *An object that can be perceived using the sense of touch.*

TACTILE SIGN. *A sign containing raised characters and/or symbols and accompanying Braille.*

[BG] TECHNICAL PRODUCTION AREA. Open elevated areas or spaces intended for entertainment technicians to walk on and occupy for servicing and operating entertainment technology systems and equipment. Galleries, including fly and lighting galleries, gridirons, catwalks, and similar areas are designed for these purposes.

TECHNICALLY INFEASIBLE. [DSA-AC] *An alteration of a building or a facility, that has little likelihood of being accomplished because the existing structural conditions require the removal or alteration of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modifica-*

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tion or addition of elements, spaces or features that are in full and strict compliance with the minimum requirements for new construction and which are necessary to provide accessibility.

TEEING GROUND. [DSA-AC] In golf, the starting place for the hole to be played.

TEMPORARY. [DSA-AC] Buildings and facilities intended for use at one location for not more than one year and seats intended for use at one location for not more than 90 days.

TEMPORARY HOLDING CELL, ROOM or AREA. [BSCC and SFM] Temporary Holding cell, room or area shall mean a room for temporary holding of inmates, detainees or incustody individuals for less than 24 hours.

TEMPORARY HOLDING FACILITY. [SFM] A building or portion of a building, operated by law enforcement personnel, with one or more temporary holding cells or rooms.

TENABLE ENVIRONMENT. [SFM] Tenable environment shall mean an environment in which the products of combustion, toxic gases, smoke and heat are limited or otherwise restricted to maintain the impact on occupants to a level that is not life threatening.

[BG] TENSILE MEMBRANE STRUCTURE. A membrane structure having a shape that is determined by tension in the membrane and the geometry of the support structure. Typically, the structure consists of both flexible elements (e.g., membrane and cables), nonflexible elements (e.g., struts, masts, beams and arches) and the anchorage (e.g., supports and foundations). This includes frame-supported tensile membrane structures.

[F] TENT. A structure, enclosure, umbrella structure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported in any manner except by air or the contents it protects (see “Umbrella structure”).

TERMINALLY ILL. As termed for an individual, means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon.

[BF] TERMINATED STOPS. Factory feature of a door frame where the stops of the door frame are terminated not more than 6 inches (152 mm) from the bottom of the door frame. Terminated stops are also known as “hospital stops” or “sanitary stops.”

TESTING AGENCY. [HCD 1 & HCD 2] An agency approved by the department as qualified and equipped for testing of products, materials, equipment and installations in accordance with nationally recognized standards. For additional information, see Health and Safety Code Section 17920(n).

TEXT TELEPHONE. Machinery or equipment that employs interactive text-based communications through the transmission of coded signals across the standard telephone network. Text telephones can include, for example, devices known as TTYs (teletypewriters) or computers.

[BG] THERMAL ISOLATION. A separation of conditioned spaces, between a sunroom and a dwelling unit, consisting of existing or new walls, doors or windows.

[BF] THERMOPLASTIC MATERIAL. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

[BF] THERMOSETTING MATERIAL. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

[BF] THROUGH PENETRATION. A breach in both sides of a floor, floor-ceiling or wall assembly to accommodate an item passing through the breaches.

[BF] THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor, floor-ceiling, or wall assembly, one or more penetrating items passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time.

[BS] TIE, WALL. Metal connector that connects wythes of masonry walls together.

[BS] TIE-DOWN (HOLD-DOWN). A device used to resist uplift of the chords of shear walls.

[BS] TILE, STRUCTURAL CLAY. A hollow masonry unit composed of burned clay, shale, fire clay or mixture thereof, and having parallel cells.

[F] TIRES, BULK STORAGE OF. Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m³).

TODDLER. Any child between 18 months and 36 months of age.

TORQUE-CONTROLLED POST-INSTALLED ANCHOR. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] A post-installed anchor that is set by the expansion of one or more sleeves or other elements against the sides of the drilled hole through the application of torque, which pulls the cone(s) into the expansion sleeve(s); after setting, tensile loading can cause additional expansion (follow-up expansion).

[A] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

[F] TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD₅₀) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD₅₀) of more than 200 milligrams per kilogram, but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC₅₀) in air of more than 200 parts per million, but not more than 2,000 parts per million by volume of gas or

vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

TRANSFER DEVICE. [DSA-AC] *Equipment designed to facilitate the transfer of a person from a wheelchair or other mobility aid to and from an amusement ride seat.*

[BG] TRANSIENT. Occupancy of a dwelling unit or sleeping unit for not more than 30 days.

[BG] TRANSIENT AIRCRAFT. Aircraft based at another location and that is at the transient location for not more than 90 days.

TRANSIENT LODGING. *A building or facility containing one or more guest room(s) for sleeping that provides accommodations that are primarily short-term in nature (generally 30 days or less). Transient lodging does not include residential dwelling units intended to be used as a residence, inpatient medical care facilities, licensed long-term care facilities, detention or correctional facilities, or private buildings or facilities that contain no more than five rooms for rent or hire and that are actually occupied by the proprietor as the residence of such proprietor.*

[DSA-AC] *See also the definition of Place of Public Accommodation.*

TRANSIT BOARDING PLATFORM. [DSA-AC] *A horizontal, generally level surface, whether raised above, recessed below or level with a transit rail, from which persons embark/disembark a fixed rail vehicle.*

TRANSITION PLATE. [DSA-AC] *A sloping pedestrian walking surface located at the end(s) of a gangway.*

TREATED WOOD. See “Fire-retardant-treated wood” and “Preservative-treated wood.”

TREAD. *The horizontal part of a step.*

TREATMENT OF WATER. *The process of conditioning and disinfection of pool water by means of a combination of filtration and the addition of chemicals to the water.*

[BF] TRIM. Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

[F] TROUBLE SIGNAL. A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

TTY. *An abbreviation for teletypewriter. Machinery that employs interactive text-based communication through the transmission of coded signals across the telephone network. TTYS may include, for example, devices known as TDDs (telecommunication display devices or telecommunication devices for deaf persons) or computers with special modems. TTYS are also called text telephones.*

[BS] TSUNAMI DESIGN GEODATABASE. The ASCE database (version 2016-1.0) of *Tsunami Design Zone* maps and associated design data for the states of Alaska, California, Hawaii, Oregon and Washington.

[BS] TSUNAMI DESIGN ZONE. An area identified on the *Tsunami Design Zone* map between the shoreline and the inundation limit, within which certain structures designated in Chapter 16 are designed for or protected from inundation.

[BS] TUBULAR DAYLIGHTING DEVICE (TDD). A non-operable fenestration unit primarily designed to transmit daylight from a roof surface to an interior ceiling via a tubular conduit. The basic unit consists of an exterior glazed weathering surface, a light-transmitting tube with a reflective interior surface, and an interior-sealing device such as a translucent ceiling panel. The unit can be factory assembled, or field-assembled from a manufactured kit.

TURNOVER TIME. *The period of time, in hours, required to circulate a volume of water equal to the pool capacity.*

[BE] TYPE A UNIT. A dwelling unit or sleeping unit designed and constructed for accessibility in accordance with this code and the provisions for Type A units in ICC A117.1.

[BE] TYPE B UNIT. A dwelling unit or sleeping unit designed and constructed for accessibility in accordance with this code and the provisions for Type B units in ICC A117.1, consistent with the design and construction requirements of the federal Fair Housing Act.

[F] UMBRELLA STRUCTURE. A structure, enclosure or shelter with or without sidewalls or drops, constructed of fabric or pliable material supported by a central pole or poles (see “Tent”).

[BS] UNDERLAYMENT. One or more layers of a material that is applied to a steep-slope roof covering deck under the roof covering and resists liquid water that penetrates the roof covering.

UNIFORMITY COEFFICIENT. *The ratio of theoretical size of a sieve that will pass 60 percent of the sand to the theoretical size of sieve that will pass 10 percent.*

[BS] UNDERPINNING. The alteration of an existing foundation to transfer loads to a lower elevation using new piers, piles or other permanent structural support elements installed below the existing foundation.

UNIT SKYLIGHT. See “Skylight, unit.”

UNREASONABLE HARDSHIP. *When the enforcing agency finds that compliance with the building standard would make the specific work of the project affected by the building standard infeasible, based on an overall evaluation of the following factors:*

1. *The cost of providing access.*
2. *The cost of all construction contemplated.*
3. *The impact of proposed improvements on financial feasibility of the project.*
4. *The nature of the accessibility which would be gained or lost.*
5. *The nature of the use of the facility under construction and its availability to persons with disabilities.*

The details of any finding of unreasonable hardship shall be recorded and entered in the files of the enforcing agency.

DEFINITIONS

[F] UNSTABLE (REACTIVE) MATERIAL. A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

[F] USE (MATERIAL). Placing a material into action, including solids, liquids and gases.

USE ZONE. *[DSA-AC]* The ground level area beneath and immediately adjacent to a play structure or play equipment that is designated by ASTM F1487 for unrestricted circulation around the play equipment and where it is predicted that a user would land when falling from or exiting the play equipment.

VALUATION THRESHOLD. *[DSA-AC]* An annually adjusted, dollar-amount figure used in part to determine the extent of required path of travel upgrades. The baseline valuation threshold of \$50,000 is based on the January 1981, "ENR US20 Cities" Average Construction Cost Index (CCI) of 3372.02 as published in Engineering News Record, McGraw Hill Publishing Company. The current valuation threshold is determined by multiplying the baseline valuation threshold by a ratio of the current year's January CCI to the baseline January 1981 CCI.

[BG] VAPOR DIFFUSION PORT. An assembly constructed or installed within a roof assembly at an opening in the roof deck to convey water vapor from an unvented attic to the outside atmosphere.

[BF] VAPOR PERMEABLE. The property of having a moisture vapor permeance rating of 5 perms (2.9×10^{-10} kg/Pa \times s \times m²) or greater, when tested in accordance with Procedure A or Procedure B of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

[BF] VAPOR RETARDER CLASS. A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E96 as follows:

Class I: 0.1 perm or less.

Class II: $0.1 < \text{perm} \leq 1.0$ perm.

Class III: $1.0 < \text{perm} \leq 10$ perm.

VARIABLE MESSAGE SIGNS (VMS). *[DSA-AC]* Electronic signs that have a message with the capacity to change by means of scrolling, streaming or paging across a background.

VARIABLE MESSAGE SIGN (VMS) CHARACTERS. *[DSA-AC]* Characters of an electronic sign are composed of pixels in an array. High resolution VMS characters have vertical pixel counts of 16 rows or greater. Low resolution VMS characters have vertical pixel counts of 7 to 15 rows.

[BS] VEGETATIVE ROOF. An assembly of interacting components designed to waterproof a building's top surface that includes, by design, vegetation and related landscape elements.

[BS] VEHICLE BARRIER. A component or a system of components, near open sides or walls of garage floors or ramps that act as a restraint for vehicles.

[BG] VEHICULAR GATE. A gate that is intended for use at a vehicular entrance or exit to a facility, building or portion thereof, and that is not intended for use by pedestrian traffic.

VEHICULAR OR PEDESTRIAN ARRIVAL POINTS. *[HCD 1-AC]* Public or resident parking areas, public transportation stops, passenger loading zones, and public streets or sidewalks.

VEHICULAR WAY. A route provided for vehicular traffic, such as in a street, driveway or parking facility.

[BF] VENEER. A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

[M] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

[BF] VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used as an exterior wall covering.

[F] VISIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of sight.

WAITING ROOM. *[SFM]* Waiting room is a room or area normally provided with seating and used for persons waiting.

WALK. *[DSA-AC]* An exterior prepared surface for pedestrian use, including pedestrian areas such as plazas and courts. (As differentiated from the definition of "Sidewalk.") *[HCD 1-AC]* A surfaced pedestrian way not located contiguous to a street used by the public. (See also "Sidewalk.")

[BG] WALKWAY, PEDESTRIAN. A walkway used exclusively as a pedestrian trafficway.

[BS] **WALL.** This definition applies only to Chapter 21.

A vertical element with a horizontal length-to-thickness ratio greater than three, used to enclose space.

Cavity wall. A wall built of masonry units or of concrete, or a combination of these materials, arranged to provide an airspace within the wall, and in which the inner and outer parts of the wall are tied together with metal ties.

Dry-stacked, surface-bonded wall. A wall built of concrete masonry units where the units are stacked dry, without mortar on the bed or head joints, and where both sides of the wall are coated with a surface-bonding mortar.

Parapet wall. The part of any wall entirely above the roof line.

[BS] **WALL, LOAD-BEARING.** Any wall meeting either of the following classifications:

1. Any metal or wood stud wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.
2. Any masonry, concrete or mass timber wall that supports more than 200 pounds per linear foot (2919 N/m) of vertical load in addition to its own weight.

[BS] **WALL, NONLOAD-BEARING.** Any wall that is not a load-bearing wall.

WATERLINE. Shall be defined as one of the following:

1. *Skimmer systems.* The waterline shall be the midpoint of the operating range of the skimmers.
2. *Overflow system.* The waterline shall be the top edge of the overflow rim.

[F] **WATER-REACTIVE MATERIAL.** A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that react violently with water or have the ability to boil water. Materials that produce flammable, toxic or other hazardous gases or evolve enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture.

Class 1. Materials that react with water with some release of energy, but not violently.

[BF] **WATER-RESISTIVE BARRIER.** A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

[BF] **WEATHER-EXPOSED SURFACES.** Surfaces of walls, ceilings, floors, roofs, soffits and similar surfaces exposed to the weather except the following:

1. Ceilings and roof soffits enclosed by walls, fascia, bulkheads or beams that extend not less than 12 inches (305 mm) below such ceiling or roof soffits.

2. Walls or portions of walls beneath an unenclosed roof area, where located a horizontal distance from an open exterior opening equal to not less than twice the height of the opening.
3. Ceiling and roof soffits located a minimum horizontal distance of 10 feet (3048 mm) from the outer edges of the ceiling or roof soffits.

WET BAR. [DSA-AC] *An area or space with a counter equipped with a sink and running water but without cooking facilities.*

[F] **WET-CHEMICAL EXTINGUISHING SYSTEM.** A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

WHEELCHAIR. *A chair mounted on wheels to be propelled by its occupant manually or with the aid of electric power, of a size and configuration conforming to the recognized standard models of the trade.*

[BE] **WHEELCHAIR SPACE.** A space for a single wheelchair and its occupant.

WILDFIRE. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

WILDFIRE EXPOSURE. [SFM] *(See Chapter 7A, Section 702A for defined term.)*

WILDLAND-URBAN INTERFACE FIRE AREA (WUI). [SFM] *(See Chapter 7A, Section 702A for defined term.)*

[BS] **WIND SPEED, V.** Basic design wind speeds.

[BS] **WIND SPEED, V_{asd} .** Allowable stress design wind speeds.

[BS] **WINDBORNE DEBRIS REGION.** Areas within hurricane-prone regions located:

1. Within 1 mile (1.61 km) of the mean high-water line where an Exposure D condition exists upwind at the waterline and the basic design wind speed, V , is 130 mph (58 m/s) or greater; or
2. In areas where the basic design wind speed is 140 mph (63 m/s) or greater.

For Risk Category II buildings and structures and Risk Category III buildings and structures, except health care facilities, the windborne debris region shall be based on Figure 1609.3.(1). For Risk Category IV buildings and structures and Risk Category III health care facilities, the windborne debris region shall be based on Figure 1609.3(2).

[BE] **WINDER.** A tread with nonparallel edges.

WINERY CAVES. *See Section 446.*

WINDFORCE-RESISTING SYSTEM, MAIN. See “Main windforce-resisting system.”

[BS] **WIRE BACKING.** Horizontal strands of tautened wire attached to surfaces of vertical supports which, when covered with the building paper, provide a backing for cement plaster.

[F] **WIRELESS PROTECTION SYSTEM.** A system or a part of a system that can transmit and receive signals without the aid of wire.

DEFINITIONS

[BS] WOOD SHEAR PANEL. A wood floor, roof or wall component sheathed to act as a shear wall or diaphragm.

[BS] WOOD STRUCTURAL PANEL. A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive.

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

[BS] WOOD/PLASTIC COMPOSITE. A composite material made primarily from wood or cellulose-based materials and plastic.

WORK AREA EQUIPMENT. *[DSA-AC] Any machine, instrument, engine, motor, pump, conveyor or other apparatus used to perform work. As used in this document, this term shall apply only to equipment that is permanently installed or built-in in employee work areas. Work area equipment does not include passenger elevators and other accessible means of vertical transportation.*

[F] WORKSTATION. A defined space or an independent principal piece of equipment using HPM within a fabrication area where a specific function, laboratory procedure or research activity occurs. Approved or listed hazardous materials storage cabinets, flammable liquid storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain ventilation equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

[DSA-AC] An area defined by equipment and/or work surfaces intended for use by employees only, and generally for one or a small number of employees at a time. Examples include ticket booths; the employee side of grocery store check stands; the bartender area behind a bar; the employee side of snack bars, sales counters and public counters; guardhouses; toll booths; kiosk vending stands; lifeguard stations; maintenance equipment closets; counter and equipment areas in restaurant kitchens; file rooms; storage areas; etc.

[BS] WYTHE. Each continuous, vertical section of a wall, one masonry unit in thickness.

[BG] YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

[F] ZONE. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent or an area in which a form of control can be executed.

[F] ZONE, NOTIFICATION. An area within a building or facility covered by notification appliances which are activated simultaneously.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 3 – OCCUPANCY CLASSIFICATION AND USE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X										
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below																				X		
Chapter / Section																						
302.1			X	X	X																	
302.1.3																					X	
303.1			X																			
303.2			X																			
303.7			X																			
303.8			X																			
304.1			X																			
305.1			X																			
305.2			X																			
305.2.1			X																			
306.2			X																			
Table 307.1(1)			X																			
Table 307.1(2)			X																			
307.1.1			X																			
308.1			X																			
308.3			X	†	†																	
308.3.3			X																			
308.4			X																			
308.4.6			X																			
308.4.7			X																			
308.4.8			X																			
308.4.9			X																			
308.5			X																			
308.5.2			X																			
308.5.3			X																			
308.5.4			X																			
310.1			X																			
310.2			X	X																		
310.3			X	X																		
310.3.1			X																			
310.3.2			X																			
310.4			X	X																		
310.4.1			X																			
310.5			X																			
310.6			X																			
313			X																			
314			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 3

OCCUPANCY CLASSIFICATION AND USE

User note:

About this chapter: Chapter 3 provides the criteria by which buildings and structures are classified into use groups and occupancies. Through the balance of the code, occupancy classification is fundamental in the setting of features of construction; occupant safety requirements, especially building limitations; means of egress; fire protection systems; and interior finishes.

SECTION 301 SCOPE

301.1 General. The provisions of this chapter shall control the classification of all buildings and structures as to occupancy and use. Different classifications of occupancy and use represent varying levels of hazard and risk to building occupants and adjacent properties.

SECTION 302 OCCUPANCY CLASSIFICATION AND USE DESIGNATION

302.1 Occupancy classification. Occupancy classification is the formal designation of the primary purpose of the building, structure or portion thereof. Structures shall be classified into one or more of the occupancy groups specified in this section based on the nature of the hazards and risks to building occupants generally associated with the intended purpose of the building or structure. An area, room or space that is intended to be occupied at different times for different purposes shall comply with all applicable requirements associated with such potential multipurpose. Structures containing multiple occupancy groups shall comply with Section 508. Where a structure is proposed for a purpose that is not specified in this section, such structure shall be classified in the occupancy it most nearly resembles based on the fire safety and relative hazard. Occupied roofs shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard, and shall comply with Section 503.1.4.

1. Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
2. Business (see Section 304): Group B.
3. *[SFM] Organized Camps (see Section 450): Group C.*
4. Educational (see Section 305): Group E.
5. Factory and Industrial (see Section 306): Groups F-1 and F-2.
6. High Hazard (see Section 307): Groups H-1, H-2, H-3, H-4 and H-5.
- ➔ 7. Institutional (see Section 308): Groups I-2, I-2.1, I-3 and I-4.
8. *[SFM] Laboratory (see Section 202): Group B, unless classified as Group L (see Section 453) or Group H (see Section 307).*
9. *[SFM] Laboratory Suites (see Section 453): Group L.*

10. Mercantile (see Section 309): Group M.
11. Residential (see Section 310): Groups R-1, R-2, R-2.1, R-3, R-3.1 and R-4.
12. Storage (see Section 311): Groups S-1 and S-2.
13. Utility and Miscellaneous (see Section 312): Group U.
14. *[SFM] Existing buildings housing existing protective social care homes or facilities established prior to 1972 (see California Fire Code Chapter 11 and California Existing Building Code).*

302.1.1 Reserved

302.1.2 Reserved

302.1.3 Pharmacies; veterinary facilities; barbering, cosmetology or electrolysis establishments; and acupuncture offices. See Chapter 12.

302.2 Use designation. Occupancy groups contain subordinate uses having similar hazards and risks to building occupants. Uses include, but are not limited to, those functional designations specified within the occupancy group descriptions in Section 302.1. Certain uses require specific limitations and controls in accordance with the provisions of Chapter 4 and elsewhere in this code.

SECTION 303 ASSEMBLY GROUP A

303.1 Assembly Group A. Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption or awaiting transportation; *motion picture and television production studio sound stages, approved production facilities and production locations; or for the showing of motion pictures when an admission fee is charged and when such building or structure is open to the public and has a capacity of 10 or more persons.*

303.1.1 Small buildings and tenant spaces. A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.

303.1.2 Small assembly spaces. The following rooms and spaces shall not be classified as Assembly occupancies:

1. A room or space used for assembly purposes with an occupant load of less than 50 persons and accessory

OCCUPANCY CLASSIFICATION AND USE

to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

2. A room or space used for assembly purposes that is less than 750 square feet (70 m²) in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

303.1.3 Associated with Group E occupancies. A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.

303.1.4 Accessory to places of religious worship. Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 per room or space are not considered separate occupancies.

303.1.5 Special amusement areas. Special amusement areas shall comply with Section 411.

303.2 Assembly Group A-1. Group A-1 occupancy includes assembly uses, usually with fixed seating, intended for the production and viewing of the performing arts or motion pictures including, but not limited to:

Motion picture and television production studio sound stages, approved production facilities and production locations. (with live audiences).

Motion picture theaters

Symphony and concert halls

Television and radio studios admitting an audience

Theaters

303.3 Assembly Group A-2. Group A-2 occupancy includes assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls

Casinos (gaming areas)

Nightclubs

Restaurants, cafeterias and similar dining facilities (including associated commercial kitchens)

Taverns and bars

303.4 Assembly Group A-3. Group A-3 occupancy includes assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A including, but not limited to:

Amusement arcades

Art galleries

Bowling alleys

Community halls

Courtrooms

Dance halls (not including food or drink consumption)

Exhibition halls

Funeral parlors

Greenhouses for the conservation and exhibition of plants that provide public access

Gymnasiums (without spectator seating)

Indoor swimming pools (without spectator seating)

Indoor tennis courts (without spectator seating)

Lecture halls

Libraries

Museums

Places of religious worship

Pool and billiard parlors

Waiting areas in transportation terminals

303.5 Assembly Group A-4. Group A-4 occupancy includes assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

Arenas

Skating rinks

Swimming pools

Tennis courts

303.6 Assembly Group A-5. Group A-5 occupancy includes assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

Amusement park structures

Bleachers

Grandstands

Stadiums

303.7 Fixed guideway transit systems. [SFM] Fixed guideway transit system buildings shall conform to the requirements of this code for their occupancy classification in addition to the provisions set forth in Section 443.

303.8 Subterranean spaces for winery facilities in natural or manmade caves. [SFM] For fire and life safety requirements, see Section 446.

SECTION 304 BUSINESS GROUP B

304.1 Business Group B. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

Airport traffic control towers

Ambulatory care facilities serving six or fewer patients (see Section 308.3.3, Institutional Group I-2.1 for facilities serving more than five patients) | |

Animal hospitals, kennels and pounds

Banks

Barber and beauty shops

Car wash

Civic administration

Clinic, outpatient [SFM] (not classified as Group I-2.1)

Dry cleaning and laundries: pick-up and delivery stations and self-service

Educational occupancies for students above the 12th grade <

Electronic data processing
 Food processing establishments and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities not more than 2,500 square feet (232 m²) in area
 Laboratories: testing and research *and [SFM] instruction*
 Motor vehicle showrooms
 Post offices
 Print shops
 Professional services (architects, attorneys, dentists, physicians, engineers, etc.)
 Radio and television stations
 Telephone exchanges
 Training and skill development not in a school or academic program (this shall include, but not be limited to, tutoring centers, martial arts studios, gymnastics and similar uses regardless of the ages served, and where not classified as a Group A occupancy)

304.2 Airport traffic control towers. Airport traffic control towers shall comply with Section 412.2.

304.3 Ambulatory care facilities. Ambulatory care facilities shall comply with Section 422.

**SECTION 305
 EDUCATIONAL GROUP E**

305.1 Educational Group E. Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, more *than six* persons at any one time for educational purposes through the 12th grade.

Exception: [SFM] A residence used as a home school for the children who normally reside at the residence. Such residences shall remain classified as Group R-2, or Group R-3 occupancies.

305.1.1 Accessory to places of religious worship. Religious educational rooms and religious auditoriums, which are accessory to places of religious worship in accordance with Section 303.1.4 and have occupant loads of less than 100 per room or space, shall be classified as Group A-3 occupancies.

305.2 Group E, child-care facilities. This group includes buildings and structures or portions thereof occupied by more than *six* children *36 months* of age *and older* who receive educational, supervision or personal care services for fewer than 24 hours per day.

Exception: [SFM] A child-care facility not otherwise classified a Group R-3 occupancy, where occupants are not capable of responding to an emergency situation without physical assistance from the staff shall be classified as Group I-4. A maximum of five infants and toddlers are allowed in a Group E child care.

305.2.1 Within places of religious worship. Rooms and spaces within places of religious worship providing such day care during religious functions shall be classified as

part of the primary occupancy *where not licensed for child-care purposes by the Department of Social Services.*

305.2.2 Five or fewer children. A facility having five or fewer children receiving such day care shall be classified as part of the primary occupancy.

305.2.3 Five or fewer children in a dwelling unit. A facility such as the above within a dwelling unit and having five or fewer children receiving such day care shall be classified as a Group R-3 occupancy or shall comply with the *California Residential Code*.

305.3 Storm shelters in Group E occupancies. Storm shelters shall be provided for Group E occupancies where required by Section 423.5.

**SECTION 306
 FACTORY GROUP F**

306.1 Factory Industrial Group F. Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.

306.2 Moderate-hazard factory industrial, Group F-1. Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

- Aircraft (manufacturing, not to include repair)
- Appliances
- Athletic equipment
- Automobiles and other motor vehicles
- Bakeries
- Beverages: over 16-percent alcohol content
- Bicycles
- Boats
- Brooms or brushes
- Business machines
- Cameras and photo equipment
- Canvas or similar fabric
- Carpets and rugs (includes cleaning)
- Clothing
- Construction and agricultural machinery
- Disinfectants
- Dry cleaning and dyeing
- Electric generation plants
- Electronics
- Energy storage systems (ESS) in dedicated use buildings
- Engines (including rebuilding)
- Food processing establishments and commercial kitchens not associated with restaurants, cafeterias and similar

dining facilities more than 2,500 square feet (232 m²) in area

- Furniture
- Hemp products
- Jute products
- Laundries
- Leather products
- Machinery
- Metals
- Millwork (sash and door)

[SFM] Motion picture and television production studio Sound Stages, Approved Production Facilities and production locations (without live audiences)

- Motion pictures and television filming (without spectators)
- Musical instruments
- Optical goods
- Paper mills or products
- Photographic film
- Plastic products
- Printing or publishing
- Recreational vehicles
- Refuse incineration
- Shoes
- Soaps and detergents
- Textiles
- Tobacco
- Trailers
- Upholstering
- Water/sewer treatment facilities
- Wood; distillation
- Woodworking (cabinet)

306.2.1 Aircraft manufacturing facilities. Aircraft manufacturing facilities shall comply with Section 412.6.

306.3 Low-hazard factory industrial, Group F-2. Factory industrial uses that involve the fabrication or manufacturing of noncombustible materials that during finishing, packing or processing do not involve a significant fire hazard shall be classified as F-2 occupancies and shall include, but not be limited to, the following:

- Beverages: up to and including 16-percent alcohol content
- Brick and masonry
- Ceramic products
- Foundries
- Glass products
- Gypsum
- Ice
- Metal products (fabrication and assembly)

**SECTION 307
HIGH-HAZARD GROUP H**

[F] 307.1 High-hazard Group H. High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas complying with Section 414, based on the maximum allowable quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this section, the requirements of Section 415 and the *California Fire Code*. Hazardous materials stored, or used on top of roofs or canopies, shall be classified as outdoor storage or use and shall comply with the *California Fire Code*.

[F] 307.1.1 Uses other than Group H. An occupancy that stores, uses or handles hazardous materials as described in one or more of the following items shall not be classified as Group H, but shall be classified as the occupancy that it most nearly resembles.

1. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 and the *California Fire Code*.
2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the *California Fire Code*.
3. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.
4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both.
5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
6. Liquor stores and distributors without bulk storage.
7. Refrigeration systems.
8. The storage or utilization of materials for agricultural purposes on the premises.
9. Stationary storage battery systems installed in accordance with the *California Fire Code*.
10. Corrosive personal or household products in their original packaging used in retail display.
11. Commonly used corrosive building materials.
12. Buildings and structures occupied for aerosol product storage, aerosol cooking spray products or plastic aerosol 3 products shall be classified as Group S-

- 1, provided that such buildings conform to the requirements of the *California Fire Code*.
- 13. Display and storage of nonflammable solid and non-flammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 414.2.5.
- 14. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the *California Fire Code*.
- 15. Stationary fuel cell power systems installed in accordance with the *California Fire Code*.
- 16. Capacitor energy storage systems in accordance with the *California Fire Code*.
- 17. *[SFM] Group L occupancies defined in Section 453.*
- 18. Distilling or brewing of beverages conforming to the requirements of the *California Fire Code*.
- 19. The storage of beer, distilled spirits and wines in barrels and casks conforming to the requirements of the *California Fire Code*.

[F] 307.2 Hazardous materials. Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the *California Fire Code*.

[F] 307.3 High-hazard Group H-1. Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:

Detonable pyrophoric materials

Explosives:

- Division 1.1
- Division 1.2
- Division 1.3
- Division 1.4
- Division 1.5
- Division 1.6

Organic peroxides, unclassified detonable

Oxidizers, Class 4

Unstable (reactive) materials, Class 3 detonable and Class 4

[F] 307.3.1 Occupancies containing explosives not classified as H-1. The following occupancies containing explosive materials shall be classified as follows:

- 1. Division 1.3 explosive materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.
- 2. Articles, including articles packaged for shipment, that are not regulated as a Division 1.4 explosive under Bureau of Alcohol, Tobacco, Firearms and

Explosives regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.

[F] 307.4 High-hazard Group H-2. Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103.4 kPa).

Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

Cryogenic fluids, flammable.

Flammable gases.

Organic peroxides, Class I.

Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103 kPa).

Pyrophoric liquids, solids and gases, nondetonable.

Unstable (reactive) materials, Class 3, nondetonable.

Water-reactive materials, Class 3.

[F] 307.5 High-hazard Group H-3. Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less

Combustible fibers, other than densely packed baled cotton, where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3

Consumer fireworks, 1.4G (Class C, Common)

Cryogenic fluids, oxidizing

Flammable solids

Organic peroxides, Class II and III

Oxidizers, Class 2

Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less

Oxidizing gases

Unstable (reactive) materials, Class 2

Water-reactive materials, Class 2

TABLE 307.1(1)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b				
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)			
Combustible dust	NA	H-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA			
Combustible fiber ^d	Loose	H-3	(100)	NA	NA	(100)	NA	NA	(20)	NA			
	Baled ^o		(1,000)			(1,000)			(200)				
Combustible liquid ^{c, i}	II	H-2 or H-3	NA	120 ^{d, e}	NA	NA	NA	NA	NA	30 ^d			
	IIIA	H-2 or H-3		330 ^{d, e}						80 ^d			
	IIIB	NA		13,200 ^{e, f}						3,300 ^f			
Cryogenic flammable	NA	H-2	NA	45 ^d	NA	NA	45 ^d	NA	NA	10 ^d			
Cryogenic inert	NA	NA	NA	NA	NL	NA	NA	NL	NA	NA			
Cryogenic oxidizing	NA	H-3	NA	45 ^d	NA	NA	45 ^d	NA	NA	10 ^d			
Explosives	Division 1.1	H-1	1 ^{e, g}	(1) ^{e, g}	NA	NA	NA	NA	NA	0.25 ^g	(0.25) ^g		
	Division 1.2	H-1	1 ^{e, g}	(1) ^{e, g}						0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	Division 1.3	H-1 or H-2	10 ^{e, g}	(10) ^{e, g}						1 ^g	(1) ^g	1 ^g	(1) ^g
	Division 1.4	H-3	50 ^{e, g}	(50) ^{e, g}						50 ^g	(50) ^g	NA	NA
	Division 1.4G	H-3	125 ^{e, 1}	NA						NA	NA	NA	NA
	Division 1.5	H-1	1 ^{e, g}	(1) ^{e, g}						0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	Division 1.6	H-1	1 ^{e, g}	NA						NA	NA	NA	NA
Flammable gas	Gaseous	H-2	NA	NA	1,000 ^{d, e}	NA	NA	1,000 ^{d, e}	NA	NA			
	Liquefied			(150) ^{d, e}	NA		(150) ^{d, e}	NA					
Flammable liquid ^c	IA	H-2 or H-3	NA	30 ^{d, e}	NA	NA	NA	NA	NA	10 ^d			
	IB and IC			120 ^{d, e}						30 ^d			
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ^{d, e, h}	NA	NA	120 ^{d, h}	NA	NA	30 ^{d, h}			
Flammable solid	NA	H-3	125 ^{d, e}	NA	NA	125 ^d	NA	NA	25 ^d	NA			
Inert gas	Gaseous	NA	NA	NA	NL	NA	NA	NL	NA	NA			
	Liquefied	NA	NA	NA	NL	NA	NA	NL	NA	NA			
Organic peroxide	UD	H-1	1 ^{e, g}	(1) ^{e, g}	NA	NA	NA	NA	NA	0.25 ^g	(0.25) ^g		
	I	H-2	5 ^{d, e}	(5) ^{d, e}						1 ^d	(1) ^d	1 ^d	(1) ^d
	II	H-3	50 ^{d, e}	(50) ^{d, e}						50 ^d	(50) ^d	10 ^d	(10) ^d
	III	H-3	125 ^{d, e}	(125) ^{d, e}						125 ^d	(125) ^d	25 ^d	(25) ^d
	IV	NA	NL	NL						NL	NL	NL	NL
	V	NA	NL	NL						NL	NL	NL	NL

(continued)

TABLE 307.1(1)—continued

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^p			USE-OPEN SYSTEMS ^p	
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)
Oxidizer	4	H-1	1 ^g	(1) ^{c, g}	NA	0.25 ^g	(0.25) ^g	NA	0.25 ^g	(0.25) ^g
	3 ^k	H-2 or H-3	10 ^{d, e}	(10) ^{d, e}		2 ^d	(2) ^d		2 ^d	(2) ^d
	2	H-3	250 ^{d, e}	(250) ^{d, e}		250 ^d	(250) ^d		50 ^d	(50) ^d
	1	NA	4,000 ^{e, f}	(4,000) ^{e, f}		4,000 ^f	(4,000) ^f		1,000 ^f	(1,000) ^f
Oxidizing gas	Gaseous	H-3	NA	NA	1,500 ^{d, e}	NA	NA	1,500 ^{d, e}	NA	NA
	Liquefied		(150) ^{d, e}	NA	(150) ^{d, e}	NA	NA	NA	NA	
Pyrophoric	NA	H-2	4 ^{e, g}	(4) ^{e, g}	50 ^{e, g}	1 ^g	(1) ^g	10 ^{e, g}	0	0
Unstable (reactive)	4	H-1	1 ^{e, g}	(1) ^{e, g}	10 ^{e, g}	0.25 ^g	(0.25) ^g	2 ^{e, g}	0.25 ^g	(0.25) ^g
	3	H-1 or H-2	5 ^{d, e}	(5) ^{d, e}	50 ^{d, e}	1 ^d	(1) ^d	10 ^{d, e}	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}	750 ^{d, e}	50 ^d	(50) ^d	750 ^{d, e}	10 ^d	(10) ^d
	1	NA	NL	NL	NL	NL	NL	NL	NL	NL
Water reactive	3	H-2	5 ^{d, e}	(5) ^{d, e}	NA	5 ^d	(5) ^d	NA	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}		50 ^d	(50) ^d		10 ^d	(10) ^d
	1	NA	NL	NL		NL	NL		NL	NL

For SI: 1 cubic foot = 0.028 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.
 NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

- a. For use of control areas, see Section 414.2.
- b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
- c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- d. [SFM] In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied cumulatively.
- e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *California Fire Code*. Where Note d also applies, the increase for both notes shall be applied cumulatively.
- f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.
- i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 605.4.2 of the *California Fire Code*.
- j. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
- k. A maximum quantity of 220 pounds of solid or 22 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment when the storage containers and the manner of storage are approved.
- l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.
- m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *California Fire Code*.
- n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
- o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- p. The following shall not be included in determining the maximum allowable quantities:
 1. Liquid or gaseous fuel in fuel tanks on vehicles.
 2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with the *California Fire Code*.
 3. Gaseous fuels in piping systems and fixed appliances regulated by the *International Fuel Gas Code*.
 4. Liquid fuels in piping systems and fixed appliances regulated by the *California Mechanical Code*.
 5. Alcohol-based hand rubs classified as Class I or II liquids in dispensers that are installed in accordance with Sections 5705.5 and 5705.5.1 of the *California Fire Code*. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the construction documents.
- q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

[F] TABLE 307.1(2)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD^{a, c, f, h, i}

MATERIAL	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
	Solid pounds ^{d, e}	Liquid gallons (pounds) ^{d, e}	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d
Corrosives	5,000	500	Gaseous 810 ^e	5,000	500	Gaseous 810 ^e	1,000	100
			Liquefied (150)			Liquefied (150)		
Highly Toxic	10	(10)	Gaseous 20 ^e	10	(10)	Gaseous 20 ^e	3	(3)
			Liquefied (4) ^e			Liquefied (4) ^e		
Toxic	500	(500)	Gaseous 810 ^e	500	(500)	Gaseous 810 ^e	125	(125)
			Liquefied (150) ^e			Liquefied (150) ^e		

For SI: 1 cubic foot = 0.028 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- a. For use of control areas, see Section 414.2.
- b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
- c. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- d. [SFM] In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
- e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the California Fire Code. Where Note d also applies, the increase for both notes shall be applied accumulatively.
- f. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
- g. Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures as specified in the California Fire Code.
- h. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
- i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the California Fire Code.

[F] 307.6 High-hazard Group H-4. Buildings and structures containing materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

- Corrosives
- Highly toxic materials
- Toxic materials

[F] 307.7 High-hazard Group H-5. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those specified in Table 307.1(1) and [F] Table 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.11.

[F] 307.8 Multiple hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

**SECTION 308
INSTITUTIONAL GROUP I**

308.1 Institutional Group I. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are incapable of self-preservation without physical assistance or in which persons are detained for penal

or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-2, I-2.1, I-3 or I-4. *Restraint shall not be permitted in any building except in Group I-2 occupancies constructed for such use in accordance with Section 407.1.1 and Group I-3 occupancies constructed for such use in accordance with Section 408.1.2.*

Where occupancies house both ambulatory and nonambulatory persons, the more restrictive requirements shall apply.

308.2 Institutional Group I-1. Not used. (See Group R-2.1 Section 310.1).

308.3 Institutional Group I-2. Institutional Group I-2 occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation or classified as nonambulatory or bedridden. This group shall include, but not be limited to, the following:

- Detoxification facilities
- Hospitals
- Nursing homes
- Psychiatric hospitals

308.3.1 Five or fewer persons receiving medical care. A facility with five or fewer persons receiving medical care shall be classified as Group R-3.1 or shall comply with the California Residential Code provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section R313 of the California Residential Code.

308.3.2 Reserved.

- **308.3.3 Institutional Group I-2.1.** *A healthcare facility that receives persons for outpatient medical care that may render the patient incapable of unassisted self-preservation and where each tenant space accommodates more than five such patients.*

➔ **308.4 Institutional Group I-3.** Institutional Group I-3 occupancy shall include buildings *or portions of buildings* and structures that are inhabited by *one or more* persons who are under restraint or security. A Group I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control *which includes persons restrained*. This group shall include, but not be limited to, the following:

- Correctional centers
 - Correctional hospitals*
 - Correctional nursing facilities*
 - Correctional mental health facilities*
 - Correctional treatment centers*
- Courthouse holding facility*
- Detention centers
 - Detention treatment room*
- Jails
- Juvenile halls*
- Prerelease centers
- Prisons
- Reformatories
- Secure interview rooms*
- Temporary holding facility*

Buildings of Group I-3 shall be classified as one of the occupancy conditions specified in Sections 308.4.1 through 308.5.8 and shall comply with Section 408.

308.4.1 Condition 1. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas, and other spaces where access or occupancy is permitted, to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.

308.4.2 Condition 2. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.

308.4.3 Condition 3. This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit composed of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such a smoke compartment to another smoke compartment.

308.4.4 Condition 4. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.4.5 Condition 5. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

308.4.6 Condition 6. *This occupancy condition shall include buildings containing only one temporary holding facility with six or fewer persons under restraint or security where the building is protected throughout with a monitored automatic sprinkler system installed in accordance with Section 903.3.1.1 and where the temporary holding facility is protected throughout with an automatic fire alarm system with notification appliances. A Condition 6 building shall be permitted to be classified as a Group B occupancy.*

308.4.7 Condition 7. *This occupancy condition shall include buildings containing only one temporary holding facility with nine or less persons under restraint or security where limited to the first or second story, provided the building complies with Section 408.1.2.6. A Condition 7 building shall be permitted to be classified as a Group B occupancy.*

308.4.8 Condition 8. *This occupancy condition shall include buildings containing not more than four secure interview rooms located within the same fire area where not more than six occupants under restraint are located in the same fire area. A Condition 8 building shall be permitted to be classified as a Group B occupancy, provided the requirements in Section 408.1.2.7 are met.*

308.4.9 Condition 9. *This occupancy condition shall include buildings where the use of the building is for correctional medical care or correctional mental health care.*

308.5 Institutional Group I-4, day care facilities. Institutional Group I-4 occupancy shall include buildings and structures occupied by more than *six clients* of any age who receive custodial care for fewer than 24 hours per day by persons other than parents or guardians; relatives by blood, marriage or adoption; and in a place other than the home of the *clients* cared for. This group shall include, but not be limited to, the following:

Adult day care

Child care (*not classified as Group E*)

308.5.1 Reserved.

308.5.2 Within a place of religious worship. Rooms and spaces within places of religious worship providing such care during religious functions shall be *licensed by the California State Department Health Services as required by Health and Safety Code Division 2 Chapter 3.5.*

308.5.3 Six or fewer persons receiving care. A facility having *six or fewer* persons receiving custodial care shall be *licensed pursuant to Health and Safety Code Division 2 Chapter 3.5 or 3.6.*

308.5.4 Six or fewer persons receiving care in a dwelling unit. A facility such as the above within a dwelling unit and having *six* or fewer persons receiving custodial care shall be classified as a Group R-3 occupancy, *where occupants are not capable of responding to an emergency situation without physical assistance from the staff shall be classified as a Group I-4.*

**SECTION 309
MERCANTILE GROUP M**

309.1 Mercantile Group M. Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and where the public has access. Mercantile occupancies shall include, but not be limited to, the following:

- Department stores
- Drug stores
- Markets
- Greenhouses for display and sale of plants that provide public access.
- Motor fuel-dispensing facilities
- Retail or wholesale stores
- Sales rooms

309.2 Quantity of hazardous materials. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 414.2.5(1).

309.3 Motor fuel-dispensing facilities. Motor fuel-dispensing facilities shall comply with Section 406.7.

**SECTION 310
RESIDENTIAL GROUP R**

310.1 Residential Group R. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *California Residential Code*. Group R occupancies not constructed in accordance with the *California Residential Code* as permitted by Sections 310.4.1 and 310.4.2 shall comply with Section 420.

310.2 Residential Group R-1. Residential Group R-1 occupancies containing sleeping units where the occupants are primarily transient in nature, including:

- Boarding houses (transient) with more than 10 occupants
- Congregate *residences* (transient) with more than 10 occupants
- Hotels (transient)
- Motels (transient)

[HCD 1] Efficiency dwelling units (transient)

310.3 Residential Group R-2. Residential Group R-2 occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including:

- Apartment houses
 - Large family child care*
 - Small family child care*
- Congregate *residences* (nontransient) with more than 16 occupants
- Boarding houses (nontransient)
- Convents
- Dormitories
- Fraternities and sororities
- Monasteries
- Hotels (nontransient)
- Live/work units
- Motels (nontransient)
- Vacation timeshare properties

[HCD 1] Efficiency dwelling units (transient)

310.3.1 Residential Group R-2.1. Residential Group R-2.1 occupancies shall include buildings, structures or parts thereof housing clients, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services.

This occupancy may contain more than six nonambulatory and/or bedridden clients. (See Section 435 Special Provisions for Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 Occupancy). This group shall include, but not be limited to, the following:

- Assisted living facilities such as:*
 - Residential care facilities,*
 - Residential care facilities for the elderly (RCFEs),*
 - Adult residential facilities,*
 - Congregate living health facilities,*
 - Group homes,*
 - Residential care facilities for the chronically ill,*
 - Congregate living health facilities for the terminally ill.*

Social rehabilitation facilities such as:

- Halfway houses,*
- Community correctional centers,*
- Community treatment programs,*
- Work furlough programs,*
- Alcoholism or drug abuse recovery or treatment facilities.*

310.3.2 Residential Group R-2.2 (CDCR Only). Residential occupancies operated by CDCR in a community located facility that provides housing and community-based program services for nontransient ambulatory participants in a nonlicensed facility with 24/7 supervision.

310.4 Residential Group R-3. Residential Group R-3 occupancies where the occupants are primarily permanent in nature

and not classified as Group R-1, R-2, R-2.1, R-2.2, R-3.1, R-4 or I, including:

Buildings that do not contain more than two dwelling units
Care facilities that provide accommodations for five or fewer persons receiving care

Congregate *residences* (nontransient) with 16 or fewer occupants

Boarding houses (nontransient)

Convents

Dormitories

Fraternities and sororities

Monasteries

Congregate *residences* (transient) with 10 or fewer occupants
[HCD 1] Efficiency dwelling units

Boarding houses (transient)

Adult care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours.

Licensing categories that may use this classification include Adult Day Programs.

Alcoholism or drug abuse recovery homes (ambulatory only)

Child-care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours.

Licensing categories that may use this classification include, but are not limited to:

*Day-Care Center for Mildly Ill Children,
Infant Care Center,
School Age Child Day-Care Center.*

Family Day-Care Homes that provide accommodations for 14 or fewer children, in the provider's own home for less than 24-hours.

Adult care and child-care facilities that are within a single family home are permitted to comply with the California Residential Code.

Lodging houses (transient) with five or fewer guest rooms and 10 or fewer occupants

310.4.1 Residential Group R-3.1. *This occupancy group may include facilities licensed by a governmental agency for a residentially based 24-hour care facility providing accommodations for six or fewer clients of any age. Clients may be classified as ambulatory, nonambulatory or bedridden. A Group R-3.1 occupancy shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in Section 435 Special Provisions For Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 Occupancy. This group may include:*

Adult residential facilities

Congregate living health facilities

Intermediate care facilities for the developmentally disabled habilitative

Intermediate care facilities for the developmentally disabled nursing

Nurseries for the full-time care of children under the age of six, but not including "infants" as defined in Chapter 2

Residential care facilities for the elderly

Small family homes and residential care facilities for the chronically ill

Exception: *Group Homes licensed by the Department of Social Services which provide nonmedical board, room and care for six or fewer ambulatory children or children two years of age or younger, and which do not have any nonambulatory clients shall not be subject to regulations found in Section 435.*

Pursuant to Health and Safety Code Section 13143 with respect to these exempted facilities, no city, county or public district shall adopt or enforce any requirement for the prevention of fire or for the protection of life and property against fire and panic unless the requirement would be applicable to a structure regardless of the special occupancy. Nothing shall restrict the application of state or local housing standards to such facilities if the standards are applicable to residential occupancies and are not based on the use of the structure as a facility for ambulatory children. For the purpose of this exception, ambulatory children do not include relatives of the licensee or the licensee's spouse.

310.4.2 Lodging houses. Owner-occupied lodging houses with five or fewer guest rooms and 10 or fewer total occupants shall be permitted to be constructed in accordance with the *California Residential Code*, provided that an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the *California Residential Code*.

310.5 Residential Group R-4. Residential Group R-4 occupancy shall include buildings, structures or portions thereof for more than six *ambulatory clients*, but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised residential environment and receive custodial care. *The persons receiving care are capable of self-preservation.* Buildings of Group R-4 shall be classified as one of the occupancy conditions specified in Section 310.5.1 or 310.5.2. *This occupancy classification may include a maximum six nonambulatory or bedridden clients (see Section 435, Special Provisions for Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4).* Group R-4 occupancies shall meet the requirements in Section 420. This group shall include, but not be limited to, the following:

Assisted living facilities such as:

Residential care facilities,

Residential care facilities for the elderly (RCFE),

Adult residential facilities,

Congregate living health facilities,

Group homes.

Social rehabilitation facilities such as:

Halfway houses,

Community treatment programs,

Work furlough programs,

Alcoholism or drug abuse recovery or treatment facilities.

310.6 Large family day-care homes. See Section 455.

SECTION 311 STORAGE GROUP S

311.1 Storage Group S. Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

311.1.1 Accessory storage spaces. A room or space used for storage purposes that is accessory to another occupancy shall be classified as part of that occupancy.

311.1.2 Combustible storage. High-piled stock or rack storage, or attic, under-floor and concealed spaces used for storage of combustible materials, shall be in accordance with Section 413.

311.2 Moderate-hazard storage, Group S-1. Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

- Aerosol products, Levels 2 and 3
- Aircraft hangar (storage and repair)
- Bags: cloth, burlap and paper
- Bamboos and rattan
- Baskets
- Belting: canvas and leather
- Beverages over 16-percent alcohol content
- Books and paper in rolls or packs
- Boots and shoes
- Buttons, including cloth covered, pearl or bone
- Cardboard and cardboard boxes
- Clothing, woolen wearing apparel
- Cordage
- Dry boat storage (indoor)
- Furniture
- Furs
- Glues, mucilage, pastes and size
- Grains
- Horns and combs, other than celluloid
- Leather
- Linoleum
- Lumber
- Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials specified in Table 307.1(1) (see Section 406.8)
- Photo engravings
- Resilient flooring
- Self-service storage facility (mini-storage)
- Silks
- Soaps
- Sugar
- Tires, bulk storage of
- Tobacco, cigars, cigarettes and snuff

Upholstery and mattresses

Wax candles

311.2.1 Aircraft hangers. Aircraft hangars used for storage or repair shall comply with Section 412.3.

311.2.2 Motor vehicle repair garages Motor vehicle repair garages shall comply with Section 406.8.

311.3 Low-hazard storage, Group S-2. Storage Group S-2 occupancies include, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Group S-2 storage uses shall include, but not be limited to, storage of the following:

- Asbestos
- Beverages up to and including 16-percent alcohol
- Cement in bags
- Chalk and crayons
- Dairy products in nonwaxed coated paper containers
- Dry cell batteries
- Electrical coils
- Electrical motors
- Empty cans
- Food products
- Foods in noncombustible containers
- Fresh fruits and vegetables in nonplastic trays or containers
- Frozen foods
- Glass
- Glass bottles, empty or filled with noncombustible liquids
- Gypsum board
- Inert pigments
- Ivory
- Meats
- Metal cabinets
- Metal desks with plastic tops and *trim*
- Metal parts
- Metals
- Mirrors
- Oil-filled and other types of distribution transformers
- Public parking garages, open or enclosed
- Porcelain and pottery
- Stoves
- Talc and soapstones
- Washers and dryers

311.3.1 Public parking garages. Public parking garages shall comply with Section 406.4 and the additional requirements of Section 406.5 for open parking garages or Section 406.6 for enclosed parking garages.

SECTION 312 UTILITY AND MISCELLANEOUS GROUP U

312.1 General. Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

- Agricultural buildings
- Aircraft hangars, accessory to a one- or two-family residence (see Section 412.4)
- Barns
- Carpports
- Communication equipment structures with a gross floor area of less than 1,500 square feet (139 m²)
- Fences more than 7 feet (2134 mm) in height
- Grain silos, accessory to a residential occupancy
- Livestock shelters
- Private garages
- Retaining walls
- Sheds
- Stables
- Tanks
- Towers

312.1.1 Greenhouses. Greenhouses not classified as another occupancy shall be classified as Use Group U.

312.2 Private garages and carpports. Private garages and carpports shall comply with Section 406.3.

312.3 Residential aircraft hangars. Aircraft hangars accessory to a one- or two-family residence shall comply with Section 412.4.

SECTION 313 LABORATORIES GROUP L [SFM]

313.1 Group L Laboratories. [SFM] Group L occupancy includes the use of a building or structure, or a portion thereof, containing one or more laboratory suites as defined in Section 453.

SECTION 314 ORGANIZED CAMPS GROUP C [SFM]

314.1 Organized Camps Group C. [SFM] An organized camp is a site with programs and facilities established for the primary purpose of providing an outdoor group living experience with social, spiritual, educational or recreational objectives, for five days or more during one or more seasons of the year.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X										
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X						X								X	
Chapter / Section																						
403			X																			
403.1			X																			
403.1.1			X																			
403.2			X																			
403.2.1			X																			
403.2.1.1			X																			
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403.3.3			X																			
403.3.5			X																			
403.4.7			X																			
403.4.7.1			X																			
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403.6			X																			
403.7			X																			
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404.6			X																			
404.11			X																			
406.2.1			X	X	X																	
406.2.2				X	X																	
406.2.3						X	X															
406.2.7				X	X	X																
406.3.1			X																			
406.6.4.1			X																			
406.8.2			X																			
406.9			X																			
406.9.1			X																			
406.9.2			X																			
406.9.3			X																			
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407.2.1			X																			
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407.2.5			X																			

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE—
continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X										
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X					X									X	
Chapter / Section																						
407.2.6			X																			
407.2.7			X																			
407.3			X																			
407.3.1			X																			
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407.4.4.5.1			X																			
407.4.4.6.1			X																			
407.4.4.6.2			X																			
407.4.5 – 407.4.5.3			X																			
407.5			X																			
407.7 – 407.7.1			X																			
407.9			X																			
407.10			X																			
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407.12			X																			
407.13 – 407.13.4			X																			
408.1.2			X																			
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408.1.2.2			X																			
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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE—
continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1 R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X									
Adopt entire chapter as amendedd (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below					X	X						X									X	
Chapter / Section																						
408.3.6			X																			
408.3.6.1			X																			
408.3.6.2			X																			
408.3.6.3			X																			
408.3.6.4			X																			
408.3.8.1			X																			
408.3.9			X																			
408.3.10			X																			
408.3.11			X																			
408.3.12			X																			
Table 408.3.13			X																			
408.4			X																			
408.4.3			X																			
408.5.1			X																			
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408.6.1			X																			
408.8.4			X																			
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412.2.6							X															
414.1.1			X																			
414.5			X																			
414.5.1			X																			
414.5.4			X																			
415.12			X																			
415.12.1			X																			
415.12.1.1			X																			

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 4 – SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE—
continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendedd (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X						X								X	
Chapter / Section																						
415.12.1.2			X																			
415.12.1.3			X																			
415.12.1.4			X																			
415.12.1.5			X																			
415.13			X																			
415.13.1			X																			
415.13.2			X																			
415.13.3			X																			
420.1			X	X	X																	
420.4			X																			
420.5			X																			
420.6			X																			
420.11.1			X	X	X																	
420.12			X	X																		
420.13			X	X		X																
420.14			X	X																		
420.15			X																			
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446			X																			
449			X																			
450			X																			
452			X																			
453			X																			
455			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 4

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

User note:

About this chapter: Chapter 4 provides detailed criteria for special uses and occupancies. The unique characteristics of a live/work unit as opposed to a 30-story high-rise building call for specific standards for each. Twenty-seven sections address covered and open mall buildings, atriums, hospitals, stages, buildings where hazardous materials are used and stored, jails and prisons, ambulatory care facilities and storm shelters, among other special occupancy issues.

SECTION 401 SCOPE

401.1 Detailed occupancy and use requirements. In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the occupancies and use described herein.

SECTION 402 COVERED MALL AND OPEN MALL BUILDINGS

402.1 Applicability. The provisions of this section shall apply to buildings or structures defined herein as covered or open mall buildings not exceeding three floor levels at any point nor more than three stories above grade plane. Except as specifically required by this section, covered and open mall buildings shall meet applicable provisions of this code.

Exceptions:

1. Foyers and lobbies of Group B, R-1 and R-2 occupancies are not required to comply with this section.
2. Buildings need not comply with the provisions of this section where they totally comply with other applicable provisions of this code.

402.1.1 Open mall building perimeter line. For the purpose of this code, a perimeter line shall be established. The perimeter line shall encircle all buildings and structures that comprise the open mall building and shall encompass any open-air interior walkways, open-air courtyards or similar open-air spaces. The perimeter line shall define the extent of the open mall building. Anchor buildings and parking structures shall be outside of the perimeter line and are not considered as part of the open mall building.

402.2 Open space. A covered mall building and attached anchor buildings and parking garages shall be surrounded on all sides by a permanent open space or not less than 60 feet (18 288 mm). An open mall building and anchor buildings and parking garages adjoining the perimeter line shall be surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm).

Exception: The permanent open space of 60 feet (18 288 mm) shall be permitted to be reduced to not less than 40

feet (12 192 mm), provided that the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the covered or open mall building and anchor buildings.
2. The exterior wall facing the reduced open space shall have a fire-resistance rating of not less than 3 hours.
3. Openings in the exterior wall facing the reduced open space shall have opening protectives with a fire protection rating of not less than 3 hours.
4. Group E, H, I or R occupancies are not located within the covered or open mall building or anchor buildings.

402.3 Lease plan. Each owner of a covered mall building or of an open mall building shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its exits after the certificate of occupancy has been issued. Modifications or changes in occupancy or use from that shown on the lease plan shall not be made without prior approval of the building official.

402.4 Construction. The construction of covered and open mall buildings, anchor buildings and parking garages associated with a mall building shall comply with Sections 402.4.1 through 402.4.3.

402.4.1 Area and types of construction. The building area and type of construction of covered mall or open mall buildings, anchor buildings and parking garages shall comply with this section.

402.4.1.1 Covered and open mall buildings. The building area of any covered mall or open mall building shall not be limited provided that the covered mall or open mall building does not exceed three floor levels at any point nor three stories above grade plane, and is of Type I, II, III or IV construction.

402.4.1.2 Anchor buildings. The building area and building height of any anchor building shall be based on the type of construction as required by Section 503 as modified by Sections 504 and 506.

Exception: The building area of any anchor building shall not be limited provided that the anchor building

is not more than three stories above grade plane, and is of Type I, II, III or IV construction.

402.4.1.3 Parking garage. The building area and building height of any parking garage shall be based on the type of construction as required by Sections 406.5 and 406.6, respectively.

402.4.2 Fire-resistance-rated separation. Fire-resistance-rated separation is not required between tenant spaces and the mall. Fire-resistance-rated separation is not required between a food court and adjacent tenant spaces or the mall.

402.4.2.1 Tenant separations. Each tenant space shall be separated from other tenant spaces by a fire partition complying with Section 708. A tenant separation wall is not required between any tenant space and the mall.

402.4.2.2 Anchor building separation. An anchor building shall be separated from the covered or open mall building by fire walls complying with Section 706.

Exceptions:

1. Anchor buildings of not more than three stories above grade plane that have an occupancy classification the same as that permitted for tenants of the mall building shall be separated by 2-hour fire-resistance-rated fire barriers complying with Section 707.
2. The exterior walls of anchor buildings separated from an open mall building by an open mall shall comply with Table 705.5.

402.4.2.2.1 Openings between anchor building and mall. Except for the separation between Group R-1 sleeping units and the mall, openings between anchor buildings of Type IA, IB, IIA or IIB construction and the mall need not be protected.

402.4.2.3 Parking garages. An attached garage for the storage of passenger vehicles having a capacity of not more than nine persons and open parking garages shall be considered as a separate building where it is separated from the covered or open mall building or anchor building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

Parking garages, which are separated from covered mall buildings, open mall buildings or anchor buildings, shall comply with the provisions of Table 705.5.

Pedestrian walkways and tunnels that connect garages to mall buildings or anchor buildings shall be constructed in accordance with Section 3104.

402.4.3 Open mall construction. Floor assemblies in, and roof assemblies over, the open mall of an open mall building shall be open to the atmosphere for not less than 20 feet (9096 mm), measured perpendicular from the face of the tenant spaces on the lowest level, from edge of balcony to edge of balcony on upper floors and from edge of roof line to edge of roof line. The openings within, or the

unroofed area of, an open mall shall extend from the lowest/grade level of the open mall through the entire roof assembly. Balconies on upper levels of the mall shall not project into the required width of the opening.

402.4.3.1 Pedestrian walkways. Pedestrian walkways connecting balconies in an open mall shall be located not less than 20 feet (9096 mm) from any other pedestrian walkway.

[F] 402.5 Automatic sprinkler system. Covered and open mall buildings and buildings connected shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, which shall comply with all of the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the mall building prior to occupancy of any of the tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with approved alternative protection.
2. Sprinkler protection for the mall of a covered mall building shall be independent from that provided for tenant spaces or anchor buildings.
3. Sprinkler protection for the tenant spaces of an open mall building shall be independent from that provided for anchor buildings.
4. Sprinkler protection shall be provided beneath exterior circulation balconies located adjacent to an open mall.
5. Where tenant spaces are supplied by the same system, they shall be independently controlled.

Exception: An automatic sprinkler system shall not be required in spaces or areas of open parking garages separated from the covered or open mall building in accordance with Section 402.4.2.3 and constructed in accordance with Section 406.5.

402.6 Interior finishes and features. Interior finishes within the mall and installations within the mall shall comply with Sections 402.6.1 through 402.6.4.

402.6.1 Interior finish Interior wall and ceiling finishes within the mall of a covered mall building and within the exits of covered or open mall buildings shall have a minimum flame spread index and smoke-developed index of Class B in accordance with Chapter 8. Interior floor finishes shall meet the requirements of Section 804.

402.6.2 Kiosks. Kiosks and similar structures (temporary or permanent) located within the mall of a covered mall building or within the perimeter line of an open mall building shall meet the following requirements:

1. Combustible kiosks or other structures shall not be located within a covered or open mall unless constructed of any of the following materials:
 - 1.1. Fire-retardant-treated wood complying with Section 2303.2.
 - 1.2. Foam plastics having a maximum heat release rate not greater than 100 kW (105 Btu/h) when tested in accordance with the exhibit booth protocol in UL 1975 or when

tested in accordance with NFPA 289 using the 20 kW ignition source.

- 1.3. Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended.
2. Kiosks or similar structures located within the mall shall be provided with approved automatic sprinkler system and detection devices.
3. The horizontal separation between kiosks or groupings thereof and other structures within the mall shall be not less than 20 feet (6096 mm).
4. Each kiosk or similar structure or groupings thereof shall have an area not greater than 300 square feet (28 m²).

402.6.3 Play structures. Play structures located within a mall building or within the perimeter line of an open mall building shall comply with Section 424. The horizontal separation between play structures, kiosks and similar structures within the mall shall be not less than 20 feet (6096 mm).

402.6.4 Plastic signs. Plastic signs affixed to the storefront of any tenant space facing a mall or open mall shall be limited as specified in Sections 402.6.4.1 through 402.6.4.5.

402.6.4.1 Area. Plastic signs shall be not more than 20 percent of the wall area facing the mall.

402.6.4.2 Height and width. Plastic signs shall be not greater than 36 inches (914 mm) in height, except that where the sign is vertical, the height shall be not greater than 96 inches (2438 mm) and the width shall be not greater than 36 inches (914 mm).

402.6.4.3 Location. Plastic signs shall be located not less than 18 inches (457 mm) from adjacent tenants.

402.6.4.4 Plastics other than foam plastics. Plastics other than foam plastics used in signs shall be light-transmitting plastics complying with Section 2606.4 or shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D1929, and a flame spread index not greater than 75 and smoke-developed index not greater than 450 when tested in the manner intended for use in accordance with ASTM E84 or UL 723 or meet the acceptance criteria of Section 803.1.1.1 when tested in accordance with NFPA 286.

402.6.4.4.1 Encasement. Edges and backs of plastic signs in the mall shall be fully encased in metal.

402.6.4.5 Foam plastics. Foam plastics used in signs shall have flame-retardant characteristics such that the sign has a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289 using the 20 kW ignition source, and the foam plastics shall have the physical characteristics specified in this section. Foam plastics used in signs installed in accordance with

Section 402.6.4 shall not be required to comply with the flame spread and smoke-developed indices specified in Section 2603.3.

402.6.4.5.1 Density. The density of foam plastics used in signs shall be not less than 20 pounds per cubic foot (pcf) (320 kg/m³).

402.6.4.5.2 Thickness. The thickness of foam plastic signs shall not be greater than 1/2 inch (12.7 mm).

[F] 402.7 Emergency systems. Covered and open mall buildings, anchor buildings and associated parking garages shall be provided with emergency systems complying with Sections 402.7.1 through 402.7.5.

[F] 402.7.1 Standpipe system. Covered and open mall buildings shall be equipped throughout with a standpipe system as required by Section 905.3.3.

[F] 402.7.2 Smoke control. Atriums connecting three or more stories in a covered mall building shall be provided with a smoke control system in accordance with Section 909.

[F] 402.7.3 Emergency power. Covered mall buildings greater than 50,000 square feet (4645 m²) in area and open mall buildings greater than 50,000 square feet (4645 m²) within the established perimeter line shall be provided with emergency power that is capable of operating the emergency voice/alarm communication system in accordance with Section 2702.

[F] 402.7.4 Emergency voice/alarm communication system. Where the total floor area is greater than 50,000 square feet (4645 m²) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided.

The fire department shall have access to any emergency voice/alarm communication systems serving a mall, required or otherwise. The systems shall be provided in accordance with Section 907.5.2.2.

[F] 402.7.5 Fire department access to equipment. Rooms or areas containing controls for air-conditioning systems or fire protection systems shall be identified for use by the fire department.

402.8 Means of egress. Covered mall buildings, open mall buildings and each tenant space within a mall building shall be provided with means of egress as required by this section and this code. Where there is a conflict between the requirements of this code and the requirements of Sections 402.8.1 through 402.8.8, the requirements of Sections 402.8.1 through 402.8.8 shall apply.

402.8.1 Mall width. For the purpose of providing required egress, malls are permitted to be considered as corridors but need not comply with the requirements of Section 1005.1 of this code where the width of the mall is as specified in this section.

402.8.1.1 Minimum width. The aggregate clear egress width of the mall in either a covered or open mall building shall be not less than 20 feet (6096 mm). The mall width shall be sufficient to accommodate the occupant

load served. Any portion of the minimum required aggregate egress width shall be not less than 10 feet (3048 mm) measured to a height of 8 feet (2438 mm) between any projection of a tenant space bordering the mall and the nearest kiosk, vending machine, bench, display opening, food court or other obstruction to means of egress travel.

402.8.2 Determination of occupant load. The occupant load permitted in any individual tenant space in a covered or open mall building shall be determined as required by this code. Means of egress requirements for individual tenant spaces shall be based on the occupant load thus determined.

402.8.2.1 Occupant formula. In determining required means of egress of the mall, the number of occupants for whom means of egress are to be provided shall be based on gross leasable area of the covered or open mall building (excluding anchor buildings) and the occupant load factor as determined by Equation 4-1.

$$OLF = (0.00007)(GLA) + 25 \quad \text{(Equation 4-1)}$$

where:

OLF = The occupant load factor (square feet per person).

GLA = The gross leasable area (square feet).

Exception: Tenant spaces attached to a covered or open mall building but with a means of egress system that is totally independent of the open mall of an open mall building or of a covered mall building shall not be considered as gross leasable area for determining the required means of egress for the mall building.

402.8.2.2 OLF range. The occupant load factor (OLF) is not required to be less than 30 and shall not exceed 50.

402.8.2.3 Anchor buildings. The occupant load of anchor buildings opening into the mall shall not be included in computing the total number of occupants for the mall.

402.8.2.4 Food courts. The occupant load of a food court shall be determined in accordance with Section 1004. For the purposes of determining the means of egress requirements for the mall, the food court occupant load shall be added to the occupant load of the covered or open mall building as calculated in Section 402.8.2.1.

402.8.3 Number of means of egress. Wherever the distance of travel to the mall from any location within a tenant space used by persons other than employees is greater than 75 feet (22 860 mm) or the tenant space has an occupant load of 50 or more, not fewer than two means of egress shall be provided.

402.8.4 Arrangements of means of egress. Assembly occupancies with an occupant load of 500 or more located within a covered mall building shall be so located such that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required means of egress opening directly to

the exterior of the covered mall building. Assembly occupancies located within the perimeter line of an open mall building shall be permitted to have their main exit open to the open mall.

402.8.4.1 Anchor building means of egress. Required means of egress for anchor buildings shall be provided independently from the mall means of egress system. The occupant load of anchor buildings opening into the mall shall not be included in determining means of egress requirements for the mall. The path of egress travel of malls shall not exit through anchor buildings. Malls terminating at an anchor building where other means of egress has not been provided shall be considered as a dead-end mall.

402.8.5 Distance to exits. Within each individual tenant space in a covered or open mall building, the distance of travel from any point to an exit or entrance to the mall shall be not greater than 200 feet (60 960 mm).

The distance of travel from any point within a mall of a covered mall building to an exit shall be not greater than 200 feet (60 960 mm). The maximum distance of travel from any point within an open mall to the perimeter line of the open mall building shall be not greater than 200 feet (60 960 mm).

402.8.6 Access to exits. Where more than one exit is required, they shall be so arranged that it is possible to travel in either direction from any point in a mall of a covered mall building to separate exits or from any point in an open mall of an open mall building to two separate locations on the perimeter line, provided that neither location is an exterior wall of an anchor building or parking garage. The width of an exit passageway or corridor from a mall shall be not less than 66 inches (1676 mm).

Exception: Access to exits is permitted by way of a dead-end mall that does not exceed a length equal to twice the width of the mall measured at the narrowest location within the dead-end portion of the mall.

402.8.6.1 Exit passageways. Where exit passageways provide a secondary means of egress from a tenant space, the exit passageways shall be constructed in accordance with Section 1024.

402.8.7 Service areas fronting on exit passageways. Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into exit passageways, provided that the exit passageway is separated from such rooms with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire protection rating of openings in the fire barriers shall be not less than 1 hour.

402.8.8 Security grilles and doors. Horizontal sliding or vertical security grilles or doors that are a part of a required means of egress shall conform to the following:

1. Doors and grilles shall remain in the full open position during the period of occupancy by the general public.

2. Doors or grilles shall not be brought to the closed position when there are 10 or more persons occupying spaces served by a single exit or 50 or more persons occupying spaces served by more than one exit.
3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more exits are required, not more than one-half of the exits shall be permitted to include either a horizontal sliding or vertical rolling grille or door.

**SECTION 403
HIGH-RISE BUILDINGS AND GROUP I-2
OCCUPANCIES HAVING OCCUPIED
FLOORS LOCATED MORE THAN 75 FEET
ABOVE THE LOWEST LEVEL OF FIRE
DEPARTMENT VEHICLE ACCESS**

403.1 Applicability. *New high-rise buildings (see Section 202 for definition of a high-rise) and new Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall comply with Sections 403.2 through 403.7.*

Exceptions: The provisions of Sections 403.2 through 403.7 shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with Section 412.2.
2. Open parking garages in accordance with Section 406.5.
3. The portion of a building containing a Group A-5 occupancy in accordance with Section 303.6.
4. Special industrial occupancies in accordance with Section 503.1.1.
5. Buildings containing any one of the following:
 - 5.1. A Group H-1 occupancy.
 - 5.2. A Group H-2 occupancy in accordance with Section 415.8, 415.9.2, 415.9.3 or 426.1.
 - 5.3. A Group H-3 occupancy in accordance with Section 415.8.
5. *Buildings such as power plants, lookout towers, steeples, grain houses and similar structures with noncontinuous human occupancy, when so determined by the enforcing agency.*

For existing high-rise buildings and for existing Group R occupancies, see California Fire Code Chapter 11 and California Existing Building Code.

For the purpose of this section, in determining the level from which the highest occupied floor is to be measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. When a building is located on sloping terrain and there is building access on more than one level, the enforcing agency

may select the level that provides the most logical and adequate fire department access.

403.2 Construction. The construction of high-rise buildings shall comply with the provisions of Sections 403.2.1 through 403.2.3.

403.2.1 Reduction in fire-resistance rating. The fire-resistance rating reductions specified in Sections 403.2.1.1 and 403.2.1.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

Exception: Buildings, or portions of buildings, classified as a Group H-1, H-2 or H-3 occupancy.

403.2.1.1 Type of construction. The following reductions in the minimum fire-resistance rating of the building elements in TABLE 601 shall be permitted as follows:

1. For buildings not greater than 420 feet (128 m) in building height, the fire-resistance rating of the building elements in Type IA construction shall be permitted to be reduced to the minimum fire-resistance ratings for the building elements in Type IB.

Exception: The required fire-resistance rating of the primary structural frame columns supporting floors shall not be reduced.

2. In other than Group F-1, H-2, H-3, H-5, M and S-1 occupancies, the fire-resistance rating of the building elements in Type IB construction shall be permitted to be reduced to the fire-resistance ratings in Type IIA.

Exception: The required fire-resistance rating of the primary structural frame shall not be permitted to be reduced.

3. The building height and building area limitations of a building containing building elements with reduced fire-resistance ratings shall be permitted to be the same as the building without such reductions.

403.2.1.2 Shaft enclosures. For buildings not greater than 420 feet (128 m) in building height, the required fire-resistance rating of the fire barriers enclosing vertical shafts, other than interior exit stairway and elevator hoistway enclosures, is permitted to be reduced to 1 hour where automatic sprinklers are installed within the shafts at the top and at alternate floor levels.

[BS] 403.2.2 Structural integrity of interior exit stairways and elevator hoistway enclosures. For high-rise buildings of Risk Category III or IV in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 m) in building height, enclosures for interior exit stairways and elevator hoistway enclosures shall comply with Sections 403.2.2.1 through 403.2.2.4.

[BS] 403.2.2.1 Wall assembly materials—soft body impact. The panels making up the enclosures for interior exit stairways and elevator hoistway enclosures

shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M when tested from the exterior side of the enclosure.

[BS] 403.2.2.2 Wall assembly materials—hard body impact. The panels making up the enclosures for interior exit stairways and elevator hoistway enclosures that are not exposed to the interior of the enclosure shall be in accordance with one of the following:

1. The wall assembly shall incorporate not fewer than two layers of impact-resistant panels, each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not fewer than one layer of impact-resistant panels that meet or exceed Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.
3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.2.3 Concrete and masonry walls. Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.2.1 and 403.2.2.2.

[BS] 403.2.2.4 Other wall assemblies. Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.2.1 for Soft Body Impact Classification Level 2 and 403.2.2.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

403.2.3 Sprayed fire-resistant materials (SFRM). The bond strength of the SFRM installed throughout the building shall be in accordance with Table 403.2.3.

**TABLE 403.2.3
MINIMUM BOND STRENGTH**

HEIGHT OF BUILDING ^a	SFRM MINIMUM BOND STRENGTH
Up to 420 feet	430 psf
Greater than 420 feet	1,000 psf

For SI: 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kW/m².

a. Above the lowest level of fire department vehicle access.

[F] 403.3 Automatic sprinkler system. Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 403.3.3. A *sprinkler water-flow alarm-initiating device and a control valve with a supervisory signal-initiating device shall be provided at the lateral connection to the riser for each floor.*

Exception: An automatic sprinkler system shall not be required in spaces or areas of telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equip-

ment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

[F] 403.3.1 Number of sprinkler system risers and system design. Each sprinkler system *servicing a floor* in buildings that are more than 420 feet (128 m) in building height shall be *connected to a minimum of two sprinkler risers or combination standpipe system risers located in separate shafts. Each sprinkler system shall be hydraulically designed so that when one connection is shut down, the other connection shall be capable of supplying the sprinkler system design demand.*

[F] 403.3.1.1 Riser location. Sprinkler risers shall be placed in interior exit stairways and ramps that are remotely located in accordance with Section 1007.1.

[F] 403.3.2 Water supply to required fire pumps. In all buildings *having an occupied floor that is more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access*, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

Exception: Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

403.3.2.1 Fire pumps. *Redundant fire pump systems shall be required for high-rise buildings having an occupied floor more than 200 feet above the lowest level of fire department vehicle access. Each fire pump system shall be capable of automatically supplying the required demand for the automatic sprinkler and standpipe systems.*

[F] 403.3.3 Secondary water supply. An automatic secondary on-site water supply having a *usable capacity of not less than the hydraulically calculated sprinkler demand, including the hose stream requirement*, shall be provided for high-rise buildings *and Group I-2 occupancies having occupied floors located more than 75 ft above the lowest level of fire department vehicle access* assigned to Seismic Design Category C, D, E or F as determined by Section 1613. An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump supplying the automatic sprinkler system. The secondary water supply shall have a duration of not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13. *The Class I standpipe system demand shall not be required to be included in the secondary on-site water*

supply calculations. In no case shall the secondary on-site water supply be less than 15,000 gallons.

[F] 403.3.4 Fire pump room. Fire pumps shall be located in rooms protected in accordance with Section 913.2.1.

403.3.5 Fire pumps. See Section 913.6.

[F] 403.4 Emergency systems. The detection, alarm and emergency systems of high-rise buildings shall comply with Sections 403.4.1 through 403.4.8.

[F] 403.4.1 Smoke detection. Smoke detection shall be provided in accordance with Section 907.2.13.1.

[F] 403.4.2 Fire alarm system. A fire alarm system shall be provided in accordance with Section 907.2.13.

[F] 403.4.3 Standpipe system. A high-rise building shall be equipped with a standpipe system as required by Section 905.3.

[F] 403.4.4 Emergency voice/alarm communication system. An emergency voice/alarm communication system shall be provided in accordance with Section 907.5.2.2.

[F] 403.4.5 Emergency communication coverage. In-building, two-way emergency responder communication coverage shall be provided in accordance with Section 510 of the *California Fire Code*.

[F] 403.4.6 Fire command. A fire command center complying with Section 911 shall be provided in a location approved by the fire code official.

403.4.7 Smoke control system. All portions of high-rise buildings shall be provided with a smoke control system in accordance with Section 909.

[F] 403.4.8 Standby and emergency power. A standby power system complying with Section 2702 and Section 3003 shall be provided for the standby power loads specified in Section 403.4.8.3. An emergency power system complying with Section 2702 shall be provided for the emergency power loads specified in Section 403.4.8.4.

[F] 403.4.8.1 Equipment room. If the standby or emergency power system includes a generator set inside a building, the system shall be located in a separate room enclosed with 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. System supervision with manual start and transfer features shall be provided at the fire command center.

Exception: In Group I-2 manual start and transfer features for the critical branch of the emergency power are not required to be provided at the fire command center.

[F] 403.4.8.2 Fuel line piping protection. Fuel lines supplying a generator set inside a building shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accor-

dance with the manufacturer's installation instructions, and shall have a rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.

2. An assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the required fire-resistance rating shall be reduced to 1 hour.

3. Other approved methods.

[F] 403.4.8.3 Standby power loads. The following are classified as standby power loads:

1. Ventilation and automatic fire detection equipment for smokeproof enclosures.
2. Elevators.
3. Where elevators are provided in a high-rise building for accessible means of egress, fire service access or occupant self-evacuation, the standby power system shall also comply with Sections 1009.4, 3007 or 3008, as applicable.

[F] 403.4.8.4 Emergency power loads. The following are classified as emergency power loads:

1. Exit signs and means of egress illumination required by Chapter 10.
2. Elevator car lighting.
3. Emergency voice/alarm communications systems.
4. Automatic fire detection systems.
5. Fire alarm systems.
6. Electrically powered fire pumps.
7. Power and lighting for the fire command center required by Section 403.4.6.

403.5 Means of egress and evacuation. The means of egress in high-rise buildings shall comply with Sections 403.5.1 through 403.5.5.

403.5.1 Remoteness of interior exit stairways. Required interior exit stairways shall be separated by a distance not less than 30 feet (9144 mm) or not less than one-fourth of the length of the maximum overall diagonal dimension of the building or area to be served, whichever is less. The distance shall be measured in a straight line between the nearest points of the enclosure surrounding the interior exit stairways. In buildings with three or more interior exit stairways, not fewer than two of the interior exit stairways shall comply with this section. Interlocking or scissor stairways shall be counted as one interior exit stairway.

403.5.2 Additional interior exit stairway. For buildings other than Group R-2 and their ancillary spaces that are more than 420 feet (128 m) in building height, one additional interior exit stairway meeting the requirements of Sections 1011 and 1023 shall be provided in addition to

the minimum number of exits required by Section 1006.3. The total capacity of any combination of remaining interior exit stairways with one interior exit stairway removed shall be not less than the total capacity required by Section 1005.1. Scissor stairways shall not be considered the additional interior exit stairway required by this section.

Exceptions:

1. An additional interior exit stairway shall not be required to be installed in buildings having elevators used for occupant self-evacuation in accordance with Section 3008.
2. An additional interior exit stairway shall not be required for other portions of the building where the highest occupiable floor level in those areas is less than 420 feet (128 m) in building height.

403.5.3 Stairway door operation. Stairway doors other than the exit discharge doors shall be permitted to be locked from the stairway side. Stairway doors that are locked from the stairway side shall be capable of being unlocked simultaneously without unlatching upon a signal from the fire command center. *Upon failure of electrical power to the locking mechanism, the door shall unlock.*

403.5.3.1 Stairway communication system. A telephone or other two-way communications system connected to an approved constantly attended station shall be provided at not less than every fifth floor in each stairway where the doors to the stairway are locked.

403.5.4 Smokeproof enclosures. *Every exit enclosure in high-rise buildings shall comply with Sections 909.20 and 1023.11. Every required interior exit stairway in Group I-2 occupancies serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall be a smokeproof enclosure in accordance with Sections 909.20 and 1023.11.*

Exception: *In high-rise buildings, exit enclosures serving three or less adjacent floors where one of the adjacent floors is the level of exit discharge.*

403.5.5 Luminous egress path markings. Luminous egress path markings shall be provided in accordance with Section 1025.

403.6 Elevators. Elevator installation and operation in high-rise buildings shall comply with Chapter 30 and Sections 403.6.1 and 403.6.2.

Enclosed elevator lobbies shall be provided in accordance with Section 3006. Exceptions 2, 3, 4 and 5 of 3006.3 shall only be permitted where approved by the Fire Chief in accordance with Section 1.11.2.1.1 or in accordance with Section 1.11.2.1.2 for all state-owned buildings, state-occupied buildings and state institutions throughout the state.

403.6.1 Fire service access elevator. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, not fewer than two fire service access elevators, or all elevators, whichever is less, shall be provided in accordance with Section 3007. Each fire service access elevator shall have

a capacity of not less than 3,500 pounds (1588 kg) and shall comply with Section 3002.4.

403.6.2 Occupant evacuation elevators. Where installed in accordance with Section 3008, passenger elevators for general public use shall be permitted to be used for occupant self-evacuation.

403.7 Existing high-rise buildings. *For existing high-rise buildings, see California Fire Code Chapter 11 and California Existing Building Code.*

SECTION 404 ATRIUMS

404.1 General. The provisions of Sections 404.1 through 404.11 shall apply to buildings containing atriums. Atriums are not permitted in buildings or structures classified as Group H.

Exception: Vertical openings that comply with Sections 712.1.1 through 712.1.3, and Sections 712.1.9 through 712.1.14.

404.2 Use. The floor of the atrium shall not be used for other than low fire hazard uses and only approved materials and decorations in accordance with the *California Fire Code* shall be used in the atrium space.

Exception: The atrium floor area is permitted to be used for any approved use where the individual space is provided with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] 404.3 Automatic sprinkler protection. An approved automatic sprinkler system shall be installed throughout the entire building.

Exceptions:

1. That area of a building adjacent to or above the atrium need not be sprinklered provided that portion of the building is separated from the atrium portion by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Where the ceiling of the atrium is more than 55 feet (16 764 mm) above the floor, sprinkler protection at the ceiling of the atrium is not required.

[F] 404.4 Fire alarm system. A fire alarm system shall be provided in accordance with Section 907.2.14.

404.5 Smoke control. A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2 and R-2.1 Condition 2, smoke control is not required for atriums that connect only two stories.
2. A smoke control system is not required for atriums connecting more than two stories when all of the following are met:
 - 2.1. Only the two lowest stories shall be permitted to be open to the atrium.

- 2.2. All stories above the lowest two stories shall be separated from the atrium in accordance with the provisions for a shaft in Section 713.4.

404.6 Enclosure of atriums. Atrium spaces shall be separated from adjacent spaces by a 1-hour fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both.

Exceptions:

1. A fire barrier is not required where a glass wall forming a smoke partition is provided. The glass wall shall comply with all of the following:
 - 1.1. Automatic sprinklers are provided along both sides of the separation wall and doors, or on the room side only if there is not a walkway on the atrium side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction;
 - 1.2. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and
 - 1.3. Where glass doors are provided in the glass wall, they shall be either self-closing or automatic-closing.
2. A fire barrier is not required where a glass-block wall assembly complying with Section 2110 and having a $3/4$ -hour fire protection rating is provided.
3. *In other than Group I and R-2.1 occupancies*, a fire barrier is not required between the atrium and the adjoining spaces of up to three floors of the atrium provided that such spaces are accounted for in the design of the smoke control system.
4. *In other than Group I and R-2.1 occupancies*, a fire barrier is not required between the atrium and the adjoining spaces where the atrium is not required to be provided with a smoke control system.
5. A horizontal assembly is not required between the atrium and openings for escalators complying with Section 712.1.3.
6. A horizontal assembly is not required between the atrium and openings for exit access stairways and ramps complying with Item 4 of Section 1019.3.

[F] 404.7 Standby power. Equipment required to provide smoke control shall be provided with standby power in accordance with Section 909.11.

404.8 Interior finish. The interior finish of walls and ceilings of the atrium shall be not less than Class B. Sprinkler protection shall not result in a reduction in class.

404.9 Exit access travel distance. Exit access travel distance for areas open to an atrium shall comply with the requirements of Section 1017.

404.10 Exit stairways in an atrium. Where an atrium contains an interior exit stairway all the following shall be met:

1. The entry to the exit stairway is the edge of the closest riser of the exit stairway.
2. The entry of the exit stairway shall have access from a minimum of two directions.
3. The distance between the entry to an exit stairway in an atrium and the entrance to a minimum of one exit stairway enclosed in accordance with Section 1023.2 shall comply with the separation required by Section 1007.1.1.
4. Exit access travel distance shall be measured to the closest riser of the exit stairway.
5. Not more than 50 percent of the exit stairways shall be located in the same atrium.

404.11 Interior exit stairway discharge. Discharge of interior exit stairways through an atrium shall be in accordance with Section 1028.

404.12 Group I and R-2.1 occupancy means of egress. *Required means of egress from sleeping rooms in Group I and R-2.1 occupancies shall not pass through the atrium.*

SECTION 405 UNDERGROUND BUILDINGS

405.1 General. The provisions of Sections 405.2 through 405.9 apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the finished floor of the lowest level of exit discharge.

Exceptions: The provisions of Section 405 are not applicable to the following buildings or portions of buildings:

1. One- and two-family dwellings, sprinklered in accordance with Section 903.3.1.3.
2. Parking garages provided with automatic sprinkler systems in compliance with Section 405.3.
3. Fixed guideway transit systems.
4. Grandstands, bleachers, stadiums, arenas and similar facilities.
5. Where the lowest story is the only story that would qualify the building as an underground building and has an area not greater than 1,500 square feet (139 m²) and has an occupant load less than 10.
6. Pumping stations and other similar mechanical spaces intended only for limited periodic use by service or maintenance personnel.

405.2 Construction requirements. The underground portion of the building shall be of Type I construction.

[F] 405.3 Automatic sprinkler system. The highest level of exit discharge serving the underground portions of the building and all levels below shall be equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1. Water-flow switches and control valves shall be supervised in accordance with Section 903.4.

405.4 Compartmentation. Compartmentation shall be in accordance with Sections 405.4.1 through 405.4.3.

405.4.1 Number of compartments. A building having a floor level more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge shall be divided into not fewer than two compartments of approximately equal size. Such compartmentation shall extend through the highest level of exit discharge serving the underground portions of the building and all levels below.

Exception: The lowest story need not be compartmented where the area is not greater than 1,500 square feet (139 m²) and has an occupant load of less than 10.

405.4.2 Smoke barrier penetration. The compartments shall be separated from each other by a smoke barrier in accordance with Section 709. Penetrations between the two compartments shall be limited to plumbing and electrical piping and conduit that are firestopped in accordance with Section 714. Doorways shall be protected by fire door assemblies that comply with Section 716, automatic-closing by smoke detection in accordance with Section 716.2.6.6 and installed in accordance with NFPA 105 and Section 716.2.2.1. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

405.4.3 Elevators. Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an enclosed elevator lobby shall be provided and shall be separated from each compartment by a smoke barrier in accordance with Section 709. Doorways in the smoke barrier shall be protected by fire door assemblies that comply with Section 716, shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1 with the UL 1784 test conducted without an artificial bottom seal, and shall be automatic-closing by smoke detection in accordance with Section 716.2.6.6.

405.5 Smoke control system. A smoke control system shall be provided in accordance with Sections 405.5.1 and 405.5.2.

405.5.1 Control system. A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and the provisions of this section. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain means of egress in a usable condition.

405.5.2 Compartment smoke control system. Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual

operation in accordance with Sections 907.2.18 and 907.2.19.

[F] 405.6 Fire alarm systems. A fire alarm system shall be provided where required by Sections 907.2.18 and 907.2.19.

405.7 Means of egress. Means of egress shall be in accordance with Sections 405.7.1 and 405.7.2.

405.7.1 Number of exits. Each floor level shall be provided with not fewer than two exits. Where compartmentation is required by Section 405.4, each compartment shall have not fewer than one exit and not fewer than one exit access doorway into the adjoining compartment.

405.7.2 Smokeproof enclosure. Every required stairway serving floor levels more than 30 feet (9144 mm) below the finished floor of its level of exit discharge shall comply with the requirements for a smokeproof enclosure as provided in Section 1023.12.

[F] 405.8 Standby and emergency power. A standby power system complying with Section 2702 shall be provided for the standby power loads specified in Section 405.8.1. An emergency power system complying with Section 2702 shall be provided for the emergency power loads specified in Section 405.8.2.

[F] 405.8.1 Standby power loads. The following are classified as standby power loads:

1. Smoke control system.
2. Ventilation and automatic fire detection equipment for smokeproof enclosures.
3. Elevators, as required in Section 3003.

[F] 405.8.2 Emergency power loads. The following are classified as emergency power loads:

1. Emergency voice/alarm communications systems.
2. Fire alarm systems.
3. Automatic fire detection systems.
4. Elevator car lighting.
5. Means of egress and exit sign illumination as required by Chapter 10.
6. Fire pumps.

[F] 405.9 Standpipe system. The underground building shall be equipped throughout with a standpipe system in accordance with Section 905.

SECTION 406 MOTOR-VEHICLE-RELATED OCCUPANCIES

406.1 General. All motor-vehicle-related occupancies shall comply with Section 406.2. Private garages and carports shall also comply with Section 406.3. Open public parking garages shall also comply with Sections 406.4 and 406.5. Enclosed public parking garages shall also comply with Sections 406.4 and 406.6. Motor fuel-dispensing facilities shall also comply with Section 406.7. Repair garages shall also comply with Section 406.8.

406.2 Design. Private garages and carports, open and enclosed public parking garages, motor fuel-dispensing facilities and repair garages shall comply with Sections 406.2.1 through 406.2.9.

406.2.1 Automatic garage door openers and vehicular gates. Automatic garage door openers shall be listed and labeled in accordance with UL 325. Where provided, automatic vehicular gates shall comply with Section 3110. *See Health and Safety Code Sections 19890, 19891 and 19892 for additional provisions for residential garage door openers.*

406.2.2 Clear height. The clear height of each floor level in vehicle and pedestrian traffic areas shall be not less than 7 feet (2134 mm). Canopies under which fuels are dispensed shall have a clear height in accordance with Section 406.7.2. *(DSA-AC, HCD 1-AC) The clear height of vehicle and pedestrian areas required to be accessible shall comply with Chapter 11A or 11B, as applicable.*

Exception: A lower clear height is permitted for a parking tier in mechanical-access open parking garages where approved by the building official.

406.2.3 Accessible parking spaces. Where parking is provided, accessible parking spaces, access aisles and vehicular routes serving accessible parking shall be provided in accordance with *Chapter 11A*.

406.2.4 Floor surfaces. Floor surfaces shall be of concrete or similar approved noncombustible and nonabsorbent materials. The area of floor used for the parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. The surface of vehicle fueling pads in motor fuel-dispensing facilities shall be in accordance with Section 406.7.1.

Exceptions:

1. Asphalt parking surfaces shall be permitted at ground level for public parking garages and private carports.
2. Slip-resistant, nonabsorbent, interior floor finishes having a critical radiant flux not more than 0.45 W/cm², as determined by ASTM E648 or NFPA 253, shall be permitted in repair garages.

406.2.5 Sleeping rooms. Openings between a motor vehicle-related occupancy and a room used for sleeping purposes shall not be permitted.

406.2.6 Fuel dispensing. The dispensing of fuel shall only be permitted in motor fuel-dispensing facilities in accordance with Section 406.7.

406.2.7 Electric vehicle charging stations and systems. Where provided, electric vehicle charging systems shall be installed in accordance with *the California Electrical Code and the California Green Building Standards Code*. Electric vehicle charging system equipment shall be listed and labeled in accordance with UL 2202. Electric vehicle supply equipment shall be listed and labeled in accordance with UL 2594. Accessibility to electric vehicle charging

stations shall be provided in accordance with *Chapters 11A and/or 11B*.

406.2.8 Mixed occupancies and uses. Mixed uses shall be allowed in the same building as public parking garages and repair garages in accordance with Section 508.1. Mixed uses in the same building as an open parking garage are subject to Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

406.2.9 Equipment and appliances. Equipment and appliances shall be installed in accordance with Sections 406.2.9.1 through 406.2.9.3 and the *California Mechanical Code, California Plumbing Code and California Electrical Code*.

406.2.9.1 Elevation of ignition sources. Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

406.2.9.1.1 Parking garages. Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 406.2.9.

Exception: This section shall not apply to appliance installations complying with Section 406.2.9.2 or 406.2.9.3.

406.2.9.2 Public garages. Appliances located in public garages, motor fuel-dispensing facilities, repair garages or other areas frequented by motor vehicles shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearances required by the appliance manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 406.2.9.1 and NFPA 30A.

406.2.9.3 Private garages. Appliances located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.

Exception: The requirements of this section shall not apply where the appliances are protected from motor

vehicle impact and are installed in accordance with Section 406.2.9.1.

406.3 Private garages and carports. Private garages and carports shall comply with Sections 406.2 and 406.3, or they shall comply with Sections 406.2 and 406.4.

406.3.1 Classification. Private garages and carports shall be classified as Group U occupancies. Each private garage shall be not greater than 1,000 square feet (93 m²) in area. Multiple private garages are permitted in a building where each private garage is separated from the other private garages by 1-hour fire barriers in accordance with Section 707, or 1-hour horizontal assemblies in accordance with Section 711, or both.

Exception: The area of a private garage accessory to Group R-3 one- or two-family dwellings shall not be greater than 3,000 square feet in area.

406.3.2 Separation. For other than private garages adjacent to dwelling units, the separation of private garages from other occupancies shall comply with Section 508. Separation of private garages from dwelling units shall comply with Sections 406.3.2.1 and 406.3.2.2.

406.3.2.1 Dwelling unit separation. The private garage shall be separated from the dwelling unit and its attic area by means of gypsum board, not less than 1/2 inch (12.7 mm) in thickness, applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than a 5/8-inch (15.9 mm) Type X gypsum board or equivalent and 1/2-inch (12.7 mm) gypsum board applied to structures supporting the separation from habitable rooms above the garage. Door openings between a private garage and the dwelling unit shall be equipped with either solid wood doors or solid or honeycomb core steel doors not less than 1 3/8 inches (34.9 mm) in thickness, or doors in compliance with Section 716.2.2.1 with a fire protection rating of not less than 20 minutes. Doors shall be self-closing and self-latching.

406.3.2.2 Ducts. Ducts in a private garage and ducts penetrating the walls or ceilings separating the dwelling unit from the garage, including its attic area, shall be constructed of sheet steel of not less than 0.019 inch (0.48 mm) in thickness and shall not have openings into the garage.

406.3.3 Carports. Carports shall be open on not fewer than two sides. Carports open on fewer than two sides shall be considered to be a garage and shall comply with the requirements for private garages.

406.3.3.1 Carport separation. A separation is not required between a Group R-3 and U carport, provided that the carport is entirely open on two or more sides and there are not enclosed areas above.

406.4 Public parking garages. Parking garages, other than private garages, shall be classified as public parking garages and shall comply with the provisions of Sections 406.2 and 406.4 and shall be classified as either an open parking garage or an enclosed parking garage. Open parking garages shall also comply with Section 406.5. Enclosed parking garages

shall also comply with Section 406.6. See Section 510 for special provisions for parking garages.

406.4.1 Guards. Guards shall be provided in accordance with Section 1015. Guards serving as vehicle barriers shall comply with Sections 406.4.2 and 1015.

406.4.2 Vehicle barriers. Vehicle barriers not less than 2 feet 9 inches (835 mm) in height shall be placed where the vertical distance from the floor of a drive lane or parking space to the ground or surface directly below is greater than 1 foot (305 mm). Vehicle barriers shall comply with the loading requirements of Section 1607.10.

Exception: Vehicle barriers are not required in vehicle storage compartments in a mechanical access parking garage.

406.4.3 Ramps. Vehicle ramps shall not be considered as required exits unless pedestrian facilities are provided. Vehicle ramps that are utilized for vertical circulation as well as for parking shall not exceed a slope of 1 unit vertical in 15 units horizontal (6.67-percent slope).

406.5 Open parking garages. Open parking garages shall comply with Sections 406.2, 406.4 and 406.5.

406.5.1 Construction. Open parking garages shall be of Type I, II or IV construction. Open parking garages shall meet the design requirements of Chapter 16. For vehicle barriers, see Section 406.4.2.

406.5.2 Openings. For natural ventilation purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in exterior walls on a tier shall be not less than 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural ventilation shall be not less than 40 percent of the perimeter of the tier. Interior walls shall be not less than 20 percent open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

406.5.2.1 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space shall be one and one-half times the depth of the opening. The width of the horizontal clear space shall be maintained from grade down to the bottom of the lowest required opening.

406.5.3 Mixed occupancies and uses. Mixed uses shall be allowed in the same building as an open parking garage subject to the provisions of Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

406.5.4 Area and height. Area and height of open parking garages shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.1.

406.5.4.1 Single use. Where the open parking garage is used exclusively for the parking or storage of private motor vehicles, and the building is without other uses, the area and height shall be permitted to comply with

Table 406.5.4, along with increases allowed by Section 406.5.5.

Exception: The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m²). Such area need not be separated from the open parking garage.

In open parking garages having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an open parking garage having a continuous spiral floor, each 9 feet 6 inches (2896 mm) of height, or portion thereof, shall be considered under these provisions to be a tier.

406.5.5 Area and height increases. The allowable area and height of open parking garages shall be increased in accordance with the provisions of this section. Garages with sides open on three-fourths of the building’s perimeter are permitted to be increased by 25 percent in area and one tier in height. Garages with sides open around the entire building’s perimeter are permitted to be increased by 50 percent in area and one tier in height. For a side to be considered open under these provisions, the total area of openings along the side shall be not less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm).

Allowable tier areas in Table 406.5.4 shall be increased for open parking garages constructed to heights less than the table maximum. The gross tier area of the garage shall not exceed that permitted for the higher structure. Not fewer than three sides of each such larger tier shall have continuous horizontal openings not less than 30 inches (762 mm) in clear height extending for not less than 80 percent of the length of the sides. All parts of such larger tier shall be not more than 200 feet (60 960 mm) horizontally from such an opening. In addition, each such opening shall face a street or yard with access to a street with a width of not less than 30 feet (9144 mm) for the full length of the opening, and standpipes shall be provided in each such tier.

Open parking garages of Type II construction, with all sides open, shall be unlimited in allowable area where the

building height does not exceed 75 feet (22 860 mm). For a side to be considered open, the total area of openings along the side shall be not less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm). All portions of tiers shall be within 200 feet (60 960 mm) horizontally from such openings or other natural ventilation openings as defined in Section 406.5.2. These openings shall be permitted to be provided in courts with a minimum dimension of 20 feet (6096 mm) for the full width of the openings.

406.5.6 Fire separation distance. Exterior walls and openings in exterior walls shall comply with Table 601 and Table 705.5. The distance to an adjacent lot line shall be determined in accordance with Section 705 and Table 705.5.

406.5.7 Means of egress. Where persons other than parking attendants are permitted, open parking garages shall meet the means of egress requirements of Chapter 10. Where persons other than parking attendants are not permitted, there shall be not fewer than two exit stairways. Each exit stairway shall be not less than 36 inches (914 mm) in width. Lifts shall be permitted to be installed for use of employees only, provided that they are completely enclosed by noncombustible materials.

[F] 406.5.8 Standpipe system. An open parking garage shall be equipped with a standpipe system as required by Section 905.3.

406.5.9 Enclosure of vertical openings. Enclosure shall not be required for vertical openings except as specified in Section 406.5.7.

406.5.10 Ventilation. Ventilation, other than the percentage of openings specified in Section 406.5.2, shall not be required.

406.5.11 Prohibitions. The following uses and alterations are not permitted:

1. Vehicle repair work.
2. Parking of buses, trucks and similar vehicles.
3. Partial or complete closing of required openings in exterior walls by tarpaulins or any other means.
4. Dispensing of fuel.

**TABLE 406.5.4
OPEN PARKING GARAGES AREA AND HEIGHT**

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m².

406.6 Enclosed parking garages. Enclosed parking garages shall comply with Sections 406.2, 406.4 and 406.6.

406.6.1 Heights and areas. Enclosed vehicle parking garages and portions thereof that do not meet the definition of open parking garages shall be limited to the allowable heights and areas specified in Sections 504 and 506 as modified by Section 507. Roof parking is permitted.

406.6.2 Ventilation. A mechanical ventilation system and exhaust system shall be provided in accordance with Chapters 4 and 5 of the *California Mechanical Code*.

Exception: Mechanical ventilation shall not be required for enclosed parking garages that are accessory to one- and two-family dwellings.

[F] 406.6.3 Automatic sprinkler system. An enclosed parking garage shall be equipped with an automatic sprinkler system in accordance with Section 903.2.10.

406.6.4 Mechanical-access enclosed parking garages. Mechanical-access enclosed parking garages shall be in accordance with Sections 406.6.4.1 through 406.6.4.4.

406.6.4.1 Separation. Mechanical-access enclosed parking garages shall be separated from other occupancies and accessory uses by not less than 2-hour fire barriers constructed in accordance with Section 707 or by not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both. Refer to Table 508.4 for additional requirements.

406.6.4.2 Smoke removal. A mechanical smoke removal system, installed in accordance with Section 910.4, shall be provided for all areas containing a mechanical-access enclosed parking garage.

406.6.4.3 Fire control equipment room. Fire control equipment, consisting of the fire alarm control unit, mechanical ventilation controls and an emergency shutdown switch, shall be provided in a room located where the equipment is able to be accessed by the fire service from a secured exterior door of the building. The room shall be not less than 50 square feet (4.65 m²) in area and shall be in a location that is approved by the fire code official.

Exception: A fire control room shall not be required where there is a fire command center provided in compliance with Section 911 of this code.

406.6.4.3.1 Emergency shutdown switch. The mechanical parking system shall be provided with a manually activated emergency shutdown switch for use by emergency personnel. The switch shall be clearly identified and shall be in a location approved by the fire code official.

406.6.4.4 Fire department access doors. Access doors shall be provided in accordance with Section 3206.7 of the *California Fire Code*.

406.7 Motor fuel-dispensing facilities. Motor fuel-dispensing facilities shall comply with the *California Fire Code* and Sections 406.2 and 406.7.

406.7.1 Vehicle fueling pad. The vehicle shall be fueled on noncoated concrete or other approved paving material having a resistance not exceeding 1 megohm as determined by the methodology in CEN EN 1081.

406.7.2 Canopies. Canopies under which fuels are dispensed shall have a clear, unobstructed height of not less than 13 feet 6 inches (4115 mm) to the lowest projecting element in the vehicle drive-through area. Canopies and their supports over pumps shall be of noncombustible materials, fire-retardant-treated wood complying with Chapter 23, heavy timber complying with Section 2304.11 or construction providing 1-hour fire resistance. Combustible materials used in or on a canopy shall comply with one of the following:

1. Shielded from the pumps by a noncombustible element of the canopy, or heavy timber complying with Section 2304.11.
2. Plastics covered by aluminum facing having a thickness of not less than 0.010 inch (0.30 mm) or corrosion-resistant steel having a base metal thickness of not less than 0.016 inch (0.41 mm). The plastic shall have a flame spread index of 25 or less and a smoke-developed index of 450 or less when tested in the form intended for use in accordance with ASTM E84 or UL 723 and a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D1929.
3. Panels constructed of light-transmitting plastic materials shall be permitted to be installed in canopies erected over motor vehicle fuel-dispensing station fuel dispensers, provided that the panels are located not less than 10 feet (3048 mm) from any building on the same lot and face yards or streets not less than 40 feet (12 192 mm) in width on the other sides. The aggregate areas of plastics shall be not greater than 1,000 square feet (93 m²). The maximum area of any individual panel shall be not greater than 100 square feet (9.3 m²).

406.7.2.1 Canopies used to support gaseous hydrogen systems. Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the canopy shall be in accordance with the following:

1. The canopy shall meet or exceed Type I construction requirements.
2. Operations located under canopies shall be limited to refueling only.
3. The canopy shall be constructed in a manner that prevents the accumulation of hydrogen gas.

406.8 Repair garages. Repair garages shall be constructed in accordance with the *California Fire Code* and Sections 406.2 and 406.8. This occupancy shall not include motor fuel-dispensing facilities, as regulated in Section 406.7.

406.8.1 Ventilation. Repair garages shall be mechanically ventilated in accordance with the *California Mechanical Code*. The ventilation system shall be controlled at the entrance to the garage.

[F] 406.8.2 Gas detection system. Repair garages used for repair of vehicles fueled by nonodorized gases including but not limited to hydrogen and nonodorized LNG, shall be provided with a gas detection system that complies with Section 916. The gas detection system shall be designed to detect leakage of nonodorized gaseous fuel. Where lubrication or chassis service pits are provided in garages used for repairing nonodorized LNG-fueled vehicles, gas sensors shall be provided in such pits.

[F] 406.8.2.1 System activation. Activation of a gas detection alarm shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the repair garage, where the ventilation system is interlocked with gas detection.
2. Deactivation of all heating systems located in the repair garage.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.

[F] 406.8.2.2 Failure of the gas detection system. Failure of the gas detection system shall automatically deactivate the heating system, activate the mechanical ventilation system where the system is interlocked with the gas detection system, and cause a trouble signal to sound at an approved location.

[F] 406.8.3 Automatic sprinkler system. A repair garage shall be equipped with an automatic sprinkler system in accordance with Section 903.2.9.1.

406.9 Electric vehicle. [SFM]

406.9.1 Charging. *In any building or interior area used for charging electric vehicles, electrical equipment shall be installed in accordance with the California Electrical Code.*

406.9.2 Ventilation. *Mechanical exhaust ventilation, when required by the California Electrical Code shall be provided at a rate as required by Article 625 or as required by Section 1203 of the California Building Code whichever is greater. The ventilation system shall include both the supply and exhaust equipment and shall be permanently installed and located to intake supply air from the outdoors, and vent the exhaust directly to, the outdoors without conducting the exhaust air through other spaces within the building.*

Exception: *Positive pressure ventilation systems shall only be allowed in buildings or areas that have been designed and approved for that application.*

406.9.3 Electrical interface. *The electrical supply circuit to electrically powered mechanical ventilation equipment shall be interlocked with the recharging equipment used to supply the vehicle(s) being charged, and shall remain energized during the entire charging cycle. Electric vehicle recharging equipment shall be marked or labeled in accordance with the California Electrical Code.*

Exceptions:

1. *Exhaust ventilation shall not be required in areas with an approved engineered ventilation system,*

which maintains a hydrogen gas concentration at less than 25 percent of the lower flammability limit.

2. *Mechanical exhaust ventilation for hydrogen shall not be required where the charging equipment utilized is installed and listed for indoor charging of electric vehicles without ventilation.*

SECTION 407 GROUP I-2 AND GROUP I-2.1

407.1 General. Occupancies in Group I-2 and I-2.1 shall comply with the provisions of Sections 407.1 through 407.13 and other applicable provisions of this code.

407.1.1 Construction. *Group I-2 occupancies wherein mental health patients are restrained shall be housed in buildings of Type IA or Type IB construction.*

Exception: *Occupancies in Group I-2 wherein mental health patients are restrained are permitted to be housed in one-story buildings of Type IIA, Type IIIA or Type VA construction provided the floor area does not exceed 5,200 square feet (483 m²) between fire walls of two-hour fire-resistive construction with openings protected by fire assemblies having a 1½-hour fire protection rating.*

407.2 Corridors continuity and separation. Corridors in occupancies in Group I-2 and I-2.1 shall be continuous to the exits and shall be separated from other areas in accordance with Section 407.3 except spaces conforming to Sections 407.2.1 through 407.2.5.

407.2.1 Waiting and similar areas. Waiting areas and similar public-use areas or group meeting spaces constructed as required for corridors shall be permitted to be open to a corridor, only where all of the following criteria are met:

1. The spaces are not occupied as care recipient's sleeping rooms, treatment rooms, incidental uses listed in Table 509, in accordance with Section 509, or hazardous uses.
2. The open space is protected by an automatic smoke detection system installed in accordance with Section 907.
3. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic smoke detection system installed in accordance with Section 907, and the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
4. The space is arranged so as not to obstruct access to the required exits.
5. *Each space is located to permit direct visual supervision by the facility staff.*

407.2.2 Nurse stations. Spaces for care providers', supervisory staff, doctors' and nurses' charting, communications and related clerical areas shall be permit-

ted to be open to, or located within the corridor, provided the required construction along the perimeter of the corridor is maintained. Construction of nurse stations or portions of nurse stations, within the envelope of the corridor is not required to be fire-resistive rated. Nurse stations in new and existing facilities see the California Code of Regulations, Title 19, Division 1, Chapter 1, Subchapter 1, Article 3, Section 3.11(d) for storage and equipment requirements.

In detention or secure mental health facilities, the provisions above applies to enclosed nurse stations within the corridor.

407.2.3 Psychiatric treatment areas. Areas wherein psychiatric care recipients who are incapable of self-preservation are housed, or group meeting or multipurpose therapeutic spaces other than incidental uses in accordance with Section 509, under continuous supervision by facility staff, shall be permitted to be open to the corridor, where the following criteria are met:

1. Each area does not exceed 1,500 square feet (140 m²).
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required exits.
4. The area is equipped with an automatic *smoke* detection system installed in accordance with Section 907.2.
5. Not more than one such space is permitted in any one smoke compartment.
6. The walls and ceilings of the space are constructed as required for corridors.

407.2.4 Gift shops. Gift shops and associated storage that are less than 500 square feet (455 m²) in area shall be permitted to be open to the corridor where such spaces are constructed as required for corridors.

407.2.5 Nursing home housing units. In Group I-2, Condition 1 occupancies, in areas where nursing home residents are housed, shared living spaces, group meeting or multipurpose therapeutic spaces shall be permitted to be open to the corridor, where all of the following criteria are met:

1. The walls and ceilings of the space are constructed as required for corridors.
2. The spaces are not occupied as resident sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
3. The open space is protected by an automatic *smoke* detection system installed in accordance with Section 907.
4. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic *smoke* detection system installed in accordance with Section 907, and the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.

5. The space is arranged so as not to obstruct access to the required exits.
6. Each space is located to permit direct visual supervision by the facility staff.

407.2.6 Nursing home cooking facilities. In Group I-2, Condition 1 occupancies, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted in fully sprinklered buildings where all of the following criteria are met:

1. The number of care recipients housed in the smoke compartment shall not be greater than 30.
2. The number of care recipients served by the cooking facility shall not be greater than 30.
3. Only one cooking facility area shall be permitted in a smoke compartment.
4. The space containing the domestic cooking facility shall be arranged so as not to obstruct access to the required exit.
5. The cooking appliance shall comply with Section 407.2.7.

407.2.7 Domestic cooking appliances. In Group I-2 occupancies, installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with the *California Mechanical Code* shall be provided over cooktops and ranges.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. A shut-off for the fuel and electrical power supply to the cooking equipment shall be provided in a location to which only staff has access.
5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906, and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

Exceptions:

1. Cooktops and ranges located within smoke compartments with no patient sleeping or patient care areas are not required to comply with *Items 3, 4 and 5* of this section.
2. Cooktops and ranges used for care recipient training or nutritional counseling are not required to comply with Item 3 of this section.

407.3 Corridor wall construction. Corridor walls shall be constructed as *fire* partitions in accordance with Section 708.

407.3.1 Corridor doors. *In fully sprinklered buildings, corridor doors, other than those in a wall required to be rated by Section 509.4 or for the enclosure of a vertical opening or an exit, shall not have a required fire protection rating and shall not be required to be equipped with self-closing or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. In Group I-2 Occupancies, self-closing or automatic-closing devices are not required on corridor doors to patient sleeping rooms, treatment rooms and offices located in areas specified in Sections 1224 and 1225, excluding offices specified in Sections 1224.21 and 1225.8. Roller latches are not permitted. Other doors shall conform to Section 716.*

407.3.1.1 Door construction. *Corridor doors not required to have a fire protection rating shall comply with the following:*

1. Solid doors shall have close-fitting operational tolerances, head and jamb stops.
2. Dutch-style doors shall have an astragal, rabbet or bevel at the meeting edges of the upper and lower door sections. Both the upper and lower door sections shall have latching hardware. Dutch-style doors shall have hardware that connects the upper and lower sections to function as a single leaf.

407.3.1.2 Swing of corridor doors. *Corridor doors, other than those equipped with self-closing or automatic-closing devices shall not swing into the required width of corridors.*

Exception: *In detention and/or secure mental health facilities, doors may swing into required width of corridors as long as 44 inches clear is maintained with any one door open 90 degrees and clear corridor widths required in Chapter 12 can be maintained with doors open 180 degrees.*

407.3.2 Glazing. *In fully sprinklered buildings, fixed fully tempered or laminated glass in wood or metal frames may be used in corridor walls, provided the glazed area does not exceed 25 percent of the areas of the corridor wall of the room. The total area of glass in corridor walls is not limited when the glazing is fixed 1/3-hour fire-protection-rated glazing in approved frames and the size of individual glazed panel does not exceed 1,296 square inches (0.836 m²).*

407.4 Means of egress. Group I-2 and I-2.1 occupancies shall be provided with means of egress complying with Chapter 10 and Sections 407.4.1 through 407.4.4. The fire safety and evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support a defend-in-place emergency response in accordance with Sections 403 and 404 of the *California Fire Code*.

407.4.1 Direct access to a corridor. Habitable rooms in Group I-2 and I-2.1 occupancies shall have an exit access door leading directly to a corridor.

Exceptions:

1. Rooms with exit doors opening directly to the outside at ground level.

2. Rooms arranged as care suites complying with Section 407.4.4.

407.4.1.1 Locking devices. Locking devices that restrict access to a care recipient's room from the corridor and that are operable only by staff from the corridor side shall not restrict the means of egress from the care recipient's room.

Exceptions:

1. This section shall not apply to rooms in psychiatric treatment and similar care areas.
2. Locking arrangements in accordance with Section 1010.2.14.

407.4.1.2 Basement exits. *All rooms below grade shall have not less than one exit access that leads directly to an exterior exit door opening directly to an exit discharge at grade plane or the public way.*

407.4.2 Distance of travel. The distance of travel between any point in a Group I-2 and I-2.1 occupancy sleeping room, not located in a care suite, and an exit access door in that room shall be not greater than 50 feet (15 240 mm).

407.4.2.1 Two means of egress. *Any sleeping room of more than 1,000 square feet (93 m²) shall have no fewer than two exit access doors from the sleeping room located in accordance with Section 1007.1. Any room, other than sleeping rooms, with an area of more than 2,500 square feet (232 m²) shall have no fewer than two exit access doors from the room located in accordance with Section 1007.1.*

407.4.3 Reserved.

407.4.4 Group I-2 and I-2.1 care suites. Care suites in Group I-2 and I-2.1 shall comply with Sections 407.4.4.1 through 407.4.4.4 and either Section 407.4.4.5 or 407.4.4.6.

407.4.4.1 Exit access through care suites. Exit access from all other portions of a building not classified as a care suite shall not pass through a care suite.

407.4.4.2 Separation. Care suites shall be separated from other portions of the building, including other care suites, not less than a one-hour fire barrier complying with Section 707. Each suite of rooms shall be separated from the remainder of the building by not less than a one-hour fire barrier.

407.4.4.3 Access to corridor. *Movement from habitable rooms shall be in accordance with Sections 407.4.4.3.1, 407.4.4.3.2 and 407.4.4.5.3.*

407.4.4.3.1 One intervening room. *Movement from habitable rooms shall not require passage through more than one intervening room and 100 feet (30 480 mm) distance of travel within the care suite.*

407.4.4.3.2 Two intervening rooms. *Movement from habitable rooms other than sleeping rooms located within a care suite, shall not require passage through more than two intervening rooms and 50 feet (15 240 mm) distance of exit access travel within the care suite.*

Exception: *The distance of travel shall be permitted to be increased to 100 feet (38 100 mm)*

where an automatic fire sprinkler system is provided throughout the Group I-2 fire area and an automatic smoke detection system is provided throughout the care suite and installed in accordance with NFPA 72.

407.4.4.4 Doors within care suites. Doors in care suites serving habitable rooms shall be permitted to comply with one of the following:

1. Manually operated horizontal sliding doors permitted in accordance with Exception 9 to Section 1010.1.2.
2. Power-operated doors permitted in accordance with Section 1010.1.2, Exception 7.
3. Means of egress doors complying with Section 1010.

407.4.4.5 Care suites containing sleeping room areas. Sleeping rooms shall be permitted to be grouped into care suites where one of the following criteria is met:

1. The arrangement of the care suite allows for direct and constant visual supervision into the sleeping rooms by care providers.
2. In fully sprinklered buildings, an automatic smoke detection system is provided in the sleeping rooms and installed in accordance with Section 907.2.6.2.2, Item 1 and NFPA 72.

407.4.4.5.1 Area. Care suites containing sleeping rooms shall be not greater than 5,000 square feet (465 m²) in area.

Exceptions:

1. Care suites containing sleeping rooms shall be permitted to be not greater than 7,500 square feet (696 m²) in area where an automatic fire sprinkler system is provided throughout the Group I-2 fire area.
2. Care suites containing sleeping rooms shall be permitted to be not greater than 10,000 square feet (929 m²) in area where an automatic fire sprinkler system is provided throughout the Group I-2 fire area and where an automatic smoke detection system is provided throughout the care suite and installed in accordance with Section 907.

407.4.4.5.2 Exit access. Any sleeping room, or any care suite that contains sleeping rooms, of more than 1,000 square feet (93 m²) shall have not fewer than two exit access doors from the care suite located in accordance with Section 1007.

407.4.4.5.3 Travel distance. The travel distance between any point in a care suite containing sleeping rooms and an exit access door from that care suite shall be not greater than 100 feet (30 480 mm).

407.4.4.6 Care suites not containing sleeping rooms. Areas not containing sleeping rooms, but only treatment areas and the associated rooms, spaces or

circulation space, shall be permitted to be grouped into care suites and shall conform to the limitations in Sections 407.4.4.6.1 and 407.4.4.6.2.

407.4.4.6.1 Area. Care suites of rooms, other than sleeping rooms, shall have an area not greater than 10,000 square feet (929 m²).

407.4.4.6.2 Exit access. Any room or care suite, other than sleeping rooms, with an area of more than 2,500 square feet (232 m²) shall have not fewer than two exit access doors from the room or care suite located in accordance with Section 1007.

407.4.5 Group I-2 and I-2.1 nonpatient-care suites. The means of egress provisions for nonpatient-care suites shall be in accordance with the primary use and occupancy of the suite.

407.4.5.1 Separation. Nonpatient-care suites shall be separated from other portions of the building, including other suites, by not less than a 1-hour fire barrier complying with Section 707. Each suite of rooms shall be separated from the remainder of the building by not less than a 1-hour fire barrier.

407.4.5.2 Area. Nonpatient-care suites of rooms shall have an area not greater than 10,000 square feet (929 m²).

407.4.5.3 Automatic sprinkler system protection. Nonpatient-care suites shall be located in fully sprinklered buildings.

407.5 Smoke barriers. Smoke barriers shall be provided to subdivide every story used by persons receiving care, treatment or sleeping into not fewer than two smoke compartments. Smoke barriers shall be provided to subdivide other stories with an occupant load of 50 or more persons, regardless of occupancy or use, into not fewer than two smoke compartments. The smoke barrier shall be in accordance with Section 709.

Exceptions:

1. This requirement shall not apply to Group I-2.1 less than 10,000 ft² (929 m²).
2. An area in an adjoining occupancy shall be permitted to serve as a smoke compartment for a Group I-2.1 facility if the following criteria are met:
 - 2.1. The separating wall and both compartments meet the requirements of 407.5.
 - 2.2. The Group I-2.1 is less than 22,500 ft² (2100 m²).
 - 2.3. Access from the Group I-2.1 to the other occupancy is unrestricted.
3. This requirement shall not apply to the following:
 - 3.1. Any story, not containing a Group I-2 or I-2.1 occupancy, that is located above a story containing a Group I-2 or I-2.1 occupancy.
 - 3.2. Areas that do not contain a Group I-2 or I-2.1 occupancy, where such areas are separated from the Group I-2 or I-2.1 occupancy

by a horizontal exit in accordance with Section 1026.2.

- 3.3. Any story, not containing a Group I-2 or I-2.1 occupancy, that is located more than one story below a story containing a Group I-2 or I-2.1 occupancy.
- 3.4. Any story housing only mechanical equipment where such story is located below a story containing a Group I-2 or I-2.1 occupancy and is separated from the story above by a horizontal assembly having not less than a 2 hour fire resistance-rating.

407.5.1 Smoke compartment size. Stories shall be divided into smoke compartments with an area of not more than 22,500 square feet (2092 m²) in Group I-2 occupancies.

407.5.2 Exit access travel distance. The distance of travel from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet (60 960 mm).

407.5.3 Refuge area. Refuge areas shall be provided within each smoke compartment. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining smoke compartment. Where a smoke compartment is adjoined by two or more smoke compartments, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 30 net square feet (2.8 m²) for each care recipient confined to bed or stretcher.
2. Not less than 6 square feet (0.56 m²) for each ambulatory care recipient not confined to bed or stretcher and for other occupants.

Areas or spaces permitted to be included in the calculation of refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

407.5.4 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated. Smoke compartments that do not contain an exit shall be provided with direct access to not less than two adjacent smoke compartments.

407.5.5 Horizontal assemblies. Horizontal assemblies supporting smoke barriers required by this section shall be designed to resist the movement of smoke. Elevator lobbies shall be in accordance with Section 3006.2.

407.6 Automatic-closing doors. Automatic-closing doors with hold-open devices shall comply with Sections 709.5 and 716.2.

407.6.1 Activation of automatic-closing doors. Automatic-closing doors on hold-open devices in accordance with Section 716.2.6.6 shall also close upon activation of a fire alarm system, an automatic sprinkler system, or both. The automatic release of the hold-open device on one door

shall release all such doors within the same smoke compartment.

[F] 407.7 Automatic sprinkler system. Every facility as specified herein wherein more than six clients or patients are housed or cared for on the premises on a 24-hour per-day-basis shall have installed and maintained in an operable condition in every building or portion thereof where clients or patients are housed, an automatic sprinkler system of a type approved by the state fire marshal. The provisions of this subsection shall apply to every person, firm or corporation establishing, maintaining or operating a hospital, children's home, children's nursery or institution, or a home or institution for the care of aged or persons with dementia or other cognitive impairments, or any institution for persons with mental illness or persons with developmental disabilities and any nursing or convalescent home, and to any state-owned or state-occupied building used for any of the types of facilities specified herein.

Exceptions:

1. This section shall not apply to homes or institutions for the 24-hour-per-day care of ambulatory children if all of the following conditions are satisfied:

1.1. The buildings or portions thereof in which children are housed are not more than two stories in height and are constructed and maintained in accordance with regulations adopted by the state fire marshal.

1.2. The buildings or portions thereof housing more than six such children shall have installed and maintained in an operable condition therein, a fire alarm system of a type approved by the state fire marshal. Such system shall be activated by detectors responding to invisible particles of combustion other than heat, except that detectors used in closets, usable under-floor areas, storage rooms, bathrooms, attached garages, attics, plenums, laundry rooms and rooms of similar use, may be heat-responsive devices.

1.3. The building or portions thereof do not house persons with mental illness or children with developmental disabilities.

2. This section shall not apply to any one-story building or structure of an institution or home for the care of the aged providing 24-hour-per-day care if such building or structure is used or intended to be used for the housing of no more than six ambulatory aged persons. Such buildings or institutions shall have installed and maintained in an operable condition herein a fire alarm system of a type approved by the state fire marshal. Such system shall be activated by detectors responding to either visible or invisible particles of combustion other than heat, except that detectors used in closets, usable under-floor areas, storage rooms, bathrooms, attached garages, attics, plenums, laundry rooms and rooms of similar use, may be heat-responsive devices.

3. This section shall not apply to occupancies or any alterations thereto conforming to the construction provisions of this exception which were under construction or in existence on March 4, 1972. "Under construction" as used in this exception shall mean that actual work had been performed on the construction site and shall not be construed to mean that the hospital, home, nursery, institution, sanitarium or any portion thereof, was or is in the planning stage. The provisions of this exception shall apply to those buildings or structures having bearing walls and structural flame protected in accordance with the provisions of Column Type 1A of Table 601.

4. In detention facilities where inmates are not restrained.

The provisions of this section shall not apply to any facility used to house six or less persons on the premises.

407.7.1 When a new addition is to be made to an unsprinklered building or structure as permitted by this subsection, such new addition shall be sprinklered as required by this section and shall be separated from the existing building or structures by not less than a two-hour fire-resistive fire barrier.

When a sprinkler system is added to an existing unsprinklered building or structure, the sprinklered area(s) shall be separated from the remainder of the building by not less than a one-hour fire-resistive fire barrier. The provisions of this section do not apply to any facility used to house six or less persons on the premises.

[F] 407.8 Fire alarm system. A fire alarm system shall be provided in accordance with Section 907.2.6.

[F] 407.9 Automatic smoke detection. Automatic smoke detection shall be provided in accordance with Section 907.2.6.2.2.

407.10 Secured yards. Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m²) for bed and stretcher care recipients and 6 net square feet (0.56 m²) for ambulatory care recipients and other occupants are located between the building and the fence. Such provided safe dispersal areas shall be located not less than 50 feet (15 240 mm) from the building they serve. Each safe dispersal area shall have a minimum of two exits. The aggregate clear width of exits from a safe dispersal area shall be determined on the basis of not less than one exit unit of 22 inches (559 mm) for each 500 persons to be accommodated, and no exit shall be less than 44 inches (1118 mm) in width. Gates shall not be installed across corridors or passageways leading to such dispersal areas unless they comply with egress requirements. Keys to gate locks shall be provided in accordance with the California Fire Code.

[F] 407.11 Electrical systems. In Group I-2 or I-2.1 occupancies, electrical construction and installation shall be in accordance with the provisions of Chapter 27 and Article 517 of the California Electrical Code.

407.12 Technology equipment center. A technology equipment center serving a Group I-2 occupancy shall be separated from other portions of the building by not less than a 1-hour fire barrier constructed in accordance with Section

707 and a 1-hour horizontal assembly constructed in accordance with Section 711 or both.

407.13 Special Hazards.

407.13.1 Storage and handling of flammable, combustible liquids and hazardous materials shall be in accordance with the California Fire Code.

407.13.2 All exterior openings in a boiler room or room containing central heating equipment, if located below openings in another story, or if less than 10 feet (3048 mm) from other doors or windows of the same building, shall be protected by a fire assembly having a three-fourths-hour fire protection rating.

407.13.3 Safety padding. See Sections 308.1 and 408.14.

407.13.4 Floor surfaces. Rooms occupied by patients whose personal liberties are restrained shall have noncombustible floor surfaces see Sections 308.1 and 804.4.3.

**SECTION 408
GROUP I-3**

408.1 General. Occupancies in Group I-3 shall comply with the provisions of Sections 408.1 through 408.11 and other applicable provisions of this code (see Section 308.5).

408.1.2 Construction. Group I-3 Occupancies shall be housed in buildings of Type IA or Type IB.

Exception: Such occupancies may be housed in one-story buildings of Type IIA, Type IIIA or Type VA construction provided the floor area does not exceed 5,200 square feet (483 m²) between fire walls of two-hour fire-resistive construction with openings protected by fire assemblies having 1- and 1½-hour fire-protection rating.

408.1.2.1 Nonbearing walls and partitions interior. Nonbearing cell or dormitory walls within cell complexes shall be of noncombustible construction.

408.1.2.2 Intervening spaces. Common rooms and spaces within Group I-3 occupancies of Type I construction shall be considered an intervening space in accordance with Section 1016.2 when the area is contained within housing units or suites, and not considered a corridor, when they meet any of the following:

1. Within prisons and local detention facilities of Type I construction, the exit access within a housing unit may be non-rated provided the required exit occupant load from any dayroom does not exceed 64 persons.
2. Within prison, jails and courthouses: Circulation within any temporary holding suite of Type I construction and an occupant load less than 100.
3. Within prisons and local detention facilities, correctional medical or mental health housing suites, of Type I construction and an occupant load less than 100.
4. Within prisons and local detention facilities of Type I construction, detention program housing units or suites having an occupant load less than 100.

408.1.2.3 Courthouse holding facilities. Group I-3 courthouse holding facilities shall be considered a separate and distinct building from the remaining courthouse building for the purpose of determining the type of construction where all of the following conditions are met:

1. 2-hour fire barriers in accordance with Section 707 and 2-hour horizontal assemblies in accordance with Section 711 are provided to separate the courthouse holding facility from all other portions of the courthouse building.
2. Any of the structure used to support courthouse holding facilities meets the requirements for the Group I-3 portion of the building.
3. Each courthouse holding facility located above the first story is less than 1,000 square feet in area, and is designed to hold 10 or less in-custody defendants.
4. Courthouse holding facilities located above the first story containing an internal stairway discharging to the main courthouse holding facility at the first story or basement.
5. Additional exits from the courthouse holding facility located above the first story shall be permitted to exit through the courtrooms.
6. The main courthouse holding facility located on the first story or basement has at least one exit directly to the exterior and additional means of egress shall be permitted to pass through a 1-hour corridor or lobby in the courthouse building.

408.1.2.4 Horizontal building separation for combined Group I-3/Group B occupancy. A Group B Administration building one story in height shall be permitted to be located above a Group I-3 (or Group I-3/I-2) housing/treatment building that is one story above grade and shall be classified as a separate and distinct building for the purpose of determining the type of construction, and shall be considered a separate fire area, where all of the following conditions are met:

1. A 3-hour floor-ceiling assembly below the administration building is constructed as a horizontal assembly in accordance with Section 711.
2. Interior shafts for stairs, elevators and mechanical systems complete the 3-hour separation between the Group B and Group I-3 (or Group I-3/I-2).
3. The Group I-3 occupancy (or Group I-3/I-2 occupancies, correctional medical and mental health uses) below is minimum Type I-B construction with 2-hour fire resistive rated exterior walls.
4. No unprotected openings are allowed in lower roofs within 10 feet of unprotected windows in the upper floor.
5. The Group B building above is of noncombustible construction and equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

6. The Group B occupancy building above has all required means of egress capable of discharging directly to the exterior to a safe dispersal area.

408.1.2.5 Temporary holding area. In buildings protected with automatic sprinklers, corridor serving temporary holding rooms shall be one hour fire resistance rated when the temporary holding occupant load is greater than 20.

408.1.2.6 Temporary holding facilities. Temporary holding facilities with nine or fewer persons under restraint may be classified as Group B when located in a buildings complying with all of the following conditions:

1. The building shall be protected throughout with a monitored automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. The building shall protected with a automatic fire alarm system with notification appliances throughout the holding facility in accordance with Section 907.2.
3. The building shall be constructed of Type I, IIA, IIIA or VA construction.

408.1.2.7 Secure interview rooms. Secure Interview Rooms used for law enforcement shall be permitted to locked, and shall not be classified as Group I-3 occupancies where all of the following conditions are met:

1. A monitored automatic sprinkler system shall be provided throughout buildings and portions thereof including secure interview rooms. The automatic sprinkler system shall comply with Section 903.3.1.1.
2. Secure interview rooms shall be located in non-combustible construction.
3. Secure interview rooms have glazed or barred openings with direct, continuous observation from law enforcement personnel who have a means to open the secure interview room.
4. Not more than 6 occupants in secure interview rooms shall be located in the same fire area.
5. An automatic smoke detection system shall be installed within secure interview rooms and mechanical and electrical rooms.

408.1.3 Security door assemblies in corridors, smoke barriers and smoke partitions. Security door assemblies shall be constructed in accordance with NFPA 252 or UL 10C, and where a smoke rating is required UL 1784, are not required to be tested or labeled.

408.2 Other occupancies. Buildings or portions of buildings in Group I-3 occupancies where security operations necessitate the locking of required means of egress shall be permitted to be classified as a different occupancy. Occupancies classified as other than Group I-3 shall meet the applicable requirements of this code for that occupancy where provisions are made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, con-

form to requirements for detention and correctional occupancies.

Exceptions:

1. It is permissible to exit through a horizontal exit into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a Group H use.
2. *Regardless of the provisions of Section 508, laundry areas and kitchens including associated dining areas, where commercial/institutional equipment is used shall be separated from the remainder of the building by construction capable of resisting the passage of smoke.*
3. *For the purpose of occupancy separation only courtroom docks that are directly accessory to courtrooms need not be separated from a courtroom.*

408.2.1 Correctional medical and mental health uses. *Where a Group I-3 occupancy occurs in building or portions of buildings, the following Subsections of Sections of 407 shall apply: 407.2.1; 407.2.2; 407.2.3; 407.3.1; 407.3.1.1; 407.4; 407.10.*

408.3 Means of egress. Except as modified or as provided for in this section, the means of egress provisions of Chapter 10 shall apply.

408.3.1 Door width. Doors to resident sleeping units shall have a clear width of not less than 28 inches (711 mm).

408.3.1.1 Cell doors shall open outwardly or slide laterally.

408.3.2 Sliding doors. Where doors in a means of egress are of the horizontal-sliding type, the force to slide the door to its fully open position shall be not greater than 50 pounds (220 N) with a perpendicular force against the door of 50 pounds (220 N).

408.3.3 Guard tower doors. A hatch or trap door not less than 16 square feet (610 m²) in area through the floor and having dimensions of not less than 2 feet (610 mm) in any direction shall be permitted to be used as a portion of the means of egress from guard towers.

408.3.4 Spiral stairways. Spiral stairways that conform to the requirements of Section 1011.10 are permitted for access to and between staff locations.

408.3.5 Ship's ladders. Ship's ladders shall be permitted for egress from control rooms or elevated facility observation rooms in accordance with Section 1011.15.

408.3.6 Exit discharge. Exits are permitted to discharge into a fenced or walled courtyard. Enclosed yards or courts shall be of a size to accommodate all occupants, be located not less than 50 feet (15 240 mm) from the building and have an area of not less than 7 square feet (0.65 m²) per person. *A gate shall be provided from the safe dispersal area to allow for the necessary relocation of occupants.*

408.3.6.1 Exterior fenced enclosures and fenced enclosures utilized for recreational or activity purposes, used for exit termination for more than 20 persons, and

which do not provide a safe dispersal area, shall have not less than two exits.

408.3.6.2 Fenced enclosure utilized for recreational or activity purposes only, for more than 49 people, and which do not provide a safe dispersal area, shall be provided with not less than two exits.

408.3.6.3 Fenced enclosures located on roofs of buildings one or more stories in height shall be provided with not less than two exits regardless of occupant load.

408.3.6.4 Fenced enclosures utilized for central control buildings not normally occupied and not accessed by inmates or the general public are permitted to have only one exit from the fenced enclosure. These fenced enclosures shall only be occupied during emergency response conditions by not more than 29 prison staff occupants. Access to the fenced area shall be controlled remotely or at the gate with a key.

408.3.7 Sallyports. A sallyport shall be permitted in a means of egress where there are provisions for continuous and unobstructed passage through the sallyport during an emergency egress condition.

408.3.8 Interior exit stairway and ramp construction. One interior exit stairway or ramp in each building shall be permitted to have glazing installed in doors and interior walls at each landing level providing access to the interior exit stairway or ramp, provided that the following conditions are met:

1. The interior exit stairway or ramp shall not serve more than four floor levels.
2. Exit doors shall be not less than $\frac{3}{4}$ -hour fire door assemblies complying with Section 716.
3. The total area of glazing at each floor level shall not exceed 5,000 square inches (3.2 m²) and individual panels of glazing shall not exceed 1,296 square inches (0.84 m²).
4. The glazing shall be protected on both sides by an automatic sprinkler system. The sprinkler system shall be designed to wet completely the entire surface of any glazing affected by fire when actuated.
5. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
6. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.3.8.1 Where the number and arrangement of exits complies with the requirements of Chapter 10, other stairways which occur within the secure area of the detention facility and are not used for required exiting but are used primarily for the movement of inmates and security staff need not extend to the exterior.

408.3.9 Dead-end balconies. Exit balconies serving cell tiers shall not extend more than 50 feet (15 240 mm) beyond an exit stairway.

408.3.10 Travel distance. The travel distance may be increased to 300 feet for portions of Group I-3 occupancies open only to staff or where inmates are escorted at all times by staff.

408.3.11 Number of exits required. In temporary holding areas of noncombustible construction, a second means of egress is required when the occupant load is greater than 20.

408.3.12 Custody station. Spaces for custody stations, communications and related clerical areas shall be permitted to be open to, or located within the corridor, provided the required construction along the perimeter of the corridor is maintained. Construction of custody stations or portions of custody stations, within the envelope of the corridor, is not required to be fire-resistance rated. These provisions shall also apply to an enclosed custody station within the corridor.

**TABLE 408.3.13
MAXIMUM FLOOR AREA ALLOWANCES FOR I-3 FACILITIES^c**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR
Detention facilities ^{a,b}	
Housing pod	Number of beds and staff
Refuge area	6 net
Safe disposal area	7 net
Instructional classroom	20 net
Exercise yard or rooms	50 gross
Dorms sleeping area	50 gross
Holding cell	10 ft ² per person/40 ft ² minimum
Bench seating	18 inches per person

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Temporary holding cells, rooms or areas shall be calculated based on policies and procedures approved by the authority having jurisdiction. See 408.3.11 for number of exits required.

b. Program rooms, day rooms and recreational yards which are dedicated to a housing pod or unit are not factored into the total occupant load of the building. Exiting from individual rooms shall meet the egress requirements of Chapter 10.

c. Refer to Chapter 10, Section 1004 or elsewhere in the code for specific requirements based on type of detention facility.

408.4 Locks. Egress doors are permitted to be locked in accordance with the applicable use condition. Doors from a refuge area to the outside are permitted to be locked with a key in lieu of locking methods described in Section 408.4.1. The keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door. *Security hardware may be used on any fire-rated door.*

408.4.1 Remote release. Remote release of locks on doors in a means of egress shall be provided with reliable means of operation, remote from the resident living areas, to release locks on all required doors. In Occupancy Condition 3 or 4, the arrangement, accessibility and security of the release mechanisms required for egress shall be such that with the minimum available staff at any time, the lock mechanisms are capable of being released within 2 minutes.

Exception: Provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are

not required provided that not more than 10 locks are necessary to be unlocked in order to move occupants from one smoke compartment to a refuge area within 3 minutes. The opening of necessary locks shall be accomplished with not more than two separate keys.

[F] 408.4.2 Power-operated doors and locks. Power-operated sliding doors or power-operated locks for swinging doors shall be operable by a manual release mechanism at the door. Emergency power shall be provided for the doors and locks in accordance with Section 2702.

Exceptions:

1. Emergency power is not required in facilities with 10 or fewer locks complying with the exception to Section 408.4.1.
2. Emergency power is not required where remote mechanical operating releases are provided.

408.4.3 Redundant operation. Remote release, mechanically operated sliding doors or remote release, mechanically operated locks shall be provided with a mechanically operated release mechanism at each door, and shall be provided with a redundant remote release control.

408.4.4 Relock capability. Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock.

408.5 Protection of vertical openings. Any vertical opening shall be protected by a shaft enclosure in accordance with Section 713, or shall be in accordance with Section 408.5.1.

408.5.1 Floor openings. The open space in front of a cell tier and connected chases, not exceeding two tiers in height, shall not be considered a vertical shaft and need not meet the fire-resistive shaft enclosure requirements of Section 713.

408.5.2 Shaft openings in communicating floor levels. Where a floor opening is permitted between communicating floor levels of a housing unit in accordance with Section 408.5.1, plumbing chases serving vertically stacked individual cells contained within the housing unit shall be permitted without a shaft enclosure.

408.6 Smoke barrier. Occupancies in Group I-3 shall have smoke barriers complying with Sections 408.6 and 709 to divide every story occupied by residents for sleeping, or any other story having an occupant load of 50 or more persons, into not fewer than two smoke compartments.

Exception: Spaces having a direct exit to one of the following, provided that the locking arrangement of the doors involved complies with the requirements for doors at the smoke barrier for the use condition involved:

1. A public way.
2. A building separated from the resident housing area by a 2-hour fire-resistance-rated assembly or 50 feet (15 240 mm) of open space.

3. A secured yard or court having a holding space 50 feet (15 240 mm) from the housing area that provides 6 square feet (0.56 m²) or more of refuge area per occupant, including residents, staff and visitors.

4. *Holding facility.*

408.6.1 Smoke compartments. The number of residents in any smoke compartment shall be not more than 200. The distance of travel to a door in a smoke barrier from any room door required as exit access shall be not greater than 150 feet (45 720 mm). The distance of travel to a door in a smoke barrier from any point in a room shall be not greater than 200 feet (60 960 mm).

Exception: The travel distance may be increased by 50 feet from areas open only to the staff.

408.6.2 Refuge area. Not less than 6 net square feet (0.56 m²) per occupant shall be provided on each side of each smoke barrier for the total number of occupants in adjoining smoke compartments. This space shall be readily available wherever the occupants are moved across the smoke barrier in a fire emergency.

408.6.3 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originates.

408.7 Security glazing. In occupancies in Group I-3, windows and doors in 1-hour fire barriers constructed in accordance with Section 707, fire partitions constructed in accordance with Section 708 and smoke barriers constructed in accordance with Section 709 shall be permitted to have security glazing installed provided that the following conditions are met.

1. Individual panels of glazing shall not exceed 1,296 square inches (0.84 m²).
2. The glazing shall be protected on both sides by an automatic sprinkler system. The sprinkler system shall be designed to, when actuated, wet completely the entire surface of any glazing affected by fire.
3. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
4. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.8 Subdivision of resident housing areas. Sleeping areas and any contiguous day room, group activity space or other common spaces where residents are housed shall be separated from other spaces in accordance with Sections 408.8.1 through 408.8.4.

408.8.1 Occupancy Conditions 3 and 4. Each sleeping area in Occupancy Conditions 3 and 4 shall be separated from the adjacent common spaces by a smoke-tight partition where the distance of travel from the sleeping area through the common space to the corridor exceeds 50 feet (15 240 mm).

408.8.2 Occupancy Condition 5. Each sleeping area in Occupancy Condition 5 shall be separated from adjacent sleeping areas, corridors and common spaces by a smoke-tight partition. Additionally, common spaces shall be separated from the corridor by a smoke-tight partition.

408.8.3 Openings in room face. The aggregate area of openings in a solid sleeping room face in Occupancy Conditions 2, 3, 4 and 5 shall not exceed 120 square inches (0.77 m²). The aggregate area shall include all openings including door undercuts, food passes and grilles. Openings shall be not more than 36 inches (914 mm) above the floor. In Occupancy Condition 5, the openings shall be closeable from the room side.

408.8.4 Smoke-tight doors. Doors in openings in partitions required to be smoke tight by Section 408.8 shall be substantial doors, of construction that will resist the passage of smoke. Latches and door *closers* are not required on cell doors.

408.9 Windowless buildings. For the purposes of this section, a windowless building or portion of a building is one with nonopenable windows, windows not readily breakable or without windows. Windowless buildings shall be provided with an engineered smoke control system to provide a tenable environment for exiting from the smoke compartment in the area of fire origin in accordance with Section 909 for each windowless smoke compartment.

408.9.1 Smoke venting. *The housing portions of windowless buildings containing use conditions 3, 4 or 5 shall be provided with an engineered smoke control system in accordance with Section 909, windows or doors, smoke vents or equivalent means to provide a tenable environment for exiting from the smoke compartment in the area of fire origin. A tenable environment for egress shall be as defined in NFPA 92. If windows, smoke vents or doors are used to meet this section, at least two windows, smoke vents or doors to the exterior must be provided at or above the highest occupied level in each smoke compartment, and the windows or doors must be operable or readily breakable and arranged to manually vent smoke.*

Exceptions:

1. *Windowless buildings or portions of a building that meet all of the following requirements:*
 - 1.1. *Are Type IA or IB construction.*
 - 1.2. *Are protected with sprinklers throughout in accordance with Section 903.3.1.1.*
 - 1.3. *Include a fire alarm system with smoke detection in accordance with NFPA 72 in the dayroom and/or corridor serving as exit access from the cells, reporting to a 24 hour central control at the institution.*
 - 1.4. *Include at least one exit from each housing unit direct to the exterior where smoke will not accumulate or to the exterior through a 1-hour-rated corridor serving only that unit.*

- 1.5. *The building is divided into at least two smoke compartments per Section 408.6.1.*
- 1.6. *As approved by the enforcing agency, an egress analysis shows that inmates can be evacuated within 6 minutes from the smoke compartment of origin 24 hours per day or when inmates are present.*
2. *No venting or smoke control is required when an engineering analysis shows an acceptable safe egress time compared to the onset of untenable conditions within a windowless building or portion of a windowless building and approved by the enforcing agency. (See Section 909.4.)*
3. *Courtroom holding areas and temporary central holding areas in courthouses that they meet all of the following requirements:*
 - 3.1. *Holding occurs for a duration less than 12 hours.*
 - 3.2. *The holding areas include no electrical outlets available to the detainees.*
 - 3.3. *The entire building includes sprinklers throughout in accordance with Section 903.3.1.1.*
 - 3.4. *The building includes a fire alarm system with smoke detection in accordance with NFPA 72 in the common rooms of holding areas and in the cells of central holding. The fire alarm system shall activate an alert signal on the floor of alarm containing the holding areas, to alert staff.*
 - 3.5. *As approved by the enforcing agency, an egress analysis shows that detainees can be evacuated within 5 minutes from the holding area of origin, or the facility is provided with gang or electric locks.*
4. *Courtroom holding areas with less than 20 persons in custody.*
5. *Windowless buildings or portions of a building that meet all of the following requirements:*
 - 5.1. *Are Type IA or IB construction.*
 - 5.2. *Are protected with sprinklers throughout in accordance with Section 903.3.1.1.*
 - 5.3. *Include a fire alarm system with smoke detection in accordance with NFPA 72 in the dayrooms and corridors serving as exit access from the cells, reporting to a 24-hour central control at the institution.*
 - 5.4. *Include at least one direct exit from each housing unit through a smoke partition to another smoke compartment. Each housing unit must be its own smoke com-*

partment and can exit through a maximum of one adjacent compartment before reaching a corridor or the exterior.

- 5.5. *As approved by the enforcing agency, an egress analysis shows that inmates can be evacuated within 6 minutes from the smoke compartment of origin 24 hours per day or when inmates are present, or the facility is provided with gang or electric locks.*
- 5.6. *Each housing unit includes a pressurization method smoke control system that complies with Section 909.*

[F] 408.10 Fire alarm system. A fire alarm system shall be provided in accordance with Section 907.2.6.3.

[F] 408.11 Automatic sprinkler system. Group I-3 occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.6.

408.12 Emergency and standby power systems. Special electrical systems, exit illumination, power installations and alternate on-site electrical supplies shall be provided for every building or portion of a building housing 10 or more inmates in a detention or correctional facility in accordance with the provisions of the California Electrical Code. There shall be a source of emergency power in all detention facilities capable of providing minimal lighting in all housing units, activity areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems.

408.13 Windows. In security areas within cell complexes sprinklered throughout, the area of glazing in one-hour corridor walls and smoke barrier walls shall not be restricted, provided:

1. *All openings are protected by fixed glazing listed and labeled for a fire-protection of at least $\frac{3}{4}$ hour; or*
2. *Fixed security glazing set in noncombustible frames. Shall comply with the minimum requirements of one of the following test standards: ASTM F1233-98, Class III glass, or; California Department of Corrections and Rehabilitation, CDCR Appendix H, or H.P. White Laboratory, Inc., HPW-TP- 0500.02, Forced Entry Level III.*
3. *In lieu of the sizes set forth in CBC, the size and area of glazed assemblies shall conform to the following: Windows required to have a three-fourths-hour fire-resistive rating or windows protected by fixed security glazing, as delineated in Items 1 and 2 above, may have an area not greater than 84 square feet (7.8 m²) with neither width nor height exceeding 12 feet (3658 mm).*

408.14 Safety padding. Padding material used on walls, floors and ceilings in Group I and R-2.1 occupancies shall be of an approved type tested in accordance with the procedures established by State Fire Marshal Standard 12-8-100, Room Fire Test for Wall and Ceiling Materials, California Code of Regulations, Title 24, Part 12.

408.15 Small management yards.

408.15.1 General. The provisions of Sections 408.15.1 through 408.15.5 shall apply to small management yards. Small management yards may be used by a maximum of two occupants at any one time for a maximum of 2 hours per day.

408.15.2 Construction. Small management yards shall be constructed in accordance with all of the following:

1. Constructed of Type IB noncombustible materials.
2. Fence material shall be noncombustible.
3. Have a maximum area of 150 square feet (14 m²).
4. Yard area covering shall not exceed 75 square feet (7 m²) or a maximum of 50 percent of the fenced enclosure.
5. Electrical lighting or devices of any type shall not be permitted within the yard.

Exception: Low voltage devices dedicated for the operation of toilets.

408.15.3 Fire protection system provisions.

408.15.3.1 Automatic sprinkler systems. An automatic sprinkler system shall be provided in accordance with Section 903.3.1.1.

Exception: Small management yards where a distance of 10 feet (3048 mm) is maintained from all buildings or structures and 4 feet (1220 mm) is maintained from containment fencing.

408.15.3.2 Fire alarm systems. An approved fire alarm system shall be provided in accordance with Section 907.

Exception: Small management yards where a distance of 10 feet (3048 mm) is maintained from all buildings or structures and 4 feet (1220 mm) is maintained from containment fencing.

408.15.4 Means of egress. Except as modified or as provided for in this section, the provisions of Section 408.3 and Chapter 10 shall apply. Small management yards shall comply with all of the following:

1. Staff-controlled manual released locks shall be provided.
2. Staff escorting inmates to and from small management yards shall be equipped with radios and personal alarms to notify central control in case of a fire.
3. The safe dispersal area as defined by Section 1027.5 shall not be reduced due to placement of these yards.
4. An exit, remote from the main entrance is required in the containment fencing.

408.15.5 Special provisions. Inmate exercise clothing and toilet paper tissue shall be the only combustible materials permitted in small management yards.

SECTION 409**MOTION PICTURE PROJECTION ROOMS**

409.1 General. The provisions of Sections 409.1 through 409.5 shall apply to rooms in which ribbon-type cellulose acetate or other safety film is utilized in conjunction with

electric arc, xenon or other light-source projection equipment that develops hazardous gases, dust or radiation. Where cellulose nitrate film is utilized or stored, such rooms shall comply with NFPA 40.

409.1.1 Projection room required. Every motion picture machine projecting film as mentioned within the scope of this section shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, shall be within the projection room or in an adjacent room of equivalent construction.

409.2 Construction of projection rooms. Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings are not required to be protected.

The room shall have a floor area of not less than 80 square feet (7.44 m²) for a single machine and not less than 40 square feet (3.7 m²) for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space of not less than 30 inches by 30 inches (762 mm by 762 mm) on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors. The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). The aggregate of openings for projection equipment shall not exceed 25 percent of the area of the wall between the projection room and the auditorium. Openings shall be provided with glass or other approved material, so as to close completely the opening.

409.3 Projection room and equipment ventilation. Ventilation shall be provided in accordance with the *California Mechanical Code*.

409.3.1 Supply air. Each projection room shall be provided with adequate air supply inlets so arranged as to provide well-distributed air throughout the room. Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment. Air is permitted to be taken from the outside; from adjacent spaces within the building, provided that the volume and infiltration rate are sufficient; or from the building air-conditioning system, provided that it is so arranged as to provide sufficient air when other systems are not in operation.

409.3.2 Exhaust air. Projection rooms are permitted to be exhausted through the lamp exhaust system. The lamp exhaust system shall be positively interconnected with the lamp so that the lamp will not operate unless there is the required airflow. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system. The projection room ventilation system is permitted to also serve appurtenant rooms, such as the generator and rewind rooms.

409.3.3 Projection machines. Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building. The lamp exhaust is permitted to serve to

exhaust air from the projection room to provide room air circulation. Such ducts shall be of rigid materials, except for a flexible connector approved for the purpose. The projection lamp or projection room exhaust system, or both, is permitted to be combined but shall not be interconnected with any other exhaust or return system, or both, within the building.

409.4 Lighting control. Provisions shall be made for control of the auditorium lighting and the means of egress lighting systems of theaters from inside the projection room and from not less than one other convenient point in the building.

409.5 Miscellaneous equipment. Each projection room shall be provided with rewind and film storage facilities.

SECTION 410 STAGES, PLATFORMS AND TECHNICAL PRODUCTION AREAS

410.1 Applicability. The provisions of Sections 410.1 through 410.7 shall apply to all parts of buildings and structures that contain stages or platforms and similar appurtenances as herein defined.

410.2 Stages. Stage construction shall comply with Sections 410.2.1 through 410.2.7.

410.2.1 Stage construction. Stages shall be constructed of materials as required for floors for the type of construction of the building in which such stages are located.

Exception: Stages need not be constructed of the same materials as required for the type of construction provided that the construction complies with one of the following:

1. Stages of Type IIB or IV construction with a nominal 2-inch (51 mm) wood deck, provided that the stage is separated from other areas in accordance with Section 410.2.4.
2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided that the space below the stage is equipped with an automatic sprinkler system or fire-extinguishing system in accordance with Section 903 or 904.
3. In all types of construction, the finished floor shall be constructed of wood or approved non-combustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors with approved safety locks.

410.2.1.1 Stage height and area. Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. Stage height shall be measured from the lowest point on the stage floor to the highest point of the roof or floor deck above the stage.

410.2.2 Technical production areas: galleries, gridirons and catwalks. Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries

and catwalks shall be constructed of approved materials consistent with the requirements for the type of construction of the building; and a fire-resistance rating shall not be required. These areas shall not be considered to be floors, stories, mezzanines or levels in applying this code.

Exception: Floors of fly galleries and catwalks shall be constructed of any approved material.

410.2.3 Exterior stage doors. Where protection of openings is required, exterior exit doors shall be protected with fire door assemblies that comply with Section 716. Exterior openings that are located on the stage for means of egress or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.

410.2.4 Proscenium wall. Where the stage height is greater than 50 feet (15 240 mm), all portions of the stage shall be completely separated from the seating area by a proscenium wall with not less than a 2-hour fire-resistance rating extending continuously from the foundation to the roof.

410.2.5 Proscenium curtain. Where a proscenium wall is required to have a fire-resistance rating, the stage opening shall be provided with a fire curtain complying with NFPA 80, horizontal sliding doors complying with Section 716 having a fire protection rating of not less than 1 hour, or an approved water curtain complying with Section 903.3.1.1 or, in facilities not utilizing the provisions of smoke-protected assembly seating in accordance with Section 1030.6.2, a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level not less than 6 feet (1829 mm) above the floor of the means of egress.

410.2.6 Scenery. Combustible materials used in sets and scenery shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8, in accordance with Section 806 and the *California Fire Code*. Foam plastics and materials containing foam plastics shall comply with Section 2603 and the *California Fire Code*.

410.2.7 Stage ventilation. Emergency ventilation shall be provided for stages larger than 1,000 square feet (93 m²) in floor area, or with a stage height greater than 50 feet (15 240 mm). Such ventilation shall comply with Section 410.2.7.1 or 410.2.7.2.

410.2.7.1 Roof vents. Two or more vents constructed to open automatically by approved heat-activated devices and with an aggregate clear opening area of not less than 5 percent of the area of the stage shall be located near the center and above the highest part of the stage area. Supplemental means shall be provided for manual operation of the ventilator. Curbs shall be provided as required for skylights in Section 2610.2. Vents shall be labeled.

[F] 410.2.7.2 Smoke control. Smoke control in accordance with Section 909 shall be provided to maintain the smoke layer interface not less than 6 feet (1829

mm) above the highest level of the assembly seating or above the top of the proscenium opening where a proscenium wall is provided in compliance with Section 410.2.4.

410.3 Platform construction. Permanent platforms shall be constructed of materials as required for the type of construction of the building in which the permanent platform is located. Permanent platforms are permitted to be constructed of fire-retardant-treated wood for Types I, II and IV construction where the platforms are not more than 30 inches (762 mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m²) in area. Where the space beneath the permanent platform is used for storage or any purpose other than equipment, wiring or plumbing, the floor assembly shall be not less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent platform is used only for equipment, wiring or plumbing, the underside of the permanent platform need not be protected.

410.3.1 Temporary platforms. Platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by this code. The space between the floor and the platform above shall only be used for plumbing and electrical wiring to platform equipment.

410.4 Dressing and appurtenant rooms. Dressing and appurtenant rooms shall comply with Sections 410.4.1 and 410.4.2.

410.4.1 Separation from stage. The stage shall be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage and other parts of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 2 hours for stage heights greater than 50 feet (15 240 mm) and not less than 1 hour for stage heights of 50 feet (15 240 mm) or less.

410.4.2 Separation from each other. Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the stage shall be separated from each other by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

410.5 Means of egress. Except as modified or as provided for in this section, the provisions of Chapter 10 shall apply.

410.5.1 Arrangement. Where two or more exits or exit access doorways from the stage are required in accordance with Section 1006.2, not fewer than one exit or exit access doorway shall be provided on each side of a stage.

410.5.2 Stairway and ramp enclosure. Exit access stairways and ramps serving a stage or platform are not required to be enclosed. Exit access stairways and ramps serving technical production areas are not required to be enclosed.

410.5.3 Technical production areas. Technical production areas shall be provided with means of egress and means of escape in accordance with Sections 410.5.3.1 through 410.5.3.5.

410.5.3.1 Number of means of egress. Not fewer than one means of egress shall be provided from technical production areas.

410.5.3.2 Exit access travel distance. The exit access travel distance shall be not greater than 300 feet (91 440 mm) for buildings without a sprinkler system and 400 feet (122 mm) for buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

410.5.3.3 Two means of egress. Where two means of egress are required, the common path of travel shall be not greater than 100 feet (30 480 mm).

Exception: A means of escape to a roof in place of a second means of egress is permitted.

410.5.3.4 Path of egress travel. The following exit access components are permitted where serving technical production areas:

1. Stairways.
2. Ramps.
3. Spiral stairways.
4. Catwalks.
5. Alternating tread devices.
6. Permanent ladders.

410.5.3.5 Width. The path of egress travel within and from technical support areas shall be not less than 22 inches (559 mm).

[F] 410.6 Automatic sprinkler system. Stages shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

Exceptions:

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height that are utilized exclusively for storage of tables and chairs, provided that the concealed space is separated from the adjacent spaces by Type X gypsum board not less than $\frac{5}{8}$ -inch (15.9 mm) in thickness.
2. Sprinklers are not required for stages 1,000 square feet (93 m²) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.
3. Sprinklers are not required within portable orchestra enclosures on stages.

[F] 410.7 Standpipes. Standpipe systems shall be provided in accordance with Section 905.

**SECTION 411
SPECIAL AMUSEMENT AREAS**

411.1 General. Special amusement areas having an occupant load of 50 or more shall comply with the requirements for the appropriate Group A occupancy and Sections 411.1 through 411.7. Special amusement areas having an occupant load of less than 50 shall comply with the requirements for a Group B occupancy and Sections 411.1 through 411.7.

Exception: Special amusement areas that are without walls or a roof and constructed to prevent the accumulation of smoke need not comply with this section.

[F] 411.2 Automatic sprinkler system. Buildings containing special amusement areas shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where the special amusement area is temporary, *less than 180 days*, the sprinkler water supply shall be of an approved temporary means *determined by the authority having jurisdiction*.

Exception: Automatic sprinklers are not required where the total floor area of a temporary, *less than 180 days*, special amusement area is less than 1,000 square feet (93 m²) and the exit access travel distance from any point in the special amusement area to an exit is less than 50 feet (15 240 mm).

[F] 411.3 Automatic smoke detection. Buildings containing special amusement areas shall be equipped with an automatic smoke detection system in accordance with Section 907.2.12.

[F] 411.4 Emergency voice/alarm communications system. An emergency voice/alarm communications system shall be provided in accordance with Section 907.2.12.

411.5 Puzzle room exiting. Puzzle room exiting shall comply with one of the following:

1. Exiting in accordance with Chapter 10.
2. An alternative design approved by the *authority having jurisdiction*.
3. Exits shall be open and readily available upon activation by the automatic fire alarm system, automatic sprinkler system, and a manual control at a constantly attended location.

411.6 Exit marking. Exit signs shall be installed at the required exit or exit access doorways serving special amusement areas in accordance with this section and Section 1013. Approved directional exit markings shall be provided. Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, approved and listed low-level exit signs that comply with Section 1013.5, and directional path markings listed in accordance with UL 1994, shall be provided and located not more than 8 inches (203 mm) above the walking surface and on or near the path of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the automatic smoke detection system and the automatic sprinkler system in accordance with Section 907.2.12.

411.6.1 Photoluminescent exit signs. Where photoluminescent exit signs are installed, activating light source and viewing distance shall be in accordance with the listing and markings of the signs.

411.7 Interior finish. The interior finish in special amusement areas shall be Class A in accordance with Section 803.1.

**SECTION 412
AIRCRAFT-RELATED OCCUPANCIES**

412.1 General. Aircraft-related occupancies shall comply with Sections 412.1 through 412.7 and the *California Fire Code*.

412.2 Airport traffic control towers. The provisions of Sections 412.2.1 through 412.2.6 shall apply to airport traffic control towers occupied only for the following uses:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.

412.2.1 Construction. The construction of airport traffic control towers shall comply with the provisions of Sections 412.2.1.1 through 412.2.1.3.

412.2.1.1 Type of construction. Airport traffic control towers shall be constructed to comply with the height limitations of Table 412.2.1.1.

**TABLE 412.2.1.1
HEIGHT LIMITATIONS FOR
AIRPORT TRAFFIC CONTROL TOWERS**

TYPE OF CONSTRUCTION	HEIGHT ^a (feet)
IA	Unlimited
IB	240
IIA	100
IIB	85
IIIA	65

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. Height to be measured from grade plane to cab floor.

[BS] 412.2.1.2 Structural integrity of interior exit stairways and elevator hoistway enclosures. Enclosures for interior exit stairways and elevator hoistway enclosures shall comply with Section 403.2.2 in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.1.3 Sprayed fire-resistant materials (SFRM). The bond strength of the SFRM installed in airport traffic control towers shall be in accordance with Section 403.2.3 where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.2 Means of egress and evacuation. The means of egress in airport traffic control towers shall comply with Sections 412.2.2.1 through 412.2.2.3.

412.2.2.1 Stairways. Stairways in airport traffic control towers shall be in accordance with Section 1011. Exit stairways shall be smokeproof enclosures

complying with one of the alternatives provided in Section 909.20.

Exception: Stairways in airport traffic control towers are not required to comply with Section 1011.12.

412.2.2.2 Exit access. From observation levels, airport traffic control towers shall be permitted to have a single means of exit access for a distance of travel not greater than 100 feet (30 480 mm). Exit access stairways from the observation level need not be enclosed.

412.2.2.3 Number of exits. Not less than one exit stairway shall be permitted for airport traffic control towers of any height provided that the occupant load per floor is not greater than 15 and the area per floor does not exceed 1,500 square feet (140 m²).

412.2.2.3.1 Interior finish. Where an airport traffic control tower is provided with only one exit stairway, interior wall and ceiling finishes shall be either Class A or Class B.

412.2.2.3.2 Exit separation. Where an airport traffic control tower is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and two exits are required, the exit separation distance required by Section 1007 shall be not less than one-fourth of the length of the maximum overall dimension of the area served.

[F] 412.2.3 Emergency systems. The detection, alarm and emergency systems of airport traffic control towers shall comply with Sections 412.2.3.1 through 412.2.3.3.

[F] 412.2.3.1 Automatic smoke detection systems. Airport traffic control towers shall be provided with an automatic smoke detection system installed in accordance with Section 907.2.22.

[F] 412.2.3.2 Fire command center. A fire command center shall be provided in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. The fire command center shall comply with Section 911.

Exceptions:

1. The fire command center shall be located in the airport control tower or an adjacent contiguous building where building functions are interdependent.
2. The room shall be not less than 150 square feet (14 m²) in area with a minimum dimension of 10 feet (3048 mm).
3. The following features shall not be required in an airport traffic control tower fire command center.
 - 3.1. Emergency voice/alarm control unit.
 - 3.2. Public address system.
 - 3.3. Status indicators and controls for the air distributions centers.

3.4. Generator supervision devices, manual start and transfer features.

3.5. Elevator emergency or standby power switches where emergency or standby power is provided.

[F] 412.2.3.3 Smoke removal. Smoke removal in airport traffic control towers shall be provided in accordance with Section 403.4.7.

[F] 412.2.4 Automatic sprinkler system. Where an occupied floor is located more than 35 feet (10 668 mm) above the lowest level of fire department vehicle access, airport traffic control towers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] 412.2.4.1 Fire pump room. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

Exception: Separation is not required for fire pumps physically separated in accordance with NFPA 20.

[F] 412.2.5 Protection of elevator wiring and cables. Wiring and cables serving elevators in airport traffic control towers shall be protected in accordance with Section 3007.8.1.

412.2.5.1 Elevators for occupant evacuation. Where provided in addition to an exit stairway, occupant evacuation elevators shall be in accordance with Section 3008.

412.2.6 Accessibility. *[DSA-AC] In air traffic control towers, an accessible route shall not be required to serve the cab and the equipment areas on the floor immediately below the cab.*

412.3 Aircraft hangars. Aircraft hangars shall be in accordance with Sections 412.3.1 through 412.3.6.

412.3.1 Exterior walls. Exterior walls located less than 30 feet (9144 mm) from lot lines or a public way shall have a fire-resistance rating not less than 2 hours.

412.3.2 Basements. Where hangars have basements, floors over basements shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall not be openings or communication between basements and the hangar. Access to basements shall be from outside only.

412.3.3 Floor surface. Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

Exception: Aircraft hangars with individual lease spaces not exceeding 2,000 square feet (186 m²) each in which servicing, repairing or washing is not conducted and fuel is not dispensed shall have floors that are graded toward the door, but shall not require a separator.

412.3.4 Heating equipment. Heating equipment shall be placed in another room separated by 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

Exceptions:

1. Unit heaters and vented infrared radiant heating equipment suspended not less than 10 feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar need not be located in a separate room provided that they are mounted not less than 8 feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. Entrance to the separated room shall be permitted by a single interior door provided that the sources of ignition in the appliances are not less than 18 inches (457 mm) above the floor.

412.3.5 Finishing. The process of “doping,” involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate detached building equipped with automatic fire-extinguishing equipment in accordance with Section 903.

[F] 412.3.6 Fire suppression. Aircraft hangars shall be provided with a fire suppression system designed in accordance with NFPA 409, based on the classification for the hangar given in Table 412.3.6.

Exception: Where a fixed base operator has separate repair facilities on site, Group II hangars operated by a fixed base operator used for storage of transient aircraft only shall have a fire suppression system, but the system is exempt from foam requirements.

[F] 412.3.6.1 Hazardous operations. Any Group III aircraft hangar according to Table 412.3.6 that contains hazardous operations including, but not limited to, the

following shall be provided with a Group I or II fire suppression system in accordance with NFPA 409 as applicable:

1. Doping.
2. Hot work including, but not limited to, welding, torch cutting and torch soldering.
3. Fuel transfer.
4. Fuel tank repair or maintenance not including defueled tanks in accordance with NFPA 409, inerted tanks or tanks that have never been fueled.
5. Spray finishing operations.
6. Total fuel capacity of all aircraft within the unsprinklered single fire area in excess of 1,600 gallons (6057 L).
7. Total fuel capacity of all aircraft within the maximum single fire area in excess of 7,500 gallons (28 390 L) for a hangar with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] 412.3.6.2 Separation of maximum single fire areas. Maximum single fire areas established in accordance with hangar classification and construction type in Table 412.3.6 shall be separated by 2-hour fire walls constructed in accordance with Section 706. In determining the maximum single fire area as set forth in Table 412.3.6, ancillary uses that are separated from aircraft servicing areas by a fire barrier of not less than 1 hour, constructed in accordance with Section 707, shall not be included in the area.

412.4 Residential aircraft hangars. Residential aircraft hangars shall comply with Sections 412.4.1 through 412.4.5.

412.4.1 Fire separation. A hangar shall not be attached to a dwelling unless separated by a fire barrier having a fire-resistance rating of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the dwelling unit. Doors into the dwelling unit shall be

**[F] TABLE 412.3.6
HANGAR FIRE SUPPRESSION REQUIREMENTS^{a, b, c}**

MAXIMUM SINGLE FIRE AREA (square feet)	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
≥ 40,001	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I
40,000	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
30,000	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
20,000	Group III	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II
15,000	Group III	Group III	Group III	Group II	Group III	Group II	Group III	Group II	Group II
12,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II	Group II
8,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II
5,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. Aircraft hangars with a door height greater than 28 feet shall be provided with fire suppression for a Group I hangar regardless of maximum fire area.

b. Groups shall be as classified in accordance with NFPA 409.

c. Membrane structures complying with Section 3102 shall be classified as a Group IV hangar.

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

equipped with self-closing devices and conform to the requirements of Section 716 with a noncombustible raised sill not less than 4 inches (102 mm) in height. Openings from a hangar directly into a room used for sleeping purposes shall not be permitted.

412.4.2 Egress. A hangar shall provide two means of egress. One of the doors into the dwelling shall be considered as meeting only one of the two means of egress.

[F] 412.4.3 Smoke alarms. Smoke alarms shall be provided within the hangar in accordance with Section 907.2.22.

412.4.4 Independent systems. Electrical, mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar shall be independent of the systems installed within the dwelling. Building sewer lines shall be permitted to be connected outside the structures.

Exception: Smoke detector wiring and feed for electrical subpanels in the hangar.

412.4.5 Height and area limits. Residential aircraft hangars shall be not greater than 2,000 square feet (186 m²) in area and 20 feet (6096 mm) in building height.

[F] 412.5 Aircraft paint hangars. Aircraft painting operations shall be conducted in an aircraft paint hangar that complies with the provisions of Sections 412.5.1 through 412.5.8. Buildings and structures, or parts thereof, used for the application of flammable finishes shall comply with the applicable provisions of Section 416.

[F] 412.5.1 Occupancy classification. Aircraft paint hangars shall be classified in accordance with the provisions of Section 307.1. Aircraft paint hangars shall comply with the applicable requirements of this code and the *California Fire Code* for such occupancy.

412.5.2 Construction. Aircraft paint hangars shall be of Type I or II construction.

[F] 412.5.3 Spray equipment cleaning operations. Spray equipment cleaning operations shall be conducted in a liquid use, dispensing and mixing room.

[F] 412.5.4 Operations. Only those flammable liquids necessary for painting operations shall be permitted in quantities less than the maximum allowable quantities per control area in Table 307.1(1). Spray equipment cleaning operations exceeding the maximum allowable quantities per control area in Table 307.1(1) shall be conducted in a liquid use, dispensing and mixing room.

[F] 412.5.5 Storage. Storage of flammable or combustible liquids exceeding the maximum allowable quantities per control area in Table 307.1(1) shall be in a liquid storage room.

[F] 412.5.6 Fire suppression. Aircraft paint hangars shall be provided with fire suppression as required by NFPA 409.

[F] 412.5.7 Ventilation. Aircraft paint hangars shall be provided with ventilation as required in the *California Mechanical Code*.

[F] 412.5.8 Electrical. Electrical equipment and devices within the aircraft paint hangar shall comply with *California Electrical Code*.

[F] 412.5.8.1 Class I, Division I hazardous locations. The area within 10 feet (3048 mm) horizontally from aircraft surfaces and from the floor to 10 feet (3048 mm) above the aircraft surface shall be classified as a Class I, Division I location.

[F] 412.5.8.2 Class I, Division 2 hazardous locations. The area horizontally from aircraft surfaces between 10 feet (3048 mm) and 30 feet (9144 mm) and from the floor to 30 feet (9144 mm) above the aircraft surface shall be classified as a Class I, Division 2 location.

412.6 Aircraft manufacturing facilities. In buildings used for the manufacturing of aircraft, exit access travel distances indicated in Section 1017.1 shall be increased in accordance with the following:

1. The building shall be of Type I or II construction.
2. Exit access travel distance shall not exceed the distances given in Table 412.6.

412.6.1 Ancillary areas. Rooms, areas and spaces ancillary to the primary manufacturing area shall be permitted to egress through such area having a minimum height as indicated in Table 412.6. Exit access travel distance within the ancillary room, area or space shall not exceed that indicated in Table 1017.2 based on the occupancy classification of that ancillary area. Total exit access travel distance shall not exceed that indicated in Table 412.6.

[F] 412.7 Heliports and helistops. Heliports and helistops shall be permitted to be erected on buildings or other locations where they are constructed in accordance with Sections 412.7.1 through 412.7.5.

**TABLE 412.6
AIRCRAFT MANUFACTURING EXIT ACCESS TRAVEL DISTANCE**

HEIGHT (feet) ^b	MANUFACTURING AREA (square feet) ^a					
	≥ 150,000	≥ 200,000	≥ 250,000	≥ 500,000	≥ 750,000	≥ 1,000,000
≥ 25	400	450	500	500	500	500
≥ 50	400	500	600	700	700	700
≥ 75	400	500	700	850	1,000	1,000
≥ 100	400	500	750	1,000	1,250	1,500

For SI: 1 foot = 304.8 mm.

- a. Contiguous floor area of the aircraft manufacturing facility having the indicated height.
- b. Minimum height from finished floor to bottom of ceiling or roof slab or deck.

[F] **412.7.1 Size.** The landing area for helicopters less than 3,500 pounds (1588 kg) shall be not less than 20 feet (6096 mm) in length and width. The landing area shall be surrounded on all sides by a clear area having an average width at roof level of 15 feet (4572 mm), and all widths shall be not less than 5 feet (1524 mm).

[F] **412.7.2 Design.** Helicopter landing areas and the supports thereof on the roof of a building shall be noncombustible construction. Landing areas shall be designed to confine any flammable liquid spillage to the landing area itself and provisions shall be made to drain such spillage away from any exit or stairway serving the helicopter landing area or from a structure housing such exit or stairway. For structural design requirements, see Section 1607.6.

412.7.3 Means of egress. The means of egress from heliports and helistops shall comply with the provisions of Chapter 10. Landing areas located on buildings or structures shall have two or more exits or access to exits. For landing areas less than 60 feet (18 288 mm) in length or less than 2,000 square feet (186 m²) in area, the second means of egress is permitted to be a fire escape, alternating tread device or ladder leading to the floor below.

[F] **412.7.4 Rooftop heliports and helistops.** Rooftop heliports and helistops shall comply with NFPA 418.

[F] **412.7.5 Standpipe system.** In buildings equipped with a standpipe system, the standpipe shall extend to the roof level in accordance with Section 905.3.6.

SECTION 413 COMBUSTIBLE STORAGE

413.1 General. High-piled stock or rack storage in any occupancy group shall comply with the *California Fire Code*.

413.2 Attic, under-floor and concealed spaces. Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are self-closing and are of noncombustible construction or solid wood core not less than 1³/₄ inches (45 mm) in thickness.

Exception: Neither fire-resistance-rated construction nor opening protectives are required in any of the following locations:

1. Areas protected by approved automatic sprinkler systems.
2. Group R-3 and U occupancies.

SECTION 414 HAZARDOUS MATERIALS

[F] **414.1 General.** The provisions of Sections 414.1 through 414.6 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of hazardous materials.

[F] **414.1.1 Other provisions.** Buildings and structures with an occupancy in Group H shall comply with this section and the applicable provisions of Section 415 and the *California Fire Code*. See Section 453 for Group L occupancies.

[F] **414.1.2 Materials.** The safe design of hazardous material occupancies is material dependent. Individual material requirements are found in Sections 307 and 415, the *California Mechanical Code* and the *California Fire Code*.

[F] **414.1.2.1 Aerosol products, aerosol cooking spray products and plastic aerosol 3 products.** Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 products shall be stored and displayed in accordance with the *California Fire Code*. See Section 311.2 and the *California Fire Code* for occupancy group requirements.

[F] **414.1.3 Information required.** A report shall be submitted to the building official identifying the maximum expected quantities of hazardous materials to be stored, used in a closed system and used in an open system, and subdivided to separately address hazardous material classification categories based on Tables 307.1(1) and 307.1(2). The methods of protection from such hazards, including but not limited to control areas, fire protection systems and Group H occupancies shall be indicated in the report and on the construction documents. The opinion and report shall be prepared by a qualified person, firm or corporation approved by the building official and provided without charge to the enforcing agency.

For buildings and structures with an occupancy in Group H, separate floor plans shall be submitted identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure.

[F] **414.2 Control areas.** Control areas shall comply with Sections 414.2.1 through 414.2.5 and the *California Fire Code*.

[F] **414.2.1 Construction requirements.** Control areas shall be separated from each other by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] **414.2.2 Percentage of maximum allowable quantities.** The percentage of maximum allowable quantities of hazardous materials per control area permitted at each floor level within a building shall be in accordance with Table 414.2.2.

[F] **414.2.3 Number.** The maximum number of control areas within a building shall be in accordance with Table 414.2.2. For the purposes of determining the number of control areas within a building, each portion of a building separated by one or more fire walls complying with Section 706 shall be considered a separate building.

[F] **414.2.4 Fire-resistance rating requirements.** The required fire-resistance rating for fire barriers shall be in accordance with Table 414.2.2. The floor assembly of the control area and the construction supporting the floor of

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

STORY		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

- a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.
- b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

the control area shall have a fire-resistance rating of not less than 2 hours.

Exception: The floor assembly of the control area and the construction supporting the floor of the control area are allowed to be 1-hour fire-resistance-rated in buildings of Types IIA, IIIA, IV and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The building is three or fewer stories above grade plane.

[F] 414.2.5 Hazardous material in Group M display and storage areas and in Group S storage areas. Hazardous materials located in Group M and Group S occupancies shall be in accordance with Sections 414.2.5.1 through 414.2.5.3.

[F] 414.2.5.1 Nonflammable solids and nonflammable and noncombustible liquids. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a Group M display and storage area, a Group S storage area or an outdoor control area is permitted to exceed the maximum allowable quantities per control area specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *California Fire Code* and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

[F] 414.2.5.2 Flammable and combustible liquids. In Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the *California Fire Code*.

[F] 414.2.5.3 Aerosol products, aerosol cooking spray products or plastic aerosol 3 products. The maximum quantity of aerosol products, aerosol cooking spray products or plastic aerosol 3 products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the *California Fire Code*.

[F] 414.3 Ventilation. Rooms, areas or spaces in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or have the potential to be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated where required by this code, the *California Fire Code* or the *California Mechanical Code*.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *California Fire Code* and the *California Mechanical Code*.

[F] 414.4 Hazardous material systems. Systems involving hazardous materials shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls, where provided, shall be designed to be fail safe.

[F] 414.5 Inside storage, dispensing, handling and use. The inside storage, dispensing and use of hazardous materials shall be in accordance with Sections 414.5.1 through 414.5.3 of this code and the *California Fire Code*.

[F] 414.5.1 Explosion control. *Explosion* control shall be provided in accordance with the *California Fire Code* as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.1(1) or where a structure, room or space is occupied for purposes involving *explosion* hazards as required by Section 415 or the *California Fire Code*.

[F] TABLE 414.2.5(1)
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN
GROUP M AND S OCCUPANCIES OF NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS^{d, e, f}

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material ^a	Class	Solids (pounds)	Liquids (gallons)
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
1. Corrosives ^{b, c}	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20 ^{b, c}	2 ^{b, c}
3. Toxics ^{b, c}	Not Applicable	1,000 ^k	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers ^{b, c}	4	Not Allowed	Not Allowed
	3	1,350 ^g	115
	2	2,250 ^h	225
	1	18,000 ^{i, j}	1,800 ^{i, j}
2. Unstable (reactives) ^{b, c}	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3 ^{b, c}	550	55
	2 ^{b, c}	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- a. Hazard categories are as specified in the *California Fire Code*.
- b. Maximum allowable quantities shall be increased 100 percent in buildings that are sprinklered in accordance with Section 903.3.1.1. Where Note c also applies, the increase for both notes shall be applied accumulatively.
- c. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, in accordance with the *California Fire Code*. Where Note b also applies, the increase for both notes shall be applied accumulatively.
- d. See Table 414.2.2 for design and number of control areas.
- e. Allowable quantities for other hazardous material categories shall be in accordance with Section 307.
- f. Maximum quantities shall be increased 100 percent in outdoor control areas.
- g. Maximum amounts shall be increased to 2,250 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- h. Maximum amounts shall be increased to 4,500 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- i. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- j. Quantities are unlimited in an outdoor control area.
- k. Maximum allowable quantities of consumer products shall be increased to 10,000 pounds where individual packages are in the original, sealed containers from the manufacturer and the toxic classification is exclusively based on the LC threshold and no other hazardous materials classifications apply.

[F] TABLE 414.2.5(2)
MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND
COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA^a

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with Note b densities and arrangements	Sprinklered in accordance with Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1 of the <i>California Fire Code</i>	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 ^c	15,000 ^c	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m².

- a. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall.
- b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:
 - 1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.
 - 2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.
- c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to not more than 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

SPECIAL DETAILED REQUIREMENTS BASED ON OCCUPANCY AND USE

[F] TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS^{a, h}

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems ^b
HAZARD CATEGORY			
Combustible dusts ^c	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA ^d	Not Required	Required
	IB ^e	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2 ^g	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Electrochemical energy storage system ⁱ	—	Not Required	Required
Energy storage system ⁱ	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist ^f	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

a. See Section 414.1.3.

b. See the *California Fire Code*.

c. Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.8.2 of the *California Fire Code*. See definition of “Combustible dust” in Chapter 2.

d. Storage or use.

e. In open use or dispensing.

f. Rooms containing dispensing and use of hazardous materials where an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.

g. A method of explosion control shall be provided where Class 2 water-reactive materials can form potentially explosive mixtures.

h. Explosion venting is not required for Group H-5 fabrication areas complying with Section 415.11.1 and the *California Fire Code*.

i. Where explosion control is required in Section 1207 of the *California Fire Code*.

[F] 414.5.2 Emergency or standby power. Where required by the *California Fire Code* or this code, mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems shall be provided with emergency or standby power in accordance with Section 2702. For storage and use areas for highly toxic or toxic materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the *California Fire Code*.

[F] 414.5.2.1 Exempt applications. Emergency or standby power is not required for the mechanical ventilation systems provided for any of the following:

1. Storage of Class IB and IC flammable and combustible liquids in closed containers not exceeding 6.5 gallons (25 L) capacity.
2. Storage of Class 1 and 2 oxidizers.

3. Storage of Class II, III, IV and V organic peroxides.
4. Storage of asphyxiant, irritant and radioactive gases.

[F] **414.5.2.2 Fail-safe engineered systems.** Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

[F] **414.5.3 Spill control, drainage and containment.** Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *California Fire Code*. The methods of spill control shall be in accordance with the *California Fire Code*.

414.5.4 Hazardous material handling. *The handling of hazardous materials shall be in accordance with California Fire Code Section 5003.*

[F] **414.6 Outdoor storage, dispensing and use.** The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the *California Fire Code*.

[F] **414.6.1 Weather protection.** Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such areas shall be considered outdoor storage or use where the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.

[F] **414.6.1.1 Walls.** Walls shall not obstruct more than one side of the structure.

Exception: Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area is not greater than 25 percent of the structure's perimeter.

[F] **414.6.1.2 Separation distance.** The distance from the structure to buildings, lot lines, public ways or means of egress to a public way shall be not less than the distance required for an outside hazardous material storage or use area without weather protection.

[F] **414.6.1.3 Noncombustible construction.** The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet (140 m²).

Exception: The maximum area is permitted to be increased as provided by Section 506.

SECTION 415 GROUPS H-1, H-2, H-3, H-4 AND H-5

[F] **415.1 General.** The provisions of Sections 415.1 through 415.11 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per control area listed in Section 307.1.

[F] **415.2 Compliance.** Buildings and structures with an occupancy in Group H shall comply with the applicable provisions of Section 414 and the *California Fire Code*.

[F] **415.3 Automatic fire detection systems.** Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.

[F] **415.4 Automatic sprinkler system.** Group H occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.

[F] **415.5 Emergency alarms.** Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

[F] **415.5.1 Storage.** An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

[F] **415.5.2 Dispensing, use and handling.** Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors, interior exit stairways or ramps, or exit passageways, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall initiate a local audible alarm.

[F] **415.5.3 Supervision.** Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be electrically supervised and monitored by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

[F] **415.5.4 Emergency alarm systems.** Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be provided with emergency or standby power in accordance with Section 2702.2.

[F] **415.6 Fire separation distance.** Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an exterior wall.

[F] **415.6.1 Rooms for flammable or combustible liquid use, dispensing or mixing in open systems.** Rooms for flammable or combustible liquid use, dispensing or mixing in open systems having a floor area of not more than 500 square feet (46.5 m²) need not be located on the outer perimeter of the building where they are in accordance with the *California Fire Code* and NFPA 30.

[F] **415.6.2 Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems.** Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems, having a floor

area of not more than 1,000 square feet (93 m²) need not be located on the outer perimeter where they are in accordance with the *California Fire Code* and NFPA 30.

[F] 415.6.3 Spray paint booths. Spray paint booths that comply with the *California Fire Code* need not be located on the outer perimeter.

[F] 415.6.4 Group H occupancy minimum fire separation distance. Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the minimum fire separation distance as set forth in Sections 415.6.4.1 through 415.6.4.4. Distances shall be measured from the walls enclosing the occupancy to lot lines, including those on a public way. Distances to assumed lot lines established for the purpose of determining exterior wall and opening protection are not to be used to establish the minimum fire separation distance for buildings on sites where explosives are manufactured or used where separation is provided in accordance with the quantity distance tables specified for explosive materials in the *California Fire Code*.

[F] 415.6.4.1 Group H-1. Group H-1 occupancies shall be set back not less than 75 feet (22 860 mm) and not less than required by the *California Fire Code*.

Exception: Fireworks manufacturing buildings separated in accordance with NFPA 1124.

[F] 415.6.4.2 Group H-2. Group H-2 occupancies shall be set back not less than 30 feet (9144 mm) where the area of the occupancy is greater than 1,000 square feet (93 m²) and it is not required to be located in a detached building.

[F] 415.6.4.3 Groups H-2 and H-3. Group H-2 and H-3 occupancies shall be set back not less than 50 feet (15 240 mm) where a detached building is required (see Table 415.6.5).

[F] 415.6.4.4 Explosive materials. Group H-2 and H-3 occupancies containing materials with explosive characteristics shall be separated as required by the *California Fire Code*. Where separations are not specified, the distances required shall be determined by a technical report issued in accordance with Section 414.1.3.

[F] 415.6.5 Detached buildings for Group H-1, H-2 or H-3 occupancy. The storage or use of hazardous materials in excess of those amounts specified in Table 415.6.5 shall be in accordance with the applicable provisions of Sections 415.7 and 415.8.

[F] 415.6.5.1 Wall and opening protection. Where a detached building is required by Table 415.6.5, wall and opening protection based on fire separation distance is not required.

[F] 415.7 Special provisions for Group H-1 occupancies. Group H-1 occupancies shall be in detached buildings not used for other purposes. Roofs shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature. Group H-1 occupancies containing materials that are in themselves both physical and health hazards in quantities

exceeding the maximum allowable quantities per control area in Table 307.1(2) shall comply with requirements for both Group H-1 and H-4 occupancies.

[F] 415.7.1 Floors in storage rooms. Floors in storage areas for organic peroxides, pyrophoric materials and unstable (reactive) materials shall be of liquid-tight, noncombustible construction.

[F] 415.8 Special provisions for Group H-2 and H-3 occupancies. Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in Table 415.6.5 shall be in detached buildings used for manufacturing, processing, dispensing, use or storage of hazardous materials. Materials specified for Group H-1 occupancies in Section 307.3 are permitted to be located within Group H-2 or H-3 detached buildings provided that the amount of materials per control area do not exceed the maximum allowed quantity specified in Table 307.1(1).

[F] 415.8.1 Multiple hazards. Group H-2 or H-3 occupancies containing materials that are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.1(2) shall comply with requirements for Group H-2, H-3 or H-4 occupancies as applicable.

[F] 415.8.2 Separation of incompatible materials. Hazardous materials other than those specified in Table 415.6.5 shall be allowed in manufacturing, processing, dispensing, use or storage areas when separated from incompatible materials in accordance with the provisions of the *California Fire Code*.

[F] 415.8.3 Water reactives. Group H-2 and H-3 occupancies containing water-reactive materials shall be resistant to water penetration. Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by approved liquid-tight construction.

Exception: Fire protection piping shall be permitted over or through areas containing water reactives without isolating it with liquid-tight construction.

[F] 415.8.4 Floors in storage rooms. Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials and water-reactive solids and liquids shall be of liquid-tight, noncombustible construction.

[F] 415.8.5 Waterproof room. Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic sprinkler systems shall not be within such rooms or areas.

[F] 415.9 Group H-2. Occupancies in Group H-2 shall be constructed in accordance with Sections 415.9.1 through 415.9.3 and the *California Fire Code*.

[F] 415.9.1 Flammable and combustible liquids. The storage, handling, processing and transporting of flammable and combustible liquids in Group H-2 and H-3 occupancies shall be in accordance with Sections 415.9.1.1 through 415.9.1.9, the *California Mechanical Code* and the *California Fire Code*.

[F] **415.9.1.1 Mixed occupancies.** Where the storage tank area is located in a building of two or more occupancies and the quantity of liquid exceeds the maximum allowable quantity for one control area, the use shall be completely separated from adjacent occupancies in accordance with the requirements of Section 508.4.

[F] **415.9.1.1.1 Height exception.** Where storage tanks are located within a building not more than one story above grade plane, the height limitation of Section 504 shall not apply for Group H.

[F] **415.9.1.2 Tank protection.** Storage tanks shall be noncombustible and protected from physical damage. Fire barriers or horizontal assemblies or both around the storage tanks shall be permitted as the method of protection from physical damage.

[F] **415.9.1.3 Tanks.** Storage tanks shall be approved tanks conforming to the requirements of the *California Fire Code*.

[F] **415.9.1.4 Leakage containment.** A liquid-tight containment area compatible with the stored liquid shall be provided. The method of spill control, drainage control and secondary containment shall be in accordance with the *California Fire Code*.

Exception: Rooms where only double-wall storage tanks conforming to Section 415.9.1.3 are used to store Class I, II and IIIA flammable and combustible liquids shall not be required to have a leakage containment area.

[F] **415.9.1.5 Leakage alarm.** An approved automatic alarm shall be provided to indicate a leak in a storage tank and room. The alarm shall sound an audible signal,

[F] **TABLE 415.6.5
DETACHED BUILDING REQUIRED**

A DETACHED BUILDING IS REQUIRED WHERE THE QUANTITY OF MATERIAL EXCEEDS THAT SPECIFIED HEREIN			
Material	Class	Solids and Liquids (tons) ^{a, b}	Gases (cubic feet) ^{a, b}
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4 ^c	1	
	Division 1.5	Maximum Allowable Quantity	
	Division 1.6	Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II	25	Not Applicable
	Class III	50	Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrophoric gases ^d	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg.

- a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Section 415.6 of this code or Chapter 56 of the *California Fire Code* based on trinitrotoluene (TNT) equivalence of the material, whichever is greater.
- b. "Maximum Allowable Quantity" means the maximum allowable quantity per control area set forth in Table 307.1(1).
- c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, provided that the net explosive weight of individual articles does not exceed 1 pound.
- d. Detached buildings are not required, for gases in gas rooms that support H-5 fabrication facilities where the gas room is separated from other areas by a fire barrier with a fire-resistance rating of not less than 2 hours and the gas is located in a gas cabinet that is internally sprinklered, equipped with continuous leak detection, automatic shutdown and is not manifolded upstream of pressure controls. Additionally, the gas supply is limited to cylinders that do not exceed 125 pounds (57 kg) water capacity in accordance with 49 CFR 173.192 for Hazard Zone A toxic gases.

15 dBA above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located. An approved sign shall be posted on every entry door to the tank storage room indicating the potential hazard of the interior room environment, or the sign shall state, "WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS." The leakage alarm shall be supervised in accordance with Chapter 9 to transmit a trouble signal.

[F] 415.9.1.6 Tank vent. Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the *California Fire Code*.

[F] 415.9.1.7 Room ventilation. Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical ventilation. The mechanical ventilation system shall be in accordance with the *California Mechanical Code* and the *California Fire Code*.

[F] 415.9.1.8 Explosion venting. Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *California Fire Code*.

[F] 415.9.1.9 Tank openings other than vents. Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.

[F] 415.9.2 Liquefied petroleum gas facilities. The construction and installation of liquefied petroleum gas facilities shall be in accordance with the requirements of this code, the *California Fire Code*, the *California Plumbing Code*, the *California Mechanical Code* and NFPA 58.

[F] 415.9.3 Dry cleaning plants. The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, the *California Mechanical Code*, the *California Plumbing Code* and NFPA 32. Dry cleaning solvents and systems shall be classified in accordance with the *California Fire Code*.

[F] 415.10 Groups H-3 and H-4. Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the *California Fire Code*.

[F] 415.10.1 Flammable and combustible liquids. The storage, handling, processing and transporting of flammable and combustible liquids in Group H-3 occupancies shall be in accordance with Section 415.9.1.

[F] 415.10.2 Gas rooms. Where gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 415.10.3 Floors in storage rooms. Floors in storage areas for corrosive liquids and highly toxic or toxic materials shall be of liquid-tight, noncombustible construction.

[F] 415.10.4 Separation of highly toxic solids and liquids. Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by not less than 1-hour fire barriers constructed in accordance with

Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 415.11 Group H-5. In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Sections 415.11.1 through 415.11.12 and the *California Fire Code*.

[F] 415.11.1 Fabrication areas. Fabrication areas shall comply with Sections 415.11.1.1 through 415.11.1.8.

[F] 415.11.1.1 Hazardous materials. Hazardous materials and hazardous production materials (HPM) shall comply with Sections 415.11.1.1.1 and 415.11.1.1.2.

[F] 415.11.1.1.1 Aggregate quantities. The aggregate quantities of hazardous materials stored and used in a single fabrication area shall not exceed the quantities set forth in Table 415.11.1.1.1.

Exception: The quantity limitations for any hazard category in Table 415.11.1.1.1 shall not apply where the fabrication area contains quantities of hazardous materials not exceeding the maximum allowable quantities per control area established by Tables 307.1(1) and 307.1(2).

[F] 415.11.1.1.2 Hazardous production materials. The maximum quantities of hazardous production materials (HPM) stored in a single fabrication area shall not exceed the maximum allowable quantities per control area established by Table 307.1(1) and Table 307.1(2).

[F] 415.11.1.2 Separation. Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.11.1.1.1, shall be separated from each other, from corridors and from other parts of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

Exceptions:

1. Doors within such fire barrier walls, including doors to corridors, shall be only self-closing fire door assemblies having a fire protection rating of not less than $\frac{3}{4}$ hour.
2. Windows between fabrication areas and corridors are permitted to be fixed glazing listed and labeled for a fire protection rating of not less than $\frac{3}{4}$ hour in accordance with Section 716.

[F] 415.11.1.3 Location of occupied levels. Occupied levels of fabrication areas shall be located at or above the first story above grade plane.

[F] 415.11.1.4 Floors. Except for surfacing, floors within fabrication areas shall be of noncombustible construction.

Openings through floors of fabrication areas are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such fabrication areas (see Section 415.11.1.5).

Floors forming a part of an occupancy separation shall be liquid tight.

[F] TABLE 415.11.1.1.1
 QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5^a

HAZARD CATEGORY		SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ NTP/square foot)
PHYSICAL-HAZARD MATERIALS				
Combustible dust		Note b	Not Applicable	Not Applicable
Combustible fiber	Loose	Note b	Not Applicable	Not Applicable
	Baled	Notes b and c		
Combustible liquid	II	Not Applicable	0.01	Not Applicable
	IIIA		0.02	
	IIIB		Not Limited	
Combination Class	I, II and IIIA		0.04	
Cryogenic gas	Flammable	Not Applicable	Not Applicable	Note d
	Oxidizing			1.25
Explosives		Note b	Note b	Note b
Flammable gas	Gaseous	Not Applicable	Not Applicable	Note d
	Liquefied			Note d
Flammable liquid	IA	Not Applicable	0.0025	Not Applicable
	IB		0.025	
	IC		0.025	
Combination Class	IA, IB and IC		0.025	
Combination Class	I, II and IIIA		0.04	
Flammable solid		0.001	Not Applicable	Not Applicable
Organic peroxide	Unclassified detonable	Note b	Not Applicable	Not Applicable
	Class I	Note b		
	Class II	0.025		
	Class III	0.1		
	Class IV	Not Limited		
	Class V	Not Limited		
Oxidizing gas	Gaseous	Not Applicable	Not Applicable	1.25
	Liquefied			1.25
Combination of gaseous and liquefied				1.25
Oxidizer	Class 4	Note b	Note b	Not Applicable
	Class 3	0.003	0.03	
	Class 2	0.003	0.03	
	Class 1	0.003	0.03	
Combination Class	1, 2, 3	0.003	0.03	
Pyrophoric materials		0.01	0.00125	Notes d and e
Unstable (reactive)	Class 4	Note b	Note b	Note b
	Class 3	0.025	0.0025	Note b
	Class 2	0.1	0.01	Note b
	Class 1	Not Limited	Not Limited	Not Limited
Water reactive	Class 3	0.01 ^f	0.00125	Not Applicable
	Class 2	0.25	0.025	
	Class 1	Not Limited	Not Limited	
HEALTH-HAZARD MATERIALS				
Corrosives		Not Limited	Not Limited	Not Limited
Highly toxic		Not Limited	Not Limited	Note d
Toxics		Not Limited	Not Limited	Note d

For SI: 1 pound = 0.454 kg, 1 pound per square foot = 4.882 kg/m², 1 gallon per square foot = 40.7 L/m², 1 cubic foot @ NTP/square foot = 0.305 m³ @ NTP/m², 1 cubic foot = 0.02832 m³.

- a. Hazardous materials within piping shall not be included in the calculated quantities.
- b. Quantity of hazardous materials in a single fabrication shall not exceed the maximum allowable quantities per control area in Tables 307.1(1) and 307.1(2).
- c. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- d. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed the greater of 0.2 cubic feet at NTP/square foot or 9,000 cubic feet at NTP.
- e. The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.6.5.
- f. Quantity of Class 3 water-reactive solids in a single tool shall not exceed 1 pound.

[F] 415.11.1.5 Shafts and openings through floors. Elevator hoistways, vent shafts and other openings through floors shall be enclosed where required by Sections 712 and 713. Mechanical, duct and piping penetrations within a fabrication area shall not extend through more than two floors. The annular space around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The fabrication area, including the areas through which the ductwork and piping extend, shall be considered to be a single conditioned environment.

[F] 415.11.1.6 Ventilation. Mechanical exhaust ventilation at the rate of not less than 1 cubic foot per minute per square foot [$0.0051 \text{ m}^3/(\text{s} \times \text{m}^2)$] of floor area shall be provided throughout the portions of the fabrication area where HPM are used or stored. The exhaust air duct system of one fabrication area shall not connect to another duct system outside that fabrication area within the building.

A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

Two or more operations at a workstation shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711 shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls.

Fire dampers shall not be installed in exhaust ducts.

[F] 415.11.1.7 Transporting hazardous production materials to fabrication areas. HPM shall be transported to fabrication areas through enclosed piping or tubing systems that comply with Section 415.11.7, through service corridors complying with Section 415.11.3, or in corridors as permitted in the exception to Section 415.11.2. The handling or transporting of HPM within service corridors shall comply with the *California Fire Code*.

[F] 415.11.1.8 Electrical. Electrical equipment and devices within the fabrication area shall comply with the *California Electrical Code*. The requirements for hazardous locations need not be applied where the average air change is not less than four times that set forth in Section 415.11.1.6 and where the number of air changes at any location is not less than three times that required by Section 415.11.1.6. The use of recirculated air shall be permitted.

[F] 415.11.1.8.1 Workstations. Workstations shall not be energized without adequate exhaust ventilation. See Section 415.11.1.6 for workstation exhaust ventilation requirements.

[F] 415.11.2 Corridors. Corridors shall comply with Chapter 10 and shall be separated from fabrication areas as specified in Section 415.11.1.2. Corridors shall not contain HPM and shall not be used for transporting such materials except through closed piping systems as provided in Section 415.11.7.4.

Exception: Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing corridors, subject to the following conditions:

1. Nonproduction HPM is allowed to be transported in corridors if utilized for maintenance, lab work and testing.
2. Where existing fabrication areas are altered or modified, HPM is allowed to be transported in existing corridors, subject to the following conditions:
 - 2.1. Corridors. Corridors adjacent to the fabrication area where the alteration work is to be done shall comply with Section 1020 for a length determined as follows:
 - 2.1.1. The length of the common wall of the corridor and the fabrication area; and
 - 2.1.2. For the distance along the corridor to the point of entry of HPM into the corridor serving that fabrication area.
 - 2.2. Emergency alarm system. There shall be an emergency telephone system, a local manual alarm station or other approved alarm-initiating device within corridors at not more than 150-foot (45 720 mm) intervals and at each exit and doorway. The signal shall be relayed to an approved central, proprietary or remote station service or the emergency control station and shall initiate a local audible alarm.
 - 2.3. Pass-throughs. Self-closing doors having a fire protection rating of not less than 1 hour shall separate pass-throughs from existing corridors. Pass-throughs shall be constructed as required for the corridors and protected by an approved automatic sprinkler system.

[F] 415.11.3 Service corridors. Service corridors within a Group H-5 occupancy shall comply with Sections 415.11.3.1 through 415.11.3.4.

[F] 415.11.3.1 Use conditions. Service corridors shall be separated from corridors as required by Section 415.11.1.2. Service corridors shall not be used as a required corridor.

[F] 415.11.3.2 Mechanical ventilation. Service corridors shall be mechanically ventilated as required by Section 415.11.1.6 or at not less than six air changes per hour.

[F] **415.11.3.3 Means of egress.** The distance of travel from any point in a service corridor to an exit, exit access corridor or door into a fabrication area shall be not greater than 75 feet (22 860 mm). Dead ends shall be not greater than 4 feet (1219 mm) in length. There shall be not less than two exits, and not more than one-half of the required means of egress shall require travel into a fabrication area. Doors from service corridors shall swing in the direction of egress travel and shall be self-closing.

[F] **415.11.3.4 Minimum width.** The clear width of a service corridor shall be not less than 5 feet (1524 mm), or 33 inches (838 mm) wider than the widest cart or truck used in the service corridor, whichever is greater.

[F] **415.11.4 Emergency alarm system.** Emergency alarm systems shall be provided in accordance with this section and Sections 415.5.1 and 415.5.2. The maximum allowable quantity per control area provisions shall not apply to emergency alarm systems required for HPM.

[F] **415.11.4.1 Service corridors.** An emergency alarm system shall be provided in service corridors, with not fewer than one alarm device in each service corridor.

[F] **415.11.4.2 Corridors and interior exit stairways and ramps.** Emergency alarms for corridors, interior exit stairways and ramps and exit passageways shall comply with Section 415.5.2.

[F] **415.11.4.3 Liquid storage rooms, HPM rooms and gas rooms.** Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with Section 415.5.1.

[F] **415.11.4.4 Alarm-initiating devices.** An approved emergency telephone system, local alarm manual pull stations, or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] **415.11.4.5 Alarm signals.** Activation of the emergency alarm system shall sound a local alarm and transmit a signal to the emergency control station.

[F] **415.11.5 Storage of hazardous production materials.** Storage of hazardous production materials (HPM) in fabrication areas shall be within approved or listed storage cabinets or gas cabinets or within a workstation. The storage of HPM in quantities greater than those specified in Section 5004.2 of the *California Fire Code* shall be in liquid storage rooms, HPM rooms or gas rooms as appropriate for the materials stored. The storage of other hazardous materials shall be in accordance with other applicable provisions of this code and the *California Fire Code*.

[F] **415.11.6 HPM rooms, gas rooms, liquid storage room construction.** HPM rooms, gas rooms and liquid shall be constructed in accordance with Sections 415.11.6.1 through 415.11.6.9.

[F] **415.11.6.1 HPM rooms and gas rooms.** HPM rooms and gas rooms shall be separated from other areas by fire barriers constructed in accordance with

Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 2 hours where the area is 300 square feet (27.9 m²) or more and not less than 1 hour where the area is less than 300 square feet (27.9 m²).

[F] **415.11.6.2 Liquid storage rooms.** Liquid storage rooms shall be constructed in accordance with the following requirements:

1. Rooms greater than 500 square feet (46.5 m²) in area, shall have not fewer than one exterior door approved for fire department access.
2. Rooms shall be separated from other areas by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than 1 hour for rooms up to 150 square feet (13.9 m²) in area and not less than 2 hours where the room is more than 150 square feet (13.9 m²) in area.
3. Shelving, racks and wainscoting in such areas shall be of noncombustible construction or wood of not less than 1-inch (25 mm) nominal thickness or fire-retardant-treated wood complying with Section 2303.2.
4. Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

[F] **415.11.6.3 Floors.** Except for surfacing, floors of HPM rooms and liquid storage rooms shall be of noncombustible liquid-tight construction. Raised grating over floors shall be of noncombustible materials.

[F] **415.11.6.4 Location.** Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have not fewer than one exterior wall and such wall shall be not less than 30 feet (9144 mm) from lot lines, including lot lines adjacent to public ways.

[F] **415.11.6.5 Explosion control.** Explosion control shall be provided where required by Section 414.5.1.

[F] **415.11.6.6 Exits.** Where two exits are required from HPM rooms, liquid storage rooms and gas rooms, one shall be directly to the outside of the building.

[F] **415.11.6.7 Doors.** Doors in a fire barrier wall, including doors to corridors, shall be self-closing fire door assemblies having a fire protection rating of not less than ³/₄ hour.

[F] **415.11.6.8 Ventilation.** Mechanical exhaust ventilation shall be provided in liquid storage rooms, HPM rooms and gas rooms at the rate of not less than 1 cubic foot per minute per square foot (0.044 L/s/m²) of floor area or six air changes per hour.

Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and direct the exhaust ventilation to an exhaust system.

[F] 415.11.6.9 Emergency alarm system. An approved emergency alarm system shall be provided for HPM rooms, liquid storage rooms and gas rooms.

Emergency alarm-initiating devices shall be installed outside of each interior exit door of such rooms.

Activation of an emergency alarm-initiating device shall sound a local alarm and transmit a signal to the emergency control station.

An approved emergency telephone system, local alarm manual pull stations or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] 415.11.7 Piping and tubing. Hazardous production materials piping and tubing shall comply with this section and ASME B31.3.

[F] 415.11.7.1 HPM having a health-hazard ranking of 3 or 4. Systems supplying HPM liquids or gases having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections, to the systems that are within a ventilated enclosure if the material is a gas, or an approved method of drainage or containment is provided for the connections if the material is a liquid.

[F] 415.11.7.2 Location in service corridors. Hazardous production materials supply piping or tubing in service corridors shall be exposed to view.

[F] 415.11.7.3 Excess flow control. Where HPM gases or liquids are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103.4 kPa), excess flow control shall be provided. Where the piping originates from within a liquid storage room, HPM room or gas room, the excess flow control shall be located within the liquid storage room, HPM room or gas room. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

[F] 415.11.7.4 Installations in corridors and above other occupancies. The installation of HPM piping and tubing within the space defined by the walls of corridors and the floor or roof above, or in concealed spaces above other occupancies, shall be in accordance with Sections 415.11.7.1 through 415.11.7.3 and the following conditions:

1. Automatic sprinklers shall be installed within the space unless the space is less than 6 inches (152 mm) in the least dimension.
2. Ventilation not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. Where the piping or tubing is used to transport HPM liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an approved location. The 1-hour enclosure shall not be used as part of the receptor.

4. HPM supply piping and tubing and nonmetallic waste lines shall be separated from the corridor and from occupancies other than Group H-5 by fire barriers or by an approved method or assembly that has a fire-resistance rating of not less than 1 hour. Access openings into the enclosure shall be protected by approved fire-protection-rated assemblies.

5. Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:

5.1. At branch connections into the fabrication area.

5.2. At entries into corridors.

Exception: Transverse crossings of the corridors by supply piping that is enclosed within a ferrous pipe or tube for the width of the corridor need not comply with Items 1 through 5.

[F] 415.11.7.5 Identification. Piping, tubing and HPM waste lines shall be identified in accordance with ANSI A13.1 to indicate the material being transported.

[F] 415.11.8 Gas detection systems. A gas detection system complying with Section 916 shall be provided for HPM gases where the physiological warning threshold level of the gas is at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases in accordance with Sections 415.11.8.1 through 415.11.8.2.

[F] 415.11.8.1 Where required. A gas detection system shall be provided in the areas identified in Sections 415.11.8.1.1 through 415.11.8.1.4.

[F] 415.11.8.1.1 Fabrication areas. A gas detection system shall be provided in fabrication areas where HPM gas is used in the fabrication area.

[F] 415.11.8.1.2 HPM rooms. A continuous gas detection system shall be provided in HPM rooms where HPM gas is used in the room.

[F] 415.11.8.1.3 Gas cabinets, exhausted enclosures and gas rooms. A gas detection system shall be provided in gas cabinets and exhausted enclosures for HPM gas. A gas detection system shall be provided in gas rooms where HPM gases are not located in gas cabinets or exhausted enclosures.

[F] 415.11.8.1.4 Corridors. Where HPM gases are transported in piping placed within the space defined by the walls of a corridor and the floor or roof above the corridor, a gas detection system shall be provided where piping is located and in the corridor.

Exception: A gas detection system is not required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

[F] 415.11.8.2 Gas detection system operation. The gas detection system shall be capable of monitoring the room, area or equipment in which the HPM gas is located at or below all the following gas concentrations:

1. Immediately dangerous to life and health (IDLH) values where the monitoring point is within an exhausted enclosure, ventilated enclosure or gas cabinet.
2. Permissible exposure limit (PEL) levels where the monitoring point is in an area outside an exhausted enclosure, ventilated enclosure or gas cabinet.
3. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 25 percent of the lower flammable limit (LFL) where the monitoring is within or outside an exhausted enclosure, ventilated enclosure or gas cabinet.
4. Except as noted in this section, monitoring for highly toxic and toxic gases shall also comply with Chapter 60 of the *California Fire Code*.

[F] 415.11.8.2.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to the emergency control station when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

[F] 415.11.8.2.2 Shutoff of gas supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception: Where the gas detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure

of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

[F] 415.11.9 Manual fire alarm system. An approved manual fire alarm system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station. The fire alarm system shall be designed and installed in accordance with Section 907.

[F] 415.11.10 Emergency control station. An emergency control station shall be provided in accordance with Sections 415.11.10.1 through 415.11.10.3.

[F] 415.11.10.1 Location. The emergency control station shall be located on the premises at an approved location outside the fabrication area.

[F] 415.11.10.2 Staffing. Trained personnel shall continuously staff the emergency control station.

[F] 415.11.10.3 Signals. The emergency control station shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. Automatic sprinkler system alarm and monitoring systems.
2. Manual fire alarm systems.
3. Emergency alarm systems.
4. Gas detection systems.
5. Smoke detection systems.
6. Emergency power system.
7. Automatic detection and alarm systems for pyrophoric liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *California Fire Code*.
8. Exhaust ventilation flow alarm devices for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in Section 2705.2.3.4 of the *California Fire Code*.

[F] 415.11.11 Emergency power system. An emergency power system shall be provided in Group H-5 occupancies in accordance with Section 2702. The emergency power system shall supply power automatically to the electrical systems specified in Section 415.11.11.1 when the normal electrical supply system is interrupted.

[F] 415.11.11.1 Required electrical systems. Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust ventilation systems.
2. HPM gas cabinet ventilation systems.
3. HPM exhausted enclosure ventilation systems.
4. HPM gas room ventilation systems.

5. HPM gas detection systems.
6. Emergency alarm systems.
7. Manual and automatic fire alarm systems.
8. Automatic sprinkler system monitoring and alarm systems.
9. Automatic alarm and detection systems for pyrophoric liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *California Fire Code*.
10. Flow alarm switches for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in Section 2705.2.3.4 of the *California Fire Code*.
11. Electrically operated systems required elsewhere in this code or in the *California Fire Code* applicable to the use, storage or handling of HPM.

[F] 415.11.11.2 Exhaust ventilation systems. Exhaust ventilation systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

[F] 415.11.12 Automatic sprinkler system protection in exhaust ducts for HPM. An approved automatic sprinkler system shall be provided in exhaust ducts conveying gases, vapors, fumes, mists or dusts generated from HPM in accordance with Sections 415.11.12.1 through 415.11.12.3 and the *California Mechanical Code*.

[F] 415.11.12.1 Metallic and noncombustible nonmetallic exhaust ducts. An approved automatic sprinkler system shall be provided in metallic and noncombustible nonmetallic exhaust ducts where all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable gases, vapors or fumes.

[F] 415.11.12.2 Combustible nonmetallic exhaust ducts. Automatic sprinkler system protection shall be provided in combustible nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than 10 inches (254 mm).

Exception: Ducts need not be provided with automatic sprinkler protection as follows:

1. Ducts listed or approved for applications without automatic sprinkler system protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

[F] 415.11.12.3 Automatic sprinkler locations. Sprinkler systems shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

415.12 Group H occupancies located on the 11th story and above.

415.12.1 Fire – smoke barrier. Any story containing a Group H occupancy on the 11th story and above shall be subdivided by a fire-smoke barrier constructed as a fire barrier having a fire resistance rating of not less than 2 hours and shall also comply with the smoke barrier requirements of Section 710. The 2-hour fire-smoke barrier shall be in accordance with Sections 415.12.1.1 through 415.12.1.5.

415.12.1.1 The 2-hour fire-smoke barrier shall be continuous from exterior wall to exterior wall.

415.12.1.2 The fire-smoke barrier shall divide the story so that the square footage on each side of the 2-hour fire-smoke barrier is not less than 30 percent of the total floor area.

415.12.1.3 A minimum of one door opening shall be provided in the 2-hour fire-smoke barrier for emergency access.

415.12.1.4 Each side of the 2-hour fire-smoke barrier shall be designed as a separate smoke zone designed in accordance with Section 909.5.

415.12.1.5 The area on each side of the 2-hour fire-smoke barrier shall be served by a minimum of one exit enclosure in accordance with Section 1022.

415.13 Elevators and elevator lobbies on the 11th story and above. Any story containing a Group H occupancy on the 11th story and above shall be provided with elevators and elevator lobbies in accordance with Sections 415.13.1 through 415.13.3.

415.13.1 An elevator that serves every story of the building shall be provided on each side of the 2-hour fire-smoke barrier.

415.13.2 An elevator lobby shall be provided on each side of the 2-hour fire-smoke barrier at each floor in accordance with Section 708.4. Exceptions to 708.4 shall not apply.

415.13.3 The elevator and its associated elevator lobbies and elevator machine rooms shall be pressurized in accordance with Section 909.5.

SECTION 416

SPRAY APPLICATION OF FLAMMABLE FINISHES

[F] 416.1 General. The provisions of this section shall apply to the construction, installation and use of buildings and structures, or parts thereof, for the spray application of flammable finishes. Operations and equipment shall comply with the *California Fire Code*.

[F] 416.2 Spray rooms. Spray rooms shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Floors shall be water-proofed and drained in an approved manner.

[F] 416.2.1 Construction. Walls and ceilings of spray rooms shall be constructed of noncombustible materials or

the interior surface shall be completely covered with noncombustible materials. Aluminum shall not be used.

[F] 416.2.2 Surfaces. The interior surfaces of spray rooms shall be smooth and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so designed to confine residues within the room.

[F] 416.2.3 Ventilation. Mechanical ventilation and interlocks with the spraying operation shall be in accordance with the *California Fire Code* and *California Mechanical Code*.

[F] 416.3 Spraying spaces. Spraying spaces shall be ventilated with an exhaust system to prevent the accumulation of flammable mist or vapors in accordance with the *California Mechanical Code*. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable vapors.

[F] 416.3.1 Surfaces. The interior surfaces of spraying spaces shall be smooth; shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning; and shall be so designed to confine residues within the spraying space. Aluminum shall not be used.

[F] 416.4 Spray booths. Spray booths shall be designed, constructed and operated in accordance with the *California Fire Code*.

[F] 416.5 Fire protection. An automatic sprinkler system or fire-extinguishing system shall be provided in all spray rooms and spray booths, and shall be installed in accordance with Chapter 9.

SECTION 417 DRYING ROOMS

[F] 417.1 General. A drying room or dry kiln installed within a building shall be constructed entirely of approved noncombustible materials or assemblies of such materials regulated by the approved rules or as required in the general and specific sections of this chapter for special occupancies and where applicable to the general requirements of the *California Mechanical Code*.

[F] 417.2 Piping clearance. Overhead heating pipes shall have a clearance of not less than 2 inches (51 mm) from combustible contents in the dryer.

[F] 417.3 Insulation. Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with 1/4-inch (6.4 mm) insulating mill board or other approved equivalent insulation.

[F] 417.4 Fire protection. Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4, shall be protected by an approved automatic fire-extinguishing system complying with the provisions of Chapter 9.

SECTION 418 ORGANIC COATINGS

[F] 418.1 Building features. Manufacturing of organic coatings shall be done only in buildings that do not have pits or basements.

[F] 418.2 Location. Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

[F] 418.3 Process mills. Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a detached building or noncombustible structure.

[F] 418.4 Tank storage. Storage areas for flammable and combustible liquid tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 418.5 Nitrocellulose storage. Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 418.6 Finished products. Storage rooms for finished products that are flammable or combustible liquids shall be separated from the processing area by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

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SECTION 419 ARTIFICIAL DECORATIVE VEGETATION

[F] 419.1 Artificial decorative vegetation. Artificial decorative vegetation exceeding 6 feet (1830 mm) in height and permanently installed outdoors within 5 feet (1524 mm) of a building, or on the roof of a building, shall comply with Section 321.1 of the *California Fire Code*.

Exception: Artificial decorative vegetation located more than 30 feet (9144 mm) from the exterior wall of a building.

SECTION 420 GROUPS R-1, R-2, R-2.1, R-2.2, R-3, R-3.1 AND R-4

420.1 General. Occupancies in Groups R-1, R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4 shall comply with the provisions of Sections 420.1 through 420.11 and other applicable provisions of this code.

420.2 Separation walls. Walls separating dwelling units in the same building, walls separating sleeping units in the same building and walls separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as fire partitions in accordance with Section 708.

420.3 Horizontal separation. Floor assemblies separating dwelling units in the same buildings, floor assemblies separating sleeping units in the same building and floor assemblies separating dwelling or sleeping units from other occupancies contiguous to them in the same building shall be constructed as horizontal assemblies in accordance with Section 711.

[F] 420.4 Automatic sprinkler system. Group R occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.8. *Group R-2.2 shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Group R-2.1 occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.6. Quick-response or residential automatic sprinklers shall be installed in accordance with Section 903.3.2.*

[F] 420.5 Fire alarm systems and smoke alarms. Fire alarm systems and smoke alarms shall be provided in Group R-1, R-2 and R-2.1 occupancies in accordance with Sections 907.2.6, 907.2.8 and 907.2.9 and 907.2.10, respectively. Single- or multiple-station smoke alarms shall be provided in Groups R-2, R-2.1, R-3 and R-4 in accordance with Section 907.2.11. *Group R-2.2 shall be equipped throughout with an automatic fire alarm systems per 907.2.9.2 and shall have a manual fire alarm pull station at the 24-hour staff watch office.*

420.6 Smoke barriers in Group R-2.1. Smoke barriers shall be provided in Group R-2.1 to subdivide every story used by persons receiving care, treatment or sleeping and to provide other stories with an occupant load of 50 or more persons, into not fewer than two smoke compartments. Such stories shall be divided into smoke compartments with an area of not more than 22,500 square feet (2092 m²) and the distance of travel from any point in a smoke compartment to a smoke barrier door shall not exceed 200 feet (60 960 mm). The smoke barrier shall be in accordance with Section 709.

420.6.1 Smoke barrier in Group R-2.2. *Occupancies in Group R-2.2 shall have smoke barriers complying with Sections 709 to divide every story occupied by residents for sleeping, into no fewer than two smoke compartments.*

Exception: *Spaces having a direct exit to a public way.*

420.6.2 Refuge area. Refuge areas shall be provided within each smoke compartment. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining smoke compartment. Where a smoke compartment is adjoined by two or more smoke compartments, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 15 net square feet (1.4 m²) for each care recipient.
2. Not less than 6 net square feet (0.56 m²) for other occupants.

Areas or spaces permitted to be included in the calculation of the refuge area are corridors, lounge or dining areas and other low-hazard areas.

420.7 Reserved.

420.8 Reserved.

420.9 Domestic cooking appliances. In Group I-1 occupancies, installation of cooking appliance used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the *California Mechanical Code* shall be provided over cooktops or ranges.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

Exceptions:

1. Cooking facilities provided within care recipients' individual dwelling units are not required to comply with this section.
2. Cooktops and ranges used for care-recipient training or nutritional counseling are not required to comply with Item 3 of this section

420.10 Group R cooking facilities. In Group R occupancies, cooking appliances used for domestic cooking operations shall be in accordance with Section 917.2 of the *California Mechanical Code*.

420.11 Group R-2 dormitory cooking facilities. Domestic cooking appliances for use by residents of Group R-2 college dormitories shall be in accordance with Sections 420.11.1 and 420.11.2.

420.11.1 Cooking appliances. Where located in Group R-2 college dormitories, domestic cooking appliances for use by residents shall be in compliance with all of the following:

1. The types of domestic cooking appliances shall be limited to ovens, cooktops, ranges, warmers, coffee makers and microwaves.
2. Domestic cooking appliances shall be limited to approved locations.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. Cooktops and ranges shall be provided with a domestic cooking hood installed and constructed in accordance with Section 505 of the *California Mechanical Code*. *Kitchen range hoods shall also*

be rated for sound and meet field verification requirements in the California Energy Code for low-rise and high-rise residential buildings.

420.11.2 Cooking appliances in sleeping rooms. Cooktops, ranges and ovens shall not be installed or used in sleeping rooms.

|| **420.12 [HCD 1] Construction waste management.** Recycle and/or salvage for reuse a minimum of 65 percent of the non-hazardous construction and demolition waste in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.

|| **420.13 Special provisions for residential hotels. [HCD 1 & HCD 1-AC]**

|| **420.13.1 Locking mail receptacles.** A locking mail receptacle for each residential unit shall be provided in all residential hotels pursuant to the requirements specified in Health and Safety Code Section 17958.3.

> || **420.14 [HCD 1] Electric vehicle (EV) charging for new construction.** Newly constructed Group R-1, R-2 and R-3 buildings shall meet requirements for electric vehicle charging in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.

420.15 Licensed 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy. See Section 435 for Special Provisions for licensed 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy.

420.16 Electronic monitoring. In Group R-2.2 occupancies there shall be continuous electronic supervision via CCTV system camera coverage and monitoring the following areas: corridors, storage rooms over 100 square feet, central kitchen and main entryway of the facility.

SECTION 421 HYDROGEN FUEL GAS ROOMS

[F] **421.1 General.** Where required by the California Fire Code, hydrogen fuel gas rooms shall be designed and constructed in accordance with Sections 421.1 through 421.7.

[F] **421.2 Location.** Hydrogen fuel gas rooms shall not be located below grade.

[F] **421.3 Design and construction.** Hydrogen fuel gas rooms not classified as Group H shall be separated from other areas of the building in accordance with Section 509.1.

[F] **421.3.1 Pressure control.** Hydrogen fuel gas rooms shall be provided with a ventilation system designed to maintain the room at a negative pressure in relation to surrounding rooms and spaces.

[F] **421.3.2 Windows.** Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted where in accordance with Section 716.

[F] **421.4 Exhaust ventilation.** Hydrogen fuel gas rooms shall be provided with mechanical exhaust ventilation in accordance with the applicable provisions of Section 502.16.1 of the California Mechanical Code.

[F] **421.5 Gas detection system.** Hydrogen fuel gas rooms shall be provided with a gas detection system that complies with Sections 421.5.1, 421.5.2, and 916.

[F] **421.5.1 System activation.** Activation of a gas detection alarm shall result in both of the following:

1. Initiation of distinct audible and visible alarm signals both inside and outside of the hydrogen fuel gas room.
2. Automatic activation of the mechanical exhaust ventilation system.

[F] **421.5.2 Failure of the gas detection system.** Failure of the gas detection system shall automatically activate the mechanical exhaust ventilation system, stop hydrogen generation, and cause a trouble signal to sound at an approved location.

[F] **421.6 Explosion control.** Explosion control shall be provided where required by Section 414.5.1.

[F] **421.7 Standby power.** Mechanical ventilation and gas detection systems shall be provided with a standby power system in accordance with Section 2702.

SECTION 422 AMBULATORY CARE FACILITIES

422.1 General. Occupancies classified as ambulatory care facilities shall comply with the provisions of Sections 422.1 through 422.7 and other applicable provisions of this code. [For OSHPD 3] For clinics licensed by California Department of Public Health also refer to Section 1226.2.

422.2 Separation. Ambulatory care facilities where the potential for four or more care recipients are to be incapable of self-preservation at any time shall be separated from adjacent spaces, corridors or tenants with a fire partition installed in accordance with Section 708.

422.3 Smoke compartments. Where the aggregate area of one or more ambulatory care facilities is greater than 10,000 square feet (929 m²) on one story, the story shall be provided with a smoke barrier to subdivide the story into not fewer than two smoke compartments. The area of any one such smoke compartment shall be not greater than 22,500 square feet (2092 m²). The distance of travel from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet (60 960 mm). The smoke barrier shall be installed in accordance with Section 709 with the exception that smoke barriers shall be continuous from outside wall to an outside wall, a floor to a floor, or from a smoke barrier to a smoke barrier or a combination thereof.

422.3.1 Means of egress. Where ambulatory care facilities require smoke compartmentation in accordance with Section 422.3, the fire safety evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support a defend-in-place emergency response in accordance with Sections 403 and 404 of the California Fire Code.

422.3.2 Refuge area. Not less than 30 net square feet (2.8 m²) for each nonambulatory care recipient shall be

provided within the aggregate area of corridors, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each smoke compartment. Each occupant of an ambulatory care facility shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

422.3.3 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.

[F] **422.4 Automatic sprinkler systems.** Automatic sprinkler systems shall be provided for ambulatory care facilities in accordance with Section 903.2.2.

[F] **422.5 Fire alarm systems.** A fire alarm system shall be provided for ambulatory care facilities in accordance with Section 907.2.2.

[F] **422.6 Electrical systems.** In ambulatory care facilities, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and *California Electrical Code Article 517*.

422.7 Domestic cooking. Installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with the *California Mechanical Code* shall be provided over cooktops or ranges.
3. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
4. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
5. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

SECTION 423 STORM SHELTERS

423.1 General. This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as rooms or spaces within buildings for the purpose of providing protection from storms that produce high winds, such as tornadoes and hurricanes, during the storm. This section specifies where storm shelters are required and provides requirements for the design and construction of storm shelters. Design of facilities for use as emergency shelters after the storm are outside the scope of ICC 500 and shall comply with Table 1604.5 as a *Risk Category IV Structure*.

423.2 Construction. Storm shelters shall be constructed in accordance with this code and ICC 500 and shall be designated as hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Buildings or structures that are also designated as emergency shelters shall also comply with Table 1604.5 as *Risk Category IV structures*.

Any storm shelter not required by this section shall be permitted to be constructed, provided that such structures meet the requirements of this code and ICC 500.

423.3 Occupancy classification. The occupancy classification for a storm shelter shall be determined in accordance with this section.

423.3.1 Dedicated storm shelters. A facility designed to be occupied solely as a storm shelter shall be classified as Group A-3 for the determination of requirements other than those covered in ICC 500.

Exceptions:

1. The occupancy category for dedicated storm shelters with an occupant load of fewer than 50 persons as determined in accordance with ICC 500 shall be in accordance with Section 303.
2. The occupancy category for a dedicated residential storm shelter shall be the Group R occupancy served.

423.3.2 Storm shelters within host buildings. Where designated storm shelters are constructed as a room or space within a host building that will normally be occupied for other purposes, the requirements of this code for the occupancy of the building, or the individual rooms or spaces thereof, shall apply unless otherwise required by ICC 500.

423.4 Critical emergency operations. In areas where the shelter design wind speed for tornados in accordance with Figure 304.2(1) of ICC 500 is 250 mph, 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations shall comply with Table 1604.5 as a *Risk Category IV structure* and shall be provided with a storm shelter constructed in accordance with ICC 500.

423.5 Group E occupancies. In areas where the shelter design wind speed for tornados is 250 mph in accordance with Figure 304.2(1) of ICC 500, all Group E occupancies with an occupant load of 50 or more shall have a storm shelter constructed in accordance with ICC 500.

Exceptions:

1. Group E day care facilities.
2. Group E occupancies accessory to places of religious worship.
3. Buildings meeting the requirements for shelter design in ICC 500.

423.5.1 Required occupant capacity. The required occupant capacity of the storm shelter shall include all of the buildings on the site and shall be the greater of the following:

1. The total occupant load of the classrooms, vocational rooms and offices in the Group E occupancy.

- The occupant load of the largest indoor assembly space that is associated with the Group E occupancy.

Exceptions:

- Where a new building is being added on an existing Group E site, and where the new building is not of sufficient size to accommodate the required occupant capacity of the storm shelter for all of the buildings on the site, the storm shelter shall at a minimum accommodate the required occupant capacity for the new building.
- Where approved by the building official, the required occupant capacity of the shelter shall be permitted to be reduced by the occupant capacity of any existing storm shelters on the site.

423.5.2 Location. Storm shelters shall be located within the buildings they serve or shall be located where the maximum distance of travel from not fewer than one exterior door of each building to a door of the shelter serving that building does not exceed 1,000 feet (305 m).

SECTION 424 PLAY STRUCTURES

424.1 General. Play structures installed inside all occupancies covered by this code that exceed 10 feet (3048 mm) in height or 150 square feet (14 m²) in area shall comply with Sections 424.2 through 424.5.

424.2 Materials. Play structures shall be constructed of noncombustible materials or of combustible materials that comply with the following:

- Fire-retardant-treated wood complying with Section 2303.2.
- Light-transmitting plastics complying with Section 2606.
- Foam plastics (including the pipe foam used in soft-contained play equipment structures) having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source.
- Aluminum composite material (ACM) meeting the requirements of Class A interior finish in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended for use.
- Textiles and films complying with the fire propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
- Plastic materials used to construct rigid components of soft-contained play equipment structures (such as tubes, windows, panels, junction boxes, pipes, slides and decks) exhibiting a peak rate of heat release not exceeding 400 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation at a thickness of 6 mm.

- Ball pool balls, used in soft-contained play equipment structures, having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source. The minimum specimen test size shall be 36 inches by 36 inches (914 mm by 914 mm) by an average of 21 inches (533 mm) deep, and the balls shall be held in a box constructed of galvanized steel poultry netting wire mesh.
- Foam plastics shall be covered by a fabric, coating or film meeting the fire propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
- The floor covering placed under the play structure shall exhibit a Class I interior floor finish classification, as described in Section 804, when tested in accordance with ASTM E648 or NFPA 253.
- Interior finishes for structures exceeding 600 square feet (56 m²) in area or 10 feet (3048 mm) in height shall have a flame spread index not greater than that specified in Table 803.13 for the occupancy group and location designated. Interior wall and ceiling finish materials tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.1.1, shall be permitted to be used where a Class A classification in accordance with ASTM E84 or UL 723 is required.

[F] 424.3 Fire protection. Play structures shall be provided with the same level of approved fire suppression and detection devices required for other structures in the same occupancy.

424.4 Separation. Play structures shall have a horizontal separation from building walls, partitions and from elements of the means of egress of not less than 5 feet (1524 mm). Play structures shall have a horizontal separation from other play structures of not less than 20 feet (6090 mm).

424.5 Area limits. Play structures shall be not greater than 600 square feet (56 m²) in area, unless a special investigation, acceptable to the building official, has demonstrated adequate fire safety.

424.5.1 Design. Play structures exceeding 600 square feet (56 m²) in area or 10 feet (3048 mm) in height shall be designed in accordance with Chapter 16.

SECTION 425 HYPERBARIC FACILITIES

425.1 Hyperbaric facilities. Hyperbaric facilities shall meet the requirements contained in Chapter 14 of NFPA 99.

SECTION [F] 426 COMBUSTIBLE DUSTS, GRAIN PROCESSING AND STORAGE

[F] 426.1 General. The provisions of Sections 426.1.1 through 426.1.7 shall apply to buildings in which materials that produce combustible dusts are stored or handled. Buildings that store or

handle combustible dusts shall comply with the applicable provisions of the *California Fire Code*. Where required by the fire code official, NFPA 652 and the applicable provisions of NFPA 61, NFPA 85, NFPA 120, NFPA 484, NFPA 654, NFPA 655 and NFPA 664 shall apply.

[F] 426.1.1 Type of construction and height exceptions.

Buildings shall be constructed in compliance with the height, number of stories and area limitations specified in Sections 504 and 506; except that where erected of Type I or II construction, the heights and areas of grain elevators and similar structures shall be unlimited, and where of Type IV construction, the maximum building height shall be 65 feet (19 812 mm) and except further that, in isolated areas, the maximum building height of Type IV structures shall be increased to 85 feet (25 908 mm).

[F] 426.1.2 Grinding rooms. Every room or space occupied for grinding or other operations that produce combustible dusts in such a manner that the room or space is classified as a Group H-2 occupancy shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating of the enclosure shall be not less than 2 hours where the area is not more than 3,000 square feet (279 m²), and not less than 4 hours where the area is greater than 3,000 square feet (279 m²).

[F] 426.1.3 Conveyors. Conveyors, chutes, piping and similar equipment passing through the enclosures of rooms or spaces shall be constructed dirt tight and vapor tight, and be of approved noncombustible materials complying with Chapter 30.

[F] 426.1.4 Explosion control. Explosion control shall be provided as specified in the *California Fire Code*, or spaces shall be equipped with the equivalent mechanical ventilation complying with the *California Mechanical Code*.

[F] 426.1.5 Grain elevators. Grain elevators, malt houses and buildings for similar occupancies shall not be located within 30 feet (9144 mm) of interior lot lines or structures on the same lot, except where erected along a railroad right-of-way.

[F] 426.1.6 Coal pockets. Coal pockets located less than 30 feet (9144 mm) from interior lot lines or from structures on the same lot shall be constructed of not less than Type IB construction. Where more than 30 feet (9144 mm) from interior lot lines, or where erected along a railroad right-of-way, the minimum type of construction of such structures not more than 65 feet (19 812 mm) in building height shall be Type IV.

[F] 426.1.7 Tire rebuilding. Buffing operations shall be located in a room separated from the remainder of the building housing the tire rebuilding or tire recapping operation by a 1-hour fire barrier.

Exception: Buffing operations are not required to be separated where all of the following conditions are met:

1. Buffing operations are equipped with an approved continuous automatic water-spray system directed at the point of cutting action.

2. Buffing machines are connected to particle-collecting systems providing a minimum air movement of 1,500 cubic feet per minute (cfm) (0.71 m³/s) in volume and 4,500 feet per minute (fpm) (23 m/s) in-line velocity.
3. The collecting system shall discharge the rubber particles to an approved outdoor noncombustible or fire-resistant container, which is emptied at frequent intervals to prevent overflow.

SECTION 427 MEDICAL GAS SYSTEMS

[F] 427.1 General. Medical gases at health care-related facilities intended for patient or veterinary care shall comply with Sections 427.2 through 427.2.3 in addition to requirements of Chapter 53 of the *California Fire Code*.

[F] 427.2 Interior supply location. Medical gases shall be located in areas dedicated to the storage of such gases without other storage or uses. Where containers of medical gases in quantities greater than the permitted amount are located inside the buildings, they shall be located in a 1-hour exterior room, 1-hour interior room or a gas cabinet in accordance with Section 427.2.1, 427.2.2 or 427.2.3, respectively. Rooms or areas where medical gases are stored or used in quantities exceeding the maximum allowable quantity per control area as set forth in TABLE 307.1(1) and [F] TABLE 307.1(2) shall be in accordance with Group H occupancies.

[F] 427.2.1 One-hour exterior room. A 1-hour exterior room shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, with a fire-resistance rating of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be provided with self-closing smoke- and draft-control assemblies having a fire protection rating of not less than 1 hour. Rooms shall have not less than one exterior wall that is provided with not less than two vents. Each vent shall have a minimum free air opening of not less than 36 square inches (232 cm²) for each 1,000 cubic feet (28 m³) at normal temperature and pressure (NTP) of gas stored in the room and shall be not less than 72 square inches (465 cm²) in aggregate free opening area. One vent shall be within 6 inches (152 mm) of the floor and one shall be within 6 inches (152 mm) of the ceiling. Rooms shall be provided with not fewer than one automatic fire sprinkler to provide container cooling in case of fire.

[F] 427.2.2 One-hour interior room. Where an exterior wall cannot be provided for the room, a 1-hour interior room shall be provided and shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, with a fire-resistance rating of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be provided with self-closing smoke- and draft-control assemblies having a fire protec-

tion rating of not less than 1 hour. An automatic sprinkler system shall be installed within the room. The room shall be exhausted through a duct to the exterior. Supply and exhaust ducts shall be enclosed in a 1-hour rated shaft enclosure from the room to the exterior. Approved mechanical ventilation shall comply with the *California Mechanical Code* and be provided with a minimum rate of 1 cubic foot per minute per square foot ($0.00508 \text{ m}^3/\text{s}/\text{m}^2$) of the area of the room.

[F] 427.2.3 Gas cabinets. Gas cabinets shall be constructed in accordance with Section 5003.8.6 of the *California Fire Code* and shall comply with the following:

1. Cabinets shall be exhausted to the exterior through a dedicated exhaust duct system installed in accordance with Chapter 5 of the *California Mechanical Code*.
2. Supply and exhaust ducts shall be enclosed in a 1-hour rated shaft enclosure from the cabinet to the exterior. The average velocity of ventilation at the face of access ports or windows shall be not less than 200 feet per minute (1.02 m/s) with a minimum of 150 feet per minute (0.76 m/s) at any point of the access port or window.
3. Cabinets shall be provided with an automatic sprinkler system internal to the cabinet.

SECTION 435 SPECIAL PROVISIONS FOR LICENSED 24-HOUR CARE FACILITIES IN A GROUP R-2.1, R-3.1, R-4 [SFM]

435.1 Scope. The provisions of this section shall apply to 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy licensed by a governmental agency.

435.2 General. The provisions in this section shall apply in addition to general requirements in this code.

435.2.1 Restraint shall not be practiced in a Group R-2.1, R-3.1 or R-4 Occupancies.

Exception: Occupancies which meet all the requirements for a Group I-3 Occupancy.

435.2.2 Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to occupancies classified as Residential Facilities (RF) and Residential Care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating

to roof coverings for Residential Care Facilities for the Elderly.

Exception: Local regulations relating to roof coverings in facilities licensed as a residential care facility for the elderly (RCFE) per Health and Safety Code Section 13133.

435.3 Building height and area provisions.

435.3.1 Group R-2.1, R-3.1 and R-4 shall be constructed in accordance with Table 504.3.

435.3.2 Limitations six or less clients. Group R-3.1 occupancies where nonambulatory clients are housed above the first story, having more than two stories in height or having more than 3,000 square feet (279 m^2) of floor area above the first story shall not be of less than one-hour fire-resistance-rated construction throughout.

In Group R3.1 occupancies housing a bedridden client, the client sleeping room shall not be located above or below the first story.

Exception: Clients who become bedridden as a result of a temporary illness as defined in Health and Safety Code Sections 1566.45, 1568.0832 and 1569.72. A temporary illness is an illness, which persists for 14 days or less. A bedridden client may be retained in excess of the 14 days upon approval by the Department of Social Services and may continue to be housed on any story in a Group R-3.1 occupancy classified as a licensed residential facility.

Every licensee admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

435.3.3 Limitations seven or more clients. Group R-4 occupancies where nonambulatory clients are housed above the first story and there is more than 3,000 square feet (279 m^2) of floor area above the first story or housing not more than 16 clients above the first story shall be constructed of not less than one-hour fire-resistance-rated construction throughout.

435.3.4 Nonambulatory elderly clients. Group R-4 occupancies housing nonambulatory elderly clients shall be of not less than one-hour fire-resistance-rated construction throughout.

435.4 Type of construction provisions.

435.4.1 Group R-2.1, occupancies are not permitted in nonfire-resistance-rated construction, see Health and Safety Code Section 13131.5.

435.5 Fire-resistance-rated construction provisions.

435.5.1 Smoke barriers required. Group R-2.1 and R-4 occupancies licensed as a Residential Care Facility (RCF) with individual floor areas over 6,000 square feet (557 m^2) per floor, shall be provided with smoke barriers, constructed in accordance with Section 709.

Group R-2.1 occupancies housing bedridden clients shall be provided with smoke barriers constructed in accordance with Section 709 regardless of the number of clients.

When smoke barriers are required, the area within a smoke compartment shall not exceed 22,500 square feet (2090 m²) nor shall its travel distance exceed 200 feet (60 960 mm). Such smoke barriers shall divide the floor as equally as possible.

435.5.2 Smoke partitions. Group R-2.1 occupancies where smoke partitions are required, framing shall be covered with noncombustible materials having an approved thermal barrier with an index of not less than 15 in accordance with FM 4880, UL 1040, NFPA 286 or UL 1715.

435.5.3 Independent egress. At least two means of egress shall be provided from each smoke compartment created by smoke barriers. Means of egress may pass through adjacent compartments provided it does not return through the smoke compartment from which means of egress originated. Smoke compartments that do not contain an exit shall be provided with direct access to not less than two adjacent smoke compartments.

435.6 Interior finish provisions.

435.6.1 Interior wall and ceiling finish. Group R-3.1 occupancies housing a bedridden client shall comply with interior wall and ceiling finish requirements specified for Group I-2 occupancies in Table 803.13.

435.6.2 Safety padding. Padding material used on walls, floors and ceilings in Group I and R-2.1 occupancies shall be of an approved type tested in accordance with the procedures established by State Fire Marshal Standard 12-8-100, Room Fire Test for Wall and Ceiling Materials, California Code of Regulations, Title 24, Part 12.

435.7 Fire protection system provisions.

435.7.1 Automatic sprinkler systems in Group R-2.1, R-3.1 and R-4 occupancies. An automatic sprinkler system shall be installed where required in Section 903.

435.7.2 Fire alarm systems in Group R-2.1 and R-4 occupancies. An approved fire alarm system shall be installed where required in Section 907.

435.7.3 Smoke alarms in Groups R-2.1, R-3.1 and R-4 occupancies. Smoke alarms shall be installed where required in Section 907.2.11.2.

435.7.4 Hearing impaired. See Section 907.5.2.3.4.

435.8 Means of egress provisions.

435.8.1 General. In addition to the general means of egress requirements of Chapter 10, this section shall apply to Group R-2.1, R-3.1 and R-4 occupancies.

435.8.2 Number of exits.

435.8.2.1 Group R-2.1, R-3.1 and R-4 occupancies shall have a minimum of two exits.

Exception: Ancillary use areas or occupancies shall have egress as required by Section 1021.

435.8.3 Egress arrangements.

435.8.3.1 Egress through adjoining dwelling units shall not be permitted.

435.8.3.2 Group R-3.1 occupancies housing non-ambulatory clients. In a Group R-3.1 occupancy, bedrooms used by nonambulatory clients shall have access to at least one of the required exits which shall conform to one of the following:

1. Egress through a hallway or area into a bedroom in the immediate area which has an exit directly to the exterior and the corridor/hallway is constructed consistent with the dwelling unit interior walls. The hallway shall be separated from common areas by a solid wood door not less than 1³/₈ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9.
2. Egress through a hallway which has an exit directly to the exterior. The hallway shall be separated from the rest of the house by a wall constructed consistent with the dwelling unit interior walls and opening protected by a solid wood door not less than 1³/₈ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9.
3. Direct exit from the bedroom to the exterior shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed, doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).
4. Egress through an adjoining bedroom which exits to the exterior.

435.8.3.3 Group R-3.1 occupancies housing only one bedridden client. In Group R-3.1 occupancies housing a bedridden client and not provided with an approved automatic sprinkler system, all of the following shall apply:

1. In Group R-3.1 occupancies housing a bedridden client, a direct exit to the exterior of the residence shall be provided from the client sleeping room.
2. Doors to a bedridden client's sleeping room shall be of a self-closing, positive latching 1³/₈ inch solid wood door. Such doors shall be provided with a gasket so installed as to provide a seal where the door meets the jam on both sides and across the top. Doors shall be maintained self-closing or shall be automatic closing by actuation of a smoke alarm in accordance with Section 716.5.9.
3. Group R-3.1 occupancies housing a bedridden client, shall not have a night latch, dead bolt, security chain or any similar locking device installed on any interior door leading from a bedridden cli-

ent's sleeping room to any interior area such as a corridor, hallway and or general use areas of the residence in accordance with Chapter 10.

4. The exterior exit door to a bedridden client's sleeping room shall be operable from both the interior and exterior of the residence.
5. Every required exit doorway from a bedridden client sleeping room shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed in exit doorways, exit doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).

Note: A sliding glass door can be used as an exterior exit doorway as long as it is operable from the inside and outside and the clear width of the exit way is not less than 32 inches (813 mm).

435.8.3.4 Intervening rooms. A means of exit shall not pass through more than one intervening room. A means of egress shall not pass through kitchens, storerooms, closets, garages or spaces used for similar purposes.

Exception: Kitchens which do not form separate rooms by construction.

435.8.4 Corridors.

435.8.4.1 Unless specified by Section 435.8.4, corridors serving Group R-2.1 and Group R-4 occupancies shall comply with Section 1018.1.

In Group R-2.1 occupancies provided with fire sprinklers throughout and which are required to have rated corridors, door closers need not be installed on doors to client sleeping rooms.

435.8.4.2 The minimum clear width of a corridor shall be as follows:

1. Group R-2.1 occupancies shall have 60 inches (1524 mm) on floors housing nonambulatory clients and 44 inches (1118 mm) on floors housing only ambulatory clients.
2. Group R-4 occupancies shall have 44 inches (1118 mm) on floors housing clients.

Exceptions:

1. Corridors serving an occupant load of 10 or less shall not be less than 36 inches (914 mm) in width.
2. Corridors serving ambulatory persons only and having an occupant load of 49 or less shall not be less than 36 inches (914 mm) in width.

435.8.4.3 In a Group R-2.1 and Group R-4 occupancies having smoke barriers, cross-corridor doors in corridors 6 feet (1829 mm) or less in width shall have, as a minimum, a door 36 inches (914 mm) in width.

435.8.5 Changes in level. In Group R-3.1 occupancies housing nonambulatory clients interior changes in level up to 0.25 inch (6 mm) may be vertical and without edge

treatment. Changes in level between 0.25 inch (6 mm) and 0.5 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50 percent slope). Changes in level greater than 0.5 inch (12.7 mm) shall be accomplished by means of a ramp.

435.8.6 Stairways.

435.8.6.1 Group R-2.1 and Group R-4 occupancies housing more than six nonambulatory clients above the first floor shall be provided with two vertical exit enclosures. Stairway enclosures shall be in compliance with Section 1022. Exceptions to Section 1022 shall not apply in facilities licensed as a 24-hour care facility.

435.8.6.2 Group R-3.1 occupancies may continue to use existing stairways (except for winding and spiral stairways which are not permitted as a required means of egress) provided the stairs have a maximum rise of 8 inches (203 mm) with a minimum run of 9 inches (229 mm). The minimum stairway width may be 30 inches (762 mm).

435.8.7 Floor separation. Group R-3.1 occupancies with non-ambulatory clients housed above the first floor shall be provided with a non-fire resistance constructed floor separation at stairs which will prevent smoke migration between floors. Such floor separation shall have equivalent construction of 0.5 inch (12.7 mm) gypsum wallboard on one side of wall framing.

Exceptions:

1. Occupancies with at least one exterior exit from floors occupied by clients.
2. Occupancies provided with automatic fire sprinkler systems complying with Chapter 9.

435.8.7.1 Doors within floor separations. Doors within such floor separations shall be tight fitting solid wood at least 1³/₈ inches (35 mm) in thickness. Door glazing shall not exceed 1296 square inches (32 918 mm²) with no dimension greater than 54 inches (1372 mm). Such doors shall be positive latching, smoke gasketed and shall be automatic-closing by smoke detection

435.8.8 Fences and gates. Grounds of a Residential Care Facility for the Elderly serving Alzheimer clients may be fenced and gates therein equipped with locks, provided safe dispersal areas are located not less than 50 feet (15 240 mm) from the buildings. Dispersal areas shall be sized to provide an area of not less than 3 square feet (0.28 m²) per occupant. Gates shall not be installed across corridors or passageways leading to such dispersal areas unless they comply with egress requirements.

435.8.9 Basement exits. One exit is required to grade level when the basement is accessible to clients.

435.8.10 Delayed egress locks. See Section 1010.2.13.

435.9 Request for alternate means of protection for facilities housing bedridden clients. Request for alternate means of protection shall apply to Sections 435 through 435.9. Request for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the local fire authority having

jurisdiction by the facility, client or the client's authorized representative. Sufficient evidence shall be submitted to substantiate the need for an alternate means of protection.

The facility, client or the client's representative or the local fire authority having jurisdiction may request a written opinion from the State Fire Marshal concerning the interpretation of the regulations promulgated by the State Fire Marshal for a particular factual dispute. The State Fire Marshal shall issue the written opinion within 45 days following the request. Approval of a request for use of an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to this section shall be limited to Group R-3.1 occupancies housing a bedridden client. Approvals made by the local fire authority having jurisdiction and the written opinion by the State Fire Marshal shall be applicable only to the requesting facility and shall not be construed as establishing any precedent for any future request by that facility or any other facility.

435.10 Temporarily bedridden clients. Clients who become temporarily bedridden as defined in Health and Safety Code Section 1569.72, as enforced by the Department of Social Services, may continue to be housed on any story in Group R-2.1, R-3.1 or R-4 occupancies classified as Residential Care Facilities for the Elderly (RCFE). Every Residential Care Facility for the Elderly (RCFE) admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

435.11 Group R-2.1, R-3.1, R-4. [SFM] Buildings housing protective social care need not be of 1-hour fire-resistive construction when not more than two stories in height. In no case shall individual floor areas exceed 3,000 square feet (279 m²). The fire-resistive protection of the exterior walls shall not be less than 1 hour where such walls are located within 5 feet (1524 mm) of the property line. Openings within such walls are not permitted. Openings in exterior nonrated walls need not be protected.

**SECTION 436
GROUP I-4 [SFM]**

436.1 Group I-4 special provisions. Rooms classified as Group I-4 shall not be located above or below the first story.

Exceptions:

1. Basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from adjacent ground level at the level of exit discharge, provided the basement or story has exterior exit doors at that level.
2. Group I-4 child-care center or adult day care may be located above the first story in buildings of Types II-A, III-A, IV-A, IV-B and IV-C construction, subject to the limitation of Section 503 when:

- 2.1. Group I-4 child-care centers with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and
- 2.2. The entire story in which the Group I-4 child-care center or adult day care is located is equipped with an approved manual fire alarm and automatic smoke-detection system. (See the California Fire Code.) Actuation of an initiating device shall sound an audible alarm throughout the entire story. When a building fire alarm system is required by other provisions of this code or the Fire Code, the alarm system shall be connected to the building alarm system. An approved alarm signal shall sound at an approved location in the Group I-4 facility to indicate a fire alarm or sprinkler flow condition in other portions of the building; and
- 2.3. Group I-4 child-care center or adult day care, if more than 1,000 square feet (92.9 m²) in area, is divided into at least two compartments of approximately the same size by a smoke barrier with door openings protected by smoke- and draft-control assemblies having a fire-protection rating of not less than 20 minutes. Smoke barriers shall have a fire-resistive rating of not less than one hour. In addition to the requirements of Section 508.3.3, occupancy separations between Group I-4 child-care center or adult day care and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier shall be tightfitting, with gaskets installed as required by Section 710, and shall be automatic closing by actuation of the automatic sprinklers, fire alarm or smoke-detection system.
- 2.4. Each compartment formed by the smoke barrier has not less than two exits or exit access doors, one of which is permitted to pass through the adjoining compartment; and
- 2.5. Where two or more exits or exit access are required at least one shall not share a common path of travel. The egress system shall comply with the requirements of Section 709 for smoke barriers.
- 2.6. The building is equipped with an automatic sprinkler system throughout.

436.1.1 Egress. Rooms used for Group I-4 child care or adult day care on the first floor shall have one exit door directly to the exterior.

Exception: One-hour rated corridors with a minimum width of 60 inches.

**SECTION 437
Reserved**

SECTION 438
Reserved

SECTION 439
ROAD TUNNELS, BRIDGES AND
OTHER LIMITED-ACCESS HIGHWAYS [SFM]

439.1 General. Road tunnels, bridges and other limited-access highways that are state owned shall comply with NFPA 502.

SECTION 440
HORSE RACING STABLES [SFM]

440.1 For automatic sprinkler and fire alarm system requirements applying to each building, barn or structure which is used by an association regulated by the California Horse Racing Board for the stabling of horses or human habitation, and the stable area grounds, including any additional location where any excess horses are stabled see Title 4, Division 4, Article 17, Section 1927.

SECTION 441
PET KENNELS AND
PET BOARDING FACILITIES [SFM]

441.1 These regulations shall apply to every building or fire area in which a pet boarding facility operates, as defined in Health and Safety Code Section 122380, or a pet dealer, as defined in Health and Safety Code Section 122125, maintains a kennel.

441.2 Automatic sprinkler system. An approved automatic sprinkler system complying with California Fire Code Section 903 shall be installed.

Exception: Where a fire alarm system that is connected to a central reporting station that alerts the local fire department in case of fire.

SECTION 442
COMBUSTION ENGINES
AND GAS TURBINES [SFM]

442.1 General. The installation of combustion engines and gas turbines shall be in accordance with NFPA-37 and this chapter.

442.2 Separation.

442.2.1 Construction. Every room in which is installed a combustion engine or gas turbine shall be separated from the remainder of the building by not less than a one-hour fire barrier.

442.2.2 Exterior openings. When doors, windows or louvered openings are located below openings in another story or less than 10 feet (3048 mm) from doors, windows or louvered openings of the same building, they shall be protected by a fire assembly having a $3/4$ -hour rating. Such fire assemblies shall be fixed, automatic or self-closing.

442.2.1 Interior openings. In other than buildings housing Group I and R-2.1 occupancies, interior openings shall be allowed in buildings protected by an automatic fire sprinkler system throughout.

442.2.3 Location. Combustion engines and gas turbines used for emergency power shall not be located in a room or area used for any other purpose other than equipment and controls related to the generation and distribution of emergency power.

442.2.4 Special hazards. The handling and use of flammable or combustible liquids shall comply with the California Fire Code.

SECTION 443
FIXED GUIDEWAY TRANSIT AND
PASSENGER RAIL SYSTEMS [SFM]

443.1 General.

443.1.1 Scope. The provisions of this section and NFPA 130 shall apply to buildings or structures defined as stations for fixed guideway transit and passenger rail systems and shall supersede other similar requirements in other sections of this code.

Note: See Chapter 35 for California Amendments to NFPA 130.

443.2 Special provisions.

443.2.1 Automatic sprinkler system. See Section 903.2.17.1.

443.2.2 Station guideway deluge system. See Section 903.2.17.2.

443.2.3 Standpipe systems. See Section 905.3.11.

443.2.4 Fire Alarm and Communication Systems. See Section 907.2.26.

443.2.5 Emergency ventilation control. Emergency ventilation systems shall comply with this section and NFPA 130.

443.2.5.1 Emergency ventilation systems shall be supervised and/or controlled in all operating modes locally (motor control center and/or fan unit) and remotely at both the Operations Control Center and the station Fire Command Center.

443.2.5.2 Fan running shall be provided by sensing devices for each fan for operation in both the supply and exhaust directions.

443.2.5.3 Trouble status signals shall be annunciated in the local control room. A summarized trouble signal shall be annunciated at Operations Control Center and Fire Command Center.

SECTION 444
EXPLOSIVES [SFM]

[Section 444 has been repealed and replaced by the adoption of California Fire Code Chapter 56.]

SECTION 445
Reserved

SECTION 446
WINERY CAVES [SFM]

446.1 Scope. *The use of subterranean space for winery facilities in natural or manmade caves shall be in accordance with this section.*

446.2 Definitions.

446.3 General. *For definitions of ASSEMBLY, FIRE APPLIANCE and NONCOMBUSTIBLE, see Chapter 2.*

446.4 Limited application. *For the purpose of Section 446, certain terms are defined as follows:*

TYPE 1 WINERY CAVES are natural or manmade caves used solely for storage and/or processing of wine at a winery facility. Type 1 winery caves are not accessible to the public.

TYPE 2 WINERY CAVES are natural or manmade caves used for the storage and/or processing of wine at a winery facility. Type 2 winery caves are accessible to the public on guided tours only.

TYPE 3 WINERY CAVES are natural or manmade caves used for the storage and/or processing of wine at a winery facility. Type 3 winery caves are accessible to the public on guided tours and contain assembly use areas.

446.5 Permits. *For permits to operate Type 2 and 3 winery caves, see Section 105.*

446.6 Fire apparatus access roads. *Fire apparatus access roads shall be constructed and maintained in accordance with the California Fire Code, Section 503.*

446.7 Construction requirements.

446.7.1 Allowable area. *The area of winery caves shall not be limited if constructed entirely of noncombustible materials. Winery caves constructed with combustible materials shall be limited in area so that no point is more than 150 feet (45 720 mm) from an exit.*

446.7.2 Interior construction. *The walls and ceilings of winery caves shall not contain hidden or concealed spaces.*

446.8 General requirements.

446.8.1 Public tours. *Tours for the public shall be continuously guided by staff knowledgeable in the location of exits and the use of emergency notification devices.*

446.8.2 Standby personnel. *Per the California Fire Code, Section 2404.20, when, in the opinion of the fire chief, it is essential for public safety, the owner, agent or lessee shall employ one or more qualified persons, as required and approved by the chief, to be on duty at such place. Such individuals shall be in uniform or otherwise easily identifiable.*

Standby personnel shall be subject to the fire chief's orders at all times when so employed and shall remain on duty during the times such places are open to the public or when such activity is being conducted.

Before the start of any activity requiring standby personnel, such individuals shall:

- 1. Inspect the required fire appliances to ensure they are in the proper place and in good working order.*
- 2. Inspect all exits to verify accessibility and proper operation.*

While on duty, such individuals shall not be required or permitted to perform any duties other than those specified by the fire chief.

446.8.3 Open-flame devices. *The use of candles and other open-flame devices shall be in accordance with California Fire Code Section 308.1.7.*

446.9 Portable fire extinguishers and other fire appliances. *Portable fire extinguishers shall be located to be readily accessible. Its type, location and spacing throughout the facility shall be in accordance with the provisions of Title 19, Chapter 3 and California Fire Code Section 906.1. Other fire appliances shall be maintained at the site as required by the fire chief.*

446.10 Fire alarm systems. *An approved manual fire alarm system conforming with the provisions of the California Fire Code, Section 907.2.1 shall be provided in all Type 3 winery caves.*

446.11 Exits.

446.11.1 Distribution. *Exits shall be located remotely from each other and arranged to minimize any possibility that more than one may be blocked off by any one fire or other emergency condition.*

446.11.2 Number. *Winery caves shall be provided with a minimum of two exits.*

Assembly areas of Type 3 winery caves shall be provided with exits as required by the California Building Code for Group A Occupancies.

446.12 Exit illumination.

446.12.1 General. *Exits shall be illuminated to a minimum intensity of not less than 1 foot-candle (10.76 lx) at floor level whenever the winery cave is occupied. Fixtures providing exit illumination shall be supplied from a dedicated circuit or source of power used only for exit illumination.*

446.12.2 Separate sources of power. *The power supply for exit illumination may be provided by the premises' wiring system. In the event of its failure, illumination shall be automatically provided from an emergency system in Types 2 and 3 winery caves. Emergency systems shall be supplied from storage batteries or an on-site generator set, and the system shall be installed in accordance with the requirements of the California Electrical Code.*

446.13 Exit signs. *Exit signs shall be installed at required exits and where otherwise necessary to clearly indicate the exits from assembly areas in Type 3 winery caves.*

446.14 Maximum occupant load. *Occupant load requirements in the assembly areas of Type 3 winery caves shall be in accordance with Section 1004.*

446.15 Seating arrangements. Seating arrangements in the assembly areas of Type 3 winery caves shall be in accordance with California Fire Code, Section 1028.9.

**SECTION 447
Reserved**

**SECTION 448
Reserved**

**SECTION 449
PUBLIC LIBRARIES [SL AND SFM]**

Public libraries funded from the California Library Construction and Renovation Act of 1988.

449.1 Automatic sprinkler system. Automatic sprinkler systems shall be installed in:

1. New facilities, including additions;
2. Existing facilities to which a project adds the lesser of 5,000 square feet (465 m²) or 10 percent of the size of the existing facility, if the existing facility does not already have an automatic sprinkler system.

449.2 System monitoring requirement. All fire protection systems shall be monitored by a fire alarm supervising station in accordance with the NFPA 72.

449.3 Book return slots. Any interior book return with a slot piercing the exterior wall shall have a separate sprinkler head and be enclosed in fire-rated construction.

449.4 Automatic sprinkler and extinguishing systems. For public libraries constructed with funds awarded under the California Reading and Literacy Improvement and Public Library Construction and Renovation Bond Act of 2000:

1. **Fire sprinkler system requirement.** All libraries funded for new construction, including additions, shall have automatic fire sprinkler systems installed.
2. **Fire sprinkler system requirement for renovations of existing facilities.** If there is no automatic fire sprinkler system in the existing facility, grant recipients shall be required to install a fire sprinkler system throughout the existing facility.
3. **Fire sprinkler system types.** The grant recipient may choose, on approval by the local fire authority, from wet-pipe, dry-pipe or pre-action systems, utilizing listed standard, early suppression fast response (ESFR), or on/off type sprinkler heads.
4. **Book return rooms and slots.** Book return rooms with slots in exterior walls shall have an automatic sprinkler head and be of approved fire-resistive construction. Book return slots and book drops shall have an additional automatic sprinkler head when shielded from the room sprinkler head.
5. **System monitoring requirement.** All fire protection systems shall be monitored by a fire alarm supervising station in accordance with the National Fire Protection Association (NFPA) 72.

6. Alternate fire-extinguishing systems for specialized areas. When approved by the fire authority having jurisdiction, other types of approved automatic fire-extinguishing systems may be utilized as an alternate to sprinklers in the following areas: rare book rooms, central computer rooms and telecommunication rooms.

7. Automatic sprinkler system plan requirement. Fire sprinkler system drawings shall use the furniture plan as a background for coordination with furniture and book stack location and height.

**SECTION 450
GROUP C [SFM]**

450.1 Group C Occupancies defined.

450.1.1 Organized camps. For the purposes of these regulations, Group C Occupancies shall mean “organized camps” as defined in Section 18897, Health and Safety Code.

450.1.1.1 Description. An organized camp is a site with programs and facilities established for the primary purpose of providing an outdoor group living experience with social, spiritual, educational or recreational objectives, for five days or more during one or more seasons of the year.

The term “organized camp” does not include a motel, tourist camp, trailer park, resort, hunting camp, auto court, labor camp, penal or correctional camp, child-care institution or home-finding agency nor does it include any charitable or recreational organization which complies with the rules and regulations for recreational trailer parks provided for by Section 18301 (b), Health and Safety Code.

450.1.2 Tents and tent structures. For the purpose of this chapter, a tent or tent structure is defined as any shelter of which 25 percent or more of the walls or roof, or both, are constructed of, or covered or protected by, a canvas or any other fabric material.

450.2 Purpose and intent. The provisions of this section are established to provide fire and life safety in organized camps, but at the same time preserve the basic concept of outdoor living. It is the intent of this section that organized camps shall be considered as a separate and distinct occupancy.

450.3 Basic building and structures.

450.3.1 Building classification. Every building or structure shall be classified into the occupancy group they most nearly resemble and be constructed in accordance with appropriate occupancy requirements specified in this part.

Exceptions:

1. Tents, tent structures, and buildings and structures that do not exceed 25 feet (7620 mm) in any lateral dimension and where such building or structure is not more than one story.
2. For fire safety, buildings or structures on the premises of an organized camp which are used for sleeping purposes, regardless of their similar-

ity to other occupancy groups, shall conform to the provisions of Sections 450.4, 450.5, 450.6 and 450.7.

3. For fire safety, buildings and structures which are not used for sleeping purposes shall conform to the provisions of Section 450.7, which shall supersede any similar provisions contained in this part.

450.3.2 Occupant load. The living shelter whether a building, structure, tent and tent structure, or cabin, shall provide a minimum of 30 square feet (2.8 m²) of superficial floor area per person for single-tier bed units, and 20 square feet (1.9 m²) of superficial floor area per person for two-tier bed units. More than two tiers per bed unit are prohibited. There shall be at least 3 feet (914 mm) of lateral distance between beds

Exception: Intermittent short-term organized camps are not required to provide shelter facilities but, if provided, they shall comply with this section.

450.4 General.

450.4.1 Buildings intended for sleeping. Buildings and structures used or intended for sleeping purposes which do not exceed any one of the limitations set forth below shall conform to the provisions of Sections 450.5 and 450.7.

1. One story in height
2. Twenty-five feet (7620 mm) in any lateral dimension

Exception: This provision shall not apply to buildings or structures conforming to construction provisions of this section in effect prior to January 1, 1985.

3. Maximum housing of 12 persons

450.4.2 Limitations. Buildings and structures used or intended for sleeping purposes, including those so used in whole or in part by staff personnel, and which exceed any one of the limitations set forth in Section 450.4.1, shall conform to the provisions of Sections 450.5 and 450.7.

Exception: Buildings or structures used exclusively for living and sleeping purposes by resident custodial or caretaker personnel only may be constructed in accordance with the provisions of these regulations for a Group R, 3 Occupancy.

450.5 Special buildings, tents and tent structures.

450.5.1 Special buildings. In addition to the provisions of Section 450.7, special buildings conforming to the limitations specified in Section 450.4.1 shall conform to the following:

1. The flame-spread end-point rating of all interior finish materials shall not exceed 200.
2. Every room or area housing more than eight persons shall be provided with not less than two approved exits, each of which shall be direct to the exterior and shall not be less than 32 inches (813 mm) in clear width and 6 feet 8 inches (2032 mm) in height. Rooms or areas housing eight or less per-

sons shall be provided with at least one such exit direct to the exterior.

3. Every exit door shall be openable from the inside without the use of any key, special knowledge or effort.
4. Exit doors need not be hung to swing in the direction of exit travel. Where exit doors are hung to swing in the direction of exit travel, a landing conforming to the provisions of Section 1010.1.5 shall be provided.
5. When the distance (measured vertically) between the ground level and the floor level exceeds 8 inches (203 mm), a stairway from each exit shall be provided. Steps shall have a rise of not more than 8 inches (203 mm) and a run of not less than 9 inches (229 mm). Such stairway shall be at least as wide as the door it serves.

Exception: In lieu of a stairway, a ramp having a slope of not more than 1 foot (305 mm) of rise for each 8 feet (2438 mm) of run may be provided.

6. When the floor level at any door opening of any building or structure is more than 30 inches (762 mm) above the adjacent ground level, handrails or guardrails shall be provided on the landing, balcony or porch, and on every stairway or ramp to ground level.
7. Buildings and structures or groups of buildings and structures shall be separated from each other by not less than 10 feet (3048 mm).

Exception: This section shall not apply to existing buildings and structures of Group C Occupancies.

450.5.2 Tents and tent structures. In addition to the provisions of Section 450.7, tents and tent structures, or groups thereof, shall conform to the provisions of Section 450.5, except as follows:

1. Regardless of any other provisions of this section, heating of tents and tent structures shall be prohibited unless written permission is obtained from the fire chief.
2. All canvas or other fabric material shall be treated and maintained in a flame-retardant condition.

Exceptions:

1. Tents in existence prior to January 1, 1979, provided the following conditions are met:
 - 1.1. Tents shall not exceed 80 square feet (7.4 m²) in area.
 - 1.2. No electrical devices, except flashlights, are installed or used in the tents.
 - 1.3. Tents are not located closer than 30 feet (9144 mm) to any open fire.
 - 1.4. Smoking is prohibited in the tents.
 - 1.5. All other applicable provisions of this article are met.

2. Canvas or materials used exclusively to protect windows and similar openings in walls.
3. Canvas or materials used as a windbreak enclosure of not more than three sides and open to the sky.

Note: It is not the intent of Section 450.5.2 that strict adherence to the width and height requirements of exit openings be enforced for exits from tents.

450.6 Building and structures for sleeping. Buildings and structures, or portions thereof, used or intended for sleeping purposes and which exceed the height, area or capacity limitations specified in Section 450.4.1 shall conform to the provisions of this section.

450.6.1 Area, height and type of construction. Buildings and structures, or portions thereof, shall not exceed the limits of area, height and type of construction specified in these regulations for a Group R-2.1 occupancy. Such buildings and structures shall not be of less than one-hour fire-resistive construction throughout.

450.6.2 Location on property. The fire-resistive protection of exterior walls and openings, as determined by location on property, shall be in accordance with the provisions of these regulations for a Group R-2.1 occupancy.

450.6.3 Exits. Stairs, exits and smoke-proof enclosures shall be provided in accordance with the provisions of Chapter 10.

450.6.4 Enclosure of vertical openings. Exits shall be enclosed as specified in Chapter 10. Elevator shafts, vent shafts and other vertical openings shall be enclosed and enclosures shall be as set forth in Chapter 7.

450.6.5 Fire-extinguishing systems. Automatic fire-extinguishing systems, standpipes and basement pipe inlets shall be installed when and as specified in Chapter 9 for buildings, based on the occupancy they most nearly resemble.

450.6.6 Automatic fire alarm system. See Section 907.

450.7 Special requirements. The provisions of this section shall apply to the premises and to all buildings and structures of all organized camps.

450.7.1 Electrical. The installation of all electrical wiring shall conform to the applicable provisions of the California Electrical Code.

450.7.2 Heating equipment. Heating equipment, and the installation thereof, shall conform to the provisions of the California Mechanical Code.

450.7.3 Motion picture booths. Motion picture machine booths shall conform to the requirements of Section 409.

450.7.4 Interior finish. Interior finish shall conform to the requirements of Chapter 8, except as permitted in Section 450.5.1, Item 1.

450.7.5 Heater room openings. All exterior openings in rooms containing central heating equipment, low-pressure boilers or water-heating boilers used as part of the heat-

ing system, if located below openings in another story, or if less than 10 feet (3048 mm) from other doors or windows of the same building, shall be protected by a fire assembly having a three-fourths-hour fire-resistive rating. Such fire assemblies shall be fixed, automatic or self-closing.

Exception: The requirement for three-fourths-hour fire assembly protection of openings may be deleted if the entire room is protected by an automatic sprinkler system conforming to the provisions of Section 903.

450.7.6 Heating rooms. Every room containing central-heating equipment, low-pressure boiler or water-heating boiler used as part of the heating system shall be separated from the rest of the building by a one-hour fire-resistive fire barrier with all openings protected as set forth in Section 707.6.

Exceptions:

1. Boilers or central heating plants where the largest piece of fuel equipment does not exceed 400,000 Btu per hour (135 kW) input.
2. When any such opening is protected by a pair of fire doors, the inactive leaf shall be normally secured in the closed position and shall be openable only by use of a tool. An astragal shall be provided and the active leaf shall be self-closing.

450.7.7 Exits. For purposes of determining occupant load for exit requirements, see Section 450.3.2.

450.7.8 Liquefied petroleum gas. The construction and installation of all tanks, cylinders, equipment and systems used or intended for use in conjunction with any liquefied petroleum gas shall conform to the provisions of the California Mechanical Code and the California Fire Code.

450.7.9 Air-conditioning and ventilation systems. Heating units used as an integral part of an air-conditioning and ventilation system shall be installed in accordance with Sections 450.7.2, 450.7.3 and 450.7.6.

450.8 Camp fire alarm. Every organized camp shall provide and maintain a device or devices suitable for sounding a fire alarm. Such device or devices may be of any type acceptable to the enforcing agency provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises. When an automatic fire alarm system is provided, as required by Section 450.6.6, all signaling devices required by this section shall be of the same type as that used in the automatic system.

**SECTION 451
Reserved**

**SECTION 452
SCHOOL FACILITIES FOR KINDERGARTEN
THROUGH 12TH GRADE AND GROUP E CHILD CARE** ||

452.1 General provisions. School facilities for Kindergarten through 12th grade and Group E child care shall comply with ||

the provisions of this section and other applicable provisions of this code including requirements for specific occupancies.

452.1.1 Location on property. All buildings housing Group E occupancies shall front directly on a public street or an exit discharge not less than 20 feet (6096 mm) in width. The exit discharge to the public street shall be a minimum 20-foot-wide (6096 mm) right-of-way, unobstructed and maintained only as access to the public street. At least one required exit shall be located on the public street or on the exit discharge.

452.1.2 Separate means of egress systems required. Every room with an occupant load of 300 or more shall have one of its exits or exit-access doorways lead directly into a separate means of egress system that consists of not less than two paths of exit travel which are separated by a smoke barrier in accordance with Section 709 in such a manner to provide an atmospheric separation that precludes contamination of both paths of exit travel by the same fire. Not more than two required exits or exit-access doorways shall enter into the same means of egress system.

452.1.3 Fences and gates. School grounds may be fenced and gates therein may be equipped with locks, provided that safe dispersal areas based on 3 square feet (0.28 m²) per occupant are located between the school and the fence. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from school buildings.

Every public and private school shall conform with Section 32020 of the Education Code which states:

The governing board of every public school district, and the governing authority of every private school, which maintains any building used for the instruction or housing of school pupils on land entirely enclosed (except for building walls) by fences of walls, shall, through cooperation with the local law enforcement and fire-protection agencies having jurisdiction of the area, make provision for the erection of gates in such fences or walls. The gates shall be of sufficient size to permit the entrance of the ambulances, police equipment and fire-fighting apparatus used by the law enforcement and fire-protection agencies. There shall be no less than one such access gate and there shall be as many such gates as needed to assure access to all major buildings and ground areas. If such gates are to be equipped with locks, the locking devices shall be designed to permit ready entrance by the use of the chain or bolt-cutting devices with which the local law enforcement and fire-protection agencies may be equipped.

452.1.4 Special provisions. Rooms used by kindergarten, first- or second-grade pupils, and Group E child care, shall not be located above or below the first story.

Exceptions:

1. Kindergarten, first- or second-grade pupils, or Group E child care may be located in basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from the adjacent ground level at the level of exit discharge,

provided the basement or story has exterior exit doors at that level.

2. In buildings equipped with an automatic sprinkler system throughout, rooms used for kindergarten, first- and second-grade children or for Group E child-care purposes may be located on the second story, provided there are at least two exterior exit doors, or other egress systems complying with Section 1020 with two exits, for the exclusive use of such occupants. Egress systems for the exclusive use of such occupants shall be maintained until exit discharge at grade is attained.
3. Group E day-care facilities may be located above the first story in buildings of Type I-A, I-B, II-A, III-A, IV-A, IV-B and IV-C construction, subject to the limitation of Section 503 when:
 - 3.1. Facilities with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and
 - 3.2. The entire story in which the day-care facility is located is equipped with an approved manual fire alarm and automatic smoke-detection system. Actuation of an initiating device shall sound an audible alarm throughout the entire story.

When a building fire alarm system is required by other provisions of this code, the alarm system shall be interconnected and sound the day-care fire alarm system; and
 - 3.3. The day-care facility, if more than 1,000 square feet (92.9 m²) in area, is divided into at least two compartments of approximately the same size by a smoke barrier in accordance with Section 709. In addition to the requirements of Section 508, occupancy separations between day-care and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier shall be tight fitting, with gaskets installed as required by Section 716.5.3.1 and shall be automatic closing by actuation of the fire sprinklers, fire alarm or smoke detection system; and
 - 3.4. Each compartment formed by the smoke barrier has not less than two exits or exit-access doors, one of which is permitted to pass through the adjoining compartment, and
 - 3.5. At least one exit or exit-access door from the day-care facility shall be into a separate means of egress with not less than two paths of exit travel, which are separated in such a manner to provide an atmospheric separation. The egress system shall comply with the requirements of Section 709 for smoke barriers.
 - 3.6. The building is equipped with an automatic sprinkler system throughout.

452.1.5 Special hazards. School classrooms constructed after January 1, 1990, not equipped with automatic sprinkler systems, which have metal grilles or bars on all their windows and do not have at least two exit doors within 3 feet (914 mm) of each end of the classroom opening to the exterior of the building or to a common hallway used for evacuation purposes, shall have an inside release for the grilles or bars on at least one window farthest from the exit doors. The window or windows with the inside release shall be clearly marked as emergency exits.

452.1.6 Class I, II or III-A flammable liquids shall not be placed, stored or used in Group E occupancies, except in approved quantities as necessary in laboratories and classrooms and for operation and maintenance as set forth in the California Fire Code.

SECTION 453 GROUP L [SFM]

453.1 Scope. The provisions of this section shall apply to buildings or structures, or portions thereof, containing one or more Group L laboratory suites as defined in Section 202.

The provisions of this section are optional and may apply to buildings or structures. See Section 304 for Group B Laboratories.

453.1.1 Technical report. The enforcing agency may require a technical opinion and report to identify and develop methods of protection from the hazards presented by the hazardous materials. A qualified person, firm or corporation, approved by the enforcing agency, shall prepare the opinion and report, and shall be provided without charge to the enforcing agency. The opinion and report may include, but is not limited to, the preparation of a hazardous material management plan (HMMP); chemical analysis; recommendations for methods of isolation, separation, containment or protection of hazardous materials or processes, including appropriate engineering controls to be applied; the extent of changes in the hazardous behavior to be anticipated under conditions of exposure to fire or from hazard control procedures; and the limitations or conditions of use necessary to achieve and maintain control of the hazardous materials or operations. The report shall be entered into the files of the code enforcement agencies. Proprietary and trade secret information shall be protected under the laws of the state or jurisdiction having authority.

453.2 Definitions. The following terms are defined in Chapter 2:

LABORATORY SUITE.

[F] LIQUID TIGHT FLOOR.

453.3 Laboratory suite requirements.

453.3.1 The gross floor area of an individual laboratory suite shall not exceed 10,000 square feet (929 m²).

453.3.2 An individual laboratory suite shall not serve more than a single tenant.

Exception: An individual laboratory suite shall have a responsible party or department for all hazardous materials within a suite.

453.4 Construction

453.4.1 Separation of laboratory suites.

453.4.1.1 Laboratory suites shall be separated from other occupancies in accordance with Table 508.4.

453.4.1.2 Laboratory suites shall be separated from other laboratory suites by a fire barrier having a fire-resistance rating of not less than 1-hour.

453.4.1.3 Laboratory suites shall be separated from control areas by a minimum 2-hour fire-resistance rating in accordance with Sections 707 and 711.

Exception: Laboratory suites shall be separated from control areas by a minimum 1-hour fire-resistance rating on floor levels below the 4th story.

453.4.1.4 Horizontal separation. The floor construction of the laboratory suite and the construction supporting the floor of the laboratory suite shall have a minimum 2-hour fire-resistance rating in accordance with Section 711.

Exceptions:

1. The floor construction of the laboratory suite and the construction supporting the floor of the laboratory suite are allowed to be 1-hour fire-resistance rated in buildings of Type IIA, IIIA and VA construction.
2. When an individual laboratory suite occupies more than one story, the intermediate floors contained within the suite shall comply with the requirements of Table 601.

453.4.2 Reserved.

453.4.3 Fire barrier and fire-smoke barrier.

453.4.3.1 Fire barrier. A fire barrier having a fire resistance rating of not less than 2-hours shall divide any story containing more than one laboratory suite on the 4th story and above.

453.4.3.1.1 Fire barriers shall be continuous from exterior wall to exterior wall,

453.4.3.1.2 The fire barrier shall divide the floor so that the square footage on each side of the 2-hour fire barrier is not less than 30 percent of the total floor area, and

453.4.3.1.3 The number of laboratory suites on each side of the 2-hour fire barrier shall not be less than 25 percent of the total number of laboratory suites on the floor.

453.4.3.2 Fire-smoke barrier. Any story containing a Group L occupancy on the 11th story and above shall be subdivided by a fire-smoke barrier constructed as a fire barrier having a fire-resistance rating of not less than 2 hours and shall also comply with the smoke barrier requirements of Section 709.

The 2-hour fire-smoke barrier shall be in accordance with Sections 453.4.3 through 453.4.3.2.3.

453.4.3.2.1 A minimum of one door opening shall be provided in the 2-hour fire-smoke barrier for emergency access.

453.4.3.2.2 Each side of the 2-hour fire-smoke barrier shall be designed as a separate smoke zone designed in accordance with Section 909.6.

453.4.3.2.3 The area on each side of the 2-hour fire-smoke barrier shall be served by a minimum of one exit enclosure in accordance with Section 1022.

453.4.4 Emergency response equipment area. When required by the fire code official, an area for emergency response equipment shall be provided on each floor in an approved location. The area shall be a minimum of 50 square feet (4.6 m²), for spill mitigation supplies per California Fire Code 5001.3.3.4 in a location approved by the fire code official, and identified with signage.

Exception: The area size for spill mitigation supplies may be reduced by the fire code official when adequate supplies are provided.

453.4.5 Liquid tight floor. All portions of the laboratory suite where hazardous materials may be stored, dispensed, handled or used shall be provided with a liquid tight floor. The intersections of such floors shall have an integral coved base that extends upward onto the wall not less than 2 inches. Where the floor is designed to provide spill control or secondary containment the floor shall be designed in accordance with California Fire Code Section 5004.2.

453.4.6 Secondary power systems. A legally required standby power system shall have an automatic transfer time of not more than 10 seconds.

453.4.6.1 Required systems. Standby power shall be provided for all electrically operated equipment, systems and connected control circuits including:

1. Mechanical ventilation systems. See Section 453.4.7.2.
2. Temperature control systems required to prevent unsafe process excursions or chemical reactions.
3. Treatment systems and scrubbers.
4. Emergency Responder Radio Coverage (ERRCS). See Section 510 of the California Fire Code.
5. Electrically operated systems required elsewhere in this code and the California Fire Code.

453.4.7 Ventilation.

453.4.7.1 Compatibility. Incompatible materials shall not be conveyed in the same duct system. Combined products in mechanical exhaust ducts shall not create a physical hazard or reaction that could degrade the duct material. The building official may require a technical report in accordance with Section 453.7.1.

453.4.7.2 Fire dampers, smoke dampers and combination fire/smoke dampers. Fire dampers, smoke dampers or fire/smoke dampers shall not be permitted in mechanical exhaust duct systems used to maintain a safe laboratory environment. When the exhaust duct

penetrates the laboratory suite boundary the exhaust duct shall be located within a horizontal or vertical assembly having a fire resistance rating equal to the fire barrier.

453.4.7.3 Reserved.

453.4.7.4 Laboratory suite exhaust air.

453.4.7.4.1 Exhaust air from laboratory suites shall not be recirculated.

453.4.7.4.2 Laboratory suite exhaust air shall be independently ducted to a point outside the building or an approved roof top structure.

Exception: Exhaust ducts serving separate laboratory suites may be connected to a common duct within a fire rated vertical shaft when the sub-duct extends vertically upward at least 22 inches.

453.4.7.4.3 Laboratory suite exhaust ducts shall not penetrate the fire barriers required by Section 453.4.1.

Exception: Where the exhaust duct is enclosed in a rated shaft in accordance with Section 713.

453.4.7.5 Ventilation rates. Mechanical exhaust ventilation systems shall provide a minimum ventilation rate not less than 1 cubic feet per minute per square foot [0.00508 m³/(s·m²)] of floor area, or 6 air exchanges per hour, whichever is greater. Systems shall operate continuously at the designed ventilation rate

Exception: Refer to California Fire Code Section 5001.3 Performance-based design alternatives, as approved by the Fire Code Official.

453.4.7.6 Reserved.

453.4.7.7 Mechanical ventilation system balancing. Mechanical ventilation systems shall be designed and balanced such that during normal and emergency conditions the door opening forces comply with the requirements of Sections 1010.1.3 and Chapter 11B as applicable. Emergency conditions shall include: supply fan shutdown or failure, closing of smoke dampers or combination fire/smoke dampers, or emergency power.

453.5 Fire protection systems. See Chapter 9.

453.6 Means of egress.

453.6.1 Access to exits. Every room of a laboratory suite containing hazardous materials and having a floor area of 500 square feet (19 m²) or more shall have access to not less than two separate exits or exit-access doorways in accordance with Section 1006.2.

453.6.2 Door swing. All exit and exit-access doors serving areas with hazardous materials shall swing in the direction of exit travel, regardless of the occupant load served.

453.6.3 Panic hardware. Exit and exit access doors from areas with hazardous materials shall not be provided with a latch or lock unless it is panic hardware or fire exit hardware.

453.6.4 Buildings more than four stories. A minimum of one exit shall be provided to serve the floor on each side of

the 2-hour fire barrier and shall comply with the provisions of Chapter 10.

453.6.5 Reserved.

453.7 Hazardous materials.

453.7.1 Multiple hazards. When a hazardous material has multiple hazards, all hazards shall be addressed and controlled in accordance with the provisions of this code and the California Fire Code.

453.7.2 Percentage of maximum allowable quantities. The percentage of the maximum allowable quantity of hazardous materials per laboratory suite permitted for each story level within a building shall be in accordance with Table 453.7.2.1.

453.7.3 Handling and transportation. The handling and transportation of hazardous materials shall be in accordance with Section 5003.10 of the California Fire Code.

453.8 Elevators and elevator lobbies on the 11th story and above. Any story containing a Group L occupancy on the 11th story and above shall be provided with elevators and elevator lobbies in accordance with Sections 453.8.1 through 453.8.3.

453.8.1. An elevator that serves every story of the building shall be provided on each side of the 2-hour fire-smoke barrier.

453.8.2. An elevator lobby shall be provided on each side of the 2-hour fire-smoke barrier at each floor in accordance with Section 3006.

453.8.3. The elevator and its associated elevator lobbies and elevator machine rooms shall be pressurized in accordance with Section 909.6.

453.9 Existing Group L and Group H-8 occupancies, additions, alterations or repairs. See California Fire Code Chapter 11, Section 1116 and California Existing Building Code.

**SECTION 454
Reserved**

**SECTION 455
LARGE FAMILY DAY-CARE HOMES [SFM]**

455.1 Large family day-care homes.

455.2. For purposes of clarification, Health and Safety Code Sections 1597.45 and 1597.46 are repeated.

1597.45.

- (a) The use of a home as a small or large family day-care home shall be considered a residential use of property and a use by right for the purposes of all local ordinances, including, but not limited to, zoning ordinances.
- (b) A local jurisdiction shall not impose a business license, fee or tax for the privilege of operating a small or large family day-care home.
- (c) Use of a home as a small or large family day-care home shall not constitute a change of occupancy for purposes of Part 1.5 (commencing with Section 17910) of Division 13 (State Housing Law) or for purposes of local building codes.
- (d) A small or large family day-care home shall not be subject to the provisions of Division 13 (commencing with Section 21000) of the Public Resources Code.

**TABLE 453.7.2.1
HAZARDOUS MATERIALS QUANTITY PER LABORATORY SUITE**

STORY		PERCENTAGE OF MAXIMUM ALLOWABLE QUANTITY PER LABORATORY SUITE ^{a, b}	NUMBER OF LAB SUITES PER FLOOR BASED ON CONSTRUCTION TYPE				
			Type IA	Type IB	Type IIA, IIIA, IV	Type IIB, IIIB, VA	Type VB
Above grade plane	Above 20	0	NP	NP	NP	NP	NP
	15 to 20	25	4	NP	NP	NP	NP
	11, 12, 13, 14	50	8	NP	NP	NP	NP
	7, 8, 9, 10	50	16	NP	NP	NP	NP
	6	75	20	20	NP	NP	NP
	4, 5	75	20	20	20	NP	NP
	3	100	UL	UL	UL	UL	NP
Below grade plane	1, 2	100	UL	UL	UL	UL	UL
	1	75 ^c	10	10	10	10	10
	2	50 ^d	5	5	5	5	5
	3 and below	0	NP	NP	NP	NP	NP

UL = Unlimited, NP= Not permitted

- a. Percentages shall be of the maximum allowable quantity per laboratory suite shown in Tables 307.1(1) and 307.1(2). Allowable hazardous material increases for buildings equipped throughout with an automatic sprinkler system shall not be applicable to Group L occupancies.
- b. When an individual laboratory suite occupies more than one story, the more restrictive percentage of the maximum allowable quantity per laboratory suite shall apply.
- c. The total aggregate quantity of flammable liquids on the first story below grade shall be limited to the maximum total aggregate quantity for Group B occupancy control areas.
- d. The total aggregate quantity of flammable liquids on the second story level below grade shall be limited to a maximum total aggregate quantity for Group B occupancy control areas.

(e) *The provisions of this chapter do not preclude a city, county or other local public entity from placing restrictions on building heights, setback or lot dimensions of a family day-care home, as long as those restrictions are identical to those applied to all other residences with the same zoning designation as the family day-care home. This chapter does not preclude a local ordinance that deals with health and safety, building standards, environmental impact standards or any other matter within the jurisdiction of a local public entity, as long as the local ordinance is identical to those applied to all other residences with the same zoning designation as the family day-care home. This chapter also does not prohibit or restrict the abatement of nuisances by a city, county, or city and county. However, the ordinance or nuisance abatement shall not distinguish family day-care homes from other homes with the same zoning designation, except as otherwise provided in this chapter.*

(f) *For purposes of this chapter, “small family day-care home or large family day-care home” includes a detached single-family dwelling, a townhouse, a dwelling unit within a dwelling or a dwelling unit within a covered multifamily dwelling in which the underlying zoning allows for residential uses. A small family day-care home or large family day-care home is where the family day-care provider resides and includes a dwelling or dwelling unit that is rented, leased or owned.*

(Amended by Stats. 2019, Ch. 244, Sec. 9. (SB 234) Effective January 1, 2020.)

1597.46.

(a) *A large family day-care home shall abide by all standards, in addition to the requirements of the State Uniform Building Standards Code, that are specifically designed to promote fire and life safety in large family day-care homes. The State Fire Marshal shall adopt separate building standards specifically relating to the subject of fire and life safety in family day-care homes, which shall be published in Title 24 of the California Code of Regulations. These standards shall apply uniformly throughout the state and shall include, but not be limited to, all of the following:*

- (1) *The requirement that a large family day-care home contain a fire extinguisher or smoke detector device, or both, that meets child-care standards established by the State Fire Marshal.*
- (2) *Specification as to the number of required exits from the home.*
- (3) *Specification as to the floor or floors on which child care may be provided and the number of required exits on each floor.*

(b) *A large family day-care home for children shall have one or more carbon monoxide detectors in the facility that meet the standards established in Chapter 8*

(commencing with Section 13260) of Part 2 of Division 12. The department shall account for the presence of these detectors during inspections.

(c) *Enforcement of this section shall be in accordance with Sections 13145 and 13146. A city, county, city and county, or district shall not adopt or enforce a building ordinance or local rule or regulation relating to the subject of fire and life safety in large family day-care homes that is inconsistent with those standards adopted by the State Fire Marshal, except to the extent the building ordinance or local rule or regulation applies to all residences with the same zoning designation in which child care is provided.*

(Repealed and added by Stats. 2019, Ch. 244, Sec. 12. (SB 234) Effective January 1, 2020.)

455.3 Smoke alarms. *Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms. The number and placement of smoke alarms shall be determined by the enforcement authority.*

455.4 Fire extinguishers. *Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A10BC rating.*

455.5 Fire alarm devices. *See Section 907.2.6.4.*

455.6 Compliance. *Every large-family day-care home shall comply with the provisions for Group R-3 occupancies. For the purposes of Section 436.1, the first story shall be designated as the floor used for residential occupancy nearest to the street level which provides primary access to the building.*

455.7 Special hazards. *Every unenclosed gas-fired water heater or furnace which is within the area used for child care in a large family day-care home shall be protected in such a way as to prevent children from making contact with those appliances.*

Exception: *This does not apply to kitchen stoves or ovens.*

455.8 Exiting. *See Section 1006.2.2.7.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 5 – GENERAL BUILDING HEIGHTS AND AREAS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
503.1, <i>Exception 1</i>			X	X																		
Figure 5-1			X																			
Table 504.3			X																			
Table 504.4			X																			
Table 506.2			X																			
506.2.3			X																			
506.2.4			X																			
508.2.4			X																			
508.3.3			X																			
Table 508.4			X																			
508.5				X	X																	
508.5.3 <i>Exception</i>				X	X																	
508.5.8 <i>Exception</i>				X	X																	
508.5.9						X	X															
508.5.10				X	X																	
508.5.11						X																
Table 509.1			X																			
509.3			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 5

GENERAL BUILDING HEIGHTS AND AREAS

User note:

About this chapter: Chapter 5 establishes the limits to which a building can be built. Building height, number of stories and building area are specified in this chapter. Chapter 5 must be used in conjunction with the occupancies established in Chapter 3 and the types of construction established in Chapter 6. This chapter also specifies the impact that mezzanines, accessory occupancies and mixed occupancies have on the overall size of a building.

SECTION 501 GENERAL

501.1 Scope. The provisions of this chapter control the height and area of structures hereafter erected and additions to existing structures.

SECTION 502 BUILDING ADDRESS

[F] 502.1 Address identification. New and existing buildings shall be provided with approved address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be a minimum of 4 inches (102 mm) high with a minimum stroke width of $\frac{1}{2}$ inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other approved sign or means shall be used to identify the structure. Address identification shall be maintained.

SECTION 503 GENERAL BUILDING HEIGHT AND AREA LIMITATIONS

503.1 General. Unless otherwise specifically modified in Chapter 4 and this chapter, building height, number of stories and building area shall not exceed the limits specified in Sections 504 and 506 based on the type of construction as determined by Section 602 and the occupancies as determined by Section 302 except as modified hereafter. Building height, number of stories and building area provisions shall be applied independently. For the purposes of determining area limitations, height limitations and type of construction, each portion of a building separated by one or more fire walls complying with Section 706 shall be considered to be a separate building.

Exceptions:

1. **[HCD 1]** Limited-density owner-built rural dwellings may be of any type of construction which will

provide for a sound structural condition. Structural hazards which result in an unsound condition and which may constitute a substandard building are delineated by Section 17920.3 of the Health and Safety Code.

2. Other than structural requirements, solar photovoltaic panels supported by a structure with no use underneath shall not constitute additional story or additional floor area and may exceed the height limit when constructed on a roof top of a building provided the following conditions are met:
 - 1.1. For all occupancies, the highest point of the structure/panel shall meet the lower of the two values below:
 1. 3' above the allowable building height per this code.
 2. 3' above the roof of the building immediately below.
 - 2.1. For installations on flat roofs in other than Group R-3 and R-4 occupancies, the highest point of the structure/panel shall meet the lower of the two values below:
 1. 10' above the allowable building height per this code.
 2. 10' above the roof of the building immediately below.
3. Other than structural requirements, solar photovoltaic panels supported by a structure over parking stalls shall not constitute additional story or additional floor area and may exceed the height limit as specified in exception 2 (above) when the following conditions are met (see Figure 5-1):
 1. The area within the perimeter of the photovoltaic array has maximum rectangular dimension of 40 feet by 150 feet.
 2. The distance between solar photovoltaic array structures is a minimum of 10 feet clear.
 3. The driveway aisle separating solar photovoltaic array structures has a minimum width of 25 feet clear.

GENERAL BUILDING HEIGHTS AND AREAS

4. *Solar photovoltaic array structure is used only for parking purposes with no storage.*
5. *Completely open on all sides (other than necessary structural supports) with no interior partitions.*

503.1.1 Special industrial occupancies. Buildings and structures designed to house special industrial processes that require large areas and unusual building heights to accommodate craneways or special machinery and equipment, including, among others, rolling mills; structural metal fabrication shops and foundries; or the production and distribution of electric, gas or steam power, shall be exempt from the building height, number of stories and building area limitations specified in Sections 504 and 506.

503.1.2 Buildings on same lot. Two or more buildings on the same lot shall be regulated as separate buildings or shall be considered as portions of one building where the building height, number of stories of each building and the aggregate building area of the buildings are within the limitations specified in Sections 504 and 506. The provisions of this code applicable to the aggregate building shall be applicable to each building.

503.1.3 Type I construction. Buildings of Type I construction permitted to be of unlimited tabular building heights and areas are not subject to the special requirements that allow unlimited area buildings in Section 507 or unlimited building height in Sections 503.1.1 and 504.3 or increased building heights and areas for other types of construction.

503.1.4 Occupied roofs. A roof level or portion thereof shall be permitted to be used as an occupied roof provided the occupancy of the roof is an occupancy that is permitted by Table 504.4 for the story immediately below the roof. The area of the occupied roofs shall not be included in the building area as regulated by Section 506. An occupied roof shall not be included in the building height or number of stories as regulated by Section 504, provided that the

penthouses and other enclosed rooftop structures comply with Section 1511.

Exceptions:

1. The occupancy located on an occupied roof shall not be limited to the occupancies allowed on the story immediately below the roof where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and occupant notification in accordance with Sections 907.5.2.1 and 907.5.2.3 is provided in the area of the occupied roof. Emergency voice/alarm communication system notification per Section 907.5.2.2 shall also be provided in the area of the occupied roof where such system is required elsewhere in the building.
2. Assembly occupancies shall be permitted on roofs of open parking spaces of Type I or Type II construction, in accordance with the exception to Section 903.2.1.6.

503.1.4.1 Enclosures over occupied roof areas. Elements or structures enclosing the occupied roof areas shall not extend more than 48 inches (1220 mm) above the surface of the occupied roof.

Exception: Penthouses constructed in accordance with Section 1511.2 and towers, domes, spires and cupolas constructed in accordance with Section 1511.5.

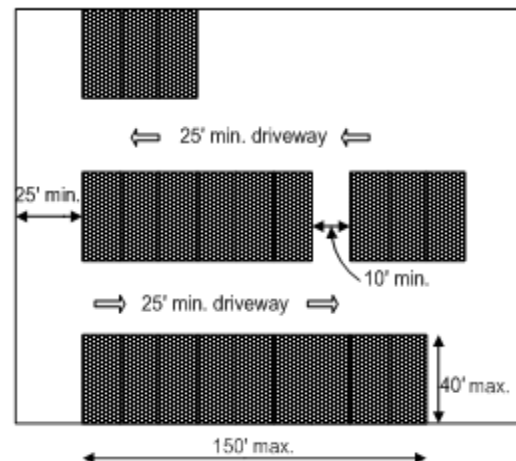
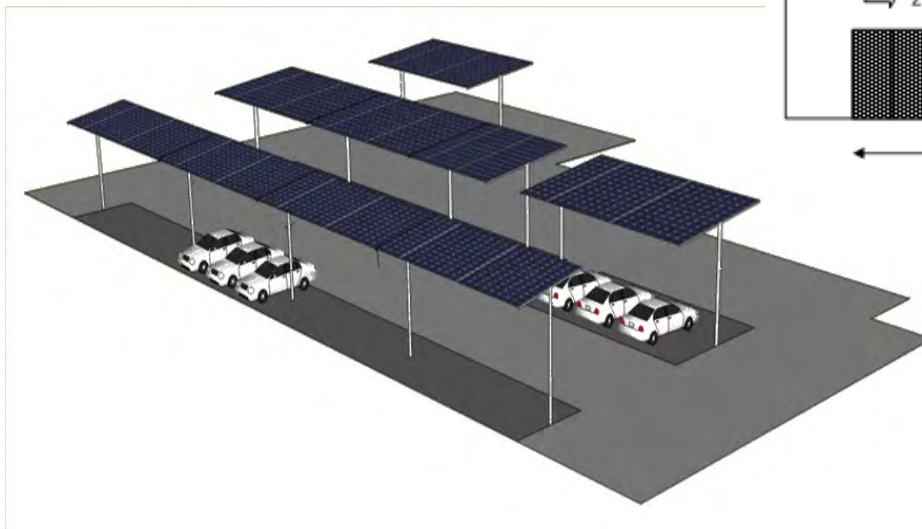


FIGURE 5-1

SECTION 504 BUILDING HEIGHT AND NUMBER OF STORIES

504.1 General. The height, in feet, and the number of stories of a building shall be determined based on the type of construction, occupancy classification and whether there is an automatic sprinkler system installed throughout the building.

Exception: The building height of one-story aircraft hangars, aircraft paint hangars and buildings used for the manufacturing of aircraft shall not be limited where the building is provided with an automatic sprinkler system or automatic fire-extinguishing system in accordance with Chapter 9 and is entirely surrounded by public ways or yards not less in width than one and one-half times the building height.

504.1.1 Unlimited area buildings. The height of unlimited area buildings shall be designed in accordance with Section 507.

504.1.2 Special provisions. The special provisions of Section 510 permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in Section 510.

504.2 Mixed occupancy. In a building containing mixed occupancies in accordance with Section 508, no individual occupancy shall exceed the height and number of story limits specified in this section for the applicable occupancies.

504.3 Height in feet. The maximum height, in feet, of a building shall not exceed the limits specified in Table 504.3.

Exception: Towers, spires, steeples and other rooftop structures shall be constructed of materials consistent with the required type of construction of the building except where other construction is permitted by Section 1511.2.4. Such structures shall not be used for habitation or storage. The structures shall be unlimited in height where of noncombustible materials and shall not extend more than 20 feet (6096 mm) above the allowable building height where of combustible materials (see Chapter 15 for additional requirements).

504.4 Number of stories. The maximum number of stories above grade plane of a building shall not exceed the limits specified in Table 504.4.

SECTION 505 MEZZANINES AND EQUIPMENT PLATFORMS

505.1 General. Mezzanines shall comply with Section 505.2. Equipment platforms shall comply with Section 505.3.

505.2 Mezzanines. A mezzanine or mezzanines in compliance with Section 505.2 shall be considered a portion of the story below. Such mezzanines shall not contribute to either the building area or number of stories as regulated by Section 503.1. The area of the mezzanine shall be included in deter-

mining the fire area. The clear height above and below the mezzanine floor construction shall be not less than 7 feet (2134 mm).

505.2.1 Area limitation. The aggregate area of a mezzanine or mezzanines within a room shall be not greater than one-third of the floor area of that room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located. In determining the allowable mezzanine area, the area of the mezzanine shall not be included in the floor area of the room.

Exceptions:

1. The aggregate area of mezzanines in buildings and structures of Type I or II construction for special industrial occupancies in accordance with Section 503.1.1 shall be not greater than two-thirds of the floor area of the room.
2. The aggregate area of mezzanines in buildings and structures of Type I or II construction shall be not greater than one-half of the floor area of the room in buildings and structures equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 and an approved emergency voice/alarm communication system in accordance with Section 907.5.2.2.
3. The aggregate area of a mezzanine within a dwelling unit that is located in a building equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 shall not be greater than one-half of the floor area of the room, provided that:
 - 3.1. Except for enclosed closets and bathrooms, the mezzanine shall be open to the room in which such mezzanine is located;
 - 3.2. The opening to the room shall be unobstructed except for walls not more than 42 inches (1067 mm) in height, columns and posts; and
 - 3.3. Exceptions to Section 505.2.3 shall not be permitted.

505.2.1.1 Aggregate area of mezzanines and equipment platforms. Where a room contains both a mezzanine and an equipment platform, the aggregate area of the two raised floor levels shall be not greater than two-thirds of the floor area of that room or space in which they are located. The area of the mezzanine shall not exceed the area determined in accordance with Section 505.2.1.

505.2.2 Means of egress. The means of egress for mezzanines shall comply with the applicable provisions of Chapter 10.

TABLE 504.3
ALLOWABLE BUILDING HEIGHT IN FEET ABOVE GRADE PLANE ^{a, i}

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
B, F, M, S, U	NS ^b	UL	160	65	55	65	55	65	65	65	65	50	40
	S	UL	180	85	75	85	75	270	180	85	85	70	60
A, E	NS ^b	UL	160	65	55	65	55	65	65	65	65	50	40
	S (without area increase)	UL	180	85	75	85	75	270	180	85	85	70	60
	S (with area increase)	UL	160	65	55	65	55	250	160	65	65	50	40
H-1, H-2, H-3, H-5, L	NS ^{c, d}	UL	160	65	55	65	55	120	90	85	65	50	40
	S (without area increase)	UL	160	65	55	65	55						
	S (with area increase)	UL	160	65	55	65	55	65	65	65	65	50	40
H-4	NS ^{c, d}	UL	160	65	55	65	55	65	65	65	65	50	40
	S (without area increase)	UL	180	85	75	85	75	140	100	85	85	70	60
	S (with area increase)	UL	160	65	55	65	55	250	160	65	65	50	40
I-3	NS ^{d, e}	UL	160	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	180	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (with area increase)	UL	160	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
I-2, I-2.1	NS ^{d, e, f}	UL	160	65	55	65	55	NP	NP	NP	65	50	40
	S (without area increase)	UL	180	85				NP	NP	NP			
	S (with area increase)	UL	160	65	NP	NP	NP						
I-4	NS ^{d, g}	UL	160	65	55	65	55	65	65	65	65	50	40
	S (without area increase)	UL	180	85	75	85	75	180	120	85	85	70	60
	S (with area increase)	UL	160	65	55	65	55	160	100	65	65	50	50
R-1 ^h	NS ^d	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	55	60	55	60	60	60	60	60	60
	S (without area increase)	UL	180	85	75	85	75	270	180	85	85	70	60
	S (with area increase)	UL	160	65	55	65	55	250	160	65	65	50	40
R-2 ^h	NS ^d	UL	160	65	55	65	55	65	65	65	65	50	40
	S13R	60	60	60	55	60	55	60	60	60	60	50	40
	S (without area increase)	UL	180	85	75	85	75	270	180	85	85	70	60
	S (with area increase)	UL	160	65	55	65	55	250	160	65	65	60 ^j	40
R-2.1 ^h	NS ^d	UL	160	65	55	65	55	65	NP	NP	NP	50	40
	S13D	60	60	60	55	60	55	60	NP	NP	NP	50	40
	S13R	60	60	60	55	60	55	60	NP	NP	NP	50	40
	S	UL	160	65	55	65	55	270	NP	NP	NP	50	40
R-2.2 ^h	NS ^d	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	180	85	NP	85	NP	270	180	85	85	70	NP
	S (with area increase)	UL	160	65	NP	65	NP	250	160	65	65	60 ^j	NP
R-3, R-3.1 ^h	NS ^d	UL	160	65	55	65	55	65	65	65	65	50	40
	S13D	60	60	60	60	60	60	60	60	60	60	50	40
	S13R	60	60	60	55	60	55	60	60	60	60	60	60
	S	UL	160	65	55	65	55	270	180	85	65	70	60
	NS ^d	UL	160	65	55	65	55	65	65	65	65	50	40
R-4 ^h	S13D	60	60	60	55	60	55	60	60	60	60	50	40
	S13R	60	60	60	55	60	55	60	60	60	60	50	40
	S	UL	160	65	55	65	55	270	180	85	65	50	40
	NS ^d	UL	160	65	55	65	55	270	180	85	65	50	40

For SI: 1 foot = 304.8 mm.

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

- a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
- b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
- c. New Group H and all Group L occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
- d. The NS value is only for use in evaluation of existing building height in accordance with the *California Existing Building Code*.
- e. New Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
- h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
- i. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
- j. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE^{a, b, n}

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
A-1	NS	UL	5	3	2	3	2	3	3	3	3	2	1
	S (without area increase)	UL	6	4	3	4	3	9	6	4	4	3	2
	S (with area increase)	UL	5	3	2	3	2	8	5	3	3	2	1
A-2	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S (without area increase)	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	UL	11	3	2	3	2	17	11	5	3	2	1
A-3	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S (without area increase)	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	UL	11	3	2	3	2	17	11	5	3	2	1
A-4	NS	UL	11	3	2	3	2	3	3	3	3	2	1
	S (without area increase)	UL	12	4	3	4	3	18	12	6	4	3	2
	S (with area increase)	UL	11	3	2	3	2	17	11	5	3	2	1
A-5	NS	UL	UL	UL	UL	UL	UL	1	1	1	UL	UL	UL
	S	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
B	NS	UL	11	5	3	5	3	5	5	5	5	3	2
	S	UL	12	6	4	6	4	18	12	9	6	4	3
E	NS	UL	5	3	2	3	2	3	3	3	3	1	1
	S (without area increase)	UL	6	4	3	4	3	9	6	4	4	2	2
	S (with area increase)	UL	5	3	2	3	2	8	7	3	3	1	1
F-1	NS	UL	11	4	2	3	2	3	3	3	4	2	1
	S	UL	12	5	3	4	3	10	7	5	5	3	2
F-2	NS	UL	11	5	3	4	3	5	5	5	5	3	2
	S	UL	12	6	4	5	4	12	8	6	6	4	3
H-1	NS ^{c, d}	1	1	1	1	1	1	NP	NP	NP	1	1	NP
	S							1	1	1			
H-2	NS ^{c, d}	20	3	2	1	2	1	1	1	1	2	1	1
	S							2	2	2			
H-3	NS ^{c, d}	20	6	4	2	4	2	3	3	3	4	2	1
	S							4	4	4			
H-4	NS ^{c, d}	20	7	5	3	5	3	5	5	5	5	3	2
	S (without area increase)	20	8	6	4	6	4	8	7	6	6	4	3
	S (with area increase)	20	7	5	3	5	3	7	6	5	5	3	2
H-5	NS ^{c, d}	4	4	3	3	3	3	2	2	2	3	3	2
	S							3	3	3			
I-2, I-2.1 ^{j, i}	NS ^{d, f}	UL	4	2	1	1	NP	NP	NP	NP	1	1	NP
	S (without area increase)	UL	5	3				NP	NP	NP			
	S (with area increase)	UL	4	2				NP	NP	NP			
I-3	NS ^{d, e}	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	3	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (with area increase)	UL	2	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
I-4 ^p	NS ^{d, g}	UL	5	3	2	3	2	3	3	3	3	1	1
	S (without area increase)	UL	6	4	3	4	3	9	6	4	4	2	2
	S (with area increase)	UL	5	3	2	3	2	8	5	3	3	1	1
L	NS	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S	20	6	5	3	5	3	8	6	5	5	3	2
M	NS	UL	11	4	2	4	2	4	4	4	4	3	1
	S	UL	12	5	3	5	3	12	8	6	5	4	2

(continued)

TABLE 504.4—continued
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE^{a, b, n}

OCCUPANCY CLASSIFICATION	TYPE OF CONSTRUCTION												
	See Footnotes	Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
R-1 ^h	NS ^d	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									3	2
	S (without area increase)	UL	12	5	5	5	5	18	12	8	5	4	3
	S (with area increase)	UL	11	4	4	4	4	17	11	7	4	3	2
R-2 ^h	NS ^d	UL	11	4	4	4	4	4	4	4	4	3	2
	S13R	4	4									4	3
	S (without area increase)	UL	12	5	5	5	5	18	12	8	5	4	3
	S (with area increase)	UL	11	4	4	4	4	17	11	7	4	4 ^o	2
R-2.1 ^h	NS ^d	UL	6 ^l	3 ^k	NP	3 ^k	NP	4	NP	NP	NP	3 ^k	NP
	S13R	UL	4 ^l	3 ^k	NP	3 ^k	NP	4	NP	NP	NP	3 ^k	NP
	S	UL	6 ^l	3 ^k	NP	3 ^k	NP	10	NP	NP	NP	3 ^k	NP
R-2.2 ^h	NS ^d	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S (without area increase)	UL	12	5	NP	5	NP	18	12	8	5	4	NP
	S (with area increase)	UL	11	4	NP	4	NP	17	11	7	4	4 ^o	NP
R-3, R 3-1 ^h	NS ^d	UL	11	4	4	4	4	4	4	4	4	3	3
	S13D	4	4									3	3
	S13R	4	4									4	4
	S	UL	12	5	5	5	5	18	12	5	5	4	4
R-4 ^h	NS ^d	UL	11 ^l	4 ^k	4 ^m	4 ^k	4 ^m	4 ^m	4 ^m	4 ^m	4 ^m	3 ^k	2 ^m
	S13D	4	4 ^l									3 ^k	2 ^m
	S13R	4	4 ^l									4	3
	S	UL	11 ^l	5	5	5	5	11 ^l	5	5	5	4	3
S-1	NS	UL	11	4	2	3	2	4	4	4	4	3	1
	S	UL	12	5	4	4	4	10	7	5	5	4	2
S-2 ⁱ	NS	UL	11	5	3	4	3	4	4	4	5	4	2
	S	UL	12	6	4	5	4	12	8	5	6	5	3
U	NS	UL	5	4	2	3	2	4	4	4	4	2	1
	S	UL	6	5	3	4	3	9	6	5	5	3	2

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

- a. See Chapters 4 and 5 for specific exceptions to the allowable height in this chapter.
- b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
- c. New Group H occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
- d. The NS value is only for use in evaluation of existing building height in accordance with the *California Existing Building Code*.
- e. Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- g. For new Group I-4 occupancies, see Exceptions 2 and 3 of Section 903.2.6.
- h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
- i. See Sections 407.1.1 and 408.1.2 for specific exceptions to construction type, allowable building areas and allowable heights.
- j. Restraint shall not be permitted in any building except in Group I-3 occupancies constructed for such use (see Section 408.1.2).
- k. Nonambulatory persons shall be limited to the first 2 stories.
- l. Nonambulatory persons shall be limited to the first 5 stories.
- m. Nonambulatory elderly clients are not permitted in buildings of these types of construction. See Sections 435.3.3 and 435.3.4.
- n. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
- o. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.
- p. See Section 436.1 for additional regulations for child-care centers and adult day care.

505.2.3 Openness. A mezzanine shall be open and unobstructed to the room in which such mezzanine is located except for walls not more than 42 inches (1067 mm) in height, columns and posts.

Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the occupant load of the aggregate area of the enclosed space is not greater than 10.
2. A mezzanine having two or more exits or access to exits is not required to be open to the room in which the mezzanine is located.
3. Mezzanines or portions thereof are not required to be open to the room in which the mezzanines are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the mezzanine area.
4. In industrial facilities, mezzanines used for control equipment are permitted to be glazed on all sides.
5. In occupancies other than Groups H and I, which are no more than two stories above grade plane and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a mezzanine having two or more exits or access to exits shall not be required to be open to the room in which the mezzanine is located.

505.3 Equipment platforms. Equipment platforms in buildings shall not be considered as a portion of the floor below. Such equipment platforms shall not contribute to either the building area or the number of stories as regulated by Section 503.1. The area of the equipment platform shall not be included in determining the fire area in accordance with Section 903. Equipment platforms shall not be a part of any mezzanine and such platforms and the walkways, stairways, alternating tread devices and ladders providing access to an equipment platform shall not serve as a part of the means of egress from the building.

505.3.1 Area limitation. The aggregate area of all equipment platforms within a room shall be not greater than two-thirds of the area of the room in which they are located. Where an equipment platform is located in the same room as a mezzanine, the area of the mezzanine shall be determined by Section 505.2.1 and the combined aggregate area of the equipment platforms and mezzanines shall be not greater than two-thirds of the room in which they are located. The area of the mezzanine shall not exceed the area determined in accordance with Section 505.2.1.

505.3.2 Automatic sprinkler system. Where located in a building that is required to be protected by an automatic sprinkler system, equipment platforms shall be fully protected by sprinklers above and below the platform, where required by the standards referenced in Section 903.3.

505.3.3 Guards. Equipment platforms shall have guards where required by Section 1015.2.

**SECTION 506
BUILDING AREA**

506.1 General. The floor area of a building shall be determined based on the type of construction, occupancy classification, whether there is an automatic sprinkler system installed throughout the building and the amount of building frontage on public way or open space.

506.1.1 Unlimited area buildings. Unlimited area buildings shall be designed in accordance with Section 507.

506.1.2 Special provisions. The special provisions of Section 510 permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in Section 510.

506.1.3 Basements. Basements need not be included in the total allowable floor area of a building provided the total area of such basements does not exceed the area permitted for a one-story above grade plane building.

506.2 Allowable area determination. The allowable area of a building shall be determined in accordance with the applicable provisions of Sections 506.2.1, 506.2.2 and 506.3.

506.2.1 Single-occupancy buildings. The allowable area of each story of a single-occupancy building shall be determined in accordance with Equation 5-1:

$$A_a = A_t + (NS \times I_f) \tag{Equation 5-1}$$

where:

A_a = Allowable area (square feet).

A_t = Tabular allowable area factor (NS, S1, S13R or S13D value, as applicable) in accordance with Table 506.2.

NS = Tabular allowable area factor in accordance with Table 506.2 for nonsprinklered building (regardless of whether the building is sprinklered).

I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

The allowable area per story of a single-occupancy building with a maximum of three stories above grade shall be determined by Equation 5-1. The total allowable area of a single-occupancy building more than three stories above grade plane shall be determined in accordance with Equation 5-2:

$$A_a = [A_t + (NS \times I_f)] \times S_a \tag{Equation 5-2}$$

where:

A_a = Allowable area (square feet).

A_t = Tabular allowable area factor (NS, S13R, S13D or SM value, as applicable) in accordance with Table 506.2.

NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building (regardless of whether the building is sprinklered).

I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

S_a = For other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, actual number of stories above grade plane exceeds three. For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, actual number of building stories above grade plane, not to exceed two.

S_a = 4 where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2.

The actual area of any individual floor shall not exceed the allowable area per Equation 5-1.

506.2.2 Mixed-occupancy buildings. The allowable area of each story of a mixed-occupancy building shall be determined in accordance with the applicable provisions of, Section 508.3.2 for nonseparated occupancies and Section 508.4.2 for separated occupancies.

For buildings with more than three stories above grade plane, the total building area shall be such that the aggregate sum of the ratios of the actual area of each story divided by the allowable area of such stories, determined in accordance with Equation 5-3 based on the applicable provisions of Section 508.1, shall not exceed three, *provided the aggregate sum of the ratios for portions of mixed-occupancy, multistory buildings containing A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, including any other associated non-separated occupancies, shall not exceed two.*

$$A_a = [A_t + (NS \times I_p)] \quad \text{(Equation 5-3)}$$

A_a = Allowable area (square feet).

A_t = Tabular allowable area factor (NS , S13R, S13D or SM value, as applicable) in accordance with Table 506.2.

NS = Tabular allowable area factor in accordance with Table 506.2 for a nonsprinklered building, regardless of whether the building is sprinklered.

I_f = Area factor increase due to frontage (percent) as calculated in accordance with Section 506.3.

506.2.2.1 Group H-2 or H-3 mixed occupancies. For a building containing Group H-2 or H-3 occupancies, the allowable area shall be determined in accordance with Section 508.4.2, with the sprinkler system increase applicable only to the portions of the building not classified as Group H-2 or H-3.

506.3 Frontage increase. Every building shall adjoin or have access to a public way to receive an area factor increase based

on frontage. Area factor increase shall be determined in accordance with Sections 506.3.1 through 506.3.3.

506.3.1 Minimum percentage of perimeter. To qualify for an area factor increase based on frontage, a building shall have not less than 25 percent of its perimeter on a public way or open space. Such open space shall be either on the same lot or dedicated for public use and shall be accessed from a street or approved fire lane.

506.3.2 Minimum frontage distance. To qualify for an area factor increase based on frontage, the public way or open space adjacent to the building perimeter shall have a minimum distance (W) of 20 feet (6096 mm) measured at right angles from the building face to any of the following:

1. The closest interior lot line.
2. The entire width of a street, alley or public way.
3. The exterior face of an adjacent building on the same property.

The frontage increase shall be based on the smallest public way or open space that is 20 feet (6096 mm) or greater, and the percentage of building perimeter having a minimum 20 feet (6096 mm) public way or open space.

506.3.3 Amount of increase. The area factor increase based on frontage shall be determined in accordance with Table 506.3.3.

506.3.3.1 Section 507 buildings. Where a building meets the requirements of Section 507, as applicable, except for compliance with the minimum 60-foot (18 288 mm) public way or yard requirement, the area factor increase based on frontage shall be determined in accordance with Table 506.3.3.1.

SECTION 507 UNLIMITED AREA BUILDINGS

507.1 General. The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.13 shall not be limited. Basements not more than one story below grade plane shall be permitted.

507.1.1 Accessory occupancies. Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.3 through 507.13 shall be applied, where applicable.

507.2 Measurement of open spaces. Where Sections 507.3 through 507.13 require buildings to be surrounded and adjoined by public ways and yards, those open spaces shall be determined as follows:

1. Yards shall be measured from the building perimeter in all directions to the closest interior lot lines or to the exterior face of an opposing building located on the same lot, as applicable.
2. Where the building fronts on a public way, the entire width of the public way shall be used.

TABLE 506.2
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET^{a, b, j}

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION												
		Type I		Type II		Type III		Type IV				Type V		
		A	B	A	B	A	B	A	B	C	HT	A	B	
A-1	NS	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500	
	S1	UL	UL	62,000	34,000	56,000	34,000	180,000	120,000	75,000	60,000	46,000	22,000	
	SM (without height increase)	UL	UL	46,500	25,500	42,000	25,500	135,000	90,000	56,250	45,000	34,500	16,500	
	SM (with height increase)	UL	UL	15,500	8,500	14,000	8,500	45,000	30,000	18,750	15,000	11,500	5,500	
A-2	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000	
	SM (without height increase)	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000	
	SM (with height increase)	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
A-3	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000	
	SM (without height increase)	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000	
	SM (with height increase)	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
A-4	NS	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
	S1	UL	UL	62,000	38,000	56,000	38,000	180,000	120,000	75,000	60,000	46,000	24,000	
	SM (without height increase)	UL	UL	46,500	28,500	42,000	28,500	135,000	90,000	56,250	45,000	34,500	18,000	
	SM (with height increase)	UL	UL	15,500	9,500	14,000	9,500	45,000	30,000	18,750	15,000	11,500	6,000	
A-5	NS	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	
	S1													
	SM													
B	NS	UL	UL	37,500	23,000	28,500	19,000	108,000	72,000	45,000	36,000	18,000	9,000	
	S1	UL	UL	150,000	92,000	114,000	76,000	432,000	288,000	180,000	144,000	72,000	36,000	
	SM	UL	UL	112,500	69,000	85,500	57,000	324,000	216,000	135,000	108,000	54,000	27,000	
E	NS	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500	
	S1	UL	UL	106,000	58,000	94,000	58,000	306,000	204,000	127,500	102,000	74,000	38,000	
	SM (without height increase)	UL	UL	79,500	43,500	70,500	43,500	229,500	153,000	95,625	76,500	55,500	28,500	
	SM (with height increase)	UL	UL	26,500	14,500	23,500	14,500	76,500	51,000	31,875	25,500	18,500	9,500	
F-1	NS	UL	UL	25,000	15,500	19,000	12,000	100,500	67,000	41,875	33,500	14,000	8,500	
	S1	UL	UL	100,000	62,000	76,000	48,000	402,000	268,000	167,500	134,000	56,000	34,000	
	SM	UL	UL	75,000	46,500	57,000	36,000	301,500	201,000	125,625	100,500	42,000	25,500	
F-2	NS	UL	UL	37,500	23,000	28,500	18,000	151,500	101,000	63,125	50,500	21,000	13,000	
	S1	UL	UL	150,000	92,000	114,000	72,000	606,000	404,000	252,500	202,000	84,000	52,000	
	SM	UL	UL	112,500	69,000	85,500	54,000	454,500	303,000	189,375	151,500	63,000	39,000	
H-1	NS ^c	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	NP	
	S1													
H-2	NS ^c	21,000	16,500	11,000	7,000	9,500	7,000	10,500	10,500	10,500	10,500	7,500	3,000	
	S1													
	SM													
H-3	NS ^c	UL	60,000	26,500	14,000	17,500	13,000	25,500	25,500	25,500	25,500	10,000	5,000	
	S1													
	SM													
H-4	NS ^{c, d}	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500	
	S1	UL	UL	150,000	70,000	114,000	70,000	288,000	216,000	162,000	144,000	72,000	26,000	
	SM (without height increase)	UL	UL	112,500	52,500	85,500	52,500	216,000	162,000	121,500	108,000	54,000	19,500	
	SM (with height increase)	UL	UL	37,500	17,500	28,500	17,500	72,000	54,000	40,500	36,000	18,000	6,500	
H-5	NS ^{c, d}	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000	
	S1	UL	UL	150,000	92,000	114,000	76,000	288,000	216,000	162,000	144,000	72,000	36,000	
	SM (without height increase)	UL	UL	112,500	69,000	85,500	57,000	216,000	162,000	121,500	108,000	54,000	27,000	
	SM (with height increase)	UL	UL	37,500	23,000	28,500	19,000	72,000	54,000	40,500	36,000	18,000	9,000	

(continued)

GENERAL BUILDING HEIGHTS AND AREAS

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_r = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET^{a, b, j}

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
I-2, I-2.1	NS ^{d, f}	UL	UL	15,000	11,000	12,000	NP	36,000	24,000	12,000	12,000	9,500	NP
	S1	UL	UL	60,000	44,000	48,000	NP	144,000	96,000	48,000	48,000	38,000	NP
	SM (without height increase)	UL	UL	45,000	33,000	36,000	NP	108,000	72,000	36,000	36,000	28,500	NP
	SM (with height increase)	UL	UL	15,000	11,000	12,000	NP	NP	NP	NP	12,000	9,500	NP
I-3	NS ^{d, e}	UL	15,100	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	S1	UL	45,300	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	SM (without height increase)	UL	30,200	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
	SM (with height increase)	UL	15,100	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
I-4	NS ^{d, g}	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
	S1	UL	121,000	106,000	52,000	94,000	52,000	306,000	204,000	102,000	102,000	74,000	36,000
	SM (without height increase)	UL	181,500	79,500	39,000	70,500	39,000	229,500	153,000	76,500	76,500	55,500	27,000
	SM (with height increase)	UL	60,500	26,500	13,000	23,500	13,000	76,500	51,000	25,500	25,500	18,500	9,000
L	NS ^c	UL	60,000	37,500	17,500	28,500	17,500	60,000	37,500	36,000	36,000	18,000	6,500
	S1												
	SM												
M	NS	UL	UL	21,500	12,500	18,500	12,500	61,500	41,000	26,625	20,500	14,000	9,000
	S1	UL	UL	86,000	50,000	74,000	50,000	246,000	164,000	102,500	82,000	56,000	36,000
	SM	UL	UL	64,500	37,500	55,500	37,500	184,500	123,000	76,875	61,500	42,000	27,000
R-1 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1												
	SM (without height increase)												
R-2 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13R												
	S1												
	SM (without height increase)												
R-2 Type VA construction ^k	NS ^d	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	12,000	NP
	S13R	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	12,000	NP
	S1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	48,000	NP
	SM (without height increase)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	36,000	NP
	SM (with height increase)	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	36,000 ^j	NP
R-2.1 ^h	NS ^d	UL	55,000	19,000	NP	16,500	NP	54,000	NP	NP	NP	10,500	NP
	S13R	UL	55,000	19,000	NP	16,500	NP					10,500	NP
	S1	UL	220,000	76,000	NP	66,000	NP	216,000	NP	NP	NP	42,000	NP
	SM (without height increase)	UL	165,000	57,000	NP	49,500	NP	162,000	NP	NP	NP	31,500	NP
	SM (with height increase)	UL	55,000	19,000	NP	16,500	NP	54,000	NP	NP	NP	10,500	NP
R-2.2 ^h	NS ^l	UL	UL	24,000	NP	24,000	NP	61,500	41,000	25,625	20,500	12,000	NP
	S1	UL	UL	96,000	NP	96,000	NP	246,000	164,000	102,500	82,000	48,000	NP
	SM (without height increase)	UL	UL	72,000	NP	72,000	NP	184,500	123,000	76,875	61,500	36,000	NP
	SM (with height increase)	UL	UL	24,000	NP	24,000	NP	61,500	41,000	25,625	20,500	12,000	NP
R-3, R-3-1 ^h	NS ^d	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL	UL
	S13D												
	S13R												
	S1												
SM													

(continued)

TABLE 506.2—continued
ALLOWABLE AREA FACTOR (A_t = NS, S1, S13R, S13D or SM, as applicable) IN SQUARE FEET^{a, b, j}

OCCUPANCY CLASSIFICATION	SEE FOOTNOTES	TYPE OF CONSTRUCTION											
		Type I		Type II		Type III		Type IV				Type V	
		A	B	A	B	A	B	A	B	C	HT	A	B
R-4 ^h	NS ^d	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
	S13D												
	S13R												
	S1	UL	UL	96,000	64,000	96,000	64,000	246,000	164,000	102,500	82,000	48,000	28,000
	SM (without height increase)	UL	UL	72,000	48,000	72,000	48,000	184,500	123,000	76,875	61,500	36,000	21,000
	SM (with height increase)	UL	UL	24,000	16,000	24,000	16,000	61,500	41,000	25,625	20,500	12,000	7,000
S-1	NS	UL	48,000	26,000	17,500	26,000	17,500	76,500	51,000	31,875	25,500	14,000	9,000
	S1	UL	192,000	104,000	70,000	104,000	70,000	306,000	204,000	127,500	102,000	56,000	36,000
	SM	UL	144,000	78,000	52,500	78,000	52,500	229,500	153,000	95,625	76,500	42,000	27,000
S-2	NS	UL	79,000	39,000	26,000	39,000	26,000	115,500	77,000	48,125	38,500	21,000	13,500
	S1	UL	316,000	156,000	104,000	156,000	104,000	462,000	308,000	192,500	154,000	84,000	54,000
	SM	UL	237,000	117,000	78,000	117,000	78,000	346,500	231,000	144,375	115,500	63,000	40,500
U	NS ⁱ	UL	35,500	19,000	8,500	14,000	8,500	54,000	36,000	22,500	18,000	9,000	5,500
	S1	UL	142,000	76,000	34,000	56,000	34,000	216,000	144,000	90,000	72,000	36,000	22,000
	SM	UL	106,500	57,000	25,500	42,000	25,500	162,000	108,000	67,500	54,000	27,000	16,500

For SI: 1 square foot = 0.0929 m².

UL = Unlimited; NP = Not Permitted; NS = Buildings not equipped throughout with an automatic sprinkler system; S1 = Buildings a maximum of one story above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; SM = Buildings two or more stories above grade plane equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1; S13R = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.2; S13D = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.3.

- a. See Chapters 4 and 5 for specific exceptions to the allowable area in this chapter.
- b. See Section 903.2 for the minimum thresholds for protection by an automatic sprinkler system for specific occupancies.
- c. New Group H and all Group L occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.5.
- d. The NS value is only for use in evaluation of existing building area in accordance with the *California Existing Building Code*.
- e. Group I-3 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- f. New and existing Group I-2 occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.6.
- g. New Group I-4 occupancies see Exceptions 2 and 3 of Section 903.2.6.
- h. New Group R occupancies are required to be protected by an automatic sprinkler system in accordance with Section 903.2.8.
- i. The maximum allowable area for a single-story nonsprinklered Group U greenhouse is permitted to be 9,000 square feet, or the allowable area shall be permitted to comply with Table C102.1 of Appendix C.
- j. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, the S increases for height and stories in Tables 504.3 and 504.4 are permitted in addition to the S area increase in accordance with Table 506.2.
- k. For Group R-2 buildings of Type VA construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, S area increase is permitted in addition to the height and story increase provided the height shall not exceed 60 feet and 4 stories.
- l. The NS value is only for use in evaluation of single-occupancy, multistory buildings per the formula in Section 506.2.3.

TABLE 506.3.3
FRONTAGE INCREASE FACTOR^a

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)			
	0 to less than 20	20 to less than 25	25 to less than 30	30 or greater
0 to less than 25	0	0	0	0
25 to less than 50	0	0.17	0.21	0.25
50 to less than 75	0	0.33	0.42	0.50
75 to 100	0	0.50	0.63	0.75

- a. Interpolation is permitted.

TABLE 506.3.3.1
SECTION 507 BUILDINGS^a

PERCENTAGE OF BUILDING PERIMETER	OPEN SPACE (feet)					
	30 to less than 35	35 to less than 40	40 to less than 45	45 to less than 50	50 to less than 55	55 to less than 60
0 to less than 25	0	0	0	0	0	0
25 to less than 50	0.29	0.33	0.38	0.42	0.46	0.50
50 to less than 75	0.58	0.67	0.75	0.83	0.92	1.00
75 to 100	0.88	1.00	1.13	1.25	1.38	1.50

a. Interpolation is permitted.

507.2.1 Reduced open space. The public ways or yards of 60 feet (18 288 mm) in width required in Sections 507.3, 507.4, 507.5, 507.6 and 507.12 shall be permitted to be reduced to not less than 40 feet (12 192 mm) in width, provided that the following requirements are met:

1. The reduced width shall not be allowed for more than 75 percent of the perimeter of the building.
2. The exterior walls facing the reduced width shall have a fire-resistance rating of not less than 3 hours.
3. Openings in the exterior walls facing the reduced width shall have opening protectives with a fire protection rating of not less than 3 hours.

507.3 Nonsprinklered, one-story buildings. The area of a Group F-2 or S-2 building not more than one story in height shall not be limited where the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.4 Sprinklered, one-story buildings. The area of a Group A-4 building not more than one story above grade plane of other than Type V construction, or the area of a Group B, F, M or S building no more than one story above grade plane of any construction type, shall not be limited where the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

Exceptions:

1. Buildings and structures of Type I or II construction for rack storage facilities that do not have access by the public shall not be limited in height, provided that such buildings conform to the requirements of Sections 507.4 and 903.3.1.1 and Chapter 32 of the *California Fire Code*.
2. The automatic sprinkler system shall not be required in areas occupied for indoor participant sports, such as tennis, skating, swimming and equestrian activities in occupancies in Group A-4, provided that the following criteria are met:
 - 2.1. Exit doors directly to the outside are provided for occupants of the participant sports areas.
 - 2.2. The building is equipped with a fire alarm system with manual fire alarm boxes installed in accordance with Section 907.

2.3. An automatic sprinkler system is provided in storage rooms, press boxes, concession booths or other spaces ancillary to the sport activity space.

507.4.1 Mixed occupancy buildings with Groups A-1 and A-2. Group A-1 and A-2 occupancies of other than Type V construction shall be permitted within mixed occupancy buildings of unlimited area complying with Section 507.4, provided that the following criteria are met:

1. Group A-1 and A-2 occupancies are separated from other occupancies as required for separated occupancies in Section 508.4.4 with no reduction allowed in the fire-resistance rating of the separation based upon the installation of an automatic sprinkler system.
2. Each area of the portions of the building used for Group A-1 or A-2 occupancies shall not exceed the maximum allowable area permitted for such occupancies in Section 503.1.
3. Exit doors from Group A-1 and A-2 occupancies shall discharge directly to the exterior of the building.

507.5 Two-story buildings. The area of a Group B, F, M or S building not more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.6 Group A-3 buildings of Type II construction. The area of a Group A-3 building not more than one story above grade plane, used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction, shall not be limited provided that the following criteria are met:

1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.7 Group A-3 buildings of Type III and IV construction. The area of a Group A-3 building of Type III or IV

construction, with not more than one story above grade plane and used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court, shall not be limited provided that the following criteria are met:

1. The building shall not have a stage other than a platform.
2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The assembly floor shall be located at or within 21 inches (533 mm) of street or grade level and all exits are provided with ramps complying with Section 1012 to the street or grade level.
4. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.8 Group H-2, H-3 and H-4 occupancies. Group H-2, H-3 and H-4 occupancies shall be permitted in unlimited area buildings containing Group F or S occupancies in accordance with Sections 507.4 and 507.5 and the provisions of Sections 507.8.1 through 507.8.4.

507.8.1 Allowable area. The aggregate floor area of Group H occupancies located in an unlimited area building shall not exceed 10 percent of the area of the building *nor* the area limitations for the Group H occupancies as specified in Section 506 based on the perimeter of each Group H floor area that fronts on a public way or open space.

507.8.1.1 Located within the building. The aggregate floor area of Group H occupancies not located at the perimeter of the building shall not exceed 25 percent of the area limitations for the Group H occupancies as specified in Section 506.

507.8.1.1.1 Rooms for flammable or combustible liquid use, dispensing or mixing in open systems. Rooms for flammable or combustible liquid use, dispensing or mixing in open systems having a floor area of not more than 500 square feet (46.5 m²) need not be located on the outer perimeter of the building where they are in accordance with the *California Fire Code* and NFPA 30.

507.8.1.1.2 Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems. Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems having a floor area of not more than 1,000 square feet (93 m²) need not be located on the outer perimeter where they are in accordance with the *California Fire Code* and NFPA 30.

507.8.1.1.3 Spray paint booths. Spray paint booths that comply with the *California Fire Code* need not be located on the outer perimeter.

507.8.2 Located on building perimeter. Except as provided for in Section 507.8.1.1, Group H occupancies shall be located on the perimeter of the building. In Group H-2 and H-3 occupancies, not less than 25 percent of the perimeter of such occupancies shall be an exterior wall.

507.8.3 Occupancy separations. Group H occupancies shall be separated from the remainder of the unlimited area building and from each other in accordance with Table 508.4.

507.8.4 Height limitations. For two-story, unlimited area buildings, Group H occupancies shall not be located more than one story above grade plane unless permitted based on the allowable height and number of stories and feet as specified in Section 504 based on the type of construction of the unlimited area building.

507.9 Unlimited mixed occupancy buildings with Group H-5. The area of a Group B, F, H-5, M or S building not more than two stories above grade plane shall not be limited where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width, provided that the following criteria are met:

1. Buildings containing Group H-5 occupancy shall be of Type I or II construction.
2. Each area used for Group H-5 occupancy shall be separated from other occupancies as required in Sections 415.11 and 508.4.
3. Each area used for Group H-5 occupancy shall not exceed the maximum allowable area permitted for such occupancies in Section 503.1 including modifications of Section 506.

Exception: Where the Group H-5 occupancy exceeds the maximum allowable area, the Group H-5 shall be subdivided into areas that are separated by 2-hour fire barriers.

507.10 Aircraft paint hangar. The area of a Group H-2 aircraft paint hangar not more than one story above grade plane shall not be limited where such aircraft paint hangar complies with the provisions of Section 412.5 and is surrounded and adjoined by public ways or yards not less in width than one and one-half times the building height.

507.11 Group E buildings. The area of a Group E building not more than one story above grade plane, of Type II, IIIA or IV construction, shall not be limited provided that the following criteria are met:

1. Each classroom shall have not less than two means of egress, with one of the means of egress being a direct exit to the outside of the building complying with Section 1022.
2. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. The building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.12 Motion picture theaters. In buildings of Type II construction, the area of a motion picture theater located on the first story above grade plane shall not be limited where the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is

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surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

507.13 Covered and open mall buildings and anchor buildings. The area of *covered and open mall buildings* and *anchor buildings* not exceeding three stories in height that comply with Section 402 shall not be limited.

SECTION 508 MIXED USE AND OCCUPANCY

508.1 General. Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3, 508.4 or 508.5, or a combination of these sections.

Exceptions:

1. Occupancies separated in accordance with Section 510.
2. Where required by Table 415.6.5, areas of Group H-1, H-2 and H-3 occupancies shall be located in a detached building or structure.

508.2 Accessory occupancies. Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Accessory occupancies shall comply with the provisions of Sections 508.2.1 through 508.2.4.

508.2.1 Occupancy classification. Accessory occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space.

508.2.2 Allowable building height. The allowable height and number of stories of the building containing accessory occupancies shall be in accordance with Section 504 for the main occupancy of the building.

508.2.3 Allowable building area. The allowable area of the building shall be based on the applicable provisions of Section 506 for the main occupancy of the building. Aggregate accessory occupancies shall not occupy more than 10 percent of the floor area of the story in which they are located and shall not exceed the tabular values for nonsprinklered buildings in Table 506.2 for each such accessory occupancy.

508.2.4 Separation of occupancies. No separation is required between accessory occupancies and the main occupancy.

Exceptions:

1. Group H-2, H-3, H-4 and H-5 and L occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group R-1, R-2, R-2.1, R-2.2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from acces-

sory occupancies contiguous to them in accordance with the requirements of Section 420.

3. Group I-2 and I-2.1 shall be separated from all other occupancies in accordance with Section 508.4.

Exception: No separation is required between Group B, E and R-2 sleeping units accessory to Group I-2 and I-2.1 and covered exterior entrances required by Section 11B-206.4.10 or Section 1224.33.2.1 accessory to Group I-2.

4. Group I-3 and vehicle sally-ports shall be separated from all other occupancies in accordance with Section 508.4.

Exception: No separation is required between Group B, E, R-2 sleeping units and S-2 occupancies accessory to Group I-3 of Type I construction.

508.3 Nonseparated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall be considered as nonseparated occupancies.

508.3.1 Occupancy classification. Nonseparated occupancies shall be individually classified in accordance with Section 302.1. The requirements of this code shall apply to each portion of the building based on the occupancy classification of that space. In addition, the most restrictive provisions of Chapter 9 that apply to the nonseparated occupancies shall apply to the total nonseparated occupancy area.

508.3.1.1 High-rise buildings. Where nonseparated occupancies occur in a high-rise building, the most restrictive requirements of Section 403 that apply to the nonseparated occupancies shall apply throughout the high-rise building.

508.3.2 Allowable building area, height and number of stories. The allowable building area, height and number of stories of the building or portion thereof shall be based on the most restrictive allowances for the occupancy groups under consideration for the type of construction of the building in accordance with Section 503.1.

508.3.3 Separation. No separation is required between nonseparated occupancies.

Exceptions:

1. Group H-2, H-3, H-4 and H-5, I-2, I-2.1 and L occupancies shall be separated from all other occupancies in accordance with Section 508.4.
2. Group R-1, R-2, R-2.1, R-2.2 and R-3 dwelling units and sleeping units shall be separated from other dwelling or sleeping units and from other occupancies contiguous to them in accordance with the requirements of Section 420.
3. Separation is required between Group I-3 and vehicle sally ports.
4. Where Group I-3 is not the main occupancy and the area is greater than 10 percent of the floor area, it shall be separated per Table 508.4.

508.4 Separated occupancies. Buildings or portions of buildings that comply with the provisions of this section shall be considered as separated occupancies.

508.4.1 Occupancy classification. Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with this code based on the occupancy classification of that portion of the building. The most restrictive provisions of Chapter 9 that apply to the separate occupancies shall apply to the total nonfire-barrier-separated occupancy areas. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring a fire protection system shall also comply with Section 901.7.

508.4.2 Allowable building area. In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable building area of each separated occupancy shall not exceed 1.

508.4.3 Allowable building height and number of stories. Each separated occupancy shall comply with the building height limitations and story limitations based on the type of construction of the building in accordance with Section 503.1.

Exception: Special provisions of Section 510 shall permit occupancies at building heights and number of stories other than provided in Section 503.1.

508.4.4 Separation. Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4.

508.4.4.1 Construction. Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies. Mass timber elements serving as fire barriers or horizontal assemblies to separate occu-

**TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)^a**

OCCUPANCY	A, E		I-4 ⁱ , R-2.1		I-2 ^j , I-2.1		I-3		R-1 ^a , R-2 ^a , R-2-2 ^a , R-3 ^a , R-3.1 ^a , R-4 ^a		F-2, S-2 ^b , U		B ^c , F-1 ^{g, h} , M, S-1		L		H-1		H-2		H-3, H-4		H-5	
	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS	S	NS
A, E	N	N	2	2	2	NP	2	NP	1	2	N	1	1	2	2	NP	NP	NP	3	4	2	3	2	NP
I-4 ⁱ , R-2.1	2	2	I ^e	NP	2	NP	2	NP	1	NP	1	2	1	2	2	NP	NP	NP	4	NP	2	NP	2	NP
I-2 ^j , I-2.1	2	NP	2	NP	N	NP	2	NP	2	NP	2	NP	2	NP	2	NP	NP	NP	4	NP	2	NP	2	NP
I-3	2	NP	2	NP	2	NP	N	NP	2	NP	2	2	2	2	2	NP	NP	NP	4	NP				
R-1 ^a , R-2 ^a , R-2-2 ^a , R-3 ^a , R-3.1 ^a , R-4 ^a	1	2	1	NP	2	NP	2	NP	N	N	1 ^c	2 ^c	1	2	4	NP	NP	NP	3	NP	2	NP	2	NP
F-2, S-2 ^b , U	N	1	1	2	2	NP	2	2	1 ^c	2 ^c	N	N	1	2	I	NP	NP	NP	3	4	2	3	2	NP
B ^c , F-1 ^{g, h} , M, S-1	1	2	1	2	2	NP	2	2	1	2	1	2	N	N	I	NP	NP	NP	2	3	1	2	1	NP
L	2	NP	2	NP	2	NP	2	NP	4	NP	I	NP	I	NP	I	NP	NP	NP	2	NP	I	NP	I	NP
H-1	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	N	NP	NP	NP	NP	NP	NP	NP
H-2	3	4	4	NP	4	NP	4	NP	3	NP	3	4	2	3	2	NP	NP	NP	N	NP	1	NP	1	NP
H-3, H-4	2	3	2	NP	2	NP			2	NP	2	3	1	2	I	NP	NP	NP	1	NP	1 ^d	NP	1	NP
H-5	2	NP	2	NP	2	NP			2	NP	2	NP	1	NP	I	NP	NP	NP	1	NP	1	NP	N	NP

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not Permitted.

a. See Section 420.

b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.

c. See Sections 406.3.2 and 406.6.4.

d. Separation is not required between occupancies of the same classification.

e. See Section 422.2 for ambulatory care facilities.

f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

g. [SFM] Group I and F1 occupancies and Group R-2.1 and F-1 occupancies shall have a 3 hour separation.

h. [SFM] Commercial kitchens not associated with cafeterias and similar dining facilities in Group I-2 and Group R-2.1 shall have a 2-hour separation and shall be protected by an automatic sprinkler system.

i. [SFM] Group E child-care separation with I-4 child care can be reduced to 1 hour with the installation of automatic fire sprinklers in accordance with Section 903.3.1.1.

j. When not considered an accessory use in accordance with Section 508.2.4, the required separation between Group I-2 and required covers for accessible entrances and emergency vehicle entrances, when in accordance with Section 406.5.2 and protected by an automatic sprinkler system, shall be reduced by 1 hour but not to less than 1 hour. See Section 903.2.2.1.

pancies in Type IV-B or IV-C construction shall be separated from the interior of the building with an approved thermal barrier consisting of gypsum board that is not less than 1/2 inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

**

508.5 Live/work units A live/work unit shall comply with Sections 508.5 through 508.5.11.

Exceptions:

1. Dwelling or sleeping units that include an office that is less than 10 percent of the area of the dwelling unit are permitted to be classified as dwelling units with accessory occupancies in accordance with Section 508.2.
2. Live/work units complying with the requirements of Section 508.5 shall be permitted to be constructed as one- and two-family dwellings or townhouses in accordance with the California Residential Code, as applicable.

508.5.1 Limitations. The following shall apply to live/work areas:

1. The live/work unit is permitted to be not greater than 3,000 square feet (279 m²) in area.
2. The nonresidential area is permitted to be not more than 50 percent of the area of each live/work unit.
3. The nonresidential area function shall be limited to the first or main floor only of the live/work unit.
4. Not more than five nonresidential workers or employees are allowed to occupy the nonresidential area at any one time.

508.5.2 Occupancies. Live/work units shall be classified as a Group R-2 occupancy. Separation requirements found in Sections 420 and 508 shall not apply within the live/work unit where the live/work unit is in compliance with Section 508.5. Nonresidential uses that would otherwise be classified as either a Group H or S occupancy shall not be permitted in a live/work unit.

Exception: Storage shall be permitted in the live/work unit provided that the aggregate area of storage in the nonresidential portion of the live/work unit shall be limited to 10 percent of the space dedicated to nonresidential activities.

508.5.3 Means of egress. Except as modified by this section, the means of egress components for a live/work unit shall be designed in accordance with Chapter 10 for the function served.

Exception: Residential areas of live/work units constructed in accordance with the California Residential Code shall not be required to comply with Chapter 10.

508.5.4 Egress capacity. The egress capacity for each element of the live/work unit shall be based on the occupant load for the function served in accordance with Table 1004.5.

508.5.5 Spiral stairways. Spiral stairways that conform to the requirements of Section 1011.10 shall be permitted.

508.5.6 Vertical openings. Floor openings between floor levels of a live/work unit are permitted without enclosure.

[F] 508.5.7 Fire protection. The live/work unit shall be provided with a monitored fire alarm system where required by Section 907.2.9 and an automatic sprinkler system in accordance with Section 903.2.8.

508.5.8 Structural. Floors within a live/work unit shall be designed for the live loads in Table 1607.1, based on the function within the space.

Exception: Residential areas of live/work units constructed in accordance with the California Residential Code shall not be required to comply with Table 1607.1.

508.5.9 Accessibility. Accessibility shall be designed in accordance with Chapter 11A and/or 11B, when applicable, for the function served.

508.5.10 Ventilation. The applicable ventilation requirements of the California Mechanical Code shall apply to each area within the live/work unit for the function within that space.

508.5.11 Plumbing facilities. The nonresidential area of the live/work unit shall be provided with minimum plumbing facilities as specified by the California Plumbing Code, based on the function of the nonresidential area. Where the nonresidential area of the live/work unit is required to be accessible, the plumbing fixtures specified by the California Plumbing Code shall be accessible.

**SECTION 509
INCIDENTAL USES**

509.1 General Incidental uses located within single occupancy or mixed occupancy buildings shall comply with the provisions of this section. Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses specified in Table 509.1.

Exception: Incidental uses within and serving a dwelling unit are not required to comply with this section.

509.2 Occupancy classification. Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located.

509.3 Area limitations. The aggregate floor area of incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.

509.4 Separation and protection. The incidental uses specified in Table 509.1 shall be separated from the remainder of the building or equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table.

509.4.1 Separation. Where Table 509.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 707 or a

horizontal assembly constructed in accordance with Section 711, or both. Construction supporting 1-hour fire barriers or horizontal assemblies used for incidental use separations in buildings of Type IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

509.4.1.1 Type IV-B and IV-C construction. Where Table 509.1 specifies a fire-resistance-rated separation, mass timber elements serving as fire barriers or horizontal assemblies in Type IV-B or IV-C construction shall be separated from the interior of the incidental use with an approved thermal barrier consisting of gypsum board that is not less than 1/2 inch (12.7 mm) in thickness or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

509.4.2 Protection. Where Table 509.1 permits an automatic sprinkler system without a fire barrier, the incidental

uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke. The walls shall extend from the top of the foundation or floor assembly below to the underside of the ceiling that is a component of a fire-resistance-rated floor assembly or roof assembly above or to the underside of the floor or roof sheathing, deck or slab above. Doors shall be self- or automatic-closing upon detection of smoke in accordance with Section 716.2.6.6. Doors shall not have air transfer openings and shall not be undercut in excess of the clearance permitted in accordance with NFPA 80. Walls surrounding the incidental use shall not have air transfer openings unless provided with smoke dampers in accordance with Section 710.8.

509.4.2.1 Protection limitation. Where an automatic sprinkler system is provided in accordance with Table 509.1, only the space occupied by the incidental use need be equipped with such a system.

[F]TABLE 509.1
INCIDENTAL USES

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies.
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops, not classified as Group H, located in occupancies other than Group F	2 hours; or 1 hour and provide automatic sprinkler system
In Group E occupancies, laboratories and vocational shops not classified as Group H	1 hour or provide automatic sprinkler system
<i>[SFM] Rooms or areas with special hazards such as laboratories, vocational shops and other such areas not classified as Group H, located in Group E occupancies where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.</i>	1 hour
In Group I-2 and I-2.1 occupancies, laboratories not classified as Group H	1 hour ^a
In ambulatory care facilities, laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
In Group I-2 and I-2.1 laundry rooms over 100 square feet	1 hour ^a
Group I-3 cells and Group I-2 and I-2.1 patient rooms equipped with padded surfaces	1 hour ^a
In Group I-2 and I-2.1 physical plant maintenance shops	1 hour ^a
In ambulatory care facilities or Group I-2 and I-2.1 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater	1 hour ^a
In other than ambulatory care facilities and Group I-2 and I-2.1 occupancies, waste and linen collection rooms over 100 square feet	1 hour or provide automatic sprinkler system
In ambulatory care facilities or Group I-2 and I-2.1 occupancies, storage rooms greater than 100 square feet	1 hour ^a
Electrical installations and transformers	See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of the <i>California Electrical Code</i> for protection and separation requirements.

For SI: 1 square foot = 0.0929 m², 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m³.

a. *[SFM] Fire barrier protection and automatic sprinkler protection required throughout the fire area in I-2 and I-2.1 occupancies as indicated.*

SECTION 510 SPECIAL PROVISIONS

510.1 General. The provisions in Sections 510.2 through 510.9 shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable building heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code. The provisions of Sections 510.2 through 510.8 are to be considered independent and separate from each other.

510.2 Horizontal building separation allowance. A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls, limitation of number of stories and type of construction where the following conditions are met:

1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 3 hours. Where vertical offsets are provided as part of a horizontal assembly, the vertical offset and the structure supporting the vertical offset shall have a fire-resistance rating of not less than 3 hours.
2. The building below, including the horizontal assembly, is of Type IA construction.
3. Shaft, stairway, ramp and escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Section 716.

Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire-resistance rating with opening protectives in accordance with Section 716, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating, provided that the following conditions are met:

1. The building above the horizontal assembly is not required to be of Type I construction.
 2. The enclosure connects fewer than four stories.
 3. The enclosure opening protectives above the horizontal assembly have a fire protection rating of not less than 1 hour.
4. Interior exit stairways located within the Type IA building are permitted to be of combustible materials where the following requirements are met:
 - 4.1. The building above the Type IA building is of Type III, IV, or V construction.
 - 4.2. The stairway located in the Type IA building is enclosed by 3-hour fire-resistance-rated construction with opening protectives in accordance with Section 716.
 5. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A occu-

pancy uses, each with an occupant load of less 300, or Group B, M, R or S occupancies.

6. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.
7. The maximum building height in feet (mm) shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane.

510.3 Group S-2 enclosed parking garage with Group S-2 open parking garage above. A Group S-2 enclosed parking garage with not more than one story above grade plane and located below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction where the following conditions are met:

1. The allowable area of the building shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage.
3. The height and the number of tiers of the Group S-2 open parking garage shall be limited as specified in Table 406.5.4.
4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage, except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet (93 m²) and mechanical equipment rooms associated with the operation of the building.

510.4 Parking beneath Group R. Where a maximum one story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area. The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section 508.4.

510.5 Group R-1 and R-2 buildings of Type IIIA construction. For buildings of Type IIIA construction in Groups R-1 and R-2, the maximum allowable height in Table

504.3 shall be increased by 10 feet (3048 mm) and the maximum allowable number of stories in Table 504.4 shall be increased by one where the first-floor assembly above the basement has a fire-resistance rating of not less than 3 hours and the floor area is subdivided by 2-hour fire-resistance-rated fire walls into areas of not more than 3,000 square feet (279 m²).

510.6 Group R-1 and R-2 buildings of Type IIA construction. The height limitation for buildings of Type IIA construction in Groups R-1 and R-2 shall be increased to nine stories and 100 feet (30 480 mm) where the building is separated by not less than 50 feet (15 240 mm) from any other building on the lot and from lot lines, the exits are segregated in an area enclosed by a 2-hour fire-resistance-rated fire wall and the first floor assembly has a fire-resistance rating of not less than 1½ hours.

510.7 Open parking garage beneath Groups A, I, B, M and R. Open parking garages constructed under Groups A, I, B, M and R shall not exceed the height and area limitations permitted under Section 406.5. The height and area of the portion of the building above the open parking garage shall not exceed the limitations in Section 503 for the upper occupancy. The height, in both feet and stories, of the portion of the building above the open parking garage shall be measured from grade plane and shall include both the open parking garage and the portion of the building above the parking garage.

510.7.1 Fire separation. Fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711 between the parking occupancy and the upper occupancy shall correspond to the required fire-resistance rating prescribed in Table 508.4 for the uses involved. The type of construction shall apply to each occupancy individually, except that structural members, including main bracing within the open parking structure, which is necessary to support the upper occupancy, shall be protected with the more restrictive fire-resistance-rated assemblies of the groups involved as shown in Table 601. Means of egress for the upper occupancy shall conform to Chapter 10 and shall be separated from the parking occupancy by fire barriers having not less than a 2-hour fire-resistance rating as required by Section 707 with self-closing doors complying with Section 716 or horizontal assemblies having not less than a 2-hour fire-resistance rating as required by Section 711, with self-closing doors complying with Section 716. Means of egress from the open parking garage shall comply with Section 406.5.

510.8 Group B or M buildings with Group S-2 open parking garage above. Group B or M occupancies located below a Group S-2 open parking garage of a lesser type of construction shall be considered as a separate and distinct building from the Group S-2 open parking garage for the purpose of determining the type of construction where the following conditions are met:

1. The buildings are separated with a horizontal assembly having a fire-resistance rating of not less than 2 hours.

2. The occupancies in the building below the horizontal assembly are limited to Groups B and M.
3. The occupancy above the horizontal assembly is limited to a Group S-2 open parking garage.
4. The building below the horizontal assembly is of Type IA construction.

Exception: The building below the horizontal assembly shall be permitted to be of Type IB or II construction, but not less than the type of construction required for the Group S-2 open parking garage above, where the building below is not greater than one story in height above grade plane.

5. The height and area of the building below the horizontal assembly does not exceed the limits set forth in Section 503.
6. The height and area of the Group S-2 open parking garage does not exceed the limits set forth in Section 406.5. The height, in both feet and stories, of the Group S-2 open parking garage shall be measured from grade plane and shall include the building below the horizontal assembly.
7. Exits serving the Group S-2 open parking garage discharge at grade with direct and unobstructed access to a street or public way and are separated from the building below the horizontal assembly by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

510.9 Multiple buildings above a horizontal assembly. Where two or more buildings are provided above the horizontal assembly separating a Group S-2 parking garage or building below from the buildings above in accordance with the special provisions in Section 510.2, 510.3 or 510.8, the buildings above the horizontal assembly shall be regarded as separate and distinct buildings from each other and shall comply with all other provisions of this code as applicable to each separate and distinct building.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 6 – TYPES OF CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
Table 601			X																			
602.1			X																			
Table 602			X																			
603.1.3				X	X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 6

TYPES OF CONSTRUCTION

User note:

About this chapter: Chapter 6 establishes five types of construction in which each building must be categorized. This chapter looks at the materials used in the building (combustible or noncombustible) and the extent to which building elements such as the building frame, roof, wall and floor can resist fire. Depending on the type of construction and the specific building element, fire resistance of 1 to 3 hours is specified.

SECTION 601 GENERAL

601.1 Scope. The provisions of this chapter shall control the classification of buildings as to type of construction.

SECTION 602 CONSTRUCTION CLASSIFICATION

602.1 General. Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5. The building elements shall have a fire-resistance rating not less than that specified in Table 601 and

exterior walls shall have a fire-resistance rating not less than that specified in Table 705.5. Where required to have a fire-resistance rating by Table 601, building elements shall comply with the applicable provisions of Section 703.2. The protection of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of this code.

Exception: Noncombustible structural members supporting solar photovoltaic panels are not required to meet the fire resistance rating for the following:

1. Photovoltaic panel supported by a structure and having no use underneath. Signs may be provided,

**TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)**

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV				TYPE V	
	A	B	A	B	A	B	A	B	C	HT	A	B
Primary structural frame ^f (see Section 202)	3 ^{a, b}	2 ^{a, b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	3 ^a	2 ^a	2 ^a	HT	1 ^{b, c}	0
Bearing walls												
Exterior ^{e, f}	3	2	1	0	2	2	3	2	2	2	1	0
Interior	3 ^a	2 ^a	1	0	1	0	3	2	2	1/HT ^g	1	0
Nonbearing walls and partitions Exterior	See Table 705.5											
Nonbearing walls and partitions Interior ^d	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
Floor construction and associated secondary structural members (see Section 202)	2	2	1	0	1	0	2	2	2	HT	1	0
Roof construction and associated secondary structural members (see Section 202)	1 1/2 ^b	1 ^{b, c}	1 ^{b, c}	0 ^c	1 ^{b, c}	0	1 1/2	1	1	HT	1 ^{b, c}	0

For SI: 1 foot = 304.8 mm.

- a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b. 1. Except in Group A, E, F-1, H, I, L, M, R-1, R-2, R-2.1 and S-1 occupancies, *high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal*, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
2. For Group A, E, I, L, R-1, R-2 and R-2.1 occupancies, *high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal*, fire protection of members other than the primary structural frame shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
3. One-story portions of Group A and E assembly occupancies the roof-framing system of Type II A or Type III A construction may be of unprotected construction when such roof-framing system is open to the assembly area and does not contain concealed spaces.
- c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
- d. Not less than the fire-resistance rating required by other sections of this code.
- e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).
- f. Not less than the fire-resistance rating as referenced in Section 704.10.
- g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

as determined by the enforcing agency prohibiting any use underneath including storage.

2. Solar photovoltaic (PV) panels supported by noncombustible framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.
3. Solar photovoltaic panels supported by a structure over parking stalls where the panels constitute the roof and all the following conditions are met (see Figure 5-1):
 - 3.1. The area within the perimeter of the solar photovoltaic array has maximum rectangular dimension of 40 feet by 150 feet.
 - 3.2. The distance between solar photovoltaic array structures is a minimum of 10 feet clear.
 - 3.3. The driveway aisle separating solar photovoltaic array structures has a minimum width of 25 feet clear.
 - 3.4. Solar photovoltaic array structure is used only for parking purposes with no storage.
 - 3.5. Completely open on all sides (other than necessary structural supports) with no interior partitions.

602.1.1 Minimum requirements. A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.

602.2 Types I and II. Types I and II construction are those types of construction in which the building elements specified in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in this code.

602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.

602.4 Type IV. Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire-resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire-resistance-rating requirements of this section based on either the fire-resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2. The minimum dimensions and permitted materials for building elements shall comply with the provisions of this section and Section 2304.11. Mass timber elements of Types IV-A, IV-B and IV-C construction shall be protected with noncombustible protection applied directly to the mass timber in accordance with Sections 602.4.1 through 602.4.3. The time assigned to the noncombustible protection shall be deter-

mined in accordance with Section 703.6 and comply with Section 722.7.

Cross-laminated timber shall be labeled as conforming to ANSI/APA PRG 320 as referenced in Section 2303.1.4.

Exterior load-bearing walls and nonload-bearing walls shall be mass timber construction, or shall be of noncombustible construction.

Exception: Exterior load-bearing walls and nonload-bearing walls of Type IV-HT Construction in accordance with Section 602.4.4.

The interior building elements, including nonload-bearing walls and partitions, shall be of mass timber construction or of noncombustible construction.

Exception: Interior building elements and nonload-bearing walls and partitions of Type IV-HT construction in accordance with Section 602.4.4.

Combustible concealed spaces are not permitted except as otherwise indicated in Sections 602.4.1 through 602.4.4. Combustible stud spaces within light frame walls of Type IV-HT construction shall not be considered concealed spaces, but shall comply with Section 718.

In buildings of Type IV-A, IV-B, and IV-C construction with an occupied floor located more than 75 feet (22 860 mm) above the lowest level of fire department access, up to and including 12 stories or 180 feet (54 864 mm) above grade plane, mass timber interior exit and elevator hoistway enclosures shall be protected in accordance with Section 602.4.1.2. In buildings greater than 12 stories or 180 feet (54 864 mm) above grade plane, interior exit and elevator hoistway enclosures shall be constructed of noncombustible materials.

602.4.1 Type IV-A. Building elements in Type IV-A construction shall be protected in accordance with Sections 602.4.1.1 through 602.4.1.6. The required fire-resistance rating of noncombustible elements and protected mass timber elements shall be determined in accordance with Section 703.2.

602.4.1.1 Exterior protection. The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistive barriers having a peak heat release rate of less than 150kW/m², a total heat release of less than 20 MJ/m² and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m².

602.4.1.2 Interior protection. Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3.

602.4.1.2.1 Protection time. Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

602.4.1.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.1.4 Roofs. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.1.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.1.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.2 Type IV-B. Building elements in Type IV-B construction shall be protected in accordance with Sections 602.4.2.1 through 602.4.2.6. The required fire-resistance rating of noncombustible elements or mass timber elements shall be determined in accordance with Section 703.2.

602.4.2.1 Exterior protection. The outside face of exterior walls of mass timber construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistant barriers having a peak heat release rate of less than 150kW/m², a total heat release of less than 20 MJ/m² and an effective heat of combustion of less than 18MJ/kg as determined in accordance with ASTM E1354, and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m².

602.4.2.2 Interior protection. Interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be

protected, as required by this section, with materials complying with Section 707.3.

602.4.2.2.1 Protection time. Noncombustible protection shall contribute a time equal to or greater than times assigned in Table 722.7.1(1), but not less than 80 minutes. The use of materials and their respective protection contributions specified in Table 722.7.1(2) shall be permitted to be used for compliance with Section 722.7.1.

602.4.2.2.2 Protected area. Interior faces of mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected in accordance with Section 602.4.2.2.1.

Exceptions: Unprotected portions of mass timber ceilings and walls complying with Section 602.4.2.2.4 and the following:

1. Unprotected portions of mass timber ceilings and walls complying with one of the following:
 - 1.1. Unprotected portions of mass timber ceilings, including attached beams, shall be permitted and shall be limited to an area equal to 20 percent of the floor area in any dwelling unit or fire area.
 - 1.2. Unprotected portions of mass timber walls, including attached columns, shall be permitted and shall be limited to an area equal to 40 percent of the floor area in any dwelling unit or fire area.
 - 1.3. Unprotected portions of both walls and ceilings of mass timber, including attached columns and beams, in any dwelling unit or fire area shall be permitted in accordance with Section 602.4.2.2.3.
2. Mass timber columns and beams that are not an integral portion of walls or ceilings, respectively, shall be permitted to be unprotected without restriction of either aggregate area or separation from one another.

602.4.2.2.3 Mixed unprotected areas. In each dwelling unit or fire area, where both portions of ceilings and portions of walls are unprotected, the total allowable unprotected area shall be determined in accordance with Equation 6-1.

$$(U_{ic}/U_{ac}) + (U_{iw}/U_{aw}) \leq 1 \quad \text{(Equation 6-1)}$$

where:

- U_{ic} = Total unprotected mass timber ceiling areas.
- U_{ac} = Allowable unprotected mass timber ceiling area conforming to Exception 1.1 of Section 602.4.2.2.2.

U_{tw} = Total unprotected mass timber wall areas.

U_{aw} = Allowable unprotected mass timber wall area conforming to Exception 1.2 of Section 602.4.2.2.2.

602.4.2.2.4 Separation distance between unprotected mass timber elements. In each dwelling unit or fire area, unprotected portions of mass timber walls and ceilings shall be not less than 15 feet (4572 mm) from unprotected portions of other walls and ceilings, measured horizontally along the ceiling and from other unprotected portions of walls measured horizontally along the floor.

602.4.2.3 Floors. The floor assembly shall contain a noncombustible material not less than 1 inch (25 mm) in thickness above the mass timber. Floor finishes in accordance with Section 804 shall be permitted on top of the noncombustible material. The underside of floor assemblies shall be protected in accordance with Section 602.4.1.2.

602.4.2.4 Roofs. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.2.2 except, in nonoccupiable spaces, they shall be treated as a concealed space with no portion left unprotected. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.2.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected in accordance with Section 602.4.1.2.

602.4.2.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 718. Both the shaft side and room side of mass timber elements shall be protected in accordance with Section 602.4.1.2.

602.4.3 Type IV-C. Building elements in Type IV-C construction shall be protected in accordance with Sections 602.4.3.1 through 602.4.3.6. The required fire-resistance rating of building elements shall be determined in accordance with Section 703.2.

602.4.3.1 Exterior protection. The exterior side of walls of combustible construction shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as determined in Table 722.7.1(1). Components of the exterior wall covering shall be of noncombustible material except water-resistant barriers having a peak heat release rate of less than 150 kW/m², a total heat release of less than 20 MJ/m² and an effective heat of combustion of less than 18 MJ/kg as determined in accordance with ASTM E1354 and having a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723. The ASTM

E1354 test shall be conducted on specimens at the thickness intended for use, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m².

602.4.3.2 Interior protection. Mass timber elements are permitted to be unprotected.

602.4.3.3 Floors. Floor finishes in accordance with Section 804 shall be permitted on top of the floor construction.

602.4.3.4 Roof coverings. Roof coverings in accordance with Chapter 15 shall be permitted on the outside surface of the roof assembly.

602.4.3.5 Concealed spaces. Concealed spaces shall not contain combustibles other than electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *California Mechanical Code*, and shall comply with all applicable provisions of Section 718. Combustible construction forming concealed spaces shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1).

602.4.3.6 Shafts. Shafts shall be permitted in accordance with Sections 713 and 718. Shafts and elevator hoistway and interior exit stairway enclosures shall be protected with noncombustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1), on both the inside of the shaft and the outside of the shaft.

602.4.4 Type IV-HT. Type IV-HT (Heavy Timber) construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated heavy timber or structural composite lumber (SCL), without concealed spaces or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials including solid timber, glued-laminated timber, SCL and cross-laminated timber (CLT) and the details of Type IV construction shall comply with the provisions of this section and Section 2304.11. Exterior walls complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rated or heavy timber conforming with Section 2304.11.2.2 shall be permitted.

602.4.4.1 Fire-retardant-treated wood in exterior walls. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies with a 2-hour rating or less.

602.4.4.2 Cross-laminated timber in exterior walls. *Cross-laminated timber (CLT)* not less than 4 inches (102 mm) in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less. Heavy timber structural members appurtenant to the *CLT exterior wall* shall meet the requirements of Table 2304.11 and be fire-resistance rated as required for the exterior wall. The exterior surface of the cross-laminated timber and

heavy timber elements shall be protected by one the following:

1. Fire-retardant-treated wood sheathing complying with Section 2303.2 and not less than $1\frac{5}{32}$ inch (12 mm) thick.
2. Gypsum board not less than $\frac{1}{2}$ inch (12.7 mm) thick.
3. A noncombustible material.

602.4.4.3 Concealed spaces. Concealed spaces shall not contain combustible materials other than building elements and electrical, mechanical, fire protection, or plumbing materials and equipment permitted in plenums in accordance with Section 602 of the *California Mechanical Code*. Concealed spaces shall comply with applicable provisions of Section 718. Concealed spaces shall be protected in accordance with one or more of the following:

1. The building shall be sprinklered throughout in accordance with Section 903.3.1.1 and automatic sprinklers shall also be provided in the concealed space.
2. The concealed space shall be completely filled with noncombustible insulation.
3. Surfaces within the concealed space shall be fully sheathed with not less than $\frac{5}{8}$ -inch Type X gypsum board.

Exception: Concealed spaces within interior walls and partitions with a 1-hour or greater fire-resistance rating complying with Section 2304.11.2.2 shall not require additional protection.

602.4.4.4 Exterior structural members. Where a horizontal separation of 20 feet (6096 mm) or more is provided, wood columns and arches conforming to heavy timber sizes complying with Section 2304.11 shall be permitted to be used externally.

602.5 Type V. Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by this code.

SECTION 603 COMBUSTIBLE MATERIAL IN TYPES I AND II CONSTRUCTION

603.1 Allowable materials. Combustible materials shall be permitted in buildings of Type I or II construction in the following applications and in accordance with Sections 603.1.1 through 603.1.3:

1. Fire-retardant-treated wood shall be permitted in:
 - 1.1. Nonbearing partitions where the required fire-resistance rating is 2 hours or less except in shaft enclosures within Group I-2 occupancies and ambulatory care facilities.
 - 1.2. Nonbearing exterior walls where fire-resistance-rated construction is not required.

1.3. Roof construction, including girders, trusses, framing and decking.

Exceptions:

1. In buildings of Type IA construction exceeding two stories above grade plane, fire-retardant-treated wood is not permitted in roof construction where the vertical distance from the upper floor to the roof is less than 20 feet (6096 mm).
2. Group I-2, roof construction containing fire-retardant-treated wood shall be covered by not less than a Class A roof covering or roof assembly, and the roof assembly shall have a fire-resistance rating where required by the construction type.

1.4. Balconies, porches, decks and exterior stairways not used as required exits on buildings three stories or less above grade plane.

2. Thermal and acoustical insulation, other than foam plastics, having a flame spread index of not more than 25.

Exceptions:

1. Insulation placed between two layers of non-combustible materials without an intervening airspace shall be allowed to have a flame spread index of not more than 100.
2. Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame spread index of not more than 200.
3. Foam plastics in accordance with Chapter 26.
4. Roof coverings that have an A, B or C classification.
5. Interior floor finish and floor covering materials installed in accordance with Section 804.
6. Millwork such as doors, door frames, window sashes and frames.
7. Interior wall and ceiling finishes installed in accordance with Section 803.
8. Trim installed in accordance with Section 806.
9. Where not installed greater than 15 feet (4572 mm) above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.
10. Finish flooring installed in accordance with Section 805.
11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a corridor serving an occupant load of 30 or more shall be permitted to be constructed of fire-retardant-treated wood, 1-hour fire-resistance-rated con-

TYPES OF CONSTRUCTION

struction or of wood panels or similar light construction up to 6 feet (1829 mm) in height.

12. Stages and platforms constructed in accordance with Sections 410.2 and 410.3, respectively.
13. Combustible exterior wall coverings, balconies and similar projections and bay or oriel windows in accordance with Chapter 14 and Section 705.2.3.1.
14. Blocking such as for handrails, millwork, cabinets and window and door frames.
15. Light-transmitting plastics as permitted by Chapter 26.
16. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
17. Exterior plastic veneer installed in accordance with Section 2605.2.
18. Nailing or furring strips as permitted by Section 803.15.
19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.4.4 and 705.2.3.1.
20. Aggregates, component materials and admixtures as permitted by Section 703.2.1.2.
21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of fire resistance tests in accordance with Section 703.2 and installed in accordance with Sections 1705.15 and 1705.16, respectively.
22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
23. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 715.
24. Materials allowed in the concealed spaces of buildings of Types I and II construction in accordance with Section 718.5.
25. Materials exposed within plenums complying with Section 602 of the *California Mechanical Code*.
26. Wall construction of freezers and coolers of less than 1,000 square feet (92.9 m²), in size, lined on both sides with noncombustible materials and the building is protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
27. Wood nailers for parapet flashing and roof cants.

603.1.1 Ducts. The use of nonmetallic ducts shall be permitted where installed in accordance with the limitations of the *California Mechanical Code*.

603.1.2 Piping. The use of combustible piping materials shall be permitted where installed in accordance with the limitations of the *California Mechanical Code* and the *California Plumbing Code*.

603.1.3 Electrical. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted where installed in accordance with the limitations of this code *and the California Electrical Code*.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 7 – FIRE AND SMOKE PROTECTION FEATURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
704.6.1			X																			
705.2.3.2			X																			
705.5			X																			
705.12			X																			
Table 706.4			X																			
Table 707.3.10			X																			
707.4			X																			
708.1			X																			
708.3			X																			
709.3			X																			
709.5			X																			
709.5.1			X																			
710.2			X																			
710.8			X																			
712.1.9			X																			
716.2.2.1			X																			
716.2.6			X																			
716.2.6.6			X																			
716.2.9.4			X																			
717.5.2			X																			
717.5.4			X																			
717.5.4.1			X																			
717.5.5			X																			
717.6.1			X																			
721.2				X	X																	
721.2.1				X	X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 7

FIRE AND SMOKE PROTECTION FEATURES

User note:

About this chapter: Chapter 7 provides detailed requirements for fire-resistance-rated construction, including structural members, walls, partitions and horizontal assemblies. Other portions of the code describe where certain fire-resistance-rated elements are required. This chapter specifies how these elements are constructed, how openings in walls and partitions are protected and how penetrations of such elements are protected.

SECTION 701 GENERAL

701.1 Scope. The provisions of this chapter shall govern the materials, systems and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

SECTION 702 MULTIPLE-USE FIRE ASSEMBLIES

702.1 Multiple-use fire assemblies. Fire assemblies that serve multiple purposes in a building shall comply with all of the requirements that are applicable for each of the individual fire assemblies.

SECTION 703 FIRE-RESISTANCE RATINGS AND FIRE TESTS

703.1 Scope. Materials prescribed herein for fire resistance shall conform to the requirements of this chapter.

703.2 Fire resistance. The fire-resistance rating of building elements, components or assemblies shall be determined in accordance with Section 703.2.1 or 703.2.2 without the use of automatic sprinklers or any other fire suppression system being incorporated, or in accordance with Section 703.2.3.

703.2.1 Tested assemblies. A fire-resistance rating of building elements, components or assemblies shall be determined by the test procedures set forth in ASTM E119 or UL 263. The fire-resistance rating of penetrations and fire-resistant joint systems shall be determined in accordance with Sections 714 and 715, respectively.

703.2.1.1 Nonsymmetrical wall construction. Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E119 or UL 263. Where evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side (see Section 705.5 for exterior walls).

703.2.1.2 Combustible components. Combustible aggregates are permitted in gypsum and Portland cement concrete mixtures for fire-resistance-rated construction. Any component material or admixture is permitted in assemblies if the resulting tested assembly meets the fire-resistance test requirements of this code.

703.2.1.3 Restrained classification. Fire-resistance-rated assemblies tested under ASTM E119 or UL 263 shall not be considered to be restrained unless evidence satisfactory to the building official is furnished by the registered design professional showing that the construction qualifies for a restrained classification in accordance with ASTM E119 or UL 263. Restrained construction shall be identified on the construction documents.

703.2.1.4 Supplemental features. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the building element, component or assembly, sufficient data shall be made available to the building official to show that the required fire-resistance rating is not reduced.

703.2.1.5 Exterior bearing walls. In determining the fire-resistance rating of exterior bearing walls, compliance with the ASTM E119 or UL 263 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior nonbearing wall with the same fire separation distance, and in a building of the same group. Where the fire-resistance rating determined in accordance with this exception exceeds the fire-resistance rating determined in accordance with ASTM E119 or UL 263, the fire exposure time period, water pressure and application duration criteria for the hose stream test of ASTM E119 or UL 263 shall be based on the fire-resistance rating determined in accordance with this section.

703.2.2 Analytical methods. The fire resistance of building elements, components or assemblies established by an analytical method shall be by any of the methods listed in this section, based on the fire exposure and acceptance criteria specified in ASTM E119 or UL 263.

1. Fire-resistance designs documented in approved sources.

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2. Prescriptive designs of fire-resistance-rated building elements, components or assemblies as prescribed in Section 721.
3. Calculations in accordance with Section 722.
4. Engineering analysis based on a comparison of building element, component or assemblies designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E119 or UL 263.
5. Fire-resistance designs certified by an approved agency.

703.2.3 Approved alternate method. The fire resistance of building elements, components or assemblies not complying with Section 703.2.1 or 703.2.2 shall be permitted to be established by an alternative protection method in accordance with Section 104.11.

703.3 Noncombustibility tests. The tests indicated in Section 703.3.1 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Types I, II, III and IV construction. The term “noncombustible” does not apply to the flame spread characteristics of interior finish or trim materials. A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.

703.3.1 Noncombustible materials. Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.

Exception: Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch (3.18 mm) in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

703.4 Fire-resistance-rated glazing. Fire-resistance-rated glazing, when tested in accordance with ASTM E119 or UL 263 and complying with the requirements of Section 707, shall be permitted. Fire-resistance-rated glazing shall bear a label marked in accordance with Table 716.1(1) issued by an agency and shall be permanently identified on the glazing.

703.5 Marking and identification. Where there is an accessible concealed floor, floor-ceiling or attic space, fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions or any other wall required to have protected openings or penetrations shall be effectively and permanently identified with signs or stenciling in the concealed space. Such identification shall:

1. Be located within 15 feet (4572 mm) of the end of each wall and at intervals not exceeding 30 feet (9144 mm) measured horizontally along the wall or partition.

2. Include lettering not less than 3 inches (76 mm) in height with a minimum $\frac{3}{8}$ -inch (9.5 mm) stroke in a contrasting color incorporating the suggested wording, “FIRE AND/OR SMOKE BARRIER—PROTECT ALL OPENINGS,” or other wording.

703.6 Determination of noncombustible protection time contribution. The time, in minutes, contributed to the fire-resistance rating by the noncombustible protection of mass timber building elements, components, or assemblies, shall be established through a comparison of assemblies tested using procedures set forth in ASTM E119 or UL 263. The test assemblies shall be identical in construction, loading and materials, other than the noncombustible protection. The two test assemblies shall be tested to the same criteria of structural failure with the following conditions:

1. Test Assembly 1 shall be without protection.
2. Test Assembly 2 shall include the representative noncombustible protection. The protection shall be fully defined in terms of configuration details, attachment details, joint sealing details, accessories and all other relevant details.

The noncombustible protection time contribution shall be determined by subtracting the fire-resistance time, in minutes, of Test Assembly 1 from the fire-resistance time, in minutes, of Test Assembly 2.

703.7 Sealing of adjacent mass timber elements. In buildings of Types IV-A, IV-B and IV-C construction, sealant or adhesive shall be provided to resist the passage of air in the following locations:

1. At abutting edges and intersections of mass timber building elements required to be fire-resistance rated.
2. At abutting intersections of mass timber building elements and building elements of other materials where both are required to be fire-resistance rated.

Sealants shall meet the requirements of ASTM C920. Adhesives shall meet the requirements of ASTM D3498.

Exception: Sealants or adhesives need not be provided where they are not a required component of a tested fire-resistance-rated assembly.

SECTION 704 FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

704.1 Requirements. The fire-resistance ratings of structural members and assemblies shall comply with this section and the requirements for the type of construction as specified in Table 601. The fire-resistance ratings shall be not less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.

Exception: Fire barriers, fire partitions, smoke barriers and horizontal assemblies as provided in Sections 707.5, 708.4, 709.4 and 711.2, respectively.

704.2 Column protection. Where columns are required to have protection to achieve a fire-resistance rating, the entire column shall be provided individual encasement protection

by protecting it on all sides for the full column height, including connections to other structural members, with materials having the required fire-resistance rating. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

Exception: Columns that meet the limitations of Section 704.4.1.

704.3 Protection of the primary structural frame other than columns. Members of the primary structural frame other than columns that are required to have protection to achieve a fire-resistance rating and support more than two floors or one floor and roof, or support a load-bearing wall or a nonload-bearing wall more than two stories high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required fire-resistance rating.

Exception: Individual encasement protection on all sides shall be permitted on all exposed sides provided that the extent of protection is in accordance with the required fire-resistance rating, as determined in Section 703.

704.4 Protection of secondary structural members. Secondary structural members that are required to have protection to achieve a fire-resistance rating shall be protected by individual encasement protection.

704.4.1 Light-frame construction. Studs, columns and boundary elements that are integral elements in walls of light-frame construction and are located entirely between the top and bottom plates or tracks shall be permitted to have required fire-resistance ratings provided by the membrane protection provided for the wall.

704.4.2 Horizontal assemblies. Horizontal assemblies are permitted to be protected with a membrane or ceiling where the membrane or ceiling provides the required fire-resistance rating and is installed in accordance with Section 711.

704.5 Truss protection. The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on approved calculations based on such tests that satisfactorily demonstrate that the assembly has the required fire resistance.

704.6 Attachments to structural members. The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within 1 inch (25 mm) of the surface of the fire protection.

704.6.1 Secondary attachments to structural members. Where primary and secondary structural steel members require fire protection, *any additional structural steel members having direct connection to the primary structural frame or secondary structural members* shall be protected with the same fire-resistive material and thickness as required for the structural member. The protection

shall extend away from the structural member a distance of not less than 12 inches (305 mm), or shall be applied to the entire length where the attachment is less than 12 inches (305 mm) long. Where an attachment is hollow and the ends are open, the fire-resistive material and thickness shall be applied to both exterior and interior of the hollow steel attachment.

704.7 Reinforcing. Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5 inch (12.7 mm) into the protection.

704.8 Embedments and enclosures. Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

704.9 Impact protection. Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than 5 feet (1524 mm) from the finished floor.

Exception: Corner protection is not required on concrete columns in parking garages.

704.10 Exterior structural members. Load-bearing structural members located within the exterior walls or on the outside of a building or structure shall be provided with the highest fire-resistance rating as determined in accordance with the following:

1. As required by Table 601 for the type of building element based on the type of construction of the building.
2. As required by Table 601 for exterior bearing walls based on the type of construction.
3. As required by Table 705.5 for exterior walls based on the fire separation distance.

704.11 Bottom flange protection. Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet 4 inches (1931 mm) whether part of the primary structural frame or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

704.12 Seismic isolation systems. Fire-resistance ratings for the isolation system shall meet the fire-resistance rating required for the columns, walls or other structural elements in which the isolation system is installed in accordance with Table 601. Isolation systems required to have a fire-resistance rating shall be protected with approved materials or construction assemblies designed to provide the same degree of fire resistance as the structural element in which the system is installed when tested in accordance with ASTM E119 or UL 263 (see Section 703.2).

Such isolation system protection applied to isolator units shall be capable of retarding the transfer of heat to the isolator

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unit in such a manner that the required gravity load-carrying capacity of the isolator unit will not be impaired after exposure to the standard time-temperature curve fire test prescribed in ASTM E119 or UL 263 for a duration not less than that required for the fire-resistance rating of the structure element in which the system is installed.

Such isolation system protection applied to isolator units shall be suitably designed and securely installed so as not to dislodge, loosen, sustain damage or otherwise impair its ability to accommodate the seismic movements for which the isolator unit is designed and to maintain its integrity for the purpose of providing the required fire-resistance protection.

704.13 Sprayed fire-resistant materials (SFRM). Sprayed fire-resistant materials (SFRM) shall comply with Sections 704.13.1 through 704.13.5.

704.13.1 Fire-resistance rating. The application of SFRM shall be consistent with the fire-resistance rating and the listing, including, but not limited to, minimum thickness and dry density of the applied SFRM, method of application, substrate surface conditions and the use of bonding adhesives, sealants, reinforcing or other materials.

704.13.2 Manufacturer's installation instructions. The application of SFRM shall be in accordance with the manufacturer's installation instructions. The instructions shall include, but are not limited to, substrate temperatures and surface conditions and SFRM handling, storage, mixing, conveyance, method of application, curing and ventilation.

704.13.3 Substrate condition. The SFRM shall be applied to a substrate in compliance with Sections 704.13.3.1 and 704.13.3.2.

704.13.3.1 Surface conditions. Substrates to receive SFRM shall be free of dirt, oil, grease, release agents, loose scale and any other condition that prevents adhesion. The substrates shall be free of primers, paints and encapsulants other than those fire tested and listed by a nationally recognized testing agency. Primed, painted or encapsulated steel shall be allowed, provided that testing has demonstrated that required adhesion is maintained.

704.13.3.2 Primers, paints and encapsulants. Where the SFRM is to be applied over primers, paints or encapsulants other than those specified in the listing, the material shall be field tested in accordance with ASTM E736. Where testing of the SFRM with primers, paints or encapsulants demonstrates that required adhesion is maintained, SFRM shall be permitted to be applied to primed, painted or encapsulated wide flange steel shapes in accordance with the following conditions:

1. The beam flange width does not exceed 12 inches (305 mm); or
2. The column flange width does not exceed 16 inches (400 mm); or
3. The beam or column web depth does not exceed 16 inches (400 mm).

4. The average and minimum bond strength values shall be determined based on not fewer than five bond tests conducted in accordance with ASTM E736. Bond tests conducted in accordance with ASTM E736 shall indicate an average bond strength of not less than 80 percent and an individual bond strength of not less than 50 percent, when compared to the bond strength of the SFRM as applied to clean, uncoated $\frac{1}{8}$ -inch-thick (3.2 mm) steel plate.

704.13.4 Temperature. A minimum ambient and substrate temperature of 40°F (4.44°C) shall be maintained during and for not fewer than 24 hours after the application of the SFRM, unless the manufacturer's instructions allow otherwise.

704.13.5 Finished condition. The finished condition of SFRM applied to structural members or assemblies shall not, upon complete drying or curing, exhibit cracks, voids, spalls, delamination or any exposure of the substrate. Surface irregularities of SFRM shall be deemed acceptable.

SECTION 705 EXTERIOR WALLS

705.1 General. Exterior walls shall comply with this section.

705.2 Projections. Cornices, eave overhangs, exterior balconies and similar projections extending beyond the exterior wall shall conform to the requirements of this section and Section 1405. Exterior egress balconies and exterior exit stairways and ramps shall comply with Sections 1021 and 1027, respectively. Projections shall not extend any closer to the line used to determine the fire separation distance than shown in Table 705.2.

Exception: Buildings on the same lot and considered as portions of one building in accordance with Section 705.3 are not required to comply with this section for projections between the buildings.

TABLE 705.2
MINIMUM DISTANCE OF PROJECTION

FIRE SEPARATION DISTANCE (FSD) (feet)	MINIMUM DISTANCE FROM LINE USED TO DETERMINE FSD
0 to less than 2	Projections not permitted
2 to less than 3	24 inches
3 to less than 5	Two-thirds of FSD
5 or greater	40 inches

For SI: 1 foot = 304.8 mm; 1 inch = 25.4 mm.

705.2.1 Types I and II construction. Projections from walls of Type I or II construction shall be of noncombustible materials or combustible materials as allowed by Sections 705.2.3.1 and 705.2.4.

705.2.2 Type III, IV or V construction. Projections from walls of Type III, IV or V construction shall be of any approved material.

705.2.3 Projection protection. Projections extending to within 5 feet (1524 mm) of the line used to determine the fire separation distance shall be one of the following:

1. Noncombustible materials.
2. Combustible materials of not less than 1-hour fire-resistance-rated construction.
3. Heavy timber construction complying with Section 2304.11.
4. Fire-retardant-treated wood.
5. As permitted by Section 705.2.3.1.

Exception: Type VB construction shall be allowed for combustible projections in Group R-3 and U occupancies with a fire separation distance greater than or equal to 5 feet (1524 mm).

705.2.3.1 Balconies and similar projections. Balconies and similar projections of combustible construction other than fire-retardant-treated wood shall be fire-resistance rated where required by Table 601 for floor construction or shall be of heavy timber construction in accordance with Section 2304.11. The aggregate length of the projections shall not exceed 50 percent of the building's perimeter on each floor.

Exceptions:

1. On buildings of Types I and II construction, three stories or less above grade plane, fire-retardant-treated wood shall be permitted for balconies, porches, decks and exterior stairways not used as required exits.
2. Untreated wood and plastic composites that comply with ASTM D7032 and Section 2612 are permitted for pickets, rails and similar guard components that are limited to 42 inches (1067 mm) in height.
3. Balconies and similar projections on buildings of Types III, IV and V construction shall be permitted to be of Type V construction and shall not be required to have a fire-resistance rating where sprinkler protection is extended to these areas.
4. Where sprinkler protection is extended to the balcony areas, the aggregate length of the balcony on each floor shall not be limited.

705.2.3.2 Vents. [SFM] Vents required by Section 2304.12.2.5 in fire-rated exterior balconies or elevated walkway surfaces shall be designed where the voids created at the intersection of the exterior curtain wall and the balcony floor are sealed with an approved material or system to retard the interior spread of flame, hot gases and products of combustion. Rated assemblies shall comply with Section 715. Ventilation openings shall comply with the fire sprinkler protection as required by Section 903.3.1.1 or 903.3.1.2 and the reference standard.

705.2.4 Bay and oriel windows. Bay and oriel windows constructed of combustible materials shall conform to the

type of construction required for the building to which they are attached.

Exception: Fire-retardant-treated wood shall be permitted on buildings three stories or less above grade plane of Type I, II, III or IV construction.

705.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection, projections and roof-covering requirements, buildings on the same lot shall be assumed to have an imaginary line between them.

Where a new building is to be erected on the same lot as an existing building, the location of the assumed imaginary line with relation to the existing building shall be such that the exterior wall and opening protection of the existing building meet the criteria as set forth in Sections 705.5 and 705.8.

Exceptions:

1. Two or more buildings on the same lot shall be either regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.
2. Where an S-2 parking garage of Construction Type I or IIA is erected on the same lot as a Group R-2 building, and there is no fire separation distance between these buildings, then the adjoining exterior walls between the buildings are permitted to have occupant use openings in accordance with Section 706.8. However, opening protectives in such openings shall only be required in the exterior wall of the S-2 parking garage, not in the exterior wall openings in the R-2 building, and these opening protectives in the exterior wall of the S-2 parking garage shall be not less than 1½-hour fire protection rating.

705.4 Materials. Exterior walls shall be of materials permitted by the building's type of construction.

705.5 Fire-resistance ratings. For other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 exterior walls shall be fire-resistance rated in accordance with Table 601, based on the type of construction, and Table 705.5, based on the fire separation distance. The required fire-resistance rating of exterior walls with a fire separation distance of greater than 10 feet (3048 mm) shall be rated for exposure to fire from the inside. The required fire-resistance rating of exterior walls with a fire separation distance of less than or equal to 10 feet (3048 mm) shall be rated for exposure to fire from both sides.

For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, exterior walls shall be fire-resistance rated in accordance with Tables 601 and 602 and this section. The required fire-resistance rating of exterior walls shall be rated for exposure to fire from both sides.

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705.6 Structural stability. Exterior walls shall extend to the height required by Section 705.11. Interior structural elements that brace the exterior wall but that are not located within the plane of the exterior wall shall have the minimum fire-resistance rating required in Table 601 for that structural element. Structural elements that brace the exterior wall but are located outside of the exterior wall or within the plane of the exterior wall shall have the minimum fire-resistance rating required in Table 601 and Table 705.5 for the exterior wall.

705.7 Unexposed surface temperature. Where protected openings are not limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E119 or UL 263 shall not apply. Where protected openings are limited by Section 705.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E119 or UL 263 shall not apply provided that a correction is made for radiation from the unexposed exterior wall surface in accordance with the following formula:

$$A_e = A + (A_f \times F_{eo}) \quad \text{(Equation 7-1)}$$

where:

A_e = Equivalent area of protected openings.

A = Actual area of protected openings.

A_f = Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E119 or UL 263 for walls are exceeded.

F_{eo} = An "equivalent opening factor" derived from Figure 705.7 based on the average temperature of the unexposed wall surface and the fire-resistance rating of the wall.

705.8 Openings. Openings in exterior walls shall comply with Sections 705.8.1 through 705.8.6.

705.8.1 Allowable area of openings. The maximum area of unprotected and protected openings permitted in an exterior wall in any story of a building shall not exceed the percentages specified in Table 705.8 based on the fire separation distance of each individual story.

Exceptions:

1. In other than Group H occupancies, unlimited unprotected openings are permitted in the first story above grade plane where the wall faces one of the following:
 - 1.1. A street and has a fire separation distance of more than 15 feet (4572 mm).
 - 1.2. An unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall be not less than 30 feet (9144 mm) in width and shall have access from a street by a posted fire lane in accordance with the *California Fire Code*.
2. Buildings whose exterior bearing walls, exterior nonbearing walls and exterior primary structural frame are not required to be fire-resistance rated shall be permitted to have unlimited unprotected openings.

705.8.2 Protected openings. Where openings are required to be protected, opening protectives shall comply with Section 716.

Exception: Opening protectives are not required where the building is equipped throughout with an automatic

TABLE 705.5
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE^{a, d, g}

FIRE SEPARATION DISTANCE = X (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H ^e , L	OCCUPANCY GROUP F-1, M, S-1 ^f	OCCUPANCY GROUP A, B, E, F-2, I, R ¹ , S-2, U ^h
X < 5 ^b	All	3	2	1
5 ≤ X < 10	IA, IVA	3	2	1
	Others	2	1	1
10 ≤ X < 30	IA, IB, IVA, IVB	2	1	1 ^c
	IIB, VB	1	0	0
	Others	1	1	1 ^c
X ≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

- a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.
- b. See Section 706.1.1 for party walls.
- c. Open parking garages complying with Section 406 shall not be required to have a fire-resistance rating.
- d. The fire-resistance rating of an exterior wall is determined based upon the fire separation distance of the exterior wall and the story in which the wall is located.
- e. For special requirements for Group H occupancies, see Section 415.6.
- f. For special requirements for Group S aircraft hangars, see Section 412.3.1.
- g. Where Table 705.8 permits nonbearing exterior walls with unlimited area of unprotected openings, the required fire-resistance rating for the exterior walls is 0 hours.
- h. For a building containing only a Group U occupancy private garage or carport, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater *or where equipped throughout with an automatic sprinkler system in accordance with Section 903.3 the fire-resistance rating shall not be required where the fire separation distance is 3 feet or greater.*
- i. For a Group R-3 building of Type II-B or Type V-B construction, the exterior wall shall not be required to have a fire-resistance rating where the fire separation distance is 5 feet (1523 mm) or greater *or where equipped throughout with an automatic sprinkler system in accordance with Section 903.3 the fire-resistance rating shall not be required where the fire separation distance is 3 feet or greater.*

sprinkler system in accordance with Section 903.3.1.1 and the exterior openings are protected by a water curtain using automatic sprinklers approved for that use.

705.8.3 Unprotected openings. Where unprotected openings are permitted, windows and doors shall be constructed of any approved materials. Glazing shall conform to the requirements of Chapters 24 and 26.

705.8.4 Mixed openings. Where both unprotected and protected openings are located in the exterior wall in any story of a building, the total area of openings shall be determined in accordance with the following:

$$(A_p/a_p) + (A_u/a_u) \leq 1 \quad \text{(Equation 7-2)}$$

A_p = Actual area of protected openings, or the equivalent area of protected openings, A_e (see Section 705.7).

a_p = Allowable area of protected openings.

A_u = Actual area of unprotected openings.

a_u = allowable area of unprotected openings.

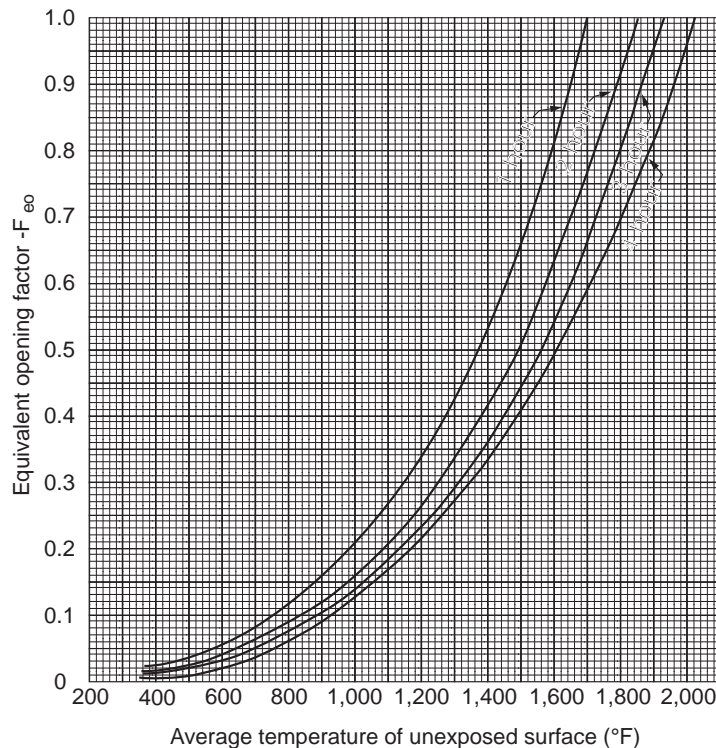
705.8.5 Vertical separation of openings. Openings in exterior walls in adjacent stories shall be separated vertically to protect against fire spread on the exterior of the buildings where the openings are within 5 feet (1524 mm) of each other horizontally and the opening in the lower story is not a protected opening with a fire protection rating of not less than $3/4$ hour. Such openings shall

be separated vertically not less than 3 feet (914 mm) by spandrel girders, exterior walls or other similar assemblies that have a fire-resistance rating of not less than 1 hour, rated for exposure to fire from both sides, or by flame barriers that extend horizontally not less than 30 inches (762 mm) beyond the exterior wall. Flame barriers shall have a fire-resistance rating of not less than 1 hour. The unexposed surface temperature limitations specified in ASTM E119 or UL 263 shall not apply to the flame barriers unless otherwise required by the provisions of this code.

Exceptions:

1. This section shall not apply to buildings that are three stories or less above grade plane.
2. This section shall not apply to buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Open parking garages.

705.8.6 Vertical exposure. For buildings on the same lot, opening protectives having a fire protection rating of not less than $3/4$ hour shall be provided in every opening that is less than 15 feet (4572 mm) vertically above the roof of an adjacent building or structure based on assuming an imaginary line between them. The opening protectives are required where the fire separation distances from the



For SI: $^{\circ}C = [(^{\circ}F) - 32] / 1.8$.

FIGURE 705.7
EQUIVALENT OPENING FACTOR

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imaginary line to each building or structure are less than 15 feet (4572 mm).

Exceptions:

- Opening protectives are not required where the roof assembly of the adjacent building or structure has a fire-resistance rating of not less than 1 hour for a minimum distance of 10 feet (3048 mm) from the exterior wall facing the imaginary

line and the entire length and span of the supporting elements for the fire-resistance-rated roof assembly has a fire-resistance rating of not less than 1 hour.

- Buildings on the same lot and considered as portions of one building in accordance with Section 705.3 are not required to comply with Section 705.8.6.

**TABLE 705.8
MAXIMUM AREA OF EXTERIOR WALL OPENINGS BASED ON
FIRE SEPARATION DISTANCE AND DEGREE OF OPENING PROTECTION**

FIRE SEPARATION DISTANCE (feet)	DEGREE OF OPENING PROTECTION	ALLOWABLE AREA ^a
0 to less than 3 ^{b, c, k}	Unprotected, Nonsprinklered (UP, NS)	Not Permitted ^k
	Unprotected, Sprinklered (UP, S) ⁱ	Not Permitted ^k
	Protected (P)	Not Permitted ^k
3 to less than 5 ^{d, e}	Unprotected, Nonsprinklered (UP, NS)	Not Permitted
	Unprotected, Sprinklered (UP, S) ⁱ	15%
	Protected (P)	15%
5 to less than 10 ^{e, f, j}	Unprotected, Nonsprinklered (UP, NS)	10% ^h
	Unprotected, Sprinklered (UP, S) ⁱ	25%
	Protected (P)	25%
10 to less than 15 ^{e, f, g, j}	Unprotected, Nonsprinklered (UP, NS)	15% ^h
	Unprotected, Sprinklered (UP, S) ⁱ	45%
	Protected (P)	45%
15 to less than 20 ^{f, g, j}	Unprotected, Nonsprinklered (UP, NS)	25%
	Unprotected, Sprinklered (UP, S) ⁱ	75%
	Protected (P)	75%
20 to less than 25 ^{f, g, j}	Unprotected, Nonsprinklered (UP, NS)	45%
	Unprotected, Sprinklered (UP, S) ⁱ	No Limit
	Protected (P)	No Limit
25 to less than 30 ^{f, g, j}	Unprotected, Nonsprinklered (UP, NS)	70%
	Unprotected, Sprinklered (UP, S) ⁱ	No Limit
	Protected (P)	No Limit
30 or greater	Unprotected, Nonsprinklered (UP, NS)	No Limit
	Unprotected, Sprinklered (UP, S) ⁱ	No Limit
	Protected (P)	No Limit

For SI: 1 foot = 304.8 mm.

UP, NS = Unprotected openings in buildings not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

UP, S = Unprotected openings in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

P = Openings protected with an opening protective assembly in accordance with Section 705.8.2.

a. Values indicated are the percentage of the area of the exterior wall, per story.

b. For the requirements for fire walls of buildings with differing heights, see Section 706.6.1.

c. For openings in a fire wall for buildings on the same lot, see Section 706.8.

d. The maximum percentage of unprotected and protected openings shall be 25 percent for Group R-3 occupancies.

e. Unprotected openings shall not be permitted for openings with a fire separation distance of less than 15 feet for Group H-2 and H-3 occupancies.

f. The area of unprotected and protected openings shall not be limited for Group R-3 occupancies, with a fire separation distance of 5 feet or greater.

g. The area of openings in an open parking structure with a fire separation distance of 10 feet or greater shall not be limited.

h. Includes buildings accessory to Group R-3.

i. Not applicable to Group H-1, H-2 and H-3 occupancies.

j. The area of openings in a building containing only a Group U occupancy private garage or carport with a fire separation distance of 5 feet or greater shall not be limited.

k. For openings between S-2 parking garage and Group R-2 building, see Section 705.3, Exception 2.

705.9 Joints. Joints made in or between exterior walls required by this section to have a fire-resistance rating shall comply with Section 715.

Exception: Joints in exterior walls that are permitted to have unprotected openings.

705.9.1 Voids. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be protected in accordance with Section 715.4.

705.10 Ducts and air transfer openings. Penetrations by air ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings shall comply with Section 717.

Exception: Foundation vents installed in accordance with this code are permitted.

705.11 Parapets. Parapets shall be provided on exterior walls of buildings.

Exceptions: A parapet need not be provided on an exterior wall where any of the following conditions exist:

1. The wall is not required to be fire-resistance rated in accordance with Table 705.5 because of fire separation distance.
2. The building has an area of not more than 1,000 square feet (93 m²) on any floor.
3. Walls that terminate at roofs of not less than 2-hour fire-resistance-rated construction or where the roof, including the deck or slab and supporting construction, is constructed entirely of noncombustible materials.
4. One-hour fire-resistance-rated exterior walls that terminate at the underside of the roof sheathing, deck or slab, provided that:
 - 4.1. Where the roof/ceiling framing elements are parallel to the walls, such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction for a width of 4 feet (1220 mm) for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.
 - 4.2. Where roof/ceiling framing elements are not parallel to the wall, the entire span of such framing and elements supporting such framing shall not be of less than 1-hour fire-resistance-rated construction.
 - 4.3. Openings in the roof shall not be located within 5 feet (1524 mm) of the 1-hour fire-resistance-rated exterior wall for Groups R and U and 10 feet (3048 mm) for other occupancies, measured from the interior side of the wall.
 - 4.4. The entire building shall be provided with not less than a Class B roof covering.
5. In Groups R-2 and R-3 where the entire building is provided with a Class C roof covering, the exterior wall shall be permitted to terminate at the underside

of the roof sheathing or deck in Types III, IV and V construction, provided that one or both of the following criteria is met:

- 5.1. The roof sheathing or deck is constructed of approved noncombustible materials or of fire-retardant-treated wood for a distance of 4 feet (1220 mm).
- 5.2. The roof is protected with 0.625-inch (16 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by not less than nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members for a minimum distance of 4 feet (1220 mm).
6. Where the wall is permitted to have not less than 25 percent of the exterior wall areas containing unprotected openings based on fire separation distance as determined in accordance with Section 705.8.

705.11.1 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall, and on any side adjacent to a roof surface, shall have noncombustible faces for the uppermost 18 inches (457 mm), including counterflashing and coping materials. The height of the parapet shall be not less than 30 inches (762 mm) above the point where the roof surface and the wall intersect. Where the roof slopes toward a parapet at a slope greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a fire separation distance where protection of wall openings is required, but the height shall be not less than 30 inches (762 mm).

705.12 Exterior graphics on exterior walls of high-rise buildings. Where installed on the exterior walls of high-rise buildings, exterior graphics, both permanent and temporary, greater than 100 square feet in area or greater than 10 feet in either dimension shall comply with the following conditions subject to the review and approval of the fire code official and building official:

1. The materials used for graphics installed at a height greater than 40 feet above the grade plane shall be noncombustible materials or shall have a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723.
2. The method of attachment and mounting of the graphics to the exterior wall shall be such that the graphics are securely attached.
3. The graphics shall not interfere with the active or passive ventilation required for the building and the required smoke control systems in the building.
4. The graphics shall not impair the functions of any fire or life safety systems in the building.

**SECTION 706
FIRE WALLS**

706.1 General. Fire walls shall be constructed in accordance with Sections 706.2 through 706.11. The extent and location

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of such fire walls shall provide a complete separation. Where a fire wall separates occupancies that are required to be separated by a fire barrier wall, the most restrictive requirements of each separation shall apply.

706.1.1 Party walls. Any wall located on a lot line between adjacent buildings, which is used or adapted for joint service between the two buildings, shall be constructed as a fire wall in accordance with Section 706. Party walls shall be constructed without openings and shall create separate buildings.

Exceptions:

1. Openings in a party wall separating an anchor building and a mall shall be in accordance with Section 402.4.2.2.1.
2. Party walls and fire walls are not required on lot lines dividing a building for ownership purposes where the aggregate height and area of the portions of the building located on both sides of the lot line do not exceed the maximum height and area requirements of this code. For the building official's review and approval, the official shall be provided with copies of dedicated access easements and contractual agreements that permit the owners of portions of the building located on either side of the lot line access to the other side for purposes of maintaining fire and life safety systems necessary for the operation of the building.

706.2 Structural stability. Fire walls shall be designed and constructed to allow collapse of the structure on either side without collapse of the wall under fire conditions. Fire walls designed and constructed in accordance with NFPA 221 shall be deemed to comply with this section.

Exception: In *Seismic Design Categories D* through *F*, where double fire walls are used in accordance with NFPA 221, floor and roof sheathing not exceeding $\frac{3}{4}$ inch (19.05 mm) thickness shall be permitted to be continuous through the wall assemblies of light frame construction.

706.3 Materials. Fire walls shall be of any approved noncombustible materials.

Exception: Buildings of Type V construction.

706.4 Fire-resistance rating. Fire walls shall have a fire-resistance rating of not less than that required by Table 706.4.

**TABLE 706.4
FIRE WALL FIRE-RESISTANCE RATINGS**

GROUP	FIRE-RESISTANCE RATING (hours)
A, B, E, H-4, I, R-1, R-2, R-2.1, R-2.2, U, L	3 ^a
F-1, H-3b, H-5, M, S-1	3
H-1, H-2	4 ^b
F-2, S-2, R-3, R-4	2

a. In Type II or V construction, walls shall be permitted to have a 2-hour fire-resistance rating.

b. For Group H-1, H-2 or H-3 buildings, also see Sections 415.7 and 415.8.

706.5 Horizontal continuity. Fire walls shall be continuous from exterior wall to exterior wall and shall extend not less than 18 inches (457 mm) beyond the exterior surface of exterior walls.

Exceptions:

1. Fire walls shall be permitted to terminate at the interior surface of combustible exterior sheathing or siding provided that the exterior wall has a fire-resistance rating of not less than 1 hour for a horizontal distance of not less than 4 feet (1220 mm) on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour.
2. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing, exterior siding or other noncombustible exterior finishes provided that the sheathing, siding or other exterior noncombustible finish extends a horizontal distance of not less than 4 feet (1220 mm) on both sides of the fire wall.
3. Fire walls shall be permitted to terminate at the interior surface of noncombustible exterior sheathing where the building on each side of the fire wall is protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

706.5.1 Exterior walls. Where the fire wall intersects exterior walls, the fire-resistance rating and opening protection of the exterior walls shall comply with one of the following:

1. The exterior walls on both sides of the fire wall shall have a 1-hour fire-resistance rating with $\frac{3}{4}$ -hour protection where opening protection is required by Section 705.8. The fire-resistance rating of the exterior wall shall extend not less than 4 feet (1220 mm) on each side of the intersection of the fire wall to exterior wall. Exterior wall intersections at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad) do not need exterior wall protection.
2. Buildings or spaces on both sides of the intersecting fire wall shall assume to have an imaginary lot line at the fire wall and extending beyond the exterior of the fire wall. The location of the assumed line in relation to the exterior walls and the fire wall shall be such that the exterior wall and opening protection meet the requirements set forth in Sections 705.5 and 705.8. Such protection is not required for exterior walls terminating at fire walls that form an angle equal to or greater than 180 degrees (3.14 rad).

706.5.2 Horizontal projecting elements. Fire walls shall extend to the outer edge of horizontal projecting elements such as balconies, roof overhangs, canopies, marquees and similar projections that are within 4 feet (1220 mm) of the fire wall.

Exceptions:

1. Horizontal projecting elements without concealed spaces, provided that the exterior wall

behind and below the projecting element has not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting element on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour.

2. Noncombustible horizontal projecting elements with concealed spaces, provided that a minimum 1-hour fire-resistance-rated wall extends through the concealed space. The projecting element shall be separated from the building by not less than 1-hour fire-resistance-rated construction for a distance on each side of the fire wall equal to the depth of the projecting element. The wall is not required to extend under the projecting element where the building exterior wall is not less than 1-hour fire-resistance rated for a distance on each side of the fire wall equal to the depth of the projecting element. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour.
3. For combustible horizontal projecting elements with concealed spaces, the fire wall need only extend through the concealed space to the outer edges of the projecting elements. The exterior wall behind and below the projecting element shall be of not less than 1-hour fire-resistance-rated construction for a distance not less than the depth of the projecting elements on both sides of the fire wall. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour.

706.6 Vertical continuity. Fire walls shall extend from the foundation to a termination point not less than 30 inches (762 mm) above both adjacent roofs.

Exceptions:

1. Stepped buildings in accordance with Section 706.6.1.
2. Two-hour fire-resistance-rated walls shall be permitted to terminate at the underside of the roof sheathing, deck or slab, provided that:
 - 2.1. The lower roof assembly within 4 feet (1220 mm) of the wall has not less than a 1-hour fire-resistance rating and the entire length and span of supporting elements for the rated roof assembly has a fire-resistance rating of not less than 1 hour.
 - 2.2. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.
 - 2.3. Each building shall be provided with not less than a Class B roof covering.
3. Walls shall be permitted to terminate at the underside of noncombustible roof sheathing, deck or slabs where both buildings are provided with not less than

a Class B roof covering. Openings in the roof shall not be located within 4 feet (1220 mm) of the fire wall.

4. In buildings of Types III, IV and V construction, walls shall be permitted to terminate at the underside of combustible roof sheathing or decks, provided that all of the following requirements are met:
 - 4.1. Roof openings are not less than 4 feet (1220 mm) from the fire wall.
 - 4.2. The roof is covered with a minimum Class B roof covering.
 - 4.3. The roof sheathing or deck is constructed of fire-retardant-treated wood for a distance of 4 feet (1220 mm) on both sides of the wall or the roof is protected with $\frac{7}{8}$ -inch (15.9 mm) Type X gypsum board directly beneath the underside of the roof sheathing or deck, supported by not less than 2-inch (51 mm) nominal ledgers attached to the sides of the roof framing members for a distance of not less than 4 feet (1220 mm) on both sides of the fire wall.
5. In buildings designed in accordance with Section 510.2, fire walls located above the 3-hour horizontal assembly required by Section 510.2, Item 1 shall be permitted to extend from the top of this horizontal assembly.
6. Buildings with sloped roofs in accordance with Section 706.6.2.

706.6.1 Stepped buildings. Where a fire wall also serves as an exterior wall for a building and separates buildings having different roof levels, such wall shall terminate at a point not less than 30 inches (762 mm) above the lower roof level. Exterior walls above the fire wall extending more than 30 inches (762 mm) above the lower roof shall be of not less than 1-hour fire-resistance-rated construction from both sides with openings protected by fire assemblies having a fire protection rating of not less than $\frac{3}{4}$ hour. Portions of the exterior walls greater than 15 feet (4572 mm) above the lower roof shall be of nonfire-resistance-rated construction unless otherwise rated construction is required by other provisions of this code.

Exception: A fire wall serving as part of an exterior wall that separates buildings having different roof levels shall be permitted to terminate at the underside of the roof sheathing, deck or slab of the lower roof, provided that Items 1, 2 and 3 are met. The exterior wall above the fire wall is not required to be of fire-resistance-rated construction unless required by other provisions of this code.

1. The lower roof assembly within 10 feet (3048 mm) of the fire wall has not less than a 1-hour fire-resistance rating.
2. The entire length and span of supporting elements for the rated roof assembly shall have a fire-resistance rating of not less than 1 hour.

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- Openings in the lower roof shall not be located within 10 feet (3048 mm) of the fire wall.

706.6.2 Buildings with sloped roofs. Where a fire wall serves as an interior wall for a building, and the roof on one side or both sides of the fire wall slopes toward the fire wall at a slope greater than 2 units vertical in 12 units horizontal (2:12), the fire wall shall extend to a height equal to the height of the roof located 4 feet (1219 mm) from the fire wall plus 30 inches (762 mm). The extension of the fire wall shall be not less than 30 inches (762 mm).

706.7 Combustible framing in fire walls. Adjacent combustible members entering into a concrete or masonry fire wall from opposite sides shall not have less than a 4-inch (102 mm) distance between embedded ends. Where combustible members frame into hollow walls or walls of hollow units, hollow spaces shall be solidly filled for the full thickness of the wall and for a distance not less than 4 inches (102 mm) above, below and between the structural members, with noncombustible materials approved for fireblocking.

706.8 Openings. Each opening through a fire wall shall be protected in accordance with Section 716 and shall not exceed 156 square feet (15 m²). The aggregate width of openings at any floor level shall not exceed 25 percent of the length of the wall.

Exceptions:

- Openings are not permitted in party walls constructed in accordance with Section 706.1.1.
- Openings shall not be limited to 156 square feet (15 m²) where both buildings are equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

706.9 Penetrations. Penetrations of fire walls shall comply with Section 714.

706.10 Joints. Joints made in or between fire walls shall comply with Section 715.

706.11 Ducts and air transfer openings. Ducts and air transfer openings shall not penetrate fire walls.

Exception: Penetrations by ducts and air transfer openings of fire walls that are not on a lot line shall be allowed provided that the penetrations comply with Section 717. The size and aggregate width of all openings shall not exceed the limitations of Section 706.8.

SECTION 707 FIRE BARRIERS

707.1 General. Fire barriers installed as required elsewhere in this code or the *California Fire Code* shall comply with this section.

707.2 Materials. Fire barriers shall be of materials permitted by the building type of construction.

707.3 Fire-resistance rating. The fire-resistance rating of fire barriers shall comply with this section.

707.3.1 Shaft enclosures. The fire-resistance rating of the fire barrier separating building areas from a shaft shall comply with Section 713.4.

707.3.2 Interior exit stairway and ramp construction. The fire-resistance rating of the fire barrier separating building areas from an interior exit stairway or ramp shall comply with Section 1023.1.

707.3.3 Enclosures for exit access stairways. The fire-resistance rating of the fire barrier separating building areas from an exit access stairway or ramp shall comply with Section 713.4.

707.3.4 Exit passageway. The fire-resistance rating of the fire barrier separating building areas from an exit passageway shall comply with Section 1024.3.

707.3.5 Horizontal exit. The fire-resistance rating of the separation between building areas connected by a horizontal exit shall comply with Section 1026.1.

707.3.6 Atriums. The fire-resistance rating of the fire barrier separating atriums shall comply with Section 404.6.

707.3.7 Incidental uses. The fire barrier separating incidental uses from other spaces in the building shall have a fire-resistance rating of not less than that indicated in Table 509.1.

707.3.8 Control areas. Fire barriers separating control areas shall have a fire-resistance rating of not less than that required in Section 414.2.4.

707.3.9 Separated occupancies. Where the provisions of Section 508.4 are applicable, the fire barrier separating mixed occupancies shall have a fire-resistance rating of not less than that indicated in Table 508.4 based on the occupancies being separated.

707.3.10 Fire areas. The fire barriers, fire walls, horizontal assemblies or combinations thereof separating a single occupancy into different fire areas shall have a fire-resistance rating of not less than that indicated in Table 707.3.10. The fire barriers, fire walls, horizontal assemblies or combinations thereof separating fire areas of mixed occupancies shall have a fire-resistance rating of not less than the highest value indicated in Table 707.3.10 for the occupancies under consideration.

**TABLE 707.3.10
FIRE-RESISTANCE-RATING
REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS
OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS**

OCCUPANCY GROUP	FIRE-RESISTANCE RATING (hours)
H-1, H-2	4
F-1, H-3, S-1	3
A, B, E, F-2, H-4, H-5, I, L, M, R, S-2	2
U	1

707.4 Exterior walls. Where exterior walls serve as a part of a required fire-resistance-rated shaft, or separation or enclosure for a stairway, ramp or exit passageway, such walls shall comply with the requirements of Section 705 for exterior

walls and the fire-resistance-rated enclosure or separation requirements shall not apply.

Exceptions:

1. Exterior walls required to be fire-resistance rated in accordance with Section 1021 for exterior egress balconies, Section 1023.7 for interior exit stairways and ramps, Section 1024.8 for exit passageways and Section 1027.6 for exterior exit stairways and ramps.
2. Exterior walls required to be fire-resistance rated in accordance with Section 1207 of the *California Fire Code* for enclosure of energy storage systems.

707.5 Continuity. Fire barriers shall extend from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, slab or deck above and shall be securely attached thereto. Such fire barriers shall be continuous through concealed space, such as the space above a suspended ceiling. Joints and voids at intersections shall comply with Sections 707.8 and 707.9

Exceptions:

1. Shaft enclosures shall be permitted to terminate at a top enclosure complying with Section 713.12.
2. Interior exit stairway and ramp enclosures required by Section 1023 and exit access stairway and ramp enclosures required by Section 1019 shall be permitted to terminate at a top enclosure complying with Section 713.12.
3. An exit passageway enclosure required by Section 1024.3 that does not extend to the underside of the roof sheathing, slab or deck above shall be enclosed at the top with construction of the same fire-resistance rating as required for the exit passageway.

707.5.1 Supporting construction. The supporting construction for a *fire barrier* shall be protected to afford the required fire-resistance rating of the fire barrier supported. Hollow vertical spaces within a fire barrier shall be fireblocked in accordance with Section 718.2 at every floor level.

Exceptions:

1. The maximum required fire-resistance rating for assemblies supporting fire barriers separating tank storage as provided for in Section 415.9.1.2 shall be 2 hours, but not less than required by Table 601 for the building construction type.
2. Supporting construction for 1-hour fire barriers required by Table 509.1 in buildings of Types IIB, IIIB and VB construction is not required to be fire-resistance rated unless required by other sections of this code.

707.6 Openings. Openings in a fire barrier shall be protected in accordance with Section 716. Openings shall be limited to a maximum aggregate width of 25 percent of the length of the wall, and the maximum area of any single opening shall not

exceed 156 square feet (15 m²). Openings in enclosures for exit access stairways and ramps, interior exit stairways and ramps and exit passageways shall also comply with Sections 1019, 1023.4 and 1024.5, respectively.

Exceptions:

1. Openings shall not be limited to 156 square feet (15 m²) where adjoining floor areas are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Openings shall not be limited to 156 square feet (15 m²) or an aggregate width of 25 percent of the length of the wall where the opening protective is a fire door serving enclosures for exit access stairways and ramps, and interior exit stairways and ramps.
3. Openings shall not be limited to 156 square feet (15 m²) or an aggregate width of 25 percent of the length of the wall where the opening protective has been tested in accordance with ASTM E119 or UL 263 and has a minimum fire-resistance rating not less than the fire-resistance rating of the wall.
4. Fire window assemblies permitted in atrium separation walls shall not be limited to a maximum aggregate width of 25 percent of the length of the wall.
5. Openings shall not be limited to 156 square feet (15 m²) or an aggregate width of 25 percent of the length of the wall where the opening protective is a fire door assembly in a fire barrier separating an enclosure for exit access stairways and ramps, and interior exit stairways and ramps from an exit passageway in accordance with Section 1023.3.1.

707.7 Penetrations. Penetrations of fire barriers shall comply with Section 714.

707.7.1 Prohibited penetrations. Penetrations into enclosures for exit access stairways and ramps, interior exit stairways and ramps, and exit passageways shall be allowed only where permitted by Sections 1019, 1023.5 and 1024.6, respectively.

707.8 Joints. Joints made in or between fire barriers, and joints made at the intersection of fire barriers with underside of a fire-resistance-rated floor or roof sheathing, slab or deck above, and the exterior vertical wall intersection shall comply with Section 715.

707.9 Voids at intersections. The voids created at the intersection of a fire barrier and a nonfire-resistance-rated roof assembly or a nonfire-resistance-rated exterior wall assembly shall be filled. An approved material or system shall be used to fill the void, and shall be securely installed in or on the intersection for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to retard the passage of fire and hot gases.

707.10 Ducts and air transfer openings. Penetrations in a fire barrier by ducts and air transfer openings shall comply with Section 717.

**SECTION 708
FIRE PARTITIONS**

708.1 General. The following wall assemblies shall comply with this section:

1. Separation walls as required by Section 420.2 for Group R occupancies.
2. Walls separating tenant spaces in covered and open mall buildings as required by Section 402.4.2.1.
3. Corridor walls as required by Section 1020.3 *and in Group I-2 and I-2.1 as required by Section 407.3.*
4. Enclosed elevator lobby separation as required by Section 3006.3.
5. Egress balconies as required by Section 1021.2
6. Walls separating ambulatory care facilities from adjacent spaces, corridors or tenant as required by Section 422.2.
7. Walls separating dwelling and sleeping units in Groups R-1 and R-2 in accordance with Sections 907.2.8.1 and 907.2.9.1.
8. Vestibules in accordance with Section 1028.2.
9. *Walls separating enclosed tenant spaces in high-rise buildings and in buildings of Types I, IIA, IIIA, IV or VA construction of Group A, E, H, I, L and R-2.1 occupancies and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.*

708.2 Materials. The walls shall be of materials permitted by the building type of construction.

708.3 Fire-resistance rating. Fire partitions shall have a fire-resistance rating of not less than 1 hour.

Exceptions:

1. Corridor walls permitted to have a 1/2-hour fire-resistance rating by Table 1020.2.
2. Dwelling unit and sleeping unit separations in buildings of Types IIB, IIIB and VB construction shall have fire-resistance ratings of not less than 1/2 hour in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. *Walls separating enclosed tenant spaces in Group B high-rise buildings of Type I and II construction equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.*

708.4 Continuity. Fire partitions shall extend from the top of the foundation or floor/ceiling assembly below and be securely attached to one of the following:

1. The underside of the floor or roof sheathing, deck or slab above.
2. The underside of a floor/ceiling or roof/ceiling assembly having a fire-resistance rating that is not less than the fire-resistance rating of the fire partition.

Exceptions:

1. Fire partitions shall not be required to extend into a crawl space below where the floor above the crawl space has a minimum 1-hour fire-resistance rating.

2. Fire partitions serving as a corridor wall shall not be required to extend above the lower membrane of a corridor ceiling provided that the corridor ceiling membrane is equivalent to corridor wall membrane, and either of the following conditions is met:

- 2.1. The room-side membrane of the corridor wall extends to the underside of the floor or roof sheathing, deck or slab of a fire-resistance-rated floor or roof above.
- 2.2. The building is equipped with an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1 or 903.3.1.2, including automatic sprinklers installed in the space between the top of the fire partition and underside of the floor or roof sheathing, deck or slab above.

3. Fire partitions serving as a corridor wall shall be permitted to terminate at the upper membrane of the corridor ceiling assembly where the corridor ceiling is constructed as required for the corridor wall.

4. Fire partitions separating tenant spaces in a covered or open mall building complying with Section 402.4.2.1 shall not be required to extend above the underside of a ceiling. Such ceiling shall not be required to be part of a fire-resistance-rated assembly, and the attic or space above the ceiling at tenant separation walls shall not be required to be subdivided by fire partitions.

708.4.1 Supporting construction. The supporting construction for a fire partition shall have a fire-resistance rating that is equal to or greater than the required fire-resistance rating of the supported fire partition.

Exception: In buildings of Types IIB, IIIB and VB construction, the supporting construction requirement shall not apply to fire partitions separating tenant spaces in covered and open mall buildings, fire partitions separating dwelling units, fire partitions separating sleeping units, fire partitions serving as corridor walls, fire partitions separating ambulatory care facilities from adjacent spaces or corridors, fire partitions separating dwelling and sleeping units from Group R-1 and R-2 occupancies and fire partitions separating vestibules from the level of exit discharge.

708.4.2 Fireblocks and draftstops in combustible construction. In combustible construction where fire partitions do not extend to the underside of the floor or roof sheathing, deck or slab above, the space above and along the line of the fire partition shall be provided with one of the following:

1. Fireblocking up to the underside of the floor or roof sheathing, deck or slab above using materials complying with Section 718.2.1.
2. Draftstopping up to the underside of the floor or roof sheathing, deck or slab above using materials com-

plying with Section 718.3.1 for floors or Section 718.4.1 for attics.

Exceptions:

1. Buildings equipped with an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1, or in accordance with Section 903.3.1.2 provided that protection is provided in the space between the top of the fire partition and underside of the floor or roof sheathing, deck or slab above as required for systems complying with Section 903.3.1.1.
2. Where corridor walls provide a sleeping unit or dwelling unit separation, draftstopping shall only be required above one of the corridor walls.
3. In Group R-2 occupancies with fewer than four dwelling units, fireblocking and draftstopping shall not be required.
4. In Group R-2 occupancies up to and including four stories in height in buildings not exceeding 60 feet (18 288 mm) in height above grade plane, the attic space shall be subdivided by draftstops into areas not exceeding 3,000 square feet (279 m²) or above every two dwelling units, whichever is smaller.
5. In Group R-3 occupancies with fewer than three dwelling units, fireblocking and draftstopping shall not be required in floor assemblies.

708.5 Exterior walls. Where exterior walls serve as a part of a required fire-resistance-rated separation, such walls shall comply with the requirements of Section 705 for exterior walls, and the fire-resistance-rated separation requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1021.2 for exterior egress balconies, Section 1023.7 for interior exit stairways and ramps and Section 1027.6 for exterior exit stairways and ramps.

708.6 Openings. Openings in a fire partition shall be protected in accordance with Section 716.

708.7 Penetrations. Penetrations of fire partitions shall comply with Section 714.

708.8 Joints. Joints made in or between fire partitions shall comply with Section 715.

708.9 Ducts and air transfer openings. Penetrations in a fire partition by ducts and air transfer openings shall comply with Section 717.

**SECTION 709
SMOKE BARRIERS**

709.1 General. Vertical and horizontal smoke barriers shall comply with this section.

709.2 Materials. Smoke barriers shall be of materials permitted by the building type of construction.

709.3 Fire-resistance rating. A 1-hour fire-resistance rating is required for smoke barriers.

709.4 Continuity. Smoke barriers shall form an effective membrane continuously from the top of the foundation or floor/ceiling assembly below to the underside of the floor or roof sheathing, deck or slab above, including continuity through concealed spaces, such as those found above suspended ceilings, and interstitial structural and mechanical spaces. The supporting construction shall be protected to afford the required fire-resistance rating of the wall or floor supported in buildings of other than Type IIB, IIIB or VB construction. Smoke-barrier walls used to separate smoke compartments shall comply with Section 709.4.1. Smoke-barrier walls used to enclose areas of refuge in accordance with Section 1009.6.4 or to enclose elevator lobbies in accordance with Section 405.4.3, 3007.6.2, or 3008.6.2 shall comply with Section 709.4.2.

Exception: Smoke-barrier walls are not required in interstitial spaces where such spaces are designed and constructed with ceilings or exterior walls that provide resistance to the passage of fire and smoke equivalent to that provided by the smoke-barrier walls.

709.4.1 Smoke-barrier assemblies separating smoke compartments. Smoke-barrier assemblies used to separate smoke compartments shall form an effective membrane enclosure that is continuous from an outside wall or smoke barrier wall to an outside wall or another smoke barrier wall and to the horizontal assemblies.

709.4.2 Smoke-barrier walls enclosing areas of refuge or elevator lobbies. Smoke-barrier walls used to enclose areas of refuge in accordance with Section 1009.6.4, or to enclose elevator lobbies in accordance with Section 405.4.3, 3007.6.2, or 3008.6.2, shall form an effective membrane enclosure that terminates at a fire barrier wall having a level of fire protection rating not less than 1 hour, another smoke barrier wall or an outside wall. A smoke and draft control door assembly as specified in Section 716.2.2.1.1 shall not be required at each elevator hoistway door opening or at each exit doorway between an area of refuge and the exit enclosure.

709.5 Openings. Openings in a smoke barrier shall be protected in accordance with Section 716.

Exceptions:

1. In Group I-2, I-2.1, R-2.1 and ambulatory care facilities, where a pair of opposite-swinging doors are installed across a corridor in accordance with Section 709.5.1, the doors shall not be required to be protected in accordance with Section 716. The doors shall be close fitting within operational tolerances, and shall not have a center mullion or undercuts in excess of 3/4 inch (19.1 mm), louvers or grilles. The doors shall have head and jamb stops, and astragals or rabbets at meeting edges. Where permitted by the door manufacturer's listing, positive-latching devices are not required. Factory-applied or field-applied protective plates are not required to be labeled. *Doors installed across corridors shall comply with Section 1010.1.1.*

FIRE AND SMOKE PROTECTION FEATURES

2. In Group I-2, R-2.1 and ambulatory care facilities, special purpose horizontal sliding, accordion or folding doors installed in accordance with Section 1010.3.3 and protected in accordance with Section 716. Doors installed across corridors shall comply with Section 1010.1.1.

709.5.1 Group I-2, I-2.1, R-2.1 and ambulatory care facilities. In Group I-2, I-2.1, R-2.1 and ambulatory care facilities, where doors protecting openings in smoke barriers are installed across a corridor and have hold-open devices, the doors shall be automatic-closing in accordance with Section 716.2.6.6. Such doors shall have a vision panel with fire-protection-rated glazing materials in fire-protection-rated frames, the area of which shall not exceed that tested. In Group I-2, where swinging doors are installed across a corridor, such doors shall be opposite swinging pairs.

709.6 Penetrations. Penetrations of smoke barriers shall comply with Section 714.

709.7 Joints. Joints made in or between smoke barriers shall comply with Section 715.

709.8 Ducts and air transfer openings. Penetrations in a smoke barrier by ducts and air transfer openings shall comply with Section 717.

SECTION 710 SMOKE PARTITIONS

710.1 General. Smoke partitions installed as required elsewhere in the code shall comply with this section.

710.2 Materials. The walls shall be of materials permitted by the building type of construction. In Group I-2 and I-2.1, smoke partitions shall have framing covered with noncombustible materials having an approved thermal barrier with an index of not less than 15 in accordance with FM 4880, UL 1040, NFPA 286 or UL 1715.

710.3 Fire-resistance rating. Unless required elsewhere in the code, smoke partitions are not required to have a fire-resistance rating.

710.4 Continuity. Smoke partitions shall extend from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

710.5 Openings. Openings in smoke partitions shall comply with Sections 710.5.1 through 710.5.3.

710.5.1 Windows. Windows in smoke partitions shall be sealed to resist the free passage of smoke or be automatic-closing upon detection of smoke.

710.5.2 Doors. Doors in smoke partitions shall comply with Sections 710.5.2.1 through 710.5.2.3.

710.5.2.1 Louvers. Doors in smoke partitions shall not include louvers.

Exception: Where permitted in accordance with Section 407.3.1.1.

710.5.2.2 Smoke and draft control doors. Where required elsewhere in the code, doors in smoke partitions shall meet the requirements for a smoke and draft control door assembly tested in accordance with UL 1784. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot [$0.015424 \text{ m}^3/(\text{s} \times \text{m}^2)$] of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature test and the elevated temperature exposure test. Installation of smoke doors shall be in accordance with NFPA 105.

710.5.2.2.1 Smoke and draft control door labeling. Smoke and draft control doors complying only with UL 1784 shall be permitted to show the letter “S” on the manufacturer’s labeling.

710.5.2.3 Self- or automatic-closing doors. Where required elsewhere in the code, doors in smoke partitions shall be self- or automatic-closing by smoke detection in accordance with Section 716.2.6.6.

710.5.3 Pass-through openings in Group I-2, Condition 2. Where pass-through openings are provided in smoke partitions in Group I-2, Condition 2 occupancies, such openings shall comply with the following:

1. The smoke compartment in which the pass-through openings occur does not contain a patient care suite or sleeping room.
2. Pass-through openings are installed in a wall, door or vision panel that is not required to have a fire-resistance rating.
3. The top of the pass-through opening is located a maximum of 48 inches (1219 mm) above the floor.
4. The aggregate area of all such pass-through openings within a single room shall not exceed 80 square inches (0.05 m^2).

710.6 Penetrations. The space around penetrating items shall be filled with an approved material to limit the free passage of smoke.

710.7 Joints. Joints shall be filled with an approved material to limit the free passage of smoke.

710.8 Ducts and air transfer openings. The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the free passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with Section 717.3.2.2. For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, duct openings in smoke partitions shall also be provided with a smoke damper complying with Section 717.3.2.2.

Exceptions:

1. Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.
2. [SFM] Smoke dampers are not required in corridor penetrations where the duct is constructed of steel

not less than 0.019-inch (0.40 mm) in thickness and there are no openings serving the corridor.

SECTION 711 FLOOR AND ROOF ASSEMBLIES

711.1 General. Horizontal assemblies shall comply with Section 711.2. Nonfire-resistance-rated floor and roof assemblies shall comply with Section 711.3.

711.2 Horizontal assemblies. Horizontal assemblies shall comply with Sections 711.2.1 through 711.2.6.

711.2.1 Materials. Assemblies shall be of materials permitted by the building type of construction.

711.2.2 Continuity. Assemblies shall be continuous without vertical openings, except as permitted by this section and Section 712.

711.2.3 Supporting construction. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

Exception: In buildings of Type IIB, IIIB or VB construction, the construction supporting the horizontal assembly is not required to be fire-resistance rated at the following:

1. Horizontal assemblies at the separations of incidental uses as specified by Table 509.1 provided that the required fire-resistance rating does not exceed 1 hour.
2. Horizontal assemblies at the separations of dwelling units and sleeping units as required by Section 420.3.
3. Horizontal assemblies at smoke barriers constructed in accordance with Section 709.

711.2.4 Fire-resistance rating. The fire-resistance rating of horizontal assemblies shall comply with Sections 711.2.4.1 through 711.2.4.6 but shall be not less than that required by the building type of construction.

711.2.4.1 Separating mixed occupancies. Where the horizontal assembly separates mixed occupancies, the assembly shall have a fire-resistance rating of not less than that required by Section 508.4 based on the occupancies being separated.

711.2.4.2 Separating fire areas. Where the horizontal assembly separates a single occupancy into different fire areas, the assembly shall have a fire-resistance rating of not less than that required by Section 707.3.10.

711.2.4.3 Dwelling units and sleeping units. Horizontal assemblies serving as dwelling or sleeping unit separations in accordance with Section 420.3 shall be not less than 1-hour fire-resistance-rated construction.

Exception: Horizontal assemblies separating dwelling units and sleeping units shall be not less than $\frac{1}{2}$ -hour fire-resistance-rated construction in a building of Types IIB, IIIB and VB construction, where the building is equipped throughout with an automatic

sprinkler system in accordance with Section 903.3.1.1.

711.2.4.4 Separating smoke compartments. Where the horizontal assembly is required to be a smoke barrier, the assembly shall comply with Section 709.

711.2.4.5 Separating incidental uses. Where the horizontal assembly separates incidental uses from the remainder of the building, the assembly shall have a fire-resistance rating of not less than that required by Section 509.

711.2.4.6 Other separations. Where a horizontal assembly is required by other sections of this code, the assembly shall have a fire-resistance rating of not less than that required by that section.

711.2.5 Ceiling panels. Where the weight of lay-in ceiling panels, used as part of fire-resistance-rated floor/ceiling or roof/ceiling assemblies, is not adequate to resist an upward force of 1 pound per square foot (48 Pa), wire or other approved devices shall be installed above the panels to prevent vertical displacement under such upward force.

711.2.6 Unusable space. In 1-hour fire-resistance-rated floor/ceiling assemblies, the ceiling membrane is not required to be installed over unusable crawl spaces. In 1-hour fire-resistance-rated roof assemblies, the floor membrane is not required to be installed where unusable attic space occurs above.

711.3 Nonfire-resistance-rated floor and roof assemblies. Nonfire-resistance-rated floor, floor/ceiling, roof and roof/ceiling assemblies shall comply with Sections 711.3.1 and 711.3.2.

711.3.1 Materials. Assemblies shall be of materials permitted by the building type of construction.

711.3.2 Continuity. Assemblies shall be continuous without vertical openings, except as permitted by Section 712.

SECTION 712 VERTICAL OPENINGS

712.1 General. Each vertical opening shall comply in accordance with one of the protection methods in Sections 712.1.1 through 712.1.16.

712.1.1 Shaft enclosures. Vertical openings contained entirely within a shaft enclosure complying with Section 713 shall be permitted.

712.1.2 Individual dwelling unit. Unconcealed vertical openings totally within an individual residential dwelling unit and connecting four stories or less shall be permitted.

712.1.3 Escalator openings. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, vertical openings for escalators shall be permitted where protected in accordance with Section 712.1.3.1 or 712.1.3.2.

712.1.3.1 Opening size. Protection by a draft curtain and closely spaced sprinklers in accordance with NFPA 13 shall be permitted where the area of the vertical opening between stories does not exceed twice the hori-

zontal projected area of the escalator. In other than Groups B and M, this application is limited to openings that do not connect more than four stories.

712.1.3.2 Automatic shutters. Protection of the vertical opening by approved shutters at every penetrated floor shall be permitted in accordance with this section. The shutters shall be of noncombustible construction and have a fire-resistance rating of not less than 1.5 hours. The shutter shall be so constructed as to close immediately upon the actuation of a smoke detector installed in accordance with Section 907.3.1 and shall completely shut off the well opening. Escalators shall cease operation when the shutter begins to close. The shutter shall operate at a speed of not more than 30 feet per minute (152.4 mm/s) and shall be equipped with a sensitive leading edge to arrest its progress where in contact with any obstacle, and to continue its progress on release therefrom.

712.1.4 Penetrations. Penetrations, concealed and unconcealed, shall be permitted where protected in accordance with Section 714.

712.1.5 Joints. Joints shall be permitted where complying with Section 712.1.5.1 or 712.1.5.2, as applicable.

712.1.5.1 Joints in or between horizontal assemblies. Joints made in or between horizontal assemblies shall comply with Section 715. The void created at the intersection of a floor/ceiling assembly and an exterior curtain wall assembly shall be permitted where protected in accordance with Section 715.4.

712.1.5.2 Joints in or between nonfire-resistance-rated floor assemblies. Joints in or between floor assemblies without a required fire-resistance rating shall be permitted where they comply with one of the following:

1. The joint shall be concealed within the cavity of a wall.
2. The joint shall be located above a ceiling.
3. The joint shall be sealed, treated or covered with an approved material or system to resist the free passage of flame and the products of combustion.

Exception: Joints meeting one of the exceptions specified in Section 715.3.

712.1.6 Ducts and air transfer openings. Penetrations by ducts and air transfer openings shall be protected in accordance with Section 717. Grease ducts shall be protected in accordance with the *California Mechanical Code*.

712.1.7 Atriums. Atriums complying with Section 404 that connect two or more stories in Group I-2 or I-3 occupancies or three or more stories in other occupancies shall be permitted.

Exceptions:

1. Atriums shall not be permitted within Group H occupancies.
2. Balconies or stories within Groups A-1, A-4 and A-5 and mezzanines that comply with Section

505 shall not be considered a story as it applies to this section

712.1.8 Masonry chimney. Approved vertical openings for masonry chimneys shall be permitted where the annular space is fireblocked at each floor level in accordance with Section 718.2.5.

712.1.9 Two-story openings. In other than Groups I-2, I-2.1 and I-3, a vertical opening that is not used as one of the applications specified in this section shall be permitted if the opening complies with all of the following items:

1. Does not connect more than two stories.
2. Does not penetrate a horizontal assembly that separates fire areas or smoke barriers that separate smoke compartments.
3. Is not concealed within the construction of a wall or a floor/ceiling assembly.
4. Is not open to a corridor in Group I and R occupancies.
5. Is not open to a corridor on nonsprinklered floors.
6. Is separated from floor openings and air transfer openings serving other floors by construction conforming to required shaft enclosures.

712.1.10 Parking garages. Vertical openings in parking garages for automobile ramps, elevators and duct systems shall comply with Section 712.1.10.1, 712.1.10.2 or 712.1.10.3, as applicable.

712.1.10.1 Automobile ramps. Vertical openings for automobile ramps in parking garages shall be permitted where constructed in accordance with Sections 406.5 and 406.6.

712.1.10.2 Elevators. Vertical openings for elevator hoistways in parking garages that serve only the parking garage, and complying with Sections 406.5 and 406.6, respectively, shall be permitted.

712.1.10.3 Duct systems. Vertical openings for mechanical exhaust or supply duct systems in parking garages complying with Sections 406.5 and 406.6, respectively, shall be permitted to be unenclosed where such duct system is contained within and serves only the parking garage.

712.1.11 Mezzanine. Vertical openings between a mezzanine complying with Section 505 and the floor below shall be permitted.

712.1.12 Exit access stairways and ramps. Vertical openings containing exit access stairways or ramps in accordance with Section 1019 shall be permitted.

712.1.13 Openings. Vertical openings for floor fire doors and access doors shall be permitted where protected by Section 712.1.13.1 or 712.1.13.2.

712.1.13.1 Horizontal fire door assemblies. Horizontal fire door assemblies used to protect openings in fire-resistance-rated horizontal assemblies shall be tested in accordance with NFPA 288, and shall achieve a fire-resistance rating not less than the assembly being pene-

trated. Horizontal fire door assemblies shall be labeled by an approved agency. The label shall be permanently affixed and shall specify the manufacturer, the test standard and the fire-resistance rating.

712.1.13.2 Access doors. Access doors shall be permitted in ceilings of fire-resistance-rated floor/ceiling and roof/ceiling assemblies, provided that such doors are tested in accordance with ASTM E119 or UL 263 as horizontal assemblies and labeled by an approved agency for such purpose.

712.1.14 Group I-3. In Group I-3 occupancies, vertical openings shall be permitted in accordance with Section 408.5.

712.1.15 Skylights. Skylights and other penetrations through a fire-resistance-rated roof deck or slab are permitted to be unprotected, provided that the structural integrity of the fire-resistance-rated roof assembly is maintained. Unprotected skylights shall not be permitted in roof assemblies required to be fire-resistance rated in accordance with Section 705.8.6. The supporting construction shall be protected to afford the required fire-resistance rating of the horizontal assembly supported.

712.1.16 Openings otherwise permitted. Vertical openings shall be permitted where allowed by other sections of this code.

**SECTION 713
SHAFT ENCLOSURES**

713.1 General. The provisions of this section shall apply to *shafts* required to protect openings and penetrations through floor/ceiling and roof/ceiling assemblies. Interior exit stairways and ramps shall be enclosed in accordance with Section 1023.

713.2 Construction. Shaft enclosures shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies in accordance with Section 711, or both.

713.3 Materials. Shaft enclosures shall be of materials permitted by the building type of construction.

713.4 Fire-resistance rating. Shaft enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more, and not less than 1 hour where connecting less than four stories. The number of stories connected by the shaft enclosure shall include any basements but not any mezzanines. Shaft enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours. Shaft enclosures shall meet the requirements of Section 703.2.1.1.

713.5 Continuity. Shaft enclosures shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, and shall have continuity in accordance with Section 707.5 for fire barriers or Section 711.2.2 for horizontal assemblies, as applicable.

713.6 Exterior walls. Where exterior walls serve as a part of a required shaft enclosure, such walls shall comply with the

requirements of Section 705 for exterior walls and the fire-resistance-rated enclosure requirements shall not apply.

Exception: Exterior walls required to be fire-resistance rated in accordance with Section 1021.2 for exterior egress balconies, Section 1023.7 for interior exit stairways and ramps and Section 1027.6 for exterior exit stairways and ramps.

713.7 Openings. Openings in a shaft enclosure shall be protected in accordance with Section 716 as required for fire barriers. Doors shall be self- or automatic-closing by smoke detection in accordance with Section 716.2.6.6.

713.7.1 Prohibited openings. Openings other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

713.8 Penetrations. Penetrations in a shaft enclosure shall be protected in accordance with Section 714 as required for fire barriers. Structural elements, such as beams or joists, where protected in accordance with Section 714 shall be permitted to penetrate a shaft enclosure.

713.8.1 Prohibited penetrations. Penetrations other than those necessary for the purpose of the shaft shall not be permitted in shaft enclosures.

Exception: Membrane penetrations shall be permitted on the outside of shaft enclosures. Such penetrations shall be protected in accordance with Section 714.4.2.

713.9 Joints. Joints in a shaft enclosure shall comply with Section 715.

713.10 Duct and air transfer openings. Penetrations of a shaft enclosure by ducts and air transfer openings shall comply with Section 717.

713.11 Enclosure at the bottom. Shafts that do not extend to the bottom of the building or structure shall comply with one of the following:

1. Be enclosed at the lowest level with construction of the same fire-resistance rating as the lowest floor through which the shaft passes, but not less than the rating required for the shaft enclosure.
2. Terminate in a room having a use related to the purpose of the shaft. The room shall be separated from the remainder of the building by fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating and opening protectives shall be not less than the protection required for the shaft enclosure.
3. Be protected by approved fire dampers installed in accordance with their listing at the lowest floor level within the shaft enclosure.

Exceptions:

1. The fire-resistance-rated room separation is not required, provided that the only openings in or penetrations of the shaft enclosure to the interior of the building occur at the bottom. The bottom of the shaft shall be closed off around the penetrating items with materials permitted by Section 718.3.1 for draftstop-

ping, or the room shall be provided with an approved automatic sprinkler system.

2. A shaft enclosure containing a waste or linen chute shall not be used for any other purpose and shall discharge in a room protected in accordance with Section 713.13.4.
3. The fire-resistance-rated room separation and the protection at the bottom of the shaft are not required provided that there are no combustibles in the shaft and there are no openings or other penetrations through the shaft enclosure to the interior of the building.

713.12 Enclosure at top. The top of shaft enclosures shall comply with one of the following:

1. Extend to the underside of the roof sheathing, deck or slab of the building, and the roof assembly shall comply with the requirements for the type of construction as specified in Table 601.
2. Terminate below the roof assembly and be enclosed at the top with construction of the same fire-resistance rating as the topmost floor penetrated by the shaft, but not less than the fire-resistance rating required for the shaft enclosure.
3. Extend past the roof assembly and comply with the requirements of Section 1511.

713.12.1 Penthouse mechanical rooms. A fire/smoke damper shall not be required at the penetration of the rooftop structure where shaft enclosures extend up through the roof assembly into a rooftop structure conforming to Section 1511. Ductwork in the shaft shall be connected directly to HVAC equipment.

713.13 Waste, recycling and linen chutes and incinerator rooms. Waste, recycling and linen chutes shall comply with the provisions of NFPA 82, Chapter 6 and shall meet the requirements of Sections 712 and 713.13.1 through 713.13.6. Incinerator rooms shall meet the provisions of Sections 713.13.4 and 713.13.5.

Exception: Chutes serving and contained within a single dwelling unit.

713.13.1 Waste, recycling and linen chute enclosures. A shaft enclosure containing a recycling, waste or linen chute shall not be used for any other purpose and shall be enclosed in accordance with Section 713.4. A shaft enclosure shall be permitted to contain recycling and waste chutes. Openings into the shaft, from access rooms and discharge rooms, shall be protected in accordance with this section and Section 716. Openings into chutes shall not be located in corridors. Doors into chutes shall be self-closing. Discharge doors shall be self-or automatic-closing upon the actuation of a smoke detector in accordance with Section 716.2.6.6, except that heat-activated closing devices shall be permitted between the shaft and the discharge room.

713.13.2 Materials. A shaft enclosure containing a waste, recycling, or linen chute shall be constructed of materials as permitted by the building type of construction.

713.13.3 Chute access rooms. Access openings for waste, recycling or linen chutes shall be located in rooms or compartments enclosed by not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings into the access rooms shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.2.6.6. The room or compartment shall be configured to allow the access door to the room or compartment to close and latch with the access panel to the chute in any position.

713.13.4 Chute discharge room. Table 509.1 Waste, recycling or linen chutes shall discharge into an enclosed room separated by fire barriers with a fire-resistance rating not less than the required fire rating of the shaft enclosure and constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings into the discharge room from the remainder of the building shall be protected by opening protectives having a fire protection rating equal to the protection required for the shaft enclosure. Doors shall be self- or automatic-closing upon the detection of smoke in accordance with Section 716.2.6.6. Waste chutes shall not terminate in an incinerator room. Waste and linen rooms that are not provided with chutes need only comply with Table 509.1.

713.13.5 Incinerator room. Incinerator rooms shall comply with Table 509.1.

713.13.6 Automatic sprinkler system. An approved automatic sprinkler system shall be installed in accordance with Section 903.2.11.2.

713.14 Elevator, dumbwaiter and other hoistways. Elevator, dumbwaiter and other hoistway enclosures shall be constructed in accordance with Sections 712 and 713, and Chapter 30.

SECTION 714 PENETRATIONS

714.1 Scope. The provisions of this section shall govern the materials and methods of construction used to protect through penetrations and membrane penetrations of horizontal assemblies and fire-resistance-rated wall assemblies.

714.1.1 Ducts and air transfer openings. Penetrations of fire-resistance-rated walls by ducts that are not protected with dampers shall comply with Sections 714.3 through 714.4.3. Penetrations of horizontal assemblies not protected with a shaft as permitted by Section 717.6, and not required to be protected with fire dampers by other sections of this code, shall comply with Sections 714.5 through 714.6.2. Ducts and air transfer openings that are protected with dampers shall comply with Section 717.

714.2 Installation. A listed penetration firestop system shall be installed in accordance with the manufacturer's installation instructions and the listing criteria.

714.3 Installation details. Where sleeves are used, they shall be securely fastened to the assembly penetrated. The space between the item contained in the sleeve and the sleeve itself and any space between the sleeve and the assembly penetrated shall be protected in accordance with this section. Insulation and coverings on or in the penetrating item shall not penetrate the assembly unless the specific material used has been tested as part of the assembly in accordance with this section.

714.4 Fire-resistance-rated walls. Penetrations into or through fire walls, fire barriers, smoke barrier walls and fire partitions shall comply with Sections 714.4.1 through 714.4.3. Penetrations in smoke barrier walls shall also comply with Section 714.5.4.

714.4.1 Through penetrations. Through penetrations of fire-resistance-rated walls shall comply with Section 714.4.1.1 or 714.4.1.2.

Exception: Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space between the penetrating item and the fire-resistance-rated wall is permitted to be protected by either of the following measures:

1. In concrete or masonry walls where the penetrating item is a maximum 6-inch (152 mm) nominal diameter and the area of the opening through the wall does not exceed 144 square inches (0.0929 m²), concrete, grout or mortar is permitted where installed the full thickness of the wall or the thickness required to maintain the fire-resistance rating.
2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

714.4.1.1 Fire-resistance-rated assemblies. Through penetrations shall be protected using systems installed as tested in the approved fire-resistance-rated assembly.

714.4.1.2 Through-penetration firestop system. Through penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water and shall have an *F rating* of not less than the required fire-resistance rating of the wall penetrated.

714.4.2 Membrane penetrations. Membrane penetrations shall comply with Section 714.4.1. Where walls or partitions are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel elec-

trical boxes that do not exceed 16 square inches (0.0103 m²) in area, provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.2 mm). Such boxes on opposite sides of the wall or partition shall be separated by one of the following:

- 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
- 1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
- 1.3. By solid fireblocking in accordance with Section 718.2.1.
- 1.4. By protecting both outlet boxes with listed putty pads.
- 1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.2 mm) unless listed otherwise. Such boxes on opposite sides of the wall or partition shall be separated by one of the following:
 - 2.1. By the horizontal distance specified in the listing of the electrical boxes.
 - 2.2. By solid fireblocking in accordance with Section 718.2.1.
 - 2.3. By protecting both boxes with listed putty pads.
 - 2.4. By other listed materials and methods.
3. Membrane penetrations by electrical boxes of any size or type, that have been listed as part of a wall opening protective material system for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.
4. Membrane penetrations by boxes other than electrical boxes, provided that such penetrating items and the annular space between the wall membrane and the box, are protected by an approved membrane penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water, and shall have an F and T rating of not less than the required

fire-resistance rating of the wall penetrated and be installed in accordance with their listing.

5. The annular space created by the penetration of an automatic sprinkler, provided that it is covered by a metal escutcheon plate.
6. Membrane penetrations of maximum 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that exceed 16 square inches (0.0103 m²) in area, or steel electrical boxes of any size having an aggregate area through the membrane exceeding 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area, provided that such penetrating items are protected by listed putty pads or other listed materials and methods, and installed in accordance with the listing.

714.4.3 Dissimilar materials. Noncombustible penetrating items shall not connect to combustible items beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the wall is maintained.

714.5 Horizontal assemblies. Penetrations of a fire-resistance-rated floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly not required to be enclosed in a shaft by Section 712.1 shall be protected in accordance with Sections 714.5.1 through 714.5.4.

714.5.1 Through penetrations. Through penetrations of horizontal assemblies shall comply with Section 714.5.1.1 or 714.5.1.2.

Exceptions:

1. Penetrations by steel, ferrous or copper conduits, pipes, tubes or vents or concrete or masonry items through a single fire-resistance-rated floor assembly where the annular space is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste when subjected to ASTM E119 or UL 263 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated. Penetrating items with a maximum 6-inch (152 mm) nominal diameter shall not be limited to the penetration of a single fire-resistance-rated floor assembly, provided that the aggregate area of the openings through the assembly does not exceed 144 square inches (92 900 mm²) in any 100 square feet (9.3 m²) of floor area.
2. Penetrations in a single concrete floor by steel, ferrous or copper conduits, pipes, tubes or vents with a maximum 6-inch (152 mm) nominal diameter, provided that the concrete, grout or mortar is installed the full thickness of the floor or the thickness required to maintain the fire-resistance rating. The penetrating items shall not be limited to the penetration of a single concrete floor, provided that the area of the opening through each floor does not exceed 144 square inches (92 900 mm²).

3. Penetrations by listed electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and installed in accordance with the instructions included in the listing.

714.5.1.1 Fire-resistance-rated assemblies. Through penetrations shall be protected using systems installed as tested in the approved fire-resistance-rated assembly.

714.5.1.2 Through-penetration firestop system. Through penetrations shall be protected by an approved through-penetration firestop system installed and tested in accordance with ASTM E814 or UL 1479, with a minimum positive pressure differential of 0.01 inch of water (2.49 Pa). The system shall have an F rating/T rating of not less than 1 hour but not less than the required rating of the floor penetrated.

Exceptions:

1. Floor penetrations contained and located within the cavity of a wall above the floor or below the floor do not require a T rating.
2. Floor penetrations by floor drains, tub drains or shower drains contained and located within the concealed space of a horizontal assembly do not require a T rating.
3. Floor penetrations of maximum 4-inch (102 mm) nominal diameter metal conduit or tubing penetrating directly into metal-enclosed electrical power switchgear do not require a T rating.

714.5.2 Membrane penetrations. Penetrations of membranes that are part of a horizontal assembly shall comply with Section 714.5.1.1 or 714.5.1.2. Where floor/ceiling assemblies are required to have a fire-resistance rating, recessed fixtures shall be installed such that the required fire resistance will not be reduced.

Exceptions:

1. Membrane penetrations by steel, ferrous or copper conduits, pipes, tubes or vents, or concrete or masonry items where the annular space is protected either in accordance with Section 714.5.1 or to prevent the free passage of flame and the products of combustion. The aggregate area of the openings through the membrane shall not exceed 100 square inches (64 500 mm²) in any 100 square feet (9.3 m²) of ceiling area in assemblies tested without penetrations.
2. Ceiling membrane penetrations of maximum 2-hour horizontal assemblies by steel electrical boxes that do not exceed 16 square inches (10 323 mm²) in area, provided that the aggregate area of such penetrations does not exceed 100 square inches (44 500 mm²) in any 100 square feet (9.29 m²) of ceiling area, and the annular space between the ceiling membrane and the box does not exceed 1/8 inch (3.2 mm).

3. Membrane penetrations by electrical boxes of any size or type, that have been listed as part of an opening protective material system for use in horizontal assemblies and are installed in accordance with the instructions included in the listing.
4. Membrane penetrations by listed electrical boxes of any material, provided that such boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the ceiling membrane and the box shall not exceed 1/8 inch (3.2 mm) unless listed otherwise.
5. The annular space created by the penetration of a fire sprinkler, provided that it is covered by a metal escutcheon plate.
6. Noncombustible items that are cast into concrete building elements and that do not penetrate both top and bottom surfaces of the element.
7. The ceiling membrane of a maximum 2-hour fire-resistance-rated horizontal assembly is permitted to be interrupted with the double wood top plate of a wall assembly that is sheathed with Type X gypsum wallboard, provided that all penetrating items through the double top plates are protected in accordance with Section 714.5.1.1 or 714.5.1.2 and the ceiling membrane is tight to the top plates.
8. Ceiling membrane penetrations by listed luminaires (light fixtures) or by luminaires protected with listed materials, which have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.

714.5.3 Dissimilar materials. Noncombustible penetrating items shall not connect to combustible materials beyond the point of firestopping unless it can be demonstrated that the fire-resistance integrity of the horizontal assembly is maintained.

714.5.4 Penetrations in smoke barriers. Penetrations in smoke barriers shall be protected by an approved through-penetration firestop system installed and tested in accordance with the requirements of UL 1479 for air leakage. The L rating of the system measured at 0.30 inch (7.47 Pa) of water in both the ambient temperature and elevated temperature tests shall not exceed either of the following:

1. 5.0 cfm per square foot (0.025 m³/s × m²) of penetration opening for each through-penetration firestop system.
2. A total cumulative leakage of 50 cfm (0.024 m³/s) for any 100 square feet (9.3 m²) of wall area, or floor area.

714.6 Nonfire-resistance-rated assemblies. Penetrations of nonfire-resistance-rated floor or floor/ceiling assemblies or the ceiling membrane of a nonfire-resistance-rated roof/ceiling assembly shall meet the requirements of Section 713 or shall comply with Section 714.6.1 or 714.6.2.

714.6.1 Noncombustible penetrating items. Noncombustible penetrating items that connect not more than five stories are permitted, provided that the annular space is filled to resist the free passage of flame and the products of combustion with an approved noncombustible material or with a fill, void or cavity material that is tested and classified for use in through-penetration firestop systems.

714.6.2 Penetrating items. Penetrating items that connect not more than two stories are permitted, provided that the annular space is filled with an approved material to resist the free passage of flame and the products of combustion.

SECTION 715 JOINTS AND VOIDS

715.1 General. The provisions of this section shall govern the materials and methods of construction used to protect joints and voids in or between horizontal and vertical assemblies.

715.2 Installation. Systems or materials protecting joints and voids shall be securely installed in accordance with the manufacturer's installation instructions in or on the joint or void for its entire length so as not to dislodge, loosen or otherwise impair its ability to accommodate expected building movements and to resist the passage of fire and hot gases. Fire-resistant joint systems or systems used to protect voids at exterior curtain walls and fire-resistance-rated floor intersections shall also be installed in accordance with the listing criteria.

715.3 Fire-resistance-rated assembly intersections. Joints installed in or between fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system designed to resist the passage of fire for a time period not less than the required fire-resistance rating of the wall, floor or roof in or between which the system is installed.

Exception: Fire-resistant joint systems shall not be required for joints in the following locations:

1. Floors within a single dwelling unit.
2. Floors where the joint is protected by a shaft enclosure in accordance with Section 713.
3. Floors within atriums where the space adjacent to the atrium is included in the volume of the atrium for smoke control purposes.
4. Floors within malls.
5. Floors and ramps within parking garages or structures constructed in accordance with Sections 406.5 and 406.6.
6. Mezzanine floors.
7. Walls that are permitted to have unprotected openings.
8. Roofs where openings are permitted.
9. Control joints not exceeding a maximum width of 0.625 inch (15.9 mm) and tested in accordance with ASTM E119 or UL 263.

10. The intersection of exterior curtain wall assemblies and the roof slab or roof deck.

715.3.1 Fire test criteria. Fire-resistant joint systems shall be tested in accordance with the requirements of either ASTM E1966 or UL 2079. Nonsymmetrical wall joint systems shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests. Where evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the building official, the wall need not be subjected to tests from the opposite side.

Exception: For exterior walls with a horizontal fire separation distance greater than 10 feet (3048 mm), the joint system shall be required to be tested for interior fire exposure only.

715.4 Exterior curtain wall/fire-resistance-rated floor intersections. Voids created at the intersection of exterior curtain wall assemblies and fire-resistance-rated floor or floor/ceiling assemblies shall be protected with an approved perimeter fire containment system to prevent the interior spread of fire. Such systems shall provide an F rating for a time period not less than the fire-resistance rating of the floor or floor/ceiling assembly.

715.4.1 Fire test criteria. Perimeter fire containment systems shall be tested in accordance with the requirements of ASTM E2307.

Exception: Voids created at the intersection of the exterior curtain wall assemblies and floor assemblies where the vision glass extends to the finished floor level shall be permitted to be protected with an approved material to prevent the interior spread of fire. Such material shall be securely installed and capable of preventing the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 time-temperature fire conditions under a minimum positive pressure differential of 0.01 inch (0.254 mm) of water column (2.5 Pa) for the time period not less than the fire-resistance rating of the floor assembly.

715.5 Exterior curtain wall/nonfire-resistance-rated floor assembly intersections. Voids created at the intersection of exterior curtain wall assemblies and nonfire-resistance-rated floor or floor/ceiling assemblies shall be filled with an approved material or system to retard the interior spread of fire and hot gases between stories.

715.6 Exterior curtain wall/vertical fire barrier intersections. Voids created at the intersection of nonfire-resistance-rated exterior curtain wall assemblies and vertical fire barriers shall be filled with an approved material or system to retard the interior spread of fire and hot gases.

715.7 Curtain wall spandrels. Height and fire-resistance requirements for curtain wall spandrels shall comply with Section 705.8.5. Where Section 705.8.5 does not require fire-resistance-rated curtain wall spandrels, the requirements of Sections 715.4 and 715.5 shall still apply to the intersection between the curtain wall spandrels and the floor.

715.8 Joints and voids in smoke barriers. Fire-resistant joint systems protecting joints in smoke barriers, and perimeter fire containment systems protecting voids at the intersection of a horizontal smoke barrier and an exterior curtain wall, shall be tested in accordance with the requirements of UL 2079 for air leakage. The L rating of the joint system shall not exceed 5 cubic feet per minute per linear foot (0.00775 m³/s m) of joint at 0.30 inch (74.7 Pa) of water for both the ambient temperature and elevated temperature tests.

SECTION 716 OPENING PROTECTIVES

716.1 General. Opening protectives required by other sections of this code shall comply with the provisions of this section and shall be installed in accordance with NFPA 80.

716.1.1 Alternative methods for determining fire protection ratings. The application of any of the alternative methods specified in this section shall be based on the fire exposure and acceptance criteria specified in NFPA 252, NFPA 257, UL 9, UL 10B or UL 10C. The required fire resistance of an opening protective shall be permitted to be established by any of the following methods or procedures:

1. Designs documented in approved sources.
2. Calculations performed in an approved manner.
3. Engineering analysis based on a comparison of opening protective designs having fire protection ratings as determined by the test procedures set forth in NFPA 252, NFPA 257, UL 9, UL 10B or UL 10C.
4. Alternative protection methods as allowed by Section 104.11.

716.1.2 Glazing. Glazing used in fire door assemblies and fire window assemblies shall comply with this section in addition to the requirements of Sections 716.2 and 716.3, respectively.

716.1.2.1 Safety glazing. Fire-protection-rated glazing and fire-resistance-rated glazing installed in fire door assemblies and fire window assemblies shall comply with the safety glazing requirements of Chapter 24 where applicable.

716.1.2.2 Marking fire-rated glazing assemblies. Fire-rated glazing assemblies shall be marked in accordance with Tables 716.1(1), 716.1(2) and 716.1(3).

716.1.2.2.1 Fire-rated glazing identification. For fire-rated glazing, the label shall bear the identification required in Tables 716.1(1) and 716.1(2). “D” indicates that the glazing is permitted to be used in fire door assemblies and meets the fire protection requirements of NFPA 252, UL 10B or UL 10C. “H” indicates that the glazing meets the hose stream requirements of NFPA 252, UL 10B or UL 10C. “T” indicates that the glazing meets the temperature requirements of Section 716.2.2.3.1. The placeholder “XXX” represents the fire-rating period, in minutes.

**TABLE 716.1(1)
MARKING FIRE-RATED GLAZING ASSEMBLIES**

FIRE TEST STANDARD	MARKING	DEFINITION OF MARKING
ASTM E119 or UL 263	W	Meets wall assembly criteria.
ASTM E119 or UL 263	FC	Meets floor/ceiling criteria ^a
NFPA 257 or UL 9	OH	Meets fire window assembly criteria including the hose stream test.
NFPA 252 or UL 10B or UL 10C	D	Meets fire door assembly criteria.
	H	Meets fire door assembly hose stream test.
	T	Meets 450°F temperature rise criteria for 30 minutes
—	XXX	The time in minutes of the fire resistance or fire protection rating of the glazing assembly.

For SI: °C = [(°F) – 32]/1.8.

a. See Section 2409.1

**TABLE 716.1(2)
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)		MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE ^a	FIRE-RATED GLAZING MARKING DOOR VISION PANEL ^{b,c}	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELIGHT/TRANSOM PANEL	
						Fire protection	Fire resistance	Fire protection	Fire resistance
Fire walls and fire barriers having a required fire-resistance rating greater than 1 hour	4		3	See Note a	D-H-W-240	Not Permitted	4	Not Permitted	W-240
	3		3 ^d	See Note a	D-H-W-180	Not Permitted	3	Not Permitted	W-180
	2		1½	100 sq. in.	≤100 sq. in. = D-H-90 >100 sq. in.=D-H-W-90	Not Permitted	2	Not Permitted	W-120
	1½		1½	100 sq. in.	≤100 sq. in. = D-H-90 >100 sq. in.= D-H-W-90	Not Permitted	1½	Not Permitted	W-90
Double fire walls constructed in accordance with NFPA 221	Single-wall assembly rating (hours) ^e	Each wall of the double-wall assembly (hours) ^f	—	—	—	—	—	—	—
	4	3	3	See Note a	D-H-W-180	Not Permitted	3	Not Permitted	W-180
	3	2	1½	100 sq. in.	≤ 100 sq. in. = D-H-90 >100 sq. in.= D-H-W-90	Not Permitted	2	Not Permitted	W-120
	2	1	1	100 sq. in.	≤ 100 sq. in. = D-H-60 > 100 sq. in. = D-H-W-60	Not Permitted	1	Not Permitted	W-60
Enclosures for shafts, interior exit stairways and interior exit ramps.	2		1½	100 sq. in. ^b	≤100 sq. in. = D-H-90 > 100 sq. in.= D-H-T-W-90	Not Permitted	2	Not Permitted	W-120

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 716.1(2)—continued
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS

TYPE OF ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE DOOR AND FIRE SHUTTER ASSEMBLY RATING (hours)	DOOR VISION PANEL SIZE ^a	FIRE-RATED GLAZING MARKING DOOR VISION PANEL ^{b,c}	MINIMUM SIDELIGHT/TRANSOM ASSEMBLY RATING (hours)		FIRE-RATED GLAZING MARKING SIDELIGHT/TRANSOM PANEL		
					Fire protection	Fire resistance	Fire protection	Fire resistance	
Horizontal exits in fire walls ^g	4	3	100 sq. in.	≤100 sq. in. = D-H-180 > 100 sq. in.=D-H-W-240	Not Permitted	4	Not Permitted	W-240	
	3	3 ^d	100 sq. in.	≤100 sq. in. = D-H-180 > 100 sq. in.=D-H-W-180	Not Permitted	3	Not Permitted	W-180	
Fire barriers having a required fire-resistance rating of 1 hour: Enclosures for shafts, exit access stairways, exit access ramps, interior exit stairways and interior exit ramps; and exit passageway walls	1	1	100 sq. in.	≤100 sq. in. = D-H-60 >100 sq. in.=D-H-T-W-60	Not Permitted	1	Not Permitted	W-60	
					Fire protection				
Other fire barriers	1	3/4	Maximum size tested	D-H	3/4 ^h		D-H ^h		
Fire partitions: Corridor walls	1	1/3 ^a	Maximum size tested	D-20	3/4 ^a		D-H-OH-45		
	0.5	1/3 ^a	Maximum size tested	D-20	1/3		D-H-OH-20		
Other fire partitions	1	3/4 ⁱ	Maximum size tested	D-H-45	3/4		D-H-45		
	0.5	1/3	Maximum size tested	D-H-20	1/3		D-H-20		
Exterior walls	3	1 1/2	100 sq. in. ^a	≤100 sq. in. = D-H-90 > 100 sq. in = D-H-W-90	Not Permitted	3	Not Permitted	W-180	
	2	1 1/2	Maximum size tested	D-H 90 or D-H-W-90	1 1/2 ^h	2	D-H-OH-90 ^h	W-120	
						Fire protection			
	1	3/4	Maximum size tested	D-H-45	3/4 ^h		D-H-45 ^h		
Smoke barriers						Fire protection			
	1	1/3	Maximum size tested	D-20	3/4		D-H-OH-45		

(continued)

**TABLE 716.1(2)—continued
OPENING FIRE PROTECTION ASSEMBLIES, RATINGS AND MARKINGS**

For SI: 1 square inch = 645.2 mm.

- a. Fire-resistance-rated glazing tested to ASTM E119 in accordance with Section 716.1.2.3 shall be permitted, in the maximum size tested.
- b. Under the column heading “Fire-rated glazing marking door vision panel,” W refers to the fire-resistance rating of the glazing, not the frame.
- c. See Section 716.1.2.2.1 and Table 716.1(1) for additional permitted markings.
- d. Two doors, each with a fire protection rating of 1½ hours, installed on opposite sides of the same opening in a fire wall, shall be deemed equivalent in fire protection rating to one 3-hour fire door.
- e. As required in Section 706.4.
- f. As allowed in Section 4.6 of NFPA 221.
- g. See Section 716.2.5.1.2.
- h. Fire-protection-rated glazing is not permitted for fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems. Fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3, shall be permitted.
- i. Two doors, each with a fire rating of 20 minutes, installed on opposite sides of the same opening in a fire partition, shall be deemed equivalent in fire protection rating to one 45-minute fire door.

**TABLE 716.1(3)
FIRE WINDOW ASSEMBLY FIRE PROTECTION RATINGS**

TYPE OF WALL ASSEMBLY	REQUIRED WALL ASSEMBLY RATING (hours)	MINIMUM FIRE WINDOW ASSEMBLY RATING (hours)	FIRE-RATED GLAZING MARKING
Interior walls			
Fire walls	All	NP ^a	W-XXX ^b
Fire barriers	>1	NP ^a	W-XXX ^b
	1	NP ^a	W-XXX ^b
Atrium separations (Section 707.3.6), Incidental use areas (Section 707.3.7), ^c Mixed occupancy separations (Section 707.3.9)	1	¾	OH-45 or W-60
Fire partitions	1	¾	OH-45 or W-60
	0.5	⅓	OH-20 or W-30
Smoke barriers	1	¾	OH-45 or W-60
Exterior walls	>1	1½	OH-90 or W-XXX ^b
	1	¾	OH-45 or W-60
	0.5	⅓	OH-20 or W-30
Party wall	All	NP	Not Applicable

NP = Not Permitted.

- a. Not permitted except fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3.
- b. XXX = The fire rating duration period in minutes, which shall be equal to the fire-resistance rating required for the wall assembly.
- c. Fire-protection-rated glazing is not permitted for fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems. Fire-resistance-rated glazing assemblies tested to ASTM E119 or UL 263, as specified in Section 716.1.2.3, shall be permitted.

716.1.2.2.2 Fire-protection-rated glazing identification. For fire-protection-rated glazing, the label shall bear the following identification required in Tables 716.1(1) and 716.1(3): “OH – XXX.” “OH” indicates that the glazing meets both the fire protection and the hose-stream requirements of NFPA 257 or UL 9 and is permitted to be used in fire window openings. The placeholder “XXX” represents the fire-rating period, in minutes.

716.1.2.2.3 Fire-resistance-rated glazing identification. For fire-resistance-rated glazing, the label shall bear the identification required in Section 703.4 and Table 716.1(1).

716.1.2.2.4 Fire-rated glazing that exceeds the code requirements. Fire-rated glazing assemblies marked as complying with hose stream requirements (H) shall be permitted in applications that do not require

compliance with hose stream requirements. Fire-rated glazing assemblies marked as complying with temperature rise requirements (T) shall be permitted in applications that do not require compliance with temperature rise requirements. Fire-rated glazing assemblies marked with ratings (XXX) that exceed the ratings required by this code shall be permitted.

716.1.2.3 Fire-resistance-rated glazing. Fire-resistance-rated glazing tested as part of a fire-resistance-rated wall or floor/ceiling assembly in accordance with ASTM E119 or UL 263 and labeled in accordance with Section 703.4 shall not otherwise be required to comply with this section where used as part of a wall or floor/ceiling assembly.

716.1.2.3.1 Glazing in fire door and fire window assemblies. Fire-resistance-rated glazing shall be permitted in fire door and fire window assemblies

where tested and installed in accordance with their listings and where in compliance with the requirements of this section.

716.2 Fire door assemblies. Fire door assemblies required by other sections of this code shall comply with the provisions of this section. Fire door frames with transom lights, sidelights or both shall be permitted in accordance with Section 716.2.5.4.

716.2.1 Testing requirements. Approved fire door and fire shutter assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of Sections 716.2.1.1 through 716.2.1.4 and the fire protection rating indicated in Table 716.1(2).

Exceptions:

1. Labeled protective assemblies that conform to the requirements of this section or UL 10A, UL 14B and UL 14C for tin-clad fire door assemblies.
2. Floor fire door assemblies in accordance with Section 712.1.13.1.

716.2.1.1 Side-hinged or pivoted swinging doors. Fire door assemblies with side-hinged and pivoted swinging doors shall be tested in accordance with NFPA 252 or UL 10C. For tests conducted in accordance with NFPA 252, the fire test shall be conducted using the positive pressure method specified in the standard.

716.2.1.2 Other types of assemblies. Fire door assemblies with other types of doors, including swinging elevator doors, horizontal sliding fire doors, rolling steel fire doors, fire shutters, bottom- and side-hinged chute intake doors, and top-hinged chute discharge doors, shall be tested in accordance with NFPA 252 or UL 10B. For tests conducted in accordance with NFPA 252, the neutral pressure plane in the furnace shall be maintained as nearly equal to the atmospheric pressure as possible at the top of the door, as specified in the standard.

716.2.1.3 Glazing in transoms lights and sidelights in corridors and smoke barriers. Glazing material in any other part of the door assembly, including transom lights and sidelights, shall be tested in accordance with NFPA 257 or UL 9, including the hose stream test, in accordance with Section 716.3.1.1.

716.2.1.4 Smoke and draft control. Fire door assemblies that serve as smoke and draft control assemblies shall be tested in accordance with UL 1784.

716.2.2 Performance requirements. Fire door assemblies shall be installed in the assemblies specified in Table 716.1(2) and shall comply with the fire protection rating specified.

716.2.2.1 Door assemblies in corridors and smoke barriers. Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke barrier walls having a fire-resistance rating in accordance with Table 716.1(2)

shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.

Exceptions:

1. Viewports that require a hole not larger than 1 inch (25 mm) in diameter through the door, have not less than a 0.25-inch-thick (6.4 mm) glass disc and the holder is of metal that will not melt out where subject to temperatures of 1,700°F (927°C).
2. Corridor door assemblies in occupancies of Group I-2 and I-2.1 in fully sprinklered buildings shall be in accordance with Section 407.3.1.
3. Unprotected openings shall be permitted for corridors in multitheater complexes where each motion picture auditorium has not fewer than one-half of its required exit or exit access doorways opening directly to the exterior or into an exit passageway.
4. Horizontal sliding doors in smoke barriers that comply with Sections 408.6 and 408.8.1 in occupancies in Group I-3.
5. *Group I-3 occupancy cell or room doors that have any of the following as integral parts of the rated door assembly:*
 - Sidelights, Cuff Ports, Speaker Ports and open into a required exit corridor within a cell complex, medical suite, mental health suite, program office, family visiting area or complex control area.*
6. *Safety room doors with a food pass with a lockable shutter, no more than 4 inches (102 mm) high, and located between 26 inches (660 mm) and 32 inches (813 mm) as measured from the bottom of the food pass to the floor.*

716.2.2.1.1 Smoke and draft control. The air leakage rate of the door assembly shall not exceed 3.0 cubic feet per minute per square foot (0.01524 m³/s × m²) of door opening at 0.10 inch (24.9 Pa) of water for both the ambient temperature and elevated temperature tests. Louvers shall be prohibited. Terminated stops shall be prohibited on doors required by Section 405.4.3 to comply with Section 716.2.2.1 and prohibited on doors required by Item 3 of Section 3006.3, or Section 3007.6.3 or 3008.6.3 to comply with this section.

716.2.2.2 Door assemblies in other fire partitions. Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in other fire partitions having a fire-resistance rating of 0.5 hour in accordance with Table 716.1(2) shall be tested in accordance with NFPA 252, UL 10B or UL 10C with the hose stream test.

716.2.2.3 Doors in interior exit stairways and ramps and exit passageways. Fire door assemblies in interior exit stairways and ramps and exit passageways shall

have a maximum transmitted temperature rise of not more than 450°F (250°C) above ambient at the end of 30 minutes of standard fire test exposure.

Exception: The maximum transmitted temperature rise is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

716.2.2.3.1 Glazing in doors. Fire-protection-rated glazing in excess of 100 square inches (0.065 m²) is not permitted. Fire-resistance-rated glazing in excess of 100 square inches (0.065 m²) shall be permitted in fire doors. Listed fire-resistance-rated glazing in a fire door shall have a maximum transmitted temperature rise in accordance with Section 716.2.2.3 when the fire door is tested in accordance with NFPA 252, UL 10B or UL 10C.

716.2.3 Fire doors Fire doors installed within a fire door assembly shall meet the fire rating indicated in Table 716.1(2).

716.2.4 Fire door frames. Fire door frames installed as part of a fire door assembly shall meet the fire rating indicated in Table 716.1(2).

716.2.5 Glazing in fire door assemblies. Fire-rated glazing conforming to the opening protection requirements in Section 716.2.1 shall be permitted in fire door assemblies.

716.2.5.1 Size limitations. Fire-resistance-rated glazing shall comply with the size limitations in Section 716.2.5.1.1. Fire-protection-rated glazing shall comply with the size limitations of NFPA 80, and as provided in Section 716.2.5.1.2.

716.2.5.1.1 Fire-resistance-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour. Fire-resistance-rated glazing tested to ASTM E119 or UL 263 and NFPA 252, UL 10B or UL 10C shall be permitted in fire door assemblies located in fire walls and in fire barriers in accordance with Table 716.1(2) to the maximum size tested and in accordance with their listings.

716.2.5.1.2 Fire-protection-rated glazing in door assemblies in fire walls and fire barriers rated greater than 1 hour. Fire-protection-rated glazing shall be prohibited in fire walls and fire barriers except as provided in Sections 716.2.5.1.2.1 and 716.2.5.1.2.2.

716.2.5.1.2.1 Horizontal exits. Fire-protection-rated glazing shall be permitted as vision panels in self-closing swinging fire door assemblies serving as horizontal exits in fire walls where limited to 100 square inches (0.065 m²).

716.2.5.1.2.2 Fire barriers. Fire-protection-rated glazing shall be permitted in fire doors having a 1½-hour fire protection rating intended for installation in fire barriers, where limited to 100 square inches (0.065 m²).

716.2.5.2 Elevator, stairway and ramp protectives. Approved fire-protection-rated glazing used in fire

door assemblies in elevator, stairway and ramp enclosures shall be so located as to furnish clear vision of the passageway or approach to the elevator, stairway or ramp.

716.2.5.3 Glazing in door assemblies in corridors and smoke barriers. In a 20-minute fire door assembly, the glazing material in the door itself shall have a minimum fire-protection-rated glazing of 20 minutes and shall be exempt from the hose stream test.

716.2.5.4 Fire door frames with transom lights and sidelights. Fire-protection-rated glazing shall be permitted in door frames with transom lights, sidelights or both, where a ¾-hour fire protection rating or less is required and in 2-hour fire-resistance-rated exterior walls in accordance with Table 716.1(2). Fire door frames with transom lights, sidelights or both, installed with fire-resistance-rated glazing tested as an assembly in accordance with ASTM E119 or UL 263 shall be permitted where a fire protection rating exceeding ¾ hour is required in accordance with Table 716.1(2).

716.2.5.4.1 Energy storage system separation.

Fire-protection-rated glazing shall not be permitted in fire door frames with transom lights and sidelights in fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems.

716.2.6 Fire door hardware and closers. Fire door hardware and closers shall be installed on fire door assemblies in accordance with the requirements of this section.

716.2.6.1 Door closing. Fire doors shall be latching and self- or automatic-closing in accordance with this section.

Exceptions:

1. Fire doors located in common walls separating sleeping units in Group R-1 shall be permitted without automatic- or self-closing devices.
2. The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I emergency recall operation.

716.2.6.2 Latch required. Unless otherwise specifically permitted, single side-hinged swinging fire doors and both leaves of pairs of side-hinged swinging fire doors shall be provided with an active latch bolt that will secure the door when it is closed.

716.2.6.3 Chute intake door latching. Chute intake doors shall be positive latching, remaining latched and closed in the event of latch spring failure during a fire emergency.

716.2.6.4 Automatic-closing fire door assemblies. Automatic-closing fire door assemblies shall be self-closing in accordance with NFPA 80.

716.2.6.5 Delayed-action closers. Doors required to be self-closing and not required to be automatic closing shall be permitted to be equipped with delayed-action closers.

716.2.6.6 Smoke-activated doors. Automatic-closing doors installed in the following locations shall be permitted to have hold-open devices. Doors shall automatically close by the actuation of smoke detectors installed in accordance with Section 907.3 or by loss of power to the smoke detector or hold-open device. Doors that are automatic-closing by smoke detection shall not have more than a 10-second delay before the door starts to close after the smoke detector is actuated. Automatic-closing doors that protect openings installed in the following locations shall comply with this section:

1. In walls that separate incidental uses in accordance with Section 509.4.
2. In fire walls in accordance with Section 706.8.
3. In fire barriers in accordance with Section 707.6.
4. In fire partitions in accordance with Section 708.6.
5. In smoke barriers in accordance with Section 709.5.
6. In smoke partitions in accordance with Section 710.5.2.3.
7. In shaft enclosures in accordance with Section 713.7.
8. In waste and linen chutes, discharge openings and access and discharge rooms in accordance with Section 713.13. Loading doors installed in waste and linen chutes shall meet the requirements of Sections 716.2.6.1 and 716.2.6.3.
9. *[SFM] Doors installed in walls required to be fire rated in accordance with Section 509.4.*
10. *[SFM] Doors installed in walls required to be fire rated in accordance with Section 508.4.*

In Group I-2 and I-2.1 occupancies smoke activated doors installed in the above locations shall be automatic closing by actuation of the fire alarm system, or actuation of smoke detectors installed in accordance with Section 907.3, or activation of the sprinkler system installed in accordance with Section 903.1.

716.2.6.7 Doors in pedestrian ways. Vertical sliding or vertical rolling steel fire doors in openings through which pedestrians travel shall be heat activated or activated by smoke detectors with alarm verification.

716.2.7 Swinging fire shutters. Where fire shutters of the swinging type are installed in exterior openings, not less than one row in every three vertical rows shall be arranged to be readily opened from the outside, and shall be identified by distinguishing marks or letters not less than 6 inches (152 mm) high.

716.2.8 Rolling fire shutters. Where fire shutters of the rolling type are installed, such shutters shall include approved automatic-closing devices.

716.2.9 Labeled protective assemblies. Fire door assemblies shall be labeled by an approved agency. The labels

shall comply with NFPA 80, and shall be permanently affixed to the door or frame.

716.2.9.1 Fire door labeling requirements. Fire doors shall be labeled showing the name of the manufacturer or other identification readily traceable back to the manufacturer, the name or trademark of the third-party inspection agency, the fire protection rating and, where required for fire doors in interior exit stairways and ramps and exit passageways by Section 716.2.2.3, the maximum transmitted temperature end point. Smoke and draft control doors complying with UL 1784 shall be labeled as such and shall comply with Section 716.2.9.3. Labels shall be approved and permanently affixed. The label shall be applied at the factory or location where fabrication and assembly are performed.

716.2.9.1.1 Light kits, louvers and components. Listed light kits and louvers and their required preparations shall be considered as part of the labeled door where such installations are done under the listing program of the third-party agency. Fire doors and fire door assemblies shall be permitted to consist of components, including glazing, vision light kits and hardware that are listed or classified and labeled for such use by different third-party agencies.

716.2.9.2 Oversized doors. Oversized fire doors shall bear an oversized fire door label by an approved agency or shall be provided with a certificate of inspection furnished by an approved testing agency. Where a certificate of inspection is furnished by an approved testing agency, the certificate shall state that the door conforms to the requirements of design, materials and construction, but has not been subjected to the fire test.

716.2.9.3 Smoke and draft control door labeling requirements. Smoke and draft control doors complying with UL 1784 shall be labeled in accordance with Section 716.2.9.1 and shall show the letter “S” on the fire-rating label of the door. This marking shall indicate that the door and frame assembly are in compliance where listed or labeled gasketing is installed.

716.2.9.4 Fire door frame labeling requirements. Fire door frames shall be labeled showing the names of the manufacturer and the third-party inspection agency.

Exception: In Group I-3 doors that are required to be 45 minutes or higher shall be fire-rated assemblies or certified by the manufacturer as being equivalent to the required standard.

716.2.9.5 Labeling. Fire-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Table 716.1(1) that shall be issued by an approved agency and shall be permanently identified on the glazing.

716.2.9.6 Fire door operator labeling requirements. Fire door operators for horizontal sliding doors shall be labeled and listed for use with the assembly.

716.2.10 Installation of door assemblies in corridors and smoke barriers. Installation of smoke doors shall be in accordance with NFPA 105.

716.3 Fire window assemblies. Fire window assemblies required by other sections of this code shall comply with the provisions of this section.

716.3.1 Testing requirements. Fire window assemblies shall be constructed of any material or assembly of component materials that conforms to the test requirements of Sections 716.3.1.1 and 716.3.1.2 and the fire protection rating indicated in Table 716.1(3).

716.3.1.1 Testing under positive pressure. NFPA 257 or UL 9 shall evaluate fire-protection-rated glazing under positive pressure. Within the first 10 minutes of a test, the pressure in the furnace shall be adjusted so not less than two-thirds of the test specimen is above the neutral pressure plane, and the neutral pressure plane shall be maintained at that height for the balance of the test.

716.3.1.2 Nonsymmetrical glazing systems. Nonsymmetrical fire-protection-rated glazing systems in fire partitions, fire barriers or in exterior walls with a fire separation distance of 10 feet (3048 mm) or less pursuant to Section 705 shall be tested with both faces exposed to the furnace, and the assigned fire protection rating shall be the shortest duration obtained from the two tests conducted in compliance with NFPA 257 or UL 9.

716.3.2 Performance requirements. Fire window assemblies shall be installed in the assemblies and comply with the fire protection rating specified in Table 716.1(3).

716.3.2.1 Interior fire window assemblies. Fire-protection-rated glazing used in fire window assemblies located in fire partitions and fire barriers shall be limited to use in assemblies with a maximum fire-resistance rating of 1 hour in accordance with this section.

716.3.2.1.1 Where $3/4$ -hour-fire-protection window assemblies permitted. Fire-protection-rated glazing requiring 45-minute opening protection in accordance with Table 716.1(3) shall be limited to fire partitions designed in accordance with Section 708 and fire barriers utilized in the applications set forth in Sections 707.3.6, 707.3.7 and 707.3.9 where the fire-resistance rating does not exceed 1 hour. Fire-resistance-rated glazing assemblies tested in accordance with ASTM E119 or UL 263 shall not be subject to the limitations of this section.

716.3.2.1.1.1 Energy storage system separation. Fire-protection-rated glazing is not permitted for use in fire window assemblies in fire barriers required by Section 1207 of the *California Fire Code* to enclose energy storage systems.

716.3.2.1.2 Area limitations. The total area of the glazing in fire-protection-rated window assemblies shall not exceed 25 percent of the area of a common wall with any room.

716.3.2.1.3 Where $1/3$ -hour-fire-protection window assemblies permitted. Fire-protection-rated glazing shall be permitted in window assemblies tested to NFPA 257 or UL 9 in fire partitions requiring $1/3$ -hour opening protection in accordance with Table 716.1(3).

716.3.3 Fire window frames. Fire window frames installed with a fire window assembly shall meet the fire-protection rating indicated in Table 716.1(3).

716.3.3.1 Window mullions. Metal mullions that exceed a nominal height of 12 feet (3658 mm) shall be protected with materials to afford the same fire-resistance rating as required for the wall construction in which the protective is located.

716.3.4 Fire-protection-rated glazing. Glazing in fire window assemblies shall be fire protection rated in accordance with this section and Table 716.1(3). Fire-protection-rated glazing in fire window assemblies shall be tested in accordance with and shall meet the acceptance criteria of NFPA 257 or UL 9. Openings in nonfire-resistance-rated exterior wall assemblies that require protection in accordance with Section 705.3, 705.8, 705.8.5 or 705.8.6 shall have a fire protection rating of not less than $3/4$ hour. Fire-protection-rated glazing in $1/2$ -hour fire-resistance-rated partitions is permitted to have a 20-minute fire protection rating.

716.3.4.1 Glass and glazing. Glazing in fire window assemblies shall be fire-protection-rated glazing installed in accordance with and complying with the size limitations set forth in NFPA 80.

716.3.5 Labeled protective assemblies. Glazing in fire window assemblies shall be labeled by an approved agency. The labels shall comply with NFPA 80 and Section 716.3.5.2.

716.3.5.1 Fire window frames. Fire window frames shall be approved for the intended application.

716.3.5.2 Labeling requirements. Fire-protection-rated glazing shall bear a label or other identification showing the name of the manufacturer, the test standard and information required in Section 716.1.2.2.2 and Table 716.1(3) that shall be issued by an approved agency and permanently identified on the glazing.

716.3.6 Installation. Fire window assemblies shall be installed in accordance with the provisions of this section.

716.3.6.1 Closure. Fire-protection-rated glazing shall be in the fixed position or be automatic-closing and shall be installed in labeled frames.

716.4 Fire protective curtain assembly. Approved fire protective curtain assemblies shall be constructed of any materials or assembly of component materials tested without hose stream in accordance with UL 10D, and shall comply with the Sections 716.4.1 through 716.4.3

716.4.1 Label. Fire protective curtain assemblies used as opening protectives in fire-rated walls and smoke partitions shall be labeled in accordance with Section 716.2.9.

716.4.2 Smoke and draft control. Fire protective curtain assemblies used to protect openings where smoke and

draft control assemblies are required shall comply with Section 716.2.1.4.

716.4.3 Installation. Fire protective curtain assemblies shall be installed in accordance with NFPA 80.

**SECTION 717
DUCTS AND AIR TRANSFER OPENINGS**

717.1 General. The provisions of this section shall govern the protection of duct penetrations and air transfer openings in assemblies required to be protected and duct penetrations in nonfire-resistance-rated floor assemblies.

717.1.1 Ducts and air transfer openings. Ducts transitioning horizontally between shafts shall not require a shaft enclosure provided that the duct penetration into each associated shaft is protected with dampers complying with this section.

717.1.2 Ducts that penetrate fire-resistance-rated assemblies without dampers. Ducts that penetrate fire-resistance-rated walls and are not required by this section to have fire dampers shall comply with the requirements of Sections 714.3 through 714.4.3. Ducts that penetrate horizontal assemblies not required to be contained within a shaft and not required by this section to have fire dampers shall comply with the requirements of Sections 714.5 through 714.6.2.

717.1.2.1 Ducts that penetrate nonfire-resistance-rated assemblies. The space around a duct penetrating a nonfire-resistance-rated floor assembly shall comply with Section 717.6.3.

717.2 Installation. Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall be installed in accordance with the manufacturer’s instructions, the dampers’ listing and Sections 717.2.1 through 717.2.3.

717.2.1 Smoke control system. Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized. Where mechanical systems including ducts and dampers utilized for normal building ventilation serve as part of the smoke control system, the expected performance of these systems in smoke control mode shall be addressed in the rational analysis required by Section 909.4.

717.2.2 Hazardous exhaust ducts. Fire dampers for hazardous exhaust duct systems shall comply with the *California Mechanical Code*.

717.2.3 Static dampers. Fire dampers and ceiling radiation dampers that are listed for use in static systems shall only be installed in heating, ventilation and air-conditioning systems that are automatically shut down in the event of a fire.

717.3 Damper testing, ratings and actuation. Damper testing, ratings and actuation shall be in accordance with Sections 717.3.1 through 717.3.3.

717.3.1 Damper testing. Dampers shall be listed and labeled in accordance with the standards in this section.

1. Fire dampers shall comply with the requirements of UL 555.
2. Smoke dampers shall comply with the requirements of UL 555S.
3. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S.
4. Ceiling radiation dampers shall comply with the requirements of UL 555C or shall be tested as part of a fire-resistance-rated floor/ceiling or roof/ceiling assembly in accordance with ASTM E119 or UL 263.
5. Corridor dampers shall comply with requirements of both UL 555 and UL 555S. Corridor dampers shall demonstrate acceptable closure performance when subjected to 150 feet per minute (0.76 mps) velocity across the face of the damper during the UL 555 fire exposure test.

717.3.2 Damper rating. Damper ratings shall be in accordance with Sections 717.3.2.1 through 717.3.2.4.

717.3.2.1 Fire damper ratings. Fire dampers shall have the minimum rating specified in Table 717.3.2.1.

**TABLE 717.3.2.1
FIRE DAMPER RATING**

TYPE OF PENETRATION	MINIMUM DAMPER RATING (hours)
Less than 3-hour fire-resistance-rated assemblies	1.5
3-hour or greater fire-resistance-rated assemblies	3

717.3.2.2 Smoke damper ratings. Smoke damper leakage ratings shall be Class I or II. Elevated temperature ratings shall be not less than 250°F (121°C).

717.3.2.3 Combination fire/smoke damper ratings. Combination fire/smoke dampers shall have the minimum rating specified for fire dampers in Table 717.3.2.1 and shall have the minimum rating specified for smoke dampers in Section 717.3.2.2.

717.3.2.4 Corridor damper ratings. Corridor dampers shall have the following minimum ratings:

1. One-hour fire-resistance rating.
2. Class I or II leakage rating as specified in Section 717.3.2.2.

717.3.3 Damper actuation. Damper actuation shall be in accordance with Sections 717.3.3.1 through 717.3.3.5 as applicable.

717.3.3.1 Fire damper actuation. Primary heat responsive devices used to actuate fire dampers shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (10°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909.

717.3.3.2 Smoke damper actuation. The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 907.3 and one of the following methods, as applicable:

1. Where a smoke damper is installed within a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes within the duct shall be within 5 feet (1524 mm) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector shall be installed on either side of the smoke barrier door opening. The detector shall be listed for releasing service if used for direct interface with the damper.
3. Where a smoke damper is installed within an air transfer opening in a wall, a spot-type detector shall be installed within 5 feet (1524 mm) horizontally of the damper. The detector shall be listed for releasing service if used for direct interface with the damper.
4. Where a smoke damper is installed in a corridor wall or ceiling, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.
5. Where a smoke detection system is installed in all areas served by the duct in which the damper will be located, the smoke dampers shall be permitted to be controlled by the smoke detection system.

717.3.3.3 Combination fire/smoke damper actuation. Combination fire/smoke damper actuation shall be in accordance with Sections 717.3.3.1 and 717.3.3.2. Combination fire/smoke dampers installed in smoke control system shaft penetrations shall not be activated by local area smoke detection unless it is secondary to the smoke management system controls.

717.3.3.4 Ceiling radiation damper actuation. The operating temperature of a ceiling radiation damper actuation device shall be 50°F (27.8°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

717.3.3.5 Corridor damper actuation. Corridor damper actuation shall be in accordance with Sections 717.3.3.1 and 717.3.3.2.

717.4 Access and identification. Access and identification of fire and smoke dampers shall comply with Sections 717.4.1 through 717.4.2.

717.4.1 Access. Fire and smoke dampers shall be provided with an approved means of access that is large enough to permit inspection and maintenance of the damper and its operating parts. Dampers equipped with fusible links, internal operators, or both shall be provided with an access door that is not less than 12 inches (305 mm) square or provided with a removable duct section.

717.4.1.1 Access openings. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

717.4.1.2 Restricted access. Where space constraints or physical barriers restrict access to a damper for periodic inspection and testing, the damper shall be a single- or multi-blade type damper and shall comply with the remote inspection requirements of NFPA 80 or NFPA 105.

717.4.2 Identification. Access points shall be permanently identified on the exterior by a label having letters not less than 1/2 inch (12.7 mm) in height reading: “FIRE/SMOKE DAMPER,” “SMOKE DAMPER” or “FIRE DAMPER.”

717.5 Where required. Fire dampers, smoke dampers, combination fire/smoke dampers, ceiling radiation dampers and corridor dampers shall be provided at the locations prescribed in Sections 717.5.1 through 717.5.7 and 717.6. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be provided.

717.5.1 Fire walls. Ducts and air transfer openings permitted in fire walls in accordance with Section 706.11 shall be protected with listed fire dampers installed in accordance with their listing.

717.5.1.1 Horizontal exits. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a fire wall that serves as a horizontal exit.

717.5.2 Fire barriers. *In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal.* Ducts and air transfer openings of fire barriers shall be protected with listed fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate enclosures for interior exit stairways and ramps and exit passageways, except as permitted by Sections 1023.5 and 1024.6, respectively.

Exceptions: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.

2. Ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire damper would interfere with the operation of a smoke control system.
3. Such walls are penetrated by fully ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, are in areas of other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a fully ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals. Nonmetal flexible air connectors shall be permitted at the following locations *in accordance with Section 603 of the California Mechanical Code*:

- 3.1. At the duct connection to the air handling unit or equipment located within the mechanical room.
- 3.2. From an overhead metal duct to a ceiling diffuser within the same room.

[SFM] For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, ducts and air transfer openings of fire barriers shall be protected with approved fire and smoke dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate exit enclosures and exit passageways except as permitted by Sections 1023.5 and 1024.6, respectively.

Exceptions:

1. Fire dampers are not required at penetrations of fire barriers where penetrations are tested in accordance with ASTM E119 as part of the fire-resistance rated assembly.
2. Fire and smoke dampers are not required where ducts are used as part of an approved smoke control system in accordance with Section 909 and where the use of a fire or smoke damper would interfere with the operation of a smoke control system.

717.5.2.1 Horizontal exits. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a fire barrier that serves as a horizontal exit.

717.5.3 Shaft enclosures. Shaft enclosures that are permitted to be penetrated by ducts and air transfer open-

ings shall be protected with listed fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where any of the following criteria are met:
 - 1.1. Steel exhaust subducts having a wall thickness of not less than 0.0187 inch (0.4712 mm) are extended not less than 22 inches (559 mm) vertically in exhaust shafts, and an exhaust fan is installed at the upper terminus of the shaft that is powered continuously in accordance with Section 909.11, so as to maintain a continuous upward airflow to the outdoors.
 - 1.2. Penetrations are tested in accordance with ASTM E119 or UL 263 as part of the fire-resistance-rated assembly.
 - 1.3. Ducts are used as part of an approved smoke control system designed and installed in accordance with Section 909 and where the fire damper will interfere with the operation of the smoke control system.
 - 1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
2. In Group B and R occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, smoke dampers are not required at penetrations of shafts where all of the following criteria are met:
 - 2.1. Kitchen, clothes dryer, bathroom and toilet room exhaust openings are installed with steel exhaust subducts, having a wall thickness of not less than 0.0187 inch (0.4712 mm).
 - 2.2. The subducts extend not less than 22 inches (559 mm) vertically.
 - 2.3. An exhaust fan is installed at the upper terminus of the shaft that is powered continuously in accordance with the provisions of Section 909.11, so as to maintain a continuous upward airflow to the outdoors.
3. Smoke dampers are not required at penetration of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.
4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 and where the smoke damper will interfere with the operation of the smoke control system.

5. Fire dampers and combination fire/smoke dampers are not required in kitchen and clothes dryer exhaust *California* where dampers are prohibited by the *California Mechanical Code*.

717.5.3.1 Continuous upward airflow. Fire dampers and smoke dampers shall not be installed in shafts that are required to maintain a continuous upward airflow path where closure of the damper would result in the loss of the airflow.

717.5.4 Fire partitions. *In other than Group A, E, I and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal,* ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listing.

Exceptions: In occupancies other than Group H and L, fire dampers are not required where any of the following apply:

1. Corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and the duct is protected as a through penetration in accordance with Section 714.
2. Tenant partitions in covered and open mall buildings where the walls are not required by provisions elsewhere in the code to extend to the underside of the floor or roof sheathing, slab or deck above.
3. The duct system is constructed of approved materials in accordance with the *California Mechanical Code* and the duct penetrating the wall complies with all of the following requirements:
 - 3.1. The duct shall not exceed 100 square inches (0.06 m²).
 - 3.2. The duct shall be constructed of steel not less than 0.0217 inch (0.55 mm) in thickness.
 - 3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
 - 3.4. The duct shall be installed above a ceiling.
 - 3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.
 - 3.6. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.

4. Such walls are penetrated by ducted HVAC systems, have a required fire-resistance rating of 1 hour or less, and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. For the purposes of this exception, a ducted HVAC system shall be a duct system for conveying supply, return or exhaust air as part of the structure's HVAC system. Such a duct system shall be constructed of sheet steel not less than No. 26 gage thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

For Group A, E, I and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listings.

Exceptions:

1. Fire dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness, protected as a through penetration in accordance with Section 713 and there are no openings serving the corridor.
2. Fire dampers are not required where the duct system is constructed of approved materials in accordance with the *California Mechanical Code* and the duct penetrating the wall complies with all of the following requirements:
 - 2.1. For other than corridors in Group I-2 occupancies the duct shall not exceed 100 square inches (0.6 m²).
 - 2.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.
 - 2.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.
 - 2.4. The duct shall be installed above a ceiling.
 - 2.5. The duct shall not terminate at a wall register in the fire-resistance rated wall.
 - 2.6. The duct shall be protected as a through penetration in accordance with Section 714 or shall comply with the all of the following:
 1. A minimum 12-inch-long (305 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening.
 2. The sleeve shall be secured to both sides of the wall and for all four sides of the sleeve with minimum 1½-inch by 1½-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles.
 3. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws.

4. The annular space between the steel sleeve and the wall opening shall be filled with mineral wool batting on all sides.

717.5.4.1 Corridors. In other than Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, duct and air transfer openings that penetrate corridors shall be protected with dampers as follows:

1. A corridor damper shall be provided where corridor ceilings, constructed as required for the corridor walls as permitted in Section 708.4, Exception 3, are penetrated.
2. A ceiling radiation damper shall be provided where the ceiling membrane of a fire-resistance-rated floor-ceiling or roof-ceiling assembly, constructed as permitted in Section 708.4, Exception 2, is penetrated.
3. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a corridor enclosure required to have smoke and draft control doors in accordance with Section 716.2.2.1.

Exceptions:

1. Smoke dampers are not required where the building is equipped throughout with an approved smoke control system in accordance with Section 909, and smoke dampers are not necessary for the operation and control of the system.
2. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

[SFM] For Group A, E, H, I, L and R occupancies, high-rise buildings, and other applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, a listed smoke damper designed to resist the passage of smoke shall also be provided at each point a duct or air transfer opening penetrates a fire-resistance rated corridor enclosure required to have smoke and draft doors in accordance with Section 716.2.2.1 or doors that provide an effective barrier to limit the transfer of smoke in accordance with Section 407.3.1.

Exceptions:

1. Smoke dampers are not required where ducts are used as part of an approved mechanical smoke control system designed in accordance with Section 909 and where the smoke damper will interfere with the operation of the smoke control system.
2. Smoke damper are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in

thickness and there are no openings serving the corridor.

717.5.5 Smoke barriers. A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a smoke barrier. Smoke dampers and smoke damper actuation methods shall comply with Section 717.3.3.2.

Exception: Smoke dampers are not required where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

717.5.6 Exterior walls. Ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section 705.10 shall be protected with listed fire dampers installed in accordance with their listing.

717.5.7 Smoke partitions. A listed smoke damper designed to resist the passage of smoke shall be provided at each point that an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section 717.3.3.2.

Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.

717.6 Horizontal assemblies. Penetrations by ducts and air transfer openings of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with Section 713 or shall comply with Sections 717.6.1 through 717.6.3.

717.6.1 Through penetrations. In occupancies other than Groups I-2, I-2.1 and I-3, a duct constructed of approved materials in accordance with the *California Mechanical Code* that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection, provided that a listed fire damper is installed at the floor line or the duct is protected in accordance with Section 714.5. For air transfer openings, see Section 712.1.9.

Exception: A duct is permitted to penetrate three floors or less without a fire damper at each floor, provided that such duct meets all of the following requirements:

1. The duct shall be contained and located within the cavity of a wall and shall be constructed of steel having a minimum wall thickness of 0.0187 inches (0.4712 mm) (No. 26 gage).
2. The duct shall open into only one dwelling unit or sleeping unit and the duct system shall be continuous from the unit to the exterior of the building.
3. The duct shall not exceed 4-inch (102 mm) nominal diameter and the total area of such ducts shall not exceed 100 square inches (0.065 m²) in any 100 square feet (9.3 m²) of floor area.
4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time-

temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with a listed ceiling radiation damper installed in accordance with Section 717.6.2.1.

717.6.2 Membrane penetrations. Ducts and air transfer openings constructed of approved materials in accordance with the *California Mechanical Code* that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 713.
2. A listed ceiling radiation damper installed at the ceiling line where a duct penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

Exceptions:

1. A fire-resistance-rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly.
 2. Where exhaust duct or outdoor air duct penetrations protected in accordance with Section 714.5.2 are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.
 3. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL 263.
3. A listed ceiling radiation damper installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

Exceptions:

1. A fire-resistance-rated assembly tested in accordance with ASTM E119 or UL 263 showing that ceiling radiation dampers are not required in order to maintain the fire-resistance rating of the assembly.
2. Where duct and air transfer openings are protected with a duct outlet penetration system tested as part of a fire-resistance-rated assembly in accordance with ASTM E119 or UL 263.

717.6.2.1 Ceiling radiation dampers testing and installation. Ceiling radiation dampers shall be tested in accordance with Section 717.3.1. Ceiling radiation

dampers shall be installed in accordance with the details specified in the fire-resistance-rated assembly and the manufacturer’s instructions and the listing.

717.6.2.1.1 Dynamic systems. Only ceiling radiation dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire.

717.6.2.1.2 Static systems. Static ceiling radiation dampers shall be provided with systems that are not designed to operate during a fire.

Exceptions:

1. Where a static ceiling radiation damper is installed at the opening of a duct, a smoke detector shall be installed inside the duct or outside the duct with sampling tubes protruding into the duct. The detector or tubes in the duct shall be within 5 feet (1524 mm) of the damper. Air outlets and inlets shall not be located between the detector or tubes and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.
2. Where a static ceiling radiation damper is installed in a ceiling, the ceiling radiation damper shall be permitted to be controlled by a smoke detection system installed in the same room or area as the ceiling radiation damper.
3. A static ceiling radiation damper shall be permitted to be installed in a room where an occupant sensor is provided within the room that will shut down the system.

717.6.3 Nonfire-resistance-rated floor assemblies. Duct systems constructed of approved materials in accordance with the *California Mechanical Code* that penetrate nonfire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 713.
2. The duct connects not more than two stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion.
3. In floor assemblies composed of noncombustible materials, a shaft shall not be required where the duct connects not more than three stories, the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion and a fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

717.7 Flexible ducts and air connectors. Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

SECTION 718 CONCEALED SPACES

718.1 General. Fireblocking and draftstopping shall be installed in combustible concealed locations in accordance with this section. Fireblocking shall comply with Section 718.2. Draftstopping in floor/ceiling spaces and attic spaces shall comply with Sections 718.3 and 718.4, respectively. The permitted use of combustible materials in concealed spaces of buildings of Type I or II construction shall be limited to the applications indicated in Section 718.5.

718.2 Fireblocking. In combustible construction, fireblocking shall be installed to cut off concealed draft openings (both vertical and horizontal) and shall form an effective barrier between floors, between a top story and a roof or attic space. Fireblocking shall be installed in the locations specified in Sections 718.2.2 through 718.2.7.

718.2.1 Fireblocking materials. Fireblocking shall consist of the following materials:

1. Two-inch (51 mm) nominal lumber.
2. Two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints.
3. One thickness of 0.719-inch (18.3 mm) wood structural panels with joints backed by 0.719-inch (18.3 mm) wood structural panels.
4. One thickness of 0.75-inch (19.1 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-fourth-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool, mineral fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.
9. Mass timber complying with Section 2304.11.

718.2.1.1 Batts or blankets of mineral wool or mineral fiber. Batts or blankets of mineral wool or mineral fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

718.2.1.2 Unfaced fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a minimum height of 16 inches (406 mm) measured vertically. Where piping,

conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

718.2.1.3 Loose-fill insulation material. Loose-fill insulation material, insulating foam sealants and caulk materials shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

718.2.1.4 Fireblocking integrity. The integrity of fireblocks shall be maintained.

718.2.1.5 Double stud walls. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be allowed as fireblocking in walls constructed using parallel rows of studs or staggered studs.

718.2.2 Concealed wall spaces. Fireblocking shall be provided in concealed spaces of stud walls and partitions, including furred spaces, and parallel rows of studs or staggered studs, as follows:

1. Vertically at the ceiling and floor levels.
2. Horizontally at intervals not exceeding 10 feet (3048 mm).

718.2.3 Connections between horizontal and vertical spaces. Fireblocking shall be provided at interconnections between concealed vertical stud wall or partition spaces and concealed horizontal spaces created by an assembly of floor joists or trusses, and between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings, cove ceilings and similar locations.

718.2.4 Stairways. Fireblocking shall be provided in concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairways shall comply with Section 1011.7.3.

718.2.5 Ceiling and floor openings. Where required by Section 712.1.8, Exception 1 of Section 714.5.1.2 or Section 714.6, fireblocking of the annular space around vents, pipes, ducts, chimneys and fireplaces at ceilings and floor levels shall be installed with a material specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and resist the free passage of flame and the products of combustion.

718.2.5.1 Factory-built chimneys and fireplaces. Factory-built chimneys and fireplaces shall be fireblocked in accordance with UL 103 and UL 127.

718.2.6 Exterior wall coverings. Fireblocking shall be installed within concealed spaces of exterior wall coverings and other exterior architectural elements where permitted to be of combustible construction as specified in Section 1405 or where erected with combustible frames. Fireblocking shall be installed at maximum intervals of 20 feet (6096 mm) in either dimension so that there will be no concealed space exceeding 100 square feet (9.3 m²) between fireblocking. Where wood furring strips are used, they shall be of approved wood of natural decay resistance or preservative-treated wood. If noncon-

tinuous, such elements shall have closed ends, with not less than 4 inches (102 mm) of separation between sections.

Exceptions:

1. Fireblocking of cornices is not required in single-family dwellings. Fireblocking of cornices of a two-family dwelling is required only at the line of dwelling unit separation.
2. Fireblocking shall not be required where the exterior wall covering is installed on noncombustible framing and the face of the exterior wall covering exposed to the concealed space is covered by one of the following materials:
 - 2.1. Aluminum having a minimum thickness of 0.019 inch (0.5 mm).
 - 2.2. Corrosion-resistant steel having a base metal thickness not less than 0.016 inch (0.4 mm) at any point.
 - 2.3. Other approved noncombustible materials.
3. Fireblocking shall not be required where the exterior wall covering has been tested in accordance with, and complies with the acceptance criteria of, NFPA 285. The exterior wall covering shall be installed as tested in accordance with NFPA 285.

718.2.7 Concealed sleeper spaces. Where wood sleepers are used for laying wood flooring on masonry or concrete fire-resistance-rated floors, the space between the floor slab and the underside of the wood flooring shall be filled with an approved material to resist the free passage of flame and products of combustion or fireblocked in such a manner that open spaces under the flooring shall not exceed 100 square feet (9.3 m²) in area and such space shall be filled solidly under permanent partitions so that communication under the flooring between adjoining rooms shall not occur.

Exceptions:

1. Fireblocking is not required for slab-on-grade floors in gymnasiums.
2. Fireblocking is required only at the juncture of each alternate lane and at the ends of each lane in a bowling facility.

718.3 Draftstopping in floors. Draftstopping shall be installed to subdivide floor/ceiling assemblies where required by Section 708.4.2. In other than Group R occupancies, draftstopping shall be installed to subdivide combustible floor/ceiling assemblies so that horizontal floor areas do not exceed 1,000 square feet (93 m²).

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

718.3.1 Draftstopping materials. Draftstopping materials shall be not less than 1/2-inch (12.7 mm) gypsum board, 3/8-

inch (9.5 mm) wood structural panel, 3/8-inch (9.5 mm) particleboard, 1-inch (25-mm) nominal lumber, cement fiberboard, batts or blankets of mineral wool or glass fiber, or other approved materials adequately supported. The integrity of draftstops shall be maintained.

718.4 Draftstopping in attics. Draftstopping shall be installed to subdivide attic spaces where required by Section 708.4.2. In other than Group R, draftstopping shall be installed to subdivide combustible attic spaces and combustible concealed roof spaces such that any horizontal area does not exceed 3,000 square feet (279 m²). Ventilation of concealed roof spaces shall be maintained in accordance with Section 1202.2.1.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

718.4.1 Draftstopping materials. Materials utilized for draftstopping of attic spaces shall comply with Section 718.3.1.

718.4.1.1 Openings. Openings in the partitions shall be protected by self-closing doors with automatic latches constructed as required for the partitions.

718.5 Combustible materials in concealed spaces in Type I or II construction. Combustible materials shall not be permitted in concealed spaces of buildings of Type I or II construction.

Exceptions:

1. Combustible materials in accordance with Section 603.
2. Combustible materials exposed within plenums complying with Section 602 of the *California Mechanical Code*.
3. Class A interior finish materials classified in accordance with Section 803.
4. Combustible piping within partitions or shaft enclosures installed in accordance with the provisions of this code.
5. Combustible piping within concealed ceiling spaces installed in accordance with the *California Mechanical Code* and the *California Plumbing Code*.
6. Combustible insulation and covering on pipe and tubing, installed in concealed spaces other than plenums, complying with Section 720.7.

**SECTION 719
FIRE-RESISTANCE
REQUIREMENTS FOR PLASTER**

719.1 Thickness of plaster. The minimum thickness of gypsum plaster or Portland cement plaster used in a fire-resistance-rated system shall be determined by the prescribed fire tests. The plaster thickness shall be measured from the face of the lath where applied to gypsum lath or metal lath.

719.2 Plaster equivalents. For fire-resistance purposes, 1/2 inch (12.7 mm) of unsanded gypsum plaster shall be deemed equivalent to 3/4 inch (19.1 mm) of one-to-three gypsum sand plaster or 1 inch (25 mm) of Portland cement sand plaster.

719.3 Noncombustible furring. In buildings of Types I and II construction, plaster shall be applied directly on concrete or masonry or on approved noncombustible plastering base and furring.

719.4 Double reinforcement. Plaster protection more than 1 inch (25 mm) in thickness shall be reinforced with an additional layer of approved lath embedded not less than 3/4 inch (19.1 mm) from the outer surface and fixed securely in place.

Exception: Solid plaster partitions or where otherwise determined by fire tests.

719.5 Plaster alternatives for concrete. In reinforced concrete construction, gypsum plaster or Portland cement plaster is permitted to be substituted for 1/2 inch (12.7 mm) of the required poured concrete protection, except that a minimum thickness of 3/8 inch (9.5 mm) of poured concrete shall be provided in reinforced concrete floors and 1 inch (25 mm) in reinforced concrete columns in addition to the plaster finish. The concrete base shall be prepared in accordance with Section 2510.7.

SECTION 720 THERMAL- AND SOUND-INSULATING MATERIALS

720.1 General. Insulating materials shall comply with the requirements of this section. Where a flame spread index or a smoke-developed index is specified in this section, such index shall be determined in accordance with ASTM E84 or UL 723. Any material that is subject to an increase in flame spread index or smoke-developed index beyond the limits herein established through the effects of age, moisture or other atmospheric conditions shall not be permitted. Insulating materials, when tested in accordance with the requirements of this section, shall include facings, when used, such as vapor retarders, vapor permeable membranes and similar coverings, and all layers of single and multilayer reflective foil insulation and similar materials.

Exceptions:

1. Fiberboard insulation shall comply with Chapter 23.
2. Foam plastic insulation shall comply with Chapter 26.
3. Duct and pipe insulation and duct and pipe coverings and linings in plenums shall comply with the *California Mechanical Code*.
4. All layers of single and multilayer reflective plastic core insulation shall comply with Section 2614.

720.2 Concealed installation. Insulating materials, where concealed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Cellulosic fiber loose-fill insulation complying with the requirements of Section 720.6 shall not be required to meet a flame spread index requirement but shall be required to meet a smoke-developed index of not more than 450 when tested in accordance with CAN/ULC S102.2.

720.2.1 Facings. Where such materials are installed in concealed spaces in buildings of Type III, IV or V construction, the flame spread and smoke-developed limitations do not apply to facings, coverings, and layers of reflective foil insulation that are installed behind and in substantial contact with the unexposed surface of the ceiling, wall or floor finish.

Exception: All layers of single and multilayer reflective plastic core insulation shall comply with Section 2614.

720.3 Exposed installation. Insulating materials, where exposed as installed in buildings of any type of construction, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Cellulosic fiber loose-fill insulation complying with the requirements of Section 720.6 shall not be required to meet a flame spread index requirement but shall be required to meet a smoke-developed index of not more than 450 when tested in accordance with CAN/ULC S102.2.

720.3.1 Attic floors. Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 watt per square centimeter when tested in accordance with ASTM E970.

720.4 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E84 or UL 723 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Sections 720.2 and 720.3 when tested in accordance with CAN/ULC S102.2.

Exception: Cellulosic fiber loose-fill insulation shall not be required to meet a flame spread index requirement when tested in accordance with CAN/ULC S102.2, provided that such insulation has a smoke-developed index of not more than 450 and complies with the requirements of Section 720.6.

720.5 Roof insulation. The use of combustible roof insulation not complying with Sections 720.2 and 720.3 shall be permitted in any type of construction provided that insulation is covered with approved roof coverings directly applied thereto.

720.6 Cellulosic fiber loose-fill insulation and self-supported spray-applied cellulosic insulation. Cellulosic fiber loose-fill insulation and self-supported spray-applied cellulosic insulation shall comply with CPSC 16 CFR Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR Parts 1209 and 1404.

720.7 Insulation and covering on pipe and tubing. Insulation and covering on pipe and tubing shall have a flame

spread index of not more than 25 and a smoke-developed index of not more than 450.

Exception: Insulation and covering on pipe and tubing installed in plenums shall comply with the *California Mechanical Code*.

**SECTION 721
PRESCRIPTIVE FIRE RESISTANCE**

721.1 General. The provisions of this section contain prescriptive details of fire-resistance-rated building elements, components or assemblies. The materials of construction specified in Tables 721.1(1), 721.1(2) and 721.1(3) shall be assumed to have the fire-resistance ratings prescribed therein. Where materials that change the capacity for heat dissipation are incorporated into a fire-resistance-rated assembly, fire test results or other substantiating data shall be made available to the building official to show that the required fire-resistance-rating time period is not reduced.

721.1.1 Thickness of protective coverings. The thickness of fire-resistant materials required for protection of structural members shall be not less than set forth in Table 721.1(1), except as modified in this section. The figures shown shall be the net thickness of the protecting materials and shall not include any hollow space in back of the protection.

721.1.2 Unit masonry protection. Where required, metal ties shall be embedded in bed joints of unit masonry for protection of steel columns. Such ties shall be as set forth in Table 721.1(1) or be equivalent thereto.

721.1.3 Reinforcement for cast-in-place concrete column protection. Cast-in-place concrete protection for steel columns shall be reinforced at the edges of such members with wire ties of not less than 0.18 inch (4.6 mm) in diameter wound spirally around the columns on a pitch of not more than 8 inches (203 mm) or by equivalent reinforcement.

721.1.4 Plaster application. The finish coat is not required for plaster protective coatings where those coatings comply with the design mix and thickness requirements of Tables 721.1(1), 721.1(2) and 721.1(3).

721.1.5 Bonded prestressed concrete tendons. For members having a single tendon or more than one tendon installed with equal concrete cover measured from the nearest surface, the cover shall be not less than that set forth in Table 721.1(1). For members having multiple tendons installed with variable concrete cover, the average tendon cover shall be not less than that set forth in Table 721.1(1), provided that:

1. The clearance from each tendon to the nearest exposed surface is used to determine the average cover.
2. The clear cover for individual tendons shall not be less than one-half of that set forth in Table 721.1(1). A minimum cover of $\frac{3}{4}$ inch (19.1 mm) for slabs

and 1 inch (25 mm) for beams is required for any aggregate concrete.

3. For the purpose of establishing a fire-resistance rating, tendons having a clear covering less than that set forth in Table 721.1(1) shall not contribute more than 50 percent of the required ultimate moment capacity for members less than 350 square inches (0.226 m²) in cross-sectional area and 65 percent for larger members. For structural design purposes, however, tendons having a reduced cover are assumed to be fully effective.

721.2 Cellular concrete. [HCD 1 & HCD 2]

721.2.1 Use and application. [HCD 1 & HCD 2] *Controlled-density cellular concrete, when used or applied, shall be in accordance with the use of materials in Bulletin No. 65 of the Federal Housing Administration, United States Department of Housing and Urban Development.*

Exceptions:

1. *Regardless of the provisions of Subsections 3.2, 3.3, 3.4 and 3.6 in Section 3, Bulletin No. 65 provisions relating to proportioning, mixing and testing, in the following shall apply to this chapter.*

1.1. Field-control weighings for control of the wet-unit weight shall be made. The design wet-unit weight for field control of the concrete shall be based on previously established data for the relation between the wet-unit weight and the air-dry-unit weight at 28 days for the mix being placed. Field-control weighings for determining the wet-unit weight shall be made at the mixer discharge and at the point of deposit. There should be one pair of weighings per batch for batch-type mixers unless equipment is provided with scales allowing the operator to adequately weigh materials.

For continuous weight-instrumented batch mixers, there should be one pair of weighings per 10 cubic yards (7.65 m³). The gain in unit weight between the mixer discharge and point of deposit shall not exceed 5 percent. The wet-unit weight at the point of deposit of the concrete shall not exceed plus 5 percent of the design wet-unit weight. A variation exceeding plus 5 percent of the design wet-unit weight shall require a modification of the mix proportions, a change of materials or a change in the mixing procedure.

- 1.2. *When tests are required by the enforcing agency, they shall be performed in the following manner:*

Two test cylinders, for compressive strength tests, shall be made for each 8,000 square feet (743 m²) of surface area placed. A minimum of two test cylinders shall be made each day.

Each strength test result shall be the average of two cylinders from the same sample tested at 28 days or at a specified earlier date.

- 1.3. The minimum air-dry density shall be 90 pounds per cubic foot (1,440 kg/m³). The minimum design compressive strength shall be 1,000 psi (6,890 kPa) when the curing procedure specified herein is applied. The minimum design compressive strength shall be 1,250 psi (8,619 kPa) if the slab is placed in a covered area of a building and a specified curing medium is not applied. The specified design compressive strength shall be increased 20 percent when the specified strength is greater than 1,000 psi (6,890 kPa) and the slab is placed in a covered area of a building and a specified curing medium is not applied.
- 1.4. The cellular concrete shall be sampled at the point of deposit in accordance with the applicable procedures of ASTM C172, *Sampling Fresh Concrete*. Cylinder molds shall be either 3 inches by 6 inches (76 mm by 152 mm) or 6 inches by 12 inches (152 mm by 305 mm). Lightly tap the sides of the mold with a rubber hammer while filling the mold instead of rodding the mix. Moist cure the specimens for seven days at 73.4°F (40.8°C) plus or minus 3°F (1.7°C). At the age of seven days, remove the specimens from the moist condition and store in a temperature of 73.4°F (40.8°C) plus or minus 3°F (1.7°C) and a relative humidity of 50 plus or minus 10 percent for 21 days; remove and air dry until the time of test at 28 days. The compressive strength test shall be in accordance with ASTM C39, *Compressive Strength of Cylindrical Concrete Specimens*. Determine the air-dry-unit weight at 28 days.
2. Regardless of the provisions of Subsections 4.1 and 4.2 in Section 4 of Bulletin No. 65, relating to placing, finishing and curing, the following shall apply to these regulations.
 - 2.1. The concrete shall be placed, finished and cured to produce a level, smooth surface. The concrete shall be placed in a single layer to a minimum thickness of 1½ inches (38 mm). The deviation from a plan shall not exceed ¼ inch (6 mm) in any 10 feet (3048 mm). The final finish of the concrete shall be suitable for the application of the specified wear-resistant covering. Cracks wider than ⅛ inch (3 mm) shall be repaired.
 - 2.2. Install a water-resistant membrane between wood or plywood subfloors and the cellular

concrete to prevent leakage of the concrete and wetting of the subfloor. The membrane shall consist of waterproof paper or plastic sheets conforming to ASTM C171, *Sheet Materials for Curing Concrete*, or Type 15 roofing felt conforming to ASTM D226, D250 or D227, or Federal Specification UUB790, *Building Paper Vegetable Fiber: (Kraft, Waterproofed, Water Repellent and Fire-resistant) Type 1, Grade B*. The sheets shall be securely fastened to the subfloor.

3. Regardless of the provisions of Subsections 6.1 and 6.2 in Section 6, of Bulletin No. 65, relating to applicator qualifications and warranty, these subsections are omitted from this chapter.

SECTION 722 CALCULATED FIRE RESISTANCE

722.1 General. The provisions of this section contain procedures by which the fire resistance of specific materials or combinations of materials is established by calculations. These procedures apply only to the information contained in this section and shall not be otherwise used. The calculated fire resistance of specific materials or combinations of materials shall be established by one of the following:

1. Concrete, concrete masonry and clay masonry assemblies shall be permitted in accordance with ACI 216.1/TMS 0216.
2. Precast and precast, prestressed concrete assemblies shall be permitted in accordance with PCI 124.
3. Steel assemblies shall be permitted in accordance with Chapter 5 of ASCE 29.
4. Exposed wood members and wood decking shall be permitted in accordance with Chapter 16 of ANS/AWC NDS.

722.2 Concrete assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of concrete assemblies are established by calculations.

722.2.1 Concrete walls. Cast-in-place and precast concrete walls shall comply with Section 722.2.1.1. Multiwythe concrete walls shall comply with Section 722.2.1.2. Joints between precast panels shall comply with Section 722.2.1.3. Concrete walls with gypsum wallboard or plaster finish shall comply with Section 722.2.1.4.

722.2.1.1 Cast-in-place or precast walls. The minimum equivalent thicknesses of cast-in-place or precast concrete walls for fire-resistance ratings of 1 hour to 4 hours are shown in Table 722.2.1.1. For solid walls with flat vertical surfaces, the equivalent thickness is the same as the actual thickness. The values in Table 722.2.1.1 apply to plain, reinforced or prestressed concrete walls.

**TABLE 721.1(1)
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON
TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS^m**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Steel columns and all of primary trusses (continued)	1-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 6" × 6" or greater (not including sandstone, granite and siliceous gravel). ^a	2½	2	1½	1
	1-1.2	Carbonate, lightweight and sand-lightweight aggregate concrete, members 8" × 8" or greater (not including sandstone, granite and siliceous gravel). ^a	2	1½	1	1
	1-1.3	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" × 12" or greater (not including sandstone, granite and siliceous gravel). ^a	1½	1	1	1
	1-1.4	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 6" × 6" or greater. ^a	3	2	1½	1
	1-1.5	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 8" × 8" or greater. ^a	2½	2	1	1
	1-1.6	Siliceous aggregate concrete and concrete excluded in Item 1-1.1, members 12" × 12" or greater. ^a	2	1	1	1
	1-2.1	Clay or shale brick with brick and mortar fill. ^a	¾	—	—	¼
	1-3.1	4" hollow clay tile in two 2" layers; ½" mortar between tile and column; ⅜" metal mesh 0.046" wire diameter in horizontal joints; tile fill. ^a	4	—	—	—
	1-3.2	2" hollow clay tile; ¾" mortar between tile and column; ⅜" metal mesh 0.046" wire diameter in horizontal joints; limestone concrete fill ^a ; plastered with ¾" gypsum plaster.	3	—	—	—
	1-3.3	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile or ⅜" metal mesh 0.046" diameter wire in horizontal joints; limestone or trap-rock concrete fill ^a extending 1" outside column on all sides.	—	—	3	—
	1-3.4	2" hollow clay tile with outside wire ties 0.08" diameter at each course of tile with or without concrete fill; ¾" mortar between tile and column.	—	—	—	2
	1-4.1	Cement plaster over metal lath wire tied to ¾" cold-rolled vertical channels with 0.049" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2½ by volume, cement to sand.	—	—	2½ ^b	⅞
	1-5.1	Vermiculite concrete, 1:4 mix by volume over paper-backed wire fabric lath wrapped directly around column with additional 2" × 2" 0.065"/0.065" (No. 16/16 B.W. gage) wire fabric placed ¾" from outer concrete surface. Wire fabric tied with 0.049" (No. 18B.W. gage) wire spaced 6" on center for inner layer and 2" on center for outer layer.	2	—	—	—
	1-6.1	Perlite or vermiculite gypsum plaster over metal lath wrapped around column and furred ¼" from column flanges. Sheets lapped at ends and tied at 6" intervals with 0.049" (No. 18 B.W. gage) tie wire. Plaster pushed through to flanges.	1½	1	—	—
	1-6.2	Perlite or vermiculite gypsum plaster over self-furring metal lath wrapped directly around column, lapped 1" and tied at 6" intervals with 0.049" (No. 18 B.W. gage) wire.	¾	⅜	1	—
	1-6.3	Perlite or vermiculite gypsum plaster on metal lath applied to ¾" cold-rolled channels spaced 24" apart vertically and wrapped flatwise around column.	1½	—	—	—
	1-6.4	Perlite or vermiculite gypsum plaster over two layers of ½" plain full-length gypsum lath applied tight to column flanges. Lath wrapped with 1" hexagonal mesh of No. 20-gage wire and tied with doubled 0.035" diameter (No. 18 B.W. gage) wire ties spaced 23" on center. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2½ cubic feet of aggregate for the 3-hour system.	2½	2	—	—

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(1)—continued
 MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON
 TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS^m

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Steel columns and all of primary trusses (continued)	1-6.5	Perlite or vermiculite gypsum plaster over one layer of 1/2" plain full-length gypsum lath applied tight to column flanges. Lath tied with doubled 0.049" (No. 18 B.W. gage) wire ties spaced 23" on center and scratch coat wrapped with 1" hexagonal mesh 0.035" (No. 20 B.W. gage) wire fabric. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate.	—	2	—	—
	1-7.1	Multiple layers of 1/2" gypsum wallboard ^c adhesively ^d secured to column flanges and successive layers. Wallboard applied without horizontal joints. Corner edges of each layer staggered. Wallboard layer below outer layer secured to column with doubled 0.049" (No. 18 B.W. gage) steel wire ties spaced 15" on center. Exposed corners taped and treated.	—	—	2	1
	1-7.2	Three layers of 5/8" Type X gypsum wallboard. ^c First and second layer held in place by 1/8" diameter by 1 5/8" long ring shank nails with 5/16" diameter heads spaced 24" on center at corners. Middle layer also secured with metal straps at mid-height and 18" from each end, and by metal corner bead at each corner held by the metal straps. Third layer attached to corner bead with 1" long gypsum wallboard screws spaced 12" on center.	—	—	1 7/8	—
	1-7.3	Three layers of 5/8" Type X gypsum wallboard, ^c each layer screw attached to 1 5/8" steel studs 0.018" thick (No. 25 carbon sheet steel gage) at each corner of column. Middle layer also secured with 0.049" (No. 18 B.W. gage) double-strand steel wire ties, 24" on center. Screws are No. 6 by 1" spaced 24" on center for inner layer, No. 6 by 1 5/8" spaced 12" on center for middle layer and No. 8 by 2 1/4" spaced 12" on center for outer layer.	—	1 7/8	—	—
	1-8.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum-to-sand aggregate applied over metal lath. Lath lapped 1" and tied 6" on center at all end, edges and spacers with 0.049" (No. 18 B.W. gage) steel tie wires. Lath applied over 1/2" spacers made of 3/4" furring channel with 2" legs bent around each corner. Spacers located 1" from top and bottom of member and not greater than 40" on center and wire tied with a single strand of 0.049" (No. 18 B.W. gage) steel tie wires. Corner bead tied to the lath at 6" on center along each corner to provide plaster thickness.	—	—	1 5/8	—
	1-9.1	Minimum W8x35 wide flange steel column (w/d ≥ 0.75) with each web cavity filled even with the flange tip with normal weight carbonate or siliceous aggregate concrete (3,000 psi minimum compressive strength with 145 pcf ± 3 pcf unit weight). Reinforce the concrete in each web cavity with a minimum No. 4 deformed reinforcing bar installed vertically and centered in the cavity, and secured to the column web with a minimum No. 2 horizontal deformed reinforcing bar welded to the web every 18" on center vertically. As an alternative to the No. 4 rebar, 3/4" diameter by 3" long headed studs, spaced at 12" on center vertically, shall be welded on each side of the web mid-way between the column flanges.	—	—	—	See Note n
2. Webs or flanges of steel beams and girders (continued)	2-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete (not including sandstone, granite and siliceous gravel) with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2	1 1/2	1	1
	2-1.2	Siliceous aggregate concrete and concrete excluded in Item 2-1.1 with 3" or finer metal mesh placed 1" from the finished surface anchored to the top flange and providing not less than 0.025 square inch of steel area per foot in each direction.	2 1/2	2	1 1/2	1
	2-2.1	Cement plaster on metal lath attached to 3/4" cold-rolled channels with 0.04" (No. 18 B.W. gage) wire ties spaced 3" to 6" on center. Plaster mixed 1:2 1/2 by volume, cement to sand.	—	—	2 1/2 ^b	7/8

(continued)

TABLE 721.1(1)—continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON
TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS^m

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
2. Webs or flanges of steel beams and girders (continued)	2-3.1	Vermiculite gypsum plaster on a metal lath cage, wire tied to 0.165" diameter (No. 8 B.W. gage) steel wire hangers wrapped around beam and spaced 16" on center. Metal lath ties spaced approximately 5" on center at cage sides and bottom.	—	7/8	—	—
	2-4.1	Two layers of 5/8" Type X gypsum wallboard ^c are attached to U-shaped brackets spaced 24" on center. 0.018" thick (No. 25 carbon sheet steel gage) 1 5/8" deep by 1" galvanized steel runner channels are first installed parallel to and on each side of the top beam flange to provide a 1/2" clearance to the flange. The channel runners are attached to steel deck or concrete floor construction with approved fasteners spaced 12" on center. U-shaped brackets are formed from members identical to the channel runners. At the bent portion of the U-shaped bracket, the flanges of the channel are cut out so that 1 5/8"-deep corner channels can be inserted without attachment parallel to each side of the lower flange. As an alternative, 0.021" thick (No. 24 carbon sheet steel gage) 1" x 2" runner and corner angles shall be used in lieu of channels, and the web cutouts in the U-shaped brackets shall not be required. Each angle is attached to the bracket with 1/2"-long No. 8 self-drilling screws. The vertical legs of the U-shaped bracket are attached to the runners with one 1/2"-long No. 8 self-drilling screw. The completed steel framing provides a 2 1/8" and 1 1/2" space between the inner layer of wallboard and the sides and bottom of the steel beam, respectively. The inner layer of wallboard is attached to the top runners and bottom corner channels or corner angles with 1 1/4"-long No. 6 self-drilling screws spaced 16" on center. The outer layer of wallboard is applied with 1 3/4"-long No. 6 self-drilling screws spaced 8" on center. The bottom corners are reinforced with metal corner beads.	—	—	1 1/4	—
	2-4.2	Three layers of 5/8" Type X gypsum wallboard ^c attached to a steel suspension system as described immediately above utilizing the 0.018" thick (No. 25 carbon sheet steel gage) 1" x 2" lower corner angles. The framing is located so that a 2 1/8" and 2" space is provided between the inner layer of wallboard and the sides and bottom of the beam, respectively. The first two layers of wallboard are attached as described immediately above. A layer of 0.035" thick (No. 20 B.W. gage) 1" hexagonal galvanized wire mesh is applied under the soffit of the middle layer and up the sides approximately 2". The mesh is held in position with the No. 6 1 5/8"-long screws installed in the vertical leg of the bottom corner angles. The outer layer of wallboard is attached with No. 6 2 1/4"-long screws spaced 8" on center. One screw is installed at the mid-depth of the bracket in each layer. Bottom corners are finished as described above.	—	1 7/8	—	—
3. Bonded pre-tensioned reinforcement in prestressed concrete ^e	3-1.1	Carbonate, lightweight, sand-lightweight and siliceous ^f aggregate concrete				
		Beams or girders	4 ^g	3 ^g	2 1/2	1 1/2
		Solid ^h		2	1 1/2	1

(continued)

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 721.1(1)—continued
MINIMUM PROTECTION OF STRUCTURAL PARTS BASED ON
TIME PERIODS FOR VARIOUS NONCOMBUSTIBLE INSULATING MATERIALS^m**

STRUCTURAL PARTS TO BE PROTECTED	ITEM NUMBER	INSULATING MATERIAL USED	MINIMUM THICKNESS OF INSULATING MATERIAL FOR THE FOLLOWING FIRE-RESISTANCE PERIODS (inches)			
			4 hours	3 hours	2 hours	1 hour
4. Bonded or unbonded post-tensioned tendons in prestressed concrete ^{e,1}	4-1.1	Carbonate, lightweight, sand-lightweight and siliceous ^f aggregate concrete Unrestrained members:				
		Solid slabs ^h	—	2	1½	—
		Beams and girders ^l				
		8" wide		4½	2½	1¾
		greater than 12" wide	3	2½	2	1½
	4-1.2	Carbonate, lightweight, sand-lightweight and siliceous aggregate Restrained members: ^k				
		Solid slabs ^h	1¼	1	¾	—
		Beams and girders ^l				
8" wide		2½	2	1¾	—	
	greater than 12" wide	2	1¾	1½	—	
5. Reinforcing steel in reinforced concrete columns, beams girders and trusses	5-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	1½	1½	1½	1½
		Siliceous aggregate concrete, members 12" or larger, square or round. (Size limit does not apply to beams and girders monolithic with floors.)	2	1½	1½	1½
6. Reinforcing steel in reinforced concrete joists ¹	6-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete	1¼	1¼	1	¾
	6-1.2	Siliceous aggregate concrete	1¾	1½	1	¾
7. Reinforcing and tie rods in floor and roof slabs ¹	7-1.1	Carbonate, lightweight and sand-lightweight aggregate concrete	1	1	¾	¾
	7-1.2	Siliceous aggregate concrete	1¼	1	1	¾

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm², 1 cubic foot = 0.0283 m³, 1 pound per cubic foot = 16.02 kg/m³.

- a. Reentrant parts of protected members to be filled solidly.
- b. Two layers of equal thickness with a ¾-inch airspace between.
- c. For all of the construction with gypsum wallboard described in Table 721.1(1), gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided that attachment is identical to that specified for the wallboard and the joints on the face layer are reinforced, and the entire surface is covered with not less than 1/16-inch gypsum veneer plaster.
- d. An approved adhesive qualified under ASTM E119 or UL 263.
- e. Where lightweight or sand-lightweight concrete having an oven-dry weight of 110 pounds per cubic foot or less is used, the tabulated minimum cover shall be permitted to be reduced 25 percent, except that the reduced cover shall be not less than ¾ inch in slabs or 1½ inches in beams or girders.
- f. For solid slabs of siliceous aggregate concrete, increase tendon cover 20 percent.
- g. Adequate provisions against spalling shall be provided by U-shaped or hooped stirrups spaced not to exceed the depth of the member with a clear cover of 1 inch.
- h. Prestressed slabs shall have a thickness not less than that required in Table 721.1(3) for the respective fire-resistance time period.
- i. Fire coverage and end anchorages shall be as follows: Cover to the prestressing steel at the anchor shall be ½ inch greater than that required away from the anchor. Minimum cover to steel-bearing plate shall be 1 inch in beams and ¾ inch in slabs.
- j. For beam widths between 8 inches and 12 inches, cover thickness shall be permitted to be determined by interpolation.
- k. Interior spans of continuous slabs, beams and girders shall be permitted to be considered restrained.
- l. For use with concrete slabs having a comparable fire endurance where members are framed into the structure in such a manner as to provide equivalent performance to that of monolithic concrete construction.
- m. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in GA 600 shall be accepted as if herein specified.
- n. Additional insulating material is not required on the exposed outside face of the column flange to achieve a 1-hour fire-resistance rating.

TABLE 721.1(2)
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
1. Brick of clay or shale	1-1.1	Solid brick of clay or shale. ^c	6	4.9	3.8	2.7
	1-1.2	Hollow brick, not filled.	5.0	4.3	3.4	2.3
	1-1.3	Hollow brick unit wall, grout or filled with perlite vermiculite or expanded shale aggregate.	6.6	5.5	4.4	3.0
	1-2.1	4" nominal thick units not less than 75 percent solid backed with a hat-shaped metal furring channel ³ / ₄ " thick formed from 0.021" sheet metal attached to the brick wall on 24" centers with approved fasteners, and ¹ / ₂ " Type X gypsum wallboard attached to the metal furring strips with 1"-long Type S screws spaced 8" on center.	—	—	5 ^d	—
2. Combination of clay brick and load-bearing hollow clay tile	2-1.1	4" solid brick and 4" tile (not less than 40 percent solid).	—	8	—	—
	2-1.2	4" solid brick and 8" tile (not less than 40 percent solid).	12	—	—	—
3. Concrete masonry units	3-1.1 ^{f, g}	Expanded slag or pumice.	4.7	4.0	3.2	2.1
	3-1.2 ^{f, g}	Expanded clay, shale or slate.	5.1	4.4	3.6	2.6
	3-1.3 ^f	Limestone, cinders or air-cooled slag.	5.9	5.0	4.0	2.7
	3-1.4 ^{f, g}	Calcareous or siliceous gravel.	6.2	5.3	4.2	2.8
4. Solid concrete ^{h, i}	4-1.1	Siliceous aggregate concrete.	7.0	6.2	5.0	3.5
		Carbonate aggregate concrete.	6.6	5.7	4.6	3.2
		Sand-lightweight concrete.	5.4	4.6	3.8	2.7
		Lightweight concrete.	5.1	4.4	3.6	2.5
5. Glazed or unglazed facing tile, non-load-bearing	5-1.1	One 2" unit cored 15 percent maximum and one 4" unit cored 25 percent maximum with ³ / ₄ " mortar-filled collar joint. Unit positions reversed in alternate courses.	—	6 ³ / ₈	—	—
	5-1.2	One 2" unit cored 15 percent maximum and one 4" unit cored 40 percent maximum with ³ / ₄ " mortar-filled collar joint. Unit positions side with ³ / ₄ " gypsum plaster. Two wythes tied together every fourth course with No. 22 gage corrugated metal ties.	—	6 ³ / ₄	—	—
	5-1.3	One unit with three cells in wall thickness, cored 29 percent maximum.	—	—	6	—
	5-1.4	One 2" unit cored 22 percent maximum and one 4" unit cored 41 percent maximum with ¹ / ₄ " mortar-filled collar joint. Two wythes tied together every third course with 0.030"(No. 22 galvanized sheet steel gage) corrugated metal ties.	—	—	6	—
	5-1.5	One 4" unit cored 25 percent maximum with ³ / ₄ " gypsum plaster on one side.	—	—	4 ³ / ₄	—
	5-1.6	One 4" unit with two cells in wall thickness, cored 22 percent maximum.	—	—	—	4
	5-1.7	One 4" unit cored 30 percent maximum with ³ / ₄ " vermiculite gypsum plaster on one side.	—	—	4 ¹ / ₂	—
	5-1.8	One 4" unit cored 39 percent maximum with ³ / ₄ " gypsum plaster on one side.	—	—	—	4 ¹ / ₂

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(2)—continued
 RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
6. Solid gypsum plaster	6-1.1	$\frac{3}{4}$ " by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with 2.6-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 ^d
	6-1.2	$\frac{3}{4}$ " by 0.05" (No. 16 carbon sheet steel gage) cold-rolled channels 16" on center with metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Perlite or vermiculite gypsum plaster each side. For three-coat work, the plaster mix for the second coat shall not exceed 100 pounds of gypsum to 2 $\frac{1}{2}$ cubic feet of aggregate for the 1-hour system.	—	—	2 $\frac{1}{2}$ ^d	2 ^d
	6-1.3	$\frac{3}{4}$ " by 0.055" (No. 16 carbon sheet steel gage) vertical cold-rolled channels, 16" on center with $\frac{3}{8}$ " gypsum lath applied to one face and attached with sheet metal clips. Gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 ^d
	6-2.1	Studless with $\frac{1}{2}$ " full-length plain gypsum lath and gypsum plaster each side. Plaster mixed 1:1 for scratch coat and 1:2 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	2 ^d
	6-2.2	Studless with $\frac{1}{2}$ " full-length plain gypsum lath and perlite or vermiculite gypsum plaster each side.	—	—	2 $\frac{1}{2}$ ^d	2 ^d
	6-2.3	Studless partition with $\frac{3}{8}$ " rib metal lath installed vertically adjacent edges tied 6" on center with No. 18 gage wire ties, gypsum plaster each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	2 ^d
7. Solid perlite and Portland cement	7-1.1	Perlite mixed in the ratio of 3 cubic feet to 100 pounds of Portland cement and machine applied to stud side of 1 $\frac{1}{2}$ " mesh by 0.058-inch (No. 17 B.W. gage) paper-backed woven wire fabric lath wire-tied to 4"-deep steel trussed wire studs 16" on center. Wire ties of 0.049" (No. 18 B.W. gage) galvanized steel wire 6" on center vertically.	—	—	3 $\frac{1}{8}$ ^d	—
8. Solid neat wood fibered gypsum plaster	8-1.1	$\frac{3}{4}$ " by 0.055-inch (No. 16 carbon sheet steel gage) cold-rolled channels, 12" on center with 2.5-pound flat metal lath applied to one face and tied with 0.049" (No. 18 B.W. gage) wire at 6" spacing. Neat gypsum plaster applied each side.	—	—	2 ^d	—
9. Solid wall-board partition	9-1.1	One full-length layer $\frac{1}{2}$ " Type X gypsum wallboard ^c laminated to each side of 1" full-length V-edge gypsum coreboard with approved laminating compound. Vertical joints of face layer and coreboard staggered not less than 3".	—	—	2 ^d	—
10. Hollow (studless) gypsum wall-board partition	10-1.1	One full-length layer of $\frac{5}{8}$ " Type X gypsum wallboard ^c attached to both sides of wood or metal top and bottom runners laminated to each side of 1" \times 6" full-length gypsum coreboard ribs spaced 2" on center with approved laminating compound. Ribs centered at vertical joints of face plies and joints staggered 24" in opposing faces. Ribs may be recessed 6" from the top and bottom.	—	—	—	2 $\frac{1}{4}$ ^d
	10-1.2	1" regular gypsum V-edge full-length backing board attached to both sides of wood or metal top and bottom runners with nails or 1 $\frac{5}{8}$ " drywall screws at 24" on center. Minimum width of runners 1 $\frac{5}{8}$ ". Face layer of $\frac{1}{2}$ " regular full-length gypsum wallboard laminated to outer faces of backing board with approved laminating compound.	—	—	4 $\frac{5}{8}$ ^d	—

(continued)

TABLE 721.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
11. Noncombustible studs—interior partition with plaster each side	11-1.1	3 1/4" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 24" on center. 5/8" gypsum plaster on metal lath each side mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	4 3/4 ^d
	11-1.2	3 3/8" × 0.055" (No. 16 carbon sheet steel gage) approved nailable ^k studs spaced 24" on center. 5/8" neat gypsum wood-fibered plaster each side over 3/8" rib metal lath nailed to studs with 6d common nails, 8" on center. Nails driven 1 1/4" and bent over.	—	—	5 5/8	—
	11-1.3	4" × 0.044" (No. 18 carbon sheet steel gage) channel-shaped steel studs at 16" on center. On each side approved resilient clips pressed onto stud flange at 16" vertical spacing, 1/4" pencil rods snapped into or wire tied onto outer loop of clips, metal lath wire-tied to pencil rods at 6" intervals, 1" perlite gypsum plaster, each side.	—	7 5/8 ^d	—	—
	11-1.4	2 1/2" × 0.044" (No. 18 carbon sheet steel gage) steel studs spaced 16" on center. Wood fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied on 3/4-pound metal lath wire tied to studs, each side. 3/4" plaster applied over each face, including finish coat.	—	—	4 1/4 ^d	—
12. Wood studs—interior partition with plaster each side	12-1.1 ^{l, m}	2" × 4" wood studs 16" on center with 5/8" gypsum plaster on metal lath. Lath attached by 4d common nails bent over or No. 14 gage by 1 1/4" by 3/4" crown width staples spaced 6" on center. Plaster mixed 1:1 1/2 for scratch coat and 1:3 for brown coat, by weight, gypsum to sand aggregate.	—	—	—	5 1/8
	12-1.2 ^l	2" × 4" wood studs 16" on center with metal lath and 7/8" neat wood-fibered gypsum plaster each side. Lath attached by 6d common nails, 7" on center. Nails driven 1 1/4" and bent over.	—	—	5 1/2 ^d	—
	12-1.3 ^l	2" × 4" wood studs 16" on center with 3/8" perforated or plain gypsum lath and 1/2" gypsum plaster each side. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard blue nails, 4" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5 1/4
	12-1.4 ^l	2" × 4" wood studs 16" on center with 3/8" Type X gypsum lath and 1/2" gypsum plaster each side. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard blue nails, 5" on center. Plaster mixed 1:2 by weight, gypsum to sand aggregate.	—	—	—	5 1/4
13. Noncombustible studs—interior partition with gypsum wallboard each side	13-1.1	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 24" on center with one full-length layer of 5/8" Type X gypsum wallboard ^e applied vertically attached with 1"-long No. 6 dry wall screws to each stud. Screws are 8" on center around the perimeter and 12" on center on the intermediate stud. Where applied horizontally, the Type X gypsum wallboard shall be attached to 3 5/8" studs and the horizontal joints shall be staggered with those on the opposite side. Screws for the horizontal application shall be 8" on center at vertical edges and 12" on center at intermediate studs.	—	—	—	2 7/8 ^d
	13-1.2	0.018" (No. 25 carbon sheet steel gage) channel-shaped studs 25" on center with two full-length layers of 1/2" Type X gypsum wallboard ^e applied vertically each side. First layer attached with 1"-long, No. 6 drywall screws, 8" on center around the perimeter and 12" on center on the intermediate stud. Second layer applied with vertical joints offset one stud space from first layer using 1 5/8" long, No. 6 drywall screws spaced 9" on center along vertical joints, 12" on center at intermediate studs and 24" on center along top and bottom runners.	—	—	3 5/8 ^d	—
	13-1.3	0.055" (No. 16 carbon sheet steel gage) approved nailable metal studs ^c 24" on center with full-length 5/8" Type X gypsum wallboard ^e applied vertically and nailed 7" on center with 6d cement-coated common nails. Approved metal fastener grips used with nails at vertical butt joints along studs.	—	—	—	4 7/8

(continued)

TABLE 721.1(2)—continued
 RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
14. Wood studs—interior partition with gypsum wallboard each side	14-1.1 ^{h, m}	2" × 4" wood studs 16" on center with two layers of 3/8" regular gypsum wallboard ^c each side, 4d cooler ⁿ or wallboard ⁿ nails at 8" on center first layer, 5d cooler ⁿ or wallboard ⁿ nails at 8" on center second layer with laminating compound between layers, joints staggered. First layer applied full length vertically, second layer applied horizontally or vertically.	—	—	—	5
	14-1.2 ^{l, m}	2" × 4" wood studs 16" on center with two layers 1/2" regular gypsum wallboard ^c applied vertically or horizontally each side ^k , joints staggered. Nail base layer with 5d cooler ⁿ or wallboard ⁿ nails at 8" on center face layer with 8d cooler ⁿ or wallboard ⁿ nails at 8" on center.	—	—	—	5 1/2
	14-1.3 ^{l, m}	2" × 4" wood studs 24" on center with 5/8" Type X gypsum wallboard ^c applied vertically or horizontally nailed with 6d cooler ⁿ or wallboard ⁿ nails at 7" on center with end joints on nailing members. Stagger joints each side.	—	—	—	4 3/4
	14-1.4 ^l	2" × 4" fire-retardant-treated wood studs spaced 24" on center with one layer of 5/8" Type X gypsum wallboard ^c applied with face paper grain (long dimension) parallel to studs. Wallboard attached with 6d cooler ⁿ or wallboard ⁿ nails at 7" on center.	—	—	—	4 3/4 ^d
	14-1.5 ^{l, m}	2" × 4" wood studs 16" on center with two layers 5/8" Type X gypsum wallboard ^c each side. Base layers applied vertically and nailed with 6d cooler ⁿ or wallboard ⁿ nails at 9" on center. Face layer applied vertically or horizontally and nailed with 8d cooler ⁿ or wallboard ⁿ nails at 7" on center. For nail-adhesive application, base layers are nailed 6" on center. Face layers applied with coating of approved wallboard adhesive and nailed 12" on center.	—	—	6	—
	14-1.6 ^l	2" × 3" fire-retardant-treated wood studs spaced 24" on center with one layer of 5/8" Type X gypsum wallboard ^c applied with face paper grain (long dimension) at right angles to studs. Wallboard attached with 6d cement-coated box nails spaced 7" on center.	—	—	—	3 5/8 ^d
15. Exterior or interior walls (continued)	15-1.1 ^{l, m}	Exterior surface with 3/4" drop siding over 1/2" gypsum sheathing on 2" × 4" wood studs at 16" on center, interior surface treatment as required for 1-hour-rated exterior or interior 2" × 4" wood stud partitions. Gypsum sheathing nailed with 1 3/4" by No.11 gage by 7/16" head galvanized nails at 8" on center. Siding nailed with 7d galvanized smooth box nails.	—	—	—	Varies
	15-1.2 ^{l, m}	2" × 4" wood studs 16" on center with metal lath and 3/4" cement plaster on each side. Lath attached with 6d common nails 7" on center driven to 1" minimum penetration and bent over. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	5 3/8
	15-1.3 ^{l, m}	2" × 4" wood studs 16" on center with 7/8" cement plaster (measured from the face of studs) on the exterior surface with interior surface treatment as required for interior wood stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies
	15-1.4	3 5/8" No. 16 gage noncombustible studs 16" on center with 7/8" cement plaster (measured from the face of the studs) on the exterior surface with interior surface treatment as required for interior, nonbearing, noncombustible stud partitions in this table. Plaster mix 1:4 for scratch coat and 1:5 for brown coat, by volume, cement to sand.	—	—	—	Varies ^d

(continued)

TABLE 721.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, c, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.5 ^m	2 1/4" x 3 3/4" clay face brick with cored holes over 1/2" gypsum sheathing on exterior surface of 2" x 4" wood studs at 16" on center and two layers 5/8" Type X gypsum wallboard ^d on interior surface. Sheathing placed horizontally or vertically with vertical joints over studs nailed 6" on center with 1 3/4" x No. 11 gage by 7/16" head galvanized nails. Inner layer of wallboard placed horizontally or vertically and nailed 8" on center with 6d cooler ⁿ or wallboard ⁿ nails. Outer layer of wallboard placed horizontally or vertically and nailed 8" on center with 8d cooler ⁿ or wallboard ⁿ nails. Joints staggered with vertical joints over studs. Outer layer joints taped and finished with compound. Nail heads covered with joint compound. 0.035 inch (No. 20 galvanized sheet gage) corrugated galvanized steel wall ties 3/4" by 6 5/8" attached to each stud with two 8d cooler ⁿ or wallboard ⁿ nails every sixth course of bricks.	—	—	10	—
	15-1.6 ^{1, m}	2" x 6" fire-retardant-treated wood studs 16" on center. Interior face has two layers of 5/8" Type X gypsum with the base layer placed vertically and attached with 6d box nails 12" on center. The face layer is placed horizontally and attached with 8d box nails 8" on center at joints and 12" on center elsewhere. The exterior face has a base layer of 5/8" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by self-furred exterior lath attached with 2 1/2", No. 12 gage galvanized roofing nails with a 3/8" diameter head and spaced 6" on center along each stud. Cement plaster consisting of a 1/2" brown coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat.	—	—	8 1/4	—
	15-1.7 ^{1, m}	2" x 6" wood studs 16" on center. The exterior face has a layer of 5/8" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by 1" by No. 18 gage self-furred exterior lath attached with 8d by 2 1/2"-long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a 1/2" scratch coat, a bonding agent and a 1/2" brown coat and a finish coat is then applied. The scratch coat is mixed in the proportion of 1:3 by weight, cement to sand with 10 pounds of hydrated lime and 3 pounds of approved additives or admixtures per sack of cement. The brown coat is mixed in the proportion of 1:4 by weight, cement to sand with the same amounts of hydrated lime and approved additives or admixtures used in the scratch coat. The interior is covered with 3/8" gypsum lath with 1" hexagonal mesh of 0.035 inch (No. 20 B.W. gage) woven wire lath furred out 5/16" and 1" perlite or vermiculite gypsum plaster. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard glued nails spaced 5" on center. Mesh attached by 1 3/4" by No. 12 gage by 3/8" head nails with 3/8" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate.	—	—	8 3/8	—

(continued)

TABLE 721.1(2)—continued
 RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.8 ^{l, m}	2" × 6" wood studs 16" on center. The exterior face has a layer of 5/8" Type X gypsum sheathing placed vertically with 6d box nails 8" on center at joints and 12" on center elsewhere. An approved building paper is next applied, followed by 1 1/2" by No. 17 gage self-furred exterior lath attached with 8d by 2 1/2"-long galvanized roofing nails spaced 6" on center along each stud. Cement plaster consisting of a 1/2" scratch coat and a 1/2" brown coat is then applied. The plaster may be placed by machine. The scratch coat is mixed in the proportion of 1:4 by weight, plastic cement to sand. The brown coat is mixed in the proportion of 1:5 by weight, plastic cement to sand. The interior is covered with 3/8" gypsum lath with 1" hexagonal mesh of No. 20-gage woven wire lath furred out 5/16" and 1" perlite or vermiculite gypsum plaster. Lath nailed with 1 1/8" by No. 13 gage by 19/64" head plasterboard glued nails spaced 5" on center. Mesh attached by 1 3/4" by No. 12 gage by 3/8" head nails with 3/8" furrings, spaced 8" on center. The plaster mix shall not exceed 100 pounds of gypsum to 2 1/2 cubic feet of aggregate.	—	—	8 3/8	—
	15-1.9	4" No. 18 gage, nonload-bearing metal studs, 16" on center, with 1" Portland cement lime plaster (measured from the back side of the 3/4-pound expanded metal lath) on the exterior surface. Interior surface to be covered with 1" of gypsum plaster on 3/4-pound expanded metal lath proportioned by weight—1:2 for scratch coat, 1:3 for brown, gypsum to sand. Lath on one side of the partition fastened to 1/4" diameter pencil rods supported by No. 20 gage metal clips, located 16" on center vertically, on each stud. 3" thick mineral fiber insulating batts friction fitted between the studs.	—	—	6 1/2 ^d	—
	15-1.10	Steel studs 0.060" thick, 4" deep or 6" at 16" or 24" centers, with 1/2" glass fiber-reinforced concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two 1/2"-long flare-bevel welds, and 4" foot attached to the GFRC skin with 5/8"-thick GFRC bonding pads that extend 2 1/2" beyond the flex anchor foot on both sides. Interior surface to have two layers of 1/2" Type X gypsum wallboard. ^e The first layer of wallboard to be attached with 1"-long Type S buglehead screws spaced 24" on center and the second layer is attached with 1 5/8"-long Type S screws spaced at 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has 1 1/2" returns packed with mineral fiber and caulked on the exterior.	—	—	6 1/2	—
	15-1.11	Steel studs 0.060" thick, 4" deep or 6" at 16" or 24" centers, respectively, with 1/2" glass fiber-reinforced concrete (GFRC) on the exterior surface. GFRC is attached with flex anchors at 24" on center, with 5" leg welded to studs with two 1/2"-long flare-bevel welds, and 4" foot attached to the GFRC skin with 5/8"-thick GFRC bonding pads that extend 2 1/2" beyond the flex anchor foot on both sides. Interior surface to have one layer of 5/8" Type X gypsum wallboard ^e , attached with 1 1/4"-long Type S buglehead screws spaced 12" on center. Cavity is to be filled with 5" of 4 pcf (nominal) mineral fiber batts. GFRC has 1 1/2" returns packed with mineral fiber and caulked on the exterior.	—	—	—	6 1/8
	15-1.12 ^q	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S dry-wall screws, spaced 12" on center. Cavity to be filled with 5 1/2" mineral wool insulation.	—	—	—	6 3/4

(continued)

TABLE 721.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls (continued)	15-1.13 ^q	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard, 4' wide, applied vertically with all joints over framing or blocking and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. R-19 mineral fiber insulation installed in stud cavity.	—	—	—	6 3/4
	15-1.14 ^q	2" × 6" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S drywall screws, spaced 7" on center.	—	—	—	6 3/4
	15-1.15 ^q	2" × 4" wood studs at 16" with double top plates, single bottom plate; interior and exterior sides covered with 5/8" Type X gypsum wallboard and sheathing, respectively, 4' wide, applied horizontally or vertically with vertical joints over studs, and fastened with 2 1/4" Type S drywall screws, spaced 12" on center. Cavity to be filled with 3 1/2" mineral wool insulation.	—	—	—	4 3/4
	15-1.16 ^q	2" × 6" wood studs at 24" centers with double top plates, single bottom plate; interior and exterior side covered with two layers of 5/8" Type X gypsum wallboard, 4' wide, applied horizontally with vertical joints over studs. Base layer fastened with 2 1/4" Type S drywall screws, spaced 24" on center and face layer fastened with Type S drywall screws, spaced 8" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Cavity to be filled with 5 1/2" mineral wool insulation.	—	—	8	—
	15-2.1 ^d	3 5/8" No. 16 gage steel studs at 24" on center or 2" × 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum 3/4" thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C1088, Grade TBS or better, installed in running bond in accordance with Section 1404.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 1 3/4". Interior side covered with one layer of 5/8"-thick Type X gypsum wallboard attached to studs with 1" long No. 6 drywall screws at 12" on center.	—	—	—	6
	15-2.2 ^d	3 5/8" No. 16 gage steel studs at 24" on center or 2" × 4" wood studs at 24" on center. Metal lath attached to the exterior side of studs with minimum 1" long No. 6 drywall screws at 6" on center and covered with minimum 3/4" thick Portland cement plaster. Thin veneer brick units of clay or shale complying with ASTM C1088, Grade TBS or better, installed in running bond in accordance with Section 1404.10. Combined total thickness of the Portland cement plaster, mortar and thin veneer brick units shall be not less than 2". Interior side covered with two layers of 5/8"-thick Type X gypsum wallboard. Bottom layer attached to studs with 1"-long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 5/8"-long No. 6 drywall screws at 12" on center.	—	—	6 7/8	—
	15-2.3 ^d	3 5/8" No. 16 gage steel studs at 16" on center or 2" × 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1"-long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 5/8" thick complying with ASTM C216 installed in accordance with Section 1404.6 with a minimum 1" airspace. Interior side covered with one layer of 5/8"-thick Type X gypsum wallboard attached to studs with 1"-long No. 6 drywall screws at 12" on center.	—	—	—	7 7/8

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, c, p}

MATERIAL	ITEM NUMBER	CONSTRUCTION	MINIMUM FINISHED THICKNESS FACE-TO-FACE ^b (inches)			
			4 hours	3 hours	2 hours	1 hour
15. Exterior or interior walls	15-2.4 ^d	3 ⁵ / ₈ " No. 16 gage steel studs at 16" on center or 2" × 4" wood studs at 16" on center. Where metal lath is used, attach to the exterior side of studs with minimum 1"-long No. 6 drywall screws at 6" on center. Brick units of clay or shale not less than 2 ⁵ / ₈ " thick complying with ASTM C216 installed in accordance with Section 1404.6 with a minimum 1" airspace. Interior side covered with two layers of 5/ ₈ "-thick Type X gypsum wallboard. Bottom layer attached to studs with 1"-long No. 6 drywall screws at 24" on center. Top layer attached to studs with 1 ⁵ / ₈ "-long No. 6 drywall screws at 12" on center.	—	—	8 ¹ / ₂	—
16. Exterior walls rated for fire resistance from the inside only in accordance with Section 705.5.	16-1.1 ^q	2" × 4" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with 5/ ₈ " Type X gypsum wallboard, 4' wide, applied horizontally unblocked, and fastened with 2 ¹ / ₄ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound. Exterior covered with 3/ ₈ " wood structural panels, applied vertically, horizontal joints blocked and fastened with 6d common nails (bright)—12" on center in the field, and 6" on center panel edges. Cavity to be filled with 3 ¹ / ₂ " mineral wool insulation. Rating established for exposure from interior side only.	—	—	—	4 ¹ / ₂
	16-1.2 ^q	2" × 6" wood studs at 16" centers with double top plates, single bottom plate; interior side covered with 5/ ₈ " Type X gypsum wallboard, 4' wide, applied horizontally or vertically with vertical joints over studs and fastened with 2 ¹ / ₄ " Type S drywall screws, spaced 12" on center, wallboard joints covered with paper tape and joint compound, fastener heads covered with joint compound, exterior side covered with 7/ ₁₆ " wood structural panels fastened with 6d common nails (bright) spaced 12" on center in the field and 6" on center along the panel edges. Cavity to be filled with 5 ¹ / ₂ " mineral wool insulation. Rating established from the gypsum-covered side only.	—	—	—	6 ⁹ / ₁₆
	16-1.3 ^q	2" × 6" wood studs at 16" centers with double top plates, single bottom plates; interior side covered with 5/ ₈ " Type X gypsum wallboard, 4' wide, applied vertically with all joints over framing or blocking and fastened with 2 ¹ / ₄ " Type S drywall screws spaced 7" on center. Joints to be covered with tape and joint compound. Exterior covered with 3/ ₈ " wood structural panels, applied vertically with edges over framing or blocking and fastened with 6d common nails (bright) at 12" on center in the field and 6" on center on panel edges. R-19 mineral fiber insulation installed in stud cavity. Rating established from the gypsum-covered side only.	—	—	—	6 ¹ / ₂

For SI: 1 inch = 25.4 mm, 1 square inch = 645.2 mm², 1 cubic foot = 0.0283 m³.

- a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.
- b. Thickness shown for brick and clay tile is nominal thicknesses unless plastered, in which case thicknesses are net. Thickness shown for concrete masonry and clay masonry is equivalent thickness defined in Section 722.3.1 for concrete masonry and Section 722.4.1.1 for clay masonry. Where all cells are solid grouted or filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, the equivalent thickness shall be the thickness of the block or brick using specified dimensions as defined in Chapter 21. Equivalent thickness shall include the thickness of applied plaster and lath or gypsum wallboard, where specified.
- c. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is not less than 75 percent of the gross cross-sectional area measured in the same plane.
- d. Shall be used for nonbearing purposes only.
- e. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided that attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with not less than 1/₁₆-inch gypsum veneer plaster.
- f. The fire-resistance time period for concrete masonry units meeting the equivalent thicknesses required for a 2-hour fire-resistance rating in Item 3, and having a thickness of not less than 7⁵/₈ inches is 4 hours where cores that are not grouted are filled with silicone-treated perlite loose-fill insulation; vermiculite loose-fill insulation; or expanded clay, shale or slate lightweight aggregate, sand or slag having a maximum particle size of 3/₈ inch.
- g. The fire-resistance rating of concrete masonry units composed of a combination of aggregate types or where plaster is applied directly to the concrete masonry shall be determined in accordance with ACI 216.1/TMS 0216. Lightweight aggregates shall have a maximum combined density of 65 pounds per cubic foot.
- h. See Note b. The equivalent thickness shall be permitted to include the thickness of cement plaster or 1.5 times the thickness of gypsum plaster applied in accordance with the requirements of Chapter 25.

(continued)

TABLE 721.1(2)—continued
RATED FIRE-RESISTANCE PERIODS FOR VARIOUS WALLS AND PARTITIONS ^{a, o, p}

- i. Concrete walls shall be reinforced with horizontal and vertical temperature reinforcement as required by Chapter 19.
- j. Studs are welded truss wire studs with 0.18 inch (No. 7 B.W. gage) flange wire and 0.18 inch (No. 7 B.W. gage) truss wires.
- k. Nailable metal studs consist of two channel studs spot welded back to back with a crimped web forming a nailing groove.
- l. Wood structural panels shall be permitted to be installed between the fire protection and the wood studs on either the interior or exterior side of the wood frame assemblies in this table, provided that the length of the fasteners used to attach the fire protection is increased by an amount not less than the thickness of the wood structural panel.
- m. For studs with a slenderness ratio, l/d , greater than 33, the design stress shall be reduced to 78 percent of allowable F'_c . For studs with a slenderness ratio, l/d , not exceeding 33, the design stress shall be reduced to 78 percent of the adjusted stress F'_c calculated for studs having a slenderness ratio l/d of 33.
- n. For properties of cooler or wallboard nails, see ASTM C514, ASTM C547 or ASTM F1667.
- o. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein specified.
- p. NCMA TEK 5-8A shall be permitted for the design of fire walls.
- q. The design stress of studs shall be equal to not more than 100 percent of the allowable F'_c calculated in accordance with Section 2306.

TABLE 721.1(3)
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS ^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
1. Siliceous aggregate concrete	1-1.1	Slab (ceiling not required). Minimum cover over nonprestressed reinforcement shall be not less than $\frac{3}{4}$ " ^b .	7.0	6.2	5.0	3.5	—	—	—	—
2. Carbonate aggregate concrete	2-1.1		6.6	5.7	4.6	3.2	—	—	—	—
3. Sand-lightweight concrete	3-1.1		5.4	4.6	3.8	2.7	—	—	—	—
4. Lightweight concrete	4-1.1		5.1	4.4	3.6	2.5	—	—	—	—
5. Reinforced concrete	5-1.1	Slab with suspended ceiling of vermiculite gypsum plaster over metal lath attached to $\frac{3}{4}$ " cold-rolled channels spaced 12" on center. Ceiling located 6" minimum below joists.	3	2	—	—	1	$\frac{3}{4}$	—	—
	5-2.1	$\frac{5}{8}$ " Type X gypsum wallboard ^c attached to 0.018 inch (No.25 carbon sheet steel gage) by $\frac{7}{8}$ " deep by $2\frac{5}{8}$ " hat-shaped galvanized steel channels with 1"-long No. 6 screws. The channels are spaced 24" on center, span 35" and are supported along their length at 35" intervals by 0.033" (No. 21 galvanized sheet gage) galvanized steel flat strap hangers having formed edges that engage the lips of the channel. The strap hangers are attached to the side of the concrete joists with $\frac{5}{32}$ " by $1\frac{1}{4}$ "-long power-driven fasteners. The wallboard is installed with the long dimension perpendicular to the channels. End joints occur on channels and supplementary channels are installed parallel to the main channels, 12" each side, at end joint occurrences. The finished ceiling is located approximately 12" below the soffit of the floor slab.	—	—	$2\frac{1}{2}$	—	—	—	$\frac{5}{8}$	—

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4	3	2	1	4	3	2	1
			hours	hours	hours	hour	hours	hours	hours	hour
6. Steel joists constructed with a poured reinforced concrete slab on metal lath forms or steel form units. ^{d, e}	6-1.1	Gypsum plaster on metal lath attached to the bottom cord with single No. 16 gage or doubled No. 18 gage wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 2-hour system. For 3-hour system plaster is neat.	—	—	2 ^{1/2}	2 ^{1/4}	—	—	3/4	5/8
	6-2.1	Vermiculite gypsum plaster on metal lath attached to the bottom chord with single No. 16 gage or doubled 0.049-inch (No. 18 B.W. gage) wire ties 6" on center.	—	2	—	—	—	5/8	—	—
	6-3.1	Cement plaster over metal lath attached to the bottom chord of joists with single No. 16 gage or doubled 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. Plaster mixed 1:2 for scratch coat, 1:3 for brown coat for 1-hour system and 1:1 for scratch coat, 1:1 ^{1/2} for brown coat for 2-hour system, by weight, cement to sand.	—	—	—	2	—	—	—	5/8 ^f
	6-4.1	Ceiling of 5/8" Type X wallboard ^c attached to 7/8" deep by 2 ^{5/8} " by 0.021 inch (No. 25 carbon sheet steel gage) hat-shaped furring channels 12" on center with 1"-long No. 6 wallboard screws at 8" on center. Channels wire tied to bottom chord of joists with doubled 0.049 inch (No. 18 B.W. gage) wire or suspended below joists on wire hangers. ^g	—	—	2 ^{1/2}	—	—	—	5/8	—
	6-5.1	Wood-fibered gypsum plaster mixed 1:1 by weight gypsum to sand aggregate applied over metal lath. Lath tied 6" on center to 3/4" channels spaced 13 ^{1/2} " on center. Channels secured to joists at each intersection with two strands of 0.049 inch (No. 18 B.W. gage) galvanized wire.	—	—	2 ^{1/2}	—	—	—	3/4	—
7. Reinforced concrete slabs and joists with hollow clay tile fillers laid end to end in rows 2 ^{1/2} " or more apart; reinforcement placed between rows and concrete cast around and over tile.	7-1.1	5/8" gypsum plaster on bottom of floor or roof construction.	—	—	8 ^h	—	—	—	5/8	—
	7-1.2	None	—	—	—	5 ^{1/2} ⁱ	—	—	—	—
8. Steel joists constructed with a reinforced concrete slab on top poured on a 1/2"-deep steel deck. ^e	8-1.1	Vermiculite gypsum plaster on metal lath attached to 3/4" cold-rolled channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center.	2 ^{1/2} ^j	—	—	—	3/4	—	—	—

(continued)

TABLE 721.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, c}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
9. 3"-deep cellular steel deck with concrete slab on top. Slab thickness measured to top.	9-1.1	Suspended ceiling of vermiculite gypsum plaster base coat and vermiculite acoustical plaster on metal lath attached at 6" intervals to 3/4" cold-rolled channels spaced 12" on center and secured to 1 1/2" cold-rolled channels spaced 36" on center with 0.065" (No. 16 B.W. gage) wire. 1 1/2" channels supported by No. 8 gage wire hangers at 36" on center. Beams within envelope and with a 2 1/2" airspace between beam soffit and lath have a 4-hour rating.	2 1/2	—	—	—	1 1/8 ^k	—	—	—
10. 1 1/2"-deep steel roof deck on steel framing. Insulation board, 30 pcf density, composed of wood fibers with cement binders of thickness shown bonded to deck with unified asphalt adhesive. Covered with a Class A or B roof covering.	10-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to 3/4" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. 3/4" channel saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	1 7/8	1	—	—	3/4 ^l	3/4 ^l
11. 1 1/2"-deep steel roof deck on steel-framing wood fiber insulation board, 17.5 pcf density on top applied over a 15-lb asphalt-saturated felt. Class A or B roof covering.	11-1.1	Ceiling of gypsum plaster on metal lath. Lath attached to 3/4" furring channels with 0.049" (No. 18 B.W. gage) wire ties spaced 6" on center. 3/4" channels saddle tied to 2" channels with doubled 0.065" (No. 16 B.W. gage) wire ties. 2" channels spaced 36" on center suspended 2" below steel framing and saddle tied with 0.165" (No. 8 B.W. gage) wire. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, gypsum-to-sand aggregate for 1-hour system. For 2-hour system, plaster mix is 1:2 by weight, gypsum-to-sand aggregate.	—	—	1 1/2	1	—	—	7/8 ^g	3/4 ^l

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
12. 1½" deep steel roof deck on steel-framing insulation of rigid board consisting of expanded perlite and fibers impregnated with integral asphalt waterproofing; density 9 to 12 pcf secured to metal roof deck by ½"-wide ribbons of waterproof, cold-process liquid adhesive spaced 6" apart. Steel joist or light steel construction with metal roof deck, insulation, and Class A or B built-up roof covering. ^e	12-1.1	Gypsum-vermiculite plaster on metal lath wire tied at 6" intervals to ¾" furring channels spaced 12" on center and wire tied to 2" runner channels spaced 32" on center. Runners wire tied to bottom chord of steel joists.	—	—	1	—	—	—	7/8	—
13. Double wood floor over wood joists spaced 16" on center. ^{m, n}	13-1.1	Gypsum plaster over 3/8" Type X gypsum lath. Lath initially applied with not less than four 1 1/8" by No. 13 gage by 19/64" head plasterboard blued nails per bearing. Continuous stripping over lath along all joist lines. Stripping consists of 3"-wide strips of metal lath attached by 1 1/2" by No. 11 gage by 1/2" head roofing nails spaced 6" on center. Alternate stripping consists of 3"-wide 0.049" diameter wire stripping weighing 1 pound per square yard and attached by No. 16 gage by 1 1/2" by 3/4" crown width staples, spaced 4" on center. Where alternate stripping is used, the lath nailing shall consist of two nails at each end and one nail at each intermediate bearing. Plaster mixed 1:2 by weight, gypsum-to-sand aggregate.	—	—	—	—	—	—	—	7/8
	13-1.2	Cement or gypsum plaster on metal lath. Lath fastened with 1 1/2" by No. 11 gage by 7/16" head barbed shank roofing nails spaced 5" on center. Plaster mixed 1:2 for scratch coat and 1:3 for brown coat, by weight, cement to sand aggregate.	—	—	—	—	—	—	—	5/8
	13-1.3	Perlite or vermiculite gypsum plaster on metal lath secured to joists with 1 1/2" by No. 11 gage by 7/16" head barbed shank roofing nails spaced 5" on center.	—	—	—	—	—	—	—	5/8
	13-1.4	1/2" Type X gypsum wallboard ^c nailed to joists with 5d cooler ^o or wallboard ^o nails at 6" on center. End joints of wallboard centered on joists.	—	—	—	—	—	—	—	1/2

(continued)

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
14. Plywood stressed skin panels consisting of $\frac{5}{8}$ "-thick interior C-D (exterior glue) top stressed skin on 2" x 6" nominal (minimum) stringers. Adjacent panel edges joined with 8d common wire nails spaced 6" on center. Stringers spaced 12" maximum on center.	14-1.1	$\frac{1}{2}$ "-thick wood fiberboard weighing 15 to 18 pounds per cubic foot installed with long dimension parallel to stringers or $\frac{3}{8}$ " C-D (exterior glue) plywood glued and/or nailed to stringers. Nailing to be with 5d cooler ^o or wallboard ^o nails at 12" on center. Second layer of $\frac{1}{2}$ " Type X gypsum wallboard ^d applied with long dimension perpendicular to joists and attached with 8d cooler ^o or wallboard ^o nails at 6" on center at end joints and 8" on center elsewhere. Wallboard joints staggered with respect to <i>fiberboard</i> joints.	—	—	—	—	—	—	—	1
15. Vermiculite concrete slab proportioned 1:4 (Portland cement to vermiculite aggregate) on a $1\frac{1}{2}$ "-deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019 inch (No. 26 carbon steel sheet gage) or greater. Slab reinforced with 4" x 8" 0.109/0.083" (No. $\frac{12}{14}$ B.W. gage) welded wire mesh.	15-1.1	None	—	—	—	3 ^j	—	—	—	—

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
16. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a 1 ¹ / ₄ "-deep steel deck supported on individually protected steel framing. Slab reinforced with 4" × 8" 0.109/0.083" (No. 1 ² / ₁₄ B.W. gage) welded wire mesh.	16-1.1	None	—	—	—	3 ¹ / ₂ ^j	—	—	—	—
17. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on a 9 ⁷ / ₁₆ "-deep steel deck supported by steel joists 4' on center. Class A or B roof covering on top.	17-1.1	Perlite gypsum plaster on metal lath wire tied to 3 ³ / ₄ " furring channels attached with 0.065" (No. 16 B.W. gage) wire ties to lower chord of joists.	—	2 ^p	2 ^p	—	—	7 ⁷ / ₈	3 ³ / ₄	—

(continued)

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)				
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour	
18. Perlite concrete slab proportioned 1:6 (Portland cement to perlite aggregate) on 1 ¹ / ₄ "-deep steel deck supported on individually protected steel framing. Maximum span of deck 6'-10" where deck is less than 0.019" (No. 26 carbon sheet steel gage) and 8'-0" where deck is 0.019" (No. 26 carbon sheet steel gage) or greater. Slab reinforced with 0.042" (No. 19 B.W. gage) hexagonal wire mesh. Class A or B roof covering on top.	18-1.1	None	—	2 ¹ / ₄ ^P	2 ¹ / ₄ ^P	—	—	—	—	—	—
19. Floor and beam construction consisting of 3"-deep cellular steel floor unit mounted on steel members with 1:4 (proportion of Portland cement to perlite aggregate) perlite-concrete floor slab on top.	19-1.1	Suspended envelope ceiling of perlite gypsum plaster on metal lath attached to ³ / ₄ " cold-rolled channels, secured to 1 ¹ / ₂ " cold-rolled channels spaced 42" on center supported by 0.203 inch (No. 6 B.W. gage) wire 36" on center. Beams in envelope with 3" minimum airspace between beam soffit and lath have a 4-hour rating.	2 ^P	—	—	—	1 ¹	—	—	—	—

(continued)

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 721.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
20. Perlite concrete proportioned 1:6 (Portland cement to perlite aggregate) poured to $\frac{1}{8}$ " thickness above top of corrugations of $1\frac{5}{16}$ "-deep galvanized steel deck maximum span 8'-0" for 0.024" (No. 24 galvanized sheet gage) or 6'-0" for 0.019" (No. 26 galvanized sheet gage) with deck supported by individually protected steel framing. Approved polystyrene foam plastic insulation board having a flame spread not exceeding 75 (1" to 4" thickness) with vent holes that approximate 3 percent of the board surface area placed on top of perlite slurry. A 2' by 4' insulation board contains six $2\frac{3}{4}$ " diameter holes. Board covered with $2\frac{1}{4}$ " minimum perlite concrete slab. Slab reinforced with mesh consisting of 0.042" (No. 19 B.W. gage) galvanized steel wire twisted together to form 2" hexagons with straight 0.065" (No. 16 B.W. gage) galvanized steel wire woven into mesh and spaced 3". Alternate slab reinforcement shall be permitted to consist of 4" x 8", 0.109/0.238" (No. 12/4 B.W. gage), or 2" x 2", 0.083/0.083" (No. 14/14 B.W. gage) welded wire fabric. Class A or B roof covering on top.	20-1.1	None	—	—	Varies	—	—	—	—	—

(continued)

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, c}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
21. Wood joists, wood I-joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with 1/2" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with 8 dnails. The wood structural panel thickness shall be not less than nominal 1/2" nor less than required by Chapter 23.	21-1.1	Base layer 5/8" Type X gypsum wallboard applied at right angles to joist or truss 24" o.c. with 1 1/4" Type S or Type W drywall screws 24" o.c. Face layer 5/8" Type X gypsum wallboard or veneer base applied at right angles to joist or truss through base layer with 1 7/8" Type S or Type W drywall screws 12" o.c. at joints and intermediate joist or truss. Face layer Type G drywall screws placed 2" back on either side of face layer end joints, 12" o.c.	—	—	—	Varies	—	—	—	1 1/4
22. Steel joists, floor trusses and flat or pitched roof trusses spaced a maximum 24" o.c. with 1/2" wood structural panels with exterior glue applied at right angles to top of joist or top chord of trusses with No. 8 screws. The wood structural panel thickness shall be not less than nominal 1/2" nor less than required by Chapter 23.	22-1.1	Base layer 5/8" Type X gypsum board applied at right angles to steel framing 24" on center with 1" Type S dry wall screws spaced 24" on center. Face layer 5/8" Type X gypsum board applied at right angles to steel framing attached through base layer with 1 5/8" Type S dry wall screws 12" on center at end joints and intermediate joints and 1 1/2" Type G dry wall screws 12 inches on center placed 2" back on either side of face layer end joints. Joints of the face layer are offset 24" from the joints of the base layer.	—	—	—	Varies	—	—	—	1 1/4
23. Wood I-joist (minimum joist depth 9 1/4" with a minimum flange depth of 1 5/16" and a minimum flange cross-sectional area of 2.25 square inches) at 24" o.c. spacing with a minimum 1 x 4 (3/4" x 3.5" actual) ledger strip applied parallel to and covering the bottom of the bottom flange of each member, tacked in place. 2" mineral wool insulation, 3.5 pcf (nominal) installed adjacent to the bottom flange of the I-joist and supported by the 1 x 4 ledger strip.	23-1.1	1/2"-deep single-leg resilient channel 16" on center (channels doubled at wallboard end joints), placed perpendicular to the furring strip and joist and attached to each joist by 1 7/8" Type S drywall screws. 5/8" Type C gypsum wallboard applied perpendicular to the channel with end joints staggered not less than 4' and fastened with 1 1/8" Type S drywall screws spaced 7" on center. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5/8

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 721.1(3)—continued
 MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
24. Wood I-joist (minimum I-joist depth 9 ¹ / ₄ " with a minimum flange depth of 1 ¹ / ₂ " and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of 3 ³ / ₈ ") @ 24" o.c., 1 ¹ / ₂ " mineral wool insulation (2.5 pcf-nominal) resting on hat-shaped furring channels.	24-1.1	Minimum 0.026" thick hat-shaped channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 ¹ / ₄ " Type S drywall screws. 5 ⁵ / ₈ " Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with 1 ¹ / ₈ " Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5 ⁵ / ₈
25. Wood I-joist (minimum I-joist depth 9 ¹ / ₄ " with a minimum flange depth of 1 ¹ / ₂ " and a minimum flange cross-sectional area of 5.25 square inches; minimum web thickness of 7 ⁷ / ₁₆ ") @ 24" o.c., 1 ¹ / ₂ " mineral wool insulation (2.5 pcf-nominal) resting on resilient channels.	25-1.1	Minimum 0.019"-thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 ⁵ / ₈ " Type S drywall screws. 5 ⁵ / ₈ " Type C gypsum wallboard applied perpendicular to the channel with end joints staggered and fastened with 1" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. at the wallboard ends. Wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	5 ⁵ / ₈
26. Wood I-joist (minimum I-joist depth 9 ¹ / ₄ " with a minimum flange thickness of 1 ¹ / ₂ " and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of 3 ³ / ₈ ") @ 24" o.c.	26-1.1	Two layers of 1/2" Type X gypsum wallboard applied with the long dimension perpendicular to the I-joists with end joints staggered. The base layer is fastened with 1 ⁵ / ₈ " Type S dry wall screws spaced 12" o.c. and the face layer is fastened with 2" Type S drywall screws spaced 12" o.c. in the field and 8" o.c. on the edges. Face layer end joints shall not occur on the same I-joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with 1 ¹ / ₂ " Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	1

(continued)

TABLE 721.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
27. Wood I-joint (minimum I-joint depth 9 ¹ / ₂ " with a minimum flange depth of 1 ⁵ / ₁₆ " and a minimum flange cross-sectional area of 1.95 square inches; minimum web thickness of 3 ³ / ₈ " @ 24" o.c.	27-1.1	Minimum 0.019" thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 ¹ / ₄ " Type S drywall screws. Two layers of 1 ¹ / ₂ " Type X gypsum wallboard applied with the long dimension perpendicular to the resilient channels with end joints staggered. The base layer is fastened with 1 ¹ / ₄ " Type S drywall screws spaced 12" o.c. and the face layer is fastened with 1 ⁵ / ₈ " Type S drywall screws spaced 12" o.c. Face layer end joints shall not occur on the same I-joint as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to also be attached to base layer with 1 ¹ / ₂ " Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	1
28. Wood I-joint (minimum I-joint depth 9 ¹ / ₄ " with a minimum flange depth of 1 ¹ / ₂ " and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of 3 ³ / ₈ " @ 24" o.c. Unfaced fiberglass insulation or mineral wool insulation is installed between the I-joists supported on the upper surface of the flange by stay wires spaced 12" o.c.	28-1.1	Base layer of 5 ⁵ / ₈ " Type C gypsum wallboard attached directly to I-joists with 1 ⁵ / ₈ " Type S drywall screws spaced 12" o.c. with ends staggered. Minimum 0.0179"-thick hat-shaped 7 ⁷ / ₈ -inch furring channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joist and attached to each joist by 1 ⁵ / ₈ " Type S drywall screws after the base layer of gypsum wallboard has been applied. The middle and face layers of 5 ⁵ / ₈ " Type C gypsum wallboard applied perpendicular to the channel with end joints staggered. The middle layer is fastened with 1" Type S drywall screws spaced 12" o.c. The face layer is applied parallel to the middle layer but with the edge joints offset 24" from those of the middle layer and fastened with 1 ⁵ / ₈ " Type S drywall screws 8" o.c. The joints shall be taped and covered with joint compound.	—	—	—	Varies	—	—	2 ³ / ₄	—
29. Channel-shaped 18 gage steel joists (minimum depth 8") spaced a maximum 24" o.c. supporting tongue-and-groove wood structural panels (nominal minimum 3 ³ / ₄ "-thick) applied perpendicular to framing members. Structural panels attached with 1 ⁵ / ₈ " Type S-12 screws spaced 12" o.c.	29-1.1	Base layer 5 ⁵ / ₈ " Type X gypsum board applied perpendicular to bottom of framing members with 1 ¹ / ₈ " Type S-12 screws spaced 12" o.c. Second layer 5 ⁵ / ₈ " Type X gypsum board attached perpendicular to framing members with 1 ⁵ / ₈ " Type S-12 screws spaced 12" o.c. Second layer joints offset 24" from base layer. Third layer 5 ⁵ / ₈ " Type X gypsum board attached perpendicular to framing members with 2 ³ / ₈ " Type S-12 screws spaced 12" o.c. Third layer joints offset 12" from second layer joints. Hat-shaped 7 ⁷ / ₈ -inch rigid furring channels applied at right angles to framing members over third layer with two 2 ³ / ₈ " TypeS-12 screws at each framing member. Face layer 5 ⁵ / ₈ " Type X gypsum board applied at right angles to furring channels with 1 ¹ / ₈ " Type S screws spaced 12" o.c.	—	—	Varies	—	—	—	3 ³ / ₈	—

(continued)

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 721.1(3)—continued
MINIMUM PROTECTION FOR FLOOR AND ROOF SYSTEMS^{a, q}**

FLOOR OR ROOF CONSTRUCTION	ITEM NUMBER	CEILING CONSTRUCTION	THICKNESS OF FLOOR OR ROOF SLAB (inches)				MINIMUM THICKNESS OF CEILING (inches)			
			4 hours	3 hours	2 hours	1 hour	4 hours	3 hours	2 hours	1 hour
30. Wood I-joist (minimum I-joist depth 9½" with a minimum flange depth of 1½" and a minimum flange cross-sectional area of 2.25 square inches; minimum web thickness of 3⁄8") @ 24" o.c. Fiberglass insulation placed between I-joists supported by the resilient channels.	30-1.1	Minimum 0.019"-thick resilient channel 16" o.c. (channels doubled at wallboard end joints), placed perpendicular to the joists and attached to each joist by 1¼" Type S dry wall screws. Two layers of ½" Type X gypsum wallboard applied with the long dimension perpendicular to the resilient channels with end joints staggered. The base layer is fastened with 1¼" Type S drywall screws spaced 12" o.c. and the face layer is fastened with 1⅝" Type S drywall screws spaced 12" o.c. Face layer end joints shall not occur on the same I-joist as base layer end joints and edge joints shall be offset 24" from base layer joints. Face layer to be attached to base layer with 1½" Type G drywall screws spaced 8" o.c. placed 6" from face layer end joints. Face layer wallboard joints to be taped and covered with joint compound.	—	—	—	Varies	—	—	—	1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m³, 1 pound per square inch = 6.895 kPa, 1 pound per linear foot = 1.4882 kg/m.

- a. Staples with equivalent holding power and penetration shall be permitted to be used as alternate fasteners to nails for attachment to wood framing.
- b. Where the slab is in an unrestrained condition, minimum reinforcement cover shall be not less than 1⅝ inches for 4 hours (siliceous aggregate only); 1¼ inches for 4 and 3 hours; 1 inch for 2 hours (siliceous aggregate only); and ¾ inch for all other restrained and unrestrained conditions.
- c. For all of the construction with gypsum wallboard described in this table, gypsum base for veneer plaster of the same size, thickness and core type shall be permitted to be substituted for gypsum wallboard, provided that attachment is identical to that specified for the wallboard, and the joints on the face layer are reinforced and the entire surface is covered with not less than 1⁄16-inch gypsum veneer plaster.
- d. Slab thickness over steel joists measured at the joists for metal lath form and at the top of the form for steel form units.
- e. (a) The maximum allowable stress level for H-Series joists shall not exceed 22,000 psi.
(b) The allowable stress for K-Series joists shall not exceed 26,000 psi, the nominal depth of such joist shall be not less than 10 inches and the nominal joist weight shall be not less than 5 pounds per linear foot.
- f. Cement plaster with 15 pounds of hydrated lime and 3 pounds of approved additives or admixtures per bag of cement.
- g. Gypsum wallboard ceilings attached to steel framing shall be permitted to be suspended with 1½-inch cold-formed carrying channels spaced 48 inches on center, that are suspended with No. 8 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire hangers spaced 48 inches on center. Cross-furring channels are tied to the carrying channels with No. 18 SWG galvanized wire (double strand) and spaced as required for direct attachment to the framing. This alternative is applicable to those steel framing assemblies recognized under Note q.
- h. Six-inch hollow clay tile with 2-inch concrete slab above.
- i. Four-inch hollow clay tile with 1½-inch concrete slab above.
- j. Thickness measured to bottom of steel form units.
- k. Five-eighths inch of vermiculite gypsum plaster plus ½ inch of approved vermiculite acoustical plastic.
- l. Furring channels spaced 12 inches on center.
- m. Double wood floor shall be permitted to be either of the following:
 - (a) Subfloor of 1-inch nominal boarding, a layer of asbestos paper weighing not less than 14 pounds per 100 square feet and a layer of 1-inch nominal tongue-and-groove finished flooring.
 - (b) Subfloor of 1-inch nominal tongue-and-groove boarding or 15⁄32-inch wood structural panels with exterior glue and a layer of 1-inch nominal tongue-and-groove finished flooring or 19⁄32-inch wood structural panel finish flooring or a layer of Type I Grade M-1 particleboard not less than 5⁄8-inch thick.
- n. The ceiling shall be permitted to be omitted over unusable space, and flooring shall be permitted to be omitted where unusable space occurs above.
- o. For properties of cooler or wallboard nails, see ASTM C514, ASTM C547 or ASTM F1667.
- p. Thickness measured on top of steel deck unit.
- q. Generic fire-resistance ratings (those not designated as PROPRIETARY* in the listing) in the GA 600 shall be accepted as if herein specified.

**TABLE 722.2.1.1
MINIMUM EQUIVALENT THICKNESS OF
CAST-IN-PLACE OR PRECAST CONCRETE WALLS,
LOAD-BEARING OR NONLOAD-BEARING**

CONCRETE TYPE	MINIMUM SLAB THICKNESS (inches) FOR FIRE-RESISTANCE RATING OF				
	1 hour	1½ hours	2 hours	3 hours	4 hours
Siliceous	3.5	4.3	5.0	6.2	7.0
Carbonate	3.2	4.0	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

722.2.1.1.1 Hollow-core precast wall panels. For hollow-core precast concrete wall panels in which the cores are of constant cross section throughout the length, calculation of the equivalent thickness by dividing the net cross-sectional area (the gross cross section minus the area of the cores) of the panel by its width shall be permitted

722.2.1.1.2 Core spaces filled. Where all of the core spaces of hollow-core wall panels are filled with loose-fill material, such as expanded shale, clay or slag, or vermiculite or perlite, the fire-resistance rating of the wall is the same as that of a solid wall of the same concrete type and of the same overall thickness.

722.2.1.1.3 Tapered cross sections. The thickness of panels with tapered cross sections shall be that determined at a distance $2t$ or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.

722.2.1.1.4 Ribbed or undulating surfaces. The equivalent thickness of panels with ribbed or undulating surfaces shall be determined by one of the following expressions:

For $s \geq 4t$, the thickness to be used shall be t

For $s \leq 2t$, the thickness to be used shall be t_e

For $4t > s > 2t$, the thickness to be used shall be

$$t + \left(\frac{4t}{s} - 1\right)(t_e - t) \tag{Equation 7-3}$$

where:

s = Spacing of ribs or undulations.

t = Minimum thickness.

t_e = Equivalent thickness of the panel calculated as the net cross-sectional area of the panel divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.

722.2.1.2 Multiwythe walls. For walls that consist of two wythes of different types of concrete, the fire-resistance ratings shall be permitted to be determined from Figure 722.2.1.2.

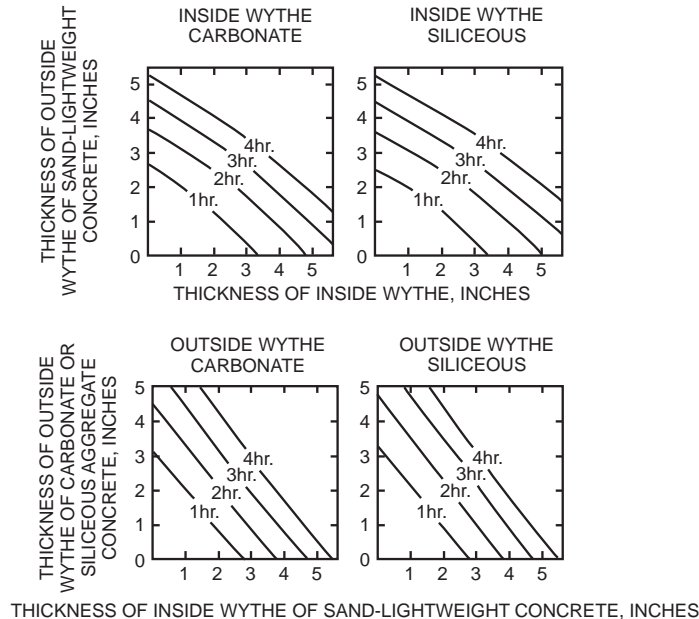
722.2.1.2.1 Two or more wythes. The fire-resistance rating for wall panels consisting of two or more wythes shall be permitted to be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59})^{1.7} \tag{Equation 7-4}$$

where:

R = The fire endurance of the assembly, minutes.

$R_p, R_2,$ and R_n = The fire endurances of the individual wythes, minutes. Values of $R_n^{0.59}$ for use in Equation 7-4 are given in Table 722.2.1.2(1). Calculated fire-resistance ratings are shown in Table 722.2.1.2(2).



For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.1.2
FIRE-RESISTANCE RATINGS OF TWO-WYTHE CONCRETE WALLS**

TABLE 722.2.1.2(1)
VALUES OF $R_n^{0.59}$ FOR USE IN EQUATION 7-4

TYPE OF MATERIAL	THICKNESS OF MATERIAL (inches)											
	1½	2	2½	3	3½	4	4½	5	5½	6	6½	7
Siliceous aggregate concrete	5.3	6.5	8.1	9.5	11.3	13.0	14.9	16.9	18.8	20.7	22.8	25.1
Carbonate aggregate concrete	5.5	7.1	8.9	10.4	12.0	14.0	16.2	18.1	20.3	21.9	24.7	27.2 ^c
Sand-lightweight concrete	6.5	8.2	10.5	12.8	15.5	18.1	20.7	23.3	26.0 ^c	Note c	Note c	Note c
Lightweight concrete	6.6	8.8	11.2	13.7	16.5	19.1	21.9	24.7	27.8 ^c	Note c	Note c	Note c
Insulating concrete ^a	9.3	13.3	16.6	18.3	23.1	26.5 ^c	Note c	Note c	Note c	Note c	Note c	Note c
Airspace ^b	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m³.

- a. Dry unit weight of 35 pcf or less and consisting of cellular, perlite or vermiculite concrete.
- b. The $R_n^{0.59}$ value for one ½" to 3½" airspace is 3.3. The $R_n^{0.59}$ value for two ½" to 3½" airspaces is 6.7.
- c. The fire-resistance rating for this thickness exceeds 4 hours.

TABLE 722.2.1.2(2)
FIRE-RESISTANCE RATINGS BASED ON $R^{0.59}$

R^a , MINUTES	$R^{0.59}$
60	11.20
120	16.85
180	21.41
240	25.37

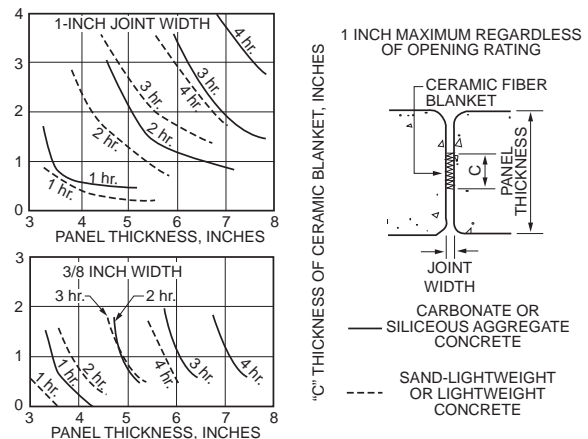
a. Based on Equation 7-4.

722.2.1.2.2 Foam plastic insulation. The fire-resistance ratings of precast concrete wall panels consisting of a layer of foam plastic insulation sandwiched between two wythes of concrete shall be permitted to be determined by use of Equation 7-4. Foam plastic insulation with a total thickness of less than 1 inch (25 mm) shall be disregarded. The R_n value for thickness of foam plastic insulation of 1 inch (25 mm) or greater, for use in the calculation, is 5 minutes; therefore $R_n^{0.59} = 2.5$.

722.2.1.3 Joints between precast wall panels. Joints between precast concrete wall panels that are not insulated as required by this section shall be considered as openings in walls. Uninsulated joints shall be included in determining the percentage of openings permitted by Table 705.8. Where openings are not permitted or are required by this code to be protected, the provisions of this section shall be used to determine the amount of joint insulation required. Insulated joints shall not be considered openings for purposes of determining compliance with the allowable percentage of openings in Table 705.8.

722.2.1.3.1 Ceramic fiber joint protection. Figure 722.2.1.3.1 shows thicknesses of ceramic fiber blankets to be used to insulate joints between precast concrete wall panels for various panel thicknesses and for joint widths of ¾ inch (9.5 mm) and 1 inch (25 mm) for fire-resistance ratings of 1 hour to 4 hours. For joint widths between ¾ inch (9.5 mm) and 1 inch (25 mm), the thickness of ceramic fiber blanket is allowed to be determined by direct

interpolation. Other tested and labeled materials are acceptable in place of ceramic fiber blankets.



For SI: 1 inch = 25.4 mm.

FIGURE 722.2.1.3.1
CERAMIC FIBER JOINT PROTECTION

722.2.1.4 Walls with gypsum wallboard or plaster finishes. The fire-resistance rating of cast-in-place or precast concrete walls with finishes of gypsum wallboard or plaster applied to one or both sides shall be permitted to be calculated in accordance with the provisions of this section.

722.2.1.4.1 Nonfire-exposed side. Where the finish of gypsum wallboard or plaster is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of the finish shall first be corrected by multiplying the actual thickness of the finish by the applicable factor determined from

Table 722.2.1.4(1) based on the type of aggregate in the concrete. The corrected thickness of finish shall then be added to the actual or equivalent thickness of concrete and fire-resistance rating of the concrete and finish determined from Tables 722.2.1.1 and 722.2.1.2(1) and Figure 722.2.1.2.

722.2.1.4.2 Fire-exposed side. Where gypsum wallboard or plaster is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 722.2.1.4(2) shall be added to the fire-resistance rating determined from Tables 722.2.1.1 and 722.2.1.2(1) and Figure 722.2.1.2 for the concrete alone, or to the rating determined in Section 722.2.1.4.1 for the concrete and finish on the nonfire-exposed side.

722.2.1.4.3 Nonsymmetrical assemblies. For a wall without finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of Sections 722.2.1.4.1 and 722.2.1.4.2 shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values.

Exception: For an exterior wall with a fire separation distance greater than 5 feet (1524 mm) the fire shall be assumed to occur on the interior side only.

722.2.1.4.4 Minimum concrete fire-resistance rating. Where finishes applied to one or both sides of a concrete wall contribute to the fire-resistance rating, the concrete alone shall provide not less than one-half of the total required fire-resistance rating. Additionally, the contribution to the fire resistance of the finish on the nonfire-exposed side of a load-bearing wall shall not exceed one-half the contribution of the concrete alone.

722.2.1.4.5 Concrete finishes. Finishes on concrete walls that are assumed to contribute to the total fire-resistance rating of the wall shall comply with the installation requirements of Section 722.3.2.5.

**TABLE 722.2.1.4(2)
TIME ASSIGNED TO FINISH MATERIALS
ON FIRE-EXPOSED SIDE OF WALL**

FINISH DESCRIPTION	TIME (minutes)
Gypsum wallboard	
3/8 inch	10
1/2 inch	15
5/8 inch	20
2 layers of 3/8 inch	25
1 layer of 3/8 inch, 1 layer of 1/2 inch	35
2 layers of 1/2 inch	40
Type X gypsum wallboard	
1/2 inch	25
5/8 inch	40
Portland cement-sand plaster applied directly to concrete masonry	See Note a
Portland cement-sand plaster on metal lath	
3/4 inch	20
7/8 inch	25
1 inch	30
Gypsum sand plaster on 3/8-inch gypsum lath	
1/2 inch	35
5/8 inch	40
3/4 inch	50
Gypsum sand plaster on metal lath	
3/4 inch	50
7/8 inch	60
1 inch	80

For SI: 1 inch = 25.4 mm.

a. The actual thickness of Portland cement-sand plaster, provided that it is 5/8 inch or less in thickness, shall be permitted to be included in determining the equivalent thickness of the masonry for use in Table 722.3.2.

**TABLE 722.2.1.4(1)
MULTIPLYING FACTOR FOR FINISHES ON NONFIRE-EXPOSED SIDE OF WALL**

TYPE OF FINISH APPLIED TO CONCRETE OR CONCRETE MASONRY WALL	TYPE OF AGGREGATE USED IN CONCRETE OR CONCRETE MASONRY			
	Concrete: siliceous or carbonate concrete masonry: siliceous or carbonate; solid clay brick	Concrete: sand-lightweight concrete masonry: clay tile; hollow clay brick; concrete masonry units of expanded shale and < 20% sand	Concrete: lightweight concrete masonry: concrete masonry units of expanded shale, expanded clay, expanded slag, or pumice < 20% sand	Concrete masonry: concrete masonry units of expanded slag, expanded clay, or pumice
Portland cement-sand plaster	1.00	0.75 ^a	0.75 ^a	0.50 ^a
Gypsum-sand plaster	1.25	1.00	1.00	1.00
Gypsum-vermiculite or perlite plaster	1.75	1.50	1.25	1.25
Gypsum wallboard	3.00	2.25	2.25	2.25

For SI: 1 inch = 25.4 mm.

a. For Portland cement-sand plaster 5/8 inch or less in thickness and applied directly to the concrete or concrete masonry on the nonfire-exposed side of the wall, the multiplying factor shall be 1.00.

722.2.2 Concrete floor and roof slabs. Reinforced and prestressed floors and roofs shall comply with Section 722.2.2.1. Multicourse floors and roofs shall comply with Sections 722.2.2.2 and 722.2.2.3, respectively.

722.2.2.1 Reinforced and prestressed floors and roofs. The minimum thicknesses of reinforced and prestressed concrete floor or roof slabs for fire-resistance ratings of 1 hour to 4 hours are shown in Table 722.2.2.1.

Exception: Minimum thickness shall not be required for floors and ramps within parking garages constructed in accordance with Sections 406.5 and 406.6.

**TABLE 722.2.2.1
MINIMUM SLAB THICKNESS (inches)**

CONCRETE TYPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

For SI: 1 inch = 25.4 mm.

722.2.2.1.1 Hollow-core prestressed slabs. For hollow-core prestressed concrete slabs in which the cores are of constant cross section throughout the length, the equivalent thickness shall be permitted to be obtained by dividing the net cross-sectional area of the slab including grout in the joints, by its width.

722.2.2.1.2 Slabs with sloping soffits. The thickness of slabs with sloping soffits (see Figure 722.2.2.1.2) shall be determined at a distance $2t$ or 6 inches (152 mm), whichever is less, from the point of minimum thickness, where t is the minimum thickness.

722.2.2.1.3 Slabs with ribbed soffits. The thickness of slabs with ribbed or undulating soffits (see Figure 722.2.2.1.3) shall be determined by one of the following expressions, whichever is applicable:

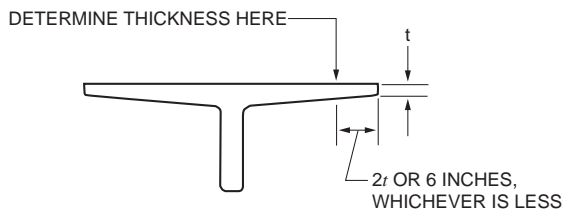
For $s > 4t$, the thickness to be used shall be t

For $s \leq 2t$, the thickness to be used shall be t_e

For $4t > s > 2t$, the thickness to be used shall be

$$t + \left(\frac{4t}{s} - 1\right)(t_e - t) \quad \text{(Equation 7-5)}$$

where:



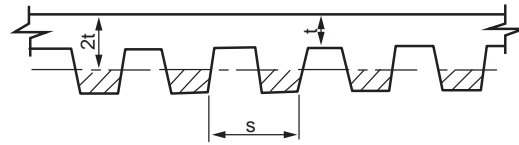
For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2.1.2
DETERMINATION OF SLAB
THICKNESS FOR SLOPING SOFFITS**

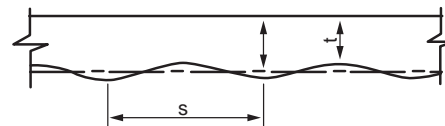
s = Spacing of ribs or undulations.

t = Minimum thickness.

t_e = Equivalent thickness of the slab calculated as the net area of the slab divided by the width, in which the maximum thickness used in the calculation shall not exceed $2t$.



NEGLECT SHADED AREA IN CALCULATION OF EQUIVALENT THICKNESS



For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2.1.3
SLABS WITH RIBBED OR UNDULATING SOFFITS**

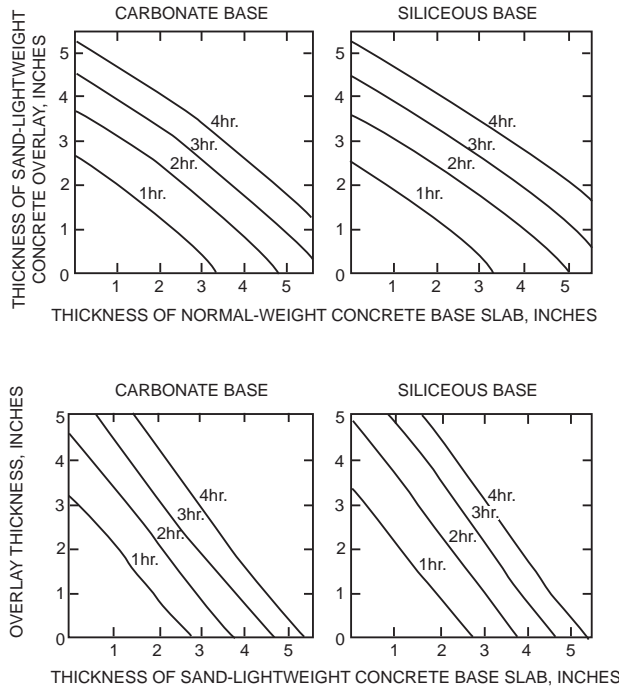
722.2.2.1.4 Flat plate concrete slabs with uniformly spaced hollow voids. Table 722.2.2.1 shall be used to determine the 1- and 2-hour fire-resistance ratings for flat plate concrete slabs with uniformly spaced hollow voids. The equivalent thickness of the slab shall be determined by dividing the net concrete volume of the slab by the floor area. The net concrete volume of the slab shall be equal to the volume of concrete of a solid slab minus the average concrete volume displaced by the hollow voids.

722.2.2.2 Multicourse floors. The fire-resistance ratings of floors that consist of a base slab of concrete with a topping (overlay) of a different type of concrete shall comply with Figure 722.2.2.2.

722.2.2.3 Multicourse roofs. The fire-resistance ratings of roofs that consist of a base slab of concrete with a topping (overlay) of an insulating concrete or with an insulating board and built-up roofing shall comply with Figures 722.2.2.3(1) and 722.2.2.3(2).

722.2.2.3.1 Heat transfer. For the transfer of heat, three-ply built-up roofing contributes 10 minutes to the fire-resistance rating. The fire-resistance rating for concrete assemblies such as those shown in Figure 722.2.2.3(1) shall be increased by 10 minutes. This increase is not applicable to those shown in Figure 722.2.2.3(2).

722.2.2.4 Joints in precast slabs. Joints between adjacent precast concrete slabs need not be considered in calculating the slab thickness provided that a concrete topping not less than 1 inch (25 mm) thick is used. Where concrete topping is not used, joints must be grouted to a depth of not less than one-third the slab thickness at the joint, but not less than 1 inch (25 mm), or the joints must be made fire resistant by other approved methods.



For SI: 1 inch = 25.4 mm.

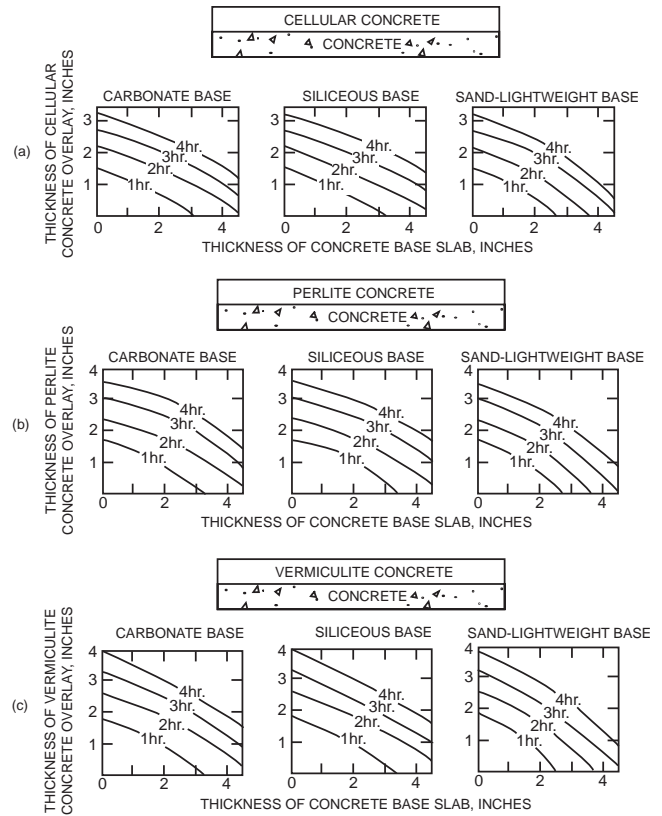
**FIGURE 722.2.2
FIRE-RESISTANCE RATINGS FOR
TWO-COURSE CONCRETE FLOORS**

722.2.3 Concrete cover over reinforcement. The minimum thickness of concrete cover over reinforcement in concrete slabs, reinforced beams and prestressed beams shall comply with this section.

722.2.3.1 Slab cover. The minimum thickness of concrete cover to the positive moment reinforcement shall comply with Table 722.2.3(1) for reinforced concrete and Table 722.2.3(2) for prestressed concrete. These tables are applicable for solid or hollow-core one-way or two-way slabs with flat undersurfaces. These tables are applicable to slabs that are either cast in place or precast. For precast prestressed concrete not covered elsewhere, the procedures contained in PCI 124 shall be acceptable.

722.2.3.2 Reinforced beam cover. The minimum thickness of concrete cover to the positive moment reinforcement (bottom steel) for reinforced concrete beams is shown in Table 722.2.3(3) for fire-resistance ratings of 1 hour to 4 hours.

722.2.3.3 Prestressed beam cover. The minimum thickness of concrete cover to the positive moment prestressing tendons (bottom steel) for restrained and unrestrained prestressed concrete beams and stemmed units shall comply with the values shown in Tables 722.2.3(4) and 722.2.3(5) for fire-resistance ratings of 1 hour to 4 hours. Values in Table 722.2.3(4) apply to beams 8 inches (203 mm) or greater in width. Values



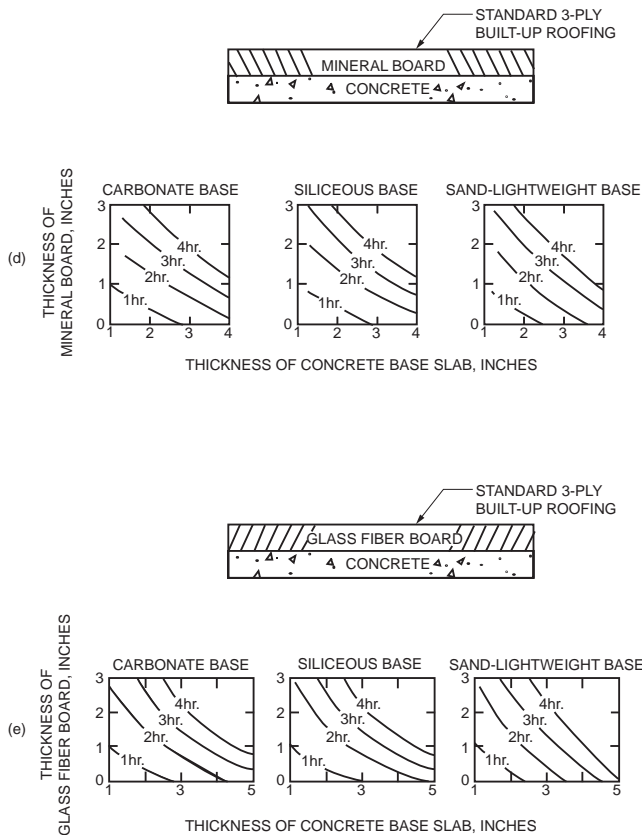
For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.3(1)
FIRE-RESISTANCE RATINGS
FOR CONCRETE ROOF ASSEMBLIES**

in Table 722.2.3(5) apply to beams or stems of any width, provided that the cross-section area is not less than 40 square inches (25 806 mm²). In case of differences between the values determined from Table 722.2.3(4) or 722.2.3(5), it is permitted to use the smaller value. The concrete cover shall be calculated in accordance with Section 722.2.3.3.1. The minimum concrete cover for nonprestressed reinforcement in prestressed concrete beams shall comply with Section 722.2.3.2.

722.2.3.3.1 Calculating concrete cover. The concrete cover for an individual tendon is the minimum thickness of concrete between the surface of the tendon and the fire-exposed surface of the beam, except that for ungrouted ducts, the assumed cover thickness is the minimum thickness of concrete between the surface of the duct and the fire-exposed surface of the beam. For beams in which two or more tendons are used, the cover is assumed to be the average of the minimum cover of the individual tendons. For corner tendons (tendons equal distance from the bottom and side), the minimum cover used in the calculation shall be one-half the actual value. For stemmed members with two or more prestressing

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tendons located along the vertical centerline of the stem, the average cover shall be the distance from the bottom of the member to the centroid of the tendons. The actual cover for any individual tendon shall be not less than one-half the smaller value shown in Tables 722.2.3(4) and 722.2.3(5), or 1 inch (25 mm), whichever is greater.

722.2.4 Concrete columns. Concrete columns shall comply with this section.

**TABLE 722.2.4
MINIMUM DIMENSION OF CONCRETE COLUMNS (inches)**

TYPES OF CONCRETE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2 ^a	3 ^a	4 ^b
Siliceous	8	9	10	12	14
Carbonate	8	9	10	11	12
Sand-lightweight	8	8½	9	10½	12

For SI: 1 inch = 25 mm.

- a. The minimum dimension is permitted to be reduced to 8 inches for rectangular columns with two parallel sides not less than 36 inches in length.
- b. The minimum dimension is permitted to be reduced to 10 inches for rectangular columns with two parallel sides not less than 36 inches in length.

722.2.4.1 Minimum size. The minimum overall dimensions of reinforced concrete columns for fire-resistance ratings of 1 hour to 4 hours for exposure to fire on all sides shall comply with this section.

For SI: 1 inch = 25.4 mm.

**FIGURE 722.2.2.3(2)
FIRE-RESISTANCE RATINGS
FOR CONCRETE ROOF ASSEMBLIES**

**TABLE 722.2.3(1)
COVER THICKNESS FOR REINFORCED CONCRETE FLOOR OR ROOF SLABS (inches)**

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	¾	¾	1	1¼	1⅝
Carbonate	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	¾	¾	¾	1¼	1¼

For SI: 1 inch = 25.4 mm.

**TABLE 722.2.3(2)
COVER THICKNESS FOR PRESTRESSED CONCRETE FLOOR OR ROOF SLABS (inches)**

CONCRETE AGGREGATE TYPE	FIRE-RESISTANCE RATING (hours)									
	Restrained					Unrestrained				
	1	1½	2	3	4	1	1½	2	3	4
Siliceous	¾	¾	¾	¾	¾	1⅛	1½	1¾	2⅜	2¾
Carbonate	¾	¾	¾	¾	¾	1	1⅜	1⅝	2⅛	2¼
Sand-lightweight or lightweight	¾	¾	¾	¾	¾	1	1⅜	1½	2	2¼

For SI: 1 inch = 25.4 mm.

TABLE 722.2.3(3)
MINIMUM COVER FOR MAIN REINFORCING BARS OF REINFORCED CONCRETE BEAMS^c
(APPLICABLE TO ALL TYPES OF STRUCTURAL CONCRETE)

RESTRAINED OR UNRESTRAINED ^a	BEAM WIDTH ^b (inches)	FIRE-RESISTANCE RATING (hours)				
		1	1½	2	3	4
Restrained	5	¾	¾	¾	1 ^a	1¼ ^a
	7	¾	¾	¾	¾	¾
	≥10	¾	¾	¾	¾	¾
Unrestrained	5	¾	1	1¼	—	—
	7	¾	¾	¾	1¾	3
	≥10	¾	¾	¾	1	1¾

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for ratings of 4 hours or less.
- b. For beam widths between the tabulated values, the minimum cover thickness can be determined by direct interpolation.
- c. The cover for an individual reinforcing bar is the minimum thickness of concrete between the surface of the bar and the fire-exposed surface of the beam. For beams in which several bars are used, the cover for corner bars used in the calculation shall be reduced to one-half of the actual value. The cover for an individual bar must be not less than one-half of the value given in Table 722.2.3(3) nor less than ¾ inch.

TABLE 722.2.3(4)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS 8 INCHES OR GREATER IN WIDTH^b

RESTRAINED OR UNRESTRAINED ^a	CONCRETE AGGREGATE TYPE	BEAM WIDTH (inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	Carbonate or siliceous	8	1½	1½	1½	1¾ ^a	2½ ^a
	Carbonate or siliceous	≥ 12	1½	1½	1½	1½	1¾ ^a
	Sand lightweight	8	1½	1½	1½	1½	2 ^a
	Sand lightweight	≥ 12	1½	1½	1½	1½	1¾ ^a
Unrestrained	Carbonate or siliceous	8	1½	¾	2½	5 ^c	—
	Carbonate or siliceous	≥ 12	1½	1½	1¾ ^a	2½	3
	Sand lightweight	8	1½	1½	2	¾	—
	Sand lightweight	≥ 12	1½	1½	1¾	2	2½

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for 4-hour ratings or less.
- b. For beam widths between 8 inches and 12 inches, minimum cover thickness can be determined by direct interpolation.
- c. Not practical for 8-inch-wide beam but shown for purposes of interpolation.

TABLE 722.2.3(5)
MINIMUM COVER FOR PRESTRESSED CONCRETE BEAMS OF ALL WIDTHS

RESTRAINED OR UNRESTRAINED ^a	CONCRETE AGGREGATE TYPE	BEAM AREA ^b A (square inches)	FIRE-RESISTANCE RATING (hours)				
			1	1½	2	3	4
Restrained	All	40 ≤ A ≤ 150	1½	1½	2	2½	—
	Carbonate or siliceous	150 < A ≤ 300	1½	1½	1½	1¾	2½
		300 < A	1½	1½	1½	1½	2
	Sand lightweight	150 < A	1½	1½	1½	1½	2
Unrestrained	All	40 ≤ A ≤ 150	2	2½	—	—	—
	Carbonate or siliceous	150 < A ≤ 300	1½	¾	2½	—	—
		300 < A	1½	1½	2	3 ^c	4 ^c
	Sand lightweight	150 < A	1½	1½	2	3 ^c	4 ^c

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square inch = 645.2 mm².

- a. Tabulated values for restrained assemblies apply to beams spaced more than 4 feet on center. For restrained beams spaced 4 feet or less on center, minimum cover of ¾ inch is adequate for 4-hour ratings or less.
- b. The cross-sectional area of a stem is permitted to include a portion of the area in the flange, provided that the width of the flange used in the calculation does not exceed three times the average width of the stem.
- c. U-shaped or hooped stirrups spaced not to exceed the depth of the member and having a minimum cover of 1 inch shall be provided.

722.2.4.1.1 Concrete strength less than or equal to 12,000 psi. For columns made with concrete having a specified compressive strength, f'_c , of less than or equal to 12,000 psi (82.7 MPa), the minimum dimension shall comply with Table 722.2.4.

722.2.4.1.2 Concrete strength greater than 12,000 psi. For columns made with concrete having a specified compressive strength, f'_c , greater than 12,000 psi (82.7 MPa), for fire-resistance ratings of 1 hour to 4 hours the minimum dimension shall be 24 inches (610 mm).

722.2.4.2 Minimum cover for R/C columns. The minimum thickness of concrete cover to the main longitudinal reinforcement in columns, regardless of the type of aggregate used in the concrete and the specified compressive strength of concrete, f'_c , shall be not less than 1 inch (25 mm) times the number of hours of required fire resistance or 2 inches (51 mm), whichever is less.

722.2.4.3 Tie and spiral reinforcement. For concrete columns made with concrete having a specified compressive strength, f'_c , greater than 12,000 psi (82.7 MPa), tie and spiral reinforcement shall comply with the following:

1. The free ends of rectangular ties shall terminate with a 135-degree (2.4 rad) standard tie hook.
2. The free ends of circular ties shall terminate with a 90-degree (1.6 rad) standard tie hook.
3. The free ends of spirals, including at lap splices, shall terminate with a 90-degree (1.6 rad) standard tie hook.

The hook extension at the free end of ties and spirals shall be the larger of six bar diameters and the extension required by Section 25.3.2 of ACI 318. Hooks shall project into the core of the column.

722.2.4.4 Columns built into walls. The minimum dimensions of Table 722.2.4 do not apply to a reinforced concrete column that is built into a concrete or masonry wall provided that all of the following are met:

1. The fire-resistance rating for the wall is equal to or greater than the required rating of the column.
2. The main longitudinal reinforcing in the column has cover not less than that required by Section 722.2.4.2.
3. Openings in the wall are protected in accordance with Section 716.

Where openings in the wall are not protected as required by Section 716, the minimum dimension of columns required to have a fire-resistance rating of 3 hours or less shall be 8 inches (203 mm), and 10 inches (254 mm) for columns required to have a fire-resistance rating of 4 hours, regardless of the type of aggregate used in the concrete.

722.2.4.5 Precast cover units for steel columns. See Section 722.5.1.4.

722.3 Concrete masonry. The provisions of this section contain procedures by which the fire-resistance ratings of concrete masonry are established by calculations.

722.3.1 Equivalent thickness. The equivalent thickness of concrete masonry construction shall be determined in accordance with the provisions of this section.

722.3.1.1 Concrete masonry unit plus finishes. The equivalent thickness of concrete masonry assemblies, T_{ea} , shall be computed as the sum of the equivalent thickness of the concrete masonry unit, T_e , as determined by Section 722.3.1.2, 722.3.1.3 or 722.3.1.4, plus the equivalent thickness of finishes, T_{ef} , determined in accordance with Section 722.3.2:

$$T_{ea} = T_e + T_{ef} \quad \text{(Equation 7-6)}$$

722.3.1.2 UngROUTED or partially grouted construction. T_e shall be the value obtained for the concrete masonry unit determined in accordance with ASTM C140.

722.3.1.3 Solid grouted construction. The equivalent thickness, T_e , of solid grouted concrete masonry units is the actual thickness of the unit.

722.3.1.4 Airspaces and cells filled with loose-fill material. The equivalent thickness of completely filled hollow concrete masonry is the actual thickness of the unit where loose-fill materials are: sand, pea gravel, crushed stone, or slag that meet ASTM C33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders that comply with ASTM C331; or perlite or vermiculite meeting the requirements of ASTM C549 and ASTM C516, respectively.

722.3.2 Concrete masonry walls. The fire-resistance rating of walls and partitions constructed of concrete masonry units shall be determined from Table 722.3.2. The rating shall be based on the equivalent thickness of the masonry and type of aggregate used.

722.3.2.1 Finish on nonfire-exposed side. Where plaster or gypsum wallboard is applied to the side of the wall not exposed to fire, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The thickness of gypsum wallboard or plaster shall be corrected by multiplying the actual thickness of the finish by applicable factor determined from Table 722.2.1.4(1). This corrected thickness of finish shall be added to the equivalent thickness of masonry and the fire-resistance rating of the masonry and finish determined from Table 722.3.2.

722.3.2.2 Finish on fire-exposed side. Where plaster or gypsum wallboard is applied to the fire-exposed side of the wall, the contribution of the finish to the total fire-resistance rating shall be determined as follows: The time assigned to the finish as established by Table 722.2.1.4(2) shall be added to the fire-resistance rating determined in Section 722.3.2 for the masonry alone, or in Section 722.3.2.1 for the masonry and finish on the nonfire-exposed side.

**TABLE 722.3.2
MINIMUM EQUIVALENT THICKNESS (inches) OF BEARING OR NONBEARING CONCRETE MASONRY WALLS^{a, b, c, d}**

TYPE OF AGGREGATE	FIRE-RESISTANCE RATING (hours)															
	1/2	3/4	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2	2 3/4	3	3 1/4	3 1/2	3 3/4	4	
Pumice or expanded slag	1.5	1.9	2.1	2.5	2.7	3.0	3.2	3.4	3.6	3.8	4.0	4.2	4.4	4.5	4.7	
Expanded shale, clay or slate	1.8	2.2	2.6	2.9	3.3	3.4	3.6	3.8	4.0	4.2	4.4	4.6	4.8	4.9	5.1	
Limestone, cinders or unexpanded slag	1.9	2.3	2.7	3.1	3.4	3.7	4.0	4.3	4.5	4.8	5.0	5.2	5.5	5.7	5.9	
Calcareous or siliceous gravel	2.0	2.4	2.8	3.2	3.6	3.9	4.2	4.5	4.8	5.0	5.3	5.5	5.8	6.0	6.2	

For SI: 1 inch = 25.4 mm.

- a. Values between those shown in the table can be determined by direct interpolation.
- b. Where combustible members are framed into the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall be not less than 93 percent of the thickness shown in the table.
- c. Requirements of ASTM C55, ASTM C73, ASTM C90 or ASTM C744 shall apply.
- d. Minimum required equivalent thickness corresponding to the hourly fire-resistance rating for units with a combination of aggregate shall be determined by linear interpolation based on the percent by volume of each aggregate used in manufacture.

722.3.2.3 Nonsymmetrical assemblies. For a wall without finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side of the wall to be the fire-exposed side. The fire-resistance rating of the wall shall not exceed the lower of the two values calculated.

Exception: For exterior walls with a fire separation distance greater than 5 feet (1524 mm), the fire shall be assumed to occur on the interior side only.

722.3.2.4 Minimum concrete masonry fire-resistance rating. Where the finish applied to a concrete masonry wall contributes to its fire-resistance rating, the masonry alone shall provide not less than one-half the total required fire-resistance rating.

722.3.2.5 Attachment of finishes. Installation of finishes shall be as follows:

1. Gypsum wallboard and gypsum lath applied to concrete masonry or concrete walls shall be secured to wood or steel furring members spaced not more than 16 inches (406 mm) on center (o.c.).
2. Gypsum wallboard shall be installed with the long dimension parallel to the furring members and shall have all joints finished.
3. Other aspects of the installation of finishes shall comply with the applicable provisions of Chapters 7 and 25.

722.3.3 Multiwythe masonry walls. The fire-resistance rating of wall assemblies constructed of multiple wythes of masonry materials shall be permitted to be based on the fire-resistance rating period of each wythe and the continuous airspace between each wythe in accordance with the following formula:

$$R_A = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59} + A_1 + A_2 + \dots + A_n)^{1.7}$$

(Equation 7-7)

where:

R_A = Fire-resistance rating of the assembly (hours).

R_1, R_2, \dots, R_n = Fire-resistance rating of wythes for 1, 2, n (hours), respectively.

A_1, A_2, \dots, A_n = 0.30, factor for each continuous airspace for 1, 2, \dots, n , respectively, having a depth of 1/2 inch (12.7 mm) or more between wythes.

722.3.4 Concrete masonry lintels. Fire-resistance ratings for concrete masonry lintels shall be determined based on the nominal thickness of the lintel and the minimum thickness of concrete masonry or concrete, or any combination thereof, covering the main reinforcing bars, as determined in accordance with Table 722.3.4, or by approved alternate methods.

**TABLE 722.3.4
MINIMUM COVER OF LONGITUDINAL REINFORCEMENT IN FIRE-RESISTANCE-RATED REINFORCED CONCRETE MASONRY LINTELS (inches)**

NOMINAL WIDTH OF LINTEL (inches)	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
6	1 1/2	2	—	—
8	1 1/2	1 1/2	1 3/4	3
10 or greater	1 1/2	1 1/2	1 1/2	1 3/4

For SI: 1 inch = 25.4 mm.

722.3.5 Concrete masonry columns. The fire-resistance rating of concrete masonry columns shall be determined based on the least plan dimension of the column in accordance with Table 722.3.5 or by approved alternate methods.

**TABLE 722.3.5
MINIMUM DIMENSION OF CONCRETE
MASONRY COLUMNS (inches)**

FIRE-RESISTANCE RATING (hours)			
1	2	3	4
8 inches	10 inches	12 inches	14 inches

For SI: 1 inch = 25.4 mm.

722.4 Clay brick and tile masonry. The provisions of this section contain procedures by which the fire-resistance ratings of clay brick and tile masonry are established by calculations.

722.4.1 Masonry walls. The fire-resistance rating of masonry walls shall be based on the equivalent thickness as calculated in accordance with this section. The calculation shall take into account finishes applied to the wall and airspaces between wythes in multiwythe construction.

722.4.1.1 Equivalent thickness. The fire-resistance ratings of walls or partitions constructed of solid or hollow clay masonry units shall be determined from Table 722.4.1(1) or Table 722.4.1(2). The equivalent thickness of the clay masonry unit shall be determined by Equation 7-8 where using Table 722.4.1(1). The fire-resistance rating determined from Table 722.4.1(1) shall be permitted to be used in the calculated fire-resistance rating procedure in Section 722.4.2.

$$T_e = V_n / LH \quad \text{(Equation 7-8)}$$

where:

T_e = The equivalent thickness of the clay masonry unit (inches).

V_n = The net volume of the clay masonry unit (inches).

L = The specified length of the clay masonry unit (inches).

H = The specified height of the clay masonry unit (inches).

722.4.1.1.1 Hollow clay units. The equivalent thickness, T_e , shall be the value obtained for hollow clay units as determined in accordance with Equation 7-8. The net volume, V_n , of the units shall be determined using the gross volume and percentage of void area determined in accordance with ASTM C67.

722.4.1.1.2 Solid grouted clay units. The equivalent thickness of solid grouted clay masonry units shall be taken as the actual thickness of the units.

722.4.1.1.3 Units with filled cores. The equivalent thickness of the hollow clay masonry units is the actual thickness of the unit where completely filled with loose-fill materials of: sand, pea gravel, crushed stone, or slag that meet ASTM C33 requirements; pumice, scoria, expanded shale, expanded clay, expanded slate, expanded slag, expanded fly ash, or cinders in compliance with ASTM C331; or perlite or vermiculite meeting the requirements of ASTM C549 and ASTM C516, respectively.

**TABLE 722.4.1(3)
VALUES OF $R_n^{0.59}$**

$R_n^{0.59}$	R (hours)
1	1.0
2	1.50
3	1.91
4	2.27

**TABLE 722.4.1(4)
COEFFICIENTS FOR PLASTER, pl^a**

THICKNESS OF PLASTER (inch)	ONE SIDE	TWO SIDES
1/2	0.3	0.6
5/8	0.37	0.75
3/4	0.45	0.90

For SI: 1 inch = 25.4 mm.

a. Values specified in the table are for 1:3 sanded gypsum plaster.

**TABLE 722.4.1(1)
FIRE-RESISTANCE PERIODS OF CLAY MASONRY WALLS**

MATERIAL TYPE	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE RESISTANCE ^{a, b, c} (inches)			
	1 hour	2 hours	3 hours	4 hours
Solid brick of clay or shale ^d	2.7	3.8	4.9	6.0
Hollow brick or tile of clay or shale, unfilled	2.3	3.4	4.3	5.0
Hollow brick or tile of clay or shale, grouted or filled with materials specified in Section 722.4.1.1.3	3.0	4.4	5.5	6.6

For SI: 1 inch = 25.4 mm.

a. Equivalent thickness as determined from Section 722.4.1.1.

b. Calculated fire resistance between the hourly increments specified shall be determined by linear interpolation.

c. Where combustible members are framed in the wall, the thickness of solid material between the end of each member and the opposite face of the wall, or between members set in from opposite sides, shall be not less than 93 percent of the thickness shown.

d. For units in which the net cross-sectional area of cored brick in any plane parallel to the surface containing the cores is not less than 75 percent of the gross cross-sectional area measured in the same plane.

TABLE 722.4.1(2)
FIRE-RESISTANCE RATINGS FOR BEARING STEEL FRAME BRICK VENEER WALLS OR PARTITIONS

WALL OR PARTITION ASSEMBLY	PLASTER SIDE EXPOSED (hours)	BRICK FACED SIDE EXPOSED (hours)
Outside facing of steel studs: 1/2" wood fiberboard sheathing next to studs, 3/4" airspace formed with 3/4" x 1 5/8" wood strips placed over the fiberboard and secured to the studs; metal or wire lath nailed to such strips, 3 3/4" brick veneer held in place by filling 3/4" airspace between the brick and lath with mortar. Inside facing of studs: 3/4" unsanded gypsum plaster on metal or wire lath attached to 5/16" wood strips secured to edges of the studs.	1.5	4
Outside facing of steel studs: 1" insulation board sheathing attached to studs, 1" airspace, and 3 3/4" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: 7/8" sanded gypsum plaster (1:2 mix) applied on metal or wire lath attached directly to the studs.	1.5	4
Same as previous assembly except use 7/8" vermiculite-gypsum plaster or 1" sanded gypsum plaster (1:2 mix) applied to metal or wire.	2	4
Outside facing of steel studs: 1/2" gypsum sheathing board, attached to studs, and 3 3/4" brick veneer attached to steel frame with metal ties every 5th course. Inside facing of studs: 1/2" sanded gypsum plaster (1:2 mix) applied to 1/2" perforated gypsum lath securely attached to studs and having strips of metal lath 3 inches wide applied to all horizontal joints of gypsum lath.	2	4

For SI: 1 inch = 25.4 mm.

TABLE 722.4.1(5)
REINFORCED MASONRY LINTELS

NOMINAL LINTEL WIDTH (inches)	MINIMUM LONGITUDINAL REINFORCEMENT COVER FOR FIRE RESISTANCE (inches)			
	1 hour	2 hours	3 hours	4 hours
6	1 1/2	2	NP	NP
8	1 1/2	1 1/2	1 3/4	3
10 or more	1 1/2	1 1/2	1 1/2	1 3/4

For SI: 1 inch = 25.4 mm.

NP = Not Permitted.

TABLE 722.4.1(6)
REINFORCED CLAY MASONRY COLUMNS

COLUMN SIZE	FIRE-RESISTANCE RATING (hours)			
	1	2	3	4
Minimum column dimension (inches)	8	10	12	14

For SI: 1 inch = 25.4 mm.

722.4.1.2 Plaster finishes. Where plaster is applied to the wall, the total fire-resistance rating shall be determined by the formula:

$$R = (R_n^{0.59} + pl)^{1.7} \quad \text{(Equation 7-9)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R_n = The fire-resistance rating of the individual wall (hours).

pl = Coefficient for thickness of plaster.

Values for R_n^{0.59} for use in Equation 7-9 are given in Table 722.4.1(3). Coefficients for thickness of plaster shall be selected from Table 722.4.1(4) based on the actual thickness of plaster applied to the wall or parti-

tion and whether one or two sides of the wall are plastered.

722.4.1.3 Multiwythe walls with airspace. Where a continuous airspace separates multiple wythes of the wall or partition, the total fire-resistance rating shall be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59} + as)^{1.7} \quad \text{(Equation 7-10)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R₁, R₂ and R_n = The fire-resistance rating of the individual wythes (hours).

as = Coefficient for continuous airspace.

Values for R_n^{0.59} for use in Equation 7-10 are given in Table 722.4.1(3). The coefficient for each continuous airspace of 1/2 inch to 3 1/2 inches (12.7 to 89 mm) separating two individual wythes shall be 0.3.

722.4.1.4 Nonsymmetrical assemblies. For a wall without finish on one side or having different types or thicknesses of finish on each side, the calculation procedures of this section shall be performed twice, assuming either side to be the fire-exposed side of the wall. The fire resistance of the wall shall not exceed the lower of the two values determined.

Exception: For exterior walls with a fire separation distance greater than 5 feet (1524 mm), the fire shall be assumed to occur on the interior side only.

722.4.2 Multiwythe walls. The fire-resistance rating for walls or partitions consisting of two or more dissimilar wythes shall be determined by the formula:

$$R = (R_1^{0.59} + R_2^{0.59} + \dots + R_n^{0.59})^{1.7} \quad \text{(Equation 7-11)}$$

where:

R = The fire-resistance rating of the assembly (hours).

R_1, R_2 and R_n = The fire-resistance rating of the individual wythes (hours).

Values for $R_n^{0.59}$ for use in Equation 7-11 are given in Table 722.4.1(3).

722.4.2.1 Multiwythe walls of different material. For walls that consist of two or more wythes of different materials (concrete or concrete masonry units) in combination with clay masonry units, the fire-resistance rating of the different materials shall be permitted to be determined from Table 722.2.1.1 for concrete; Table 722.3.2 for concrete masonry units or Table 722.4.1(1) or Table 722.4.1(2) for clay and tile masonry units.

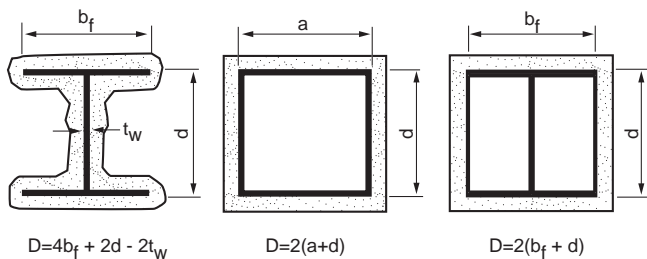
722.4.3 Reinforced clay masonry lintels. Fire-resistance ratings for clay masonry lintels shall be determined based on the nominal width of the lintel and the minimum covering for the longitudinal reinforcement in accordance with Table 722.4.1(5).

722.4.4 Reinforced clay masonry columns. The fire-resistance ratings shall be determined based on the last plan dimension of the column in accordance with Table 722.4.1(6). The minimum cover for longitudinal reinforcement shall be 2 inches (51 mm).

722.5 Steel assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of steel assemblies are established by calculations.

722.5.1 Structural steel columns. The fire-resistance ratings of structural steel columns shall be based on the size of the element and the type of protection provided in accordance with this section.

722.5.1.1 General. These procedures establish a basis for determining the fire resistance of column assemblies as a function of the thickness of fire-resistant material, and the weight, W , and heated perimeter, D , of structural steel columns. As used in these sections, W is the average weight of a structural steel column in pounds per linear foot. The heated perimeter, D , is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 722.5.1(1).



**FIGURE 722.5.1(1)
DETERMINATION OF THE HEATED
PERIMETER OF STRUCTURAL STEEL COLUMNS**

722.5.1.1.1 Nonload-bearing protection. The application of these procedures shall be limited to column assemblies in which the fire-resistant material is not designed to carry any of the load acting on the column.

722.5.1.1.2 Embedments. In the absence of substantiating fire-endurance test results, ducts, conduit, piping, and similar mechanical, electrical, and plumbing installations shall not be embedded in any required fire-resistant materials.

722.5.1.1.3 Weight-to-perimeter ratio. Table 722.5.1(1) contains weight-to-heated-perimeter ratios (W/D) for both contour and box fire-resistant profiles, for the wide flange shapes most often used as columns. For different fire-resistant protection profiles or column cross sections, the weight-to-heated-perimeter ratios (W/D) shall be determined in accordance with the definitions given in this section.

722.5.1.2 Gypsum wallboard protection. The fire resistance of structural steel columns with weight-to-heated-perimeter ratios (W/D) less than or equal to 3.65 and that are protected with Type X gypsum wallboard shall be permitted to be determined from the following expression:

$$R = 130 \left[\frac{h(W/D)}{2} \right]^{0.75} \quad \text{(Equation 7-12)}$$

where:

R = Fire resistance (minutes).

h = Total thickness of gypsum wallboard (inches).

D = Heated perimeter of the structural steel column (inches).

W' = Total weight of the structural steel column and gypsum wallboard protection (pounds per linear foot).

$$W' = W + 50hD/144.$$

722.5.1.2.1 Attachment. The gypsum board or gypsum panel products shall be supported as illustrated in either Figure 722.5.1(2) for fire-resistance ratings of 4 hours or less, or Figure 722.5.1(3) for fire-resistance ratings of 3 hours or less.

722.5.1.2.2 Gypsum wallboard equivalent to concrete. The determination of the fire resistance of structural steel columns from Figure 722.5.1(4) is permitted for various thicknesses of gypsum wallboard as a function of the weight-to-heated-perimeter ratio (W/D) of the column. For structural steel columns with weight-to-heated-perimeter ratios (W/D) greater than 3.65, the thickness of gypsum wallboard required for specified fire-resistance ratings shall be the same as the thickness determined for a W14 × 233 wide flange shape.

**TABLE 722.5.1(1)
W/D RATIOS FOR STEEL COLUMNS**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 × 233	2.55	3.65
× 211	2.32	3.35
× 193	2.14	3.09
× 176	1.96	2.85
× 159	1.78	2.60
× 145	1.64	2.39
× 132	1.56	2.25
× 120	1.42	2.06
× 109	1.29	1.88
× 99	1.18	1.72
× 90	1.08	1.58
× 82	1.23	1.68
× 74	1.12	1.53
× 68	1.04	1.41
× 61	0.928	1.28
× 53	0.915	1.21
× 48	0.835	1.10
× 43	0.752	0.99
W12 × 190	2.50	3.51
× 170	2.26	3.20
× 152	2.04	2.90
× 136	1.86	2.63
× 120	1.65	2.36
× 106	1.47	2.11
× 96	1.34	1.93
× 87	1.22	1.76
× 79	1.11	1.61
× 72	1.02	1.48
× 65	0.925	1.35
× 58	0.925	1.31
× 53	0.855	1.20
× 50	0.909	1.23
× 45	0.829	1.12
× 40	0.734	1.00
W10 × 112	1.81	2.57
× 100	1.64	2.33
× 88	1.45	2.08
× 77	1.28	1.85
× 68	1.15	1.66
× 60	1.01	1.48
× 54	0.922	1.34
× 49	0.84	1.23
× 45	0.888	1.24
× 39	0.78	1.09
× 33	0.661	0.93

(continued)

**TABLE 722.5.1(1)—continued
W/D RATIOS FOR STEEL COLUMNS**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W8 × 67	1.37	1.94
× 58	1.20	1.71
× 48	1.00	1.44
× 40	0.849	1.23
× 35	0.749	1.08
× 31	0.665	0.97
× 28	0.688	0.96
× 24	0.591	0.83
× 21	0.577	0.77
× 18	0.499	0.67
W6 × 25	0.696	1.00
× 20	0.563	0.82
× 16	0.584	0.78
× 15	0.431	0.63
× 12	0.448	0.60
× 9	0.338	0.46
W5 × 19	0.644	0.93
× 16	0.55	0.80
W4 × 13	0.556	0.79

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.5.1(2)
PROPERTIES OF CONCRETE**

PROPERTY	NORMAL-WEIGHT CONCRETE	STRUCTURAL LIGHTWEIGHT CONCRETE
Thermal conductivity (k_c)	0.95 Btu/hr × ft × °F	0.35 Btu/hr × ft × °F
Specific heat (c_c)	0.20 Btu/lb °F	0.20 Btu/lb °F
Density (P_c)	145 lb/ft ³	110 lb/ft ³
Equilibrium (free) moisture content (m) by volume	4%	5%

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 lb/ft³ = 16.0185 kg/m³, Btu/hr × ft × °F = 1.731 W/(m × K).

**TABLE 722.5.1(3)
THERMAL CONDUCTIVITY OF CONCRETE OR CLAY MASONRY UNITS**

DENSITY (ρ_m) OF UNITS (lb/ft ³)	THERMAL CONDUCTIVITY (k) OF UNITS (Btu/hr · ft · °F)
Concrete Masonry Units	
80	0.207
85	0.228
90	0.252
95	0.278
100	0.308
105	0.340
110	0.376
115	0.416
120	0.459
125	0.508
130	0.561
135	0.620
140	0.685
145	0.758
150	0.837
Clay Masonry Units	
120	1.25
130	2.25

For SI: 1 pound per cubic foot = 16.0185 kg/m³, Btu/hr × ft × °F = 1.731 W/(m × K)

TABLE 722.5.1(4)
WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR
TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W36 × 300	2.50	3.33
× 280	2.35	3.12
× 260	2.18	2.92
× 245	2.08	2.76
× 230	1.95	2.61
× 210	1.96	2.45
× 194	1.81	2.28
× 182	1.72	2.15
× 170	1.60	2.01
× 160	1.51	1.90
× 150	1.43	1.79
× 135	1.29	1.63
W33 × 241	2.13	2.86
× 221	1.97	2.64
× 201	1.79	2.42
× 152	1.53	1.94
× 141	1.43	1.80
× 130	1.32	1.67
× 118	1.21	1.53
W30 × 211	2.01	2.74
× 191	1.85	2.50
× 173	1.66	2.28
× 132	1.47	1.85
× 124	1.39	1.75
× 116	1.30	1.65
× 108	1.21	1.54
× 99	1.12	1.42
W27 × 178	1.87	2.55
× 161	1.70	2.33
× 146	1.55	2.12
× 114	1.39	1.76
× 102	1.24	1.59
× 94	1.15	1.47
× 84	1.03	1.33
W24 × 162	1.88	2.57
× 146	1.70	2.34
× 131	1.54	2.12
× 117	1.38	1.91
× 104	1.24	1.71
× 94	1.28	1.63
× 84	1.15	1.47
× 76	1.05	1.34

(continued)

TABLE 722.5.1(4)—continued
WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR
TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W24 × 68	0.942	1.21
× 62	0.934	1.14
× 55	0.828	1.02
W21 × 147	1.87	2.60
× 132	1.68	2.35
× 122	1.57	2.19
× 111	1.43	2.01
× 101	1.30	1.84
× 93	1.40	1.80
× 83	1.26	1.62
× 73	1.11	1.44
× 68	1.04	1.35
W21 × 62	0.952	1.23
× 57	0.952	1.17
× 50	0.838	1.04
× 44	0.746	0.92
W18 × 119	1.72	2.42
× 106	1.55	2.18
× 97	1.42	2.01
× 86	1.27	1.80
× 76	1.13	1.60
× 71	1.22	1.59
× 65	1.13	1.47
× 60	1.04	1.36
× 55	0.963	1.26
× 50	0.88	1.15
× 46	0.878	1.09
× 40	0.768	0.96
× 35	0.672	0.85
W16 × 100	1.59	2.25
× 89	1.43	2.03
× 77	1.25	1.78
× 67	1.09	1.56
× 57	1.09	1.43
× 50	0.962	1.26
× 45	0.870	1.15
× 40	0.780	1.03
× 36	0.702	0.93
× 31	0.661	0.83
× 26	0.558	0.70
W14 × 132	1.89	3.00
× 120	1.71	2.75
× 109	1.57	2.52

(continued)

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.5.1(4)—continued
WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR
TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W14 × 99	1.43	2.31
× 90	1.31	2.11
× 82	1.45	2.12
× 74	1.32	1.93
× 68	1.22	1.78
× 61	1.10	1.61
× 53	1.06	1.48
× 48	0.970	1.35
W14 × 43	0.874	1.22
× 38	0.809	1.09
× 34	0.725	0.98
× 30	0.644	0.87
× 26	0.628	0.79
× 22	0.534	0.68
W12 × 87	1.47	2.34
× 79	1.34	2.14
× 72	1.23	1.97
× 65	1.11	1.79
× 58	1.10	1.69
× 53	1.02	1.55
× 50	1.06	1.54
× 45	0.974	1.40
× 40	0.860	1.25
× 35	0.810	1.11
× 30	0.699	0.96
× 26	0.612	0.84
× 22	0.623	0.77
× 19	0.540	0.67
× 16	0.457	0.57
× 14	0.405	0.50
W10 × 112	2.17	3.38
× 100	1.97	3.07
× 88	1.74	2.75
× 77	1.54	2.45
× 68	1.38	2.20
× 60	1.22	1.97
× 54	1.11	1.79
× 49	1.01	1.64
× 45	1.06	1.59
× 39	0.94	1.40
× 33	0.77	1.20

(continued)

**TABLE 722.5.1(4)—continued
WEIGHT-TO-HEATED-PERIMETER RATIOS (W/D) FOR
TYPICAL WIDE FLANGE BEAM AND GIRDER SHAPES**

STRUCTURAL SHAPE	CONTOUR PROFILE	BOX PROFILE
W10 × 30	0.806	1.12
× 26	0.708	0.98
× 22	0.606	0.84
× 19	0.607	0.78
× 17	0.543	0.70
× 15	0.484	0.63
× 12	0.392	0.51
W8 × 67	1.65	2.55
× 58	1.44	2.26
× 48	1.21	1.91
× 40	1.03	1.63
× 35	0.907	1.44
× 31	0.803	1.29
× 28	0.819	1.24
× 24	0.704	1.07
× 21	0.675	0.96
× 18	0.583	0.84
× 15	0.551	0.74
× 13	0.483	0.65
× 10	0.375	0.51
W6 × 25	0.839	1.33
× 20	0.678	1.09
× 16	0.684	0.96
× 15	0.521	0.83
× 12	0.526	0.75
× 9	0.398	0.57
W5 × 19	0.776	1.24
× 16	0.664	1.07
W4 × 13	0.670	1.05

For SI: 1 pound per linear foot per inch = 0.059 kg/m/mm.

**TABLE 722.5.1(5)
FIRE RESISTANCE OF CONCRETE
MASONRY PROTECTED STEEL COLUMNS**

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1 hour	2 hours	3 hours	4 hours
W14 × 82	80	0.74	1.61	2.36	3.04
	100	0.89	1.85	2.67	3.40
	110	0.96	1.97	2.81	3.57
	120	1.03	2.08	2.95	3.73
W14 × 68	80	0.83	1.70	2.45	3.13
	100	0.99	1.95	2.76	3.49
	110	1.06	2.06	2.91	3.66
	120	1.14	2.18	3.05	3.82
W14 × 53	80	0.91	1.81	2.58	3.27
	100	1.07	2.05	2.88	3.62
	110	1.15	2.17	3.02	3.78
	120	1.22	2.28	3.16	3.94
W14 × 43	80	1.01	1.93	2.71	3.41
	100	1.17	2.17	3.00	3.74
	110	1.25	2.28	3.14	3.90
	120	1.32	2.38	3.27	4.05
W12 × 72	80	0.81	1.66	2.41	3.09
	100	0.91	1.88	2.70	3.43
	110	0.99	1.99	2.84	3.60
	120	1.06	2.10	2.98	3.76
W12 × 58	80	0.88	1.76	2.52	3.21
	100	1.04	2.01	2.83	3.56
	110	1.11	2.12	2.97	3.73
	120	1.19	2.23	3.11	3.89
W12 × 50	80	0.91	1.81	2.58	3.27
	100	1.07	2.05	2.88	3.62
	110	1.15	2.17	3.02	3.78
	120	1.22	2.28	3.16	3.94
W12 × 40	80	1.01	1.94	2.72	3.41
	100	1.17	2.17	3.01	3.75
	110	1.25	2.28	3.14	3.90
	120	1.32	2.39	3.27	4.06
W10 × 68	80	0.72	1.58	2.33	3.01
	100	0.87	1.83	2.65	3.38
	110	0.94	1.95	2.79	3.55
	120	1.01	2.06	2.94	3.72
W10 × 54	80	0.88	1.76	2.53	3.21
	100	1.04	2.01	2.83	3.57
	110	1.11	2.12	2.98	3.73
	120	1.19	2.24	3.12	3.90

(continued)

**TABLE 722.5.1(5)—continued
FIRE RESISTANCE OF CONCRETE
MASONRY PROTECTED STEEL COLUMNS**

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1 hour	2 hours	3 hours	4 hours
W10 × 45	80	0.92	1.83	2.60	3.30
	100	1.08	2.07	2.90	3.64
	110	1.16	2.18	3.04	3.80
	120	1.23	2.29	3.18	3.96
W10 × 33	80	1.06	2.00	2.79	3.49
	100	1.22	2.23	3.07	3.80
	110	1.30	2.34	3.20	3.96
	120	1.37	2.44	3.33	4.12
W8 × 40	80	0.94	1.85	2.63	3.33
	100	1.10	2.10	2.93	3.67
	110	1.18	2.21	3.07	3.83
	120	1.25	2.32	3.20	3.99
W8 × 31	80	1.06	2.00	2.78	3.49
	100	1.22	2.23	3.07	3.81
	110	1.29	2.33	3.20	3.97
	120	1.36	2.44	3.33	4.12
W8 × 24	80	1.14	2.09	2.89	3.59
	100	1.29	2.31	3.16	3.90
	110	1.36	2.42	3.28	4.05
	120	1.43	2.52	3.41	4.20
W8 × 18	80	1.22	2.20	3.01	3.72
	100	1.36	2.40	3.25	4.01
	110	1.42	2.50	3.37	4.14
	120	1.48	2.59	3.49	4.28
8 × 8 × 1/2 wall thickness	80	0.77	1.66	2.44	3.13
	100	0.92	1.91	2.75	3.49
	110	1.00	2.02	2.89	3.66
	120	1.07	2.14	3.03	3.82
8 × 8 × 3/8 wall thickness	80	0.91	1.84	2.63	3.33
	100	1.07	2.08	2.92	3.67
	110	1.14	2.19	3.06	3.83
	120	1.21	2.29	3.19	3.98
8 × 8 × 1/4 wall thickness	80	1.10	2.06	2.86	3.57
	100	1.25	2.28	3.13	3.87
	110	1.32	2.38	3.25	4.02
	120	1.39	2.48	3.38	4.17
6 × 6 × 1/2 wall thickness	80	0.82	1.75	2.54	3.25
	100	0.98	1.99	2.84	3.59
	110	1.05	2.10	2.98	3.75
	120	1.12	2.21	3.11	3.91

(continued)

FIRE AND SMOKE PROTECTION FEATURES

TABLE 722.5.1(5)—continued
FIRE RESISTANCE OF CONCRETE
MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_a (inches)			
		1 hour	2 hours	3 hours	4 hours
$6 \times 6 \times \frac{3}{8}$ wall thickness	80	0.96	1.91	2.71	3.42
	100	1.12	2.14	3.00	3.75
	110	1.19	2.25	3.13	3.90
	120	1.26	2.35	3.26	4.05
$6 \times 6 \times \frac{1}{4}$ wall thickness	80	1.14	2.11	2.92	3.63
	100	1.29	2.32	3.18	3.93
	110	1.36	2.43	3.30	4.08
	120	1.42	2.52	3.43	4.22
$4 \times 4 \times \frac{1}{2}$ wall thickness	80	0.93	1.90	2.71	3.43
	100	1.08	2.13	2.99	3.76
	110	1.16	2.24	3.13	3.91
	120	1.22	2.34	3.26	4.06
$4 \times 4 \times \frac{3}{8}$ wall thickness	80	1.05	2.03	2.84	3.57
	100	1.20	2.25	3.11	3.88
	110	1.27	2.35	3.24	4.02
	120	1.34	2.45	3.37	4.17
$4 \times 4 \times \frac{1}{4}$ wall thickness	80	1.21	2.20	3.01	3.73
	100	1.35	2.40	3.26	4.02
	110	1.41	2.50	3.38	4.16
	120	1.48	2.59	3.50	4.30
6 double extra strong 0.864 wall thickness	80	0.59	1.46	2.23	2.92
	100	0.73	1.71	2.54	3.29
	110	0.80	1.82	2.69	3.47
	120	0.86	1.93	2.83	3.63
6 extra strong 0.432 wall thickness	80	0.94	1.90	2.70	3.42
	100	1.10	2.13	2.98	3.74
	110	1.17	2.22	3.11	3.89
	120	1.24	2.34	3.24	4.04
6 standard 0.280 wall thickness	80	1.14	2.12	2.93	3.64
	100	1.29	2.33	3.19	3.94
	110	1.36	2.43	3.31	4.08
	120	1.42	2.53	3.43	4.22
5 double extra strong 0.750 wall thickness	80	0.70	1.61	2.40	3.12
	100	0.85	1.86	2.71	3.47
	110	0.91	1.97	2.85	3.63
	120	0.98	2.02	2.99	3.79
5 extra strong 0.375 wall thickness	80	1.04	2.01	2.83	3.54
	100	1.19	2.23	3.09	3.85
	110	1.26	2.34	3.22	4.00
	20	1.32	2.44	3.34	4.14

(continued)

TABLE 722.5.1(5)—continued
FIRE RESISTANCE OF CONCRETE
MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CONCRETE MASONRY DENSITY POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CONCRETE MASONRY PROTECTION ASSEMBLY, T_a (inches)			
		1 hour	2 hours	3 hours	4 hours
5 standard 0.258 wall thickness	80	1.20	2.19	3.00	3.72
	100	1.34	2.39	3.25	4.00
	110	1.41	2.49	3.37	4.14
	120	1.47	2.58	3.49	4.28
4 double extra strong 0.674 wall thickness	80	0.80	1.75	2.56	3.28
	100	0.95	1.99	2.85	3.62
	110	1.02	2.10	2.99	3.78
	120	1.09	2.20	3.12	3.93
4 extra strong 0.337 wall thickness	80	1.12	2.11	2.93	3.65
	100	1.26	2.32	3.19	3.95
	110	1.33	2.42	3.31	4.09
	120	1.40	2.52	3.43	4.23
4 standard 0.237 wall thickness	80	1.26	2.25	3.07	3.79
	100	1.40	2.45	3.31	4.07
	110	1.46	2.55	3.43	4.21
	120	1.53	2.64	3.54	4.34

For SI: 1 inch = 25.4 mm, 1 pound per cubic feet = 16.02 kg/m³.

Note: Tabulated values assume 1-inch air gap between masonry and steel section.

TABLE 722.5.1(6)
FIRE RESISTANCE OF CLAY MASONRY PROTECTED STEEL COLUMNS

COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)				COLUMN SIZE	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
W14 × 82	120	1.23	2.42	3.41	4.29	W10 × 68	120	1.27	2.46	3.26	4.35
	130	1.40	2.70	3.78	4.74		130	1.44	2.75	3.83	4.80
W14 × 68	120	1.34	2.54	3.54	4.43	W10 × 54	120	1.40	2.61	3.62	4.51
	130	1.51	2.82	3.91	4.87		130	1.58	2.89	3.98	4.95
W14 × 53	120	1.43	2.65	3.65	4.54	W10 × 45	120	1.44	2.66	3.67	4.57
	130	1.61	2.93	4.02	4.98		130	1.62	2.95	4.04	5.01
W14 × 43	120	1.54	2.76	3.77	4.66	W10 × 33	120	1.59	2.82	3.84	4.73
	130	1.72	3.04	4.13	5.09		130	1.77	3.10	4.20	5.13
W12 × 72	120	1.32	2.52	3.51	4.40	W8 × 40	120	1.47	2.70	3.71	4.61
	130	1.50	2.80	3.88	4.84		130	1.65	2.98	4.08	5.04
W12 × 58	120	1.40	2.61	3.61	4.50	W8 × 31	120	1.59	2.82	3.84	4.73
	130	1.57	2.89	3.98	4.94		130	1.77	3.10	4.20	5.17
W12 × 50	120	1.43	2.65	3.66	4.55	W8 × 24	120	1.66	2.90	3.92	4.82
	130	1.61	2.93	4.02	4.99		130	1.84	3.18	4.28	5.25
W12 × 40	120	1.54	2.77	3.78	4.67	W8 × 18	120	1.75	3.00	4.01	4.91
	130	1.72	3.05	4.14	5.10		130	1.93	3.27	4.37	5.34
STEEL TUBING						STEEL PIPE					
NOMINAL TUBE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)				NOMINAL PIPE SIZE (inches)	CLAY MASONRY DENSITY, POUNDS PER CUBIC FOOT	MINIMUM REQUIRED EQUIVALENT THICKNESS FOR FIRE-RESISTANCE RATING OF CLAY MASONRY PROTECTION ASSEMBLY, T_e (inches)			
		1 hour	2 hours	3 hours	4 hours			1 hour	2 hours	3 hours	4 hours
4 × 4 × 1/2 wall thickness	120	1.44	2.72	3.76	4.68	4 double extra strong 0.674 wall thickness	120	1.26	2.55	3.60	4.52
	130	1.62	3.00	4.12	5.11		130	1.42	2.82	3.96	4.95
4 × 4 × 3/8 wall thickness	120	1.56	2.84	3.88	4.78	4 extra strong 0.337 wall thickness	120	1.60	2.89	3.92	4.83
	130	1.74	3.12	4.23	5.21		130	1.77	3.16	4.28	5.25
4 × 4 × 1/4 wall thickness	120	1.72	2.99	4.02	4.92	4 standard 0.237 wall thickness	120	1.74	3.02	4.05	4.95
	130	1.89	3.26	4.37	5.34		130	1.92	3.29	4.40	5.37
6 × 6 × 1/2 wall thickness	120	1.33	2.58	3.62	4.52	5 double extra strong 0.750 wall thickness	120	1.17	2.44	3.48	4.40
	130	1.50	2.86	3.98	4.96		130	1.33	2.72	3.84	4.83
6 × 6 × 3/8 wall thickness	120	1.48	2.74	3.76	4.67	5 extra strong 0.375 wall thickness	120	1.55	2.82	3.85	4.76
	130	1.65	3.01	4.13	5.10		130	1.72	3.09	4.21	5.18
6 × 6 × 1/4 wall thickness	120	1.66	2.91	3.94	4.84	5 standard 0.258 wall thickness	120	1.71	2.97	4.00	4.90
	130	1.83	3.19	4.30	5.27		130	1.88	3.24	4.35	5.32
8 × 8 × 1/2 wall thickness	120	1.27	2.50	3.52	4.42	6 double extra strong 0.864 wall thickness	120	1.04	2.28	3.32	4.23
	130	1.44	2.78	3.89	4.86		130	1.19	2.60	3.68	4.67
8 × 8 × 3/8 wall thickness	120	1.43	2.67	3.69	4.59	6 extra strong 0.432 wall thickness	120	1.45	2.71	3.75	4.65
	130	1.60	2.95	4.05	5.02		130	1.62	2.99	4.10	5.08
8 × 8 × 1/4 wall thickness	120	1.62	2.87	3.89	4.78	6 standard 0.280 wall thickness	120	1.65	2.91	3.94	4.84
	130	1.79	3.14	4.24	5.21		130	1.82	3.19	4.30	5.27

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m³.

FIRE AND SMOKE PROTECTION FEATURES

TABLE 722.5.1(7)
MINIMUM COVER (inch) FOR STEEL COLUMNS
ENCASED IN NORMAL-WEIGHT CONCRETE^a
[FIGURE 722.5.1(6)(c)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)							
	1	1½	2	3	4			
W14 × 233	1	1	1	1½	2			
× 176				2½				
× 132								
× 90				1½	2	3		
× 61								
× 48								
× 43				1½	2½			
W12 × 152	1	1	1	2	2½			
× 96				2				
× 65								
× 50					1½	1½	2½	3
× 40								
W10 × 88	1	1½	1½	2	3			
× 49	1			2½	3			
× 45								
× 39								
× 33						2	3½	
× 33								
W8 × 67						1	1	1½
× 58								
× 48								
× 31	1½	2	3	3½				
× 21								
× 18					4			
× 18								
W6 × 25	1	1½	2	3	3½			
× 20								
× 16								
× 15		2	2½	3½	4			
× 9						1½		

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based on the assumed properties of normal-weight concrete given in Table 722.5.1(2).

TABLE 722.5.1(8)
MINIMUM COVER (inch) FOR STEEL COLUMNS
ENCASED IN STRUCTURAL LIGHTWEIGHT CONCRETE^a
[FIGURE 722.5.1(6)(c)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (HOURS)					
	1	1½	2	3	4	
W14 × 233	1	1	1	1	1½	
× 193				2		
× 74						
× 61				1½	2	2½
× 43						
× 43						
W12 × 65				1	1	1
× 53	2	2½				
× 40						
W10 × 112	1	1	1	1½	2	
× 88				2	2½	
× 60						
× 33						1½
W8 × 35	1	1	1½	2	2½	
× 28				2	3	
× 24						
× 18						2½
× 18						

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based on the assumed properties of structural lightweight concrete given in Table 722.5.1(2).

TABLE 722.5.1(9)
MINIMUM COVER (inch) FOR STEEL COLUMNS
IN NORMAL-WEIGHT PRECAST COVERS^a
[FIGURE 722.5.1 (6)(a)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)					
	1	1½	2	3	4	
W14 × 233	1½	1½	1½	2½	3	
× 211			2		3½	
× 176				2		4
× 145		2	4½			
× 109				2	4½	
× 99		2	4½			
× 61				2	4½	
× 43		2	4½			
W12 × 190				1½	1½	1½
× 152	2	4				
× 120			2			4
× 96	2	4½				
× 87			2		4½	
× 58	2	4½				
× 40			2		4½	
W10 × 112	1½	1½				2
× 88			2		3	
× 77		2		3½		
× 54			2		4½	
× 33		2		4½		
W8 × 67	1½		1½		2	3
× 58		2		3½		
× 48			2		3½	
× 28		2½		4		
× 21			2½		4	
× 18		2½		4		
W6 × 25			1½		2	2½
× 20	2½	3				
× 16				2½	3	
× 12	2	4				
× 9				2	5	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based on the assumed properties of normal-weight concrete given in Table 722.5.1(2).

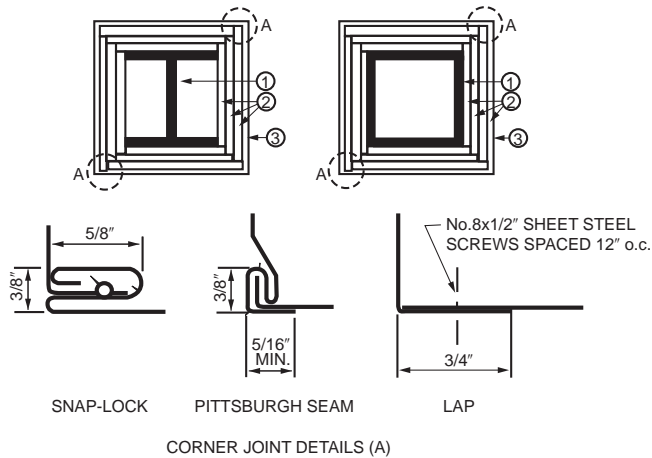
TABLE 722.5.1(10)
MINIMUM COVER (inch) FOR STEEL COLUMNS
IN STRUCTURAL LIGHTWEIGHT PRECAST COVERS^a
[FIGURE 722.5.1 (6)(a)]

STRUCTURAL SHAPE	FIRE-RESISTANCE RATING (hours)				
	1	1½	2	3	4
W14 × 233	1½	1½	1½	2	2½
× 176				2½	3
× 145					
× 132			2½	3	
× 109					2
× 99			2	3½	
× 68					2
× 43			2	3½	
W12 × 190					1½
× 152	2	3			
× 136			2½	3	
× 106	2½	3½			
× 96			2	3½	
× 87	2	3½			
× 65			2	3½	
× 40	2	3½			
W10 × 112			1½	1½	
× 100	2½	3			
× 88					2
× 77	2	3½			
× 60					2
× 39	2	3½			
× 33					2
W8 × 67	1½	1½	1½	2½	
× 48			2	3	
× 35					2
× 28			2	3	
× 18					2
× 9			2	3	
W6 × 25	1½	2			2
× 15			2½	3	
× 9					2½
× 9			2½	3	

For SI: 1 inch = 25.4 mm.

a. The tabulated thicknesses are based on the assumed properties of structural lightweight concrete given in Table 722.5.1(2).

FIRE AND SMOKE PROTECTION FEATURES



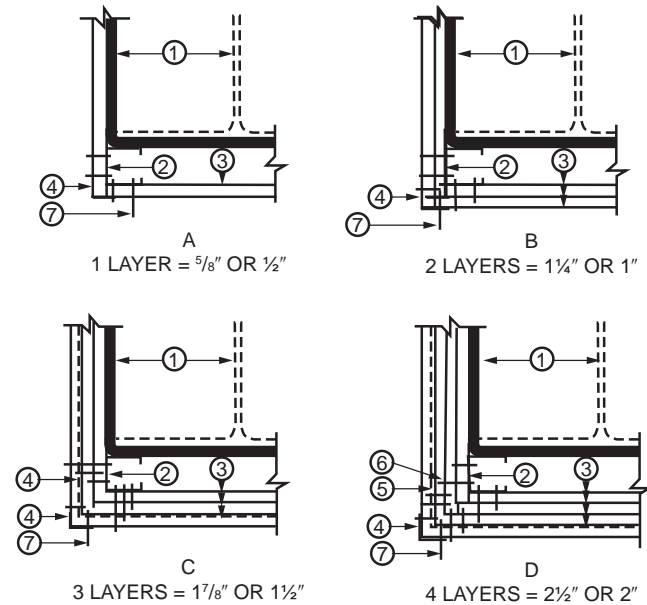
For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. Type X gypsum board or gypsum panel products in accordance with ASTM C1177, C1178, C1278, C1396 or C1658. The total thickness of gypsum board or gypsum panel products calculated as h in Section 722.5.1.2 shall be applied vertically to an individual column using one of the following methods:

1. As a single layer without horizontal joints.
2. As multiple layers with horizontal joints not permitted in any layer.
3. As multiple layers with horizontal joints staggered not less than 12 inches vertically between layers and not less than 8 feet vertically in any single layer. The total required thickness of gypsum board or gypsum panel products shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (W/D) of the column. For fire-resistance ratings of 2 hours or less, one of the required layers of gypsum board or gypsum panel product may be applied to the exterior of the sheet steel column covers with 1-inch long Type S screws spaced 1 inch from the wallboard edge and 8 inches on center. For such installations, 0.0149-inch minimum thickness galvanized steel corner beads with 1 1/2-inch legs shall be attached to the wallboard with Type S screws spaced 12 inches on center.

3. For fire-resistance ratings of 3 hours or less, the column covers shall be fabricated from 0.0239-inch minimum thickness galvanized or stainless steel. For 4-hour fire-resistance ratings, the column covers shall be fabricated from 0.0239-inch minimum thickness stainless steel. The column covers shall be erected with the Snap Lock or Pittsburgh joint details. For fire-resistance ratings of 2 hours or less, column covers fabricated from 0.0269-inch minimum thickness galvanized or stainless steel shall be permitted to be erected with lap joints. The lap joints shall be permitted to be located anywhere around the perimeter of the column cover. The lap joints shall be secured with 1/2-inch-long No. 8 sheet metal screws spaced 12 inches on center. The column covers shall be provided with a minimum expansion clearance of 1/8 inch per linear foot between the ends of the cover and any restraining construction.

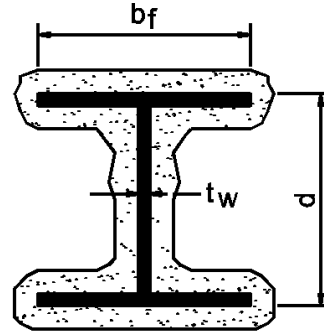
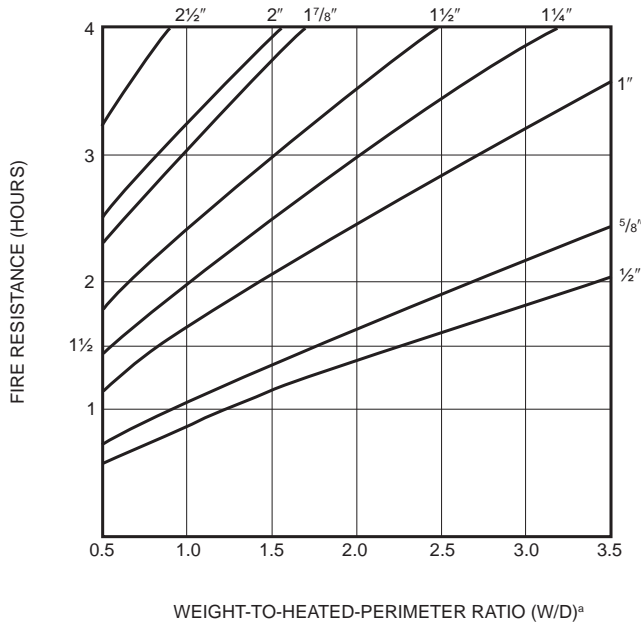
FIGURE 722.5.1(2)
GYPSUM-PROTECTED STRUCTURAL
STEEL COLUMNS WITH SHEET STEEL COLUMN COVERS



For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. Structural steel column, either wide flange or tubular shapes.
2. 1 5/8-inch deep studs fabricated from 0.0179-inch minimum thickness galvanized steel with 1 5/16 or 1 7/16-inch legs. The length of the steel studs shall be 1/2 inch less than the height of the assembly.
3. Type X gypsum board or gypsum panel products in accordance with ASTM C1177, C1178, C1278, C1396 or C1658. The total thickness of gypsum board or gypsum panel products calculated as h in Section 722.5.1.2 shall be applied vertically to an individual column using one of the following methods:
 1. As a single layer without horizontal joints.
 2. As multiple layers with horizontal joints not permitted in any layer.
 3. As multiple layers with horizontal joints staggered not less than 12 inches vertically between layers and not less than 8 feet vertically in any single layer. The total required thickness of gypsum board or gypsum panel products shall be determined on the basis of the specified fire-resistance rating and the weight-to-heated-perimeter ratio (W/D) of the column.
4. Galvanized 0.0149-inch minimum thickness steel corner beads with 1 1/2-inch legs attached to the gypsum board or gypsum panel products with 1-inch-long Type S screws spaced 12 inches on center.
5. No. 18 SWG steel tie wires spaced 24 inches on center.
6. Sheet metal angles with 2-inch legs fabricated from 0.0221-inch minimum thickness galvanized steel.
7. Type S screws, 1 inch long, shall be used for attaching the first layer of gypsum board or gypsum panel product to the steel studs and the third layer to the sheet metal angles at 24 inches on center. Type S screws 1 3/4 inches long shall be used for attaching the second layer of gypsum board or gypsum panel product to the steel studs and the fourth layer to the sheet metal angles at 12 inches on center. Type S screws 2 1/4 inches long shall be used for attaching the third layer of gypsum board or gypsum panel product to the steel studs at 12 inches on center.

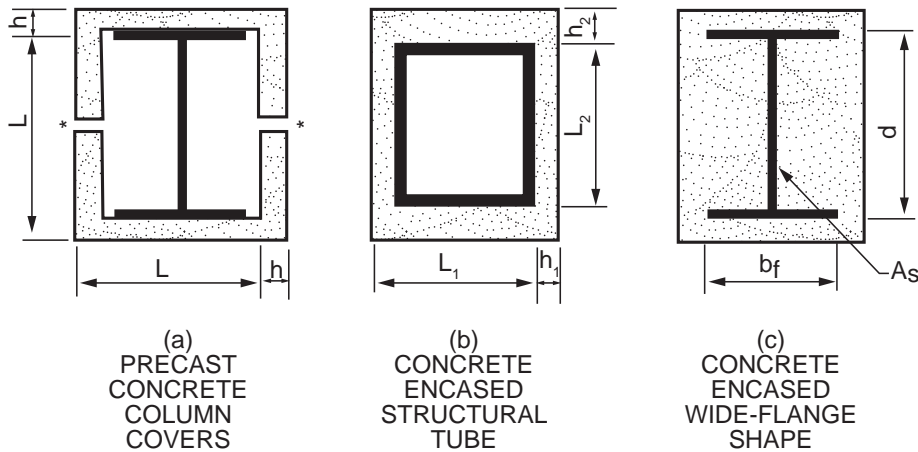
FIGURE 722.5.1(3)
GYPSUM-PROTECTED STRUCTURAL STEEL COLUMNS
WITH STEEL STUD/SCREW ATTACHMENT SYSTEM



**FIGURE 722.5.1(5)
WIDE FLANGE STRUCTURAL STEEL COLUMNS WITH
SPRAYED FIRE-RESISTANT MATERIALS**

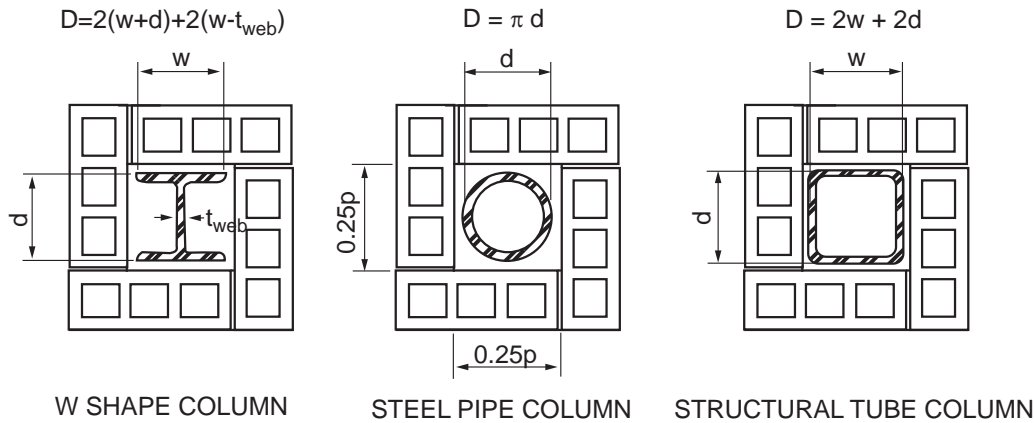
For SI: 1 inch = 25.4 mm, 1 pound per linear foot/inch = 0.059 kg/m/mm.
a. The W/D ratios for typical wide flange columns are listed in Table 722.5.1(1). For other column shapes, the W/D ratios shall be determined in accordance with Section 722.5.1.1.

**FIGURE 722.5.1(4)
FIRE RESISTANCE OF STRUCTURAL
STEEL COLUMNS PROTECTED WITH VARIOUS
THICKNESSES OF TYPE X GYPSUM WALLBOARD**



a. Where the inside perimeter of the concrete protection is not square, L shall be taken as the average of L_1 and L_2 . Where the thickness of concrete cover is not constant, h shall be taken of the average of h_1 and h_2 .
b. Joints shall be protected with not less than a 1-inch thickness of ceramic fiber blanket but in no case less than one-half the thickness of the column cover (see Section 722.2.1.3).

**FIGURE 722.5.1(6)
CONCRETE PROTECTED STRUCTURAL STEEL COLUMNS^{a, b}**



For SI: 1 inch = 25.4 mm.

d = Depth of a wide flange column, outside diameter of pipe column, or outside dimension of structural tubing column (inches).

t_{web} = Thickness of web of wide flange column (inches).

w = Width of flange of wide-flange column (inches).

FIGURE 722.5.1(7)
CONCRETE OR CLAY MASONRY PROTECTED STRUCTURAL STEEL COLUMNS

722.5.1.3 Sprayed fire-resistant materials. The fire resistance of wide-flange structural steel columns protected with sprayed fire-resistant materials, as illustrated in Figure 722.5.1(5), shall be permitted to be determined from the following expression:

$$R = [C_1(W/D) + C_2]h \quad \text{(Equation 7-13)}$$

where:

R = Fire resistance (minutes).

h = Thickness of sprayed fire-resistant material (inches).

D = Heated perimeter of the structural steel column (inches).

C_1 and C_2 = Material-dependent constants.

W = Weight of structural steel columns (pounds per linear foot).

The fire resistance of structural steel columns protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

722.5.1.3.1 Material-dependent constants. The material-dependent constants, C_1 and C_2 , shall be determined for specific fire-resistant materials on the basis of standard fire endurance tests in accordance with Section 703.2. Unless evidence is submitted to the building official substantiating a broader application, this expression shall be limited to determining the fire resistance of structural steel columns with weight-to-heated-perimeter ratios (W/D) between the largest and smallest columns for which standard fire-resistance test results are available.

722.5.1.3.2 Identification. Sprayed fire-resistant materials shall be identified by density and thickness required for a given fire-resistance rating.

722.5.1.4 Concrete-protected columns. The fire resistance of structural steel columns protected with concrete, as illustrated in Figure 722.5.1(6) illustrations (a) and (b), shall be permitted to be determined from the following expression:

$$R = R_o(1 + 0.03m) \quad \text{(Equation 7-14)}$$

where:

$$R_o = 10 (W/D)^{0.7} + 17 (h^{1.6}/k_c^{0.2}) \times [1 + 26 \{H/p_c c_c h (L + h)\}^{0.8}]$$

As used in these expressions:

R = Fire endurance at equilibrium moisture conditions (minutes).

R_o = Fire endurance at zero moisture content (minutes).

m = Equilibrium moisture content of the concrete by volume (percent).

W = Average weight of the structural steel column (pounds per linear foot).

D = Heated perimeter of the structural steel column (inches).

h = Thickness of the concrete cover (inches).

k_c = Ambient temperature thermal conductivity of the concrete (Btu/hr ft °F).

H = Ambient temperature thermal capacity of the steel column = 0.11W (Btu/ ft °F).

p_c = Concrete density (pounds per cubic foot).

c_c = Ambient temperature specific heat of concrete (Btu/lb °F).

L = Interior dimension of one side of a square concrete box protection (inches).

722.5.1.4.1 Reentrant space filled. For wide-flange structural steel columns completely encased in concrete with all reentrant spaces filled Figure 722.5.1(6), illustration (c), the thermal capacity of the concrete within the reentrant spaces shall be permitted to be added to the thermal capacity of the steel column, as follows:

$$H = 0.11 W + (p_c c_c / 144) (b_f d - A_s) \quad \text{(Equation 7-15)}$$

where:

b_f = Flange width of the structural steel column (inches).

d = Depth of the structural steel column (inches).

A_s = Cross-sectional area of the steel column (square inches).

722.5.1.4.2 Concrete properties unknown. If specific data on the properties of concrete are not available, the values given in Table 722.5.1(2) are permitted.

722.5.1.4.3 Minimum concrete cover. For structural steel column encased in concrete with all reentrant spaces filled, Figure 722.5.1(6), illustration (c) and Tables 722.5.1(7) and 722.5.1(8) indicate the thickness of concrete cover required for various fire-resistance ratings for typical wide-flange sections. The thicknesses of concrete indicated in these tables apply to structural steel columns larger than those specified.

722.5.1.4.4 Minimum precast concrete cover. For structural steel columns protected with precast concrete column covers as shown in Figure 722.5.1(6), illustration (a), Tables 722.5.1(9) and 722.5.1(10) indicate the thickness of the column covers required for various fire-resistance ratings for typical wide-flange shapes. The thicknesses of concrete given in these tables apply to structural steel columns larger than those specified.

722.5.1.4.5 Masonry protection. The fire resistance of structural steel columns protected with concrete masonry units or clay masonry units as illustrated in Figure 722.5.1(7) shall be permitted to be determined from the following expression:

$$R = 0.17 (W/D)^{0.7} + [0.285 (T_e^{1.6}/K^{0.2})] [1.0 + 42.7 \{(A_s/d_m T_e)/(0.25p + T_e)\}^{0.8}] \quad \text{(Equation 7-16)}$$

where:

R = Fire-resistance rating of column assembly (hours).

W = Average weight of structural steel column (pounds per foot).

D = Heated perimeter of structural steel column (inches) [see Figure 722.5.1(7)].

T_e = Equivalent thickness of concrete or clay masonry unit (inches) (see Table 722.3.2, Note a or Section 722.4.1).

K = Thermal conductivity of concrete or clay masonry unit (Btu/hr × ft × °F) [see Table 722.5.1(3)].

A_s = Cross-sectional area of structural steel column (square inches).

d_m = Density of the concrete or clay masonry unit (pounds per cubic foot).

p = Inner perimeter of concrete or clay masonry protection (inches) [see Figure 722.5.1(7)].

722.5.1.4.6 Equivalent concrete masonry thickness. For structural steel columns protected with concrete masonry, Table 722.5.1(5) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes. For structural steel columns protected with clay masonry, Table 722.5.1(6) gives the equivalent thickness of concrete masonry required for various fire-resistance ratings for typical column shapes.

722.5.2 Structural steel beams and girders. The fire-resistance ratings of structural steel beams and girders shall be based on the size of the element and the type of protection provided in accordance with this section.

722.5.2.1 Determination of fire resistance. These procedures establish a basis for determining resistance of structural steel beams and girders that differ in size from that specified in approved fire-resistance-rated assemblies as a function of the thickness of fire-resistant material and the weight (W) and heated perimeter (D) of the beam or girder. As used in these sections, W is the average weight of a structural steel element in pounds per linear foot (plf). The heated perimeter, D , is the inside perimeter of the fire-resistant material in inches as illustrated in Figure 722.5.2.

722.5.2.1.1 Weight-to-heated perimeter. The weight-to-heated-perimeter ratios (W/D), for both contour and box fire-resistant protection profiles, for the wide flange shapes most often used as beams or girders are given in Table 722.5.1(4). For different shapes, the weight-to-heated-perimeter ratios (W/D) shall be determined in accordance with the definitions given in this section.

722.5.2.1.2 Beam and girder substitutions. Except as provided for in Section 722.5.2.2, structural steel beams in approved fire-resistance-rated assemblies shall be considered to be the minimum permissible size. Other beam or girder shapes shall be permitted to be substituted provided that the weight-to-heated-perimeter ratio (W/D) of the substitute beam is equal to or greater than that of the beam specified in the approved assembly.

722.5.2.2 Sprayed fire-resistant materials. The provisions in this section apply to structural steel beams and girders protected with sprayed fire-resistant materials. Larger or smaller beam and girder shapes shall be

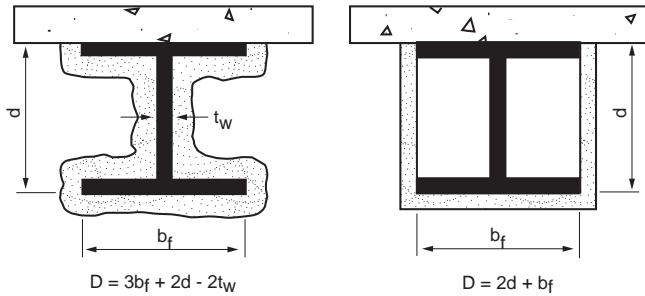


FIGURE 722.5.2
DETERMINATION OF THE HEATED PERIMETER OF
STRUCTURAL STEEL BEAMS AND GIRDERS

permitted to be substituted for beams specified in approved unrestrained or restrained fire-resistance-rated assemblies, provided that the thickness of the fire-resistant material is adjusted in accordance with the following expression:

$$h_2 = h_1 [(W_1 / D_1) + 0.60] / [(W_2 / D_2) + 0.60]$$

(Equation 7-17)

where:

h = Thickness of sprayed fire-resistant material in inches.

W = Weight of the structural steel beam or girder in pounds per linear foot.

D = Heated perimeter of the structural steel beam in inches.

Subscript 1 refers to the beam and fire-resistant material thickness in the approved assembly.

Subscript 2 refers to the substitute beam or girder and the required thickness of fire-resistant material.

The fire resistance of structural steel beams and girders protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire-resistance tests in accordance with Section 703.2.

722.5.2.2.1 Minimum thickness. The use of Equation 7-17 is subject to the following conditions:

1. The weight-to-heated-perimeter ratio for the substitute beam or girder (W_2/D_2) shall be not less than 0.37.
2. The thickness of fire protection materials calculated for the substitute beam or girder (T_1) shall be not less than $3/8$ inch (9.5 mm).
3. The unrestrained or restrained beam rating shall be not less than 1 hour.
4. Where used to adjust the material thickness for a restrained beam, the use of this procedure is limited to structural steel sections classified as compact in accordance with AISC 360.

722.5.2.3 Structural steel trusses. The fire resistance of structural steel trusses protected with fire-resistant materials sprayed to each of the individual truss

elements shall be permitted to be determined in accordance with this section. The thickness of the fire-resistant material shall be determined in accordance with Section 722.5.1.3. The weight-to-heated-perimeter ratio (W/D) of truss elements that can be simultaneously exposed to fire on all sides shall be determined on the same basis as columns, as specified in Section 722.5.1.1. The weight-to-heated-perimeter ratio (W/D) of truss elements that directly support floor or roof assembly shall be determined on the same basis as beams and girders, as specified in Section 722.5.2.1.

The fire resistance of structural steel trusses protected with intumescent or mastic fire-resistant coatings shall be determined on the basis of fire resistance tests in accordance with Section 703.2.

722.6 Wood assemblies. The provisions of this section contain procedures by which the fire-resistance ratings of wood assemblies are established by calculations.

722.6.1 General. This section contains procedures for calculating the fire-resistance ratings of walls, floor/ceiling and roof/ceiling assemblies based in part on the standard method of testing referenced in Section 703.2.

722.6.1.1 Maximum fire-resistance rating. Fire-resistance ratings calculated for assemblies using the methods in Section 722.6 shall be limited to not more than 1 hour.

722.6.1.2 Dissimilar membranes. Where dissimilar membranes are used on a wall assembly that requires consideration of fire exposure from both sides, the calculation shall be made from the least fire-resistant (weaker) side.

722.6.2 Walls, floors and roofs. These procedures apply to both load-bearing and nonload-bearing assemblies.

722.6.2.1 Fire-resistance rating of wood frame assemblies. The fire-resistance rating of a wood frame assembly is equal to the sum of the time assigned to the membrane on the fire-exposed side, the time assigned to the framing members and the time assigned for additional contribution by other protective measures such as insulation. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly.

722.6.2.2 Time assigned to membranes. Table 722.6.2(1) indicates the time assigned to membranes on the fire-exposed side.

722.6.2.3 Exterior walls. For an exterior wall with a fire separation distance greater than 10 feet (3048 mm), the wall is assigned a rating dependent on the interior membrane and the framing as described in Table 722.6.2(1) and Table 722.6.2(2). The membrane on the outside of the nonfire-exposed side of exterior walls with a fire separation distance greater than 10 feet (3048 mm) shall consist of sheathing, sheathing paper and siding as described in Table 722.6.2(3).

722.6.2.4 Floors and roofs. In the case of a floor or roof, the standard test provides only for testing for fire exposure from below. Except as noted in Section 703.2.3, floor or roof assemblies of wood framing shall

have an upper membrane consisting of a subfloor and finished floor conforming to Table 722.6.2(4) or any other membrane that has a contribution to fire resistance of not less than 15 minutes in Table 722.6.2(1).

722.6.2.5 Additional protection. Table 722.6.2(5) indicates the time increments to be added to the fire resistance where glass fiber, rockwool, slag mineral wool or cellulose insulation is incorporated in the assembly.

722.6.2.6 Fastening. Fastening of wood frame assemblies and the fastening of membranes to the wood framing members shall be done in accordance with Chapter 23.

722.7 Fire-resistance rating for mass timber. The required fire resistance of mass timber elements in Section 602.4 shall be determined in accordance with Section 703.2 or Section 703.3. The fire-resistance rating of building elements shall be as required in Tables 601 and 705.5 and as specified elsewhere in this code. The fire-resistance rating of the mass

timber elements shall consist of the fire resistance of the unprotected element added to the protection time of the noncombustible protection.

722.7.1 Minimum required protection. Where required by Sections 602.4.1 through 602.4.3, noncombustible protection shall be provided for mass timber building elements in accordance with Table 722.7.1(1). The rating, in minutes, contributed by the noncombustible protection of mass timber building elements, components or assemblies, shall be established in accordance with Section 703.6. The protection contributions indicated in Table 722.7.1(2) shall be deemed to comply with this requirement where installed and fastened in accordance with Section 722.7.2.

722.7.2 Installation of gypsum board noncombustible protection. Gypsum board complying with Table 722.7.1(2) shall be installed in accordance with this section.

TABLE 722.6.2(1)
TIME ASSIGNED TO WALLBOARD MEMBRANES^{a, b, c, d}

DESCRIPTION OF FINISH	TIME ^e (minutes)
³ / ₈ -inch wood structural panel bonded with exterior glue	5
¹⁵ / ₃₂ -inch wood structural panel bonded with exterior glue	10
¹⁹ / ₃₂ -inch wood structural panel bonded with exterior glue	15
³ / ₈ -inch gypsum wallboard	10
¹ / ₂ -inch gypsum wallboard	15
⁵ / ₈ -inch gypsum wallboard	30
¹ / ₂ -inch Type X gypsum wallboard	25
⁵ / ₈ -inch Type X gypsum wallboard	40
Double ³ / ₈ -inch gypsum wallboard	25
¹ / ₂ -inch + ³ / ₈ -inch gypsum wallboard	35
Double ¹ / ₂ -inch gypsum wallboard	40

For SI: 1 inch = 25.4 mm.

- a. These values apply only where membranes are installed on framing members that are spaced 16 inches o.c. or less.
- b. Gypsum wallboard installed over framing or furring shall be installed so that all edges are supported, except ⁵/₈-inch Type X gypsum wallboard shall be permitted to be installed horizontally with the horizontal joints staggered 24 inches each side and unsupported but finished.
- c. On wood frame floor/ceiling or roof/ceiling assemblies, gypsum board shall be installed with the long dimension perpendicular to framing members and shall have all joints finished.
- d. The membrane on the unexposed side shall not be included in determining the fire resistance of the assembly. Where dissimilar membranes are used on a wall assembly, the calculation shall be made from the least fire-resistant (weaker) side.
- e. The time assigned is not a finished rating.

TABLE 722.6.2(2)
TIME ASSIGNED FOR CONTRIBUTION OF WOOD FRAME^{a, b, c}

DESCRIPTION	TIME ASSIGNED TO FRAME (minutes)
Wood studs 16 inches o.c.	20
Wood floor and roof joists 16 inches o.c.	10

For SI: 1 inch = 25.4 mm.

- a. This table does not apply to studs or joists spaced more than 16 inches o.c.
- b. All studs shall be nominal 2 × 4 and all joists shall have a nominal thickness of not less than 2 inches.
- c. Allowable spans for joists shall be determined in accordance with Sections 2308.4.2.1, 2308.7.1 and 2308.7.2.

FIRE AND SMOKE PROTECTION FEATURES

**TABLE 722.6.2(3)
MEMBRANE^a ON EXTERIOR FACE OF WOOD STUD WALLS**

SHEATHING	PAPER	EXTERIOR FINISH
⁵ / ₈ -inch T & G lumber ⁵ / ₁₆ -inch exterior glue wood structural panel ¹ / ₂ -inch gypsum wallboard ⁵ / ₈ -inch gypsum wallboard ¹ / ₂ -inch fiberboard	Sheathing paper	Lumber siding
		Wood shingles and shakes
		¹ / ₄ -inch fiber-cement lap, panel or shingle siding
		¹ / ₄ -inch wood structural panels-exterior type
		¹ / ₄ -inch hardboard
		Metal siding
		Stucco on metal lath
		Masonry veneer
		Vinyl siding
None	—	³ / ₈ -inch exterior-grade wood structural panels

For SI: 1 inch = 25.4 mm.

a. Any combination of sheathing, paper and exterior finish is permitted.

**TABLE 722.6.2(4)
FLOORING OR ROOFING OVER WOOD FRAMING^a**

ASSEMBLY	STRUCTURAL MEMBERS	SUBFLOOR OR ROOF DECK	FINISHED FLOORING OR ROOFING
Floor	Wood	¹⁵ / ₃₂ -inch wood structural panels or ¹¹ / ₁₆ -inch T & G softwood	Hardwood or softwood flooring on building paper; resilient flooring; parquet floor; felted-synthetic fiber floor coverings, carpeting, or ceramic tile on ¹ / ₄ -inch-thick fiber-cement underlayment or ³ / ₈ -inch-thick panel-type underlayment; ceramic tile on ¹ / ₄ -inch mortar bed.
Roof	Wood	¹⁵ / ₃₂ -inch wood structural panels or ¹¹ / ₁₆ -inch T & G softwood	Finished roofing material with or without insulation

For SI: 1 inch = 25.4 mm.

a. This table applies only to wood joist construction. It is not applicable to wood truss construction.

**TABLE 722.6.2(5)
TIME ASSIGNED FOR ADDITIONAL PROTECTION**

DESCRIPTION OF ADDITIONAL PROTECTION	FIRE RESISTANCE (minutes)
Add to the fire-resistance rating of wood stud walls if the spaces between the studs are completely filled with glass fiber mineral wool batts weighing not less than 2 pounds per cubic foot (0.6 pound per square foot of wall surface) or rockwool or slag material wool batts weighing not less than 3.3 pounds per cubic foot (1 pound per square foot of wall surface), or cellulose insulation having a nominal density not less than 2.6 pounds per cubic foot.	15

For SI: 1 pound/cubic foot = 16.0185 kg/m³.

722.7.2.1 Interior surfaces. Layers of Type X gypsum board serving as noncombustible protection for interior surfaces of wall and ceiling assemblies determined in accordance with Table 722.7.1(1) shall be installed in accordance with the following:

- Each layer shall be attached with Type S drywall screws of sufficient length to penetrate the mass timber at least 1 inch (25 mm) when driven flush with the paper surface of the gypsum board.

Exception: The third layer, where determined necessary by Section 722.7, shall be permitted to be attached with 1-inch (25 mm) No. 6 Type S drywall screws to furring channels in accordance with AISI S220.

- Screws for attaching the base layer shall be 12 inches (305 mm) on center in both directions.
- Screws for each layer after the base layer shall be 12 inches (305 mm) on center in both directions and offset from the screws of the previous layers by 4 inches (102 mm) in both directions.
- All panel edges of any layer shall be offset 18 inches (457 mm) from those of the previous layer.
- All panel edges shall be attached with screws sized and offset as in Items 1 through 4 and placed at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge.
- All panels installed at wall-to-ceiling intersections shall be installed such that ceiling panels are

installed first and the wall panels are installed after the ceiling panel has been installed and is fitted tight to the ceiling panel. Where multiple layers are required, each layer shall repeat this process.

7. All panels installed at a wall-to-wall intersection shall be installed such that the panels covering an exterior wall or a wall with a greater fire-resistance rating shall be installed first and the panels covering the other wall shall be fitted tight to the panel covering the first wall. Where multiple layers are required, each layer shall repeat this process.
8. Panel edges of the face layer shall be taped and finished with joint compound. Fastener heads shall be covered with joint compound.
9. Panel edges protecting mass timber elements adjacent to unprotected mass timber elements in accordance with Section 602.4.2.2 shall be cov-

ered with 1¹/₄-inch (32 mm) metal corner bead and finished with joint compound.

722.7.2.2 Exterior surfaces. Layers of Type X gypsum board serving as noncombustible protection for the outside of the exterior mass timber walls determined in accordance with Table 722.7.1(1) shall be fastened 12 inches (305 mm) on center each way and 6 inches (152 mm) on center at all joints or ends. All panel edges shall be attached with fasteners located at least 1 inch (25 mm) but not more than 2 inches (51 mm) from the panel edge. Fasteners shall comply with one of the following:

1. Galvanized nails of minimum 12 gage with a 7¹/₁₆-inch (11 mm) head of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).
2. Screws that comply with ASTM C1002 (Type S, W or G) of sufficient length to penetrate the mass timber a minimum of 1 inch (25 mm).

**TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL**

REQUIRED FIRE-RESISTANCE RATING OF BUILDING ELEMENT PER TABLE 601 AND TABLE 705.5 (hours)	MINIMUM PROTECTION REQUIRED FROM NONCOMBUSTIBLE PROTECTION (minutes)
1	40
2	80
3 or more	120

**TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL**

NONCOMBUSTIBLE PROTECTION	PROTECTION CONTRIBUTION (minutes)
1/2-inch Type X gypsum board	25
5/8-inch Type X gypsum board	40

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 7A – MATERIALS AND CONSTRUCTION
METHODS FOR EXTERIOR WILDFIRE EXPOSURE**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter			X																			
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

CHAPTER 7A [SFM]

**MATERIALS AND CONSTRUCTION METHODS
FOR EXTERIOR WILDFIRE EXPOSURE**

**SECTION 701A
SCOPE, PURPOSE AND APPLICATION**

701A.1 Scope. This chapter applies to building materials, systems and/or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface (WUI) Fire Area as defined in Section 702A.

701A.2 Purpose. The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface (WUI) Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

701A.3 Application. New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface (WUI) Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this chapter. This shall include all new buildings with residential, commercial, educational, institutional or similar occupancy type use, which shall be referred to in this chapter as “applicable building(s)” (see definition in Section 702A), as well as new buildings and structures accessory to those applicable buildings (see Exceptions 1 and 4).

Exceptions:

- Group U occupancy accessory buildings of any size located at least 50 feet (15 240 mm) from an applicable building on the same lot.
- Group U occupancy agricultural buildings, as defined in Section 202 of this code of any size located at least 50 feet (15 240 mm) from an applicable building.

- Group C occupancy special buildings conforming to the limitations specified in Section 450.4.1.
- New accessory buildings and miscellaneous structures specified in Section 710A shall comply only with the requirements of that section.
- Additions to and remodels of buildings originally constructed prior to July 1, 2008.

701A.3.1 Application date and where required. New buildings for which an application for a building permit is submitted on or after July 1, 2008 located in any Fire Hazard Severity Zone or Wildland Interface Fire Area shall comply with all sections of this chapter, including all of the following areas:

- All unincorporated lands designated by the State Board of Forestry and Fire Protection as State Responsibility Area (SRA) including:
 - Moderate Fire Hazard Severity Zones.
 - High Fire Hazard Severity Zones.
 - Very-High Fire Hazard Severity Zones.
- Land designated as Very-High Fire Hazard Severity Zone by cities and other local agencies.
- Land designated as Wildland Interface Fire Area by cities and other local agencies.

Exceptions:

- New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas, for which an application for a building permit is submitted on or after January 1, 2008, shall comply with all sections of this chapter.

2. *New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland Interface Fire Area designated by cities and other local agencies for which an application for a building permit is submitted on or after December 1, 2005 but prior to July 1, 2008, shall only comply with the following sections of this chapter:*

- 2.1. *Section 705A – Roofing.*
- 2.2. *Section 706A – Attic Ventilation.*

701A.4 Inspection and certification. *Building permit applications and final completion approvals for buildings within the scope and application of this chapter shall comply with the following:*

1. *Building permit issuance. The local building official shall, prior to construction, provide the owner or applicant a certification that the building as proposed to be built complies with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a building permit by the local building official for the proposed building shall be considered as complying with this section.*
2. *Building permit final. The local building official shall, upon completion of construction, provide the owner or applicant with a copy of the final inspection report that demonstrates the building was constructed in compliance with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a certificate of occupancy by the local building official for the proposed building shall be considered as complying with this section.*

701A.5 Vegetation management compliance. *Prior to building permit final approval, the property shall be in compliance with the vegetation management requirements prescribed in California Fire Code Section 4906, including California Public Resources Code 4291 or California Government Code Section 51182. Acceptable methods of compliance inspection and documentation shall be determined by the enforcing agency and shall be permitted to include any of the following:*

1. *Local, state or federal fire authority or designee authorized to enforce vegetation management requirements.*
2. *Enforcing agency.*
3. *Third party inspection and certification authorized to enforce vegetation management requirements.*
4. *Property owner certification authorized by the enforcing agency.*

**SECTION 702A
DEFINITIONS**

For the purposes of this chapter, certain terms are defined below:

APPLICABLE BUILDING. *A building that has residential, commercial, educational, institutional or similar occupancy type use.*

DIRECTOR. *Director of the California Department of Forestry and Fire Protection (CAL FIRE).*

EXTERIOR WALL ASSEMBLY. *A system or assembly of exterior wall components, including exterior wall covering materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.*

EXTERIOR WALL COVERING. *A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to veneers, siding, exterior insulation and finish systems, architectural trim, and embellishments such as cornices, soffits, fascias, gutters and leaders.*

FIRE HAZARD SEVERITY ZONES. *Geographical areas designated pursuant to California Public Resources Codes Sections 4201 through 4204 and classified as Very High, High or Moderate in State Responsibility Areas or as Local Responsibility Areas in Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189. See California Fire Code Chapter 49.*

The California Code of Regulations, Title 14, Section 1280, entitles the maps of these geographical areas as “Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California.”

FIRE PROTECTION PLAN. *A document prepared for a specific project or development proposed for a Wildland-Urban Interface (WUI) Fire Area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.*

The Fire Protection Plan shall be in accordance with this chapter and the California Fire Code, Chapter 49.

FIRE-RESISTANT VEGETATION. *Plants, shrubs, trees and other vegetation that exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.*

Note: *The following sources contain examples of types of vegetation that can be considered as fire-resistant vegetation. (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)*

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section 704A.2.

LOCAL RESPONSIBILITY AREA (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.

LOG WALL CONSTRUCTION. A type of construction in which exterior walls are constructed of solid wood members and where the smallest horizontal dimension of each solid wood member is at least 6 inches (152 mm).

RAFTER TAIL. The portion of roof rafter framing in a sloping roof assembly that projects beyond and overhangs an exterior wall.

ROOF EAVE. The lower portion of a sloping roof assembly that projects beyond and overhangs an exterior wall at the lower end of the rafter tails. Roof eaves may be either “open” or “enclosed.” Open roof eaves have exposed rafter tails and an unenclosed space on the underside of the roof deck. Enclosed roof eaves have a boxed-in roof eave soffit with a horizontal underside or sloping rafter tails with an exterior covering applied to the underside of the rafter tails.

ROOF EAVE SOFFIT. An enclosed boxed-in soffit under a roof eave with exterior covering material applied to the soffit framing creating a horizontal surface on the exposed underside.

STATE RESPONSIBILITY AREA (SRA). Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing forest fires is primarily the responsibility of the state.

WILDFIRE. Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property or resources as defined in Public Resources Code Sections 4103 and 4104.

WILDFIRE EXPOSURE. One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

WILDLAND-URBAN INTERFACE (WUI). A geographical area identified by the state as a “Fire Hazard Severity Zone” in accordance with the Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

**SECTION 703A
STANDARDS OF QUALITY**

703A.1 General. Building material, systems, assemblies and methods of construction used in this chapter shall be in accordance with Section 703A.

703A.2 Qualification by testing. Material and material assemblies tested in accordance with the requirements of Section 703A shall be accepted for use when the results and conditions of those tests are met. Product evaluation testing of material and material assemblies shall be approved or

listed by the State Fire Marshal, or identified in a current report issued by an approved agency.

703A.3 Approved agency. Product evaluation testing shall be performed by an approved agency as defined in Section 1702. The scope of accreditation for the approved agency shall include building product compliance with this code.

703A.4 Labeling. Material and material assemblies tested in accordance with the requirements of Section 703A shall bear an identification label showing the fire test results. That identification label shall be issued by a testing and/or inspecting agency approved by the State Fire Marshal.

1. Identification mark of the approved testing and/or inspecting agency.
2. Contact and identification information of the manufacturer.
3. Model number or identification of the product or material.
4. Pre-test weathering specified in this chapter.
5. Compliance standard as described under Section 703A.7.

703A.5 Weathering and surface treatment protection.

703A.5.1 General. Material and material assemblies tested in accordance with the requirements of Section 703A shall maintain their fire test performance under conditions of use, when installed in accordance with the manufacturers instructions.

703A.5.2 Weathering. Fire-retardant-treated wood and fire-retardant-treated wood shingles and shakes shall meet the fire test performance requirements of this chapter after being subjected to the weathering conditions contained in the following standards, as applicable to the materials and the conditions of use.

703A.5.2.1 Fire-retardant-treated wood. Fire-retardant-treated wood shall be tested in accordance with ASTM D2898 (Method A) and the requirements of Section 2303.2.

703A.5.2.2 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes shall be approved and listed by the State Fire Marshal in accordance with Section 208(c), Title 19 California Code of Regulations.

703A.5.3 Surface treatment protection. The use of paints, coatings, stains or other surface treatments are not an approved method of protection as required in this chapter.

703A.6 Alternates for materials, design, tests and methods of construction. The enforcing agency is permitted to modify the provisions of this chapter for site-specific conditions in accordance with Section 1.11.2.4. When required by the enforcing agency for the purposes of granting modifications, a fire protection plan shall be submitted in accordance with the California Fire Code, Chapter 49.

703A.7 Standards of quality. The State Fire Marshal standards for exterior wildfire exposure protection listed below and as referenced in this chapter are located in the Califor-

nia Referenced Standards Code, Part 12 and Chapter 35 of this code.

SFM Standard 12-7A-1, Exterior Wall Siding and Sheathing. A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for a 10-minute duration.

SFM Standard 12-7A-2, Exterior Windows. A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for an 8-minute duration.

SFM Standard 12-7A-3, Horizontal Projection Underside A fire resistance test standard consisting of a 300 kW intensity direct flame exposure for a 10-minute duration.

SFM Standard 12-7A-4, Decking. A two-part test consisting of a heat release rate (Part A) deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3-minute duration, and a (Part B) sustained deck assembly combustion test consisting of a deck upper surface burning ember exposure with a 12 mph wind for 40 minutes using a 2.2lb (1kg) burning “Class A” size 12" x 12" x 2.25" (300 mm x 300 mm x 57 mm) roof test brand.

SFM Standard 12-7A-4A, Decking Alternate Method A. A heat release rate deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3-minute duration.

ASTM D2898 Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.

ASTM D3909/D3909M Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules.

ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.

ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.

ASTM E2632/E2632M Standard Test Method for Evaluating the Under-Deck Fire Test Response of Deck Materials.

ASTM E2707 Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure.

ASTM E2726/E2726M Standard Test Method for Evaluating the Fire Test Response of Deck Structures to Burning Brands.

ASTM E2768 Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30-minute Tunnel Test).

ASTM E2886/E2886M Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement.

ASTM E2957 Standard Test Method for Resistance to Wildfire Penetration of Eaves, Soffits and Other Projections.

NFPA 257 Standard on Fire Test for Window and Glass Block Assemblies.

UL 263 Standard for Fire Tests of Building Construction and Materials.

UL 723 Standard for Test for Surface Burning Characteristics of Building Materials.

**SECTION 704A
IGNITION-RESISTANT CONSTRUCTION**

704A.1 General. The materials prescribed herein for ignition resistance shall conform to the requirements of this chapter.

704A.2 Ignition-resistant materials. Ignition-resistant materials shall comply with one of the following:

1. The requirements in Section 704A.3, or
2. One of the alternative methods in Section 704A.4.

704A.3 Conditions of acceptance for ignition-resistant materials. The material shall comply with the conditions of acceptance in Items 1 and 2 below or with the conditions of acceptance of ASTM E2768.

1. The material shall exhibit a listed flame spread index not exceeding 25 when tested in accordance with ASTM E84 or UL 723.
2. Additionally, the ASTM E84 or UL 723 test shall be continued for an additional 20-minute period, and the material shall exhibit a flame front that does not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burner at any time during the test period.

704A.3.1 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of ¹/₈ inch (3.2 mm).

704A.4 Alternative methods for determining ignition-resistant material. Any one of the following shall be accepted as meeting the definition of ignition-resistant material:

1. Noncombustible material. Material that complies with the definition for noncombustible materials in Section 202.
2. Fire-retardant-treated wood. Fire-retardant-treated wood identified for exterior use that complies with the requirements of Section 2303.2.
3. Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes, as defined in Section 1505.6 and listed by State Fire Marshal for use as “Class B” roof covering, shall be accepted as an ignition-resistant wall covering material when installed over solid sheathing.

**SECTION 705A
ROOFING**

705A.1 General. Roofs shall comply with the requirements of Chapter 7A and Chapter 15. Roofs shall have a roofing assembly installed in accordance with its listing and the manufacturer’s installation instructions. Roof assemblies in the Fire Hazard Severity Zones shall be Class A rating when tested in accordance with ASTM E108 or UL790.

705A.2 Roof coverings. Where the roofing profile has an airspace under the roof covering, installed over a combustible deck, a 72 lb. (32.7 kg) cap sheet complying with ASTM D3909 Standard Specification for “Asphalt Rolled Roofing (Glass

Felt) Surfaced with Mineral Granules,” shall be installed over the roof deck. Bird stops shall be used at the eaves when the profile fits, to prevent debris at the eave. Hip and ridge caps shall be mudded in to prevent intrusion of fire or embers.

Exception: Cap sheet is not required when no less than 1” of mineral wool board or other noncombustible material is located between the roofing material and wood framing or deck.

Alternately, a Class A fire rated roof underlayment, tested in accordance with ASTM E108, shall be permitted to be used. If the sheathing consists of exterior fire-retardant-treated wood, the underlayment shall not be required to comply with a Class A classification. Bird stops shall be used at the eaves when the profile fits, to prevent debris at the eave. Hip and ridge caps shall be mudded in to prevent intrusion of fire or embers.

705A.3 Roof valleys. Where valley flashing is installed, the flashing shall be not less than 0.019-inch (0.48 mm) No. 26 gage galvanized sheet corrosion-resistant metal installed over not less than one layer of minimum 72 pound (32.4 kg) mineral-surfaced nonperforated cap sheet complying with ASTM D3909, at least 36-inch-wide (914 mm) running the full length of the valley.

705A.4 Roof gutters. Roof gutters shall be provided with the means to prevent the accumulation of leaves and debris in the gutter.

SECTION 706A VENTS

706A.1 General. Where provided, ventilation openings for enclosed attics, gable ends, ridge ends, under eaves and cornices, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, underfloor ventilation, foundations and crawl spaces, or any other opening intended to permit ventilation, either in a horizontal or vertical plane, shall be in accordance with Section 1202 and Sections 706A.1 through 706A.2 to resist building ignition from the intrusion of burning embers and flame through the ventilation openings.

706A.2 Requirements. Ventilation openings shall be fully covered with Wildfire Flame and Ember Resistant vents approved and listed by the California State Fire Marshal, or WUI vents tested to ASTM E2886 and listed, by complying with all of the following requirements:

1. There shall be no flaming ignition of the cotton material during the Ember Intrusion Test.
2. There shall be no flaming ignition during the Integrity Test portion of the Flame Intrusion Test.
3. The maximum temperature of the unexposed side of the vent shall not exceed 662°F (350°C).

706A.2.1 Off ridge and ridge vents. Vents that are installed on a sloped roof, such as dormer vents, shall comply with all of the following:

1. Vents shall be covered with a mesh where the dimensions of the mesh therein shall be a minimum of 1/16-inch (1.6 mm) and shall not exceed 1/8-inch (3.2 mm) in diameter.

2. The mesh material shall be noncombustible.
3. The mesh material shall be corrosion resistant.

SECTION 707A EXTERIOR COVERING

707A.1 Scope. The provisions of this section shall govern the materials and construction methods used to resist building ignition and/or safeguard against the intrusion of flames resulting from small ember and short-term direct flame contact exposure.

707A.2 General. The following exterior covering materials and/or assemblies shall comply with this section:

1. Exterior wall coverings.
2. Exterior wall assemblies.
3. Exterior exposed underside of roof eave overhangs.
4. Exterior exposed underside of roof eave soffits.
5. Exposed underside of exterior porch ceilings.
6. Exterior exposed underside of floor projections.
7. Exterior underfloor areas.

Exceptions to Section 707A.2:

1. Exterior wall architectural trim, embellishments, fascias and gutters.
2. Roof or wall top cornice projections and similar assemblies.
3. Deck walking surfaces shall comply with Section 709A.4 only.

707A.3 Exterior wall coverings. The exterior wall covering shall comply with one or more of the following requirements, except as permitted for exterior wall assemblies complying with Section 707A.4:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.

707A.3.1 Extent of exterior wall covering. Exterior wall coverings shall extend from the top of the foundation to the roof, and terminate at 2 inch (50.8 mm) nominal solid wood blocking between rafters at all roof overhangs, or in the case of enclosed eaves, terminate at the enclosure.

707A.4 Exterior wall assemblies. Exterior wall assemblies of buildings or structures shall be constructed using one or more of the following methods, unless they are covered by an exterior wall covering complying with Section 707A.3:

1. Assembly of sawn lumber or glue-laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks splined, tongue-and-groove, or set close together and well spiked.
2. Log wall construction assembly.

3. Assembly that has been tested in accordance with the test procedures for a 10-minute direct flame contact exposure test set forth in ASTM E2707 with the conditions of acceptance shown in Section 707A.4.1.
4. Assembly that meets the performance criteria in accordance with the test procedures for a 10-minute direct flame contact exposure test set forth in SFM Standard 12-7A-1.
5. Assembly suitable for exterior fire exposure with a 1-hour fire-resistance rating, rated from the exterior side, as tested in accordance with ASTM E119 or UL 263.
6. Assembly suitable for exterior fire exposure containing one layer of 5/8-inch (15.9 mm) Type X gypsum sheathing applied behind the exterior wall covering or cladding on the exterior side of the framing.
7. Assembly suitable for exterior fire exposure containing any of the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual as complying with a 1-hour fire-resistance rating, as tested in accordance with ASTM E119 or UL 263.

707A.4.1 Conditions of acceptance when tested in accordance with ASTM E2707. The ASTM E2707 test shall be conducted on a minimum of three test specimens, and the conditions of acceptance in Items 1 and 2 below shall be met. If any one of the three tests do not meet the conditions of acceptance, three additional tests shall be run. All the additional tests shall meet the conditions of acceptance.

1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 70-minute test.

707A.5 Open roof eaves. The exposed roof deck on the underside of unenclosed roof eaves shall consist of one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (15.9 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the roof deck.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the roof deck designed for exterior fire exposure, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.

Exception to Section 707A.5: The following materials do not require protection:

Fascia and other architectural trim boards.

707A.6 Enclosed roof eaves and roof eave soffits. The exposed underside of enclosed roof eaves having either a boxed-in roof eave soffit with a horizontal underside, or sloping rafter tails with an exterior covering applied to the underside of the rafter tails, shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (15.9 mm) Type X gypsum sheathing applied behind the exterior covering or cladding on the underside of the rafter tails or soffit.
6. The exterior portion of a 1-hour fire-resistive exterior assembly applied to the underside of the rafter tails or soffit, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. Boxed-in roof eave soffit assemblies with a horizontal underside that meet the performance criteria in Section 707A.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. Boxed-in roof eave soffit assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section 707A.6: The following materials do not require protection:

Fascia and other architectural trim boards.

707A.7 Exterior porch ceilings. The exposed underside of exterior porch ceilings shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (15.9 mm) Type X gypsum sheathing applied behind the exterior covering or cladding on the underside of the rafter tails or soffit.

6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119, applied to the underside of the ceiling assembly, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. Porch ceiling assemblies with a horizontal underside that meet the performance criteria in Section 707A.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. Porch ceiling assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section 707A.7: Architectural trim boards do not require protection.

707A.8 Floor projections. The exposed underside of a cantilevered floor projection where a floor assembly extends over an exterior wall shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum sheathing applied behind the exterior covering on the underside of the ceiling.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119, applied to the underside of the ceiling assembly, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. The underside of a floor projection assembly that meets the performance criteria in Section 707A.10 when tested in accordance with the test procedures set forth in ASTM E2957.
8. The underside of a floor projection assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section 707A.8: Architectural trim boards do not require protection.

707A.9 Underfloor protection. The underfloor area of elevated or overhanging buildings shall be enclosed to grade in accordance with the requirements of this chapter or the underside of the exposed underfloor shall be protected by one or more of the following:

1. Noncombustible material.

2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the floor, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. The underside of a floor assembly that meets the performance criteria in Section 707A.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. The underside of a floor assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section 707A.9: Structural columns and beams do not require protection when constructed with sawn lumber or glue-laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks shall be splined, tongue-and-groove, or set close together and well spiked.

707A.10 Underside of appendages. When required by the enforcing agency, the underside of overhanging appendages shall be enclosed to grade in accordance with the requirements of this chapter, or the underside of the exposed underfloor shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum sheathing applied behind the exterior covering on the underside of the appendage projection.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the appendage, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.

7. The underside of an appendage assembly that meets the performance criteria in Section 707A.11 when tested in accordance with the test procedures set forth in ASTM E2957.

8. The underside of an appendage assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section 707A.10: Structural columns and beams do not require protection when constructed with sawn lumber or glue laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks shall be splined, tongue-and-groove, or set close together and well spiked.

707A.11 Conditions of acceptance when tested in accordance with ASTM E2957. The test shall be conducted on a minimum of three test specimens and the conditions of acceptance in Items 1 through 3 below shall be met. If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Absence of flame penetration of the eaves or horizontal projection assembly at any time.
2. Absence of structural failure of the eaves or horizontal projection subassembly at any time.
3. Absence of sustained combustion of any kind at the conclusion of the 40-minute test.

SECTION 708A

EXTERIOR WINDOWS, SKYLIGHTS AND DOORS

708A.1 General.

708A.2 Exterior glazing. The following exterior glazing materials and/or assemblies shall comply with this section:

1. Exterior windows.
2. Exterior glazed doors.
3. Glazed openings within exterior doors.
4. Glazed openings within exterior garage doors.
5. Exterior structural glass veneer.
6. Skylights.
7. Vents.

708A.2.1 Exterior windows, skylights and exterior glazed door assembly requirements. Exterior windows, skylights and exterior glazed door assemblies shall comply with one of the following requirements:

1. Be constructed of multipane glazing with a minimum of one tempered pane meeting the requirements of Section 2406 Safety Glazing, or
2. Be constructed of glass block units, or
3. Have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 257, or
4. Be tested to meet the performance requirements of SFM Standard 12-7A-2.

708A.2.2 Operable skylights. Operable skylights shall be protected by a non-combustible mesh screen where the dimensions of the openings in the screen shall not exceed $\frac{1}{8}$ -inch (3.2 mm).

708A.2.3 Structural glass veneer. The wall assembly behind structural glass veneer shall comply with Section 707A.3.

708A.3 Exterior doors. Exterior doors shall comply with one of the following:

1. The exterior surface or cladding shall be of noncombustible material.
2. The exterior surface or cladding shall be of ignition-resistant material.
3. The exterior door shall be constructed of solid core wood that complies with the following requirements:
 - 3.1. Stiles and rails shall not be less than $1\frac{3}{8}$ inches thick.
 - 3.2. Panels shall not be less than $1\frac{1}{4}$ inches thick, except for the exterior perimeter of the panel that shall be permitted to taper to a tongue not less than $\frac{3}{8}$ inch thick.
4. The exterior door assembly shall have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 252.
5. The exterior surface or cladding shall be tested to meet the performance requirements of Section 707A.3.1 when tested in accordance with ASTM E2707.
6. The exterior surface or cladding shall be tested to meet the performance requirements of SFM Standard 12-7A-1.

708A.3.1 Exterior door glazing. Glazing in exterior doors shall comply with Section 708A.2.1.

708A.4 Garage door perimeter gap. Exterior garage doors shall resist the intrusion of embers from entering by preventing gaps between doors and door openings, at the bottom, sides and tops of doors, from exceeding $\frac{1}{8}$ inch (3.2 mm). Gaps between doors and door openings shall be controlled by one of the following methods:

1. Weather-stripping products made of materials that:
 - (a) have been tested for tensile strength in accordance with ASTM D638 (Standard Test Method for Tensile Properties of Plastics) after exposure to ASTM G155 (Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials) for a period of 2,000 hours, where the maximum allowable difference in tensile strength values between exposed and non-exposed samples does not exceed 10%; and (b) exhibit a V-2 or better flammability rating when tested to UL 94, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.
2. Door overlaps onto jambs and headers.
3. Garage door jambs and headers covered with metal flashing.

**SECTION 709A
DECKING**

709A.1 General. The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section.

709A.1.1 Flashing. A minimum of a 6-inch (150 mm) metal flashing, applied vertically on the exterior of the wall, shall be installed at all deck-to-wall intersections.

709A.2 Where required. The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section when any portion of such surface is within 10 feet (3048 mm) of the building.

709A.3 Decking Surfaces. The walking surface material of decks, porches, balconies and stairs shall be constructed with one of the following materials:

1. Material that complies with the performance requirements of Section 709A.4 when tested in accordance with both ASTM E2632 and ASTM E2726.
2. Ignition-resistant material that complies with the performance requirements of Section 704A.3.
3. Material that complies with the performance requirements of both SFM Standard 12-7A-4 and Section 704A.3.
4. Exterior fire-retardant-treated wood.
5. Noncombustible material.
6. Any material that complies with the performance requirements of SFM Standard 12-7A-4A when attached exterior wall covering is also composed of noncombustible or ignition-resistant material.

Exception: Wall material shall be permitted to be of any material that otherwise complies with this chapter when the decking surface material complies with the performance requirements ASTM E84 with a Class B flame spread index.

7. Any material that complies with the performance requirements of Section 709A.5 when tested in accordance with ASTM E2632 and when attached exterior wall covering is also composed of only noncombustible or ignition-resistant materials.

Exception: Wall material shall be permitted to be of any material that otherwise complies with this chapter when the decking surface material complies with the performance requirements ASTM E84 with a Class B flame spread index.

709A.4 Requirements for type of material in Section 709A.3, Item 1. The material shall be tested in accordance with both ASTM E2632 and ASTM E2726 and shall comply with the conditions of acceptance in Sections 709A.4.1 and 709A.4.2. The material shall also be tested in accordance with ASTM E84 or UL 723 and comply with the performance requirements of Section 704A.3.

709A.4.1 Conditions of acceptance for ASTM E2632. The ASTM E2632 test shall be conducted on a minimum of three test specimens and the conditions of acceptance in Items 1 through 3 below shall be met. If any one of the

three tests does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Peak heat release rate of less than or equal to 25 kW/ft² (269 kW/m²).
2. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-min observation period.
3. Absence of falling particles that are still burning when reaching the burner or floor.

709A.4.2 Conditions of acceptance for ASTM E2726. The ASTM E2726 test shall be conducted, using a "Class A" size roof test brand, on a minimum of three test specimens and the conditions of acceptance in Items 1 and 2 below shall be met. If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-min observation period.
2. Absence of falling particles that are still burning when reaching the burner or floor.

709A.5 Requirements for type of material in Section 709A.3, Item 7. The material shall be tested in accordance with ASTM E2632 and shall comply with the following condition of acceptance. The ASTM E2632 test shall be conducted on a minimum of three test specimens and the peak heat release rate shall be less than or equal to 25 kW/ft² (269 kW/m²). If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All the additional tests shall meet the condition of acceptance.

**SECTION 710A
ACCESSORY BUILDINGS
AND MISCELLANEOUS STRUCTURES**

710A.1 General. Group U occupancy accessory buildings and miscellaneous structures that have the potential to pose a significant exterior fire exposure hazard during wildfires shall be constructed to conform to the ignition-resistance requirements of this section.

710A.2 Applicability. Unless otherwise addressed by the exceptions of Section 701A.3, the provisions of this section shall apply to buildings accessory to an applicable building on the same lot. This section shall also apply to attached and detached miscellaneous structures that require a building permit, including but not limited to trellises, arbors, patio covers, gazebos and similar structures.

Exceptions:

1. Decks shall comply with the requirements of Section 709A.
2. Awnings and canopies shall comply with the requirements of Section 3105.
3. Exterior wall architectural trim, embellishments and fascia.

710A.3 Where required. *Miscellaneous structures that require a permit, and accessory buildings of any size, when separated from an applicable building on the same lot by a distance of less than 3 feet (914 mm), shall comply with Section 710A.3.1. Accessory buildings that are greater than 120 square feet (11.15 m²), when separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 240 mm) shall comply with Section 710A.3.2.*

When required by the enforcing agency, miscellaneous structures that require a permit, and accessory buildings that are 120 square feet (11.15 m²) or less, when separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 240 mm), shall comply with either Section 710A.3.4 or Section 710A.3.3, respectively.

No requirements shall apply to accessory buildings or miscellaneous structures when located 50 feet (15 240 mm) or more from an applicable building on the same lot.

710A.3.1 Structures and accessory buildings within 3 feet (914 mm). *Miscellaneous structures that require a permit, and accessory buildings, attached to or separated from an applicable building on the same lot by a distance of less than 3 feet (914 mm), shall be constructed of non-combustible materials or of ignition-resistant materials as described in Section 704A.2.*

710A.3.2 Accessory buildings greater than 120 square feet (11.15 m²), located 3 feet (914 mm) or more but less than 50 feet (15 240 mm). *Accessory buildings that are greater than 120 square feet (11.15 m²) in size and separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 240 mm) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section 704A.2.*

710A.3.3 Accessory buildings 120 square feet (11.15 m²) or less, located 3 feet (914 mm) or more but less than 50 feet (15 240 mm). *When required by the enforcing agency, accessory buildings 120 square feet (11.15 m²) or less and separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 240 mm) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section 704A.2.*

710A.3.4 Miscellaneous structures located 3 feet (914 mm) or more but less than 50 feet (15 240 mm). *When required by the enforcing agency, miscellaneous structures that require a permit and are separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 240 mm) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section 704A.2.*

710A.4 Roof construction. *Roofs of accessory buildings required to be constructed entirely of noncombustible materials or of ignition-resistant materials shall comply with the requirements of Chapter 7A and Chapter 15. Roofs shall have*

a roofing assembly installed in accordance with its listing and the manufacturer's installation instructions. Roof assemblies in Fire Hazard Severity Zones shall comply with a Class A rating when tested in accordance with ASTM E108 or UL 790.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 8 – INTERIOR FINISHES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X			X	X			X	X	X	X	X	X	X								
Adopt entire chapter as amendedd (amended sections listed below)			X																			
Adopt only those sections that are listed below		X																				
Chapter / Section																						
801.1		X																				
Table 803.13			X																			
804.1			X																			
804.4			X																			
804.4.1			X																			
804.4.2			X																			
804.4.3			X																			
806.4			X																			
806.7			X																			

The state agency does not adopt sections identified by the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 8

INTERIOR FINISHES

User notes:

About this chapter: Chapter 8 contains the performance requirements for controlling fire growth and smoke propagation within buildings by restricting interior finish and decorative materials. The provisions of this chapter require materials used as interior finishes and decorations to meet certain flame spread index or flame propagation criteria and smoke development criteria based on the relative fire hazard associated with the occupancy. The performance of the material is evaluated based on test standards.

SECTION 801 SCOPE

801.1 Scope. The provisions of this chapter shall govern the use of materials used as interior finishes, trim and decorative materials. [BSC-CG] See California Green Building Standards Code, Chapter 5, Division 5.5 for additional finish material pollutant control requirements.

SECTION 802 GENERAL

802.1 Interior wall and ceiling finish. The provisions of Section 803 shall limit the allowable fire performance and smoke development of interior wall and ceiling finish materials based on occupancy classification.

802.2 Interior floor finish. The provisions of Section 804 shall limit the allowable fire performance of interior floor finish materials based on occupancy classification.

[F] **802.3 Decorative materials and trim.** Decorative materials and trim shall be restricted by combustibility, fire performance or flame propagation performance criteria in accordance with Section 806.

802.4 Applicability. For buildings in flood hazard areas as established in Section 1612.3, interior finishes, trim and decorative materials below the elevation required by Section 1612 shall be flood-damage-resistant materials.

802.5 Application. Combustible materials shall be permitted to be used as finish for walls, ceilings, floors and other interior surfaces of buildings.

802.6 Windows. Show windows in the exterior walls of the first story above grade plane shall be permitted to be of wood or of unprotected metal framing.

802.7 Foam plastics. Foam plastics shall not be used as interior finish except as provided in Section 803.4. Foam plastics shall not be used as interior trim except as provided in Section 806.5 or 2604.2. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

SECTION 803 WALL AND CEILING FINISHES

803.1 General. Interior wall and ceiling finish materials shall be classified for fire performance and smoke development in

accordance with Section 803.1.1 or 803.1.2, except as shown in Sections 803.1.3 through 803.15. Materials tested in accordance with Section 803.1.1 shall not be required to be tested in accordance with Section 803.1.2.

803.1.1 Interior wall and ceiling finish materials tested in accordance with NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and comply with Section 803.1.1.1. Materials complying with Section 803.1.1.1 shall be considered to also comply with the requirements of Class A.

803.1.1.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m².

803.1.2 Interior wall and ceiling finish materials tested in accordance with ASTM E84 or UL 723. Interior wall and ceiling finish materials shall be classified in accordance with ASTM E84 or UL 723. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indices.

Class A = *Flame spread index 0–25; smoke-developed index 0–450.*

Class B = *Flame spread index 26–75; smoke developed index 0–450.*

Class C = *Flame spread index 76–200; smoke-developed index 0–450.*

Exception: Materials tested in accordance with Section 803.1.1 and as indicated in Sections 803.1.3 through 803.13.

803.1.3 Interior wall and ceiling finish materials with different requirements. The materials indicated in Sections 803.2 through 803.13 shall be tested as indicated in the corresponding sections.

803.2 Thickness exemption. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings shall not be required to be tested.

803.3 Heavy timber exemption. Exposed portions of building elements complying with the requirements for buildings of heavy timber construction in Section 602.4 or Section 2304.11 shall not be subject to interior finish requirements except in interior exit stairways, interior exit ramps, and exit passageways.

803.4 Foam plastics. Foam plastics shall not be used as interior finish except as provided in Section 2603.9. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

803.5 Textile wall coverings. Where used as interior wall finish materials, textile wall coverings, including materials having woven or nonwoven, napped, tufted, looped or similar surface and carpet and similar textile materials, shall be tested in the manner intended for use, using the product-mounting system, including adhesive, and shall comply with the requirements of one of the following: Section 803.1.1, 803.5.1 or 803.5.2.

803.5.1 Room corner test for textile wall coverings and expanded vinyl wall coverings. Textile wall coverings and expanded vinyl wall coverings shall meet the criteria of Section 803.5.1.1 when tested in the manner intended for use in accordance with the Method B protocol of NFPA 265 using the product-mounting system, including adhesive.

803.5.1.1 Acceptance criteria for NFPA 265. The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 by 305 mm) walls.
3. Flashover, as defined in NFPA 265, shall not occur.
4. The total smoke release throughout the test shall not exceed 1,000 m².

803.5.2 Acceptance criteria for textile and expanded vinyl wall or ceiling coverings tested to ASTM E84 or UL 723. Textile wall and ceiling coverings and expanded vinyl wall and ceiling coverings shall have a Class A flame spread index in accordance with ASTM E84 or UL 723 and be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

803.6 Textile ceiling coverings. Where used as interior ceiling finish materials, textile ceiling coverings, including materials having woven or nonwoven, napped, tufted, looped or similar surface and carpet and similar textile materials, shall be tested in the manner intended for use, using the product-mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1 or 803.5.2.

803.7 Expanded vinyl wall coverings. Where used as interior wall finish materials, expanded vinyl wall coverings shall

be tested in the manner intended for use, using the product-mounting system, including adhesive, and shall comply with the requirements of one of the following: Section 803.1.1, 803.5.1 or 803.5.2.

803.8 Expanded vinyl ceiling coverings. Where used as interior ceiling finish materials, expanded vinyl ceiling coverings shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1 or 803.5.2.

803.9 High-density polyethylene (HDPE) and polypropylene (PP). Where high-density polyethylene or polypropylene is used as an interior finish, it shall comply with Section 803.1.1.

803.10 Site-fabricated stretch systems. Where used as interior wall or interior ceiling finish materials, site-fabricated stretch systems containing all three components described in the definition in Chapter 2 shall be tested in the manner intended for use, and shall comply with the requirements of Section 803.1.1 or with the requirements of Class A in accordance with Section 803.1.2. If the materials are tested in accordance with ASTM E84 or UL 723, specimen preparation and mounting shall be in accordance with ASTM E2573.

803.11 Laminated products factory produced with a wood substrate. Laminated products factory produced with a wood substrate shall comply with one of the following:

1. The laminated product shall meet the criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 using the product-mounting system, including adhesive, as described in Section 5.8 of NFPA 286.
2. The laminated product shall have a Class A, B, or C flame spread index and smoke-developed index, based on the requirements of Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.

803.12 Facings or wood veneers intended to be applied on site over a wood substrate. Facings or veneers intended to be applied on site over a wood substrate shall comply with one of the following:

1. The facing or veneer shall meet the criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, as described in Section 5.9 of NFPA 286.
2. The facing or veneer shall have a Class A, B or C flame spread index and smoke-developed index, based on the requirements of Table 803.13, in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

803.13 Interior finish requirements based on occupancy. Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.13 for the group and location designated. Interior wall and ceiling finish materials tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.1.1, shall be permitted to be used where a Class A classification in accordance with ASTM E84 or UL 723 is required.

**TABLE 803.13
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY^k**

GROUP	SPRINKLERED ^l			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c	Interior exit stairways and ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c
A-1 & A-2	B	B	C	A	A ^d	B ^e
A-3 ^f , A-4, A-5	B	B	C	A	A ^d	C
B, E, M, R-1	B	C ^m	C	A	B	C
R-4 ⁿ	B	C	C	A	B	B
F	C	C	C	B	C	C
H, L	B	B	C ^g	NP	NP	NP
I-2 ⁿ , I-2.1	B	B	B ^{h, i}	A	A	B
I-3	A	A ^j	B	NP	NP	NP
I-4	B	B	B ^{h, i}	A	A	B
R-2	C	C	C	B	B	C
R-2.1	B	C	C	A	B	B
R-2.2	C	C	C	B	B	C
R-3 ⁿ , R-3.1	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No restrictions			No restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m².

NP = Not permitted [SFM]

- a. Class C interior finish materials shall be permitted for wainscotting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.15.1.
- b. In other than Group I-3 occupancies in buildings less than three stories above grade plane, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
- c. Requirements for rooms and enclosed spaces shall be based on spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered to be enclosing spaces and the rooms or spaces on both sides shall be considered to be one room or space. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor regardless of the group classification of the building or structure.
- d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall be not less than Class B materials.
- e. Class C interior finish materials shall be permitted in places of assembly with an occupant load of 300 persons or less.
- f. For places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be permitted.
- g. Class B material is required where the building exceeds two stories.
- h. Class C interior finish materials shall be permitted in administrative spaces.
- i. Class C interior finish materials shall be permitted in rooms with a capacity of four persons or less.
- j. Class B materials shall be permitted as wainscotting extending not more than 48 inches above the finished floor in corridors and exit access stairways and ramps.
- k. Finish materials as provided for in other sections of this code.
- l. Applies when protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
- m. Corridors in ambulatory care facilities shall be provided with Class A or B materials.
- n. Where Group R-3 and R-4 occupancies are permitted in Section 903.2.8 to be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.3, the requirements for a non-sprinklered building shall apply.
- o. Where patients are restrained in psychiatric treatment areas of Group I-2, finishes shall comply with the requirements of a Group I-3.

803.14 Stability. Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

803.15 Application of interior finish materials to fire-resistance-rated or noncombustible building elements. Where interior finish materials are applied on walls, ceilings or structural elements required to have a fire-resistance rating or to be of noncombustible construction,

these finish materials shall comply with the provisions of this section.

803.15.1 Direct attachment and furred construction. Where walls, ceilings or structural elements are required by any provision in this code to be of fire-resistance-rated or noncombustible construction, the interior finish material shall be applied directly against such construction or to furring strips not exceeding 1³/₄ inches (44 mm), applied directly against such surfaces.

803.15.1.1 Furred construction. If the interior finish material is applied to furring strips, the intervening spaces between such furring strips shall comply with one of the following:

1. Be filled with material that is inorganic or non-combustible.
2. Be filled with material that meets the requirements of a Class A material in accordance with Section 803.1.1 or 803.1.2.
3. Be fireblocked at not greater than 8 feet (2438 mm) in every direction in accordance with Section 718.

Exception: Compliance with Item 1, 2 or 3 is not required where the materials used to create the concealed space are noncombustible.

803.15.2 Set-out construction. Where walls and ceilings are required to be of fire-resistance-rated or noncombustible construction and walls are set out or ceilings are dropped distances greater than specified in Section 803.15.1, Class A finish materials, in accordance with Section 803.1.1 or 803.1.2, shall be used.

Exceptions:

1. Where interior finish materials are protected on both sides by an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Where interior finish materials are attached to noncombustible backing or furring strips installed as specified in Section 803.15.1.1.
3. Where the combustible void is filled with a non-combustible material.

803.15.2.1 Hangers and assembly members. The hangers and assembly members of such dropped ceilings that are below the horizontal fire-resistance-rated floor or roof assemblies shall be of noncombustible materials. The construction of each set-out wall and horizontal fire-resistance-rated floor or roof assembly shall be of fire-resistance-rated construction as required elsewhere in this code.

Exception: In Types III and V construction, fire-retardant-treated wood shall be permitted for use as hangers and assembly members of dropped ceilings.

803.15.3 Heavy timber construction. Wall and ceiling finishes of all classes as permitted in this chapter that are installed directly against the wood decking or planking of heavy timber construction in Section 602.4.4.2 or 2304.11 or to wood furring strips applied directly to the wood decking or planking shall be fireblocked as specified in Section 803.15.1.1.

803.15.4 Materials. An interior wall or ceiling finish material that is not more than 1/4 inch (6.4 mm) thick shall be applied directly onto the wall, ceiling or structural element without the use of furring strips and shall not be

suspended away from the building element to which that finish material it is applied.

Exceptions:

1. Noncombustible interior finish materials.
2. Materials that meet the requirements of Class A materials in accordance with Section 803.1.1 or 803.1.2 where the qualifying tests were made with the material furred out from the noncombustible backing shall be permitted to be used with furring strips.
3. Materials that meet the requirements of Class A materials in accordance with Section 803.1.1 or 803.1.2 where the qualifying tests were made with the material suspended away from the non-combustible backing shall be permitted to be used suspended away from the building element.

**SECTION 804
INTERIOR FLOOR FINISH**

804.1 General. Interior floor finish and floor covering materials shall comply with Sections 804.2 through 804.4.2.

Exception: *In areas except Groups I-2 with detention and I-3, floor finishes and coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials that are not composed of fibers.*

804.2 Classification. Interior floor finish and floor covering materials required by Section 804.4.2 to be of Class I or II materials shall be classified in accordance with ASTM E648 or NFPA 253. The classification referred to herein corresponds to the classifications determined by ASTM E648 or NFPA 253 as follows: Class I, 0.45 watts/cm² or greater; Class II, 0.22 watts/cm² or greater.

804.3 Testing and identification. Interior floor finish and floor covering materials shall be tested by an agency in accordance with ASTM E648 or NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the interior floor finish or floor covering classification in accordance with Section 804.2. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the building official on request.

804.4 Interior floor finish requirements. Interior floor covering materials shall comply with Sections 804.4.1 and 804.4.2 and interior floor finish materials shall comply with Section 804.4.3.

804.4.1 Test requirement. In all occupancies, interior floor finish and interior floor covering materials shall comply with the requirements of the *ASTM Standard E648, and having a specific optical density smoke rating not to exceed 450 per ASTM E662. For Group I-3 occu-*

pancies and Group I-2 areas where patients are restrained, see Section 804.4.3.

804.4.2 Minimum critical radiant flux. In all occupancies, interior floor finish and floor covering materials in enclosures for stairways and ramps, exit passageways, corridors and rooms or spaces not separated from corridors by partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux. The minimum critical radiant flux shall be not less than Class I in Groups I-2 and I-3 areas where restraint is not used and R-2.1 and not less than Class II in Groups A, B, E, H, I-2.1, I-4, M, R-1, R-2, R-2.2 and S. For Group I-3 areas occupied by inmates or Group I-2 areas where patients are restrained, see Section 804.4.3.

Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, Class II materials are permitted in any area where Class I materials are required, and materials complying with *ASTM Standard E648*, and having a specific optical density smoke rating not to exceed 450 per *ASTM E662* are permitted in any area where Class II materials are required.

804.4.3 Group I-2 and Group I-3 Occupancy floor surfaces. Interior floor finish and floor coverings occupied by inmates or patients whose personal liberties are restrained shall be noncombustible.

Exception: Carpet or other floor covering materials may be used in areas protected by an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1. Carpet or other floor coverings shall comply with the requirements of *ASTM Standard E648*; the minimum critical radiant flux shall be not less than Class I and the specific optical density smoke rating shall not exceed 450 per *ASTM E662*. Carpeting and carpet padding shall be tested as a unit in accordance with floor covering radiant panel test meeting class I and has a critical radiant flux limit of not less than 0.45 watt per centimeter square. The carpeting and padding shall be identified by a hang-tag or other suitable method as to manufacturer and style and shall indicate the classification of the material based on the limits set forth above.

SECTION 805 COMBUSTIBLE MATERIALS IN TYPES I AND II CONSTRUCTION

805.1 Application. Combustible materials installed on or embedded in floors of buildings of Type I or II construction shall comply with Sections 805.1.1 through 805.1.3.

Exception: Stages and platforms constructed in accordance with Sections 410.2 and 410.3, respectively.

805.1.1 Subfloor construction. Floor sleepers, bucks and nailing blocks shall not be constructed of combustible materials, unless the space between the fire-resistance-rated floor assembly and the flooring is either solidly filled with noncombustible materials or fireblocked in accordance with Section 718, and provided that such open

spaces shall not extend under or through permanent partitions or walls.

805.1.2 Wood finish flooring. Wood finish flooring is permitted to be attached directly to the embedded or fire-blocked wood sleepers and shall be permitted where cemented directly to the top surface of fire-resistance-rated floor assemblies or directly to a wood subfloor attached to sleepers as provided for in Section 805.1.1.

805.1.3 Insulating boards. Combustible insulating boards not more than 1/2 inch (12.7 mm) thick and covered with finish flooring are permitted where attached directly to a noncombustible floor assembly or to wood subflooring attached to sleepers as provided for in Section 805.1.1.

SECTION 806 DECORATIVE MATERIALS AND TRIM

[F] 806.1 General. The following requirements shall apply to all occupancies:

1. Furnishings or decorative materials of an explosive or highly flammable character shall not be used.
2. Fire-retardant coatings in existing buildings shall be maintained so as to retain the effectiveness of the treatment under service conditions encountered in actual use.
3. Furnishings or other objects shall not be placed to obstruct exits, access thereto, egress therefrom or visibility thereof.
4. The permissible amount of decorative vegetation and noncombustible decorative materials shall not be limited.

[F] 806.2 Combustible decorative materials. In Groups A, B, E, I, M and R-1 and in dormitories in Group R-2, curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings shall comply with Section 806.4 and shall not exceed 10 percent of the specific wall or ceiling area to which such materials are attached.

Fixed or movable walls and partitions, paneling, wall pads and crash pads applied structurally or for decoration, acoustical correction, surface insulation or other purposes shall be considered to be interior finish, shall comply with Section 803 and shall not be considered to be decorative materials or furnishings.

Exceptions:

1. In auditoriums in Group A, the permissible amount of curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings shall not exceed 75 percent of the aggregate wall area where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, and where the material is installed in accordance with Section 803.15 of this code.
2. In Group R-2 dormitories, within sleeping units and dwelling units, the permissible amount of curtains, draperies, fabric hangings and similar decorative

materials suspended from walls or ceiling shall not exceed 50 percent of the aggregate wall areas where the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.

3. In Group B and M occupancies, the amount of combustible fabric partitions suspended from the ceiling and not supported by the floor shall comply with Section 806.4 and shall not be limited.
4. The 10-percent limit shall not apply to curtains, draperies, fabric hangings and similar combustible decorative materials used as window coverings.

806.3 Occupancy-based requirements. Occupancy-based requirements for combustible decorative materials, other than decorative vegetation, not complying with Section 806.4 shall comply with Sections 807.5.1 through 807.5.6 of the *California Fire Code*.

[F] 806.4 Acceptance criteria and reports. Where required to exhibit improved fire performance, curtains, draperies, fabric hangings and similar combustible decorative materials suspended from walls or ceilings shall be tested by an approved agency and *shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8*. Reports of test results shall be prepared in accordance with the test method used and furnished to the building official on request.

[F] 806.5 Foam plastic. Foam plastic used as trim in any occupancy shall comply with Section 2604.2.

[F] 806.6 Pyroxylin plastic. Imitation leather or other material consisting of or coated with a pyroxylin or similarly hazardous base shall not be used in Group A occupancies.

[F] 806.7 Interior trim. Material, other than foam plastic used as interior trim, shall have a minimum *Class B flame spread and 450 smoke-developed index in Group I-3 and for all other occupancies Class C flame spread and smoke-developed index* when tested in accordance with ASTM E84 or UL 723, as described in Section 803.1.2. Combustible trim, excluding handrails and guardrails, shall not exceed 10 percent of the specific wall or ceiling area to which it is attached.

[F] 806.8 Interior floor-wall base. Interior floor-wall base that is 6 inches (152 mm) or less in height shall be tested in accordance with Section 804.2 and shall be not less than Class II. Where a Class I floor finish is required, the floor-wall base shall be Class I.

Exception: Interior trim materials that comply with Section 806.7.

[F] 806.9 Combustible lockers. Where lockers constructed of combustible materials are used, the lockers shall be considered to be interior finish and shall comply with Section 803.

Exception: Lockers constructed entirely of wood and noncombustible materials shall be permitted to be used wherever interior finish materials are required to meet a Class C classification in accordance with Section 803.1.2.

SECTION 807 INSULATION

807.1 Insulation. Thermal and acoustical insulation shall comply with Section 720.

SECTION 808 ACOUSTICAL CEILING SYSTEMS

808.1 Acoustical ceiling systems. The quality, design, fabrication and erection of metal suspension systems for acoustical tile and lay-in panel ceilings in buildings or structures shall conform to generally accepted engineering practice, the provisions of this chapter and other applicable requirements of this code.

808.1.1 Materials and installation. Acoustical materials complying with the interior finish requirements of Section 803 shall be installed in accordance with the manufacturer's recommendations and applicable provisions for applying interior finish.

808.1.1.1 Suspended acoustical ceilings. Suspended acoustical ceiling systems shall be installed in accordance with the provisions of ASTM C635 and ASTM C636.

808.1.1.2 Fire-resistance-rated construction. Acoustical ceiling systems that are part of fire-resistance-rated construction shall be installed in the same manner used in the assembly tested and shall comply with the provisions of Chapter 7.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
901.5			X																			
Table 901.6			X																			
901.7			X																			
902.1			X																			
903.1.1			X																			
903.2			X																			
903.2.1.2			X																			
903.2.1.3			X																			
903.2.3			X																			
903.2.4.1			X																			
903.2.5.4			X																			
903.2.6			X																			
903.2.6.1			X																			
903.2.6.2			X																			
903.2.7			X																			
903.2.8			X																			
903.2.10			X																			
Table 903.2.11.6			X																			
903.2.14			X																			
903.2.14.1			X																			
903.2.14.2			X																			
903.2.15			X																			
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903.2.17.2.4			X																			
903.2.17.2.5			X																			
903.2.17.2.6			X																			
903.2.18			X																			
903.2.19			X																			
903.2.19.1			X																			
903.2.19.1.1			X																			
903.2.19.1.2			X																			
903.2.20			X																			
903.2.21			X																			
903.3			X																			

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
903.3.1.1			X																			
903.3.1.1.1			X																			
903.3.1.1.3			X																			
903.3.1.2			X																			
903.3.1.3			X																			
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903.3.5			X																			
903.3.9			X																			
903.4.2			X																			
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905.3.11.1			X																			
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905.7.2			X																			
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906.2			X																			
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907.1.3			X																			
907.1.4			X																			
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907.2.1			X																			

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendedd (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
907.2.1.1			X																			
907.2.1.3			X																			
907.2.2			X																			
907.2.2.2			X																			
907.2.3			X																			
907.2.3.1			X																			
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907.2.3.6.2			X																			
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907.2.3.10			X																			
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907.2.11			X																			
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907.2.11.2			X																			
907.2.11.2.1 – 907.2.11.2.5			X																			
907.2.11.3			X																			
907.2.11.4			X																			
907.2.11.5			X																			

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
907.2.11.6			X																			
907.2.11.8			X																			
907.2.12.1.2			X																			
907.2.13			X																			
907.2.24			X																			
907.2.24.1			X																			
907.2.24.2			X																			
907.2.24.3			X																			
907.2.24.4			X																			
907.2.24.4.1			X																			
907.2.24.4.2			X																			
907.2.24.4.3			X																			
907.2.25			X																			
907.2.25.1			X																			
907.2.25.2			X																			
907.2.26			X																			
907.2.26.1			X																			
907.2.26.2			X																			
907.2.26.3			X																			
907.2.26.4			X																			
907.2.26.4.1			X																			
907.2.26.4.2			X																			
907.2.27			X																			
907.2.28			X																			
907.2.28.1			X																			
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907.2.29.1			X																			
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907.3.2.1			X																			
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907.3.2.3			X																			
907.3.2.4			X																			
907.3.2.5			X																			
907.3.3			X																			
907.4.2.1			X																			
907.4.2.2			X				X															
907.4.2.7			X																			
907.5 – 907.5.1.1			X																			
907.5.2.1			X																			
907.5.2.1.4			X																			
907.5.2.2			X																			
907.5.2.2.4			X																			
907.5.2.3			X				X															

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CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
907.5.2.3.1			X				X															
907.5.2.3.2			X				X															
Table 907.5.2.3.2			X				X															
907.5.2.3.3			X	X	X	X	X															
907.5.2.3.4			X				X															
907.5.2.4			X																			
907.5.2.5			X																			
907.6.1				X	X																	
907.6.1.1			X																			
907.6.4			X																			
907.6.4.1			X																			
907.6.4.1.1			X																			
907.6.4.2			X																			
907.6.4.3			X																			
907.6.4.4			X																			
907.6.6			X																			
907.6.6.4			X																			
908.2			X																			
908.4			X																			
909.5.3			X																			
909.5.3.1			X																			
909.12.1			X																			
909.16			X																			
909.16.1			X																			
909.18.9			X																			
909.20			X																			
909.20.1			X																			
909.20.2.2			X																			
909.20.2.3			X																			
909.20.2.4			X																			
909.20.2.5			X																			
909.20.3			X																			
909.20.3.3			X																			
909.20.4			X																			
909.20.4.1			X																			
909.20.4.2			X																			
910.2.1			X																			
910.3.1			X																			
911.1.2			X																			
911.1.6			X																			
911.1.7			X																			
912.4			X																			

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X																	
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
912.6			X																			
913.1			X																			
913.6			X																			
915.1			X	X	X																	
915.1.1			X																			
915.2			X	X	X																	
915.2.1			X	X	X																	
915.2.3			X																			
915.4			X	X	X																	
915.4.1, Exceptions 2 and 3			X	X	X																	
915.4.2			X	X	X																	
915.4.3			X																			
915.4.4			X	X	X																	
915.4.5				X	X																	
915.5.2			X	X	X																	
915.5.3			X	X	X																	
915.6			X	X	X																	
915.7			X			X																

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 9

FIRE PROTECTION AND LIFE SAFETY SYSTEMS

User note:

About this chapter: Chapter 9 prescribes the minimum requirements for active fire protection equipment systems to perform the functions of detecting a fire, alerting the occupants or fire department of a fire emergency, mass notification, gas detection, controlling smoke and controlling or extinguishing the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the California Fire Code.

SECTION 901 GENERAL

901.1 Scope. The provisions of this chapter shall specify where fire protection and life safety systems are required and shall apply to the design, installation and operation of fire protection and life safety systems.

901.2 Fire protection systems. Fire protection and life safety systems shall be installed, repaired, operated and maintained in accordance with this code and the *California Fire Code*.

Any fire protection or life safety system for which an exception or reduction to the provisions of this code has been granted shall be considered to be a required system.

Exception: Any fire protection or life safety system or portion thereof not required by this code shall be permitted to be installed for partial or complete protection provided that such system meets the requirements of this code.

901.3 Modifications. Persons shall not remove or modify any fire protection system installed or maintained under the provisions of this code or the *California Fire Code* without approval by the building official.

901.4 Threads. Threads provided for fire department connections to sprinkler systems, standpipes, yard hydrants or any other fire hose connection shall be compatible with the connections used by the local fire department.

901.5 Administration of installation acceptance tests. Fire protection systems shall be tested in accordance with the requirements of this code and the *California Fire Code*. Where required, the tests shall be conducted in the presence of the building official. Tests required by this code, the *California Fire Code* and the standards listed in this code shall be conducted at the expense of the owner or the owner's authorized agent. It shall be unlawful to occupy portions of a structure until the required fire protection systems within that portion of the structure have been tested and approved.

901.6 Supervisory service. Where required, fire protection systems shall be monitored by an approved supervising station in accordance with NFPA 72.

901.6.1 Automatic sprinkler systems. Automatic sprinkler systems shall be monitored by an approved supervising station.

Exceptions:

1. A supervising station is not required for automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area systems in accordance with Section 903.3.8.

[F] 901.6.2 Integrated testing. Where two or more fire protection or life safety systems are interconnected, the intended response of subordinate fire protection and life safety systems shall be verified when required testing of the initiating system is conducted. In addition, integrated testing shall be performed in accordance with Sections 901.6.2.1 and 901.6.2.2.

[F] 901.6.2.1 High-rise buildings. For high-rise buildings, integrated testing shall comply with NFPA 4, with an integrated test performed prior to issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

[F] 901.6.2.2 Smoke control systems. Where a fire alarm system is integrated with a smoke control system as outlined in Section 909, integrated testing shall comply with NFPA 4, with an integrated test performed prior to issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

901.6.3 Fire alarm systems. Fire alarm systems required by the provisions of Section 907.2 of this code and

Sections 907.2 and 907.9 of the *California Fire Code* shall be monitored by an approved supervising station in accordance with Section 907.6.6 of this code.

Exceptions:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies.
3. Supervisory service is not required for automatic sprinkler systems in one- and two-family dwellings.

901.6.4 Group H. Supervision and monitoring of emergency alarm, detection and automatic fire-extinguishing systems in Group H occupancies shall be in accordance with the *California Fire Code*.

901.7 Fire areas. Where buildings, or portions thereof, are divided into fire areas so as not to exceed the limits established for requiring a fire protection system in accordance with this chapter, such fire areas shall be separated by fire walls constructed in accordance with Section 706, fire barriers constructed in accordance with Section 707, or horizontal assemblies constructed in accordance with Section 711, or a combination thereof having a fire-resistance rating of not less than that determined in accordance with Section 707.3.10.

**SECTION 902
FIRE PUMP AND RISER ROOM SIZE**

[F] 902.1 Pump and riser room size. Where provided, fire pump rooms and automatic sprinkler system riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working room around the stationary equipment. Clearances around equipment to elements of permanent construction, including other installed equipment and appliances, shall be sufficient to allow inspection, service, repair or replacement without removing such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly. Fire pump and automatic sprinkler system riser rooms shall be provided with doors and unobstructed passageways large enough to allow removal of the largest piece of equipment.

[F] 902.1.1 Access. Automatic sprinkler system risers, fire pumps and controllers shall be provided with ready access. Where located in a fire pump room or automatic sprinkler system riser room, the door shall be permitted to be locked provided that the key is available at all times.

[F] 902.1.2 Marking on access doors. Access doors for automatic sprinkler system riser rooms and fire pump rooms shall be labeled with an approved sign. The lettering shall be in contrasting color to the background. Letters shall have a minimum height of 2 inches (51 mm) with a minimum stroke of $\frac{3}{8}$ inch (10 mm).

[F] 902.1.3 Environment. Automatic sprinkler system riser rooms and fire pump rooms shall be maintained at a temperature of not less than 40°F (4°C). Heating units shall be permanently installed.

[F] 902.1.4 Lighting. Permanently installed artificial illumination shall be provided in the automatic sprinkler system riser rooms and fire pump rooms.

**SECTION 903
AUTOMATIC SPRINKLER SYSTEMS**

[F] 903.1 General. Automatic sprinkler systems shall comply with this section.

[F] 903.1.1 Alternative protection. Alternative automatic fire-extinguishing systems complying with Section 904 shall be permitted instead of automatic sprinkler system protection where recognized by the applicable standard and approved by the fire code official.

[F] 903.2 Where required. Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12 and Sections 903.2.14 through 903.2.21.

Exception: Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic smoke detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

[F] 903.2.1 Group A. An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section.

[F] 903.2.1.1 Group A-1. An automatic sprinkler system shall be provided throughout stories containing Group A-1 occupancies and throughout all stories from the Group A-1 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. The fire area contains a multitheater complex.

[F] 903.2.1.2 Group A-2. An automatic sprinkler system shall be provided throughout stories containing Group A-2 occupancies and throughout all stories from the Group A-2 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 5,000 square feet (464 m²).
2. The fire area has an occupant load of 100 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. *The structure exceeds 5,000 square feet (465 m²), contains more than one fire area containing a Group A-2 occupancy, and is separated into two*

or more buildings by fire walls of less than four-hour fire-resistance rating without openings.

[F] 903.2.1.3 Group A-3. An automatic sprinkler system shall be provided throughout stories containing Group A-3 occupancies and throughout all stories from the Group A-3 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. *The structure exceeds 12,000 square feet (1155 m²), contains more than one fire area containing exhibition and display rooms, and is separated into two or more buildings by fire walls of less than four-hour fire-resistance rating without openings.*

[F] 903.2.1.4 Group A-4. An automatic sprinkler system shall be provided throughout stories containing Group A-4 occupancies and throughout all stories from the Group A-4 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

[F] 903.2.1.5 Group A-5. An automatic sprinkler system shall be provided for all enclosed Group A-5 accessory use areas in excess of 1,000 square feet (93 m²).

[F] 903.2.1.5.1 Spaces under grandstands or bleachers. Enclosed spaces under grandstands or bleachers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where either of the following exist:

1. The enclosed area is 1,000 square feet (93 m²) or less and is not constructed in accordance with Section 1030.1.1.1.
2. The enclosed area exceeds 1,000 square feet (93 m²).

[F] 903.2.1.6 Assembly occupancies on roofs. Where an occupied roof has an assembly occupancy with an occupant load exceeding 100 for Group A-2 and 300 for other Group A occupancies, all floors between the occupied roof and the level of exit discharge shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

Exception: Open parking garages of Type I or Type II construction.

903.2.1.7 Multiple fire areas. An automatic sprinkler system shall be provided where multiple fire areas of Group A-1, A-2, A-3 or A-4 occupancies share exit or

exit access components and the combined occupant load of these fire areas is 300 or more.

[F] 903.2.2 Ambulatory care facilities. An automatic sprinkler system shall be installed throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:

1. Four or more care recipients are incapable of self-preservation.
2. One or more care recipients that are incapable of self-preservation are located at other than the level of exit discharge serving such a facility.

In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest level of exit discharge, the level of exit discharge, and all floors below the level of exit discharge.

Exception: Floors classified as an open parking garage are not required to be sprinklered.

[F] 903.2.3 Group E. An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Throughout all Group E fire areas greater than 12,000 square feet (1115 m²) in area.
2. The Group E fire area is located on a floor other than a level of exit discharge serving such occupancies.

Exception: In buildings where every classroom has not fewer than one exterior exit door at ground level, an automatic sprinkler system is not required in any area below the lowest level of exit discharge serving that area.

3. The Group E fire area has an occupant load of 300 or more.
4. *In rooms or areas with special hazards such as laboratories, vocational shops and other such areas where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.*
5. *Throughout any Group E structure greater than 12,000 square feet (1115 m²) in area, which contains more than one fire area, and which is separated into two or more buildings by fire walls of less than four hour fire resistance rating without openings.*
6. *For public school state funded construction projects see Section 903.2.19.*
7. *For public school campuses: Kindergarten through 12th grade, see Section 903.2.20.*

[F] 903.2.4 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 fire area exceeds 12,000 square feet (1115 m²).
2. A Group F-1 fire area is located more than three stories above grade plane.

3. The combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).

[F] 903.2.4.1 Woodworking operations. An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain wood-working operations in excess of 2,500 square feet (232 m²) in area that generate finely divided combustible waste or use finely divided combustible materials.

[SFM] A fire wall of less than four-hour fire-resistance rating without openings, or any fire wall with openings, shall not be used to establish separate fire areas.

[F] 903.2.4.2 Group F-1 distilled spirits. An automatic sprinkler system shall be provided throughout a Group F-1 fire area used for the manufacture of distilled spirits.

[F] 903.2.4.3 Group F-1 upholstered furniture or mattresses. An automatic sprinkler system shall be provided throughout a Group F-1 fire area that exceeds 2,500 square feet (232 m²) used for the manufacture of upholstered furniture or mattresses.

[F] 903.2.5 Group H. Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.5.1 through 903.2.5.3.

[F] 903.2.5.1 General. An automatic sprinkler system shall be installed in Group H occupancies.

[F] 903.2.5.2 Group H-5 occupancies. An automatic sprinkler system shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall be not less than that required by this code for the occupancy hazard classifications in accordance with Table 903.2.5.2.

Where the design area of the sprinkler system consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

**[F] TABLE 903.2.5.2
GROUP H-5 SPRINKLER DESIGN CRITERIA**

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

[F] 903.2.5.3 Pyroxylin plastics. An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

[F] 903.2.5.4 Group H occupancies located on the 11th story and above. The fire sprinkler system shall be designed and zoned to provide separate indication

upon water-flow for each side of the 2-hour fire-smoke barrier on the 11th story and above.

[F] 903.2.6 Group I. An automatic sprinkler system shall be provided throughout buildings with a Group I fire area.

Exceptions:

1. Those areas exempted by Section 407.6 of the California Building Code.
2. Pursuant to Health and Safety Code Section 13113(d), Group I-2 occupancies, or any alterations thereto, located in Type IA construction in existence on March 4, 1972.

[F] 903.2.6.1 Group I-2. In an existing, unsprinklered Group I-2, nurse station open to fire-resistive exit access corridors shall be protected by an automatic sprinkler system located directly above the nurse station. It shall be permitted to connect the automatic sprinkler system to the domestic water service.

[F] 903.2.6.2 Group I-3. Every building, or portion thereof, where inmates or persons are in custody or restrained shall be protected by an automatic sprinkler system conforming to NFPA 13. The main sprinkler control valve or valves and all other control valves in the system shall be locked in the open position and electrically supervised so that at least an audible and visual alarm will sound at a constantly attended location when valves are closed. The sprinkler branch piping serving cells may be embedded in the concrete construction.

[F] 903.2.7 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M fire area exceeds 12,000 square feet (1115 m²).
2. A Group M fire area is located more than three stories above grade plane.
3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
4. The structure exceeds 24,000 square feet (465 m²), contains more than one fire area containing a Group M occupancy, and is separated into two or more buildings by fire walls of less than 4-hour fire resistance rating without openings.

[F] 903.2.7.1 High-piled storage. An automatic sprinkler system shall be provided in accordance with the California Fire Code in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

[F] 903.2.7.2 Group M upholstered furniture or mattresses. An automatic sprinkler system shall be provided throughout a Group M fire area where the area used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m²).

[F] **903.2.8 Group R.** An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.

Exceptions:

1. Existing Group R-3 occupancies converted to Group R-3.1 occupancies not housing bedridden clients, not housing nonambulatory clients above the first floor and not housing clients above the second floor.
2. Existing Group R-3 occupancies converted to Group R-3.1 occupancies housing only one bedridden client and complying with Section 435.8.3.3.
3. Pursuant to Health and Safety Code Section 13113 occupancies housing ambulatory children only, none of whom are mentally ill children or children with intellectual disabilities, and the buildings or portions thereof in which such children are housed are not more than two stories in height, and buildings or portions thereof housing such children have an automatic fire alarm system activated by approved smoke detectors.
4. Pursuant to Health and Safety Code Section 13143.6 occupancies licensed for protective social care which house ambulatory clients only, none of whom is a child (under the age of 18 years) or who is elderly (65 years of age or over).

When not used for height increases or for area increases, an automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be allowed in Group R-2.1 occupancies.

An automatic sprinkler system designed in accordance with Section 903.3.1.3 shall not be utilized in Group R-2.1 or R-4 occupancies.

[F] **903.2.8.1 Group R-3.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 occupancies.

[F] **903.2.8.2 Group R-4, Condition 1.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-4, Condition 1 occupancies.

[F] **903.2.8.3 Group R-4, Condition 2.** An automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4, Condition 2 occupancies.

[F] **903.2.8.4 Care facilities.** An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in care facilities with five or fewer individuals in a single-family dwelling.

[F] **903.2.9 Group S-1.** An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m²).

2. A Group S-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
4. A Group S-1 fire area used for the storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

[F] **903.2.9.1 Repair garages.** An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406, as shown:

1. Buildings having two or more stories above grade plane, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m²).
2. Buildings not more than one story above grade plane, with a fire area containing a repair garage exceeding 12,000 square feet (1115 m²).
3. Buildings with repair garages servicing vehicles parked in basements.
4. A Group S-1 fire area used for the repair of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

[F] **903.2.9.2 Bulk storage of tires.** Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m³) shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

[F] **903.2.9.3 Group S-1 Distilled spirits or wine.** An automatic sprinkler system shall be provided throughout a Group S-1 fire area used for the bulk storage of distilled spirits or wine.

[F] **903.2.9.4 Group S-1 upholstered furniture and mattresses.** An automatic sprinkler system shall be provided throughout a Group S-1 fire area where the area used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m²).

Exception: Self-service storage facilities not greater than one story above grade plane where all storage spaces can be accessed directly from the exterior.

[F] **903.2.10 Group S-2 parking garages.** An automatic sprinkler system shall be provided throughout buildings classified as parking garages where any of the following conditions exists:

1. Where the fire area of the enclosed parking garage in accordance with Section 406.6 exceeds 12,000 square feet (1115 m²).
2. Where the enclosed parking garage in accordance with Section 406.6 is located beneath other groups.

Exception: Enclosed parking garages located beneath Group R-3 occupancies.

3. Where the fire area of the open parking garage in accordance with Section 406.5 exceeds 48,000 square feet (4460 m²).

[F] 903.2.10.1 Commercial parking garages. An automatic sprinkler system shall be provided throughout buildings used for storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

[F] 903.2.10.2 Mechanical-access enclosed parking garages. An approved automatic sprinkler system shall be provided throughout buildings used for the storage of motor vehicles in a mechanical-access enclosed parking garage. The portion of the building that contains the mechanical-access enclosed parking garage shall be protected with a specially engineered automatic sprinkler system.

[F] 903.2.11 Specific building areas and hazards. In all occupancies other than Group U, an automatic sprinkler system shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through 903.2.11.6.

[F] 903.2.11.1 Stories without openings. An automatic sprinkler system shall be installed throughout all stories, including basements, of all buildings where the floor area exceeds 1,500 square feet (139.4 m²) and where the story does not comply with the following criteria for exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with Section 1011 or an outside ramp complying with Section 1012. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm).
2. Openings entirely above the adjoining ground level totaling not less than 20 square feet (1.86 m²) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm). The height of the bottom of the clear opening shall not exceed 44 inches (1118 mm) measured from the floor.

[F] 903.2.11.1.1 Opening dimensions and access. Openings shall have a minimum dimension of not less than 30 inches (762 mm). Access to such openings shall be provided for the fire department from the exterior and shall not be obstructed in a manner such that fire fighting or rescue cannot be accomplished from the exterior.

[F] 903.2.11.1.2 Openings on one side only. Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall be equipped throughout with an approved automatic sprinkler system, or openings shall be provided on not fewer than two sides of the story.

[F] 903.2.11.1.3 Basements. Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.11.1, or where walls, partitions or other obstructions are installed that restrict the application of water from hose streams, the basement shall be equipped throughout with an approved automatic sprinkler system.

[F] 903.2.11.2 Rubbish and linen chutes. An automatic sprinkler system shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. Access to sprinklers in chutes shall be provided for servicing.

[F] 903.2.11.3 Buildings 55 feet or more in height. An automatic sprinkler system shall be installed throughout buildings that have one or more stories with an occupant load of 30 or more located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access, measured to the finished floor.

Exception: Occupancies in Group F-2.

[F] 903.2.11.4 Ducts conveying hazardous exhausts. Where required by the *California Mechanical Code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust or flammable or combustible materials.

Exception: Ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

[F] 903.2.11.5 Commercial cooking operations. An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct systems where an automatic sprinkler system is used to comply with Section 904.

[F] 903.2.11.6 Other required fire protection systems. In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 require the installation of a fire protection system for certain buildings and areas.

[F]TABLE 903.2.11.6
ADDITIONAL REQUIRED PROTECTION SYSTEMS

SECTION	SUBJECT
402.5, 402.6.2	Covered and open mall buildings
403.3	High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access
404.3	Atriums
405.3	Underground structures
406.6.4	Mechanical-access enclosed parking garages
407.7	Group I-2
410.6	Stages
411.3	Special amusement buildings
412.2.4	Airport traffic control towers
412.3.6, 412.3.6.1, 412.5.6	Aircraft hangars
415.11.11	Group H-5 HPM exhaust ducts
416.5	Flammable finishes
417.4	Drying rooms
424.3	Play structures
428	Buildings containing Group L occupancies
440	Horse racing stables
441	Pet kennels
449	Public libraries
507	Unlimited area buildings
508.5.7	Live/work units
509.4	Incidental uses
1030.6.2.3	Smoke-protected assembly seating
CFC	Sprinkler system requirements as set forth in Section 903.2.11.6 of the California Fire Code
California Fire Code Section 1207	Stationary and mobile energy storage systems

[[F] **903.2.12 During construction.** Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with Chapter 33 of the California Fire Code.

903.2.13 Reserved.

903.2.14 Motion picture and television production studio sound stages, approved production facilities and production locations.

903.2.14.1 Existing sound stages and approved production facilities. All existing sound stages and approved production facilities equipped with an automatic fire sprinkler system shall be maintained in accordance with the provisions of California Fire Code Chapter 9.

903.2.14.2 New sound stages. All new sound stages shall be equipped with an approved automatic fire sprinkler system. The system shall be installed in accordance with the provisions of the California Fire

Code Chapter 9 and shall meet the minimum design requirements of an Extra Hazard, Group 2 system.

903.2.15 Automatic sprinkler system—existing high-rise buildings. See California Fire Code Chapter 11 and California Existing Building Code.

903.2.15.1 Existing Group R-1 and R-2 high-rise buildings fire-extinguishing systems. See California Fire Code Chapter 11 and California Existing Building Code.

903.2.16 Group L occupancies. An automatic sprinkler system shall be installed throughout buildings housing Group L occupancies. Sprinkler systems for Group L occupancy shall be designed for the square footage area of the Group L occupancy based on an area of sprinkler operation of 2,500 square feet (232 m²) and design density of 0.20 gpm/sf.

In mixed occupancies, portions of floors with Group L occupancies, but not classified as Group L, shall be provided with a sprinkler protection system per NFPA 13.

903.2.16.1 Group L occupancies located on the 11th story and above. The automatic sprinkler system shall be designed and zoned to provide separate indication upon water-flow for each side of the 2-hour fire-smoke barrier on the 11th story and above.

903.2.17 Fixed guideway and passenger rail transit systems.

903.2.17.1 Automatic sprinkler system. An automatic sprinkler system shall be installed in all stations of fixed guideway transit systems.

Exceptions:

1. Guideways when the closest sprinkler heads to the guideway are within 3 feet (914 mm) of the edge, over the platform, and spaced 6 feet (1829 mm) on center parallel to the guideway
2. Station agent booths not exceeding 150 square feet (13.9 m²) in area, when provided with an approved smoke detector connected to the building fire alarm system
3. Power substations
4. Machinery rooms, electrical rooms and train control rooms protected by an approved automatic fixed fire-extinguishing system
5. Open stations
6. Station platform areas open to three or more sides

903.2.17.2 Station guideway deluge system. Underground stations and stations in open cuts with walls 5 feet (1524 mm) above the top of the running rail and with a raised platform shall be provided with an under-vehicle guideway manually activated deluge sprinkler system. In open cut stations, such system shall be provided in guideways which are situated between a raised platform edge and a retaining wall.

903.2.17.2.1 Systems shall be provided along the entire length of track at each station platform.

903.2.17.2.2 *Deluge nozzles with caps shall be located in the approximate center of track with spacing designed to completely wet the undersides of the vehicle at the applied density.*

903.2.17.2.3 *System density shall be a minimum of 0.19 gallon per minute (gpm) per square foot (0.72 L/m per m²) for the design area. When more than one zone is provided, two adjacent zones are required to be considered operating for calculating purposes.*

903.2.17.2.4 *Deluge systems shall be directly connected to a water supply capable of supplying the required flow rate for a minimum 30-minute duration.*

903.2.17.2.5 *Controls or manually operable valves shall be in a location acceptable to the Fire Code Official. All deluge systems shall be monitored by the station fire alarm system.*

903.2.17.2.6 *Each valve shall be monitored by a separate circuit. The alarm panel shall be located in an area normally occupied by station personnel or signals shall be transmitted to the operations control center (OCC).*

903.2.18 Group U private garages and carports accessory to Group R-3 occupancies. *Carports with habitable space above and attached garages, accessory to Group R-3 occupancies, shall be protected by residential fire sprinklers in accordance with this section. Residential fire sprinklers shall be connected to, and installed in accordance with, an automatic residential fire sprinkler system that complies with Section R313 of the California Residential Code or with NFPA 13D. Fire sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a minimum density of 0.05 gpm/ft² (2.04 mm/min) over the area of the garage and/or carport, but not to exceed two sprinklers for hydraulic calculation purposes. Garage doors shall not be considered obstructions with respect to sprinkler placement.*

Exception: *An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing carports and/or garages that do not have an automatic residential fire sprinkler system installed in accordance with this section.*

903.2.19 Public school state funded construction projects for kindergarten through 12th grade - automatic sprinkler system requirements.

903.2.19.1 New public school campus. *An automatic sprinkler system shall be provided in all occupancies. The provisions of this section shall apply to any public school project consisting of one or more buildings on a new school campus and receiving state funds pursuant to Leroy F. Greene School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079. For purposes of this section, new campus refers to a school site, where an application for construction of original buildings was made to DSA on or after July 1, 2002.*

An automatic fire sprinkler system is not required in locations identified in Section 903.2.20.

903.2.19.1.1 *Sprinklers shall be installed in spaces where the ceiling creates a “ceiling-plenum” or space above the ceiling is utilized for environmental air.*

903.2.19.1.2 Fire-resistive substitution for new campus. *A new public school campus shall be entitled to include in the design and construction documents all of the applicable fire-resistive construction substitutions as permitted by this code.*

903.2.20 Public school campuses. *An automatic fire sprinkler system is not required to be provided in the following locations on Kindergarten through 12th grade.*

1. *A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.*
2. *Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include but not be limited to:*

- Concession Stand*
- Press Box*
- Restroom Facilities*
- Shade Structure*
- Snack Bar*
- Storage Building*
- Ticket Booth*

903.2.21 Required exterior entrance covers. *An automatic sprinkler system shall be provided throughout covered exterior entrances required by California Building Code Section 11B-206.4.10 or Section 1224.33.2.1.*

[F] 903.3 Installation requirements. *Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.9.*

[F] 903.3.1 Standards. *Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1 unless otherwise permitted by Sections 903.3.1.2 and 903.3.1.3 and other chapters of this code, as applicable.*

[F] 903.3.1.1 NFPA 13 sprinkler systems. *Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 as amended in Chapter 35 except as provided in Sections 903.3.1.1.1 through 903.3.1.1.3.*

[F] 903.3.1.1.1 Exempt locations. *Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in*

accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from a room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.

1. A room where the application of water, or flame and water, constitutes a serious life or fire hazard *as determined by the authority having jurisdiction.*
2. A room or space where sprinklers are considered undesirable because of the nature of the contents *as determined by the authority having jurisdiction.*
3. *Machine rooms, machinery spaces, control rooms, control spaces and hoistways associated with fire service access elevators provided in accordance with Section 3007.*
4. *Machine rooms, machinery spaces, control rooms and control spaces and hoistways associated with occupant evacuation elevators designed in accordance with Section 3008.*
5. *Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, and associated electrical power distribution equipment, provided those spaces or areas are equipped throughout with an automatic smoke detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 or not less than 2-hour horizontal assemblies constructed in accordance with Section 712, or both.*
6. *Elevator hoistways, machine rooms, machinery spaces, control spaces and control rooms in accordance with Section 3005.4.1 of the California Building Code.*

[F] 903.3.1.1.2 Bathrooms. In Group R occupancies sprinklers shall not be required in bathrooms that do not exceed 55 square feet (5 m²) in area and are located within individual dwelling units or sleeping units, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating.

903.3.1.1.3 Solar photovoltaic power systems. Automatic sprinklers shall not be required in the following areas:

1. *Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath, including storage.*

2. *Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.*

[F] 903.3.1.2 NFPA 13R sprinkler systems. Automatic sprinkler systems in Group R occupancies shall be permitted to be installed throughout in accordance with NFPA 13R *as amended in Chapter 35.*

1. Four stories or fewer above grade plane.
2. The floor level of the highest story is 30 feet (9144 mm) or less above the lowest level of fire department vehicle access.
3. The floor level of the lowest story is 30 feet (9144 mm) or less below the lowest level of fire department vehicle access.

The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 shall be measured from grade plane.

[F] 903.3.1.2.1 Balconies and decks. Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of dwelling units and sleeping units where either of the following conditions exists:

1. The building is of Type V construction, provided that there is a roof or deck above.
2. Exterior balconies, decks and ground floor patios of dwelling units and sleeping units are constructed in accordance with Section 705.2.3.1, Exception 3.

Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

[F] 903.3.1.2.2 Corridors and balconies in the means of egress. Sprinkler protection shall be provided in corridors and for balconies in the means of egress where any of the following conditions apply:

1. Corridors with combustible floor or walls.
2. Corridors with an interior change of direction exceeding 45 degrees (0.79 rad).
3. Corridors that are less than 50 percent open to the outside atmosphere at the ends.
4. Open-ended corridors and associated exterior stairways and ramps as specified in Section 1027.6, Exception 3.
5. Egress balconies not complying with Sections 1021.2 and 1021.3.

[F] **903.3.1.2.3 Attics.** Attic protection shall be provided as follows:

1. Attics that are used or intended for living purposes or storage shall be protected by an automatic sprinkler system.
2. Where fuel-fired equipment is installed in an unsprinklered attic, not fewer than one quick-response intermediate temperature sprinkler shall be installed above the equipment.
3. Where located in a building of Type III, Type IV or Type V construction designed in accordance with Section 510.2 or 510.4, attics not required by Item 1 to have sprinklers shall comply with one of the following if the roof assembly is located more than 55 feet (16 764 mm) above the lowest level of fire department vehicle access needed to meet the provisions in Section 503.
 - 3.1. Provide automatic sprinkler system protection.
 - 3.2. Construct the attic using noncombustible materials.
 - 3.3. Construct the attic using fire-retardant-treated wood complying with Section 2303.2.
 - 3.4. Fill the attic with noncombustible insulation.

The height of the roof assembly shall be determined by measuring the distance from the lowest required fire vehicle access road surface adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. For the purpose of this measurement, required fire vehicle access roads shall include only those roads that are necessary for compliance with Section 503 of the *California Fire Code*.

[F] **903.3.1.3 NFPA 13D sprinkler systems.** Automatic sprinkler systems installed in one- and two-family dwellings; Group R-3; Group R-4, Condition 1; and townhouses shall be permitted to be installed throughout in accordance with NFPA 13D *as amended in Chapter 35*.

[F] **903.3.2 Quick-response and residential sprinklers.** Where automatic sprinkler systems are required by this code, quick-response or residential automatic sprinklers shall be installed in all of the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing care recipient sleeping units in Group I-2 in accordance with this code.

2. Throughout all spaces within a smoke compartment containing gas fireplace appliances and decorative gas appliances in Group I-2.
3. Throughout all spaces within a smoke compartment containing treatment rooms in ambulatory care facilities.
4. Dwelling units and sleeping units in Group R occupancies.
5. Light-hazard occupancies as defined in NFPA 13.

[F] **903.3.3 Obstructed locations.** Automatic sprinklers shall be installed with regard to obstructions that will delay activation or obstruct the water distribution pattern and shall be in accordance with the applicable automatic sprinkler system standard that is being used. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands, or equipment that exceeds 4 feet (1219 mm) in width. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

Exception: Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

[F] **903.3.4 Actuation.** Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.

[F] **903.3.5 Water supplies.** Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with *the Health and Safety Code Section 13114.7*. For connections to public waterworks systems, the water supply test used for design of fire protection systems shall be adjusted to account for seasonal and daily pressure fluctuations based on information from the water supply authority and as approved by the fire code official.

[F] **903.3.5.1 Domestic services.** Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with this section.

[F] **903.3.5.2 Residential combination services.** A single combination water supply shall be allowed provided that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

[F] **903.3.6 Hose threads.** Fire hose threads and fittings used in connection with automatic sprinkler systems shall be as prescribed by the fire code official.

[F] **903.3.7 Fire department connections.** Fire department connections for automatic sprinkler systems shall be installed in accordance with Section 912.

[F] **903.3.8 Limited area sprinkler systems.** Limited area sprinkler systems shall be in accordance with the standards listed in Section 903.3.1 except as provided in Sections 903.3.8.1 through 903.3.8.5.

903.3.8.1 Number of sprinklers. Limited area sprinkler systems shall not exceed six sprinklers in any single fire area.

903.3.8.2 Occupancy hazard classification. Only areas classified by NFPA 13 as Light Hazard or Ordinary Hazard Group 1 shall be permitted to be protected by limited area sprinkler systems.

903.3.8.3 Piping arrangement. Where a limited area sprinkler system is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system. Where a limited area sprinkler system is installed in a building without an automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system provided that the plumbing system is capable of simultaneously supplying domestic and sprinkler demands.

903.3.8.4 Supervision. Control valves shall not be installed between the water supply and sprinklers unless the valves are of an approved indicating type that are supervised or secured in the open position.

903.3.8.5 Calculations. Hydraulic calculations in accordance with NFPA 13 shall be provided to demonstrate that the available water flow and pressure are adequate to supply all sprinklers installed in any single fire area with discharge densities corresponding to the hazard classification.

[F] 903.3.9 Floor control valves. Floor control valves and waterflow detection assemblies shall be installed at each floor where any of the following occur:

1. Buildings where the floor level of the highest story is located more than 30 feet above the lowest level of fire department vehicle access
2. Buildings that are four or more stories in height
3. Buildings that are two or more stories below the highest level of fire department vehicle access

Exception: Group R-3 and R-3.1 occupancies floor control valves and waterflow detection assemblies shall not be required.

[F] 903.4 Sprinkler system supervision and alarms. Valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and waterflow switches on all sprinkler systems shall be electrically supervised by a listed fire alarm control unit.

Exceptions:

1. Automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area sprinkler systems in accordance with Section 903.3.8.
3. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the automatic sprinkler system, and a separate shutoff valve for the automatic sprinkler system is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.

5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.
6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.
8. Underground key or hub gate valves in roadway boxes.

[F] 903.4.1 Monitoring. Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, where approved by the fire code official, shall sound an audible signal at a constantly attended location.

Exception: Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

[F] 903.4.2 Alarms. One exterior approved audible device, located on the exterior of the building in an approved location, shall be connected to each automatic sprinkler system. Such sprinkler waterflow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system. Visible alarm notification appliances shall not be required except when required by Section 907.

[F] 903.4.3 Floor control valves. Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access.

[F] 903.5 Testing and maintenance. Automatic sprinkler systems shall be tested and maintained in accordance with the California Fire Code.

**SECTION 904
ALTERNATIVE AUTOMATIC
FIRE-EXTINGUISHING SYSTEMS**

[F] 904.1 General. Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.

[F] 904.2 Where permitted. Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official.

[F] 904.2.1 Restriction on using automatic sprinkler system exceptions or reductions. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed for automatic sprinkler systems or by other requirements of this code.

[F] 904.2.2 Commercial hood and duct systems. Each required commercial kitchen exhaust hood and duct system required by Section 606 of the *California Fire Code* or Chapter 5 of the *California Mechanical Code* to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

[F] 904.3 Installation. Automatic fire-extinguishing systems shall be installed in accordance with this section.

[F] 904.3.1 Electrical wiring. Electrical wiring shall be in accordance with the *California Electrical Code*.

[F] 904.3.2 Actuation. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.11.1. Where more than one hazard could be simultaneously involved in fire due to their proximity, all hazards shall be protected by a single system designed to protect all hazards that could become involved.

Exception: Multiple systems shall be permitted to be installed if they are designed to operate simultaneously.

[F] 904.3.3 System interlocking. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required by the design and installation standard utilized for the hazard.

[F] 904.3.4 Alarms and warning signs. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible and visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with Section 907.5.2.

[F] 904.3.5 Monitoring. Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.

[F] 904.4 Inspection and testing. Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

[F] 904.4.1 Inspection. Prior to conducting final acceptance tests, all of the following items shall be inspected:

1. Hazard specification for consistency with design hazard.

2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

[F] 904.4.2 Alarm testing. Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

[F] 904.4.2.1 Audible and visible signals. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

[F] 904.4.3 Monitor testing. Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

[F] 904.5 Wet-chemical systems. Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17A and their listing. Records of inspections and testing shall be maintained.

[F] 904.6 Dry-chemical systems. Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17 and their listing. Records of inspections and testing shall be maintained.

[F] 904.7 Foam systems. Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*, NFPA 11 and NFPA 16 and their listing. Records of inspections and testing shall be maintained.

[F] 904.8 Carbon dioxide systems. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*, NFPA 12 and their listing. Records of inspections and testing shall be maintained.

[F] 904.9 Halon systems. Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*, NFPA 12A and their listing. Records of inspections and testing shall be maintained.

[F] 904.10 Clean-agent systems. Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*, NFPA 2001 and

their listing. Records of inspections and testing shall be maintained.

[F] 904.11 Automatic water mist systems. Automatic water mist systems shall be permitted in applications that are consistent with the applicable listing or approvals and shall comply with Sections 904.11.1 through 904.11.3.

[F] 904.11.1 Design and installation requirements. Automatic water mist systems shall be designed and installed in accordance with Sections 904.11.1.1 through 904.11.1.4.

[F] 904.11.1.1 General. Automatic water mist systems shall be designed and installed in accordance with NFPA 750 and the manufacturer's instructions.

[F] 904.11.1.2 Actuation. Automatic water mist systems shall be automatically actuated.

[F] 904.11.1.3 Water supply protection. Connections to a potable water supply shall be protected against backflow in accordance with the *California Plumbing Code*.

[F] 904.11.1.4 Secondary water supply. Where a secondary water supply is required for an *automatic* sprinkler system, an automatic water mist system shall be provided with an approved secondary water supply.

[F] 904.11.2 Water mist system supervision and alarms. Supervision and alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.

[F] 904.11.2.1 Monitoring. Monitoring shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.1.

[F] 904.11.2.2 Alarms. Alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.2.

[F] 904.11.2.3 Floor control valves. Floor control valves shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.3.

[F] 904.11.3 Testing and maintenance. Automatic water mist systems shall be tested and maintained in accordance with the *California Code of Regulations, Title 19, Division 1, Chapter 5 and California Fire Code*.

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[F] 904.12 Aerosol fire-extinguishing systems. Aerosol fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with NFPA 2010, and their listing.

Such devices and appurtenances shall be listed and installed in compliance with manufacturers' instructions.

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[F] 904.13 Commercial cooking systems. *Commercial cooking equipment that produces grease-laden vapors shall be provided with a Type I Hood, in accordance with the California Mechanical Code, and an automatic fire extinguishing system that is listed and labeled for its intended use as follows:*

1. *Wet chemical extinguishing system, complying with UL 300.*

2. *Carbon dioxide extinguishing systems.*

3. *Automatic fire sprinkler systems.*

All existing dry chemical and wet chemical extinguishing systems shall comply with UL 300.

Exception: *Public school kitchens, without deep-fat fryers, shall be upgraded to a UL 300-compliant system during state-funded modernization projects that are under the jurisdiction of the Division of the State Architect.*

All systems shall be installed in accordance with the California Mechanical Code, appropriate adopted standards, their listing and the manufacturer's installation instructions.

Exception: Factory-built commercial cooking recirculating systems that are tested in accordance with UL 710B and listed, labeled and installed in accordance with Section 304.1 of the *California Mechanical Code*.

[F] 904.13.1 Manual system operation. A manual actuation device shall be located at or near a means of egress from the cooking area not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) or less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

Exception: Automatic sprinkler systems shall not be required to be equipped with manual actuation means.

[F] 904.13.2 System interconnection. The actuation of the fire suppression system shall automatically shut down the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

[F] 904.13.3 Carbon dioxide systems. Where carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect against all hazards venting through a common duct simultaneously.

[F] 904.13.3.1 Ventilation system. Commercial-type cooking equipment protected by an automatic carbon dioxide-extinguishing system shall be arranged to shut off the ventilation system upon activation.

[F] 904.13.4 Special provisions for automatic sprinkler systems. Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, indicating-type control valve that is identified. Access to the control valve shall be provided.

[F] **904.13.4.1 Listed sprinklers.** Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, listed for that application and installed in accordance with their listing.

* | [F] **904.14 Domestic cooking facilities.** Cooktops and ranges installed in the following occupancies shall be protected in accordance with Section 904.14.1:

1. In Group R-2.1 occupancies where domestic cooking facilities are installed in accordance with Section 420.9.
2. In Group I-2 occupancies where domestic cooking facilities are installed in accordance with Section 407.2.7.
3. In Group R-2 college dormitories where domestic cooking facilities are installed in accordance with Section 420.11.

[F] **904.14.1 Protection from fire.** Cooktops and ranges shall be protected in accordance with Section 904.14.1.1 or 904.14.1.2.

[F] **904.14.1.1 Automatic fire-extinguishing system.** The domestic recirculating or exterior vented cooking hood provided over the cooktop or range shall be equipped with an approved automatic fire-extinguishing system complying with the following:

1. The automatic fire-extinguishing system shall be of a type recognized for protection of domestic cooking equipment. Preengineered automatic fire-extinguishing systems shall be listed and labeled in accordance with UL 300A and installed in accordance with the manufacturer's instructions.
2. Manual actuation of the fire-extinguishing system shall be provided in accordance with Section 904.13.1.
3. Interconnection of the fuel and electric power supply shall be in accordance with Section 904.13.2.

[F] **904.14.1.2 Ignition prevention.** Cooktops and ranges shall include burners that have been tested and listed to prevent ignition of cooking oil with burners turned on to their maximum heat settings and allowed to operate for 30 minutes.

SECTION 905 STANDPIPE SYSTEMS

[F] **905.1 General.** Standpipe systems shall be provided in new buildings and structures in accordance with Sections 905.2 through 905.11. In buildings used for high-piled combustible storage, fire protection shall be in accordance with the *California Fire Code*.

[F] **905.2 Installation standard.** Standpipe systems shall be installed in accordance with this section and NFPA 14 as amended in Chapter 35. Fire department connections for standpipe systems shall be in accordance with Section 912.

[F] **905.3 Required installations.** Standpipe systems shall be installed where required by Sections 905.3.1 through

905.3.11.1. Standpipe systems are allowed to be combined with automatic sprinkler systems.

Exception: Standpipe systems are not required in Group R-3 occupancies.

[F] **905.3.1 Height.** In other than Group R-3 and R-3.1 occupancies, Class III standpipe systems shall be installed throughout each floor where any of the following occur:

1. Buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access.
2. Buildings that are four or more stories in height.
3. Buildings where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.
4. Buildings that are two or more stories below the highest level of fire department vehicle access.

Exceptions:

1. Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Class I standpipes are allowed in Group B and E occupancies.
3. Class I standpipes are allowed in parking garages.
4. Class I standpipes are allowed in basements equipped throughout with an automatic sprinkler system.
5. Class I standpipes are allowed in buildings where occupant-use hose lines will not be utilized by trained personnel or the fire department.
6. In determining the lowest level of fire department vehicle access, it shall not be required to consider either of the following:
 - 6.1. Recessed loading docks for four vehicles or less.
 - 6.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

[F] **905.3.2 Group A.** Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

Exceptions:

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings that are not high-rise buildings.

[F] **905.3.3 Covered and open mall buildings.** Covered mall and open mall buildings shall be equipped throughout with a standpipe system where required by Section 905.3.1. Mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped

with Class I hose connections connected to the automatic sprinkler system sized to deliver water at 250 gallons per minute (946.4 L/min) at the hydraulically most remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed to not exceed a 50 pounds per square inch (psi) (345 kPa) residual pressure loss with a flow of 250 gallons per minute (946.4 L/min) from the fire department connection to the hydraulically most remote hose connection. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passageway or corridor.
2. At each floor-level landing within interior exit stairways opening directly on the mall.
3. At exterior public entrances to the mall of a covered mall building.
4. At public entrances at the perimeter line of an open mall building.
5. At other locations as necessary so that the distance to reach all portions of a tenant space does not exceed 200 feet (60 960 mm) from a hose connection.

[F] 905.3.4 Stages. Stages greater than 1,000 square feet in area (93 m²) shall be equipped with a Class III wet standpipe system with 1½-inch and 2½-inch (38 mm and 64 mm) hose connections on each side of the stage.

Exception: Where the building or area is equipped throughout with an automatic sprinkler system, a 1½-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.

[F] 905.3.4.1 Hose and cabinet. The 1½-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1½-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

[F] 905.3.5 Underground buildings. Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

[F] 905.3.6 Helistops and heliports. Buildings with a rooftop helistop or heliport shall be equipped with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located in accordance with Section 2007.5 of the *California Fire Code*.

[F] 905.3.7 Marinas and boatyards. Standpipes in marinas and boatyards shall comply with Chapter 36 of the *California Fire Code*.

[F] 905.3.8 Landscaped roofs. Buildings or structures that have landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the landscaped roof is located.

[F] 905.3.9 Smokeproof enclosures. For smokeproof enclosures see Section 909.20.

[F] 905.3.10 Group I-3. A housing pod within housing units where 50 or more inmates are restrained shall be provided with Class I wet standpipes. In addition, Class I wet standpipes shall be located so that it will not be necessary to extend hose lines through interlocking security doors and any doors in smoke-barrier walls, horizontal fire walls or fire barrier walls. Standpipes located in housing units may be placed in secured pipe chases.

905.3.11 Fixed-guideway and passenger rail transit systems. Fixed-guideway and passenger rail transit systems shall be provided with a Class I standpipe system in accordance with this section.

905.3.11.1 Underground stations. Underground stations shall be provided with an automatic Class I standpipe system.

905.3.11.2 All other stations. All other stations shall be provided with a Class I.

Exception: Open at-grade stations with unrestricted fire department access need not be provided with a standpipe system.

[F] 905.4 Location of Class I standpipe hose connections. Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required interior exit stairway, a hose connection shall be provided for each story above and below grade plane. Hose connections shall be located at the main floor landing unless otherwise approved by the fire code official. See Section 909.20.2.3 for additional provisions in smokeproof enclosures.

Exception: A single hose connection shall be permitted to be installed in the open corridor or open breezeway between open stairs that are not greater than 75 feet (22 860 mm) apart.

2. On each side of the wall adjacent to the exit opening of a horizontal exit.

Exception: Where floor areas adjacent to a horizontal exit are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose as measured along the path of travel, a hose connection shall not be required at the horizontal exit.

3. In every exit passageway, at the entrance from the exit passageway to other areas of a building.

Exception: Where floor areas adjacent to an exit passageway are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the entrance from the exit passageway to other areas of the building.

4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall. In open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent

to each entrance from an exit passageway or exit corridor to the mall.

5. Where the roof has a slope less than 4 units vertical in 12 units horizontal (33.3-percent slope), a hose connection shall be located to serve the roof or at the highest landing of an interior exit stairway with access to the roof provided in accordance with Section 1011.12.

➡ 6. Where the most remote portion of a floor or story is more than 150 feet (45 720 mm) from a hose connection, the fire code official is authorized to require that additional hose connections be provided in approved locations. *The distances from a hose connection shall be measured along the path of travel.*

[F] 905.4.1 Protection. Risers and laterals of Class I standpipe systems not located within an interior exit stairway shall be protected by a degree of fire resistance equal to that required for vertical enclosures in the building in which they are located.

Exception: In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an interior exit stairway are not required to be enclosed within fire-resistance-rated construction.

[F] 905.4.2 Interconnection. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

[F] 905.5 Location of Class II standpipe hose connections. Class II standpipe hose connections located so that all portions of the building are within 30 feet (9144 mm) of a listed variable stream fog nozzle attached to 100 feet (30 480 mm) of hose. Class II standpipe hose connections shall be located where they will have ready access.

[F] 905.5.1 Groups A-1 and A-2. In Group A-1 and A-2 occupancies having occupant loads exceeding 1,000 persons, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

[F] 905.5.2 Protection. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

[F] 905.5.3 Class II system 1-inch hose. A minimum 1-inch (25 mm) hose shall be allowed to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the fire code official.

[F] 905.6 Location of Class III standpipe hose connections. Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

[F] 905.6.1 Protection. Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

[F] 905.6.2 Interconnection. In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

[F] 905.7 Cabinets. Cabinets containing fire-fighting equipment such as standpipes, fire hoses, fire extinguishers or fire department valves shall not be blocked from use or obscured from view.

[F] 905.7.1 Cabinet equipment identification. Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

Exceptions:

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

[F] 905.7.2 Locking cabinet doors. Cabinets shall be unlocked.

Exceptions:

1. Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
2. Approved locking arrangements.
3. Group I-3 and in mental health areas of Group I-2 occupancies.

[F] 905.8 Dry standpipes. Dry standpipes shall not be installed.

Exception: Where subject to freezing and in accordance with NFPA 14.

[F] 905.9 Valve supervision. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall be transmitted to the control unit.

Exceptions:

1. Valves to underground key or hub valves in roadway boxes do not require supervision.
2. Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

[F] 905.10 During construction. Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3311.

[F] 905.11 Locking standpipe outlet caps. The fire code official is authorized to require locking caps on the outlets on standpipes where the responding fire department carries key wrenches for the removal that are compatible with locking FDC connection caps.

**SECTION 906
PORTABLE FIRE EXTINGUISHERS**

[F] 906.1 Where required. Portable fire extinguishers shall be installed in all of the following locations:

1. In Group A, B, E, F, H, I, L, M, R-1, R-2, R-2.1, R-2.2, R.3.1, R-4 and S occupancies.

Exception: In Group R-2 occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each dwelling unit is provided with a portable fire extinguisher having a minimum rating of 1-A:10-B:C.

2. Within 30 feet (9144 mm) distance of travel from commercial cooking equipment and from domestic cooking equipment in Group R-2 college dormitory occupancies.
3. In areas where flammable or combustible liquids are stored, used or dispensed.
4. On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 3315.1 of the *California Fire Code*.
5. Where required by the *California Fire Code* sections indicated in Table 906.1.
6. Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the fire code official.
7. *Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A:10B:C rating.*
8. *Where required by California Code of Regulations, Title 19, Division 1, Chapter 3.*
9. *Within 30 feet (9144 mm) of domestic cooking equipment located in a Group I-2.*

[F] 906.2 General requirements. Portable fire extinguishers shall be selected and installed in accordance with this section and *California Code of Regulations, Title 19, Division 1, Chapter 3*.

Exceptions:

1. The distance of travel to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.
2. In Group I-3 and in mental health areas of Group I-2, portable fire extinguishers shall be permitted to be located at staff locations.

[F] 906.3 Size and distribution. The size and distribution of portable fire extinguishers shall be in accordance with Sections 906.3.1 through 906.3.4.

**[F] TABLE 906.1
ADDITIONAL REQUIRED PORTABLE
FIRE EXTINGUISHERS IN THE CALIFORNIA FIRE CODE**

IFC SECTION	SUBJECT
303.5	Asphalt kettles
307.5	Open burning
308.1.3	Open flames—torches
309.4	Powered industrial trucks
1204.10	Portable Generators
2005.2	Aircraft towing vehicles
2005.3	Aircraft welding apparatus
2005.4	Aircraft fuel-servicing tank vehicles
2005.5	Aircraft hydrant fuel-servicing vehicles
2005.6	Aircraft fuel-dispensing stations
2007.7	Heliports and helistops
2108.4	Dry cleaning plants
2305.5	Motor fuel-dispensing facilities
2310.6.4	Marine motor fuel-dispensing facilities
2311.6	Repair garages
2404.4.1	Spray-finishing operations
2405.4.2	Dip-tank operations
2406.4.2	Powder-coating areas
2804.3	Lumberyards/woodworking facilities
2808.8	Recycling facilities
2809.5	Exterior lumber storage
2903.5	Organic-coating areas
3006.3	Industrial ovens
3107.9	Tents and membrane structures
3206.10	High-piled storage
3315.1	Buildings under construction or demolition
3318.3	Roofing operations
3408.2	Tire rebuilding/storage
3504.2.6	Welding and other hot work
3604.4	Marinas
3703.6	Combustible fibers
5703.2.1	Flammable and combustible liquids, general
5704.3.3.1	Indoor storage of flammable and combustible liquids
5704.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
5705.4.9	Solvent distillation units
5706.2.7	Farms and construction sites—flammable and combustible liquids storage
5706.4.10.1	Bulk plants and terminals for flammable and combustible liquids
5706.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
5706.6.4	Tank vehicles for flammable and combustible liquids
5906.5.7	Flammable solids
6108.2	LP-gas

**[F] TABLE 906.3(1)
FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS**

	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum-rated single extinguisher	2-A ^c	2-A	4-A ^a
Maximum floor area per unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum floor area for extinguisher ^b	11,250 square feet	11,250 square feet	11,250 square feet
Maximum distance of travel to extinguisher	75 feet	75 feet	75 feet

- For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929m², 1 gallon = 3.785 L.
- Two 2½-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.
 - California Code of Regulations, Title 19, Division 1, Chapter 3* concerning application of the maximum floor area criteria.
 - Two water-type extinguishers each with a 1-A rating shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

**[F] TABLE 906.3(2)
FIRE EXTINGUISHERS FOR FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH DEPTHS LESS THAN OR EQUAL TO 0.25 INCH^a**

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS (feet)
Light (Low)	5-B	30
	10-B	50
Ordinary (Moderate)	10-B	30
	20-B	50
Extra (High)	40-B	30
	80-B	50

- For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
- For requirements on water-soluble flammable liquids and alternative sizing criteria, see Section 5.5 of *California Code of Regulations, Title 19, Division 1, Chapter 3*.

[F] 906.3.1 Class A fire hazards. The minimum sizes and distribution of portable fire extinguishers for occupancies that involve primarily Class A fire hazards shall comply with Table 906.3(1).

[F] 906.3.2 Class B fire hazards. Portable fire extinguishers for occupancies involving flammable or combustible liquids with depths less than or equal to 0.25-inch (6.4 mm) shall be selected and placed in accordance with Table 906.3(2).

Portable fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25-inch (6.4 mm) shall be selected and placed in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

[F] 906.3.3 Class C fire hazards. Portable fire extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or B hazard.

[F] 906.3.4 Class D fire hazards. Portable fire extinguishers for occupancies involving combustible metals

shall be selected and placed in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

[F] 906.4 Cooking equipment fires. Fire extinguishers provided for the protection of cooking equipment shall be of an approved type compatible with the automatic fire-extinguishing system agent. Cooking equipment involving solid fuels or vegetable or animal oils and fats shall be protected by a Class K-rated portable extinguisher in accordance with Sections 906.1, Item 2, 906.4.1 and 906.4.2 of the *California Fire Code*, as applicable.

[F] 906.5 Conspicuous location. Portable fire extinguishers shall be located in conspicuous locations where they will have *ready access* and be immediately available for use. These locations shall be along normal paths of travel, unless the fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.

[F] 906.6 Unobstructed and unobscured. Portable fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.

[F] 906.7 Hangers and brackets. Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer’s installation instructions.

[F] 906.8 Cabinets. Cabinets used to house portable fire extinguishers shall not be locked.

Exceptions:

- Where portable fire extinguishers subject to malicious use or damage are provided with a means of ready access.
- In Group I-3 occupancies and in mental health areas in Group I-2 occupancies, access to portable fire extinguishers shall be permitted to be locked or to be located in staff locations provided that the staff has keys.

[F] 906.9 Extinguisher installation. The installation of portable fire extinguishers shall be in accordance with Sections 906.9.1 through 906.9.3.

[F] 906.9.1 Extinguishers weighing 40 pounds or less. Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 5 feet (1524 mm) above the floor.

[F] 906.9.2 Extinguishers weighing more than 40 pounds. Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 3.5 feet (1067 mm) above the floor.

[F] 906.9.3 Floor clearance. The clearance between the floor and the bottom of installed hand-held portable fire extinguishers shall be not less than 4 inches (102 mm).

[F] 906.10 Wheeled units. Wheeled fire extinguishers shall be conspicuously located in a designated location.

**SECTION 907
FIRE ALARM AND DETECTION SYSTEMS**

[F] **907.1 General.** This section covers the application, installation, performance and maintenance of fire alarm systems and their components.

[F] **907.1.1 Construction documents.** Construction documents for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code, the *California Fire Code*; and relevant laws, ordinances, rules and regulations, as determined by the fire code official.

[F] **907.1.2 Fire alarm shop drawings.** Shop drawings for fire alarm systems shall be prepared in accordance with NFPA 72 and submitted for review and approval prior to system installation.

[F] **907.1.3 Equipment.** Systems and components shall be *California State Fire Marshal* listed and approved in accordance with *California Code of Regulations, Title 19, Division 1* for the purpose for which they are installed.

[F] **907.1.4 Fire-walls and fire barrier walls.** For the purpose of Section 907 fire walls and fire barrier walls shall not define separate buildings.

[F] **907.1.5 Fire alarm use.** A fire alarm system shall not be used for any purpose other than fire warning or mass notification and where permitted by NFPA 72.

[F] **907.2 Where required—new buildings and structures.** An approved fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.29 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code.

Not fewer than one manual fire alarm box shall be provided in an approved location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers, or automatic fire alarm systems, a single fire alarm box shall be installed at a location approved by the enforcing agency.

Exceptions:

1. The manual fire alarm box is not required for fire alarm control units dedicated to elevator recall control, supervisory service and fire sprinkler monitoring.
2. The manual fire alarm box is not required for Group R-2 occupancies unless required by the fire code official to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event. Where provided, the manual fire alarm box shall not be located in an area that is open to the public.
3. The manual fire alarm box is not required to be installed when approved by the fire code official.

[F] **907.2.1 Group A.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more, or where the Group A occupant load is more than 100 persons above or below the lowest level of exit discharge. Group A occupancies not separated from one another in accordance with Section 707.3.10 shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes with an occupant load of less than 1,000, shall be provided with a fire alarm system as required for the Group E occupancy.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

Every Group A building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not necessarily be limited to, every community college and university.

Exception: Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.

[F] **907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more.** Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2. Group A occupancies with an occupant load of 10,000 or more, see Section 907.2.1.3.

Exception: Where approved, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an approved, constantly attended location.

[F] **907.2.1.2 Emergency voice/alarm communication captions.** Stadiums, arenas and grandstands required to caption audible public announcements shall be in accordance with Section 907.5.2.2.4.

907.2.1.3 Public address system. Pursuant to Health and Safety Code Section 13108.9, for all buildings or structures constructed on or after July 1, 1991, which are intended for public assemblies of 10,000 or more persons a public address system with an emergency backup power system shall be required.

[F] **907.2.2 Group B.** A manual fire alarm system, which activates the occupant notification system in accordance with Section 907.5, shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B occupant load of all floors is 500 or more.

2. The Group B occupant load is more than 100 persons above or below the lowest level of exit discharge.
3. The fire area contains an ambulatory care facility.
4. *Group B occupancies containing educational facilities, see Section 907.2.2.2.*

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.2.1 Ambulatory care facilities. Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public corridors and elevator lobbies.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, provided that the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

907.2.2.2 Group B Educational facilities. Every Group B building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not necessarily be limited to, every community college and university.

Exception: Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.

[F] 907.2.3 Group E. A manual and automatic fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies with an occupant load of 50 or more persons or containing more than one classroom or one or more rooms used for Group E or I-4 child-care purposes in accordance with this section. Where automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system. One additional manual fire alarm box shall be located at the administration office or location approved by the AHJ.

Exceptions:

1. For public school state funded construction projects see Section 907.2.29.
2. For public schools see Section 907.2.3.7.
3. For private schools see Section 907.2.3.8.

907.2.3.1 System connection. Where more than one fire alarm control unit is used at the school campus,

they shall be interconnected and shall operate all notification appliances.

Exception: Interconnection of fire alarm control units is not required when all the following are provided:

1. Buildings that are separated a minimum of 20 feet (6096 mm) and in accordance with the California Building Code; and
2. There is a method of two way communication between each classroom and the school administrative office approved by the fire enforcing agency; and
3. A method of manual activation of each fire alarm system is provided.

907.2.3.2 Assemblies located within a Group E occupancy. Assembly occupancies with an occupant load of less than 1,000 and located within a Group E occupancy campus or building shall be provided with a fire alarm system as required for the Group E occupancy.

907.2.3.3 Notification. The fire alarm system notification shall comply with the requirements of Section 907.5.

907.2.3.4 Annunciation. Annunciation of the fire alarm system shall comply with the requirements of Section 907.6.3.1.

907.2.3.5 Monitoring. School fire alarm systems shall be monitored in accordance with Section 907.6.6.2.

907.2.3.6 Automatic fire alarm system. Automatic detection shall be provided in accordance with this section.

907.2.3.6.1 Smoke detectors. Smoke detectors shall be installed at the ceiling of every room and in “ceiling-plenums” utilized for environmental air. Where the ceiling is attached directly to the underside of the roof structure, smoke detectors shall be installed on the ceiling only.

Exception: Where the environment or ambient conditions exceed smoke detector installation guidelines; heat detectors or fire sprinklers shall be used.

907.2.3.6.2 Heat detectors. Heat detectors shall be installed in combustible spaces where sprinklers or smoke detectors are not installed.

907.2.3.7 Public school campuses. An automatic fire alarm system in compliance with Section 907.2.3 shall be provided in new buildings for all occupancies on Kindergarten through 12th grade public school campuses.

Exceptions:

1. A manual fire alarm system may be provided for a relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary founda-

tion in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.

2. A fire alarm system is not required for detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include but not be limited to a:

- Concession Stand
- Press Box
- Restroom Facility
- Shade Structure
- Snack Bar
- Storage Building
- Ticket Booth

907.2.3.8 Private schools. An automatic fire alarm system shall be provided in new buildings of private schools.

Exception: Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

907.2.3.9 Day-care, Group E.

907.2.3.9.1 An automatic fire alarm system shall be provided in all buildings used as or containing a Group E day-care.

Exception: Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

907.2.3.9.2 Smoke detectors shall be installed in every room used for sleeping or napping.

907.2.3.10 Day-care, Group E or Group I-4 located on a public school campus. An automatic fire alarm system shall be provided in all buildings used as or containing a Group E or Group I-4 day-care.

[F] 907.2.4 Group F. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

1. The Group F occupancy is two or more stories in height.
2. The Group F occupancy has a combined occupant load of 500 or more above or below the lowest level of exit discharge.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appli-

ances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.5 Group H. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively, of the California Fire Code.

907.2.5.1 Group H occupancies located on the 11th story and above. Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit on the 11th story and above.

[F] 907.2.6 Group I. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2 and 907.2.6.3.3.

Exceptions:

1. Large family day-care.
2. Manual fire alarm boxes in sleeping units of Group I-1 and I-2 occupancies shall not be required at exits if located at all care providers' control stations or other constantly attended staff locations, provided that such manual fire alarm boxes are visible and provided with ready access, and the distances of travel required in Section 907.4.2.1 are not exceeded.
3. Occupant notification systems are not required to be activated where private mode signaling installed in accordance with NFPA 72 is approved by the fire code official and staff evacuation responsibilities are included in the fire safety and evacuation plan required by Section 404 of the California Fire Code.

[F] 907.2.6.1 Reserved.

[F] 907.2.6.2 Group I-2 and Group I-2.1. A manual and automatic fire alarm system shall be installed in Group I-2 and I-2.1 occupancies. Where automatic fire suppression systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

Exception: Where an entire facility is used for the housing of persons, none of whom are physically or mentally handicapped or nonambulatory, and are between the ages of 18 and 64, the buildings or structures comprising such facility shall be exempt from the provisions of this subsection relating to the installation of an automatic fire alarm system.

907.2.6.2.1 Notification. The fire alarm notification system shall be in accordance with Section 907.5.2.5.

907.2.6.2.2 Automatic fire detection. *Smoke detectors shall be provided in accordance with this section.*

1. *In patient and client sleeping rooms. Actuation of such detectors shall cause a visual display on the corridor side of the room in which the detector is located and shall cause an audible and visual alarm at the respective nurse station. A nurse call system listed for this function is an acceptable means of providing the audible and visual alarm at the respective nurse station and corridor room display. Operation of the smoke detector shall not include any alarm verification feature.*

Exception: *In patient and client rooms equipped with existing automatic door closers having integral smoke detector, the integral detector is allowed to substitute for the room smoke detector, provided it meets all the required alerting functions.*

2. *Group I-2 nurse stations. A minimum of one (1) smoke detector shall be installed at the nurse station and centrally located.*
3. *In waiting areas and corridors onto which they open, in the same smoke compartment, in accordance with Section 407.2.1.*
4. *In areas where patients are restrained, smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke compartments and in adjacent smoke compartments where occupants of those compartments utilize the same means of egress.*

[F] 907.2.6.3 Group I-3 occupancies. *Group I-3 occupancies shall be equipped with a manual fire alarm system and automatic smoke detection system installed for alerting staff.*

Exception: *An automatic smoke detection system is not required within temporary holding cells.*

[F] 907.2.6.3.1 System initiation. *Actuation of an automatic fire-extinguishing system, automatic sprinkler system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal that automatically notifies staff.*

[F] 907.2.6.3.2 Manual fire alarm boxes. *Manual fire alarm boxes are not required to be located in accordance with Section 907.4.2 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.*

[F] 907.2.6.3.2.1 Manual fire alarm boxes in detainee areas. *Manual fire alarm boxes are allowed to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.*

[F] 907.2.6.3.3 Automatic smoke detection system.

An automatic smoke detection system shall be installed throughout resident housing areas, including sleeping units and contiguous day rooms, group activity spaces and other common spaces normally open to inmates.

Exceptions:

1. *Other approved smoke detection arrangements may be used to prevent damage or tampering or for other purposes provided the function of detecting any fire is fulfilled and the location of the detectors is such that the speed of detection will be equivalent to that provided by the spacing and location required in accordance with NFPA 72 as referenced in Chapter 35. This may include the location of detectors in return air ducts from cells, behind grilles or in other locations. Spot type, combination duct and open area smoke detectors may be used when located not more than 14 inches (356 mm) from the return air grill. For initiation and annunciation purposes, these detectors may be combined in groups of four. The fire code official having jurisdiction, however, must approve the proposed equivalent performance of the design.*
2. *For detention housing and/or mental health housing area(s), including correctional medical and mental health uses, automatic smoke detection system in sleeping units shall not be required when all of the following conditions are met:*
 - 2.1. *All rooms, including the inmate cells are provided with an automatic sprinkler system in accordance with Section 903.3.1.1.*
 - 2.2. *Building is continuously staffed by a correctional officer at all times.*
3. *Smoke detectors are not required to be installed in inmate cells with two or fewer occupants in detention facilities which do not have a correctional medical and mental health use.*
4. *Smoke detectors are not required to be installed in inmate day rooms of detention facilities where 24-hour direct visual supervision is provided by a correctional officer(s) and a manual fire alarm box is located in the control room.*

907.2.6.3.4 System annunciation. *A staff alerting fire alarm shall sound at all staff control stations on the floor of activation and an audible and visual signal shall be indicated on an annunciator at the facility control center upon activation of any automatic extinguishing system, automatic detection system, or any smoke detector or manual actuating*

or initiating device. In addition, where there are staff-control stations on the floor, an audible, visual and manual alarm shall be located in each staff control station.

Fire and trouble signals of fire alarm systems and sprinkler water-flow and supervisory signals of extinguishing systems shall be annunciated in an area designated as the facility control center which shall be constantly attended by staff personnel. All such signals shall produce both an audible signal and visual display at the facility control center indicating the building, floor zone or other designated area from which the signal originated in accordance with Section 907.6.4.

All local detention facilities within the scope of Section 6031.4 of the Penal Code shall have an automatic smoke detection system. A manual fire alarm-initiating device shall be installed in all guard control stations and shall be capable of alerting personnel in a central control point to the presence of fire or smoke within the facility.

907.2.6.4 Group I-4. An automatic smoke detection system shall be installed throughout the Group I-4, including contiguous day rooms, group activity spaces and other common spaces normally occupied by the clients. Group I-4 facilities located above the first story shall comply with the provisions of Section 436.1.

907.2.6.5 Large family day-care. Every large family day-care home shall be provided with at least one manual fire alarm box at a location approved by the authority having jurisdiction. Such device shall activate a fire alarm signal, which shall be audible throughout the facility at a minimum level of 15 dB above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control unit or be electrically supervised or provided with emergency power. Such device or devices shall be attached to the structure and must be a device that is listed and approved by the Office of the State Fire Marshal.

[F] 907.2.7 Group M. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:

1. The combined Group M occupant load of all floors is 500 or more persons.
2. The Group M occupant load is more than 100 persons above or below the lowest level of exit discharge.

Exceptions:

1. A manual fire alarm system is not required in covered or open mall buildings complying with Section 402.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an auto-

matic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will automatically activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.7.1 Occupant notification. During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a waterflow switch shall not be required to activate the alarm notification appliances when an alarm signal is activated at a constantly attended location from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

[F] 907.2.8 Group R-1. Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

[F] 907.2.8.1 Manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R- 1 occupancies.

Exceptions:

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by not less than 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building where all of the following conditions are met:
 - 2.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
 - 2.2. The notification appliances will activate upon sprinkler water flow.
 - 2.3. Not fewer than one manual fire alarm box is installed at an approved location.

[F] 907.2.8.2 Automatic smoke detection system. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed throughout all interior corridors serving sleeping units.

Exception: An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

[F] **907.2.8.3 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

[F] **907.2.9 Group R-2, R-2.1 and R-2.2.** Fire alarm systems and smoke alarms shall be installed in Group R-2 and R-2.1 occupancies as required in Sections 907.2.9.1 and 907.2.9.4.1. *Group R-2.2 shall be equipped throughout with an automatic fire alarm system and shall have a manual fire alarm pull station at the 24-hour staff watch office.*

[F] **907.2.9.1 Manual fire alarm system.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies where any of the following conditions apply:

1. Any dwelling unit or sleeping unit is located three or more stories above the lowest level of exit discharge.
2. Any dwelling unit or sleeping unit is located more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit.
3. The building contains more than 16 dwelling units or sleeping units.
4. *Congregate residences with more than 16 occupants.*

Exceptions:

1. A fire alarm system is not required in buildings not more than two stories in height where all dwelling units or sleeping units and contiguous attic and crawl spaces are separated from each other and public or common areas by not less than 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and the occupant notification appliances will automatically activate throughout the notification zones upon a sprinkler water flow.
3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1027.6, Exception 3.

[F] **907.2.9.2 Smoke alarms.** Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

[F] **907.2.9.3 Group R-2 college and university buildings.** An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies operated by a college or university for student or staff housing in all of the following locations:

1. Common spaces outside of dwelling units and sleeping units.
2. Laundry rooms, mechanical equipment rooms and storage rooms.
3. All interior corridors serving sleeping units or dwelling units.

Exception: An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units or dwelling units and where each sleeping unit or dwelling unit either has a means of egress door opening directly to an exterior exit access that leads directly to an exit or a means of egress door opening directly to an exit.

Required smoke alarms in dwelling units and sleeping units in Group R-2 occupancies operated by a college or university for student or staff housing shall be interconnected with the fire alarm system in accordance with NFPA 72.

907.2.9.4 Licensed Group R-2.1 occupancies. *Licensed Group R-2.1 occupancies housing more than six nonambulatory, elderly clients shall be provided with an approved manual and automatic fire alarm system.*

Exceptions: *Buildings housing nonambulatory clients on the first story only and which are protected throughout by the following:*

1. *An approved and supervised automatic sprinkler system, as specified in Sections 903.3.1.1 or 903.3.1.2, which upon activation will initiate the fire alarm system to notify all occupants.*
2. *A manual fire alarm system.*
3. *Smoke alarms required by Section 907.2.11.*

907.2.9.4.1 Smoke alarms. *Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.*

[F] **907.2.10 Group S.** A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group S public- and self-storage occupancies three stories or greater in height for interior corridors and interior common areas. Visible notification appliances are not required within storage units.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, and the occupant notification appli-

ances will activate throughout the notification zones upon sprinkler water flow.

[F] 907.2.11 Single- and multiple-station smoke alarms. Listed single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.7 and NFPA 72.

Exception: For Group R occupancies. A fire alarm system with smoke detectors located in accordance with this section may be installed in lieu of smoke alarms. Upon actuation of the detector, only those notification appliances in the dwelling unit or guest room where the detector is actuated shall activate.

[F] 907.2.11.1 Group R-1. Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In every room in the path of the means of egress from the sleeping area to the door leading from the sleeping unit.
3. In each story within the sleeping unit, including basements. For sleeping units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

See Section 907.2.11.8 for specific location requirements.

[F] 907.2.11.2 Groups R-2, R-2.1, R-2.2, R-3, R-3.1, R-4 and R-4.1. Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4 regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. In each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. In a Group R-3.1 occupancies, in addition to the above, smoke alarms shall be provided throughout the habitable areas of the dwelling unit except kitchens.

See Section 907.2.11.8 for specific location requirements.

907.2.11.2.1 Licensed Group R-2.1 occupancies. Licensed Group R-2.1 occupancies housing more than six nonambulatory, elderly clients shall be pro-

vided with an approved manual and automatic fire alarm system.

Exceptions: Buildings housing nonambulatory clients on the first story only and which are protected throughout by the following:

1. An approved and supervised automatic sprinkler system, as specified in the California Fire Code Sections 903.3.1.1 or 903.3.1.2, which upon activation will initiate the fire alarm system to notify all occupants.
2. A manual fire alarm system.
3. Smoke alarms required by the California Fire Code Section 907.2.10.

907.2.11.2.1.1 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with California Fire Code Section 907.2.11.

907.2.11.2.2 Group I-4 occupancies. Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms.

907.2.11.2.3 Group R-3.1. In all facilities housing a bedridden client, smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms shall be electrically interconnected so as to cause all smoke alarms to sound a distinctive alarm signal upon actuation of any single smoke alarm. Such alarm signal shall be audible throughout the facility at a minimal level of 15 dB above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control unit, or be electrically supervised or provided with emergency power.

907.2.11.2.4 Smoke alarms. Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms that no longer function shall be replaced.

907.2.11.2.5 Existing Group R occupancies. See the California Residential Code for existing Group R-3 occupancies or Chapter 11 of the California Fire Code for all other existing Group R occupancies.

907.2.11.2.6 Group R-4. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-4 occupancies housing nonambulatory clients.

[F] 907.2.11.3 Installation near cooking appliances. See Section 907.2.11.8.

[F] 907.2.11.4 Installation near bathrooms. See Section 907.2.11.8.

[F] 907.2.11.5 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R occupancies, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical

interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

[F] 907.2.11.6 Power source. In new construction, and in newly classified Group R-3.1 occupancies, required smoke alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system in accordance with Section 2702. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exception: Smoke alarms are not required to be equipped with battery backup where they are connected to an emergency electrical system that complies with Section 2702.

[F] 907.2.11.7 Smoke detection system. Smoke detectors listed in accordance with UL 268 and provided as part of the building fire alarm system shall be an acceptable alternative to single- and multiple-station smoke alarms and shall comply with the following:

1. The fire alarm system shall comply with all applicable requirements in Section 907.
2. Activation of a smoke detector in a dwelling unit or sleeping unit shall initiate alarm notification in the dwelling unit or sleeping unit in accordance with Section 907.5.2.
3. Activation of a smoke detector in a dwelling unit or sleeping unit shall not activate alarm notification appliances outside of the dwelling unit or sleeping unit, provided that a supervisory signal is generated and monitored in accordance with Section 907.6.6.

907.2.11.8 Specific location requirements.

Extract from NFPA 72 Section 29.11.3.4 Specific Location Requirements.*

This extract has been provided by NFPA for the Office of the State Fire Marshal adoption by reference as follows:

29.11.3.4 Specific location requirements. The installation of smoke alarms and smoke detectors shall comply with the following requirements:

- (1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.
- (2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).

- (3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.
- (4) Smoke alarms and smoke detectors shall not be installed within an area of exclusion determined by a 10-foot (3.0 m) radial distance along a horizontal flow path from a stationary or fixed cooking appliance, unless listed for installation in close proximity to cooking appliances. Smoke alarms and smoke detectors installed between 10 feet (3.0 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed appliance shall be equipped with an alarm-silencing means or use photoelectric detection.
- (5) Smoke alarms or smoke detectors that use photoelectric detection shall be permitted for installation at a radial distance greater than 6 feet (1.8 m) from any stationary or fixed cooking appliance when both of the following conditions are met:
 - (a) The kitchen or cooking area and adjacent spaces have no clear partitions or headers.
 - (b) The 10-foot (3.0 m) area of exclusion would prohibit the placement of a smoke alarm or smoke detector required by other sections of this code.
- (6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 feet (1.8 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking.
- (7) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from a door to a bathroom containing a shower or tub unless listed for installation in close proximity to such locations.
- (8) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.
- (9) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan unless the room configuration restricts meeting this requirement.
- (10) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.

- (11) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.
- (12) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 inches (300 mm) vertically down from the highest point.
- (13) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4 of NFPA 72.
- (14) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3 of NFPA 72.

*For additional requirements or clarification see NFPA 72.

907.2.11.9 Existing Group R occupancies. See the California Residential Code for existing Group R-3 occupancies or Chapter 11 of the California Fire Code for all other existing Group R occupancies.

[F] 907.2.12 Special amusement areas. An automatic smoke detection system shall be provided in special amusement areas and throughout the exit access to the point of exit discharge in accordance with Sections 907.2.12.1 through 907.2.12.3.

[F] 907.2.12.1 Alarm. Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately activate an audible and visible alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.12.2.

[F] 907.2.12.2 System response. The activation of two or more smoke detectors, a single smoke detector equipped with an alarm verification feature, the automatic sprinkler system or other approved fire detection device shall automatically do all of the following:

1. Cause illumination of the means of egress with light of not less than 1 footcandle (11 lux) at the walking surface level.
2. Stop any conflicting or confusing sounds and visual distractions.
3. Activate an approved directional exit marking that will become apparent in an emergency.
4. Activate a prerecorded message, audible throughout the special amusement area and throughout the exit access to the point of exit discharge, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound that is distinctive from other sounds used during normal operation.

[F] 907.2.12.3 Emergency voice/alarm communication system. An emergency voice/alarm communication system, which is allowed to serve as a public address system, shall be installed in accordance with Section 907.5.2.2 and be audible throughout the entire special amusement area and throughout the exit access to the point of exit discharge.

[F] 907.2.13 High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access. High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be provided with an automatic smoke detection system in accordance with Section 907.2.13.1, a fire department communication system in accordance with Section 907.2.13.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

Exceptions:

1. Airport traffic control towers in accordance with Sections 412 and 907.2.22.
2. Open parking garages in accordance with Section 406.5.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1.
4. Low-hazard special occupancies in accordance with Section 503.1.1.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415.
6. In Group I-2, I-2.1 and R-2.1 occupancies, the alarm shall sound at a constantly attended location and occupant notification shall be broadcast by the emergency voice/alarm communication system.

[F] 907.2.13.1 Automatic smoke detection. Automatic smoke detection in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be in accordance with Sections 907.2.13.1.1 and 907.2.13.1.2.

[F] 907.2.13.1.1 Area smoke detection. Area smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this section shall activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.9, smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room that is not provided with sprinkler protection.
2. In each elevator machine room, machinery space, control room and control space and in elevator lobbies.

[F] **907.2.13.1.2 Duct smoke detection.** *Smoke detectors listed for use in air duct systems shall be provided in accordance with this section and the California Mechanical Code. The activation of any detector required by this section shall initiate a visible and audible supervisory signal at a constantly attended location.* Duct smoke detectors complying with Section 907.3.1 shall be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m³/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m³/s) and serving not more than 10 air-inlet openings.

[F] **907.2.13.2 Fire department communication system.** Where a wired communication system is approved in lieu of an in-building two-way emergency responder communication coverage system in accordance with Section 510 of the *California Fire Code*, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 911, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside interior exit stairways. The fire department communication device shall be provided at each floor level within the interior exit stairway.

[F] **907.2.13.3 Multiple-channel voice evacuation.** In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, voice evacuation systems for high-rise buildings shall be multiple-channel systems.

[F] **907.2.14 Atriums connecting more than two stories.** A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories, with smoke detection installed in locations required by a rational analysis in Section 909.4 and in accordance with the system operation requirements in Section 909.17. The system shall be activated in accordance with Section 907.5. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.5.2.2.

[F] **907.2.15 High-piled combustible storage areas.** An automatic smoke detection system shall be installed throughout high-piled combustible storage areas where required by Section 3206.5 of the *California Fire Code*.

[F] **907.2.16 Aerosol storage uses.** Aerosol product rooms and general-purpose warehouses containing aerosol

products shall be provided with an *approved* manual fire alarm system where required by the *California Fire Code*.

[F] **907.2.17 Lumber, wood structural panel and veneer mills.** Lumber, wood structural panel and veneer mills shall be provided with a manual fire alarm system.

[F] **907.2.18 Underground buildings with smoke control systems.** Where a smoke control system is installed in an underground building in accordance with this code, automatic smoke detectors shall be provided in accordance with Section 907.2.18.1.

[F] **907.2.18.1 Smoke detectors.** Not fewer than one smoke detector listed for the intended purpose shall be installed in all of the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cubic feet per minute (2.4 m³/s) and serving not more than 10 air-inlet openings.

[F] **907.2.18.2 Alarm required.** Activation of the smoke control system shall activate an audible alarm at a constantly attended location.

[F] **907.2.19 Deep underground buildings.** Where the lowest level of a structure is more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

[F] **907.2.20 Covered and open mall buildings.** Where the total floor area exceeds 50,000 square feet (4645 m²) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided. Access to emergency voice/alarm communication systems serving a mall, required or otherwise, shall be provided for the fire department. The system shall be provided in accordance with Section 907.5.2.2.

[F] **907.2.21 Residential aircraft hangars.** Not fewer than one single-station smoke alarm shall be installed within a residential aircraft hangar as defined in Chapter 2 and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the dwelling.

[F] **907.2.22 Airport traffic control towers.** An automatic smoke detection system that activates the occupant

notification system in accordance with Section 907.5 shall be provided in airport control towers in accordance with Sections 907.2.22.1 and 907.2.22.2.

Exception: Audible appliances shall not be installed within the control tower cab.

[F] 907.2.22.1 Airport traffic control towers with multiple exits and automatic sprinklers. Airport traffic control towers with multiple exits and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Outside each opening into interior exit stairways.
5. Along the single means of egress permitted from observation levels.
6. Outside each opening into the single means of egress permitted from observation levels.

[F] 907.2.22.2 Other airport traffic control towers. Airport traffic control towers with a single exit or where sprinklers are not installed throughout shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.
6. Means of egress.
7. Utility shafts where access to smoke detectors can be provided.

[F] 907.2.23 Energy storage systems. An automatic smoke detection system or radiant-energy detection system shall be installed in rooms, areas and walk-in units containing energy storage systems as required in Section 1207.5.4 of the *California Fire Code*.

907.2.24 Motion picture and television production studio sound stages and approved production facilities.

907.2.24.1 Sound stages-solid-ceiling sets and platforms. Where required by Chapter 48 of the *California Fire Code*, all interior solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms (when provided) over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height shall be protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.5 or a local alarm which will give an audible signal at a constantly attended location.

907.2.24.2 Production locations—solid-ceiling sets and platforms. Where required by Chapter 48 of the *California Fire Code* in buildings with existing fire protection systems and where production intends to construct solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height shall be protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.6 or a local alarm which will give an audible signal at a constantly attended location.

907.2.24.3 Fire alarm control units. Fire alarm control units shall be California State Fire Marshal listed and shall be utilized in accordance with their listing. Control units are permitted to be temporarily supported by sets, platforms or pedestals.

907.2.24.4 Heat detectors.

907.2.24.4.1 Heat detection required by this section shall be defined as a portable system as it is intended to be reinstalled when platforms or sets are changed.

907.2.24.4.2 Heat detectors shall be secured to standard outlet boxes and are allowed to be temporarily supported by sets, platforms or pedestals.

907.2.24.4.3 Heat detectors shall be provided for solid-ceiling sets and platforms where required by Sections 4805.3 and 4811.14.

907.2.25 Group C occupancies (organized camps).

907.2.25.1 General. Every building and structure used or intended for sleeping purposes shall be provided with an automatic smoke detection system.

Exceptions:

1. Buildings and structures in existence and in operation prior to January 1, 1985.
2. Tents, tent structures and buildings and structures that do not exceed 25 ft (7620 mm) in any lateral dimensions and where such building or structure is not more than one story.

907.2.25.2 Camp fire alarm. Every organized camp shall provide and maintain audible appliances, or devices suitable for sounding a fire alarm. Such audible appliances or devices may be of any type acceptable to the enforcing agency provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises. When an automatic fire alarm system is provided, as required by Section 450.6.6 of the *California Building Code*, all audible appliances required by this section shall be of the same type as that used in the automatic system.

907.2.26 Fixed-guideway and passenger rail transit systems fire alarm and communication systems.

907.2.26.1 General. Every fixed-guideway transit station shall be provided with an approved emergency voice/alarm communication system in accordance with NFPA 72. The emergency voice/alarm communication system, designed and installed so that damage to any one speaker will not render any paging zone of the system inoperative.

Exception: Open stations.

907.2.26.2 System components. Each station fire alarm system shall consist of:

1. Fire alarm control unit at a location as permitted by the enforcing agency.
2. An alarm annunciator(s). The annunciator(s) shall be located at a point acceptable to the enforcing agency. The annunciator(s) shall indicate the type of device and general location of alarm. All alarm, supervisory and trouble signals shall be transmitted to the local annunciator(s) and the operations control center.
3. Manual fire alarm boxes shall be provided throughout passenger platforms and stations.

Exception: Two-way emergency communication reporting devices (emergency telephones) are allowed to be used in lieu of manual fire alarm boxes as permitted by the enforcing agency. Such devices shall provide two-way communication between the operations control center and each device. Such devices shall be located as required for manual fire alarm boxes, and shall be distinctly identified by signs, coloring or other means acceptable to the enforcing agency.

4. Automatic smoke detectors in all ancillary spaces.

Exceptions:

1. Ancillary spaces protected by an approved fixed automatic extinguishing system; or
2. Ancillary spaces protected by quick-response sprinklers.

5. Automatic control of exiting components.

907.2.26.3 Emergency voice/alarm communication system. Each station shall be provided with an emergency voice/alarm communication system capable of transmitting voice, recorded or electronically generated textual messages to all areas of the station. The system(s) shall be configured such that the messages can be initiated from either the Emergency Management Panel (EMP) or the operations control center.

907.2.26.4 Emergency telephones. A dedicated two-way emergency communication phone system designed and installed in accordance with NFPA 72 shall be provided in all underground stations to facilitate direct communications for emergency response between remote locations and the EMP.

907.2.26.4.1 Remote emergency phones shall be located at ends of station platforms, each hose outlet connection and station valve rooms.

907.2.26.4.2 Provisions shall be made in the design of this two-way emergency communication phone system for extensions of the system to the next passenger station or guideway portal.

907.2.27 Winery caves. An approved manual fire alarm system conforming to the provisions of Section 907.2 shall be provided in all Type 3 winery caves.

907.2.28 Group L. A manual fire alarm system shall be installed throughout buildings having Group L occupancies. When Group L occupancies are located in mixed use buildings, at least one manual fire alarm box shall be located within the Group L occupancy.

907.2.28.1 Group L occupancies located on the 11th story and above. Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit on the 11th story and above.

907.2.29 Public school state funded construction projects for kindergarten through 12th grade - automatic fire alarm system requirements.

907.2.29.1 Alterations to existing buildings on an existing public school campus. An automatic fire alarm system shall be provided for all portions within the scope of an alteration project. The provisions of this section shall apply to any public school project on an existing campus and receiving state funds pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079. For purposes of this section, an existing campus refers to a school site, where an application for construction of original buildings was made to DSA prior to July 1, 2002.

Exceptions:

1. A manual fire alarm system may be provided for a construction project that has an estimated total cost of less than \$200,000.
2. A manual fire alarm system may be provided for a relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. See California Administrative Code, Section 4-314 for definition of relocatable building.
3. A fire alarm system is not required for detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

Concession Stand
 Press Box
 Restroom Facilities
 Shade Structure
 Snack Bar
 Storage Building
 Ticket Booth

[F] 907.3 Fire safety functions. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building's fire alarm control unit where a fire alarm system is *installed*. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

[F] 907.3.1 Duct smoke detectors. Smoke detectors installed in ducts shall be listed for the air velocity, temperature and humidity present in the duct. Duct smoke detectors shall be connected to the building's fire alarm control unit where a fire alarm system is required by Section 907.2. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location and shall perform the intended fire safety function in accordance with this code and the *California Mechanical Code*. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal and not as a fire alarm. They shall not be used as a substitute for required open area detection.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building's alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

[F] 907.3.2 Special locking systems. Where special locking systems are installed on means of egress doors in accordance with Sections 1010.2.13 or 1010.2.14, an automatic *smoke* detection system shall be installed as required by *those sections and Sections 907.3.2.1 through 907.3.2.5*.

907.3.2.1 Delayed egress. *In other than Groups I, R-2.1 and R-4 occupancies for single-story building, smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces. For multiple-story buildings, smoke detectors shall be installed throughout all occupied areas and mechanical/electrical spaces for the story where delayed egress devices are installed. Additional detectors are required on adjacent stories where occupants of those stories utilize the same means of egress.*

Exception: *Refer to Section 907.3.2.4 for Group A courthouse occupancies.*

907.3.2.2 Delayed egress for Group I and R-2.1 occupancies. *Smoke detectors shall be installed at ceilings*

throughout all occupied areas and mechanical/electrical spaces of smoke-compartments where delayed egress devices are installed. Additional detectors are required in adjacent smoke-compartments where occupants of those compartments utilize the same means of egress.

907.3.2.3 Delayed egress for Group R-4. *Occupancies licensed as residential care facilities for the elderly, and housing clients with Alzheimer's disease or dementia residential facilities, smoke detectors shall be installed at ceilings throughout all occupiable rooms and areas and mechanical/ electrical rooms and spaces.*

907.3.2.4 Delayed egress for Group A Courthouse occupancies. *An approved automatic smoke detection system shall be installed at ceilings in all occupied corridors and mechanical/electrical spaces of occupancies where delayed egress devices are installed.*

907.3.2.5 Controlled egress doors for Group I-2 occupancies. *Smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke-compartments where controlled egress doors are installed.*

[F] 907.3.3 Elevator emergency operation. Automatic fire detectors installed for elevator emergency operation shall be installed in accordance with the provisions of *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* and NFPA 72.

[F] 907.3.4 Wiring. The wiring to the auxiliary devices and equipment used to accomplish the fire safety functions shall be monitored for integrity in accordance with NFPA 72.

[F] 907.4 Initiating devices. Where a fire alarm system is required by another section of this code, occupant notification in accordance with Section 907.5 shall be initiated by one or more of the following. Initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

1. Manual fire alarm boxes.
2. Automatic fire detectors.
3. Automatic sprinkler system waterflow devices.
4. Automatic fire-extinguishing systems.

[F] 907.4.1 Protection of fire alarm control unit. In areas that are not continuously occupied, a single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders, and supervising station transmitting equipment.

Exception: Where ambient conditions prohibit installation of a smoke detector, a heat detector shall be permitted.

[F] 907.4.2 Manual fire alarm boxes. Where a manual fire alarm system is required by another section of this code, it shall be activated by fire alarm boxes installed in accordance with Sections 907.4.2.1 through 907.4.2.6.

[F] 907.4.2.1 Location. Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the

entrance to each exit. In buildings not protected by an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, additional manual fire alarm boxes shall be located so that the distance of travel to the nearest box does not exceed 200 feet (60 960 mm).

Exception: When individual dwelling units are served by a single exit stairway, additional boxes at other than the ground floor may be omitted.

[F] 907.4.2.2 Height. The height of the manual fire alarm boxes shall be not less than 42 inches (1067 mm) and not more than 48 inches (1219 mm) measured vertically, from the floor level to the *highest point of the activating handle or lever of the box. Manual fire alarm boxes shall also comply with Section 11B-309.*

[F] 907.4.2.3 Color. Manual fire alarm boxes shall be red in color.

[F] 907.4.2.4 Signs. Where fire alarm systems are not monitored by an approved supervising station in accordance with Section 907.6.6, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads: WHEN ALARM SOUNDS CALL FIRE DEPARTMENT.

Exception: Where the manufacturer has permanently provided this information on the manual fire alarm box.

[F] 907.4.2.5 Protective covers. The fire code official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved. Protective covers shall not project more than that permitted by Section 1003.3.3.

[F] 907.4.2.6 Unobstructed and unobscured. Manual fire alarm boxes shall be provided with ready access, unobstructed, unobscured and visible at all times.

907.4.2.7 Operation. *Manual fire alarm boxes shall be operable with one hand including boxes with protective covers.*

[F] 907.4.3 Automatic smoke detection. Where an automatic smoke detection system is required, it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, approved automatic heat detectors shall be permitted.

[F] 907.4.3.1 Automatic sprinkler system. For conditions other than specific fire safety functions noted in Section 907.3, in areas where ambient conditions prohibit the installation of smoke detectors, an automatic sprinkler system installed in such areas in accordance with Section 903.3.1.1 or 903.3.1.2 and that is connected to the fire alarm system shall be approved as automatic heat detection.

[F] 907.5 Occupant notification. Occupant notification by fire alarms shall be in accordance with Sections 907.5.1 through 907.5.2.5. Occupant notification by smoke alarms in Group R-1 and R-2 occupancies shall comply with Section 907.5.2.1.3.2.

907.5.1 Alarm activation and annunciation. Upon activation, fire alarm systems shall initiate occupant notification and shall annunciate at the fire alarm control unit, or where allowed elsewhere by Section 907, at a constantly attended location.

907.5.1.1 Presignal feature. A presignal feature shall be provided only where approved. The presignal shall be annunciated at an approved, constantly attended location, having the capability to activate the occupant notification system in the event of fire or other emergency.

Exception: A presignal feature shall not be permitted to be installed in a Group I-2, I-2.1 or R-2.1 occupancy.

[F] 907.5.2 Alarm notification appliances. Alarm notification appliances shall be provided and shall be listed for their purpose.

[F] 907.5.2.1 Audible alarms. Audible alarm notification appliances shall be provided and emit a distinctive sound that is not to be used for any purpose other than that of a fire alarm. *In Group I-2 occupancies, audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff. See Section 907.5.2.5.*

Exceptions:

1. Audible alarm notification appliances are not required in *patient* areas of Group I-2 occupancies that are in compliance with Section 907.5.2.5.
2. A visible alarm notification appliance installed in a nurses' control station or other continuously attended staff location in a Group I-2 *care* suite shall be an acceptable alternative to the installation of audible alarm notification appliances throughout a *care* suite in Group I-2 occupancies that are in compliance with Section 907.5.2.5.
3. Where provided, audible notification appliances located in each enclosed occupant evacuation elevator lobby in accordance with Section 3008.9.1 shall be connected to a separate notification zone for manual paging only.

[F] 907.5.2.1.1 Average sound pressure. The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level or 5 dBA above the maximum sound level having a duration of not less than 60 seconds, whichever is greater, in every occupiable space within the building.

[F] 907.5.2.1.2 Maximum sound pressure. The total sound pressure level produced by combining the ambient sound pressure level with all audible notifi-

cation appliances operating shall not exceed 110 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 105 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

[F] 907.5.2.1.3 Audible signal frequency in Group R-1 and R-2 sleeping rooms. Audible signal frequency in Group R-1 and R-2 occupancies shall be in accordance with Sections 907.5.2.1.3.1 and 907.5.2.1.3.2.

[F] 907.5.2.1.3.1 Fire alarm system signal. In sleeping rooms of Group R-1 and R-2 occupancies, the audible alarm activated by a fire alarm system shall be a 520-Hz low-frequency signal complying with NFPA 72.

[F] 907.5.2.1.3.2 Smoke alarm signal in sleeping rooms. In sleeping rooms of Group R-1 and R-2 occupancies that are required by Section 907.2.8 or 907.2.9 to have a fire alarm system, the audible alarm signal activated by single- or multiple-station smoke alarms in the dwelling unit or sleeping unit shall be a 520-Hz signal complying with NFPA 72. Where a sleeping room smoke alarm is unable to produce a 520-Hz signal, the 520-Hz alarm signal shall be provided by a listed notification appliance or a smoke detector with an integral 520-Hz sounder.

907.5.2.1.4 Audible alarm signal. *The audible signal shall be the standard fire alarm evacuation signal, ANSI S3.41 Audible Emergency Evacuation Signal, “three pulse temporal pattern,” as described in NFPA 72.*

Exception: *The use of the existing evacuation signaling scheme shall be permitted where approved by the enforcing agency.*

[F] 907.5.2.2 Emergency voice/alarm communication systems. Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions for a general or staged evacuation in accordance with the building’s fire safety and evacuation plans required by Section 404 of the *California Fire Code*. In high-rise buildings, and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access the system shall operate on at least the alarming floor, the floor above and the floor below. Speakers shall be provided throughout the building by paging zones. At a minimum, paging zones shall be provided as follows:

1. Elevator groups.
2. Interior exit stairways.

3. Each floor.
4. Areas of refuge as defined in Chapter 2.

Exception: In Group I-2 and I-2.1 occupancies, where in accordance with Section 907.5.2.5, audible fire alarm notification devices are not provided, upon receipt of an alarm at a constantly attended location, a general occupant notification shall be broadcast over the public-address system.

[F] 907.5.2.2.1 Manual override. A manual override for emergency voice communication shall be provided on a selective and all-call basis for all paging zones.

[F] 907.5.2.2.2 Live voice messages. The emergency voice/alarm communication system shall have the capability to broadcast live voice messages by paging zones on a selective and all-call basis.

[F] 907.5.2.2.3 Alternative uses. The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided that the manual fire alarm use takes precedence over any other use.

[F] 907.5.2.2.4 Emergency voice/alarm communication captions. Where stadiums, arenas and grandstands have 15,000 fixed seats or more and provide audible public announcements, the emergency/voice alarm communication system shall provide prerecorded or real-time captions. Prerecorded or live emergency captions shall be from an approved location constantly attended by personnel trained to respond to an emergency.

[F] 907.5.2.2.5 Standby power. Emergency voice/alarm communications systems shall be provided with standby power in accordance with Section 2702.

[F] 907.5.2.3 Visible alarms. Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.4.

Exceptions:

1. In other than Group I-2 and I-2.1, visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.
2. Visible alarm notification appliances shall not be required in enclosed exit stairways, enclosed exit ramps, exterior exit stairs and exterior exit ramps.
3. Visible alarm notification appliances shall not be required in elevator cars.
4. Visual alarm notification appliances are not required in critical care areas of Group I-2 occupancies that are in compliance with Section 907.5.2.5.
5. A visible alarm notification appliance installed in a nurses’ control station or other

continuously attended staff location in a Group I-2 *care* suite shall be an acceptable alternative to the installation of visible alarm notification appliances throughout the *care* suite in Group I-2 occupancies that are in compliance with Section 907.5.2.5.

[F] 907.5.2.3.1 Public use areas and common use areas. Visible alarm notification appliances shall be provided in public use areas and common use areas, *including but not limited to:*

1. *Band rooms*
2. *Classrooms*
3. *Corridors*
4. *Gymnasiums*
5. *Lobbies*
6. *Meeting rooms*
7. *Multipurpose rooms*
8. *Music practice rooms*
9. *Occupational shops*
10. *Occupied rooms where ambient noise impairs hearing of the fire alarm*
11. *Sanitary facilities including restrooms, bathrooms and shower rooms.*

Exception: Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with not less than 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing-impaired employee(s).

[F] 907.5.2.3.2 Groups R-1 and R-2.1. Habitable spaces in dwelling units and sleeping units in Group R-1 and R-2.1 occupancies in accordance with Table 907.5.2.3.2 shall be provided with visible alarm notification. Visible alarms shall be activated by the in-room smoke alarm and the building fire alarm system.

**[F] TABLE 907.5.2.3.2
VISIBLE ALARMS**

NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

[SFM] Also see Chapter 11B, Section 11B-224.4 and Table 11B-224.4.

[F] 907.5.2.3.3 Group R-2. In Group R-2 occupancies required by Section 907 to have a fire alarm system, each story that contains dwelling units and sleeping units shall be provided with the capability to support future visible alarm notification appliances in accordance with NFPA 72. Such capability shall accommodate wired or wireless equipment.

[F] 907.5.2.3.3.1 Wired equipment. Where wired equipment is used to comply with the future capability required by Section 907.5.2.3.3, the system shall include one of the following capabilities:

1. The replacement of audible appliances with combination audible/visible appliances or additional visible notification appliances.
2. The future extension of the existing wiring from the unit smoke alarm locations to required locations for visible appliances.
3. For wired equipment, the fire alarm power supply and circuits shall have not less than 5-percent excess capacity to accommodate the future addition of visible alarm notification appliances, and a single access point to such circuits shall be available on every story. Such circuits shall not be required to be extended beyond a single access point on a story. The fire alarm system shop drawings required by Section 907.1.2 shall include the power supply and circuit documentation to accommodate the future addition of visible notification appliances.

907.5.2.3.4 Groups R-2.1, R-3.1 and R-4. *Protective social care facilities which house persons who are hearing impaired, shall be provided with notification appliances for the hearing impaired installed in accordance with NFPA 72 and which shall activated upon initiation of the fire alarm system or the smoke alarms.*

907.5.2.4 Group E schools. *One audible alarm notification appliance shall be mounted on the exterior of a buildings to alert occupants at each playground area.*

907.5.2.5 Groups I-2 and I-2.1. *Audible notification appliances shall be used in nonpatient areas. Visible appliances are allowed to be used in lieu of audible appliances in patient occupied areas. Audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff.*

Where audible fire alarm notification devices are not provided, upon receipt of an alarm at a constantly attended location, a general occupant notification shall be broadcast over the public-address system.

In occupancies housing nonambulatory persons where restraint is practiced, staff and attendants shall be provided and housed or located in such a manner that such supervisory personnel will also be alerted upon activation of the fire alarm system or any detector required by this section.

[F] 907.6 Installation and monitoring. A fire alarm system shall be installed and monitored in accordance with Sections 907.6.1 through 907.6.6.3 and NFPA 72.

[F] 907.6.1 Wiring. Wiring shall comply with the requirements of the *California Electrical Code* and NFPA 72. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

907.6.1.1 High-rise buildings. Wiring for fire alarm network communication circuits between multiple-control units shall be in accordance with the following:

1. Class A or Class X in accordance with NFPA 72.
2. Installed in enclosed continuous metallic raceways or raceways encased in not less than 2 inches (51 mm) of concrete in accordance with the *California Electrical Code*.

[F] 907.6.2 Power supply. The primary and secondary power supply for the fire alarm system shall be provided in accordance with NFPA 72.

Exception: Back-up power for single-station and multiple-station smoke alarms as required in Section 907.2.11.6.

[F] 907.6.3 Initiating device identification. The fire alarm system shall identify the specific initiating device address, location, device type, floor level where applicable and status including indication of normal, alarm, trouble and supervisory status, as appropriate.

Exceptions:

1. Fire alarm systems in single-story buildings less than 22,500 square feet (2090 m²) in area.
2. Fire alarm systems that only include manual fire alarm boxes, waterflow initiating devices and not more than 10 additional alarm-initiating devices.
3. Special initiating devices that do not support individual device identification.
4. Fire alarm systems or devices that are replacing existing equipment.

[F] 907.6.3.1 Annunciation. The initiating device status shall be annunciated at an approved on-site location.

[F] 907.6.4 Zones. Fire alarm systems shall be divided into zones where required by this section. For the purposes of annunciation and notification, zoning shall be in accordance with the following:

1. Where the fire-protective signaling system serves more than one building, each building shall be considered as a separate zone.
2. Each floor of a building shall be considered as a separate zone.
3. Each section of floor of a building that is separated by fire walls or by horizontal exits shall be considered as a separate zone.

4. Each zone shall not exceed 22,500 square feet (2090 m²). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

Exception: Automatic sprinkler system zones shall not exceed the area permitted by NFPA 13.

5. For Group I-3 occupancies each cell complex shall be considered a separate zone.
6. For Group H and L occupancies on the 11th story and above, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.
7. Annunciation shall be further divided into zones where deemed necessary by the enforcing agency.

907.6.4.1 Annunciation. Alarm, supervisory and trouble signals shall be annunciated in the main control unit by means of an audible signal and a visual display in accordance with NFPA 72. Identification of the type of alarm and supervisory initiating devices, such as manual, automatic, sprinkler waterflow, sprinkler valve supervisory, fire-pump supervisory, etc., shall be separately indicated.

Exception: Group R-3 occupancies.

[F] 907.6.4.1.1 Annunciator panel. An annunciator panel complying with Section 907.6.4.1 and the associated controls shall be provided in an approved remote location where deemed necessary by the enforcing agency. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible-alarm silencing switch.

[F] 907.6.4.2 High-rise buildings. In high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire protection systems.

907.6.4.3 High-rise buildings zoning annunciator panel. In high-rise buildings, a zoning annunciator panel shall be provided in the Fire Command Center. This panel shall not be combined with the Firefighter Smoke Control Panel unless approved. Panel shall be in matrix format or an approved equivalent configuration. All indicators shall be based upon positive confirmation. The panel shall include the following features at a minimum:

1. Fire alarm initiating devices with individual annunciation per floor for manual fire alarm boxes, area smoke detectors, elevator lobby smoke detectors, duct smoke detectors, heat detectors, auxiliary alarms and sprinkler waterflow. (Red LED)

2. Sprinkler and standpipe system control valves per floor—supervisory. (Yellow LED)
3. Common fire alarm system trouble. (Yellow LED)
4. Annunciation Panel Power On. (Green LED)
5. Lamp test. (Push Button)

907.6.4.4 Notification zoning. Upon activation of initiating devices where occupant notification is required for evacuation, all notification zones shall operate simultaneously throughout the building.

Exceptions:

1. High-rise buildings as permitted in Section 907.2.12.
2. Hospitals and convalescent facilities with staff alerting notification appliances or emergency voice/alarm communication, zoning shall be in accordance with the approved fire plan.
3. Detention facilities.
4. Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the notification zones are separated by a minimum of a 2-hour fire barrier and 2-hour fire-resistive floor assembly. The system shall have the capability to activate all other notification zones by automatic and manual means.
5. Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the activated initiating device or fire extinguishing system is separated from any nonactive notification zones by a minimum of 300-ft horizontal distance. The system shall have the capability to activate all other notification zones by automatic and manual means.
6. Where a Group H or L occupancy is located above the 10th story, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.

[F] 907.6.5 Access. Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

[F] 907.6.6 Monitoring. Fire alarm systems required by this chapter or by the *California Fire Code* shall be monitored by an approved supervising station in accordance with NFPA 72 and this section.

Exception: Monitoring by a supervising station is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies shall be monitored in accordance with Section 907.2.6.3.
3. Automatic sprinkler systems in one- and two-family dwellings.

[F] 907.6.6.1 Transmission of alarm signals. Transmission of alarm signals to a supervising station shall be in accordance with NFPA 72.

[F] 907.6.6.2 MIY Monitoring. Direct transmission of alarms associated with monitor it yourself (MIY) transmitters to a public safety answering point (PSAP) shall not be permitted unless approved by the fire code official.

[F] 907.6.6.3 Termination of monitoring service. Termination of fire alarm monitoring services shall be in accordance with Section 901.9 of the *California Fire Code*.

907.6.6.4 Group E schools. Automatic fire alarm systems shall be monitored and shall transmit the alarm, supervisory and trouble signals to an approved supervising station in accordance with NFPA 72. The supervising station shall be listed as either UUFEX (Central Station) or UUJS (remote & proprietary) by the Underwriters Laboratory Inc. (UL) or other approved listing and testing laboratory or shall comply with the requirements of standard, FM 3011. Termination of monitoring services shall be in accordance with Section 907.6.6.2.

[F] 907.7 Acceptance tests and completion. Upon completion of the installation, the fire alarm system and all fire alarm components shall be tested in accordance with NFPA 72.

[F] 907.7.1 Single- and multiple-station alarm devices. When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the smoke alarm provisions of NFPA 72.

[F] 907.7.2 Record of completion. A record of completion in accordance with NFPA 72 verifying that the system has been installed and tested in accordance with the approved plans and specifications shall be provided.

[F] 907.7.3 Instructions. Operating, testing and maintenance instructions and record drawings (“as-builts”) and equipment specifications shall be provided at an approved location.

[F] 907.8 Inspection, testing and maintenance. The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Section 907.8 of the *California Fire Code*.

SECTION 908 EMERGENCY ALARM SYSTEMS

[F] 908.1 Group H occupancies. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided in accordance with Section 415.5.

[F] 908.2 Group H-5 occupancy. Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 415.11.4.

[F] 908.3 Fire alarm system interface. Where an emergency alarm system is interfaced with a building’s fire alarm

system, the signal produced at the fire alarm control unit shall be a supervisory signal.

SECTION 909 SMOKE CONTROL SYSTEMS

[F] 909.1 Scope and purpose. This section applies to mechanical or passive smoke control systems where they are required by other provisions of this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat-removal provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *California Mechanical Code*.

[F] 909.2 General design requirements. Buildings, structures or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to adequately describe the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied by sufficient information and analysis to demonstrate compliance with these provisions.

[F] 909.3 Special inspection and test requirements. In addition to the ordinary inspection and test requirements that buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms in Section 1704.

[F] 909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.7.

[F] 909.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system's capabilities. In determining the maximum probable stack

effect, altitude, elevation, weather history and interior temperatures shall be used.

[F] 909.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system's capabilities.

[F] 909.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of Chapter 16.

[F] 909.4.4 HVAC systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the HVAC systems.

[F] 909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

[F] 909.4.6 Duration of operation. All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

909.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

[F] 909.5 Smoke barrier construction. Smoke barriers required for passive smoke control and a smoke control system using the pressurization method shall comply with Section 709. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls $A/A_w = 0.00100$
2. Interior exit stairways and ramps and exit passageways:
 $A/A_w = 0.00035$
3. Enclosed exit access stairways and ramps and all other shafts: $A/A_w = 0.00150$
4. Floors and roofs: $A/A_f = 0.00050$

where:

A = Total leakage area, square feet (m^2).

A_f = Unit floor or roof area of barrier, square feet (m^2).

A_w = Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings due to gaps around doors and operable windows. The total leakage area of the smoke barrier shall be determined in accordance with Section 909.5.1 and tested in accordance with Section 909.5.2.

[F] 909.5.1 Total leakage area. Total leakage area of the barrier is the product of the smoke barrier gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

[F] 909.5.2 Testing of leakage area. Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as approved by the fire code official.

[F] 909.5.3 Opening protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with Section 716.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with Section 907.3. *When used in Group I-2 or I-2.1, such detectors shall activate the fire alarm system and shall close all the smoke barrier doors within the effected zone.*
2. Fixed openings between smoke zones that are protected utilizing the airflow method *in other than Group I-2 or I-2.1.*
3. In Group I-2, *I-2.1, R-2.1;* and ambulatory care facilities, where a pair of opposite-swinging doors are installed across a corridor in accordance with Section 909.5.3.1, the doors shall be protected in accordance with Section 716. The doors shall not have a center mullion. *Positive-latching devices are required. Doors installed across corridors shall comply with Section 1010.1.1.*
4. In Group I-2, *I-2.1, R-2.1* and ambulatory care facilities, where such doors are special-purpose horizontal sliding, accordion or folding door assemblies installed in accordance with Section 1010.3.3 and are automatic closing by smoke detection in accordance with Section 716.2.6.6, *they shall be protected in accordance with Section 716. Doors installed across corridors shall comply with Section 1010.1.1.*
5. Group I-3.
6. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.
7. *In Group I-2 or I-2.1, smoke damper activation may be accomplished by a fire alarm control unit provided that an open area smoke detection system is provided within all areas served by an HVAC system.*

909.5.3.1 Group I-2, I-2.1, R-2.1 and ambulatory care facilities. In Group I-2, *I-2.1, R-2.1;* and ambulatory care facilities, where doors are installed across a corridor, the doors shall be automatic closing by smoke

detection in accordance with Section 716.2.6.5 and shall have a vision panel with fire-protection-rated glazing materials in fire protection-rated frames, the area of which shall not exceed that tested. *Vision panels consisting of fire-rated glazing in approved frames shall be provided in each cross-corridor swinging door and at each cross-corridor horizontal-sliding door in a smoke barrier. In Group I-2, where swinging doors are installed across a corridor, such doors shall be opposite swinging pairs.*

[F] 909.5.3.2 Ducts and air transfer openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke damper complying with Section 717.

[F] 909.6 Pressurization method. The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

[F] 909.6.1 Minimum pressure difference. The pressure difference across a smoke barrier used to separate smoke zones shall be not less than 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences not less than two times the maximum calculated pressure difference produced by the design fire.

[F] 909.6.2 Maximum pressure difference. The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1010.1.3. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W-d) \tag{Equation 9-1}$$

where:

A = Door area, square feet (m²).

d = Distance from door handle to latch edge of door, feet (m).

F = Total door opening force, pounds (N).

F_{dc} = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches of water (Pa).

[F] 909.6.3 Pressurized stairways and elevator hoistways. Where stairways or elevator hoistways are pressurized, such pressurization systems shall comply with Section 909 as smoke control systems, in addition to the requirements of Sections 909.20 of this code and 909.21 of the *California Fire Code*.

[F] 909.7 Airflow design method. Where approved by the fire code official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92.

[F] 909.7.1 Prohibited conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. Airflow toward the fire shall not exceed 200 feet per minute (1.02 m/s). Where the calculated airflow exceeds this limit, the airflow method shall not be used.

[F] 909.8 Exhaust method. Where approved by the fire code official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

[F] 909.8.1 Smoke layer. The height of the lowest horizontal surface of the smoke layer interface shall be maintained not less than 6 feet (1829 mm) above a walking surface that forms a portion of a required egress system within the smoke zone.

[F] 909.9 Design fire. The design fire shall be based on a rational analysis performed by the registered design professional and approved by the fire code official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

[F] 909.9.1 Factors considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

[F] 909.9.2 Design fire fuel. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

[F] 909.9.3 Heat-release assumptions. The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

[F] 909.9.4 Sprinkler effectiveness assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

[F] 909.10 Equipment. Equipment including, but not limited to, fans, ducts, automatic dampers and balance dampers, shall be suitable for its intended use, suitable for the probable exposure temperatures that the rational analysis indicates and as approved by the fire code official.

[F] 909.10.1 Exhaust fans. Components of exhaust fans shall be rated and certified by the manufacturer for the

probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c/mc) + (T_a) \quad \text{(Equation 9-2)}$$

where:

c = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg × K).

m = Exhaust rate, pounds per second (kg/s).

Q_c = Convective heat output of fire, Btu/s (kW).

T_a = Ambient temperature, °F (K).

T_s = Smoke temperature, °F (K).

Exception: Reduced T_s as calculated based on the assurance of adequate dilution air.

[F] 909.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *California Mechanical Code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception: Flexible connections, for the purpose of vibration isolation, complying with the *California Mechanical Code* and that are constructed of approved fire-resistance-rated materials.

[F] 909.10.3 Equipment, inlets and outlets. Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

[F] 909.10.4 Automatic dampers. Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved, recognized standards.

[F] 909.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty, with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the requirements of Chapter 16.

Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts), as determined from

measurement of actual current draw, and shall have a minimum service factor of 1.15.

[F] 909.11 Standby power. Smoke control systems shall be provided with standby power in accordance with Section 2702.

909.11.1 Equipment room. The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gears and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 909.11.2 Power sources and power surges. Elements of the smoke control system relying on volatile memories or the like shall be supplied with uninterruptible power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke control system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

[F] 909.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

909.12.1 Verification. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

The status of dampers shall be determined using limit or proximity switches installed at the damper or incorporated into the damper actuator. Where multiple dampers are grouped together in an assembly requiring one or more actuators, each damper shall be independently controlled by a separate actuator and provided with an individual limit or proximity switch, or the dampers shall be linked together by a reliable and durable mechanical or otherwise permanent means into one or more groups, with each group provided with a common limit or proximity switch.

The status of fans shall be determined by sensing the air flow downstream of the fans using pressure differential switches or transmitters, or by other means of positive proof of air flow where approved by the enforcing authority.

Exception: Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the

preprogrammed weekly testing, where *approved* by the building official and in accordance with both of the following:

1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a *listed* control unit.
2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section 909.20.6 of the *California Fire Code*.

[F] 909.12.2 Wiring. In addition to meeting requirements of the *California Electrical Code*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

[F] 909.12.3 Activation. Smoke control systems shall be activated in accordance with this section.

[F] 909.12.3.1 Pressurization, airflow or exhaust method. Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

[F] 909.12.3.2 Passive method. Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

[F] 909.12.4 Automatic control. Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1, manual controls provided with ready access for the fire department and any smoke detectors required by engineering analysis.

[F] 909.13 Control air tubing. Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

[F] 909.13.1 Materials. Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B42, ASTM B43, ASTM B68/B68M, ASTM B88, ASTM B251 and ASTM B280. Fittings shall be wrought copper or brass, solder type in accordance with ASME B16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP-5 brazing alloy with solidus above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices provided that all of the following conditions are met:

1. Tubing shall comply with the requirements of *Chapter 6* of the *California Mechanical Code*.

2. Tubing and connected devices shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or Teflon or by suitable brass compression to male barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing connected to devices on doors shall be fastened along hinges.

[F] 909.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

[F] 909.13.3 Testing. Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

[F] 909.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

[F] 909.15 Control diagrams. Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file with the fire code official, the fire department and in the fire command center in a format and manner approved by the fire code official.

[F] 909.16 Fire fighter’s smoke control panel. A fire fighter’s smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 911 in high-rise buildings. *Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access* or buildings with smoke-protected assembly seating. In all other buildings, the fire fighter’s smoke control panel shall be installed in an approved location adjacent to the fire alarm control panel. The fire fighter’s smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

[F] 909.16.1 Smoke control systems. Fans within the building shall be shown on the fire fighter’s control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone, and by *approved* pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.

2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

[F] 909.16.2 Smoke control panel. The fire fighter’s control panel shall provide control capability over the complete smoke control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire fighter’s control panel.

Exceptions:

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

[F] 909.16.3 Control action and priorities. The fire-fighter’s control panel actions shall be as follows:

1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire fighter’s control panel, automatic or manual control from any other control point within the building shall not contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment including, but not limited to, duct freezestats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices, such means shall be capable of being overridden by the fire fighter’s control panel. The last control action as indicated by each fire fighter’s control panel switch position shall prevail. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

Exception: Power disconnects required by *the California Electrical Code*.

2. Only the AUTO position of each three-position fire-fighter's control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire fighter's control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described in Section 909.16.1. Where directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

[F] 909.17 System response time. Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire fighter's control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. Upon receipt of an alarm condition at the fire alarm control panel, fans, dampers and automatic doors shall have achieved their proper operating state and the final status shall be indicated at the smoke control panel within 90 seconds. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

[F] 909.18 Acceptance testing. Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

[F] 909.18.1 Detection devices. Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. Where applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

[F] 909.18.2 Ducts. Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

[F] 909.18.3 Dampers. Dampers shall be tested for function in their installed condition.

[F] 909.18.4 Inlets and outlets. Inlets and outlets shall be read using generally accepted practices to determine air quantities.

[F] 909.18.5 Fans. Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute (rpm) and belt tension shall be made.

[F] 909.18.6 Smoke barriers. Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

[F] 909.18.7 Controls. Each smoke zone equipped with an automatic-initiation device shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire fighter's control panel and simulation of standby power conditions.

[F] 909.18.8 Testing for smoke control. Smoke control systems shall be tested by a special inspector in accordance with Section 1705.19.

[F] 909.18.8.1 Scope of testing. Testing shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

[F] 909.18.8.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

[F] 909.18.8.3 Reports. A complete report of testing shall be prepared by the approved agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall sign, seal and date the report.

[F] 909.18.8.3.1 Report filing. A copy of the final report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.

[F] 909.18.9 Identification and documentation. Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing its proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

An approved operations manual describing the complete operations of the smoke control system and functioning of the firefighters smoke control panel shall be maintained at the fire command center.

[F] 909.19 System acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the fire code official determines that the provisions of this section have been fully complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system and a written maintenance program complying with the requirements of Section 909.20.1 of the *California Fire Code* has been submitted and approved by the fire code official.

Exception: In buildings of phased construction, a temporary certificate of occupancy, as approved by the fire code official, shall be allowed provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

909.20 Smokeproof enclosures. Where required by Section 1023.12, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an interior exit stairway or ramp that is enclosed in accordance with the applicable provisions of Section 1023 and an open exterior balcony, ventilated vestibule or pressurized stair and pressurized entrance vestibule meeting the requirements of this section. Where access to the roof is required by the *California Fire Code*, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

909.20.1 Access. Access to the stairway or ramp shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall be not less than the required width of the corridor leading to the vestibule calculated in accordance with Section 1005.1, but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

909.20.2 Construction. The smokeproof enclosure shall be separated from the remainder of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Openings are not permitted other than the required means of egress doors. The vestibule shall be separated from the stairway or ramp by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The open exterior balcony shall be constructed in accordance with the fire-resistance rating requirements for floor assemblies.

909.20.2.1 Door closers. Doors in a smokeproof enclosure shall be self- or automatic closing by actuation of a smoke detector in accordance with Section 716.2.6.6 and shall be installed at the floor-side entrance to the

smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.3.

909.20.2.2 Vestibule doors. Where access to the stairway is by way of a vestibule, the door assembly from the building into the vestibule shall be a 90-minute fire door assembly complying with Section 716.5.5. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating and shall comply with the requirements for a smoke door assembly in accordance with Section 716.5.3. The door shall be installed in accordance with NFPA-105.

909.20.2.3 Standpipes. Where access to the stairway is by way of a vestibule, Fire department standpipe connections and valves serving the floor shall be within the vestibule unless otherwise approved by the fire code official. Standpipe connections in vestibules shall be located in such a manner so as not to obstruct egress where hose lines are connected and charged.

909.20.2.4 Pressure differences. The minimum pressure differences within the vestibule with the doors closed shall be 0.05-inch water gage (12.44 Pa) positive pressure relative to the fire floor and 0.05-inch water gage (12.44 Pa) negative pressure relative to the exit enclosure. No pressure difference is required relative to a nonfire floor.

909.20.2.5 Relief vent. A relief vent capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of such pressurized exit enclosures.

Exception: When approved by the enforcing agency, other engineered design methods capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be permitted.

909.20.3 Natural ventilation alternative. The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.

909.20.3.1 Balcony doors. Where access to the stairway or ramp is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door assembly in accordance with Section 716.

909.20.3.2 Vestibule ventilation. Where access to the stairway is by way of a vestibule, each vestibule shall have a minimum net area of 16 square feet (1.5 m²) of opening in a wall facing an outer court, yard or public way that is not less than 20 feet (6096 mm) in width.

909.20.4 Mechanical pressurization alternative. The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of pressurization enclosures by mechanical means.

909.20.4.1 Pressure differences. *The pressurization system shall be designed so that the minimum pressure differences provided within the vestibule with the doors closed shall be 0.05-inch water gage (12.44 Pa) positive pressure relative to the fire floor and 0.05-inch water gage (12.44 Pa) negative pressure relative to the exit enclosure. No pressure difference is required relative to a nonfire floor.*

909.20.4.2 Relief vent. *A relief vent capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of such pressurized exit stairway or ramp enclosures.*

Exception: *When approved by the enforcing agency, other engineered design methods capable of discharging a minimum of 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be permitted.*

909.20.5 Reserved.

909.20.6 Pressurized stair and vestibule alternative. The provisions of Sections 909.20.6.1 through 909.20.6.3 shall apply to smokeproof enclosures using a pressurized stair and pressurized entrance vestibule.

909.20.6.1 Vestibule doors. The door assembly from the building into the vestibule shall be a fire door assembly complying with Section 716.2.2.1. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating and meet the requirements for a smoke door assembly in accordance with Section 716.2.2.1. The door shall be installed in accordance with NFPA 105.

909.20.6.2 Pressure difference. The stair enclosure shall be pressurized to not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the vestibule with all stairway doors closed under the maximum anticipated stack pressures. The vestibule, with doors closed, shall have not less than 0.05 inch of water gage (12.44 Pa) positive pressure relative to the fire floor. The pressure difference across doors shall not exceed 30 pounds (133-N) maximum force to begin opening the door.

909.20.6.3 Dampened relief opening. A controlled relief vent having the capacity to discharge not less than 2,500 cubic feet per minute (1180 L/s) of air at the design pressure difference shall be located in the upper portion of the pressurized exit enclosure.

909.20.7 Pressurization equipment. The activation of *pressurization* equipment required by the alternatives in Sections 909.20.4, 909.20.5 and 909.20.6 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure and upon activation of the automatic controls required by Section 909.12.4. When the closing device for the stairway and ramp shaft and vestibule doors is activated by smoke detection or power failure, the mechanical

equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

909.20.7.1 Pressurization systems. Smokeproof enclosure *pressurization* systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.
3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

Exception:

1. Control wiring and power wiring located outside of a 2-hour fire barrier construction shall be protected using any one of the following methods:
 - 1.1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
 - 1.2. Where encased with not less than 2 inches (51 mm) of concrete.
 - 1.3. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.

909.20.7.2 Standby power. *Pressurization* and stairway and ramp shaft ventilation systems and automatic fire detection systems shall be provided with standby power in accordance with Section 2702.

909.20.7.3 Acceptance and testing. Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

909.21 Elevator hoistway pressurization alternative. Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with Sections 909.21.1 through 909.21.11.

909.21.1 Pressurization requirements. Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors closed. The pressure differentials shall be measured between the hoistway and the adjacent elevator landing. The opening and closing of hoistway doors at each level must be demonstrated during this test. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

Exceptions:

1. On floors containing only Group R occupancies, the pressure differential is permitted to be measured between the hoistway and a dwelling unit or sleeping unit.
2. Where an elevator opens into a lobby enclosed in accordance with Section 3007.6 or 3008.6, the pressure differential is permitted to be measured between the hoistway and the space immediately outside the door(s) from the floor to the enclosed lobby.
3. The pressure differential is permitted to be measured relative to the outdoor atmosphere on floors other than the following:
 - 3.1. The fire floor.
 - 3.2. The two floors immediately below the fire floor.
 - 3.3. The floor immediately above the fire floor.
4. The minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to occupied floors are not required at the floor of recall with the doors open.

909.21.1.1 Use of ventilation systems. Ventilation systems, other than hoistway supply air systems, are permitted to be used to exhaust air from adjacent spaces on the fire floor, two floors immediately below and one floor immediately above the fire floor to the building's exterior where necessary to maintain positive pressure relationships as required in Section 909.21.1 during operation of the elevator shaft pressurization system.

909.21.2 Rational analysis. A rational analysis complying with Section 909.4 shall be submitted with the construction documents.

909.21.3 Ducts for system. Any duct system that is part of the pressurization system shall be protected with the same fire-resistance rating as required for the elevator shaft enclosure.

909.21.4 Fan system. The fan system provided for the pressurization system shall be as required by Sections 909.21.4.1 through 909.21.4.4.

909.21.4.1 Fire resistance. Where located within the building, the fan system that provides the pressurization shall be protected with the same fire-resistance rating required for the elevator shaft enclosure.

909.21.4.2 Smoke detection. The fan system shall be equipped with a smoke detector that will automatically shut down the fan system when smoke is detected within the system.

909.21.4.3 Separate systems. A separate fan system shall be used for each elevator hoistway.

909.21.4.4 Fan capacity. The supply fan shall be either adjustable with a capacity of not less than 1,000 cubic feet per minute (0.4719 m³/s) per door, or that specified by a registered design professional to meet the requirements of a designed pressurization system.

909.21.5 Standby power. The pressurization system shall be provided with standby power in accordance with Section 2702.

909.21.6 Activation of pressurization system. The elevator pressurization system shall be activated upon activation of either the building fire alarm system or the elevator lobby smoke detectors. Where both a building fire alarm system and elevator lobby smoke detectors are present, each shall be independently capable of activating the pressurization system.

909.21.7 Testing. Testing for performance shall be required in accordance with Section 909.18.8. System acceptance shall be in accordance with Section 909.19.

909.21.8 Marking and identification. Detection and control systems shall be marked in accordance with Section 909.14.

909.21.9 Control diagrams. Control diagrams shall be provided in accordance with Section 909.15.

909.21.10 Control panel. A control panel complying with Section 909.16 shall be provided.

909.21.11 System response time. Hoistway pressurization systems shall comply with the requirements for smoke control system response time in Section 909.17.

**SECTION 910
SMOKE AND HEAT REMOVAL**

[F] 910.1 General. Where required by this code, smoke and heat vents or mechanical smoke removal systems shall conform to the requirements of this section.

[F] 910.2 Where required. Smoke and heat vents or a mechanical smoke removal system shall be installed as required by Sections 910.2.1 and 910.2.2.

Exceptions:

1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
2. Smoke and heat removal shall not be required in areas of buildings equipped with early suppression fast-response (ESFR) sprinklers.
3. Smoke and heat removal shall not be required in areas of buildings equipped with control mode special application sprinklers with a response time index of $50 (m \times s)^{1/2}$ or less that are listed to control a fire in stored commodities with 12 or fewer sprinklers.

910.2.1 Group F-1 or S-1. Smoke and heat vents installed in accordance with Section 910.3 or a mechanical smoke removal system installed in accordance with Section 910.4 shall be installed in buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m²) of undivided area. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

Exception: *Group F-1 aircraft manufacturing buildings and Group S-1 aircraft repair hangars.*

[F] 910.2.2 High-piled combustible storage. Smoke and heat removal required by Table 3206.2 of the *California Fire Code* for buildings and portions thereof containing high-piled combustible storage shall be installed in accordance with Section 910.3 in unsprinklered buildings. In buildings and portions thereof containing high-piled combustible storage equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a smoke and heat removal system shall be installed in accordance with Section 910.3 or 910.4. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

[F] 910.3 Smoke and heat vents. The design and installation of smoke and heat vents shall be in accordance with Sections 910.3.1 through 910.3.3.

[F] 910.3.1 Listing and labeling. Smoke and heat vents shall be *listed* and labeled to indicate compliance with UL 793 or FM 4430 or *ICC ES AC 331*.

[F] 910.3.2 Smoke and heat vent locations. Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barriers. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2 with

consideration given to roof pitch, sprinkler location and structural members.

910.3.3 Smoke and heat vents area. The required aggregate area of smoke and heat vents shall be calculated as follows:

For buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1:

$$A_{VR} = V/9000 \quad \text{(Equation 9-3)}$$

where:

A_{VR} = The required aggregate vent area (ft²).

V = Volume (ft³) of the area that requires smoke removal.

For unsprinklered buildings:

$$A_{VR} = A_{FA}/50 \quad \text{(Equation 9-4)}$$

where:

A_{VR} = The required aggregate vent area (ft²).

A_{FA} = The area of the floor in the area that requires smoke removal.

[F] 910.3.4 Vent operation. Smoke and heat vents shall be capable of being operated by approved automatic and manual means.

[F] 910.3.5 Fusible link temperature rating. Where vents are installed in areas provided with automatic fire sprinklers and the vents operate by fusible link, the fusible link shall have a temperature rating of 360°F (182°C).

[F] 910.4 Mechanical smoke removal systems. Mechanical smoke removal systems shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7.

910.4.1 Automatic sprinklers required. The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

910.4.2 Exhaust fan construction. Exhaust fans that are part of a mechanical smoke removal system shall be rated for operation at 221°F (105°C). Exhaust fan motors shall be located outside of the exhaust fan air stream.

910.4.3 System design criteria. The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based on the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute (14.2 m³/s).

910.4.3.1 Makeup air. Makeup air openings shall be provided within 6 feet (1829 mm) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of makeup air inlets shall be 8 square feet per 1,000 cubic feet per minute (0.74 m² per 0.4719 m³/s) of smoke exhaust.

910.4.4 Activation. The mechanical smoke removal system shall be activated by manual controls only.

910.4.5 Manual control location. Manual controls shall be located where they are able to be accessed by the fire service from an exterior door of the building and separated from the remainder of the building by not less than 1-hour

fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

[F] 910.4.6 Control wiring. Wiring for operation and control of mechanical smoke removal systems shall be connected ahead of the main disconnect in accordance with Section 701.12E of *the California Electrical Code* and be protected against interior fire exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes.

[F] 910.4.7 Controls. Where building air-handling and mechanical smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *California Mechanical Code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.

910.5 Maintenance. Smoke and heat vents and mechanical smoke removal systems shall be maintained in accordance with the *California Fire Code*.

SECTION 911 FIRE COMMAND CENTER

[F] 911.1 General. Where required by other sections of this code, in buildings classified as high-rise buildings by this code and in all F-1 and S-1 occupancies with a building footprint of over 500,000 square feet (46 452 m²) and *Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access*, a fire command center for fire department operations shall be provided and shall comply with Sections 911.1.1 through 911.1.7.

[F] 911.1.1 Location and access. The location and access to the fire command center shall be approved by the fire code official.

[F] 911.1.2 Separation. The fire command center shall be separated from the remainder of the building by not less than a 2-hour fire barrier constructed in accordance with Section 707 or horizontal assembly constructed in accordance with Section 711, or both.

[F] 911.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m²) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater. Where a fire command is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m²) in area, the fire command center shall have a minimum size of 96 square feet (9 m²) with a minimum dimension of 8 feet (2348 mm) where approved by the fire code official.

[F] 911.1.4 Layout approval. A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation.

[F] 911.1.5 Storage. Storage unrelated to operation of the fire command center shall be prohibited.

[F] 911.1.6 Required features. The fire command center shall comply with NFPA 72 and shall contain all of the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. *Fire alarm system zoning annunciator panel required by Section 907.6.4.3.*
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking interior exit stairway doors simultaneously.
8. Sprinkler valve and waterflow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire fighter air replenishment system, fire-fighting equipment and fire department access and the location of fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
13. An approved Building Information Card that contains, but is not limited to, the following information:
 - 13.1. General building information that includes: property name, address, the number of floors in the building above and below grade, use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor), and the estimated building population during the day, night and weekend.
 - 13.2. Building emergency contact information that includes: a list of the building's emergency contacts including but not limited to building manager and building engineer and their respective work phone number, cell phone number, e-mail address.
 - 13.3. Building construction information that includes: the type of building construction including but not limited to floors, walls, columns, and roof assembly.
 - 13.4. Exit access and exit stairway information that includes: number of exit access and

exit stairways in the building, each exit access and exit stairway designation and floors served, location where each exit access and exit stairway discharges, interior exit stairways that are pressurized, exit stairways provided with emergency lighting, each exit stairway that allows reentry, exit stairways providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve; location of elevator machine rooms, control rooms and control spaces; location of sky lobby, location of freight elevator banks.

- 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator, location of natural gas service.
- 13.6. Fire protection system information that includes: location of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers, location of different types of automatic sprinkler systems installed including, but not limited to, dry, wet and pre-action.
- 13.7. Hazardous material information that includes: location of hazardous material, quantity of hazardous material.
- 14. Work table.
- 15. Generator supervision devices, manual start and transfer features.
- 16. Public address system, where specifically required by other sections of this code.
- 17. Elevator fire recall switch in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.
- 18. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.
- 19. A master switch for unlocking elevator lobby doors permitted by Section 1010.2.12.1.

[SFM] Fire command centers shall not be used for the housing of any boiler, heating unit, generator, combustible storage or similar hazardous equipment or storage.

[F] 911.1.7 Fire command center identification. The fire command center shall be identified by a permanent easily visible sign reading “FIRE COMMAND CENTER” located on the door to the fire command center.

911.1.8 Ventilation. The fire command center shall be provided with an independent ventilation or air-conditioning system.

SECTION 912 FIRE DEPARTMENT CONNECTIONS

[F] 912.1 Installation. Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.6.

[F] 912.2 Location. With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be approved by the fire code official.

[F] 912.2.1 Visible location. Fire department connections shall be located on the street side of buildings or facing approved fire apparatus access roads, fully visible and recognizable from the street, fire apparatus access road or nearest point of fire department vehicle access or as otherwise approved by the fire code official.

[F] 912.2.2 Existing buildings. On existing buildings, wherever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an approved sign mounted on the street front or on the side of the building. Such sign shall have the letters “FDC” not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the fire code official.

[F] 912.3 Fire hose threads. Fire hose threads used in connection with standpipe systems shall be approved and shall be compatible with fire department hose threads.

[F] 912.4 Access. Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or moveable object. Access to fire department connections shall be approved by the fire code official.

Exceptions:

1. Fences, where provided with an access gate equipped with a sign complying with the legend requirements of Section 912.5 and a means of emergency operation. The gate and the means of emergency operation shall be approved by the fire code official and maintained operational at all times.
2. When acceptable to the fire authority having jurisdiction, fire department connections for Group I-3 detention facilities may be located inside all security walls or fences on the property.

[F] 912.4.1 Locking fire department connection caps. The fire code official is authorized to require locking caps on fire department connections for water-based fire protection systems where the responding fire department carries appropriate key wrenches for removal.

[F] 912.4.2 Clear space around connections. A working space of not less than 36 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to

the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections, except as otherwise required or approved by the fire code official.

[F] 912.4.3 Physical protection. Where fire department connections are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312 of the *California Fire Code*.

[F] 912.5 Signs. A metal sign with raised letters not less than 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: "AUTOMATIC SPRINKLERS," "STANDPIPES," or "TEST CONNECTION," or a combination thereof as applicable. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

[P] 912.6 Backflow protection. The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the *Health and Safety Code Section 13114.7*.

SECTION 913 FIRE PUMPS

[F] 913.1 General. Where provided, fire pumps for fire protection systems shall be installed in accordance with this section and NFPA 20.

Exception: Pumps for automatic sprinkler systems installed in accordance with Section 903.3.1.3, or Section R313 of the *California Residential Code*.

[F] 913.2 Protection against interruption of service. The fire pump, driver and controller shall be protected in accordance with NFPA 20 against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions.

913.2.1 Protection of fire pump rooms. Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour fire barriers constructed in accordance with Section 707 or 2-hour horizontal assemblies constructed in accordance with Section 711, or both.

Exceptions:

1. In other than high-rise buildings, separation by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Separation is not required for fire pumps physically separated in accordance with NFPA 20.

[F] 913.2.2 Circuits supplying fire pumps. Cables used for survivability of circuits supplying fire pumps shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.
4. The cable or raceway is encased in a minimum of 2 inches (51 mm) of concrete.

Exception: This section shall not apply to cables, or portions of cables, located within a fire pump room or generator room which is separated from the remainder of the occupancy with fire-resistance-rated construction.

[F] 913.3 Temperature of pump room. Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (5°C).

[F] 913.3.1 Engine manufacturer's recommendation. Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer's recommendations for oil heaters shall be followed.

[F] 913.4 Valve supervision. Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

1. Central-station, proprietary or remote-station signaling service.
2. Local signaling service that will cause the sounding of an audible signal at a constantly attended location.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

[F] 913.4.1 Test outlet valve supervision. Fire pump test outlet valves shall be supervised in the closed position.

[F] 913.5 Acceptance test. Acceptance testing shall be done in accordance with the requirements of NFPA 20.

913.6 Fire pumps in high-rise buildings. Engine-driven fire pumps and electric drive fire pumps supplied by generators shall both be provided with an on-premises fuel supply, sufficient for not less than 8-hour full-demand operation at 100 percent of the rated pump capacity in addition to all other required supply demands in accordance with NFPA 20 and this section.

SECTION 914 EMERGENCY RESPONDER SAFETY FEATURES

[F] 914.1 Shaftway markings. Vertical shafts shall be identified as required by Sections 914.1.1 and 914.1.2.

[F] 914.1.1 Exterior access to shaftways. Outside openings accessible to the fire department and that open directly on a hoistway or shaftway communicating between two or more floors in a building shall be plainly marked with the word “SHAFTWAY” in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

[F] 914.1.2 Interior access to shaftways. Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word “SHAFTWAY” in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

Exception: Markings shall not be required on shaftway openings that are readily discernible as openings onto a shaftway by the construction or arrangement.

[F] 914.2 Equipment room identification. Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning systems, sprinkler risers and valves or other fire detection, suppression or control elements shall be identified for the use of the fire department. Approved signs required to identify fire protection equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

SECTION 915 CARBON MONOXIDE DETECTION

[F] 915.1 General. Carbon monoxide detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.7. *[Not adopted by HCD]* Carbon monoxide detection shall be installed in existing buildings in accordance with Chapter 11 of the *California Fire Code*.

Pursuant to Health and Safety Code Section 17926, carbon monoxide detection shall be installed in all existing Group R buildings as required in Section 915.

[F] 915.1.1 Where required. Carbon monoxide detection shall be provided in Group I-2, I-4 and R occupancies and in classrooms in Group E occupancies in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.

[F] 915.1.2 Fuel-burning appliances and fuel-burning fireplaces. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms that contain a fuel-burning appliance or a fuel-burning fireplace.

[F] 915.1.3 Fuel burning, forced-air furnaces. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms served by a fuel-burning, forced-air furnace.

Exception: Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms if a carbon monoxide detector is provided in the first room or area served by each main duct leaving the

furnace, and the carbon monoxide alarm signals are automatically transmitted to an approved location.

[F] 915.1.4 Fuel-burning appliances outside of dwelling units, sleeping units and classrooms. Carbon monoxide detection shall be provided in *dwelling units*, sleeping units and classrooms located in buildings that contain fuel-burning appliances or fuel-burning fireplaces.

Exceptions:

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.
2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where a carbon monoxide detector is provided in one of the following locations:
 - 2.1. In an approved location between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.
 - 2.2. On the ceiling of the room containing the fuel-burning appliance or fuel-burning fireplace.

[F] 915.1.5 Private garages. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages.

Exceptions:

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the private garage and the dwelling unit, sleeping unit or classroom.
2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms located more than one story above or below a private garage.
3. Carbon monoxide detection shall not be required where the private garage connects to the building through an open-ended corridor.
4. Where a carbon monoxide detector is provided in an approved location between openings to a private garage and dwelling units, sleeping units or classrooms.

[F] 915.1.6 Exempt garages. For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 or an enclosed parking garage complying with Section 406.6 shall not be considered a private garage.

[F] 915.2 Locations. Where required by Section 915.1.1, carbon monoxide detection shall be installed *in accordance with the manufacturer’s published instructions* in the locations specified in Sections 915.2.1 through 915.2.3.

[F] 915.2.1 Dwelling units. Carbon monoxide detection shall be installed in dwelling units *in the following locations:*

1. Outside of each separate sleeping area in the immediate vicinity of the bedrooms.
2. *On every occupiable level of a dwelling unit, including basements.*
3. Where a fuel-burning appliance is located within a bedroom or its attached bathroom, carbon monoxide detection shall be installed within the bedroom.

[F] 915.2.2 Sleeping units. Carbon monoxide detection shall be installed in sleeping units.

Exception: Carbon monoxide detection shall be allowed to be installed outside of each separate sleeping area in the immediate vicinity of the sleeping unit where the sleeping unit or its attached bathroom does not contain a fuel-burning appliance and is not served by a forced air furnace.

[F] 915.2.3 Group E occupancies. Carbon monoxide detectors shall be installed in classrooms in Group E occupancies *where classrooms include any of the conditions identified in Sections 915.1.2 through 915.1.6.* Carbon monoxide alarm signals shall be automatically transmitted to an on-site location *as approved by the authority having jurisdiction.*

Exception: Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies with an occupant load of 30 or less.

[F] 915.3 Carbon monoxide detection. Carbon monoxide detection required by Sections 915.1 through 915.2.3 shall be provided by carbon monoxide alarms complying with Section 915.4 or carbon monoxide detection systems complying with Section 915.5.

[F] 915.4 Carbon monoxide alarms. Carbon monoxide alarms shall comply with Sections 915.4.1 through 915.4.5.

[F] 915.4.1 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than that required for overcurrent protection.

Exceptions:

1. Where installed in buildings without commercial power, battery-powered carbon monoxide alarms shall be an acceptable alternative.
2. *Carbon monoxide alarms in Group R occupancies shall be permitted to receive their primary power from other power sources recognized for use by NFPA 72.*
3. *Carbon monoxide alarms in Group R occupancies shall be permitted to be battery-powered or plug-in with a battery backup in existing build-*

ings built prior to January 1, 2011, under any of the following conditions:

- 3.1. *No construction is taking place.*
- 3.2. *Repairs or alterations do not result in the removal of interior wall and ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*
- 3.3. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
- 3.4. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*

[F] 915.4.2 Listings. Residential carbon monoxide alarms shall be listed in accordance with UL 2034.

No person shall install, market, distribute, offer for sale, or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the Office of the State Fire Marshal.

[F] 915.4.3 Locations. Carbon monoxide alarms shall only be installed in dwelling units and in sleeping units. They shall not be installed in locations where the code requires carbon monoxide detectors to be used.

[F] 915.4.4 Combination alarms. Combination carbon monoxide/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination carbon monoxide/smoke alarms shall be listed in accordance with UL 217 and UL 2034.

Combination carbon monoxide/smoke alarms shall comply with Section 915, and all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

915.4.5 Interconnection. *Where more than one carbon monoxide alarm is required to be installed within a dwelling unit or within a sleeping unit in Group R occupancies, the alarms shall be interconnected in a manner that activation of one alarm shall activate all of the alarms in the individual unit.*

Exception: *Interconnection is not required in existing buildings, built prior to January 1, 2011, under any of the following conditions:*

1. *Physical interconnection is not required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.*
2. *No construction is taking place.*
3. *Repairs or alterations do not result in the removal of interior wall and ceiling finishes*

exposing the structure in areas/spaces where carbon monoxide alarms are required.

4. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
5. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*

[F] 915.5 Carbon monoxide detection systems. Carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide alarms and shall comply with Sections 915.5.1 through 915.5.3.

[F] 915.5.1 General. Carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

[F] 915.5.2 Locations. Carbon monoxide detectors shall be installed in the locations specified in Section 915.2 or NFPA 72.

[F] 915.5.3 Combination detectors. Combination carbon monoxide/smoke detectors installed in carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide detectors, provided that they are listed in accordance with UL 268 and UL 2075.

Combination carbon monoxide/smoke detectors shall comply with all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

[F] 915.6 Maintenance. Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with NFPA 72. *Carbon monoxide alarms and carbon monoxide detectors that become inoperable or begin producing end-of-life signals shall be replaced.*

915.7 Visible alarms. *In buildings containing covered multi-family dwellings as defined in Chapter 2, all required carbon monoxide alarms shall be equipped with the capability to support visible alarm notification in accordance with NFPA 72.*

SECTION 916 GAS DETECTION SYSTEMS

[F] 916.1 Gas detection systems. Gas detection systems required by this code shall comply with Sections 916.2 through 916.11.

[F] 916.2 Permits. Permits shall be required as set forth in Section 105.6.10 of the *California Fire Code*.

[F] 916.2.1 Construction documents. Documentation of the gas detection system design and equipment to be used that demonstrates compliance with the requirements of this code and the *California Fire Code* shall be provided with the application for permit.

[F] 916.3 Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturer's instructions.

[F] 916.4 Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an unswitched receptacle using an approved restraining means that secures the plug to the receptacle.

[F] 916.5 Emergency and standby power. Standby or emergency power shall be provided or the gas detection system shall initiate a trouble signal at an approved location if the power supply is interrupted.

[F] 916.6 Sensor locations. Sensors shall be installed in approved locations where leaking gases are expected to accumulate.

[F] 916.7 Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except as follows:

1. For HPM gases, sample analysis shall be performed at intervals not exceeding 30 minutes.
2. For toxic gases that are not HPM, sample analysis shall be performed at intervals not exceeding 5 minutes in accordance with Section 6004.2.2.7 of the *California Fire Code*.
3. Where a less frequent or delayed sampling interval is approved.

[F] 916.8 System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the following thresholds:

1. For flammable gases, a gas concentration exceeding 25 percent of the lower flammability limit (LFL).
2. For nonflammable gases, a gas concentration exceeding one-half of the IDLH, unless a different threshold is specified by the section of this code requiring a gas detection system.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the section of this code requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

[F] 916.9 Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

[F] 916.10 Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturer's instructions.

[F] 916.11 Inspection, testing and sensor calibration. Gas detection systems and sensors shall be inspected, tested and calibrated in accordance with the *California Fire Code*.

**SECTION 917
MASS NOTIFICATION SYSTEMS**

[F] **917.1 College and university campuses.** Prior to construction of a new building requiring a fire alarm system on a multiple-building college or university campus having a cumulative building occupant load of 1,000 or more, a mass notification risk analysis shall be conducted in accordance with NFPA 72. Where the risk analysis determines a need for mass notification, an approved mass notification system shall be provided in accordance with the findings of the risk analysis.

**SECTION 918
EMERGENCY RESPONDER
COMMUNICATION COVERAGE**

[F] **918.1 General.** In-building two-way emergency responder communication coverage shall be provided in all new buildings in accordance with Section 510 of the *California Fire Code*.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 10 – MEANS OF EGRESS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X					X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X	X					X	X	X		X	X						
Adopt only those sections that are listed below							X															
Chapter / Section																						
1001.1			X																			
1003.1, not SFM exception							X															
1003.1			X			X																
1003.1.1										X												
1003.1.2											X	X			X							
1003.2			X																			
1003.3 Exc.			X																			
1003.3.1			X																			
1003.3.3.1			X																			
1003.3.4				X	X	X																
1003.5			X	X	X	X																
Table 1004.5			X																			
1004.9			X																			
1005.3.1			X																			
1005.3.2			X																			
1005.7.1			X																			
1005.7.2			X																			
1006.2.1			X																			
Table 1006.2.1			X																			
1006.2.2			X																			
1006.2.2.2			X																			
1006.2.2.3			X																			
1006.2.2.4			X																			
1006.2.2.6			X																			
1006.2.2.7			X																			
1006.2.2.8			X																			
1006.3.3			X																			
Table 1006.3.3(1)			X																			
Table 1006.3.3(2)			X																			
1008.2			X																			
1008.3.2			X																			
1009.1			X	X	X	X	X															
1009.2						X	X															
1009.2.1							X															
1009.3						X	X															
1009.4			X				X															
1009.4.1			X																			
1009.4.2							X															

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 10 – MEANS OF EGRESS—continued**

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5								
Adopt entire chapter	X							X	X					X									
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X	X				X	X	X			X	X							
Adopt only those sections that are listed below							X																
Chapter / Section																							
1009.5			X	X	X	X	X																
1009.6							X																
1009.6.1							X																
1009.6.2							X																
1009.6.3			X	X	X	X	X																
1009.6.4							X																
1009.6.5							X																
1009.7							X																
1009.7.1							X																
1009.7.2							X																
1009.7.3							X																
1009.7.4							X																
1009.8							X																
1009.8.1							X																
1009.8.1.1						X	X																
1009.8.2			X			X	X																
1009.9						X	X																
1009.10							X																
1009.11						X	X																
1009.12			X			X	X																
1010 (1st paragraph below title only)							X																
1010.1.1			X			X																	
1010.1.1.1			X																				
1010.1.2			X																				
1010.1.2.1			X																				
1010.1.4						X	X																
1010.1.6						X	X																
1010.1.7						X	X																
1010.1.14			X																				
1010.2.1			X																				
1010.2.2			X			X	X																
1010.2.9			X																				
1010.2.8.2			X																				
1010.2.12.1			X																				
1010.2.13			X																				
1010.2.13.1			X																				
1010.2.13.1 (Item 4, 6.3 & 6.4 only)							X																
1010.2.14			X																				

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 10 – MEANS OF EGRESS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X					X								
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X	X						X	X	X								
Adopt only those sections that are listed below							X															
Chapter / Section																						
1010.2.5			X																			
1010.2.8.1			X																			
1010.2.13			X																			
1010.3.1						X																
1011(1st paragraph below title only)							X															
1011.2			X																			
1011.5.2			X																			
1011.5.2 [DSA-AC: exc. 4 only]							X															
1011.6			X																			
1011.11			X																			
1011.11 (2nd paragraph only)							X															
1011.15			X																			
1012 (1st paragraph below title only)							X															
1012.1						X																
1012.6.3						X																
1012.6.4						X																
1012.6.5						X																
1012.10						X																
1013.1			X																			
1013.2			X																			
1013.4			X			X	X															
1013.6.3			X																			
1013.7			X																			
1013.8			X																			
1014 (1st paragraph below title only)							X															
1014.8			X			X																
1015.2			X				X															
1015.3			X	X	X	X	X															
1015.4			X																			
1015.8				X	X	X																
1016.2			X																			
Table 1017.2			X																			
1018.2 (1st paragraph below title only)							X															
1018.3 Exception only							X															
1018.5 Exception only							X															
1019.3			X																			
1019.4			X																			
1020.1			X																			

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 10 – MEANS OF EGRESS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X				X									
Adopt entire chapter as amendedd (amended sections listed below)			X	X	X	X				X	X	X		X	X							
Adopt only those sections that are listed below							X															
Chapter / Section																						
Table 1020.1			X																			
Table 1020.2			X																			
1020.3			X																			
1020.4			X																			
1020.5			X							X		X		X								
1020.6			X																			
1022.3			X																			
1023.2			X																			
1023.9			X			X																
1023.9 (2nd paragraph only)							X															
1023.9.1			X																			
1023.11						X																
1023.11.2			X																			
1024.2			X																			
1026.4.1			X																			
1026.4.2			X																			
1028.5			X																			
1029.1			X																			
1029.2			X																			
1029.3			X																			
1029.3.1			X																			
1029.9.1			X																			
1030.1			X																			
1030.1.1			X																			
1030.6.3.2			X																			
1032.2.1.2			X																			
1032.2.1.3			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 10

MEANS OF EGRESS

User notes:

About this chapter: Chapter 10 provides the general criteria for designing the means of egress established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system (exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics that will permit the safe use of components without special knowledge or effort are specified.

The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Chapter 10 is subdivided into four main sections: general (Sections 1003–1015), exit access (Sections 1016–1021), exit (Sections 1022–1027) and exit discharge (Sections 1028–1029). Special allowances for the unique requirements for assembly spaces (Section 1030) and emergency escape and rescue openings (Section 1031) complete the chapter. Chapter 10 of this code is duplicated in Chapter 10 of the California Fire Code; however, the California Fire Code contains one additional section on maintenance of the means of egress system in existing buildings.

Section 1010 was extensively reorganized for the 2021 edition. For complete information, see the moved sections table in the preface information for the California Building Code.

SECTION 1001 ADMINISTRATION

1001.1 General. Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof.

1001.2 Minimum requirements. It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the minimum width or required capacity of the means of egress to less than required by this code.

[F] SECTION 1002 MAINTENANCE AND PLANS

[F] 1002.1 Maintenance. Means of egress shall be maintained in accordance with the *California Fire Code*.

[F] 1002.2 Fire safety and evacuation plans. Fire safety and evacuation plans shall be provided for all occupancies and buildings where required by the *California Fire Code*. Such fire safety and evacuation plans shall comply with the applicable provisions of Sections 401.2 and 404 of the *California Fire Code*.

SECTION 1003 GENERAL MEANS OF EGRESS

1003.1 Applicability. The general requirements specified in Sections 1003 through 1015 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.

[DSA-AC & HCD 1-AC] In addition to the requirement of this chapter, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development, or Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, as applicable.

Exception: Exiting requirements for Fixed Guideway Transit Systems shall be as per Section 443.

1003.1.1 Means of egress for hospitals. [OSHPD 1] In addition to the requirements of this chapter, means of egress for hospitals shall comply with Part 10 California Existing Building Code Section 308A.

1003.1.2 Means of egress for hospital buildings removed from acute care service, skilled nursing facilities, intermediate care facilities and acute psychiatric hospitals. [OSHPD 1R, 2 & 5] In addition to the requirements of this chapter, means of egress for hospital buildings removed from acute care service, skilled nursing facilities, intermediate care facilities and acute psychiatric hospitals shall comply with OSHPD amendments to Part 10 California Existing Building Code Section 308.

1003.2 Ceiling height. The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm) above the finished floor.

Exceptions:

1. Sloped ceilings in accordance with Section 1208.2.
2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1208.2.

MEANS OF EGRESS

3. Allowable projections in accordance with Section 1003.3.
4. Stair headroom in accordance with Section 1011.3.
5. Door height in accordance with Section 1010.1.1.
6. Ramp headroom in accordance with Section 1012.5.2.
7. The clear height of floor levels in vehicular and pedestrian traffic areas of public and private parking garages in accordance with Section 406.2.2.
8. Areas above and below mezzanine floors in accordance with Section 505.2.
9. *In Group I-2, I-2.1 and I-3 occupancies, the means of egress shall have a ceiling height of not less than 8 feet (2439 mm).*

1003.3 Protruding objects. Protruding objects on circulation paths shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.

Exception: *In Group I-2 and Group I-2.1 occupancies, protruding objects shall not extend more than 12 inches (305 mm) below the minimum ceiling height required by Section 1003.2.*

1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 where a minimum headroom of 80 inches (2032 mm) is provided over any circulation paths, including walks, corridors, aisles and passageways. *In other than Group I-2 and Group I-2.1 occupancies, Not more than 50 percent of the ceiling area of a means of egress shall be permitted to be reduced in height by protruding objects.*

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance above a circulation path is less than 80 inches (2032 mm) high above the finished floor. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the finished floor.

1003.3.2 Post-mounted objects. A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 4 inches (102 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the finished floor. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finished floor or ground.

Exception: These requirements shall not apply to sloping portions of handrails between the top and bottom riser of stairs and above the ramp run.

1003.3.3 Horizontal projections. Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finished floor shall not proj-

ect horizontally more than 4 inches (102 mm) into the circulation path.

Exception: Handrails are permitted to protrude 4½ inches (114 mm) from the wall or guard.

1003.3.3.1 Horizontal projections for Group I-2 and I-2.1 occupancies. *Structural elements, fixtures or furnishings shall not project horizontally from either side more than 1½ inches (38 mm) into the required width of an exit access corridor serving any area caring for one or more nonambulatory or bedridden persons.*

Exceptions:

1. *Handrails are permitted to protrude 3½ inches (89 mm) from the wall.*
2. *Alcohol-based hand-rub dispensers are permitted to protrude 4 inches.*
3. *Manual fire alarm boxes with a protective cover installed are permitted to protrude 4 inches.*

1003.3.4 Clear width. Protruding objects shall not reduce the minimum clear width of accessible routes *as required in Chapter 11A or Chapter 11B.*

1003.4 Slip-resistant surface. Circulation paths of the means of egress shall have a slip-resistant surface and be securely attached.

1003.5 Elevation change. Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than one unit vertical in 20 units horizontal (5-percent slope), ramps complying with Section 1012 shall be used. Where the difference in elevation is 6 inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials.

Exceptions:

1. Steps at exterior doors complying with Section 1010.1.4.
2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by Chapter 11A or 11B where the risers and treads comply with Section 1011.5, the minimum depth of the tread is 13 inches (330 mm) and not less than one handrail complying with Section 1014 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair.
3. A step is permitted in aisles serving seating that has a difference in elevation less than 12 inches (305 mm) at locations not required to be accessible by Chapter 11A or 11B, provided that the risers and treads comply with Section 1030.14 and the aisle is provided with a handrail complying with Section 1030.16.

Throughout a story in a Group I-2 and I-2.1 occupancies, any change in elevation in portions of the means of egress that serve nonambulatory persons shall be by means of a ramp or sloped walkway.

1003.6 Means of egress continuity. The path of egress travel along a means of egress shall not be interrupted by a building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the minimum width or required capacity of a means of egress component except projections permitted by this chapter. The minimum width or required capacity of a means of egress system shall not be diminished along the path of egress travel.

1003.7 Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

Exception: Elevators used as an accessible means of egress in accordance with Section 1009.4.

**SECTION 1004
OCCUPANT LOAD**

1004.1 Design occupant load. In determining means of egress requirements, the number of occupants for whom means of egress facilities are provided shall be determined in accordance with this section.

1004.2 Cumulative occupant loads. Where the path of egress travel includes intervening rooms, areas or spaces, cumulative occupant loads shall be determined in accordance with this section.

1004.2.1 Intervening spaces or accessory areas. Where occupants egress from one or more rooms, areas or spaces through others, the design occupant load shall be the combined occupant load of interconnected accessory or intervening spaces. Design of egress path capacity shall be based on the cumulative portion of occupant loads of all rooms, areas or spaces to that point along the path of egress travel.

1004.2.2 Adjacent levels for mezzanines. That portion of the occupant load of a mezzanine with required egress through a room, area or space on an adjacent level shall be added to the occupant load of that room, area or space.

1004.2.3 Adjacent stories. Other than for the egress components designed for convergence in accordance with Section 1005.6, the occupant load from separate stories shall not be added.

1004.3 Multiple function occupant load. Where an area under consideration contains multiple functions having different occupant load factors, the design occupant load for such area shall be based on the floor area of each function calculated independently.

1004.4 Multiple occupancies. Where a building contains two or more occupancies, the means of egress requirements shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

1004.5 Areas without fixed seating. The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.5. For areas without fixed

**TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR ^a
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Exhibit gallery and museum	30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	150 gross
Concentrated business use areas	See Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Day care	35 net
Dormitories	50 gross
Educational	
Classroom area	20 net
Shops and other vocational room areas	50 net
Exercise rooms	50 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Laboratory	
Educational (K–12 th grade)	50 net
Laboratories, non-educational	100 net
Laboratory suite ^b	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2
Mercantile	60 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. Floor area in square feet per occupant.

b. See Section 453.2.

c. See Table 408.3.13 for I-3 facilities.

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seating, the occupant load shall be not less than that number determined by dividing the floor area under consideration by the occupant load factor assigned to the function of the space as set forth in Table 1004.5. Where an intended function is not listed in Table 1004.5, the building official shall establish a function based on a listed function that most nearly resembles the intended function.

Exception: Where approved by the building official, the actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design occupant load.

1004.5.1 Increased occupant load. The occupant load permitted in any building, or portion thereof, is permitted to be increased from that number established for the occupancies in Table 1004.5, provided that all other requirements of the code are met based on such modified number and the occupant load does not exceed one occupant per 7 square feet (0.65 m²) of occupiable floor space. Where required by the building official, an approved aisle, seating or fixed equipment diagram substantiating any increase in occupant load shall be submitted. Where required by the building official, such diagram shall be posted.

1004.6 Fixed seating. For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. The occupant load for areas in which fixed seating is not installed, such as waiting spaces, shall be determined in accordance with Section 1004.5 and added to the number of fixed seats.

The occupant load of wheelchair spaces and the associated companion seat shall be based on one occupant for each wheelchair space and one occupant for the associated companion seat provided in accordance with Section 1109.2.3.

For areas having fixed seating without dividing arms, the occupant load shall be not less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

1004.7 Outdoor areas. Yards, patios, occupied roofs, courts and similar outdoor areas accessible to and usable by the building occupants shall be provided with means of egress as required by this chapter. The occupant load of such outdoor areas shall be assigned by the building official in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, means of egress requirements for the building shall be based on the sum of the occupant loads of the building plus the outdoor areas.

Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one means of egress.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

1004.8 Concentrated business use areas. The occupant load factor for concentrated business use shall be applied to telephone call centers, trading floors, electronic data processing centers and similar business use areas with a higher density of occupants than would normally be expected in a typical business occupancy environment. Where approved by the building official, the occupant load for concentrated business use areas shall be the actual occupant load, but not less than one occupant per 50 square feet (4.65 m²) of gross occupiable floor space.

1004.9 Posting of occupant load. Every room or space which is used for assembly, classroom, dining, drinking or similar purposes having an occupant load of 50 or more shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space, for the intended configurations. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or the owner's authorized agent.

SECTION 1005 MEANS OF EGRESS SIZING

1005.1 General. All portions of the means of egress system shall be sized in accordance with this section.

Exception: Aisles and aisle accessways in rooms or spaces used for assembly purposes complying with Section 1030.

1005.2 Minimum width based on component. The minimum width, in inches (mm), of any means of egress components shall be not less than that specified for such component, elsewhere in this code.

1005.3 Required capacity based on occupant load. The required capacity, in inches (mm), of the means of egress for any room, area, space or story shall be not less than that determined in accordance with Sections 1005.3.1 and 1005.3.2.

1005.3.1 Stairways. The capacity, in inches, of means of egress stairways shall be calculated by multiplying the occupant load served by such stairways by a means of egress capacity factor of 0.3 inch (7.6 mm) per occupant. Where stairways serve more than one story, only the occupant load of each story considered individually shall be used in calculating the required capacity of the stairways serving that story.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of means of egress stairways shall be calculated by multiplying the occupant load served by such stairways by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

2. Facilities with smoke-protected assembly seating shall be permitted to use the capacity factors in Table 1030.6.2 indicated for stepped aisles for exit access or exit stairways where the entire path for means of egress from the seating to the exit discharge is provided with a smoke control system complying with Section 909.
3. Facilities with open-air assembly seating shall be permitted to the capacity factors in Section 1030.6.3 indicated for stepped aisles for exit access or exit stairways where the entire path for means of egress from the seating to the exit discharge is open to the outdoors.
4. *For Group H-1, H-2, H-3 and H-4 occupancies the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.7 inches (7.62 mm) per occupant.*

1005.3.2 Other egress components. The capacity, in inches, of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.15 inch (3.8 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.
2. Facilities with smoke-protected assembly seating shall be permitted to use the capacity factors in Table 1030.6.2 indicated for level or ramped aisles for means of egress components other than stairways where the entire path for means of egress from the seating to the exit discharge is provided with a smoke control system complying with Section 909.
3. Facilities with open-air assembly seating shall be permitted to the capacity factors in Section 1030.6.3 indicated for level or ramped aisles for means of egress components other than stairways where the entire path for means of egress from the seating to the exit discharge is open to the outdoors.
4. *For Group H-1, H-2, H-3 and H-4 occupancies the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.4 inches (5.08 mm) per occupant.*

1005.4 Continuity. The minimum width or required capacity of the means of egress required from any story of a building

shall not be reduced along the path of egress travel until arrival at the public way.

1005.5 Distribution of minimum width and required capacity. Where more than one exit, or access to more than one exit, is required, the means of egress shall be configured such that the loss of any one exit, or access to one exit, shall not reduce the available capacity or width to less than 50 percent of the required capacity or width.

1005.6 Egress convergence. Where the means of egress from stories above and below converge at an intermediate level, the capacity of the means of egress from the point of convergence shall be not less than the largest minimum width or the sum of the required capacities for the stairways or ramps serving the two adjacent stories, whichever is larger.

1005.7 Encroachment. Encroachments into the required means of egress width shall be in accordance with the provisions of this section.

1005.7.1 Doors. Doors, when fully opened, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half.

Exceptions:

1. *In other than Group I-2 occupancies,* surface-mounted latch release hardware shall be exempt from inclusion in the 7-inch maximum (178 mm) encroachment where both of the following conditions exist:
 - 1.1. The hardware is mounted to the side of the door facing away from the adjacent wall where the door is in the open position.
 - 1.2. The hardware is mounted not less than 34 inches (865 mm) nor more than 48 inches (1219 mm) above the finished floor.
2. The restrictions on door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 occupancies and dwelling units of Group R-3 occupancies.

1005.7.2 Other projections. Handrail projections shall be in accordance with the provisions of Section 1014.8. Other nonstructural projections such as trim and similar decorative features shall be permitted to project into the required width not more than 1¹/₂ inches (38 mm) on each side.

1005.7.3 Protruding objects. Protruding objects shall comply with the applicable requirements of Section 1003.3.

SECTION 1006 NUMBER OF EXITS AND EXIT ACCESS DOORWAYS

1006.1 General. The number of exits or exit access doorways required within the means of egress system shall comply with the provisions of Section 1006.2 for spaces, including mezzanines, and Section 1006.3 for stories or occupied roofs.

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1006.2 Egress from spaces. Rooms, areas or spaces, including mezzanines, within a story or basement shall be provided with the number of exits or access to exits in accordance with this section.

1006.2.1 Egress based on occupant load and common path of egress travel distance. Two exits or exit access doorways from any space shall be provided where the design occupant load or the common path of egress travel distance exceeds the values listed in Table 1006.2.1. The cumulative occupant load from adjacent rooms, areas or spaces shall be determined in accordance with Section 1004.2.

Exceptions:

1. The number of exits from foyers, lobbies, vestibules or similar spaces need not be based on cumulative occupant loads for areas discharging

through such spaces, but the capacity of the exits from such spaces shall be based on applicable cumulative occupant loads.

2. *Rooms and care suites* in Group I-2 and I-2.1 occupancies complying with Section 407.4.
3. Unoccupied mechanical rooms and penthouses are not required to comply with the common path of egress travel distance measurement.
4. *In detention and correctional facilities and holding cells, such as are found in courthouse buildings, when the occupant load is more than 20 see Section 408.3.11.*

1006.2.1.1 Three or more exits or exit access doorways. Three exits or exit access doorways shall be provided from any space with an occupant load of 501

**TABLE 1006.2.1
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY**

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)		
		Without Sprinkler System (feet)		With Sprinkler System (feet)
		Occupant Load		
		OL ≤ 30	OL > 30	
A ^c , E, M	49	75	75	75 ^a
B	49	100	75	100 ^a
F	49	75	75	100 ^a
H-1, H-2, H-3	3	NP	NP	25 ^b
H-4, H-5	10	NP	NP	75 ^b
I-2 ^d , I-2.1, I-4	10	NP ⁱ	NP ⁱ	75 ^a
I-3	10	NP	NP	100 ^a
R-1	10	NP	NP	75 ^a
R-2	20	NP	NP	125 ^a
R-2.1	10	NP	NP	75 ^a
R-2.2	20	NP	NP	125 ^a
R-3 ^e , R-3.1 ^e	20	NP	NP	125 ^{a, g}
R-4 ^e	20	NP	NP	125 ^{a, g}
S ^f	29	100	75	100 ^a
U	49	100	75	75 ^a
L	See Section 453.6.1		NP	NP

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

- a. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.
- b. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.
- c. For a room or space used for assembly purposes having fixed seating, see Section 1030.8.
- d. For the travel distance limitations and number of exit and exit access requirements for rooms and spaces in Group I-2 or I-2.1, see Section 407.4.
- e. The common path of egress travel distance shall only apply in a Group R-3 occupancy located in a mixed occupancy building.
- f. The length of common path of egress travel distance in a Group S-2 open parking garage shall be not more than 100 feet.
- g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3, see Section 1006.2.2.6.
- h. For holding cells, see Section 408.3.11.
- i. In accordance with Health and Safety Code Section 13113(d), there is no requirement for automatic sprinkler protection in an existing Group I-2 located in Type IA construction.

to 1,000. Four exits or exit access doorways shall be provided from any space with an occupant load greater than 1,000.

1006.2.2 Egress based on use. The numbers, configuration and types of components of exits or access to exits shall be provided in the uses described in Sections 1006.2.2.1 through 1006.2.2.7.

1006.2.2.1 Boiler, incinerator and furnace rooms.

Two exit access doorways are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m²) and any fuel-fired equipment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two exit access doorways are required, one is permitted to be a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the length of the maximum overall diagonal dimension of the room.

1006.2.2.2 Refrigeration machinery rooms. Machinery rooms larger than 1,000 square feet (93 m²) shall have not less than two exits or exit access doorways. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of the room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway.

Exit and exit access doorways shall swing in the direction of egress travel and shall be equipped with panic hardware, regardless of the occupant load served. Exit and exit access doorways shall be tight fitting and self-closing.

1006.2.2.3 Refrigerated rooms or spaces. Rooms or spaces having a floor area larger than 1,000 square feet (93 m²), containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two exits or exit access doorways.

Exit access travel distance shall be determined as specified in Section 1017.1. All portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an exit or exit access doorway leading to a nonrefrigerated area where such rooms are not protected by an approved automatic sprinkler system.

Exception: Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *California Mechanical Code*. Egress is allowed through adjoining refrigerated rooms or spaces.

1006.2.2.4 Electrical rooms. The location and number of exit or exit access doorways shall be provided for electrical rooms in accordance with Section 110.26 of NFPA 70 for electrical equipment rated 1,000 volts or less, and Section 110.33 of NFPA 70 for electrical equipment rated over 1,000 volts. Panic hardware shall be provided where required in accordance with Section 1010.2.9.2.

1006.2.2.5 Vehicular ramps. Vehicular ramps shall not be considered as an exit access ramp unless pedestrian facilities are provided.

1006.2.2.6 Groups R-3 and R-4. Where Group R-3 occupancies are permitted by Section 903.2.8 to be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.3, the exit access travel distance for Group R-3 shall be not more than 125 feet (38 100 mm). Where Group R-4 occupancies are permitted by Section 903.2.8 to be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.3, the exit access travel distance for Group R-4 shall be not more than 75 feet (22 860 mm).

1006.2.2.7 Large family day-care home. Every story or basement of a large family day-care home shall be provided with two exits which are remotely located from each other. Every required exit shall be of a size to permit the installation of a door not less than 32 inches (813 mm) in clear width and not less than 6 feet 8 inches (2,032 mm) in height. A manually operated horizontal sliding door may be used as one of the two required exits.

Where basements are used for day-care purposes, one of the two required exits shall provide access directly to the exterior without entering the first story. The second exit from the basement may either pass through the story above or exit directly to the exterior.

Rooms used for day-care purposes shall not be located above the first story.

Exception: Buildings equipped with an automatic sprinkler system throughout and which have at least one of the required exits providing access directly to the exterior. NFPA 13R may be used in large family day-care homes. The sprinkler omissions of NFPA 13R shall not apply unless approved by the enforcing agency.

Exit doors, including manually operated horizontal sliding doors, shall be openable from the inside without use of a key or any special knowledge or effort.

Tables 1006.3.3(1) and 1006.3.3(2) are not applicable to this occupancy classification.

1006.2.2.8 Group I-4 means of egress. Group I-4 facilities, rooms or spaces where care is provided for more than 10 children that are 36 months of age or less shall have access to not less than two exits or exit access doorways.

1006.3 Egress from stories or occupied roofs. The means of egress system serving any story or occupied roof shall be provided with the number of separate and distinct exits or access to exits based on the aggregate occupant load served in accordance with this section.

1006.3.1 Occupant load. Where stairways serve more than one story, or more than one story and an occupied roof, only the occupant load of each story or occupied roof, considered individually, shall be used when calculating the required number of exits or access to exits serving that story.

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1006.3.2 Path of egress travel. The path of egress travel to an exit shall not pass through more than one adjacent story.

Exception: The path of egress travel to an exit shall be permitted to pass through more than one adjacent story in any of the following:

1. In Group R-1, R-2 or R-3 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit, sleeping unit or live/work unit.
2. Exit access stairways serving and contained within a Group R-3 congregate residence or a Group R-4 facility.
3. Exit access stairways and ramps within an atrium complying with Section 404.
4. Exit access stairways and ramps in open parking garages that serve only the parking garage.
5. Exit access stairways and ramps serving open-air assembly seating complying with the exit access travel distance requirements of Section 1030.7.
6. Exit access stairways and ramps between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.
7. Exterior exit access stairways and ramps between occupied roofs.

1006.3.3 Egress based on occupant load. Each story and occupied roof shall have the minimum number of separate and distinct exits, or access to exits, as specified in Table 1006.3.3. A single exit or access to a single exit shall be permitted in accordance with Section 1006.3.4. The required number of exits, or exit access stairways or ramps providing access to exits, from any story or occupied roof shall be maintained until arrival at the exit discharge or a public way.

**TABLE 1006.3.3
MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS PER STORY**

OCCUPANT LOAD PER STORY	MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS FROM STORY
1-500	2
501-1,000	3
More than 1,000	4

**TABLE 1006.3.4(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 AND R-3 OCCUPANCIES**

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2 ^{a, b}	4 dwelling units	125 feet
	R-3 ^a	NA	NA
Fourth story above grade plane and higher	R-3 ^a	NA	125 feet

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.

b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

1006.3.4 Single exits. A single exit or access to a single exit shall be permitted from any story or occupied roof where one of the following conditions exists:

1. The occupant load, number of dwelling units and exit access travel distance do not exceed the values in Table 1006.3.4(1) or 1006.3.4(2).
2. Rooms, areas and spaces complying with Section 1006.2.1 with exits that discharge directly to the exterior at the level of exit discharge, are permitted to have one exit or access to a single exit.
3. Parking garages where vehicles are mechanically parked shall be permitted to have one exit or access to a single exit.
4. Group R-3 and R-4 occupancies shall be permitted to have one exit or access to a single exit.
5. Individual single-story or multistory dwelling units shall be permitted to have a single exit or access to a single exit from the dwelling unit provided that both of the following criteria are met:
 - 5.1. The dwelling unit complies with Section 1006.2.1 as a space with one means of egress.
 - 5.2. Either the exit from the dwelling unit discharges directly to the exterior at the level of exit discharge, or the exit access outside the dwelling unit's entrance door provides access to not less than two approved independent exits.

1006.3.4.1 Mixed occupancies. Where one exit, or exit access stairway or ramp providing access to exits at other stories, is permitted to serve individual stories, mixed occupancies shall be permitted to be served by single exits provided that each individual occupancy complies with the applicable requirements of Table 1006.3.4(1) or 1006.3.4(2) for that occupancy. Where applicable, cumulative occupant loads from adjacent occupancies shall be considered to be in accordance with the provisions of Section 1004.1. In each story of a mixed occupancy building, the maximum number of occupants served by a single exit shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occu-

pants indicated in Table 1006.3.4(2) for each occupancy does not exceed one. Where dwelling units are located on a story with other occupancies, the actual number of dwelling units divided by four plus the ratio from the other occupancy does not exceed one.

**SECTION 1007
EXIT AND EXIT ACCESS
DOORWAY CONFIGURATION**

1007.1 General. Exits, exit access doorways, and exit access stairways and ramps serving spaces, including individual building stories, shall be separated in accordance with the provisions of this section.

1007.1.1 Two exits or exit access doorways. Where two exits, exit access doorways, exit access stairways or ramps, or any combination thereof, are required from any portion of the exit access, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between them. Interlocking or scissor stairways shall be counted as one exit stairway.

Exceptions:

1. Where interior exit stairways or ramps are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1020, the required exit separation shall be measured along the shortest direct line of travel within the corridor.
2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance shall be not less than one-third of the length of the maximum overall diagonal dimension of the area served.

1007.1.1.1 Measurement point. The separation distance required in Section 1007.1.1 shall be measured in accordance with the following:

1. The separation distance to exit or exit access doorways shall be measured to any point along the width of the doorway.
2. The separation distance to exit access stairways shall be measured to the closest riser.
3. The separation distance to exit access ramps shall be measured to the start of the ramp run.

1007.1.2 Three or more exits or exit access doorways. Where access to three or more exits is required, not less than two exit or exit access doorways shall be arranged in accordance with the provisions of Section 1007.1.1. Additional required exit or exit access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available.

1007.1.3 Remoteness of exit access stairways or ramps. Where two exit access stairways or ramps provide the required means of egress to exits at another story, the required separation distance shall be maintained for all portions of such exit access stairways or ramps.

1007.1.3.1 Three or more exit access stairways or ramps. Where more than two exit access stairways or ramps provide the required means of egress, not less than two shall be arranged in accordance with Section 1007.1.3.

**SECTION 1008
MEANS OF EGRESS ILLUMINATION**

1008.1 Means of egress illumination. Illumination shall be provided in the means of egress in accordance with Section 1008.2. Under emergency power, means of egress illumination shall comply with Section 1008.3.

**TABLE 1006.3.4(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES**

STORY	OCCUPANCY ^e	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B ^b , E, F ^b , M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2 ^{a,c} , R-2.2	10	75
	I-2, I-2.1	7	50
	S ^{b,d}	29	75
Second story above grade plane	B, F, M, S ^d	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

- a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
- b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall have a maximum exit access travel distance of 100 feet.
- c. This table is used for R-2 occupancies consisting of sleeping units. For R-2 occupancies consisting of dwelling units, use Table 1006.3.4(1).
- d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.
- e. For Group L Occupancies see Section 453.6.1.

1008.2 Illumination required. The means of egress serving a room or space shall be illuminated at all times that the room or space is occupied.

Exceptions:

1. Occupancies in Group U.
2. Aisle accessways in Group A.
3. Dwelling units and sleeping units in Groups R-1, R-2 and R-3.
4. Sleeping units of Group I, *R-2.1 and R-4* occupancies.

1008.2.1 Illumination level under normal power. The means of egress illumination level shall be not less than 1 footcandle (11 lux) at the walking surface. Along exit access stairways, exit stairways and at their required landings, the illumination level shall not be less than 10 footcandles (108 lux) at the walking surface when the stairway is in use.

Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the walking surface is permitted to be reduced during performances by one of the following methods provided that the required illumination is automatically restored upon activation of a premises' fire alarm system:

1. Externally illuminated walking surfaces shall be permitted to be illuminated to not less than 0.2 footcandle (2.15 lux).
2. Steps, landings and the sides of ramps shall be permitted to be marked with self-luminous materials in accordance with Sections 1025.2.1, 1025.2.2 and 1025.2.4 by systems listed in accordance with UL 1994.

1008.2.2 Group I-2. In Group I-2 occupancies where two or more exits are required, on the exterior landings required by Section 1010.1.5, means of egress illumination levels for the exit discharge shall be provided such that failure of a single lamp in a luminaire shall not reduce the illumination level on that landing to less than 1 footcandle (11 lux).

1008.2.3 Exit discharge. Illumination shall be provided along the path of travel for the exit discharge from each exit to the public way.

Exception: Illumination shall not be required where the path of the exit discharge meets both of the following requirements:

1. The path of exit discharge is illuminated from the exit to a safe dispersal area complying with Section 1028.5.
2. A dispersal area shall be illuminated to a level not less than 1 footcandle (11 lux) at the walking surface.

1008.3 Emergency power for illumination. The power supply for means of egress illumination shall normally be provided by the premises' electrical supply.

1008.3.1 General. In the event of power supply failure in rooms and spaces that require two or more exits or access to exits, an emergency electrical system shall automatically illuminate all of the following areas:

1. Aisles.
2. Corridors.
3. Exit access stairways and ramps.

1008.3.2 Buildings. In the event of power supply failure in buildings that require two or more exits or access to exits, an emergency electrical system shall automatically illuminate all of the following areas:

1. Interior exit access stairways and ramps.
2. Interior and exterior exit stairways and ramps.
3. Exit passageways.
4. Vestibules and areas on the level of discharge used for exit discharge in accordance with Section 1028.2.
5. Exterior landings as required by Section 1010.1.5 for exit doorways that lead directly to the exit discharge.
6. *Group I-2 and I-2.1 exit discharge stairways, ramps, aisles, walkways and escalators leading to a public way or to a safe dispersal area in accordance with Section 1028.5.*

1008.3.3 Rooms and spaces. In the event of power supply failure, an emergency electrical system shall automatically illuminate all of the following areas:

1. Electrical equipment rooms.
2. Fire command centers.
3. Fire pump rooms.
4. Generator rooms.
5. Public restrooms with an area greater than 300 square feet (27.87 m²).

1008.3.4 Duration. The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702.

1008.3.5 Illumination level under emergency power. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 footcandle (11 lux) and a minimum at any point of 0.1 footcandle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle (6 lux) average and a minimum at any point of 0.06 footcandle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded. In Group I-2 occupancies, failure of a single lamp in a luminaire shall not reduce the illumination level to less than 0.2 footcandle (2.2 lux).

SECTION 1009 ACCESSIBLE MEANS OF EGRESS

1009.1 Accessible means of egress required. Accessible means of egress shall comply with this section. Accessible spaces shall be provided with not less than one accessible means of egress. Where more than one means of egress is required by Section 1006.2 or 1006.3 from any accessible space, each accessible portion of the space shall be served by accessible means of egress *in at least the same number as required by Sections 1006.2 or 1006.3. In addition to the requirements of this chapter, means of egress, which provide access to, or egress from, buildings for persons with disabilities, shall also comply with the requirements of Chapter 11A or 11B as applicable.*

Exceptions:

1. One accessible means of egress is required from an accessible mezzanine level in accordance with Section 1009.3, 1009.4 or 1009.5, *and Chapter 11A or 11B, as applicable.*
2. In assembly areas with ramped aisles or stepped aisles, one accessible means of egress is permitted where the common path of egress travel is accessible and meets the requirements in Section 1030.8 *and Chapter 11A or 11B, as applicable.*

1009.2 Continuity and components. Each required accessible means of egress shall be continuous to a public way and shall consist of one or more of the following components:

1. Accessible routes complying with *Chapter 11A, Sections 1110A.1 and 1120A, or Chapter 11B, Sections 11B-206 and 11B-402, as applicable.*
2. Interior exit stairways complying with Sections 1009.3 and 1023, *and Chapter 11A, Section 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*
3. Exit access stairways complying with Sections 1009.3 and 1019.3 or 1019.4, *Chapter 11A, Section 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*
4. Exterior exit stairways complying with Sections 1009.3 and 1027, *and Chapter 11A, Section 1115A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable,* and serving levels other than the level of exit discharge.
5. Elevators complying with Section 1009.4, *and Chapter 11A, Section 1124A, or Chapter 11B, Sections 11B-206.6 and 11B-407, as applicable.*
6. Platform lifts complying with Section 1009.5, *and Chapter 11A, Section 1124A, or Chapter 11B, Sections 11B-206.7, 11B-207.2 and 11B-410 as applicable.*
7. Horizontal exits complying with Section 1026.
8. Ramps complying with Section 1012, *and Chapter 11A, Sections 1114A and 1122A, or Chapter 11B, 11B-405, as applicable.*
9. Areas of refuge complying with Section 1009.6.

10. Exterior areas for assisted rescue complying with Section 1009.7 serving exits at the level of exit discharge.

1009.2.1 Elevators required. In buildings where a required accessible floor or occupied roof is four or more stories above or below a level of exit discharge, not less than one required accessible means of egress shall be an elevator complying with Section 1009.4.

Exceptions:

1. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a horizontal exit and located at or above the levels of exit discharge.
2. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a ramp conforming to the provisions of Section 1012.

1009.3 Stairways. In order to be considered part of an accessible means of egress, a stairway between stories shall comply with Sections 1009.3.1 through 1009.3.3. *[DSA-AC & HCD 1-AC] In addition, exit stairways shall comply with Chapter 11A, Sections 1115A and 1123A, or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.*

1009.3.1 Exit access stairways. Exit access stairways that connect levels in the same story are not permitted as part of an accessible means of egress.

Exception: Exit access stairways providing means of egress from mezzanines are permitted as part of an accessible means of egress.

1009.3.2 Stairway width. Stairways shall have a clear width of 48 inches (1219 mm) minimum between handrails.

Exceptions:

1. The clear width of 48 inches (1219 mm) between handrails is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The clear width of 48 inches (1219 mm) between handrails is not required for stairways accessed from a refuge area in conjunction with a horizontal exit.

1009.3.3 Area of refuge. Stairways shall either incorporate an area of refuge within an enlarged floor-level landing or shall be accessed from an area of refuge complying with Section 1009.6.

Exceptions:

1. Areas of refuge are not required at exit access stairways where two-way communication is provided at the elevator landing in accordance with Section 1009.8.

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2. Areas of refuge are not required at stairways in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Areas of refuge are not required at stairways serving open parking garages.
4. Areas of refuge are not required for smoke-protected or open-air assembly seating areas complying with Sections 1030.6.2 and 1030.6.3.
5. Areas of refuge are not required at stairways in Group R-2 occupancies.
6. Areas of refuge are not required for stairways accessed from a refuge area in conjunction with a horizontal exit.

1009.4 Elevators. In order to be considered part of an accessible means of egress, an elevator shall comply with Sections 1009.4.1 and 1009.4.2.

1009.4.1 Standby power. The elevator shall meet the emergency operation and signaling device requirements of *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*. Standby power shall be provided in accordance with Chapter 27 and Section 3003.

1009.4.2 Area of refuge. The elevator shall be accessed from an area of refuge complying with Section 1009.6.

Exceptions:

1. Areas of refuge are not required at the elevator in open parking garages.
2. Areas of refuge are not required in buildings and facilities equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Areas of refuge are not required at elevators not required to be located in a shaft in accordance with Section 712.
4. Areas of refuge are not required at elevators serving smoke-protected or open-air assembly seating areas complying with Sections 1030.6.2 and 1030.6.3.
5. Areas of refuge are not required for elevators accessed from a refuge area in conjunction with a horizontal exit.

1009.5 Platform lifts. Platform lifts shall be permitted to serve as part of an accessible means of egress where allowed as part of a required accessible route in *Chapter 11A, Sections 1121A and 1124A.11, or Chapter 11B, Sections 11B-206.7.1 through 11B-206.7.10, as applicable*. Standby power for the platform lift shall be provided in accordance with Chapter 27.

[DSA-AC] See Chapter 11B, Section 11B-207.2 for additional accessible means of egress requirements at platform lifts.

1009.6 Areas of refuge. Every required area of refuge shall be accessible from the space it serves by an accessible means of egress.

[DSA-AC] Areas of refuge shall comply with the requirements of this code and shall adjoin an accessible route complying with Sections 11B-206 and 11B-402,

1009.6.1 Travel distance. The maximum travel distance from any accessible space to an area of refuge shall not exceed the exit access travel distance permitted for the occupancy in accordance with Section 1017.1.

1009.6.2 Stairway or elevator access. Every required area of refuge shall have direct access to a stairway complying with Sections 1009.3 and 1023 or an elevator complying with Section 1009.4.

Exception: An interior area of refuge at the level of exit discharge that provides direct access to an exterior exit door.

1009.6.3 Size. Each area of refuge shall be sized to accommodate *two* wheelchair spaces that are not less than 30 inches by 52 inches (762 mm by 1320 mm). *The total number of such 30-inch by 52-inch (762 mm by 1320 mm) spaces per story shall be not less than one for every 200 persons of calculated occupant load served by the area of refuge.* Such wheelchair spaces shall not reduce the means of egress minimum width or required capacity. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

Exception: *The enforcing agency may reduce the size of each required area of refuge to accommodate one wheelchair space that is not less than 30 inches by 52 inches (762 mm by 1320 mm) on floors where the occupant load is less than 200.*

1009.6.4 Separation. Each area of refuge shall be separated from the remainder of the story by a smoke barrier complying with Section 709 or a horizontal exit complying with Section 1026. Each area of refuge shall be designed to minimize the intrusion of smoke.

Exceptions:

1. Areas of refuge located within an enclosure for interior exit stairways complying with Section 1023.
2. Areas of refuge in outdoor facilities where exit access is essentially open to the outside.

1009.6.5 Two-way communication. Areas of refuge shall be provided with a two-way communication system complying with Sections 1009.8.1 and 1009.8.2.

1009.7 Exterior areas for assisted rescue. Exterior areas for assisted rescue shall be accessed by an accessible route from the area served.

Where the exit discharge does not include an accessible route from an exit located on the level of exit discharge to a public way, an exterior area of assisted rescue shall be provided on the exterior landing in accordance with Sections 1009.7.1 through 1009.7.4.

1009.7.1 Size. Each exterior area for assisted rescue shall be sized to accommodate wheelchair spaces in accordance with Section 1009.6.3.

1009.7.2 Separation. Exterior walls separating the exterior area of assisted rescue from the interior of the building shall have a minimum fire-resistance rating of 1 hour, rated for exposure to fire from the inside. The fire-resistance-rated exterior wall construction shall extend horizontally not less than 10 feet (3048 mm) beyond the landing on either side of the landing or equivalent fire-resistance-rated construction is permitted to extend out perpendicular to the exterior wall not less than 4 feet (1219 mm) on the side of the landing. The fire-resistance-rated construction shall extend vertically from the ground to a point not less than 10 feet (3048 mm) above the floor level of the area for assisted rescue or to the roof line, whichever is lower. Openings within such fire-resistance-rated exterior walls shall be protected in accordance with Section 716.

Exception: The fire-resistance rating and opening protectives are not required in the exterior wall where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

1009.7.3 Openness. The exterior area for assisted rescue shall be open to the outside air. The sides other than the separation walls shall be not less than 50 percent open, and the open area shall be distributed so as to minimize the accumulation of smoke or toxic gases.

1009.7.4 Stairways. Stairways that are part of the means of egress for the exterior area for assisted rescue shall provide a minimum clear width of 48 inches (1219 mm) between handrails.

Exception: The minimum clear width of 48 inches (1219 mm) between handrails is not required at stairways serving buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

1009.8 Two-way communication. A two-way communication system complying with Sections 1009.8.1 and 1009.8.2 shall be provided at the landing serving each elevator or bank of elevators on each accessible floor that is one or more stories above or below the level of exit discharge.

Exceptions:

1. Two-way communication systems are not required at the landing serving each elevator or bank of elevators where the two-way communication system is provided within areas of refuge in accordance with Section 1009.6.5.
2. Two-way communication systems are not required on floors provided with ramps conforming to the provisions of Section 1012.
3. Two-way communication systems are not required at the landings serving only service elevators that are not designated as part of the accessible means of egress or serve as part of the required accessible route into a facility.

4. Two-way communication systems are not required at the landings serving only freight elevators.
5. Two-way communication systems are not required at the landing serving a private residence elevator.
6. Two-way communication systems are not required in Group I-2 or I-3 facilities.

1009.8.1 System requirements. Two-way communication systems shall provide communication between each required location and the fire command center or a central control point location approved by the fire department. Where the central control point is not a constantly attended location, the two-way communication system shall have timed, automatic telephone dial-out capability that provides two-way communication with an approved supervising station or 9-1-1. The two-way communication system shall include both audible and visible signals.

1009.8.1.1 Visible communication method. [DSA-AC and HCD 1-AC] A button complying with Section 1138A.4 or Sections 11B-205 and 11B-309 in the area of refuge shall activate both a light in the area of refuge indicating that rescue has been requested and a light at the central control point indicating that rescue is being requested. A button at the central control point shall activate both a light at the central control point and a light in the area of refuge indicating that the request has been received.

1009.8.2 Directions. Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system and written identification of the location shall be posted adjacent to the two-way communication system. Signage shall comply with Chapter 11A, Section 1143A or Section 11B-703.5 requirements for visual characters.

1009.9 Signage. Signage indicating special accessibility provisions shall be provided as shown:

1. Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign stating, "AREA OF REFUGE."
2. Each door providing access to an exterior area for assisted rescue shall be identified by a sign stating, "EXTERIOR AREA FOR ASSISTED RESCUE."

Signage shall comply with Chapter 11A, Section 1143A and Chapter 11B, Section 11B-703.5 as applicable, requirements for visual characters and include the International Symbol of Accessibility. Where exit sign illumination is required by Section 1013.3, the signs shall be illuminated. Additionally, visual characters, raised character and braille signage complying with Chapter 11A, Section 1143A or Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5 shall be located at each door to an area of refuge and exterior area for assisted rescue in accordance with Section 1013.4. *The International Symbol of Accessibility shall comply with Chapter 11A, Section 1143A or Chapter 11B, Section 11B-703.7.2.1.*

1009.10 Directional signage. Directional signage complying with Chapter 11B, Section 11B-703.5 indicating the location

MEANS OF EGRESS

of all other means of egress and which of those are accessible means of egress shall be provided at the following:

1. At exits serving a required accessible space but not providing an approved accessible means of egress.
2. At elevator landings.
3. Within areas of refuge.

1009.11 Instructions. In areas of refuge and exterior areas for assisted rescue, instructions on the use of the area under emergency conditions shall be posted. Signage shall comply with *Chapter 11A, Section 1143A or Chapter 11B, Section 11B-703.5* requirements for visual characters. The instructions shall include all of the following:

1. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
2. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
3. Directions for use of the two-way communication system where provided.

1009.12 Alarms/emergency warning systems/two-way communication systems. Required emergency warning systems shall activate a means of warning the hearing impaired. Emergency warning systems provided as part of the fire-alarm system and two-way communication systems required by Chapter 10 shall be designed and installed in accordance with NFPA 72 as amended in Chapter 35.

SECTION 1010 DOORS, GATES AND TURNSTILES

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Sections 11B-206.5 and 11B-404, as applicable.

1010.1 General. Doors in the means of egress shall comply with the requirements of Sections 1010.1.1 through 1010.3.4. Exterior exit doors shall also comply with the requirements of Section 1022.2. Gates in the means of egress shall comply with the requirements of Sections 1010.4 and 1010.4.1. Turnstiles in the means of egress shall comply with the requirements of Sections 1010.5 through 1010.5.4.

Doors, gates and turnstiles provided for egress purposes in numbers greater than required by this code shall comply with the requirements of this section.

Doors in the means of egress shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.

1010.1.1 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width

of 32 inches (813 mm). The clear opening width of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear opening width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 32 inches (813 mm). In Group I-2 or I-2.1, doors serving as means of egress doors where used for the movement of beds and stretcher patients shall provide a minimum clear opening width of 44 inches (1118 mm). Where this section requires a minimum clear opening width of 44 inches (1118 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 44 inches (1118 mm). The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

Exceptions:

1. In Group R-2 and R-3 dwelling and sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A* the minimum width shall not apply to door openings that are not part of the required means of egress.
2. In Group I-3, door openings to resident sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A* shall have a minimum clear opening width of 28 inches (711 mm).
3. Door openings to storage closets less than 10 square feet (0.93 m²) in area shall not be limited by the minimum clear opening width.
4. The maximum width of door leaves in revolving doors that comply with Section 1010.3.1 shall not be limited.
5. The maximum width of door leaves in power-operated doors that comply with Section 1010.3.2 shall not be limited.
6. Door openings within a dwelling unit or sleeping unit shall have a minimum clear opening height of 78 inches (1981 mm).
7. In dwelling and sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A*, exterior door openings other than the required exit door shall have a minimum clear opening height of 76 inches (1930 mm).
8. In Groups R-2, R-3 and R-4, in dwelling and sleeping units that are not required to be *adaptable or accessible as specified in Chapter 11A*, the minimum clear opening widths shall not apply to interior egress doors.
9. Doors to walk-in freezers and coolers less than 1,000 square feet (93 m²) in area shall have a maximum width of 60 inches (1524 mm) nominal.
10. The minimum clear opening width shall not apply to doors for *nonadaptable or nonaccessible*

shower or sauna compartments, *as specified in Chapter 11A.*

10. Doors serving *nonadaptable* or nonaccessible single-user shower or sauna compartments, toilet stalls or dressing, fitting or changing rooms shall have a minimum clear opening width of 20 inches (508 mm).

1010.1.1.1 Projections into clear opening. There shall not be projections into the required clear opening width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).

Exceptions:

1. Door closers, overhead door stops, power door operators, and electromagnetic door locks shall be permitted to be 78 inches (1980 mm) minimum above the floor.
2. *In a Group I-2 or I-2.1 occupancy, there shall be no projections into the clear width of doors used for the movement of beds and stretcher patients in the means of egress.*

1010.1.2 Egress door types. Egress doors shall be of the side-hinged swinging door, pivoted door, or balanced door types.

Exceptions:

1. Private garages, office areas, factory and storage areas with an occupant load of 10 or less.
2. Group I-3 occupancies used as a place of detention.
3. Critical or intensive care patient rooms within suites of health care facilities.
4. Doors within or serving a single dwelling unit in Groups R-2 and R-3.
5. In other than Group H occupancies, revolving doors complying with Section 1010.3.1.
6. In other than Group H occupancies, special purpose horizontal sliding, accordion or folding door assemblies complying with Section 1010.3.3.
7. Power-operated doors in accordance with Section 1010.3.2.
8. Doors serving a bathroom within an individual sleeping unit in Group R-1.
9. In other than Group H occupancies, manually operated horizontal sliding doors are permitted in a means of egress from spaces with an occupant load of 10 or less.
10. *In I-2 and I-2.1 occupancies, exit doors serving an occupant load of 50 or more, shall not be of the pivoted or balanced type.*

1010.1.2.1 Direction of swing. Side-hinged swinging doors, pivoted doors and balanced doors shall swing in the direction of egress travel where serving a room or

area containing an occupant load of 50 or more persons or a Group H occupancy. *For Group L occupancies, see Section 453.6.2.*

In a Group I-2 occupancy, all required exterior egress doors shall open in the direction of egress regardless of the occupant load served.

1010.1.3 Forces to unlatch and open doors. The forces to unlatch doors shall comply with the following:

1. Where door hardware operates by push or pull, the operational force to unlatch the door shall not exceed 15 pounds (67 N).
2. Where door hardware operates by rotation, the operational force to unlatch the door shall not exceed 28 inch-pounds (315 N-cm).

The force to open doors shall comply with the following:

1. For interior swinging egress doors that are manually operated, other than doors required to be fire rated, the force for pushing or pulling open the door shall not exceed 5 pounds (22 N).
2. For other swinging doors, sliding doors or folding doors, and doors required to be fire rated, the door shall require not more than a 30-pound (133 N) force to be set in motion and shall move to a full-open position when subjected to not more than a 15-pound (67 N) force.

1010.1.3.1 Location of applied forces. Forces shall be applied to the latch side of the door.

1010.1.3.2 Manual horizontal sliding doors. Where a manual horizontal sliding door is required to latch, the latch or other mechanism shall prevent the door from rebounding into a partially open position when the door is closed.

1010.1.4 Floor elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

Exceptions:

1. At doors serving individual dwelling units or sleeping units in Groups R-2 and R-3 : a door is permitted to open at the top step of an interior flight of stairs, provided that the door does not swing over the top step.
2. At exterior doors serving Groups F, H, R-2 and S and where such doors are not part of an *adaptable* or accessible route *or, not required to be accessible by Chapter 11A or 11B of the California Building Code*, the landing at an exterior door shall not be more than 7 inches (178 mm) below the landing on the egress side of the door, provided that the door, other than an exterior storm or screen door, does not swing over the landing.

3. At exterior doors serving Group U and individual dwelling units and sleeping units in Groups R-2 and R-3, and where such units are not required to be *adaptable or accessible*, the landing at an exterior doorway shall be not more than $7\frac{3}{4}$ inches (197 mm) below the landing on the egress side of the door. Such doors, including storm or screen doors, shall be permitted to swing over either landing.
4. Variations in elevation due to differences in finish materials, but not more than $\frac{1}{2}$ inch (12.7 mm).
5. Exterior decks, patios or balconies that are part of *adaptable or accessible* dwelling units, have impervious surfaces and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the dwelling unit. *See also Chapter 11A, Section 1132A.4.*
6. Doors serving equipment spaces not required to be *adaptable or accessible* and serving an occupant load of five or less shall be permitted to have a landing on one side to be not more than 7 inches (178 mm) above or below the landing on the egress side of the door.

1010.1.5 Landings at doors. Landings shall have a width not less than the width of the stairway or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). Where a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception: Landing length in the direction of travel in Groups R-3 and U and within individual units of Group R-2 need not exceed 36 inches (914 mm).

1010.1.6 Thresholds. Thresholds at doorways shall not exceed $\frac{3}{4}$ inch (19.1 mm) in height above the finished floor or landing for sliding doors serving dwelling units or $\frac{1}{2}$ inch (12.7 mm) above the finished floor or landing for other doors. Raised thresholds and floor level changes greater than $\frac{1}{4}$ inch (6.4 mm) at doorways shall be beveled with a slope not greater than one unit vertical in two units horizontal (50-percent slope).

Exceptions:

1. In occupancy Group R-2 or R-3, threshold heights for sliding and side-hinged exterior doors shall be permitted to be up to $7\frac{3}{4}$ inches (197 mm) in height if all of the following apply:
 - 1.1. The door is not part of the required means of egress.
 - 1.2. The door is not part of an accessible route as required by Chapter 11A or 11B.
 - 1.3. The door is not part of an *adaptable or accessible dwelling unit*.

2. In *adaptable or accessible dwelling* units, where Exception 5 to Section 1010.1.4 permits a 4-inch (102 mm) elevation change at the door, the threshold height on the exterior side of the door shall not exceed $4\frac{3}{4}$ inches (120 mm) in height above the exterior deck, patio or balcony for sliding doors or $4\frac{1}{2}$ inches (114 mm) above the exterior deck, patio or balcony for other doors.

1010.1.7 Door arrangement. Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.

Exceptions:

1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual dwelling units in Groups R-2 and R-3 other than *adaptable or accessible* dwelling units.

1010.2 Door operations. Except as specifically permitted by this section, egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

1010.2.1 Unlatching. The unlatching of any door or leaf for egress shall require not more than one motion in a single linear or rotational direction to release all latching and all locking devices.

Exceptions:

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1010.2.5.
3. Doors with automatic flush bolts as permitted by Section 1010.2.4, Item 4.
4. Doors from individual dwelling units and sleeping units of Group R occupancies as permitted by Section 1010.2.4, Item 5.

1010.2.2 Hardware. Door handles, pulls, latches, locks and other operating devices on doors required to be accessible by Chapter 11A or 11B shall not require tight grasping, tight pinching or twisting of the wrist to operate.

These design requirements for door handles, pulls, latches, locks and other operating devices, intended for use on required means of egress doors in other than Group R and M occupancies with an occupant load of 10 or less, shall comply with SFM Standard 12-10-2, Section 12-10-202 contained in the CCR, Title 24, Part 12, California Referenced Standards Code.

1010.2.3 Hardware height. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Locks used only for

security purposes and not used for normal operation are permitted at any height.

Exception: Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the latch release on self-latching devices at 54 inches (1370 mm) maximum above the finished floor or ground, provided that the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

1010.2.4 Locks and latches. Locks and latches shall be permitted to prevent operation of doors where any of the following exist:

1. Places of detention or restraint.
2. In Group I-1, Condition 2 and Group I-2 occupancies where the clinical needs of persons receiving care require containment or where persons receiving care pose a security threat, provided that all clinical staff can readily unlock doors at all times, and all such locks are keyed to keys carried by all clinical staff at all times or all clinical staff have the codes or other means necessary to operate the locks at all times.
3. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in places of religious worship, the main door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
 - 3.1. The locking device is readily distinguishable as locked.
 - 3.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: THIS DOOR TO REMAIN UNLOCKED WHEN THIS SPACE IS OCCUPIED. The sign shall be in letters 1 inch (25 mm) high on a contrasting background.
 - 3.3. The use of the key-operated locking device is revocable by the building official for due cause.
4. Where egress doors are used in pairs, approved automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush bolts does not have a doorknob or surface-mounted hardware.
5. Doors from individual dwelling or sleeping units of Group R occupancies having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.
6. Fire doors after the minimum elevated temperature has disabled the unlatching mechanism in accordance with listed fire door test procedures.
7. Doors serving roofs not intended to be occupied shall be permitted to be locked preventing entry to the building from the roof.
8. Other than egress courts, where occupants must egress from an exterior space through the building for means of egress, exit access doors shall be permitted to be equipped with an approved locking device where installed and operated in accordance with all of the following:
 - 8.1. The maximum occupant load shall be posted where required by Section 1004.9. Such signage shall be permanently affixed inside the building and shall be posted in a conspicuous space near all the exit access doorways.
 - 8.2. A weatherproof telephone or two-way communication system installed in accordance with Sections 1009.8.1 and 1009.8.2 shall be located adjacent to not less than one required exit access door on the exterior side.
 - 8.3. The egress door locking device is readily distinguishable as locked and shall be a key-operated locking device.
 - 8.4. A clear window or glazed door opening, not less than 5 square feet (0.46 m²) in area, shall be provided at each exit access door to determine if there are occupants using the outdoor area.
 - 8.5. A readily visible, durable sign shall be posted on the interior side on or adjacent to each locked required exit access door serving the exterior area stating, "THIS DOOR TO REMAIN UNLOCKED WHEN THE OUTDOOR AREA IS OCCUPIED." The letters on the sign shall be not less than 1 inch (25.4 mm) high on a contrasting background.
 - 8.6. The occupant load of the occupied exterior area shall not exceed 300 occupants in accordance with Section 1004.
9. Locking devices are permitted on doors to balconies, decks or other exterior spaces serving individual dwelling or sleeping units.
10. Locking devices are permitted on doors to balconies, decks or other exterior spaces of 250 square feet (23.23 m²) or less serving a private office space.

1010.2.5 Bolt locks. Manually operated flush bolts or surface bolts are not permitted.

Exceptions:

1. On doors not required for egress in individual dwelling units or sleeping units.
2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.
3. Where a pair of doors serves an occupant load of less than 50 persons in a Group B, F or S occupancy, manually operated edge- or surface-

mounted bolts are permitted on the inactive leaf. The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.

4. Where a pair of doors serves a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf provided that such inactive leaf is not needed to meet egress capacity requirements and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.
5. *Manually operated edge- and surface-mounted bolts shall be permitted on the inactive leaf of pairs of doors that serve patient care rooms in Group I-2 occupancies, provided that the bolts are self-latching and the inactive leaf is not needed to meet the minimum clear opening width required by Section 1010.1.1 of the California Building Code.* The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.

1010.2.6 Closet doors. Closet doors that latch in the closed position shall be openable from inside the closet.

1010.2.7 Stairway doors. Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions:

1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. This section shall not apply to doors arranged in accordance with Section 403.5.3.
3. Stairway exit doors are permitted to be locked from the side opposite the egress side, provided that they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the fire command center, if present, or a signal by emergency personnel from a single location inside the main entrance to the building.
4. Stairway exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group B, F, M and S occupancies where the only interior access to the tenant space is from a single exit stairway where permitted in Section 1006.3.4.
5. Stairway exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group R-2 occupancies where the only interior access to the dwelling unit is from a single exit stairway where permitted in Section 1006.3.4.

1010.2.8 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors from classrooms, offices and other occupied rooms with locking arrangements designed to keep intruders from entering the room shall comply with all of the following conditions:

1. The door shall be capable of being unlocked from outside the room with a key or other approved means.
2. The door shall be openable from within the room in accordance with Section 1010.2.
3. Modifications shall not be made to listed panic hardware, fire door hardware or door closers.
4. Modifications to fire door assemblies shall be in accordance with NFPA 80.

Remote locking or unlocking of doors from an approved location shall be permitted in addition to the unlocking operation in Item 1.

1010.2.8.1 Special provisions—school classrooms. *School classrooms constructed after January 1, 1990, not equipped with automatic sprinkler systems, which have metal grilles or bars on all their windows and do not have at least two exit doors within 3 feet (914 mm) of each end of the classroom opening to the exterior of the building or to a common hallway used for evacuation purposes, shall have an inside release for the grilles or bars on at least one window farthest from the exit doors. The window or windows with the inside release shall be clearly marked as emergency exits.*

1010.2.8.2 Group E lockable doors from the inside. *New buildings that are included in public schools (kindergarten through 12th grade) state funded projects and receiving state funding pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079, and that are submitted to the Division of the State Architect for plan review after July 1, 2011 in accordance with Education Code 17075.50, shall include locks that allow doors to classrooms and any room with an occupancy of five or more persons to be locked from the inside. The locks shall conform to the specification and requirements found in Section 1010.2.*

Exceptions:

1. *Doors that are locked from the outside at all times such as, but not limited to, janitor's closet, electrical room, storage room, boiler room, elevator equipment room and pupil restroom.*
2. *Reconstruction projects that utilize original plans in accordance with California Administrative Code, Section 4-314.*
3. *Existing relocatable buildings that are relocated within same site in accordance with California Administrative Code, Section 4-314.*

1010.2.9 Panic and fire exit hardware. Swinging doors serving a Group H occupancy and swinging doors serving rooms or spaces with an occupant load of 50 or more in a Group A or E occupancy *assembly area not classified as an assembly occupancy E, I-2 or I-2.1 occupancies* shall not be provided with a latch or lock other than panic hardware or fire exit hardware. *For Group L occupancies see Section 453.6.3.*

Exceptions:

1. A main exit of a Group A occupancy shall be permitted to have locking devices in accordance with Section 1010.2.4, Item 3.
2. Doors provided with panic hardware or fire exit hardware and serving a Group A or E occupancy shall be permitted to be electrically locked in accordance with Section 1010.2.11 or 1010.2.12.
3. Exit access doors serving occupied exterior areas shall be permitted to be locked in accordance with Section 1010.2.4, Item 8.
4. Courtrooms shall be permitted to be locked in accordance with Section 1010.2.13, Item 3.

1010.2.9.1 Refrigeration machinery room. Refrigeration machinery rooms larger than 1,000 square feet (93 m²) shall have not less than two exit or exit access doorways that swing in the direction of egress travel and shall be equipped with panic hardware or fire exit hardware.

1010.2.9.2 Rooms with electrical equipment. Exit or exit access doors serving transformer vaults, rooms designated for batteries or energy storage systems, or modular data centers shall be equipped with panic hardware or fire exit hardware. Rooms containing electrical equipment rated 800 amperes or more that contain overcurrent devices, switching devices or control devices and where the exit or exit access door is less than 25 feet (7620 mm) from the equipment working space as required by NFPA 70, such doors shall not be provided with a latch or lock other than panic hardware or fire exit hardware. The doors shall swing in the direction of egress travel.

1010.2.9.3 Installation. Where panic or fire exit hardware is installed, it shall comply with the following:

1. Panic hardware shall be listed in accordance with UL 305.
2. Fire exit hardware shall be listed in accordance with UL 10C and UL 305.
3. The actuating portion of the releasing device shall extend not less than one-half of the door leaf width.
4. The maximum unlatching force shall not exceed 15 pounds (67 N).

1010.2.9.4 Balanced doors. If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend

more than one-half the width of the door measured from the latch side.

1010.2.10 Monitored or recorded egress. Where electrical systems that monitor or record egress activity are incorporated, the locking system shall comply with Section 1010.2.11, 1010.2.12, 1010.2.13, 1010.2.14 or 1010.2.15 or shall be readily openable from the egress side without the use of a key or special knowledge or effort.

1010.2.11 Door hardware release of electrically locked egress doors. Door hardware release of electric locking systems shall be permitted on doors in the means of egress in any occupancy except Group H where installed and operated in accordance with all of the following:

1. The door hardware that is affixed to the door leaf has an obvious method of operation that is readily operated under all lighting conditions.
2. The door hardware is capable of being operated with one hand and shall comply with Section 1010.2.1.
3. Operation of the door hardware directly interrupts the power to the electric lock and unlocks the door immediately.
4. Loss of power to the electric locking system automatically unlocks the door.
5. Where panic or fire exit hardware is required by Section 1010.2.9, operation of the panic or fire exit hardware also releases the electric lock.
6. The locking system units shall be listed in accordance with UL 294.

1010.2.12 Sensor release of electrically locked egress doors. Sensor release of electric locking systems shall be permitted on doors located in the means of egress in any occupancy except Group H where installed and operated in accordance with all of the following criteria:

1. The sensor shall be installed on the egress side, arranged to detect an occupant approaching the doors, and shall cause the electric locking system to unlock.
2. The electric locks shall be arranged to unlock by a signal from or loss of power to the sensor.
3. Loss of power to the lock or locking system shall automatically unlock the electric locks.
4. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor and within 5 feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the electric lock—*independent of other electronics*—and the electric lock shall remain unlocked for not less than 30 seconds.

5. Activation of the building fire alarm system, where provided, shall automatically unlock the electric lock, and the electric lock shall remain unlocked until the fire alarm system has been reset.
6. Activation of the building automatic sprinkler system or fire detection system, where provided, shall automatically unlock the electric lock. The electric lock shall remain unlocked until the fire alarm system has been reset.
7. Emergency lighting shall be provided on the egress side of the door.
8. The door locking system units shall be listed in accordance with UL 294.

1010.2.12.1 Access-controlled elevator lobby doors in high-rise office buildings. For elevator lobbies in high-rise office buildings where the occupants of the floor are not required to travel through the elevator lobby to reach an exit, when approved by the fire chief, the doors separating the elevator lobby from the adjacent occupied tenant space that also serve as the entrance doors to the tenant space shall be permitted to be equipped with an approved entrance and egress access control system provided all of the following requirements are met:

1. The building is provided throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. A smoke detector is installed on the ceiling on the tenant side of the elevator lobby doors along the center line of the door opening, not less than 1 foot and not more than 5 feet from the door opening, and is connected to the fire alarm system.
3. A remote master switch capable of unlocking the elevator lobby doors shall be provided in the fire command center for use by the fire department.
4. Locks for the elevator lobby shall be U.L. and California State Fire Marshal listed fail-safe type locking mechanisms. The locking device shall automatically release on activation of any fire alarm device on the floor of alarm (waterflow, smoke detector, manual pull stations, etc.). All locking devices shall unlock, but not unlatch, upon activation.
5. A two-way voice communication system, utilizing dedicated lines, shall be provided from each locked elevator lobby to the 24-hour staffed location on site, annunciated as to location. Operating instructions shall be posted above each two-way communication device.

Exception: When approved by the fire chief, two-way voice communication system to an off-site facility may be permitted where means to remotely unlock the access controlled doors from the off-site facility are provided.

6. An approved momentary mushroom-shaped palm button connected to the doors and installed adjacent to each locked elevator lobby door shall be provided to release the door locks when operated by an individual in the elevator lobby. The locks shall be reset manually at the door. Mount palm button so that the center line is 48 inches above the finished floor.

Provide a sign stating:

**“IN CASE OF EMERGENCY,
PUSH PALM BUTTON,
DOOR WILL UNLOCK
AND SECURITY ALARM
WILL SOUND.”**

The sign lettering shall be ³/₄-inch high letters by ¹/₈-inch width stroke on a contrasting background.

7. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.

1010.2.13 Delayed egress. Delayed egress locking systems shall be permitted to be installed on doors serving the following occupancies in buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke or heat detection system installed in accordance with Section 907.

1. Group B, F, I, M, R, S and U occupancies.
2. Group E classrooms with an occupant load of less than 50.
3. In courtrooms in Group A-3 and B occupancies, delayed egress locking systems shall be permitted to be installed on exit or exit access doors, other than the main exit or exit access door, in buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke detection system installed in accordance with Section 907.

1010.2.13.1 Delayed egress locking system. The delayed egress locking system shall be installed and operated in accordance with all of the following:

1. The delay electronics of the delayed egress locking system shall deactivate upon actuation of the automatic sprinkler system or automatic fire detection system, allowing immediate free egress.
2. The delay electronics of the delayed egress locking system shall deactivate upon loss of electrical power controlling the lock or lock mechanism, allowing immediate free egress, to any one of the following:
 - 2.1. The egress-control device itself.
 - 2.2. The smoke detection system.
 - 2.3. Means of egress illumination as required by Section 1008.

3. The delayed egress locking system shall have the capability of being deactivated at the fire command center and other approved locations.
4. An attempt to egress shall initiate an irreversible process that shall allow such egress in not more than 15 seconds when a physical effort to exit is applied to the egress side door hardware for not more than 3 seconds. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the delay electronics have been deactivated, rearming the delay electronics shall be by manual means only. *The time delay established for each egress-control device shall not be field adjustable. For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, 11B-404.2.9.*

Exception: *In facilities housing Alzheimer’s or dementia clients, a delay of not more than 30 seconds is permitted on a delayed egress door.*

5. The egress path from any point shall not pass through more than one delayed egress locking system.

Exceptions:

1. In Group R-2.1, Group I-2 or I-3 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided that the combined delay does not exceed 30 seconds.

5.1. A tactile sign shall also be provided in Braille and raised characters, which complies with Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.

2. In Group R-2.1 or Group I-4 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided the combined delay does not exceed 30 seconds and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

6. A sign shall be provided on the door and shall be located above and within 12 inches (305 mm) of the door exit hardware:

Exception: Where approved, in Group I occupancies, the installation of a sign is not required where care recipients who because of clinical needs require restraint or containment as part of the function of the treatment area.

- 6.1. For doors that swing in the direction of egress, the sign shall read, “PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS.”

- 6.2. For doors that swing in the opposite direction of egress, the sign shall read, “PULL UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS.”

- 6.3. The sign shall comply with the visual character requirements in Section 11B-703.5. *Sign lettering shall be at least 1 inch (25 mm) in height and shall have a stroke of not less than 1/8 inch (3.2 mm).*

- 6.4. *A tactile sign shall also be provided in Braille and raised characters, which complies with Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.*

7. Emergency lighting shall be provided on the egress side of the door.
8. The delayed egress locking system units shall be listed in accordance with UL 294.
9. *Actuation of the panic bar or other door-latching hardware shall activate an audible signal at the door.*
10. *The unlatching shall not require more than one operation.*
11. *Regardless of the means of deactivation, relocking of the egress-control device shall be by manual means only at the door.*

1010.2.14 Controlled egress doors in Group I-2. Electric locking systems, including electro-mechanical locking systems and electromagnetic locking systems, shall be permitted to be locked in the means of egress in Group I-2 occupancies where the clinical needs of persons receiving psychiatric or mental health treatment require their restraint or containment. Controlled egress doors shall be permitted in such occupancies where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke detection system installed in accordance with Section 907, provided that the doors are installed and operate in accordance with all of the following:

1. The door locks shall unlock on actuation of the automatic sprinkler system or automatic smoke detection system.
2. The door locks shall unlock on loss of power controlling the lock or lock mechanism.
3. The door locking system shall be installed to have the capability of being unlocked by a switch located at the fire command center, a nursing station or other approved location. The switch shall directly break power to the lock.
4. A building occupant shall not be required to pass through more than one door equipped with a controlled egress locking system before entering an exit.
5. All staff shall have the keys, codes or other means necessary to operate the locking systems.

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- 6. Emergency lighting shall be provided at the door.
- 7. The door locking system units shall be listed in accordance with UL 294.

Exception: Items 1 through 4 shall not apply to doors to areas occupied by persons who, because of clinical needs, require restraint or containment as part of the function of a psychiatric or *mental health* treatment area.

1010.2.15 Reserved.

1010.3 Special doors. Special doors and security grilles shall comply with the requirements of Sections 1010.3.1 through 1010.3.4.

1010.3.1 Revolving doors. Revolving doors shall comply with the following:

- 1. Revolving doors shall comply with BHMA A156.27 and shall be installed in accordance with the manufacturer’s instructions.
- 2. Each revolving door shall be capable of breakout in accordance with BHMA A156.27 and shall provide an aggregate width of not less than 36 inches (914 mm).
- 3. A revolving door shall not be located within 10 feet (3048 mm) of the foot or top of stairways or escalators. A dispersal area shall be provided between the stairways or escalators and the revolving doors.
- 4. The revolutions per minute (rpm) for a revolving door shall not exceed the maximum rpm as specified in BHMA A156.27. Manual revolving doors shall comply with Table 1010.3.1(1). Automatic or power-operated revolving doors shall comply with Table 1010.3.1(2).
- 5. An emergency stop switch shall be provided near each entry point of power or automatic operated revolving doors within 48 inches (1219 mm) of the door and between 34 inches (864 mm) and 48 inches (1219 mm) above the floor. The activation area of the emergency stop switch button shall be not less than 1 inch (25 mm) in diameter and shall be red.
- 6. Each revolving door shall have a side-hinged swinging door that complies with Section 1010.1 in the same wall and within 10 feet (3048 mm) of the revolving door.
- 7. Revolving doors shall not be part of an accessible route required by Section 1009 and Chapter *IIA or IIB*.

**TABLE 1010.3.1(1)
MAXIMUM DOOR SPEED MANUAL REVOLVING DOORS**

REVOLVING DOOR MAXIMUM NOMINAL DIAMETER (FT-IN)	MAXIMUM ALLOWABLE REVOLVING DOOR SPEED (RPM)
6-0	12
7-0	11
8-0	10
9-0	9
10-0	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**TABLE 1010.3.1(2)
MAXIMUM DOOR SPEED AUTOMATIC
OR POWER-OPERATED REVOLVING DOORS**

REVOLVING DOOR MAXIMUM NOMINAL DIAMETER (FT-IN)	MAXIMUM ALLOWABLE REVOLVING DOOR SPEED (RPM)
8-0	7.2
9-0	6.4
10-0	5.7
11-0	5.2
12-0	4.8
12-6	4.6
14-0	4.1
16-0	3.6
17-0	3.4
18-0	3.2
20-0	2.9
24-0	2.4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

1010.3.1.1 Egress component. A revolving door used as a component of a means of egress shall comply with Section 1010.3.1 and the following three conditions:

- 1. Revolving doors shall not be given credit for more than 50 percent of the minimum width or required capacity.
- 2. Each revolving door shall be credited with a capacity based on not more than a 50-person occupant load.
- 3. Each revolving door shall provide for egress in accordance with BHMA A156.27 with a breakout force of not more than 130 pounds (578 N).

1010.3.1.2 Other than egress component. A revolving door used as other than a component of a means of egress shall comply with Section 1010.3.1. The breakout force of a revolving door not used as a component of a means of egress shall not be more than 180 pounds (801 N).

Exception: A breakout force in excess of 180 pounds (801 N) is permitted if the breakout force is reduced to not more than 130 pounds (578 N) when not less than one of the following conditions is satisfied:

- 1. There is a power failure or power is removed to the device holding the door wings in position.
- 2. There is an actuation of the automatic sprinkler system where such system is provided.
- 3. There is an actuation of a smoke detection system that is installed in accordance with Section 907 to provide coverage in areas within the building that are within 75 feet (22 860 mm) of the revolving doors.

4. There is an actuation of a manual control switch, in an approved location and clearly identified, that reduces the breakout force to not more than 130 pounds (578 N).

1010.3.2 Power-operated doors. Where means of egress doors are operated or assisted by power, the design shall be such that in the event of power failure, the door is capable of being opened manually to permit means of egress travel or closed where necessary to safeguard means of egress. The forces required to open these doors manually shall not exceed those specified in Section 1010.1.3, except that the force to set the door in motion shall not exceed 50 pounds (220 N). The door shall be capable of opening from any position to the full width of the opening in which such door is installed when a force is applied to the door on the side from which egress is made. Power-operated swinging doors, power-operated sliding doors and power-operated folding doors shall comply with BHMA A156.10. Power-assisted swinging doors and low-energy power-operated swinging doors shall comply with BHMA A156.19. Low-energy power-operated sliding doors and low-energy power-operated folding doors shall comply with BHMA A156.38.

Exceptions:

1. Occupancies in Group I-3.
2. Special purpose horizontal sliding, accordion or folding doors complying with Section 1010.3.3.
3. For a biparting door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement of Section 1010.1.1, provided that a minimum 32-inch (813 mm) clear opening is provided when the two biparting leaves meeting in the center are broken out.

1010.3.3 Special purpose horizontal sliding, accordion or folding doors. In other than Group H occupancies, special purpose horizontal sliding, accordion or folding door assemblies permitted to be a component of a means of egress in accordance with Exception 6 to Section 1010.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.
2. The doors shall be openable by a simple method without special knowledge or effort from the egress side or sides.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.

5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.2.6.6, shall be installed in accordance with NFPA 80 and shall comply with Section 716.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

1010.3.4 Security grilles. In Groups B, F, M and S, horizontal sliding or vertical security grilles are permitted at the main exit and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more exits or access to exits are required, not more than one-half of the exits or exit access doorways shall be equipped with horizontal sliding or vertical security grilles.

1010.4 Gates. Gates serving the means of egress system shall comply with the requirements of this section. Gates used as a component in a means of egress shall conform to the applicable requirements for doors.

Exception: Horizontal sliding or swinging gates exceeding the 4-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

1010.4.1 Stadiums. Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet (0.28 m²) per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See Section 1028.5 for means of egress from safe dispersal areas.

1010.5 Turnstiles and similar devices. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress, except where permitted in accordance with Sections 1010.5.1, 1010.5.2 and 1010.5.3.

1010.5.1 Capacity. Each turnstile or similar device shall be credited with a capacity based on not more than a 50-person occupant load where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost and on the manual release by an employee in the area.
2. Such devices are not given credit for more than 50 percent of the required egress capacity or width.
3. Each device is not more than 39 inches (991 mm) high.

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- Each device has not less than 16¹/₂ inches (419 mm) clear width at and below a height of 39 inches (991 mm) and not less than 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

1010.5.1.1 Clear width. Where located as part of an accessible route, turnstiles shall have not less than 36 inches (914 mm) clear width at and below a height of 34 inches (864 mm), not less than 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

1010.5.2 Security access turnstiles. Security access turnstiles that inhibit travel in the direction of egress utilizing a physical barrier shall be permitted to be considered as a component of the means of egress, provided that all of the following criteria are met:

- The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 903.3.1.1.
- Each security access turnstile lane configuration has a minimum clear passage width of 22 inches (559 mm).
- Any security access turnstile lane configuration providing a clear passage width of less than 32 inches (810 mm) shall be credited with a maximum egress capacity of 50 persons.
- Any security access turnstile lane configuration providing a clear passage width of 32 inches (810 mm) or more shall be credited with a maximum egress capacity as calculated in accordance with Section 1005.
- Each secured physical barrier shall automatically retract or swing to an unobstructed open position in the direction of egress, under each of the following conditions:
 - Upon loss of power to the turnstile or any part of the access control system that secures the physical barrier.
 - Upon actuation of a clearly identified manual release device with ready access that results in direct interruption of power to each secured physical barrier, after which such barriers remain in the open position for not less than 30 seconds. The manual release device shall be positioned at one of the following locations:
 - On the egress side of each security access turnstile lane.
 - At an approved location where it can be actuated by an employee assigned to the area at all times that the building is occupied.
 - Upon actuation of the building fire alarm system, if provided, after which the physical

barrier remains in the open position until the fire alarm system is manually reset.

Exception: Actuation of a manual fire alarm box.

- Upon actuation of the building automatic sprinkler system or fire detection system, after which the physical barrier remains in the open position until the fire alarm system is manually reset.

1010.5.3 High turnstile. Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors or the requirements of Section 1010.5.2 for security access turnstiles.

1010.5.4 Additional door. Where serving an occupant load greater than 300, each turnstile that is not portable shall have a side-hinged swinging door that conforms to Section 1010.1 within 50 feet (15 240 mm).

Exception: A side-hinged swinging door is not required at security access turnstiles that comply with Section 1010.5.2.

SECTION 1011 STAIRWAYS

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Sections 11B-210 and 11B-504, as applicable.

1011.1 General. Stairways serving occupied portions of a building shall comply with the requirements of Sections 1011.2 through 1011.13. Alternating tread devices shall comply with Section 1011.14. Ship's ladders shall comply with Section 1011.15. Ladders shall comply with Section 1011.16.

Exception: Within rooms or spaces used for assembly purposes, stepped aisles shall comply with Section 1030.

1011.2 Width and capacity. The required capacity of stairways shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm). See Section 1009.3 for accessible means of egress stairways.

Exceptions:

- Stairways serving an occupant load of less than 50 shall have a width of not less than 36 inches (914 mm).
- Spiral stairways as provided for in Section 1011.10.
- Where an incline platform lift or stairway chairlift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, a clear passage width not less than 20

inches (508 mm) shall be provided. Where the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

Means of egress stairs in a Group I-2 or I-2.1 occupancy used for the movement of beds and stretcher patients shall provide a clear width not less than 44 inches (1118 mm).

1011.3 Headroom. Stairways shall have a headroom clearance of not less than 80 inches (2032 mm) measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.

Exceptions:

1. Spiral stairways complying with Section 1011.10 are permitted a 78-inch (1981 mm) headroom clearance.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom not more than $4\frac{3}{4}$ inches (121 mm).

1011.4 Walkline. The walkline across winder treads shall be concentric to the direction of travel through the turn and located 12 inches (305 mm) from the side where the winders are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. Where winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

1011.5 Stair treads and risers. Stair treads and risers shall comply with Sections 1011.5.1 through 1011.5.5.3.

1011.5.1 Dimension reference surfaces. For the purpose of this section, all dimensions are exclusive of carpets, rugs or runners.

1011.5.2 Riser height and tread depth. Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured vertically between the nosings of adjacent treads or between the stairway landing and the adjacent tread. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's nosing. Winder treads shall have a minimum tread depth of 11 inches (279 mm) between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the stair.

Exceptions:

1. Spiral stairways in accordance with Section 1011.10.

2. Stairways connecting stepped aisles to cross aisles or concourses shall be permitted to use the riser/tread dimension in Section 1030.14.2.
3. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; the maximum riser height shall be $7\frac{3}{4}$ inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum winder tread depth at the walkline shall be 10 inches (254 mm); and the minimum winder tread depth shall be 6 inches (152 mm). A nosing projection not less than $\frac{3}{4}$ inch (19.1 mm) but not more than $1\frac{1}{4}$ inches (32 mm) shall be provided on stairways with solid risers where the tread depth is less than 11 inches (279 mm).
4. See *California Fire Code Chapter 11 and California Existing Building Code* for the replacement of existing stairways. [DSA-AC] For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, Section 11B-202.
5. In Group I-3 facilities, stairways providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m²) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).
6. [SFM] Stairways providing access to lifeguard towers not open to the public, not more than 250 square feet (23 m²) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).

1011.5.3 Winder treads. Winder treads are not permitted in means of egress stairways except within a dwelling unit.

Exceptions:

1. Curved stairways in accordance with Section 1011.9.
2. Spiral stairways in accordance with Section 1011.10.

1011.5.4 Dimensional uniformity. Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed $\frac{3}{8}$ inch (9.5 mm) in any flight of stairs. The greatest winder tread depth at the walkline within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

Exceptions:

1. Stairways connecting stepped aisles to cross aisles or concourses shall be permitted to comply with the dimensional nonuniformity in Section 1030.14.2.
2. Consistently shaped winders, complying with Section 1011.5, differing from rectangular treads in the same flight of stairs.

3. Nonuniform riser dimension complying with Section 1011.5.4.1.

1011.5.4.1 Nonuniform height risers. Where the bottom or top riser adjoins a sloping public way, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed one unit vertical in 12 units horizontal (8-percent slope) of stair width. The nosings or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other nosing marking provided on the stair flight. The distinctive marking stripe shall be visible in descent of the stair and shall have a slip-resistant surface. Marking stripes shall have a width of not less than 1 inch (25 mm) but not more than 2 inches (51 mm).

1011.5.5 Nosing and riser profile. *Nosings* shall have a curvature or bevel of not less than $\frac{1}{16}$ inch (1.6 mm) but not more than $\frac{9}{16}$ inch (14.3 mm) from the foremost projection of the tread. Risers shall be solid and vertical or sloped under the tread above from the underside of the nosing above at an angle not more than 30 degrees (0.52 rad) from the vertical.

1011.5.5.1 Nosing projection size. The leading edge (nosings) of treads shall project not more than $1\frac{1}{4}$ inches (32 mm) beyond the tread below.

1011.5.5.2 Nosing projection uniformity. Nosing projections of the leading edges shall be of uniform size, including the projections of the nosing's leading edge of the floor at the top of a flight.

1011.5.5.3 Solid risers. Risers shall be solid.

Exceptions:

1. Solid risers are not required for stairways that are not required to comply with Section 1009.3, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. Solid risers are not required for occupancies in Group I-3 or in Group F, H and S occupancies other than areas accessible to the public. The size of the opening in the riser is not restricted.
3. Solid risers are not required for spiral stairways constructed in accordance with Section 1011.10.

1011.6 Stairway landings. There shall be a floor or landing at the top and bottom of each stairway. The width of landings, measured perpendicularly to the direction of travel, shall be not less than the width of stairways served. Every landing shall have a minimum depth, measured parallel to the direction of travel, equal to the width of the stairway or 48 inches (1219 mm), whichever is less. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door shall not project more than 7 inches (178 mm) into the required width

of a landing. Where wheelchair spaces are required on the stairway landing in accordance with Section 1009.6.3, the wheelchair space shall not be located in the required width of the landing and doors shall not swing over the wheelchair spaces.

Exceptions:

1. Where stairways connect stepped aisles to cross aisles or concourses, stairway landings are not required at the transition between stairways and stepped aisles constructed in accordance with Section 1030.
2. Where curved stairways of constant radius have intermediate landings, the landing depth shall be measured horizontally between the intersection of the walkline of the lower flight at the landing nosing and the intersection of the walkline of the upper flight at the nosing of the lowest tread of the upper flight.
3. Where a landing turns 90 degrees (1.57 rad) or more, the minimum landing depth in accordance with this section shall not be required where the landing provided is not less than that described by an arc with a radius equal to the width of the flight served.
4. *In Group R-3 occupancies a floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.*

1011.7 Stairway construction. Stairways shall be built of materials consistent with the types permitted for the type of construction of the building.

Exceptions:

1. Wood handrails shall be permitted in all types of construction.
2. Interior exit stairways in accordance with Section 510.2.

1011.7.1 Stairway walking surface. The walking surface of treads and landings of a stairway shall not be sloped steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

Exceptions:

1. Openings in stair walking surfaces shall be a size that does not permit the passage of $\frac{1}{2}$ -inch-diameter (12.7 mm) sphere. Elongated openings shall be placed so that the long dimension is perpendicular to the direction of travel.
2. In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided that a sphere with a diameter of $1\frac{1}{8}$ inches (29 mm) cannot pass through the opening.

1011.7.2 Outdoor conditions. Outdoor stairways and outdoor approaches to stairways shall be designed so that water will not accumulate on walking surfaces.

1011.7.3 Enclosures under interior stairways. The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by 1-hour fire-resistance-rated construction or the fire-resistance rating of the stairway enclosure, whichever is greater. Access to the enclosed space shall not be directly from within the stairway enclosure.

Exception: Spaces under stairways serving and contained within a single residential dwelling unit in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

1011.7.4 Enclosures under exterior stairways. There shall not be enclosed usable space under exterior exit stairways unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under exterior stairways shall not be used for any purpose.

1011.8 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

Exception: Spiral stairways used as a means of egress from technical production areas.

1011.9 Curved stairways. Curved stairways with winder treads shall have treads and risers in accordance with Section 1011.5 and the smallest radius shall be not less than twice the minimum width or required capacity of the stairway.

Exception: The radius restriction shall not apply to curved stairways in Group R-3 and within individual dwelling units in Group R-2.

1011.10 Spiral stairways. Spiral stairways are permitted to be used as a component in the means of egress only within dwelling units or from a space not more than 250 square feet (23 m²) in area and serving not more than five occupants, or from technical production areas in accordance with Section 410.5.

A spiral stairway shall have a 6³/₄-inch (171 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than 9¹/₂ inches (241 mm). The minimum stairway clear width at and below the handrail shall be 26 inches (660 mm).

1011.11 Handrails. Flights of stairways shall have handrails on each side and shall comply with Section 1014. Where glass is used to provide the handrail, the handrail shall comply with Section 2407.

[DSA-AC] For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, Sections 11B-504.6 and 11B-505.

Exceptions:

1. Flights of stairways within dwelling units and flights of spiral stairways are permitted to have a handrail on one side only.

2. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
3. *[SFM]* In Group R-3 occupancies, a continuous run of treads or flight of stairs with less than four risers does not require handrails.
4. Changes in room elevations of three or fewer risers within dwelling units and sleeping units in Groups R-2 and R-3 do not require handrails.
5. Where a platform lift is in a stationary position and the floor of the platform lift serves as the upper landing of a stairway, handrails shall not be required on the stairway, provided that all of the following criteria are met:
 - 5.1. The stairway contains not more than two risers.
 - 5.2. A handhold, positioned horizontally or vertically, is located on one side of the stairway adjacent to the top landing.
 - 5.3. The handhold is located not less than 34 inches (864 mm) and not more than 42 inches (1067 mm) above the bottom landing of the stairway.
 - 5.4. The handhold gripping surface complies with Section 1014.3, and is not less than 4.5 inches (114 mm) in length.

1011.12 Stairway to roof. In buildings four or more stories above grade plane, one stairway shall extend to the roof surface unless the roof has a slope steeper than four units vertical in 12 units horizontal (33-percent slope).

Exception: Other than where required by Section 1011.12.1, in buildings without an occupied roof access to the roof from the top story shall be permitted to be by an alternating tread device, a ships ladder or a permanent ladder.

1011.12.1 Stairway to elevator equipment. Roofs and penthouses containing elevator equipment that must be accessed for maintenance are required to be accessed by a stairway.

1011.12.2 Roof access. Where a stairway is provided to a roof, access to the roof shall be provided through a penthouse complying with Section 1511.2.

Exception: In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m²) in area and having a minimum dimension of 2 feet (610 mm).

1011.13 Guards. Guards shall be provided along stairways and landings where required by Section 1015 and shall be constructed in accordance with Section 1015. Where the roof hatch opening providing the required access is located within 10 feet (3049 mm) of the roof edge, such roof access or roof edge shall be protected by guards installed in accordance with Section 1015.

1011.14 Alternating tread devices. Alternating tread devices are limited to an element of a means of egress in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m²) in area and that serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m²) in area and for access to unoccupied roofs. Alternating tread devices used as a means of egress shall not have a rise greater than 20 feet (6096 mm) between floor levels or landings.

1011.14.1 Handrails of alternating tread devices. Handrails shall be provided on both sides of alternating tread devices and shall comply with Section 1014.

1011.14.2 Treads of alternating tread devices. Alternating tread devices shall have a minimum tread depth of 5 inches (127 mm), a minimum projected tread depth of 8½ inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9½ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception: Alternating tread devices used as an element of a means of egress in buildings from a mezzanine area not more than 250 square feet (23 m²) in area that serves not more than five occupants shall have a minimum tread depth of 3 inches (76 mm) with a minimum projected tread depth of 10½ inches (267 mm). The rise to the next alternating tread surface shall not exceed 8 inches (203 mm).

1011.15 Ship's ladders. Ship's ladders are permitted to be used in *lifeguard towers not open to the public* and Group I-3 as a component of a means of egress to and from control rooms or elevated facility observation stations not more than 250 square feet (23 m²) with not more than three occupants and for access to unoccupied roofs. The minimum clear width at and below the handrails shall be 20 inches (508 mm). Ship's ladders shall be designed for the live loads indicated in Section 1607.17.

1011.15.1 Handrails of ship's ladders. Handrails shall be provided on both sides of ship's ladders.

1011.15.2 Treads of ship's ladders. Ship's ladders shall have a minimum tread depth of 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is not less than 8½ inches (216 mm). The maximum riser height shall be 9½ inches (241 mm).

1011.16 Ladders. Permanent ladders shall not serve as a part of the means of egress from occupied spaces within a building. Permanent ladders shall be constructed in accordance with Section 306.5 of the *California Mechanical Code* and designed for the live loads indicated in Section 1607.17.

Permanent ladders shall be permitted to provide access to the following areas:

1. Spaces frequented only by personnel for maintenance, repair or monitoring of equipment.
2. Nonoccupiable spaces accessed only by catwalks, crawl spaces, freight elevators or very narrow passageways.
3. Raised areas used primarily for purposes of security, life safety or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers or lifeguard stands.
4. Elevated levels in Group U not open to the general public.
5. Nonoccupied roofs that are not required to have stairway access in accordance with Section 1011.12.1.
6. Where permitted to access equipment and appliances in accordance with Section 306.5 of the *California Mechanical Code*.

SECTION 1012 RAMPS

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-405, as applicable.

1012.1 Scope. The provisions of this section shall apply to ramps used as a component of a means of egress.

Exceptions:

1. Ramped aisles within assembly rooms or spaces shall comply with the provisions in Section 1030.
2. Curb ramps shall comply with *Chapter 11A or 11B, 11B-406, as applicable*.
3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 1012.3 through 1012.10 where they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.

1012.2 Slope. Ramps used as part of a means of egress shall have a running slope not steeper than 1 unit vertical in 12 units horizontal (8.3-percent slope). The slope of other pedestrian ramps shall not be steeper than 1 unit vertical in 8 units horizontal (12.5-percent slope).

1012.3 Cross slope. The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than one unit vertical in 48 units horizontal (2-percent slope).

1012.4 Vertical rise. The rise for any ramp run shall be 30 inches (762 mm) maximum.

1012.5 Minimum dimensions. The minimum dimensions of means of egress ramps shall comply with Sections 1012.5.1 through 1012.5.3.

1012.5.1 Width and capacity. The minimum width and required capacity of a means of egress ramp shall be not less than that required for corridors by Section 1020.3. The clear width of a ramp between handrails, if provided, or other permissible projections shall be 36 inches (914 mm) minimum.

1012.5.2 Headroom. The minimum headroom in all parts of the means of egress ramp shall be not less than 80 inches (2032 mm) above the finished floor of the ramp run and any intermediate landings. The minimum clearance shall be maintained for the full width of the ramp and landing.

1012.5.3 Restrictions. Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

1012.6 Landings. Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits and at doors. Landings shall comply with Sections 1012.6.1 through 1012.6.5.

1012.6.1 Slope. Landings shall have a slope not steeper than one unit vertical in 48 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.

1012.6.2 Width. The landing width shall be not less than the width of the widest ramp run adjoining the landing.

1012.6.3 Length. The landing length shall be 60 inches (1525 mm) minimum.

Exceptions:

1. In Group R-2 and R-3 individual dwelling and sleeping units that are not required to be *accessible* in accordance with *Chapter 11A*, landings are permitted to be 36 inches (914 mm) minimum.
2. Where the ramp is not a part of an accessible route, the length of the landing shall not be required to be more than 48 inches (1219 mm) in the direction of travel.

1012.6.4 Change in direction. Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

Exception: In Group R-2 and R-3 individual dwelling or sleeping units that are not required to be *accessible* in accordance with *Chapter 11A*, landings are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

1012.6.5 Doorways. Where doorways are located adjacent to a ramp landing, maneuvering clearances required for *accessibility* are permitted to overlap the required landing area as specified in *Chapter 11A or 11B*, as applicable.

1012.7 Ramp construction. Ramps shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

1012.7.1 Ramp surface. The surface of ramps shall be of slip-resistant materials that are securely attached.

1012.7.2 Outdoor conditions. Outdoor ramps and outdoor approaches to ramps shall be designed so that water will not accumulate on walking surfaces.

1012.8 Handrails. Ramps with a rise greater than 6 inches (152 mm) shall have handrails on both sides. Handrails shall comply with Section 1014.

1012.9 Guards. Guards shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015.

1012.10 Edge protection. Edge protection complying with Section 1012.10.1 or 1012.10.2 shall be provided on each side of ramp runs and at each side of ramp landings.

Exceptions:

1. Edge protection is not required on ramps that are not required to have handrails, provided they have flared sides that comply with *Chapter 11A or 11B*.
2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection is not required on the sides of ramp landings having a vertical dropoff of not more than $\frac{1}{2}$ inch (12.7 mm) within 10 inches (254 mm) horizontally of the required landing area.

1012.10.1 Curb, rail, wall or barrier. A curb, rail, wall or barrier shall be provided to serve as edge protection. A curb shall be not less than 4 inches (102 mm) in height. Barriers shall be constructed so that the barrier prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.

1012.10.2 Extended floor or ground surface. The floor or ground surface of the ramp run or landing shall extend 12 inches (305 mm) minimum beyond the inside face of a handrail complying with Section 1014.

SECTION 1013 EXIT SIGNS

1013.1 Where required. Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that any point in an exit access corridor or exit passageway is within 100 feet (30 480 mm) or the listed viewing distance of the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Exit signs are not required in rooms or areas that require only one exit or exit access.

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2. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the building official.
3. Exit signs are not required in occupancies in Group U and individual sleeping units or dwelling units in Group R-1, R-2 or R-3 or R-3.1.
4. Exit signs are not required *where inmates are housed or held* in dayrooms, sleeping rooms or dormitories in occupancies in Group I-3.
5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.

1013.2 Low-level exit signs in Group R-1. See Section 1013.7.

1013.3 Illumination. Exit signs shall be internally or externally illuminated.

Exception: Tactile signs required by Section 1013.4 need not be provided with illumination.

1013.4 Raised character and braille exit signs. Where exit signs are provided at an area of refuge with direct access to a stairway, an exterior area for assisted rescue, an exit stairway or ramp, an exit passageway, a horizontal exit and the exit discharge, a sign stating "EXIT" in visual characters, raised characters and braille and complying with ICC A117.1 shall be provided.

Tactile exit signs shall be required at the following locations:

1. *Each grade-level exterior exit door that is required to comply with Section 1013.1, shall be identified by a tactile exit sign with the word, "EXIT".*
2. *Each exit door that is required to comply with Section 1013.1, and that leads directly to a grade-level exterior exit by means of a stairway or ramp shall be identified by a tactile exit sign with the following words as appropriate:*
 - 2.1. "EXIT STAIR DOWN"
 - 2.2. "EXIT RAMP DOWN"
 - 2.3. "EXIT STAIR UP"
 - 2.4. "EXIT RAMP UP"
3. *Each exit door that is required to comply with Section 1013.1, and that leads directly to a grade-level exterior exit by means of an exit enclosure or an exit passageway shall be identified by a tactile exit sign with the words, "EXIT ROUTE."*
4. *Each exit access door from an interior room or area to a corridor or hallway that is required to comply with Section 1013.1, shall be identified by a tactile exit sign with the words "EXIT ROUTE."*
5. *Each exit door through a horizontal exit that is required to comply with Section 1013.1, shall be identified by a sign with the words, "TO EXIT."*

Raised character and Braille exit signs shall comply with Chapter 11A, Section 1143A or Chapter 11B, Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.

1013.5 Internally illuminated exit signs. Electrically powered, self-luminous and photoluminescent exit signs shall be listed and labeled in accordance with UL 924 and shall be installed in accordance with the manufacturer's instructions and Chapter 27. Exit signs shall be illuminated at all times.

1013.6 Externally illuminated exit signs. Externally illuminated exit signs shall comply with Sections 1013.6.1 through 1013.6.3.

1013.6.1 Graphics. Every exit sign and directional exit sign shall have plainly legible letters not less than 6 inches (152 mm) high with the principal strokes of the letters not less than $\frac{3}{4}$ inch (19.1 mm) wide. The word "EXIT" shall have letters having a width not less than 2 inches (51 mm) wide, except the letter "I," and the minimum spacing between letters shall be not less than $\frac{3}{8}$ inch (9.5 mm). Signs larger than the minimum established in this section shall have letter widths, strokes and spacing in proportion to their height.

The word "EXIT" shall be in high contrast with the background and shall be clearly discernible when the means of exit sign illumination is or is not energized. If a chevron directional indicator is provided as part of the exit sign, the construction shall be such that the direction of the chevron directional indicator cannot be readily changed.

1013.6.2 Exit sign illumination. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux).

1013.6.3 Power source. Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Chapter 27. Group I-2 exit sign illumination shall not be provided by unit equipment batteries only.

Exception: Approved exit sign illumination types that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.

1013.7 Floor-level exit signs. *Where exit signs are required by Chapter 10, additional approved low-level exit signs which are internally or externally illuminated photoluminescent or self-luminous, shall be provided in all interior corridors of Group A, E, I and R-2.1 occupancies and in all areas serving guest rooms of hotels in Group R, Division 1 occupancies.*

Exceptions:

1. *Group A occupancies that are protected throughout by an approved supervised fire sprinkler system.*
2. *Group E Occupancies where direct exits have been provided from each classroom.*

3. Group I and R-2.1 occupancies which are provided with smoke barriers constructed in accordance with Section 407.5.

4. Group I-3 occupancies.

The bottom of the sign shall not be less than 6 inches (152 mm) or more than 8 inches (203 mm) above the floor level and shall indicate the path of exit travel. For exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign or marker within 4 inches (102 mm) of the door frame.

Note: Pursuant to Health and Safety Code Section 13143, this California amendment applies to all newly constructed buildings or structures subject to this section for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

1013.8 Path marking. When exit signs are required by Chapter 10, in addition to approved floor-level exit signs, approved path marking shall be installed at floor level or no higher than 8 inches (203 mm) above the floor level in all interior rated exit corridors of unsprinklered Group A, R-1 and R-2 occupancies.

Such marking shall be continuous except as interrupted by door-ways, corridors or other such architectural features in order to provide a visible delineation along the path of travel.

Note: Pursuant to Health and Safety Code Section 13143, the California amendments of this section shall apply to all newly constructed buildings or structures subject to this section for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

SECTION 1014 HANDRAILS

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-505, as applicable.

1014.1 Where required. Handrails serving flights of stairways, ramps, stepped aisles and ramped aisles shall be adequate in strength and attachment in accordance with Section 1607.9. Handrails required for flights of stairways by Section 1011.11 shall comply with Sections 1014.2 through 1014.9. Handrails required for ramps by Section 1012.8 shall comply with Sections 1014.2 through 1014.8. Handrails for stepped aisles and ramped aisles required by Section 1030.16 shall comply with Sections 1014.2 through 1014.8.

1014.2 Height. Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm). Handrail height of alternating tread devices and ships ladders, measured above tread nosings, shall be

uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

Exceptions:

1. Where handrail fittings or bendings are used to provide continuous transition between flights, the fittings or bendings shall be permitted to exceed the maximum height.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are associated with a Group R-3 occupancy or associated with individual dwelling units in Group R-2 occupancies; where handrail fittings or bendings are used to provide continuous transition between flights, transition at winder treads, transition from handrail to guard, or where used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.
3. Handrails on top of a guard where permitted along stepped aisles and ramped aisles in accordance with Section 1030.16.

1014.3 Handrail graspability. Required handrails shall comply with Section 1014.3.1 or shall provide equivalent graspability.

Exception: In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; handrails shall be Type I in accordance with Section 1014.3.1, Type II in accordance with Section 1014.3.2 or shall provide equivalent graspability.

1014.3.1 Type I. Handrails with a circular cross section shall have an outside diameter of not less than $1\frac{1}{4}$ inches (32 mm) and not greater than 2 inches (51 mm). Where the handrail is not circular, it shall have a perimeter dimension of not less than 4 inches (102 mm) and not greater than $6\frac{1}{4}$ inches (160 mm) with a maximum cross-sectional dimension of $2\frac{1}{4}$ inches (57 mm) and minimum cross-sectional dimension of 1 inch (25 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

1014.3.2 Type II. Handrails with a perimeter greater than $6\frac{1}{4}$ inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of $\frac{3}{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of not less than $\frac{5}{16}$ inch (8 mm) within $\frac{7}{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $\frac{3}{8}$ inch (10 mm) to a level that is not less than $1\frac{3}{4}$ inches (45 mm) below the tallest portion of the profile. The width of the handrail above the recess shall be not less than $1\frac{1}{4}$ inches (32 mm) to not greater than $2\frac{3}{4}$ inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

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1014.4 Continuity. Handrail gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

Exceptions:

1. Handrails within dwelling units are permitted to be interrupted by a newel post at a turn or landing.
2. Within a dwelling unit, the use of a volute, turnout, starting easing or starting newel is allowed over the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within 1½ inches (38 mm) of the bottom of the handrail shall not be considered obstructions. For each ½ inch (12.7 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance dimension of 1½ inches (38 mm) shall be permitted to be reduced by ⅛ inch (3.2 mm).
4. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of the handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
5. Handrails serving stepped aisles or ramped aisles are permitted to be discontinuous in accordance with Section 1030.16.1.

1014.5 Fittings. Handrails shall not rotate within their fittings.

1014.6 Handrail extensions. Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent flight of stairs or ramp run. Where handrails are not continuous between flights, the handrails shall extend horizontally not less than 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. At ramps where handrails are not continuous between runs, the handrails shall extend horizontally above the landing 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. The extensions of handrails shall be in the same direction of the flights of stairs at stairways and the ramp runs at ramps.

Exceptions:

1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser.
2. Handrails serving aisles in rooms or spaces used for assembly purposes are permitted to comply with the handrail extensions in accordance with Section 1030.16.
3. Handrails for alternating tread devices and ships ladders are permitted to terminate at a location vertically above the top and bottom risers. Handrails for alternating tread devices are not required to be continuous between flights or to extend beyond the top or bottom risers.

1014.7 Clearance. Clear space between a handrail and a wall or other surface shall be not less than 1½ inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

1014.8 Projections. On ramps and on ramped aisles that are part of an accessible route, the clear width between handrails shall be 36 inches (914 mm) minimum. Projections into the required width of aisles, stairways and ramps at each side shall not exceed 4½ inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1011.3. Projections due to intermediate handrails shall not constitute a reduction in the egress width. Where a pair of intermediate handrails are provided within the stairway width without a walking surface between the pair of intermediate handrails and the distance between the pair of intermediate handrails is greater than 6 inches (152 mm), the available egress width shall be reduced by the distance between the closest edges of each such intermediate pair of handrails that is greater than 6 inches (152 mm).

In Group I-2 occupancy ramps required for exit access shall not be less than 8 ft in width and handrails are permitted to protrude 3½ inches from the wall on both sides. Ramps used as exits and stairways used for the movement of bed and litter patients, the clear width between handrails shall be 44 inches (1118 mm) minimum.

[HCD 1-AC] In addition, projections shall comply with Chapter 11A, when applicable.

1014.9 Intermediate handrails. Stairways shall have intermediate handrails located in such a manner that all portions of the stairway minimum width or required capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

SECTION 1015 GUARDS

1015.1 General. Guards shall comply with the provisions of Sections 1015.2 through 1015.7. Operable windows with sills located more than 72 inches (1829 mm) above finished grade or other surface below shall comply with Section 1015.8.

1015.2 Where required. Guards shall be located along open-sided walking surfaces, including mezzanines, equipment platforms, aisles, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Guards shall be adequate in strength and attachment in accordance with Section 1607.9.

Exceptions: Guards are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of stages and raised platforms, including stairs leading up to the stage and raised platforms.

3. On raised stage and platform floor areas, such as runways, ramps and side stages used for entertainment or presentations.
4. At vertical openings in the performance area of stages and platforms.
5. At elevated walking surfaces appurtenant to stages and platforms for access to and utilization of special lighting or equipment.
6. Along vehicle service pits not accessible to the public.
7. In assembly seating areas at cross aisles in accordance with Section 1030.17.2.
8. On the loading side of station platforms on fixed guideway transit or passenger rail systems.
9. *Elevated facility observation station access hatches at detention facilities.*

1015.2.1 Glazing. Where glass is used to provide a guard or as a portion of the guard system, the guard shall comply with Section 2407. Where the glazing provided does not meet the strength and attachment requirements of Section 1607.9, complying guards shall be located along glazed sides of open-sided walking surfaces.

1015.3 Height. Required guards shall be not less than 42 inches (1067 mm) high, measured vertically as follows:

1. From the adjacent walking surfaces.
2. On stairways and stepped aisles, from the line connecting the leading edges of the tread nosings.
3. On ramps and ramped aisles, from the ramp surface at the guard.

Exceptions:

1. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, guards on the open sides of stairs shall have a height not less than 34 inches (864 mm) measured vertically from a line connecting the leading edges of the treads.
2. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, where the top of the guard serves as a handrail on the open sides of stairs, the top of the guard shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.
3. The guard height in assembly seating areas shall comply with Section 1030.17 as applicable.
4. Along alternating tread devices and ships ladders, guards where the top rail serves as a handrail shall have height not less than 30 inches (762 mm) and not more than 34 inches (864 mm), measured vertically from the leading edge of the device tread nosing.

5. In Group F occupancies where exit access stairways serve fewer than three stories and such stairways are not open to the public, and where the top of the guard also serves as a handrail, the top of the guard shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

1015.4 Opening limitations. Required guards shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter from the walking surface to the required guard height.

Exceptions:

1. From a height of 36 inches (914 mm) to 42 inches (1067 mm), guards shall not have openings that allow passage of a sphere $4\frac{3}{8}$ inches (111 mm) in diameter.
2. The triangular openings at the open sides of a stair, formed by the riser, tread and bottom rail shall not allow passage of a sphere 6 inches (152 mm) in diameter.
3. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or equipment, guards shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.
4. In areas that are not open to the public within occupancies in Group I-3, F, H or S, and for alternating tread devices and ships ladders, guards shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.
5. In assembly seating areas, guards required at the end of aisles in accordance with Section 1030.17.4 shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, guards shall not have openings that allow passage of a sphere 8 inches (203 mm) in diameter.
6. Within individual dwelling units and sleeping units in Group R-2 and R-3 occupancies, guards on the open sides of stairs shall not have openings that allow passage of a sphere $4\frac{3}{8}$ (111 mm) inches in diameter.
7. *In lifeguard towers not open to the public, guards shall not have openings which allow passage of a sphere 21 inches (533 mm) in diameter.*

1015.5 Screen porches. Porches and decks that are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

1015.6 Mechanical equipment, systems and devices. Guards shall be provided where various components that

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require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of such components. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: Guards are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

1015.7 Roof access. Guards shall be provided where the roof hatch opening is located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of the hatch parallel to the roof edge. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: Guards are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z 359.1 are installed.

1015.8 Window openings. Windows in Group R-1, R-2 and R-3 buildings including dwelling units, where the bottom of the clear opening of an operable window is located less than 36 inches (914 mm) above the finished floor and more than 72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, shall comply with one of the following:

1. Operable windows where the top of the sill of the opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below and that are provided with window fall prevention devices that comply with ASTM F2006.
2. Operable windows where the openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the window is in its largest opened position.
3. Operable windows where the openings are provided with window fall prevention devices that comply with ASTM F2090.
4. Operable windows that are provided with window opening control devices that comply with Section 1015.8.1.

1015.8.1 Window opening control devices. Window opening control devices shall comply with ASTM F2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1031.3.1.

SECTION 1016 EXIT ACCESS

1016.1 General. The exit access shall comply with the applicable provisions of Sections 1003 through 1015. Exit access arrangement shall comply with Sections 1016 through 1021.

1016.2 Egress through intervening spaces. Egress through intervening spaces shall comply with this section.

1. Exit access through an enclosed elevator lobby is permitted *in other than a Group I-2 and I-2.1*. Where access to two or more exits or exit access doorways is required in Section 1006.2.1, access to not less than one of the required exits shall be provided without travel through the enclosed elevator lobbies required by Section 3006. Where the path of exit access travel passes through an enclosed elevator lobby, the level of protection required for the enclosed elevator lobby is not required to be extended to the exit unless direct access to an exit is required by other sections of this code.
2. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas and the area served are accessory to one or the other, are not a Group H occupancy and provide a discernible path of egress travel to an exit.

Exception: Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H, S or F occupancy where the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.

3. An exit access shall not pass through a room that can be locked to prevent egress.
4. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.
5. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes.

Exceptions:

1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit.
2. Means of egress are not prohibited through stockrooms in Group M occupancies where all of the following are met:
 - 2.1. The stock is of the same hazard classification as that found in the main retail area.
 - 2.2. Not more than 50 percent of the exit access is through the stockroom.
 - 2.3. The stockroom is not subject to locking from the egress side.
 - 2.4. There is a demarcated, minimum 44-inch-wide (1118 mm) aisle defined by full- or partial-height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.
6. *The means of egress shall not pass through any room subject to locking except in Group I-3 occupancies*

classified as detention facilities and psychiatric treatment areas in Group I-2 occupancies.

1016.2.1 Multiple tenants. Where more than one tenant occupies any one floor of a building or structure, each tenant space, dwelling unit and sleeping unit shall be provided with access to the required exits without passing through adjacent tenant spaces, dwelling units and sleeping units.

Exception: The means of egress from a smaller tenant space shall not be prohibited from passing through a larger adjoining tenant space where such rooms or spaces of the smaller tenant occupy less than 10 percent of the area of the larger tenant space through which they pass; are the same or similar occupancy group; a discernible path of egress travel to an exit is provided; and the means of egress into the adjoining space is not subject to locking from the egress side. A required means of egress serving the larger tenant space shall not pass through the smaller tenant space or spaces.

1016.2.2 Basement exits in Group I-2 occupancies. For additional requirements for occupancies in Group I-2 or I-2.1, see Section 407.

**SECTION 1017
EXIT ACCESS TRAVEL DISTANCE**

1017.1 General. Travel distance within the exit access portion of the means of egress system shall be in accordance with this section.

1017.2 Limitations. Exit access travel distance shall not exceed the values given in Table 1017.2.

**TABLE 1017.2
EXIT ACCESS TRAVEL DISTANCE^a**

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200 ^c	250 ^b
R-2.1	Not Permitted	250 ^b
B	200	300 ^c
F-2, S-2, U	300	400 ^c
H-1	Not Permitted	75 ^d
H-2	Not Permitted	100 ^d
H-3	Not Permitted	150 ^d
H-4	Not Permitted	175 ^d
H-5	Not Permitted	200 ^c
I-2, I-2.1, I-3 ^f	Not Permitted	200 ^c
I-4	150	200 ^c
L	Not Permitted	200 ^c

For SI: 1 foot = 304.8 mm.

a. See the following sections for modifications to exit access travel distance requirements:

- Section 402.8: For the distance limitation in malls.
- Section 407.4: For the distance limitation in Group I-2 or I-2.1.
- Section 408.3.10: For increased limitation in Group I-3
- Sections 408.6.1 and 408.8.1: For the distance limitations in Group I-3.

- Section 411.2: For the distance limitation in special amusement areas.
- Section 412.6: For the distance limitations in aircraft manufacturing facilities.
- Section 1006.2.2.2: For the distance limitation in refrigeration machinery rooms.
- Section 1006.2.2.3: For the distance limitation in refrigerated rooms and spaces.
- Section 1006.3.4: For buildings with one exit.
- Section 1017.2.2: For increased distance limitation in Groups F-1 and S-1.
- Section 1030.7: For increased limitation in assembly seating.
- Section 3103.4: For temporary structures.
- Section 3104.9: For pedestrian walkways.
- b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.
- c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- d. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.1.
- e. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.
- f. Not permitted in nonsprinklered Group I-3 occupancies.

1017.2.1 Exterior egress balcony increase. Exit access travel distances specified in Table 1017.2 shall be increased up to an additional 100 feet (30 480 mm) provided that the last portion of the exit access leading to the exit occurs on an exterior egress balcony constructed in accordance with Section 1021. The length of such balcony shall be not less than the amount of the increase taken.

1017.2.2 Groups F-1 and S-1 increase. The maximum exit access travel distance shall be 400 feet (122 m) in Group F-1 or S-1 occupancies where all of the following conditions are met:

1. The portion of the building classified as Group F-1 or S-1 is limited to one story in height.
2. The minimum height from the finished floor to the bottom of the ceiling or roof slab or deck is 24 feet (7315 mm).
3. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

1017.3 Measurement. Exit access travel distance shall be measured from the most remote point of each room, area or space along the natural and unobstructed path of horizontal and vertical egress travel to the entrance to an exit. Where more than one exit is required, exit access travel distance shall be measured to the nearest exit.

Exceptions:

1. In open parking garages, exit access travel distance is permitted to be measured to the closest riser of an exit access stairway or the closest slope of an exit access ramp.
2. In smoke protected seating and open air assembly seating, exit access travel distance shall be measured in accordance with Section 1030.7.

1017.3.1 Exit access stairways and ramps. Travel distance on exit access stairways or ramps shall be included in the exit access travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stair and landings. The measurement along ramps shall be made on the walking surface in the center of the ramp and landings.

1017.3.2 Atriums. Exit access travel distance for areas open to an atrium shall comply with the requirements of Sections 1017.3.2.1 through 1017.3.2.3.

1017.3.2.1 Egress not through the atrium. Where required access to the exits is not through the atrium, exit access travel distance shall comply with Section 1017.2.

1017.3.2.2 Exit access travel distance at the level of exit discharge. Where the path of egress travel is through an atrium space, exit access travel distance at the level of exit discharge shall be determined in accordance with Section 1017.2.

1017.3.2.3 Exit access travel distance at other than the level of exit discharge. Where the path of egress travel is not at the level of exit discharge from the atrium, that portion of the total permitted exit access travel distance that occurs within the atrium shall be not greater than 200 feet (60 960 mm).

**SECTION 1018
AISLES**

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 11B-403, as applicable.

1018.1 General. Aisles and aisle accessways serving as a portion of the exit access in the means of egress system shall comply with the requirements of this section. Aisles or aisle accessways shall be provided from all occupied portions of the exit access that contain seats, tables, furnishings, displays and similar fixtures or equipment. The minimum width or required capacity of aisles shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

1018.2 Aisles in assembly spaces. Aisles and aisle accessways serving a room or space used for assembly purposes shall comply with Section 1030.

1018.3 Aisles in Groups B and M. In Group B and M occupancies, the minimum clear aisle width shall be determined by Section 1005.1 for the occupant load served, but shall be not less than that required for corridors by Section 1020.3.

Exception: Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11B, (see Section 11B-403) need not exceed 28 inches (711 mm) in width.

1018.4 Aisle accessways in Group M. An aisle accessway shall be provided on not less than one side of each element within the merchandise pad. The minimum clear width for an aisle accessway not required to be accessible shall be 30 inches (762 mm). The required clear width of the aisle accessway shall be measured perpendicular to the elements and merchandise within the merchandise pad. The 30-inch (762 mm) minimum clear width shall be maintained to provide a path to an adjacent aisle or aisle accessway. The common path of egress travel shall not exceed 30 feet (9144 mm) from any point in the merchandise pad.

Exception: For areas serving not more than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).

1018.5 Aisles in other than assembly spaces and Groups B and M. In other than rooms or spaces used for assembly purposes and Group B and M occupancies, the minimum clear aisle capacity shall be determined by Section 1005.1 for the occupant load served, but the width shall be not less than that required for corridors by Section 1020.3.

Exception: Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11B, (see Section 11B-403) need not exceed 28 inches (711 mm) in width.

**SECTION 1019
EXIT ACCESS STAIRWAYS AND RAMPS**

1019.1 General. Exit access stairways and ramps serving as an exit access component in a means of egress system shall comply with the requirements of this section. The number of stories connected by exit access stairways and ramps shall include basements, but not mezzanines.

1019.2 All occupancies. Exit access stairways and ramps that serve floor levels within a single story are not required to be enclosed.

1019.3 Occupancies other than Groups I-2, I-2.1, I-3 and R-2.1. In other than Group I-2, I-2.1, I-3 and R-2.1 occupancies, floor openings containing exit access stairways or ramps shall be enclosed with a shaft enclosure constructed in accordance with Section 713.

Exceptions:

1. Exit access stairways and ramps that serve or atmospherically communicate between only two adjacent stories. Such interconnected stories shall not be open to other stories.
2. In Group R-1, R-2, R-2.1, R-3 or R-3.1 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit or sleeping unit or live/work unit.
3. Exit access stairways serving and contained within a Group R-3 congregate residence or a Group R-4 facility are not required to be enclosed.
4. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where

the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or ramp and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.

5. Exit access stairways and ramps within an atrium complying with the provisions of Section 404.
6. Exit access stairways and ramps in open parking garages that serve only the parking garage.
7. Exit access stairways and ramps serving smoke-protected or open-air assembly seating complying with the exit access travel distance requirements of Section 1030.7.
8. Exit access stairways and ramps between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.
9. Exterior exit access stairways or ramps between occupied roofs.
10. *Fixed-guideway transit stations, constructed in accordance with Section 443.*

1019.4 Group I-2, I-2.1, I-3 and R-2.1 occupancies. In Group I-2, I-2.1, I-3 and R-2.1 occupancies, floor openings between stories containing exit access stairways or ramps are required to be enclosed with a shaft enclosure constructed in accordance with Section 713.

Exception: In Group I-3 occupancies, exit access stairways or ramps constructed in accordance with Section 408 are not required to be enclosed.

**SECTION 1020
CORRIDORS**

1020.1 General. Corridors serving as an exit access component in a means of egress system shall comply with the requirements of Sections 1020.2 through 1020.7.

1020.2 Construction. Corridors shall be fire-resistance rated in accordance with Table 1020.2. The corridor walls required to be fire-resistance rated shall comply with Section 708 for fire partitions.

Exceptions:

1. A fire-resistance rating is not required for corridors in an occupancy in Group E where each room that is used for instruction has not less than one door opening directly to the exterior and rooms for assembly purposes have not less than one-half of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A fire-resistance rating is not required for corridors contained within a dwelling unit or sleeping unit in an occupancy in Group R.

3. A fire-resistance rating is not required for corridors in open parking garages.
4. A fire-resistance rating is not required for corridors in an occupancy in Group B that is a space requiring only a single means of egress complying with Section 1006.2.
5. Corridors adjacent to the exterior walls of buildings shall be permitted to have unprotected openings on unrated exterior walls where unrated walls are permitted by Table 705.5 and unprotected openings are permitted by Table 705.8.
6. *A fire-resistance rating is not required for corridors within suites in a Group I-2 or I-2.1 constructed in accordance with Section 407.4.4 or 407.4.5.*
7. *A fire-resistance rating is not required for corridors within Group I-3 occupancies that comply with intervening spaces, see Section 408.1.2.2.*

**TABLE 1020.2
CORRIDOR FIRE-RESISTANCE RATING**

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system
H-1, H-2, H-3	All	Not Permitted	1 ^c
H-4, H-5, L	Greater than 30	Not Permitted	1 ^c
A, B, E, F, M, S, U	Greater than 30	1	0
R-1, R-2, R-3, R-3.1, R-4	Greater than 10	Not Permitted	1
I-2 ^a , I-2.1	Greater than 6	1	1
I-3, R-2.1	Greater than 6	Not Permitted	1 ^{b,c}
I-4	All	1	0
E	Greater than 10	1	0

- a. For requirements for occupancies in Group I-2 and I-2.1, see Sections 407.2 and 407.3.
- b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.8.
- c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
- d. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.
- e. [SFM] See Section 1029.

1020.2.1 Hoistway opening protection. Elevator hoistway openings shall be protected in accordance with Section 3006.2.1.

1020.3 Width and capacity. The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.3.

Exception: In Group I-2 occupancies, corridors are not required to have a clear width of 96 inches (2438 mm) in areas where there will not be stretcher or bed movement for access to care or as part of the defend-in-place strategy.

**TABLE 1020.3
MINIMUM CORRIDOR WIDTH**

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed in this table	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a dwelling unit	36
In Group E with a corridor having an occupant load of 100 or more	72
In corridors and areas serving stretcher traffic in ambulatory care facilities	72
Group I-2 and I-3 in areas where required for bed movement	96
Corridors in Group I-2 and I-3 occupancies serving any area caring for one or more nonambulatory persons. ^a	72

For SI: 1 inch = 25.4 mm.

a. See Section 1224.4.7.1 for Group I-2.

1020.4 Obstruction. The minimum width or required capacity of corridors shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

1020.5 Dead ends. Where more than one exit or exit access doorway is required, the exit access shall be arranged such that dead-end corridors do not exceed 20 feet (6096 mm) in length.

Exceptions:

1. In Group I-3, Condition 2, 3 or 4, occupancies, the dead end in a corridor shall not exceed 50 feet (15 240 mm).
2. In occupancies in Groups B, E, F, M, R-1, R-2, R-2.1, R-2.2, S and U, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of the dead-end corridors shall not exceed 50 feet (15 240 mm).
3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.
4. In Group I-2 and I-2.1 occupancies, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of dead-end corridors that do not serve patient rooms or patient treatment spaces shall not exceed 30 feet (9144 mm).

1020.6 Air movement in corridors. Corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts.

Exceptions:

1. Use of a corridor as a source of makeup air for exhaust systems in rooms that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such corridor is directly

supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.

2. Where located within a dwelling unit, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m²) or less in area, utilization of corridors for conveying return air is permitted.
4. Transfer air movement required to maintain the pressurization difference within health care facilities and Group L occupancies in accordance with ASHRAE 170.
5. For health care facilities under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD), see the California Mechanical Code.

1020.6.1 Corridor ceiling. Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction.
2. The corridor is separated from the plenum by fire-resistance-rated construction.
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by the California Mechanical Code.
4. The air-handling system serving the corridor is shut down upon detection of sprinkler water flow where the building is equipped throughout with an automatic sprinkler system.
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.

1020.7 Corridor continuity. Fire-resistance-rated corridors shall be continuous from the point of entry to an exit, and shall not be interrupted by intervening rooms. Where the path of egress travel within a fire-resistance-rated corridor to the exit includes travel along unenclosed exit access stairways or ramps, the fire-resistance rating shall be continuous for the length of the stairway or ramp and for the length of the connecting corridor on the adjacent floor leading to the exit.

Exceptions:

1. Foyers, lobbies or reception rooms constructed as required for corridors shall not be construed as intervening rooms.
2. Enclosed elevator lobbies as permitted by Item 1 of Section 1016.2 shall not be construed as intervening rooms.
3. [SFM] In fully sprinklered office buildings, corridors may lead through enclosed elevator lobbies if all areas of the building have access to at least one required exit without passing through the elevator lobby.

SECTION 1021 EGRESS BALCONIES

1021.1 General. Balconies used for egress purposes shall conform to the same requirements as corridors for minimum width, required capacity, headroom, dead ends and projections.

1021.2 Wall separation. Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.

Exception: Separation is not required where the exterior egress balcony is served by not less than two stairways and a dead-end travel condition does not require travel past an unprotected opening to reach a stairway.

1021.3 Openness. The long side of an egress balcony shall be not less than 50 percent open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

1021.4 Location. Exterior egress balconies shall have a minimum fire separation distance of 10 feet (3048 mm) measured at right angles from the exterior edge of the egress balcony to the following:

1. Adjacent lot lines.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 based on fire separation distance.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

SECTION 1022 EXITS

1022.1 General. Exits shall comply with Sections 1022 through 1027 and the applicable requirements of Sections 1003 through 1015. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge. Exits shall be continuous from the point of entry into the exit to the exit discharge.

1022.2 Exterior exit doors. Buildings or structures used for human occupancy shall have not less than one exterior door that meets the requirements of Section 1010.1.1.

1022.2.1 Detailed requirements. Exterior exit doors shall comply with the applicable requirements of Section 1010.1.

1022.2.2 Arrangement. Exterior exit doors shall lead directly to the exit discharge or the public way.

|| **1022.3 Basement exits in Group I-2 occupancies.** For additional requirements for occupancies in Group I-2 or I-2.1, see Section 407.4.1.2.

SECTION 1023 INTERIOR EXIT STAIRWAYS AND RAMPS

1023.1 General. Interior exit stairways and ramps serving as an exit component in a means of egress system shall comply with the requirements of this section. Interior exit stairways and ramps shall be enclosed and lead directly to the exterior of the building or shall be extended to the exterior of the building with an exit passageway conforming to the requirements of Section 1024, except as permitted in Section 1028.2. An interior exit stairway or ramp shall not be used for any purpose other than as a means of egress and a circulation path.

1023.2 Construction. Enclosures for interior exit stairways and ramps shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. Interior exit stairway and ramp enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more and not less than 1 hour where connecting less than four stories. The number of stories connected by the interior exit stairways or ramps shall include any basements, but not any mezzanines. Enclosures for interior exit stairways and ramp enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

Exceptions:

1. Interior exit stairways and ramps in Group I-3 occupancies in accordance with the provisions of Section 408.3.8 of the *California Building Code*.
2. Interior exit stairways within an atrium enclosed in accordance with Section 404.6 of the *California Building Code*.
3. Interior exit stairways in accordance with Section 510.2.
4. Fixed guideway transit stations, constructed in accordance with Section 443.

1023.3 Termination. Interior exit stairways and ramps shall terminate at an exit discharge or a public way.

Exception: A combination of interior exit stairways, interior exit ramps and exit passageways, constructed in accordance with Sections 1023.2, 1023.3.1 and 1024, respectively, and forming a continuous protected enclosure, shall be permitted to extend an interior exit stairway or ramp to the exit discharge or a public way.

1023.3.1 Extension. Where interior exit stairways and ramps are extended to an exit discharge or a public way by an exit passageway, the interior exit stairway and ramp shall be separated from the exit passageway by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. The fire-resistance rating shall be not less than that required for the interior exit stairway and ramp. A fire door assembly complying with Section 716 shall be installed in the fire barrier to provide a means of egress from the interior exit stairway and ramp to the exit passageway. Openings in the fire barrier other

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than the fire door assembly are prohibited. Penetrations of the fire barrier are prohibited.

Exceptions:

1. Penetrations of the fire barrier in accordance with Section 1023.5 shall be permitted.
2. Separation between an interior exit stairway or ramp and the exit passageway extension shall not be required where there are no openings into the exit passageway extension.
3. Separation between an interior exit stairway or ramp and the exit passageway extension shall not be required where the interior exit stairway and the exit passageway extension are pressurized in accordance with Section 909.20.5.

1023.4 Openings. Interior exit stairway and ramp opening protectives shall be in accordance with the requirements of Section 716.

Openings in interior exit stairways and ramps other than unprotected exterior openings shall be limited to those required for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

Elevators shall not open into interior exit stairways and ramps.

1023.5 Penetrations. Penetrations into or through interior exit stairways and ramps are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. Fire protection systems.
3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication systems.
6. Electrical raceway serving the interior exit stairway and ramp and terminating at a steel box not exceeding 16 square inches (0.010 m²).
7. Structural elements supporting the interior exit stairway or ramp or enclosure, such as beams or joists.

Such penetrations shall be protected in accordance with Section 714. There shall not be penetrations or communication openings, whether protected or not, between adjacent interior exit stairways and ramps.

Exception: Membrane penetrations shall be permitted on the outside of the interior exit stairway and ramp. Such penetrations shall be protected in accordance with Section 714.4.2.

1023.6 Ventilation. Equipment and ductwork for interior exit stairway and ramp ventilation as permitted by Section 1023.5 shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the interior exit stairway and ramp by ductwork enclosed in construction as required for shafts.

2. Where such equipment and ductwork is located within the interior exit stairway and ramp, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 for shaft enclosures.

The interior exit stairway and ramp ventilation systems shall be independent of other building ventilation systems.

1023.7 Interior exit stairway and ramp exterior walls.

Exterior walls of the interior exit stairway or ramp shall comply with the requirements of Section 705 for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway or ramps and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost landing of the stairway or ramp, or to the roof line, whichever is lower.

1023.8 Barrier at level of exit discharge. An interior exit stairway and ramp shall not continue below its level of exit discharge unless an approved barrier is provided at the level of exit discharge to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in Section 1013.

1023.9 Stairway identification signs. A sign shall be provided at each floor landing in an interior exit stairway and ramp connecting more than three stories designating the floor level, the terminus of the top and bottom of the interior exit stairway and ramp and the identification of the stairway or ramp. The signage shall state the story of and direction to the exit discharge, and the availability of roof access from the interior exit stairway and ramp for the fire department. The bottom of the sign shall be located not less than 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

In addition to the stairway identification sign, raised characters and braille floor identification signs that comply with Chapter 11A, Section 1143A or Chapter 11B shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.

1023.9.1 Signage requirements. Stairway identification signs shall comply with all of the following requirements:

1. The signs shall be a minimum size of 18 inches (457 mm) by 12 inches (305 mm).
2. The letters designating the identification of the interior exit stairway and ramp *such as STAIR NO. 1 or WEST STAIR*, shall be placed at the top of the sign and shall be not less than $1\frac{1}{2}$ inches (38 mm) in height block lettering with $\frac{1}{4}$ -inch (6 mm) strokes.
3. The number designating the floor level shall be not less than 5 inches (127 mm) in height with $\frac{3}{4}$ -inch (19 mm) strokes and located in the center of the sign. *The mezzanine levels shall have the letter "M" preceding the floor level. Basement levels shall have the letter "B" preceding the floor number.*
4. Other lettering and numbers shall be not less than 1 inch (25 mm) in height.
5. *The stairway's upper terminus, such as ROOF ACCESS or NO ROOF ACCESS, shall be placed under the stairway identification in 1-inch-high (25 mm) block lettering with $\frac{1}{4}$ -inch (6 mm) strokes.*
6. *The lower and upper terminus of the stairway shall be placed at the bottom of the sign in 1-inch-high (25 mm) block lettering with $\frac{1}{4}$ -inch (6 mm) strokes.*
7. Characters and their background shall have a non-glare finish. Characters shall contrast with their background, with either light characters on a dark background or dark characters on a light background.
8. Where signs required by Section 1023.9 are installed in the interior exit stairways and ramps of buildings subject to Section 1025, the signs shall be made of the same materials as required by Section 1025.4.

1023.10 Elevator lobby identification signs. At landings in interior exit stairways where two or more doors lead to the floor level, any door with direct access to an enclosed elevator lobby shall be identified by signage located on the door or directly adjacent to the door stating "Elevator Lobby." Signage shall be in accordance with Section 1023.9.1, Items 4, 5 and 6.

1023.11 Tactile floor-level signs. Where floor level signs are provided in interior exit stairways and ramps, a floor-level sign identifying the floor level in visual characters, raised characters and braille complying with *Chapter 11A, Section 1143A* shall be located at each floor-level landing adjacent to the door leading from the interior exit stairway and ramp into the corridor.

1023.12 Smokeproof enclosures. Where required by Section 403.5.4, 405.7.2 or 412.2.2.1, interior exit stairways and ramps shall be smokeproof enclosures in accordance with Section 909.20.

1023.12.1 Termination and extension. A smokeproof enclosure shall terminate at an exit discharge or a public way. The smokeproof enclosure shall be permitted to be extended by an exit passageway in accordance with Section 1023.3. The exit passageway shall be without

openings other than the fire door assembly required by Section 1023.3.1 and those necessary for egress from the exit passageway. The exit passageway shall be separated from the remainder of the building by 2-hour fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

Exceptions:

1. Openings in the exit passageway serving a smokeproof enclosure are permitted where the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure, and openings are protected as required for access from other floors.
2. The fire barrier separating the smokeproof enclosure from the exit passageway is not required, provided that the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure.
3. A smokeproof enclosure shall be permitted to egress through areas on the level of exit discharge or vestibules as permitted by Section 1028.

1023.12.2 Enclosure access. Access to the stairway or ramp within a smokeproof enclosure shall be by way of a vestibule or an open exterior balcony.

1023.13 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1024 EXIT PASSAGEWAYS

1024.1 General. Exit passageways serving as an exit component in a means of egress system shall comply with the requirements of this section. An exit passageway shall not be used for any purpose other than as a means of egress and a circulation path.

1024.2 Width and capacity. The required capacity of exit passageways shall be determined as specified in Section 1005.1 but the minimum width shall be not less than 44 inches (1118 mm), except that exit passageways serving an occupant load of less than 50 shall be not less than 36 inches (914 mm) in width. The minimum width or required capacity of exit passageways shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

The clear width of exit passageways in a Group I-2 occupancy used for the movement of beds and litters shall be 44-inch (1118) minimum.

1024.3 Construction. Exit passageway enclosures shall have walls, floors and ceilings of not less than a 1-hour fire-resistance rating, and not less than that required for any connecting interior exit stairway or ramp. Exit passageways shall be constructed as fire barriers in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both.

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1024.4 Termination. Exit passageways on the level of exit discharge shall terminate at an exit discharge. Exit passageways on other levels shall terminate at an exit.

1024.5 Openings. Exit passageway opening protectives shall be in accordance with the requirements of Section 716.

Except as permitted in Section 402.8.7, openings in exit passageways other than unprotected exterior openings shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway.

Where an interior exit stairway or ramp is extended to an exit discharge or a public way by an exit passageway, the exit passageway shall comply with Section 1023.3.1.

Elevators shall not open into an exit passageway.

1024.6 Penetrations. Penetrations into or through an exit passageway are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. Fire protection systems.
3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication.
6. Electrical raceway serving the exit passageway and terminating at a steel box not exceeding 16 square inches (0.010 m²).

Such penetrations shall be protected in accordance with Section 714. There shall not be penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

Exception: Membrane penetrations shall be permitted on the outside of the exit passageway. Such penetrations shall be protected in accordance with Section 714.4.2.

1024.7 Ventilation. Equipment and ductwork for exit passageway ventilation as permitted by Section 1024.6 shall comply with one of the following:

1. The equipment and ductwork shall be located exterior to the building and shall be directly connected to the exit passageway by ductwork enclosed in construction as required for shafts.
2. Where the equipment and ductwork is located within the exit passageway, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or the air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, the equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 for shaft enclosures.

Exit passageway ventilation systems shall be independent of other building ventilation systems.

1024.8 Exit passageway exterior walls. Exterior walls of the exit passageway shall comply with Section 705. Where nonrated walls or unprotected openings enclose the exterior of the exit passageway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the floor of the exit passageway, or to the roof line, whichever is lower.

1024.9 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1025 LUMINOUS EGRESS PATH MARKINGS

1025.1 General. Approved luminous egress path markings delineating the exit path shall be provided in high-rise buildings of Group A, B, E, M or R-1 occupancies in accordance with this section.

Exception: Luminous egress path markings shall not be required on the level of exit discharge in lobbies that serve as part of the exit path in accordance with Section 1028.2, Exception 1.

1025.2 Markings within exit components. Egress path markings shall be provided in interior exit stairways, interior exit ramps and exit passageways, in accordance with Sections 1025.2.1 through 1025.2.6.3.

1025.2.1 Steps. A solid and continuous stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed not more than $\frac{1}{2}$ inch (12.7 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than $\frac{1}{2}$ inch (12.7 mm) down the vertical face of the step.

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

1025.2.2 Landings. The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

1025.2.3 Handrails. Handrails and handrail extensions shall be marked with a solid and continuous stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn

corners, the stripe shall not have a gap of more than 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

1025.2.4 Perimeter demarcation lines. Stair landings and other floor areas within interior exit stairways, interior exit ramps and exit passageways, with the exception of the sides of steps, shall be provided with solid and continuous demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 to 2 inches (25 mm to 51 mm) wide with interruptions not exceeding 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

1025.2.4.1 Floor-mounted demarcation lines. Perimeter demarcation lines shall be placed within 4 inches (102 mm) of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

Exception: Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit and through which occupants must travel to complete the exit path.

1025.2.4.2 Wall-mounted demarcation lines. Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe not more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such door.

Exception: Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit and through which occupants must travel to complete the exit path.

1025.2.4.3 Transition. Where a wall-mounted demarcation line transitions to a floor-mounted demarcation line, or vice versa, the wall-mounted demarcation line shall drop vertically to the floor to meet a complementary extension of the floor-mounted demarcation line, thus forming a continuous marking.

1025.2.5 Obstacles. Obstacles at or below 6 feet 6 inches (1981 mm) in height and projecting more than 4 inches (102 mm) into the egress path shall be outlined with markings not less than 1 inch (25 mm) in width comprised of a pattern of alternating equal bands, of luminous material and black, with the alternating bands not more than 2 inches (51 mm) thick and angled at 45 degrees (0.79 rad).

Obstacles shall include, but are not limited to, standpipes, hose cabinets, wall projections and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

Exception: The minimum width of 1 inch (25 mm) shall not apply to markings listed in accordance with UL 1994.

1025.2.6 Doors within the exit path. Doors through which occupants must pass in order to complete the exit path shall be provided with markings complying with Sections 1025.2.6.1 through 1025.2.6.3.

1025.2.6.1 Emergency exit symbol. The doors shall be identified by a low-location luminous emergency exit symbol complying with NFPA 170. The exit symbol shall be not less than 4 inches (102 mm) in height and shall be mounted on the door, centered horizontally, with the top of the symbol not higher than 18 inches (457 mm) above the finished floor.

1025.2.6.2 Door hardware markings. Door hardware shall be marked with not less than 16 square inches (10323 mm²) of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle or escutcheon. Where a panic bar is installed, such material shall be not less than 1 inch (25 mm) wide for the entire length of the actuating bar or touchpad.

1025.2.6.3 Door frame markings. The top and sides of the door frame shall be marked with a solid and continuous 1-inch- to 2-inch-wide (25 mm to 51 mm) stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

1025.3 Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same enclosure.

1025.4 Self-luminous and photoluminescent. Luminous egress path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not be limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either of the following standards:

1. UL 1994.
2. ASTM E2072, except that the charging source shall be 1 footcandle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

1025.5 Illumination. Where photoluminescent exit path markings are installed, they shall be provided with not less than 1 footcandle (11 lux) of illumination for not less than 60 minutes prior to periods when the building is occupied and continuously during occupancy.

SECTION 1026 HORIZONTAL EXITS

1026.1 General. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit minimum width or required capacity shall be horizontal exits.

Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100 percent of the exits required for occupancies in Group I-3. Not less than 6 square feet (0.6 m²) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

1026.2 Separation. The separation between buildings or refuge areas connected by a horizontal exit shall be provided by a fire wall complying with Section 706; or by a fire barrier complying with Section 707 or a horizontal assembly complying with Section 711, or both. The minimum fire-resistance rating of the separation shall be 2 hours. Opening protectives in horizontal exits shall also comply with Section 716. Duct and air transfer openings in a fire wall or fire barrier that serves as a horizontal exit shall also comply with Section 717. The horizontal exit separation shall extend vertically through all levels of the building unless floor assemblies have a fire-resistance rating of not less than 2 hours and do not have unprotected openings.

Exception: A fire-resistance rating is not required at horizontal exits between a building area and an above-grade pedestrian walkway constructed in accordance with Section 3104, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exits constructed as fire barriers shall be continuous from exterior wall to exterior wall so as to divide completely the floor served by the horizontal exit.

1026.3 Opening protectives. Fire doors in horizontal exits shall be self-closing or automatic-closing when activated by a smoke detector in accordance with Section 716.2.6.6. Doors, where located in a cross-corridor condition, shall be automatic-closing by activation of a smoke detector installed in accordance with Section 716.2.6.6.

1026.4 Refuge area. The refuge area of a horizontal exit shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original occupant load of the refuge area plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit

doors entering the refuge area or the total occupant load of the adjoining compartment, whichever is less.

1026.4.1 Capacity. The capacity of the refuge area shall be computed based on a net floor area allowance of 3 square feet (0.2787 m²) for each occupant to be accommodated therein. Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-2, I-2.1, I-3 and R-2.1 occupancies shall comply with Sections 407.5.3, 408.6.2 and 420.6.2 as applicable.

1026.4.2 Number of exits. The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering the refuge area through horizontal exits from other areas. *In other than I-3 occupancies*, not less than one refuge area exit shall lead directly to the exterior or to an interior exit stairway or ramp.

Exception: The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided that the refuge area into which a horizontal exit leads has stairways or doors leading directly outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

1026.5 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1027 EXTERIOR EXIT STAIRWAYS AND RAMPS

1027.1 General. Exterior exit stairways and ramps serving as an exit component in a means of egress system shall comply with the requirements of this section.

1027.2 Use in a means of egress. Exterior exit stairways shall not be used as an element of a required means of egress for Group I-2 occupancies. For occupancies in other than Group I-2, exterior exit stairways and ramps shall be permitted as an element of a required means of egress for buildings not exceeding six stories above grade plane or that are not high-rise buildings.

1027.3 Open side. Exterior exit stairways and ramps serving as an element of a required means of egress shall be open on not less than one side, except for required structural columns, beams, handrails and guards. An open side shall have not less than 35 square feet (3.3 m²) of aggregate open area adjacent to each floor level and the level of each intermediate landing. The required open area shall be located not less than 42 inches (1067 mm) above the adjacent floor or landing level.

1027.4 Side yards. The open areas adjoining exterior exit stairways or ramps shall be either yards, courts or public ways; the remaining sides are permitted to be enclosed by the exterior walls of the building.

1027.5 Location. Exterior exit stairways and ramps shall have a minimum fire separation distance of 10 feet (3048 mm) measured at right angles from the exterior edge of the stairway or ramps, including landings, to:

1. Adjacent lot lines.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 based on fire separation distance.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

Exception: Exterior exit stairways and ramps serving individual dwelling units of Group R-3 shall have a minimum fire separation distance of 5 feet (1525 mm).

1027.6 Exterior exit stairway and ramp protection. Exterior exit stairways and ramps shall be separated from the interior of the building as required in Section 1023.2. Openings shall be limited to those necessary for egress from normally occupied spaces. Where a vertical plane projecting from the edge of an exterior exit stairway or ramp and landings is exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the exterior wall shall be rated in accordance with Section 1023.7.

Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are not more than two stories above grade plane where a level of exit discharge serving such occupancies is the first story above grade plane.
2. Separation from the interior of the building is not required where the exterior exit stairway or ramp is served by an exterior exit ramp or balcony that connects two remote exterior exit stairways or other approved exits with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be not less than 50 percent of the height of the enclosing wall, with the top of the openings not less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the open-ended corridor of the building is not required for exterior exit stairways or ramps, provided that Items 3.1 through 3.5 are met:
 - 3.1. The building, including open-ended corridors, and stairways and ramps, shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
 - 3.2. The open-ended corridors comply with Section 1020.
 - 3.3. The open-ended corridors are connected on each end to an exterior exit stairway or ramp complying with Section 1027.

3.4. The exterior walls and openings adjacent to the exterior exit stairway or ramp comply with Section 1023.7.

3.5. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m²) or an exterior stairway or ramp shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.

4. In Group R-3 occupancies not more than four stories in height, exterior exit stairways and ramps serving individual dwelling units are not required to be separated from the interior of the building where the exterior exit stairway or ramp discharges directly to grade.

SECTION 1028 EXIT DISCHARGE

1028.1 General. The exit discharge shall comply with Sections 1028 and 1029 and the applicable requirements of Sections 1003 through 1015.

1028.2 Exit discharge. Exits shall discharge directly to the exterior of the building. The exit discharge shall be at grade or shall provide a direct path of egress travel to grade. The exit discharge shall not reenter a building. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and minimum width or required capacity of the required exits.

Exceptions:

1. Not more than 50 percent of the number and minimum width or required capacity of interior exit stairways and ramps is permitted to egress through areas, including atriums, on the level of discharge provided that all of the following conditions are met:
 - 1.1. Discharge of interior exit stairways and ramps shall be provided with a free and unobstructed path of travel to an exterior exit door and such exit is readily visible and identifiable from the point of termination of the enclosure.
 - 1.2. The entire area of the level of exit discharge is separated from areas below by construction conforming to the fire-resistance rating for the enclosure.
 - 1.3. The egress path from the interior exit stairway and ramp on the level of exit discharge is protected throughout by an approved automatic sprinkler system. Portions of the level of exit discharge with access to the egress path shall be either equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or

903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of interior exit stairways or ramps.

- 1.4. Where a required interior exit stairway or ramp and an exit access stairway or ramp serve the same floor level and terminate at the same level of exit discharge, the termination of the exit access stairway or ramp and the exit discharge door of the interior exit stairway or ramp shall be separated by a distance of not less than 30 feet (9144 mm) or not less than one-fourth the length of the maximum overall diagonal dimension of the building, whichever is less. The distance shall be measured in a straight line between the exit discharge door from the interior exit stairway or ramp and the last tread of the exit access stairway or termination of slope of the exit access ramp.
2. Not more than 50 percent of the number and minimum width or required capacity of the interior exit stairways and ramps is permitted to egress through a vestibule provided that all of the following conditions are met:
 - 2.1. The entire area of the vestibule is separated from areas below by construction conforming to the fire-resistance rating of the interior exit stairway or ramp enclosure.
 - 2.2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the length is not greater than 30 feet (9144 mm).
 - 2.3. The area is separated from the remainder of the level of exit discharge by a fire partition constructed in accordance with Section 708.

Exception: The maximum transmitted temperature rise is not required.
 - 2.4. The area is used only for means of egress and exits directly to the outside.
3. Horizontal exits complying with Section 1026 shall not be required to discharge directly to the exterior of the building.

1028.3 Exit discharge width or capacity. The minimum width or required capacity of the exit discharge shall be not less than the minimum width or required capacity of the exits being served.

1028.4 Exit discharge components. Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.

1028.5 Access to a public way. The exit discharge shall provide a direct and unobstructed access to a public way.

Exception: Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate not less than 5 square feet (0.46 m²) for each person.

2. For other than Group E buildings, the area shall be located on the same lot not less than 50 feet (15 240 mm) away from the building requiring egress. For Group E buildings, the area shall be located on the same lot at least 50 feet (15 240 mm) away from any building.
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.
5. In correctional facilities, the area shall be of a size to accommodate not less than 7 square feet (0.6503 m²) for each person. Accessible path of egress travel to the safe dispersal area and clear ground space for 5 percent of the occupants meeting Section 11B-305.3 shall be provided.

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SECTION 1029 EGRESS COURTS

1029.1 General. Egress courts serving as an exit discharge component in the means of egress system shall comply with the requirements in this section.

1029.2 Width or capacity. The required capacity of egress courts shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm), except as specified herein. Egress courts serving Group R-3 and U occupancies shall be not less than 36 inches (914 mm) in width. The required capacity and width of egress courts shall be unobstructed to a height of 7 feet (2134 mm). The width of the egress court shall be not less than the required capacity.

Exception: Encroachments complying with Section 1005.7.

1029.3 Construction and openings. Where an egress court serving a building or portion thereof is less than 10 feet (3048 mm) in width, the egress court walls shall have not less than 1-hour fire-resistance-rated construction for a distance of 10 feet (3048 mm) above the floor of the egress court. Openings within such walls shall be protected by opening protectives having a fire protection rating of not less than ³/₄ hour.

Exceptions:

1. Egress courts serving an occupant load of less than 10.
2. Egress courts serving Group R-3.

SECTION 1030 ASSEMBLY

1030.1 General. A room or space used for assembly purposes that contains seats, tables, displays, equipment or other material shall comply with this section.

Exception: Group A occupancies within Group I-3 facilities are exempt from egress requirements of Section 1029.

1030.1.1 Bleachers. Bleachers, grandstands and folding and telescopic seating, that are not building elements, shall comply with ICC 300.

1030.1.1.1 Spaces under grandstands and bleachers.

Spaces under grandstands or bleachers shall be separated by fire barriers complying with Section 707 and horizontal assemblies complying with Section 711 with not less than 1-hour fire-resistance-rated construction.

Exceptions:

1. Ticket booths less than 100 square feet (9.29 m²) in area.
2. Toilet rooms.
3. Other accessory use areas 1,000 square feet (92.9 m²) or less in area and equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

1030.2 Assembly main exit. A building, room or space used for assembly purposes that has an occupant load of greater than 300 and is provided with a main exit, that main exit shall be of sufficient capacity to accommodate not less than one-half of the occupant load, but such capacity shall be not less than the total required capacity of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on not less than one street or an unoccupied space of not less than *20 feet (6096 mm)* in width that adjoins a street or public way. In a building, room or space used for assembly purposes where there is not a well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total capacity of egress is not less than 100 percent of the required capacity *and not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or publicway. Smoke-protected seating shall comply with Section 1029.6.2.*

1030.3 Assembly other exits. In addition to having access to a main exit, each level in a building used for assembly purposes having an occupant load greater than 300 and provided with a main exit, shall be provided with additional means of egress that shall provide an egress capacity for not less than one-half of the total occupant load served by that level and shall comply with Section 1007.1. *Not less than one-half of the additional means of egress required by this section shall be directly to an exit, or through a lobby, that is not used to access the main exit, to an exit or to a 1-hour-rated corridor to an exit. In a building used for assembly purposes where there is not a well-defined main exit or where multiple main exits are provided, exits for each level shall be permitted to be distributed around the perimeter of the building, provided that the total width of egress is not less than 100 percent of the required width and not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or publicway. Smoke-protected seating shall comply with Section 1029.6.2.*

1030.3.1 Occupant loads between 100 and 300. *Group A occupancies or assembly occupancies accessory to Group E occupancies that have an occupant load of 100 to 300 not less than one of the required means of egress shall exit through one of the following:*

1. *Directly to an exit*
2. *Egress through a lobby that is not used to access the other required exit*
3. *To a one-hour rated corridor to an exit*
4. *Continuous through a one-hour rated lobby to an exit.*

Not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or public way.

1030.4 Foyers and lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available, such persons shall be allowed to wait in a lobby or similar space, provided that such lobby or similar space shall not encroach on the minimum width or required capacity of the means of egress. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.

1030.5 Interior balcony and gallery means of egress. For balconies, galleries or press boxes having a seating capacity of 50 or more located in a building, room or space used for assembly purposes, not less than two means of egress shall be provided, with one from each side of every balcony, gallery or press box.

1030.6 Capacity of aisle for assembly. The required capacity of aisles shall be not less than that determined in accordance with Section 1030.6.1 where smoke-protected assembly seating is not provided, Section 1030.6.2 where smoke-protected assembly seating is provided and Section 1030.6.3 where open-air assembly seating is provided.

1030.6.1 Without smoke protection. The required capacity in inches (mm) of the aisles for assembly seating without smoke protection shall be not less than the occupant load served by the egress element in accordance with all of the following, as applicable:

1. Not less than 0.3 inch (7.6 mm) of aisle capacity for each occupant served shall be provided on stepped aisles having riser heights 7 inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread nosings.
2. Not less than 0.005 inch (0.127 mm) of additional aisle capacity for each occupant shall be provided for each 0.10 inch (2.5 mm) of riser height above 7 inches (178 mm).
3. Where egress requires stepped aisle descent, not less than 0.075 inch (1.9 mm) of additional aisle capacity for each occupant shall be provided on those portions of aisle capacity that do not have a handrail within a horizontal distance of 30 inches (762 mm).

- Ramped aisles, where slopes are steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have not less than 0.22 inch (5.6 mm) of clear aisle capacity for each occupant served. Level or ramped aisles, where slopes are not steeper than one unit vertical in 12 units horizontal (8-percent slope), shall have not less than 0.20 inch (5.1 mm) of clear aisle capacity for each occupant served.

1030.6.2 Smoke-protected assembly seating. The required capacity in inches (mm) of the aisle for smoke-protected assembly seating shall be not less than the occupant load served by the egress element multiplied by the appropriate factor in Table 1030.6.2. The total number of seats specified shall be those within the space exposed to the same smoke-protected environment. Interpolation is permitted between the specific values shown. A life safety evaluation, complying with NFPA 101, shall be done for a facility utilizing the reduced width requirements of Table 1030.6.2 for smoke-protected assembly seating.

1030.6.2.1 Smoke control. Aisles and aisle accessways serving a smoke-protected assembly seating area shall be provided with a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level not less than 6 feet (1829 mm) above the floor of the means of egress.

1030.6.2.2 Roof height. A smoke-protected assembly seating area with a roof shall have the lowest portion of the roof deck not less than 15 feet (4572 mm) above the highest aisle or aisle accessway.

Exception: A roof canopy in an outdoor stadium shall be permitted to be less than 15 feet (4572 mm) above the highest aisle or aisle accessway provided that there are no objects less than 80 inches (2032 mm) above the highest aisle or aisle accessway.

1030.6.2.3 Automatic sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exceptions:

- The floor area used for contests, performances or entertainment provided that the roof construction is more than 50 feet (15 240 mm)

above the floor level and the use is restricted to low fire hazard uses.

- Press boxes and storage facilities less than 1,000 square feet (93 m²) in area.

1030.6.3 Open-air assembly seating. In open-air assembly seating, the required capacity in inches (mm) of aisles shall be not less than the total occupant load served by the egress element multiplied by 0.08 (2.0 mm) where egress is by stepped aisle and multiplied by 0.06 (1.52 mm) where egress is by level aisles and ramped aisles.

Exception: The required capacity in inches (mm) of aisles shall be permitted to comply with Section 1030.6.2 for the number of seats in the open-air assembly seating where Section 1030.6.2 permits less capacity.

1030.6.3.1 Automatic sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing open-air assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exceptions:

- The floor area used for contests, performances or entertainment, provided that the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low fire hazard uses.
- Press boxes and storage facilities less than 1,000 square feet (93 m²) in area.
- Open-air assembly seating facilities where seating and the means of egress in the seating area are essentially open to the outside.

1030.6.3.2 Public address system. See Section 907.2.1.1.

1030.7 Travel distance. The exit access travel distance shall comply with Section 1017. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessways without travel over or on the seats.

Exceptions:

- In facilities with smoke-protected assembly seating, the total exit access travel distance shall be not greater than 400 feet (122 m). That portion of the total permitted exit access travel distance from each

**TABLE 1030.6.2
CAPACITY FOR AISLES FOR SMOKE-PROTECTED ASSEMBLY**

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY SEATING	INCHES OF CAPACITY PER SEAT SERVED			
	Stepped aisles with handrails within 30 inches	Stepped aisles without handrails within 30 inches	Level aisles or ramped aisles not steeper than 1 in 10 in slope	Ramped aisles steeper than 1 in 10 in slope
Equal to or less than 5,000	0.200	0.250	0.150	0.165
10,000	0.130	0.163	0.100	0.110
15,000	0.096	0.120	0.070	0.077
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The portion of the total permitted exit access travel distance from the entrance to the vomitory or concourse to one of the following shall not exceed 200 feet (60 960 mm):

- 1.1. The closest riser of an exit access stairway.
- 1.2. The closest slope of an exit access ramp.
- 1.3. An exit.
2. In facilities with open-air assembly seating of Type III, IV or V construction, the total exit access travel distance to one of the following shall not exceed 400 feet (122 m):
 - 2.1. The closest riser of an exit access stairway.
 - 2.2. The closest slope of an exit access ramp.
 - 2.3. An exit.
3. In facilities with open-air assembly seating of Type I or II construction, the total exit access travel distance shall not be limited.

1030.8 Common path of egress travel. The common path of egress travel shall not exceed 30 feet (9144 mm) from any seat to a point where an occupant has a choice of two paths of egress travel to two exits.

Exceptions:

1. For areas serving less than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).
2. For smoke-protected or open-air assembly seating, the common path of egress travel shall not exceed 50 feet (15 240 mm).

1030.8.1 Path through adjacent row. Where one of the two paths of travel is across the aisle through a row of seats to another aisle, there shall be not more than 24 seats between the two aisles, and the minimum clear width between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row between aisles.

Exception: For smoke-protected or open-air assembly seating there shall be not more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat.

1030.9 Assembly aisles are required. Every occupied portion of any building, room or space used for assembly purposes that contains seats, tables, displays, similar fixtures or equipment shall be provided with aisles leading to exits or exit access doorways in accordance with this section.

1030.9.1 Minimum aisle width. The minimum clear width for aisles shall comply with one of the following:

1. Forty-eight inches (1219 mm) for stepped aisles having seating on both sides.

Exception: Thirty-six inches (914 mm) where the stepped aisles serve less than 50 seats.

2. Thirty-six inches (914 mm) for stepped aisles having seating on only one side.

Exception: Twenty-three inches (584 mm) between a stepped aisle handrail and seating where a stepped aisle does not serve more than five rows on one side.

3. Twenty-three inches (584 mm) between a stepped aisle handrail or guard and seating where the stepped aisle is subdivided by a mid-aisle handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

Exceptions:

1. Thirty-six inches (914 mm) where the aisle serves less than 50 seats.
2. Thirty inches (762 mm) where the aisle serves less than 15 seats and does not serve as part of an accessible route.
5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.

Exception: Thirty inches (762 mm) where the aisle serves fewer than 15 seats and does not serve as part of an accessible route.

6. *Libraries with open book stacks shall have main aisles not less than 44 inches (1118 mm) in width, and side, range and end aisles not less than 36 inches (914 mm) in width.*

1030.9.2 Aisle catchment area. The aisle shall provide sufficient capacity for the number of persons accommodated by the catchment area served by the aisle. The catchment area served by an aisle is that portion of the total space served by that section of the aisle. In establishing catchment areas, the assumption shall be made that there is a balanced use of all means of egress, with the number of persons in proportion to egress capacity.

1030.9.3 Converging aisles. Where aisles converge to form a single path of egress travel, the required capacity of that path shall be not less than the combined required capacity of the converging aisles.

1030.9.4 Uniform width and capacity. Those portions of aisles, where egress is possible in either of two directions, shall be uniform in minimum width or required capacity.

1030.9.5 Dead-end aisles. Each end of an aisle shall be continuous to a cross aisle, foyer, doorway, vomitory, concourse or stairway in accordance with Section 1030.9.7 having access to an exit.

Exceptions:

1. Dead-end aisles shall be not greater than 20 feet (6096 mm) in length.
2. Dead-end aisles longer than 16 rows are permitted where seats beyond the 16th row dead-end aisle are not more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above

seven in the row where seats have backrests or beyond 10 where seats are without backrests in the row.

3. For smoke-protected or open-air assembly seating, the dead-end aisle length of vertical aisles shall not exceed a distance of 21 rows.
4. For smoke-protected or open-air assembly seating, a longer dead-end aisle is permitted where seats beyond the 21-row dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat above seven in the row where seats have backrests or beyond 10 where seats are without backrests in the row.

1030.9.6 Aisle measurement. The clear width for aisles shall be measured to walls, edges of seating and tread edges except for permitted projections.

Exception: The clear width of aisles adjacent to seating at tables shall be permitted to be measured in accordance with Section 1030.13.1.

1030.9.6.1 Assembly aisle obstructions. There shall not be obstructions in the minimum width or required capacity of aisles.

Exception: Handrails are permitted to project into the required width of stepped aisles and ramped aisles in accordance with Section 1014.8.

1030.9.7 Stairways connecting to stepped aisles. A stairway that connects a stepped aisle to a cross aisle or concourse shall be permitted to comply with the assembly aisle walking surface requirements of Section 1030.14. Transitions between stairways and stepped aisles shall comply with Section 1030.10.

1030.9.8 Stairways connecting to vomitories. A stairway that connects a vomitory to a cross aisle or concourse shall be permitted to comply with the assembly aisle walking surface requirements of Section 1030.14. Transitions between stairways and stepped aisles shall comply with Section 1030.10.

1030.10 Transitions. Transitions between stairways and stepped aisles shall comply with either Section 1030.10.1 or 1030.10.2.

1030.10.1 Transitions to stairways that maintain stepped aisle riser and tread dimensions. Stepped aisles, transitions and stairways that maintain the stepped aisle riser and tread dimensions shall comply with Section 1030.14 as one exit access component.

1030.10.2 Transitions to stairways that do not maintain stepped aisle riser and tread dimensions. Transitions between stairways and stepped aisles having different riser and tread dimensions shall comply with Sections 1030.10.2.1 through 1030.10.3.

1030.10.2.1 Stairways and stepped aisles in a straight run. Where stairways and stepped aisles are in a straight run, transitions shall have one of the following:

1. A depth of not less than 22 inches (559 mm) where the treads on the descending side of the transition have greater depth.
2. A depth of not less than 30 inches (762 mm) where the treads on the descending side of the transition have lesser depth.

1030.10.2.2 Stairways that change direction from stepped aisles. Transitions where the stairway changes direction from the stepped aisle shall have a minimum depth of 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater, between the stepped aisle and stairway.

1030.10.3 Transition marking. A distinctive marking stripe shall be provided at each nosing or leading edge adjacent to the transition. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide. The edge marking stripe shall be distinctively different from the stepped aisle contrasting marking stripe.

1030.11 Stepped aisles at vomitories. Stepped aisles that change direction at vomitories shall comply with Section 1030.11.1 Transitions between a stepped aisle above a vomitory and a stepped aisle to the side of a vomitory shall comply with Section 1030.11.2.

1030.11.1 Stepped aisles that change direction at vomitories. Stepped aisle treads where the stepped aisle changes direction at a vomitory shall have a depth of not less than 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater. The height of a stepped aisle tread above a transition at a vomitory shall comply with Section 1030.14.2.2.

1030.11.2 Stepped aisle transitions at the top of vomitories. Transitions between the stepped aisle above a vomitory and stepped aisles to the side of a vomitory shall have a depth of not less than 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater.

1030.12 Construction. Aisles, stepped aisles and ramped aisles shall be built of materials consistent with the types permitted for the type of construction of the building.

Exception: Wood handrails shall be permitted for all types of construction.

1030.12.1 Walking surface. The surface of aisles, stepped aisles and ramped aisles shall be of slip-resistant materials that are securely attached. The surface for stepped aisles shall comply with Section 1011.7.1.

1030.12.2 Outdoor conditions. Outdoor aisles, stepped aisles and ramped aisles and outdoor approaches to aisles, stepped aisles and ramped aisles shall be designed so that water will not accumulate on the walking surface.

1030.13 Aisle accessways. Aisle accessways for seating at tables shall comply with Section 1030.13.1. Aisle accessways for seating in rows shall comply with Section 1030.13.2.

1030.13.1 Seating at tables. Where seating is located at a table or counter and is adjacent to an aisle or aisle accessway, the measurement of required clear width of the aisle or aisle accessway shall be made to a line 19 inches (483 mm) away from and parallel to the edge of the table or counter. The 19-inch (483 mm) distance shall be measured perpendicular to the side of the table or counter. In the case of other side boundaries for aisles or aisle accessways, the clear width shall be measured to walls, edges of seating and tread edges.

Exception: Where tables or counters are served by fixed seats, the width of the aisle or aisle accessway shall be measured from the back of the seat.

1030.13.1.1 Aisle accessway capacity and width for seating at tables. Aisle accessways serving arrangements of seating at tables or counters shall comply with the capacity requirements of Section 1005.1 but shall not have less than 12 inches (305 mm) of width plus 1/2 inch (12.7 mm) of width for each additional 1 foot (305 mm), or fraction thereof, beyond 12 feet (3658 mm) of aisle accessway length measured from the center of the seat farthest from an aisle.

Exception: Portions of an aisle accessway having a length not exceeding 6 feet (1829 mm) and used by a total of not more than four persons.

1030.13.1.2 Seating at table aisle accessway length. The length of travel along the aisle accessway shall not exceed 30 feet (9144 mm) from any seat to the point where a person has a choice of two or more paths of egress travel to separate exits.

1030.13.2 Clear width of aisle accessways serving seating in rows. Where seating rows have 14 or fewer seats, the minimum clear aisle accessway width shall be not less than 12 inches (305 mm) measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats, the measurement shall be made with seats in the raised position. Where any chair in the row

does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet arm in the used position.

Exception: For seats with folding tablet arms, row spacing is permitted to be determined with the tablet arm in the stored position where the tablet arm when raised manually to vertical position in one motion automatically returns to the stored position by force of gravity.

1030.13.2.1 Dual access. For rows of seating served by aisles or doorways at both ends, there shall be not more than 100 seats per row. The minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14 seats where seats have backrests or beyond 21 where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

Exception: For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1030.13.2.1.

1030.13.2.2 Single access. For rows of seating served by an aisle or doorway at only one end of the row, the minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven seats where seats have backrests or beyond 10 where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

Exception: For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1030.13.2.1.

**TABLE 1030.13.2.1
SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY AISLE ACCESSWAYS**

NUMBER OF SEATS IN THE SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY SEATING	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY			
	Aisle or doorway at both ends of row		Aisle or doorway at one end of row only	
	Seats with backrests	Seats without backrests	Seats with backrests	Seats without backrests
Less than 4,000	14	21	7	10
4,000 to 6,999	15	22	7	10
7,000 to 9,999	16	23	8	11
10,000 to 12,999	17	24	8	11
13,000 to 15,999	18	25	9	12
16,000 to 18,999	19	26	9	12
19,000 to 21,999	20	27	10	13
22,000 and greater	21	28	11	14

For SI: 1 inch = 25.4 mm.

1030.14 Assembly aisle walking surfaces. Ramped aisles shall comply with Sections 1030.14.1 through 1030.14.1.3. Stepped aisles shall comply with Sections 1030.14.2 through 1030.14.2.4.

1030.14.1 Ramped aisles. Aisles that are sloped more than 1 unit vertical in 20 units horizontal (5-percent slope) shall be considered to be a ramped aisle. Ramped aisles that serve as part of an accessible route in accordance with Sections 1009 and 1109.2 shall have a maximum slope of 1 unit vertical in 12 units horizontal (8-percent slope). The slope of other ramped aisles shall not exceed 1 unit vertical in 8 units horizontal (12.5-percent slope).

1030.14.1.1 Cross slope. The slope measured perpendicular to the direction of travel of a ramped aisle shall not be steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

1030.14.1.2 Landings. Ramped aisles shall have landings in accordance with Sections 1012.6 through 1012.6.5. Landings for ramped aisles shall be permitted to overlap required aisles or cross aisles.

1030.14.1.3 Edge protection. Ramped aisles shall have edge protection in accordance with Sections 1012.10 and 1012.10.1.

Exception: In assembly spaces with fixed seating, edge protection is not required on the sides of ramped aisles where the ramped aisles provide access to the adjacent seating and aisle accessways.

1030.14.2 Stepped aisles. Aisles with a slope exceeding one unit vertical in eight units horizontal (12.5-percent slope) shall consist of a series of risers and treads that extends across the full width of aisles and complies with Sections 1030.14.2.1 through 1030.14.2.4.

1030.14.2.1 Treads. Tread depths shall be not less than 11 inches (279 mm) and shall have dimensional uniformity.

Exception: The tolerance between adjacent treads shall not exceed $\frac{3}{16}$ inch (4.8 mm).

1030.14.2.2 Risers. Where the gradient of stepped aisles is to be the same as the gradient of adjoining seating areas, the riser height shall be not less than 4 inches (102 mm) nor more than 8 inches (203 mm) and shall be uniform within each flight.

Exceptions:

1. Riser height nonuniformity shall be limited to the extent necessitated by changes in the gradient of the adjoining seating area to maintain adequate sightlines. Where nonuniformities exceed $\frac{3}{16}$ inch (4.8 mm) between adjacent risers, the exact location of such nonuniformities shall be indicated with a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide. The edge marking stripe shall be distinc-

tively different from the contrasting marking stripe.

2. Riser heights not exceeding 9 inches (229 mm) shall be permitted where they are necessitated by the slope of the adjacent seating areas to maintain sightlines.

1030.14.2.2.1 Construction tolerances. The tolerance between adjacent risers on a stepped aisle that were designed to be equal height shall not exceed $\frac{3}{16}$ inch (4.8 mm). Where the stepped aisle is designed in accordance with Exception 1 of Section 1030.14.2.2, the stepped aisle shall be constructed so that each riser of unequal height, determined in the direction of descent, is not more than $\frac{3}{8}$ inch (9.5 mm) in height different from adjacent risers where stepped aisle treads are less than 22 inches (560 mm) in depth and $\frac{3}{4}$ inch (19.1 mm) in height different from adjacent risers where stepped aisle treads are 22 inches (560 mm) or greater in depth.

1030.14.2.3 Tread contrasting marking stripe. A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be not less than 1 inch (25 mm) and not more than 2 inches (51 mm) wide.

Exception: The contrasting marking stripe is permitted to be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

1030.14.2.4 Nosing and profile. Nosing and riser profile shall comply with Sections 1011.5.5 through 1011.5.5.3.

1030.15 Seat stability. In a building, room or space used for assembly purposes, the seats shall be securely fastened to the floor.

Exceptions:

1. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating and with 200 or fewer seats, the seats shall not be required to be fastened to the floor.
2. In a building, room or space used for assembly purposes or portions thereof with seating at tables and without ramped or tiered floors for seating, the seats shall not be required to be fastened to the floor.
3. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating and with greater than 200 seats, the seats shall be fastened together in groups of not less than three or the seats shall be securely fastened to the floor.
4. In a building, room or space used for assembly purposes where flexibility of the seating arrangement is an integral part of the design and function of the space and seating is on tiered levels, not more than 200 seats shall not be required to be fastened to the

floor. Plans showing seating, tiers and aisles shall be submitted for approval.

5. Groups of seats within a building, room or space used for assembly purposes separated from other seating by railings, guards, partial height walls or similar barriers with level floors and having not more than 14 seats per group shall not be required to be fastened to the floor.
6. Seats intended for musicians or other performers and separated by railings, guards, partial height walls or similar barriers shall not be required to be fastened to the floor.

1030.16 Handrails. Ramped aisles having a slope exceeding one unit vertical in 15 units horizontal (6.7-percent slope) and stepped aisles shall be provided with handrails in compliance with Section 1014 located either at one or both sides of the aisle or within the aisle width. Where stepped aisles have seating on one side and the aisle width is 74 inches (1880 mm) or greater, two handrails are required. Where two handrails are required, one of the handrails shall be within 30 inches (762 mm) horizontally of the stepped aisle.

Exceptions:

1. Handrails are not required for ramped aisles with seating on both sides.
2. Handrails are not required where, at the side of the aisle, there is a guard with a top surface that complies with the graspability requirements of handrails in accordance with Section 1014.3.
3. Handrail extensions are not required at the top and bottom of stepped aisles and ramped aisles to permit crossovers within the aisles.

1030.16.1 Discontinuous mid-aisle handrails. Where there is seating on both sides of the aisle, the mid-aisle handrails shall be discontinuous. Where a stepped aisle is required to have two handrails, the mid-aisle handrails shall be discontinuous. Gaps or breaks shall be provided at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the mid-aisle handrail shall have rounded terminations or bends.

1030.16.2 Handrail termination. Handrails located on the side of stepped aisles shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent stepped aisle flight.

1030.16.3 Mid-aisle termination. Mid-aisle handrails shall not extend beyond the lowest riser and shall terminate within 18 inches (381 mm), measured horizontally, from the lowest riser. Handrail extensions are not required.

Exception: Mid-aisle handrails shall be permitted to extend beyond the lowest riser where the handrail extensions do not obstruct the width of the cross aisle.

1030.16.4 Rails. Where mid-aisle handrails are provided in stepped aisles, there shall be an additional rail located approximately 12 inches (305 mm) below the handrail.

The rail shall be adequate in strength and attachment in accordance with Section 1607.9.1.2.

1030.17 Assembly guards. Guards adjacent to seating in a building, room or space used for assembly purposes shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015 except where provided in accordance with Sections 1030.17.1 through 1030.17.4. At bleachers, grandstands and folding and telescopic seating, guards must be provided where required by ICC 300 and Section 1030.17.1.

1030.17.1 Perimeter guards. Perimeter guards shall be provided where the footboards or walking surface of seating facilities are more than 30 inches (762 mm) above the floor or grade below. Where the seatboards are adjacent to the perimeter, guard height shall be 42 inches (1067 mm) high minimum, measured from the seatboard. Where the seats are self-rising, guard height shall be 42 inches (1067 mm) high minimum, measured from the floor surface. Where there is an aisle between the seating and the perimeter, the guard height shall be measured in accordance with Section 1015.3.

Exceptions:

1. Guards that impact sightlines shall be permitted to comply with Section 1030.17.3.
2. Bleachers, grandstands and folding and telescopic seating shall not be required to have perimeter guards where the seating is located adjacent to a wall and the space between the wall and the seating is less than 4 inches (102 mm).

1030.17.2 Cross aisles. Cross aisles located more than 30 inches (762 mm) above the floor or grade below shall have guards in accordance with Section 1015.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

Exception: Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

1030.17.3 Sightline-constrained guard heights. Unless subject to the requirements of Section 1030.17.4, a fascia or railing system in accordance with the guard requirements of Section 1015 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating.

1030.17.4 Guards at the end of aisles. A fascia or railing system complying with the guard requirements of Section 1015 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be not less than 36 inches (914 mm) high and shall provide not less than 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest tread.

SECTION 1031 EMERGENCY ESCAPE AND RESCUE

1031.1 General. Emergency escape and rescue openings shall comply with the requirements of this section.

1031.2 Where required. In addition to the means of egress required by this chapter, emergency escape and rescue openings shall be provided in *Group R* occupancies.

Basements and sleeping rooms below the fourth story above grade plane shall have not fewer than one emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way or to a yard or court that opens to a public way.

Exceptions:

1. In *Groups R-1* and *R-2* occupancies constructed of *Type I*, *Type IIA*, *Type IIIA* or *Type IV* construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
2. *Group R-2.1* occupancies meeting the requirements for delayed egress in accordance with Section 1010.2.13 may have operable windows that are breakable in sleeping rooms permanently restricted to a maximum of 4-inch open position.
3. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
4. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior egress balcony that opens to a public way.
5. Basements without habitable spaces and having not more than 200 square feet (18.6 m²) in floor area shall not be required to have emergency escape and rescue openings.
6. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
7. Within individual dwelling and sleeping units in *Groups R-2* and *R-3*, where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 7.1. One means of egress and one emergency escape and rescue opening.
 - 7.2. Two means of egress.
8. In *Group R-2.2* occupancies a certified fire escape is acceptable as a secondary means of egress for existing buildings for this section of the code.

1031.2.1 Operational constraints and opening control devices. Emergency escape and rescue openings and any exit doors shall be maintained free of any obstructions other than those allowed by this section and shall be operational from inside the room without the use of keys or tools. Window-opening control devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening. The release mechanism shall be maintained operable at all times.

Such bars, grills, grates or any similar devices shall be equipped with an approved exterior release device for use by the fire department only when required by the authority having jurisdiction.

Where security bars (burglar bars) are installed on emergency egress and rescue windows or doors, on or after July 1, 2000, such devices shall comply with California Building Standards Code, Part 12, Chapter 12-3 and other applicable provisions of Part 2.

Exception: *Group R-1* occupancies provided with a monitored fire sprinkler system in accordance with Section 903.2.8 and designed in accordance with NFPA 13 may have operable windows permanently restricted to a maximum 4-inch (102 mm) open position.

1031.2.2 Maintenance. Fire escape stairways and balconies shall be kept clear and unobstructed at all times and shall be maintained in good working order.

1031.2.3 Examination. Fire escape stairways and balconies shall be examined for structural adequacy and safety by a registered design professional or other person acceptable to the fire code official every 5 years. The examination shall determine whether the fire escape stairways and balconies can support the dead load plus a live load of not less than 100 pounds per square foot (4.78 kN/m). An inspection report shall be submitted to the fire code official after such examination.

1031.3 Emergency escape and rescue openings. Emergency escape and rescue openings shall comply with Sections 1031.3.1 through 1031.3.3.

1031.3.1 Minimum size. Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.53 m²).

Exception: The minimum net clear opening for grade-floor emergency escape and rescue openings shall be 5 square feet (0.46 m²).

1031.3.2 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

1031.3.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

1031.4 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be a swinging door or a sliding door.

1031.5 Area wells. An emergency escape and rescue opening with the bottom of the clear opening below the adjacent grade shall be provided with an area well in accordance with Sections 1031.5.1 through 1031.5.3.

1031.5.1 Minimum size. The minimum horizontal area of the area well shall be 9 square feet (0.84 m²), with a horizontal projection and width of not less than 36 inches (914 mm). The area well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section 1031.5.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

1031.5.2 Ladders or steps. Area wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. The ladder or steps shall not be obstructed by the emergency escape and rescue opening when the window or door is in the open position. Ladders or steps required by this section shall not be required to comply with Section 1011.

1031.5.2.1 Ladders. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the area well.

1031.5.2.2 Steps. Steps shall have an inside width of not less than 12 inches (305 mm), shall have treads greater than 5 inches (127 mm) in depth and a riser height not greater than 18 inches (457 mm) for the full height of the area well.

1031.5.3 Drainage. Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section 1805.

Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, in accordance with Section 1803.5.1.

1031.6 Bars, grilles, covers and screens. Where bars, grilles, covers, screens or similar devices are placed over emergency escape and rescue openings or area wells that serve such openings, the minimum net clear opening size shall comply with Sections 1031.3 and 1031.5. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the emergency escape and rescue opening.

CHAPTER 11
RESERVED

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 11A – HOUSING ACCESSIBILITY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter						X																	
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below							X																
Chapter / Section																							
1150A.1							X																

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CHAPTER 11A

HOUSING ACCESSIBILITY

NOTE 1: Covered multifamily dwellings may be subject to the requirements of more than one jurisdiction or law, which would require compliance with each law. Where federal, state or local laws differ, the more stringent requirements apply. For additional information, see the Joint Statement of the Department of Housing and Urban Development and the Department of Justice issued April 30, 2013 (www.hud.gov).

NOTE 2: Dwelling units constructed as senior citizen housing may also be subject to the Unruh Civil Rights Act. Refer to Division I, Part 2 of the California Civil Code. For additional information regarding application, interpretation and enforcement, contact the California Department of Fair Employment and Housing.

Division I – APPLICATION, GENERAL PROVISIONS AND DEFINITIONS

Division I Table of Contents

- Section 1101A Application
- Section 1102A Building Accessibility
- Section 1103A Design and Construction
- Section 1104A Covered Multifamily Dwellings
- Section 1105A Garages, Carports and Parking Facilities
- Section 1106A Site and Building Characteristics
- Section 1107A Definitions

SECTION 1101A APPLICATION

1101A.1 Scope. The application and authority of this chapter are identified and referenced in Sections 1.8.2.1.2 and 1102A for the Department of Housing and Community Development. Applicable sections are identified in the Matrix Adoption Tables of this code under the abbreviation HCD 1-AC. The provisions of this chapter shall apply to the following:

1. All newly-constructed covered multifamily dwellings.
2. New common use areas serving existing covered multifamily dwellings.
3. Additions to existing buildings, where the addition alone meets the definition of a covered multifamily dwelling.
4. New common-use areas serving new covered multifamily dwellings.
5. Where any portion of a building's exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of this chapter.

Chapter 11A generally does not apply to public accommodations such as hotels and motels and public housing. Public use areas, public accommodations and public housing as defined in Chapter 2 of this code are subject to provisions of the Division of the State Architect (DSA-AC) in Chapter 11B, and are referenced in Section 1.9.1.

Newly constructed covered multifamily dwellings, which can also be defined as public housing, shall be subject to the requirements of Chapter 11A and Chapter 11B.

SECTION 1102A BUILDING ACCESSIBILITY

1102A.1 Where required. Buildings or portions of buildings and facilities within the scope of this chapter shall be accessible to persons with disabilities. Each building on a building site shall be considered separately when determining the requirements contained in this chapter, except when calculating the number of units which must comply with Section 1102A.3.1. Dwelling units within a single structure separated by firewalls do not constitute separate buildings.

Newly-constructed covered multifamily dwellings as defined in this chapter, include, but are not limited to, the following:

1. Apartment buildings with 3 or more dwelling units including timeshare apartments not considered a place of public accommodation or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
2. Condominiums with 4 or more dwelling units including timeshare condominiums not considered a place of public accommodation or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
3. Lodging houses, as defined in Chapter 2 of the California Building Code, used as a residence with more than 3 but not more than 5 guest rooms.
4. Congregate residences, as defined in Chapter 2 of the California Building Code, with 3 or more sleeping units.
5. Dwellings with 3 or more efficiency units, as defined in Chapter 2 of this code, or Section 17958.1 of the California Health and Safety Code.
6. Shelters for homeless persons, not otherwise subject to the disabled access provisions of the Division of the State Architect-Access Compliance (DSA-AC).
7. Dormitories, as defined in Chapter 2 of this code, with 3 or more guest rooms as defined in Chapter 2 of the California Building Code.
8. Timeshare dwellings with 3 or more units, not considered a place of public accommodations or transient lodging as defined in Health and Safety Code Section 19955 (a), and Chapter 2 of the California Building Code.
9. Other Group R occupancies in covered multifamily dwellings which are regulated by the Office of the State Fire Marshal. See Section 1.11.

HOUSING ACCESSIBILITY

10. Public housing as defined in Chapter 2 of this code is subject to provisions of the Division of the State Architect (DSA-AC) in Chapter 11B. Newly constructed covered multifamily dwellings, which can also be defined as public housing, shall be subject to the requirements of Chapter 11A and Chapter 11B.

1102A.2 Existing buildings. The building standards contained in this chapter do not apply to the alteration, repair, rehabilitation or maintenance of multifamily dwellings constructed for first occupancy on or before March 13, 1991.

Covered multifamily dwellings shall be maintained in compliance with the accessibility standards in effect at the time of construction. Apartments constructed prior to March 13, 1991 shall be maintained in compliance with the accessibility standards in effect at the time of construction.

Additions shall be subject to the requirements of this chapter, provided the addition, when considered alone, meets the definition of a covered multifamily dwelling, as defined in Chapter 2. New common use spaces serving existing covered multifamily dwellings shall be subject to the requirements of this chapter.

Note: For all existing public use areas, public accommodations and public housing, see Chapter 11B for provisions of the Division of the State Architect-Access Compliance (DSA-AC).

1102A.3 Multistory dwellings.

1102A.3.1 Multistory apartment or condominium dwellings in buildings with no elevator. This section shall apply to multistory dwelling units on the ground floor of buildings without elevators for which an application for a construction permit is submitted on or after July 1, 2005.

Exception: Carriage units as defined in Chapter 2 and regulated only by the Department of Housing and Community Development as referenced in Section 1.8.2.1.2.

At least 10 percent but not less than one of the multistory dwellings in apartment buildings with 3 or more dwelling units and/or condominiums with 4 or more dwelling units shall comply with the following:

1. The primary entry to the dwelling unit shall be on an accessible route unless exempted by site impracticality tests in Section 1150A.
2. At least one powder room or bathroom shall be located on the primary entry level, served by an accessible route and shall comply with the provisions in Division IV.
3. All rooms or spaces located on the primary entry level shall be served by an accessible route and shall comply with the provisions in Division IV. Rooms and spaces located on the primary entry level and subject to this chapter may include but are not limited to kitchens, powder rooms, bathrooms, living rooms, bedrooms or hallways.
4. Common use areas covered by this section shall be accessible as required by this chapter. Public use areas as defined in Chapter 2 of this code are sub-

ject to provisions of the Division of the State Architect (DSA-AC) and are referenced in Section 1.9.1.1.

The minimum number of multifamily dwelling units which must comply with this section shall be calculated using the total number of all multistory dwelling units in buildings on a site which are subject to this section. Any fraction thereof shall be rounded to the next highest whole number.

1102A.3.2 Multistory dwelling units in buildings with one or more elevators. Multistory dwelling units contained in buildings with elevators shall comply with this section. For multistory dwelling units in buildings with elevators, the story of the unit that is served by the building elevator is considered a ground floor and the primary entry floor to the unit and shall comply with the following:

1. At least 1 powder room or bathroom shall be located on the primary entry level.
2. At least 1 kitchen shall be located on the primary entry level.
3. All rooms or spaces located on the primary entry level shall be served by an accessible route and shall comply with Division IV.

1102A.4 Temporary restrictions. During periods of partial or restricted use of a building or facility, the entrances used for primary access shall be accessible to and usable by persons with disabilities.

SECTION 1103A DESIGN AND CONSTRUCTION

1103A.1 General. When buildings are required to be accessible, they shall be designed and constructed as provided in this chapter.

SECTION 1104A COVERED MULTIFAMILY DWELLINGS

1104A.1 General. All ground-floor dwelling units in nonelevator buildings shall be adaptable and on an accessible route, unless an accessible route is not required as determined by site impracticality provisions in Section 1150A. For buildings with elevators, see Section 1106A.

Multistory dwelling units shall comply with Section 1102A.3.

1104A.2 Ground floors above grade. Where the first floor containing dwelling units in a building is above grade, all units on that floor shall be served by an accessible route. This floor will be considered a ground floor and all dwelling units are considered covered multifamily dwelling units.

Exception: Carriage units as defined in Chapter 2 and regulated only by the Department of Housing and Community Development as referenced in Section 1.8.2.1.2.

Multistory dwelling units shall comply with Section 1102A.3.

**SECTION 1105A
GARAGES, CARPORTS AND PARKING FACILITIES**

1105A.1 General. Garages, carports and other parking facilities, which are accessory to covered multifamily dwelling units, shall be accessible as required in Section 1109A.

**SECTION 1106A
SITE AND BUILDING CHARACTERISTICS**

1106A.1 General. Covered multifamily dwellings with elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route, regardless of terrain or unusual characteristics of the site. Covered multifamily dwellings without elevators shall be designed and constructed to provide at least one accessible entrance on an accessible route unless terrain or unusual characteristics of the site prevent an accessible route based on the conditions listed below:

1. **Accessible entrance.** Regardless of site considerations described in Section 1150A, an accessible entrance on an accessible route is required when there is an elevator connecting the parking area with the dwelling units on a ground floor. (In this case, those dwelling units on the ground floor served by an elevator and at least one of each type of public- and common-use areas, would be subject to these requirements.)
2. **Elevator building.** When a building elevator or elevators are provided as a means of access to dwelling units other than dwelling units on a ground floor (see Section 1104A.2), the building is an elevator building. All dwelling units become covered multifamily dwellings in

that building. The elevator in that building must provide accessibility to all dwelling units in the building, regardless of the slope of the natural terrain. For multistory dwelling units in buildings with one or more elevators, see Section 1102A.3.2.

Note: Where a building elevator is provided only as means of creating an accessible route to covered multifamily dwelling units on a ground floor, the building is not considered to be an elevator building, only dwelling units located on the ground floor shall be required to comply with this chapter.

3. **Elevated walkway.** When an elevated walkway is planned between a building entrance and a vehicular or pedestrian arrival point and the planned walkway has a slope no greater than 10 percent (1 unit vertical in 10 units horizontal), the floor being served by the elevated walkway becomes a ground floor and accessibility to all dwellings on that ground floor is required.

Note: Since the planned walkway meets the 10 percent slope criterion, it is required to provide an accessible route to the entrance and the slope of the walkway must be reduced to 1 unit vertical in 12 units horizontal (8.33 percent slope) maximum.

1106A.2 Site impracticality. For tests to determine site impracticality due to terrain considerations in nonelevator buildings, see Section 1150A.

**SECTION 1107A
DEFINITIONS**

All definitions are located in Chapter 2.

Division II – EXTERIOR FACILITIES**Division II Table of Contents**

Section 1108A	General Requirements for Accessible Parking and Exterior Routes of Travel
Section 1109A	Parking Facilities
Section 1110A	Exterior Accessible Routes
Section 1111A	Changes in Level on Accessible Routes
Section 1112A	Curb Ramps on Accessible Routes
Section 1113A	Walks and Sidewalks on Accessible Routes
Section 1114A	Exterior Ramps and Landings on Accessible Routes
Section 1115A	Exterior Stairways
Section 1116A	Hazards on Accessible Routes

**SECTION 1108A
GENERAL REQUIREMENTS FOR ACCESSIBLE
PARKING AND EXTERIOR ROUTES OF TRAVEL**

Note: In addition to provisions of this division, exterior routes of travel that provide access to, or egress from, buildings for persons with disabilities shall also comply with Chapter 10.

**SECTION 1109A
PARKING FACILITIES**

1109A.1 Accessible parking required. Each parking facility provided for covered multifamily dwellings and facilities (e.g., swimming pools, club houses, recreation areas and laundry rooms) that serve covered multifamily dwellings shall provide accessible parking as required by this section.

1109A.2 Parking facilities. Parking facilities shall include, but not be limited to, the following:

1. Garages
2. Private garages
3. Carports
4. Off-street parking (parking lots/spaces)

1109A.2.1 Private garages. Private garages accessory to covered multifamily dwelling units, shall be accessible as required in Section 1109A. Private garages include individual garages and multiple individual garages grouped together.

Exception: A private garage attached to and directly serving a single covered multifamily dwelling unit providing at least one of the following options:

1. A door leading directly from the covered dwelling unit, which immediately enters the garage. The door shall comply on both sides with Sections 1132A.3 through 1132A.9.
2. An accessible route of travel from the covered dwelling unit to an exterior door entering the garage. See Section 1132A.1 for requirements at both exit doors.
3. An accessible route of travel from the dwelling unit's primary entry door to the vehicular

entrance at the garage. See Section 1132A.1 for requirements at the primary entry door.

1109A.3 Required accessible parking spaces. Accessible parking spaces shall be provided at a minimum rate of 2 percent of the covered multifamily dwelling units. At least one space of each type of parking facility shall be made accessible even if the total number exceeds 2 percent.

1109A.4 Assigned accessible parking spaces. When assigned parking spaces are provided for a resident or a group of residents, at least 2 percent of the assigned parking spaces serving covered multifamily dwelling units shall be accessible in each type of parking facility. At least one space of each type of parking facility shall be made accessible even if the total number exceeds 2 percent. When assigned parking is provided, signage as required by Section 1109A.8.8 shall not be required.

1109A.5 Unassigned and visitor parking spaces. When parking is provided for covered multifamily dwellings and is not assigned to a resident or a group of residents at least 5 percent of the parking spaces shall be accessible and provide access to grade-level entrances of covered multifamily dwellings and facilities (e.g., swimming pools, club houses, recreation areas and laundry rooms) that serve covered multifamily dwellings. Accessible parking spaces shall be provided with signage as required by Section 1109A.8.8. Such signage shall not be blocked from view by a vehicle parked in the space.

1109A.6 Requests for accessible parking spaces. When assigned parking is provided, designated accessible parking for the dwelling unit shall be provided on request of residents with disabilities on the same terms and with the full range of choices (e.g., off-street parking, carport or garage) that are available for other residents.

1109A.7 Location of accessible parking spaces. The location of accessible parking spaces shall comply with the following:

1. Accessible parking spaces shall be located on the shortest possible accessible route to an accessible building, or covered multifamily dwelling unit entrance. All van accessible spaces may be grouped on one level of a multilevel parking facility.
2. When parking facilities are located adjacent to a building with multiple accessible entrances, accessible parking spaces shall be dispersed and located near the accessible building entrances.
3. When practical, the accessible route shall not cross lanes for vehicular traffic. When crossing vehicle traffic lanes is necessary, the accessible route shall be designated and marked as a crosswalk.
4. Parking facilities that do not serve a particular building shall have accessible parking spaces located on the shortest possible accessible route to an accessible pedestrian entrance of the parking facility.
5. Accessible parking spaces shall be located so that persons with disabilities are not compelled to wheel or walk behind parked cars other than their own.

Exception: When the enforcement agency determines that compliance with this section or providing equivalent facilitation would create an unreasonable hardship, parking spaces may be provided

which would require a person with physical disabilities to wheel or walk behind other than accessible parking spaces.

1109A.8 Design and construction. Accessible parking required by this section shall be designed and constructed in accordance with Section 1109A.

1109A.8.1 Vertical clearances. All entrances, exits and vehicular passageways to and from required accessible parking spaces within parking facilities, shall have a minimum vertical clearance of 8 feet 2 inches (2489 mm) from the floor to the lowest projection of the ceiling. Reflective warning signs complying with Section 1143A for character height shall be installed at transitions from the 8 feet 2 inch ceiling to lower ceiling heights in vehicular passageways in the same parking level.

1109A.8.2 Arrangement of parking spaces. Parking spaces shall be arranged to comply with the following:

1. In each parking area, a bumper or curb shall be provided and located to prevent encroachment of cars over the required width of walkways.
2. Ramps, including curb ramps, shall not encroach into any accessible parking space or the adjacent loading and unloading access aisle.

1109A.8.3 Slope of accessible parking spaces and access aisles. Surface slopes of accessible parking spaces and access aisles shall be the minimum possible and shall not exceed $\frac{1}{4}$ inch (6.35 mm) per foot (2.083-percent gradient) in any direction.

1109A.8.4 Accessible parking space size. Accessible parking spaces shall comply with Sections 1109A.8.5 and 1109A.8.6.

1109A.8.5 Accessible single parking space. Where accessible single spaces are provided, they shall be constructed in accordance with the following:

1. Single spaces shall be 14 feet (4267 mm) wide minimum, and shall provide a 9-foot (2743 mm) wide parking area and a 5-foot (1524 mm) wide loading and unloading access aisle. Access aisles shall be permitted to be located on either side of the vehicle, and shall extend the full required length of the parking spaces they serve.
2. When more than one space is provided, two 9-foot (2743 mm) wide parking spaces may be lined on each side of a 5-foot (1524 mm) wide loading and unloading access aisle.
3. The minimum length of each parking space shall be 18 feet (5486 mm).
4. The loading and unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36 inches (914 mm) on center shall be painted a color contrasting with the parking surface, preferably blue or white. The words "NO PARKING" shall be painted on the ground within each 5-foot (1524 mm) wide loading and unloading access aisle. This notice shall be painted in white letters no less than 12 inches (305

mm) high and located so that it is visible from the adjacent vehicular way.

Note: See Figures 11A-2A, 11A-2B and 11A-2C.

1109A.8.6 Van accessible parking space. One in every eight accessible spaces, but not less than one, shall be van accessible and shall be constructed in accordance with the following:

1. Each van-accessible parking space shall be 17 feet (5181 mm) wide minimum, and shall provide either of the following:
 - 1.1. A 12-foot (3658 mm) wide minimum parking area and a 5-foot (1524 mm) wide minimum loading and unloading access aisle.
 - 1.2. A 9-foot (2743 mm) wide minimum parking area and an 8-foot (2438 mm) wide minimum loading and unloading access aisle.

Access aisles shall be located on the passenger side of the vehicle with the vehicle parked in the forward position, and shall extend the full required length of the parking spaces they serve.
2. The minimum length of each space shall be 18 feet (5486 mm).
3. Each space shall be designated "van accessible" as required by Section 1109A.8.8.
4. All van accessible spaces may be grouped on one level of a multilevel parking facility.
5. The loading and unloading access aisle shall be marked by a border painted blue. Within the blue border, hatched lines a maximum of 36 inches (914 mm) on center shall be painted a color contrasting with the parking surface, preferably blue or white. The words "NO PARKING" shall be painted on the ground within each loading and unloading access aisle. This notice shall be painted in white letters no less than 12 inches (305 mm) high and located so that it is visible from the adjacent vehicular way.

Note: See Figures 11A-2A, 11A-2B and 11A-2C.

1109A.8.7 Adjacent parking. Parking spaces adjacent to accessible parking spaces shall not be considered as loading and unloading access aisles.

1109A.8.8 Identification. Each accessible parking space shall be identified with signage and surface marking in accordance with Sections 1109A.8.8.1 and 1109A.8.8.2.

1109A.8.8.1 Parking signage. Each accessible parking space reserved for persons with disabilities shall be identified by a reflective sign consisting of the "International Symbol of Accessibility" complying with Section 1143A.8. The sign shall not be smaller than 70 square inches (4516 mm²) in area, and shall be posted 60 inches minimum above the finish floor or ground surface, measured to the bottom of the sign. Signs located on accessible routes shall be posted at a minimum height of 80 inches (2032 mm) above the finish floor or ground surface of the accessible route, measured to the bottom of the sign.

Signs identifying accessible parking spaces shall be visible from each parking space they serve, and shall be permanently posted immediately adjacent to the parking space or within the projected parking space width at the head end of the parking space. Signs may also be permanently posted on a wall at the interior end of the parking space.

Van accessible spaces shall comply with Section 1109A.8.6 and shall have an additional sign or additional language stating “Van Accessible” below the symbol of accessibility.

An additional sign shall also be posted in a conspicuous place at each entrance to off-street parking facilities or immediately adjacent to and visible from each accessible stall or space. The sign shall not be less than 17 inches (432 mm) by 22 inches (559 mm) in size with lettering not less than 1 inch (25.4 mm) in height, and shall clearly and conspicuously state the following:

“Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at the owner’s expense. Towed vehicles may be reclaimed at _____ or by telephoning _____.”

Blank spaces are to be filled in with appropriate information as a permanent part of the sign.

1109A.8.8.2 Parking space marking. In addition to the signage requirements, each accessible parking space shall have a surface identification complying with either of the following:

1. The parking space shall be outlined or painted blue, and shall be marked with the “International Symbol of Accessibility” in white or a suitable contrasting color. The “International Symbol of Accessibility” shall be 36 inches (914 mm) wide by 36 inches (914 mm) high minimum, with the centerline 6 inches (152 mm) maximum from the centerline of the parking space, its sides parallel to the length of the parking space, and its lower side aligned with the end of the parking space.
2. The parking space shall be marked with the “International Symbol of Accessibility”, in white on a blue background, 36 inches (914 mm) wide by 36 inches (914 mm) high minimum in size. The centerline of the “International Symbol of Accessibility” shall be 6 inches (152 mm) maximum from the centerline of the parking space, its sides shall be parallel to the length of the parking space, and its lower side shall be aligned with the end of the parking space length.

Note: See Figures 11A-2A, 11A-2B and 11A-2C.

SECTION 1110A EXTERIOR ACCESSIBLE ROUTES

1110A.1 General. When a building or portion of a building is required to be accessible or adaptable, an accessible route

shall be provided to all portions of the building, accessible building entrances and between the building and the public way. The accessible route shall be the most practical direct route and to the maximum extent feasible, coincide with the route for the general public and building residents.

Exterior accessible routes shall be provided as follows:

1. At least one accessible route within the boundary of the site shall be provided from public transportation stops, accessible parking and accessible passenger loading and unloading zones, and public streets or sidewalks to the accessible building entrance they serve. Where more than one route of travel is provided, all routes shall be accessible.
2. At least one accessible route shall connect accessible buildings, facilities, elements and spaces that are on the same site. Accessible routes shall be provided between accessible buildings and accessible site facilities when more than one building or facility is located on a site.
3. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces, elements and covered multifamily dwelling units.
4. An accessible route shall connect at least one accessible entrance of each covered multifamily dwelling unit with exterior spaces and facilities that serve the dwelling unit.
5. Where elevators are provided for vertical access, all elevators shall be accessible. See Section 1124A.

Note: If the slope of the finished grade between covered multifamily dwellings and site arrival points, public use or common use facilities (including parking) exceeds 1 unit vertical in 12 units horizontal (8.33-percent slope), or where other physical barriers (natural or artificial) or legal restrictions, all of which are outside the control of the owner, prevent the installation of an accessible route, an acceptable alternative is to provide access by a vehicular route, provided:

1. There is accessible parking on an accessible route for at least 2 percent of the covered multifamily dwelling units, and
2. Necessary site provisions such as parking spaces and curb ramps are provided at the public use or common use facility.

1110A.2 Signs. At every primary public entrance and at every major junction where the accessible route diverges from the circulation path along or leading to an accessible route, entrance or facility, there shall be a sign displaying the “International Symbol of Accessibility.” Signs shall indicate the direction to accessible building entrances and facilities and shall comply with the requirements found in Section 1143A.

1110A.3 Floor and ground surfaces. Floor and ground surfaces shall be stable, firm and slip resistant. If carpet or carpet tile is used in a common-use area or public-use area on a ground or floor surface, it shall have firm backing or no backing. Carpet or carpet tile shall have a level loop, textured loop, level cut pile or level cut/uncut pile texture. The maximum pile height shall be 1/2 inch (12.7 mm). Exposed

edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with Section 1111A requirements for changes in level.

1110A.3.1 Recessed doormats. Recessed doormats shall be adequately anchored to prevent interference with wheelchair traffic.

1110A.4 Exterior accessible routes over 200 feet. Exterior accessible routes that exceed 200 feet (60 960 mm) in length shall comply with Section 1138A.1.2. (See Figure 11A-1L)

SECTION 1111A CHANGES IN LEVEL ON ACCESSIBLE ROUTES

1111A.1 Changes in level not exceeding $\frac{1}{2}$ inch. Abrupt changes in level along any accessible route shall not exceed $\frac{1}{2}$ inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding $\frac{1}{4}$ inch (6.35 mm) may be vertical.

1111A.2 Changes greater than $\frac{1}{2}$ inch. Changes in level greater than $\frac{1}{2}$ inch (12.7 mm) shall be made by means of a sloped surface not greater than 1 unit vertical in 20 units horizontal (5-percent slope), or a curb ramp, ramp, elevator or platform (wheelchair) lift. Stairs shall not be part of an accessible route. When stairs are located along or adjacent to an accessible route they shall comply with Section 1115A for exterior stairways.

SECTION 1112A CURB RAMPS ON ACCESSIBLE ROUTES

1112A.1 General. Curb ramps within the boundary of the site shall be constructed at each corner of street intersections and where a pedestrian way crosses a curb. The preferred and recommended location for curb ramps is in the center of the crosswalk of each street corner. Where it is necessary to locate a curb ramp in the center of the curb return, the street surfaces shall be marked to identify pedestrian crosswalks, and the lower end of the curb ramp shall terminate within such crosswalk areas. Curb ramps do not require handrails.

1112A.2 Obstructions. Curb ramps shall be located or protected to prevent obstruction by parked cars. Built-up curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces or the adjacent loading and unloading access aisle.

1112A.3 Width of curb ramps. Curb ramps shall be a minimum of 48 inches (1219 mm) in width.

1112A.4 Diagonal curb ramps. If diagonal (or corner-type) curb ramps have returned curbs or other well-defined edges, such edges shall be parallel to the direction of pedestrian flow. The bottom of diagonal curb ramps shall have a 48-inch (1219 mm) minimum clear space as shown in Figures 11A-3A through 11A-3L. If diagonal curb ramps are provided at marked crossings, the 48-inch (1219 mm) clear space shall be within the markings (see Figures 11A-3A through 11A-3L). If diagonal curb ramps have flared sides, they shall also have at least a 24-inch-long (610 mm) segment of straight

curb located on each side of the curb ramp and within the marked crossing. See Figures 11A-3A through 11A-3L.

1112A.5 Slope of curb ramps. The slope of curb ramps shall not exceed 1 unit vertical to 12 units horizontal (8.33-percent slope) and shall lie, generally, in a single sloped plane. Transitions from ramps to walks, gutters or streets shall be flush and free of abrupt changes. Maximum slopes of adjoining gutters, road surface immediately adjacent to the curb ramp, or accessible route shall not exceed 1 unit vertical to 20 units horizontal (5-percent slope) within 4 feet (1219 mm) of the top and bottom of the curb ramp.

If a curb ramp is located where pedestrians must walk across the ramp, then it shall have flared sides; the maximum slope of the flare shall be 1 unit vertical in 10 units horizontal (10-percent slope). Curb ramps with returned curbs may be used where pedestrians would not normally walk across the ramp. See Figures 11A-3A through 11A-3L.

1112A.6 Level landing. A level landing 48 inches (1219 mm) deep shall be provided at the upper end of each curb ramp over its full width to permit safe egress from the ramp surface, or the slope of the fanned or flared sides of the curb ramp, shall not exceed 1 unit vertical to 12 units horizontal (8.33-percent slope).

1112A.7 Finish. The surface of each curb ramp and its flared sides shall be stable, firm and slip-resistant and shall be of contrasting finish from that of the adjacent sidewalk.

1112A.8 Border. All curb ramps shall have a grooved border 12 inches (305 mm) wide at the level surface of the sidewalk along the top and each side approximately $\frac{3}{4}$ inch (19 mm) on center. All curb ramps constructed between the face of the curb and the street shall have a grooved border at the level surface of the sidewalk. See Figures 11A-3A through 11A-3K.

1112A.9 Detectable warnings. See Chapter 11B.

SECTION 1113A WALKS AND SIDEWALKS ON ACCESSIBLE ROUTES

1113A.1 Width and continuous surface. Walks and sidewalks subject to this chapter shall have a continuous common surface, not interrupted by steps or by abrupt changes in level exceeding $\frac{1}{2}$ inch (12.7 mm). (See Section 1111A).

Walking surfaces shall be stable, firm and slip resistant, and shall comply with Section 1110A.3.

1113A.1.1 Width. Walks and sidewalks shall be a minimum of 48 inches (1219 mm) in width, except that walks serving an individual dwelling unit in covered multifamily buildings may be reduced to 36 inches (914 mm) in clear width except at doors.

1113A.1.2 Surface cross slopes. Surface cross slopes shall not exceed 1 unit vertical in 48 units horizontal (2.083-percent slope).

1113A.2 Walks with continuous gradients. All walks on an accessible route with continuous gradients shall have level areas at least 60 inches (1524 mm) in length at intervals of at least every 400 feet (122 m).

1113A.3 Five percent gradient. When the slope in the direction of travel of any walk on an accessible route exceeds 1

unit vertical in 20 units horizontal (5-percent slope), it shall comply with the ramp provisions of Section 1114A.

1113A.4 Level areas. Walks on an accessible route shall be provided with a level area at each side of a door or gate. Level areas shall comply with the applicable requirements for maneuvering clearances in Section 1126A.3.

1113A.5 Gratings. Walks, sidewalks and pedestrian ways on an accessible route shall be free of gratings whenever possible. Gratings located in the surface of any of these areas, grid openings in gratings shall be limited to 1/2 inch (12.7 mm) in the direction of traffic. Elongated openings in gratings shall be placed so that the long dimension is perpendicular to the dominant direction of traffic.

Exceptions:

1. Where the enforcement agency determines that compliance with this section would create an unreasonable hardship, an exception may be granted when equivalent facilitation is provided.
2. This section shall not apply in those conditions where, due to legal or physical constraints, all or portions of the site of the project will not allow compliance with these building standards or equivalent facilitation on all or portions of one site without creating an unreasonable hardship.

1113A.6 Handrails. Handrails provided along walking surfaces with running slopes not steeper than one unit vertical in 20 units horizontal (5-percent slope) shall comply with Section 1114A.6.

**SECTION 1114A
EXTERIOR RAMPS AND LANDINGS
ON ACCESSIBLE ROUTES**

1114A.1 Width. The clear width of ramps shall be consistent with the requirements in Chapter 10 of this code, but in no case shall be less than 48 inches (1219 mm)

Handrails may project into the required clear width of the ramp at each side 3 1/2 inches (89 mm) maximum at the hand-rail height. Curbs, wheel guides and/or appurtenances shall not project into the required clear width of ramps.

Exception: The clear width of ramps serving accessible entrances to covered multifamily dwellings with an occupant load of 10 or less may be 36 inches (914 mm) minimum between handrails.

Note: See Section 1114A.6.2.4 for handrail projections.

1114A.2 Slope. The maximum slope of ramps on an accessible route shall be no greater than 1 unit vertical in 12 units horizontal (8.33-percent slope). Transitions from ramps to walks, gutters or streets shall be flush and free of abrupt changes.

Exception: Ramps serving decks, patios or balconies as specified in Section 1132A.4.

1114A.2.1 Cross slope. The cross slope of ramp surfaces shall be no greater than 1 unit vertical in 48 units horizontal (2.083-percent slope).

1114A.3 Outdoor ramps. Outdoor ramps, ramp landings and their approaches shall be designed so that water will not accumulate on the walking surface.

1114A.4 Landings. Ramp landings shall be level and comply with this section.

1114A.4.1 Location of landings. Landings shall be provided at the top and bottom of each ramp. Intermediate landings shall be provided at intervals not exceeding 30 inches (762 mm) of vertical rise and at each change of direction. Landings are not considered in determining the maximum horizontal distance of each ramp.

Note: Examples of ramp dimensions are:

SLOPE (Grading %)	MAXIMUM RISE (Inches)	MAXIMUM HORIZONTAL PROJECTION (Feet)
	(x 25.4 for mm)	(x 304.8 for mm)
1:12 (8.33%)	30	30
1:15 (6.67%)	30	37.5
1:16 (6.25%)	30	40
1:20 (5.00%)	30	50

1114A.4.2 Size of top landings. Top landings shall not be less than 60 inches (1524 mm) wide. Top landings shall have a minimum length of not less than 60 inches (1524 mm) in the direction of the ramp run. See Section 1126A.3 for maneuvering clearances at doors.

1114A.4.3 Size of bottom and intermediate landings. The minimum width of bottom and intermediate landings shall not be less than the width of the ramp.

Intermediate landings shall have a length in the direction of ramp run of not less than 60 inches (1524 mm). Bottom landings shall have a length in the direction of ramp run of not less than 72 inches (1829 mm).

1114A.4.4 Encroachment of doors. Doors in any position shall not reduce the minimum dimension of the landing to less than 42 inches (1067 mm) and shall not reduce the required width by more than 3 inches (76.2 mm) when fully open. (See Figure 11A-6D).

1114A.4.5 Strike edge extension. The width of the landing shall comply with Section 1126A.3 for strike edge extension and maneuvering clearance at doors.

Where doorways are located adjacent to a ramp landing, maneuvering clearance required by Section 1126A.3 shall be permitted to overlap the required landing area.

1114A.4.6 Change of direction. Intermediate landings at a change of direction shall be sized to provide 60 inches turning space complying with Section 1138A.1.3. Intermediate landings at a change of direction in excess of 30 degrees shall have a length in the direction of ramp run of not less than 72 inches (1829 mm). (See Figures 11A-6C and 11A-6D.)

1114A.5 Ramp height. Ramps more than 30 inches (762 mm) above the adjacent floor or ground and open on one or both sides shall be provided with guardrails as required by Section 1013. Guardrails shall be continuous from the top of the ramp to the bottom of the ramp.

1114A.6 Ramp handrails.

1114A.6.1 Where required. Handrails shall be provided at each side of ramps when the slope exceeds 1 unit vertical in 20 units horizontal (5-percent slope).

Exceptions:

1. Curb ramps.
2. Ramps that serve an individual dwelling unit may have one handrail, except that ramps open on one or both sides shall have handrails provided on the open side or sides.
3. Ramps at exterior door landings with less than 6 inches (152 mm) rise or less than 72 inches (1829 mm) in length.

1114A.6.2 Handrail configuration.

1114A.6.2.1 Handrail heights. The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the ramp surface.

1114A.6.2.2 Handrail continuity. Handrails on all ramps shall be continuous within the full length of each ramp run. Inside handrails on switchback or dogleg ramps shall be continuous between ramp runs.

1114A.6.2.3 Handrail extensions. Handrails shall extend a minimum of 12 inches (305 mm) horizontally above landings, beyond the top and bottom of the ramp runs. Extensions shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent ramp run. Handrail extensions shall be in the same direction as the ramp runs. (See Figure 11A-5A.)

1114A.6.2.4 Handrail projections. Handrails projecting from a wall shall have a space of 1½ inches (38.1 mm) minimum between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B.)

1114A.6.2.5 Handrail gripping surfaces. Handrail gripping surfaces shall be continuous along their length, and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. When provided, horizontal projections shall occur 1½ inches (38 mm) minimum below the bottom of the handrail gripping surface. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by ⅛ inch (3.2 mm) for each ½ inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements, and shall have rounded edges.

Exception: Where handrails are provided along walking surfaces with slopes not steeper than 1 unit vertical in 20 units horizontal, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.

1114A.6.2.6 Cross section. Handrail gripping surfaces shall comply with this section, or the shape shall provide equivalent gripping surface.

1. **Circular cross section.** The handrail gripping surfaces with a circular cross section shall not be less than 1¼ inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension.
2. **Noncircular cross section.** Handrail gripping surfaces with a noncircular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6¼ inches (159 mm) maximum, and a cross-section dimension of 2¼ inches (57 mm) maximum.

1114A.6.2.7 Fittings. Handrails shall not rotate within their fittings.

1114A.7 Edge protection. Ramps and ramp landings shall be provided with a continuous and uninterrupted barrier on each side along the entire length in compliance with ramp provisions located in Chapter 10. (See Figure 11A-5A.)

Note: Extended floors or ground surfaces, as permitted in Chapter 10, are not allowed for ramps and ramp landings part of an accessible route.

SECTION 1115A EXTERIOR STAIRWAYS

1115A.1 General. Exterior stairways serving buildings on a site containing covered multifamily dwelling units shall comply with this section.

1115A.2 Open risers. Open risers are not permitted on exterior stairways.

Exceptions:

1. An opening of not more than ½ inch (12.7 mm) may be permitted between the base of the riser and the tread.
2. Risers constructed of grating containing openings of not more than ½ inch (12.7 mm) may be permitted.

1115A.3 Treads. All tread surfaces shall be stable, firm and slip resistant, and shall comply with Section 1110A.3. Treads shall have smooth, rounded or chamfered exposed edges, and no abrupt edges at the nosing (lower front edge).

1115A.4 Nosing. Nosing shall not project more than 1¼ inches (31.8 mm) past the face of the riser below. Risers shall be sloped or the underside of the nosing shall have an angle not more than 30 degrees (0.52 rad) from the vertical. (See Figure 11A-6A).

1115A.5 Striping for the visually impaired. Exterior stairs serving buildings on a site containing multifamily dwelling units shall have the upper approach and all treads marked by a stripe providing clear visual contrast.

The stripe shall be a minimum of 2 inches (50.8 mm) wide to a maximum of 4 inches (101.6 mm) wide placed parallel to, and not more than 1 inch (25.4 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A

Painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

1115A.6 Exterior stairway handrails.

1115A.6.1 Where required. Stairways shall have handrails on each side. Intermediate handrails shall be located equidistant from the sides of the stairway and comply with Section 1012.9.

Exception: Stairways serving an individual dwelling unit may have one handrail, except that stairways open on one or both sides shall have handrails on the open side or sides.

1115A.6.2 Handrail configuration.

1115A.6.2.1 Handrail heights. The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the nosing of the treads.

1115A.6.2.2 Handrail continuity. Handrails on all stairways shall be continuous within the full length of each stair flight. Inside handrails on switchback or dogleg stairs shall be continuous between stair flights.

1115A.6.2.3 Handrail extensions. At the top of stair flights, handrails shall extend a minimum of 12 inches (305 mm) horizontally above landings, beginning directly above the first riser nosing. Extensions shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent stair flight.

At the bottom of stair flights, handrails shall extend at the slope of the stair flight for a distance equal to one tread depth beyond the last riser nosing. Such extension shall continue with 12 inches (305 mm) minimum horizontal extension, shall be continuous to the handrail of an adjacent stair flight, or shall return to a wall, guard or the walking surface. Handrail horizontal extensions shall be in the same direction as the stair flights. (See Figures 11A-6A and 11A-6E.)

1115A.6.2.4 Handrail projections. Handrails projecting from a wall shall have a space of 1½ inches (38.1 mm) minimum between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B.)

1115A.6.2.5 Handrail gripping surfaces. Handrail gripping surfaces shall be continuous along their length, and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. When provided, horizontal projections shall occur 1½ inches (38.1 mm) minimum below the bottom of the handrail gripping surface. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by 1/8 inch (3.2 mm) for each 1/2 inch (12.7 mm) of addi-

tional handrail perimeter dimension that exceeds 4 inches (102 mm).

Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements, and shall have rounded edges.

1115A.6.2.6 Cross section. Handrail gripping surfaces shall comply with this section, or the shape shall provide equivalent gripping surface.

1. Circular cross section. Handrail gripping surfaces with a circular cross section shall not be less than 1¼ inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension.

2. Noncircular cross section. Handrail gripping surfaces with a noncircular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6¼ inches (159 mm) maximum, and a cross-section dimension of 2¼ inches (57 mm) maximum.

1115A.6.2.7 Fittings. Handrails shall not rotate within their fittings.

SECTION 1116A HAZARDS ON ACCESSIBLE ROUTES

1116A.1 Warning curbs. Abrupt changes in level exceeding 4 inches (101.6 mm) in vertical dimension, such as changes in level at planters or fountains located in or adjacent to walks, sidewalks or other pedestrian ways shall be identified by curbs or other approved barriers projecting at least 6 inches (152.4 mm) in height above the walk or sidewalk surface to warn the blind of a potential drop-off.

Exceptions:

- Between a walk or sidewalk and an adjacent street or driveway.
- When a guardrail or handrail is provided with edge protection in accordance with Section 1010.10.1.

1116A.2 Headroom clearance. Walks, pedestrian ways, and other circulation spaces, which are part of the required egress system, shall have a minimum clear headroom as required in Section 1003.2. Other walks, pedestrian ways and circulation spaces shall have a minimum clear headroom of 80 inches (2032 mm). If the vertical clearance of an area adjoining an accessible route is reduced to less than 80 inches (2032 mm), a guardrail or other barrier having its leading edge at or below 27 inches (686 mm) above the finished floor shall be provided.

Exception: Doorways and archways less than 24 inches (610 mm) in depth may have a minimum clear headroom of 80 inches (2032 mm). (See Section 1126A for door requirements.)

1116A.3 Overhanging obstructions. Any obstruction that overhangs a pedestrian way shall be a minimum of 80 inches (2032 mm) above the walking surface as measured from the bottom of the obstruction. (See Figure 11A-1B.) Where a guy support is used parallel to a path of travel,

including, but not limited to, sidewalks, a guy brace, sidewalk guy or similar device shall be used to prevent an overhanging obstruction. (See Section 1116A.2 for required headroom clearance.)

Exception: Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

1116A.4 Free-standing signs. Wherever signs mounted on posts or pylons protrude from the post or pylons and the bottom edge of the sign is less than 80 inches (2032 mm) above the finished floor or ground level, the edges of such signs shall be rounded or eased and the corners shall have a minimum radius of 0.125 inches (see Section 1116A.2 for required headroom clearance).

1116A.5 Detectable warnings at vehicular areas. When a walk crosses or adjoins a vehicular way, the walking surface shall be separated from the vehicular area by curbs, railings or other elements, or the boundary between the pedestrian areas and the vehicular areas shall be defined by a continuous detectable warning 36 inches (914 mm) wide minimum, complying with Chapter 11B, Section 11B-705.

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**SECTION 1117A
GENERAL REQUIREMENTS FOR ACCESSIBLE
ENTRANCES, EXITS, INTERIOR ROUTES OF
TRAVEL AND FACILITY ACCESSIBILITY**

Note: In addition to provisions of this division, interior routes of travel that provide access to, or egress from, buildings for persons with disabilities shall also comply with Chapter 10.

1117A.1 General. When buildings are required to be accessible, building facilities shall be accessible as provided in this division. Where specific floors of a building are required to be accessible, the requirements of this division shall apply only to the facilities located on accessible floors.

1117A.2 Primary entrances and exterior exit doors. All primary entrances and exterior ground floor exit doors to buildings and facilities on accessible routes shall be accessible to persons with disabilities.

1117A.3 Separate dwelling unit entrances. When a ground-floor dwelling unit of a building has a separate entrance, each such ground-floor dwelling unit shall be served by an accessible route, except where the terrain or unusual characteristics of the site prohibit an accessible route (see Section 1150A for site impracticality tests).

1117A.4 Multiple entrances. Only one entrance to covered multifamily buildings is required to be accessible to any one ground floor of a building, except in cases where an individual dwelling unit has a separate exterior entrance. Where the building contains clusters of dwelling units with each cluster sharing a different exterior entrance, more than one entrance may be required to be accessible, as determined by analysis of the site. In every case, the accessible entrance shall be on an accessible route to the covered dwelling units it serves.

1117A.5 Entrances from parking structures, tunnels or elevated walkways. Where direct access for pedestrians is provided from a parking structure to a building or facility, each direct access to the building or facility entrance shall be accessible.

Where direct access for pedestrians is provided from a pedestrian tunnel or elevated walkway to a building or facility,

all entrances to the building or facility from each tunnel or walkway shall be accessible.

**SECTION 1118A
EGRESS AND AREAS OF REFUGE**

1118A.1 General. Including but not limited to the requirements contained in this chapter for accessible routes, signage and emergency warning systems in buildings or portions of buildings required to be accessible shall be provided with accessible means of egress as required by Chapter 10. (See Section 1007.)

**SECTION 1119A
INTERIOR ACCESSIBLE ROUTES**

1119A.1 General. When a building or portion of a building is required to be accessible or adaptable, an accessible route shall be provided to all portions of the building, accessible building entrances and to covered multifamily dwelling units. The accessible route shall, to the maximum extent feasible, coincide with the route for the general public and other building residents. Accessible routes shall not pass through kitchens, storage rooms, restrooms, closets or other spaces used for similar purposes except within an individual dwelling unit.

Interior accessible routes shall be provided as follows:

1. Where more than one route of travel is provided, all routes shall be accessible.
2. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces, elements and covered multifamily dwelling units.
3. An accessible route shall connect at least one accessible primary entrance of each covered multifamily dwelling unit with interior and exterior spaces and facilities that serve the unit.
4. Where elevators are provided for vertical access, all elevators shall be accessible.

1119A.2 Floor and ground surfaces. Floor and ground surfaces shall be stable, firm and slip resistant. If carpet or carpet tile is used in a common use area or public use area on a ground or floor surface, it shall have firm backing or no backing. Carpet or carpet tile shall have a level loop, textured loop, level cut pile or level cut/uncut pile texture. The maximum pile height shall be 1/2 inch (12.7 mm). Exposed edges of carpet shall be fastened to floor surfaces and have trim along the entire length of the exposed edge. Carpet edge trim shall comply with Section 1121A requirements for changes in level.

1119A.2.1 Recessed doormats. Recessed doormats shall be adequately anchored to prevent interference with wheelchair traffic.

1119A.3 Widths. Interior accessible routes serving an occupant load of 10 or more shall not be less than 44 inches (1118 mm) in width. Interior accessible routes serving an occupant load of less than 10 shall not be less than 36 inches (914 mm) in width.

If a person in a wheelchair must make a turn around a corner or an obstruction, the minimum clear width of the accessible route shall be as specified in Section 1138A.1.5.

1119A.4 Interior accessible routes over 200 feet. Interior accessible routes that exceed 200 feet (60 960 mm) in length shall comply with Section 1138A.1.2. (See Figure 11A-1L.)

1119A.5 Changes in elevation. Interior accessible routes which have changes in elevation shall be transitioned and comply with Sections 1121A or 1122A.

Exception: Doors and thresholds as provided in Section 1126A.

SECTION 1120A Reserved

SECTION 1121A CHANGES IN LEVEL ON ACCESSIBLE ROUTES

1121A.1 Changes in level not exceeding 1/2 inch. Abrupt changes in level along any accessible route shall not exceed 1/2 inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding 1/4 inch (6.35 mm) may be vertical.

1121A.2 Changes greater than 1/2 inch. Changes in level greater than 1/2 inch (12.7 mm) shall be made by means of a sloped surface not greater than 1 unit vertical in 20 units horizontal (5-percent slope), or a curb ramp, ramp, elevator or platform (wheelchair) lift. Stairs shall not be part of an accessible route. When stairs are located along or adjacent to an accessible route they shall comply with Section 1123A for interior stairways.

SECTION 1122A INTERIOR RAMPS AND LANDINGS ON ACCESSIBLE ROUTES

1122A.1 Width. The clear width of ramps shall be consistent with the requirements in Chapter 10 of this code, but in no case shall be less than 48 inches (1219 mm).

Handrails may project into the required clear width of the ramp at each side 3 1/2 inches (89 mm) maximum at the handrail height. Curbs, wheel guides and/or appurtenances shall not project into the required clear width of ramps.

Exception: The clear width of ramps serving accessible entrances to covered multifamily dwellings with an occupant load of 10 or less may be 36 inches (914 mm) minimum between handrails.

Note: See Section 1122A.5.2.4 for handrail projections.

1122A.2 Slope. The maximum slope of ramps on an accessible route shall be no greater than 1 unit vertical in 12 units horizontal (8.33-percent slope).

1122A.2.1 Cross slope. The cross slope of ramp surfaces shall be no greater than 1 unit vertical in 48 units horizontal (2.083-percent slope).

1122A.3 Landings. Ramp landings shall be level and comply with this section. (See Figure 11A-6C.)

1122A.3.1 Location of landings. Landings shall be provided at the top and bottom of each ramp. Intermediate landings shall be provided at intervals not exceeding 30 inches (762 mm) of vertical rise and at each change of

direction. Landings are not considered in determining the maximum horizontal distance of each ramp.

Note: Examples of ramp dimensions are:

SLOPE (Grading %)	MAXIMUM RISE (Inches)	MAXIMUM HORIZONTAL PROJECTION (Feet)
	(x 25.4 for mm)	(x 304.8 for mm)
1:12 (8.33%)	30	30
1:15 (6.67%)	30	37.5
1:16 (6.25%)	30	40
1:20 (5.00%)	30	50

1122A.3.2 Size of top landings. Top landings shall not be less than 60 inches (1524 mm) wide. Top landings shall have a minimum length of not less than 60 inches (1524 mm) in the direction of the ramp run. See Section 1126A.3 for maneuvering clearances at doors. (See Figure 11A-6C.)

1122A.3.3 Size of bottom and intermediate landings. The minimum width of bottom and intermediate landings shall not be less than the width of the ramp.

Intermediate landings shall have a length in the direction of ramp run of not less than 60 inches (1524 mm).

Bottom landings shall have a length in the direction of ramp run of not less than 72 inches (1829 mm).

1122A.3.4 Encroachment of doors. Doors in any position shall not reduce the minimum dimension of the landing to less than 42 inches (1067 mm) and shall not reduce the required width by more than 3 inches (76.2 mm) when fully open. (See Figure 11A-6D.)

1122A.3.5 Strike edge extension. The width of the landing shall comply with Section 1126A.3 for maneuvering clearance at doors.

Where doorways are located adjacent to a ramp landing, maneuvering clearance required by Section 1126A.3 shall be permitted to overlap the required landing area.

1122A.3.6 Change of direction. Intermediate landings at a change of direction shall be sized to provide 60 inches turning space complying with Section 1138A.1.3. Intermediate landings at a change of direction in excess of 30 degrees shall have a length in the direction of ramp run of not less than 72 inches (1829 mm). (See Figures 11A-6C and 11A-6D.)

1122A.4 Ramp height. Ramps more than 30 inches (762 mm) above the adjacent floor or ground and open on one or both sides shall be provided with a guard as required by Section 1013. Guardrails shall be continuous from the top of the ramp to the bottom of the ramp.

1122A.5 Ramp handrails.

1122A.5.1 Where required. Handrails shall be provided at each side of ramps when the slope exceeds 1 unit vertical in 20 units horizontal (5-percent slope).

Exceptions:

1. Curb ramps.
2. Ramps that serve an individual dwelling unit may have one handrail, except that ramps open on one or both sides shall have handrails provided on the open side or sides.

1122A.5.2 Handrail configuration.

1122A.5.2.1 Handrail heights. The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the ramp surface.

1122A.5.2.2 Handrail continuity. Handrails on all ramps shall be continuous within the full length of each ramp run. Inside handrails on switchback or dogleg ramps shall be continuous between ramp runs.

1122A.5.2.3 Handrail extensions. Handrails shall extend a minimum of 12 inches (305 mm) horizontally above landings, beyond the top and bottom of the ramp runs. Extensions shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent ramp run. Handrail extensions shall be in the same direction as the ramp runs. (See Figure 11A-5A.)

1122A.5.2.4 Handrail projections. Handrails projecting from a wall shall have a space of 1½ inches (38.1 mm) minimum between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B.)

1122A.5.2.5 Handrail gripping surfaces. Handrail gripping surfaces shall be continuous along their length, and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. When provided, horizontal projections shall occur 1½ inches (38 mm) minimum below the bottom of the handrail gripping surface. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by ⅛ inch (3.2 mm) for each ½ inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements, and shall have rounded edges.

Exception: Where handrails are provided along walking surfaces with slopes not steeper than 1 unit vertical in 20 units horizontal, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.

1122A.5.2.6 Cross section. Handrail gripping surfaces shall comply with this section, or the shape shall provide equivalent gripping surface.

1. **Circular cross section.** The handrail gripping surfaces with a circular cross section shall not be less than 1¼ inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension.
2. **Noncircular cross section.** Handrail gripping surfaces with a noncircular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6¼ inches (159 mm) maximum, and a cross-section dimension of 2¼ inches (57 mm) maximum.

1122A.5.2.7 Fittings. Handrails shall not rotate within their fittings.

1122A.6 Edge protection. Ramps and ramp landings shall be provided with a continuous and uninterrupted barrier on each side along the entire length in compliance with Sections 1010.10 and 1010.10.1. (See Figure 11A-5A.)

Note: Extended floors or ground surfaces, as permitted in Section 1010.10.2, are not allowed for ramps and ramp landings providing access to, or egress from, buildings or facilities where accessibility is required.

SECTION 1123A INTERIOR STAIRWAYS

1123A.1 General. Interior stairways serving buildings containing covered multifamily dwelling units shall comply with this section.

1123A.2 Open risers. Open risers shall not be permitted on interior stairways.

Exception: Stairways within an individual dwelling unit.

1123A.3 Treads. All tread surfaces shall be stable, firm and slip resistant, and shall comply with Section 1119A.2. Treads shall have smooth, rounded or chamfered exposed edges and no abrupt edges at the nosing (lower front edge).

1123A.4 Nosing. Nosing shall not project more than 1¼ inches (31.8 mm) past the face of the riser below. Risers shall be sloped or the underside of the nosing shall have an angle not more than 30 degrees (0.52 rad) from the vertical. (See Figure 11A-6A.)

1123A.5 Striping for the visually impaired. Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast.

The stripe shall be a minimum of 2 inches (50.8 mm) wide to a maximum of 4 inches (101.6 mm) wide placed parallel to, and not more than 1 inch (25.4 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

Exception: Striping is not required for stairways within individual dwelling units.

1123A.6 Interior stairway handrails.

1123A.6.1 Where required. Stairways shall have handrails on each side. Intermediate handrails shall be located equidistant from the sides of the stairway and comply with Section 1012.9.

Exception: Stairways serving an individual dwelling unit may have one handrail, except that stairways open on one or both sides shall have handrails on the open side or sides.

1123A.6.2 Handrail configuration.

1123A.6.2.1 Handrail heights. The top of handrails shall be 34 to 38 inches (864 to 965 mm) above the nosing of the treads.

1123A.6.2.2 Handrail continuity. Handrails on all stairways shall be continuous within the full length of

each stair flight. Inside handrails on switchback or dogleg stairs shall be continuous between stair flights.

1123A.6.2.3 Handrail extensions. At the top of stair flights, handrails shall extend a minimum of 12 inches (305 mm) horizontally above landings, beginning directly above the first riser nosing. Extensions shall return to a wall, guard or the walking surface, or shall be continuous to the handrail of an adjacent stair flight.

At the bottom of stair flights, handrails shall extend at the slope of the stair flight for a distance equal to one tread depth beyond the last riser nosing. Such extension shall continue with 12 inches (305 mm) minimum horizontal extension, shall be continuous to the handrail of an adjacent stair flight, or shall return to a wall, guard or the walking surface. Handrail horizontal extensions shall be in the same direction as the stair flights. (See Figures 11A-6A and 11A-6E.)

Exception: Stairways within an individual dwelling unit.

1123A.6.2.4 Handrail projections. Handrails projecting from a wall shall have a space of 1½ inches (38.1 mm) minimum between the wall and the handrail.

Handrails may be located in a recess if the recess is a maximum of 3 inches (76.2 mm) deep and extends at least 18 inches (457 mm) above the top of the rail. Any wall or other surface adjacent to the handrail shall be free of sharp or abrasive elements. (See Figure 11A-6B.)

1123A.6.2.5 Handrail gripping surfaces. Handrail gripping surfaces shall be continuous along their length, and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. When provided, horizontal projections shall occur 1½ inches (38 mm) minimum below the bottom of the handrail gripping surface. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by ⅛ inch (3.2 mm) for each ½ inch (12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements, and shall have rounded edges.

1123A.6.2.6 Cross section. Handrail gripping surfaces shall comply with this section, or the shape shall provide equivalent gripping surface.

1. **Circular cross section.** The handrail gripping surfaces with a circular cross section shall not be less than 1¼ inches (31.75 mm) nor more than 2 inches (50.8 mm) in cross-sectional dimension.
2. **Noncircular cross section.** Handrail gripping surfaces with a noncircular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6¼ inches (159 mm) maximum, and a cross-section dimension of 2¼ inches (57 mm) maximum.

1123A.6.2.7 Fittings. Handrails shall not rotate within their fittings.

SECTION 1124A ELEVATORS AND PLATFORM (WHEELCHAIR) LIFTS

1124A.1 General. Elevators provided in covered multifamily buildings shall be accessible. Elevators required to be accessible shall comply with this chapter, ASME A17.1 (Safety Code for Elevators and Escalators), Title 8 of the California Code of Regulations, under “Elevator Safety Orders,” and any other applicable safety regulations of other administrative authorities having jurisdiction.

Exception: Private elevators serving only one dwelling unit.

1124A.2 Location. Passenger elevators shall be located on a major accessible route and provisions shall be made to ensure that they remain accessible and usable at all times that the building is occupied.

1124A.3 Size of cab and control locations.

1124A.3.1 General. Elevators serving covered multifamily buildings shall be sized to accommodate a wheelchair in accordance with this section.

Exception: When the enforcing agency determines that compliance with any requirement of this section would create an unreasonable hardship, an exception to the requirement shall be granted when equivalent facilitation is provided, and where it can be demonstrated that a person using a wheelchair can enter and operate the elevator.

1124A.3.2 Car inside. The elevator car shall be designed to comply with one of the following:

1. **Door centered on the wall.** When the door is centered on the car wall, it shall provide a clear width of 42 inches (1067 mm) minimum, and the clear distance between car side walls shall be 80 inches (2032 mm) minimum. The clear distance between the back wall and the return panel shall be 51 inches (1295 mm) minimum. The clear distance between the back wall and the inside face of the door shall be 54 inches (1372 mm) minimum.
2. **Door not centered on the wall.** When the door is not centered on the car wall, it shall provide a clear width of 36 inches (914 mm) minimum, and the clear distance between car side walls shall be 68 inches (1727 mm) minimum. The clear distance between the back wall and the return panel shall be 51 inches (1295 mm) minimum. The clear distance between the back wall and the inside face of the door shall be 54 inches (1372 mm) minimum.
3. **Door at any location.** An elevator door with 36 inches (914 mm) minimum clear width may be installed at any location if one of the following is met:
 - 3.1. The car inside, with the door closed, shall provide a turning clear space at least 60 inches (1524 mm) in diameter to allow for the turning of a wheelchair.
 - 3.2. The clear distance between car side walls shall be 54 inches (1372 mm) minimum. The clear distance between the back wall and the return panel shall be 80 inches (2032 mm)

minimum. The clear distance between the back wall and the inside face of the door shall be 80 inches (2032 mm) minimum.

Note: See Table 1124A.3.2 and Figure 11A-7A.

1124A.3.3 Car controls.

1124A.3.3.1 Car control location. Elevator floor buttons shall be located within one of the reach ranges specified in Section 1138A.3. Except for photoelectric tube bypass switches, emergency controls, including the emergency stop and alarm, shall be grouped in or adjacent to the bottom of the panel and shall be no lower than 35 inches (889 mm) from the floor. For multiple controls, only one set must comply with these height requirements. Floor buttons shall be provided with visual indicators to show when each call is registered. The visual indicators shall be extinguished when each call is answered.

1124A.3.3.2 Car control buttons. Passenger elevator car controls shall have a minimum dimension of $\frac{3}{4}$ inch (19.1 mm) and shall be raised $\frac{1}{8}$ inch (3.2 mm) plus or minus $\frac{1}{32}$ inch (0.8 mm) above the surrounding surface.

Control buttons shall be illuminated, shall have square shoulders and shall be activated by a mechanical motion that is detectable.

All control buttons shall be designated by a $\frac{5}{8}$ -inch-minimum (15.9 mm) raised characters and standard raised symbols that comply with Sections 1143A.6 and 1143A.7 immediately to the left of the control button. Contracted Grade 2 Braille that conforms to Section 1143A.7 shall be located immediately below the numeral, character or symbol. A minimum clear space of $\frac{3}{8}$ inch (9.5 mm) or other suitable means of separation shall be provided between rows of control buttons. (See Figure 11A-7B.)

The raised characters and symbols shall be white on a black background. Controls and emergency equipment identified by raised symbols shall include, but not be limited to, “door open,” “door close,” “alarm bell,” “emergency stop” and “telephone.” The call

button for the main entry floor shall be designated by a raised star at the left of the floor designation.

1124A.3.4 Emergency telephone. When an emergency telephone system is installed, the emergency telephone handset shall be positioned no higher than 48 inches (1219 mm) above the floor, and the handset cord shall be a minimum of 29 inches (737 mm) in length. If the telephone system is located in a closed compartment, the compartment door hardware shall conform to the provisions of Section 1138A.4.4. Emergency intercommunication shall not require voice communication.

1124A.4 Hall call buttons. Call operation buttons and keypads shall be located within one of the reach ranges specified in Section 1138A.3, measured to the centerline of the highest operable part. Buttons shall have square shoulders, shall be a minimum of $\frac{3}{4}$ inch (19.1 mm) in size, and shall be raised $\frac{1}{8}$ inch (3.2 mm) plus or minus $\frac{1}{32}$ inch (0.8 mm) above the surrounding surface. The button designating the “Up” direction shall be on top. A clear floor or ground space complying with Section 1138A.1.4 shall be provided at call controls.

Visual indication shall be provided to show each call registered and extinguished when answered. Objects adjacent to, and below, hall call buttons shall not project more than 4 inches (101.6 mm) from the wall. Hall call buttons shall be internally illuminated with a white light over the entire surface of the button.

1124A.5 Minimum illumination. The minimum illumination at the car controls threshold and the landing when the car and landing doors are open shall not be less than 5 foot-candles (54 lx).

1124A.6 Hall lantern. A visual and audible signal shall be provided at each hoistway entrance indicating to the prospective passenger the car answering the call and its direction of travel as follows:

1. The visual signal for each direction shall be a minimum of 2½ inches (63.5 mm) high by 2½ inches (63.5 mm) wide, and visible from the proximity of the hall call button.

**TABLE 1124A.3.2
ELEVATOR CAR DIMENSIONS**

DOOR LOCATION	MINIMUM DIMENSIONS			
	DOOR CLEAR WIDTH	INSIDE CAR, SIDE TO SIDE	INSIDE CAR, BACK WALL TO FRONT RETURN	INSIDE CAR, BACK WALL TO INSIDE FACE OF DOOR
Centered	42 inches (1067 mm)	80 inches (2032 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Side (off-centered)	36 inches (914 mm) ¹	68 inches (1727 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Any	36 inches (914 mm) ¹	54 inches (1372 mm)	80 inches (2032 mm)	80 inches (2032 mm)
Any	36 inches (914 mm) ²	60 inches (1524 mm) ²	60 inches (1524 mm) ²	60 inches (1524 mm) ²

1. A tolerance of minus $\frac{5}{8}$ inch (15.9 mm) is permitted.

2. Other car configurations that provide a turning space complying with Section 1138A.1.3 with the door closed shall be permitted.

2. The audible signal shall sound once for the “up” direction and twice for the “down” direction or of a configuration which distinguishes between up and down elevator travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency of 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call button.
3. The center line of the fixture shall be located a minimum of 6 feet (1829 mm) in height above the finish floor.
4. The use of in-car lanterns, located in or on the car doorjamb, visible from the proximity of the hall call buttons and conforming to the above requirements of this section, shall be acceptable.

Note: The use of arrow shapes are preferred for visible signals.

1124A.7 Door delay.

1124A.7.1 Hall call. The minimum acceptable time from notification that a car is answering a call (lantern and audible signal) until the doors of the car start to close shall be calculated by the following equations, but shall be no less than 5 seconds:

$$T = D / (1.5 \text{ ft/s}) \text{ or } T = D / (445 \text{ mm/s})$$

Where *T* is the total time in seconds and *D* is the distance from a point in the lobby or landing area 60 inches (1524 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door (see Figure 11A-7D). For cars with in-car lanterns, *T* begins when the lantern is visible from the vicinity of hall call buttons and an audible signal is sounded.

1124A.7.2 Door delay for car calls. The minimum acceptable time for the door to remain fully open after receiving a call shall not be less than 5 seconds.

1124A.8 Doorjamb marking. The floor level at all elevator hoistway entrances shall be designated by raised characters provided on both jambs. Characters shall be 2 inches (50.8 mm) in height located 48 inches (1219 mm) minimum above the finish floor, measured from the baseline of the lowest Braille cells, and 60 inches (1524 mm) maximum above the finish floor, measured from the baseline of the highest line of raised characters.

On the main entry level, a raised five-pointed star shall be placed to the left of the raised character. The outside diameter of the star shall be 2 inches (50.8 mm) and all points shall be of equal length. The raised characters and the star shall be white on a black background. Contracted Grade 2 Braille, conforming to Section 1143A.7, shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall state “MAIN”. The raised characters shall comply with Section 1143A.6. (See Figure 11A-7C.)

1124A.9 Door protective and reopening devices. Doors closed by automatic means shall be provided with a door-reopening device that will function to stop and reopen a car

door and adjacent hoistway door in case the car door is obstructed while closing.

This reopening device shall also be capable of sensing an object or person in the path of a closing door without requiring contact for activation at a nominal 5 inches and 29 inches (127 mm and 737 mm) above the floor.

Door-reopening devices shall remain effective for a period of not less than 20 seconds. After such an interval, the doors may close in accordance with the requirements of ASME A17.1.

1124A.10 Operation and leveling. The elevator shall be automatic and be provided with a self-leveling feature that will automatically bring the car to the floor landings within a tolerance of plus or minus 1/2 inch (12.7 mm) under rated loading to zero loading conditions. This self-leveling shall, within its zone, be entirely automatic and independent of the operating device and shall correct the overtravel or undertravel. The car shall also be maintained approximately level with the landing, irrespective of load.

The clearance between the car platform sill and the edge of the hoistway landing shall be no greater than 1 1/4 inches (31.75 mm).

1124A.11 Platform (wheelchair) lifts.

1124A.11.1 General. Platform (wheelchair) lifts may be provided between levels, in lieu of passenger elevators, when the vertical distance between landings, as well as the structural design and safeguards are as allowed by ASME A18.1 (Safety Standard for Platform Lifts and Stairway Chair Lifts), California Code of Regulations, Title 8 (Elevator Safety Orders), and any applicable safety regulations of other administrative authorities having jurisdiction.

If lifts are provided, they shall be designed and constructed to facilitate unassisted entry, operation and exit from the lift, and shall comply with restrictions and enhancements of this section in conjunction with Title 8 of the California Code of Regulations.

1124A.11.2 Size and clear floor space. Platform (wheelchair) lifts shall be of sufficient size to accommodate a wheelchair in accordance with Section 1138A.1.4.

1124A.11.3 Lift access. There shall be a level and clear floor area or landing at each floor or level served by platform (wheelchair) lifts. Clear floor areas or landings shall meet the applicable “accessible route” requirements.

1124A.11.4 Standby power. To ensure continued operation in case of primary power loss, platform (wheelchair) lifts shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of five upward and downward trips.

1124A.11.5 Openness. Platform (wheelchair) lifts on an accessible means of egress shall not be installed in a fully enclosed hoistway.

1124A.11.6 Doors and gates. Lifts shall have low energy power-operated doors or gates, which shall remain open for 20 seconds minimum. End doors shall have 32 inches

(813 mm) minimum clear opening width. Side doors clear opening width shall be 42 inches (1067 mm) minimum.

Exception: Lifts having doors or gates on opposite sides shall be permitted to have self-closing manual doors or gates.

1124A.11.7 Restriction sign. A sign complying with Section 1143A shall be securely fastened in a conspicuous place at each landing and on the platform. The sign shall state “No Freight” in letters not less than 5/8 inch (16 mm) high and include the “International Symbol of Accessibility.”

SECTION 1125A HAZARDS ON ACCESSIBLE ROUTES

1125A.1 Warning curbs. Abrupt changes in level exceeding 4 inches (101.6 mm) in vertical dimension, such as changes in level at planters or fountains located in or adjacent to walks, halls, corridors, passageways, aisles, pedestrian ways and other circulation spaces shall be identified by curbs projecting at least 6 inches (152.4 mm) in height above the walk or sidewalk surface to warn the blind of a potential drop-off.

Exception: When a guardrail or handrail is provided with edge protection in accordance with Section 1010.10.1.

1125A.2 Headroom clearance. Walks, halls, corridors, passageways, aisles, pedestrian ways and other circulation spaces which are part of the required egress system shall have a minimum clear headroom as required in Section 1003.2. Other walks, pedestrian ways and circulation spaces shall have a minimum clear headroom of 80 inches (2032 mm). If the vertical clearance of an area adjoining an accessible route is reduced to less than 80 inches (2032 mm), a guardrail or other barrier having its leading edge at or below 27 inches (686 mm) above the finished floor shall be provided.

Exception: Doorways and archways less than 24 inches (610 mm) in depth may have a minimum clear headroom of 80 inches (2032 mm). (See Section 1126A for door requirements.)

1125A.3 Overhanging obstructions. Any obstruction that overhangs a pedestrian way shall be a minimum of 80 inches (2032 mm) above the walking surface as measured from the bottom of the obstruction. (See Figure 11A-1B.) Where a guy support is used parallel to a path of travel, including, but not limited to, sidewalks, a guy brace, sidewalk guy or similar device shall be used to prevent an overhanging obstruction (see Section 1125A.2 for required headroom clearance).

Exception: Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

1125A.4 Free-standing signs. Wherever signs mounted on posts or pylons protrude from the posts or pylons and the bottom edge of the sign is less than 80 inches (2032 mm) above the finished floor or ground level, the edges of such signs shall be rounded or eased and the corners shall have a minimum radius of 0.125 inches. (See Section 1125A.2 for required headroom clearance).

SECTION 1126A DOORS, GATES AND WINDOWS

1126A.1 Width and height of doors and gates. Doorways which provide access to common use areas or covered multi-family dwellings shall comply with the following:

1. Permit the installation of a door or gate not less than 36 inches (914 mm) in width, not less than 80 inches (2032 mm) in height, and provide a clear opening of not less than 32 inches (813 mm), measured with the door positioned at an angle of 90 degrees from its closed position.
2. Doors or gates shall be capable of opening at least 90 degrees.
3. A pair of doors or gates, manual or automatic, shall have at least one leaf which provides a clear width of not less than 32 inches (813 mm), measured with the door or gate positioned at an angle of 90 degrees from its closed position.
4. The width of any component in the egress system shall not be less than the minimum width required by Section 1005.
5. Revolving doors or gates shall not be used as required entrances for persons with disabilities, and shall not be part of an accessible route.

1126A.2 Level floor or landing. The floor or landing on each side of an exit door or gate shall be level. (See Chapter 10.)

1126A.2.1 Thresholds and changes in elevation. The floor or landing shall not be more than 1/2 inch (12.7 mm) lower than the top of the threshold of the doorway. (See Figure 11A-8I.)

Changes in level between 1/4 inch (6.35 mm) and 1/2 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level greater than 1/2 inch (12.7 mm) shall be accomplished by means of a ramp. (See Section 1122A.)

1126A.3 Maneuvering clearances.

1126A.3.1 General. The minimum maneuvering clearance at doors or gates shall comply with Sections 1126A.3.2, 1126A.3.3 and 1126A.3.4. The floor or landing area within the required maneuvering clearance shall be level and clear. The required length shall be measured at right angles to the plane of the door or gate in its closed position. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearances (strike edge maneuvering clearances).

1126A.3.2 Swinging doors and gates.

1126A.3.2.1 Front approach. The following provisions shall apply to swinging doors or gates with front approach:

1. **Pull side approach.** The level floor or landing shall extend in the direction of the door or gate swing at least 60 inches (1524 mm). (See Figure 11A-8A(a).)
2. **Push side approach.** The level floor or landing shall extend in the direction of the door or gate swing at least 48 inches (1219 mm). (See Figure 11A-8A(a).)

3. **Doors and gates with push side approach having both a closer and a latch.** Doors or gates with push side approach having both a closer and a latch shall be provided with a clear and level area extending a minimum of 12 inches (305 mm) past the strike edge on the approach side of the door or gate. (See Figure 11A-8A(a).)

4. **Strike edge maneuvering space.** The width of the level area on the side to which the door or gate swings shall extend at least 24 inches (610 mm) past the strike edge for exterior doors or gates and at least 18 inches (457 mm) past the strike edge for interior doors or gates. (See Figure 11A-8A(a).)

Note: See Section 1132A.5 for maneuvering clearances at primary entry doors and all required exit doors to covered multifamily dwellings.

1126A.3.2.2 Hinge side approach. The following provisions shall apply to swinging doors or gates with hinge side approach:

1. **Pull side approach.** Doors or gates with pull side approach shall be provided with a level floor or landing not less than 60 inches (1524 mm) in depth. A clear and level area shall extend a minimum of 36 inches (914 mm) past the strike edge on the approach side of the door or gate. (See Figure 11A-8A(b).)
2. **Push side approach.** Doors or gates with push side approach shall have a level floor or landing not less than 44 inches (1118 mm) in depth, and shall be provided with a clear and level area extending a minimum of 54 inches (1372 mm) from the strike edge of the door or gate jamb past the hinge side of the door or gate. Doors or gates with a latch and closer shall have a level floor or landing not less than 48 inches (1219 mm) depth at the push side of the door or gate. (See Figure 11A-8A(b).)

1126A.3.2.3 Latch side approach. The following provisions shall apply to swinging doors or gates with latch side approach:

1. **Pull side approach.** Doors or gates with pull side approach shall have a level floor or landing not less than 60 inches (1524 mm) in depth, and shall be provided with a clear and level area extending a minimum of 24 inches (610 mm) past the strike edge on the approach side of the door or gate. (See Figure 11A-8A(c).)
2. **Push side approach.** Doors or gates with push side approach shall have a level floor or landing not less than 44 inches (1118 mm) in depth, and shall be provided with a clear and level area extending a minimum of 24 inches (610 mm) past the strike edge on the approach side of the door or gate. Doors or gates with a closer shall have a level floor or landing not less than 48 inches

(1219 mm) depth at the push side of the door or gate. (See Figure 11A-8A(c).)

1126A.3.3 Space between consecutive doors or gates. The minimum space between two hinged or pivoted doors or gates in series, serving other than a required exit stairway, shall provide a minimum of 48 inches (1219 mm) plus the width of the door or gate swinging into the space. Doors or gates in a series shall swing either in the same direction or away from the space between the doors or gates. (See Figures 11A-8G and 11A-8H.)

Where the door or gate opens into a stair or smokeproof enclosure, the landing need not have a minimum length of 60 inches (1524 mm). (See Figure 11A-8H.)

1126A.3.4 Doorways without doors or gates, sliding doors and folding doors. Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors or folding doors shall have maneuvering clearances complying with this section.

1126A.3.4.1 Front approach. The level floor or landing shall extend at least 48 inches (1219 mm) on each side, perpendicular to the doorway. Strike edge maneuvering clearance for front approach is not required. (See Figure 11A-8B(a).)

1126A.3.4.2 Side approach. Doorways without doors or gates, and side approach, shall be provided with level floor or landing extending 42 inches (1067 mm) minimum on each side, perpendicular to the doorway. Strike edge maneuvering clearance is not required. (See Figure 11A-8B(d).)

1126A.3.4.3 Pocket/ hinge side approach. Doors with pocket or hinge approach shall be provided with a level floor or landing not less than 42 inches (1067 mm) in depth. The level floor or landing shall extend a minimum of 22 inches (559 mm) beyond the pocket/hinge side. (See Figure 11A-8B(b).)

1126A.3.4.4 Stop/latch side approach. Doors with stop or latch approach shall have a level floor or landing not less than 42 inches (1067 mm) in depth. The level floor or landing shall extend a minimum of 24 inches (610 mm) beyond the stop/latch side. (See Figure 11A-8B(c).)

1126A.3.4.5 Recessed doors or gates. Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side of an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door or gate, measured perpendicular to the face of the door or gate. (See Figure 11A-8C.)

1126A.4 Closer-effort to operate doors or gates. Maximum effort to operate doors or gates shall not exceed 8½ pounds (38 N) for exterior doors or gates and 5 pounds (22 N) for interior doors or gates, such pull or push effort being applied at right angles to hinged doors or gates and at the center plane of sliding or folding doors. Compensating devices or automatic door or gate operators may be utilized to meet these standards. When fire doors are required, the maximum

effort to operate the door may be increased to the minimum allowable by the appropriate enforcement agency, not to exceed 15 pounds (66.7 N).

1126A.4.1 Door or gate closer. If a door or gate has a closer, the sweep period of the closer shall be adjusted so that from an open position of 90 degrees, the door or gate will take 5 seconds minimum to move to a position of 12 degrees from the latch.

1126A.4.2 Spring hinges. Spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum.

1126A.5 Type of latch and lock. The type of latch and lock required for all doors or gates shall be in accordance with Section 1126A.6 and Chapter 10, Section 1008.

1126A.6 Hand-activated door or gate hardware. Hand-activated door or gate latching, locking and opening hardware shall be centered between 30 inches (762 mm) and 44 inches (1118 mm) above the floor. Latching and locking doors or gates that are hand-activated and on an accessible route shall be operable with a single effort by lever type hardware, panic bars, push-pull activating bars or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. Locked exit doors or gates shall operate consistent with Section 1126A.4, in the direction of egress. When sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.

Exception: Access gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the release of latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

1126A.6.1 Lever type hardware. The lever or lever of actuated latches or locks shall be curved with a return to within $\frac{1}{2}$ inch (12.7 mm) of the door or gate to prevent catching on the clothing of persons during egress.

Exception: Group R and U occupancies with an occupant load of 10 or less.

1126A.7 Smooth surface. Swinging door or gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within $\frac{1}{16}$ inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped.

Exceptions:

1. Automatic doors or gates.
2. Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal.
3. Doors or gates that do not extend to within 10 inches (254 mm) of the finish floor or ground.

1126A.8 Windows. Where glazed openings are provided in accessible rooms or spaces for operation by occupants, at least one opening shall comply with Section 1138A.4.

Each glazed opening required by the enforcing agency to be operable shall comply with Section 1138A.4.

SECTION 1127A COMMON USE FACILITIES

Note: For public use facilities, see Chapter 11B of this code.

1127A.1 General. When provided, common use areas and facilities in covered multifamily housing developments shall be accessible to persons with disabilities. Common use facilities include, but are not limited to, lobbies, toilet and bathing facilities, laundry facilities, community rooms, clubhouses, health and fitness facilities, game rooms and portions of common use tenant storage. All entrances, doors, fixtures and controls shall be on an accessible route. Facilities and fixtures required to be accessible shall comply with the following provisions:

1. **Doors.** Doors to accessible bathrooms shall comply with Section 1126A. Doors shall not swing into the floor space required for any fixture.
2. **Clear floor space.** All fixtures and controls shall be on an accessible route. Clear floor spaces at fixtures and controls, the accessible route and the turning space may overlap. This clear space shall comply with Sections 1138A.1.4 and 1138A.3.
3. **Water closets.** Where a toilet stall is provided, it shall comply with Section 1127A.2.1 or 1127A.2.2, and its water closet shall comply with Section 1127A.2.3.
4. **Lavatory and mirrors.** Where a lavatory and/or mirror is provided, it shall comply with Sections 1127A.3 and/or 1127A.8.3.
5. **Controls and dispensers.** Where controls, dispensers, receptacles or other types of equipment are provided, at least one of each shall be on an accessible route and shall comply with Sections 1127A.8 and 1138A.3.
6. **Bathing and shower facilities.** Where bathtubs or showers are provided, at least one fixture of each type provided shall be accessible per room. For bathtubs, see Section 1127A.5.2. For shower compartments, see Section 1127A.5.3.
7. **Toilet facilities.** Toilet facilities shall comply with Section 1127A.2.
8. **Laundry facilities.** Laundry facilities shall comply with Section 1127A.10.
9. **Storage facilities.** Storage facilities shall comply with Section 1127A.11.
10. **Fixed or built-in seating, tables and counters.** Fixed or built-in seating, tables and counters shall comply with Section 1127A.12.

1127A.2 Toilet facilities. When common use toilet facilities are provided for residents or guests, at least one percent of the total number of fixtures but not less than one of each type shall comply with this section.

1127A.2.1 Multiple-accommodation toilet facilities. Multiple-accommodation toilet facilities shall have the following:

Note: (See Figures 11A-9A and 11A-9B.)

1. **Wheelchair turning space.** Turning space of sufficient size to inscribe a circle with a diameter not less than 60 inches (1524 mm) or a T-shaped space shall be provided within the toilet facility. The wheelchair turning space shall comply with Section 1138A.1.3. Other than the door to the accessible water closet compartment, a door, in any position, may encroach into this space by not more than 12 inches (305 mm).
2. **Clear space at fixtures.** Doors shall not swing into the clear floor space required for any fixture. Required clear floor space, clearance at fixtures, and turning space shall be permitted to overlap.
3. **Accessible water closet compartment.** Accessible water closet compartments shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, 56 inches (1422 mm) deep minimum for wall hung water closets and 59 inches (1499 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. (See Figure 11A-9A(c).)

Water closet fixtures located in accessible water closet compartments shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition.

In ambulatory accessible toilet compartments specified in Item 6 of this section, the water closet shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition. (See Figure 11A-9A (d).)

Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

A minimum 48 inches (1219 mm) deep and 60 inches (1524 mm) wide clear maneuvering space shall be provided in front of the water closet if the compartment has an end-opening door (facing the water closet). A minimum 60 inches (1524 mm) deep and 60 inches (1524 mm) wide clear maneuvering space shall be provided in a compartment with the door located at the side. (See Figure 11A-9A.)

4. **Grab bars.** Grab bars shall be provided on the side wall closest to the water closet and on the rear wall.

Grab bars shall comply with this section and Section 1127A.4.

The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extend 54 inches (1372 mm) minimum from the rear wall. The front end of the side grab bar shall be positioned 24 inches (610 mm) minimum in front of the water closet.

The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

Exceptions:

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, when wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
 2. When the enforcing agency requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.
5. **Compartment doors.** Compartment doors shall comply with Section 1126A and the following:
 - 5.1. The water closet compartment shall be equipped with a door that has an automatic-closing device, and shall have a clear, unobstructed opening width of 32 inches (813 mm) when located at the end and 34 inches (864 mm) when located at the side with the door positioned at an angle of 90 degrees from its closed position.
 - 5.2. When standard compartment doors are used, with a minimum 9-inch (228.6 mm) clearance for footrests underneath and a self-closing device, clearance at the strike edge as specified in Section 1126A.3.2 is not required.
 - 5.3. The inside and outside of the compartment door shall be equipped with a loop or U-shaped handle immediately below the latch. The latch shall be flip-over style, sliding or other hardware not requiring the user to grasp or twist.
 - 5.4. Except for door-opening widths and door swings, a clear, unobstructed access of not less than 44 inches (1118 mm) shall be provided to water closet compartments designed for use by persons with disabilities, and the space immediately in front of a water closet compartment shall not be less than 48 inches (1219 mm) as measured at right angles to compartment door in its closed position.
 - 5.5. Doors shall be located in the front or in the side wall or partition farthest from the water

closet. Where located in the front partition, the door opening shall be 4 inches (102 mm) maximum from the side wall or partition. Where located in the side wall or partition, the door opening shall be 4 inches (102 mm) maximum from the front wall or partition.

6. **Ambulatory accessible compartments.** When six or more toilet compartments are provided within a multiple-accommodation toilet room, or when the combination of urinals and water closets totals six or more fixtures, at least one compartment shall comply with Section 1127A.2.1, Items 2 and 3. At least one additional ambulatory compartment shall have a depth of 60 inches (1524 mm) minimum, and a width of 35 inches (890 mm) minimum and 37 inches (940 mm) maximum.

The ambulatory accessible compartment shall have a self-closing door, which shall not swing into the minimum required compartment area. Grab bars, complying with Sections 1127A.4.2, 1127A.4.3, 1127A.4.4 and 1127A.4.5, shall be installed on each compartment side wall. (See Figure 11A-9A (d).)

1127A.2.2 Single-accommodation toilet facilities. Single-accommodation toilet facilities shall comply with the following:

Note: See Figures 11A-9A and 11A-9B.

1. **Wheelchair clearance.** There shall be sufficient space in the toilet room for a wheelchair measuring 30 inches (762 mm) wide by 48 inches (1219 mm) long to enter the room and permit the door to close. There shall be in the room a clear turning space of at least 60 inches (1524 mm) in diameter or a T-shaped space complying with Section 1138A.1.3.

Required clear floor space, clearance at fixtures and turning space shall be permitted to overlap.

2. **Encroachment of doors.** Doors shall not encroach into the turning space specified in Item 1 of this section by more than 12 inches (305 mm).
3. **Accessible water closet.** A water closet fixture located in a single-accommodation toilet facility shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition.

Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures, and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

A minimum 48 inches (1219 mm) deep and 60 inches (1524 mm) wide clear maneuvering space shall be provided in front of the water closet.

4. **Grab bars.** Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. Grab bars shall comply with this section and Section 1127A.4.

The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extend 54 inches (1372 mm) minimum from the rear wall. The front end of the side grab bar shall be positioned 24 inches (610 mm) minimum in front of the water closet.

The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the centerline of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

Exceptions:

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, when wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
2. When the enforcing agency requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.
5. **Accessible route.** All doors, fixtures and controls shall be on an accessible route. The minimum clear width of an accessible route shall be 36 inches (914 mm) except at doors (See Section 1126A). If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as specified in Section 1138A.1.5.

1127A.2.3 Water closets. Water closets required to be accessible shall comply with the following:

Note: See Figure 11A-9B.

1. **Height.** The height of accessible water closets shall be a minimum of 17 inches (432 mm) to a maximum of 19 inches (483 mm) measured to the top of a maximum 2-inch-high (50.8 mm) toilet seat.
2. **Controls.** Flush controls shall be hand operated or automatic. Hand operated controls shall be operable with one hand and shall not require tight grasping, pinching or twisting. Controls for the flush valves shall be mounted on the open side of the water closet no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N).
3. **Toilet seats.** Seats shall not be sprung to return to a lifted position.

1127A.2.4 Accessible urinals. When urinals are provided, at least one shall comply with the following:

1. **Height and wall projection.** Urinals shall be floor mounted (stall type) or wall hung. The rim of the wall hung urinals shall be 17 inches (432 mm) maximum above the finish floor. Urinals (floor mounted and wall hung) shall be 13½ inches (343 mm) deep minimum measured from the outer face of the rim to the back of the fixture.
2. **Flush controls.** Flush controls shall be hand operated or automatic. Hand operated controls shall be operable with one hand, shall not require tight grasping, pinching or twisting of the wrist and shall be mounted no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N). Electronic automatic flushing controls are preferable.
3. **Clear floor space.** A clear floor space 30 inches by 48 inches (762 mm by 1219 mm) shall be provided in front of the urinal to allow forward approach. The clear floor space shall comply with Section 1138A.1.4.

1127A.3 Accessible lavatories. When common use lavatories are provided for residents or guests, at least one, and not less than 1 percent of all lavatories, shall comply with the following:

1. **Location.** Lavatories shall be installed with the centerline of the fixture a minimum of 18 inches (457 mm) horizontally from an adjoining wall, partition or fixture. The top of the fixture rim shall be a maximum of 34 inches (864 mm) above the finished floor.
2. **Floor space.** A clear floor space at least 30 inches by 48 inches (762 mm by 1219 mm) shall be provided in front of accessible lavatories to allow forward approach. Such clear floor space shall adjoin or overlap an accessible route or another clear floor space.
3. **Knee and toe space.** A clear and obstructed knee and toe space, complying with Section 1138A.2, shall be provided underneath the lavatory. The knee and toe space shall be centered on the fixture. The clear floor space required by Item 2 shall not extend into the knee and toe space more than 19 inches (483 mm). (See Figure 11A-9D.)
4. **Finished floor.** The finished floor beneath the lavatory shall be extended to the wall.
5. **Plumbing protection.** Water supply and drain pipes under lavatories shall be insulated or otherwise covered to protect against contact. There shall be no sharp or abrasive surfaces under lavatories.
6. **Lavatory faucet controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds (22.2N). Lever operated, push type and electronically controlled mechanisms are examples of acceptable designs. Hand operated metering faucets are allowed if the faucet remains open for at least 10 seconds.

1127A.4 Grab bars, tub and shower seats, fasteners and mounting devices.

1127A.4.1 General. Grab bars, tub and shower seats, fasteners and mounting devices required by this chapter shall comply with this section.

1127A.4.2 Location. Grab bars shall be installed in a horizontal position, 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface.

Exception: The height of the lower grab bar on the back wall of a bathtub shall comply with Section 1127A.5.2.

1127A.4.3 Diameter or width. The diameter or width of the gripping surfaces of a grab bar shall comply with the following:

Note: See Figure 11A-9C.

1. **Circular cross section.** Grab bars with circular cross section shall have an outside diameter of 1¼ inches (32 mm) minimum and 2 inches (51 mm) maximum.
2. **Noncircular cross section.** Grab bars with noncircular cross section shall have a cross-section dimension of 2 inches (51 mm) maximum. The perimeter dimension of grab bars with non-circular cross section shall be 4 inches (102 mm) minimum and 4.8 inches (122 mm) maximum.
3. **Alternate configuration.** L-shaped or U-shaped grab bars shall be permitted.

1127A.4.4 Structural strength. The structural strength of grab bars, tub and shower seats, fasteners and mounting devices shall meet the following specifications:

1. Bending stress in a grab bar or seat induced by the maximum bending moment from the application of a 250-pound (1112 N) point load shall be less than the allowable stress for the material of the grab bar or seat.
2. Shear stress induced in a grab bar or seat by the application of a 250-pound (1112 N) point load shall be less than the allowable shear stress for the material of the grab bar or seat, and if its mounting bracket or other support is considered to be fully restrained, then direct and torsional shear stresses shall not exceed the allowable shear stress.
3. Shear force induced in a fastener or mounting device from the application of a 250-pound (1112 N) point load shall be less than the allowable lateral load of either the fastener or mounting device or the supporting structure, whichever is the smaller allowable load.
4. Tensile force induced in a fastener by a direct tension force of a 250-pound (1112 N) point load, plus the maximum moment from the application of a 250-pound (1112 N) point load, shall be less than the allowable withdrawal load between the fastener and supporting structure.
5. Grab bars shall not rotate within their fittings.

1127A.4.5 Surface. A grab bar and any wall or other surface adjacent to it shall be free of any sharp or abrasive elements and shall have rounded edges.

1127A.4.6 Spacing. When grab bars are mounted adjacent to a wall, the space between the wall and the grab bars shall be 1½ inches (38 mm). (See Figure 11A-9C.) The space between the grab bar and projecting objects below and at the ends shall be 1½ inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum.

Exceptions:

1. The space between the grab bars and shower controls, shower fittings and other grab bars above shall be permitted to be 1½ inches (38 mm) minimum.
2. For L-shaped or U-shaped grab bars the space between the walls and the grab bar shall be 1½ inches (38 mm) minimum for a distance of 6 inches (152 mm) on either side of the inside corner between two adjacent wall surfaces.

1127A.5 Bathing facilities.

1127A.5.1 General. When common use bathing facilities are provided for residents or guests, including showers, bathtubs or lockers, at least one of each type of fixture in each facility, and not less than 1 percent of all fixtures, shall comply with this section.

1127A.5.2 Bathtubs. Bathtubs required to be accessible shall comply with the following:

1127A.5.2.1 Floor space. Clearance in front of bathtubs shall extend the length of the bathtub and shall be 48 inches (1219 mm) wide minimum for forward approach and 30 inches (762 mm) wide minimum for parallel approach. A lavatory complying with Section 1127A.3 shall be permitted at the control end of the clearance. When a permanent seat is provided at the head end of the bathtub, the clearance shall extend 12 inches (305 mm) minimum beyond the wall at the head end of the bathtub. (See Figure 11A-9E.)

1127A.5.2.2 Seat. A removable in-tub seat or a permanent seat at the head end of the tub shall be provided. The structural strength of seats and their attachments shall comply with Section 1127A.4.4. Seats shall be mounted securely and shall not slip during use.

The top of bathtub seats shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. The depth of a removable in-tub seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum. Permanent seats at the head end of the bathtub shall be 15 inches (381 mm) deep minimum and shall extend from the back wall to or beyond the outer edge of the bathtub. (See Figure 11A-9E.)

1127A.5.2.3 Grab bars. Grab bars complying with Section 1127A.4 shall be provided in accordance with this section. (See Figure 11A-9F.) When separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting the

dimensional requirements of this section shall be permitted.

1. **Bathtubs with permanent seats.** Two horizontal grab bars shall be installed on the back wall. One shall be located 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, and the other shall be located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 48 inches (1219 mm) long minimum, and shall be installed 15 inches (381 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

2. **Bathtubs with removable seats.** Two horizontal grab bars shall be installed on the back wall. One shall be located 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, and the other shall be located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 24 inches (610 mm) long minimum and shall be installed 24 inches (610 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub. A grab bar 12 inches (305 mm) long minimum shall be installed on the head end wall at the front edge of the bathtub.

1127A.5.2.4 Controls. Faucets and controls (other than drain stoppers) shall be located on an end wall between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. (See Figure 11A-9F.)

Controls shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

1127A.5.2.5 Shower spray unit. A shower spray unit with a hose at least 59 inches (1524 mm) long that can be used both as a fixed shower head and as a hand-held shower shall be provided.

The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of the grab bars.

1127A.5.2.6 Bathtub enclosures. When provided, enclosures for bathtubs shall not obstruct controls, faucets, shower and spray units, or obstruct transfer from wheelchairs onto bathtub seats or into bathtubs. Enclosures on bathtubs shall not have tracks installed on the rim of the open face of the bathtub.

1127A.5.3 Shower compartments. Shower compartments required to be accessible shall comply with this section. (See Figures 11A-9H, 11A-9I, 11A-9J and 11A-9K.)

1127A.5.3.1 Size and clearance.

1. **Standard roll-in shower compartments.** Standard roll-in shower compartments shall meet one of the following:

1.1 30 inches (762 mm) minimum in depth and 60 inches (1524 mm) minimum in width between wall surfaces measured at center points of opposing sides, with a full opening width on the long side.

A clear floor space 30 inches (914 mm) minimum by 60 inches (1524 mm) minimum shall be provided adjacent to the open face of the shower compartment.

1.2 42 inches (1067 mm) in width between wall surfaces, and 48 inches (1219 mm) minimum in depth with an entrance opening of 42 inches (1067 mm).

2. **Alternate roll-in shower compartments.** Alternate roll-in shower compartments shall be 36 inches (914 mm) minimum in depth and 60 inches (1524 mm) minimum in width between wall surfaces measured at center points of opposing sides. A 36-inch (914 mm) wide minimum entry shall be provided at one end of the long side of the compartment.

1127A.5.3.2 Thresholds. Thresholds in roll-in shower compartments shall be $\frac{1}{2}$ inch (12.7 mm) maximum in height and shall be beveled with a slope no greater than one unit vertical in two units horizontal (50-percent slope). (See Figure 11A-1F.)

Exception: Changes in level not exceeding $\frac{1}{4}$ inch (6.35 mm) shall be permitted to be vertical.

1127A.5.3.3 Enclosures. Enclosures, when provided for shower compartments, shall not obstruct controls, faucets, shower spray units and transfer from wheelchairs onto shower seats.

1127A.5.3.4 Floor. Shower compartment floor surfaces shall be stable, firm and slip resistant. The maximum slope of the floor shall be $\frac{1}{4}$ inch (6.35 mm) per foot (2.083 percent slope) in any direction. When drains are provided, grate openings shall be $\frac{1}{4}$ inch (6.35 mm) maximum and located flush with the floor surface.

1127A.5.3.5 Controls. Controls, faucets and shower spray units in shower compartments shall be operable with one hand, and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum. All controls and faucets shall be of a single-lever design.

1127A.5.3.5.1 Standard roll-in shower compartments. In standard roll-in shower compartments, operable parts of controls and faucets shall be installed on the back wall of the compartment adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of controls and faucets shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) minimum and 41 inches (1041 mm) maximum above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the back wall adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of the shower spray unit, including the handle, shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor (measured to the top of the mounting bracket).

1127A.5.3.5.2 Alternate roll-in shower compartments. In alternate roll-in shower compartments, operable parts of controls and faucets shall be installed on the side wall of the compartment adjacent to the seat wall, 19 inches (483 mm) minimum and 27 inches (686 mm) maximum from the seat wall.

Operable parts of controls and faucets shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor, with their centerline at 39 inches (991 mm) minimum and 41 inches (1041 mm) maximum above the shower floor.

Operable parts of the shower spray unit, including the handle, shall be installed on the following locations:

1. On the side wall of the compartment adjacent to the seat wall, 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the seat wall; or
2. On the back wall opposite the seat, 15 inches (381 mm) maximum, left or right, of the centerline of the seat.

Operable parts of the shower spray unit, including the handle, shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

1127A.5.3.6 Hand-held shower sprayer unit. A flexible hand-held shower spray unit with a hose at least 59 inches (1524 mm) long that can be used both as a fixed shower head and as a hand-held shower shall be provided.

The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars.

1127A.5.3.6.1 Sprayer unit alternative. When accessible shower facilities are provided in areas subject to excessive vandalism, in lieu of providing the fixed flexible hose, two wall-mounted shower heads shall be installed. Each shower head shall be installed so that it can be operated independently of the other and shall have swivel angle adjustments, both vertically and horizontally. One shower head shall be located at a height of 48 inches (1219 mm) maximum above the floor.

1127A.5.3.7 Shower compartment seats. A seat in a standard roll-in shower compartment shall be a folding type, installed on the side wall adjacent to the controls. The seat shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. A seat in an alternate roll-in type shower compartment shall be a folding type, installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (76 mm) of the compartment entry.

Shower compartment seats shall comply with Section 1127A.4.4 and shall be located within 27 inches (686 mm) of the shower controls. The top of the seat shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. When folded, the seat shall not extend more than 6 inches (152 mm) from the mounting wall.

1127A.5.3.7.1 Rectangular seats. The rear edge of a rectangular seat shall be 2 1/2 inches (64 mm) maximum from the seat wall. The front edge of a rectangular seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The side edge of the seat shall be 1 1/2 inches (38 mm) maximum from the adjacent wall.

1127A.5.3.7.2 L-shaped seats. The rear edge of an L-shaped seat shall be 2 1/2 inches (64 mm) maximum from the seat wall. The front edge of an L-shaped seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The rear edge of the "L" portion of the seat shall be 1 1/2 inches (38 mm) maximum from the wall. The front edge shall be 14 inches (356 mm) minimum and 15 inches (381 mm) maximum from the wall. The end of the "L" shall be 22 inches (559 mm) minimum and 23 inches (584 mm) maximum from the main seat wall.

1127A.5.3.8 Grab bars. Accessible shower compartments shall be provided with grab bars, installed in accordance with Section 1127A.5.3.8.1 or Section 1127A.5.3.8.2. Grab bars shall also comply with Section 1127A.4.

When multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor. When separate grab bars are required on adjacent walls at a common mounting height, L-shaped or U-shaped grab bars meeting the dimensional requirements of Section 1127A.5.3.8.1 or Section 1127A.5.3.8.2 shall be permitted. (See Figure 11A-9H or Figure 11A-9I.)

1127A.5.3.8.1 Standard roll-in shower compartments. Grab bars shall be installed on the back wall and on the side wall opposite the seat. Grab bars above the seat are not permitted. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

1127A.5.3.8.2 Alternate roll-in shower compartments. Grab bars shall be installed on the back wall and the side wall farthest from the compartment entry. Grab bars above the seat are not permitted. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

1127A.5.3.9 Soap dish. When a soap dish is provided, it shall be located on the control wall at a maximum height of 40 inches (1016 mm) above the shower floor, and within the reach limits from the seat.

1127A.5.3.10 Open showers. When no separate shower compartments are provided, the shower for persons with disabilities shall be located in a corner with L-shaped grab bars extending along two adjacent walls with a folding seat adjacent to the shower controls. (See Figure 11A-9J.)

1127A.5.3.11 Multiple showers. When two or more accessible showers are provided within the same functional area, there shall be at least one shower constructed opposite hand from the other or others (i.e., one left-hand control versus right-hand controls).

1127A.6 Lockers.

1127A.6.1 General. Where lockers are provided for residents or guests, at least one locker and not less than 1 percent of all lockers shall be accessible to persons with disabilities. An accessible route not less than 36 inches (914 mm) in clear width shall be provided to these lockers. See Section 1138A for required clear space, allowable reach ranges and requirements for control and operating mechanisms.

1127A.7 Signs.

1127A.7.1 General. All accessible toilet and bathing facilities shall be identified by the "International Symbol of Accessibility." Signs need not be provided for facilities within a dwelling unit or guestroom.

1127A.7.2 Identification symbols. Doorways leading to sanitary facilities (toilet or bathing rooms) shall be identified by a geometric symbol in compliance with this section. Geometric symbols shall be centered horizontally on the door at a height of 58 inches (1473 mm) minimum and 60 inches (1524 mm) maximum above the finish floor measured to the center of the symbol. When a door is provided, the symbol shall be mounted within 1 inch (25 mm) of the vertical centerline of the door. Directional signs indicating the location of the nearest accessible toilet or bathing rooms shall be provided. Such directional signs shall comply with Section 1143.5 and shall include the International Symbol of Accessibility.

Edges of accessibility signage shall be rounded, chamfered or eased. Corners shall have a minimum radius of 1/8 inch (3.2 mm). See Section 1143A for additional signage requirements applicable to sanitary facilities.

1127A.7.2.1 Men's sanitary facilities. Men's sanitary facilities shall be identified by an equilateral triangle, 1/4 inch (6.4 mm) thick with edges 12 inches (305 mm) long and a vertex pointing upward. The triangle symbol shall contrast with the door, either light on a dark background or dark on a light background.

1127A.7.2.2 Women's sanitary facilities. Women's sanitary facilities shall be identified by a circle, 1/4 inch (6.4 mm) thick and 12 inches (305 mm) in diameter. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

1127A.7.2.3 Unisex sanitary facilities. Unisex sanitary facilities shall be identified by a circle, $\frac{1}{4}$ inch (6.4 mm) thick and 12 inches (305 mm) in diameter with a $\frac{1}{4}$ inch (6.4 mm) thick triangle superimposed on the circle and within the 12-inch (305 mm) diameter. The triangle symbol shall contrast with the circle symbol, either light on a dark background or dark on a light background. The circle symbol shall contrast with the door, either light on a dark background or dark on a light background.

1127A.8 Toilet room fixtures and accessories.

1127A.8.1 Towel, sanitary napkins, waste receptacles.

Where towel, sanitary napkins, waste receptacles and other similar dispensing and disposal fixtures are provided, at least one of each type shall be located with all operable parts, including coin slots, within 40 inches (1016 mm) from the finished floor. Controls and operating mechanisms shall comply with Section 1138A.4.

1127A.8.2 Toilet tissue dispensers. Toilet tissue dispensers shall be located on the wall or partition closest to the water closet, 7 inches (180 mm) minimum and 9 inches (230 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be below the grab bar, 19 inches (483 mm) minimum above the finish floor. The outlet of the dispenser shall not be located behind grab bars. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow. (See Figure 11A-9B.)

1127A.8.3 Mirrors. Where mirrors are provided, at least one shall be accessible. Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor.

1127A.9 Space allowances and reach ranges in common use areas.

Space allowances and reach ranges in common use areas shall comply with Section 1138A.

1127A.10 Common accessible laundry rooms.

1127A.10.1 General. Where common use laundry rooms are provided, at least one of each type of appliance provided in each laundry area shall be accessible, shall be on an accessible route and shall comply with this section. Such appliances include clothes washing machines, dryers, soap dispensers and any related features such as wash sinks, tables and storage areas.

Where laundry rooms are provided on floors of an elevator building, each laundry room shall be accessible. Where there is one laundry room on a ground floor in each building, each laundry room shall be accessible. Where there is a laundry room on the ground floor of a building and another located in the basement, it is acceptable to have only the ground floor laundry room accessible.

1127A.10.2 Clear floor space. There shall be a minimum clear space 30 inches perpendicular by 48 inches parallel (762 mm by 1219 mm) in front of clothes washers and dryers required to be accessible. There shall be a minimum clear space 30 inches by 48 inches (762 mm by 1219 mm) provided for at least one of each type of fixture or appliance provided in the laundry room (e.g., soap dispensers, wash sinks, tables, storage areas).

1127A.10.3 Controls and operating mechanisms.

Clothes washers and dryers including stacked clothes washers and dryers required to be accessible shall have controls and operating mechanisms (including doors, coin slots, lint screens, detergent and bleach compartments) within the reach range of a seated user. Controls and operating mechanisms shall be located no higher than 48 inches (1219 mm), and no lower than 15 inches (381 mm), above the finished floor measured to the center of the grip. If the reach is over an obstruction (for example, washer or dryer), operating mechanisms shall be located within the reach ranges specified in Section 1138A.3. Controls and operating mechanisms that do not satisfy these specifications are acceptable, provided that comparable mechanisms, controls or outlets that perform the same functions are provided within the same area and are accessible.

Controls and operating mechanisms shall be operable with one hand and not require tight grasping, pinching or twisting of the wrist. The force required to activate controls and operating mechanisms shall be no greater than 5 pounds (22.2 N).

1127A.10.4 Washing machines and clothes dryers.

Washing machines and clothes dryers in accessible common use laundry rooms shall be front loading.

The bottom of the opening to the laundry compartment shall be located 15 inches (381 mm) minimum and 36 inches (914 mm) maximum above the finish floor.

1127A.11 Storage.

1127A.11.1 General. If fixed storage facilities such as cabinets, shelves, closets or drawers are provided where access is required by Sections 1.8.2.1.2 and 1102A, at least one of each type of facility provided shall comply with this section. Additional storage may be provided outside of the reach ranges specified in Section 1138A.3.

1127A.11.2 Clear floor space. A clear floor space at least 30 inches by 48 inches (762 mm by 1219 mm) complying with Section 1138A.1.4 that allows either a forward or parallel approach by a person using a wheelchair shall be provided at accessible storage facilities.

1127A.11.3 Height. Accessible storage spaces and clothes rods shall be within at least one of the reach ranges specified in Section 1138A.3. (See Figure 11A-1J and Figure 11A-1I.)

1127A.11.4 Hardware. Hardware for accessible storage facilities shall comply with Section 1138A.4. Touch latches and U-shaped pulls are acceptable.

1127A.12 Fixed or built-in seating, tables and counters.

1127A.12.1 Minimum seating. *Where fixed or built-in seating, tables or counters are provided for residents or guests, 5 percent, but not less than one, shall be accessible as provided in this section.*

1127A.12.2 Clear floor space. *When seating spaces for persons in wheelchairs are provided at fixed tables or counters, clear floor space complying with Section 1138A.1.4 positioned for a forward approach shall be provided. Such clear floor space shall not overlap the required knee and toe space by more than 19 inches (483 mm). (See Figure 11A-1K.)*

1127A.12.3 Knee and toe space. *When seating for persons in wheelchairs is provided at fixed tables or counters, knee and toe space complying with Section 1138A.2 shall be provided. (See Figure 11A-1K.)*

1127A.12.4 Height of work surfaces. *The tops of tables and counters shall be 28 inches to 34 inches (711 mm to 864 mm) from the finish floor.*

Exception: *When food or drink is served for consumption at a counter exceeding 34 inches (864 mm) in height, only a portion of the main counter, 60 inches (1524 mm) minimum in length, shall be provided in compliance with this section.*

1127A.13 Electric vehicle charging stations. (Reserved)

Division IV – DWELLING UNIT FEATURES**Division IV Table of Contents**

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**SECTION 1128A
COVERED DWELLING UNITS**

1128A.1 General. Covered multifamily dwelling units shall be adaptable and accessible into and throughout the dwelling unit as provided in this division.

Note: See Sections 1101A “Application” and 1102A “Building Accessibility” for dwelling units required to comply with this division.

**SECTION 1129A
Reserved**

**SECTION 1130A
ACCESSIBLE ROUTE WITHIN COVERED
MULTIFAMILY DWELLING UNITS**

1130A.1 General. An accessible route shall be provided through all rooms and spaces of the dwelling unit. The accessible route shall pass through the primary entry door, and shall connect with all additional exterior doors, required clear floor spaces at kitchen appliances and bathroom fixtures. For the purpose of this section, “accessible routes” may include hallways, corridors and ramps.

Exception: An accessible route is not required from the interior of the unit into a basement or garage, except as provided in Section 1105A.1.

1130A.2 Width. The accessible route into and throughout covered multifamily dwelling units shall be at least 36 inches (914 mm) wide.

**SECTION 1131A
CHANGES IN LEVEL ON ACCESSIBLE ROUTES**

1131A.1 Changes in level not exceeding 1/2 inch. Abrupt changes in level along any accessible route shall not exceed 1/2 inch (12.7 mm). When changes in level do occur, they shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level not exceeding 1/4 inch (6.35 mm) may be vertical.

1131A.2 Changes greater than 1/2 inch. Changes in level greater than 1/2 inch (12.7 mm) shall be made by means of a sloped surface not greater than 1 unit vertical in 20 units hor-

izontal (5-percent slope), or a ramp, elevator or platform (wheelchair) lift. See Section 1122A for ramps and Section 1124A.11 for platform (wheelchair) lifts.

**SECTION 1132A
DOORS**

1132A.1 Primary entry doors and required exit doors. The width and height of primary entry doors and all required exit doors shall comply with Section 1126A.1. The requirements of Sections 1126A.3 shall apply to maneuvering clearances at the side of the door exposed to common or public use spaces (e.g., entry or exit doors which open from the covered multifamily dwelling unit into a corridor, hallway or lobby, or directly to the outside).

1132A.2 Interior doors and secondary exterior doors. Except as allowed by Section 1109A.2, interior doors intended for user passage and secondary exterior doors shall comply with this section. The provisions of this section shall apply to the dwelling unit side of doors leading from the interior of the dwelling unit to an unfinished basement or an attached garage.

1132A.3 Width and height of interior doors and secondary exterior doors. Doors shall comply with the following:

1. Doors shall not be less than 6 feet 8 inches (2032 mm) in height.
2. Swinging doors shall provide a net clear opening width of not less than 32 inches (813 mm), measured with the door or doors positioned at an angle of 90 degrees from the closed position.
3. Swinging doors shall be capable of opening at least 90 degrees.
4. A nominal 32-inch (813 mm) clear opening provided by a standard 6-foot wide (1829 mm) sliding patio door assembly is acceptable.
5. A pair of doors, manual or automatic, must have at least one leaf which provides a clear width of not less than 32 inches (813 mm), measured with the door positioned at an angle of 90 degrees from its closed position.
6. The width of any component in the means of egress system shall not be less than the minimum width required by Section 1005.

1132A.4 Level floor or landing. See also Chapter 10. The floor or landing on each side of a door shall be level. Primary entry doors, required exit doors or secondary exterior doors with changes in height between the interior surface or floor level and the exterior surface or floor level shall comply with the following:

1. Exterior landings of impervious construction (e.g., concrete, brick, flagstone) serving primary entry doors and required exit doors are limited to not more than 1/2 inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 1131A.
2. Exterior landings of pervious construction (e.g., wood decking with spaces) shall be the same level as the interior landing, except that secondary exterior doors may

have no more than $\frac{1}{2}$ inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 1131A.

3. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 4 inches (101.6 mm). Changes in height greater than $\frac{1}{2}$ inch (12.7 mm) shall be accomplished by means of a ramp complying with Section 1114A or by means of a platform constructed to the level of the floor as illustrated in Figure 11A-8J.
4. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 1 inch (25.4 mm), provided a ramp with a maximum slope of 1:8 is permanently installed. (See Figure 11A-8K.)
5. In buildings containing covered multifamily dwelling units, the floor or landing immediately outside the entry may be sloped up to $\frac{1}{4}$ inch (6.35 mm) per foot (12 inches) (305 mm), in a direction away from the primary entrance of the dwelling unit for drainage.

1132A.4.1 Thresholds. Thresholds at the primary entry and required exit doors shall be no higher than $\frac{1}{2}$ inch (12.7 mm). Thresholds at secondary exterior doors, including sliding door tracks, shall be no higher than $\frac{3}{4}$ inch (19.05 mm). Changes in height at interior door thresholds (e.g., floor material changes at door thresholds) shall not exceed $\frac{1}{2}$ inch (12.7 mm). Thresholds shall comply with the following:

1. Thresholds with a change in height of not more than $\frac{1}{4}$ inch (6.35 mm) may be vertical.
2. Thresholds with a change in height between $\frac{1}{4}$ inch (6.35 mm) and $\frac{3}{4}$ inch (19.05 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope).

1132A.5 Maneuvering clearances at doors.

1132A.5.1 General. The floor or landing on the dwelling unit side of the primary entry door and any required exit door shall have a minimum length of not less than 44 inches (1118 mm). Section 1126A.3 shall apply to maneuvering clearances at the side of the door exposed to common or public use spaces.

Maneuvering clearances at interior doors shall provide a minimum length on both sides of the door of at least 42 inches (1067 mm) measured at a right angle to the plane of the door in its closed position.

Exception: A 39-inch (991 mm) length is acceptable at interior doors when a minimum clear opening width of 34 inches (864 mm) is provided.

1132A.5.2 Strike edge maneuvering space at doors. The width of the level area on the side to which the door swings shall extend 18 inches (457 mm) past the strike edge for all doors. The width of the level area at the exte-

rior side of the primary entry door and any required exit doors shall comply with Section 1126A.

Notes:

1. See Section 1134A for bathrooms that are required to be accessible.
2. Twenty-four inches (610 mm) is preferred for strike edge clearance.

1132A.6 Closer-effort to operate doors. Maximum effort to operate doors shall not exceed $8\frac{1}{2}$ pounds (38 N) for exterior doors and 5 pounds (22 N) for interior doors, such pull or push effort being applied at right angles to hinged doors and at the center plane of sliding or folding doors. Compensating devices or automatic door operators may be utilized to meet these standards. When fire doors are required, the maximum effort to operate the door may be increased to the minimum allowable by the appropriate enforcement agency, not to exceed 15 pounds (66.7 N).

1132A.7 Type of lock or latch. The type of latch and lock required for all doors shall be in accordance with Section 1132A.8 and Chapter 10, Section 1010.

1132A.8 Hand-activated door hardware. Hand-activated door latching, locking and opening hardware shall be centered between 30 inches (762 mm) and 44 inches (1118 mm) above the floor. Latching and locking doors that are hand-activated and on an accessible route shall be operable with a single effort by lever-type hardware, panic bars, push-pull activating bars or other hardware designed to provide passage without requiring the ability to grasp the opening hardware. Locked exit doors shall operate consistent with Section 1132A.6, in the direction of egress.

1132A.8.1 Lever-type hardware. The lever or lever of actuated latches or locks shall be curved with a return to within $\frac{1}{2}$ inch (12.7 mm) of the door to prevent catching on the clothing of persons during egress in Group R and U occupancies with an occupant load greater than 10.

1132A.9 Smooth surface. Swinging door or gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within $\frac{1}{16}$ inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped.

Exceptions:

1. Automatic doors.
2. Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal.
3. Doors or gates that do not extend to within 10 inches (254 mm) of the finish floor.

1132A.10 Door signal devices. Every primary entrance to a covered multifamily dwelling unit shall be provided with a door buzzer, bell, chime or equivalent. The activating mechanism shall be mounted a maximum of 48 inches (1219 mm) above the floor and connected to permanent wiring.

SECTION 1133A KITCHENS

1133A.1 General. Kitchens shall be on an accessible route and shall comply with this section. (See Figure 11A-10A.)

1133A.2 Clear floor space. Clear floor space at kitchens shall comply with the following:

1. A clear floor space at least 30 inches (762 mm) by 48 inches (1219 mm) that allows a parallel approach by a person in a wheelchair shall be provided at the range or cooktop.
2. A clear floor space at least 30 inches (762 mm) by 48 inches (1219 mm) that allows either a parallel or forward approach shall be provided at the kitchen sink and all other fixtures or appliances including the oven, dishwasher, refrigerator/freezer and trash compactor.
3. A clear floor space at least 30 inches (762 mm) by 48 inches (1219 mm) that allows either a parallel or a forward approach shall be provided at the work surface required by Section 1133A.4.
4. The centerline of the 30-inch (762 mm) by 48-inch (1219 mm) clear floor space provided for parallel or forward approach shall be aligned with the centerline of the work surface, appliance or fixture.

1133A.2.1 Clear width. Kitchens shall have a minimum clear width measured between any cabinet, countertop or the face of any appliance (excluding handles and controls) that projects into the kitchen and the opposing cabinet, countertop, appliance or wall as follows:

1. U-shaped kitchens, designed with parallel approach at a range or cooktop located at the base of the U, shall have a minimum clear width of at least 60 inches (1524 mm). (See Figure 11A-10A.)
2. U-shaped kitchens, designed with a cooktop or sink located at the base of the U, which provides a knee and toe space in accordance with Section 1133A.7 to allow for a forward approach, shall have a clear width of at least 48 inches (1219 mm). (See Figure 11A-10A.)
3. All other kitchen designs shall provide a minimum clear width of at least 48 inches (1219 mm). (See Figure 11A-10A.)

1133A.3 Removable base cabinets. Sinks and work surfaces required by Section 1133A.4 (see Item 1 and Item 2) shall be provided with knee and toe space complying with Section 1133A.7. Base cabinets (including toeboard and shelving) directly under kitchen sinks and work surfaces shall be removable without the use of specialized tools or specialized knowledge in order to provide knee and toe space. The finish floor beneath kitchen sinks and work surfaces shall be extended to the wall.

1133A.4 Countertops. Kitchen countertops shall comply with this section and shall be provided with the following:

1. A minimum linear length of 30 inches (762 mm) of countertop shall be provided for the kitchen sink installation.

2. A minimum linear length of 30 inches (762 mm) of countertop shall be provided for a work surface.
3. Sinks and work surfaces may be a single integral unit a minimum of 60 inches (1524 mm) in length, or be separate components.

Exception: Two 15-inch (381 mm) wide minimum breadboards may be provided in lieu of the required 30 inches (762 mm) of countertop work surface.

1133A.4.1 Repositionable countertops. Repositionable countertops shall be provided in a minimum of 5 percent of the covered multifamily dwelling units. Repositionable countertops shall comply with the following:

1. Sinks and work surfaces required by Section 1133A.4 shall be designed to enable repositioning to a minimum height of 28 inches (711 mm).
2. Base cabinets directly under sinks and work surfaces shall be removable as required in Section 1133A.3.
3. The sides of adjacent cabinets and the back wall, which may become exposed to moisture or food handling when a countertop is lowered, shall be constructed of durable, nonabsorbent materials appropriate for such uses.
4. Finished flooring shall be extended to the wall beneath the sink and work surface.

Exceptions:

1. Stone, cultured stone and tiled countertops may be used without meeting the repositioning requirements.
2. Two 15-inch (381 mm) wide minimum breadboards may be provided in lieu of the required 30 inches (762 mm) of countertop work surface, and used without meeting the repositioning requirements.

1133A.5 Lower shelving. Lower shelving and/or drawer space shall be provided in the kitchen at a height of no more than 48 inches (1219 mm) above the floor.

1133A.6 Kitchen sink faucet controls. Faucet controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pounds (22.2 N). Lever-operated, push-type and electronically controlled mechanisms are examples of acceptable designs. Self-closing valves are allowed if the faucet remains open for at least 10 seconds.

1133A.7 Knee and toe space. Knee and toe space, when required by Section 1133A, shall comply with Section 1138A.2 and the following:

1. The knee and toe space shall be clear and unobstructed, or removable base cabinets in compliance with Section 1133A.3 shall be provided.
2. The knee and toe space shall be 30 inches (762 mm) wide minimum, centered on the sink, countertop or appliance.

3. A clear floor space shall not extend into the knee and toe space more than 19 inches (483 mm).

1133A.7.1 Plumbing protection. Water supply and drain pipes under kitchen sinks shall be insulated or otherwise covered to protect against contact. There shall be no sharp or abrasive surfaces under kitchen sinks.

**SECTION 1134A
BATHING AND TOILET FACILITIES**

1134A.1 General. All bathrooms, bathing and toilet facilities within covered multifamily dwelling units shall comply with this section.

1134A.2 Number of complying bathrooms. Bathrooms shall be designed to comply with one of the following options:

Option 1. All bathrooms within the dwelling unit shall be designed to comply with the following:

1. Toilet, bathing and shower facilities shall comply with Section 1134A.4.
2. Bathtubs shall comply with Section 1134A.5.
3. Showers shall comply with Section 1134A.6.
4. Water closets shall comply with Section 1134A.7.
5. Lavatories, vanities, mirrors and towel fixtures shall comply with Section 1134A.8.
6. Bathrooms shall be provided with an accessible route into and through the bathroom.
7. If a door is provided, it shall comply with the requirements of Section 1132A.5.
8. A minimum 18-inch (457 mm) clear maneuvering space shall be provided on the swing side of the door at the strike edge of the door.
9. Switches, outlets and controls shall comply with Section 1142A.
10. Reinforced walls to allow for the future installation of grab bars around the toilet, tub and shower shall comply with Sections 1134A.5 for bathtubs, 1134A.6 for showers and 1134A.7 for water closets.

Option 2. Only one bathroom within the dwelling unit shall be designed to comply with the following:

1. Toilet, bathing and shower facilities shall comply with Section 1134A.4.
2. Bathtubs shall comply with Section 1134A.5.
3. Showers shall comply with Section 1134A.6.
4. Water closets shall comply with Section 1134A.7.
5. Lavatories, vanities, mirrors and towel fixtures shall comply with Section 1134A.8.
6. Where both a tub and shower are provided in the bathroom, at least one shall be made accessible. Additional requirements apply to dwelling units containing two or more bathrooms when a bathtub is provided as the accessible bathing fixture.

Where two or more bathrooms are provided within the same dwelling unit and a bathtub is

installed to comply with Option 2, Item 6 in one bathroom and a shower stall is provided in a subsequent bathroom, both the bathtub selected to comply with Option 2, Item 6 and at least one shower stall within the dwelling unit shall meet all the applicable accessibility requirements provided in Section 1134A. (See Section 1134A.5 for bathtubs, or Section 1134A.6 for showers.)

7. When two or more lavatories are provided, at least one shall be made accessible and comply with Section 1134A.8.
8. Bathrooms shall be provided with an accessible route into and through the bathroom.
9. If a door is provided, it shall comply with the requirements of Section 1132A.5.
10. A minimum 18-inch (457 mm) clear maneuvering space shall be provided on the swing side of the door at the strike edge of the door.
11. Switches, outlets and controls shall comply with Section 1142A.
12. Reinforced walls to allow for the future installation of grab bars around the toilet, tub and shower shall comply with Sections 1134A.5 for bathtubs, 1134A.6 for showers and 1134A.7 for water closets.

When Option 2 is used, all additional bathrooms must comply with Items 8 through 12 above.

1134A.3 Powder rooms. All powder rooms shall be designed to comply with Section 1134A.2, Option 2, Items 8 through 12. When the powder room is the only toilet facility located on an accessible level, it shall comply with the Option 2 items listed above, plus all additional requirements located in Sections 1134A.4, 1134A.7 and 1134A.8.

1134A.4 Sufficient maneuvering space. Bathing and toilet facilities required to be adaptable shall provide sufficient maneuvering space for a person using a wheelchair or other mobility aid to enter and close the door, use the fixtures, reopen the door and exit.

Where the door swings into the bathroom or powder room, there shall be a clear maneuvering space outside the swing of the door of at least 30 inches by 48 inches (762 mm by 1219 mm) within the room. The clear maneuvering space shall allow the user to position a wheelchair or other mobility aid clear of the path of the door as it is closed and to permit use of fixtures.

Doors may swing into the required clear space at any fixture when a clear maneuvering space is provided outside the swing arc of the door so it can be closed.

Maneuvering spaces may include any knee space or toe space available below bathroom fixtures.

1134A.5 Bathtubs. Bathtubs required to be accessible shall comply with this section.

1. **Floor space.** There shall be a minimum clear floor space 48 inches parallel by 30 inches perpendicular (1219 mm by 762 mm) to the side of a bathtub or bath-

tub-shower combination to provide for the maneuvering of a wheelchair and transfer to and from the bathing facilities. The controls shall be on the wall at the foot of the bathtub. The edge of the clear floor space shall be flush with the control wall surface. The area under a lavatory, located at the control end of the tub, may be included in the clear floor space provided the lavatory is 19 inches (483 mm) maximum deep, and the knee and toe space comply with Section 1134A.8. Cabinets under lavatories and toilets shall not encroach into the clear floor space.

2. **Reinforced walls for grab bars.** A bathtub installed without surrounding walls shall provide reinforced areas for the installation of floor-mounted grab bars.

Where a bathtub is installed with surrounding walls, grab bar reinforcement shall be located on each end of the bathtub, 32 inches to 38 inches (813 mm to 965 mm) above the floor, extending a minimum of 24 inches (610 mm) from the front edge of the bathtub toward the back wall of the bathtub. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height. (See Figure 11A-9G.)

Grab bar reinforcement shall be installed on the back wall of the bathtub a maximum of 6 inches (152.4 mm) above the bathtub rim extending upward to at least 38 inches (965 mm) above the floor. Grab bar backing shall be installed horizontally to permit the installation of a 48-inch (1219 mm) grab bar with each end a maximum of 6 inches (152.4 mm) from the end walls of the bathtub. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

3. **Bathtub controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pounds (22.2 N). Lever operated, push type and electronically controlled mechanisms are examples of acceptable designs.

4. **Shower unit.** A shower spray unit is not required in bathtubs.
5. **Bathtub enclosures.** Doors and panels of bathtub enclosures shall be substantially constructed from approved, shatter-resistant materials. Hinged doors shall open outward. Glazing used in doors and panels of bathtub enclosures shall be fully tempered, laminated safety glass or approved plastic. When glass is used, it shall have minimum thickness of not less than $\frac{1}{8}$ inch (3.17 mm) when fully tempered, or $\frac{1}{4}$ inch (6.35 mm) when laminated, and shall pass the test requirements of this part, Chapter 24, Glass and Glazing. Plastics used in doors and panels of bathtub enclosures shall be of a shatter-resistant type.

1134A.6 Showers. Showers required to be accessible shall comply with this section.

1. **Size.** When one or more shower stalls are provided within the same dwelling units, at least one shower stall comply with one of the following requirements.

- 1.1. The shower stall shall measure at least 42 inches wide by 48 inches deep (1067 mm by 1219 mm) with an entrance opening of at least 36 inches (914 mm); or

- 1.2. The shower stall shall measure at least 30 inches deep by 60 inches wide (762 mm by 1524 mm) with an entrance opening of at least 60 inches (1524 mm). A water closet may project a maximum of 12 inches (305 mm) into the opening, provided that a minimum of 36 inches (914 mm) clear space is maintained between the water closet and the shower wall as illustrated in Figure 11A-9L; or

- 1.3. Other shower stall configurations shall measure at least 36 inches deep by 60 inches wide (914 mm by 1524 mm) with an entrance opening of at least 36 inches (914 mm) when a wall is installed on the opening side.

2. **Slope.** The maximum slope of the shower floor shall be $\frac{1}{2}$ inch (12.7 mm) per foot in any direction and shall slope to a drain. The floor surfaces shall be of Carborundum or grit-faced tile or of material providing equivalent slip resistance.

3. **Floor space.** A clear maneuvering space at least 30 inches in width by 48 inches in length (762 mm by 1219 mm) shall be located outside the shower, flush and parallel to the control wall.

4. **Reinforced walls for grab bars.** Grab bar reinforcement shall be installed continuous in the walls of showers 32 inches to 38 inches (813 mm to 965 mm) above the floor. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

Glass-walled shower stalls shall provide reinforcement for installation of floor-mounted or ceiling-mounted grab bars.

5. **Thresholds.** When a threshold is used, it shall be a maximum of 2 inches (50.8 mm) in height and have a beveled or sloped angle not exceeding 1 unit vertical in 2 units horizontal (26.6 degrees from the horizontal). Thresholds $\frac{1}{2}$ inch (12.7 mm) or less in height may have a beveled or sloped angle not exceeding 1 unit vertical in 1 unit horizontal (45 degrees from the horizontal).

6. **Shower controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate controls shall be no greater than 5 pounds (22.2 N). Lever operated, push-type and electronically controlled mechanisms are examples of acceptable designs.

7. **Shower enclosures.** Doors and panels of shower enclosures shall be substantially constructed from approved, shatter-resistant materials. Hinged shower doors shall open outward. Glazing used in doors and panels of shower enclosures shall be fully tempered, laminated safety glass or approved plastic. When glass is used, it shall have minimum thickness of not less than $\frac{1}{8}$ inch (3.17 mm) when fully tempered, or $\frac{1}{4}$ inch (6.35 mm) when laminated, and shall pass the test requirements of this part, Chapter 24, Glass and Glazing. Plastics used in doors and panels of shower enclosures shall be of a shatter-resistant type.

1134A.7 Water closets. Water closets in bathrooms or powder rooms required to be accessible shall comply with this section.

1. **Floor space and location.** The minimum floor space provided at a water closet shall be 48 inches (1219 mm) in clear width. The clear floor space shall extend past the front edge of the water closet at least 36 inches (914 mm). See Figure 11A-9M.

Exception: The 48-inch (1219 mm) minimum clear width may be reduced to 36 inches (914 mm) for lavatories, cabinets, wing walls or privacy walls located immediately adjacent to a water closet which extend no more than 24 inches (610 mm) in depth.

Water closets shall be located within bathrooms in a manner that permits a grab bar to be installed on at least one side of the fixture. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from a grab bar wall or partition. In locations where water closets are adjacent to non-grab bar walls, vanities, lavatories or bathtubs, the centerline of the fixture shall be a minimum of 18 inches (457 mm) from the obstacle.

2. **Reinforced walls for grab bars.** Where the water closet is not placed adjacent to a side wall capable of accommodating a grab bar, the bathroom shall have provisions for installation of floor-mounted, foldaway or similar alternative grab bars.

Where the water closet is placed adjacent to a side wall, reinforcement shall be installed on both sides or one side and the back. If reinforcement is installed at the back, it shall be installed between 32 inches (813 mm) and 38 inches (965 mm) above the floor. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height. The backing shall be a minimum of 40 inches (1016 mm) in length.

Reinforcement installed at the side of the water closet shall be installed 32 inches to 38 inches (813 mm to 965 mm) above the floor. The reinforcement shall be installed a maximum of 12 inches (305 mm) from the rear wall and shall extend a minimum of 26 inches (660 mm) in front of the water closet. The grab bar reinforcement shall be a minimum of 6 inches (152.4 mm) nominal in height.

3. **Seat height.** The minimum height of water closet seats shall be 15 inches (381 mm) above the floor.

4. **Water closet controls.** Water closet controls shall be mounted no more than 44 inches (1118 mm) above the floor. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

1134A.8 Lavatories, vanities, mirrors and towel fixtures. Bathrooms or powder rooms required to be accessible shall have at least one accessible lavatory. Where mirrors and towel fixtures are provided, at least one of each shall be accessible.

1. **Location.** Vanities and lavatories shall be installed with the centerline of the fixture a minimum of 18 inches (457 mm) horizontally from an adjoining wall or fixture to allow for forward approach. When parallel approach is provided, lavatories shall be installed with the centerline of the fixture a minimum of 24 inches (610 mm) horizontally from an adjoining wall or fixture. The top of the fixture rim shall be a maximum of 34 inches (864 mm) above the finished floor.
2. **Floor space.** A clear maneuvering space at least 30 inches by 48 inches (762 mm by 1219 mm) shall be provided at lavatories and shall be centered on the lavatory.
3. **Cabinets.** Cabinets under lavatories are acceptable provided the bathroom has space to allow a parallel approach by a person in a wheelchair and the lavatory cabinets are designed with adaptable knee and toe space.
4. **Knee and toe space.** Knee and toe space shall be provided by one of the following:
- 4.1. The space beneath the lavatory shall be left clear and unobstructed;
 - 4.2. Any cabinet beneath the lavatory shall be removable without the use of specialized knowledge or specialized tools; or
 - 4.3. Doors to the cabinet beneath the lavatory shall be removable or openable to provide the required unobstructed knee and toe space.

The knee and toe space shall be centered on the fixture, and shall comply with Section 1138A.2. The clear floor space required by Item 2 shall not extend into the knee and toe space more than 19 inches (483 mm). (See Figure 11A-9D.)

5. **Finished floor.** The finished floor beneath the lavatory shall be extended to the wall.
6. **Plumbing protection.** Water supply and drain pipes under lavatories shall be insulated or otherwise covered to protect against contact. There shall be no sharp or abrasive surfaces under lavatories.
7. **Lavatory faucet controls.** Faucet controls and operation mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls shall be no greater than 5 pounds (22.2 N). Lever operated, push-type and electronically controlled mechanisms are examples of acceptable designs. Self-closing valves are

allowed if the faucet remains open for at least 10 seconds.

8. **Mirrors and towel fixtures.** Where mirrors or towel fixtures are provided they shall be mounted with the bottom edge no higher than 40 inches (1016 mm) from the floor.

SECTION 1135A LAUNDRY ROOMS

1135A.1 General. If clothes washing machines and clothes dryers are provided in covered multifamily dwelling units, one of each type of appliance shall be provided. Where front-loading clothes washers are not provided, management shall provide assistive devices, on request of the occupant, to permit the use of top-loading clothes washers.

SECTION 1136A ELECTRICAL RECEPTACLE, SWITCH AND CONTROL HEIGHTS

1136A.1 Receptacle heights. Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall be located no more than 48 inches (1219 mm) measured from the top of the receptacle outlet box nor less than 15 inches (381 mm) measured from the bottom of the receptacle outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), receptacles shall be located within the reach ranges specified in Section 1138A.3. Physical barriers and obstructions shall not extend more than 25 inches (635 mm) from the wall beneath the receptacle. Countertops shall be allowed to extend 25½ inches (647.7 mm) from the wall beneath the receptacle.

Receptacle outlets that do not satisfy these specifications are acceptable provided that comparable receptacle outlets, that perform the same functions, are provided within the same area and are accessible.

Exceptions:

1. Receptacle outlets installed as part of permanently installed baseboard heaters are exempt.
2. Required receptacle outlets shall be permitted in floors when adjacent to sliding panels or walls.
3. Baseboard electrical outlets used in relocatable partitions, window walls or other electrical convenience floor outlets are not subject to the minimum height requirements.
4. This section shall not apply to existing buildings when the enforcing agency determines that compliance with these standards would create an unreasonable hardship.

1136A.2 Switch and control heights. Controls or switches intended to be used by the occupant of the room or area to control lighting and receptacle outlets, appliances, alarms or cooling, heating and ventilating equipment shall be located no more than 48 inches (1219 mm) measured from the top of the outlet box nor less than 15 inches (381 mm) measured

from the bottom of the outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet) switches and controls shall be located within the reach ranges specified in Section 1138A.3. Physical barriers or obstructions shall not extend more than 25 inches (635 mm) from the wall beneath a control or switch. Countertops shall be allowed to extend 25½ inches (647.7 mm) from the wall beneath a control or switch.

Switches and controls that do not satisfy these specifications are acceptable provided that comparable controls or outlets, that perform the same functions, are provided within the same area and are accessible.

Exception: Appliances (e.g., kitchen stoves, dishwashers, range hoods, microwave ovens and similar appliances) which have controls located on the appliance.

Division V – FEATURES COMMON TO EXTERIOR AND INTERIOR OF BUILDINGS

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SECTION 1137A OTHER FEATURES AND FACILITIES

1137A.1 General. This division shall apply to features and facilities of common use areas on accessible floors or sites.

Note: The provisions in this division are not applicable to dwelling units, unless otherwise specified.

SECTION 1138A SPACE ALLOWANCES AND REACH RANGES

1138A.1 Space allowances.

1138A.1.1 Single wheelchair passage width. The minimum clear width for single wheelchair passage shall be 36 inches (914 mm) continuously. (See Figure 11A-1E.)

See Section 1113A for minimum clear width of side-walks, and Section 1120A for minimum clear width of interior accessible routes.

Exception: 32 inches (813 mm) in width is acceptable at a point not to exceed 24 inches (610 mm) in length. The segments with reduced width shall be separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.

1138A.1.2 Width for two wheelchairs passing. The minimum width for two wheelchairs to pass is 60 inches (1524 mm) (See Figure 11A-1E).

An accessible route (exterior and interior) with a clear width less than 60 inches (1524 mm) shall provide passing spaces at intervals of 200 feet (60 960 mm) maximum. Passing spaces shall be either: a space 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with Section 1138A.1.3.1, where the base and arms of the T-shaped space extend 48 inches (1219 mm) minimum beyond the intersection. (See Figure 11A-1L.)

1138A.1.3 Wheelchair turning space. The space required for a wheelchair to make a 180-degree turn shall be a circular clear space of 60 inches (1524 mm) diameter minimum (See Figure 11A-1D(a)); or a T-shaped space complying with Section 1138A.1.3.1. The circular turning

space shall be permitted to include knee and toe clearance complying with Section 1138A.2.

If a person in a wheelchair must make a turn around an obstruction, the minimum clear width of the accessible route shall be as required in Section 1138A.1.5.

1138A.1.3.1 T-shaped turning space. A T-shaped turning space shall be within a 60 inch (1524 mm) square minimum with arms and base 36 inches (914 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction, and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with Section 1138A.2 only at the end of either the base or one arm. (See Figure 11A-1D (b).)

1138A.1.3.2 Surfaces of turning spaces. Turning spaces for wheelchairs shall be stable, firm, slip resistant, and shall comply with Section 1110A.3 or Section 1119A.2. Changes in level are not permitted. Slopes not steeper than 1:48 shall be permitted.

1138A.1.4 Clear floor or ground space for wheelchairs.

1138A.1.4.1 Size and approach. The minimum clear floor or ground space shall be 30 inches by 48 inches (762 mm by 1219 mm). The minimum clear floor or ground space may be positioned for forward or parallel approach to an object (See Figure 11A-1G). Clear floor or ground space may be part of the knee and toe space required under some objects unless otherwise specified.

1138A.1.4.2 Relationship of maneuvering clearances to wheelchair spaces. One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin an accessible route or adjoin another wheelchair clear floor space.

If a clear floor space is located in an alcove or otherwise confined on all or a part of three sides, additional maneuvering clearances shall be provided in accordance with the following: (See Figure 11A-1H).

- 1. Forward approach.** Alcoves shall be 36 inches (914 mm) wide minimum when the depth exceeds 24 inches (610 mm).
- 2. Parallel approach.** Alcoves shall be 60 inches (1524 mm) wide minimum when the depth exceeds 15 inches (381 mm).

1138A.1.4.3 Surfaces of wheelchair spaces. Clear floor or ground spaces for wheelchairs shall be stable, firm, slip resistant, and shall comply with Section 1110A.3 or Section 1119A.2. Changes in level are not permitted. Slopes not steeper than 1:48 shall be permitted.

1138A.1.4.3.1 Gratings. Gratings located in ground and floor surfaces along accessible routes shall be limited to spaces no greater than 1/2-inch (12.7 mm) wide in one direction. If gratings have elongated openings, they shall be placed so that the long

dimension is perpendicular to the dominant direction of traffic.

1138A.1.5 Turn around obstruction. When the accessible route makes a 180 degree turn around an element which is less than 48 inches (1219 mm) wide, clear width shall be 42 inches (1067 mm) minimum approaching the turn, 48 inches (1219 mm) minimum at the turn and 42 inches (1067 mm) minimum leaving the turn. When the clear width at the turn is 60 inches (1524 mm) minimum, the clear width when approaching and when leaving the turn shall be 36 inches (914 mm) minimum. (See Figure 11A-1C (b).)

When the accessible route makes a 90 degree turn around an element which is more than 48 inches (1219 mm) wide, clear width shall be 36 inches (914 mm) minimum approaching the turn, at the turn and leaving the turn. (See Figure 11A-1C (a).)

1138A.2 Knee and toe space. When space beneath an accessible element is included as part of a clear floor space, or turning space, the space shall comply with this section. Additional space shall not be prohibited beneath an element but shall not be considered as part of the clear floor space or turning space. (See Figure 11A-9D.)

1138A.2.1 Knee space. Space under an element between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor shall be considered knee space. The knee space shall be clear and unobstructed.

Exceptions:

1. For lavatories required to be accessible, the knee space shall be at least 29 inches (737 mm) high at the front face and reducing to not less than 27 inches (686 mm) at a point 8 inches (203.2 mm) back from the front edge.
2. For lavatories and sinks required to be accessible, the dip of the overflow shall not be considered in determining knee and toe clearances.

1138A.2.1.1 Minimum width. Knee space shall be 30 inches (762 mm) wide minimum.

1138A.2.1.2 Maximum depth. Knee space shall extend 25 inches (635 mm) maximum under an element at 9 inches (229 mm) above the finish floor.

1138A.2.1.3 Minimum depth. When knee space is required under an element as part of a clear floor space, the knee space shall be 11 inches (279 mm) deep minimum at 9 inches (229 mm) above the finish floor, and 8 inches (203 mm) deep minimum at 27 inches (686 mm) above the finish floor, measured from the front edge of the element.

Exceptions:

1. Combined knee and toe space shall extend 19 inches (483 mm) minimum under sinks required to be accessible.
2. Combined knee and toe space shall extend 19 inches (483 mm) minimum under built-in dining and work surfaces required to be accessible.

1138A.2.1.4 Clearance reduction. Between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor, the knee space shall be permitted to be reduced at a rate of 1 inch (25 mm) in depth for each 6 inches (152 mm) in height.

1138A.2.2 Toe space. Space under an element between the finish floor and 9 inches (229 mm) above the finish floor shall be considered toe space.

1138A.2.2.1 Minimum width. Toe space shall be 30 inches (762 mm) wide minimum.

1138A.2.2.2 Maximum depth. Toe space shall extend 25 inches (635 mm) maximum under an element.

1138A.2.2.3 Minimum depth. When toe space is required under an element as part of a clear floor space, the toe space shall extend 17 inches (432 mm) minimum under the element, measured from the front edge of the element.

Exceptions:

1. Combined knee and toe space shall extend 19 inches (483 mm) minimum under sinks required to be accessible.
2. Combined knee and toe space shall extend 19 inches (483 mm) minimum under build-in dining and work surfaces required to be accessible.

1138A.2.2.4 Additional clearance. Space extending greater than 6 inches (152 mm) beyond the available knee space at 9 inches (229 mm) above the finish floor shall not be considered toe space.

1138A.3 Reach ranges.

1138A.3.1 Forward reach.

1. **Unobstructed.** When the clear floor space allows only forward approach to an object, the maximum high forward reach allowed shall be 48 inches (1219 mm) and the minimum low forward reach shall be no less than 15 inches (381 mm) above the finish floor. (See Figure 11A-11(a).)
2. **Obstructed high reach.** When the high forward reach is over an obstruction, the clear floor space shall extend beneath the element for a distance not less than the reach depth over the obstruction.

The high forward reach shall be 48 inches (1219 mm) maximum when the reach depth is 20 inches (508 mm) maximum. When the reach depth exceeds 20 inches (508 mm), but is not more than 25 inches (635 mm), the high forward reach shall be 44 inches (1118 mm) maximum. (See Figure 11A-11(b).)

1138A.3.2 Side reach.

1. **Unobstructed.** When a clear floor space allows a parallel approach to an element, and the side reach is unobstructed, the high side reach shall be 48 inches (1219 mm) maximum, and the low side reach shall be 15 inches (381 mm) minimum

above the finish floor. (See Figures 11A-1J(a) and 11A-1J(b).)

Exceptions:

1. An obstruction shall be permitted between the clear floor space and the element when the depth of the obstruction is 10 inches (254 mm) maximum.
2. Bookshelves shall be permitted to be 54 inches (1372 mm) maximum above the finish floor. Bookshelves may be greater than 54 inches (1372 mm) above the finish floor when an attendant is available to assist persons with disabilities.
2. **Obstructed high reach.** When a clear floor space allows a parallel approach to an element and the high side reach is over an obstruction, the height of the obstruction shall be 34 inches (864 mm) maximum and the depth of the obstruction shall be 24 inches (610 mm) maximum.

The high side reach shall be 48 inches (1219 mm) maximum for a reach depth of 10 inches (254 mm) maximum. When the reach depth exceeds 10 inches (254 mm), but no more than 24 inches (610 mm), the high side reach shall be 46 inches (1168 mm) maximum. (See Figure 11A-1J(c).)

Exception: Kitchen countertops in dwelling units, and the top of washing machines and clothes dryers shall be permitted to be 36 inches (914 mm) maximum above the finish floor.

1138A.4 Controls and operating mechanisms.

Note: See also Section 1142A for receptacle, switch and control installation.

1138A.4.1 General. Controls and operating mechanisms in accessible spaces, along accessible routes or as part of accessible elements shall comply with this section.

1138A.4.2 Clear floor space. Clear floor space complying with Section 1138A.1.4 that allows a forward or parallel approach by a person using a wheelchair shall be provided at all controls and operating mechanisms.

1138A.4.3 Height. Controls and operating mechanisms shall be located no higher than 48 inches (1219 mm), and no lower than 15 inches (381 mm), above the finished floor measured to the center of the grip. If the reach is over an obstruction (for example, washer or dryer), controls and operating mechanisms shall be located within the reach ranges specified in Section 1138A.3. Controls and operating mechanisms that do not satisfy these specifications are acceptable, provided that comparable mechanisms, controls or outlets, that perform the same functions, are provided within the same area and are accessible.

1138A.4.4 Operation. Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.

The force required to activate controls and operating mechanisms shall be no greater than 5 pounds (22.2 N).

**SECTION 1139A
ACCESSIBLE DRINKING FOUNTAINS**

1139A.1 General. Drinking fountains and water coolers in common use areas and/or sites shall comply with this section. A side approach drinking fountain is not acceptable. (See Figure 11A-11A.)

1139A.2 Accessible route. Drinking fountains and water coolers shall be on an accessible route.

1139A.3 Depth. Drinking fountains shall be a minimum of 18 inches (457 mm) and a maximum of 19 inches (483 mm) in depth.

1139A.4 Clear floor space. Drinking fountains shall be provided with 30 inches by 48 inches (762 mm by 1219 mm) clear floor space, centered on the unit. The clear floor space shall be positioned for a forward approach.

1139A.4.1 Knee and toe space. Drinking fountains shall be provided with a clear and unobstructed knee and toe space. Knee and toe space shall comply with Section 1138A.2.

1139A.5 Spout location. The spout shall be located 15 inches (381 mm) minimum from the vertical support and 5 inches (127 mm) maximum from the front edge of the drinking fountain, including bumpers. Spout outlets shall be 36 inches (914 mm) maximum above the finish floor.

1139A.6 Water flow. The spout shall provide a flow of water at least 4 inches (101.6 mm) high to allow the insertion of a cup or glass under the flow of water. The angle of the water stream shall be measured horizontally relative to the front face of the unit. When spouts are located less than 3 inches (76 mm) from the front of the unit, the angle of the water stream shall be 30 degrees maximum. When spouts are located between 3 inches (76 mm) and 5 inches (127 mm) maximum from the front of the unit, the angle of the water stream shall be 15 degrees maximum.

1139A.7 Controls and operating mechanisms. The flow of water shall be activated by manually or electronically operated controls. The manually operated controls shall be front mounted or side mounted, located within 6 inches (152 mm) of the front edge of the fountain. The force required to activate controls shall be no greater than 5 pounds (22.2 N).

1139A.8 Location. Drinking fountains shall be located completely within alcoves, between wing walls or otherwise positioned so as not to encroach into pedestrian ways. The alcove or otherwise protected area in which the drinking fountain is located shall not be less than 32 inches (813 mm) in width and 18 inches (457 mm) in depth. When the depth of the protected area where the drinking fountain is located exceeds 24 inches (610 mm), additional maneuvering clearance shall be provided in accordance with Section 1138A.1.4.2 and Figure 11A-1H.

When provided, wing walls shall project out from the supporting wall at least as far as the drinking fountain to within 6 inches (152.4 mm) vertically from the finish floor.

Protruding objects located in alcoves or otherwise positioned so as to limit encroachment into pedestrian ways are permitted to project 4 inches (101.6 mm) into walks, halls, corridors, passageways or aisles. (See Figure 11A-11A.)

SECTION 1140A ACCESSIBLE TELEPHONES

1140A.1 General. When public telephones are provided, they shall comply with this section. On floors where public telephones are provided, at least one telephone shall be accessible. On any floor where two or more banks of multiple telephones are provided, at least one telephone in each bank shall be accessible.

1140A.2 Clear floor or ground space. A clear floor or ground space at least 30 inches by 48 inches (762 mm by 1219 mm) that allows either a forward or parallel approach by a person using a wheelchair shall be provided at telephones. The clear floor or ground space shall comply with Section 1138A.1.4. Bases, enclosures and fixed seats shall not impede approaches to telephones by people who use wheelchairs. (See Figure 11A-11B.)

Clear floor or ground space for wheelchairs may be part of the knee space required under some objects.

1140A.3 Relationship of maneuvering clearances to wheelchair spaces. One full unobstructed side of the clear floor or ground space for a wheelchair shall adjoin another wheelchair clear floor space. If a clear floor space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearances shall be provided. (See Section 1138A.1.4.)

1140A.4 Mounting height. The highest operable part of the telephone shall be within the reach ranges specified in Section 1138A.3 (See Figure 11A-11B.)

1140A.5 Enclosures. If telephone enclosures are provided, they shall comply with Sections 1140A.5.1 and 1140A.5.2. (See Figure 11A-11B.)

1140A.5.1 Parallel approach. Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit shall be 10 inches (254 mm) maximum.

1140A.5.2 Forward approach. Where a forward approach is provided, the counter may extend beyond the face of the telephone 20 inches (508 mm) maximum into the required clear floor or ground space and the enclosure may extend beyond the face of the telephone 24 inches (610 mm) maximum. If an additional 6 inches (152 mm) in width of clear floor space is provided, creating a clear floor space of 36 inches by 48 inches (914 mm by 1219 mm), the enclosure may extend more than 24 inches (610 mm) beyond the face of the telephone.

1140A.6 Equipment for hearing impaired people. Telephones shall be equipped with a receiver that generates a

magnetic field in the area of the receiver cap. A reasonable number of the public telephones provided, but always at least one on each floor or in each bank, whichever is more, in a building or facility, shall be equipped with a volume control. Such telephones shall be capable of providing a gain adjustable up to 20 dB minimum. For incremental volume control, at least one intermediate step of 12 dB of gain minimum shall be provided. An automatic reset shall also be provided. Public telephones with volume control shall be hearing aid compatible and shall be identified by a sign containing a depiction of a telephone handset with radiating sound waves. (See Figure 11A-11D.)

1140A.7 Text telephones (TTY). If a total of four or more public pay telephones are provided at the interior and exterior of a site, and if at least one of the total number provided is located in an interior location, at least one interior public text telephone shall be provided. TTYS provided at a public pay telephone shall be permanently affixed within, or adjacent to, the telephone enclosure. Where an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the TTY and the telephone receiver.

1140A.7.1 Signage. Text telephones shall be identified by the International TTY symbol (see Figure 11A-11C). If a facility has a public text telephone, directional signage indicating the location of the nearest such telephone shall be placed adjacent to all banks of telephones that do not contain a text telephone. Such directional signage shall include the International TTY symbol. If a facility has no banks of telephones, the directional signage shall be provided at the entrance or in a building directory.

1140A.7.2 Height. When in use, the touch surface of TTY keypads shall be 34 inches (864 mm) minimum above the finish floor.

1140A.8 Controls. Telephones shall have push-button controls where service for such equipment is available. Controls and operating mechanisms shall comply with Section 1138A.4.

1140A.9 Cord length. The cord from the telephone to the handset shall be at least 29 inches (737 mm) long.

1140A.10 Telephone books. If telephone books are provided, they shall be located in a position that complies with the reach ranges in Section 1138A.3.

1140A.11 Shelf. Public pay telephones required to accommodate a portable TTY shall be equipped with a shelf and an electrical outlet within or adjacent to the telephone enclosure. The telephone handset shall be capable of being placed flush on the surface of the shelf. The shelf shall be capable of accommodating a TTY and shall have 6 inches (152 mm) minimum vertical clearance above the area where the TTY is to be placed.

SECTION 1141A ACCESSIBLE SWIMMING POOLS

1141A.1 General. Swimming pools in common use areas shall comply with the provisions of this section and Chapter 31B.

1141A.2 Swimming pool deck areas. Swimming pool deck areas must be accessible, and a mechanism to assist persons with disabilities gain entry into the pool and exit from the

pool shall be provided. Such a mechanism may consist of a swimming pool lift device as long as the device meets all of the following criteria:

1. Has a seat that meets all of the following:
 - 1.1. The seat must be rigid;
 - 1.2. The seat must be not less than 17 inches (432 mm) and not more than 19 inches (483 mm), inclusive of any cushioned surface that might be provided, above the pool deck;
 - 1.3. The seat must have two armrests. The armrest on the side of the seat by which access is gained shall be either removable or fold clear of the seat;
 - 1.4. The seat must have a back support that is at least 12 inches (305 mm) tall; and
 - 1.5. The seat must have an occupant restraint for use by the occupant of the seat and the restraint must meet the standards for operable controls in compliance with Section 1138A.4.4.
2. Be capable of unassisted operation from both the deck and water levels.
3. Be stable and not permit unintended movement when a person is getting into or out of the seat.
4. Be designed to have a live-load capacity of not less than 300 pounds.
5. Be positioned so that, if the pool has water of different depths, it will place the operator into water that is at least 3 feet (914 mm) deep.
6. Be capable of lowering the operator at least 18 inches (457 mm) below the surface of the water.

SECTION 1142A ELECTRICAL RECEPTACLE, SWITCH AND CONTROL HEIGHTS

1142A.1 Receptacle heights. Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall be located no more than 48 inches (1219 mm) measured from the top of the receptacle outlet box nor less than 15 inches (381 mm) measured from the bottom of the receptacle outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), receptacles shall be located within the reach ranges specified in Section 1138A.3. Physical barriers and obstructions shall not extend more than 25 inches (635 mm) from the wall beneath the receptacle.

Receptacle outlets that do not satisfy these specifications are acceptable provided that comparable receptacle outlets, that perform the same functions, are provided within the same area and are accessible.

Exceptions:

1. Receptacle outlets installed as part of permanently installed baseboard heaters are exempt.
2. Required receptacle outlets shall be permitted in floors when adjacent to sliding panels or walls.

3. Baseboard electrical outlets used in relocatable partitions, window walls or other electrical convenience floor outlets are not subject to the minimum height requirements.
4. This section shall not apply to existing buildings when the enforcing agency determines that compliance with these standards would create an unreasonable hardship.

1142A.2 Switch and control heights. Controls or switches intended to be used by the occupant of the room or area to control lighting and receptacle outlets, appliances, alarms or cooling, heating and ventilating equipment shall be located no more than 48 inches (1219 mm) measured from the top of the outlet box nor less than 15 inches (381 mm) measured from the bottom of the outlet box to the level of the finished floor or working platform. If the reach is over a physical barrier or an obstruction (for example, a kitchen base cabinet), switches and controls shall be located within the reach ranges specified in Section 1138A.3. Physical barriers or obstructions shall not extend more than 25 inches (635 mm) from the wall beneath a switch or control.

Switches and controls that do not satisfy these specifications are acceptable provided that comparable controls or outlets, that perform the same functions, are provided within the same area and are accessible.

SECTION 1143A SIGNAGE

1143A.1 General. When signs and/or identification devices are provided they shall comply with this section.

When both visual and tactile characters are required, either one sign with both visual and tactile characters, or two separate signs—one with visual and one with tactile characters—shall be provided.

Exception: Signs need not be provided within dwelling units.

Note: See Section 1127A.7 for additional signage requirements applicable to sanitary facilities, and Section 1124A for additional signage requirements applicable to elevators.

1143A.2 Identification signs. When signs identify permanent rooms and spaces of a building or site, they shall comply with Sections 1143A.1, 1143A.5, 1143A.6 and 1143A.7.

Exception: Exterior signs that are not located at the door to the space they serve shall not be required to comply with Section 1143A.6.

1143A.3 Directional and informational signs. When signs direct to or give information about permanent rooms and spaces of a building or site, they shall comply with Sections 1143A.5.

1143A.4 Accessibility signs. When signs identify, direct or give information about accessible elements and features of a building or site, they shall include the appropriate symbol of accessibility and shall comply with Section 1143A.5.

**TABLE 1143A.5
VISUAL CHARACTER HEIGHT**

HEIGHT TO FINISH FLOOR FROM BASELINE OF CHARACTER	HORIZONTAL VIEWING DISTANCE	MINIMUM CHARACTER HEIGHT
40 inches (1016 mm) to less than or equal to 70 inches (1778 mm)	Less than 72 inches (1829 mm)	$\frac{5}{8}$ inch (15.9 mm)
	72 inches (1829 mm) and greater	$\frac{5}{8}$ inch (15.9 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1829 mm)
Greater than 70 inches (1778 mm) to less than or equal to 120 inches (3048 mm)	Less than 180 inches (4572 mm)	2 inches (51 mm)
	180 inches (4572 mm) and greater	2 inches (51 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4572 mm)
Greater than 120 inches (3048 mm)	Less than 21 feet (6401 mm)	3 inches (76 mm)
	21 feet (6401 mm) and greater	3 inches (76 mm), plus $\frac{1}{8}$ inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6401 mm)

1143A.5 Visual characters. Signs with visual characters shall comply with this section.

- 1. Finish and contrast.** Characters and their background shall have a non-glare finish. Characters shall contrast with their background, either light on a dark background or dark on a light background.
- 2. Character type.** Characters shall be uppercase, lowercase or a combination of both. Characters shall be conventional in form, and shall not be italic, oblique, script, highly decorative or of other unusual forms.
- 3. Proportions.** Characters on signs shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
- 4. Character height.** Visual characters shall be sized in accordance with Table 1143A.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter “I”.
- 5. Height from finish floor.** Visual characters shall be 40 inches (1016 mm) minimum above the finish floor.

Exceptions:

1. Visual characters indicating elevator car controls.
2. Floor-level exit signs complying with Chapter 10, Section 1011.6.
- 6. Stroke thickness.** Stroke thickness of the uppercase letter “I” shall be 10 percent minimum and 20 percent maximum of the height of the character.
- 7. Character spacing.** Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.
- 8. Line spacing.** Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.
- 9. Character format.** Text shall be in a horizontal format.

1143A.6 Raised characters and pictorial symbol signs. When raised characters are required or when pictorial symbols (pictograms) are used on such signs, they shall comply with this section. Raised characters and pictorial symbols shall be duplicated in Braille complying with Section 1143A.7.

- 1. Character type.** Raised characters on signs shall be $\frac{1}{32}$ inch (0.8 mm) minimum above their background. Characters shall be sans serif uppercase, and shall not be italic, oblique, script, highly decorative or of other unusual forms.
- 2. Character height.** Character height measured vertically from the baseline of the character shall be $\frac{5}{8}$ inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “I”.
- 3. Character format.** Characters and Braille shall be in a horizontal format.
- 4. Proportions.** Raised characters on signs shall be selected from fonts when the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
- 5. Stroke thickness.** Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.
- 6. Character spacing.** Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. When characters have rectangular cross sections, spacing between individual raised characters shall be $\frac{1}{8}$ inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. When characters have other cross sections, spacing between individual raised characters shall be $\frac{1}{16}$ inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and $\frac{1}{8}$ inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements $\frac{3}{8}$ inch (9.5 mm) minimum.
- 7. Line spacing.** Spacing between the baselines of separate lines of raised characters within a message shall

be 135 percent minimum and 170 percent maximum of the raised character height.

8. **Location.** When a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. When a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. When a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. When there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (457 mm) minimum by 18 inches (457 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. When permanent identification signage is provided for rooms and spaces they shall be located on the approach side of the door as one enters the room or space. Signs that identify exits shall be located on the approach side of the door as one exits the room or space.

9. **Height.** Signs with raised characters shall be located 48 inches (1219 mm) minimum above the finish floor, measured from the baseline of the lowest Braille cells and 60 inches (1524 mm) maximum above the finish floor, measured from the baseline of the highest line of raised characters.

Exception: Tactile characters for elevator car controls shall not be required to comply with this section.

10. **Pictorial symbol signs (pictograms).** Pictorial symbol signs (pictograms) shall be accompanied by a text description located directly below the pictogram field. The text description shall comply with Sections 1143A.6 and 1143A.7. The outside dimension of the pictogram field shall be a minimum of 6 inches (152 mm) in height. Characters and Braille shall not be located in the pictogram field.

1143A.7 Braille. Contracted Grade 2 Braille shall be used wherever Braille is required in other portions of these standards.

1143A.7.1 Dimensions and capitalization. Braille dots shall have a domed or rounded shape and shall comply with Table 1143A.7.1. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials and acronyms.

1143A.7.2 Position. Braille shall be positioned below the corresponding text in a horizontal format, flush left or centered. If text is multilined, braille shall be placed below the entire text. Braille shall be separated $\frac{3}{8}$ inch (9.5 mm) minimum and $\frac{1}{2}$ inch (12.7 mm) maximum from any other tactile characters and $\frac{3}{8}$ inch (9.5 mm) minimum from raised borders and decorative elements.

Exception: Braille provided on elevator car controls shall be separated $\frac{3}{16}$ inch (4.8 mm) minimum and

shall be located directly below the corresponding raised characters or symbols.

TABLE 1143A.7.1 BRAILLE DIMENSIONS

MEASUREMENT RANGE	MINIMUM IN INCHES MAXIMUM IN INCHES
Dot base diameter	0.059 (1.5 mm) to 0.063 (1.6 mm)
Distance between two dots in the same cell ¹	0.100 (2.5 mm)
Distance between corresponding dots in adjacent cells ¹	0.300 (7.6 mm)
Dot height	0.025 (0.6 mm) to 0.037 (0.9 mm)
Distance between corresponding dots from one cell directly below ¹	0.395 (10 mm) to 0.400 (10.2 mm)

1. Measured center to center.

1143A.8 Symbols of accessibility. Symbols of accessibility and their background shall have a non-glare finish. Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background. Symbols of accessibility shall comply with the following:

1. **International Symbol of Accessibility.** The “International Symbol of Accessibility” shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C. (See Figure 11A-1A.)
2. **International Symbol of TTY.** (See Figure 11A-11C.)
3. **Volume Control Telephones.** (See Figure 11A-11D.)
4. **Assistive Listening Systems.** (See Figure 11A-11E.)
5. **Cleaner Air Symbol.** (See Chapter 11B.)
6. **Toilet and Bathing Facilities Geometric Symbols.** (See Section 1127A.7.)

SECTION 1144A
Reserved

SECTION 1145A
Reserved

SECTION 1146A
Reserved

SECTION 1147A
Reserved

SECTION 1148A
Reserved

SECTION 1149A
Reserved

Division VI – SITE IMPRACTICALITY TESTS**Division VI Table of Contents**

Section 1150A Site Impracticality Tests

Test No. 1—Individual Building Test

Test No. 2—Site Analysis Test

Test No. 3—Unusual Characteristics Test

**SECTION 1150A
SITE IMPRACTICALITY TESTS**

1150A.1 General. Covered multifamily dwellings in buildings without an elevator, located on sites with difficult terrain conditions or unusual characteristics, may employ the site impracticality tests in this division for determining the accessibility and adaptability provisions required by this chapter.

Except as provided for in Section 1102A.3.1, the provisions of this section do not apply to multistory dwelling units in nonelevator buildings.

**SINGLE BUILDING WITH
ONE COMMON (LOBBY) ENTRANCE**

The following may only be used for determining required access to covered multifamily dwelling units, in a single building with one common (lobby) entrance, located on a site with difficult terrain conditions or unusual characteristics:

All ground floor units in nonelevator buildings shall be adaptable and on an accessible route unless an accessible route to the common (lobby) entrance is not required as determined by Test No. 1, Individual Building Test, or Test No. 3, Unusual Characteristics Test, as described in this section.

Sites where either Test No. 1 or Test No. 3 is used and it is determined that an accessible route to the common (lobby) entrance is not required, at least 20 percent of the ground floor dwelling units shall comply with Division IV, and all remaining ground floor dwelling units shall comply with the features listed in Section 1150A.2 unless exempted by Test No. 3, Unusual Characteristics Test.

Test No. 1—Individual Building Test may only be used if the site has terrain over 15 percent slope.

Test No. 3—Unusual Characteristics Test may be used if applicable.

Provisions to Test Nos. 1 and 2. Where a building elevator is provided only as means of creating an accessible route to covered multifamily dwelling units on a ground floor, the building is not considered to be an elevator building for purposes of this code; hence, only the ground floor dwelling units would be covered.

TEST NO. 1—INDIVIDUAL BUILDING TEST

It is not required by this code to provide an accessible route when the terrain of the site is such that both of the following apply:

1. The slopes of the undisturbed site measured between the planned entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance exceed 15 percent; and
2. The slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance also exceed 15 percent.

If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the slope for the purposes of Test No. 1 will be measured to the closest vehicular or pedestrian arrival point.

For purposes of these requirements, vehicular or pedestrian arrival points include public or resident parking areas, public transportation stops, passenger loading zones and public streets or sidewalks. To determine site impracticality, the slope would be measured at ground level from the point of the planned entrance on a straight line to (1) each vehicular or pedestrian arrival point that is within 50 feet (15 240 mm) of the planned entrance, or (2) if there are no vehicular or pedestrian arrival points within the specified area, the vehicular or pedestrian arrival point closest to the planned entrance. In the case of sidewalks, the closest point to the entrance will be where a public sidewalk entering the site intersects with the walk to the entrance. In the case of resident parking areas, the closest point to the planned entrance will be measured from the entry point to the parking area that is located closest to the planned entrance.

TEST NO. 2—SITE ANALYSIS TEST

For a site having multiple buildings, or a site with a single building with multiple entrances, it is not required to provide an accessible route to all ground floor units under the following conditions:

1. Calculate the percentage of the total buildable area of the undisturbed site with a natural grade less than 10-percent slope. The analysis of the existing slope (before grading) shall be done on a topographic survey with 2-foot (610 mm) contour intervals with slope determination made between each successive interval. The accuracy of the slope analysis shall be certified by a licensed engineer, landscape architect, architect or surveyor.
2. Determine the requirement of providing an accessible route to planned multifamily dwellings based on the topography of the existing natural terrain. The minimum percentage of ground floor units required on an accessible route shall equal the percentage of the total buildable area (not restricted-use areas) of

HOUSING ACCESSIBILITY

the undisturbed site with an existing natural grade of less than 10-percent slope. In no case shall less than 20 percent of the ground floor dwelling units be on an accessible route and comply with the provisions of Division IV.

3. *In addition to the percentage established in paragraph (2), all additional ground floor units in a building or ground floor units served by a particular entrance, that fall within an 8.33-percent slope between their planned entrances and an arrival point shall be on an accessible route and comply with the provisions of Division IV.*
4. *All additional ground floor units in a building, or ground floor units served by a particular entrance, not on an accessible route shall comply with the features listed in Section 1150A.2.*

TEST NO. 3—UNUSUAL CHARACTERISTICS TEST

Unusual characteristics include sites located in a state or federally designated floodplain or coastal high-hazard areas and sites subject to other similar requirements of law or code that require the lowest floor or the lowest structural member of the lowest floor to be designed to a specified level at or above the base flood elevation. An accessible route to a building entrance is impractical due to unusual characteristics of the site when:

1. *The original site characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance; or*
2. *If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the unusual characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and the closest vehicular or pedestrian arrival point.*

1150A.2 Additional requirements for Section 1150A.

All other ground floor dwelling units in nonelevator buildings shall be made to comply with the following requirements:

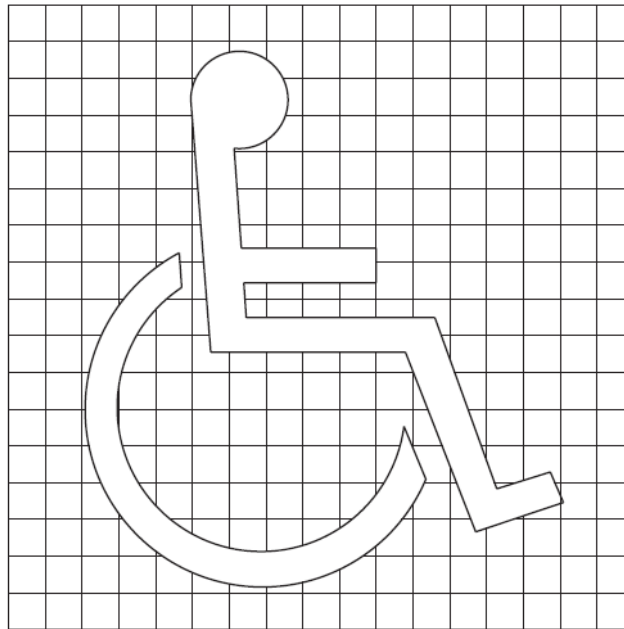
1. *Grab bar reinforcement: see Section 1134A.*
2. *Thirty-two inch (813 mm) clear door interior opening width: see Section 1132A.3.*
3. *Lever hardware: see Section 1132A.8.*
4. *Door signal devices: see Section 1132A.10.*
5. *Clear space by doors: see Chapters 10 and 11A.*
6. *Minimum 15-inch (381 mm) water closet seat height: see Section 1134A.7, Item 3.*
7. *Electrical receptacle outlet height: see Section 1136A.*
8. *Lighting and environmental control height: see Section 1136A.*
9. *Faucet controls: see Section 1134A.8, Item 7.*

10. *Water closet, bathtub and lavatory minimum space requirements: see Section 1134A.*

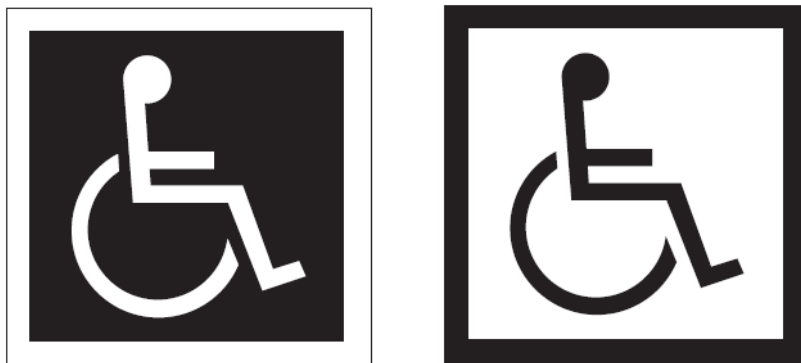
11. *Removable cabinets under the kitchen sink counter area: see Section 1133A.3.*

Division VII – FIGURES

Diagrams illustrate the specific requirements of these regulations and are intended only as an aid for building design and construction. Diagrams are not to scale.



(a) SYMBOL PROPORTIONS



(b) DISPLAY CONDITIONS

**FIGURE 11A-1A
INTERNATIONAL ACCESSIBILITY SYMBOL**

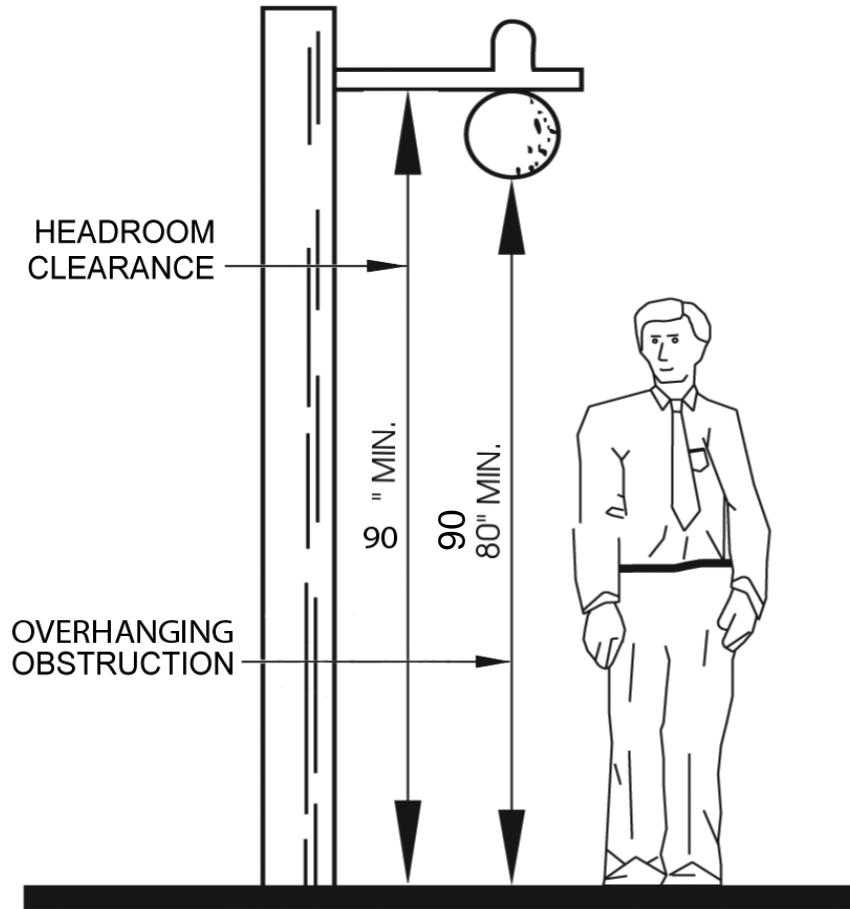
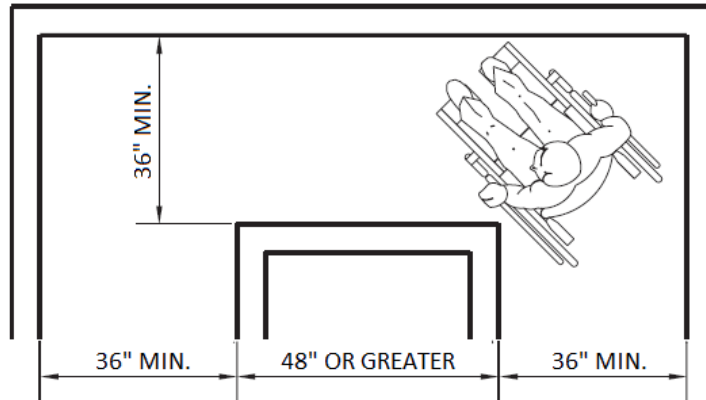
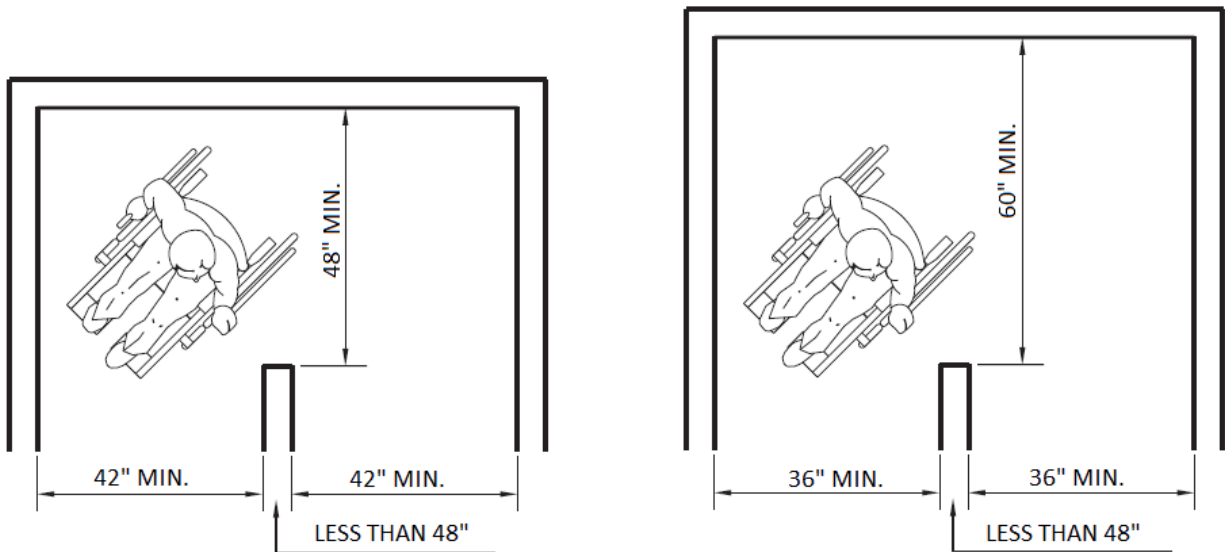


FIGURE 11A-1B
HEADROOM CLEARANCE AND OVERHANGING OBSTRUCTION



(a) 90° TURN AROUND OBSTRUCTION



(b) 180° TURN AROUND OBSTRUCTION

FIGURE 11A-1C
WIDTH OF ACCESSIBLE ROUTE AT TURNS

HOUSING ACCESSIBILITY

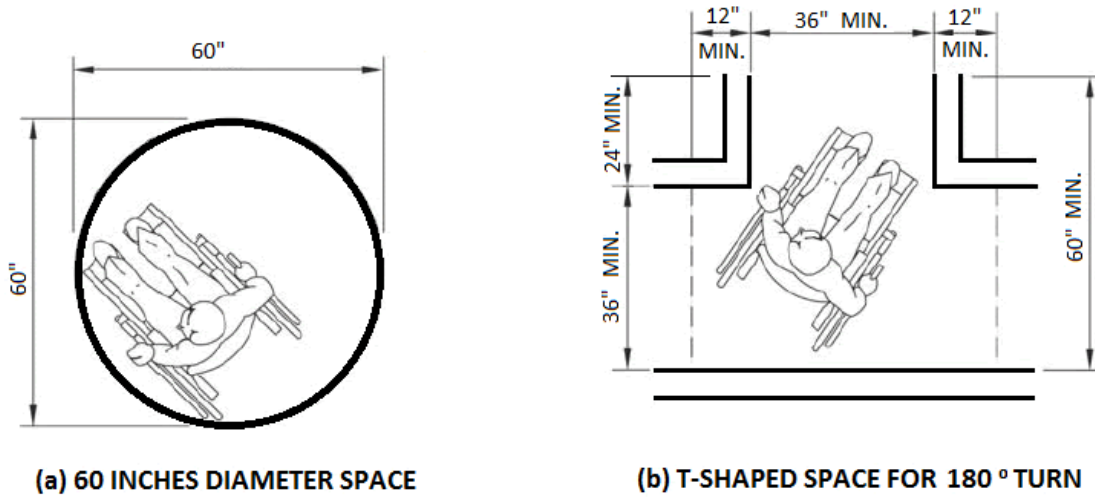


FIGURE 11A-1D
WHEELCHAIR TURNING SPACE

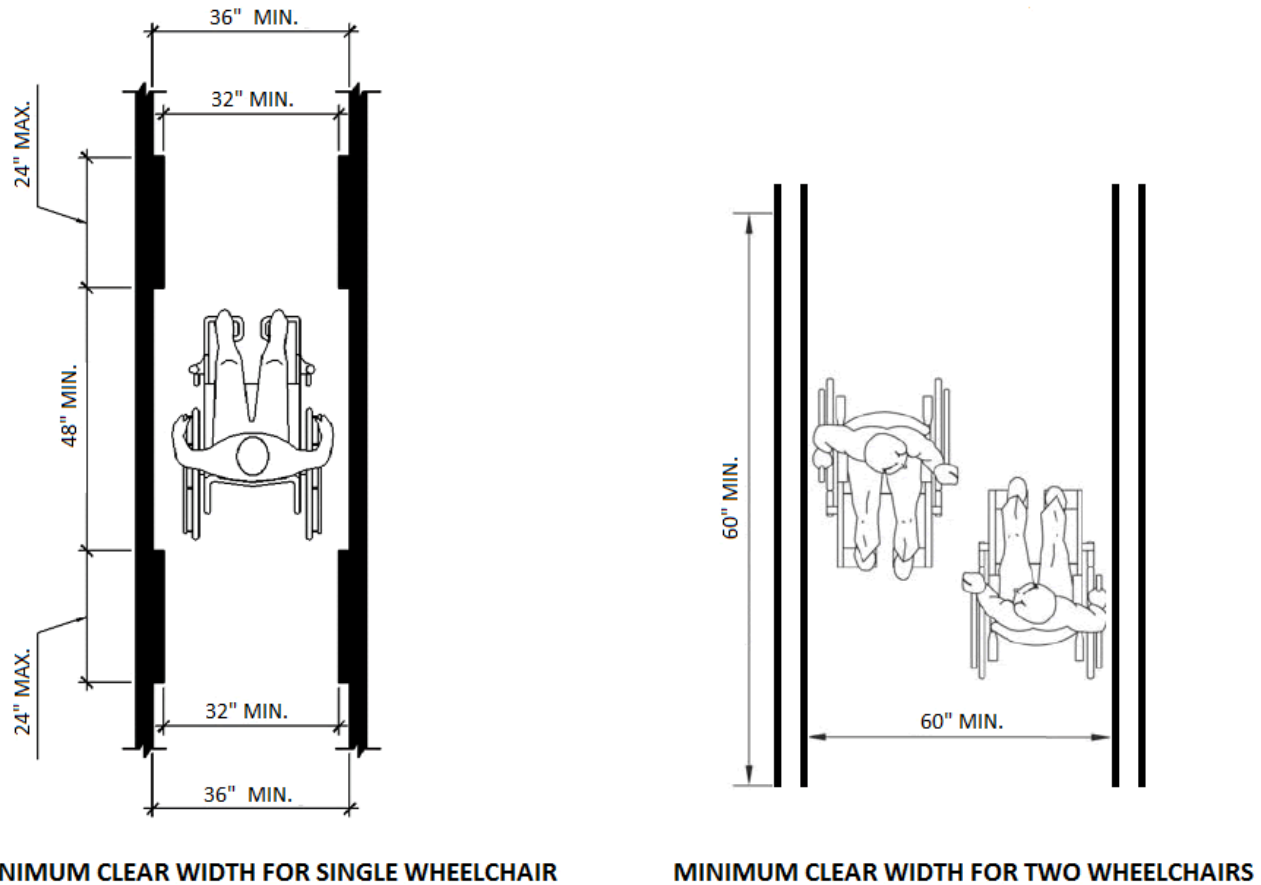
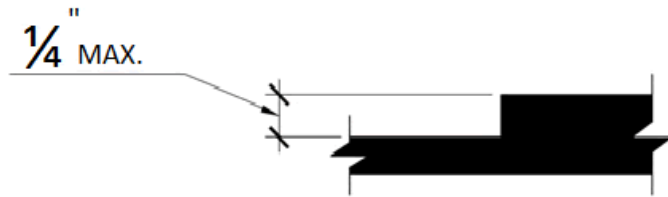
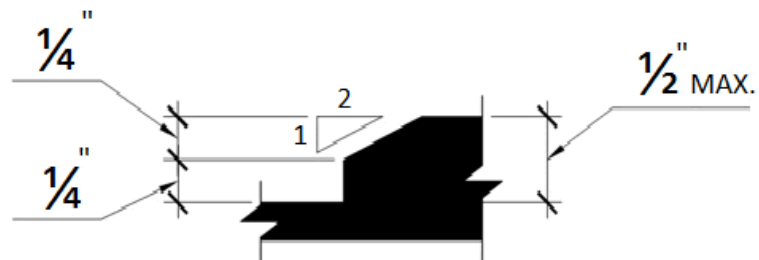


FIGURE 11A-1E
WHEELCHAIR PASSAGE WIDTH

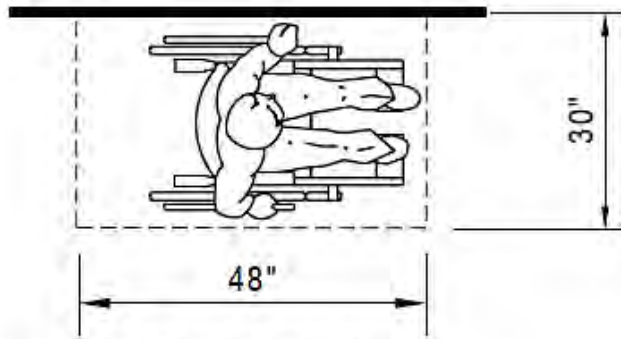


(a) VERTICAL CHANGE IN LEVEL

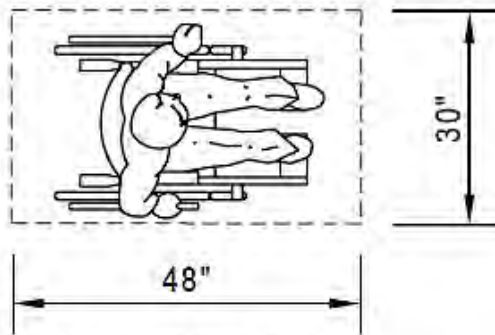


(b) BEVELED CHANGE IN LEVEL

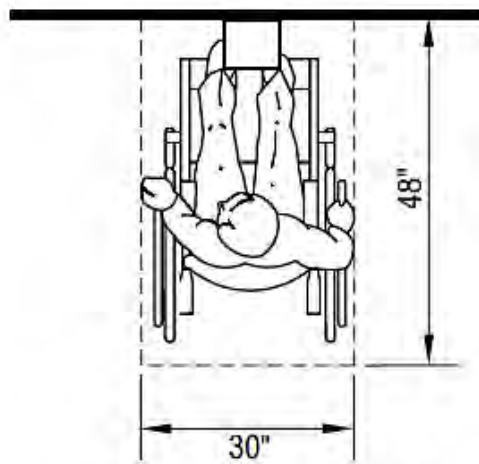
FIGURE 11A-1F
CHANGE IN LEVEL



(a) PARALLEL APPROACH

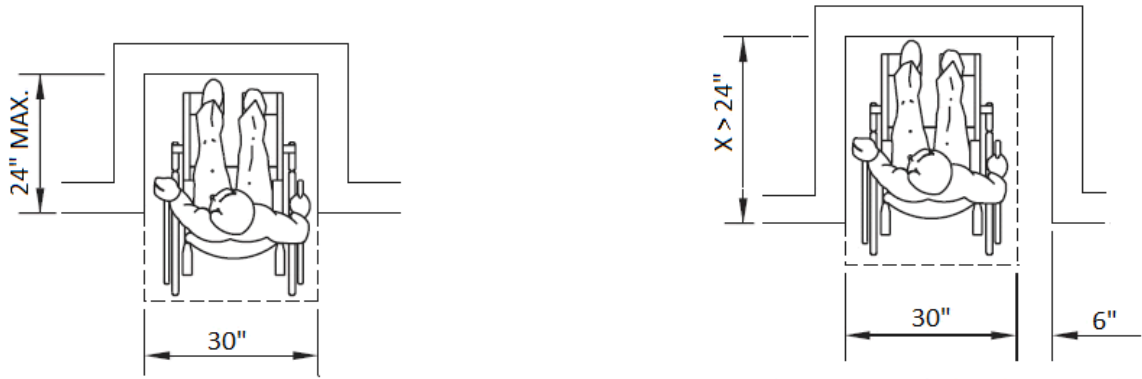


(b) CLEAR FLOOR SPACE



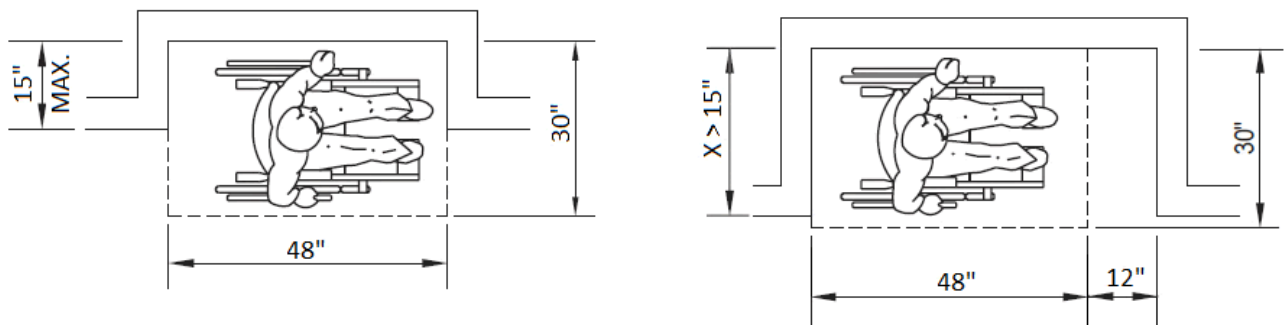
(c) FORWARD APPROACH

**FIGURE 11A-1G
MINIMUM CLEAR FLOOR SPACE FOR WHEELCHAIRS**



IF X > 24", ADDITIONAL MANEUVERING CLEARANCE OF 6" SHALL BE PROVIDED.

(a) FORWARD APPROACH



IF X > 15", ADDITIONAL MANEUVERING CLEARANCE OF 12" SHALL BE PROVIDED.

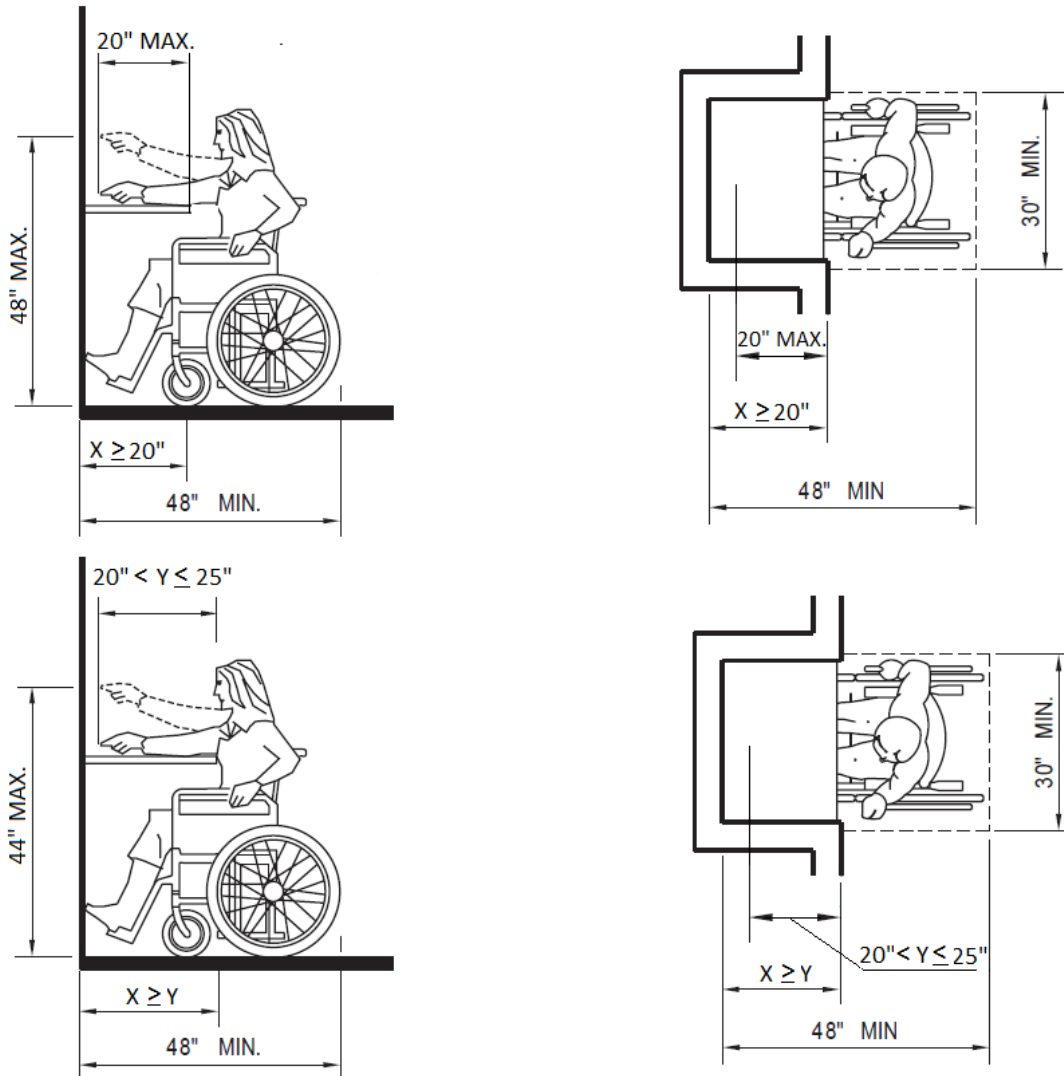
(b) PARALLEL APPROACH

FIGURE 11A-1H
MINIMUM CLEAR FLOOR SPACE IN ALCOVES

HOUSING ACCESSIBILITY

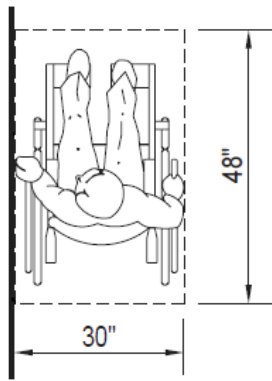


(a) UNOBSTRUCTED FORWARD REACH

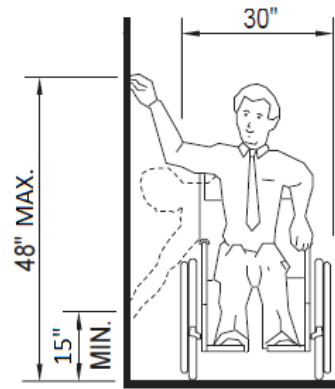


(b) FORWARD REACH OVER OBSTRUCTION

FIGURE 11A-11
FORWARD REACH

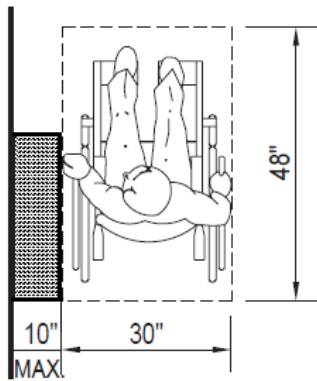


CLEAR FLOOR SPACE FOR PARALLEL APPROACH

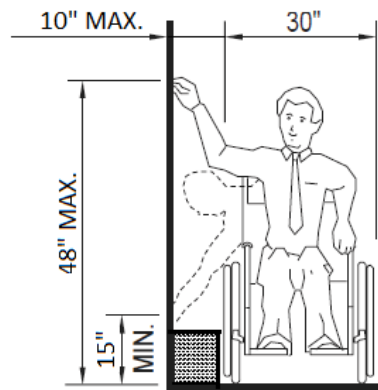


HIGH AND LOW SIDE REACH LIMITS

(a) UNOBSTRUCTED SIDE REACH

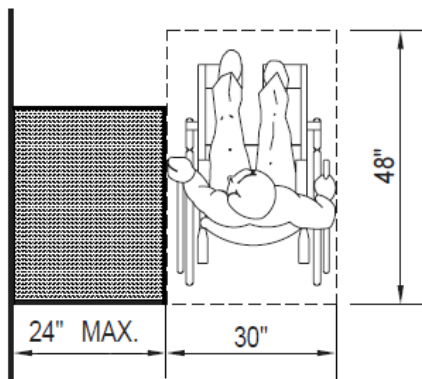


CLEAR FLOOR SPACE FOR PARALLEL APPROACH

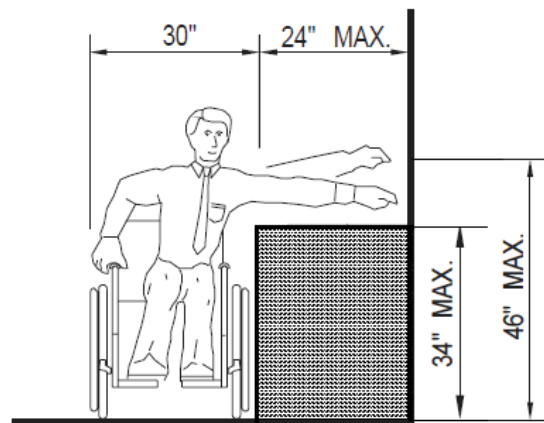


HIGH AND LOW SIDE REACH LIMITS

(b) SIDE REACH OVER OBSTRUCTION 10" MAXIMUM



CLEAR FLOOR SPACE FOR PARALLEL APPROACH



MAXIMUM SIDE REACH OVER OBSTRUCTION

(c) SIDE REACH OVER OBSTRUCTION > 10" AND 24" MAXIMUM

**FIGURE 11A-1J
SIDE REACH**

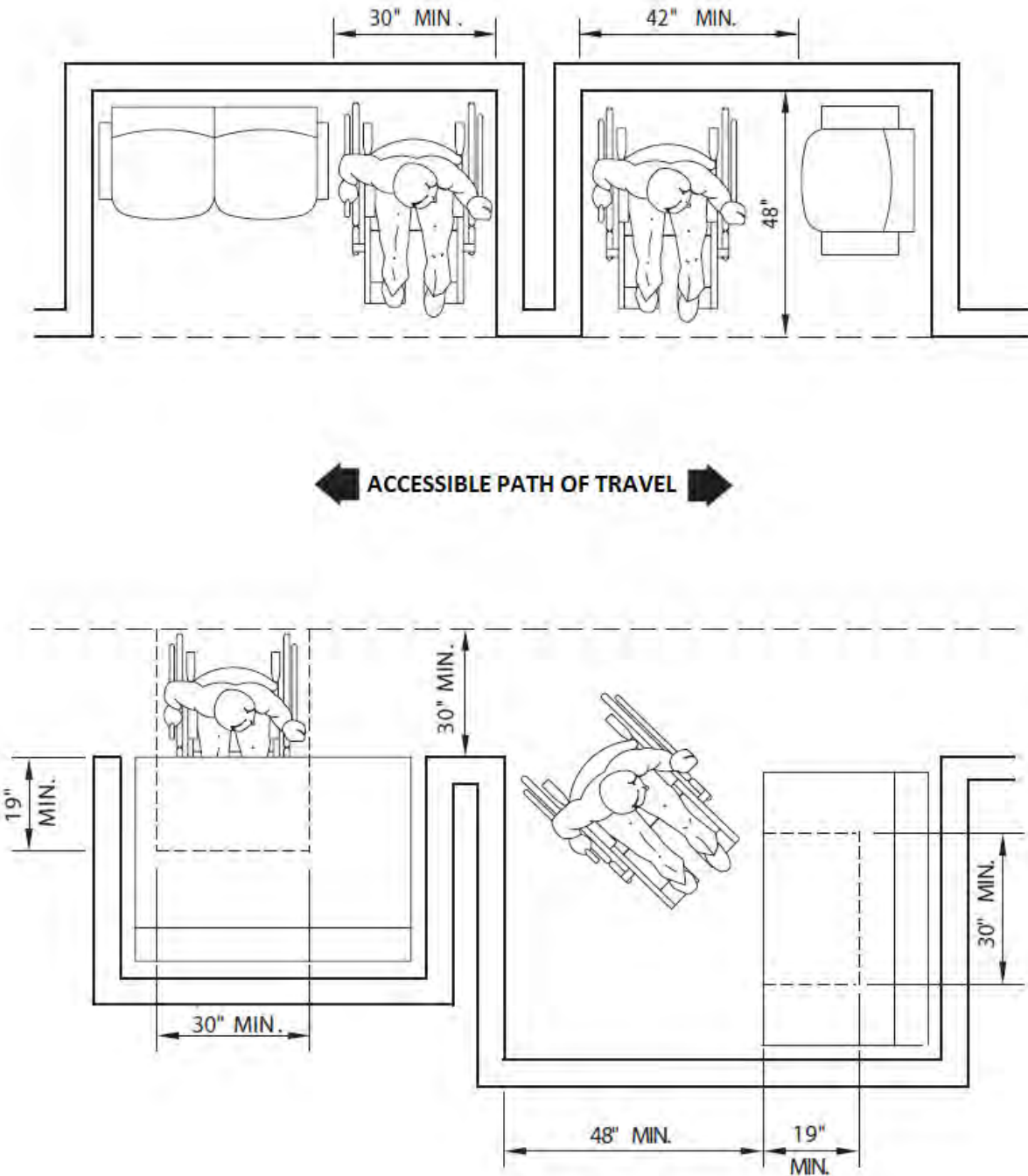
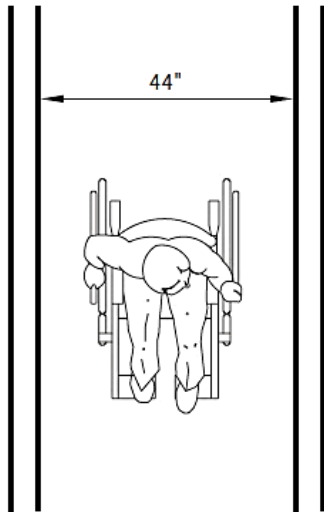
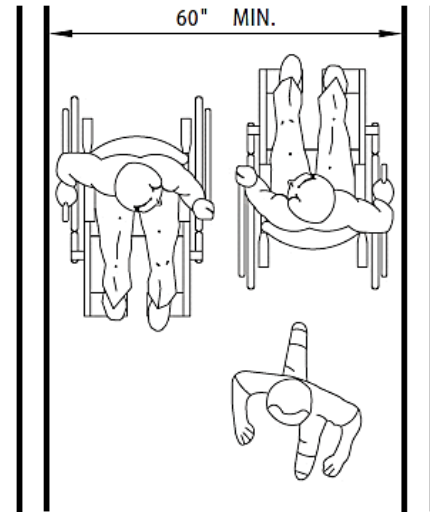


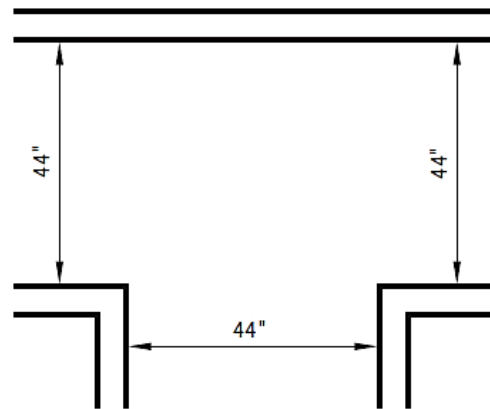
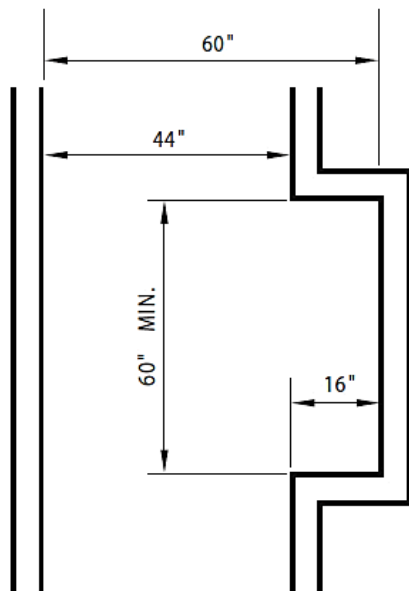
FIGURE 11A-1K
MINIMUM CLEARANCES FOR SEATING AND TABLE



(a) MINIMUM WIDTH FOR CORRIDORS

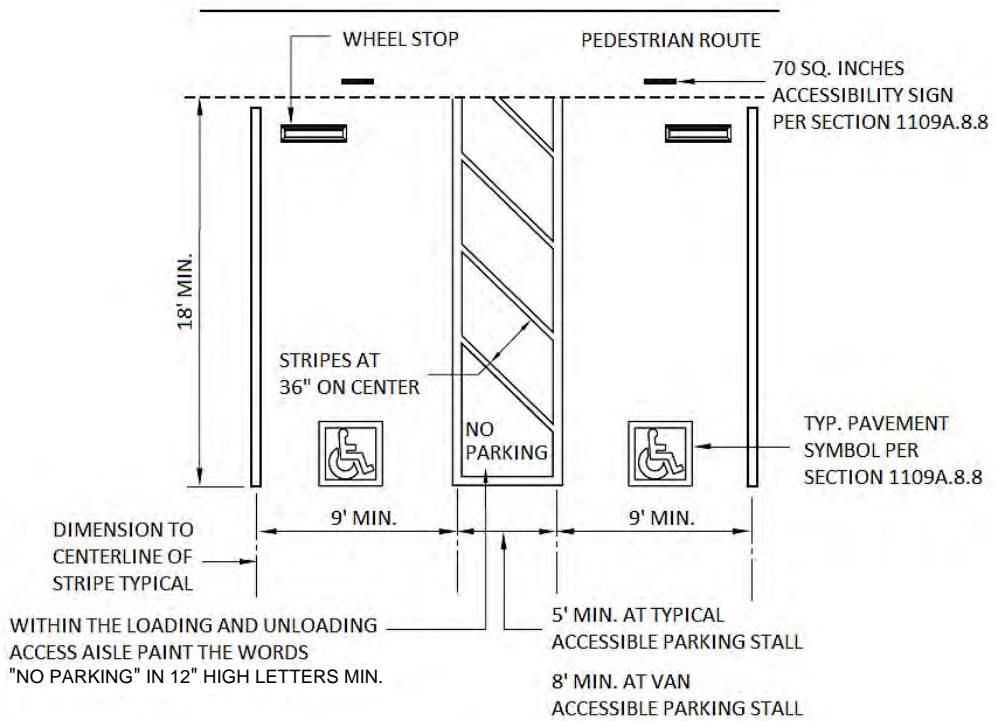


(b) MINIMUM WIDTH FOR CORRIDORS OVER 200 FEET

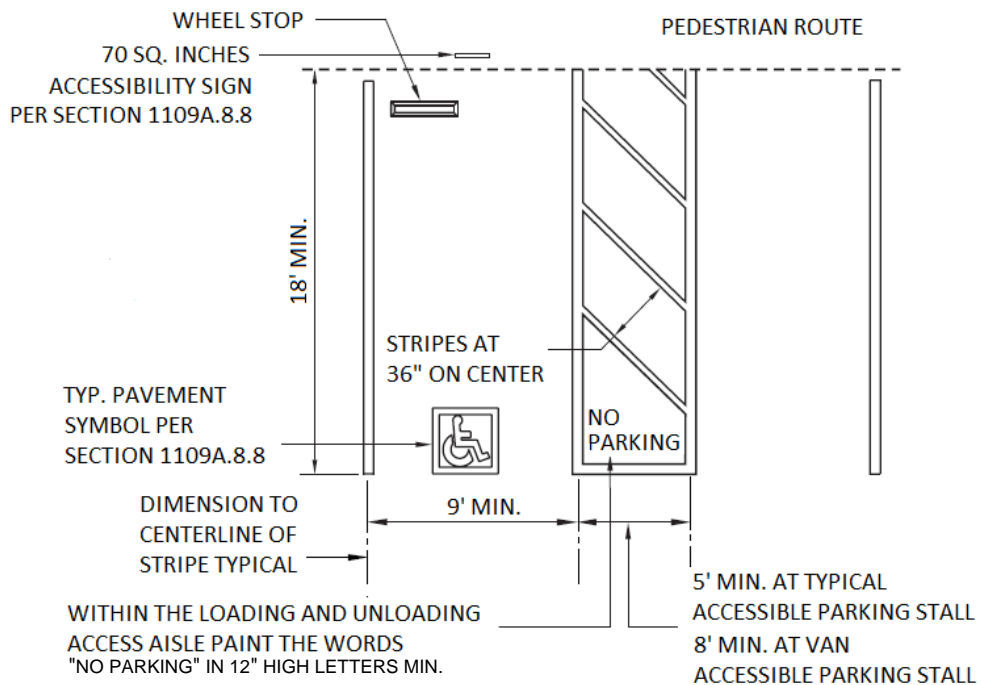


(c) PASSING METHODS FOR CORRIDORS WITH LENGTH OVER 200 FEET AND WIDTH LESS THAN 60"

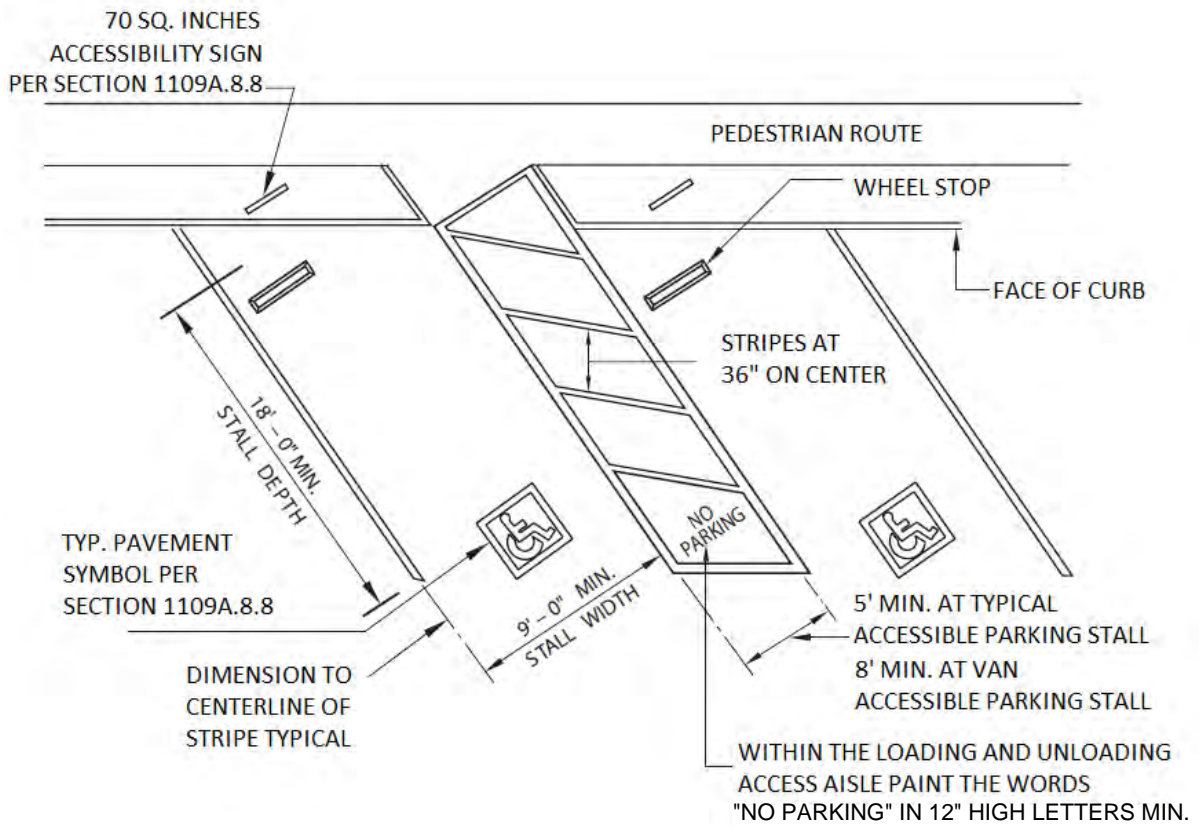
FIGURE 11A-1L
INTERIOR ACCESSIBLE ROUTE (CORRIDOR) OVER 200 FEET; OCCUPANT LOAD 10 OR MORE



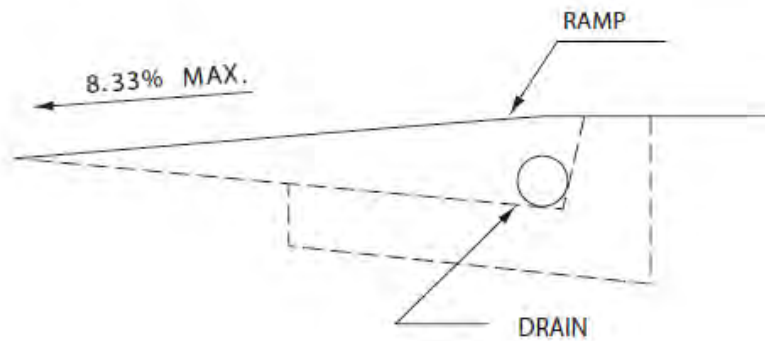
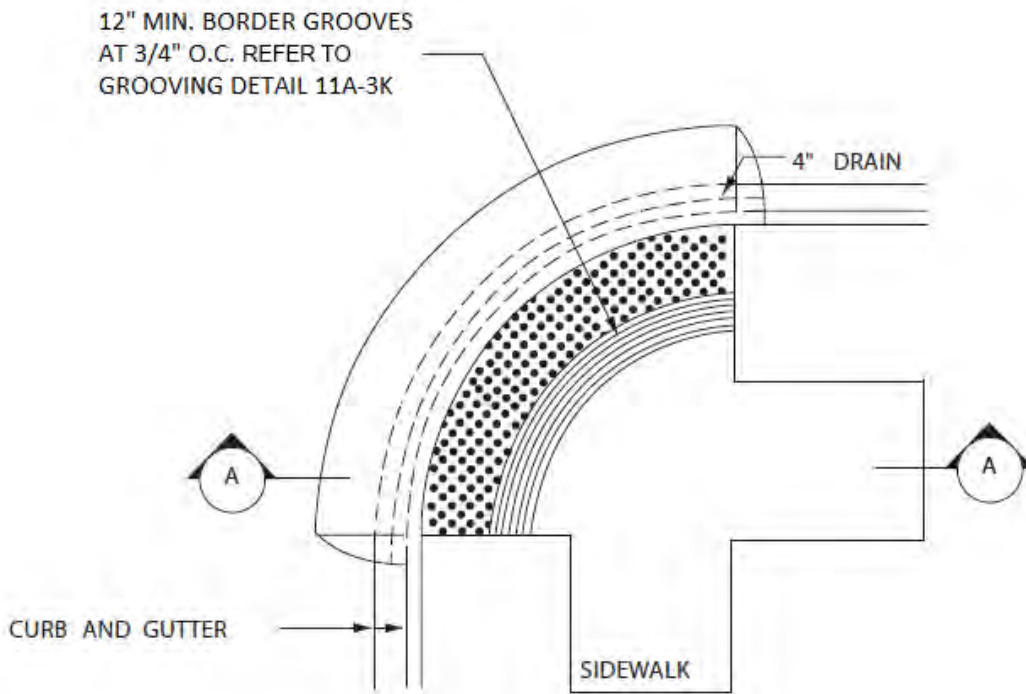
**FIGURE 11A-2A
DOUBLE PARKING STALLS**



**FIGURE 11A-2B
SINGLE AND VAN ACCESSIBLE PARKING STALLS**

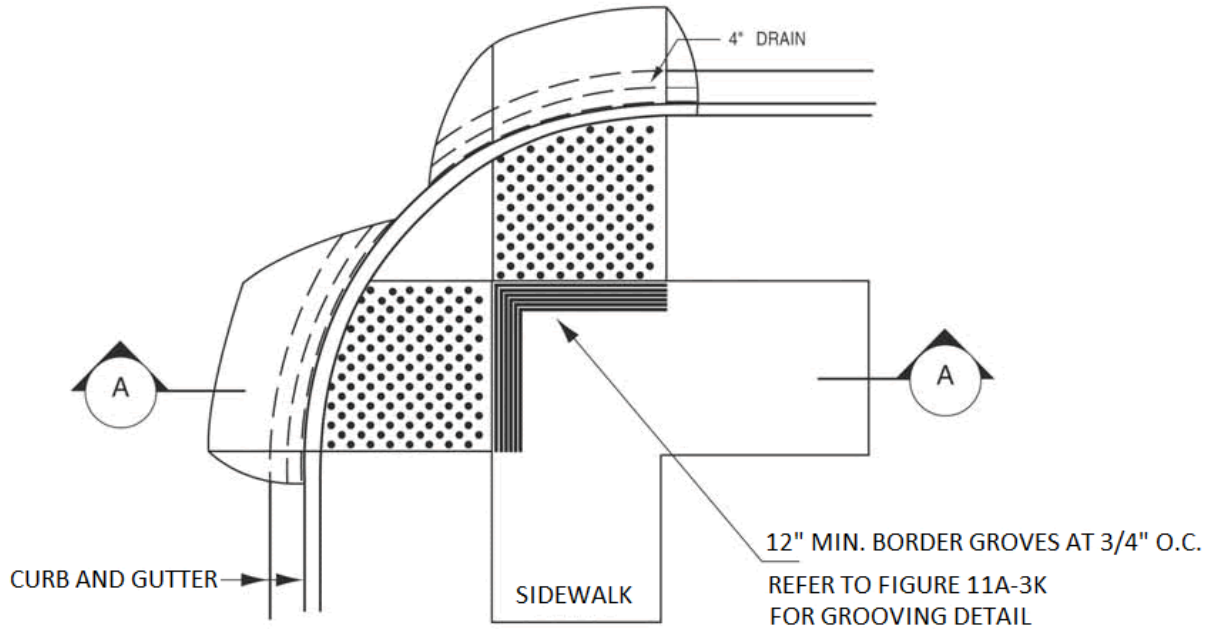


**FIGURE 11A-2C
DIAGONAL PARKING STALLS**

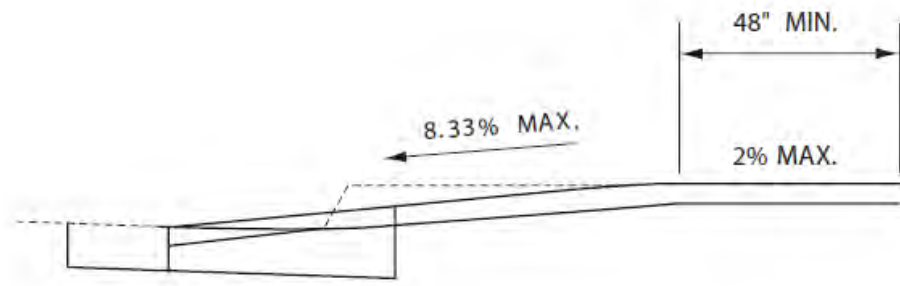
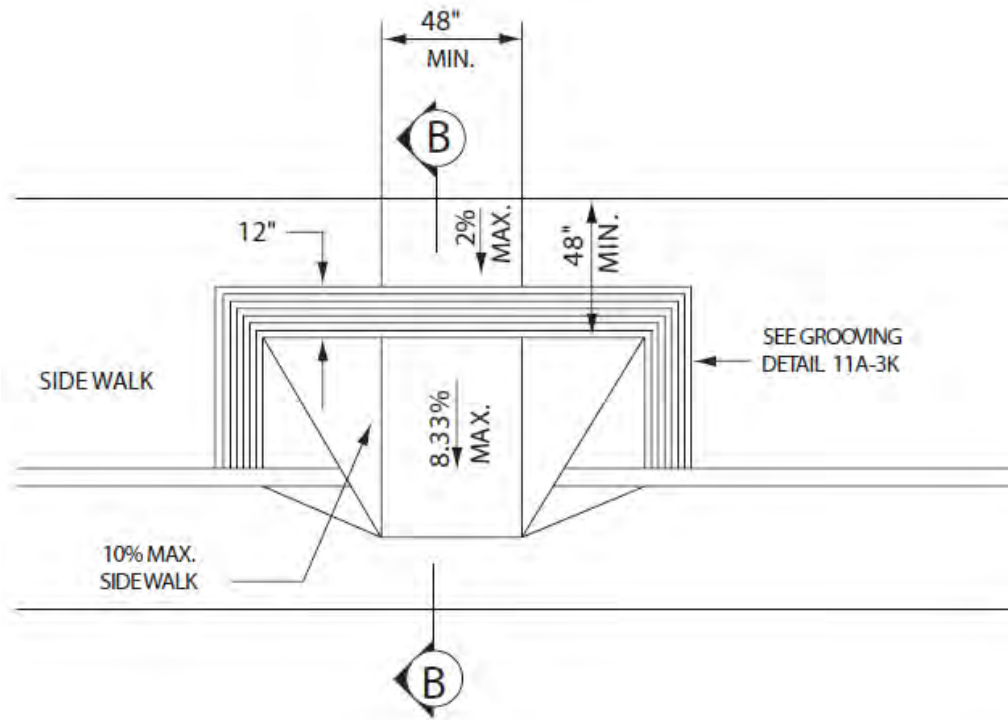


SECTION A-A

FIGURE 11A-3A
CURB DETAILS



**FIGURE 11A-3B
CURB DETAIL**



SECTION B-B

**FIGURE 11A-3C
CURB DETAIL**

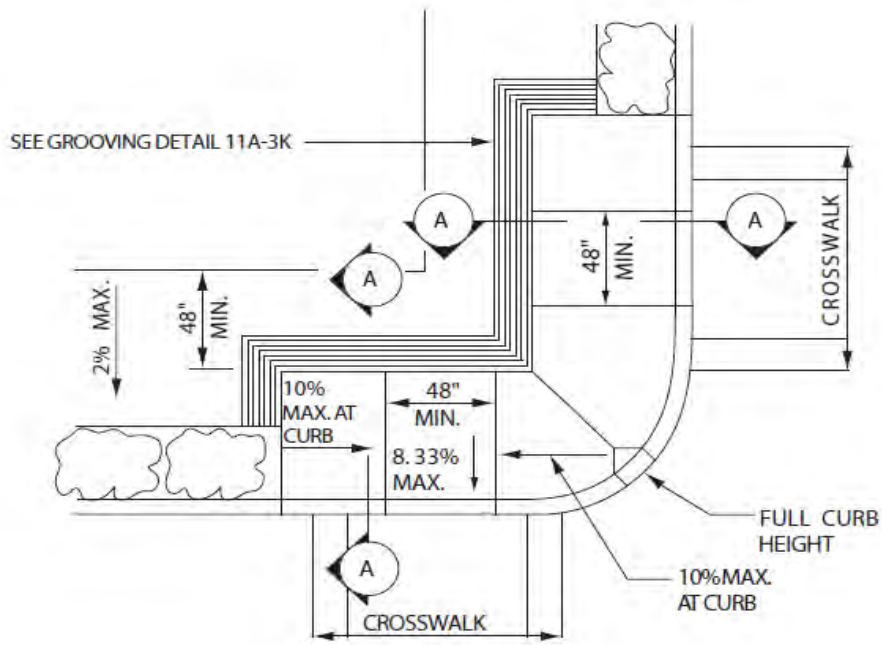


FIGURE 11A-3D
CURB DETAIL

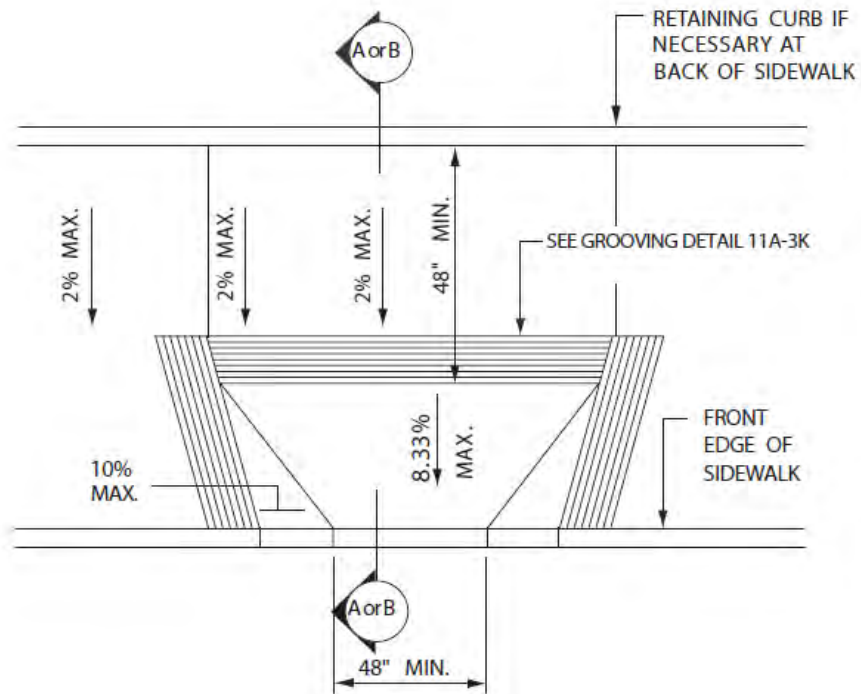


FIGURE 11A-3E
CURB DETAIL

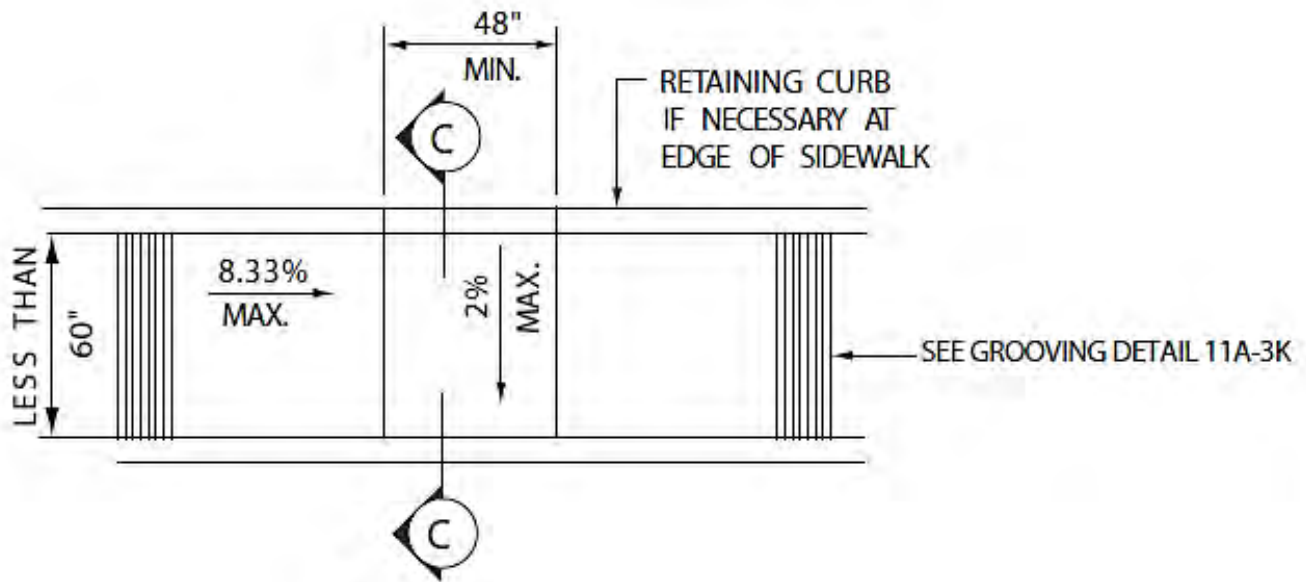


FIGURE 11A-3F
CURB DETAIL - SIDEWALK LESS THAN 60" WIDE

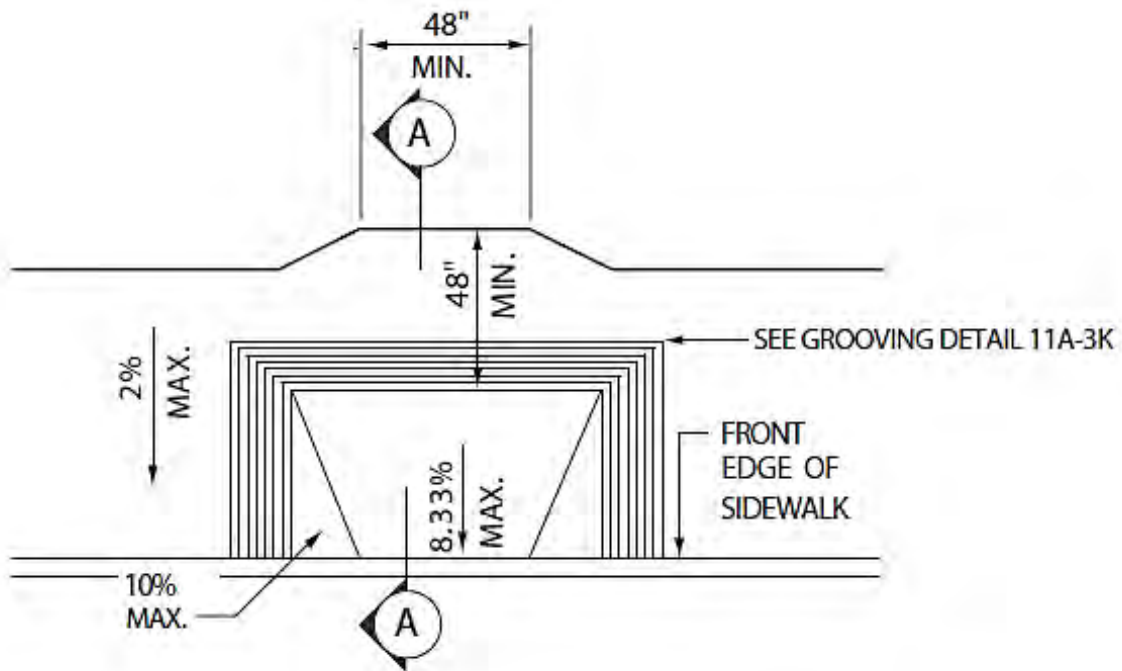


FIGURE 11A-3G
CURB DETAIL

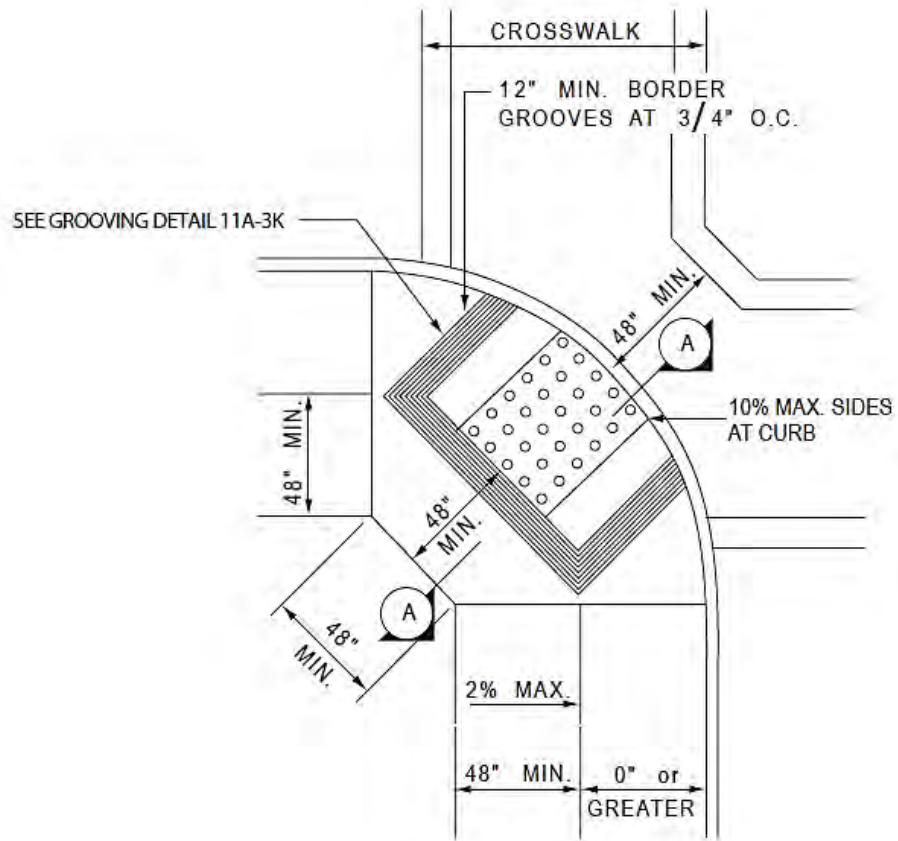


FIGURE 11A-3H
CURB DETAIL

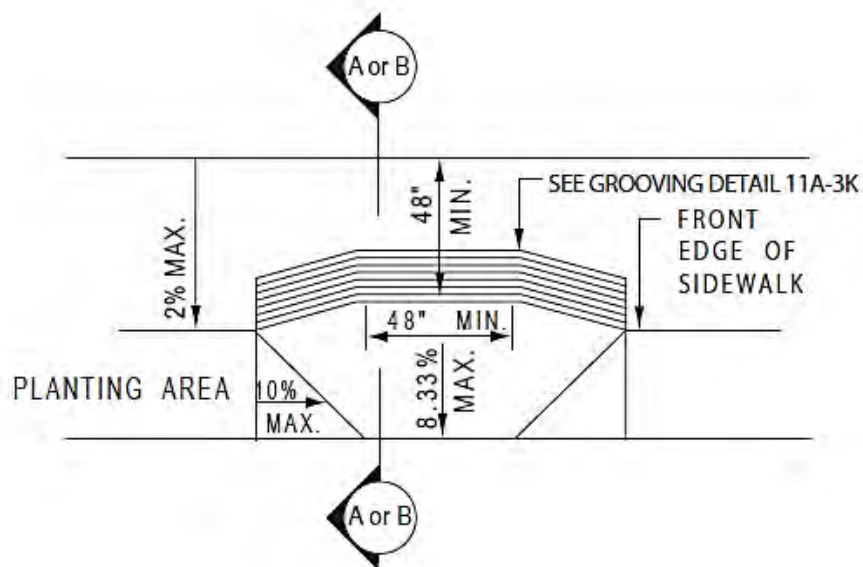


FIGURE 11A-3I
CURB DETAIL

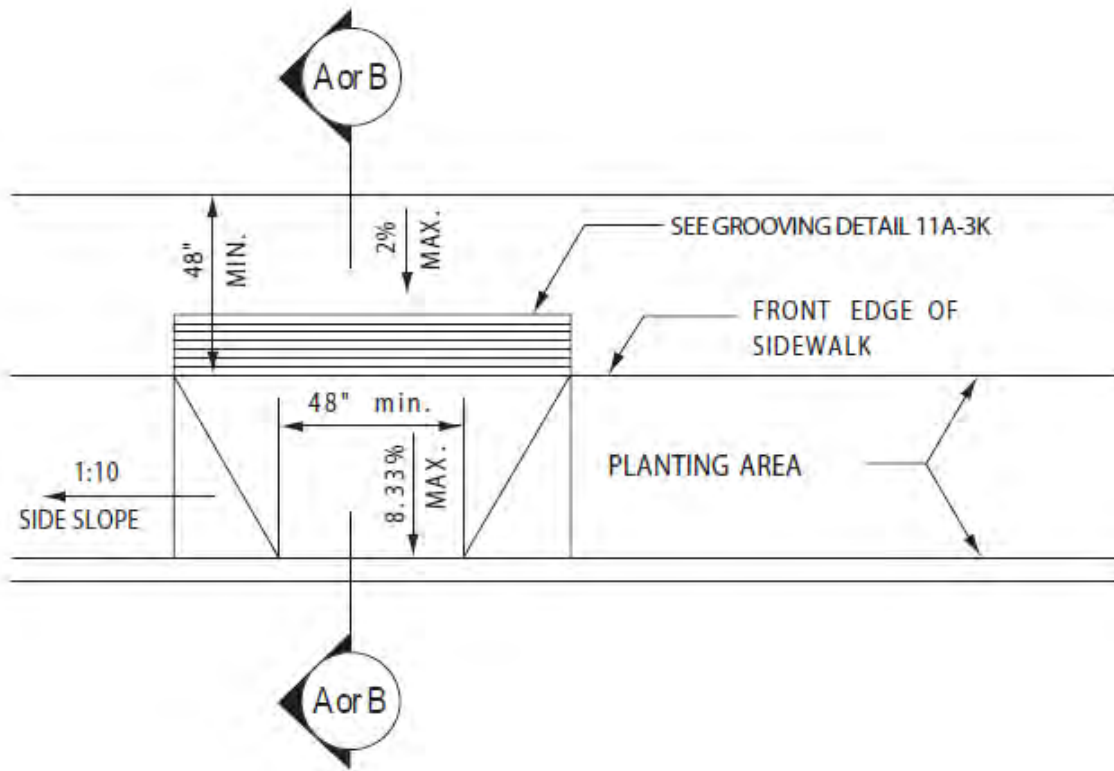
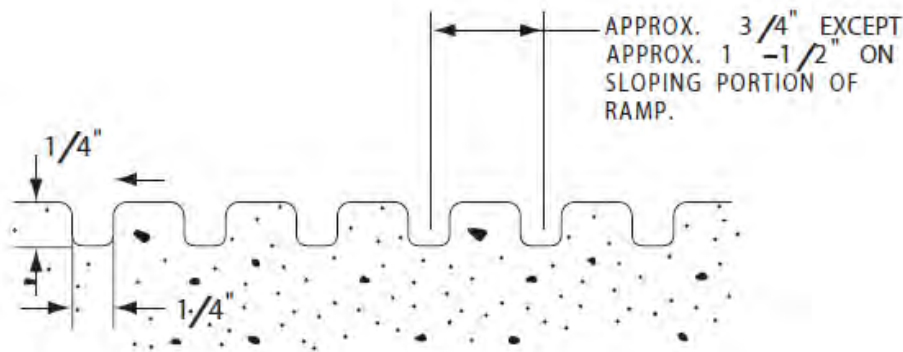
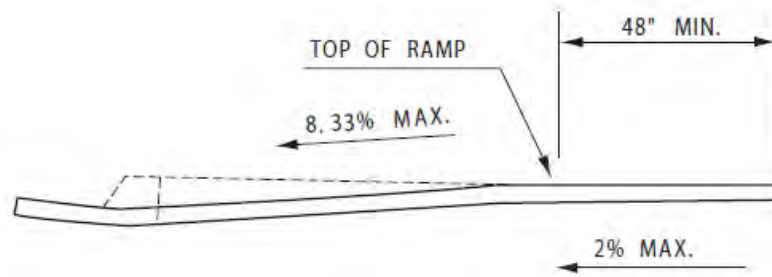


FIGURE 11A-3J
CURB DETAIL

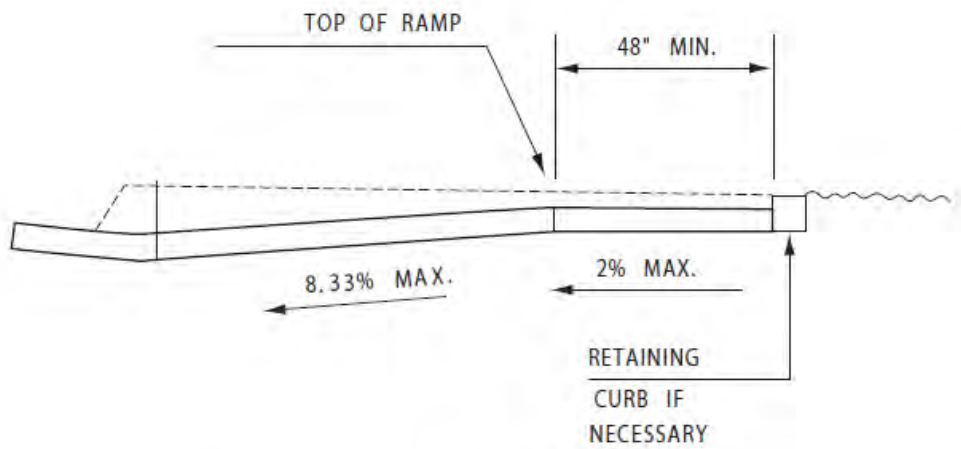


GROOVING DETAIL

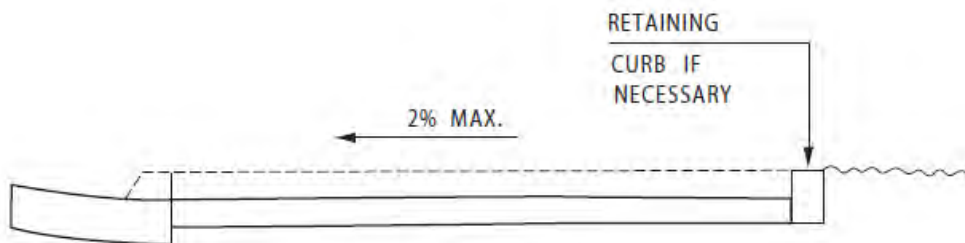
FIGURE 11A-3K
CURB DETAIL



SECTION A-A

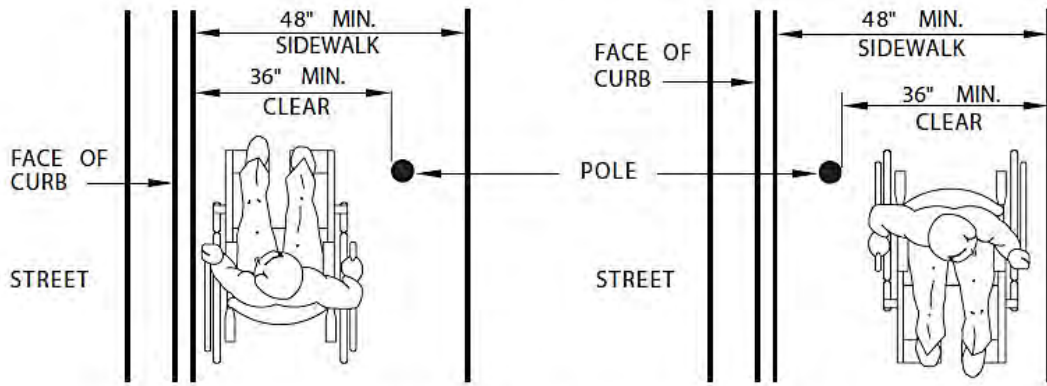


SECTION B-B
DEPRESS ENTIRE SIDEWALK AS REQUIRED

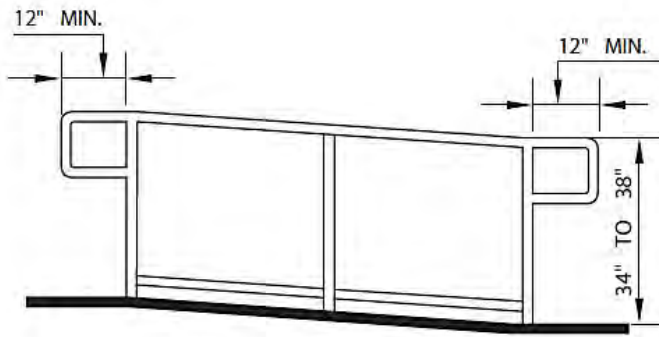


SECTION C-C

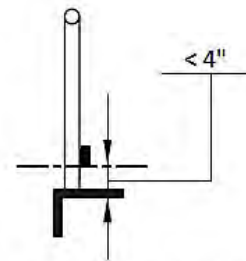
FIGURE 11A-3L
CURB SECTIONS



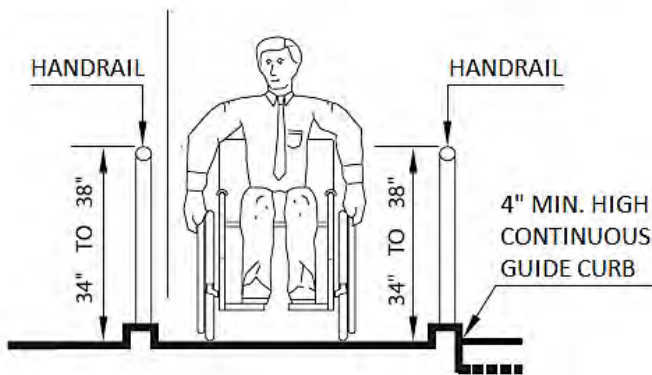
(a) SIDEWALK OBSTRUCTIONS



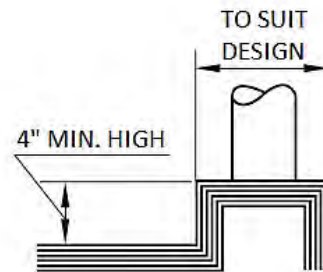
(b) HANDRAIL AND GUIDERAIL



GUIDE RAIL DETAIL

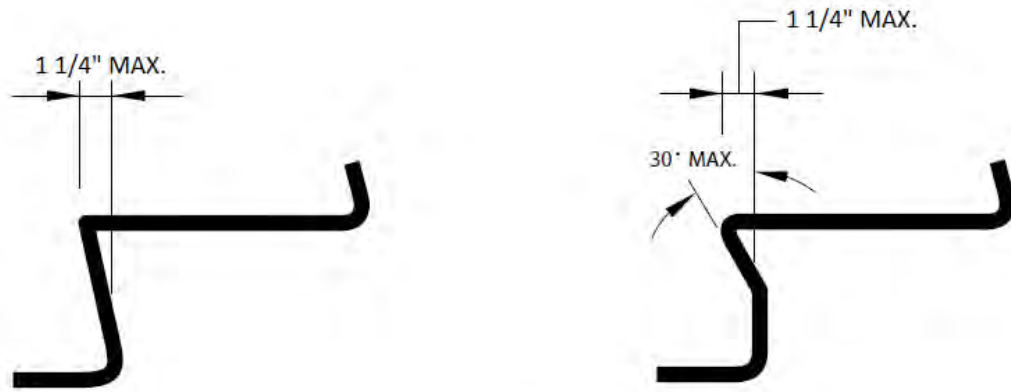


(c) GUIDE CURB



GUIDE CURB DETAIL

FIGURE 11A-5A
RAMPS AND SIDEWALKS



STAIRS

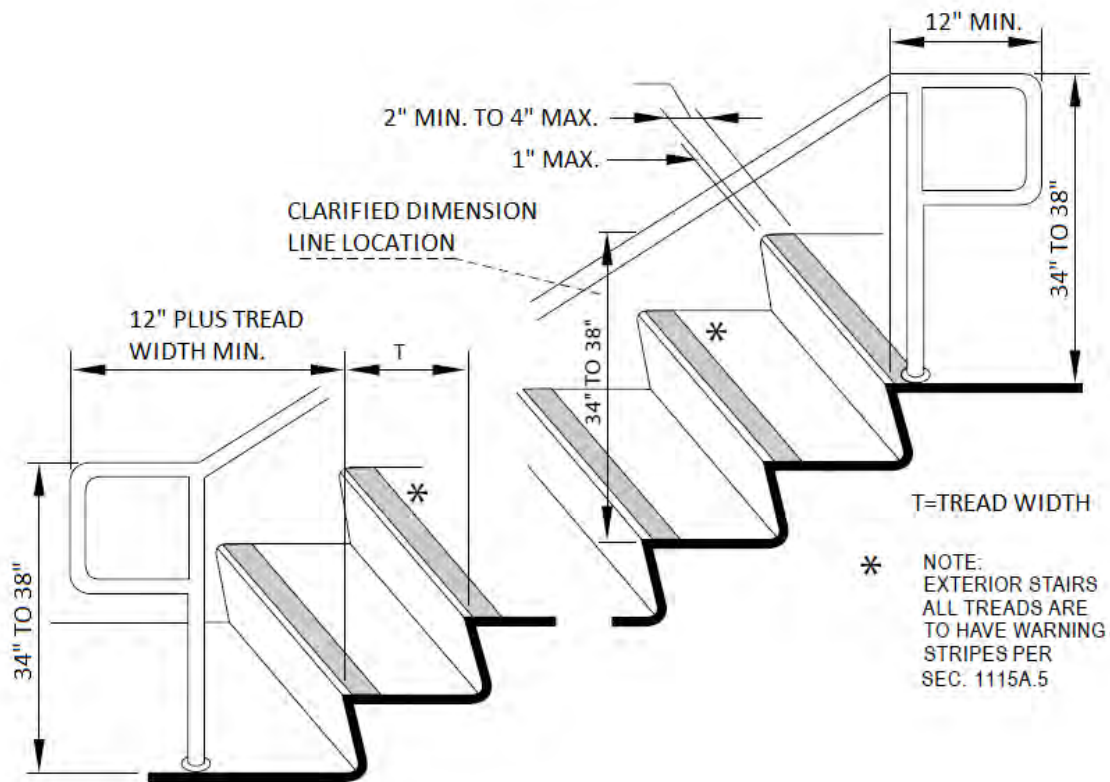
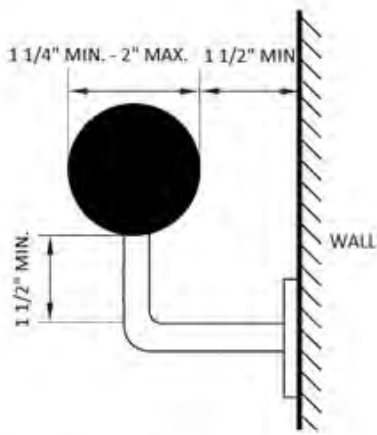
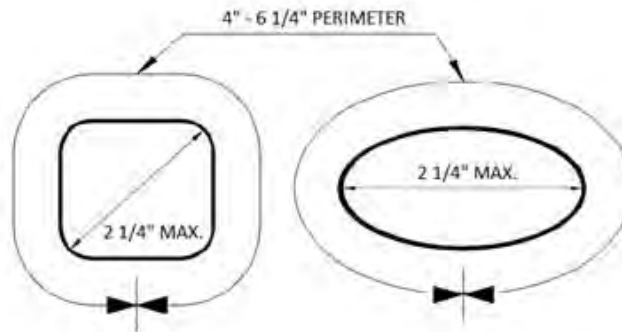


FIGURE 11A-6A
WARNING STRIPING AND HANDRAIL EXTENSIONS

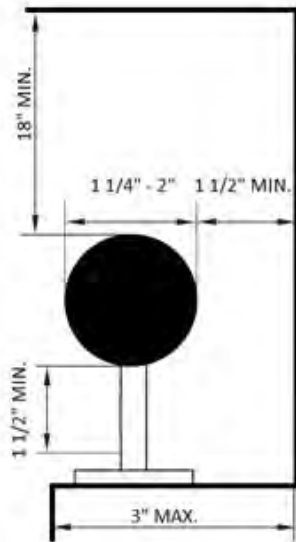
HOUSING ACCESSIBILITY



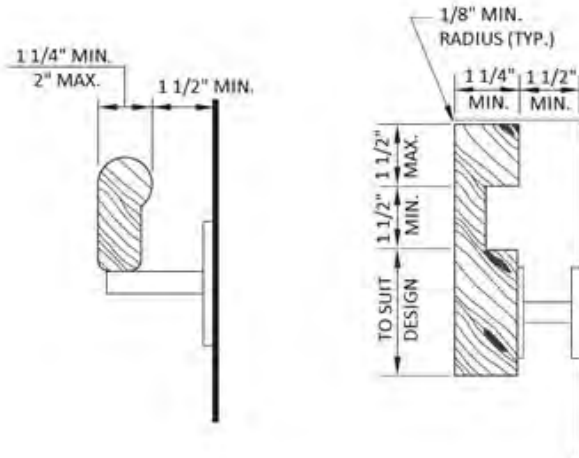
(a) HANDRAILS WITH CIRCULAR CROSS SECTION



(b) HANDRAILS WITH NON-CIRCULAR CROSS SECTION



(c) HANDRAILS LOCATED IN A RECESS

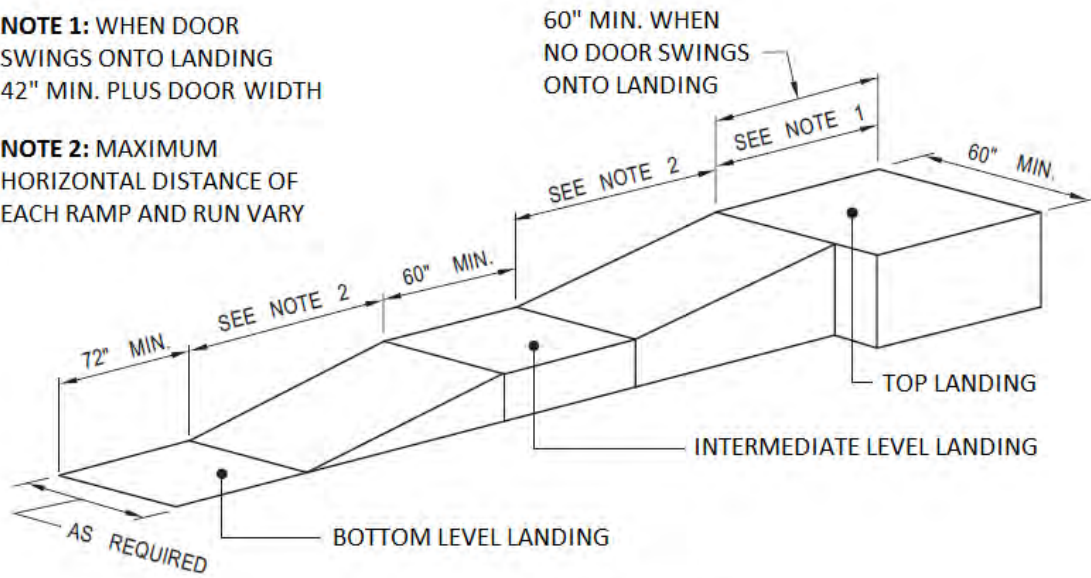


(d) HANDRAILS WITH EQUIVALENT GRIPPING SURFACES

FIGURE 11A-6B
HANDRAILS

NOTE 1: WHEN DOOR SWINGS ONTO LANDING
42" MIN. PLUS DOOR WIDTH

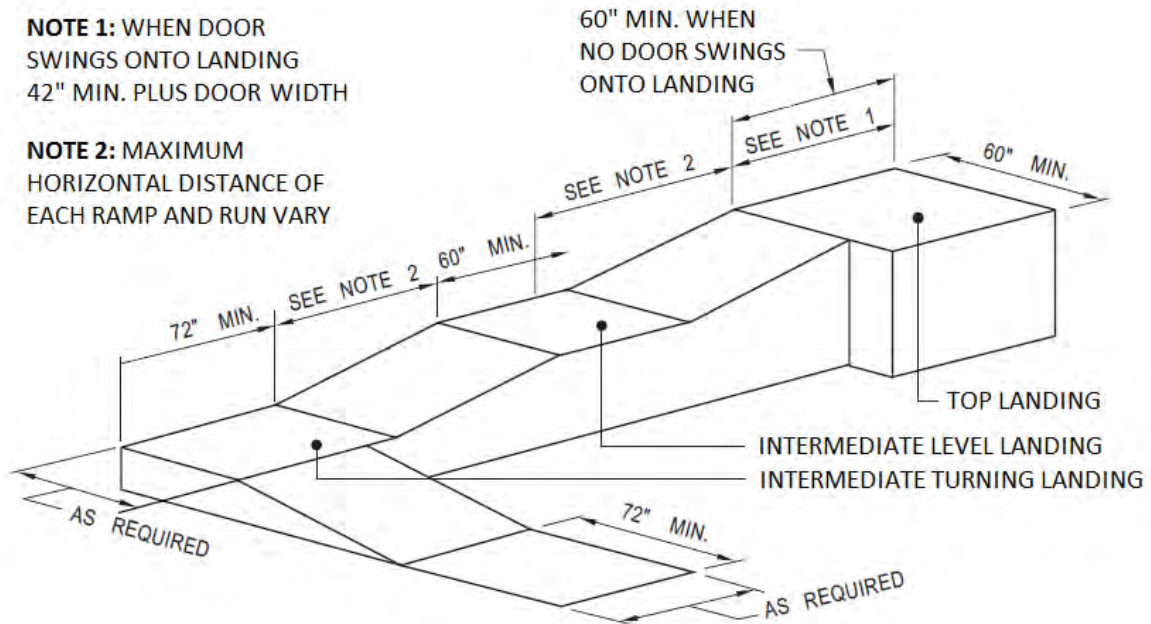
NOTE 2: MAXIMUM HORIZONTAL DISTANCE OF EACH RAMP AND RUN VARY



(a) STRAIGHT RAMP RUN

NOTE 1: WHEN DOOR SWINGS ONTO LANDING
42" MIN. PLUS DOOR WIDTH

NOTE 2: MAXIMUM HORIZONTAL DISTANCE OF EACH RAMP AND RUN VARY

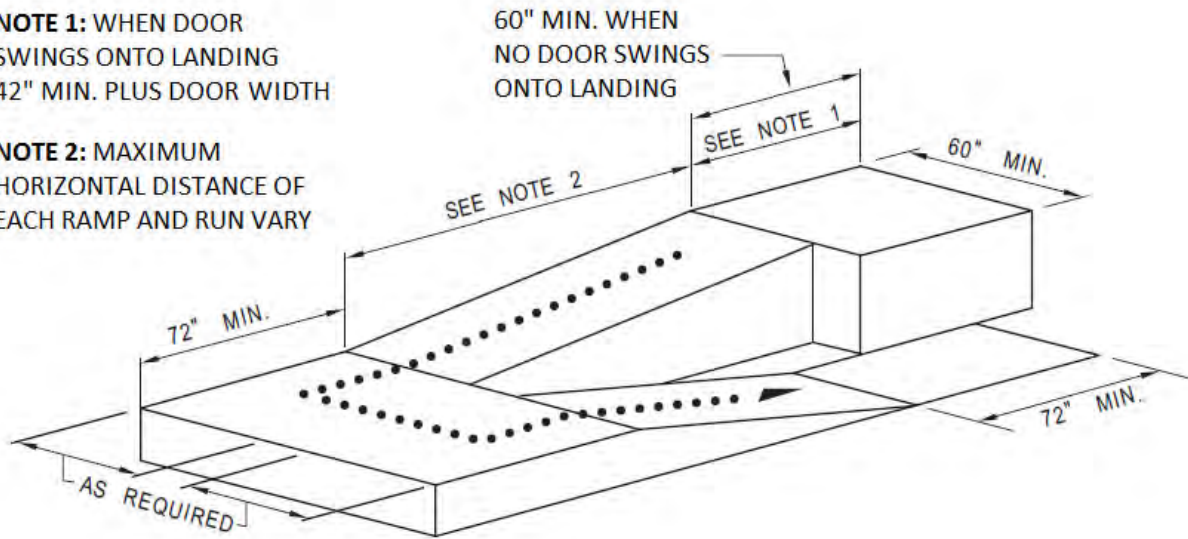


(b) RAMP WITH TURNING LANDING

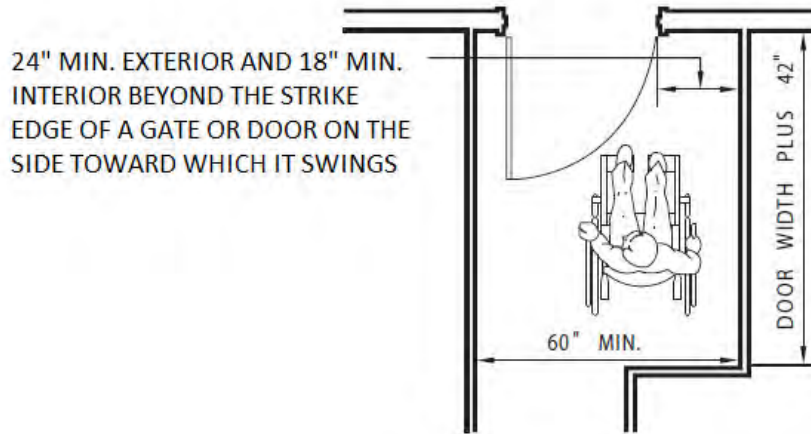
**FIGURE 11A-6C
RAMP DIMENSIONS**

NOTE 1: WHEN DOOR SWINGS ONTO LANDING
42" MIN. PLUS DOOR WIDTH

NOTE 2: MAXIMUM HORIZONTAL DISTANCE OF EACH RAMP AND RUN VARY

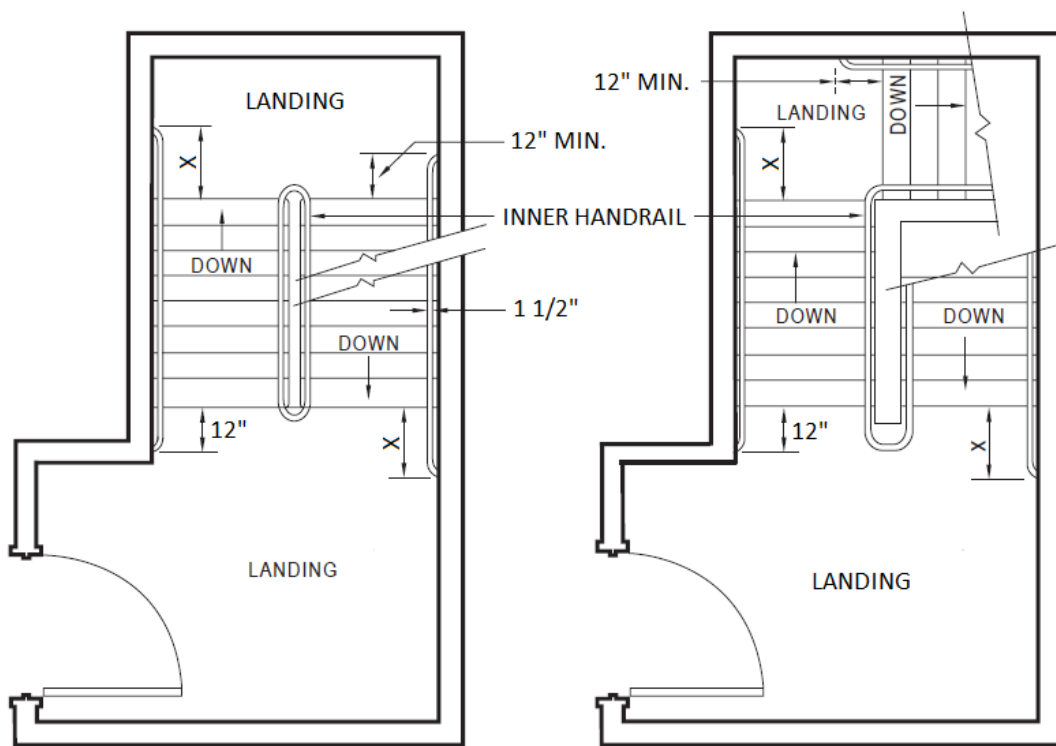


(a) RAMP WITH INTERMEDIATE SWITCH BACK LANDING



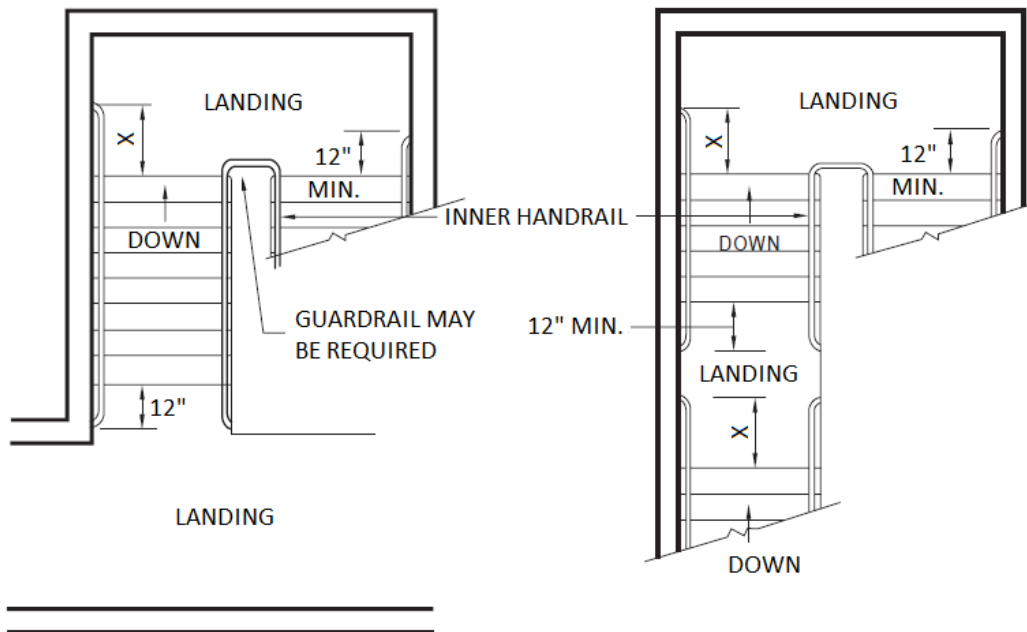
(b) RAMP LANDING AT DOORWAY

**FIGURE 11A-6D
RAMP LANDING AND DOORWAY**



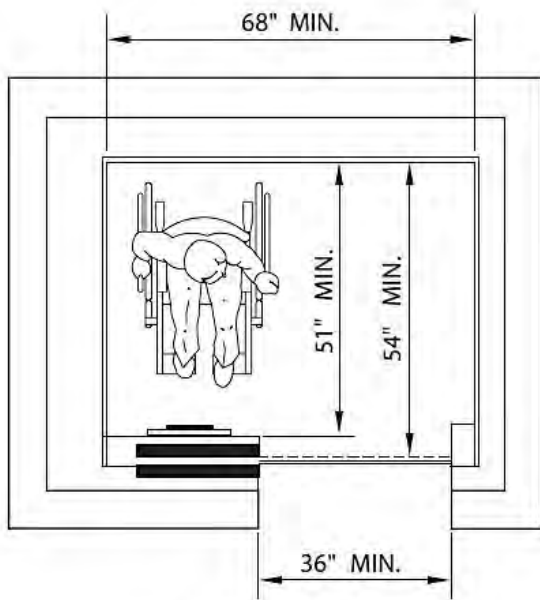
NOTE: INNER HANDRAIL AT LANDINGS OF STAIRS THAT DOUBLE BACK OR IMMEDIATELY TURN SHALL BE CONTINUOUS AND SHALL NOT EXTEND INTO LANDING OR PATH OF TRAVEL .

X: EXTENSION OF HANDRAIL SHALL BE EQUAL TO THE TREAD WIDTH PLUS 12" .

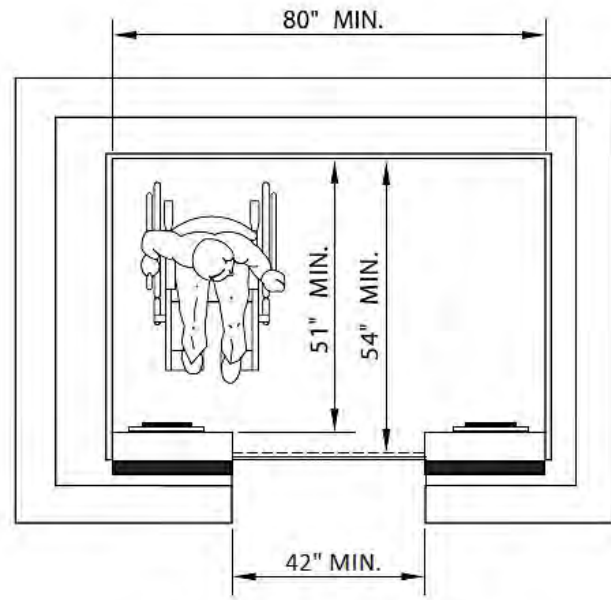


**FIGURE 11A-6E
STAIR HANDRAILS**

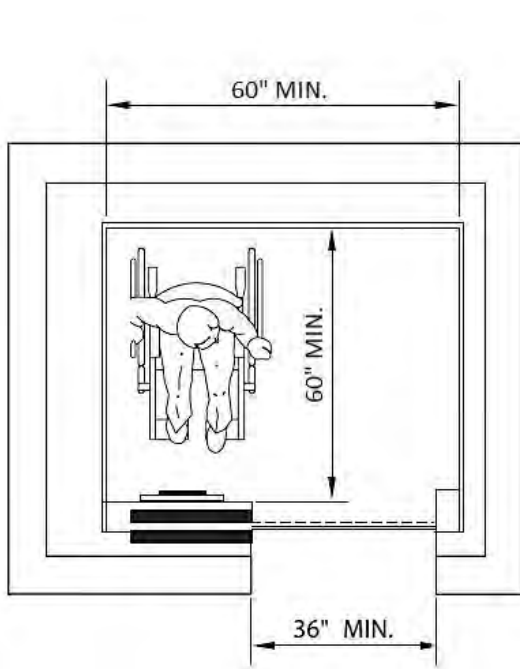
HOUSING ACCESSIBILITY



(a) SIDE OPENING DOOR



(b) CENTER OPENING DOOR



(c) DOOR AT ANY LOCATION

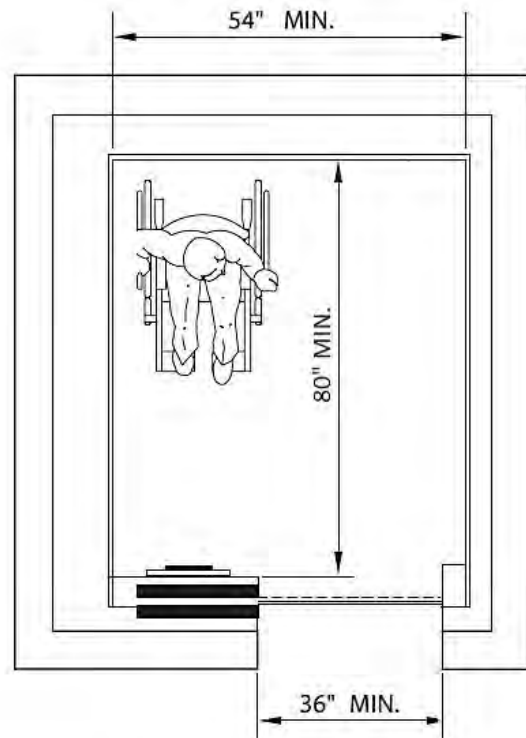


FIGURE 11A-7A
MINIMUM DIMENSIONS OF ELEVATOR CARS

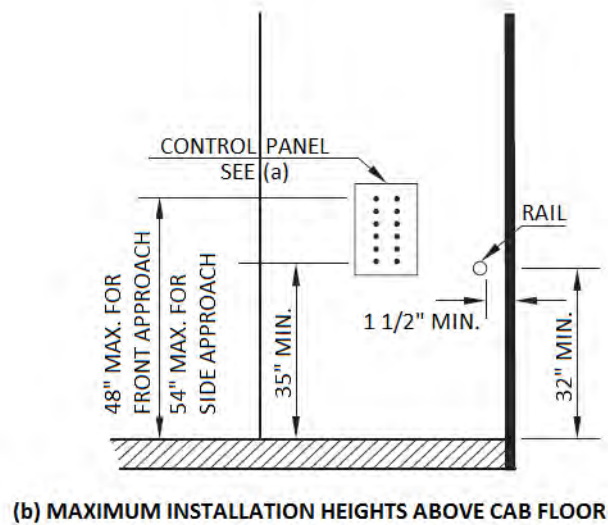
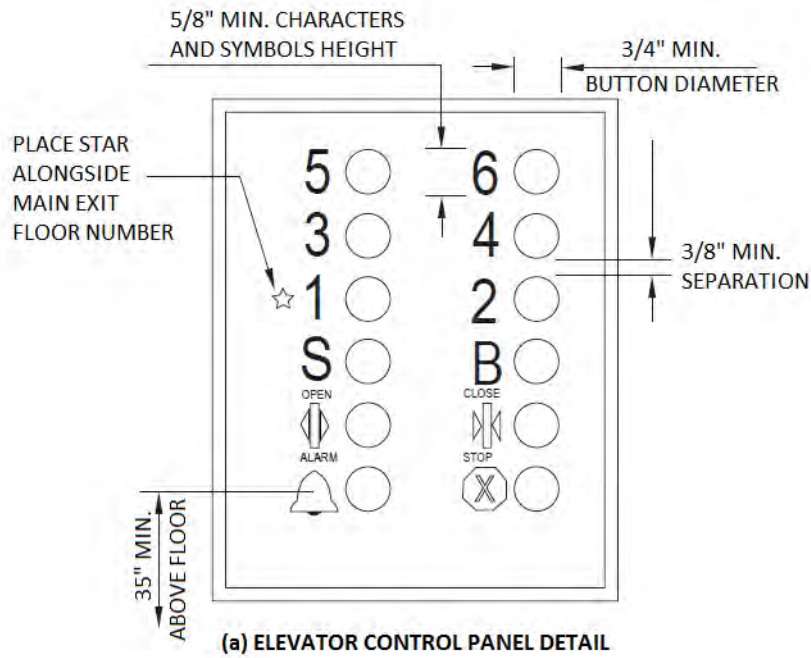
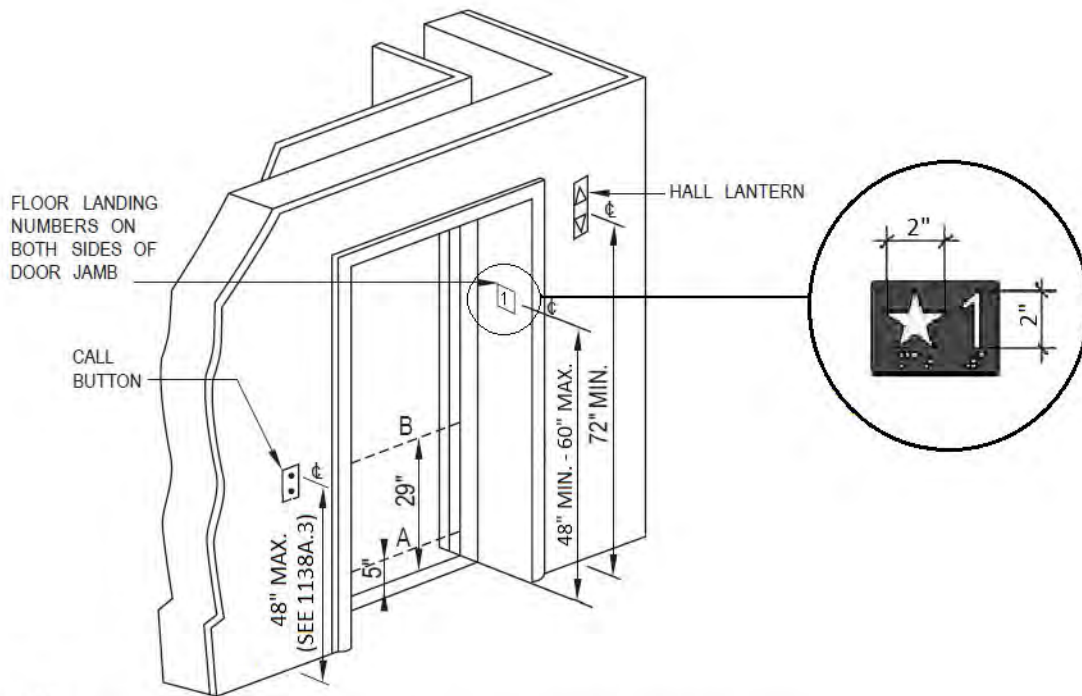


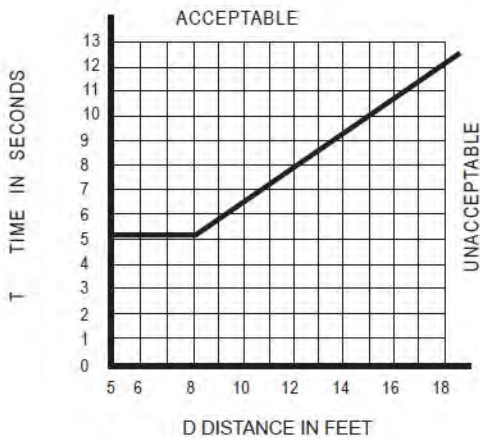
FIGURE 11A-7B
ELEVATOR CONTROL PANEL

HOUSING ACCESSIBILITY

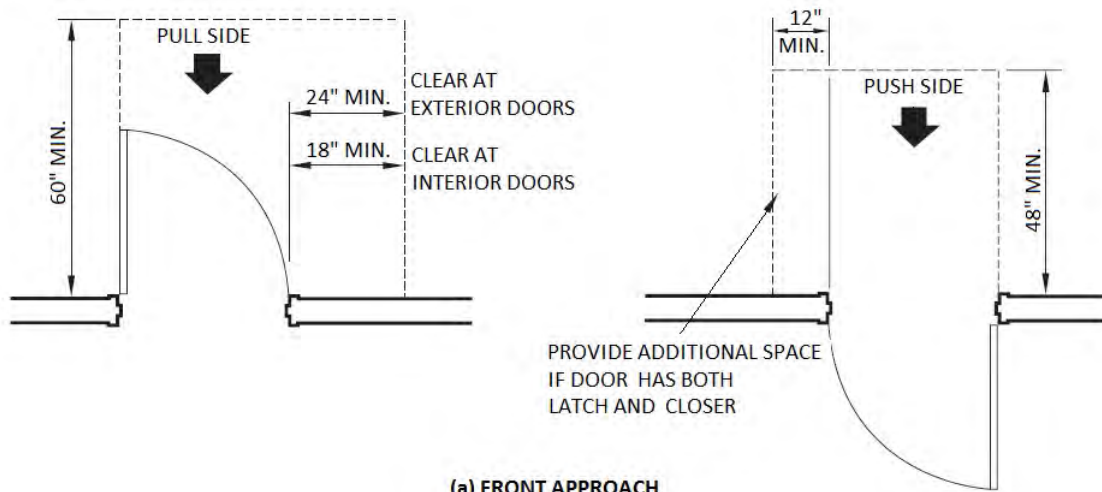


NOTE:
 THE AUTOMATIC DOOR REOPENING DEVICE IS ACTIVATED IF AN OBJECT PASSES THROUGH EITHER LINE A OR LINE B. LINE A AND LINE B REPRESENT THE VERTICAL LOCATION OF THE DOOR REOPENING DEVICE NOT REQUIRING CONTACT.

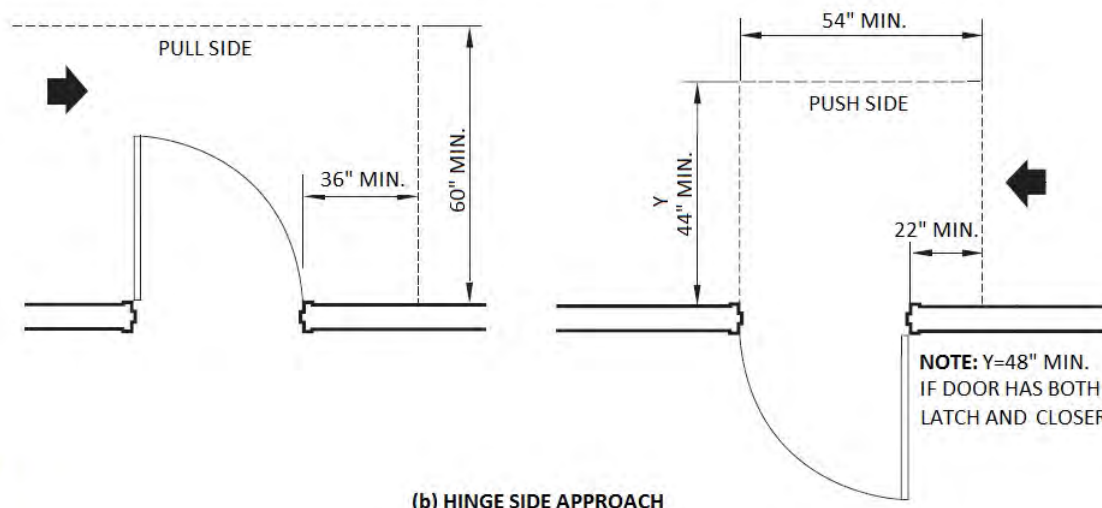
**FIGURE 11A-7C
 HOISTWAY AND ELEVATOR ENTRANCES**



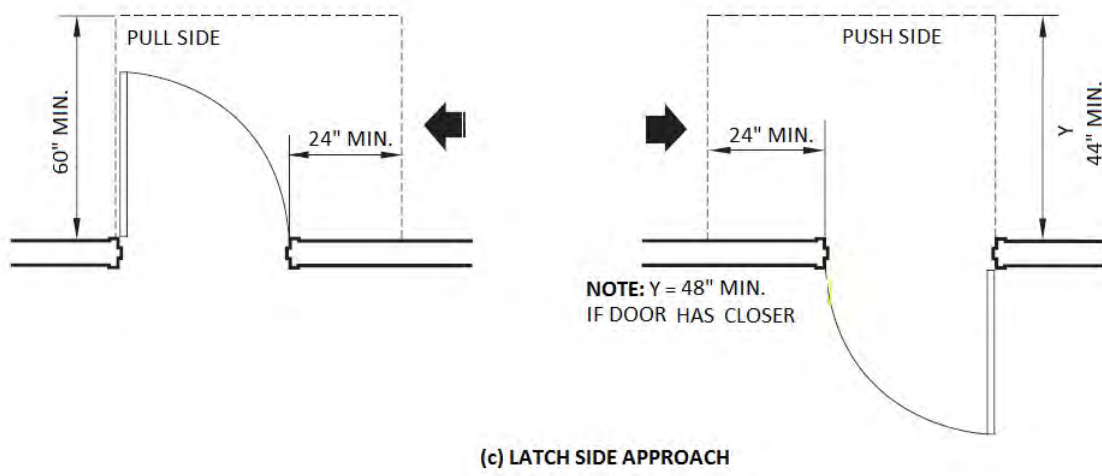
**FIGURE 11A-7D
 GRAPH OF TIMING EQUATION**



(a) FRONT APPROACH



(b) HINGE SIDE APPROACH



(c) LATCH SIDE APPROACH

FIGURE 11A-8A
MANEUVERING CLEARANCE AT SWINGING DOORS

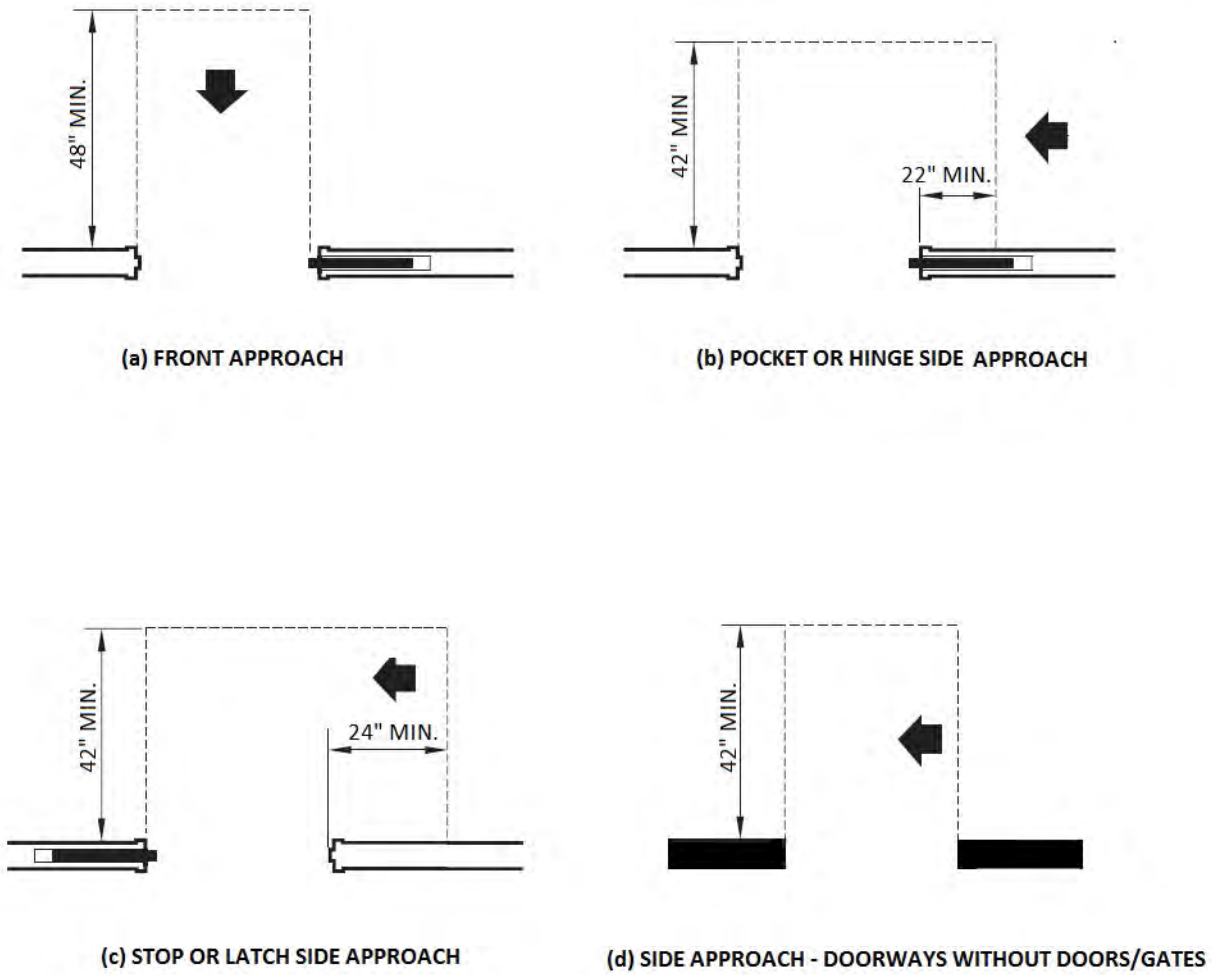
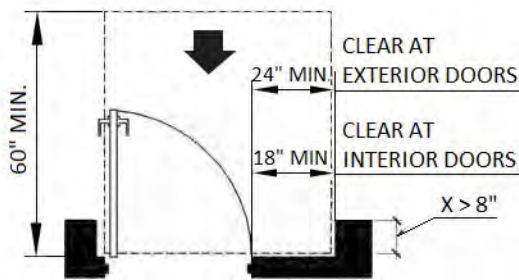
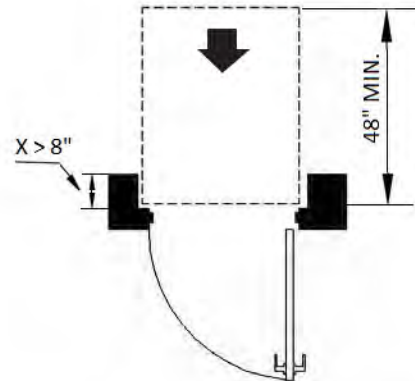


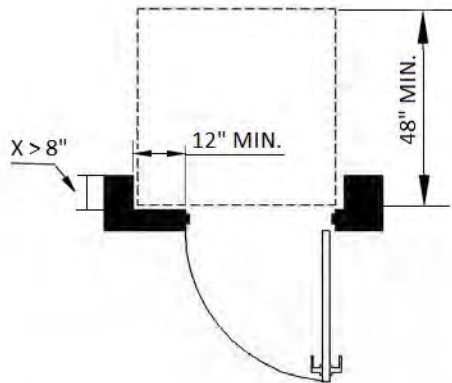
FIGURE 11A-8B
MANEUVERING CLEARANCE AT DOORWAYS, SLIDING DOORS AND FOLDING DOORS



(a) PULL SIDE APPROACH

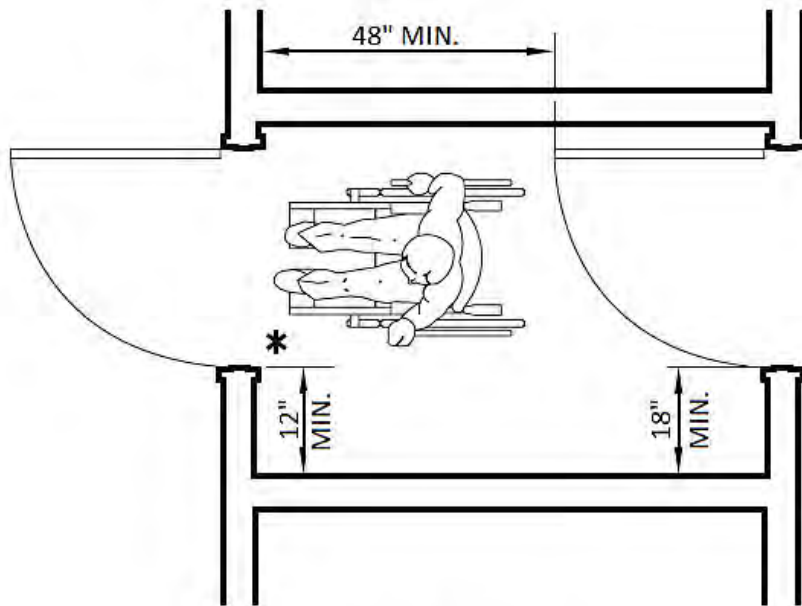


(b) PUSH SIDE APPROACH

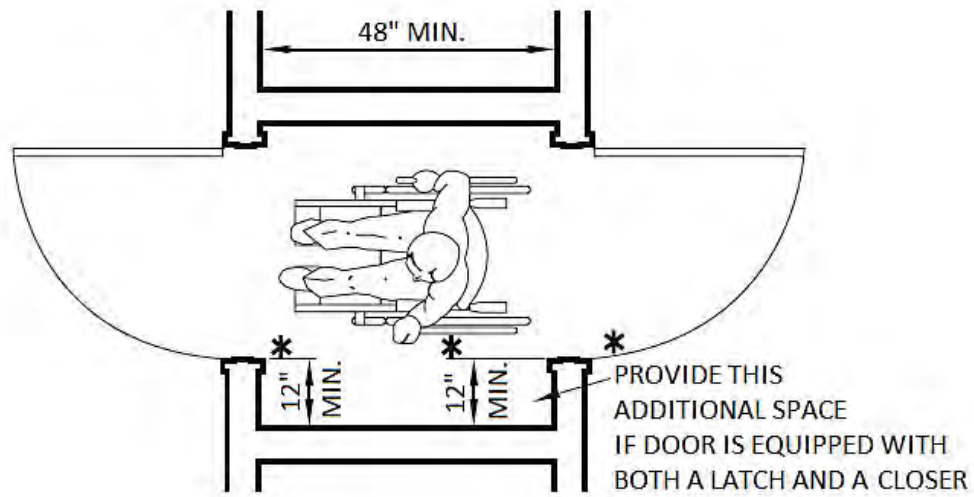


(c) PUSH SIDE APPROACH - DOOR WITH BOTH A LATCH AND A CLOSER

FIGURE 11A-8C
MANEUVERING CLEARANCES AT RECESSED DOORS



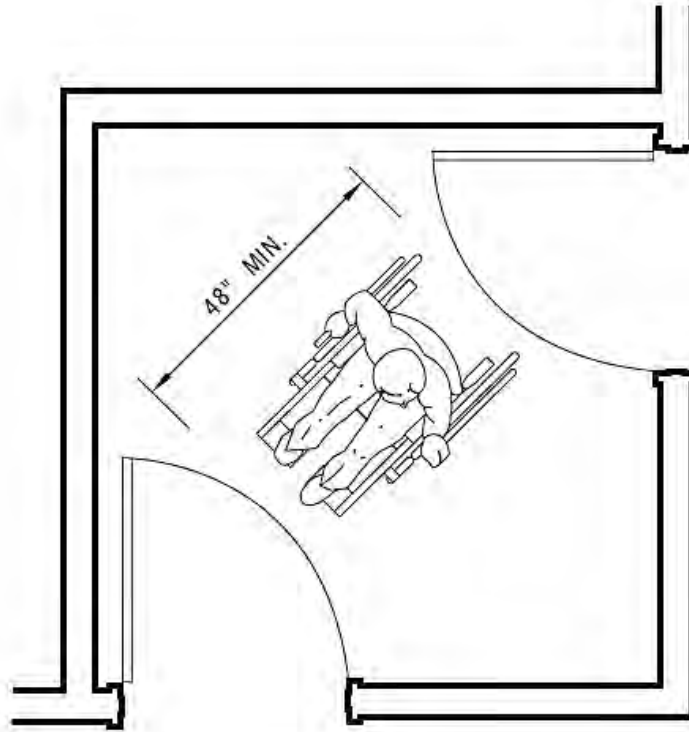
(a) DOORS IN SERIES



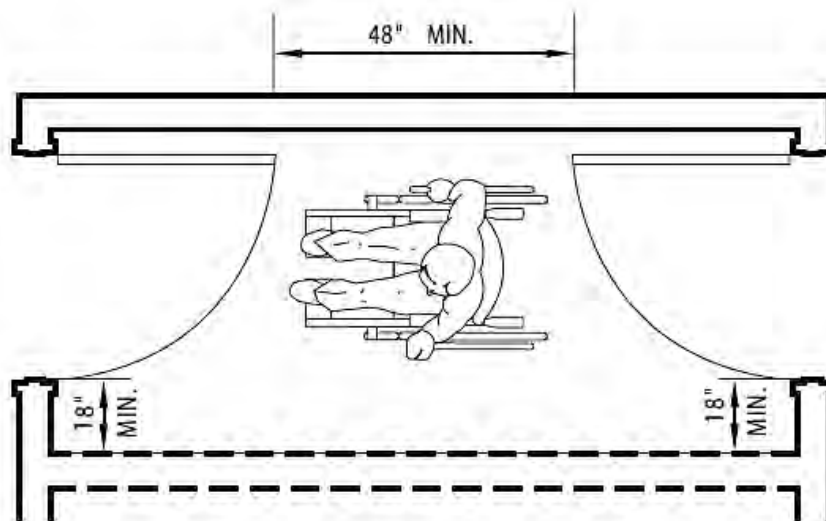
(b) BOTH DOORS OPEN OUT

(SERVING OTHER THAN A REQUIRED EXIT STAIRWAY)

FIGURE 11A-8G
VESTIBULE



(a) DOORS AT ADJACENT WALLS



(b) DOORS AT OPPOSITE WALLS

FIGURE 11A-8H
VESTIBULE

(SERVING OTHER THAN A REQUIRED EXIT STAIRWAY)

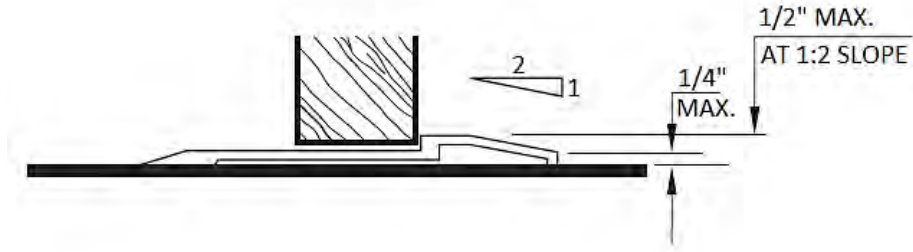


FIGURE 11A-8I
THRESHOLDS

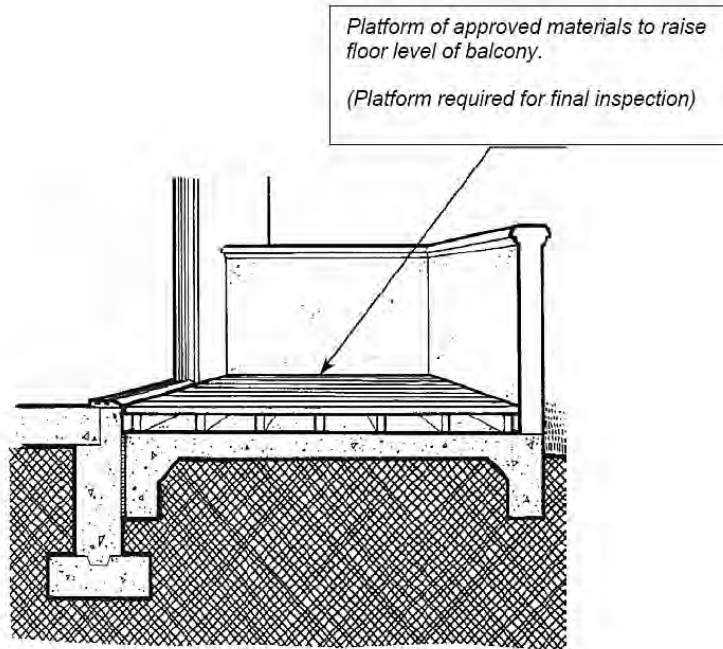


FIGURE 11A-8J
PLATFORM AT SECONDARY EXTERIOR DOOR

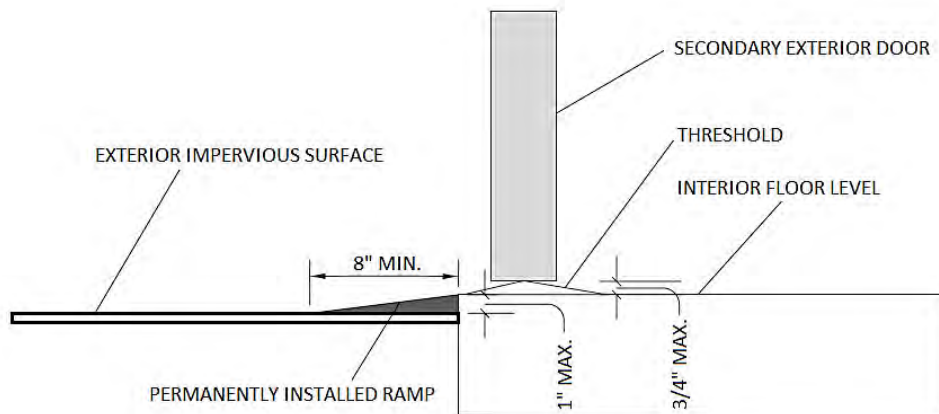
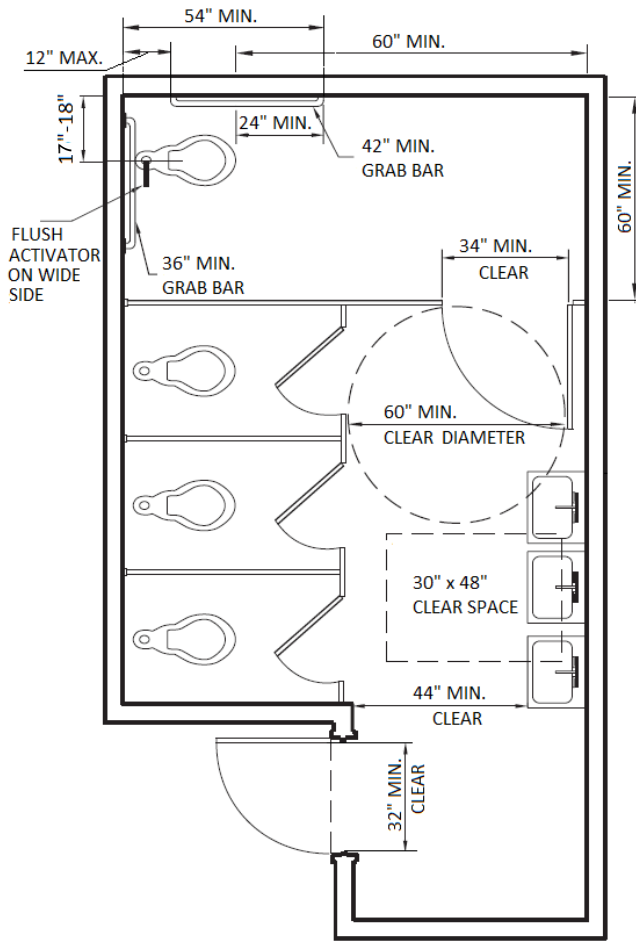
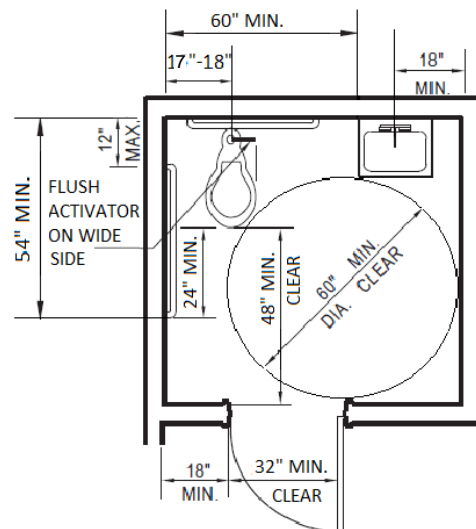


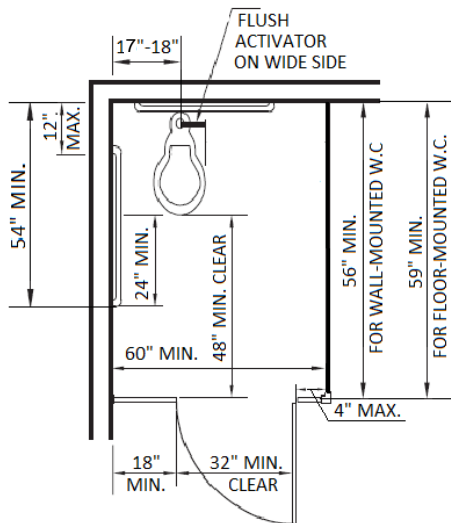
FIGURE 11A-8K
RAMP AT SECONDARY EXTERIOR DOOR



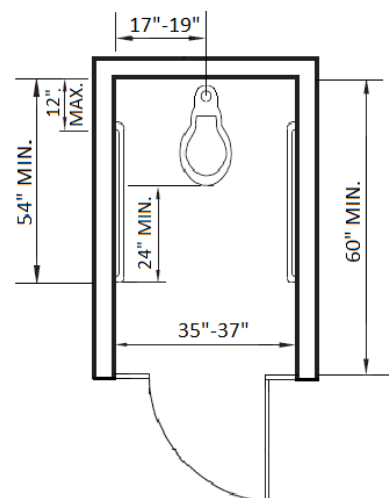
(a) MULTIPLE-ACCOMMODATION TOILET FACILITY



(b) SINGLE-ACCOMMODATION TOILET FACILITY

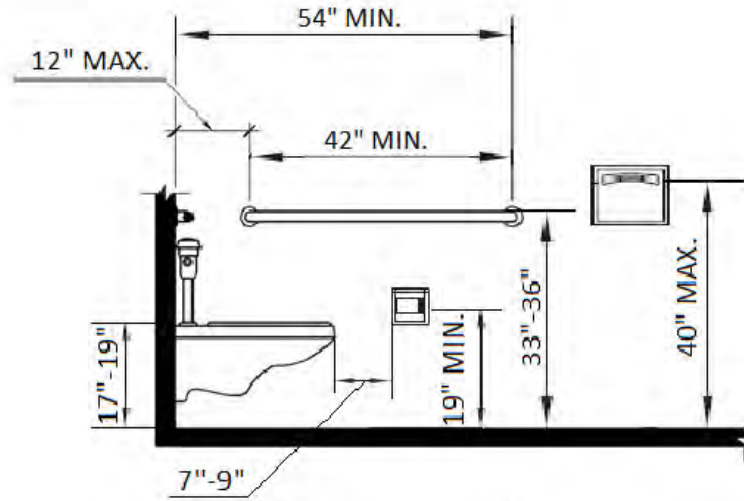


(c) ACCESSIBLE WATER CLOSET COMPARTMENT
WITHIN MULTIPLE-ACCOMMODATION TOILET FACILITY

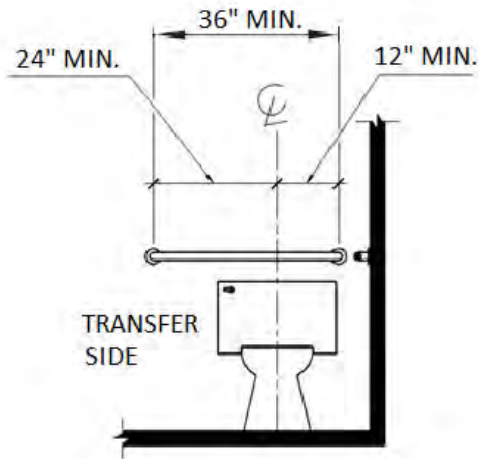


(d) AMBULATORY ACCESSIBLE COMPARTMENT

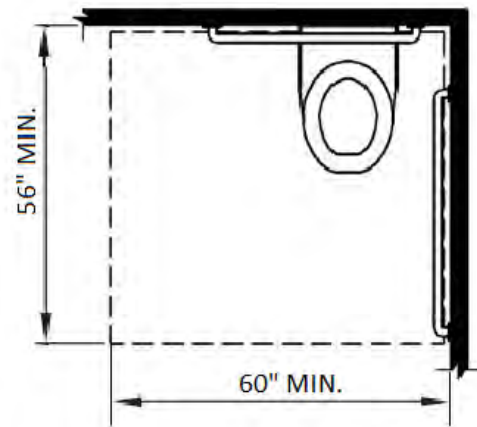
FIGURE 11A-9A
TOILET FACILITIES



(a) SIDE VIEW

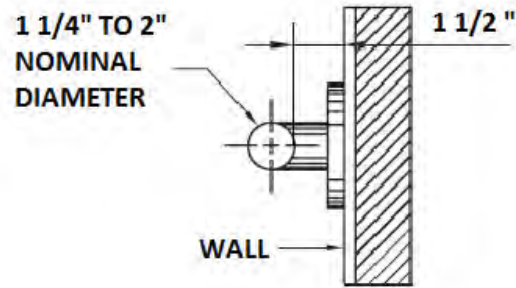


(b) FRONT VIEW

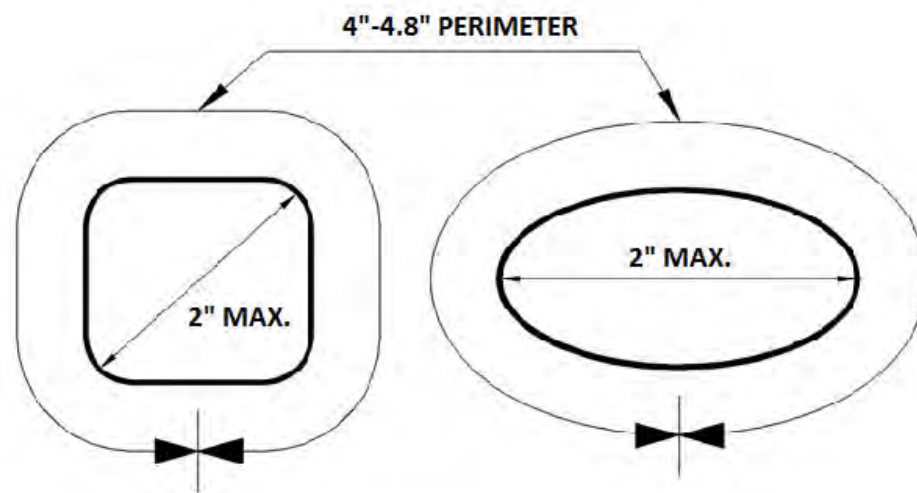


(c) CLEAR FLOOR SPACE AT WATER CLOSETS

FIGURE 11A-9B
WATER CLOSETS



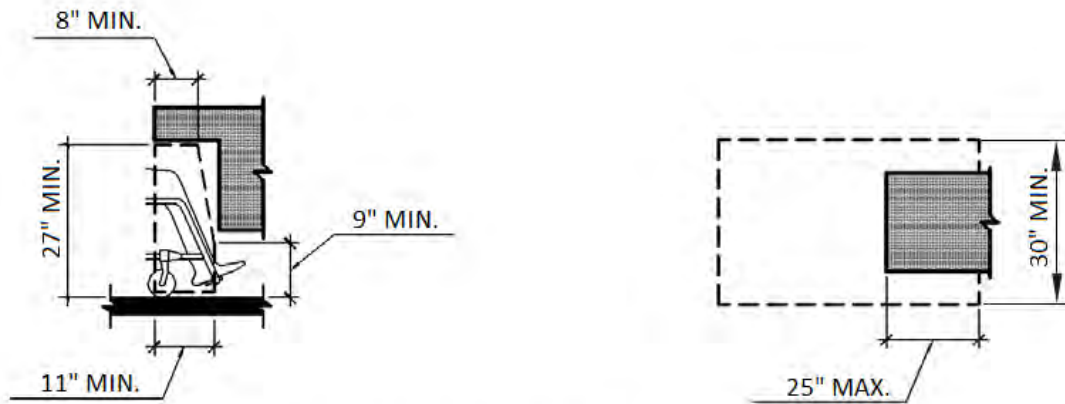
(a) SECTION THROUGH TYPICAL CIRCULAR GRAB BAR



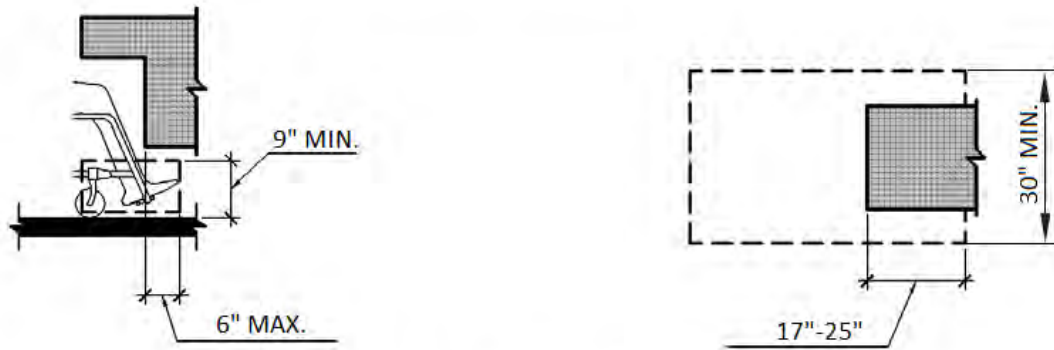
(b) NON-CIRCULAR CROSS SECTIONS

FIGURE 11A-9C
GRAB BARS

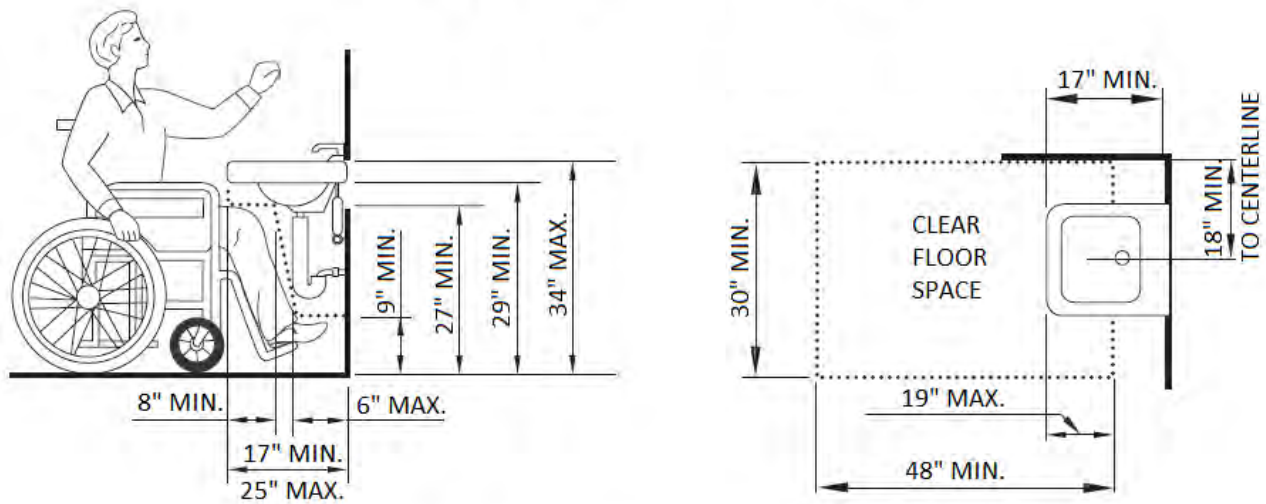
HOUSING ACCESSIBILITY



(a) KNEE SPACE - GENERAL REQUIREMENT

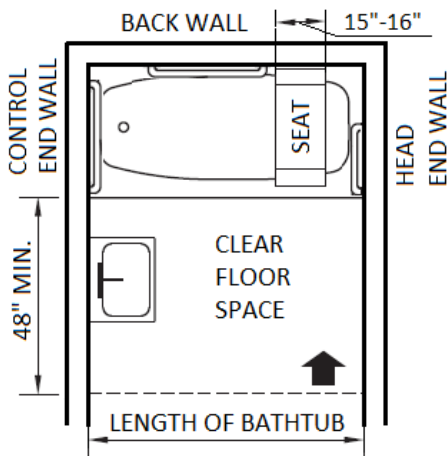


(b) TOE SPACE - GENERAL REQUIREMENT

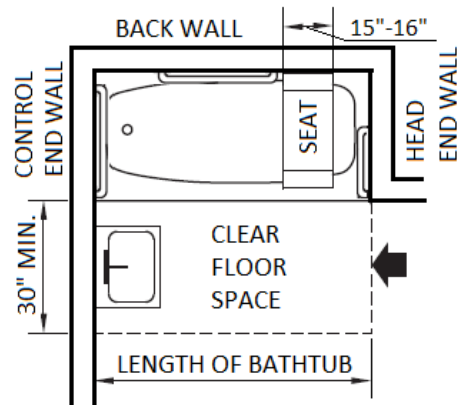


(c) KNEE AND TOE SPACE FOR LAVATORIES

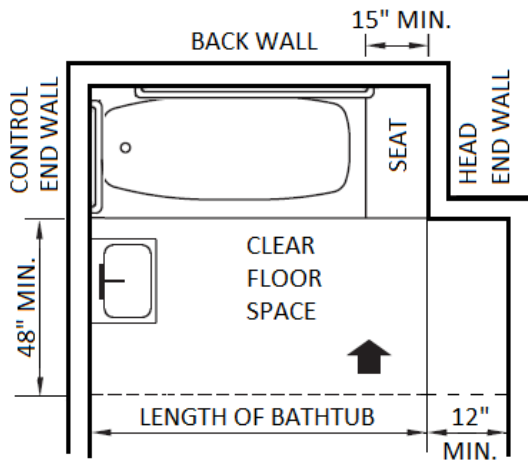
FIGURE 11A-9D
KNEE AND TOE SPACE



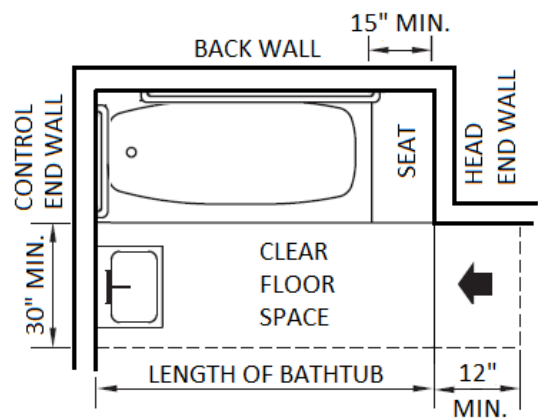
(a) REMOVABLE SEAT IN TUB - FRONT APPROACH



(b) REMOVABLE SEAT IN TUB - SIDE APPROACH



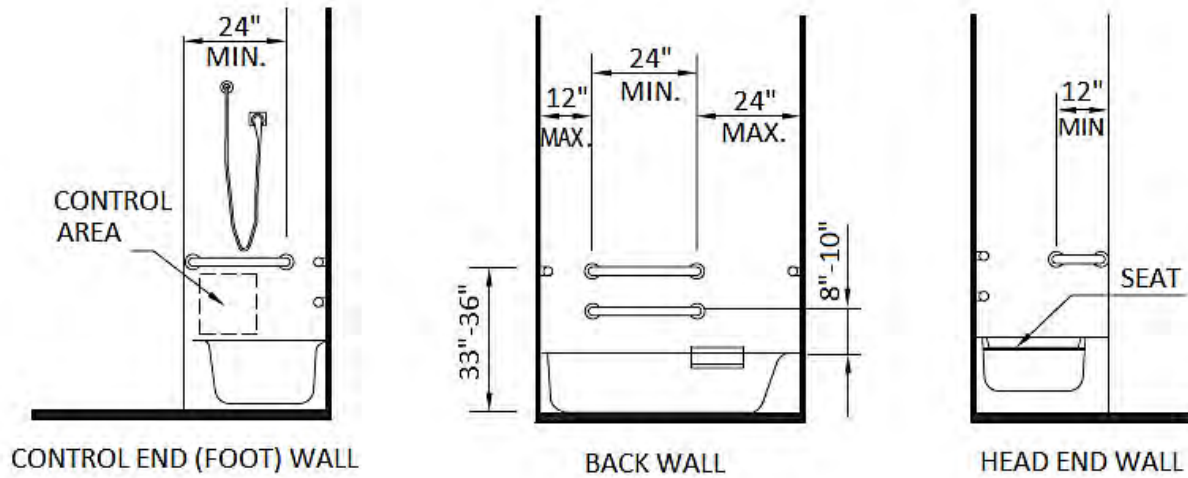
(c) PERMANENT SEAT IN TUB - FRONT APPROACH



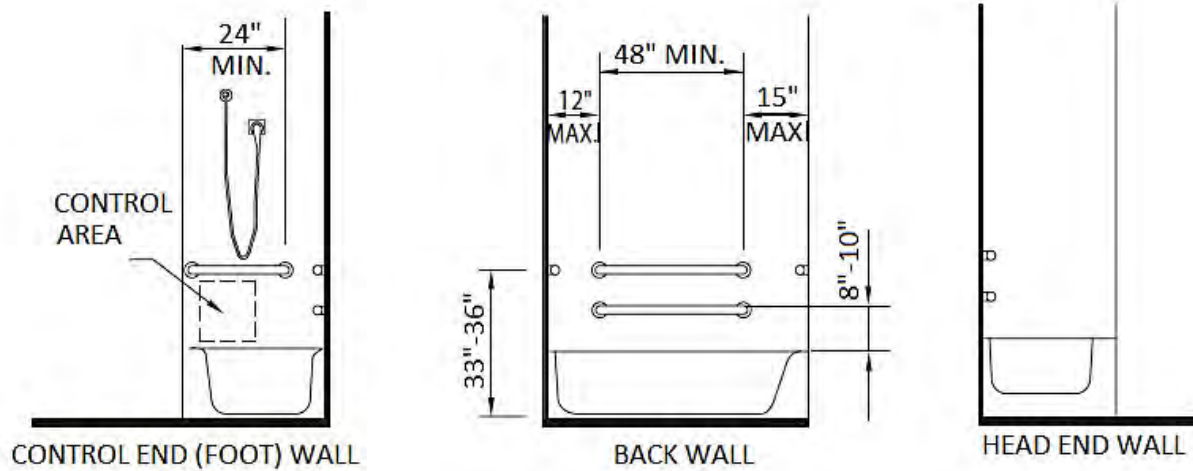
(d) PERMANENT SEAT IN TUB - SIDE APPROACH

NOTE: SEE FIGURE 11A-9F FOR SIZE OF GRAB BARS

FIGURE 11A-9E
CLEAR FLOOR SPACE AT BATHTUBS



(a) WITH REMOVABLE SEAT IN TUB

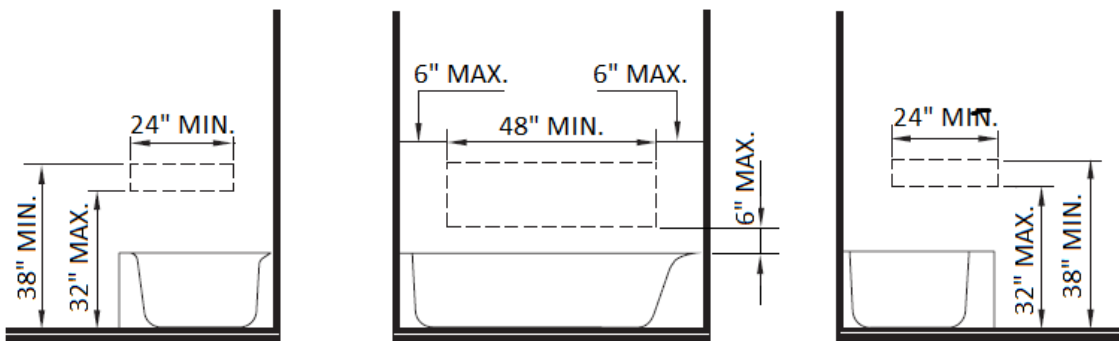


(b) WITH PERMANENT SEAT AT HEAD OF TUB

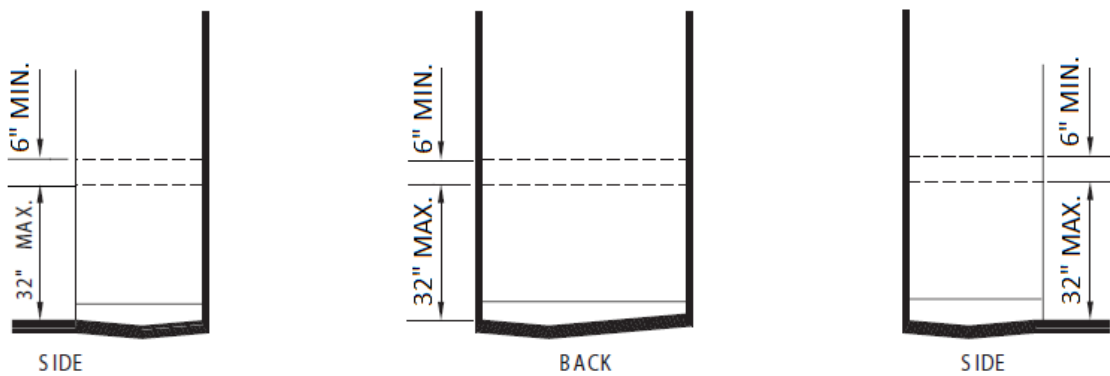
FIGURE 11A-9F
GRAB BARS AT BATHTUBS



(a) GRAB BAR REINFORCEMENT FOR ADAPTABLE WATER CLOSETS



(b) GRAB BAR REINFORCEMENT FOR ADAPTABLE BATHTUBS

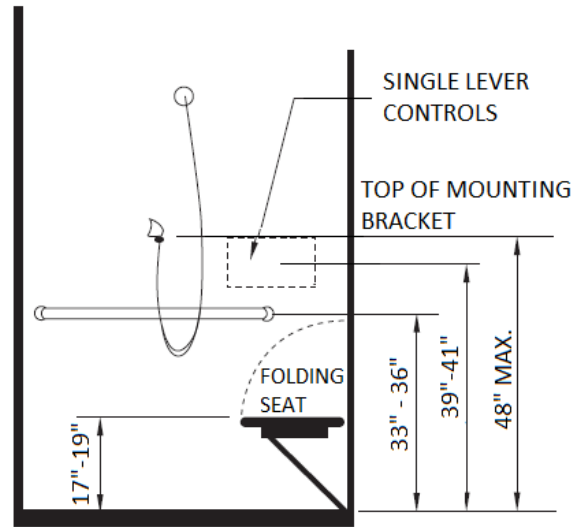
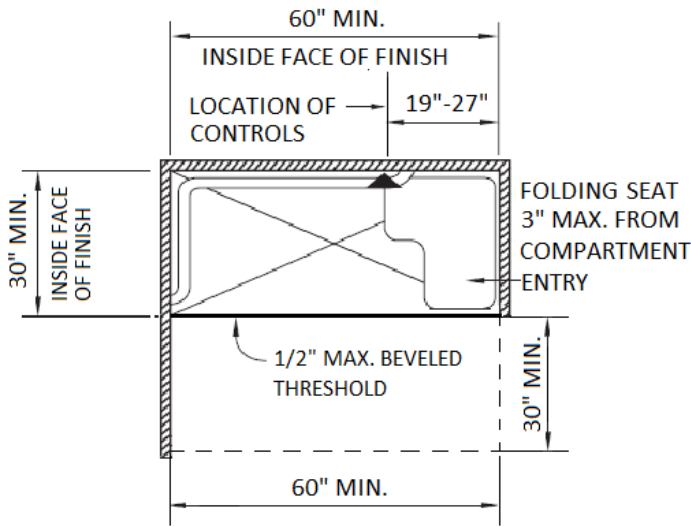


(c) GRAB BAR REINFORCEMENT FOR ADAPTABLE SHOWERS

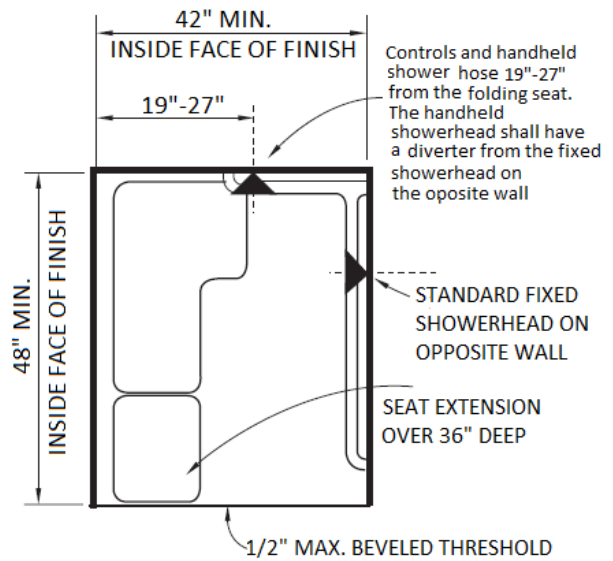
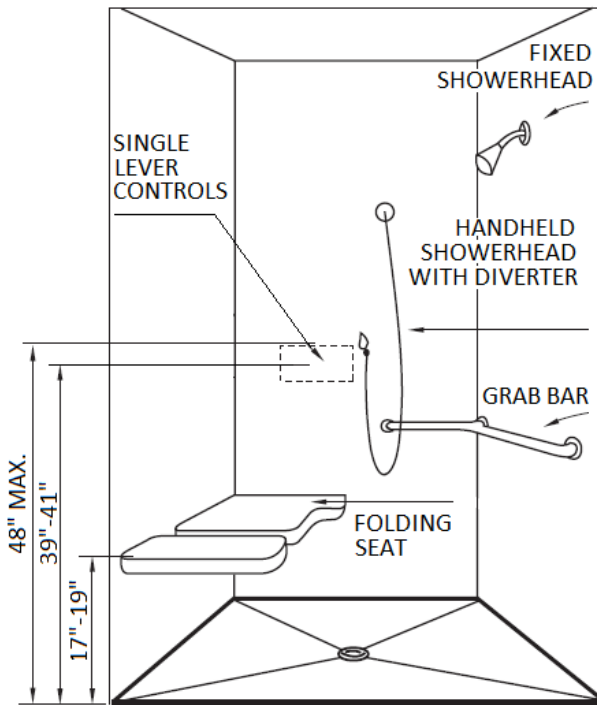
AREAS OUTLINED IN DASHED LINES REPRESENT LOCATION FOR FUTURE INSTALLATION OF GRAB BARS

FIGURE 11A-9G
REINFORCEMENT FOR GRAB BARS

HOUSING ACCESSIBILITY

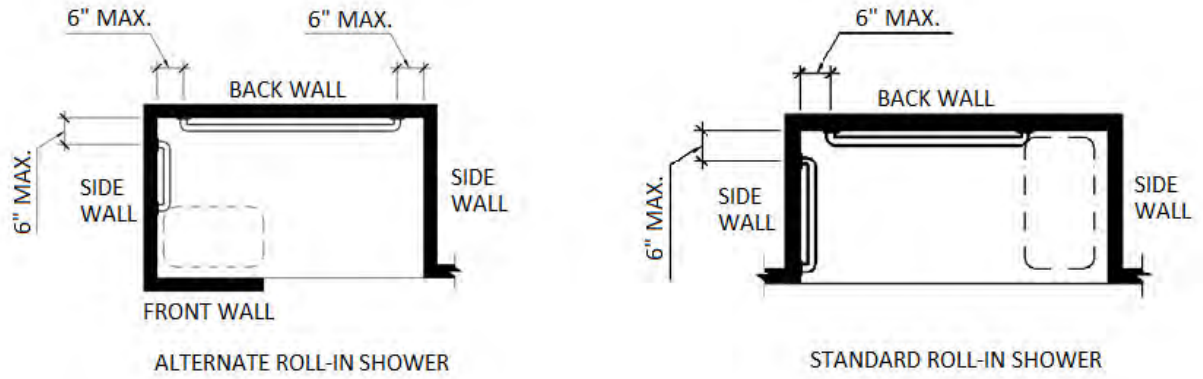


(a) 60" x 30" ROLL-IN SHOWER



(b) 42" x 48" ROLL-IN SHOWER

FIGURE 11A-9H
STANDARD ROLL-IN SHOWER

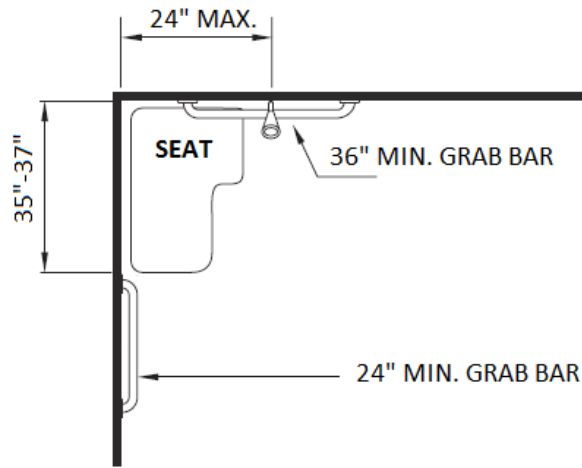


(a) GRAB BARS

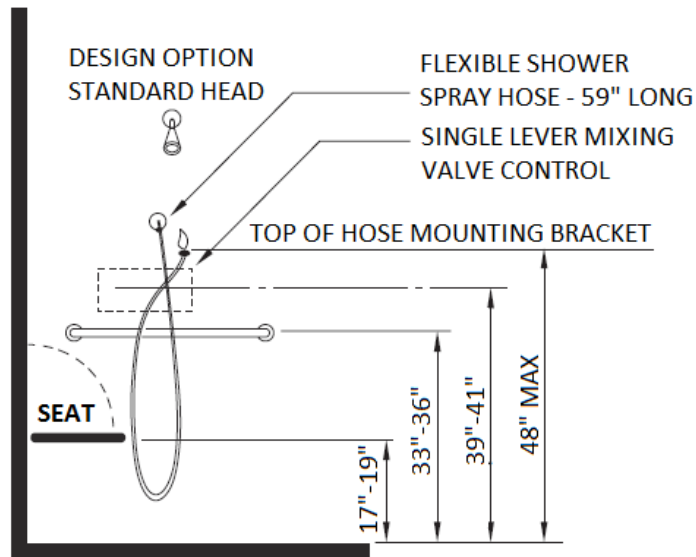


(b) SHOWER SEATS

FIGURE 1A-9I
SHOWER SEATS AND GRAB BARS



(a) PLAN VIEW



(b) ELEVATION

FIGURE 11A-9J
OPEN SHOWER

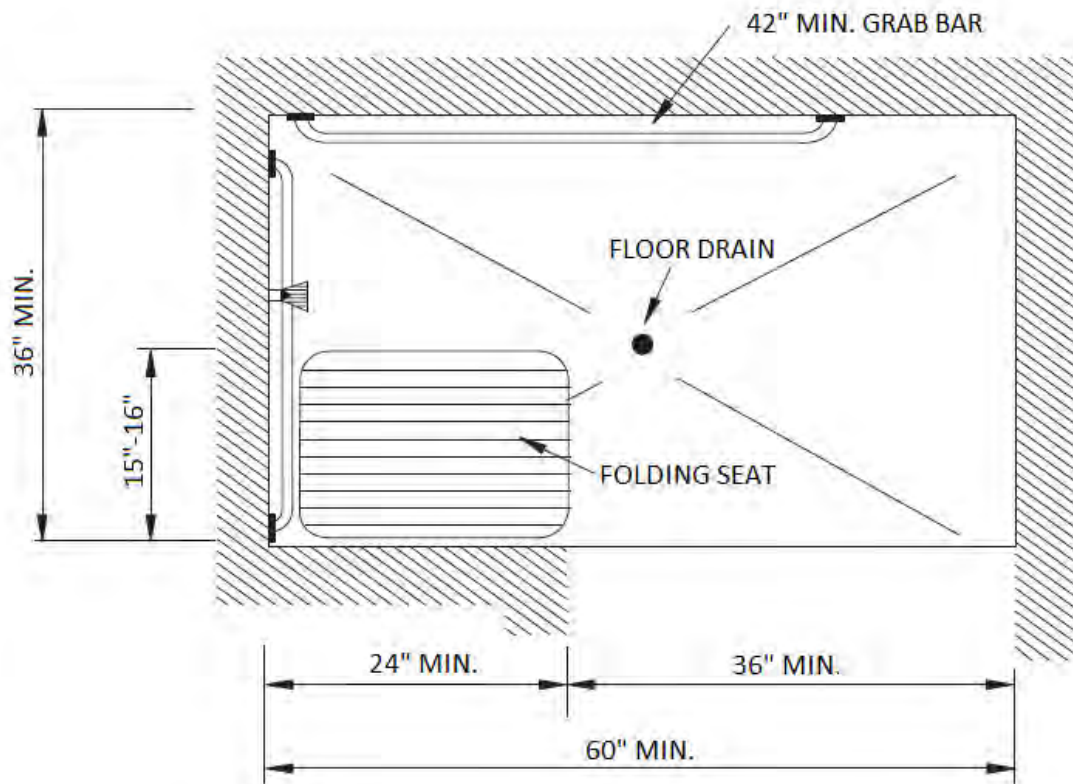


FIGURE 11A-9K
ALTERNATE ROLL-IN SHOWER

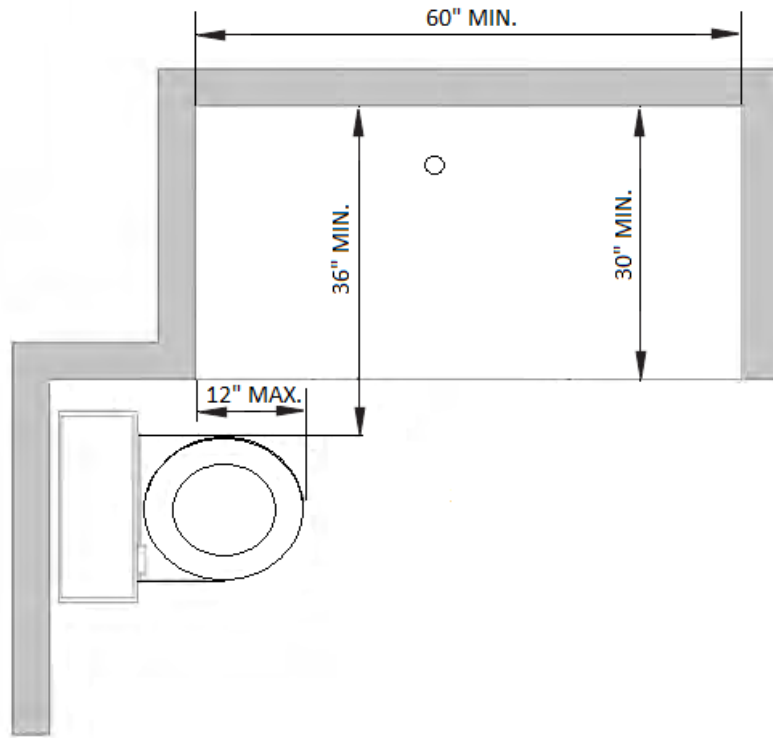


FIGURE 11A-9L
SHOWER WITH WATER CLOSET

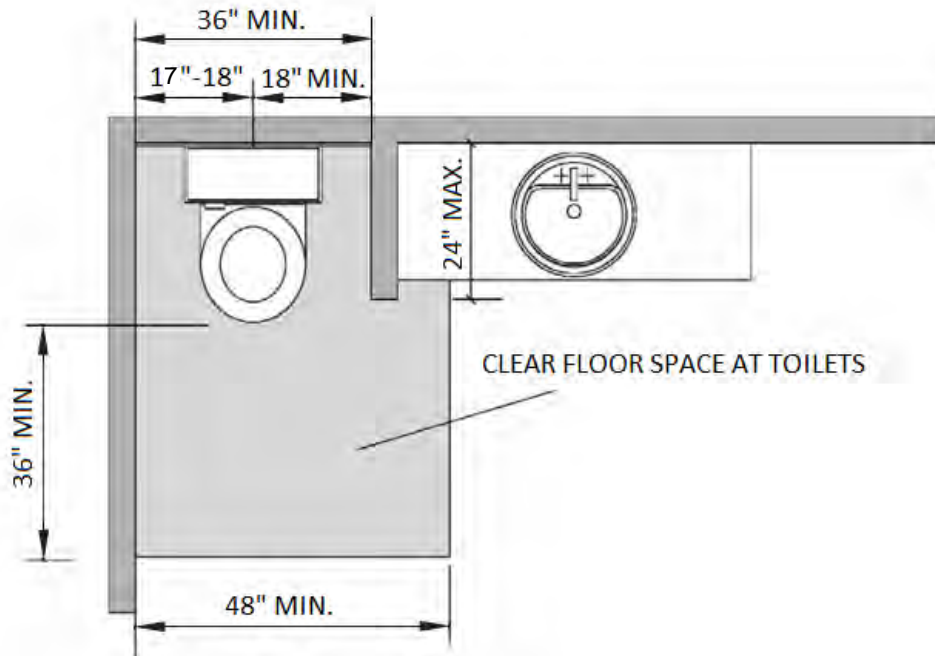
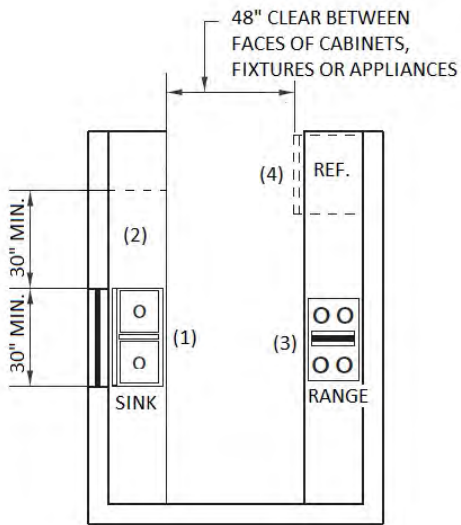
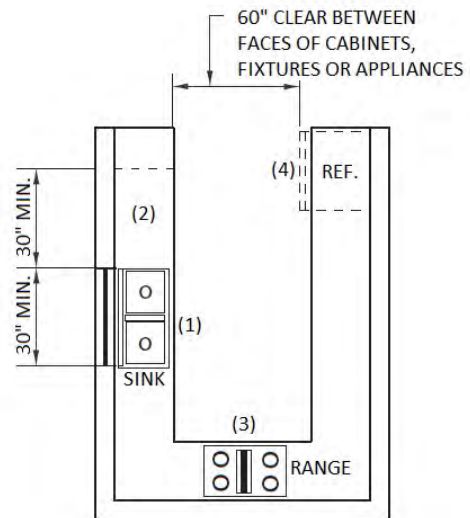


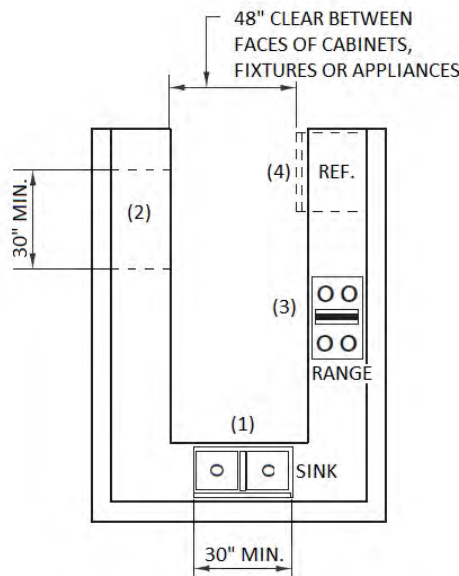
FIGURE 11A-9M
WING WALL OR CABINET AT WATER CLOSET



(a) TYPICAL KITCHEN



(b) "U" SHAPED KITCHEN WITH RANGE AT THE BASE



(c) "U" SHAPED KITCHEN WITH SINK AT THE BASE

- (1) 30" minimum countertop space for sink installation with removable base cabinet and finish flooring beneath the sink; 30" x 48" minimum clear floor space to allow parallel or forward approach.
- (2) 30" minimum countertop for work surface with removable base cabinet and finish flooring beneath; 30" x 48" minimum clear floor space to allow parallel or forward approach.
- (3) 30" x 48" minimum clear floor space adjacent to range to allow parallel approach.
- (4) 30" x 48" clear floor space at refrigerator, dishwasher, trash compactor or other appliances to allow parallel or forward approach.

**FIGURE 11A-10A
KITCHEN SPECIFICATIONS**

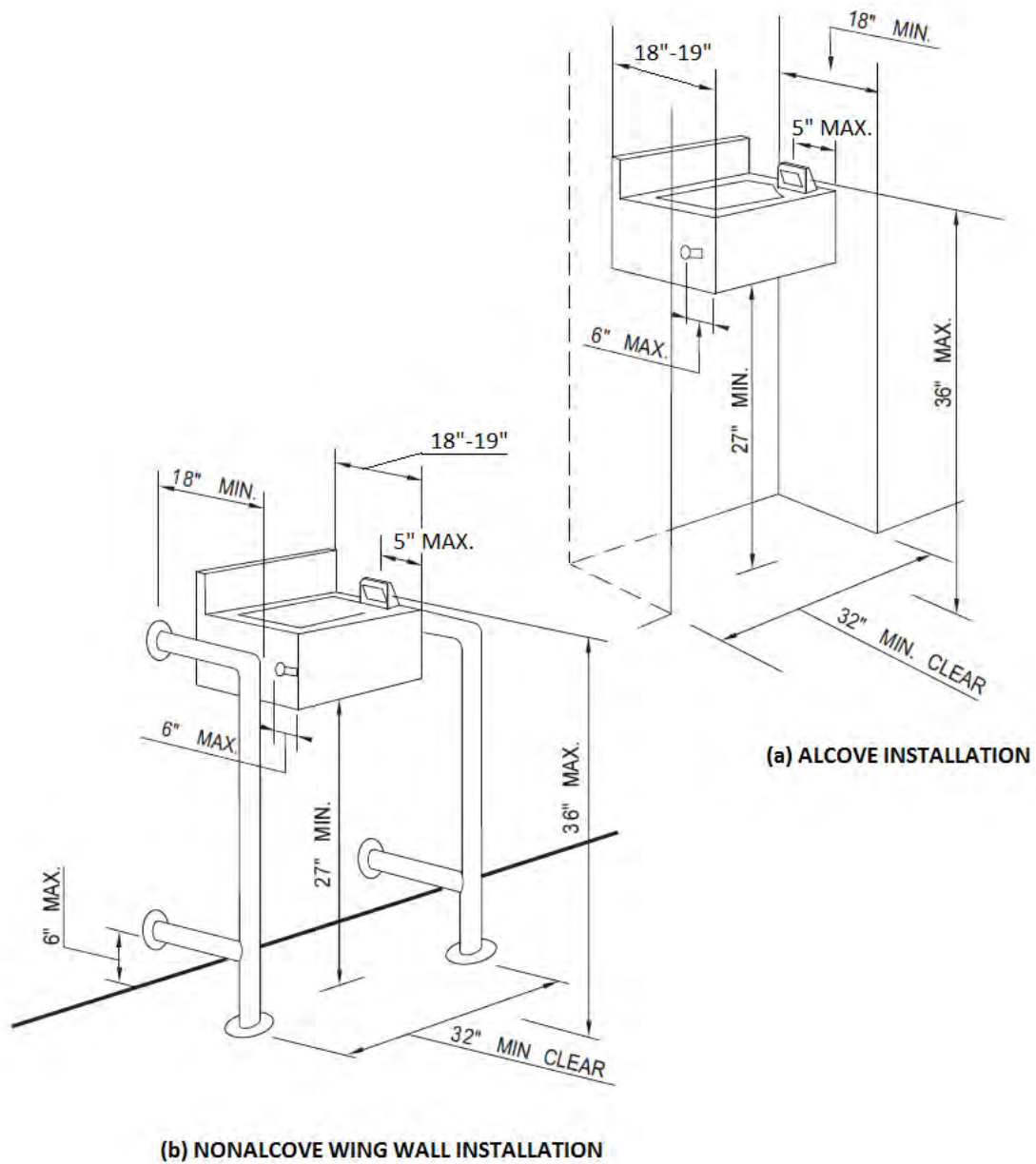
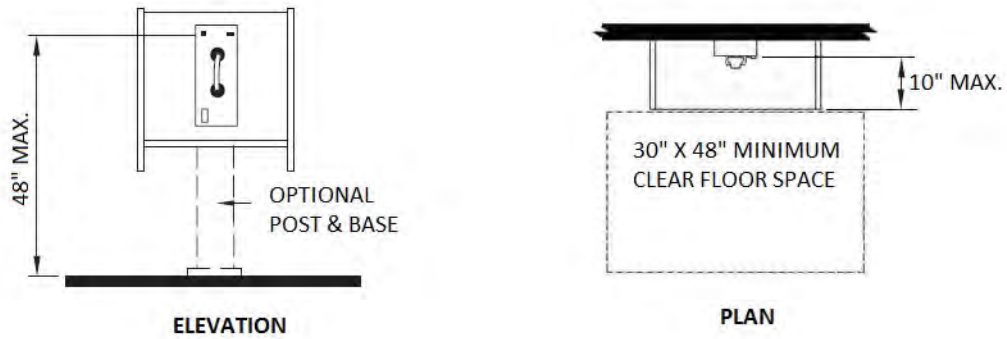
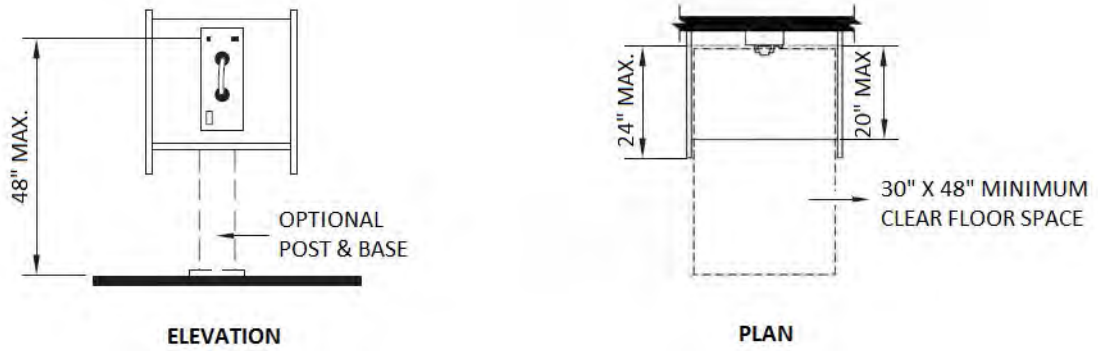


FIGURE 11A-11A
DRINKING FOUNTAINS



(a) PARALLEL APPROACH



(b) FORWARD APPROACH

FIGURE 11A-11B
TELEPHONES



FIGURE 11A-11C
INTERNATIONAL TTY SYMBOL



FIGURE 11A-11D
VOLUME CONTROL TELEPHONES



FIGURE 11A-11E
INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 11B – ACCESSIBILITY TO PUBLIC BUILDINGS, PUBLIC ACCOMMODATIONS,
COMMERCIAL BUILDINGS AND PUBLIC HOUSING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter							X															
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

CHAPTER 11B

ACCESSIBILITY TO PUBLIC BUILDINGS, PUBLIC ACCOMMODATIONS, COMMERCIAL BUILDINGS AND PUBLIC HOUSING

DIVISION 1: APPLICATION AND ADMINISTRATION

11B-101 Purpose

11B-101.1 General. This *chapter* contains scoping and technical requirements for accessibility to sites, facilities, buildings and elements by individuals with disabilities. The requirements are to be applied during the design, construction, additions to, and alteration of sites, facilities, buildings and elements to the extent required by *Chapter 1, Section 1.9*.

11B-101.2 Reserved.

11B-102 Dimensions for adults and children. The technical requirements are based on adult dimensions and anthropometrics. In addition, this *chapter* includes technical requirements based on children’s dimensions and anthropometrics for drinking fountains, water closets, toilet compartments, lavatories and sinks, dining surfaces and work surfaces.

11B-103 Equivalent facilitation. Nothing in these requirements prevents the use of designs, products or technologies as alternatives to those prescribed, provided they result in substantially equivalent or greater accessibility and usability.

11B-104 Conventions

11B-104.1 Dimensions. Dimensions that are not stated as “maximum” or “minimum” are absolute.

11B-104.1.1 Construction and manufacturing tolerances. All dimensions are subject to conventional industry tolerances except where the requirement is stated as a range with specific minimum and maximum end points.

11B-104.2 Calculation of percentages. Where the required number of elements or facilities to be provided is determined by calculations of ratios or percentages and remainders or fractions result, the next greater whole number of such elements or facilities shall be provided. Where the determination of the required size or dimension of an element or facility involves ratios or percentages, rounding down for values less than one half shall be permitted.

11B-104.3 Figures. Unless specifically stated otherwise, figures are provided for informational purposes only.

11B-105 Referenced standards.

11B-105.1 General. See *Chapter 35*.

11B-106 Definitions

11B-106.1 General. For the purpose of this *chapter*, the terms listed in *Section 11B-106.5* and defined in *Chapter 2* have the indicated meaning.

11B-106.2 Terms defined in referenced standards. Terms not listed in *Section 11B-106.5* and not defined in *Chapter 2*,

Section 202, but specifically defined in a referenced standard, shall have the specified meaning from the referenced standard unless otherwise stated.

11B-106.3 Undefined terms. The meaning of terms not specifically listed in *Section 11B-106.5*, and not defined in *Chapter 2, Section 202*, or in referenced standards shall be as defined by collegiate dictionaries in the sense that the context implies.

11B-106.4 Interchangeability. See *Chapter 2, Section 201.2*.

Convention	Description
	dimension showing English units (in inches unless otherwise specified) above the line and SI units (in millimeters unless otherwise specified) below the line
	dimension for small measurements
	dimension showing a range with minimum - maximum
min	minimum
max	maximum
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
	boundary of clear floor space or maneuvering clearance
	centerline
	a permitted element or its extension
	direction of travel or approach
	a wall, floor, ceiling or other element cut in section or plan
	a highlighted element in elevation or plan
	location zone of element, control or feature

**FIGURE 11B-104
GRAPHIC CONVENTION FOR FIGURES**

11B-106.5 Defined terms. The following terms are defined in Chapter 2, Section 202.

<i>ACCESS AISLE</i>	CURB RAMP
<i>ACCESSIBILITY</i>	DETECTABLE WARNING
<i>ACCESSIBLE</i>	<i>DIRECTIONAL SIGN</i>
<i>ACCESSIBLE ELEMENT</i>	<i>DISABILITY</i>
<i>ACCESSIBLE MEANS OF EGRESS</i>	<i>DORMITORY</i>
<i>ACCESSIBLE ROUTE</i>	<i>DRIVE-UP ELECTRIC VEHICLE CHARGING STATION</i>
<i>ACCESSIBLE SPACE</i>	<i>ELECTRIC VEHICLE (EV)</i>
<i>ADAPTABLE</i>	<i>ELECTRIC VEHICLE (EV) CHARGER</i>
<i>ADDITION</i>	<i>ELECTRIC VEHICLE CHARGING SPACE (EV SPACE)</i>
<i>ADJUSTED CONSTRUCTION COST</i>	<i>ELECTRIC VEHICLE CHARGING STATION (EVCS)</i>
<i>ADMINISTRATIVE AUTHORITY</i>	<i>ELECTRIC VEHICLE (EV) CONNECTOR</i>
<i>AISLE</i>	ELEMENT
<i>ALTERATION</i>	ELEVATED PLAY COMPONENT
<i>AMUSEMENT ATTRACTION</i>	<i>ELEVATOR, PASSENGER</i>
<i>AMUSEMENT RIDE</i>	EMPLOYEE WORK AREA
<i>AMUSEMENT RIDE SEAT</i>	<i>ENFORCING AGENCY</i>
<i>ANSI</i>	ENTRANCE
<i>APPROVED</i>	<i>EQUIVALENT FACILITATION</i>
<i>APPROVED TESTING AGENCY</i>	<i>EXISTING BUILDING OR FACILITY</i>
<i>AREA OF REFUGE</i>	<i>EXIT</i>
<i>AREA OF SPORT ACTIVITY</i>	FACILITY
<i>ASSEMBLY AREA</i>	<i>FUNCTIONAL AREA</i>
<i>ASSISTIVE LISTENING SYSTEM (ALS)</i>	GANGWAY
<i>AUTOMATIC DOOR</i>	GOLF CAR PASSAGE
<i>AUTOMATIC TELLER MACHINE (ATM)</i>	<i>GRAB BAR</i>
<i>BATHROOM</i>	<i>GRADE (ADJACENT GROUND ELEVATION)</i>
<i>BLENDED TRANSITION</i>	<i>GRADE BREAK</i>
BOARDING PIER	<i>GROUND FLOOR</i>
BOAT LAUNCH RAMP	GROUND LEVEL PLAY COMPONENT
BOAT SLIP	<i>GUARD</i>
BUILDING	<i>HANDRAIL</i>
<i>BUILDING OFFICIAL</i>	<i>HEALTH CARE PROVIDER</i>
CATCH POOL	<i>HISTORICAL BUILDINGS</i>
CCR	<i>HOUSING AT A PLACE OF EDUCATION</i>
CHARACTERS	<i>IF, IF . . . THEN</i>
CHILDREN'S USE	<i>INTERNATIONAL SYMBOL OF ACCESSIBILITY</i>
CIRCULATION PATH	KEY STATION
<i>CLEAR</i>	<i>KICK PLATE</i>
<i>CLEAR FLOOR SPACE</i>	<i>KITCHEN OR KITCHENETTE</i>
CLOSED-CIRCUIT TELEPHONE	<i>LAVATORY</i>
<i>COMMERCIAL FACILITIES</i>	MAIL BOXES
COMMON USE	MARKED CROSSING
<i>COMPLY WITH</i>	<i>MAY</i>
CROSS SLOPE	MEZZANINE
<i>CURB CUT</i>	<i>MULTIBEDROOM HOUSING UNIT</i>
	<i>NFPA</i>
	<i>NOSING</i>

OCCUPANT LOAD	SHOULD
OCCUPIABLE SPACE	SIDEWALK
OPEN RISER	SIGN
OPERABLE PART	SINK
PASSENGER ELEVATOR	SITE
PATH OF TRAVEL	SLEEPING ACCOMMODATIONS
PEDESTRIAN	SOFT CONTAINED PLAY STRUCTURE
PEDESTRIAN WAY	SPACE
PERMANENT	SPECIFIED PUBLIC TRANSPORTATION
PERMIT	STAGE
PICTOGRAM	STAIR
PLACE OF PUBLIC ACCOMMODATION	STAIRWAY
PLATFORM	STORY
PLATFORM (WHEELCHAIR) LIFT	STRUCTURAL FRAME
PLAY AREA	STRUCTURE
PLAY COMPONENT	TACTILE
POINT-OF-SALE DEVICE	TACTILE SIGN
POWDER ROOM	TECHNICALLY INFEASIBLE
POWER-ASSISTED DOOR	TEEING GROUND
PRIVATE BUILDING OR FACILITY	TEMPORARY
PROFESSIONAL OFFICE OF A HEALTH CARE PROVIDER	TEXT TELEPHONE
PUBLIC BUILDING OR FACILITY	TRANSFER DEVICE
PUBLIC ENTITY	TRANSIENT LODGING
PUBLIC ENTRANCE	TRANSIT BOARDING PLATFORM
PUBLIC HOUSING	TRANSITION PLATE
PUBLIC USE	TTY
PUBLIC-USE AREAS	UNREASONABLE HARDSHIP
PUBLIC WAY	USE ZONE
QUALIFIED HISTORIC BUILDING OR FACILITY	VALUATION THRESHOLD
RAMP	VEHICULAR WAY
REASONABLE PORTION	WALK
RECOMMEND	WET BAR
REMODELING	WHEELCHAIR
REPAIR	WHEELCHAIR SPACE
RESIDENTIAL DWELLING UNIT	WORKSTATION
RESTRICTED ENTRANCE	WORK AREA EQUIPMENT
RISER	<i>11B-107 Special conditions appeals action. See Chapter 1, Section 1.9.1.5.</i>
RUNNING SLOPE	<i>11B-108 Maintenance of accessible features. Features, facilities and equipment required by Chapter 11B to be accessible to and useable by persons with disabilities shall be maintained in operable working condition. Isolated or temporary interruptions in service or accessibility due to maintenance or repairs shall be permitted.</i>
SELF-SERVICE STORAGE	
SERVICE ENTRANCE	
SHALL	
SHOPPING CENTER (OR SHOPPING MALL)	

DIVISION 2: SCOPING REQUIREMENTS

11B-201 Application

11B-201.1 Scope. All areas of newly designed and newly constructed buildings and facilities and altered portions of existing buildings and facilities shall comply with these requirements.

11B-201.2 Application based on building or facility use. Where a site, building, facility, room or space contains more than one use, each portion shall comply with the applicable requirements for that use.

11B-201.3 Temporary and permanent structures. These requirements shall apply to temporary and permanent buildings and facilities.

11B-201.4 Construction support facilities. *These requirements shall apply to temporary or permanent construction support facilities for uses and activities not directly associated with the actual processes of construction, including but not limited to offices, meeting rooms, plan rooms, other administrative or support functions. When provided, toilet and bathing facilities serving construction support facilities shall comply with Section 11B-213. When toilet and bathing facilities serving construction support facilities are provided by portable units, at least one of each type shall be accessible and connected to the construction support facilities it serves by an accessible route.*

Exception: *During construction an accessible route shall not be required between site arrival points or the boundary of the area of construction and the entrance to the construction support facilities if the only means of access between them is a vehicular way not providing pedestrian access.*

11B-202 Existing buildings and facilities

11B-202.1 General. Additions and alterations to existing buildings or facilities shall comply with Section 11B-202.

11B-202.2 Additions. Each addition to an existing building or facility shall comply with the requirements for new construction and shall comply with Section 11B-202.4.

11B-202.3 Alterations. Where existing elements or spaces are altered, each altered element or space shall comply with the applicable requirements of Division 2, including Section 11B-202.4.

Exceptions:

1. **Reserved.**
2. **Technically infeasible.** In alterations, where the enforcing authority determines compliance with applicable requirements is technically infeasible, the alteration shall provide equivalent facilitation or comply with the requirements to the maximum extent feasible. *The details of the finding that full compliance with the requirements is technically infeasible shall be recorded and entered into the files of the enforcing agency.*

3. Residential dwelling units not required to be accessible in compliance with *this code* shall not be required to comply with Section 11B-202.3.

11B-202.3.1 Prohibited reduction in access. An alteration that decreases or has the effect of decreasing the accessibility of a building or facility below the requirements for new construction at the time of the alteration is prohibited.

11B-202.3.2 Extent of application. An alteration of an existing element, space or area of a building or facility shall not impose a requirement for accessibility greater than required for new construction.

11B-202.3.3 Alteration of single elements. *If alterations of single elements, when considered together, amount to an alteration of a room or space in a building or facility, the entire room or space shall be made accessible.*

11B-202.4 Path of travel requirements in alterations, additions and structural repairs. *When alterations or additions are made to existing buildings or facilities, an accessible path of travel to the specific area of alteration or addition shall be provided. The primary accessible path of travel shall include:*

1. A primary entrance to the building or facility,
2. Toilet and bathing facilities serving the area,
3. Drinking fountains serving the area,
4. Public telephones serving the area, and
5. Signs.

Exceptions:

1. Residential dwelling units shall comply with Section 11B-233.3.4.2.
2. *If the following elements of a path of travel have been constructed or altered in compliance with the accessibility requirements of the immediately preceding edition of the California Building Code, it shall not be required to retrofit such elements to reflect the incremental changes in this code solely because of an alteration to an area served by those elements of the path of travel:*

1. A primary entrance to the building or facility,
2. Toilet and bathing facilities serving the area,
3. Drinking fountains serving the area,
4. Public telephones serving the area, and
5. Signs.

Note: *The language in this exception, which refers to the "immediately preceding edition of the California Building Code," shall permit a reference back to one CBC edition only and is not accumulative to prior editions.*

3. *Additions or alterations to meet accessibility requirements consisting of one or more of the following items shall be limited to the actual scope of*

work of the project and shall not be required to comply with Section 11B-202.4:

1. Altering one building entrance.
 2. Altering one existing toilet facility.
 3. Altering existing elevators.
 4. Altering existing steps.
 5. Altering existing handrails.
4. Alterations solely for the purpose of barrier removal undertaken pursuant to the requirements of the Americans with Disabilities Act (Public Law 101-336, 28 C.F.R., Section 36.304) or the accessibility requirements of this code as those requirements or regulations now exist or are hereafter amended including, but not limited to, one or more of the following items shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4:
1. Installing ramps.
 2. Making curb cuts in sidewalks and entrance.
 3. Repositioning shelves.
 4. Rearranging tables, chairs, vending machines, display racks and other furniture.
 5. Repositioning telephones.
 6. Adding raised markings on elevator control buttons.
 7. Installing flashing alarm lights.
 8. Widening doors.
 9. Installing offset hinges to widen doorways.
 10. Eliminating a turnstile or providing an alternative accessible route.
 11. Installing accessible door hardware.
 12. Installing grab bars in toilet stalls.
 13. Rearranging toilet partitions to increase maneuvering space.
 14. Insulating lavatory pipes under sinks to prevent burns.
 15. Installing a raised toilet seat.
 16. Installing a full-length bathroom mirror.
 17. Repositioning the paper towel dispenser in a bathroom.
 18. Creating designated accessible parking spaces.
 19. Removing high-pile, low-density carpeting.
5. Alterations of existing parking lots by resurfacing and/or restriping shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4.
6. The addition or replacement of signs and/or identification devices shall be limited to the actual scope of work of the project and shall not be required to comply with Section 11B-202.4.
7. Projects consisting only of heating, ventilation, air conditioning, reroofing, electrical work not involving placement of switches and receptacles, cosmetic work that does not affect items regulated by this code, such as painting, equipment not considered to be a part of the architecture of the building or area, such as com-

puter terminals and office equipment shall not be required to comply with Section 11B-202.4 unless they affect the usability of the building or facility.

8. When the adjusted construction cost, as defined, is less than or equal to the current valuation threshold, as defined, the cost of compliance with Section 11B-202.4 shall be limited to 20 percent of the adjusted construction cost of alterations, structural repairs or additions. When the cost of full compliance with Section 11B-202.4 would exceed 20 percent, compliance shall be provided to the greatest extent possible without exceeding 20 percent.

When the adjusted construction cost, as defined, exceeds the current valuation threshold, as defined, and the enforcing agency determines the cost of compliance with Section 11B-202.4 is an unreasonable hardship, as defined, full compliance with Section 11B-202.4 shall not be required. Compliance shall be provided by equivalent facilitation or to the greatest extent possible without creating an unreasonable hardship; but in no case shall the cost of compliance be less than 20 percent of the adjusted construction cost of alterations, structural repairs or additions. The details of the finding of unreasonable hardship shall be recorded and entered into the files of the enforcing agency and shall be subject to Chapter 1, Section 1.9.1.5, Special Conditions for Persons with Disabilities Requiring Appeals Action Ratification.

For the purposes of this exception, the adjusted construction cost of alterations, structural repairs or additions shall not include the cost of alterations to path of travel elements required to comply with Section 11B-202.4.

In choosing which accessible elements to provide, priority should be given to those elements that will provide the greatest access in the following order:

1. An accessible entrance;
2. An accessible route to the altered area;
3. At least one accessible restroom for each sex or one accessible unisex (single-user or family) restroom;
4. Accessible telephones;
5. Accessible drinking fountains; and
6. When possible, additional accessible elements such as parking, signs, storage and alarms.

If an area has been altered without providing an accessible path of travel to that area, and subsequent alterations of that area or a different area on the same path of travel are undertaken within three years of the original alteration, the total cost of alterations to the areas on that path of travel during the preceding three-year period shall be considered in determining whether the cost of making that path of travel accessible is disproportionate.

9. Certain types of privately funded, multistory buildings and facilities were formerly exempt from accessibility requirements above and below the first floor under this code, but as of April 1, 1994 are no longer exempt due to more restrictive provisions in the

federal Americans with Disabilities Act. In alteration projects involving buildings and facilities previously approved and built without elevators, areas above and below the ground floor are subject to the 20-percent disproportionality provisions described in Exception 8, above, even if the value of the project exceeds the valuation threshold in Exception 8. The types of buildings and facilities are:

1. Office buildings and passenger vehicle service stations of three stories or more and 3,000 or more square feet (279 m²) per floor.
2. Offices of physicians and surgeons.
3. Shopping centers.
4. Other buildings and facilities three stories or more and 3,000 or more square feet (279 m²) per floor if a reasonable portion of services sought and used by the public is available on the accessible level.

For the general privately funded multistory building exception applicable to new construction and alterations, see Section 11B-206.2.3, Exception 1.

The elevator exception set forth in this section does not obviate or limit in any way the obligation to comply with the other accessibility requirements in this code. For example, floors above or below the accessible ground floor must meet the requirements of this section except for elevator service. If toilet or bathing facilities are provided on a level not served by an elevator, then toilet or bathing facilities must be provided on the accessible ground floor.

10. Alterations solely for the purpose of installing electric vehicle charging stations (EVCS) at facilities where vehicle fueling, recharging, parking or storage is a primary function shall comply with Section 11B-202.4 to the maximum extent feasible without exceeding 20 percent of the cost of the work directly associated with the installation of EVCS. A "primary function" is a major activity for which the facility is intended.

Alterations solely for the purpose of installing EVCS at facilities where vehicle fueling, recharging, parking or storage is not a primary function shall not be required to comply with Section 11B-202.4

11B-202.5 Alterations to qualified historic buildings and facilities. Alterations to a qualified historic building or facility shall comply with the State Historical Building Code, Part 8, Title 24, of the California Code of Regulations.

Exception: Reserved.

11B-203 General exceptions

11B-203.1 General. Sites, buildings, facilities and elements are exempt from these requirements to the extent specified by 11B-203.

11B-203.2 Construction sites. Structures and sites directly associated with the actual processes of construction, including but not limited to, scaffolding, bridging, materials hoists, materials storage and construction trailers shall not be required to comply with these requirements or to be on an accessible route. Portable toilet units provided for use exclu-

sively by construction personnel on a construction site shall not be required to comply with Section 11B-213 or to be on an accessible route.

11B-203.3 Raised areas. Areas raised primarily for purposes of security, life safety or fire safety, including but not limited to observation or lookout galleries, prison guard towers, fire towers or life guard stands, shall not be required to comply with these requirements or to be on an accessible route.

11B-203.4 Limited access spaces. Spaces not customarily occupied and accessed only by ladders, catwalks, crawl spaces or very narrow passageways shall not be required to comply with these requirements or to be on an accessible route.

11B-203.5 Machinery spaces. Spaces frequented only by service personnel for maintenance, repair or occasional monitoring of equipment shall not be required to comply with these requirements or to be on an accessible route. Machinery spaces include, but are not limited to, elevator pits or elevator penthouses; mechanical, electrical or communications equipment rooms; piping or equipment catwalks; water or sewage treatment pump rooms and stations; electric substations and transformer vaults; and highway and tunnel utility facilities.

11B-203.6 Single occupant structures. Single occupant structures accessed only by passageways below grade or elevated above standard curb height, including but not limited to, toll booths that are accessed only by underground tunnels, shall not be required to comply with these requirements or to be on an accessible route.

11B-203.7 Detention and correctional facilities. In detention and correctional facilities, common use areas that are used only by inmates or detainees and security personnel and that do not serve holding cells or housing cells required to comply with Section 11B-232, shall not be required to comply with these requirements or to be on an accessible route.

11B-203.8 Residential facilities. In residential facilities, common use areas that do not serve residential dwelling units required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4 or adaptable features complying with Sections 11B-809.6 through 11B-809.12 shall not be required to comply with these requirements or to be on an accessible route.

11B-203.9 Employee workstations. Employee workstations shall be on an accessible route complying with Division 4. Spaces and elements within employee workstations shall only be required to comply with Sections 11B-207.1, 11B-215.3, 11B-302, 11B-303, 11B-308.1.1, 11B-308.1.2 and 11B-404.2.3 unless exempted by other parts of this code. Common use circulation paths within employee workstations shall comply with Section 11B-206.2.8.

Exception: Receptacles, controls and switches that are an integral part of workstation furnishings, fixtures and equipment shall not be required to comply with Sections 11B-308.1.1 and 11B-308.1.2.

11B-203.10 Raised refereeing, judging and scoring areas. Raised structures used solely for refereeing, judging or scoring a sport shall not be required to comply with these requirements or to be on an accessible route. An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.

11B-203.11 Water slides. Water slides shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

11B-203.12 Animal containment areas. Animal containment areas that are not for public use shall not be required to comply with these requirements or to be on an accessible route. *Animal containment areas for public use shall be on an accessible route.*

11B-203.13 Raised boxing or wrestling rings. Raised boxing or wrestling rings shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

11B-203.14 Raised diving boards and diving platforms. Raised diving boards and diving platforms shall not be required to comply with these requirements or to be on an accessible route. *An accessible route complying with Division 4 shall be provided to the ground- or floor-level entry points, where provided, of stairs, ladders or other means of reaching the raised elements or areas.*

11B-204 Protruding objects

11B-204.1 General. Protruding objects on circulation paths shall comply with *Section 11B-307.*

Exceptions:

1. Within areas of sport activity, protruding objects on circulation paths shall not be required to comply with *Section 11B-307.*
2. Within play areas, protruding objects on circulation paths shall not be required to comply with *Section 11B-307* provided that ground level accessible routes provide vertical clearance in compliance with *Section 11B-1008.2.*

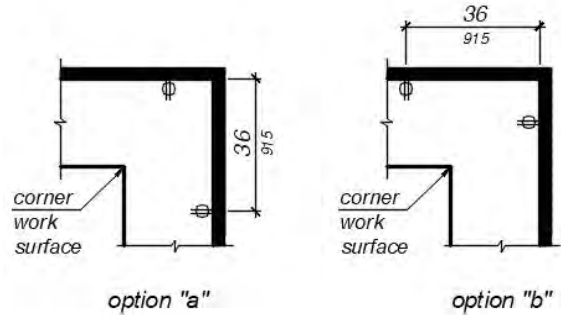
11B-205 Operable parts

11B-205.1 General. Operable parts on accessible elements, accessible routes, and in accessible rooms and spaces shall comply with *Section 11B-309.*

Exceptions:

1. Operable parts that are intended for use only by service or maintenance personnel shall not be required to comply with *Section 11B-309.*
2. Electrical or communication receptacles serving a dedicated use shall not be required to comply with *Section 11B-309.*
3. **Reserved.**
4. Floor electrical receptacles shall not be required to comply with *Section 11B-309.*
5. HVAC diffusers shall not be required to comply with *Section 11B-309.*
6. Except for light switches, where redundant controls are provided for a single element, one control in each space shall not be required to comply with *Section 11B-309.*

7. Cleats and other boat securement devices shall not be required to comply with *Section 11B-309.3.*
8. Exercise machines and exercise equipment shall not be required to comply with *Section 11B-309.*
9. *In residential dwelling units with mobility features where receptacles are provided in a kitchen at a corner work surface, one receptacle shall be located 36 inches (915 mm) from either wall at the inside corner.*



**FIGURE 11B-205.1 Ex. 9
ELECTRICAL RECEPTACLES AT CORNER WORKSURFACES**

11B-206 Accessible routes

11B-206.1 General. Accessible routes shall be provided in accordance with *Section 11B-206* and shall comply with *Division 4.*

11B-206.2 Where required. Accessible routes shall be provided where required by *Section 11B-206.2.*

11B-206.2.1 Site arrival points. At least one accessible route shall be provided within the site from accessible parking spaces and accessible passenger *drop-off and loading zones*; public streets and sidewalks; and public transportation stops to the accessible building or facility entrance they serve. *Where more than one route is provided, all routes must be accessible.*

Exceptions:

1. **Reserved.**
2. An accessible route shall not be required between site arrival points and the building or facility entrance if the only means of access between them is a vehicular way not providing pedestrian access.
3. *General circulation paths shall be permitted when located in close proximity to an accessible route.*

11B-206.2.2 Within a site. At least one accessible route shall connect accessible buildings, accessible facilities, accessible elements and accessible spaces that are on the same site.

Exception: An accessible route shall not be required between accessible buildings, accessible facilities, accessible elements and accessible spaces if the only means of access between them is a vehicular way not providing pedestrian access.

11B-206.2.3 Multistory buildings and facilities. At least one accessible route shall connect each story and mezzanine in multistory buildings and facilities.

Exceptions:

1. *The following types of privately funded multi-story buildings do not require a ramp or elevator above and below the first floor:*

1.1. *Multistoried office buildings (other than the professional office of a health care provider) and passenger vehicle service stations less than three stories high or less than 3,000 square feet (279 m²) per story.*

1.2. *Any other privately funded multistoried building that is not a shopping center, shopping mall or the professional office of a health care provider or a terminal, depot or other station used for specified public transportation or an airport passenger terminal and that is less than three stories high or less than 3,000 square feet (279 m²) per story if a reasonable portion of all facilities and accommodations normally sought and used by the public in such a building are accessible to and usable by persons with disabilities.*

2. **Reserved.**

3. In detention and correctional facilities, an accessible route shall not be required to connect stories where cells with mobility features required to comply with *Section 11B-807.2*, all common use areas serving cells with mobility features required to comply with *Section 11B-807.2*, and all public use areas are on an accessible route.

4. In residential facilities, an accessible route shall not be required to connect stories where residential dwelling units with mobility features required to comply with *Sections 11B-809.2 through 11B-809.4*, *residential dwelling units with adaptable features complying with Sections 11B-809.6 through 11B-809.12*, all common use areas serving residential dwelling units with mobility features required to comply with *Sections 11B-809.2 through 11B-809.4*, *all common use areas serving residential dwelling units with adaptable features complying with Sections 11B-809.6 through 11B-809.12*, and public use areas serving residential dwelling units are on an accessible route.

5. Within multistory transient lodging guest rooms with mobility features required to comply with *Section 11B-806.2*, an accessible route shall not be required to connect stories provided that spaces complying with *Section 11B-806.2* are on an accessible route and sleeping accommodations for two persons minimum are provided on a story served by an accessible route.

6. In air traffic control towers, an accessible route shall not be required to serve the cab and *the equipment areas* on the floor immediately below the cab.

7. **Reserved.**

11B-206.2.3.1 Stairs and escalators in existing buildings. In alterations and additions, where an escalator or stair is provided where none existed previously and major structural modifications are necessary for the installation, an accessible route shall be provided between the levels served by the escalator or stair

unless exempted by *Section 11B-206.2.3 Exceptions 1 through 7*.

11B-206.2.3.2 Distance to elevators. In new construction of buildings where elevators are required by *Section 11B-206.2.3*, and which exceed 10,000 square feet (929 m²) on any floor, an accessible means of vertical access via ramp, elevator or lift shall be provided within 200 feet (60,960 mm) of travel of each stair and each escalator. In existing buildings that exceed 10,000 square feet (929 m²) on any floor and in which elevators are required by *Section 11B-206.2.3*, whenever a newly constructed means of vertical access is provided via stairs or an escalator, an accessible means of vertical access via ramp, elevator or lift shall be provided within 200 feet (60,960 mm) of travel of each new stair or escalator.

Exception: *Stairs used solely for emergency egress.*

11B-206.2.4 Spaces and elements. At least one accessible route shall connect accessible building or facility entrances with all accessible spaces and elements within the building or facility, *including mezzanines*, which are otherwise connected by a circulation path unless exempted by *Section 11B-206.2.3 Exceptions 1 through 7*.

Exceptions:

1. **Reserved.**

2. In assembly areas with fixed seating required to comply with *Section 11B-221*, an accessible route shall not be required to serve fixed seating where wheelchair spaces required to be on an accessible route are not provided.

3. **Reserved.**

11B-206.2.5 Restaurants, cafeterias, banquet facilities and bars. In *restaurants, cafeterias, banquet facilities, bars and similar facilities*, an accessible route shall be provided to all *functional* areas, including raised or sunken areas, and outdoor areas.

Exceptions:

1. In *alterations of buildings* or facilities not required to provide an accessible route between stories, an accessible route shall not be required to a mezzanine dining area where the mezzanine contains less than 25 percent of the total combined area for seating and dining and where the same decor and services are provided in the accessible area.

2. **Reserved.**

3. In sports facilities, tiered dining areas providing seating required to comply with *Section 11B-221* shall be required to have accessible routes serving at least 25 percent of the dining area provided that accessible routes serve seating complying with *Section 11B-221* and each tier is provided with the same services.

11B-206.2.6 Performance areas. Where a circulation path directly connects a performance area to an assembly seating area, an accessible route shall directly connect the assembly seating area with the performance area. An accessible route shall be provided from performance areas

to ancillary areas or facilities used by performers unless exempted by *Section 11B-206.2.3* Exceptions 1 through 7.

11B-206.2.7 Press boxes. Press boxes in assembly areas shall be on an accessible route.

Exceptions:

1. An accessible route shall not be required to press boxes in bleachers that have points of entry at only one level provided that the aggregate area of all press boxes is 500 square feet (46 m²) maximum.
2. An accessible route shall not be required to free-standing press boxes that are elevated above grade 12 feet (3660 mm) minimum provided that the aggregate area of all press boxes is 500 square feet (46 m²) maximum.

11B-206.2.8 Employee work areas. Common use circulation paths within employee work areas shall comply with *Section 11B-402*.

Exceptions:

1. *Reserved.*
2. Common use circulation paths located within employee work areas that are an integral component of work area equipment shall not be required to comply with *Section 11B-402*.
3. Common use circulation paths located within exterior employee work areas that are fully exposed to the weather shall not be required to comply with *Section 11B-402*.

11B-206.2.9 Amusement rides. Amusement rides required to comply with *Section 11B-234* shall provide accessible routes in accordance with *Section 11B-206.2.9*. Accessible routes serving amusement rides shall comply with *Division 4* except as modified by *Section 11B-1002.2*.

11B-206.2.9.1 Load and unload areas. Load and unload areas shall be on an accessible route. Where load and unload areas have more than one loading or unloading position, at least one loading and unloading position shall be on an accessible route.

11B-206.2.9.2 Wheelchair spaces, ride seats designed for transfer, and transfer devices. When amusement rides are in the load and unload position, wheelchair spaces complying with *Section 11B-1002.4*, amusement ride seats designed for transfer complying with *Section 11B-1002.5*, and transfer devices complying with *Section 11B-1002.6* shall be on an accessible route.

11B-206.2.10 Recreational boating facilities. Boat slips required to comply with *Section 11B-235.2* and boarding piers at boat launch ramps required to comply with *Section 11B-235.3* shall be on an accessible route. Accessible routes serving recreational boating facilities shall comply with *Division 4*, except as modified by *Section 11B-1003.2*.

11B-206.2.11 Bowling lanes. Where bowling lanes are provided, at least 5 percent, but no fewer than one of each type of bowling lane, shall be on an accessible route.

11B-206.2.12 Court sports. In court sports, at least one accessible route shall directly connect both sides of the court.

11B-206.2.13 Exercise machines and equipment. Exercise machines and equipment required to comply with *11B-236* shall be on an accessible route.

11B-206.2.14 Fishing piers and platforms. Fishing piers and platforms shall be on an accessible route. Accessible routes serving fishing piers and platforms shall comply with *Division 4* except as modified by *Section 11B-1005.1*.

11B-206.2.15 Golf facilities. At least one accessible route shall connect accessible elements and spaces within the boundary of the golf course. In addition, accessible routes serving golf car rental areas; bag drop areas; course weather shelters complying with *Section 11B-238.2.3*; course toilet rooms; and practice putting greens, practice teeing grounds and teeing stations at driving ranges complying with *Section 11B-238.3* shall comply with *Division 4* except as modified by *Section 11B-1006.2*.

Exception: Golf car passages complying with *Section 11B-1006.3* shall be permitted to be used for all or part of accessible routes required by *Section 11B-206.2.15*.

11B-206.2.16 Miniature golf facilities. Holes required to comply with *Section 11B-239.2*, including the start of play, shall be on an accessible route. Accessible routes serving miniature golf facilities shall comply with *Division 4* except as modified by *Section 11B-1007.2*.

11B-206.2.17 Play areas. Play areas shall provide accessible routes in accordance with *Section 11B-206.2.17*. Accessible routes serving play areas shall comply with *Division 4* except as modified by *Section 11B-1008.2*.

11B-206.2.17.1 Ground level and elevated play components. At least one accessible route shall be provided within the play area. The accessible route shall connect ground level play components required to comply with *Section 11B-240.2.1* and elevated play components required to comply with *Section 11B-240.2.2*, including entry and exit points of the play components.

11B-206.2.17.2 Soft contained play structures. Where three or fewer entry points are provided for soft contained play structures, at least one entry point shall be on an accessible route. Where four or more entry points are provided for soft contained play structures, at least two entry points shall be on an accessible route.

11B-206.2.18 Area of sport activity. An accessible route shall be provided to the boundary of each area of sport activity.

11B-206.2.19 Pedestrian street crossings. Where walks or sidewalks are provided, a curb ramp, blended transition or a combination of curb ramps and blended transitions

complying with Section 11B-406 shall connect the walks or sidewalks at each pedestrian street crossing. The curb ramp (excluding any flared sides) or blended transition shall be contained wholly within the width of the pedestrian street crossing served.

Exception: Compliance with Section 11B-206.2.19 shall not be required where pedestrian crossing is prohibited by the appropriate administrative authority.

11B-206.3 Location. Accessible routes shall coincide with or be located in the same area as general circulation paths. Where circulation paths are interior, required accessible routes shall also be interior. An accessible route shall not pass through kitchens, storage rooms, restrooms, closets or other spaces used for similar purposes, except as permitted by Chapter 10.

11B-206.4 Entrances. Entrances shall be provided in accordance with Section 11B-206.4. Entrance doors, doorways and gates shall comply with Section 11B-404 and shall be on an accessible route complying with Section 11B-402.

Exceptions:

1. *Reserved.*
2. *Reserved.*

11B-206.4.1 Entrances. All entrances shall comply with Section 11B-404.

11B-206.4.2 Parking structure entrances. Where direct access is provided for pedestrians from a parking structure to a building or facility entrance, each direct access to the building or facility entrance shall comply with Section 11B-404.

11B-206.4.3 Entrances from tunnels or elevated walkways. Where direct access is provided for pedestrians from a pedestrian tunnel or elevated walkway to a building or facility, all entrances to the building or facility from each tunnel or walkway shall comply with Section 11B-404.

11B-206.4.4 Transportation facilities. In addition to the requirements of Sections 11B-206.4.2, 11B-206.4.3 and 11B-206.4.5 through 11B-206.4.9, transportation facilities shall provide entrances in accordance with Section 11B-206.4.4.

11B-206.4.4.1 Location. In transportation facilities, where different entrances serve different transportation fixed routes or groups of fixed routes, entrances serving each fixed route or group of fixed routes shall comply with Section 11B-404.

Exception: Entrances to key stations and existing intercity rail stations retrofitted in accordance with 49 CFR 37.49 or 49 CFR 37.51 shall not be required to comply with Section 11B-206.4.4.1.

11B-206.4.4.2 Direct connections. Direct connections to other facilities shall provide an accessible route complying with Section 11B-404 from the point of connection to boarding platforms and all transportation system elements required to be accessible. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and

all transportation system elements required to be accessible.

Exception: In key stations and existing intercity rail stations, existing direct connections shall not be required to comply with Section 11B-404.

11B-206.4.4.3 Key stations and intercity rail stations. Key stations and existing intercity rail stations required by Subpart C of 49 CFR part 37 to be altered, shall have entrances complying with Section 11B-404.

11B-206.4.5 Tenant spaces. All entrances to each tenancy in a facility shall comply with Section 11B-404.

Exception: Self-service storage facilities not required to comply with Section 11B-225.3 shall not be required to be on an accessible route.

11B-206.4.6 Residential dwelling unit primary entrance. In residential dwelling units, at least one primary entrance shall comply with Section 11B-404. The primary entrance to a residential dwelling unit shall not be to a bedroom.

11B-206.4.7 Restricted entrances. Where restricted entrances are provided to a building or facility, all restricted entrances to the building or facility shall comply with Section 11B-404.

11B-206.4.8 Service entrances. If a service entrance is the only entrance to a building or to a tenancy in a facility, that entrance shall comply with Section 11B-404. In existing buildings and facilities, a service entrance shall not be the sole accessible entrance unless it is the only entrance to a building or facility.

11B-206.4.9 Entrances for inmates or detainees. Where entrances used only by inmates or detainees and security personnel are provided at judicial facilities, detention facilities or correctional facilities, at least one such entrance shall comply with Section 11B-404.

11B-206.4.10 Medical care and long-term care facilities. Weather protection by a canopy or roof overhang shall be provided at a minimum of one accessible entrance to licensed medical care and licensed long-term care facilities where the period of stay may exceed twenty-four hours. The area of weather protection shall include the passenger drop-off and loading zone complying with Section 11B-209.3 and the accessible route from the passenger loading zone to the accessible entrance it serves.

11B-206.5 Doors, doorways and gates. Doors, doorways and gates providing user passage shall be provided in accordance with Section 11B-206.5.

11B-206.5.1 Entrances. Each entrance to a building or facility required to comply with Section 11B-206.4 shall comply with Section 11B-404.

11B-206.5.2 Rooms and spaces. Within a building or facility, every door, doorway or gate serving rooms and spaces complying with this chapter shall comply with Section 11B-404.

11B-206.5.3 Transient lodging facilities. In transient lodging facilities, entrances, doors and doorways provid-

ing user passage into and within guest rooms that are not required to provide mobility features complying with *Section 11B-806.2* shall comply with *Section 11B-404.2.3*.

Exception: Shower and sauna doors in guest rooms that are not required to provide mobility features complying with *Section 11B-806.2* shall not be required to comply with *Section 11B-404.2.3*.

11B-206.5.4 Residential dwelling units. In residential dwelling units required to provide mobility features complying with *Sections 11B-809.2* through *11B-809.4*, all doors and doorways providing user passage shall comply with *Section 11B-404*.

11B-206.6 Elevators. Elevators provided for passengers shall comply with *Section 11B-407*. Where multiple elevators are provided, each elevator shall comply with *Section 11B-407*.

Exceptions:

1. In a building or facility permitted to use the exceptions to *Section 11B-206.2.3* or permitted by *Section 11B-206.7* to use a platform lift, elevators complying with *Section 11B-408* shall be permitted.
2. Elevators complying with *Section 11B-408* or *11B-409* shall be permitted in multistory residential dwelling units. *Elevators provided as a means of access within a private residence shall be installed so that they are not accessible to the general public or to other occupants of the building.*
3. *Destination-oriented elevators complying with Section 11B-411 shall be permitted.*

11B-206.6.1 Existing elevators. Where elements of existing elevators are altered, the same element shall also be altered in all elevators that are programmed to respond to the same hall call control as the altered elevator and shall comply with the requirements of *Section 11B-407* for the altered element.

Exception: *Where a group of existing elevators are altered into a destination-oriented elevator system, or where elements of existing destination-oriented elevators are altered, the same elements shall also be altered in all elevators that are programmed to respond to the same call console or group of call consoles and shall comply with the requirements of Section 11B-411 for the altered elements.*

11B-206.7 Platform lifts. Platform lifts shall comply with *Section 11B-410*. Platform lifts shall be permitted as a component of an accessible route in new construction in accordance with *Section 11B-206.7*. Platform lifts shall be permitted as a component of an accessible route in an existing building or facility.

11B-206.7.1 Performance areas and speakers' platforms. Platform lifts shall be permitted to provide accessible routes to performance areas and speakers' platforms.

11B-206.7.2 Wheelchair spaces. Platform lifts shall be permitted to provide an accessible route to comply with the wheelchair space dispersion and line-of-sight requirements of *Sections 11B-221* and *11B-802*.

11B-206.7.3 Incidental spaces. Platform lifts shall be permitted to provide an accessible route to incidental spaces which are not public use spaces and which are occupied by five persons maximum.

11B-206.7.4 Judicial spaces. Platform lifts shall be permitted to provide an accessible route to: jury boxes and witness stands; raised courtroom stations, including judges' benches, clerks' stations, bailiffs' stations, deputy clerks' stations and court reporters' stations; and to depressed areas such as the well of a court.

11B-206.7.5 Existing site constraints. Platform lifts shall be permitted where existing exterior site constraints make use of a ramp or elevator infeasible.

11B-206.7.6 Guest rooms and residential dwelling units. Platform lifts shall be permitted to connect levels within transient lodging guest rooms required to provide mobility features complying with *Section 11B-806.2* or residential dwelling units required to provide mobility features complying with *Sections 11B-809.2* through *11B-809.4* or *adaptable features complying with Sections 11B-809.6* through *11B-809.12*.

11B-206.7.7 Amusement rides. Platform lifts shall be permitted to provide accessible routes to load and unload areas serving amusement rides.

11B-206.7.8 Play areas. Platform lifts shall be permitted to provide accessible routes to play components or soft contained play structures.

11B-206.7.9 Team or player seating. Platform lifts shall be permitted to provide accessible routes to team or player seating areas serving areas of sport activity.

11B-206.7.10 Recreational boating facilities and fishing piers and platforms. Platform lifts shall be permitted to be used instead of gangways that are part of accessible routes serving recreational boating facilities and fishing piers and platforms.

11B-206.8 Security barriers. Security barriers, including but not limited to security bollards and security check points, shall not obstruct a required accessible route or accessible means of egress.

Exception: Where security barriers incorporate elements that cannot comply with these requirements such as certain metal detectors, fluoroscopes or other similar devices, the accessible route shall be permitted to be located adjacent to security screening devices. The accessible route shall permit persons with disabilities passing around security barriers to maintain visual contact with their personal items to the same extent provided others passing through the security barrier.

11B-207 Accessible means of egress

11B-207.1 General. Means of egress shall comply with Chapter 10, Section 1009 and Section 11B-207.

Exceptions:

1. Where means of egress are permitted by local building or life safety codes to share a common path of egress travel, accessible means of egress shall be permitted to share a common path of egress travel.
2. Areas of refuge shall not be required in detention and correctional facilities.
3. Accessible means of egress are not required to be provided in existing buildings.
4. Doors that provide access only to interior or exterior stairways shall not be required to comply with Section 11B-404.
5. Exits in excess of those required by Chapter 10, and which are more than 24 inches (610 mm) above grade shall not be required to comply with Section 11B-404 or be on an accessible route. Directional signs shall be provided in compliance with Chapter 10, Section 1009.10.

11B-207.2 Platform lifts. Standby power shall be provided for platform lifts permitted by Chapter 10, Section 1009.5 to serve as a part of an accessible means of egress. To ensure continued operation in case of primary power loss, platform lifts shall be provided with standby power or with self-rechargeable battery power that provides sufficient power to operate all platform lift functions for a minimum of five upward and downward trips.

11B-208 Parking spaces

11B-208.1 General. Where parking spaces are provided, parking spaces shall be provided in accordance with Section 11B-208. For the purposes of this section, electric vehicle charging stations are not parking spaces; see Section 11B-228.

Exceptions:

1. Parking spaces used exclusively for buses, trucks, other delivery vehicles or vehicular impound shall not be required to comply with Section 11B-208 provided that lots accessed by the public are provided with a passenger drop-off and loading zone complying with Section 11B-503.
2. In public housing facilities, electric vehicle chargers are permitted to be installed at an accessible parking space assigned to the resident.

11B-208.2 Minimum number. Parking spaces complying with Section 11B-502 shall be provided in accordance with Table 11B-208.2 except as required by Sections 11B-208.2.1, 11B-208.2.2 and 11B-208.2.3. Where more than one parking facility is provided on a site, the number of accessible spaces provided on the site shall be calculated according to the number of spaces required for each parking facility.

11B-208.2.1 Hospital outpatient facilities. Ten percent of patient and visitor parking spaces provided to serve hospital outpatient facilities, and free-standing buildings providing outpatient clinical services of a hospital, shall comply with Section 11B-502.

11B-208.2.2 Rehabilitation facilities and outpatient physical therapy facilities. Twenty percent of patient and visitor parking spaces provided to serve rehabilitation facilities specializing in treating conditions that affect mobility and outpatient physical therapy facilities shall comply with Section 11B-502.

11B-208.2.3 Residential facilities. Parking spaces provided to serve residential facilities shall comply with Section 11B-208.2.3.

11B-208.2.3.1 Parking for residents. Where at least one parking space is provided for each residential dwelling unit, at least one parking space complying with Section 11B-502 shall be provided for each residential dwelling unit required to provide mobility fea-

**TABLE 11B-208.2
PARKING SPACES**

TOTAL NUMBER OF PARKING SPACES PROVIDED IN PARKING FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE PARKING SPACES
1 to 25	1
26 to 50	2
51 to 75	3
76 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 400	8
401 to 500	9
501 to 1000	2 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000

tures complying with *Sections 11B-809.2 through 11B-809.4*. Where fewer than one parking space is provided for each residential dwelling unit, parking spaces complying with *Section 11B-502* shall be provided in accordance with *Table 11B-208.2*.

11B-208.2.3.2 Additional parking spaces for residents. Where the total number of parking spaces provided for each residential dwelling unit exceeds one parking space per residential dwelling unit, 2 percent, but no fewer than one space, of all the parking spaces not covered by *Section 11B-208.2.3.1* shall comply with *Section 11B-502*.

11B-208.2.3.3 Parking for guests, employees and other non-residents. Where parking spaces are provided for persons other than residents, parking shall be provided in accordance with *Table 11B-208.2*.

11B-208.2.4 Van parking spaces. For every six or fraction of six parking spaces required by *Section 11B-208.2* to comply with *Section 11B-502*, at least one shall be a van parking space complying with *Section 11B-502*.

11B-208.3 Location. Parking facilities shall comply with *Section 11B-208.3*.

11B-208.3.1 General. Parking spaces complying with *Section 11B-502* that serve a particular building or facility shall be located on the shortest accessible route from parking to an entrance complying with *Section 11B-206.4*. Where parking serves more than one accessible entrance, parking spaces complying with *Section 11B-502* shall be dispersed and located on the shortest accessible route to the accessible entrances. In parking facilities that do not serve a particular building or facility, parking spaces complying with *Section 11B-502* shall be located on the shortest accessible route to an accessible pedestrian entrance of the parking facility.

Exceptions:

1. All van parking spaces shall be permitted to be grouped on one level within a multistory parking facility.
2. Parking spaces shall be permitted to be located in different parking facilities if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance or entrances, parking fee and user convenience.

11B-208.3.2 Residential facilities. In residential facilities containing residential dwelling units required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4*, and adaptable features complying with *Sections 11B-809.6 through 11B-809.12*, parking spaces provided in accordance with *Section 11B-208.2.3.1* shall be located on the shortest accessible route to the residential dwelling unit entrance they serve. Spaces provided in accordance with *Section 11B-208.2.3.2* shall be dispersed throughout all types of parking provided for the residential dwelling units.

Exception: Parking spaces provided in accordance with *Section 11B-208.2.3.2* shall not be required to be dispersed throughout all types of parking if substan-

tially equivalent or greater accessibility is provided in terms of distance from an accessible entrance, parking fee and user convenience.

11B-208.3.3 Private garages accessory to residential dwelling units. Private garages accessory to residential dwelling units shall comply with *Section 11B-208.3*. Private garages include individual garages and multiple individual garages grouped together.

11B-208.3.3.1 Detached private garages accessory to residential dwelling units shall be accessible as required by Section 11B-208.3.

11B-208.3.3.2 Attached private garages directly serving a single residential dwelling unit shall provide at least one of the following options:

1. A door leading directly from the residential dwelling unit which immediately enters the garage.
2. An accessible route from the residential dwelling unit to an exterior door entering the garage.
3. An accessible route from the residential dwelling unit's primary entry door to the vehicular entrance at the garage.

11B-209 Passenger drop-off and loading zones and bus stops

11B-209.1 General. Passenger drop-off and loading zones shall be provided in accordance with *Section 11B-209*.

11B-209.2 Type. Where provided, passenger drop-off and loading zones shall comply with *Section 11B-209.2*.

11B-209.2.1 Passenger drop-off and loading zones. Passenger drop-off and loading zones, except those required to comply with *Sections 11B-209.2.2 and 11B-209.2.3*, shall provide at least one passenger drop-off and loading zone complying with *Section 11B-503* in every continuous 100 linear feet (30480 mm) of drop-off and loading zone space, or fraction thereof.

11B-209.2.2 Bus loading zones. In bus loading zones restricted to use by designated or specified public transportation vehicles, each bus bay, bus stop or other area designated for lift or ramp deployment shall comply with *Section 11B-810.2*.

11B-209.2.3 On-street bus stops. On-street bus stops shall comply with *Section 11B-810.2* to the maximum extent practicable.

11B-209.3 Medical care and long-term care facilities. At least one passenger drop-off and loading zone complying with *Section 11B-503* shall be provided at an accessible entrance to licensed medical care and licensed long-term care facilities where the period of stay may exceed twenty-four hours.

11B-209.4 Valet parking. Parking facilities that provide valet parking services shall provide at least one passenger drop-off and loading zone complying with *Section 11B-503*. The parking requirements of *Section 11B-208.1* apply to facilities with valet parking.

11B-209.5 Mechanical access parking garages. Mechanical access parking garages shall provide at least one passenger

drop-off and loading zone complying with Section 11B-503 at vehicle drop-off and vehicle pick-up areas.

11B-210 Stairways

11B-210.1 General. Interior and exterior stairs shall comply with Section 11B-504.

Exceptions:

1. In detention and correctional facilities, stairs that are not located in public use areas shall not be required to comply with Section 11B-504.
2. In alterations, stairs between levels that are connected by an accessible route shall not be required to comply with Section 11B-504, except that *striping complying with Section 11B-504.4.1* and handrails complying with Section 11B-505 shall be provided when the stairs are altered.
3. In assembly areas, aisle stairs shall not be required to comply with Section 11B-504 *except that striping complying with Section 11B-504.4.1 shall be provided.*
4. Stairs that connect play components shall not be required to comply with Section 11B-504 *except that striping complying with Section 11B-504.4.1 shall be provided.*

11B-211 Drinking fountains and bottle-filling stations

11B-211.1 General. Where drinking fountains are provided on an exterior site, on a floor, or within a secured area they shall be provided in accordance with Section 11B-211.

Exception: In detention or correctional facilities, drinking fountains only serving holding or housing cells not required to comply with Section 11B-232 shall not be required to comply with Section 11B-211.

11B-211.2 Minimum number. No fewer than two drinking fountains shall be provided. *When provided, one drinking fountain shall comply with Sections 11B-602.1 through 11B-602.6, 11B-602.8 and 11B-602.9 and one drinking fountain shall comply with Sections 11B-602.7 and 11B-602.9.*

Exception: Where a single drinking fountain complies with Sections 11B-602.1 through 11B-602.9, it shall be permitted to be substituted for two separate drinking fountains.

11B-211.3 More than minimum number. Where more than the minimum number of drinking fountains specified in Section 11B-211.2 are provided, 50 percent of the total number of drinking fountains provided shall comply with Sections 11B-602.1 through 11B-602.6, 11B-602.8 and 11B-602.9, and 50 percent of the total number of drinking fountains provided shall comply with Sections 11B-602.7 and 11B-602.9.

Exception: Where 50 percent of the drinking fountains yields a fraction, 50 percent shall be permitted to be rounded up or down provided that the total number of drinking fountains complying with Section 11B-211 equals 100 percent of drinking fountains.

11B-211.4 Bottle-filling stations. *Where bottle-filling stations are provided they shall comply with Section 11B-602.10.*

Exception: *In detention or correctional facilities, bottle-filling stations only serving holding or housing cells not required to comply with Section 11B-232 shall not be required to comply with Section 11B-211.4.*

11B-212 Kitchens, kitchenettes, wet bars and sinks

11B-212.1 General. Where provided, kitchens, kitchenettes, wet bars and sinks shall comply with Section 11B-212.

11B-212.2 Kitchens, kitchenettes and wet bars. Kitchens, kitchenettes and wet bars shall comply with Section 11B-804.

11B-212.3 Sinks. Where sinks are provided, at least 5 percent, but no fewer than one, of each type provided in each accessible room or space shall comply with Section 11B-606.

Exceptions:

1. Mop, service or scullery sinks shall not be required to comply with Section 11B-212.3.
2. *Scrub sinks, as defined in California Plumbing Code Section 221.0, shall not be required to comply with Section 11B-606.*

11B-213 Toilet facilities and bathing facilities

11B-213.1 General. Where toilet facilities and bathing facilities are provided, they shall comply with Section 11B-213. Where toilet facilities and bathing facilities are provided in facilities permitted by Section 11B-206.2.3 *Exception 1* not to connect stories by an accessible route, toilet facilities and bathing facilities shall be provided on a story connected by an accessible route to an accessible entrance.

11B-213.1.1 Toilet facilities for designated user groups. *Where separate toilet facilities are provided for the exclusive use of separate user groups, the toilet facilities serving each user group shall comply with Section 11B-213.*

11B-213.2 Toilet rooms and bathing rooms. Where toilet rooms are provided, each toilet room shall comply with Section 11B-603. Where bathing rooms are provided, each bathing room shall comply with Section 11B-603.

Exceptions:

1. In alterations where it is technically infeasible to comply with Section 11B-603, altering existing toilet or bathing rooms shall not be required where a single unisex (*single-user or family*) toilet room or bathing room complying with Section 11B-213.2.1 is provided and located in the same area and on the same floor as existing inaccessible toilet or bathing rooms.
2. **Reserved.**
3. Where multiple single user portable toilet or bathing units are clustered at a single location 5 percent, *but no fewer than one*, of the toilet units and bathing units at each cluster shall comply with Section 11B-

603. Portable toilet units and bathing units complying with *Section 11B-603* shall be identified by the International Symbol of Accessibility complying with *Section 11B-703.7.2.1*.

4. Where multiple single user toilet rooms are clustered at a single location, 50 percent, *but no fewer than one*, of the single user toilet rooms for each use at each cluster shall comply with *Section 11B-603*.
5. *Where toilet and bathing rooms are provided in guest rooms that are not required to provide mobility features complying with Section 11B-806.2, toilet and bathing fixtures shall only be required to comply with Section 11B-603.6.*

11B-213.2.1 Unisex (single-user or family) toilet and unisex (single-user or family) bathing rooms. Unisex (*single-user or family*) toilet rooms shall contain not more than one lavatory, and *not more than two* water closets without urinals or one water closet and one urinal. Unisex (*single-user or family*) bathing rooms shall contain one shower or one shower and one bathtub, one lavatory, and one water closet. Doors to unisex (*single-user or family*) toilet rooms and unisex (*single-user or family*) bathing rooms shall have privacy latches.

11B-213.2.2 Unisex (Patient) toilet rooms in medical care and long-term care facilities. *Common-use unisex toilet rooms for exclusive patient use not located within patient bedrooms shall contain a lavatory and one water closet.*

11B-213.2.3 Unisex (Patient) bathing rooms in medical care and long-term care facilities. *Common-use unisex bathing rooms for exclusive patient use not located within patient bedrooms shall contain one shower or one bathtub, one lavatory, and one water closet.*

11B-213.3 Plumbing fixtures and accessories. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with *Section 11B-213.2* shall comply with *Section 11B-213.3*.

11B-213.3.1 Toilet compartments. Where toilet compartments are provided, at least *five percent of the toilet compartments, or five percent of the combination of toilet compartments and urinals, but no fewer than one* toilet compartment shall comply with *Section 11B-604.8.1*. In addition to the *compartments* required to comply with *Section 11B-604.8.1*, where six or more toilet compartments are provided, or where the combination of urinals and water closets totals six or more fixtures, *toilet compartments complying with Section 11B-604.8.2 shall be provided in the same quantity as the toilet compartments required to comply with Section 11B-604.8.1.*

11B-213.3.2 Water closets. Where water closets are provided, at least *5 percent but no fewer than one* shall comply with *Section 11B-604*.

11B-213.3.3 Urinals. Where *one or more urinals* are provided, at least *10 percent but no fewer than one* shall comply with *Section 11B-605*.

11B-213.3.4 Lavatories. Where lavatories are provided, at least *10 percent but no fewer than one* shall comply

with *Section 11B-606* and shall not be located in a toilet compartment.

11B-213.3.5 Mirrors. Where mirrors are provided, at least one shall comply with *Section 11B-603.3*.

11B-213.3.6 Bathing facilities. Where bathtubs or showers are provided, at least one bathtub complying with *Section 11B-607* or at least one shower complying with *Section 11B-608* shall be provided. *Where two or more accessible showers are provided within the same functional area, at least one shower shall be opposite hand from the other or others (that is, one left-hand controls versus right-hand controls). Transfer-type shower compartments shall be permitted in transient lodging guest rooms, multibedroom housing units in undergraduate student housing and residential dwelling units; and shall not be permitted at other locations to meet the requirements of Section 11B-213.3.6.*

11B-213.3.7 Coat hooks and shelves. Where coat hooks or shelves are provided in toilet rooms without toilet compartments, at least one of each type shall comply with *Section 11B-603.4*. Where coat hooks or shelves are provided in toilet compartments, at least one of each type complying with *Section 11B-604.8.3* shall be provided in toilet compartments required to comply with *Section 11B-213.3.1*. Where coat hooks or shelves are provided in bathing facilities, at least one of each type complying with *Section 11B-603.4* shall serve fixtures required to comply with *Section 11B-213.3.6*.

11B-214 Washing machines and clothes dryers

11B-214.1 General. Where provided, washing machines and clothes dryers shall comply with *Section 11B-214*.

11B-214.2 Washing machines. Where three or fewer washing machines are provided, at least one shall comply with *Section 11B-611*. Where more than three washing machines are provided, at least two shall comply with *Section 11B-611*.

11B-214.3 Clothes dryers. Where three or fewer clothes dryers are provided, at least one shall comply with *Section 11B-611*. Where more than three clothes dryers are provided, at least two shall comply with *Section 11B-611*.

11B-215 Fire alarm systems and carbon monoxide alarm systems

11B-215.1 General. Where fire alarm systems *and carbon monoxide alarm systems* provide audible alarm coverage, alarms shall comply with *Section 11B-215*.

Exception: In existing facilities, visible alarms *for fire alarm systems* shall not be required except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.

11B-215.2 Public and common use areas. Alarms in public use areas and common use areas shall comply with *Chapter 9, Section 907.5.2.3.1*.

11B-215.3 Employee work areas. Where employee work areas have audible alarm coverage, the wiring system shall be designed so that visible alarms complying with *Chapter 9*,

Section 907.5.2.3.1 Exception can be integrated into the alarm system.

11B-215.4 Transient lodging. Guest rooms required to comply with Section 11B-224.4 shall provide fire alarms complying with Chapter 9, Section 907.5.2.3.2, and carbon monoxide alarms, where provided, complying with Chapter 9, Section 915.

11B-215.5 Residential facilities. Where provided in residential dwelling units required to comply with Section 11B-809.5, fire alarms shall comply with Chapter 9, Section 907.5.2.3.3 and carbon monoxide alarms shall comply with Chapter 9, Section 915.

11B-216 Signs

11B-216.1 General. New or altered signs shall be provided in accordance with Section 11B-216 and shall comply with Section 11B-703. The addition of or replacement of signs shall not trigger any additional path of travel requirements.

Exceptions:

1. Building directories, menus, seat and row designations in assembly areas, occupant names, building addresses, and company names and logos shall not be required to comply with Section 11B-216.
2. Reserved.
3. Temporary, 7 days or less, signs shall not be required to comply with Section 11B-216.
4. In detention and correctional facilities, signs not located in public use areas shall not be required to comply with Section 11B-216.

11B-216.2 Designations. Interior and exterior signs identifying permanent rooms and spaces shall comply with Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5. Where pictograms are provided as designations of permanent rooms and spaces, the pictograms shall comply with Section 11B-703.6 and shall have text descriptors complying with Sections 11B-703.2 and 11B-703.5.

Exception: Exterior signs that are not located at the door to the space they serve shall not be required to comply with Section 11B-703.2.

11B-216.3 Directional and informational signs. Signs that provide direction to or information about interior and exterior spaces and facilities of the site shall comply with Section 11B-703.5.

11B-216.4 Means of egress. Signs for means of egress shall comply with Section 11B-216.4.

11B-216.4.1 Exit doors. Signs required by Chapter 10, Section 1013.4 at doors to exit passageways, exit discharge and exit stairways shall comply with Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.

11B-216.4.2 Areas of refuge and exterior areas for assisted rescue. Signs required by Chapter 10, Section 1009.11 to provide instructions in areas of refuge shall comply with Section 11B-703.5. Signs required by Chapter 10, Section 1009.9 at doors to areas of refuge and exterior areas for assisted rescue shall comply with Sections

11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5 and include an International Symbol of Accessibility complying with Section 11B-703.7.2.1.

11B-216.4.3 Directional signs. Signs required by Chapter 10, Section 1009.10 to provide directions to accessible means of egress shall comply with Section 11B-703.5.

11B-216.4.4 Delayed egress locks. Signs required by Chapter 10, Section 1010.2.13.1, Item 6.4 at doors with delayed egress locks shall comply with Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5.

11B-216.5 Parking. Signs identifying parking spaces and signs within parking facilities shall comply with Section 11B-216.5.

11B-216.5.1 Parking spaces. Parking spaces complying with Section 11B-502 shall be identified by signs complying with Sections 11B-502.6 and 11B-502.8.

Exceptions:

1. Reserved.
2. In residential facilities, where parking spaces are assigned to specific residential dwelling units, identification of accessible parking spaces shall not be required.

11B-216.5.2 Parking facilities. Signs within parking facilities shall comply with Section 11B-216.5.2.

11B-216.5.2.1 Signs intended for use by pedestrians. Signs intended for use by pedestrians within parking facilities, including directional or informational signs indicating parking sections or levels, shall comply with the requirements of Section 11B-216.

11B-216.5.2.2 Additional signs. Signs within parking facilities containing parking spaces complying with Section 11B-502 shall comply with Section 11B-502.8.

11B-216.6 Entrances. In existing buildings and facilities where not all entrances comply with Section 11B-404, entrances complying with Section 11B-404 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Directional signs complying with Section 11B-703.5 that indicate the location of the nearest entrance complying with Section 11B-404 shall be provided at entrances that do not comply with Section 11B-404. Directional signs complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1, indicating the accessible route to the nearest accessible entrance shall be provided at junctions when the accessible route diverges from the regular circulation path.

11B-216.7 Elevators. Where existing elevators do not comply with Section 11B-407, elevators complying with Section 11B-407 shall be clearly identified with the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Existing buildings that have been remodeled to provide specific elevators for public use that comply with these building standards shall have the location of and the directions to these elevators posted in the building lobby on a

sign complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1.

11B-216.8 Toilet rooms and bathing rooms. Where existing toilet rooms or bathing rooms do not comply with Section 11B-603, directional signs indicating the location of the nearest toilet room or bathing room complying with Section 11B-603 within the facility shall be provided. Signs shall comply with Section 11B-703.5 and shall include the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Where existing toilet rooms or bathing rooms do not comply with Section 11B-603, the toilet rooms or bathing rooms complying with Section 11B-603 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1. Where clustered single user toilet rooms or bathing facilities are permitted to use exceptions to Section 11B-213.2, toilet rooms or bathing facilities complying with Section 11B-603 shall be identified by the International Symbol of Accessibility complying with Section 11B-703.7.2.1 unless all toilet rooms and bathing facilities comply with Section 11B-603. Existing buildings that have been remodeled to provide specific toilet rooms or bathing rooms for public use that comply with these building standards shall have the location of and the directions to these rooms posted in or near the building lobby or entrance on a sign complying with Section 11B-703.5, including the International Symbol of Accessibility complying with Section 11B-703.7.2.1.

11B-216.8.1 Geometric symbols. Geometric symbols complying with Section 11B-703.7.2.6 shall be provided at entrances to toilet and bathing rooms.

Exceptions:

1. Geometric symbols shall not be required at entrances to toilet and bathing rooms located within private or semi-private rooms or spaces. Such spaces include but are not limited to: patient sleeping rooms, transient lodging guest rooms and residential dwelling units.
2. Geometric symbols shall not be required at entrances to inmate toilet rooms and bathing rooms in detention and correctional facilities where only one gender is housed.

11B-216.9 TTYs. Identification and directional signs for public TTYs shall be provided in accordance with Section 11B-216.9.

11B-216.9.1 Identification signs. Public TTYs shall be identified by the International Symbol of TTY complying with Section 11B-703.7.2.2.

11B-216.9.2 Directional signs. Directional signs indicating the location of the nearest public TTY shall be provided at all banks of public pay telephones not containing a public TTY. In addition, where signs provide direction to public pay telephones, they shall also provide direction to public TTYs. If a facility has no banks of telephones, the directional signs shall be provided at the entrance or in a building directory. Directional signs shall comply with Section 11B-703.5 and shall include the International Symbol of TTY complying with Section 11B-703.7.2.2.

11B-216.10 Assistive listening systems. Each assembly area required by Section 11B-219 to provide assistive listening systems shall provide signs informing patrons of the availability of the assistive listening system. The sign shall include wording that states “Assistive-Listening System Available” and shall be posted in a prominent place at or near the assembly area entrance. Assistive listening signs shall comply with Section 11B-703.5 and shall include the International Symbol of Access for Hearing Loss complying with Section 11B-703.7.2.4.

Exception: Where ticket offices or windows are provided, signs shall not be required at each assembly area provided that signs are displayed at each ticket office or window informing patrons of the availability of assistive listening systems.

11B-216.11 Check-out aisles. Where more than one check-out aisle is provided, check-out aisles complying with Section 11B-904.3 shall be identified by a sign complying with Section 11B-904.3.4. Where check-out aisles are identified by numbers, letters or functions, signs identifying check-out aisles complying with Section 11B-904.3 shall be located in the same location as the check-out aisle identification.

Exception: Where all check-out aisles comply with Section 11B-904.3, signs complying with Section 11B-703.7.2.1 shall not be required.

11B-216.12 Amusement rides. Signs identifying the type of access provided on amusement rides shall be provided at entries to queues and waiting lines. In addition, where accessible unload areas also serve as accessible load areas, signs indicating the location of the accessible load and unload areas shall be provided at entries to queues and waiting lines. Signs shall comply with Section 11B-703.5 and shall include the International Symbol of Accessibility complying with Section 11B-703.7.2.1.

11B-216.13 Variable message signs. Where provided in transportation facilities, variable message signs conveying transportation-related information shall comply with Section 11B-703.8. Where provided in buildings that are designed as emergency shelters, variable message signs conveying emergency-related information shall comply with Section 11B-703.8.

11B-217 Telephones

11B-217.1 General. Where coin-operated public pay telephones, coinless public pay telephones, public closed-circuit telephones, public courtesy phones, or other types of public telephones are provided, public telephones shall be provided in accordance with Section 11B-217 for each type of public telephone provided. For purposes of this section, a bank of telephones shall be considered to be two or more adjacent telephones.

11B-217.2 Wheelchair accessible telephones. Where public telephones are provided, wheelchair accessible telephones complying with Section 11B-704.2 shall be provided in accordance with Table 11B-217.2.

Exception: Drive-up only public telephones shall not be required to comply with Section 11B-217.2.

11B-217.3 Volume controls. All public telephones shall have volume controls complying with *Section 11B-704.3*.

11B-217.4 TTYs. TTYs complying with *Section 11B-704.4* shall be provided in accordance with *Section 11B-217.4*.

11B-217.4.1 Bank requirement. Where four or more public pay telephones are provided at a bank of telephones, at least one public TTY complying with *Section 11B-704.4* shall be provided at that bank.

Exception: Reserved.

11B-217.4.2 Floor requirement. TTYs in public buildings shall be provided in accordance with *Section 11B-217.4.2.1*. TTYs in private buildings shall be provided in accordance with *Section 11B-217.4.2.2*.

11B-217.4.2.1 Public buildings. Where at least one public pay telephone is provided on a floor of a public building, at least one public TTY shall be provided on that floor.

11B-217.4.2.2 Private buildings. Where four or more public pay telephones are provided on a floor of a private building, at least one public TTY shall be provided on that floor.

11B-217.4.3 Building requirement. TTYs in public buildings shall be provided in accordance with *Section 11B-217.4.3.1*. TTYs in private buildings shall be provided in accordance with *Section 11B-217.4.3.2*.

11B-217.4.3.1 Public buildings. Where at least one public pay telephone is provided in a public building, at least one public TTY shall be provided in the building. Where at least one public pay telephone is provided in a public use area of a public building, at least one public TTY shall be provided in the public building in a public use area.

11B-217.4.3.2 Private buildings. Where four or more public pay telephones are provided in a private building, at least one public TTY shall be provided in the building.

Exception: *In a stadium or arena, in a convention center, in a hotel with a convention center or in a covered mall, if an interior public pay telephone is provided at least one interior public TTY shall be provided in the facility.*

11B-217.4.4 Exterior site requirement. Where four or more public pay telephones are provided on an exterior site, at least one public TTY shall be provided on the site.

11B-217.4.5 Rest stops, emergency roadside stops and service plazas. Where at least one public pay telephone is provided at a public rest stop, emergency roadside stop

or service plaza, at least one public TTY shall be provided.

11B-217.4.6 Hospitals. Where at least one public pay telephone is provided serving a hospital emergency room, hospital recovery room or hospital waiting room, at least one public TTY shall be provided at each location.

11B-217.4.7 Transportation facilities. In transportation facilities, in addition to the requirements of *Sections 11B-217.4.1* through *11B-217.4.4*, where at least one public pay telephone serves a particular entrance to a bus or rail facility, at least one public TTY shall be provided to serve that entrance. In airports, in addition to the requirements of *Sections 11B-217.4.1* through *11B-217.4.4*, where four or more public pay telephones are located in a terminal outside the security areas, a concourse within the security areas or a baggage claim area in a terminal, at least one public TTY shall be provided in each location.

11B-217.4.8 Detention and correctional facilities. In detention and correctional facilities, where at least one pay telephone is provided in a secured area used only by detainees or inmates and security personnel, at least one TTY shall be provided in at least one secured area.

11B-217.5 Shelves for portable TTYs. Where a bank of telephones in the interior of a building consists of three or more public pay telephones, at least one public pay telephone at the bank shall be provided with a shelf and an electrical outlet in accordance with *Section 11B-704.5*.

Exceptions:

1. Secured areas of detention and correctional facilities where shelves and outlets are prohibited for purposes of security or safety shall not be required to comply with *Section 11B-217.5*.
2. The shelf and electrical outlet shall not be required at a bank of telephones with a TTY.

11B-218 Transportation facilities.

11B-218.1 General. Transportation facilities shall comply with *Section 11B-218*.

11B-218.2 New and altered fixed guideway stations. New and altered stations in rapid rail, light rail, commuter rail, intercity rail, high speed rail and other fixed guideway systems shall comply with *Sections 11B-810.5* through *11B-810.10*.

11B-218.3 Key stations and existing intercity rail stations. Key stations and existing intercity rail stations shall comply with *Sections 11B-810.5* through *11B-810.10*.

**TABLE 11B-217.2
WHEELCHAIR ACCESSIBLE TELEPHONES**

NUMBER OF TELEPHONES PROVIDED ON A FLOOR, LEVEL OR EXTERIOR SITE	MINIMUM NUMBER OF REQUIRED WHEELCHAIR ACCESSIBLE TELEPHONES
1 or more single units	<i>At least 50 percent of telephone units, but not less than 1 per floor, level and exterior site</i>
1 bank	<i>At least 50 percent of telephone units per bank, but not less than 1 per floor, level and exterior site</i>
2 or more banks	<i>At least 50 percent of telephone units per bank, but not less than 1 per bank At least 1 telephone per floor shall meet the requirements for a forward reach telephone.</i>

11B-218.4 Bus shelters. Where provided, bus shelters shall comply with *Section 11B-810.3*.

11B-218.5 Other transportation facilities. In other transportation facilities, public address systems shall comply with *Section 11B-810.7* and clocks shall comply with *Section 11B-810.8*.

11B-219 Assistive listening systems

11B-219.1 General. Assistive listening systems shall be provided in accordance with *Section 11B-219* and shall comply with *Section 11B-706*.

11B-219.2 Required systems. *An assistive listening system shall be provided in assembly areas, including conference and meeting rooms.*

Exception: *This section does not apply to systems used exclusively for paging, background music, or a combination of these two uses.*

11B-219.3 Receivers. *The minimum number of receivers to be provided shall be equal to 4 percent of the total number of seats, but in no case less than two. Twenty-five percent minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with Section 11B-706.3.*

Exceptions:

1. Where a building contains more than one assembly area and the assembly areas required to provide assistive listening systems are under one management, the total number of required receivers shall be permitted to be calculated according to the total number of seats in the assembly areas in the building provided that all receivers are usable with all systems.
2. Where all seats in an assembly area are served by an induction loop assistive listening system, the minimum number of receivers required by *Section 11B-219.3* to be hearing-aid compatible shall not be required to be provided.

11B-219.4 Location. *If the assistive-listening system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot (15240 mm) viewing distance of the stage or playing area and shall have a complete view of the stage or playing area.*

11B-219.5 Permanent and portable systems. *Permanently installed assistive-listening systems are required in areas if (1) they accommodate at least 50 persons or if they have audio-amplification systems, and (2) they have fixed seating. If portable assistive-listening systems are used for conference or meeting rooms, the system may serve more than one room. An adequate number of electrical outlets or other supplementary wiring necessary to support a portable assistive-listening system shall be provided.*

11B-220 Automatic teller machines, fare machines and point-of-sale devices.

11B-220.1 Automatic teller machines and fare machines. Where automatic teller machines or self-service fare vending, collection, or adjustment machines are provided *they shall*

comply with Section 11B-220.1. Where bins are provided for envelopes, waste paper, or other purposes, at least one of each type shall comply with *Section 11B-811*.

11B-220.1.1 One automatic teller machine or fare machine. *Where one automatic teller machine or fare machine is provided at a location, it shall comply with Sections 11B-707.2 through 11B-707.8.*

11B-220.1.2 Two automatic teller machines or fare machines. *Where two automatic teller machines or fare machines are provided at a location, one shall comply with Sections 11B-707.2 through 11B-707.8 and one shall comply with Sections 11B-707.3, 11B-707.4, 11B-707.5, 11B-707.6, 11B-707.7.2 and 11B-707.8.*

11B-220.1.3 Three or more automatic teller machines or fare machines. *Where three or more automatic teller machines or fare machines are provided at a location, at least 50 percent shall comply with Sections 11B-707.2 through 11B-707.8 and the rest shall comply with Sections 11B-707.3, 11B-707.4, 11B-707.5, 11B-707.6, 11B-707.7.2 and 11B-707.8.*

11B-220.2 Point-of-sale devices. *Where point-of-sale devices are provided, all devices at each location shall comply with Sections 11B-707.3, 11B-707.7.2 and 11B-707.9. Where point-of-sale devices are provided at check stands and sales and service counters required to comply with Sections 11B-227.2 and 11B-227.3, they shall comply with Sections 11B-707.2, 11B-707.3, 11B-707.7.2 and 11B-707.9.*

Exceptions:

1. *Where a single point-of-sale device is installed for use with any type of motor fuel, it shall comply with Sections 11B-707.2, 11B-707.3, 11B-707.7.2 and 11B-707.9. Where more than one point-of-sale device is installed for use with a specific type of motor fuel, a minimum of two for that type shall comply with Sections 11B-707.2, 11B-707.3, 11B-707.7.2 and 11B-707.9. Types of motor fuel include, but are not limited to, gasoline, diesel, compressed natural gas, methanol or ethanol.*
2. *Point-of-sale devices at electric vehicle charging stations required to comply with Section 11B-812 shall comply with Section 11B-812.10.3.*

11B-221 Assembly areas.

11B-221.1 General. Assembly areas shall provide wheelchair spaces, companion seats, designated aisle seats and semi-ambulant seats complying with *Sections 11B-221 and 11B-802*. In addition, lawn seating shall comply with *Section 11B-221.5*.

11B-221.2 Wheelchair spaces. Wheelchair spaces complying with *Section 11B-221.2* shall be provided in assembly areas with fixed seating.

Note: *When required wheelchair spaces are not occupied by persons eligible for those spaces, individual, removable seats may be placed in those spaces.*

11B-221.2.1 Number and location. Wheelchair spaces shall be provided complying with *Section 11B-221.2.1*.

11B-221.2.1.1 General seating. Wheelchair spaces complying with *Section 11B-802.1* shall be provided in accordance with *Table 11B-221.2.1.1*.

11B-221.2.1.2 Luxury boxes, club boxes and suites in arenas, stadiums and grandstands. In each luxury box, club box and suite within arenas, stadiums and grandstands, wheelchair spaces complying with *Section 11B-802.1* shall be provided in accordance with *Table 11B-221.2.1.1*.

11B-221.2.1.3 Other boxes. In boxes other than those required to comply with *Section 11B-221.2.1.2*, the total number of wheelchair spaces required shall be determined in accordance with *Table 11B-221.2.1.1*. Wheelchair spaces shall be located in not less than 20 percent of all boxes provided. Wheelchair spaces shall comply with *Section 11B-802.1*.

11B-221.2.1.4 Team or player seating. At least one wheelchair space complying with *Section 11B-802.1* shall be provided in team or player seating areas serving areas of sport activity.

Exception: Wheelchair spaces shall not be required in team or player seating areas serving bowling lanes not required to comply with *Section 11B-206.2.11*.

11B-221.2.1.5 Stadium-style movie theaters. In stadium-style movie theaters, the total number of wheelchair spaces required shall be determined in accordance with *Table 11B-221.2.1.1*. The required wheelchair spaces shall be located on risers or cross-aisles in the stadium section that satisfy at least one of the following criteria:

1. Located within the rear 60 percent of the seats provided in the theater; or
2. Located within the area of the theater in which the vertical viewing angles (as measured to the top of the screen) are from the 40th to the 100th percentile of vertical viewing angles for all seats as ranked from the seats in the first row (1st percentile) to seats in the back row (100th percentile).

11B-221.2.1.6 Specialty seating areas. In assembly areas, wheelchair spaces shall be provided in each specialty seating area that provides spectators with dis-

tinct services or amenities that generally are not available to other spectators. The number of wheelchair spaces provided in specialty seating areas shall be included in, rather than be in addition to, the total number of wheelchair spaces required by Table 11B-221.2.1.1.

Exception: In existing buildings and facilities, if it is not readily achievable for wheelchair spaces to be placed in each specialty seating area, those services or amenities shall be provided to individuals with disabilities, and their companions, at other designated accessible locations at no additional cost.

11B-221.2.2 Integration. Wheelchair spaces shall be an integral part of the seating plan.

11B-221.2.3 Lines of sight and dispersion. Wheelchair spaces shall provide lines of sight complying with *Section 11B-802.2* and shall comply with *Section 11B-221.2.3*. In providing lines of sight, wheelchair spaces shall be dispersed. Wheelchair spaces shall provide spectators with choices of seating locations and viewing angles that are substantially equivalent to, or better than, the choices of seating locations and viewing angles available to all other spectators. When the number of wheelchair spaces required by *Section 11B-221.2.1* has been met, further dispersion shall not be required. *In stadiums, arenas and grandstands, wheelchair spaces shall be dispersed to all levels that include seating served by an accessible route.*

Exception: Wheelchair spaces in team or player seating areas serving areas of sport activity shall not be required to comply with *Section 11B-221.2.3*.

11B-221.2.3.1 Horizontal dispersion. Wheelchair spaces shall be dispersed horizontally. *In assembly areas that have seating encircling, in whole or in part, a field of play or performance, wheelchair spaces shall be dispersed horizontally around the field of play or performance area.*

Exceptions:

1. Horizontal dispersion shall not be required in assembly areas with 300 or fewer seats if the companion seats required by *Section 11B-221.3* and wheelchair spaces are located within the 2nd or 3rd quartile of the total row length. Intermediate aisles shall be included in

**TABLE 11B-221.2.1.1
NUMBER OF WHEELCHAIR SPACES IN ASSEMBLY AREAS**

NUMBER OF SEATS	MINIMUM NUMBER OF REQUIRED WHEELCHAIR SPACES
4 to 25	1
26 to 50	2
51 to 150	4
151 to 300	5
301 to 500	6
501 to 5000	6, plus 1 for each 100, or fraction thereof, between 501 through 5000
5001 and over	46, plus 1 for each 200, or fraction thereof, over 5000

determining the total row length. If the row length in the 2nd and 3rd quartile of a row is insufficient to accommodate the required number of companion seats and wheelchair spaces, the additional companion seats and wheelchair spaces shall be permitted to be located in the 1st and 4th quartile of the row.

2. In row seating, two wheelchair spaces shall be permitted to be located side-by-side.

11B-221.2.3.2 Vertical dispersion. Wheelchair spaces shall be dispersed vertically at varying distances from the screen, performance area or playing field. In addition, wheelchair spaces shall be located in each balcony or mezzanine that is located on an accessible route.

Exceptions:

1. Vertical dispersion shall not be required in assembly areas with 300 or fewer seats if the wheelchair spaces provide viewing angles that are equivalent to, or better than, the average viewing angle provided in the facility.
2. In bleachers, wheelchair spaces shall not be required to be provided in rows other than rows at points of entry to bleacher seating.

11B-221.2.4 Temporary structures. Wheelchair spaces shall not be located on, or be obstructed by, temporary platforms or other movable structures.

Exception: When an entire seating section is placed on temporary platforms or other movable structures in an area where fixed seating is not provided, in order to increase seating for an event, wheelchair spaces may be placed in that section.

11B-221.3 Companion seats. At least one companion seat complying with Section 11B-802.3 shall be provided immediately adjacent to each wheelchair space required by Section 11B-221.2.1.

11B-221.4 Designated aisle seats. At least 5 percent of the total number of aisle seats provided shall comply with Section 11B-802.4 and shall be the aisle seats located closest to accessible routes.

Exception: Team or player seating areas serving areas of sport activity shall not be required to comply with Section 11B-221.4.

11B-221.5 Lawn seating. Lawn seating areas and exterior overflow seating areas, where fixed seats are not provided, shall connect to an accessible route.

11B-221.6 Semi-ambulant seats. At least 1 percent of the total number of seats, and no fewer than two, shall be semi-ambulant seats complying with Section 11B-802.5.

11B-222 Dressing, fitting and locker rooms

11B-222.1 General. Where dressing rooms, fitting rooms or locker rooms are provided, at least 5 percent, but no fewer than one, of each type of use in each cluster provided shall comply with Section 11B-803.

Exception: In alterations, where it is technically infeasible to provide rooms in accordance with Section 11B-222.1,

one room for each sex on each level shall comply with Section 11B-803. Where only unisex rooms are provided, unisex rooms shall be permitted.

11B-222.2 Coat hooks and shelves. Where coat hooks or shelves are provided in dressing, fitting or locker rooms without individual compartments, at least one of each type shall comply with Section 11B-803.5. Where coat hooks or shelves are provided in individual compartments at least one of each type complying with Section 11B-803.5 shall be provided in individual compartments in dressing, fitting or locker rooms required to comply with Section 11B-222.1.

11B-222.3 Mirrors. Where mirrors are provided in dressing, fitting or locker rooms without individual compartments, at least one of each type shall comply with Section 11B-803.6. Where mirrors are provided in individual compartments at least one of each type complying with Section 11B-803.6 shall be provided in individual compartments in dressing, fitting or locker rooms required to comply with Section 11B-222.1.

11B-223 Medical care and long-term care facilities

11B-223.1 General. In licensed medical care facilities and licensed long-term care facilities where the period of stay exceeds twenty-four hours, patient bedrooms or resident sleeping rooms shall be provided in accordance with Sections 11B-223 and 11B-805.

Exception: Toilet rooms that are part of critical or intensive care patient sleeping rooms shall not be required to comply with Section 11B-603.

11B-223.1.1 Alterations. Where patient bedrooms or resident sleeping rooms are altered or added, the requirements of Section 11B-223 shall apply only to the patient bedrooms or resident sleeping rooms being altered or added until the number of patient bedrooms or resident sleeping rooms complies with the minimum number required for new construction.

11B-223.1.1.1 Area alterations. Patient bedrooms or resident sleeping rooms added or altered as part of a planned renovation of an entire wing, a department or other discrete area of an existing medical facility shall comply with Section 11B-805.2 until the number of patient bedrooms or resident sleeping rooms provided within the area of renovation complies with the minimum number required for new construction by Section 11B-223.2 or 11B-223.3.

11B-223.1.1.2 Individual alterations. Patient bedrooms or resident sleeping rooms added or altered individually, and not as part of an alteration of an entire area, shall comply with Section 11B-805.2, until either: a) the number of patient bedrooms or resident sleeping rooms provided in the department or area containing the individually altered or added patient bedrooms or resident sleeping rooms complies with the minimum number required if the percentage requirements of Section 11B-223.2 or 11B-223.3 were applied to that department or area; or b) the overall number of patient bedrooms or resident sleeping rooms in the facility complies with the minimum number required

for new construction by Section 11B-223.2 or 11B-223.3.

11B-223.1.1.3 Toilet and bathing facilities. Toilet/bathing rooms which are part of patient bedrooms added or altered and required to be accessible shall comply with Section 11B-805.2.4.

11B-223.2 Hospitals, rehabilitation facilities, psychiatric facilities and detoxification facilities. Hospitals, rehabilitation facilities, psychiatric facilities and detoxification facilities shall comply with Section 11B-223.2. All public use and common use areas shall be accessible in compliance with this chapter.

11B-223.2.1 Facilities not specializing in treating conditions that affect mobility. In facilities not specializing in treating conditions that affect mobility, including hospitals, psychiatric and detoxification facilities, at least 10 percent, but no fewer than one, of the patient bedrooms or resident sleeping rooms shall provide mobility features complying with Section 11B-805. Accessible patient bedrooms or resident sleeping rooms shall be dispersed in a manner that is proportionate by type of medical specialty.

11B-223.2.2 Facilities specializing in treating conditions that affect mobility. In facilities specializing in treating conditions that affect mobility, 100 percent of the patient bedrooms shall provide mobility features complying with Section 11B-805.

11B-223.2.3 On-call rooms. Where physician or staff on-call sleeping rooms are provided, at least 10 percent, but no fewer than one, of the on-call rooms shall provide mobility features complying with Sections 11B-806.2.3, 11B-806.2.4 and 11B-806.2.6.

11B-223.3 Long-term care facilities. In licensed long-term care facilities, including skilled nursing facilities, intermediate care facilities and nursing homes, at least 50 percent, but no fewer than one, of each type of patient bedroom or resident sleeping room shall provide mobility features complying with Section 11B-805.

11B-223.4 Professional offices of health care providers. Professional offices of health care providers shall comply with Section 11B-805.

11B-224 Transient lodging guest rooms, housing at a place of education and social service center establishments

11B-224.1 General. Hotels, motels, inns, dormitories, resorts and similar transient lodging facilities shall provide guest rooms in accordance with Sections 11B-224.1 through 11B-224.6.

11B-224.1.1 Alterations. Where guest rooms are altered or added, the requirements of Section 11B-224 shall apply only to the guest rooms being altered or added until the number of guest rooms complies with the minimum number required for new construction.

11B-224.1.2 Guest room doors and doorways. Entrances, doors and doorways providing user passage into and within guest rooms that are not required to provide mobility features complying with Section 11B-806.2

shall comply with Section 11B-404.2.3. Bathrooms doors shall be either sliding or hung to swing in the direction of egress from the bathroom.

Exception: Shower and sauna doors in guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall not be required to comply with Section 11B-404.2.3.

11B-224.1.3 Range of accommodations. Accessible guest rooms or suites shall be dispersed among the various classes of sleeping accommodations to provide a range of options applicable to room sizes, costs and amenities provided.

11B-224.1.4 Guest room toilet and bathing rooms. Where toilet and bathing rooms are provided in guest rooms that are not required to provide mobility features complying with Section 11B-806.2, toilet and bathing fixtures shall only be required to comply with Section 11B-603.6.

11B-224.2 Guest rooms with mobility features. In transient lodging facilities, guest rooms with mobility features complying with Section 11B-806.2 shall be provided in accordance with Table 11B-224.2, as follows.

11B-224.2.1 Fifty or less guest room facilities. Facilities that are subject to the same permit application on a common site that each have fifty or fewer guest rooms may be combined for the purposes of determining the required number of accessible rooms and type of accessible bathing facility.

11B-224.2.2 More than fifty guest room facilities. Facilities with more than fifty guest rooms shall be treated separately for the purposes of determining the required number of accessible rooms and type of accessible bathing facility.

11B-224.3 Beds. In guest rooms having more than 25 beds, 5 percent minimum of the beds shall have clear floor space complying with Section 11B-806.2.3.

11B-224.4 Guest rooms with communication features. In transient lodging facilities, guest rooms with communication features complying with Section 11B-806.3 shall be provided in accordance with Table 11B-224.4.

11B-224.5 Dispersion. Guest rooms required to provide mobility features complying with Section 11B-806.2 and guest rooms required to provide communication features complying with Section 11B-806.3 shall be dispersed among the various classes of guest rooms, and shall provide choices of types of guest rooms, number of beds and other amenities comparable to the choices provided to other guests. Where the minimum number of guest rooms required to comply with Section 11B-806 is not sufficient to allow for complete dispersion, guest rooms shall be dispersed in the following priority: guest room type, number of beds and amenities. At least one guest room required to provide mobility features complying with Section 11B-806.2 shall also provide communication features complying with Section 11B-806.3. Not more than 10 percent of guest rooms required to provide mobility features complying with Section 11B-806.2 shall be used to satisfy the minimum number of guest rooms required to provide communication features complying with Section 11B-806.3.

**TABLE 11B-224.2
GUEST ROOMS WITH MOBILITY FEATURES**

TOTAL NUMBER OF GUEST ROOMS PROVIDED	MINIMUM NUMBER OF REQUIRED ROOMS WITHOUT ROLL-IN SHOWERS ¹	MINIMUM NUMBER OF REQUIRED ROOMS WITH ROLL-IN SHOWERS ²	TOTAL NUMBER OF REQUIRED ROOMS
1	1	0	1
2 to 25	1	1	2
26 to 50	2	1	3
51 to 75	3	1	4
76 to 100	4	1	5
101 to 150	5	2	7
151 to 200	6	2	8
201 to 300	7	3	10
301 to 400	8	4	12
401 to 500	9	4	13
501 to 1000	2 percent of total	1 percent of total	3 percent of total
1001 and over	20, plus 1 for each 100, or fraction thereof, over 1000	10, plus 1 for each 100, or fraction thereof, over 1000	30, plus 2 for each 100, or fraction thereof, over 1000

1. Provide either a bathtub complying with Section 11B-607 or a transfer type shower complying with Section 11B-608.2.1.
2. Provide either a standard roll-in type shower complying with Section 11B-608.2.2 or an alternate type roll-in shower complying with Section 11B-608.2.3.

**TABLE 11B-224.4
GUEST ROOMS WITH COMMUNICATION FEATURES**

TOTAL NUMBER OF GUEST ROOMS PROVIDED	MINIMUM NUMBER OF REQUIRED GUEST ROOMS WITH COMMUNICATION FEATURES
1	1
2 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1000	5 percent of total
1001 and over	50, plus 3 for each 100 over 1000

11B-224.6 Storage. Fixed or built-in storage facilities within guest rooms required to provide mobility features shall comply with Section 11B-225.

11B-224.7 Housing at a place of education. Housing at a place of education subject to this section shall comply with Sections 11B-224.1 through 11B-224.6 and 11B-806 for transient lodging guest rooms. For the purposes of the application of this section, the term “sleeping room” is interchangeable with “guest room” as used in the transient lodging standards.

Exception: Housing facilities that are provided by or on behalf of a place of education, with residential dwelling units leased on a year-round basis exclusively to graduate students or faculty, and that do not contain any public use or common use areas available for educational programming, are not subject to Section 11B-224 and shall comply with Section 11B-233.

11B-224.7.1 Multibedroom housing units with mobility features. Multibedroom housing units containing accessible sleeping rooms with mobility features shall have an accessible route throughout the unit in compliance with Section 11B-809.2. Kitchens, when provided, within housing units containing accessible sleeping rooms with mobility features shall comply with Section 11B-804.

11B-224.7.2 Accessible dwelling units with adaptable features. Accessible dwelling units with adaptable features shall be provided as required by Section 11B-233.3.1.2. The number of required accessible dwelling units with adaptable features shall be reduced by the number of units with mobility features required by Section 11B-224.2.

11B-224.8 Social service center establishments. Group homes, halfway houses, shelters or similar social service center establishments that provide either temporary sleeping accommodations or residential dwelling units subject to this section shall comply with Section 11B-233.3.

11B-224.8.1 More than 25-bed sleeping rooms. In sleeping rooms with more than 25 beds, a minimum of 5 percent of the beds shall have clear floor space complying with Section 11B-806.2.3.

11B-224.8.2 More than 50-bed facilities. Facilities with more than 50 beds that provide common use bathing facilities shall provide at least one roll-in shower with a seat that complies with Section 11B-608. When separate shower facilities are provided for men and women, at least one roll-in shower shall be provided for each group.

11B-225 Storage

11B-225.1 General. Storage facilities shall comply with Section 11B-225.

11B-225.2 Storage. Where storage is provided in accessible spaces, at least one of each type shall comply with Section 11B-811.

11B-225.2.1 Lockers. Where lockers are provided, at least 5 percent, but no fewer than one of each type, shall comply with *Section 11B-811*.

11B-225.2.2 Self-service shelving. Self-service shelves shall be located on an accessible route complying with *Section 11B-402*. Self-service shelving shall not be required to comply with *Section 11B-308*.

11B-225.2.3 Library book stacks. Book stacks available for public use shall be 54 inches (1372 mm) maximum above the finish floor.

Exceptions:

1. Book stacks available for public use may be higher than 54 inches (1372 mm) maximum above the finish floor when an attendant is available to assist persons with disabilities.
2. Book stacks restricted to employee use are not required to comply with these requirements.

11B-225.3 Self-service storage facilities. Self-service storage facilities shall provide individual self-service storage spaces complying with these requirements in accordance with *Table 11B-225.3*.

**TABLE 11B-225.3
SELF-SERVICE STORAGE FACILITIES**

TOTAL SPACES IN FACILITY	MINIMUM NUMBER OF SPACES REQUIRED TO BE ACCESSIBLE
1 to 200	5 percent, but no fewer than 1
201 and over	10, plus 2 percent of total number of units over 200

11B-225.3.1 Dispersion. Individual self-service storage spaces shall be dispersed throughout the various classes of spaces provided. Where more classes of spaces are provided than the number required to be accessible, the number of spaces shall not be required to exceed that required by *Table 11B-225.3*. Self-service storage spaces complying with *Table 11B-225.3* shall not be required to be dispersed among buildings in a multibuilding facility.

11B-226 Dining surfaces and work surfaces

11B-226.1 General. Where dining surfaces are provided for the consumption of food or drink, at least 5 percent of the seating spaces and standing spaces at the dining surfaces shall comply with *Section 11B-902*. In addition, where work surfaces are provided for use by other than employees, at least 5 percent shall comply with *Section 11B-902*.

Exceptions:

1. Sales counters and service counters shall not be required to comply with *Section 11B-902*. See *Section 11B-227*.
2. Check writing surfaces provided at check-out aisles not required to comply with *Section 11B-904.3* shall not be required to comply with *Section 11B-902*.

11B-226.2 Dispersion. Dining surfaces required to comply with *Section 11B-902* shall be dispersed throughout the space or facility containing dining surfaces for each type of seating in a functional area. Work surfaces required to comply with

Section 11B-902 shall be dispersed throughout the space or facility containing work surfaces.

11B-226.3 Dining surfaces exceeding 34 inches in height. Where food or drink is served for consumption at a counter exceeding 34 inches (864 mm) in height, a portion of the main counter 60 inches (1525 mm) minimum in length shall be provided in compliance with *Section 11B-902.3*.

11B-226.4 Baby diaper changing station. Baby diaper changing stations shall comply with *Sections 11B-309* and *11B-902*. Baby diaper changing stations when deployed shall not obstruct the required width of an accessible route except as allowed by *Section 11B-307.2*. Baby diaper changing stations shall not be located in toilet compartments complying with *Section 11B-604.8* within a multiple accommodation toilet facility.

11B-227 Sales and service

11B-227.1 General. Where provided, check-out aisles, sales counters, service counters, food service lines, queues and waiting lines shall comply with *Sections 11B-227* and *11B-904*.

11B-227.2 Check-out aisles. Where check-out aisles are provided, check-out aisles complying with *Section 11B-904.3* shall be provided in accordance with *Table 11B-227.2*. Where check-out aisles serve different functions, check-out aisles complying with *Section 11B-904.3* shall be provided in accordance with *Table 11B-227.2* for each function. Where check-out aisles are dispersed throughout the building or facility, check-out aisles complying with *Section 11B-904.3* shall be dispersed. When not all check-out aisles are accessible, accessible check-out aisles shall be identified by a sign complying with *Section 11B-904.3.4*.

Note: Operational procedures are often necessary to ensure the Americans with Disabilities Act accessibility requirements are met. When check-out aisles are open for customer use, the business should ensure that a minimum of one accessible check-out aisle is always available for use by persons with disabilities. As check-out aisles are opened and closed based on fluctuating customer levels, the business should ensure that the number of accessible check-out aisles available complies with *Table 11B-227.2*.

Exception: In existing buildings, where the selling space is under 5000 square feet (465 m²) no more than one check-out aisle complying with *Section 11B-904.3* shall be required.

**TABLE 11B-227.2
CHECK-OUT AISLES**

NUMBER OF CHECK-OUT AISLES OF EACH FUNCTION	MINIMUM NUMBER OF CHECK-OUT AISLES OF EACH FUNCTION REQUIRED TO COMPLY WITH 11B-904.3
1 to 4	1
5 to 8	2
9 to 15	3
16 and over	3, plus 20 percent of additional aisles

11B-227.2.1 Altered check-out aisles. Where check-out aisles are altered, at least one of each check-out aisle serving each function shall comply with *Section 11B-904.3* until the number of check-out aisles complies with *Section 11B-227.2*.

11B-227.3 Counters. Where provided, at least one of each type of sales counter and service counter shall comply with Section 11B-904.4. Where counters are dispersed throughout the building or facility, counters complying with Section 11B-904.4 also shall be dispersed.

11B-227.4 Food service lines. Food service lines shall comply with Section 11B-904.5. Where self-service shelves are provided, at least 50 percent, but no fewer than one, of each type provided shall comply with Section 11B-308.

11B-227.5 Queues and waiting lines. Queues and waiting lines servicing counters or check-out aisles required to comply with Sections 11B-904.3 or 11B-904.4 shall comply with Section 11B-403.

11B-228 Depositories, vending machines, change machines, mail boxes, fuel dispensers and electric vehicle charging stations.

11B-228.1 General. Where provided, at least one of each type of depository, vending machine, change machine and fuel dispenser shall comply with Section 11B-309. *Electric vehicle charging stations shall comply with Section 11B-228.3.*

Exception: Drive-up only depositories shall not be required to comply with Section 11B-309.

11B-228.2 Mail boxes. Where mail boxes are provided in an interior location, at least 5 percent, but no fewer than one, of each type shall comply with Section 11B-309. In residential facilities, where mail boxes are provided for each residential dwelling unit, mail boxes complying with Section 11B-309 shall be provided for each residential dwelling unit required to provide mobility features complying with Sections 11B-809.2 through 11B-809.4 and adaptable features complying with Sections 11B-809.6 through 11B-809.12.

11B-228.3 Electric vehicle charging stations

11B-228.3.1 General. Where electric vehicle charging stations (EVCS) are provided, EVCS shall be provided in accordance with Section 11B-228.3.

11B-228.3.1.1 Existing facilities. Where new EVCS are added to a facility with existing EVCS, the requirements of Section 11B-812 shall apply only to the new EVCS installed. Alterations to existing EVCS shall comply with Section 11B-228.3.

11B-228.3.1.2 Operable parts. Where EV chargers are provided, operable parts on all EV chargers shall comply with Section 11B-309.4.

11B-228.3.2 Minimum number. EVCS complying with Section 11B-812 shall be provided in accordance with Section 11B-228.3.2 for each combination of charging level and EV connector type integral to the EV charger. Each combination of charging level (such as: AC Level 1, AC Level 2, DC Fast Charge) and EV connector type shall be considered as a facility. Where EVCS are provided in more than one facility on a site, the number of EVCS complying with Section 11B-228.3.2 provided on the site shall be calculated according to the number required for each facility. In public housing facilities, EVCS provided for common use of residents shall comply with Section 11B-228.3.2. Where an EV charger can simultaneously charge more than one vehicle, the number of EV chargers provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

Exceptions:

1. EVCS not available to the general public and intended for use by a designated vehicle or driver shall not be required to comply with Section 11B-228.3.2. Examples include, but are not limited to, EVCS serving public or private fleet vehicles and EVCS assigned to an employee.
2. In public housing facilities, EVCS intended for use by an EV owner or operator at their residence shall not be required to comply with Section 11B-228.3.2.

Note: Electric vehicle charging provided in newly constructed facilities are also subject to the California Green Building Standards Code.

11B-228.3.2.1 Public use or common use EVCS. Where EVCS are provided for public use or common use, EVCS complying with Section 11B-812 shall be provided in accordance with Table 11B-228.3.2.1. Where new EVCS are installed in facilities with existing EVCS, the “Total Number of EVCS at a Facility” in Table 11B-228.3.2.1 shall include both existing and new EVCS.

Exception: All drive-up EVCS shall comply with Section 11B-812.

**TABLE 11B-228.3.2.1
ELECTRIC VEHICLE CHARGING STATIONS FOR PUBLIC USE AND COMMON USE**

TOTAL NUMBER OF EVCS AT A FACILITY ¹	MINIMUM NUMBER (by type) OF EVCS REQUIRED TO COMPLY WITH SECTION 11B-812 ¹		
	Van Accessible	Standard Accessible	Ambulatory
1 to 4	1	0	0
5 to 25	1	1	0
26 to 50	1	1	1
51 to 75	1	2	2
76 to 100	1	3	3
101 and over	1, plus 1 for each 300, or fraction thereof, over 100	3, plus 1 for each 60, or fraction thereof, over 100	3, plus 1 for each 50, or fraction thereof, over 100

1. Where an EV charger can simultaneously charge more than one vehicle, the number of EVCS provided shall be considered equivalent to the number of electric vehicles that can be simultaneously charged.

11B-229 Windows

11B-229.1 General. Where glazed openings are provided in accessible rooms or spaces for operation by occupants, at least one opening shall comply with *Section 11B-309*. Each glazed opening required by an administrative authority to be operable shall comply with *Section 11B-309*.

Exception:

1. Glazed openings in residential dwelling units required to comply with *Section 11B-809* shall not be required to comply with *Section 11B-229*.
2. Glazed openings in guest rooms required to provide communication features and in guest rooms required to comply with *Section 11B-206.5.3* shall not be required to comply with *Section 11B-229*.

11B-230 Two-way communication systems

11B-230.1 General. Where a two-way communication system is provided to gain admittance to a building or facility or to restricted areas within a building or facility, the system shall comply with *Section 11B-708*.

11B-231 Judicial facilities

11B-231.1 General. Judicial facilities shall comply with *Section 11B-231*.

11B-231.2 Courtrooms. Each courtroom shall comply with *Section 11B-808*.

11B-231.3 Holding cells. Where provided, central holding cells and court-floor holding cells shall comply with *Section 11B-231.3*.

11B-231.3.1 Central holding cells. Where separate central holding cells are provided for adult male, juvenile male, adult female or juvenile female, one of each type shall comply with *Section 11B-807.2*. Where central holding cells are provided and are not separated by age or sex, at least one cell complying with *Section 11B-807.2* shall be provided.

11B-231.3.2 Court-floor holding cells. Where separate court-floor holding cells are provided for adult male, juvenile male, adult female or juvenile female, each courtroom shall be served by one cell of each type complying with *Section 11B-807.2*. Where court-floor holding cells are provided and are not separated by age or sex, courtrooms shall be served by at least one cell complying with *Section 11B-807.2*. Cells may serve more than one courtroom.

11B-231.4 Visiting areas. Visiting areas shall comply with *Section 11B-231.4*.

11B-231.4.1 Cubicles and counters. At least 5 percent, but no fewer than one, of cubicles shall comply with *Section 11B-902* on both the visitor and detainee sides. Where counters are provided, at least one shall comply with *Section 11B-904.4.2* on both the visitor and detainee sides.

Exception: The detainee side of cubicles or counters at non-contact visiting areas not serving holding cells required to comply with *Section 11B-231* shall not be required to comply with *Sections 11B-902* or *11B-904.4.2*.

11B-231.4.2 Partitions. Where solid partitions or security glazing separate visitors from detainees at least one of each type of cubicle or counter partition shall comply with *Section 11B-904.6*.

11B-232 Detention facilities and correctional facilities

11B-232.1 General. Buildings, facilities, or portions thereof, in which people are detained for penal or correction purposes, or in which the liberty of the inmates is restricted for security reasons shall comply with *Section 11B-232*.

11B-232.2 General holding cells and general housing cells. General holding cells and general housing cells shall be provided in accordance with *Section 11B-232.2*.

Exception: Reserved.

11B-232.2.1 Cells with mobility features. At least 3 percent, but no fewer than one, of the total number of cells in a facility shall provide mobility features complying with *Section 11B-807.2*.

11B-232.2.1.1 Beds. In cells having more than 25 beds, at least 5 percent of the beds shall have clear floor space complying with *Section 11B-807.2.3*.

11B-232.2.1.2 Dispersion. Cells with mobility features shall be provided in each classification level.

11B-232.2.1.3 Substitute cells. When alterations are made to specific cells, detention and correctional facility operators may satisfy their obligation to provide the required number of cells with mobility features by providing the required mobility features in substitute cells (cells other than those where alterations are originally planned), provided that each substitute cell meets the following conditions:

1. Located within the same prison site.
2. Integrated with the other cells to the maximum extent feasible.
3. Has equal physical access as the altered cells to areas used by inmates or detainees for visitation, dining, recreation, educational programs, medical services, work programs, religious services and participation in other programs that the facility offers to inmates or detainees.

11B-232.2.1.4 Technically infeasible. Where it is technically infeasible to locate a substitute cell within the same prison site in compliance with *Section 11B-232.2.1.3*, a substitute cell shall be provided at another prison site within the correctional system.

11B-232.2.2 Cells with communication features. At least 2 percent, but no fewer than one, of the total number of general holding cells and general housing cells equipped with audible emergency alarm systems and permanently installed telephones within the cell shall provide communication features complying with *Section 11B-807.3*.

11B-232.3 Special holding cells and special housing cells. Where special holding cells or special housing cells are provided, at least one cell serving each purpose shall provide mobility features complying with *Section 11B-807.2*. Cells

subject to this requirement include, but are not limited to, those used for purposes of orientation, protective custody, administrative or disciplinary detention or segregation, detoxification and medical isolation.

Exception: Reserved.

11B-232.4 Medical care facilities. Patient bedrooms or cells required to comply with *Section 11B-223* shall be provided in addition to any medical isolation cells required to comply with *Section 11B-232.3*.

11B-232.5 Visiting areas. Visiting areas shall comply with *Section 11B-232.5*.

11B-232.5.1 Cubicles and counters. At least 5 percent, but no fewer than one, of cubicles shall comply with *Section 11B-902* on both the visitor and detainee sides. Where counters are provided, at least one shall comply with *Section 11B-904.4.2* on both the visitor and detainee or inmate sides.

Exception: The inmate or detainee side of cubicles or counters at non-contact visiting areas not serving holding cells or housing cells required to comply with *Section 11B-232* shall not be required to comply with *Section 11B-902* or *11B-904.4.2*.

11B-232.5.2 Partitions. Where solid partitions or security glazing separate visitors from detainees or inmates at least one of each type of cubicle or counter partition shall comply with *Section 11B-904.6*.

11B-233 Public housing facilities

11B-233.1 General. *Public housing facilities* with residential dwelling units shall comply with *Section 11B-233*. See *Chapter 2, Section 202* of this code for the definition of *Public Housing*.

11B-233.2 Reserved.

11B-233.3 Public housing facilities. *Public housing facilities* with residential dwelling units shall comply with *Section 11B-233.3*.

Note: *Senior citizen housing* may also be subject to *Civil Code, Division 1, Part 2, Sections 51.2, 51.3 and 51.4*.

11B-233.3.1 Minimum number: new construction. Newly constructed facilities with residential dwelling units shall comply with *Section 11B-233.3.1*.

Exception: Where facilities contain 15 or fewer residential dwelling units, the requirements of *Sections 11B-233.3.1.1* and *11B-233.3.1.3* shall apply to the total number of residential dwelling units that are constructed under a single contract, or are developed as a whole, whether or not located on a common site.

11B-233.3.1.1 Residential dwelling units with mobility features. In facilities with residential dwelling units, at least 5 percent, but no fewer than one unit, of the total number of residential dwelling units shall provide mobility features complying with *Sections 11B-809.2* through *11B-809.4* and shall be on an accessible route as required by *Section 11B-206*.

11B-233.3.1.2 Residential dwelling units with adaptable features. In facilities with residential dwelling units, adaptable residential dwelling units complying

with *Sections 11B-809.6* through *11B-809.12* shall be provided as required by *Sections 11B-233.3.1.2.1* through *11B-233.3.1.2.6*. Adaptable residential dwelling units shall be on an accessible route as required by *Section 11B-206*.

Exception: The number of required adaptable residential dwelling units shall be reduced by the number of units required by *Section 11B-233.3.1.1*.

11B-233.3.1.2.1 Elevator buildings. Residential dwelling units on floors served by an elevator shall be adaptable.

11B-233.3.1.2.2 Non-elevator buildings. Ground floor residential dwelling units in non-elevator buildings shall be adaptable.

11B-233.3.1.2.3 Ground floors above grade. Where the first floor in a building containing residential dwelling units is a floor above grade, all units on that floor shall be adaptable.

11B-233.3.1.2.4 Multistory residential dwelling units in buildings with one or more elevators. In elevator buildings, facilities with multistory residential dwelling units shall comply with the following:

1. The primary entry of the multistory residential dwelling unit shall be on an accessible route on the floor served by the elevator.
2. At least one powder room or bathroom and kitchen shall be located on the primary entry level.
3. Rooms or spaces located on the primary entry level shall be served by an accessible route and comply with *Sections 11B-809.6* through *11B-809.12*.

11B-233.3.1.2.5 Multistory residential dwelling units in buildings with no elevator. In non-elevator buildings, a minimum of 10 percent but not less than one of the ground floor multistory residential dwelling units shall be calculated using the total number of multistory residential dwelling units in buildings on a site and shall comply with the following:

1. The primary entry of the multistory residential dwelling unit shall be on an accessible route.
2. At least one powder room or bathroom shall be located on the primary entry level.
3. Rooms or spaces located on the primary entry level shall be served by an accessible route and comply with *Sections 11B-809.6* through *11B-809.12*.

11B-233.3.1.2.6 Public housing facility site impracticality. The site impracticality tests in this section may be used to determine the number of required residential dwelling units with adaptable features in buildings without an elevator, located on sites with difficult terrain conditions or unusual characteristics.

Except as provided for in *Section 11B-233.3.1.2.5*, the provisions of this section do not apply to multistory dwelling units in non-elevator buildings.

11B-233.3.1.2.6.1 Single building with one common (lobby) entrance. The following may only be used for determining required access to multifamily dwelling units, in a single building with one common (lobby) entrance, located on a site with difficult terrain conditions or unusual characteristics:

All ground floor units in non-elevator buildings shall be adaptable and on an accessible route unless an accessible route to the common (lobby) entrance is not required as determined by Test No. 1, Individual Building Test, or Test No. 3, Unusual Characteristics Test, as described in this section.

Sites where either Test No. 1 or Test No. 3 is used and it is determined that an accessible route to the common (lobby) entrance is not required, a minimum of 20 percent of the ground floor dwelling units shall comply with Section 11B-809.6, and all remaining ground floor dwelling units shall comply with the features listed in Section 11B-233.3.1.2.6.2 unless exempted by Test No. 3, Unusual Characteristics Test.

Test No. 1—Individual Building Test may only be used if the site has terrain over 15 percent slope.

Test No. 3—Unusual Characteristics Test may be used if applicable.

Provisions to Test Nos. 1 and 2. Where a building elevator is provided only as means of creating an accessible route to dwelling units on a ground floor, the building is not considered to be an elevator building for purposes of this code; hence, only the ground floor dwelling units would be covered.

11B-233.3.1.2.6.2 Test number one, individual building test

It is not required by this code to provide an accessible route when the terrain of the site is such that both of the following apply:

1. The slopes of the undisturbed site measured in a straight line between the planned entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance exceed 15 percent; and
2. The slopes of the planned finished grade measured between the entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance also exceed 15 percent.

If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the slope for the purposes of Test No. 1 will be measured to the closest vehicular or pedestrian arrival point.

For purposes of these requirements, vehicular or pedestrian site arrival points include public or resident parking areas, public transportation

stops, passenger loading zones and public streets or sidewalks. To determine site impracticality, the slope would be measured at ground level from the point of the planned entrance on a straight line to:

1. Each vehicular or pedestrian arrival point that is within 50 feet (15 240 mm) of the planned entrance, or
2. If there are no vehicular or pedestrian arrival points within the specified area, the vehicular or pedestrian arrival point closest to the planned entrance.

In the case of sidewalks, the closest point to the entrance will be where a public sidewalk entering the site intersects with the walk to the entrance. In the case of resident parking areas, the closest point to the planned entrance will be measured from the entry point to the parking area that is located closest to the planned entrance.

11B-233.3.1.2.6.3 Test number two, site analysis test

For a site having multiple buildings, or a site with a single building with multiple entrances, it is not required to provide a building entrance on an accessible route to all ground floor units under the following conditions:

1. Calculate the percentage of the total buildable area of the undisturbed site with a natural grade less than 10 percent slope. The analysis of the existing slope (before grading) shall be done on a topographic survey with 2 foot (610 mm) contour intervals with slope determination made between each successive interval. The accuracy of the slope analysis shall be certified by a licensed engineer, landscape architect, architect or surveyor.
2. Determine the requirement of providing an accessible route to planned multifamily dwellings based on the topography of the existing natural terrain. The minimum percentage of ground floor units required on an accessible route shall equal the percentage of the total buildable area (not restricted-use areas, flood plains or wetlands) of the undisturbed site with an existing natural grade of less than 10 percent slope.
3. In addition to the percentage established in paragraph (2), all ground floor units in a building, or ground floor units served by a particular entrance on an accessible route defined by a calculation of the straight line slope not exceeding 8.33 percent, between their planned entrances and an arrival point, shall be on an accessible route and comply with the provisions of Section 11B-809.6.

4. All additional ground floor units in a building, or ground floor units served by a particular entrance, not on an accessible route shall comply with the features listed in Section 11B-233.3.1.2.6.5.
5. In no case shall less than 20 percent of the ground floor dwelling units be on an accessible route and comply with the provisions of Sections 11B-809.6 through 11B-809.12.

11B-233.3.1.2.6.4 Test number three, unusual characteristics test

Unusual characteristics include sites located in a state or federally designated floodplain or coastal high-hazard areas and sites subject to other similar requirements of law or code that require the lowest floor or the lowest structural member of the lowest floor be designed to a specified level at or above the base flood elevation. An accessible route to a building entrance is impractical due to unusual characteristics of the site when:

1. The original site characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and all vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance; or
2. If there are no vehicular or pedestrian arrival points within 50 feet (15 240 mm) of the planned entrance, the unusual characteristics result in a difference in finished grade elevation exceeding 30 inches (762 mm) and 10 percent measured between an entrance and the closest vehicular or pedestrian arrival point.

11B-233.3.1.2.6.5 Additional requirements.

1. Grab bar reinforcement complying with Section 11B-809.10.5.2, 11B-809.10.6.4 or 11B-809.10.7.3.
2. Interior door opening width complying with Section 11B-404.3.1.
3. Door and gate hardware complying with Section 11B-404.2.7.
4. Door signal devices complying with Section 11B-809.8.1.
5. Door maneuvering clearance complying with Section 11B-809.8.
6. Water closet seat height complying with Section 11B-809.10.7.4.
7. Electrical receptacles, switches and controls complying with Section 11B-809.12.
8. Faucets complying with Section 11B-809.10.8.6.

9. Water closet, bathtub and lavatory maneuvering clearances complying with Section 11B-809.10.
10. Removable base cabinets complying with Section 11B-809.9.3.

11B-233.3.1.3 Residential dwelling units with communication features. In public housing facilities with residential dwelling units, at least 2 percent, but no fewer than one unit, of the total number of residential dwelling units shall provide communication features complying with Section 11B-809.5.

11B-233.3.2 Residential dwelling units for sale. Residential dwelling units designed and constructed or altered by public entities that will be offered for sale to individuals shall provide accessible features to the extent required by this chapter.

11B-233.3.2.1 Buyer identified residential dwelling units for sale. The requirements of Section 11B-233.3.2 also apply to housing programs that are operated by public entities where design and construction of particular residential dwelling units take place only after a specific buyer has been identified. In such programs, the covered entity must provide the units that comply with the requirements for accessible features to those pre-identified buyers with disabilities who have requested such a unit.

11B-233.3.3 Additions. Where an addition to an existing building results in an increase in the number of residential dwelling units, the requirements of Section 11B-233.3.1 shall apply only to the residential dwelling units that are added until the total number of residential dwelling units complies with the minimum number required by Section 11B-233.3.1. Residential dwelling units required to comply with Sections 11B-233.3.1.1 and 11B-233.3.1.2 shall be on an accessible route as required by Section 11B-206.

11B-233.3.4 Alterations. Alterations shall comply with Section 11B-233.3.4.

Exception: Where compliance with Section 11B-809.2, 11B-809.3 or 11B-809.4 is technically infeasible, or where it is technically infeasible to provide an accessible route to a residential dwelling unit, the entity shall be permitted to alter or construct a comparable residential dwelling unit to comply with Sections 11B-809.2 through 11B-809.4 provided that the minimum number of residential dwelling units required by Sections 11B-233.3.1.1 and 11B-233.3.1.3, as applicable, is satisfied.

11B-233.3.4.1 Alterations to vacated buildings. Where a building is vacated for the purposes of alteration, and the altered building contains more than 15 residential dwelling units, at least 5 percent of the residential dwelling units shall comply with Sections 11B-809.2 through 11B-809.4 and shall be on an accessible route as required by Section 11B-206. In addition, at least 2 percent of the residential dwelling units shall comply with Section 11B-809.5.

11B-233.3.4.2 Alterations to individual residential dwelling units. In individual residential dwelling units, where a bathroom or a kitchen is substantially altered, and at least one other room is altered, the requirements of *Section 11B-233.3.1* shall apply to the altered residential dwelling units until the total number of residential dwelling units complies with the minimum number required by *Sections 11B-233.3.1.1 and 11B-233.3.1.3*. Residential dwelling units required to comply with *Section 11B-233.3.1.1* shall be on an accessible route as required by *Section 11B-206*.

Exception: Where facilities contain 15 or fewer residential dwelling units, the requirements of *Sections 11B-233.3.1.1 and 11B-233.3.1.3* shall apply to the total number of residential dwelling units that are altered under a single contract, or are developed as a whole, whether or not located on a common site.

11B-233.3.4.3 Alterations to residential dwelling units with adaptable features. *The building standards for residential dwelling units with adaptable features do not apply to the alteration, repair, rehabilitation or maintenance of residential dwelling units constructed for first occupancy on or prior to March 13, 1991. Multifamily dwelling units with adaptable features constructed for first occupancy after March 13, 1991 shall be maintained in compliance with the accessibility standards in effect at the time of construction.*

Exception: *Where any portion of a building's exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings and a new building is constructed behind the existing exterior, the building is considered a new building for determining the application of this chapter.*

11B-233.3.5 Dispersion. Residential dwelling units required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4* and residential dwelling units required to provide communication features complying with *Section 11B-809.5* shall be dispersed among the various types of residential dwelling units in the facility and shall provide choices of residential dwelling units comparable to, and integrated with, those available to other residents.

Exception: *Where multistory residential dwelling units are one of the types of residential dwelling units provided, one-story residential dwelling units shall be permitted as a substitute for multistory residential dwelling units where equivalent spaces and amenities are provided in the one-story residential dwelling unit.*

11B-233.3.6 Graduate student and faculty housing at a place of education. *Housing facilities that are provided by or on behalf of a place of education, with residential dwelling units leased on a year-round basis exclusively to graduate students or faculty, and that do not contain any public use or common use areas available for educational programming, are not subject to Section 11B-224 and shall comply with Section 11B-233.*

11B-234 Amusement rides

11B-234.1 General. Amusement rides shall comply with *Section 11B-234*.

Exception: Mobile or portable amusement rides shall not be required to comply with *Section 11B-234*.

11B-234.2 Load and unload areas. Load and unload areas serving amusement rides shall comply with *Section 11B-1002.3*.

11B-234.3 Minimum number. Amusement rides shall provide at least one wheelchair space complying with *Section 11B-1002.4*, or at least one amusement ride seat designed for transfer complying with *Section 11B-1002.5*, or at least one transfer device complying with *Section 11B-1002.6*.

Exceptions:

1. Amusement rides that are controlled or operated by the rider shall not be required to comply with *Section 11B-234.3*.
2. Amusement rides designed primarily for children, where children are assisted on and off the ride by an adult, shall not be required to comply with *Section 11B-234.3*.
3. Amusement rides that do not provide amusement ride seats shall not be required to comply with *Section 11B-234.3*.

11B-234.4 Existing amusement rides. Where existing amusement rides are altered, the alteration shall comply with *Section 11B-234.4*.

11B-234.4.1 Load and unload areas. Where load and unload areas serving existing amusement rides are newly designed and constructed, the load and unload areas shall comply with *Section 11B-1002.3*.

11B-234.4.2 Minimum number. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with *Section 11B-234.3*.

11B-235 Recreational boating facilities

11B-235.1 General. Recreational boating facilities shall comply with *Section 11B-235*.

11B-235.2 Boat slips. Boat slips complying with *Section 11B-1003.3.1* shall be provided in accordance with *Table 11B-235.2*. Where the number of boat slips is not identified, each 40 feet (12192 mm) of boat slip edge provided along the perimeter of the pier shall be counted as one boat slip for the purpose of this section.

11B-235.2.1 Dispersion. Boat slips complying with *Section 11B-1003.3.1* shall be dispersed throughout the various types of boat slips provided. Where the minimum number of boat slips required to comply with *Section 11B-1003.3.1* has been met, no further dispersion shall be required.

11B-235.3 Boarding piers at boat launch ramps. Where boarding piers are provided at boat launch ramps, at least 5

percent, but no fewer than one, of the boarding piers shall comply with *Section 11B-1003.3.2*.

11B-236 Exercise machines and equipment

11B-236.1 General. At least one of each type of exercise machine and equipment shall comply with *Section 11B-1004*.

11B-237 Fishing piers and platforms

11B-237.1 General. Fishing piers and platforms shall comply with *Section 11B-1005*.

**TABLE 11B-235.2
BOAT SLIPS**

TOTAL NUMBER OF BOAT SLIPS PROVIDED IN FACILITY	MINIMUM NUMBER OF REQUIRED ACCESSIBLE BOAT SLIPS
1 to 25	1
26 to 50	2
51 to 100	3
101 to 150	4
151 to 300	5
301 to 400	6
401 to 500	7
501 to 600	8
601 to 700	9
701 to 800	10
801 to 900	11
901 to 1000	12
1001 and over	12, plus 1 for every 100, or fraction thereof, over 1000

11B-238 Golf facilities

11B-238.1 General. Golf facilities shall comply with *Section 11B-238*.

11B-238.2 Golf courses. Golf courses shall comply with *Section 11B-238.2*.

11B-238.2.1 Teeing grounds. Where one teeing ground is provided for a hole, the teeing ground shall be designed and constructed so that a golf car can enter and exit the teeing ground. Where two teeing grounds are provided for a hole, the forward teeing ground shall be designed and constructed so that a golf car can enter and exit the teeing ground. Where three or more teeing grounds are provided for a hole, at least two teeing grounds, including the forward teeing ground, shall be designed and constructed so that a golf car can enter and exit each teeing ground.

Exception: In existing golf courses, the forward teeing ground shall not be required to be one of the teeing grounds on a hole designed and constructed so that a golf car can enter and exit the teeing ground where compliance is not feasible due to terrain.

11B-238.2.2 Putting greens. Putting greens shall be designed and constructed so that a golf car can enter and exit the putting green.

11B-238.2.3 Weather shelters. Where provided, weather shelters shall be designed and constructed so that a golf car can enter and exit the weather shelter and shall comply with *Section 11B-1006.4*.

11B-238.3 Practice putting greens, practice teeing grounds and teeing stations at driving ranges. At least 5 percent, but no fewer than one, of practice putting greens, practice teeing grounds and teeing stations at driving ranges shall be designed and constructed so that a golf car can enter and exit the practice putting greens, practice teeing grounds and teeing stations at driving ranges.

11B-239 Miniature golf facilities

11B-239.1 General. Miniature golf facilities shall comply with *Section 11B-239*.

11B-239.2 Minimum number. At least 50 percent of holes on miniature golf courses shall comply with *Section 11B-1007.3*.

11B-239.3 Miniature golf course configuration. Miniature golf courses shall be configured so that the holes complying with *Section 11B-1007.3* are consecutive. Miniature golf courses shall provide an accessible route from the last hole complying with *Section 11B-1007.3* to the course entrance or exit without requiring travel through any other holes on the course.

Exception: One break in the sequence of consecutive holes shall be permitted provided that the last hole on the miniature golf course is the last hole in the sequence.

11B-240 Play areas

11B-240.1 General. Play areas for children ages 2 and over shall comply with *Section 11B-240*. Where separate play areas are provided within a site for specific age groups, each play area shall comply with *Section 11B-240*.

Exceptions:

1. Play areas located in family child-care facilities where the proprietor actually resides shall not be required to comply with *Section 11B-240*.
2. In existing play areas, where play components are relocated for the purposes of creating safe use zones and the ground surface is not altered or extended for more than one use zone, the play area shall not be required to comply with *Section 11B-240*.
3. Amusement attractions shall not be required to comply with *Section 11B-240*.
4. Where play components are altered and the ground surface is not altered, the ground surface shall not be required to comply with *Section 11B-1008.2.6* unless required by *Section 11B-202.4*.

11B-240.1.1 Additions. Where play areas are designed and constructed in phases, the requirements of *Section 11B-240* shall apply to each successive addition so that when the addition is completed, the entire play area complies with all the applicable requirements of *Section 11B-240*.

11B-240.2 Play components. Where provided, play components shall comply with *Section 11B-240.2*.

11B-240.2.1 Ground level play components. Ground level play components shall be provided in the number and types required by *Section 11B-240.2.1*. Ground level play components that are provided to comply with *Section 11B-240.2.1.1* shall be permitted to satisfy the additional number required by *Section 11B-240.2.1.2* if the minimum required types of play components are satisfied. Where

two or more required ground level play components are provided, they shall be dispersed throughout the play area and integrated with other play components.

11B-240.2.1.1 Minimum number and types. Where ground level play components are provided, at least one of each type shall be on an accessible route and shall comply with *Section 11B-1008.4*.

11B-240.2.1.2 Additional number and types. Where elevated play components are provided, ground level play components shall be provided in accordance with Table 11B-240.2.1.2 and shall comply with *Section 11B-1008.4*.

Exception: If at least 50 percent of the elevated play components are connected by a ramp and at least 3 of the elevated play components connected by the ramp are different types of play components, the play area shall not be required to comply with *Section 11B-240.2.1.2*.

11B-240.2.2 Elevated play components. Where elevated play components are provided, at least 50 percent shall be on an accessible route and shall comply with *Section 11B-1008.4*.

11B-241 Saunas and steam rooms

11B-241.1 General. Where provided, saunas and steam rooms shall comply with *Section 11B-612*.

Exception: Where saunas or steam rooms are clustered at a single location, no more than 5 percent of the saunas and steam rooms, but no fewer than one, of each type in each cluster shall be required to comply with *Section 11B-612*.

11B-242 Swimming pools, wading pools and spas

11B-242.1 General. Swimming pools, wading pools and spas shall comply with *Section 11B-242*.

11B-242.2 Swimming pools. At least two accessible means of entry shall be provided for swimming pools. Accessible means of entry shall be swimming pool lifts complying with *Section 11B-1009.2*; sloped entries complying with *Section 11B-1009.3*; transfer walls complying with *Section 11B-1009.4*; transfer systems complying with *Section 11B-1009.5*;

and pool stairs complying with *Section 11B-1009.6*. At least one accessible means of entry provided shall comply with *Sections 11B-1009.2* or *11B-1009.3*.

Exceptions:

1. Where a swimming pool has less than 300 linear feet (91 m) of swimming pool wall, no more than one accessible means of entry shall be required provided that the accessible means of entry is a swimming pool lift complying with *Section 11B-1009.2* or sloped entry complying with *Section 11B-1009.3*.
2. Wave action pools, leisure rivers, sand bottom pools and other pools where user access is limited to one area shall not be required to provide more than one accessible means of entry provided that the accessible means of entry is a swimming pool lift complying with *Section 11B-1009.2*, a sloped entry complying with *Section 11B-1009.3*, or a transfer system complying with *Section 11B-1009.5*.
3. Catch pools shall not be required to provide an accessible means of entry provided that the catch pool edge is on an accessible route.

11B-242.3 Wading pools. At least one accessible means of entry shall be provided for wading pools. Accessible means of entry shall comply with sloped entries complying with *Section 11B-1009.3*.

11B-242.4 Spas. At least one accessible means of entry shall be provided for spas. Accessible means of entry shall comply with swimming pool lifts complying with *Section 11B-1009.2*; transfer walls complying with *Section 11B-1009.4*; or transfer systems complying with *Section 11B-1009.5*.

Exception: Where spas are provided in a cluster, no more than 5 percent, but no fewer than one, spa in each cluster shall be required to comply with *Section 11B-242.4*.

11B-243 Shooting facilities with firing positions

11B-243.1 General. Where shooting facilities with firing positions are designed and constructed at a site, at least 5 percent, but no fewer than one, of each type of firing position shall comply with *Section 11B-1010*.

**TABLE 11B-240.2.1.2
NUMBER AND TYPES OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON ACCESSIBLE ROUTES**

NUMBER OF ELEVATED PLAY COMPONENTS PROVIDED	MINIMUM NUMBER OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON AN ACCESSIBLE ROUTE	MINIMUM NUMBER OF DIFFERENT TYPES OF GROUND LEVEL PLAY COMPONENTS REQUIRED TO BE ON AN ACCESSIBLE ROUTE
1	Not applicable	Not applicable
2 to 4	1	1
5 to 7	2	2
8 to 10	3	3
11 to 13	4	3
14 to 16	5	3
17 to 19	6	3
20 to 22	7	4
23 to 25	8	4
26 and over	8, plus 1 for each additional 3, or fraction thereof, over 25	5

11B-244 Religious facilities

11B-244.1 General. Religious facilities shall be accessible in accordance with the provisions of this code. Where specific areas within religious facilities contain more than one use, each portion shall comply with the applicable requirements for that use.

11B-245 Public accommodations located in private residences

11B-245.1 General. Public accommodations located in private residences shall comply with Section 11B-245.

11B-245.2 Application. When a public accommodation is located in a private residence, that portion used exclusively in the operation of the public accommodation or that portion used both for the public accommodation and for residential purposes is covered by the new construction and alterations requirements of this chapter.

Exception: The portion of the residence used exclusively as a residence is not required to be accessible in accordance with this chapter.

11B-245.3 Accessible elements required. The accessible portion of the residence extends to those elements used to enter the public accommodation, including the front sidewalk, if any, the door or entryway, and hallways; and those portions of the residence, interior or exterior, available to or used by employees or visitors of the public accommodation, including restrooms.

11B-246 Outdoor developed areas

11B-246.1 General. Outdoor developed areas shall comply with Section 11B-246.

Exceptions:

1. Where the enforcing agency finds that, in specific areas, the natural environment would be materially damaged by compliance with these regulations, such areas shall be subject to these regulations only to the extent that such material damage would not occur.
2. Automobile access or accessible routes are not required when the enforcing agency determines compliance with this chapter would create an unreasonable hardship as defined in Chapter 2, Section 202.

11B-246.2 Camping facilities. In camping facilities where campsites are provided, at least two campsites and one additional campsite for each 100 campsites or fraction thereof, shall be accessed by and connected to sanitary facilities by travel routes with a maximum slope of 1:12. Permanent toilet and bathing facilities serving campsites shall comply with Section 11B-603.

11B-246.3 Beaches. Beaches shall be accessible.

11B-246.4 Day use areas and vista points. Day use areas, vista points and similar areas shall be accessible.

11B-246.5 Picnic areas. Where picnic tables are provided, at least one picnic table, and one additional table for each 20 tables or fraction thereof, shall be accessible and comply with Section 11B-902.

11B-246.6 Parking lots. Parking lots shall comply with Sections 11B-208 and 11B-502 and shall be provided with curb cuts leading to adjacent walks, paths or trails.

11B-246.7 Trails and paths. Trails, paths and nature walk areas, or portions of them, shall be constructed with gradients permitting at least partial use by wheelchair occupants. Buildings and other functional areas shall be served by paths or walks with firm and stable surfaces.

11B-246.8 Nature trails. Nature trails and similar educational and informational areas shall be accessible to individuals with vision impairments by the provision of rope guidelines, raised Arabic numerals and symbols, or other similar guide and assistance devices.

11B-247 Detectable warnings and detectable directional texture**11B-247.1 Detectable warnings.**

11B-247.1.1 General. Detectable warnings shall be provided in accordance with Section 11B-247.1 and shall comply with Section 11B-705.1.

11B-247.1.2 Where required. Detectable warnings shall be provided where required by Section 11B-247.1.2.

11B-247.1.2.1 Platform edges. Platform boarding edges shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.1.

11B-247.1.2.2 Curb ramps. Curb ramps shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.2.

11B-247.1.2.3 Islands or cut-through medians. Islands or cut-through medians shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.3.

11B-247.1.2.4 Bus stops. Where detectable warnings are provided at bus stop boarding and alighting areas in compliance with Section 11B-810.2.3, detectable warnings shall comply with Sections 11B-705.1.1 and 11B-705.1.2.4.

11B-247.1.2.5 Blended transitions. Blended transitions shall have detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.5.

11B-247.1.2.6 Reflecting pools. The edges of reflecting pools shall be protected by railings, walls, warning curbs or detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.6.

11B-247.1.2.7 Track crossings. Where it is necessary to cross tracks to reach transit boarding platforms, detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.7 shall be provided.

11B-247.2 Detectable directional texture. At transit boarding platforms, the pedestrian access shall be identified with a detectable directional texture complying with Section 11B-705.2.

11B-248 Common use areas and employee work areas.

11B-248.1 Common use areas. Common use areas shall comply with this chapter.

11B-248.2 Employee work areas. *Employee work areas shall comply with this chapter.*

11B-249 Adult changing facilities

11B-249.1 General. *Adult changing facilities shall comply with Section 11B-249.*

11B-249.1.1 *Where adult changing facilities are provided, each adult changing facility shall comply with Section 11B-813.*

11B-249.1.2 *Newly constructed commercial places of public amusement shall provide no fewer than one adult changing facility in compliance with Section 11B-813.*

11B-250 Circulation paths

11B-250.1 General. *Circulation paths contiguous to vehicular traffic shall be physically separated from vehicular traffic. Vehicular traffic includes travel through parking facilities, into and out of parking spaces, into and out of electric vehicle charging spaces, and along roadways, driveways and drive aisles. Physical separation shall be provided with circulation paths raised 4 inches (102 mm) minimum above the area where vehicular traffic occurs.*

Exceptions:

1. *Curb ramps and blended transitions with detectable warnings complying with Section 11B-247 may be used to connect raised circulation paths and pedestrian crossings within areas of vehicular traffic. Blended transitions and cut-through medians with detectable warnings complying with Section 11B-247 may be used to connect circulation paths and pedestrian crossings at similar elevations within areas of vehicular traffic.*
2. *At locations where sidewalks and walks in the public right-of-way cross driveways without yield or stop traffic control, compliance with this section shall not be required.*
3. *At locations where circulation paths cross driveways or drive aisles, circulation paths shall not be required to comply with this section and detectable warnings shall not be permitted. Beyond the crossing where continuation of the circulation path within a parking facility leads immediately to and does not continue beyond only parking spaces complying with Section 11B-502, passenger drop-off and loading zones complying with Section 11B-503 and electric vehicle charging stations complying with Section 11B-812, the circulation path shall not be required to be raised.*
4. *In alterations to existing parking facilities, including alterations required by Section 11B-202.4, physical separation may be provided with detectable warnings complying with Sections 11B-247 and 11B-705.1 in lieu of raised circulation paths.*
5. *Access aisles serving any electric vehicle charging station vehicle spaces complying with Section 11B-812, parking spaces complying with Section 11B-502, or passenger drop-off and loading zones complying with Section 11B-503 shall not be required to comply with this section.*
6. *At each electric vehicle charging station complying with Section 11B-812 where the charger and its controls are oriented toward the vehicle space it serves and the charger's clear floor spaces for operable parts and point-of-sale devices are at the same elevation as the vehicle space, the accessible route complying with Section 11B-812.5.2 shall not be required to comply with this section.*

DIVISION 3: BUILDING BLOCKS

11B-301 General

11B-301.1 Scope. The provisions of *Division 3* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

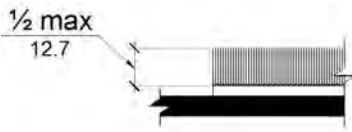
11B-302 Floor or ground surfaces

11B-302.1 General. Floor and ground surfaces shall be stable, firm and slip resistant and shall comply with *Section 11B-302*.

Exceptions:

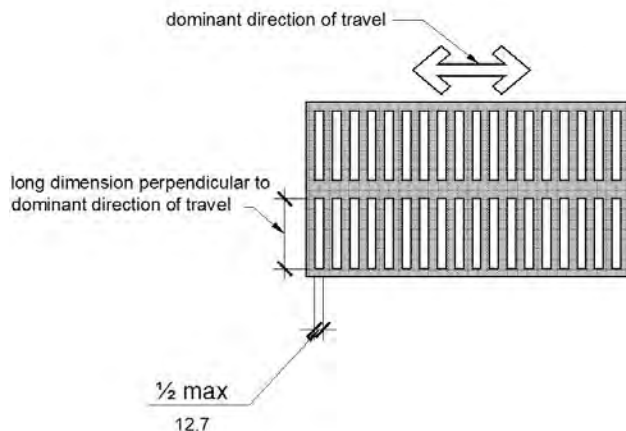
1. Within animal containment areas, floor and ground surfaces shall not be required to be stable, firm and slip resistant.
2. Areas of sport activity shall not be required to comply with *Section 11B-302*.

11B-302.2 Carpet. Carpet or carpet tile shall be securely attached and shall have a firm cushion, pad, or backing or no cushion or pad. Carpet or carpet tile shall have a level loop, textured loop, level cut pile, level cut/uncut pile texture. Pile height shall be $\frac{1}{2}$ inch (12.7 mm) maximum. Exposed edges of carpet shall be fastened to floor surfaces and shall have trim on the entire length of the exposed edge. Carpet edge trim shall comply with *Section 11B-303*.



**FIGURE 11B-302.2
CARPET PILE HEIGHT**

11B-302.3 Openings. Openings in floor or ground surfaces shall not allow passage of a sphere more than $\frac{1}{2}$ inch (12.7 mm) diameter except as allowed in *Sections 11B-407.4.3, 11B-409.4.3, 11B-410.4, 11B-810.5.3* and *11B-810.10*. Elongated openings shall be placed so that the long dimension is perpendicular to the dominant direction of travel.



**FIGURE 11B-302.3
ELONGATED OPENINGS IN FLOOR OR GROUND SURFACES**

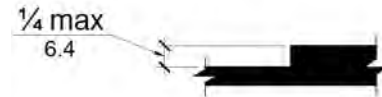
11B-303 Changes in level

11B-303.1 General. Where changes in level are permitted in floor or ground surfaces, they shall comply with *Section 11B-303*.

Exceptions:

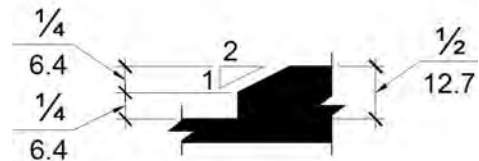
1. Animal containment areas shall not be required to comply with *Section 11B-303*.
2. Areas of sport activity shall not be required to comply with *Section 11B-303*.

11B-303.2 Vertical. Changes in level of $\frac{1}{4}$ inch (6.4 mm) high maximum shall be permitted to be vertical *and without edge treatment*.



**FIGURE 11B-303.2
VERTICAL CHANGE IN LEVEL**

11B-303.3 Beveled. Changes in level between $\frac{1}{4}$ inch (6.4 mm) high minimum and $\frac{1}{2}$ inch (12.7 mm) high maximum shall be beveled with a slope not steeper than 1:2.



**FIGURE 11B-303.3
BEVELED CHANGE IN LEVEL**

11B-303.4 Ramps. Changes in level greater than $\frac{1}{2}$ inch (12.7 mm) high shall be ramped, and shall comply with *Section 11B-405* or *11B-406*.

11B-303.5 Warning curbs. Abrupt changes in level exceeding 4 inches (102 mm) in a vertical dimension between walks, sidewalks or other pedestrian ways and adjacent surfaces or features shall be identified by warning curbs at least 6 inches (152 mm) in height above the walk or sidewalk surface.

Exceptions:

1. A warning curb is not required between a walk or sidewalk and an adjacent street or driveway.
2. A warning curb is not required when a guard or handrail is provided with a guide rail centered 2 inches (51 mm) minimum and 4 inches (102 mm) maximum above the surface of the walk or sidewalk.

11B-304 Turning space

11B-304.1 General. Turning space shall comply with *Section 11B-304*.

11B-304.2 Floor or ground surfaces. Floor or ground surfaces of a turning space shall comply with Section 11B-302. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-304.3 Size. Turning space shall comply with Section 11B-304.3.1 or 11B-304.3.2.

11B-304.3.1 Circular space. The turning space shall be a space of 60 inches (1524 mm) diameter minimum. The space shall be permitted to include knee and toe clearance complying with Section 11B-306.

11B-304.3.2 T-Shaped space. The turning space shall be a T-shaped space within a 60 inch (1524 mm) square minimum with arms and base 36 inches (914 mm) wide minimum. Each arm of the T shall be clear of obstructions 12 inches (305 mm) minimum in each direction and the base shall be clear of obstructions 24 inches (610 mm) minimum. The space shall be permitted to include knee and toe clearance complying with Section 11B-306 only at the end of either the base or one arm.

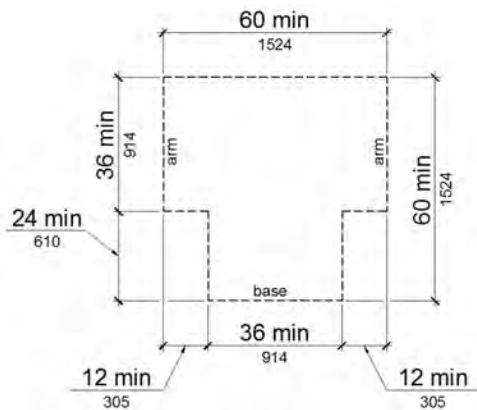


FIGURE 11B-304.3.2 T-SHAPED TURNING SPACE

11B-304.4 Door swing. Doors shall be permitted to swing into turning spaces.

11B-305 Clear floor or ground space

11B-305.1 General. Clear floor or ground space shall comply with Section 11B-305.

11B-305.2 Floor or ground surfaces. Floor or ground surfaces of a clear floor or ground space shall comply with Section 11B-302. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-305.3 Size. The clear floor or ground space shall be 30 inches (762 mm) minimum by 48 inches (1219 mm) minimum.

11B-305.4 Knee and toe clearance. Unless otherwise specified, clear floor or ground space shall be permitted to include knee and toe clearance complying with Section 11B-306.

11B-305.5 Position. Unless otherwise specified, clear floor or ground space shall be positioned for either forward or parallel approach to an element.

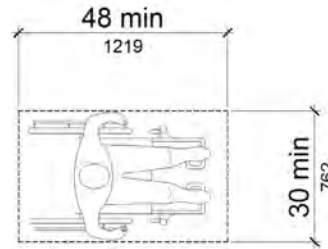


FIGURE 11B-305.3 CLEAR FLOOR OR GROUND SPACE

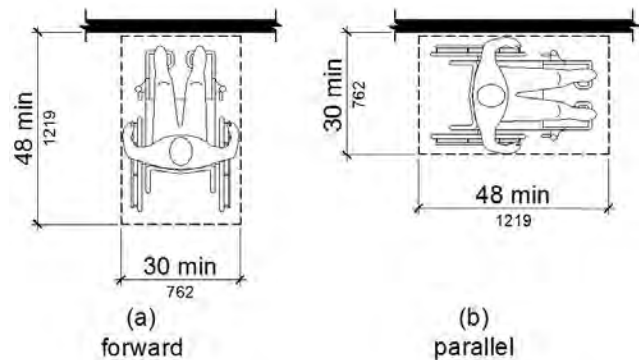


FIGURE 11B-305.5 POSITION OF CLEAR FLOOR OR GROUND SPACE

11B-305.6 Approach. One full unobstructed side of the clear floor or ground space shall adjoin an accessible route or adjoin another clear floor or ground space. Clear floor or ground space may overlap an accessible route, unless specifically prohibited elsewhere in this chapter.

11B-305.7 Maneuvering clearance. Where a clear floor or ground space is located in an alcove or otherwise confined on all or part of three sides, additional maneuvering clearance shall be provided in accordance with Sections 11B-305.7.1 and 11B-305.7.2.

11B-305.7.1 Forward approach. Alcoves shall be 36 inches (914 mm) wide minimum where the depth exceeds 24 inches (610 mm).

11B-305.7.2 Parallel approach. Alcoves shall be 60 inches (1524 mm) wide minimum where the depth exceeds 15 inches (381 mm).

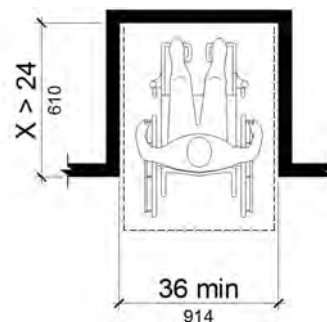


FIGURE 11B-305.7.1 MANEUVERING CLEARANCE IN AN ALCOVE, FORWARD APPROACH

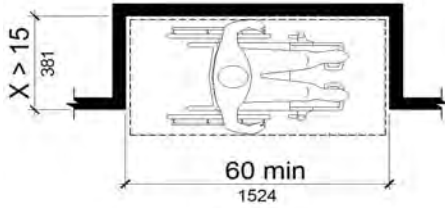


FIGURE 11B-305.7.2
MANEUVERING CLEARANCE IN
AN ALCOVE, PARALLEL APPROACH

11B-306 Knee and toe clearance

11B-306.1 General. Where space beneath an element is included as part of clear floor or ground space or turning space, the space shall comply with *Section 11B-306*. Additional space shall not be prohibited beneath an element but shall not be considered as part of the clear floor or ground space or turning space.

11B-306.2 Toe clearance

11B-306.2.1 General. Space under an element between the finish floor or ground and 9 inches (229 mm) above the finish floor or ground shall be considered toe clearance and shall comply with *Section 11B-306.2*.

11B-306.2.2 Maximum depth. Toe clearance shall extend 25 inches (635 mm) maximum under an element.

Exception: Toe clearance shall extend 19 inches (483 mm) maximum under lavatories required to be accessible by *Section 11B-213.3.4*.

11B-306.2.3 Minimum required depth. Where toe clearance is required at an element as part of a clear floor space, the toe clearance shall extend 17 inches (432 mm) minimum under the element.

Exceptions:

1. The toe clearance shall extend 19 inches (483 mm) minimum under sinks required to be accessible by *Section 11B-212.3*.
2. The toe clearance shall extend 19 inches (483 mm) minimum under built-in dining and work surfaces required to be accessible.

11B-306.2.4 Additional clearance. Space extending greater than 6 inches (152 mm) beyond the available knee

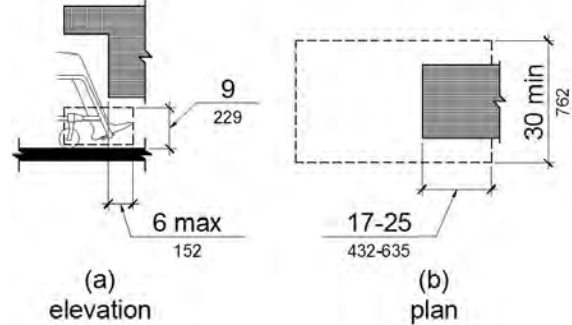


FIGURE 11B-306.2
TOE CLEARANCE

clearance at 9 inches (229 mm) above the finish floor or ground shall not be considered toe clearance.

11B-306.2.5 Width. Toe clearance shall be 30 inches (762 mm) wide minimum.

11B-306.3 Knee clearance.

11B-306.3.1 General. Space under an element between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor or ground shall be considered knee clearance and shall comply with *Section 11B-306.3*.

Exception: At lavatories required to be accessible by *Section 11B-213.3.4*, space between 9 inches (229 mm) and 29 inches (737 mm) above the finish floor or ground, shall be considered knee clearance.

11B-306.3.2 Maximum depth. Knee clearance shall extend 25 inches (635 mm) maximum under an element at 9 inches (229 mm) above the finish floor or ground.

11B-306.3.3 Minimum required depth. Where knee clearance is required under an element as part of a clear floor space, the knee clearance shall be 11 inches (279 mm) deep minimum at 9 inches (229 mm) above the finish floor or ground, and 8 inches (203 mm) deep minimum at 27 inches (686 mm) above the finish floor or ground.

Exceptions:

1. At lavatories required to be accessible by *Section 11B-213.3.4*, the knee clearance shall be 27 inches (686 mm) high minimum above the finish floor or ground at a depth of 8 inches (203 mm) minimum increasing to 29 inches (737 mm) high minimum above the finish floor or ground at the front edge

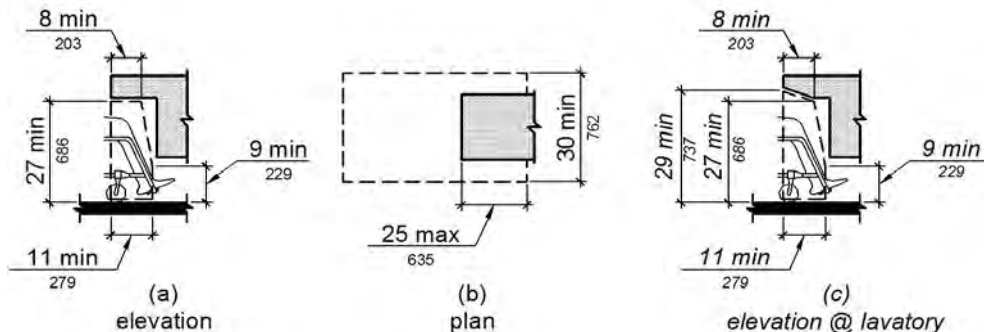


FIGURE 11B-306.3
KNEE CLEARANCE

of a counter with a built-in lavatory or at the front edge of a wall-mounted lavatory fixture.

- At dining and work surfaces required to be accessible, knee clearance shall extend 19 inches (483 mm) deep minimum at 27 inches (686 mm) above the finish floor or ground.

11B-306.3.4 Clearance reduction. Between 9 inches (229 mm) and 27 inches (686 mm) above the finish floor or ground, the knee clearance shall be permitted to reduce at a rate of 1 inch (25 mm) in depth for each 6 inches (152 mm) in height.

Exception: The knee clearance shall not be reduced at built-in dining and work surfaces required to be accessible by Section 11B-226.1.

11B-306.3.5 Width. Knee clearance shall be 30 inches (762 mm) wide minimum.

11B-307 Protruding objects

11B-307.1 General. Protruding objects shall comply with Section 11B-307.

11B-307.2 Protrusion limits. Objects with leading edges more than 27 inches (686 mm) and not more than 80 inches (2032 mm) above the finish floor or ground shall protrude 4 inches (102 mm) maximum horizontally into the circulation path.

Exception: Handrails shall be permitted to protrude 4½ inches (114 mm) maximum.

11B-307.3 Post-mounted objects. Free-standing objects mounted on posts or pylons shall overhang circulation paths 12 inches (305 mm) maximum when located 27 inches (686 mm) minimum and 80 inches (2032 mm) maximum above the finish floor or ground. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finish floor or ground.

Exception: The sloping portions of handrails serving stairs and ramps shall not be required to comply with Section 11B-307.3.

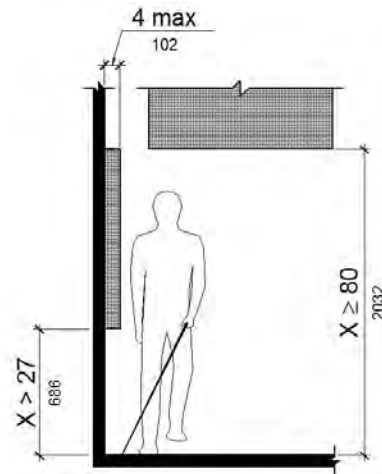


FIGURE 11B-307.2 LIMITS OF PROTRUDING OBJECTS

11B-307.3.1 Edges and corners. Where signs or other objects are mounted on posts or pylons, and their bottom edges are less than 80 inches (2032 mm) above the floor or ground surface, the edges of such signs and objects shall be rounded or eased and the corners shall have a minimum radius of 1/8 inch (3.2 mm).

11B-307.4 Vertical clearance. Vertical clearance shall be 80 inches (2032 mm) high minimum. Guardrails or other barriers shall be provided where the vertical clearance is less than 80 inches (2032 mm) high. The leading edge of such guardrail or barrier shall be located 27 inches (686 mm) maximum above the finish floor or ground.

Exception: Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

11B-307.4.1 Guy braces. Where a guy support is used within either the width of a circulation path or 24 inches (610 mm) maximum outside of a circulation path, a vertical guy brace, sidewalk guy or similar device shall be used to prevent a hazard or an overhead obstruction.

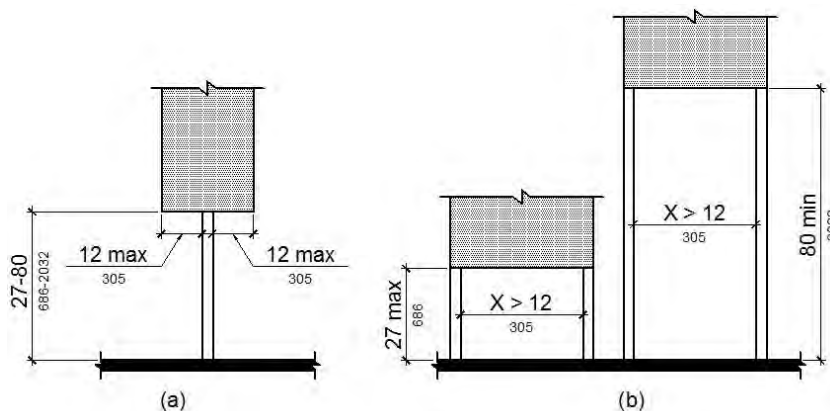


FIGURE 11B-307.3 POST-MOUNTED PROTRUDING OBJECTS

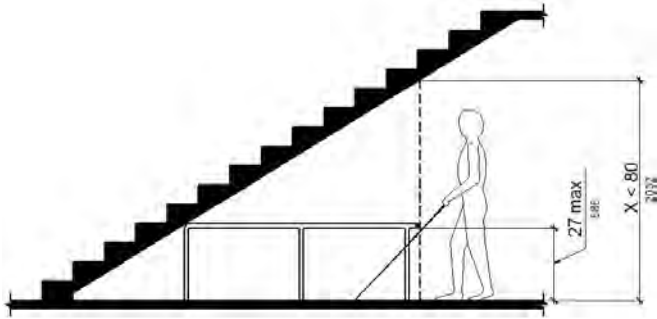


FIGURE 11B-307.4
VERTICAL CLEARANCE

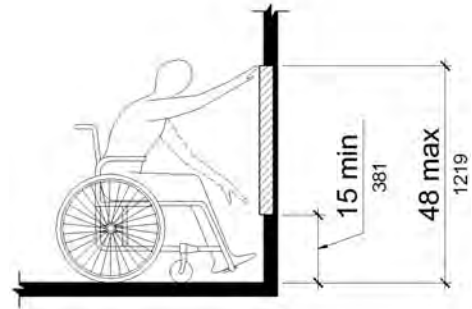


FIGURE 11B-308.2.1
UNOBSTRUCTED FORWARD REACH

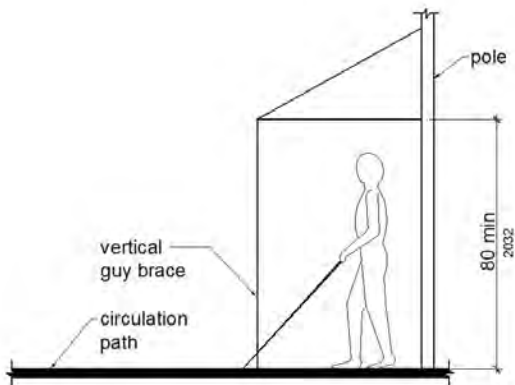


FIGURE 11B-307.4.1
GUY BRACES

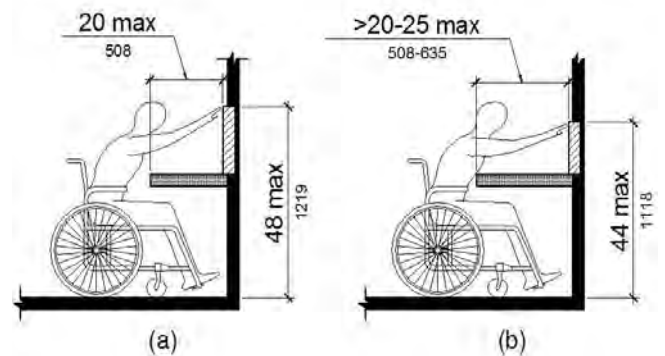


FIGURE 11B-308.2.2
OBSTRUCTED HIGH FORWARD REACH

11B-307.5 Required clear width. Protruding objects shall not reduce the clear width required for accessible routes.

11B-308 Reach ranges

11B-308.1 General. Reach ranges shall comply with Section 11B-308.

11B-308.1.1 Electrical switches. Controls and switches intended to be used by the occupant of a room or area to control lighting and receptacle outlets, appliances or cooling, heating and ventilating equipment, shall comply with Section 11B-308 except the low reach shall be measured to the bottom of the outlet box and the high reach shall be measured to the top of the outlet box.

11B-308.1.2 Electrical receptacle outlets. Electrical receptacle outlets on branch circuits of 30 amperes or less and communication system receptacles shall comply with Section 11B-308 except the low reach shall be measured to the bottom of the outlet box and the high reach shall be measured to the top of the outlet box.

11B-308.2 Forward reach.

11B-308.2.1 Unobstructed. Where a forward reach is unobstructed, the high forward reach shall be 48 inches (1219 mm) maximum and the low forward reach shall be 15 inches (381 mm) minimum above the finish floor or ground.

11B-308.2.2 Obstructed high reach. Where a high forward reach is over an obstruction, the clear floor space shall extend beneath the element for a distance not less than the required reach depth over the obstruction. The high forward reach shall be 48 inches (1219 mm) maximum where the reach depth is 20 inches (508 mm) maximum. Where the reach depth exceeds 20 inches (508 mm), the high forward reach shall be 44 inches (1118 mm) maximum and the reach depth shall be 25 inches (635 mm) maximum.

11B-308.3 Side reach.

11B-308.3.1 Unobstructed. Where a clear floor or ground space allows a parallel approach to an element and the side reach is unobstructed, the high side reach shall be 48 inches (1219 mm) maximum and the low side reach shall be 15 inches (381 mm) minimum above the finish floor or ground.

Exceptions:

1. An obstruction shall be permitted between the clear floor or ground space and the element where the depth of the obstruction is 10 inches (254 mm) maximum.
2. Operable parts of fuel dispensers shall be permitted to be 54 inches (1372 mm) maximum measured from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

11B-308.3.2 Obstructed high reach. Where a clear floor or ground space allows a parallel approach to an element and the high side reach is over an obstruction, the height of the obstruction shall be 34 inches (864 mm) maximum and the depth of the obstruction shall be 24 inches (610 mm) maximum. The high side reach shall be 48 inches (1219 mm) maximum for a reach depth of 10 inches (254 mm) maximum. Where the reach depth exceeds 10 inches (254 mm), the high side reach shall be 46 inches (1168 mm) maximum for a reach depth of 24 inches (610 mm) maximum.

Exceptions:

1. The top of washing machines and clothes dryers shall be permitted to be 36 inches (914 mm) maximum above the finish floor.
2. Operable parts of fuel dispensers shall be permitted to be 54 inches (1372 mm) maximum mea-

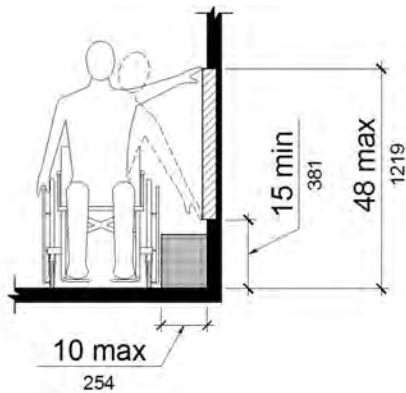


FIGURE 11B-308.3.1 UNOBSTRUCTED SIDE REACH

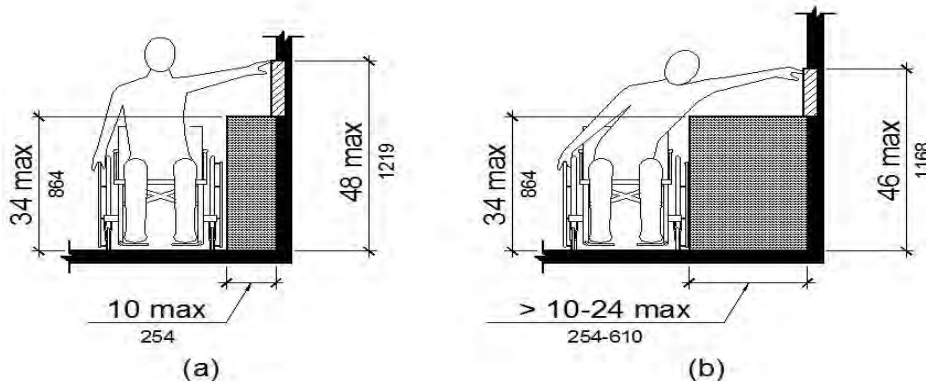


FIGURE 11B-308.3.2 OBSTRUCTED HIGH SIDE REACH

sured from the surface of the vehicular way where fuel dispensers are installed on existing curbs.

11B-308.4 Suggested reach ranges for children. Where building elements such as coat hooks, lockers or operable parts are designed for use primarily by children, the suggested dimensions of Table 11B-308.4 shall be permitted. These dimensions apply to either forward or side reaches.

TABLE 11B-308.4 SUGGESTED DIMENSIONS FOR CHILDREN'S USE

SUGGESTED REACH RANGES FOR CHILDREN AGES 3 THROUGH 12			
Forward or Side Reach	Ages 3 and 4	Ages 5 through 8	Ages 9 through 12
High (maximum)	36 inches (914 mm)	40 inches (1016 mm)	44 inches (1118 mm)
Low (minimum)	20 inches (508 mm)	18 inches (457 mm)	16 inches (406 mm)

11B-309 Operable parts

11B-309.1 General. Operable parts shall comply with Section 11B-309.

11B-309.2 Clear floor space. A clear floor or ground space complying with Section 11B-305 shall be provided.

11B-309.3 Height. Operable parts shall be placed within one or more of the reach ranges specified in Section 11B-308.

11B-309.4 Operation. Operable parts shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist. The force required to activate operable parts shall be 5 pounds (22.2 N) maximum.

Exception: Gas pump nozzles and electric vehicle connectors shall not be required to provide operable parts that have an activating force of 5 pounds (22.2 N) maximum.

DIVISION 4: ACCESSIBLE ROUTES

11B-401 General

11B-401.1 Scope. The provisions of *Division 4* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-402 Accessible routes

11B-402.1 General. Accessible routes shall comply with 11B-402.

11B-402.2 Components. Accessible routes shall consist of one or more of the following components: walking surfaces with a running slope not steeper than 1:20, doorways, ramps, curb ramps excluding the flared sides, elevators and platform lifts. All components of an accessible route shall comply with the applicable requirements of *Division 4*.

11B-403 Walking surfaces

11B-403.1 General. Walking surfaces that are a part of an accessible route shall comply with *Section 11B-403*.

11B-403.2 Floor or ground surface. Floor or ground surfaces shall comply with *Section 11B-302*.

11B-403.3 Slope. The running slope of walking surfaces shall not be steeper than 1:20. The cross slope of walking surfaces shall not be steeper than 1:48.

Exception: *The running slope of sidewalks shall not exceed the general grade established for the adjacent street or highway.*

11B-403.4 Changes in level. Changes in level shall comply with *Section 11B-303*.

11B-403.5 Clearances. Walking surfaces shall provide clearances complying with *Section 11B-403.5*.

Exception: Within employee work areas, clearances on common use circulation paths shall be permitted to be decreased by work area equipment provided that the decrease is essential to the function of the work being performed.

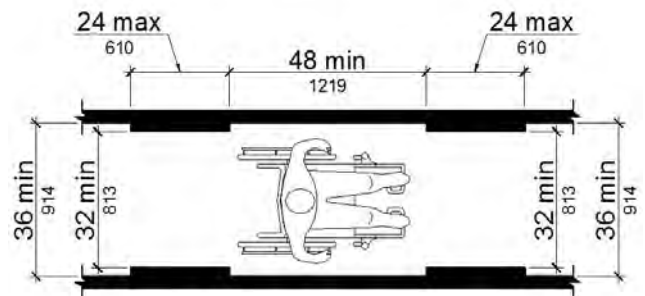
11B-403.5.1 Clear width. Except as provided in *Sections 11B-403.5.2* and *11B-403.5.3*, the clear width of walking surfaces shall be 36 inches (914 mm) minimum.

Exceptions:

1. The clear width shall be permitted to be reduced to 32 inches (813 mm) minimum for a length of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.
2. The clear width for walking surfaces in corridors serving an occupant load of 10 or more shall be 44 inches (1118 mm) minimum.
3. The clear width for sidewalks and walks shall be 48 inches (1219 mm) minimum. When, because of right-of-way restrictions, natural barriers or other existing conditions, the enforcing agency

determines that compliance with the 48-inch (1219 mm) clear sidewalk width would create an unreasonable hardship, the clear width may be reduced to 36 inches (914 mm).

4. The clear width for aisles shall be 36 inches (914 mm) minimum if serving elements on only one side, and 44 inches (1118 mm) minimum if serving elements on both sides.
5. The clear width for accessible routes to accessible toilet compartments shall be 44 inches (1118 mm) except for door-opening widths and door swings.



**FIGURE 11B-403.5.1
CLEAR WIDTH OF AN ACCESSIBLE ROUTE**

11B-403.5.2 Clear width at turn. Where the accessible route makes a 180 degree turn around an element which is less than 48 inches (1219 mm) wide, clear width shall be 42 inches (1067 mm) minimum approaching the turn, 48 inches (1219 mm) minimum at the turn and 42 inches (1067 mm) minimum leaving the turn.

Exception: Where the clear width at the turn is 60 inches (1524 mm) minimum compliance with *Section 11B-403.5.2* shall not be required.

11B-403.5.3 Passing spaces. An accessible route with a clear width less than 60 inches (1524 mm) shall provide passing spaces at intervals of 200 feet (60,960 mm) maximum. Passing spaces shall be either: a space 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum; or, an intersection of two walking surfaces providing a T-shaped space complying with *Section 11B-304.3.2* where the base and arms of the T-shaped space extend 48 inches (1219 mm) minimum beyond the intersection.

11B-403.6 Handrails. Where handrails are provided along walking surfaces with running slopes not steeper than 1:20 they shall comply with *Section 11B-505*.

11B-403.7 Continuous gradient. All walks with continuous gradients shall have resting areas, 60 inches (1524 mm) in length, at intervals of 400 feet (121,920 mm) maximum. The resting area shall be at least as wide as the walk. The slope of the resting area in all directions shall be 1:48 maximum.

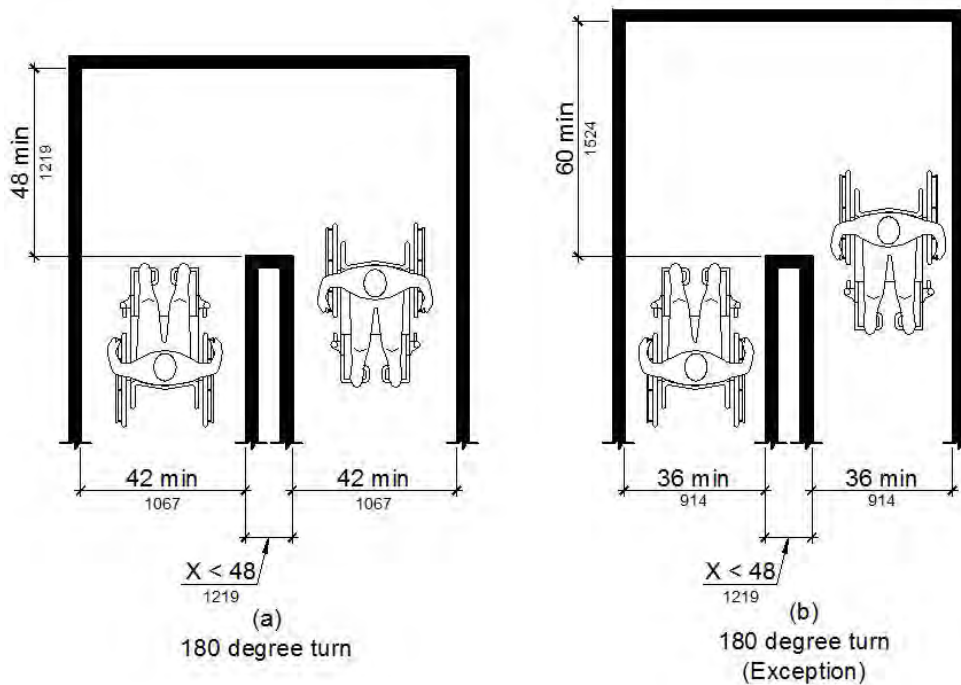


FIGURE 11B-403.5.2
CLEAR WIDTH AT TURN

11B-404 Doors, doorways and gates

11B-404.1 General. Doors, doorways and gates that are part of an accessible route shall comply with Section 11B-404.

Exceptions:

1. Doors, doorways and gates designed to be operated only by security personnel shall not be required to comply with Sections 11B-404.2.7, 11B-404.2.8, 11B-404.2.9, 11B-404.3.2 and 11B-404.3.4 through 11B-404.3.7. A sign visible from the approach side complying with Section 11B-703.5 shall be posted stating “Entry restricted and controlled by security personnel”.
2. At detention and correctional facilities, doors, doorways and gates designed to be operated only by security personnel shall not be required to comply with Sections 11B-404.2.7, 11B-404.2.8, 11B-404.2.9, 11B-404.3.2 and 11B-404.3.4 through 11B-404.3.7.

11B-404.2 Manual doors, doorways and manual gates. Manual doors and doorways and manual gates intended for user passage shall comply with Section 11B-404.2.

11B-404.2.1 Revolving doors, gates and turnstiles. Revolving doors, revolving gates and turnstiles shall not be part of an accessible route.

11B-404.2.2 Double-leaf doors and gates. At least one of the active leaves of doorways with two leaves shall comply with Sections 11B-404.2.3 and 11B-404.2.4.

11B-404.2.3 Clear width. Door openings shall provide a clear width of 32 inches (813 mm) minimum. Clear openings of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees. Openings more than 24 inches (610 mm) deep shall provide a clear opening of 36 inches (914 mm) minimum. There shall be no projections into the required clear opening width lower than 34 inches (864 mm) above the finish floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the finish floor or ground shall not exceed 4 inches (102 mm).

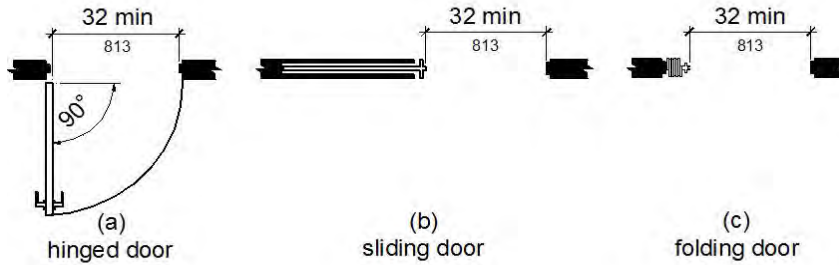
Exceptions:

1. In alterations, a projection of $\frac{5}{8}$ inch (15.9 mm) maximum into the required clear width shall be permitted for the latch side stop.
2. Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the finish floor or ground.

11B-404.2.4 Maneuvering clearances. Minimum maneuvering clearances at doors and gates shall comply with Section 11B-404.2.4. Maneuvering clearances shall extend the full width of the doorway and the required latch side or hinge side clearance.

Exception: Reserved.

11B-404.2.4.1 Swinging doors and gates. Swinging doors and gates shall have maneuvering clearances complying with Table 11B-404.2.4.1.



**FIGURE 11B-404.2.3
CLEAR WIDTH OF DOORWAYS**

**TABLE 11B-404.2.4.1
MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES**

TYPE OF USE		MINIMUM MANEUVERING CLEARANCE	
Approach direction	Door or gate side	Perpendicular to doorway	Parallel to doorway (beyond latch side unless noted)
From front	Pull	60 inches (1524 mm)	18 inches (457 mm) ⁵
From front	Push	48 inches (1219 mm)	0 inches (0 mm) ¹
From hinge side	Pull	60 inches (1524 mm)	36 inches (914 mm)
From hinge side	Push	44 inches (1118 mm) ²	22 inches (559 mm) ³
From latch side	Pull	60 inches (1524 mm)	24 inches (610 mm)
From latch side	Push	44 inches (1118 mm) ⁴	24 inches (610 mm)

1. Add 12 inches (305 mm) if closer and latch are provided.
2. Add 4 inches (102 mm) if closer and latch are provided.
3. Beyond hinge side.
4. Add 4 inches (102 mm) if closer is provided.
5. Add 6 inches (152 mm) at exterior side of exterior doors.

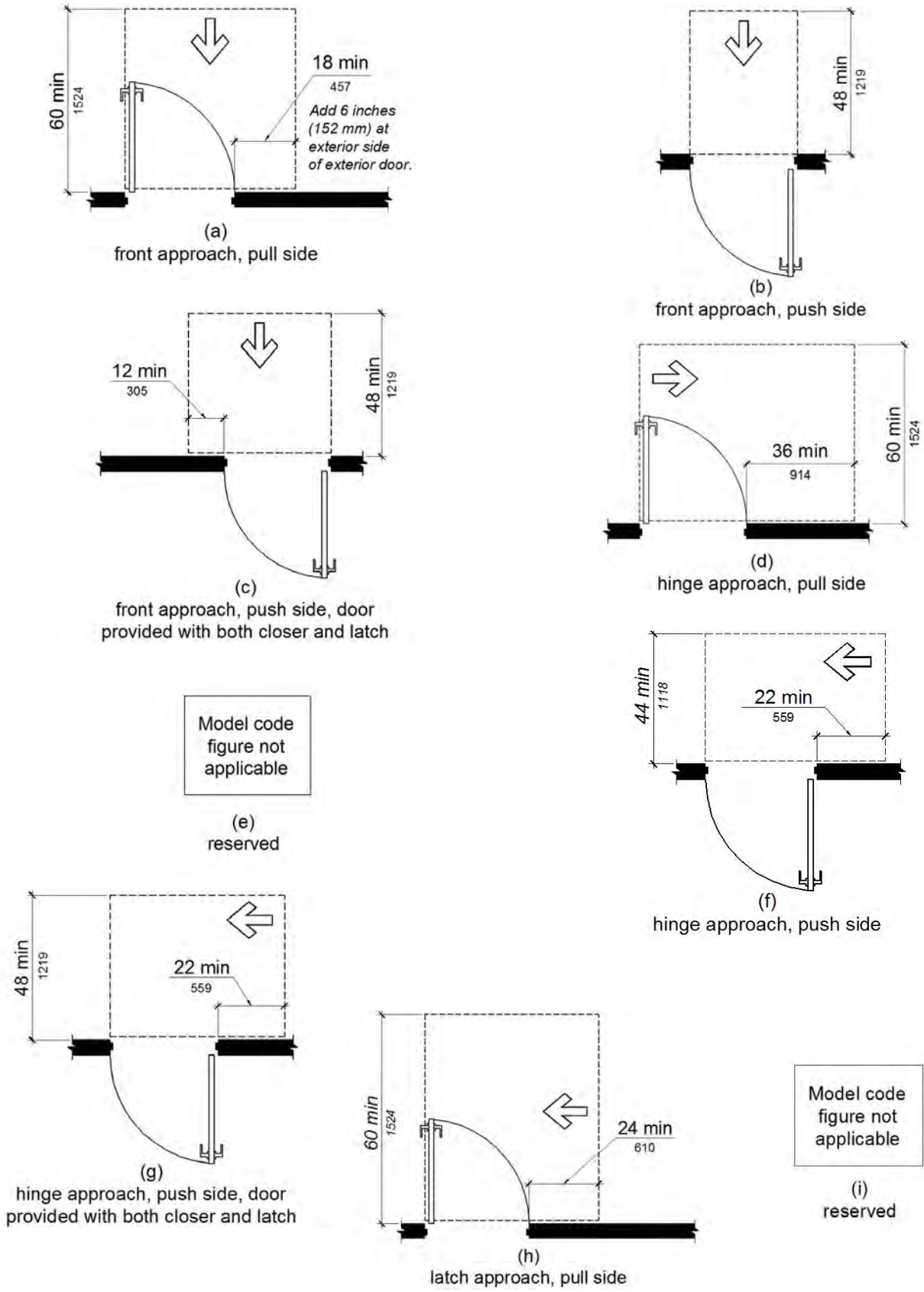


FIGURE 11B-404.2.4.1
 MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES

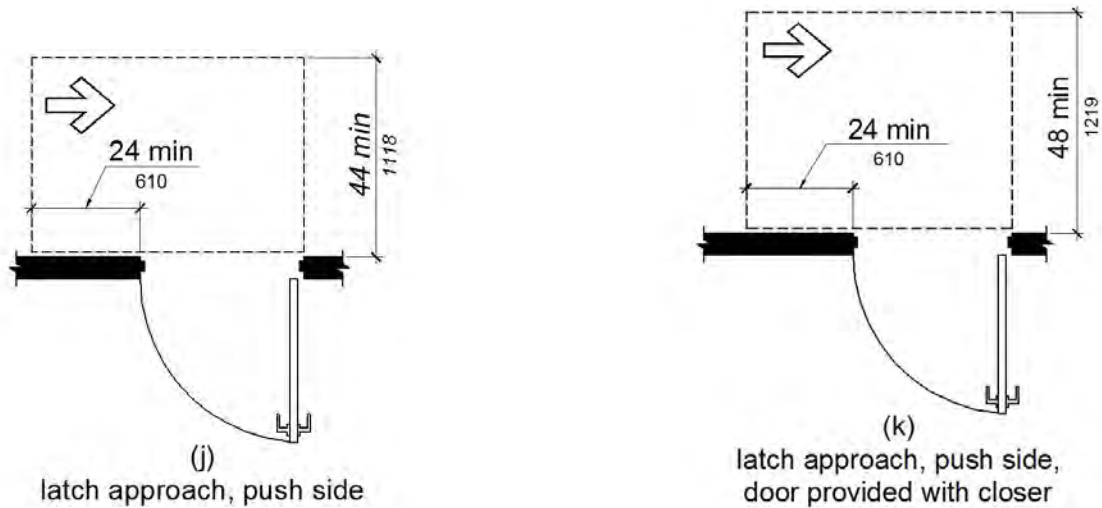


FIGURE 11B-404.2.4.1—continued
MANEUVERING CLEARANCES AT MANUAL SWINGING DOORS AND GATES

11B-404.2.4.2 Doorways without doors or gates, sliding doors and folding doors. Doorways less than 36 inches (914 mm) wide without doors or gates, sliding doors or folding doors shall have maneuvering clearances complying with Table 11B-404.2.4.2.

11B-404.2.4.3 Recessed doors and gates. Maneuvering clearances for forward approach shall be provided when any obstruction within 18 inches (457 mm) of the latch side at an interior doorway, or within 24 inches (610 mm) of the latch side of an exterior doorway, projects more than 8 inches (203 mm) beyond the face of the door, measured perpendicular to the face of the door or gate.

11B-404.2.4.4 Floor or ground surface. Floor or ground surface within required maneuvering clearances shall comply with Section 11B-302. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exceptions:

1. Reserved.
2. Changes in level at thresholds complying with Section 11B-404.2.5 shall be permitted.

11B-404.2.5 Thresholds. Thresholds, if provided at doorways, shall be 1/2 inch (12.7 mm) high maximum. Raised thresholds and changes in level at doorways shall comply with Sections 11B-302 and 11B-303.

Exception: Reserved.

11B-404.2.6 Doors in series and gates in series. The distance between two hinged or pivoted doors in series and gates in series shall be 48 inches (1219 mm) minimum plus the width of doors or gates swinging into the space.

11B-404.2.7 Door and gate hardware. Handles, pulls, latches, locks and other operable parts on doors and gates shall comply with Section 11B-309.4. Operable parts of such hardware shall be 34 inches (864 mm) minimum and 44 inches (1118 mm) maximum above the finish floor or ground. Where sliding doors are in the fully open position, operating hardware shall be exposed and usable from both sides.

Exceptions:

1. Existing locks shall be permitted in any location at existing glazed doors without stiles, existing overhead rolling doors or grilles and similar existing doors or grilles that are designed with locks that are activated only at the top or bottom rail.
2. Access gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the release of latch on self-latching devices at 54 inches (1372 mm) maximum above the finish floor or ground provided the self-latching devices are not also self-locking devices and operated by means of a key, electronic opener or integral combination lock.

11B-404.2.8 Closing speed. Door and gate closing speed shall comply with Section 11B-404.2.8.

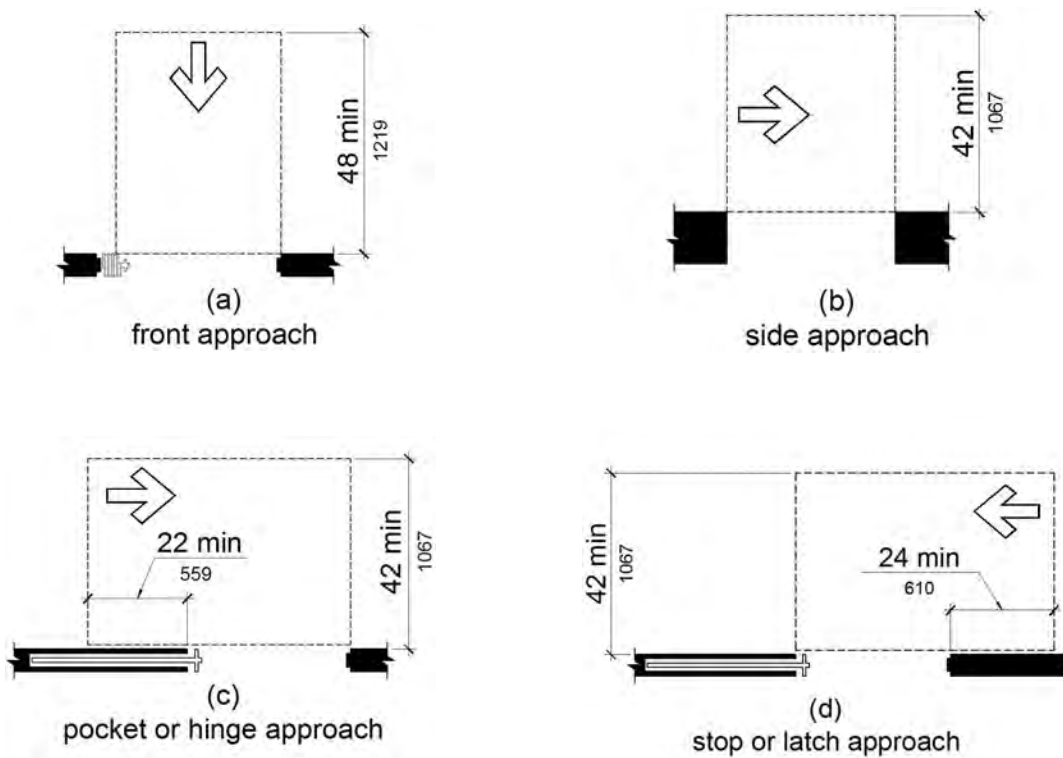
11B-404.2.8.1 Door closers and gate closers. Door closers and gate closers shall be adjusted so that from an open position of 90 degrees, the time required to move the door to a position of 12 degrees from the latch is 5 seconds minimum.

11B-404.2.8.2 Spring hinges. Door and gate spring hinges shall be adjusted so that from the open position of 70 degrees, the door or gate shall move to the closed position in 1.5 seconds minimum.

**TABLE 11B-404.2.4.2
MANEUVERING CLEARANCES AT DOORWAYS WITHOUT DOORS OR
GATES, MANUAL SLIDING DOORS and MANUAL FOLDING DOORS**

Approach direction	MINIMUM MANEUVERING CLEARANCE	
	Perpendicular to doorway	Parallel to doorway (beyond stop/latch side unless noted)
From front	48 inches (1219 mm)	0 inches (0 mm)
From side ¹	42 inches (1067 mm)	0 inches (0 mm)
From pocket/hinge side	42 inches (1067 mm)	22 inches (559 mm) ²
From stop/latch side	42 inches (1067 mm)	24 inches (610 mm)

- 1. Doorway with no door only.
- 2. Beyond pocket/hinge side.



**FIGURE 11B-404.2.4.2
MANEUVERING CLEARANCES AT DOORWAYS WITHOUT DOORS, SLIDING DOORS, GATES and FOLDING DOORS**

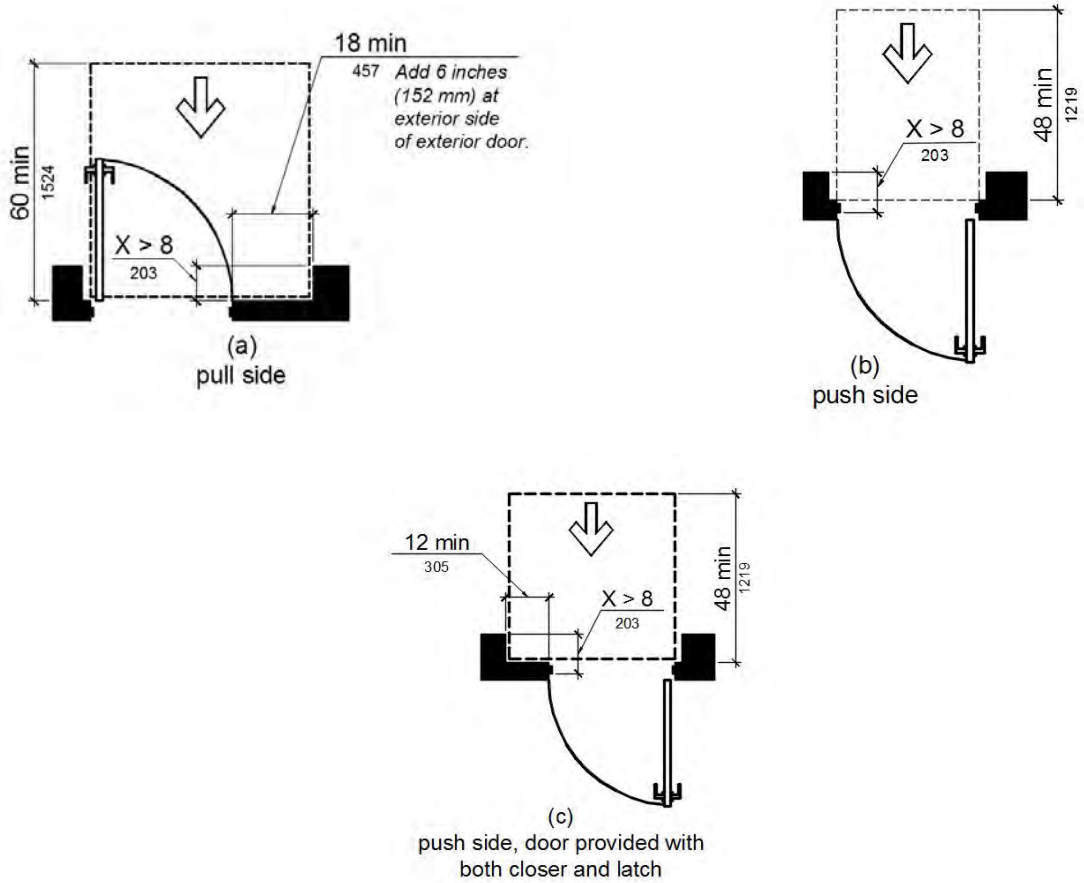


FIGURE 11B-404.2.4.3
MANEUVERING CLEARANCES AT RECESSED DOORS AND GATES

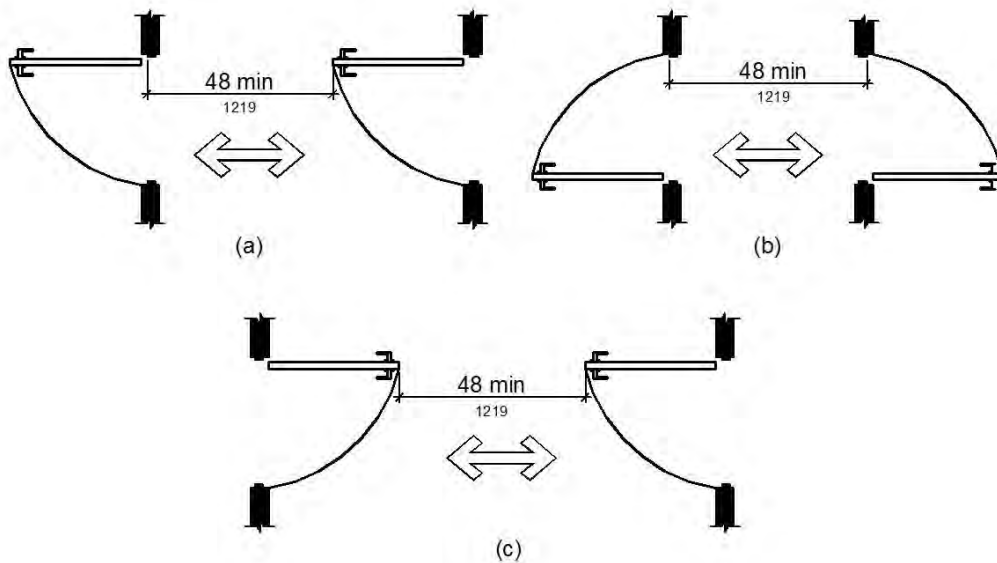


FIGURE 11B-404.2.6
DOORS IN SERIES AND GATES IN SERIES

11B-404.2.9 Door and gate opening force. The force for pushing or pulling open a door or gate shall be as follows:

1. Interior hinged doors and gates: 5 pounds (22.2 N) maximum.
2. Sliding or folding doors: 5 pounds (22.2 N) maximum.
3. Required fire doors: the minimum opening force allowable by the appropriate administrative authority, not to exceed 15 pounds (66.7 N).
4. Exterior hinged doors: 5 pounds (22.2 N) maximum.

These forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door or gate in a closed position.

Exception: When, at a single location, one of every eight exterior door leaves, or fraction of eight, is a powered door, other exterior doors at the same location, serving the same interior space, may have a maximum opening force of 8.5 pounds (37.8 N). The powered leaf(s) shall be located closest to the accessible route.

- a. Powered doors shall comply with Section 11B-404.3. Powered doors shall be fully automatic doors complying with Builders Hardware Manufacturers' Association (BHMA) A156.10 or low energy operated doors complying with BHMA A156.19.
- b. Powered doors serving a building or facility with an occupancy of 150 or more shall be provided with a back-up battery or back-up generator. The back-up power source shall be able to cycle the door a minimum of 100 cycles.
- c. Powered doors shall be controlled on both the interior and exterior sides of the doors by sensing devices, push plates, vertical actuation bars or other similar operating devices complying with Section 11B-309.

At each location where push plates are provided there shall be two push plates; the centerline of one push plate shall be 7 inches (178 mm) minimum and 8 inches (203 mm) maximum above the floor or ground surface and the centerline of the second push plate shall be 30 inches (762 mm) minimum and 44 inches (1118 mm) maximum above the floor or ground surface. Each push plate shall be a minimum of 4 inches (102 mm) diameter or a minimum of 4 inches by 4 inches (102 mm by 102 mm) square and shall display the International Symbol of Accessibility complying with Section 11B-703.7.

At each location where vertical actuation bars are provided the operable portion shall be located so the bottom is 5 inches (127 mm) maximum above the floor or ground surface and the top is 35 inches (889 mm) minimum above the floor or ground surface. The operable portion of each vertical actuation bar shall be a minimum of 2 inches (51 mm) wide and shall display the

International Symbol of Accessibility complying with Section 11B-703.7.

Where push plates, vertical actuation bars or other similar operating devices are provided, they shall be placed in a conspicuous location. A level and clear floor or ground space for forward or parallel approach complying with Section 11B-305 shall be provided, centered on the operating device. Doors shall not swing into the required clear floor or ground space.

- d. Signs identifying the accessible entrance required by Section 11B-216.6 shall be placed on, or immediately adjacent to, each powered door. Signs shall be provided in compliance with BHMA A156.10 or BHMA A156.19, as applicable.
- e. In addition to the requirements of Item d, where a powered door is provided in buildings or facilities containing assembly occupancies of 300 or more, a sign displaying the International Symbol of Accessibility measuring 6 inches by 6 inches (152 mm by 152 mm), complying with Section 11B-703.7, shall be provided above the door on both the interior and exterior sides of each powered door.

11B-404.2.10 Door and gate surfaces. Swinging door and gate surfaces within 10 inches (254 mm) of the finish floor or ground measured vertically shall have a smooth surface on the push side extending the full width of the door or gate. Parts creating horizontal or vertical joints in these surfaces shall be within $\frac{1}{16}$ inch (1.6 mm) of the same plane as the other and be free of sharp or abrasive edges. Cavities created by added kick plates shall be capped.

Exceptions:

1. Sliding doors shall not be required to comply with Section 11B-404.2.10.
2. Tempered glass doors without stiles and having a bottom rail or shoe with the top leading edge tapered at 60 degrees minimum from the horizontal shall not be required to meet the 10 inch (254 mm) bottom smooth surface height requirement.
3. Doors and gates that do not extend to within 10 inches (254 mm) of the finish floor or ground shall not be required to comply with Section 11B-404.2.10.
4. Reserved.

11B-404.2.11 Vision lights. Doors, gates and side lights adjacent to doors or gates, containing one or more glazing panels that permit viewing through the panels shall have the bottom of at least one glazed panel located 43 inches (1092 mm) maximum above the finish floor.

Exception: Glazing panels with the lowest part more than 66 inches (1676 mm) from the finish floor or ground shall not be required to comply with Section 11B-404.2.11.

11B-404.3 Automatic and power-assisted doors and gates. Automatic doors and automatic gates shall comply with Sec-

tion 11B-404.3. Full-powered automatic doors shall comply with ANSI/BHMA A156.10. Low-energy and power-assisted doors shall comply with ANSI/BHMA A156.19.

11B-404.3.1 Clear width. Doorways shall provide a clear opening of 32 inches (813 mm) minimum in power-on and power-off mode. The minimum clear width for automatic door systems in a doorway shall provide a clear, unobstructed opening of 32 inches (813 mm) with one leaf positioned at an angle of 90 degrees from its closed position.

11B-404.3.2 Maneuvering clearance. Clearances at power-assisted doors and gates shall comply with Section 11B-404.2.4. Clearances at automatic doors and gates without standby power and serving an accessible means of egress shall comply with Section 11B-404.2.4.

Exception: Where automatic doors and gates remain open in the power-off condition, compliance with Section 11B-404.2.4 shall not be required.

11B-404.3.3 Thresholds. Thresholds and changes in level at doorways shall comply with Section 11B-404.2.5.

11B-404.3.4 Doors in series and gates in series. Doors in series and gates in series shall comply with Section 11B-404.2.6.

11B-404.3.5 Controls. Manually operated controls shall comply with Section 11B-309. The clear floor space adjacent to the control shall be located beyond the arc of the door swing.

11B-404.3.6 Break out opening. Where doors and gates without standby power are a part of a means of egress, the clear break out opening at swinging or sliding doors and gates shall be 32 inches (813 mm) minimum when operated in emergency mode.

Exception: Where manual swinging doors and gates comply with Section 11B-404.2 and serve the same means of egress compliance with Section 11B-404.3.6 shall not be required.

11B-404.3.7 Revolving doors, revolving gates and turnstiles. Revolving doors, revolving gates and turnstiles shall not be part of an accessible route.

11B-405 Ramps

11B-405.1 General. Ramps on accessible routes shall comply with Section 11B-405.

Exception: In assembly areas, aisle ramps adjacent to seating and not serving elements required to be on an accessible route shall not be required to comply with Section 11B-405.

11B-405.2 Slope. Ramp runs shall have a running slope not steeper than 1:12.

Exception: Reserved.

11B-405.3 Cross slope. Cross slope of ramp runs shall not be steeper than 1:48.

11B-405.4 Floor or ground surfaces. Floor or ground surfaces of ramp runs shall comply with Section 11B-302. Changes in level other than the running slope and cross slope are not permitted on ramp runs.

11B-405.5 Clear width. The clear width of a ramp run shall be 48 inches (1219 mm) minimum.

Exceptions:

1. Within employee work areas, the required clear width of ramps that are a part of common use circulation paths shall be permitted to be decreased by work area equipment provided that the decrease is essential to the function of the work being performed.
2. Handrails may project into the required clear width of the ramp at each side 3¹/₂ inches (89 mm) maximum at the handrail height.
3. The clear width of ramps in residential uses serving an occupant load of fifty or less shall be 36 inches (914 mm) minimum between handrails.

11B-405.6 Rise. The rise for any ramp run shall be 30 inches (762 mm) maximum.

11B-405.7 Landings. Ramps shall have landings at the top and the bottom of each ramp run. Landings shall comply with Section 11B-405.7.

11B-405.7.1 Slope. Landings shall comply with Section 11B-302. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-405.7.2 Width. The landing clear width shall be at least as wide as the widest ramp run leading to the landing.

11B-405.7.2.1: Top landings shall be 60 inches (1524 mm) wide minimum.

11B-405.7.3 Length. The landing clear length shall be 60 inches (1524 mm) long minimum.

11B-405.7.3.1: Bottom landings shall extend 72 inches (1829 mm) minimum in the direction of ramp run.

11B-405.7.4 Change in direction. Ramps that change direction between runs at landings shall have a clear landing 60 inches (1525 mm) minimum by 72 inches (1829 mm) minimum in the direction of downward travel from the upper ramp run.

11B-405.7.5 Doorways. Where doorways are located adjacent to a ramp landing, maneuvering clearances required by Sections 11B-404.2.4 and 11B-404.3.2 shall be permitted to overlap the required landing area. Doors, when fully open, shall not reduce the required ramp landing width by more than 3 inches (76 mm). Doors, in any position, shall not reduce the minimum dimension of the ramp landing to less than 42 inches (1067 mm).

11B-405.8 Handrails. Ramp runs shall have handrails complying with Section 11B-505.

Exceptions:

1. Reserved.
2. Reserved.
3. Curb ramps do not require handrails.
4. At door landings, handrails are not required on ramp runs less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

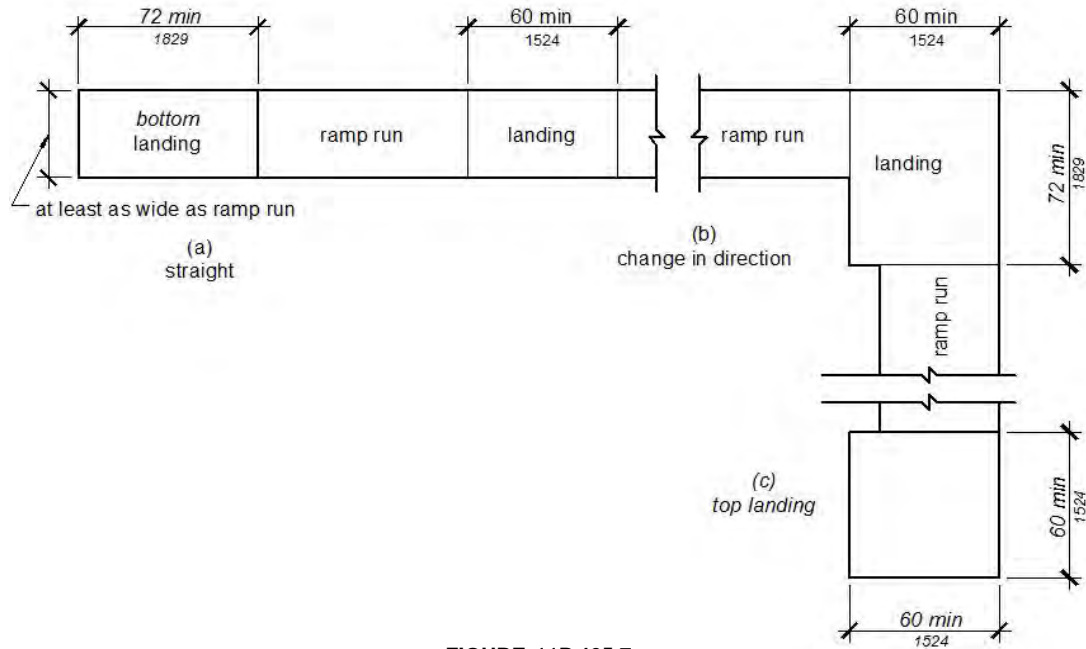


FIGURE 11B-405.7 RAMP LANDINGS

11B-405.9 Edge protection. Edge protection complying with Section 11B-405.9.2 shall be provided on each side of ramp runs and at each side of ramp landings.

Exceptions:

1. Edge protection shall not be required on ramps that are not required to have handrails and have sides complying with Section 11B-406.2.2.
2. Edge protection shall not be required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection shall not be required on the sides of ramp landings having a vertical drop-off of 1/2 inch (12.7 mm) maximum within 10 inches (254 mm) horizontally of the minimum landing area specified in Section 11B-405.7.

11B-405.9.1 Reserved.

11B-405.9.2 Curb or barrier. A curb or barrier shall be provided that prevents the passage of a 4-inch (102 mm) diameter sphere, where any portion of the sphere is within 4 inches (102 mm) of the finish floor or ground surface. To prevent wheel entrapment, the curb or barrier shall provide a continuous and uninterrupted barrier along the length of the ramp.

11B-405.10 Wet conditions. Landings subject to wet conditions shall be designed to prevent the accumulation of water.

11B-406 Curb ramps, blended transitions and islands

11B-406.1 General. Curb ramps, blended transitions and islands on accessible routes shall comply with Section 11B-406. Curb ramps may be perpendicular, parallel, or a combination of perpendicular and parallel.

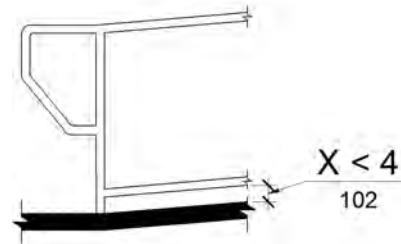


FIGURE 11B-405.9.2 CURB OR BARRIER EDGE PROTECTION

11B-406.1.1 Perpendicular curb ramps. Perpendicular curb ramps shall comply with Section 11B-406.2.

11B-406.1.2 Parallel curb ramps. Parallel curb ramps shall comply with Section 11B-406.3.

11B-406.1.3 Blended transitions. Blended transitions shall comply with Section 11B-406.4.

11B-406.1.4 Islands. Islands shall comply with Section 11B-406.6.

11B-406.2 Perpendicular curb ramps. Perpendicular curb ramps shall comply with Sections 11B-406.2 and 11B-406.5.

11B-406.2.1 Slope. Ramp runs shall have a running slope not steeper than 1:12.

11B-406.2.2 Sides of curb ramps. Where provided, curb ramp flares shall not be steeper than 1:10.

11B-406.3 Parallel curb ramps. Parallel curb ramps shall comply with Sections 11B-406.3 and 11B-406.5. A parallel curb ramp may be provided with one sloping segment or two opposing sloping segments.

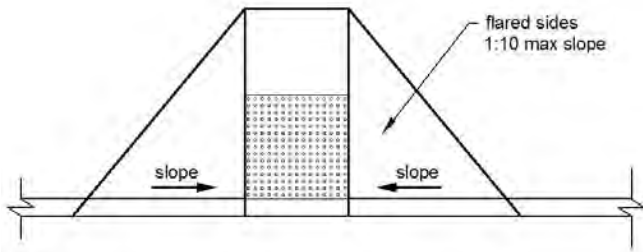


FIGURE 11B-406.2.2
SIDES OF CURB RAMPS

11B-406.3.1 Slope. The running slope of the curb ramp segments shall be in-line with the direction of sidewalk travel. Ramp runs shall have a running slope not steeper than 1:12.

11B-406.3.2 Turning space. A turning space 48 inches (1219 mm) minimum by 48 inches (1219 mm) minimum shall be provided at the bottom of the curb ramp. The slope of the turning space in all directions shall be 1:48 maximum.

11B-406.4 Blended transitions. Blended transitions shall comply with Sections 11B-406.4 and 11B-406.5.

11B-406.4.1 Slope. Blended transitions shall have a running slope not steeper than 1:20.

11B-406.5 Common requirements. Curb ramps and blended transitions shall comply with Section 11B-406.5.

11B-406.5.1 Location. Curb ramps and the flared sides of curb ramps shall be located so that they do not project into vehicular traffic lanes, parking spaces or parking access aisles. Curb ramps at marked crossings shall be wholly contained within the markings, excluding any flared sides.

Exception: Diagonal curb ramps shall comply with Section 11B-406.5.9.

11B-406.5.2 Width. The clear width of curb ramp runs (excluding any flared sides), blended transitions, and turning spaces shall be 48 inches (1219 mm) minimum.

11B-406.5.3 Landings. Landings shall be provided at the tops of curb ramps and blended transitions. The landing clear length shall be 48 inches (1219 mm) minimum. The landing clear width shall be at least as wide as the curb ramp, excluding any flared sides, or the blended transition leading to the landing. The slope of the landing in all directions shall be 1:48 maximum.

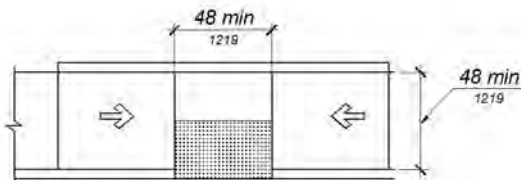


FIGURE 11B-406.3.2
PARALLEL CURB RAMPS

Exception: Parallel curb ramps shall not be required to comply with Section 11B-406.5.3.

11B-406.5.4 Floor or ground surfaces. Floor or ground surfaces of curb ramps and blended transitions shall comply with Section 11B-405.4.

11B-406.5.5 Wet conditions. Curb ramps and blended transitions shall comply with Section 11B-405.10.

11B-406.5.6 Grade breaks. Grade breaks at the top and bottom of curb ramp runs shall be perpendicular to the direction of the ramp run. Grade breaks shall not be permitted on the surface of ramp runs and turning spaces. Surface slopes that meet at grade breaks shall be flush.

11B-406.5.7 Cross slope. The cross slope of curb ramps and blended transitions shall be 1:48 maximum.

11B-406.5.8 Counter slope. Counter slopes of adjoining gutters and road surfaces immediately adjacent to and within 24 inches (610 mm) of the curb ramp shall not be steeper than 1:20. The adjacent surfaces at transitions at curb ramps to walks, gutters and streets shall be at the same level.

11B-406.5.9 Clear space at diagonal curb ramps. The bottom of diagonal curb ramps shall have a clear space 48 inches (1219 mm) minimum outside active traffic lanes of the roadway. Diagonal curb ramps provided at marked crossings shall provide the 48 inches (1219 mm) minimum clear space within the markings.

11B-406.5.10 Diagonal curb ramps. Diagonal or corner type curb ramps are perpendicular or parallel curb ramps that are oriented diagonally at an intersection. Diagonal or corner type curb ramps with returned curbs or other well-defined edges shall have the edges parallel to the direction of pedestrian flow. Diagonal curb ramps with flared sides shall have a segment of curb 24 inches (610 mm) long minimum located on each side of the curb ramp and within the marked crossing.

11B-406.5.11 Reserved.

11B-406.5.12 Detectable warnings. Curb ramps and blended transitions shall have detectable warnings complying with Section 11B-705.

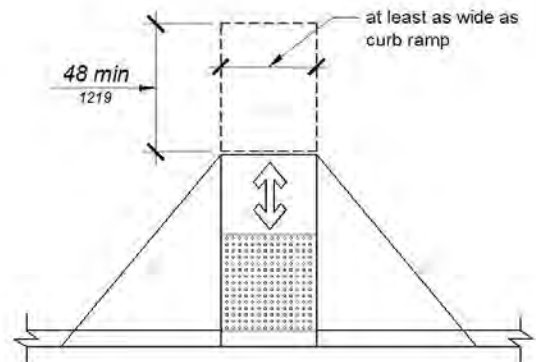


FIGURE 11B-406.5.3
LANDINGS AT THE TOP OF CURB RAMPS

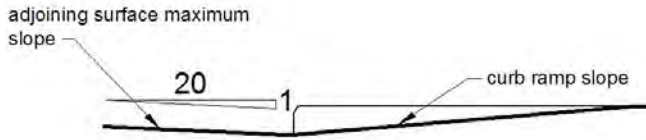


FIGURE 11B-406.5.8
COUNTER SLOPE OF SURFACES ADJACENT TO CURB RAMPS

11B-406.6 Islands. Raised islands in crossings shall be cut through level with the street or have curb ramps at both sides. The clear width of the accessible route at islands shall be 60 inches (1524 mm) wide minimum. Where curb ramps are provided, they shall comply with Section 11B-406. Landings complying with Section 11B-406.5.3 and the accessible route shall be permitted to overlap. Islands shall have detectable warnings complying with Section 11B-705.

11B-407 Elevators

11B-407.1 General. Elevators shall comply with Section 11B-407 and with ASME A17.1 They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

11B-407.1.1 Combined passenger and freight elevators. When the only elevators provided for use by the public and employees are combination passenger and freight elevators, they shall comply with Section 11B-407 and with ASME A17.1.

11B-407.2 Elevator landing requirements. Elevator landings shall comply with Section 11B-407.2.

11B-407.2.1 Call controls. Where elevator call buttons or keypads are provided, they shall comply with Sections 11B-407.2.1 and 11B-309.4.

Exception: Reserved.

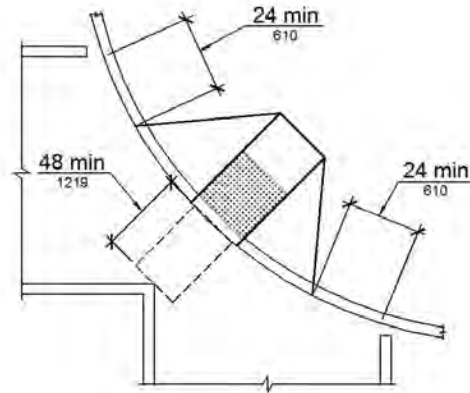


FIGURE 11B-406.5.10
DIAGONAL OR CORNER TYPE CURB RAMPS

11B-407.2.1.1 Height. Call buttons and keypads shall be located within one of the reach ranges specified in Section 11B-308, measured to the centerline of the highest operable part.

Exception: Reserved.

11B-407.2.1.2 Size and shape. Call buttons shall have square shoulders, be $\frac{3}{4}$ inch (19.1 mm) minimum in the smallest dimension and shall be raised $\frac{1}{8}$ inch (3.2 mm) plus or minus $\frac{1}{32}$ inch (0.8 mm) above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable.

Exception: Reserved.

11B-407.2.1.3 Clear floor or ground space. A clear floor or ground space complying with Section 11B-305 shall be provided at call controls.

11B-407.2.1.4 Location. The call button that designates the up direction shall be located above the call button that designates the down direction.

Exception: Reserved.

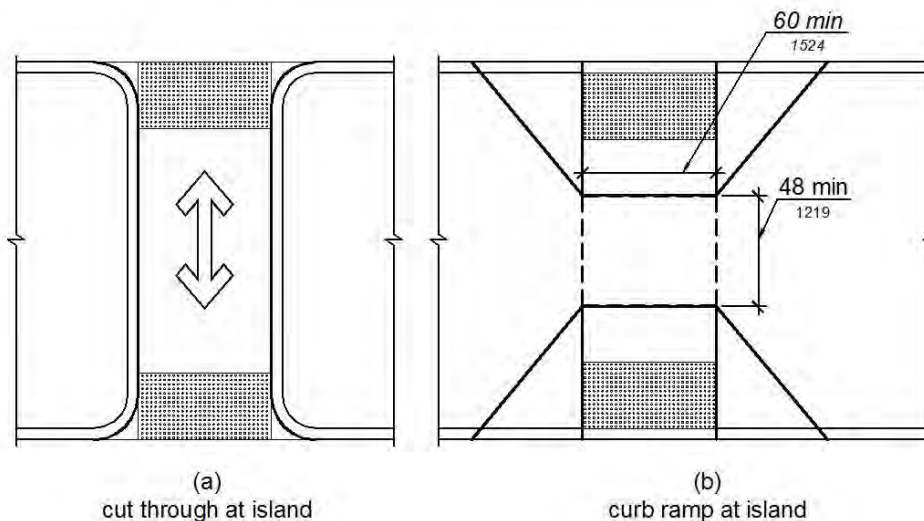


FIGURE 11B-406.6
ISLANDS IN CROSSINGS

11B-407.2.1.5 Signals. Call buttons shall have visible signals that will activate when each call is registered and will extinguish when each call is answered. Call buttons shall be internally illuminated with a white light over the entire surface of the button.

Exceptions:

1. Reserved.
2. Reserved.

11B-407.2.1.6 Keypads. Where keypads are provided, keypads shall be in a standard telephone keypad arrangement and shall comply with Section 11B-407.4.7.2.

11B-407.2.2 Hall signals. Hall signals, including in-car signals, shall comply with Section 11B-407.2.2.

11B-407.2.2.1 Visible and audible signals. A visible and audible signal shall be provided at each hoistway entrance to indicate which car is answering a call and the car's direction of travel. Where in-car signals are provided, they shall be visible from the floor area adjacent to the hall call buttons.

Exceptions:

1. Reserved.
2. Reserved.

11B-407.2.2.2 Visible signals. Visible signal fixtures shall be centered at 72 inches (1829 mm) minimum above the finish floor or ground. The visible signal elements shall be a minimum 2½ inches (64 mm) high by 2½ inches (64 mm) wide. Signals shall be visible from the floor area adjacent to the hall call button.

Exceptions:

1. Reserved.
2. Reserved.

11B-407.2.2.3 Audible signals. Audible signals shall sound once for the up direction and twice for the down direction, or shall have verbal annunciators that indicate the direction of elevator car travel. Audible signals shall have a frequency of 1500 Hz maximum. Verbal annunciators shall have a frequency of 300 Hz minimum and 3000 Hz maximum. The audible signal and verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the hall call button.

Exceptions:

1. Reserved
2. Reserved.

11B-407.2.2.4 Reserved

11B-407.2.3 Hoistway signs. Signs at elevator hoistways shall comply with Section 11B-407.2.3.

11B-407.2.3.1 Floor designation. Floor designations complying with Sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Floor designations shall be provided in both

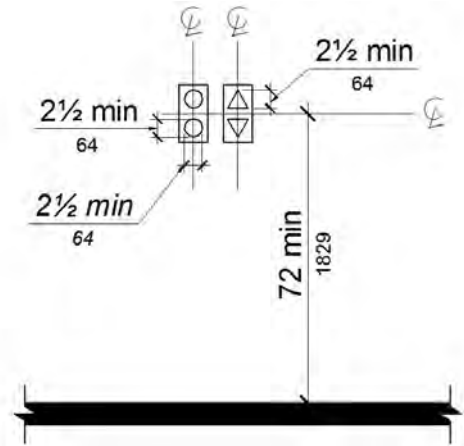


FIGURE 11B-407.2.2.2 VISIBLE HALL SIGNALS

raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. A raised star, placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches (51 mm) and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with Section 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be "MAIN". Applied plates are acceptable if they are permanently fixed to the jamb.

11B-407.2.3.2 Reserved

11B-407.3 Elevator door requirements. Hoistway and car doors shall comply with Section 11B-407.3.

11B-407.3.1 Type. Elevator doors shall be the horizontal sliding type. Car gates shall be prohibited.

11B-407.3.2 Operation. Elevator hoistway and car doors shall open and close automatically.

Exception: Existing manually operated hoistway swing doors shall be permitted provided that they comply with Sections 11B-404.2.3 and 11B-404.2.9. Car door closing shall not be initiated until the hoistway door is closed.

11B-407.3.3 Reopening device. Elevator doors shall be provided with a reopening device complying with Section 11B-407.3.3 that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person.

Exception: Existing elevators with manually operated doors shall not be required to comply with Section 11B-407.3.3.

11B-407.3.3.1 Height. The device shall be activated by sensing an obstruction passing through the opening at 5 inches (127 mm) nominal and 29 inches (737 mm) nominal above the finish floor.

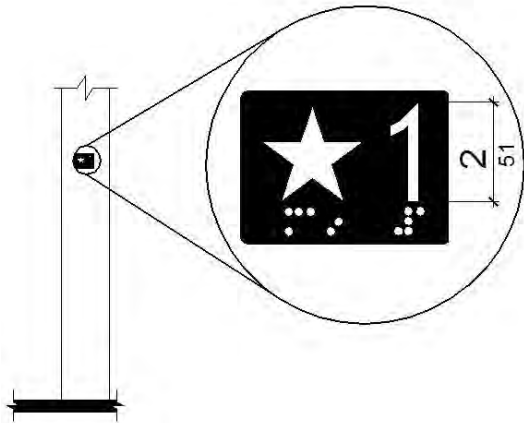


FIGURE 11B-407.2.3.1
FLOOR DESIGNATIONS ON JAMBS
OF ELEVATOR HOISTWAY ENTRANCES

11B-407.3.3.2 Contact. The device shall not require physical contact to be activated, although contact is permitted to occur before the door reverses.

11B-407.3.3.3 Duration. Door reopening devices shall remain effective for 20 seconds minimum.

11B-407.3.4 Door and signal timing. The minimum acceptable time from notification that a car is answering a call until the doors of that car start to close shall be calculated from the following equation:

$T = D/(1.5 \text{ ft/s})$ or $T = D/(457 \text{ mm/s}) = 5$ seconds minimum where T equals the total time in seconds and D equals the distance (in feet or millimeters) from the point in the lobby or corridor 60 inches (1524 mm) directly in front of the farthest call button controlling that car to the centerline of its hoistway door.

Exceptions:

1. For cars with in-car lanterns, T shall be permitted to begin when the signal is visible from the point 60 inches (1524 mm) directly in front of the farthest hall call button and the audible signal is sounded.
2. *Reserved.*

11B-407.3.5 Door delay. Elevator doors shall remain fully open in response to a car call for 5 seconds minimum.

11B-407.3.6 Width. The width of elevator doors shall comply with Table 11B-407.4.1.

Exception: In existing elevators, a power-operated car door complying with Section 11B-404.2.3 shall be permitted.

11B-407.4 Elevator car requirements. Elevator cars shall comply with Section 11B-407.4.

11B-407.4.1 Car dimensions. Inside dimensions of elevator cars and clear width of elevator doors shall comply with Table 11B-407.4.1.

Exception: In existing buildings, where existing shaft configuration prohibits strict compliance with Section 11B-407.4.1, existing elevator car configurations that provide a clear floor area of 18 square feet (1.67 m²) minimum and also provide an inside clear depth 54 inches (1372 mm) minimum and a clear width 48 inches (1219 mm) minimum shall be permitted.

11B-407.4.2 Floor surfaces. Floor surfaces in elevator cars shall comply with Sections 11B-302 and 11B-303.

11B-407.4.3 Platform to hoistway clearance. The clearance between the car platform sill and the edge of any hoistway landing shall be 1¹/₄ inch (32 mm) maximum.

11B-407.4.4 Leveling. Each car shall be equipped with a self-leveling feature that will automatically bring and maintain the car at floor landings within a tolerance of 1/2 inch (12.7 mm) under rated loading to zero loading conditions.

11B-407.4.5 Illumination. The level of illumination at the car controls, platform, car threshold and car landing sill shall be 5 foot candles (54 lux) minimum.

11B-407.4.6 Elevator car controls. Where provided, elevator car controls shall comply with Sections 11B-407.4.6 and 11B-309.4.

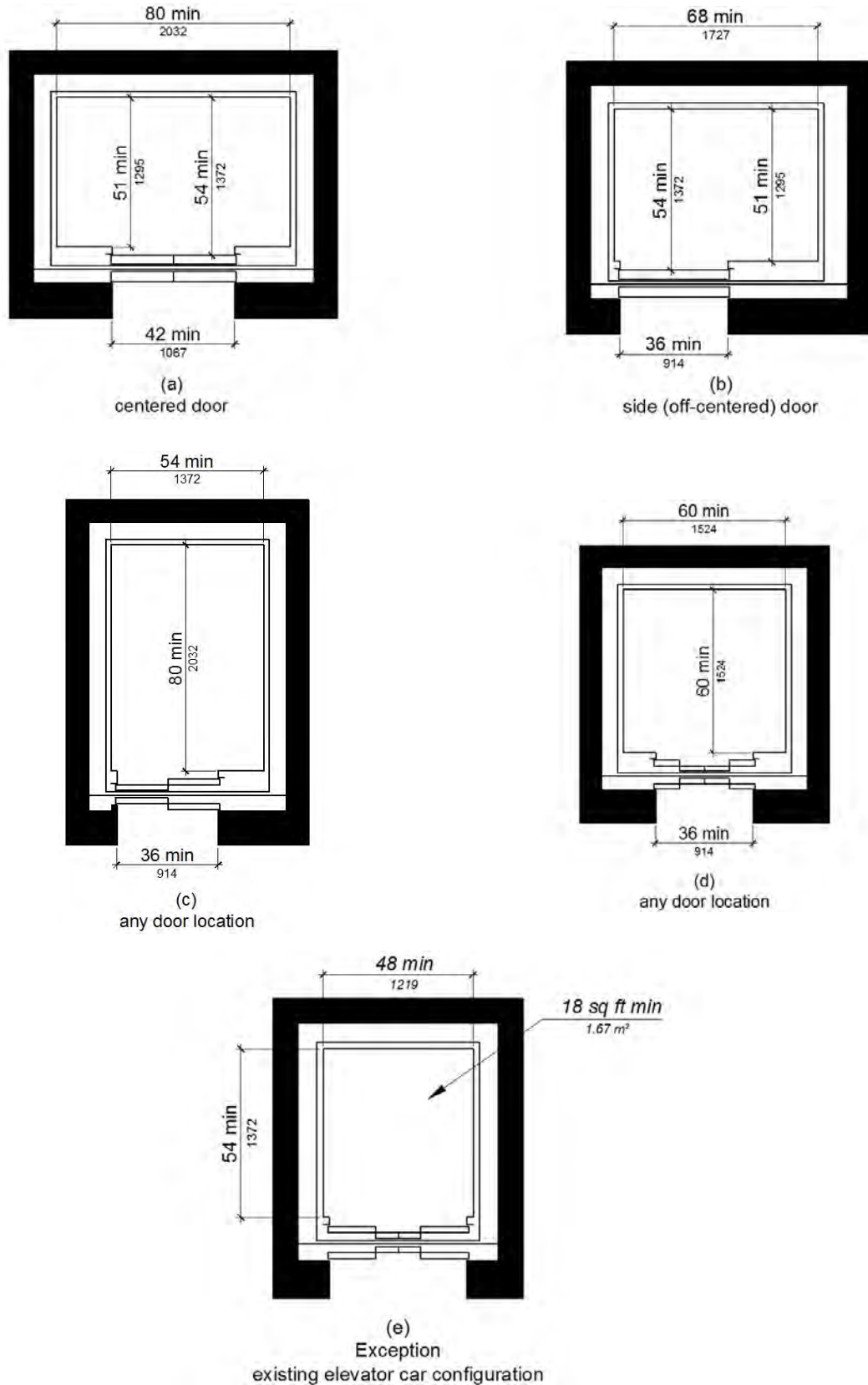
Exception: In existing elevators, where a new car operating panel complying with Section 11B-407.4.6 is provided, existing car operating panels may remain operational and shall not be required to comply with Section 11B-407.4.6.

TABLE 11B-407.4.1
ELEVATOR CAR DIMENSIONS

Door location	MINIMUM DIMENSIONS			
	Door clear width	Inside car, side to side	Inside car, back wall to front return	Inside car, back wall to inside face of door
Centered	42 inches (1067 mm)	80 inches (2032 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Side (off-centered)	36 inches (914 mm) ¹	68 inches (1727 mm)	51 inches (1295 mm)	54 inches (1372 mm)
Any	36 inches (914 mm) ¹	54 inches (1372 mm)	80 inches (2032 mm)	80 inches (2032 mm)
Any	36 inches (914 mm) ²	60 inches (1524 mm) ²	60 inches (1524 mm) ²	60 inches (1524 mm) ²

1. A tolerance of minus 3/8 inch (15.9 mm) is permitted.

2. Other car configurations that provide a turning space complying with Section 11B-304 with the door closed shall be permitted.



**FIGURE 11B-407.4.1
 ELEVATOR CAR DIMENSIONS**

11B-407.4.6.1 Location. Controls shall be located within one of the reach ranges specified in *Section 11B-308*.

Exceptions:

1. Where the elevator panel serves more than 16 openings and a parallel approach is provided, buttons with floor designations shall be permitted to be 54 inches (1372 mm) maximum above the finish floor.
2. In existing elevators, car control buttons with floor designations shall be permitted to be located 54 inches (1372 mm) maximum above the finish floor where a parallel approach is provided.

11B-407.4.6.2 Buttons. Car control buttons with floor designations shall comply with *Section 11B-407.4.6.2*.

Exception: Reserved.

11B-407.4.6.2.1 Size and shape. Buttons shall have square shoulders, be $\frac{3}{4}$ inch (19.1 mm) minimum in their smallest dimension and be raised $\frac{1}{8}$ inch (3.2 mm) plus or minus $\frac{1}{32}$ inch (0.8 mm) above the surrounding surface.

11B-407.4.6.2.2 Arrangement. Buttons shall be arranged with numbers in ascending order. When two or more columns of buttons are provided they shall read from left to right.

11B-407.4.6.2.3 Illumination. Car control buttons shall be illuminated.

11B-407.4.6.2.4 Operation. Car control buttons shall be activated by a mechanical motion that is detectable.

11B-407.4.6.3 Keypads. Car control keypads shall be in a standard telephone keypad arrangement and shall comply with *Section 11B-407.4.7.2*.

11B-407.4.6.4 Emergency controls. Emergency controls shall comply with *Section 11B-407.4.6.4*.

11B-407.4.6.4.1 Height. Emergency control buttons shall have their centerlines 35 inches (889 mm) minimum above the finish floor.

11B-407.4.6.4.2 Location. Emergency controls, including the emergency alarm, shall be grouped at the bottom of the panel.

11B-407.4.7 Designations and indicators of car controls. Designations and indicators of car controls shall comply with *Section 11B-407.4.7*.

Exception: In existing elevators, where a new car operating panel complying with *Section 11B-407.4.7* is provided, existing car operating panels may remain operational and shall not be required to comply with *Section 11B-407.4.7*.

11B-407.4.7.1 Buttons. Car control buttons shall comply with *Section 11B-407.4.7.1*.

11B-407.4.7.1.1 Type. Control buttons shall be identified by raised characters or symbols, white on a black background, complying with *Section 11B-703.2* and Braille complying with *Section 11B-703.3*.






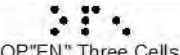



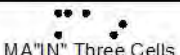

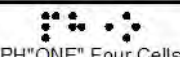
11B-407.4.7.1.2 Location. Raised characters or symbols and Braille designations shall be placed immediately to the left of the control button to which the designations apply.

Exception: Reserved.

11B-407.4.7.1.3 Symbols. The control button for the emergency stop, alarm, door open, door close, main entry floor and phone, shall be identified with raised symbols and Braille as shown in *Table 11B-407.4.7.1.3*.

11B-407.4.7.1.4 Visible indicators. Buttons with floor designations shall be provided with visible indicators to show that a call has been registered. The visible indication shall extinguish when the car arrives at the designated floor.

**TABLE 11B-407.4.7.1.3
ELEVATOR CONTROL BUTTON IDENTIFICATION**

Control Button	Raised Symbol	Braille Message
Emergency Stop		"ST"OP Three Cells 
Alarm		AL"AR"M Four Cells 
Door Open		OP"EN" Three Cells 
Door Close		CLOSE Five Cells 
Main Entry Floor		MA"IN" Three Cells 
Phone		PH"ONE" Four Cells 

11B-407.4.7.1.5 Button spacing. A minimum clear space of $\frac{3}{8}$ inch (9.5 mm) or other suitable means of separation shall be provided between rows of control buttons.

11B-407.4.7.2 Keypads. Keypads shall be identified by characters complying with Section 11B-703.5 and shall be centered on the corresponding keypad button. The number five key shall have a single raised dot. The dot shall be 0.118 inch (3 mm) to 0.120 inch (3.05 mm) base diameter and in other aspects comply with Table 11B-703.3.1.

11B-407.4.8 Car position indicators. Audible and visible car position indicators shall be provided in elevator cars.

11B-407.4.8.1 Visible indicators. Visible indicators shall comply with Section 11B-407.4.8.1.

11B-407.4.8.1.1 Size. Characters shall be $\frac{1}{2}$ inch (12.7 mm) high minimum.

11B-407.4.8.1.2 Location. Indicators shall be located above the car control panel or above the door.

11B-407.4.8.1.3 Floor arrival. As the car passes a floor and when a car stops at a floor served by the elevator, the corresponding character shall illuminate.

Exception: Reserved.

11B-407.4.8.1.4 Reserved.

11B-407.4.8.2 Audible indicators. Audible indicators shall comply with Section 11B-407.4.8.2.

11B-407.4.8.2.1 Signal type. The signal shall be an automatic verbal annunciator which announces the floor at which the car is about to stop.

Exception: For elevators that have a rated speed of 200 feet per minute (1 m/s) or less, a non-verbal audible signal with a frequency of 1500 Hz maximum which sounds as the car passes or is about to stop at a floor served by the elevator shall be permitted.

11B-407.4.8.2.2 Signal level. The verbal annunciator shall be 10 dB minimum above ambient, but shall not exceed 80 dB, measured at the annunciator.

11B-407.4.8.2.3 Frequency. The verbal annunciator shall have a frequency of 300 Hz minimum to 3000 Hz maximum.

11B-407.4.9 Emergency communication. Emergency two-way communication systems shall comply with Section 11B-308. Raised symbols or characters, white on a black background and Braille shall be provided adjacent to the device and shall comply with Sections 11B-703.2 and 11B-703.3. Emergency two-way communication systems between the elevator and a point outside the hoistway shall comply with ASME A17.1.

11B-407.4.10 Support rail. Support rails shall be provided on at least one wall of the car.

11B-407.4.10.1 Location. Clearance between support rails and adjacent surfaces shall be $1\frac{1}{2}$ inches (38 mm) minimum. Top of support rails shall be 31 inches (787 mm) minimum to 33 inches (838 mm) maximum above

the floor of the car. The ends of the support rail shall be 6 inches (152 mm) maximum from adjacent walls.

11B-407.4.10.2 Surfaces. Support rails shall be smooth and any surface adjacent to them shall be free of sharp or abrasive elements.

11B-407.4.10.3 Structural strength. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the support rail, fastener, mounting device or supporting structure.

11B-408 Limited-use/limited-application elevators

11B-408.1 General. Limited-use/limited-application elevators shall comply with Section 11B-408 and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

11B-408.2 Elevator landings. Landings serving limited-use/limited-application elevators shall comply with Section 11B-408.2.

11B-408.2.1 Call buttons. Elevator call buttons and keypads shall comply with Section 11B-407.2.1.

11B-408.2.2 Hall signals. Hall signals shall comply with Section 11B-407.2.2.

11B-408.2.3 Hoistway signs. Signs at elevator hoistways shall comply with Section 11B-407.2.3.1.

11B-408.3 Elevator doors. Elevator hoistway doors shall comply with Section 11B-408.3.

11B-408.3.1 Sliding doors. Sliding hoistway and car doors shall comply with Sections 11B-407.3.1 through 11B-407.3.3 and 11B-408.4.1.

11B-408.3.2 Swinging doors. Swinging hoistway doors shall open and close automatically and shall comply with Sections 11B-404, 11B-407.3.2 and 11B-408.3.2.

11B-408.3.2.1 Power operation. Swinging doors shall be power-operated and shall comply with ANSI/BHMA A156.19.

11B-408.3.2.2 Duration. Power-operated swinging doors shall remain open for 20 seconds minimum when activated.

11B-408.4 Elevator cars. Elevator cars shall comply with Section 11B-408.4.

11B-408.4.1 Car dimensions and doors. Elevator cars shall provide a clear width 42 inches (1067 mm) minimum and a clear depth 54 inches (1372 mm) minimum. Car doors shall be positioned at the narrow ends of cars and shall provide 32 inches (813 mm) minimum clear width.

Exceptions:

1. Cars that provide a clear width 51 inches (1295 mm) minimum shall be permitted to provide a clear depth 51 inches (1295 mm) minimum provided that car doors provide a clear opening 36 inches (914 mm) wide minimum.

2. **Reserved.**

11B-408.4.2 Floor surfaces. Floor surfaces in elevator cars shall comply with *Sections 11B-302 and 11B-303*.

11B-408.4.3 Platform to hoistway clearance. The platform to hoistway clearance shall comply with *Section 11B-407.4.3*.

11B-408.4.4 Leveling. Elevator car leveling shall comply with *Section 11B-407.4.4*.

11B-408.4.5 Illumination. Elevator car illumination shall comply with *Section 11B-407.4.5*.

11B-408.4.6 Car controls. Elevator car controls shall comply with *Section 11B-407.4.6*. Control panels shall be centered on a side wall.

11B-408.4.7 Designations and indicators of car controls. Designations and indicators of car controls shall comply with *Section 11B-407.4.7*.

11B-408.4.8 Emergency communications. Car emergency signaling devices complying with *Section 11B-407.4.9* shall be provided.

11B-409 Private residence elevators

11B-409.1 General. Private residence elevators that are provided within a residential dwelling unit required to provide mobility features complying with *Sections 11B-809.2 through 11B-809.4* shall comply with *Section 11B-409* and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

11B-409.2 Call buttons. Call buttons shall be $\frac{3}{4}$ inch (19.1 mm) minimum in the smallest dimension and shall comply with *Section 11B-309*.

11B-409.3 Elevator doors. Hoistway doors, car doors and car gates shall comply with *Sections 11B-409.3 and 11B-404*.

Exception: Doors shall not be required to comply with the maneuvering clearance requirements in *Section 11B-404.2.4.1* for approaches to the push side of swinging doors.

11B-409.3.1 Power operation. Elevator car and hoistway doors and gates shall be power operated and shall comply with ANSI/BHMA A156.19. Power operated doors and gates shall remain open for 20 seconds minimum when activated.

Exception: In elevator cars with more than one opening, hoistway doors and gates shall be permitted to be of the manual-open, self-close type.

11B-409.3.2 Location. Elevator car doors or gates shall be positioned at the narrow end of the clear floor spaces required by *Section 11B-409.4.1*.

11B-409.4 Elevator cars. Private residence elevator cars shall comply with *Section 11B-409.4*.

11B-409.4.1 Inside dimensions of elevator cars. Elevator cars shall provide a clear floor space of 36 inches (914 mm) minimum by 48 inches (1219 mm) minimum and shall comply with *Section 11B-305*.

11B-409.4.2 Floor surfaces. Floor surfaces in elevator cars shall comply with *Sections 11B-302 and 11B-303*.

11B-409.4.3 Platform to hoistway clearance. The clearance between the car platform and the edge of any landing sill shall be $1\frac{1}{2}$ inch (38 mm) maximum.

11B-409.4.4 Leveling. Each car shall automatically stop at a floor landing within a tolerance of $\frac{1}{2}$ inch (12.7 mm) under rated loading to zero loading conditions.

11B-409.4.5 Illumination levels. Elevator car illumination shall comply with *Section 11B-407.4.5*.

11B-409.4.6 Car controls. Elevator car control buttons shall comply with *Sections 11B-409.4.6, 11B-309.3, 11B-309.4* and shall be raised or flush.

11B-409.4.6.1 Size. Control buttons shall be $\frac{3}{4}$ inch (19.1 mm) minimum in their smallest dimension.

11B-409.4.6.2 Location. Control panels shall be on a side wall, 12 inches (305 mm) minimum from any adjacent wall.

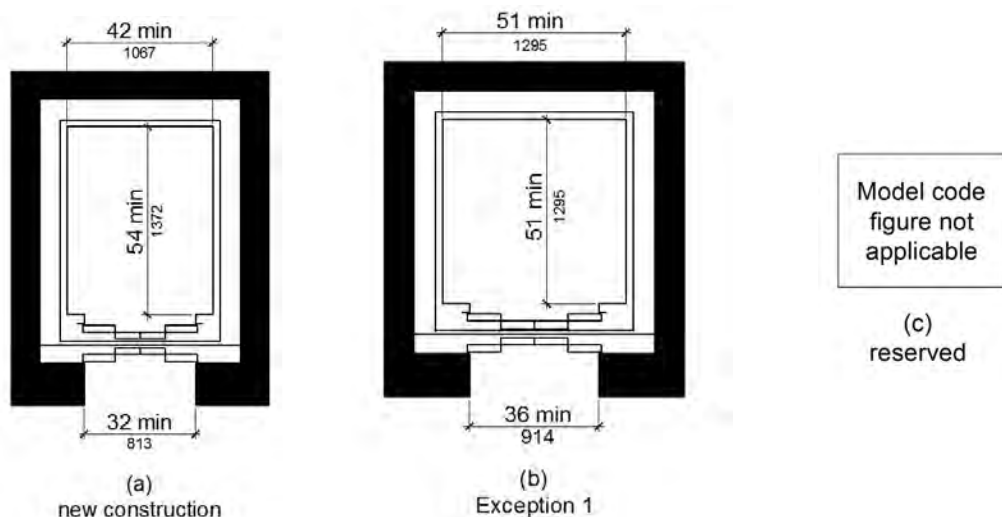


FIGURE 11B-408.4.1 LIMITED-USE/LIMITED-APPLICATION (LULA) ELEVATOR CAR DIMENSIONS

11B-409.4.7 Emergency communications. Emergency two-way communication systems shall comply with Section 11B-409.4.7.

11B-409.4.7.1 Type. A telephone and emergency signal device shall be provided in the car.

11B-409.4.7.2 Operable parts. The telephone and emergency signaling device shall comply with Sections 11B-309.3 and 11B-309.4.

11B-409.4.7.3 Compartment. If the telephone or device is in a closed compartment, the compartment door hardware shall comply with Section 11B-309.

11B-409.4.7.4 Cord. The telephone cord shall be 29 inches (737 mm) long minimum.

11B-410 Platform lifts

11B-410.1 General. Platform lifts shall comply with ASME A18.1. Platform lifts shall not be attendant-operated and shall provide unassisted entry and exit from the lift.

11B-410.2 Floor surfaces. Floor surfaces in platform lifts shall comply with Sections 11B-302 and 11B-303.

11B-410.3 Clear floor space. Clear floor space in platform lifts shall comply with Section 11B-305.

11B-410.4 Platform to runway clearance. The clearance between the platform sill and the edge of any runway landing shall be 1¼ inch (32 mm) maximum.

11B-410.5 Operable parts. Controls for platform lifts shall comply with Section 11B-309.

11B-410.6 Doors and gates. Platform lifts shall have low-energy power-operated doors or gates complying with Section 11B-404.3. Doors shall remain open for 20 seconds minimum. End doors and gates shall provide a clear width 32 inches (813 mm) minimum. Side doors and gates shall provide a clear width 42 inches (1067 mm) minimum.

Exception: Platform lifts serving two landings maximum and having doors or gates on opposite sides shall be permitted to have self-closing manual doors or gates.

11B-410.7 Landing size. The minimum size of landings at platform lifts shall be 60 inches by 60 inches (1524 mm by 1524 mm).

11B-410.8 Restriction sign. A sign complying with Section 11B-703.5 shall be posted in a conspicuous place at each landing and within the platform enclosure stating “No Freight” and include the International Symbol of Accessibility complying with Section 11B-703.7.2.1.

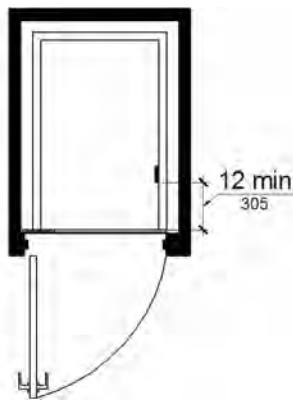
11B-411 Destination-oriented elevators.

11B-411.1 General. Destination-oriented elevators shall comply with Section 11B-411 and with ASME A17.1. They shall be passenger elevators as classified by ASME A17.1. Elevator operation shall be automatic.

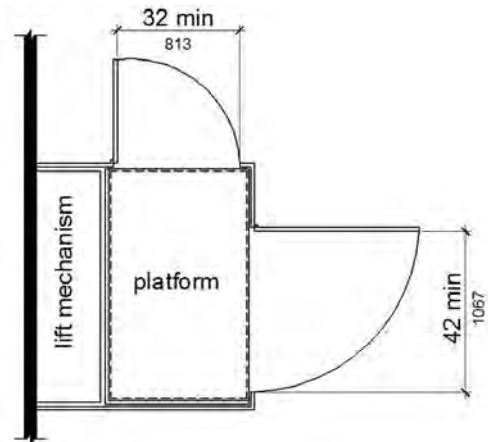
11B-411.1.1 Floor designations. In facilities served by destination-oriented elevator systems, floor designations shall be numeric characters only. Floor designations shall be “one” (1) or “zero” (0) at the main entry level and shall increase by one for each successive higher story or level. The initial floor below the main entry level shall be designated “minus one” (-1) and the designation for each successive lower story or level shall decrease by one. Stories or levels shall not be designated by alphabetic characters.

Exceptions:

1. In existing facilities where new elevators are installed or existing elevators are altered into a destination-oriented elevator system, levels within stories, such as mezzanines located above or below the main entry level shall be permitted to be designated with an alpha-numeric character such as “M2”, indicating “mezzanine” and the “story number”, respectively, in which it is located, provided there is no duplication with alpha-numeric designations of elevator cars in the facility.
2. Non-successive floor numbering shall be permitted where a specific floor number is omitted or where a floor is frequented only by service personnel for maintenance, repair or occasional monitoring of equipment.



**FIGURE 11B-409.4.6.2
LOCATION OF PRIVATE RESIDENCE
ELEVATOR CONTROL PANEL**



**FIGURE 11B-410.6
PLATFORM LIFT DOORS AND GATES**

11B-411.1.2 Car designations. Elevator cars shall be designated with a single alphabetic character. For elevators programmed to the same hall call console or group of hall call consoles, each elevator car shall be designated with a different single alphabetic character.

Exception: Elevator systems with more than 26 elevators shall be permitted to use alpha-numeric designations such as “A1”.

11B-411.2 Elevator landing requirements. Elevator landings shall comply with Section 11B-411.2.

11B-411.2.1 Hall call consoles. Hall call consoles shall comply with Sections 11B-411.2.1 and 11B-309.

11B-411.2.1.1 Location. Hall call consoles shall be wall-mounted. On floors with a building entry, including parking and transfer levels, each hoistway entrance shall be adjacent to a hall call console. On other floors, a minimum of one hoistway entrance shall be adjacent to a hall call console.

Exception: Hall call consoles beyond those required by Section 11B-411.2.1.1 shall be permitted to be provided outside the elevator landing and to be wall-mounted, pedestal-mounted or mounted on a kiosk or security turnstile.

11B-411.2.1.2 Required features. Hall call consoles shall include a touch screen or keypad with display screen, an accessibility function button and audio output loudspeaker.

11B-411.2.1.2.1 Keypads. Keypads shall be in a 12-key ascending telephone keypad layout. Characters and symbols shall be centered on the corresponding button. The number five key shall have a single raised dot. The dot shall have a base diameter of 0.118 inch (3 mm) minimum and 0.120 inch (3.05 mm) maximum and a height of 0.025 inch (0.6 mm) minimum and 0.037 inch (0.9 mm) maximum. Keypads shall have a star (☆) on the lower left button and a minus sign (-) on the lower right button. From any level above and below the main egress level, when the star button is pressed an elevator shall be dispatched to the main egress level.

11B-411.2.1.2.2 Touch screen. Touch screen display shall comply with Section 11B-411.2.1.2.4.

11B-411.2.1.2.3 Accessibility function button. The accessibility function button shall be identified by the International Symbol of Accessibility and a raised indication. The International Symbol of Accessibility shall comply with Section 11B-703.7.2.1, and shall be $\frac{5}{8}$ inch (15.9 mm) minimum in height. The indication shall be three raised dots. Each dot shall have a base diameter of 0.059 inch (1.5 mm) minimum and 0.063 inch (1.6 mm) maximum and a height of 0.025 inch (0.6 mm) minimum and 0.037 inch (0.9 mm) maximum. The dots shall be spaced $\frac{1}{4}$ inch (6.4 mm), measured center to center, in the form of an equilateral triangle with a vertex pointing up. The

accessibility function button shall not be provided with a key repeat function.

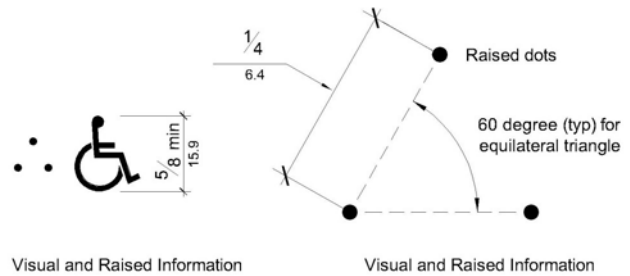


FIGURE 11B-411.2.1.2.3 DESTINATION-ORIENTED ELEVATOR ACCESSIBILITY FUNCTION BUTTON INDICATION

11B-411.2.1.2.4 Display screen. Upon activation of the accessibility function button, the display screen shall display information including but not limited to, operating instructions, user input confirmation, elevator assignment characters, direction to the assigned elevator and error messages. The display screen shall comply with Section 11B-411.2.1.2.4.

11B-411.2.1.2.4.1 Contrast. Display screens shall provide contrast with light characters and symbols on a dark background or dark characters and symbols on a light background. The background shall be solid and static.

11B-411.2.1.2.4.2 Size. Elevator assignment characters shall be 1 inch high (25 mm) minimum.

11B-411.2.1.2.4.3 Duration. Elevator assignment characters shall be displayed for a minimum of 5 seconds.

11B-411.2.1.2.5 Audio output. Upon activation of the accessibility function button, the audio output shall provide verbal announcements, including but not limited to, operating instructions, user input confirmation, announcement of the elevator assignment characters, direction to the assigned elevator and error messages. Audio output shall be recorded or digitized human speech, and shall be delivered through a loudspeaker. Auditory volume shall be at least 10 dB above ambient sound level, but shall not exceed 80 dB, measured 36 inches (914 mm) in front of the console. At hall call console locations where the ambient sound level varies, auditory volume shall be maintained at the required volume by an automatic gain control or shall be set at not less than 75 dB.

11B-411.2.1.3 Arrangement. Hall call console arrangement of required features shall comply with Section 11B-411.2.1.3.

11B-411.2.1.3.1 Keypad call console arrangement. Where keypad call consoles are provided, the display screen shall be located directly above the keypad. The accessibility function button shall be located directly below the keypad at a height of 36 inches (914 mm) to 42 inches (1067 mm) above the finish floor.

11B-411.2.1.3.2 Touch screen call console arrangement. Where touch screen call consoles are provided, the touch screen shall be located directly above the accessibility function button. The accessibility function button shall be located at a height of 36 inches (914 mm) to 42 inches (1067 mm) above the finish floor.

11B-411.2.1.3.3 Proximity of required elements. Required features shall be provided on a hall call console assembly or as individual elements grouped in close proximity.

11B-411.2.1.3.4 Position. Display screens and touch screens shall be positioned so glare is reduced on the screen. Keypads or buttons shall slope away from the user at 15 to 25 degrees from the vertical plane. Touch screens shall be sloped away from the user at 7 to 25 degrees from the vertical plane.

11B-411.2.1.4 Additional features. Hall call console additional features, if provided, shall comply with Sections 11B-309 and 11B-411.2.1.4.

11B-411.2.1.4.1 Hall call console additional buttons. Hall call console buttons provided in addition to the accessibility function button and keypad buttons shall comply with Section 11B-411.2.1.4.1. Buttons in addition to the accessibility function button are not permitted on hall call consoles using a touch screen.

11B-411.2.1.4.1.1 Arrangement. Buttons shall be arranged in columns to the right of the keypad with a minimum horizontal spacing of 1.5 times the horizontal spacing between the numeric keys and with the same vertical spacing as the numeric keys.

11B-411.2.1.4.1.2 Identification. Buttons shall be identified by raised characters and symbols, white on a black background, complying with Section 11B-703.2 and Braille complying with Section 11B-703.3. Identification shall be placed immediately to the left of the control button to which the designation applies.

11B-411.2.1.4.2 Security or access controls. Security or access control system card readers associated with elevator operation shall be in close proximity to each hall call console in a consistent manner throughout the facility.

11B-411.2.1.5 Button requirements. Keypad buttons, the accessibility function button and additional

hall call console buttons shall comply with Section 11B-411.2.1.5.

11B-411.2.1.5.1 Size. Buttons shall have square shoulders, be $\frac{3}{4}$ inch (19.1 mm) minimum in the smallest dimension and shall be raised $\frac{1}{8}$ inch (3.2 mm) plus or minus $\frac{1}{32}$ inch (0.8 mm) above the surrounding surface. The buttons shall be activated by a mechanical motion that is detectable.

11B-411.2.1.5.2 Color. Characters and symbols on buttons, where provided, shall be white on a black background.

11B-411.2.1.6 Identification of floors served. In buildings with two or more elevator banks, each serving a different group of specific floors, hall call consoles located on floors with a building entry, including parking and transfer levels, shall be provided with signs complying with Sections 11B-703.2, 11B-703.3 and 11B-703.5 on the surface of or above the hall call console stating "FLOORS n1 – n2," where n1 – n2 represents the range of floors served. Characters shall be white on a black background. When the accessibility function button is pressed, the audio output shall provide a verbal announcement of the floors served by the elevator group.

11B-411.2.1.7 Elevator car assignment. When the accessibility function button is pressed, elevator car assignment shall comply with Section 11B-411.2.1.7.

11B-411.2.1.7.1 Assignment by keypad hall call console. The audio output shall provide verbal instruction for the user to enter a destination floor. The selected destination floor shall be confirmed by verbal announcement and on the display screen. Verbal and visible indication of an invalid input shall be provided. The display screen shall indicate the elevator assignment characters and a verbal announcement shall be made of the assigned elevator responding to the call. Visual and verbal direction to the assigned elevator shall be provided.

11B-411.2.1.7.2 Assignment by touch screen hall call console. The audio output shall provide verbal instruction for the user to press the accessibility function button as a response to verbal direction in order to select the destination floor. The selected destination floor shall be confirmed by verbal announcement and on the display screen. Verbal and visible indication of an invalid input shall be provided. The display screen shall indicate the elevator assignment characters and a verbal announcement shall be made of the assigned elevator responding to the call. Visual and verbal direction to the assigned elevator shall be provided.

Exception: In addition to assignment by Section 11B-411.2.1.7.2, a verbal announcement providing the user with an option to select an alternative mode of operation shall be permit-

ted. Alternative operation shall be by one of the following options:

1. *Virtual keypad.* The size of the keypad shall be a nominal 4 inches (102 mm) wide by 5 inches (127 mm) high in a 12-key ascending telephone keypad layout centered in the console. Characters and symbols shall be centered on the corresponding button. Keypads shall have a star (☆) on the lower left button and a minus sign (-) on the lower right button. Operation shall be by contact with the touch screen with a press on the key. The audio output shall provide user input confirmation after each key is pressed. Keys shall not be provided with a key repeat function. From any level above and below the main egress level, when the star button is pressed an elevator shall be dispatched to the main egress level.
2. *Gesture-based mode of operation.* Operation shall be by contact with the touch screen, without specific contact with an icon, and using established non-proprietary gestures for selection and input, including but not limited to tapping, sliding and tap-hold contact-release to select. The audio output shall provide verbal direction on use of the touch screen, and indication of floor selection options, until assignment to the elevator is given.

11B-411.2.1.7.3 Assignment by security credential. If a security system or other form of access control system is provided, the audio output shall provide a verbal announcement and direction to the location of the access control activation sensor, such as “present security credential at the sensor immediately to the left”. Upon presentation of security credential, the destination floor shall be confirmed by verbal announcement and on the display screen. The display screen shall indicate the elevator assignment characters and a verbal announcement shall be made of the assigned elevator responding to the call. Visual and verbal direction to the assigned elevator shall be provided.

11B-411.2.1.7.4 Adjacency assignment. The system shall assign an elevator car immediately to the left or right of the hall call console.

Exception: The most adjacent elevator serving the selected floor shall be assigned by hall call consoles located outside the elevator landing.

11B-411.2.2 Elevator car identification at elevator landings. Elevator car identification shall comply with Section 11B-411.2.2.

11B-411.2.2.1 Visible identification. Above or adjacent to each elevator car entrance there shall be a visible identification fixture with a car designation character. The identification fixture shall be 80 inches (2032 mm) minimum above the finish floor or ground to the bottom of the fixture. The characters on the fixture shall be upper case with a height of 4 inches (102 mm) minimum complying with Sections 11B-703.5.1, 11B-703.5.3, 11B-703.5.4, 11B-703.5.7 and 11B-703.5.8.

Exception: Existing buildings shall be permitted to have a visible identification fixture with a car designation character adjacent to each elevator car entrance centered at 72 inches (1829 mm) above the finish floor or ground. The character on the fixture shall be upper case with a height of 2½ inches (64 mm) minimum complying with Sections 11B-703.5.1, 11B-703.5.3, 11B-703.5.4, 11B-703.5.7 and 11B-703.5.8.

11B-411.2.2.2 Verbal identification. When the accessibility function button is pressed, verbal announcement of the car designation shall be provided at the elevator car entrance upon arrival. Audio output shall be recorded or digitized human speech, and shall be delivered through a loud-speaker. The verbal annunciator shall have a frequency of 300 Hz minimum and 3000 Hz maximum. Auditory volume shall be at least 10 dB above ambient sound level, but shall not exceed 80 dB, measured 36 inches (914 mm) in front of the elevator entrance and at 48 inches (1219 mm) above the floor. At elevator entrances where the ambient sound level varies, auditory volume shall be maintained at the required volume by an automatic gain control or shall be set at not less than 75 dB.

11B-411.2.3 Signs on jambs of elevator hoistway entrances. Signs on jambs of elevator hoistway entrances shall comply with Section 11B-411.2.3.

11B-411.2.3.1 Floor designation signs. Floor designation signs complying with Sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of elevator hoistway entrances. Signs shall be provided in both raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. A raised star placed to the left of the floor designation, shall be provided on both jambs at the main entry level. The outside diameter of the star shall be 2 inches (51 mm) and all points shall be of equal length. Raised characters, including the star, shall be white on a black background. Braille complying with Section 11B-703.3 shall be placed below the corresponding raised characters and the star. The Braille translation for the star shall be “MAIN”. Applied plates are acceptable if they are permanently fixed to the jamb.

11B-411.2.3.2 Car designation signs. Car designation signs complying with Sections 11B-703.2 and 11B-703.4.1 shall be provided on both jambs of the hoistway immediately below the floor designation.

nation. Signs shall be provided in both raised characters and Braille. Raised characters shall be 2 inches (51 mm) high. Raised characters shall be white on a black background. Braille complying with Section 11B-703.3 shall be placed below the corresponding raised characters. Applied plates are acceptable if they are permanently fixed to the jamb.

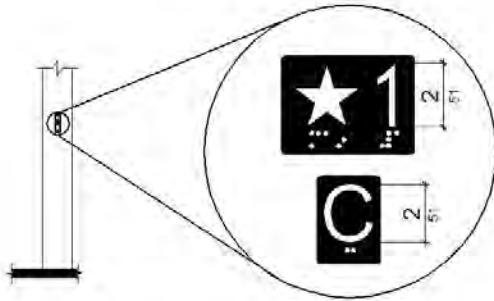


FIGURE 11B-411.2.3
FLOOR DESIGNATION AND CAR DESIGNATION
SIGNS ON JAMBS OF DESTINATION-ORIENTED
ELEVATOR HOISTWAY ENTRANCES

11B-411.3 Elevator door requirements. Hoistway and car doors shall comply with Section 11B-411.3.

11B-411.3.1 Type. Elevator door type shall comply with Section 11B-407.3.1.

11B-411.3.2 Operation. Elevator hoistway and car doors shall open and close automatically.

11B-411.3.3 Reopening device. Elevator doors shall be provided with a reopening device complying with Section 11B-411.3.3 that shall stop and reopen a car door and hoistway door automatically if the door becomes obstructed by an object or person.

11B-411.3.3.1 Height. The height of the reopening device shall comply with Section 11B-407.3.3.1.

11B-411.3.3.2 Contact. The device contact shall comply with Section 11B-407.3.3.2.

11B-411.3.3.3 Duration. The door reopening device duration shall comply with Section 11B-407.3.3.3.

11B-411.3.4 Door delay. Door delay shall comply with Section 11B-407.3.5.

11B-411.3.5 Width. The width of elevator doors shall comply with Table 11B-407.4.1.

11B-411.4 Elevator car requirements. Elevator cars shall comply with Section 11B-411.4.

11B-411.4.1 Car dimensions. Inside dimensions of elevator cars and clear width of elevator doors shall comply with Section 11B-407.4.1.

11B-411.4.2 Floor surfaces. Floor surfaces in elevator cars shall comply with Section 11B-407.4.2.

11B-411.4.3 Platform to hoistway clearance. Platform to hoistway clearance shall comply with Section 11B-407.4.3.

11B-411.4.4 Leveling. Elevator car leveling shall comply with Section 11B-407.4.4.

11B-411.4.5 Illumination. The level of illumination at the car controls shall comply with Section 11B-407.4.5.

11B-411.4.6 Elevator car controls. Where provided, elevator car controls shall comply with Sections 11B-411.4.6 and 11B-309.4.

11B-411.4.6.1 Location. Controls shall be located within one of the reach ranges specified in Section 11B-308.

11B-411.4.6.2 Buttons. Car control buttons shall comply with Sections 11B-407.4.6.2.1 and 11B-407.4.6.2.4. The car shall not have non-functional, exposed floor buttons.

11B-411.4.6.3 Emergency controls. Emergency controls shall comply with Section 11B-407.4.6.4.

11B-411.4.7 Designations and indicators of car control buttons. Designations and indicators of car control buttons shall comply with Section 11B-411.4.7.

11B-411.4.7.1 Type. Control button type shall comply with Section 11B-407.4.7.1.1.

11B-411.4.7.2 Location. Raised characters or symbols and Braille designations shall comply with Section 11B-407.4.7.1.2.

11B-411.4.7.3 Symbols. The control button for the emergency stop, alarm, door open, door close and phone shall be identified with raised symbols and Braille as shown in Table 11B-407.4.7.1.3.

11B-411.4.7.4 Button spacing. Button spacing shall comply with Section 11B-407.4.7.1.5.

11B-411.4.8 Car position indicators. Audible and visible car position indicators shall be provided in elevator cars.

11B-411.4.8.1 Visible indicators. Visible indicators shall comply with Section 11B-411.4.8.1.

11B-411.4.8.1.1 Size. Characters shall comply with Section 11B-407.4.8.1.1.

11B-411.4.8.1.2 Location. Location of indicators shall comply with Section 11B-407.4.8.1.2.

11B-411.4.8.2 Audible indicators. Audible indicators shall comply with Section 11B-411.4.8.2.

11B-411.4.8.2.1 Signal type. The signal shall be an automatic verbal annunciator which announces the floor at which the car is about to stop.

11B-411.4.8.2.2 Signal level. The verbal annunciator signal level shall comply with Section 11B-407.4.8.2.2.

11B-411.4.8.2.3 Frequency. The verbal annunciator frequency shall comply with Section 11B-407.4.8.2.3.

11B-411.4.9 Emergency communication. Emergency communication shall comply with Section 11B-407.4.9.

11B-411.4.10 Support rail. Support rails complying with Section 11B-407.4.10 shall be provided on at least one wall of the car.

11B-411.4.11 Floor destination indicators. There shall be on each elevator car door jamb a visual display indicating floor destinations.

11B-411.4.11.1 Height. Floor destination characters shall be 1 inch (25 mm) high minimum complying with Section 11B-703.5.3.

11B-411.4.11.2 Contrast. Visual display shall provide contrast with light characters on a dark background or dark characters on a light background. The background shall be solid and static.

11B-411.4.11.3 Duration. Floor destination characters shall be displayed upon elevator car arrival at the input floor and shall not extinguish until the elevator car arrives at the destination floor.

DIVISION 5: GENERAL SITE AND BUILDING ELEMENTS

11B-501 General

11B-501.1 Scope. The provisions of *Division 5* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-502 Parking spaces

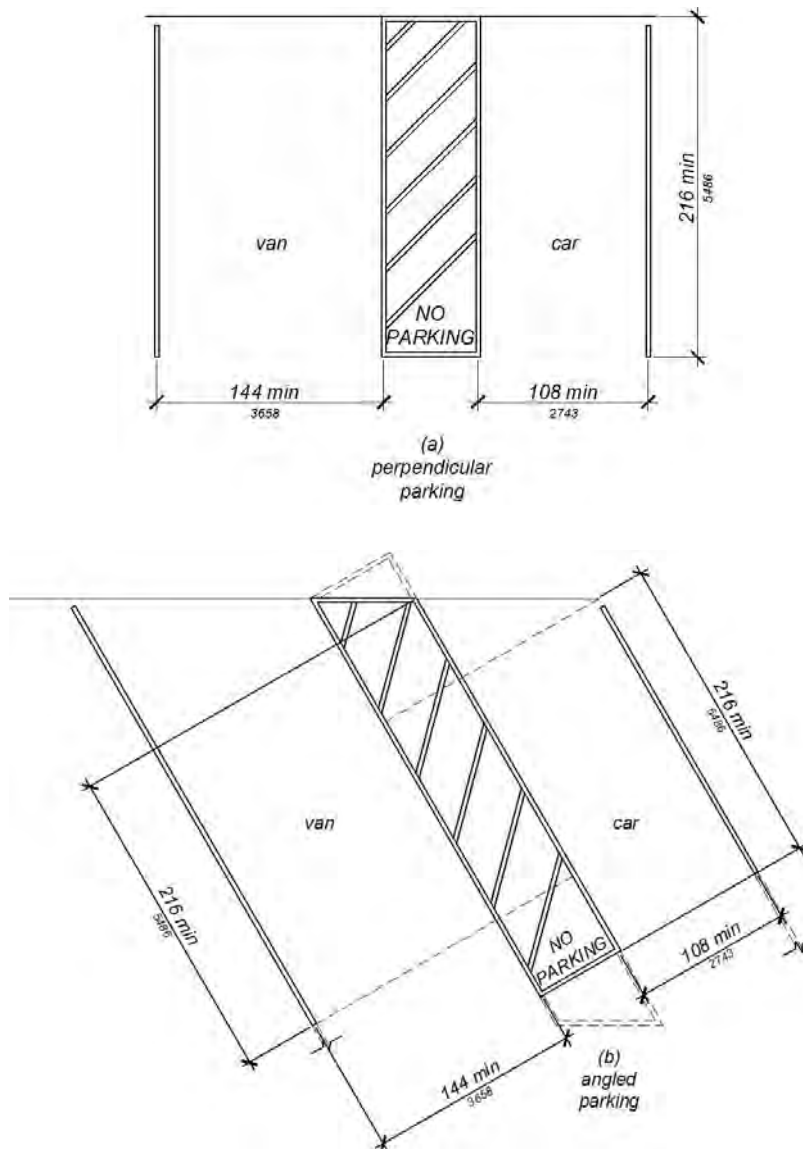
11B-502.1 General. Car and van parking spaces shall comply with *Section 11B-502*. Where parking spaces are marked with lines, width measurements of parking spaces and access aisles shall be made from the centerline of the markings.

Exception: Where parking spaces or access aisles are not adjacent to another parking space or access aisle, measure-

ments shall be permitted to include the full width of the line defining the parking space or access aisle.

11B-502.2 Vehicle spaces. Car and van parking spaces shall be 216 inches (5486 mm) long minimum. Car parking spaces shall be 108 inches (2743 mm) wide minimum and van parking spaces shall be 144 inches (3658 mm) wide minimum, shall be marked to define the width, and shall have an adjacent access aisle complying with *Section 11B-502.3*.

Exception: Van parking spaces shall be permitted to be 108 inches (2743 mm) wide minimum where the access aisle is 96 inches (2438 mm) wide minimum.



**FIGURE 11B-502.2
VEHICLE PARKING SPACES**

11B-502.3 Access aisle. Access aisles serving parking spaces shall comply with Section 11B-502.3. Access aisles shall adjoin an accessible route. Two parking spaces or one parking space and one electric vehicle charging space shall be permitted to share a common access aisle.

11B-502.3.1 Width. Access aisles serving car and van parking spaces shall be 60 inches (1524 mm) wide minimum.

11B-502.3.2 Length. Access aisles shall extend the full required length of the parking spaces they serve.

11B-502.3.3 Marking. Access aisles shall be marked with a blue painted borderline around their perimeter. The area within the blue borderlines shall be marked with

hatched lines a maximum of 36 inches (914 mm) on center in a color contrasting with that of the aisle surface, preferably blue or white. The words "NO PARKING" shall be painted on the surface within each access aisle in white letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way. Access aisle markings may extend beyond the minimum required length.

11B-502.3.4 Location. Access aisles shall not overlap the vehicular way. Access aisles shall be permitted to be placed on either side of the parking space except for van parking spaces which shall have access aisles located on the passenger side of the parking spaces.

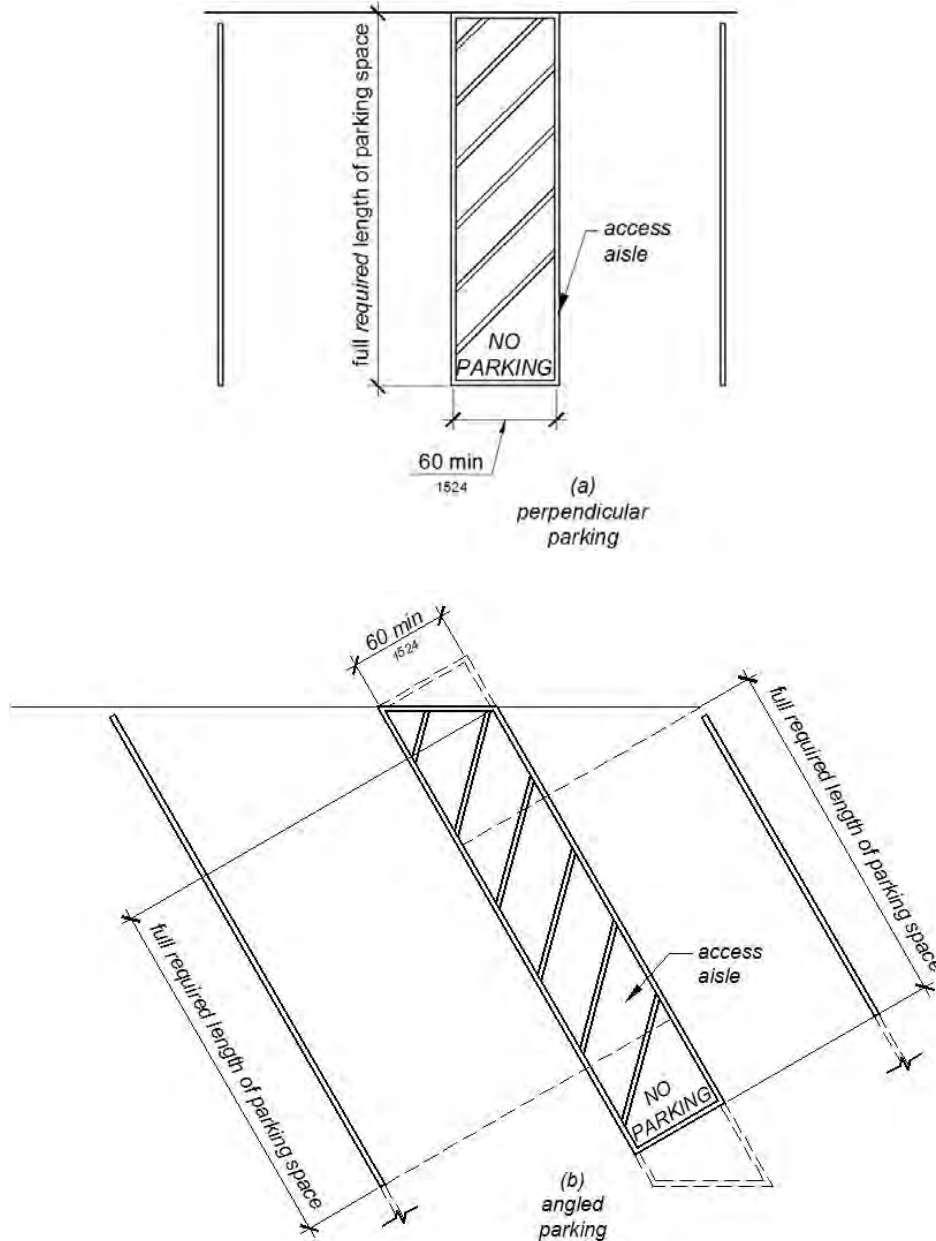


FIGURE 11B-502.3
PARKING SPACE ACCESS AISLE

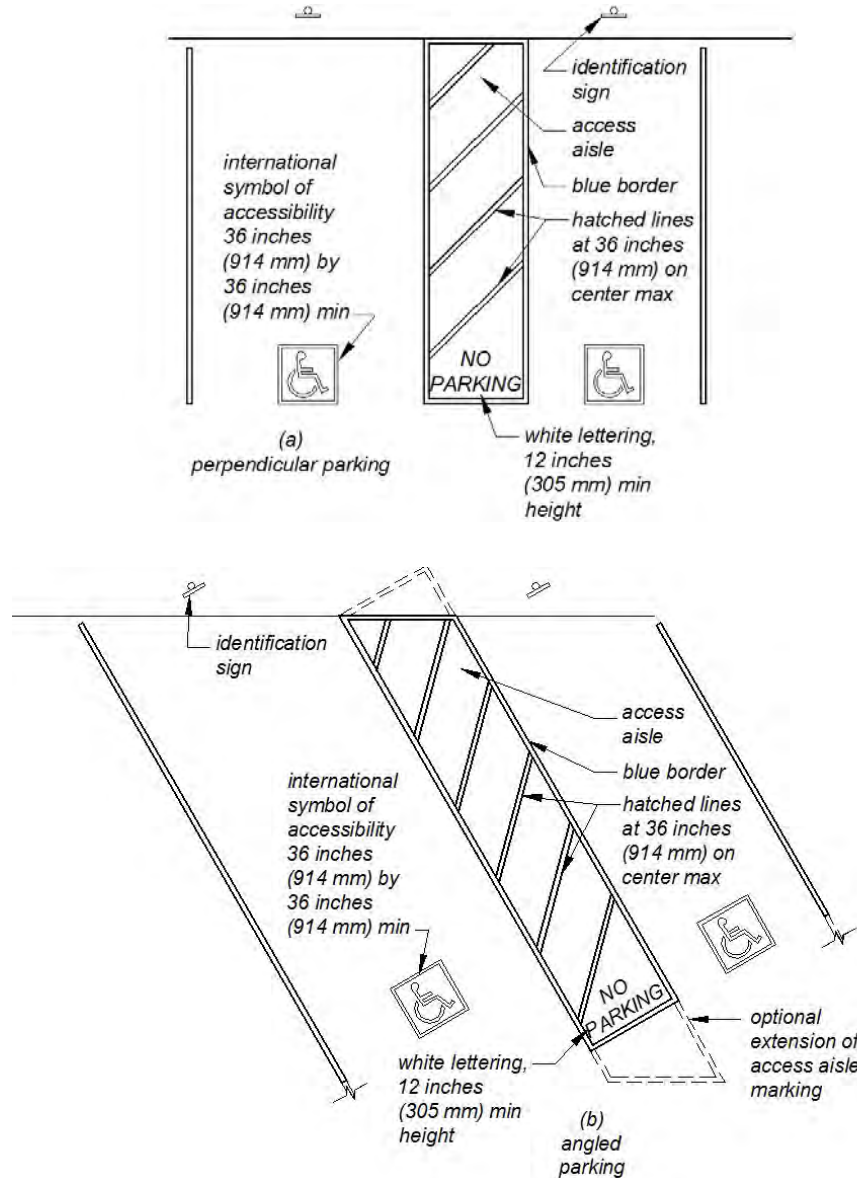


FIGURE 11B-502.3.3
ANGLED AND PERPENDICULAR PARKING IDENTIFICATION

11B-502.4 Floor or ground surfaces. Parking spaces and access aisles serving them shall comply with Section 11B-302. Access aisles shall be at the same level as the parking spaces they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-502.5 Vertical clearance. Parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum.

Exception: In existing multistory parking facilities, car parking spaces, access aisles and vehicular routes serving them shall provide a vertical clearance of 80 inches (2032 mm) minimum. Existing vertical clearance in excess of 80 inches (2032 mm) and less than 98 inches (2489 mm) shall

be maintained. This exception shall not apply to van parking spaces, access aisles or vehicular routes serving them.

11B-502.6 Identification. Parking space identification signs shall include the International Symbol of Accessibility complying with Section 11B-703.7.2.1 in white on a blue background. Signs identifying van parking spaces shall contain additional language or an additional sign with the designation “van accessible”. Signs shall be 60 inches (1524 mm) minimum above the finish floor or ground surface measured to the bottom of the sign.

Exception: Signs located within a circulation path shall be a minimum of 80 inches (2032 mm) above the finish floor or ground surface measured to the bottom of the sign.

11B-502.6.1 Finish and size. Parking identification signs shall be reflectorized with a minimum area of 70 square inches (45,161 mm²).

11B-502.6.2 Minimum fine. Additional language or an additional sign below the International Symbol of Accessibility shall state “Minimum Fine \$250”.

11B-502.6.3 Location. A parking space identification sign shall be visible from each parking space. Signs shall be permanently posted either immediately adjacent to the parking space or within the projected parking space width at the head end of the parking space. Signs may also be permanently posted on a wall at the interior end of the parking space.

11B-502.6.4 Marking. Each accessible car and van space shall have surface identification complying with either Section 11B-502.6.4.1 or 11B-502.6.4.2.

11B-502.6.4.1 The parking space shall be marked with an International Symbol of Accessibility complying with Section 11B-703.7.2.1 in white on a blue background a minimum 36 inches wide by 36 inches high (914 mm by 914 mm). The centerline of the International Symbol of Accessibility shall be a maximum of 6 inches (152 mm) from the centerline of the parking space, its sides parallel to the length of the parking space and its lower corner at, or lower side aligned with, the end of the parking space length.

11B-502.6.4.2 The parking space shall be outlined in blue or painted blue and shall be marked with an International Symbol of Accessibility complying with Section 11B-703.7.2.1 a minimum 36 inches wide by 36 inches high (914 mm by 914 mm) in white or a suitable contrasting color. The centerline of the International Symbol of Accessibility shall be a maximum of 6 inches (152 mm) from the centerline of the parking space, its sides parallel to the length of the parking space and its lower corner at, or lower side aligned with, the end of the parking space.

11B-502.7 Relationship to accessible routes. Parking spaces and access aisles shall be designed so that cars and vans, when parked, cannot obstruct the required clear width of adjacent accessible routes.

11B-502.7.1 Arrangement. Parking spaces and access aisles shall be designed so that persons using them are not required to travel behind parking spaces other than to pass behind the parking space in which they parked.

11B-502.7.2 Wheel stops. A curb or wheel stop shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.

11B-502.8 Additional signs. An additional sign shall be posted either; 1) in a conspicuous place at each entrance to an off-street parking facility or 2) immediately adjacent to on-site accessible parking and visible from each parking space.

11B-502.8.1 Size. The additional sign shall not be less than 17 inches (432 mm) wide by 22 inches (559 mm) high.

11B-502.8.2 Lettering. The additional sign shall clearly state in letters with a minimum height of 1 inch (25 mm) the following:

“Unauthorized vehicles parked in designated accessible spaces not displaying distinguishing placards or special license plates issued for persons with disabilities will be towed away at the owner’s expense. Towed vehicles may be reclaimed at: _____ or by telephoning _____.”

Blank spaces shall be filled in with appropriate information as a permanent part of the sign.

11B-503 Passenger drop-off and loading zones

11B-503.1 General. Passenger drop-off and loading zones shall comply with Section 11B-503.

11B-503.2 Vehicle pull-up space. Passenger drop-off and loading zones shall provide a vehicular pull-up space 96 inches (2438 mm) wide minimum and 20 feet (6096 mm) long minimum.

11B-503.3 Access aisle. Passenger drop-off and loading zones shall provide access aisles complying with Section 11B-503 adjacent and parallel to the vehicle pull-up space. Access aisles shall adjoin an accessible route and shall not overlap the vehicular way.

11B-503.3.1 Width. Access aisles serving vehicle pull-up spaces shall be 60 inches (1524 mm) wide minimum.

11B-503.3.2 Length. Access aisles shall extend the full length of the vehicle pull-up spaces they serve.

11B-503.3.3 Marking. Access aisles shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches (914 mm) on center in a color contrasting with that of the aisle surface.

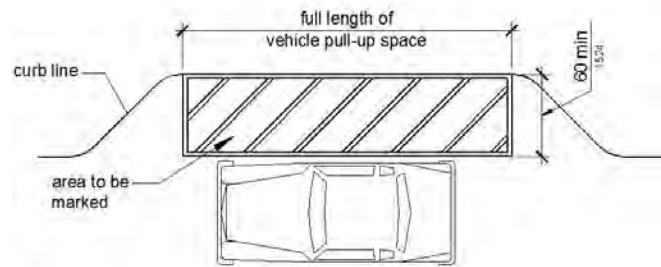


FIGURE 11B-503.3 PASSENGER DROP-OFF AND LOADING ZONE ACCESS AISLE

11B-503.4 Floor and ground surfaces. Vehicle pull-up spaces and access aisles serving them shall comply with Section 11B-302. Access aisles shall be at the same level as the vehicle pull-up space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-503.5 Vertical clearance. Vehicle pull-up spaces, access aisles serving them and a vehicular route from an entrance to the passenger *drop-off and* loading zone and from the passenger *drop-off and* loading zone to a vehicular exit shall provide a vertical clearance of 114 inches (2896 mm) minimum.

11B-504 Stairways

11B-504.1 General. Stairs shall comply with Section 11B-504.

11B-504.2 Treads and risers. All steps on a flight of stairs shall have uniform riser heights and uniform tread depths. Risers shall be 4 inches (102 mm) high minimum and 7 inches (178 mm) high maximum. Treads shall be 11 inches (279 mm) deep minimum.

Exception: Curved stairways with winder treads are permitted at stairs which are not part of a required means of egress.

11B-504.3 Open risers. Open risers are not permitted.

Exceptions:

1. On exterior stairways, an opening of not more than 1/2 inch (12.7 mm) may be permitted between the base of the riser and the tread.
2. On exterior stairways, risers constructed of grating containing openings of not more than 1/2 inch (12.7 mm) may be permitted.

11B-504.4 Tread surface. Stair treads shall comply with Section 11B-302. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

Exception: Reserved.

11B-504.4.1 Contrasting stripe. Interior stairs shall have the upper approach and lower tread marked by a stripe providing clear visual contrast. Exterior stairs shall have the upper approach and all treads marked by a stripe providing clear visual contrast.

The stripe shall be a minimum of 2 inches (51 mm) wide to a maximum of 4 inches (102 mm) wide placed parallel to, and not more than 1 inch (25 mm) from, the nose of the step or upper approach. The stripe shall extend the full width of the step or upper approach and shall be of material that is at least as slip resistant as the other treads of the stair. A painted stripe shall be acceptable. Grooves shall not be used to satisfy this requirement.

11B-504.5 Nosings. The radius of curvature at the leading edge of the tread shall be 1/2 inch (12.7 mm) maximum. Nosings that project beyond risers shall have the underside of the leading edge curved or beveled. Risers shall be permitted to slope under the tread at an angle of 30 degrees maximum from vertical. The permitted projection of the nosing shall extend 1 1/4 inches (32 mm) maximum over the tread below.

Exception: In existing buildings there is no requirement to retroactively alter existing nosing projections of 1 1/2 inches (38 mm) which were constructed in compliance with the building code in effect at the time of original construction.

11B-504.6 Handrails. Stairs shall have handrails complying with Section 11B-505.

11B-504.7 Wet conditions. Stair treads and landings subject to wet conditions shall be designed to prevent the accumulation of water.

11B-504.8 Floor identification. Floor identification signs required by Chapter 10, Section 1023.9 complying with Sections 11B-703.1, 11B-703.2, 11B-703.3 and 11B-703.5 shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.

11B-505 Handrails

11B-505.1 General. Handrails provided along walking surfaces complying with Section 11B-403, required at ramps complying with Section 11B-405, and required at stairs complying with Section 11B-504 shall comply with Section 11B-505.

11B-505.2 Where required. Handrails shall be provided on both sides of stairs and ramps.

Exceptions:

1. In assembly areas, handrails shall not be required on both sides of aisle ramps where a handrail is provided at either side or within the aisle width.
2. Curb ramps do not require handrails.
3. At door landings, handrails are not required when the ramp run is less than 6 inches (152 mm) in rise or 72 inches (1829 mm) in length.

11B-505.2.1 Orientation. The orientation of at least one handrail shall be in the direction of the stair run, perpendicular to the direction of the stair nosing, and shall not reduce the minimum required width of the stair.

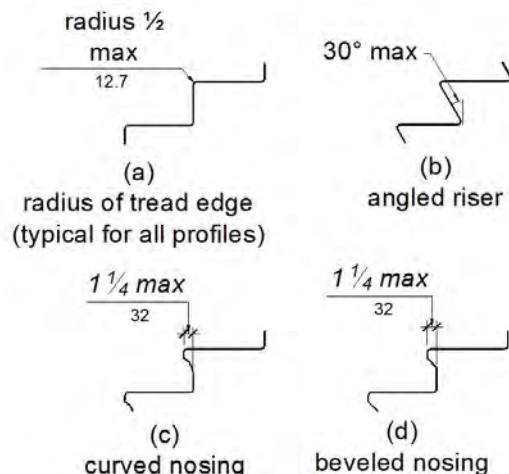
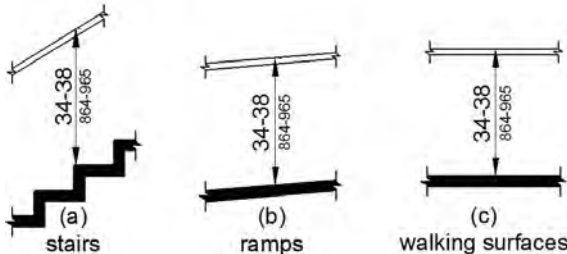


FIGURE 11B-504.5 STAIR NOSINGS

11B-505.3 Continuity. Handrails shall be continuous within the full length of each stair flight or ramp run. Inside handrails on switchback or dogleg stairs and ramps shall be continuous between flights or runs.

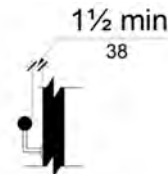
Exception: In assembly areas, ramp handrails adjacent to seating or within the aisle width shall not be required to be continuous in aisles serving seating.

11B-505.4 Height. Top of gripping surfaces of handrails shall be 34 inches (864 mm) minimum and 38 inches (965 mm) maximum vertically above walking surfaces, stair nosings and ramp surfaces. Handrails shall be at a consistent height above walking surfaces, stair nosings and ramp surfaces.



**FIGURE 11B-505.4
HANDRAIL HEIGHT**

11B-505.5 Clearance. Clearance between handrail gripping surfaces and adjacent surfaces shall be 1½ inches (38 mm) minimum. Handrails may be located in a recess if the recess is 3 inches (76 mm) maximum deep and 18 inches (457 mm) minimum clear above the top of the handrail.



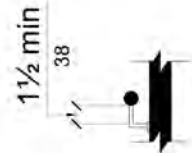
**FIGURE 11B-505.5
HANDRAIL CLEARANCE**

11B-505.6 Gripping surface. Handrail gripping surfaces shall be continuous along their length and shall not be obstructed along their tops or sides. The bottoms of handrail gripping surfaces shall not be obstructed for more than 20 percent of their length. Where provided, horizontal projections shall occur 1½ inches (38 mm) minimum below the bottom of the handrail gripping surface.

Exceptions:

1. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
2. The distance between horizontal projections and the bottom of the gripping surface shall be permitted to be reduced by 1/8 inch (3.2 mm) for each 1/2 inch

(12.7 mm) of additional handrail perimeter dimension that exceeds 4 inches (102 mm).

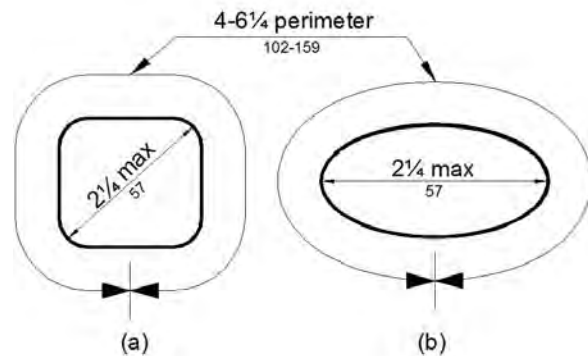


**FIGURE 11B-505.6
HORIZONTAL PROJECTIONS BELOW GRIPPING SURFACE**

11B-505.7 Cross section. Handrail gripping surfaces shall have a cross section complying with Section 11B-505.7.1 or 11B-505.7.2.

11B-505.7.1 Circular cross section. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 1¼ inches (32 mm) minimum and 2 inches (51 mm) maximum.

11B-505.7.2 Non-circular cross sections. Handrail gripping surfaces with a non-circular cross section shall have a perimeter dimension of 4 inches (102 mm) minimum and 6¼ inches (159 mm) maximum, and a cross-section dimension of 2¼ inches (57 mm) maximum.



**FIGURE 11B-505.7.2
HANDRAIL NON-CIRCULAR CROSS SECTION**

11B-505.8 Surfaces. Handrail gripping surfaces and any surfaces adjacent to them shall be free of sharp or abrasive elements and shall have rounded edges.

11B-505.9 Fittings. Handrails shall not rotate within their fittings.

11B-505.10 Handrail extensions. Handrail gripping surfaces shall extend beyond and in the same direction of stair flights and ramp runs in accordance with Section 11B-505.10.

Exceptions:

1. Extensions shall not be required for continuous handrails at the inside turn of switchback or dogleg stairs and ramps.
2. In assembly areas, extensions shall not be required for ramp handrails in aisles serving seating where the handrails are discontinuous to provide access to seating and to permit crossovers within aisles.
3. In alterations, where the extension of the handrail in the direction of stair flight or ramp run would create a

hazard, the extension of the handrail may be turned 90 degrees from the direction of stair flight or ramp run.

11B-505.10.1 Top and bottom extension at ramps.

Ramp handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. Extensions shall return to a wall, guard or the landing surface, or shall be continuous to the handrail of an adjacent ramp run.

11B-505.10.2 Top extension at stairs. At the top of a stair flight, handrails shall extend horizontally above the landing for 12 inches (305 mm) minimum beginning directly above the first riser nosing. Extensions shall return to a wall, guard or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.

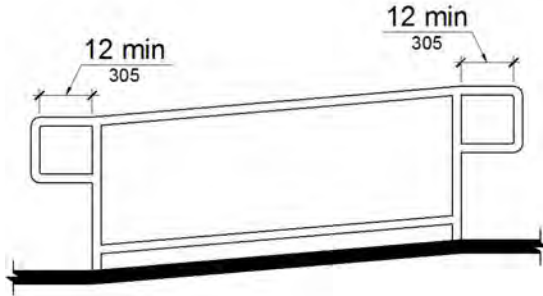


FIGURE 11B-505.10.1
TOP AND BOTTOM HANDRAIL EXTENSION AT RAMPS

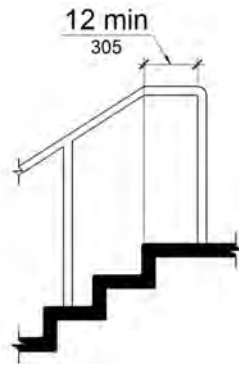


FIGURE 11B-505.10.2
TOP HANDRAIL EXTENSION AT STAIRS

11B-505.10.3 Bottom extension at stairs. At the bottom of a stair flight, handrails shall extend at the slope of the stair flight for a horizontal distance equal to one tread depth beyond the last riser nosing. *The horizontal extension of a handrail shall be 12 inches (305 mm) long minimum and a height equal to that of the sloping portion of*

the handrail as measured above the stair nosings. Extension shall return to a wall, guard or the landing surface, or shall be continuous to the handrail of an adjacent stair flight.

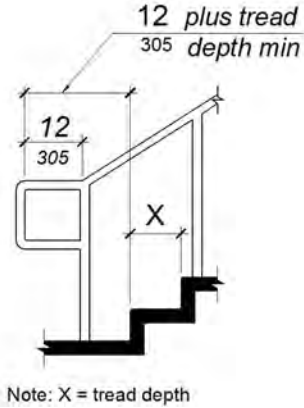


FIGURE 11B-505.10.3
BOTTOM HANDRAIL EXTENSION AT STAIRS

DIVISION 6: PLUMBING ELEMENTS AND FACILITIES

11B-601 General

11B-601.1 Scope. The provisions of *Division 6* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-602 Drinking fountains and bottle-filling stations

11B-602.1 General. Drinking fountains shall comply with *Sections 11B-307* and *11B-602*.

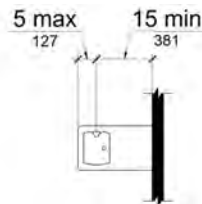
11B-602.2 Clear floor space. Units shall have a clear floor or ground space complying with *Section 11B-305* positioned for a forward approach and centered on the unit. Knee and toe clearance complying with *Section 11B-306* shall be provided.

Exception: A parallel approach complying with *Section 11B-305* shall be permitted at units for children's use where the spout is 30 inches (762 mm) maximum above the finish floor or ground and is 3½ inches (89 mm) maximum from the front edge of the unit, including bumpers.

11B-602.3 Operable parts. Operable parts shall comply with *Section 11B-309*. The flow of water shall be activated by a manually operated system that is front mounted or side mounted and located within 6 inches (152 mm) of the front edge of the fountain or an automatic electronically controlled device.

11B-602.4 Spout height. Spout outlets shall be 36 inches (914 mm) maximum above the finish floor or ground.

11B-602.5 Spout location. The spout shall be located 15 inches (381 mm) minimum from the vertical support and 5 inches (127 mm) maximum from the front edge of the unit, including bumpers.



**FIGURE 11B-602.5
DRINKING FOUNTAIN SPOUT LOCATION**

11B-602.6 Water flow. The spout shall provide a flow of water 4 inches (102 mm) high minimum and shall be located 5 inches (127 mm) maximum from the front of the unit. The angle of the water stream shall be measured horizontally relative to the front face of the unit. Where spouts are located less than 3 inches (76 mm) of the front of the unit, the angle of the water stream shall be 30 degrees maximum. Where spouts are located between 3 inches (76 mm) and 5 inches (127 mm) maximum from the front of the unit, the angle of the water stream shall be 15 degrees maximum.

11B-602.7 Drinking fountains for standing persons. Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) minimum and 43 inches (1092 mm) maximum above the finish floor or ground.

11B-602.8 Depth. Wall- and post-mounted cantilevered drinking fountains shall be 18 inches (457 mm) minimum and 19 inches (483 mm) maximum in depth.

11B-602.9 Pedestrian protection. All drinking fountains shall either be located completely within alcoves, positioned completely between wing walls, or otherwise positioned so as not to encroach into pedestrian ways. The protected area within which a drinking fountain is located shall be 32 inches (813 mm) wide minimum and 18 inches (457 mm) deep minimum, and shall comply with *Section 11B-305.7*. When used, wing walls or barriers shall project horizontally at least as far as the drinking fountain and to within 6 inches (152 mm) vertically from the floor or ground surface.

11B-602.10 Bottle-filling stations. Bottle-filling stations shall comply with *Sections 11B-307* and *11B-309*.

Exception: Where bottle-filling stations are provided at a drinking fountain for standing persons, the bottle-filling station is not required to comply with this section provided a bottle-filling station is located at the drinking fountain complying with *Sections 11B-602.2* through *11B-602.6*.

11B-603 Toilet and bathing rooms

11B-603.1 General. Toilet and bathing rooms shall comply with *Section 11B-603*.

11B-603.2 Clearances. Clearances shall comply with *Section 11B-603.2*.

11B-603.2.1 Turning space. Turning space complying with *Section 11B-304* shall be provided within the room.

11B-603.2.2 Overlap. Required clear floor spaces, clearance at fixtures and turning space shall be permitted to overlap.

11B-603.2.3 Door swing. Doors shall not swing into the clear floor space or clearance required for any fixture. Doors to accessible water closet compartments shall be permitted to encroach into the turning space without limitation. Other than doors to accessible water closet compartments, a door, in any position, shall be permitted to encroach into the turning space by 12 inches (305 mm) maximum.

Exceptions:

1. *Reserved.*
2. Where the toilet room or bathing room is for individual use and a clear floor space complying with *Section 11B-305.3* is provided within the room beyond the arc of the door swing, doors shall be permitted to swing into the clear floor space or clearance required for any fixture.
3. *In residential dwelling units complying with Section 11B-233.3.1.1, doors shall be permitted to swing over the turning space without limitation.*

11B-603.3 Mirrors. Mirrors located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 40 inches (1016 mm) maximum above the finish floor or ground. Mirrors not located above lavatories or countertops shall be installed with the bottom edge of the reflecting surface 35 inches (889 mm) maximum above the finish floor or ground.

11B-603.4 Coat hooks, shelves and medicine cabinets. Coat hooks shall be located within one of the reach ranges specified in Section 11B-308. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor. Medicine cabinets shall be located with a usable shelf no higher than 44 inches (1118 mm) maximum above the finish floor.

11B-603.5 Accessories. Where towel or sanitary napkin dispensers, waste receptacles or other accessories are provided in toilet facilities, at least one of each type shall be located on an accessible route. All operable parts, including coin slots, shall be 40 inches (1016 mm) maximum above the finish floor.

Exception: Baby diaper changing stations are not required to comply with Section 11B-603.5.

11B-603.6 Guest room toilet and bathing rooms. Toilet and bathing rooms within guest rooms that are not required to provide mobility features complying with Section 11B-806.2 shall provide all toilet and bathing fixtures in a location that allows a person using a wheelchair measuring 30 inches by 48 inches (762 mm by 1219 mm) to touch the wheelchair to any lavatory, urinal, water closet, tub, sauna, shower stall and any other similar sanitary installation, if provided.

11B-604 Water closets and toilet compartments

11B-604.1 General. Water closets and toilet compartments shall comply with Sections 11B-604.2 through 11B-604.8.

Exception: Water closets and toilet compartments for children's use shall be permitted to comply with Section 11B-604.9.

11B-604.2 Location. The water closet shall be positioned with a wall or partition to the rear and to one side. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from the side wall or partition, except that the water closet shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in Section 11B-604.8.2. Water closets shall be arranged for a left-hand or right-hand approach.

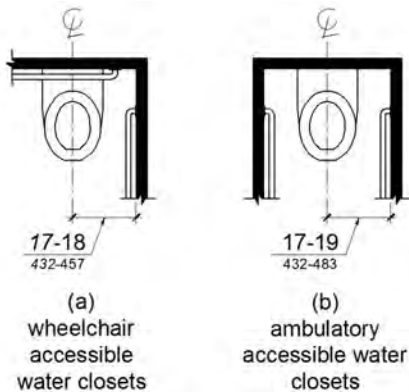


FIGURE 11B-604.2 WATER CLOSET LOCATION

11B-604.3 Clearance. Clearances around water closets and in toilet compartments shall comply with Section 11B-604.3.

11B-604.3.1 Size. Clearance around a water closet shall be 60 inches (1524 mm) minimum measured perpendicular

from the side wall and 56 inches (1422 mm) minimum measured perpendicular from the rear wall. A minimum 60 inches (1524 mm) wide and 48 inches (1219 mm) deep maneuvering space shall be provided in front of the water closet.

Exception: In residential dwelling units complying with Section 11B-233.3.1.1, maneuvering space in front of the water closet shall be a minimum 60 inches (1524 mm) wide and 36 inches (914 mm) deep.

11B-604.3.2 Overlap. The required clearance around the water closet shall be permitted to overlap the water closet, associated grab bars, dispensers, sanitary napkin disposal units, coat hooks, shelves, accessible routes, clear floor space and clearances required at other fixtures and the turning space. No other fixtures or obstructions shall be located within the required water closet clearance.

Exception: In residential dwelling units, a lavatory complying with Section 11B-606 shall be permitted on the rear wall 26 inches (660 mm) minimum from the water closet centerline to allow for the installation of a grab bar where the clearance at the water closet is 66 inches (1676 mm) minimum measured perpendicular from the rear wall.

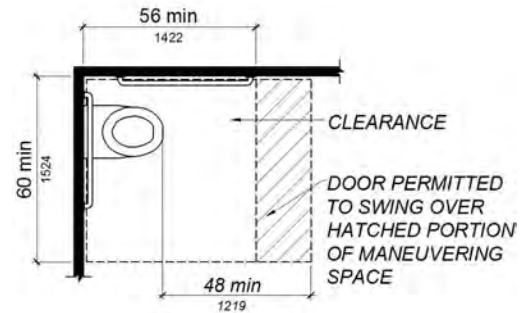


FIGURE 11B-604.3.1 SIZE OF CLEARANCE AT WATER CLOSETS

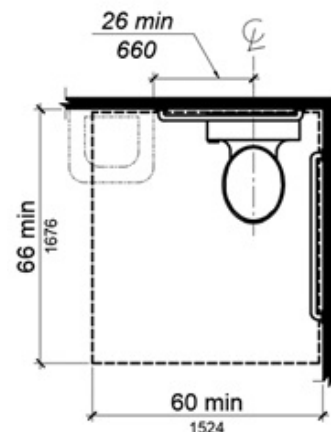


FIGURE 11B-604.3.2 (EXCEPTION) OVERLAP OF WATER CLOSET CLEARANCE IN RESIDENTIAL DWELLING UNITS

11B-604.4 Seats. The seat height of a water closet above the finish floor shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum measured to the top of the seat.

Seats shall not be sprung to return to a lifted position. *Seats shall be 2 inches (51 mm) high maximum.*

Exceptions:

1. *Reserved.*
2. In residential dwelling units, the height of water closets shall be permitted to be 15 inches (381 mm) minimum and 19 inches (483 mm) maximum above the finish floor measured to the top of the seat.
3. A 3-inch (76 mm) high seat shall be permitted only in alterations where the existing fixture is less than 15 inches (381 mm) high.

11B-604.5 Grab bars. Grab bars for water closets shall comply with Section 11B-609. Grab bars shall be provided on the side wall closest to the water closet and on the rear wall. *Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped grab bar meeting the dimensional requirements of Sections 11B-604.5.1 and 11B-604.5.2 shall be permitted.*

Exceptions:

1. *Reserved.*
2. In residential dwelling units, grab bars shall not be required to be installed in toilet or bathrooms provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with Section 11B-604.5.
3. In detention or correction facilities, grab bars shall not be required to be installed in housing or holding cells that are specially designed without protrusions for purposes of suicide prevention.

11B-604.5.1 Side wall. The side wall grab bar shall be 42 inches (1067 mm) long minimum, located 12 inches (305 mm) maximum from the rear wall and extending 54 inches (1372 mm) minimum from the rear wall with the front end positioned 24 inches (610 mm) minimum in front of the water closet.

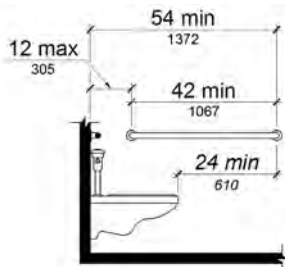


FIGURE 11B-604.5.1
SIDE WALL GRAB BAR AT WATER CLOSETS

11B-604.5.2 Rear wall. The rear wall grab bar shall be 36 inches (914 mm) long minimum and extend from the center-line of the water closet 12 inches (305 mm) minimum on one side and 24 inches (610 mm) minimum on the other side.

Exceptions:

1. The rear grab bar shall be permitted to be 24 inches (610 mm) long minimum, centered on the water closet, where wall space does not permit a length of 36 inches (914 mm) minimum due to the location of a recessed fixture adjacent to the water closet.
2. Where an administrative authority requires flush controls for flush valves to be located in a position that conflicts with the location of the rear grab bar, then the rear grab bar shall be permitted to be split or shifted to the open side of the toilet area.

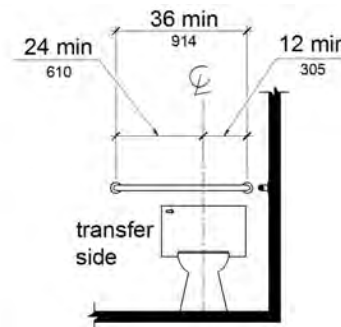


FIGURE 11B-604.5.2
REAR WALL GRAB BAR AT WATER CLOSETS

11B-604.6 Flush controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with Section 11B-309 *except they shall be located 44 inches (1118 mm) maximum above the floor.* Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with Section 11B-604.8.2.

11B-604.7 Dispensers and disposal units. Toilet paper dispensers and sanitary napkin disposal units shall comply with Section 11B-604.7. Combination accessory units are not permitted to encroach into the space required by Section 11B-609.3.

11B-604.7.1 Dispensers. Toilet paper dispensers shall comply with Section 11B-309.4 and shall be 7 inches (178 mm) minimum and 9 inches (229 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be below the grab bar, 19 inches (483 mm) minimum above the finish floor and shall not be located behind grab bars. Dispensers shall

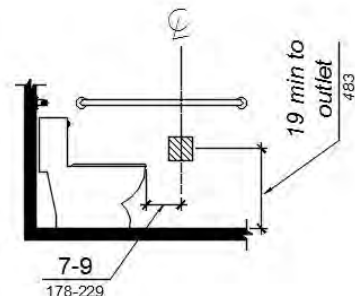


FIGURE 11B-604.7.1
DISPENSER OUTLET LOCATION

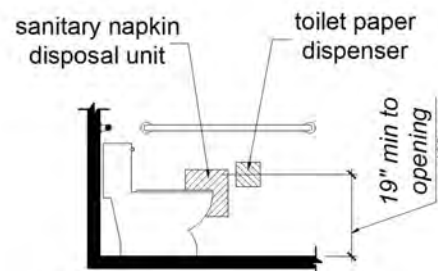


FIGURE 11B-604.7.2
DISPOSAL UNIT LOCATION

not be of a type that controls delivery or that does not allow continuous paper flow.

11B-604.7.2 Disposal units. Sanitary napkin disposal units, if provided, shall comply with Section 11B-309.4 and shall be wall mounted and located on the sidewall between the rear wall of the toilet and the toilet paper dispenser, adjacent to the toilet paper dispenser. The disposal unit shall be located below the grab bar with the opening of the disposal unit 19 inches minimum (483 mm) above the finish floor.

11B-604.8 Toilet compartments. Wheelchair accessible toilet compartments shall meet the requirements of Sections 11B-604.8.1 and 11B-604.8.3. Compartments containing more than one plumbing fixture shall comply with Section 11B-603. Ambulatory accessible compartments shall comply with Sections 11B-604.8.2 and 11B-604.8.3.

11B-604.8.1 Wheelchair accessible compartments. Wheelchair accessible compartments shall comply with Section 11B-604.8.1.

11B-604.8.1.1 Size. Wheelchair accessible compartments shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 56 inches (1422 mm) deep minimum for wall hung water closets and 59 inches (1499 mm) deep minimum for floor mounted water closets measured perpendicular to the rear wall. Wheelchair accessible compartments shall additionally provide maneuvering space complying with Section 11B-604.8.1.1.1, 11B-604.8.1.1.2 or 11B-604.8.1.1.3, as applicable. Wheelchair accessible compartments for children's use shall be 60 inches (1524 mm) wide minimum measured perpendicular to the side wall, and 59 inches (1499 mm) deep minimum for wall hung and floor mounted water closets measured perpendicular to the rear wall.

11B-604.8.1.1.1 Maneuvering space with in-swinging door. In a wheelchair accessible compartment with an in-swinging door, a minimum 60 inches (1524 mm) wide by 36 inches (914 mm) deep maneuvering space shall be provided in front of the clearance required in Section 11B-604.8.1.1. See Figures 11B-604.8.1.1.2 (b) and 11B-604.8.1.1.3 (b).

11B-604.8.1.1.2 Maneuvering space with side-opening door. In a wheelchair accessible compartment with a door located in the side wall or partition, either in-swinging or out-swinging, a minimum 60 inches (1524 mm) wide and 60 inches (1524 mm) deep maneuvering space shall be provided in front of the water closet. See Figure 11B-604.8.1.1.2.

11B-604.8.1.1.3 Maneuvering space with end-opening door. In a wheelchair accessible compartment with a door located in the front wall or partition (facing the water closet), either in-swinging or out-swinging, a minimum 60 inches (1524 mm) wide and 48 inches (1219 mm) deep maneuvering space shall be provided in front of the water closet. See Figure 11B-604.8.1.1.3.

11B-604.8.1.2 Doors. Toilet compartment doors, including door hardware, shall comply with Section 11B-404 except that if the approach is from the push side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 48 inches (1219 mm) minimum measured perpendicular to the compartment door in its closed position. Doors shall be located in the front partition or in the side wall or partition farthest from the water closet. Where located in the front partition, the door opening shall be 4 inches (102 mm) maximum from the side wall or partition farthest from the water closet. Where located in the side wall or partition, the door opening

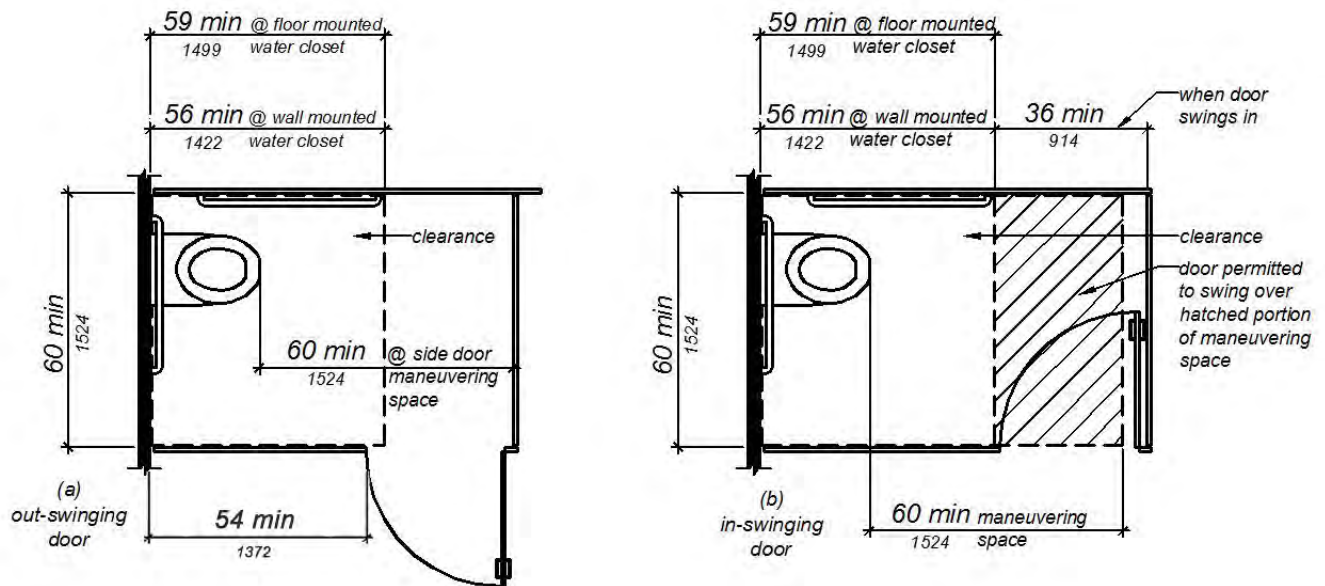


FIGURE 11B-604.8.1.1.2
MANEUVERING SPACE WITH SIDE-OPENING DOOR

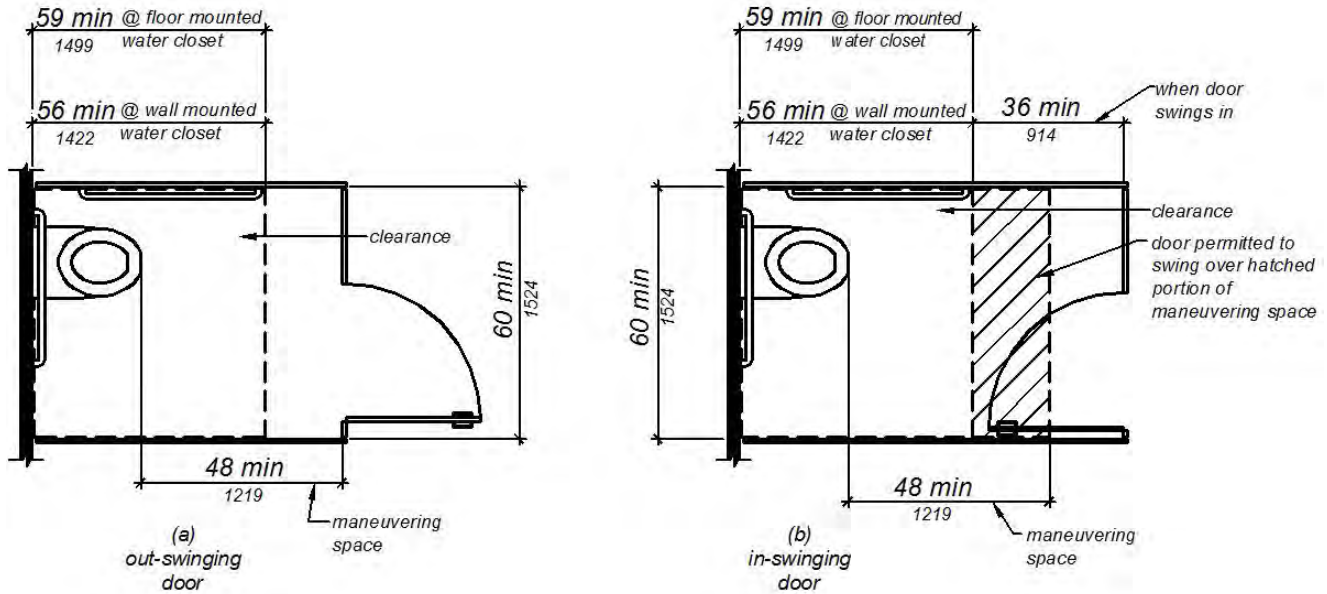


FIGURE 11B-604.8.1.1.3
MANEUVERING SPACE WITH END-OPENING DOOR

shall be farthest from the water closet and shall be 54 inches (1372 mm) minimum from the rear wall. The door shall be self-closing. A door pull complying with Section 11B-404.2.7 shall be placed on both sides of the door near the latch. Doors shall not swing into the clear floor space or clearance required for any fixture. Doors may swing into that portion of maneuvering space which does not overlap the clearance required at a water closet.

Exception: When located at the side of a toilet compartment, the toilet compartment door opening shall provide a clear width of 34 inches (864 mm) minimum.

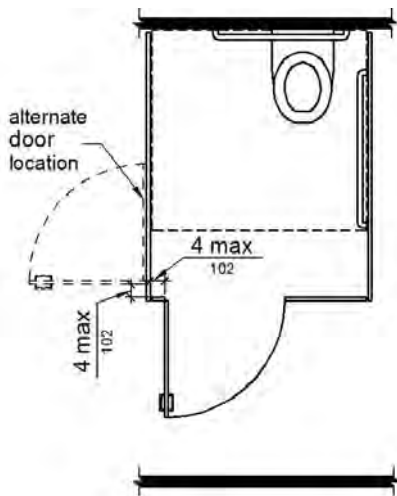


FIGURE 11B-604.8.1.2
WHEELCHAIR ACCESSIBLE TOILET COMPARTMENT DOORS

11B-604.8.1.3 Approach. Compartments shall be arranged for left-hand or right-hand approach to the water closet.

11B-604.8.1.4 Toe clearance. At least one side partition shall provide a toe clearance of 9 inches (229 mm) minimum above the finish floor and 6 inches (152 mm) deep minimum beyond the compartment-side face of the partition, exclusive of partition support members. Partition components at toe clearances shall be smooth without sharp edges or abrasive surfaces. Compartments for children's use shall provide a toe clearance of 12 inches (305 mm) minimum above the finish floor.

Exception: Toe clearance at the side partition is not required in a compartment greater than 66 inches (1676 mm) wide.

11B-604.8.1.5 Grab bars. Grab bars shall comply with Section 11B-609. A side-wall grab bar complying with Section 11B-604.5.1 shall be provided and shall be located on the wall closest to the water closet. In addition, a rear-wall grab bar complying with Section 11B-604.5.2 shall be provided. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped grab bar meeting the dimensional requirements of Sections 11B-604.5.1 and 11B-604.5.2 shall be permitted.

11B-604.8.2 Ambulatory accessible compartments. Ambulatory accessible compartments shall comply with Section 11B-604.8.2.

11B-604.8.2.1 Size. Ambulatory accessible compartments shall have a depth of 60 inches (1524 mm) minimum and a width of 35 inches (889 mm) minimum and 37 inches (940 mm) maximum.

11B-604.8.2.2 Doors. Toilet compartment doors, including door hardware, shall comply with Section 11B-404, except that if the approach is to the latch side of the compartment door, clearance between the door side of the compartment and any obstruction shall be 44 inches (1118 mm) minimum. The door shall be self-

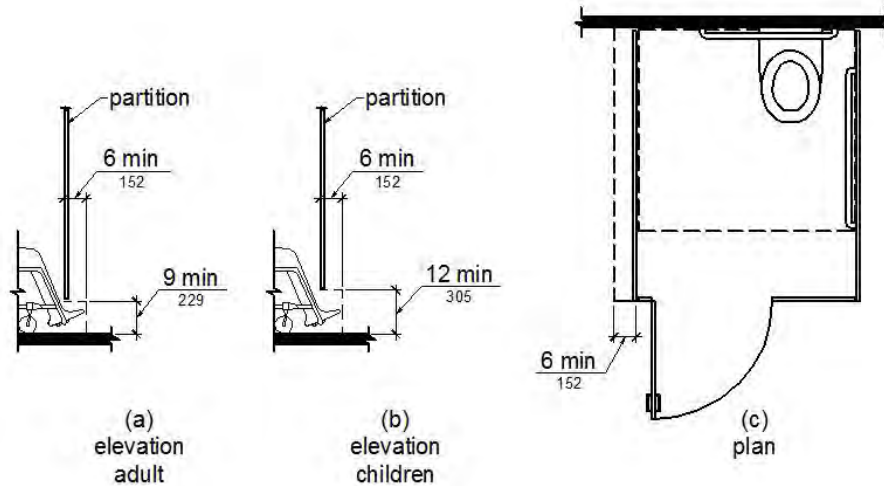
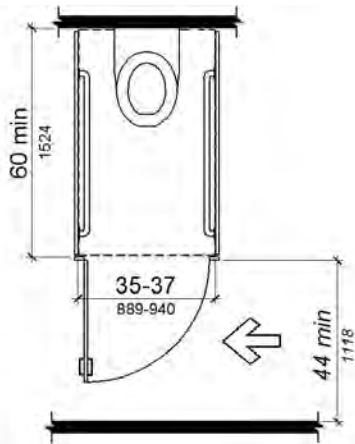


FIGURE 11B-604.8.1.4
WHEELCHAIR ACCESSIBLE TOILET COMPARTMENT TOE CLEARANCE

closing. A door pull complying with Section 11B-404.2.7 shall be placed on both sides of the door near the latch. Toilet compartment doors shall not swing into the minimum required compartment area.

11B-604.8.2.3 Grab bars. Grab bars shall comply with Section 11B-609. A side-wall grab bar complying with Section 11B-604.5.1 shall be provided on both sides of the compartment.



11B-604.8.2
AMBULATORY ACCESSIBLE TOILET COMPARTMENT

11B-604.8.3 Coat hooks and shelves. Coat hooks shall be located within one of the reach ranges specified in Section 11B-308. Shelves shall be located 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor.

11B-604.9 Water closets and toilet compartments for children's use. Water closets and toilet compartments for children's use shall comply with Section 11B-604.9. When the exception in Section 11B-604.1 is used, the suggested dimensions of Table 11B-604.9 for a single age group shall be applied consistently to the installation of a water closet and all associated components.

11B-604.9.1 Location. The water closet shall be located with a wall or partition to the rear and to one side. The centerline of the water closet shall be 12 inches (305 mm) minimum and 18 inches (457 mm) maximum from the side wall or partition, except that the water closet shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum from the side wall or partition in the ambulatory accessible toilet compartment specified in Section 11B-604.8.2. Compartments shall be arranged for left-hand or right-hand approach to the water closet.

11B-604.9.2 Clearance. Clearance around a water closet shall comply with Section 11B-604.3.

11B-604.9.3 Height. The height of water closets shall be 11 inches (279 mm) minimum and 17 inches (432 mm) maximum measured to the top of the seat. Seats shall not be sprung to return to a lifted position.

11B-604.9.4 Grab bars. Grab bars for water closets shall comply with Section 11B-604.5.

11B-604.9.5 Flush controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with Sections 11B-309.2 and 11B-309.4 and shall be installed 36 inches (914 mm) maximum above the finish floor. Flush controls shall be located on the open side of the water closet except in ambulatory accessible compartments complying with Section 11B-604.8.2.

11B-604.9.6 Dispensers. Toilet paper dispensers shall comply with Section 11B-309.4 and shall be 7 inches (178 mm) minimum and 9 inches (229 mm) maximum in front of the water closet measured to the centerline of the dispenser. The outlet of the dispenser shall be 14 inches (356 mm) minimum and 19 inches (483 mm) maximum above the finish floor. There shall be a clearance of 1½ inches (38 mm) minimum below the grab bar. Dispensers shall not be of a type that controls delivery or that does not allow continuous paper flow.

11B-604.9.7 Toilet compartments. Toilet compartments shall comply with Section 11B-604.8.

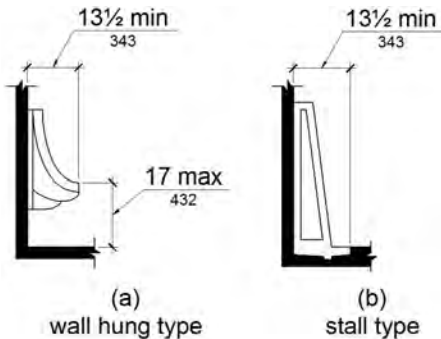
**TABLE 11B-604.9
SUGGESTED DIMENSIONS FOR CHILDREN'S USE**

SUGGESTED DIMENSIONS FOR WATER CLOSETS SERVING CHILDREN AGES 3 THROUGH 12			
	Ages 3 and 4	Ages 5 through 8	Ages 9 through 12
Water Closet Centerline	12 inches (305 mm)	12 to 15 inches (305 to 381 mm)	15 to 18 inches (381 to 457 mm)
Toilet Seat Height	11 to 12 inches (279 to 305 mm)	12 to 15 inches (305 to 381 mm)	15 to 17 inches (381 to 432 mm)
Grab Bar Height	18 to 20 inches (457 to 508 mm)	20 to 25 inches (508 to 635 mm)	25 to 27 inches (635 to 686 mm)
Dispenser Height	14 inches (356 mm)	14 to 17 inches (356 to 432 mm)	17 to 19 inches (432 to 483 mm)

11B-605 Urinals

11B-605.1 General. Urinals shall comply with *Section 11B-605*.

11B-605.2 Height and depth. Urinals shall be the stall-type or the wall-hung type with the rim 17 inches (432 mm) maximum above the finish floor or ground. Urinals shall be 13½ inches (343 mm) deep minimum measured from the outer face of the urinal rim to the back of the fixture.



**FIGURE 11B-605.2
HEIGHT AND DEPTH OF URINALS**

11B-605.3 Clear floor space. A clear floor or ground space complying with *Section 11B-305* positioned for forward approach shall be provided.

11B-605.4 Flush controls. Flush controls shall be hand operated or automatic. Hand operated flush controls shall comply with *Section 11B-309* except that the flush control shall be mounted at a maximum height of 44 inches (1118 mm) above the finish floor.

11B-606 Lavatories and sinks

11B-606.1 General. Lavatories and sinks shall comply with *Section 11B-606*.

11B-606.2 Clear floor space. A clear floor space complying with *Section 11B-305*, positioned for a forward approach, and knee and toe clearance complying with *Section 11B-306* shall be provided.

Exceptions:

1. A parallel approach complying with *Section 11B-305* shall be permitted to a kitchen sink in a space where a cook top or conventional range is not provided and to wet bars.
2. *Reserved.*
3. In residential dwelling units, cabinetry shall be permitted under lavatories and kitchen sinks provided that all of the following conditions are met:
 - (a) the cabinetry can be removed without removal or replacement of the fixture;
 - (b) the finish floor extends under the cabinetry; and
 - (c) the walls behind and surrounding the cabinetry are finished.
4. A knee clearance of 24 inches (610 mm) minimum above the finish floor or ground shall be permitted at lavatories and sinks used primarily by children 6 through 12 years where the rim or counter surface is 31 inches (787 mm) maximum above the finish floor or ground.
5. A parallel approach complying with *Section 11B-305* shall be permitted to lavatories and sinks used primarily by children 5 years and younger.
6. The dip of the overflow shall not be considered in determining knee and toe clearances.
7. No more than one bowl of a multibowl sink shall be required to provide knee and toe clearance complying with *Section 11B-306*.

11B-606.3 Height. Lavatories and sinks shall be installed with the front of the higher of the rim or counter surface 34 inches (864 mm) maximum above the finish floor or ground.

Exceptions:

1. *Reserved.*
2. In residential dwelling unit kitchens, sinks that are adjustable to variable heights, 29 inches (737 mm) minimum and 36 inches (914 mm) maximum, shall be permitted where rough-in plumbing permits connections of supply and drain pipes for sinks mounted at the height of 29 inches (737 mm).

11B-606.4 Faucets. Controls for faucets shall comply with *Section 11B-309*. Hand-operated metering faucets shall remain open for 10 seconds minimum.

11B-606.5 Exposed pipes and surfaces. Water supply and drain pipes under lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under lavatories and sinks.

11B-606.6 Adjacent side wall or partition. Lavatories, when located adjacent to a side wall or partition, shall be a minimum of 18 inches (457 mm) to the centerline of the fixture.

11B-606.7 Sink depth. Where a forward approach is required at a sink, knee and toe clearance shall be provided in compliance with *Section 11B-306*.

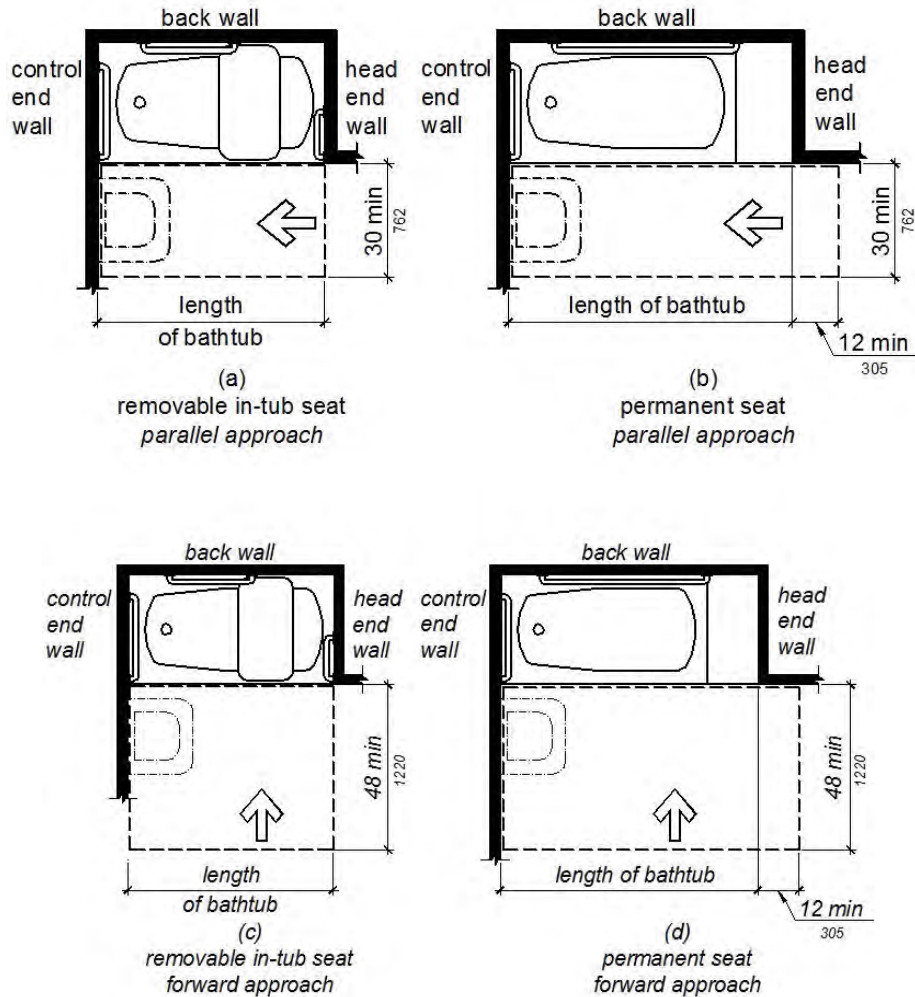
11B-607 Bathtubs

11B-607.1 General. Bathtubs shall comply with *Section 11B-607*.

11B-607.2 Clearance. Clearance in front of bathtubs shall extend the length of the bathtub and shall be 48 inches (1219 mm) wide minimum for forward approach and 30 inches (762 mm) wide minimum for parallel approach. A lavatory complying with *Section 11B-606* shall be permitted at the control end of the clearance. Where a permanent seat is provided at the head end of the bathtub, the clearance shall extend 12 inches (305 mm) minimum beyond the wall at the head end of the bathtub.

11B-607.3 Seat. A permanent seat at the head end of the bathtub or a removable in-tub seat shall be provided. Seats shall comply with *Section 11B-610*.

11B-607.4 Grab bars. Grab bars for bathtubs shall comply with *Section 11B-609* and shall be provided in accordance with *Section 11B-607.4.1* or *11B-607.4.2*. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting



**FIGURE 11B-607.2
CLEARANCE FOR BATHTUBS**

the dimensional requirements of Section 11B-607.4.1 or 11B-607.4.2 shall be permitted.

Exceptions:

1. *Reserved.*
2. In residential dwelling units, grab bars shall not be required to be installed in bathtubs located in bathing facilities provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with Section 11B-607.4.

11B-607.4.1 Bathtubs with permanent seats. For bathtubs with permanent seats, grab bars shall be provided in accordance with Section 11B-607.4.1.

11B-607.4.1.1 Back wall. Two grab bars shall be installed on the back wall, one located in accordance with Section 11B-609.4 and the other located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be installed 15 inches (381 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

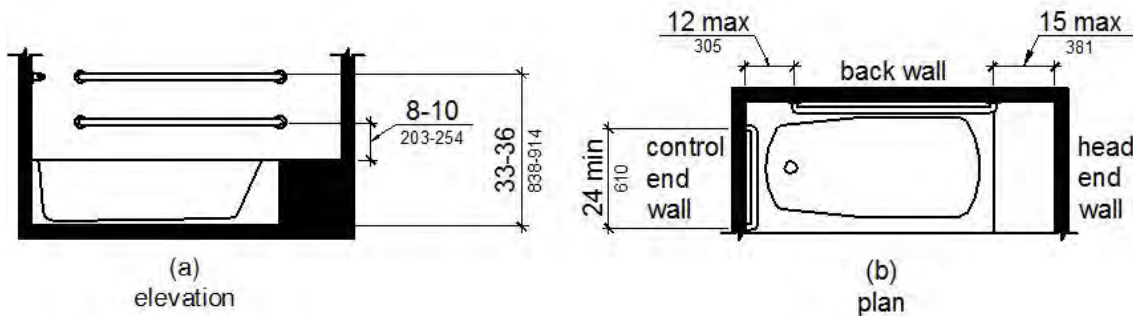
11B-607.4.1.2 Control end wall. A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

11B-607.4.2 Bathtubs without permanent seats. For bathtubs without permanent seats, grab bars shall comply with Section 11B-607.4.2.

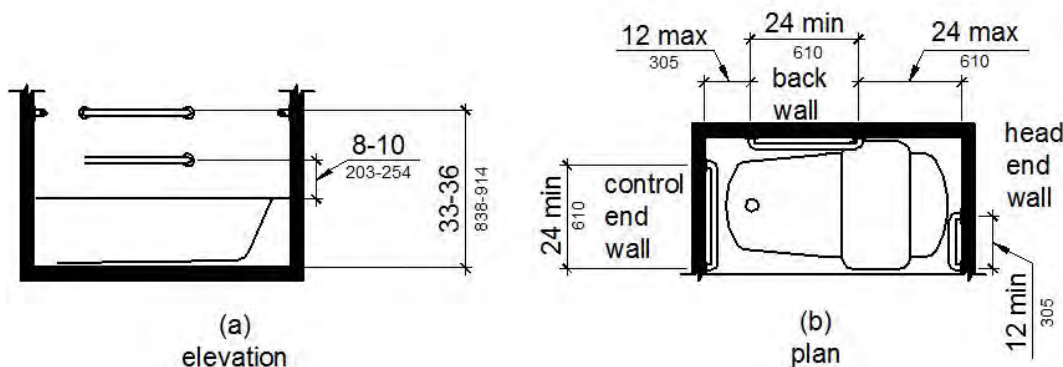
11B-607.4.2.1 Back wall. Two grab bars shall be installed on the back wall, one located in accordance with Section 11B-609.4 and the other located 8 inches (203 mm) minimum and 10 inches (254 mm) maximum above the rim of the bathtub. Each grab bar shall be 24 inches (610 mm) long minimum and shall be installed 24 inches (610 mm) maximum from the head end wall and 12 inches (305 mm) maximum from the control end wall.

11B-607.4.2.2 Control end wall. A grab bar 24 inches (610 mm) long minimum shall be installed on the control end wall at the front edge of the bathtub.

11B-607.4.2.3 Head end wall. A grab bar 12 inches (305 mm) long minimum shall be installed on the head end wall at the front edge of the bathtub.

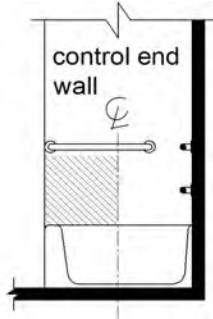


**FIGURE 11B-607.4.1
GRAB BARS FOR BATHTUBS WITH PERMANENT SEATS**



**FIGURE 11B-607.4.2
GRAB BARS FOR BATHTUBS WITH REMOVABLE IN-TUB SEATS**

11B-607.5 Controls. Controls, other than drain stoppers, shall be located on an end wall. Controls shall be between the bathtub rim and grab bar, and between the open side of the bathtub and the centerline of the width of the bathtub. Controls shall comply with *Section 11B-309.4*.



**FIGURE 11B-607.5
BATHTUB CONTROL LOCATION**

11B-607.6 Shower spray unit and water. A shower spray unit with a hose 59 inches (1499 mm) long minimum that can be used both as a fixed-position shower head and as a handheld shower shall be provided. The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars. Bathtub shower spray units shall deliver water that is 120°F (49°C) maximum.

11B-607.7 Bathtub enclosures. Enclosures for bathtubs shall not obstruct controls, faucets, shower and spray units or obstruct transfer from wheelchairs onto bathtub seats or into bathtubs. Enclosures on bathtubs shall not have tracks installed on the rim of the open face of the bathtub.

11B-608 Shower compartments

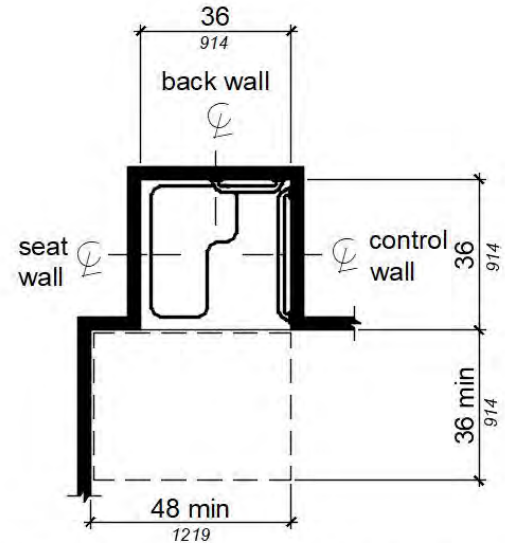
11B-608.1 General. Shower compartments shall comply with *Section 11B-608*.

11B-608.2 Size and clearances for shower compartments. Shower compartments shall have sizes and clearances complying with *Section 11B-608.2*.

11B-608.2.1 Transfer type shower compartments.

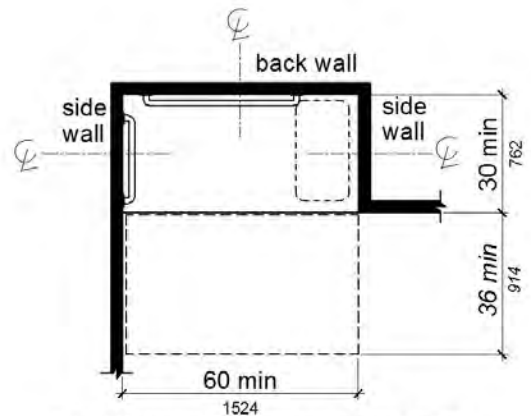
Transfer type shower compartments shall be 36 inches (914 mm) by 36 inches (914 mm) clear inside dimensions measured at the center points of opposing sides and shall have a 36-inch (914 mm) wide minimum entry on the face of the shower compartment. Clearance of 36 inches (914 mm) wide minimum by 48 inches (1219 mm) long minimum measured from the control wall shall be provided. *Transfer type shower compartments shall be permitted in transient lodging guest rooms, multibed-room housing units in undergraduate student housing and residential dwelling units; and shall not be permitted at other locations to meet the requirements of Section 11B-213.3.6.*

11B-608.2.2 Standard roll-in type shower compartments. Standard roll-in type shower compartments shall be 30 inches (762 mm) wide minimum by 60 inches (1524 mm) deep minimum clear inside dimensions measured at center points of opposing sides with a full opening width on the long side.



Note: inside finished dimensions measured at the center points of opposing sides

**FIGURE 11B-608.2.1
TRANSFER TYPE SHOWER
COMPARTMENT SIZE AND CLEARANCE**



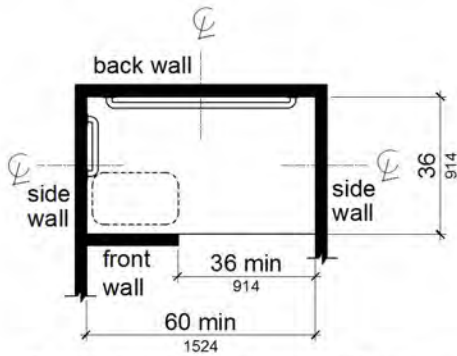
Note: inside finished dimensions measured at the center points of opposing sides

**FIGURE 11B-608.2.2
STANDARD ROLL-IN TYPE
SHOWER COMPARTMENT SIZE AND CLEARANCE**

11B-608.2.2.1 Clearance. A 36 inch (914 mm) wide minimum by 60 inch (1524 mm) long minimum clearance shall be provided adjacent to the open face of the shower compartment.

Exception: Reserved.

11B-608.2.3 Alternate roll-in type shower compartments. Alternate roll-in type shower compartments shall be 36 inches (914 mm) wide and 60 inches (1524 mm) deep minimum clear inside dimensions measured at center points of opposing sides. A 36 inch (914 mm) wide minimum entry shall be provided at one end of the long side of the compartment.



Note: inside finished dimensions measured at the center points of opposing sides

FIGURE 11B-608.2.3 ALTERNATE ROLL-IN TYPE SHOWER COMPARTMENT SIZE AND CLEARANCE

11B-608.3 Grab bars. Grab bars shall comply with Section 11B-609 and shall be provided in accordance with Section 11B-608.3. Where multiple grab bars are used, required horizontal grab bars shall be installed at the same height above the finish floor. Where separate grab bars are required on adjacent walls at a common mounting height, an L-shaped or U-shaped grab bar meeting the dimensional requirements of Section 11B-608.3.2 or 11B-608.3.3 shall be permitted.

Exceptions:

1. *Reserved.*
2. In residential dwelling units, grab bars shall not be required to be installed in showers located in bathing facilities provided that reinforcement has been installed in walls and located so as to permit the installation of grab bars complying with Section 11B-608.3.

11B-608.3.1 Transfer type shower compartments. In transfer type compartments, grab bars shall be provided across the control wall and back wall to a point 18 inches (457 mm) from the control wall.

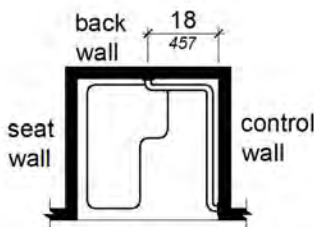


FIGURE 11B-608.3.1 GRAB BARS FOR TRANSFER TYPE SHOWERS

11B-608.3.2 Standard roll-in type shower compartments. Grab bars shall be provided on the back wall and the side wall opposite the seat. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

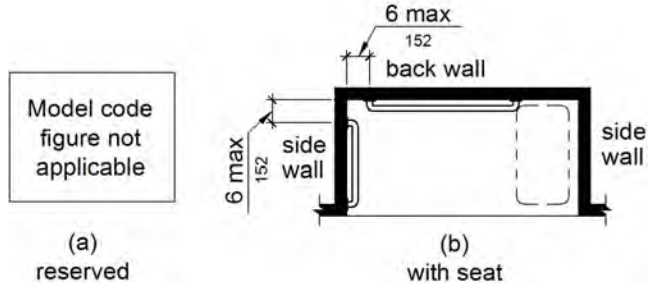


FIGURE 11B-608.3.2 GRAB BARS FOR STANDARD ROLL-IN TYPE SHOWER

11B-608.3.3 Alternate roll-in type shower compartments. In alternate roll-in type shower compartments, grab bars shall be provided on the back wall and the side wall farthest from the compartment entry. Grab bars shall not be provided above the seat. Grab bars shall be installed 6 inches (152 mm) maximum from adjacent walls.

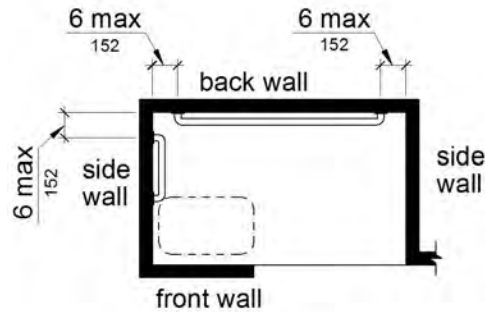


FIGURE 11B-608.3.3 GRAB BARS FOR ALTERNATE ROLL-IN TYPE SHOWERS

11B-608.4 Seats. A folding seat shall be provided in roll-in type showers and transfer type shower compartments. Seats shall comply with Section 11B-610.

Exception: In residential dwelling units, seats shall not be required in shower compartments provided that reinforcement has been installed in walls so as to permit the installation of seats complying with Section 11B-608.4.

11B-608.5 Controls. Controls, faucets and shower spray units shall comply with Section 11B-309.4. Controls and faucets shall allow the user to close and open the water supply.

11B-608.5.1 Transfer type shower compartments. In transfer type shower compartments, the controls, faucets and shower spray unit shall be installed on the side wall opposite the seat 38 inches (965 mm) minimum and 48 inches (1219 mm) maximum above the shower floor and shall be located on the control wall 15 inches (380 mm)

maximum from the centerline of the seat toward the shower opening.

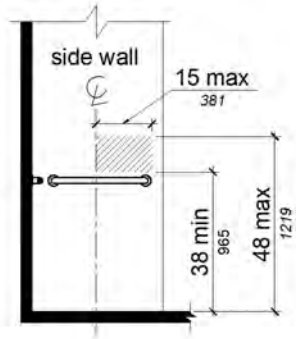


FIGURE 11B-608.5.1
TRANSFER TYPE SHOWER
COMPARTMENT CONTROL LOCATION

11B-608.5.2 Standard roll-in type shower compartments. In standard roll-in type shower compartments, the controls, faucets and the shower spray unit shall be located on the back wall of the compartment adjacent to the seat wall 16 inches (406 mm) minimum and 27 inches (686 mm) maximum from the seat wall; and shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

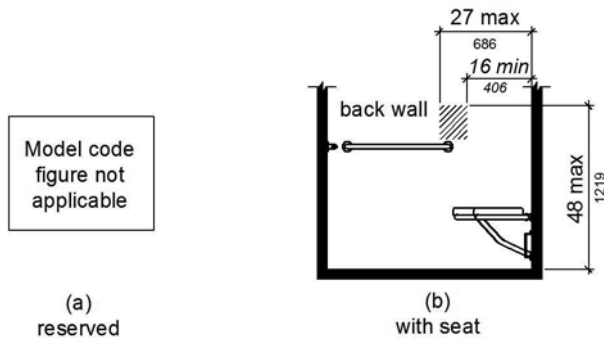


FIGURE 11B-608.5.2
STANDARD ROLL-IN TYPE
SHOWER COMPARTMENT CONTROL LOCATION

11B-608.5.3 Alternate roll-in type shower compartments. In alternate roll-in type shower compartments, the controls, faucets and shower spray unit shall be located on the side wall of the compartment adjacent to the seat wall 16 inches (406 mm) minimum and 27 inches (686 mm) maximum from the seat wall or shall be located on the back wall opposite the seat 15 inches (381 mm) maximum, left or right of the centerline of the seat. The controls, faucets and shower spray units shall be located above the grab bar, but no higher than 48 inches (1219 mm) above the shower floor.

11B-608.6 Shower spray unit and water. A shower spray unit with a hose 59 inches (1499 mm) long minimum that can be used both as a fixed-position shower head and as a handheld shower shall be provided. The shower spray unit shall have an on/off control with a non-positive shut-off. If an adjustable-height shower head on a vertical bar is used, the bar shall be installed so as not to obstruct the use of grab bars. Shower spray units shall deliver water that is 120°F (49°C) maximum.

Exception: Where subject to excessive vandalism, two fixed shower heads shall be permitted instead of a handheld spray unit in facilities that are not medical care facilities, long-term care facilities, transient lodging guest rooms or residential dwelling units. Each shower head shall be installed so it can be operated independently of the other and shall have swivel angle adjustments, both vertically and horizontally. One shower head shall be located at a height of 48 inches (1219 mm) maximum above the shower finish floor.

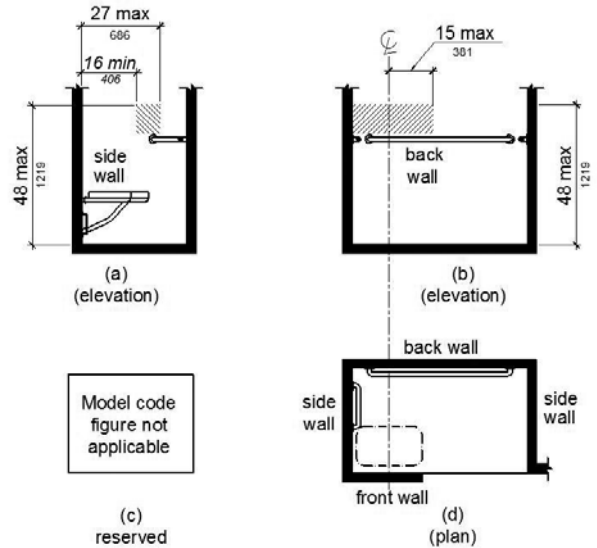


FIGURE 11B-608.5.3
ALTERNATE ROLL-IN TYPE
SHOWER COMPARTMENT CONTROL LOCATION

11B-608.7 Thresholds. Thresholds in roll-in type shower compartments shall be 1/2 inch (12.7 mm) high maximum in accordance with Section 11B-303. In transfer type shower compartments, thresholds 1/2 inch (12.7 mm) high maximum shall be beveled, rounded or vertical.

Exception: A threshold 2 inches (51 mm) high maximum shall be permitted in transfer type shower compartments in existing facilities where provision of a 1/2 inch (12.7 mm) high threshold would disturb the structural reinforcement of the floor slab.

11B-608.8 Shower enclosures. Enclosures for shower compartments shall not obstruct controls, faucets and shower

spray units or obstruct transfer from wheelchairs onto shower seats.

11B-608.9 Shower floor or ground surface. Floor or ground surfaces of showers shall comply with Section 11B-302.1 and shall be sloped 1:48 maximum in any direction. Where drains are provided, grate openings shall be $\frac{1}{4}$ inch (6.4 mm) maximum and flush with the floor surface.

11B-608.10 Soap dish. Where a soap dish is provided, it shall be located on the control wall at 40 inches (1016 mm) maximum above the shower floor, and within the reach limits from the seat.

11B-609 Grab bars

11B-609.1 General. Grab bars in toilet facilities and bathing facilities shall comply with Section 11B-609.

11B-609.2 Cross section. Grab bars shall have a cross section complying with Section 11B-609.2.1 or 11B-609.2.2.

11B-609.2.1 Circular cross section. Grab bars with circular cross sections shall have an outside diameter of $1\frac{1}{4}$ inches (32 mm) minimum and 2 inches (51 mm) maximum.

11B-609.2.2 Non-circular cross section. Grab bars with non-circular cross sections shall have a cross-section dimension of 2 inches (51 mm) maximum and a perimeter dimension of 4 inches (102 mm) minimum and 4.8 inches (122 mm) maximum.

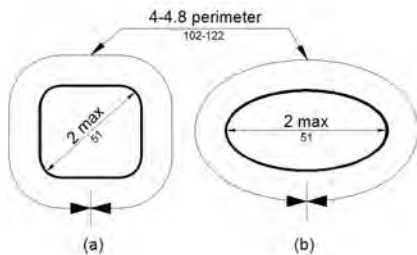


FIGURE 11B-609.2.2 GRAB BAR NON-CIRCULAR CROSS SECTION

11B-609.3 Spacing. The space between the wall and the grab bar shall be $1\frac{1}{2}$ inches (38 mm). The space between the grab bar and projecting objects below and at the ends shall be $1\frac{1}{2}$ inches (38 mm) minimum. The space between the grab bar and projecting objects above shall be 12 inches (305 mm) minimum.

Exceptions:

1. The space between the grab bars and shower controls, shower fittings, and other grab bars above shall be permitted to be $1\frac{1}{2}$ inches (38 mm) minimum.
2. For L-shaped or U-shaped grab bars complying with Section 11B-609.9 the space between the walls and the grab bar shall be $1\frac{1}{2}$ inches (38 mm) mini-

um for a distance of 6 inches on either side of the inside corner between two adjacent wall surfaces.

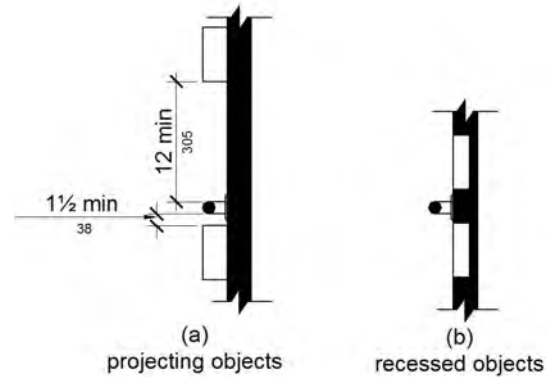


FIGURE 11B-609.3 SPACING OF GRAB BARS

11B-609.4 Position of grab bars. Grab bars shall be installed in a horizontal position, 33 inches (838 mm) minimum and 36 inches (914 mm) maximum above the finish floor measured to the top of the gripping surface, except that at water closets for children's use complying with Section 11B-604.9, grab bars shall be installed in a horizontal position 18 inches (457 mm) minimum and 27 inches (686 mm) maximum above the finish floor measured to the top of the gripping surface. The height of the lower grab bar on the back wall of a bathtub shall comply with Section 11B-607.4.1.1 or 11B-607.4.2.1.

11B-609.5 Surface hazards. Grab bars and any wall or other surfaces adjacent to grab bars shall be free of sharp or abrasive elements and shall have rounded edges.

11B-609.6 Fittings. Grab bars shall not rotate within their fittings.

11B-609.7 Installation. Grab bars shall be installed in any manner that provides a gripping surface at the specified locations and that does not obstruct the required clear floor space.

11B-609.8 Structural strength. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the grab bar, fastener, mounting device or supporting structure.

11B-609.9 Alternate configuration. L-shaped or U-shaped grab bars shall be permitted.

11B-610 Seats

11B-610.1 General. Seats in bathtubs and shower compartments shall comply with Section 11B-610.

11B-610.2 Bathtub seats. The top of bathtub seats shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. The depth of a removable in-tub seat shall be 15 inches (381 mm) minimum and 16 inches (406 mm) maximum. The seat shall be capable of secure placement. Permanent seats at the head end of the

bath tub shall be 15 inches (381 mm) deep minimum and shall extend from the back wall to or beyond the outer edge of the bathtub.

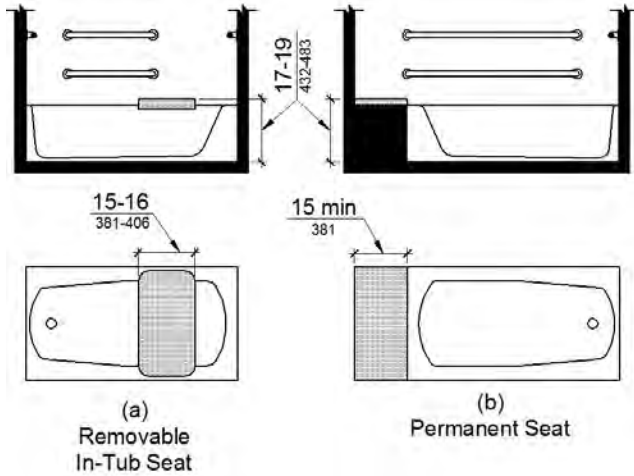


FIGURE 11B-610.2 BATH TUB SEATS

11B-610.3 Shower compartment seats. A seat in a standard roll-in shower compartment shall be a folding type, shall be installed on the side wall adjacent to the controls, and shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. A seat in an alternate roll-in type shower compartment shall be a folding type, shall be installed on the front wall opposite the back wall, and shall extend from the adjacent side wall to a point within 3 inches (76 mm) of the compartment entry. In transfer type showers, the seat shall extend from the back wall to a point within 3 inches (76 mm) of the compartment entry. The top of the seat shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the bathroom finish floor. When folded, the seat shall extend 6 inches (152 mm) maximum from the mounting wall. Seats shall comply with Section 11B-610.3.1 or 11B-610.3.2.

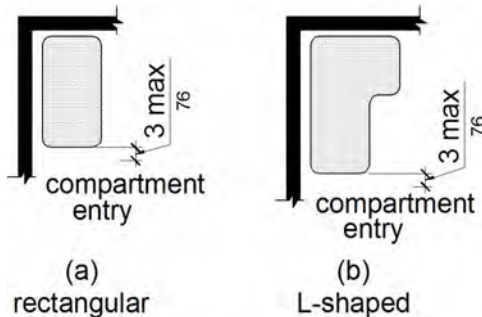


FIGURE 11B-610.3 EXTENT OF SEAT

11B-610.3.1 Rectangular seats. The rear edge of a rectangular seat shall be 2½ inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The side

edge of the seat shall be 1½ inches (38 mm) maximum from the adjacent wall.

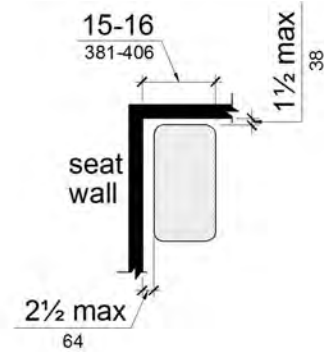


FIGURE 11B-610.3.1 RECTANGULAR SHOWER SEAT

11B-610.3.2 L-shaped seats. The rear edge of an L-shaped seat shall be 2½ inches (64 mm) maximum and the front edge 15 inches (381 mm) minimum and 16 inches (406 mm) maximum from the seat wall. The rear edge of the “L” portion of the seat shall be 1½ inches (38 mm) maximum from the wall and the front edge shall be 14 inches (356 mm) minimum and 15 inches (381 mm) maximum from the wall. The end of the “L” shall be 22 inches (559 mm) minimum and 23 inches (584 mm) maximum from the main seat wall.

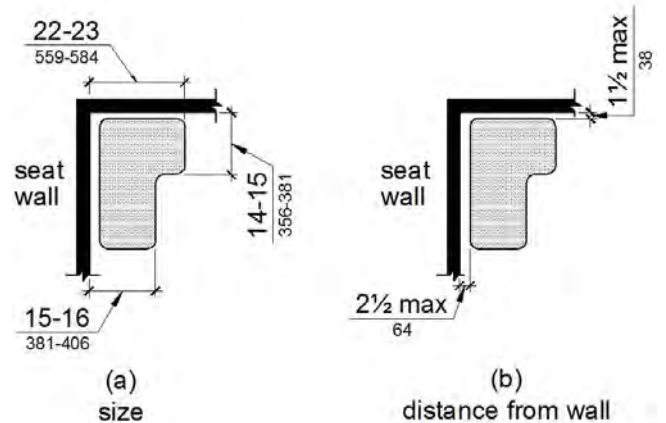


FIGURE 11B-610.3.2 L-SHAPED SHOWER SEAT

11B-610.4 Structural strength. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device or supporting structure.

11B-611 Washing machines and clothes dryers

11B-611.1 General. Washing machines and clothes dryers shall comply with Section 11B-611.

11B-611.2 Clear floor space. A clear floor or ground space complying with Section 11B-305 positioned for parallel approach shall be provided. The clear floor or ground space shall be centered on the appliance.

11B-611.3 Operable parts. Operable parts, including doors, lint screens and detergent and bleach compartments shall comply with *Section 11B-309*.

11B-611.4 Height. Top loading machines shall have the door to the laundry compartment located 36 inches (914 mm) maximum above the finish floor. Front loading machines shall have the bottom of the opening to the laundry compartment located 15 inches (381 mm) minimum and 36 inches (914 mm) maximum above the finish floor.

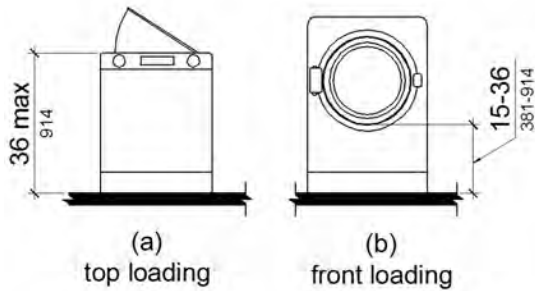


FIGURE 11B-611.4
HEIGHT OF LAUNDRY COMPARTMENT OPENING

11B-612 Saunas and steam rooms

11B-612.1 General. Saunas and steam rooms shall comply with *Section 11B-612*.

11B-612.2 Bench. Where seating is provided in saunas and steam rooms, at least one bench shall comply with *Section 11B-903*. Doors shall not swing into the clear floor space required by *Section 11B-903.2*.

Exception: A readily removable bench shall be permitted to obstruct the turning space required by *Section 11B-612.3* and the clear floor or ground space required by *Section 11B-903.2*.

11B-612.3 Turning space. A turning space complying with *Section 11B-304* shall be provided within saunas and steam rooms.

DIVISION 7: COMMUNICATION ELEMENTS AND FEATURES

11B-701 General

11B-701.1 Scope. The provisions of *Division 7* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-702 Fire alarm systems

11B-702.1 General. Fire alarm systems shall have permanently installed audible and visible alarms complying with NFPA 72 and *Chapter 9, Sections 907.5.2.1 and 907.5.2.3*.

Exception: Reserved.

11B-703 Signs

11B-703.1 General. Signs shall comply with *Section 11B-703*. Where both visual and tactile characters are required, either one sign with both visual and tactile characters or two separate signs, one with visual, and one with tactile characters, shall be provided.

11B-703.1.1 Plan review and inspection. Signs as specified in *Section 11B-703*, or in other sections of this code, when included in the construction of new buildings or facilities, or when included, altered or replaced due to additions, alterations or renovations to existing buildings or facilities, and when a permit is required, shall comply with *Sections 11B-703.1.1.1 and 11B-703.1.1.2*.

11B-703.1.1.1 Plan review. Plans, specifications or other information indicating compliance with these regulations shall be submitted to the enforcing agency for review and approval.

11B-703.1.1.2 Inspection. Signs and identification devices shall be field inspected after installation and approved by the enforcing agency prior to the issuance of a final certificate of occupancy per *Chapter 1, Division II, Section 111*, or final approval where no certificate of occupancy is issued. The inspection shall include, but not be limited to, verification that Braille dots and cells are properly spaced and the size, proportion and type of raised characters are in compliance with these regulations.

11B-703.2 Raised characters. Raised characters shall comply with *Section 11B-703.2* and shall be duplicated in Braille complying with *Section 11B-703.3*. Raised characters shall be installed in accordance with *Section 11B-703.4*.

11B-703.2.1 Depth. Raised characters shall be $\frac{1}{32}$ inch (0.8 mm) minimum above their background.

11B-703.2.2 Case. Characters shall be uppercase.

11B-703.2.3 Style. Characters shall be sans serif. Characters shall not be italic, oblique, script, highly decorative or of other unusual forms.

11B-703.2.4 Character proportions. Characters shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.

11B-703.2.5 Character height. Character height measured vertically from the baseline of the character shall be $\frac{5}{8}$ inch (15.9 mm) minimum and 2 inches (51 mm) maximum based on the height of the uppercase letter “T”.

Exception: Reserved.

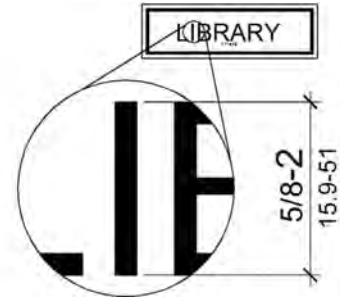


FIGURE 11B-703.2.5
HEIGHT OF RAISED CHARACTERS

11B-703.2.6 Stroke thickness. Stroke thickness of the uppercase letter “I” shall be 15 percent maximum of the height of the character.

11B-703.2.7 Character spacing. Character spacing shall be measured between the two closest points of adjacent raised characters within a message, excluding word spaces. Where characters have rectangular cross sections, spacing between individual raised characters shall be $\frac{1}{8}$ inch (3.2 mm) minimum and 4 times the raised character stroke width maximum. Where characters have other cross sections, spacing between individual raised characters shall be $\frac{1}{16}$ inch (1.6 mm) minimum and 4 times the raised character stroke width maximum at the base of the cross sections, and $\frac{1}{8}$ inch (3.2 mm) minimum and 4 times the raised character stroke width maximum at the top of the cross sections. Characters shall be separated from raised borders and decorative elements $\frac{3}{8}$ inch (9.5 mm) minimum.

11B-703.2.8 Line spacing. Spacing between the baselines of separate lines of raised characters within a message shall be 135 percent minimum and 170 percent maximum of the raised character height.

11B-703.2.9 Format. Text shall be in a horizontal format.

11B-703.3 Braille. Braille shall be contracted (Grade 2) and shall comply with *Sections 11B-703.3 and 11B-703.4*.

11B-703.3.1 Dimensions and capitalization. Braille dots shall have a domed or rounded shape and shall comply with *Table 11B-703.3.1*. The indication of an uppercase letter or letters shall only be used before the first word of sentences, proper nouns and names, individual letters of the alphabet, initials and acronyms.

TABLE 11B-703.3.1
BRAILLE DIMENSIONS

MEASUREMENT RANGE	MINIMUM IN INCHES MAXIMUM IN INCHES
Dot base diameter	0.059 (1.5 mm) to 0.063 (1.6 mm)
Distance between two dots in the same cell ¹	0.100 (2.5 mm)
Distance between corresponding dots in adjacent cells ¹	0.300 (7.6 mm)
Dot height	0.025 (0.6 mm) to 0.037 (0.9 mm)
Distance between corresponding dots from one cell directly below ¹	0.395 (10 mm) to 0.400 (10.2 mm)

1. Measured center to center.

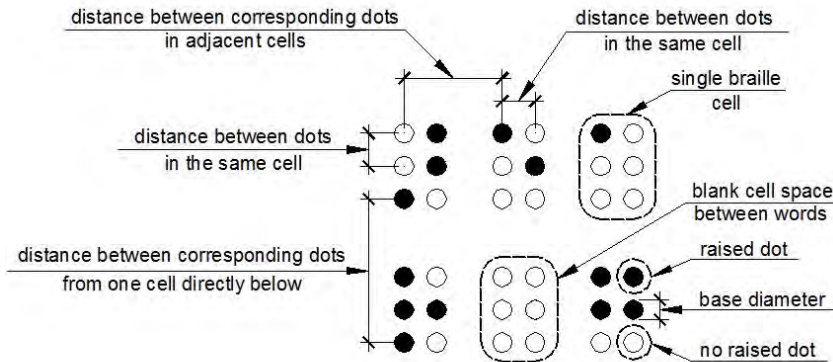


FIGURE 11B-703.3.1
BRAILLE MEASUREMENT

11B-703.3.2 Position. Braille shall be positioned below the corresponding text *in a horizontal format, flush left or centered*. If text is multilined, Braille shall be placed below the entire text. Braille shall be separated $\frac{3}{8}$ inch (9.5 mm) minimum and $\frac{1}{2}$ inch (12.7 mm) maximum from any other tactile characters and $\frac{3}{8}$ inch (9.5 mm) minimum from raised borders and decorative elements.

Exception: Braille provided on elevator car controls shall be separated $\frac{3}{16}$ inch (4.8 mm) minimum and shall be located directly below the corresponding raised characters or symbols.

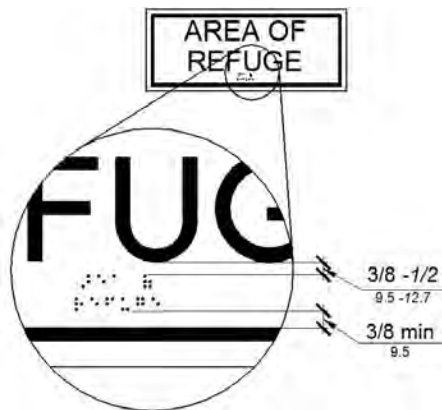


FIGURE 11B-703.3.2
POSITION OF BRAILLE

11B-703.4 Installation height and location. Signs with tactile characters shall comply with Section 11B-703.4.

11B-703.4.1 Height above finish floor or ground. Tactile characters on signs shall be located 48 inches (1219 mm) minimum above the finish floor or ground surface, measured from the baseline of the lowest Braille cells and 60 inches (1524 mm) maximum above the finish floor or ground surface, measured from the baseline of the highest line of raised characters.

Exception: Tactile characters for elevator car controls shall not be required to comply with Section 11B-703.4.1.

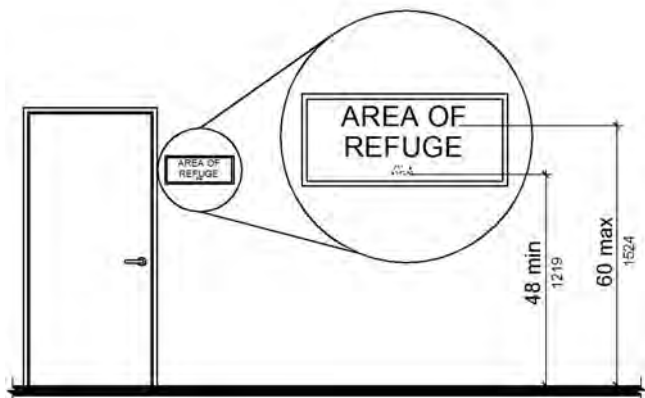
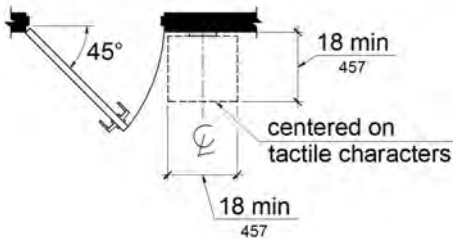


FIGURE 11B-703.4.1
HEIGHT OF TACTILE CHARACTERS
ABOVE FINISH FLOOR OR GROUND

11B-703.4.2 Location. Where a tactile sign is provided at a door, the sign shall be located alongside the door at the latch side. Where a tactile sign is provided at double doors with one active leaf, the sign shall be located on the inactive leaf. Where a tactile sign is provided at double doors with two active leaves, the sign shall be located to the right of the right hand door. Where there is no wall space at the latch side of a single door or at the right side of double doors, signs shall be located on the nearest adjacent wall. Signs containing tactile characters shall be located so that a clear floor space of 18 inches (457 mm) minimum by 18 inches (457 mm) minimum, centered on the tactile characters, is provided beyond the arc of any door swing between the closed position and 45 degree open position. *Where provided, signs identifying permanent rooms and spaces shall be located at the entrance to, and outside of the room or space. Where provided, signs identifying exits shall be located at the exit door when approached in the direction of egress travel.*

Exception: *In alterations where sign installation locations identified in Section 11B-703.4.2 are obstructed or otherwise unavailable for sign installation, signs with tactile characters shall be permitted on the push side of doors with closers and without hold-open devices.*



**FIGURE 11B-703.4.2
LOCATION OF TACTILE SIGNS AT DOORS**

11B-703.5 Visual characters. Visual characters shall comply with Section 11B-703.5.

Exception: Where visual characters comply with Section 11B-703.2 and are accompanied by Braille complying with Section 11B-703.3, they shall not be required to comply with Sections 11B-703.5.2 through 11B-703.5.6, 11B-703.5.8 and 11B-703.5.9.

11B-703.5.1 Finish and contrast. Characters and their background shall have a non-glare finish. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.

11B-703.5.2 Case. Characters shall be uppercase or lowercase or a combination of both.

11B-703.5.3 Style. Characters shall be conventional in form. Characters shall not be italic, oblique, script, highly decorative or of other unusual forms.

11B-703.5.4 Character proportions. Characters shall be selected from fonts where the width of the uppercase letter “O” is 60 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.

11B-703.5.5 Character height. Minimum character height shall comply with Table 11B-703.5.5. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. Character height shall be based on the uppercase letter “I”.

Exception: *Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with Section 11B-703.5.5.*

11B-703.5.6 Height from finish floor or ground. Visual characters shall be 40 inches (1016 mm) minimum above the finish floor or ground.

Exceptions:

1. Visual characters indicating elevator car controls shall not be required to comply with Section 11B-703.5.6.

**TABLE 11B-703.5.5
VISUAL CHARACTER HEIGHT**

HEIGHT TO FINISH FLOOR OR GROUND FROM BASELINE OF CHARACTER	HORIZONTAL VIEWING DISTANCE	MINIMUM CHARACTER HEIGHT
40 inches (1016 mm) to less than or equal to 70 inches (1778 mm)	less than 72 inches (1829 mm)	⁵ / ₈ inch (15.9 mm)
	72 inches (1829 mm) and greater	⁵ / ₈ inch (15.9 mm), plus ¹ / ₈ inch (3.2 mm) per foot (305 mm) of viewing distance above 72 inches (1829 mm)
Greater than 70 inches (1778 mm) to less than or equal to 120 inches (3048 mm)	less than 180 inches (4572 mm)	2 inches (51 mm)
	180 inches (4572 mm) and greater	2 inches (51 mm), plus ¹ / ₈ inch (3.2 mm) per foot (305 mm) of viewing distance above 180 inches (4572 mm)
greater than 120 inches (3048 mm)	less than 21 feet (6401 mm)	3 inches (76 mm)
	21 feet (6401 mm) and greater	3 inches (76 mm), plus ¹ / ₈ inch (3.2 mm) per foot (305 mm) of viewing distance above 21 feet (6401 mm)

2. Floor-level exit signs complying with Chapter 10, Section 1013.7 shall not be required to comply with Section 11B-703.5.6.
3. Where provided, floor plans providing emergency procedures information in accordance with Title 19 shall not be required to comply with Section 11B-703.5.6.

11B-703.5.7 Stroke thickness. Stroke thickness of the uppercase letter “P” shall be 10 percent minimum and 20 percent maximum of the height of the character.

11B-703.5.8 Character spacing. Character spacing shall be measured between the two closest points of adjacent characters, excluding word spaces. Spacing between individual characters shall be 10 percent minimum and 35 percent maximum of character height.

11B-703.5.9 Line spacing. Spacing between the baselines of separate lines of characters within a message shall be 135 percent minimum and 170 percent maximum of the character height.

11B-703.5.10 Format. Text shall be in a horizontal format.

11B-703.6 Pictograms. Pictograms shall comply with Section 11B-703.6.

11B-703.6.1 Pictogram field. Pictograms shall have a field height of 6 inches (152 mm) minimum. Characters and Braille shall not be located in the pictogram field.

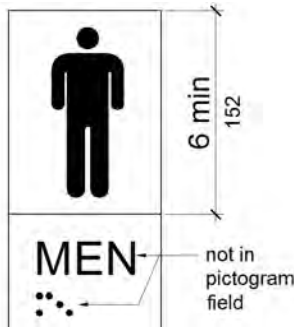


FIGURE 11B-703.6.1 PICTOGRAM FIELD

11B-703.6.2 Finish and contrast. Pictograms and their field shall have a non-glare finish. Pictograms shall contrast with their field with either a light pictogram on a dark field or a dark pictogram on a light field.

11B-703.6.3 Text descriptors. Pictograms shall have text descriptors located directly below the pictogram field. Text descriptors shall comply with Sections 11B-703.2, 11B-703.3 and 11B-703.4.

11B-703.7 Symbols of accessibility. Symbols of accessibility shall comply with Section 11B-703.7.

11B-703.7.1 Finish and contrast. Symbols of accessibility and their background shall have a non-glare finish.

Symbols of accessibility shall contrast with their background with either a light symbol on a dark background or a dark symbol on a light background.

11B-703.7.2 Symbols

11B-703.7.2.1 International Symbol of Accessibility. The International Symbol of Accessibility shall comply with Figure 11B-703.7.2.1. The symbol shall consist of a white figure on a blue background. The color blue shall approximate FS 15090 in Federal Standard 595C. A border may be provided inside or outside of the minimum required International Symbol of Accessibility dimension.

Exceptions:

1. The appropriate enforcement agency may approve other colors provided the symbol contrast is light on dark or dark on light.
2. On the accessibility function button on hall call consoles in a destination-oriented elevator system the International Symbol of Accessibility shall be a white symbol on a black background.

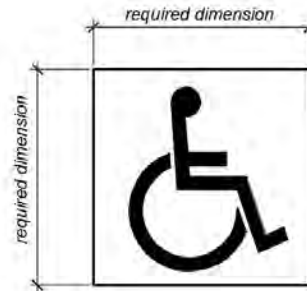


FIGURE 11B-703.7.2.1 INTERNATIONAL SYMBOL OF ACCESSIBILITY

11B-703.7.2.2 International Symbol of TTY. The International Symbol of TTY shall comply with Figure 11B-703.7.2.2.



FIGURE 11B-703.7.2.2 INTERNATIONAL SYMBOL OF TTY

11B-703.7.2.3 Volume control telephones. Telephones with a volume control shall be identified by a pictogram of a telephone handset with radiating sound

waves on a square field such as shown in Figure 11B-703.7.2.3.



FIGURE 11B-703.7.2.3
VOLUME CONTROL TELEPHONE

11B-703.7.2.4 Assistive listening systems. Assistive listening systems shall be identified by the International Symbol of Access for Hearing Loss complying with Figure 11B-703.7.2.4.



FIGURE 11B-703.7.2.4
INTERNATIONAL SYMBOL OF ACCESS FOR HEARING LOSS

11B-703.7.2.5 Reserved.

11B-703.7.2.6 Toilet and bathing facilities geometric symbols. Geometric symbols at entrances to toilet and bathing rooms shall be mounted at 58 inches (1473 mm) minimum and 60 inches (1524 mm) maximum above the finish floor or ground surface measured from the centerline of the symbol. Where a door is provided the symbol shall be mounted within 1 inch (25 mm) of the vertical centerline of the door.

11B-703.7.2.6.1 Men’s toilet and bathing facilities.

A triangle symbol shall be located at entrances to men’s toilet and bathing facilities. The triangle symbol shall be an equilateral triangle $\frac{1}{4}$ inch (6.4 mm) thick with edges 12 inches (305 mm) long and a vertex pointing upward. The color of the triangle symbol shall contrast with the color of the door or surface on which the triangle symbol is mounted, either light on a dark background or dark on a light background.

Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be $\frac{1}{4}$ inch (6.4 mm) thick.

11B-703.7.2.6.2 Women’s toilet and bathing facilities.

A circle symbol shall be located at entrances to women’s toilet and bathing facilities. The circle symbol shall be $\frac{1}{4}$ inch (6.4 mm) thick and 12 inches (305 mm) in diameter. The color of the circle symbol shall contrast with the color of the door or surface on which the circle symbol is mounted, either light on a dark background or dark on a light background.

Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be $\frac{1}{4}$ inch (6.4 mm) thick.

11B-703.7.2.6.3 Unisex toilet and bathing facilities. A combined circle and triangle symbol shall be located at entrances to unisex toilet and bathing facilities. The combined circle and triangle symbol shall consist of a circle symbol $\frac{1}{4}$ inch (6.4 mm) thick and 12 inches (305 mm) in diameter with a $\frac{1}{4}$ inch (6.4 mm) thick equilateral triangle symbol superimposed on and geometrically inscribed within the 12-inch (305 mm) diameter of the circle symbol. The vertices of the triangle symbol shall be located $\frac{1}{4}$ inch (6.4 mm) maximum from the edge of the circle symbol with a vertex pointing upward. The color of the triangle symbol shall contrast with the color of the circle symbol, either light on a dark background or dark on a light background. The color of the circle symbol shall contrast with the color of the door or surface on which the combined circle and triangle symbol is mounted, either light on a dark background or dark on a light background.

Exception: Within secure perimeter of detention and correctional facilities, geometric symbols shall not be required to be $\frac{1}{4}$ inch (6.4 mm) thick.

11B-703.7.2.6.4 Edges and vertices on geometric symbols. Edges shall be eased or rounded at $\frac{1}{16}$ inch (1.59 mm) minimum, or chamfered at $\frac{1}{8}$ inch (3.2 mm) maximum. Vertices shall be radiused between $\frac{1}{8}$ inch (3.2 mm) minimum and $\frac{1}{4}$ inch (6.4 mm) maximum.

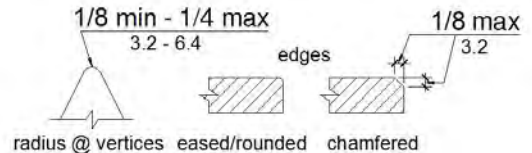


FIGURE 11B-703.7.2.6.4
EDGES AND VERTICES ON GEOMETRIC SYMBOLS

11B-703.7.2.7 Pedestrian traffic-control buttons.

Pole-supported pedestrian traffic-control buttons shall be identified with color coding consisting of a textured horizontal yellow band 2 inches (51 mm) in width encircling the pole, and a 1-inch-wide (25 mm) dark border band above and below this yellow band. Color coding shall be placed immediately above the control button. Control buttons shall be located no higher than 48 inches (1219 mm) above the ground surface adjacent to the pole.

11B-703.8 Variable message signs.

11B-703.8.1 General. High resolution variable message sign (VMS) characters shall comply with Sections 11B-703.5 and 11B-703.8.12 through 11B-703.8.14. Low resolution variable message sign (VMS) characters shall comply with Section 11B-703.8.

11B-703.8.2 Case. Low resolution VMS characters shall be uppercase.

11B-703.8.3 Style. Low resolution VMS characters shall be conventional in form, shall be sans serif, and shall not be italic, oblique, script, highly decorative or of other unusual forms.

11B-703.8.4 Character height. The uppercase letter “I” shall be used to determine the allowable height of all low resolution VMS characters of a font. Viewing distance shall be measured as the horizontal distance between the character and an obstruction preventing further approach towards the sign. The uppercase letter “I” of the font shall have a minimum height complying with Table 11B-703.8.4.

Exception: In assembly seating where the maximum viewing distance is 100 feet (30.5 m) or greater, the height of the uppercase “I” of low resolution VMS fonts shall be permitted to be 1 inch (25 mm) for every 30 feet (9144 mm) of viewing distance, provided the character height is 8 inches (203 mm) minimum. Viewing distance shall be measured as the horizontal distance between the character and where someone is expected to view the sign.

11B-703.8.5 Character width. The uppercase letter “O” shall be used to determine the allowable width of all low resolution VMS characters of a font. Low resolution VMS characters shall comply with the pixel count for character width in Table 11B-703.8.5.

11B-703.8.6 Stroke width. The uppercase letter “I” shall be used to determine the allowable stroke width of all low resolution VMS characters of a font. Low resolution VMS characters shall comply with the pixel count for stroke width in Table 11B-703.8.5.

11B-703.8.7 Character spacing. Spacing shall be measured between the two closest points of adjacent low resolution VMS characters within a message, excluding word spaces. Low resolution VMS character spacing shall comply with the pixel count for character spacing in Table 11B-703.8.5.

11B-703.8.8 Line spacing. Low resolution VMS characters shall comply with Section 11B-703.5.9.

11B-703.8.9 Height above floor. Low resolution VMS characters shall be 40 inches (1016 mm) minimum above the floor of the viewing position, measured to the baseline of the character. Heights of low resolution variable mes-

sage sign characters shall comply with Table 11B-703.8.4, based on the size of the characters on the sign.

11B-703.8.10 Finish. The background of low resolution VMS characters shall have a nonglare finish.

11B-703.8.11 Contrast. Low resolution VMS characters shall be light characters on a dark background.

11B-703.8.12 Protective covering. Where a protective layer is placed over VMS characters through which the VMS characters must be viewed, the protective covering shall have a nonglare finish.

11B-703.8.13 Brightness. The brightness of variable message signs in exterior locations shall automatically adjust in response to change in ambient light levels.

11B-703.8.14 Rate of change. Where a VMS message can be displayed in its entirety on a single screen, it shall be displayed on a single screen and shall remain motionless on the screen for a minimum 3 seconds or 1 second minimum for every seven characters of the message including spaces, whichever is longer.

**TABLE 11B-703.8.5
PIXEL COUNT FOR LOW RESOLUTION VMS**

CHARACTER HEIGHT	CHARACTER WIDTH RANGE	STROKE WIDTH RANGE	CHARACTER SPACING RANGE
7	5-6	1	2
8	6-7	1-2	2-3
9	6-8	1-2	2-3
10	7-9	2	2-4
11	8-10	2	2-4
12	8-11	2	3-4
13	9-12	2-3	3-5
14	10-13	2-3	3-5
15	11-14	2-3	3-5

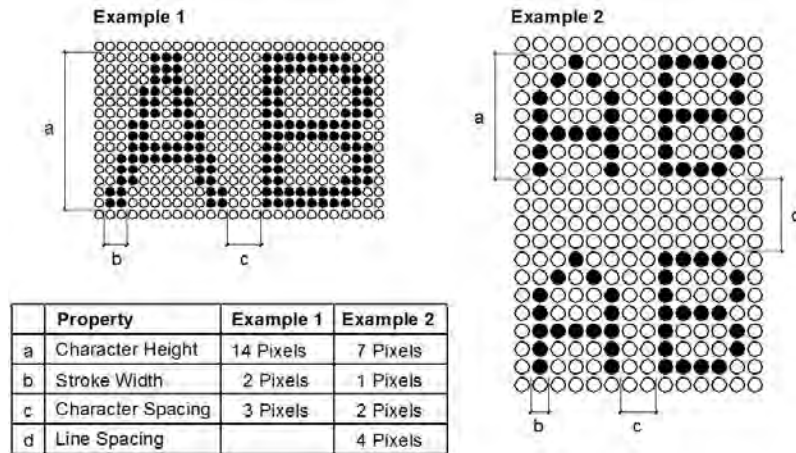
11B-704 Telephones

11B-704.1 General. Public telephones shall comply with Section 11B-704.

11B-704.2 Wheelchair accessible telephones. Wheelchair accessible telephones shall comply with Section 11B-704.2.

**TABLE 11B-703.8.4
LOW RESOLUTION VMS CHARACTER HEIGHT**

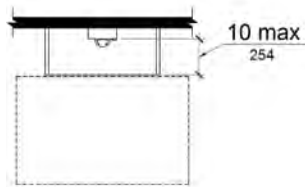
HEIGHT ABOVE FLOOR TO BASELINE OF CHARACTER	HORIZONTAL VIEWING DISTANCE	MINIMUM CHARACTER HEIGHT
40 inches (1016 mm) to less than or equal to 70 inches (1778 mm)	Less than 10 feet (3048 mm)	2 inches (51 mm)
	10 feet (3048 mm) and greater	2 inches (51 mm), plus 1/5 inch (5.1 mm) per foot (305 mm) of viewing distance above 10 feet (3048 mm)
Greater than 70 inches (1778 mm) to less than or equal to 120 inches (3048 mm)	Less than 15 feet (4572 mm)	3 inches (76 mm)
	15 feet (4572 mm) and greater	3 inches (76 mm), plus 1/5 inch (5.1 mm) per foot (305 mm) of viewing distance above 15 feet (4572 mm)
Greater than 120 inches (3048 mm)	Less than 20 feet (6096 mm)	4 inches (102 mm)
	20 feet (6096 mm) and greater	4 inches (102 mm), plus 1/5 inch (5.1 mm) per foot (305 mm) of viewing distance above 20 feet (6096 mm)



**FIGURE 11B-703.8.5
LOW RESOLUTION VMS CHARACTERS**

11B-704.2.1 Clear floor or ground space. A clear floor or ground space complying with *Section 11B-305* shall be provided. The clear floor or ground space shall not be obstructed by bases, enclosures or seats.

11B-704.2.1.1 Parallel approach. Where a parallel approach is provided, the distance from the edge of the telephone enclosure to the face of the telephone unit shall be 10 inches (254 mm) maximum.



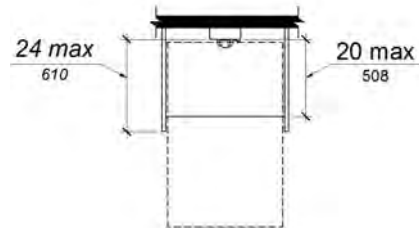
**FIGURE 11B-704.2.1.1
PARALLEL APPROACH TO TELEPHONE**

11B-704.2.1.2 Forward approach. Where a forward approach is provided at a telephone within an enclosure, the counter may extend beyond the face of the telephone 20 inches (508 mm) into the required clear floor or ground space and the enclosure may extend beyond the face of the telephone 24 inches (610 mm). If an additional 6 inches (152 mm) in width of clear floor space is provided, creating a clear floor space of 36 inches by 48 inches (914 mm by 1219 mm), the enclosure may extend more than 24 inches (610 mm) beyond the face of the telephone.

11B-704.2.2 Operable parts. Operable parts shall comply with *Section 11B-309*. Telephones shall have push-button controls where such service is available.

11B-704.2.3 Telephone directories. Telephone directories, where provided, shall be located in accordance with *Section 11B-309*.

11B-704.2.4 Cord length. The cord from the telephone to the handset shall be 29 inches (737 mm) long minimum.



**FIGURE 11B-704.2.1.2
FORWARD APPROACH TO TELEPHONE**

11B-704.3 Volume control telephones. Public telephones required to have volume controls shall be equipped with a receive volume control that provides a gain adjustable up to 20 dB minimum. For incremental volume control, provide at least one intermediate step of 12 dB of gain minimum. An automatic reset shall be provided. *Volume control telephones shall be equipped with a receiver that generates a magnetic field in the area of the receiver cap. Public telephones with volume control shall be hearing aid compatible.*

11B-704.4 TTYs. TTYs provided at a public pay telephone shall be permanently affixed within, or adjacent to, the telephone enclosure. Where an acoustic coupler is used, the telephone cord shall be sufficiently long to allow connection of the TTY and the telephone receiver.

11B-704.4.1 Height. When in use, the touch surface of TTY keypads shall be 34 inches (864 mm) minimum above the finish floor.

Exception: Where seats are provided, TTYs shall not be required to comply with *Section 11B-704.4.1*.

11B-704.5 TTY shelf. Public pay telephones required to accommodate portable TTYs shall be equipped with a shelf and an electrical outlet within or adjacent to the telephone enclosure. The telephone handset shall be capable of being placed flush on the surface of the shelf. The shelf shall be capable of accommo-

dating a TTY and shall have 6 inches (152 mm) minimum vertical clearance above the area where the TTY is to be placed.

11B-705 Detectable warnings and detectable directional texture

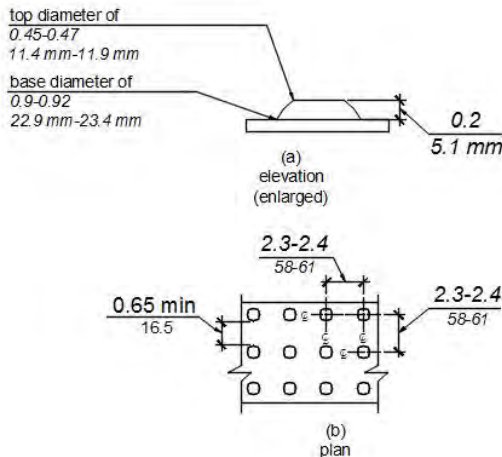
11B-705.1 Detectable warnings

11B-705.1.1 General. Detectable warnings shall consist of a surface of truncated domes and shall comply with Section 11B-705.

11B-705.1.1.1 Dome size. Truncated domes in a detectable warning surface shall have a base diameter of 0.9 inch (22.9 mm) minimum and 0.92 inch (23.4 mm) maximum, a top diameter of 0.45 inch (11.4 mm) minimum and 0.47 inch (11.9 mm) maximum, and a height of 0.2 inch (5.1 mm).

11B-705.1.1.2 Dome spacing. Truncated domes in a detectable warning surface shall have a center-to-center spacing of 2.3 inches (58 mm) minimum and 2.4 inches (61 mm) maximum, and a base-to-base spacing of 0.65 inch (16.5 mm) minimum, measured between the most adjacent domes on a square grid.

Exception: Where installed in a radial pattern, truncated domes shall have a center-to-center spacing of 1.6 inches (41 mm) minimum to 2.4 inches (61 mm) maximum.



**FIGURE 11B-705.1
SIZE AND SPACING OF TRUNCATED DOMES**

11B-705.1.1.3 Color and contrast. Detectable warning surfaces shall comply with Section 11B-705.1.1.3.1. The material used to comply with this section shall be an integral part of the detectable warning surface.

Exceptions:

1. Replacement of less than 20 percent of existing detectable warnings at a single contiguous location shall be permitted to be in-kind at existing curb ramps, islands or cut-through medians with detectable warnings in compliance with the code requirements in effect at the time of installation.
2. Existing installed detectable warnings at curb ramps, islands or cut-through medians may

comply with Section 11B-705.1.1.3.2 in lieu of Section 11B-705.1.1.3.1.

11B-705.1.1.3.1 Detectable warning surfaces shall be yellow and approximate 33538 of SAE AMS-STD-595A.

11B-705.1.1.3.2 Detectable warning surfaces shall provide a 70 percent minimum visual contrast with adjacent walking surfaces. Contrast in percent shall be determined by:

$$\text{Contrast percent} = [(B1-B2)/B1] \times 100 \text{ where}$$

B1 = light reflectance value (LRV) of the lighter area and

B2 = light reflectance value (LRV) of the darker area.

Exception: Where the detectable warning surface does not provide a 70 percent minimum contrast with adjacent walking surfaces, a 1-inch (25 mm) wide minimum visually contrasting surface shall separate the detectable warning from adjacent walking surfaces. The visually contrasting surface shall contrast with both the detectable warning and adjacent walking surfaces, either light-on-dark or dark-on-light.

11B-705.1.1.4 Resiliency. Detectable warning surfaces shall differ from adjoining surfaces in resiliency or sound-on-cane contact.

Exception: Detectable warning surfaces at curb ramps, islands or cut-through medians shall not be required to comply with Section 11B-705.1.1.4.

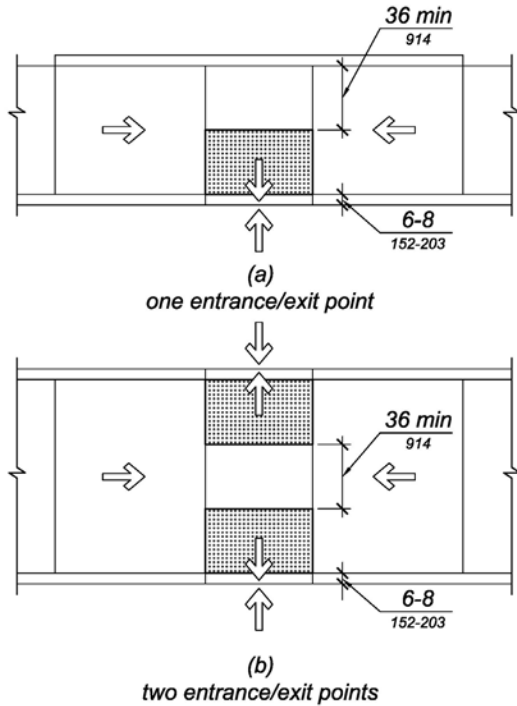
11B-705.1.2 Locations. Detectable warnings at the following locations shall comply with Section 11B-705.1.

11B-705.1.2.1 Platform edges. Detectable warning surfaces at platform boarding edges shall be 24 inches (610 mm) wide and shall extend the full length of the public use areas of the platform.

11B-705.1.2.2 Curb ramps. Detectable warnings at curb ramps shall comply with Section 11B-705.1.2.2.

11B-705.1.2.2.1 Perpendicular curb ramps. Detectable warnings at curb ramps shall extend 36 inches (914 mm) in the direction of travel. Detectable warnings shall extend the full width of the ramp run less 2 inches (51 mm) maximum on each side, excluding any flared sides. Detectable warnings shall be located so the edge nearest the curb is 6 inches (152 mm) minimum and 8 inches (203 mm) maximum from the demarcation line at the face of the curb between the curb and the gutter, street or highway.

11B-705.1.2.2.2 Parallel curb ramps. Detectable warnings at parallel curb ramps shall be located so the edge nearest the curb is 6 inches (152 mm) minimum and 8 inches (203 mm) maximum from the demarcation line at the face of the curb between the curb and the gutter, street or highway. Detectable warnings shall extend the full width of the turning space at the demarcation between the street and the sidewalk less 2 inches (51 mm) maximum on each side.



**FIGURE 11B-705.1.2.2.2
PARALLEL CURB RAMPS**

11B-705.1.2.2.2.1 One entrance/exit point. Where the turning space has one entrance/exit point other than the sloped ramp segments, detectable warnings shall be 36 inches (914 mm) deep, as measured perpendicular to the curb, and the turning space shall provide a minimum 36 inches (914 mm) wide portion without detectable warnings to allow pedestrian travel in the direction of the sidewalk without travelling over the detectable warnings.

Exceptions:

1. Where it is technically infeasible to provide a minimum 72 inches (1828 mm) wide turning space, as measured perpendicular to the curb, the depth of detectable warnings may be reduced to 24 inches (610 mm) minimum.
2. Existing parallel curb ramps with detectable warnings in compliance with the code requirements in effect at the time of installation shall not be required to provide a minimum 36 inches (914 mm) wide portion of the turning space without detectable warnings.

11B-705.1.2.2.2.2 Two entrance/exit points. Where the turning space has two entrance/exit points other than the sloped ramp segments, detectable warnings shall be 36 inches (914 mm) deep at both entrance/exit points, as measured perpendicular to the curb, and the turning space shall provide a minimum 36 inches (914 mm) wide

portion without detectable warnings to allow pedestrian travel in the direction of the sidewalk without travelling over the detectable warnings.

Exceptions:

1. Where it is technically infeasible to provide a minimum 108 inches (2743 mm) wide turning space, as measured perpendicular to the curb, the depth of detectable warnings may be reduced to 24 inches (610 mm) minimum.
2. Existing parallel curb ramps with detectable warnings in compliance with the code requirements in effect at the time of installation shall not be required to provide a minimum 36 inches (914 mm) wide portion of the turning space without detectable warnings.

11B-705.1.2.3 Islands or cut-through medians. Detectable warnings at pedestrian islands or cut-through medians shall be 36 inches (914 mm) minimum in depth extending the full width of the pedestrian path or cut-through less 2 inches (51 mm) maximum on each side, placed at the edges of the pedestrian island or cut-through median, and shall be separated by 24 inches (610 mm) minimum of walking surface without detectable warnings.

Exception: Detectable warnings shall be 24 inches (610 mm) minimum in depth at pedestrian islands or cut-through medians that are less than 96 inches (2438 mm) in length in the direction of pedestrian travel.

11B-705.1.2.4 Bus stops. When detectable warnings are provided at bus stop boarding and alighting areas, the detectable warnings shall extend the full width of the boarding/alighting area and shall be 36 inches (914 mm) minimum in depth.

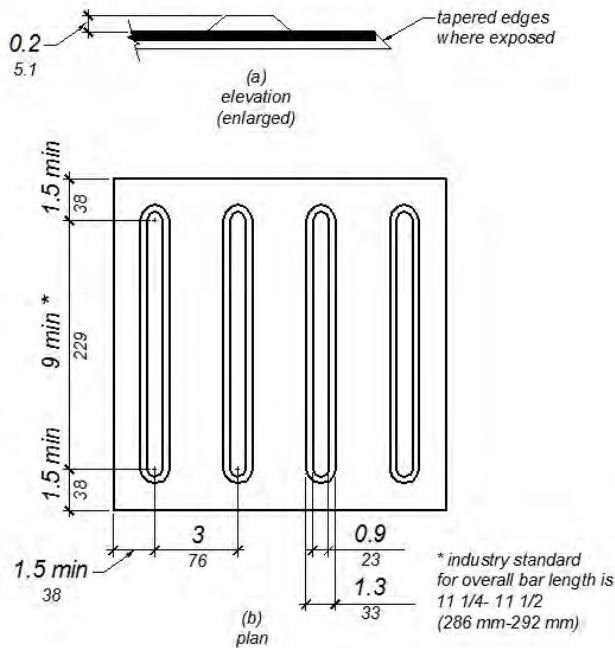
11B-705.1.2.5 Blended transitions. Detectable warnings at blended transitions shall be 36 inches (914 mm) in width.

11B-705.1.2.6 Reflecting pools. When detectable warnings are provided at reflecting pools, it shall be 24 inches (610 mm) minimum and 36 inches (914 mm) maximum in width.

11B-705.1.2.7 Track crossings. Detectable warnings at track crossings shall be 36 inches (914 mm) in the direction of pedestrian travel and extend the full width of the circulation path.

11B-705.2 Detectable directional texture. Detectable directional texture at transit boarding platforms shall comply with Figure 11B-705.2 and shall be 0.1 inch (2.5 mm) in height that tapers off to 0.04 inch (1.0 mm), with bars raised 0.2 inch (5.1 mm) from the surface. The raised bars shall be 1.3 inches (33 mm) wide and 3 inches (76 mm) from center-to-center of each bar. This surface shall differ from adjoining walking surfaces in resiliency or sound-on-cane contact. The color shall be yellow and approximate FS 33538 of Federal Standard 595C. This surface will be placed directly behind the yellow detectable warning texture specified in Section 11B-705.1.2.1, aligning with all doors of the transit vehicles

where passengers will embark. The width of the directional texture shall be equal to the width of the transit vehicle's door opening. The depth of the texture shall not be less than 36 inches (914 mm).



**FIGURE 11B-705.2
DETECTABLE DIRECTIONAL TEXTURE**

11B-705.3 Product approval. Only approved DSA-AC detectable warning products and directional surfaces shall be installed as provided in the California Code of Regulations (CCR), Title 24, Part 1, Chapter 5, Articles 2, 3 and 4. Refer to CCR Title 24, Part 12, Chapter 11B, Section 12-11B.205 for building and facility access specifications for product approval for detectable warning products and directional surfaces.

11B-706 Assistive listening systems

11B-706.1 General. Assistive listening systems required in assembly areas, conference and meeting rooms shall comply with Section 11B-706.

11B-706.2 Receiver jacks. Receivers required for use with an assistive listening system shall include a 1/8 inch (3.2 mm) standard mono jack.

11B-706.3 Receiver hearing-aid compatibility. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops.

11B-706.4 Sound pressure level. Assistive listening systems shall be capable of providing a sound pressure level of 110 dB minimum and 118 dB maximum with a dynamic range on the volume control of 50 dB.

11B-706.5 Signal-to-noise ratio. The signal-to-noise ratio for internally generated noise in assistive listening systems shall be 18 dB minimum.

11B-706.6 Peak clipping level. Peak clipping shall not exceed 18 dB of clipping relative to the peaks of speech.

11B-707 Automatic teller machines, fare machines and point-of-sale devices

11B-707.1 General. Automatic teller machines, fare machines and point-of-sale devices shall comply with Section 11B-707.

11B-707.2 Clear floor or ground space. A clear floor or ground space complying with Section 11B-305 shall be provided.

Exception: Clear floor or ground space shall not be required at drive-up only automatic teller machines and fare machines.

11B-707.3 Operable parts. Operable parts shall comply with Section 11B-309. Unless a clear or correct key is provided, each operable part shall be able to be differentiated by sound or touch, without activation.

Exceptions:

1. Drive-up only automatic teller machines and fare machines shall not be required to comply with Sections 11B-309.2 and 11B-309.3.
2. Where automatic teller machines and fare machines do not require compliance with Section 11B-707.2, compliance with Sections 11B-309.2 and 11B-309.3 shall not be required.
3. Where point-of-sale devices do not require compliance with Section 11B-707.2, compliance with Sections 11B-309.2 and 11B-309.3 shall not be required.

11B-707.4 Privacy. Automatic teller machines shall provide the opportunity for the same degree of privacy of input and output available to all individuals.

11B-707.5 Speech output. Machines shall be speech enabled. Operating instructions and orientation, visible transaction prompts, user input verification, error messages, and all displayed information for full use shall be accessible to and independently usable by individuals with vision impairments. Speech shall be delivered through a mechanism that is readily available to all users, including but not limited to, an industry standard connector or a telephone handset. Speech shall be recorded or digitized human, or synthesized.

Exceptions:

1. Audible tones shall be permitted instead of speech for visible output that is not displayed for security purposes, including but not limited to, asterisks representing personal identification numbers.
2. Advertisements and other similar information shall not be required to be audible unless they convey information that can be used in the transaction being conducted.
3. Where speech synthesis cannot be supported, dynamic alphabetic output shall not be required to be audible.

11B-707.5.1 User control. Speech shall be capable of being repeated or interrupted. Volume control shall be provided for the speech function.

Exception: Speech output for any single function shall be permitted to be automatically interrupted when a transaction is selected.

11B-707.5.2 Receipts. Where receipts are provided, speech output devices shall provide audible balance inquiry information, error messages and all other information on the printed receipt necessary to complete or verify the transaction.

Exceptions:

1. Machine location, date and time of transaction, customer account number, and the machine identifier shall not be required to be audible.
2. Information on printed receipts that duplicates information available on-screen shall not be required to be presented in the form of an audible receipt.
3. Printed copies of bank statements and checks shall not be required to be audible.

11B-707.6 Input. Input devices shall comply with Section 11B-707.6.

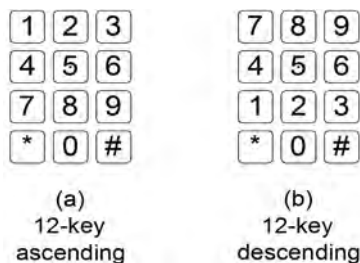
11B-707.6.1 Input controls. At least one tactilely discernible input control shall be provided for each function. Where provided, key surfaces not on active areas of display screens, shall be raised above surrounding surfaces. Where membrane keys are the only method of input, each shall be tactilely discernible from surrounding surfaces and adjacent keys.

11B-707.6.2 Numeric keys. Numeric keys shall be arranged in a 12-key ascending or descending telephone keypad layout. The number five key shall be tactilely distinct from the other keys.

11B-707.6.3 Function keys. Function keys shall comply with Section 11B-707.6.3.

11B-707.6.3.1 Contrast. Function keys shall contrast visually from background surfaces. Characters and symbols on key surfaces shall contrast visually from key surfaces. Visual contrast shall be either light-on-dark or dark-on-light.

Exception: Tactile symbols required by Section 11B-707.6.3.2 shall not be required to comply with Section 11B-707.6.3.1.



**FIGURE 11B-707.6.2
NUMERIC KEY LAYOUT**

11B-707.6.3.2 Tactile symbols. Function key surfaces shall have tactile symbols as follows: Enter or Proceed key: raised circle; Clear or Correct key: raised left arrow;

Cancel key: raised letter ex; Add Value key: raised plus sign; Decrease Value key: raised minus sign.

11B-707.7 Display screen. The display screen shall comply with Section 11B-707.7.

Exception: Drive-up only automatic teller machines and fare machines shall not be required to comply with Section 11B-707.7.1.

11B-707.7.1 Visibility. The display screen shall be visible from a point located 40 inches (1016 mm) above the center of the clear floor space in front of the machine.

11B-707.7.1.1 Vertically mounted display screen. Where display screens are mounted vertically or tipped away from the viewer less than 30 degrees, the center line of the display screen and other display devices shall be no more than 52 inches (1321 mm) above the floor or ground surface.

11B-707.7.1.2 Angle-mounted display screen. Where display screens are mounted tipped away from the viewer 30 degrees to less than 60 degrees from vertical, the center line of the display screen and other display devices shall be no more than 44 inches (1118 mm) above the floor or ground surface.

11B-707.7.1.3 Horizontally mounted display screen. Where display screens are mounted tipped away from the viewer 60 degrees to 90 degrees (horizontal) from vertical, the center line of the display screen and other display devices shall be no more than 34 inches (864 mm) above the floor or ground surface.

11B-707.7.2 Characters. Characters displayed on the screen shall be in a sans serif font. Characters shall be ³/₁₆ inch (4.8 mm) high minimum based on the uppercase letter “T”. Characters shall contrast with their background with either light characters on a dark background or dark characters on a light background.

11B-707.8 Braille instructions. Braille instructions for initiating the speech mode shall be provided. Braille shall comply with Section 11B-703.3.

11B-707.9 Point-of-sale devices. Point-of-sale devices shall comply with Section 11B-707.9.

11B-707.9.1 General. Point-of-sale systems that include a video touch screen or any other non-tactile keypad shall be equipped with either of the following:

11B-707.9.1.1 Tactilely discernible numerical keypad. A tactilely discernible numerical keypad similar to a telephone keypad containing a raised dot with a dot base diameter between 1.5 mm and 1.6 mm and a height between 0.6 mm and 0.9 mm on the number 5 key that enables a visually impaired person to enter his or her own personal identification number or any other personal information necessary to process the transaction in a manner that provides the opportunity for the same degree of privacy input and output available to all individuals.

11B-707.9.1.2 Other technology. Other technology, such as a radio frequency identification device, fingerprint biometrics or some other mechanism that enables

a visually impaired person to access the video touch screen device with his or her personal identifier and to process his or her transaction in a manner that provides the opportunity for the same degree of privacy input and output available to all individuals. Where a video screen overlay is provided it shall be equipped with a tactilely discernible numerical keypad complying with Section 11B-707.9.1.1.

11B-708 Two-way communication systems

11B-708.1 General. Two-way communication systems shall comply with Section 11B-708.

11B-708.2 Audible and visual indicators. The system shall provide both audible and visual signals.

11B-708.3 Handsets. Handset cords, if provided, shall be 29 inches (737 mm) long minimum.

11B-708.4 Residential dwelling unit communication systems. Communications systems between a residential dwelling unit and a site, building or floor entrance shall comply with Section 11B-708.4.

11B-708.4.1 Common use or public use system interface. The common use or public use system interface shall include the capability of supporting voice and TTY communication with the residential dwelling unit interface.

11B-708.4.2 Residential dwelling unit interface. The residential dwelling unit system interface shall include a telephone jack capable of supporting voice and TTY communication with the common use or public use system interface.

DIVISION 8: SPECIAL ROOMS, SPACES AND ELEMENTS

11B-801 General

11B-801.1 Scope. The provisions of *Division 8* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

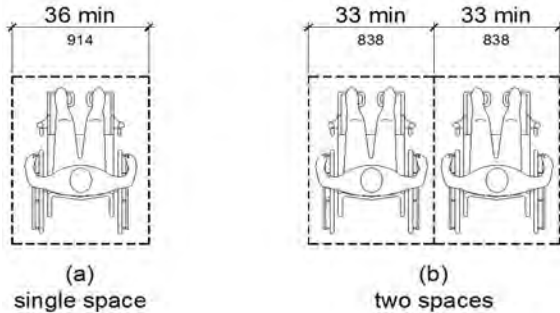
11B-802 Wheelchair spaces, companion seats and designated aisle seats and semi-ambulant seats

11B-802.1 Wheelchair spaces. Wheelchair spaces shall comply with *Section 11B-802.1*.

11B-802.1.1 Floor or ground surface. The floor or ground surface of wheelchair spaces shall comply with *Section 11B-302*. Changes in level, *slopes exceeding 1:48*, and *detectable warnings shall not be permitted*.

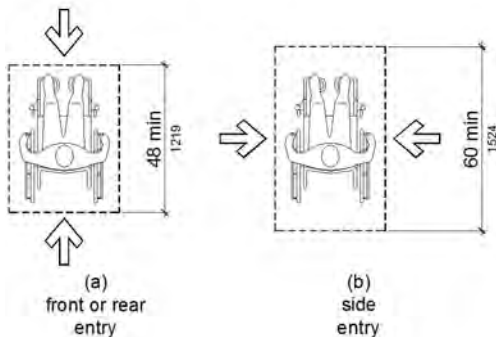
Exception: *Reserved.*

11B-802.1.2 Width. A single wheelchair space shall be 36 inches (914 mm) wide minimum. Where two adjacent wheelchair spaces are provided, each wheelchair space shall be 33 inches (838 mm) wide minimum.



**FIGURE 11B-802.1.2
WIDTH OF WHEELCHAIR SPACES**

11B-802.1.3 Depth. Where a wheelchair space can be entered from the front or rear, the wheelchair space shall be 48 inches (1219 mm) deep minimum. Where a wheelchair space can be entered only from the side, the wheelchair space shall be 60 inches (1524 mm) deep minimum.



**FIGURE 11B-802.1.3
DEPTH OF WHEELCHAIR SPACES**

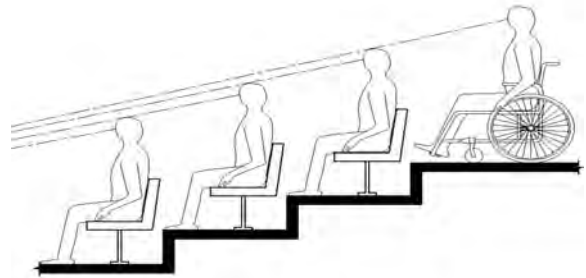
11B-802.1.4 Approach. Wheelchair spaces shall adjoin accessible routes. Accessible routes shall not overlap wheelchair spaces.

11B-802.1.5 Overlap. Wheelchair spaces shall not overlap circulation paths.

11B-802.2 Lines of sight. Lines of sight to the screen, performance area or playing field for spectators in wheelchair spaces shall comply with *Section 11B-802.2*.

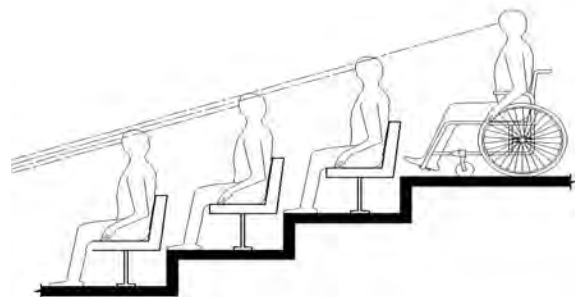
11B-802.2.1 Lines of sight over seated spectators. Where spectators are expected to remain seated during events, spectators in wheelchair spaces shall be afforded lines of sight complying with *Section 11B-802.2.1*.

11B-802.2.1.1 Lines of sight over heads. Where spectators are provided lines of sight over the heads of spectators seated in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the heads of seated spectators in the first row in front of wheelchair spaces.



**FIGURE 11B-802.2.1.1
LINES OF SIGHT OVER THE
HEADS OF SEATED SPECTATORS**

11B-802.2.1.2 Lines of sight between heads. Where spectators are provided lines of sight over the shoulders and between the heads of spectators seated in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the shoulders and between the heads of seated spectators in the first row in front of wheelchair spaces.

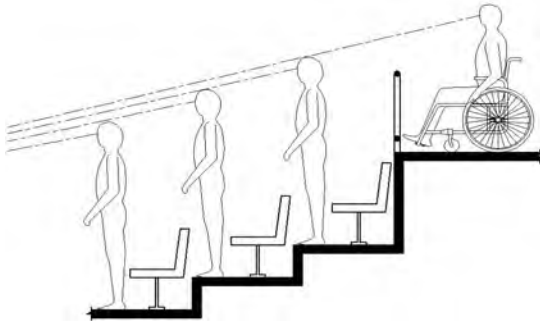


**FIGURE 11B-802.2.1.2
LINES OF SIGHT BETWEEN THE
HEADS OF SEATED SPECTATORS**

11B-802.2.2 Lines of sight over standing spectators.

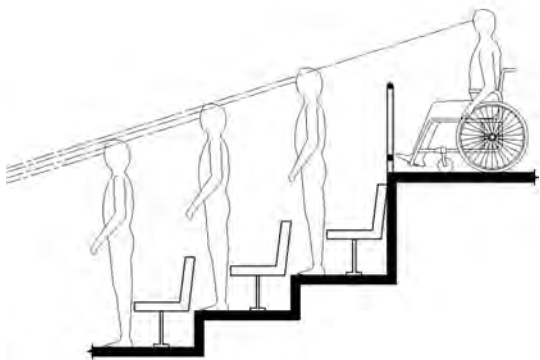
Where spectators are expected to stand during events, spectators in wheelchair spaces shall be afforded lines of sight complying with *Section 11B-802.2.2*.

11B-802.2.2.1 Lines of sight over heads. Where standing spectators are provided lines of sight over the heads of spectators standing in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the heads of standing spectators in the first row in front of wheelchair spaces.



**FIGURE 11B-802.2.2.1
LINES OF SIGHT OVER THE
HEADS OF STANDING SPECTATORS**

11B-802.2.2.2 Lines of sight between heads. Where standing spectators are provided lines of sight over the shoulders and between the heads of spectators standing in the first row in front of their seats, spectators seated in wheelchair spaces shall be afforded lines of sight over the shoulders and between the heads of standing spectators in the first row in front of wheelchair spaces.



**FIGURE 11B-802.2.2.2
LINES OF SIGHT BETWEEN THE
HEADS OF STANDING SPECTATORS**

11B-802.3 Companion seats. Companion seats shall comply with *Section 11B-802.3*.

11B-802.3.1 Alignment. In row seating, companion seats shall be located to provide shoulder alignment with adjacent wheelchair spaces. The shoulder alignment point of the wheelchair space shall be measured 36 inches (914 mm) from the front of the wheelchair space. The floor surface of the companion seat shall be at the same elevation as the floor surface of the wheelchair space.

11B-802.3.2 Type. Companion seats shall be equivalent in size, quality, comfort and amenities to the seating in the immediate area. Companion seats shall be permitted to be movable.

11B-802.4 Designated aisle seats. Designated aisle seats shall comply with *Section 11B-802.4*.

11B-802.4.1 Armrests. Where armrests are provided on the seating in the immediate area, folding or retractable armrests shall be provided on the aisle side of the seat.

11B-802.4.2 Identification. Each designated aisle seat shall be identified by a sign or marker with the *International Symbol of Accessibility* complying with *Section 11B-703.7.2.1*. Signs complying with *Section 11B-703.5*, notifying patrons of the availability of such seats shall be posted at the ticket office.

11B-802.5 Semi-ambulant seats. Semi-ambulant seats shall provide at least 24 inches (610 mm) clear leg space between the front of the seat to the nearest obstruction or to the back of the seat immediately in front.

11B-803 Dressing, fitting and locker rooms

11B-803.1 General. Dressing, fitting and locker rooms shall comply with *Section 11B-803*.

11B-803.2 Turning space. Turning space complying with *Section 11B-304* shall be provided within the room.

11B-803.3 Door swing. Doors shall not swing into the room unless a turning space complying with *Section 11B-304.3* is provided beyond the arc of the door swing.

11B-803.4 Benches. A bench complying with *Section 11B-903* shall be provided within the room.

11B-803.5 Coat hooks and shelves. Coat hooks provided within the room shall be located within one of the reach ranges specified in *Section 11B-308*. Shelves shall be 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor or ground. Coat hooks shall not be located above the bench or other seating in the room.

11B-803.6 Mirrors. Mirrors shall be installed with the bottom edge of the reflecting surface 20 inches (508 mm) maximum above the finish floor or ground. Mirrors shall be full length with a reflective surface 18 inches (457 mm) wide minimum by 54 inches (1372 mm) high minimum and shall be mounted in a position affording a view to a person on the bench as well as to a person in a standing position.

11B-804 Kitchens, kitchenettes and wet bars.

11B-804.1 General. Kitchens, kitchenettes and wet bars shall comply with *Section 11B-804*.

11B-804.2 Clearance. Where a pass through kitchen is provided, clearances shall comply with *Section 11B-804.2.1*. Where a U-shaped kitchen is provided, clearances shall comply with *Section 11B-804.2.2*.

Exception: Spaces that do not provide a cooktop or conventional range shall not be required to comply with *Section 11B-804.2*.

11B-804.2.1 Pass through kitchen. In pass through kitchens where counters, appliances or cabinets are on two opposing sides, or where counters, appliances or cabinets are opposite a parallel wall, clearance between all oppos-

ing base cabinets, counter tops, appliances or walls within kitchen work areas shall be 40 inches (1016 mm) minimum. Pass through kitchens shall have two entries.

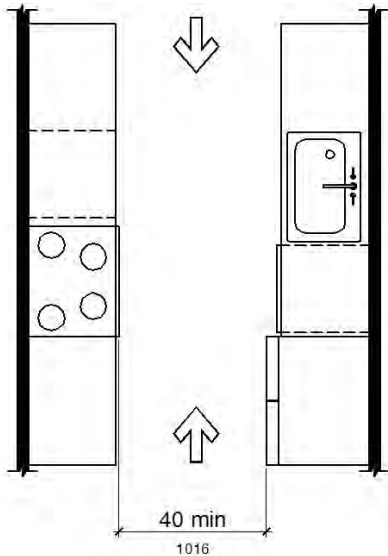


FIGURE 11B-804.2.1
PASS THROUGH KITCHENS

11B-804.2.2 U-shaped. In U-shaped kitchens enclosed on three contiguous sides, clearance between all opposing base cabinets, counter tops, appliances or walls within kitchen work areas shall be 60 inches (1524 mm) minimum.

11B-804.2.3 Turning space. In kitchens within multi-bedroom housing units and on floors containing accessible sleeping rooms with adaptable features in undergraduate student housing, turning spaces complying with Section 11B-304 shall be provided.

11B-804.3 Kitchen work surface. In residential dwelling units required to comply with Section 11B-809, at least one 30 inches (762 mm) wide minimum section of counter shall provide a kitchen work surface that complies with Section 11B-804.3. In kitchens within multi-bedroom housing units and on floors con-

taining accessible sleeping rooms with adaptable features in undergraduate student housing, at least one 30 inches (762 mm) wide minimum section of counter shall provide a kitchen work surface that complies with Section 11B-804.3.

11B-804.3.1 Clear floor or ground space. A clear floor space complying with Section 11B-305 positioned for a forward approach shall be provided. The clear floor or ground space shall be centered on the kitchen work surface and shall provide knee and toe clearance complying with Section 11B-306.

Exception: Cabinetry shall be permitted under the kitchen work surface provided that all of the following conditions are met:

- (a) the cabinetry can be removed without removal or replacement of the kitchen work surface;
- (b) the finish floor extends under the cabinetry; and
- (c) the walls behind and surrounding the cabinetry are finished.

11B-804.3.2 Height. The kitchen work surface shall be 34 inches (864 mm) maximum above the finish floor or ground.

Exception: A counter that is adjustable to provide a kitchen work surface at variable heights, 29 inches (737 mm) minimum and 36 inches (914 mm) maximum, shall be permitted.

11B-804.3.3 Exposed surfaces. There shall be no sharp or abrasive surfaces under the work surface counters.

11B-804.4 Sinks. Sinks shall comply with Section 11B-606.

11B-804.5 Storage. At least 50 percent of shelf space in storage facilities shall comply with Section 11B-811.

11B-804.6 Appliances. Where provided, kitchen appliances shall comply with Section 11B-804.6.

11B-804.6.1 Clear floor or ground space. A clear floor or ground space complying with Section 11B-305 shall be provided at each kitchen appliance. Clear floor or ground spaces shall be permitted to overlap.

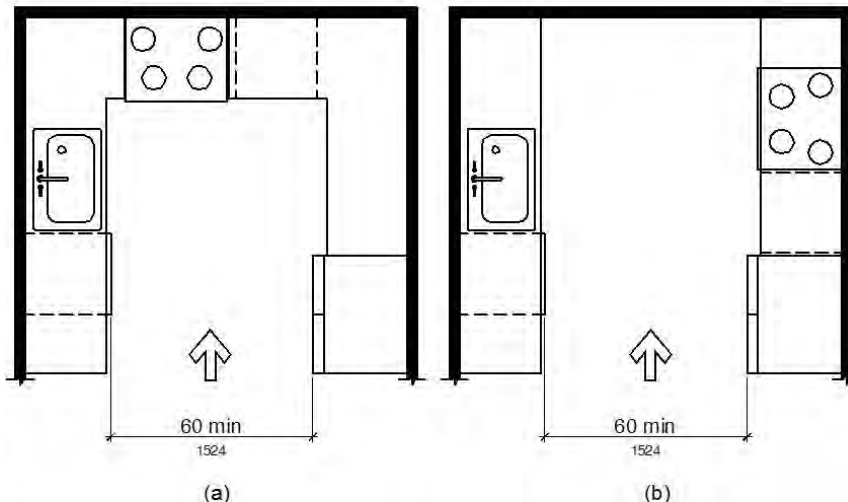


FIGURE 11B-804.2.2
U-SHAPED KITCHENS

11B-804.6.2 Operable parts. All appliance controls shall comply with *Section 11B-309*.

Exceptions:

1. Appliance doors and door latching devices shall not be required to comply with *Section 11B-309.4*.
2. Bottom-hinged appliance doors, when in the open position, shall not be required to comply with *Section 11B-309.3*.

11B-804.6.3 Dishwasher. Clear floor or ground space shall be positioned adjacent to the dishwasher door. The dishwasher door, in the open position, shall not obstruct the clear floor or ground space for the dishwasher or the sink.

11B-804.6.4 Range or cooktop. Where a forward approach is provided, the clear floor or ground space shall provide knee and toe clearance complying with *Section 11B-306*. Where knee and toe space is provided, the underside of the range or cooktop shall be insulated or otherwise configured to prevent burns, abrasions or electrical shock. The location of controls shall not require reaching across burners.

11B-804.6.5 Oven. Ovens shall comply with *Section 11B-804.6.5*.

11B-804.6.5.1 Side-hinged door ovens. Side-hinged door ovens shall have the work surface required by *Section 11B-804.3* positioned adjacent to the latch side of the oven door.

11B-804.6.5.2 Bottom-hinged door ovens. Bottom-hinged door ovens shall have the work surface required by *Section 11B-804.3* positioned adjacent to one side of the door.

11B-804.6.5.3 Controls. Ovens shall have controls on front panels.

11B-804.6.6 Refrigerator/freezer. Combination refrigerators and freezers shall have at least 50 percent of the freezer space 54 inches (1372 mm) maximum above the finish floor or ground. The clear floor or ground space shall be positioned for a parallel approach to the space dedicated to a refrigerator/freezer with the centerline of the clear floor or ground space offset 24 inches (610 mm) maximum from the centerline of the dedicated space.

11B-805 Medical care and long-term care facilities

11B-805.1 General. *Medical care facilities and long-term care facilities shall comply with Section 11B-805. All common use spaces and public use spaces in medical care facilities and long-term care facilities shall comply with this chapter.*

11B-805.2 Patient bedrooms and resident sleeping rooms. *Patient bedrooms and resident sleeping rooms required to provide mobility features shall comply with Section 11B-805.2.*

11B-805.2.1 Hand washing fixtures. *Hand washing fixtures shall comply with Section 11B-606.*

11B-805.2.2 Beds. *A 36 inch (914 mm) minimum wide clear space shall be provided along the full length of each side of the beds.*

11B-805.2.3 Turning space. *Turning space complying with Section 11B-304 shall be provided within the room.*

11B-805.2.4 Toilet and bathing rooms. *Toilet and bathing rooms that are provided as part of patient bedrooms and resident sleeping rooms complying with Section 11B-223.2 or 11B-223.3 shall comply with Section 11B-603. Where provided, one water closet, one lavatory and one bathtub or shower shall comply with the applicable requirements of Sections 11B-603 through 11B-610.*

11B-805.3 Waiting rooms. *Waiting rooms shall comply with Section 11B-805.3.*

11B-805.3.1 Wheelchair spaces. *Where seating is provided in waiting rooms, at least 5 percent of the seating shall be wheelchair spaces complying with Section 11B-802.1.*

Exception: *In waiting rooms serving facilities specializing in treating conditions that affect mobility, 10 percent of the seating shall be wheelchair spaces complying with Section 11B-802.1.*

11B-805.4 Examination, diagnostic and treatment rooms. *Examination, diagnostic and treatment rooms shall comply with Section 11B-805.4.*

11B-805.4.1 Beds, exam tables, procedure tables, gurneys and lounge chairs. *A 36-inch (914 mm) minimum wide clear space shall be provided along the full length of each side of beds, exam tables, procedure tables, gurneys and lounge chairs.*

Exception: *General exam rooms in non-emergency settings may provide clear space on only one side of beds, gurneys and exam tables.*

11B-805.4.2 Equipment. *Clear space complying with Section 11B-305.2 shall be provided as required for specific equipment.*

11B-805.4.3 Turning space. *Turning space complying with Section 11B-304 shall be provided within the room.*

11B-805.5 Patient change areas. *Areas where patients change or are prepared for a procedure shall comply with Section 11B-222.*

11B-805.6 Hand washing fixtures, lavatories and sinks. *All hand washing fixtures, lavatories and sinks shall comply with Section 11B-606.*

Exception: *Scrub sinks, as defined in California Plumbing Code Section 221.0, shall not be required to comply with Section 11B-606.*

11B-805.7 Built-in cabinets and work surfaces. *Built-in cabinets, counters and work surfaces shall be accessible, including: patient wardrobes, nurse stations, administrative*

centers, reception desks, medicine preparation areas, laboratory work stations, equipment consoles, clean and soiled utility cabinets and storage areas; and shall comply with Sections 11B-225 and 11B-902.

Exceptions:

1. Built-in wardrobes in patient bedrooms and resident sleeping rooms not required to be accessible are not required to comply with the provisions of this chapter.
2. Clinical laboratory work stations provided in a laboratory area that are in addition to the minimum number required to be accessible (5 percent of the work stations provided, but no fewer than one), are not required to comply with the provisions of Section 11B-902.

11B-806 Transient lodging guest rooms

11B-806.1 General. Transient lodging guest rooms shall comply with Section 11B-806. Guest rooms required to provide mobility features shall comply with Section 11B-806.2. Guest rooms required to provide communication features shall comply with Section 11B-806.3.

11B-806.2 Guest rooms with mobility features. Guest rooms required to provide mobility features shall comply with Section 11B-806.2.

11B-806.2.1 Living and dining areas. Living and dining areas shall be accessible.

11B-806.2.2 Exterior spaces. Exterior spaces, including patios, terraces and balconies, that serve the guest room shall be accessible.

11B-806.2.3 Sleeping areas. At least one sleeping area shall provide a 36 inch (914 mm) by 48 inch (1219 mm) minimum clear space on both sides of a bed. The clear space shall be positioned for parallel approach to the side of the bed.

Exception: Where a single clear floor space complying with Section 11B-305 positioned for parallel approach is provided between two beds, a clear floor or ground space shall not be required on both sides of a bed.

11B-806.2.3.1 Personal lift device floor space. There shall be a clear space under the bed for the use of a personal lift device. The clear space shall extend under the bed parallel to the long side and be adjacent to an accessible route. The clear space shall extend to points horizontally 30 inches (762 mm), vertically 7 inches (178 mm) and not more than 12 inches (305 mm) from the head and foot end of the bed.

11B-806.2.4 Toilet and bathing facilities. At least one bathroom that is provided as part of a guest room shall comply with Section 11B-603. No fewer than one water closet, one lavatory and one bathtub or shower shall comply with applicable requirements of Sections 11B-603 through 11B-610. In addition, required roll-in shower compartments shall comply with Section 11B-608.2.2 or 11B-608.2.3. Toilet and bathing fixtures required to comply with Sections 11B-603 through 11B-610 shall be permitted to be located in more than one toilet or bathing

area, provided that travel between fixtures does not require travel between other parts of the guest room.

11B-806.2.4.1 Vanity counter top space. If vanity counter top space is provided in non-accessible guest toilet or bathing rooms, comparable vanity counter top space, in terms of size and proximity to the lavatory, shall also be provided in accessible guest toilet or bathing rooms.

11B-806.2.5 Kitchens, kitchenettes and wet bars. Kitchens, kitchenettes and wet bars shall comply with Section 11B-804.

11B-806.2.6 Turning space. Turning space complying with Section 11B-304 shall be provided within the guest room.

11B-806.3 Guest rooms with communication features. Guest rooms required to provide communication features shall comply with Section 11B-806.3.

11B-806.3.1 Alarms. Where emergency warning systems are provided, fire alarms shall comply with Section 11B-702 and carbon monoxide alarms shall comply with Chapter 9, Section 915.

11B-806.3.2 Notification devices. Visible notification devices shall be provided to alert room occupants of incoming telephone calls and a door knock or bell. Notification devices shall not be connected to visible alarm signal appliances. Telephones shall have volume controls compatible with the telephone system and shall comply with Section 11B-704.3. Telephones shall be served by an electrical outlet complying with Section 11B-309 located within 48 inches (1219 mm) of the telephone to facilitate the use of a TTY.

11B-807 Holding cells and housing cells

11B-807.1 General. Holding cells and housing cells shall comply with Section 11B-807.

11B-807.2 Cells with mobility features. Cells required to provide mobility features shall comply with Section 11B-807.2.

11B-807.2.1 Turning space. Turning space complying with Section 11B-304 shall be provided within the cell.

11B-807.2.2 Benches. Where benches are provided, at least one bench shall comply with Section 11B-903.

11B-807.2.3 Beds. Where beds are provided, clear floor space complying with Section 11B-305 shall be provided on at least one side of the bed. The clear floor space shall be positioned for parallel approach to the side of the bed.

11B-807.2.4 Toilet and bathing facilities. Toilet facilities or bathing facilities that are provided as part of a cell shall comply with Section 11B-603. Where provided, no fewer than one water closet, one lavatory and one bathtub or shower shall comply with the applicable requirements of Sections 11B-603 through 11B-610.

11B-807.3 Cells with communication features. Cells required to provide communication features shall comply with Section 11B-807.3.

11B-807.3.1 Alarms. Where audible emergency alarm systems are provided to serve the occupants of cells, visible alarms complying with *Section 11B-702* shall be provided.

Exception: Visible alarms shall not be required where inmates or detainees are not allowed independent means of egress.

11B-807.3.2 Telephones. Telephones, where provided within cells, shall have volume controls complying with *Section 11B-704.3*.

11B-808 Courtrooms

11B-808.1 General. Courtrooms shall comply with *Section 11B-808*.

11B-808.2 Turning space. Where provided, areas that are raised or depressed and accessed by ramps or platform lifts with entry ramps shall provide unobstructed turning space complying with *Section 11B-304*.

11B-808.3 Clear floor space. Each jury box and witness stand shall have, within its defined area, clear floor space complying with *Section 11B-305*.

Exception: In alterations, wheelchair spaces are not required to be located within the defined area of raised jury boxes or witness stands and shall be permitted to be located outside these spaces where ramp or platform lift access poses a hazard by restricting or projecting into a means of egress required by the appropriate administrative authority.

11B-808.4 Judges' benches and courtroom stations. Judges' benches, clerks' stations, bailiffs' stations, deputy clerks' stations, court reporters' stations and litigants' and counsel stations shall comply with *Section 11B-902*.

11B-809 Residential dwelling units

11B-809.1 General. When located within public housing facilities, residential dwelling units shall comply with *Section 11B-809*. Residential dwelling units required to provide mobility features shall comply with *Sections 11B-809.2* through *11B-809.4*. Residential dwelling units required to provide communication features shall comply with *Section 11B-809.5*.

11B-809.2 Accessible routes. Accessible routes complying with *Division 4* shall be provided within residential dwelling units in accordance with *Section 11B-809.2*.

Exception: Accessible routes shall not be required to or within unfinished attics or unfinished basements.

11B-809.2.1 Location. At least one accessible route shall connect all spaces and elements which are a part of the residential dwelling unit. Where only one accessible route is provided, it shall not pass through bathrooms, closets or similar spaces.

11B-809.2.2 Turning space. All rooms served by an accessible route shall provide a turning space complying with *Section 11B-304*.

Exception: Turning space shall not be required in exterior spaces 30 inches (762 mm) maximum in depth or width.

11B-809.3 Kitchen. Where a kitchen is provided, it shall comply with *Section 11B-804*.

11B-809.4 Toilet facilities and bathing facilities. At least one bathroom shall comply with *Section 11B-603*. No fewer than one of each type of fixture provided *within the bathroom* shall comply with applicable requirements of *Sections 11B-603* through *11B-610*. Toilet and bathing fixtures required to comply with *Sections 11B-603* through *11B-610* shall be located in the same *bathroom or* toilet and bathing area, such that travel between fixtures does not require travel between other parts of the residential dwelling unit.

11B-809.4.1 Subsequent bathrooms. In residential dwelling units with more than one bathroom, when a bathtub is installed in the first bathroom in compliance with *Section 11B-809.4* and a shower compartment is provided in a subsequent bathroom, at least one shower compartment shall comply with *Section 11B-608*.

11B-809.5 Residential dwelling units with communication features. Residential dwelling units required to provide communication features shall comply with *Section 11B-809.5*.

11B-809.5.1 Building fire alarm system. Where a building fire alarm system is provided, the system wiring shall be extended to a point within the residential dwelling unit in the vicinity of the residential dwelling unit smoke detection system.

11B-809.5.1.1 Alarm appliances. Where alarm appliances are provided within a residential dwelling unit as part of the building fire alarm system, they shall comply with *Chapter 9, Section 907.5.2.3.3*.

11B-809.5.1.2 Activation. All visible alarm appliances provided within the residential dwelling unit for building fire alarm notification shall be activated upon activation of the building fire alarm in the portion of the building containing the residential dwelling unit.

11B-809.5.2 Residential dwelling unit smoke detection system and carbon monoxide detection system. Residential dwelling unit smoke detection systems shall comply with *Chapter 9, Section 907.2.11*. *Residential dwelling unit carbon monoxide detection systems shall comply with Chapter 4*.

11B-809.5.2.1 Activation. All visible alarm appliances provided within the residential dwelling unit for smoke detection notification shall be activated upon smoke detection. *All visible alarm appliances provided within the residential dwelling unit for carbon monoxide detection notification shall be activated upon carbon monoxide detection*.

11B-809.5.3 Interconnection. The same visible alarm appliances shall be permitted to provide notification of residential dwelling unit smoke detection, building fire alarm activation and *carbon monoxide detection*.

11B-809.5.4 Prohibited use. Visible alarm appliances used to indicate residential dwelling unit smoke detection, *carbon monoxide detection* or building fire alarm activation shall not be used for any other purpose within the residential dwelling unit.

11B-809.5.5 Residential dwelling unit primary entrance. Communication features shall be provided at the residential dwelling unit primary entrance complying with Section 11B-809.5.5.

11B-809.5.5.1 Notification. A hard-wired electric doorbell shall be provided. A button or switch shall be provided outside the residential dwelling unit primary entrance. Activation of the button or switch shall initiate an audible tone and visible signal within the residential dwelling unit. Where visible doorbell signals are located in sleeping areas, they shall have controls to deactivate the signal.

11B-809.5.5.2 Identification. A means for visually identifying a visitor without opening the residential dwelling unit entry door shall be provided and shall allow for a minimum 180 degree range of view.

11B-809.5.6 Site, building or floor entrance. Where a system, including a closed-circuit system, permitting voice communication between a visitor and the occupant of the residential dwelling unit is provided, the system shall comply with Section 11B-708.4.

11B-809.6 Residential dwelling units with adaptable features. Multi-family residential dwelling units with adaptable features shall comply with Sections 11B-809.7 through 11B-809.12.

11B-809.7 Accessible routes. An accessible route shall be provided complying with Section 11B-809.7. The accessible route shall pass through the primary entry door, through all rooms within the dwelling unit and exterior decks and balconies. The accessible route shall adjoin or overlap clear floor spaces and connect all exterior doors.

Exceptions:

1. An accessible route shall not be required from the interior of the unit into a basement.
2. An accessible route to a garage shall comply with Section 11B-208.3.3.
3. An accessible route shall not be required to rooms or spaces not located on the primary entry level of a multistory dwelling unit.

11B-809.7.1 Width. The clear width for the accessible route shall be 36 inches (914 mm) minimum.

Exception: The clear width shall be permitted to be reduced to 32 inches (813 mm) minimum at doors.

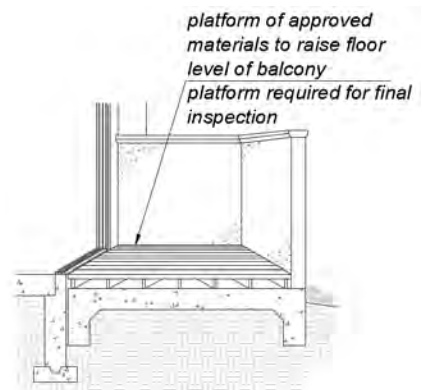
11B-809.7.2 Changes in level. Changes in level shall comply with Sections 11B-303.2 and 11B-303.3. Ramps complying with Section 11B-405, elevators complying with Section 11B-407 or platform lifts complying with Section 11B-410 shall be provided where changes in level exceed 1/2 inch (12.7 mm) high.

11B-809.8 Doors. Primary entry doors, required exit doors, secondary exterior doors and interior doors intended for user passage shall comply with this section and Section 11B-404.2. Doors to small mechanical closets specifically dedi-

cated to furnaces or hot water heaters shall not be required to comply with this section.

Exceptions: At primary entry doors, required exit doors, secondary exit doors and interior doors the following exceptions apply:

1. The floor or landing at primary entry doors, required exit doors, and secondary exit doors where a change in elevation occurs between the interior and the exterior surface of the floor or landing, shall comply with the following:
 - a. Exterior landings of impervious construction (e.g., concrete, brick, flagstone) serving primary entry doors and required exit doors are limited to not more than 1/2 inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 11B-809.7.2.
 - b. Exterior landings of pervious construction (e.g., wood decking with spaces) shall be the same level as the interior landing, except that secondary exterior doors may have no more than 1/2 inch (12.7 mm) of change in height between floor surfaces. Changes in level shall comply with Section 11B-809.7.2.
 - c. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 4 inches (102 mm). Changes in height greater than 1/2 inch (12.7 mm) shall be accomplished by means of a ramp complying with Section 11B-405 or by means of a platform constructed to the level of the floor as illustrated in Figure 11B-809.8(c).



**FIGURE 11B-809.8 Ex. 1(c)
PLATFORM AT SECONDARY EXTERIOR DOOR**

- d. Secondary exterior doors onto decks, patios or balcony surfaces constructed of impervious materials (e.g., concrete, brick, flagstone) may have a maximum change in height from the interior landing of 1 inch (25 mm), provided a ramp with

a maximum slope of 1:8 is permanently installed as illustrated in Figure 11B-809.8(d).

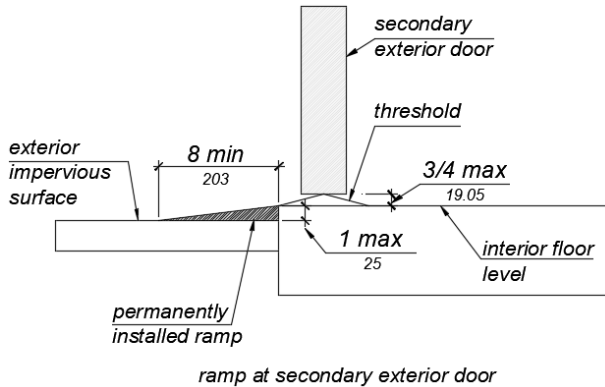


FIGURE 11B-809.8 Ex. 1(d)
RAMP AT SECONDARY EXTERIOR DOOR

11B-809.8.1 Door thresholds. Secondary exterior door thresholds, including sliding door tracks, shall be $\frac{3}{4}$ inch (19.1 mm) high maximum with a 1:2 maximum slope.

11B-809.8.2 Door opening force. The opening force for primary entry exterior doors and secondary exterior doors shall be 8.5 pounds (38 N) maximum.

11B-809.8.3 Door maneuvering clearance.

1. At the dwelling unit side of the primary entry doors, secondary exterior doors, and required exit doors maneuvering clearances shall be 44 inches (1118 mm) minimum in length measured perpendicular to the face of the door in the closed position. The width of the maneuvering clearance shall extend 18 inches (457 mm) beyond the strike edge at the pull side of the door.
2. At interior doors maneuvering clearances shall be 42 inches (1067 mm) minimum in length on both sides of the door measured perpendicular to the face of the door in the closed position. A 39-inch (991 mm) minimum length is allowed at interior doors when a clear opening width of 34 inches (864 mm) minimum is provided. The width of the maneuvering clearance shall extend 18 inches (457 mm) beyond the strike edge at the pull side of the door.

11B-809.8.4 Door signal devices. Every primary entrance to a residential dwelling unit with adaptable features shall be provided with a door buzzer, bell, chime or equivalent. The activating mechanism shall be mounted 48 inches (1219 mm) maximum above the floor and connected to permanent wiring.

11B-809.9 Kitchens. Kitchens shall be on an accessible route and shall comply with this section.

11B-809.9.1 Clear floor space. Clear floor spaces 30 inches (762 mm) by 48 inches (1219 mm), with centerlines aligned with the centerline of the work surface, appliance, sink or fixture, shall be provided in the following locations:

1. For a parallel approach at the range.

2. For parallel or forward approach at a cooktop.
3. For a parallel or forward approach to the sink and to the work surface required by Sections 11B-809.9.3 and 11B-809.9.4.
4. For a parallel or forward approach to all other fixtures or appliances.

11B-809.9.2 Clear width. Kitchens shall have a minimum clear width measured between any cabinet, work surface or the face of any appliance (excluding handles and controls) and the opposing cabinet, work surface, appliance or wall as follows:

- a. U-shaped kitchens, designed with parallel approach at a sink, range, cooktop or other fixtures and appliances located at the base of the U without knee and toe clearance, shall provide a clear width of 60 inches (1524 mm) minimum.
- b. U-shaped kitchens, with a cooktop, sink or work surface located at the base of the U, that provides knee and toe space complying Sections 11B-809.9.3 and 11B-809.9.4 to allow for a forward approach, shall provide a clear width of 48 inches (1219 mm) minimum.
- c. All other kitchen designs shall provide a clear width of 48 inches (1219 mm) minimum.

11B-809.9.3 Removable base cabinets. Knee and toe space complying with Section 11B-306 shall be provided at sinks and work surfaces required to comply with Section 11B-809.9.4.

Exception: Removable base cabinets shall be permitted under sinks and work surfaces provided that all of the following conditions are met:

- a) base cabinets can be removed without the use of specialized tools or knowledge;
- b) the finish floor extends under the base cabinet; and
- c) the walls behind and surrounding the base cabinets are finished.

11B-809.9.4 Work surfaces. Work surfaces shall be 36 inches (914 mm) maximum above the finish floor with minimum lengths at the following locations as required by this section:

1. Linear length of 30 inches (762 mm) minimum for installation of a sink.
2. Linear length of 30 inches (762 mm) minimum for work surfaces.
3. A sink and work surface in a single integral unit 60 inches (1524 mm) minimum in length, is permitted.

11B-809.9.5 Lower shelving. Lower shelving and/or drawer space shall be provided at a height of 48 inches (1219 mm) maximum above the finish floor.

11B-809.9.6 Controls. Controls for faucets shall comply with Section 11B-309.1. Hand-operated metering faucets shall remain open for 10 seconds minimum.

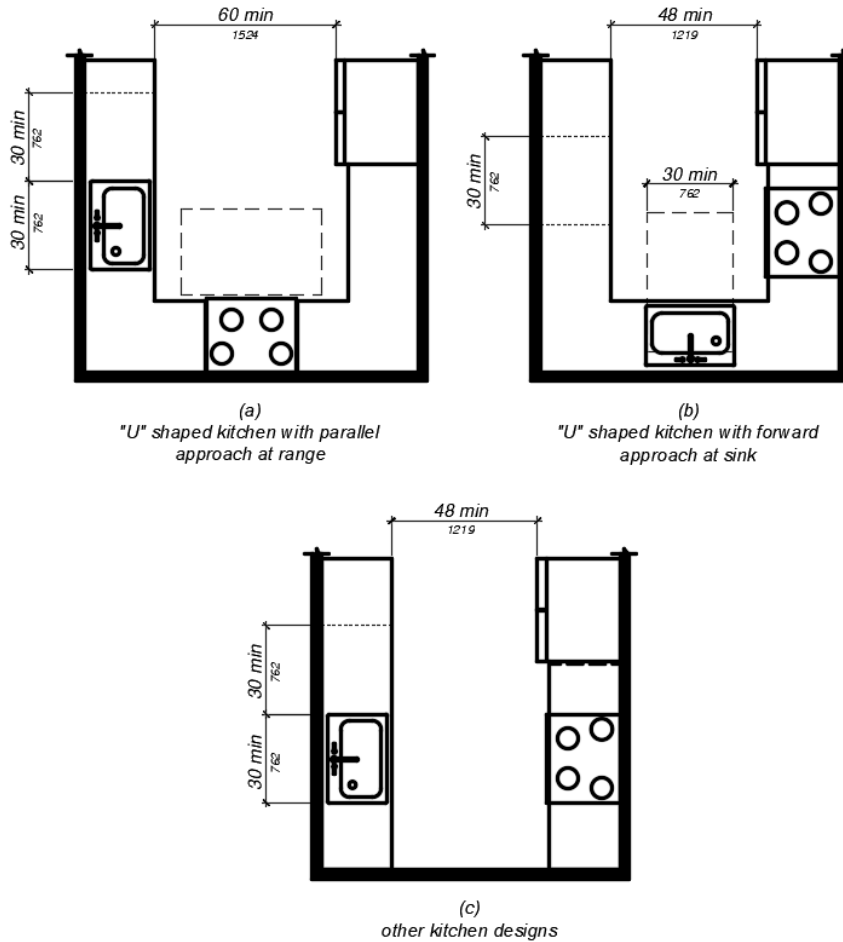


FIGURE 11B-809.9.2
CLEAR WIDTH AT KITCHENS

11B-809.9.7 Exposed pipes and surfaces. Exposed water supply and drain pipes under sinks and lavatories shall comply with Section 11B-606.5.

11B-809.10 Toilet and bathing rooms.

11B-809.10.1 General. All toilet and bathing rooms on an accessible route within residential dwelling units with adaptable features shall comply with Sections 11B-809.7, 11B-809.8, 11B-809.10.6.4, 11B-809.10.7.3 and 11B-809.12.

11B-809.10.2 Number of complying bathing rooms and fixtures. One bathing room and one fixture of each type within the dwelling unit shall be designed to comply with the following:

1. Maneuvering space in toilet, bathing and shower rooms shall comply with Section 11B-809.10.4.
2. Bathtubs complying with Section 11B-809.10.5.
3. Showers complying with Section 11B-809.10.6.
4. Water closets complying with Section 11B-809.10.7.
5. Lavatories, vanities, mirrors and towel bars complying with Section 11B-809.10.8. When two or more

lavatories are provided, at least one shall comply with Section 11B-809.10.8.

6. Where both a tub and shower are provided in the bathroom, at least one shall be made accessible. Where two or more bathrooms are provided, when a bathtub is installed in the first bathroom in compliance with Section 11B-809.10.5 and a shower compartment is provided in a subsequent bathroom, at least one shower compartment shall comply with Section 11B-809.10.6.

11B-809.10.3 Powder rooms. Powder rooms shall be designed to comply with Sections 11B-809.7, 11B-809.8, 11B-809.10.5.2, 11B-809.10.6.4, 11B-809.10.7.3 and 11B-809.12. When the powder room is the only toilet facility located on an accessible level it shall, in addition, comply with Sections 11B-809.10.4, 11B-809.10.7 and 11B-809.10.8.

11B-809.10.4 Sufficient maneuvering space. Where doors swing into the toilet and bathing or powder rooms required to comply with Section 11B-809.10, a clear maneuvering space of 30 inches (762 mm) by 48 inches (1219 mm) minimum shall be provided outside the arc of

the door swing. The clear maneuvering space shall be permitted to include knee and toe clearance under bathroom fixtures. Doors shall be permitted to encroach into the clear floor space or clearance for fixtures where clear maneuvering space is provided outside the arc of the door swing. A turning space is not required within the room.

11B-809.10.5 Bathtubs. Bathtubs required by Section 11B-809.10 shall comply with this section.

11B-809.10.5.1 Clear floor space. A clear floor space 30 inches (762 mm) minimum by 48 inches (1219 mm) minimum shall be located with the long edge of the clear floor space parallel to the side of the bathtub or bathtub-shower combination. Controls shall be located on the wall at the foot of the bathtub. The edge of the clear floor space shall be flush with the control wall surface. The area under a lavatory, located at the control end of the tub, shall be permitted to encroach on the clear floor space provided the lavatory is 19 inches (483 mm) maximum in depth, and knee and toe clearance complying with Section 11B-306 is provided. Cabinets under lavatories and toilets shall not encroach on the clear floor space.

11B-809.10.5.2 Reinforcement for grab bars. Reinforcement for grab bars shall comply with the following:

1. Where bathtubs are installed without surrounding walls reinforcement shall be provided for floor-mounted grab bars.
2. Where bathtubs are installed with surrounding walls, grab bar reinforcement shall be installed as follows:
 - a. At the control end wall and head end wall, between 30 inches (762 mm) maximum to 38 inches (965 mm) minimum above the finish floor, extending 28 inches (711 mm) minimum from the front edge of the bathtub to the back wall of the bathtub. The grab bar reinforcement shall be 8 inches (203 mm) minimum in height.
 - b. At the back wall, from 5 inches (127 mm) maximum above the bathtub rim to 38 inches (965

mm) minimum above the finish floor. Grab bar backing shall be installed horizontally to permit the installation of a 48-inch (1219 mm) grab bar with each end 6 inches (152 mm) maximum from the end walls of the bathtub.

11B-809.10.5.3 Controls. Controls and operating mechanisms shall comply with Section 11B-309.4.

Exception: Shower spray units are not required in bathtubs.

11B-809.10.5.4 Bathtub enclosures. Doors and panels of bathtub enclosures shall be constructed from approved, shatter-resistant materials. Hinged doors shall open outward. Glazing used in doors and panels of bathtub enclosures shall be fully tempered, laminated safety glass or approved plastic. When glass is used, it shall be 1/8-inch (3.2 mm) thick minimum when fully tempered, or 1/4-inch (6.4 mm) thick minimum when laminated, and shall pass the test requirements of this part, Chapter 24 Glass and Glazing. Plastics used in doors and panels of bathtub enclosures shall be of a shatter-resistant type.

11B-809.10.6 Showers. Showers required by Section 11B-809.10 shall comply with this section.

11B-809.10.6.1 Size. When one or more shower stalls are provided within the same dwelling unit, as least one shower stall shall comply with one of the following:

1. A transfer type shower compartment 36 inches (914 mm) wide by 36 inches (914 mm) deep with an entrance opening 36 inches (914 mm) complying with Section 11B-608.1; or
2. A shower stall 30 inches (762 mm) deep minimum by 60 inches (1524 mm) wide minimum with an entrance opening 60 inches (1524 mm) minimum. A water closet shall be permitted to project 12 inches (305 mm) maximum into the opening provided that 36 inches (914 mm) minimum clear space is maintained between the water closet and the shower wall as illustrated in Figure 11B-809.10.6.1; or
3. A shower stall 36 inches (914 mm) deep by 60 inches (1524 mm) wide minimum with an

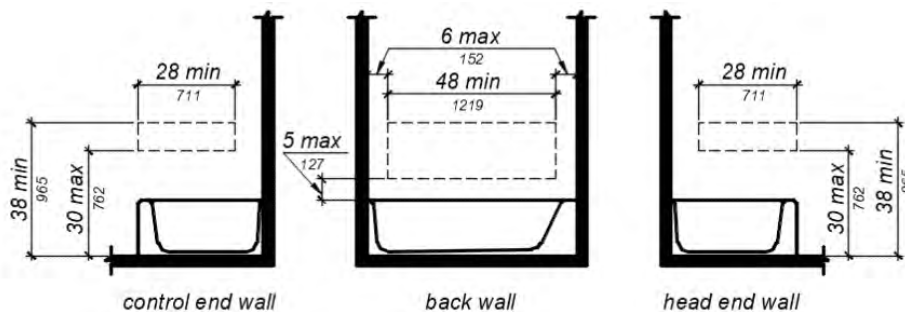


FIGURE 11B-809.10.5.2
REINFORCEMENT FOR GRAB BARS

entrance 36 inches (914 mm) minimum when a wall is installed on the opening side.

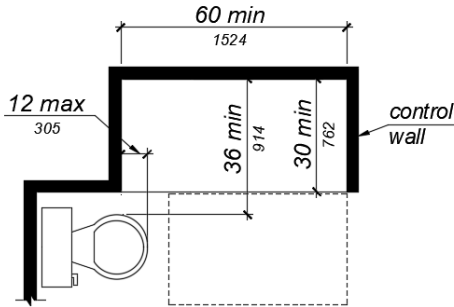


FIGURE 11B-809.10.6.1 SHOWERS

11B-809.10.6.2 Slope. The slope of the shower floor shall be 1/2 inch (12.7 mm) per foot maximum in any direction and shall slope to a drain. The floor surfaces shall be of Carborundum, grit-faced tile or of material providing equivalent slip resistance.

11B-809.10.6.3 Floor space. A clear maneuvering space 30 inches (762 mm) wide minimum by 48 inches (1219 mm) minimum in length shall be located outside the shower, with the width flush with the control wall and the length parallel to the length of the shower.

11B-809.10.6.4 Reinforcement for grab bars. Reinforcement for grabs bars shall comply with the following: Continuous reinforcement shall be installed in the walls of showers 30 inches (762 mm) maximum to 38 inches (965 mm) minimum above the finish floor. The grab bar reinforcement shall be 8 inches (203 mm) minimum in height. Glass-walled shower stalls shall provide reinforcement for installation of floor-mounted or ceiling-mounted grab bars.

11B-809.10.6.5 Thresholds. Where provided thresholds shall be 2 inches (51 mm) maximum in height and have a beveled or sloped angle not exceeding 1 unit vertical in 2 units horizontal (26.6 degrees from the horizontal). Thresholds 1/2 inch (12.7 mm) or less in height shall have a beveled or sloped angle not exceeding 1 unit vertical in 1 unit horizontal (45 degrees from the horizontal).

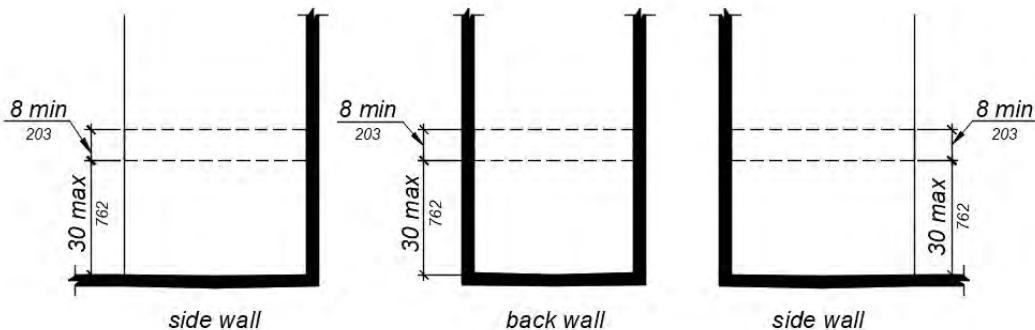


FIGURE 11B-809.10.6.4 REINFORCEMENT FOR GRAB BARS

11B-809.10.6.6 Controls. Controls and operating mechanisms shall comply with Section 11B-309.4.

11B-809.10.6.7 Shower enclosures. Doors and panels of shower enclosures shall comply with Section 11B-809.10.5.4.

11B-809.10.7 Water closets. Water closets required by Section 11B-809.10 shall comply with this section.

11B-809.10.7.1 Floor space. The floor space at water closets shall be 48 inches (1219 mm) wide minimum measured perpendicular to the side wall. A floor space 48 inches (1219 mm) wide minimum by 36 inches (914 mm) deep minimum shall be provided in front of the water closet.

Exception: The 48-inch (1219 mm) minimum clear width may be reduced to 36 inches (914 mm) minimum for lavatories, cabinets, wing walls or privacy walls located immediately adjacent to a water closet which extend 24 inches (610 mm) maximum in depth.

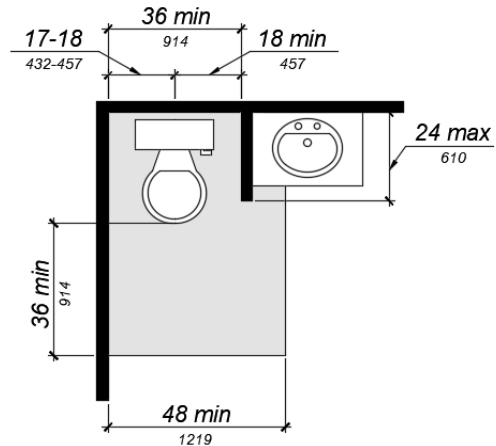


FIGURE 11B-809.10.7.1 FLOOR SPACE

11B-809.10.7.2 Location. Water closets shall be located within bathrooms in a manner that permits a grab bar to be installed on at least one side of the fixture. The centerline of the water closet shall be 17 inches (432 mm) minimum to 18 inches (457 mm) maximum from a wall or partition that is 54 inches (1372 mm) minimum in length. In locations where water clos-

ets are adjacent to other walls, vanities, lavatories or bathtubs, the centerline of the fixture shall be 18 inches (457 mm) minimum from the obstacle.

11B-809.10.7.3 Reinforcement for grab bars. Reinforcement for grab bars shall comply with the following:

1. Where water closets are not placed adjacent to a side wall capable of accommodating a grab bar, the bathroom shall have provisions for installation of floor-mounted, foldaway or similar alternative grab bars.
2. Where water closets are placed adjacent to a side wall, reinforcement shall be installed on both sides or one side and the back. Where reinforcement is installed at the back, it shall be installed between 30 inches (762 mm) maximum and 38 inches (965 mm) minimum above the finish floor. The grab bar reinforcement shall be 8 inches (203 mm) minimum in height. The backing shall be 40 inches (1016 mm) minimum in length.
3. Where the water closet is located adjacent to lavatories, cabinets, wing walls or privacy walls, the grab bar reinforcement shall be 36 inches (914 mm) in length. Reinforcement installed at the side wall of the water closet shall be between 30 inches (762 mm) minimum to 38 inches (965 mm) maximum above the finish floor. The reinforcement shall be 10 inches (254 mm) maximum from the rear wall and shall extend 30 inches (762 mm) minimum in front of the water closet. The grab bar reinforcement shall be 8 inches (203 mm) minimum in height.

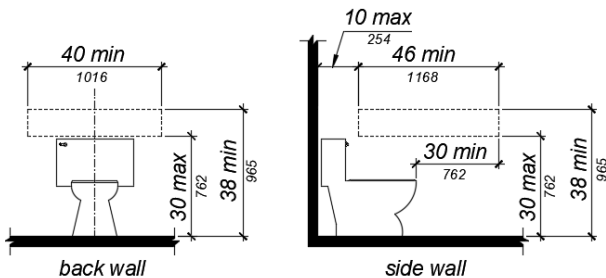


FIGURE 11B-809.10.7.3 REINFORCEMENT FOR GRAB BARS

11B-809.10.7.4 Seat height. Water closet seats shall be 15 inches (381 mm) minimum and 19 inches (483 mm) maximum measured to the top of the seat above the finish floor.

11B-809.10.7.5 Controls. Controls shall be mounted 44 inches (1118 mm) maximum above the finish floor. The force required to activate controls shall be 5 pounds (22.2 N) maximum.

11B-809.10.8 Lavatories, vanities, mirrors and towel bars. Bathing rooms or powder rooms required to comply with Section 11B-809.10 shall provide lavatories complying with this section. Where mirrors or towel bars are provided, no less than one of each shall comply with this section.

11B-809.10.8.1 Location. Lavatories without base cabinets shall be installed with the centerline 18 inches (457

mm) minimum from an adjoining wall or fixture to allow for forward approach. Lavatories with base cabinets shall be installed with the centerline 24 inches (610 mm) minimum from an adjoining wall or fixture to allow for a parallel approach. The top of the lavatory rim shall be 34 inches (864 mm) maximum above the finished floor.

11B-809.10.8.2 Floor space. A floor space 30 inches (762 mm) minimum by 48 inches (1219 mm) minimum shall be provided centered on the lavatory.

11B-809.10.8.3 Cabinets. Cabinets shall be removable without the use of specialized knowledge and/or tools. The finished floor shall extend to the wall under the lavatory.

11B-809.10.8.4 Knee and toe clearance. Knee and toe clearance shall be provided and comply with Section 11B-306.

11B-809.10.8.5 Plumbing protection. Plumbing protection shall comply with Section 11B-809.9.7.

11B-809.10.8.6 Controls. Faucet controls and operating mechanisms shall comply with Section 11B-309.4.

11B-809.10.8.7 Mirrors and towel bars. Where mirrors are provided the bottom edge of the reflective surface shall be 40 inches (1016 mm) maximum above the finish floor. Where towel bars are provided, they shall be installed 40 inches (1016 mm) maximum above the finish floor to the top of the bar.

11B-809.11 Washing machines and clothes dryers. Where washing machines and clothes dryers are provided in residential dwelling units with adaptable features, one of each type shall be provided.

11B-809.12 Electrical receptacles, controls and switches. Electrical receptacles on branch circuits of 30 amperes or less, communication system receptacles, controls and switches shall be located as follows:

1. Where there is no obstruction, 48 inches (1219 mm) maximum measured from the top of the receptacle box and 15 inches (381 mm) minimum measured from the bottom of the receptacle box to the finish floor.
2. Where the reach is over an obstruction, electrical receptacles, controls and switches shall comply with Sections 11B-308.3 and 11B-309.2.
3. When the reach is over a kitchen work surface and base cabinet, the work surface shall be 36 inches (914 mm) maximum above the finish floor and 25½ inches (650 mm) maximum in depth. The base cabinet shall be 24 inches (610 mm) maximum in depth.
4. Where receptacles are provided in a kitchen at a corner work surface, one receptacle shall be located 36 inches (915 mm) from either wall at the inside corner.

Exceptions:

- a. Electrical receptacles installed as part of permanently installed baseboard heaters.
- b. Electrical receptacles in floors adjacent to sliding panels or walls.

- c. Baseboard electrical receptacles in relocatable partitions, window walls or other electrical convenience floor outlets.
- d. Appliances (e.g., stoves, dishwashers, range hoods, microwave ovens and similar appliances) which have controls located on the appliance.
- e. Electrical receptacles dedicated to specific appliances.
- f. Circuit breakers.

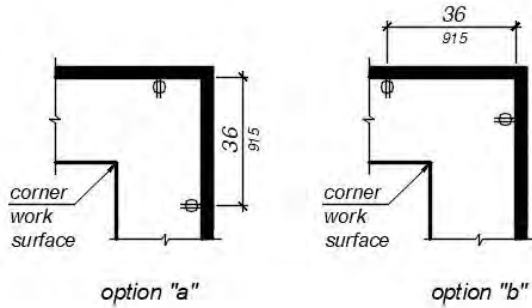


FIGURE 11B-809.12

ELECTRICAL RECEPTACLES AT CORNER WORKSURFACES

11B-810 Transportation facilities

11B-810.1 General. Transportation facilities shall comply with Section 11B-810.

11B-810.1.1 Vehicle boarding. Stations shall not be designed or constructed so as to require persons with disabilities to board or alight from a vehicle at a location other than one used by the general public.

11B-810.1.2 Baggage systems. Baggage check-in and retrieval systems shall be on an accessible route complying with Section 11B-402 and shall have space immediately adjacent complying with Section 11B-302.

11B-810.2 Bus boarding and alighting areas. Bus boarding and alighting areas shall comply with Section 11B-810.2.

11B-810.2.1 Surface. Bus stop boarding and alighting areas shall have a firm, stable surface.

11B-810.2.2 Dimensions. Bus stop boarding and alighting areas shall provide a clear length of 96 inches (2438 mm)

minimum, measured perpendicular to the curb or vehicle roadway edge, and a clear width of 60 inches (1524 mm) minimum, measured parallel to the vehicle roadway.

11B-810.2.3 Connection. Bus stop boarding and alighting areas shall be connected to streets, sidewalks or pedestrian paths by an accessible route complying with Section 11B-402. Newly constructed bus stop boarding and alighting areas shall provide a detectable transition between the boarding/alighting area and the roadway; the detectable transition shall consist of a curb with the face sloped at 35 degrees maximum from vertical or detectable warnings complying with Sections 11B-705.1.1 and 11B-705.1.2.4.

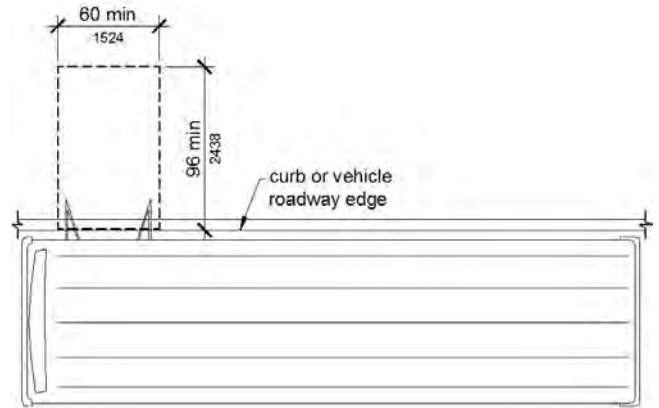


FIGURE 11B-810.2.2

DIMENSIONS OF BUS BOARDING AND ALIGHTING AREAS

11B-810.2.4 Slope. Parallel to the roadway, the slope of the bus stop boarding and alighting area shall be the same as the roadway, to the maximum extent practicable. Perpendicular to the roadway, the slope of the bus stop boarding and alighting area shall not be steeper than 1:48.

11B-810.3 Bus shelters. Bus shelters shall provide a minimum clear floor or ground space complying with Section 11B-305 entirely within the shelter. Bus shelters shall be connected by an accessible route complying with Section 11B-402 to a boarding and alighting area complying with Section 11B-810.2.

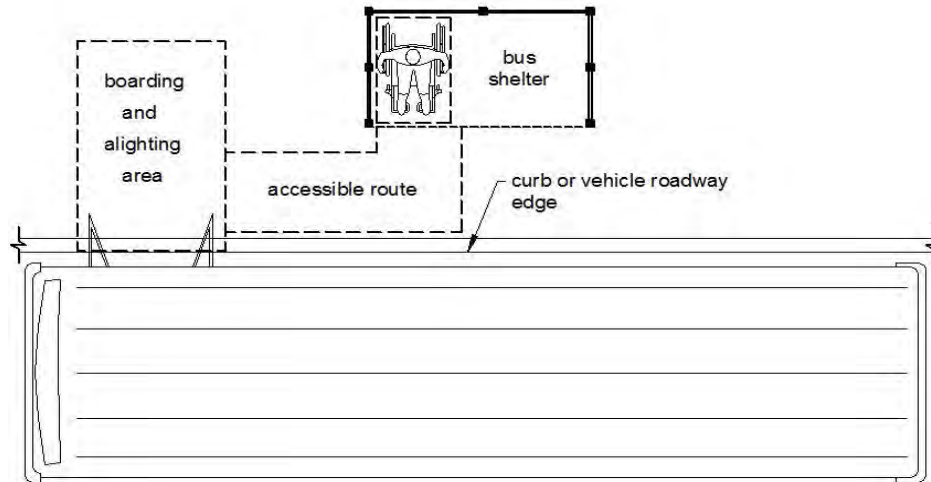


FIGURE 11B-810.3

BUS SHELTERS

11B-810.4 Bus signs. Bus route identification signs shall comply with *Sections 11B-703.5.1 through 11B-703.5.4 and Sections 11B-703.5.7 and 11B-703.5.8*. In addition, to the maximum extent practicable, bus route identification signs shall comply with *Section 11B-703.5.5*.

Exception: Bus schedules, timetables and maps that are posted at the bus stop or bus bay shall not be required to comply.

11B-810.5 Rail platforms. Rail platforms shall comply with *Section 11B-810.5*.

11B-810.5.1 Slope. Rail platforms shall not exceed a slope of 1:48 in all directions.

Exception: Where platforms serve vehicles operating on existing track or track laid in existing roadway, the slope of the platform parallel to the track shall be permitted to be equal to the slope (grade) of the roadway or existing track.

11B-810.5.2 Detectable warnings. Platform boarding edges not protected by platform screens or guards shall have detectable warnings complying with *Section 11B-705* along the full length of the public use area of the platform.

11B-810.5.3 Platform and vehicle floor coordination. Station platforms shall be positioned to coordinate with vehicles in accordance with the applicable requirements of 36 CFR Part 1192. Low-level platforms shall be 8 inches (203 mm) minimum above top of rail.

Exception: Where vehicles are boarded from sidewalks or street-level, low-level platforms shall be permitted to be less than 8 inches (203 mm).

11B-810.6 Rail station signs. Rail station signs shall comply with *Section 11B-810.6*.

Exception: Signs shall not be required to comply with *Sections 11B-810.6.1 and 11B-810.6.2* where audible signs are remotely transmitted to hand-held receivers or are user- or proximity-actuated.

11B-810.6.1 Entrances. Where signs identify a station or its entrance, at least one sign at each entrance shall comply with *Section 11B-703.2* and shall be placed in uniform locations to the maximum extent practicable. Where signs identify a station that has no defined entrance, at least one sign shall comply with *Section 11B-703.2* and shall be placed in a central location.

11B-810.6.2 Routes and destinations. Lists of stations, routes and destinations served by the station which are located on boarding areas, platforms or mezzanines shall comply with *Section 11B-703.5*. At least one tactile sign identifying the specific station and complying with *Section 11B-703.2* shall be provided on each platform or boarding area. Signs covered by this requirement shall, to the maximum extent practicable, be placed in uniform locations within the system.

Exception: Where sign space is limited, characters shall not be required to exceed 3 inches (76 mm).

11B-810.6.3 Station names. Stations covered by this section shall have identification signs complying with *Section 11B-703.5*. Signs shall be clearly visible and within the sight lines

of standing and sitting passengers from within the vehicle on both sides when not obstructed by another vehicle.

11B-810.7 Public address systems. Where public address systems convey audible information to the public, the same or equivalent information shall be provided in a visual format.

11B-810.8 Clocks. Where clocks are provided for use by the public, the clock face shall be uncluttered so that its elements are clearly visible. Hands, numerals and digits shall contrast with the background either light-on-dark or dark-on-light. Where clocks are installed overhead, numerals and digits shall comply with *Section 11B-703.5*.

11B-810.9 Escalators. Where provided, escalators shall comply with *Sections 6.1.3.5.6 and 6.1.3.6.5* of ASME A17.1 and shall have a clear width of 32 inches (813 mm) minimum.

Exception: Existing escalators in key stations shall not be required to comply with *Section 11B-810.9*.

11B-810.10 Track crossings. Where a circulation path serving boarding platforms crosses tracks, it shall comply with *Section 11B-402*.

Exception: Openings for wheel flanges shall be permitted to be $2\frac{1}{2}$ inches (64 mm) maximum.



FIGURE 11B-810.10 (EXCEPTION)
TRACK CROSSINGS

11B-811 Storage

11B-811.1 General. Storage shall comply with *Section 11B-811*.

11B-811.2 Clear floor or ground space. A clear floor or ground space complying with *Section 11B-305* shall be provided.

11B-811.3 Height. Storage elements shall comply with at least one of the reach ranges specified in *Section 11B-308*.

11B-811.4 Operable parts. Operable parts shall comply with *Section 11B-309*.

11B-812 Electric vehicle charging stations

11B-812.1 General. Electric vehicle charging stations (EVCS) shall comply with *Section 11B-812* as required by *Section 11B-228.3*. Where vehicle spaces and access aisles are marked with lines, measurements shall be made from the centerline of the markings.

Exception: Where vehicle spaces or access aisles are not adjacent to another vehicle space, access aisle or parking space, measurements shall be permitted to include the full width of the line defining the vehicle space or access aisle.

11B-812.2 Operable parts. Operable parts shall comply with *Section 11B-309*.

11B-812.3 Floor or ground surfaces. Vehicle spaces and access aisles serving them shall comply with *Section 11B-302*.

Access aisles shall be at the same level as the vehicle space they serve. Changes in level, slopes exceeding 1:48, and detectable warnings shall not be permitted.

11B-812.4 Vertical clearance. Vehicle spaces, access aisles serving them, and vehicular routes serving them shall provide a vertical clearance of 98 inches (2489 mm) minimum. Where provided, overhead cable management systems shall not obstruct required vertical clearance.

11B-812.5 Accessible routes

11B-812.5.1 Accessible route to building or facility. EVCS complying with Section 11B-812 that serve a particular building or facility shall be located on an accessible route to an entrance complying with Section 11B-206.4. Where EVCS do not serve a particular building or facility, EVCS complying with Section 11B-812 shall be located on an accessible route to an accessible pedestrian entrance of the EV charging facility.

Exception: EVCS complying with Section 11B-812 shall be permitted to be located in different EV charging facilities if substantially equivalent or greater accessibility is provided in terms of distance from an accessible entrance or entrances, charging fee, and user convenience.

11B-812.5.2 Accessible route to EV charger. An accessible route complying with Section 11B-402 shall connect the vehicle space and the EV charger which serves it.

11B-812.5.3 Relationship to accessible routes. Vehicle spaces and access aisles shall be designed so that when the vehicle space is occupied the required clear width of adjacent accessible routes is not obstructed. A curb, wheel stop, bollards or other barrier shall be provided if required to prevent encroachment of vehicles over the required clear width of adjacent accessible routes.

11B-812.5.4 Arrangement. Vehicle spaces and access aisles shall be designed so that persons using them are not required to travel behind vehicle spaces or parking spaces other than the vehicle space in which their vehicle has been left to charge.

Exceptions:

1. Ambulatory EVCS shall not be required to comply with Section 11B-812.5.4.
2. Vehicle spaces installed in existing facilities shall comply with Section 11B-812.5.4 to the maximum extent feasible.

11B-812.5.5 Obstructions. EVCS shall be designed so accessible routes are not obstructed by cables or other elements.

11B-812.6 Vehicle spaces. Vehicle spaces serving van accessible, standard accessible, ambulatory and drive-up EVCS shall be 216 inches (5486 mm) long minimum and shall comply with Sections 11B-812.6.1 through 11B-812.6.4 as applicable. All vehicle spaces shall be marked to define their width.

Exceptions:

1. Where the long dimension of vehicle spaces is parallel to the traffic flow in the adjacent vehicular way,

the length of vehicle spaces shall be 240 inches (6096 mm) minimum.

2. Vehicle spaces at drive-up EVCS shall be 240 inches (6096 mm) long minimum and shall not be required to be marked to define their width.

11B-812.6.1 Van accessible. Vehicle spaces serving van accessible EVCS shall be 144 inches (3658 mm) wide minimum and shall have an adjacent access aisle complying with Section 11B-812.7.

11B-812.6.2 Standard accessible. Vehicle spaces serving standard accessible EVCS shall be 108 inches (2743 mm) wide minimum and shall have an adjacent access aisle complying with Section 11B-812.7.

11B-812.6.3 Ambulatory. Vehicle spaces serving ambulatory EVCS shall be 120 inches (3048 mm) wide minimum and shall not be required to have an adjacent access aisle.

11B-812.6.4 Drive-up. Vehicle spaces serving drive-up EVCS shall be 204 inches (5182 mm) wide minimum and shall not be required to have an adjacent access aisle.

11B-812.7 Access aisle. Access aisles shall adjoin an accessible route. Two vehicle spaces or one parking space and one electric vehicle charging space shall be permitted to share a common access aisle. Access aisles shall be 60 inches (1524 mm) wide minimum and shall extend the full required length of the vehicle spaces they serve.

11B-812.7.1 Location. Access aisles at vehicle spaces shall not overlap the vehicular way and may be placed on either side of the vehicle space they serve except for van accessible spaces which shall have access aisles located on the passenger side of the vehicle spaces.

Exception: Where four or fewer total EVCS are provided within a facility, the access aisle for non-angled van accessible spaces may be located on either the driver or passenger side of the vehicle space.

11B-812.7.2 Marking. Access aisles at vehicle spaces shall be marked with a painted borderline around their perimeter. The area within the borderlines shall be marked with hatched lines a maximum of 36 inches (914 mm) on center. The color of the borderlines, hatched lines and letters shall contrast with that of the surface of the access aisle. The blue color required for identification of access aisles for accessible parking shall not be used. Access aisle markings may extend beyond the minimum required length.

Exception: Where one parking space and one electric vehicle charging space share an access aisle, access aisle marking shall comply with Section 11B-502.3.3 and shall not be required to comply with Section 11B-812.7.2.

11B-812.7.3 Lettering. The words "NO PARKING" shall be painted on the surface within each access aisle in letters a minimum of 12 inches (305 mm) in height and located to be visible from the adjacent vehicular way.

11B-812.8 Identification signs. EVCS identification signs shall be provided in compliance with Section 11B-812.8.

11B-812.8.1 Four or fewer. Where four or fewer total EVCS are provided, identification with an International Symbol of Accessibility (ISA) and signs identifying van accessible spaces shall not be required.

11B-812.8.2 Five to twenty-five. Where five to twenty-five total EVCS are provided, one van accessible EVCS shall be identified by an ISA complying with Section 11B-703.7.2.1. The required standard accessible EVCS shall not be required to be identified with an ISA.

11B-812.8.3 Twenty-six or more. Where twenty-six or more total EVCS are provided, all required van accessible and all required standard accessible EVCS shall be identified by an ISA complying with Section 11B-703.7.2.1.

11B-812.8.4 Ambulatory. Ambulatory EVCS shall not be required to be identified by an ISA.

11B-812.8.5 Drive-up. Drive-up EVCS shall not be required to be identified by an ISA.

11B-812.8.6 Finish and size. Identification signs shall be reflectorized with a minimum area of 70 square inches (45 161 mm²).

11B-812.8.7 Location. Required identification signs shall be visible from the EVCS it serves. Signs shall be permanently posted either immediately adjacent to the vehicle space or within the projected vehicle space width at the head end of the vehicle space. Signs identifying van accessible vehicle spaces shall contain the designation “van accessible.” Signs shall be 60 inches (1525 mm) minimum above the finish floor or ground surface measured to the bottom of the sign. Signs located within a circulation path shall be 80 inches (2032 mm) minimum above the finish floor or ground surface measured to the bottom of the sign. Signs may also be permanently posted on a wall at the interior end of the vehicle space.

11B-812.9 Surface marking. EVCS vehicle spaces shall provide surface marking stating “EV CHARGING ONLY” in letters 12 inches (305 mm) high minimum. The centerline of the text shall be a maximum of 6 inches (152 mm) from the centerline of the vehicle space and its lower corner at, or lower side aligned with, the end of the vehicle space length.

11B-812.10 Electric vehicle chargers

11B-812.10.1 General. EV chargers shall comply with Section 11B-812.10.

11B-812.10.2 Operable parts. Operable parts and charging cord storage shall comply with Section 11B-309.

11B-812.10.3 Point-of-sale devices. Where provided, point-of-sale devices shall comply with Sections 11B-707.2, 11B-707.3, 11B-707.7.2 and 11B-707.9.

11B-812.10.4 Location. EV chargers shall be adjacent to, and within the projected width of, the vehicle space being served.

Exceptions:

1. EV chargers serving more than one EVCS shall be adjacent to, and within the combined projected width of, the vehicle spaces being served.
2. For alterations at existing facilities where an accessible route or general circulation path is not provided adjacent to the head end of the vehicle space or access aisle, the EV charger may be located within the projected width of the access aisle 36 inches (914 mm) maximum from the head end of the space.
3. Where the long dimension of a vehicle space is parallel to the vehicular way, the EV charger shall be adjacent to, and 48 inches (1219 mm)

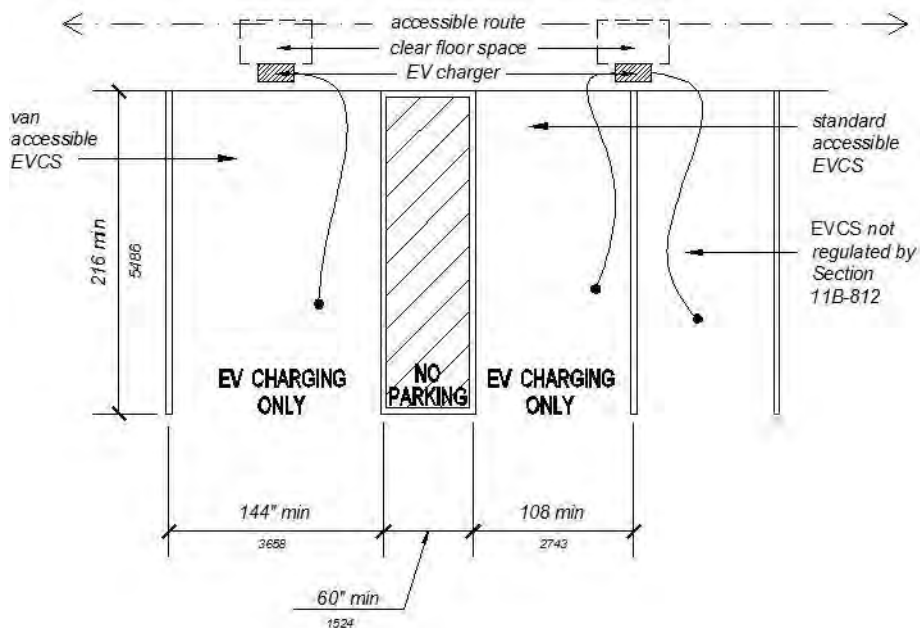


FIGURE 11B-812.9 SURFACE MARKING

maximum from the head end or foot end of the vehicle space or access aisle being served.

11B-813 Adult changing facilities. Adult changing facilities shall comply with Section 11B-813.

11B-813.1 Location. Adult changing facilities shall be provided within a unisex (single-user or family) toilet room or other similar private room.

11B-813.2 Features. Adult changing facilities shall provide features in compliance with Section 11B-813.2.

11B-813.2.1 Adult changing table. Adult changing tables shall be fixed to the floor or a wall and shall comply with Section 11B-813.2.1.

11B-813.2.1.1 Size. Adult changing tables shall have a changing surface of 70 inches (1778 mm) minimum length and 30 inches (762 mm) minimum width.

11B-813.2.1.2 Clearance. A 36 inches (914 mm) minimum width side clearance shall be provided along the entire length of one side of adult changing tables. At both ends of adult changing tables, clearance shall be provided measuring 36 inches (914 mm) minimum wide and a minimum length as long as the table width plus the width of the side clearance. End and side clearances shall be measured from the outermost extent of the table. Floor or ground surfaces of clearances shall comply with Section 11B-302. Changes in level are not permitted.

11B-813.2.1.3 Height and operation. Adult changing table height shall be adjustable from 17 inches (432 mm) above the floor or ground to 38 inches (965 mm) above the floor or ground, as measured to the top of the changing surface. Height adjustability shall be powered. Operable parts shall comply with Section 11B-309.

11B-813.2.1.4 Capacity. Adult changing tables shall provide a minimum weight capacity of 300 pounds (136 kg).

11B-813.2.1.5 Obstructions. When deployed, changing tables shall not obstruct the required width of an accessible route except as allowed by Section 11B-307.2.

11B-813.2.2 Water closet. No fewer than one water closet in compliance with Section 11B-604.

11B-813.2.3 Lavatory. One lavatory in compliance with Section 11B-606.

11B-813.2.4 Waste receptacle. No fewer than one waste receptacle in compliance with Section 11B-603.5.

11B-813.2.5 Coat hook. No fewer than one coat hook shall be provided in close proximity to the changing table and within one of the reach ranges specified in Section 11B-308.

11B-813.2.6 Shelf. No fewer than one shelf shall be provided in close proximity to the changing table at 40 inches (1016 mm) minimum and 48 inches (1219 mm) maximum above the finish floor.

11B-813.2.7 Accessories. Where provided, no fewer than one of each accessory shall comply with Section 11B-603.5.

11B-813.2.8 Turning space. Turning space complying with Section 11B-304 shall be provided within adult changing facilities.

11B-813.2.9 Overlap. Required clear floor spaces, clearance at fixtures and turning space shall be permitted to overlap.

11B-813.2.10 Door swing. A door, in any position, shall be permitted to encroach into the turning space by 12 inches (305 mm) maximum. Where a clear floor space complying with Section 11B-305.3 is provided within the room beyond the arc of the door swing, doors shall be permitted to swing into the clear floor space, clearance required for any fixture and clearance required for adult changing tables.

11B-813.2.11 Privacy latch. Each door to adult changing facilities shall have a privacy latch.

11B-813.2.12 Signs. A room identification sign complying with Section 11B-216 shall be provided at entrances to adult changing facilities. The text of the room identification sign shall be "ADULT CHANGING ROOM".

An informational sign complying with Section 11B-216 shall be provided within adult changing facilities and in close proximity to the changing table. The informational sign shall indicate the maximum weight capacity of the adult changing table, as determined by the table manufacturer.

Where the commercial place of public amusement has a central directory, the central directory shall indicate the location of adult changing facilities. Where other directories indicate the location of toilet facilities, the other directories shall also indicate the location of adult changing facilities.

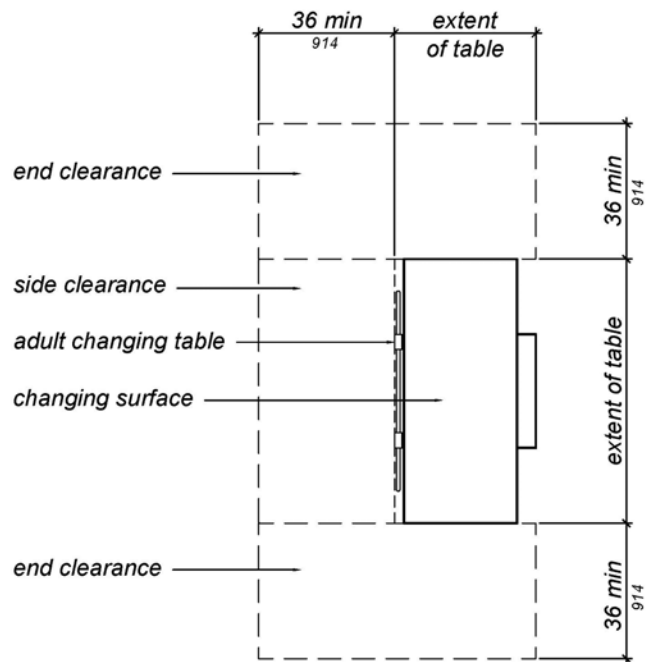


FIGURE 11B-813.2.1.2
CLEARANCE AROUND ADULT CHANGING TABLE

DIVISION 9: BUILT-IN ELEMENTS

11B-901 General

11B-901.1 Scope. The provisions of *Division 9* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-902 Dining surfaces and work surfaces

11B-902.1 General. Dining surfaces and work surfaces shall comply with *Sections 11B-902.2* and *11B-902.3*.

Exception: Dining surfaces and work surfaces for children's use shall be permitted to comply with *Section 11B-902.4*.

11B-902.2 Clear floor or ground space. A clear floor space complying with *Section 11B-305* positioned for a forward approach shall be provided. Knee and toe clearance complying with *Section 11B-306* shall be provided.

11B-902.3 Height. The tops of dining surfaces and work surfaces shall be 28 inches (711 mm) minimum and 34 inches (864 mm) maximum above the finish floor or ground.

11B-902.4 Dining surfaces and work surfaces for children's use. Accessible dining surfaces and work surfaces for children's use shall comply with *Section 11B-902.4*.

Exception: Dining surfaces and work surfaces that are used primarily by children 5 years and younger shall not be required to comply with *Section 11B-902.4* where a clear floor or ground space complying with *Section 11B-305* positioned for a parallel approach is provided.

11B-902.4.1 Clear floor or ground space. A clear floor space complying with *Section 11B-305* positioned for forward approach shall be provided. Knee and toe clearance complying with *Section 11B-306* shall be provided, except that knee clearance 24 inches (610 mm) minimum above the finish floor or ground shall be permitted.

11B-902.4.2 Height. The tops of tables and counters shall be 26 inches (660 mm) minimum and 30 inches (762 mm) maximum above the finish floor or ground.

11B-903 Benches

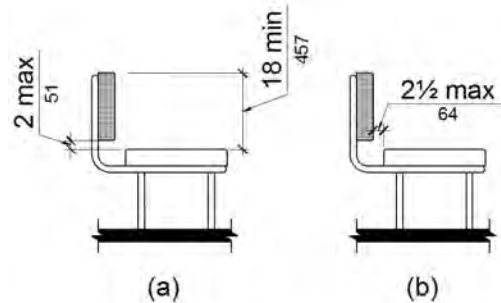
11B-903.1 General. Benches shall comply with *Section 11B-903*.

11B-903.2 Clear floor or ground space. Clear floor or ground space complying with *Section 11B-305* shall be provided and shall be positioned at the end of the bench seat and parallel to the short axis of the bench.

11B-903.3 Size. Benches shall have seats that are 48 inches (1219 mm) long minimum and 20 inches (508 mm) deep minimum and 24 inches (610 mm) deep maximum.

11B-903.4 Back support. The bench shall provide for back support or shall be affixed to a wall *along its long dimension*. Back support shall be 48 inches (1219 mm) long minimum and shall extend from a point 2 inches (51 mm) maximum above the seat surface to a point 18 inches (457 mm) minimum above the seat surface. Back support shall be 2½ inches (64 mm) maximum from the rear edge of the seat measured horizontally.

11B-903.5 Height. The top of the bench seat surface shall be 17 inches (432 mm) minimum and 19 inches (483 mm) maximum above the finish floor or ground.



**FIGURE 11B-903.4
BENCH BACK SUPPORT**

11B-903.6 Structural strength. Benches shall be affixed to the wall or floor. Allowable stresses shall not be exceeded for materials used when a vertical or horizontal force of 250 pounds (1112 N) is applied at any point on the seat, fastener, mounting device or supporting structure.

11B-903.7 Wet locations. Where installed in wet locations, the surface of the seat shall be slip resistant and shall not accumulate water.

11B-904 Check-out aisles and sales and service counters

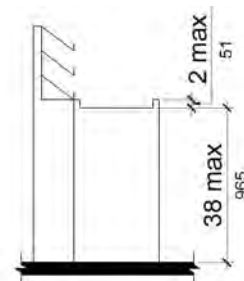
11B-904.1 General. Check-out aisles and sales and service counters shall comply with the applicable requirements of *Section 11B-904*.

11B-904.2 Approach. All portions of counters required to comply with *Section 11B-904* shall be located adjacent to a walking surface complying with *Section 11B-403*.

11B-904.3 Check-out aisles. Check-out aisles shall comply with *Section 11B-904.3*.

11B-904.3.1 Aisle. Aisles shall comply with *Section 11B-403*.

11B-904.3.2 Counter. The counter surface height shall be 38 inches (965 mm) maximum above the finish floor or ground. The top of the counter edge protection shall be 2 inches (51 mm) maximum above the top of the counter surface on the aisle side of the check-out counter.



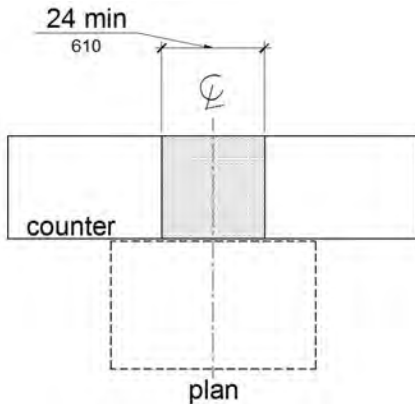
**FIGURE 11B-904.3.2
CHECK-OUT AISLE COUNTERS**

11B-904.3.3 Check writing surfaces. Where provided, check writing surfaces shall comply with *Section 11B-902.3*.

11B-904.3.4 Identification sign. When not all check-out aisles are accessible, accessible check-out aisles shall be identified by a sign clearly visible to a person in a wheelchair displaying the International Symbol of Accessibility complying with *Section 11B-703.7.2.1*. The sign shall be a minimum of 4 inches by 4 inches (102 mm by 102 mm).

11B-904.4 Sales and service counters. Sales counters and service counters shall comply with *Section 11B-904.4.1* or *11B-904.4.2*. The accessible portion of the counter top shall extend the same depth as the sales or service counter top.

Exception: In alterations, when the provision of a counter complying with *Section 11B-904.4* would result in a reduction of the number of existing counters at work stations or a reduction of the number of existing mail boxes, the counter shall be permitted to have a portion which is 24 inches (610 mm) long minimum complying with *Section 11B-904.4.1* provided that the required clear floor or ground space is centered on the accessible length of the counter.



**FIGURE 11B-904.4 (EXCEPTION)
ALTERATION OF SALES AND SERVICE COUNTERS**

11B-904.4.1 Parallel approach. A portion of the counter surface that is 36 inches (914 mm) long minimum and 34 inches (864 mm) high maximum above the finish floor shall be provided. A clear floor or ground space complying with *Section 11B-305* shall be positioned for a parallel approach adjacent to the 36 inch (914 mm) minimum length of counter.

Exception: Where the provided counter surface is less than 36 inches (914 mm) long, the entire counter surface shall be 34 inches (864 mm) high maximum above the finish floor.

11B-904.4.2 Forward approach. A portion of the counter surface that is 36 inches (914 mm) long minimum and 34 inches (864 mm) high maximum shall be provided. Knee and toe space complying with *Section 11B-306* shall be provided under the counter. A clear floor or ground space complying with *Section 11B-305* shall be positioned for a forward approach to the counter.

11B-904.5 Food service lines. Counters in food service lines shall comply with *Section 11B-904.5*.

11B-904.5.1 Self-service shelves and dispensing devices. Self-service shelves and dispensing devices for tableware, dishware, condiments, food and beverages shall comply with *Section 11B-308*.

11B-904.5.2 Tray slides. The tops of tray slides shall be 28 inches (711 mm) minimum and 34 inches (864 mm) maximum above the finish floor or ground.

11B-904.6 Security glazing. Where counters or teller windows have security glazing to separate personnel from the public, a method to facilitate voice communication shall be provided. Telephone handset devices, if provided, shall comply with *Section 11B-704.3*.

DIVISION 10: RECREATION FACILITIES

11B-1001 General

11B-1001.1 Scope. The provisions of *Division 10* shall apply where required by *Division 2* or where referenced by a requirement in this *chapter*.

11B-1002 Amusement rides

11B-1002.1 General. Amusement rides shall comply with *Section 11B-1002*.

11B-1002.2 Accessible routes. Accessible routes serving amusement rides shall comply with *Division 4*.

Exceptions:

1. In load or unload areas and on amusement rides, where compliance with *Section 11B-405.2* is not structurally or operationally feasible, ramp slope shall be permitted to be 1:8 maximum.
2. In load or unload areas and on amusement rides, handrails provided along walking surfaces complying with *Section 11B-403* and required on ramps complying with *Section 11B-405* shall not be required to comply with *Section 11B-505* where compliance is not structurally or operationally feasible.

11B-1002.3 Load and unload areas. A turning space complying with *Sections 11B-304.2* and *11B-304.3* shall be provided in load and unload areas.

11B-1002.4 Wheelchair spaces in amusement rides. Wheelchair spaces in amusement rides shall comply with *Section 11B-1002.4*.

11B-1002.4.1 Floor or ground surface. The floor or ground surface of wheelchair spaces shall be stable and firm.

11B-1002.4.2 Slope. The floor or ground surface of wheelchair spaces shall have a slope not steeper than 1:48 when in the load and unload position.

11B-1002.4.3 Gaps. Floors of amusement rides with wheelchair spaces and floors of load and unload areas shall be coordinated so that, when amusement rides are at rest in the load and unload position, the vertical difference between the floors shall be within plus or minus $\frac{5}{8}$ inches (15.9 mm) and the horizontal gap shall be 3 inches (76 mm) maximum under normal passenger load conditions.

Exception: Where compliance is not operationally or structurally feasible, ramps, bridge plates or similar devices complying with the applicable requirements of 36 CFR 1192.83(c) shall be provided.

11B-1002.4.4 Clearances. Clearances for wheelchair spaces shall comply with *Section 11B-1002.4.4*.

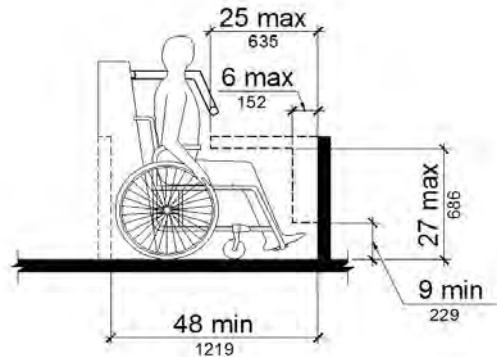
Exceptions:

1. Where provided, securement devices shall be permitted to overlap required clearances.
2. Wheelchair spaces shall be permitted to be mechanically or manually repositioned.
3. Wheelchair spaces shall not be required to comply with *Section 11B-307.4*.

11B-1002.4.4.1 Width and length. Wheelchair spaces shall provide a clear width of 30 inches (762 mm) minimum and a clear length of 48 inches (1219 mm) minimum measured to 9 inches (229 mm) minimum above the floor surface.

11B-1002.4.4.2 Side entry. Where wheelchair spaces are entered only from the side, amusement rides shall be designed to permit sufficient maneuvering clearance for individuals using a wheelchair or mobility aid to enter and exit the ride.

11B-1002.4.4.3 Permitted protrusions in wheelchair spaces. Objects are permitted to protrude a distance of 6 inches (152 mm) maximum along the front of the wheelchair space, where located 9 inches (229 mm) minimum and 27 inches (686 mm) maximum above the floor or ground surface of the wheelchair space. Objects are permitted to protrude a distance of 25 inches (635 mm) maximum along the front of the wheelchair space, where located more than 27 inches (686 mm) above the floor or ground surface of the wheelchair space.



**FIGURE 11B-1002.4.4.3
PROTRUSIONS IN WHEELCHAIR
SPACES IN AMUSEMENT RIDES**

11B-1002.4.5 Ride entry. Openings providing entry to wheelchair spaces on amusement rides shall be 32 inches (813 mm) minimum clear.

11B-1002.4.6 Approach. One side of the wheelchair space shall adjoin an accessible route when in the load and unload position.

11B-1002.4.7 Companion seats. Where the interior width of the amusement ride is greater than 53 inches (1346 mm), seating is provided for more than one rider, and the wheelchair is not required to be centered within the amusement ride, a companion seat shall be provided for each wheelchair space.

11B-1002.4.7.1 Shoulder-to-shoulder seating. Where an amusement ride provides shoulder-to-shoulder seating, companion seats shall be shoulder-to-shoulder with the adjacent wheelchair space.

Exception: Where shoulder-to-shoulder companion seating is not operationally or structurally feasible,

compliance with this requirement shall be required to the maximum extent practicable.

11B-1002.5 Amusement ride seats designed for transfer. Amusement ride seats designed for transfer shall comply with *Section 11B-1002.5* when positioned for loading and unloading.

11B-1002.5.1 Clear floor or ground space. A clear floor or ground space complying with *Section 11B-305* shall be provided in the load and unload area adjacent to the amusement ride seats designed for transfer.

11B-1002.5.2 Transfer height. The height of amusement ride seats designed for transfer shall be 14 inches (356 mm) minimum and 24 inches (610 mm) maximum measured from the surface of the load and unload area.

11B-1002.5.3 Transfer entry. Where openings are provided for transfer to amusement ride seats, the openings shall provide clearance for transfer from a wheelchair or mobility aid to the amusement ride seat.

11B-1002.5.4 Wheelchair storage space. Wheelchair storage spaces complying with *Section 11B-305* shall be provided in or adjacent to unload areas for each required amusement ride seat designed for transfer and shall not overlap any required means of egress or accessible route.

11B-1002.6 Transfer devices for use with amusement rides. Transfer devices for use with amusement rides shall comply with *Section 11B-1002.6* when positioned for loading and unloading.

11B-1002.6.1 Clear floor or ground space. A clear floor or ground space complying with *Section 11B-305* shall be provided in the load and unload area adjacent to the transfer device.

11B-1002.6.2 Transfer height. The height of transfer device seats shall be 14 inches (356 mm) minimum and 24 inches (610 mm) maximum measured from the load and unload surface.

11B-1002.6.3 Wheelchair storage space. Wheelchair storage spaces complying with *Section 11B-305* shall be provided in or adjacent to unload areas for each required transfer device and shall not overlap any required means of egress or accessible route.

11B-1003 Recreational boating facilities

11B-1003.1 General. Recreational boating facilities shall comply with *Section 11B-1003*.

11B-1003.2 Accessible routes. Accessible routes serving recreational boating facilities, including gangways and floating piers, shall comply with *Division 4* except as modified by the exceptions in *Section 11B-1003.2*.

11B-1003.2.1 Boat slips. Accessible routes serving boat slips shall be permitted to use the exceptions in *Section 11B-1003.2.1*.

Exceptions:

1. Where an existing gangway or series of gangways is replaced or altered, an increase in the length of the gangway shall not be required to

comply with *Section 11B-1003.2* unless required by *Section 11B-202.4*.

2. Gangways shall not be required to comply with the maximum rise specified in *Section 11B-405.6*.
3. Where the total length of a gangway or series of gangways serving as part of a required accessible route is 80 feet (24384 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
4. Where facilities contain fewer than 25 boat slips and the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
5. Where gangways connect to transition plates, landings specified by *Section 11B-405.7* shall not be required.
6. Where gangways and transition plates connect and are required to have handrails, handrail extensions shall not be required. Where handrail extensions are provided on gangways or transition plates, the handrail extensions shall not be required to be parallel with the ground or floor surface.
7. The cross slope specified in *Sections 11B-403.3* and *11B-405.3* for gangways, transition plates and floating piers that are part of accessible routes shall be measured in the static position.
8. Changes in level complying with *Sections 11B-303.3* and *11B-303.4* shall be permitted on the surfaces of gangways and boat launch ramps.

11B-1003.2.2 Boarding piers at boat launch ramps. Accessible routes serving boarding piers at boat launch ramps shall be permitted to use the exceptions in *Section 11B-1003.2.2*.

Exceptions:

1. Accessible routes serving floating boarding piers shall be permitted to use Exceptions 1, 2, 5, 6, 7 and 8 in *Section 11B-1003.2.1*.
2. Where the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.
3. Where the accessible route serving a floating boarding pier or skid pier is located within a boat launch ramp, the portion of the accessible route located within the boat launch ramp shall not be required to comply with *Section 11B-405*.

11B-1003.3 Clearances. Clearances at boat slips and on boarding piers at boat launch ramps shall comply with *Section 11B-1003.3*.

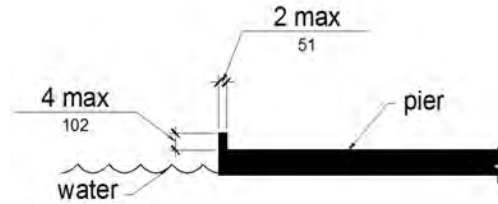
11B-1003.3.1 Boat slip clearance. Boat slips shall provide clear pier space 60 inches (1524 mm) wide minimum and at least as long as the boat slips. Each 10 feet (3048 mm) maximum of linear pier edge serving boat slips shall contain at

least one continuous clear opening 60 inches (1524 mm) wide minimum.

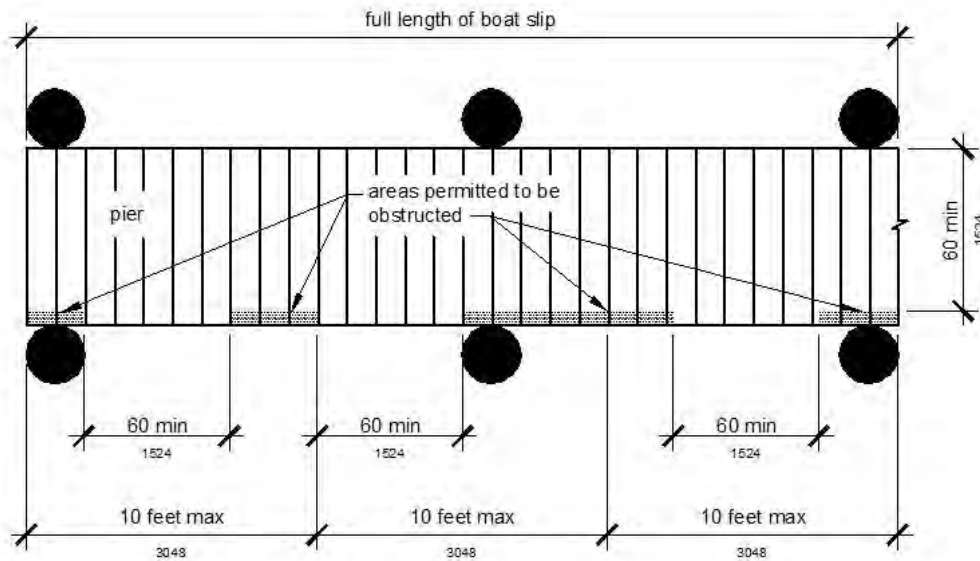
Exceptions:

1. Clear pier space shall be permitted to be 36 inches (914 mm) wide minimum for a length of 24 inches (610 mm) maximum, provided that multiple 36 inch (914 mm) wide segments are separated by segments that are 60 inches (1524 mm) wide minimum and 60 inches (1524 mm) long minimum.
2. Edge protection shall be permitted at the continuous clear openings, provided that it is 4 inches (102 mm) high maximum and 2 inches (51 mm) wide maximum.
3. In existing piers, clear pier space shall be permitted to be located perpendicular to the boat slip and shall extend the width of the boat slip, where

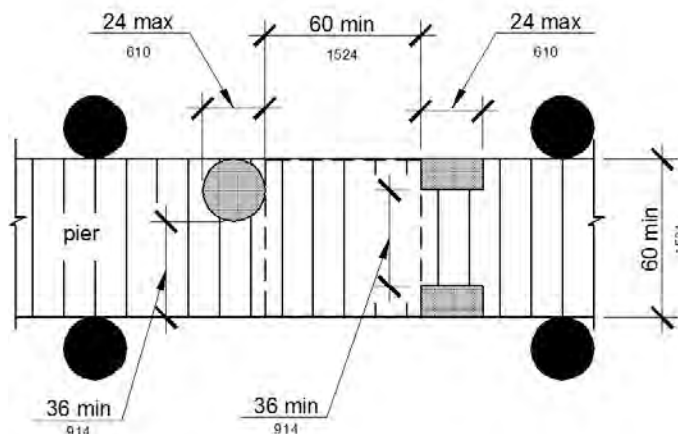
the facility has at least one boat slip complying with Section 11B-1003.3, and further compliance with Section 11B-1003.3 would result in a reduction in the number of boat slips available or result in a reduction of the widths of existing slips.



**FIGURE 11B-1003.3.1 (EXCEPTION 2)
EDGE PROTECTION AT BOAT SLIPS**



**FIGURE 11B-1003.3.1
BOAT SLIP CLEARANCE**



**FIGURE 11B-1003.3.1 (EXCEPTION 1)
CLEAR PIER SPACE REDUCTION AT BOAT SLIPS**

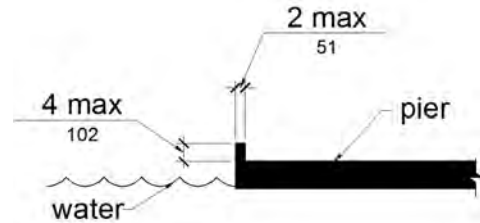
11B-1003.3.2 Boarding pier clearances. Boarding piers at boat launch ramps shall provide clear pier space 60 inches (1524 mm) wide minimum and shall extend the full length of the boarding pier. Every 10 feet (3048 mm) maximum of linear pier edge shall contain at least one continuous clear opening 60 inches (1524 mm) wide minimum.

Exceptions:

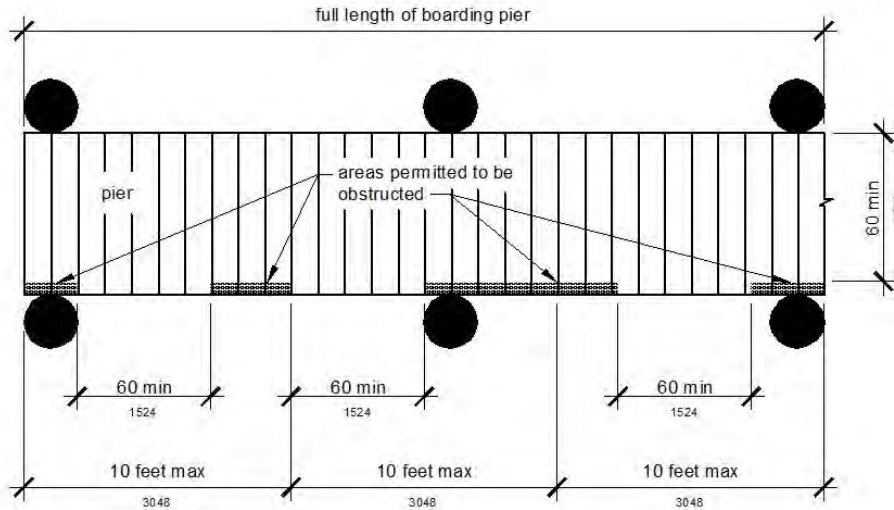
1. The clear pier space shall be permitted to be 36 inches (914 mm) wide minimum for a length of 24 inches (610 mm) maximum provided that multiple 36 inch (914 mm) wide segments are separated by segments that are 60 inches (1524 mm) wide minimum and 60 inches (1524 mm) long minimum.
2. Edge protection shall be permitted at the continuous clear openings provided that it is 4 inches (102 mm) high maximum and 2 inches (51 mm) wide maximum.

11B-1004 Exercise machines and equipment

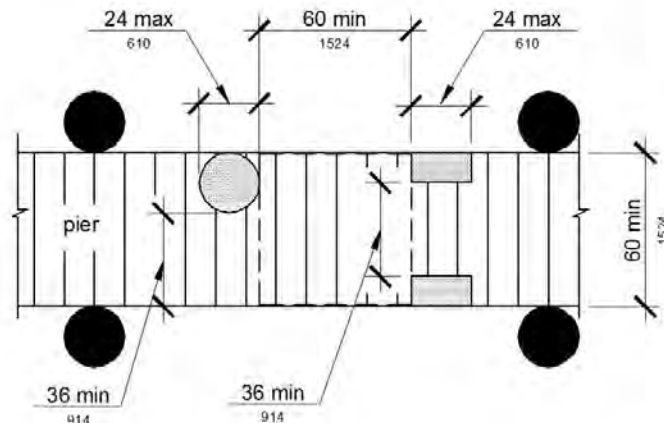
11B-1004.1 Clear floor space. Exercise machines and equipment shall have a clear floor space complying with Section 11B-305 positioned for transfer or for use by an individual seated in a wheelchair. Clear floor or ground spaces required at exercise machines and equipment shall be permitted to overlap.



**FIGURE 11B-1003.3.2 (EXCEPTION 2)
EDGE PROTECTION AT BOARDING PIERS**



**FIGURE 11B-1003.3.2
BOARDING PIER CLEARANCE**



**FIGURE 11B-1003.3.2 (EXCEPTION 1)
CLEAR PIER SPACE REDUCTION AT BOARDING PIERS**

11B-1005 Fishing piers and platforms

11B-1005.1 Accessible routes. Accessible routes serving fishing piers and platforms, including gangways and floating piers, shall comply with *Division 4*.

Exceptions:

1. Accessible routes serving floating fishing piers and platforms shall be permitted to use Exceptions 1, 2, 5, 6, 7 and 8 in *Section 11B-1003.2.1*.
2. Where the total length of the gangway or series of gangways serving as part of a required accessible route is 30 feet (9144 mm) minimum, gangways shall not be required to comply with *Section 11B-405.2*.

11B-1005.2 Railings. Where provided, railings, guards or handrails shall comply with *Section 11B-1005.2*.

11B-1005.2.1 Height. At least 25 percent of the railings, guards or handrails shall be 34 inches (864 mm) maximum above the ground or deck surface.

Exception: Where a guard complying with *Chapter 10, Sections 1015.2 through 1015.4* is provided, the guard shall not be required to comply with *Section 11B-1005.2.1*.

11B-1005.2.1.1 Dispersion. Railings, guards or handrails required to comply with *Section 11B-1005.2.1* shall be dispersed throughout the fishing pier or platform.

11B-1005.3 Edge protection. Where railings, guards or handrails complying with *Section 11B-1005.2* are provided, edge protection complying with *Section 11B-1005.3.1* or *11B-1005.3.2* shall be provided.

11B-1005.3.1 Curb or barrier. Curbs or barriers shall extend 2 inches (51 mm) minimum above the surface of the fishing pier or platform.

11B-1005.3.2 Extended ground or deck surface. The ground or deck surface shall extend 12 inches (305 mm) minimum beyond the inside face of the railing. Toe clearance shall be provided and shall be 30 inches (762 mm)

wide minimum and 9 inches (229 mm) minimum above the ground or deck surface beyond the railing.

11B-1005.4 Clear floor or ground space. At each location where there are railings, guards or handrails complying with *Section 11B-1005.2.1*, a clear floor or ground space complying with *Section 11B-305* shall be provided. Where there are no railings, guards or handrails, at least one clear floor or ground space complying with *Section 11B-305* shall be provided on the fishing pier or platform.

11B-1005.5 Turning space. At least one turning space complying with *Section 11B-304.3* shall be provided on fishing piers and platforms.

11B-1006 Golf facilities

11B-1006.1 General. Golf facilities shall comply with *Section 11B-1006*.

11B-1006.2 Accessible routes. Accessible routes serving teeing grounds, practice teeing grounds, putting greens, practice putting greens, teeing stations at driving ranges, course weather shelters, golf car rental areas, bag drop areas and course toilet rooms shall comply with *Division 4* and shall be 48 inches (1219 mm) wide minimum. Where handrails are provided, accessible routes shall be 60 inches (1524 mm) wide minimum.

Exception: Handrails shall not be required on golf courses. Where handrails are provided on golf courses, the handrails shall not be required to comply with *Section 11B-505*.

11B-1006.3 Golf car passages. Golf car passages shall comply with *Section 11B-1006.3*.

11B-1006.3.1 Clear width. The clear width of golf car passages shall be 48 inches (1219 mm) minimum.

11B-1006.3.2 Barriers. Where curbs or other constructed barriers prevent golf cars from entering a fairway, openings 60 inches (1524 mm) wide minimum shall be provided at intervals not to exceed 75 yards (69 m).

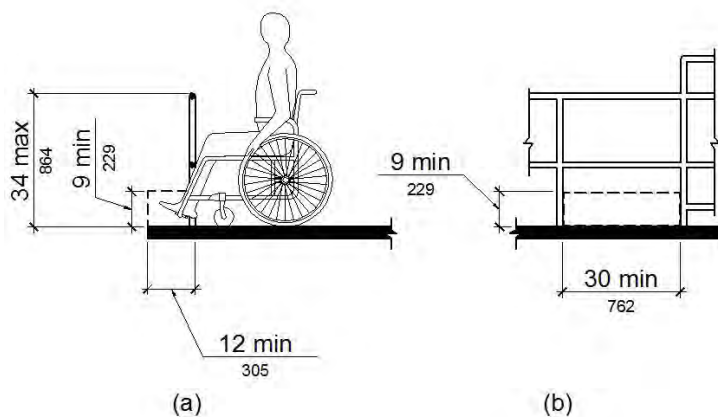


FIGURE 11B-1005.3.2
EXTENDED GROUND OR DECK SURFACE AT FISHING PIERS AND PLATFORMS

11B-1006.4 Weather shelters. A clear floor or ground space 60 inches (1524 mm) minimum by 96 inches (2438 mm) minimum shall be provided within weather shelters.

11B-1007 Miniature golf facilities

11B-1007.1 General. Miniature golf facilities shall comply with *Section 11B-1007*.

11B-1007.2 Accessible routes. Accessible routes serving holes on miniature golf courses shall comply with *Division 4*. Accessible routes located on playing surfaces of miniature golf holes shall be permitted to use the exceptions in *Section 11B-1007.2*.

Exceptions:

1. Playing surfaces shall not be required to comply with *Section 11B-302.2*.
2. Where accessible routes intersect playing surfaces of holes, a 1 inch (25 mm) maximum curb shall be permitted for a width of 32 inches (813 mm) minimum.
3. A slope not steeper than 1:4 for a 4 inch (102 mm) maximum rise shall be permitted.
4. Ramp landing slopes specified by *Section 11B-405.7.1* shall be permitted to be 1:20 maximum.
5. Ramp landing length specified by *Section 11B-405.7.3* shall be permitted to be 48 inches (1219 mm) long minimum.
6. Ramp landing size specified by *Section 11B-405.7.4* shall be permitted to be 48 inches (1219 mm) minimum by 60 inches (1524 mm) minimum.
7. Handrails shall not be required on holes. Where handrails are provided on holes, the handrails shall not be required to comply with *Section 11B-505*.

11B-1007.3 Miniature golf holes. Miniature golf holes shall comply with *Section 11B-1007.3*.

11B-1007.3.1 Start of play. A clear floor or ground space 48 inches (1219 mm) minimum by 60 inches (1524 mm) minimum with slopes not steeper than 1:48 shall be provided at the start of play.

11B-1007.3.2 Golf club reach range area. All areas within holes where golf balls rest shall be within 36 inches (914 mm) maximum of a clear floor or ground space 36 inches (914 mm) wide minimum and 48 inches (1219 mm) long minimum having a running slope not steeper than 1:20. The clear floor or ground space shall be served by an accessible route.

11B-1008 Play areas

11B-1008.1 General. Play areas shall comply with *Section 11B-1008*.

11B-1008.2 Accessible routes. Accessible routes serving play areas shall comply with *Division 4* and *Section 11B-1008.2* and shall be permitted to use the exceptions in *Sections 11B-1008.2.1* through *11B-1008.2.3*. Where accessible routes serve ground level play components, the vertical clearance shall be 80 inches high (2032 mm) minimum.

11B-1008.2.1 Ground level and elevated play components. Accessible routes serving ground level play components and elevated play components shall be permitted to use the exceptions in *Section 11B-1008.2.1*.

Exceptions:

1. Transfer systems complying with *Section 11B-1008.3* shall be permitted to connect elevated play components except where 20 or more elevated play components are provided no more than 25 percent of the elevated play components shall be permitted to be connected by transfer systems.
2. Where transfer systems are provided, an elevated play component shall be permitted to connect to another elevated play component as part of an accessible route.

11B-1008.2.2 Soft contained play structures. Accessible routes serving soft contained play structures shall be permitted to use the exception in *Section 11B-1008.2.2*.

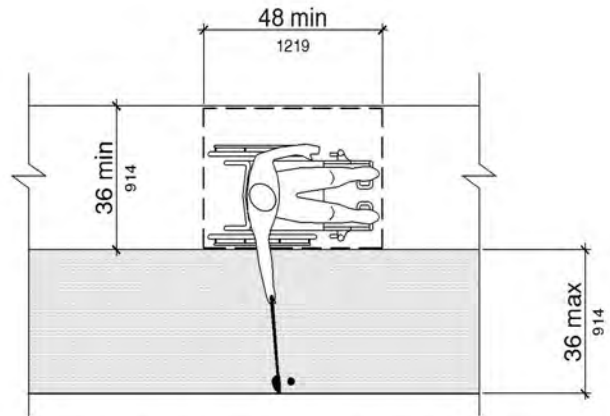
Exception: Transfer systems complying with *Section 11B-1008.3* shall be permitted to be used as part of an accessible route.

11B-1008.2.3 Water play components. Accessible routes serving water play components shall be permitted to use the exceptions in *Section 11B-1008.2.3*.

Exceptions:

1. Where the surface of the accessible route, clear floor or ground spaces or turning spaces serving water play components is submerged, compliance with *Sections 11B-302*, *11B-403.3*, *11B-405.2*, *11B-405.3* and *11B-1008.2.6* shall not be required.
2. Transfer systems complying with *Section 11B-1008.3* shall be permitted to connect elevated play components in water.

11B-1008.2.4 Clear width. Accessible routes connecting play components shall provide a clear width complying with *Section 11B-1008.2.4*.



Note: Running Slope of Clear Floor or Ground Space Not Steeper Than 1:20

FIGURE 11B-1007.3.2 GOLF CLUB REACH RANGE AREA

11B-1008.2.4.1 Ground level. At ground level, the clear width of accessible routes shall be 60 inches (1524 mm) minimum.

Exceptions:

1. In play areas less than 1000 square feet (93 m²), the clear width of accessible routes shall be permitted to be 44 inches (1118 mm) minimum, if at least one turning space complying with *Section 11B-304.3* is provided where the restricted accessible route exceeds 30 feet (9144 mm) in length.
2. The clear width of accessible routes shall be permitted to be 36 inches (914 mm) minimum for a distance of 60 inches (1524 mm) maximum provided that multiple reduced width segments are separated by segments that are 60 inches (1524 mm) wide minimum and 60 inches (1524 mm) long minimum.

11B-1008.2.4.2 Elevated. The clear width of accessible routes connecting elevated play components shall be 36 inches (914 mm) minimum.

Exceptions:

1. The clear width of accessible routes connecting elevated play components shall be permitted to be reduced to 32 inches (813 mm) minimum for a distance of 24 inches (610 mm) maximum provided that reduced width segments are separated by segments that are 48 inches (1219 mm) long minimum and 36 inches (914 mm) wide minimum.
2. The clear width of transfer systems connecting elevated play components shall be permitted to be 24 inches (610 mm) minimum.

11B-1008.2.5 Ramps. Within play areas, ramps connecting ground level play components and ramps connecting elevated play components shall comply with *Section 11B-1008.2.5*.

11B-1008.2.5.1 Ground level. Ramp runs connecting ground level play components shall have a running slope not steeper than 1:16.

11B-1008.2.5.2 Elevated. The rise for any ramp run connecting elevated play components shall be 12 inches (305 mm) maximum.

11B-1008.2.5.3 Handrails. Where required on ramps serving play components, the handrails shall comply with *Section 11B-505* except as modified by *Section 11B-1008.2.5.3*.

Exceptions:

1. Handrails shall not be required on ramps located within ground level use zones.
2. Handrail extensions shall not be required.

11B-1008.2.5.3.1 Handrail gripping surfaces. Handrail gripping surfaces with a circular cross section shall have an outside diameter of 0.95 inch (24 mm) minimum and 1.55 inches (39 mm) maximum. Where the shape of the gripping surface is non-circular, the handrail shall provide an equivalent gripping surface.

11B-1008.2.5.3.2 Handrail height. The top of handrail gripping surfaces shall be 20 inches (508 mm) minimum and 28 inches (711 mm) maximum above the ramp surface.

11B-1008.2.6 Ground surfaces. Ground surfaces on accessible routes, clear floor or ground spaces, and turning spaces shall comply with *Section 11B-1008.2.6*.

11B-1008.2.6.1 Accessibility. Ground surfaces shall comply with ASTM F1951. Ground surfaces shall be inspected and maintained regularly and frequently to ensure continued compliance with ASTM F1951.

11B-1008.2.6.2 Use zones. Ground surfaces located within use zones shall comply with ASTM F1292 (1999 edition or 2004 edition).

11B-1008.3 Transfer systems. Where transfer systems are provided to connect to elevated play components, transfer systems shall comply with *Section 11B-1008.3*.

11B-1008.3.1 Transfer platforms. Transfer platforms shall be provided where transfer is intended from wheelchairs or other mobility aids. Transfer platforms shall comply with *Section 11B-1008.3.1*.

11B-1008.3.1.1 Size. Transfer platforms shall have level surfaces 14 inches (356 mm) deep minimum and 24 inches (610 mm) wide minimum.

11B-1008.3.1.2 Height. The height of transfer platforms shall be 11 inches (279 mm) minimum and 18 inches (457 mm) maximum.

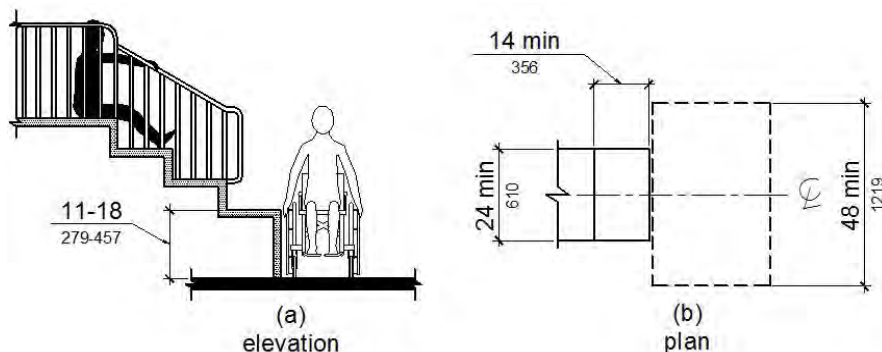


FIGURE 11B-1008.3.1
TRANSFER PLATFORMS

inches (457 mm) maximum measured to the top of the surface from the ground or floor surface.

11B-1008.3.1.3 Transfer space. A transfer space complying with Sections 11B-305.2 and 11B-305.3 shall be provided adjacent to the transfer platform. The 48 inch (1219 mm) long minimum dimension of the transfer space shall be centered on and parallel to the 24 inch (610 mm) long minimum side of the transfer platform. The side of the transfer platform serving the transfer space shall be unobstructed.

11B-1008.3.1.4 Transfer supports. At least one means of support for transferring shall be provided.

11B-1008.3.2 Transfer steps. Transfer steps shall be provided where movement is intended from transfer platforms to levels with elevated play components required to be on accessible routes. Transfer steps shall comply with Section 11B-1008.3.2.

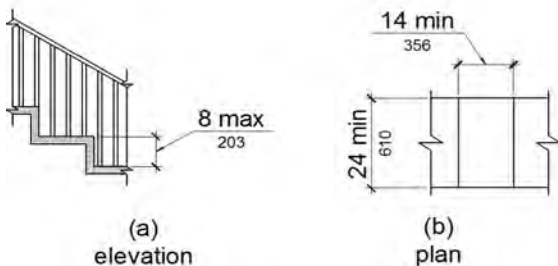


FIGURE 11B-1008.3.2
TRANSFER STEPS

11B-1008.3.2.1 Size. Transfer steps shall have level surfaces 14 inches (356 mm) deep minimum and 24 inches (610 mm) wide minimum.

11B-1008.3.2.2 Height. Each transfer step shall be 8 inches (203 mm) high maximum.

11B-1008.3.2.3 Transfer supports. At least one means of support for transferring shall be provided.

11B-1008.3.2.4 Contrasting stripe. Striping complying with Section 11B-504.4.1 shall be provided at each transfer step.

11B-1008.4 Play components. Ground level play components on accessible routes and elevated play components connected by ramps shall comply with Section 11B-1008.4.

11B-1008.4.1 Turning space. At least one turning space complying with Section 11B-304 shall be provided on the same level as play components. Where swings are provided, the turning space shall be located immediately adjacent to the swing.

11B-1008.4.2 Clear floor or ground space. Clear floor or ground space complying with Sections 11B-305.2 and 11B-305.3 shall be provided at play components.

11B-1008.4.3 Play tables. Where play tables are provided, knee clearance 24 inches (610 mm) high minimum, 17 inches deep (432 mm) minimum, and 30 inches (762 mm) wide minimum shall be provided. The tops of rims,

curbs or other obstructions shall be 31 inches (787 mm) high maximum.

Exception: Play tables designed and constructed primarily for children 5 years and younger shall not be required to provide knee clearance where the clear floor or ground space required by Section 11B-1008.4.2 is arranged for a parallel approach.

11B-1008.4.4 Entry points and seats. Where play components require transfer to entry points or seats, the entry points or seats shall be 11 inches (279 mm) minimum and 24 inches (610 mm) maximum from the clear floor or ground space.

Exception: Entry points of slides shall not be required to comply with Section 11B-1008.4.4.

11B-1008.4.5 Transfer supports. Where play components require transfer to entry points or seats, at least one means of support for transferring shall be provided.

11B-1009 Swimming pools, wading pools and spas

11B-1009.1 General. Where provided, pool lifts, sloped entries, transfer walls, transfer systems and pool stairs shall comply with Section 11B-1009.

11B-1009.2 Pool lifts. Pool lifts shall comply with Section 11B-1009.2.

11B-1009.2.1 Pool lift location. Pool lifts shall be located where the water level is 36 inches (914 mm) minimum and 48 inches (1219 mm) maximum.

Exceptions:

1. Where the entire pool depth is less than 36 inches (914 mm) or greater than 48 inches (1219 mm), compliance with Section 11B-1009.2.1 shall not be required.
2. Where multiple pool lift locations are provided, no more than one pool lift shall be required to be located in an area where the water level is 48 inches (1219 mm) maximum.

11B-1009.2.2 Seat location. In the raised position, the centerline of the seat shall be located over the deck and 16 inches (406 mm) minimum from the edge of the pool. The deck surface between the centerline of the seat and the pool edge shall have a slope not steeper than 1:48.

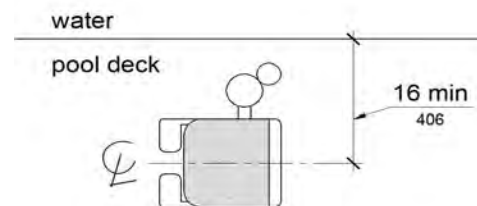


FIGURE 11B-1009.2.2
POOL LIFT SEAT LOCATION

11B-1009.2.3 Clear deck space. On the side of the seat opposite the water, a clear deck space shall be provided parallel with the seat. The space shall be 36 inches (914 mm) wide minimum and shall extend forward 48 inches

(1219 mm) minimum from a line located 12 inches (305 mm) behind the rear edge of the seat. The clear deck space shall have a slope not steeper than 1:48.

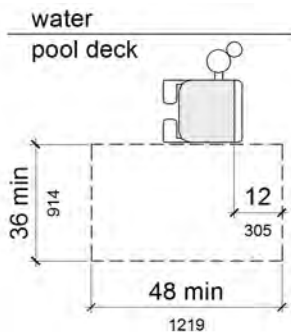


FIGURE 11B-1009.2.3
CLEAR DECK SPACE AT POOL LIFTS

11B-1009.2.4 Seat. The seat shall be rigid and shall have a back support that is at least 12 inches (305 mm) tall. The height of the lift seat shall be designed to allow a stop at 17 inches (432 mm) minimum to 19 inches (483 mm) maximum measured from the deck to the top of the seat surface when in the raised (load) position. The seat shall have a restraint for the use of the occupant with operable parts complying with Section 11B-309.

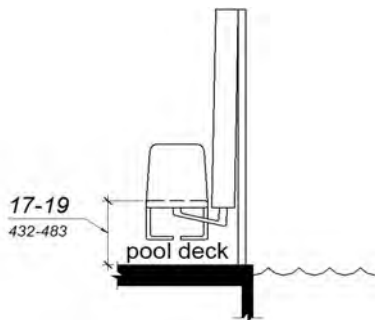


FIGURE 11B-1009.2.4
POOL LIFT SEAT HEIGHT

11B-1009.2.5 Seat width. The seat shall be 16 inches (406 mm) wide minimum.

11B-1009.2.6 Footrests and armrests. Footrests shall be provided and shall move with the seat. The seat shall have two armrests. The armrest positioned opposite the water shall be removable or shall fold clear of the seat when the seat is in the raised (load) position.

Exception: Footrests shall not be required on pool lifts provided in spas.

11B-1009.2.7 Operation. The lift shall be capable of unassisted operation from both the deck and water levels. Controls and operating mechanisms shall be unobstructed when the lift is in use and shall comply with Section 11B-309.4. The lift shall be stable and not permit unintended movement when a person is getting into or out of the seat.

11B-1009.2.8 Submerged depth. The lift shall be designed so that the seat will submerge to a water depth of 18 inches (457 mm) minimum below the stationary water level.

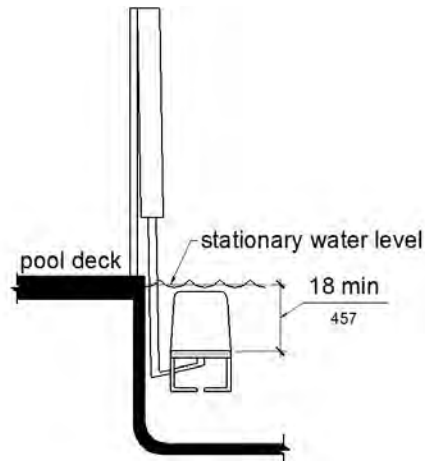


FIGURE 11B-1009.2.8
POOL LIFT SUBMERGED DEPTH

11B-1009.2.9 Lifting capacity. Single person pool lifts shall have a weight capacity of 300 pounds (136 kg) minimum and be capable of sustaining a static load of at least one and a half times the rated load.

11B-1009.3 Sloped entries. Sloped entries shall comply with Section 11B-1009.3.

11B-1009.3.1 Sloped entries. Sloped entries shall comply with Division 4 except as modified in Sections 11B-1009.3.1 through 11B-1009.3.3.

Exception: Where sloped entries are provided, the surfaces shall not be required to be slip resistant.

11B-1009.3.2 Submerged depth. Sloped entries shall extend to a depth of 24 inches (610 mm) minimum and 30 inches (762 mm) maximum below the stationary water level. Where landings are required by Section 11B-405.7, at least one landing shall be located 24 inches (610 mm) minimum and 30 inches (762 mm) maximum below the stationary water level.

Exception: In wading pools, the sloped entry and landings, if provided, shall extend to the deepest part of the wading pool.

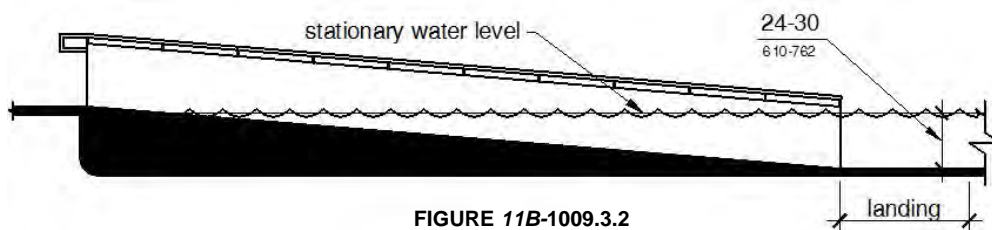
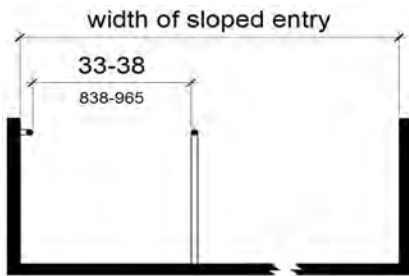


FIGURE 11B-1009.3.2
SLOPED ENTRY SUBMERGED DEPTH

11B-1009.3.3 Handrails. At least two handrails complying with *Section 11B-505* shall be provided on the sloped entry. The clear width between required handrails shall be 33 inches (838 mm) minimum and 38 inches (965 mm) maximum.

Exceptions:

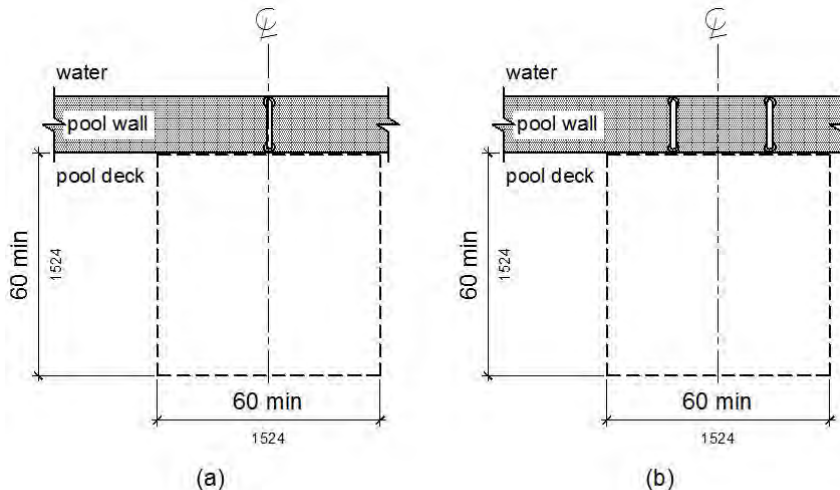
1. Handrail extensions specified by *Section 11B-505.10.1* shall not be required at the bottom landing serving a sloped entry.
2. Where a sloped entry is provided for wave action pools, leisure rivers, sand bottom pools and other pools where user access is limited to one area, the handrails shall not be required to comply with the clear width requirements of *Section 11B-1009.3.3*.
3. Sloped entries in wading pools shall not be required to provide handrails complying with *Section 11B-1009.3.3*. If provided, handrails on sloped entries in wading pools shall not be required to comply with *Section 11B-505*.



**FIGURE 11B-1009.3.3
HANDRAILS FOR SLOPED ENTRY**

11B-1009.4 Transfer walls. Transfer walls shall comply with *Section 11B-1009.4*.

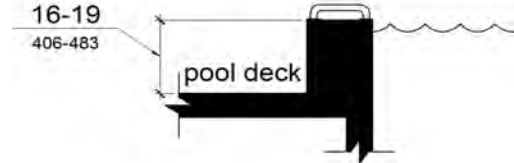
11B-1009.4.1 Clear deck space. A clear deck space of 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum with a slope not steeper than 1:48 shall be provided



**FIGURE 11B-1009.4.1
CLEAR DECK SPACE AT TRANSFER WALLS**

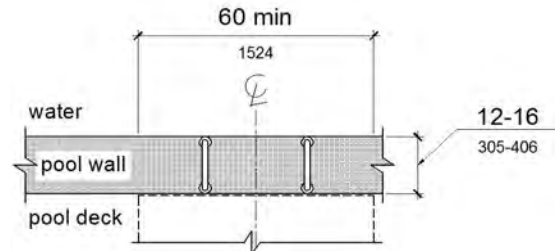
at the base of the transfer wall. Where one grab bar is provided, the clear deck space shall be centered on the grab bar. Where two grab bars are provided, the clear deck space shall be centered on the clearance between the grab bars.

11B-1009.4.2 Height. The height of the transfer wall shall be 16 inches (406 mm) minimum and 19 inches (483 mm) maximum measured from the deck.



**FIGURE 11B-1009.4.2
TRANSFER WALL HEIGHT**

11B-1009.4.3 Wall depth and length. The depth of the transfer wall shall be 12 inches (305 mm) minimum and 16 inches (406 mm) maximum. The length of the transfer wall shall be 60 inches (1524 mm) minimum and shall be centered on the clear deck space.



**FIGURE 11B-1009.4.3
DEPTH AND LENGTH OF TRANSFER WALLS**

11B-1009.4.4 Surface. Surfaces of transfer walls shall not be sharp and shall have rounded edges.

11B-1009.4.5 Grab bars. At least one grab bar complying with *Section 11B-609* shall be provided on the transfer wall. Grab bars shall be perpendicular to the pool wall and shall extend the full depth of the transfer wall. The top of the gripping surface shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above transfer walls. Where one grab bar is provided, clearance shall be 24 inches (610 mm) minimum on both sides of the grab bar. Where two grab bars are provided, clearance between grab bars shall be 24 inches (610 mm) minimum.

Exception: Grab bars on transfer walls shall not be required to comply with *Section 11B-609.4*.

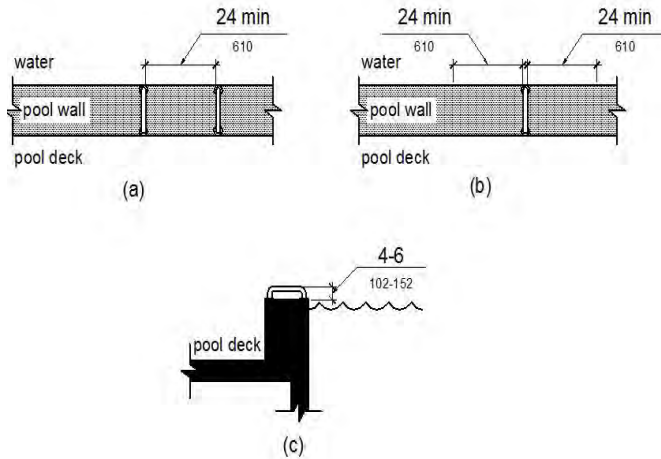


FIGURE 11B-1009.4.5
GRAB BARS FOR TRANSFER WALLS

11B-1009.5 Transfer systems. Transfer systems shall comply with *Section 11B-1009.5*.

11B-1009.5.1 Transfer platform. A transfer platform shall be provided at the head of each transfer system. Transfer platforms shall provide 19 inches (483 mm) minimum clear depth and 24 inches (610 mm) minimum clear width.

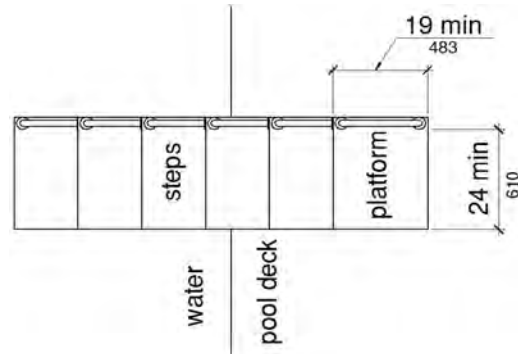


FIGURE 11B-1009.5.1
SIZE OF TRANSFER PLATFORM

11B-1009.5.2 Transfer space. A transfer space of 60 inches (1524 mm) minimum by 60 inches (1524 mm) minimum with a slope not steeper than 1:48 shall be provided at the base of the transfer platform surface and shall be centered along a 24 inch (610 mm) minimum side of the transfer platform. The side of the transfer platform serving the transfer space shall be unobstructed.

11B-1009.5.3 Height. The height of the transfer platform shall comply with *Section 11B-1009.4.2*.

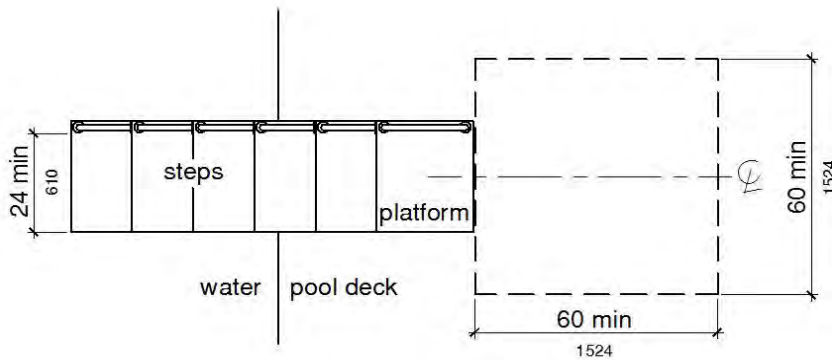
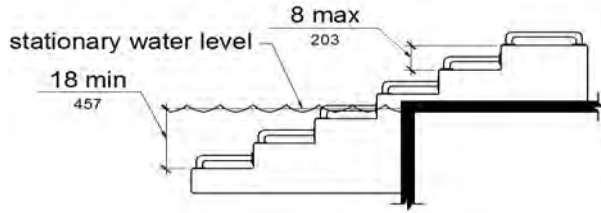


FIGURE 11B-1009.5.2
CLEAR DECK SPACE AT TRANSFER PLATFORM

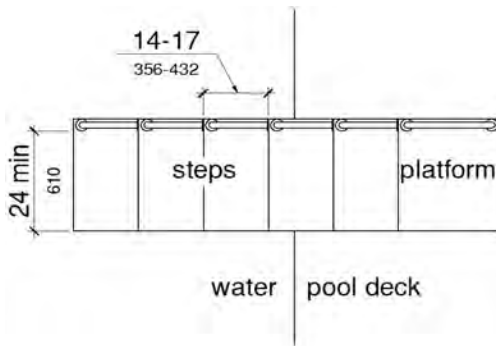
11B-1009.5.4 Transfer steps. Transfer step height shall be 8 inches (203 mm) maximum. The surface of the bottom tread shall extend to a water depth of 18 inches (457 mm) minimum below the stationary water level.



**FIGURE 11B-1009.5.4
TRANSFER STEPS**

11B-1009.5.5 Surface. The surface of the transfer system shall not be sharp and shall have rounded edges.

11B-1009.5.6 Size. Each transfer step shall have a tread clear depth of 14 inches (356 mm) minimum and 17 inches (432 mm) maximum and shall have a tread clear width of 24 inches (610 mm) minimum.



**FIGURE 11B-1009.5.6
SIZE OF TRANSFER STEPS**

11B-1009.5.7 Grab bars. At least one grab bar on each transfer step and the transfer platform or a continuous grab bar serving each transfer step and the transfer platform shall be provided. Where a grab bar is provided on each step, the tops of gripping surfaces shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above each step and transfer platform. Where a continuous grab bar is provided, the top of the gripping surface shall be 4 inches (102 mm) minimum and 6 inches (152 mm) maximum above the step nosing and transfer platform. Grab bars shall comply with Section 11B-609 and be located on at least one side of the transfer system. The grab bar located at the transfer platform shall not obstruct transfer.

Exception: Grab bars on transfer systems shall not be required to comply with Section 11B-609.4.

11B-1009.6 Pool stairs. Pool stairs shall comply with Section 11B-1009.6.

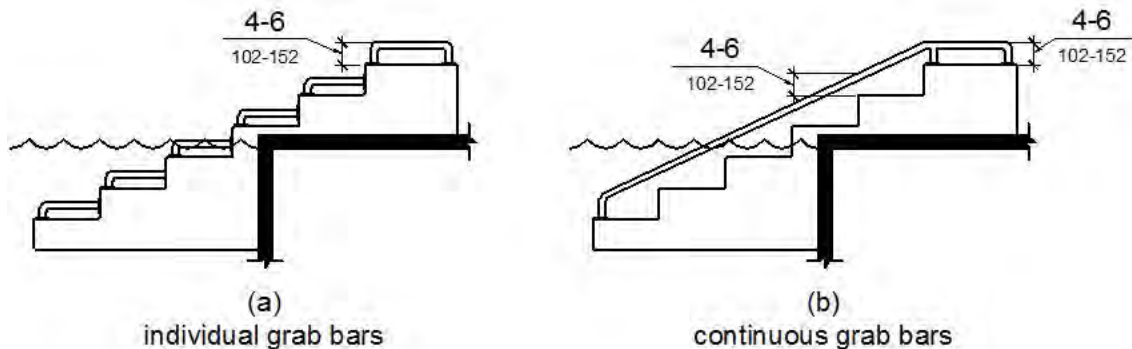
11B-1009.6.1 Pool stairs. Pool stairs shall comply with Section 11B-504.

Exception: Pool step riser heights shall not be required to be 4 inches (102 mm) high minimum and 7 inches (178 mm) high maximum provided that riser heights are uniform.

11B-1009.6.2 Handrails. The width between handrails shall be 20 inches (508 mm) minimum and 24 inches (610 mm) maximum. Handrail extensions required by Section 11B-505.10.3 shall not be required on pool stairs.

11B-1010 Shooting facilities with firing positions

11B-1010.1 Turning space. A circular turning space 60 inches (1524 mm) diameter minimum with slopes not steeper than 1:48 shall be provided at shooting facilities with firing positions.



**FIGURE 11B-1009.5.7
GRAB BARS**

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 12 – INTERIOR ENVIRONMENT

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X	X													
Adopt entire chapter as amended (amended sections listed below)	X			X	X					X	X	X	X	X	X							
Adopt only those sections that are listed below		X	X												X	X	X			X		
Chapter / Section																						
1202.1				X	X																	
1202.2.1				X	X																	
1202.3				X	X																	
1202.4.1.3																					X	
1202.5				X	X																	
1202.5.2.1				X	X																	
1202.6			X																			
1203.1, Exceptions 2 & 4				X	X																	
1203.1, Exception 3										X	X	X	X	X	X							
Table 1203.3.1																			X			
1203.4.1.1																					X	
1203.4.2																					X	
1204.1				X	X																	
1204.4.1				X	X																	
1204.6		X																				
1204.7	X																					
1204.7.1	X																					
1205			X																			
1206.3, Exception				X	X																	
1206.4				X	X																	
1206.5		X																				
1208.1				X																		
1208.2										X	X	X	X	X	X							
1208.2, Exception 5										X		X	X		X							
1208.2, Exception 6														X								
1208.4				X																		
1209			X																			
1209.1.1																					X	
1210.2										X		X	X	X	X							
1211 – 1211.6				X	X																	
1212				X																		
Table 1224.4.6.5										X	X	X	X	X	X							
1224										X												
1225												X										
1226													X									
1227														X								
1228															X							
1230																X						
1231																X						
1235																	X					
1236																		X				
1237																			X			

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 12 – INTERIOR ENVIRONMENT—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X	X													
Adopt entire chapter as amendeded (amended sections listed below)	X			X	X					X	X	X	X	X	X							
Adopt only those sections that are listed below		X	X												X	X	X			X		
Chapter / Section																						
1240																						
1241																						
1242																						
1243																						
1250																						
1251																						
1252																						
1253																						
1254																						

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 12

INTERIOR ENVIRONMENT

User note:

About this chapter: Chapter 12 provides minimum provisions for the interior of buildings—the occupied environment. Ventilation, lighting, and space heating are directly regulated in this chapter and in conjunction with the California Mechanical Code and the California Energy Code. Minimum room size, maximum room-to-room sound transmission and classroom acoustics are set for educational occupancies.

SECTION 1201 GENERAL

1201.1 Scope. The provisions of this chapter shall govern ventilation, temperature control, lighting, yards and courts, sound transmission, room dimensions, surrounding materials and rodentproofing associated with the interior spaces of buildings.

SECTION 1202 VENTILATION

1202.1 General. Buildings shall be provided with natural ventilation in accordance with Section 1202.5, or mechanical ventilation in accordance with the *California Mechanical Code*.

1202.2 Roof ventilation. Roof assemblies shall be ventilated in accordance with this section or shall comply with Section 1202.3.

1202.2.1 Ventilated attics and rafter spaces. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof framing members shall have cross ventilation for each separate space by ventilation openings protected against the entrance of rain and snow. Blocking and bridging shall be arranged so as not to interfere with the movement of air. An airspace of not less than 1 inch (25 mm) shall be provided between the insulation and the roof sheathing. The net free ventilating area shall be not less than $\frac{1}{150}$ of the area of the space ventilated. Ventilators shall be installed in accordance with manufacturer's installation instructions.

Exception: The net free cross-ventilation area shall be permitted to be reduced to $\frac{1}{300}$ provided both of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. At least 40 percent and not more than 50 percent of the required venting area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically, with the balance of the ventilation provided by eave or cornice vents. Where the location of wall or roof framing members conflicts with the

installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

1202.2.2 Openings into attic. Exterior openings into the attic space of any building intended for human occupancy shall be protected to prevent the entry of birds, squirrels, rodents, snakes and other similar creatures. Openings for ventilation having a least dimension of not less than $\frac{1}{16}$ inch (1.6 mm) and not more than $\frac{1}{4}$ inch (6.4 mm) shall be permitted. Openings for ventilation having a least dimension larger than $\frac{1}{4}$ inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of not less than $\frac{1}{16}$ inch (1.6 mm) and not more than $\frac{1}{4}$ inch (6.4 mm). Where combustion air is obtained from an attic area, it shall be in accordance with Chapter 7 of the *California Mechanical Code*.

1202.3 Unvented attic and unvented enclosed rafter assemblies. Unvented attics and unvented enclosed roof framing assemblies created by ceilings applied directly to the underside of the roof framing members/rafters and the structural roof sheathing at the top of the roof framing members shall be permitted where all of the following conditions are met:

1. The unvented attic space is completely within the building thermal envelope.
2. No interior Class I vapor retarders are installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, not less than a $\frac{1}{4}$ -inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any air-impermeable insulation shall be a Class II vapor retarder or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.

4.1. [HCD 1 & HCD 2] In California Climate Zones 14 and 16, a Class I or Class II vapor retarder shall be installed on the indirectly conditioned space side of all insulation in an unvented attic with air-permeable insulation, for condensation control.

5. Insulation shall comply with either Item 5.1 or 5.2, and additionally Item 5.3.

5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing. **[HCD 1 & HCD 2]** *No insulation shall be required when roof tiles, wood shingles or wood shakes, or any other roofing system using battens and no continuous underlayment is installed. A continuous underlayment shall be considered to exist if sheathing, roofing paper or any continuous layer having a perm rate of no more than one perm under the dry cup method is present.*

5.1.1. Where only air-impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.

5.1.2. Where air-permeable insulation is provided inside the building thermal envelope, it shall be installed in accordance with Item 5.1.1. In addition to the air-permeable insulation installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-values in Table 1202.3 for condensation control.

5.1.3. Where both air-impermeable and air-permeable insulation are provided, the air-impermeable insulation shall be applied in direct contact with the underside of the structural roof sheathing and shall be in accordance with the R-values in Table 1202.3 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented attics shall meet the following requirements:

5.2.1. A vapor diffusion port shall be installed not more than 12 inches (305 mm) from the highest point of the

roof, measured vertically from the highest point of the roof to the lower edge of the port.

5.2.2. The port area shall be greater than or equal to $\frac{1}{600}$ of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.

5.2.3. The vapor permeable membrane in the vapor diffusion port shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.

5.2.4. The vapor diffusion port shall serve as an air barrier between the attic and the exterior of the building.

5.2.5. The vapor diffusion port shall protect the attic against the entrance of rain and snow.

5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (50 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.

5.2.7. The roof slope shall be greater than or equal to 3 units vertical in 12 units horizontal (3:12).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top of the attic floor, or on top of the ceiling.

5.2.9. Where only air-permeable insulation is used and is installed directly below the structural roof sheathing, air shall be supplied at a flow rate greater than or equal to 50 cubic feet per minute (23.6 L/s) per 1,000 square feet (93 m²) of ceiling.

5.3. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

Exceptions:

1. Section 1202.3 does not apply to special use structures or enclosures such as swimming pool enclosures, data processing centers, hospitals or art galleries.

- 2. Section 1202.3 does not apply to enclosures in Climate Zones 5 through 8 that are humidified beyond 35 percent during the three coldest months.

**TABLE 1202.3
INSULATION FOR CONDENSATION CONTROL**

CLIMATE ZONE	MINIMUM R-VALUE OF AIR-IMPERMEABLE INSULATION ^a
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

a. Contributes to, but does not supersede, thermal resistance requirements for attic and roof assemblies in the *California Energy Code*.

1202.3.1 California Energy Code and International Energy Conservation Code Climate Zones. The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Table 1202.3.1.

**TABLE 1202.3.1
IECC VERSUS CALIFORNIA ENERGY CODE
CLIMATE ZONE COMPARISON**

IECC ^a	CALIFORNIA ENERGY CODE	DESCRIPTION ^b
6	16	Includes Alpine, Mono Counties
5	11, 12, 16	Includes Siskiyou, Modoc, Lassen, Plumas, Sierra, Nevada Counties
4 (marine)	1, 2, 16	Includes Del Norte and Humboldt Counties
4	2, 12, 13, 16	Includes Inyo, Trinity, Lake, El Dorado, Amador, Calaveras, Tuolumne, Mariposa Counties
3	8, 9, 10, 11, 12, 13, 14, 15, 16	Includes Shasta, Tehama, Butte, Glenn, Colusa, Yuba, Contra Costa, Sutter, Yolo, Sacramento, Placer, San Joaquin, Solano, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, Ventura, Los Angeles, Orange, San Bernardino, Riverside Counties
3 (marine)	1, 2, 3, 4, 5, 6, 9, 12, 16	Includes Mendocino, Sonoma, Marin, San Francisco, San Mateo, Alameda, Santa Cruz, Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Diego Counties
2	14, 16	Includes Imperial County

a. IECC Climate Zones 1, 7 and 8 do not occur in California, nor do any IECC moist climate zones.

b. IECC boundaries are defined by county political boundary lines. California Energy Code boundaries are based on a metes and bounds specifications aligned with climate-affecting geographic features, which often do not coincide with county lines.

1202.4 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any building except spaces occupied by basements or cellars shall be provided with ventilation in accordance with Section 1202.4.1, 1202.4.2 or 1202.4.3.

1202.4.1 Ventilation openings. Ventilation openings through foundation walls shall be provided. The openings shall be placed so as to provide cross ventilation of the under-floor space. The net area of ventilation openings shall be in accordance with Section 1202.4.1.1 or 1202.4.1.2. Ventilation openings shall be covered for their height and width with any of the following materials, provided that the least dimension of the covering shall be not greater than 1/4 inch (6.4 mm):

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grilles or gratings.
4. Extruded load-bearing vents.
5. Hardware cloth of 0.035-inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension not greater than 1/8 inch (3.2 mm).
7. Operable louvres, where ventilation is provided in accordance with Section 1202.4.1.2.

1202.4.1.1 Ventilation area for crawl spaces with open earth floors. The net area of ventilation openings for crawl spaces with uncovered earth floors shall be not less than 1 square foot for each 150 square feet (0.67 m² for each 100 m²) of crawl space area.

1202.4.1.2 Ventilation area for crawl spaces with covered floors. The net area of ventilation openings for crawl spaces with the ground surface covered with a Class I vapor retarder shall be not less than 1 square foot for each 1,500 square feet (0.67 m² for each 1000 m²) of crawl space area.

1202.4.1.3 [SPCB] Openings for under-floor ventilation shall be not less than 1 1/2 square feet (0.135 m²) for each 25 linear feet (7620 linear mm) of exterior wall. They shall be covered with corrosion-resistant wire mesh with mesh openings not less than 1/4 inch (6.4 mm) nor more than 1/2 inch (13 mm) in any dimension.

1202.4.2 Ventilation in cold climates. In extremely cold climates, where a ventilation opening will cause a detrimental loss of energy, ventilation openings to the interior of the structure shall be provided.

1202.4.3 Mechanical ventilation. Mechanical ventilation shall be provided to crawl spaces where the ground surface is covered with a Class I vapor retarder. Ventilation shall be in accordance with Section 1202.4.3.1 or 1202.4.3.2.

1202.4.3.1 Continuous mechanical ventilation. Continuously operated mechanical ventilation shall be

INTERIOR ENVIRONMENT

provided at a rate of 1.0 cubic foot per minute (cfm) for each 50 square feet (1.02 L/s for each 10 m²) of crawl space ground surface area and the ground surface shall be covered with a Class I vapor retarder.

1202.4.3.2 Conditioned space. The crawl space shall be conditioned in accordance with the *California Mechanical Code* and the walls of the crawl space shall be insulated in accordance with the *California Energy Code*.

1202.4.4 Flood hazard areas. For buildings in flood hazard areas as established in Section 1612.3, the openings for under-floor ventilation shall be deemed as meeting the flood opening requirements of ASCE 24 provided that the ventilation openings are designed and installed in accordance with ASCE 24.

1202.5 Natural ventilation. Natural ventilation of an occupied space shall be through windows, doors, louvers or other openings to the outdoors. The operating mechanism for such openings shall be provided with ready access so that the openings are readily controllable by the building occupants.

[HCD 1] In employee housing, all openable windows in rooms used for living, dining, cooking or sleeping purposes, and toilet and bath buildings, shall be provided and maintained with insect screening.

[HCD 1] Door openings of rooms used for dining, cooking, toilet and bathing facilities in employee housing shall be provided and maintained with insect screening or with solid doors equipped with self-closing devices in lieu thereof, when approved by the enforcement agency.

[HCD 1] The windows, doors, louvers or other approved closeable openings not required by Section 1030 may open into a passive solar energy collector for ventilation required by this section. The area of ventilation openings to the outside of the passive solar energy collector shall be increased to compensate for the openings required by the interior space.

1202.5.1 Ventilation area required. The openable area of the openings to the outdoors shall be not less than 4 percent of the floor area being ventilated.

1202.5.1.1 Adjoining spaces. Where rooms and spaces without openings to the outdoors are ventilated through an adjoining room, the opening to the adjoining room shall be unobstructed and shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 25 square feet (2.3 m²). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

Exception: Exterior openings required for ventilation shall be allowed to open into a sunroom with thermal isolation or a patio cover provided that the openable area between the sunroom addition or patio cover and the interior room shall have an area of not less than 8 percent of the floor area of the interior room or space, but not less than 20 square feet (1.86 m²). The openable area of the openings to the outdoors shall be based on the total floor area being ventilated.

1202.5.1.2 Openings below grade. Where openings below grade provide required natural ventilation, the outside horizontal clear space measured perpendicular to the opening shall be one and one-half times the depth of the opening. The depth of the opening shall be measured from the average adjoining ground level to the bottom of the opening.

1202.5.2 Contaminants exhausted. Contaminant sources in naturally ventilated spaces shall be removed in accordance with the *California Mechanical Code* and the *California Fire Code*.

1202.5.2.1 Bathrooms. Rooms containing bathtubs, showers, spas and similar bathing fixtures shall be mechanically ventilated in accordance with the *California Mechanical Code*.

The minimum exhaust rate shall not be less than that established by Table 403.7 "Minimum Exhaust Rates." See California Mechanical Code, Chapter 5, for additional provisions related to environmental air ducts.

[HCD 1] In addition to the requirements in this section and in the California Mechanical Code, bathrooms in Group R occupancies shall be mechanically ventilated in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.

1202.5.3 Openings on yards or courts. Where natural ventilation is to be provided by openings onto yards or courts, such yards or courts shall comply with Section 1205.

1202.6 Other ventilation and exhaust systems. Ventilation and exhaust systems for occupancies and operations involving flammable or combustible hazards or other contaminant sources as covered in the *California Mechanical Code* or the *California Fire Code* shall be provided as required by both codes.

SECTION 1203 TEMPERATURE CONTROL

1203.1 Equipment and systems. Interior spaces intended for human occupancy shall be provided with active or passive space heating systems capable of maintaining an indoor temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor on the design heating day.

Exceptions:

1. Space heating systems are not required for:
 - 1.1. Interior spaces where the primary purpose of the space is not associated with human comfort.
 - 1.2. Group F, H, S or U occupancies.
2. *[HCD 1] For limited-density owner-built rural dwellings, a heating facility or appliance shall be installed in each dwelling subject to the provisions of Subchapter 1, Chapter 1, Title 25, California Code of Regulations, commencing with Section 74; however, there shall be no specified requirement for heating capacity or temperature maintenance. The use of solid-fuel or*

solar-heating devices shall be deemed as complying with the requirements of this section. If nonrenewable fuel is used in these dwellings, rooms so heated shall meet current installation standards.

3. **[OSHPD 1, 1R, 2, 3, 4 & 5]** Space heating systems shall comply with the requirements of the California Mechanical Code.
4. **[HCD 1]** When a passive solar energy collector is designed as a conditioned area it shall comply with the California Energy Code. Nonconditioned passive solar energy collectors are exempt from compliance with the California Energy Code.

SECTION 1204 LIGHTING

1204.1 General. Every space intended for human occupancy shall be provided with natural light by means of exterior glazed openings in accordance with Section 1204.2 or shall be provided with artificial light in accordance with Section 1204.3. Exterior glazed openings shall open directly onto a public way or onto a yard or court in accordance with Section 1205.

[HCD 1] Glazed openings may open into a passive solar energy collector provided the area of exterior glazed openings in the passive solar energy collector is increased to compensate for the area required by the interior space.

1204.2 Natural light. The minimum net glazed area shall be not less than 8 percent of the floor area of the room served.

1204.2.1 Adjoining spaces. For the purpose of natural lighting, any room is permitted to be considered as a portion of an adjoining room where one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room or 25 square feet (2.32 m²), whichever is greater.

Exception: Openings required for natural light shall be permitted to open into a sunroom with thermal isolation or a patio cover where the common wall provides a glazed area of not less than one-tenth of the floor area of the interior room or 20 square feet (1.86 m²), whichever is greater.

1204.2.2 Exterior openings. Exterior openings required by Section 1204.2 for natural light shall open directly onto a public way, yard or court, as set forth in Section 1205.

Exceptions:

1. Required exterior openings are permitted to open into a roofed porch where the porch meets all of the following criteria:
 - 1.1. Abuts a public way, yard or court.
 - 1.2. Has a ceiling height of not less than 7 feet (2134 mm).
 - 1.3. Has a longer side at least 65 percent open and unobstructed.

2. Skylights are not required to open directly onto a public way, yard or court.

1204.3 Artificial light. Artificial light shall be provided that is adequate to provide an average illumination of 10 footcandles (107 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.

1204.4 Stairway illumination. Stairways within dwelling units and exterior stairways serving a dwelling unit shall have an illumination level on tread runs of not less than 1 footcandle (11 lux). Stairways in other occupancies shall be governed by Chapter 10.

1204.4.1 Controls. The control for activation of the required stairway lighting shall be in accordance with the California Electrical Code.

1204.5 Emergency egress lighting. The means of egress shall be illuminated in accordance with Section 1008.1.

1204.6 Light pollution reduction. **[BSC-CG]** See California Green Building Standards Code, Chapter 5, Division 5.1 for additional light pollution reduction requirements.

1204.7 Campus lighting for parking facilities and primary walkways at California state universities, colleges and community colleges. **[BSC]** Artificial light shall be provided for parking facilities and primary walkways at California State Universities, colleges and community colleges in accordance with provisions of this subsection. This subsection shall not apply to the University of California unless the Regents of the University of California, by resolution, make it applicable.

1204.7.1 Lighting requirements. Based on the recommendations of the most current edition of the Illumination Engineering Society lighting handbook, the following lighting standards shall be used for all new construction of open parking facilities, covered parking facilities and primary walkways:

1. Open and covered parking facilities.
 - 1.1. Medium-level activity usage when medium usage is present.
 - 1.2. High-level activity usage when high usage is present.
2. Primary campus walkways.
 - 2.1. Medium-level activity usage when medium usage is present.
 - 2.2. High-level activity usage when high usage is present.

SECTION 1205 YARDS OR COURTS

1205.1 General. This section shall apply to yards and courts adjacent to exterior openings that provide natural light or ventilation. Such yards and courts shall be on the same lot as the building.

1205.2 Yards. Yards shall be not less than 3 feet (914 mm) in width for buildings two stories or less above grade plane. For buildings more than two stories above grade plane, the minimum width of the yard shall be increased at the rate of 1 foot

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(305 mm) for each additional story. For buildings exceeding 14 stories above grade plane, the required width of the yard shall be computed on the basis of 14 stories above grade plane.

1205.3 Courts. Courts shall be not less than 3 feet (914 mm) in width. Courts having windows opening on opposite sides shall be not less than 6 feet (1829 mm) in width. Courts shall be not less than 10 feet (3048 mm) in length unless bounded on one end by a public way or yard. For buildings more than two stories above grade plane, the court shall be increased 1 foot (305 mm) in width and 2 feet (610 mm) in length for each additional story. For buildings exceeding 14 stories above grade plane, the required dimensions shall be computed on the basis of 14 stories above grade plane.

1205.3.1 Court access. Access shall be provided to the bottom of courts for cleaning purposes.

1205.3.2 Air intake. Courts more than two stories in height shall be provided with a horizontal air intake at the bottom not less than 10 square feet (0.93 m²) in area and leading to the exterior of the building unless abutting a yard or public way.

1205.3.3 Court drainage. The bottom of every court shall be properly graded and drained to a public sewer or other approved disposal system complying with the *California Plumbing Code*.

SECTION 1206 SOUND TRANSMISSION

1206.1 Scope. This section shall apply to common interior walls, partitions and floor/ceiling assemblies between adjacent dwelling units and sleeping units or between dwelling units and sleeping units and adjacent public areas.

1206.2 Airborne sound. Walls, partitions and floor-ceiling assemblies separating dwelling units and sleeping units from each other or from public or service areas shall have a sound transmission class of not less than 50 where tested in accordance with ASTM E90, or have a Normalized Noise Isolation Class (NNIC) rating of not less than 45 if field tested, in accordance with ASTM E336 for airborne noise. Alternatively, the sound transmission class of walls, partitions and floor-ceiling assemblies shall be established by engineering analysis based on a comparison of walls, partitions and floor-ceiling assemblies having sound transmission class ratings as determined by the test procedures set forth in ASTM E90. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. This requirement shall not apply to entrance doors; however, such doors shall be tight fitting to the frame and sill.

1206.2.1 Masonry. The sound transmission class of concrete masonry and clay masonry assemblies shall be calculated in accordance with TMS 302 or determined through testing in accordance with ASTM E90.

1206.3 Structure-borne sound. Floor-ceiling assemblies between dwelling units and sleeping units or between a

dwelling unit or sleeping unit and a public or service area within the structure shall have an impact insulation class rating of not less than 50 where tested in accordance with ASTM E492, or have a Normalized Impact Sound Rating (NISR) of not less than 45 if field tested in accordance with ASTM E1007. Alternatively, the impact insulation class of floor-ceiling assemblies shall be established by engineering analysis based on a comparison of floor-ceiling assemblies having impact insulation class ratings as determined by the test procedures in ASTM E492.

Exception: Impact sound insulation is not required for floor-ceiling assemblies over nonhabitable rooms or spaces not designed to be occupied, such as garages, mechanical rooms or storage areas.

1206.4 Allowable interior noise levels. Interior noise levels attributable to exterior sources shall not exceed 45 dB in any habitable room. The noise metric shall be either the day-night average sound level (*L_{dn}*) or the community noise equivalent level (*CNEL*), consistent with the noise element of the local general plan.

1206.5 Acoustical control. [BSC-CG] See California Green Building Standards Code, Chapter 5, Division 5.5 for additional sound transmission requirements.

SECTION 1207 ENHANCED CLASSROOM ACOUSTICS

1207.1 General. Enhanced classroom acoustics, where required by this section, shall comply with Section 808 of ICC A117.1.

1207.2 Where required. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (566 m³) or less.

SECTION 1208 INTERIOR SPACE DIMENSIONS

1208.1 Minimum room widths. Habitable spaces, other than a kitchen, shall be not less than 7 feet (2134 mm) in any plan dimension. Kitchens shall have a clear passageway of not less than 3 feet (914 mm) between counter fronts and appliances or counter fronts and walls.

[HCD 1] For limited-density owner-built rural dwellings, there shall be no requirements for room dimensions, provided there is adequate light and ventilation and adequate means of egress.

1208.2 Minimum ceiling heights. Occupiable spaces, habitable spaces and corridors shall have a ceiling height of not less than 7 feet 6 inches (2286 mm) above the finished floor. Bathrooms, toilet rooms, kitchens, storage rooms and laundry rooms shall have a ceiling height of not less than 7 feet (2134 mm) above the finished floor.

Exceptions:

1. In one- and two-family dwellings, beams or girders spaced not less than 4 feet (1219 mm) on center shall be permitted to project not more than 6 inches (152 mm) below the required ceiling height.

2. If any room in a building has a sloped ceiling, the prescribed ceiling height for the room is required in one-half the area thereof. Any portion of the room measuring less than 5 feet (1524 mm) from the finished floor to the ceiling shall not be included in any computation of the minimum area thereof.
3. The height of mezzanines and spaces below mezzanines shall be in accordance with Section 505.2.
4. Corridors contained within a dwelling unit or sleeping unit in a Group R occupancy shall have a ceiling height of not less than 7 feet (2134 mm) above the finished floor.
5. *[OSHPD 1, 2, 3 & 5] Minimum ceiling heights shall comply with Section 1224.4.10.*
6. *[OSHPD 4] Minimum ceiling heights shall comply with Section 1227.8.*

1208.2.1 Furred ceiling. Any room with a furred ceiling shall be required to have the minimum ceiling height in two-thirds of the area thereof, but in no case shall the height of the furred ceiling be less than 7 feet (2134 mm).

1208.3 Room area. Every dwelling unit shall have not less than one room that shall have not less than 120 square feet (11.2 m²) of net floor area. Other habitable rooms shall have a net floor area of not less than 70 square feet (6.5 m²).

Exception: Kitchens are not required to be of a minimum floor area.

1208.4 Efficiency dwelling units. *[HCD 1] Unless modified by local ordinance pursuant to Health and Safety Code Section 17958.1, efficiency dwelling units shall comply with the following:*

1. The unit shall have a living room of not less than 190 square feet (17.7 m²) of floor area.
2. The unit shall be provided with a separate closet.
3. For other than Accessible, *adaptable* dwelling units, the unit shall be provided with a kitchen sink, cooking appliance and refrigerator, each having a clear working space of not less than 30 inches (762 mm) in front. Light and ventilation conforming to this code shall be provided.
4. The unit shall be provided with a separate bathroom containing a water closet, lavatory and bathtub or shower.

SECTION 1209 ACCESS TO UNOCCUPIED SPACES

1209.1 Crawl spaces. Crawl spaces shall be provided with not less than one access opening that shall be not less than 18 inches by 24 inches (457 mm by 610 mm).

1208.1.1 [SPCB] Accessible under-floor areas shall be provided with an 18-inch by 24-inch (457 mm by 610 mm) access crawl hole. Pipes, ducts and other nonstructural construction shall not interfere with the accessibility to or within under-floor areas.

1209.2 Attic spaces. An opening not less than 20 inches by 30 inches (559 mm by 762 mm) shall be provided to any attic area having a clear height of over 30 inches (762 mm). Clear headroom of not less than 30 inches (762 mm) shall be provided in the attic space at or above the access opening.

1209.3 Mechanical appliances. Access to mechanical appliances installed in under-floor areas, in attic spaces and on roofs or elevated structures shall be in accordance with the *California Mechanical Code*.

SECTION 1210 TOILET AND BATHROOM REQUIREMENTS

[P] 1210.1 Required fixtures. The number and type of plumbing fixtures provided in any occupancy shall comply with the *California Plumbing Code*.

[P] 1210.2 Finish materials. Walls, floors and partitions in toilet and bathrooms shall comply with Sections 1210.2.1 through 1210.2.4.

[OSHPD 1, 2, 3 & 5] Facilities subject to OSHPD 1, 2, 3 & 5 shall also comply with Section 1224.4.11.

[OSHPD 4] Facilities subject to OSHPD 4 shall also comply with Section 1227.9.

[P] 1210.2.1 Floors and wall bases. In other than dwelling units, toilet, bathing and shower room floor finish materials shall have a smooth, hard, nonabsorbent surface. The intersections of such floors with walls shall have a smooth, hard, nonabsorbent vertical base that extends upward onto the walls not less than 4 inches (102 mm).

[P] 1210.2.2 Walls and partitions. Walls and partitions within 2 feet (610 mm) of service sinks, urinals and water closets shall have a smooth, hard, nonabsorbent surface, to a height of not less than 4 feet (1219 mm) above the floor, and except for structural elements, the materials used in such walls shall be of a type that is not adversely affected by moisture.

Exception: This section does not apply to the following buildings and spaces:

1. Dwelling units and sleeping units.
2. Toilet rooms that are not accessible to the public and that have not more than one water closet.

Accessories such as grab bars, towel bars, paper dispensers and soap dishes, provided on or within walls, shall be installed and sealed to protect structural elements from moisture.

[P] 1210.2.3 Showers. Shower compartments and walls above bathtubs with installed shower heads shall be finished with a smooth, nonabsorbent surface to a height not less than 72 inches (1829 mm) above the drain inlet.

[P] 1210.2.4 Waterproof joints. Built-in tubs with showers shall have waterproof joints between the tub and adjacent wall.

[P] 1210.3 Privacy. Public restrooms shall be visually screened from outside entry or exit doorways to ensure user privacy within the restroom. This provision shall also apply

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where mirrors would compromise personal privacy. Privacy at water closets and urinals shall be provided in accordance with Sections 1210.3.1 and 1210.3.2.

Exception: Visual screening shall not be required for single-occupant toilet rooms with a lockable door.

[P] 1210.3.1 Water closet compartment. Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 occupancy housing areas.

[P] 1210.3.2 Urinal partitions. Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The walls or partitions shall begin at a height not more than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family or assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

SECTION 1211 [HCD 1 & HCD 2] GARAGE DOOR SPRINGS

1211.1 General. This section shall apply to applications listed in Sections 1.8.2.1.1 and 1.8.2.1.3 regulated by the Department of Housing and Community Development.

1211.1.1 Garage door extension springs. Every garage door extension spring sold or offered for sale, whether new or as a replacement, or installed in any garage or carport which is accessory to an apartment house, hotel, motel or dwelling shall conform to the following requirements:

Hard-drawn spring wire shall conform to ASTM A227/A227M-17 or a more current version, and shall be

made by the steel processes described therein, conforming to the chemical composition requirements listed and meeting the standards of steel heat as set forth by the ladle analysis. Wire tensile strength and dimension variations shall meet the prescribed properties of established standards.

Oil-tempered wire shall conform to ASTM A229/A229M-17 or a more current version, and shall be made by the steel processes described therein, conforming to the chemical composition requirements listed and meeting the standards of steel heat as set forth by the ladle analysis. Wire tensile strength and dimension variations shall meet the prescribed properties of established standards.

Extension springs shall be fabricated from either hard-drawn spring wire or oil-tempered wire as specified above.

1211.2 Design standards. Minimum design standard shall be 9,000 cycles. (One cycle is an action on the door from the fully closed position, to the fully open position, and returned to the fully closed position.)

1211.3 Certification. Mill certification of wire physical tests and chemical properties shall be kept on file by the spring manufacturer.

Physical cycling tests shall be performed for each extension spring design and shall be certified by an approved testing agency acceptable to the department and reports kept on file by the spring manufacturer.

1211.4 Restraining devices. Each extension spring shall be equipped with an approved device capable of restraining the spring or any part thereof in the event it breaks. Restraining devices shall be physically tested for each extension spring family of products in accordance with ANSI/DASMA 103-2017 or an equivalent standard. Tests shall be certified by an approved testing agency acceptable to the department. Test reports shall be kept on file by the manufacturer responsible for the restraining device.

1211.5 Identification. Extension springs, or door systems with extension springs and restraining devices shall be permanently identified as to manufacturer and shall indicate maximum recommended stretch. Both extension springs and restraining devices shall bear information stating that they have been manufactured in accordance with requirements of the California Department of Housing and Community Development.

1211.6 Installation. Installation of extension springs, restraining devices and hardware shall be in accordance with the door manufacturer's installation instructions. Instructions shall be provided by the door manufacturer and shall specify the approved method of restraint and maximum recommended stretch. Unless otherwise permitted by the door manufacturer's installation instructions, the hardware and extension springs shall be mounted to nominal 2 by 6 framing members, conforming to the applicable provisions of Section 2303.

**SECTION 1212 [HCD 1]
POLLUTANT CONTROL**

1212.1 Finish material pollutant control. *Finish materials, including adhesives, sealants, caulks, paints and coatings, aerosol paints and coatings, carpet systems, carpet cushion, carpet adhesive, resilient flooring systems and composite wood products shall meet the volatile organic compound (VOC) emission limits in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

**SECTION 1213
Reserved**

**SECTION 1214
Reserved**

**SECTION 1215
Reserved**

**SECTION 1216
Reserved**

**SECTION 1217
Reserved**

**SECTION 1218
Reserved**

**SECTION 1219
Reserved**

**SECTION 1220
Reserved**

**SECTION 1221
Reserved**

**SECTION 1222
Reserved**

**SECTION 1223
Reserved**

**SECTION 1224 [OSHPD 1]
HOSPITALS**

1224.1 Scope. *[OSHPD 1] The provisions of this section shall apply to general acute-care hospitals and general acute-care hospitals providing only acute medical rehabilitation center services. The provisions of Section 1225 shall apply to distinct part skilled nursing and intermediate-care services on a general acute-care hospital license provided in a separate unit.*

[OSHPD 1R] *This section shall apply to buildings removed from acute care service, in compliance with Part 10, California Existing Building Code, Chapter 3A, and remain under OSHPD jurisdiction.*

1224.2 Application. *New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electric*

Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code, California Existing Building Code (Parts 3, 4, 5, 6, 9 and 10 of Title 24) and this section.

Exceptions:

1. *Facilities licensed and in operation prior to the effective date of this section shall not be required to institute corrective alterations or construction to comply with any new requirements imposed thereby or subsequently, except where specifically required or where the enforcing agency determines that a definite hazard to health and safety exists. Facilities for which preliminary drawings have been submitted to the enforcing agency prior to the effective date of this change shall not be required to comply with such new requirements, provided working drawings are submitted within one year of the effective date of such new requirements.*
2. *A change in function shall require compliance with all the functional requirements for new construction in this code, including requirements in Sections 1224, 1225, 1226, 1227 and 1228.*
3. *The provisions of this section do not prohibit the use of alternate space utilization, new concepts of design, treatment techniques, equipment and alternate finish materials provided the intent of this section is accommodated and written approval for such alternative is granted by the enforcing agency. Written substantiating evidence in support of the alternate and a written request for consideration shall be submitted to the enforcing agency.*
4. *Nothing in this section shall prohibit the provisions of required services from a centralized service facility serving two or more licensed facilities when approved in writing by the licensing agency. Buildings and required spaces for services provided in a separate centralized services facility shall comply with all applicable provisions of these regulations and applicable local codes and ordinances for the services so provided.*
5. *Acute psychiatric hospitals and general acute-care hospitals providing only acute medical rehabilitation center services may provide for surgical and anesthesia services to be provided by an outside licensed facility when approved by the licensing agency.*
6. *When the Corrections Standards Authority, the Department of Corrections or the Department of Youth Authority determines that a particular requirement for hospitals located in a correctional facility may compromise the safety, security or protection of staff, inmates or property, the enforcement agency shall consider an alternate design.*

1224.2.1 Removed from acute care service [OSHPD 1R]. *Hospital buildings removed from acute care service in accordance with Part 10, California Existing Building Code, Section 309A may provide outpatient services and*

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other uses. Required Basic or Supplemental Services on the hospital's license may not be provided.

Exceptions:

1. Duplicative hospital services when permitted by California Department of Public Health.
2. Skilled Nursing Services may be provided in conformance with Section 1225.
3. Acute Psychiatric Services may be provided in conformance with Section 1228.

1224.3 Definitions. Specific terms and definitions are provided to facilitate consistency in the interpretation and application of these requirements. Some of these terms may have a broader definition in other contexts, but the definitions provided here reflect the use of the terms for OSHPD requirements.

AIR CONDITIONING. The process or system by which simultaneously the temperature, humidity, air motion and quality are maintained within required limits.

AIRBORNE INFECTION ISOLATION ROOM. A single-occupancy patient room where environmental factors are controlled in an effort to minimize the transmission of those infectious agents usually spread from person to person by droplet nuclei associated with coughing and inhalation.

AMBULATORY CARE. A defined health care encounter(s) of less than 24 hours in duration that requires direct professional health care support within a specific facility.

AMBULATORY SURGICAL FACILITY. Any surgical facility organized for the purpose of providing procedural, invasive surgical care to patients with the expectation that they will be recovered sufficiently to be discharged in less than a 24-hour period.

ANGIOGRAPHY. The radiographic visualization of blood vessels following introduction of contrast material for purposes of diagnosis.

BASIC SERVICES. Those essential services required for licensure as a hospital, including medical, nursing, surgical, anesthesia, laboratory, radiology, pharmacy, dietary services and support services. See "SUPPLEMENTAL SERVICES."

BIOTERRORISM. The use or threat of use, of biological agents to intimidate a political entity or population group.

CENTRAL AIR-HANDLING SYSTEMS. Any units requiring ductwork on the supply or inlet side and serving more than one room.

CHANGE IN FUNCTION. A change in function is a change in activity, service or licensed service provided, within the project limits, that does not necessarily change the use, specific use and/or occupancy. Conversion of a space that results in a change in activity such that the space will be required to satisfy the functional requirements under a different code sub-section than that of the prior use is considered a change in function.

CLEAR DIMENSION. An unobstructed room dimension exclusive of built-in casework and equipment and available for functional use.

COURT. An open exterior space bounded on three or more sides by the walls of a structure.

ENVIRONMENT OF CARE. Those features in a built health care entity that are created, structured and maintained to support quality health care.

EXAM ROOM. A room with a bed, stretcher or examination table and capability for periodic monitoring (e.g., measurement of blood pressure or pulse oximetry) in which procedures that do not require a specialized suite can be performed (e.g., pelvic examination, blood transfusion).

FLOOR AREA, CLEAR. The actual occupied area exclusive of fixed or wall-mounted cabinets, fixed beds and furnishings, built-in shelves, toilet rooms, closets, lockers, wardrobes, alcoves, anterooms or vestibules.

GENERAL ACUTE-CARE HOSPITAL. A hospital, licensed by the California Department of Public Health, having a duly constituted governing body with overall administrative and professional responsibility and an organized medical staff which provides 24-hour inpatient care, including the basic services.

HANDWASHING STATION. A clinical staff-use area that provides a handwashing fixture, cleansing agents and means for drying hands. Handwashing stations shall be immediately accessible to the patient care area they serve without requiring passage through a doorway, unless hands-free door operation of the door is provided. Refer to the California Plumbing Code, Section 210.0 for the definition of handwashing fixture.

HOSPITAL. A general acute-care hospital, including those providing only acute medical rehabilitation center services and acute psychiatric hospitals.

HOUSEKEEPING. Services anywhere within a health care facility that include general cleaning and tidying and the provision and positioning of identified materials, e.g., soaps, towels, etc. (While routine disinfection protocols can be included in such a definition, the definition is not intended to include complex, nonroutine disinfection procedures nor the nonroutine disposition of hazardous materials such as potentially toxic drugs or other chemicals and radioactive wastes.)

INVASIVE PROCEDURE. A procedure that is performed in an aseptic surgical field and penetrates the protective surfaces of a patient's body (e.g., subcutaneous tissue, mucous membranes, cornea). An invasive procedure may fall into one or more of the following categories:

1. Requires entry into or opening of a sterile body cavity (i.e., cranium, chest, abdomen, pelvis, joint spaces).
2. Involves insertion of an indwelling foreign body.
3. Includes excision and grafting of burns that cover more than 20 percent of total body area.
4. Does not begin as an open procedure but has a recognized measurable risk of requiring conversion to an open procedure.

LDR. Labor, Delivery, Recovery (an unlicensed patient bed)

LDRP. Labor, Delivery, Recovery, Postpartum (a licensed patient bed)

LICENSING AGENCY. The Department of Public Health, Licensing and Certification.

LOCATION TERMINOLOGY (terms for relationship to an area or room)

ADJACENT. Located next to but not necessarily connected to the identified area or room.

DIRECTLY ACCESSIBLE. Connected to the identified area or room through a doorway or other opening without going through an intervening room or public space.

IMMEDIATELY ACCESSIBLE. Available either in the identified area or room, or directly accessible from a room or area located within the same department or service space.

IN. Located within the identified area or room.

READILY ACCESSIBLE. Located within the same department or service space as the identified area or room, located in and shared with an adjacent unit, or within 200 feet (60.96 m) of the department or service space in an accessible corridor.

MONOLITHIC. A surface free of fissures, cracks, perforations and crevices.

MONOLITHIC CEILING. A ceiling constructed with a surface free of fissures, cracks and crevices. Any penetrations such as lights, diffusers and access panels shall be sealed or gasketed. Lay-in ceilings are not considered “monolithic.”

NURSING UNIT. A designated patient care area of the hospital which is planned organized, operated and maintained to function as a unit. It includes patient rooms with adequate support facilities, services and personnel providing nursing care and necessary management of patients.

OPERATING ROOM. A room specifically designed for the performance of surgical procedures. (In common understanding, this means most types of surgical procedures, especially those involving the administration of anesthesia, multiple personnel, recovery room access and a fully controlled environment.)

HYBRID OPERATING ROOM. A room that meets the definition of an operating room and is also equipped to enable diagnostic imaging before, during and after surgical procedures. Imaging equipment is permanently installed in the room and may include MRI, fixed single-plane and bi-plane tomographic imaging systems and computed tomographic equipment.

Note: Use of portable imaging technology does not make an operating room a hybrid operating room.

OUTPATIENT SERVICE. An organizational unit of the hospital, which provides nonemergency healthcare services to patients.

PATIENT CARE LOCATIONS. Multi-patient treatment rooms, where allowed, may provide patient care stations in bays or cubicles as follows:

BAY (patient). A space for human occupancy with one hard wall at the headwall and up to one hard wall at either side, with two to three soft walls (e.g., cubicle curtains or portable privacy screen). The required area for the specific

patient care space shall be provided within the cubicle curtain and not overlap with access circulation aisle.

CUBICLE. A space intended for human occupancy that has at least one opening and no door and is enclosed on three sides with full-height or partial-height partitions.

PATIENT CARE STATION. A designated space for a specific patient care function. This term does not imply any structural requirement (e.g., a Post-anesthesia Care Unit (PACU) can have 10 patient care stations of which three are rooms, three are cubicles and four are bays).

PATIENT ROOM. Licensed patient bed rooms. Also referred to as a patient bedroom.

PERIOPERATIVE. Patient care and other related supportive activities before, during or after the operative event.

PROCEDURE ROOM. A room designated for the performance of patient care that requires high-level disinfection or sterile instruments and some environmental controls but is not required to be performed with the environmental controls of an operating room.

PROTECTIVE ENVIRONMENT. A bedded unit or patient room where severely immunosuppressed patients are cared for.

RESTRICTED AREA. Applies to a designated space contained within the semi-restricted area and accessible only through a semi-restricted area. The restricted area includes operating and other rooms in which operative or other invasive procedures are performed. Such space has one or more of the following attributes: specific signage, physical barriers, security controls and protocols that delineate requirements for monitoring, maintenance, attire and use.

ROOM. A space enclosed by hard walls and having a door. Where the word “room” or “office” is used, a separate, enclosed space for the one named function is intended. Otherwise, the described area may be a specific space in another room or common area.

SCRUB SINK. A sink used to wash and scrub the hands and arms during the aseptic preparation for surgery and equipped with a supply spout and controls as required for a handwashing fixture. Refer to the California Plumbing Code Sections 210.0 and 221.0.

SEMI-RESTRICTED AREA. Applies to peripheral areas that support surgical services or intermediate level procedures or imaging. These areas may include storage for equipment and clean and sterile supplies; work area for processing instruments; sterile processing facilities; hand scrub stations; corridors leading from the unrestricted area to the restricted area of the surgical suite; entrances to staff changing areas; pre- and postoperative patient care areas; and sterile processing facilities. The semi-restricted area of the surgical suite is entered directly from the unrestricted area past a nurse station or from other areas. Public access is controlled.

SERVICE SINK. A sink located in a housekeeping room and designed for the purpose of cleaning mops and the disposal of waste water.

SERVICE SPACE. Service Space refers to the distinct area of a health facility where a licensed Basic Service or Supple-

mental Service is provided. The Service Space shall include all the functional area requirements required to deliver the specific Service. Basic Service Spaces are identified in Sections 1224.14 through 1224.27. Supplemental Service Spaces are identified in Sections 1224.28 through 1224.41. Similar distinctions are made between Basic and Supplemental or Optional Services in Section 1225 through Section 1228. Required functional areas may be a portion of a larger space, one or more Patient Care Locations, support areas or separate Rooms as defined in Section 1224.3. See departmental boundary requirements under Section 1224.4.7.6.

SUB-ACUTE CARE. A segment within a continuum of levels of care determined by patient acuity, clinical stability and resource needs.

SUPPLEMENTAL SERVICE. An inpatient or outpatient service which is not required to be provided by law or regulation for licensure. A supplemental service, when provided, must accommodate the provisions of this section.

Note: See “BASIC SERVICES.”

SURGICAL SERVICE SPACE. A space that includes the operating room(s) and service areas.

UNRESTRICTED AREA. Applies to any area of the surgery or medical department that is not defined as semi-restricted or restricted. These areas may include a central control point for designated personnel to monitor the entrance of patients, personnel and materials into the semi-restricted areas; staff changing areas; a staff lounge; offices; waiting rooms or area; pre- and postoperative patient care areas; or access to procedure rooms. Public access may be limited.

1224.4 GENERAL CONSTRUCTION.

1224.4.1 Jurisdiction.

1224.4.1.1 Services/systems and utilities.

[OSHPD 1] Services/systems and utilities shall comply with California Existing Building Code Section 307A.

[OSHPD 1R] Services/systems and utilities shall only originate in, or pass through or under structures which are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1224.4.1.2 Means of egress.

[OSHPD 1] Means of egress shall comply with Part 10, California Existing Building Code, Section 308A.

[OSHPD 1R] Means of egress shall only pass through structures that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1224.4.2 Environmental engineering and support service spaces. Spaces for dietary, laundry, morgue, ambulance entrance, receiving areas, power plants, mechanical equipment, incinerator, garbage can cleaning, automobile parking and storage areas for garbage, trash and medical gases shall be located and constructed to minimize noise, steam, odors, hazards and unsightliness in patient-care areas and bedrooms.

1224.4.3 Treatment spaces. Radiology, laboratory, pharmacy, physical therapy and service spaces serving only outpatients and similar outpatient service departments shall not be located in nursing units, surgical units, perinatal units, nursery areas, central sterilization rooms, food-service areas, power plants, mechanical equipment rooms, maintenance shops, general storage, laundry, employees’ dressing or housekeeping facilities.

Exception: Physical and occupational therapy spaces of a rehabilitation service may serve both outpatients and inpatients.

1224.4.4 Support areas for patient care. Identifiable spaces shall be provided for each function indicated in all Basic and applicable Supplemental Service Space sections with requirements for support areas. The following rooms and spaces are common to most types of health care facilities and the requirements associated with each, as listed below, shall be used unless modified under a specific Service Space section.

1224.4.4.1 Examination, treatment and procedure rooms.

1224.4.4.1.1 Examination room. Unless specified elsewhere, if an exam room is provided, it shall have a minimum clear floor area of 80 square feet (7.4 m²), the least dimension of which shall be 8 feet (2438 mm). The room shall contain a handwashing fixture and accommodations for written or electronic documentation shall be provided.

1224.4.4.1.2 Treatment room. Unless specified elsewhere, if a treatment room is provided, it shall have a minimum clear floor area of 120 square feet (11.15 m²), the least dimension of which shall be 10 feet (3048 mm). A minimum of 3 feet (914 mm) is required between the sides and foot of the bed/gurney/table and any wall or other fixed obstruction. The room shall contain an examination light, a work counter for medical equipment, a handwashing fixture, cabinets, medication storage and counter space for writing or electronic documentation. If used for exercise stress testing, include space for a crash cart and patient resuscitation and omit the exam light. Multi-bed treatment rooms shall have separate patient cubicles with a minimum clear floor area of 80 square feet (7.4 m²) per cubicle. Each cubicle shall contain an examination light, counter and storage facilities. In multi-bed treatment rooms, a handwashing fixture shall be provided in the room for each three or fewer cubicles.

1224.4.4.1.3 Airborne infection isolation exam/treatment room. When provided, the airborne infection isolation room shall be an exam/treatment room, shall be labeled with the words “Airborne Infection Room”, and provide the following:

1. Capacity. Each airborne infection isolation exam/treatment room shall contain only one examination table or recliner.

2. *Handwashing station.* A handwashing station shall be located in each airborne infection isolation exam/treatment room.
3. *Gowning and storage area.* An area for gowning and storage of clean and soiled materials shall be located directly outside or inside the entry door to the airborne infection isolation exam/treatment room.
4. *Doors.* Room doors shall be self-closing and include latching devices.
5. *Sealed-tight room.* Room perimeter walls, ceiling, floors, doors and penetration shall be sealed tightly to minimize air infiltration from the outside or from other spaces.
6. *Ventilation.* The ventilation shall be provided as required by the California Mechanical Code for airborne infection isolation room.

1224.4.4.1.3.1 Airborne infection isolation exam/treatment anteroom. An airborne infection isolation anteroom is not required; however, when an anteroom is provided, it shall meet the following requirements:

1. The anteroom shall provide space for persons to don personal protective equipment before entering the patient room.
2. All doors to the anteroom shall have self-closing devices.
3. The anteroom shall provide storage of personal protective equipment (e.g., respirators, gowns, gloves) and clean equipment.
4. Ventilation shall be provided in the anteroom as required by the California Mechanical Code for airborne infection isolation anteroom.

1224.4.4.1.4 Procedure room. Unless specified elsewhere, if a procedure room is provided, it shall meet the requirements in this section.

1224.4.4.1.4.1 General.

- (1) *Application.* The governing body shall perform a clinical assessment of the procedures to be performed to determine the appropriate room type and location for these procedures and document this in the Functional Program in compliance with the California Administrative Code, Section 7-119. Where a procedure room is used for multiple procedure types, the room shall meet the most stringent requirements for the space.
- (2) *Location.* The procedure room shall meet the requirements of a semi-restricted area. The procedure room shall be permitted to be accessed from a semi-restricted corridor or from an unrestricted corridor.

1224.4.4.1.4.2 Space requirements.

- (1) *Area.* Procedure rooms shall have a minimum clear floor area of 130 square feet

(12.08 m²). Procedure rooms where anesthesia will be administered using an anesthesia machine and supply carts shall have a minimum clear floor area of 160 square feet (14.86 m²). Procedure rooms where procedures will be performed that require additional personnel and/or large equipment shall be sized to accommodate the personnel and equipment planned to be in the room during procedures, including additional personnel and equipment that will be needed for emergency rescue.

- (2) *Clearances.* Procedure rooms shall have the following minimum clearances around the table, gurney or procedure chair:

- (a) 3 feet 6 inches (1070 mm) on each side.
- (b) 3 feet (914.4 mm) at the head and foot. Where an anesthesia machine and associated supply cart is used, the clearance at the head shall be a minimum of 6 feet (1830 mm).

- (3) *Fixed encroachments into the minimum clear floor area.* Fixed encroachments shall be permitted to be included when determining the minimum clear floor area for a procedure room as long as:

- (a) The encroachments do not extend more than 12 inches (305 mm) into the minimum clear floor area.
- (b) Where a sterile field is provided, the encroachment shall not extend into the sterile field.
- (c) The encroachment width along each wall does not exceed 10 percent of the length of that wall.

1224.4.4.1.4.3 Documentation area.

- (1) Accommodations for written and/or electronic documentation shall be provided in the procedure room.
- (2) Where a built-in feature is provided for documentation, it shall allow for direct observation of the patient.

1224.4.4.1.4.4 Patient privacy. Provisions shall be made for patient visual and speech privacy.

1224.4.4.1.4.5 Handwashing station. A handwashing station shall be provided in the procedure room. Where a hand scrub station is directly accessible to the procedure room, omission of the handwashing station is permitted.

1224.4.4.1.5 Seclusion room. Where provided, seclusion rooms shall comply with the following requirements:

1224.4.4.1.5.1 General.

1. *Capacity.* Each room shall accommodate only one patient.

2. *Layout and access.* Seclusion rooms shall be accessed through an anteroom or vestibule that also provides access to a toilet room. The door openings to the anteroom and the toilet room shall have a minimum clear width of 3 feet 8 inches (1118 mm).
3. *The room(s) shall be located to permit observation from the nurse station.*
4. *Seclusion rooms shall be permitted to be grouped together and may share a common vestibule/anteroom.*

1224.4.4.1.5.2 Space requirements. *Seclusion rooms shall have a minimum clear floor area of 60 square feet (5.57 m²) with a minimum wall length of 7 feet (2134 mm) and a maximum wall length of 11 feet (3353 mm).*

Exception: *Where a room for restraining patients is authorized by the California Department of Public Health, it shall have a minimum clear floor area of 80 square feet (7.43 m²) with a minimum wall length of 7 feet (2134 mm) and a maximum wall length of 11 feet (3353 mm).*

1224.4.4.1.5.3 Special design elements. *Seclusion rooms shall be designed and constructed in compliance with the following requirements:*

1. *The walls, ceiling and floor of the seclusion room shall be designed to withstand direct and forceful impact. If padded materials are used inside the room, they shall meet the interior finish requirements in Chapter 8, Interior Finishes, of this code.*
2. *Minimum ceiling height shall be 9 feet (2743 mm).*
3. *Doors.*
 - 3.1. *Door hardware shall be ligature resistant.*
 - 3.2. *The entrance door to the seclusion room shall swing outward.*
 - 3.3. *Doors shall permit staff observation of the patient through a view panel while also maintaining provisions for patient privacy. The maximum sill height shall be 36 inches (914 mm) above the finish floor. The view panel shall be fixed glazing with polycarbonate or laminate on the inside of the glazing.*
4. *Seclusion rooms shall not contain outside corners or edges.*
5. *All items in the room (e.g., lighting fixtures, sprinkler heads, HVAC grilles and surveillance cameras, etc.) shall be tamper resistant.*

6. *Electrical switches and receptacles are prohibited in the seclusion room.*

1224.4.4.2 Nurse station(s). *This area shall have space for counters and storage and at least one hand-washing station shall be located in or directly accessible to the nurse station. It may be combined with or include centers for reception, charting and communication.*

1224.4.4.3 Specimen and blood collection facilities.

1224.4.4.3.1 Specimen collection facilities. *When provided, specimen collection facilities shall comply with the following requirements:*

1. *Urine collection rooms shall be equipped with a water closet and handwashing station.*
Exception: *The handwashing station may be located immediately outside the collection room when the specimen is used for drug testing.*
2. *Use of the toilet room provided within the examination and treatment room shall be permitted for specimen collection.*

1224.4.4.3.2 Blood collection facilities. *When provided, blood collection facilities shall comply with the following requirements:*

1. *Space for a chair and work counter shall be provided.*
2. *A handwashing station shall be provided.*

1224.4.4.4 Medication station. *Provision shall be made for distribution of medications. This shall be done from a medication preparation room or from a self-contained dispensing unit.*

1224.4.4.4.1 Medication preparation room. *If provided, this room shall be lockable. When a medicine preparation room is to be used to store one or more self-contained medicine dispensing units, the room shall be designed with adequate space to prepare medicines with the self-contained medicine dispensing unit(s) present. Medicine preparation rooms shall include:*

1. *Work counter.*
2. *Handwashing station.*
3. *Refrigerator.*
4. *Locked storage for controlled drugs.*

1224.4.4.4.2 Self-contained medication dispensing unit. *If provided, a self-contained medicine dispensing unit shall be located at the nurse station, in the clean utility room, or in an area where access to the self-contained medication dispensing unit is under the monitoring and control of nursing staff. Self-contained medication dispensing units shall be provided with essential power and lighting.*

**TABLE 1224.4.6.1
STATION OUTLETS FOR OXYGEN, VACUUM (SUCTION) AND MEDICAL AIR SYSTEMS^{1, 6}**

	LOCATIONS	OXYGEN	VACUUM	MEDICAL AIR	WAGD ³
1	Patient rooms (medical/surgical unit)	1/bed	1/bed	—	—
2	Examination or treatment (medical/surgical unit and postpartum care)	1/room	1/room	—	—
3	Airborne infection isolation or protective environment rooms (medical/surgical unit)	1/bed	1/bed	—	—
4	Seclusion room (medical/surgical unit and postpartum care)	1/bed	1/bed	—	—
5	Intensive care (general)	3/bed	3/bed	1/bed	—
6	Airborne infection isolation (intensive care)	3/bed	3/bed	1/bed	—
7	Coronary-care service space	3/bed	2/bed	1/bed	—
8	Pediatric intensive care	3/bed	3/bed	1/bed	—
9	Newborn intensive care	3/bassinets	3/bassinets	3/bassinets	—
10	Newborn nursery (full term)	1/4 bassinets ²	1/4 bassinets ²	1/4 bassinets ²	—
11	Pediatric and adolescent	1/bed	1/bed	1/bed	—
12	Pediatric nursery	1/bassinets	1/bassinets	1/bassinets	—
13	Psychiatric patient room	—	—	—	—
14	Seclusion treatment room (psychiatric unit)	—	—	—	—
15	General operating room	2/room	5/room	1/room	1/room
16	Cardio and special procedures	2/room	5/room	1/room	1/room
17	Orthopedic surgery	2/room	5/room	1/room	1/room
18	Surgical cystoscopic and other endo-urologic procedures	1/room	3/room	—	—
19	Post-anesthesia care unit	2/bed	3/bed	1/bed	—
20	Anesthesia workroom	1/workstation	—	1/workstation	—
21	Endoscopy procedure room	1/room	3/room	—	—
22	Postpartum bedroom	1/bed	1/bed	—	—
23	Cesarean operating/delivery room	2/room	4/room	1/room	1/room
24	Recovery space for cesarean delivery	1/bed	3/bed	1/bed	—
25	Infant resuscitation space ⁴	3/bassinets	3/bassinets	3/bassinets	—
26	Labor room	1/room	1/room	—	—
27	OB recovery room	1/bed	3/bed	—	—
28	Labor/delivery/recovery (LDR) ⁵	1/bed	1/bed	—	—
29	Labor/deliver/recovery/postpartum (LDRP) ⁵	1/bed	1/bed	—	—
30	Initial emergency management	1/bed	1/bed	1/bed	—
31	Triage area (definitive emergency care)	1/station	1/station	—	—
32	Definitive emergency care examination or treatment rooms	1/bed	1/bed	1/bed	—
33	Observation unit ⁸	1/bed	1/bed	—	—
34	Trauma/cardiac room(s)	2/bed	3/bed	1/bed	—
35	Orthopedic and cast room	1/room	1/room	—	—
36	Cardiac catheterization lab	2/bed	2/bed	2/bed	—
37	Autopsy room	—	1/workstation	—	—
38	MRI	1/room	1/room	1/room	—
39	Interventional imaging procedure room	2/room	2/room	1/room	—
40	Hyperbaric suite pre-procedure/patient holding area	2/station	2/station	—	—
41	Electroconvulsive therapy procedure room	1/room ⁷	1/room ⁷	—	—

- For any area or room not described above, the facility clinical staff shall determine outlet requirements after consultation with the enforcing agency.
- Four bassinets may share one outlet that is accessible to each bassinet.
- WAGD stands for “waste anesthesia gas disposal” system.
- When infant resuscitation takes place in a room such as cesarean section/delivery or LDRP, then the infant resuscitation services shall be provided in that room in addition to the minimum service required for the mother.
- One outlet for mother and one for each bassinet.
- Renovation projects of existing spaces where the existing function is not changed, are not required to comply with the requirements of this table.
- Use of portable equipment shall be permitted.
- Use of portable equipment is permitted in outpatient observation units provided under Section 1224.39.6.

INTERIOR ENVIRONMENT

TABLE 1224.4.6.5
[OSHPD 1, 2, 3, 4 & 5] LOCATION OF NURSE CALL DEVICES
• = Required

AREA DESIGNATION	STATION TYPE	1224	1225	1226	1227	1228
Nursing Units						
Patient toilet room	B	•	•		•	
Patient bathing	B	•	•		•	
Special bathing	E	•				
Patient bed (nursing service)	P,E,C	•			•	
Patient bed (intensive care)	P,E,C	•			•	
Patient bed (LDR/LDRP)	P,E,C	•			•	
Patient bed (Dementia Unit)	P	•	•		•	
Patient bed (SNF/ICF)	P	•	•		•	
NICU	E,C	•			•	
Nursery	E,C	•			•	
Support Areas						
Nurse/control station	M	•	•	•	•	•
Medication preparation room	D	•			•	
Soiled workroom/utility/holding	D	•			•	
Clean workroom/utility/holding	D	•			•	
Diagnostic and Treatment Areas						
Seclusion room or vestibule	E	•				•
Emergency exam, treatment, triage rooms	P,E	•			•	
Operating room/Cesarean	E,C	•		•	•	
Delivery room/Birthing room	E,C	•		•	•	
Observation unit bed/gurney	P,E,C	•			•	
Pre-op patient care	P,E,C	•		•	•	
Post-op patient care/PACU	P,E,C	•		•	•	
Imaging exam/procedure room	E,C	•		•	•	
Procedure Room, including Endoscopy	E,C	•		•	•	
Patient toilet room	B	•		• ¹	•	
Electroconvulsive therapy	E,C	•			•	•

Station Types

P = Patient Station, B = Bath Station, E = Staff Emergency, C = Code Call, M = Master, D = Duty

1. Not required for Primary Care, Chronic Dialysis, Rehabilitation or Psychology Clinics.

1224.4.4.5 Nourishment area or room. Nourishment areas or rooms required in patient care areas shall include the following:

1. Sink
2. Work counter
3. Refrigerator
4. Storage cabinets
5. Equipment for hot and cold nourishment between scheduled meals.
6. The nourishment shall include space for trays and dishes used for nonscheduled meal service.
7. Provisions and space shall be included for separate temporary storage of unused and soiled dietary trays not picked up at mealtime.

8. Handwashing stations separate from the nourishment sink shall be in the nourishment area or immediately accessible without passing through a door.

1224.4.4.6 Clean utility/workroom. The clean workroom or clean supply room shall be separate from and have no connection with the soiled workroom or soiled holding room. If the room is used for preparing patient care items, it shall contain the following:

1. Work counter
2. Handwashing station
3. Storage facilities for clean and sterile supplies

1224.4.4.6.1 Clean supply room. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter or a handwashing station may be omitted.

1224.4.4.7 Soiled utility/workroom. The soiled workroom or soiled holding room shall be separate from and have no connection with either clean workrooms or clean supply rooms. The soiled utility/workroom shall contain:

1. Clinical sink (or equivalent flushing-rim fixture).
2. Handwashing station
3. Work counter
4. Space for separate covered containers for soiled linen and/or waste

1224.4.4.7.1 Soiled holding room. Rooms used only for temporary holding soiled material may omit the clinical sink and work counter. If the flushing-rim clinical sink is eliminated, facilities for cleaning bedpans shall be provided elsewhere.

1224.4.4.8 Toilet rooms. Separate toilet rooms shall be provided for the use of patients, staff and public.

1224.4.4.8.1 Staff toilets. The number of staff toilets provided in a health facility shall comply with the requirements of the California Plumbing Code, Tables 4-2 and 4-3. When staff toilet rooms are required to be dedicated to a specific Service Space, the number of staff toilet rooms provided under the California Plumbing Code shall be based on the number of staff within the specific Service Space served. Satellite service spaces do not require dedicated toilet rooms.

1224.4.4.8.2 Signage. When provided, single-user toilets shall include a door-mounted geometric symbol, as identified in Section 11B-703.7.2.6.3, Unisex toilet and bathing facilities and wall signage designating use for patients, staff or public. When existing toilet rooms are not compliant with Section 11B-603, Toilet and bathing rooms, directional signage in compliance with Section 11B-216.8, Toilet rooms and bathing rooms, shall also be provided.

Exception: Patient toilet rooms accessed directly from patient bedrooms are not required to include signage.

1224.4.5 Outpatient waiting rooms. Waiting rooms for outpatients shall provide a seating area and space for wheelchairs and have public corridor access. Public toilets, drinking fountains and telephones shall be readily accessible.

Note: One waiting area may serve more than one department or service.

1224.4.5.1 Outpatient access. Outpatient access to services shall not traverse a nursing unit.

1224.4.6 Miscellaneous requirements.

1224.4.6.1 Station outlets. Station outlets for oxygen, vacuum and medical air shall comply with Table 1224.4.6.1.

1224.4.6.2 Gas and vacuum systems. The design, installation and testing of medical gas and vacuum systems shall conform to Table 1224.4.6.1 and NFPA 99.

1224.4.6.3 Hyperbaric facilities. The design and construction of hyperbaric facilities shall conform to NFPA 99; Health Care Facilities and Section 1224.39.5.

1224.4.6.4 Laboratories. The design and construction of hospital laboratories shall conform to NFPA 99.

1224.4.6.5 Nurse call systems. The location of nurse call devices shall comply with Table 1224.4.6.5. The design of call systems shall comply with the California Electrical Code, Part 3 of Title 24.

1224.4.7 Corridors.

1224.4.7.1 Width. The minimum width of corridors and hallways shall be 8 feet (2438 mm).

Exception: Patient-care corridors and hallways in hospitals for psychiatric care of patients who are not bedridden shall have a minimum clear and unobstructed width of 6 feet (1829 mm). For the purposes of this section, bedridden patients shall be defined as patients confined to beds who would be transported or evacuated in beds or litters.

1224.4.7.2 Light traffic. Service corridors and hallways with anticipated light traffic volume for nonpatient use may be reduced to a width of 5 feet (1524 mm) if approved by the enforcing agency.

Exception: Corridors and hallways in administrative and business areas may be reduced to a width of 44 inches (1118 mm).

1224.4.7.3 Outpatient services. Outpatient clinics or outpatient departments which contain facilities for outpatient use only, such as laboratory, x-ray, physical therapy or occupational therapy, shall have a minimum corridor or hallway width of 5 feet (1524 mm). Corridors serving gurney or stretcher traffic shall comply with minimum width requirements of Section 1020.2. Outpatient clinics and outpatient departments consisting only of waiting rooms, business offices, doctor's offices and examining rooms, where there is no traffic through such area to other services or to exits from the building, shall have a minimum corridor or hallway width of 44 inches (1118 mm).

1224.4.7.4 Handrails. Corridors for patient traffic in areas providing skilled nursing, intermediate care or rehabilitation services shall be furnished with a handrail on both sides at a height not less than 30 inches (762 mm) or greater than 36 inches (914 mm).

1224.4.7.5 Connections. Corridor systems shall connect all patient rooms and basic services.

Exception: Covered pedestrian walkways connecting separate buildings are permitted for ambulatory, psychiatric or chemical dependency patients.

1224.4.7.6 Departmental boundaries. Department/service space areas shall be contiguous and include internal circulation to access each of the rooms/spaces associated with it, as identified under the specific Service Space requirements. Identifiable spaces are required for each of the indicated functions for all service areas, including their support spaces. Where the words “room” or “offices” are used, a separate, enclosed space for the one named function is intended; otherwise, the described area may be specific space in another room or common area.

Exceptions:

1. Satellite radiology, laboratory, pharmacy and physical and occupational therapy space serving inpatients may be located in nursing units and inpatient treatment areas.
2. Rooms and functional areas specifically noted under the Service Space requirements that may be shared with other units and departments.

1224.4.8 Doors and door openings.

1224.4.8.1 Toilet room doors. Doors to toilet rooms shall have an opening of not less than 32 inches (813 mm) clear in width and shall be equipped with hardware which will permit the door to swing outward or in a manner to negate the need to push against a patient who may have collapsed within the toilet room.

1224.4.8.2 Pocket doors. Pocket sliding doors are not permitted.

Exception: Administration and business areas.

1224.4.9 Windows and screens.

1224.4.9.1 Windows. Rooms approved for the housing of patients shall be provided with natural light by means of exterior glazed openings excluding clerestory windows, obscure glass and skylights, with an area not less than one tenth of the total floor area.

1224.4.9.2 Operation and sills. Patient room windows shall have sills not more than 36 inches (914 mm) above the floor. If operable windows are provided that require the use of tools or keys for operation, the tools or keys shall be located at the nurse station.

Exception: Window sills in intensive-care units may be 60 inches (1524 mm) above the floor.

1224.4.9.2.1 Airborne infection isolation or protective environment rooms. If operable windows are provided in airborne infection isolation or protective environment rooms, they shall only be operable by the use of tools or keys which shall be located at the nurse station.

1224.4.9.3 Psychiatric unit windows. Safety glass or plastic glazing materials shall be used in windows in psychiatric patient areas.

1224.4.9.4 Screens. Windows which may be frequently left in an open position shall be provided with insect screens of 16 meshes to the inch.

1224.4.9.5 Light and ventilation. All portions of a building used by patients, personnel or other persons shall be provided with artificial light and a mechanically operated ventilating system as specified in the California Electrical Code and the California Mechanical Code.

1224.4.10 Ceiling heights.

1224.4.10.1 Minimum height. The minimum height of ceilings shall be 8 feet (2438 mm).

Exception: Closet, toilet room and bathroom minimum ceiling heights and soffits over fixed cabinets and work surfaces, shall not be less than 7 feet (2134 mm).

1224.4.10.2 Minimum height with fixed ceiling equipment. Operating rooms, emergency rooms, delivery rooms, radiographic rooms and other rooms containing ceiling-mounted, major fixed equipment or ceiling-mounted surgical light fixtures shall have ceiling heights to accommodate the equipment or fixtures and their normal movement. Suspended tracks, rails and pipes located in the traffic path for patients in beds and/or on stretchers, including those in inpatient service areas, shall be not less than 7 feet (2134 mm) above the floor.

Exception: Mobile suspended tracks such as traverse rails for overhead patient lifts that may be moved out of the traffic path shall provide a clearance of not less than 6 feet, 8 inches (2032 mm) above the floor when in use.

1224.4.11 Interior finishes. For imaging, examination/treatment, procedure and operating rooms, also see Table 1224.4.11.4a.

1224.4.11.1 Floor finishes. Floor finishes shall be smooth, waterproof and durable. Flooring surfaces shall provide smooth transitions between different floor materials. Slip-resistant flooring products shall be used for flooring surfaces in wet areas (e.g., kitchens, shower and bath areas), ramps, stairways, entries from exterior to interior space and other areas as determined by the functional program. Joints for floor openings for pipes, ducts and conduits shall be tightly sealed. Joints of structural elements shall be similarly sealed.

Exception: Upon written appropriate documented requests, the licensing agency may grant approval of the installation of carpets. See Table 1224.4.11.

1224.4.11.1.1 Coved base. Resilient flooring, if used in toilet and bathing rooms, shall be continuous and extend upward onto the wall at least 5 inches (127 mm) to minimize moisture infiltration. Wood bases are prohibited except in waiting areas and administration departments.

**TABLE 1224.4.11
ACCEPTABLE CEILING AND CARPET LOCATIONS**

AREAS/ROOMS ^{3,4}	GENERAL ACUTE CARE HOSPITAL CEILING/CARPET		ACUTE PSYCHIATRIC HOSPITAL CEILING/CARPET		SKILLED NURSING AND INTERMEDIATE-CARE FACILITIES CEILING/CARPET		CLINIC CEILING/CARPET	
Patient bedrooms	3	*	3	*	3	*	—	—
Patient corridors/hallways	3	*	3	*	3	*	3	*
Airborne infection isolation rooms	2	N	2	N	2	N	2	N
Protective environment rooms	1	N	1	N	1	N	-	-
Nurse or administration station	3	Y	3	Y	3	Y	3	Y
Utility rooms	2	N	2	N	2	N	2	N
Surgical units ²	2	N	—	—	—	—	2	N
Operation rooms	1	N	—	—	—	—	1	N
Surgical corridors/hallways	2	N	—	—	—	—	2	N
Recovery	3	N	—	—	—	—	3	N
Radiological unit ²	3	*	3	*	—	—	3	—
X-ray rooms ¹	3	N	3	N	—	—	3	N
Treatment rooms ²	2	N	3	N	2	N	2	N
Examination rooms	3	*	3	*	3	*	3	*
Administration	4	Y	4	Y	4	Y	4	Y
Central sterile supply	2	N	2	N	2	N	2	N
Clinical laboratories	3	N	3	N	—	—	3	N
Pharmacy	3	*	3	*	3	*	3	*
Morgue and autopsies	3	N	—	—	—	—	—	—
General storage rooms	3	N	3	N	3	N	3	N
Housekeeping rooms	2	N	2	N	2	N	2	N
Laundry	1 ⁵	N	1 ⁵	N	1 ⁵	N	—	—
Soiled linen	2	N	3	N	3	N	3	N
Clean linen	3	N	3	N	3	N	3	N
Kitchens	1 ⁵	N	1 ⁵	N	1 ⁵	N	1 ⁵	N
Dining rooms	3	*	3	*	3	*	3	*
Dishwasher rooms	2	N	2	N	2	N	2	N
Dietary day storage	2	N	2	N	2	N	—	—
Catheterization laboratory	1	N	—	—	—	—	—	—
Chronic dialysis	3	*	—	—	—	—	3	*
Coronary care	3	*	—	—	—	—	—	—
Dental	3	*	—	—	—	—	3	*
Hydrotherapy	2	N	2	N	2	N	2	N
Intensive-care nursery	3	*	—	—	—	—	—	—
Intensive care	3	*	—	—	—	—	—	—
Occupational therapy	3	*	3	*	3	*	3	*
Obstetrical unit ²	3	*	—	—	—	—	—	—
Delivery rooms	1	N	—	—	—	—	—	—
Labor rooms, LDRP and LDR	3	N	—	—	—	—	—	—
Nurseries	3	N	—	—	—	—	—	—
Physical therapy	3	*	3	*	3	*	3	*
Radiation therapy	3	*	—	—	—	—	3	*
Speech pathology and audiology	3	Y	3	Y	3	Y	3	Y

Ceilings:

1 – Continuous monolithic surface equal in smoothness to enamel plaster.

2 – Smooth and easily cleanable without perforations or fissures.

3 – Pin perforated, fine fissured or lightly textured.

4 – Any finish meeting code requirements.

Carpets:

Yes = Y

No = N

* Upon approval by the licensing agency with adequate maintenance procedure. However, should the carpet not be maintained adequately, the licensing agency has the right to have it removed and replaced with another acceptable material.

Footnotes:

1. Carpet permitted in mammography.

2. Except those rooms specified otherwise.

3. For rooms not listed, contact the Office of Statewide Health Planning and Development (OSHPD).

4. Table applies to new construction, additions, remodels and conversions. The patching and replacement of existing materials will be permitted.

5. Lay-in ceiling meeting the requirements of Section 1224.4.11.4.1.7 may be substituted in laundry and kitchens.

INTERIOR ENVIRONMENT

**TABLE 1224.4.11.4a
EXAMINATION/TREATMENT, IMAGING, PROCEDURE AND OPERATING ROOM CLASSIFICATION^{1, 2}**

ROOM	USE	ROOM TYPE	LOCATION	SURFACES
<i>Exam or treatment room</i>	<i>Patient care that may require high-level disinfection or sterile instruments but does not require the environmental controls of a procedure room</i>	<i>Unrestricted area</i>	<i>Accessed from an unrestricted area</i>	<i>Flooring: cleanable and wear-resistant for the location; stable, firm and slip-resistant Wall finishes: washable Ceiling: cleanable with routine housekeeping equipment; lay-in ceiling permitted</i>
<i>Class 1 imaging room</i>	<i>Diagnostic radiology, fluoroscopy, mammography, computed tomography (CT), ultrasound, magnetic resonance imaging (MRI) and other imaging modalities. Services that use natural orifice entry and do not pierce or penetrate natural protective membranes</i>			
<i>Procedure room</i>	<i>Patient care that requires high-level disinfection of the room, sterile instruments and some environmental controls but does not require the environmental controls of an operating room. Endoscopic procedures</i>	<i>Semi-restricted area</i>	<i>Accessed from an unrestricted or a semi-restricted area</i>	<i>Flooring: cleanable and wear-resistant for the location; stable, firm and slip-resistant Floor and wall base assemblies: monolithic floor with integral coved wall base carried up the wall a minimum of 6 inches Wall finishes: washable; free of fissures, open joints or crevices Ceiling: smooth and without crevices, scrubbable, non-absorptive, non-perforated; capable of withstanding cleaning chemicals; lay-in ceiling permitted if gasketed or each ceiling tile weighs at least 1 pound per square foot and no perforated, tegular, serrated or highly textured tiles</i>
<i>Class 2 imaging room</i>	<i>Diagnostic and therapeutic procedures such as coronary, neurological or peripheral angiography. Electrophysiology procedures</i>			
<i>Operating room</i>	<i>Invasive procedures³ or any procedure during which the patient will require physiological monitoring and is anticipated to require active life support</i>	<i>Restricted area</i>	<i>Accessed from a semi-restricted area</i>	<i>Flooring: cleanable and wear-resistant for the location, stable, firm and slip-resistant Floor and wall assemblies: monolithic floor with integral coved wall base carried up the wall a minimum of 6 inches Wall finishes: washable; free of fissures, open joints or crevices Ceiling: monolithic, scrubbable, capable of withstanding cleaning and/or disinfecting chemical, gasketed access openings</i>
<i>Class 3 imaging room</i>	<i>Invasive procedures³ or any Class 2 procedure during which the patient will require physiological monitoring and is anticipated to require active life support</i>			

1. This table includes a brief description of the services performed in these room types and a summary of some applicable requirements that appear elsewhere in the California Building Code.
2. Other requirements that apply to these room types include, but are not limited to, ventilation, lighting and sound transmission requirements. See California Mechanical Code Table 4-A and ASHRAE 170 for ventilation requirements. See California Electrical Code, Article 517 for lighting and power requirements. See California Building Code Table 1224.4.19 for noise transmission requirements.
3. "Invasive procedure" is defined in Section 1224.3 definitions.

1224.4.11.1.2 Food preparation areas. Floors in areas used for food preparation and assembly shall be water-resistant. Floor surfaces, including tile joints, shall be resistant to food acids. Floor construction in dietary and food preparation areas shall be free of spaces that can harbor pests.

1224.4.11.1.3 Wet cleaning. In all areas subject to frequent wet-cleaning methods, flooring materials shall not be physically affected by germicidal or other types of cleaning solutions.

1224.4.11.1.4 Airborne infection isolation, airborne infection isolation exam/treatment and protective environment rooms. These rooms and anterooms shall have seamless flooring with integral coved base.

1224.4.11.2 Wall bases.

1224.4.11.2.1 Material. The material and textures of bases and the installation thereof shall be such as to minimize dust-catching surfaces, moisture, infiltration and the harboring of vermin.

Exception: In locations where carpet is permitted as a floor finish material, the use of carpeted base (coved or strip base) up to a maximum height of 5 inches (127 mm) is also permissible.

1224.4.11.2.2 Wet cleaning. Floor and wall base assemblies in the following rooms shall be monolithic and have an integral coved wall base that is carried up the wall a minimum of 6 inches (150 mm) and is tightly sealed to the wall:

1. Operating rooms
2. Interventional imaging rooms, including cardiac catheterization labs
3. Cesarean delivery rooms
4. Cystoscopy, urology and minor surgical procedure rooms
5. Endoscopy procedure rooms
6. Endoscopy instrument processing rooms
7. IV and chemotherapy preparation rooms
8. Airborne infection isolation (AII) rooms
9. Protective environment (PE) rooms
10. Anterooms to AII and PE rooms, where provided
11. Cast rooms

The floors and wall bases of kitchens, soiled and clean utility rooms, housekeeping rooms with mop sinks, patient, public and staff sanitary facilities and other areas subject to frequent wet cleaning, shall also be homogeneous, nonabsorbent, smooth, easily cleaned and not physically affected by germicidal cleaning solutions, but may have tightly sealed joints and shall be constructed without voids at the intersection of floor and wall surfaces.

1224.4.11.3 Wall finishes. Wall finishes shall comply with the following requirements:

1. Wall finishes shall be washable. In the vicinity of plumbing fixtures, wall finishes shall be smooth, scrubbable and water-resistant.
2. Wall finishes in areas such as operating rooms, delivery rooms and trauma rooms shall be monolithic, scrubbable and able to withstand cleaning with chemicals.
3. Wall finishes in operating rooms, cesarean delivery rooms, isolation rooms and sterile processing rooms shall be free of fissures, open joints or crevices that may retain or permit passage of dirt particles.
4. Wall finishes in areas such as clean corridors, central sterile supply spaces, specialized radiographic rooms and minor surgical procedure rooms shall be washable, smooth and able to withstand cleaning with chemicals.
5. Wall areas penetrated by pipes, ducts and conduits shall be tightly sealed to minimize entry of rodents and insects. Joints of structural elements shall be similarly sealed.
6. Wall finish requirements of Section 1224.4.11.3 do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

1224.4.11.3.1 Dietary and food preparation areas. Dietary and food preparation areas shall comply with the following requirements:

1. In dietary and food preparation areas, wall construction, finish and trim, including the joints between the walls and the floors, shall be free of spaces that can harbor insects and rodents.
2. Wall surfaces in wet areas (e.g., kitchens, environmental services closets) shall be monolithic and all seams shall be covered and/or sealed.

1224.4.11.4 Ceilings. Ceilings in areas occupied by patients and the public shall be cleanable with the use of routine housekeeping equipment. Acoustic and lay-in ceiling, where used, shall not create ledges or crevices.

1224.4.11.4.1 Ceiling finishes. Ceiling finishes shall comply with Table 1224.4.11, Table 1224.4.11.4.1a and the following requirements:

Semirestricted areas:

1. Ceiling finishes in semirestricted areas such as airborne infection isolation exam/treatment rooms, surgical corridors, central sterile supply spaces and minor surgical procedure rooms, shall be nonabsorptive, nonperforated, capable of withstanding cleaning with chemicals, and without crev-

ices that can harbor mold and bacterial growth.

2. If a lay-in ceiling is provided in semi-restricted areas, it shall be gasketed or each ceiling tile shall weigh at least one pound per square foot to prevent the passage of particles from the cavity above the ceiling plane into the semirestricted environment. Perforated, tegular, serrated cut or highly textured tiles are not acceptable.

Restricted areas:

3. Ceilings in restricted areas shall be monolithic with no cracks or perforations.
4. Ceilings in restricted areas shall be scrubable and able to withstand cleaning and/or disinfecting chemicals.
5. All access openings in restricted area ceilings shall be gasketed.

Dietary and laundry areas:

6. Provide either a sealed monolithic and scrubable gypsum board ceiling or a lay-in ceiling.
7. If a lay-in ceiling is provided, it shall include the following:
 - a) A rust-free grid.
 - b) Ceiling tiles that weigh at least one pound per square foot and are smooth, scrubable, nonabsorptive, nonperforated and able to withstand cleaning with chemicals.
8. Ceiling finish requirements of Section 1224.4.11.4.1 do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

1224.4.12 Courts. Where one or more walls of a court contain a door or window of one or more patients' bedrooms, the least dimension of the court shall be 20 feet (6096 mm) between facing structures.

1224.4.13 Elevators.

1224.4.13.1 Patient. Patient elevators shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm), and a minimum clear door opening of 4 feet 0 inches (1219 mm).

1224.4.13.2 Passenger. Passenger elevators shall have minimum inside platform dimensions of 4 feet 8 inches by 7 feet 4 inches (1422 mm by 2236 mm).

1224.4.13.3 Patient services. Buildings over one story in height with accommodations or services for patients on floors without grade-level entrance shall provide at least one patient elevator.

1224.4.13.4 Low patient capacity. If bed patients are accommodated on one or more floors, other than the

main entrance floor or where operating rooms or delivery rooms are above or below the main entrance floor, at least one patient elevator shall be provided.

1224.4.13.5 Medium patient capacity. At least one patient elevator and one service elevator shall be provided in hospitals with a capacity of from 60 to 149 beds on floors other than the main entrance floor.

1224.4.13.6 High patient capacity. At least one patient elevator, one passenger elevator and one service elevator shall be provided in hospitals with a capacity of 150 or more beds on floors other than the main entrance floor.

1224.4.14 Garbage, solid waste and trash storage. Rooms or screening enclosures shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash and other solid wastes. Such rooms or screening enclosures shall include the following:

1. A concrete floor with a curb and with a drain connected to the sewer.
2. Steam or hot-water and cold-water supply.
3. A minimum floor area of $1/2$ square foot (0.046 m²) per bed, but not less than 25 square feet (2.3 m²), the least dimension of which shall be 4 feet (1219 mm).
4. A method of limiting access to the material except by authorized persons.

1224.4.15 Housekeeping room. This room shall be a minimum floor area of 15 square feet (1.4 m²). It shall contain a service sink or floor receptor and provisions for storage of supplies and housekeeping equipment.

1224.4.16 Laundry and trash chutes. Gravity-type laundry and trash chutes shall have a minimum diameter of 2 feet (610 mm) and shall be designed to prevent distribution of airborne contaminating elements to all floors served.

1224.4.17 Telephone. Each floor accommodating patients shall have a telephone installed for patient use. Such telephones shall be readily accessible to patients who are limited to wheel chairs and stretchers. This may not be required in separate buildings having six or fewer beds which are restricted to occupancy by ambulatory patients.

1224.4.18 Grab bars. Each toilet, bathtub and shower serving patients in rooms not required to provide mobility features, shall have conveniently placed grab bars that shall comply with Chapter 11B, Sections 11B-609.2, 11B-609.3, 11B-609.5, 11B-609.6 and 11B-609.8.

Exception: Excluding facilities designed for use by persons with disabilities, grab bars may be deleted from those facilities serving chemical dependency recovery and psychiatric patients.

1224.4.19 Noise control.

1224.19.1 Impact noises. Recreation rooms, exercise rooms, equipment rooms and similar spaces where impact noises may be generated, shall not be located directly over patient bed areas or delivery and operat-

ing suites, unless special provisions are made to minimize such noise.

1224.19.2 Noise reduction. The noise reduction criteria shown in Table 1224.4.19 shall apply to partitions, floors and ceiling construction in patient areas.

**TABLE 1224.4.19
SOUND TRANSMISSION LIMITATIONS IN HOSPITALS**

NEW CONSTRUCTION	AIRBORNE SOUND TRANSMISSION CLASS (STC) ¹	
	Partitions	Floors
Patient room to patient room	45	50
Public space to patient room ³	50	40
Service areas to patient room ⁴	60	45
Patient room access corridor ⁵	35	45
Exam room to corridor	35	
Exam room to exam room	50 ²	
Exam room to public space ³	50	
Treatment room to room	50	
Treatment room to corridor	35	
Toilet room to public space ³	45	
Consultation rooms/conference rooms to public space	50	
Consultation rooms/conference rooms to patient rooms	50	
Consultation room to corridor	35	
Patient room to MRI room	60	
Exam room to MRI room	60	
Public space to MRI room	50	
Staff lounges to patient rooms	45	

1. Sound Transmission Class (STC) shall be determined by tests in accordance with methods set forth in ASTM 90 and ASTM 413. Where partitions do not extend to the structure above, sound transmission through ceilings and composite STC performance shall be considered.
2. Treatment rooms shall be treated the same as patient rooms. STC rating may be reduced to 40 dBA for rooms with electronic masking. Electronic masking shall provide a maximum background level of 48 dBA.
3. Public space includes corridors (except patient room access corridors), lobbies, dining rooms, recreation rooms and similar space.
4. Service areas for the purposes of this table include kitchens, elevators, elevator machine rooms, laundries, garages, maintenance rooms, boiler and mechanical equipment rooms and similar spaces of high noise. Mechanical equipment located on the same floor or above patient rooms, offices, nurse stations and similar occupied space shall be effectively isolated from the floor.
5. Patient room access corridors contain composite walls with doors/windows and have direct access to patient rooms.
6. Renovation projects of existing spaces where the existing function is not changed, are not required to comply with the requirements of Table 1224.4.19.

1224.5 Communications Systems. Technology and medical communication rooms shall comply with the California Electrical Code, California Mechanical Code, California Plumbing Code and the requirements of this section.

1224.5.1 Telecommunications service entrance room. The telecommunications service entrance room houses

the point at which outside carrier data and voice circuits and services enter the facility and outdoor cabling interfaces with the building's internal cabling infrastructure. Each hospital facility shall have at least one telecommunications service entrance room, and each room that is provided shall be dedicated to the telecommunications function with related support facilities and meet the requirements of this section.

1224.5.2 Technology equipment center.

1224.5.2.1 Number. Each hospital shall have at least one technology equipment center space that is not used for any purpose other than electronic data storage, processing and networking.

1224.5.2.2 Size. The technology equipment center shall be sized to provide space to meet the service requirements for the required equipment.

1224.5.2.3 Location. The technology equipment center shall be located to minimize the risk of water damage, both from internal and external sources. The technology equipment center shall be located above any floodways or flood hazard areas as described in the National Flood Insurance Program.

1224.5.3 Technology distribution room.

1224.5.3.1 Number. There shall be a minimum of one technology distribution room on each floor of the facility.

Exception: For existing facilities not undergoing major renovation, a technology distribution room may serve adjacent floors.

1224.5.3.2 Size.

1. Technology distribution rooms shall be sized based on the area of the floor being served, with minimum clear dimensions as follows:

Area Served in Square Feet (m ²)	Minimum Technology Distribution Room Size
≤ 8,000 square feet (740 m ²)	10 feet by 10 feet (3.05 m by 3.05 m)
8,001 – 15,000 square feet (1400 m ²)	10 feet by 12 feet (3.05 m by 3.66 m)
15,001 – 25,000 square feet (2325 m ²)	10 feet by 14 feet (3.05 m by 4.27 m)
> 25,000 square feet (2325 m ²)	12 feet by 14 feet (3.66 m by 4.27 m)

2. Where ceilings are provided, the minimum clear height shall be 9 feet (2.75 m).

Exception: Existing buildings shall be permitted to have a minimum clear height of 8 feet (2.44 m).

1224.5.3.3 Location. Technology distribution rooms shall be provided throughout the facility as necessary to meet the maximum cable distance requirement for the cabling system specified.

1224.5.4 SPC/NPC compliance. The location of spaces required by this section shall meet the requirements of

California Existing Building Code, Section 310A, Compliance Alternatives for Services/Systems and Utilities.

1224.5.5 Access. Access to the spaces required by this section shall be controlled and not require passage through patient-care or sterile space.

1224.5.6 Combining spaces. The combining of the telecommunications service entrance room, technology equipment center and technology distribution room shall be permitted, provided that the requirements for each of the individual spaces are met.

BASIC SERVICES

1224.6 Reserved

1224.7 Reserved

1224.8 Reserved

1224.9 Reserved

1224.10 Reserved

1224.11 Reserved

1224.12 Reserved

1224.13 Reserved

1224.14 NURSING SERVICE SPACE.

1224.14.1 Patient rooms.

1224.14.1.1 Capacity. No patient room shall be designed to accommodate more than four beds.

Exception: Where renovation of existing individual patient rooms is undertaken in facilities built under the 2013, or prior, California Building Code, maximum room capacity shall be no more than the present capacity, to a maximum of eight patients per patient room. Placement of beds shall not be more than three deep from the exterior window.

1224.14.1.2 Space requirements. In new construction, patient rooms shall have a minimum of 100 square feet (9.29 m²) of clear floor area per bed in multiple-bed rooms and 120 square feet (11.15 m²) of clear floor area for single-bed rooms. The dimensions and arrangement of rooms shall be such that there is a minimum of 3 feet (914 mm) between the sides and foot of the bed and any wall or any other fixed obstruction. In multiple-bed rooms, a minimum clearance of 3 feet (914 mm) shall be provided between beds and a clearance of 4 feet (1219 mm) shall be available at the foot of each bed to permit the passage of equipment and beds.

Exception: Where renovation of existing patient rooms is undertaken in facilities built under the 2001 or prior California Building Code, patient rooms shall have no less than 80 square feet (7.43 m²) of clear floor area per bed in multiple-bed rooms and 110 square feet. (10.22 m²) of clear floor area in single-bed rooms.

1224.14.1.3 Windows. Each patient room shall have a window in accordance with Section 1224.4.9.

1224.14.1.4 Arrangement. Patient rooms shall not be designed to permit the placement of beds more than three deep from the exterior window, but shall be of such shape and dimensions to allow for the performance of routine functions, including the easy transfer of patients to and from bed to wheelchair or wheeled gurney.

1224.14.1.5 Outside exposure. All patient bedrooms shall have an outside exposure and shall not be below ground level.

1224.14.1.6 Handwashing stations. A handwashing station shall be provided in the patient room. This handwashing station shall be located at or adjacent to the entrance to the patient room with unobstructed access for use by health care personnel and others entering and leaving the room. Water spouts used shall have clearances adequate to avoid contaminating utensils and the contents of carafes, etc. In multiple-bed rooms the handwashing station shall be located outside of the patient's cubicle curtain so that it is immediately accessible to staff. Where renovation of patient rooms is undertaken a handwashing station shall be located in the patient toilet room or patient room.

1224.14.1.7 Toilet room. Each patient shall have access to a toilet room without having to enter the general corridor area. One toilet room shall serve no more than four beds and no more than two patient rooms. The toilet room shall contain a water closet and a lavatory and the door shall swing outward or be double acting. Unless located in a toilet room, bedpan-washing fixtures shall be installed in dedicated rooms, separate from patient care areas.

1224.14.1.8 Patient storage. Each patient shall have within his or her room a separate wardrobe, locker or closet suitable for hanging full-length garments and for storing personal effects.

1224.14.1.9 Privacy. A method of assuring visual privacy for each patient shall be maintained in patient rooms and in tub, shower and toilet rooms. Windows or doors within a normal sightline that would permit observation into the room shall be arranged or curtailed as necessary for patient privacy. In multiple-bed rooms, visual privacy from casual observation by other patients and visitors shall be provided for each patient. The design for privacy shall not restrict patient access to the entrance, lavatory or toilet room.

1224.14.1.10 Grab bars. Grab bars shall be installed in accordance with Section 1224.4.18.

1224.14.1.11 Room identification. Each patient room shall be labeled with an identification number, letter or combination of the two.

1224.14.2 Support areas. The size and location of each support area will depend upon the numbers and types of beds served. If it has direct access to the unit, some support areas may be arranged and located to serve more than one nursing unit as indicated below, but, unless noted

otherwise, at least one such support area shall be provided on each nursing floor.

1224.14.2.1 Nurse station(s). Nurse station(s) shall be provided in each nursing unit and shall comply with Section 1224.4.4.2.

1224.14.2.2 Nurse or supervisor office. A nurse or supervisor office shall be provided and may be shared between adjacent nursing units on the same floor.

1224.14.2.3 Toilet room(s) for staff use. Staff toilet rooms may be shared between adjacent nursing units on the same floor.

1224.14.2.4 Multipurpose room(s) Multipurpose rooms shall be provided for staff, patients, patients' families for patient conferences, reports, education, training sessions and consultation. These rooms must be readily accessible to each nursing unit. One such room may serve several nursing units and/or departments.

1224.14.2.5 Examination or treatment room(s). Examination or treatment rooms are optional. If provided, provision shall be made to preserve patient privacy from observation from outside the exam room through an open door.

1224.14.2.6 Clean utility/workroom. Clean utility/workroom shall be provided and shall comply with Section 1224.4.4.6.

1224.14.2.7 Soiled workroom or soiled holding room. A soiled workroom or soiled holding room shall be provided and shall comply with Section 1224.4.4.7.

1224.14.2.8 Medication station. A medication station shall be provided in each nursing unit and shall comply with Section 1224.4.4.4.

1224.14.2.9 Clean linen storage. Each nursing unit shall contain a designated area for clean linen storage. This may be within the clean utility room or a separate closet.

1224.14.2.10 Nourishment area. A nourishment area or room shall be provided for each nursing unit and shall comply with Section 1224.4.4.5.

1224.14.2.11 Ice machine. Each nursing unit shall have equipment to provide ice for treatments and nourishment. Ice making equipment may be in the clean utility room/holding room or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

1224.14.2.12 Equipment storage room. Appropriate room(s) shall be provided for storage of equipment necessary for patient care with not less than 10 square feet (0.93 m²) per patient bed.

1224.14.2.13 Gurneys and wheelchairs. Provide a storage room or alcove for gurneys and wheelchairs which shall be a minimum of 15 square feet (1.39 m²).

1224.14.2.14 Centralized bathing facilities. When individual bathing facilities are not provided in patient rooms, there shall be at least one shower and/or bath-

tub for each 12 beds without such facilities. Each bathtub or shower shall be in an individual room or enclosure that provides privacy for bathing, drying and dressing. Each centralized bathing facility shall have direct access to a patient toilet and handwashing fixture.

1224.14.2.15 Special bathing facilities. If provided, special bathing facilities for patients on gurneys, carts and wheelchairs shall include space for an attendant.

1224.14.2.16 Patient toilet room(s). Common patient toilet room(s), in addition to those serving bed areas, shall be located adjacent to multipurpose room(s) and within, or directly accessible to each central bathing facility.

1224.14.2.17 Emergency equipment storage. Space shall be provided for emergency equipment that is under direct control of the nursing staff, such as a cardiopulmonary resuscitation (CPR) cart. This space shall be directly accessible from the nursing station, but out of normal traffic.

1224.14.2.18 Housekeeping room. Housekeeping rooms may be shared between adjacent compatible nursing units.

1224.14.2.19 Grab bars. Grab bars shall be installed in accordance with Section 1224.4.18.

1224.14.3 Airborne infection isolation rooms.

1224.14.3.1 General. Single rooms shall be provided for the isolation of patients with airborne communicable disease at a ratio of one room for each 35 licensed beds, and for each major fraction thereof. At least one airborne infection isolation room shall be provided. Airborne infection isolation rooms shall be labeled with the words "Airborne Infection Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

Exceptions:

1. Acute psychiatric hospitals shall provide airborne infection isolation rooms at the ratio of one room for each 50 beds, or major fraction thereof.
2. Airborne infection isolation rooms are not required for chemical dependency recovery services.

1224.14.3.2 Anteroom doors. Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

1224.14.3.3 Anteroom. A separate anteroom shall be provided between the airborne infection isolation room and the corridor, which shall constitute the primary entrance to the airborne infection isolation room. This anteroom shall have a handwashing station, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the isolation room and means to allow for airflow from the anteroom into the airborne infection isolation room. Doors shall be aligned to allow large equipment to be

wheeled into the airborne infection isolation room unless a secondary door complying with Section 1224.14.3.2 is provided. One anteroom may serve no more than two airborne infection isolation rooms.

1224.14.3.4 Secondary entry. When a secondary entry is provided, the secondary doors shall be provided with locking devices which are readily operable from the room side and which are readily operable by the facility staff on the other side. When key locks are used on isolation rooms, keys shall be located at the nurse station in a prominent readily accessible location.

1224.14.3.5 Sealed-tight room. Airborne infection isolation room perimeter walls, ceilings, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

1224.14.3.6 Adjoining toilet room. Each isolation room shall have its own directly accessible toilet room with an emergency nurse call system, a lavatory, a shower providing a seat or a space for a shower chair and a toilet equipped with a bedpan flushing attachment with a vacuum breaker.

1224.14.4 Protective environment room(s).

1224.14.4.1 General. Protective environment rooms for the protection of certain immunosuppressed patients may be provided by the facility. Protective environment rooms shall be labeled “Protective Environment Room” on or adjacent to the anteroom side of the door between the isolation room and the anteroom. Protective environment rooms shall contain only one bed.

1224.14.4.2 Anteroom doors. Protective environment room (s) shall have self-closing and latching devices on all anteroom doors.

1224.14.4.3 Anteroom. A separate anteroom shall be provided between the protective environment room and the corridor, hallway or adjoining space which shall constitute the only entrance to the protective environment room. This anteroom shall have a handwashing station, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the protective environment room. There shall be means to allow for airflow from the protective environment room into the anteroom. Anteroom doors shall be aligned so that large equipment can be wheeled into the protective environment room. One anteroom may serve no more than one protective environment room.

Exception: Alternate designs for protective environment rooms, without individual anterooms, may be approved by the enforcement agency when it can be demonstrated that the alternate design meets the requirements of the California Mechanical Code and does not compromise or alter any health or fire protection component, assembly or system.

1224.14.4.4 Adjoining toilet room. Room shall meet the requirements of Section 1224.14.3.6.

1224.14.4.5 Sealed-tight room. Protective environment room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

1224.14.5 Seclusion room(s). If provided, the hospital shall provide one or more single bedrooms for patients needing close supervision for medical and/or psychiatric care. This may be part of the psychiatric unit described in Section 1224.31. If the single bedroom(s) is part of the acute-care nursing unit, the provisions of Section 1224.14.1 shall apply, with the following exceptions: each room shall be for single occupancy; each shall be located to permit staff observation of the entrance, preferably adjacent to the nurse station; and each shall be designed to minimize the potential for escape, hiding, injury or suicide. If vision panels are used for observation of patients, the arrangement shall insure patient privacy and prevent casual observation by visitors and other patients.

1224.15 SURGICAL SERVICE SPACE.

1224.15.1 General. The surgical service space shall be divided into two designated areas: 1) semi-restricted areas (e.g., storage areas for clean and sterile supplies, sterile processing rooms, scrub stations and corridors leading to restricted areas of the surgical suite, etc.); and 2) restricted areas (e.g., operating rooms, hybrid operating rooms, sterile procedure rooms, cardiac catheterization labs, sterile cores, etc.) that can be reached only through a semi-restricted area. The surgical service space shall be located and arranged to provide direct support from the anesthesia/recovery service space with a common door to prevent nonrelated traffic through the surgical service space.

An operating room suite design with a sterile core shall provide for no cross traffic of staff and supplies from the decontaminated/soiled areas to the sterile/clean areas. The use of facilities outside the operating room for soiled/decontaminated processing and clean assembly and sterile processing shall be designed to move the flow of goods and personnel from dirty to clean/sterile without compromising universal precautions or aseptic techniques in either department.

The number of operating rooms and recovery beds, and the sizes of the support areas, shall be based on the expected surgical workload. Hospitals shall maintain at least the number of operating rooms in ratio to licensed bed capacity as follows:

Licensed Bed Capacity	Number of Operating Rooms
Less than 25	One
25 to 99	Two
100 or more	Three

For each additional 100 beds, and for each major fraction thereof, at least one additional operating room shall be maintained, unless approved to the contrary by the Department of Public Health. Required operating rooms are in addition to special operating rooms, cys-

toscopy rooms and fracture rooms which are provided by the hospital. Beds in a distinct-part skilled nursing service, intermediate care service or psychiatric unit shall be excluded from calculating the number of operating rooms required.

Exception: Surgical service space is not required in a rural general acute care hospital, if the hospital maintains written transfer agreements with one or more general acute care hospitals that provide surgical and anesthesia services. Written transfer agreements shall be approved by the Department of Public Health, Licensing and Certification.

1224.15.2 Surgery.

1224.15.2.1 General operating room(s). Each room shall have a minimum clear floor area of 400 square feet (37.16 m²) with a minimum of 20 feet (6096 mm) clear dimension between fixed cabinets and built-in shelves; and a system for emergency communication with the surgical service space control station. X-ray or imaging viewing capabilities shall be provided.

Exception: Where renovation of existing operating rooms is undertaken in facilities built under the 2001 or prior California Building Code, each operating room shall have a minimum clear floor area of 324 square feet (30.10 m²) with a minimum of 18 feet (5486 mm) clear dimension between fixed cabinets and built-in shelves.

1224.15.2.2 Procedure room(s). Where a procedure room is provided, it shall comply with Section 1224.4.4.1.4 unless specified elsewhere.

1224.15.2.2.1 Surgical cystoscopic and other endourologic procedures. Each room shall have a minimum clear floor area of 250 square feet (23.23 m²) with a minimum of 15 feet (4572 mm) clear dimension between fixed cabinets and built-in shelves. X-ray viewing and/or other imaging modality capabilities shall be provided

Exception: Where renovation of operating rooms is undertaken in facilities built under the 2001 or prior California Building Code rooms for surgical cystoscopy shall have a minimum clear floor area of 180 square feet (16.72 m²). Cast rooms for open reductions, if provided, shall have a minimum clear floor area of 180 square feet (16.72 m²), no dimension of which shall be less than 11 feet (3353 mm).

1224.15.3 Service areas. Services, except for the enclosed soiled workroom referenced in Section 1224.15.3.7 and the housekeeping room referenced in Section 1224.15.3.12, may be shared with the obstetrical facilities. Service areas, when shared with delivery rooms, shall be designed to avoid the passing of patients or staff between the operating room and the delivery room areas. The following shall be provided in support of the surgical service space:

1224.15.3.1 Control station. Control stations shall be located to permit visual observation of all traffic into the surgical service space.

1224.15.3.2 Supervisor’s office or station.

1224.15.3.3 Sub-sterile areas. If provided within the surgery suite, a sub-sterile area(s) shall be equipped with a flash sterilizer, warming cabinet, countertop and handwashing station. If a sterilizing facility(ies) with high-speed sterilizer(s) or other sterilizing equipment for immediate or emergency use are provided, they shall be directly accessible from the operating room(s) it serves or shall be located inside the clean core if the clean core is directly accessible from the operating room(s). This room shall be accessible without traveling through any operating room. Other facilities for processing and sterilizing reusable instruments, etc., may be located in another hospital department such as central sterile supply.

1224.15.3.4 Medication station. A medication station shall be provided in accordance with Section 1224.4.4.4.

1224.15.3.5 Scrub facilities. Scrub sinks shall be located outside of sterile areas. A minimum of two scrub sinks shall be provided in a surgical unit containing one operating room. Four scrub sinks shall be provided in surgical units containing two operating rooms. One additional scrub sink shall be provided for each additional operating room. Scrub sinks shall have water supply controls not requiring direct contact of the hands for operation.

1224.15.3.6 Clock. A direct-wired or battery-operated clock or other equivalent timing device shall be visible from the scrub-up sinks.

1224.15.3.7 Soiled workroom. An enclosed soiled workroom (or soiled holding room that is part of a system for the collection and disposal of soiled material) for the exclusive use of the surgical service space shall be provided. The soiled workroom shall contain a flushing-rim clinical sink or equivalent flushing-rim fixture, a handwashing station, a work counter and space for waste receptacles and soiled linen receptacles. Rooms used only for temporary holding of soiled material may omit the flushing-rim clinical sink and work counters. However, if the flushing-rim clinical sink is omitted, other provisions for disposal of liquid waste shall be provided. The room shall not have direct connection with operating rooms. Soiled and clean utility room or holding rooms shall be separated. The soiled workroom shall provide 24 square feet (2.23 m²) per operating room up to eight operating rooms and shall have a minimum area of 48 square feet (4.46 m²), with no dimension less than 6 feet (1829 mm).

1224.15.3.8 Clean utility room. This room shall not be used for food preparation.

A clean utility room is required when clean materials are assembled within the surgical service space prior to use or following the decontamination cycle. It shall contain a work counter, a handwashing station, storage facilities for clean supplies and a space to package reusable items. The storage for sterile supplies must be separated from this space. If the room is used only for storage and holding as part of a system for distribution

of clean supply materials, the work counter and hand-washing station may be omitted. Soiled and clean utility rooms or holding rooms shall be separated.

1224.15.3.9 Anesthesia workroom. Provide an anesthesia workroom for cleaning, testing and storing anesthesia equipment. This room shall contain work counter(s) and sink(s) and racks for cylinders.

1224.15.3.10 Equipment storage room(s) for equipment and supplies used in surgical service space. Each surgical service space shall provide sufficient storage area to keep its required corridor width free of equipment and supplies, but not less than 150 square feet (13.94 m²) or 50 square feet (4.65 m²) per operating room, whichever is greater.

1224.15.3.11 Staff clothing change areas. Appropriate areas shall be provided for male and female staff working within the surgical service space. The areas shall contain lockers, showers, toilets, handwashing stations and space for donning surgical attire. These areas shall be arranged to ensure a traffic pattern so that personnel entering from unrestricted area outside the surgical service space enter, change their clothing and move directly into the surgical service space semi-restricted corridor.

1224.15.3.12 Housekeeping room. Shall be provided for the exclusive use of the surgical service space. It shall be directly accessible from the service space.

1224.16 ANESTHESIA/RECOVERY SERVICE SPACE.

1224.16.1 General. The anesthesia/recovery service space shall provide perioperative support services to the surgical service space as required under this section. Perioperative services shall include preoperative patient care and post-operative recovery with a Post-Anesthesia Care Unit (PACU). The anesthesia/recovery service space shall be located adjacent to the surgical service space with direct access to the surgical suite's semi-restricted corridor.

Exception: In a rural general acute care hospital, when the surgical service space is not provided, the anesthesia service space is not required. The hospital must maintain written transfer agreements with one or more general acute care hospitals that provide surgical and anesthesia services. Written transfer agreements shall be approved by the Department of Public Health, Licensing and Certification.

1224.16.2 Preoperative patient holding area(s). In facilities with two or more operating rooms, area(s) with patient care stations shall be provided to accommodate gurney patients or sitting space for ambulatory patients not requiring gurneys. The preoperative area is an unrestricted area and shall be under the direct visual control of the nursing staff and may be part of the recovery space. If the preoperative patient care area will serve other purposes, such as overflow PACU or holding area, applicable requirements in Section 1224.16.3 PACU shall be met.

1224.16.2.1 Space requirements. Each station shall have a minimum clear floor area of 80 square feet (7.43 m²) and a minimum clearance of 3 feet (914 mm) shall be provided between the sides and foot of patient

lounge chairs/gurneys and adjacent walls, partitions or fixed elements.

1224.16.2.2 Patient privacy. Provisions for patient privacy such as cubicle curtains shall be made.

1224.16.2.3 Handwashing stations. Handwashing station(s) shall be provided in the preoperative service area at a ratio of one for each 4 stations, and for each major fraction thereof, in open bay areas. A handwashing station shall be provided in each single care station room.

1224.16.3 Recovery and Post-Anesthesia Care Unit (PACU). The recovery area and Post-Anesthesia Care Unit is an unrestricted area and located such that at least one door to the recovery room shall provide access directly from the surgical service space without crossing unrestricted corridors. A minimum of 1.5, or major fraction thereof, post-anesthesia care stations per operating room shall be provided. If pediatric surgery is provided, pediatric recovery stations shall be provided. They shall be separate from adult stations, and shall include space for family or visitors and be visible from the nurse station.

1224.16.3.1 Space requirements. A minimum of 4 feet (1218 mm) clearance shall be provided between the sides and the foot of patient gurneys or beds and adjacent walls or other fixed elements. A minimum clear floor area of 80 square feet (7.43 m²) shall be provided for each station in an open-bay plan. A minimum clearance of 5 feet (1524 mm) shall be provided between sides of gurneys or beds, and a minimum of 3 feet (914 mm) clearance shall be provided between the foot of the gurney or bed, to a closed cubicle curtain. A minimum width of 6 feet (1829 mm) of access/circulation outside the curtain shall be provided. See Patient Bay under Patient Care Locations in Section 1224.3.

1224.16.3.2 Patient privacy. Provisions for patient privacy such as cubicle curtains shall be made.

1224.16.3.3 Handwashing stations. Handwashing stations shall be provided in the post-anesthesia care unit with at least one for every four patient positions, and for each major fraction thereof, uniformly distributed to provide equal access from each patient station. A handwashing station shall be provided in each single care station room.

1224.16.4 Reserved.

1224.16.5 Support areas for patient care.

1224.16.5.1 Nurse station. A nurse station shall be provided in postoperative patient care areas, and shall allow direct observation of the patients and charting facilities. The nurse station shall comply with the requirements of Section 1224.4.4.2.

1224.16.5.2 Clinical sink. A clinical sink shall be provided in postoperative patient care areas with provisions for bedpan cleaning.

1224.16.5.3 Medication station. Each Post-Anesthesia Care Unit shall contain a medication station. The med-

ication station shall comply with the requirements of Section 1224.4.4.4.

1224.16.5.4 Ice-making. Ice-making equipment shall be provided in the perioperative service space. Ice-making equipment is permitted to be located in preoperative or postoperative patient care areas, however, it shall not be located in semi-restricted areas.

1224.16.5.5 Storage. Storage shall be provided for gurneys, supplies and equipment.

1224.16.6 Support areas for staff. Staff toilet rooms shall be immediately accessible to the postoperative patient care area(s) to maintain staff availability to patients.

1224.16.7 Support areas for patients, families and visitors.

1224.16.7.1 Waiting area. A waiting area, in compliance with Section 1224.4.5, shall be provided.

1224.16.7.2 Patient change area. A changing area shall be provided for outpatient use in perioperative areas in support of surgical suites that provide outpatient procedures. The changing area shall include space for changing or gowning, provisions for storing patients' belongings during the procedure, and access to patient toilet(s).

1224.17 CLINICAL LABORATORY SERVICE SPACE.

1224.17.1 General requirements. All hospitals shall provide space and equipment to perform urinalysis, complete blood counts, hemoglobin blood typing and cross matching. If laboratory facilities for bacteriological, serological, pathological and additional hematological procedures are not available in the community, then space, equipment and supplies for such procedures shall be provided.

1224.17.2 Laboratory work areas. The following laboratory work areas shall be provided:

1224.17.2.1 Laboratory workstation(s). Space shall be provided to accommodate equipment used and, at minimum, shall include a laboratory work counter and a sink. All work counter(s) in areas used for specimen handling, preparation of specimens or reagents, and laboratory testing shall be constructed of nonporous materials. Access to the following shall be provided as required:

1. Tele/data service.
2. Electrical service.
3. Computer/printer.

1224.17.2.2 Handwashing station(s).

1224.17.2.2.1. If there is one work station, a handwashing station shall be provided at the workstation.

1224.17.2.2.2. If more than one work station is provided, a handwashing station shall be provided within 25 feet (762 mm) of all testing and specimen-handling areas.

1224.17.2.2.3. A handwashing station shall be provided in each enclosed room where bio-hazardous specimens and/or hazardous chemicals are handled.

1224.17.2.3 Refrigerated storage facilities. Refrigerated blood storage facilities for transfusions shall be provided. Blood storage refrigerators shall be equipped with temperature-monitoring and alarm signals that are monitored continuously.

1224.17.2.4 Storage facilities.

1. Storage for reagents, specimens, flammable materials, acids, bases and other supplies shall be provided as necessary.
2. Separate facilities shall be provided for such incompatible materials as acids and bases.
3. Vented storage shall be provided for volatile solvents.

1224.17.2.5 Terminal sterilization. Facilities and equipment may be provided for terminal sterilization of bio-hazardous waste before transport (autoclave or electric oven).

Notes:

1. Terminal sterilization is not required for waste that is incinerated on-site.
2. Terminal sterilization is subject to other state and federal regulatory requirements.

Exception: Terminal sterilization facilities are not required when it can be demonstrated to the licensing agency that transport and terminal sterilization can be effectively contracted to an independent medical waste treatment facility.

1224.17.2.6 Radioactive material handling. If radioactive materials are employed, facilities for long-term storage and disposal of these materials shall be provided.

1224.17.3 Specimen collection facilities.

1224.17.3.1 General. Space shall be provided for specimen collection. Facilities for this function shall be located outside the laboratory work area.

1224.17.3.2 Facility requirements. At a minimum, specimen collection facilities shall have the following:

1. A blood collection area with a work counter, space for patient seating, handwashing station(s) and supply storage.
2. A urine and feces collection facility equipped with a toilet and a handwashing station.
3. Storage spaces for specimen collection supplies.
4. Work counters for labeling and computerized data entry.
5. Storage for specimens awaiting pickup.

1224.17.4 Administrative areas. Office(s) and space for clerical work, filing and record maintenance and storage shall be provided.

1224.18 RADIOLOGICAL/DIAGNOSTIC IMAGING SERVICE SPACE. Space and equipment shall be provided to accommodate all required elements, and any additional imaging modalities included in the service space, as required in this section. To differentiate the design and construction requirements needed to achieve the environmental controls and other requirements that support the amount of intervention to be provided, imaging rooms shall be classified as described in Table 1224.4.11.4a (Examination/Treatment, Imaging, Procedure and Operating Room Classification). Where an imaging room will be used for Class 1 and Class 2 procedures, the more stringent requirements for the higher class room shall apply. Where imaging procedures meeting Class 3 criteria are performed, rooms that meet the requirements for the applicable imaging suite and for an operating room per Section 1224.15.2.1 or hybrid operating room per Section 1224.28.5 shall be provided. If Class 3 interventional or image-guided procedures are performed in the imaging services area, additional provisions shall be as described in Section 1224.28 Supplemental Surgery and other Special Procedure Services. If nuclear medicine is provided in the imaging services area, spaces shall also comply with the requirements described in Section 1224.34 Nuclear Medicine.

1224.18.1 Minimum requirements. Hospital shall provide a minimum of:

1. One fluoroscopy room or CT room on approval of Licensing Agency, which can also provide x-ray examination services.
2. Space for processing or viewing images.
3. A toilet room shall adjoin and be directly accessible to each fluoroscopy room. In addition to the fluoroscopy toilet rooms, common patient toilet room facilities shall be located in the radiological/diagnostic imaging service space.
4. An office or other suitable area for viewing and reporting radiographic examination.
5. Storage spaces for all image equipment, supplies and copies of reports.
6. Handwashing stations located within the unit.
 - a) Handwashing station(s) shall be provided within the unit to serve imaging spaces not served by a dedicated handwashing station within the imaging room or scrub facility located directly outside the imaging/procedure room.
 - b) A handwashing station shall be provided in Class 1 imaging rooms, unless specified otherwise for a specific imaging modality.
 - c) A handwashing station or hand scrub facility shall be provided for Class 2 imaging rooms. If a handwashing station is provided, it shall be directly accessible to the imaging room. If a hand scrub facility is provided, it shall be directly outside the entrance to the imaging room.
 - d) Hand scrub facilities shall be provided directly outside the entrance to a Class 3 imaging room.
7. Dressing room facilities.

1224.18.1.1 Radiation protection. A certified physicist or other qualified expert shall specify the type, location and amount of radiation protection to be installed in accordance with the final approved department layout and equipment selections. Where protected alcoves with view windows are required, a minimum of 1'-6" (0.45 meter) between the view window and the outside partition edge shall be provided. Radiation protection requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5 and Subchapter 4.

1. The control alcove or room shall be, at minimum, sized and configured in compliance with the manufacturer's recommendations for installation, service and maintenance.
2. A control alcove or room shall be permitted to serve more than one imaging room, provided the manufacturer's recommendations for installation, service and maintenance are accommodated for all rooms served.
3. The control alcove or room shall include a shielded view window, as specified in the physicist's report, designed to provide a full view of the examination/procedure table and the patient at all times, including a full view of the patient during imaging activities (e.g., when the table is tilted or the chest x-ray is in use).
4. The control room shall be physically separated from a Class 2 or Class 3 imaging room with walls and a door.
5. Where an imaging room requires positive (or negative) pressure, a door shall be provided between the control room and the imaging room.

1224.18.1.2 Multiple-modality devices. Where two or more individual imaging or therapy modalities are integrated into one imaging device (e.g., PET/CT, SPECT/CT or PET/MRI), the minimum requirements for that room shall include the criteria for each individual contributing modality. Refer to Section 1224.34 for modalities not included under Section 1224.18.

1224.18.2 Angiography. If provided, diagnostic angiography space shall accommodate the following:

1. A control room with a view window to permit full view of the patient.
2. A scrub sink located outside the staff entry to the procedure room.
3. Patient holding area shall accommodate at least one patient gurney with a minimum of 3-foot (914 mm) clearance on the long side.
4. Storage for portable equipment and catheters shall be provided.

1224.18.2.1 Interventional angiography procedures. If interventional angiography procedures are to be performed in the angiography room, the suite shall comply

with interventional imaging requirements in Section 1224.28.4. If cardiac catheterization procedures are performed refer to Section 1224.28.2.

1224.18.3 Computerized tomography (CT) scanning. If provided, CT space shall accommodate the following:

1224.18.3.1 Spaces required. If provided, CT scan spaces shall accommodate the equipment with a minimum of 3 feet (914 mm) on all sides of the equipment, together with the following:

1. A control room or alcove shall be provided that is designed to accommodate the computer and other controls for the equipment. A view window shall be provided to permit view of the patient.
2. A patient toilet room readily accessible to the procedure room.

1224.18.3.2 Intraoperative computerized tomography. If provided, intraoperative CT scanning spaces shall comply with Section 1224.28.5.

1224.18.4 Magnetic resonance imaging (MRI). If provided, the MRI room shall accommodate the equipment with a minimum of 3 feet (914 mm) on all sides of the equipment, together with the following:

1. A control room shall be provided with full view of the patient in the MRI scanner. The control console shall be positioned so the operator has a full view of the approach and entrance to the MRI scanner room.
2. An anteroom or area visible from the control room shall be located outside the MRI scanner room so that patients, health care personnel and other employees must pass through it before entering the scanning area and control room. The room or area shall be outside the restricted areas of the MRI's magnetic field.
3. Safety Zones One through Four shall be identified.
 - a) Zone One consists of all areas freely accessible to the general public. This zone includes the entrance to the MR facility.
 - b) Zone Two acts as a buffer between Zone One and the more restrictive Zone Three. Patients are under the general supervision of MR personnel. Zone Two may include the reception area, dressing room and interview room.
 - c) Zone Three should be restricted by a physical barrier. The MR control room and/or computer room are located within Zone Three.
 - d) Zone Four is strictly the area within the walls of the MR scanner room. Access into the MR scanner room should only be available by passing through Zone Three.
4. An imaging equipment room shall be provided if needed for the operation of the MRI.

1224.18.4.1 Handwashing station. Handwashing station(s) shall be immediately accessible to the MRI scanner room.

1224.18.4.2 Wall, floor and ceiling assemblies. Wall, floor and ceiling assemblies shall accommodate the installation of required radio frequency (RF)-shielded assemblies. All doors, windows and penetrations into the RF-shielded enclosure shall be RF-shielded. As well as RF shielding, individual sites may also require magnetic shielding on some or all surfaces to contain portions of the magnetic field not contained by the RF shield.

1224.18.4.3 Lighted sign. MRI rooms shall be clearly marked with a red light and lighted sign stating, "The Magnet Is On". This light and sign are to be lighted at all times and have a backup energy source to remain illuminated for at least 24 hours in the event of a loss of power.

1224.18.4.4 Magnetic field strength identification. Facilities shall use finishes or markings to identify the critical values of the magnetic field surrounding the MRI scanner, including the 5-gauss exclusion zone or other magnetic field strength values that may impair the operation of equipment.

1224.18.4.5 Special ventilation requirements. Where superconducting MRI scanners are installed, an insulated cryogen quench exhaust pipe as well as room exhaust and pressure equalization shall be provided to protect occupants in the event of a cryogen breach.

1224.18.4.6 Intraoperative magnetic resonance imaging. If provided, the intraoperative magnetic resonance imaging (iMRI) suite shall comply with Section 1224.28.5.

1224.18.5 Ultrasound. When provided, the ultrasound room shall comply with the following:

1224.18.5.1 Space requirements.

1. Area. Rooms used for ultrasound examination/treatment shall have a minimum clear floor area of 120 square feet (11.15 m²).
2. Clearances. A minimum clear dimension of 3 feet (914 mm) shall be provided on three sides of the table/stretcher.

1224.18.5.2 Handwashing station. A handwashing station shall be provided within the exam room.

1224.18.5.3 Patient toilet(s). A patient toilet shall be directly accessible to the ultrasound exam room. The patient toilet may be permitted to serve more than one ultrasound exam room. If exams performed are limited to cardiology, vascular, breast ultrasound or used only for image guided procedures, then the toilet is not required to have direct access.

1224.18.5.4 Processing room. If provided, a processing room shall contain distinct areas for cleaning and decontaminating instruments. The cleaning area shall

provide for flow of instruments from the contaminated area to the clean area and then to storage.

1224.18.5.4.1 The decontamination area shall be equipped with the following:

1. One freestanding handwashing station.
2. Work counter space(s).
3. Separate storage room or cabinets for HLD probes.

1224.18.6 Mammography. When provided, the mammography room shall comply with the following:

1224.18.6.1 Space requirements.

1. Area. Mammography rooms shall be a minimum of 100 square feet (9.3 m²).
2. Shielded alcove. Each x-ray room shall include a shielded control alcove. For mammography machines with built-in shielding for the operator, omission of the alcove shall be permitted when approved by the certified physicist.

1224.18.6.2 Handwashing station. A handwashing station shall be provided within the procedure room.

1224.18.7 Support spaces. The following spaces are common to the imaging service area and are minimum requirements unless stated otherwise:

1224.18.7.1 Patient's toilet room(s). In service spaces with procedure rooms that do not have dedicated patient toilets, provide a minimum of one patient toilet room within the service space.

1224.18.7.2 Patient dressing areas. Dressing areas shall be provided adjacent to the imaging rooms.

1224.18.7.3 Staff facilities. In service space of three or more procedure rooms, staff toilet room(s) internal to the service space shall be provided.

1224.18.7.4 Film storage (active). If film systems are used, provide the following:

1. A room with cabinet or shelves for filing patient film for immediate retrieval shall be provided.
2. Storage facilities for unexposed film which shall include protection of film against exposure or damage.

1224.18.7.5 Locked storage. Provision shall be made for locked storage of medications and drugs.

1224.19 PHARMACEUTICAL SERVICE SPACE

1224.19.1 General. Facilities shall be provided to accommodate services and equipment associated with the drug distribution system used, the number of patients to be served, and the extent of shared or purchased services as licensed by the California Board of Pharmacy. Hospital pharmacies shall comply with the requirements of Section 1250 and include the functional spaces under Sections 1224.19.2 through 1224.19.7. Exempt hospitals shall provide a drug room and the supporting spaces, in compliance with Section 1224.19.1.2.

1224.19.1.1 Licensed pharmacy. All hospitals having a licensed capacity of 100 or more beds shall have a pharmacy on the premises licensed by the California Board of Pharmacy.

Note: See General Acute Care Hospitals §70263(a), Article 3, Chapter 1, Division 5, Title 22, California Code of Regulations, for requirements concerning hospitals with fewer than 100 beds. The pharmacy room or service space shall conform to the requirements of § 1751, Article 7, Division 17, Title 16, California Code of Regulations as enforced by the California Board of Pharmacy.

1224.19.1.2 Less than 100-bed exemption. Hospitals under a Hospital Pharmacy Permit Exemption issued by the Board of Pharmacy, associated with Business and Professions Code Section 4056, shall provide all basic pharmaceutical services in compliance with Section 1224.19.1.2.

1224.19.1.2.1 Drug room. Licensed pharmaceutical space with drug distribution shall be under the supervision of a physician and be monitored by a pharmacist consultant. The drug room shall include the following:

1224.19.1.2.1.1. A room or area for receiving, breakout and inventory control of drugs used in the hospital.

1224.19.1.2.1.2. Cleanable work counters and space for automated and/or manual dispensing activities.

1224.19.1.2.1.3. Reserved.

1224.19.1.2.1.4. An area for reviewing and recording.

1224.19.1.2.1.5. An area for storage, exchange and restocking of carts.

1224.19.1.2.1.6. Security provisions for drugs and personnel in the dispensing counter area.

1224.19.1.2.2 Handwashing station. A hand-washing station shall be provided in the area where medication(s) are handled or be immediately accessible, without going through a door unless the door is equipped with hands-free operation.

1224.19.1.2.3 Storage. Cabinets, shelves and/or separate rooms or closets shall be provided for the following:

1224.19.1.2.3.1. Bulk storage.

1224.19.1.2.3.2. Active storage.

1224.19.1.2.3.3. Refrigerated storage.

1224.19.1.2.3.4. Storage for volatile fluids and alcohol in accordance with applicable fire safety codes for the substances involved.

1224.19.1.2.3.5. Secured lockable storage for controlled drugs.

1224.19.1.2.3.6. Equipment and supply storage for general supplies and equipment not in use.

1224.19.2 Pharmacy areas.

1224.19.2.1 Dispensing facilities. Hospital pharmacies shall provide the following areas for patient-specific compounding and dose repackaging of non-sterile preparations.

1224.19.2.1.1 Receiving. A room or area for receiving, breakout and inventory control of materials used in the pharmacy.

1224.19.2.1.1.1 Size. A minimum of 120 square feet (11.15 m²) shall be provided.

1224.19.2.1.2 Dispensing. Work counters and space for automated and/or manual dispensing activities shall be provided to serve the volume of doses per day for in-patient and out-patient needs.

1224.19.2.1.3 Non-sterile compounding areas. An extemporaneous compounding/dose repackaging area shall be located next to bulk storage and include the following:

1224.19.2.1.3.1 Size. Work stations shall have sufficient counter space for drug preparation, with a minimum area of 120 square feet (11.15 m²) per station.

1224.19.2.1.3.2 Handwashing station. Handwashing station(s) shall be in or immediately accessible to all areas where pharmaceuticals are handled without going through a door unless the door is equipped with hands-free operation.

1224.19.2.1.3.3 Utility sink. A utility sink shall be provided.

1224.19.2.1.3.4. If carousel or analogous robotic technologies are used, the area shall respond to the special system requirements.

1224.19.2.1.4 Recording. An area for reviewing and recording shall be provided. The area shall include counter space and electronic workstation(s).

1224.19.2.1.5 Temporary storage. An area for temporary storage, exchange and restocking of carts.

1224.19.2.1.6 Security. Security provisions shall be provided for drugs and personnel in the dispensing counter area.

1224.19.2.3 Storage. The following storage facilities shall be provided in the pharmaceutical service area.

1224.19.2.3.1 Bulk storage. A separate bulk storage area, or room, may be provided.

1224.19.2.3.2 Active storage. Active storage in support of repackaging and dispensing activities shall be provided.

1224.19.2.3.3 Refrigerated storage. Refrigeration/freezer area shall be provided.

1224.19.2.3.4 Hazardous materials. Storage for volatile fluids and alcohol shall comply with Section 307.

1224.19.2.3.5 Secured storage. Secured lockable storage shall be provided for narcotics and controlled drugs.

1224.19.2.3.6 Equipment and supplies. Equipment and supply storage for general supplies and equipment not in use.

1224.19.3 Sterile compounding areas.

1224.19.3.1 General. If sterile compounding areas are provided, the requirements in this section shall be met. Buffer rooms (also known as clean rooms) and their anterooms, and Segregated Compounding Areas (SCA) are classified as semi-restricted areas. The pharmacy shall be laid out to preclude unrelated traffic to hazardous and nonhazardous preparation rooms. The buffer room, anteroom and SCA must be separated from areas not directly related to compounding and must be appropriately controlled to achieve and maintain required air quality classifications. A monitoring system shall be used in a cleanroom suite to continuously monitor the pressure differential between the anteroom(s) and buffer room(s) and between the ante-room and the general pharmacy area. Sterile compounding areas in hospitals shall comply with Sections 1735 and 1751 in Article 4.5 of Division 17 of Title 16 of the California Code of Regulations and US Pharmacopeia (USP) Chapters 797 and 800, and the requirements in this section.

Note: Where robotic systems are used in the preparation of IV solutions in either the positive pressure nonhazardous preparation room or the negative pressure hazardous prep room, the robotics shall be separate systems and not pass through from one area to the other.

1224.19.3.2 Nonhazardous sterile preparation area. If IV solutions are prepared in the pharmacy, a sterile compounding work area with a laminar airflow workstation designed for product protection shall be provided in accordance with Title 16, Section 1735, and USP Chapter 797 and include the following.

1224.19.3.2.1 Workstation. The Primary Engineering Control (PEC) shall be a laminar airflow work bench or isolator (CAI) as required. The workstation shall have a visible pressure gauge for detection of filter leaks or defects. All exposed sides of the workstation shall be accessible for cleaning and allow for reach behind the unit if not built against a wall. If built against a wall, the space behind the unit shall be sealed to prevent intrusion of moisture, contaminants and bacteria growth.

1224.19.3.2.2 Buffer room. Workstations shall be located in a Secondary Engineering Control (SEC) room. The SEC shall be a buffer/clean room, with the following requirements:

1224.19.3.2.2.1 Size. The minimum size for a non-hazardous buffer room is 120 square feet (11.15 m²) for a single workstation, and 75 square feet (6.97 m²) for each additional workstation.

1224.19.3.2.2.2 Air quality. Nonhazardous buffer rooms shall be sealed tight, and be under positive pressure relative to the anteroom. Air supply shall be laminar airflow with a low-level return. Refer to California Mechanical Code Table 4A, Title 16 Section 1735 and USP Chapter 797 for additional requirements.

1224.19.3.2.2.3 Finishes. The buffer room is considered a semi-restricted area with non-porous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless, impervious, free from cracks and crevices and be non-shedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Junctures of ceilings to walls shall be covered or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems shall be recessed, covered, easily cleanable and of a type suitable for a cleanroom environment. Wall finishes shall be 2-coat epoxy-covered gypsum board, seamless vinyl or other impervious covering. Work surfaces, shelving and cabinets shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic, so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

1224.19.3.2.2.4 Eyewash station. If provided in the buffer room, the eyewash station shall be located just inside the door from the anteroom, and must be dry, unless in use. Drains are not permitted in the buffer room.

1224.19.3.2.2.5 Sealed tight room. Room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other rooms. Buffer room doors shall be glass, metal or other phenolic material, self-closing and with hands-free door operation. Normal operation may include automatic door controls sequencing such that only the buffer room door or the anteroom door is open at one time. Egress provisions shall not be impeded.

1224.19.3.2.2.6. If a pass-through is used, both doors shall not be capable of being open at the same time, and the doors should be interlocking.

1224.19.3.2.3 Anteroom. Nonhazardous buffer rooms shall be accessed through an anteroom with the following requirements:

1224.19.3.2.3.1 Size. The anteroom shall be of adequate size to accommodate a demarked area for donning and doffing, and anticipated staging of carts and supplies. The minimum size for the anteroom is 120 square feet (11.15 m²).

Note: A common anteroom may be shared between hazardous and nonhazardous buffer rooms. The anteroom must comply with both 1224.19.3.2.3 and 1224.19.3.3.3, provide a minimum of 5 feet (1524 mm) between the buffer room doors, and provide automatic door controls sequencing such that only one of the buffer room doors may be open at one time. Egress provisions shall not be impeded.

1224.19.3.2.3.2 Air quality. Nonhazardous anterooms shall be under negative pressure relative to the buffer room and positive pressure relative to nonrestricted areas. Refer to California Mechanical Code Table 4A, Title 16 Section 1735 and USP Chapter 797 for additional requirements.

1224.19.3.2.3.3 Handwashing station. A handwashing station, with hands-free controls and nonrefillable closed soap dispensing system, providing support for scrubbing up to the elbows, shall be located in the anteroom.

1224.19.3.2.3.4 Eyewash station. An eyewash station shall be provided in the anteroom if one is not provided in the buffer room.

1224.19.3.2.3.5 Housekeeping. Dedicated environmental services, materials and supplies for the buffer room and the anteroom shall be located in the anteroom.

1224.19.3.2.3.6 Finishes. The anteroom room is considered a semi-restricted area with non-porous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless, impervious, free from cracks and crevices and be non-shedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Junctures of ceilings to walls shall be covered or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems shall be recessed, covered, easily cleanable and of a type suitable for a cleanroom environment. Wall finishes shall be 2-coat epoxy-covered gypsum board, seamless vinyl or other impervious covering. Work surfaces, shelving and cabinets shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

1224.19.3.2.3.7 Sealed tight room. Room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other rooms. Buffer room doors shall be glass, metal or other phenolic material, self-closing and with hands-free door operation.

1224.19.3.2.4 Segregated Compounding Area (SCA). When provided in lieu of a buffer/clean room and anteroom, a segregated compounding area, with a limitation on permitted compounded sterile preparations and allowable time of use, shall comply with the requirements of Title 16, Section 1735 and USP Chapter 797. The SCA shall include the PEC and extend to a line of demarcation between the PEC and other surrounding areas with a minimum clearance of 3.281 feet (1 meter) between the PEC and the line of demarcation.

1224.19.3.2.4.1 Air quality. Nonhazardous Segregated Compounding Areas shall provide airflow from clean to less clean areas. Refer to California Mechanical Code Table 4A, Title 16 Section 1735 and USP Chapter 797 for additional requirements.

1224.19.3.2.4.2 Handwashing station. A handwashing station, with hands-free controls and nonrefillable closed soap dispensing system, providing support for scrubbing up to the elbows, shall be located in the SCA with a minimum clearance of 3.281 feet (1 meter) between the rim of the sink and the PEC.

1224.19.3.2.4.3 Finishes. The segregated compounding area is considered a semi-restricted area with nonporous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless, impervious, free from cracks and crevices and be non-shedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Junc-tures of ceilings to walls shall be coved or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems shall be recessed, covered and easily cleanable. Wall finishes shall be 2-coat epoxy-covered gypsum board, seamless vinyl or other impervious covering. Work surfaces, shelving and cabinets shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

1224.19.3.3 Hazardous sterile preparation room. If hazardous drugs are used in compounding activities, a separate room shall be provided for preparation of hazardous admixtures in accordance with Title 16, Sections 1735 and 1751 and USP Chapters 797 and 800.

1224.19.3.3.1 Workstation. The Primary Engineering Control (PEC) shall be a negative pressure biological safety cabinet or isolator (CACI) as required. The workstation shall have an exhaust to the outside with a visible pressure gauge for detection of filter leaks or defects. All exposed sides of the workstation shall be accessible for cleaning and

allow for reach behind the unit if not built against a wall. If built against a wall, the space behind the unit shall be sealed to prevent intrusion of moisture, contaminants and bacteria growth.

1224.19.3.3.2 Buffer room. Workstations shall be located in a Secondary Engineering Control (SEC) room. The SEC shall be a buffer/clean room, with the following requirements:

1224.19.3.3.2.1 Size. The minimum size for a non-hazardous buffer room is 130 square feet (12.08 m²) for a single workstation, and a minimum of 75 square feet (6.97 m²) for each additional workstation.

1224.19.3.3.2.2 Air quality. Hazardous buffer rooms shall be sealed tight and be under negative pressure relative to the anteroom. Air supply shall be laminar airflow with a low-level return. Refer to California Mechanical Code Table 4A, Title 16 Section 1751 and USP Chapter 800 for additional requirements.

1224.19.3.3.2.3 Finishes. The buffer room is considered a semirestricted area with nonporous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless and impervious, free from cracks and crevices and be non-shedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Junc-ture of ceilings to wall shall be coved or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems shall be recessed, covered, easily cleanable and of a type suitable for a cleanroom environment. Wall finishes shall be 2-coat epoxy covered gypsum board, seamless vinyl or other impervious covering. Work surfaces, shelving and cabinets shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

1224.19.3.3.2.4 Eyewash station. If provided in the buffer room, the eyewash station shall be located just inside the door from the anteroom, a minimum clearance of 3.281 feet (1 meter) from the PEC, and must be dry, unless in use. Drains are not permitted in the buffer room.

1224.19.3.3.2.5 Refrigerator. Refrigerated storage may be provided in the negative pressure buffer room. Clearance around the refrigerator shall be accessible for cleaning.

1224.19.3.3.2.6 Doffing area. An area for doffing with a hamper shall be demarked inside the buffer/clean room at the door to the anteroom.

1224.19.3.3.2.7 Sealed tight room. Room perimeter walls, ceiling, floors, doors and penetrations

shall be sealed tightly to minimize air infiltration from the outside or from other rooms. Buffer room doors shall be glass, metal or other phenolic material, self-closing and with hands-free door operation. Normal operation may include automatic door controls sequencing such that only the buffer room door or the anteroom door is open at one time. Egress provisions shall not be impeded.

1224.19.3.3.2.8 Pass-throughs. If a pass-through is used between the buffer and anteroom, both doors should not be capable of being open at the same time, and the doors should be interlocking. A pass-through is not permitted between the hazardous drug buffer room and any unclassified area.

1224.19.3.3.2.9 Housekeeping. Dedicated environmental services, materials and supplies shall be located in the buffer room.

1224.19.3.3.3 Anteroom. Hazardous buffer rooms shall be accessed through an anteroom with the following requirements:

1224.19.3.3.3.1 Size. The anteroom shall be of adequate size to accommodate a demarked area for donning and doffing, and anticipated staging of carts and supplies. The minimum size for the anteroom is 120 square feet (11.15 m²).

Note: A common anteroom may be shared between hazardous and nonhazardous buffer rooms. Refer to note under Section 1224.19.3.2.3.1.

1224.19.3.3.3.2 Air quality. Hazardous anterooms shall be under positive pressure relative to the buffer room and positive pressure relative to nonrestricted areas. Refer to California Mechanical Code Table 4A, Title 16 Section 1751 and USP Chapter 800 for additional requirements.

1224.19.3.3.3.3 Handwashing station. A handwashing station with hands-free controls and nonrefillable closed soap dispensing system, providing support for scrubbing up to the elbows, shall be located in the anteroom, with a minimum clearance of 3.281 feet (1 meter) between the rim of the sink and the door opening to the buffer room.

1224.19.3.3.3.4 Eyewash station. An eyewash station shall be provided in the anteroom if one is not provided in the buffer room.

1224.19.3.3.3.5 Housekeeping. Dedicated environmental services, materials and supplies shall be located in the anteroom.

1224.19.3.3.3.6 Finishes. The anteroom is considered a semi-restricted area with nonporous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless and impervi-

ous, free from cracks and crevices and be nonshedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Juncture of ceilings to wall shall be coved or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems shall be recessed, covered, easily cleanable and of a type suitable for a cleanroom environment. Wall finishes shall be 2-coat epoxy-covered gypsum board, seamless vinyl or other impervious covering. Work surfaces, shelving and cabinets shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

1224.19.3.3.3.7 Sealed tight room. Room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other rooms. Buffer room doors shall be glass, metal or other phenolic material, self-closing and with hands-free door operation.

1224.19.3.3.4 Segregated Compounding Area (SCA). When provided in lieu of a buffer/clean room and anteroom, a segregated compounding area, with a limitation on permitted compounded sterile preparations and allowable time of use, shall comply with the requirements of Title 16 Section 1751 and USP Chapter 800. The SCA shall include the PEC and be located in a negative pressure room dedicated to this use.

1224.19.3.3.4.1 Air quality. Hazardous Segregated Compounding Areas shall be under negative pressure and provide airflow from clean to less clean areas. Refer to California Mechanical Code Table 4A, Title 16 Section 1735 and USP Chapter 797 for additional requirements.

1224.19.3.3.4.2 Handwashing station. A handwashing station, with hands-free controls and nonrefillable closed soap dispensing system, providing support for scrubbing up to the elbows, shall be located in the SCA with a minimum clearance of 3.281 feet (1 meter) between the rim of the sink and the PEC.

1224.19.3.3.4.3 Finishes. The segregated compounding area is considered a semi-restricted area with nonporous and cleanable surfaces, ceilings, walls and floors subject to wet cleaning. The surfaces of ceilings, walls, floors, fixtures, shelving, counters and cabinets shall be smooth, seamless, impervious, free from cracks and crevices and be nonshedding. Ceilings shall be monolithic or utilize cleanroom style scrubbable and gasketed panels, able to withstand cleaning with chemicals. Juncture of ceilings to wall shall be coved or caulked to avoid cracks and crevices where dirt can accumulate. Sprinkler systems

shall be recessed, covered and easily cleanable. Wall finishes shall be 2-coat epoxy-covered gypsum board, seamless vinyl or other impervious covering. Work surfaces shall be constructed of smooth, impervious materials, such as stainless steel or molded plastic so that they are easily cleaned and disinfected. Plastic laminate finish over a pervious substrate is not permitted.

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1224.19.6 Support areas for the pharmacy.

1224.19.6.1 Access to information.

1224.19.6.1.1 Patient information. Provisions shall be made for cross-checking medication and drug profiles of individual patients.

1224.19.6.1.2 Pharmacological information. Provisions shall be made for access to poison control, reaction data and drug information.

1224.19.6.2 Office. A separate room shall be provided for the Chief Pharmacist's office.

1224.19.6.3 Education and training. A multipurpose room shared with other departments shall be permitted to serve this purpose.

1224.19.6.4 Outpatient medication consultation. If medication is dispensed to outpatients from the hospital pharmacy, an area for consultation and patient education shall be provided.

1224.19.6.5 Additional equipment and supply storage. If a dose procedure is used, additional space and equipment shall be provided to accommodate supplies, packaging, labeling and storage, including space for carts.

1224.19.7 Support areas for staff.

1224.19.7.1 Lounge, locker and toilet facilities. Provide pharmacy staff lounge, toilet rooms and lockers that are readily accessible.

1224.20 DIETETIC SERVICE SPACE

1224.20.1 General. Food and nutrition facilities shall be provided to support food services provided for staff, visitors and patients. Adequate space for the preparation and serving of food shall be provided. Equipment shall be placed so as to provide aisles of sufficient width to permit easy movement of personnel, mobile equipment and supplies. Food service facilities and equipment shall conform to these standards, the standards of the National Sanitation Foundation and the requirements of the local public health agency.

1224.20.2 Functional elements. On-site conventional food service preparation shall be provided as follows in the size and number appropriate for the type of food service selected:

1224.20.2.1 Location. Patient food preparation areas shall be directly accessible to the entry for food supply

deliveries and for the removal of kitchen wastes, interior transportation, storage, etc., without traversing patient or public circulation. Food preparation, service and storage shall be inaccessible to nondietetic service staff.

1224.20.2.2 Receiving/control stations. Provide an area for the receiving and control of incoming dietary supplies. Space shall be provided for the delivery and transport equipment used, such as receiving carts/jacks, transport carts and returnables. The exterior door into the receiving area shall have a minimum clear width of 4 feet (1.22 m) and a minimum clear height of 7 feet (2.14 m).

1224.20.2.3 Storage.

1. Food storage space shall be readily accessible to the receiving area and shall be located to exclude traffic through the food preparation area to reach them. Storage spaces for bulk, refrigerated and frozen foods shall be provided. At least one week's (7 days) supply of staple foods and at least two (2) days' supply of frozen and two (2) days' supply of perishable foods shall be maintained on the premises. Food storage components shall be grouped for convenient access from receiving and to the food preparation areas. All food shall be stored clear of the floor. Lowest shelf shall be not less than 12 inches (305 mm) above the floor or shall be closed in and sealed tight for ease of cleaning.

As a minimum, dietary storage space shall be provided in accordance with the following schedule:

Licensed Bed Capacity	Storage Space
1 to 99 beds	2 square feet (0.19 m ²) per bed
100 to 199 beds	200 square feet (18.58 m ²) plus 1 square foot (0.0929 m ²) per bed in excess of 100 beds
200 beds and over	300 square feet (27.99 m ²), plus 1/2 square foot (0.0465 m ²) per bed in excess of 200 beds

Space to allow refrigeration for the storage of frozen and chilled foods shall be provided at a minimum of 2 cubic feet (0.057 m³) of usable space per bed.

2. Additional storage space for dietetic service supplies, such as paper products, equipment, tray delivery carts, etc., shall be provided.

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3. Storage areas and sanitizing facilities for cans, carts and mobile-tray conveyors shall be provided.
4. Waste storage and recycling facilities (per local requirements) shall be located in a separate room immediately accessible to the outside for direct pickup or disposal.

1224.20.2.4 Cleaning supplies storage. Provide a separate storage room for the storage of nonfood items such as cleaning supplies that might contaminate edibles.

1224.20.2.5 Food preparation workspaces. Provide workspaces for food preparation, cooking and baking. These areas shall be as close as possible to the user (i.e., tray assembly and dining). Provide additional spaces for thawing and portioning.

1224.20.2.6 Assembly and distribution. The patient tray assembly area shall be immediately accessible to the food preparation and distribution areas.

1224.20.2.7 Food service carts. A cart distribution system shall be provided with spaces for storage, loading, distribution, receiving and sanitizing of the food service carts. The cart traffic shall be designed to eliminate any danger of cross-circulation between outgoing food carts and incoming soiled carts and the cleaning and sanitizing process. Cart circulation shall not be through food preparation areas.

1224.20.2.8 Dining area. Provide dining space(s) for patients, staff and visitors. These spaces shall be separate from the food preparation and distribution areas.

1224.20.2.8.1 Employee dining. Where separate employee dining space is provided, a minimum of 15 square feet (1.4 m²) of floor area per person served, including serving area, shall be maintained.

1224.20.2.9 Vending services. If vending devices are used for unscheduled meals, provide a separate room that can be accessed without having to enter the main dining area.

1224.20.2.10 Ware-washing facilities. Ware-washing space shall be provided in a room separate from food preparation and serving areas. It shall be designed to prevent contamination of clean wares with soiled wares through cross-traffic. The clean wares shall be transferred for storage or use in the dining room area without having to pass through food preparation areas.

1. Commercial-type ware-washing equipment shall be provided.
2. Space shall be provided for receiving, scraping, sorting and stacking soiled tableware separate from food preparation areas.
3. Handwashing stations shall be provided in the ware-washing space.

1224.20.2.11 Pot washing facilities. Pot washing shall include multi-compartmented sinks.

1224.20.2.12 Waste storage room. A food waste storage room shall be readily accessible to the food preparation and ware washing areas but not within the food preparation area. It shall have direct access to the hospital's waste collection and disposal facilities.

1224.20.2.13 Handwashing stations. Handwashing stations shall be provided within 20 feet (6096 mm) of each food preparation or serving area.

1224.20.2.14 Office and administrative space. An office shall be provided for the dietician or dietetic service supervisor. Dietetic service administrative staff shall have offices or other suitable space necessary to conduct business related to the dietetic service. Such office and administrative space shall:

1. Provide privacy and accommodate the preparation and maintenance of menus, reports and records.
2. Be located to provide an unobstructed view of the food preparation area.

Note: This location requirement applies to all new dietetic service space.

1224.20.2.15 Toilet room(s) and locker spaces. Toilet rooms shall be provided for the exclusive use of the dietary staff. They shall not open directly into the food preparation areas, but shall be readily accessible to them. An enclosed, separate locker area shall be provided for dietetic service employee's clothing and personal belongings.

1224.20.2.16 Housekeeping room. A housekeeping room, meeting the requirements of Section 1224.4.15, shall be provided within the dietary department for the exclusive use of the dietary department.

1224.20.3 Outside service. On approval of the Licensing Agency, when food is provided by an outside food service, all applicable licensing and certification requirements shall be met. The facility shall maintain adequate space, equipment and food supplies to accommodate required functional elements listed in Section 1224.20.2, as required to provide patient food service in the event that outside food service is interrupted. A temporary mobile kitchen approved by the licensing agency can be used to meet the requirements of Section 1224.20.2 during construction.

SUPPORT SERVICES

1224.21 ADMINISTRATIVE SPACE.

1224.21.1 Administration. An administration area shall be provided which shall provide for the following functions:

1. A lobby with reception and information counter or desk, waiting space, men's and women's public toilet room facilities, telephones and drinking fountain.
2. Offices for administrator and admitting.

1224.21.2 Records. Hospitals shall provide a health record service which shall accommodate the following functions:

1. Work area for sorting and recording records for either paper or electronic media.
2. Storage area for records for either paper or electronic media.

1224.22 CENTRAL STERILE SUPPLY.

1224.22.1 Minimum requirements. A central supply and sterilizing area shall be provided. Rooms and distinct spaces shall accommodate the following services and equipment:

1. **Soiled work area.** A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled material.
2. **Clean work area.** A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. **Sterilizing space.**
4. **Storage.** Provide storage space for sterile supplies and unsterile supplies.

Exception: Section 1224.22.1 does not apply to hospitals which serve psychiatric or alcoholism patients exclusively.

1224.22.2 All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

Exception: Small instrument sterilizers.

1224.23 STORAGE.

1224.23.1 General storage. Hospitals shall provide general storage space of at least 20 square feet (1.86 m²) per bed in addition to specialized storage spaces. All storage spaces shall be located within a conforming hospital building and readily accessible to the connecting corridor required under Section 1224.4.7.5. Required storage, including but not limited to patient, dietary, etc., shall accommodate at least 72 hours of storage capacity in a conforming building. Storage beyond this requirement may be in a non-hospital or nonconforming building.

1224.23.2 Specialized storage. Specialized storage spaces shall include the following:

1224.23.2.1 Linen. Provide separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m²) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m²), except where linen chutes are provided, and may be within the soiled utility room.

1224.23.2.2 Supply. One supply storage space having a minimum area of 15 square feet (1.39 m²) shall be provided in each nursing unit. Supply storage may be

within the clean utility room used only as part of a system for distributing clean and sterile supplies.

1224.23.2.3 Wheelchairs. A room or space shall be provided in each nursing unit for wheelchairs and gurneys. The wheelchair and gurney space shall have a minimum area of 15 square feet (1.39 m²).

1224.23.2.4 Sterile and unsterile supplies shall be stored separately.

1224.23.2.5 Food storage shall be as described in Section 1224.20.

1224.24 MORGUE AND AUTOPSY FACILITIES.

1224.24.1 General acute-care hospitals with a licensed bed capacity of 50 or more beds shall provide a morgue with autopsy facilities.

Exception: This may not be required if it can be demonstrated to the licensing agency that morgue and autopsy facilities are available locally.

1224.24.2 Minimum requirements. The morgue and autopsy space shall have a minimum of 250 square feet (23.23 m²) of floor area, no dimension of which shall be less than 10 feet (3048 mm), and provide for:

1. Handwashing station.
2. Space for refrigerated compartments if human remains are held unembalmed. Refrigerated rooms and prefabricated body refrigerator temperatures shall not be higher than 45°F (25°C).

1224.25 EMPLOYEE DRESSING ROOMS AND LOCKERS.

1224.25.1 Minimum facilities. Hospitals shall provide the following:

1. Separate dressing rooms for male and female personnel with lockers and a toilet room.
2. Additional dressing rooms for the surgical service and as required within any of the supplemental services.

1224.26 HOUSEKEEPING ROOMS. Shall be provided to serve each department and nursing unit, and may be shared by compatible departments, except when specifically required by other sections.

1224.27 LAUNDRY.

1224.27.1 If a laundry is to be provided, the following is required in addition to the laundry room:

1. A separate soiled linen receiving, holding and sorting room with handwashing fixture.
2. A separate clean linen storage, issuing and holding room.
3. Storage for laundry supplies.

1224.27.2 Outside service. If linen is processed off site, the following shall be provided within the hospital:

1. Soiled linen holding room.
2. Clean linen receiving room.
3. Clean linen storage room.

SUPPLEMENTAL SERVICES

1224.28 SUPPLEMENTAL SURGERY AND SPECIAL PROCEDURE SERVICES. When provided, the following supplemental surgery and special procedure services shall meet the requirements below:

1224.28.1 Cardiovascular and other special procedures. When provided, the cardiovascular room shall have a minimum clear floor area of 650 square feet (60.39 m²), with a minimum of 20 feet (6096 mm) clear dimension. Orthopedic surgical and other special procedure rooms shall have a minimum clear floor area of 600 square feet (55.74 m²), with a minimum of 20 feet (6096 mm) clear dimension. When open-heart surgery is performed, an additional room in the restricted area of the surgical service space, that is directly accessible to this operating room, shall be designated as a pump room where extra corporeal pump(s), supplies and accessories are stored and serviced. Appropriate plumbing and electrical connections shall be provided in the cardiovascular, pump and storage rooms.

1224.28.1.1 Service areas. Shall be provided in accordance with Section 1224.15.3.

Exception: Where renovation work is undertaken in facilities built under the 2001 or prior California Building Code, existing rooms for cardiovascular, and other special procedures may have a minimum clear floor area of 500 square feet (46.45 m²). Orthopedic surgical rooms shall have a minimum clear floor area of 360 square feet (33.44 m²) and a minimum dimension of 18 feet (5486 mm).

1224.28.2 Cardiac catheterization.

1224.28.2.1 Procedure room. A procedure room with a minimum clear floor area of 400 square feet (37.16 m²) for the procedure room in addition to spaces for control, monitoring and recording equipment and imaging equipment power and controls and a minimum of one scrub sink for each catheterization laboratory. This space does not include the control room.

1224.28.2.1.1 Emergency response space. Where electrophysiology studies are performed, dedicated space and equipment for emergency resuscitation and stabilization shall be immediately accessible to the procedure room.

1224.28.2.2 Control room. A control room or area shall be provided. A view window permitting full view of the patient from the control console shall be provided.

1224.28.2.3 Equipment space. An equipment space or enclosure large enough to contain imaging equipment transformers, power modules and associated electronics and electrical gear shall be provided.

1224.28.2.4 Scrub facilities. Scrub facilities with hands-free operable controls shall be provided adjacent to the entrance of procedure rooms.

1224.28.2.5 Staff clothing change areas. Appropriate areas shall be provided for male and female staff work-

ing within the surgical service space. The areas shall contain lockers, showers, toilets, handwashing stations and space for donning surgical attire. These areas shall be arranged to ensure a traffic pattern so that personnel entering from outside the service space can enter, change their clothing and move directly into the cardiac catheterization service space. The staff change area may be combined with the surgical staff change area.

1224.28.2.6 Patient holding. A patient preparation, holding, and recovery area or room shall be provided and arranged to provide visual observation before and after the procedure. This may occur in a unit outside of the catheterization service space.

1224.28.2.7 Clean utility room. A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter and handwashing station. If the room is used only for storage and holding of clean and sterile supply materials, the work counter and handwashing station shall be permitted to be omitted. The clean utility room may be shared with an adjacent surgical unit.

1224.28.2.8 Soiled utility room. A soiled utility room shall be provided which shall contain a handwashing station and a clinical sink (or equivalent flushing rim fixtures). When the room is used for temporary holding or soiled materials, the clinical sink and handwashing station shall be permitted to be omitted. The soiled utility may be shared with an adjacent surgical unit.

1224.28.2.9 Housekeeping room. Shall be a minimum floor area of 15 square feet (1.4 m²). It shall contain a service sink or floor receptor and provisions for storage of supplies and housekeeping equipment. This may be shared with an adjacent surgical unit.

1224.28.3 Freestanding cardiac catheterization laboratory service space. A general acute care hospital referenced in Health and Safety Code Section 1255 (d)(3)(E) may provide cardiac catheterization laboratory service in a freestanding nonhospital building in conformance with this section and Section 1226.2.2. In addition, the service space shall comply with Section 1224.28.2 and applicable requirements in Section 1224.15.3 that are not covered by this section.

1224.28.3.1 Outpatient support areas. Outpatient support areas shall include outpatient waiting rooms in compliance with Section 1224.4.5. A separate space shall be provided where outpatients change from street clothing and are prepared for a procedure. This space shall include provisions for clothing storage, toilet room(s), sink and an area for clothing change and gowning.

1224.28.3.2 Connection to hospital. The freestanding cardiac catheterization laboratory service space shall be located in the nonhospital building such that the service space has a direct connection to the general acute care hospital providing cardiac surgery by a patient corridor link in compliance with Section 1224.4.7. The corridor link shall have a minimum width of 8 feet

(2438 mm) as required under Section 1224.4.7.1. The corridor link shall connect to the hospital corridor system with access to all basic services as required under Section 1224.4.7.5.

1224.28.3.3 Control station. Control station(s) shall be located to permit visual observation of all traffic into the semi-restricted service space from unrestricted corridors and/or passageways.

1224.28.3.4 Essential electrical system. Cardiac catheterization laboratories shall meet the provisions for ambulatory surgical clinics required in the California Electrical Code including the requirements of Article 517.45 for an essential electrical system.

1224.28.3.5 Services/systems and utilities. Services/systems and utilities that support the catheterization laboratory space include, but are not limited to: normal power; emergency power; nurse call; communication and data systems; space heating systems; cooling systems; domestic hot and cold water systems; building drain and sewer systems; and medical gas systems. When these systems serve other portions of the building, any alteration to the system shall be subject to review by the Office of Statewide Health Planning and Development.

1224.28.4 Interventional imaging. Image-guided interventional procedures shall be performed in procedure rooms in compliance with this section. Cardiac catheterization operating rooms shall be in compliance with Section 1224.28.2, and hybrid operating rooms shall be in compliance with Section 1224.28.5.

1224.28.4.1 Space requirements. The procedure room shall meet the space, clearance and storage requirements for the imaging equipment contained in the room and the following:

1. A minimum clear dimension of 18 feet (5486 mm).
2. The procedure room shall also be sized to allow a minimum clearance of 4 feet (1219 mm) on all sides of the procedure table.

1224.28.4.2 Pre-procedure and recovery. Pre-procedure and recovery areas shall be immediately accessible to procedure rooms and separate from corridors. The pre-procedure and recovery areas shall comply with the requirements of Section 1224.16 Anesthesia/Recovery Service Space.

1224.28.4.3 Interventional MRI facilities. Interventional and intraoperative magnetic resonance imaging (I-MRI) procedure rooms shall comply with Section 1224.28.5 Hybrid Operating Rooms.

1224.28.4.4 Control room or area. A control room or area shall be provided.

1. The control room or area shall be sized to accommodate the image-recording and viewing equipment.
2. A shielded view window permitting direct observation of the patient from the control console shall be provided.

3. The shielded control room shall be configured to prevent radiation exposure into occupied areas of the control room when ionizing radiation modalities are used.

4. Where the procedure room requires positive (or negative) pressure, a door shall be provided between the control room and the procedure room or between the combined control room/procedure room and other adjacent space.

5. Where control functions for ionizing radiation exposures take place in the procedure room, storage for personal radiation protection devices shall be provided.

1224.28.4.5 Scrub facilities. Scrub sinks shall be located outside of sterile areas. A minimum of one scrub sink station shall be provided for each interventional imaging procedure room. Scrub sinks shall have water supply controls not requiring direct contact of the hands for operation.

1224.28.4.6 Medication station. A medication station shall be provided in compliance with the requirements in Section 1224.4.4.4.

1224.28.4.7 Reading room. A reading room for reviewing images shall be available for use by the interventional imaging suite.

1224.28.4.8 Imaging equipment room. Imaging equipment room or enclosures large enough to contain x-ray transformers, power modules and associated electronics and electrical gear shall be provided. Sharing of imaging equipment rooms by multiple procedure rooms is permitted.

1224.28.4.9 Clean utility room. A clean utility room shall be provided in accordance with the requirements in Section 1224.4.4.6.

1224.28.4.10 Soiled workroom. A soiled workroom shall be provided in accordance with Section 1224.4.4.7.

1224.28.4.11 Housekeeping room. A housekeeping room shall be provided in accordance with the requirements of Section 1224.4.15.

1224.28.4.12 Staff changing areas. Male and female staff changing areas shall be provided and arranged to ensure a traffic pattern so that personnel can enter from an unrestricted area, change their clothing and move directly into the interventional imaging suite.

1224.28.5 Hybrid operating room(s). Hybrid operating rooms shall comply with the requirements of Section 1224.15 and comply with the requirements in this section.

1224.28.5.1 Space requirements. Each hybrid operating room shall meet the space, clearance and storage requirements for the imaging equipment contained in the room and the following:

1. A minimum clear floor area of 650 square feet (60.39 m²) is required for a hybrid operating room unless the imaging equipment requires a larger area.

2. The minimum clear dimension shall be 24 feet (7315 mm) unless the requirements for the specific imaging equipment require a greater distance.
3. If mobile storage units are used in lieu of fixed cabinets, the minimum clear dimension shall be available between such units when they are parked against a permanent partition.

1224.28.5.2 Control room. If required, a control room shall be provided that accommodates the imaging system control equipment and the following requirements:

1. The control room shall have a minimum clear floor area of 120 square feet (11.15 m²), which may include fixed work surfaces.
2. The room shall be physically separated from the hybrid operating rooms with walls and a door.
3. The room shall have viewing windows that provide for a full view of the patient and the surgical team. Cameras shall be permitted to provide for full view of patient while positioned inside bore.
4. If the control room is adjacent to a restricted area, it must be physically separated from the restricted area with walls and a door.

1224.28.5.3 Imaging equipment room. An imaging equipment room shall be provided for each hybrid operating room.

1224.28.5.4 Radiation protection. If the imaging equipment emits ionizing radiation, protection shall be provided in accordance with Section 1224.18.1.1.

1224.28.5.5 Requirements for specific types of hybrid operating rooms.

1224.28.5.5.1 CT. Hybrid operating rooms with intraoperative computerized tomography (CT) systems shall have control rooms that comply with Section 1224.18.3.1.

1224.28.5.5.2 iMRI. Hybrid operating rooms with intraoperative magnetic resonance imaging (iMRI) systems shall comply with the following:

1. Space and configuration requirements in Section 1224.18.4, except the clearances shall meet the requirements of 1224.28.5.1.
2. The control room shall comply with Section 1224.18.4, Item 1.
3. The anteroom shall comply with Section 1224.18.4, Item 2.
4. Entry doors to iMRI hybrid rooms shall swing outward from inside the room.

1224.28.5.5.3 Vascular imaging. Hybrid operating rooms with vascular imaging systems shall comply with Section 1224.28.4.

1224.28.5.6 Pre-procedure and recovery. Pre-procedure and recovery areas shall be immediately accessible to procedure rooms and separate from corridors. The pre-procedure and recovery areas shall comply

with the requirements of Section 1224.16 (Anesthesia/recovery Service Space).

1224.28.6 Electroconvulsive Therapy. If electroconvulsive therapy (ECT) is provided, the requirements of this section shall be met. Where a psychiatric unit is part of a general acute care hospital (Section 1224.31 Psychiatric Nursing Unit), all the requirements in this section shall be permitted to be accommodated in a procedure suite that complies with the requirements in this section or in an operating room in a surgical suite that meets the requirements in Section 1224.15.

1224.28.6.1 General. The ECT procedure area may be a single procedure room or a suite of procedure rooms.

1224.28.6.2 ECT procedure room.

1. Space requirements. Each ECT procedure room shall have a minimum clear floor area of 200 square feet (18.6 m²) with a minimum clear dimension of 14 feet (4267 mm).
2. Handwashing station. A handwashing station shall be provided.
3. Documentation area. Accommodation for written or electronic documentation shall be provided.

1224.28.6.3 Pre-procedure and recovery area. When ECT services have a low-volume of procedures, the ECT procedure room may be used for pre-procedure patient care and recovery. If a pre-procedure and recovery areas are provided they shall comply with the requirements of Section 1224.16.

1224.28.6.4 Emergency equipment storage. Space shall be provided in the procedure room(s) for storage of emergency equipment such as a CPR cart. A separate emergency equipment storage is permitted to serve more than one ECT procedure room.

1224.28.6.5 Patient support areas. A waiting area and changing area shall be provided for outpatient use in perioperative areas in support ECT suites that provide outpatient procedures. The waiting room shall comply with Section 1224.4.5. The changing area shall include space for changing or gowning, provisions for storing patients' belongings during the procedure and access to patient toilet(s).

1224.29 INTENSIVE CARE UNITS.

1224.29.1 General. The following shall apply to all types of intensive care service spaces, acute respiratory-care service spaces, burn center spaces, critical-care units, coronary-care service spaces, pediatric intensive-care service spaces unless otherwise noted. Each unit shall comply with the following provisions:

1224.29.1.1 Service space. Each intensive-care unit shall contain not less than four or more than 12 beds.

Exception: When approved by the licensing agency a small or rural hospital intensive care unit may consist of less than four but not less than two patient beds.

1224.29.1.2 Patient space. In new construction, each patient space (whether separate rooms, cubicles or multiple bed space) shall have a minimum of 200 square feet (18.58 m²) of clear floor area with a minimum headwall width of 13 feet (3962 mm) per bed. There shall be a minimum clear dimension of 1 foot (305 mm) clear space from the head of the bed to the wall, a minimum of 5 feet (1524 mm) clear space from the foot of the bed to the wall, a minimum of 5 feet (1524 mm) clear space on one side of each bed for patient transfer, a minimum of 4 feet (1218 mm) clear width on the non-transfer side and a minimum of 8 feet (2438 mm) clear space between beds.

Exception: Where renovation of existing intensive care units is undertaken, in facilities approved under the 2001 or prior California Building Code, existing patient space (whether separate rooms, cubicles or multiple bed space) may be renovated or replaced in kind one for one in the renovated space. Such patient space shall have no less than 132 square feet (12.26 m²) with no dimension less than 11 feet (3353 mm), and with 4 feet (1219 mm) of clearance at each side and the foot of the bed, and with a minimum of 8 feet (2438 mm) between beds. The space shall be designed so that all beds shall be placed in relation to the nurse station or work area to permit, enable or allow maximum observance of patients.

1224.29.1.3 Private rooms. When private rooms or cubicles are provided, view panels to the corridor shall be required with a means to provide visual privacy. Where only one door is provided to a bed space, it shall be arranged to minimize interference with movement of beds and large equipment. Sliding doors shall not have floor tracks. Where sliding doors are used for access to cubicles within a service space, a 3-foot-wide (914 mm) swinging door may also be provided for personnel communication.

1224.29.1.4 Modular toilet. Modular toilet/sink combination units located within a privacy curtain may be used within each patient space or private room. The toilet fixture shall be completely contained within cabinetry when not in use. This fixture shall not be equipped with a bedpan washing attachment. Exhaust ventilation requirements shall comply with the California Mechanical Code.

1224.29.1.5 Visitors and visual privacy. Each patient bed area shall have space at each bedside for visitors, and provisions for visual privacy from casual observation by other patients and visitors. For both adult and pediatric units, there shall be a minimum of 8 feet (2438 mm) between beds.

1224.29.1.6 Outside environment. Each patient bed shall have visual access, other than clerestory windows and skylights, to the outside environment with not less than one outside window in each patient bed area.

1224.29.1.6.1 Distance. The distance from the patient bed to the outside window shall not exceed

50 feet (15 240 mm). When partitioned cubicles are used, patients' view to outside windows may be through no more than two separate clear vision panels.

1224.29.1.7 Handwashing stations. Handwashing stations shall be directly accessible to nurse stations and patient bed areas. There shall be at least one handwashing station for every three beds in open plan areas, and one in each patient room. The handwashing station shall be located near the entrance to the patient cubicle or room.

1224.29.1.8 Nurse station. This area shall have space for counters and storage. It may be combined with or include centers for reception and communication.

1224.29.1.9 Nurses' work area. There shall be direct visual observation between either a centralized or distributed nurse station or work station and the heads of all patient beds in the intensive care unit.

1224.29.1.10 Monitoring. Each unit shall contain equipment for continuous monitoring. Monitors shall be located to permit easy viewing but not interfere with access to the patient.

1224.29.1.11 Emergency equipment storage. Space that is easily accessible to the staff shall be provided for emergency equipment such as a CPR cart.

1224.29.1.12 Medication station. A medication station shall be provided in accordance with Section 1224.4.4.4. Refrigerated storage is required.

1224.29.1.13 Airborne infection isolation room. At least one airborne infection isolation room shall be provided per unit. The room shall comply with the requirements of Section 1224.14.3; however, the adjoining toilet room is not required. Modular toilet units located within a privacy curtain may be used within the airborne infection isolation room. The modular toilet fixture shall comply with Section 1224.29.1.4.

Exception: When approved by the licensing agency an airborne infection isolation room is not required for small or rural hospitals or protected environment units.

1224.29.1.14 Additional service spaces. The following additional service spaces shall be immediately accessible within each intensive care service space. These may be shared by more than one intensive care unit provided that direct access is available from each.

1224.29.1.14.1 Clean utility/workroom. Clean utility/workroom shall be provided in accordance with Section 1224.4.4.6.

1224.29.1.14.2 Clean linen storage. There shall be a designated area for clean linen storage. This may be within the clean utility room or a separate closet.

1224.29.1.14.3 Soiled utility/workroom. Soiled workroom or soiled holding room shall be provided in accordance with Section 1224.4.4.7.

1224.29.1.14.4 Nourishment area. A nourishment area or room shall be provided in accordance with Section 1224.4.4.5.

1224.29.1.14.5 Ice machine. Each unit shall have equipment to provide ice for treatments and nourishment. Ice-making equipment may be in the clean utility room or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

1224.29.1.14.6 Equipment storage room. Appropriate room(s) shall be provided for storage of large items of equipment necessary for patient care. Each intensive care unit shall provide not less than 20 square feet (1.86 m²) per patient bed.

1224.29.1.15 Support. The following shall be provided and shall be located immediately accessible to the unit:

1. **Visitors' waiting room.**
2. **Office space.**
3. **Staff lounge(s) and toilet room(s).**
4. **Multipurpose room(s).** Provide for staff, patients and patients' families for patient conferences, reports, education, training sessions and consultation.
5. **Housekeeping room.** Provide within or immediately adjacent to the intensive care unit. It shall not be shared with other nursing units or departments.
6. **Gurney and wheelchair storage.** Provide a minimum 15 square feet (1.39 m²) per each nursing unit.

1224.29.2 Newborn intensive care units (NICU). The NICU shall comply with all the requirements of Section 1224.29.1 except as supplemented, amended or modified below.

1224.29.2.1 Entrance. The NICU shall have a clearly identified entrance and reception area for families. The area shall permit visual observation and contact with all traffic entering the unit.

1224.29.2.2 Handwashing station(s). Provide one handwashing station for each four infants and for each major fraction thereof. In a multiple-bed room, every bed position shall be within 20 feet (6096 mm) of a handwashing station. Where an individual room concept is used, a handwashing station shall be provided within each infant care room.

1224.29.2.3 Doors. At least one door to each patient room shall be a minimum of 44 inches (1118 mm) wide.

1224.29.2.4 View windows. When viewing windows are provided, provision shall be made to control casual viewing of infants. Controls shall be provided to enable lighting to be adjusted over individual patient care spaces. Darkening sufficient for transillumination shall be available when necessary.

1224.29.2.5 Control station. A central area shall serve as a control station, and shall have space for counters

and storage, and direct access to a handwashing station. It may be combined with or include centers for reception, communication and patient monitoring.

1224.29.2.6 Area. Each patient care space shall contain a minimum of 120 square feet (11.15 m²) of clear floor area per bassinet excluding handwashing fixtures and aisles with a minimum width of 11 feet (3353 mm) at headwall. There shall be an aisle for circulation adjacent to each patient care space with a minimum width of 4 feet (1219 mm). Where multi-patient rooms are used, a separate treatment area of 120 square feet (15.15 m²) shall be provided in compliance with Section 1224.4.4.1.2.

Exception: Where renovation of existing NICUs is undertaken in facilities built under the 2001 or prior California Building Code, patient care areas shall have no less than 80 square feet (7.43 m²) of clear floor area per bassinet exclusive of space for nurse control, scrubbing and gowning and reception area.

1224.29.2.6.1 Treatment area/room. A treatment area/room, with temperature control, shall be provided immediately accessible to the general patient care space.

1224.29.2.7 Ceilings. Ceilings shall have a noise reduction coefficient (NRC) of at least 0.90.

1224.29.2.8 Airborne infection isolation room. Shall comply with the requirements of Section 1224.29.1.13 except for separate toilet, bathtubs or shower. The room shall be enclosed and separated from the nursery unit with provisions for observation of the infant from adjacent nurseries or control area(s).

1224.29.2.9 Lactation. Space shall be provided for lactation support and consultation in or immediately adjacent to the NICU.

1224.29.2.10 Infant formula facilities. Nourishment area required under Section 1224.29.1.14.4 not required. Newborn intensive care units shall include infant formula facilities complying with the following requirements:

1224.29.2.10.1 Location.

1. Where infant formula is prepared on site, direct access from the formula preparation room to any infant care room is prohibited.
2. The formula preparation room shall be located in or adjacent to the NICU. The formula preparation room may be located at another location as approved by the Licensing Agency.

1224.29.2.10.2 Formula preparation room. The formula preparation room shall be securable, facilitate workflow that supports aseptic technique, and include the following:

1. A separate cleanup area for washing and sanitizing. This area shall include a handwashing station, a work counter and work space and

equipment for washing, rinsing and sanitizing bottles, other feeding utensils and equipment.

2. A separate area for preparing infant formula. This area shall contain a refrigerator, a freezer, a work counter, a formula sterilizer, storage facilities and a handwashing station.

1224.29.2.10.3 Refrigerated storage and warming facilities for infant formula. Shall be accessible for use by NICU personnel at all times.

1224.29.2.10.4 Commercial infant formula. Where only commercially prepared infant formula is used, omission of the formula preparation room may be permitted. Storage and handling may occur in the NICU workroom or in a formula preparation area adjacent to the nursing unit. The preparation area shall not have direct access to any infant care room and shall include the following:

1. A work counter
2. A hand-washing station
3. Storage facilities

1224.29.2.10.5 Cleaning equipment and supplies storage. Separate provisions for dedicated cleaning equipment and supplies shall be readily available to the formula preparation room and the formula preparation area.

1224.29.2.11 Emergency equipment storage. Space shall be provided for emergency equipment that is under direct control of the nursing staff, such as a CPR cart.

1224.29.2.12 Housekeeping room. Shall be directly accessible from the unit and be dedicated for the exclusive use of the neonatal intensive care unit.

1224.29.2.13 Daylight. In addition to meeting the requirements in Section 1224.4.9, at least one source of daylight shall be visible from newborn care areas.

1. External windows in infant care rooms shall be glazed with insulating glass to minimize heat gain or loss.
2. External windows in infant care rooms shall be situated at least 2 feet (610 mm) away from any part of a baby's bed to minimize radiant heat loss from the baby.
3. All external windows shall be equipped with easily cleaned shading devices that are neutral color or opaque to minimize color distortion from transmitted light.

1224.30 PEDIATRIC AND ADOLESCENT UNIT. A pediatric nursing unit shall be provided if the hospital has eight or more licensed pediatric beds. The unit shall meet the following standards:

1224.30.1 Patient rooms. Patient rooms shall have direct visual observation between either a centralized or distributed nurse station or workstation or by other means if

approved by licensing agency. Each patient room shall meet the following standards:

1224.30.1.1 Beds. The space requirements for pediatric patient beds shall be the same as required by Section 1224.14.1.2.

1224.30.1.2 Windows. Each patient room shall have a window in accordance with Section 1224.4.9.

1224.30.2 Examination room and treatment rooms. An exam room and treatment room shall be provided in or adjacent to the pediatric unit for pediatric and adolescent patients. A separate area for infant examination and treatment may be provided within the pediatric nursery workroom.

1224.30.3 Service areas. The service areas in the pediatric and adolescent nursing units shall conform to Section 1224.14.2 and shall also provide the following:

1224.30.3.1 Playroom. A playroom shall be provided and have direct visual observation between either a centralized or distributed nurse station or workstation or by other means if approved by licensing agency.

1224.30.3.2 Infant formula. Space for preparation and storage of infant formula shall be provided immediately accessible to the unit.

1224.30.3.3 Toilet rooms. Patient toilet room(s) with a lavatory in each room, in addition to those serving bed areas, shall be located adjacent to play area(s) and in or directly accessible to each central bathing facility.

1224.30.3.4 Storage. Closets or cabinets for toys, educational and recreational equipment shall be provided.

1224.30.3.5 Airborne infection isolation room. At least one airborne infection isolation room shall be provided within each pediatric unit; minimum of one per 15 beds. Airborne infection isolation room(s) shall comply with the requirements of Section 1224.14.3.

1224.30.3.6 Clean and soiled workrooms. Separate clean and soiled workrooms or holding rooms shall be provided as described in Sections 1224.14.2.6 and 1224.14.2.7.

1224.31 PSYCHIATRIC NURSING UNIT.

1224.31.1 Psychiatric unit space. A psychiatric unit shall be housed in a separate and distinct nursing unit and shall provide the following:

1224.31.1.1 General. A psychiatric nursing unit shall meet the requirements of Section 1224.14 for a unit that provides acute medical care or 1228.14 for a non-medical unit, in addition to the requirements of Section 1228.4, based on the functional program. Specific application shall respond to the patient injury and suicide prevention component of the Patient Safety Risk Assessment prepared under California Administrative Code (Part 1 of Title 24) Section 7-119. If a unit provides acute medical care, the unit shall be located in a building that is compliant with California Administrative Code Chapter 6 for OSHPD-1.

1224.31.1.2 Windows. Windows modified to prevent patients from leaving the unit.

1224.31.1.3 Access control. Entrances and exits which may be locked if necessary.

1224.31.1.4 Seclusion room(s). Seclusion rooms shall be provided and comply with Section 1224.4.4.1.4.

1224.31.1.5 Consultation room(s). Used for interviewing patients.

1224.31.1.6 Dining and recreation. Provide spaces for dining and recreation. The total area for these purposes shall be not less than 30 square feet (2.8 m²) per patient.

1224.31.1.7 Storage. Storage closets or cabinets for recreational and occupation therapy equipment.

1224.31.1.8 Exam or treatment room. A room for physical examinations and medical treatment.

1224.31.1.9 Activity spaces. Indoor and outdoor space for therapeutic activities.

1224.31.1.10 Occupational therapy. Facilities for occupational therapy shall comply with Section 1224.35.3, Items 1, 2 and 3.

1224.31.1.11 Recreation. A recreation room with a minimum of 100 square feet (9.3 m²) in each building, and on each floor of a building accommodating six or more psychiatric patients.

1224.31.1.12 Nurse call. Refer to Section 1224.4.6.5.

1224.31.1.13 Privacy. Visual privacy in multibed rooms (e.g., cubicle curtains) is not required.

1224.31.1.14 Tamper resistant. The ceiling and the air distribution devices, lighting fixtures, sprinkler heads and other appurtenances shall be of a tamper-resistant type.

1224.31.1.15 Toilet rooms. Each patient room shall be provided with a private toilet room that meets the following requirements:

1. The door shall not be lockable from within.
2. The door shall be capable of swinging outward.
3. The ceiling shall be of tamper-resistant construction and the air distribution devices, lighting fixtures, sprinkler heads and other appurtenances shall be of the tamper-resistant type.

1224.31.1.16 Handwashing stations. Handwashing stations located in patient rooms and patient toilet rooms may include anti-ligature features that do not compromise compliance with the hot and cold water supply controls, laminar flow and sink requirements of Section 210.0 and Table 4-2 of the California Plumbing Code. Handwashing stations within patient rooms and patient toilet rooms in psychiatric nursing units are not required to be equipped with gooseneck spouts and the discharge point may be less than 5 inches (127 mm) above the fixture rim.

1224.31.1.17 Administrative center(s) or nurse station(s). The distance between the nurse station's

entrance and the center of the doorway of the most remote patient bedroom shall not exceed 90 linear feet (27 432 mm). Refer to Section 1224.4.4.2.

1224.31.2 Education. If a unit treats children of school age over a period of one month or more, it shall provide physical facilities for an educational program, such as classrooms and an office for the teacher.

1224.31.3 Service areas. The standards noted in Section 1224.14.2 shall apply to service areas for psychiatric nursing units.

1224.32 OBSTETRICAL FACILITIES (PERINATAL UNIT SPACE)

1224.32.1 General. The obstetrical facility, including cesarean operating room(s) and delivery room(s), shall be located and designed to prohibit nonrelated traffic through the unit.

1224.32.2 Antepartum and postpartum unit

1224.32.2.1 Patient bedrooms. Antepartum and postpartum bedrooms shall comply with Section 1224.14.1.

1224.32.2.2 Service areas. Shall be provided in accordance with Section 1224.14.2 with the following additions:

1. Staff lounge.
2. Staff storage. Lockable closets or cabinets for personal articles of staff.
3. Consultation/conference room(s).

1224.32.3 Cesarean delivery and delivery service space. When cesarean operating rooms are located in the obstetrical suite, access and service arrangements shall be such that neither staff nor patients are required to travel through the cesarean delivery area to access other services.

1224.32.3.1 Cesarean delivery suite. A minimum of one cesarean operating room shall be provided in the obstetrical unit, unless a surgical operating room is designated specifically for cesarean delivery procedures. The cesarean delivery suite shall include the following:

1224.32.3.1.1 Cesarean operating room(s). Provide a minimum clear floor area of 360 square feet (33.45 m²) with a minimum dimension of 16 feet (4877 mm). There shall be a minimum of one such room.

1224.32.3.1.2 Scrub facilities. Scrub sinks shall be located outside of sterile areas and meet the requirements of Section 1224.32.3.8.2.4.

1224.32.3.1.3 Control/nurse station. A control station shall be provided in accordance with Section 1224.15.3.1 and shall be located to restrict unauthorized traffic into the suite.

1224.32.3.1.4 Soiled workroom. A soiled workroom shall be provided in accordance with Section 1224.15.3.7.

1224.32.3.1.5 Housekeeping. A housekeeping room shall be provided for the use of the cesarean delivery suite.

1224.32.3.1.6 Perioperative support services. Pre-operative patient holding and post-anesthesia recovery shall be provided in accordance with Section 1224.16. Post-anesthesia care shall provide direct access to the cesarean surgical service space without crossing unrestricted corridors.

1224.32.3.2 Delivery room(s). At least one delivery room shall be provided in the obstetrical unit. Delivery rooms shall have a minimum clear floor area of 300 square feet (27.87 m²). An emergency communication system shall be connected with the obstetrical facilities control station.

1224.32.3.2.1 Postpartum bed ratio. Delivery rooms, which are used for no other purpose, shall be provided at the ratio of one per 12 postpartum beds and for each major fraction thereof.

Exceptions:

1. If LDR or LDRP beds are provided, each LDR or LDRP may be counted as a delivery room in the postpartum bed ratio. This does not exempt the delivery room required per Section 1224.32.3.2.
2. When approved by the licensing agency, the operating room of small or rural hospitals with a licensed bed capacity of 50 or less may serve as the delivery room.

1224.32.3.3 Clocks. Shall be provided as follows:

1. A direct-wired or battery-operated clock with sweep second hand and lapsed time indicators in each cesarean operating and delivery room.
2. A direct-wired or battery-operated clock or other equivalent timing device, visible from the scrub-up sinks.

1224.32.3.4 Surgical lights. Provide a surgical light in each cesarean operating or delivery room.

1224.32.3.5 Infant resuscitation. Provide within cesarean operating rooms and delivery rooms a minimum clear floor area of 80 square feet (7.43 m²) in addition to the required area of each room or may be provided in a separate but immediately accessible room with a clear floor area of 150 square feet (13.94 m²). Six single or three duplex electrical outlets shall be provided for the infant in addition to the facilities required for the mother.

1224.32.3.6 Labor room(s) (LDR or LDRP rooms may be substituted). Where LDRs or LDRPs are not provided, a minimum of two labor beds shall be provided for each cesarean operating room. Each room shall be designed for either one or two beds with a minimum clear floor area of 120 square feet (11.15 m²) per bed. Each labor room shall contain a handwashing station and have access to a toilet room. One toilet room may serve two labor rooms, Labor rooms shall have con-

trolled access with doors that are arranged for observation from a nursing station. At least one shower (which may be separate from the labor room if under staff control) for use of patients in labor shall be provided. Windows in labor rooms, if provided, shall be located, draped or otherwise arranged, to preserve patient privacy from casual observation from outside the labor room.

Exception: Where renovation of labor rooms is undertaken in facilities built under the 2001 or prior California Building Code, existing labor rooms shall have a minimum clear floor area of 100 square feet (9.29 m²) per bed.

1224.32.3.7 Recovery room(s) (LDR or LDRP rooms may be substituted). Each recovery room shall contain at least two patient care stations and have a nurse station, with charting facilities, located to permit visual observation of all beds. Each room shall include a handwashing station and a medication station. A clinical sink with bedpan flushing device shall be directly accessible, as shall storage for supplies and equipment. Provide visual privacy of the new family.

1224.32.3.8 Service areas. Individual rooms shall be provided as indicated in the following standards; otherwise, alcoves or other open spaces that do not interfere with traffic may be used.

1224.32.3.8.1 Services. The following services shall be provided:

1. Control/nurse station. This shall be located to restrict unauthorized traffic into the service space.
2. Soiled workroom or soiled holding room. See Section 1224.4.4.7.
3. Fluid waste disposal.

1224.32.3.8.2 Shared services. The following services shall be provided and may be shared with the surgical facilities. Where shared, areas shall be arranged to avoid direct traffic between the delivery and operating rooms.

1224.32.3.8.2.1 Supervisor's office or station. Office or station shall be a minimum of 80 square feet (7.43 m²) and have a desk.

1224.32.3.8.2.2 Waiting room. This room shall have toilet rooms, telephone(s) and drinking fountains that are immediately accessible. The toilet rooms shall contain a lavatory.

1224.32.3.8.2.3 Drug distribution station. The drug distribution station shall have a handwashing station and provisions for controlled storage, preparation and distribution of medication.

1224.32.3.8.2.4 Scrub facilities for cesarean operating or delivery rooms(s). Two positions shall be provided adjacent to entrance to the first cesarean operating room. Provide one additional scrub sink per cesarean or delivery operating room. Scrub facilities shall be arranged to mini-

mize any splatter on nearby personnel or supply carts. In new construction, provide view windows at scrub stations to permit the observation of room interiors.

1224.32.3.8.2.5 Clean utility room. A clean utility room shall be provided if clean materials are assembled within the obstetrical service space prior to use. If a clean utility room is provided see Section 1224.4.4.6.

1224.32.3.8.2.6 Storage.

1. Clean sterile storage area readily accessible to the delivery room.
2. Equipment storage room(s) for equipment and supplies used in the obstetrical service space.

1224.32.3.8.2.7 Workroom. An anesthesia workroom for cleaning, testing and storing anesthesia equipment. It shall contain a work counter, sink and provisions for separation of clean and soiled items.

1224.32.3.8.2.8 Male and female staff clothing change areas. The clothing change area shall be designed to ensure a traffic pattern so that personnel entering from unrestricted area outside the delivery service space enter, change their clothing and move directly into the delivery service semi-restricted area, and eliminate cross-traffic between clean and contaminated personnel. The area shall contain lockers, showers, toilets, handwashing stations and space for donning and disposing scrub suits and booties.

1224.32.3.8.2.9 Staff lounge. Lounge and toilet room facilities for obstetrical staff shall be readily accessible to cesarean operating rooms(s), delivery room(s), labor rooms(s) and recovery room(s). Each toilet room shall contain a handwashing station.

1224.32.3.8.2.10 On-call room. An on-call room(s) for physician and/or staff shall be provided, but may be located elsewhere in the facility.

1224.32.3.8.2.11 Housekeeping room.

1224.32.4 LDR and LDRP facilities.

1224.32.4.1 Location. LDR room(s) may be located in a separate LDR service space or as part of the cesarean/delivery service space. The postpartum unit may contain LDRP rooms.

1224.32.4.2 Space requirements. These rooms shall have a minimum of 250 square feet (23.23 m²) of clear floor area with a minimum dimension of 13 feet (3962 mm). There shall be space for crib and sleeping space for support person. An area within the room but distinct from the mother's area shall be provided for infant stabilization and resuscitation. The medical gas outlets shall be located in the room so that they are accessible to the mother's delivery area and infant resuscitation area.

1224.32.4.3 Occupancy. Each LDR or LDRP room shall be for single occupancy.

1224.32.4.4 Shower or tub. Each LDR or LDRP room shall have direct access to a private toilet room with shower or tub.

1224.32.4.5 Handwashing stations. Each LDR or LDRP room shall be equipped with handwashing stations.

1224.32.5 Newborn/well baby nurseries

1224.32.5.1 General. Infants shall be housed in nurseries that comply with the standards below. All nurseries shall be immediately accessible to the postpartum unit and obstetrical facilities. The nurseries shall be located and arranged to preclude the need for unrelated pedestrian traffic. No nursery shall open directly onto another nursery. Each nursery shall contain the following:

1224.32.5.1.1 Handwashing stations. At least one handwashing station shall be provided for each six infant bassinets.

1224.32.5.1.2 Storage. Storage for linens and infant supplies at each nursery room.

1224.32.5.1.3 Lactation. A consultation/demonstration/breast feeding or pump room shall be provided in a location that is readily accessible to the nursery. Provisions shall be made, either within the room or immediately accessible to the room, for a sink, counter, refrigeration and freezing, storage for pump and attachments and educational materials. This area may be shared between units.

1224.32.5.1.4 Workroom(s). Each nursery shall be served by a connecting workroom. The workroom shall contain gowning facilities at the entrance for staff and housekeeping personnel, work counter, refrigerator, storage for supplies and a handwashing station. One workroom may serve more than one nursery room provided that required services are convenient to each. Adequate provision shall be made for storage of emergency cart(s) and equipment out of traffic and for the sanitary storage and disposal of soiled waste.

1224.32.5.1.5 Housekeeping room. A housekeeping room shall be provided for the exclusive use of the nursery unit. It shall be directly accessible from the unit.

1224.32.5.1.6 Charting space. Charting facilities shall have linear surface space to ensure that staff and physicians may chart and have simultaneous access to information and communication systems.

1224.32.5.2 Space requirements. Each newborn nursery room shall contain no more than 16 infant stations. Nurseries shall provide a minimum of 25 square feet (2.32 m²) of floor area per bassinet, with at least 3 feet (914 mm) between bassinets and at least 6 inches (152 mm) from a wall.

1224.33 EMERGENCY SERVICE.

1224.33.1 Definition. Levels of emergency care range from initial emergency management as Standby Emergency Medical Service, with a Physician on call; to definitive emergency care as Basic Emergency Medical Service, with a Physician on duty; to a Comprehensive Emergency Medical Service as an Emergency Department.

1224.33.2 Standby Emergency Medical Service. If provided, initial emergency management shall be provided in a specifically designated area of the hospital which shall include the following elements:

1224.33.2.1 Exterior entrance. A well-marked, illuminated and covered entrance, at grade level. The emergency vehicle entry cover shall provide shelter for both the patient and the emergency medical crew during transfer from an emergency vehicle into the building. This exterior entrance shall not be substituted for the required accessible entrance to the hospital, protected from the weather by canopy or roof overhang assigned for passengers loading zone. Ambulance entrances shall provide a minimum of 6 feet (183 mm) in clear width to accommodate bariatric stretchers, mobile patient lift devices and accompanying attendants. Reception shall be located to permit staff observation and control of access to treatment area, pedestrian and ambulance entrances and public waiting area.

1224.33.2.2 Treatment room. Standby emergency service shall include at least one treatment room with the following elements:

1. The area shall not be less than 120 square feet (11.15 m²) of clear floor area, exclusive of toilet room(s), waiting area and storage.
2. Each treatment room shall contain an examination light, work counter and handwashing station.
3. Medical equipment, cabinets, medication storage and counter space for writing.
4. The dimensions and arrangement of treatment rooms shall be such that there is a minimum of 3 feet (914 mm) between the sides and foot of the bed/gurney and any wall or any other fixed obstruction. The treatment room may have additional space and provisions for several patients with cubicle curtains for privacy.
5. Multiple-station treatment rooms shall provide a minimum of 80 square feet (7.43 m²) per patient gurney, with a minimum 8 foot width (2,438 mm) and 3 feet (914 mm) at the foot of the bed/gurney, with a minimum of 3 feet to any wall or fixed obstruction, and a minimum of 5 feet (1524 mm) between patient gurneys. Patient gurneys shall be separated from adjoining patient care stations by curtains. A minimum width of 6 feet (1829 mm) of access/circulation outside the curtain shall be provided. Handwashing stations shall be provided for each four treatment stations and for each major fraction

thereof in multiple-station areas. These shall be uniformly distributed to provide equal access from each patient station.

Exception: Where renovation of existing treatment rooms is undertaken in facilities approved under the 2001 or prior California Building Code, existing treatment rooms may be renovated, or replaced in kind one for one in the renovated space. Such treatment rooms shall have no less than 80 square feet (7.43 m²) of clear floor area, the least dimension of which shall be 8 feet (2438 mm).

1224.33.2.3 Storage. Equipment and supply storage shall be provided and be sized for general medical/surgical emergency supplies, medications and equipment such as ventilator, defibrillator, splints, etc. This storage shall be located in an alcove or room, out of corridor or hallway traffic and under staff control.

1224.33.2.4 Lobby. Provisions for reception, control and public waiting, including a public toilet room(s) with handwashing fixture(s) and public telephone.

1224.33.2.5 Toilet room(s). Patient toilet room(s) with handwashing station(s) shall be immediately accessible to the treatment room(s).

1224.33.2.6 Communication. Communication connections to the Poison Control Center and local EMS system shall be provided.

1224.33.2.7 Observation area. A patient station with a minimum clear floor area of 100 square feet (9.29 m²) shall be provided under the visual control of an emergency service staff work area. The patient station shall have space at bedside for visitors and shall have provision for visual privacy from casual observation by other patients and visitors. The dimensions and arrangement of rooms with multiple beds/gurneys shall be such that there is a minimum of 3 feet (914 mm) between the sides and any wall or any other fixed obstruction. A minimum clearance of 3 feet (914 mm) shall be provided between beds, and a clearance of 4 feet (1219 mm) shall be available at the foot of each bed to permit the passage of equipment and beds. A handwashing station shall be located in each room, and at least one handwashing station shall be provided for every four patient stations, and for each major fraction thereof, in open-bay areas. These shall be uniformly distributed to provide equal access from each patient station.

Exception: For small and rural hospitals, the observation area need not be dedicated solely for that purpose.

1224.33.2.8 Airborne infection isolation exam/treatment room. If provided, the airborne infection isolation exam/treatment room shall comply with the requirements of Section 1224.4.4.1.3.

1224.33.3 Basic Emergency Medical Service. When 24-hour basic emergency service is to be provided, at a minimum, all the provisions of Standby Emergency Service

under Section 1224.33.2 and the following shall be provided:

1224.33.3.1 Exterior entrance. In addition to the requirements of Section 1224.33.2.1 the emergency entrance shall have direct access from public roads for ambulance and vehicle traffic conforming with the requirements of the local authorities having jurisdiction. Entrance and driveway shall be clearly marked. If a raised platform is used for ambulance discharge, provide a ramp for pedestrian and wheelchair access.

1224.33.3.2 Patient access. Paved emergency access shall be provided to permit discharge of patients from automobiles and ambulances, and temporary parking convenient to the entrance.

1224.33.3.3 Reception, triage and control station(s). This area shall be located to permit staff observation and control of access to treatment areas, pedestrian and ambulance entrances and public waiting area.

1224.33.3.4 Wheelchair and gurney storage. Storage for wheelchairs and gurneys for arriving patients shall be located out of circulation paths with access to emergency entrances.

1224.33.3.5 Public waiting area. A public waiting area shall be provided in compliance with Section 1224.4.5 and include provision of public toilet room(s), drinking fountains and telephone adjacent to the waiting area, dedicated to, and within, the Emergency Service Space.

1224.33.3.6 Examination and treatment room(s). Examination and treatment rooms shall meet the requirements under Section 1224.33.2.2.

1224.33.3.7 Trauma/cardiac rooms. These rooms are for emergency procedures, including emergency surgery, and shall have at least 250 square feet (23.23 m²) of clear floor space. A minimum clearance of 5 feet (152 mm) shall be provided around all sides of the procedure table or gurney. Each room shall have cabinets and emergency supply shelves, image viewing capability, examination lights and counter space for writing. Additional space with cubicle curtains for privacy may be provided to accommodate more than one patient at a time in the trauma room with a minimum clear floor area of 200 square feet (18.58 m²) for each patient bay defined by the privacy curtains. There shall be storage provided for immediate access to attire used for universal precautions. Doors leading from the ambulance entrance to the cardiac trauma room shall have an opening with a minimum width of 5 feet (1524 mm). At least one scrub sink shall be located outside the entrance to each trauma room. One scrub station consisting of two scrub positions is permitted to serve two trauma rooms if located adjacent to the entrance of each procedure room. The placement of scrub sinks shall not restrict the minimum required corridor width. If a handwashing station is provided within the trauma room, it does not satisfy the requirement for a scrub sink. The handwashing station shall have a minimum of 5 feet (1524 mm) clearance from the procedure table

and not located between any curtained procedure area and the entrance to a multi-bay trauma room.

1224.33.3.8 Orthopedic and cast work. At least one orthopedic or cast room shall be provided within the emergency service space. Provisions shall include storage for splints and other orthopedic supplies, traction hooks, image viewing capability and examination lights. If a sink is used for the disposal of plaster of paris, a plaster trap shall be provided. The clear floor space for this area shall be a minimum of 180 square feet (16.7 m²)

1224.33.3.9 Poison Control Center and EMS communications center. Communication connections shall be provided as required under Section 1224.33.2.6. The communications center may be a part of the staff work and charting area.

1224.33.3.10 Emergency equipment storage space. Equipment and supply storage shall be provided as required under Section 1224.33.2.3.

1224.33.3.11 Patients' toilet room. A patient toilet room with a lavatory shall be immediately accessible to the treatment room(s). Where there are more than eight treatment stations, a minimum of two toilet rooms, with a lavatory in each toilet room, shall be required.

1224.33.3.12 Storage. Provide rooms for clean, soiled or used supplies.

1224.33.3.12.1 Soiled workroom or soiled holding room. See Section 1224.4.4.7. This room is for the exclusive use of the emergency service space.

1224.33.3.12.2 Clean utility room. See Section 1224.4.4.6.

1224.33.3.13 Administrative center or nurse station for staff work and charting. These areas shall have space for counters, cabinets and shall be provided with handwashing stations. They may be combined with or include centers for reception and communication.

1224.33.3.14 Medication preparation room. A minimum of one medication preparation room shall be provided in accordance with Section 1224.4.4.4.1. Self-contained medication dispensing units may be provided in addition.

1224.33.3.15 Staff lounge. A staff lounge shall be located within the Emergency Department and include staff clothing change areas with lockers, showers, toilets and handwashing stations for male and female staff.

1224.33.3.16 Housekeeping room. A housekeeping room, compliant with Section 1224.4.15, shall be located within the unit and dedicated to the emergency service space.

1224.33.3.17 Airborne infection isolation exam/treatment room. If provided shall comply with the requirements of Section 1224.4.4.1.3.

1224.33.3.18 Secured holding room. When a secure holding room is provided, it shall meet the following requirements. The location of the secure holding

room(s) shall facilitate staff observation and monitoring of patients in these areas. The secure holding room shall have a minimum clear floor area of 60 square feet (5.57 square meters) with a minimum wall length of 7 feet (2.13 meters) and a maximum wall length of 11 feet (3.35 meters). This room shall be designed to prevent injury to patients:

1. All finishes, light fixtures, vents, diffusers and fire protection/alarm components shall be tamper resistant and ligature resistant.
2. There shall not be any electrical outlets, medical gas outlets or similar devices.
3. There shall be no sharp corners, edges or protrusions, and the walls shall be free of objects or accessories of any kind.
4. Patient room doors shall swing out and shall have hardware on the exterior side of the door only. The minimum width shall be 44 inches (1120 mm).
5. A small impact-resistant view panel or window shall be provided in the door for discreet staff observation of the patient.

1224.33.4 Comprehensive Emergency Medical Service. When 24-hour comprehensive emergency service is to be provided, an Emergency Department shall be provided. At a minimum, all the provisions of Stand-by Emergency Service under Section 1224.33.2, the provisions of Basic Emergency Service under Section 1224.33.3, and all of the following shall be provided:

1224.33.4.1 Triage stations. In addition to the requirements of Section 1224.33.3.3, the triage area shall include triage station(s) with the following minimum requirements:

1. 100 square feet (9.29 m²) minimum clear floor area for each private triage room and 80 square feet (7.4 m²) minimum clear floor area for each station in open-bay triage areas.
2. Provisions for patient privacy.
3. Handwashing station in each triage room. In open-bay triage areas, one handwashing station shall be provided for every four triage stations.
4. Immediate access to emergency call and code call stations.
5. Medical gas outlets for triage areas in compliance with Table 1224.4.6.1.

1224.33.4.2 Fast-track area. A fast-track area may be used for treating patients presenting simple and less serious conditions. If a fast-track area is provided, it shall meet the following requirements:

1. Space requirements – each fast-track station shall have a minimum 100 square feet (9.29 m²) of clear floor area.
2. Each station shall include a handwashing station, work/documentation counter, examination table light.

3. Storage areas for supplies and medication.

4. A separate procedure room may be provided. It shall have a minimum clear floor area of 120 square feet (11.15 m²).

1224.33.4.3 Pre-screening stations. A pre-screening area may be used prior to admission to the Emergency Department. If pre-screening is provided, each station must have a minimum of 80 square feet (7.4 m²) of clear floor area, a handwashing station, documentation counter and a storage cabinet. In open bay pre-screening areas, one handwashing station shall be provided for every four patient stations. Pre-screening stations, whether private rooms or open bays, are considered a part of the waiting area and must meet the same ventilation requirements.

1224.33.4.4 Diagnostic service areas. Radiological/Imaging services shall be readily accessible. The Emergency Department shall be supported by Clinical Laboratory services. A STAT lab may be provided within the emergency medical service space in addition to more comprehensive support provided by the Clinical Lab.

1224.33.4.5 On-call room(s). Provisions shall be made to accommodate on-call sleeping room(s) for physicians and/or medical staff within the Emergency Department.

1224.33.4.6 Police and press room. Provisions shall be made to accommodate police briefing/debriefing and press releases. This may be located outside the Emergency Department.

1224.33.5 Other space considerations.

1224.33.5.1 Observation units. Observation rooms for the monitoring of patients up to 24 hours may be provided as a distinct unit within, the emergency department. If provided the unit shall have the following:

1. Handwashing stations shall be provided in each patient room and for each four treatment stations, and for each major fraction thereof. These shall be uniformly distributed to provide equal access from each patient station. Handwashing stations shall be directly accessible to nurse stations and patient care areas.
2. Each patient station shall provide space at each bedside for visitors and provision for visual privacy from casual observation by other patients and visitors. Single station rooms shall have a minimum of 120 square feet (11.15 m²) of clear floor area. Multiple-station rooms shall provide a minimum of 80 square feet (7.43 m²) per patient station with a minimum 8-foot width (2438 mm). A minimum distance of 3 feet (914 mm) between the sides and any wall or any other fixed obstruction shall be provided. A minimum distance of 3 feet (914 mm) shall be provided between beds and 4 feet (1219 mm) at the foot of each bed to permit the passage of equipment and beds.

Patient gurneys shall be separated from adjoining patient stations by curtains.

3. One toilet room shall be provided for each six treatment stations and for each major fraction thereof.
4. An administrative center/nurse station, in compliance with Section 1224.4.4.2, positioned to allow staff to observe each patient care station or room.
5. A nourishment area in compliance with Section 1224.4.4.5.

1224.34 NUCLEAR MEDICINE

1224.34.1 General. If nuclear medicine is provided, the following shall be provided:

1224.34.1.1 Radiation protection. A certified physicist shall specify the type, location and amount of radiation protection to be installed in accordance with final approved department layout and equipment selection. A physicist report shall also address dosing areas and circulation paths of dosed patients, including within multi-bay scanner rooms. Radiation protection requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, and Subchapter 4.

1224.34.1.2 Nuclear medicine room. Shall be sized to accommodate the equipment and a gurney.

When provided, the following facilities shall meet the requirements below:

1224.34.1.2.1 Scintigraphy (Gamma Camera) Facilities. Shall include the following:

1. Scanner room. The scanner room shall provide a minimum clearance of 4 feet (1218 mm) at each side and the foot of the table.
2. Handwashing stations shall be provided throughout the gamma camera suite at locations of patient contact and at locations where radiopharmaceutical materials are handled, prepared or disposed of.

1224.34.1.2.2 Positron Emission Tomography (PET). Shall include the following:

1. Scanner room shall provide a minimum clearance of 4 feet (1218 mm) at each side and the foot of the table. Additional space shall be provided when PET is combined with CT, and include compliance with Section 1224.18.3 and shielding requirements in Section 1224.34.1.1.
2. Cyclotron room. Where radiopharmaceuticals are prepared on-site, a cyclotron shall be provided. Cyclotron facilities shall be located in access-restricted areas. Shielding require-

ments for cyclotron facilities shall comply with Section 1224.34.1.1.

3. Control room. A control room shall be provided with a full direct view of the patient in the PET scanner.
4. Patient uptake/cool-down room. A shielded room with access to a dedicated patient toilet, to accommodate radioactive waste, and lavatory shall be provided.
5. Handwashing stations shall be provided throughout the PET suite at locations of patient contact and at locations where radiopharmaceutical materials are handled, prepared or disposed of.
6. Pre-procedure patient care and recovery area shall be provided to accommodate at least two stretchers. This area shall comply with Section 1224.34.2.6.
7. Imaging equipment room shall be provided in support of the equipment provided.
8. Contaminated (hot) soiled holding shall be provided and operationally integrated to minimize incidental exposure to ionizing radiation.

1224.34.1.2.3 Single-Photon Emission Computed Tomography (SPECT) Facilities. When provided shall include the following:

1. Scanner room shall provide a minimum clearance of 4 feet (1218 mm) at each side and the foot of the table. Additional space shall be provided when SPECT is combined with CT, and include compliance with Section 1224.18.3 and shielding requirements in Section 1224.34.1.1.
2. A control room shall be provided with a full view of the patient in the SPECT scanner.
3. Imaging equipment room shall be provided in support of the equipment provided.
4. Handwashing stations shall be provided throughout the SPECT suite at locations of patient contact and at locations where radiopharmaceutical materials are handled, prepared or disposed of.

1224.34.1.3 Radiopharmacy. If radiopharmaceutical preparation is performed, an area adequate to house a radiopharmacy shall be provided with appropriate shielding. This area shall include adequate space for storage of radionuclides, chemicals for preparation, dose calibrators and record keeping. If preprepared materials are used, storage and calculation area may be considerably smaller than that for on-site preparation. Space shall provide adequately for dose calibration, quality assurance and record keeping. The area may still require shielding from other portions of the facilities.

1224.34.2 Support areas for nuclear medicine services. The nuclear medicine area shall provide the following support areas. If nuclear medicine is provided within the imaging department, compatible areas may be shared with other imaging modalities:

1224.34.2.1 Entrance. Space shall be adequate to permit entry of gurneys, beds, and able to accommodate imaging equipment, electronic consoles, and if present, computer terminals.

1224.34.2.2 Cleanup. Provisions for cleanup shall be located within the service space and be readily accessible. They shall include a service sink or floor receptacle as well as storage space for equipment and supplies.

1224.34.2.3 Consultation. A consultation area may be provided.

1224.34.2.4 Waiting. Waiting areas shall be provided out of traffic, under staff control. If the department is routinely used for outpatients and inpatients at the same time, separate waiting areas shall be provided with screening or visual privacy between the waiting areas.

1224.34.2.5 Dose administration area. Provide a dose administration area that is immediately accessible to the preparation area. Since as much as several hours may elapse for the dose to take effect, the area shall provide for visual privacy from other areas.

1224.34.2.6 Pre-procedure/holding area. A pre-procedure/holding area for patients on gurneys or beds shall be provided out of traffic and under control of staff and may be combined with the dose administration area with visual privacy between the areas.

1224.34.2.7 Patient dressing rooms. Patient dressing rooms shall be immediately accessible to the waiting area and procedure rooms. Each dressing room shall include a seat or bench, a mirror, and provisions for hanging patients' clothing and for securing valuables.

1224.34.2.8 Patient toilet room(s). Patient toilet rooms shall be reserved for nuclear medicine patients and shall be immediately accessible to waiting and procedure rooms.

1224.34.2.9 Staff toilet rooms. Staff toilet rooms shall be readily accessible to the nuclear medicine laboratory.

1224.34.2.10 Handwashing stations. Handwashing stations shall be located within each procedure room.

1224.34.2.11 Control desk and reception.

1224.34.2.12 Storage area for clean linen.

1224.34.2.13 Soiled and contaminated material. Provisions with handwashing stations shall be made for holding soiled material. Separate provisions shall be made for holding contaminated material.

1224.34.2.14 Hot lab for scintigraphy (gamma camera), PET and SPECT facilities. A securable area or

room shall be provided in which radiopharmaceuticals can be safely stored and doses can be calculated and prepared.

1. A single hot lab shall be permitted to serve multiple scanners and nuclear medicine modalities.
2. The hot lab shall be shielded in compliance with Section 1224.34.1.1.
3. A source storage area, a dose area and a storage area for syringe shields shall be provided.

1224.34.3 Radiotherapy service space.

1224.34.3.1 Radiation therapy space. If radiation therapy is provided, the following shall be accommodated:

1. Patient reception and waiting areas.
2. Space for medical and physics staff functions.
3. Space for equipment and supplies.
4. Housekeeping room.
5. Direct access to space provided for radiation measurement and calibration equipment, including a calibration constancy instrument and access to a secondary standard dose meter.
 - 5.1. A megavoltage treatment unit capable of delivering x-rays or gamma rays of effective energy 500 KeV or more and conforming to the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.
 - 5.2. Access to a medium voltage or superficial treatment unit delivering 500 KeV or less, but otherwise having the same functional characteristics as the above mega-voltage units and conforming to the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.
 - 5.3. Direct access to space provided for brachytherapy equipment which shall meet the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.
 - 5.4. Shielding of the rooms shall meet the requirements of Chapter 31C and the California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5, Subchapter 4.

1224.34.3.2 Radiation protection. Cobalt, linear accelerators, hot lab and high dose rate brachytherapy rooms and simulation rooms require radiation protection. All rooms that provide radiation treatment shall be appropriately shielded. A certified physicist shall specify the type, location and amount of protection to be installed in accordance with final approved department layout and equipment selection. Radiation protec-

tion requirements shall be incorporated into the construction documents and comply with Chapter 31C and the requirements of California Radiation Control Regulations, California Code of Regulations, Title 17, Division 1, Chapter 5 and Subchapter 4.

1224.34.3.3 Room sizes. Rooms shall be sized as follows:

1. Cobalt rooms and linear accelerators shall be sized in accordance with equipment requirements and shall accommodate a gurney for litter borne patients. Layouts shall provide for preventing the escape of radioactive particles. Openings into the room, including doors, ductwork, vents and electrical raceways and conduits, shall be baffled to prevent direct exposure to other areas of the facility.
2. Simulator, accelerator and cobalt rooms shall be sized to accommodate the equipment with patient access on a gurney, medical staff access to the equipment and patient, and service access.
3. Where a table is used, the room shall be sized to provide a minimum clearance of 4 feet (1218 mm) on three sides of the table to facilitate bed transfer and provide access to the patient. The door swing shall not encroach on the equipment space, patient circulation space or transfer space.
4. Minimum room size shall be 260 square feet (24.15 m²) for the simulator room; 680 square feet (63.17 m²), including the maze, for accelerator rooms; 200 square feet (18.58 m²) for brachytherapy rooms; and 450 square feet (41.81 m²) for cobalt rooms.

1224.34.3.4 General support area. The following areas shall be provided:

1. A gurney hold area adjacent to the treatment rooms, screened for privacy and combined with a seating area for outpatients.
2. Exam or treatment room shall be provided with a minimum of 100 square feet (9.29 m²) with a minimum dimension of 8 feet (2438 mm). Each exam room shall be equipped with a handwashing station.

Exceptions:

1. Where renovation of existing treatment rooms is undertaken in facilities built under the 2001 or prior California Building Code, treatment rooms shall have no less than 80 square feet (7.43 m²) of clear floor area.
2. Darkroom is optional. If provided, shall be readily accessible to the treatment room(s)
3. Patient gowning area with provision for safe storage of valuables and clothing and with direct access to toilet room(s). At least

one space shall be large enough for staff-assisted dressing.

4. Film files area is optional. If provided shall have storage for unprocessed film.

1224.34.4 Additional support areas for linear accelerator.

1224.34.4.1 Mold room with exhaust hood and handwashing fixture.

1224.34.4.2 Block room with storage. The block room may be combined with the mold room.

1224.34.5 Additional support areas for cobalt room.

1224.34.5.1 Hot lab. A hot lab shall be provided in accordance with Section 1224.34.2.14.

1224.34.6 Radiosurgery suite. If radiosurgery (gamma knife/cyber knife) is provided, the following shall be provided:

1224.34.6.1 General. The radiosurgery suite shall be located near the imaging services suite to facilitate image acquisition prior to radiosurgery treatment. Location of gamma knife or cyber knife treatment rooms in a radiation therapy suite shall be permitted.

1224.34.6.2 Radiosurgery treatment rooms. Radiosurgery (gamma knife/cyber knife) treatment rooms shall provide a minimum clearance of 4 feet (1218 mm) shall be provided on all sides of the treatment table/chair. The door shall not encroach on the equipment or on patient circulation or transfer space. A handwashing station shall be provided in each radiosurgery treatment room.

1224.34.6.3 Pre-procedure/recovery accommodations. If provided, pre-procedure/recovery patient care stations shall meet the following requirements:

1. Pre-procedure and recovery area(s) shall be immediately accessible to procedure rooms and separate from corridors. The pre-procedure and recovery patient area or room shall be arranged to permit visual observation of the patient by staff before and after the procedure. Bays, cubicles or single-bed rooms shall be permitted to serve as patient care stations.
2. Area. Where open bays are used, each patient care station shall have a minimum clear floor area of 80 square feet (7.43 m²).
3. Clearances. Each bay or cubicle shall have a minimum clearance of 3 feet (914 mm) between walls or partitions and the sides and foot of gurneys or patient beds. Each bay shall have a minimum clearance of 4 feet (1218 mm) between sides of gurneys or patient beds. A minimum width of 6 feet (1829 mm) of access/circulation outside the curtain shall be provided.
4. Patient privacy. Provisions such as cubicle curtains shall be provided for patient privacy.

5. *Handwashing station.* A handwashing station shall be provided within the pre-procedure/recovery area.

1224.34.6.4 Support areas for radiosurgery treatment rooms. The following shall be provided:

1. Space for sterilization of head-frames.
2. Area for target planning.
3. Medication station.
4. Nourishment area.
5. Head-frame storage.
6. Toilet room(s) for patients, staff and the public.
7. Area for sedation of pediatric patients.

1224.35 REHABILITATION THERAPY DEPARTMENT.

Where two or more rehabilitation services are provided, facilities and equipment between services may be shared. Rehabilitation therapy services may be provided as part of a dedicated inpatient nursing unit in a rehabilitation center or as outpatient services, or both.

1224.35.1 Rehabilitation center space. If provided, a rehabilitation center space shall be designed to meet the requirements of Section 1224.14, except as follows:

1. Patient bedrooms shall contain a minimum of 110 square feet (10.22 m²) of clear floor area per bed, exclusive of toilet room(s), closets, lockers, wardrobes, alcoves or vestibules, with greater space provided for special needs such as circ-o-electric beds.
2. Space for group dining shall be provided at the minimum rate of 20 square feet (1.86 m²) per bed.
3. Space for group recreation or patient's lounge shall be provided at the minimum rate of 20 square feet (1.86 m²) per bed.
4. Space for staff conferences, patient evaluation and progress reports.
5. A classroom space.
6. If outpatient rehabilitation services are provided, an examination and treatment room, adjacent or directly accessible to an office for the physician in charge of the outpatient service.
7. If outpatient rehabilitation services are provided, a patient waiting area with access to telephone, drinking fountain and men's and women's toilet room facilities in or adjacent to the rehabilitation outpatient service area. Outpatients shall not traverse an inpatient nursing unit.
8. Access to an outside area to be used for therapeutic procedures for patients.
9. At least one training toilet room in each patient unit with minimum dimensions of 5 feet by 6 feet (1524 mm by 1829 mm).
10. Patient bathtubs, where provided, of standard height and located to provide access to both sides and one end of the tub.

11. Patient showers, where provided in centralized bathing facilities, shall comply with Section 11B-608.2.2, no dimension of which shall be less than 4 feet (1219 mm), be equipped with handrails, privacy curtains, and designed for ease of accessibility. The floor shall be sloped to provide drainage.

1224.35.2 Physical therapy service space. If physical therapy is part of the service, the following shall be included:

1. The minimum floor area for a physical therapy space shall be 300 square feet (27.87 m²) with no dimensions less than 12 feet (3658 mm). Each individual patient care station shall have a minimum clear floor area of 60 square feet (5.57 m²), except individual patient care stations formed with permanent partitions shall have a minimum clear floor area of 80 square feet (7.43 m²). Each individual patient care station shall have privacy screens or curtains.
2. Handwashing stations for staff shall be provided in each treatment room. At least one handwashing station shall be provided for every four patient care stations, and for every major fraction thereof, in an open treatment area. One handwashing station may serve several treatment stations.
3. Exercise area and facilities.
4. Clean linen and towel storage.
5. Storage for equipment and supplies.
6. Separate storage for soiled linen, towels and supplies.

Exception: When approved by the licensing agency small or rural hospitals are exempt from Sections 1224.35.2.1 through 1224.35.2.6.

1224.35.3 Occupational therapy service space. If this service is provided, the following shall be included:

1. Work areas and counters suitable for wheelchair access.
2. Handwashing stations.
3. Storage for supplies and equipment.
4. An area for teaching daily living activities shall be provided. It shall contain an area for a bed, kitchen counter with appliances and sink, bathroom and a table/chair.

1224.35.4 Speech pathology and/or audiology service space. If a speech pathology service is provided, space shall be provided for:

1. Tables and chairs to conduct interviews, consultations and treatment, and to accommodate patients in wheelchairs and stretchers.
2. A waiting area with access to public toilet room(s) if outpatients are being served.
3. Handwashing stations.
4. Testing unit. If an audiology service is provided, there shall be, in addition to Items 1, 2 and 3 above,

a minimum of one two-room testing unit that meets the American National Standards Institute, ANSI/ASA S-3.1, 1999, (2008) Maximum Permissible Ambient Noise Levels for Audiometric Test Rooms.

1224.36 RENAL DIALYSIS SERVICE SPACE (ACUTE AND CHRONIC)

1224.36.1 General. If provided, renal dialysis service shall comply with the following:

1224.36.2 Treatment area.

1224.36.2.1 Location. The treatment area may be an open area and shall be separate from administrative and waiting areas.

1224.36.2.2 Nurse station(s). Shall be located within the dialysis treatment area and designed to provide visual observation of all patient stations.

1224.36.2.3 Individual patient treatment areas. Shall contain at least 80 square feet (7.44 m²). There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs.

1224.36.2.4 Handwashing stations. Handwashing stations shall be directly accessible to the nurse station and to patient treatment areas. Handwashing stations shall be provided for each four treatment stations, and for each major fraction thereof. These shall be uniformly distributed to provide equal access from each patient station.

1224.36.2.5 Privacy. The open unit shall be designed to provide privacy for each patient.

1224.36.2.6 Bloodborne infection isolation room. A minimum of one bloodborne infection isolation room of at least 120 square feet (11.15 m²) of clear floor space shall be provided for patients. This room shall contain a counter and handwashing station.

1224.36.2.7 Medication station. There shall be a medication station for the dialysis center. The medication station shall comply with the provisions of Section 1224.4.4.4.

1224.36.2.8 Home training. If provided in the unit, a private treatment area of at least 120 square feet (11.15 m²) shall be provided for patients who are being trained to use dialysis equipment at home. This room shall contain a counter, a handwashing station and a separate drain for fluid disposal.

1224.36.2.9 Examination room. An examination room with a handwashing station shall be provided with at least 100 square feet (9.29 m²).

1224.36.2.10 Clean utility room. A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing station and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing fixture may be omitted. Soiled and clean utility

rooms or holding rooms shall be separated and have no direct connection.

1224.36.2.11 Soiled utility room. A soiled workroom shall be provided and contain a sink, handwashing station, work counter, storage cabinets, waste receptacles and a soiled linen receptacle.

1224.36.2.12 Reprocessing room. If dialyzers are reused, a reprocessing room is required and sized to perform the functions required and include one-way flow of materials from soiled to clean with provisions for a refrigerator (temporary storage or dialyzer), decontamination/cleaning areas, sinks, processors, computer processors and label printers, packaging area and dialyzer storage and disinfectants cabinets.

1224.36.2.13 Nourishment station. If a nourishment station for the dialysis service is provided, the nourishment station shall contain a sink, a work counter, a refrigerator, storage cabinets and equipment for serving nourishments as required.

1224.36.2.14 Housekeeping room. Provide a housekeeping room that is immediately accessible to, and for the exclusive use of the unit.

1224.36.2.15 Repair room. If required, an equipment repair and breakdown room shall be equipped with a handwashing fixture, deep service sink, work counter and storage cabinet. Needs water supply and drain connection for testing machines.

1224.36.2.16 Supplies. Supply areas or supply carts shall be provided.

1224.36.2.17 Storage. Storage space shall be available for wheelchairs and gurneys, if gurneys are provided, out of direct line of traffic.

1224.36.2.18 Clean linen storage. A clean linen storage area shall be provided. This may be within the clean utility room, a separate closet or an approved distribution system. If a closed cart system is used, storage may be in an alcove. It must be out of the path of normal traffic and under staff control.

1224.36.2.19 Mixing room. Each facility using a central batch delivery system shall provide, either on the premises or through written arrangements, individual delivery systems for the treatment of any patient requiring special dialysis solutions. The mixing room shall also include a sink, storage space and holding tanks.

1224.36.2.20 Water treatment room. The water treatment equipment shall be located in an enclosed room.

1224.36.2.21 Patient toilet. A patient toilet room with a lavatory shall be provided.

1224.36.3 Ancillary facilities.

1224.36.3.1 Staff lounge, lockers and toilet(s). Space shall be available for male and female personnel for staff clothing change area and lounge. The areas shall contain lockers, shower, toilet(s) and handwashing stations.

1224.36.3.2 Patient storage. Storage for patients' belongings shall be provided.

1224.36.3.3 Waiting room. A waiting room, toilet room(s) with handwashing stations, drinking fountain, public telephone and seating accommodations for waiting periods shall be available or accessible to the dialysis unit.

1224.36.3.4 Administrative services. Provide office and clinical work space.

1224.37 RESPIRATORY THERAPY SERVICE SPACE. If respiratory service is provided, the following elements shall be included:

1. **Storage for equipment and supplies.**
2. **Space and utilities for cleaning and disinfecting equipment.** Provide physical separation of the space for receiving and cleaning soiled materials from the space for storage of clean equipment and supplies. Appropriate local exhaust ventilation shall be provided if gluteraldehyde or other noxious disinfectants are used in the cleaning process. This space may be co-located with other reprocessing functions within the hospital.
3. **Additional facilities.** If respiratory services such as testing and demonstration for outpatients are part of the program, additional facilities and equipment shall be provided including but not limited to:
 - 3.1. Patient waiting.
 - 3.2. A reception and control station.

1224.38 INTERMEDIATE-CARE SERVICE SPACE. An intermediate-care service unit shall be housed in a separate and distinct nursing unit and shall comply with the applicable requirements of Section 1225.

1224.39 OUTPATIENT SERVICE SPACE.

1224.39.1 Waiting area(s). Provide with access to public toilet room facilities, a public telephone and a drinking fountain. These facilities may be shared with other services.

1224.39.2 Outpatient surgery. If outpatient surgery is performed in the out patient service space, the following shall be provided:

1224.39.2.1 Operating rooms. An operating room(s) with a minimum clear floor area of 270 square feet (25.08 m²), no dimension of which shall be less than 15 feet (4572 mm).

1224.39.2.2 Perioperative services. Preoperative patient holding and postanesthesia recovery area(s) shall be provided which meet the requirements of Section 1224.16.

1224.39.2.3 Service areas. Each surgical unit shall provide the service areas required under Section 1224.15.3 as modified by the following:

1224.39.2.3.1 Soiled workroom. A separate soiled workroom separated from any surgical sterilizing facilities. The soiled workroom shall provide 24

square feet (2.2 m²) per operating room up to eight operating rooms and shall have the minimum area of 48 square feet (4.5 m²), with no dimension less than 6 feet (1829 mm).

1224.39.2.3.2 Housekeeping. A housekeeping room shall be provided for the exclusive use of outpatient surgery. It shall be directly accessible from the service area.

1224.39.3 Gastrointestinal endoscopy. If gastrointestinal endoscopy is performed in the outpatient service area, the endoscopy suite shall be divided into a minimum of three major functional areas: the procedure room(s), instrument processing room(s) and patient holding/preparation and recovery room or area and the following shall be provided:

1224.39.3.1 Procedure room(s).

1224.39.3.1.1 Space requirements. Procedure room shall have a minimum clear floor area of 200 square feet (18.6 m²). Room arrangement shall permit a minimum clearance of 3 feet, 6 inches (1067 mm) at each side, head and foot of the gurney/table.

1224.39.3.1.2 Handwashing stations. A separate dedicated handwashing station with hands-free controls shall be provided in the procedure room.

1224.39.3.2 Processing room.

1224.39.3.2.1 Dedicated processing room(s) shall provide distinct areas for cleaning and decontaminating instruments. The cleaning area shall allow for flow of instruments from the contaminated area to the clean assembly area and then to storage.

1224.39.3.2.2 The decontamination area shall be equipped with the following:

1. Utility sink(s) shall be provided as appropriate to the method of decontamination used.
2. One freestanding handwashing station.
3. Work counter space(s).
4. Eyewash station.

1224.39.3.3 Preoperative patient holding. A preoperative patient holding area shall be provided in accordance with Section 1224.16.2.

1224.39.3.4 Post-anesthesia recovery area. A post-anesthesia recovery area shall meet the requirements of Section 1224.16.

1224.39.3.5 Communication system. A system for emergency communication shall be provided.

1224.39.3.6 Service areas. Each gastrointestinal endoscopy unit shall provide the support areas required under Section 1226.5.11.6 if not shared within the department.

1224.39.4 CANCER TREATMENT/INFUSION THERAPY SERVICE SPACE.

1224.39.4.1 General. If provided, cancer treatment/infusion therapy service shall comply with the following:

1224.39.4.2 Treatment area.

1224.39.4.2.1 Location. The treatment area may be an open area and shall be separated from administrative and waiting areas.

1224.39.4.2.2 Nurse station(s). Shall be located within the cancer treatment/infusion therapy area and designed to provide visual observation of all patient stations.

1224.39.4.2.3 Individual patient treatment areas. Shall contain at least 80 square feet (7.4 m²).

There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs used for chemotherapy treatment/infusion.

1224.39.4.2.4 Handwashing stations. Handwashing stations shall be directly accessible to the nurse station and patient treatment areas. Handwashing stations shall be provided for each four patient stations, and for each major fraction thereof. These shall be uniformly distributed to provide equal access from each patient station.

1224.39.4.2.5 Privacy. The open unit shall be designed to provide privacy for each patient.

1224.39.4.2.6 Medication dispensing. If provided, there shall be a medication dispensing station for the cancer treatment/infusion therapy area. A work counter and handwashing station shall be included in the area. Provisions shall be made for the controlled storage, preparation, distribution and refrigeration of medications.

1224.39.4.2.7 Examination room. An examination room with a handwashing station shall be provided with at least 100 square feet (9.29 m²) of clear floor area.

1224.39.4.2.8 Clean utility room. A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing station and storage facilities for clean and sterile supplies. If the room is used for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing station may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

1224.39.4.2.9 Soiled utility room. A soiled workroom shall be provided and contain a sink, handwashing station, work counter, storage cabinets, waste receptacles and a soiled linen receptacle.

1224.39.4.2.10 Nourishment station. If nourishment station for the cancer treatment/infusion therapy service is provided, the nourishment station shall contain a sink, a work counter, a refrigerator, storage cabinets and equipment for serving nourishment as required.

1224.39.4.2.11 Housekeeping room. Provide a housekeeping room that is immediately accessible to and for the exclusive use of the unit.

1224.39.4.2.12 Supplies. Supply areas or supply carts shall be provided.

1224.39.4.2.13 Storage. Storage space shall be available for wheelchairs and gurneys. If gurneys are provided, they shall be out of the direct line of traffic.

1224.39.4.2.14 Clean linen storage. A clean linen storage area shall be provided. This may be within the clean utility room, a separate closet or an approved distribution system. If a closed cart system is used, storage may be in an alcove. It must be out of the path of normal traffic and under staff control.

1224.39.4.2.15 Patient toilet. A patient toilet room with a lavatory shall be provided.

1224.39.4.3 Ancillary facilities.

1224.39.4.3.1 Staff lounge, lockers and toilets. Space shall be available for male and female personnel for staff clothing change area and lounge. The areas shall contain lockers, toilets and handwashing stations.

1224.39.4.3.2 Patient storage. Storage for patients' belongings shall be provided.

1224.39.4.3.3 Administrative services. Office and clinical work space shall be provided.

1224.39.4.3.4 Special design elements. Decorative water features and fish tanks shall not be located inside cancer treatment/infusion therapy unit.

1224.39.5 HYPERBARIC THERAPY SERVICE SPACE.

1224.39.5.1 General. If provided, clinical hyperbaric oxygen therapy service space shall meet the requirements of the "Hyperbaric Facilities" chapter in NFPA 99: Health Care Facilities Code and shall comply with the following:

1224.39.5.2 Hyperbaric chambers.

1224.39.5.2.1 Class A chamber (multi-place facilities).

1. **Clearances.** There shall be a minimum clearance of 3 feet (914 mm) around the chamber. The area in front of the chamber entry designed for gurney or bed access shall have a minimum clearance of 8 feet (2438 mm) for gurney or bed approach. The area in front of the chamber entry designed for ambulatory or wheelchair access only shall have a minimum clearance of 5 feet (1524 mm) for wheelchair approach.
2. **Entries.** Chamber entries shall be provided with access ramps that are flush with the chamber entry doorway. Chamber entries not designed for gurney/bed access shall be a minimum of 3 feet (914 mm).

1224.39.5.2.2 Class B chamber (mono-place facilities).

1. **Clearances.** There shall be a minimum clearance of 3 feet (914 mm) around the chamber. A minimum clearance of 44 inches (1118 mm) shall be provided between the control sides of two chambers. The area in front of the chamber entry shall be designed for gurney or bed access with a minimum clearance of 8 feet (2438 mm) for gurney or bed approach.
2. **Oxygen.** An oxygen service valve shall be provided for each chamber.

1224.39.5.3 Pre-procedure patient holding area(s). In facilities with a Class A hyperbaric chamber or with three or more Class B chambers, a pre-procedure/patient holding area shall be provided to accommodate patients on gurneys or beds and sitting space for ambulatory patients. The area shall permit visual observation of the patient by nursing staff and be located out of traffic flow. Each gurney station shall be a minimum clear floor area of 80 square feet (7.43 m²) and shall have a minimum clearance of 3 feet (914 mm) on the sides of the gurneys and the foot of the gurney. There shall be provisions for privacy such as cubicle curtains.

1224.39.5.4 Medical gas station outlets. Refer to Table 1224.4.6.1 Station Outlets for Oxygen, Vacuum (Suction) and Medical Air.

1224.39.5.5 Support areas for the hyperbaric suite.

1224.39.5.5.1 Reception/control desk. An administrative center/nurse station shall be provided within the hyperbaric suite.

1224.39.5.5.2 Examination/treatment room(s). Room(s) for individual consultation and treatment shall be provided and meet the requirements of Section 1224.4.4.1.

1224.39.5.5.3 Clean linen storage. A clean linen storage area shall be provided. This may be within the clean utility room, a separate closet or an approved distribution system. If a closed cart system is used, storage may be in an alcove. It must be out of the path of normal traffic and under staff control.

1224.39.5.5.4 Clean supply room. A clean supply room shall be provided and meet the requirements of Section 1224.4.4.6.1. This room may be omitted if the suite is served by a cart system.

1224.39.5.5.5 Gas cylinder room. The gas cylinder room shall provide space to house eight (H) cylinders and two gas manifolds, consisting of at least two (H) cylinders on each manifold.

1224.39.5.5.6 Gurney and wheelchair storage. Space for gurney and wheelchair storage shall be provided.

1224.39.5.5.7 Housekeeping room. A housekeeping room shall be provided and shall be immediately accessible to the hyperbaric suite.

1224.39.5.5.8 Compressor room. A compressor room shall be provided to house the chamber compressors, accumulator tanks and fire suppression system.

1224.39.5.6 Support areas for staff. Toilet rooms with a handwashing stations shall be immediately accessible to the hyperbaric suite for staff use.

1224.39.5.7 Support areas for patients.

1224.39.5.7.1 Patient waiting area. The patient waiting area shall be provided and meet the requirements of Section 1224.39.1.

1224.39.5.7.2 Patient changing areas. Changing area(s) for outpatients shall be provided for patient clothing and for securing valuables.

1224.39.5.7.3 Patient toilet room. A patient toilet room with a handwashing station shall be directly accessible to the hyperbaric suite.

1224.39.6 OUTPATIENT OBSERVATION UNITS.

1224.39.6.1 General. If provided, outpatient observation unit(s) shall comply with the following:

1224.39.6.2 Location. The unit shall be located outside of any inpatient unit and not part of the Emergency Department. Location shall be in compliance with Section 1224.4.3. Corridor systems shall connect the unit to all Basic and applicable Supplemental Services.

1224.39.6.3 Signage. The unit shall be marked with a sign identifying the unit as an outpatient unit. The signage shall use the term "outpatient" in the title of the designated area.

1224.39.6.4 Patient care stations. Each patient station shall provide minimum clear floor area that includes space at each bedside for visitors. Provisions for visual privacy from casual observation by other patients and visitors shall be provided. Patient care stations shall meet the following:

1224.39.6.4.1 Space requirements:

1. Single-station rooms: 110 square feet (10.2 m²). A minimum distance of 3 feet (914 mm) shall be provided between the sides and foot of bed and any wall or other fixed obstructions.
2. Multi-station rooms or areas: 80 square feet (7.4 m²) per patient station. A minimum distance of 3 feet (914 mm) shall be provided between beds and 4 feet (1219 mm) between the foot of beds, walls or other fixed obstructions for access/circulation.

1224.39.6.4.2 Negative-pressure isolation room with anteroom. Negative pressure isolation is optional. If provided, signage shall be labeled with the words "Negative-Pressure Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom. A separate anteroom shall be provided between the negative-pressure isolation room and the corridor, which shall

constitute the primary entrance to the negative-pressure isolation room. This anteroom shall have a handwashing station, a work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the isolation room and means to allow for airflow from the anteroom into the negative pressure isolation room. Doors shall be aligned to allow large equipment to be wheeled into the negative-pressure isolation room unless a second entry is provided. An adjoining patient toilet room shall be provided which has an emergency nurse call system, a lavatory and a toilet equipped with a bedpan flushing attachment with a vacuum breaker.

1224.39.6.4.3 Handwashing station(s). A handwashing station shall be provided at each nurse station.

1224.39.6.4.4 Patient toilet room(s). A minimum of one toilet room shall be provided for the use of patients. Patient toilet room(s) shall be equipped with a handwashing station and shall be immediately accessible to the observation unit(s) from the corridor.

1224.39.6.5 Service areas. Unless otherwise indicated, provisions for the services listed below shall be in or immediately accessible to each outpatient observation unit.

1224.39.6.5.1 Nurse station. A minimum of one nurse station shall be provided, in compliance with Section 1224.4.4.2. The distance between the nurse station entrance and the most remote patient station or room shall not exceed 90 linear feet (27,432 linear mm).

1224.39.6.5.2 Nurse or supervisor office.

1224.39.6.5.3 Staff toilet room(s). Readily accessible toilet room(s) provided for staff use.

1224.39.6.5.4 Multipurpose room(s). A minimum of one multipurpose room shall be provided for staff, patients and/or patients' families for uses such as patient conferences, reports, education, training sessions and consultation. Room(s) must be readily accessible to each outpatient observation unit. One such room may be shared and serve several units and/or departments.

1224.39.6.5.5 Examination or treatment room(s). Examination or treatment rooms are optional. If provided, examination and/or treatment rooms must be readily accessible, but may be shared with other units or compatible departments. Provisions shall be made to preserve patient privacy from observation from outside the exam room through an open door. The room shall have a minimum area of 80 square feet (7.4 m²), the least dimension of which 8 feet (2438 mm).

1224.39.6.5.6 Medication station(s). Medication station(s) shall be provided, and in conformance with Section 1224.4.4.4.

1224.39.6.5.7 Nourishment area. A nourishment area, in compliance with Section 1224.4.4.5, shall be provided within the unit.

1224.39.6.5.8 Clean utility room. A clean utility/workroom shall be provided, and in conformance with Section 1224.4.4.6.

1224.39.6.5.9 Soiled workroom. A soiled workroom or soiled holding room shall be provided, and in conformance with Section 1224.4.4.7.

1224.39.6.5.10 Clean linen storage. Clean linen storage shall be provided. It may be within the clean utility room or a separate closet.

1224.39.6.5.11 Ice machine. An ice machine shall be provided for treatment and nourishment. Ice-making equipment may be in the clean utility room/holding room or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

1224.39.6.5.12 Equipment storage. Appropriate room(s) shall be provided for storage of equipment necessary for patient care. Equipment storage must be readily accessible but may be shared with other units and/or departments.

1224.39.6.5.13 Gurneys and wheelchairs. A storage room or alcove for gurneys and wheelchairs shall be provided and shall be a minimum of 15 square feet (1.39 m²).

1224.39.6.5.14 Emergency equipment storage. Space shall be provided for emergency equipment that is under direct control of the nursing staff, such as a cardiopulmonary resuscitation crash cart. This space shall be directly accessible from the nursing station, but out of normal traffic.

1224.39.6.5.15 Portable oxygen storage. Space shall be provided for portable oxygen storage, and shall meet the requirements of Section 307 for allowable quantities and hazard group for fire separations. Portable oxygen storage may be omitted if station outlets per Table 1224.4.6.1 "observation unit" footnote 8 are provided.

1224.39.6.5.16 Housekeeping room. A housekeeping room must be readily accessible but may be shared with other units and/or departments.

1224.40 SKILLED NURSING SERVICE SPACE. If provided a skilled nursing service unit shall be housed in a separate and distinct nursing unit and shall comply with the applicable requirements of Section 1225.

1224.41 SOCIAL SERVICE SPACE. If provided, the social service space shall include office or other space for privacy in interviewing, telephoning and conducting conferences.

**SECTION 1225 [OSHPD 2]
SKILLED NURSING AND
INTERMEDIATE-CARE FACILITIES**

1225.1 Scope. The provisions of this section shall apply to skilled nursing and intermediate-care facilities, including distinct part skilled nursing and intermediate-care services of a general acute-care or acute psychiatric hospital license, provided either is in a separate unit or a freestanding building. Skilled nursing facilities and intermediate-care facilities shall provide all common elements and support services. The required services for skilled nursing and intermediate-care facility licensure: physician, skilled nursing, dietary, pharmaceutical services and activity program shall be provided. At the option of the provider, the medical model or the household model may be used.

1225.1.1 Small house skilled nursing facilities. Skilled nursing facilities participating in the Small House Nursing Facilities Pilot Program established by and in conformance with Section 1323.5 of the California Health and Safety Code, shall meet all the provisions of Section 1225.4 Common Elements and Section 1225.5.2 Household Model applicable to small house skilled nursing facilities.

1225.1.2 Subacute care. Patient rooms providing subacute care shall comply with Section 1225.5.1.2. Equipment and components supporting subacute bed(s) shall have special seismic certification per Section 1705. Electrical requirements shall comply with California Electrical Code Article 517.

Note: Construction documents for OSHPD 2 buildings without subacute beds shall explicitly state that the skilled nursing facility or intermediate care facility does not admit patients needing sustained electrical life support equipment

1225.2 Application. New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Fire Code (Parts 3, 4, 5 and 9 of Title 24), and this section.

Exception: See Section 1224.2.

1225.2.1 Services/systems and utilities. Services/systems and utilities shall only originate in, pass through or under structures which are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1225.2.2 Means of egress. Means of egress shall only pass through structures that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1225.3 Definitions. Refer to Section 1224.3.

1225.4 COMMON ELEMENTS.

1225.4.1 NURSING SERVICE SPACE.

1225.4.1.1 Nurse station. A nurse station in free-standing skilled nursing and intermediate-care facilities shall be provided within each nursing unit. Nurse

stations shall be designed to serve no more than 60 beds.

1225.4.1.1.1 Components. Nurse stations shall be provided with a cabinet, a desk, space for records, a bulletin board, a telephone, a specifically designated, lockable and illuminated medicine storage compartment and a handwashing station. If a separate medicine room is provided, it shall have a lockable door and a sink. This sink cannot replace the required nurse station handwashing fixture.

1225.4.1.1.2 Size. Nurse stations serving 25 or less beds shall have a minimum floor area of 100 square feet (9.29 m²). Nurse stations servicing more than 25 beds shall have a minimum floor area of 125 square feet (11.6 m²). The minimum dimension of any nurse station shall not be less than 8 feet (2438 mm).

1225.4.1.1.3 Distance. In free-standing skilled nursing and intermediate-care facilities, the distance between the nurse station entrance and the center of the doorway of the most remote patient bedroom shall not exceed 150 linear feet (45,720 mm).

Exception: The 150-foot (45,720 mm) limit does not apply to distinct part skilled nursing and intermediate-care services provided as a separate unit in a general acute-care hospital or acute psychiatric hospital.

1225.4.1.2 Room identification. Each patient room shall be labeled with an identification number, letter or combination of the two.

Exception: Small house skilled nursing facilities.

1225.4.1.3 Utility rooms. Utility rooms shall be provided in each nursing unit. Soiled and clean utility or holding rooms shall be separated and have no direct connection.

1225.4.1.3.1 Clean utility room. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing station and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials, the work counter and handwashing station may be omitted.

1225.4.1.3.2 Soiled workroom or soiled holding room. This room shall be separate from the clean utility room. The soiled workroom/utility room shall contain a clinical sink (or equivalent flushing-rim fixture). The room shall contain a handwashing station. The above fixtures shall both have a hot and cold mixing faucet. The room shall have a work counter and space for separate covered containers for soiled linen and waste. Rooms used only for temporary holding of soiled material may omit the clinical sink and work counter. If the flushing-rim clinical sink is eliminated, facilities for cleaning bedpans shall be provided elsewhere.

1225.4.1.4 Visual privacy. A method of assuring visual privacy for each patient shall be provided in patient rooms and in tub, shower and toilet rooms.

1225.4.1.5 Treatment or exam room. If provided, the treatment or exam room shall comply with all of the requirements of Section 1224.4.4.

1225.4.1.6 Toilet room and bath facilities. Separate toilet room facilities shall be provided for the use of patients, staff and the public. Fixtures serving individual patient rooms shall not be considered as meeting the required ratios for bedrooms not served by individual adjoining toilet room or bathrooms.

1225.4.1.6.1 Grab bars. Each toilet, bathtub and shower serving patients shall be provided with conveniently located grab bars.

1225.4.1.6.2 Toilet rooms. One patient toilet room shall serve no more than two patients. The toilet room shall contain a toilet, a handwashing station, a mirror and individual storage for the personal effects of each patient.

Exception. Where renovation of existing patient rooms is undertaken in facilities built under the 2013, or prior, California Building Code, each toilet room may continue to serve up to the number of beds previously served, but not more than two patient rooms or eight beds.

1225.4.1.6.3 Bathroom facilities. Bathtubs or showers shall be provided at a ratio of 1:20 patients, and for each major fraction thereof, with a minimum of one bathtub per floor. A separate private toilet shall be provided that is directly accessible to each multi-bathing fixture central bathing area without requiring entry into the general corridor.

1225.4.1.7 Patient/nurse call system. A patient/nurse call system complying with Section 517.123, California Electrical Code, shall be provided.

1225.4.1.7.1 In small house skilled nursing facilities, visitor toilet room(s) shall be equipped with a nurse call station.

1225.4.1.8 Special-purpose rooms. Special-purpose rooms for the purpose of single-patient occupancy shall be provided at a ratio of one room for every 35 patients or fraction thereof. Airborne infection isolation rooms may be included in determining the number of special-purpose rooms required for the facilities.

Exception: The special-purpose room may be omitted if all patient rooms are single-resident rooms.

1225.4.1.9 Airborne infection isolation rooms. If provided, the airborne infection isolation room shall comply with all of the requirements of Section 1224.14.3.

1225.4.1.10 Protective environment room(s). If provided, the protective environment room shall comply with all of the requirements of Section 1224.14.4.

1225.4.1.11 Quiet room. If a quiet room is provided, the quiet room shall comply with the following requirements.

1225.4.1.11.1 Space requirements. Refer to Section 1225.5.1.2, Nursing service space.

1225.4.1.11.2 Toilet room. Provide a patient toilet room adjacent to the quiet room. The patient toilet room shall not be shared with another patient room. If the quiet room is located in a common area, the patient toilet room may be shared with compatible services or activities.

1225.4.1.11.3 Noise control. The quiet room shall comply with the acoustic requirements of Section 1224.4.19, Noise control.

1225.4.2 DIETETIC SERVICE SPACE.

1225.4.2.1 General. Food service facilities and equipment shall conform with these standards, the standards of the National Sanitation Foundation and the requirements of the local public health agency.

1225.4.2.1.1 Distribution. Provision(s) shall be made for transport of hot and cold foods as required, appropriate for the type of food service selected.

1225.4.2.1.2 Dining space. Separate dining spaces shall be provided for patients and staff. These spaces shall be separate from the food preparation and distribution areas.

Exception: Shared dining shall be provided for patients and staff in small house skilled nursing facilities.

1225.4.2.1.3 Location. The design and location of dining facilities shall encourage patient use.

1225.4.2.1.4 Food service. Facilities shall be furnished to provide nourishment and snacks between scheduled meal service.

1225.4.2.2 Functional elements. The following facilities, in the size and number appropriate for the type of food service selected, shall be provided:

1225.4.2.2.1 Location. Food-service areas shall be directly accessible to the entry for food supply deliveries and for the removal of kitchen wastes.

1225.4.2.2.2 Receiving/control stations. A control station shall be provided for the receiving and control of incoming dietary supplies.

1225.4.2.2.3 Food preparation facilities. Food preparation facilities shall be provided to accommodate the method of food preparation required.

1. Conventional food preparation systems require space and equipment for preparing, cooking and baking.

2. Convenience food service systems using frozen prepared meals, bulk packaged entrees, individual packaged portions or those using contractual commissary services require space and equipment for thawing, portioning, cooking and baking.

1225.4.2.2.4 Handwashing stations. Handwashing stations shall be located in the food preparation area.

1225.4.2.2.5 Ice-making facilities. Ice-making facilities may be located in the food preparation area or in a separate room. They shall be easily cleanable and immediately accessible to the dietary function.

1225.4.2.2.6 Assembly and distribution. A patient tray assembly area shall be provided and shall be immediately accessible to the food preparation and distribution areas.

1. If food service carts are utilized, a cart distribution system shall accommodate spaces for storage, loading, distribution, receiving and sanitizing of the food service carts. Cart circulation shall not be through food preparation areas.

1225.4.2.2.7 Ware-washing facilities. Ware-washing space shall be provided in a room separate from the food preparation and serving area. It shall be designed to prevent contamination of clean wares with soiled wares through cross-traffic. The clean wares shall be transferred for storage or use in the dining area without having to pass through food preparation areas.

1. Commercial-type ware-washing equipment shall be provided.
2. Space shall be provided for receiving, scraping, sorting and stacking soiled tableware and for transferring clean tableware to the using areas.
3. Handwashing stations shall be provided in the ware-washing space.

1225.4.2.2.8 Pot-washing facilities. Pot-washing facilities shall include multi-compartmented sinks.

1225.4.2.2.9 Office space. Office or other space shall be provided for the dietician or dietetic service supervisor.

1225.4.2.2.10 Storage.

1. Food storage space, including cold storage, shall be provided for a supply of food of at least a 7 day staple, 2 day frozen, 2 day perishable, and an emergency food and water supply. All food shall be stored clear of the floor. The lowest shelf shall be not less than 12 inches (305 mm) above the floor or shall be closed in and sealed tight, for ease of cleaning.

As a minimum, dietary storage space shall be provided in accordance with the following schedule:

Licensed Bed Capacity	Storage Space
1 to 99 beds	2 square feet (0.19 m ²) per bed
100 to 199 beds	200 square feet (18.58 m ²) plus 1 square foot (0.0929 m ²) per bed in excess of 100 beds
200 beds and over	300 square feet (27.99 m ²), plus 1/2 square foot (0.0465 m ²) per bed in excess of 200 beds

Space to allow refrigeration for the storage of frozen and chilled foods shall be provided at a minimum of 2 cubic feet (0.057 m³) of usable space per bed.

2. Additional storage space for dietetic service supplies, such as paper products, equipment, tray delivery carts, etc. shall be provided.
3. Storage areas and sanitizing facilities for cans, carts and mobile-tray conveyors shall be provided.
4. Waste, storage and recycling facilities (per local requirements) shall be located in a separate room easily accessible to the outside for direct pickup or disposal.

1225.4.2.2.11 Toilet rooms. Toilet rooms shall be provided for the exclusive use of the dietary staff. They shall not open directly into the food preparation areas, but shall be readily accessible.

Exception: Small house skilled nursing facilities utilizing staff trained for dietary and care-giving responsibilities may provide toilet room(s) serving both the dietary and nursing service areas.

1225.4.2.2.12 Lockers. An enclosed, separate area shall be provided for dietetic service employees' clothing and personal belongings.

Exception: Small house skilled nursing facilities utilizing staff trained for dietary and care-giving responsibilities may provide common locker room(s) serving both the dietary and nursing service areas.

1225.4.2.2.13 Housekeeping room. A housekeeping room meeting the requirements of Section 1224.4.15 shall be located within the dietary department for the exclusive use of the dietary department.

1225.4.2.3 Outside service. On approval of the Licensing Agency, when food is provided by an outside food service, the facility shall maintain adequate space, equipment and food supplies to accommodate required functional elements listed in Section 1225.4.2.2, as

required to provide patient food service in the event that the outside food service is interrupted.

SUPPORT SERVICES

1225.4.3 ADMINISTRATION SPACE.

1225.4.3.1 Administration and public spaces. An administration area shall be provided which shall include space for business, administration, admitting, public toilet room(s), lobby and public telephone.

1225.4.3.2 Medical record storage. Space shall be provided for the storage of medical records.

1225.4.3.3 Office. An office for the director of nurses shall be provided.

1225.4.3.4 Small house skilled nursing facilities. Small house skilled nursing facility units may provide the administration and public spaces, medical record storage and the nursing director's office in a separate centralized support area attached to the unit(s) or detached in a separate building in close proximity to the unit(s), as a part of the small house skilled nursing facility. This building shall be under OSHPD jurisdiction.

1225.4.4 STERILE SUPPLIES.

1225.4.4.1 Storage. Each facility shall provide space for the storage of disposable sterile supplies or provide space for sterilization and disinfection equipment.

Exception: Facilities with contractual arrangements for outside autoclaving and sterilizing services.

1225.4.4.2 Central sterile supply. If provided, shall accommodate the following:

1225.4.4.2.1 Minimum requirements. A central supply and sterilizing area shall be provided. Rooms and spaces shall accommodate the following services and equipment:

1. Soiled work area. A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled material.
2. Clean work area. A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. Sterilizing space.
4. Storage. Space for sterile supplies and unsterile supplies.

1225.4.4.2.2 Sterilizers. All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

Exception: Small instrument sterilizers.

1225.4.5 STORAGE.

1225.4.5.1 Required areas. Facilities shall provide combined general and specialized storage in accordance with the following schedule:

Licensed Bed Capacity	Storage Area
1 to 10 beds	120 square feet (11.15 m ²) minimum
11 to 100 beds	12 square feet (1.11 m ²) per bed
Over 100 beds	1,200 square feet (111.48 m ²) plus 5 square feet (0.46 m ²) per bed for each bed over 100

1225.4.5.2 Specialized storage. Shall include those spaces identified in the dietetic food storage of Section 1225.4.2.2.10 and as follows:

1225.4.5.2.1 Linen. Separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m²) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m²), except where linen chutes are provided, and may be within the soiled utility room.

1225.4.5.2.2 Supply. One supply storage space having a minimum area of 15 square feet (1.39 m²) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.

1225.4.5.2.3 Wheelchairs. A room or space shall be provided in each nursing unit for wheelchairs and stretchers. The wheelchair and stretcher space shall have a minimum area of 15 square feet (1.39 m²).

1225.4.5.2.4 Separate supplies. Sterile and unsterile supplies shall be stored separately.

1225.4.5.2.5 Location. All storage spaces shall be readily accessible in the licensed facility.

1225.4.6 HOUSEKEEPING ROOMS. Housekeeping rooms shall be provided to serve each department and nursing unit, and may be shared by compatible departments, except when specifically required by other sections.

1225.4.7 LAUNDRY. If a laundry is to be provided, the following is required in addition to the laundry room:

1. A separate soiled linen receiving, holding and sorting room with handwashing station.
2. A separate clean linen storage, issuing and holding room.
3. Storage for laundry supplies.

1225.4.7.1 Outside service. If linen is processed off site, the following shall be provided within the facility:

1. A soiled linen holding room.
2. A separate clean linen receiving and storage room.

1225.4.8 EMPLOYEE DRESSING ROOMS AND LOCKERS. Separate dressing rooms with toilet(s), lavatories and lockers for male and female personnel shall be provided.

Exception: Small house skilled nursing facilities, with a peak shift of less than five staff, may provide a single toilet room serving both male and female personnel in compliance with the California Plumbing Code Table 4-3, footnote 7.

1225.5 SKILLED NURSING UNIT MODELS. The requirements of the Medical Model or the Household Model shall apply to the Nursing Unit(s) in its entirety.

1225.5.1 MEDICAL MODEL.

1225.5.1.1 General construction. Skilled nursing and intermediate-care facilities shall comply with Sections 1224.4 through 1224.13 whenever applicable.

1225.5.1.2 NURSING SERVICE SPACE.

1225.5.1.2.1 Patient bedrooms. Patients shall be accommodated only in rooms with the following minimum floor area, exclusive of toilet rooms, wardrobes, entrance vestibules and fixed furnishings or equipment.

1. Single-patient rooms: 110 square feet (10.21 m²).
2. Multi-patient rooms: 80 square feet (7.43 m²) per bed.

1225.5.1.2.2 Bed clearance. The dimensions and arrangement shall be such that there is a minimum distance of 3 feet (914 mm) between the sides and foot of the beds and any wall or any other fixed obstruction. In multiple-bed rooms, in addition to the above, a minimum clearance of 3 feet (914 mm) shall be provided between beds and a clearance of 4 feet (1219 mm) shall be available at the foot of each bed to permit the passage of equipment and beds.

1225.5.1.2.3 Patient room beds. Patient rooms shall be of such shape and dimensions to allow for the performance of routine functions, including the easy transfer of patients to and from bed to wheelchair or wheeled stretcher. Patient rooms shall provide direct access to a toilet room without entering or passing through a patient bed area. Maximum occupancy shall be two patients per patient room.

Exception: Where renovation of existing individual patient rooms is undertaken in facilities built under the 2013, or prior, California Building Code, maximum room capacity shall be no more than the present capacity, to a maximum of four patients per patient room. Placement of beds

shall not be more than three deep from the exterior window. This exception is not permitted for patient rooms providing subacute care.

1225.5.1.2.4 Outside exposure. Each patient bed area shall have an outside exposure and shall not be below ground level. The window or glazed opening shall provide an unobstructed view from the head of each patient bed to the outdoors and shall be accessible to approach using a wheelchair or other patient-operated mobility device.

1225.5.1.2.5 Patient storage. Each patient room shall be provided with wardrobe or locker spaces for clothing, toilet articles or other personal belongings for each patient.

Exception: Pediatric and psychiatric patient rooms.

1225.5.1.2.6 Patient toilet room. Each patient room shall have its own patient toilet room. Each patient shall have direct access to a toilet room without entering a general corridor or patient bed area in a shared patient room.

1225.5.1.3 PHARMACEUTICAL SERVICE SPACE.

1225.5.1.3.1 Drug space and storage. Adequate space shall be provided at each nursing station for the storage of drugs and preparation of medication doses.

1225.5.1.3.2 Drug access. All spaces and areas used for the storage of drugs shall be lockable and accessible to authorized personnel only.

1225.5.1.3.3 Narcotics. Specific space shall be designed for safe storage of narcotics and other dangerous drugs.

1225.5.1.3.4 Drug refrigeration. Facilities shall provide for storage of drugs requiring refrigeration.

1225.5.1.3.5 Pharmacy. The pharmacy shall not serve the general public unless a separate public entrance or a separate public serving window is utilized.

1225.5.1.4 ACTIVITY PROGRAMMING SPACE. Designated activity areas appropriate to independent and group needs of patients shall be provided as follows:

1225.5.1.4.1 Skilled nursing facilities.

1. Recreation room. Each floor of each building accommodating six or more patients shall be provided with a recreation room with a minimum of 100 square feet (9.29 m²).
2. Recreation and dining. A minimum of 100 square feet (9.29 m²) plus 12 square feet (1.11 m²) per bed shall be provided for recreation and dining activities.

1225.5.1.4.2 Intermediate-care facilities.

1. Recreation room. Each floor of each building accommodating five or more patients shall be

provided with a recreation room with a minimum of 150 square feet (13.94 m²).

2. Recreation and dining. A minimum of 30 square feet (2.79 m²) per bed for recreation and dining activities.
3. Outdoor space for activities and recreation.

1225.5.1.4.3 Equipment and supplies. Recreation and dining spaces shall be provided with space to store equipment and supplies.

1225.5.2 HOUSEHOLD MODEL.

1225.5.2.1 General construction. Skilled nursing and intermediate-care facilities and small house skilled nursing facilities shall comply with Sections 1224.4 through 1224.13 whenever applicable, and the following sections:

1225.5.2.1.1 Door thresholds. Door thresholds, except where required at exterior doors and expansion joint covers, shall be designed to facilitate use of wheelchairs and carts and to prevent tripping, and shall provide a smooth and level transition from surface-to-surface.

1225.5.2.1.2 Seating area. A seating area(s) located out of the required egress width shall be provided along the access corridor that is used by patients.

1225.5.2.1.3 Towel bars. Towel bars shall be provided at each bathing facility.

1225.5.2.1.4 Hardware. All patient use plumbing fixtures and door operating hardware shall be equipped with lever type hardware for easy gripping and turning.

1225.5.2.1.5 Drinking fountain. A minimum of one drinking fountain shall be provided per resident floor, unless drinking water is available from the resident dietary area.

1225.5.2.2 Cluster/household unit and resident unit.

1225.5.2.2.1 Design. Each resident unit shall consist of the resident rooms, resident support areas and resident living areas. The unit shall be designed as a cluster/household resident unit or as a resident unit with double or single loaded access corridors. If the cluster/household unit design is utilized, it shall be designed around resident support and living areas with a maximum of 20 patients per cluster/household unit. If the double or single loaded corridor resident unit design is utilized, the access corridor shall be designed so that travel distance from the entrance of the resident unit to the furthest resident room door is no more than 60 feet (18.29 m) without a change of corridor direction or a node for a resident sitting area.

Exception: Small house skilled nursing facilities are limited to household units with a maximum of 12 patients per unit. Small house household units

may also be developed as individual, free-standing facilities.

1225.5.2.2.2 Arrangement. Each resident unit shall be arranged to avoid unnecessary and unrelated travel through the unit.

1225.5.2.2.3 Distinct parts or neighborhoods. Both the cluster/household unit and resident unit designs may be grouped into distinct parts or neighborhoods to a maximum of 60 patients. These distinct parts or neighborhoods composed of the resident unit(s) as described in Section 1225.5.2.2.1 may share the functional requirements of the resident support areas as described in Sections 1225.5.2.4 and 1225.5.2.5 of this code.

1225.5.2.3 Resident room.

1225.5.2.3.1 Capacity. In new construction and additions, the maximum room capacity shall be two patients. Resident sleeping areas in all double resident room designs shall be visually separated from each other by a full height wall or a permanently installed sliding or folding door or partition, and shall provide each patient direct use of and direct access to an exterior window at all times. Walls, doors or partitions used to separate resident beds shall provide visual and acoustical separation. A door leading to each resident bed area in addition to the corridor door is not required. Other resident room arrangements where a permanent partition or door is not used to separate the resident sleeping areas may be utilized if adequate visual separation such as a cubicle curtain(s) and an exterior window for each individual resident sleeping area is provided. In this case individual thermostats for the resident bed areas shall not be required.

Exception: In small house skilled nursing facilities, resident sleeping areas in all double-resident room designs shall be visually separated from each other by a full-height wall or a permanently installed sliding or folding door or partition, and shall provide each patient direct use of and direct access to an exterior window at all times. Walls, doors or partitions used to separate resident beds shall provide visual and acoustical separation.

1225.5.2.3.2 Renovation. Where renovation work is undertaken of the resident room that alters the physical configuration of the resident room and the present capacity is more than two patients, the maximum room capacity shall be no more than two patients at the conclusion of the renovation.

1225.5.2.3.3 Space requirements. Rooms shall have a minimum of 100 square feet (9.29 m²) of clear floor area per bed in double resident rooms and 120 square feet (11.15 m²) of clear floor area in single resident rooms, exclusive of the space consumed by toilet rooms, closets, lockers, wardrobes, lavatories, alcoves and door swings into the room or entrance vestibules, whichever is greater. For the purpose of

minimum clear floor area, the entrance vestibule is defined as that floor area located between the room entrance door and the room floor area containing the resident bed(s).

1225.5.2.3.4 Arrangement. Dimensions and arrangement of resident rooms shall be designed to accommodate at least two bed positions to provide patient choice of bed placement. All such bed positions shall be designed so that the bed will not obstruct access to the supporting utilities serving the bed, such as the nurse call station, and the required electrical outlets that provide service for that bed. Only one bed position design shall be required for a bed that is equipped with a piped medical gas headwall unit, unless special requirements such as providing care for bariatric patients does permit the design of two bed positions in the room.

1225.5.2.3.5 Clearance. A 3 feet (0.91 m) wide clear access to each bed shall be provided along at least 75 percent of the length of one side of the bed and shall be designed to allow access for the use of a wheelchair and other portable equipment. For beds equipped with a piped-in medical gas headwall unit, there shall be a minimum of 3 feet (0.91 m) between the sides and foot of the bed and any wall or any other fixed obstruction. For planning purposes, a full-size bed is assumed to be 3 feet 6 inches (1.07 m) wide by 8 feet (2.43 m) long.

1225.5.2.3.6 Renovations. For renovations that alter the physical configuration of the resident room but have existing structural limitations that require two resident beds to be located in a shared resident sleeping area, there shall be a minimum of 3 feet (0.91 m) between the sides and foot of the bed and the adjacent bed. If one bed must be located to the side of the other bed, there shall be a clearance of 4 feet (1.22 m) to any fixed obstruction available at the foot of this bed to permit the passage of equipment and bed without moving the resident's bed located nearest to the room door.

Exception: In small house skilled nursing facilities, two beds shall not be permitted in a shared resident sleeping area.

1225.5.2.3.7 Resident toilet or bath room. Each patient shall have access to a toilet room without having to enter the general corridor area or the resident bed area in a shared resident room. One toilet room shall serve no more than two patients and no more than two resident rooms. The door to the toilet room shall be side hinged and either swing out from the toilet room or be equipped with emergency release hardware. Sliding doors equipped with sliding door hardware located on the resident room side of the wall and not equipped with a bottom door track shall be permitted. If a sliding door is used in a resident toilet or bath room, a D-shaped handle at least 4 inches (10.16 cm) long shall be provided to open the door. The

sliding door shall permit access, and negate the need to push against a patient who may have collapsed within the toilet room. Unless otherwise required by this code, this door shall be at least 36 inches (914.4 mm) wide. A lavatory shall be provided in each resident toilet room.

1225.5.2.3.8 Wardrobe closet. Each resident room shall be provided with a wardrobe or closet for each patient. Each wardrobe or closet shall have minimum inside dimensions of 2 feet (0.61 m) in depth by 1 foot 8 inches (0.51 m) in width. Each shall be accessible to the patient at all times and shall have adjustable shelf(s) and an adjustable clothes rod that is adjustable in at most 4 inches (10.16 cm) increments from 4 feet (1.22 m) to 5 feet 8 inches (1.73 m) above finished floor or higher as closet size permits. When the wardrobe or closet is designed to meet the requirements for accessibility per Chapter 11B of this code, it shall include additional accessible storage area(s) for full-length garments. The shelf may be omitted if the clothing unit provides at least two drawers. Locked storage for personal items shall be provided within the resident sleeping room or area.

1225.5.2.4 Resident support area.

1225.5.2.4.1 Features and arrangement. Size and features of each resident support area will depend upon the number and type of patients served. The resident support area may be arranged and located to serve more than one resident unit, but at least one such support area shall be provided on each resident floor. The following resident support areas shall be located in or be readily accessible to each resident unit.

1225.5.2.4.2 Staff work area. A centralized staff work area shall be provided. It shall have space for supervisory administrative work activities, charting and storage. In each resident unit, the functions of administrative work, charting and storage may be located among several separate direct care staff work areas. In this case, a centralized staff work area is not required.

1225.5.2.4.3 Clean utility. A clean utility or clean holding room for storage and distribution of clean supply materials shall be provided. If the room is used for preparing patient care items, it shall contain a work counter, a handwashing station and storage facilities for clean and sterile supplies. If the room is used only for storage and holding as a part of a system for distribution of clean and sterile supply materials, the work counter and handwashing station requirements may be omitted. The minimum size of the room shall be 15 square feet (1.39 m²) with 1 square foot (0.092 m²) of additional space provided per patient for over 15 patients and may be allocated among several clean utility or clean holding rooms or closets.

1225.5.2.4.4 Soiled utility. A soiled utility or soiled holding room(s) shall be provided. The soiled utility function shall be comprised of a flushing rim clinical service sink or other appropriate flushing fixture, with bedpan rinsing device, soiled linen receptacles, waste receptacles, handwashing station and a work counter with a usable minimum work surface area of 6 square feet (0.56 m²). The total minimum size of the room shall be 20 square feet (1.86 m²) with 1.5 square feet (0.140 m²) of additional space provided per patient for over 15 patients and may be allocated among several soiled utility or soiled holding rooms. Rooms used only for the holding of soiled materials need contain only a handwashing station.

1225.5.2.4.5 Medicine preparation. A medicine preparation room or a self-contained medicine dispensing unit shall be provided for the provision of medication distribution. The self-contained medicine dispensing unit shall be under the visual control of the staff. If a medicine preparation room is utilized, it shall be equipped with a lockable door, have a minimum area of 50 square feet (4.65 m²) and shall contain a refrigerator, locked storage for controlled drugs, a handwashing station and a work counter with a minimum of 6 square feet (0.56 m²) of work surface. If a self-contained medicine dispensing unit is utilized, it may be located at the nurse station, in the clean utility room, in an alcove, or in other spaces convenient for staff control provided the area occupied by the unit does not encroach upon required minimum areas. The dispensing unit may be used in a medicine preparation room as locked storage for controlled drugs within the minimum area of 50 square feet (4.65 m²), however, the standard “cup sinks” provided in many self-contained units shall not be a substitute for the required handwashing station. If there is no linen storage in the clean utility room, medicine preparation may be part of the clean utility room in which case an additional 20 square feet (1.8 m²) dedicated for this purpose shall be required. A refrigerator shall also be required if medicine preparation is included in this room. Non-controlled prescription drugs may be stored inside the resident’s sleeping room or toilet room if they are secured inside of an automatic closing and automatic locking dispensing unit that is secured in place.

1225.5.2.4.5.1. In small house skilled nursing facilities, if self-contained medicine dispensing units are provided, they shall be located in either a medication preparation room or a clean utility room.

1225.5.2.4.6 Equipment storage. An equipment storage room(s) shall be provided for storage of resident unit equipment. The minimum area required shall be equal to 2 square feet (0.19 m²) for each patient with no room being less than 20 square feet (1.86 m²) in area.

1225.5.2.4.7 Housekeeping room. A housekeeping room(s) shall be provided for storage and use of housekeeping supplies and equipment.

1225.5.2.4.8 Clean linen room. A clean linen storage room, closet or area shall be provided. This area may be located within the clean utility or clean holding room and shall be large enough to accommodate the storage of linen carts.

1225.5.2.4.9 Nourishment room. A nourishment room or area for serving nourishments between meals shall be provided and shall contain a work counter, refrigerator, storage cabinets and sink. Ice for patients’ consumption shall be provided by an icemaker unit that may serve more than one nourishment station if the nourishment stations are in close proximity to each other. Where the icemaker unit is accessible to patients or the public, it shall be a self-dispensing type. The nourishment room shall include space for trays and dishes used for non-scheduled meal service. A handwashing station shall be in or immediately accessible from the nourishment room.

1225.5.2.4.9.1 In small house skilled nursing facilities, the nourishment area may be provided as part of the resident dietary area required under Section 1225.5.2.5.4.

1225.5.2.4.10 Storage alcove. A storage alcove space for a wheelchair(s) shall be provided in an area located out of the required means of exit access.

1225.5.2.4.11 Resident bathing facilities. Resident bathing facilities shall be provided with a minimum of one bathtub or one hydro tub per resident unit, or one shower for every 20 patients and for each major fraction thereof not otherwise served by bathing facilities in resident rooms. When centralized bathing is provided, patients shall have access to at least one bathing room per floor or unit sized to permit assisted bathing in a tub or shower in that resident unit. The bathtub in this room shall be accessible to patients in wheelchairs and the shower shall accommodate a shower chair. Other tubs or showers shall be in individual rooms or curtained enclosures with space for private use of the bathing fixture, for drying and dressing, and access to a grooming location containing a sink, mirror and counter or shelf. A separate private toilet shall be provided that is directly accessible to each multi-bathing fixture central bathing area without requiring entry into the general corridor. This toilet may also serve as a toilet training facility. This centralized bathing area shall comply with Chapter 11B of this code.

1225.5.2.4.12 Private bathing. All showers located in bathrooms connected directly to the resident room shall be designed so that a shower chair can be easily rolled over the threshold. Resident rooms and associated toilet rooms, required to be accessible, shall comply with Chapter 11B of this code.

1225.5.2.5 Resident living area.

1225.5.2.5.1 Dining. Dining, lounges, and recreation and social areas for patients shall be provided in each resident unit. The total area of these spaces shall be a minimum of 35 square feet (3.25 m²) per patient with a minimum total area of 225 square feet (20.90 m²). At least 20 square feet (1.86 m²) per patient shall be available for dining. Storage for supplies and equipment shall be provided in the recreation area.

1225.5.2.5.2 Outdoor area. Outdoor area(s) shall be provided for the use of all patients and shall include walking paths of durable materials, benches, shaded areas and visual focusing element(s) such as landscaping, sculpture(s) or fountain(s). Security fencing if used shall be of a residential design and provide some visual connection to the exterior of the secured area. If an exterior visual connection is not possible or desirable, then the interior of the outside area shall be landscaped to be visually interesting.

1225.5.2.5.3 Storage. Storage for supplies, patient needs and recreation shall be provided. The minimum required area shall be 5 square feet (0.46 m²) per bed up to 600 square feet (55.74 m²).

1225.5.2.5.4 Dietary area. A resident dietary area shall be provided in the resident unit for the use of staff, patients and family. The resident dietary area may include cooking equipment, counter tops, kitchen sink and storage areas. This dietary area is in addition to the dietetic service space requirements in Section 1225.4.2.

1225.5.2.5.4.1 Food preparation spaces in the resident dietary area in a small house skilled nursing facility shall be designed to accommodate the method of food preparation required. The California Department of Public Health, Licensing and Certification shall review proposed food services spaces at a preliminary stage of plan review.

1225.5.2.5.4.2 The resident dietary area in a small house skilled nursing facility shall provide a handwashing station. This handwashing station shall be in addition to the kitchen sink and shall be located in or immediately accessible to the resident kitchen facilities.

1225.5.2.5.4.3 When provided, the resident dietary area in a small house skilled nursing facility shall have a commercial ware-washing space meeting the requirements for the care model used. This space shall be designed to prevent cross contamination by providing area for receiving, scraping, sorting and stacking soiled tableware and for transferring clean tableware to point-of-use areas.

1225.5.2.5.4.4 The resident dietary area in a small house skilled nursing facility shall provide

access to self-dispensing drinking water and self-dispensing ice.

- (a) Ice-making equipment shall be accessible to residents and visitors
- (b) Ice-making equipment shall be located, designed and installed to minimize noise.
- (c) Ice-making equipment shall be permitted to serve more than one food area within resident kitchen facilities.

1225.5.2.5.5 Therapy unit. If provided, physical, speech and occupational therapy units shall comply with Sections 1225.6.2 through 1225.6.4.

1225.5.2.5.6 Barber/beauty room. If provided, the barber/beauty room shall be a minimum of 120 square feet (11.15 m²) with the least dimension of 10 feet (3.05 m).

1225.5.2.5.7 Resident laundry facilities. If provided, resident laundry facilities including washing and drying equipment may be provided for staff, family or individual patient use for the laundering of patient's personal items. If provided they shall be readily accessible from each resident unit without requiring the user to enter another resident unit or floor, and may be shared between two resident units. These resident laundry facilities may utilize residential laundry equipment. Each resident laundry area shall contain a handwashing fixture.

1225.5.2.6 STAFF SUPPORT AREA.

1225.5.2.6.1 Staff lounge. Staff lounge area(s) shall be provided. It may be shared by multiple resident units if the lounge is located so it is accessible without requiring the user to enter into or through any other resident unit.

1225.5.2.6.2 Storage. Lockable closets, drawers or compartments shall be provided on the resident unit for staff and may be located in the lounge for safekeeping of staff's personal effects.

1225.5.2.6.3 Staff toilet rooms. Staff toilet rooms shall be readily accessible to each resident unit.

1225.5.2.6.4 Multipurpose room. At least one multipurpose room per skilled nursing facility shall be provided for conferences, meetings and health education purposes, and shall accommodate the use of visual aids. This room shall have a minimum area of 120 square feet (11.15 m²).

1225.5.2.6.5 Conference room. Conference or consultation room for patient and family use shall be provided and may be shared by more than two resident units if it is centrally located to each.

1225.6 OPTIONAL SERVICES.

1225.6.1 General. Waiting areas and access to optional services for outpatients shall accommodate the following:

1225.6.1.1 Outpatient waiting rooms. Waiting rooms for outpatients shall provide a seating area and space for wheelchairs, and have public corridor access to or

provisions for, public toilet room(s), drinking fountain and telephone.

Note: One waiting area may serve more than one department or service.

1225.6.1.2 Circulation. If x-ray examinations are to be performed on outpatients, outpatient access to the radiological spaces shall not traverse a nursing unit.

Exception: Satellite radiology, laboratory, pharmacy, and physical and occupational therapy space serving inpatients may be located in nursing units and inpatient treatment areas.

1225.6.2 PHYSICAL THERAPY SERVICE. Refer to Section 1224.35.2.

1225.6.3 OCCUPATIONAL THERAPY SERVICE. Refer to Section 1224.35.3.

1225.6.4 SPEECH PATHOLOGY AND/OR AUDIOLOGY SERVICE. At least one space free of ambient noise shall be provided. A handwashing station shall be provided.

1225.6.5 SOCIAL WORK SERVICE. Office space for privacy in interviewing, telephoning and conferences shall be provided.

1225.6.6 SPECIAL TREATMENT PROGRAM SERVICE. Refer to California Administrative Code (Part 1 of Title 24), Section 7-119, Functional Program, for requirements. Projects associated with Special Treatment Program Services in skilled nursing and intermediate-care facilities shall include a Patient Safety Risk Assessment.

1225.6.6.1 Location. A special treatment program service providing therapeutic services to an identified mentally disordered population group shall be located in a distinct separate unit of the facility.

1225.6.6.2 Nursing service. The nursing service space shall comply with Section 1225.4.1.

1225.6.6.3 Activity program. The activity program space shall provide a minimum of 25 square feet (2.3 m²) of dining and recreation space per bed.

1225.6.6.4 Indoor and outdoor space. Shall be designated for the special treatment program.

**SECTION 1226 [OSHPD 3]
CLINICS**

1226.1 Scope. The provisions of this section shall apply to primary care clinics, specialty clinics and psychology clinics, licensed by the California Department of Public Health. Primary care clinics include free clinics, community clinics, employee clinics and optometric clinics. Specialty clinics include surgical clinics, chronic dialysis clinics, rehabilitation clinics and alternative birth centers (ABC). This section shall also apply to outpatient clinical services of a hospital when provided in a freestanding building.

1226.2 Application. All new buildings and additions, alterations or repairs to existing buildings and conversion of space to a clinic use within existing buildings, subject to

licensure by Licensing and Certification, California Department of Public Health, shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Fire Code, (Parts 3, 4, 5 and 9 of Title 24) and this section. OSHPD requirements apply to all facilities described above and are not dependent upon Occupancy Group designations.

Exception: See Section 1224.2.

1226.2.1 Outpatient clinical services. Hospitals providing outpatient clinical services and clinics licensed under Health and Safety Code Section 1200 providing services that are not covered by this section shall meet the applicable requirements in Section 1224.

1226.2.2 Special services. A general acute care hospital referenced in Health and Safety Code Section 1255 (d) (3) (E), that provides special services in conformance with Health and Safety Code Section 1255, shall meet all the provisions of Section 1224.28.3 in addition to Section 1226.2. The Office of Statewide Health Planning and Development (OSHPD) shall review any proposed construction or alteration for OSHPD compliance.

1226.3 Definitions. Refer to Section 1224.3.

1226.4 General construction. Clinics and outpatient clinical services under a hospital license shall comply with the provisions under Section 1224.4, General Construction, where applicable, except as supplemented, amended or modified below.

1226.4.1 Examination and treatment areas.

1226.4.1.1 Service spaces. Refer to Section 1224.4.2.

1226.4.1.2 Treatment spaces. Refer to Section 1224.4.3.

1226.4.1.3 Examination or treatment room. Refer to Section 1224.4.4.1.

1226.4.1.4 Airborne infection isolation exam/treatment room. Refer to Section 1224.4.4.1.3.

1226.4.2 Miscellaneous requirements.

1226.4.2.1 Station outlets. When provided, refer to Section 1224.4.6.1.

1226.4.2.2 Gas and vacuum systems. When provided refer to Section 1224.4.6.2.

1226.4.2.3 Hyperbaric facilities. When provided, refer to Section 1224.4.6.3.

1226.4.2.4 Laboratories. Refer to Section 1224.4.6.4.

1226.4.2.5 Nurse call systems. Refer to Section 1224.4.6.5.

1226.4.2.6 Noise reduction. The noise reduction criteria shown in Table 1224.4.19 shall apply to partitions, floors and ceiling construction in patient treatment areas.

1226.4.3 Corridors.

1226.4.3.1 Outpatient services. Refer to Section 1224.4.7.3

1226.4.3.2 Corridor width. For clinics with bed/gurney patient(s) refer to Section 1224.4.7.1.

1226.4.3.3 Light traffic. Refer Section 1224.4.7.2.

1226.4.3.4 Handrails. For rehabilitation services space, refer to Section 1224.4.7.4.

1226.4.3.5 Contiguous functions. Basic services of a single licensed clinic may be located in separate suites. Each clinic suite shall be contiguous and include internal circulation to access each of the required functions identified for that specific basic service.

Exceptions:

1. Various functions including but not limited to reception, waiting, staff support areas such as toilets, storage and lounge may be located outside of the clinic suite with approval from the California Department of Public Health.
2. If toilets and drinking fountain(s) serving the public are provided as part of the overall building features, they need not be provided within the clinic suite.
3. Shared services. Space for general storage, laundry, housekeeping and waste management may be shared with other tenants.

1226.4.4 Doors and door openings.

1226.4.4.1 Toilet room doors. Refer to Section 1224.4.8.1.

1226.4.4.2 Pocket doors. Refer to Section 1224.4.8.2.

1226.4.5 Windows.

1226.4.5.1 Window screens. Refer to Section 1224.4.9.4.

1226.4.5.2 Light and ventilation. Refer to Section 1224.4.9.5.

1226.4.6 Ceiling heights.

1226.4.6.1 Minimum height. For minimum ceiling height requirements, refer to Section 1224.4.10.1.

1226.4.6.2 Minimum height with fixed ceiling equipment. Refer to Section 1224.4.10.2.

1226.4.7 Interior finishes.

1226.4.7.1 Floor finishes. Refer to Section 1224.4.11.1 and Table 1224.4.11.

1226.4.7.1.1 Covered base. Refer to Section 1224.4.11.1.1.

1226.4.7.1.2 Wet cleaning. Refer to Section 1224.4.11.1.3.

1226.4.7.1.3 Airborne infection isolation exam/treatment room. Refer to Section 1224.11.1.4.

1226.4.7.2 Wall bases.

1226.4.7.2.1 Material. Refer to Section 1224.4.11.2.1.

1226.4.7.2.2 Wet cleaning. Refer to Section 1224.4.11.2.2.

1226.4.7.3 Wall finishes. Refer to Section 1224.4.11.3.

1226.4.7.4 Ceilings. Ceiling finishes shall comply with Section 1224.4.11.4 and Table 1224.4.11.

1226.4.8 Elevators.

1226.4.8.1 Elevator cab requirements. Buildings over one story in height with accommodations or services for patients on floors without grade-level entrance shall provide at least one elevator in compliance with Section 3002.4.

1226.4.8.2 Dimensions. Elevators used for the routine transport of wheeled stretchers shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm) and a minimum clear door opening of 3 feet 8 inches (1118 mm).

1226.4.9 Garbage, solid waste, medical waste and trash storage. These facilities shall comply with the appropriate local health and environmental authorities' requirements, California Department of Public Health requirements for medical waste management, and comply with the following minimum requirements:

1226.4.9.1 Location. A location shall be provided for waste collection and storage with sufficient space based upon the volume of projected waste and length of anticipated storage. The location of compactors, balers, sharps containers and recycling container staging at docks or other waste removal areas shall comply with Section 1224.4.2.

1226.4.9.2 Enclosure. A lockable room or screened enclosure of at least 25 square feet (2.32 m²) shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash and other solid wastes.

Exception: This amount of space may not be required by the enforcing agency if there is a proposed method of handling and storage which requires a lesser amount of space. Additional space may be required by the enforcing agency when special operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

The room or screened enclosure shall include the following:

1. **Floor and curb.** A concrete floor with a curb and with a drain connected to the sewer.
2. **Water.** Steam or hot water and cold water supplies in accordance with the California Plumbing Code.
3. **Size.** A minimum floor area of not less than 25 square feet (2.32 m²), the least dimension of which shall be 4 feet (1219 mm). This amount of space may not be required by the enforcing agency if there is proposed a method of handling, storage or cleaning of containers which requires a lesser amount of space. Additional space may be required by the enforcing agency when special operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

1226.4.9.3 Waste holding room. As an alternative to the requirements in Section 1226.4.9.2, a holding room for medical waste and garbage may be provided.

Exception: This amount of space may not be required by the enforcing agency if there is a proposed method of handling and storage which requires a lesser amount of space. Additional space may be required by the enforcing agency when special operations or collection and disposal methods result in greater than usual accumulation of solid wastes.

The waste holding room shall comply with the following:

1. The waste holding room shall be a minimum of 25 square feet, with the least dimension of which is 4 feet.
2. The waste holding room shall have 100 percent exhaust ventilation.
3. All finishes in the waste holding room shall comply with the requirements in Section 1224.4.11.
4. The waste holding room shall be immediately accessible to an exterior door.

1226.4.10 Compactors. Trash compactor systems shall meet the drainage and wash-down requirements under Section 1226.4.9.2, Items 1 and 2.

Exception: If a dumpster system is proposed, operational procedures for handling and storage must be specifically approved by the local health officials.

1226.4.11 Housekeeping room. Refer to Section 1224.4.15.

1226.4.12 Laundry and trash chutes. Gravity-type laundry and trash chutes shall comply with Section 1224.4.16.

1226.4.13 Support areas for examination and treatment rooms.

1226.4.13.1 Nurse station(s). If required, this area shall have space for counters and storage and shall have direct access to a handwashing stations (refer to Section 1224.3 for definition of handwashing station). It may be combined with or include centers for reception, charting and communication.

1226.4.13.2 Medication station. Provision shall be made for distribution of medications. This shall be done from a medicine preparation room or a self-contained medicine dispensing unit.

1226.4.13.2.1 Medicine preparation room or area. When provided, the entry of the medicine preparation room or area shall be under the visual control of the staff. This may be a part of the administrative center or nurse station and shall include all of the following:

1. Work counter
2. Sink
3. Lockable refrigerator
4. Immediate access to handwashing station

5. Locked storage for biologicals and drugs

When a medicine preparation room or area is to be used to store self-contained medicine dispensing units, the room shall be designed with adequate space to prepare medicines with the self-contained medicine-dispensing units present.

1226.4.13.2.2 Self-contained medicine-dispensing unit. When provided, the location of a self-contained medicine-dispensing unit shall be permitted in the clean workroom or at the administrative center or nurse station, provided there is adequate security for medications and adequate lighting to easily identify drugs. Immediate access to a handwashing station shall be provided.

1226.4.13.3 Clean utility room. A clean utility room shall be provided. If the room is used for preparing patient care items, it shall contain:

1. Work counter
2. Handwashing station
3. Storage facilities for clean and sterile supplies

If the room is used only for storage and holding as part of a system for distribution of clean and sterile materials from a central sterile supply, the work counter and handwashing station may be omitted. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

1226.4.13.4 Soiled workroom or soiled holding room. Soiled workroom or soiled holding room shall be provided and contain:

1. Clinic sink

Exception: For primary care clinics, a utility sink or patient toilet room equipped with a bedpan flushing device may be provided in lieu of a clinic sink. A utility sink may be used for soaking or rinsing and shall be provided as appropriate to the method of decontamination used.

2. Handwashing station
3. Work counter
4. Storage cabinets
5. A designated area for waste receptacle(s)
6. A designated area for soiled linen receptacle(s)

If the clinic includes a central sterile supply that complies with Section 1224.22 and the soiled holding room is used only for temporary holding of soiled materials, the clinic sink and work counter may be omitted. Where rooms are used for temporary holding of materials, provisions shall be made for separate collection, storage and disposal of soiled materials. Soiled and clean utility rooms or holding rooms shall be separated and have no direct connection.

1226.4.13.5 Sterile and pharmaceutical supply storage. Separate storage for sterile supplies and pharmaceutical supplies shall be provided.

1226.4.13.6 Sterilization facilities. When provided, a sterilization facility shall meet the following applicable requirements:

1226.4.13.6.1 Storage. Each facility shall provide space for the storage of disposable sterile supplies or provide space for sterilization and disinfection equipment.

Exception: Facilities with contractual arrangements for outside autoclaving and sterilizing services.

1226.4.13.6.2 Central sterile supply and sterilizing area. When provided, rooms and spaces of the central supply and sterilizing area shall comply with the following:

1. **Soiled work area.** A receiving and gross cleaning area which shall contain work space and equipment for cleaning medical and surgical equipment and for disposal of or processing of soiled materials.
2. **Clean work area.** A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. **Sterilizing and equipment disinfection space.**
4. **Storage.** Space for sterile supplies and unsterile supplies.

1226.4.13.6.3 Sterilizers. When provided, all sterilizers and autoclaves which emit system steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

Exception: Small instrument sterilizers.

1226.4.13.7 Nourishment room. When provided, the nourishment room or area shall have all of the following:

1. Sink
2. Work counter
3. Refrigerator
4. Storage cabinets
5. Equipment for serving nourishment
6. A handwashing station, as defined in Section 1224.3, shall be located in the nourishment room or be immediately accessible without going through a door.

1226.4.14 Support areas for patients.

1226.4.14.1 Patient toilet room(s). Toilet room(s) with a lavatory shall be provided separate from public use toilet(s) and shall be located to permit access from patient care areas without passing through publicly accessible areas.

Exception: For primary care clinics where the facility contains no more than three examination and/or

treatment rooms, the patient toilet room shall be permitted to serve outpatient waiting room(s).

1226.4.14.2 Specimen and/or blood collection facilities. When provided, refer to Section 1224.4.4.2. Use of patient toilet room(s) shall be permitted for specimen collection.

1226.4.15 General support services and facilities.

1226.4.15.1 Areas for off-site laundry services. If linen is to be processed off site, the following shall be provided:

1. Soiled linen holding area or designated and dedicated area for soiled laundry cart.
2. Clean linen storage area that protects linen from soil or damage.

1226.4.16 Public and administrative areas.

1226.4.16.1 Public.

1226.4.16.1.1 Reception. A reception and information counter or desk shall be provided.

1226.4.16.1.2 Outpatient waiting rooms. Refer to Section 1224.4.5.

1226.4.16.2 Administrative services.

1226.4.16.2.1 Medical records storage. Outpatient clinics shall provide a health record service which shall comply with the following:

1. Work area for sorting and recording records for either paper or electronic media.
2. Storage area for records for either paper or electronic media.

1226.4.16.2.2 Equipment and supply storage. General storage facilities for office supplies and equipment shall be provided.

1226.4.17 Support areas for staff.

1226.4.17.1 Staff toilet(s). Provide staff toilet(s) in addition to and separate from, public and patient facilities. The areas shall contain toilet(s) and handwashing stations pursuant to the California Plumbing Code, Table 4-2.

1226.4.17.2 Storage for employees. Provide storage for staff personal effects with locking drawers or cabinets (may be individual desks or cabinets). Such storage shall be readily accessible to individual workstations and shall be staff controlled.

1226.4.17.3 Staff lounge. When provided, the lounge shall have adequate space to accommodate staff.

OUTPATIENT CLINICAL SERVICES OF A HOSPITAL

1226.5 OUTPATIENT CLINICAL SERVICES OF A HOSPITAL. A licensed hospital may elect to locate certain outpatient services in a freestanding building. To be considered a freestanding building, refer to the California Administrative Code Section 7-111. See Section 309A.5.1 of the California Existing Building Code for eligibility for jurisdiction of the local enforcement agency over freestanding buildings adjacent to hospital buildings.

Outpatient clinical services of a hospital provided in a freestanding building are regulated under the banner [OSHPD 3] instead of [OSHPD 1]. These services shall comply with Sections 1226.4.2 through 1226.4.8 and the provisions of this section. Outpatient clinical services of a hospital that are not addressed in the provisions of Section 1226 shall comply with applicable provisions of Section 1224 and/or Section 1228 as if those provisions were repeated in Section 1226.5.

GENERAL SUPPORT AREAS FOR OUTPATIENT CLINICAL SERVICES - Requirements for all service types.

1226.5.1 Support areas for patients.

1226.5.1.1 Patient toilet room(s). Refer to Section 1226.4.14.1.

1226.5.1.2 Specimen and/or blood collection facilities. When provided, refer to Section 1224.4.4.2.

1226.5.2 General support services and facilities.

1226.5.2.1 Garbage, solid waste, medical waste and trash storage. Refer to Section 1226.4.9.

1226.5.2.2 Housekeeping room. Refer to Section 1224.4.15.

1226.5.3 Public and administrative areas.

1226.5.3.1 Public area.

1226.5.3.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.5.3.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.5.3.1.3 Public toilet(s). Refer to Section 1224.4.5.

1226.5.3.1.4 Public telephone access. Refer to Section 1224.4.5.

1226.5.3.1.5 Drinking fountain(s). Refer to Section 1224.4.5.

1226.5.3.2 Administrative services.

1226.5.3.2.1 Medical records storage. Refer to Section 1226.4.16.2.1.

1226.5.3.2.2 Equipment and supply storage. Refer to Section 1226.4.16.2.2.

1226.5.4 Support areas for staff.

1226.5.4.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.5.4.2 Storage for employees. Refer to Section 1226.4.17.2.

RADIOLOGICAL/IMAGING SERVICE SPACE

1226.5.5 Radiological/imaging service space. When x-ray examination services, computerized tomography scanning, magnetic resonance imaging, ultrasound and/or mammography services are provided, the radiological/imaging services space shall comply with the provisions of this section.

1226.5.5.1 Support spaces for radiological/imaging services. The following spaces are common to the imaging service area and are minimum requirements:

1226.5.5.1.1 Patient toilet room(s). In service spaces with procedure rooms that do not require dedicated patient toilets, provide a minimum of one patient toilet room within the service space, refer to Section 1226.4.14.1.

1226.5.5.1.2 Outpatient change area. A separate space shall be provided where outpatients change from street clothing. This shall include provisions for clothing storage, space for clothing change and gowning area. Dressing rooms shall be readily accessible to the imaging rooms.

1226.5.5.1.3 Staff facilities. In service space of three or more procedure rooms, staff toilet room(s) internal to the service space.

1226.5.5.1.4 Handwashing stations. Handwashing stations shall be located within the unit.

1226.5.5.1.5 Imaging storage (active). If imaging storage systems are used, provide a means of sorting and filing patient film or electronic media for immediate retrieval shall be provided.

1226.5.5.1.6 Medication station. Provision shall be made for locked storage of medications and drugs. Refer to Section 1226.4.13.2.

1226.5.5.1.7 Areas for off-site laundry services. Refer to Section 1226.4.15.1.

1226.5.5.2 Radiation protection. Radiation protection requirements for equipment refer to Section 1224.18.1.1.

1226.5.6 X-ray examination services. When provided, x-ray examination services space shall comply with the following:

1. X-ray room.
2. When shielded control alcove with protective view windows is provided, refer to Section 1224.18.1.1.
3. Fluoroscopy room, when provided, shall have a toilet room directly accessible to the fluoroscopy room. This toilet room is in addition to common patient toilet room facilities located in the radiological/imaging service space.
4. Space for processing images.
5. An office or other suitable area for viewing and reporting radiographic examination.

1226.5.7 Computerized tomography (CT) scanning. When provided, CT services space shall comply with the requirements of Section 1224.18.3.

1226.5.8 Magnetic resonance imaging (MRI). When provided, MRI services space shall comply with the requirements of Section 1224.18.4.

1226.5.9 Ultrasound. When ultrasound is provided, refer to Section 1224.18.5.

1226.5.10 Mammography. When mammography is provided, refer to Section 1224.18.6.

GASTROINTESTINAL ENDOSCOPY

1226.5.11 Gastrointestinal endoscopy. When provided, gastrointestinal endoscopy services space shall comply with Section 1224.39.3 and the provisions of this section:

1226.5.11.1 Procedure Room(s).

1226.5.11.1.1 Space requirements. Refer to Section 1224.39.3.1.1.

1226.5.11.1.2 Handwashing station. Refer to Section 1224.39.3.1.2.

1226.5.11.2 Processing room. Refer to Section 1224.39.3.2.

1226.5.11.3 Preoperative patient holding. Refer to Section 1224.16.2.

1226.5.11.4 Post-anesthesia recovery area. Refer to Section 1224.16.

1226.5.11.5 Communication system. Refer to Section 1224.39.3.5.

1226.5.11.6 Support areas for outpatient gastrointestinal endoscopy.

1226.5.11.6.1 Control station. Refer to Section 1224.15.3.1.

1226.5.11.6.2 Medication station. Refer to Section 1226.4.13.2.

1226.5.11.6.3 Soiled workroom. Refer to Section 1224.15.3.7.

1226.5.11.6.4 Clean utility room. Refer to Section 1224.15.3.8.

1226.5.11.6.5 Anesthesia workroom. Refer to Section 1224.15.3.9.

1226.5.11.6.6 Storage room(s) for equipment and supplies used in gastrointestinal endoscopy service space. Refer to Section 1224.15.3.10.

1226.5.11.6.7 Staff clothing change areas. Refer to Section 1224.15.3.11.

1226.5.11.6.8 Housekeeping room. Refer to Section 1224.39.2.3.2.

1226.5.11.6.9 Sterile and pharmaceutical supply storage. Refer to Section 1226.4.13.5.

1226.5.11.7 Additional support areas for patients.

1226.5.11.7.1 Outpatient change area. A separate space shall be provided where patients change out of their street clothing and are prepared for the procedure. This space shall include provisions for clothing storage, toilet room(s), sink, space for clothing change and gowning area.

NUCLEAR MEDICINE

1226.5.12 Nuclear medicine. When provided, nuclear medicine services space shall comply with Section 1224.34 and the provisions of this section:

1226.5.12.1 Radiation protection. When provided, refer to Section 1224.34.1.1.

1226.5.12.2 Nuclear medicine room. Refer to Section 1224.34.1.2.

1226.5.12.3 Radiopharmacy. When provided, refer to Section 1224.34.1.3.

1226.5.12.4 Support areas for nuclear medicine services.

1226.5.12.4.1 Cleanup. Refer to Section 1224.34.2.2.

1226.5.12.4.2 Dose administration area. Refer to Section 1224.34.2.5.

1226.5.12.4.3 Holding. Refer to Section 1224.34.2.6.

1226.5.12.4.4 Patient dressing rooms. Refer to Section 1224.34.2.7.

1226.5.12.4.5 Patient toilet room(s). Refer to Section 1224.34.2.8.

1226.5.12.4.6 Staff toilet room(s). Refer to Section 1224.34.2.9.

1226.5.12.4.7 Handwashing stations. Refer to Section 1224.34.2.10.

1226.5.12.4.8 Control desk and reception. Refer to Section 1226.5.3.

1226.5.12.4.9 Clean linen storage. A storage area for clean linen shall be provided.

1226.5.12.4.10 Soiled and contaminated material. Refer to Section 1224.34.2.13.

1226.5.12.5 Radiotherapy service space. When provided, radiotherapy service space shall comply with the following provisions of this section:

1226.5.12.5.1 Radiation protection. Refer to Section 1224.34.3.2.

1226.5.12.5.2 Room sizes. Refer to Section 1224.34.3.3.

1226.5.12.5.3 General support area. Refer to Section 1224.34.3.4.

1226.5.12.6 Additional support areas for linear accelerator.

1226.5.12.6.1 Mold room. Refer to Section 1224.34.4.1.

1226.5.12.6.2 Block room. Refer to Section 1224.34.4.2.

1226.5.12.7 Additional support areas for cobalt room.

1226.5.12.7.1 Hot lab.

1226.5.12.8 High dose rate brachytherapy room.

CANCER TREATMENT/INFUSION THERAPY

1226.5.13 Cancer treatment/infusion therapy service space. When provided, cancer treatment/infusion therapy service space shall comply with the provisions of this section:

1226.5.13.1 Treatment area.

1226.5.13.1.1 Location. Refer to Section 1224.39.4.2.1.

INTERIOR ENVIRONMENT

1226.5.13.1.2 Nurse station(s). Refer to Section 1224.39.4.2.2.

1226.5.13.1.3 Individual patient treatment areas. Refer to Section 1224.39.4.2.3.

1226.5.13.1.4 Handwashing stations. Refer to Section 1224.39.4.2.4.

1226.5.13.1.5 Privacy. Refer to Section 1224.39.4.2.5.

1226.5.13.1.6 Medication dispensing. Refer to Section 1224.39.4.2.6.

1226.5.13.1.7 Examination room. Refer to Section 1224.39.4.2.7.

1226.5.13.1.8 Clean utility room. Refer to Section 1224.39.4.2.8.

1226.5.13.1.9 Soiled utility room. Refer to Section 1224.39.4.2.9.

1226.5.13.1.10 Nourishment station. Refer to Section 1224.39.4.2.10.

1226.5.13.1.11 Housekeeping room. Refer to Section 1224.39.4.2.11.

1226.5.13.1.12 Supplies. Refer to Section 1224.39.4.2.12.

1226.5.13.1.13 Storage. Refer to Section 1224.39.4.2.13.

1226.5.13.1.14 Clean linen storage. Refer to Section 1224.39.4.2.14.

1226.5.13.1.15 Patient storage. Refer to Section 1224.39.4.3.2.

HYPERBARIC THERAPY

1226.5.14 Hyperbaric therapy service space. When provided, hyperbaric therapy service space shall comply with Section 1224.39.5 and the provisions of this section:

1226.5.14.1 General. Refer to Section 1224.39.5.1.

1226.5.14.2 Hyperbaric chambers. Refer to Section 1224.39.5.2.

1226.5.14.3 Pre-procedure patient holding area(s). Refer to Section 1224.39.5.3.

1226.5.14.4 Medical gas station outlets. Refer to Section 1224.39.5.4.

1226.5.14.5 Support areas for the hyperbaric suite.

1226.5.14.5.1 Reception/control desk. Refer to Section 1224.39.5.5.1.

1226.5.14.5.2 Examination/treatment room(s). Refer to Section 1224.39.5.5.2.

1226.5.14.5.3 Clean linen storage. Refer to Section 1224.39.5.5.3.

1226.5.14.5.4 Clean supply room. Refer to Section 1224.39.5.5.4.

1226.5.14.5.5 Gas cylinder room. Refer to Section 1224.39.5.5.5.

1226.5.14.5.6 Gurney and wheelchair storage. Refer to Section 1224.39.5.5.6.

1226.5.14.5.7 Housekeeping room. Refer to Section 1224.39.5.5.7.

1226.5.14.5.8 Compressor room. Refer to Section 1224.39.5.5.8.

1226.5.14.6 Support areas for staff. Refer to Section 1224.39.5.6.

1226.5.14.7 Support areas for patients.

1226.5.14.7.1 Patient waiting area. Refer to Section 1224.39.5.7.1.

1226.5.14.7.2 Patient changing area. Refer to Section 1224.39.5.7.2.

1226.5.14.7.3 Patient toilet room. Refer to Section 1224.39.5.7.3.

PRIMARY CARE CLINICS

1226.6 PRIMARY CARE CLINICS. Primary care clinics and outpatient clinical services of a hospital providing services equivalent to a primary care clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

1226.6.1 Examination and treatment areas.

1226.6.1.1 Examination room(s). Refer to Section 1224.4.4.1.

1226.6.1.2 Treatment room(s). Treatment room(s) for minor procedures (e.g., minor surgical procedures, casting), if provided, shall have a minimum area of 120 square feet (11.15 m²), the least dimension of which shall be a minimum of 10 feet (3048 mm), excluding such spaces as vestibules and work counters, and shall meet the requirements in Section 1224.4.4.1.

1226.6.1.3 Dental examination and treatment areas. When provided, the examination and treatment space shall be permitted to be a room or a patient care station in an open treatment area.

1226.6.1.3.1 Area. The treatment space shall have a minimum clear floor area of 80 square feet (7.4 m²). This space is required for each station in an open operator or treatment area. A minimum of 3 feet (915 mm) clearance shall be provided along the full length of one side of the chair, the head of the chair, and between the cuspidor and the head of the chair on the other side for assisting dental staff.

1226.6.1.3.2 Pediatric patients. At least one private consultation/treatment room shall be provided when pediatric patients are treated in a facility.

1226.6.1.3.3 Handwashing. Each treatment room shall include a handwashing station. If treatment is provided at stations in an open operator, a handwashing station may be permitted to serve two treatment stations.

1226.6.1.3.4 Imaging. If provided, space for a dental panoramic x-ray system and printer shall also comply with shielding requirements in Section

1226.5.5.2 and alcove requirements in Section 1224.18.1.1.

1226.6.1.4 Oral surgery. When provided, treatment areas for procedures for which general anesthesia is used on more than five patients at a time shall comply with the requirements in Section 1226.8.

1226.6.2 Support areas for examination rooms.

1226.6.2.1 Nurse station. Refer to Section 1226.4.13.1.

1226.6.2.2 Medication station. Refer to Section 1226.4.13.2.

1226.6.2.3 Clean utility room. Refer to Section 1226.4.13.3.

1226.6.2.4 Soiled workroom or soiled linen holding. Refer to Section 1226.4.13.4.

1226.6.2.5 Consultation room. Dental facilities must provide a consultation room for private conferences with patients.

1226.6.2.6 Sterilization facilities. If sterile processing and/or high level disinfection is provided, the sterile processing room shall consist of a decontamination area and a clean work area. The sterile processing/high level disinfection room shall be designed to provide one-way flow of contaminated materials/instruments to the sterilizer/high level disinfection equipment. Sterile/high level disinfected instruments should be distributed from the area in such a manner that processed items do not pass through the decontamination area.

1226.6.2.6.1 Decontamination area. The decontamination area shall be equipped with the following:

1. Countertop, separated from clean countertop by 4 feet minimum distance.
2. Handwashing station separate from the instrument washing sink.
3. Sink for washing instruments. To avoid splash, the decontamination sink shall be separated from the clean work area by either a 4-foot distance from the edge of the sink or a separating wall or screen. If a screen is used, it shall extend a minimum of 4 feet (1220 mm) above the sink rim.
4. Storage for supplies.

1226.6.2.6.2 Clean work area. The clean work area shall be equipped with the following:

1. Countertop, separated from decontamination countertop by 4 feet minimum distance.
2. Sterilizer/high level disinfection equipment, as required for the services provided.
3. Handwashing station, may share with decontamination area handwashing station.
4. Built-in storage for supplies.

1226.6.2.7 Laboratory. Facilities for laboratory services shall be provided in dental facilities or through a contract arrangement with a laboratory service.

1226.6.3 Support areas for patients.

1226.6.3.1 Patient toilet room(s). Refer to Section 1226.4.14.1.

1226.6.3.2 Specimen collection and/or blood collection facilities. When provided, refer to Section 1224.4.4.2.

1226.6.4 General support services and facilities.

1226.6.4.1 Garbage, solid waste, medical waste and trash storage. Refer to Section 1226.4.9.

1226.6.4.2 Housekeeping room. Refer to Section 1224.4.15.

1226.6.5 Public and administrative areas.

1226.6.5.1 Public area.

1226.6.5.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.6.5.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.6.5.1.3 Public toilet(s). Refer to Section 1224.4.5.

1226.6.5.1.4 Public telephone access. Refer to Section 1224.4.5.

1226.6.5.1.5 Drinking fountain(s). Refer to Section 1224.4.5.

1226.6.5.2 Administrative services

1226.6.5.2.1 Medical records storage. Refer to Section 1226.4.16.2.1.

1226.6.5.2.2 Equipment and supply storage. Refer to Section 1226.4.16.2.2.

1226.6.6 Support areas for staff.

1226.6.6.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.6.6.2 Storage for employees. Refer to Section 1226.4.17.2.

1226.7 Reserved.

1226.8 SURGICAL CLINICS. Outpatient surgical clinics, and outpatient clinical services of a hospital providing services equivalent to a surgical clinic, shall comply with Sections 1226.4.2 through 1226.4.8 and the provisions of this section.

1226.8.1 Outpatient surgical service space.

1226.8.1.1 Operating room(s). Refer to Section 1224.39.2, Item 1.

1226.8.1.2 Perioperative services. Provide preoperative patient holding and post-anesthesia recovery area. Refer to Section 1224.16.

1226.8.2 Support areas for outpatient surgery.

1226.8.2.1 Control station. Refer to Section 1224.15.3.1.

1226.8.2.2 Supervisor's office or station. Refer to Section 1224.15.3.2.

1226.8.2.3 Substerile areas. When provided, refer to Section 1224.15.3.3.

1226.8.2.4 Medication station. Refer to Section 1226.4.13.2.

1226.8.2.5 Scrub facilities. Refer to Section 1224.15.3.5.

1226.8.2.6 Clock. Refer to Section 1224.15.3.6.

1226.8.2.7 Soiled workroom. Refer to Section 1224.15.3.7.

1226.8.2.8 Clean utility room. Refer to Section 1224.15.3.8.

1226.8.2.9 Anesthesia workroom. Refer to Section 1224.15.3.9.

1226.8.2.10 Equipment storage room(s) for equipment and supplies used in outpatient surgery. Refer to Section 1224.15.3.10.

1226.8.2.11 Staff clothing change areas. Refer to Section 1224.15.3.11.

1226.8.2.12 Housekeeping room. Refer to Section 1224.39.2, Item 7.

1226.8.2.13 Sterile and pharmaceutical supply storage. Refer to Section 1226.4.13.5.

1226.8.2.14 Sterilization facilities. Refer to Section 1226.4.13.6.

1226.8.3 Support areas for patients.

1226.8.3.1 Patient toilet room(s). Refer to Section 1226.4.14.1.

1226.8.3.2 Outpatient change area. A separate space shall be provided where patients change out of their street clothing and are prepared for the procedure. This space shall include provisions for clothing storage, toilet room(s), sink, space for clothing change and gowning area.

1226.8.4 General support services and facilities.

1226.8.4.1 Garbage, solid waste, medical waste and trash storage. Refer to Section 1226.4.9.

1226.8.4.2 Areas for off-site laundry services. Refer to Section 1226.4.15.1.

1226.8.5 Public and administrative areas.

1226.8.5.1 Public area.

1226.8.5.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.8.5.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.8.5.1.3 Public toilet(s). Refer to Section 1224.4.5.

1226.8.5.1.4 Public telephone access. Refer to Section 1224.4.5.

1226.8.5.1.5 Drinking fountain(s). Refer to Section 1224.4.5.

1226.8.5.2 Administrative services

1226.8.5.2.1 Medical records storage. Refer to Section 1226.4.16.2.1.

1226.8.6 Support areas for staff.

1226.8.6.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.8.6.2 Storage for employees. Refer to Section 1226.4.17.2.

CHRONIC DIALYSIS CLINICS

1226.9 CHRONIC DIALYSIS CLINICS. Chronic dialysis clinics and outpatient clinical services of a hospital providing services equivalent to a chronic dialysis clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

1226.9.1 Examination and treatment rooms.

1226.9.1.1 Examination room(s). An examination room with a handwashing fixture shall be provided with a minimum clear floor area of 100 square feet (9.29 m²).

1226.9.1.2 Treatment room(s). When provided, refer to Section 1224.4.4.1.

1226.9.1.3 Individual patient treatment areas. Individual patient treatment areas shall contain at least 80 square feet (7.44 m²). There shall be at least a 4-foot (1219 mm) space around and between beds and/or lounge chairs. In addition, the following shall be provided:

1. **Location.** The treatment area may be an open area and shall be separate from administrative area and outpatient waiting room.
2. **Privacy.** An open unit shall be designed to provide visual privacy for each patient.

1226.9.1.4 Reception. Refer to Section 1226.4.16.1.1.

1226.9.1.5 Outpatient waiting room. Refer to Section 1224.4.5.

1226.9.1.6 Bloodborne infection isolation room. A minimum of one bloodborne infection isolation room of at least 120 square feet (11.15 m²) of clear floor space shall be provided for patients. This room shall contain a counter and handwashing station.

1226.9.1.7 Airborne infection isolation exam/treatment room. When provided, refer to Section 1224.4.4.1.3.

1226.9.1.8 Home training. When provided in the unit, a private treatment area of at least 120 square feet (11.15 m²) shall be provided for patients who are being trained to use dialysis equipment at home. This room shall contain a counter, a handwashing station and a separate drain for fluid disposal.

1226.9.2 Support areas for examination and treatment rooms.

1226.9.2.1 Administrative center or nurse station. Administrative center or nurse station shall be located within the dialysis treatment area and designed to provide visual observation of all patient stations. In addition, refer to Section 1226.4.13.1 for nurse station(s) requirements.

1226.9.2.1.1 Handwashing stations. Handwashing stations shall be directly accessible to the administrative center or nurse station and to patient treatment areas. Handwashing stations shall be provided for each four patient stations and for each major fraction thereof. These shall be uniformly distributed to provide equal access from each patient station. Refer to Section 1224.3 for the definition of a handwashing station.

1226.9.2.2 Medication station. Refer to Section 1226.4.13.2.

1226.9.2.3 Clean utility room. Refer to Section 1226.4.13.3.

1226.9.2.4 Soiled workroom or soiled linen holding. Refer to Section 1226.4.13.4.

1226.9.2.5 Housekeeping room. Provide a housekeeping room that is immediately accessible to, and for the exclusive use of, the unit. This room shall have a minimum floor area of 15 square feet (1.4 m²) and shall include the following:

1. Service sink or floor receptor
2. Supply storage
3. Housekeeping equipment storage

1226.9.2.6 Nourishment room. When provided, refer to Section 1226.4.13.7.

1226.9.2.7 Sterilization facilities. When provided, refer to Section 1226.4.13.6.

1226.9.3 Administrative services. Provide office and clinical work space including the following:

1226.9.3.1. Medical records storage. Refer to Section 1226.4.16.2.1.

1226.9.3.2 Equipment and supply storage. Refer to Section 1226.4.16.2.2.

1226.9.4 Support areas for patients.

1226.9.4.1 Patient toilet room(s). Provide patient toilet room(s) directly accessible from treatment area. The toilet shall be equipped with bedpan flushing attachment(s). Refer to Section 1226.4.14.1.

1226.9.4.2 Patient storage. Provide space for storage of patient clothing and personal items.

1226.9.4.3 Specimen collection facilities. When provided, refer to Section 1224.4.4.2.

1226.9.5 General support services and facilities.

1226.9.5.1 Garbage, solid waste, medical waste and trash storage. Refer to Section 1226.4.9.

1226.9.5.2 Areas for off-site laundry services. Refer to Section 1226.4.15.1.

1226.9.5.3 Reprocessing room. When dialyzers are reused, a reprocessing room is required and sized to perform the functions required and include one-way flow of materials from soiled to clean with provisions for a refrigerator for temporary storage of dialyzer, decontamination/cleaning areas, sinks, processors, computer processors and label printers, packaging area, dialyzer storage and disinfectants storage.

1226.9.5.4 Repair room. When required, an equipment repair and breakdown room shall be equipped with a handwashing fixture, deep service sink, work counter and storage cabinet. Provide water supply and drain connection for testing machines.

1226.9.5.5 Mixing room. Each facility using a central batch delivery system shall provide, either on the premises or through written arrangements, individual delivery systems for the treatment of any patient requiring special dialysis solutions. The mixing room shall also include a sink, storage space and holding tanks.

1226.9.5.6 Water treatment room. The water treatment equipment shall be located in an enclosed room.

1226.9.6 Support areas for staff.

1226.9.6.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.9.6.2 Storage for employees. Refer to 1226.4.17.2.

REHABILITATION CLINICS

1226.10 REHABILITATION CLINICS. Rehabilitation clinics and outpatient clinical services of a hospital providing services equivalent to a rehabilitation clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

SUPPORT AREAS FOR THERAPY SERVICES.

1226.10.1 Support area for patients.

1226.10.1.1 Patient toilet room(s). Refer to Section 1226.4.14.1.

1226.10.2 General support.

1226.10.2.1 Garbage. Refer to Section 1226.4.9.

1226.10.2.2 Housekeeping. Refer to Section 1224.4.15.

1226.10.2.3 Areas for off-site laundry services. Refer to Section 1226.4.15.1.

1226.10.3 Public and administrative.

1226.10.3.1 Public area.

1226.10.3.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.10.3.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.10.3.1.3 Toilets. Refer to Section 1224.4.5.

1226.10.3.1.4 Drinking fountain. Refer to Section 1224.4.5.

1226.10.3.1.5 Telephone. Refer to Section 1224.4.5.

1226.10.3.2 Administrative services. Provide office and clinical work space including the following:

INTERIOR ENVIRONMENT

1226.10.3.2.1 Medical records storage. Refer to Section 1226.4.16.2.1.

1226.10.3.2.2 Equipment and supply storage. Refer to Section 1226.4.16.2.2.

1226.10.4. Support areas for staff.

1226.10.4.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.10.4.2 Storage for employees. Refer to Section 1226.4.17.2.

REHABILITATION THERAPY SERVICE SPACES.

1226.10.5 Physical therapy service space. A physical therapy service space shall be provided. The service space shall comply with the following provisions:

1. **Individual treatment area(s).** Refer to Section 1224.35.2, Item 1.
2. **Handwashing station(s).** Refer to Section 1224.35.2, Item 2.
3. **Exercise area.** Refer to Section 1224.35.2, Item 3.
4. **Clean linen and towel storage.** Refer to Section 1224.35.2, Item 4.
5. **Storage for equipment and supplies.** Refer to Section 1224.35.2, Item 5.
6. **Separate storage for soiled linen, towels and supplies.** Refer to Section 1224.35.2, Item 6.

1226.10.6 Occupational therapy service space. When an occupational therapy service is provided, the service space shall comply with following provisions:

1. **Work areas and counters.** Refer to Section 1224.35.3, Item 1.
2. **Handwashing station(s).** Refer to Section 1224.35.3, Item 2.
3. **Storage for supplies and equipment.** Refer to Section 1224.35.3, Item 3.
4. **Area for teaching daily living activities.** Refer to Section 1224.35.3, Item 4.

1226.10.7 Speech pathology and/or audiology service space. When speech pathology and/ or audiology service(s) is provided, the service space shall comply with the following provisions:

1. **Interview, consultation and treatment space.** Refer to Section 1224.35.4, Item 1.
2. **Waiting area.** Refer to Section 1224.35.4, Item 2.
3. **Handwashing station(s).** Refer to Section 1224.35.4, Item 3.
4. **Testing unit.** If an audiology service is provided. Refer to Section 1224.35.4, Item 4.

ALTERNATIVE BIRTHING CLINICS

1226.11 ALTERNATIVE BIRTHING CLINICS. Alternative birthing clinics and outpatient clinical services of a hospital providing services equivalent to alternative birthing clinics shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section:

1226.11.1 Birthing service space.

1226.11.1.1 Birthing room. A birthing room shall have a minimum clear floor area of 200 square feet (18.58 square meters), including the newborn care area. A birthing room shall have a minimum clear dimension of 12 feet (3658 mm). The maximum number of beds per room shall be one.

1226.11.1.2 Location. Birthing rooms shall be located out of the path of unrelated traffic and under direct supervision of the facility staff.

1226.11.1.3 Nurse call system. A nurse call system shall be located in the birthing room which will alert the nearest continually staffed administrative center or nurse station. Refer to Section 1224.4.6.5 for requirements.

1226.11.1.4 Hand-washing stations. A handwashing fixture, as defined in Section 1224.3, shall be located within or directly outside the room. If the fixture is located within the room, the fixture may be screened or within openable casework.

1226.11.1.5 Lighting. Lighting capable of 1076 lux (100 footcandles) at working surfaces shall be provided. Dimmer switches may be used.

1226.11.1.6 Window. Each birthing room shall have an outside window. Refer to Sections 1224.4.9.4 and 1224.4.9.5.

1226.11.1.7 Privacy. Windows or doors within a normal sightline that would permit observation into the room shall be arranged or draped, as necessary, for mother and newborn privacy.

1226.11.1.8 Newborn care area. When provided, a separate newborn care area shall be provided that is in addition to the birthing room.

1226.11.1.9 Examination room. When provided, the examination room shall meet the requirements of Section 1224.4.4.

1226.11.2 Support areas for birthing services.

1226.11.2.1 Nurse station. Refer to Section 1226.4.13.1.

1226.11.2.2 Medication station. Refer to Section 1226.4.13.2.

1226.11.2.3 Clean utility room. Refer to Section 1226.4.13.3.

1226.11.2.4 Soiled utility or soiled holding room. Refer to Section 1226.4.13.4.

1226.11.2.5 Crash cart space. Space for storing crash cart shall be provided.

1226.11.2.6 Clean-up room. Each birthing room shall have immediate access to a clean-up room with a handwashing station and work space which is separate from any sterilizing facilities. The clean-up room shall provide 24 square feet (2.23 m²) per birthing room up to eight rooms, with no dimensions less than 6 feet (1829 mm).

1226.11.2.7 Ice-making equipment. Each facility shall have equipment to provide ice for treatments and nourishment. Ice-making equipment shall be permitted in the clean utility or the nourishment room/area. Ice intended for human consumption shall be provided in the nourishment station and shall be served from self-dispensing ice-makers.

1226.11.2.8 Nourishment room or area. When provided, refer to Section 1226.4.13.7.

1226.11.2.9 Medical gas outlets. When provided, oxygen and suction capabilities may be portable or piped.

1226.11.3 Support areas for mother and newborn.

1226.11.3.1 Patient toilet room(s). Each birthing room shall have direct access to a private toilet room with lavatory, shower or tub and nurse call system. Facilities for cleaning bedpans shall be provided in the toilet room.

1226.11.4 General support services and facilities.

1226.11.4.1 Housekeeping room. Refer to Section 1224.4.15.

1226.11.4.2 Garbage, solid waste, medical waste and trash storage. Refer to Section 1226.4.9.

1226.11.4.3 Areas for off-site laundry services. Refer to Section 1226.4.15.1.

1226.11.5 Public and administrative areas.

1226.11.5.1 Public area.

1226.11.5.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.11.5.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.11.5.1.3 Public toilet(s). Refer to Section 1224.4.5.

1226.11.5.1.4 Public telephone. Refer to Section 1224.4.5.

1226.11.5.1.5 Drinking fountain. Refer to Section 1224.4.5.

1226.11.5.2 Administrative services.

1226.11.5.2.1 Medical records storage. Refer to Section 1226.4.16.2.1.

1226.11.5.2.2 Equipment and supply storage. Refer to 1226.4.16.2.2.

1226.11.6 Support areas for staff.

1226.11.6.1 Staff toilet(s). Refer to Section 1226.4.17.1.

1226.11.6.2 Storage for employees. Refer to Section 1226.4.17.2.

1226.11.6.3 Staff lounge. Refer to Section 1226.4.17.3.

1226.11.6.4 Staff clothing change area. When provided, a changing room with shower shall be provided for staff to change into work attire.

PSYCHOLOGY CLINICS

1226.12 PSYCHOLOGY CLINICS. Psychology clinics and outpatient clinical services of a hospital providing services equivalent to a psychology clinic shall comply with Sections 1226.4.3 through 1226.4.8 and the provisions of this section.

Psychology clinics shall provide at least an interview room, consulting room and group therapy room.

1226.12.1 Public and administrative area.

1226.12.1.1 Public area.

1226.12.1.1.1 Reception. Refer to Section 1226.4.16.1.1.

1226.12.1.1.2 Outpatient waiting room. Refer to Section 1224.4.5.

1226.12.1.1.3 Public toilet(s). Refer to Section 1224.4.5.

1226.12.1.1.4 Drinking fountain. Refer to Section 1224.4.5.

1226.12.1.1.5 Public telephone. Refer to Section 1224.4.5.

1226.12.1.2 Administrative Area.

1226.12.1.2.1 Medical Records storage. Refer to Section 1226.4.16.2.1.

1226.12.1.2.2 Equipment and supply storage. Refer to Section 1226.4.16.2.2.

**SECTION 1227 [OSHPD 4]
CORRECTIONAL TREATMENT CENTERS**

1227.1 Scope. The provisions of this section shall apply to correctional treatment centers.

1227.2 Application. New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code and California Fire Code (Parts 3, 4, 5 and 9 of Title 24) and this section.

Note: Refer to Section 1224.2, Exception 6.

1227.3 Definitions.

BASIC SERVICES for correctional treatment centers are those services required for licensure as a correctional treatment center, including medical, surgical, psychiatrist, psychologist, nursing, pharmacy and dietary. See "Optional services."

HANDWASHING STATION. An area that provides a handwashing fixture, cleaning agents and means for drying hands. Refer to the California Plumbing Code, Section 210.0 for the definition of handwashing fixture as amended in this section. The water supply spout discharge point may be less than 5 inches (127 mm) above the fixture rim. Fixtures shall be equipped with hot and cold supply controls not requiring direct contact of the hands for operation. The fixture cannot be equipped with an aerator or wrist or elbow blade handles.

INTERIOR ENVIRONMENT

LICENSING AGENCY is the California Department of Public Health.

OPTIONAL SERVICES are inpatient or outpatient services which are not required to be provided by law or regulation for licensure. An optional service, when provided, must accommodate the provisions of this section. See "Basic services."

OUTPATIENT SERVICE is an organizational unit of the correctional treatment center which provides nonemergency health care services to patients.

1227.4 GENERAL CONSTRUCTION.

1227.4.1 Services/systems and utilities. Correctional treatment centers shall comply with this section.

1227.4.1.1 Oxygen, vacuum and medical air. Correctional treatment centers shall comply with the requirements of Section 1224.4.6 wherever applicable.

1227.4.2 Service spaces. Spaces for dietary, laundry, morgue, ambulance entrance, receiving areas, power plants, mechanical equipment, incinerator, garbage can cleaning, automobile parking and storage areas for garbage, trash and medical gases shall be located and constructed to minimize noise, steam, odors and hazards in patient care areas and bedrooms.

1227.4.3 Treatment spaces. Radiology, laboratory, pharmacy and physical therapy spaces shall not be located in nursing units, surgical units, perinatal units, nursery areas, central sterilization rooms, food service areas, power plants, mechanical equipment rooms, maintenance shops, general storage, laundry, employees' dressing or housekeeping facilities.

1227.4.4 Exam room. Unless specified elsewhere, if an exam room is provided, it shall have a minimum clear floor area of 80 square feet (7.43 m²), the least dimension of which shall be 8 feet (2438 mm) and contain a handwashing station.

1227.4.5 Treatment room. Unless specified elsewhere, if a treatment room is provided, it shall have a minimum clear floor area of 120 square feet (11.15 m²), the least dimension of which shall be 10 feet (3048 mm). A minimum of 3 feet (914 mm) is required between the sides and foot of the bed/gurney/table and any wall or other fixed obstruction. The room shall contain an examination light, a work counter for medical equipment, a handwashing station, cabinets, medication storage and counter for writing or electronic documentation.

1227.5 CORRIDORS.

1227.5.1 Width. The minimum width of corridors shall be 8 feet (2438 mm).

Exception: Patient-care corridors in correctional treatment centers for psychiatric care of patients who are not bedridden shall have a minimum clear and unobstructed width of 6 feet (1829 mm). For the purpose of this section, bedridden patients shall be defined as patients confined to beds who would be transported or evacuated in beds or litters.

1227.5.2 Service corridors width. Service corridors with anticipated light traffic volume for nonpatient use may be reduced to a width of 5 feet (1524 mm) if approved by the enforcing agency.

Exception: Corridors in administrative and business areas may be reduced to a width of 44 inches (1118 mm).

1227.5.3 Handrails. Corridors for patient traffic in areas providing skilled nursing, intermediate, care or rehabilitation services shall be furnished with a handrail on both sides at a height not less than 30 inches (762 mm) or greater than 36 inches (914 mm).

1227.5.4 Connections. Corridor systems shall connect all patient rooms and essential services.

1227.6 DOORS AND DOOR OPENINGS.

1227.6.1 Toilet room doors. Doors to toilet rooms shall have an opening of not less than 32 inches (813 mm) clear in width and shall be equipped with hardware which will permit the door to swing outward or in a manner to negate the need to push against a patient who may have collapsed within the toilet room.

1227.6.2 Pocket doors. Pocket sliding doors are not permitted.

Exception: Doors not serving as exit doors from administration areas.

1227.6.3 Door view windows. Doors to patient bedrooms shall be provided with a view window with a minimum area of 288 square inches (0.186 square meters). Window sill height shall not be higher than 42 inches (1067 mm) from the floor.

1227.7 WINDOWS AND SCREENS.

1227.7.1 Natural light. Rooms approved for the housing of patients shall be provided with natural light by means of glazed openings.

1227.7.2 Screens. When windows are operable, they shall be provided with insect screens of 16 meshes to the inch.

1227.7.3 Light and ventilation. All portions of a building used by patients, personnel or other persons shall be provided with artificial light and a mechanically operated ventilating system as specified in the California Electrical Code and the California Mechanical Code.

1227.7.4 Patient viewing windows. Each patient bedroom shall be provided with viewing windows from the corridor to allow full and unobstructed visual observation of the patient.

1227.8 CEILING HEIGHTS.

1227.8.1 Minimum height. The minimum height of ceilings shall be 8 feet (2438 mm).

Exception: Closet, toilet rooms and bathroom minimum ceiling heights shall not be less than 7 feet (2134 mm).

1227.8.2 Minimum height with fixed ceiling equipment. Rooms containing ceiling-mounted, major fixed equipment or ceiling-mounted surgical light fixtures shall have ceil-

ing heights to accommodate the equipment or fixtures and their normal movement.

1227.9 INTERIOR FINISHES.

1227.9.1 Floor finishes.

1227.9.1.1 Floor finishes. Shall be smooth, waterproof and durable.

Exception: Upon written appropriate documented request, the enforcing agency may grant approval of the installation of carpet. See Table 1224.4.11.

1227.9.1.2 Resilient flooring. If used in toilet and bathing rooms, shall be continuous and extend upward onto the walls at least 5 inches (127 mm).

1227.9.2 Wall bases.

1227.9.2.1 Materials and installation. The material and textures of bases and the installation thereof shall be such as to minimize dust-catching surfaces, moisture, infiltration and the harboring of vermin.

Exception: In locations where carpet is permitted as a floor finish material, the use of carpeted base (coved or strip base) up to a maximum height of 5 inches (127 mm) is also permissible.

1227.9.2.2 Wood bases. Wood bases are prohibited except in administration departments and other offices described in Section 1227.16.

Exceptions: Wall bases in kitchens, operating rooms, delivery rooms, emergency operating rooms, cast rooms, special procedure rooms and other areas which are subject to wet cleaning methods shall be made integral and coved with the floor, and constructed without voids at the intersection of floor and wall surfaces.

1227.9.3 Walls. Interior wall finishes shall be smooth, washable and durable.

1227.9.4 Ceilings. Ceiling finishes shall be in compliance with Table 1224.4.11.

Exceptions: Walls and ceiling finish requirements do not apply to boiler rooms, mechanical equipment rooms, administration departments, other offices, enclosed stairways, maintenance shops and similar spaces.

1227.10 ELEVATORS.

1227.10.1 Patient elevators shall have minimum inside platform dimensions of 5 feet by 8 feet (1524 mm by 2438 mm) and a minimum clear door opening of 4 feet, 0 inches (1118 mm).

1227.10.2 Passenger elevators shall have minimum inside platform dimensions of 4 feet, 8 inches by 7 feet, 4 inches (1422 mm by 2236 mm).

1227.10.3 Buildings over one story in height with accommodations or services for patients on floors without grade level entrance shall provide at least one passenger or patient elevator.

1227.10.4 If bed patients are accommodated on one or more floors, other than the main entrance floor or where

operating rooms or delivery rooms are above or below the main entrance floor, at least one patient elevator shall be provided.

1227.10.5 At least one patient elevator and one service elevator shall be provided in correctional treatment centers with a capacity of 60 to 149 beds on floors other than the main entrance floor.

1227.10.6 At least one patient elevator, one passenger elevator and one service elevator shall be provided in hospitals with a capacity of 150 or more beds on floors other than the main entrance floor.

1227.10.7 If elevators in the correctional institution meet the above size requirements and are easily accessible, the elevators need not be duplicated in the correctional treatment centers.

1227.11 GARBAGE-SOLID WASTE AND TRASH STORAGE. Rooms or screening enclosures shall be provided for the washing and cleaning of garbage containers and for the storage of garbage, trash and other solid wastes. Such rooms or screening enclosures shall include the following:

1. A concrete floor with a curb and with a drain connected to the sewer.
2. Steam or hot-water and cold-water supply.
3. A minimum floor area of .5 square feet (0.046 m²) per bed, but not less than 25 square feet (2.32 m²), the least dimension of which shall be 4 feet (1219 mm).
4. A method of limiting access to the material except by authorized persons.

BASIC SERVICES

1227.12 NURSING SERVICE SPACE.

1227.12.1 Patient bedrooms. Patients shall be accommodated only in rooms with the following minimum floor area, exclusive of toilet rooms, wardrobes, entrance vestibules, and fixed furnishings or equipment.

1. Single-patient rooms: 110 square feet (10.22 m²).
2. Multi-patient rooms: 80 square feet (7.43 m²) per bed.

1227.12.2 Distance. A minimum distance of 3 feet (914 mm) shall be provided between beds and 4 feet (1219 mm) between the foot of beds and walls or fixed objects in multipatient rooms, and 3 feet (914 mm) in single-patient rooms.

1227.12.3 Airborne infection isolation rooms. Single rooms shall be provided for the isolation of patients with airborne communicable disease at a ratio of one room for each 35 beds, and for each major fraction thereof. At least one airborne infection isolation room shall be provided. Airborne infection isolation rooms shall be labeled with the words "Airborne Infection Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

1227.12.3.1 Alternates. Alternate designs for modifications to isolation rooms in operation prior to the effective date of this section may be utilized when it can be

demonstrated that the alternate design meets performance requirements, without compromising any health or life-safety requirement.

1227.12.3.2 Anteroom doors. Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

1227.12.3.3 Anteroom. A separate anteroom shall be provided between the airborne infection isolation room and the corridor, which shall constitute the primary entrance to the negative pressure isolation room. This anteroom shall have a handwashing station, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and soiled materials. There shall be a view window from the anteroom to the isolation room and means to allow for airflow from the anteroom into the negative pressure isolation room. Doors shall be aligned to allow large equipment to be wheeled into the airborne infection isolation room unless a secondary door complying with Section 1227.12.3.4 is provided. One anteroom may serve no more than two airborne infection isolation rooms.

1227.12.3.4 Secondary entry. When a secondary entry is provided directly from the corridor to the negative-pressure isolation room, secondary doors shall be provided with locking devices which are readily openable from the room side and which are readily openable by the facility staff on the other side. When key locks are used on isolation rooms, keys shall be located at the nurse station in a prominent readily accessible location.

1227.12.3.5 Adjoining toilet facilities. Each isolation room shall have its own toilet room facilities with an emergency nurse call system, a lavatory, a shower providing a seat or a space for a shower chair and a toilet equipped with a bedpan flushing attachment with a vacuum breaker.

1227.12.3.6 Sealed-tight room. Airborne infection isolation room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

1227.12.4 Protective environment rooms. Protective environment rooms for the protection of certain immunosuppressed patients may be provided by the facility. Protective environment rooms shall be labeled "Protective Environment Room" on or adjacent to the anteroom side of the door between the isolation room and the anteroom.

1227.12.4.1 Anteroom doors. Airborne infection isolation room(s) shall have self-closing and latching devices on all anteroom doors.

1227.12.4.2 Anteroom. A separate anteroom shall be provided between the protective environment room and the corridor or adjoining space which shall constitute the only entrance to the protective environment isolation room. This anteroom shall have a handwashing station, work counter at least 3 feet (914 mm) long, cabinets and space to gown and to store clean and

soiled materials. There shall be a view window from the anteroom to the positive-pressure isolation room. There shall be means to allow for airflow from the protective environment room into the anteroom. Anteroom doors shall be aligned so that large equipment can be wheeled into the isolation room. One anteroom may serve no more than one protective environment room.

Exception: Alternate designs for protective environment rooms, without individual anterooms, may be approved by the enforcement agency when it can be demonstrated that the alternate design meets the requirements of the California Mechanical Code and does not compromise or alter any health or fire-protection component, assembly or system.

1227.12.4.3 Toilet room(s). Adjoining toilet room facilities shall meet the requirements of Section 1227.12.3.5.

1227.12.4.4 Sealed-tight room. Protective environment room perimeter walls, ceiling, floors, doors and penetrations shall be sealed tightly to minimize air infiltration from the outside or from other spaces.

1227.12.5 Identification. Each patient room shall be labeled with an identification number, letter or combination of the two.

1227.12.6 Seclusion rooms. Seclusion rooms shall comply with the requirements of Section 1224.4.4.1 and the following:

1227.12.6.1 Seclusion rooms. Provide for disturbed/special patients at a ratio of one room for each 30 beds and for each major fraction thereof. At least one seclusion room shall be provided in each nursing service unit.

1227.12.6.2 Viewing windows. Seclusion rooms shall be provided with viewing windows to allow full and unobstructed visual observation of the patient. They shall be located near the nurse station and toilet room facilities.

1227.12.6.3 Appendages and equipment. Rooms shall be free of appendages and equipment which could facilitate suicide or self-mutilation.

1227.12.7 Nurse station. A nurse station shall be provided within each nursing unit.

1227.12.7.1 Components. Nurse stations shall be provided with a cabinet, a desk, space for records, a bulletin board, a telephone, and a specifically designated and lockable and illuminated medicine storage compartment and a handwashing fixture. If a separate medicine room is provided, it shall have a lockable door and a medicine sink. This sink cannot replace the required nurse station handwashing station.

1227.12.7.2 Size. Nurse stations serving 25 or less beds shall have a minimum floor area of 100 square feet (9.29 m²). Nurse stations servicing more than 25 beds shall have a minimum floor area of 125 square feet (11.6 m²). The minimum dimension of any nurse station shall not be less than 8 feet (2438 mm).

1227.12.7.3 Distance. The distance between the nurse station entrance and the center of the doorway of the most remote patient bedroom shall not exceed 90 linear feet (27432 mm).

Exception: This section does not preclude designs based on primary nursing concepts incorporating more than one single nursing station of less than 100 square feet (9.29 m²) each and an additional work space or station for unit clerk/receptionist junctions.

1227.12.7.4 Correctional officer. A separate space for the correctional officer may adjoin the nurse station but shall not be included in the minimum square footage requirement for a nurse station.

1227.12.8 Utility rooms. Utility rooms shall be provided in each nursing unit. Soiled and clean utility or holding rooms shall be separated and have no direct connection.

1227.12.8.1 Clean utility room. Clean utility rooms shall contain a work counter, handwashing station and storage facilities unless the room is used only for storage and holding as part of a system for distribution of clean and sterile supplies, in which case the work counter and handwashing fixture may be omitted.

1227.12.8.2 Soiled workroom or soiled holding room. Soiled utility rooms shall contain a flushing-rim clinical sink or equivalent flushing-rim device, handwashing station, work counter, waste receptacles and linen hampers unless the room is used only for the temporary holding of soiled materials, in which case the flushing-rim clinical sink, handwashing station and work counter may be omitted. However, if the flushing-rim clinical sink is omitted, other provisions for disposal of liquid waste shall be provided.

1227.12.9 Treatment and exam rooms. If treatment rooms or exam rooms are provided, they shall comply with Sections 1227.4.4 and 1227.4.5.

1227.12.10 Toilet and bath facilities. Separate toilet room facilities shall be provided for the use of patients and personnel.

1227.12.10.1 Bathroom facilities. Provide for patients in the nursing unit in at least the following ratios:

Bathtubs or showers 1:12 patients

Lavatories 1:8 patients

(Fixtures shall be equipped without aerators and may have conventional controls. Gooseneck spouts shall not be used)

Toilets 1:6 patients

Fixtures serving individual patient rooms shall not be considered as meeting the required ratios for bedrooms not served by individual adjoining toilet rooms or bathrooms.

Changes in these ratios for wards or units in which bed patients only are to be cared for may be permitted by the enforcing agency.

1227.12.11 Patient/nurse call system. A patient/nurse call system shall be provided in compliance with Table 1224.4.6.5 and the provisions of Section 517.123 of the California Electrical Code.

1227.13 PHARMACEUTICAL SERVICE SPACE.

1227.13.1 Licensed pharmacy. A licensed pharmacy shall be provided and shall comply with the provisions of Section 1250.

1227.13.1.1 Entrance and waiting. If the pharmacy dispenses directly to inmates from the correctional institution, an entrance and a waiting area separate from the inpatient areas shall be provided.

1227.14 DIETETIC SERVICE SPACE.

1227.14.1 Dietetic service space. The dietetic service space shall accommodate the provisions of Section 1225.4.2.

Exceptions:

1. Unless the dietetic service in the correctional institution is found acceptable to the licensing agency.
2. A contractual arrangement for dietetic services with another health facility is acceptable to the licensing agency.

1227.15 OFFICES. Office spaces shall be provided for the provisions of nursing, physician, psychiatric and psychological services.

1227.15.1 Consultation/interviews. Consultation/interview rooms shall be provided.

1227.15.2 Conference/group activities. Separate rooms or spaces shall be provided for conferences and group activities.

Exception: If conference room or space is available to the correctional treatment facility staff in the correctional institution, this room or space need not be duplicated.

1227.16 ADMINISTRATION SPACE.

1227.16.1 Administration. An administration area shall be provided which shall provide for the following functions:

1. Waiting area.
2. Offices for the administrator and clerical personnel.

1227.16.2 Records. Spaces shall be provided which accommodate the following functions:

1. Work area for sorting and recording records, for either paper or electronic media.
2. Secure storage area for medical records, for either paper or electronic media.

1227.17 CENTRAL STERILE SUPPLY.

1227.17.1 Minimum requirements. A central supply and sterilizing area shall be provided. Rooms and spaces shall accommodate the following services and equipment:

1. Soiled work area. A receiving and gross cleaning area which shall contain workspace and equipment

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for cleaning medical and surgical equipment and for disposal of or processing of soiled material.

2. Clean work area. A clean work area which shall contain work space and equipment for sterilizing medical and surgical equipment and supplies.
3. Sterilizing space.

Exception: Items 1 through 3 do not apply to facilities with contractual arrangements for outside autoclaving and sterilizing services.

4. Storage. Space for sterile supplies and unsterile supplies.

1227.17.2 Sterilizers and autoclaves. All sterilizers and autoclaves which emit steam exhaust shall be vented to the outside of the building. Such vents shall be independent from the plumbing vent system.

Exception: Small instrument sterilizers.

1227.18 STORAGE.

1227.18.1 General storage. Correctional treatment centers shall provide combined general and specialized storage space in accordance with the following:

1–10 beds	120 square feet (11.15 m ²) minimum
11–100 beds	12 square feet (1.11 m ²) per bed
over 100 beds	1,200 square feet (111.48 m ²) plus 5 square feet (0.46 m ²) per bed for each bed over 100

1227.18.2 Specialized storage. Specialized storage spaces shall include the following:

1. Linen. Separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m²) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m²), and may be within the soiled utility room.
2. Supply. One supply storage space having a minimum area of 15 square feet (1.39 m²) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.
3. Wheelchairs. A room or space shall be provided in each nursing unit for wheelchairs and stretchers. The wheelchair and stretcher space shall have a minimum area of 15 square feet (1.39 m²).
4. Storage. Sterile and unsterile supplies shall be stored separately.

1227.19 EMPLOYEE DRESSING ROOMS AND LOCKERS.

1227.19.1 Minimum facilities. Correctional treatment centers shall provide the following:

1. Dressing rooms. Separate dressing rooms for male and female personnel with lockers, lavatory and toilet(s).

Exception: If provided for the correctional treatment center staff in adjacent correctional institutions, dressing rooms and lockers need not be duplicated.

1227.20 HOUSEKEEPING ROOM.

1227.20.1 A securely lockable housekeeping room with service sink and supply storage spaces shall be provided in each nursing unit.

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1227.21 SERVICE SPACES. Service spaces, such as laboratory, radiology and any other services approved by the licensing agency, shall comply with the applicable space requirements of Sections 1224 and 1225. Service spaces shall also comply with applicable provisions of the California Building Standards Administrative Code (Part 1).

1227.22 OUTPATIENT SERVICES. The following shall be provided or made available to an outpatient service space.

1227.22.1 Waiting. Waiting area(s) shall be provided with access to toilet room facilities and a drinking fountain both meeting the requirements of Sections 1231.3.1, 1231.3.2 and 1231.3.3.

1227.22.1.1 Holding cell. If a temporary holding cell or room is used for this purpose, it shall comply with Section 1231.2.2.

Exception: The minimum floor area shall be 80 square feet (7.43 m²).

1227.23 24-HOUR MENTAL HEALTH CARE SERVICES.

1227.23.1 Program/dining space. Provide within the Correctional Treatment Center for use by mental health treatment program patients, as is consistent with security requirements. Program/dining space shall be provided with a minimum floor area of 30 square feet (2.79 m²) per patient served at a given time.

1227.23.2 Mental health treatment. Correctional treatment centers providing a mental health treatment program shall include one seclusion room providing direct observation of every portion of the room for every 15 mental health beds and for each major fraction thereof. At least one seclusion room shall be provided.

SECTION 1228 [OSHPD 5] ACUTE PSYCHIATRIC HOSPITALS

1228.1 Scope. The provisions of this section shall apply to acute psychiatric hospitals.

1228.2 Application. New buildings and additions, alterations or repairs to existing buildings subject to licensure shall comply with applicable provisions of the California Electrical Code, California Mechanical Code, California Plumbing Code, California Energy Code, California Fire Code (Parts 3, 4, 5, 6 and 9 of Title 24) and this section.

Note: Refer to the applicable exceptions under Section 1224.2.

1228.2.1 Functional program. Refer to California Administrative Code (Part 1 of Title 24), Section 7-119, Functional Program, for requirements. Projects associated with acute psychiatric hospitals and with psychiatric nursing units in general acute-care hospitals shall include a Patient Safety Risk Assessment.

1228.3 Definitions. The definitions provided under Section 1224.3 apply to this section except as modified below:

ACUTE PSYCHIATRIC HOSPITAL. Acute psychiatric hospital means a hospital having a duly constituted governing body with overall administrative and professional responsibility and an organized medical staff which provides 24-hour inpatient care for mentally disordered, incompetent or other patients referred to in Division 5 (commencing with Section 5000) or Division 6 (commencing with Section 6000) of the Welfare and Institutions Code, including the following basic services: medical, nursing, rehabilitative, pharmacy and dietary services.

BASIC SERVICES. Basic services mean those essential services required by law for licensure as an acute psychiatric hospital including medical, nursing, rehabilitative, pharmaceutical, dietary and support services.

HOSPITAL. Hospital, where used in this section, means an acute psychiatric hospital.

SALLY PORT. A compartment provided with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time.

1228.4 GENERAL CONSTRUCTION. Acute psychiatric hospitals shall comply with the provisions under Section 1224.4, General Construction, where applicable, except as supplemented, amended or modified below. Specific application shall respond to the patient injury and suicide prevention component of the Patient Safety Risk Assessment prepared under California Administrative Code (Part 1 of Title 24), Section 7-119.

1228.4.1 Jurisdiction.

1228.4.1.1 Services/systems and utilities. Services/systems and utilities shall only originate in, pass through or under structures which are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1228.4.1.2 Means of egress. Means of egress shall only pass through structures that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

1228.4.2 Reserved.

1228.4.3 Reserved.

1228.4.4 Support areas for patients.

1228.4.4.1 Examination and treatment rooms.

1228.4.4.1.1 Examination room. Examination rooms in acute psychiatric hospitals shall meet the

requirements of Section 1224.4.4.1.1 as amended below:

1228.4.4.1.1.1 Location. Examination rooms shall be permitted to serve several nursing units and shall be permitted to be on a different floor, unless prohibited by specific sections of this code or by the Patient Safety Risk Assessment.

1228.4.4.1.1.2 Space requirements. Examination rooms shall have a minimum clear floor area of 120 square feet (11.15 m²).

1228.4.4.1.2 Treatment room. Where provided, refer to Section 1224.4.4.1.2.

1228.4.4.1.3 Airborne infection isolation exam/treatment room. Where provided, refer to Section 1224.4.4.1.3.

1228.4.4.1.4 Seclusion room. Refer to Section 1224.4.4.1.4.

1228.4.4.1.5 Quiet room. Where provided, a quiet room for a single patient who requires a period of solitude but does not require a seclusion room, shall have a minimum clear floor area of 80 square feet (7.43 m²).

1228.4.4.2 Reserved.

1228.4.4.3 Specimen and blood collection facilities. Where provided, refer to Section 1224.4.4.3.

1228.4.4.4 Medication station. Refer to Section 1224.4.4.4.

1228.4.4.5 Nourishment area or room. Refer to Section 1224.4.4.5.

1228.4.4.6 Clean utility/work room. Refer to Section 1224.4.4.6.

1228.4.4.7 Soiled utility/work room. Refer to Section 1224.4.4.7.

1228.4.5 Outpatient waiting rooms. Where provided, refer to Section 1224.4.5.

1228.4.6 Miscellaneous requirements. Refer to Section 1224.4.6 for requirements regarding station outlets, gas and vacuum systems, hyperbaric facilities, laboratories and nurse call systems.

1228.4.7 Corridors. Refer to Section 1224.4.7.

1228.4.8 Doors and door openings. Refer to Section 1224.4.8 with the following modifications and amendments:

1. Where indicated by the Patient Safety Risk Assessment, toilet room doors shall be equipped with keyed locks that allow staff to control access to the toilet room.
2. Use of door closers is to be avoided unless required by other sections of this code.
3. Door hinges shall be designed to minimize accessible anchor points (e.g., cut hinge type, piano hinge, concealed hinge, etc.).

4. Except for specifically designed ligature-resistant hardware, door lever handles shall point downward when in the latched and in the unlatched position.
5. All hardware shall have tamper-resistant fasteners.
6. Soft doors may be used for patient room toilets where indicated in the Patient Safety Risk Assessment.

1228.4.9 Windows and screens.

1. Windows located in patient care areas or areas used by patients, shall limit the opportunities for patients to inflict harm to themselves or others.
 - 1.1. All glazing (interior and exterior) shall be fabricated with polycarbonate or laminate on the inside of the glazing or with any glazing that meets or exceeds the requirements for Class 1.4 per ASTM F1233-08 (2013), Standard Test Method for Security Glazing Material and Systems.

Exception: Use of tempered glass for interior borrowed lights shall be permitted where allowed by the Patient Safety Risk Assessment.
 - 1.2. Where window treatments are provided, they shall be designed without accessible anchor points.
 - 1.3. Where operable windows are provided in patient rooms or suites, openings shall be limited to prevent the passage of a 4-inch (102 mm) sphere.
2. Anchorage for windows and window assemblies (including frames, hinges and locking devices) shall be designed to resist impact loads applied from the inside and shall be tested in accordance with ANSI Z97.1, Safety Glazing Materials Used in Buildings.
3. A minimum net glazed area of not less than 8 percent of the floor area of each indoor activity space and dining space shall be provided.

1228.4.10 Ceiling heights. Refer to Section 1224.4.10 unless noted otherwise.

1228.4.11 Interior finishes. Interior finishes shall comply with Section 1224.4.11 as amended in this section. Special design consideration shall be given to injury and suicide prevention in the context of the Patient Safety Risk Assessment.

1228.4.11.1 Reserved.

1228.4.11.2 Reserved.

1228.4.11.3 Reserved.

1228.4.11.4 Ceilings. Refer to Section 1224.4.11.4 with the following modifications and amendments:

Ceilings shall be monolithic in seclusion rooms, exam/treatment rooms, patient bedrooms, patient toilet rooms or patient bathing facilities.

1. In these rooms, the ceiling shall be secured from patient access.

2. Mechanical, electrical and plumbing systems, other than terminal elements serving the room (e.g., diffusers, registers, luminaires, etc.), shall be concealed above the ceiling.

1228.4.12 Courts. Refer to Section 1224.4.12.

1228.4.13 Elevators. Refer to Section 1224.4.13.

1228.4.14 Garbage, solid waste and trash storage. Refer to Section 1224.4.14.

1228.4.15 Housekeeping room. Refer to Section 1224.4.15.

1228.4.16 Laundry and trash chutes. Refer to Section 1224.4.16.

1228.4.17 Telephones. Refer to Section 1224.4.17.

1228.4.18 Grab bars. Refer to Section 1224.4.18 with the following modifications and amendments:

1. Grab bars, including those that are part of fixtures such as soap dishes, shall be sufficiently anchored to sustain a concentrated load of 250 pounds (113.4 kg).
2. Grab bars shall be graspable and shall be ligature resistant.

1228.4.19 Noise control. Refer to Section 1224.4.19.

1228.4.20 Built-in furnishings. Built-in furnishings in areas accessible to patients shall comply with the following requirements:

1. Built-in furnishings with doors or drawers shall not be provided.
2. Open shelves shall be fixed with tamper-resistant hardware.
3. When provided, clothing rods or hooks shall be ligature resistant.
4. The following are not permitted:
 - 4.1. Towel bars.
 - 4.2. Shower curtain rods.
 - 4.3. Lever handles, except where a specifically designed ligature-resistant lever handle is used.

1228.4.21 Building systems.

1228.4.21.1 Lighting. Lighting in areas identified in the Patient Safety Risk Assessment as high- and medium-risk areas shall be tamper resistant. Refer to California Electrical Code.

1228.4.21.2 Receptacles. When electrical receptacles are provided in a patient bedroom, the receptacles shall be in compliance with California Electrical Code.

1228.4.22 Handwashing stations. All handwashing fixtures that are accessible to patients, including those located in patient rooms and patient toilet rooms, shall include ligature-resistant features that do not compromise compliance with the hot and cold water supply controls, laminar flow and sink requirements of the California Plumbing Code. Handwashing fixtures within patient rooms and patient toilet rooms in psychiatric nursing units

are not required to be equipped with gooseneck spouts and the discharge point may be less than 5 inches (127 mm) above the fixture rim.

1228.5 Communication system. Refer to Section 1224.5.

BASIC SERVICES

1228.6 Reserved.

1228.7 Reserved.

1228.8 Reserved.

1228.9 Reserved.

1228.10 Reserved.

1228.11 Reserved.

1228.12 Reserved.

1228.13 PSYCHIATRIC REHABILITATION ACTIVITIES SERVICE SPACE. The psychiatric rehabilitation activities service space may be centralized for common use or may be located in each nursing unit in response to the Patient Safety Risk Assessment. The following areas are required in the psychiatric rehabilitation activities service space:

1228.13.1 Patient care areas.

1228.13.1.1 Indoor activity rooms.

1. At least two separate activity rooms, one appropriate for group recreation and one for quiet activities to serve as a patient lounge, shall be provided.
2. Space requirements. The combined area of these rooms shall have a minimum of 25 square feet (2.32 m²) per patient bed, with at least 120 square feet (11.15 m²) of clear floor area for each of the two spaces.

1228.13.1.2 Outdoor activity area. An outdoor activity area shall be provided. Outdoor areas shall meet the following requirements:

1. Fences and walls shall be designed to:
 - 1.1. Be installed with tamper-resistant hardware.
 - 1.2. Have a minimum height of 10 feet (3048 mm) above the outdoor area elevation.
 - 1.3. Be anchored and constructed to withstand the body force of a 350-pound (158-kg) person.
2. If provided, gates or doors in the fence or wall shall:
 - 2.1. Swing away from the outdoor activity area.
 - 2.2. Have the hinge installed on the outside of the outdoor activity area.
 - 2.3. Be provided with a locking mechanism that has been coordinated with egress requirements of Section 1004.5, *Outdoor areas*.
3. Lights shall not be accessible to patients. Lighting in the outdoor activity area shall not be pole mounted.

4. If provided, security cameras shall not be accessible to patients and cameras shall view the entire outdoor activity area.

5. If provided, furniture shall be secured from movement. Furniture shall not be placed in locations where it can be used to climb the fence or wall.

1228.13.1.3 General support areas.

1. Space for staff conferences, patient evaluation and progress reports.
 - 1.1. Staff conference room. A conference and treatment planning room shall be provided.
 - 1.2. Office space separate from the activities area.
2. Where outpatients are treated, there shall be a waiting area compliant with the requirements of Section 1228.4.5.

1228.13.2 Physical therapy service space. The physical therapy service space shall comply with Section 1224.35.2.

1228.13.3 Occupational therapy service space. The occupational therapy service space shall comply with Section 1224.35.3, Items 1, 2 and 3.

1228.13.4 Speech pathology and/or audiology service space. The speech pathology service space shall comply with Section 1224.35.4.

1228.14 PSYCHIATRIC NURSING SERVICE SPACE. Psychiatric nursing units shall comply with the requirements of this section. If the nursing unit is a locked unit, the primary access point to the unit shall be through a sally port. For “secure treatment facilities,” alternate designs for locked unit access without individual sally ports may be approved by the enforcement agency when it can be demonstrated that the alternate design meets performance requirements without compromising any health or life-safety requirement.

1228.14.1 Patient rooms. Each patient bedroom shall meet the following standards:

1228.14.1.1 Capacity. Maximum room capacity shall be two patients.

Exception: Where renovation of existing individual acute psychiatric hospital patient rooms is undertaken in facilities built under the 2013, or prior, California Building Code, maximum room capacity shall be no more than the present capacity, to a maximum of eight patients per patient room. Placement of beds shall not be more than three deep from the exterior window.

1228.14.1.2 Space requirements. Patient bedrooms shall have a minimum clear floor area of 110 square feet (10.2 m²) for single-bed rooms and 80 square feet (7.43 m²) per bed for multiple-bed rooms.

1228.14.1.3 Windows. Each patient bedroom shall have a window in accordance with Section 1228.4.9.

1228.14.1.4 Reserved.

1228.14.1.5 Outside exposure. Refer to Section 1224.14.1.5.

1228.14.1.6 Handwashing stations. Handwashing stations shall comply with Section 1228.4.22. Handwashing stations are required in patient toilet rooms. Handwashing stations are not required in patient bedrooms.

1228.14.1.7 Patient toilet room.

1. Each patient shall have access to a toilet room without having to enter a corridor.

Exception: Corridor access to the patient toilet room shall be permitted at pediatric or adolescent patient bedrooms and in specific patient bedrooms where the use of corridor access is part of the hospital's written Patient Safety Risk Assessment and management program.

2. One toilet room shall serve no more than two patient bedrooms and no more than four patients.
3. The toilet room shall contain a toilet and a handwashing station.

1228.14.1.8 Patient storage. Each patient shall have in their room a separate wardrobe, locker or closet for storing personal effects. Shelves for folded garments shall be used instead of arrangements for hanging garments.

1228.14.1.9 Privacy. Visual privacy in multibed rooms (e.g., cubicle curtains) is not required in psychiatric nursing units.

1228.14.1.10 Grab bars. Grab bars provided in accessible patient toilet rooms shall comply with Section 1228.4.18.

1228.14.1.11 Room identification. Each patient room shall be labeled with an identification number, letter or combination of the two.

1228.14.2 Service areas. Provision for the services listed below shall be in or immediately accessible to each psychiatric nursing unit. The size and location of each service area will depend upon the numbers and types of beds served. Identifiable spaces are required for each of the indicated functions. If a service area is specifically permitted to serve more than one nursing unit, there shall be at least one such service area located on each nursing unit floor.

1228.14.2.1 Administrative center(s) or nurse station(s). Refer to Section 1224.4.4.2.

1228.14.2.1.1 Documentation area. A separate charting area with provisions for acoustic and patient file privacy shall be provided.

1228.14.2.1.2 Handwashing station(s). Refer to Section 1228.4.22 for the definition of handwashing station. Handwashing stations in high- or medium-patient-risk areas shall be ligature resistant.

1228.14.2.2 Office(s) for staff. Office(s) for staff shall be provided.

1228.14.2.3 Support areas for staff.

1. Staff lounge facilities. Staff lounge facilities may be combined between units.
2. Staff toilet rooms.
3. Staff storage locations. Securable closets or cabinet compartments for the personal effects of nursing personnel shall be immediately accessible to the administrative center or nurse station.

1228.14.2.4 Multipurpose room(s). Multipurpose rooms shall be provided for staff, patients, patients' families for patient visits, conferences, reports, education, training sessions and consultation. These rooms shall be readily accessible to each nursing unit. One such room may serve several psychiatric nursing units.

1228.14.2.5 Examination and treatment room. Refer to Section 1228.4.4.1.1.

1228.14.2.6 Clean utility/workroom. Refer to Section 1228.4.4.6.

1228.14.2.7 Soiled utility/workroom. Refer to Section 1228.4.4.7.

1228.14.2.8 Medication station. Refer to Section 1228.4.4.4.

1228.14.2.9 Clean linen storage. Each psychiatric nursing unit shall contain a designated area for clean linen storage. This may be within the clean utility room or a separate closet.

1228.14.2.10 Nourishment area. Refer to Section 1228.4.4.5.

1228.14.2.11 Ice-making equipment. Each nursing unit shall have equipment to provide ice for treatments and nourishment. Ice-making equipment may be in the clean utility/workroom or at the nourishment station. Ice intended for human consumption shall be from self-dispensing icemakers.

1228.14.2.12 Equipment and supply storage. Appropriate room(s) shall be provided for storage of equipment necessary for patient care. Each unit shall provide not less than 15 square feet (1.39 m²). Location of the storage areas shall not present a risk to the patient population as indicated in the functional program.

1228.14.2.13 Reserved.

1228.14.2.14 Patient bathing facilities. A bathtub or shower shall be provided for each six patient beds not otherwise served by bathing facilities at patient bedrooms.

1228.14.2.15 Common patient toilet room(s). In addition to the toilet rooms serving bed areas, common patient toilet rooms shall be located adjacent to multipurpose room(s) and within or directly accessible to each common patient bathing facility.

1228.14.2.16 Emergency equipment storage. Emergency equipment storage shall be provided at each nursing unit that is under visual observation of staff.

1228.14.2.17 Housekeeping room. One housekeeping room shall be permitted to serve more than one nursing unit on a floor. Refer to Section 1228.4.15.

1228.14.2.18 Grab bars. Grab bars in common patient toilets and bathing facilities shall be installed in accordance with Section 1228.4.18.

SPECIAL PATIENT CARE ROOMS

1228.14.3 Airborne Infection Isolation (AII) room(s). There shall be at least one airborne infection isolation (AII) room provided for each 50 beds, and for each major fraction thereof. Airborne infection isolation rooms for pediatric/adolescent and forensic supplemental service nursing units shall be calculated independently from, and shall not be shared with each other or any other psychiatric nursing unit. Refer to Section 1224.14.3 and the general construction requirements of Section 1228.4. A bedpan flushing attachment is not required.

1228.14.4 Protective environment room(s). If provided, refer to Section 1224.14.4 and the general construction requirements of Section 1228.4.

1228.14.5 Seclusion room(s). There shall be at least one seclusion room provided for each 24 licensed beds, and for each major fraction thereof. At least one seclusion room shall be provided. A seclusion room may be shared by psychiatric nursing units. Seclusion rooms for pediatric/adolescent and forensic supplemental service nursing units shall be calculated independently from, and shall not be shared with each other or any other psychiatric nursing unit. Refer to the general construction requirements of Section 1228.4.

1228.14.6 Quiet room. A quiet room shall be provided in each psychiatric nursing unit for a patient who needs to be alone for a short period of time but does not require a seclusion room. Refer to Section 1228.4.4.1.5.

1228.14.7 Visitor/consultation room(s). Visitor/consultation rooms shall be provided at a room-to-bed ratio of one consultation room for each 12 psychiatric beds, or major fraction thereof with a minimum of one, in each psychiatric nursing unit. Additionally, the following requirements shall be met:

1. Visitor/consultation room(s) shall have a minimum clear floor area of 100 square feet (9.29 m²).
2. The room(s) shall be designed for acoustical and visual privacy. Refer to Table 1224.4.19, Sound Transmission Limitations in Hospitals.

1228.14.8 Conference room. A conference and treatment planning room shall be provided for use by the psychiatric nursing unit.

1228.14.9 Space for group therapy. An enclosed private space with a minimum clear floor area of at least 225 square feet (20.90 m²) shall be available for group therapy activities.

1228.15 Reserved.

1228.16 Reserved.

1228.17 Reserved.

1228.18 Reserved.

1228.19 PHARMACEUTICAL SERVICE SPACE. Pharmaceutical service space shall comply with the provisions of Section 1224.19.

1228.20 DIETETIC SERVICE SPACE. Refer to Section 1224.20, Dietetic Service Space for requirements, as modified below:

1228.20.1 Dining area. Provide dining space(s) for ambulatory patients, staff and visitors. Provide patient dining room(s) of 20 square feet (1.86 m²) per patient bed separate from staff dining. These spaces shall be separate from the food preparation and distribution areas.

SUPPORT SERVICES

1228.21 ADMINISTRATIVE SPACE. Refer to Section 1224.21.

1228.22 CENTRAL STERILE SUPPLY. Refer to Section 1224.22.

1228.23 STORAGE.

1228.23.1 General storage. Psychiatric hospitals shall provide general storage space of at least 10 square feet (0.93 m²) per bed in addition to specialized storage spaces. All storage spaces shall be located within the hospital building and shall be readily accessible to the connecting corridor required under Section 1224.4.7.5.

1228.23.2 Specialized storage. Specialized storage spaces shall include the following:

1228.23.2.1 Linen. Provide separate and enclosed facilities for clean and soiled linen in each nursing unit. The clean linen storage space shall have a minimum area of 10 square feet (0.93 m²) and may be within the clean utility room. The soiled linen collection space shall have an area of no less than 10 square feet (0.93 m²), except where linen chutes are provided, and may be within the soiled utility room.

1228.23.2.2 Supply. One supply storage space having a minimum area of 15 square feet (1.39 m²) shall be provided in each nursing unit. Supply storage may be within the clean utility room used only as part of a system for distributing clean and sterile supplies.

1228.23.2.3 Wheelchairs. A room or space shall be provided in each nursing unit for wheelchairs. Wheelchair storage areas may be located within the nursing unit or outside but readily accessible to the unit. The wheelchair space shall have a minimum area of 15 square feet (1.39 m²).

1228.23.2.4 Sterile and unsterile supplies shall be stored separately.

1228.23.2.5 Food storage shall be as described in Section 1224.20.

1228.23.3 Patient storage facilities. A staff-controlled secured storage area shall be provided for patient's effects

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that are determined to be potentially harmful (e.g., razors, nail files, cigarette lighters).

1228.24 MORGUE.

1228.24.1 Acute-care Psychiatric Hospitals with a licensed bed capacity of 50, or more, shall provide a morgue with autopsy facilities.

Exception: This may not be required if it can be demonstrated to the licensing agency that morgue and autopsy facilities are available locally.

1228.24.2 Minimum requirements. Refer to Section 1224.24.2.

1228.25 EMPLOYEE DRESSING ROOMS AND LOCKERS. Refer to Section 1224.25.

1228.26 HOUSEKEEPING ROOMS. Refer to Section 1224.26.

1228.27 LAUNDRY. Refer to Section 1224.27.

SUPPLEMENTAL SERVICES

1228.28 ELECTROCONVULSIVE THERAPY SERVICE SPACE. If electroconvulsive therapy (ECT) is provided in the facility, the requirements in Section 1224.28.6 shall be met.

1228.29 Reserved.

1228.30 PEDIATRIC AND ADOLESCENT PSYCHIATRIC SERVICE SPACE. Pediatric and adolescent psychiatric service space patient areas shall be separate and distinct from adult psychiatric service space patient areas. The requirements of Section 1228.14, Psychiatric Nursing Service Space shall apply to pediatric and adolescent units as amended below:

1228.30.1 Patient bedroom.

1228.30.1.1 Capacity. Maximum bedroom capacity shall be four patients.

1228.30.1.2 Space requirements. Patient bedroom areas (with beds or cribs) shall meet the following requirements:

1. For single-bed rooms, a minimum clear floor area of 100 square feet (9.29 m²).
2. For multiple-bed rooms, a minimum clear floor area of 80 square feet (7.43 m²) per bed and 60 square feet (5.57 m²) minimum clear floor area per crib.

1228.30.2 Patient toilet room.

1. Each patient shall have access to a toilet room, either from the patient room or from the corridor outside the patient room.
2. Where access is provided via a corridor, the following requirements shall be met:
 - 2.1. The toilet room shall be located in the nursing unit.
 - 2.2. The toilet room shall be located no more than 150 feet (45.72 m) from the bedroom.

1228.30.3 Activity areas. The pediatric and adolescent activities space may be centralized for common use by

multiple pediatric and adolescent psychiatric units or may be located in each individual unit, in response to the Patient Safety Risk Assessment. Centralized activity areas shall be readily accessible without traversing adult patient areas.

1228.30.3.1 Space requirements.

1. The combined area for activity space shall have 35 square feet (3.25 m²) of clear floor area per patient bed.
2. A separate dining space shall be provided and shall have a minimum of 15 square feet (1.39 m²) of clear floor area per patient bed.

1228.30.3.2 Outdoor areas. Pediatric and adolescent outdoor areas shall be separate from adult outdoor areas. Refer to Section 1228.13.1.2.

1228.30.4 Support areas for the pediatric and adolescent psychiatric unit. Storage space shall be provided for toys, equipment, extra cribs and beds and cots or recliners for parents who may stay overnight.

1228.30.5 Education. If a unit treats children of school age over a period of one month or more, it shall provide physical facilities for an educational program, such as classrooms and an office for the teacher.

1228.31 FORENSIC PSYCHIATRIC UNIT. Where provided, a forensic psychiatric unit shall be separate and distinct from other patient areas. The requirements of Section 1228.14, Psychiatric Nursing Service Space shall apply to forensic units as amended below:

1228.31.1 Sally port. Forensic units shall have security vestibules or sally ports at the unit entrance. For "secure treatment facilities," alternate designs for locked unit access without individual sally ports, may be approved by the enforcement agency when it can be demonstrated that the alternate design meets performance requirements, without compromising any health or life-safety requirement.

1228.31.2 Pediatrics and adolescents. Forensic unit areas for pediatrics and adolescents shall be separated from adult areas. Refer to Section 1228.30.

1228.31.3 Space requirements. Specialized program requirements may result in additional treatment areas, police and courtroom space, and security considerations. When a forensic unit is provided, the needs of the patient population and special requirements shall be specifically addressed in the Patient Safety Risk Assessment.

1228.32 Reserved.

1228.33 Reserved.

1228.34 Reserved.

1228.35 Reserved.

1228.36 Reserved.

1228.37 Reserved.

1228.38 INTERMEDIATE-CARE SERVICE SPACE. Where provided, an intermediate-care service unit shall be housed in a separate and distinct nursing unit and shall com-

ply with the applicable requirements of Section 1225 and the general construction provisions of Section 1228.4.

1228.39 OUTPATIENT SERVICE SPACE. Where provided, outpatient service space shall comply with the applicable requirements of Section 1224.39 and the general construction provisions of Section 1228.4.

1228.40 SKILLED NURSING SERVICE SPACE. Where provided, the skilled nursing service unit shall be housed in a separate and distinct nursing unit and shall comply with the applicable requirements of Section 1225 and the general construction provisions of Section 1228.4.

1228.41 Reserved.

1228.42 CLINICAL LABORATORY SERVICE SPACE. Where provided, clinical laboratory service space shall comply with the requirements of Section 1224.17, Clinical Laboratory Service Space.

1228.43 RADIOLOGICAL SERVICE SPACE. Where provided, Radiology/Imaging Service Space shall comply with the requirements of Section 1224.18, Radiological/Imaging Service Space and the general construction provisions of Section 1228.4.

**SECTION 1229
Reserved**

**SECTION 1230 [BSCC]
MINIMUM STANDARDS FOR JUVENILE FACILITIES**

1230.1 Design criteria for required spaces.

1230.1.1 Reception/intake admission. In each juvenile hall, space used for the reception of youth pending admission to juvenile hall shall have the following space and equipment:

1. Weapons lockers as specified in Section 1230.2.9;
2. A secure room for the confinement of youth pending admission to juvenile hall as specified in Section 1230.1.2;

In each juvenile hall, camp and ranch, space used for the reception of youth pending admission to these facilities shall have the following space and equipment:

3. Access to a shower;
4. A secure vault or storage space for youth, valuables;
5. Telephones accessible to youth; and
6. Access to hot and cold running water for staff use.

1230.1.2 Locked holding room. A locked holding room shall:

1. Contain a minimum of 15 square feet (1.4 m²) of floor area per youth;
2. Provide no less than 45 square feet (4.2 m²) of floor space and have a clear ceiling height of 8 feet (2438 mm) or more;

3. Contain seating to accommodate all youth as specified in Section 1230.2.8;
4. Be equipped with a toilet, wash basin, mirror and drinking fountain as specified in Section 1230.2, unless a procedure is in effect to give the youth access to a toilet, wash basin, mirror and drinking fountain;
5. Maximize visual supervision of youth by staff; and
6. Have an outward swinging or lateral sliding door.

1230.1.3 Natural light. Outer-facing exterior windows where youth's privacy is not at risk shall be provided in locked sleeping rooms, single occupancy sleeping rooms, double occupancy sleeping rooms, dormitories and day rooms. Natural light may be provided by, but is not limited to, skylights or windows in dayrooms, windows in adjacent exterior exercise areas, and in sleeping rooms and/or dormitories.

1230.1.4 Corridors. Corridors in living units shall be at least 8 feet (2438 mm) wide.

1230.1.5 Living unit. A living unit shall be a self-contained unit containing locked sleeping rooms, single and double occupancy sleeping rooms or dormitories, day-room space, toilet, wash basins, drinking fountains and showers commensurate to the number of youth housed. A living unit shall not be divided in a way that hinders direct access, supervision, immediate intervention or other action if needed. In juvenile halls, the number of youth housed in a living unit shall not exceed 30.

1230.1.6 Locked sleeping rooms. Locked sleeping rooms shall be equipped with an individual or combination toilet, wash basin, mirror and drinking fountain. Doors to locked sleeping rooms shall swing outward or slide laterally.

1230.1.7 Single occupancy sleeping rooms. Single occupancy sleeping rooms shall provide the following:

1. A minimum of 70 square feet (1.78 m²) of floor area;
2. A minimum clear ceiling height of 8 feet (2438 mm); and
3. The door into this room shall swing outward or slide laterally and be provided with a view panel, a minimum of 144 square inches (92,903 mm²), constructed of security glazing.
4. Contain a bed as specified in 1230.2.5.

1230.1.8 Double occupancy sleeping rooms. Double occupancy sleeping rooms shall provide the following:

1. A minimum of 100 square feet (9.3 m²) of floor area;
2. A minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 7 feet (2134 mm); and
3. The door into this room shall swing outward or slide laterally and be provided with a view panel, a minimum of 144 square inches (92,903 mm²), constructed of security glazing.
4. Contain beds as specified in 1230.2.5.

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**TABLE 1230A
REQUIRED SPACES AND EQUIPMENT IN JUVENILE FACILITIES**

SECTION NUMBERS	REGULATION	HALLS	CAMPS	SPJH
1230.1.1	Reception/intake admission	X		
1230.1.2	Locked holding rooms	X	X ¹	
1230.1.3	Natural light	X	X	X
1230.1.4	Corridors	X ¹	X ¹	X ¹
1230.1.5	Living units	X		
1230.1.6	Locked sleeping rooms	X ¹	X ¹	X ¹
1230.1.7	Single occupancy sleeping rooms	X ¹	X ¹	X ¹
1230.1.8	Double occupancy sleeping rooms	X ¹	X ¹	X ¹
1230.1.9	Dormitories	X ¹	X ¹	X ¹
1230.1.10	Day rooms	X	X	X
1230.1.11	Physical activity and recreation areas	X	X	
1230.1.12	Academic classrooms	X	X	
1230.1.13	Safety rooms	X ¹		
1230.1.14	Medical examination rooms	X	X	
1230.1.15	Pharmaceutical storage	X	X	X
1230.1.16	Dining areas	X	X	
1230.1.17	Visiting space	X	X	X
1230.1.18	Institutional storage	X	X	X
1230.1.19	Personal storage	X	X	X
1230.1.20	Safety equipment storage	X	X	X
1230.1.21	Janitorial closet	X	X	X
1230.1.22	Audio monitoring system	X	X	X
1230.1.23	Emergency power	X	X	X
1230.1.24	Confidential interview rooms	X	X	X
1230.1.25	Special-purpose juvenile halls	X		
1230.1.26	Court holding rooms for youth*	X ¹		
1230.2.1	Toilets/urinals	X	X	X
1230.2.2	Wash basins	X	X	X
1230.2.3	Drinking fountains	X	X	X
1230.2.4	Showers	X	X	X
1230.2.5	Beds	X	X	X
1230.2.6	Lighting	X	X	X
1230.2.7	Padding	X ¹		
1230.2.8	Seating	X	X	X
1230.2.9	Weapons lockers	X	X ¹	X
1230.2.10	Security glazing	X	X ¹	X ¹
1230.2.11	Mirrors	X	X	X

Key:

Halls = Juvenile halls.

Camps = Camps, ranches, forestry camps or boot camps.

SPJH = Special-purpose juvenile halls.

* = For youth in jail, youth in temporary custody in a law enforcement facility and youth in court holding facilities, see Sections 1520, 1540 and 1560 of Title 15, respectively.

X = Regulation is applicable for all juvenile facilities.

X¹ = Regulation is applicable for halls, camps and special-purpose juvenile halls dependent on operational characteristics of the facility.

1230.1.9 Dormitories. Dormitories shall provide the following:

1. A minimum of 50 square feet (4.6 m²) of floor area per youth with the minimum size of a dormitory being 200 square feet (18.6 m²) of floor area and a minimum 8-foot (2438 mm) clear ceiling height;
2. Designed for no fewer than four youth;
3. Dormitories in juvenile halls shall be designed for no more than 30 youth;
4. Camps shall conform to Items 1 and 2.

1230.1.10 Dayrooms. Dayrooms shall contain 35 square feet (3.3 m²) of floor area per youth, and contain tables and seating to accommodate the maximum numbers of youth allowed access at a given time. Access must be provided to toilets, wash basins, drinking fountains and showers as specified in Section 1230.2.

1230.1.11 Physical activity and recreation areas. Indoor / outdoor physical activity and recreation areas shall be designed as follows:

- | 1. Facility capacity | Minimum indoor outdoor recreation space |
|----------------------|--|
| 40 or less | 9,000 square feet (836 m ²) |
| 41 to 274 | 225 square feet (21 m ²) per youth up to 61,650 square feet (5727 m ²) |
| 275 or more | 61,650 square feet (5727 m ²), plus 145 square feet (13.47 m ²) for each youth beyond 274 [up to a maximum of 87,120 square feet (8093 m ²)] |
- 1.1. At least one quarter of the dedicated indoor/outdoor space shall be a paved or like surface.
 - 1.2. The required recreation area shall contain no single dimension less than 40 feet (12.2 m).
 2. A portion of the dedicated space for physical activity and recreation shall be out-of-doors and be of sufficient size and equipped in such a manner to allow compliance with Title 15, Section 1371, which requires at least one hour per day of outdoor activity for each detained youth.
 3. Lighting of outdoor recreation areas shall be provided to allow for evening activities and to provide security.
 4. Access must be provided to a toilet, wash basin and drinking fountain as specified in Section 1230.2.

1230.1.12 Academic classrooms. There shall be dedicated classroom space for every juvenile in every facility. The primary purpose for the academic classroom shall be for education. Each academic classroom shall contain a minimum of 160 square feet (14.9 m²) of floor space for the teachers' desk and work area and a minimum of 28 square feet (2.6 m²) of floor space per minor. A communication system shall be provided in each classroom to allow for

immediate response to emergencies. The classroom shall be designed for a maximum of 20 minors. There shall be space available in every juvenile facility that may be used for specialized, one-on-one or small group educational purposes.

1230.1.13 Safety room. A safety room shall:

1. Contain a minimum of 48 square feet (4.5 m²) of floor area and a minimum clear ceiling height of 8 feet (2438 mm);
2. Be limited to one youth;
3. Be padded as specified in Section 1230.2.7;
4. Provide one or more vertical view panels constructed of security glazing. These view panels shall be no more than 4 inches (102 mm) wide nor less than 24 inches (610 mm) long, which shall provide a view of the entire room;
5. Provide an audio monitoring system as specified in Section 1230.1.22;
6. Contain a flushing ring toilet, capable of accepting solid waste, mounted flush with the floor, the controls for which must be located outside of the room;
7. Be equipped with a variable intensity, security-type lighting fixture with controls located outside the room;
8. Any wall or ceiling-mounted devices must be designed to prohibit access to the youth occupant; and
9. Provide a food pass with lockable shutter, no more than 4 inches (102 mm) high, and located between 26 inches (660 mm) and 32 inches (813 mm) as measured from the bottom of the food pass to the floor.

1230.1.14 Medical examination room. There must be a minimum of one suitably equipped medical examination room in every juvenile facility. Medical examination rooms shall provide the following:

1. Space for carrying out routine medical examinations and emergency care and used for no other purpose;
2. Privacy for youth;
3. Lockable storage space for medical supplies;
4. Not less than 144 square feet (13.4 m²) of floor space with no single dimension less than 7 feet (2134 mm);
5. Hot and cold running water;
6. Smooth, nonporous, washable surfaces;
7. A medical exam table; and
8. Adequate lighting.

1230.1.15 Pharmaceutical storage. Provide lockable storage space for medical supplies and pharmaceutical preparations as specified by Title 15, Section 1438.

1230.1.16 Dining areas. Dining areas in juvenile facilities shall contain a minimum of 15 square feet (1.4 m²) of floor space and sufficient tables and seating for each person being fed. Persons being fed include youth, staff

and visitors. Dining areas shall not contain toilets or showers in the same room without appropriate visual barrier.

1230.1.17 Visiting space. Space shall be provided in all juvenile facilities for in-person visiting which shall be unobstructed by barriers such as, but not limited to, security glazing or mesh.

1230.1.18 Institutional storage. One or more storage rooms shall be provided to accommodate a minimum of 80 cubic feet (2.3 m³) of storage space per minor. Items to be stored shall be institutional clothing, bedding, supplies and activity equipment.

1230.1.19 Personal storage. Each youth in a juvenile facility shall be provided with a minimum of 9 cubic feet (0.25 m³) of secure storage space for personal clothing and belongings.

1230.1.20 Safety equipment storage. In all juvenile facilities, a secure area shall be provided for the storage of safety equipment, such as fire extinguishers, self-contained breathing apparatus, wire and bar cutters, emergency lights, etc.

1230.1.21 Janitorial closet. In all juvenile facilities, at least one securely lockable janitorial closet, containing a mop sink and sufficient area for the storage of cleaning implements, must be provided within the security area of the facility.

1230.1.22 Audio monitoring system. In safety rooms, locked holding rooms, locked sleeping rooms, single and double occupancy rooms and dormitories, there must be an audio monitoring system capable of actuation by the minor that alerts personnel.

1230.1.23 Emergency power. There shall be a source of emergency power in all juvenile facilities capable of providing minimal lighting in all living units, activities areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems (Title 24, Part 2, Chapter 27). Such an emergency power source shall conform to the requirements specified in Title, 24, Part 3, Article 700, California Electrical Code, California Code of Regulations.

1230.1.24 Confidential interview room. Confidential interview rooms shall contain a minimum of 60 square feet (5.6 m²) of floor area. In juvenile halls there shall be a minimum of one suitably furnished interview room for each 30 youth. In camps there shall be a minimum of one suitably furnished interview room for each facility. This interview room shall provide for confidential consultations with youth.

1230.1.25 Special-purpose juvenile halls. Special-purpose juvenile halls shall conform to all minimum standards for juvenile facilities contained in this section with the following exceptions:

1. Physical activity and recreation areas as specified in Section 1230.1.11;
2. Academic classrooms as specified in Section 1230.1.12;

3. Medical examination room as specified in Section 1230.1.14; and

4. Dining areas as specified in Section 1230.1.16.

1230.1.26 Court holding room for youth. A court holding room shall:

1. Contain a minimum of 10 square feet (0.93 m²) of floor area per youth;
2. Be limited to no more than 16 youth;
3. Provide no less than 40 square feet (3.7 m²) of floor area and have clear ceiling height of 8 feet (2438 mm) or more;
4. Contain seating to accommodate all youth as specified in Section 1230.2.8;
5. Contain a toilet, wash basin and drinking fountain as specified in Section 1230.2;
6. Maximize visual supervision of youth by staff; and
7. A mirror of a material appropriate to the level of security shall be provided as specified in Section 1230.2.11.

1230.1.27 Program and activity areas. All juvenile facilities shall include adequate space for specific programs in addition to recreation and exercise areas.

1230.2 Design criteria for furnishings and equipment.

1230.2.1 Toilet/urinals. All toilet areas shall provide privacy for the youth and help reduce the risk of voyeurism without mitigating staff's ability to supervise. Toilets must be available in a ratio to youth as follows:

1. Juvenile halls 1:6;
2. Camps 1:10; and
3. Locked holding rooms 1:8;

One toilet and one urinal may be substituted for every 15 males.

1230.2.2 Wash basins. In living units, wash basins must be available in a ratio to youth as follows:

1. Juvenile halls 1:6;
2. Camps 1:10; and
3. Locked holding rooms 1:8;

Wash basins must be provided with hot and cold or tempered water.

1230.2.3 Drinking fountains. In living areas and indoor and outdoor recreation areas, drinking fountains must be accessible to youth and to staff.

1. The drinking fountain bubbler shall be on an angle which prevents waste water from flowing over the drinking bubbler; and
2. The water flow shall be actuated by a mechanical means.

1230.2.4 Showers. Shower areas shall provide privacy for the youth and help reduce the risk of voyeurism without mitigating staff's ability to supervise. Showers shall be available to all youth on a ratio of at least one shower or

bathtub to every six youth. Showers shall be provided with tempered water.

1230.2.5 Beds. Beds shall be at least 30 inches (762 mm) wide and 76 inches (1930 mm) long and be of the solid bottom type. Beds shall be at least 12 inches (305 mm) off the floor and spaced no less than 36 inches (914 mm) apart. Bunk beds must have no less than 33 inches vertically between the solid bottoms. In secure facilities, the bunks shall be securely anchored and flushed against the floor and/or wall.

1230.2.6 Lighting. Lighting in locked sleeping rooms, single occupancy rooms, double occupancy rooms, dormitories, day rooms and activity areas shall provide not less than 20 footcandles (216 lux) of illumination at desk level. Night lighting is required in these areas to provide good visibility for supervision and be conducive to sleep.

1230.2.7 Padding. In safety rooms, padding shall cover the entire floor, door, walls and everything on the walls to a clear height of 8 feet (2438 mm). Benches or platforms are not to be placed on the floor of this room.

All padded rooms must be equipped with a tamper-resistant fire sprinkler as approved by the State Fire Marshal. All padding must be:

1. Approved for use by the State Fire Marshal;
2. Nonporous to facilitate cleaning;
3. At least 1/2 inch (12.7 mm) thick;
4. Of a unitary or laminated construction to prevent its destruction by teeth, hand tearing or small metal objects;
5. Firmly bonded to all padded surfaces to prevent tearing or ripping; and
6. Without any exposed seams susceptible to tearing or ripping.

1230.2.8 Seating. Seating shall be designed to the level of security. When bench seating is used, 18 inches (457 mm) of bench is seating for one person.

1230.2.9 Weapons lockers. Weapons lockers are required in all secure juvenile facilities and shall be located outside the secure area of the facility. Weapons lockers shall be equipped with individual compartments, each with an individual locking device.

1230.2.10 Security glazing. Security glazing shall comply with the minimum requirements of one of the following test standards: American Society for Testing and Materials, ASTM F1233-98, Class III glass, or; California Department of Corrections and Rehabilitation, CDCR 860-94d, Appendix H, Class C glass or; H.P. White Laboratory, Inc., HPW-TP-0500.02, Forced Entry Level III.

1230.2.11 Mirrors. A mirror of a material appropriate to the level of security must be provided near each wash basin specified in these regulations.

SECTION 1231 [BSCC] LOCAL DETENTION

1231.1 Definitions.

BOARD OF STATE & COMMUNITY CORRECTIONS means the Board of State & Community Corrections, which acts by and through its executive officer, deputy directors and field representatives.

LIVING AREAS means those areas of a facility utilized for the day-to-day housing and activities of inmates. These areas do not include special-use cells such as sobering, safety and holding or staging cells normally located in receiving areas.

LOCAL DETENTION FACILITY is any city, county, city and county or regional jail, camp, court holding facility or other correctional facility, whether publicly or privately operated, and court holding facility used for the confinement of adults or of both adults and minors, but does not include that portion of a facility for the confinement of both adults and minors which is devoted only to the confinement of minors. The types of local detention facilities are as follows:

Court holding facility means a local detention facility constructed within a court building after January 1, 1978, used for the confinement of persons solely for the purpose of a court appearance for a period not to exceed 12 hours.

Temporary holding facility means a local detention facility constructed after January 1, 1978, used for the confinement of persons for 24 hours or less pending release, transfer to another facility or appearance in court.

Type I facility means a local detention facility used for the detention of persons usually pending arraignment for not more than 96 hours, excluding holidays, after booking. Such a Type I facility may also detain persons on court order either for their own safe-keeping or sentenced to a city jail as an inmate worker, and may house inmate workers sentenced to the county jail provided such placement in the facility is made on a voluntary basis on the part of the inmate. As used in this section, an inmate worker is defined as a person assigned to perform designated tasks outside of his or her cell or dormitory, pursuant to the written policy of the facility, for a minimum of four hours each day on a five-day scheduled work week.

TYPE II FACILITY means a local detention facility used for the detention of persons pending arraignment, after arraignment, during trial and upon a sentence of commitment.

TYPE III FACILITY means a local detention facility used only for the detention of convicted and sentenced persons.

TYPE IV FACILITY means a local detention facility or portion thereof designated for the housing of inmates eligible, under Penal Code Section 1208, for work/education furlough and/or other programs involving inmate access into the community.

RATED CAPACITY means the number of inmate occupants for which a facility's single-and double-occupancy cells or dormitories, except those dedicated for medical or disci-

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plinary isolation housing, were planned and designed in conformity to the standards and requirements contained herein and in Title 15, C.C.R.

1231.2 Design criteria for required spaces.

1231.2.1 Reception and booking. Facilities where booking and housing occur shall have the following space and equipment:

1. Weapons locker as specified in Section 1231.3.12.
2. A cell or room for the confinement of inmates pending their booking, complying with Section 1231.2.2.
3. A sobering cell as described in Section 1231.2.4 if intoxicated, inmates who may pose a danger to themselves or others are held. For those facilities

that accept male and female intoxicated inmates two sobering cells shall be provided.

4. Access to a shower within the secure portion of the facility.
5. Provide access to a secure vault or storage space for inmate valuables.
6. A safety cell or cells as described in Section 1231.2.5 if the program statement identifies the need for such a cell.
7. Telephones which are accessible to the inmates.
8. Unobstructed access to hot and cold running water for staff use.

**TABLE 1231A
REQUIRED SPACES AND EQUIPMENT IN JUVENILE FACILITIES**

	TYPE I	TYPE II	TYPE III	TYPE IV	COURT HOLDING	TEMPORARY HOLDING
Reception/booking	x	x	*	*		*
Temporary holding cells or room	x	x	*	*	x	x
Detoxification cell	*	x				
Safety cell	*	*				
Single-occupancy cell	x	x	*			
Dormitories	*	x	x	x		
Day room	*	x	x			
Exercise area		x	x	x ¹		
Shower area/delousing room	x	x				*
Program/multipurpose space		x	x	x		
Medical exam room ²		x	x			
Pharmaceutical storage space	x	x	x	x		*
Medical care housing		*	*			
Hair care space		x	x			
Commissary ³			x	x ³		
Dining facility ⁴	*	x	x	*		
Visiting space	x	x	x	x		
Attorney interview rooms	x	x	x		x	x
Confidential interview rooms		x	*			
Safety equipment storage	x	x ²	x	x	x	x
Janitor closet	x	x	x	x	x	x
Storage rooms	x	x ⁵	x	x	x	x
Audio/video-monitoring systems	x	x	x ⁶	*	x	x
Laundry facility		x		x ⁷		
Fire-detection alarm system	x	x	x	x	x	x
Emergency	x	x	x	x	x	x

x - Required.

* - Required when program statement identifies need.

1. Not required if community recreation facilities are available.
2. Not required if the inmate population is less than 25.
3. Not required if community access is available.
4. Not required if meals are served in day room.
5. Must be securely lockable and located within the security area.
6. Required in areas housing prisoners of higher than minimum security.
7. Not required if community access is permitted.

1231.2.2 Temporary holding cell or room. A temporary holding cell or room shall:

1. Contain a minimum of 10 square feet (0.93 m²) of floor area per inmate;
2. Be limited to no more than 16 inmates;
3. Be no smaller than 40 square feet (3.7 m²) and have a clear ceiling height of 8 feet (2438 mm) or more;
4. Contain seating to accommodate all inmates as required in Section 1231.3;
5. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3;
6. Maximize visual supervision of inmates by staff; and
7. When located in a temporary holding facility, the cell or room shall be equipped with a bunk if inmates are to be held longer than 12 hours.

1231.2.3 Temporary staging cell or room. A temporary staging cell or room shall:

1. Be constructed for the purpose of holding inmates who have been classified and segregated in accordance with Sections 1050 and 1053 of Title 15, Division 1, California Code of Regulations.
2. Be limited to holding inmates up to four hours.
3. Be limited to no more than 80 inmates.
4. Contain a minimum of 10 square feet (0.93 m²) of floor area per inmate and a clear ceiling height of 8 feet (2438 mm) or more.
5. Be no smaller than 160 square feet (14.9 m²).
6. Contain seating to accommodate all inmates as required in Section 1231.3.
7. Contain toilet, wash basin and drinking fountain as specified in Section 1231.3.
8. Maximize visual supervision of inmates by staff.

1231.2.4 Sobering cell. A sobering cell shall:

1. Contain a minimum of 20 square feet (1.9 m²) of floor area per inmate;
2. Be limited to eight inmates;
3. Be no smaller than 60 square feet (5.6 m²) and have a clear ceiling height of 8 feet (2438 mm) or more;
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3;
5. Have padded partitions located next to toilet fixture in such a manner that they provide support to the user;
6. Maximize visual supervision of inmates by staff;
7. Be padded on the floor as specified in Section 1231.3; and
8. Have accessible a shower in the secure portion of the facility.

1231.2.5 Safety cell. A safety cell shall:

1. Contain a minimum of 48 square feet (4.5 m²) of floor area with no one floor dimension being less than 6 feet (1829 mm) and a clear ceiling height of 8 feet (2438 mm) or more;

2. Be limited to one inmate;
3. Contain a flushing ring toilet, capable of accepting solid waste, mounted flush with the floor, the controls for which must be located outside of the cell;
4. Be padded as specified in Section 1231.3;
5. Be equipped with a variable intensity, security-type lighting fixture which is inaccessible to the inmate occupant, control of which is located outside of the cell;
6. Provide one or more vertical view panels not more than 4 inches (102 mm) wide nor less than 24 inches (610 mm) long which shall provide a view of the entire room;
7. Provide a food pass with lockable shutter, no more than 4 inches (102 mm) high, and located between 26 inches (660 mm) and 32 inches (813 mm) as measured from the bottom of the food pass to the floor; and
8. Any wall or ceiling mounted devices must be inaccessible to the inmate occupant.

1231.2.6 Single-occupancy cells. Single-occupancy cells shall:

1. Have a maximum capacity of one inmate;
2. Contain a minimum of 60 square feet (5.6 m²) of floor area in Type I facilities and 70 square feet (6.5 m²) of floor area in Type II and Type III facilities;
3. Have a minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 6 feet (1829 mm);
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3; and
5. Contain a bunk, desk and seat as specified in Section 1231.3.

Exception: A Type I facility does not require a desk and seat.

1231.2.7 Double-occupancy cells. Double-occupancy cells shall:

1. Have a maximum capacity of two inmates;
2. Contain a minimum of 60 square feet (5.6 m²) of floor area in Type I facilities and 70 square feet (6.5 m²) of floor area in Type II and Type III facilities;
3. Have a minimum clear ceiling height of 8 feet (2438 mm) and a minimum width of 6 feet (1829 mm);
4. Contain a toilet, wash basin and drinking fountain as specified in Section 1231.3; and
5. Contain two bunks, and at least one desk and seat as specified in Section 1231.3.

Exception: A Type I facility does not require a desk and seat.

1231.2.8 Dormitories. Dormitories shall:

1. Contain a minimum of 50 square feet (4.7 m²) of floor area per inmate for a single-bed unit; a minimum of 70 square feet (7 m²) for a double-bed unit; and a minimum of 90 square feet (9.3 m²) for triple-

bed unit and have a minimum ceiling height of 8 feet (2438 mm);

2. Be designed for no more than 64 inmates and no fewer than four inmates;
3. Provide access to water closets separate from the wash basin and drinking fountains as specified in Section 1231.3; and
4. In other than Type I facilities, provide storage space for personal items and clothing for each occupant.

1231.2.9 Dayrooms.

Dayrooms or dayroom space shall:

1. Contain 35 square feet (3.3 m²) of floor area per inmate in width in front of cells/rooms;
2. Contain tables and seating to accommodate the maximum number of inmates;
3. Provide access to water closets, wash basins and drinking fountains as specified in Section 1231.3;
4. Provide access to a shower or showers as specified in Section 1231.3; and
5. Be provided to all inmates in Type II and Type III facilities (except those housed in special-use cells) and to inmate workers in Type I facilities.

Dayroom space as described in this section may be a part of a single occupancy cell used for administrative segregation or a dormitory, in which case the floor area of the cell or a dormitory must be increased by the square footage required for the dayroom.

1231.2.10 Exercise area. An outdoor exercise area or areas must be provided in every Type II and Type III facility. The minimum clear height must be 15 feet (4572 mm) and the minimum number of square feet of surface area will be computed by multiplying 80 percent of maximum rated population by 50 square feet (4.7 m²) and dividing the result by the number of one-hour exercise periods per day.

The exercise area must contain or provide free access to a toilet, wash basin, and drinking fountain as provided in Section 1231.3.

There must be at least one exercise area of not less than 600 square feet (55.7 m²). The design shall facilitate security and supervision appropriate to the level of custody.

Type IV facilities shall have an outdoor recreation area or access to community recreation facilities.

1231.2.11 Correctional program/multipurpose space. An area for correctional programming must be provided in every Type II and Type III facility. The program area and furnishings shall be designed to meet the needs specified by the facility's program statement.

Type IV facilities shall have multipurpose space for games and activities, dining, visiting, TV meetings and quiet space for study and reading, such that activities do not conflict with each other.

1231.2.12 Medical examination room. There must be a minimum of one suitably equipped medical examination

room in every facility which provides on-site health care. The examination room shall be designed in consultation with the responsible physician/health authority. Such a medical examination room shall:

1. Be located within the security area and provide for privacy of the inmates;
2. Provide not less than 100 square feet (9.3 m²) of floor space with no single dimension less than 7 feet (2134 mm);
3. Provide hot and cold running water;
4. Provide lockable storage for medical supplies;
5. Provide an examination table;
6. Provide adequate lighting; and
7. Any room where medical procedures are provided must be equipped with hot and cold running water

1231.2.13 Pharmaceutical storage space. Provide lockable storage space for medical supplies and pharmaceutical preparations as referenced by Title 15, California Code of Regulations, Section 1216.

1231.2.14 Medical care housing. There shall be some means to provide medical care and housing of ill and/or infirm inmates. When the program statement for a Type II or Type III facility indicates that medical care housing is needed, such housing must provide lockable storage space for medical instruments and must be located within the security area of the facility accessible to both female and male inmates, but not in the living area of either. The medical care housing unit shall be designed in consultation with the health authority. Medical/mental health areas may contain other than single occupancy cells.

If negative pressure isolation rooms are being planned, they shall be designed to recognized industry standards.

1231.2.15 Reserved.

1231.2.16 Commissary. In all Type II, III and IV facilities, except where community access is available, there shall be provisions made for inmates to purchase items (such as candy, toilet articles, stationery supplies, books, newspapers and magazines, etc.). An area shall be provided for the secure storage of the stock for such inmate canteen items.

1231.2.17 Dining facilities. In all Type II, III and IV facilities which serve meals, dining areas shall be provided which will allow groups of inmates to dine together. Such dining areas shall not contain toilets, wash basins or showers in the same room without appropriate visual barrier. Wherever the facility contains a central dining room or rooms, it shall contain a minimum of 15 square feet (1.4 m²) of floor space and sufficient tables and seating for each inmate being fed.

1231.2.18 Visiting space. Space shall be provided in all Types I, II, III and IV facilities for in-person visiting.

1231.2.19 Safety equipment storage. A secure area shall be provided for the storage of safety equipment such as fire extinguishers, self-contained breathing apparatus, wire and barcutters, emergency lights, etc.

1231.2.20 Janitors' closet. In Type II facilities, at least one securely lockable janitors' closet with sufficient area for the storage of cleaning implements and supplies must be provided within the security areas of the facility. A mop sink shall also be available within the security area of the facility. In court holding, temporary holding, Types I, III and IV facilities, the closet need not be in the security area.

1231.2.21 Storage rooms. One or more storage rooms shall be provided to accommodate a minimum of 80 cubic feet (2.3 m³) of storage area per inmate for inmate clothing and personal property, institutional clothing, bedding and supplies. Court holding, temporary holding and Type I facilities may be excluded from the storage space requirement for personal and institutional clothing unless clothing is issued.

1231.2.22 Audio monitoring system. In court holding, temporary holding, Type I, Type II and Type II facilities there shall be an inmate- or sound-actuated audio monitoring system in temporary holding cells or rooms, temporary staging cells or rooms, sobering cells, safety cells, single and double occupancy cells, dormitories, day-rooms, exercise areas and correctional program/multipurpose space, which is capable of alerting personnel who can respond immediately.

1231.2.23 Laundry facilities. In Type IV facilities, provision shall be made for washing and drying personal clothing by machines, either in the facility or in the community, if access is permitted for same.

1231.2.24 Emergency power. There shall be a source of emergency power in all detention facilities capable of providing minimal lighting in all housing units, activities areas, corridors, stairs and central control points, and to maintain fire and life safety, security, communications and alarm systems. Such an emergency power source shall conform to the requirements specified in Title 24, Part 3, Article 700, California Electrical Code, California Code of Regulations.

1231.2.25 Confidential interview rooms. There must be a minimum of one suitably furnished interview room for confidential interviews in every facility which provides on-site health care. The interview room shall be designed in consultation with responsible custodial staff and health care staff. Such an interview room shall:

1. Be located within the security area accessible to both female and male inmates; and
2. Provide not less than 70 square feet (6.5 m²) of floor space with no single dimension less than 6 feet (1829 mm).

1231.2.26 Attorney interview space. All facilities except Type IV facilities shall include attorney interview areas which provide for confidential consultation with inmates.

Exception: The design of court holding and temporary holding facilities shall include the following required spaces from Sections 1231.2.2, 1231.2.19, 1231.2.20, 1231.2.21, 1231.2.22, 1231.2.24 and 1231.2.26.

1231.3 Design criteria for furnishings and equipment. Furnishings and equipment shall be as follows:

1231.3.1 Toilets/urinals.

1. Toilets/urinals must be provided in single-occupancy cells and double-occupancy cells.
2. In dormitories, toilets/urinals must be provided in a ratio to inmates of 1:10.
3. Toilets/urinals must be accessible to the occupants of day-rooms and exercise areas.
4. In temporary holding cells and temporary staging cells toilets/urinals must be provided in a ratio to inmates of 1:16.
5. In sobering cells toilets/urinals must be provided in a ratio to inmates of 1:8.
6. One urinal or 2 feet (610 mm) of urinal trough may be substituted for each toilet up to one third of the total number of toilets required, except in those facilities or portions thereof used for females.
7. Toilet areas shall provide modesty for inmates with staff being able to visually supervise.

1231.3.2 Wash basins.

1. Wash basins must be provided in single occupancy cells and double occupancy cells.
2. In dormitories, wash basins must be provided in a ratio to inmates of 1:10.
3. Wash basins must be accessible to the occupants of day-rooms and exercise areas.
4. In temporary holding cells and temporary staging cells, wash basins must be provided in a ratio to inmates of 1:16.
5. In sobering cells, wash basins must be provided in a ratio to inmates of 1:8.
6. Wash basins must be provided with hot and cold or tempered water.
7. Two feet (610 mm) of wash basin trough may be substituted for each basin required.

1231.3.3 Drinking fountains. There must be a minimum of one drinking fountain in every single-occupancy cell, double-occupancy cell, dormitory, temporary holding cell, temporary staging cell, sobering cell, and be accessible to the occupants of day rooms and exercise areas. Additional drinking fountains shall be located in other areas of the facility so that drinking water will be available to inmates and staff. Such drinking fountains must meet the following minimum health requirements:

1. The drinking fountain bubbler shall be on an angle which prevents waste water from flowing over the drinking fountain bubbler.
2. Water flow shall be actuated by mechanical means.

1231.3.4 Showers must be available to all inmates on a ratio of at least one shower to every 20 inmates or fraction thereof and must provide hot and cold water or tempered water. Shower stalls/shower areas must be designed and

constructed of materials which are impervious to water and soap so they may be easily cleaned. Shower areas shall provide modesty for inmates with staff being able to visually supervise.

1231.3.5 Beds must be elevated off the floor, have a solid bottom, and a sleeping surface of at least 30 inches (762 mm) wide and 76 inches (1930 mm) long. Multiple beds must have a minimum of 21 inches (533 mm) between bed pans. Except in minimum security areas, beds must be securely fastened to the floor or the wall.

1231.3.6 Lighting. Lighting in housing units, dayrooms and activity areas must be sufficient to permit easy reading by a person with normal vision, and shall not be less than 20 footcandles (215.2 lux) at desk level and in the grooming area. Lighting shall be centrally controlled and/or occupant controlled in housing cells or rooms. Night lighting in these areas shall be sufficient to give good visibility for purposes of supervision. In minimum-security areas, lighting may be supplied by ordinary lighting fixtures, and in areas of higher security, light fixtures must be of secure design.

1231.3.7 Windows. In housing areas of higher than minimum security, exterior windows which are constantly accessible to inmates for escape must be designed and constructed so that if broken out, the net area accessible for escape is no greater than 5 inches (127 mm) in one dimension.

1231.3.8 Cell padding. In sobering cells, the floor and partition shall be padded. In safety cells, padding must cover the entire floor, doors and walls and everything on them to a clear height of 8 feet (2438 mm).

All such padded cells must be equipped with a tamper-resistant fire sprinkler as approved by the State Fire Marshal. All padding must be:

1. Approved for use by the State Fire Marshal;
2. Nonporous to facilitate cleaning;
3. At least 1/2-inch (12.7 mm) thick;
4. Of a unitary or laminated construction to prevent its destruction by teeth, hand tearing or small metal objects;
5. Firmly bonded to all padded surfaces to prevent tearing or ripping; and
6. Without any exposed seams susceptible to tearing or ripping.

1231.3.9 Mirrors. A mirror of a material appropriate to the level of security must be provided near each wash basin specified in these regulations.

1231.3.10 Seating. In temporary holding and temporary staging cells, seating must be securely fixed to the floor and/or wall. When bench seating is used, 18 inches (457 mm) of bench is seating for one person.

1231.3.11 Table/seat. In single- and double-occupancy cells, a table and seat for the purpose of writing and dining shall be provided.

Exception: A Type I facility does not require a table and a seat.

1231.3.12 Weapons locker. A secure weapons locker shall be located outside the security perimeter of the facility. Such weapons lockers shall be equipped with individual compartments, each with an individual locking device. Weapons lockers are required in temporary and court holding facilities and in all facilities of higher than minimum security.

Exception: The design of court holding and temporary holding facilities shall include the design criteria for furnishings and equipment from Sections 1231.3.1, 1231.3.2, 1231.3.3, 1231.3.6, 1231.3.10 and 1231.3.12.

1231.4 Enclosure of vertical openings. Elevator shafts, vent shafts and other vertical openings shall be enclosed, and the enclosure shall be as set forth in Chapter 7.

1231.5 Fire-extinguishing systems. Automatic fire-extinguishing systems, standpipes and basement pipe inlets shall be installed when and as required by Chapter 9.

1231.6 Existing Group I occupancies. Existing buildings housing existing protective social-care homes or facilities established prior to the effective date of these regulations may have their use continued if they conform, or are made to conform, to the following provisions.

1231.6.1 Use of floors. The use of floor levels in buildings of Type III, IV or V nonfire-rated construction may be as follows:

Nonambulatory—first floor only;

Ambulatory—not higher than the third-floor level, provided walls and partitions are constructed of materials equal in fire-resistive quality to that of wood lath and plaster in good repair and all walls are firestopped at each floor level.

1231.6.2 Enclosure of exits and vertical openings. Except for two-story structures housing ambulatory guests, all interior stairs shall be enclosed in accordance with Chapter 10. In lieu of stairway enclosures, floor separations or smoke barriers may be provided in such a manner that fire and smoke will not spread rapidly to floors above or otherwise impair exit facilities. In these instances, floor separations or smoke barriers shall have a fire resistance equal to not less than 1/2-inch (12.7 mm) gypsum wall board on each side of wood studs with openings protected by not less than a 1 3/4-inch (44 mm) solid bonded wood-core door of the self-closing type. All other vertical openings shall be enclosed in accordance with the provisions of Chapter 7.

1231.6.3 Exit access. Each floor or portion thereof of buildings used for the housing of existing protective social-care homes or facilities shall have access to not less than two exits in such a manner as to furnish egress from the building or structure in the event of an emergency substantially equivalent to the provisions of Chapter 10.

1231.6.4 Corridor openings. Openings from rooms to interior corridors shall be protected by not less than 1 3/4-

inch (44 mm) solid-bonded wood-core doors. Transoms and other similar openings shall be sealed with materials equivalent to existing corridor wall construction.

1231.6.5 Interior wall and ceiling finishes shall conform to the requirements for a Group R, Division 1 occupancy as specified in Chapter 8.

1231.6.6 Automatic sprinkler systems shall be installed in existing protective social-care occupancies in accordance with the provisions of Chapter 9.

1231.6.7 Fire alarm systems. Automatic fire alarm systems shall be installed in existing protective social-care homes or facilities in accordance with the provisions of Chapter 9.

Exception: When an approved automatic sprinkler system conforming to Chapter 9 is installed, a separate fire alarm system as specified in this subsection need not be provided.

**SECTION 1232
Reserved**

**SECTION 1233
Reserved**

**SECTION 1234
Reserved**

**SECTION 1235 [DPH]
SANITARY CONTROL OF SHELLFISH
(PLANTS AND OPERATIONS)**

1235.1 Culling plants. Culling plants shall be located in areas free from unsanitary conditions and faulty sewage disposal. They shall be provided with an ample supply of water under adequate pressure from a source approved by the Department of Health Services for the purpose of hosing down floor and benches and cleaning the shellfish. Floors and premises shall be kept in a clean and sanitary condition.

1235.2 Plant arrangement. Unless shellfish are shucked directly into packing containers with no further processing, the shucking and packing processes shall be done in separate rooms. There shall be installed in the partition between the two rooms a delivery window through which the shucked stock is passed to the packing room. Provision shall be made for storing the employees' outer garments, aprons, gloves, etc., in a separate room.

Note: In special instances where shucking is done on a small scale for local retail sales, shucking and packing may be permitted in a single room if approved by the Department of Health Services. This single room and all operations shall conform to all requirements of these regulations except that of separate shucking and packing rooms. "Limited" certificates shall be issued in these instances and all containers of shucked shellfish shall be

clearly labeled or marked with words "Limited Certificate" and the appropriate certificate number.

1235.3 Floors. The floors of all rooms in which shellfish are stored, shucked, washed, packed or otherwise processed shall be constructed of concrete or other equally impervious material, graded to drain quickly, free from cracks or uneven surfaces that might interfere with proper cleaning or drainage, and maintained in clean and satisfactory condition.

1235.4 Walls and ceilings. Walls and ceilings shall be maintained in a smooth, clean, washable, light-colored conditions. They shall be impervious to moisture and shall be kept in good repair. Walls contiguous to benches shall, to a height of 2 feet (610 mm) above the bench top, be of smooth concrete, metal or equally nonabsorbent material.

1235.5 Screening. The plant shall have all openings effectively screened, unless other effective means are provided to prevent the entrance of flies and other insects.

1235.6 Light. Ample light to work by shall be provided in all working rooms. A light intensity of not less than 10 footcandles (108 lux) shall be maintained on all working surfaces when workers are at their working positions.

1235.7 Ventilation. Adequate ventilation shall be provided to prevent condensation on ceilings or other surfaces.

1235.8 Toilet facilities. Every shellfish culling, shucking, packing or repacking plant shall be provided with clean and adequate toilet facilities conveniently located. No toilet room shall be used for the storage of garments, food products, containers or equipment. Construction and maintenance of toilets shall comply with all local and state regulations.

1235.9 Handwashing facilities. An adequate number of lavatories shall be provided at locations convenient to toilet rooms and shellfish handling operations, including running hot and cold water, soap and individual disposal towels. The use of a common towel is prohibited. All employees shall wash their hands thoroughly with running water and soap on beginning work and after each visit to the toilet. Signs to this effect shall be posted in conspicuous places in the plant and in the toilet rooms.

1235.10 Sewers and drains. Sewage and other liquid wastes shall be discharged into public sewers wherever possible. Where private sewage or waste disposal systems must be utilized, they shall be constructed in accordance with state and local regulations pertaining thereto. Plant waste systems shall be properly trapped and vented. Waste liquids shall be disposed of in a manner that will not adversely affect the quality of the water in which shellfish are grown or stored. Waste lines from washing machines shall have suitable protection against the possibility of sewage or wastes entering these machines.

1235.11 Water supply. Shucking, packing or repacking plants shall be provided with an ample supply of water under adequate pressure from a source approved by the Department of Health Services. The supply shall be accessible to all parts of the plant, adequate in quantity, and of a safe sanitary quality. No cross connections with unapproved supplies or other possible sources of contamination shall be permitted.

**SECTION 1236 [DPH]
LABORATORY ANIMAL QUARTERS**

Laboratory animal quarters shall meet the requirements of Part 12 California Referenced Standards Code, Chapter 12-4A, Section 12-4A-101.

See the 2010 Edition, Title 24, Part 12, Chapter 12-4A.

**SECTION 1237 [DPH]
WILD ANIMAL QUARANTINE FACILITIES**

1237.1 Scope. The provisions of this section are intended to provide standards for the quarantine of wild animals.

1237.2 Definitions. For the purpose of this chapter, the following terms shall have the meaning indicated:

ESCAPEPROOF is a condition that will prohibit unintended release of wild animals from their quarantine enclosure.

HOUSING FACILITY is a room, building or area used to contain a primary enclosure or enclosures for animal quarantine.

PRIMARY ENCLOSURE is a structure used to immediately restrict an animal or animals to a limited amount of space, such as a room, pen, run, cage or compartment within the quarantine facility.

QUARANTINE FACILITY is a facility for the quarantine confinement of imported wild animals.

SPACE CONDITIONING is the regulation of ambient temperature.

1237.3 Construction.

1237.3.1 General. Housing facilities used for quarantine shall be constructed in accordance with these provisions and Group B occupancy requirements.

1237.3.2 Entry. Quarantine housing facilities shall restrict the entry of other animals and unauthorized persons by locking or bolting devices or other equipment methods.

Rooms containing primary enclosures shall be entered through double doors that maintain a minimum distance of 4 feet (1219 mm) between doors permitting closure of one door before the second is opened.

All animals must be visible through a viewpoint from the entry area.

Windows to the outside shall be escapeproof.

One handwashing sink shall be provided in each room in which animals are quarantined.

1237.3.3 Special provision. The interior building surfaces of housing facilities shall be smooth and impervious to moisture.

1237.4 Light and ventilation. All portions of the wild animal quarantine facility shall be space conditioned to maintain the health of the wild animals. Ventilation shall be provided in housing facilities so as not to cre-

ate a health hazard by one or more of the following methods.

1. Openable windows
2. Doors
3. Vents
4. Air conditioning
5. Fans

Uniformly distributed illumination of not less than 50 footcandles (538 lux) at least the level of the cage racks shall be provided.

1237.5 Primary enclosure. Primary enclosures shall be capable of containing quarantined animals and excluding access by other animals. Enclosures shall provide space to allow each animal to make normal postural adjustments with freedom of movement and maintain social activity. Primates shall be provided with a minimum floor space equal to an area of at least three times the area occupied by such primates when standing on four feet.

**SECTION 1238
Reserved**

**SECTION 1239
Reserved**

**SECTION 1240 [AGR]
MEAT AND POULTRY PROCESSING PLANTS**

1240.1 General construction. The buildings shall be of sound construction and kept in good repair.

1240.1.1 The doors, windows, skylights and other outside openings of the plant, shall be protected by fitted screens or other devices, such as air screens, against the entrance of flies and other insects.

1240.1.2 Outside doors shall be hung so as to be close fitting when closed.

1240.1.3 Rooms or compartments used for edible products shall be separated and distinct from inedible products departments and from rooms where live poultry are held or slaughtered. Separate rooms shall be provided when required for conducting processing operations in a sanitary manner; and all rooms shall be able to accommodate equipment for processing operations.

Note: In the event of specific conflict, in federally inspected plants, between the provisions of Title 24 and federal regulations, the federal regulations shall take precedence.

1240.1.4 The rooms and compartments in which any product is prepared or handled shall be free from objectionable odors.

1240.1.5 The outer premises of every official establishment, including docks and areas where cars and vehicles

are loaded, and the driveways, approaches, yards, pens and alleys shall be paved.

1240.2 Refuse rooms. A separate refuse room shall be required in official establishments where accumulations of refuse occur. Refuse rooms shall be entirely separate from other rooms in the establishment, and shall provide for the following:

1. Tight fitting doors.
2. Ventilation.
3. Drainage.
4. Cleanup facilities.
5. Floors and walls to a height of 6 feet (1829 mm) above the floor shall be impervious to moisture.
6. Wall above 6 feet (1829 mm), and ceilings shall be moisture resistant.

1240.3 Rooms for holding carcasses for further inspection. Room or other acceptable facilities in which carcasses or parts thereof are held for further inspection shall be in such numbers and such locations as needs of the inspection in the establishment may require. These rooms or facilities shall be equipped with hasps for locking.

1240.4 Coolers and freezers. Coolers and freezers shall be of adequate size and capacity and have cooling capability to fully enable compliance with the regulations governing the inspection of meat and poultry and meat and poultry products.

1240.5 Boiler room. The boiler room shall be a separate room where necessary to prevent dirt and objectionable odors entering from it into any room where dressed poultry or poultry products are prepared, handled or stored.

1240.6 Inspector’s office. Office space for the use of government personnel shall be provided. The room or space must meet the approval of the inspection service and provide for the following:

1. Light
2. Heat
3. Ventilation
4. Desk space
5. File cabinets

1240.7 Facilities for program employees. Establishments shall have facilities for program employees.

1240.8 Lunch rooms. Lunch rooms or lunch areas separate from the processing, packing or supply rooms shall be provided in establishments where employees eat their lunches.

1240.9 Floors. All floors in rooms where exposed products are prepared or handled shall be constructed of, or finished with, materials impervious to moisture. The floors in killing, ice cooling, ice packing, eviscerating, cooking, boning and cannery rooms shall be graded for complete runoff with no standing water.

1240.10 Walls, posts, partitions and doors. All walls, posts, partitions and doors in rooms where exposed products are

prepared or handled shall be smooth and constructed of materials impervious to moisture to a height of at least 8 feet (2438 mm) above the floor. All surfaces above this height must be smooth and finished with moisture-resistant material.

1240.11 Ceilings. Ceilings must be moisture resistant in rooms where exposed products are prepared or handled, finished and sealed.

1240.12 Rails. Rails should be located and passageway space provided so that exposed product does not come in contact with posts, walls and other fixed parts of the building or with barrels, boxes or other containers trafficked through holding and operation areas.

1240.13 Lighting. There shall be either natural or artificial light or both for all rooms and compartments.

1240.13.1 All rooms in which poultry or livestock are killed, eviscerated or otherwise processed shall have at least 30 foot-candles (323 lux) of light intensity on all working surfaces.

Exceptions:

1. At the inspection stations such light intensity shall be at least 50 footcandles (538 lux).
2. In all other rooms in which poultry or livestock are not killed, eviscerated or otherwise processed, there shall be provided at least 5 footcandles (54 lux) of light intensity when measured at a distance of 30 inches (762 mm) from the floor.

1240.14 Ventilation. There shall be either natural or artificial ventilation, adequate to control odors, vapors and condensation to the extent necessary to prevent adulteration of product and the creation of insanitary conditions, in all rooms and compartments.

1240.14.1 Freezing rooms, other than those for plate freezers or liquid freezing, shall have forced-air circulation, and freezers and coolers shall be equipped with floor racks or pallets unless other means are used which will assure that products will be maintained in a wholesome condition.

1240.14.2 Toilet rooms shall be ventilated to the outside of the building.

1240.15 Lavatories, toilets and other sanitary facilities.

1240.15.1 Lavatory and toilet accommodations, including but not limited to, running hot and cold water, shall be provided as follows in Table 1240.15.1.

TABLE 1240.15.1

PERSONS OF SAME SEX	TOILET BOWLS REQUIRED
1 to 15, inclusive	1
1 to 15, inclusive	2
1 to 15, inclusive	3*
1 to 15, inclusive	4*
For each additional 30 persons in excess of 80	1*

* Urinals may be substituted for toilet bowls, but only to the extent of one-third of the total number of bowls stated.

INTERIOR ENVIRONMENT

1240.15.2 Lavatories shall be in or adjacent to toilet and locker rooms and at other places in the plant to provide for the cleanliness of all personnel handling products.

1240.15.3 Toilet rooms opening directly into rooms where products are exposed shall have self-closing doors.

1240.15.4 Dressing rooms and toilet rooms shall be provided in each establishment and shall be ample in size and readily accessible. They shall be separated from the rooms and compartments in which products are prepared, stored or handled. Where both sexes are employed, separate facilities shall be provided.

1240.15.5 Lockers or other facilities shall be provided for employees' wearing apparel and for the storing and changing of clothing. Lockers shall not be located in rooms where processing operations are conducted.

1240.15.6 Handwashing facilities serving areas where dressed livestock and poultry carcasses and parts and meat and poultry products are prepared shall be operated by other than hand-operated controls, or shall be continuous flow type that provides flow of water for washing hands.

1240.15.7 Catch basins. All catch basins on the premises shall accommodate the provisions of Section 1243.5.

SECTION 1241 [AGR] COLLECTION CENTERS AND FACILITIES

1241.1 General construction.

1241.1.1 Collection centers shall have facilities for the storage of carcasses and parts of dead animals and the cleaning and sanitizing of vehicles.

1241.1.2 Buildings used for the temporary storage of animal carcasses, packinghouse wastes and other products before transportation to a licensed rendering plant shall be of sound construction and shall be of such construction as to prevent the entrance or harboring of vermin.

1241.1.3 The floors, walls, ceilings, partitions and doors shall be of such material, construction and finish as to make them readily cleanable.

1241.1.4 The area for the cleaning and sanitizing of vehicles shall be provided with adequate live steam or hot water, producing a temperature of at least 180°F (82°C), or other method for sanitizing vehicles.

1241.1.5 Facilities shall be provided for the holding and disposal of solid waste resulting from the cleaning operation. Such facilities shall be accessible and easily cleaned and so constructed as to prevent the entrance or harborage of vermin, flies and other insects.

1241.1.6 The cleaning and sanitizing of vehicles shall be done on a slab of concrete or other material approved by the Department, which is sloped to drains so as to permit the rapid runoff of water.

1241.1.7 Carcasses and packinghouse waste. The unloading slab shall be of sufficient size to hold all animal carcasses and packinghouse waste material, be constructed

of concrete or other material approved by the Department and sloped to drains so as to permit the rapid runoff of water.

1241.2 Floors. Floors of rooms in which carcasses and packinghouse wastes are received or stored shall be graded to permit runoff of water with no standing water. In new construction and in renovated buildings where floors are to be resurfaced, the pitch shall not be less than 1/4 inch per foot (2 percent) to drains.

1241.3 Lavatories and toilets. Modern lavatory accommodations, including running hot and cold water, shall be provided except where the Department determines that they are not necessary.

SECTION 1242 [AGR] RENDERERS

1242.1 General construction.

1242.1.1 Separation from other businesses. Every licensed rendering establishment shall be separate and distinct from any establishments in which any meat, meat byproducts, poultry or poultry byproducts are handled and from any other business at the discretion of the Department.

1242.1.2 The cleaning and sanitizing of vehicles shall be done on a slab of concrete or other material approved by the Department; which is sloped to drains so as to permit the rapid runoff of water.

SECTION 1243 [AGR] HORSEMEAT AND PET FOOD ESTABLISHMENTS

1243.1 Scope. In the event of specific conflict between the provisions of Title 24 and federal regulations, the federal regulations shall take precedence in establishments under federal inspection.

1243.2 General.

1243.2.1 Facilities for program employees. Office space, including light and heat shall be provided by official establishments for the inspector and other program employees. The office space shall be conveniently located and adequately ventilated, heated, cooled and provided with adequate desk and file space.

1243.2.2 Final inspection places.

1243.2.2.1 Final inspection places shall, by size, rail arrangement and other equipment, prevent contamination of edible carcasses or parts by inedible carcasses or parts.

1243.2.2.2 Floors. The floors shall be of such construction as to facilitate the maintenance of sanitary conditions and shall have drainage connections. When the final inspection place is part of a larger floor, it shall be separated from the rest of the floor by a curb, railing or otherwise.

1243.2.3 Docks and receiving rooms. Docks and receiving rooms shall be provided.

1243.2.4 The floors, walls, ceilings, partitions, posts, doors and other parts of all structures shall be of such material, construction and finish as will make them readily and thoroughly cleanable. The floors shall be kept watertight.

1243.2.5 Rails. Rails shall be located and passageway space provided, so that exposed product does not come in contact with post, walls and other fixed parts of the building or with barrels, boxes and other containers trafficked through holding and operation areas.

1243.2.6 The rooms and compartments used for edible products shall be separated and distinct from those used for inedible products.

1243.2.7 The rooms and compartments in which any product is prepared or handled shall be free from objectionable odor.

1243.2.8 Precaution shall be taken to exclude flies, rats, mice and other vermin from official establishments.

1243.2.9 The outer premises of horsemeat and pet food establishments shall meet the requirements of Section 1240.1.5.

1243.3 Lighting. There shall be light and ventilation for all rooms and compartments.

1243.4 Sanitary facilities and accommodations. Sanitary facilities and accommodations shall be furnished by every official establishment.

1243.4.1 Dressing rooms and toilet rooms shall be provided in each establishment and shall be ample in size and readily accessible. They shall be separated from the rooms and compartments in which products are prepared, stored or handled. Where both sexes are employed, separate facilities shall be provided.

1243.4.2 Lavatories, including running hot and cold water, shall be placed in or adjacent to toilet and urinal rooms and at other places in the establishment to assure cleanliness of all persons handling any product.

1243.4.3 Facilities shall be provided for cleansing and disinfecting utensils.

1243.5 Catch basins. All catch basins on the premises shall be of such construction and location to ensure they are kept clean and odorless. Catch basins shall not be located in department where any product is prepared, handled or stored.

1243.6 Final inspection space. Such spaces shall be equipped with hot water and a lavatory.

**SECTION 1244
Reserved**

**SECTION 1245
Reserved**

**SECTION 1246
Reserved**

**SECTION 1247
Reserved**

**SECTION 1248
Reserved**

**SECTION 1249
Reserved**

**SECTION 1250 [CA]
PHARMACIES**

1250.1 Application. This section applies to pharmacies listed in Section 1.4.1 regulated by the Department of Consumer Affairs.

1250.2 Restrooms. A pharmacy shall maintain a readily accessible restroom. The restroom shall contain a toilet and washbasin supplied with running water.

1250.3 Sink. All pharmacies shall be equipped with a sink within the pharmacy for pharmaceutical purposes. The sink shall be supplied with hot and cold running water.

1250.4 Compounding area for parenteral solutions. The pharmacy shall have a designated area for the preparation of sterile products for dispensing which shall:

1. In accordance with Federal Standard 209 (b), Clean Room and Work Station Requirements, Controlled Environment as approved by the Commission, Federal Supply Service, General Service Administration meet standards for Class 100 HEPA (high efficiency particulate air) filtered air such as laminar airflow hood or clean room.
2. Have nonporous and cleanable surfaces, ceilings and ceiling tiles, walls, floors and floor coverings.
3. The pharmacy shall be arranged in such a manner that the laminar-flow hood is located in an area which is exposed to minimal traffic flow, and is separate from any area used for bulk storage of items not related to the compounding of parenteral solutions.

There shall be sufficient space, well separated from the laminar-flow hood area for the storage of bulk materials, equipment and waste materials.

4. A sink with hot and cold running water must be within the parenteral solution compounding area or adjacent to it.
5. Any pharmacy that compounds sterile injectable products from one or more nonsterile ingredients must compound the medication in one of the following environments:
 - 5.1. An ISO class 5 laminar airflow hood within an ISO class 7 cleanroom. The cleanroom must have a positive air pressure differential relative adjacent areas.
 - 5.2. An ISO class 5 cleanroom.
 - 5.3. A barrier isolator that provides an ISO class 5 environment for compounding.

Note: For additional pharmacy mechanical standard requirements, see Chapter 5, California Mechanical Code.

**SECTION 1251 [CA]
VETERINARY FACILITIES**

1251.1 All premises where veterinary medicine, veterinary dentistry or veterinary surgery is being practiced, and all instruments, apparatus and apparel used in connection with those practices, shall be kept clean and sanitary at all times and shall conform to the standards of this section.

1251.2 Indoor lighting for halls, wards, reception areas and examining and surgical rooms shall be adequate for their intended purpose. All surgical rooms shall be provided with emergency lighting.

1251.3 A veterinary facility where animals are housed shall contain the following:

1. A reception room and office, or a combination of the two.
2. An examination room separate from other areas of the facility and of sufficient size to accommodate the doctor, assistant, patient and client.
3. A surgery room separate and distinct from all other rooms.
4. Housing. In those veterinary hospitals where animals are retained for treatment or hospitalization, the following shall be provided:
 - 4.1. Separate compartments, one for each animal, maintained in a sanitary manner so as to assure comfort.
 - 4.2. Facilities allowing for the effective separation of contagious and noncontagious cases.
 - 4.3. Exercise runs which provide and allow effective separation of animals and their waste products.

Note: Where animals are kept in clinics for 24 hours or more, walking the animal meets this requirement.

1251.4 Practice management.

1251.4.1 Veterinary facilities shall maintain a sanitary environment to avoid sources and transmission of infection. This is to include the proper routine of disposal of waste materials and proper sterilization or sanitation of all equipment used in diagnosis or treatment.

1251.4.2 Fire precautions shall meet the requirements of local and state fire prevention codes.

1251.4.3 The temperature and ventilation of the facility shall be maintained so as to assure the comfort of all patients.

1251.4.4 The veterinary facility must have the capacity to render adequate diagnostic radiological services, either in the hospital or through other commercial facilities. Radiological procedures shall be in accordance with state public health standards.

1251.4.5 Sanitary methods for the disposal of deceased animals shall be provided and maintained. Where the owner of a deceased animal has not given the veterinarian authorization to dispose of the animal, the veterinarian shall be required to retain the carcass in a freezer for at least 14 days.

**SECTION 1252 [CA]
BARBER COLLEGES AND SHOPS**

1252.1 Barber college floors. Floors of barber colleges shall be covered with hardwood, linoleum, asphalt tile or some other washable and nonporous material other than paint.

1252.2 Barber shop floors. Floors of barber shops shall be covered with hardwood, linoleum, asphalt tile, carpeting or some other washable material other than paint.

1252.3 Barber shop washbasin(s) and lavatory(ies). A barber shop owner shall provide washbasin(s) or lavatory(ies) within the working area of the barber shop.

1252.4 Minimum barber shop size. A barber shop shall be a minimum of 8 feet (2438 mm) wide, 8 feet (2438 mm) long, with an 8-foot (2438 mm) ceiling.

1252.5 Barber college premises. In a college of barbering, the room for practical work and demonstrations shall be at least 14 feet (4267 mm) wide for one row of barber chairs and shall be at least 20 feet (6096 mm) wide for two rows of chairs.

**SECTION 1253 [CA]
SCHOOLS OF COSMETOLOGY,
COSMETOLOGICAL ESTABLISHMENTS AND
SATELLITE CLASSROOMS**

1253.1 Floor space.

1253.1.1 Schools of cosmetology. The minimum floor space in any school of cosmetology premises shall be 3,000 square feet (279 m²), not less than 2,000 square feet (185.8 m²) of which shall be provided for the working, practice and classroom areas.

Exception: When the average daily attendance for either day or night school in a school of cosmetology exceeds 50 students for a period of three months, an additional 30 square feet (2.8 m²) of floor space shall be required for each additional student after the first 50, which shall be provided for the working, practice and classroom areas.

1253.1.2 Schools of electrology. The minimum floor space in any school of electrology premises shall be 1,000 square feet (93 m²), not less than 600 square feet (55.7 m²) of which shall be provided for the working, practice and classroom areas.

Exception: When the average daily attendance for either day or night school of electrology exceeds 15 students, an additional 30 square feet (2.8 m²) of floor space shall be required for each additional student after the first 15, which shall be provided for working, practice and classroom areas.

1253.1.3 Satellite classrooms. The minimum floor space in any satellite classroom of a school of cosmetology or electrology shall be 1,000 square feet (93 m²).

Exception: For each additional student after the first 50, an additional 20 square feet (1.9 m²) of floor space shall be required.

1253.2 Floor finish. *The floors in the toilet area of each school and establishment shall be of nonabsorbent material.*

1253.3 Ceiling height. *The minimum ceiling height of the practice and classroom areas of school premises shall be at least 9 feet (2743 mm) in height.*

**SECTION 1254 [CA]
ACUPUNCTURE OFFICES**

1254.1 Acupuncture offices. *Every acupuncture office shall have a readily accessible bathroom facility which shall be maintained in a clean and sanitary condition at all times. In addition, there shall be a sink with hot and cold running water in or near each treatment room.*

CHAPTER 13
ENERGY EFFICIENCY

Refer to California Energy Code, Title 24, Part 6.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 14 – EXTERIOR WALLS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC		
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5	
Adopt entire chapter	X																							
Adopt entire chapter as amended (amended sections listed below)				X	X			X	X	X	X	X												
Adopt only those sections that are listed below		X	X																					
Chapter / Section																								
1401			X																					
1402			X																					
1402.2.1		X																						
1403			X																					
1404			X																					
1404.1.1								X	X	X	X	X												
1404.3.1				X	X																			
1404.3.2				X	X																			
Table 1404.3.3				†	†																			
1405			X																					
1406			X																					
1407			X																					
1408			X																					
1410								X	X	X	X	X												

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 14

EXTERIOR WALLS

User notes:

About this chapter: Chapter 14 addresses requirements for exterior walls of buildings. Minimum standards for wall covering materials, such as material performance and fire resistance, installation of wall coverings and the ability of the wall to provide weather protection are provided. This chapter also contains limitations on the areas and heights of combustible wall coverings based on fire separation distances, radiant heat exposure and surface burning characteristics.

Code development reminder: Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 1401 GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for exterior walls; exterior wall coverings; exterior wall openings; exterior windows and doors; and architectural trim.

SECTION 1402 PERFORMANCE REQUIREMENTS

1402.1 General. The provisions of this section shall apply to exterior walls, wall coverings and components thereof.

1402.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1404.4. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1403.2, and a means for draining water that enters the assembly to the exterior. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section 1404.3.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1403.2 and 1404.4, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall

envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

- 2.1. Exterior wall envelope test assemblies shall include not fewer than one opening, one control joint, one wall/eave interface and one wall sill. Tested openings and penetrations shall be representative of the intended end-use configuration.
- 2.2. Exterior wall envelope test assemblies shall be not less than 4 feet by 8 feet (1219 mm by 2438 mm) in size.
- 2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (0.297 kN/m²).
- 2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

3. Exterior insulation and finish systems (EIFS) complying with Section 1407.4.1.

1402.2.1 [BSC-CG] See California Green Building Standards Code, Chapter 5, Division 5.4 for additional weather protection requirements.

[BS] 1402.3 Structural. Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required by Chapter 16.

1402.4 Fire resistance. Exterior walls shall be fire-resistance rated as required by other sections of this code with opening protection as required by Chapter 7.

1402.5 Water-resistive barriers. Exterior walls on buildings of Type I, II, III or IV construction that are greater than 40 feet (12 192 mm) in height above grade plane and contain a combustible water-resistive barrier shall be tested in accordance with and comply with the acceptance criteria of NFPA 285. Combustibility shall be determined in accordance with Section 703.3. For the purposes of this section, fenestration products, flashing of fenestration products and water-resistive-barrier flashing and accessories at other locations,

EXTERIOR WALLS

including through wall flashings, shall not be considered part of the water-resistive barrier.

Exceptions:

1. Walls in which the water-resistive barrier is the only combustible component and the exterior wall has a wall covering of brick, concrete, stone, terra cotta, stucco or steel with minimum thicknesses in accordance with Table 1404.2.
2. Walls in which the water-resistive barrier is the only combustible component and the water-resistive barrier complies with the following:
 - 2.1. A peak heat release rate of less than 150 kW/m², a total heat release of less than 20 MJ/m² and an effective heat of combustion of less than 18 MJ/kg when tested on specimens at the thickness intended for use, in accordance with ASTM E1354, in the horizontal orientation and at an incident radiant heat flux of 50 kW/m².
 - 2.2. A flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723, with test specimen preparation and mounting in accordance with ASTM E2404.

[BS] 1402.6 Flood resistance. For buildings in flood hazard areas as established in Section 1612.3, exterior walls extending below the elevation required by Section 1612 shall be constructed with flood-damage-resistant materials.

[BS] 1402.7 Flood resistance for coastal high-hazard areas and coastal A zones. For buildings in coastal high-hazard areas and coastal A zones as established in Section 1612.3, electrical, mechanical and plumbing system components shall not be mounted on or penetrate through exterior walls that are designed to break away under flood loads.

SECTION 1403 MATERIALS

1403.1 General. Materials used for the construction of *exterior walls* shall comply with the provisions of this section. Materials not prescribed herein shall be permitted, provided that any such alternative has been approved.

1403.2 Water-resistive barrier. Not fewer than one layer of water-resistive barrier material shall be attached to the studs or sheathing, with flashing as described in Section 1404.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

Water-resistive barriers shall comply with one of the following:

1. No. 15 felt complying with ASTM D226, Type 1.
2. ASTM E2556, Type I or II.
3. ASTM E331 in accordance with Section 1402.2.
4. Other approved materials installed in accordance with the manufacturer's installation instructions.

[BS] 1403.3 Wood. Exterior walls of wood construction shall be designed and constructed in accordance with Chapter 23.

[BS] 1403.3.1 Basic hardboard. Basic hardboard shall conform to the requirements of ANSI A135.4.

[BS] 1403.3.2 Hardboard siding. Hardboard siding shall conform to the requirements of ANSI A135.6 and, where used structurally, shall be so identified by the label of an approved agency.

[BS] 1403.4 Masonry. Exterior walls of masonry construction shall be designed and constructed in accordance with this section and Chapter 21. Masonry units, mortar and metal accessories used in anchored and adhered veneer shall meet the physical requirements of Chapter 21. The backing of anchored and adhered veneer shall be of concrete, masonry, steel framing or wood framing. Continuous insulation meeting the applicable requirements of this code shall be permitted between the backing and the masonry veneer.

[BS] 1403.5 Metal. Exterior walls constructed of cold-formed or structural steel shall be designed in accordance with Chapter 22. Exterior walls constructed of aluminum shall be designed in accordance with Chapter 20.

[BS] 1403.5.1 Aluminum siding. Aluminum siding shall conform to the requirements of AAMA 1402.

[BS] 1403.5.2 Cold-rolled copper. Copper shall conform to the requirements of ASTM B370.

[BS] 1403.5.3 Lead-coated copper. Lead-coated copper shall conform to the requirements of ASTM B101.

[BS] 1403.6 Concrete. Exterior walls of concrete construction shall be designed and constructed in accordance with Chapter 19.

[BS] 1403.7 Glass-unit masonry Exterior walls of glass-unit masonry shall be designed and constructed in accordance with Chapter 21.

1403.8 Plastics. Plastic panel, apron or spandrel walls as defined in this code shall not be limited in thickness, provided that such plastics and their assemblies conform to the requirements of Chapter 26 and are constructed of approved weather-resistant materials of adequate strength to resist the wind loads for cladding specified in Chapter 16.

1403.9 Vinyl siding. Vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D3679 by an approved quality control agency.

1403.10 Fiber-cement siding. Fiber-cement siding shall conform to the requirements of ASTM C1186, Type A (or ISO 8336, Category A), and shall be so identified on labeling listing an approved quality control agency.

1403.11 Exterior insulation and finish systems. Exterior insulation and finish systems (EIFS) and exterior insulation and finish systems (EIFS) with drainage shall comply with Section 1407.

1403.12 Polypropylene siding. Polypropylene siding shall be certified and labeled as conforming to the requirements of ASTM D7254 and those of Section 1403.12.1 or 1403.12.2 by an approved quality control agency. Polypropylene siding shall be installed in accordance with the requirements of

Section 1404.18 and in accordance with the manufacturer’s instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

1403.12.1 Flame spread index. The certification of the flame spread index shall be accompanied by a test report stating that all portions of the test specimen ahead of the flame front remained in position during the test in accordance with ASTM E84 or UL 723.

1403.12.2 Fire separation distance. The fire separation distance between a building with polypropylene siding and the adjacent building shall be not less than 10 feet (3048 mm).

1403.13 Foam plastic insulation. Foam plastic insulation used in exterior wall covering assemblies shall comply with Chapter 26.

1403.14 Attachments through insulation. Exterior wall coverings attached to the building structure through foam plastic insulating sheathing shall comply with the attachment requirements of Section 2603.11, 2603.12, or 2603.13.

**SECTION 1404
INSTALLATION OF WALL COVERINGS**

1404.1 General. Exterior wall coverings shall be designed and constructed in accordance with the applicable provisions of this section.

1404.1.1 Additional requirements. [DSA-SS & DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of Sections 1404.6, 1404.7, 1404.8, 1404.9 and 1404.10, the installation of anchored or adhered veneer shall comply with applicable provisions of Section 1410.

1404.2 Weather protection. Exterior walls shall provide weather protection for the building. The materials of the minimum nominal thickness specified in Table 1404.2 shall be acceptable as approved weather coverings.

1404.3 Vapor retarders. Vapor retarder materials shall be classified in accordance with Table 1404.3(1). A vapor retarder shall be provided on the interior side of frame walls in accordance with Tables 1404.3(2) and 1404.3(3), or an approved design using accepted engineering practice for hygrothermal analysis. The appropriate climate zone shall be selected in accordance with Chapter 3 of the California Energy Code. Where a Class II vapor retarder is used in combination with foam plastic insulating sheathing installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table 1404.3(4) and the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B). Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an approved design.

[HCD 1 & HCD 2] Class I or II vapor retarders shall be provided on the interior side of frame walls of low-rise residential buildings in California Climate

**TABLE 1404.2
MINIMUM THICKNESS OF WEATHER COVERINGS**

COVERING TYPE	MINIMUM THICKNESS (inches)
Adhered masonry veneer	0.25
Aluminum siding	0.019
Anchored masonry veneer	
Stone (natural)	2.0
Architectural cast stone	2.5
Other	2.0
Asbestos-cement boards	0.125
Asbestos shingles	0.156
Cold-rolled copper ^d	0.0216 nominal
Copper shingles ^d	0.0162 nominal
Exterior plywood (with sheathing)	0.313
Exterior plywood (without sheathing)	See Section 2304.6
Fiber cement lap siding	0.25 ^c
Fiber cement panel siding	0.25 ^c
Fiberboard siding	0.5
Glass-fiber reinforced concrete panels	0.375
Hardboard siding ^c	0.25
High-yield copper ^d	0.0162 nominal
Lead-coated copper ^d	0.0216 nominal
Lead-coated high-yield copper	0.0162 nominal
Marble slabs	1
Particleboard (with sheathing)	See Section 2304.6
Particleboard (without sheathing)	See Section 2304.6
Porcelain tile	0.125 nominal
Steel (approved corrosion resistant)	0.0149
Structural glass	0.344
Stucco or exterior cement plaster	
Three-coat work over:	
Metal plaster base	0.875 ^b
Unit masonry	0.625 ^b
Cast-in-place or precast concrete	0.625 ^b
Two-coat work over:	
Unit masonry	0.5 ^b
Cast-in-place or precast concrete	0.375 ^b
Terra cotta (anchored)	1
Terra cotta (adhered)	0.25
Vinyl siding	0.035
Wood shingles	0.375
Wood siding (without sheathing) ^a	0.5

For SI: 1 inch = 25.4 mm, 1 ounce = 28.35 g, 1 square foot = 0.093 m².
a. Wood siding of thicknesses less than 0.5 inch shall be placed over sheathing that conforms to Section 2304.6.
b. Exclusive of texture.
c. As measured at the bottom of decorative grooves.
d. 16 ounces per square foot for cold-rolled copper and lead-coated copper, 12 ounces per square foot for copper shingles, high-yield copper and lead-coated high-yield copper.

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Zones 14 and 16, as required in the California Energy Code (see definition of “Low-rise residential building”).

Exceptions:

1. Basement walls.
2. Below-grade portion of any wall.
3. Construction where accumulation, condensation or freezing of moisture will not damage the materials.
4. Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.

1404.3.2 Class III vapor retarders. Only Class III vapor retarders shall be used on the interior side of frame walls where foam plastic insulating sheathing with a perm rating of less than 1 is applied in accordance with Table 1404.3(3) on the exterior side of the frame wall.

[HCD 1 & HCD 2] Class III vapor retarders shall be permitted where any one of the conditions in Items 1, 2 or 3 below are met. This section shall apply to “Low-rise residential buildings” as defined in the California Energy Code.

1. Vented cladding over fiberboard
2. Vented cladding over gypsum
3. Insulated sheathing with $R\text{-value} \geq R4$

Spray foam with a minimum density of 2 lbs/ft³ applied to the interior cavity side of OSB, plywood, fiberboard, insulating sheathing or gypsum is deemed to meet the insulating sheathing requirement where the spray foam R-value meets or exceeds the specified insulating sheathing R-value.

**TABLE 1404.3(1)
VAPOR RETARDER MATERIALS AND CLASSES**

VAPOR RETARDER CLASS	ACCEPTABLE MATERIALS
I	Sheet polyethylene, nonperforated aluminum foil, or other approved materials with a perm rating of less than or equal to 0.1
II	Kraft-faced fiberglass batts or vapor retarder paint or other approved materials, applied in accordance with the manufacturer’s instructions for a perm rating greater than 0.1 and less than or equal to 1.0
III	Latex paint, enamel paint, or other approved materials, applied in accordance with the manufacturer’s instructions for a perm rating of greater than 1.0 and less than or equal to 10

**TABLE 1404.3(2)
VAPOR RETARDER OPTIONS**

CLIMATE ZONE	VAPOR RETARDER CLASS		
	I	II	III ^a
1, 2	Not Permitted	Not Permitted	Permitted
3	Not Permitted	Permitted	Permitted
4 (except Marine 4)	Not Permitted	Permitted	See Table 1404.3(3)
Marine 4, 5, 6, 7, 8	Permitted	Permitted	See Table 1404.3(3)

a. See also Sections 1404.3.1 and 1404.3.2.

**TABLE 1404.3(3)
CLASS III VAPOR RETARDERS**

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR: ^{a, b}
4	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Continuous insulation with $R\text{-value} \geq R\text{-2.5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-3.75}$ over 2×6 wall
5	Vented cladding over wood structural panels Vented cladding over fiberboard Vented cladding over gypsum Continuous insulation with $R\text{-value} \geq R\text{-5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-7.5}$ over 2×6 wall
6	Vented cladding over fiberboard Vented cladding over gypsum Continuous insulation with $R\text{-value} \geq R\text{-7.5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-11.25}$ over 2×6 wall
7	Continuous insulation with $R\text{-value} \geq R\text{-10}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-15}$ over 2×6 wall
8	Continuous insulation with $R\text{-value} \geq R\text{-12.5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-20}$ over 2×6 wall

a. Vented cladding shall include vinyl lap siding, polypropylene, or horizontal aluminum siding, brick veneer with airspace as specified in this code, and other approved vented claddings.

b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of the California Energy Code.

**TABLE 1404.3(4)
CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER**

CLIMATE ZONE	PERMITTED CONDITIONS ^a
3	Continuous insulation with $R\text{-value} \geq R\text{-2}$
4, 5, 6	Continuous insulation with $R\text{-value} \geq R\text{-3}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-5}$ over 2×6 wall
7	Continuous insulation with $R\text{-value} \geq R\text{-5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-7.5}$ over 2×6 wall
8	Continuous insulation with $R\text{-value} \geq R\text{-7.5}$ over 2×4 wall Continuous insulation with $R\text{-value} \geq R\text{-10}$ over 2×6 wall

a. In addition to the vapor retarder, spray foam with a maximum permeance of 1.5 perms at the installed thickness, applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum is deemed to comply with the continuous insulation requirement only for the moisture control purposes of this table where the spray foam R-value plus any continuous insulation R-value provided equals or exceeds the specified continuous insulation R-value.

1404.3.2.1 Spray foam plastic insulation for moisture control with Class III vapor retarders. For purposes of compliance with Table 1404.3(3), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior cavity side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation moisture control requirement where the spray foam *R*-value meets or exceeds the specified continuous insulation *R*-value.

1404.3.2.1.1 Hybrid insulation for moisture control with Class III vapor retarders. For the purposes of compliance with Table 1404.3(3), the combined *R*-values of spray foam plastic insulation and continuous insulation shall be permitted to be counted toward the continuous *R*-value requirement.

1404.3.3 California Energy Code and International Energy Conservation Code Climate Zones. *The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.*

1404.4 Flashing. Flashing shall be installed in such a manner so as to prevent moisture from entering the wall or to redirect that moisture to the surface of the exterior wall finish or to a water-resistive barrier complying with Section 1403.2 and that is part of a means of drainage complying with Section 1402.2. Flashing shall be installed at the perimeters of exterior door and window assemblies, penetrations and terminations of exterior wall assemblies, exterior wall intersections with roofs, chimneys, porches, decks, balconies and similar projections and at built-in gutters and similar locations where moisture could enter the wall. Flashing with projecting flanges shall be installed on both sides and the ends of copings, under sills and continuously above projecting trim. Where self-adhered membranes are used as flashings of fenestration in wall assemblies, those self-adhered flashings shall comply with AAMA 711. Where fluid applied membranes are used as flashing for exterior wall openings, those fluid applied membrane flashings shall comply with AAMA 714.

1404.4.1 Exterior wall pockets. In exterior walls of buildings or structures, wall pockets or crevices in which moisture can accumulate shall be avoided or protected with caps or drips, or other approved means shall be provided to prevent water damage.

1404.4.2 Masonry. Flashing and weep holes in anchored veneer designed in accordance with Section 1404.6 shall be located not more than 10 inches (245 mm) above finished ground level above the foundation wall or slab. At other points of support including structural floors, shelf angles and lintels, flashing and weep holes shall be located in the first course of masonry above the support.

1404.5 Wood veneers. Wood veneers on exterior walls of buildings of Types I, II, III and IV construction shall be not less than 1 inch (25 mm) nominal thickness, 0.438-inch (11.1 mm) exterior hardboard siding or 0.375-inch (9.5 mm) exte-

rior-type wood structural panels or particleboard and shall conform to the following:

1. The veneer shall not exceed 40 feet (12 190 mm) in height above grade. Where fire-retardant-treated wood is used, the height shall not exceed 60 feet (18 290 mm) in height above grade.
2. The veneer is attached to or furred from a noncombustible backing that is fire-resistance rated as required by other provisions of this code.
3. Where open or spaced wood veneers (without concealed spaces) are used, they shall not project more than 24 inches (610 mm) from the building wall.

[BS] 1404.6 Anchored masonry veneer. Anchored masonry veneer shall comply with the provisions of Sections 1404.6 through 1404.9 and Sections 12.1 and 12.2 of TMS 402.

[BS] 1404.6.1 Tolerances. Anchored masonry veneers in accordance with Chapter 14 are not required to meet the tolerances in Article 3.3 F1 of TMS 602.

[BS] 1404.6.2 Seismic requirements. Anchored masonry veneer located in Seismic Design Category C, D, E or F shall conform to the requirements of Section 12.2.2.11 of TMS 402.

[BS] 1404.7 Stone veneer. Anchored stone veneer units not exceeding 10 inches (254 mm) in thickness shall be anchored directly to masonry, concrete or to stud construction by one of the following methods:

1. With concrete or masonry backing, anchor ties shall be not less than 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, formed beyond the base of the backing. The legs of the loops shall be not less than 6 inches (152 mm) in length bent at right angles and laid in the mortar joint, and spaced so that the eyes or loops are 12 inches (305 mm) maximum on center in both directions. There shall be provided not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire tie, or approved equal, threaded through the exposed loops for every 2 square feet (0.2 m²) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length bent so that the tie will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.
2. With wood stud backing, a 2-inch by 2-inch (51 by 51 mm) 0.0625-inch (1.59 mm) zinc-coated or nonmetallic coated wire mesh with two layers of water-resistive barrier in accordance with Section 1403.2 shall be applied directly to wood studs spaced not more than 16 inches (406 mm) on center. On studs, the mesh shall be attached with 2-inch-long (51 mm) corrosion-resistant steel wire furring nails at 4 inches (102 mm) on center providing a minimum 1.125-inch (29 mm) penetration into each stud and with 8d annular threaded nails at 8 inches (203 mm) on center. into top and bottom plates or with equivalent wire ties. There shall be not less than a 0.1055-inch (2.68 mm) zinc-coated or nonmetallic

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coated wire, or approved equal, attached to the stud with not smaller than an 8d (0.120 in. diameter) annular threaded nail for every 2 square feet (0.2 m²) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that the tie will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. One-inch (25 mm) minimum thickness of cement grout shall be placed between the backing and the stone veneer.

3. With cold-formed steel stud backing, a 2-inch by 2-inch (51 by 51 mm) 0.0625-inch (1.59 mm) zinc-coated or nonmetallic coated wire mesh with two layers of water-resistive barrier in accordance with Section 1403.2 shall be applied directly to steel studs spaced a not more than 16 inches (406 mm) on center. The mesh shall be attached with corrosion-resistant #8 self-drilling, tapping screws at 4 inches (102 mm) on center, and at 8 inches (203 mm) on center into top and bottom tracks or with equivalent wire ties. Screws shall extend through the steel connection not fewer than three exposed threads. There shall be not less than a 0.1055-inch (2.68 mm) corrosion-resistant wire, or approved equal, attached to the stud with not smaller than a #8 self-drilling, tapping screw extending through the steel framing not fewer than three exposed threads for every 2 square feet (0.2 m²) of stone veneer. This tie shall be a loop having legs not less than 15 inches (381 mm) in length, so bent that the tie will lie in the stone veneer mortar joint. The last 2 inches (51 mm) of each wire leg shall have a right-angle bend. Cement grout not less than 1 inch (25 mm) in thickness shall be placed between the backing and the stone veneer. The cold-formed steel framing members shall have a minimum bare steel thickness of 0.0428 inches (1.087 mm).

[BS] 1404.8 Slab-type veneer. Anchored slab-type veneer units not exceeding 2 inches (51 mm) in thickness shall be anchored directly to masonry, concrete or light-frame construction. For veneer units of marble, travertine, granite or other stone units of slab form, ties of corrosion-resistant dowels in drilled holes shall be located in the middle third of the edge of the units, spaced not more than 24 inches (610 mm) apart around the periphery of each unit with not less than four ties per veneer unit. Units shall not exceed 20 square feet (1.9 m²) in area. If the dowels are not tight fitting, the holes shall be drilled not more than 0.063 inch (1.6 mm) larger in diameter than the dowel, with the hole countersunk to a diameter and depth equal to twice the diameter of the dowel in order to provide a tight-fitting key of cement mortar at the dowel locations where the mortar in the joint has set. Veneer ties shall be corrosion-resistant metal capable of resisting, in tension or compression, a force equal to two times the weight of the attached veneer. If made of sheet metal, veneer ties shall be not smaller in area than 0.0336 by 1 inch (0.853 by 25 mm) or, if made of wire, not smaller in diameter than 0.1483-inch (3.76 mm) wire.

[BS] 1404.9 Terra cotta. Anchored terra cotta or ceramic units not less than 1⁵/₈ inches (41 mm) thick shall be anchored directly to masonry, concrete or stud construction. Tied terra cotta or ceramic veneer units shall be not less than 1⁵/₈ inches (41 mm) thick with projecting dovetail webs on the back surface spaced approximately 8 inches (203 mm) on center. The facing shall be tied to the backing wall with corrosion-resistant metal anchors of not less than No. 8 gage wire installed at the top of each piece in horizontal bed joints not less than 12 inches (305 mm) nor more than 18 inches (457 mm) on center; these anchors shall be secured to 1¹/₄-inch (6.4 mm) corrosion-resistant pencil rods that pass through the vertical aligned loop anchors in the backing wall. The veneer ties shall have sufficient strength to support the full weight of the veneer in tension. The facing shall be set with not less than a 2-inch (51 mm) space from the backing wall and the space shall be filled solidly with Portland cement grout and pea gravel. Immediately prior to setting, the backing wall and the facing shall be drenched with clean water and shall be distinctly damp when the grout is poured.

[BS] 1404.10 Adhered masonry veneer. Adhered masonry veneer shall comply with the applicable requirements in this section and Sections 12.1 and 12.3 of TMS 402.

[BS] 1404.10.1 Exterior adhered masonry veneer. Exterior adhered masonry veneer shall be installed in accordance with Section 1404.10 and the manufacturer's instructions.

[BS] 1404.10.1.1 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section 2510.6.

[BS] 1404.10.1.2 Flashing. Flashing shall comply with the applicable requirements of Sections 1404.4 and 1404.10.1.2.1.

[BS] 1404.10.1.2.1 Flashing at foundation. A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48 mm) or 26 gage galvanized or plastic with a minimum vertical attachment flange of 3¹/₂ inches (89 mm) shall be installed to extend not less than 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section 1404.4. The water-resistive barrier shall lap over the exterior of the attachment flange of the screed or flashing.

[BS] 1404.10.1.3 Clearances. On exterior stud walls, adhered masonry veneer shall be installed not less than 4 inches (102 mm) above the earth, or not less than 2 inches (51 mm) above paved areas, or not less than 1¹/₂ inch (12.7 mm) above exterior walking surfaces that are supported by the same foundation that supports the exterior wall.

[BS] 1404.10.1.4 Adhered masonry veneer installed with lath and mortar. Exterior adhered masonry veneer installed with lath and mortar shall comply with the following.

[BS] 1404.10.1.4.1 Lathing. Lathing shall comply with the requirements of Section 2510.

[BS] 1404.10.1.4.2 Scratch coat. A nominal $\frac{1}{2}$ -inch-thick (12.7 mm) layer of mortar complying with the material requirements of Sections 2103 and 2512.2 shall be applied, encapsulating the lathing. The surface of this mortar shall be scored horizontally, resulting in a scratch coat.

[BS] 1404.10.1.4.3 Adhering veneer. The masonry veneer units shall be adhered to the mortar scratch coat with a nominal $\frac{1}{2}$ -inch-thick (12.7 mm) setting bed of mortar complying with Sections 2103 and 2512.2 applied to create a full setting bed for the back of the masonry veneer units. The masonry veneer units shall be worked into the setting bed resulting in a nominal $\frac{3}{8}$ -inch (9.5 mm) setting bed after the masonry veneer units are applied.

[BS] 1404.10.1.5 Adhered masonry veneer applied directly to masonry and concrete. Adhered masonry veneer applied directly to masonry or concrete shall comply with the applicable requirements of Section 1404.10 and with the requirements of Section 1404.10.1.4 or 2510.7.

[BS] 1404.10.1.6 Cold weather construction. Cold weather construction of adhered masonry veneer shall comply with the requirements of Sections 2104 and 2512.4.

[BS] 1404.10.1.7 Hot weather construction. Hot weather construction of adhered masonry veneer shall comply with the requirements of Section 2104.

[BS] 1404.10.2 Exterior adhered masonry veneers—porcelain tile. Adhered units weighing more than 3.5 pounds per square foot (0.17 kN/m²) shall not exceed 48 inches (1219 mm) in any face dimension nor more than 9 square feet (0.8 m²) in total face area and shall not weigh more than 6 pounds per square foot (0.29 kN/m²). Adhered units weighing less than or equal to 3.5 pounds per square foot (0.17 kN/m²) shall not exceed 72 inches (1829 mm) in any face dimension nor more than 17.5 square feet (1.6 m²) in total face area. Porcelain tile shall be adhered to an approved backing system.

[BS] 1404.10.3 Interior adhered masonry veneers. Interior adhered masonry veneers shall have a maximum weight of 20 psf (0.958 kg/m²) and shall be installed in accordance with Section 1404.10. Where the interior adhered masonry veneer is supported by wood construction, the supporting members shall be designed to limit deflection to $\frac{1}{600}$ of the span of the supporting members.

[BS] 1404.11 Metal veneers. Veneers of metal shall be fabricated from approved corrosion-resistant materials or shall be protected front and back with porcelain enamel, or otherwise be treated to render the metal resistant to corrosion. Such veneers shall be not less than 0.0149-inch (0.378 mm) nominal thickness sheet steel mounted on wood or metal furring strips or approved sheathing on light-frame construction.

[BS] 1404.11.1 Attachment. Exterior metal veneer shall be securely attached to the supporting masonry or framing members with corrosion-resistant fastenings, metal ties or by other approved devices or methods. The spacing of the

fastenings or ties shall not exceed 24 inches (610 mm) either vertically or horizontally, but where units exceed 4 square feet (0.4 m²) in area there shall be not less than four attachments per unit. The metal attachments shall have a cross-sectional area not less than provided by W 1.7 wire. Such attachments and their supports shall be designed and constructed to resist the wind loads as specified in Section 1609 for components and cladding.

1404.11.2 Weather protection. Metal supports for exterior metal veneer shall be protected by painting, galvanizing or by other equivalent coating or treatment. Wood studs, furring strips or other wood supports for exterior metal veneer shall be approved pressure-treated wood or protected as required in Section 1402.2. Joints and edges exposed to the weather shall be caulked with approved durable waterproofing material or by other approved means to prevent penetration of moisture.

1404.11.3 Backup. Masonry backup shall not be required for metal veneer unless required by the fire-resistance requirements of this code.

1404.11.4 Grounding. Grounding of metal veneers on buildings shall comply with the requirements of Chapter 27 of this code.

[BS] 1404.12 Glass veneer. The area of a single section of thin exterior structural glass veneer shall not exceed 10 square feet (0.93 m²) where that section is not more than 15 feet (4572 mm) above the level of the sidewalk or grade level directly below, and shall not exceed 6 square feet (0.56 m²) where it is more than 15 feet (4572 mm) above that level.

[BS] 1404.12.1 Length and height. The length or height of any section of thin exterior structural glass veneer shall not exceed 48 inches (1219 mm).

[BS] 1404.12.2 Thickness. The thickness of thin exterior structural glass veneer shall be not less than 0.344 inch (8.7 mm).

[BS] 1404.12.3 Application. Thin exterior structural glass veneer shall be set only after backing is thoroughly dry and after application of an approved bond coat uniformly over the entire surface of the backing so as to effectively seal the surface. Glass shall be set in place with an approved mastic cement in sufficient quantity so that not less than 50 percent of the area of each glass unit is directly bonded to the backing by mastic not less than $\frac{1}{4}$ inch (6.4 mm) thick and not more than $\frac{5}{8}$ inch (15.9 mm) thick. The bond coat and mastic shall be evaluated for compatibility and shall bond firmly together.

[BS] 1404.12.4 Installation at sidewalk level. Where glass extends to a sidewalk surface, each section shall rest in an approved metal molding, and be set not less than $\frac{1}{4}$ inch (6.4 mm) above the highest point of the sidewalk. The space between the molding and the sidewalk shall be thoroughly caulked and made watertight.

[BS] 1404.12.4.1 Installation above sidewalk level. Where thin exterior structural glass veneer is installed above the level of the top of a bulkhead facing, or at a level more than 36 inches (914 mm) above the sidewalk level, the mastic cement binding shall be supplemented

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with approved nonferrous metal shelf angles located in the horizontal joints in every course. Such shelf angles shall be not less than 0.0478-inch (1.2 mm) thick and not less than 2 inches (51 mm) long and shall be spaced at approved intervals, with not less than two angles for each glass unit. Shelf angles shall be secured to the wall or backing with expansion bolts, toggle bolts or by other approved methods.

[BS] 1404.12.5 Joints. Unless otherwise specifically approved by the building official, abutting edges of thin exterior structural glass veneer shall be ground square. Mitered joints shall not be used except where specifically approved for wide angles. Joints shall be uniformly buttered with an approved jointing compound and horizontal joints shall be held to not less than 0.063 inch (1.6 mm) by an approved nonrigid substance or device. Where thin exterior structural glass veneer abuts nonresilient material at sides or top, expansion joints not less than 1/4 inch (6.4 mm) wide shall be provided.

[BS] 1404.12.6 Mechanical fastenings. Thin exterior structural glass veneer installed above the level of the heads of show windows and veneer installed more than 12 feet (3658 mm) above sidewalk level shall, in addition to the mastic cement and shelf angles, be held in place by the use of fastenings at each vertical or horizontal edge, or at the four corners of each glass unit. Fastenings shall be secured to the wall or backing with expansion bolts, toggle bolts or by other methods. Fastenings shall be so designed as to hold the glass veneer in a vertical plane independent of the mastic cement. Shelf angles providing both support and fastenings shall be permitted.

[BS] 1404.12.7 Flashing. Exposed edges of thin exterior structural glass veneer shall be flashed with overlapping corrosion-resistant metal flashing and caulked with a waterproof compound in a manner to effectively prevent the entrance of moisture between the glass veneer and the backing.

1404.13 Exterior windows and doors. Windows and doors installed in exterior walls shall conform to the testing and performance requirements of Section 1709.5.

1404.13.1 Installation. Windows and doors shall be installed in accordance with approved manufacturer's instructions. Fastener size and spacing shall be provided in such instructions and shall be calculated based on maximum loads and spacing used in the tests.

[BS] 1404.14 Vinyl siding. Vinyl siding conforming to the requirements of this section and complying with ASTM D3679 shall be permitted on exterior walls where the design wind pressure determined in accordance with Section 1609 does not exceed 30 pounds per square foot (1.44 kN/m²). Where the design wind pressure exceeds 30 pounds per square foot (1.44 kN/m²), tests or calculations indicating compliance with Chapter 16 shall be submitted. Vinyl siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

[BS] 1404.14.1 Application. The siding shall be applied over sheathing or materials listed in Section 2304.6. Siding shall be applied to conform to the water-resistive

barrier requirements in Section 1402. Siding and accessories shall be installed in accordance with the approved manufacturer's instructions.

1404.14.1.1 Fasteners and fastener penetration for wood construction. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding and accessories shall be corrosion resistant and have not less than a 0.313-inch (7.9 mm) head diameter and 1/8-inch (3.18 mm) shank diameter. The penetration into nailable substrate shall be not less than 1 1/4 inches (32 mm).

1404.14.1.2 Fasteners and fastener penetration for cold-formed steel light-frame construction. For cold-formed steel light-frame construction, corrosion-resistant fasteners shall be used. Screw fasteners shall penetrate through the steel with not fewer than three exposed threads. Other fasteners shall be installed in accordance with the approved construction documents and manufacturer's instructions.

1404.14.1.3 Fastener spacing. Unless specified otherwise by the approved manufacturer's instructions, fasteners shall be installed in the middle third of the slots of the nail hem and spacing between fasteners shall be not greater than 16 inches (406 mm) for horizontal siding and 12 inches (305 mm) for vertical siding.

[BS] 1404.15 Cement plaster. Cement plaster applied to exterior walls shall conform to the requirements specified in Chapter 25.

[BS] 1404.16 Fiber-cement siding. Fiber-cement siding complying with Section 1403.10 shall be permitted on exterior walls of Types I, II, III, IV and V construction for wind pressure resistance or wind speed exposures as indicated by the manufacturer's listing and label and approved installation instructions. Where specified, the siding shall be installed over sheathing or materials listed in Section 2304.6 and shall be installed to conform to the water-resistive barrier requirements in Section 1402. Siding and accessories shall be installed in accordance with approved manufacturer's instructions. Unless otherwise specified in the approved manufacturer's instructions, nails used to fasten the siding to wood studs shall be corrosion-resistant round head smooth shank and shall be long enough to penetrate the studs not less than 1 inch (25 mm). For cold-formed steel light-frame construction, corrosion-resistant fasteners shall be used. Screw fasteners shall penetrate the cold-formed steel framing not fewer than three exposed full threads. Other fasteners shall be installed in accordance with the approved construction documents and manufacturer's instructions.

[BS] 1404.16.1 Panel siding. Fiber-cement panels shall comply with the requirements of ASTM C1186, Type A, minimum Grade II (or ISO 8336, Category A, minimum Class 2). Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be protected with caulking, with battens or flashing, or be vertical or horizontal shiplap or otherwise designed to comply with Section 1402.2. Panel siding shall be

installed with fasteners in accordance with the approved manufacturer's instructions.

[BS] 1404.16.2 Lap siding. Fiber-cement lap siding having a maximum width of 12 inches (305 mm) shall comply with the requirements of ASTM C1186, Type A, minimum Grade II (or ISO 8336, Category A, minimum Class 2). Lap siding shall be lapped not less than 1¹/₄ inches (32 mm) and lap siding not having tongue-and-groove end joints shall have the ends protected with caulking, covered with an H-section joint cover, located over a strip of flashing or shall be otherwise designed to comply with Section 1402.2. Lap siding courses shall be installed with the fastener heads exposed or concealed in accordance with the approved manufacturer's instructions.

[BS] 1404.17 Fastening. Weather boarding and wall coverings shall be securely fastened with aluminum, copper, zinc, zinc-coated or other approved corrosion-resistant fasteners in accordance with the nailing schedule in Table 2304.10.2 or the approved manufacturer's instructions. Shingles and other weather coverings shall be attached with appropriate standard-shingle nails to furring strips securely nailed to studs, or with approved mechanically bonding nails, except where sheathing is of wood not less than 1-inch (25 mm) nominal thickness or of wood structural panels as specified in Table 2308.6.3(3).

[BS] 1404.18 Polypropylene siding. Polypropylene siding conforming to the requirements of this section and complying with Section 1403.12 shall be limited to exterior walls located in areas where the wind speed specified in Chapter 16 does not exceed 100 miles per hour (45 m/s) and the building height is less than or equal to 40 feet (12 192 mm) in Exposure C. Where construction is located in areas where the basic wind speed exceeds 100 miles per hour (45 m/s), or building heights are in excess of 40 feet (12 192 mm), tests or calculations indicating compliance with Chapter 16 shall be submitted. Polypropylene siding shall be installed in accordance with the manufacturer's instructions. Polypropylene siding shall be secured to the building so as to provide weather protection for the exterior walls of the building.

SECTION 1405 COMBUSTIBLE MATERIALS ON THE EXTERIOR SIDE OF EXTERIOR WALLS

1405.1 Combustible exterior wall coverings. Combustible exterior wall coverings shall comply with this section.

Exception: Plastics complying with Chapter 26.

1405.1.1 Types I, II, III and IV construction. On buildings of Types I, II, III and IV construction, exterior wall coverings shall be permitted to be constructed of combustible materials, complying with the following limitations:

1. Combustible exterior wall coverings shall not exceed 10 percent of an exterior wall surface area where the fire separation distance is 5 feet (1524 mm) or less.

2. Combustible exterior wall coverings shall be limited to 40 feet (12 192 mm) in height above grade plane.
3. Combustible exterior wall coverings constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation shall not be limited in wall surface area where the fire separation distance is 5 feet (1524 mm) or less and shall be permitted up to 60 feet (18 288 mm) in height above grade plane regardless of the fire separation distance.
4. Wood veneers shall comply with Section 1404.5.

1405.1.1.1 Ignition resistance. Where permitted by Section 1405.1.1, combustible exterior wall coverings shall be tested in accordance with NFPA 268.

Exceptions:

1. Wood or wood-based products.
2. Other combustible materials covered with an exterior weather covering, other than vinyl sidings, included in and complying with the thickness requirements of Table 1404.2.
3. Aluminum having a minimum thickness of 0.019 inch (0.48 mm).

1405.1.1.1.1 Fire separation 5 feet or less. Where installed on exterior walls having a fire separation distance of 5 feet (1524 mm) or less, combustible exterior wall coverings shall not exhibit sustained flaming as defined in NFPA 268.

1405.1.1.1.2 Fire separation greater than 5 feet. For fire separation distances greater than 5 feet (1524 mm), any exterior wall covering shall be permitted that has been exposed to a reduced level of incident radiant heat flux in accordance with the NFPA 268 test method without exhibiting sustained flaming. The minimum fire separation distance required for the exterior wall covering shall be determined from Table 1405.1.1.1.2 based on the maximum tolerable level of incident radiant heat flux that does not cause sustained flaming of the exterior wall covering.

1405.1.2 Location. Combustible exterior wall coverings located along the top of exterior walls shall be completely backed up by the exterior wall and shall not extend over or above the top of the exterior wall.

1405.1.3 Fireblocking. Where the combustible exterior wall covering is furred out from the exterior wall and forms a solid surface, the distance between the back of the exterior wall covering and the exterior wall shall not exceed 1⁵/₈ inches (41 mm). The concealed space thereby created shall be fireblocked in accordance with Section 718.

Exception: The distance between the back of the exterior wall covering and the exterior wall shall be permitted to exceed 1⁵/₈ inches (41 mm) where the concealed space is not required to be fireblocked by Section 718.

**TABLE 1405.1.1.1.2
MINIMUM FIRE SEPARATION FOR
COMBUSTIBLE EXTERIOR WALL COVERINGS**

FIRE SEPARATION DISTANCE (feet)	TOLERABLE LEVEL INCIDENT RADIANT HEAT ENERGY (kW/m ²)
5	12.5
6	11.8
7	11.0
8	10.3
9	9.6
10	8.9
11	8.3
12	7.7
13	7.2
14	6.7
15	6.3
16	5.9
17	5.5
18	5.2
19	4.9
20	4.6
21	4.4
22	4.1
23	3.9
24	3.7
25	3.5

For SI: 1 foot = 304.8 mm, 1 Btu/H² × °F = 0.0057 kW/m² × K.

**SECTION 1406
METAL COMPOSITE MATERIALS (MCM)**

1406.1 General. The provisions of this section shall govern the materials, construction and quality of metal composite materials (MCM) for use as exterior wall coverings in addition to other applicable requirements of Chapters 14 and 16.

1406.2 Exterior wall covering. MCM used as exterior wall covering or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1406.4 through 1406.13 .

1406.3 Architectural trim and embellishments. MCM used as architectural trim or embellishments shall comply with Sections 1406.7 through 1406.13 .

1406.4 Structural design. MCM systems shall be designed and constructed to resist wind loads as required by Chapter 16 for components and cladding.

1406.5 Approval. Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind loads.

1406.6 Weather resistance. MCM systems shall comply with Section 1402 and shall be designed and constructed to

resist wind and rain in accordance with this section and the manufacturer’s installation instructions.

1406.7 Durability. MCM systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1406 for the duration of use.

1406.8 Fire-resistance rating. Where MCM systems are used on exterior walls required to have a fire-resistance rating in accordance with Section 705, evidence shall be submitted to the building official that the required fire-resistance rating is maintained.

Exception: MCM systems that are part of an exterior wall envelope not containing foam plastic insulation and are installed on the outer surface of a fire-resistance-rated exterior wall in a manner such that the attachments do not penetrate through the entire exterior wall assembly, shall not be required to comply with this section.

1406.9 Surface-burning characteristics. Unless otherwise specified, MCM shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723.

1406.10 Types I, II, III and IV construction. Where installed on buildings of Types I, II, III and IV construction, metal composite material (MCM) shall comply with Sections 1406.10.1 and 1406.10.2 for installations up to 40 feet (12 192 mm) above grade plane. Where installed on buildings of Types I, II, III and IV construction, MCMs and MCM systems shall comply with Sections 1406.10.1 through 1406.10.3, for installations greater than 40 feet (12 192 mm) above grade plane.

1406.10.1 Surface-burning characteristics. MCM shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723.

1406.10.2 Thermal barriers. MCM shall be separated from the interior of a building by an approved thermal barrier consisting of 1/2-inch (12.7 mm) gypsum wallboard or material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

Exceptions:

1. The MCM system is specifically approved based on tests conducted in accordance with NFPA 286 and with the acceptance criteria of Section 803.1.1.1, UL 1040 or UL 1715. Such testing shall be performed with the MCM in the maximum thickness intended for use. The MCM system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The MCM is used as elements of balconies and similar projections, architectural trim or embellishments.

1406.10.3 Full-scale tests. The MCM system shall be tested in accordance with, and comply with, the accep-

tance criteria of NFPA 285. Such testing shall be performed on the MCM system with the MCM in the maximum thickness intended for use.

➔ **1406.11 Type V construction.** MCM shall be permitted to be installed on buildings of Type V construction.

1406.12 Foam plastic insulation. Where MCM systems are included in an exterior wall envelope containing foam plastic insulation, the exterior wall envelope shall also comply with the requirements of Section 2603.

1406.13 Labeling. MCM shall be labeled in accordance with Section 1703.5.

SECTION 1407 EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS)

1407.1 General. The provisions of this section shall govern the materials, construction and quality of exterior insulation and finish systems (EIFS) for use as exterior wall coverings in addition to other applicable requirements of Chapters 7, 14, 16, 17 and 26.

1407.2 Performance characteristics. EIFS shall be constructed such that it meets the performance characteristics required in ASTM E2568.

[BS] **1407.3 Structural design.** The underlying structural framing and substrate shall be designed and constructed to resist loads as required by Chapter 16.

1407.4 Weather resistance. EIFS shall comply with Section 1402 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's application instructions.

1407.4.1 EIFS with drainage. EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance the requirements of ASTM E2273 and is required on framed walls of Type V construction, Group R1, R2, R3 and R4 occupancies.

1407.4.1.1 Water-resistive barrier. For EIFS with drainage, the water-resistive barrier shall comply with Section 1403.2 or ASTM E2570.

1407.5 Installation. Installation of the EIFS and EIFS with drainage shall be in accordance with the EIFS manufacturer's instructions.

1407.6 Special inspections. EIFS installations shall comply with the provisions of Sections 1704.2 and 1705.17 .

SECTION 1408 HIGH-PRESSURE DECORATIVE EXTERIOR-GRADE COMPACT LAMINATES (HPL)

1408.1 General. The provisions of this section shall govern the materials, construction and quality of High-Pressure Decorative *Exterior-Grade Compact Laminates (HPL)* for use as exterior wall coverings in addition to other applicable requirements of Chapters 14 and 16.

1408.2 Exterior wall covering. HPL used as exterior wall covering or as elements of balconies and similar projections and bay and oriel windows to provide cladding or weather resistance shall comply with Sections 1408.4 through 1408.14.

1408.3 Architectural trim and embellishments. HPL used as architectural trim or embellishments shall comply with Sections 1408.7 through 1408.14.

[BS] **1408.4 Structural design.** HPL systems shall be designed and constructed to resist wind loads as required by Chapter 16 for components and cladding.

1408.5 Approval. Results of approved tests or an engineering analysis shall be submitted to the building official to verify compliance with the requirements of Chapter 16 for wind loads.

1408.6 Weather resistance. HPL systems shall comply with Section 1402 and shall be designed and constructed to resist wind and rain in accordance with this section and the manufacturer's instructions.

1408.7 Durability. HPL systems shall be constructed of approved materials that maintain the performance characteristics required in Section 1408 for the duration of use.

1408.8 Fire-resistance rating. Where HPL systems are used on exterior walls required to have a fire-resistance rating in accordance with Section 705, evidence shall be submitted to the building official that the required fire-resistance rating is maintained.

Exception: HPL systems not containing foam plastic insulation, which are installed on the outer surface of a fire-resistance-rated exterior wall in a manner such that the attachments do not penetrate through the entire exterior wall assembly, shall not be required to comply with this section.

1408.9 Surface-burning characteristics. Unless otherwise specified, HPL shall have a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E84 or UL 723.

1408.10 Types I, II, III and IV construction. Where installed on buildings of Types I, II, III and IV construction, HPL systems shall comply with Sections 1408.10.1 through 1408.10.4, or Section 1408.11.

1408.10.1 Surface-burning characteristics. HPL shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in the minimum and maximum thicknesses intended for use in accordance with ASTM E84 or UL 723.

1408.10.2 Thermal barriers. HPL shall be separated from the interior of a building by an approved thermal barrier consisting of 1/2-inch (12.7 mm) gypsum wallboard or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

1408.10.3 Thermal barrier not required. The thermal barrier specified for HPL in Section 1408.10.2 is not required where:

1. The HPL system is specifically approved based on tests conducted in accordance with NFPA 286, and with the acceptance criteria of Section 803.1.1.1, or with UL 1040 or UL 1715. Such testing shall be performed with the HPL in the minimum and maximum thicknesses intended for use. The HPL system shall include seams, joints and other typical details used in the installation and shall be tested in the manner intended for use.
2. The HPL is used as elements of balconies and similar projections, architectural trim or embellishments.

1408.10.4 Full-scale tests. The HPL system shall be tested in accordance with, and comply with, the acceptance criteria of NFPA 285. Such testing shall be performed on the HPL system with the HPL in the minimum and maximum thicknesses intended for use.

1408.11 Alternate conditions. HPL and HPL systems shall not be required to comply with Sections 1408.10.1 through 1408.10.4 provided that such systems comply with Section 1408.11.1.

1408.11.1 Installations up to 40 feet in height. HPL shall be permitted to be installed up to 40 feet (12 190 mm) in height above grade plane where installed in accordance with Section 1408.11.1.1 or 1408.11.1.2.

1408.11.1.1 Fire separation distance of 5 feet or less. Where the fire separation distance is 5 feet (1524 mm) or less, the area of HPL shall not exceed 10 percent of the exterior wall surface.

1408.11.1.2 Fire separation distance greater than 5 feet. Where the fire separation distance is greater than 5 feet (1524 mm), the area of exterior wall surface coverage using HPL shall not be limited.

1408.12 Type V construction. HPL shall be permitted to be installed on buildings of Type V construction.

1408.13 Foam plastic insulation. HPL systems containing foam plastic insulation shall comply with the requirements of Section 2603.

1408.14 Labeling. HPL shall be labeled in accordance with Section 1703.5.

SECTION 1409 PLASTIC COMPOSITE DECKING

1409.1 Plastic composite decking. Exterior deck boards, stair treads, handrails and guards constructed of plastic composites, including plastic lumber, shall comply with Section 2612.

SECTION 1410 [DSA-SS & DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] ADDITIONAL REQUIREMENTS FOR ANCHORED AND ADHERED VENEER

1410.1 General. *In no case shall veneer be considered as part of the backing in computing strength or deflection nor shall it be considered a part of the required thickness of the backing.*

Veneer shall be anchored in a manner which will not allow relative movement between the veneer and the wall.

Anchored or adhered veneer shall not be used on overhead horizontal surfaces.

1410.2 Adhered veneer. *Units of tile, masonry, stone or terra cotta which exceed $\frac{5}{8}$ inch (16 mm) in thickness shall be applied as for anchored veneer where used over exit ways or more than 20 feet (6096 mm) in height above adjacent ground elevation.*

1410.2.1 Bond strength and tests. *Veneer shall develop a bond to the backing in accordance with TMS 402, Section 12.3.2.4.*

Not less than two shear tests shall be performed for the adhered veneer between the units and the supporting element. At least one shear test shall be performed at each building for each 5,000 square feet (465 m²) of floor area or fraction thereof.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 15 – ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter														X								
Adopt entire chapter as amended (amended sections listed below)	X			X	X			X	X	X	X	X		X	X							
Adopt only those sections that are listed below			X													X	X	X			X	
Chapter / Section																						
1501			X																			
1502.1				X	X																	
1502.2				X	X																	
1505			X																			
1506			X																			
1507			X																			
1507.3.10								X	X	X	X	X		X	X							
1507.7.8								X	X	X	X	X		X	X							
1509			X																			
1511.9	X			X	X			X	X	X	X	X		X	X							
1512			X																			
1513								X	X	X	X	X		X	X							

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 15

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

User notes:

About this chapter: Chapter 15 provides minimum requirements for the design and construction of roof assemblies and rooftop structures. The criteria address the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is largely prescriptive in nature and is based on decades of experience with various traditional materials, but it also recognizes newer products. Section 1511 addresses rooftop structures, which include penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.

Code development reminder: Code change proposals to sections preceded by the designation [BF], [BG] or [P] will be considered by one of the code development committees meeting during the 2021 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 1501 GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

SECTION 1502 ROOF DRAINAGE

[P] **1502.1 General.** Design and installation of roof drainage systems shall comply with this section, Section 1611 of this code and Chapter 11 of the *California Plumbing Code*.

[P] **1502.2 Secondary (emergency overflow) drains or scuppers.** Where roof drains are required, secondary (emergency overflow) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason. The installation and sizing of secondary emergency overflow drains, leaders and conductors shall comply with Section 1611 of this code and Chapter 11 of the *California Plumbing Code*.

1502.3 Scuppers. Where scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1611.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

1502.4 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or not less than Schedule 40 plastic pipe.

SECTION 1503 WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed in accordance with this code, and installed in accordance with this code and the manufacturer's approved instructions.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent water from entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction and around roof openings. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.483 mm) (No. 26 galvanized sheet).

1503.3 Parapet walls. Parapet walls shall be coped or covered in accordance with Sections 1503.3.1 and 1503.3.2. The top surface of the parapet wall shall provide positive drainage.

1503.3.1 Fire-resistance-rated parapet walls. Parapet walls required by Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall such that the fire-resistance rating of the wall is not decreased.

1503.3.2 Other parapet walls. Parapet walls meeting one of the exceptions in Section 705.11 shall be coped or covered with weatherproof materials of a width not less than the thickness of the parapet wall.

1503.4 Attic and rafter ventilation. Intake and exhaust vents shall be provided in accordance with Section 1202.2 and the vent product manufacturer's installation instructions.

1503.5 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpen-

pendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section 2405.5 and flashed in accordance with the manufacturer’s instructions shall be permitted to be installed without a cricket or saddle.

**SECTION 1504
PERFORMANCE REQUIREMENTS**

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3, 1504.4 and 1504.5

1504.2 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table 1504.2 for the appropriate maximum basic wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table 1504.2.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table 1504.2.

1504.3 Wind resistance of clay and concrete tile. Wind loads on clay and concrete tile roof coverings shall be in accordance with Section 1609.5.

1504.3.1 Testing. Testing of concrete and clay roof tiles shall be in accordance with Sections 1504.3.1.1, 1504.3.1.2 and 1504.3.1.3.

1504.3.1.1 Overturning resistance. Concrete and clay roof tiles shall be tested to determine their resistance to overturning due to wind in accordance with Chapter 15 and either SBCCI SSTD 11 or ASTM C1568.

1504.3.1.2 Wind tunnel testing. Where concrete and clay roof tiles do not satisfy the limitations in Chapter 16 for rigid tile, a wind tunnel test shall be used to

determine the wind characteristics of the concrete or clay tile roof covering in accordance with Chapter 15 and either SBCCI SSTD 11 or ASTM C1569.

1504.3.1.3 Air permeability testing. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined in accordance with SBCCI SSTD 11 or ASTM C1570.

1504.4 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.5.2. The wind load on the roof covering shall be permitted to be determined using allowable stress design.

1504.4.1 Other roof systems. Built-up, modified bitumen, fully adhered or mechanically attached single-ply roof systems, metal panel roof systems applied to a solid or closely fitted deck and other types of membrane roof coverings shall be tested in accordance with FM 4474, UL 580 or UL 1897.

1504.4.2 Structural metal panel roof systems. Where the metal roof panel functions as the roof deck and roof covering and it provides both weather protection and support for loads, the structural metal panel roof system shall comply with this section. Structural standing-seam metal panel roof systems shall be tested in accordance with ASTM E1592 or FM 4474. Structural through-fastened metal panel roof systems shall be tested in accordance with ASTM E1592, FM 4474 or UL 580.

Exceptions:

1. Metal roofs constructed of cold-formed steel shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2210.1.
2. Metal roofs constructed of aluminum shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2002.1.

**TABLE 1504.2
CLASSIFICATION OF STEEP SLOPE ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161 OR D7158**

MAXIMUM BASIC WIND SPEED, V, FROM FIGURES 1609.3(1)–(8) OR ASCE 7(mph)	MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V _{asd} , FROM Table 1609.3.1 (mph)	ASTM D7158* CLASSIFICATION	ASTM D3161 or UL 7103 CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm; 1 mph = 0.447 m/s.

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

1504.4.3 Metal roof shingles. Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580 or UL 1897. Metal roof shingles tested in accordance with ASTM D3161 shall meet the classification requirements of Table 1504.2 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table 1504.2.

1504.5 Ballasted low-slope single-ply roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings installed in accordance with Section 1507.12 shall be designed in accordance with ANSI/SPRI RP-4.

1504.6 Edge systems for low-slope roofs. Metal edge systems, except gutters and counterflashing, installed on built-up, modified bitumen and single-ply roof systems having a slope less than 2 units vertical in 12 units horizontal (2:12) shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with Test Methods RE-1, RE-2 and RE-3 of ANSI/SPRI ES-1, except basic design wind speed, V, shall be determined from Figures 1609.3(1) through 1609.3(12) as applicable.

1504.6.1 Gutter securement for low-slope roofs. Gutters that are used to secure the perimeter edge of the roof membrane on low-slope (less than 2:12 slope) built-up, modified bitumen, and single-ply roofs, shall be designed, constructed and installed to resist wind loads in accordance with Section 1609 and shall be tested in accordance with Test Methods G-1 and G-2 of SPRI GT-1.

1504.7 Physical properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with

Section 1507 shall demonstrate physical integrity over the working life of the roof based on 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G152, ASTM G154 or ASTM G155. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

1504.8 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D3746, ASTM D4272 or the “Resistance to Foot Traffic Test” in FM 4470.

1504.9 Wind resistance of aggregate-surfaced roofs. Parapets shall be provided for aggregate surfaced roofs and shall comply with Table 1504.9.

**SECTION 1505
FIRE CLASSIFICATION**

[BF] 1505.1 General. Roof assemblies shall be divided into the classes defined in this section. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

**TABLE 1504.9
MINIMUM REQUIRED PARAPET HEIGHT (INCHES) FOR AGGREGATE SURFACED ROOFS^{a, b, c}**

AGGREGATE SIZE	MEAN ROOF HEIGHT (ft)	WIND EXPOSURE AND BASIC DESIGN WIND SPEED (MPH)																	
		Exposure B									Exposure C ^d								
		≤ 95	100	105	110	115	120	130	140	150	≤ 95	100	105	110	115	120	130	140	150
ASTMD1863 (No. 7 or No. 67)	15	2	2	2	2	12	12	16	20	24	2	13	15	18	20	23	27	32	37
	20	2	2	2	2	12	14	18	22	26	12	15	17	19	22	24	29	34	39
	30	2	2	2	13	15	17	21	25	30	14	17	19	22	24	27	32	37	42
	50	12	12	14	16	18	21	25	30	35	17	19	22	25	28	30	36	41	47
	100	14	16	19	21	24	27	32	37	42	21	24	26	29	32	35	41	47	53
ASTMD1863 (No. 6)	15	2	2	2	2	12	12	12	15	18	2	2	2	13	15	17	22	26	30
	20	2	2	2	2	12	12	13	17	21	2	2	12	15	17	19	23	28	32
	30	2	2	2	2	12	12	16	20	24	2	12	14	17	19	21	26	31	35
	50	12	12	12	12	14	16	20	24	28	12	15	17	19	22	24	29	34	39
	100	12	12	14	16	19	21	26	30	35	16	18	21	24	26	29	34	39	45
	150	12	14	17	19	22	24	29	34	39	18	21	23	26	29	32	37	43	48

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

a. Interpolation shall be permitted for mean roof height and parapet height.

b. Basic design wind speed, V, and wind exposure shall be determined in accordance with Section 1609.

c. Where the minimum required parapet height is indicated to be 2 inches (51 mm), a gravel stop shall be permitted and shall extend not less than 2 inches (51 mm) from the roof surface and not less than the height of the aggregate.

d. For Exposure D, add 8 inches (203 mm) to the parapet height required for Exposure C and the parapet height shall not be less than 12 inches (305 mm).

**TABLE 1505.1
MINIMUM ROOF COVERING
CLASSIFICATION FOR TYPES OF CONSTRUCTION^a**

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C	B	C	B	B	C

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. Unless otherwise required in accordance with *Chapter 7A* or due to the location of the building within a fire district in accordance with Appendix D.

1505.1.1 Roof coverings within fire hazard severity zones. *The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class A.*

Exception: *The requirements shall not apply in any jurisdiction that adopts the model ordinance approved by the State Fire Marshal pursuant to Section 51189 of the Government Code or an ordinance that substantially conforms to the model ordinance and transmits a copy to the State Fire Marshal.*

1505.1.2 Roof coverings within all other areas. *The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class C.*

1505.1.3 Roofing requirements in a Wildland-Urban Interface Fire Area. *Roofing requirements for structures located in a Wildland-Urban Interface Fire Area shall also comply with Section 705A.*

[BF] 1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on non-combustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.
3. Class A roof assemblies include minimum 16 ounce per square foot (0.0416 kg/m²) copper sheets installed over combustible decks.
4. Class A roof assemblies include slate installed over ASTM D226, Type II underlayment over combustible decks.

[BF] 1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

[BF] 1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

[BF] 1505.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

[BF] 1505.6 Fire-retardant-treated wood shingles and shakes. *Fire-retardant-treated wood shakes and shingles are wood shakes and shingles complying with UBC Standard 15-3 or 15-4 which are impregnated by the full-cell vacuum-pressure process with fire-retardant chemicals, and which have been qualified by UBC Standard 15-2 for use on Class A, B or C roofs.*

Fire-retardant-treated wood shakes and shingles shall comply with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7(j). Each bundle shall bear labels from an ICC accredited quality control agency identifying their roof-covering classification and indicating their compliance with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7(j).

Health and Safety Code Section 13132.7(j). No wood roof covering materials shall be sold or applied in this state unless both of the following conditions are met:

- (1) *The materials have been approved and listed by the State Fire Marshal as complying with the requirements of this section.*
- (2) *The materials have passed at least five years of the 10-year natural weathering test. The 10-year natural weathering test required by this subdivision shall be conducted in accordance with standard 15-2 of the 1994 edition of the Uniform Building Code at a testing facility recognized by the State Fire Marshal.*

[BF] 1505.7 Special purpose roofs. Special purpose wood shingle or wood shake roofing shall conform to the grading and application requirements of Section 1507.8 or 1507.9. In addition, an underlayment of 5/8-inch (15.9 mm) Type X water-resistant gypsum backing board or gypsum sheathing shall be placed under minimum nominal 1/2-inch-thick (12.7 mm) wood structural panel solid sheathing or 1-inch (25 mm) nominal spaced sheathing.

[BF] 1505.8 Building-integrated photovoltaic (BIPV) products. *BIPV products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with Section 1505.1.*

[BF] 1505.9 Rooftop mounted photovoltaic (PV) panel systems. Rooftop mounted photovoltaic (PV) panel systems shall be tested, listed and identified with a fire classification in accordance with UL 2703. Listed systems shall be installed in accordance with the manufacturer’s installation instructions and their listing. The fire classification shall comply with Table 1505.1 based on the type of construction of the building.

[BF] **1505.10 Landscaped roofs.** Landscaped roofs shall comply with Sections 1505.1 and 1507.15 and shall be installed in accordance with ANSI/SPRI VF-1.

**SECTION 1506
MATERIALS**

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the roof covering listing as required by Section 1505. Installation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter.

1506.3 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer’s identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

**SECTION 1507
REQUIREMENTS FOR ROOF COVERINGS**

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer’s installation instructions.

1507.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and photovoltaic shingles shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance with the standard designation and, if applicable, type classification indicated in Table 1507.1.1(1). Underlayment shall be applied in accordance with Table 1507.1.1(2). Underlayment shall be attached in accordance with Table 1507.1.1(3).

Exceptions:

1. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer modified bitumen membrane complying with ASTM D1970 and installed in accordance with the manufacturer’s installation instructions for the deck material shall be applied over all joints in the roof decking. An approved underlayment for the applicable roof covering for design wind speeds less than 120 mph (54 m/s) shall be applied over the 4-inch-wide (102 mm) membrane strips.
2. As an alternative, two layers of underlayment complying with ASTM D226 Type II or ASTM D4869 Type IV shall be permitted to be installed as follows: Apply a 19-inch (483 mm) strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide (914 mm) strips of

**TABLE 1507.1.1(1)
UNDERLAYMENT TYPES**

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, V < 140 MPH	MAXIMUM BASIC DESIGN WIND SPEED, V ≥ 140 MPH
Asphalt shingles	1507.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757
Clay and concrete tiles	1507.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral surfaced roll roofing
Metal roof panels	1507.4	Manufacturer’s instructions	ASTM D226 Type II ASTM D4869 Type IV
Metal roof shingles	1507.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Mineral-surfaced roll roofing	1507.6	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Slate shingles	1507.7	ASTM D226 Type II ASTM D4869 Type III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shingles	1507.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Wood shakes	1507.9	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type IV
Photovoltaic shingles	1507.16	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type IV ASTM D6757

continued

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

**TABLE 1507.1.1(2)
UNDERLAYMENT APPLICATION**

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, $V < 140$ MPH	MAXIMUM BASIC DESIGN WIND SPEED, $V \geq 140$ MPH
Asphalt shingles	1507.2	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches, Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches
Clay and concrete tile	1507.3	For roof slopes from 2½ units vertical in 12 units horizontal (2½:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be not fewer than two layers applied as follows: Starting at the eave, a 19-inch strip of underlayment shall be applied parallel with the eave. Starting at the eave, a 36-inch-wide strip of underlayment felt shall be applied, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches
Metal roof panels	1507.4	Apply in accordance with the manufacturer’s installation instructions	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 4 inches. End laps shall be 4 inches and shall be offset by 6 feet.
Metal roof shingles	1507.5		
Mineral-surfaced roll roofing	1507.6		
Slate shingles	1507.7		
Wood shingles	1507.8		
Wood shakes	1507.9		
Photovoltaic shingles	1507.16	For roof slopes from 3 units vertical in 12 units horizontal (3:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied as follows: Apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied as follows: Underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Same as Maximum Basic Design Wind Speed, $V < 140$ mph except all laps shall be not less than 4 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

TABLE 1507.1.1(3)
UNDERLAYMENT ATTACHMENT

ROOF COVERING	SECTION	MAXIMUM BASIC DESIGN WIND SPEED, V < 140 MPH	MAXIMUM BASIC DESIGN WIND SPEED, V ≥ 140 MPH
Asphalt shingles	1507.2	Fastened sufficiently to hold in place	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using metal or plastic cap nails or cap staples with a nominal cap diameter of not less than 1 inch. Metal caps shall have a thickness of not less than 32-gage (0.0134 inch) sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch for ring shank cap nails and 0.091 inch for smooth shank cap nails. Staples shall be not less than 21 gage (0.032 inch). The cap nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing.
Clay and concrete tile	1507.3		
Photovoltaic shingles	1507.16		
Metal roof panels	1507.4	Manufacturer's installation instructions	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using metal or plastic cap nails or cap staples with a nominal cap diameter of not less than 1 inch. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch for ring shank cap nails and 0.091 inch for smooth shank cap nails. Staples shall be not less than 21 gage. The cap nail shank and cap staple legs shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing.
Metal roof shingles	1507.5		
Mineral-surfaced roll roofing	1507.6		
Slate shingles	1507.7		
Wood shingles	1507.8		
Wood shakes	1507.9		

For SI: 1 inch = 25.4 mm; 1 mile per hour = 0.447 m/s.

underlayment felt, overlapping successive sheets 19 inches (483 mm). The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at side and end laps. End laps shall be 4 inches (102 mm) and shall be offset by 6 feet (1829 mm). Underlayment shall be attached using metal or plastic cap nails with a nominal cap diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.254 mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (0.89 mm). The cap nail shank shall be not less than 0.083 inch (2.1 mm) for ring shank cap nails and 0.091 inch (2.3 mm) for smooth shank cap nails. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch (19.1 mm) into the roof sheathing.

3. Structural metal panels that do not require a substrate or underlayment.

1507.1.2 Ice barriers. In areas where there has been a history of ice forming along the eaves causing a backup of water, an ice barrier shall be installed for asphalt shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, and wood shakes. The ice barrier shall consist of not less than two layers of

underlayment cemented together, or a self-adhering polymer modified bitumen sheet shall be used in place of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that do not contain conditioned floor area.

1507.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

1507.2.1 Deck requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of 2 units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from 2 units vertical in 12 units horizontal (17-percent slope) up to 4 units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.1.1.

1507.2.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.2.4 Asphalt shingles. Asphalt shingles shall comply with ASTM D3462.

1507.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (2.67 mm)] shank with a minimum 3/8-inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and not less than 3/4 inch (19.1 mm) into the roof sheathing. Where

the roof sheathing is less than 3/4 inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F1667.

1507.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), shingles shall be installed as required by the manufacturer.

1507.2.7 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.2.8 Flashings. Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer’s printed instructions.

1507.2.8.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with the manufacturer’s instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness or mineral-surfaced roll roofing weighing not less than 77 pounds per 100 square feet (3.76 kg/m²). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.483 mm) thickness.

1507.2.8.2 Valleys. Valley linings shall be installed in accordance with the manufacturer’s instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed) lined with metal, the valley lining shall be not less than 24 inches (610 mm) wide and of any of the corrosion-resistant metals in Table 1507.2.8.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing complying with ASTM D3909 or ASTM D6380 shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer not less than 36 inches (914 mm) wide.

3. For closed valleys (valleys covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D6380, and not less than 36 inches (914 mm) wide or types as described in Item 1 or 2 above shall be permitted. Self-adhering polymer modified bitumen underlayment bearing a label indicating compliance with ASTM D1970 shall be permitted in lieu of the lining material.

1507.2.8.3 Drip edge. A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of the drip edge shall be lapped not less than 2 inches (51 mm). The vertical leg of drip edges shall be not less than 1 1/2 inches (38 mm) in width and shall extend not less than 1/4 inch (6.4 mm) below sheathing. The drip edge shall extend back on the roof not less than 2 inches (51 mm). Underlayment shall be installed over drip edges along eaves. Drip edges shall be installed over underlayment along rake edges. Drip edges shall be mechanically fastened at intervals not greater than 12 inches (305 mm) on center.

1507.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

1507.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing.

Exception: Spaced lumber sheathing shall be permitted in Seismic Design Categories A, B and C.

1507.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of 2 1/2 units vertical in 12 units horizontal (21-percent slope) or greater. For roof slopes from 2 1/2 units vertical in 12 units horizontal (21-percent slope) to 4 units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.1.1.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D226, Type II; ASTM D2626 or ASTM D6380, Class M mineral-surfaced roll roofing.

**TABLE 1507.2.8.2
VALLEY LINING MATERIAL**

MATERIAL	MINIMUM THICKNESS	GAGE	WEIGHT
Aluminum	0.024 in.	—	—
Cold-rolled copper	0.0216 in.	—	ASTM B370, 16 oz. per square ft.
Copper	—	—	16 oz
Galvanized steel	0.0179 in.	26 (zinc-coated G90)	—
High-yield copper	0.0162 in.	—	ASTM B370, 12 oz. per square ft.
Lead	—	—	2.5 pounds
Lead-coated copper	0.0216 in.	—	ASTM B101, 16 oz. per square ft.
Lead-coated high-yield copper	0.0162 in.	—	ASTM B101, 12 oz. per square ft.
Painted terne	—	—	20 pounds
Stainless steel	—	28	—
Zinc alloy	0.027 in.	—	—

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 ounce = 28.35 g, 1 square foot = 0.0929 m².

1507.3.4 Clay tile. Clay roof tile shall comply with ASTM C1167.

1507.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C1492.

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 11-gage, [0.120 inch (3 mm)], $\frac{5}{16}$ -inch (8.0 mm) head, and of sufficient length to penetrate the deck not less than $\frac{3}{4}$ inch (19.1 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Table 1507.3.7.

1507.3.8 Application. Tile shall be applied according to the manufacturer's installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley, or a self-adhering polymer-modified bitumen sheet bearing a label indicating compliance with ASTM D1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solid cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

1507.3.10 Additional requirements. [DSA-SS & DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of 1507.3.6 and 1507.3.7, the installation of clay and concrete tile roof coverings shall comply with seismic anchorage provisions of Section 1513.

1507.4 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

1507.4.1 Deck requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck slope. Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered seam metal roof panels without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope).
2. The minimum slope for lapped, nonsoldered seam metal roof panels with applied lap sealant shall be one-half unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the approved manufacturer's installation instructions.
3. The minimum slope for standing-seam metal roof panel systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

1507.4.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).

1507.4.4 Attachment. Metal roof panels shall be secured to the supports in accordance with the approved manufacturer's fasteners. In the absence of manufacturer recommendations, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. Copper, brass, bronze, copper alloy or 300 series stainless-steel fasteners shall be used for copper roofs.
3. Stainless-steel fasteners are acceptable for all types of metal roofs.
4. Aluminum fasteners are acceptable for aluminum roofs attached to aluminum supports.

1507.4.5 Underlayment and high wind. Underlayment shall comply with Section 1507.1.1.

1507.5 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

1507.5.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

**TABLE 1507.3.7
CLAY AND CONCRETE TILE ATTACHMENT^{a, b, c}**

GENERAL—CLAY OR CONCRETE ROOF TILE				
Maximum Allowable Stress Design Wind Speed, V_{asd} ^f (mph)	Mean roof height (feet)	Roof slope < 3:12	Roof slope 3:12 and over	
85	0-60	One fastener per tile. Flat tile without vertical laps, two fasteners per tile.	Two fasteners per tile. Only one fastener on slopes of 7:12 and less for tiles with installed weight exceeding 7.5 lbs./sq. ft. having a width not more than 16 inches.	
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. Rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS ^{d, e} (Installations on spaced/solid sheathing with battens or spaced sheathing)				
Maximum Allowable Stress Design Wind Speed, V_{asd} (mph)	Mean roof height (feet)	Roof slope < 5:12	Roof slope 5:12 < 12:12	Roof slope 12:12 and over
85	0-60	Fasteners are not required. Tiles with installed weight less than 9 lbs./sq. ft. require not fewer than one fastener per tile.	One fastener per tile every other row. Perimeter tiles require one fastener. Tiles with installed weight less than 9 lbs./sq. ft. require not fewer than one fastener per tile.	One fastener required for every tile. Tiles with installed weight less than 9 lbs./sq. ft. require not fewer than one fastener per tile.
100	0-40			
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. Rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		
INTERLOCKING CLAY OR CONCRETE ROOF TILE WITH PROJECTING ANCHOR LUGS (Installations on solid sheathing without battens)				
Maximum Allowable Stress Wind Speed, V_{asd} ^f (mph)	Mean roof height (feet)	All roof slopes		
85	0-60	One fastener per tile.		
100	0-40	One fastener per tile.		
100	> 40-60	The head of all tiles shall be nailed. The nose of all eave tiles shall be fastened with approved clips. Rake tiles shall be nailed with two nails. The nose of all ridge, hip and rake tiles shall be set in a bead of roofer's mastic.		
110	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
120	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
130	0-60	The fastening system shall resist the wind forces in Section 1609.5.3.		
All	> 60	The fastening system shall resist the wind forces in Section 1609.5.3.		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 4.882 kg/m².

- a. Minimum fastener size. Corrosion-resistant nails not less than No. 11 gage with ⁵/₁₆-inch head. Fasteners shall be long enough to penetrate into the sheathing ³/₄ inch or through the thickness of the sheathing, whichever is less. Attaching wire for clay and concrete tile shall not be smaller than 0.083 inch.
- b. Snow areas. Not fewer than two fasteners per tile are required or battens and one fastener.
- c. Roof slopes greater than 24:12. The nose of all tiles shall be securely fastened.
- d. Horizontal battens. Battens shall be not less than 1 inch by 2 inches nominal. Provisions shall be made for drainage by a riser of not less than ¹/₈ inch at each nail or by 4-foot-long battens with not less than a ¹/₂-inch separation between battens. Horizontal battens are required for slopes over 7:12.
- e. Perimeter fastening areas include three tile courses but not less than 36 inches from either side of hips or ridges and edges of eaves and gable rakes.
- f. V_{asd} shall be determined in accordance with Section 1609.3.1.

**TABLE 1507.4.3(1)
METAL ROOF COVERINGS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B209, 0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc alloy coated steel	ASTM A792 AZ 50
Cold-rolled copper	ASTM B370 minimum 16 oz./sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Copper	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A653 G90 zinc-coated ^a .
Hard lead	2 lbs./sq. ft.
Lead-coated copper	ASTM B101
Prepainted steel	ASTM A755
Soft lead	3 lbs./sq. ft.
Stainless steel	ASTM A240, 300 Series Alloys
Steel	ASTM A924
Terne and terne-coated stainless	Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness; 99.995% electrolytic high-grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m², 1 pound per square foot = 4.882 kg/m², 1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A653 galvanized steel roofing shall be G60.

**TABLE 1507.4.3(2)
MINIMUM CORROSION RESISTANCE**

55% Aluminum-zinc alloy coated steel	ASTM A792 AZ 50
5% Aluminum alloy-coated steel	ASTM A875 GF60
Aluminum-coated steel	ASTM A463 T2 65
Galvanized steel	ASTM A653 G90
Prepainted steel	ASTM A755 ^a

a. Paint systems in accordance with ASTM A755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A463, ASTM A653, ASTM A792 or ASTM A875.

1507.5.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

1507.5.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.5.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.5.5 Material standards. Metal roof shingle roof coverings shall comply with Table 1507.4.3(1). The mate-

rials used for metal-roof shingle roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).

1507.5.6 Attachment. Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

1507.5.7 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3(1). The valley flashing shall extend not less than 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than 3/4 inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of either one layer of underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet bearing a label indicating compliance with ASTM D1970, in addition to underlayment required for metal roof shingles. The metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for roof slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

1507.6 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

1507.6.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

1507.6.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.6.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.6.5 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D3909 or ASTM D6380.

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.7.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.7.5 Material standards. Slate shingles shall comply with ASTM C406.

1507.7.6 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.6. Slate shingles shall be secured to the roof with two fasteners per slate.

**TABLE 1507.7.6
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm.

1507.7.7 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be not less than 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.455 mm) zinc-coated G90. Chimneys, stucco or brick walls shall have not fewer than two plies of felt for a cap flashing consisting of a 4-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend over the base flashing 2 inches (51 mm).

1507.7.8 Additional requirements. [DSA-SS & DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of Section 1507.7.5, the installation of slate shingle roof coverings shall comply with the requirements of Sections 1507.3.6 and 1507.3.7, and the seismic anchorage provisions of Section 1513.

1507.8 Wood shingles. The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.8.2 Deck slope. Wood shingles shall be installed on slopes of not less than three units vertical in 12 units horizontal (25-percent slope).

1507.8.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.8.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.8.5 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.5.

1507.8.6 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 3/4 inch (19.1 mm) into the sheathing. For sheathing less than

1/2 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with not fewer than two fasteners.

**TABLE 1507.8.5
WOOD SHINGLE MATERIAL REQUIREMENTS**

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

1507.8.7 Application. Wood shingles shall be laid with a side lap not less than 1 1/2 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 1/4 to 3/8 inch (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.7.

**TABLE 1507.8.7
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3.75	5
		No. 2	3.5	4
		No. 3	3	3.5
	18	No. 1	4.25	5.5
		No. 2	4	4.5
		No. 3	3.5	4
	24	No. 1	5.75	7.5
		No. 2	5.5	6.5
		No. 3	5	5.5

For SI: 1 inch = 25.4 mm.

1507.8.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet bearing a label indicating compliance with ASTM D1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

**TABLE 1507.8
WOOD SHINGLE AND SHAKE INSTALLATION**

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of not less than 3 units vertical in 12 units horizontal (3:12).	Wood shakes shall be installed on slopes of not less than 4 units vertical in 12 units horizontal (4:12).
2. Deck requirement		
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1" × 4" nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1" × 4" nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1" × 4" spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
In areas where the average daily temperature in January is 25°F or less or where there is a possibility of ice forming along the eaves causing a backup of water.	Solid sheathing is required.	Solid sheathing is required.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D226, Type 1.
4. Underlayment		
Temperate climate	Underlayment shall comply with Section 1507.1.1.	Underlayment shall comply with Section 1507.1.1.
5. Application		
Attachment	Fasteners for wood shingles shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) stainless steel with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be hot-dipped galvanized or Type 304 (Type 316 for coastal areas) with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.7.	Weather exposures shall not exceed those set forth in Table 1507.9.8.
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative-treated taper sawn shakes.
Flashing	In accordance with Section 1507.8.8.	In accordance with Section 1507.9.9.

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

1507.8.9 Label required. Each bundle of shingles shall be identified by a label of an approved grading or inspection bureau or agency.

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid sheathing required. Solid sheathing is required in areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water.

1507.9.2 Deck slope. Wood shakes shall only be used on slopes of not less than 4 units vertical in 12 units horizontal (33-percent slope).

1507.9.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.9.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.9.5 Interlayment. Interlayment shall comply with ASTM D226, Type I.

1507.9.6 Material standards. Wood shakes shall comply with the requirements of Table 1507.9.6.

**TABLE 1507.9.6
WOOD SHAKE MATERIAL REQUIREMENTS**

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.

TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.7 Attachment. Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of $\frac{3}{4}$ inch (19.1 mm) into the sheathing. For sheathing less than $\frac{1}{2}$ inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with not fewer than two fasteners.

1507.9.8 Application. Wood shakes shall be laid with a side lap not less than $1\frac{1}{2}$ inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be $\frac{3}{8}$ to $\frac{5}{8}$ inch (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be $\frac{1}{4}$ to $\frac{3}{8}$ inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.8.

**TABLE 1507.9.8
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10 ^a
Preservative-treated taper sawn shakes of Southern yellow pine	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5
Taper sawn shakes of naturally durable wood	18	No. 1	7.5
	24	No. 1	10
	18	No. 2	5.5
	24	No. 2	7.5

For SI: 1 inch = 25.4 mm.

a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

1507.9.9 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer’s installation instructions, and where of metal, shall be not less than 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) underlayment of either one layer of Type I underlayment running the full length of the valley or a self-adhering polymer-modified bitumen sheet bearing a label indicating compliance with ASTM D1970, in addition to other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less or where there is a possibility of ice forming along the eaves causing a backup of water, the metal valley flashing underlayment shall be solidly cemented to the roofing underlayment for slopes under seven units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet shall be installed.

1507.9.10 Label required. Each bundle of shakes shall be identified by a label of an approved grading or inspection bureau or agency.

1507.10 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section.

1507.10.1 Slope. Built-up roofs shall have a design slope of not less than $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of not less than $\frac{1}{8}$ unit vertical in 12 units horizontal (1-percent slope).

1507.10.2 Material standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2 or UL 55A.

1507.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section.

1507.11.1 Slope. Modified bitumen roofing shall have a design slope of not less than $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.11.2 Material standards. Modified bitumen roofing materials shall comply with ASTM D6162, ASTM D6163, ASTM D6164, ASTM D6222, ASTM D6223, ASTM D6298 or ASTM D6509.

1507.11.2.1 Base sheet. A base sheet that complies with the requirements of Section 1507.11.2, ASTM D1970 or ASTM D4601 shall be permitted to be used with a modified bitumen cap sheet.

**TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D6083
Aggregate surfacing	ASTM D1863
Asphalt adhesive used in roofing	ASTM D3747
Asphalt cements used in roofing	ASTM D2822; D3019; D4586
Asphalt-coated glass fiber base sheet	ASTM D4601
Asphalt coatings used in roofing	ASTM D1227; D2823; D2824; D4479
Asphalt glass felt	ASTM D2178
Asphalt primer used in roofing	ASTM D41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D2626
Asphalt-saturated organic felt (perforated)	ASTM D226
Asphalt used in roofing	ASTM D312
Coal-tar cements used in roofing	ASTM D4022; D5643
Coal-tar saturated organic felt	ASTM D227
Coal-tar pitch used in roofing	ASTM D450; Type I or II
Coal-tar primer used in roofing, damp-proofing and waterproofing	ASTM D43
Glass mat, coal tar	ASTM D4990
Glass mat, venting type	ASTM D4897
Mineral-surfaced inorganic cap sheet	ASTM D3909
Thermoplastic fabrics used in roofing	ASTM D5665, D5726

1507.12 Single-ply roofing. The installation of single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Single-ply membrane roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.12.2 Material standards. Single-ply roof coverings shall comply with the material standards in Table 1507.12.2.

**TABLE 1507.12.2
SINGLE-PLY ROOFING MATERIAL STANDARDS**

MATERIAL	MATERIAL STANDARD
Chlorosulfonated polyethylene (CSPE) or polyisobutylene (PIB)	ASTM D5019
Ethylene propylene diene monomer (EPDM)	ASTM D4637
Ketone Ethylene Ester (KEE)	ASTM D6754
Polyvinyl Chloride (PVC) or (PVC/KEE)	ASTM D4434
Thermoplastic polyolefin (TPO)	ASTM D6878

1507.12.3 Ballasted low-slope roofs. Ballasted low-slope roofs (roof slope < 2:12) shall be installed in accordance with this section and Section 1504.5. Stone used as ballast shall comply with ASTM D448 or ASTM D7655.

1507.13 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

1507.13.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.13.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ASTM C1029 Type III or IV or ASTM D7425.

1507.13.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Table 1507.13.3 shall be applied not less than 2 hours nor more than 72 hours following the application of the foam.

**TABLE 1507.13.3
PROTECTIVE COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

1507.13.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.14 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

1507.14.1 Slope. Liquid-applied roofing shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope).

1507.14.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, ASTM C957 or ASTM D3468.

1507.15 Vegetative roofs and landscaped roofs. Vegetative roofs and landscaped roofs shall comply with the requirements of this chapter, Section 1607.14.2.2 and the *California Fire Code*.

[BF] 1507.15.1 Structural fire resistance. The structural frame and roof construction supporting the load imposed on the roof by the vegetative roof or landscaped roofs shall comply with the requirements of Table 601.

1507.16 Photovoltaic shingles. The installation of photovoltaic shingles shall comply with the provisions of this section.

1507.16.1 Deck requirements. Photovoltaic shingles shall be applied to a solid or closely fitted deck, except where the shingles are specifically designed to be applied over spaced sheathing.

1507.16.2 Deck slope. Photovoltaic shingles shall be installed on roof slopes of not less than 2 units vertical in 12 units horizontal (2:12).

1507.16.3 Underlayment. Underlayment shall comply with Section 1507.1.1.

1507.16.4 Ice barrier. Where required, ice barriers shall comply with Section 1507.1.2.

1507.16.5 Fasteners. Fasteners for photovoltaic shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (2.67 mm)] shank with a minimum 3/8-inch-diameter (9.5 mm) head,

of a length to penetrate through the roofing materials and not less than $\frac{3}{4}$ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than $\frac{3}{4}$ inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F1667.

1507.16.6 Material standards. Photovoltaic shingles shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.16.7 Attachment. Photovoltaic shingles shall be attached in accordance with the manufacturer’s installation instructions.

1507.16.8 Wind resistance. Photovoltaic shingles shall comply with the classification requirements of Table 1504.2 for the appropriate maximum nominal design wind speed.

1507.17 Building-integrated photovoltaic roof panels. The installation of building-integrated photovoltaic (BIPV) roof panels shall comply with the provisions of this section.

1507.17.1 Deck requirements. BIPV roof panels shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied over spaced sheathing.

1507.17.2 Deck slope. BIPV roof panels shall be used only on roof slopes of 2 units vertical in 12 units horizontal (2:12) or greater.

1507.17.3 Underlayment. Underlayment shall comply with ASTM D226, ASTM D4869 or ASTM D6757.

1507.17.4 Underlayment application. Underlayment shall be applied shingle fashion, parallel to and starting from the eave, lapped 2 inches (51 mm) and fastened sufficiently to hold in place.

1507.17.4.1 High-wind attachment. Underlayment applied in areas subject to high winds [V_{asd} greater than 110 mph (49 m/s) as determined in accordance with Section 1609.3.1] shall be applied in accordance with the manufacturer’s instructions. Fasteners shall be applied along the overlap at not more than 36 inches (914 mm) on center. Underlayment installed where V_{asd} is not less than 120 mph (54 m/s) shall comply with ASTM D226, Type III, ASTM D4869, Type IV or ASTM D6757. The underlayment shall be attached in a grid pattern of 12 inches (305 mm) between side laps with a 6-inch (152 mm) spacing at the side laps. The underlayment shall be applied in accordance with Section 1507.1.1 except all laps shall be not less than 4 inches (102 mm). Underlayment shall be attached using cap nails or cap staples. Caps shall be metal or plastic with a nominal head diameter of not less than 1 inch (25.4 mm). Metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Power-driven metal caps shall have a thickness of not less than 0.010 inch (0.25 mm). Thickness of the outside edge of plastic caps shall be not less than 0.035 inch (0.89 mm). The cap nail shank shall be not less than 0.083 inch (2.11 mm) for ring shank cap nails and 0.091 inch (2.31 mm) for smooth shank cap nails. Staple gage shall be not less than 21 gage [0.02 inch (0.81 mm)]. Cap nail shank

and cap staple legs shall have a length sufficient to penetrate through-the-roof sheathing or not less than $\frac{3}{4}$ inch (19.1 mm) into the roof sheathing.

Exception: As an alternative, adhered underlayment complying with ASTM D1970 shall be permitted.

1507.17.4.2 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a back-up of water, an ice barrier consisting of not fewer than two layers of underlayment cemented together or of a self-adhering polymer modified bitumen sheet shall be used instead of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that do not contain conditioned floor area.

1507.17.5 Material standards. BIPV roof panels shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

1507.17.6 Attachment. BIPV roof panels shall be attached in accordance with the manufacturer’s installation instructions.

SECTION 1508 ROOF INSULATION

[BF] 1508.1 General. The use of above-deck thermal insulation shall be permitted provided that such insulation is covered with an approved roof covering and passes the tests of NFPA 276 or UL 1256 when tested as an assembly.

Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26.
2. Where a concrete or composite metal and concrete roof deck is used and the above-deck thermal insulation is covered with an approved roof covering.

[BF] 1508.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

**[BF] TABLE 1508.2
MATERIAL STANDARDS FOR ROOF INSULATION**

Cellular glass board	ASTM C552
Composite boards	ASTM C1289, Type III, IV, V or VII
Expanded polystyrene	ASTM C578
Extruded polystyrene	ASTM C578
Fiber-reinforced gypsum board	ASTM C1278
Glass-faced gypsum board	ASTM C1177
High-density polyisocyanurate board	ASTM C1289, Type II, Class 4
Mineral fiber insulation board	ASTM C726
Perlite board	ASTM C728
Polyisocyanurate board	ASTM C1289, Type I or II
Wood fiberboard	ASTM C208, Type II

**SECTION 1509
ROOF COATINGS**

1509.1 General. The installation of a roof coating on a roof covering shall comply with the requirements of Section 1505 and this section.

1509.2 Material standards. Roof coating materials shall comply with the standards in Table 1509.2.

**TABLE 1509.2
ROOF COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphaltic emulsion coating	ASTM D1227
Asphalt coating	ASTM D2823
Asphalt roof coating	ASTM D4479
Aluminum-pigmented asphalt coating	ASTM D2824
Silicone coating	ASTM D6694
Moisture-cured polyurethane coating	ASTM D6947

**SECTION 1510
RADIANT BARRIERS INSTALLED ABOVE DECK**

[BF] 1510.1 General. A radiant barrier installed above a deck shall comply with Sections 1510.2 through 1510.4.

[BF] 1510.2 Fire testing. Radiant barriers shall be permitted for use above decks where the radiant barrier is covered with an approved roof covering and the system consisting of the radiant barrier and the roof covering complies with the requirements of either FM 4450 or UL 1256.

[BF] 1510.3 Installation. The low emittance surface of the radiant barrier shall face the continuous airspace between the radiant barrier and the roof covering.

[BF] 1510.4 Material standards. A radiant barrier installed above a deck shall comply with ASTM C1313/1313M.

**SECTION 1511
ROOFTOP STRUCTURES**

[BG] 1511.1 General. The provisions of this section shall govern the construction of rooftop structures.

1511.1.1 Area limitation. The aggregate area of penthouses and other enclosed rooftop structures shall not exceed one-third the area of the supporting roof deck. Such penthouses and other enclosed rooftop structures shall not be required to be included in determining the building area or number of stories as regulated by Section 503.1. The area of such penthouses shall not be included in determining the fire area specified in Section 901.7.

[BG] 1511.2 Penthouses. Penthouses in compliance with Sections 1511.2.1 through 1511.2.4 shall be considered as a portion of the story directly below the roof deck on which such penthouses are located. Other penthouses shall be considered as an additional story of the building.

[BG] 1511.2.1 Height above roof deck. Penthouses constructed on buildings of other than Type I construction shall not exceed 18 feet (5486 mm) in height above the roof deck as measured to the average height of the roof of the penthouse. Penthouses located on the roof of buildings of Type I construction shall not be limited in height.

Exception: Where used to enclose tanks or elevators that travel to the roof level, penthouses shall be permitted to have a maximum height of 28 feet (8534 mm) above the roof deck.

[BG] 1511.2.2 Use limitations. Penthouses shall not be used for purposes other than the shelter of mechanical or electrical equipment, tanks, elevators and related machinery, stairways or vertical shaft openings in the roof assembly, including ancillary spaces used to access elevators and stairways.

[BG] 1511.2.3 Weather protection. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical and electrical equipment and the building interior from the elements.

[BG] 1511.2.4 Type of construction. Penthouses shall be constructed of building elements as required for the type of construction of the building on which such penthouses are built.

Exceptions:

1. On buildings of Type I construction, the exterior walls and roofs of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating. The exterior walls and roofs of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall not be required to have a fire-resistance rating.
2. On buildings of Type I construction two stories or less in height above grade plane or of Type II construction, the exterior walls and roofs of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating or a lesser fire-resistance rating as required by Table 705.5 and be constructed of fire-retardant-treated wood. The exterior walls and roofs of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall be permitted to be constructed of fire-retardant-treated wood and shall not be required to have a fire-resistance rating. Interior framing and walls shall be permitted to be constructed of fire-retardant-treated wood.
3. On buildings of Type III, IV or V construction, the exterior walls of penthouses with a fire separation distance greater than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be permitted to have not less than a 1-hour fire-resistance rating or a lesser fire-resistance rating as required by Table 705.5. On buildings of Type III, IV or VA

construction, the exterior walls of penthouses with a fire separation distance of 20 feet (6096 mm) or greater shall be permitted to be of heavy timber construction complying with Sections 602.4 and 2304.11 or noncombustible construction or fire-retardant-treated wood and shall not be required to have a fire-resistance rating.

[BG] 1511.3 Tanks. Tanks having a capacity of more than 500 gallons (1893 L) located on the roof deck of a building shall be supported on masonry, reinforced concrete, steel or heavy timber construction complying with Section 2304.11 provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.

[BG] 1511.3.1 Valve and drain. In the bottom or on the side near the bottom of the tank, a pipe or outlet, fitted with a suitable quick-opening valve for discharging the contents into a drain in an emergency shall be provided.

[BG] 1511.3.2 Location. Tanks shall not be placed over or near a stairway or an elevator shaft, unless there is a solid roof or floor underneath the tank.

[BG] 1511.3.3 Tank cover. Unenclosed roof tanks shall have covers sloping toward the perimeter of the tanks.

[BG] 1511.4 Cooling towers. Cooling towers located on the roof deck of a building and greater than 250 square feet (23.2 m²) in base area or greater than 15 feet (4572 mm) in height above the roof deck, as measured to the highest point on the cooling tower, where the roof is greater than 50 feet (15 240 mm) in height above grade plane shall be constructed of noncombustible materials. The base area of cooling towers shall not exceed one-third the area of the supporting roof deck.

Exception: Drip boards and the enclosing construction shall be permitted to be of wood not less than 1 inch (25 mm) nominal thickness, provided that the wood is covered on the exterior of the tower with noncombustible material.

[BG] 1511.5 Towers, spires, domes and cupolas. Towers, spires, domes and cupolas shall be of a type of construction having fire-resistance ratings not less than required for the building on top of which such tower, spire, dome or cupola is built. Towers, spires, domes and cupolas greater than 85 feet (25 908 mm) in height above grade plane as measured to the highest point on such structures, and either greater than 200 square feet (18.6 m²) in horizontal area or used for any purpose other than a belfry or an architectural embellishment, shall be constructed of and supported on Type I or II construction.

[BG] 1511.5.1 Noncombustible construction required. Towers, spires, domes and cupolas greater than 60 feet (18 288 mm) in height above the highest point at which such structure contacts the roof as measured to the highest point on such structure, or that exceeds 200 square feet (18.6 m²) in area at any horizontal section, or which is intended to be used for any purpose other than a belfry or architectural embellishment, or is located on the top of a building greater than 50 feet (1524 mm) in building height shall be constructed of and supported by noncombustible materials

and shall be separated from the building below by construction having a fire-resistance rating of not less than 1.5 hours with openings protected in accordance with Section 711. Such structures located on the top of a building greater than 50 feet (15 240 mm) in building height shall be supported by noncombustible construction.

[BG] 1511.5.2 Towers and spires. Enclosed towers and spires shall have exterior walls constructed as required for the building on top of which such towers and spires are built. The roof covering of spires shall be not less than the same class of roof covering required for the building on top of which the spire is located.

[BG] 1511.6 Mechanical equipment screens. Mechanical equipment screens shall be constructed of the materials specified for the exterior walls in accordance with the type of construction of the building. Where the fire separation distance is greater than 5 feet (1524 mm), mechanical equipment screens shall not be required to comply with the fire-resistance rating requirements.

[BG] 1511.6.1 Height limitations. Mechanical equipment screens shall not exceed 18 feet (5486 mm) in height above the roof deck, as measured to the highest point on the mechanical equipment screen.

Exception: Where located on buildings of Type IA construction, the height of mechanical equipment screens shall not be limited.

[BG] 1511.6.2 Type I, II, III or IV construction. Regardless of the requirements in Section 1511.6, mechanical equipment screens that are located on the roof decks of buildings of Type I, II, III or IV construction shall be permitted to be constructed of combustible materials in accordance with any one of the following limitations:

1. The fire separation distance shall be not less than 20 feet (6096 mm) and the height of the mechanical equipment screen above the roof deck shall not exceed 4 feet (1219 mm) as measured to the highest point on the mechanical equipment screen.
2. The fire separation distance shall be not less than 20 feet (6096 mm) and the mechanical equipment screen shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation.
3. Where exterior wall covering panels are used, the panels shall have a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use, with each face tested independently in accordance with ASTM E84 or UL 723. The panels shall be tested in the minimum and maximum thicknesses intended for use in accordance with, and shall comply with the acceptance criteria of, NFPA 285 and shall be installed as tested. Where the panels are tested as part of an exterior wall assembly in accordance with NFPA 285, the panels shall be installed on the face of the mechanical equipment screen supporting structure in

the same manner as they were installed on the tested exterior wall assembly.

[BG] 1511.6.3 Type V construction. The height of mechanical equipment screens located on the roof decks of buildings of Type V construction, as measured from grade plane to the highest point on the mechanical equipment screen, shall be permitted to exceed the maximum building height allowed for the building by other provisions of this code where complying with any one of the following limitations, provided that the fire separation distance is greater than 5 feet (1524 mm):

1. Where the fire separation distance is not less than 20 feet (6096 mm), the height above grade plane of the mechanical equipment screen shall not exceed 4 feet (1219 mm) more than the maximum building height allowed.
2. The mechanical equipment screen shall be constructed of noncombustible materials.
3. The mechanical equipment screen shall be constructed of fire-retardant-treated wood complying with Section 2303.2 for exterior installation.
4. Where the fire separation distance is not less than 20 feet (6096 mm), the mechanical equipment screen shall be constructed of materials having a flame spread index of 25 or less when tested in the minimum and maximum thicknesses intended for use with each face tested independently in accordance with ASTM E84 or UL 723.

[BG] 1511.7 Other rooftop structures. Rooftop structures not regulated by Sections 1511.2 through 1511.6 shall comply with Sections 1511.7.1 through 1511.7.5, as applicable.

[BG] 1511.7.1 Aerial supports. Aerial supports shall be constructed of noncombustible materials.

Exception: Aerial supports not greater than 12 feet (3658 mm) in height as measured from the roof deck to the highest point on the aerial supports shall be permitted to be constructed of combustible materials.

[BG] 1511.7.2 Bulkheads. Bulkheads used for the shelter of mechanical or electrical equipment or vertical shaft openings in the roof assembly shall comply with Section 1511.2 as penthouses. Bulkheads used for any other purpose shall be considered as an additional story of the building.

[BG] 1511.7.3 Dormers. Dormers shall be of the same type of construction as required for the roof in which such dormers are located or the exterior walls of the building.

[BG] 1511.7.4 Fences. Fences and similar structures shall comply with Section 1511.6 as mechanical equipment screens.

[BG] 1511.7.5 Flagpoles. Flagpoles and similar structures shall not be required to be constructed of noncombustible materials and shall not be limited in height or number.

[BG] 1511.8 Structural fire resistance. The structural frame and roof construction supporting loads imposed upon the roof

by any rooftop structure shall comply with the requirements of Table 601. The fire-resistance reduction permitted by Table 601, Note a, shall not apply to roofs containing rooftop structures.

1511.9 Photovoltaic (PV) panel systems. [BSC, DSA-SS, DSA-SS/CC, HCD 1 & HCD 2, OSHPD 1, 1R, 2, 4 & 5] Rooftop-mounted photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2 and shall be installed in accordance with the manufacturer's instructions.

1511.9.1 Installation. [DSA-SS, DSA-SS/CC, HCD 1 & HCD 2, OSHPD 1, 1R, 2, 4 & 5] Supports and attachments of photovoltaic panels to the roof structure, the panels, modules and components shall be designed for applied loads per this code, and shall comply with industry standards determined applicable by the enforcement agency. Seismic design requirements shall be determined from ASCE 7 Section 13.6.12. Wind design pressures shall be determined from ASCE 7 Section 29.4.3 or 29.4.4 using effective wind area per ASCE 7 Section 26.2. Calculations and drawings of the supports and attachments shall be submitted to the enforcement agency for review.

SECTION 1512 REROOFING

1512.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

Exceptions:

1. Roof replacement or roof recover of existing low-slope roof coverings shall not be required to meet the minimum design slope requirement of $\frac{1}{4}$ unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.
2. Recovering or replacing an existing roof covering shall not be required to meet the requirement for secondary (emergency overflow) drains or scuppers in Section 1502.2 for roofs that provide for positive roof drainage. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1502.2.

1512.2 Roof replacement. Roof replacement shall include the removal of all existing layers of roof assembly materials down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section 1507.

*

1512.2.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions.
2. Complete and separate roofing systems, such as standing-seam metal roof panel systems, that are designed to transmit the roof loads directly to the building's structural system and that do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs when applied in accordance with Section 1512.3.
4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, built-up roof, spray polyurethane foam roofing system, metal roof shingles, mineral-surfaced roll roofing, modified bitumen roofing or thermoset and thermoplastic single-ply roofing shall be permitted without tear off of existing roof coverings.

1512.2.1.1 Exceptions. A roof recover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

1512.3 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

1512.4 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Existing vent flashing, metal edgings, drain outlets, collars and metal counterflashings shall not be reinstalled where rusted, damaged or deteriorated. Existing ballast that is damaged, cracked or broken shall not be reinstalled. Existing aggregate surfacing materials from built-up roofs shall not be reinstalled.

1512.5 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

SECTION 1513
[DSA-SS & DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5]
SEISMIC ANCHORAGE OF SLATE SHINGLE, CLAY AND CONCRETE TILE ROOF COVERINGS

1513.1 Fasteners. Nails shall be long enough to penetrate into the sheathing $\frac{3}{4}$ inch (19 mm). Where sheathing is less than $\frac{3}{4}$ inch (19 mm) in thickness, nails shall be driven into supports, unless nails with ring shanks are used.

All fasteners shall be corrosion resistant and fabricated of copper, stainless steel or brass, or shall have a hot dipped galvanized coating not less than 1.0 ounce of zinc per square foot (305 gm/m²).

Nails for slate shingles and clay or concrete tile shall be copper, brass or stainless steel with gage and length per common ferrous nails.

1513.2 Wire. Wire for attaching slate shingles and clay or concrete tile shall be copper, brass or stainless steel capable of supporting four times the weight of tile.

Wire supporting a single tile or shingle shall not be smaller than $\frac{1}{16}$ inch (1.6 mm) in diameter. Continuous wire ties supporting more than one tile shall not be smaller than 0.084 inch (2 mm) in diameter.

1513.3 Metal strips. Metal strips for attaching slate shingles and clay or concrete tile shall be copper, brass or stainless steel capable of supporting four times the weight of tile.

1513.4 Clay or concrete tiles. Clay or concrete tile shall be installed in accordance with Table 1507.3.7 and as described herein.

1. On wood roofs or roofs of other material to which wood strips are secured, every cover or top tile when fastened with nails shall be nailed directly into $1\frac{1}{4}$ inches (32 mm) sound grain soft wood strips of sufficient height to support the tile.

Pan or bottom tiles shall be nailed directly to the roof sheathing or to wood strips. Wood strips shall be secured to the roof by nails spaced not over 12 inches (305 mm) apart.

2. On concrete roofs, wires shall be secured in place by wire loops embedded into the concrete not less than 2 inches (51 mm). The wire loops shall be spaced not more than 36 inches (914 mm) on center parallel to the eaves, and spaced vertically to allow for the minimum 3 inches (76 mm) lapping of the tile.

3. Where continuous ties of twisted wire, interlocking wires or metal strips extending from the ridge to eave are used to attach tile, the ties shall be attached to the roof construction at the ridge, eave and at intervals not exceeding 10 feet 0 inch (3048 mm) on center. The ties within 2 feet 0 inch (610 mm) of the rake shall be attached at intervals of 5 feet 0 inch (1524 mm).

Attachment for continuous ties shall be nails, screws staples or approved clips of the same material as the ties, and shall not be subjected to withdrawal forces. Attachments for continuous ties shall have an allowable working stress shear resistance of not less

than twice the dead weight of the tile tributary to the attachment, but not less than 300 pounds (136 kg).

- 4. Tile with projecting anchor lugs at the bottom of the tiles shall be held in position by means of 1- inch by 2- inch (25mm by 51mm) wood stripping nailed to the roof sheathing over the underlay.*
- 5. Clay or concrete tile on roofs with slopes exceeding 24 units vertical in 12 units horizontal (200 percent slope) shall be attached as required for veneer in Chapter 14. The nose of all tiles shall be securely fastened.*
- 6. Clay or concrete tile shall have a minimum of two fasteners per tile. Tiles that are 8 inches (203 mm) in width or less are permitted to be fastened at the center of the head with one fastener per tile.*
- 7. Interlocking clay or concrete tile shall have a minimum of one nail near center of head or two wire ties per tile.*

1513.5 Slate shingles. *Slate shingles on roofs with slopes exceeding 24 units vertical in 12 units horizontal (200 percent slope) shall be attached as required for veneer per Chapter 14.*

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HISTORY NOTE APPENDIX

2022 California Building Code California Code of Regulations, Title 24, Part 2 Volume 1

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Building Code* 2019 Triennial Edition, effective January 1, 2020.

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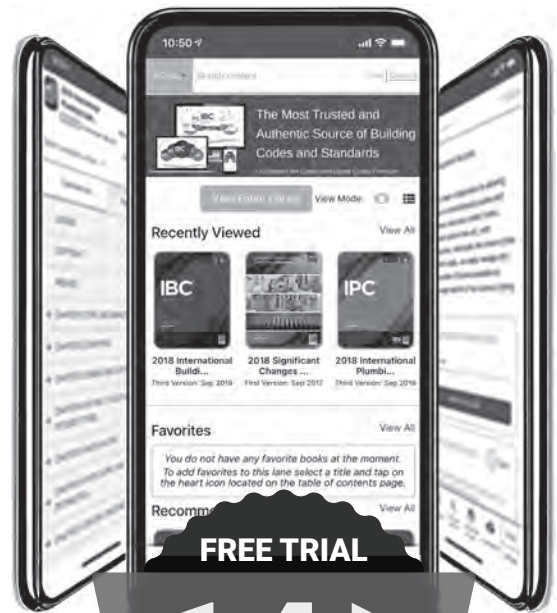
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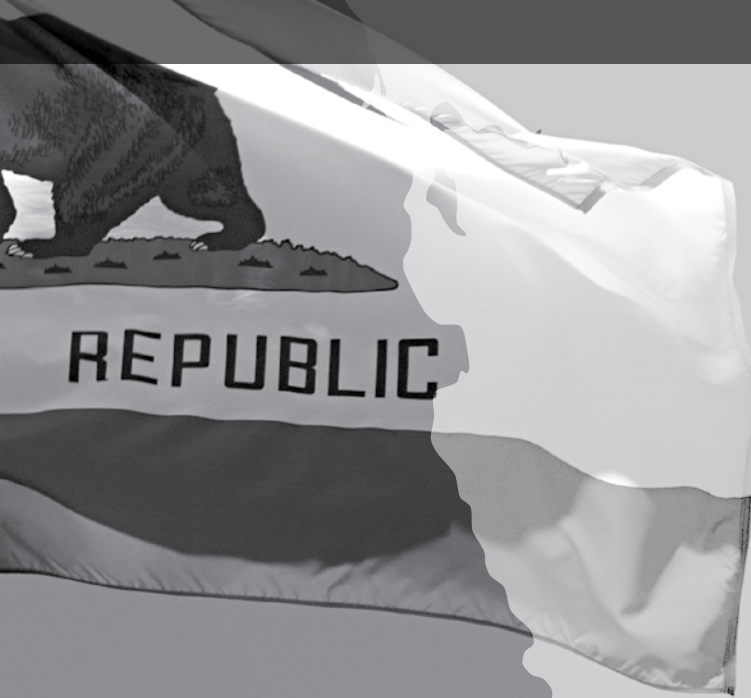
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PREFACE

This document is Part 2 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

Secretary Yolanda Richardson – Chair

Rajesh Patel – Vice-Chair

Erick Mikiten

Elley Klausbruckner

Aaron Stockwell

Juvilyn Alegre

Peter Santillan

Kent Sasaki

Laura Rambin

Mia Marvelli – Executive Director

Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page iv.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov..... (916) 445-5073

Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc..... (916) 263-0916

State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov..... **Energy Hotline** (800) 772-3300

Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov..... (562) 499-6312

Marine Oil Terminal Standards

California State Library

www.library.ca.gov..... (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov..... (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov..... (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov..... (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov..... (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov..... (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov..... (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdfa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards.....(916) 900-5004

Dairy Standards.....(916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov.....(800) 952-8356

Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov.....(916) 449-5661

Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa.....(916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,

Restoration or Relocation Standards

Office of Statewide Health Planning and Development

**AKA: California Department of Health Care Access and
Information (HCAI)**

www.hcai.ca.gov.....(916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov.....(916) 568-3800

Code Development and Analysis

Fire Safety Standards

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

Legend of Acronyms of Adopting State Agencies

BSC	California Building Standards Commission (see Section 1.2)
BSC-CG	California Building Standards Commission-CALGreen (see Section 1.2.2)
BSCC	Board of State and Community Corrections (see Section 1.3)
SFM	Office of the State Fire Marshal (see Section 1.11)
HCD 1	Department of Housing and Community Development (see Section 1.8.2.1.1)
HCD 2	Department of Housing and Community Development (see Section 1.8.2.1.3)
HCD 1/AC	Department of Housing and Community Development (see Section 1.8.2.1.2)
DSA-AC	Division of the State Architect-Access Compliance (see Section 1.9.1)
DSA-SS	Division of the State Architect-Structural Safety (see Section 1.9.2)
DSA-SS/CC	Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)
OSHPD 1	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 1R	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 2	Office of Statewide Health Planning and Development (see Section 1.10.2)
OSHPD 3	Office of Statewide Health Planning and Development (see Section 1.10.3)
OSHPD 4	Office of Statewide Health Planning and Development (see Section 1.10.4)
OSHPD 5	Office of Statewide Health Planning and Development (see Section 1.10.5)
DPH	Department of Public Health (see Section 1.7)
AGR	Department of Food and Agriculture (see Section 1.6)
CEC	California Energy Commission (see Section 100 in Part 6, the California Energy Code)
CA	Department of Consumer Affairs (see Section 1.4): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Household Goods & Services Structural Pest Control Board (SPCB)
SL	State Library (see Section 1.12)
SLC	State Lands Commission (see Section 1.14)
DWR	Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages vii and viii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency’s statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies’ adoption as follows:

Adopt the entire IBC chapter without state amendments.

If there is an “X” under a particular state agency’s acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA BUILDING CODE-MATRIX ADOPTION TABLE

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user. See Chapter 1 for state agency authority and building applications.)

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter			X																			
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter/Section																						

Adopt the entire IBC chapter as amended, state-amended sections are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an “X” in the column, by that particular section, under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter 1																						
202			X																			

Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below					X	X		S	A	M	P	L	E									
Chapter 1																						
202					X	X		S	A	M	P	L	E									
202					X	X			C	O	N	T.										
203					X	X																
203					X	X																

Marginal Markings

Symbols in the margin indicate the status of code changes as follows:

- || This symbol indicates that a change has been made to a California amendment.
- > This symbol indicates deletion of California amendment language.
- | This symbol indicates that a change has been made to International Code Council model language.
- ➔ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2018 edition of the *International Building Code*.

2021 LOCATION	2018 LOCATION
508.5–508.5.11	419.1–419.9
904.12	904.14
904.13	904.12
904.14	904.13
1010.2	1010.1.9
1010.2.1	1010.1.9.6
1010.2.2	1010.1.9.1
1010.2.3	1010.1.9.2
1010.2.4	1010.1.9.4
1010.2.5	1010.1.9.5
1010.2.6	1010.1.9.6.1
1010.2.7	1010.1.9.12
1010.2.8	1010.1.4.4
1010.2.9	1010.1.10
1010.2.9.3	1010.1.10.1
1010.2.9.4	1010.1.10.2
1010.2.10	1010.1.9.3
1010.2.11	1010.1.9.10
1010.2.12	1010.1.9.9
1010.2.13	1010.1.9.8
1010.2.13.1	1010.1.9.8.1
1010.2.14	1010.1.9.7
1010.2.15	1010.1.9.11
1010.3	1010.1.4
1010.3.1	1010.1.4.1
Table 1010.3.1(1)	Table 1010.1.4.1(1)
Table 1010.3.1(2)	Table 1010.1.4.1(2)
1010.3.1.1	1010.1.4.1.1
1010.3.1.2	1010.1.4.1.2
1010.3.2	1010.1.4.2
1010.3.3	1010.1.4.3
1029.1	1028.4
1029.2	1028.4.2
1029.3	1028.4.2

(continued)

RELOCATIONS—continued

2021 LOCATION	2018 LOCATION
1107.3	1109.14
1110.14	1109.12.1
1605.2	605.3.2
1607.14.2.2	1607.13.3
1607.14.4.3	1607.13.5.2.1
2304.12.2.6	2304.12.3
2304.12.2.6.1	2304.12.3.1
2304.12.2.7	2304.12.4
2304.12.2.8	2304.12.5
3301.2.1	1511.2

Coordination of the International Codes

The coordination of technical provisions is one of the strengths of the ICC family of model codes. The codes can be used as a complete set of complementary documents, which will provide users with full integration and coordination of technical provisions. Individual codes can also be used in subsets or as stand-alone documents. To make sure that each individual code is as complete as possible, some technical provisions that are relevant to more than one subject area are duplicated in some of the model codes. This allows users maximum flexibility in their application of the I-Codes.

Maintenance

The *International Building Code* is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate.

The ICC Code Development Process reflects principles of openness, transparency, balance, due process and consensus, the principles embodied in OMB Circular A-119, which governs the federal government's use of private-sector standards. The ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the ICC's cloud-based app, *cdp-Access*[®]. A broad cross section of interests are represented in the ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC's important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- American Institute of Architects (AIA)
- National Association of Home Builders (NAHB)
- National Association of State Fire Marshals (NASFM)

The code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the International Code Council.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. The ICC does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

As mentioned in the preceding material, in each code development cycle, code change proposals to this code are considered at the Committee Action Hearings by 11 different code development committees.

Code change proposals to sections of the code that are preceded by a bracketed letter designation, such as [A], will be considered by a committee other than the building code committee listed for the chapter or appendix on the preceding page. For example, proposed code changes to Section [F] 307.1.1 will be considered by the International Fire Code Development Committee during the Committee Action Hearing in the 2021 (Group A) code development cycle.

The bracketed letter designations for committees responsible for portions of this code are as follows:

- [A] = Administrative Code Development Committee
- [BE] = IBC—Egress Code Development Committee
- [BF] = IBC—Fire Safety Code Development Committee
- [BG] = IBC—General Code Development Committee
- [BS] = IBC—Structural Code Development Committee
- [E] = International Commercial Energy Conservation Code Development Committee or International Residential Energy Conservation Code Development Committee
- [EB] = International Existing Building Code Development Committee
- [F] = International Fire Code Development Committee
- [FG] = International Fuel Gas Code Development Committee
- [M] = International Mechanical Code Development Committee
- [P] = International Plumbing Code Development Committee

For the development of the 2024 edition of the I-Codes, there will be two groups of code development committees and they will meet in separate years, as shown in the following Code Development Hearings Table.

Code change proposals submitted for code sections that have a letter designation in front of them will be heard by the respective committee responsible for such code sections. Because different committees hold Committee Action Hearings in different years, proposals for the IBC will be heard by committees in both the 2021 (Group A) and the 2022 (Group B) code development cycles.

For instance, every section of Chapter 16 is the responsibility of the IBC—Structural Code Development Committee. As noted in the preceding table, that committee will hold its Committee Action Hearings in 2022 to consider code change proposals for the chapters for which it is responsible. Therefore any proposals received for Chapter 16 of this code will be assigned to the IBC—Structural Code Development Committee and will be considered in 2022, during the Group B code change cycle.

It is very important that anyone submitting code change proposals understands which code development committee is responsible for the section of the code that is the subject of the code change proposal. For further information on the Code Development Committee responsibilities, please visit the ICC website at www.iccsafe.org/current-code-development-cycle.

CODE DEVELOPMENT HEARINGS

Group A Codes (Heard in 2021, Code Change Proposals Deadline: January 11, 2021)	Group B Codes (Heard in 2022, Code Change Proposals Deadline: January 10, 2022)
International Building Code – Egress (Chapters 10, 11, Appendix E) – Fire Safety (Chapters 7, 8, 9, 14, 26) – General (Chapters 2–6, 12, 27–33, Appendices A, B, C, D, K, N)	Administrative Provisions (Chapter 1 of all codes except IECC, IRC and IgCC; IBC Appendix O; the appendices titled “Board of Appeals” for all codes except IECC, IRC, IgCC, ICCPC and IZC; administrative updates to currently referenced standards; and designated definitions)
International Fire Code	International Building Code – Structural (Chapters 15–25, Appendices F, G, H, I, J, L, M)
International Fuel Gas Code	International Existing Building Code
International Mechanical Code	International Energy Conservation Code—Commercial
International Plumbing Code	International Energy Conservation Code—Residential – IECC—Residential – IRC—Energy (Chapter 11)
International Property Maintenance Code	International Green Construction Code (Chapter 1)
International Private Sewage Disposal Code	International Residential Code – IRC—Building (Chapters 1–10, Appendices AE, AF, AH, AJ, AK, AL, AM, AO, AQ, AR, AS, AT, AU, AV, AW)
International Residential Code – IRC—Mechanical (Chapters 12–23) – IRC—Plumbing (Chapters 25–33, Appendices AG, AI, AN, AP)	
International Swimming Pool and Spa Code	
International Wildland-Urban Interface Code	
International Zoning Code	

Note: Proposed changes to the ICCPC will be heard by the code development committee noted in brackets [] in the text of the ICCPC.

Effective Use of the International Building Code

The IBC is a model code that provides minimum requirements to safeguard the public health, safety and general welfare of the occupants of new and existing buildings and structures. The IBC is fully compatible with the ICC family of codes, including: the IECC, IEBC, IFC, IFGC, IgCC, IMC, IPC, IPSDC, IPMC, IRC, ISPSC, IWUIC, IZC and ICCPC.

The IBC addresses structural strength, means of egress, sanitation, adequate lighting and ventilation, accessibility, energy conservation and life safety in regard to new and existing buildings, facilities and systems. The codes are promulgated on a 3-year cycle to allow for new construction methods and technologies to be incorporated into the codes. Alternative materials, designs and methods not specifically addressed in the code can be approved by the building official where the proposed materials, designs or methods comply with the intent of the provisions of the code (see Section 104.11).

The IBC applies to all occupancies, including one- and two-family dwellings and townhouses that are not within the scope of the IRC. The IRC is referenced for coverage of detached one- and two-family dwellings and townhouses as defined in the exception to Section 101.2 and the definition for “Townhouse” in Chapter 2. The IRC can also be used for the construction of live/work units (as defined in Section 508.5) and small bed and breakfast-style hotels where there are five or fewer guest rooms and the hotel is owner occupied. The IBC applies to all types of buildings and structures unless exempted. Work exempted from permits is listed in Section 105.2.

ARRANGEMENT AND FORMAT OF THE 2021 IBC

Before applying the requirements of the IBC, it is beneficial to understand its arrangement and format. The IBC, like other codes published by ICC, is arranged and organized to follow sequential steps that generally occur during a plan review or inspection.

The following table shows how the IBC is divided. The three tables following that show IBC requirements that are correlated with other I-Codes. Lastly, the ensuing chapter-by-chapter synopsis details the scope and intent of the provisions of the IBC.

CHAPTER TOPICS

Chapters	Subjects
1–2	Administration and definitions
3	Use and occupancy classifications
4, 31	Special requirements for specific occupancies or elements
5–6	Height and area limitations based on type of construction
7–9	Fire resistance and protection requirements
10	Requirements for evacuation
11	Specific requirements to allow use and access to a building for persons with disabilities
12–13, 27–30	Building systems, such as lighting, HVAC, plumbing fixtures, elevators
14–26	Structural components—performance and stability
32	Encroachment outside of property lines
33	Safeguards during construction
35	Referenced standards
Appendices A–O	Appendices

IFC Correlated Topics

The IBC requirements for hazardous materials, fire-resistance-rated construction, interior finish, fire protection systems, means of egress, emergency and standby power, and temporary structures are directly correlated with the requirements of the IFC. The following table shows chapters/sections of the IBC that are correlated with the IFC:

IBC/IFC CORRELATED TOPICS

IBC Chapter/Section	IFC Chapter/Section	Subject
Sections 307, 414, 415	Chapters 50–67	Hazardous materials and Group H requirements
Chapter 7	Chapter 7	Fire-resistance-rated construction (fire and smoke protection features in the IFC)
Chapter 8	Chapter 8	Interior finish, decorative materials and furnishings
Chapter 9	Chapter 9	Fire protection systems
Chapter 10	Chapter 10	Means of egress
Chapter 27	Section 604	Standby and emergency power
Section 3103	Chapter 31	Temporary structures

IMC Correlated Topics

The IBC requirements for smoke control systems, and smoke and fire dampers are directly correlated to the requirements of the IMC. IBC Chapter 28 is a reference to the IMC and the IFGC for chimneys, fireplaces and barbecues, and all aspects of mechanical systems. The following table shows chapters/sections of the IBC that are correlated with the IMC:

IBC/IMC CORRELATED TOPICS		
IBC Chapter/Section	IMC Chapter/Section	Subject
Section 717	Section 607	Smoke and fire dampers
Section 909	Section 513	Smoke control

IPC Correlated Topics

The IBC requirements for plumbing fixtures and toilet rooms are directly correlated to the requirements of the IPC. The following table shows chapters/sections of the IBC that are correlated with the IPC:

IBC/IPC CORRELATED TOPICS		
IBC Chapter/Section	IPC Chapter/Section	Subject
Chapter 29	Chapters 3 & 4	Plumbing fixtures and facilities

Chapter 1 Scope and Administration

Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts, Part 1— Scope and Application (Sections 101-102) and Part 2—Administration and Enforcement (Sections 103-116). Section 101 identifies which buildings and structures come under its purview and references other I-Codes as applicable. Standards and codes are scoped to the extent referenced (see Section 102.4).

The building code is intended to be adopted as a legally enforceable document and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the building official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

Chapter 2 Definitions

All terms that are defined in the code are listed alphabetically in Chapter 2. While a defined term may be used in one chapter or another, the meaning provided in Chapter 2 is applicable throughout the code.

Where understanding a term's definition is especially key to or necessary for understanding a particular code provision, the term is shown in italics. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code is provided.

Chapter 3 Occupancy Classification and Use

Chapter 3 provides for the classification of buildings, structures and parts thereof based on the purpose or purposes for which they are used. Section 302 identifies the groups into which all buildings, structures and parts thereof must be classified. Sections 303 through 312 identify the occupancy characteristics of each group classification. In some sections, specific group classifications having requirements in common are collectively organized such that one term applies to all. For example, Groups A-1, A-2, A-3, A-4 and A-5 are individual groups for assembly-type buildings. The general term “Group A,” however, includes each of these individual groups. Other groups include Business (B), Educational (E), Factory (F-1, F-2), High Hazard (H-1, H-2, H-3, H-4, H-5), Institutional (I-1, I-2, I-3, I-4), Mercantile (M), Residential (R-1, R-2, R-3, R-4), Storage (S-1, S-2) and Utility (U). In some occupancies, the smaller number means a higher hazard, but that is not always the case.

Defining the use of the buildings is very important as it sets the tone for the remaining chapters of the code. Occupancy works with the height, area and construction type requirements in Chapters 5 and 6, as well as the special provisions in Chapter 4, to determine “equivalent risk,” or providing a reasonable level of protection or life safety for building occupants. The determination of equivalent risk involves three interdependent considerations: (1) the level of fire hazard associated with the specific occupancy of the facility; (2) the reduction of fire hazard by limiting the floor area and the height of the building based on the fuel load (combustible contents and burnable building components); and (3) the level of overall fire resistance provided by the type of construction used for the building. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type.

Occupancy classification also plays a key part in organizing and prescribing the appropriate protection measures. As such, threshold requirements for fire protection and means of egress systems are based on occupancy classification (see Chapters 9 and 10). Other sections of the code also contain requirements respective to the classification of building groups. For example, Section 706 specifies requirements for fire wall fire-resistance ratings that are tied to the occupancy classification of a building and Section 803.11 contains interior finish requirements that are dependent upon the occupancy classification. The use of the space, rather than the occupancy of the building, is utilized for determining occupant loading (Section 1004) and live loading (Section 1607).

Over the useful life of a building, the activities in the building will evolve and change. Where the provisions of the code address uses differently, moving from one activity to another or from one level of activity to another is, by definition, a change of occupancy. The new occupancy must be in compliance with the applicable provisions.

Chapter 4 Special Detailed Requirements Based on Occupancy and Use

Chapter 4 contains the requirements for protecting special uses and occupancies, which are supplemental to the remainder of the code. Chapter 4 contains provisions that may alter requirements found elsewhere in the code; however, the general requirements of the code still apply unless modified within the chapter. For example, the height and area limitations established in Chapter 5 apply to all special occupancies unless Chapter 4 contains height and area limitations. In this case, the limitations in Chapter 4 supersede those in other sections. An example of this is the height and area limitations for open parking garages given in Section 406.5.4, which supersede the limitations given in Sections 504 and 506.

In some instances, it may not be necessary to apply the provisions of Chapter 4. For example, if a covered mall building complies with the provisions of the code for Group M, Section 402 does not apply; however, other sections that address a use, process or operation must be applied to that specific occupancy, such as stages and platforms, special amusement buildings and hazardous materials (Sections 410, 411 and 414).

The chapter includes requirements for buildings and conditions that apply to one or more groups, such as high-rise buildings, underground buildings or atriums. Special uses may also imply specific occupancies and operations, such as for Group H, hazardous materials, application of flammable finishes, drying rooms, organic coatings and combustible storage or hydrogen fuel gas rooms, all of which are coordinated with the IFC. Unique consideration is taken for special use areas, such as covered mall buildings, motor-vehicle-related occupancies, special amusement buildings and aircraft-related occupancies. Special facilities within other occupancies are considered, such as stages and platforms, motion picture projection rooms, children’s play structures and storm shelters. Finally, in order that the overall package of protection features can be easily understood, unique considerations for specific occupancies are addressed: Groups I-1, I-2, I-3, R-1, R-2, R-3 and R-4; and ambulatory care facilities and live/work units.

Chapter 5 General Building Heights and Areas

Chapter 5 contains the provisions that regulate the minimum type of construction for area limits and height limits based on the occupancy of the building. Height and area increases (including allowances for basements, mezzanines and equipment platforms) are permitted based on open frontage for fire department access, separation and the type of sprinkler protection provided (Sections 503-506, 510). These thresholds are reduced for buildings over three stories in height in accordance with Sections 506.2.1 and 506.2.2. Provisions include the protection and/or separation of incidental uses (Table 509.1), accessory occupancies (Section 508.2) and mixed uses in the same building (Sections 506.2.2, 508.3, 508.4 and 510). Unlimited area buildings are permitted in certain occupancies when they meet special provisions (Section 507). Live/work units are provided for in Section 508.5.

Tables 504.3, 504.4 and 506.2 are the keystones in setting thresholds for building size based on the building's use and the materials with which it is constructed. If one then looks at Tables 504.3, 504.4 and 506.2, the relationship among group classification, allowable heights and areas and types of construction becomes apparent. Respective to each group classification, the greater the fire-resistance rating of structural elements, as represented by the type of construction, the greater the floor area and height allowances. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type. Starting in the 2015 edition, the table that once contained both height and area has been separated and these three new tables address the topics individually. In addition, the tables list criteria for buildings with and without automatic sprinkler systems.

Chapter 6 Types of Construction

The interdependence of these fire safety considerations can be seen by first looking at Tables 601 and 705.5, which show the fire-resistance ratings of the principal structural elements comprising a building in relation to the five classifications for types of construction. Type I construction is the classification that generally requires the highest fire-resistance ratings for structural elements, whereas Type V construction, which is designated as a combustible type of construction, generally requires the least amount of fire-resistance-rated structural elements. The greater the potential fire hazards indicated as a function of the group, the lesser the height and area allowances for a particular construction type. Section 603 includes a list of combustible elements that can be part of a non-combustible building (Types I and II construction).

Chapter 7 Fire and Smoke Protection Features

The provisions of Chapter 7 present the fundamental concepts of fire performance that all buildings are expected to achieve in some form. This chapter identifies the acceptable materials, techniques and methods by which proposed construction can be designed and evaluated against to determine a building's ability to limit the impact of fire. The fire-resistance-rated construction requirements within Chapter 7 provide passive resistance to the spread and effects of fire. Types of separations addressed include fire walls, fire barriers, fire partitions, horizontal assemblies, smoke barriers and smoke partitions. A fire produces heat that can weaken structural components and smoke products that cause property damage and place occupants at risk. The requirements of Chapter 7 work in unison with height and area requirements (Chapter 5), active fire detection and suppression systems (Chapter 9) and occupant egress requirements (Chapter 10) to contain a fire should it occur while helping ensure occupants are able to safely exit.

Chapter 7A Materials and Construction Methods for Exterior Wildfire Exposure

The purpose of this chapter is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface (WUI) Fire Area to resist the intrusion of flames or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

Chapter 8 Interior Finishes

This chapter contains the performance requirements for controlling fire growth within buildings by restricting interior finish and decorative materials. Past fire experience has shown that interior fin-

ish and decorative materials are key elements in the development and spread of fire. The provisions of Chapter 8 require materials used as interior finishes and decorations to meet certain flame-spread index or flame-propagation criteria based on the relative fire hazard associated with the occupancy. As smoke is also a hazard associated with fire, this chapter contains limits on the smoke development characteristics of interior finishes. The performance of the material is evaluated based on test standards.

Chapter 9 Fire Protection and Life Safety Systems

Chapter 9 prescribes the minimum requirements for active systems of fire protection equipment to perform the following functions: detect a fire; alert the occupants or fire department of a fire emergency; and control smoke and control or extinguish the fire. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the IFC; however, the IFC Chapter 9 also contains periodic testing criteria that are not contained in the IBC. In addition, the special fire protection system requirements based on use and occupancy found in IBC Chapter 4 are duplicated in IFC Chapter 9 as a user convenience.

Chapter 10 Means of Egress

The general criteria set forth in Chapter 10 regulating the design of the means of egress are established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system (i.e., exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics also are specified for the components that will permit their safe use without special knowledge or effort. The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Chapter 10 of the IBC is duplicated in Chapter 10 of the IFC; however, the IFC contains one additional section on the means of egress system in existing buildings.

Chapter 11A - Housing Accessibility and/or Chapter 11B - Accessibility to Public Buildings, Public Accommodations, Commercial Buildings and Public Housing

Verify compliance with accessibility provisions. In order to be considered as accessible, buildings and their individual elements must comply with the applicable scoping and technical provisions of Chapter 11A and/or Chapter 11B.

Chapter 12 Interior Environment

Chapter 12 provides minimum standards for the interior environment of a building. The standards address the minimum sizes of spaces, minimum temperature levels, and minimum light and ventilation levels. The collection of requirements addresses limiting sound transmission through walls, ventilation of attic spaces and under floor spaces (crawl spaces). Finally, the chapter provides minimum standards for toilet and bathroom construction, including privacy shielding and standards for walls, partitions and floors to resist water intrusion and damage.

Chapter 13 Energy Efficiency

Refer to California Energy Code, Title 24, Part 6.

Chapter 14 Exterior Walls

This chapter addresses requirements for exterior walls of buildings. Minimum standards for wall covering materials, installation of wall coverings and the ability of the wall to provide weather protection are provided. This chapter also requires exterior walls that are close to lot lines, or that are bearing walls for certain types of construction, to comply with the minimum fire-resistance ratings specified in Chapters 6 and 7. The installation of each type of wall covering, be it wood, masonry, vinyl, metal composite material or an exterior insulation and finish system, is critical to its long-term performance in protecting the interior of the building from the elements and the spread of fire. Limitations on the use of combustible materials on exterior building elements such as balconies, eaves, decks and architectural trim are also addressed in this chapter.

Chapter 15 Roof Assemblies and Rooftop Structures

Chapter 15 provides standards for both roof assemblies and structures that sit on top of the roofs of buildings. The criteria address roof construction and covering, including the weather-protective barrier at the roof and, in most circumstances, a fire-resistant barrier. The chapter is prescriptive in nature and is based on decades of experience with various traditional materials, but it also addresses newer products such as photovoltaic shingles. These prescriptive rules are very important for satisfying performance of one type of roof covering or another. Section 1511 addresses rooftop structures, including penthouses, tanks, towers and spires. Rooftop penthouses larger than prescribed in this chapter must be treated as a story under Chapter 5.

Chapter 16 Structural Design

Chapter 16 prescribes minimum structural loading requirements for use in the design and construction of buildings and structural components. It includes minimum design loads, assignment of risk categories and permitted design methodologies. Standards are provided for minimum design loads (live, dead, snow, wind, rain, flood, ice and earthquake as well as the required load combinations). The application of these loads and adherence to the serviceability criteria will enhance the protection of life and property. The chapter references and relies on many nationally recognized design standards. A key standard is the American Society of Civil Engineers' *Minimum Design Loads for Buildings and Other Structures* (ASCE 7). Structural design must address the conditions of the site and location. Therefore, maps are provided of rainfall, seismic, snow and wind criteria in different regions.

Chapter 17 Special Inspections and Tests

Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, labeling materials and assemblies and special inspection of structural assemblies. This chapter expands on the inspections of Chapter 1 by requiring special inspection where indicated and, in some cases, structural observation. It also spells out additional responsibilities for the owner, contractor, design professionals and special inspectors. Proper assembly of structural components, proper quality of materials used and proper application of materials are essential to ensuring that a building, once constructed, complies with the structural and fire-resistance minimums of the code and the approved design. To determine this compliance often requires continuous or frequent inspection and testing. Chapter 17 establishes standards for special inspection, testing and reporting of the work to the building official.

Chapter 18 Soils and Foundations

Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads from the structure above. This chapter includes requirements for soils investigation and site preparation for receiving a foundation, including the allowed load-bearing values for soils and for protecting the foundation from water intrusion. Section 1808 addresses the basic requirements for all foundation types. Later sections address foundation requirements that are specific to shallow foundations and deep foundations. Due care must be exercised in the planning and design of foundation systems based on obtaining sufficient soils information, the use of accepted engineering procedures, experience and good technical judgment.

Chapter 19 Concrete

This chapter provides minimum accepted practices for the design and construction of buildings and structural components using concrete—both plain and reinforced. Chapter 19 relies primarily on the reference to American Concrete Institute (ACI) 318, *Building Code Requirements for Structural Concrete*. This chapter also includes references to additional standards. Structural concrete must be designed and constructed to comply with this code and all listed standards. There are specific sections of the chapter addressing concrete slabs, anchorage to concrete and shotcrete. Because of the variable properties of material and numerous design and construction options available in the uses of concrete, due care and control throughout the construction process is necessary.

Chapter 20 Aluminum

Chapter 20 contains standards for the use of aluminum in building construction. Only the structural applications of aluminum are addressed. This chapter does not address the use of aluminum in specialty products such as storefront or window framing or architectural hardware. The use of aluminum in heating, ventilating or air-conditioning systems is addressed in the IMC. This chapter references national standards from the Aluminum Association for use of aluminum in building construction, AA ASM 35, *Aluminum Sheet Metal Work in Building Construction*, and AA ADM, *Aluminum Design Manual*. By utilizing the standards set forth, a proper application of this material can be obtained.

Chapter 21 Masonry

This chapter provides comprehensive and practical requirements for masonry construction. The provisions of Chapter 21 require minimum accepted practices and the use of standards for the design and construction of masonry structures. The provisions address: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; and required details of construction, including the execution of construction. Masonry design methodologies including allowable stress design, strength design and empirical design are covered by provisions of this chapter. Also addressed are masonry fireplaces and chimneys, masonry heaters and glass unit masonry. Fire-resistant construction using masonry is also required to comply with Chapter 7. Masonry foundations are also subject to the requirements of Chapter 18.

Chapter 22 Steel

Chapter 22 provides the requirements necessary for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. This chapter specifies appropriate design and construction standards for these types of structures. It also provides a road map of the applicable technical requirements for steel structures. Because steel is a noncombustible building material, it is commonly associated with Types I and II construction; however, it is permitted to be used in all types of construction. Chapter 22 requires that the design and use of steel materials be in accordance with the specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.

Chapter 23 Wood

This chapter provides minimum requirements for the design of buildings and structures that use wood and wood-based products. The chapter is organized around three design methodologies: allowable stress design (ASD), load and resistance factor design (LRFD) and conventional light-frame construction. Included in this chapter are references to design and manufacturing standards for various wood and wood-based products; general construction requirements; design criteria for lateral force-resisting systems and specific requirements for the application of the three design methods. In general, only Type III, IV or V buildings may be constructed of wood.

Chapter 24 Glass and Glazing

This chapter establishes regulations for glass and glazing that, when installed in buildings and structures, are subjected to wind, snow and dead loads. Engineering and design requirements are included in the chapter. Additional structural requirements are found in Chapter 16. Another concern of this chapter is glass and glazing used in areas where it is likely to be impacted by the occupants. Section 2406 identifies hazardous locations where glazing installed must either be safety glazing or blocked to prevent human impact. Safety glazing must meet stringent standards and be appropriately marked or identified. Additional requirements are provided for glass and glazing in guards, handrails, elevator hoistways and elevator cars, as well as in athletic facilities.

Chapter 25 Gypsum Board, Gypsum Panel Products and Plaster

Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum board, gypsum panel products and plaster. It also addresses reinforced gypsum concrete. These represent the most common interior and exterior finish materials in the building industry. This chapter primarily addresses quality-control-related issues with regard to material specifications and installation requirements. Most products are manufactured under the control of industry standards. The building official or inspector primarily needs to verify that the appropriate product is used and properly installed for the intended use and location. While often simply used as wall and ceiling coverings, proper design and application are necessary to provide weather resistance and required fire protection for both structural and nonstructural building components.

Chapter 26 Plastic

The use of plastics in building construction and components is addressed in Chapter 26. This chapter provides standards addressing foam plastic insulation, foam plastics used as interior finish and trim, and other plastic veneers used on the inside or outside of a building. Plastic siding is regulated by Chapter 14. Sections 2606 through 2611 address the use of light-transmitting plastics in various configurations such as walls, roof panels, skylights, signs and as glazing. Requirements for the use of fiber-reinforced polymers, fiberglass-reinforced polymers and reflective plastic core insulation are also contained in this chapter. Additionally, requirements specific to the use of wood-plastic composites and plastic lumber are contained in this chapter. Some plastics exhibit rapid flame spread and heavy smoke density characteristics when exposed to fire. Exposure to the heat generated by a fire can cause some plastics to deform, which can affect their performance. The requirements and limitations of this chapter are necessary to control the use of plastic and foam plastic products such that they do not compromise the safety of building occupants.

Chapter 27 Electrical

Since electrical systems and components are an integral part of almost all structures, it is necessary for the code to address the installation of such systems. For this purpose, Chapter 27 references the National Electrical Code (NEC). In addition, Section 2702 addresses emergency and standby power requirements. Such systems must comply with the *IFC* and referenced standards. This section also provides references to the various code sections requiring emergency and standby power, such as high-rise buildings and buildings containing hazardous materials.

Chapter 28 Mechanical Systems

Nearly all buildings will include mechanical systems. This chapter provides references to the IMC and the IFGC for the design and installation of mechanical systems. In addition, Chapter 21 of this code is referenced for masonry chimneys, fireplaces and barbecues.

Chapter 29 Plumbing Systems

Chapter 29 regulates the minimum number of plumbing fixtures that must be provided for every type of building. This chapter also regulates the location of the required fixtures in various types of buildings. This section requires separate facilities for males and females except for certain types of small occupancies. The regulations in this chapter come directly from Chapters 3 and 4 of the IPC.

Chapter 30 Elevators and Conveying Systems

Chapter 30 provides standards for the installation of elevators into buildings. Referenced standards provide the requirements for the elevator system and mechanisms. Detailed standards are provided in the chapter for hoistway enclosures, machine rooms and requirements for sizing of elevators. Beginning in the 2015 edition of this code, the elevator lobby requirements were moved from Chapter 7 to Chapter 30 to pull all the elevator-related construction requirements together. New provisions were added in the 2009 edition for fire service access elevators required in high-rise buildings and for the optional choice of occupant evacuation elevators (see Section 403).

Chapter 31 Special Construction

Chapter 31 contains a collection of regulations for a variety of unique structures and architectural features. Pedestrian walkways and tunnels connecting two buildings are addressed in Section 3104. Membrane and air-supported structures are addressed by Section 3102. Safeguards for swimming pool safety are addressed by way of reference to the ISPSA in Section 3109. Standards for temporary structures, including permit requirements, are provided in Section 3103. Structures as varied as awnings, marquees, signs, telecommunication and broadcast towers and automatic vehicular gates are also addressed (see Sections 3105 through 3108 and 3110).

Chapter 31A Systems for Window Cleaning or Exterior Building Maintenance

Chapter 31B Public Pools

Chapter 31C Radiation

Chapter 31D Food Establishments

Chapter 31E Reserved

Chapter 31F Marine Oil Terminals

Chapter 32 Encroachments into the Public Right-of-way

Buildings and structures from time to time are designed to extend over a property line and into the public right-of-way. Local regulations outside of the building code usually set limits to such encroachments, and such regulations take precedence over the provisions of this chapter. Standards are provided for encroachments below grade for structural support, vaults and areaways. Encroachments

above grade are divided into below 8 feet, 8 feet to 15 feet, and above 15 feet, because of headroom and vehicular height issues. This includes steps, columns, awnings, canopies, marquees, signs, windows and balconies. Similar architectural features above grade are also addressed. Pedestrian walkways must also comply with Chapter 31.

Chapter 33 Safeguards During Construction

Chapter 33 provides safety requirements during construction and demolition of buildings and structures. These requirements are intended to protect the public from injury and adjoining property from damage. In addition the chapter provides for the progressive installation and operation of exit stairways and standpipe systems during construction.

Chapter 34 Reserved

During the 2015 code change cycle the membership voted to delete Chapter 34, Existing Structures, from this code and reference the IEBC. The provisions that were in Chapter 34 appear in the IEBC. Former Sections 3402 through 3411 appear as IEBC Chapter 4 and Section 3412 as Chapter 14.

Chapter 35 Referenced Standards

The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 35 contains a comprehensive list of all standards that are referenced in the code, including the appendices. The standards are part of the code to the extent of the reference to the standard (see Section 102.4). Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the building official, contractor, designer and owner.

Chapter 35 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based upon the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

Appendices

Appendices are provided in the IBC to offer optional or supplemental criteria to the provisions in the main chapters of the code. Appendices provide additional information for administration of the Department of Building Safety as well as standards not typically administered by all building departments. Appendices have the same force and effect as the first 35 chapters of the IBC only when explicitly adopted by the jurisdiction.

Appendix A Employee Qualifications

Effective administration and enforcement of the family of International Codes depends on the training and expertise of the personnel employed by the jurisdiction and their knowledge of the codes. Section 103 of the code establishes the Department of Building Safety and calls for the appointment of a building official and deputies such as plans examiners and inspectors. Appendix A provides standards for experience, training and certification for the building official and the other staff mentioned in Chapter 1.

Appendix B Board of Appeals

Section 113 requires the establishment of a board of appeals to hear appeals regarding determinations made by the building official. Appendix B provides qualification standards for members of the board as well as operational procedures of such board.

Appendix C Group U—Agricultural Buildings

Appendix C provides a more liberal set of standards for the construction of agricultural buildings, rather than strictly following the utility building provision, reflective of their specific usage and limited occupant load. The provisions of this appendix, when adopted, allow reasonable heights and areas commensurate with the risk of agricultural buildings.

Appendix D Fire Districts

Fire districts have been a tool used to limit conflagration hazards in areas of a city with intense and concentrated development. More frequently used under the model codes that preceded the IBC, this appendix is provided to allow jurisdictions to continue the designation and use of fire districts. Fire district standards restrict certain occupancies within the district, as well as setting higher minimum construction standards.

Appendix E *Reserved*

Appendix F Rodentproofing

The provisions of this appendix are minimum mechanical methods to prevent the entry of rodents into a building. These standards, when used in conjunction with cleanliness and maintenance programs, can significantly reduce the potential of rodents invading a building.

Appendix G Flood-resistant Construction

Appendix G is intended to fulfill the flood-plain management and administrative requirements of the National Flood Insurance Program (NFIP) that are not included in the code. Communities that adopt the IBC and Appendix G will meet the minimum requirements of NFIP as set forth in Title 44 of the Code of Federal Regulations.

Appendix H Signs

Appendix H gathers in one place the various code standards that regulate the construction and protection of outdoor signs. Whenever possible, this appendix provides standards in performance language, thus allowing the widest possible application.

Appendix I Patio Covers

Appendix I provides standards applicable to the construction and use of patio covers. It is limited in application to patio covers accessory to dwelling units. Covers of patios and other outdoor areas associated with restaurants, mercantile buildings, offices, nursing homes or other nondwelling occupancies would be subject to standards in the main code and not this appendix.

Appendix J Grading

Appendix J provides standards for the grading of properties. This appendix also provides standards for administration and enforcement of a grading program including permit and inspection requirements. Appendix J was originally developed in the 1960s and used for many years in jurisdictions throughout the western United States. It is intended to provide consistent and uniform code requirements anywhere grading is considered an issue.

Appendix K *Group R-3 and Group R-3.1 Occupancies Protected by the Facilities of the Central Valley Flood Protection Plan*

Appendix K provides provisions applicable to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612 of Group R-3 and R-3.1 located in areas protected by the facilities of the Central Valley Flood Protection Plan.

Appendix L Earthquake Recording Instrumentation

The purpose of this appendix is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the IBC.

Appendix M Tsunami-Generated Flood Hazards

Addressing a tsunami risk for all types of construction in a tsunami hazard zone through building code requirements would typically not be cost effective, making tsunami-resistant construction impractical at an individual building level. However, this appendix does allow the adoption and enforcement of requirements for tsunami hazard zones that regulate the presence of high-risk or high-hazard structures.

Appendix N Replicable Buildings

Many jurisdictions have recognized the need for some form of expedited review process for replicable buildings. By codifying the approach contained in the ICC G1-2010 *Guideline for Replicable Buildings*, this appendix provides jurisdictions with a means of incorporating replicable building requirements into their building code adoption process. The intent is to streamline the plan review process at the local level by removing redundant reviews.

Appendix O Performance-based Application

Appendix O provides an optional design, review and approval framework for use by the building official. It simply extracts the relevant administrative provisions from the ICCPC into a more concise, usable appendix format for a jurisdiction confronted with such a need. Typical uses would include cases of alternate methods in Chapter 1 and select areas of the code that require a rational analysis, such as Section 909.

Appendix P *Emergency Housing*

This appendix shall be applicable to emergency housing and emergency housing facilities. Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and assembled in accordance with this appendix shall be occupied only during declaration of state of emergency, local emergency or shelter crises. Buildings and structures constructed in accordance with the California Building Code, used as emergency housing, shall be permitted to be permanently occupied.

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CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 16 – STRUCTURAL DESIGN

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter													X									
Adopt entire chapter as amended (amended sections listed below)	X			X	X				X		X	X			X							
Adopt only those sections that are listed below						X	X														X	
Chapter / Section																						
1601.1.1									X		X	X			X							
1601.1.2									X		X	X			X							
1601.1.3									X													
1601.1.4									X		X	X			X							
1601.2									X		X	X			X							
1603.1											X	X			X							
Table 1604.5												X			X							
1605.2											X	B			X							
Table 1607.1											X	X			X							
1607.9						X																
1607.9.2						X	X															
1612.3, Exception											X	X			X							
1613.1											X	X			X							
1613.1.1																					X	
1613.1.2	X																					
1613.1.3	X																					
1613.2.1, Exception											X	X			X							
Table 1613.2.3(1)											X	X			X							
Table 1613.2.3(2)											X	X			X							
1613.2.5, Exception											X	X			X							
1613.2.5.1											X	X			X							
1613.2.5.2											X	X			X							
1613.3											X	X			X							
1613.4											X	X			X							
1617									X													

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11. (A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 16

STRUCTURAL DESIGN

User notes:

About this chapter: Chapter 16 establishes minimum design requirements so that the structural components of buildings are proportioned to resist the loads that are likely to be encountered. In addition, this chapter assigns buildings and structures to risk categories that are indicative of their intended use. The loads specified herein along with the required load combinations have been established through research and service performance of buildings and structures. The application of these loads and adherence to the serviceability criteria enhance the protection of life and property.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 1601 GENERAL

1601.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

1601.1.1 Application. [DSA-SS/CC, OSHPD] The scope of application of Chapter 16 is as follows:

1. Structures regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.
2. Hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by the Office of Statewide Health Planning and Development (OSHPD) as listed in Sections 1.10.1, 1.10.2 and 1.10.5.

1601.1.2 Amendments in this chapter. DSA-SS/CC and OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Division of the State Architect - Structural Safety/Community Colleges:

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

2. OSHPD amendments [OSHPD] appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 5] - For applications listed in Section 1.10.5.

1601.1.3 Reference to other chapters. [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

1601.1.4 Amendments. [DSA-SS/CC, OSHPD]

1. [OSHPD 1R, 2 & 5] In addition to the amendments in this chapter, these buildings shall comply with the requirements of Sections 1617A.1.1, 1617A.1.4, 1617A.1.18 – 1617A.1.20, 1617A.1.27, 1617A.1.39 and 1617A.1.41.
2. [DSA-SS/CC] See Section 1617 for additional requirements.

1601.2 Enforcement agency approval. [DSA-SS/CC, OSHPD 1R, 2 & 5] In addition to requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the Registered Design Professional (RDP), are also subject to approval by the enforcement agency.

SECTION 1602 NOTATIONS

1602.1 Notations. The following notations are used in this chapter:

D = Dead load.

D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.

E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.

F = Load due to fluids with well-defined pressures and maximum heights.

F_a = Flood load in accordance with Chapter 5 of ASCE 7.

H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.

L = Live load.

L_r = Roof live load.

R = Rain load.

S = Snow load.

T = Cumulative effects of self-straining load forces and effects.

STRUCTURAL DESIGN

V_{asd} = Allowable stress design wind speed, miles per hour (mph) (km/hr) where applicable.

V = Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609.3(1) through 1609.3(12) or ASCE 7.

W = Load due to wind pressure.

W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603 CONSTRUCTION DOCUMENTS

1603.1 General. Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. Ground snow load, p_g .
3. Basic design wind speed, V , miles per hour (mph) (km/hr) and allowable stress design wind speed, V_{asd} , as determined in accordance with Section 1609.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612.3.
6. Design load-bearing values of soils.
7. Rain load data.

[OSHPD 1R, 2 & 5] Additional requirements are included in Sections 7-115 and 7-125 of the California Administrative Code (Part 1, Title 24, C.C.R).

1603.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607.12 shall be indicated for each type of live load used in the design.

1603.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas (Section 1607.14).

1603.1.3 Roof snow load data. The ground snow load, p_g , shall be indicated. In areas where the ground snow load, p_g , exceeds 10 pounds per square foot (psf) (0.479 kN/m²), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, p_f .
2. Snow exposure factor, C_e .
3. Snow load importance factor, I_s .
4. Thermal factor, C_r .
5. Slope factor(s), C_s .

6. Drift surcharge load(s), p_d , where the sum of p_d and p_f exceeds 20 psf (0.96 kN/m²).

7. Width of snow drift(s), w .

1603.1.4 Wind design data. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Basic design wind speed, V , miles per hour and allowable stress design wind speed, V_{asd} , as determined in accordance with Section 1609.3.1.
2. Risk category.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m²).

1603.1.5 Earthquake design data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.
2. Seismic importance factor, I_e .
3. Mapped spectral response acceleration parameters, S_S and S_1 .
4. Site class.
5. Design spectral response acceleration parameters, S_{DS} and S_{D1} .
6. Seismic design category.
7. Basic seismic force-resisting system(s).
8. Design base shear(s).
9. Seismic response coefficient(s), CS .
10. Response modification coefficient(s), R .
11. Analysis procedure used.

1603.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the construction documents.

1603.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612.3, the documentation pertaining to design, if required in Section 1612.4, shall be included and the following information, referenced to the datum on the community's *Flood Insurance Rate Map* (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.

3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry floodproofed.
4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603.1.9 Roof rain load data. Rain intensity, i (in/hr) (cm/hr), shall be shown regardless of whether rain loads govern the design.

SECTION 1604 GENERAL DESIGN REQUIREMENTS

1604.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604.3.

1604.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604.3.2 through 1604.3.5 or that permitted by Table 1604.3.

1604.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604.3.6 Limits. The deflection limits of Section 1604.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

1604.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the “component and cladding” wind loads shall not exceed either of the following:

1. $\frac{1}{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $\frac{1}{240}$ of the length of span of the framing member + $\frac{1}{4}$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift. Where required by ASCE 7, provisions shall be made for the increased forces induced on resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

TABLE 1604.3
DEFLECTION LIMITS^{a, b, c, h, i}

CONSTRUCTION	L or L_r	S or W^f	$D + L^{d, g}$
Roof members: ^c			
Supporting plaster or stucco ceiling	$l/360$	$l/360$	$l/240$
Supporting nonplaster ceiling	$l/240$	$l/240$	$l/180$
Not supporting ceiling	$l/180$	$l/180$	$l/120$
Floor members	$l/360$	—	$l/240$
Exterior walls:			
With plaster or stucco finishes	—	$l/360$	—
With other brittle finishes	—	$l/240$	—
With flexible finishes	—	$l/120$	—
Interior partitions: ^b			
With plaster or stucco finishes	$l/360$	—	—
With other brittle finishes	$l/240$	—	—
With flexible finishes	$l/120$	—	—
Farm buildings	—	—	$l/180$
Greenhouses	—	—	$l/120$

For SI: 1 foot = 304.8 mm.

- a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed $l/60$. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed $l/150$. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed $l/90$. For roofs, this exception only applies when the metal sheets have no roof covering.
- b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607.16.
- c. See Section 2403 for glass supports.
- d. The deflection limit for the $D + (L + L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from $0.5D$. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D . The value of $0.5D$ shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.
- e. The preceding deflections do not be used against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.
- f. The wind load shall be permitted to be taken as 0.42 times the “component and cladding” loads or directly calculated using the 10-year mean return interval wind speed for the purpose of determining deflection limits in Table 1604.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604.3.7
- g. For steel structural members, the deflection due to creep component of long-term dead load shall be permitted to be taken as zero.
- h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed $l/60$. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed $l/175$ for each glass lite or $l/60$ for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed $l/120$.
- i. l = Length of the member between supports. For cantilever members, l shall be taken as twice the length of the cantilever.

1604.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604.5 shall be used in lieu of ASCE 7, Table 1.5-1.

Exception: The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

1604.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to

the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher risk category, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604.5.

**TABLE 1604.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. • <i>[OSHPD 2] Skilled nursing facilities, intermediate care facilities, Group I-2 occupancy with 50 or more care recipients.</i> • <i>[OSHPD 5] Acute psychiatric hospitals, Group I-2 occupancy with 50 or more care recipients.</i> • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.^a • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and • Are sufficient to pose a threat to the public if released.^b
IV	Buildings and other structures designated as essential facilities, including but not limited to: <ul style="list-style-type: none"> • Group I-2, Condition 2 occupancies having emergency surgery or emergency treatment facilities. • Ambulatory care facilities having emergency surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and • Are sufficient to pose a threat to the public if released.^b • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

1604.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708.

1604.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by *approved* engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707, shall be load tested in accordance with Section 1709.

1604.8 Anchorage. Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604.8.1 through 1604.8.3, as applicable.

1604.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

1604.8.2 Structural walls. Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to *Seismic Design Category A* and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613 for earthquake design requirements.

1604.8.3 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607.1, or the snow load specified in Section 1608, in accordance with Section 1605, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

1604.9 Wind and seismic detailing. Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7 Chapters 11, 12, 13, 15, 17 and 18 as applicable, even where wind load effects are greater than seismic load effects.

Exception: References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

1604.10 Loads on storm shelters. Loads and load combinations on storm shelters shall be determined in accordance with ICC 500.

SECTION 1605 LOAD COMBINATIONS

1605.1 General. Buildings and other structures and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the allowable stress design load combinations specified in ASCE 7, Section 2.4, or the alternative allowable stress design load combinations of Section 1605.2.

Exceptions:

1. The modifications to load combinations of ASCE 7, Section 2.3, ASCE 7, Section 2.4, and Section 1605.2 specified in ASCE 7 Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, flat roof snow loads of 30 pounds per square foot (1.44 kN/m²) and roof live loads of 30 pounds per square foot (1.44 kN/m²) or less need not be combined with seismic load. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m²), 20 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind loads.

1605.1.1 Stability. Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 2.3 or 2.4 of ASCE 7, and in Section 1605.2 shall be permitted. Where the load combinations specified in ASCE 7, Section 2.3 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807.2.3.

1605.2 Alternative allowable stress design load combinations. In lieu of the load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the

following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect, E_v , in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, Section 2.3.6 shall be used. *[OSHPD 1R, 2B & 5] Each load combination shall be investigated with one or more of the variable loads set to zero.*

$$D + L + (L_r \text{ or } S \text{ or } R) \quad \text{(Equation 16-1)}$$

$$D + L + 0.6W \quad \text{(Equation 16-2)}$$

$$D + L + 0.6W + S/2 \quad \text{(Equation 16-3)}$$

$$D + L + S + 0.6W/2 \quad \text{(Equation 16-4)}$$

$$D + L + S + E/1.4 \quad \text{(Equation 16-5)}$$

$$0.9D + E/1.4 \quad \text{(Equation 16-6)}$$

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 pounds per square foot (1.44 kN/m²) or less and roof live loads of 30 pounds per square foot (1.44 kN/m²) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m²), 20 percent shall be combined with seismic loads.

SECTION 1606 DEAD LOADS

1606.1 General. Dead loads are those loads defined in Chapter 2 of this code. Dead loads shall be considered to be permanent loads.

1606.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid

contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

SECTION 1607 LIVE LOADS

1607.1 General. Live loads are those loads defined in Chapter 2 of this code.

1607.2 Loads not specified. For occupancies or uses not designated in Section 1607, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607.1.

1607.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated live loads, given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of 2¹/₂ feet by 2¹/₂ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load is 80 psf (3.83 kN/m²) or greater. The partition load shall be not less than a uniformly distributed live load of 15 psf (0.72 kN/m²).

**TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS**

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION	
1.	Apartments (see residential)	—	—	—	
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms	150 ^b	—	—	
4.	Assembly areas	Fixed seats (fastened to floor)	60 ^a	—	—
		Follow spot, projections and control rooms	50		
		Lobbies	100 ^a		
		Movable seats	100 ^a		
		Stage floors	150 ^b		
		Platforms (assembly)	100 ^a		
		Bleachers, folding and telescopic seating and grandstands	100 ^a (See Section 1607.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60 ^a (See Section 1607.19)		
		Other assembly areas	100 ^a		
5.	Balconies and decks	1.5 times the live load for the area served, not required to exceed 100	—	—	
6.	Catwalks for maintenance and service access	40	300	—	
7.	Cornices	60	—	—	
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants	100 ^a	—	—	
10.	Dwellings (see residential)	—	—	—	
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)	—	300	—	
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200	—	
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders	See Section 1607.17		—	
15.	Garages	Passenger vehicles only	40 ^c	See Section 1607.7	—
		Trucks and buses	See Section 1607.8		
16.	Handrails, guards and grab bars	See Section 1607.9		—	
17.	Helipads	See Section 1607.6		—	
18.	Hospitals	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)	—	—	—	
20.	Libraries	Corridors above first floor	80	1,000	—
		Reading rooms	60	1,000	—
		Stack rooms	150 ^b	1,000	Section 1607.18

(continued)

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION		
21.	Manufacturing	Heavy	250 ^b	3,000	—	
		Light	125 ^b	2,000		
22.	Marquees, except one- and two-family dwellings		75	—	—	
23.	Office buildings	Corridors above first floor	80	2,000	—	
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy		—		—
		Lobbies and first-floor corridors		100		2,000
		Offices		50		2,000
24.	Penal institutions	Cell blocks	40	—	—	
		Corridors	100			
25.	Recreational uses	Bowling alleys, poolrooms and similar uses	75 ^a	—	—	
		Dance halls and ballrooms	100 ^a			
		Gymnasiums	100 ^a			
		Ice skating rinks	250 ^b			
		Roller skating rinks	100 ^a			
26.	Residential	One- and two-family dwellings:		—	Section 1607.22	
		Uninhabitable attics without storage	10			
		Uninhabitable attics with storage	20			
		Habitable attics and sleeping areas	30			
		Canopies, including marquees	20			
		All other areas	40			
		Hotels and multifamily dwellings:				
		Private rooms and corridors serving them	40			
Public rooms ^a and corridors serving them	100					
27.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)	20	—	Section 1607.14.2	
		Roof areas used for assembly purposes	100 ^a	—		
		Roof areas used for occupancies other than assembly	Same as occupancy served	—		
		Vegetative and landscaped roofs:		—		
		Roof areas not intended for occupancy	20	—		
		Roof areas used for assembly purposes	100 ^a	—		
		Roof areas used for other occupancies	Same as occupancy served	—		
		Awnings and canopies:		—		
		Fabric construction supported by a skeleton structure	5 ^a	—		
		All other construction, except one- and two-family dwellings	20	—		
		Primary roof members exposed to a work floor:				
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages	—	2,000		Section 1607.15.2
All other primary roof members	—	300				
All roof surfaces subject to maintenance workers	—	300				

(continued)

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION	
28.	Schools	Classrooms	40	1,000	—
		Corridors above first floor	80	1,000	
		First-floor corridors	100	1,000	
29.	Scuttles, skylight ribs and accessible ceilings		—	200	—
30.	Sidewalks, vehicular driveways and yards, subject to trucking		250 ^b	8,000	Section 1607.20
31.	Stairs and exits	One- and two-family dwellings	40	300	Section 1607.21
		All other	100	300	Section 1607.21
32.	Storage areas above ceilings		20	—	—
33.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250 ^b	—	—
		Light	125 ^b		
34.	Stores	Retail:			—
		First floor	100	1,000	
		Upper floors	75	1,000	
		Wholesale, all floors	125 ^b	1,000	
35.	Vehicle barriers		See Section 1607.10		—
36.	Walkways and elevated platforms (other than exitways)		60	—	—
37.	Yards and terraces, pedestrian		100 ^a	—	—
38.	[OSHPD IR, 2 & 5] Storage racks and wall-hung cabinets.		Total loads ^d	—	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kN/m², 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m³.

- a. Live load reduction is not permitted.
- b. Live load reduction is only permitted in accordance with Section 1607.12.1.2 or Item 1 of Section 1607.12.2.
- c. Live load reduction is only permitted in accordance with Section 1607.12.1.3 or Item 2 of Section 1607.12.2.
- d. [OSHPD IR, 2 & 5] The minimum vertical design live load shall be as follows:

Paper media:

- 12-inch-deep (305 mm) shelf 33 pounds per lineal foot (482 N/m)
- 15-inch-deep (381 mm) shelf 41 pounds per lineal foot (598 N/m), or
- 33 pounds per cubic foot (5183 N/m³) per total volume of the rack or cabinet, whichever is less.

Film media:

- 18-inch-deep (457 mm) shelf 100 pounds per lineal foot (1459 N/m), or
- 50 pounds per cubic foot (7853 N/m³) per total volume of the rack or cabinet, whichever is less.

Other media:

- 20 pounds per cubic foot (311 N/m³) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

1607.6 Helipads. Helipads shall be designed for the following live loads:

1. A uniform live load, L , as specified in Items 1.1 and 1.2. This load shall not be reduced.
 - 1.1. 40 psf (1.92 kN/m²) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.
 - 1.2. 60 psf (2.87 kN/m²) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).
2. A single concentrated live load, L , of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
3. Two single concentrated live loads, L , 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

1607.7 Passenger vehicle garages. Floors in garages or portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads indicated in Table 1607.1 or the following concentrated load:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).
2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607.8 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607.8.1 through 1607.8.5.

1607.8.1 Loads. Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required

by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607.8.2 Fire truck and emergency vehicles. Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official.
2. The live loading specified in Section 1607.8.1.

1607.8.3 Heavy vehicle garages. Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such loads and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.9 kN/m²). This live load shall not be reduced.

1607.8.4 Forklifts and movable equipment. Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted in accordance with Section 1607.8.5.

1607.8.4.1 Impact and fatigue. Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section 106.1.

1607.9 Loads on handrails, guards, grab bars, shower seats, dressing room bench and seats. Handrails and guards shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607.9.2.

1607.9.1 Handrails and guards. Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. Glass handrail assemblies and guards shall comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.9.1.1 shall be applied.

- In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607.9.1.1 Concentrated load. Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

1607.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607.9.2 Grab bars, shower seats and accessible benches. Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum load effects. *[DSA-AC & HCD 1-AC] See Chapter 11A, Section 1127A.4 and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

1607.10 Vehicle barriers. Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

1607.11 Impact loads. The live loads specified in Sections 1607.3 through 1607.10 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.11.1 Elevators. Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1/CSA B44.

1607.11.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

- Light machinery, shaft- or motor-driven, 20 percent.
- Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607.11.3 Elements supporting hoists for façade access and building maintenance equipment. In addition to any other applicable live loads, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a live load of 2.5 times the rated load of the hoist or the stall load of the hoist, whichever is larger.

1607.11.4 Fall arrest, lifeline, and rope descent system anchorages. In addition to any other applicable live loads, fall arrest, lifeline, and rope descent system anchorages

and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the load can be applied.

Anchorage of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

1607.12 Reduction in uniform live loads. Except for uniform live loads at roofs, all other minimum uniformly distributed live loads, L_o , in Table 1607.1 are permitted to be reduced in accordance with Section 1607.12.1 or 1607.12.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.14.2.

1607.12.1 Basic uniform live load reduction. Subject to the limitations of Sections 1607.12.1.1 through 1607.12.1.3 and Table 1607.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m²) or more are permitted to be designed for a reduced uniformly distributed live load, L , in accordance with the following equation:

$$L = L_o \left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}} \right) \quad \text{(Equation 16-7)}$$

$$\text{For SI: } L = L_o \left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}} \right)$$

where:

L = Reduced design live load per square foot (m²) of area supported by the member.

L_o = Unreduced design live load per square foot (m²) of area supported by the member (see Table 1607.1).

K_{LL} = Live load element factor (see Table 1607.12.1).

A_T = Tributary area, in square feet (m²).

L shall be not less than $0.50L_o$ for members supporting one floor and L shall be not less than $0.40L_o$ for members supporting two or more floors.

**TABLE 1607.12.1
LIVE LOAD ELEMENT FACTOR, K_{LL}**

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
Members not previously identified including:	1
Edge beams with cantilever slabs	
Cantilever beams	
One-way slabs	
Two-way slabs	
Members without provisions for continuous shear transfer normal to their span	

1607.12.1.1 One-way slabs. The tributary area, A_T , for use in Equation 16-7 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

1607.12.1.2 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m²) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load shall be not less than L as calculated in Section 1607.12.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607.12.1.3 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load shall be not less than L as calculated in Section 1607.12.1.

1607.12.2 Alternative uniform live load reduction. As an alternative to Section 1607.12.1 and subject to the limitations of Table 1607.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m²) except that the design live load for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

Exception: For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.
3. For live loads not exceeding 100 psf (4.79 kN/m²), the design live load for any structural member supporting 150 square feet (13.94 m²) or more is permitted to be reduced in accordance with Equation 16-8
4. For one-way slabs, the area, A , for use in Equation 16-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

$$R = 0.08(A - 150) \quad \text{(Equation 16-8)}$$

For SI: $R = 0.861(A - 13.94)$

Such reduction shall not exceed the smallest of:

1. 40 percent for members supporting one floor.
2. 60 percent for members supporting two or more floors.
3. R as determined by the following equation:

$$R = 23.1(1 + D/L_o) \quad \text{(Equation 16-9)}$$

where:

A = Area of floor supported by the member, square feet (m²).

D = Dead load per square foot (m²) of area supported.

L_o = Unreduced live load per square foot (m²) of area supported.

R = Reduction in percent.

1607.13 Distribution of floor loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607.12.

1607.14 Roof loads. The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.14.1 Distribution of roof loads. Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m²) in accordance with Section 1607.14.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607.14.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

1607.14.2 Reduction in uniform roof live loads. The minimum uniformly distributed live loads of roofs and marquees, L_o , in Table 1607.1 are permitted to be reduced in accordance with Section 1607.14.2.1.

1607.14.2.1 Ordinary roofs, awnings and canopies.

Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r , as specified in the following equations or other controlling combinations of loads as specified in Section 1605, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a

lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m²).

$$L_r = L_o R_1 R_2 \quad \text{(Equation 16-10)}$$

where: $12 \leq L_r \leq 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \leq L_r \leq 0.96$

L_o = Unreduced roof live load per square foot (m²) of horizontal projection supported by the member (see Table 1607.1).

L_r = Reduced roof live load per square foot (m²) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

$$R_1 = 1 \text{ for } A_t \leq 200 \text{ square feet (18.58 m}^2\text{)} \quad \text{(Equation 16-11)}$$

$$R_1 = 1.2 - 0.001A_t \text{ for } 200 \text{ square feet} < A_t < 600 \text{ square feet} \quad \text{(Equation 16-12)}$$

For SI: $1.2 - 0.011A_t$ for 18.58 square meters < A_t < 55.74 square meters

$$R_1 = 0.6 \text{ for } A_t \geq 600 \text{ square feet (55.74 m}^2\text{)} \quad \text{(Equation 16-13)}$$

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m²) supported by the member, and

$$R_2 = 1 \text{ for } F \leq 4 \quad \text{(Equation 16-14)}$$

$$R_2 = 1.2 - 0.05 F \text{ for } 4 < F < 12 \quad \text{(Equation 16-15)}$$

$$R_2 = 0.6 \text{ for } F \geq 12 \quad \text{(Equation 16-16)}$$

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.14.2.2 Occupiable roofs. Areas of roofs that are occupiable, such as vegetative roofs, landscaped roofs or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.12.

1607.14.3 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for snow loads and wind loads as specified in Sections 1608 and 1609.

1607.14.4 Photovoltaic panel systems. Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607.14.4.1 through 1607.14.4.5, as applicable.

1607.14.4.1 Roof live load. Roof structures that support photovoltaic panel systems shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof loads with the photovoltaic panel system dead loads.

Exception: Roof live loads need not be applied to the area covered by photovoltaic panels where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.

2. Applicable uniform and concentrated roof loads without the photovoltaic panel system present.

1607.14.4.2 Photovoltaic panels or modules. The structure of a roof that supports solar photovoltaic panels or modules shall be designed to accommodate the full solar photovoltaic panels or modules and ballast dead load, including concentrated loads from support frames in combination with the loads from Section 1607.14.4.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic panels or modules shall be included.

1607.14.4.3 Photovoltaic panels installed on open grid roof structures. Structures with open grid framing and without a roof deck or sheathing supporting photovoltaic panel systems shall be designed to support the uniform and concentrated roof live loads specified in Section 1607.14.4.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m²).

1607.14.4.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load. Other loads and combinations in accordance with Section 1605 shall be accommodated.

1607.14.4.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604.4; checked in accordance with Section 1604.3.6 for deflections; and checked in accordance with Section 1611 for ponding.

1607.15 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.15.1 Maximum wheel load. The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

1607.15.2 Vertical impact force. The maximum wheel loads of the crane shall be increased by the following

percentages to account for the effects of vertical impact or vibration:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-gearred bridge, trolley and hoist	0 percent

1607.15.3 Lateral force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

1607.15.4 Longitudinal force. The longitudinal force on crane runway beams, except for bridge cranes with hand-gearred bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.16 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m²).

1607.16.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following load conditions:

1. The horizontal distributed load need only be applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm²)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

1607.16.2 Fire walls. In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, fire walls and their supports shall be designed to withstand a minimum horizontal allowable stress load of 5 psf (0.240 kN/m²).

1607.17 Fixed ladders. Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7.

Ship's ladders shall be designed to resist the stair loads given in Table 1607.1.

1607.18 Library stack rooms. The live loading indicated in Table 1607.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).
2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607.19 Seating for assembly uses. Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607.19.1.

1607.19.1 Horizontal sway loads. The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.
2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607.20 Sidewalks, vehicular driveways, and yards subject to trucking. The live loading indicated in Table 1607.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

1607.20.1 Uniform loads. In addition to the loads indicated in Table 1607.1, other uniform loads in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607.20.2 Concentrated loads. The concentrated wheel load indicated in Table 1607.1 shall be applied on an area of 4¹/₂ inches by 4¹/₂ inches (114 mm by 114 mm).

1607.21 Stair treads. The concentrated load indicated in Table 1607.1 for stair treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This load need not be assumed to act concurrently with the uniform load.

1607.22 Residential attics. The live loads indicated in Table 1607.1 for attics in residential occupancies shall comply with the requirements of this section.

1607.22.1 Uninhabitable attics without storage. In residential occupancies, uninhabitable attic areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need not be assumed to act concurrently with any other live load requirement.

1607.22.2 Uninhabitable attics with storage. In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).
2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m²).

1607.22.3 Attics served by stairs. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

**SECTION 1608
SNOW LOADS**

1608.1 General. Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 1607.

1608.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figures 1608.2(1) and 1608.2(2) for the contiguous United States and Table 1608.2 for Alaska. Site-specific case studies shall be made in areas designated “CS” in Figures 1608.2(1) and 1608.2(2). Ground snow loads for sites at elevations above the limits indicated in Figures 1608.2(1) and 1608.2(2) and for all sites within the CS areas shall be approved. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval). Snow loads are zero for Hawaii, except in mountainous regions as approved by the building official.

1608.3 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

**SECTION 1609
WIND LOADS**

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

**TABLE 1608.2
GROUND SNOW LOADS, p_g , FOR ALASKAN LOCATIONS**

LOCATION	POUNDS PER SQUARE FOOT
Adak	30
Anchorage	50
Angoon	70
Barrow	25
Barter Island	35
Bethel	40
Big Delta	50
Cold Bay	25
Cordova	100
Fairbanks	60
Fort Yukon	60
Galena	60
Gulkana	70
Homer	40
Juneau	60
Kenai	70
Kodiak	30
Kotzebue	60
McGrath	70
Nenana	80
Nome	70
Palmer	50
Petersburg	150
St. Paul Islands	40
Seward	50
Shemya	25
Sitka	50
Talkeetna	120
Unalakleet	50
Valdez	160
Whittier	300
Wrangell	60
Yakutat	150

For SI: 1 pound per square foot = 0.0479 kN/m².

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609 or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AWC WFCM.

3. Subject to the limitations of Section 1609.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.

The wind speeds in Figures 1609.3(1) through 1609.3(12) are basic design wind speeds, V , and shall be converted in accordance with Section 1609.3.1 to allowable stress design wind speeds, V_{asd} , when the provisions of the standards referenced in Exceptions 4 and 5 are used.

1609.1.1.1 Applicability. The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of ICC 600, AWC WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting all of the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C.
2. The maximum average slope of the hill exceeds 10 percent.
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 2 miles (3.22 km), whichever is greater.

1609.2 Protection of openings. In windborne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E1996 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.

2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.

Exceptions:

1. Wood structural panels with a minimum thickness of $\frac{7}{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less that are classified as a Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609.3.1 does not exceed 140 mph (63 m/s).
2. Glazing in *Risk Category I* buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in *Risk Category II, III or IV* buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

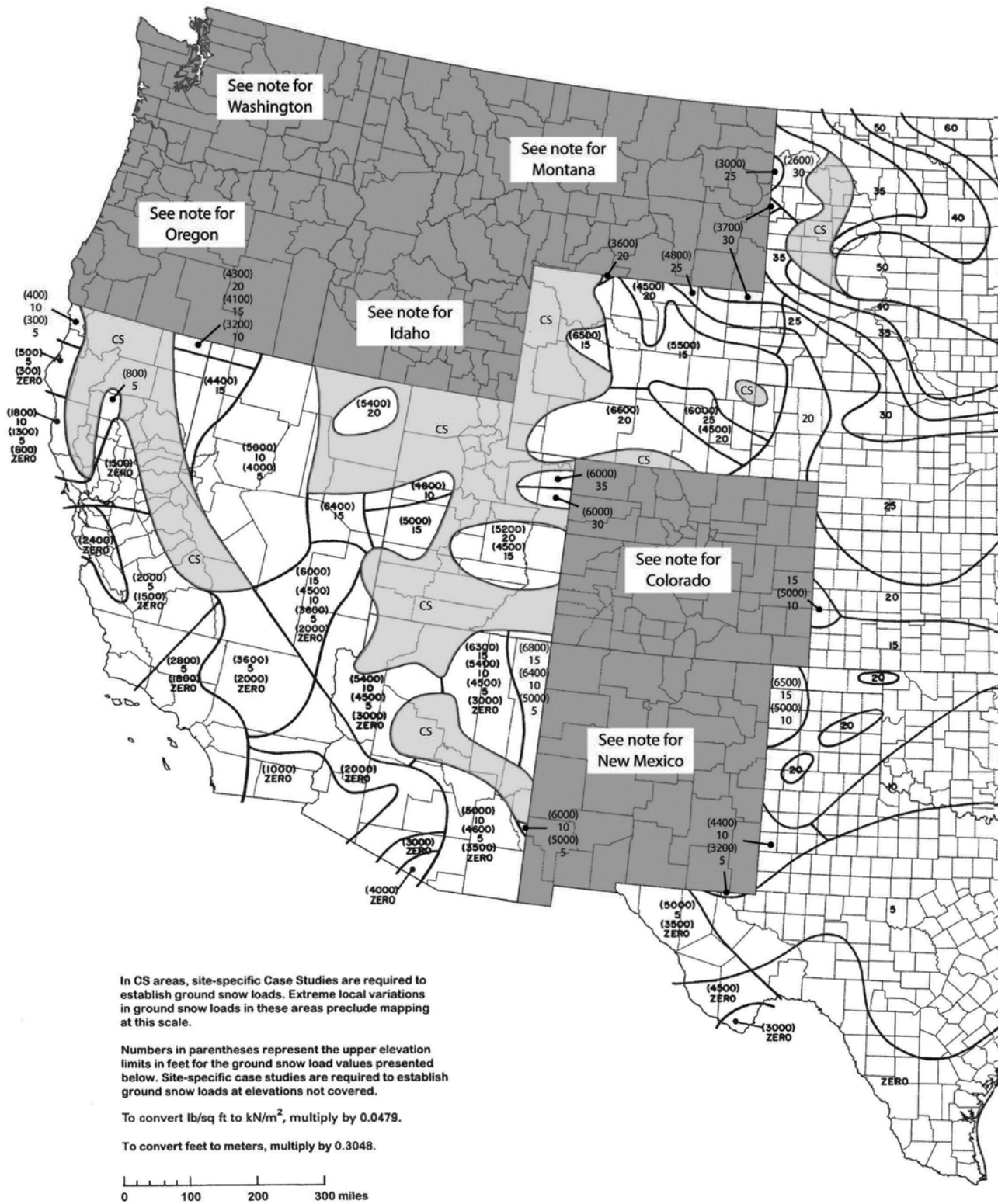
1609.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540.

TABLE 1609.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS^{a, b, c, d}

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
$\frac{1}{4}$ -inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

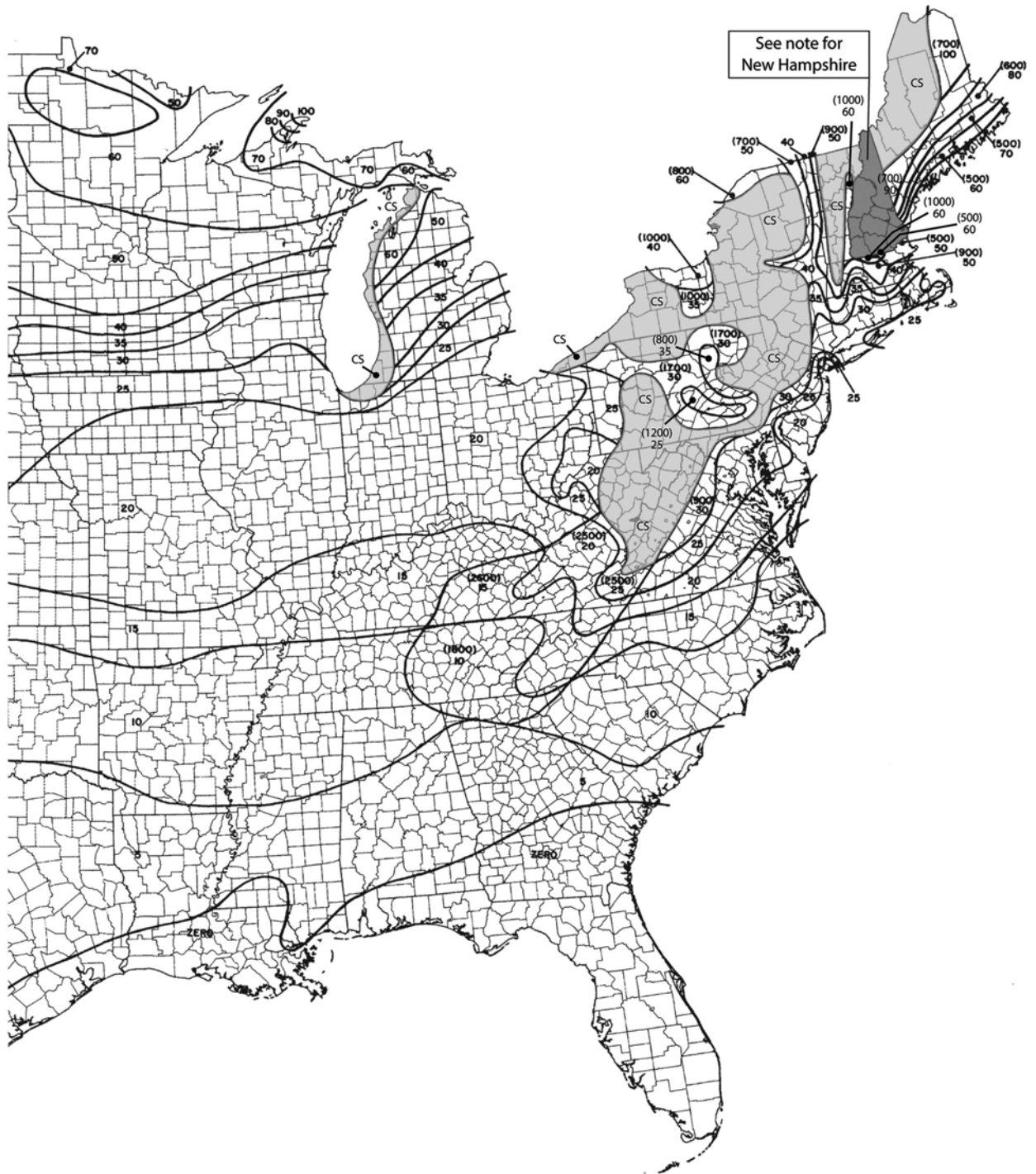
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

- a. This table is based on 140 mph wind speeds and a 45-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.
- c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located not less than $2\frac{1}{2}$ inches from the edge of concrete block or concrete.
- d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.



NOTE: See ASCE 7 Table 7.2-2 for Colorado, Table 7.2-3 for Idaho, Table 7.2-4 for Montana, Table 7.2-5 for Washington, Table 7.2-6 for New Mexico and Table 7.2-7 for Oregon.

FIGURE 1608.2(1)
GROUND SNOW LOADS, p_g , FOR THE UNITED STATES (psf)



NOTE: See ASCE 7 Table 7.2-8 for New Hampshire.

FIGURE 1608.2(2)
GROUND SNOW LOADS, p_g , FOR THE UNITED STATES (psf)

1609.2.2 Application of ASTM E1996. The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the basic design wind speed, V , as follows:

6.2.2.1 *Wind Zone 1*—130 mph \leq basic design wind speed, $V < 140$ mph.

6.2.2.2 *Wind Zone 2*—140 mph \leq basic design wind speed, $V < 150$ mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 *Wind Zone 3*—150 mph (67 m/s) \leq basic design wind speed, $V \leq 160$ mph (72 m/s), or 140 mph (63 m/s) \leq basic design wind speed, $V \leq 160$ mph (72 m/s) and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 *Wind Zone 4*— basic design wind speed, $V > 160$ mph (72 m/s).

1609.2.3 Garage doors. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

1609.3 Basic design wind speed. The basic design wind speed, V , in mph, for the determination of the wind loads shall be determined by Figures 1609.3(1) through 1609.3(12). The basic design wind speed, V , for use in the design of *Risk Category II* buildings and structures shall be obtained from Figures 1609.3(1), 1609.3(5) and 1609.3(6). The basic design wind speed, V , for use in the design of *Risk Category III* buildings and structures shall be obtained from Figures 1609.3(2), 1609.3(7) and 1609.3(8). The basic design wind speed, V , for use in the design of *Risk Category IV* buildings and structures shall be obtained from Figures 1609.3(3), 1609.3(9) and 1609.3(10). The basic design wind speed, V , for use in the design of *Risk Category I* buildings and structures shall be obtained from Figures 1609.3(4), 1609.3(11) and 1609.3(12). The basic design wind speed, V , for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic design wind speeds, V , determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7.

In nonhurricane-prone regions, when the basic design wind speed, V , is estimated from regional climatic data, the basic design wind speed, V , shall be determined in accordance with Chapter 26 of ASCE 7.

1609.3.1 Wind speed conversion. Where required, the basic design wind speeds of Figures 1609.3(1) through 1609.3(12) shall be converted to allowable stress design wind speeds, V_{asd} , using Table 1609.3.1 or Equation 16-17.

$$V_{asd} = V\sqrt{0.6} \quad \text{(Equation 16-17)}$$

where:

V_{asd} = Allowable stress design wind speed applicable to methods specified in Exceptions 4 and 5 of Section 1609.1.1.

V = Basic design wind speeds determined from Figures 1609.3(1) through 1609.3(12).

1609.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the following categories, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

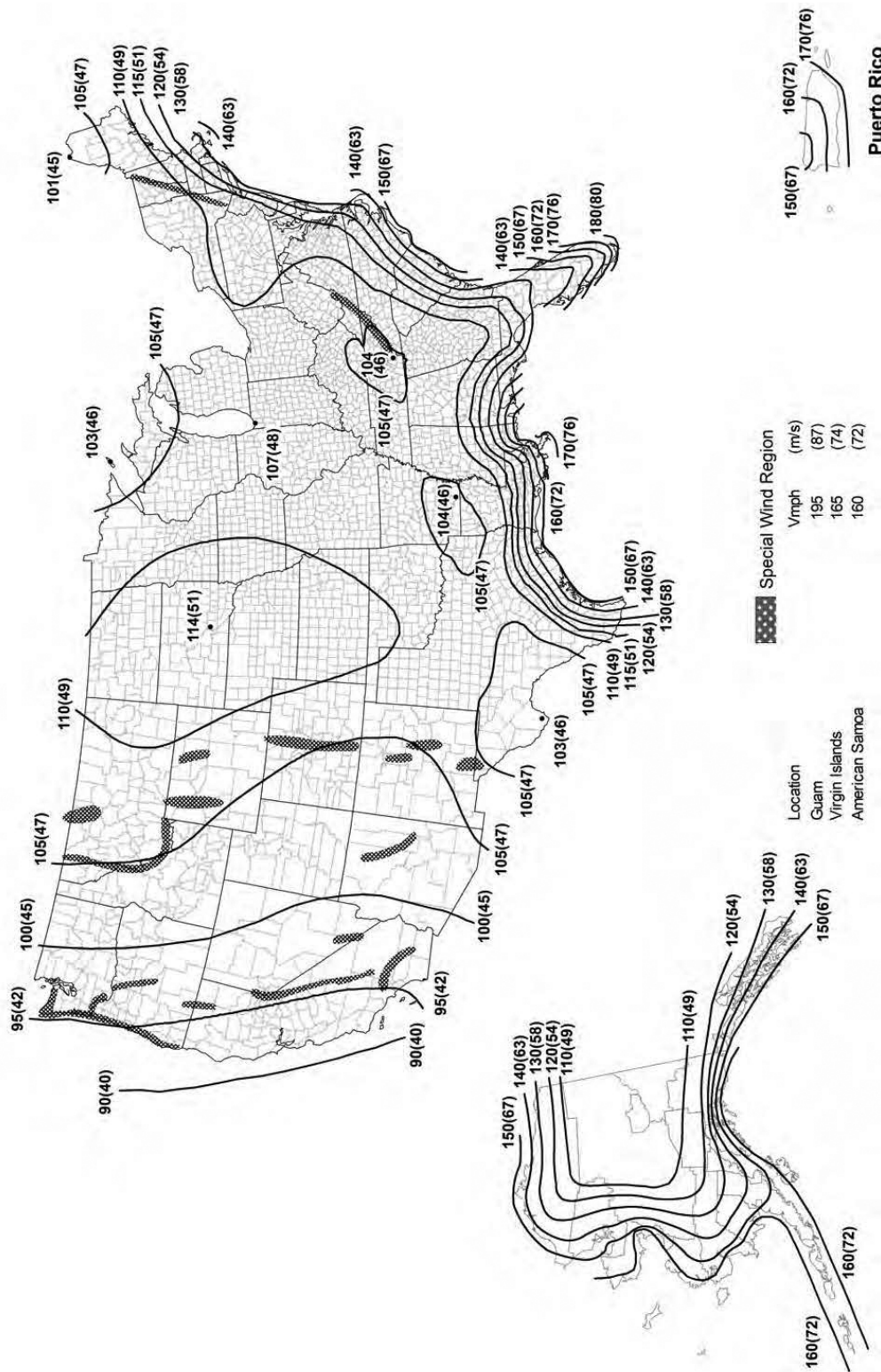
Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of not less than 1,500 feet (457 m). For buildings with a mean roof height greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of not less than 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exposure C. Exposure C shall apply for all cases where Exposure B or D does not apply.

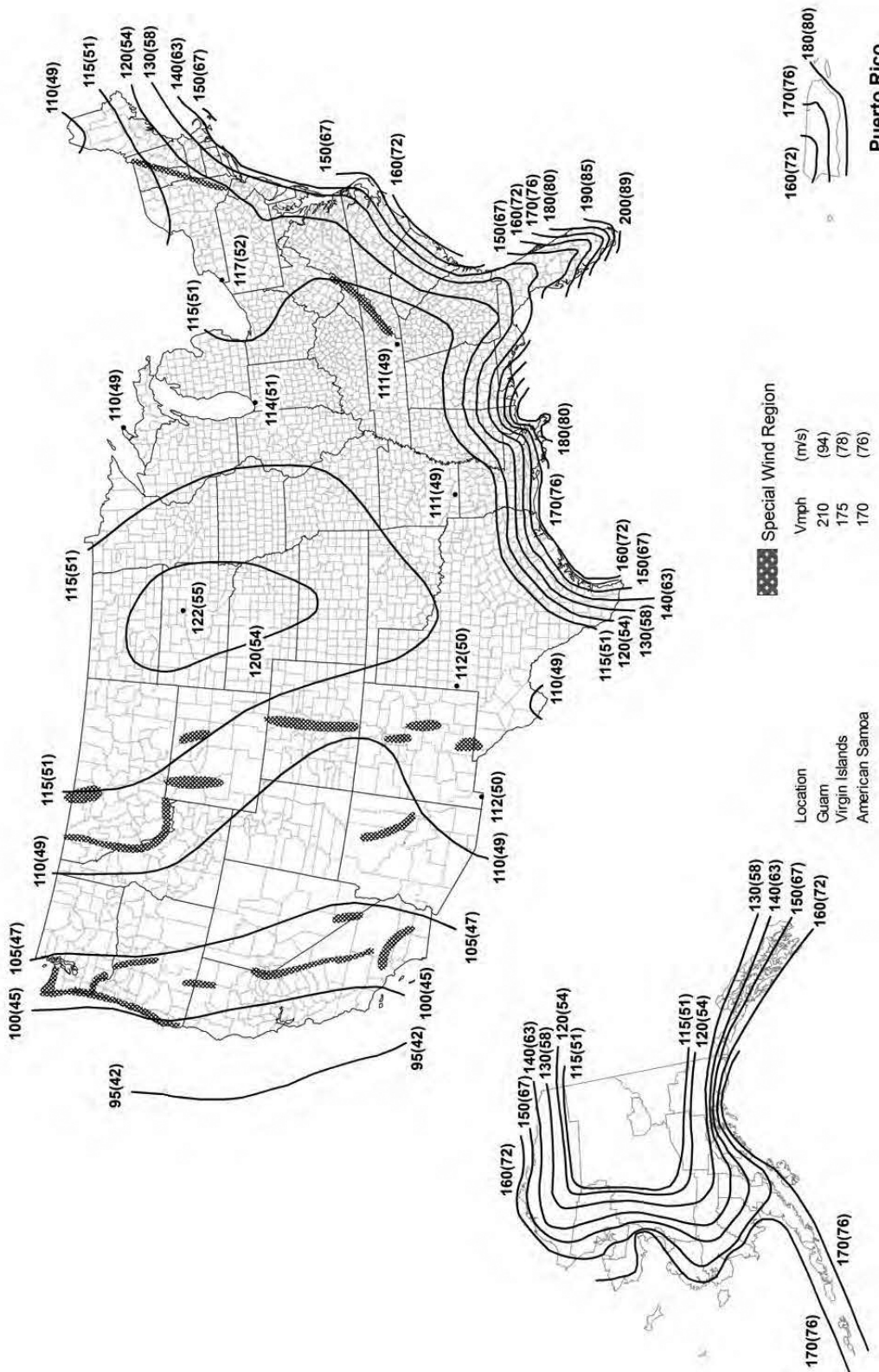
Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.



Notes:

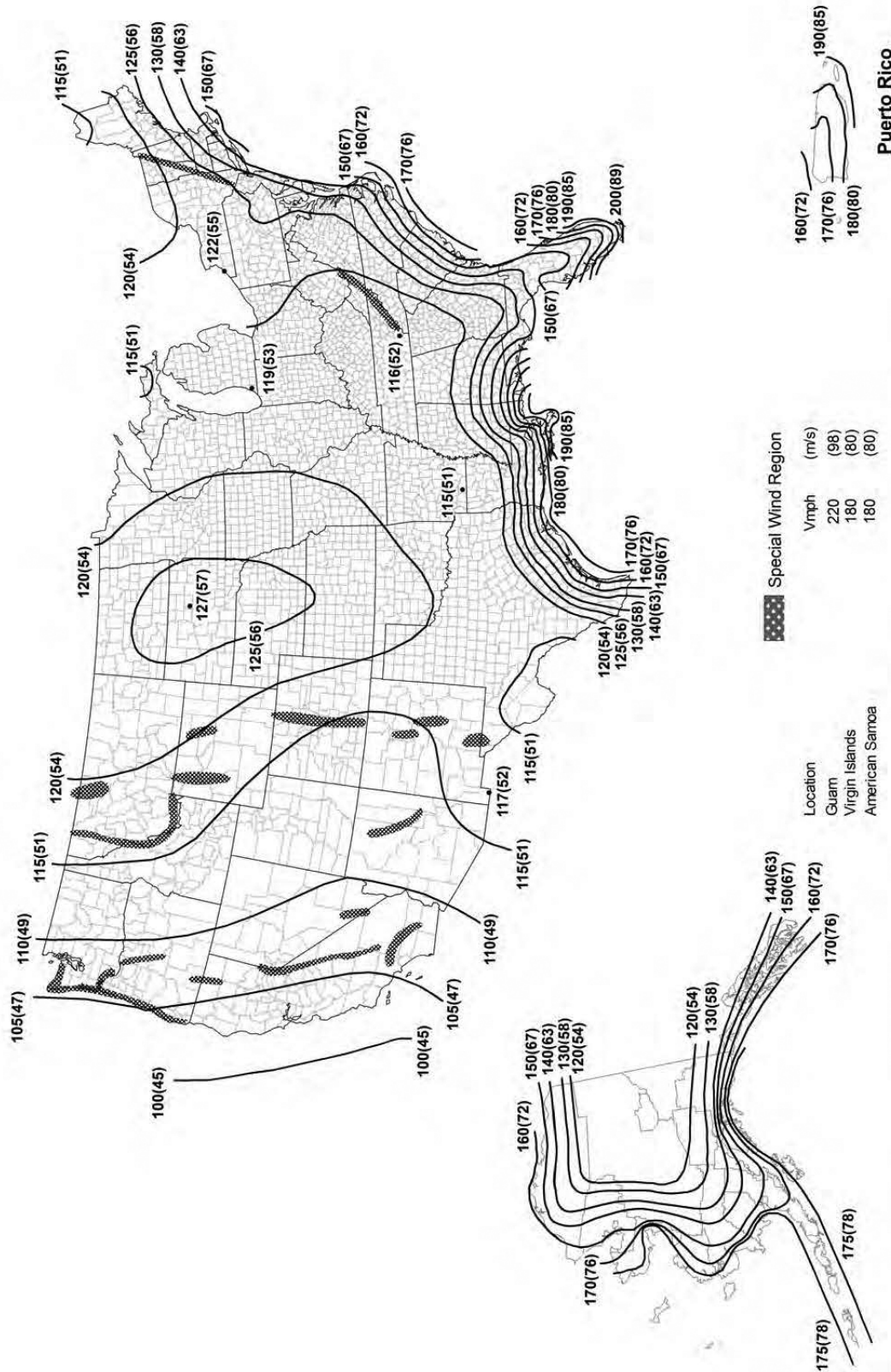
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
2. Linear interpolation between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be determined using www.atcouncil.org/windspeed

**FIGURE 1609.3(1)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES**



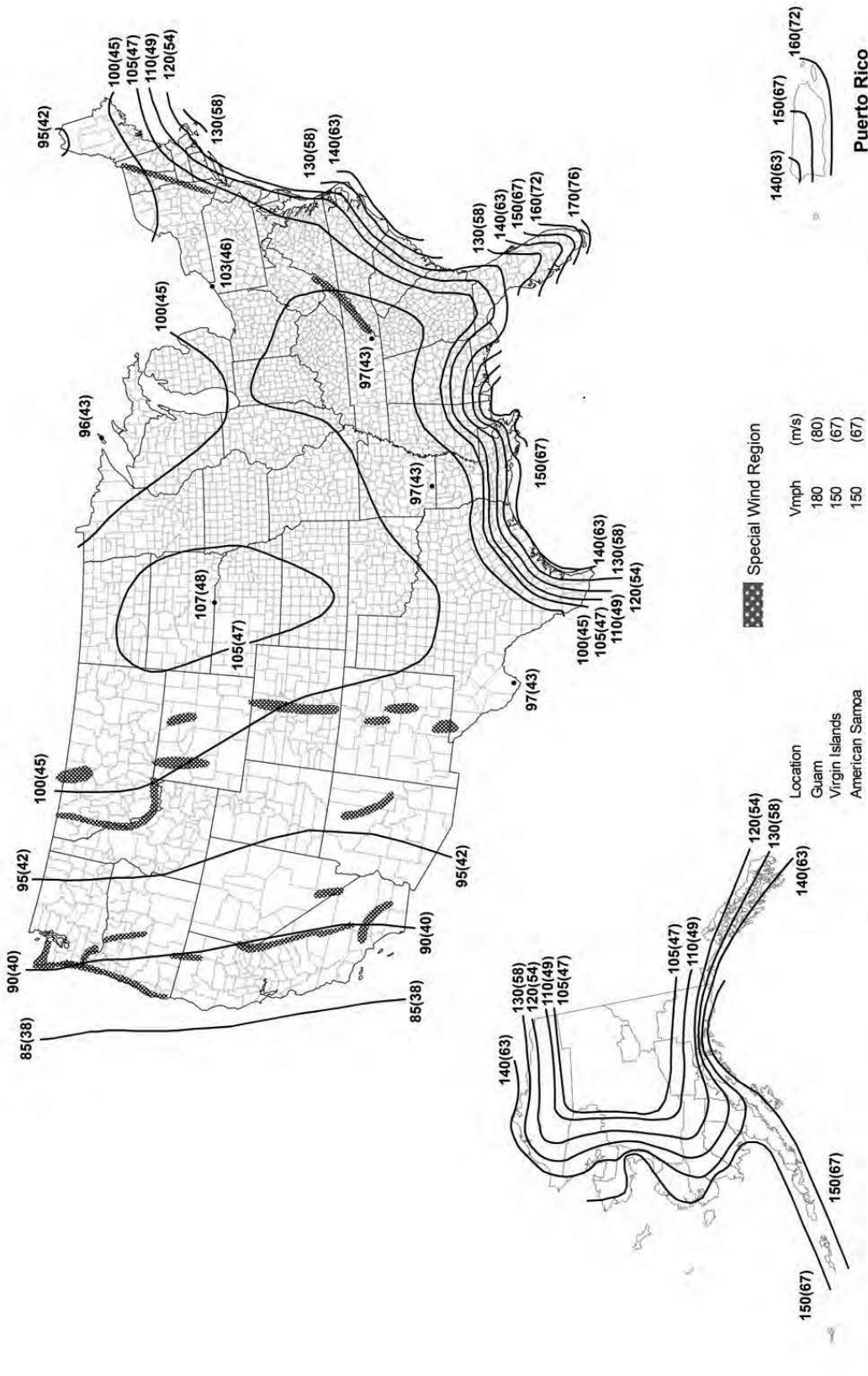
- Notes:**
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
 2. Linear interpolation between contours. Point values are provided to aid with interpolation.
 3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
 4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
 5. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
 6. Location-specific basic wind speeds shall be determined using www.atcouncil.org/windspeed

FIGURE 1609.3(2) BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES



- Notes:**
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
 2. Linear interpolation between contours. Point values are provided to aid with interpolation.
 3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
 4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
 5. Wind speeds correspond to approximately a 1.6% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00033, MRI = 3000 Years).
 6. Location-specific basic wind speeds shall be determined using www.atcouncil.org/windspeed

FIGURE 1609.3(3) BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES



- Notes:**
1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
 2. Linear interpolation between contours. Point values are provided to aid with interpolation.
 3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
 4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
 5. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00333, MRI = 300 Years).
 6. Location-specific basic wind speeds shall be determined using www.atcouncil.org/windspeed.

FIGURE 1609.3(4)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES

➔ **1609.5 Roof systems.** Roof systems shall be designed and constructed in accordance with Sections 1609.5.1 through 1609.5.3, as applicable.

1609.5.1 Roof deck. The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609.5.2 Roof coverings. Roof coverings shall comply with Section 1609.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind-resistance requirements of Section 1504.2.

1609.5.3 Rigid tile. Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - G C_p] \quad \text{(Equation 16-18)}$$

For SI:

$$M_a = \frac{q_h C_L b L L_a [1.0 - G C_p]}{1,000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.3.1.

G C_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76*L* from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and

fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m²) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.
3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have not less than two-thirds of the tile's area free of mortar or adhesive contact.

SECTION 1610

SOIL LOADS AND HYDROSTATIC PRESSURE

1610.1 Lateral pressures. Foundation walls and retaining walls shall be designed to resist lateral soil loads from adjacent soil. Soil loads specified in Table 1610.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Lateral pressure from surcharge loads shall be added to the lateral soil load. Lateral pressure shall be increased if expan-

TABLE 1609.3.1
WIND SPEED CONVERSIONS^{a, b, c}

<i>V</i>	100	110	120	130	140	150	160	170	180	190	200
<i>V_{asd}</i>	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b. *V_{asd}* = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609.1.1.

c. *V* = basic design wind speeds determined from Figures 1609.3(1) through 1609.3(12).

STRUCTURAL DESIGN

sive soils are present at the site. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805.4.2 and 1805.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

1610.2 Uplift loads on floor and foundations. Basement floors, slabs on ground, foundations, and similar approximately horizontal elements below grade shall be designed to resist uplift loads where applicable. The upward pressure of water shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic load shall be measured from the underside of the element being evaluated. The design for upward loads caused by expansive soils shall comply with Section 1808.6.

SECTION 1611 RAIN LOADS

1611.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. The design rainfall shall be based on the 100-year 15-minute duration event, or on other rainfall rates determined from approved local weather data. Alternatively, a design rainfall of twice the 100-year hourly rainfall rate indicated in Figures 1611.1(1) through 1611.1(5) shall be permitted.

$$R = 5.2(d_s + d_h) \quad \text{(Equation 16-19)}$$

For SI: $R = 0.0098(d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (in other words, the hydraulic head), in inches (mm).

d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary drainage system is blocked (in other words, the static head), in inches (mm).

R = Rain load on the undeflected roof, in psf (kN/m²). Where the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

1611.2 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

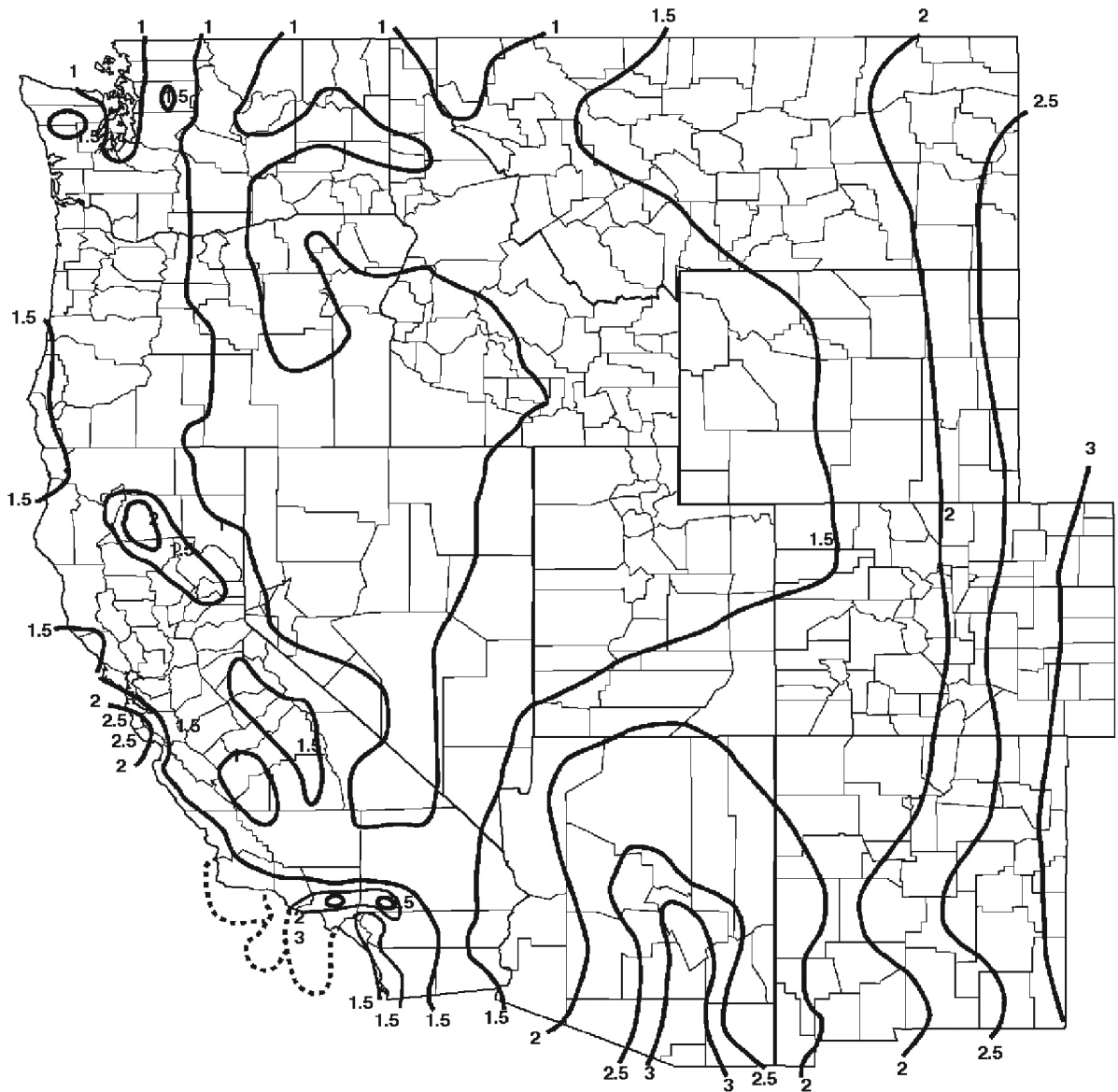
1611.3 Controlled drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611.1. Such roofs shall be checked for ponding instability in accordance with Section 1611.2.

**TABLE 1610.1
LATERAL SOIL LOAD**

DESCRIPTION OF BACKFILL MATERIAL ^c	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD ^a (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

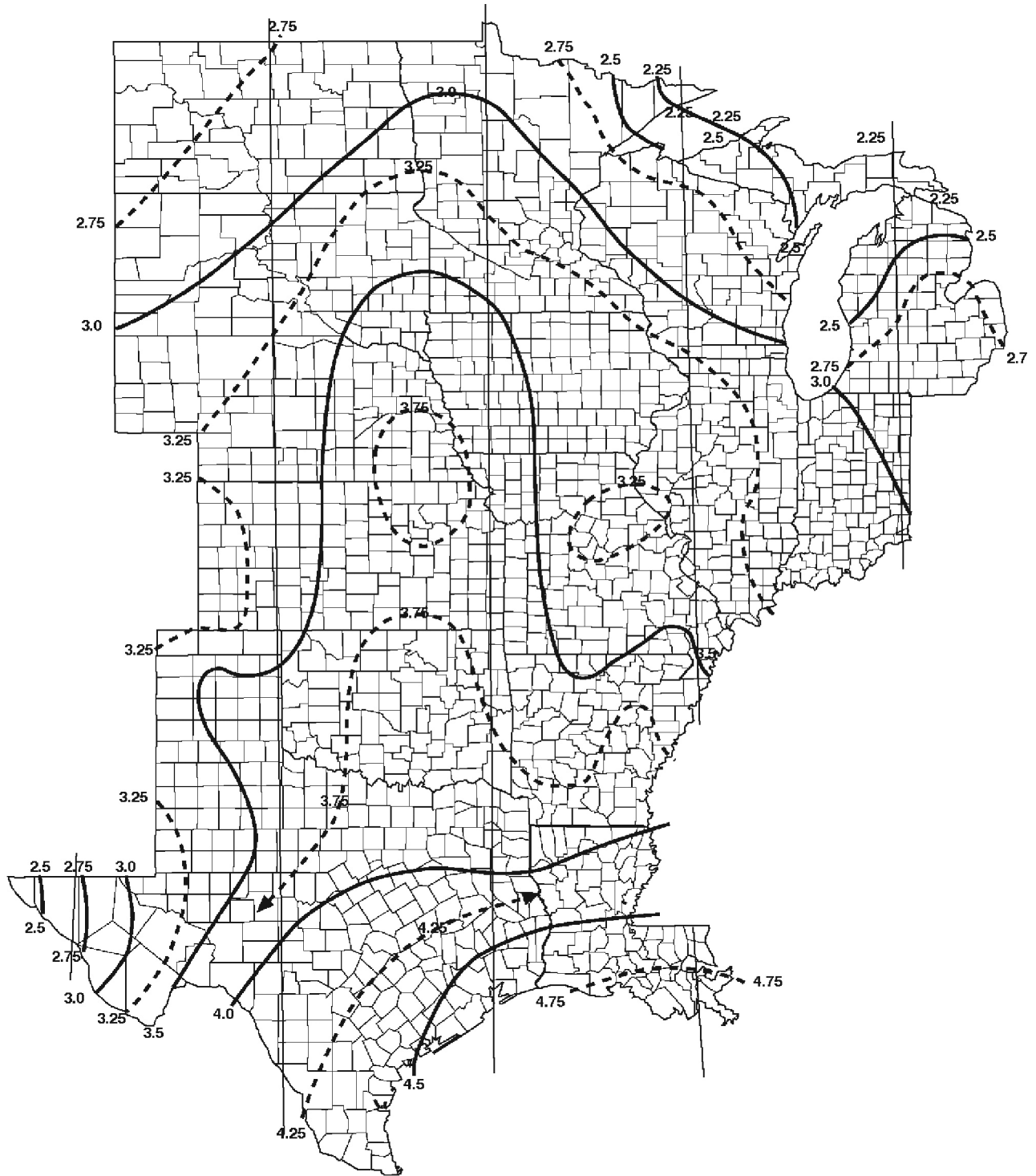
- Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.
- Unsuitable as backfill material.
- The definition and classification of soil materials shall be in accordance with ASTM D2487.



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

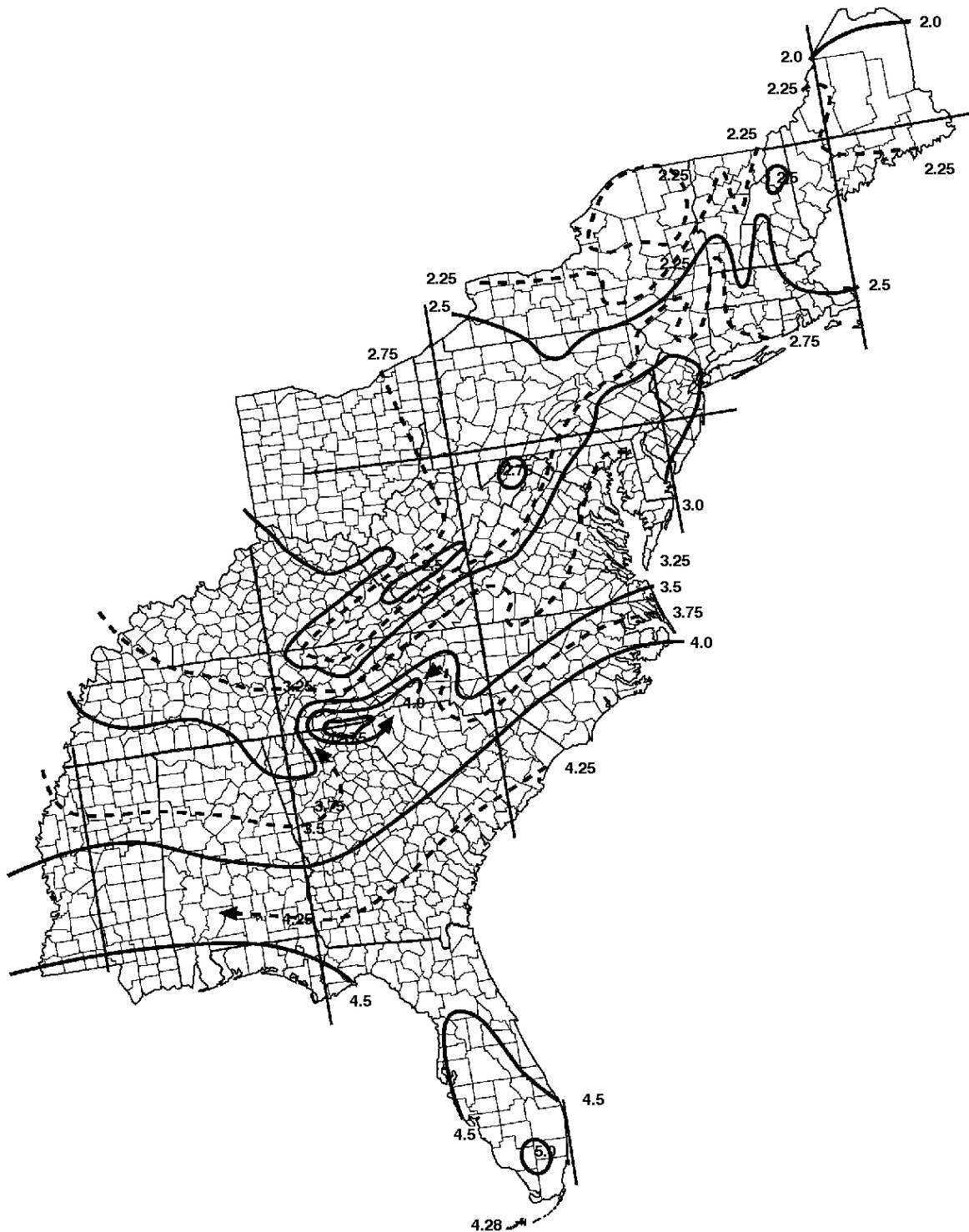
FIGURE 1611.1(1)
100-YEAR, 1-HOUR RAINFALL (INCHES) WESTERN UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

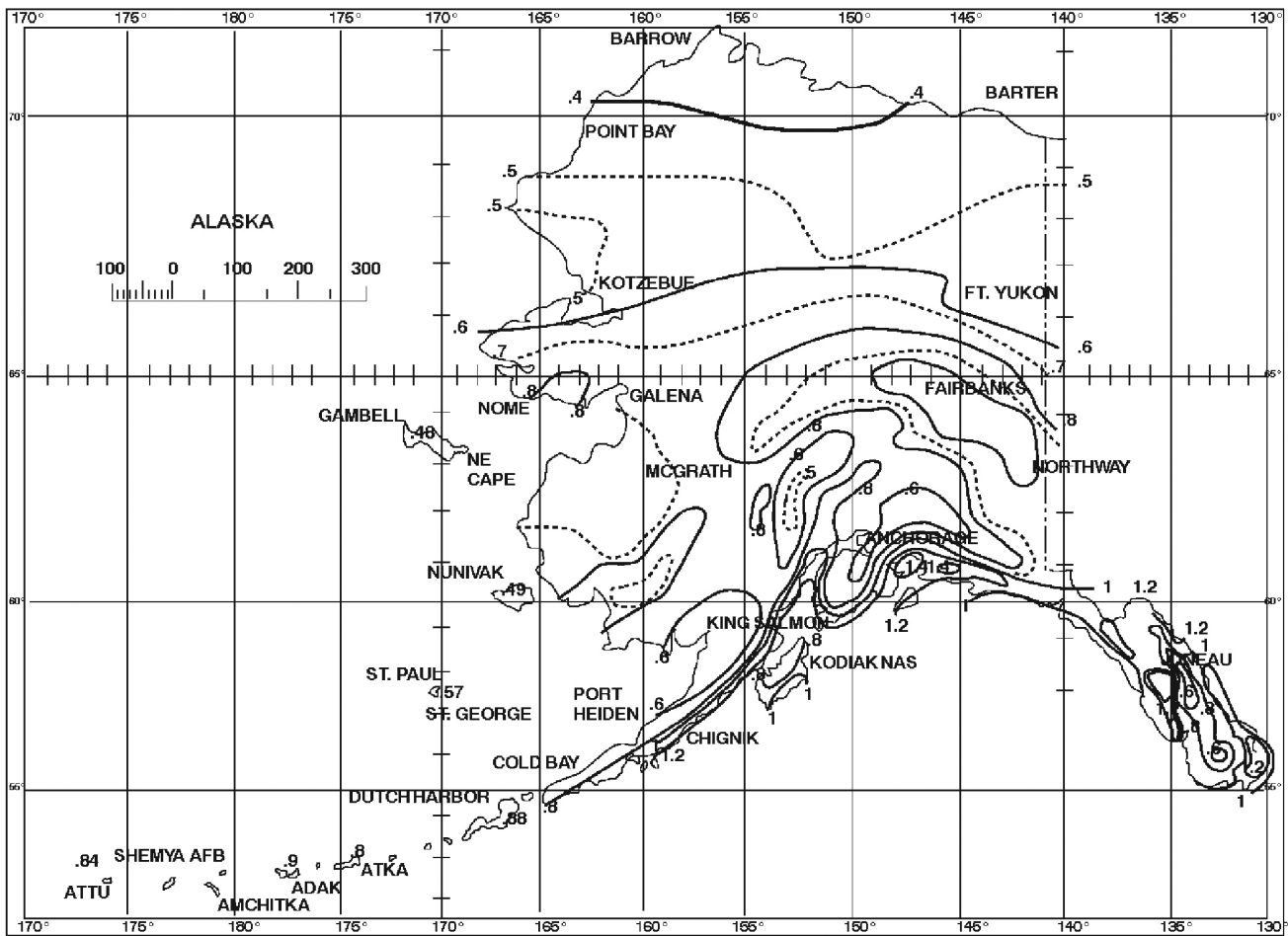
FIGURE 1611.1(2)
100-YEAR, 1-HOUR RAINFALL (INCHES) CENTRAL UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

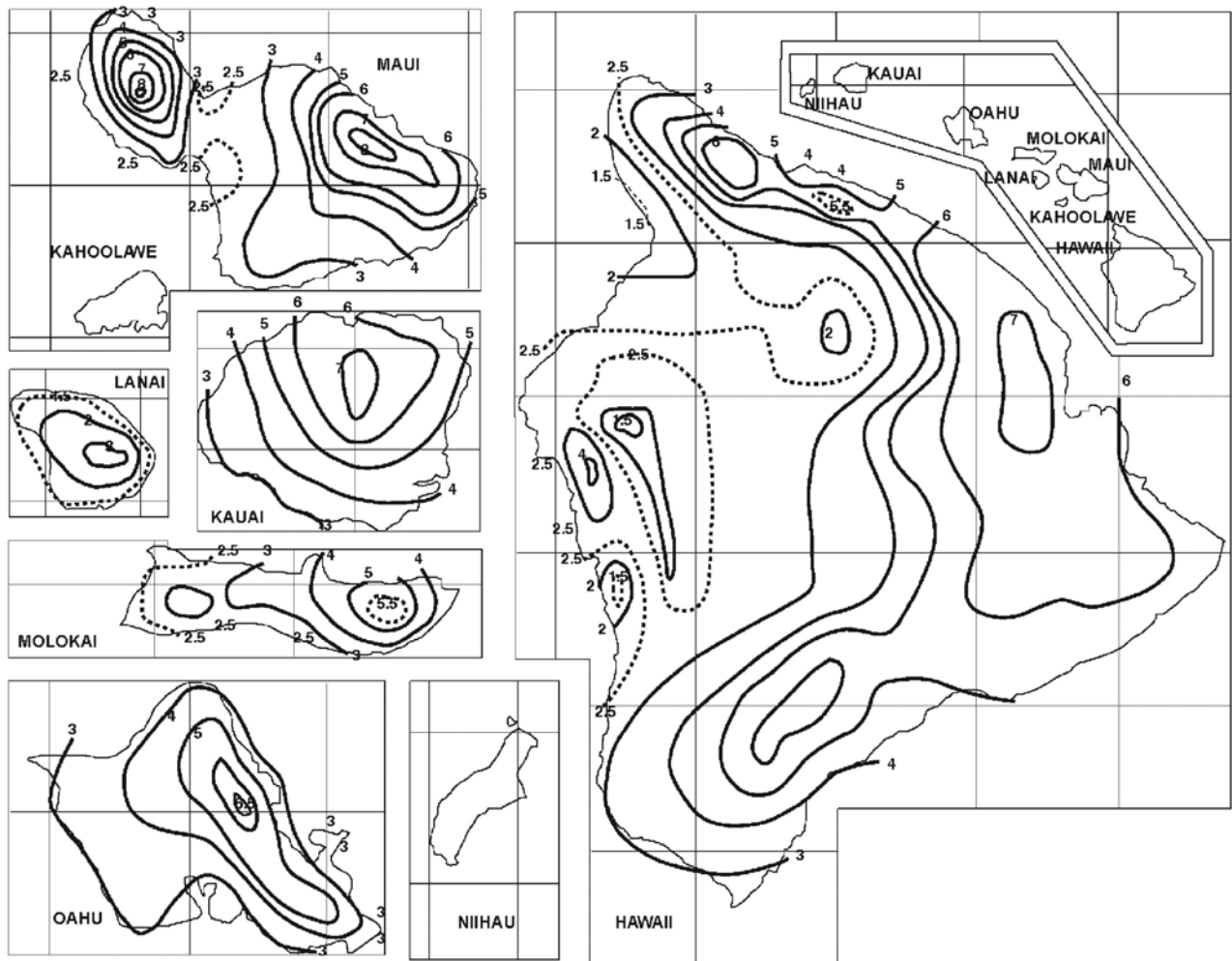
FIGURE 1611.1(3)
100-YEAR, 1-HOUR RAINFALL (INCHES) EASTERN UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

FIGURE 1611.1(4)
100-YEAR, 1-HOUR RAINFALL (INCHES) ALASKA



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

FIGURE 1611.1(5)
100-YEAR, 1-HOUR RAINFALL (INCHES) HAWAII

SECTION 1612 FLOOD LOADS

1612.1 General. Within flood hazard areas as established in Section 1612.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612.2 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

1612.3 Establishment of flood hazard areas. To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency in an engineering report entitled “The *Flood Insurance Study* for [INSERT NAME OF JURISDICTION],” dated [INSERT DATE OF ISSUANCE], as amended or revised with the accompanying *Flood Insurance Rate Map* (FIRM) and *Flood Boundary and Floodway Map* (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

Exception: [OSHPD 1R, 2 & 5] The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency’s Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located.

1612.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612.3, or where floodways are not designated, the building official is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source.
2. Determine the design flood elevation or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood

elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:
 - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
 - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
 - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24 and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.
2. For construction in *coastal high hazard areas* and *coastal A zones*:
 - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
 - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
 - 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m²) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.
 - 2.4. For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.

SECTION 1613 EARTHQUAKE LOADS

1613.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The seismic design category for a structure is permitted to be determined in accordance with Section 1613 or ASCE 7.

Exceptions:

1. Detached one- and two-family dwellings, assigned to *Seismic Design Category A, B or C*, or located where the mapped short-period spectral response acceleration, S_s , is less than 0.4 g.
2. The seismic force-resisting system of wood-frame buildings that conform to the provisions of Section 2308 are not required to be analyzed as specified in this section. *[OSHPD 1R, 2 & 5] Not permitted by OSHPD, see Section 2308.*
3. Agricultural storage structures intended only for incidental human occupancy.
4. Structures that require special consideration of their response characteristics and environment that are not addressed by this code or ASCE 7 and for which other regulations provide seismic criteria, such as vehicular bridges, electrical transmission towers, hydraulic structures, buried utility lines and their appurtenances and nuclear reactors.
5. References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.
6. *[OSHPD 1R, 2 & 5] Seismic Design Category shall be in accordance with exception to Section 1613.2.5.*

1613.1.1 Scope. *[SL] For applications listed in Section 1.12 regulated by the State Librarian, only the provisions of ASCE 7 Tables 13.5-1 and 1607.1, as amended, of this code shall apply.*

1613.1.2 State-owned buildings. *[BSC] State-owned buildings, including those of the University of California, CSU and Judicial Council, shall not be constructed where any portion of the foundation would be within a mapped area of earthquake-induced liquefaction or landsliding or within 50 feet of a mapped fault rupture hazard as established by Section 1803.7.*

1613.1.3 Existing state buildings. *[BSC] Additions, alterations, repairs or change of occupancy category of existing buildings shall be in accordance with the California Existing Building Code, Part 10.*

1613.2 Seismic ground motion values. Seismic ground motion values shall be determined in accordance with this section.

1613.2.1 Mapped acceleration parameters. The parameters S_s and S_1 shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures

1613.2.1(1) through 1613.2.1(10). Where S_1 is less than or equal to 0.04 and S_s is less than or equal to 0.15, the structure is permitted to be assigned *Seismic Design Category A*.

Exception: *[OSHPD 1R, 2 & 5] Seismic Design Category shall be in accordance with exception to Section 1613.2.5.*

1613.2.2 Site class definitions. Based on the site soil properties, the site shall be classified as *Site Class A, B, C, D, E or F* in accordance with Chapter 20 of ASCE 7.

Where the soil properties are not known in sufficient detail to determine the site class, *Site Class D*, subjected to the requirements of Section 1613.2.3, shall be used unless the building official or geotechnical data determines that *Site Class E or F* soils are present at the site.

Where site investigations that are performed in accordance with Chapter 20 of ASCE 7 reveal rock conditions consistent with *Site Class B*, but site-specific velocity measurements are not made, the site coefficients F_a and F_v shall be taken at unity (1.0).

1613.2.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. The maximum considered earthquake spectral response acceleration for short periods, S_{MS} , and at 1-second period, S_{M1} , adjusted for site class effects shall be determined by Equations 16-20 and 16-21, respectively:

$$S_{MS} = F_a S_s \quad \text{(Equation 16-20)}$$

$$S_{M1} = F_v S_1 \quad \text{(Equation 16-21)}$$

but S_{MS} shall not be taken less than S_{M1} except when determining the seismic design category in accordance with Section 1613.2.5.

where:

F_a = Site coefficient defined in Table 1613.2.3(1).

F_v = Site coefficient defined in Table 1613.2.3(2).

S_s = The mapped spectral accelerations for short periods as determined in Section 1613.2.1.

S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1613.2.1.

Where *Site Class D* is selected as the default site class per Section 1613.2.2, the value of F_a shall be not less than 1.2. Where the simplified design procedure of ASCE 7, Section 12.14 is used, the value of F_a shall be determined in accordance with ASCE 7, Section 12.14.8.1, and the values of F_v , S_{MS} and S_{M1} need not be determined.

1613.2.4 Design spectral response acceleration parameters. Five-percent damped design spectral response acceleration at short periods, S_{DS} , and at 1-second period, S_{D1} , shall be determined from Equations 16-22 and Equation 16-23, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \quad \text{(Equation 16-22)}$$

$$S_{DI} = \frac{2}{3}S_{M1} \quad \text{(Equation 16-23)}$$

where:

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613.2.3.

S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613.2.3.

1613.2.5 Determination of seismic design category. Structures classified as *Risk Category* I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1 , is greater than or equal to 0.75 shall be assigned to *Seismic Design Category E*. Structures classified as *Risk Category* IV that are located where the mapped spectral response acceleration parameter at 1-second period, S_1 , is greater than or equal to 0.75 shall be assigned to *Seismic Design Category F*. Other structures shall be assigned to a seismic design category based on their risk category and the design spectral response acceleration parameters, S_{DS} and S_{DI} , determined in accordance with Section 1613.2.4 or the

site-specific procedures of ASCE 7. Each building and structure shall be assigned to the more severe seismic design category in accordance with Table 1613.2.5(1) or 1613.2.5(2), irrespective of the fundamental period of vibration of the structure, T .

Exception: [OSHPD 1R, 2 & 5] Structures not assigned to Seismic Design Category E or F above shall be assigned to Seismic Design Category D.

1613.2.5.1 Alternative seismic design category determination. Where S_1 is less than 0.75, the seismic design category is permitted to be determined from Table 1613.2.5(1) alone where all of the following apply:

1. In each of the two orthogonal directions, the approximate fundamental period of the structure, T_a , in each of the two orthogonal directions determined in accordance with Section 12.8.2.1 of ASCE 7, is less than $0.8 T_s$ determined in accordance with Section 11.8.6 of ASCE 7.
2. In each of the two orthogonal directions, the fundamental period of the structure used to calculate the story drift is less than T_s .

**TABLE 1613.2.3(1) [OSHPD 1R, 2 & 5]
VALUES OF SITE COEFFICIENT F_a^a**

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT SHORT PERIOD					
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s = 1.25$	$S_s \geq 1.5$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9	0.9	0.9	0.9	0.9	0.9
C	1.3	1.3	1.2	1.2	1.2	1.2
D	1.6	1.4	1.2	1.1	1.0	1.0
E	2.4	1.7	1.3	1.2 ^c	1.2 ^c	1.2 ^c
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s .

b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.

c. See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7. These values of F_a shall only be used for calculation of T_s , determination of *Seismic Design Category*, linear interpolation for intermediate values of S_s , and when taking the exception under Item 2 within Section 11.4.8 of ASCE 7.

**TABLE 1613.2.3(2)
VALUES OF SITE COEFFICIENT F_v^a**

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT 1-SECOND PERIOD					
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 = 0.5$	$S_1 \geq 0.6$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8	0.8	0.8	0.8	0.8	0.8
C	1.5	1.5	1.5	1.5	1.5	1.4
D	2.4	2.2 ^c	2.0 ^c	1.9 ^c	1.8 ^c	1.7 ^c
E	4.2	3.3 ^c	2.8 ^c	2.4 ^c	2.2 ^c	2.0 ^c
F	Note b	Note b	Note b	Note b	Note b	Note b

a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1 .

b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.

c. See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7. [OSHPD 1R, 2 & 5] These values of F_v shall only be used for calculation of T_s , determination of *Seismic Design Category*, linear interpolation for intermediate values of S_1 , and when taking the exceptions under Items 1 and 2 of Section 11.4.8 for the calculation of S_{DI} .

3. Equation 12.8-2 of ASCE 7 is used to determine the seismic response coefficient, C_s .
4. The diaphragms are rigid or are permitted to be idealized as rigid in accordance with Section 12.3.1 of ASCE 7 or, for diaphragms permitted to be idealized as flexible in accordance with Section 12.3.1 of ASCE 7, the distances between vertical elements of the seismic force-resisting system do not exceed 40 feet (12 192 mm).

Exception: [OSHPD 1R, 2 & 5] Seismic design category shall be determined in accordance with exception to Section 1613.2.5.

1613.2.5.2 Simplified design procedure. Where the alternate simplified design procedure of ASCE 7 is used, the seismic design category shall be determined in accordance with ASCE 7.

Exception: [OSHPD 1R, 2 & 5] Seismic design category shall be determined in accordance with exception to Section 1613.2.5.

1613.3 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure. Ballasted nonpenetrating systems shall be designed and installed only on roofs with slopes not more than one unit vertical in 12 units horizontal. Ballasted nonpenetrating systems shall be designed to resist sliding and uplift resulting from lateral and vertical forces as required by Section 1605, using a coefficient of friction determined by acceptable engineering principles. In structures assigned to *Seismic Design Category* C, D, E or F, ballasted nonpenetrating systems shall be designed to accommodate seismic displacement determined by nonlinear response-hi story or other approved analysis or

shake-table testing, using input motions consistent with ASCE 7 lateral and vertical seismic forces for nonstructural components on roofs. [OSHPD 1R, 2 & 5] Ballasted photovoltaic panel systems shall be considered as an alternative system.

1613.4 Component Importance Factors. [OSHPD 1R, 2 & 5] Nonstructural components designated below shall have a component importance factor, I_p , equal to 1.5:

1. For components that are required for life-safety purposes after an earthquake, including emergency and standby power systems, mechanical smoke removal systems, fire protection sprinkler systems and fire alarm control panels.
2. For medical equipment required for patient life support.

**SECTION 1614
ATMOSPHERIC ICE LOADS**

1614.1 General. Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

**SECTION 1615
TSUNAMI LOADS**

1615.1 General. The design and construction of *Risk Category* III and IV buildings and structures located in the *Tsunami Design Zones* defined in the *Tsunami Design Geodatabase* shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code.

**TABLE 1613.2.5(1)
SEISMIC DESIGN CATEGORY BASED ON SHORT-PERIOD (0.2 second) RESPONSE ACCELERATION**

VALUE OF S_{DS}	RISK CATEGORY		
	I or II	III	IV
$S_{DS} < 0.167g$	A	A	A
$0.167g \leq S_{DS} < 0.33g$	B	B	C
$0.33g \leq S_{DS} < 0.50g$	C	C	D
$0.50g \leq S_{DS}$	D	D	D

**TABLE 1613.2.5(2)
SEISMIC DESIGN CATEGORY BASED ON 1-SECOND PERIOD RESPONSE ACCELERATION**

VALUE OF S_{D1}	RISK CATEGORY		
	I or II	III	IV
$S_{D1} < 0.067g$	A	A	A
$0.067g \leq S_{D1} < 0.133g$	B	B	C
$0.133g \leq S_{D1} < 0.20g$	C	C	D
$0.20g \leq S_{D1}$	D	D	D

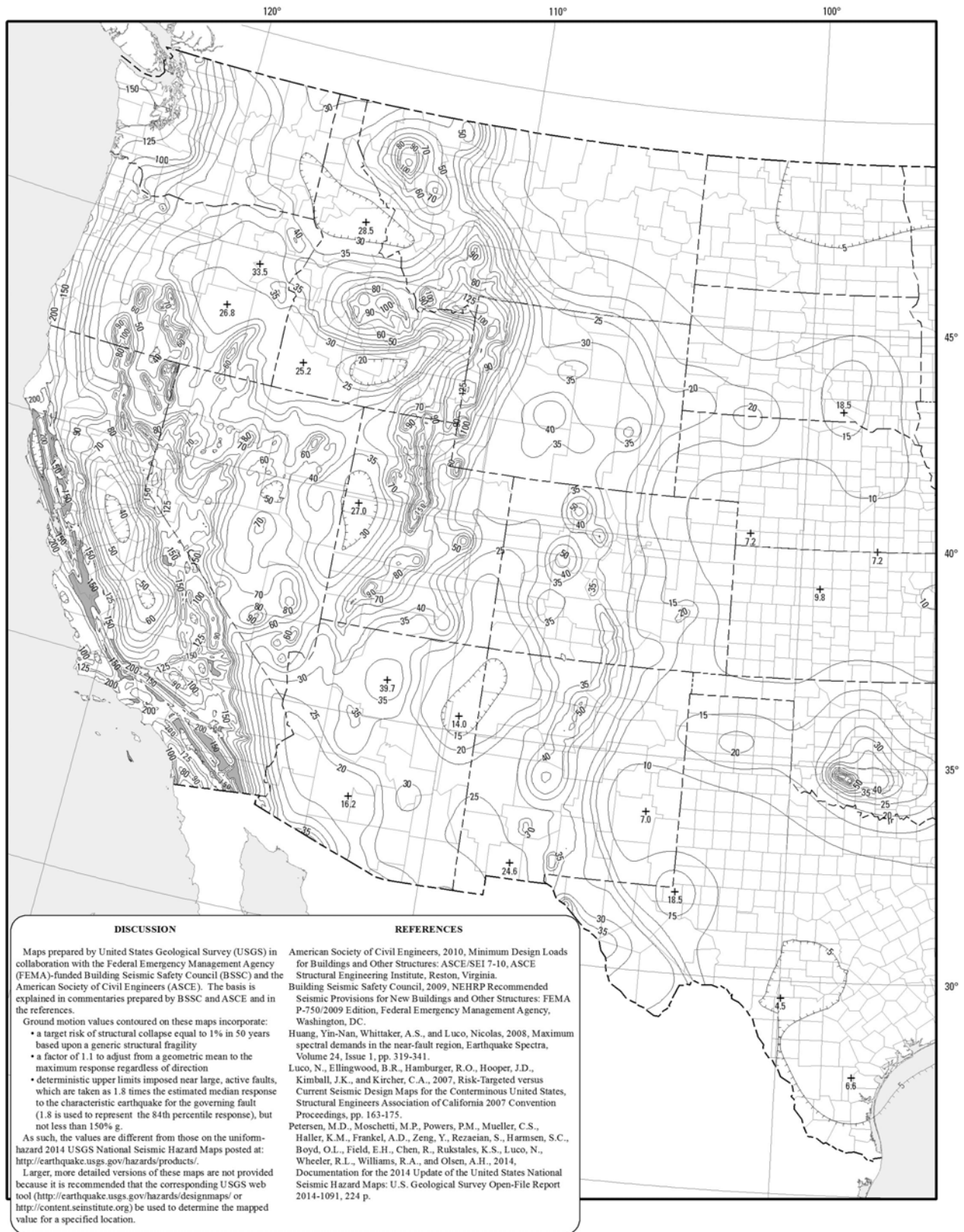


FIGURE 1613.2.1(1)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE CONTERMINOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)



FIGURE 1613.2.1(2)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE
CONTIGUOUS UNITED STATES OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)

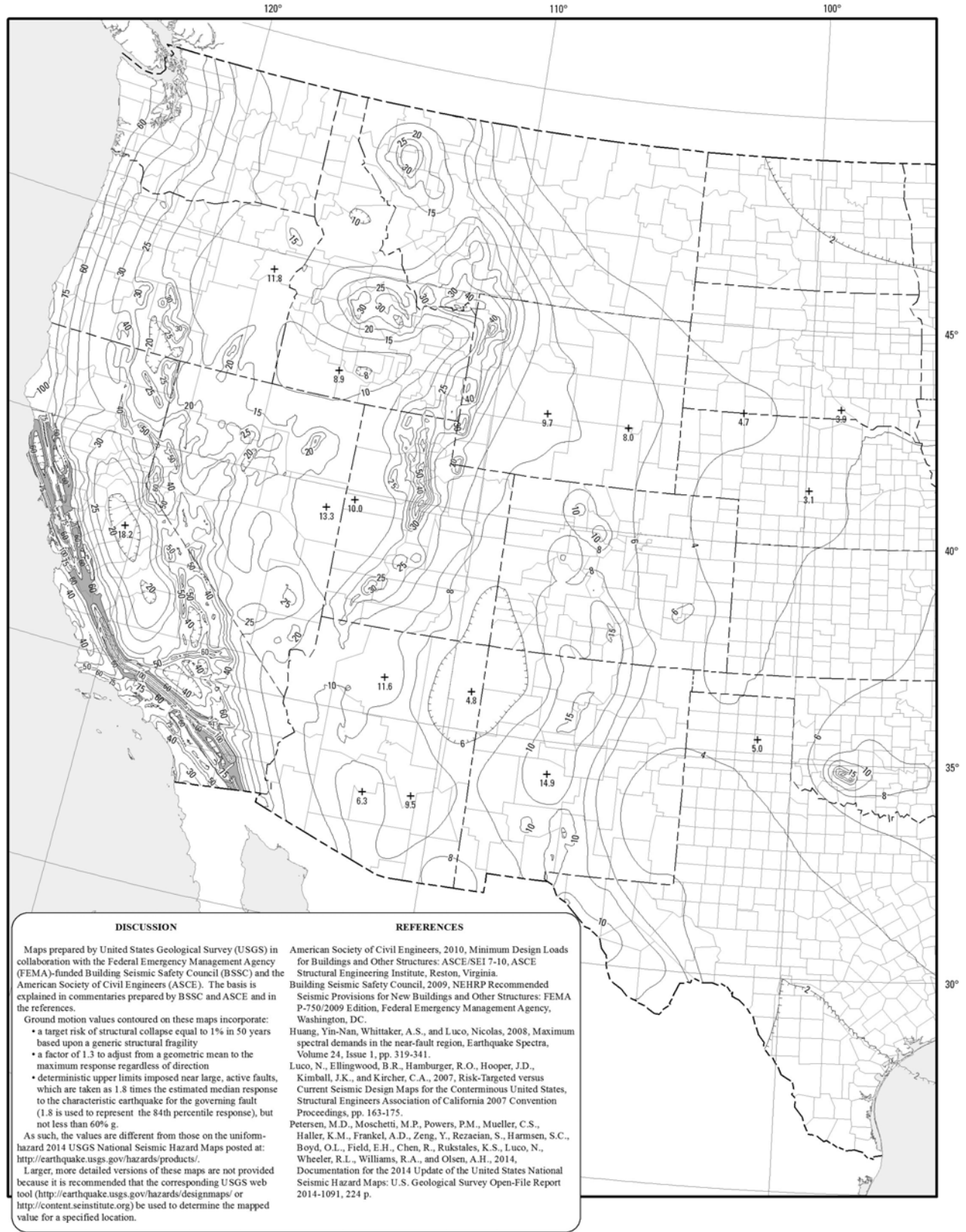


FIGURE 1613.2.1(3)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE
CONTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)

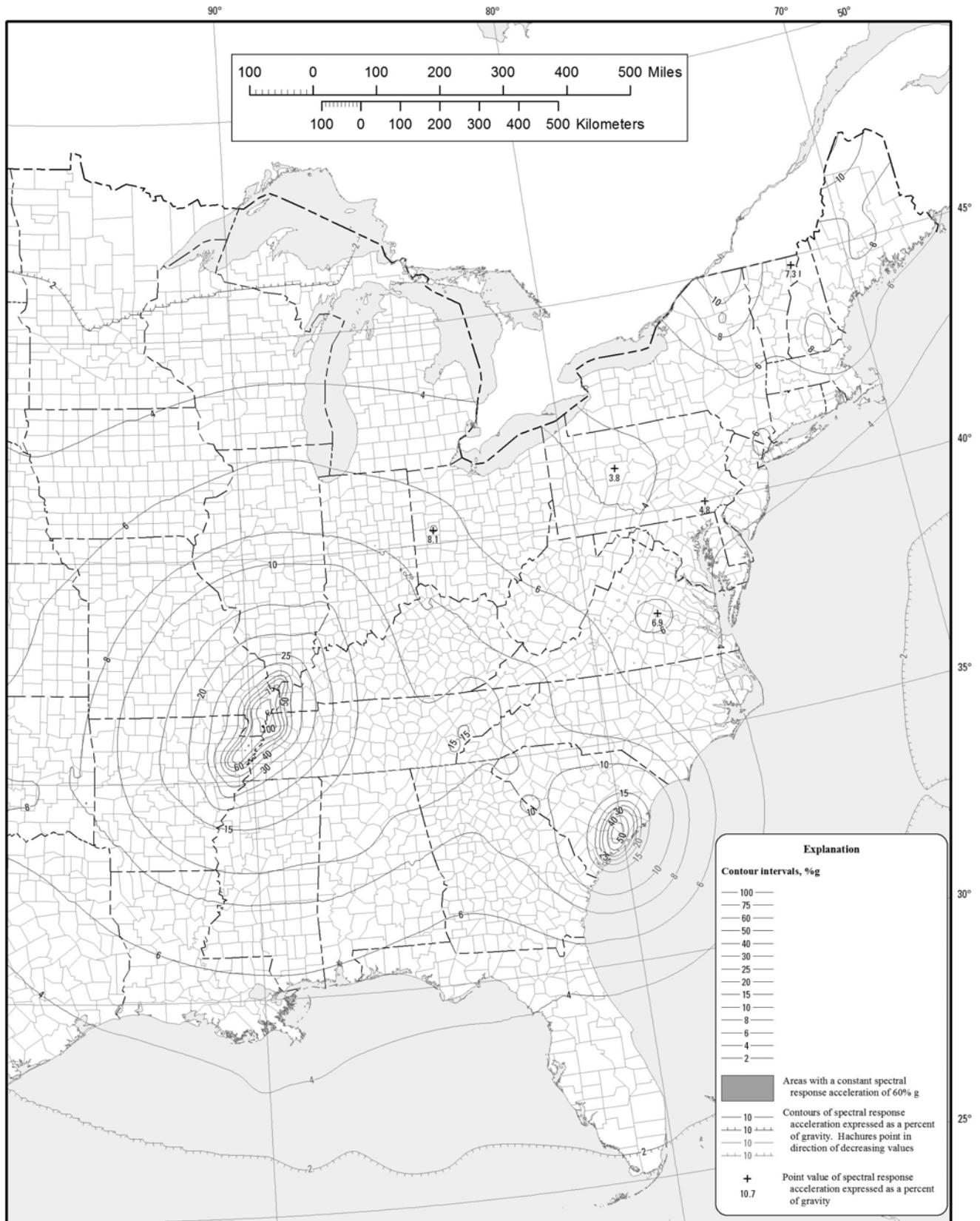
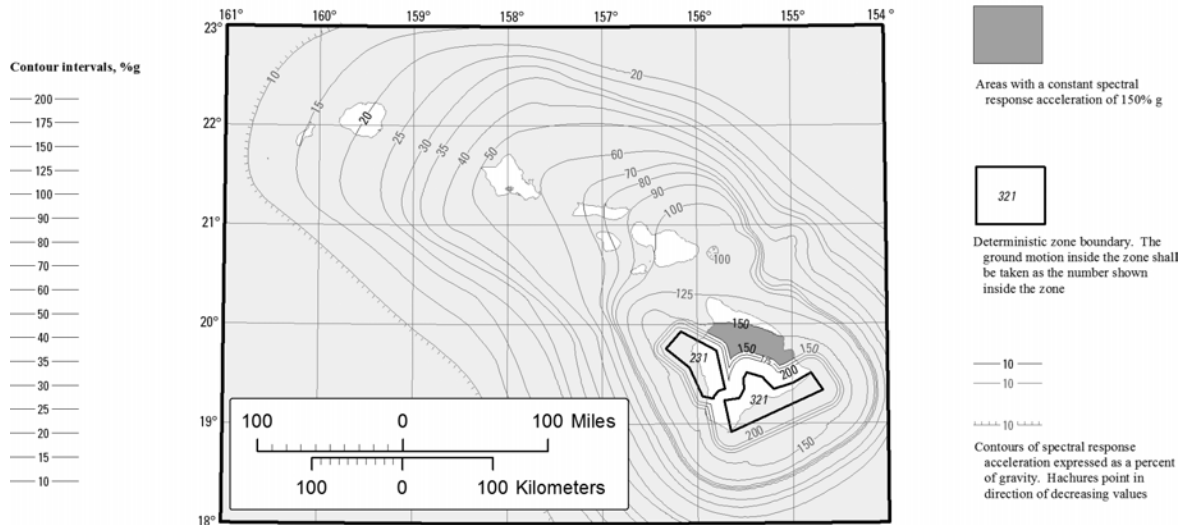
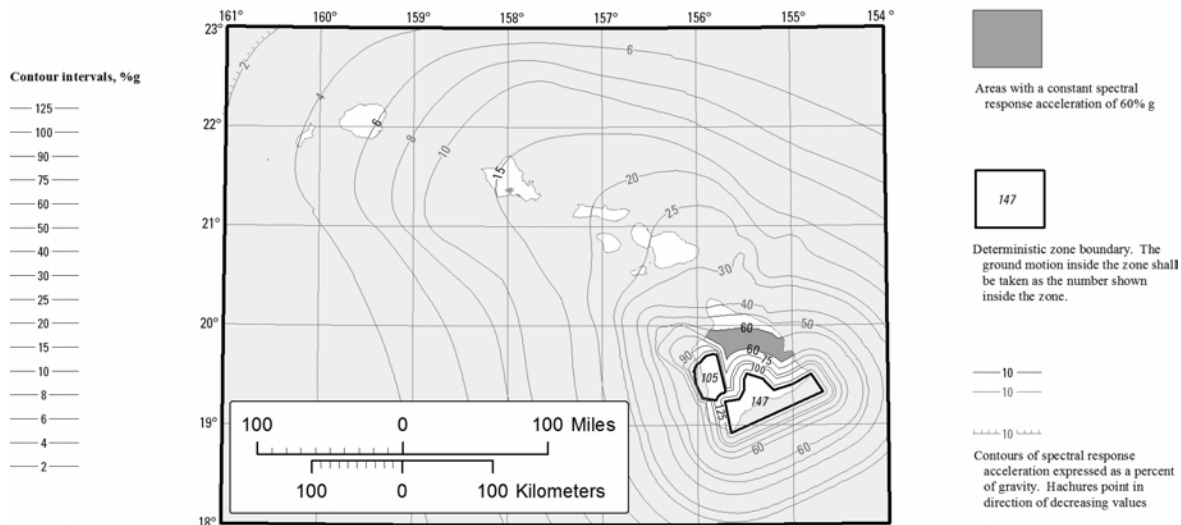


FIGURE 1613.2.1(4)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR THE COTERMINOUS UNITED STATES OF 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)



0.2 Second Spectral Response Acceleration (5% of Critical Damping)



1.0 Second Spectral Response Acceleration (5% of Critical Damping)

DISCUSSION	REFERENCES
<p>Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.</p> <p>Ground motion values contoured on these maps incorporate:</p> <ul style="list-style-type: none"> • a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility • deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% and 60% g for 0.2 and 1.0 sec, respectively. <p>As such, the values are different from those on the uniform-hazard 1998 USGS National Seismic Hazard Maps for Hawaii posted at http://earthquake.usgs.gov/hazmaps.</p> <p>Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (http://earthquake.usgs.gov/designmaps or http://content.seisintstitute.org) be used to determine the mapped value for a specified location.</p>	<p>Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.</p> <p>Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.</p> <p>Klein, F., Frankel, A.D., Mueller, C.S., Wesson, R.L., and Okubo, P., 2001, Seismic hazard in Hawaii: high rate of large earthquakes and probabilistic ground-motion maps, Bulletin of the Seismological Society of America, Volume 91, pp. 479-498.</p> <p>Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.</p>

**FIGURE 1613.2.1(5)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR HAWAII OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)**

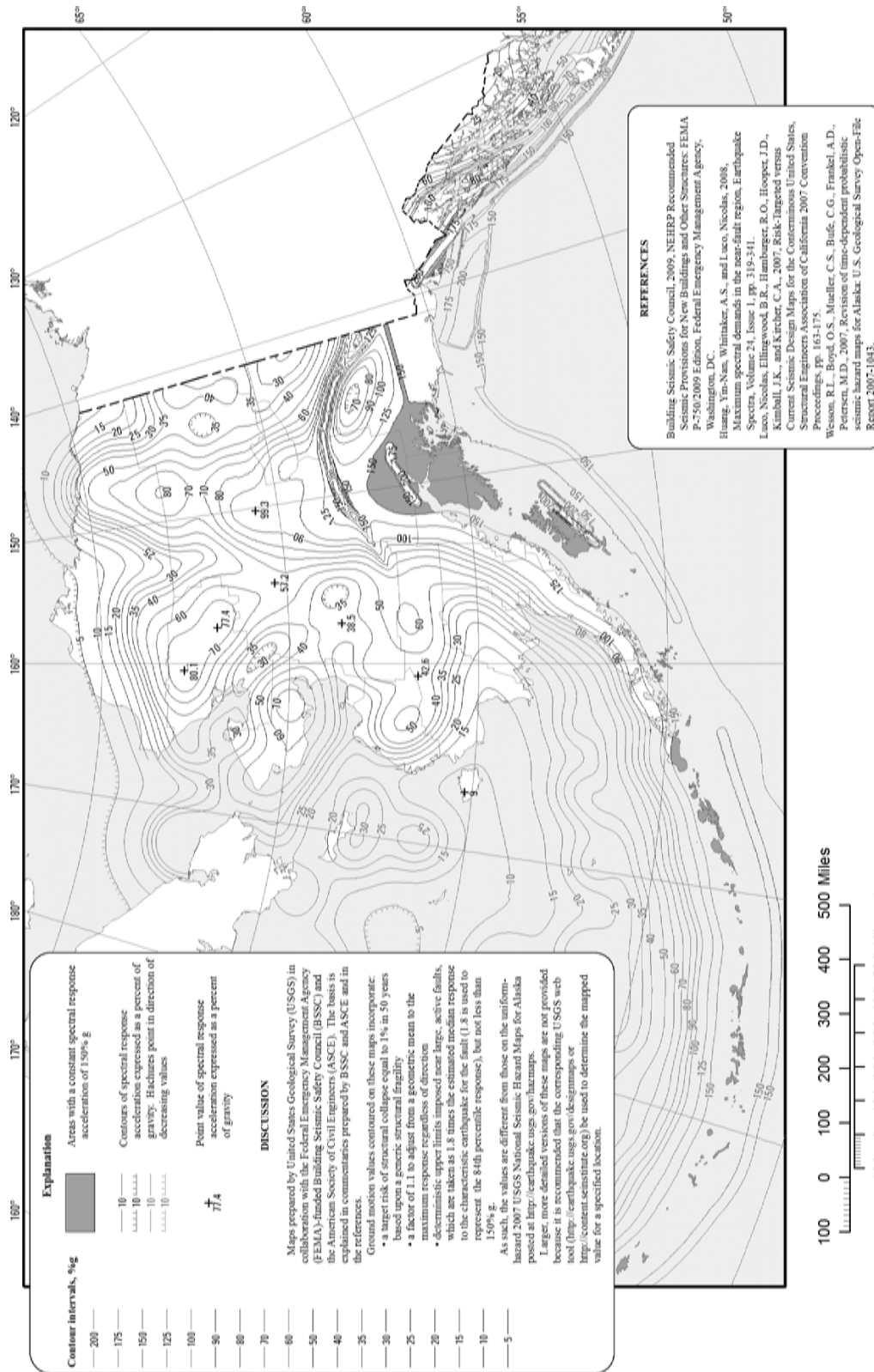
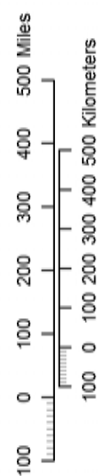


FIGURE 1613.2.1(6)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR ALASKA OF 0.2-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)



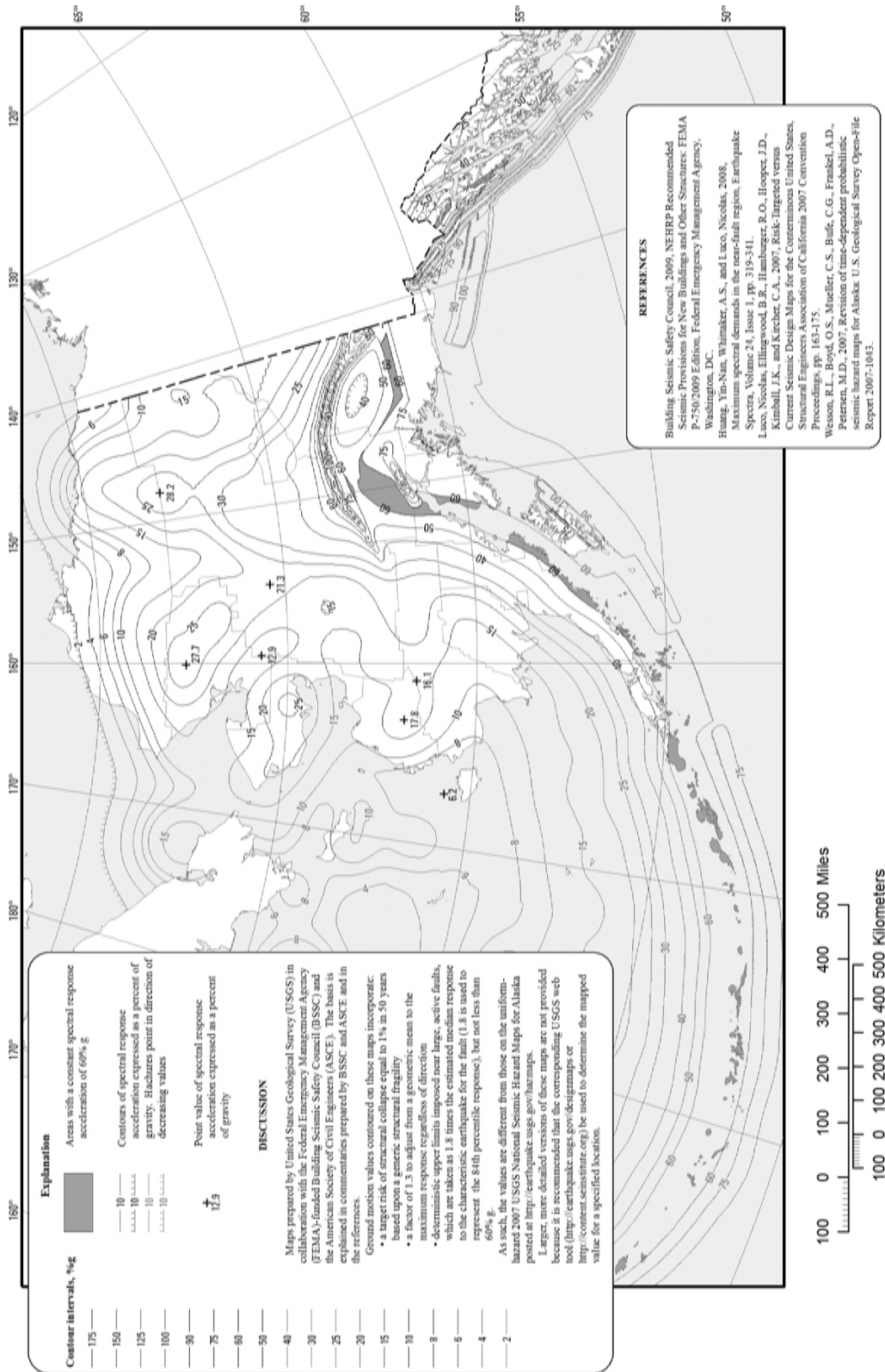
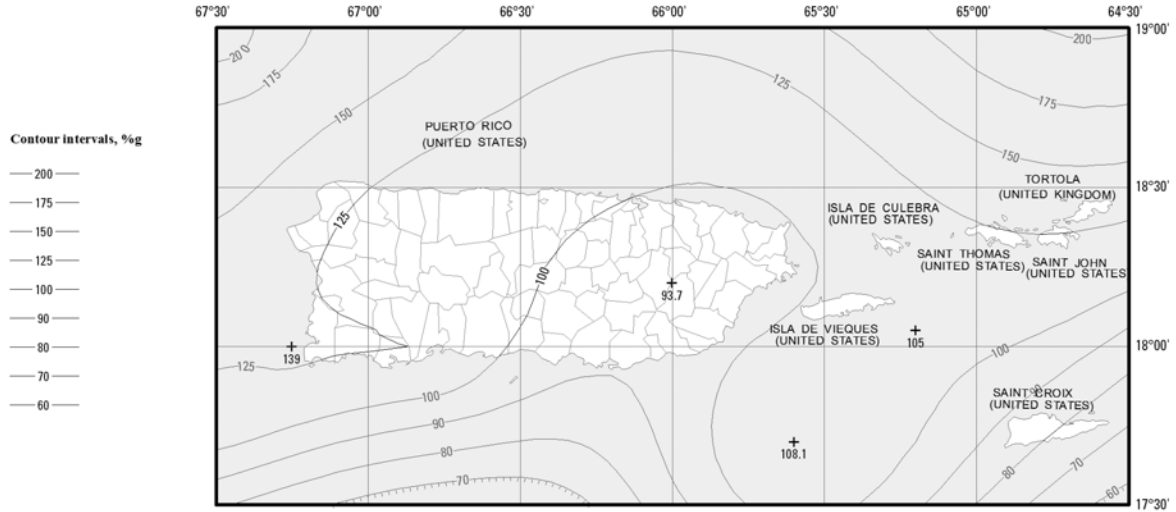
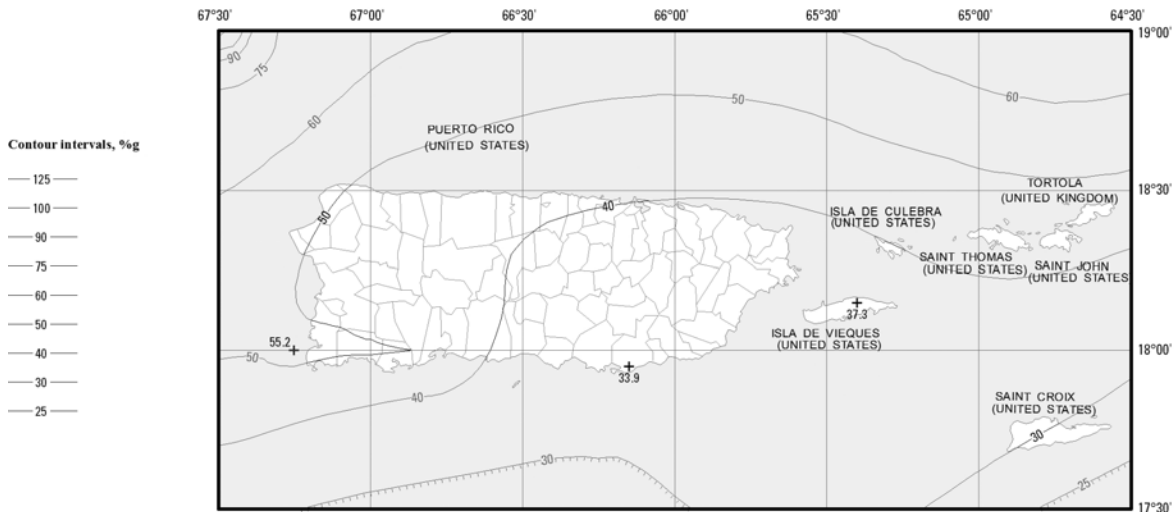


FIGURE 1613.2.1(7)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR ALASKA OF 1.0-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)



0.2 Second Spectral Response Acceleration (5% of Critical Damping)



1.0 Second Spectral Response Acceleration (5% of Critical Damping)

Explanation

— 10 —
— 10 —
+ 93.7

Contours of spectral response acceleration expressed as a percent of gravity. Hachures point in direction of decreasing values

Point value of spectral response acceleration expressed as a percent of gravity

DISCUSSION

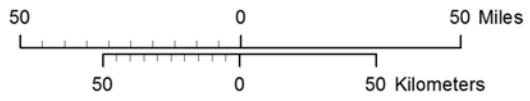
Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC) and the American Society of Civil Engineers (ASCE). The basis is explained in commentaries prepared by BSSC and ASCE and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.1 and 1.3 for 0.2 and 1.0 sec, respectively, to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% and 60% g for 0.2 and 1.0 sec, respectively.

As such, the values are different from those on the uniform-hazard 2003 USGS National Seismic Hazard Maps for Puerto Rico and the U.S. Virgin Islands posted at <http://earthquake.usgs.gov/hazmaps>.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (<http://earthquake.usgs.gov/designmaps> or <http://content.seisintstitute.org>) be used to determine the mapped value for a specified location.



REFERENCES

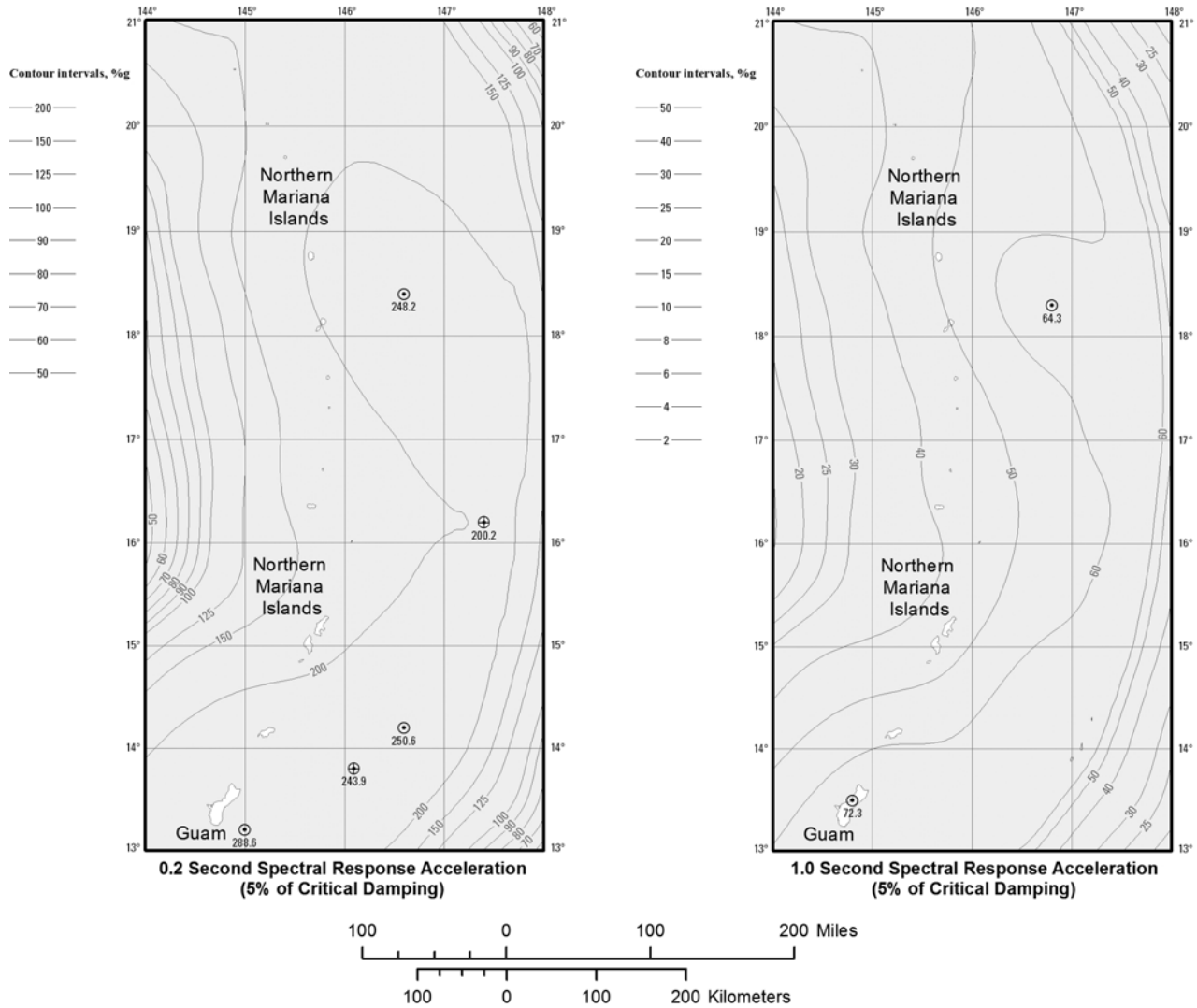
Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Mueller, C.S., Frankel, A.D., Petersen, M.D., and Leyendecker, E.V., 2003, Documentation for the 2003 USGS Seismic Hazard Maps for Puerto Rico and the U.S. Virgin Islands: U.S. Geological Survey Open-File Report 03-379.

FIGURE 1613.2.1(8)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR PUERTO RICO AND THE UNITED STATES VIRGIN ISLANDS OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)



Explanation

Contours of spectral response acceleration expressed as a percent of gravity.

— 10 —
— 10 —

Point values of spectral response acceleration expressed as a percent of gravity.

⊕ Local minimum
200.2
⊙ Local maximum
250.6
⊕ Saddle point
243.9

DISCUSSION

Maps prepared by United States Geological Survey (USGS) in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council (BSSC). The basis is explained in commentary prepared by BSSC and in the references.

Ground motion values contoured on these maps incorporate:

- a target risk of structural collapse equal to 1% in 50 years based upon a generic structural fragility
- a factor of 1.1 and 1.3 for 0.2 and 1.0 sec, respectively, to adjust from a geometric mean to the maximum response regardless of direction
- deterministic upper limits imposed near large, active faults, which are taken as 1.8 times the estimated median response to the characteristic earthquake for the fault (1.8 is used to represent the 84th percentile response), but not less than 150% and 60% g for 0.2 and 1.0 sec, respectively.

As such, the values are different from those on the uniform-hazard 2012 USGS National Seismic Hazard Maps for Guam and the Northern Mariana Islands posted at <http://earthquake.usgs.gov/hazmaps>.

Larger, more detailed versions of these maps are not provided because it is recommended that the corresponding USGS web tool (<http://earthquake.usgs.gov/designmaps>) be used to determine the mapped value for a specified location.

REFERENCES

Building Seismic Safety Council, 2009, NEHRP Recommended Seismic Provisions for New Buildings and Other Structures: FEMA P-750/2009 Edition, Federal Emergency Management Agency, Washington, DC.

Huang, Yin-Nan, Whittaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra, Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Mueller, C.S., Haller, K.M., Luco, Nicolas, Petersen, M.D., and Frankel, A.D., 2012, Seismic Hazard Assessment for Guam and the Northern Mariana Islands: U.S. Geological Survey Open-File Report 2012-1015.

FIGURE 1613.2.1(9)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS FOR GUAM AND THE NORTHERN MARIANA ISLANDS OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION (5% OF CRITICAL DAMPING)

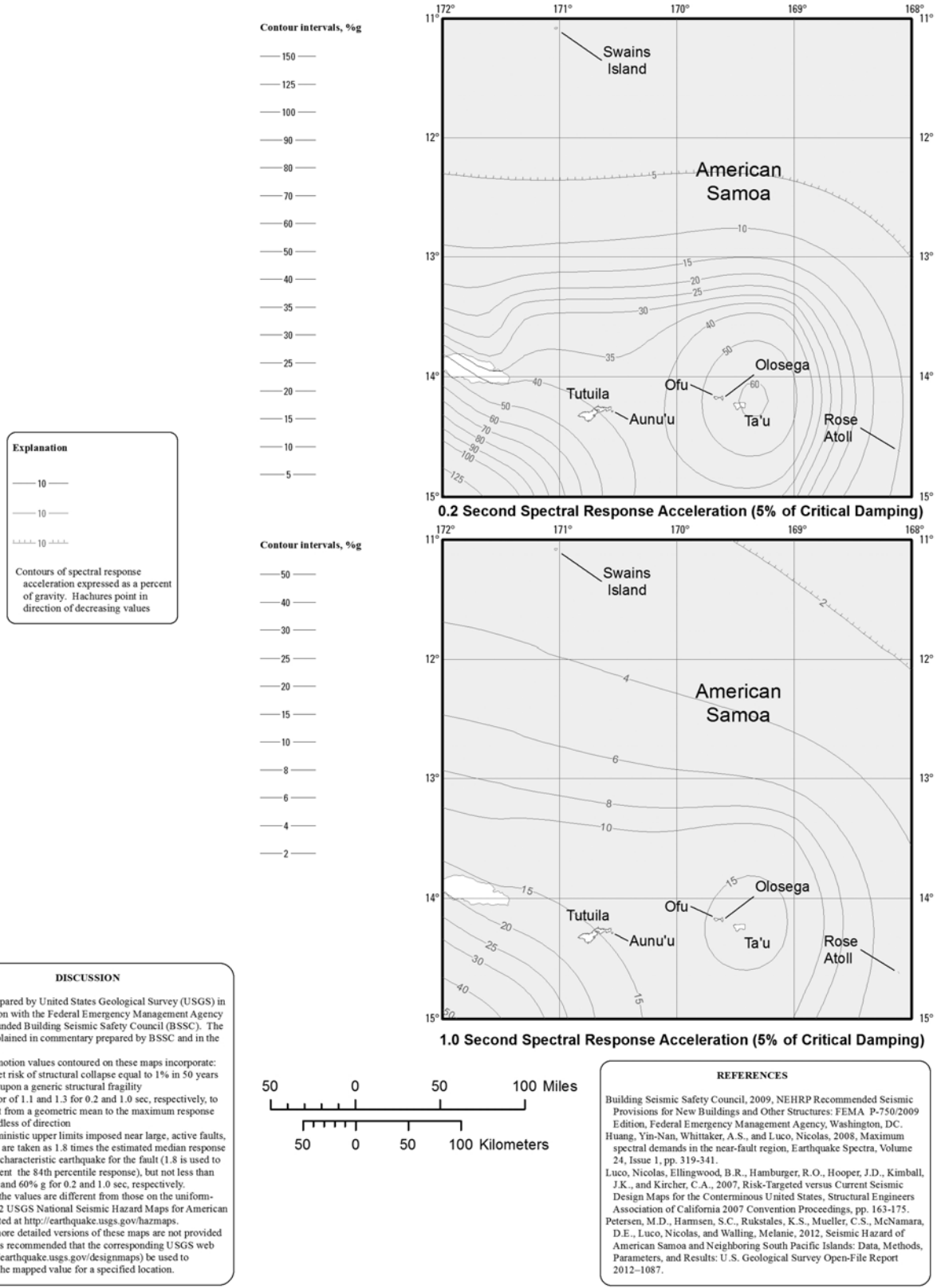


FIGURE 1613.2.1(10)
RISK-TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) GROUND MOTION RESPONSE ACCELERATIONS
FOR AMERICAN SAMOA OF 0.2- AND 1-SECOND SPECTRAL RESPONSE ACCELERATION
(5% OF CRITICAL DAMPING)

**SECTION 1616
STRUCTURAL INTEGRITY**

1616.1 General. High-rise buildings that are assigned to *Risk Category III* or *IV* shall comply with the requirements of Section 1616.2 if they are frame structures, or Section 1616.3 if they are bearing wall structures.

1616.2 Frame structures. Frame structures shall comply with the requirements of this section.

1616.2.1 Concrete frame structures. Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

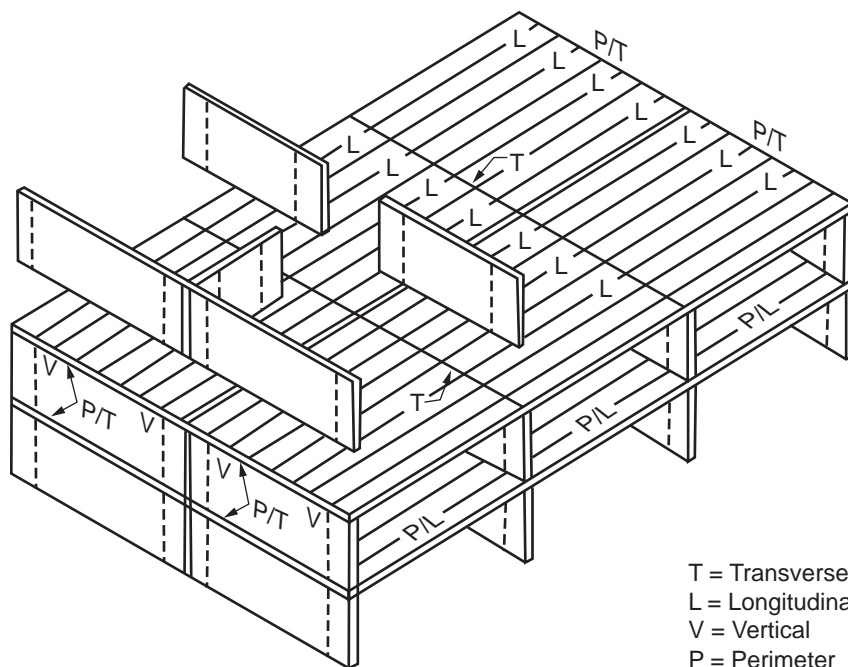
Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures. Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

1616.2.2.1 Columns. Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1616.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than 3/8-inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two *orthogonal* directions with an area not less than 0.0015 times the



T = Transverse
L = Longitudinal
V = Vertical
P = Perimeter

**FIGURE 1616.3
LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES**

concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for *LFRD*, but not less than 10 kips (45 kN).

1616.3 Bearing wall structures. Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616.3.

1616.3.1 Concrete wall structures. Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 16.2.4 and 16.2.5 of ACI 318.

1616.3.2 Other bearing wall structures. Ties in bearing wall structures other than those covered in Section 1616.3.1 shall conform to this section.

1616.3.2.1 Longitudinal ties. Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength, T_T , given by Equation 16-24. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = wLS \leq \alpha_T S \quad (\text{Equation 16-24})$$

where:

L = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

w = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m²).

S = The spacing between ties, feet (m).

α_T = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

1616.3.2.2 Transverse ties. Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed not farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength T_T , given by Equation 16-24. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

1616.3.2.3 Perimeter ties. Perimeter ties shall consist of continuous reinforcement in slabs; continuous or

spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than T_p , given by Equation 16-25. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \quad (\text{Equation 16-25})$$

$$\text{For SI: } T_p = 90.7w \leq \beta_T$$

where:

w = As defined in Section 1616.3.2.1.

β_T = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for structures with bearing walls of cold-formed steel light-frame construction.

1616.3.2.4 Vertical ties. Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. Not fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

SECTION 1617 ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

1617.1 Construction documents.

1617.1.1 Additional requirements for construction documents are included in Sections 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R).

1617.1.2 Connections. Connections that resist design seismic forces shall be designed and detailed on the design drawings.

1617.1.3 Construction procedures. Where unusual erection or construction procedures are considered essential by the project structural engineer or architect in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the plans or in the specifications.

1617.2 General design requirements.

1617.2.1 Lateral load deflections.

1617.2.1.1 Horizontal diaphragms. The maximum span-depth ratio for any roof or floor diaphragm con-

sisting of steel and composite steel slab decking or concrete shall be based on test data and design calculations acceptable to the enforcement agency.

1617.2.1.2 Veneers. The deflection shall not exceed $l/600$ for veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing.

1617.2.1.3 Risk Category of buildings and other structures. Risk Category IV includes structures as defined in the California Administrative Code, Section 4-207 and all structures required for their continuous operation or access/egress.

1617.2.1.4 Analysis. Structural analysis shall explicitly include consideration of stiffness of diaphragm in accordance with ASCE 7, Section 12.3.1. A diaphragm is rigid for the purpose of distribution of story shear and torsional moment where so indicated in Section 12.3.1 of ASCE 7.

1617.2.2 Structural walls. For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.

1617.3 Load combinations.

1617.3.1 Stability. When checking stability under the provisions of Section 1605.1.1 using allowable stress design, the factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported. Strength design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.5 for all strength design load combinations, except that Resistance Factor (ϕ) shall be permitted to be 1.0 for load combinations with overstrength factor. Allowable stress design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.6 for all allowable stress design load combinations, and shall be established to be consistent with strength design requirements in ASCE 7, Section 12.13.5.

1617.3.2 Alternative allowable stress design load combinations. Where the alternative allowable stress design load combinations of Section 1605.2 are used, each load combination shall be investigated with one or more of the variable loads set to zero.

1617.3.3 Modifications to load combinations in ICC 300. Modify the text of ICC 300 as follows:

1617.3.3.1 ICC 300, Section 303.5.2. Modify Section 303.5.2 by adding Equation 3-5a as follows:

$$D + 0.4L + Z \quad \text{(Equation 3-5a)}$$

1617.3.3.2 ICC 300, Section 303.5.3. Modify Section 303.5.3 as follows:

The uniform live load, L , used in Equation 3-2 and 3-4 may be taken as zero when evaluating elements supporting the handrail/guardrail provided those elements do not also support L .

1617.4 Roof dead loads. The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is

permitted to be applied over the original roofing without its removal, in accordance with Section 1512.

1617.5 Live loads.

1617.5.1 Modifications to Table 1607.1.

1617.5.1.1 Item 4. Assembly areas. The following minimum loads for stage accessories apply:

1. Gridirons and fly galleries: 75 pounds per square foot uniform live load.
2. Loft block wells: 250 pounds per lineal foot vertical load and lateral load.
3. Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.
4. Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.
5. Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot (0.72 kN/m²).

1617.5.1.2 Reserved.

1617.5.1.3 Item 4. Bleachers, folding and telescopic seating and grandstands. The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.

1617.5.1.4 Item 37. Yards and terraces, pedestrians. Item 37 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.

1617.5.1.5 Item 38. Storage racks and wall-hung cabinets. The minimum vertical design live load shall be as follows:

Paper media:

12-inch-deep (305 mm) shelf - 33 pounds per lineal foot (482 N/m)

15-inch-deep (381 mm) shelf - 41 pounds per lineal foot (598 N/m), or 33 pounds per cubic foot (5183 N/m³) per total volume of the rack or cabinet, whichever is less.

Film media:

18-inch-deep (457 mm) shelf - 100 pounds per lineal foot (1459 N/m), or

50 pounds per cubic foot (7853 N/m³) per total volume of the rack or cabinet, whichever is less.

Other media:

20 pounds per cubic foot (311 N/m³) or 20 pounds per square foot (958 Pa), whichever is less, but not less than actual loads.

1617.5.2 Uncovered open-frame roof structures. Uncovered open-frame roof structures shall be designed for a

vertical live load of not less than 10 pounds per square foot (0.48 kN/m²) of the total area encompassed by the framework.

1617.5.3 Seating for assembly uses. Replace Section 1607.19 with the following:

Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300 as modified by Section 1617.3.3 load combinations. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607.19.1.

1617.6 Determination of snow loads. The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA. See Section 106.1.2 for snow load posting requirements.

1617.7 Wind loads.

1617.7.1 Story drift for wind loads. The calculated story drift due to wind pressures with ultimate design wind speed, V_{ult} , shall not exceed 0.008 times the story height for buildings less than 65 feet (19 812 mm) in height or 0.007 times the story height for buildings 65 feet (19 812 mm) or greater in height.

Exception: This story drift limit need not be applied for single-story open structures in Risk Categories I and II.

1617.8 Establishment of flood hazard areas. Flood hazard maps shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's Flood Insurance Study (FIS) adopted by the local authority having jurisdiction where the project is located, as amended or revised with the accompanying Flood Insurance Rate Map (FIRM) and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto.

1617.9 Earthquake loads.

1617.9.1 Modifications to Table 1613.2.3(1). Replace Table 1613.2.3(1) with Table 1613A.2.3(1).

1617.9.2 Modifications to Table 1613.2.3(2). Replace Table 1613.2.3(2) with Table 1613A.2.3(2).

1617.9.3 Seismic design category. The seismic design category for a structure shall be determined in accordance with Section 1613.

1617.9.4 Mapped acceleration parameters. Seismic Design Category shall be determined in accordance with Section 1613.2.5.

1617.9.5 Determination of seismic design category. Structures not assigned to Seismic Design Category E or F, in accordance with Section 1613.2, shall be assigned to Seismic Design Category D.

1617.9.5.1 Alternative seismic design category determination. The alternative Seismic Design Category

determination procedure of Section 1613.2.5.1 is not permitted by DSA-SS/CC.

1617.9.5.2 Simplified design procedure. The simplified design procedure of Section 1613.2.5.2 is not permitted by DSA-SS/CC.

1617.9.6 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems shall comply with ASCE 7, Section 13.6.12.

1617.10 Tsunami loads. The design and construction of Risk Category III or IV buildings and structures located in the ASCE Tsunami Design Zones defined in the ASCE Tsunami Design Geodatabase, or other data determined applicable by the enforcement agency, shall be in accordance with Section 1615.1 except as modified by this code. Tsunami Risk Category for community college buildings and structures shall be identified and submitted for acceptance by DSA. Determination of Tsunami Risk Category shall be proposed by the design professional in general responsible charge in coordination with the owner and local community based upon the relative importance of that facility to provide vital services, provide important functions and protect special populations. The determination of relative importance shall include consideration of a tsunami warning and evacuation plan and procedure when adopted by the local community.

1617.11 Modifications to ASCE 7. The text of ASCE 7 shall be modified as indicated in Sections 1617.11.1 through 1617.11.24.

1617.11.1 ASCE 7, Section 1.3. Modify ASCE 7, Section 1.3 by adding Section 1.3.8 as follows:

1.3.8 Structural design criteria. Where design is based on ASCE 7, Chapters 16, 17, 18 or 31, the ground motion, wind tunnel design recommendations, analysis and design methods, material assumptions, testing requirements and acceptance criteria proposed by the engineer shall be submitted to the enforcement agency in the form of structural design criteria for approval.

Peer review requirements in Section 322 of the California Existing Buildings Code shall apply to design reviews required by ASCE 7 Chapters 17 and 18.

1617.11.2 ASCE 7, Section 11.4. Modify ASCE 7, Section 11.4 to include the following:

Seismic ground motion values shall include updated subsections in Supplement 3.

1617.11.3 ASCE 7, Table 12.2-1. Modify ASCE 7, Table 12.2-1 as follows:

A. BEARING WALL SYSTEMS

17. Light-framed walls with shear panels of all other materials—*Not permitted by DSA-SS/CC.*

B. BUILDING FRAME SYSTEMS

24. Light-framed walls with shear panels of all other materials—*Not permitted by DSA-SS/CC.*

C. MOMENT RESISTING FRAME SYSTEMS

12. Cold-formed steel — special bolted moment frame—*Not permitted by DSA-SS/CC.*

Exceptions:

1. Systems listed in this section can be used as an alternative system when pre-approved by the enforcement agency.
2. Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7, Chapter 13.
3. Systems listed in this section can be used for seismically isolated buildings when permitted by ASCE 7, Section 17.2.5.4.

1617.11.4 ASCE 7, Sections 12.2.3, 12.2.3.1 and 12.2.3.2. Modify ASCE 7, Sections 12.2.3, 12.2.3.1 and 12.2.3.2 as follows:

1617.11.4.1 ASCE 7, Section 12.2.3. Replace ASCE 7, Section 12.2.3 with the following:

Where different seismic force-resisting systems are used in combinations to resist seismic forces in the same direction, other than those combinations considered as dual systems, the design shall comply with the requirements of this section. The most stringent applicable structural system limitations contained in Table 12.2-1 shall apply, except as otherwise permitted by this section.

1617.11.4.2 ASCE 7, Section 12.2.3.1. Replace ASCE 7, Section 12.2.3.1, Items 1 and 2 by the following:

The value of the response modification coefficient, R , used for design at any story shall not exceed the lowest value of R that is used in the same direction at any story above that story. Likewise, the deflection amplification factor, C_d , and the system over strength factor, Ω_p , used for the design at any story shall not be less than the largest value of these factors that are used in the same direction at any story above that story.

1617.11.4.3 ASCE 7, Section 12.2.3.2. Modify ASCE 7, Section 12.2.3.2 by modifying Item a and adding Items f, g and h, as follows:

- a. The stiffness of the lower portion shall be at least 10 times the stiffness of the upper portion. For purposes of determining this ratio, the base shear shall be computed and distributed vertically according to Section 12.8. Using these forces, the stiffness for each portion shall be computed as the ratio of the base shear for that portion to the elastic displacement, δ_{xe} , computed at the top of that portion, considering the portion fixed at its base. For the lower portion, the applied forces shall include the reactions from the upper portion, modified as required in Item d.

- f. The structural height of the upper portion shall not exceed the height limits of Table 12.2-1 for the seismic force-resisting system used, where the height is measured from the base of the upper portion.

- g. Where Horizontal Irregularity Type 4 or Vertical Irregularity Type 4 exists at the transition from the upper to the lower portion, the reactions from the upper portion shall be amplified in accordance with Sections 12.3.3.3, 12.10.1.1 and 12.10.3.3 as applicable, in addition to amplification required by Item d.

- h. Where design of vertical elements of the upper portion is governed by special seismic load combinations, the special loads shall be considered in the design of the lower portions.

1617.11.5 Reserved.

1617.11.6 ASCE 7, Section 12.2.5.6.1. The exception in Item a is not permitted by DSA-SS/CC.

1617.11.7 ASCE 7, Section 12.2.5.7.1. The exception in Item a is not permitted by DSA-SS/CC.

1617.11.8 ASCE 7, Section 12.2.5.7.2. The exception in Item a is not permitted by DSA-SS/CC.

1617.11.9 ASCE 7, Section 12.3.3.1. Modify ASCE 7, Section 12.3.3.1 as follows:

12.3.3.1 Prohibited horizontal and vertical irregularities for Seismic Design Categories D through F. Structures assigned to Seismic Design Category E or F having horizontal structural irregularity Type 1b of Table 12.3-1 or vertical structural irregularities Type 1b, 5a or 5b of Table 12.3-2 shall not be permitted. Structures assigned to Seismic Design Category D having vertical irregularity Type 1b or 5b of Table 12.3-2 shall not be permitted.

Exceptions:

1. Structures with reinforced concrete or reinforced masonry shear wall systems and rigid or semi-rigid diaphragms, consisting of concrete slabs or concrete-filled metal deck having a span-to-depth ratio of 3 or less, having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided that the maximum story drift in the direction of the irregularity, computed including the torsional amplification factor from Section 12.8.4.3, is less than 10 percent of the allowable story drift in ASCE 7, Table 12.12-1.
2. Structures having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided a redundancy factor, ρ , of 1.3 as defined in ASCE 7, Section 12.3.4 is assigned to the seismic force-resisting system in both orthogonal directions and the structure is designed for one of the orthogonal procedures as defined in ASCE 7, Section 12.5.3.1.

1617.11.10 ASCE 7, Section 12.7.2. Modify ASCE 7, Section 12.7.2 by adding Item 6 to read as follows:

6. Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a Geotechnical engineer qualified in soils engineering, plus the difference in earth pressures shall be added to the lateral forces provided in this section.

1617.11.11 Reserved.

1617.11.12 Reserved.

1617.11.13 ASCE 7, Section 12.13.1. Modify ASCE 7, Section 12.13.1 by adding Section 12.13.1.1 as follows:

12.13.1.1 Foundations and superstructure-to-foundation connections. The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605.1.1.

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. The strength of the superstructure elements.
2. The maximum forces that can be delivered to the foundation in a fully yielded structural system.
3. Forces from the Load Combinations with over-strength factor in accordance with ASCE 7, Section 12.4.3.1.

Exceptions:

1. Where referenced standards specify the use of higher design loads.
2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.
3. Where seismic force-resisting system consists of light-framed walls with shear panels, unless the reference standard specifies the use of higher design loads.

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by Section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

1617.11.14 ASCE 7, Section 12.13.9.2. Modify ASCE 7, Section 12.13.9.2 by the following sentence added to the end of Item b as follows:

Seismic load effects determined in accordance with Section 12.4 need not be considered in this check.

1617.11.15 ASCE 7, Section 13.1.4. Replace ASCE 7, Section 13.1.4 by the following:

13.1.4 The following nonstructural components and equipment shall be anchored in accordance with this section. Design and detailing shall be in accordance with Chapter 13 except as modified by this section.

1. **Fixed Equipment:** Equipment shall be anchored if it is directly attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "directly attached" shall include all electrical connections except plugs for 110/220-volt receptacles having a flexible cable/cord. Equipment that is connected to the building plumbing system with a shut-off valve in proximity to the equipment shall not be considered as directly attached provided the inside diameter of the pipe/tubing is less than 1/2 inch (12.7 mm).
2. **Movable Equipment:** Equipment is subject to the same requirement as fixed equipment, but is permitted to be anchored by re-attachable anchors or restraints in a manner approved by the enforcement agency. Utilities and services at the equipment shall have flexible connections to allow for necessary movement.
3. **Mobile Equipment:** Equipment heavier than 400 pounds (181.4 kg) or that has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly supports the equipment shall be restrained in a manner approved by the enforcement agency. Mobile equipment shall be restrained when not in use and is stored, unless the equipment is stored in a storage room that does not house hazardous materials or any facility systems or fixed equipment that can be affected by mobile equipment lacking restraint.
4. **Countertop Equipment:** Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed or movable equipment, as applicable. Countertop equipment shall also be subject to the same requirements as mobile or other equipment if weight of equipment is greater than 100 pounds (45 kg) and has a center of mass located 4 feet (1219 mm) or more above the adjacent floor level or if equipment could fall and block a required means of egress.
5. **Other Equipment:** Equipment shall be anchored where any of the following apply:
 - a. Weight of equipment is greater than 100 pounds (45 kg) and essential to operations for emergency preparedness, communica-

tions and operations centers and other facilities required for emergency response of state-owned essential services buildings as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.

- b. Could fall and block a required means of egress.
- c. Weight of equipment is greater than 400 pounds (181.4 kg) or center of mass is located greater than 4 feet (1219 mm) above the finished floor or roof level that directly supports the component.

- 6. Equipment with hazardous contents.
- 7. Other architectural, mechanical and electrical components stated in Chapter 13.
- 8. Wall-, Roof- or Floor-Hung Equipment: Seismic design and seismic details shall be provided for wall-, roof- or floor-hung nonstructural components and equipment when the component weighs more than 20 pounds (9 kg).

Exemptions: The following nonstructural components are exempt from the requirements of ASCE 7, Chapter 13:

- 1. Furniture except storage cabinets as noted in Table 13.5-1.
- 2. Discrete architectural, mechanical and electrical components and fixed equipment that are positively attached to the structure, provided that none of the conditions in this section apply, and flexible connections are provided between the component and associated ductwork, piping and conduit where required.

1617.11.16 ASCE 7, Section 13.5.6.2. Modify ASCE 7, Section 13.5.6.2 by the following exception added to the end of Section 13.5.6.2.2 and by adding Section 13.5.6.2.3 as follows:

Exception to Section 13.5.8.1 shall not be used in accordance with ASTM E580 Section 5.5.

13.5.6.2.3 Modification to ASTM E580. Modify ASTM E580 by the following:

- 1. **Exitways.** Lay-in ceiling assemblies in exitways of hospitals and essential services buildings shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors. Lateral force diagonal bracing may be omitted in the short or transverse direction of exitways, not exceeding 8 feet wide, when perimeter support in

accordance with ASTM E580 Sections 5.2.2 and 5.2.3 is provided and the perimeter wall laterally supporting the ceiling in the short or transverse direction is designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces.

- 2. **Corridors and lobbies.** Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.
- 3. **Lay-in panels.** Metal panels and panels weighing more than $\frac{1}{2}$ pounds per square foot (24 N/m^2) other than acoustical tiles shall be positively attached to the ceiling suspension runners.
- 4. **Lateral force bracing.** Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 are provided and perimeter walls are designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces. Horizontal restraint point spacing shall be justified by analysis or test and shall not exceed a spacing of 12 feet by 12 feet. Bracing wires shall be secured with four tight twists in $1\frac{1}{2}$ inches, or an approved alternate connection.
- 5. Ceiling support and bracing wires shall be spaced a minimum of 6 inches from all pipes, ducts, conduits and equipment that are not braced for horizontal forces, unless approved otherwise by the building official.

1617.11.17 ASCE 7, Section 13.6.5. Replace ASCE 7, Section 13.6.5 as follows:

13.6.5 Distribution systems: Conduit, cable tray and raceways. Cable trays and raceways shall be designed for seismic forces and seismic relative displacements as required in Section 13.3. Conduit equal to or greater than 2.5 inches (64 mm) trade size and attached to panels, cabinets or other equipment subject to seismic relative displacement, D_{pb} , shall be provided with flexible connections or designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions:

- 1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for raceways where flexible connections or other assemblies are provided between the cable tray or raceway and associated components to accommodate the relative displacement, where the cable tray or raceway is positively attached to the structure, and where one of the following apply:
 - a. Trapeze assemblies with $\frac{3}{8}$ -inch (10 mm) or $\frac{1}{2}$ -inch (13 mm) diameter rod

hangers not exceeding 12 inches (305 mm) in length from the conduit, cable tray, or raceway support point to the connection at the supporting structure are used to support the cable tray or raceway, and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or

b. The conduit, cable tray or raceway is supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in diameter, and each hanger in the raceway run is 12 inches (305 mm) or less in length from the conduit, cable tray or raceway support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for conduit, regardless of the value of I_p , where the conduit is less than 2.5 inches (64 mm) trade size.

Design for the displacements across seismic joints shall be required for conduit, cable trays and raceways with $I_p = 1.5$ without consideration of conduit size.

1617.11.18 ASCE 7, Section 13.6.6. Replace ASCE 7, Section 13.6.6 with the following:

13.6.6 Distribution Systems: Duct Systems. HVACR and other duct systems shall be designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions: The following exceptions pertain to ductwork not designed to carry toxic, highly toxic or flammable gases or not used for smoke control:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for duct systems where flexible connections or other assemblies are provided to accommodate the relative displacement between the duct system and associated components, the duct system is positively attached to the structure, and where one of the following apply:

a. Trapeze assemblies with $\frac{3}{8}$ -inch (10 mm) or $\frac{1}{2}$ -inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the duct support point to the connection at the supporting structure are used to support duct, and the total weight supported by any single trapeze is less than 10 lb/ft (146 N/m) and 100 pounds or less; or

b. The duct is supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in diameter, and each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support point to the connection at the supporting structure,

and the total weight supported by any single rod is 50 pounds (220 N) or less.

2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required where provisions are made to avoid impact with other ducts or mechanical components or to protect the ducts in the event of such impact, the distribution system is positively attached to the structure; and HVACR ducts have a cross-sectional area of less than 6 square feet (0.557 m²) and weigh 20 lb/ft (292 N/m) or less.

Components that are installed in line with the duct system and have an operating weight greater than 75 pounds (334 N), such as fans, terminal units, heat exchangers and humidifiers, shall be supported and laterally braced independent of the duct system, and such braces shall meet the force requirements of Section 13.3.1. Components that are installed in line with the duct system, have an operating weight of 75 pounds (334 N) or less, such as small terminal units, dampers, louvers and diffusers, and are otherwise not independently braced shall be positively attached with mechanical fasteners to the rigid duct on both sides. Piping and conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate the seismic relative displacements of Section 13.3.2.

1617.11.19 ASCE 7, Section 13.6.7.3. Replace ASCE 7, Section 13.6.7.3 with the following:

13.6.7.3 Additional provisions for piping and tubing systems.

A) Design for the seismic forces of Section 13.3 shall not be required for piping systems where flexible connections, expansion loops or other assemblies are provided to accommodate the relative displacement between component and piping, where the piping system is positively attached to the structure, and where any of the following conditions apply:

1. Trapeze assemblies are supported by $\frac{3}{8}$ -inch (10 mm) or $\frac{1}{2}$ -inch (13-mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the pipe support point to the connection at the supporting structure, and no single pipe exceeds the diameter limits set forth in item 2b or 2 inches (50 mm) where I_p is greater than 1.0 and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or

2. Piping that has an R_p in Table 13.6-1 of 4.5 or greater is either supported by rod hangers and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact, or pipes with $I_p = 1.0$ are supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in

diameter, where each hanger in the pipe run is 12 inches (305 mm) or less in length from the pipe support point to the connection at the supporting structure; and the total weight supported by any single hanger is 50 pounds (220 N) or less. In addition, the following limitations on the size of piping shall be observed:

- a. In structures assigned to Seismic Design Category D, E or F where I_p is greater than 1.0, the nominal pipe size shall be 1 inch (25 mm) or less.
 - b. In structures assigned to Seismic Design Category D, E or F where $I_p = 1.0$, the nominal pipe size shall be 3 inches (80 mm) or less.
3. Pneumatic tube systems supported with trapeze assemblies using $\frac{3}{8}$ -inch (10 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.
 4. Pneumatic tube systems supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

B) Flexible connections in piping required in Section 13.6.7.3 are not required where pipe is rigidly attached to the same floor or wall that provides vertical and lateral support for the equipment, or to a fixture.

C) Flexible connections in piping are required at seismic separation joints and shall be detailed to accommodate the seismic relative displacements at connections.

1617.11.20 ASCE 7, Section 13.6.11.1. Modify ASCE 7, Section 13.6.11.1 by adding Section 13.6.11.1.1, as follows:

13.6.11.1.1 Elevators guide rail support. The design of guide rail support bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not more than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one-third to the top guiding members and two-thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.11.1, the minimum seismic forces shall be 0.5g allowable stress design load acting in any horizontal direction.

1617.11.21 ASCE 7, Section 13.6.11.4. Replace ASCE 7, Section 13.6.11.4, as follows:

13.6.11.4 Retainer plates. Retainer plates are required at the top and bottom of the car and counterweight, except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:

1. The seismic force shall be computed per the requirements of ASCE 7, Section 13.6.11.1. The minimum horizontal acceleration shall be 0.5g allowable stress design load for all buildings.
2. W_p shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.
3. With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below.

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	1 ¹ / ₄	0.20
11	1 ¹ / ₂	0.30
12	1 ³ / ₄	0.40
15	1 ³¹ / ₃₂	0.50
18 ¹ / ₂	1 ³¹ / ₃₂	0.50
22 ¹ / ₂	2	0.50
30	2 ¹ / ₄	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

Note: Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

4. Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.
5. The use of spreader brackets is allowed.
6. Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g allowable stress design load.

1617.11.22 Reserved.

1617.11.23 Reserved.

1617.11.24 ASCE 7, Section 17.2.4.7. Modify ASCE 7, Section 17.2.4.7 by adding the following to the end of the section:

The effects of uplift shall be explicitly accounted for in the analysis and in the testing of the isolator units.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 16A – STRUCTURAL DESIGN

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X		X				X								
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below							X				X			X								
Chapter / Section																						
1607A.9.2							X															
1617A.1.18											X			X								

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 16A

STRUCTURAL DESIGN

SECTION 1601A GENERAL

1601A.1 Scope. The provisions of this chapter shall govern the structural design of buildings, structures and portions thereof regulated by this code.

1601A.1.1 Application. *The scope of application of Chapter 16A is as follows:*

1. Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.
2. Applications listed in Sections 1.10.1 and 1.10.4, regulated by the Office of Statewide Health Planning and Development (OSHDP). These applications include hospitals and correctional treatment centers.

1601A.1.2 Amendments in this chapter. *DSA-SS and OSHDP adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. Division of the State Architect-Structural Safety:
[DSA-SS] – For applications listed in Section 1.9.2.1.
2. Office of Statewide Health Planning and Development:
[OSHDP 1] – For applications listed in Section 1.10.1.
[OSHDP 4] – For applications listed in Section 1.10.4.

1601A.2 Enforcement agency approval. *In addition to the requirements of the California Administrative Code and the California Building Code, any aspect of project design, construction, quality assurance or quality control programs for which this code requires approval by the Registered Design Professional (RDP), are also subject to approval by the enforcement agency.*

SECTION 1602A NOTATIONS

1602A.1 Notations. The following notations are used in this chapter:

- D = Dead load.
- D_i = Weight of ice in accordance with Chapter 10 of ASCE 7.
- E = Combined effect of horizontal and vertical earthquake induced forces as defined in Section 12.4 of ASCE 7.

- F = Load due to fluids with well-defined pressures and maximum heights.
- F_a = Flood load in accordance with Chapter 5 of ASCE 7.
- H = Load due to lateral earth pressures, ground water pressure or pressure of bulk materials.
- L = Live load.
- L_r = Roof live load.
- R = Rain load.
- S = Snow load.
- T = Cumulative effects of self-straining load forces and effects.
- V_{asd} = Allowable stress design wind speed, miles per hour (mph) (km/hr) where applicable.
- V = Basic design wind speeds, miles per hour (mph) (km/hr) determined from Figures 1609A.3(1) through 1609A.3(12) or ASCE 7.
- W = Load due to wind pressure.
- W_i = Wind-on-ice in accordance with Chapter 10 of ASCE 7.

SECTION 1603A CONSTRUCTION DOCUMENTS

1603A.1 General. Construction documents shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603A.1.1 through 1603A.1.10 shall be indicated on the construction documents.

Exception: Construction documents for buildings constructed in accordance with the conventional light-frame construction provisions of Section 2308 shall indicate the following structural design information:

1. Floor and roof dead and live loads.
2. Ground snow load, p_g .
3. Basic design wind speed, V , miles per hour (mph) (km/hr) and allowable stress design wind speed, V_{asd} , as determined in accordance with Section 1609A.3.1 and wind exposure.
4. Seismic design category and site class.
5. Flood design data, if located in flood hazard areas established in Section 1612A.3.
6. Design load-bearing values of soils.
7. Rain load data.

[DSA-SS] *Additional requirements are included in Section 4-210 and 4-317 of the California Administrative Code (Part 1, Title 24, C.C.R.).*

[OSHDP 1] *Additional requirements are included in Section 7-115 and 7-125 of the California Administrative Code.*

1603A.1.1 Floor live load. The uniformly distributed, concentrated and impact floor live load used in the design shall be indicated for floor areas. Use of live load reduction in accordance with Section 1607A.12 shall be indicated for each type of live load used in the design.

1603A.1.2 Roof live load. The roof live load used in the design shall be indicated for roof areas (Section 1607A.14).

1603A.1.3 Roof snow load data. The ground snow load, p_g , shall be indicated. In areas where the ground snow load, p_g , exceeds 10 pounds per square foot (psf) (0.479 kN/m²), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, p_f .
2. Snow exposure factor, C_e .
3. Snow load importance factor, I_s .
4. Thermal factor, C_t .
5. Slope factor(s), C_s .
6. Drift surcharge load(s), p_d , where the sum of p_d and p_f exceeds 20 psf (0.96 kN/m²).
7. Width of snow drift(s), w .

1603A.1.4 Wind design data. The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force-resisting system of the structure:

1. Basic design wind speed, V , miles per hour and allowable stress design wind speed, V_{asd} , as determined in accordance with Section 1609A.3.1.
2. Risk category.
3. Wind exposure. Applicable wind direction if more than one wind exposure is utilized.
4. Applicable internal pressure coefficient.
5. Design wind pressures and their applicable zones with dimensions to be used for exterior component and cladding materials not specifically designed by the registered design professional responsible for the design of the structure, pounds per square foot (kN/m²).

1603A.1.5 Earthquake design data. The following information related to seismic loads shall be shown, regardless of whether seismic loads govern the design of the lateral force-resisting system of the structure:

1. Risk category.
2. Seismic importance factor, I_e .
3. Mapped spectral response acceleration parameters, S_S and S_1 .
4. Site class.
5. Design spectral response acceleration parameters, S_{DS} and S_{D1} .
6. Seismic design category.
7. Basic seismic force-resisting system(s).

8. Design base shear(s).
9. Seismic response coefficient(s), CS .
10. Response modification coefficient(s), R .
11. Analysis procedure used.
12. *Applicable horizontal structural irregularities.*
13. *Applicable vertical structural irregularities.*
14. *Location of base as defined in ASCE 7, Section 11.2.*

1603A.1.5.1 Connections. *Connections that resist design seismic forces shall be designed and detailed on the design drawings.*

1603A.1.6 Geotechnical information. The design load-bearing values of soils shall be shown on the construction documents.

1603A.1.7 Flood design data. For buildings located in whole or in part in flood hazard areas as established in Section 1612A.3, the documentation pertaining to design, if required in Section 1612A.4, shall be included and the following information, referenced to the datum on the community's Flood Insurance Rate Map (FIRM), shall be shown, regardless of whether flood loads govern the design of the building:

1. Flood design class assigned according to ASCE 24.
2. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation of the proposed lowest floor, including the basement.
3. In flood hazard areas other than coastal high hazard areas or coastal A zones, the elevation to which any nonresidential building will be dry floodproofed.
4. In coastal high hazard areas and coastal A zones, the proposed elevation of the bottom of the lowest horizontal structural member of the lowest floor, including the basement.

1603A.1.8 Special loads. Special loads that are applicable to the design of the building, structure or portions thereof, including but not limited to the loads of machinery or equipment, and that are greater than specified floor and roof loads shall be specified by their descriptions and locations.

1603A.1.8.1 Photovoltaic panel systems. The dead load of rooftop-mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1603A.1.9 Roof rain load data. Rain intensity, i (in/hr) (cm/hr), shall be shown regardless of whether rain loads govern the design.

1603A.1.10 Construction procedures. *Where unusual erection or construction procedures are considered essential by the Registered Design Professional (RDP) in order to accomplish the intent of the design or influence the construction, such procedure shall be indicated on the construction documents.*

1603A.2 Site data reports. *Geotechnical and geohazard reports for review by the enforcement agency shall be accompanied by a description of the project prepared by the regis-*

tered design professional (RDP) in responsible charge, which shall include the following:

1. Type of service such as general acute care facility, central utility plants, K-12 school, community college, essential services, etc.
2. Construction materials used for the project such as steel, concrete, masonry, wood, etc.
3. Type of construction project such as new, addition, alteration, repair, etc.
4. For existing buildings, extent of construction such as incidental, minor, major and/or voluntary seismic improvements as defined in Section 318, Part 10, Title 24, CCR [DSA-SS] Section 202 and California Existing Building Code Section 202A [OSHDP 1].
5. Seismic force resisting system used for each structure in the project.
6. Foundation system that will be used for each structure in the project such as spread footing, drilled piers, etc.
7. Analysis procedure used and basis of design such as ASCE 7 Equivalent Lateral Force Procedure, ASCE 41 Nonlinear Dynamic Procedure, etc.
8. Building characteristics such as number of stories above and below grade, foot print area at grade, grade slope on site, etc.
9. Special features such as requirement for shoring, underpinning, retaining walls, etc.

1603A.3 Structural design basis and calculations. The application for the approval of construction documents that involves structural elements or components shall be accompanied by complete and accurate structural design computations, which shall comply with requirements prescribed by the enforcement agency:

1. The computations shall be preceded by a detailed index.
2. The computations including each major subsection shall be prefaced by a statement clearly and concisely outlining the basis for the structural design and indicating the manner in which the structure will resist the vertical loads and lateral forces.
3. The computations shall be sufficiently complete to the extent that calculations for the individual structural members and connections can be readily interpreted.

SECTION 1604A GENERAL DESIGN REQUIREMENTS

1604A.1 General. Building, structures and parts thereof shall be designed and constructed in accordance with strength design, load and resistance factor design, allowable stress design, empirical design or conventional construction methods, as permitted by the applicable material chapters and referenced standards.

1604A.2 Strength. Buildings and other structures, and parts thereof, shall be designed and constructed to support safely the

factored loads in load combinations defined in this code without exceeding the appropriate strength limit states for the materials of construction. Alternatively, buildings and other structures, and parts thereof, shall be designed and constructed to support safely the nominal loads in load combinations defined in this code without exceeding the appropriate specified allowable stresses for the materials of construction.

Loads and forces for occupancies or uses not covered in this chapter shall be subject to the approval of the building official.

1604A.3 Serviceability. Structural systems and members thereof shall be designed to have adequate stiffness to limit deflections as indicated in Table 1604A.3.

1604A.3.1 Deflections. The deflections of structural members shall not exceed the more restrictive of the limitations of Sections 1604A.3.2 through 1604A.3.9 or that permitted by Table 1604A.3.

1604A.3.2 Reinforced concrete. The deflection of reinforced concrete structural members shall not exceed that permitted by ACI 318.

1604A.3.3 Steel. The deflection of steel structural members shall not exceed that permitted by AISC 360, AISI S100, ASCE 8, SJI 100 or SJI 200, as applicable.

1604A.3.4 Masonry. The deflection of masonry structural members shall not exceed that permitted by TMS 402.

1604A.3.5 Aluminum. The deflection of aluminum structural members shall not exceed that permitted by AA ADM.

1604A.3.6 Limits. The deflection limits of Section 1604A.3.1 shall be used unless more restrictive deflection limits are required by a referenced standard for the element or finish material.

1604A.3.7 Framing supporting glass. The deflection of framing members supporting glass subjected to 0.6 times the “component and cladding” wind loads shall not exceed either of the following:

1. $\frac{1}{175}$ of the length of span of the framing member, for framing members having a length not more than 13 feet 6 inches (4115 mm).
2. $\frac{1}{240}$ of the length of span of the framing member + $\frac{1}{4}$ inch (6.4 mm), for framing members having a length greater than 13 feet 6 inches (4115 mm).

1604A.3.8 Horizontal diaphragms. The maximum span-depth ratio for any roof or floor diaphragm consisting of steel and composite steel slab decking shall not exceed those given in Table 1604A.4, unless test data and design calculations acceptable to the enforcement agency are submitted and approved for the use of other span-depth ratios. Concrete diaphragms shall not exceed the span depth ratios for the equivalent composite steel-slab diaphragm in Table 1604A.4.

1604A.3.9 Deflections. Deflection criteria for materials not specified shall be developed by the project architect or structural engineer in a manner consistent with the provisions of this section and approved by the enforcement agency.

TABLE 1604A.3
DEFLECTION LIMITS^{a, b, c, h, i}

CONSTRUCTION	L or L_r	E, S or W^1	$D + (L$ or $L_r)^{d, 9}$
Roof members: ^c			
Supporting plaster or stucco ceiling	$l/360$	$l/360$	$l/240$
Supporting nonplaster ceiling	$l/240$	$l/240$	$l/180$
Not supporting ceiling	$l/180$	$l/180$	$l/120$
Floor members	$l/360$	—	$l/240$
Exterior walls:			
With plaster or stucco finishes	—	$l/360$	—
With other brittle finishes	—	$l/240$	—
With flexible finishes	—	$l/120$	—
Veneered walls, anchored veneers and adhered veneers over 1 inch (25 mm) thick, including the mortar backing	—	$l/600$	—
Interior partitions: ^b			
With plaster or stucco finishes	$l/360$	—	—
With other brittle finishes	$l/240$	—	—
With flexible finishes	$l/120$	—	—
Farm buildings	—	—	$l/180$
Greenhouses	—	—	$l/120$

For SI: 1 foot = 304.8 mm.

- a. For structural roofing and siding made of formed metal sheets, the total load deflection shall not exceed $l/60$. For secondary roof structural members supporting formed metal roofing, the live load deflection shall not exceed $l/150$. For secondary wall members supporting formed metal siding, the design wind load deflection shall not exceed $l/90$. For roofs, this exception only applies when the metal sheets have no roof covering.
- b. Flexible, folding and portable partitions are not governed by the provisions of this section. The deflection criterion for interior partitions is based on the horizontal load defined in Section 1607A.16.
- c. See Section 2403 for glass supports.
- d. The deflection limit for the $D + (L + L_r)$ load combination only applies to the deflection due to the creep component of long-term dead load deflection plus the short-term live load deflection. For lumber, structural glued laminated timber, prefabricated wood I-joists and structural composite lumber members that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection shall be permitted to be estimated as the immediate dead load deflection resulting from $0.5D$. For lumber and glued laminated timber members installed or used at all other moisture conditions or cross laminated timber and wood structural panels that are dry at time of installation and used under dry conditions in accordance with the ANSI/AWC NDS, the creep component of the long-term deflection is permitted to be estimated as the immediate dead load deflection resulting from D . The value of $0.5D$ shall not be used in combination with ANSI/AWC NDS provisions for long-term loading.
- e. The preceding deflections do not ensure against ponding. Roofs that do not have sufficient slope or camber to ensure adequate drainage shall be investigated for ponding. See Chapter 8 of ASCE 7.
- f. The wind load shall be permitted to be taken as 0.42 times the “component and cladding” loads or directly calculated using the 10-year mean return interval wind speed for the purpose of determining deflection limits in Table 1604A.3. Where framing members support glass, the deflection limit therein shall not exceed that specified in Section 1604A.3.7
- g. For steel structural members, the deflection due to creep component of long-term dead load shall be permitted to be taken as zero.
- h. For aluminum structural members or aluminum panels used in skylights and sloped glazing framing, roofs or walls of sunroom additions or patio covers not supporting edge of glass or aluminum sandwich panels, the total load deflection shall not exceed $l/60$. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed $l/175$ for each glass lite or $l/60$ for the entire length of the member, whichever is more stringent. For aluminum sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed $l/120$.
- i. l = Length of the member between supports. For cantilever members, l shall be taken as twice the length of the cantilever.

1604A.4 Analysis. Load effects on structural members and their connections shall be determined by methods of structural analysis that take into account equilibrium, general stability, geometric compatibility and both short- and long-term material properties.

Members that tend to accumulate residual deformations under repeated service loads shall have included in their analysis the effects of added deformations expected to occur during their service life.

Any system or method of construction to be used shall be based on a rational analysis in accordance with well-established principles of mechanics. Such analysis shall result in a system that provides a complete load path capable of transferring loads from their point of origin to the load-resisting elements.

The total lateral force shall be distributed to the various vertical elements of the lateral force-resisting system in proportion to their rigidities, considering the rigidity of the horizontal bracing system or diaphragm. Rigid elements assumed not to be a part of the lateral force-resisting system are permitted to be incorporated into buildings provided that their effect on the action of the system is considered and provided for in the design. *Structural analysis shall explicitly include consideration of stiffness of diaphragms in accordance with ASCE 7, Section 12.3.1.* A diaphragm is rigid for the purpose of distribution of story shear and torsional moment when the lateral deformation of the diaphragm is less than or equal to two times the average story drift. Where required by ASCE 7, provisions shall be made for the increased forces induced on

resisting elements of the structural system resulting from torsion due to eccentricity between the center of application of the lateral forces and the center of rigidity of the lateral force-resisting system.

Every structure shall be designed to resist the effects caused by the forces specified in this chapter, including overturning, uplift and sliding. Where sliding is used to isolate the elements, the effects of friction between sliding elements shall be included as a force.

1604A.5 Risk category. Each building and structure shall be assigned a risk category in accordance with Table 1604A.5. Where a referenced standard specifies an occupancy category, the risk category shall not be taken as lower than the occupancy category specified therein. Where a referenced standard specifies that the assignment of a risk category be in accordance with ASCE 7, Table 1.5-1, Table 1604A.5 shall be used in lieu of ASCE 7, Table 1.5-1.

Exception: The assignment of buildings and structures to Tsunami Risk Categories III and IV is permitted to be in accordance with Section 6.4 of ASCE 7.

1604A.5.1 Multiple occupancies. Where a building or structure is occupied by two or more occupancies not included in the same risk category, it shall be assigned the classification of the highest risk category corresponding to the various occupancies. Where buildings or structures have two or more portions that are structurally separated, each portion shall be separately classified. Where a separated portion of a building or structure provides required access to, required egress from or shares life safety components with another portion having a higher risk

category, both portions shall be assigned to the higher risk category.

Exception: Where a storm shelter designed and constructed in accordance with ICC 500 is provided in a building, structure or portion thereof normally occupied for other purposes, the risk category for the normal occupancy of the building shall apply unless the storm shelter is a designated emergency shelter in accordance with Table 1604A.5.

1604A.6 In-situ load tests. The building official is authorized to require an engineering analysis or a load test, or both, of any construction whenever there is reason to question the safety of the construction for the intended occupancy. Engineering analysis and load tests shall be conducted in accordance with Section 1708A.

1604A.7 Preconstruction load tests. Materials and methods of construction that are not capable of being designed by approved engineering analysis or that do not comply with the applicable referenced standards, or alternative test procedures in accordance with Section 1707A, shall be load tested in accordance with Section 1709A.

1604A.8 Anchorage. Buildings and other structures, and portions thereof, shall be provided with anchorage in accordance with Sections 1604A.8.1 through 1604A.8.3, as applicable.

1604A.8.1 General. Anchorage of the roof to walls and columns, and of walls and columns to foundations, shall be provided to resist the uplift and sliding forces that result from the application of the prescribed loads.

TABLE 1604A.4
MAXIMUM HORIZONTAL DIAPHRAGM SPAN AND SPAN-DEPTH RATIOS^{1, 3, 4}

FLEXIBILITY FACTOR(F) ²	MAXIMUM DIAPHRAGM SPAN FOR MASONRY OR CONCRETE WALLS (feet)	DIAPHRAGM SPAN-DEPTH LIMITATION			
		Rotation (torsion) Not Considered in Diaphragm		Rotation (torsion) Considered in Diaphragm	
		Masonry or Concrete Walls	Flexible Walls	Masonry or Concrete Walls	Flexible Walls
More than 150	Not to be used	Not to be used	2:1	Not to be used	1 ¹ / ₂ :1
70–150	200	2:1 or as required for deflection	3:1	Not to be used	2:1
10–70	400	2 ¹ / ₂ :1 or as required for deflection	4:1	As required for deflection	2 ¹ / ₂ :1
1–10	No limitation	3:1 or as required for deflection	5:1	As required for deflection	3:1
Less than 1	No limitation	As required for deflection	No limitation	As required for deflection	3 ¹ / ₂ :1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 plf = 14.594 N/m, 1 psi = 6894 Pa

- Diaphragms shall satisfy span-depth limitations based on flexibility.
- Flexibility factor (F) is the average deflection in micro inches (10⁻⁶) or μm of the diaphragm web per foot (m) of span stressed with a shear of 1 pound per foot (N/m).
- The total deflection Δ of the diaphragm may be computed from the equation: Δ = Δ_f + Δ_w.

Where:

Δ_f = Flexural deflection of the diaphragm determined in the same manner as the deflection of beams. The flexural stiffness of the web of diaphragms consisting of bare steel decking shall be neglected.

Δ_w = Web deflection of the diaphragm may be determined solving the following equation:

$$F = \frac{\Delta_w \times 10^6}{q_{ave} L}$$

Where:

L = Distance in feet (m) between the vertical resisting element (such as a shear wall) and the point to which the deflection is to be determined.

q_{ave} = Average shear in the diaphragm in pounds per foot (N/m) over length L.

- When applying these limitations to cantilevered diaphragms, the allowable span-depth ratio will be half of that shown.

**TABLE 1604A.5
RISK CATEGORY OF BUILDINGS AND OTHER STRUCTURES**

RISK CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities.
II	Buildings and other structures except those listed in Risk Categories I, III and IV.
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: <ul style="list-style-type: none"> • Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures containing one or more public assembly spaces, each having an occupant load greater than 300 and a cumulative occupant load of these public assembly spaces of greater than 2,500. • Buildings and other structures containing Group E or Group I-4 occupancies or combination thereof, with an occupant load greater than 250. • Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500. • Group I-2, Condition 1 occupancies with 50 or more care recipients. • Group I-2, Condition 2 occupancies not having emergency surgery or emergency treatment facilities. • Group I-3 occupancies. • Any other occupancy with an occupant load greater than 5,000.^a • Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public utility facilities not included in Risk Category IV. • Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and • Are sufficient to pose a threat to the public if released.^b
IV	Buildings and other structures designated as essential facilities, including but not limited to: <ul style="list-style-type: none"> • <i>[OSHPD 1 & 4] General Acute-care Hospital Buildings, General Acute-care Hospital Buildings providing only acute medical rehabilitation center services, and Correctional Treatment Center Buildings and all structures required for their continuous operation or access/egress.</i> • Ambulatory care facilities having emergency surgery or emergency treatment facilities. • Fire, rescue, ambulance and police stations and emergency vehicle garages • Designated earthquake, hurricane or other emergency shelters. • Designated emergency preparedness, communications and operations centers and other facilities required for emergency response. <i>[DSA-SS] as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.</i> • Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures. • Buildings and other structures containing quantities of highly toxic materials that: <ul style="list-style-type: none"> • Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the <i>California Fire Code</i>; and • Are sufficient to pose a threat to the public if released.^b • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water storage facilities and pump structures required to maintain water pressure for fire suppression.

a. For purposes of occupant load calculation, occupancies required by Table 1004.5 to use gross floor area calculations shall be permitted to use net floor areas to determine the total occupant load.

b. Where approved by the building official, the classification of buildings and other structures as Risk Category III or IV based on their quantities of toxic, highly toxic or explosive materials is permitted to be reduced to Risk Category II, provided that it can be demonstrated by a hazard assessment in accordance with Section 1.5.3 of ASCE 7 that a release of the toxic, highly toxic or explosive materials is not sufficient to pose a threat to the public.

1604A.8.2 Structural walls. Walls that provide vertical load-bearing resistance or lateral shear resistance for a portion of the structure shall be anchored to the roof and to all floors and members that provide lateral support for the wall or that are supported by the wall. The connections shall be capable of resisting the horizontal forces specified in Section 1.4.4 of ASCE 7 for walls of structures assigned to Seismic Design Category A and to Section 12.11 of ASCE 7 for walls of structures assigned to all other seismic design categories. *For anchorage of concrete or masonry walls to roof and floor diaphragms, the out-of-plane strength design force shall not be less than 280 lb/linear ft (4.09 kN/m) of wall.* Required anchors in masonry walls of hollow units or cavity walls shall be embedded in a reinforced grouted structural element of the wall. See Sections 1609 for wind design requirements and 1613A for earthquake design requirements.

1604A.8.3 Decks. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads as applicable. Such attachment shall not be accomplished by the use of toenails or nails subject to withdrawal. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting. Connections of decks with cantilevered framing members to exterior walls or other framing members shall be designed for both of the following:

1. The reactions resulting from the dead load and live load specified in Table 1607A.1, or the snow load specified in Section 1608A, in accordance with Section 1605A, acting on all portions of the deck.
2. The reactions resulting from the dead load and live load specified in Table 1607A.1, or the snow load specified in Section 1608A, in accordance with Section 1605A, acting on the cantilevered portion of the deck, and no live load or snow load on the remaining portion of the deck.

1604A.9 Wind and seismic detailing. Lateral force-resisting systems shall meet seismic detailing requirements and limitations prescribed in this code and ASCE 7, Chapters 11, 12, 13, 15, 17 and 18 as applicable, even where wind load effects are greater than seismic load effects.

Exception: References within ASCE 7 to Chapter 14 shall not apply, except as specifically required herein.

1604A.10 Loads on storm shelters. Loads and load combinations on storm shelters shall be determined in accordance with ICC 500.

SECTION 1605A LOAD COMBINATIONS

1605A.1 General. Buildings and other structures and portions thereof shall be designed to resist the strength load combinations specified in ASCE 7, Section 2.3, the allowable stress design load combinations specified in ASCE 7, Section

2.4, or the alternative allowable stress design load combinations of Section 1605A.2.

Exceptions:

1. The modifications to load combinations of ASCE 7, Section 2.3, ASCE 7, Section 2.4, and Section 1605A.2 specified in ASCE 7, Chapters 18 and 19 shall apply.
2. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, flat roof snow loads of 30 pounds per square foot (1.44 kN/m²) and roof live loads of 30 pounds per square foot (1.44 kN/m²) or less need not be combined with seismic load. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m²), 20 percent shall be combined with seismic loads.
3. Where the allowable stress design load combinations of ASCE 7, Section 2.4 are used, crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind loads.

1605A.1.1 Stability. Regardless of which load combinations are used to design for strength, where overall structure stability (such as stability against overturning, sliding, or buoyancy) is being verified, use of the load combinations specified in Section 2.3 or 2.4 of ASCE 7, and in Section 1605A.2 shall be permitted. Where the load combinations specified in ASCE 7, Section 2.3 are used, strength reduction factors applicable to soil resistance shall be provided by a registered design professional. The stability of retaining walls shall be verified in accordance with Section 1807A.2.3. *When using allowable stress design, factor of safety for soil bearing values shall not be less than the overstrength factor of the structures supported. Strength design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.5 for all strength design load combinations, except that Resistance Factor (ϕ) shall be permitted to be 1.0 for load combinations with overstrength factor. Allowable stress design for foundation geotechnical capacity shall be in accordance with ASCE 7, Section 12.13.6 for all allowable stress design load combinations, and shall be established to be consistent with strength design requirements in ASCE 7, Section 12.13.5.*

1605A.2 Alternative allowable stress design load combinations. In lieu of the load combinations in ASCE 7, Section 2.4, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. Where using these alternative allowable stress load combinations that include wind or seismic loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of

foundation overturning from Section 12.13.4 in ASCE 7 shall not be used. Where using these alternative basic load combinations for proportioning foundations for loadings, which include seismic loads, the vertical seismic load effect, E_v , in Equation 12.4-4 of ASCE 7 is permitted to be taken equal to zero. Where required by ASCE 7, Chapters 12, 13 and 15, the load combinations including overstrength of ASCE 7, Section 2.3.6 shall be used. *Each load combination shall be investigated with one or more of the variable loads set to zero.*

$$D + L + (L_r \text{ or } S \text{ or } R) \quad \text{(Equation 16A-1)}$$

$$D + L + 0.6W \quad \text{(Equation 16A-2)}$$

$$D + L + 0.6W + S/2 \quad \text{(Equation 16A-3)}$$

$$D + L + S + 0.6W/2 \quad \text{(Equation 16A-4)}$$

$$D + L + S + E/1.4 \quad \text{(Equation 16A-5)}$$

$$0.9D + E/1.4 \quad \text{(Equation 16A-6)}$$

Exceptions:

1. Crane hook loads need not be combined with roof live loads or with more than three-fourths of the snow load or one-half of the wind load.
2. Flat roof snow loads of 30 pounds per square foot (1.44 kN/m²) or less and roof live loads of 30 pounds per square foot (1.44 kN/m²) or less need not be combined with seismic loads. Where flat roof snow loads exceed 30 pounds per square foot (1.44 kN/m²), 20 percent shall be combined with seismic loads.

1605A.3 Modifications to load combinations in ICC 300. *Modify the text of ICC 300 as follows:*

1605A.3.1 ICC 300, Section 303.5.2. *Modify Section 303.5.2 by adding Equation 3-5a as follows:*

$$D + 0.4L + Z \quad \text{(Equation 3-5a)}$$

1605A.3.2 ICC 300, Section 303.5.3. *Modify Section 303.5.3 as follows:*

The uniform live load L used in Equation 3-2 and 3-4 may be taken as zero when evaluating elements supporting the handrail/guard provided those elements do not also support L.

**SECTION 1606A
DEAD LOADS**

1606A.1 General. Dead loads are those loads defined in Chapter 2 of this code. Dead loads shall be considered to be permanent loads.

1606A.2 Weights of materials of construction. For purposes of design, the actual weights of materials of construction shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

1606A.3 Weight of fixed service equipment. In determining dead loads for purposes of design, the weight of fixed service equipment, including the maximum weight of the contents of

fixed service equipment, shall be included. The components of fixed service equipment that are variable, such as liquid contents and movable trays, shall not be used to counteract forces causing overturning, sliding, and uplift conditions in accordance with Section 1.3.6 of ASCE 7.

Exceptions:

1. Where force effects are the result of the presence of the variable components, the components are permitted to be used to counter those load effects. In such cases, the structure shall be designed for force effects with the variable components present and with them absent.
2. For the calculation of seismic force effects, the components of fixed service equipment that are variable, such as liquid contents and movable trays, need not exceed those expected during normal operation.

1606A.4 Photovoltaic panel systems. The weight of photovoltaic panel systems, their support system, and ballast shall be considered as dead load.

1606A.5 Vegetative and landscaped roofs. The weight of all landscaping and hardscaping materials for vegetative and landscaped roofs shall be considered as dead load. The weight shall be computed considering both fully saturated soil and drainage layer materials and fully dry soil and drainage layer materials to determine the most severe load effects on the structure.

1606A.6 Roof dead loads. *The design dead load shall provide for the weight of at least one additional roof covering in addition to other applicable loadings if the new roof covering is permitted to be applied over the original roofing without its removal, in accordance with Section 1512.*

**SECTION 1607A
LIVE LOADS**

1607A.1 General. Live loads are those loads defined in Chapter 2 and Section 1602A.1 of this code.

1607A.2 Loads not specified. For occupancies or uses not designated in Section 1607A, the live load shall be determined in accordance with a method approved by the building official.

1607A.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall not be less than the minimum uniformly distributed live loads given in Table 1607A.1.

1607A.4 Concentrated live loads. Floors, roofs and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607A.3 or the concentrated live loads, given in Table 1607A.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area of 2½ feet by 2½ feet (762 mm by 762 mm) and shall be located so as to produce the maximum load effects in the structural members.

**TABLE 1607A.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS**

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION	
1.	Apartments (see residential)	—	—	—	
2.	Access floor systems	Office use	50	2,000	—
		Computer use	100	2,000	—
3.	Armories and drill rooms	150 ^b	—	—	
4.	Assembly areas ^{c, e}	Fixed seats (fastened to floor)	60 ^a	—	—
		Follow spot, projections and control rooms	50		
		Lobbies	100 ^a		
		Movable seats	100 ^a		
		Stage floors	150 ^b		
		Platforms (assembly)	100 ^a		
		Bleachers, folding and telescopic seating and grandstands ^f	100 ^a (See Section 1607A.19)		
		Stadiums and arenas with fixed seats (fastened to the floor)	60 ^a (See Section 1607A.19)		
	Other assembly areas	100 ^a			
5.	Balconies and decks	1.5 times the live load for the area served, not required to exceed 100	—	—	
6.	Catwalks for maintenance and service access	40	300	—	
7.	Cornices	60	—	—	
8.	Corridors	First floor	100	—	—
		Other floors	Same as occupancy served except as indicated		
9.	Dining rooms and restaurants	100 ^a	—	—	
10.	Dwellings (see residential)	—	—	—	
11.	Elevator machine room and control room grating (on area of 2 inches by 2 inches)	—	300	—	
12.	Finish light floor plate construction (on area of 1 inch by 1 inch)	—	200	—	
13.	Fire escapes		100	—	—
		On single-family dwellings only	40		
14.	Fixed ladders	See Section 1607A.17		—	
15.	Garages	Passenger vehicles only	40 ^c	See Section 1607A.7	—
		Trucks and buses	See Section 1607A.8		
16.	Handrails, guards and grab bars	See Section 1607A.9		—	
17.	Helipads	See Section 1607A.6		—	
18.	Hospitals [OSHPD 1 & 4]	Corridors above first floor	80	1,000	—
		Operating rooms, laboratories	60 ^a	1,000	
		Patient rooms	40	1,000	
19.	Hotels (see residential)	—	—	—	

(continued)

TABLE 1607A.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION		
20.	Libraries	Corridors above first floor	80	1,000	—	
		Reading rooms	60	1,000	—	
		Stack rooms	150 ^b	1,000	Section 1607A.18	
21.	Manufacturing	Heavy	250 ^b	3,000	—	
		Light	125 ^b	2,000		
22.	Marquees, except one- and two-family dwellings		75	—	—	
23.	Office buildings ^b	Corridors above first floor	80	2,000	—	
		File and computer rooms shall be designed for heavier loads based on anticipated occupancy		—		—
		Lobbies and first-floor corridors	100	2,000		
		Offices	50	2,000		
24.	Penal institutions	Cell blocks	40	—	—	
		Corridors	100			
25.	Recreational uses	Bowling alleys, poolrooms and similar uses	75 ^a	—	—	
		Dance halls and ballrooms	100 ^a			
		Gymnasiums	100 ^a			
		Ice skating rinks	250 ^b			
		Roller skating rinks	100 ^a			
26.	Residential	One- and two-family dwellings:		—	Section 1607A.22	
		Uninhabitable attics without storage				10
		Uninhabitable attics with storage				20
		Habitable attics and sleeping areas				30
		Canopies, including marquees				20
		All other areas				40
		Hotels and multifamily dwellings:				
		Private rooms and corridors serving them				40
Public rooms ^a and corridors serving them		100				
27.	Roofs	Ordinary flat, pitched, and curved roofs (that are not occupiable)		20	—	
		Roof areas used for assembly purposes		100 ^a	—	
		Roof areas used for occupancies other than assembly		Same as occupancy served	—	
		Vegetative and landscaped roofs:			—	
		Roof areas not intended for occupancy		20	—	
		Roof areas used for assembly purposes		100 ^a	—	
		Roof areas used for other occupancies		Same as occupancy served	—	
		Awnings and canopies:			—	
		Fabric construction supported by a skeleton structure		5 ^a	—	
		All other construction, except one- and two-family dwellings		20	—	
		Primary roof members exposed to a work floor:				
		Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs over manufacturing, storage warehouses, and repair garages		—	2,000	Section 1607A.15.2
All other primary roof members		—	300			
All roof surfaces subject to maintenance workers		—	300			

(continued)

TABLE 1607A.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS, L_o , AND MINIMUM CONCENTRATED LIVE LOADS

OCCUPANCY OR USE		UNIFORM (psf)	CONCENTRATED (pounds)	ALSO SEE SECTION	
28.	Schools ^d	Classrooms	40 [DSA-SS] 50 ^f	1,000	—
		Corridors above first floor	80	1,000	
		First-floor corridors	100	1,000	
29.	Scuttles, skylight ribs and accessible ceilings	—	200	—	
30.	Sidewalks, vehicular driveways and yards, subject to trucking	250 ^b	8,000	Section 1607A.20	
31.	Stairs and exits	One- and two-family dwellings	40	300	Section 1607A.21
		All other	100	300	Section 1607A.21
32.	Storage areas above ceilings	20	—	—	
33.	Storage warehouses (shall be designed for heavier loads if required for anticipated storage)	Heavy	250 ^b	—	—
		Light	125 ^b		
34.	Stores	Retail:			—
		First floor	100	1,000	
		Upper floors	75	1,000	
		Wholesale, all floors	125 ^b	1,000	
35.	Vehicle barriers	See Section 1607A.10		—	
36.	Walkways and elevated platforms (other than exitways)	60	—	—	
37.	Yards and terraces, pedestrian ^h	100 ^a	—	—	
38.	Storage racks and wall-hung cabinets	Total loads ^d	—	—	

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kN/m², 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m³.

- a. Live load reduction is not permitted.
- b. Live load reduction is only permitted in accordance with Section 1607A.12.1.2 or Item 1 of Section 1607A.12.2.
- c. Live load reduction is only permitted in accordance with Section 1607A.12.1.3 or Item 2 of Section 1607A.12.2.
- d. The minimum vertical design live load shall be as follows:
 - Paper media:
 - 12-inch-deep shelf 33 pounds per lineal foot
 - 15-inch-deep shelf 41 pounds per lineal foot, or
 - 33 pounds per cubic foot per total volume of the rack or cabinet, whichever is less.
 - Film media:
 - 18-inch-deep shelf 100 pounds per lineal foot, or
 - 50 pounds per cubic foot per total volume of the rack or cabinet, whichever is less.
 - Other media:
 - 20 pounds per cubic foot or 20 pounds per square foot, whichever is less, but not less than actual loads.
- e. [DSA-SS] The following minimum loads for stage accessories apply:
 1. Gridirons and fly galleries: 75 pounds per square foot uniform live load.
 2. Loft block wells: 250 pounds per lineal foot vertical load and lateral load.
 3. Head block wells and sheave beams: 250 pounds per lineal foot vertical load and lateral load. Head block wells and sheave beams shall be designed for all tributary loft block well loads. Sheave blocks shall be designed with a safety factor of five.
 4. Scenery beams where there is no gridiron: 300 pounds per lineal foot vertical load and lateral load.
 5. Ceiling framing over stages shall be designed for a uniform live load of 20 pounds per square foot. For members supporting a tributary area of 200 square feet or more, this additional load may be reduced to 15 pounds per square foot.
- f. [DSA-SS] Live load reduction is not permitted for classrooms classified as Group A occupancies.
- g. [DSA-SS] The minimum uniform live load for a press box floor or accessible roof with railing is 100 psf.
- h. [DSA-SS] Item 37 applies to pedestrian bridges and walkways that are not subjected to uncontrolled vehicle access.

1607A.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load is 80 psf (3.83 kN/m²) or greater. The partition load shall be not less than a uniformly distributed live load of 15 psf (0.72 kN/m²).

1607A.6 Helipads. Helipads shall be designed for the following live loads:

1. A uniform live load, *L*, as specified in Items 1.1 and 1.2. This load shall not be reduced.
 - 1.1. 40 psf (1.92 kN/m²) where the design basis helicopter has a maximum take-off weight of 3,000 pounds (13.35 kN) or less.
 - 1.2. 60 psf (2.87 kN/m²) where the design basis helicopter has a maximum take-off weight greater than 3,000 pounds (13.35 kN).
2. A single concentrated live load, *L*, of 3,000 pounds (13.35 kN) applied over an area of 4.5 inches by 4.5 inches (114 mm by 114 mm) and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated load is not required to act concurrently with other uniform or concentrated live loads.
3. Two single concentrated live loads, *L*, 8 feet (2438 mm) apart applied on the landing pad (representing the helicopter's two main landing gear, whether skid type or wheeled type), each having a magnitude of 0.75 times the maximum take-off weight of the helicopter, and located so as to produce the maximum load effects on the structural elements under consideration. The concentrated loads shall be applied over an area of 8 inches by 8 inches (203 mm by 203 mm) and are not required to act concurrently with other uniform or concentrated live loads.

Landing areas designed for a design basis helicopter with maximum take-off weight of 3,000 pounds (13.35 kN) shall be identified with a 3,000-pound (13.34 kN) weight limitation. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The indication for the landing area weight limitation shall be a minimum 5 feet (1524 mm) in height.

1607A.7 Passenger vehicle garages. Floors in garages or portions of a building used for the storage of motor vehicles shall be designed for the uniformly distributed live loads indicated in Table 1607A.1 or the following concentrated load:

1. For garages restricted to passenger vehicles accommodating not more than nine passengers, 3,000 pounds (13.35 kN) acting on an area of 4.5 inches by 4.5 inches (114 mm by 114 mm).
2. For mechanical parking structures without slab or deck that are used for storing passenger vehicles only, 2,250 pounds (10 kN) per wheel.

1607A.8 Heavy vehicle loads. Floors and other surfaces that are intended to support vehicle loads greater than a 10,000-pound (4536 kg) gross vehicle weight rating shall comply with Sections 1607A.8.1 through 1607A.8.5.

1607A.8.1 Loads. Where any structure does not restrict access for vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, those portions of the structure subject to such loads shall be designed using the vehicular live loads, including consideration of impact and fatigue, in accordance with the codes and specifications required by the jurisdiction having authority for the design and construction of the roadways and bridges in the same location of the structure.

1607A.8.2 Fire truck and emergency vehicles. Where a structure or portions of a structure are accessed and loaded by fire department access vehicles and other similar emergency vehicles, the structure shall be designed for the greater of the following loads:

1. The actual operational loads, including outrigger reactions and contact areas of the vehicles as stipulated and approved by the building official.
2. The live loading specified in Section 1607A.8.1.

1607A.8.3 Heavy vehicle garages. Garages designed to accommodate vehicles that exceed a 10,000-pound (4536 kg) gross vehicle weight rating, shall be designed using the live loading specified by Section 1607A.8.1. For garages the design for impact and fatigue is not required.

Exception: The vehicular live loads and load placement are allowed to be determined using the actual vehicle weights for the vehicles allowed onto the garage floors, provided that such loads and placement are based on rational engineering principles and are approved by the building official, but shall be not less than 50 psf (2.9 kN/m²). This live load shall not be reduced.

1607A.8.4 Forklifts and movable equipment. Where a structure is intended to have forklifts or other movable equipment present, the structure shall be designed for the total vehicle or equipment load and the individual wheel loads for the anticipated vehicles as specified by the owner of the facility. These loads shall be posted in accordance with Section 1607A.8.5.

1607A.8.4.1 Impact and fatigue. Impact loads and fatigue loading shall be considered in the design of the supporting structure. For the purposes of design, the vehicle and wheel loads shall be increased by 30 percent to account for impact.

1607A.8.5 Posting. The maximum weight of vehicles allowed into or on a garage or other structure shall be posted by the owner or the owner's authorized agent in accordance with Section 106.1.

1607A.9 Loads on handrails, guards, grab bars and seats. Handrails and guards shall be designed and constructed for the structural loading conditions set forth in Section 1607A.9.1. Grab bars, shower seats and accessible benches shall be designed and constructed for the structural loading conditions set forth in Section 1607A.9.2.

1607A.9.1 Handrails and guards. Handrails and guards shall be designed to resist a linear load of 50 pounds per linear foot (plf) (0.73 kN/m) in accordance with Section 4.5.1.1 of ASCE 7. Glass handrail assemblies and guards shall comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607A.9.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607A.9.1.1 Concentrated load. Handrails and guards shall be designed to resist a concentrated load of 200 pounds (0.89 kN) in accordance with Section 4.5.1 of ASCE 7.

1607A.9.1.2 Guard component loads. Balusters, panel fillers and guard infill components, including all rails except the handrail and the top rail, shall be designed to resist a concentrated load of 50 pounds (0.22 kN) in accordance with Section 4.5.1.2 of ASCE 7.

1607A.9.2 Grab bars, shower seats and accessible benches. Grab bars, shower seats and accessible benches shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point on the grab bar, shower seat, or seat of the accessible bench so as to produce the maximum load effects. *[DSA-AC] See Chapter 11A, Section 1127A.4 and Chapter 11B, Sections 11B-609.8, 11B-610.4 and 11B-903.6 for grab bars, shower seats and dressing room bench seats, as applicable.*

1607A.10 Vehicle barriers. Vehicle barriers for passenger vehicles shall be designed to resist a concentrated load of 6,000 pounds (26.70 kN) in accordance with Section 4.5.3 of ASCE 7. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provisions for traffic railings.

1607A.11 Impact loads. The live loads specified in Sections 1607A.3 through 1607A.10 shall be assumed to include adequate allowance for ordinary impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607A.11.1 Elevators. Members, elements and components subject to dynamic loads from elevators shall be designed for impact loads and deflection limits prescribed by ASME A17.1/CSA B44.

1607A.11.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact:

1. Light machinery, shaft- or motor-driven, 20 percent.
2. Reciprocating machinery or power-driven units, 50 percent.

Percentages shall be increased where specified by the manufacturer.

1607A.11.3 Elements supporting hoists for façade access and building maintenance equipment. In addition to any other applicable live loads, structural elements that support hoists for façade access and building maintenance equipment shall be designed for a live load of 2.5 times the rated load of the hoist or the stall load of the hoist, whichever is larger.

1607A.11.4 Fall arrest, lifeline, and rope descent system anchorages. In addition to any other applicable live loads, fall arrest, lifeline, and rope descent system anchorages and structural elements that support these anchorages shall be designed for a live load of not less than 3,100 pounds (13.8 kN) for each attached line, in any direction that the load can be applied.

Anchorage of horizontal lifelines and the structural elements that support these anchorages shall be designed for the maximum tension that develops in the horizontal lifeline from these live loads.

1607A.12 Reduction in uniform live loads. Except for uniform live loads at roofs, all other minimum uniformly distributed live loads, L_o , in Table 1607A.1 are permitted to be reduced in accordance with Section 1607A.12.1 or 1607A.12.2. Uniform live loads at roofs are permitted to be reduced in accordance with Section 1607.14.2.

1607A.12.1 Basic uniform live load reduction. Subject to the limitations of Sections 1607A.12.1.1 through 1607A.12.1.3 and Table 1607A.1, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m²) or more are permitted to be designed for a reduced uniformly distributed live load, L , in accordance with the following equation:

$$L = L_o \left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}} \right) \quad \text{(Equation 16A-7)}$$

$$\text{For SI: } L = L_o \left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}} \right)$$

where:

L = Reduced design live load per square foot (m²) of area supported by the member.

L_o = Unreduced design live load per square foot (m²) of area supported by the member (see Table 1607A.1).

K_{LL} = Live load element factor (see Table 1607A.12.1).

A_T = Tributary area, in square feet (m²).

L shall be not less than $0.50L_o$ for members supporting one floor and L shall be not less than $0.40L_o$ for members supporting two or more floors.

1607A.12.1.1 One-way slabs. The tributary area, A_T , for use in Equation 16-7 for one-way slabs shall not exceed an area defined by the slab span times a width normal to the span of 1.5 times the slab span.

**TABLE 1607A.12.1
LIVE LOAD ELEMENT FACTOR, K_{LL}**

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
Members not previously identified including:	1
Edge beams with cantilever slabs	
Cantilever beams	
One-way slabs	
Two-way slabs	
Members without provisions for continuous shear transfer normal to their span	

1607A.12.1.2 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m²) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load shall be not less than L as calculated in Section 1607A.12.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

1607A.12.1.3 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages.

Exception: The live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent, but the live load shall be not less than L as calculated in Section 1607A.12.1.

1607A.12.2 Alternative uniform live load reduction. As an alternative to Section 1607A.12.1 and subject to the limitations of Table 1607A.1, uniformly distributed live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m²) except that the design live load for members supporting two or more floors is permitted to be reduced by not greater than 20 percent.

Exception: For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

2. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by not greater than 20 percent.
3. For live loads not exceeding 100 psf (4.79 kN/m²), the design live load for any structural member supporting 150 square feet (13.94 m²) or more is permitted to be reduced in accordance with Equation 16-8
4. For one-way slabs, the area, A , for use in Equation 16-8 shall not exceed the product of the slab span and a width normal to the span of 0.5 times the slab span.

$$R = 0.08(A - 150) \quad \text{(Equation 16A-8)}$$

$$\text{For SI: } R = 0.861(A - 13.94)$$

Such reduction shall not exceed the smallest of:

1. 40 percent for members supporting one floor.
2. 60 percent for members supporting two or more floors.
3. R as determined by the following equation:

$$R = 23.1(1 + D/L_o) \quad \text{(Equation 16A-9)}$$

where:

A = Area of floor supported by the member, square feet (m²).

D = Dead load per square foot (m²) of area supported.

L_o = Unreduced live load per square foot (m²) of area supported.

R = Reduction in percent.

1607A.13 Distribution of floor loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest load effect at each location under consideration. Floor live loads are permitted to be reduced in accordance with Section 1607A.12.

1607A.14 Roof loads. The structural supports of roofs and marquees shall be designed to resist wind and, where applicable, snow and earthquake loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607A.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607A.14.1 Distribution of roof loads. Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m²) in accordance with Section 1607A.14.2.1 and are applied to the design of structural members arranged so as to create continuity, the reduced roof live load shall be applied to adjacent spans or to alternate spans, whichever produces the most unfavorable load effect. See Section 1607A.14.2 for reductions in minimum roof live loads and Section 7.5 of ASCE 7 for partial snow loading.

1607A.14.2 Reduction in uniform roof live loads. The minimum uniformly distributed live loads of roofs and

marquees, L_o , in Table 1607A.1 are permitted to be reduced in accordance with Section 1607A.14.2.1.

1607A.14.2.1 Ordinary roofs, awnings and canopies.

Ordinary flat, pitched and curved roofs, and awnings and canopies other than of fabric construction supported by a skeleton structure, are permitted to be designed for a reduced uniformly distributed roof live load, L_r , as specified in the following equations or other controlling combinations of loads as specified in Section 1605A, whichever produces the greater load effect.

In structures such as greenhouses, where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equations shall not be used unless approved by the building official. Such structures shall be designed for a minimum roof live load of 12 psf (0.58 kN/m²).

$$L_r = L_o R_1 R_2 \quad \text{(Equation 16A-10)}$$

where: $12 \leq L_r \leq 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \leq L_r \leq 0.96$

L_o = Unreduced roof live load per square foot (m²) of horizontal projection supported by the member (see Table 1607A.1).

L_r = Reduced roof live load per square foot (m²) of horizontal projection supported by the member.

The reduction factors R_1 and R_2 shall be determined as follows:

$$R_1 = 1 \text{ for } A_t \leq 200 \text{ square feet (18.58 m}^2\text{)} \quad \text{(Equation 16A-11)}$$

$$R_1 = 1.2 - 0.001A_t \text{ for } 200 \text{ square feet} < A_t < 600 \text{ square feet} \quad \text{(Equation 16A-12)}$$

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t < 55.74$ square meters

$$R_1 = 0.6 \text{ for } A_t \geq 600 \text{ square feet (55.74 m}^2\text{)} \quad \text{(Equation 16A-13)}$$

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m²) supported by the member, and

$$R_2 = 1 \text{ for } F \leq 4 \quad \text{(Equation 16A-14)}$$

$$R_2 = 1.2 - 0.05 F \text{ for } 4 < F < 12 \quad \text{(Equation 16A-15)}$$

$$R_2 = 0.6 \text{ for } F \geq 12 \quad \text{(Equation 16A-16)}$$

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607A.14.2.2 Occupiable roofs. Areas of roofs that are occupiable, such as vegetative roofs, landscaped roofs or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607A.12.

1607A.14.3 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607A.1 as well as for snow loads and wind loads as specified in Sections 1608A and 1609A.

1607A.14.4 Photovoltaic panel systems. Roof structures that provide support for photovoltaic panel systems shall be designed in accordance with Sections 1607A.14.4.1 through 1607A.14.4.5, as applicable.

1607A.14.4.1 Roof live load. Roof structures that support photovoltaic panel systems shall be designed to resist each of the following conditions:

1. Applicable uniform and concentrated roof loads with the photovoltaic panel system dead loads.

Exception: Roof live loads need not be applied to the area covered by photovoltaic panels where the clear space between the panels and the roof surface is 24 inches (610 mm) or less.

2. Applicable uniform and concentrated roof loads without the photovoltaic panel system present.

1607A.14.4.2 Photovoltaic panels or modules. The structure of a roof that supports solar photovoltaic panels or modules shall be designed to accommodate the full solar photovoltaic panels or modules and ballast dead load, including concentrated loads from support frames in combination with the loads from Section 1607A.14.4.1 and other applicable loads. Where applicable, snow drift loads created by the photovoltaic panels or modules shall be included.

1607A.14.4.3 Photovoltaic panels installed on open grid roof structures. Structures with open grid framing and without a roof deck or sheathing supporting photovoltaic panel systems shall be designed to support the uniform and concentrated roof live loads specified in Section 1607A.14.4.1, except that the uniform roof live load shall be permitted to be reduced to 12 psf (0.57 kN/m²).

1607A.14.4.4 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic (PV) panel systems that are independent structures and do not have accessible/occupied space underneath are not required to accommodate a roof photovoltaic live load. Other loads and combinations in accordance with Section 1605A shall be accommodated.

1607A.14.4.5 Ballasted photovoltaic panel systems. Roof structures that provide support for ballasted photovoltaic panel systems shall be designed, or analyzed, in accordance with Section 1604A.4; checked in accordance with Section 1604A.3.6 for deflections; and checked in accordance with Section 1611A for ponding.

1607A.14.5 Uncovered open-frame roof structures. Uncovered open-frame roof structures shall be designed for a vertical live load of not less than 10 pounds per square foot (0.48 kN/m²) of the total area encompassed by the framework.

1607A.15 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607A.15.1 Maximum wheel load. The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its runway at the location where the resulting load effect is maximum.

1607A.15.2 Vertical impact force. The maximum wheel loads of the crane shall be increased by the following percentages to account for the effects of vertical impact or vibration:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-gearred bridge, trolley and hoist	0 percent

1607A.15.3 Lateral force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed with due regard to the lateral stiffness of the runway beam and supporting structure.

1607A.15.4 Longitudinal force. The longitudinal force on crane runway beams, except for bridge cranes with hand-gearred bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607A.16 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m²). *The 5 psf (0.24 kN/m²) allowable stress design load need not be applied simultaneously with wind or seismic loads. The deflection of such walls under a load of 5 psf (0.24 kN/m²) shall not exceed the limits in Table 1604A.3.*

1607A.16.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength and stiffness to resist the following load conditions:

1. The horizontal distributed load need only be applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch-diameter (203 mm) area [50.3 square inches (32 452 mm²)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

1607A.16.2 Fire walls. In order to meet the structural stability requirements of Section 706.2 where the structure on either side of the wall has collapsed, fire walls and their supports shall be designed to withstand a minimum horizontal allowable stress load of 5 psf (0.240 kN/m²).

1607A.17 Fixed ladders. Fixed ladders with rungs shall be designed to resist a single concentrated load of 300 pounds (1.33 kN) in accordance with Section 4.5.4 of ASCE 7. Where rails of fixed ladders extend above a floor or platform at the top of the ladder, each side rail extension shall be designed to resist a single concentrated load of 100 pounds (0.445 kN) in accordance with Section 4.5.4 of ASCE 7. Ship's ladders shall be designed to resist the stair loads given in Table 1607A.1.

1607A.18 Library stack rooms. The live loading indicated in Table 1607A.1 for library stack rooms applies to stack room floors that support nonmobile, double-faced library book stacks, subject to the following limitations:

1. The nominal book stack unit height shall not exceed 90 inches (2290 mm).
2. The nominal shelf depth shall not exceed 12 inches (305 mm) for each face.
3. Parallel rows of double-faced book stacks shall be separated by aisles not less than 36 inches (914 mm) in width.

1607A.19 Seating for assembly uses. Bleachers, folding and telescopic seating and grandstands shall be designed for the loads specified in ICC 300 *as modified by Section 1605A.3 load combinations*. Stadiums and arenas with fixed seats shall be designed for the horizontal sway loads in Section 1607A.19.1.

1607A.19.1 Horizontal sway loads. The design of stadiums and arenas with fixed seats shall include horizontal swaying forces applied to each row of seats as follows:

1. 24 pounds per linear foot (0.35 kN/m) of seat applied in a direction parallel to each row of seats.

2. 10 pounds per linear foot (0.15 kN/m) of seat applied in a direction perpendicular to each row of seats.

The parallel and perpendicular horizontal swaying forces are not required to be applied simultaneously.

1607A.20 Sidewalks, vehicular driveways, and yards subject to trucking. The live loading indicated in Table 1607A.1 for sidewalks, vehicular driveways, and yards subject to trucking shall comply with the requirements of this section.

1607A.20.1 Uniform loads. In addition to the loads indicated in Table 1607A.1, other uniform loads in accordance with an approved method that contains provisions for truck loading shall be considered where appropriate.

1607A.20.2 Concentrated loads. The concentrated wheel load indicated in Table 1607A.1 shall be applied on an area of 4½ inches by 4½ inches (114 mm by 114 mm).

1607A.21 Stair treads. The concentrated load indicated in Table 1607A.1 for stair treads shall be applied on an area of 2 inches by 2 inches (51 mm by 51 mm). This load need not be assumed to act concurrently with the uniform load.

1607A.22 Residential attics. The live loads indicated in Table 1607A.1 for attics in residential occupancies shall comply with the requirements of this section.

1607A.22.1 Uninhabitable attics without storage. In residential occupancies, uninhabitable attic areas without storage are those where the maximum clear height between the joists and rafters is less than 42 inches (1067 mm), or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607A.1 need not be assumed to act concurrently with any other live load requirement.

1607A.22.2 Uninhabitable attics with storage. In residential occupancies, uninhabitable attic areas with storage are those where the maximum clear height between the joist and rafter is 42 inches (1067 mm) or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches (1067 mm) in height by 24 inches (610 mm) in width, or greater, within the plane of the trusses. The live load in Table 1607A.1 need only be applied to those portions of the joists or truss bottom chords where both of the following conditions are met:

1. The attic area is accessed from an opening not less than 20 inches (508 mm) in width by 30 inches (762 mm) in length that is located where the clear height in the attic is not less than 30 inches (762 mm).
2. The slope of the joists or truss bottom chords is not greater than 2 units vertical in 12 units horizontal.

The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot (0.48 kN/m²).

1607A.22.3 Attics served by stairs. Attic spaces served by stairways other than the pull-down type shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

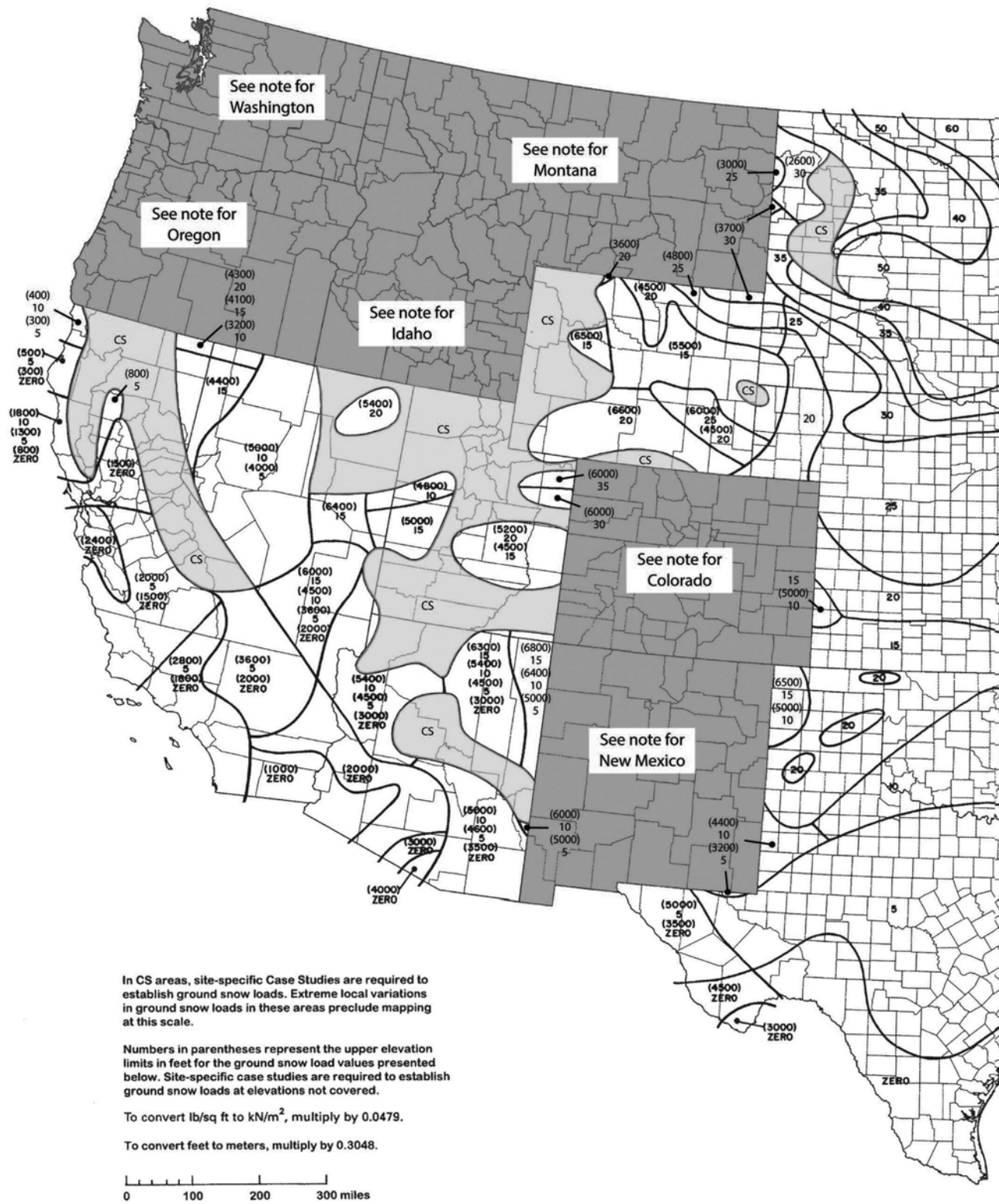
SECTION 1608A SNOW LOADS

1608A.1 General. Design snow loads shall be determined in accordance with Chapter 7 of ASCE 7, but the design roof load shall be not less than that determined by Section 1607A.

1608A.2 Ground snow loads. The ground snow loads to be used in determining the design snow loads for roofs shall be determined in accordance with ASCE 7 or Figures 1608A.2(1) and 1608A.2(2) for the contiguous United States. Site-specific case studies shall be made in areas designated “CS” in Figures 1608A.2(1) and 1608A.2(2). Ground snow loads for sites at elevations above the limits indicated in Figures 1608A.2(1) and 1608A.2(2) and for all sites within the CS areas shall be approved. Ground snow load determination for such sites shall be based on an extreme value statistical analysis of data available in the vicinity of the site using a value with a 2-percent annual probability of being exceeded (50-year mean recurrence interval).

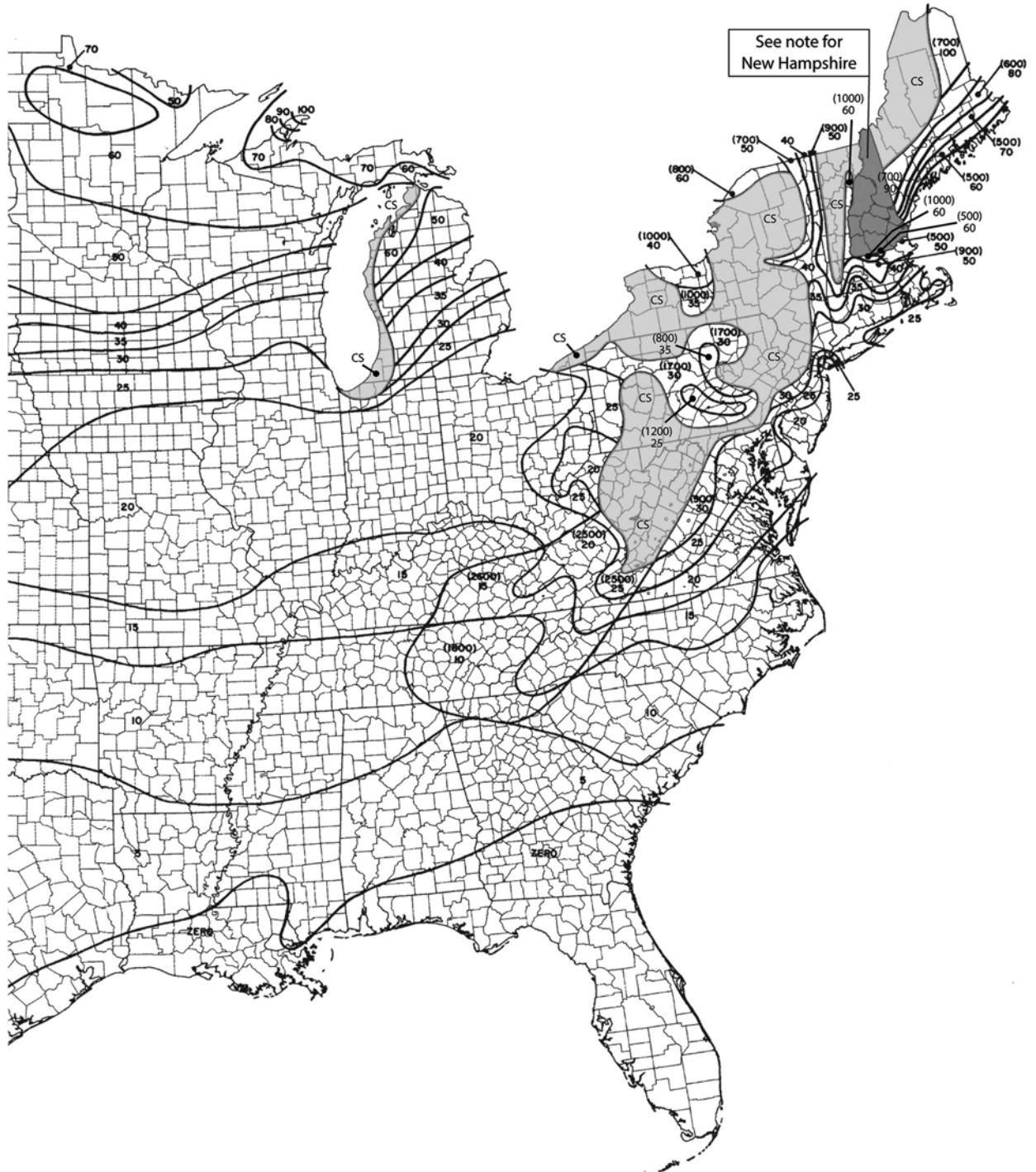
1608A.3 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

1608A.4 Determination of snow loads. *[DSA-SS] The ground snow load or the design snow load for roofs shall conform with the adopted ordinance of the city, county, or city and county in which the project site is located, and shall be approved by DSA. See Section 106.1.2 for snow load posting requirements.*



NOTE: See ASCE 7 Table 7.2-2 for Colorado, Table 7.2-3 for Idaho, Table 7.2-4 for Montana, Table 7.2-5 for Washington, Table 7.2-6 for New Mexico and Table 7.2-7 for Oregon.

FIGURE 1608.A.2(1)
GROUND SNOW LOADS, p_g , FOR THE UNITED STATES (psf)



NOTE: See ASCE 7 Table 7.2-8 for New Hampshire.

FIGURE 1608.A.2(2)
GROUND SNOW LOADS, p_g , FOR THE UNITED STATES (psf)

**SECTION 1609A
WIND LOADS**

1609A.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

1609A.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapters 26 to 30 of ASCE 7. The type of opening protection required, the basic design wind speed, V , and the exposure category for a site is permitted to be determined in accordance with Section 1609A or ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Exceptions:

1. Subject to the limitations of Section 1609A.1.1.1, the provisions of ICC 600 shall be permitted for applicable Group R-2 and R-3 buildings.
2. Subject to the limitations of Section 1609A.1.1.1, residential structures using the provisions of AWC WFCM.
3. Subject to the limitations of Section 1609A.1.1.1, residential structures using the provisions of AISI S230.
4. Designs using NAAMM FP 1001.
5. Designs using TIA-222 for antenna-supporting structures and antennas, provided that the horizontal extent of Topographic Category 2 escarpments in Section 2.6.6.2 of TIA-222 shall be 16 times the height of the escarpment.
6. Wind tunnel tests in accordance with ASCE 49 and Sections 31.4 and 31.5 of ASCE 7.

The wind speeds in Figures 1609A.3(1) through 1609A.3(12) are basic design wind speeds, V , and shall be converted in accordance with Section 1609A.3.1 to allowable stress design wind speeds, V_{asd} , when the pro-

visions of the standards referenced in Exceptions 4 and 5 are used.

1609A.1.1.1 Applicability. The provisions of ICC 600 are applicable only to buildings located within Exposure B or C as defined in Section 1609A.4. The provisions of ICC 600, AWC WFCM and AISI S230 shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting all of the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C.
2. The maximum average slope of the hill exceeds 10 percent.
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 2 miles (3.22 km), whichever is greater.

1609A.1.2 Story drift for wind loads. The calculated story drift due to wind pressures with ultimate design wind speed, V_{ult} , shall not exceed 0.008 times the story height for buildings less than 65 feet (19812 mm) in height or 0.007 times the story height for buildings 65 feet (19812 mm) or greater in height.

Exception: [DSA-SS] This story drift limit need not be applied for single-story open structures in Risk Categories I and II.

Exception: [OSHPD 1 & 4] This story drift limit need not be applied for single-story open structures.

1609A.2 Protection of openings. In windborne debris regions, glazing in buildings shall be impact resistant or protected with an impact-resistant covering meeting the requirements of an approved impact-resistant standard or ASTM E1996 referenced herein as follows:

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the large missile test of ASTM E1996.

**TABLE 1609A.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS^{a, b, c, d}**

FASTENER TYPE	FASTENER SPACING (inches)		
	Panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
1/4-inch diameter lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

- a. This table is based on 140 mph wind speeds and a 45-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.
- c. Anchors shall penetrate through the exterior wall covering with an embedment length of 2 inches minimum into the building frame. Fasteners shall be located not less than 2 1/2 inches from the edge of concrete block or concrete.
- d. Where panels are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum ultimate withdrawal capacity of 1,500 pounds.

2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the small missile test of ASTM E1996.

Exceptions:

1. Wood structural panels with a minimum thickness of $\frac{7}{16}$ inch (11.1 mm) and maximum panel span of 8 feet (2438 mm) shall be permitted for opening protection in buildings with a mean roof height of 33 feet (10 058 mm) or less that are classified as a Group R-3 or R-4 occupancy. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609A.2 with corrosion-resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where V_{asd} determined in accordance with Section 1609A.3.1 does not exceed 140 mph (63 m/s).
2. Glazing in Risk Category I buildings, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Risk Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458 m) of the building shall be permitted to be unprotected.

1609A.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet the requirements of AMCA 540.

1609A.2.2 Application of ASTM E1996. The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the basic design wind speed, V , as follows:

6.2.2.1 Wind Zone 1—130 mph \leq basic design wind speed, $V < 140$ mph.

6.2.2.2 Wind Zone 2—140 mph \leq basic design wind speed, $V < 150$ mph at greater than one mile (1.6 km) from the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.3 Wind Zone 3—150 mph (67 m/s) \leq basic design wind speed, $V \leq 160$ mph (72 m/s), or 140 mph (63 m/s) \leq basic design wind speed, $V \leq 160$ mph (72 m/s)

and within one mile (1.6 km) of the coastline. The coastline shall be measured from the mean high water mark.

6.2.2.4 Wind Zone 4— basic design wind speed, $V > 160$ mph (72 m/s).

1609A.2.3 Garage doors. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

1609A.3 Basic design wind speed. The basic design wind speed, V , in mph, for the determination of the wind loads shall be determined by Figures 1609A.3(1) through 1609A.3(12). The basic design wind speed, V , for use in the design of Risk Category II buildings and structures shall be obtained from Figures 1609A.3(1), 1609A.3(5) and 1609A.3(6). The basic design wind speed, V , for use in the design of Risk Category III buildings and structures shall be obtained from Figures 1609A.3(2), 1609A.3(7) and 1609A.3(8). The basic design wind speed, V , for use in the design of Risk Category IV buildings and structures shall be obtained from Figures 1609A.3(3), 1609A.3(9) and 1609A.3(10). The basic design wind speed, V , for use in the design of Risk Category I buildings and structures shall be obtained from Figures 1609A.3(4), 1609A.3(11) and 1609A.3(12). The basic design wind speed, V , for the special wind regions indicated near mountainous terrain and near gorges shall be in accordance with local jurisdiction requirements. The basic design wind speeds, V , determined by the local jurisdiction shall be in accordance with Chapter 26 of ASCE 7.

In nonhurricane-prone regions, when the basic design wind speed, V , is estimated from regional climatic data, the basic design wind speed, V , shall be determined in accordance with Chapter 26 of ASCE 7.

1609A.3.1 Wind speed conversion. Where required, the basic design wind speeds of Figures 1609A.3(1) through 1609A.3(12) shall be converted to allowable stress design wind speeds, V_{asd} , using Table 1609A.3.1 or Equation 16-17.

$$V_{asd} = V\sqrt{0.6} \quad \text{(Equation 16A-17)}$$

where:

V_{asd} = Allowable stress design wind speed applicable to methods specified in Exceptions 4 and 5 of Section 1609A.1.1.

V = Basic design wind speeds determined from Figures 1609A.3(1) through 1609A.3(12).

1609A.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

1609A.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609A.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609A.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609A.4.3 from the following categories, for the purpose of assigning an exposure category as defined in Section 1609A.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country, and grasslands.

Surface Roughness D. Flat, unobstructed areas and water surfaces. This category includes smooth mud flats, salt flats and unbroken ice.

1609A.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

Exposure B. For buildings with a mean roof height of less than or equal to 30 feet (9144 mm), Exposure B shall apply where the ground surface roughness, as defined by Surface Roughness B, prevails in the upwind direction for a distance of not less than 1,500 feet (457 m). For buildings with a mean roof height

greater than 30 feet (9144 mm), Exposure B shall apply where Surface Roughness B prevails in the upwind direction for a distance of not less than 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exposure C. Exposure C shall apply for all cases where Exposure B or D does not apply.

Exposure D. Exposure D shall apply where the ground surface roughness, as defined by Surface Roughness D, prevails in the upwind direction for a distance of not less than 5,000 feet (1524 m) or 20 times the height of the building, whichever is greater. Exposure D shall apply where the ground surface roughness immediately upwind of the site is B or C, and the site is within a distance of 600 feet (183 m) or 20 times the building height, whichever is greater, from an Exposure D condition as defined in the previous sentence.

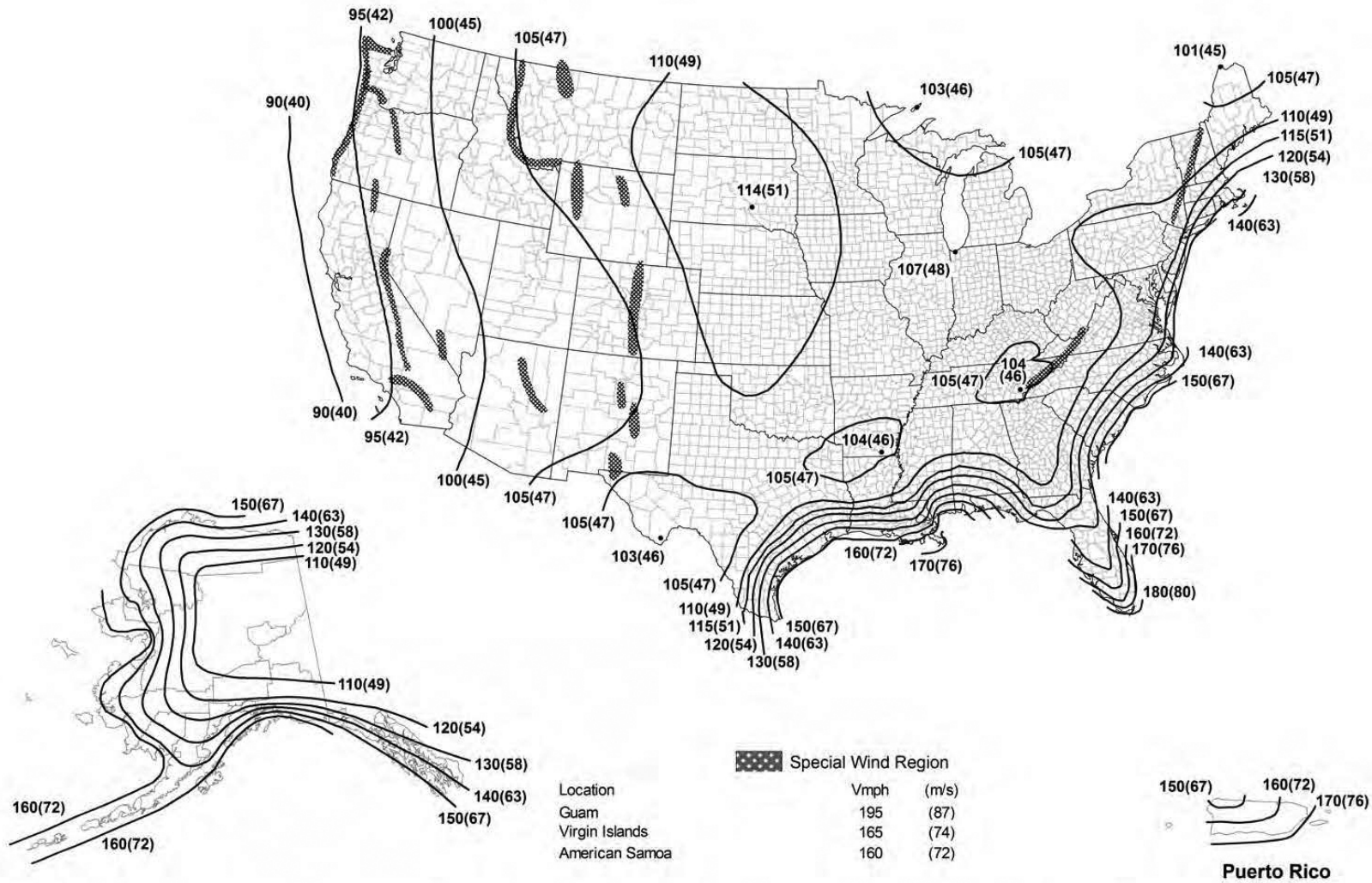
1609A.5 Roof systems. Roof systems shall be designed and constructed in accordance with Sections 1609A.5.1 through 1609A.5.3, as applicable.

1609A.5.1 Roof deck. The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609A.5.2 Roof coverings. Roof coverings shall comply with Section 1609A.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609A.5.1 are permitted to be designed in accordance with Section 1609A.5.3.

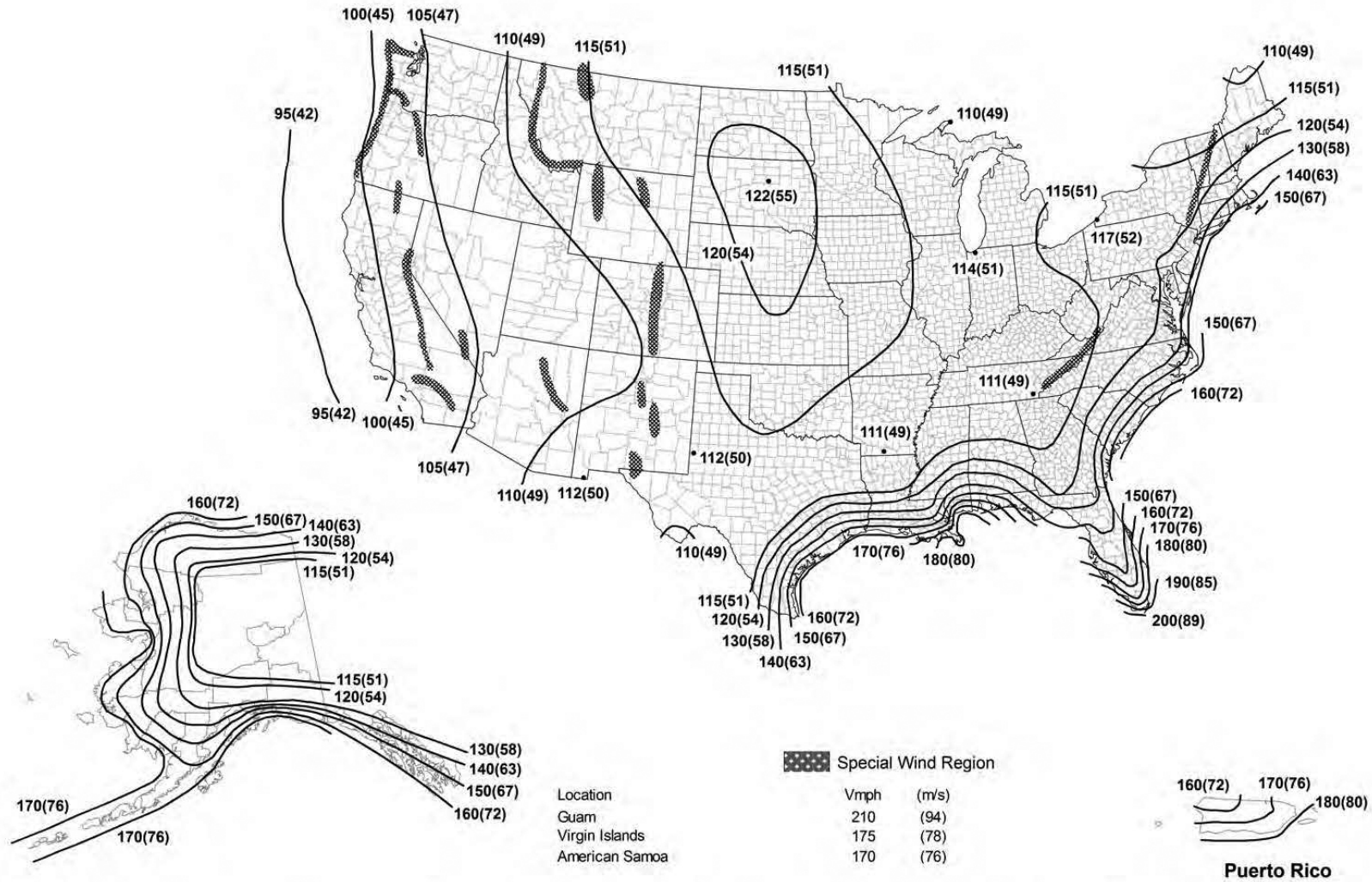
Asphalt shingles installed over a roof deck complying with Section 1609A.5.1 shall comply with the wind-resistance requirements of Section 1504.2.



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
2. Linear interpolation between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

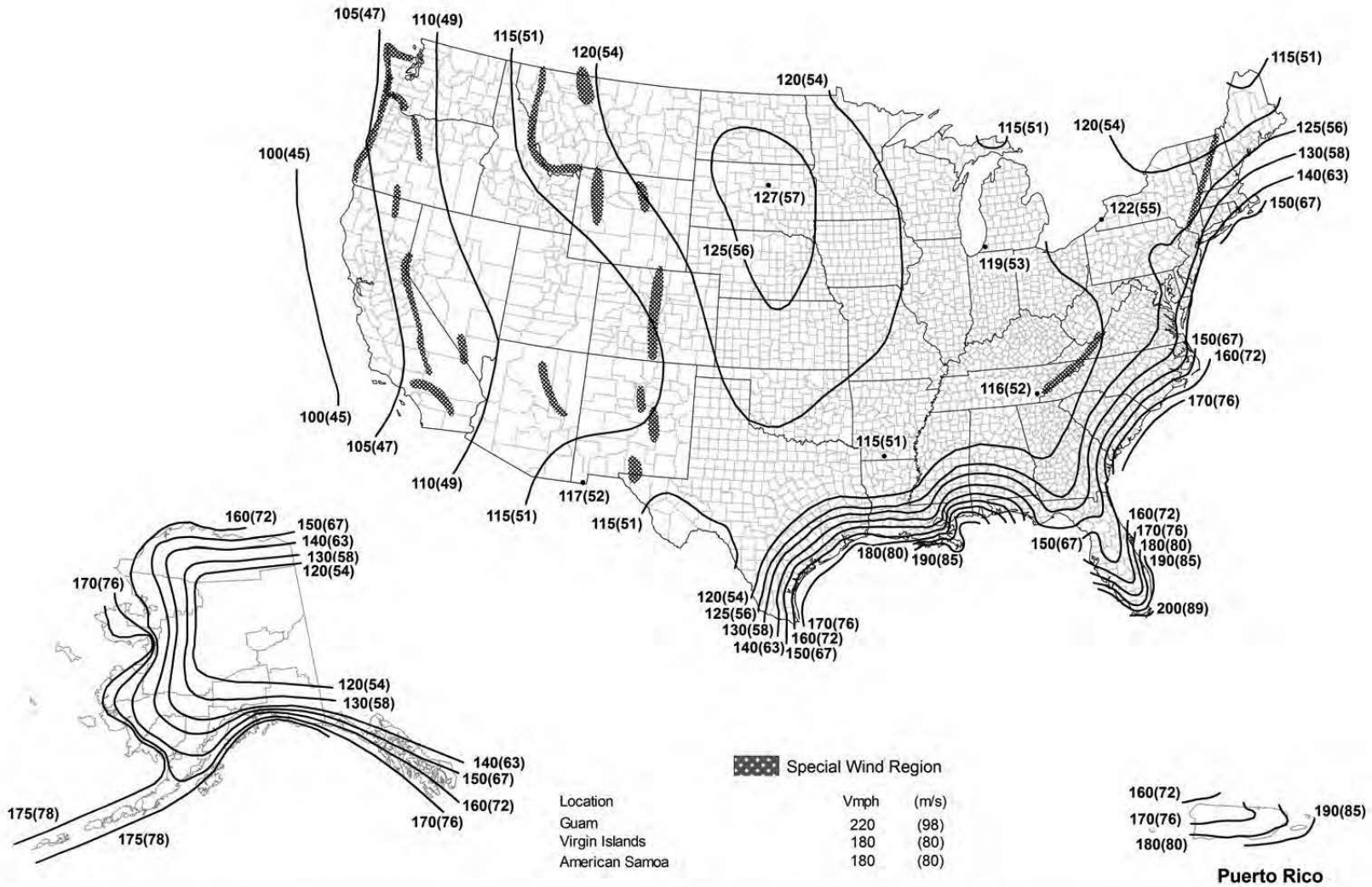
**FIGURE 1609A.3(1)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY II BUILDINGS AND OTHER STRUCTURES**



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
2. Linear interpolation between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 3% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

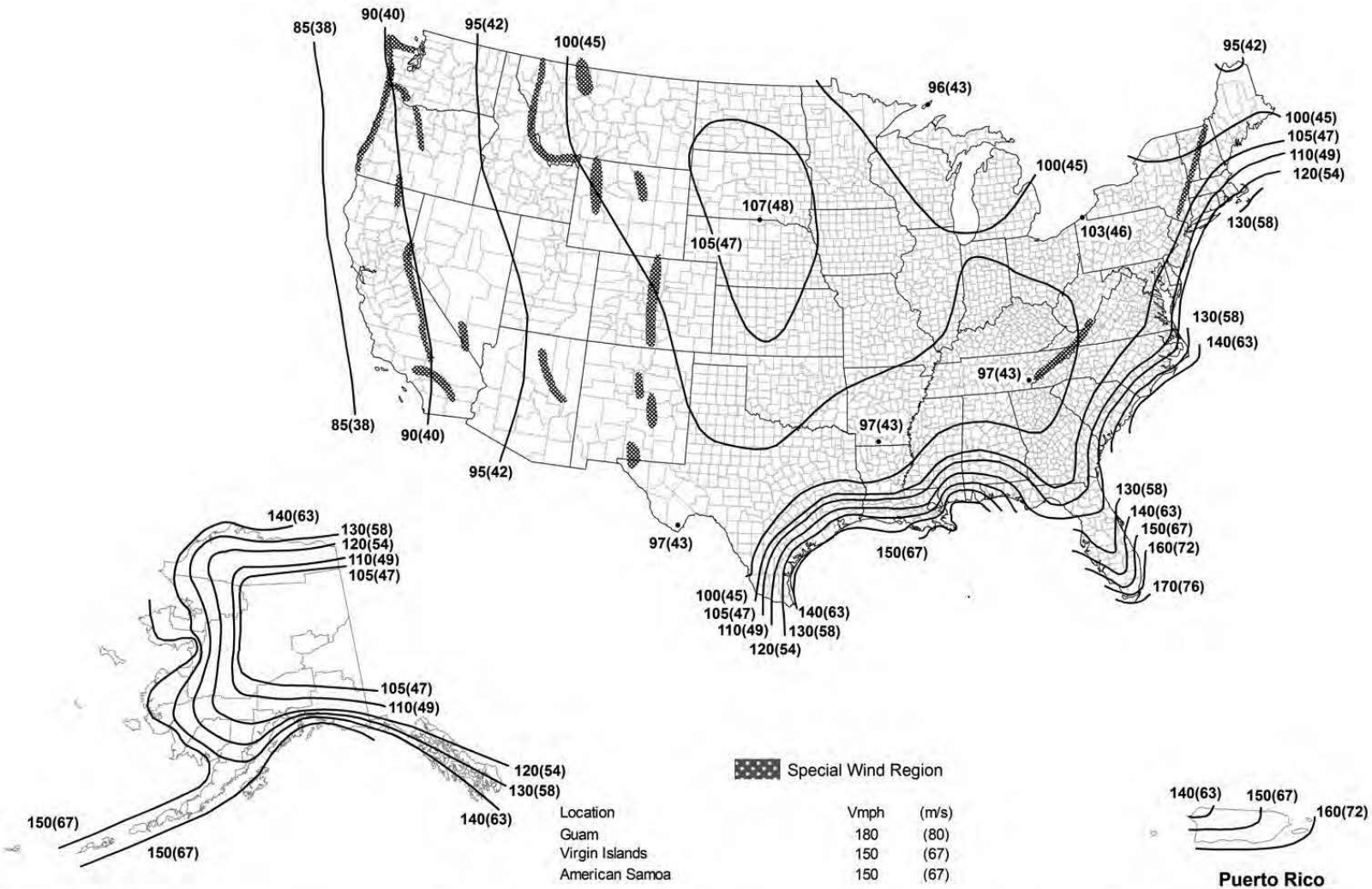
FIGURE 1609A.3(2)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY III BUILDINGS AND OTHER STRUCTURES



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
2. Linear interpolation between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 1.6% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00033, MRI = 3000 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed

**FIGURE 1609A.3(3)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY IV BUILDINGS AND OTHER STRUCTURES**



Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet (10 m) above ground for Exposure C Category.
2. Linear interpolation between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 15% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00333, MRI = 300 Years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed.

**FIGURE 1609A.3(4)
BASIC DESIGN WIND SPEEDS, V, FOR RISK CATEGORY I BUILDINGS AND OTHER STRUCTURES**

TABLE 1609A.3.1
WIND SPEED CONVERSIONS^{a, b, c}

V	100	110	120	130	140	150	160	170	180	190	200
V_{asd}	78	85	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.44 m/s.

a. Linear interpolation is permitted.

b. V_{asd} = allowable stress design wind speed applicable to methods specified in Exceptions 1 through 5 of Section 1609A.1.1.

c. V = basic design wind speeds determined from Figures 1609A.3(1) through 1609A.3(12).

1609A.5.3 Rigid tile. Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \quad \text{(Equation 16A-18)}$$

For SI:

$$M_a = \frac{q_h C_L b L L_a [1.0 - GC_p]}{1,000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1504.3.1.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 30 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at 0.76L from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

M_a = Aerodynamic uplift moment, feet-pounds (N-mm) acting to raise the tail of the tile.

q_h = Wind velocity pressure, psf (kN/m^2) determined from Section 26.10.2 of ASCE 7.

Concrete and clay roof tiles complying with the following limitations shall be designed to withstand the aerodynamic uplift moment as determined by this section.

1. The roof tiles shall be either loose laid on battens, mechanically fastened, mortar set or adhesive set.
2. The roof tiles shall be installed on solid sheathing that has been designed as components and cladding.

3. An underlayment shall be installed in accordance with Chapter 15.
4. The tile shall be single lapped interlocking with a minimum head lap of not less than 2 inches (51 mm).
5. The length of the tile shall be between 1.0 and 1.75 feet (305 mm and 533 mm).
6. The exposed width of the tile shall be between 0.67 and 1.25 feet (204 mm and 381 mm).
7. The maximum thickness of the tail of the tile shall not exceed 1.3 inches (33 mm).
8. Roof tiles using mortar set or adhesive set systems shall have not less than two-thirds of the tile's area free of mortar or adhesive contact.

SECTION 1610A SOIL LOADS AND HYDROSTATIC PRESSURE

1610A.1 Lateral pressures. Foundation walls and retaining walls shall be designed to resist lateral soil loads from adjacent soil. Soil loads specified in Table 1610A.1 shall be used as the minimum design lateral soil loads unless determined otherwise by a geotechnical investigation in accordance with Section 1803A. Foundation walls and other walls in which horizontal movement is restricted at the top shall be designed for at-rest pressure. Retaining walls free to move and rotate at the top shall be permitted to be designed for active pressure. Lateral pressure from surcharge loads shall be added to the lateral soil load. Lateral pressure shall be increased if expansive soils are present at the site. Foundation walls shall be designed to support the weight of the full hydrostatic pressure of undrained backfill unless a drainage system is installed in accordance with Sections 1805A.4.2 and 1805A.4.3.

Exception: Foundation walls extending not more than 8 feet (2438 mm) below grade and laterally supported at the top by flexible diaphragms shall be permitted to be designed for active pressure.

1610A.2 Uplift loads on floor and foundations. Basement floors, slabs on ground, foundations, and similar approximately horizontal elements below grade shall be designed to resist uplift loads where applicable. The upward pressure of water shall be taken as the full hydrostatic pressure applied over the entire area. The hydrostatic load shall be measured from the underside of the element being evaluated. The design for upward loads caused by expansive soils shall comply with Section 1808A.6.

TABLE 1610A.1
LATERAL SOIL LOAD

DESCRIPTION OF BACKFILL MATERIAL ^c	UNIFIED SOIL CLASSIFICATION	DESIGN LATERAL SOIL LOAD ^a (pound per square foot per foot of depth)	
		Active pressure	At-rest pressure
Well-graded, clean gravels; gravel-sand mixes	GW	30	60
Poorly graded clean gravels; gravel-sand mixes	GP	30	60
Silty gravels, poorly graded gravel-sand mixes	GM	40	60
Clayey gravels, poorly graded gravel-and-clay mixes	GC	45	60
Well-graded, clean sands; gravelly sand mixes	SW	30	60
Poorly graded clean sands; sand-gravel mixes	SP	30	60
Silty sands, poorly graded sand-silt mixes	SM	45	60
Sand-silt clay mix with plastic fines	SM-SC	45	100
Clayey sands, poorly graded sand-clay mixes	SC	60	100
Inorganic silts and clayey silts	ML	45	100
Mixture of inorganic silt and clay	ML-CL	60	100
Inorganic clays of low to medium plasticity	CL	60	100
Organic silts and silt clays, low plasticity	OL	Note b	Note b
Inorganic clayey silts, elastic silts	MH	Note b	Note b
Inorganic clays of high plasticity	CH	Note b	Note b
Organic clays and silty clays	OH	Note b	Note b

For SI: 1 pound per square foot per foot of depth = 0.157 kPa/m, 1 foot = 304.8 mm.

- a. Design lateral soil loads are given for moist conditions for the specified soils at their optimum densities. Actual field conditions shall govern. Submerged or saturated soil pressures shall include the weight of the buoyant soil plus the hydrostatic loads.
- b. Unsuitable as backfill material.
- c. The definition and classification of soil materials shall be in accordance with ASTM D2487.

**SECTION 1611A
RAIN LOADS**

1611A.1 Design rain loads. Each portion of a roof shall be designed to sustain the load of rainwater as per the requirements of Chapter 8 of ASCE 7. The design rainfall shall be based on the 100-year 15-minute duration event, or on other rainfall rates determined from approved local weather data. Alternatively, a design rainfall of twice the 100-year hourly rainfall rate indicated in Figures 1611A.1(1) through 1611A.1(5) shall be permitted.

$$R = 5.2(d_s + d_h) \quad \text{(Equation 16A-19)}$$

For SI: $R = 0.0098(d_s + d_h)$

where:

d_h = Additional depth of water on the undeflected roof above the inlet of secondary drainage system at its design flow (in other words, the hydraulic head), in inches (mm).

d_s = Depth of water on the undeflected roof up to the inlet of secondary drainage system when the primary

drainage system is blocked (in other words, the static head), in inches (mm).

R = Rain load on the undeflected roof, in psf (kN/m²). Where the phrase “undeflected roof” is used, deflections from loads (including dead loads) shall not be considered when determining the amount of rain on the roof.

1611A.2 Ponding instability. Susceptible bays of roofs shall be evaluated for ponding instability in accordance with Chapters 7 and 8 of ASCE 7.

1611A.3 Controlled drainage. Roofs equipped with hardware to control the rate of drainage shall be equipped with a secondary drainage system at a higher elevation that limits accumulation of water on the roof above that elevation. Such roofs shall be designed to sustain the load of rainwater that will accumulate on them to the elevation of the secondary drainage system plus the uniform load caused by water that rises above the inlet of the secondary drainage system at its design flow determined from Section 1611A.1. Such roofs shall be checked for ponding instability in accordance with Section 1611A.2.

SECTION 1612A FLOOD LOADS

1612A.1 General. Within flood hazard areas as established in Section 1612A.3, all new construction of buildings, structures and portions of buildings and structures, including substantial improvement and restoration of substantial damage to buildings and structures, shall be designed and constructed to resist the effects of flood hazards and flood loads. For buildings that are located in more than one flood hazard area, the provisions associated with the most restrictive flood hazard area shall apply.

1612A.2 Design and construction. The design and construction of buildings and structures located in flood hazard areas, including coastal high hazard areas and coastal A zones, shall be in accordance with Chapter 5 of ASCE 7 and ASCE 24.

1612A.3 Establishment of flood hazard areas. To establish flood hazard areas, the applicable governing authority shall adopt a flood hazard map and supporting data. The flood hazard map shall include, at a minimum, areas of special flood hazard as identified by the Federal Emergency Management Agency's *Flood Insurance Study (FIS)* adopted by the local authority having jurisdiction where the project is located, as amended or revised with the accompanying *Flood Insurance Rate Map (FIRM)* and Flood Boundary and Floodway Map (FBFM) and related supporting data along with any revisions thereto. The adopted flood hazard map and supporting data are hereby adopted by reference and declared to be part of this section.

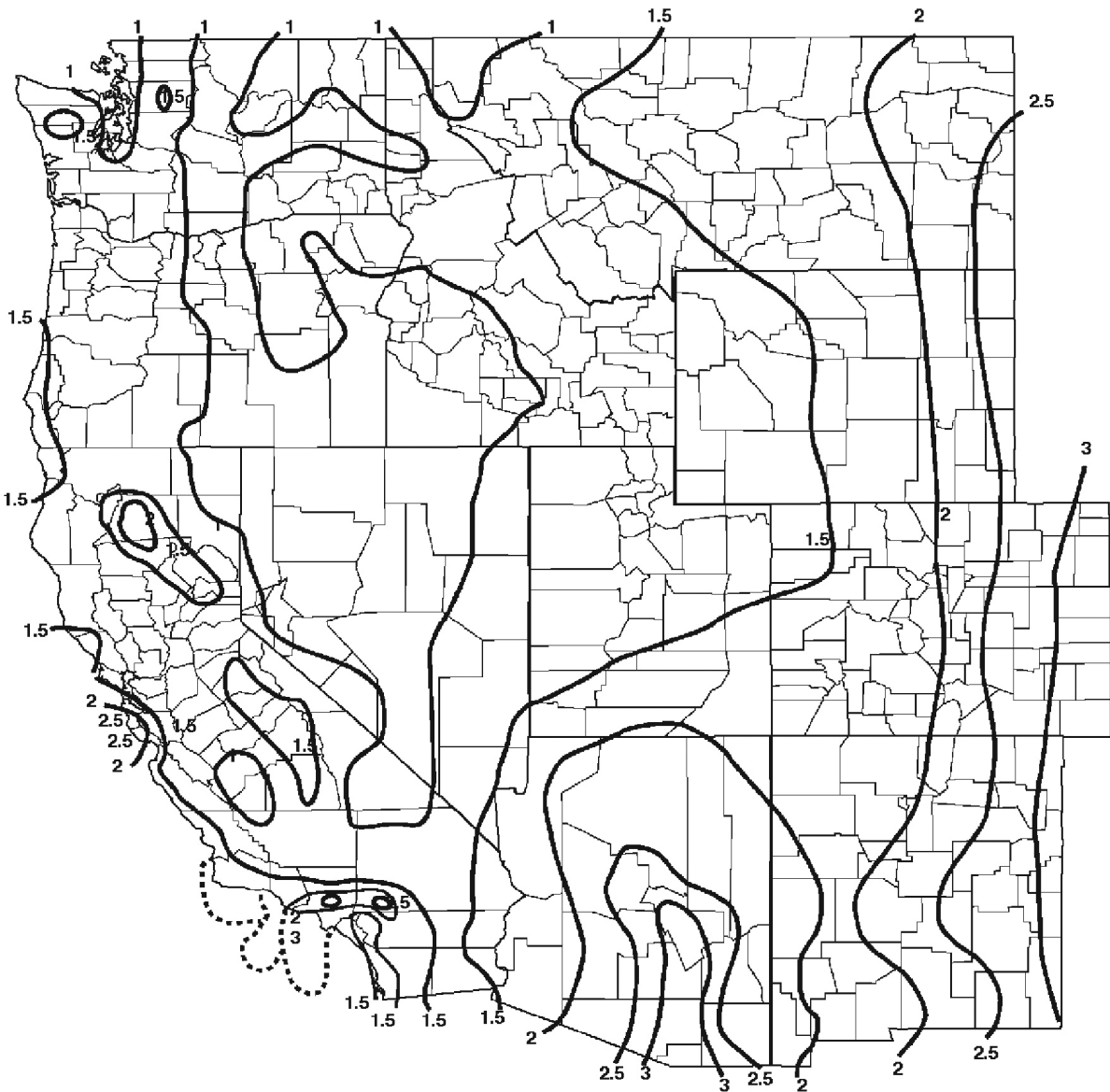
1612A.3.1 Design flood elevations. Where design flood elevations are not included in the flood hazard areas established in Section 1612A.3, or where floodways are not designated, the building official is authorized to require the applicant to do one of the following:

1. Obtain and reasonably utilize any design flood elevation and floodway data available from a federal, state or other source.
2. Determine the design flood elevation or floodway in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice.

1612A.3.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall provide a floodway analysis that demonstrates that the proposed work will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction of the applicable governing authority.

1612A.4 Flood hazard documentation. The following documentation shall be prepared and sealed by a registered design professional and submitted to the building official:

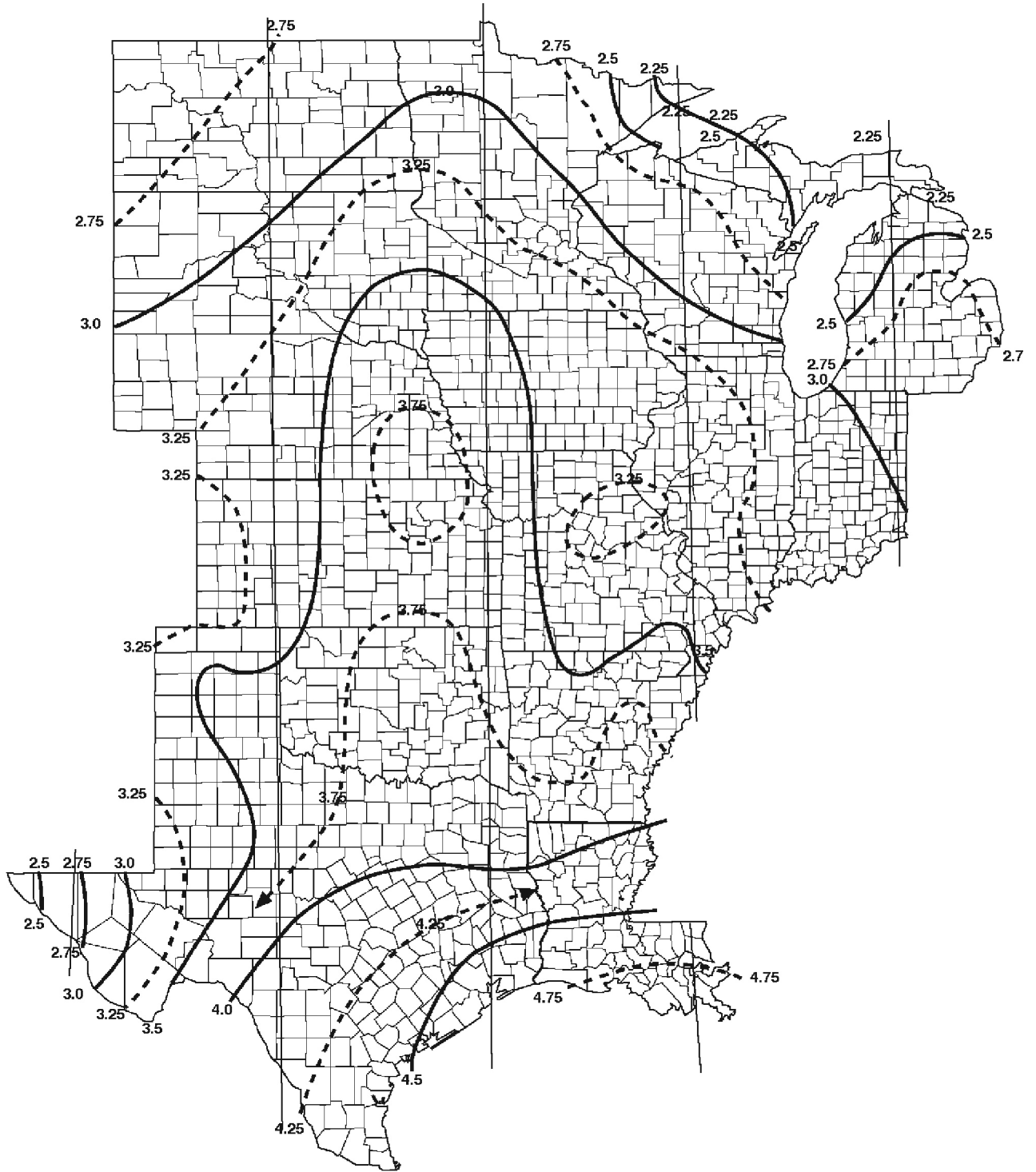
1. For construction in flood hazard areas other than coastal high hazard areas or coastal A zones:
 - 1.1. The elevation of the lowest floor, including the basement, as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
 - 1.2. For fully enclosed areas below the design flood elevation where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.
 - 1.3. For dry floodproofed nonresidential buildings, construction documents shall include a statement that the dry floodproofing is designed in accordance with ASCE 24 and shall include the flood emergency plan specified in Chapter 6 of ASCE 24.
2. For construction in coastal high hazard areas and coastal A zones:
 - 2.1. The elevation of the bottom of the lowest horizontal structural member as required by the lowest floor elevation inspection in Section 110.3.3 and for the final inspection in Section 110.3.12.1.
 - 2.2. Construction documents shall include a statement that the building is designed in accordance with ASCE 24, including that the pile or column foundation and building or structure to be attached thereto is designed to be anchored to resist flotation, collapse and lateral movement due to the effects of wind and flood loads acting simultaneously on all building components, and other load requirements of Chapter 16.
 - 2.3. For breakaway walls designed to have a resistance of more than 20 psf (0.96 kN/m²) determined using allowable stress design, construction documents shall include a statement that the breakaway wall is designed in accordance with ASCE 24.
 - 2.4. For breakaway walls where provisions to allow for the automatic entry and exit of floodwaters do not meet the minimum requirements in Section 2.7.2.1 of ASCE 24, construction documents shall include a statement that the design will provide for equalization of hydrostatic flood forces in accordance with Section 2.7.2.2 of ASCE 24.



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

FIGURE 1611A.1(1)
100-YEAR, 1-HOUR RAINFALL (INCHES) WESTERN UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

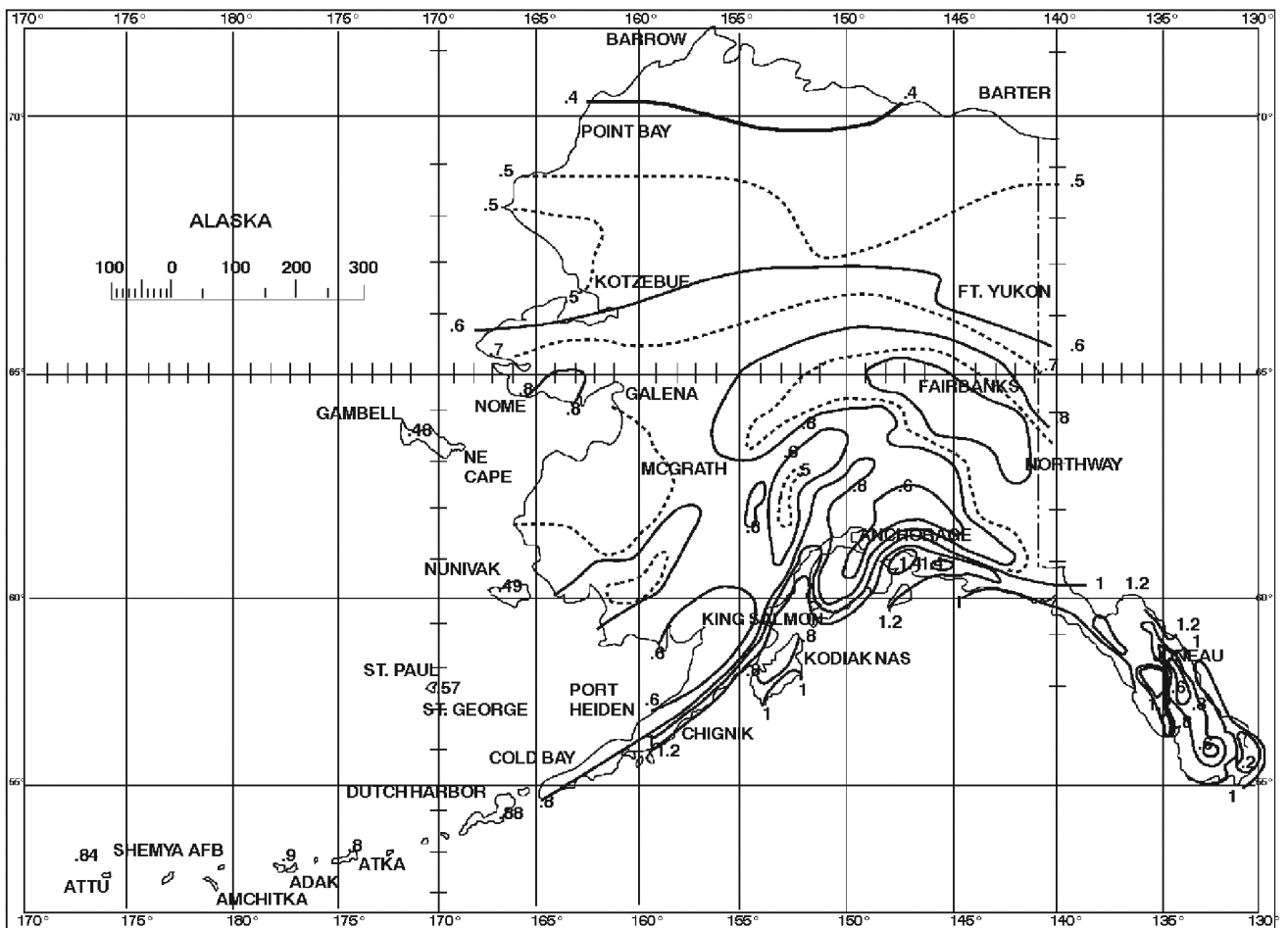
FIGURE 1611A.1(2)
100-YEAR, 1-HOUR RAINFALL (INCHES) CENTRAL UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

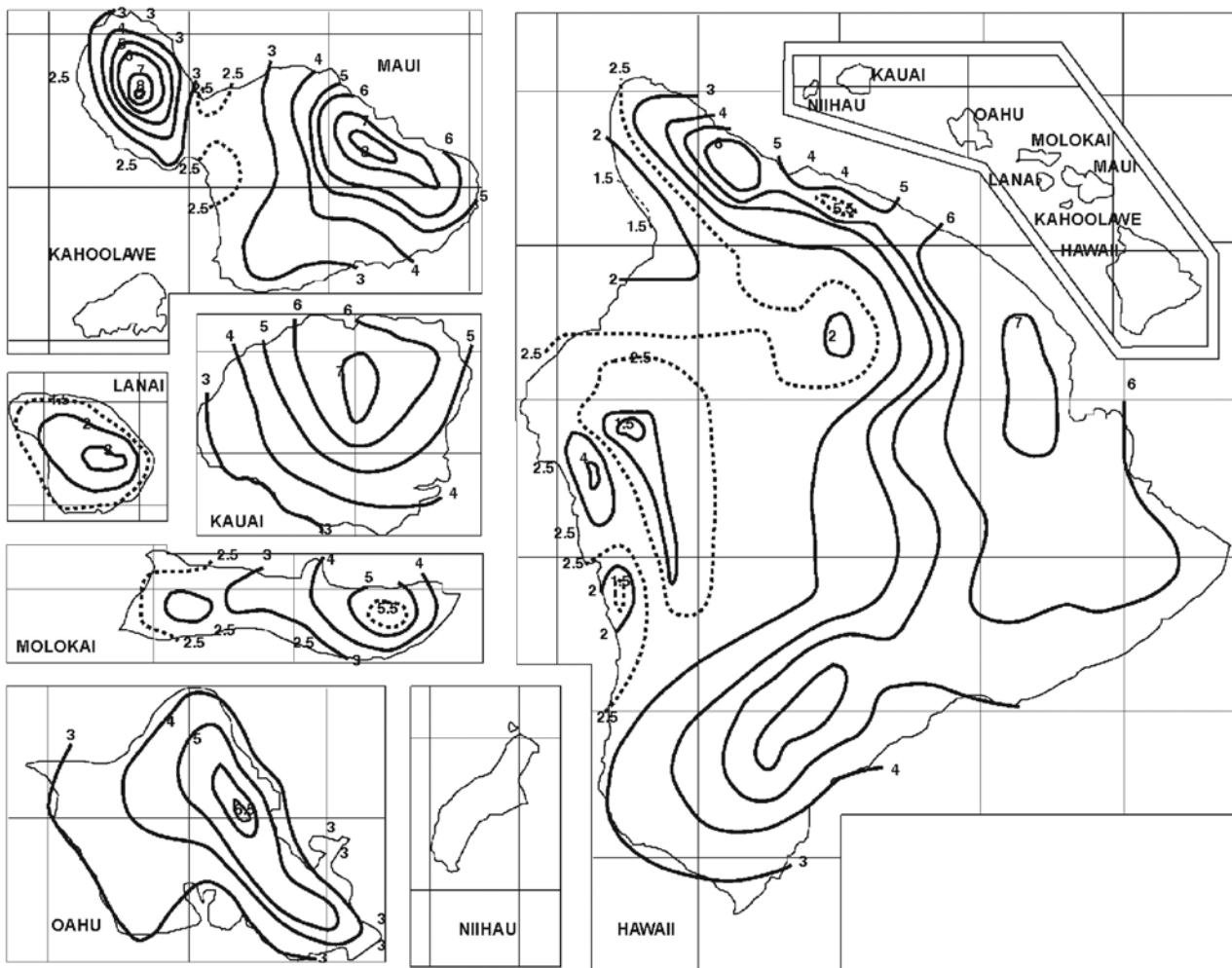
FIGURE 1611A.1(3)
100-YEAR, 1-HOUR RAINFALL (INCHES) EASTERN UNITED STATES



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

FIGURE 1611A.1(4)
100-YEAR, 1-HOUR RAINFALL (INCHES) ALASKA



For SI: 1 inch = 25.4 mm.

Source: National Weather Service, National Oceanic and Atmospheric Administration, Washington, DC.

FIGURE 1611A.1(5)
100-YEAR, 1-HOUR RAINFALL (INCHES) HAWAII

**SECTION 1613A
EARTHQUAKE LOADS**

1613A.1 Scope. Every structure, and portion thereof, including nonstructural components that are permanently attached to structures and their supports and attachments, shall be designed and constructed to resist the effects of earthquake motions in accordance with Chapters 11, 12, 13, 15, 17 and 18 of ASCE 7, as applicable. The seismic design category for a structure shall be determined in accordance with Section 1613A.

1613A.2 Seismic ground motion values. Seismic ground motion values shall be determined in accordance with this section.

1613A.2.1 Mapped acceleration parameters. The parameters S_s and S_1 shall be determined from the 0.2 and 1-second spectral response accelerations shown on Figures 1613.2.1(1) through 1613.2.1(10).

1613A.2.2 Site class definitions. Based on the site soil properties, the site shall be classified as Site Class A, B, C, D, E or F in accordance with Chapter 20 of ASCE 7.

Where the soil properties are not known in sufficient detail to determine the site class, Site Class D, subjected to the requirements of Section 1613A.2.3, shall be used unless the building official or geotechnical data determines that Site Class E or F soils are present at the site.

Where site investigations that are performed in accordance with Chapter 20 of ASCE 7 reveal rock conditions consistent with Site Class B, but site-specific velocity measurements are not made, the site coefficients F_a and F_v shall be taken at unity (1.0).

1613A.2.3 Site coefficients and adjusted maximum considered earthquake spectral response acceleration parameters. The maximum considered earthquake spectral response acceleration for short periods, S_{MS} , and at 1-second period, S_{M1} , adjusted for site class effects shall be determined by Equations 16A-20 and 16-21, respectively:

$$S_{MS} = F_a S_s \quad \text{(Equation 16A-20)}$$

$$S_{M1} = F_v S_1 \quad \text{(Equation 16A-21)}$$

but S_{MS} shall not be taken less than S_{M1} except when determining the seismic design category in accordance with Section 1613A.2.5.

where:

F_a = Site coefficient defined in Table 1613A.2.3(1).

F_v = Site coefficient defined in Table 1613A.2.3(2).

S_s = The mapped spectral accelerations for short periods as determined in Section 1613A.2.1.

S_1 = The mapped spectral accelerations for a 1-second period as determined in Section 1613A.2.1.

Where Site Class D is selected as the default site class per Section 1613A.2.2, the value of F_a shall be not less than 1.2.

1613A.2.4 Design spectral response acceleration parameters. Five-percent damped design spectral response acceleration at short periods, S_{DS} , and at 1-second period, S_{D1} , shall be determined from Equations 16-22 and Equation 16-23, respectively:

$$S_{DS} = \frac{2}{3} S_{MS} \quad \text{(Equation 16A-22)}$$

$$S_{D1} = \frac{2}{3} S_{M1} \quad \text{(Equation 16A-23)}$$

where:

S_{MS} = The maximum considered earthquake spectral response accelerations for short period as determined in Section 1613A.2.3.

S_{M1} = The maximum considered earthquake spectral response accelerations for 1-second period as determined in Section 1613A.2.3.

1613A.2.5 Determination of seismic design category. Structures classified as Risk Category I, II or III that are located where the mapped spectral response acceleration parameter at 1-second period, S_1 , is greater than or equal to 0.75 shall be assigned to Seismic Design Category E. Structures classified as Risk Category IV that are located where the mapped spectral response acceleration parameter at 1-second period, S_1 , is greater than or equal to 0.75 shall be assigned to Seismic Design Category F. Other structures shall be assigned to *Seismic Design Category D*.

1613A.2.5.1 Alternative seismic design category determination. *Not permitted by DSA-SS and OSHPD.*

1613A.2.5.2 Simplified design procedure. *Not permitted by DSA-SS and OSHPD.*

1613A.3 Ballasted photovoltaic panel systems. Ballasted, roof-mounted photovoltaic panel systems need not be rigidly attached to the roof or supporting structure.

[DSA-SS] Ballasted, roof-mounted photovoltaic panel systems shall comply with ASCE 7 13.6.12.

[OSHPD 1 & 4] Ballasted photovoltaic panel systems shall be considered as an alternative system.

**SECTION 1614A
ATMOSPHERIC ICE LOADS**

1614A.1 General. Ice-sensitive structures shall be designed for atmospheric ice loads in accordance with Chapter 10 of ASCE 7.

TABLE 1613A.2.3(1)
VALUES OF SITE COEFFICIENT F_a^a

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT SHORT PERIOD					
	$S_s \leq 0.25$	$S_s = 0.50$	$S_s = 0.75$	$S_s = 1.00$	$S_s = 1.25$	$S_s \geq 1.5$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.9	0.9	0.9	0.9	0.9	0.9
C	1.3	1.3	1.2	1.2	1.2	1.2
D	1.6	1.4	1.2	1.1	1.0	1.0
E	2.4	1.7	1.3	1.2 ^c	1.2 ^c	1.2 ^c
F	Note b	Note b	Note b	Note b	Note b	Note b

- a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at short period, S_s .
- b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.
- c. See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7. These values of F_a shall only be used for calculation of T_s , determination of Seismic Design Category, linear interpolation for intermediate values of S_s , and when taking the exception under Item 2 within Section 11.4.8 of ASCE 7.

TABLE 1613A.2.3(2)
VALUES OF SITE COEFFICIENT F_v^a

SITE CLASS	MAPPED RISK TARGETED MAXIMUM CONSIDERED EARTHQUAKE (MCE_R) SPECTRAL RESPONSE ACCELERATION PARAMETER AT 1-SECOND PERIOD					
	$S_1 \leq 0.1$	$S_1 = 0.2$	$S_1 = 0.3$	$S_1 = 0.4$	$S_1 = 0.5$	$S_1 \geq 0.6$
A	0.8	0.8	0.8	0.8	0.8	0.8
B	0.8	0.8	0.8	0.8	0.8	0.8
C	1.5	1.5	1.5	1.5	1.5	1.4
D	2.4	2.2 ^c	2.0 ^c	1.9 ^c	1.8 ^c	1.7 ^c
E	4.2	3.3 ^c	2.8 ^c	2.4 ^c	2.2 ^c	2.0 ^c
F	Note b	Note b	Note b	Note b	Note b	Note b

- a. Use straight-line interpolation for intermediate values of mapped spectral response acceleration at 1-second period, S_1 .
- b. Values shall be determined in accordance with Section 11.4.8 of ASCE 7.
- c. See requirements for site-specific ground motions in Section 11.4.8 of ASCE 7. These values of F_v shall only be used for calculation of T_s , determination of Seismic Design Category, linear interpolation for intermediate values of S_1 , and when taking the exceptions under Items 1 and 2 of Section 11.4.8 for the calculation of S_{D1} .

SECTION 1615A
TSUNAMI LOADS

1615A.1 General. The design and construction of Risk Category III and IV buildings and structures located in the Tsunami Design Zones defined in the ASCE Tsunami Design Geodatabase, or other data determined applicable by the enforcement agency, shall be in accordance with Chapter 6 of ASCE 7, except as modified by this code. *[DSA-SS] Tsunami Risk Category for public school, community college and state-owned or state-leased essential services buildings and structures shall be identified and submitted for acceptance by DSA. Determination of the Tsunami Risk Category shall be proposed by the design professional in general responsible charge in coordination with the owner and local community based upon the relative importance of that facility to provide vital services, provide important functions and protect special populations. The determination of relative importance shall include consideration of a tsunami warning and evacuation plan and procedure when adopted by the local community.*

SECTION 1616A
STRUCTURAL INTEGRITY

1616A.1 General. High-rise buildings that are assigned to Risk Category III or IV shall comply with the requirements of Section 1616A.2 if they are frame structures, or Section 1616A.3 if they are bearing wall structures.

1616A.2 Frame structures. Frame structures shall comply with the requirements of this section.

1616A.2.1 Concrete frame structures. Frame structures constructed primarily of reinforced or prestressed concrete, either cast-in-place or precast, or a combination of these, shall conform to the requirements of Section 4.10 of ACI 318. Where ACI 318 requires that nonprestressed reinforcing or prestressing steel pass through the region bounded by the longitudinal column reinforcement, that reinforcing or prestressing steel shall have a minimum nominal tensile strength equal to two-thirds of the required one-way vertical strength of the connection of the floor or roof system to the column in each direc-

tion of beam or slab reinforcement passing through the column.

Exception: Where concrete slabs with continuous reinforcement having an area not less than 0.0015 times the concrete area in each of two orthogonal directions are present and are either monolithic with or equivalently bonded to beams, girders or columns, the longitudinal reinforcing or prestressing steel passing through the column reinforcement shall have a nominal tensile strength of one-third of the required one-way vertical strength of the connection of the floor or roof system to the column in each direction of beam or slab reinforcement passing through the column.

1616A.2.2 Structural steel, open web steel joist or joist girder, or composite steel and concrete frame structures. Frame structures constructed with a structural steel frame or a frame composed of open web steel joists, joist girders with or without other structural steel elements or a frame composed of composite steel or composite steel joists and reinforced concrete elements shall conform to the requirements of this section.

1616A.2.2.1 Columns. Each column splice shall have the minimum design strength in tension to transfer the design dead and live load tributary to the column between the splice and the splice or base immediately below.

1616A.2.2.2 Beams. End connections of all beams and girders shall have a minimum nominal axial tensile strength equal to the required vertical shear strength for allowable stress design (ASD) or two-thirds of the required shear strength for load and resistance factor

design (LRFD) but not less than 10 kips (45 kN). For the purpose of this section, the shear force and the axial tensile force need not be considered to act simultaneously.

Exception: Where beams, girders, open web joist and joist girders support a concrete slab or concrete slab on metal deck that is attached to the beam or girder with not less than $\frac{3}{8}$ -inch-diameter (9.5 mm) headed shear studs, at a spacing of not more than 12 inches (305 mm) on center, averaged over the length of the member, or other attachment having equivalent shear strength, and the slab contains continuous distributed reinforcement in each of two orthogonal directions with an area not less than 0.0015 times the concrete area, the nominal axial tension strength of the end connection shall be permitted to be taken as half the required vertical shear strength for ASD or one-third of the required shear strength for LRFD, but not less than 10 kips (45 kN).

1616A.3 Bearing wall structures. Bearing wall structures shall have vertical ties in all load-bearing walls and longitudinal ties, transverse ties and perimeter ties at each floor level in accordance with this section and as shown in Figure 1616A.3.

1616A.3.1 Concrete wall structures. Precast bearing wall structures constructed solely of reinforced or prestressed concrete, or combinations of these shall conform to the requirements of Sections 16.2.4 and 16.2.5 of ACI 318.

1616A.3.2 Other bearing wall structures. Ties in bearing wall structures other than those covered in Section 1616A.3.1 shall conform to this section.

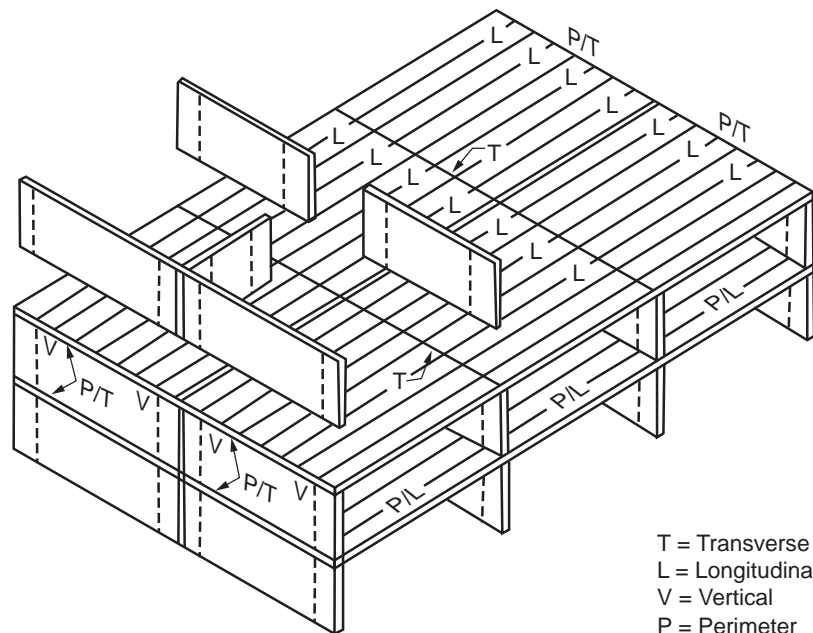


FIGURE 1616A.3
LONGITUDINAL, PERIMETER, TRANSVERSE AND VERTICAL TIES

1616A.3.2.1 Longitudinal ties. Longitudinal ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Longitudinal ties shall extend across interior load-bearing walls and shall connect to exterior load-bearing walls and shall be spaced at not greater than 10 feet (3038 mm) on center. Ties shall have a minimum nominal tensile strength, T_T , given by Equation 16A-24. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_T = wLS \leq \alpha_T S \quad \text{(Equation 16A-24)}$$

where:

L = The span of the horizontal element in the direction of the tie, between bearing walls, feet (m).

w = The weight per unit area of the floor or roof in the span being tied to or across the wall, psf (N/m²).

S = The spacing between ties, feet (m).

α_T = A coefficient with a value of 1,500 pounds per foot (2.25 kN/m) for masonry bearing wall structures and a value of 375 pounds per foot (0.6 kN/m) for structures with bearing walls of cold-formed steel light-frame construction.

1616A.3.2.2 Transverse ties. Transverse ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Transverse ties shall be placed not farther apart than the spacing of load-bearing walls. Transverse ties shall have minimum nominal tensile strength T_T , given by Equation 16A-24. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

1616A.3.2.3 Perimeter ties. Perimeter ties shall consist of continuous reinforcement in slabs; continuous or spliced decks or sheathing; continuous or spliced members framing to, within or across walls; or connections of continuous framing members to walls. Ties around the perimeter of each floor and roof shall be located within 4 feet (1219 mm) of the edge and shall provide a nominal strength in tension not less than T_p , given by Equation 16A-25. For ASD the minimum nominal tensile strength shall be permitted to be taken as 1.5 times the allowable tensile stress times the area of the tie.

$$T_p = 200w \leq \beta_T \quad \text{(Equation 16A-25)}$$

For SI: $T_p = 90.7w \leq \beta_T$

where:

w = As defined in Section 1616A.3.2.1.

β_T = A coefficient with a value of 16,000 pounds (7200 kN) for structures with masonry bearing walls and a value of 4,000 pounds (1300 kN) for

structures with bearing walls of cold-formed steel light-frame construction.

1616A.3.2.4 Vertical ties. Vertical ties shall consist of continuous or spliced reinforcing, continuous or spliced members, wall sheathing or other engineered systems. Vertical tension ties shall be provided in bearing walls and shall be continuous over the height of the building. The minimum nominal tensile strength for vertical ties within a bearing wall shall be equal to the weight of the wall within that story plus the weight of the diaphragm tributary to the wall in the story below. Not fewer than two ties shall be provided for each wall. The strength of each tie need not exceed 3,000 pounds per foot (450 kN/m) of wall tributary to the tie for walls of masonry construction or 750 pounds per foot (140 kN/m) of wall tributary to the tie for walls of cold-formed steel light-frame construction.

SECTION 1617A MODIFICATIONS TO ASCE 7

1617A.1 General. The text of ASCE 7 shall be modified as indicated in Sections 1617A.1.1 through 1617A.1.40.

1617A.1.1 ASCE 7, Section 1.3. Modify ASCE 7, Section 1.3 by adding Section 1.3.8 as follows:

1.3.8 Structural design criteria. Where design is based on ASCE 7, Chapters 16, 17 or 18, the ground motion, analysis and design methods, material assumptions, testing requirements and acceptance criteria proposed by the engineer shall be submitted to the enforcement agency in the form of structural design criteria for approval. [DSA-SS] Structural design criteria including wind tunnel design recommendations are required where design is based on ASCE 7, Chapter 31.

[DSA-SS] Peer review requirements in Section 322 of the California Existing Building Code shall apply to design reviews required by ASCE 7, Chapters 17 and 18.

[OSHPD 1 & 4] Peer review requirements in Section 1617A.1.41 of this code shall apply to design reviews required by ASCE 7, Chapters 17 and 18.

1617A.1.2 ASCE 7, Section 11.1.3. Replace last paragraph of ASCE 7, Section 11.1.3, by the following:

Non-building structures similar to buildings shall be designed and detailed in accordance with Chapter 12.

1617A.1.3 ASCE 7, Section 11.4. Modify ASCE 7, Section 11.4 to include the following:

Seismic ground motion values shall include updated subsections in Supplement 3. [OSHPD 1 & 4] Use of the 2020 NEHRP Provisions for multi-period spectra shall be permitted, where all of the following are included.

1. A detailed seismic design criterion shall be submitted to and approved by the AHJ.
2. Seismic Ground Motion values shall be determined using the 2020 NEHRP Provisions, Section 11.4.

3. *Geologic Hazard and Geotechnical Investigation shall be performed using the 2020 NEHRP Provisions, Section 11.8.*
4. *Vertical Ground Motions, where required, shall be determined using the 2020 NEHRP Provisions, Section 11.9.*
5. *Site Classification shall be determined using the 2020 NEHRP Provisions, Chapter 20.*
6. *Site-Specific Ground Motion Procedures shall be determined using the 2020 NEHRP Provisions, Chapter 21.*
7. *Seismic Ground Motion and Long-period Transition Maps shall be used from Chapter 22 of the 2020 NEHRP Provisions.*
8. *S_{DS} and S_{D1} obtained from the multi-period spectra determined using the 2020 NEHRP Provisions shall be used, where required in Chapter 12, 13 and 15 of ASCE 7-16.*

1617A.1.4 ASCE 7, Table 12.2-1. *Modify ASCE 7, Table 12.2-1 as follows:*

A. BEARING WALL SYSTEMS

5. *Intermediate Precast Shear Walls—Not permitted by OSHPD.*
17. *Light-framed walls with shear panels of all other materials—Not permitted by OSHPD and DSA-SS.*

B. BUILDING FRAME SYSTEMS

3. *Ordinary steel concentrically braced frames—Not permitted by OSHPD.*
8. *Intermediate Precast Shear Walls—Not permitted by OSHPD.*
24. *Light-framed walls with shear panels of all other materials—Not permitted by OSHPD and DSA-SS.*
26. *Special steel plate shear wall—Not permitted by OSHPD.*

C. MOMENT-RESISTING FRAME SYSTEMS

2. *Special steel truss moment frames—Not permitted by OSHPD.*
3. *Intermediate steel moment frames—Not permitted by OSHPD.*
4. *Ordinary steel moment frames—Not permitted by OSHPD.*
12. *Cold-formed steel—special bolted moment frame—Not permitted by DSA-SS and OSHPD.*

G. CANTILEVER COLUMN SYSTEMS DETAILED TO CONFORM WITH THE REQUIREMENTS FOR:

1. *Steel special cantilever column systems—Not permitted by OSHPD.*
3. *Special reinforced concrete moment frames—Not permitted by OSHPD.*

Exceptions:

1. *Systems listed in this section can be used as an alternative system when preapproved by the enforcement agency.*
2. *Rooftop or other supported structures not exceeding two stories in height and 10 percent of the total structure weight can use the systems in this section when designed as components per ASCE 7, Chapter 13.*
3. *Systems listed in this section can be used for seismically isolated buildings, when permitted by ASCE 7, Section 17.2.5.4.*

1617A.1.5 ASCE 7, Section 12.2.3, 12.2.3.1 and 12.2.3.2. *Modify ASCE 7, Sections 12.2.3, 12.2.3.1 and 12.2.3.2 as follows:*

1617A.1.5.1 ASCE 7, Section 12.2.3. *Replace ASCE 7, Section 12.2.3 with the following:*

Where different seismic force-resisting systems are used in combinations to resist seismic forces in the same direction, other than those combinations considered as dual systems, the design shall comply with the requirements of this section. The most stringent applicable structural system limitations contained in Table 12.2-1 shall apply, except as otherwise permitted by this section.

1617A.1.5.2 ASCE 7, Section 12.2.3.1. *Replace ASCE 7, Section 12.2.3.1, Items 1 and 2, by the following:*

The value of the response modification coefficient, R , used for design at any story shall not exceed the lowest value of R that is used in the same direction at any story above that story. Likewise, the deflection amplification factor, C_d , and the system over strength factor, Ω_0 , used for the design at any story shall not be less than the largest value of these factors that are used in the same direction at any story above that story.

1617A.1.5.3 ASCE 7, Section 12.2.3.2. *Modify ASCE 7, Section 12.2.3.2 by modifying Item a and adding Items f, g and h, as follows:*

- a. *The stiffness of the lower portion shall be at least 10 times the stiffness of the upper portion. For purposes of determining this ratio, the base shear shall be computed and distributed vertically according to Section 12.8. Using these forces, the stiffness for each portion shall be computed as the ratio of the base shear for that portion to the elastic displacement, δ_{xe} , computed at the top of that portion, considering the portion fixed at its base. For the lower portion, the applied forces shall include the reactions from the upper portion, modified as required in Item d.*
- f. *The structural height of the upper portion shall not exceed the height limits of Table 12.2-1 for the seismic force-resisting system used, where the height is measured from the base of the upper portion. [OSHPD 1 & 4] Not permitted by OSHPD.*

- g. Where Horizontal Irregularity Type 4 or Vertical Irregularity Type 4 exists at the transition from the upper to the lower portion, the reactions from the upper portion shall be amplified in accordance with Sections 12.3.3.3, 12.10.1.1 and 12.10.3.3 as applicable, in addition to amplification required by Item d.
- h. Where design of vertical elements of the upper portion is governed by special seismic load combinations, the special loads shall be considered in the design of the lower portion.

1617A.1.6 Reserved.

1617A.1.7 ASCE 7, Section 12.2.5.6.1 [DSA-SS] The exception after the first paragraph is not permitted by DSA-SS.

1617A.1.8 ASCE 7, Section 12.2.5.7.1 [DSA-SS] The exception after the first paragraph is not permitted by DSA-SS.

1617A.1.9 ASCE 7, Section 12.2.5.7.2 [DSA-SS] The exception after the first paragraph is not permitted by DSA-SS.

1617A.1.10 ASCE 7, Section 12.3.3.1. Modify first sentence of ASCE 7, Section 12.3.3.1 and add exceptions as follows:

12.3.3.1 Prohibited horizontal and vertical irregularities for Seismic Design Categories D through F. Structures assigned to Seismic Design Category D, E or F having horizontal structural irregularity Type 1b of Table 12.3-1 or vertical structural irregularities Type 1b, 5a or 5b of Table 12.3-2 shall not be permitted.

Exceptions:

1. Structures with reinforced concrete or reinforced masonry shear wall systems and rigid or semi-rigid diaphragms, consisting of concrete slabs or concrete-filled metal deck having a span-to-depth ratio of 3 or less, having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided that the maximum story drift in the direction of the irregularity, computed including the torsional amplification factor from Section 12.8.4.3, is less than 10 percent of the allowable story drift in ASCE 7, Table 12.12-1.
2. Structures having a horizontal structural irregularity Type 1b of Table 12.3-1 are permitted, provided a redundancy factor, ρ , of 1.3 as defined in ASCE 7 12.3.4 is assigned to the seismic force-resisting system in both orthogonal directions and the structure is designed for one of the orthogonal procedures as defined in ASCE 7, Section 12.5.3.1.

1617A.1.11 ASCE 7, Section 12.7.2. Modify ASCE 7, Section 12.7.2, by adding Item 6 to read as follows:

6. Where buildings provide lateral support for walls retaining earth, and the exterior grades on opposite

sides of the building differ by more than 6 feet (1829 mm), the load combination of the seismic increment of earth pressure due to earthquake acting on the higher side, as determined by a geotechnical engineer qualified in soils engineering plus the difference in earth pressures shall be added to the lateral forces provided in this section.

1617A.1.12 Reserved.

1617A.1.13 Reserved.

1617A.1.14 ASCE 7, Section 12.12.3. [OSHPD 1 & 4] Replace ASCE 7 Equation 12.12-1 by the following:

$$\delta_M = C_d \delta_{max} \text{ (Equation 12.12-1)}$$

1617A.1.15 ASCE 7, Section 12.13.1. Modify ASCE 7, Section 12.13.1 by adding Section 12.13.1.1 as follows:

12.13.1.1 Foundations and superstructure-to-foundation connections. The foundation shall be capable of transmitting the design base shear and the overturning forces from the structure into the supporting soil. Stability against overturning and sliding shall be in accordance with Section 1605A.1.1.

In addition, the foundation and the connection of the superstructure elements to the foundation shall have the strength to resist, in addition to gravity loads, the lesser of the following seismic loads:

1. The strength of the superstructure elements.
2. The maximum forces that can be delivered to the foundation in a fully yielded structural system.
3. Forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3.1.

Exceptions:

1. Where referenced standards specify the use of higher design loads.
2. When it can be demonstrated that inelastic deformation of the foundation and superstructure-to-foundation connection will not result in a weak story or cause collapse of the structure.
3. Where seismic force-resisting system consists of light framed walls with shear panels, unless the reference standard specifies the use of higher design loads.

Where the computation of the seismic overturning moment is by the equivalent lateral-force method or the modal analysis method, reduction in overturning moment permitted by section 12.13.4 of ASCE 7 may be used.

Where moment resistance is assumed at the base of the superstructure elements, the rotation and flexural deformation of the foundation as well as deformation of the superstructure-to-foundation connection shall be considered in the drift and deformation compatibility analyses.

1617A.1.16 ASCE 7, Section 12.13.9.2. Modify ASCE 7, Section 12.13.9.2 by the following sentence added to the end of Item b as follows:

Seismic load effects determined in accordance with Section 12.4 need not be considered in this check.

1617A.1.17 ASCE 7, Section 13.1.3. [OSHPD 1 & 4] Modify ASCE 7, Section 13.1.3 by the following:

All nonstructural components shall have a component importance factor, I_p , equal to 1.5.

Exception: *Hospital buildings rated SPC-1 and SPC-2 not providing services/systems, utilities or access/egress to general acute care buildings designated as SPC 3 or higher in accordance with Chapter 6 of the California Administrative Code, shall be permitted to use component importance factor, I_p , as given in ASCE 7, Section 13.3.1.*

1617A.1.18 ASCE 7, Section 13.1.4. Replace ASCE 7, Section 13.1.4, with the following:

13.1.4. *The following nonstructural components and equipment shall be anchored in accordance with this section. Design and detailing shall be in accordance with Chapter 13 except as modified by this section.*

1. *Fixed Equipment: Equipment shall be anchored if it is directly attached to the building utility services such as electricity, gas or water. For the purposes of this requirement, "directly attached" shall include all electrical connections except plugs for 110/220-volt receptacles having a flexible cable/cord. Equipment that is connected to the building plumbing system with a shut-off valve in proximity to the equipment shall not be considered as directly attached provided the inside diameter of the pipe/tubing is less than $\frac{1}{2}$ inch (12.7 mm).*
2. *Movable Equipment: Equipment is subject to the same requirement as fixed equipment, but is permitted to be anchored by re-attachable anchors or restraints in a manner approved by the enforcement agency. Utilities and services at the equipment shall have flexible connections to allow for necessary movement.*
3. **[OSHPD 1, 2, 4 & 5]** *Mobile Equipment: Equipment heavier than 400 pounds (181.4 kg) that has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly support the equipment shall be restrained in a manner approved by the enforcement agency when stored and not in use, unless the equipment is stored in an equipment storage room.*

[DSA-SS] *Mobile Equipment: Equipment heavier than 400 pounds (181.4 kg) or has a center of mass located 4 feet (1219 mm) or more above the adjacent floor or roof level that directly supports the equipment shall be restrained in a manner approved by the enforcement agency. Mobile equipment shall be restrained when not in use and is stored, unless the equipment is stored in a storage room that does not house hazardous*

materials or any facility systems or fixed equipment that can be affected by mobile equipment lacking restraint.

4. **[OSHPD 1, 2, 4 & 5]** *Countertop Equipment: Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed, movable, mobile or other equipment, as applicable.*

[DSA-SS] *Countertop Equipment: Countertop equipment shall be subject to the same anchorage or restraint requirements for fixed or movable equipment, as applicable. Countertop equipment shall also be subject to the same requirements as mobile or other equipment if weight of equipment is greater than 100 pounds (45 kg) and has a center of mass located 4 feet (1219 mm) or more above the adjacent floor level or if equipment could fall and block a required means of egress.*

5. **[OSHPD 1, 2, 4 & 5]** *Temporary Equipment: Equipment for uses greater than 30 days but less than or equal to 180 days and where this section requires supports and attachments, the following shall apply:*

- a. *Seismic design for supports and attachments for temporary equipment shall meet the requirements of Chapter 13; however, the calculated F_p may be reduced by 50 percent. It is acceptable to use ballasts for seismic bracing supports and attachments and to limit the design criteria to overturning unless directly or indirectly supported by the building structure.*
- b. *Wind design speeds may be reduced as prescribed in ASCE 37-14 or other standard approved by OSHPD.*
- c. *Temporary piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of temporary piping, conductors and ductwork is not required.*

6. **[OSHPD 1, 2, 4 & 5]** *Interim Equipment:*

- a. *Seismic design for supports and attachments for interim equipment shall meet the requirements of Chapter 13. It is acceptable to use ballasts for seismic or wind bracing supports and attachments.*
- b. *Wind design speeds may be reduced as prescribed in ASCE 37-14 or other standard approved by OSHPD.*
- c. *Piping, conductors and ductwork shall be supported. Seismic design for supports and attachments of piping, conductors and ductwork is not required.*

7. *Other Equipment: Equipment shall be anchored where any of the following apply:*

- a. **[OSHPD 1, 2, 4 & 5]** *Essential to hospital operations and weight of equipment is greater than 100 pounds (45 kg).*

[DSA-SS] Weight of equipment is greater than 100 pounds (45 kg) and essential to operations for emergency preparedness, communications and operations centers, and other facilities required for emergency response of state-owned essential services buildings as defined in the California Administrative Code (Title 24, Part 1, CCR) Section 4-207 and all structures required for their continuous operation or access/egress.

- b. *[OSHPD 1, 2, 4 & 5] Could fall within the patient care vicinity as defined in Article 517.2 of the California Electrical Code.*
 - c. *Could fall and block a required means of egress. [OSHPD 1, 2, 4 & 5] Weight of equipment is greater than 400 pounds (181.4 kg).*
 - d. *[DSA-SS] Weight of equipment is greater than 400 pounds (181.4 kg) or center of mass is located greater than 4 feet (1219 mm) above the finished floor or roof level that directly supports the component.*
- [OSHPD 1, 2, 4 & 5] Weight of equipment is greater than 200 pounds (90 kg) and center of mass located greater than 4 feet (1219 mm) measured from the finished floor.*
- 8. *Equipment with hazardous contents.*
 - 9. *Other architectural, mechanical and electrical components stated in Chapter 13.*
 - 10. *Wall-, Roof- or Floor-Hung Equipment: Seismic design and seismic details shall be provided for wall-, roof- or floor-hung nonstructural components and equipment when the component weighs more than 20 pounds (9 kg) [OSHPD 1, 2, 4 & 5] or, in the case of a distributed system, more than 5 pounds per foot (73 N/m).*

[OSHPD 1, 2, 4 & 5] Exemptions:

- 1. *Furniture except storage cabinets as noted in Table 13.5-1.*
- 2. *Nonstructural components and equipment, that are attached to the building, provided that the component weighs 20 pounds (9 kg) or less or, in the case of a distributed system, 5 pounds per foot (73 N/m) or less. Seismic design and seismic details need not be provided.*
- 3. *Seismic design need not be provided for discrete architectural, mechanical and electrical components and equipment that are attached to the building and anchorage is detailed on the plans, provided that the component weighs 400 pounds (18.44 kg) or less, and the center of mass is located 4 feet (1219 mm) or less above the adjacent floor or roof level that directly support the component and flexible connections are provided between the component and associated ductwork, piping and conduit where required.*

[DSA-SS] Exemptions: *The following nonstructural components are exempt from the requirements of ASCE 7, Chapter 13:*

- 1. *Furniture except storage cabinets as noted in Table 13.5-1.*
- 2. *Discrete architectural, mechanical and electrical components and fixed equipment that are positively attached to the structure, provided that none of the conditions in this section apply, and flexible connections are provided between the component and associated ductwork, piping and conduit where required.*

1617A.1.19 ASCE 7, Section 13.4 *Replace ASCE 7, Sections 13.4.2.3, with the following:*

13.4.2.3 Prequalified post-installed anchors and specialty inserts in concrete and masonry.

Post-installed anchors and specialty inserts in concrete that are pre-qualified for seismic applications in accordance with ACI 355.2, ACI 355.4, ICC-ES AC193, ICC-ES AC232, ICC-ES AC308 or ICC-ES AC446 shall be permitted. Post-installed anchors in masonry shall be pre-qualified for seismic applications in accordance with ICC-ES AC01, AC58 or AC106.

Use of screw anchors shall be limited to dry interior conditions and shall not be used in building enclosures. Re-use of screw anchors or screw anchor holes shall not be permitted.

Exception: *[DSA-SS] Screw anchors are permitted for use in building enclosures and may also be used in exterior conditions when permitted in accordance with a valid evaluation report.*

1617A.1.20 ASCE 7, Section 13.4.5 *Modify ASCE 7, Section 13.4.5 by adding Section 13.4.5.1 as follows:*

13.4.5.1 Power actuated fasteners. *Power actuated fasteners qualified in accordance with ICC ES AC 70 shall be deemed to satisfy the requirements of Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from permit requirements by Section 1617A.1.18 of this code and for interior non-bearing non-shear wall partitions only. Power actuated fastener shall not be used to anchor seismic bracing, exterior cladding or curtain wall systems.

Exception: *Power actuated fasteners in steel to steel connections prequalified for seismic application by cyclic tests in accordance with ICC ES AC 70 shall be permitted for seismic design.*

1617A.1.21 ASCE 7, Section 13.5.6.2. *Modify ASCE 7, Section 13.5.6.2 by the following exception added to the*

end of Section 13.5.6.2.2 and by adding Section 13.5.6.2.3 as follows:

Exception to Section 13.5.8.1 shall not be used in accordance with ASTM E580 Section 5.5.

13.5.6.2.3 Modification to ASTM E580. Modify ASTM E580 by the following:

1. **Exitways.** Lay-in ceiling assemblies in exitways shall be installed with a main runner or cross runner surrounding all sides of each piece of tile, board or panel and each light fixture or grille. A cross runner that supports another cross runner shall be considered as a main runner for the purpose of structural classification. Splices or intersections of such runners shall be attached with through connectors such as pop rivets, screws, pins, plates with end tabs or other approved connectors. Lateral force diagonal bracing may be omitted in the short or transverse direction of exitways, not exceeding 8 feet wide, when perimeter support in accordance with ASTM E580 Sections 5.2.2 and 5.2.3 is provided and the perimeter wall laterally supporting the ceiling in the short or transverse direction is designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces.
2. **Corridors and lobbies.** Expansion joints shall be provided in the ceiling at intersections of corridors and at junctions of corridors and lobbies or other similar areas.
3. **Lay-in panels.** Metal panels and panels weighing more than $\frac{1}{2}$ pounds per square foot (24 N/m^2) other than acoustical tiles shall be positively attached to the ceiling suspension runners.
4. **Lateral force bracing.** Lateral force bracing is required for all ceiling areas except that they shall be permitted to be omitted in rooms with floor areas up to 144 square feet when perimeter support in accordance with ASTM E580, Sections 5.2.2 and 5.2.3, are provided and perimeter walls are designed to carry the ceiling lateral forces. The connections between the ceiling grid, wall angle and the wall shall be designed to resist the ceiling lateral forces. Horizontal restraint point spacing shall be justified by analysis or test and shall not exceed a spacing of 12 feet by 12 feet. Bracing wires shall be secured with four tight twists in $1\frac{1}{2}$ inches, or an approved alternate connection.
5. Ceiling support and bracing wires shall be spaced a minimum of 6 inches from all pipes, ducts, conduits and equipment that are not braced for horizontal forces, unless approved otherwise by the building official.

1617A.1.22 ASCE 7, Section 13.5.7. [OSHPD 1 & 4] Modify ASCE 7, Section 13.5.7, by the following:

All access floors shall be special access floors in accordance with Section 13.5.7.2, except for raised roof or exterior floor paver systems.

1617A.1.23 ASCE 7, Section 13.6.2.1 and ASCE 7, Tables 13.5-1 and 13.6-1. Modify Section 13.6.2.1 by adding the following to the end of the section:

[OSHPD 1 & 4] Use of this section shall be considered as an alternative system. Alternatively, HVACR systems shall require special seismic certification in accordance with Section 1705A.13.3.

ASCE 7, Tables 13.5-1 and 13.6-1. Modify ASCE 7, Tables 13.5-1 & 13.6-1 by the following:

Where $I_p = 1.5$, overstrength factor (Ω_0) need not exceed the values of R_p for design of anchorage to concrete.

1617A.1.24 ASCE 7, Section 13.6.5. Replace ASCE 7, Section 13.6.5 as follows:

13.6.5 Distribution Systems: Conduit, Cable Tray and Raceways. Cable trays and raceways shall be designed for seismic forces and seismic relative displacements as required in Section 13.3. Conduit equal to or greater than 2.5 inches (64 mm) trade size and attached to panels, cabinets or other equipment subject to seismic relative displacement, D_{pp} , shall be provided with flexible connections or designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for raceways where flexible connections or other assemblies are provided between the cable tray or raceway and associated components to accommodate the relative displacement, where the cable tray or raceway is positively attached to the structure, and one of the following apply:
 - a. Trapeze assemblies with $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13-mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the conduit, cable tray or raceway support point to the connection at the supporting structure are used to support the cable tray or raceway, and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or
 - b. The conduit, cable tray or raceway is supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in diameter, and each hanger in the raceway run is 12 inches (305 mm) or less in length from the conduit, cable tray or raceway support point connection to the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for conduit, regardless of the value of I_p , where the conduit is less than 2.5 inches (64 mm) trade size.

Design for the displacements across seismic joints shall be required for conduit, cable trays and raceways with $I_p = 1.5$ without consideration of conduit size.

1617A.1.25 ASCE 7, Section 13.6.6. Replace ASCE 7, Section 13.6.6 with the following:

13.6.6 Distribution Systems: Duct Systems. HVACR and other duct systems shall be designed for seismic forces and seismic relative displacements as required in Section 13.3.

Exceptions: The following exceptions pertain to ductwork not designed to carry toxic, highly toxic or flammable gases or not used for smoke control:

1. Design for the seismic forces and relative displacements of Section 13.3 shall not be required for duct systems where flexible connections or other assemblies are provided to accommodate the relative displacement between the duct system and associated components, the duct system is positively attached to the structure, and where one of the following apply:
 - a. Trapeze assemblies with $3/8$ -inch (10 mm) or $1/2$ -inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the duct support point to the connection at the supporting structure are used to support duct, and the total weight supported by any single trapeze is less than 10 lb/ft (146 N/m) and 100 pounds or less; or
 - b. The duct is supported by individual rod hangers $3/8$ inch (10 mm) or $1/2$ inch (13 mm) in diameter, and each hanger in the duct run is 12 inches (305 mm) or less in length from the duct support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.
2. Design for the seismic forces and relative displacements of Section 13.3 shall not be required where provisions are made to avoid impact with other ducts or mechanical components or to protect the ducts in the event of such impact, the distribution system is positively attached to the structure; and HVACR ducts have a cross-sectional area of less than 6 square feet (0.557 m²) and weigh 20 lb/ft (292 N/m) or less.

Components that are installed in line with the duct system and have an operating weight greater than 75 pounds (334 N), such as fans, terminal units, heat exchangers and humidifiers, shall be supported and

laterally braced independent of the duct system, and such braces shall meet the force requirements of Section 13.3.1. Components that are installed in line with the duct system, have an operating weight of 75 pounds (334 N) or less, such as small terminal units, dampers, louvers and diffusers, and are otherwise not independently braced shall be positively attached with mechanical fasteners to the rigid duct on both sides. Piping and conduit attached to in-line equipment shall be provided with adequate flexibility to accommodate the seismic relative displacements of Section 13.3.2.

1617A.1.26 ASCE 7, Section 13.6.7.3. Replace ASCE 7, Section 13.6.7.3 with the following:

13.6.7.3 Additional Provisions for Piping and Tubing Systems.

A) Design for the seismic forces of Section 13.3 shall not be required for piping systems where flexible connections, expansion loops or other assemblies are provided to accommodate the relative displacement between component and piping, where the piping system is positively attached to the structure, and where any of the following conditions apply:

1. Trapeze assemblies are supported by $3/8$ -inch (10 mm) or $1/2$ -inch (13 mm) diameter rod hangers not exceeding 12 inches (305 mm) in length from the pipe support point to the connection at the supporting structure, and no single pipe exceeds the diameter limits set forth in item 2b below or 2 inches (50 mm) where I_p is greater than 1.0 and the total weight supported by any single trapeze is 100 pounds (445 N) or less; or

2. Piping that has an R_p in Table 13.6-1 of 4.5 or greater supported by rod hangers and provisions are made to avoid impact with other structural or nonstructural components or to protect the piping in the event of such impact, or pipes with $I_p = 1.0$ supported by individual rod hangers $3/8$ inch (10 mm) or $1/2$ inch (13 mm) in diameter, where each hanger in the pipe run is 12 inches (305 mm) or less in length from the pipe support point to the connection at the supporting structure; and the total weight supported by any single hanger is 50 pounds (220 N) or less. In addition, the following limitations on the size of piping shall be observed:

- a. In structures assigned to Seismic Design Category D, E or F where I_p is greater than 1.0, the nominal pipe size shall be 1 inch (25 mm) or less.

- b. In structures assigned to Seismic Design Categories D, E or F where $I_p = 1.0$, the nominal pipe size shall be 3 inches (80 mm) or less.

3. Pneumatic tube systems supported with trapeze assemblies using $\frac{3}{8}$ inch (10 mm) in diameter rod hangers not exceeding 12 inches (305 mm) in length from the tube support point to the connection at the supporting structure and the total weight supported by any single trapeze is 100 pounds (445 N) or less.
4. Pneumatic tube systems supported by individual rod hangers $\frac{3}{8}$ inch (10 mm) or $\frac{1}{2}$ inch (13 mm) in diameter, and each hanger in the run is 12 inches (305 mm) or less in length from the tube support point to the connection at the supporting structure, and the total weight supported by any single rod is 50 pounds (220 N) or less.

B) Flexible connections in piping required in Section 13.6.7.3 are not required where pipe is rigidly attached to the same floor or wall that provides vertical and lateral support for the equipment, or to a fixture.

C) Flexible connections in piping are required at seismic separation joints and shall be detailed to accommodate the seismic relative displacements at connections.

1617A.1.27 ASCE 7, Section 13.6.11.1. Modify ASCE 7, Section 13.6.11.1, by adding Section 13.6.11.1.1 as follows:

13.6.11.1.1 Elevators guide rail support. The design of guide rail support-bracket fastenings and the supporting structural framing shall use the weight of the counterweight or maximum weight of the car plus not less than 40 percent of its rated load. The seismic forces shall be assumed to be distributed one third to the top guiding members and two thirds to the bottom guiding members of cars and counterweights, unless other substantiating data are provided. In addition to the requirements of ASCE 7, Section 13.6.11.1, the minimum seismic forces shall be 0.5g allowable stress design load acting in any horizontal direction.

1617A.1.28 ASCE 7, Section 13.6.11.4. Replace ASCE 7, Section 13.6.11.4, as follows:

13.6.11.4 Retainer plates. Retainer plates are required at the top and bottom of the car and counterweight, except where safety devices acceptable to the enforcement agency are provided which meet all requirements of the retainer plates, including full engagement of the machined portion of the rail. The design of the car, cab stabilizers, counterweight guide rails and counterweight frames for seismic forces shall be based on the following requirements:

1. The seismic force shall be computed per the requirements of ASCE 7, Section 13.6.11.1. The minimum horizontal acceleration shall be 0.5g allowable stress design load for all buildings.
2. W_p shall equal the weight of the counterweight or the maximum weight of the car plus not less than 40 percent of its rated load.

3. With the car or counterweight located in the most adverse position, the stress in the rail shall not exceed the limitations specified in these regulations, nor shall the deflection of the rail relative to its supports exceed the deflection listed below:

RAIL SIZE (weight per foot of length, pounds)	WIDTH OF MACHINED SURFACE (inches)	ALLOWABLE RAIL DEFLECTION (inches)
8	1 $\frac{1}{4}$	0.20
11	1 $\frac{1}{2}$	0.30
12	1 $\frac{3}{4}$	0.40
15	1 $\frac{31}{32}$	0.50
18 $\frac{1}{2}$	1 $\frac{31}{32}$	0.50
22 $\frac{1}{2}$	2	0.50
30	2 $\frac{1}{4}$	0.50

For SI: 1 inch = 25 mm, 1 foot = 305 mm, 1 pound = 0.454 kg.

Note: Deflection limitations are given to maintain a consistent factor of safety against disengagement of retainer plates from the guide rails during an earthquake.

4. Where guide rails are continuous over supports and rail joints are within 2 feet (610 mm) of their supporting brackets, a simple span may be assumed.
5. The use of spreader brackets is allowed.
6. Cab stabilizers and counterweight frames shall be designed to withstand computed lateral load with a minimum horizontal acceleration of 0.5g allowable stress design load.

1617A.1.29 Reserved.

1617A.1.30 Reserved.

1617A.1.31 Reserved.

1617A.1.32 Reserved.

1617A.1.33 Reserved.

1617A.1.34 Reserved.

1617A.1.35 ASCE 7, Section 17.2.4.7. Modify ASCE 7, Section 17.2.4.7, by adding the following:

The effects of uplift shall be explicitly accounted for in the testing of the isolator units.

1617A.1.36 ASCE 7, Section 17.4. Modify ASCE 7, Section 17.4.2, by adding the following:

17.4.2.3 Linear procedures. Linear procedures shall not be used in Seismic Design Category E & F structures.

1617A.1.37 Reserved.

1617A.1.38 ASCE 7, Section 18.3. Replace exception to ASCE 7, Section 18.3 with the following:

Exception: If the calculated force in an element of the seismic force-resisting system does not exceed 1.5 times its nominal strength for the Risk-Targeted Maximum Considered Earthquake (MCE_R) the element is permitted to be modeled as linear. For this section, the MCE_R response shall be based on largest response due to a

single ground motion and not the average response of suite of ground motions.

1617A.1.39 Earthquake Motion Measuring Instrumentation and Post-earthquake Structural Monitoring/Verification. [OSHPD 1 & 4] Modify ASCE 7 by the following:

Scope: For buildings with a seismic isolation system, a damping system or a lateral force-resisting system (LFRS) not listed in ASCE 7, Table 12.2-1, earthquake motion measuring instrumentation and monitoring shall be required. For buildings with welded steel moment frames constructed under a permit issued prior to October 25, 1994 post-earthquake verification shall be in accordance with this section.

Instrumentation: Earthquake monitoring instrumentation shall be installed in accordance with Section 104.11.4.

Monitoring: After every significant seismic event, where the ground shaking acceleration at the site exceeds 0.3g or the acceleration at any monitored building level exceeds 0.8g as measured by the seismic monitoring system in the building, the owner shall retain a structural engineer to make an inspection of the structural system. The inspection shall include viewing the performance of the building, reviewing the strong motion records, and a visual examination of the isolators, dampers and connections for deterioration, offset or physical damage. A report for each inspection, including conclusions on the continuing adequacy of the structural system, shall be submitted to the enforcement agency.

Verification: After every seismic event that generates ground motions specified in the California Administrative Code, Chapter 6, Section 4.2.0.1 or the damage indicators specified in the California Administrative Code, Chapter 6, Section 4.2.0.2 at a welded steel moment frame building constructed under a permit issued prior to October 25, 1994, the owner shall retain a structural engineer to perform detailed joint evaluations required to meet the following requirements:

1. A detailed joint evaluation program shall be submitted to the enforcement agency for approval prepared in accordance with the requirements of the California Administrative Code, Chapter 6, Section 4.2.0.3.
2. Upon approval of the joint evaluation program required by Item 1 above for the joint inspections, a project to perform the joint inspections, detailed in the program, shall be submitted and a building permit shall be obtained by the owner no later than 6 months from the date of occurrence of the seismic event.

Exception: Where the ground motions at the building site are less than 0.4g, the permit shall be obtained no later than 12 months from the date of occurrence of the seismic event.

3. A detailed joint evaluation report shall be submitted to the enforcement agency no later than 6

months of obtaining the building permit. The report shall document the findings from the inspections of the joints and include conclusions on the adequacy of the structural system. Where unsafe conditions are discovered, the provisions of Section 116 shall apply.

Where the detailed joint evaluation report is not submitted within the timeframes specified above, the building shall not be issued a building permit for any projects except for those for seismic compliance, maintenance and repair until the detailed joint evaluation work is complete.

1617A.1.40 Operational nonstructural performance level requirements. [OSHPD 1 & 4] New general acute care hospitals and new building(s) required for general acute care services shall satisfy Operational Nonstructural Performance Level (NPC-5) requirements.

Exception: A new building which is required for general acute care services that is added to an existing general acute care hospital and which has a building area of 4,000 square feet (371 m²) or less, need not satisfy the NPC-5 requirements until the deadline specified in California Administrative Code (Part 1, Title 24 CCR), Chapter 6.

Hospitals and buildings designed and constructed to the provisions of this code for new construction shall be deemed to satisfy Operational Nonstructural Performance Level (NPC-5) requirements when:

1. The facility has on-site supplies of water and holding tanks for sewage and liquid waste, sufficient to support 72 hours of emergency operations for the hospital or building, which are integrated into the building plumbing systems in accordance with the California Plumbing Code.
2. An on-site emergency system as defined in the California Electrical Code is incorporated into the building electrical system for critical care areas. Additionally, the system shall provide for radiological service and an onsite fuel supply for 72 hours of acute care operation.

Emergency and standby generators shall not be located below the higher of the Design Flood Elevation (DFE) or Base Flood Elevation (BFE) plus two feet (BFE + 2 ft.) or 500 year flood elevation, whichever is higher, and shall be located at an elevation close to grade for easy accessibility from outside for maintenance.

1617A.1.41 Peer Review Requirements. [OSHPD 1, 1R, 2, 4, & 5]

1. **General.** Independent peer review is an objective technical review by knowledgeable reviewer(s) experienced in structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of the building, basic engineering concept employed and recommendations for action.
2. **Timing of Independent Review.** The independent reviewer (s) shall be selected prior to initiation of sub-

stantial portion of the design and analysis work that is to be reviewed, and review shall start as soon as practical and sufficient information defining the project is available.

3. Qualifications and Terms of Employment. *The reviewer shall be independent from the design and construction team.*

3.1. *The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.*

3.2. *The reviewer shall be selected and paid by owner and shall have technical expertise similar to the project being reviewed, as determined by enforcement agent.*

3.3. *The reviewer (in case of review team, the chair) shall be a California-licensed structural engineer who is familiar with technical issues and regulations governing the work to be reviewed.*

3.4. *The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to enforcement agent, owner and the engineer of record. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days or a timeframe mutually agreed to by the Owner, Registered Design Professional (RDP) and the Office.*

4. Scope of Review. *Review activities shall include, where appropriate, available construction documents, design criteria, observation of the condition of structure, all new and original inspection reports, including methods of sampling, analyses prepared by the engineer of record and consultants, and the new, retrofit or repair design. Review shall include consideration of the proposed design approach, method, materials and details.*

5. Reports. *The reviewer(s) shall prepare a written report to the owner and responsible enforcement agent that covers all aspect of the review performed including conclusions reached by the reviewer. Report shall be issued after the schematic phase, during design development, and at the completion of construction documents, but prior to their issuance of permit. Such report shall include, at the minimum, statement of the following:*

a. *Scope of engineering design peer review with limitations defined.*

b. *The status of the project documents at each review stage.*

c. *Ability of selected materials and framing systems to meet the performance criteria with given loads and configuration.*

d. *Degree of structural system redundancy and the deformation compatibility among structural and nonstructural elements.*

e. *Basic constructability of the new, retrofit or repair system.*

f. *Other recommendation that will be appropriate for the specific project.*

g. *Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.*

h. *Recommendations.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)	X			X	X						X	X			X								
Adopt only those sections that are listed below			X																				
Chapter / Section																							
1701			X																				
1701.1.1										X	X				X								
1701.1.2										X	X				X								
1701.1.3										X	X				X								
1702			X																				
1703			X																				
1703.4										X	X				X								
1704.2, Exception 5				X	X																		
1704.2, Exceptions 3 & 4										X	X				X								
1704.2.3	X																						
1704.2.3 Exception										X	X				X								
1704.2.4										X	X				X								
1704.2.5.1										X	X				X								
1704.3.2										X	X				X								
1705.1			X																				
1705.2.1										X	X				X								
1705.2.3.1										X	X				X								
1705.2.4.1										X	X				X								
1705.2.5										X	X				X								
1705.2.6										X	X				X								
1705.3			X																				
1705.3 Exception										X	X				X								
1705.3.3										X	X				X								
1705.3.3.1										X	X				X								
Table 1705.3										X	X				X								
1705.3.4										X	X				X								
1705.3.5										X	X				X								
1705.3.6										X	X				X								
1705.3.7										X	X				X								
1705.3.8										X	X				X								
1705.3.9										X	B				X								
1705.3.9.1										X	B				X								
1705.3.9.2										X	B				X								
1705.4										X	X				X								
1705.4.1										X	X				X								
1705.5.3			X																				
Table 1705.5.3			X																				
1705.5.5										X	B				X								
1705.5.6										X	X				X								
1705.6.1										X	X				X								

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 17 – SPECIAL INSPECTIONS AND TESTS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter													X									
Adopt entire chapter as amended (amended sections listed below)	X			X	X						X	X			X							
Adopt only those sections that are listed below			X																			
Chapter / Section																						
1705.7.1										X	X			X								
1705.12.1			X																			
1705.12.2			X																			
1705.13.1.1 Exception										X	X			X								
1705.13.1.2 Exception										X	X			X								
1705.13.2			X																			
1705.13.3			X																			
1705.13.3.1										X	X			X								
1705.15			X																			
1705.16			X																			
1705.17										X	X			X								
1705.18			X																			
1705.19			X																			
1705.20			X																			
1707.1	X			X	X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 17

SPECIAL INSPECTIONS AND TESTS

User notes:

About this chapter: Chapter 17 provides a variety of procedures and criteria for testing materials and assemblies, and labeling materials and assemblies. Its key purposes are to establish where additional inspections/observations and testing must be provided, and the submittals and verifications that must be provided to the building official. This chapter expands on the inspections of Chapter 1 by requiring special inspection by a qualified individual where indicated and, in some cases, structural observation by a registered design professional. Quality assurance measures that verify proper assembly of structural components and the suitability of the installed materials are intended to provide a building that, once constructed, complies with the minimum structural and fire-resistance code requirements as well as the approved design. To determine this compliance often requires frequent inspections and testing at specific stages of construction.

Code development reminder: Code change proposals to sections preceded by the designation [BF] will be considered by the IBC—Fire Safety Code Development Committee during the 2021 (Group A) Code Development Cycle. Sections preceded by the designation [F] will be considered by the International Fire Code Development Committee during the 2021 (Group A) Code Development Cycle. All other code change proposals will be considered by the IBC—Structural Code Development Committee during the Group B cycle.

SECTION 1701 GENERAL

1701.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

1701.1.1 Application. *The scope of application of Chapter 17 is as follows:*

Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings as listed in Sections 1.10.1, 1.10.2 and 1.10.5.

1701.1.2 Amendments in this chapter. *OSHPD adopts this chapter and all amendments.*

Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction as defined in Health and Safety Code Section 129725 need not comply with [OSHPD 2] amendments, except those in Sections 1701.1, 1703.4, 1704.2, 1705.3.3, 1705.5.3, 1705.13.3.1.

1701.1.3 Identification of amendments. *[OSHPD 1R, 2 & 5] Office of Statewide Health Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:*

[OSHPD 1R] – For applications listed in Section 1.10.1.

[OSHPD 2] – For applications listed in Section 1.10.2.

[OSHPD 5] – For applications listed in Section 1.10.5.

SECTION 1702 NEW MATERIALS

1702.1 General. New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed

for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.

SECTION 1703 APPROVALS

1703.1 Approved agency. An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements specified in Sections 1703.1.1 through 1703.1.3.

1703.1.1 Independence. An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall disclose to the building official and the registered design professional in responsible charge possible conflicts of interest so that objectivity can be confirmed.

1703.1.2 Equipment. An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.

1703.1.3 Personnel. An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and special inspections.

1703.2 Written approval. Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.

1703.3 Record of approval. For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be available for public review at appropriate times.

1703.4 Performance. Specific information consisting of test reports conducted by an approved agency in accordance with

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the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the product, material or assembly meets the applicable code requirements.

[OSHPD 1R, 2 & 5] Tests performed by an independent approved testing agency/laboratory or under the responsible charge of a competent approved independent Registered Design Professional shall be deemed to comply with requirements of this section. Test reports for structural tests shall be reviewed and accepted by an independent California licensed structural engineer.

1703.4.1 Research and investigation. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

1703.4.2 Research reports. Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1703.5 Labeling. Products, materials or assemblies required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703.5.1 through 1703.5.4.

1703.5.1 Testing. An approved agency shall test a representative sample of the product, material or assembly being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

1703.5.3 Label information. The label shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the approved agency's identification.

1703.5.4 Method of labeling. Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components,

the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703.6.1 Follow-up inspection. The owner or the owner's authorized agent shall provide for special inspections of fabricated items in accordance with Section 1704.2.5.

1703.6.2 Test and inspection records. Copies of necessary test and special inspection records shall be filed with the building official.

SECTION 1704 SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

1704.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section.

1704.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105, or 1.8.4, as applicable, the owner or the owner's authorized agent, other than the contractor, shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705 and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

[OSHPD 1R, 2 & 5] In addition, the approved agencies shall provide special inspections and tests during construction on the types of work listed under Chapters 17, 18, 19, 20, 21, 22, 23 and 25, and noted in the Test, Inspection and Observation (TIO) program as required by the Office.

The inspectors shall act under the direction of the architect or structural engineer or both, and be responsible to the Owner. Where California Administrative Code Section 7-115 (a) 2 permits construction documents to be prepared under the responsible charge of a mechanical, electrical or civil engineer, inspectors shall be permitted to work under the direction of an engineer in the appropriate branch as permitted therein.

Exceptions:

1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. Unless otherwise required by the building official, special inspections and tests are not required for Group U occupancies that are accessory to a residential occupancy including, but not limited to, those listed in Section 312.1.
3. Special inspections and tests are not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.1.2 or the

conventional light-frame construction provisions of Section 2308. *[OSHPD IR, 2 & 5] Not permitted by OSHPD.*

4. The contractor is permitted to employ the approved agencies where the contractor is also the owner. *[OSHPD IR, 2 & 5] Not permitted by OSHPD.*
5. *[HCD 1] The provisions of Health and Safety Code Division 13, Part 6 and the California Code of Regulations, Title 25, Division 1, Chapter 3, commencing with Section 3000, shall apply to the construction and inspection of factory-built housing as defined in Health and Safety Code Section 19971.*

1704.2.1 Special inspector qualifications. Prior to the start of the construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as an approved agency and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

1704.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.

1704.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections in accordance with Section 107.1, *Chapter 1, Division II*, as a condition for permit issuance. This statement shall be in accordance with Section 1704.3.

Exception: A statement of special inspections is not required for portions of structures designed and constructed in accordance with the cold-formed steel light-frame construction provisions of Section 2211.1.2 or the conventional light-frame construction provisions of Section 2308. *[OSHPD IR, 2 & 5] Not permitted by OSHPD.*

1704.2.4 Report requirement. Approved agencies shall keep records of special inspections and tests. The approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge. Reports shall indicate that work inspected or tested was or was not completed in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not

corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official. *[OSHPD IR, 2 & 5] Report requirement shall be per 1704A.2.4.*

1704.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication, except where the fabricator has been approved to perform work without special inspections in accordance with Section 1704.2.5.1.

1704.2.5.1 Fabricator approval. *[OSHPD IR, 2 & 5] Not permitted by OSHPD.* Special inspections during fabrication are not required where the work is done on the premises of a fabricator approved to perform such work without special inspection. Approval shall be based on review of the fabricator's written fabrication procedures and quality control manuals that provide a basis for control of materials and workmanship, with periodic auditing of fabrication and quality control practices by an approved agency or the building official. At completion of fabrication, the approved fabricator shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that the work was performed in accordance with the approved construction documents.

1704.3 Statement of special inspections. Where special inspections or tests are required by Section 1705, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704.3.1 for submittal by the applicant in accordance with Section 1704.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

1704.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705.12, 1705.13 and 1705.14 .

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5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.

1704.3.2 Seismic requirements in the statement of special inspections. Where Section 1705.13 or 1705.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the designated seismic systems and seismic force-resisting systems that are subject to the special inspections or tests. *[OSHPD IR, 2 & 5] Where Section 1705.12 or 1705.13 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the equipment/components that require special seismic certification and seismic force-resisting systems that are subject to the special inspection or tests.*

1704.3.3 Wind requirements in the statement of special inspections. Where Section 1705.12 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

1704.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, designated seismic system or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

1704.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following:

1. Certificates of compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of an approved fabricator in accordance with Section 1704.2.5.1.
2. Certificates of compliance for the seismic qualification of nonstructural components, supports and attachments in accordance with Section 1705.14.2.
3. Certificates of compliance for designated seismic systems in accordance with Section 1705.14.3.
4. Reports of preconstruction tests for shotcrete in accordance with ACI 318.
5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207.5.
6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.

7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category B, C, D, E or F.

1704.6 Structural observations. Where required by the provisions of Section 1704.6.1, the owner or the owner's authorized agent shall employ a registered design professional to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705 or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

1704.6.1 Structural observations for structures. Structural observations shall be provided for those structures where one or more of the following conditions exist:

1. The structure is classified as Risk Category III or IV.
2. The structure is a high-rise building.
3. The structure is assigned to Seismic Design Category E, and is greater than two stories above the grade plane.
4. Such observation is required by the registered design professional responsible for the structural design.
5. Such observation is specifically required by the building official.

SECTION 1705 REQUIRED SPECIAL INSPECTIONS AND TESTS

1705.1 General. Special inspections and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705.1.1 Special cases. Special inspections and tests shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
2. Unusual design applications of materials described in this code.

3. Materials and systems required to be installed in accordance with additional manufacturer’s instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures, and portions thereof shall be in accordance with this section.

Exception: Special inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator’s ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the approved construction documents.

1705.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 360.

Exception: Special inspection of railing systems composed of structural steel elements shall be limited to welding inspection of welds at the base of cantilevered rail posts.

[OSHPD 1R, 2 & 5] Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance inspection requirements of AISC 360, Chapter 22 and quality control requirements of AISC 360, AISC 341 and AISC 358.

AISC 360, Chapter N and AISC 341, Chapter J are adopted, except as noted below:

The following provisions of AISC 360, Chapter N are not adopted:

1. N4, Item 2 (Quality Assurance Inspector Qualifications).
2. N5, Item 2 (Quality Assurance).
3. N5, Item 3 (Coordinated Inspection).

4. N5, Item 4 (Inspection of Welding).
5. N6 (Approved Fabricators and Erectors).
6. N7 (Nonconforming Material and Workmanship).

1705.2.2 Cold-formed steel deck. Special inspections and qualification of welding special inspectors for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI QA/QC.

1705.2.3 Open-web steel joists and joist girders. Special inspections of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705.2.3.

1705.2.3.1 Steel joist and joist girder inspection. *[OSHPD 1R, 2 & 5] Special inspection is required during the manufacture and welding of steel joists or joist girders. The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.*

1705.2.4 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705.2.4.1 Light-framed steel truss inspection and testing. *[OSHPD 1R, 2 & 5] Regardless of truss span, the manufacture of cold-formed light-framed steel trusses shall be continuously inspected by an approved agency. The approved agency shall verify conformance of materials and manufacture with approved plans and specifications. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process. Refer to Section 2211.1.3.3 for requirements applicable to manufactured trusses specified therein.*

**TABLE 1705.2.3
REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD ^a
1. Installation of open-web steel joists and joist girders.			
a. End connections – welding or bolted.	—	X	SJI specifications listed in Section 2207.1.
b. Bridging – horizontal or diagonal.	—	—	—
1. Standard bridging.	—	X	SJI specifications listed in Section 2207.1.
2. Bridging that differs from the SJI specifications listed in Section 2207.1.	—	X	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.13.

1705.2.5 Inspection and tests of structural welding. [OSHPD 1R, 2 & 5] Inspection and testing (including nondestructive testing) of all shop and field welding operations shall be in accordance with this section and Section 1705.2.1. Inspections shall be made by a qualified welding inspector approved by the enforcement agency. The minimum requirements for a qualified welding inspector shall be as those for an AWS Certified Welding Inspector (CWI), as defined in the provisions of the AWS QCI.

The welding inspector shall make a systematic daily record of all welds. This record shall include:

1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects.

The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The inspector shall verify that the installation of end-welded stud shear connectors is in accordance with the requirements of Section 2213.2 and the approved plans and specifications. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding has been done in conformance with AWS D1.1, D1.3, D1.4, D1.8, and the approved construction documents.

1705.2.6 Special inspection and tests of high-strength fastener assemblies. [OSHPD 1R, 2 & 5] Special inspections and tests for high-strength fasteners shall be in accordance with this section and Section 2213.1.

1705.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705.3.

Exceptions: Special inspections and tests shall not be required for: [OSHPD 1R, 2 & 5] Exceptions 1 through 4 are not permitted by OSHPD.

1. Isolated spread concrete footings of buildings three stories or less above grade plane that are fully supported on earth or rock.
2. Continuous concrete footings supporting walls of buildings three stories or less above grade plane that are fully supported on earth or rock where:
 - 2.1. The footings support walls of light-frame construction.
 - 2.2. The footings are designed in accordance with Table 1809.7.
 - 2.3. The structural design of the footing is based on a specified compressive strength, f'_c , not more than 2,500 pounds per square inch (psi) (17.2 MPa), regardless of the compressive strength specified in the approved construction documents or used in the footing construction.
3. Nonstructural concrete slabs supported directly on the ground, including prestressed slabs on grade, where the effective prestress in the concrete is less than 150 psi (1.03 MPa).

4. Concrete foundation walls constructed in accordance with Table 1807.1.6.2.
5. Concrete patios, driveways and sidewalks, on grade.

1705.3.1 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

1705.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19 and 20 of ACI 318, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19 and 20 of ACI 318.

1705.3.3 Batch plant inspection. [OSHPD 1R, 2 & 5] Except as provided under this section, the quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected by an approved agency at the location where materials are measured.

1705.3.3.1 Waiver of continuous batch plant inspection. [OSHPD 1R, 2 & 5] Continuous batch plant inspection may be waived by the registered design professional, subject to approval by the enforcement agency under either of the following conditions:

1. The concrete plant complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.
2. For single-story light-framed construction (without basement or retaining walls higher than 6 feet in height measured from bottom of footing to top of wall) and isolated foundations supporting equipment only, where deep foundation elements are not used.

When continuous batch plant inspection is waived, the following requirements shall apply and shall be described in the construction documents:

1. An approved agency shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.
2. A licensed weighmaster shall positively identify quantity of materials and certify each load by a batch ticket.
3. Batch tickets, including material quantities and weights, shall accompany the load, shall be transmitted to the inspector of record by the truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector of record shall keep a daily record of placements, identifying each truck, its load, time of receipt at the job site and approximate location of deposit in the structure and shall maintain a copy of the daily record as required by the enforcement agency.

**TABLE 1705.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD ^a	CBC REFERENCE
1. Inspect reinforcement, including prestressing tendons, and verify placement.	—	X	ACI 318: Ch. 20, 25.2, 25.3, 26.6.1-26.6.3	—
2. Reinforcing bar welding:				
a. Verify weldability of reinforcing bars other than ASTM A706;	—	X	AWS D1.4 ACI 318: 26.6.4	—
b. Inspect single-pass fillet welds, maximum $\frac{5}{16}$ " ; and	—	X		
c. Inspect all other welds.	X	—		
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2	—
4. Inspect anchors post-installed in hardened concrete members. ^b				
a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. ^c	X	—	ACI 318: 17.8.2.4	—
b. Mechanical anchors and adhesive anchors not defined in 4.a.	—	X	ACI 318: 17.8.2	
5. Verify use of required design mix.	—	X	ACI 318: Ch. 19, 26.4.3, 26.4.4	1904.1, 1904.2
6. Prior to concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172 ACI 318: 26.5, 26.12	—
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5	—
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3-26.5.5	—
9. Inspect prestressed concrete for:				
a. Application of prestressing forces; and	X	—	ACI 318: 26.10	—
b. Grouting of bonded prestressing tendons.	X	—		
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9	—
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category C, D, E or F, inspect such connections and reinforcement in the field for:				
a. Installation of the embedded parts	X	—	ACI 318: 26.13.1.3	—
b. Completion of the continuity of reinforcement across joints.	X	—	ACI 550.5	
c. Completion of connections in the field.	X	—		
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.11.2	—
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b)	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705.13.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. *[OSHPD 1R, 2 & 5] Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI Certified Adhesive Anchor Installer, except where the factored design tension on the anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents or where the anchors are shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system.*

1705.3.4 Inspection and testing of prestressed concrete. [OSHPD 1R, 2 & 5] Inspections and tests for prestressed concrete work shall be in accordance with this section. Tests for prestressing steel and anchorage shall be per Section 1910A.3. Inspection shall be in accordance with the following:

1. In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of post-tensioned members constructed at the site shall be continuously inspected by an inspector specially approved for this purpose by the enforcement agency.

Exception: The special inspector need not be continuously present for the placement of prestress or post-tensioned cables or tendons.

2. The prestressed concrete plant fabrication inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The approved agency shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.
3. The inspector of prestressed members post-tensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The approved agency shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed and such other information as may be required.
4. The verified reports of construction shall show that of the inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure

1705.3.5 Concrete pre-placement inspection. [OSHPD 1R, 2 & 5] Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the Inspector of Record.

1705.3.6 Placing record. [OSHPD 1R, 2 & 5] A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.

1705.3.7 Composite construction cores. [OSHPD 1R, 2 & 5] Composite construction cores shall be taken and tested in accordance with Section 1910A.4.

1705.3.8 Special Inspections and tests for post-installed anchors in concrete. [OSHPD 1R, 2 & 5] Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705.3 and Section 1901.3.

1705.3.9 Shotcrete. [OSHPD 1R, 2B & 5] All shotcrete work shall be continuously inspected during placing by an approved agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified report that of his or her own personal knowledge the work covered by the report has been performed and materials have been used and installed in every material respect in compliance with the duly approved plans and specifications. Preconstruction and strength tests of shotcrete shall be in accordance with Sections 1908.5 and 1908.10, respectively.

1705.3.9.1 Visual examination for structural soundness of in-place shotcrete. Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.

Exception: Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.

1705.3.9.2 Preconstruction tests. A shotcrete mockup panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The mockup panel shall be representative of the project and simulate job conditions as closely as possible. The mockup panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. Adequate encasement of bars larger than No. 5 shall be demonstrated by the mockup panels. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704.5.

1705.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602. [OSHPD 1R, 2 & 5] as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21. Testing shall be performed in accordance with Section 2105. Special inspec-

tion and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17 and 19.

Exception: [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Special inspections and tests shall not be required for:

1. Empirically designed masonry, glass unit masonry or masonry veneer designed in accordance with Section 2109, Section 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category I, II or III.
2. Masonry foundation walls constructed in accordance with Table 1807.1.6.3(1), 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4).
3. Masonry fireplaces, masonry heaters or masonry chimneys installed or constructed in accordance with Section 2111, 2112 or 2113, respectively.

1705.4.1 Glass unit masonry and masonry veneer in Risk Category IV. Special inspections and tests for glass unit masonry or masonry veneer designed in accordance with Section 2110 or Chapter 14, respectively, where they are part of a structure classified as Risk Category IV shall be performed in accordance with TMS 602 Level 2. [OSHPD 1R, 2 & 5] Not permitted by OSHPD.

[OSHPD 1R, 2 & 5] *Glass unit masonry and masonry veneer in Risk Category II, III or IV. Special inspections and tests for glass unit masonry or masonry veneer designed by Section 2110 or Chapter 14, respectively, in structures classified as Risk Category II, III or IV, shall be performed in accordance with TMS 602 Tables 3 and 4, Level 2 Quality Assurance.*

1705.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705.4.

1705.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in

accordance with Section 1704.2.5. Special inspections of site-built assemblies shall be in accordance with this section.

1705.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306.2 shall be installed with special inspections as indicated in Section 1704.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705.5.3 Mass timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705.5.3.

1705.5.4 [OSHPD 1R, 2 & 5] Manufactured trusses and assemblies. *The fabrication of trusses and other assemblies constructed using wood and metal members, or using light metal plate connectors, shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report that the lumber species, grades and moisture content; type of glue, temperature and gluing procedure; type of metal members and metal plate connectors; and the workmanship conform in every material respect with the duly approved construction documents. Each inspected truss shall be stamped by the approved agency with an identifying mark.*

**TABLE 1705.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

TYPE		CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2.	Inspect erection of mass timber construction.	—	X
3.	Inspection of connections where installation methods are required to meet design loads.		
	Threaded fasteners	Verify use of proper installation equipment.	—
		Verify use of pre-drilled holes where required.	—
		Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—
	Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	—
	Adhesive anchors not defined in preceding cell.	—	X
	Bolted connections.	—	X
	Concealed connections.	—	X

1705.5.5 Structural glued laminated and cross-laminated timber. [OSHPD 1R, 2B & 5] Manufacture of all structural glued laminated and cross-laminated timber shall be continuously inspected by an approved agency.

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.

Exception: Special Inspection is not required for non-custom prismatic glued laminated members identified on drawings and sourced from stock or general inventory of 5½-inch (140 mm) maximum width and 18-inch (457 mm) maximum depth, and with a maximum clear span of 32 feet (9754 mm), manufactured and marked in accordance with ANSI A190.1 Section 13.1 for non-custom members.

1705.5.6 Manufactured open web trusses. [OSHPD 1R, 2 & 5] The manufacture of open web trusses shall be continuously inspected by an approved agency.

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the approved agency.

1705.5.7 Timber connectors. [OSHPD 1R, 2 & 5] The installation of all split ring and shear plate timber connectors and timber rivets shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report verifying that the materials, timber connectors and workmanship conform to the approved construction documents.

1705.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

Exception: Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density

of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

1705.6.1 Soil fill. [OSHPD 1R, 2 & 5] All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during construction involving such fills.

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; and the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspections required by the approved construction documents were completed and whether the tested materials and/or inspected work meet the requirements of the approved construction documents.

1705.7 Driven deep foundations. Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in Table 1705.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705.7.1 Driven deep foundations observation. [OSHPD 1R, 2 & 5] The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment,

**TABLE 1705.6
REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

**TABLE 1705.7
REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705.2.	In accordance with Section 1705.2	
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705.3.	In accordance with Section 1705.3	
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	In accordance with Statement of Special Inspections	

identifying marks for each deep foundation pile, total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used, and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

1705.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in Table 1705.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

1705.10 Structural integrity of deep foundation elements. Whenever there is a reasonable doubt as to the structural integrity of a deep foundation element, an engineering assessment shall be required. The engineering assessment shall include tests for defects performed in accordance with ASTM D4945, ASTM D5882, ASTM D6760 or ASTM D7949, or other approved method.

1705.11 Fabricated items. Special inspections of fabricated items shall be performed in accordance with Section 1704.2.5.

1705.12 Special inspections for wind resistance. Special inspections for wind resistance specified in Sections 1705.12.1 through 1705.12.3, unless exempted by the exceptions to Section 1704.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where V is 150 miles per hour (67 m/sec) or greater.
2. In wind Exposure Category C or D, where V is 140 mph (62.6 m/sec) or greater.

1705.12.1 Structural wood. Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

Exception: Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the main windforce-resisting system, where the lateral resistance is provided by structural sheathing and the specified fastener spacing at panel edges is more than 4 inches (102 mm) on center.

1705.12.2 Cold-formed steel light-frame construction. Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

Exception: Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screwing, bolting, anchoring and other fastening to components of the windforce-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the specified fastener spacing at the panel or sheet edges is more than 4 inches (102 mm) on center (o.c.).

1705.12.3 Wind-resisting components. Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.
2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

**TABLE 1705.8
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705.3.	In accordance with Section 1705.3	

1705.13 Special inspections for seismic resistance. Special inspections for seismic resistance shall be required as specified in Sections 1705.13.1 through 1705.13.9, unless exempted by the exceptions of Section 1704.2.

Exception: The special inspections specified in Sections 1705.13.1 through 1705.13.9 are not required for structures designed and constructed in accordance with one of the following:

1. The structure consists of light-frame construction; the design spectral response acceleration at short periods, S_{DS} , as determined in Section 1613.2.4, does not exceed 0.5; and the building height of the structure does not exceed 35 feet (10 668 mm).
2. The seismic force-resisting system of the structure consists of reinforced masonry or reinforced concrete; the design spectral response acceleration at short periods, S_{DS} , as determined in Section 1613.2.4, does not exceed 0.5; and the building height of the structure does not exceed 25 feet (7620 mm).
3. The structure is a detached one- or two-family dwelling not exceeding two stories above grade plane and does not have any of the following horizontal or vertical irregularities in accordance with Section 12.3 of ASCE 7:
 - 3.1. Torsional or extreme torsional irregularity.
 - 3.2. Nonparallel systems irregularity.
 - 3.3. Stiffness-soft story or stiffness-extreme soft story irregularity.
 - 3.4. Discontinuity in lateral strength-weak story irregularity.

1705.13.1 Structural steel. Special inspections for seismic resistance shall be in accordance with Section 1705.13.1.1 or 1705.13.1.2, as applicable.

1705.13.1.1 Seismic force-resisting systems. Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

Exceptions:

1. In buildings and structures assigned to Seismic Design Category B or C, special inspec-

tions are not required for structural steel seismic force-resisting systems where the response modification coefficient, R, designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, has been used for design and detailing.

2. In structures assigned to Seismic Design Category D, E, or F, special inspections are not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

1705.13.1.2 Structural steel elements. Special inspections of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

Exceptions:

1. In buildings and structures assigned to Seismic Design Category B or C, special inspections of structural steel elements are not required for seismic force-resisting systems with a response modification coefficient, R, of 3 or less.
2. In structures assigned to Seismic Design Category D, E, or F, special inspections of structural steel elements are not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Special inspection shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

1705.13.2 Structural wood. For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.

2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

Exception: Special inspections are not required for wood shear walls, shear panels and diaphragms, including nailing, bolting, anchoring and other fastening to other elements of the seismic force-resisting system, where the lateral resistance is provided by structural sheathing, and the specified fastener spacing at the panel edges is more than 4 inches (102 mm) on center.

1705.13.3 Cold-formed steel light-frame construction.

For the seismic force-resisting systems of structures assigned to Seismic Design Category C, D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

Exception: Special inspections are not required for cold-formed steel light-frame shear walls and diaphragms, including screw installation, bolting, anchoring and other fastening to components of the seismic force-resisting system, where either of the following applies:

1. The sheathing is gypsum board or fiberboard.
2. The sheathing is wood structural panel or steel sheets on only one side of the shear wall, shear panel or diaphragm assembly and the specified fastener spacing at the panel or sheet edge is more than 4 inches (102 mm) on center.

1705.13.4 Designated seismic systems. For structures assigned to Seismic Design Category C, D, E or F, the special inspector shall examine designated seismic systems requiring seismic qualification in accordance with Section 13.2.2 of ASCE 7 and verify that the label, anchorage and mounting conform to the certificate of compliance.

1705.13.5 Architectural components. Periodic special inspection is required for the erection and fastening of exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

Exception: Periodic special inspection is not required for the following:

1. Exterior cladding, interior and exterior nonbearing walls and interior and exterior veneer 30 feet (9144 mm) or less in height above grade or walking surface.
2. Exterior cladding and interior and exterior veneer weighing 5 psf (0.24 kN/m²) or less.

3. Interior nonbearing walls weighing 15 psf (0.72 kN/m²) or less.

1705.13.5.1 Access floors. Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

1705.13.6 Plumbing, mechanical and electrical components. Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category C, D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category C, D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category C, D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category C, D, E or F where the approved construction documents require a nominal clearance of $\frac{1}{4}$ inch (6.4 mm) or less between the equipment support frame and restraint.
6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic sprinkler systems are installed in structures assigned to Seismic Design Category C, D, E or F to verify one of the following:
 - 6.1. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7.
 - 6.2. A nominal clearance of not less than 3 inches (76 mm) has been provided between automatic sprinkler system drops and sprigs and: structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

1705.13.7 Storage racks. Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to Seismic Design Category D, E or F shall be provided with periodic special inspection as required by Table 1705.13.7.

1705.13.8 Seismic isolation systems. Periodic special inspection shall be provided for seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F during the fabrication and installation of isolator units and energy dissipation devices.

**TABLE 1705.13.7
REQUIRED INSPECTIONS OF STORAGE RACK SYSTEMS**

TYPE	CONTINUOUS INSPECTION	PERIODIC INSPECTION	REFERENCED STANDARD	CBC REFERENCE
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	—	X	—	—
2. Fabricated storage rack elements.	—	X	—	Section 1704.2.5
3. Storage rack anchorage installation.	—	X	ANSI/MH16.1 Section 7.3.2	—
4. Completed storage rack system, to indicate compliance with the approved construction documents.	—	X	—	—

1705.13.9 Cold-formed steel special bolted moment frames. Periodic special inspection shall be provided for the installation of cold-formed steel special bolted moment frames in the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F.

1705.14 Testing for seismic resistance. Testing for seismic resistance shall be required as specified in Sections 1705.14.1 through 1705.14.4, unless exempted from special inspections by the exceptions of Section 1704.2.

1705.14.1 Structural steel. Nondestructive testing for seismic resistance shall be in accordance with Section 1705.14.1.1 or 1705.14.1.2, as applicable.

1705.14.1.1 Seismic force-resisting systems. Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category B, C, D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

Exceptions: *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing is not required for structural steel seismic force-resisting systems where the response modification coefficient, R, designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, has been used for design and detailing.
2. In structures assigned to Seismic Design Category D, E, or F, nondestructive testing is not required for structural steel seismic force-resisting systems where design and detailing in accordance with AISC 360 is permitted by ASCE 7, Table 15.4-1.

1705.14.1.2 Structural steel elements. Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category B, C, D, E or F other than those covered in Section 1705.14.1.1, including struts, collectors, chords and foundation elements, shall be

performed in accordance with the quality assurance requirements of AISC 341.

Exceptions: *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.*

1. In buildings and structures assigned to Seismic Design Category B or C, nondestructive testing of structural steel elements is not required for seismic force-resisting systems with a response modification coefficient, R, of 3 or less.
2. In structures assigned to Seismic Design Category D, E or F, nondestructive testing of structural steel elements is not required for seismic force-resisting systems where design and detailing other than AISC 341 is permitted by ASCE 7, Table 15.4-1. Nondestructive testing of structural steel elements shall be in accordance with the applicable referenced standard listed in ASCE 7, Table 15.4-1.

1705.14.2 Nonstructural components. For structures assigned to Seismic Design Category B, C, D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by seismic qualification as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic qualification by analysis, testing or experience data. Certificates of compliance for the seismic qualification shall be submitted to the building official as specified in Section 1704.5.

[OSHPD 1R, 2 & 5] Seismic sway bracing components satisfying requirements of FM 1950 or using an alternative testing protocol approved by the building official shall be deemed to satisfy the requirements of this section.

1705.14.3 Designated seismic systems. For structures assigned to Seismic Design Category C, D, E or F and with designated seismic systems that are subject to the requirements of Section 13.2.2 of ASCE 7 for certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis, testing or experience data as specified

therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704.5.

1705.14.3.1 Special seismic certification. [OSHPD IR, 2 & 5]

1. *Special seismic certification shall be required for life-safety components, such as emergency and standby power systems, mechanical smoke removal systems and fire sprinkler/fire protection systems.*
2. *Medical, mechanical and electrical equipment and components required for life support for patients shall have special seismic certification in accordance with Section 1705A.14.3.*

1705.14.4 Seismic isolation systems. Seismic isolation systems in seismically isolated structures assigned to Seismic Design Category B, C, D, E or F shall be tested in accordance with Section 17.8 of ASCE 7.

[BF] 1705.15 Sprayed fire-resistant materials. Special inspections and tests of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705.15.1 through 1705.15.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed during construction with an additional visual inspection after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705.15.4.1 through 1705.15.4.9.

[BF] 1705.15.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.
2. Thickness of application.
3. Density in pounds per cubic foot (kg/m³).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705.15.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the sprayed fire-resistant material.

[BF] 1705.15.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

[BF] 1705.15.4 Thickness. Not more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705.15.4.1.

[BF] 1705.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus 1/4 inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705.15.4.2 and 1705.15.4.3.

[BF] 1705.15.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m²) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705.15.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

[BF] 1705.15.4.5 Structural members. The thickness of the sprayed fire-resistant material applied to structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

[BF] 1705.15.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.8 Wide-flanged columns. At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at not

fewer than four locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705.15.5 Density. The density of the sprayed fire-resistant material shall be not less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m²) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m²) of floor area or portion thereof in each story.

[BF] 1705.15.6 Bond strength. The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) (7.18 kN/m²). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705.15.6.1 through 1705.15.6.3.

[BF] 1705.15.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m²) of the sprayed area, or portion thereof, in each story.

[BF] 1705.15.6.2 Structural members. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m²) of floor area or portion thereof in each story.

[BF] 1705.15.6.3 Primer, paint and encapsulant bond tests. Bond tests to qualify a primer, paint or encapsulant shall be conducted where the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

[BF] 1705.16 Mastic and intumescent fire-resistant coatings. Special inspections and tests for mastic and intumescent fire-resistant coatings applied to structural elements and

decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents. Special inspections and tests shall be performed during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

1705.17 Exterior insulation and finish systems (EIFS). Special inspections shall be required for all EIFS applications.

Exceptions:

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

1705.17.1 Water-resistive barrier coating. A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

[BF] 1705.18 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to *Risk Category III* or *IV*, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems that are tested and listed in accordance with Sections 714.4.1.2, 714.5.1.2, 715.3.1 and 715.4 shall be in accordance with Section 1705.18.1 or 1705.18.2.

[OSHPD 1R, 2 & 5] Buildings assigned to all Risk Categories shall be subject to special inspections for fire-resistant penetrations and joints.

[BF] 1705.18.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714.4.1.2 and 714.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

[BF] 1705.18.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715.3.1 and 715.4 shall be conducted by an approved agency in accordance with ASTM E2393.

[F] 1705.19 Testing for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 1705.19.1 Testing scope. The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

[F] **1705.19.2 Qualifications.** Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

1705.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

SECTION 1706 DESIGN STRENGTHS OF MATERIALS

1706.1 Conformance to standards. The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

1706.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707.

SECTION 1707 ALTERNATIVE TEST PROCEDURE

1707.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Sections 104.11 or 1.8.7, as applicable. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

[BSC] In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 1.2.1, Chapter 1, Division I. The cost of all tests and other investigations required under the provisions of this code shall be borne by the applicant.

SECTION 1708 IN-SITU LOAD TESTS

1708.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability

or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1708.2 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1708.2.1 or 1708.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1708.2.1 Load test procedure specified. Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708.2.2 shall apply.

1708.2.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1709 PRECONSTRUCTION LOAD TESTS

1709.1 General. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of

construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

1709.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709.3 shall apply.

1709.3 Load test procedures not specified. Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1709.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the least of:

1. The load at the deflection limitation given in Section 1709.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1709.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

1709.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1709.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709.5.1 or 1709.5.2. For exterior windows and doors tested in accordance with Section 1709.5.1 or 1709.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exception: Structural wind load design pressures for window or door assemblies other than the size tested in accordance with Section 1709.5.1 or 1709.5.2 shall be permitted to be different than the design value of the tested assembly, provided that such pressures are determined by accepted engineering analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709.5.2. Components of the alternate size assembly shall be the same as the tested or labeled assembly. Where engineering analysis is used, it shall be performed in accordance with the analysis procedures of AAMA 2502.

1709.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403.2 and 2403.3.

1709.5.2 Exterior windows and door assemblies not provided for in Section 1709.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. Exterior window and door assemblies containing glass shall comply with Section 2403. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

1709.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

1709.5.3 Windborne debris protection. Protection of exterior glazed openings in buildings located in windborne debris regions shall be in accordance with Section 1609.2.

1709.5.3.1 Impact protective systems testing and labeling. Impact protective systems shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996 and for design wind pressure for compliance

with ASTM E330. Required design wind pressures shall be determined in accordance with ASCE 7, and for the purposes of this section, multiplied by 0.6 to convert to allowable stress design.

Impact protective systems shall have a permanent label applied in accordance with Section 1703.5.4, identifying the manufacturer, product designation, performance characteristics, and approved inspection agency.

1709.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the requirements of Chapter 24.

1709.7 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 17A – SPECIAL INSPECTIONS AND TESTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X	X	X												
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 17A

SPECIAL INSPECTIONS AND TESTS

SECTION 1701A GENERAL

1701A.1 Scope. The provisions of this chapter shall govern the quality, workmanship and requirements for materials covered. Materials of construction and tests shall conform to the applicable standards listed in this code.

1701A.1.1 Application. *The scope of application of Chapter 17A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Sections 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1 and 1.10.4. These applications include hospitals and correctional treatment centers.*

1701A.1.2 Amendments in this chapter. *DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.*

Exceptions: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect - Structural Safety:*

[DSA-SS] For applications listed in Section 1.9.2.1.

[DSA-SS/CC] For applications listed in Section 1.9.2.2.

2. *Office of Statewide Health Planning and Development:*

[OSHPD 1] – For applications listed in Section 1.10.1.

[OSHPD 4] – For applications listed in Section 1.10.4.

1701A.1.3 Reference to other chapters.

1701A.1.3.1 [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A, 22A and 23, the provisions in Chapters 16, 19, 21, 22 and 23, respectively, shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.*

1701A.3 Special inspections and tests. [OSHPD 1 and 4] *In addition to the inspector(s) of record required by the California Administrative Code (CCR, Title 24, Part 1), Section 7-144, the owner shall employ one or more approved agencies to provide special inspections and tests during construction*

on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23 and 25, and noted in the Test, Inspection and Observation (TIO) program required by Sections 7-141, 7-145 and 7-149, of the California Administrative Code. Test, Inspection and Observation (TIO) program shall satisfy requirements of Section 1704A.

1701A.4 Special inspections and tests. [DSA-SS & DSA-SS/CC] *In addition to the project inspector required by the California Administrative Code (CCR, Title 24, Part 1), Section 4-333, the owner shall employ one or more approved agencies to provide special inspections and tests as required by the enforcement agency during construction on the types of work listed under Chapters 17A, 18A, 19A, 20, 21A, 22A, 23 and 25 and the California Existing Building Code and noted in the special test, inspection and observation plan required by Section 4-335 of the California Administrative Code.*

SECTION 1702A NEW MATERIALS

1702A.1 General. *New building materials, equipment, appliances, systems or methods of construction not provided for in this code, and any material of questioned suitability proposed for use in the construction of a building or structure, shall be subjected to the tests prescribed in this chapter and in the approved rules to determine character, quality and limitations of use.*

SECTION 1703A APPROVALS

1703A.1 Approved agency. *An approved agency shall provide all information as necessary for the building official to determine that the agency meets the applicable requirements specified in Sections 1703A.1.1 through 1703A.1.3.*

1703A.1.1 Independence. *An approved agency shall be objective, competent and independent from the contractor responsible for the work being inspected. The agency shall disclose to the building official and the registered design professional in responsible charge possible conflicts of interest so that objectivity can be confirmed.*

1703A.1.2 Equipment. *An approved agency shall have adequate equipment to perform required tests. The equipment shall be periodically calibrated.*

1703A.1.3 Personnel. *An approved agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and special inspections.*

1703A.2 Written approval. *Any material, appliance, equipment, system or method of construction meeting the requirements of this code shall be approved in writing after satisfactory completion of the required tests and submission of required test reports.*

SPECIAL INSPECTIONS AND TESTS

1703A.3 Record of approval. For any material, appliance, equipment, system or method of construction that has been approved, a record of such approval, including the conditions and limitations of the approval, shall be kept on file in the building official's office and shall be available for public review at appropriate times.

1703A.4 Performance. Specific information consisting of test reports conducted by an approved agency in accordance with the appropriate referenced standards, or other such information as necessary, shall be provided for the building official to determine that the product, material or assembly meets the applicable code requirements.

[OSHPD 1 & 4] Tests performed by an independent approved testing agency/laboratory or under the responsible charge of a competent approved independent Registered Design Professional shall be deemed to comply with requirements of this section. Test reports for structural tests shall be reviewed and accepted by an independent California licensed structural engineer.

1703A.4.1 Research and investigation. Sufficient technical data shall be submitted to the building official to substantiate the proposed use of any product, material or assembly. If it is determined that the evidence submitted is satisfactory proof of performance for the use intended, the building official shall approve the use of the product, material or assembly subject to the requirements of this code. The costs, reports and investigations required under these provisions shall be paid by the owner or the owner's authorized agent.

1703A.4.2 Research reports. Supporting data, where necessary to assist in the approval of products, materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1703A.5 Labeling. Products, materials or assemblies required to be labeled shall be labeled in accordance with the procedures set forth in Sections 1703A.5.1 through 1703A.5.4.

1703A.5.1 Testing. An approved agency shall test a representative sample of the product, material or assembly being labeled to the relevant standard or standards. The approved agency shall maintain a record of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

1703A.5.2 Inspection and identification. The approved agency shall periodically perform an inspection, which shall be in-plant if necessary, of the product or material that is to be labeled. The inspection shall verify that the labeled product, material or assembly is representative of the product, material or assembly tested.

1703A.5.3 Label information. The label shall contain the manufacturer's identification, model number, serial number or definitive information describing the performance characteristics of the product, material or assembly and the approved agency's identification.

1703A.5.4 Method of labeling. Information required to be permanently identified on the product, material or assembly shall be acid etched, sand blasted, ceramic fired, laser

etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

1703A.6 Evaluation and follow-up inspection services. Where structural components or other items regulated by this code are not visible for inspection after completion of a prefabricated assembly, the owner or the owner's authorized agent shall submit a report of each prefabricated assembly. The report shall indicate the complete details of the assembly, including a description of the assembly and its components, the basis upon which the assembly is being evaluated, test results and similar information and other data as necessary for the building official to determine conformance to this code. Such a report shall be approved by the building official.

1703A.6.1 Follow-up inspection. The owner or the owner's authorized agent shall provide for special inspections of fabricated items in accordance with Section 1704A.2.5.

1703A.6.2 Test and inspection records. Copies of necessary test and special inspection records shall be filed with the building official.

SECTION 1704A SPECIAL INSPECTIONS AND TESTS, CONTRACTOR RESPONSIBILITY AND STRUCTURAL OBSERVATION

1704A.1 General. Special inspections and tests, statements of special inspections, responsibilities of contractors, submittals to the building official and structural observations shall meet the applicable requirements of this section.

1704A.2 Special inspections and tests. Where application is made to the building official for construction as specified in Section 105, the owner shall employ one or more approved agencies to provide special inspections and tests during construction on the types of work specified in Section 1705A and identify the approved agencies to the building official. These special inspections and tests are in addition to the inspections by the building official that are identified in Section 110.

[OSHPD 1 & 4] The inspectors shall act under the direction of the architect or structural engineer or both, and be responsible to the Owner. Where the California Administrative Code (CAC) Section 7-115 (a) 2 permits construction documents to be prepared under the responsible charge of a mechanical, electrical or civil engineer, inspectors shall be permitted to work under the direction of engineer in appropriate branch as permitted therein.

Exceptions:

1. Special inspections and tests are not required for construction of a minor nature or as warranted by conditions in the jurisdiction as approved by the building official.
2. *[DSA-SS, DSA-SS/CC] Reference to Section 105 and Section 110 shall be to the California Administrative Code instead.*

1704A.2.1 Special inspector qualifications. Prior to the start of the construction, the approved agencies shall provide written documentation to the building official demonstrating the competence and relevant experience or training of the special inspectors who will perform the special inspections and tests during construction. Experience or training shall be considered to be relevant where the documented experience or training is related in complexity to the same type of special inspection or testing activities for projects of similar complexity and material qualities. These qualifications are in addition to qualifications specified in other sections of this code.

The registered design professional in responsible charge and engineers of record involved in the design of the project are permitted to act as an approved agency and their personnel are permitted to act as special inspectors for the work designed by them, provided they qualify as special inspectors.

1704A.2.2 Access for special inspection. The construction or work for which special inspection or testing is required shall remain accessible and exposed for special inspection or testing purposes until completion of the required special inspections or tests.

1704A.2.3 Statement of special inspections. The applicant shall submit a statement of special inspections prepared by the registered design professional in general responsible charge in accordance with Section 107.1 as a condition for construction documents review. This statement shall be in accordance with Section 1704A.3.

[DSA-SS, DSA-SS/CC] Reference to Section 107.1 shall be to the California Administrative Code instead.

1704A.2.4 Report requirement. The inspector(s) of record and approved agencies shall keep records of special inspections and tests. The inspector of record and approved agency shall submit reports of special inspections and tests to the building official and to the registered design professional in responsible charge as required by the California Administrative Code. Reports shall indicate that work inspected or tested was or was not completed in conformance to approved construction documents as required by the California Administrative Code and this code. Discrepancies shall be brought to the immediate attention of the contractor for correction. If they are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and tests, and correction of any discrepancies noted in the inspections or tests, shall be submitted at a point in time agreed upon prior to the start of work by the owner or the owner's authorized agent to the building official.

1704A.2.5 Special inspection of fabricated items. Where fabrication of structural, load-bearing or lateral load-resisting members or assemblies is being conducted on the premises of a fabricator's shop, special inspections of the fabricated items shall be performed during fabrication.

1704A.2.5.1 Fabricator approval. Not permitted by DSA-SS, DSA-SS/CC or OSHPD.

1704A.3 Statement of special inspections. Where special inspections or tests are required by Section 1705A, the registered design professional in responsible charge shall prepare a statement of special inspections in accordance with Section 1704A.3.1 for submittal by the applicant in accordance with Section 1704A.2.3.

Exception: The statement of special inspections is permitted to be prepared by a qualified person approved by the building official for construction not designed by a registered design professional.

1704A.3.1 Content of statement of special inspections. The statement of special inspections shall identify the following:

1. The materials, systems, components and work required to have special inspections or tests by the building official or by the registered design professional responsible for each portion of the work.
2. The type and extent of each special inspection.
3. The type and extent of each test.
4. Additional requirements for special inspections or tests for seismic or wind resistance as specified in Sections 1705A.12, 1705A.13 and 1705A.14.
5. For each type of special inspection, identification as to whether it will be continuous special inspection, periodic special inspection or performed in accordance with the notation used in the referenced standard where the inspections are defined.

1704A.3.2 Seismic requirements in the statement of special inspections. Where Section 1705A.13 or 1705A.14 specifies special inspections or tests for seismic resistance, the statement of special inspections shall identify the equipment/components that require special seismic certification and seismic force-resisting systems that are subject to the special inspections or tests.

1704A.3.3 Wind requirements in the statement of special inspections. Where Section 1705A.12 specifies special inspection for wind resistance, the statement of special inspections shall identify the main windforce-resisting systems and wind-resisting components that are subject to special inspections.

1704A.4 Contractor responsibility. Each contractor responsible for the construction of a main wind- or seismic force-resisting system, installation of equipment/components requiring special seismic certification or a wind- or seismic force-resisting component listed in the statement of special inspections shall submit a written statement of responsibility to the building official and the owner or the owner's authorized agent prior to the commencement of work on the system or component. The contractor's statement of responsibility shall contain acknowledgement of awareness of the special requirements contained in the statement of special inspections.

1704A.5 Submittals to the building official. In addition to the submittal of reports of special inspections and tests in accordance with Section 1704A.2.4, reports and certificates shall be submitted by the owner or the owner's authorized agent to the building official for each of the following:

- 1. **[OSHPD 1 & 4]** Certificates of compliance for the fabrication of structural, load-bearing or lateral load-resisting members or assemblies on the premises of an approved fabricator in accordance with Section 1704A.2.5.1.
- 2. Certificates of compliance for the *manufacturer's certification* of nonstructural components, supports and attachments in accordance with Section 1705A.14.2.
- 3. Certificates of compliance for *equipment/components requiring special seismic certification* in accordance with Section 1705A.14.3.
- 4. Reports of preconstruction tests for shotcrete in accordance with ACI 318 and 1705A.3.9.2.
- 5. Certificates of compliance for open web steel joists and joist girders in accordance with Section 2207A.5.
- 6. Reports of material properties verifying compliance with the requirements of AWS D1.4 for weldability as specified in Section 26.6.4 of ACI 318 for reinforcing bars in concrete complying with a standard other than ASTM A706 that are to be welded.
- 7. Reports of mill tests in accordance with Section 20.2.2.5 of ACI 318 for reinforcing bars complying with ASTM A615 and used to resist earthquake-induced flexural or axial forces in the special moment frames, special structural walls or coupling beams connecting special structural walls of seismic force-resisting systems in structures assigned to Seismic Design Category D, E or F.

1704A.6 Structural observations. The owner shall employ a registered design professional to perform structural observations. The structural observer shall visually observe representative locations of structural systems, details and load paths for general conformance to the approved construction documents. Structural observation does not include or waive the responsibility for the inspections in Section 110 or the special inspections in Section 1705A or other sections of this code. Prior to the commencement of observations, the structural observer shall submit to the building official a written statement identifying the frequency and extent of structural observations. At the conclusion of the work included in the permit, the structural observer shall submit to the building official a written statement that the site visits have been made and identify any reported deficiencies that, to the best of the structural observer's knowledge, have not been resolved.

[DSA-SS, DSA-SS/CC] Reference to Section 110 shall be to the California Administrative Code instead.

SECTION 1705A

REQUIRED SPECIAL INSPECTIONS AND TESTS

1705A.1 General. Special inspections and tests of elements and nonstructural components of buildings and structures shall meet the applicable requirements of this section.

1705A.1.1 Special cases. Special inspections and tests shall be required for proposed work that is, in the opinion of the building official, unusual in its nature, such as, but not limited to, the following examples:

- 1. Construction materials and systems that are alternatives to materials and systems prescribed by this code.
- 2. Unusual design applications of materials described in this code.
- 3. Materials and systems required to be installed in accordance with additional manufacturer's instructions that prescribe requirements not contained in this code or in standards referenced by this code.

1705A.2 Steel construction. The special inspections and nondestructive testing of steel construction in buildings, structures, and portions thereof shall be in accordance with this section.

Exception: Special inspections of the steel fabrication process shall not be required where the fabrication process for the entire building or structure does not include any welding, thermal cutting or heating operation of any kind. In such cases, the fabricator shall be required to submit a detailed procedure for material control that demonstrates the fabricator's ability to maintain suitable records and procedures such that, at any time during the fabrication process, the material specification and grade for the main stress-carrying elements are capable of being determined. Mill test reports shall be identifiable to the main stress-carrying elements where required by the approved construction documents.

1705A.2.1 Structural steel. Special inspections and nondestructive testing of structural steel elements in buildings, structures and portions thereof shall be in accordance with the quality assurance requirements of *this section, Chapter 22A and quality control requirements of AISC 360, AISC 341 and AISC 358.*

Exception: Special inspection of railing systems composed of structural steel elements shall be limited to welding inspection of welds at the base of cantilevered rail posts.

AISC 360, Chapter N and AISC 341, Chapter J are adopted, except as noted below:

The following provisions of AISC 360, Chapter N are not adopted:

- 1. N4, Item 2 (Quality Assurance Inspector Qualifications).
- 2. N5, Item 2 (Quality Assurance).
- 3. N5, Item 3 (Coordinated Inspection).
- 4. N5, Item 4 (Inspection of Welding).

5. N6 (Approved Fabricators and Erectors).

6. N7 (Nonconforming Material and Workmanship).

Additionally, the requirements of Table 1705A.2.1 of the California Building Code shall apply.

In addition to the quality assurance requirements contained in AISC 341, Chapter J, Section J5 (Inspection Tasks), the requirements of Section 1704A.3 and Table 1705A.2.1 of the California Building Code shall apply.

[DSA-SS, DSA-SS/CC] Modify AISC 360, Section N5.5(b), as follows:

For structures in Risk Category II, III or IV, UT shall be performed by QA on all complete-joint-penetration (CJP) groove welds subject to transversely applied tension loading in butt, T- and corner joints, in material $\frac{5}{16}$ in. (8 mm) thick or greater.

1705A.2.2 Cold-formed steel deck. Special inspections for cold-formed steel floor and roof deck shall be in accordance with the quality assurance inspection requirements of SDI QA/QC.

Deck weld special inspection and testing shall also satisfy requirements in Table 1705A.2.1 and Section 1705A.2.5.

1705A.2.3 Open-web steel joists and joist girders. Special inspections of open-web steel joists and joist girders in buildings, structures and portions thereof shall be in accordance with Table 1705A.2.3.

1705A.2.3.1 Steel joist and joist girder inspection. Special inspection is required during the manufacture and welding of steel joists or joist girders. The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected joist or joist girder. This mark or tag shall remain on the joist or joist girder throughout the job site receiving and erection process.

1705A.2.4 Cold-formed steel trusses spanning 60 feet or greater. Where a cold-formed steel truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705A.2.4.1 Light-framed steel truss inspection and testing. Regardless of truss span, the manufacture of cold-formed light framed steel trusses shall be continuously inspected by an approved agency. The approved agency shall verify conformance of materials and manufacture with approved plans and specifications. The approved agency shall place a distinguishing mark, and/or tag with this distinguishing mark, on each inspected truss. This mark or tag shall remain on the truss throughout the job site receiving and erection process. Refer to Section

2211A.1.3.3 for requirements applicable to manufactured trusses specified therein.

1705A.2.5 Inspection and tests of structural welding. Inspection and testing (including nondestructive testing) of all shop and field welding operations shall be in accordance with this section, Section 1705A.2.1 and Table 1705A.2.1. Inspections shall be made by a qualified welding inspector approved by the enforcement agency. The minimum requirements for a qualified welding inspector shall be as those for an AWS certified welding inspector (CWI), as defined in the provisions of the AWS QCI.

[DSA-SS, DSA-SS/CC] Welding inspector approval by the enforcement agency shall occur when specified in the California Administrative Code. Nondestructive testing shall be performed by qualified NDT Level II personnel employed by the approved agency.

The welding inspector shall make a systematic daily record of all welds. In addition to other required records, this record shall include:

1. Identification marks of welders.
2. List of defective welds.
3. Manner of correction of defects.

The welding inspector shall check the material, details of construction and procedure, as well as workmanship of the welds. The inspector shall verify that the installation and testing of end-welded stud shear connectors is in accordance with the requirements of Section 2213A.2 (**[DSA-SS/CC]** 2212.6.2) and the approved plans and specifications. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a verified report that the welding has been done in conformance with AWS D1.1, D1.3, D1.4, D1.8 and the approved construction documents.

1705A.2.6 Special inspection and tests of high-strength fastener assemblies. Special inspections and tests for high-strength fasteners shall be in accordance with this section, Section 1705A.2.1 and Table 1705A.2.1. High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards [**OSHPD 1 & 4**] and in accordance with Section 2213A.1.

[DSA-SS, DSA-SS/CC] The minimum requirements for a qualified high-strength bolting special inspector shall be an International Code Council certified Structural Steel and Bolting Special Inspector (SI).

1705A.3 Concrete construction. Special inspections and tests of concrete construction shall be performed in accordance with this section and Table 1705A.3.

Exception: Special inspections and tests shall not be required for concrete patios, driveways and sidewalks, on grade.

1705A.3.1 Welding of reinforcing bars. Special inspections of welding and qualifications of special inspectors for reinforcing bars shall be in accordance with 1705A.2.5, the requirements of AWS D1.4 for special inspection and of AWS D1.4 for special inspector qualification.

SPECIAL INSPECTIONS AND TESTS

**TABLE 1705A.2.1
REQUIRED SPECIAL INSPECTIONS AND TESTS OF STEEL CONSTRUCTION**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD	CBC REFERENCE ^a
1. Material identification and testing of high-strength bolts, nuts and washers:				
a. Identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	RCSC: 1.5, AISC 360: A3.3, J3.1 and applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
b. Manufacturer's certificate of compliance required.	—	X	RCSC: 1.5 & 2.1; AISC 360: A3.3 & N3.2	—
c. Testing of high-strength bolts, nuts and washers.	—	—	RCSC: 7.2, Applicable ASTM material standards	1705A.2.6, [OSHPD 1 & 4] 2213A.1
2. Inspection of high-strength bolting:				
a. Snug-tight joints.	—	X	RCSC: 7-9, AISC 360: J3.1, J3.2, M2.5 & N5.6	1705A.2.6, 2204A.2, [DSA-SS/CC] 2204.2
b. Pretensioned and slip-critical joints using turn-of-nut with matchmarking, twist-off bolt or direct tension indicator methods of installation	—	X		
c. Pretensioned and slip-critical joints using turn-of-nut without matchmarking or calibrated wrench methods of installation.	X	—		
3. Material identification and testing of structural steel and cold-formed steel deck:				
a. For structural steel, identification markings to conform to AISC 360.	—	X	AISC 360: A3.1	2202A.1, [DSA-SS/CC] 2202.1
b. For other steel, identification markings to conform to ASTM standards specified in the approved construction documents.	—	X	Applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
c. Manufacturer's certified test reports.	—	X	AISC 360: A3.1 & N3.2	—
d. Testing of unidentified steel.	—	—	Applicable ASTM material standards	2202A.1, [DSA-SS/CC] 2202.1
4. Material identification of welding consumables and testing of welded elements:				
a. Identification markings to conform to AWS specification in the approved construction documents.	—	X	AISC 360, A3.5 & N3.2 and applicable AWS A5 documents	—
b. Manufacturer's certificate of compliance required.	—	X	AISC 360: N3.2	—
c. Nondestructive testing of welded joints.	—	—	AISC 360: N5.5	—
5. Inspection of welding:				
a. Structural steel and cold-formed steel deck:				
1. Complete and partial joint penetration groove welds	X	—	AISC 360: J2, M2.4, & M4.5, AWS D1.1 AWS D1.8	1705A.2.1, 1705A.2.5
2. Multipass fillet welds.	X	—		
3. Single-pass fillet welds > 5/16"	X	—		
4. Plug and slot welds.	X	—		
5. Single-pass fillet welds ≤ 5/16"	—	X		
6. Floor and roof deck welds.	—	X	AWS D1.3, SDI QA/QC	1705A.2.1, 1705A.2.2 1705A.2.5
7. End-welded studs.	—	X	AWS D1.1	1705A.2.5, 2213A.2, [DSA-SS/CC] 2212.6.2
8. Welded sheet steel for cold-formed framing members	—	X	AWS D1.3	1705A.2.5, 1705A.2.4.1
b. Reinforcing steel				Table 1705A.3, Item 2
6. Inspection of steel frame joint details for compliance:				
a. Details such as bracing and stiffening.	—	X	AISC 360: N5.8	1705A.2.1
b. Member locations.	—	X		
c. Application of joint details at each connection.	—	X		

For SI: 1 inch = 25.4 mm.

a. Where applicable, see also Section 1705A.13, Special inspections for seismic resistance.

**TABLE 1705A.2.3
REQUIRED SPECIAL INSPECTIONS OF OPEN-WEB STEEL JOISTS AND JOIST GIRDERS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD ^a
1. Installation of open-web steel joists and joist girders.			
a. End connections – welding or bolted.	—	X	SJI specifications listed in Section 2207.1.
b. Bridging – horizontal or diagonal.	—	—	—
1. Standard bridging.	—	X	SJI specifications listed in Section 2207.1.
2. Bridging that differs from the SJI specifications listed in Section 2207.1.	—	X	—

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705A.13.

1705A.3.2 Material tests. In the absence of sufficient data or documentation providing evidence of conformance to quality standards for materials in Chapters 19, 20 and 26 of ACI 318, as modified by Chapter 19A, the building official shall require testing of materials in accordance with the appropriate standards and criteria for the material in Chapters 19, 20 and 26 of ACI 318 as modified by Chapter 19A. Cementitious materials shall be in accordance with 1910A.1 ([DSA-SS/CC] 1909.2.3). Tests of reinforcing bars shall be in accordance with Section 1910A.2 ([DSA-SS/CC] 1909.2.4).

1705A.3.3 Batch plant inspection. Except as provided under this section, the quality and quantity of materials used in transit-mixed concrete and in batched aggregates shall be continuously inspected by an approved agency at the location where materials are measured.

1705A.3.3.1 Waiver of continuous batch plant inspection. Continuous batch plant inspection may be waived by the registered design professional, subject to approval by the enforcement agency under either of the following conditions:

1. The concrete plant complies fully with the requirements of ASTM C94, Sections 9 and 10, and has a current certificate from the National Ready Mixed Concrete Association or another agency acceptable to the enforcement agency. The certification shall indicate that the plant has automatic batching and recording capabilities.
2. For single-story light-framed construction (without basement or retaining walls higher than 6 feet in height measured from bottom of footing to top of wall) and isolated foundations supporting equipment only, where deep foundation elements are not used.

When continuous batch plant inspection is waived, the following requirements shall apply and shall be described in the construction documents:

1. An approved agency shall check the first batch at the start of the day to verify materials and proportions conform to the approved mix design.
2. A licensed weighmaster shall positively identify quantity of materials and certify each load by a batch ticket.

3. Batch tickets, including material quantities and weights shall accompany the load, shall be transmitted to the inspector of record by the truck driver with load identified thereon. The load shall not be placed without a batch ticket identifying the mix. The inspector of record shall keep a daily record of placements, identifying each truck, its load, and time of receipt at the jobsite, and approximate location of deposit in the structure and shall maintain a copy of the daily record as required by the enforcement agency.

1705A.3.3.2 Batch plant inspection not required. [DSA-SS, DSA-SS/CC] Batch plant inspection is not required for any of the following conditions, provided they are identified on the approved construction documents and the licensed weighmaster and batch ticket requirements of Section 1705A.3.3.1 are implemented:

1. Site flatwork
2. Unenclosed site structures, including but not limited to lunch or car shelters, bleachers, solar structures, flag or light poles, or retaining walls.
3. Controlled low-strength material backfill.
4. Single-story relocatable buildings less than 2,160 square feet.

1705A.3.4 Inspection and testing of prestressed concrete. Inspections and tests for prestressed concrete work shall be in accordance with this section. Tests for prestressing steel and anchorage shall be per Section 1910A.3 ([DSA-SS/CC] 1909.2.5). Inspection shall be in accordance with the following:

1. In addition to the general inspection required for concrete work, all plant fabrication of prestressed concrete members or tensioning of posttensioned members constructed at the site shall be continuously inspected by an inspector specially approved for this purpose by the enforcement agency.

Exception: The special inspector need not be continuously present for the placement of prestressing or post-tensioned cables or tendons.

[DSA-SS, DSA-SS/CC] Special inspector approval by the enforcement agency shall occur when specified in the California Administrative Code.

SPECIAL INSPECTIONS AND TESTS

**TABLE 1705A.3
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CONCRETE CONSTRUCTION**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION	REFERENCED STANDARD ^a	CBC REFERENCE
1. Inspect <i>and test</i> reinforcement, including prestressing tendons, and verify placement. a. Reinforcement in special moment frames, boundary elements of special structural walls and coupling beams. b. All other reinforcement	X —	— X	ACI 318: Ch. 20, 25.2, 25.3, 25.5.1, 26.6.1–26.6.3, 26.13.1, 26.13.3.2, 26.13.3.3	1705A.3.9, 1908A.1, 1910A.2, 1910A.3; [DSA-SS/CC] 1909.2.4, 1909.2.5, 1909.4.1
2. Reinforcing bar welding: a. Verify weldability of reinforcing bars other than ASTM A706; b. Inspect single-pass fillet welds, maximum ⁵ / ₁₆ " ; not defined in 2.d or 2.e. c. Inspect all other welds. d. Reinforcing steel resisting flexural and axial forces in intermediate and special moment frames, and boundary elements and coupling beams of special structural walls of concrete and shear reinforcement. e. Shear reinforcement.	— — X X X	X X — — —	AWS D1.4 ACI 318: 18.2.8, 25.5.7, 26.6.4, 26.13.1.4, 26.13.3.2, 26.13.3.3	1705A.3.1, 1903A.8
3. Inspect anchors cast in concrete.	—	X	ACI 318: 17.8.2, 26.7.2, 26.8.2, 26.13.1, 26.13.3.3	—
4. Inspect <i>and test</i> anchors post-installed in hardened concrete members. ^b a. Adhesive anchors installed in horizontally or upwardly inclined orientations to resist sustained tension loads. b. Mechanical anchors and adhesive anchors not defined in 4.a.	X —	— X	ACI 318: 17.8.2.4, 26.7.2, 26.13.1, 26.13.3.2 ACI 318: 17.8.2, 26.7.2, 26.13.1, 26.13.3.3	1705A.3.8, 1910A.5, [DSA-SS/CC] 1909.2.7, 1705A.3.8, 1910A.5, [DSA-SS/CC] 1909.2.7
5. Verify use of required design mix.	X	—	ACI 318: Ch. 19, 26.4, 26.13.3.2	1903A.5, 1903A.6, 1903A.7, 1904A.1, 1904A.2, 1910A.1, [OSHDP 1 & 4] 1908A.1, [DSA-SS/CC] 1909.2.1, 1909.2.2, 1909.2.3
6. Prior to <i>and during</i> concrete placement, fabricate specimens for strength tests, perform slump and air content tests, and determine the temperature of the concrete.	X	—	ASTM C31 ASTM C172, ACI 318: 26.4, 26.5, 26.12	1705A.3.5, 1705A.3.6, 1705A.3.9, 1905A.1.17, [DSA-SS/CC] 1909.3.9
7. Inspect concrete and shotcrete placement for proper application techniques.	X	—	ACI 318: 26.5, 26.13, ACI 506: 3.4	1705A.3.9, 1905A.1.15, 1905A.1.16, [DSA-SS/CC] 1909.3.7, 1909.3.8
8. Verify maintenance of specified curing temperature and techniques.	—	X	ACI 318: 26.5.3–26.5.5, 26.13.3.3	—
9. Inspect prestressed concrete for: a. Application of prestressing forces; and b. Grouting of bonded prestressing tendons.	X X	— —	ACI 318: 26.10.2, 26.13.1, 26.13.3.2	1705A.3.4
10. Inspect erection of precast concrete members.	—	X	ACI 318: 26.9, 26.13.1, 26.13.3.3	—
11. For precast concrete diaphragm connections or reinforcement at joints classified as moderate or high deformability elements (MDE or HDE) in structures assigned to Seismic Design Category D, E or F, inspect such connections and reinforcement in the field for: a. Installation of the embedded parts b. Completion of the continuity of reinforcement across joints. c. Completion of connections in the field.	X X X	— — —	ACI 318: 26.13.1.3 ACI 550.5	—
12. Inspect installation tolerances of precast concrete diaphragm connections for compliance with ACI 550.5.	—	X	ACI 318: 26.13.1.3	—
13. Verify in-situ concrete strength, prior to stressing of tendons in post-tensioned concrete and prior to removal of shores and forms from beams and structural slabs.	—	X	ACI 318: 26.10.2, 26.11.2, 26.13.3.3	—
14. Inspect formwork for shape, location and dimensions of the concrete member being formed.	—	X	ACI 318: 26.11.1.2(b), 26.13.3.3	1908A.3, [DSA-SS/CC] 1909.4.3

For SI: 1 inch = 25.4 mm.

a. Where applicable, see Section 1705A.13.

b. Specific requirements for special inspection shall be included in the research report for the anchor issued by an approved source in accordance with 17.8.2 in ACI 318, or other qualification procedures. Where specific requirements are not provided, special inspection requirements shall be specified by the registered design professional and shall be approved by the building official prior to the commencement of the work.

c. Installation of all adhesive anchors in horizontal and upwardly inclined positions shall be performed by an ACI/CRSI Certified Adhesive Anchor Installer, except where the design tension on the anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents or where the anchors are shear dowels across cold joints in slabs on grade where the slab is not part of the lateral force-resisting system.

2. The prestressed concrete plant fabrication inspector shall check the materials, equipment, tensioning procedure and construction of the prestressed members and prepare daily written reports. The approved agency shall make a verified report identifying the members by mark and shall include such pertinent data as lot numbers of tendons used, tendon jacking forces, age and strength of concrete at time of tendon release and such other information that may be required.
3. The inspector of prestressed members post-tensioned at the site shall check the condition of the prestressing tendons, anchorage assemblies and concrete in the area of the anchorage, the tensioning equipment and the tensioning procedure and prepare daily written reports. The approved agency shall make a verified report of the prestressing operation identifying the members or tendons by mark and including such pertinent data as the initial cable slack, net elongation of tendons, jacking force developed, and such other information as may be required.
4. The verified reports of construction shall show that of the inspector's own personal knowledge, the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications for plant fabrication inspection. The verified report shall be accompanied by test reports required for materials used. For site post-tensioning inspections the verified report shall be accompanied by copies of calibration charts, certified by an approved testing laboratory, showing the relationship between gage readings and force applied by the jacks used in the prestressing procedure.

1705A.3.5 Concrete preplacement inspection. Concrete shall not be placed until the forms and reinforcement have been inspected, all preparations for the placement have been completed, and the preparations have been checked by the inspector of record.

1705A.3.6 Placing record. A record shall be kept on the site of the time and date of placing the concrete in each portion of the structure. Such record shall be kept until the completion of the structure and shall be open to the inspection of the enforcement agency.

1705A.3.7 Composite construction cores. Composite construction cores shall be taken and tested in accordance with Section 1910A.4 ([DSA-SS/CC] 1909.2.6).

1705A.3.8 Special Inspections and tests for post-installed anchors in concrete. Special inspections and tests for post-installed anchors in concrete shall be in accordance with Table 1705A.3 and Section 1910A.5 ([DSA-SS/CC] 1909.2.7).

1705A.3.9 Shotcrete. All shotcrete work shall be continuously inspected during placing by an approved agency. The special shotcrete inspector shall check the materials, placing equipment, details of construction and construction procedure. The approved agency shall furnish a verified

report that of his or her own personal knowledge the work covered by the report has been performed and materials used and installed in every material respect in compliance with the duly approved plans and specifications.

[DSA-SS, DSA-SS/CC] Testing requirements per ACI 318 and ACI 506.2 shall also apply.

1705A.3.9.1 Visual examination for structural soundness of in-place shotcrete. Completed shotcrete work shall be checked visually for reinforcing bar embedment, voids, rock pockets, sand streaks and similar deficiencies by examining a minimum of three 3-inch (76 mm) cores taken from three areas chosen by the design engineer which represent the worst congestion of reinforcing bars occurring in the project. Extra reinforcing bars may be added to noncongested areas and cores may be taken from these areas. The cores shall be examined by the special inspector and a report submitted to the enforcement agency prior to final approval of the shotcrete.

Exception: Shotcrete work fully supported on earth, minor repairs, and when, in the opinion of the enforcement agency, no special hazard exists.

1705A.3.9.2 Preconstruction tests. A shotcrete mockup panel shall be shot, cured, cored or sawn, examined and tested prior to commencement of the project. The mockup panel shall be representative of the project and simulate job conditions as closely as possible. The mockup panel thickness and reinforcing shall reproduce the thickest and most congested area specified in the structural design. It shall be shot at the same angle, using the same nozzleman and with the same concrete mix design that will be used on the project. Adequate encasement of bars larger than No. 5 shall be demonstrated by the mockup panel. The equipment used in preconstruction testing shall be the same equipment used in the work requiring such testing, unless substitute equipment is approved by the building official. Reports of preconstruction tests shall be submitted to the building official as specified in Section 1704A.5. Approval from the enforcement agency must be obtained prior to performing shotcrete mockup panels.

1705A.4 Masonry construction. Special inspections and tests of masonry construction shall be performed in accordance with the quality assurance program requirements of TMS 402 and TMS 602, as set forth in Tables 3 and 4, Level 3 requirements and Chapter 21A. Testing shall be performed in accordance with Section 2105A ([DSA-SS/CC] 2115.8). Special inspection and testing of post-installed anchors in masonry shall be required in accordance with requirements for concrete in Chapters 17A and 19A.

1705A.4.1 Glass unit masonry and masonry veneer in Risk Category II, III or IV. Special inspections and tests for glass unit masonry or masonry veneer designed in accordance with Section 2110A or Chapter 14, respectively, where they are part of a structure classified as Risk Category II, III or IV shall be performed in accordance with TMS 602 Tables 3 and 4, Level 2.

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1705A.4.2 Vertical masonry foundation elements. Special inspections and tests of vertical masonry foundation elements shall be performed in accordance with Section 1705A.4.

1705A.5 Wood construction. Special inspections of prefabricated wood structural elements and assemblies shall be in accordance with Section 1704A.2.5 *except as modified in this section*. Special inspections of site-built assemblies shall be in accordance with this section.

1705A.5.1 High-load diaphragms. High-load diaphragms designed in accordance with Section 2306A.2 shall be installed with special inspections as indicated in Section 1704A.2. The special inspector shall inspect the wood structural panel sheathing to ascertain whether it is of the grade and thickness shown on the approved construction documents. Additionally, the special inspector must verify the nominal size of framing members at adjoining panel edges, the nail or staple diameter and length, the number of fastener lines and that the spacing between fasteners in each line and at edge margins agrees with the approved construction documents.

1705A.5.2 Metal-plate-connected wood trusses spanning 60 feet or greater. Where a truss clear span is 60 feet (18 288 mm) or greater, the special inspector shall verify that the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing are installed in accordance with the approved truss submittal package.

1705A.5.3 Mass timber construction. Special inspections of mass timber elements in Types IV-A, IV-B and IV-C construction shall be in accordance with Table 1705A.5.3.

1705A.5.4 Wood structural elements and assemblies. *Special inspection of wood structural elements and assemblies is required, as specified in this section, to ensure conformance with approved construction documents and applicable standards.*

The approved agency shall furnish a verified report to the design professional in general responsible charge of construction observation, the structural engineer and the enforcement agency, in accordance with the California Administrative Code and this chapter. The verified report shall list all inspected members or trusses, and shall indicate whether or not the inspected members or trusses conform with applicable standards and the approved drawings and specifications. Any nonconforming items shall be indicated on the verified report.

1705A.5.5 Structural glued laminated and cross-laminated timber. *Manufacture of all structural glued laminated and cross-laminated timber shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected member shall be stamped by the approved agency with an identification mark.

Exception: *Special Inspection is not required for non-custom prismatic glued laminated members identified on drawings and sourced from stock or general inventory of 5 1/2-inch maximum width and 18-inch maximum depth, and with a maximum clear span of 32 feet, manufactured and marked in accordance with ANSI A190.1 Section 13.1 for noncustom members.*

1705A.5.6 Manufactured open web trusses. *The manufacture of open web trusses shall be continuously inspected by an approved agency.*

The approved agency shall verify that proper quality control procedures and tests have been employed for all materials and the manufacturing process, and shall perform visual inspection of the finished product. Each inspected truss shall be stamped with an identification mark by the approved agency.

**TABLE 1705A.5.3
REQUIRED SPECIAL INSPECTIONS OF MASS TIMBER CONSTRUCTION**

TYPE		CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1.	Inspection of anchorage and connections of mass timber construction to timber deep foundation systems.	—	X
2.	Inspect erection of mass timber construction.	—	X
3.	Inspection of connections where installation methods are required to meet design loads.		
	3.1. Threaded fasteners.	—	—
	3.1.1. Verify use of proper installation equipment.	—	X
	3.1.2. Verify use of pre-drilled holes where required.	—	X
	3.1.3. Inspect screws, including diameter, length, head type, spacing, installation angle and depth.	—	X
	3.2. Adhesive anchors installed in horizontal or upwardly inclined orientation to resist sustained tension loads.	X	—
	3.3. Adhesive anchors not defined in 3.2.	—	X
	3.4. Bolted connections.	—	X
	3.5. Concealed connections.	—	X

1705A.5.7 Timber connectors. The installation of all split ring and shear plate timber connectors, and timber rivets shall be continuously inspected by an approved agency. The approved agency shall furnish the architect, structural engineer and the enforcement agency with a report verifying that the materials, timber connectors and workmanship conform to the approved construction documents.

1705A.6 Soils. Special inspections and tests of existing site soil conditions, fill placement and load-bearing requirements shall be performed in accordance with this section and Table 1705A.6. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

Exception: Where Section 1803 does not require reporting of materials and procedures for fill placement, the special inspector shall verify that the in-place dry density of the compacted fill is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557.

1705A.6.1 Soil fill. All fills used to support the foundations of any building or structure shall be continuously inspected by the geotechnical engineer or his or her qualified representative. It shall be the responsibility of the geotechnical engineer to verify that fills meet the requirements of the approved construction documents and to coordinate all fill inspection and testing during the construction involving such fills.

The duties of the geotechnical engineer or his or her qualified representative shall include, but need not be limited to, the inspection of cleared areas and benches prepared to receive fill; inspection of the removal of all unsuitable soils and other materials; the approval of soils to be used as fill material; the inspection of placement and compaction of fill materials; the testing of the completed fills; the inspection or review of geotechnical drainage devices, buttress fills or other similar protective measures in accordance with the approved construction documents.

A verified report shall be submitted by the geotechnical engineer as required by the California Administrative Code. The report shall indicate that all tests and inspection required by the approved construction documents

were completed and that the tested materials and/or inspected work meet the requirements of the approved construction documents.

1705A.6.2 Earth-retaining shoring. Special inspections and tests of earth-retaining shoring shall be in accordance with applicable portions of Section 1812A.

1705A.6.3 Vibro stone columns. Special inspections and tests of vibro stone columns for ground improvement shall be in accordance with Section 1813A.5.

1705A.7 Driven deep foundations. Special inspections and tests shall be performed during installation of driven deep foundation elements as specified in 1810A.3.3.1.2 and Table 1705A.7. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705A.7.1 Driven deep foundations observation. The installation of driven deep foundations shall be continuously observed by a qualified representative of the geotechnical engineer responsible for that portion of the project.

The representative of the geotechnical engineer shall make a report of the deep foundation pile-driving operation giving such pertinent data as the physical characteristics of the deep foundation pile-driving equipment, identifying marks for each deep foundation pile, the total depth of embedment for each deep foundation; and when the allowable deep foundation pile loads are determined by a dynamic load formula, the design formula used and the permanent penetration under the last 10 blows. One copy of the report shall be sent to the enforcement agency.

1705A.8 Cast-in-place deep foundations. Special inspections and tests shall be performed during installation of cast-in-place deep foundation elements as specified in 1810A.3.3.1.2 and Table 1705A.8. The approved geotechnical report and the construction documents prepared by the registered design professionals shall be used to determine compliance.

1705A.8.1 Micropile tests. Micropile preproduction and production load tests shall be in accordance with Section 1810A.3.10.4.

**TABLE 1705A.6
REQUIRED SPECIAL INSPECTIONS AND TESTS OF SOILS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify materials below shallow foundations are adequate to achieve the design bearing capacity.	—	X
2. Verify excavations are extended to proper depth and have reached proper material.	—	X
3. Perform classification and testing of compacted fill materials.	—	X
4. During fill placement, verify use of proper materials and procedures in accordance with the provisions of the approved geotechnical report. Verify densities and lift thicknesses during placement and compaction of compacted fill.	X	—
5. Prior to placement of compacted fill, inspect subgrade and verify that site has been prepared properly.	—	X

**TABLE 1705A.7
REQUIRED SPECIAL INSPECTIONS AND TESTS OF DRIVEN DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Verify element materials, sizes and lengths comply with the requirements.	X	—
2. Determine capacities of test elements and conduct additional load tests, as required.	X	—
3. Inspect driving operations and maintain complete and accurate records for each element.	X	—
4. Verify placement locations and plumbness, confirm type and size of hammer, record number of blows per foot of penetration, determine required penetrations to achieve design capacity, record tip and butt elevations and document any damage to foundation element.	X	—
5. For steel elements, perform additional special inspections in accordance with Section 1705A.2.	In accordance with Section 1705A.2	
6. For concrete elements and concrete-filled elements, perform tests and additional special inspections in accordance with Section 1705A.3.	In accordance with Section 1705A.3	
7. For specialty elements, perform additional inspections as determined by the registered design professional in responsible charge.	In accordance with Statement of Special Inspections	

**TABLE 1705A.8
REQUIRED SPECIAL INSPECTIONS AND TESTS OF CAST-IN-PLACE DEEP FOUNDATION ELEMENTS**

TYPE	CONTINUOUS SPECIAL INSPECTION	PERIODIC SPECIAL INSPECTION
1. Inspect drilling operations and maintain complete and accurate records for each element.	X	—
2. Verify placement locations and plumbness, confirm element diameters, bell diameters (if applicable), lengths, embedment into bedrock (if applicable) and adequate end-bearing strata capacity. Record concrete or grout volumes.	X	—
3. For concrete elements, perform tests and additional special inspections in accordance with Section 1705A.3.	In accordance with Section 1705A.3	

1705A.9 Helical pile foundations. Continuous special inspections shall be performed during installation of helical pile foundations. The information recorded shall include installation equipment used, pile dimensions, tip elevations, final depth, final installation torque and other pertinent installation data as required by the registered design professional in responsible charge. The approved geotechnical report and the construction documents prepared by the registered design professional shall be used to determine compliance.

1705A.9.1 Helical pile tests. Helical pile preproduction and production load tests shall be in accordance with Section 1810A.3.1.5.1.

1705A.10 Structural integrity of deep foundation elements. Whenever there is a reasonable doubt as to the structural integrity of a deep foundation element, an engineering assessment shall be required. The engineering assessment shall include tests for defects performed in accordance with ASTM D4945, ASTM D5882, ASTM D6760 or ASTM D7949, or other approved method.

1705A.11 Fabricated items. Special inspections of fabricated items shall be performed in accordance with Section 1704A.2.5.

1705A.12 Special inspections for wind resistance. Special inspections for wind resistance specified in Sections 1705A.12.1 through 1705A.12.3, unless exempted by the

exceptions to Section 1704A.2, are required for buildings and structures constructed in the following areas:

1. In wind Exposure Category B, where V is 150 miles per hour (67 m/sec) or greater.
2. In wind Exposure Category C or D, where V is 140 mph (62.6 m/sec) or greater.

1705A.12.1 Structural wood. Continuous special inspection is required during field gluing operations of elements of the main windforce-resisting system. Periodic special inspection is required for nailing, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including wood shear walls, wood diaphragms, drag struts, braces and hold-downs.

1705A.12.2 Cold-formed steel light-frame construction. Periodic special inspection is required for welding operations of elements of the main windforce-resisting system. Periodic special inspection is required for screw attachment, bolting, anchoring and other fastening of elements of the main windforce-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

1705A.12.3 Wind-resisting components. Periodic special inspection is required for fastening of the following systems and components:

1. Roof covering, roof deck and roof framing connections.

2. Exterior wall covering and wall connections to roof and floor diaphragms and framing.

1705A.13 Special inspections for seismic resistance.

Special inspections for seismic resistance shall be required as specified in Sections 1705A.13.1 through 1705A.13.9, unless exempted by the exceptions of Section 1704A.2.

1705A.13.1 Structural steel. Special inspections for seismic resistance shall be in accordance with Section 1705A.13.1.1 or 1705A.13.1.2, as applicable.

1705A.13.1.1 Seismic force-resisting systems. Special inspections of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341 as modified by Section 1705A.2.1 of this code.

1705A.13.1.2 Structural steel elements. Special inspections of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category D, E or F other than those covered in Section 1705A.13.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341 as modified by Section 1705A.2.1 of this code.

1705A.13.2 Structural wood. For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F:

1. Continuous special inspection shall be required during field gluing operations of elements of the seismic force-resisting system.
2. Periodic special inspection shall be required for nailing, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including wood shear walls, wood diaphragms, drag struts, braces, shear panels and hold-downs.

1705A.13.3 Cold-formed steel light-frame construction.

For the seismic force-resisting systems of structures assigned to Seismic Design Category D, E or F, periodic special inspection shall be required for both:

1. Welding operations of elements of the seismic force-resisting system.
2. Screw attachment, bolting, anchoring and other fastening of elements of the seismic force-resisting system, including shear walls, braces, diaphragms, collectors (drag struts) and hold-downs.

1705A.13.4 Special inspection for special seismic certification.

For structures assigned to Seismic Design Category D, E or F, the special inspector shall examine *equipment and components* requiring *special seismic certification* in accordance with Section 1705A.14.3 or ASCE 7, Section 13.2.2 and verify that the label, anchorage and mounting conform to the certificate of compliance.

1705A.13.5 Architectural components. Periodic special inspection is required for the erection and fastening of

exterior cladding, interior and exterior nonbearing walls, *ceilings* and interior and exterior veneer in structures assigned to Seismic Design Category D, E or F.

[OSHPD 1] Exception: *Periodic special inspection is not required where continuous inspection of the work is performed in accordance with Section 7-145 of the CAC.*

1705A.13.5.1 Access floors. Periodic special inspection is required for the anchorage of access floors in structures assigned to Seismic Design Category D, E or F.

1705A.13.5.2 Structural sealant glazing. *Special inspection shall be in accordance with Section 2410.2 Item 9.*

1705A.13.6 Plumbing, mechanical and electrical components.

Periodic special inspection of plumbing, mechanical and electrical components shall be required for the following:

1. Anchorage of electrical equipment for emergency and standby power systems in structures assigned to Seismic Design Category D, E or F.
2. Anchorage of other electrical equipment in structures assigned to Seismic Design Category D, E or F.
3. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units in structures assigned to Seismic Design Category D, E or F.
4. Installation and anchorage of ductwork designed to carry hazardous materials in structures assigned to Seismic Design Category D, E or F.
5. Installation and anchorage of vibration isolation systems in structures assigned to Seismic Design Category D, E or F where the approved construction documents require a nominal clearance of $\frac{1}{4}$ inch (6.4 mm) or less between the equipment support frame and restraint.
6. Installation of mechanical and electrical equipment, including duct work, piping systems and their structural supports, where automatic sprinkler systems are installed in structures assigned to Seismic Design Category D, E or F to verify one of the following:

- 6.1. Minimum clearances have been provided as required by Section 13.2.3 ASCE/SEI 7.
- 6.2. A nominal clearance of not less than 3 inches (76 mm) has been provided between automatic sprinkler system drops and sprigs and; structural members not used collectively or independently to support the sprinklers; equipment attached to the building structure; and other systems' piping.

Where flexible sprinkler hose fittings are used, special inspection of minimum clearances is not required.

1705A.13.7 Storage racks. Steel storage racks and steel cantilevered storage racks that are 8 feet (2438 mm) in height or greater and assigned to Seismic Design Category D, E or F shall be provided with periodic special inspection as required by Table 1705A.13.7.

1705A.13.8 Seismic isolation and damping systems. Periodic special inspection shall be provided for seismic isolation and damping systems in structures assigned to Seismic Design Category D, E or F during the fabrication and installation of isolator units and energy dissipation devices. *Continuous special inspection is required for prototype and production testing of isolator units and damping devices.*

1705A.14 Testing for seismic resistance. Testing for seismic resistance shall be required as specified in Sections 1705A.14.1 through 1705A.14.4, unless exempted from special inspections by the exception of Section 1704A.2.

1705A.14.1 Structural steel. Nondestructive testing for seismic resistance shall be in accordance with Section 1705A.14.1.1 or 1705A.14.1.2, as applicable.

1705A.14.1.1 Seismic force-resisting systems. Nondestructive testing of structural steel in the seismic force-resisting systems in buildings and structures assigned to Seismic Design Category D, E or F shall be performed in accordance with the quality assurance requirements of AISC 341.

1705A.14.1.2 Structural steel elements. Nondestructive testing of structural steel elements in the seismic force-resisting systems of buildings and structures assigned to Seismic Design Category D, E or F other than those covered in Section 1705A.14.1.1, including struts, collectors, chords and foundation elements, shall be performed in accordance with the quality assurance requirements of AISC 341.

1705A.14.2 Nonstructural components. For structures assigned to Seismic Design Category D, E or F, where the requirements of Section 13.2.1 of ASCE 7 for nonstructural components, supports or attachments are met by *manufacturer's certification* as specified in Item 2 therein, the registered design professional shall specify on the approved construction documents the requirements for seismic certification by analysis or testing. Certificates of compliance for the *manufacturer's certification* shall be

submitted to the building official as specified in Section 1704A.5.

Seismic sway bracing components satisfying requirements of FM 1950 or using an alternative testing protocol approved by the building official shall be deemed to satisfy the requirements of this section.

1705A.14.2.1 Structural sealant glazing testing. *Testing and the manufacturer's certification shall be in accordance with Section 2410.1.2.*

1705A.14.3 Special seismic certification. For structures assigned to Seismic Design Category D, E or F equipment and components that are subject to the requirements of Section 13.2.2 of ASCE 7 for special seismic certification, the registered design professional shall specify on the approved construction documents the requirements to be met by analysis or testing as specified therein. Certificates of compliance documenting that the requirements are met shall be submitted to the building official as specified in Section 1704A.5.

Active or energized equipment and components shall be certified exclusively on the basis of approved shake table testing in accordance with ICC-ES AC 156 or equivalent shake table testing criteria approved by the building official. Minimum of two equipment/components shall be tested for a product line with similar structural configuration. Where a range of products are tested, the two equipment/components shall be either the largest and a small unit, or approved alternative representative equipment/components.

Exception: *When a single product (and not a product line with more than one product with variations) is certified and manufacturing process is ISO 9001 certified, one test shall be permitted.*

For a multi-component system, where active or energized components are certified by tests, connecting elements, attachments and supports can be justified by supporting analysis.

1705A.14.3.1 [OSHPD 1 & 4] Special seismic certification shall be required for the following systems, equipment and components:

1. Emergency and standby power systems.
2. Elevator equipment (excluding elevator cabs).

**TABLE 1705A.13.7
REQUIRED INSPECTIONS OF STORAGE RACK SYSTEMS**

TYPE	CONTINUOUS INSPECTION	PERIODIC INSPECTION	REFERENCED STANDARD	CBC REFERENCE
1. Materials used, to verify compliance with one or more of the material test reports in accordance with the approved construction documents.	—	X	—	—
2. Fabricated storage rack elements.	—	X	—	Section 1704A.2.5
3. Storage rack anchorage installation.	—	X	ANSI/MH16.1 Section 7.3.2	—
4. Completed storage rack system, to indicate compliance with the approved construction documents.	—	X	—	—

3. Components with hazardous contents.
4. Exhaust and smoke control fans.
5. Switchgear and switchboards.
6. Motor control centers.
7. Imaging equipment needed for diagnostic services of emergency/trauma patients, a minimum of one such equipment.
8. Air conditioning units excluding Variable/Constant Air Volume (VAV/CAV) boxes up to 75 lbs.
9. Air handling units.
10. Chillers, including associated evaporators, and condensers.
11. Cooling towers.
12. Transformers.
13. Electrical substations.
14. UPS and batteries.
15. Panelboards as defined in the California Electrical Code (CEC) Article 100.
16. Industrial control panels as defined in the California Electrical Code (CEC) Article 100.
17. Power isolation and correction systems.
18. Motorized surgical lighting systems.
19. Motorized operating table systems.
20. Internal communication servers, routers and switches failure of which could impair the continued operation of the facility.
21. Medical gas and vacuum systems.
22. Electrical busways as defined in UL 857.
23. Electrical control panels powered by the life safety branch in accordance with the California Electrical Code (CEC) Article 517.33 or the critical branch in accordance with the California Electrical Code (CEC) Article 517.34.

Exceptions:

1. Equipment and components weighing not more than 50 lbs. supported directly on structures or surface mounted on equipment or components that are not required to have special seismic certification by this section.
2. Mobile equipment/components.
3. Pipes, ducts, conduits and cable trays, excluding in-line equipment and components.
4. Underground tanks.
5. Electric motors, base-mounted horizontal pumps and compressors.
6. Base-mounted vertical pumps up to 20 hp.
7. Certified subcomponents up to operating weight of 10 lbs.
8. Components where importance factor, I_p , is permitted to be 1.0 by this code.

9. Emergency generators up to 25 kilowatts.
10. Equipment and components used for clinical trials only.
11. Elevator machines and governors.
12. Temporary and Interim equipment.

For Exceptions 5, 6 and 7:

Exempt subcomponents, which are an integral part of equipment that require special seismic certification, shall be tested attached to the equipment. Exempt subcomponents shall be permitted to be substituted without testing, provided that the substituted subcomponent relative to the certified subcomponent has:

1. Similar configuration with equivalent function.
2. Supports and attachments of similar configuration with equivalent strength and stiffness.
3. Same attachment location.
4. Changes in dimensions, center of gravity and mass, of not more than 10 percent of the certified subcomponent and still meets Exception 5, 6 or 7.
5. Manufacturing process with ISO 9001 certification.

1705A.14.4 Seismic isolation and damping systems. Seismic isolation and damping systems in structures assigned to Seismic Design Category D, E or F shall be tested in accordance with Section 17.8 and 18.6 of ASCE 7.

Prototype and production testing and associated acceptance criteria for isolator units and damping devices shall be subject to preapproval by the building official. Testing exemption for similar units shall require approval by the building official.

[BF] 1705A.15 Sprayed fire-resistant materials. Special inspections and tests of sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be performed in accordance with Sections 1705A.15.1 through 1705A.15.6. Special inspections shall be based on the fire-resistance design as designated in the approved construction documents. The tests set forth in this section shall be based on samplings from specific floor, roof and wall assemblies and structural members. Special inspections and tests shall be performed during construction with an additional visual inspection after the rough installation of electrical, automatic sprinkler, mechanical and plumbing systems and suspension systems for ceilings, and before concealment where applicable. The required sample size shall not exceed 110 percent of that specified by the referenced standards in Sections 1705A.15.4.1 through 1705A.15.4.9.

[BF] 1705A.15.1 Physical and visual tests. The special inspections and tests shall include the following to demonstrate compliance with the listing and the fire-resistance rating:

1. Condition of substrates.

2. Thickness of application.
3. Density in pounds per cubic foot (kg/m^3).
4. Bond strength adhesion/cohesion.
5. Condition of finished application.

[BF] 1705A.15.2 Structural member surface conditions. The surfaces shall be prepared in accordance with the approved fire-resistance design and the written instructions of approved manufacturers. The prepared surface of structural members to be sprayed shall be inspected by the special inspector before the application of the sprayed fire-resistant material.

[BF] 1705A.15.3 Application. The substrate shall have a minimum ambient temperature before and after application as specified in the written instructions of approved manufacturers. The area for application shall be ventilated during and after application as required by the written instructions of approved manufacturers.

[BF] 1705A.15.4 Thickness. Not more than 10 percent of the thickness measurements of the sprayed fire-resistant materials applied to floor, roof and wall assemblies and structural members shall be less than the thickness required by the approved fire-resistance design, and none shall be less than the minimum allowable thickness required by Section 1705A.15.4.1.

[BF] 1705A.15.4.1 Minimum allowable thickness. For design thicknesses 1 inch (25 mm) or greater, the minimum allowable individual thickness shall be the design thickness minus $\frac{1}{4}$ inch (6.4 mm). For design thicknesses less than 1 inch (25 mm), the minimum allowable individual thickness shall be the design thickness minus 25 percent. Thickness shall be determined in accordance with ASTM E605. Samples of the sprayed fire-resistant materials shall be selected in accordance with Sections 1705A.15.4.2 and 1705A.15.4.3.

[BF] 1705A.15.4.2 Floor, roof and wall assemblies. The thickness of the sprayed fire-resistant material applied to floor, roof and wall assemblies shall be determined in accordance with ASTM E605, making not less than four measurements for each 1,000 square feet (93 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705A.15.4.3 Cellular decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area.

[BF] 1705A.15.4.4 Fluted decks. Thickness measurements shall be selected from a square area, 12 inches by 12 inches (305 mm by 305 mm) in size. Not fewer than four measurements shall be made, located symmetrically within the square area, including one each of the following: valley, crest and sides. The average of the measurements shall be reported.

[BF] 1705A.15.4.5 Structural members. The thickness of the sprayed fire-resistant material applied to

structural members shall be determined in accordance with ASTM E605. Thickness testing shall be performed on not less than 25 percent of the structural members on each floor.

[BF] 1705A.15.4.6 Beams and girders. At beams and girders thickness measurements shall be made at nine locations around the beam or girder at each end of a 12-inch (305 mm) length.

[BF] 1705A.15.4.7 Joists and trusses. At joists and trusses, thickness measurements shall be made at seven locations around the joist or truss at each end of a 12-inch (305 mm) length.

[BF] 1705A.15.4.8 Wide-flanged columns. At wide-flanged columns, thickness measurements shall be made at 12 locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705A.15.4.9 Hollow structural section and pipe columns. At hollow structural section and pipe columns, thickness measurements shall be made at not fewer than four locations around the column at each end of a 12-inch (305 mm) length.

[BF] 1705A.15.5 Density. The density of the sprayed fire-resistant material shall be not less than the density specified in the approved fire-resistance design. Density of the sprayed fire-resistant material shall be determined in accordance with ASTM E605. The test samples for determining the density of the sprayed fire-resistant materials shall be selected as follows:

1. From each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) or portion thereof of the sprayed area in each story.
2. From beams, girders, trusses and columns at the rate of not less than one sample for each type of structural member for each 2,500 square feet (232 m^2) of floor area or portion thereof in each story.

[BF] 1705A.15.6 Bond strength. The cohesive/adhesive bond strength of the cured sprayed fire-resistant material applied to floor, roof and wall assemblies and structural members shall be not less than 150 pounds per square foot (psf) ($7.18 \text{ kN}/\text{m}^2$). The cohesive/adhesive bond strength shall be determined in accordance with the field test specified in ASTM E736 by testing in-place samples of the sprayed fire-resistant material selected in accordance with Sections 1705A.15.6.1 through 1705A.15.6.3.

[BF] 1705A.15.6.1 Floor, roof and wall assemblies. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from each floor, roof and wall assembly at the rate of not less than one sample for every 2,500 square feet (232 m^2) of the sprayed area, or portion thereof, in each story.

[BF] 1705A.15.6.2 Structural members. The test samples for determining the cohesive/adhesive bond strength of the sprayed fire-resistant materials shall be selected from beams, girders, trusses, columns and other structural members at the rate of not less than one

sample for each type of structural member for each 2,500 square feet (232 m²) of floor area or portion thereof in each story.

[BF] 1705A.15.6.3 Primer, paint and encapsulant bond tests. Bond tests to qualify a primer, paint or encapsulant shall be conducted where the sprayed fire-resistant material is applied to a primed, painted or encapsulated surface for which acceptable bond-strength performance between these coatings and the fire-resistant material has not been determined. A bonding agent approved by the SFRM manufacturer shall be applied to a primed, painted or encapsulated surface where the bond strengths are found to be less than required values.

[BF] 1705A.16 Mastic and intumescent fire-resistant coatings. Special inspections and tests for mastic and intumescent fire-resistant coatings applied to structural elements and decks shall be performed in accordance with AWCI 12-B. Special inspections and tests shall be based on the fire-resistance design as designated in the approved construction documents. Special inspections and tests shall be performed during construction. Additional visual inspection shall be performed after the rough installation and, where applicable, prior to the concealment of electrical, automatic sprinkler, mechanical and plumbing systems.

1705A.17 Exterior insulation and finish systems (EIFS). Special inspections shall be required for all EIFS applications.

Exceptions:

1. Special inspections shall not be required for EIFS applications installed over a water-resistive barrier with a means of draining moisture to the exterior.
2. Special inspections shall not be required for EIFS applications installed over masonry or concrete walls.

1705A.17.1 Water-resistive barrier coating. A water-resistive barrier coating complying with ASTM E2570 requires special inspection of the water-resistive barrier coating where installed over a sheathing substrate.

[BF] 1705A.18 Fire-resistant penetrations and joints. In high-rise buildings, in buildings assigned to Risk Category III or IV, or in fire areas containing Group R occupancies with an occupant load greater than 250, special inspections for through-penetrations, membrane penetration firestops, fire-resistant joint systems and perimeter fire containment systems that are tested and listed in accordance with Sections 714A.4.1.2, 714A.5.1.2, 715A.3.1 and 715A.4 shall be in accordance with Section 1705A.18.1 or 1705A.18.2.

[DSA SS, DSA-SS/CC] Buildings assigned to Risk Category II, III or IV shall be subject to special inspections for fire-resistant penetrations and joints.

[BF] 1705A.18.1 Penetration firestops. Inspections of penetration firestop systems that are tested and listed in accordance with Sections 714A.4.1.2 and 714A.5.1.2 shall be conducted by an approved agency in accordance with ASTM E2174.

[BF] 1705A.18.2 Fire-resistant joint systems. Inspection of fire-resistant joint systems that are tested and listed in accordance with Sections 715A.3.1 and 715A.4 shall be conducted by an approved agency in accordance with ASTM E2393.

[F] 1705A.19 Testing for smoke control. Smoke control systems shall be tested by a special inspector.

[F] 1705A.19.1 Testing scope. The test scope shall be as follows:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure difference testing, flow measurements and detection and control verification.

[F] 1705A.19.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

1705.20 Sealing of mass timber. Periodic special inspections of sealants or adhesives shall be conducted where sealant or adhesive required by Section 703.7 is applied to mass timber building elements as designated in the approved construction documents.

SECTION 1706A DESIGN STRENGTHS OF MATERIALS

1706A.1 Conformance to standards. The design strengths and permissible stresses of any structural material that are identified by a manufacturer's designation as to manufacture and grade by mill tests, or the strength and stress grade is otherwise confirmed to the satisfaction of the building official, shall conform to the specifications and methods of design of accepted engineering practice or the approved rules in the absence of applicable standards.

1706A.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1707A.

SECTION 1707A ALTERNATIVE TEST PROCEDURE

1707A.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11. The cost of all tests and other investigations required under the provisions of this code shall be borne by the owner or the owner's authorized agent.

SECTION 1708A IN-SITU LOAD TESTS

1708A.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. The in-situ load tests shall be conducted in accordance with Section 1708A.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1708A.2 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1708A.2.1 or 1708A.2.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1708A.2.1 Load test procedure specified. Where a referenced material standard contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1708A.2.2 shall apply.

1708A.2.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a material standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to an approved test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic force-resisting system, at a minimum the test load shall be equal to the specified factored design loads. For materials such as wood that have strengths that are dependent on load duration, the test load shall be adjusted to account for the difference in load duration of the test compared to the expected duration of the design loads being considered. For statically loaded components, the test load shall be left in place for a period of 24 hours. For components that carry dynamic loads (for example, machine supports or fall arrest anchors), the load shall be left in place for a period consistent with the component's actual function. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.

3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1709A PRECONSTRUCTION LOAD TESTS

1709A.1 General. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1709A. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

1709A.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable referenced standards, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1709A.3 shall apply.

1709A.3 Load test procedures not specified. Where load test procedures are not specified in the applicable referenced standards, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that are not a part of the seismic force-resisting system, the test shall be as specified in Section 1709A.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1709A.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1709A.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1709A.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the least of:

1. The load at the deflection limitation given in Section 1709A.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1709A.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3.

1709A.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1709A.5 Exterior window and door assemblies. The design pressure rating of exterior windows and doors in buildings shall be determined in accordance with Section 1709A.5.1 or 1709A.5.2. For exterior windows and doors tested in accordance with Section 1709A.5.1 or 1709A.5.2, required design wind pressures determined from ASCE 7 shall be permitted to be converted to allowable stress design by multiplying by 0.6.

Exception: Structural wind load design pressures for window or door assemblies other than the size tested in accordance with Section 1709A.5.1 or 1709A.5.2 shall be permitted to be different than the design value of the tested assembly, provided that such pressures are determined by accepted engineering analysis or validated by an additional test of the window or door assembly to the alternative allowable design pressure in accordance with Section 1709A.5.2. Components of the alternate size assembly shall be the same as the tested or labeled assembly. Where engineering analysis is used, it shall be performed in accordance with the analysis procedures of AAMA 2502.

1709A.5.1 Exterior windows and doors. Exterior windows and sliding doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440. The label shall state the name of the manufacturer, the approved labeling agency and the product designation as specified in AAMA/WDMA/CSA101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA101/I.S.2/A440 or comply with Section 1709A.5.2. Products tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 shall not be subject to the requirements of Sections 2403A.2 and 2403A.3.

1709A.5.2 Exterior windows and door assemblies not provided for in Section 1709A.5.1. Exterior window and door assemblies shall be tested in accordance with ASTM E330. Exterior window and door assemblies containing glass shall comply with Section 2403A. The design pressure for testing shall be calculated in accordance with Chapter 16. Each assembly shall be tested for 10 seconds at a load equal to 1.5 times the design pressure.

1709A.5.2.1 Garage doors and rolling doors. Garage doors and rolling doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108. Garage doors and rolling doors shall be labeled with a permanent label identifying the door manufacturer, the door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

1709A.5.3 Windborne debris protection. Protection of exterior glazed openings in buildings located in windborne debris regions shall be in accordance with Section 1609A.2.

1709A.5.3.1 Impact protective systems testing and labeling. Impact protective systems shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996 and for design wind pressure for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with ASCE 7, and for the purposes of this section, multiplied by 0.6 to convert to allowable stress design.

Impact protective systems shall have a permanent label applied in accordance with Section 1703A.5.4, identifying the manufacturer, product designation, performance characteristics, and approved inspection agency.

1709A.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the requirements of Chapter 24.

1709A.7 Test specimens. Test specimens and construction shall be representative of the materials, workmanship and details normally used in practice. The properties of the materials used to construct the test assembly shall be determined on the basis of tests on samples taken from the load assembly or on representative samples of the materials used to construct the load test assembly. Required tests shall be conducted or witnessed by an approved agency.

Notation for [DSA-SS]

Authority: Education Code §17310 and 81142, and H&S Code §16022.

Reference: Education Code §§17280 through 17317, and 81130 through 81147, and Health and Safety Code §§16000 through 16023.

Notation for [DSA-SS/CC]

Authority: Education Code §81053.

Reference: Education Code §81052, 81053, and 81130 through 81147.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 18 – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X													X								
Adopt entire chapter as amended (amended sections listed below)				X	X						X	X				X						
Adopt only those sections that are listed below																						
Chapter / Section																						
1801.1.1– 1801.1.3											X	X				X						
1802.1				X																		
1803.1											X	X				X						
1803.1.1– 1803.1.1.5				X																		
1803.2												X										
1803.3.1											X	X				X						
1803.5.4 Exception											X	X				X						
1803.6											X	X				X						
1803.7											X	X				X						
1804.4.1				X																		
1805.2											X	X				X						
1805.4.1, Exception 2				X																		
1805.4.3																						
1807.1.3											X	X				X						
1807.1.4											X	X				X						
1807.1.5 Exception											X	X				X						
1807.1.6											X	X				X						
1807.2											X	X				X						
1807.2.2											X	X				X						
1807.2.5											X	X				X						
1808.8 Exception											X	X				X						
Table 1808.8.1											X	X				X						
1808.8.6											X	X				X						
1809.3											X	X				X						
1809.7											X	X				X						
1809.8											X	X				X						
1809.9											X	X				X						
1809.12											X	X				X						
1809.14											X	X				X						
1810.3.1.5.1											X	B				X						
1810.3.3.1.9 #3											X	B				X						
1810.3.2.4											X	X				X						
1810.3.5.3.3											X	X				X						
1810.3.8 Exceptions											X	B				X						
1810.3.8.3.3 Exception											X	X				X						
1810.3.9.4.2.1											X	X				X						
1810.3.10.4	X			X																		
1810.3.10.4.1											X	B				X						
1810.3.11											X	X				X						

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 18 – SOILS AND FOUNDATIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X												X									
Adopt entire chapter as amended (amended sections listed below)				X	X						X	X				X						
Adopt only those sections that are listed below																						
Chapter / Section																						
1810.3.11.2 #3, Exception #2											X	B			X							
1810.3.12 Exception											X	B			X							
1810.4.1.5											X	X			X							
1811											X	B			X							
1812											X	B			X							
1813											X	X			X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 18

SOILS AND FOUNDATIONS

User notes:

About this chapter: Chapter 18 provides criteria for geotechnical and structural considerations in the selection, design and installation of foundation systems to support the loads imposed by the structure above. This chapter includes requirements for soils investigation and site preparation for receiving a foundation, including the load-bearing values for soils and protection for the foundation from frost and water intrusion. Section 1808 addresses the basic requirements for all foundation types while subsequent sections address foundation requirements that are specific to shallow foundations and deep foundations.

Code development reminder: Code change proposals to this chapter will be considered by the IBC–Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 1801 GENERAL

1801.1 Scope. The provisions of this chapter shall apply to building and foundation systems.

1801.1.1 Application. The scope of application of Chapter 18 is as follows:

Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1, 1.10.2 and 1.10.5. These applications include: Hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings.

1801.1.2 Amendments in this chapter. OSHPD adopts this chapter and all amendments.

Exception: Amendments not adopted or adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency.

1801.1.3 Identification of amendments. [OSHPD IR, 2 & 5] Office of Statewide Health Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD IR] – For applications listed in Section 1.10.1.

[OSHPD 2] – For applications listed in Section 1.10.2.

[OSHPD 5] – For applications listed in Section 1.10.5.

SECTION 1802 DESIGN BASIS

1802.1 General. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The quality and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23. Excavations and fills shall comply with Chapter 33.

[HCD 1] For limited-density owner-built rural dwellings, pier foundations, stone masonry footings and foundations, pressure-treated lumber, poles or equivalent foundation materials or designs may be used, provided that the bearing is sufficient for the purpose intended.

SECTION 1803 GEOTECHNICAL INVESTIGATIONS

1803.1 General. Geotechnical investigations shall be conducted in accordance with Section 1803.2 and reported in accordance with Section 1803.6. Where required by the building official or where geotechnical investigations involve in-situ testing, laboratory testing or engineering calculations, such investigations shall be conducted by a registered design professional. [OSHPD IR, 2 & 5] The classification, testing and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, certified engineering geologist and a registered geophysicist, where applicable.

1803.1.1 General and where required for applications listed in Section 1.8.2.1.1 regulated by the Department of Housing and Community Development. [HCD 1] Foundation and soils investigations shall be conducted in conformance with Health and Safety Code Sections 17953 through 17957 as summarized below.

1803.1.1.1 Preliminary soil report. Each city, county, or city and county shall enact an ordinance which requires a preliminary soil report, prepared by a civil engineer who is registered by the state. The report shall be based upon adequate test borings or excavations, of every subdivision, where a tentative and final map is required pursuant to Section 66426 of the Government Code.

The preliminary soil report may be waived if the building department of the city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall determine that, due to the

knowledge such department has as to the soil qualities of the soil of the subdivision or lot, no preliminary analysis is necessary.

1803.1.1.2 Soil investigation by lot, necessity, preparation and recommendations. If the preliminary soil report indicates the presence of critically expansive soils or other soil problems which, if not corrected, would lead to structural defects, such ordinance shall require a soil investigation of each lot in the subdivision.

The soil investigation shall be prepared by a civil engineer who is registered in this state. It shall recommend corrective action which is likely to prevent structural damage to each dwelling proposed to be constructed on the expansive soil.

1803.1.1.3 Approval, building permit conditions, appeal. The building department of each city, county, or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, shall approve the soil investigation if it determines that the recommended action is likely to prevent structural damage to each dwelling to be constructed. As a condition to the building permit, the ordinance shall require that the approved recommended action be incorporated in the construction of each dwelling. Appeal from such determination shall be to the local appeals board.

1803.1.1.4 Liability. A city, county, city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section 1803.1.1, is not liable for any injury which arises out of any act or omission of the city, county, city and county, other enforcement agency, or a public employee or any other person under Section 1803.1.1.

1803.1.1.5 Alternate procedures. The governing body of any city, county, or city and county may enact an ordinance prescribing an alternate procedure which is equal to or more restrictive than the procedure specified in Section 1803.1.1.

1803.2 Investigations required. Geotechnical investigations shall be conducted in accordance with Sections 1803.3 through 1803.5.

Exception: The building official shall be permitted to waive the requirement for a geotechnical investigation where satisfactory data from adjacent areas is available that demonstrates an investigation is not necessary for any of the conditions in Sections 1803.5.1 through 1803.5.6 and Sections 1803.5.10 and 1803.5.11.

[OSHPD 2] Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V construction and 4,000 square feet (371 m²) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS). Allowable foundation and lateral soil pressure values may be determined from Table 1806.2.

1803.3 Basis of investigation. Soil classification shall be based on observation and any necessary tests of the materials

disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803.3.1 Scope of investigation. The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

[OSHPD 1R, 2 & 5] There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m²) of building area at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.

Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.

Borings shall be of sufficient depth and size to adequately characterize subsurface conditions.

Exception: Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel frame construction.

1803.4 Qualified representative. The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

1803.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803.5.1 through 1803.5.12.

1803.5.1 Classification. Soil materials shall be classified in accordance with ASTM D2487.

1803.5.2 Questionable soil. Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

1803.5.3 Expansive soil. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No.200 sieve (75 μm), determined in accordance with ASTM D422.

3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

1803.5.4 Ground-water table. A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

Exception: [OSHPD 1R, 2 & 5] Not permitted by OSHPD. A subsurface soil investigation to determine the location of the ground-water table shall not be required where waterproofing is provided in accordance with Section 1805.

1803.5.5 Deep foundations. Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.
2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1803.5.6 Rock strata. Where subsurface explorations at the project site indicate variations in the structure of rock on which foundations are to be constructed, a sufficient number of borings shall be drilled to sufficient depths to assess the competency of the rock and its load-bearing capacity.

1803.5.7 Excavation near foundations. Where excavation will reduce support from any foundation, a registered design professional shall prepare an assessment of the structure as determined from examination of the structure, available design documents, available subsurface data, and, if necessary, excavation of test pits. The registered design professional shall determine the requirements for support and protection of any existing foundation and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by underpinning, bracing, excavation retention systems, or by other means acceptable to the building official.

1803.5.8 Compacted fill material. Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803.5.9 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803.5.10 Alternate setback and clearance. Where setbacks or clearances other than those required in Section 1808.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

1803.5.11 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

1803.5.12 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803.5.11 shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
 - 2.1. A site-specific study in accordance with Chapter 21 of ASCE 7.
 - 2.2. In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:
 - 3.1. Estimation of total and differential settlement.
 - 3.2. Lateral soil movement.
 - 3.3. Lateral soil loads on foundations.
 - 3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
 - 3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
 - 3.6. Increases in soil lateral pressures on retaining walls.
 - 3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to, the following:
 - 4.1. Selection of appropriate foundation type and depths.
 - 4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
 - 4.3. Ground stabilization.
 - 4.4. Any combination of these measures and how they shall be considered in the design of the structure.
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.
6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803.5.9.
11. **[OSHPD 1R, 2 & 5]** *The report shall consider the effects of seismic hazard in accordance with Section 1803.7.*

1803.7 Geohazard reports. **[OSHPD 1R, 2 & 5]** *Geohazard reports shall be required for all proposed construction.*

Exceptions:

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type V skilled nursing or intermediate care facilities construction and 4,000 square feet (371 m²) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS); nonstructural, associated structural or voluntary structural alterations and incidental structural additions or alterations, and structural repairs for other than earthquake damage.*
2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.

The preparation of the geohazard report shall consider the most recent CGS Note 48; Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals and Essential Services Buildings. In addition, the most recent version of CGS Special Publication 42, Fault Rupture Hazard Zones in California, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, Guidelines for Evaluating and Mitigating Seismic Hazards in California,

1803.6 Reporting. Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the permit applicant at the time of permit application. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered.

shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be fully supported by satisfactory data and analysis.

In addition to requirements in Sections 1803.5.11 and 1803.5.12, the report shall include, but shall not be limited to, the following:

1. Site geology.
2. Evaluation of the known active and potentially active faults, both regional and local.
3. Ground-motion parameters, as required by Section 1613 and ASCE 7.

SECTION 1804 EXCAVATION, GRADING AND FILL

1804.1 Excavation near foundations. Excavation for any purpose shall not reduce vertical or lateral support for any foundation or adjacent foundation without first underpinning or protecting the foundation against detrimental lateral or vertical movement, or both, in accordance with Section 1803.5.7.

1804.2 Underpinning. Where underpinning is chosen to provide the protection or support of adjacent structures, the underpinning system shall be designed and installed in accordance with provisions of this chapter and Chapter 33.

1804.2.1 Underpinning sequencing. Underpinning shall be installed in a sequential manner that protects the neighboring structure and the working construction site. The sequence of installation shall be identified in the approved construction documents.

1804.3 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: CLSM need not be compacted.

1804.4 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm) measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped not less than 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

Exceptions:

1. Where climatic or soil conditions warrant, the slope of the ground away from the building foundation

shall be permitted to be reduced to not less than 1 unit vertical in 48 units horizontal (2-percent slope).

2. Impervious surfaces shall be permitted to be sloped less than 2 percent where the surface is a door landing or ramp that is required to comply with Section 1010.1.4, 1012.3 or 1012.6.1.

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1804.4.1 [HCD 1] Construction plans. Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.

1804.5 Grading and fill in flood hazard areas. In flood hazard areas established in Section 1612.3, grading, fill, or both, shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In coastal high hazard areas, unless such fill is conducted or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

1804.6 Compacted fill material. Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

Exception: Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided that the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557. The compaction shall be verified by special inspection in accordance with Section 1705.6.

1804.7 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803.

SECTION 1805 DAMP-PROOFING AND WATERPROOFING

1805.1 General. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and dampproofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1202.4.

1805.1.1 Story above grade plane. Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be dampproofed in accordance with Section 1805.2 and a foundation drain shall be installed in accordance with Section 1805.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803.5.4, 1805.3 and 1805.4.1 shall not apply in this case.

1805.1.2 Under-floor space. The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803.5.4, 1805.2, 1805.3 and 1805.4 shall not apply in this case.

1805.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on one side or more.

Exception: Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.

1805.1.3 Ground-water control. Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be dampproofed in accordance with Section 1805.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

1805.2 Dampproofing. Where hydrostatic pressure will not occur as determined by Section 1803.5.4, floors and walls for other than wood foundation systems shall be dampproofed in accordance with this section. *[OSHPD 1R, 2 & 5] Wood foundation systems are not permitted by OSHPD.* Wood

foundation systems shall be constructed in accordance with AWC PWF.

1805.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m²) of acrylic modified cement, ¹/₈ inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805.3.2 or other approved methods or materials.

1805.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than ³/₈ inch (9.5 mm) of Portland cement mortar. The parging shall be coved at the footing.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1805.3 Waterproofing. Where the ground-water investigation required by Section 1803.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805.1.3, walls and floors shall be waterproofed in accordance with this section.

1805.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805.2.2.1.

1805.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made watertight utilizing approved methods and materials.

1805.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805.1.3 shall be deemed adequate for lowering the ground-water table.

1805.4.1 Floor base course. Floors of basements, except as provided for in Section 1805.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exceptions:

1. Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.
2. [HCD 1] When a capillary break is installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.

1805.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend not less than 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of

joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805.4.1, and shall be covered with not less than 6 inches (152 mm) of the same material.

1805.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

SECTION 1806 PRESUMPTIVE LOAD-BEARING VALUES OF SOILS

1806.1 Load combinations. The presumptive load-bearing values provided in Table 1806.2 shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806.2 shall be permitted to be increased by one-third where used with the alternative allowable stress design load combinations of Section 1605.2 that include wind or earthquake loads.

1806.2 Presumptive load-bearing values. The load-bearing values used in design for supporting soils near the surface shall not exceed the values specified in Table 1806.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil, the requirements of Section 1803.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical characteristics and dispositions. Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

Exception: A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared fill is adequate for the support of lightweight or temporary structures.

1806.3 Lateral load resistance. Where the presumptive values of Table 1806.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806.3.1 through 1806.3.4.

1806.3.1 Combined resistance. The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806.2.

1806.3.2 Lateral sliding resistance limit. For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, the lateral sliding resistance shall not exceed one-half the dead load.

**TABLE 1806.2
PRESUMPTIVE LOAD-BEARING VALUES**

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction ^a	Cohesion (psf) ^b
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806.3.2.

1806.3.3 Increase for depth. The lateral bearing pressures specified in Table 1806.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a value that is not greater than 15 times the tabular value.

1806.3.4 Increase for poles. Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a 1/2-inch (12.7 mm) motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

**SECTION 1807
FOUNDATION WALLS, RETAINING WALLS
AND EMBEDDED POSTS AND POLES**

1807.1 Foundation walls. Foundation walls shall be designed and constructed in accordance with Sections 1807.1.1 through 1807.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808.

1807.1.1 Design lateral soil loads. Foundation walls shall be designed for the lateral soil loads set forth in Section 1610.

1807.1.2 Unbalanced backfill height. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

1807.1.3 Rubble stone foundation walls. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Foundation walls of rough or random rubble stone shall be not less than 16 inches (406 mm) thick. Rubble stone shall not be used for foundation walls of structures assigned to Seismic Design Category C, D, E or F.

1807.1.4 Permanent wood foundation systems. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Permanent wood foundation systems shall be designed and installed in accordance with AWC PWF. Lumber and plywood shall be preservative treated in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.2) and shall be identified in accordance with Section 2303.1.9.1.

1807.1.5 Concrete and masonry foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19 or 21, as applicable.

Exception: [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Concrete and masonry foundation walls shall be permitted to be designed and constructed in accordance with Section 1807.1.6.

1807.1.6 Prescriptive design of concrete and masonry foundation walls. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Concrete and masonry foundation walls that are laterally supported at the top and bottom shall be permitted to be designed and constructed in accordance with this section.

1807.1.6.1 Foundation wall thickness. The thickness of prescriptively designed foundation walls shall be not less than the thickness of the wall supported, except that foundation walls of not less than 8-inch (203 mm) nominal width shall be permitted to support brick-veneered frame walls and 10-inch-wide (254 mm) cavity walls provided that the requirements of Section 1807.1.6.2 or 1807.1.6.3 are met.

1807.1.6.2 Concrete foundation walls. Concrete foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.2.
2. The size and spacing of vertical reinforcement shown in Table 1807.1.6.2 are based on the use of reinforcement with a minimum yield strength of 60,000 pounds per square inch (psi) (414 MPa). Vertical reinforcement with a minimum yield strength of 40,000 psi (276 MPa) or 50,000

psi (345 MPa) shall be permitted, provided that the same size bar is used and the spacing shown in the table is reduced by multiplying the spacing by 0.67 or 0.83, respectively.

3. Vertical reinforcement, where required, shall be placed nearest the inside face of the wall a distance, d , from the outside face (soil face) of the wall. The distance, d , is equal to the wall thickness, t , minus 1.25 inches (32 mm) plus one-half the bar diameter, d_b , [$d = t - (1.25 + d_b / 2)$]. The reinforcement shall be placed within a tolerance of $\pm 3/8$ inch (9.5 mm) where d is less than or equal to 8 inches (203 mm) or $\pm 1/2$ inch (12.7 mm) where d is greater than 8 inches (203 mm).
4. In lieu of the reinforcement shown in Table 1807.1.6.2, smaller reinforcing bar sizes with

closer spacings that provide an equivalent cross-sectional area of reinforcement per unit length shall be permitted.

5. Concrete cover for reinforcement measured from the inside face of the wall shall be not less than $3/4$ inch (19.1 mm). Concrete cover for reinforcement measured from the outside face of the wall shall be not less than $1\frac{1}{2}$ inches (38 mm) for No. 5 bars and smaller, and not less than 2 inches (51 mm) for larger bars.
6. Concrete shall have a specified compressive strength, f'_c of not less than 2,500 psi (17.2 MPa).
7. The unfactored axial load per linear foot of wall shall not exceed $1.2 t f'_c$ where t is the specified wall thickness in inches.

**TABLE 1807.1.6.2
CONCRETE FOUNDATION WALLS^{b,c}**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^e (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)								
		Design lateral soil load ^a (psf per foot of depth)								
		30 ^d			45 ^d			60		
		Minimum wall thickness (inches)								
		7.5	9.5	11.5	7.5	9.5	11.5	7.5	9.5	11.5
5	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
6	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	PC	PC	PC
7	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 48	PC	PC
	7	PC	PC	PC	#5 at 46	PC	PC	#6 at 48	PC	PC
8	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 43	PC	PC
	7	PC	PC	PC	#5 at 41	PC	PC	#6 at 43	PC	PC
9	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 39	PC	PC
	7	PC	PC	PC	#5 at 37	PC	PC	#6 at 38	#5 at 37	PC
10	8	#5 at 41	PC	PC	#6 at 38	#5 at 37	PC	#7 at 39	#6 at 39	#4 at 48
	9 ^d	#6 at 46	PC	PC	#7 at 41	#6 at 41	PC	#7 at 31	#7 at 41	#6 at 39
	4	PC	PC	PC	PC	PC	PC	PC	PC	PC
10	5	PC	PC	PC	PC	PC	PC	PC	PC	PC
	6	PC	PC	PC	PC	PC	PC	#5 at 37	PC	PC
	7	PC	PC	PC	PC	PC	PC	#6 at 35	#6 at 48	PC
	8	#5 at 38	PC	PC	#7 at 47	#6 at 47	PC	#7 at 35	#7 at 47	#6 at 45
	9 ^d	#6 at 41	#4 at 48	PC	#7 at 37	#7 at 48	#4 at 48	#6 at 22	#7 at 37	#7 at 47
	10 ^d	#7 at 45	#6 at 45	PC	#7 at 31	#7 at 40	#6 at 38	#6 at 22	#7 at 30	#7 at 38

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.2.

c. PC = Plain Concrete.

d. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).

e. For height of unbalanced backfill, see Section 1807.1.2.

1807.1.6.2.1 Seismic requirements. Based on the seismic design category assigned to the structure in accordance with Section 1613, concrete foundation walls designed using Table 1807.1.6.2 shall be subject to the following limitations:

1. Seismic Design Categories A and B. Not less than one No. 5 bar shall be provided around window, door and similar sized openings. The bar shall be anchored to develop f_y in tension at the corners of openings.
2. Seismic Design Categories C, D, E and F. Tables shall not be used except as allowed for plain concrete members in Section 1905.1.7.

1807.1.6.3 Masonry foundation walls. Masonry foundation walls shall comply with the following:

1. The thickness shall comply with the requirements of Table 1807.1.6.3(1) for plain masonry walls or Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4) for masonry walls with reinforcement.
2. Vertical reinforcement shall have a minimum yield strength of 60,000 psi (414 MPa).
3. The specified location of the reinforcement shall equal or exceed the effective depth distance, d , noted in Tables 1807.1.6.3(2), 1807.1.6.3(3) and 1807.1.6.3(4) and shall be measured from the face of the exterior (soil) side of the wall to the center of the vertical reinforcement. The reinforcement shall be placed

within the tolerances specified in TMS 602, Article 3.4.B.11, of the specified location.

4. Grout shall comply with Section 2103.3.
5. Concrete masonry units shall comply with ASTM C90.
6. Clay masonry units shall comply with ASTM C652 for hollow brick, except compliance with ASTM C62 or ASTM C216 shall be permitted where solid masonry units are installed in accordance with Table 1807.1.6.3(1) for plain masonry.
7. Masonry units shall be laid in running bond and installed with Type M or S mortar in accordance with Section 2103.2.1.
8. The unfactored axial load per linear foot of wall shall not exceed $1.2 t f'_m$ where t is the specified wall thickness in inches and f'_m is the specified compressive strength of masonry in pounds per square inch.
9. Not less than 4 inches (102 mm) of solid masonry shall be provided at girder supports at the top of hollow masonry unit foundation walls.
10. Corbeling of masonry shall be in accordance with Section 2104.1. Where an 8-inch (203 mm) wall is corbeled, the top corbel shall not extend higher than the bottom of the floor framing and shall be a full course of headers not less than 6 inches (152 mm) in length or the top course bed joint shall be tied to the vertical wall

**TABLE 1807.1.6.3(1)
PLAIN MASONRY FOUNDATION WALLS^{a, b, c}**

MAXIMUM WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^e (feet)	MINIMUM NOMINAL WALL THICKNESS (inches)		
		Design lateral soil loads (psf per foot of depth)		
		30'	45'	60
7	4 (or less)	8	8	8
	5	8	10	10
	6	10	12	10 (solid ^c)
	7	12	10 (solid ^c)	10 (solid ^c)
8	4 (or less)	8	8	8
	5	8	10	12
	6	10	12	12 (solid ^c)
	7	12	12 (solid ^c)	Note d
	8	10 (solid ^c)	12 (solid ^c)	Note d
9	4 (or less)	8	8	8
	5	8	10	12
	6	12	12	12 (solid ^c)
	7	12(solid ^c)	12 (solid ^c)	Note d
	8	12(solid ^c)	Note d	Note d
	9 ^f	Note d	Note d	Note d

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

- a. For design lateral soil loads, see Section 1610.
- b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.
- c. Solid grouted hollow units or solid masonry units.
- d. A design in compliance with Chapter 21 or reinforcement in accordance with Table 1807.1.6.3(2) is required.
- e. For height of unbalanced backfill, see Section 1807.1.2.
- f. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable (see Section 1610).

projection. The tie shall be W2.8 (4.8 mm) and spaced at a maximum horizontal distance of 36 inches (914 mm). The hollow space behind the corbelled masonry shall be filled with *mortar* or grout.

1807.1.6.3.1 Alternative foundation wall reinforcement. In lieu of the reinforcement provisions for masonry foundation walls in Table 1807.1.6.3(2), 1807.1.6.3(3) or 1807.1.6.3(4), alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per linear foot (mm) of wall shall be permitted to be used, provided that the spacing of reinforcement does not exceed 72 inches (1829 mm) and reinforcing bar sizes do not exceed No. 11.

1807.1.6.3.2 Seismic requirements. Based on the seismic design category assigned to the structure in accordance with Section 1613, masonry foundation

walls designed using Tables 1807.1.6.3(1) through 1807.1.6.3(4) shall be subject to the following limitations:

1. Seismic Design Categories A and B. No additional seismic requirements.
2. Seismic Design Category C. A design using Tables 1807.1.6.3(1) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.3 of TMS 402.
3. Seismic Design Category D. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.4 of TMS 402.
4. Seismic Design Categories E and F. A design using Tables 1807.1.6.3(2) through 1807.1.6.3(4) is subject to the seismic requirements of Section 7.4.5 of TMS 402.

TABLE 1807.1.6.3(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE $d \geq 5$ INCHES^{a, b, c}

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^d (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load ^a (psf per foot of depth)		
		30°	45°	60
7-4	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-4	#5 at 48	#6 at 48	#7 at 48
8-0	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#4 at 48
	6-0	#4 at 48	#5 at 48	#5 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#5 at 48	#6 at 48	#7 at 48
8-8	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-8 ^e	#6 at 48	#7 at 48	#8 at 48
9-4	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
	9-4 ^e	#7 at 48	#8 at 48	#9 at 48
10-0	4-0 (or less)	#4 at 48	#4 at 48	#4 at 48
	5-0	#4 at 48	#4 at 48	#5 at 48
	6-0	#4 at 48	#5 at 48	#6 at 48
	7-0	#5 at 48	#6 at 48	#7 at 48
	8-0	#6 at 48	#7 at 48	#8 at 48
	9-0 ^e	#7 at 48	#8 at 48	#9 at 48
	10-10 ^e	#7 at 48	#9 at 48	#9 at 48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

a. For design lateral soil loads, see Section 1610.

b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.

c. For alternative reinforcement, see Section 1807.1.6.3.1.

d. For height of unbalanced backfill, see Section 1807.1.2.

e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

SOILS AND FOUNDATIONS

1807.2 Retaining walls. Retaining walls shall be designed in accordance with Sections 1807.2.1 through 1807.2.5. *[OSHPD 1R, 2 & 5] Freestanding cantilever walls shall be designed in accordance with Section 1807.2.5.*

1807.2.1 General. Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1807.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil loads set forth in Section 1610. *[OSHPD 1R, 2 & 5] Retaining wall lateral soil loads determined by a geotechnical investigation report in accordance with Section 1803.5.12 and shall not be less than 80 percent of the lateral soil loads determined in accordance with Section 1610. For use with the load combinations, lateral soil loads due to gravity load surcharge shall be considered gravity loads and seismic earth pressure increases due to earthquake shall be considered as seismic loads.* For structures assigned to Seismic Design Category D, E, or F, the design of retain-

ing walls supporting more than 6 feet (1829 mm) of backfill height shall incorporate the additional seismic lateral earth pressure in accordance with the geotechnical investigation where required in Section 1803.2.

1807.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605 shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nominal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

TABLE 1807.1.6.3(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE d ≥ 6.75 INCHES^{a, b, c}

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^d (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load ^a (psf per foot of depth)		
		30°	45°	60
7-4	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-4	#4 at 56	#5 at 56	#6 at 56
8-0	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
8-8	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#4 at 56	#5 at 56
	7-0	#4 at 56	#5 at 56	#6 at 56
8-8°	8-8°	#5 at 56	#7 at 56	#8 at 56
	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
9-4	7-0	#4 at 56	#5 at 56	#6 at 56
	8-0	#5 at 56	#6 at 56	#7 at 56
	9-4°	#6 at 56	#7 at 56	#7 at 56
	4-0 (or less)	#4 at 56	#4 at 56	#4 at 56
10-0	5-0	#4 at 56	#4 at 56	#4 at 56
	6-0	#4 at 56	#5 at 56	#5 at 56
	7-0	#5 at 56	#6 at 56	#7 at 56
	8-0	#5 at 56	#7 at 56	#8 at 56
	9-0°	#6 at 56	#7 at 56	#9 at 56
	10-0°	#7 at 56	#8 at 56	#9 at 56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 1.157 kPa/m.

- a. For design lateral soil loads, see Section 1610.
- b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.
- c. For alternative reinforcement, see Section 1807.1.6.3.1.
- d. For height of unbalanced backfill, see Section 1807.1.2.
- e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

1807.2.4 Segmental retaining walls. Dry-cast concrete units used in the construction of segmental retaining walls shall comply with ASTM C1372.

1807.2.5 Freestanding cantilever walls. [OSHPD 1R, 2 & 5] A stability check against the possibility of overturning shall be performed for isolated spread footings which support freestanding cantilever walls. The stability check shall be made by dividing R_p used for the wall by 2.0. The allowable soil pressure may be doubled for this evaluation.

Exception: For overturning about the principal axis of rectangular footings with symmetrical vertical loading and the design lateral force applied, a triangular or trapezoidal soil pressure distribution which covers the full width of the footing will meet the stability requirement.

1807.3 Embedded posts and poles. Designs to resist both axial and lateral loads employing posts or poles as columns

embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807.3.1 through 1807.3.3.

1807.3.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWWA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

**TABLE 1807.1.6.3(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCEMENT WHERE $d \geq 8.75$ INCHES^{a, b, c}**

MAXIMUM WALL HEIGHT (feet-inches)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^d (feet-inches)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Design lateral soil load ^a (psf per foot of depth)		
		30°	45°	60
7-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-4	#4 at 72	#5 at 72	#6 at 72
8-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
8-8	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
8-8	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#4 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
9-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
9-4	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#5 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72
10-0	4 (or less)	#4 at 72	#4 at 72	#4 at 72
	5-0	#4 at 72	#4 at 72	#4 at 72
	6-0	#4 at 72	#5 at 72	#5 at 72
	7-0	#4 at 72	#6 at 72	#6 at 72

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/m.

- a. For design lateral soil loads, see Section 1610.
- b. Provisions for this table are based on design and construction requirements specified in Section 1807.1.6.3.
- c. For alternative reinforcement, see Section 1807.1.6.3.1.
- d. For height of unbalanced backfill, see Section 1807.1.2.
- e. Where unbalanced backfill height exceeds 8 feet and design lateral soil loads from Table 1610.1 are used, the requirements for 30 and 45 psf per foot of depth are not applicable. See Section 1610.

1807.3.2 Design criteria. The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807.3.2.1 through 1807.3.2.3, or by other methods approved by the building official.

1807.3.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral loads where lateral constraint is not provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where lateral constraint is not provided above the ground surface, such as by a structural diaphragm.

$$d = 0.5A \{ 1 + [1 + (4.36h/A)]^{1/2} \} \quad \text{(Equation 18-1)}$$

where:

$$A = 2.34P/(S_1b).$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet (m) from ground surface to point of application of "P."

P = Applied lateral force in pounds (kN).

S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

1807.3.2.2 Constrained. The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or pavement.

$$d = \sqrt{\frac{4.25Ph}{S_3b}} \quad \text{(Equation 18-2)}$$

or alternatively

$$d = \sqrt{\frac{4.25M_g}{S_3b}} \quad \text{(Equation 18-3)}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).

S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1806.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

1807.3.2.3 Vertical load. The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806.2.

1807.3.3 Backfill. The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8

MPa). The hole shall be not less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.

2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

SECTION 1808 FOUNDATIONS

1808.1 General. Foundations shall be designed and constructed in accordance with Sections 1808.2 through 1808.9. Shallow foundations shall satisfy the requirements of Section 1809. Deep foundations shall satisfy the requirements of Section 1810.

1808.2 Design for capacity and settlement. Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is minimized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808.6.

1808.3 Design loads. Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 2.3 or 2.4 of ASCE 7 or the alternative allowable stress design load combinations of Section 1605.2. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607.12 and 1607.14, shall be permitted to be used in the design of foundations.

1808.3.1 Seismic overturning. Where foundations are proportioned using the load combinations of Section 2.3 or 2.4 of ASCE 7 and the computation of seismic overturning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

1808.3.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or the surcharge. Existing footings or foundations that will be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against detrimental lateral or vertical movement or both.

Exception: Minor grading for landscaping purposes shall be permitted where done with walk-behind equipment, where the grade is not increased more than 1 foot (305 mm) from original design grade or where approved by the building official.

1808.4 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

1808.5 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

1808.6 Design for expansive soils. Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808.6.1 or 1808.6.2.

Exceptions: Foundation design need not comply with Section 1808.6.1 or 1808.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808.6.3.
2. The building official approves stabilization of the soil in accordance with Section 1808.6.4.

1808.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1808.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with WRI/CRSI *Design of Slab-on-Ground Foundations* or PTI DC 10.5. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI *Design of Slab-on-Ground Foundations* and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5. It shall be

permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

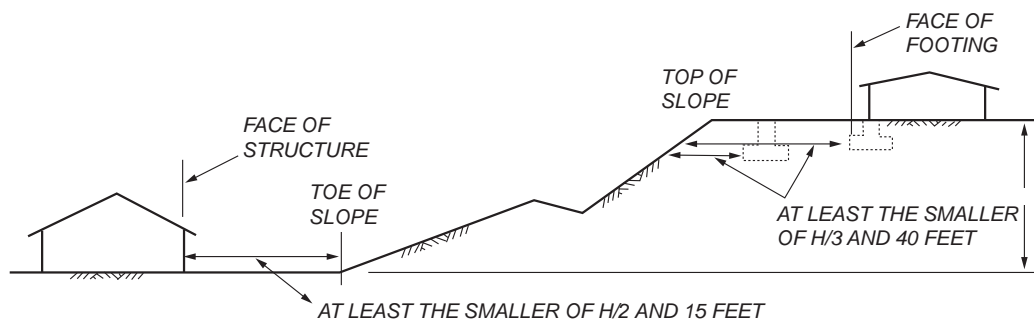
1808.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804.5 or 1804.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided that the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

1808.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808.6.1 or 1808.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

1808.7 Foundations on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808.7.1 through 1808.7.5.

1808.7.1 Building clearance from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808.7.5 and Figure 1808.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.



For SI: 1 foot = 304.8 mm.

FIGURE 1808.7.1
FOUNDATION CLEARANCES FROM SLOPES

1808.7.2 Foundation setback from descending slope surface. Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808.7.5 and Figure 1808.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

1808.7.3 Pools. The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.

1808.7.4 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

1808.7.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803.5.10.

1808.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808.8.1 through 1808.8.6 and the provisions of Chapter 19.

Exception: *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.* Where concrete footings supporting walls of light-frame construction are designed in accordance with Table 1809.7, a specific design in accordance with Chapter 19 is not required.

1808.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808.8.1.

Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

1808.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808.8.2. Longitudinal bars spaced less than 1½ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.5.1.3.5 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

1808.8.3 Placement of concrete. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

1808.8.4 Protection of concrete. Concrete foundations shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

1808.8.5 Forming of concrete. Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Section 26.11 of ACI 318.

**TABLE 1808.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category A, B or C <i>[OSHPD 1R, 2 & 5] Not permitted by OSHPD.</i>	2,500 psi
2a. Foundations for Group R or U occupancies of light-frame construction, two stories or less in height, assigned to Seismic Design Category D, E or F <i>[OSHPD 1R, 2 & 5] Not permitted by OSHPD.</i>	2,500 psi
2b. Foundations for other structures assigned to Seismic Design Category D, E or F	3,000 psi
3. Precast nonprestressed driven piles	4,000 psi
4. Socketed drilled shafts	4,000 psi
5. Micropiles	4,000 psi
6. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

**TABLE 1808.8.2
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.5 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	3 inches 2 inches In accordance with Section 20.5.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	2.5 inches In accordance with Section 20.5.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

1808.8.6 Seismic requirements. [OSHPD IR, 2 & 5] See Section 1905 for additional requirements for foundations of structures assigned to Seismic Design Category C, D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of Section 18.13 of ACI 318 shall apply where not in conflict with the provisions of Sections 1808 through 1810.

Exceptions: [OSHPD IR, 2 & 5] Not permitted by OSHPD.

1. Detached one- and two-family dwellings of light-frame construction and two stories or less above grade plane are not required to comply with the provisions of Section 18.13 of ACI 318.
2. Section 18.13.4.3(a) of ACI 318 shall not apply.

1808.9 Vertical masonry foundation elements. Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402.

SECTION 1809 SHALLOW FOUNDATIONS

1809.1 General. Shallow foundations shall be designed and constructed in accordance with Sections 1809.2 through 1809.13.

1809.2 Supporting soils. Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804.5. CLSM shall be placed in accordance with Section 1804.6.

1809.3 Stepped footings. The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10-percent slope).

[OSHPD IR, 2 & 5] Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50-percent slope) unless otherwise recommended by a geotechnical report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.

1809.4 Depth and width of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

1809.5 Frost protection. Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.
2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I.
2. Area of 600 square feet (56 m²) or less for light-frame construction or 400 square feet (37 m²) or less for other than light-frame construction.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

1809.5.1 Frost protection at required exits. Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required exit doors.

1809.6 Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30

degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1809.7 Prescriptive footings for light-frame construction. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Where a specific design is not provided, concrete or masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

**TABLE 1809.7
PRESCRIPTIVE FOOTINGS SUPPORTING
WALLS OF LIGHT-FRAME CONSTRUCTION^{a, b, c, d, e}**

NUMBER OF FLOORS SUPPORTED BY THE FOOTING ^f	WIDTH OF FOOTING (inches)	THICKNESS OF FOOTING (inches)
1	12	6
2	15	6
3	18	8 ^g

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Depth of footings shall be in accordance with Section 1809.4.
- b. The ground under the floor shall be permitted to be excavated to the elevation of the top of the footing.
- c. Interior stud-bearing walls shall be permitted to be supported by isolated footings. The footing width and length shall be twice the width shown in this table, and footings shall be spaced not more than 6 feet on center.
- d. See Section 1905 for additional requirements for concrete footings of structures assigned to Seismic Design Category C, D, E or F.
- e. For thickness of foundation walls, see Section 1807.1.6.
- f. Footings shall be permitted to support a roof in addition to the stipulated number of floors. Footings supporting roof only shall be as required for supporting one floor.
- g. Plain concrete footings for Group R-3 occupancies shall be permitted to be 6 inches thick.

1809.8 Plain concrete footings. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. The edge thickness of plain concrete footings supporting walls of other than light-frame construction shall be not less than 8 inches (203 mm) where placed on soil or rock.

Exception: For plain concrete footings supporting Group R-3 occupancies, the edge thickness is permitted to be 6 inches (152 mm), provided that the footing does not extend beyond a distance greater than the thickness of the footing on either side of the supported wall.

1809.9 Masonry-unit footings. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. The design, materials and construction of masonry-unit footings shall comply with Sections 1809.9.1 and 1809.9.2, and the provisions of Chapter 21.

Exception: Where a specific design is not provided, masonry-unit footings supporting walls of light-frame construction shall be permitted to be designed in accordance with Table 1809.7.

1809.9.1 Dimensions. Masonry-unit footings shall be laid in Type M or S mortar complying with Section 2103.2.1 and the depth shall be not less than twice the projection beyond the wall, pier or column. The width shall be not less than 8 inches (203 mm) wider than the wall supported thereon.

1809.9.2 Offsets. The maximum offset of each course in brick foundation walls stepped up from the footings shall be 1½ inches (38 mm) where laid in single courses, and 3 inches (76 mm) where laid in double courses.

1809.10 Pier and curtain wall foundations. Except in Seismic Design Categories D, E and F, pier and curtain wall foundations shall be permitted to be used to support light-frame construction not more than two stories above grade plane, provided that the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings bonded integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or 3⁵/₈ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced 6 feet (1829 mm) on center (o.c.).
3. Piers shall be constructed in accordance with Chapter 21 and the following:
 - 3.1. The unsupported height of the masonry piers shall not exceed 10 times their least dimension.
 - 3.2. Where structural clay tile or hollow concrete masonry units are used for piers supporting beams and girders, the cellular spaces shall be filled solidly with concrete or Type M or S mortar.

Exception: Unfilled hollow piers shall be permitted where the unsupported height of the pier is not more than four times its least dimension.
 - 3.3. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete or the cavities of the top course shall be filled with concrete or grout.

4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood frame walls and floors shall not be more than 4 feet (1219 mm) in height.

5. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry, nor 12 inches (305 mm) for hollow masonry.

1809.11 Steel grillage footings. Grillage footings of structural steel elements shall be separated with approved steel spacers and be entirely encased in concrete with not less than 6 inches (152 mm) on the bottom and not less than 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1809.12 Timber footings. [OSHPD 1R, 2 & 5] Not permitted by OSHPD. Timber footings shall be permitted for buildings of Type V construction and as otherwise approved by the building official. Such footings shall be treated in accordance with AWPA U1 (Commodity Specification A, Use Category 4B). Treated timbers are not required where placed entirely below permanent water level, or where used as capping for wood piles that project above the water level over submerged or marsh lands. The compressive stresses

perpendicular to grain in untreated timber footings supported on treated piles shall not exceed 70 percent of the allowable stresses for the species and grade of timber as specified in the ANSI/AWC NDS.

1809.13 Footing seismic ties. Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Chapter 20 of ASCE 7 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient, S_{DS} , divided by 10 and 25 percent of the smaller footing design gravity load.

1809.14 Pipes and Trenches. [OSHPD 1R, 2 & 5] *Unless otherwise recommended by the soils report, open or back-filled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50-percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.*

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

Exception: *Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional in responsible charge and the enforcement agent.*

SECTION 1810 DEEP FOUNDATIONS

1810.1 General. Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810.1 through 1810.4.

1810.1.1 Geotechnical investigation. Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803.

1810.1.2 Use of existing deep foundation elements. Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

1810.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate

lateral support is provided in accordance with Section 1810.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

1810.1.4 Special types of deep foundations. The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

1810.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810.2.1 through 1810.2.5.

1810.2.1 Lateral support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

1810.2.2 Stability. Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered to be braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced not less than 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is not less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-

family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided that the centers of the elements are located within the width of the supported wall.

1810.2.3 Settlement. The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810.2.4 Lateral loads. The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

1810.2.4.1 Seismic Design Categories D through F.

For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 1810.3.8.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810.3.9.4.2.2.

1810.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element. Group effects shall be evaluated using a generally accepted method of analysis; the analysis for uplift of grouped elements with center-to-center spacing less than three times the least horizontal dimension of an element shall be evaluated in accordance with Section 1810.3.3.1.6.

1810.3 Design and detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810.3.1 through 1810.3.13.

1810.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810.3.1.1 through 1810.3.1.6, as applicable.

1810.3.1.1 Design methods for concrete elements.

Where concrete deep foundations are laterally supported in accordance with Section 1810.2.1 for the entire height and applied forces cause bending moments not greater than those resulting from accidental eccentricities, structural design of the element using the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2 and the allowable stresses specified in this chapter shall be permitted. Otherwise, the structural design of concrete deep foundation elements shall use the strength load combinations specified in ASCE 7, Section 2.3 and approved strength design methods.

1810.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

1810.3.1.3 Mislocation. The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by not less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

1810.3.1.4 Driven piles. Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1810.3.1.5 Helical piles. Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

1810.3.1.5.1 Helical piles seismic requirements.

[OSHPD 1R, 2B & 5] For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to design strength determined by using load combinations in ASCE 7, Section 2.3.6.

Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least $1/10$ inch corrosion allowance.

Helical piles shall not be considered as carrying any horizontal loads.

1810.3.1.6 Casings. Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist

collapse and sufficiently watertight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810.3.6.

1810.3.2 Materials. The materials used in deep foundation elements shall satisfy the requirements of Sections 1810.3.2.1 through 1810.3.2.8, as applicable.

1810.3.2.1 Concrete. Where concrete is cast in a steel pipe or where an enlarged base is formed by compacting concrete, the maximum size for coarse aggregate shall be $\frac{3}{4}$ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

1810.3.2.1.2 ACI 318 Equation (25.7.3.3). Where this chapter requires detailing of concrete deep foundation elements in accordance with Section 18.7.5.4 of ACI 318, compliance with Equation (25.7.3.3) of ACI 318 shall not be required.

1810.3.2.2 Prestressing steel. Prestressing steel shall conform to ASTM A416.

1810.3.2.3 Steel. Structural steel H-piles and structural steel sheet piling shall conform to the material requirements in ASTM A6. Steel pipe piles shall conform to the material requirements in ASTM A252. Fully welded steel piles shall be fabricated from plates that conform to the material requirements in ASTM A36, ASTM A283, ASTM A572, ASTM A588 or ASTM A690.

1810.3.2.4 Timber. *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.* Timber deep foundation elements shall be designed as piles or poles in accordance with ANSI/AWC NDS. Round timber elements shall conform to ASTM D25. Sawn timber elements shall conform to DOC PS-20.

1810.3.2.4.1 Preservative treatment. Timber deep foundation elements used to support permanent structures shall be treated in accordance with this section unless it is established that the tops of the untreated timber elements will be below the lowest ground-water level assumed to exist during the life of the structure. Preservative and minimum final retention shall be in accordance with AWWA U1 (Commodity Specification E, Use Category 4C) for round timber elements and AWWA U1 (Commodity Specification A, Use Category 4B) for sawn timber elements. Preservative-treated timber elements shall be subject to a quality control program administered by an approved agency. Element cutoffs shall be treated in accordance with AWWA M4.

1810.3.2.5 Protection of materials. Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1810.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810.3.2.6.

1810.3.2.7 Increased allowable compressive stress for cased mandrel-driven cast-in-place elements. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.
3. The thickness of the casing shall be not less than manufacturer's standard gage No.14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength (F_y) to specified compressive strength (f'_c) shall be not less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

1810.3.2.8 Justification of higher allowable stresses. Use of allowable stresses greater than those specified in Section 1810.3.2.6 shall be permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include the following:

1. A geotechnical investigation in accordance with Section 1803.
2. Load tests in accordance with Section 1810.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

**TABLE 1810.3.2.6
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS**

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS ^a
1. Concrete or grout in compression ^b Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 or Section 1810.3.5.3.4 Cast-in-place in other permanent casing or rock Cast-in-place without a permanent casing Precast nonprestressed Precast prestressed	$0.4 f'_c$ $0.33 f'_c$ $0.3 f'_c$ $0.33 f'_c$ $0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \leq 30,000$ psi
3. Steel in compression Cores within concrete-filled pipes or tubes Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Pipes or tubes for micropiles Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.5 F_y \leq 32,000$ psi $0.4 F_y \leq 32,000$ psi $0.35 F_y \leq 24,000$ psi $0.6 F_y \leq 0.5 F_u$
4. Nonprestressed reinforcement in tension Within micropiles Other conditions For load combinations that do not include wind or seismic loads For load combinations that include wind or seismic loads	$0.6 f_y$ $0.5 f_y \leq 30,000$ psi $0.5 f_y \leq 40,000$ psi
5. Steel in tension Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.35 F_y \leq 24,000$ psi $0.6 F_y \leq 0.5 F_u$
6. Timber	In accordance with the ANSI/AWC NDS

- a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.
- b. The stresses specified apply to the gross cross-sectional area of the concrete for precast prestressed piles and to the net cross-sectional area for all other piles. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the outer edge of the concrete cross-section.

1810.3.3 Determination of allowable loads. The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

1810.3.3.1 Allowable axial load. The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810.3.3.1.1 through 1810.3.3.1.9.

Exception: Where approved by the building official, load testing is not required.

1810.3.3.1.1 Driving criteria. The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810.3.3.1.2. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements.

The use of a follower is permitted only with the approval of the building official. The introduction of fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

1810.3.3.1.2 Load tests. Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810.3.2.6, where the design load for any deep foundation element is in doubt, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D1143 or ASTM D4945. One element or more shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential

settlements at design load in accordance with Section 1810.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (for example, net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance.

1810.3.3.1.3 Load test evaluation methods. It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90-percent Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1810.3.3.1.4 Allowable shaft resistance. The assumed shaft resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806.2, up to 500 psf (24 kPa), unless a greater value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803 or a greater value is substantiated by a load test in accordance with Section 1810.3.3.1.2. Shaft resistance and end-bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803.

1810.3.3.1.5 Uplift capacity of a single deep foundation element. Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810.3.3.1.2, using the results of load tests conducted in accordance with ASTM D3689, divided by a factor of safety of two.

Exception: Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

1810.3.3.1.6 Allowable uplift load of grouped deep foundation elements. For grouped deep foundation elements subjected to uplift, the allowable uplift load for the group shall be calculated by a generally accepted method of analysis. Where the deep founda-

tion elements in the group are placed at a center-to-center spacing less than three times the least horizontal dimension of the largest single element, the allowable uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual allowable uplift load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

1810.3.3.1.7 Load-bearing capacity. Deep foundation elements shall develop ultimate load capacities of not less than twice the design working loads in the designated load-bearing layers. Analysis shall show that soil layers underlying the designated load-bearing layers do not cause the load-bearing capacity safety factor to be less than two.

1810.3.3.1.8 Bent deep foundation elements. The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

1810.3.3.1.9 Helical piles. The allowable axial design load, P_a , of helical piles shall be determined as follows:

$$P_a = 0.5 P_u \quad \text{(Equation 18-4)}$$

where P_u is the least value of:

1. Base capacity plus shaft resistance of the helical pile. The base capacity is equal to the sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests where required by Section 1810.3.3.1.2. *[OSHPD IR, 2B & 5] Load tests are required to determine the ultimate capacity.*
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

1810.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests to not less than twice the proposed design working load. The resulting allowable load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the

top of foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810.3.4 Subsiding soils or strata. Where deep foundation elements are installed through subsiding soils or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces potentially imposed on the elements by the subsiding upper strata.

Where the influence of subsiding soils or strata is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

1810.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810.3.5.1 through 1810.3.5.3, as applicable.

1810.3.5.1 Precast. The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

1810.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810.3.5.2.1 Cased. Cast-in-place or grouted-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

1810.3.5.2.2 Uncased. Cast-in-place or grouted-in-place deep foundation elements without a permanent casing shall have a specified diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the specified diameter.

Exception: The length of the element is permitted to exceed 30 times the specified diameter, provided that the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

1810.3.5.2.3 Micropiles. Micropiles shall have a nominal diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810.3.5 shall not apply to micropiles.

1810.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

1810.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $\frac{3}{8}$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810.3.5.3.2 Fully welded steel piles fabricated from plates. Sections of fully welded steel piles fabricated from plates shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $\frac{3}{8}$ inch (9.5 mm).

1810.3.5.3.3 Structural steel sheet piling. Individual sections of structural steel sheet piling shall conform to the profile indicated by the manufacturer, and shall conform to the general requirements specified by ASTM A6.

[OSHPD 1R, 2 & 5] Installation of sheet piling shall satisfy inspection, monitoring and observation requirements in Sections 1812.6 and 1812.7.

1810.3.5.3.4 Steel pipes and tubes. Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have not less than 0.34 square inch (219 mm²) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C,

D, E or F shall have a wall thickness of not less than $\frac{3}{16}$ inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than $\frac{3}{8}$ inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be $\frac{1}{10}$ inch (2.5 mm).

1810.3.5.3.5 Helical piles. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

1810.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Exception: For buildings assigned to Seismic Design Category A or B, splices need not comply with the 50-percent tension and bending strength requirements where justified by supporting data.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810.3.6.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element.
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.7 Top of element detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

1810.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ACI 318.

Exceptions:

1. For precast prestressed piles in Seismic Design Category C, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.4 of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_o . In such cases, minimum transverse reinforcement index shall be as specified in Section 13.4.5.6 of ACI 318. **[OSHPD 1R, 2B & 5] not permitted by OSHPD.**
2. For precast prestressed piles in Seismic Design Categories D through F, the minimum volumetric ratio of spirals or circular hoops required by Section 18.13.5.10.5(c) of ACI 318 shall not apply in cases where the design includes full consideration of load combinations specified in ASCE 7, Section 2.3.6 or Section 2.4.5 and the applicable overstrength factor, Ω_o . In such cases, minimum transverse reinforcement shall be as specified in Section 13.4.5.6 of ACI 318. **[OSHPD 1R, 2B & 5] not permitted by OSHPD.**

[OSHPD 1R, 2B & 5] Exception: Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_o , the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.

1810.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810.3.9.1 through 1810.3.9.6.

1810.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3 \sqrt{f'_c} S_m \quad \text{(Equation 18-5)}$$

$$\text{For SI: } \phi M_n = 0.25 \sqrt{f'_c} S_m$$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm³).

1810.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of ASCE 7, Section 2.3 exceeds the design cracking moment determined in

accordance with Section 1810.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

1810.3.9.3 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semifluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the building official.

1810.3.9.4 Seismic reinforcement. Where a structure is assigned to Seismic Design Category C, reinforcement shall be provided in accordance with Section 1810.3.9.4.1. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where the lateral load, E, to the top of the ele-

ment does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810.2.1.

3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810.2.1.
4. Closed ties or spirals where required by Section 1810.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810.3.9.4.1 Seismic reinforcement in Seismic Design Category C. For structures assigned to Seismic Design Category C, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.0025, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-third of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals with a minimum $\frac{3}{8}$ inch (9.5 mm) diameter. Spacing of transverse reinforcement shall not exceed the smaller of 6 inches (152 mm) or 8-longitudinal-bar diameters, within a distance of three times the least element dimension from the bottom of the pile cap. Spacing of transverse reinforcement shall not exceed 16 longitudinal bar

diameters throughout the remainder of the reinforced length.

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than the manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810.3.9.4.2.1 or 1810.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.

2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension *at* the bottom of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(g) of ACI 318 shall be permitted. *[OSHPD 1R, 2 & 5] A transverse spiral reinforcement ratio of not less than one-half of that required in Section 18.7.5.4 of ACI 318 shall be permitted for concrete deep foundation elements.*

1810.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension of the pile cap and within seven times the least element dimension of the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay.

1810.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810.3.10.1 through 1810.3.10.4.

1810.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $\frac{3}{16}$ inch (4.8 mm). Splices shall comply with Section 1810.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810.3.10.4 Seismic reinforcement. For structures assigned to Seismic Design Category C, a permanent steel casing shall be provided from the top of the micropile down to the point of zero curvature. For structures assigned to Seismic Design Category D, E or F, the micropile shall be considered as an alternative system in accordance with Sections 104.11 or 1.8.7, as applicable. The alternative system design, supporting documentation and test data shall be submitted to the building official for review and approval.

1810.3.10.4.1 Seismic requirements. [OSHPD 1R, 2B & 5] For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of $\frac{3}{8}$ inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810.3.3 by at least two project specific pre-production tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to

design strength determined by using load combinations in ASCE 7, Section 2.3.6.

Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 18.13.5.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least $\frac{1}{16}$ -inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

1810.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. [OSHPD 1R, 2 & 5] A combined pile raft foundation shall be an alternative system. The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap in accordance with ACI 318.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
 - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element.

- 1.2. The nominal tensile strength of a steel element.
- 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.
3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7, Section 12.4.3 or 12.14.3.2.
2. Connections need not be provided where the foundation or supported structure does not rely on the tensile capacity of the piles for stability under the design seismic force. *[OSHPD 1R, 2B & 5] Not permitted by OSHPD.*

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810.3.12 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7. *[OSHPD 1R, 2B & 5] Need not comply with Section 18.13.3 of ACI 318.*

1810.3.13 Seismic ties. Seismic ties shall comply with the provisions of ACI 318.

Exception: In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior

decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

1810.4 Installation. Deep foundations shall be installed in accordance with Section 1810.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

1810.4.1 Structural integrity. Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that would adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

1810.4.1.1 Compressive strength of precast concrete piles. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of not less than 75 percent of the specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810.4.1.2 Shafts in unstable soils. Where cast-in-place deep foundation elements are formed through unstable soils, the open hole shall be stabilized by a casing, slurry, or other approved method prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

1810.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If driving near uncased concrete elements causes the concrete surface in any completed element to rise or drop significantly or bleed additional water, the completed element shall be replaced.

1810.4.1.4 Driving near cased concrete. Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

1810.4.1.5 Defective timber piles. *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.* Any substantial sudden change in rate of penetration of a timber pile shall be investigated for possible damage. If the sudden change in rate of penetration cannot be correlated to soil strata, the pile shall be removed for inspection or rejected.

1810.4.2 Identification. Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested

by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1810.4.3 Location plan. A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

1810.4.4 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be advanced below the preexcavated depth until the required resistance or penetration is obtained.

1810.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810.3.3.1.1.
2. The pile is to be used only for lateral resistance.

1810.4.6 Heaved elements. Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810.3.3.1.2.

1810.4.7 Enlarged base cast-in-place elements. Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

1810.4.8 Hollow-stem augered, cast-in-place elements. Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is

withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810.4.10 Micropiles. Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond

zone and reinserted or some other suitable means employed to ensure grout coverage outside the casing.

1810.4.11 Helical piles. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the helical pile.

1810.4.12 Special inspection. Special inspections in accordance with Sections 1705.7 and 1705.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705.9 shall be provided for helical piles.

SECTION 1811 PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS [OSHPD 1R, 2B & 5]

1811.1 General. The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces, resulting in tension on shallow foundations.

1811.2 Adoption. Except for the modifications as set forth in Sections 1811.3 and 1811.4, all prestressed rock and soil foundation anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.

1811.3 Geotechnical requirements. The geotechnical report for the Prestressed Rock & Soil Foundation Anchors shall address the following:

1. Minimum diameter and minimum spacing for the anchors including consideration of group effects.
2. Maximum unbonded length and minimum bonded length of the tendon.
3. Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.
4. Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.
5. Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.
6. Minimum grout pressure for installation and post-grout pressure.
7. Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.
8. Performance test shall be at a minimum of 1.6 times the design loads, but shall not exceed 80 percent of the specified minimum tensile strength of the tendons. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or a maximum of 0.80 times the specified minimum tensile strength of the tendon. A creep test is

required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.

9. Lock-off prestressing load requirements.
10. Acceptable drilling methods.
11. Geotechnical observation and monitoring requirements.

1811.4 Structural Requirements.

1. Tendons shall be thread-bar anchors conforming to ASTM A722.
2. The anchors shall be placed vertical.
3. Design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.
4. Ultimate load shall be based upon the lesser of the strength of the superstructure elements, the maximum forces from a fully yielded structural system and forces from the load combinations with overstrength factor in accordance with ASCE 7, Section 12.4.3 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.
5. The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.
6. Foundation design shall incorporate the effect of lock-off loads.
7. Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.
8. Design shall account for both short- and long-term deformation.
9. Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.

SECTION 1812 EARTH RETAINING SHORING [OSHPD 1R, 2B & 5]

1812.1 General. The requirements of this section shall apply to temporary and permanent earth-retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new facilities, is not regulated by this section and shall satisfy the requirements of the authorities having jurisdiction.

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1812.2 through 1812.8.

1812.2 Duration. Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than or equal to 2 years, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for

support in anyway. Wood components shall not be used for permanent shoring lasting more than 2 years. Wood components of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.

All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWWA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall be identified in accordance with Section 2303.1.9.

1812.3 Surcharge. Surcharge pressure due to footings, traffic or other sources shall be considered in the design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close to a footing), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.

1812.4 Design and testing. Except for the modifications as set forth in Sections 1812.4.1 through 1812.4.3, all Prestressed Rock and Soil Tie-back Anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.

1812.4.1 Geotechnical requirements. The geotechnical report for the earth retaining shoring shall address the following:

1. Minimum diameter and minimum spacing for the anchors including consideration of group effects.
2. Maximum unbonded length and minimum bonded length of the tie-back anchors.
3. Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.
4. Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to the ground soil interface as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.6.
5. Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post-grout pressure of 300 psi may be used for all soil types.
6. Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.

7. Performance test for the anchors shall be at a minimum of two times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.
8. Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.
9. Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor locations and the drilled pier concrete shafts at the lowest grade level.
10. Allowable vertical soil bearing pressure, friction resistance and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.
11. Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.
12. Acceptable drilling methods.
13. Geotechnical observation and monitoring recommendations.

1812.4.2 Structural requirements:

1. Tendons shall be thread-bar anchors conforming to ASTM A722.
2. Anchor design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.
3. The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.
4. Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section 1812.8
5. Design of shoring system shall account for both short- and long-term deformation.

1812.4.3 Testing of tie-back anchors:

1. The geotechnical engineer shall keep a record at the job site of all test loads and total anchor movement, and report their accuracy.
2. If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be re-grouted and retested. If the anchor continues to fail, the followings steps shall be taken:
 - a. The contractor shall determine the cause of failure: (variations of the soil conditions, installation methods, materials, etc.).
 - b. The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by geotechnical engineer, shoring design engineer and the building official.

3. After a satisfactory test, each anchor shall be locked off in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors Section 8.4.
4. The shoring design engineer shall specify design loads for each anchor.

1812.5 Construction: The construction procedure shall address the following:

1. Holes drilled for piles/tie-back anchors shall be done without detrimental loss of ground, sloughing or caving of materials and without endangering previously installed shoring members or existing foundations.
2. Drilling of earth anchor shafts for tie-backs shall occur when the drill bench reaches 2 to 3 feet below the level of the tie-back pockets.
3. Casing or other methods shall be used where necessary to prevent loss of ground and collapse of the hole.
4. Drill cuttings from the earth anchor shaft shall be removed prior to anchor installation.
5. Unless tremie methods are used, all water and loose materials shall be removed from the holes prior to installing piles/tie-backs.
6. Tie-back anchor rods with attached centralizing devices shall be installed into the shaft or through the drill casing. Centralizing devices shall not restrict movement of the grout.
7. After lagging installation, voids between lagging and soil shall be backfilled immediately to the full height of lagging.
8. The soldier piles shall be placed within specified tolerances in the drilled hole and braced against displacement during grouting. Fill shafts with concrete up to top of footing elevation, rest of the shaft can generally be filled with lean concrete. Excavation for lagging shall not be started until concrete has achieved sufficient strength for all anticipated loads as determined by the shoring design engineer.
9. Where boulders and/or cobbles have been identified in the geotechnical reports, the contractor shall be prepared to address boulders and/or cobbles that may be encountered during the drilling of soldier piles and tie-back anchors.
10. The grouting equipment shall produce grout free of lumps and indispensed cement. The grouting equipment shall be sized to enable the grout to be pumped in continuous operation. The mixer shall be capable of continuously agitating the grout.
11. The quantity of grout and grout pressure shall be recorded. The grout pressure shall be controlled to prevent excessive heave in soils or fracturing rock formations.
12. If post-grouting is required, post-grouting operation shall be performed after initial grout has set for 24 hours in the bond length only. Tie-backs shall be grouted over a sufficient length (anchor bond length)

to transfer the maximum anchor force to the anchor grout.

13. Testing of anchors may be performed after post-grouting operations, provided that grout has reached a strength of 3,000 psi as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.11.
14. Anchor rods shall be tensioned straight and true. Excavation directly below the anchors shall not continue before those anchors are tested.

1812.6 Inspection, survey monitoring and observation.

1. The shoring design engineer or his designee shall make periodic inspections of the job site for the purpose of observing the installation of the shoring system, testing of tie-back anchors and monitoring of the survey.
2. Testing, inspection and observation shall be in accordance with testing, inspection and observation requirements approved by the building official. The following activities and materials shall be tested, inspected or observed by the special inspector and geotechnical engineer:
 - a. Sampling and testing of concrete in soldier pile and tie-back anchor shafts.
 - b. Fabrication of tie-back anchor pockets on soldier beams
 - c. Installation and testing of tie-back anchors.
 - d. Survey monitoring of soldier pile and tie-back load cells.
 - e. Survey monitoring of existing buildings.
3. A complete and accurate record of all soldier pile locations, depths, concrete strengths, tie-back locations and lengths, tie-back grout strength, quantity of concrete per pile, quantity of grout per tie-back and applied tie-back loads shall be maintained by the special inspector and geotechnical engineer. The shoring design engineer shall be notified of any unusual conditions encountered during installation.
4. Calibration data for each test jack, pressure gauge and master pressure gauge shall be verified by the special inspector and geotechnical engineer. The calibration tests shall be performed by an independent testing laboratory and within 120 calendar days of the data submitted.
5. Monitoring points shall be established at the top and at the anchor heads of selected soldier piles and at intermediate intervals as considered appropriate by the geotechnical engineer.
6. Control points shall be established outside the area of influence of the shoring system to ensure the accuracy of the monitoring readings.
7. The periodic basis of shoring monitoring, at a minimum, shall be as follows:
 - a. Initial monitoring shall be performed prior to any excavation.

- b. Once excavation has begun, the periodic readings shall be taken weekly until excavation reaches the estimated subgrade elevation and the permanent foundation is complete.
 - c. If performance of the shoring is within established guidelines, shoring design engineer may permit the periodic readings to be biweekly. Once initiated, biweekly readings shall continue until the building slab at ground floor level is completed and capable of transmitting lateral loads to the permanent structure. Thereafter, readings can be monthly.
 - d. Where the building has been designed to resist lateral earth pressures, the periodic monitoring of the soldier piles and adjacent structure can be discontinued once the ground floor diaphragm and subterranean portion of the structure is capable of resisting lateral soil loads and approved by the shoring design engineer, geotechnical engineer and the building official.
 - e. Additional readings shall be taken when requested by special inspector, shoring design engineer, geotechnical engineer or the building official.
8. Monitoring readings shall be submitted to shoring design engineer, engineer in responsible charge, and the building official within 3 working days after they are conducted. Monitoring readings shall be accurate to within 0.01 feet. Results are to be submitted in tabular form showing at least the initial date of monitoring and reading, current monitoring date and reading and difference between the two readings.
9. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $\frac{1}{2}$ inch or soldier piles movement reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineers shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues.
10. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $\frac{3}{4}$ inch or soldier piles movement reaches $1\frac{1}{2}$ inches all excavation activities shall be suspended until the causes, if any, can be determined. Supplemental shoring shall be devised to eliminate further movement and the building official shall review and approve the supplemental shoring before excavation continues.
11. Monitoring of tie-back anchor loads:
- a. Load cells shall be installed at the tie-back heads adjacent to buildings at maximum interval of 50 feet, with a minimum of one load cell per wall.
 - b. Load cell readings shall be taken once a day during excavation and once a week during the remainder of construction.

- c. Load cell readings shall be submitted to the geotechnical engineer, shoring design engineer, engineer in responsible charge and the building official.
- d. Load cell readings can be terminated once the temporary shoring no longer provides support for the buildings.

1812.7 Monitoring of existing OSHPD 1, 1R, 2, 4 and 5 structures.

1. The contractor shall complete a written and photographic log of all existing OSHPD 1, 1R, 2, 4 & 5 structures within 100 feet or three times depth of shoring, prior to construction. A licensed surveyor shall document all existing substantial cracks in adjacent existing structures.
2. The contractor shall document the existing condition of wall cracks adjacent to shoring walls prior to start of construction.
3. The contractor shall monitor existing walls for movement or cracking that may result from adjacent shoring.
4. If excessive movement or visible cracking occurs, the contractor shall stop work and shore/reinforce excavation and contact the shoring design engineer and the building official.
5. Monitoring of the existing structure shall be at reasonable intervals as required by the registered design professional, subject to approval of the building official. Monitoring shall be performed by a licensed surveyor and shall consist of vertical and lateral movement of the existing structures. Prior to starting shoring installation a preconstruction meeting shall take place between the contractor, shoring design engineer, surveyor, geotechnical engineer and the building official to identify monitoring locations on existing buildings.
6. If in the opinion of the building official or shoring design engineer, monitoring data indicate excessive movement or other distress, all excavation shall cease until the geotechnical engineer and shoring design engineer investigate the situation and make recommendations for remediation or continuing.
7. All reading and measurements shall be submitted to the building official and shoring design engineer.

1812.8 Tolerances. The following tolerances shall be specified on the construction documents.

1. Soldier piles:
 - i. Horizontal and vertical construction tolerances for the soldier pile locations.
 - ii. Soldier pile plumbness requirements (angle with vertical line).
2. Tie-back anchors:
 - i. Allowable deviation of anchor projected angle from specified vertical and horizontal design projected angle.
 - ii. Anchor clearance to the existing/new utilities and structures.

SECTION 1813
VIBRO STONE COLUMNS FOR GROUND
IMPROVEMENT [OSHPD 1R, 2 & 5]

1813.1 General. This section shall apply to Vibro Stone Columns (VSCs) for ground improvement using unbounded aggregate materials. Vibro stone column provisions in this section are intended to increase bearing capacity, reduce settlements and mitigate liquefaction for shallow foundations. These requirements shall not be used for grouted or bonded stone columns, ground improvement for deep foundation elements or changing site class. VSCs shall not be considered as a deep foundation element.

Ground improvement shall be installed under the entire building/structure footprint and not under isolated foundation elements only.

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1813.2 through 1813.5.

1813.2 Geotechnical report. The geotechnical report shall specify vibro stone column requirements to ensure uniformity in total and differential immediate settlement, long-term settlement and earthquake-induced settlement. The report shall address the following:

1. Soil compaction shall be sufficient to mitigate potential for liquefaction as described in California Geological Survey (CGS) Special Publication 117A (SP-117A): Guidelines for Evaluating and Mitigating Seismic Hazard in California.
2. The area replacement ratio for the compaction elements and the basis of its determination shall be explained. Minimum factor of safety for soil compaction shall be in accordance with SP-117A.
3. The depth of soil compaction elements and extent beyond the footprint of structures/foundation shall be defined. Extent beyond the foundation shall be half the depth of the VSCs with a minimum of 10' or an approved alternative.
4. The minimum diameter and maximum spacing of soil compaction elements shall be specified. VSCs shall not be less than 2 feet in diameter and center to center spacing shall not exceed 8 feet.
5. The modulus of subgrade reactions for shallow foundations shall account for the presence of compaction elements.
6. The modulus of subgrade reactions, long-term settlement and post-earthquake settlement shall be specified along with expected total and differential settlements for design.
7. The acceptance criteria for friction cone and piezocone penetration testing in accordance with ASTM D5778 complemented by a standard penetration test (SPT) in accordance with ASTM D1586, if necessary, to verify soil improvement shall be specified

8. The requirements for special inspection and observation by the geotechnical engineer shall be specified.
9. A Final Verified Report (FVR) documenting the installation of the ground improvement system and confirming that the ground improvement acceptance criteria have been met shall be prepared by the geotechnical engineer and submitted to the enforcement agency for review and approval.

1813.3 Shallow Foundations. VSCs under the shallow foundation shall be located symmetrically around the centroid of the footing or load, and:

1. There shall be a minimum of four stone columns under each isolated or continuous/combined footing or an approved equivalent.
2. The VSCs or deep foundation elements shall not be used to resist tension or overturning uplift from the shallow foundations.
3. The foundation design for the shallow foundation shall consider the increased vertical stiffness of the VSCs as point supports for analysis, unless it is substantiated that the installation of the VSCs results in improvement of the surrounding soils such that the modulus of subgrade reaction, long-term settlement and post-earthquake settlement can be considered uniform throughout.

1813.4 Installation. VSCs shall be installed with vibratory probes. Vertical columns of compacted unbounded aggregate shall be formed through the soils to be improved by adding gravel near the tip of the vibrator and progressively raising and re-penetrating the vibrator, which will result in the gravel being pushed into the surrounding soil.

Gravel aggregate for VSCs shall be well graded with a maximum size of 6 inches and not more than 10 percent smaller than $\frac{3}{8}$ inch after compaction.

1813.5 Construction Documents. Construction documents for VSCs, at a minimum, shall include the following:

1. Size, depth and location of VSCs.
2. The extent of soil improvements along with building/structure foundation outlines.
3. Field verification requirements and acceptance criteria using CPT/SPT.
4. The locations where CPT/SPT shall be performed.
5. A Testing, Inspection and Observation (TIO) program indicating the inspection and observation required for the VSCs.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 18A – SOILS AND FOUNDATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X	X	X												
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 18A

SOILS AND FOUNDATIONS

SECTION 1801A GENERAL

1801A.1 Scope. The provisions of this chapter shall apply to building and foundation systems.

1801A.1.1 Application. *The scope of application of Chapter 18A is as follows:*

1. Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings
2. Applications listed in Section 1.10.1 and 1.10.4 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.

1801A.1.2 Amendments in this chapter. DSA-SS, DSA-SS/CC adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Division of the State Architect-Structural Safety:
[DSA-SS] For applications listed in Section 1.9.2.1.
[DSA-SS/CC] For applications listed in Section 1.9.2.2.
2. Office of Statewide Health Planning and Development:
[OSHPD 1] - For applications listed in Section 1.10.1.
[OSHPD 4] - For applications listed in Section 1.10.4.

1801A.1.3 Reference to other chapters.

1801A.1.3.1 [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 16A, 19A, 21A and 22A, the provisions in Chapters 16, 19, 21 and 22, respectively shall apply instead as defined in Section 1.9.2.2. Referenced sections may not directly correlate, but the corresponding DSA-SS/CC sections to such references still apply.

SECTION 1802A DESIGN BASIS

1802A.1 General. Allowable bearing pressures, allowable stresses and design formulas provided in this chapter shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605.2. The qual-

ity and design of materials used structurally in excavations and foundations shall comply with the requirements specified in Chapters 16, 19, 21, 22 and 23. Excavations and fills shall comply with Chapter 33.

SECTION 1803A GEOTECHNICAL INVESTIGATIONS

1803A.1 General. Geotechnical investigations shall be conducted in accordance with Section 1803A.2 and reported in accordance with Section 1803A.7. The classification and investigation of the soil shall be made under the responsible charge of a California registered geotechnical engineer. All recommendations contained in geotechnical and geohazard reports shall be subject to the approval of the enforcement agency. All reports shall be prepared and signed by a registered geotechnical engineer, a certified engineering geologist and a registered geophysicist, where applicable.

1803A.2 Investigations required. Geotechnical investigations shall be conducted in accordance with Sections 1803A.3 through 1803A.6.

Exceptions:

1. Geotechnical reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m²) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan. Allowable foundation and lateral soil pressure values may be determined from Table 1806A.2.
2. A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.

1803A.3 Basis of investigation. Soil classification shall be based on observation and any necessary tests of the materials disclosed by borings, test pits or other subsurface exploration made in appropriate locations. Additional studies shall be made as necessary to evaluate slope stability, soil strength, position and adequacy of load-bearing soils, the effect of moisture variation on soil-bearing capacity, compressibility, liquefaction and expansiveness.

1803A.3.1 Scope of investigation. The scope of the geotechnical investigation including the number and types of borings or soundings, the equipment used to drill or sample, the in-situ testing equipment and the laboratory testing program shall be determined by a registered design professional.

There shall not be less than one boring or exploration shaft for each 5,000 square feet (465 m²) of building area

SOILS AND FOUNDATIONS

at the foundation level with a minimum of two provided for any one building. A boring may be considered to reflect subsurface conditions relevant to more than one building, subject to the approval of the enforcement agency.

Borings shall be of sufficient size to permit visual examination of the soil in place or, in lieu thereof, cores shall be taken.

Borings shall be of sufficient depth and size to adequately characterize sub-surface conditions.

1803A.4 Qualified representative. The investigation procedure and apparatus shall be in accordance with generally accepted engineering practice. The registered design professional shall have a fully qualified representative on site during all boring or sampling operations.

1803A.5 Investigated conditions. Geotechnical investigations shall be conducted as indicated in Sections 1803A.5.1 through 1803A.5.12.

1803A.5.1 Classification. Soil materials shall be classified in accordance with ASTM D2487.

1803A.5.2 Questionable soil. Where the classification, strength or compressibility of the soil is in doubt or where a load-bearing value superior to that specified in this code is claimed, the building official shall be permitted to require that a geotechnical investigation be conducted.

1803A.5.3 Expansive soil. In areas likely to have expansive soil, the building official shall require soil tests to determine where such soils do exist.

Soils meeting all four of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No.200 sieve (75 μ m), determined in accordance with ASTM D422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.
4. Expansion index greater than 20, determined in accordance with ASTM D4829.

1803A.5.4 Ground-water table. A subsurface soil investigation shall be performed to determine whether the existing ground-water table is above or within 5 feet (1524 mm) below the elevation of the lowest floor level where such floor is located below the finished ground level adjacent to the foundation.

1803A.5.5 Deep foundations. Where deep foundations will be used, a geotechnical investigation shall be conducted and shall include all of the following, unless sufficient data on which to base the design and installation is otherwise available:

1. Recommended deep foundation types and installed capacities.

2. Recommended center-to-center spacing of deep foundation elements.
3. Driving criteria.
4. Installation procedures.
5. Field inspection and reporting procedures (to include procedures for verification of the installed bearing capacity where required).
6. Load test requirements.
7. Suitability of deep foundation materials for the intended environment.
8. Designation of bearing stratum or strata.
9. Reductions for group action, where necessary.

1803A.5.6 Rock strata. Where subsurface explorations at the project site indicate variations in the structure of rock on which foundations are to be constructed, a sufficient number of borings shall be drilled to sufficient depths to assess the competency of the rock and its load-bearing capacity.

1803A.5.7 Excavation near foundations. Where excavation will reduce support from any foundation, a registered design professional shall prepare an assessment of the structure as determined from examination of the structure, available design documents, available subsurface data, and, if necessary, excavation of test pits. The registered design professional shall determine the requirements for support and protection of any existing foundation and prepare site-specific plans, details and sequence of work for submission. Such support shall be provided by underpinning, bracing, excavation retention systems, or by other means acceptable to the building official.

1803A.5.8 Compacted fill material. Where shallow foundations will bear on compacted fill material more than 12 inches (305 mm) in depth, a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of compacted fill material.
2. Specifications for material to be used as compacted fill.
3. Test methods to be used to determine the maximum dry density and optimum moisture content of the material to be used as compacted fill.
4. Maximum allowable thickness of each lift of compacted fill material.
5. Field test method for determining the in-place dry density of the compacted fill.
6. Minimum acceptable in-place dry density expressed as a percentage of the maximum dry density determined in accordance with Item 3.
7. Number and frequency of field tests required to determine compliance with Item 6.

1803A.5.9 Controlled low-strength material (CLSM).

Where shallow foundations will bear on controlled low-strength material (CLSM), a geotechnical investigation shall be conducted and shall include all of the following:

1. Specifications for the preparation of the site prior to placement of the CLSM.
2. Specifications for the CLSM.
3. Laboratory or field test method(s) to be used to determine the compressive strength or bearing capacity of the CLSM.
4. Test methods for determining the acceptance of the CLSM in the field.
5. Number and frequency of field tests required to determine compliance with Item 4.

1803A.5.10 Alternate setback and clearance. Where setbacks or clearances other than those required in Section 1808A.7 are desired, the building official shall be permitted to require a geotechnical investigation by a registered design professional to demonstrate that the intent of Section 1808A.7 would be satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

1803A.5.11 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, a geotechnical investigation shall be conducted, and shall include an evaluation of all of the following potential geologic and seismic hazards:

1. Slope instability.
2. Liquefaction.
3. Total and differential settlement.
4. Surface displacement due to faulting or seismically induced lateral spreading or lateral flow.

1803A.5.12 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, the geotechnical investigation required by Section 1803A.5.11 shall include all of the following as applicable:

1. The determination of dynamic seismic lateral earth pressures on foundation walls and retaining walls supporting more than 6 feet (1.83 m) of backfill height due to design earthquake ground motions.
2. The potential for liquefaction and soil strength loss evaluated for site peak ground acceleration, earthquake magnitude and source characteristics consistent with the maximum considered earthquake ground motions. Peak ground acceleration shall be determined based on one of the following:
 - 2.1. A site-specific study in accordance with Chapter 21 of ASCE 7.
 - 2.2. In accordance with Section 11.8.3 of ASCE 7.
3. An assessment of potential consequences of liquefaction and soil strength loss including, but not limited to, the following:

- 3.1. Estimation of total and differential settlement.
- 3.2. Lateral soil movement.
- 3.3. Lateral soil loads on foundations.
- 3.4. Reduction in foundation soil-bearing capacity and lateral soil reaction.
- 3.5. Soil downdrag and reduction in axial and lateral soil reaction for pile foundations.
- 3.6. Increases in soil lateral pressures on retaining walls.
- 3.7. Flotation of buried structures.
4. Discussion of mitigation measures such as, but not limited to, the following:
 - 4.1. Selection of appropriate foundation type and depths.
 - 4.2. Selection of appropriate structural systems to accommodate anticipated displacements and forces.
 - 4.3. Ground stabilization.
 - 4.4. Any combination of these measures and how they shall be considered in the design of the structure.

1803A.6 Geohazard reports. *Geohazard reports shall be required for all proposed construction.*

Exceptions:

1. *Reports are not required for one-story, wood-frame and light-steel-frame buildings of Type II or Type V construction and 4,000 square feet (371 m²) or less in floor area, not located within Earthquake Fault Zones or Seismic Hazard Zones as shown in the most recently published maps from the California Geological Survey (CGS) or in seismic hazard zones as defined in the Safety Element of the local General Plan; nonstructural, associated structural or voluntary structural alterations, and incidental structural additions or alterations, and structural repairs for other than earthquake damage.*
2. *A previous report for a specific site may be resubmitted, provided that a reevaluation is made and the report is found to be currently appropriate.*

The purpose of the geohazard report shall be to identify geologic and seismic conditions that may require project mitigations. The reports shall contain data which provide an assessment of the nature of the site and potential for earthquake damage based on appropriate investigations of the regional and site geology, project foundation conditions and the potential seismic shaking at the site. The report shall be prepared by a California-certified engineering geologist in consultation with a California-registered geotechnical engineer.

The preparation of the geohazard report shall consider the most recent CGS Note 48: Checklist for the Review of Engineering Geology and Seismology Reports for California Public School, Hospitals, and Essential Services Build-

ings. In addition, the most recent version of CGS Special Publication 42, *Fault Rupture Hazard Zones in California*, shall be considered for project sites proposed within an Alquist-Priolo Earthquake Fault Zone. The most recent version of CGS Special Publication 117, *Guidelines for Evaluating and Mitigating Seismic Hazards in California*, shall be considered for project sites proposed within a Seismic Hazard Zone. All conclusions shall be supported by satisfactory data and analysis.

In addition to requirements in Sections 1803A.5.11 and 1803A.5.12, the report shall include, but shall not be limited to, the following:

1. Site geology.
2. Evaluation of the known active and potentially active faults, both regional and local.
3. Ground-motion parameters, as required by Sections 1613A and 1617A, and ASCE 7.

The Next Generation Attenuation West 2 (NGA-West 2) relations used for the 2014 USGS seismic hazards maps for Western United States (WUS) shall be utilized to determine the site-specific ground motion. When supported by data and analysis, and approved by the enforcement agency, other attenuation relations that were not used for the 2014 USGS maps shall be permitted as additions or substitutions. No fewer than three NGA attenuation relations shall be utilized.

1803A.7 Geotechnical reporting. Where geotechnical investigations are required, a written report of the investigations shall be submitted to the building official by the permit applicant at the time of permit application. The geotechnical report shall provide completed evaluations of the foundation conditions of the site and the potential geologic/seismic hazards affecting the site. The geotechnical report shall include, but shall not be limited to, site-specific evaluations of design criteria related to the nature and extent of foundation materials, groundwater conditions, liquefaction potential, settlement potential and slope stability. The report shall contain the results of the analyses of problem areas identified in the geohazard report. The geotechnical report shall incorporate estimates of the characteristics of site ground motion provided in the geohazard report. This geotechnical report shall include, but need not be limited to, the following information:

1. A plot showing the location of the soil investigations.
2. A complete record of the soil boring and penetration test logs and soil samples.
3. A record of the soil profile.
4. Elevation of the water table, if encountered. *Historic high ground water elevations shall be addressed in the report to adequately evaluate liquefaction and settlement potential.*
5. Recommendations for foundation type and design criteria, including but not limited to: bearing capacity of natural or compacted soil; provisions to mitigate the effects of expansive soils; mitigation of the effects of liquefaction, differential settlement and varying soil strength; and the effects of adjacent loads.

6. Expected total and differential settlement.
7. Deep foundation information in accordance with Section 1803A.5.5.
8. Special design and construction provisions for foundations of structures founded on expansive soils, as necessary.
9. Compacted fill material properties and testing in accordance with Section 1803A.5.8.
10. Controlled low-strength material properties and testing in accordance with Section 1803A.5.9.
11. *The report shall consider the effects of stepped footings addressed in Section 1809A.3.*
12. *The report shall consider the effects of seismic hazards in accordance with Section 1803A.6 and shall incorporate the associated geohazard report.*

1803A.8 Geotechnical peer review. [DSA-SS and DSA-SS/CC] When alternate foundations designs or ground improvements are employed or where slope stabilization is required, a qualified peer review by a California-licensed geotechnical engineer, in accordance with Section 322 of Part 10, Title 24, CCR, may be required by the enforcement agency. In Section 322 of Part 10, Title 24, CCR, where reference is made to structural or seismic-resisting system, it shall be replaced with geotechnical, foundation or ground improvement, as appropriate.

SECTION 1804A EXCAVATION, GRADING AND FILL

1804A.1 Excavation near foundations. Excavation for any purpose shall not reduce vertical or lateral support for any foundation or adjacent foundation without first underpinning or protecting the foundation against detrimental lateral or vertical movement, or both, in accordance with Section 1803A.5.7.

1804A.2 Underpinning. Where underpinning is chosen to provide the protection or support of adjacent structures, the underpinning system shall be designed and installed in accordance with provisions of this chapter and Chapter 33.

1804A.2.1 Underpinning sequencing. Underpinning shall be installed in a sequential manner that protects the neighboring structure and the working construction site. The sequence of installation shall be identified in the approved construction documents.

1804A.3 Placement of backfill. The excavation outside the foundation shall be backfilled with soil that is free of organic material, construction debris, cobbles and boulders or with a controlled low-strength material (CLSM). The backfill shall be placed in lifts and compacted in a manner that does not damage the foundation or the waterproofing or dampproofing material.

Exception: CLSM need not be compacted.

1804A.4 Site grading. The ground immediately adjacent to the foundation shall be sloped away from the building at a slope of not less than 1 unit vertical in 20 units horizontal (5-percent slope) for a minimum distance of 10 feet (3048 mm)

measured perpendicular to the face of the wall. If physical obstructions or lot lines prohibit 10 feet (3048 mm) of horizontal distance, a 5-percent slope shall be provided to an approved alternative method of diverting water away from the foundation. Swales used for this purpose shall be sloped not less than 2 percent where located within 10 feet (3048 mm) of the building foundation. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

Exceptions:

1. Where climatic or soil conditions warrant, the slope of the ground away from the building foundation shall be permitted to be reduced to not less than 1 unit vertical in 48 units horizontal (2-percent slope).
2. Impervious surfaces shall be permitted to be sloped less than 2 percent where the surface is a door landing or ramp that is required to comply with Section 1010A.1.4, 1012A.3 or 1012A.6.1.

The procedure used to establish the final ground level adjacent to the foundation shall account for additional settlement of the backfill.

1804A.5 Grading and fill in flood hazard areas. In flood hazard areas established in Section 1612A.3, grading, fill, or both, shall not be approved:

1. Unless such fill is placed, compacted and sloped to minimize shifting, slumping and erosion during the rise and fall of flood water and, as applicable, wave action.
2. In floodways, unless it has been demonstrated through hydrologic and hydraulic analyses performed by a registered design professional in accordance with standard engineering practice that the proposed grading or fill, or both, will not result in any increase in flood levels during the occurrence of the design flood.
3. In coastal high hazard areas, unless such fill is conducted or placed to avoid diversion of water and waves toward any building or structure.
4. Where design flood elevations are specified but floodways have not been designated, unless it has been demonstrated that the cumulative effect of the proposed flood hazard area encroachment, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point.

1804A.6 Compacted fill material. Where shallow foundations will bear on compacted fill material, the compacted fill shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803A.

Exception: Compacted fill material 12 inches (305 mm) in depth or less need not comply with an approved report, provided that the in-place dry density is not less than 90 percent of the maximum dry density at optimum moisture content determined in accordance with ASTM D1557. The compaction shall be verified by special inspection in accordance with Section 1705A.6.

1804A.7 Controlled low-strength material (CLSM). Where shallow foundations will bear on controlled low-

strength material (CLSM), the CLSM shall comply with the provisions of an approved geotechnical report, as set forth in Section 1803A.

SECTION 1805A DAMP-PROOFING AND WATERPROOFING

1805A.1 General. Walls or portions thereof that retain earth and enclose interior spaces and floors below grade shall be waterproofed and damp-proofed in accordance with this section, with the exception of those spaces containing groups other than residential and institutional where such omission is not detrimental to the building or occupancy.

Ventilation for crawl spaces shall comply with Section 1202.4.

1805A.1.1 Story above grade plane. Where a basement is considered a story above grade plane and the finished ground level adjacent to the basement wall is below the basement floor elevation for 25 percent or more of the perimeter, the floor and walls shall be damp-proofed in accordance with Section 1805A.2 and a foundation drain shall be installed in accordance with Section 1805A.4.2. The foundation drain shall be installed around the portion of the perimeter where the basement floor is below ground level. The provisions of Sections 1803A.5.4, 1805A.3 and 1805A.4.1 shall not apply in this case.

1805A.1.2 Under-floor space. The finished ground level of an under-floor space such as a crawl space shall not be located below the bottom of the footings. Where there is evidence that the ground-water table rises to within 6 inches (152 mm) of the ground level at the outside building perimeter, or that the surface water does not readily drain from the building site, the ground level of the under-floor space shall be as high as the outside finished ground level, unless an approved drainage system is provided. The provisions of Sections 1803A.5.4, 1805A.2, 1805A.3 and 1805A.4 shall not apply in this case.

1805A.1.2.1 Flood hazard areas. For buildings and structures in flood hazard areas as established in Section 1612.3, the finished ground level of an under-floor space such as a crawl space shall be equal to or higher than the outside finished ground level on one side or more.

Exception: Under-floor spaces of Group R-3 buildings that meet the requirements of FEMA TB 11.

1805A.1.3 Ground-water control. Where the ground-water table is lowered and maintained at an elevation not less than 6 inches (152 mm) below the bottom of the lowest floor, the floor and walls shall be damp-proofed in accordance with Section 1805A.2. The design of the system to lower the ground-water table shall be based on accepted principles of engineering that shall consider, but not necessarily be limited to, permeability of the soil, rate at which water enters the drainage system, rated capacity of pumps, head against which pumps are to operate and the rated capacity of the disposal area of the system.

1805A.2 Dampproofing. Where hydrostatic pressure will not occur as determined by Section 1803A.5.4, floors and walls shall be dampproofed in accordance with this section.

1805A.2.1 Floors. Dampproofing materials for floors shall be installed between the floor and the base course required by Section 1805A.4.1, except where a separate floor is provided above a concrete slab.

Where installed beneath the slab, dampproofing shall consist of not less than 6-mil (0.006 inch; 0.152 mm) polyethylene with joints lapped not less than 6 inches (152 mm), or other approved methods or materials. Where permitted to be installed on top of the slab, dampproofing shall consist of mopped-on bitumen, not less than 4-mil (0.004 inch; 0.102 mm) polyethylene, or other approved methods or materials. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805A.2.2 Walls. Dampproofing materials for walls shall be installed on the exterior surface of the wall, and shall extend from the top of the footing to above ground level.

Dampproofing shall consist of a bituminous material, 3 pounds per square yard (16 N/m²) of acrylic modified cement, $\frac{1}{8}$ inch (3.2 mm) coat of surface-bonding mortar complying with ASTM C887, any of the materials permitted for waterproofing by Section 1805A.3.2 or other approved methods or materials.

1805A.2.2.1 Surface preparation of walls. Prior to application of dampproofing materials on concrete walls, holes and recesses resulting from the removal of form ties shall be sealed with a bituminous material or other approved methods or materials. Unit masonry walls shall be parged on the exterior surface below ground level with not less than $\frac{3}{8}$ inch (9.5 mm) of Portland cement mortar. The parging shall be covered at the footing.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

1805A.3 Waterproofing. Where the ground-water investigation required by Section 1803A.5.4 indicates that a hydrostatic pressure condition exists, and the design does not include a ground-water control system as described in Section 1805A.1.3, walls and floors shall be waterproofed in accordance with this section.

1805A.3.1 Floors. Floors required to be waterproofed shall be of concrete and designed and constructed to withstand the hydrostatic pressures to which the floors will be subjected.

Waterproofing shall be accomplished by placing a membrane of rubberized asphalt, butyl rubber, fully adhered/fully bonded HDPE or polyolefin composite membrane or not less than 6-mil [0.006 inch (0.152 mm)] polyvinyl chloride with joints lapped not less than 6 inches (152 mm) or other approved materials under the slab. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805A.3.2 Walls. Walls required to be waterproofed shall be of concrete or masonry and shall be designed and constructed to withstand the hydrostatic pressures and other lateral loads to which the walls will be subjected.

Waterproofing shall be applied from the bottom of the wall to not less than 12 inches (305 mm) above the maximum elevation of the ground-water table. The remainder of the wall shall be dampproofed in accordance with Section 1805A.2.2. Waterproofing shall consist of two-ply hot-mopped felts, not less than 6-mil (0.006 inch; 0.152 mm) polyvinyl chloride, 40-mil (0.040 inch; 1.02 mm) polymer-modified asphalt, 6-mil (0.006 inch; 0.152 mm) polyethylene or other approved methods or materials capable of bridging nonstructural cracks. Joints in the membrane shall be lapped and sealed in accordance with the manufacturer's installation instructions.

1805A.3.2.1 Surface preparation of walls. Prior to the application of waterproofing materials on concrete or masonry walls, the walls shall be prepared in accordance with Section 1805A.2.2.1.

1805A.3.3 Joints and penetrations. Joints in walls and floors, joints between the wall and floor and penetrations of the wall and floor shall be made watertight utilizing approved methods and materials.

1805A.4 Subsoil drainage system. Where a hydrostatic pressure condition does not exist, dampproofing shall be provided and a base shall be installed under the floor and a drain installed around the foundation perimeter. A subsoil drainage system designed and constructed in accordance with Section 1805A.1.3 shall be deemed adequate for lowering the ground-water table.

1805A.4.1 Floor base course. Floors of basements, except as provided for in Section 1805A.1.1, shall be placed over a floor base course not less than 4 inches (102 mm) in thickness that consists of gravel or crushed stone containing not more than 10 percent of material that passes through a No. 4 (4.75 mm) sieve.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a floor base course is not required.

1805A.4.2 Foundation drain. A drain shall be placed around the perimeter of a foundation that consists of gravel or crushed stone containing not more than 10-percent material that passes through a No. 4 (4.75 mm) sieve. The drain shall extend not less than 12 inches (305 mm) beyond the outside edge of the footing. The thickness shall be such that the bottom of the drain is not higher than the bottom of the base under the floor, and that the top of the drain is not less than 6 inches (152 mm) above the top of the footing. The top of the drain shall be covered with an approved filter membrane material. Where a drain tile or perforated pipe is used, the invert of the pipe or tile shall not be higher than the floor elevation. The top of joints or the top of perforations shall be protected with an approved filter membrane material. The pipe or tile shall be placed on not less than 2 inches (51 mm) of gravel or crushed stone complying with Section 1805A.4.1, and

shall be covered with not less than 6 inches (152 mm) of the same material.

1805A.4.3 Drainage discharge. The floor base and foundation perimeter drain shall discharge by gravity or mechanical means into an approved drainage system that complies with the *California Plumbing Code*.

Exception: Where a site is located in well-drained gravel or sand/gravel mixture soils, a dedicated drainage system is not required.

**SECTION 1806A
PRESUMPTIVE LOAD-BEARING
VALUES OF SOILS**

1806A.1 Load combinations. The presumptive load-bearing values provided in Table 1806A.2 shall be used with the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605A.2. The values of vertical foundation pressure and lateral bearing pressure given in Table 1806A.2 shall be permitted to be increased by one-third where used with the alternative allowable stress design load combinations of Section 1605A.2 that include wind or earthquake loads.

1806A.2 Presumptive load-bearing values. The load-bearing values used in design for supporting soils near the surface shall not exceed the values specified in Table 1806A.2 unless data to substantiate the use of higher values are submitted and approved. Where the building official has reason to doubt the classification, strength or compressibility of the soil, the requirements of Section 1803A.5.2 shall be satisfied.

Presumptive load-bearing values shall apply to materials with similar physical characteristics and dispositions. Mud, organic silt, organic clays, peat or unprepared fill shall not be assumed to have a presumptive load-bearing capacity unless data to substantiate the use of such a value are submitted.

Exception: A presumptive load-bearing capacity shall be permitted to be used where the building official deems the load-bearing capacity of mud, organic silt or unprepared

fill is adequate for the support of lightweight or temporary structures.

1806A.3 Lateral load resistance. Where the presumptive values of Table 1806A.2 are used to determine resistance to lateral loads, the calculations shall be in accordance with Sections 1806A.3.1 through 1806A.3.4.

1806A.3.1 Combined resistance. The total resistance to lateral loads shall be permitted to be determined by combining the values derived from the lateral bearing pressure and the lateral sliding resistance specified in Table 1806A.2.

1806A.3.2 Lateral sliding resistance limit. For clay, sandy clay, silty clay, clayey silt, silt and sandy silt, the lateral sliding resistance shall not exceed one-half the dead load.

1806A.3.3 Increase for depth. The lateral bearing pressures specified in Table 1806A.2 shall be permitted to be increased by the tabular value for each additional foot (305 mm) of depth to a value that is not greater than 15 times the tabular value.

1806A.3.4 Increase for poles. Isolated poles for uses such as flagpoles or signs and poles used to support buildings that are not adversely affected by a 1/2-inch (12.7 mm) motion at the ground surface due to short-term lateral loads shall be permitted to be designed using lateral bearing pressures equal to two times the tabular values.

**SECTION 1807A
FOUNDATION WALLS, RETAINING WALLS
AND EMBEDDED POSTS AND POLES**

1807A.1 Foundation walls. Foundation walls shall be designed and constructed in accordance with Sections 1807A.1.1 through 1807A.1.6. Foundation walls shall be supported by foundations designed in accordance with Section 1808A.

1807A.1.1 Design lateral soil loads. Foundation walls shall be designed for the lateral soil loads *determined by a geotechnical investigation, in accordance with Section 1803A.*

**TABLE 1806A.2
PRESUMPTIVE LOAD-BEARING VALUES**

CLASS OF MATERIALS	VERTICAL FOUNDATION PRESSURE (psf)	LATERAL BEARING PRESSURE (psf/ft below natural grade)	LATERAL SLIDING RESISTANCE	
			Coefficient of friction ^a	Cohesion (psf) ^b
1. Crystalline bedrock	12,000	1,200	0.70	—
2. Sedimentary and foliated rock	4,000	400	0.35	—
3. Sandy gravel and gravel (GW and GP)	3,000	200	0.35	—
4. Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000	150	0.25	—
5. Clay, sandy clay, silty clay, clayey silt, silt and sandy silt (CL, ML, MH and CH)	1,500	100	—	130

For SI: 1 pound per square foot = 0.0479kPa, 1 pound per square foot per foot = 0.157 kPa/m.

a. Coefficient to be multiplied by the dead load.

b. Cohesion value to be multiplied by the contact area, as limited by Section 1806A.3.2.

1807A.1.2 Unbalanced backfill height. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab on grade is provided and is in contact with the interior surface of the foundation wall, the unbalanced backfill height shall be permitted to be measured from the exterior finish ground level to the top of the interior concrete slab.

1807A.1.3 Rubble stone foundation walls. Not permitted by DSA-SS, DSA-SS/CC or OSHPD.

1807A.1.4 Permanent wood foundation systems. Not permitted by DSA-SS, DSA-SS/CC or OSHPD.

1807A.1.5 Concrete and masonry foundation walls. Concrete and masonry foundation walls shall be designed in accordance with Chapter 19A or 21A, as applicable.

1807A.2 Retaining walls. Retaining walls shall be designed in accordance with Sections 1807A.2.1 through 1807A.2.4. *Freestanding cantilever walls shall be designed in accordance with Section 1807A.2.5.*

1807A.2.1 General. Retaining walls shall be designed to ensure stability against overturning, sliding, excessive foundation pressure and water uplift.

1807A.2.2 Design lateral soil loads. Retaining walls shall be designed for the lateral soil loads *determined by a geotechnical investigation in accordance with Section 1803A and shall not be less than eighty percent of the lateral soil loads determined in accordance with Section 1610A. For use with the load combinations, lateral soil loads due to gravity loads surcharge shall be considered gravity loads and seismic earth pressure increases due to earthquake shall be considered as seismic loads.* For structures assigned to Seismic Design Category D, E, or F, the design of retaining walls supporting more than 6 feet (1829 mm) of backfill height shall incorporate the additional seismic lateral earth pressure in accordance with the geotechnical investigation where required in Section 1803A.2.

1807A.2.3 Safety factor. Retaining walls shall be designed to resist the lateral action of soil to produce sliding and overturning with a minimum safety factor of 1.5 in each case. The load combinations of Section 1605A shall not apply to this requirement. Instead, design shall be based on 0.7 times nominal earthquake loads, 1.0 times other nominal loads, and investigation with one or more of the variable loads set to zero. The safety factor against lateral sliding shall be taken as the available soil resistance at the base of the retaining wall foundation divided by the net lateral force applied to the retaining wall.

Exception: Where earthquake loads are included, the minimum safety factor for retaining wall sliding and overturning shall be 1.1.

1807A.2.4 Segmental retaining walls. Dry-cast concrete units used in the construction of segmental retaining walls shall comply with ASTM C1372.

1807A.2.5 Freestanding cantilever walls. *Freestanding cantilever walls shall comply with Section 15.6.8 of ASCE 7. [OSHPD 1 & 4]. A stability check against the possibility of overturning shall be performed for isolated spread footings which support freestanding cantilever walls. The allowable soil pressure may be doubled for this evaluation.*

Exception [OSHPD 1 & 4]: *For overturning about the principal axis of rectangular footings with symmetrical vertical loading and the design lateral force applied, a triangular or trapezoidal soil pressure distribution which covers the full width of the footing will meet the stability requirement.*

1807A.3 Embedded posts and poles. Designs to resist both axial and lateral loads employing posts or poles as columns embedded in earth or in concrete footings in earth shall be in accordance with Sections 1807A.3.1 through 1807A.3.3.

1807A.3.1 Limitations. The design procedures outlined in this section are subject to the following limitations:

1. The frictional resistance for structural walls and slabs on silts and clays shall be limited to one-half of the normal force imposed on the soil by the weight of the footing or slab.
2. Posts embedded in earth shall not be used to provide lateral support for structural or nonstructural materials such as plaster, masonry or concrete unless bracing is provided that develops the limited deflection required.

Wood poles shall be treated in accordance with AWP A U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B).

1807A.3.2 Design criteria. The depth to resist lateral loads shall be determined using the design criteria established in Sections 1807A.3.2.1 through 1807A.3.2.3, or by other methods approved by the building official.

1807A.3.2.1 Nonconstrained. The following formula shall be used in determining the depth of embedment required to resist lateral loads where lateral constraint is not provided at the ground surface, such as by a rigid floor or rigid ground surface pavement, and where lateral constraint is not provided above the ground surface, such as by a structural diaphragm.

$$d = 0.5A \{ 1 + [1 + (4.36h/A)]^{1/2} \} \quad (\text{Equation 18A-1})$$

where:

$$A = 2.34P / (S_1 b)$$

b = Diameter of round post or footing or diagonal dimension of square post or footing, feet (m).

d = Depth of embedment in earth in feet (m) but not over 12 feet (3658 mm) for purpose of computing lateral pressure.

h = Distance in feet (m) from ground surface to point of application of "P."

P = Applied lateral force in pounds (kN).

S_1 = Allowable lateral soil-bearing pressure as set forth in Section 1806A.2 based on a depth of one-third the depth of embedment in pounds per square foot (psf) (kPa).

1807A.3.2.2 Constrained. The following formula shall be used to determine the depth of embedment required to resist lateral loads where lateral constraint is provided at the ground surface, such as by a rigid floor or pavement.

$$d = \sqrt{\frac{4.25Ph}{S_3b}} \quad \text{(Equation 18A-2)}$$

or alternatively

$$d = \sqrt{\frac{4.25M_g}{S_3b}} \quad \text{(Equation 18A-3)}$$

where:

M_g = Moment in the post at grade, in foot-pounds (kN-m).

S_3 = Allowable lateral soil-bearing pressure as set forth in Section 1806A.2 based on a depth equal to the depth of embedment in pounds per square foot (kPa).

1807A.3.2.3 Vertical load. The resistance to vertical loads shall be determined using the vertical foundation pressure set forth in Table 1806A.2.

1807A.3.3 Backfill. The backfill in the annular space around columns not embedded in poured footings shall be by one of the following methods:

1. Backfill shall be of concrete with a specified compressive strength of not less than 2,000 psi (13.8 MPa). The hole shall be not less than 4 inches (102 mm) larger than the diameter of the column at its bottom or 4 inches (102 mm) larger than the diagonal dimension of a square or rectangular column.
2. Backfill shall be of clean sand. The sand shall be thoroughly compacted by tamping in layers not more than 8 inches (203 mm) in depth.
3. Backfill shall be of controlled low-strength material (CLSM).

SECTION 1808A FOUNDATIONS

1808A.1 General. Foundations shall be designed and constructed in accordance with Sections 1808A.2 through 1808A.9. Shallow foundations shall satisfy the requirements of Section 1809A. Deep foundations shall satisfy the requirements of Section 1810A.

1808A.2 Design for capacity and settlement. Foundations shall be so designed that the allowable bearing capacity of the soil is not exceeded, and that differential settlement is mini-

mized. Foundations in areas with expansive soils shall be designed in accordance with the provisions of Section 1808A.6.

The enforcing agency may require an analysis of foundation elements to determine subgrade deformations in order to evaluate their effect on the superstructure, including story drift.

1808A.3 Design loads. Foundations shall be designed for the most unfavorable effects due to the combinations of loads specified in Section 2.3 or 2.4 of ASCE 7 or the alternative allowable stress design load combinations of Section 1605.2. The dead load is permitted to include the weight of foundations and overlying fill. Reduced live loads, as specified in Sections 1607A.12 and 1607A.14, shall be permitted to be used in the design of foundations.

1808A.3.1 Seismic overturning. Where foundations are proportioned using the load combinations of Section 2.3 or 2.4 of ASCE 7 and the computation of seismic overturning effects is by equivalent lateral force analysis or modal analysis, the proportioning shall be in accordance with Section 12.13.4 of ASCE 7.

1808A.3.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or the surcharge. Existing footings or foundations that will be affected by any excavation shall be underpinned or otherwise protected against settlement and shall be protected against detrimental lateral or vertical movement or both.

Exception: Minor grading for landscaping purposes shall be permitted where done with walk-behind equipment, where the grade is not increased more than 1 foot (305 mm) from original design grade or where approved by the building official.

1808A.4 Vibratory loads. Where machinery operations or other vibrations are transmitted through the foundation, consideration shall be given in the foundation design to prevent detrimental disturbances of the soil.

1808A.5 Shifting or moving soils. Where it is known that the shallow subsoils are of a shifting or moving character, foundations shall be carried to a sufficient depth to ensure stability.

1808A.6 Design for expansive soils. Foundations for buildings and structures founded on expansive soils shall be designed in accordance with Section 1808A.6.1 or 1808A.6.2.

Exceptions: Foundation design need not comply with Section 1808A.6.1 or 1808A.6.2 where one of the following conditions is satisfied:

1. The soil is removed in accordance with Section 1808A.6.3.
2. The building official approves stabilization of the soil in accordance with Section 1808A.6.4.

1808A.6.1 Foundations. Foundations placed on or within the active zone of expansive soils shall be designed to resist differential volume changes and to prevent structural

damage to the supported structure. Deflection and racking of the supported structure shall be limited to that which will not interfere with the usability and serviceability of the structure.

Foundations placed below where volume change occurs or below expansive soil shall comply with the following provisions:

1. Foundations extending into or penetrating expansive soils shall be designed to prevent uplift of the supported structure.
2. Foundations penetrating expansive soils shall be designed to resist forces exerted on the foundation due to soil volume changes or shall be isolated from the expansive soil.

1808A.6.2 Slab-on-ground foundations. Moments, shears and deflections for use in designing slab-on-ground, mat or raft foundations on expansive soils shall be determined in accordance with WRI/CRSI Design of Slab-on-Ground Foundations or PTI DC 10.5. Using the moments, shears and deflections determined above, nonprestressed slabs-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with WRI/CRSI Design of Slab-on-Ground Foundations and post-tensioned slab-on-ground, mat or raft foundations on expansive soils shall be designed in accordance with PTI DC 10.5. It shall be permitted to analyze and design such slabs by other methods that account for soil-structure interaction, the deformed shape of the soil support, the plate or stiffened plate action of the slab as well as both center lift and edge lift conditions. Such alternative methods shall be rational and the basis for all aspects and parameters of the method shall be available for peer review.

1808A.6.3 Removal of expansive soil. Where expansive soil is removed in lieu of designing foundations in accordance with Section 1808A.6.1 or 1808A.6.2, the soil shall be removed to a depth sufficient to ensure a constant moisture content in the remaining soil. Fill material shall not contain expansive soils and shall comply with Section 1804A.5 or 1804A.6.

Exception: Expansive soil need not be removed to the depth of constant moisture, provided that the confining pressure in the expansive soil created by the fill and supported structure exceeds the swell pressure.

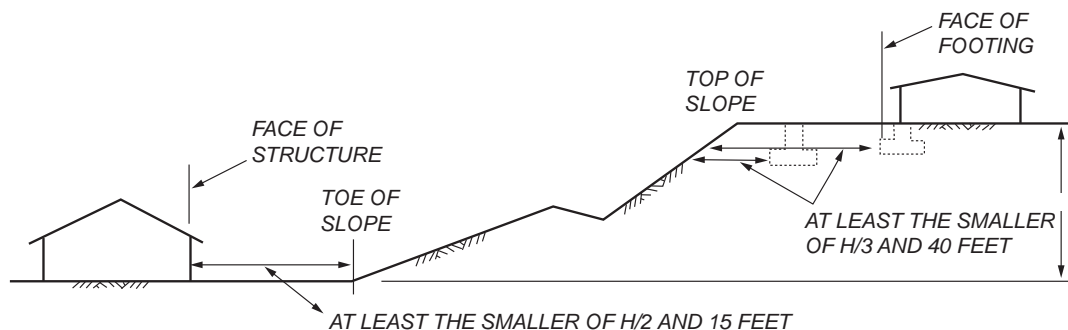
1808A.6.4 Stabilization. Where the active zone of expansive soils is stabilized in lieu of designing foundations in accordance with Section 1808A.6.1 or 1808A.6.2, the soil shall be stabilized by chemical, dewatering, presaturation or equivalent techniques.

1808A.7 Foundations on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than one unit vertical in three units horizontal (33.3-percent slope) shall comply with Sections 1808A.7.1 through 1808A.7.5.

1808A.7.1 Building clearance from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section 1808A.7.5 and Figure 1808A.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than one unit vertical in one unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

1808A.7.2 Foundation setback from descending slope surface. Foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and set back from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement. Except as provided for in Section 1808A.7.5 and Figure 1808A.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

1808A.7.3 Pools. The setback between pools regulated by this code and slopes shall be equal to one-half the building footing setback distance required by this section. That portion of the pool wall within a horizontal distance of 7 feet (2134 mm) from the top of the slope shall be capable of supporting the water in the pool without soil support.



For SI: 1 foot = 304.8 mm.

FIGURE 1808A.7.1
FOUNDATION CLEARANCES FROM SLOPES

1808A.7.4 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

1808A.7.5 Alternate setback and clearance. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official shall be permitted to require a geotechnical investigation as set forth in Section 1803A.5.10.

1808A.8 Concrete foundations. The design, materials and construction of concrete foundations shall comply with Sections 1808A.8.1 through 1808A.8.6 and the provisions of Chapter 19A.

1808A.8.1 Concrete or grout strength and mix proportioning. Concrete or grout in foundations shall have a specified compressive strength (f'_c) not less than the largest applicable value indicated in Table 1808A.8.1.

Where concrete or grout is to be pumped, the mix design including slump shall be adjusted to produce a pumpable mixture.

1808A.8.2 Concrete cover. The concrete cover provided for prestressed and nonprestressed reinforcement in foundations shall be not less than the largest applicable value specified in Table 1808A.8.2. Longitudinal bars spaced less than 1½ inches (38 mm) clear distance apart shall be considered to be bundled bars for which the concrete cover provided shall be not less than that required by Section 20.5.1.3.5 of ACI 318. Concrete cover shall be measured from the concrete surface to the outermost surface of the steel to which the cover requirement applies. Where concrete is placed in a temporary or permanent casing or a mandrel, the inside face of the casing or mandrel shall be considered to be the concrete surface.

1808A.8.3 Placement of concrete. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-size foundation. Concrete shall not be placed through water unless a tremie or other method approved by the building official is used. Where placed under or in the presence of water, the concrete shall be deposited by approved means to ensure minimum segregation of the mix and negligible turbulence of the water. Where depositing concrete from the top of a deep foundation element, the concrete shall be chuted directly into smooth-sided pipes or tubes or placed in a rapid and continuous operation through a funnel hopper centered at the top of the element.

**TABLE 1808A.8.1
MINIMUM SPECIFIED COMPRESSIVE STRENGTH f'_c OF CONCRETE OR GROUT**

FOUNDATION ELEMENT OR CONDITION	SPECIFIED COMPRESSIVE STRENGTH, f'_c
1. Foundations for structures assigned to Seismic Design Category D, E or F	3,000 psi
2. Precast nonprestressed driven piles	4,000 psi
3. Socketed drilled shafts	4,000 psi
4. Micropiles	4,000 psi
5. Precast prestressed driven piles	5,000 psi

For SI: 1 pound per square inch = 0.00689 MPa.

**TABLE 1808A.8.2
MINIMUM CONCRETE COVER**

FOUNDATION ELEMENT OR CONDITION	MINIMUM COVER
1. Shallow foundations	In accordance with Section 20.5 of ACI 318
2. Precast nonprestressed deep foundation elements Exposed to seawater Not manufactured under plant conditions Manufactured under plant control conditions	3 inches 2 inches In accordance with Section 20.5.1.3.3 of ACI 318
3. Precast prestressed deep foundation elements Exposed to seawater Other	2.5 inches In accordance with Section 20.5.1.3.3 of ACI 318
4. Cast-in-place deep foundation elements not enclosed by a steel pipe, tube or permanent casing	2.5 inches
5. Cast-in-place deep foundation elements enclosed by a steel pipe, tube or permanent casing	1 inch
6. Structural steel core within a steel pipe, tube or permanent casing	2 inches
7. Cast-in-place drilled shafts enclosed by a stable rock socket	1.5 inches

For SI: 1 inch = 25.4 mm.

1808A.8.4 Protection of concrete. Concrete foundations shall be protected from freezing during depositing and for a period of not less than 5 days thereafter. Water shall not be allowed to flow through the deposited concrete.

1808A.8.5 Forming of concrete. Concrete foundations are permitted to be cast against the earth where, in the opinion of the building official, soil conditions do not require formwork. Where formwork is required, it shall be in accordance with Section 26.11 of ACI 318.

1808A.8.6 Seismic requirements. See Section 1905A for additional requirements for foundations of structures assigned to Seismic Design Category D, E or F.

For structures assigned to Seismic Design Category D, E or F, provisions of Section 18.13 of ACI 318 shall apply where not in conflict with the provisions of Sections 1808A through 1810A.

1808A.9 Vertical masonry foundation elements. Vertical masonry foundation elements that are not foundation piers as defined in Section 202 shall be designed as piers, walls or columns, as applicable, in accordance with TMS 402.

SECTION 1809A SHALLOW FOUNDATIONS

1809A.1 General. Shallow foundations shall be designed and constructed in accordance with Sections 1809A.2 through 1809A.13.

1809A.2 Supporting soils. Shallow foundations shall be built on undisturbed soil, compacted fill material or controlled low-strength material (CLSM). Compacted fill material shall be placed in accordance with Section 1804A.5. CLSM shall be placed in accordance with Section 1804A.6.

1809A.3 Stepped footings. The top surface of footings shall be level. The bottom surface of footings shall be permitted to have a slope not exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footing or where the surface of the ground slopes more than 1 unit vertical in 10 units horizontal (10-percent slope).

Individual steps in continuous footings shall not exceed 18 inches (457 mm) in height and the slope of a series of such steps shall not exceed 1 unit vertical to 2 units horizontal (50 percent slope) unless otherwise recommended by a geotechnical report. The steps shall be detailed on the drawings. The local effects due to the discontinuity of the steps shall be considered in the design of the foundation.

1809A.4 Depth and width of footings. The minimum depth of footings below the undisturbed ground surface shall be 12 inches (305 mm). Where applicable, the requirements of Section 1809A.5 shall be satisfied. The minimum width of footings shall be 12 inches (305 mm).

1809A.5 Frost protection. Except where otherwise protected from frost, foundations and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extending below the frost line of the locality.

2. Constructing in accordance with ASCE 32.
3. Erecting on solid rock.

Exception: Free-standing buildings meeting all of the following conditions shall not be required to be protected:

1. Assigned to Risk Category I.
2. Area of 600 square feet (56 m²) or less for light-frame construction or 400 square feet (37 m²) or less for other than light-frame construction.
3. Eave height of 10 feet (3048 mm) or less.

Shallow foundations shall not bear on frozen soil unless such frozen condition is of a permanent character.

1809A.5.1 Frost protection at required exits. Frost protection shall be provided at exterior landings for all required exits with outward-swinging doors. Frost protection shall only be required to the extent necessary to ensure the unobstructed opening of the required *exit* doors.

1809A.6 Location of footings. Footings on granular soil shall be so located that the line drawn between the lower edges of adjoining footings shall not have a slope steeper than 30 degrees (0.52 rad) with the horizontal, unless the material supporting the higher footing is braced or retained or otherwise laterally supported in an approved manner or a greater slope has been properly established by engineering analysis.

1809A.7 Prescriptive footings for light-frame construction. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809A.8 Plain concrete footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809A.9 Masonry-unit footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809A.10 Pier and curtain wall foundations. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809A.11 Steel grillage footings. Grillage footings of structural steel elements shall be separated with approved steel spacers and be entirely encased in concrete with not less than 6 inches (152 mm) on the bottom and not less than 4 inches (102 mm) at all other points. The spaces between the shapes shall be completely filled with concrete or cement grout.

1809A.12 Timber footings. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1809A.13 Footing seismic ties. Where a structure is assigned to Seismic Design Category D, E or F, individual spread footings founded on soil defined in Chapter 20 of ASCE 7 as Site Class E or F shall be interconnected by ties. Unless it is demonstrated that equivalent restraint is provided by reinforced concrete beams within slabs on grade or reinforced concrete slabs on grade, ties shall be capable of carrying, in tension or compression, a force equal to the lesser of the product of the larger footing design gravity load times the seismic coefficient, S_{DS} , divided by 10 and 25 percent of the smaller footing design gravity load.

1809A.14 Pipes and trenches. *Unless otherwise recommended by the soils report, open or backfilled trenches parallel with a footing shall not be below a plane having a downward slope of 1 unit vertical to 2 units horizontal (50*

percent slope) from a line 9 inches (229 mm) above the bottom edge of the footing, and not closer than 18 inches (457 mm) from the face of such footing.

Where pipes cross under footings, the footings shall be specially designed. Pipe sleeves shall be provided where pipes cross through footings or footing walls and sleeve clearances shall provide for possible footing settlement, but not less than 1 inch (25 mm) all around pipe.

Exception: Alternate trench locations and pipe clearances shall be permitted when approved by registered design professional in responsible charge and the enforcement agent.

> || **1809A.15 Grade beams.** [DSA-SS, DSA-SS/CC] Where grade beams in shallow foundations are provided, they shall comply with Section 1810A.3.12.

SECTION 1810A DEEP FOUNDATIONS

1810A.1 General. Deep foundations shall be analyzed, designed, detailed and installed in accordance with Sections 1810A.1 through 1810A.4.

1810A.1.1 Geotechnical investigation. Deep foundations shall be designed and installed on the basis of a geotechnical investigation as set forth in Section 1803A.

1810A.1.2 Use of existing deep foundation elements. Deep foundation elements left in place where a structure has been demolished shall not be used for the support of new construction unless satisfactory evidence is submitted to the building official, which indicates that the elements are sound and meet the requirements of this code. Such elements shall be load tested or redriven to verify their capacities. The design load applied to such elements shall be the lowest allowable load as determined by tests or redriving data.

1810A.1.3 Deep foundation elements classified as columns. Deep foundation elements standing unbraced in air, water or fluid soils shall be classified as columns and designed as such in accordance with the provisions of this code from their top down to the point where adequate lateral support is provided in accordance with Section 1810A.2.1.

Exception: Where the unsupported height to least horizontal dimension of a cast-in-place deep foundation element does not exceed three, it shall be permitted to design and construct such an element as a pedestal in accordance with ACI 318.

1810A.1.4 Special types of deep foundations. The use of types of deep foundation elements not specifically mentioned herein is permitted, subject to the approval of the building official, upon the submission of acceptable test data, calculations and other information relating to the structural properties and load capacity of such elements. The allowable stresses for materials shall not in any case exceed the limitations specified herein.

1810A.2 Analysis. The analysis of deep foundations for design shall be in accordance with Sections 1810A.2.1 through 1810A.2.5.

1810A.2.1 Lateral support. Any soil other than fluid soil shall be deemed to afford sufficient lateral support to prevent buckling of deep foundation elements and to permit the design of the elements in accordance with accepted engineering practice and the applicable provisions of this code.

Where deep foundation elements stand unbraced in air, water or fluid soils, it shall be permitted to consider them laterally supported at a point 5 feet (1524 mm) into stiff soil or 10 feet (3048 mm) into soft soil unless otherwise approved by the building official on the basis of a geotechnical investigation by a registered design professional.

1810A.2.2 Stability. Deep foundation elements shall be braced to provide lateral stability in all directions. Three or more elements connected by a rigid cap shall be considered to be braced, provided that the elements are located in radial directions from the centroid of the group not less than 60 degrees (1 rad) apart. A two-element group in a rigid cap shall be considered to be braced along the axis connecting the two elements. Methods used to brace deep foundation elements shall be subject to the approval of the building official.

Deep foundation elements supporting walls shall be placed alternately in lines spaced not less than 1 foot (305 mm) apart and located symmetrically under the center of gravity of the wall load carried, unless effective measures are taken to provide for eccentricity and lateral forces, or the foundation elements are adequately braced to provide for lateral stability.

Exceptions:

1. Isolated cast-in-place deep foundation elements without lateral bracing shall be permitted where the least horizontal dimension is not less than 2 feet (610 mm), adequate lateral support in accordance with Section 1810A.2.1 is provided for the entire height and the height does not exceed 12 times the least horizontal dimension.
2. A single row of deep foundation elements without lateral bracing is permitted for one- and two-family dwellings and lightweight construction not exceeding two stories above grade plane or 35 feet (10 668 mm) in building height, provided that the centers of the elements are located within the width of the supported wall.

1810A.2.3 Settlement. The settlement of a single deep foundation element or group thereof shall be estimated based on approved methods of analysis. The predicted settlement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810A.2.4 Lateral loads. The moments, shears and lateral deflections used for design of deep foundation elements shall be established considering the nonlinear interaction of the shaft and soil, as determined by a registered design

professional. Where the ratio of the depth of embedment of the element to its least horizontal dimension is less than or equal to six, it shall be permitted to assume the element is rigid.

1810A.2.4.1 Seismic Design Categories D through F.

For structures assigned to Seismic Design Category D, E or F, deep foundation elements on Site Class E or F sites, as determined in Section 1613A.2.2, shall be designed and constructed to withstand maximum imposed curvatures from earthquake ground motions and structure response. Curvatures shall include free-field soil strains modified for soil-foundation-structure interaction coupled with foundation element deformations associated with earthquake loads imparted to the foundation by the structure.

Exception: Deep foundation elements that satisfy the following additional detailing requirements shall be deemed to comply with the curvature capacity requirements of this section.

1. Precast prestressed concrete piles detailed in accordance with Section 1810A.3.8.
2. Cast-in-place deep foundation elements with a minimum longitudinal reinforcement ratio of 0.005 extending the full length of the element and detailed in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 as required by Section 1810A.3.9.4.2.2.

1810A.2.5 Group effects. The analysis shall include group effects on lateral behavior where the center-to-center spacing of deep foundation elements in the direction of lateral force is less than eight times the least horizontal dimension of an element. The analysis shall include group effects on axial behavior where the center-to-center spacing of deep foundation elements is less than three times the least horizontal dimension of an element. Group effects shall be evaluated using a generally accepted method of analysis; the analysis for uplift of grouped elements with center-to-center spacing less than three times the least horizontal dimension of an element shall be evaluated in accordance with Section 1810A.3.3.1.6.

1810A.3 Design and detailing. Deep foundations shall be designed and detailed in accordance with Sections 1810A.3.1 through 1810A.3.13.

1810A.3.1 Design conditions. Design of deep foundations shall include the design conditions specified in Sections 1810A.3.1.1 through 1810A.3.1.6, as applicable.

1810A.3.1.1 Design methods for concrete elements.

Where concrete deep foundations are laterally supported in accordance with Section 1810A.2.1 for the entire height and applied forces cause bending moments not greater than those resulting from accidental eccentricities, structural design of the element using the allowable stress design load combinations specified in ASCE 7, Section 2.4 or the alternative allowable stress design load combinations of Section 1605A.2 and the allowable stresses specified in this chapter shall be

permitted. Otherwise, the structural design of concrete deep foundation elements shall use the strength load combinations specified in ASCE 7, Section 2.3 and approved strength design methods.

1810A.3.1.2 Composite elements. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section of the composite assembly shall satisfy the applicable requirements of this code, and the maximum allowable load in each section shall be limited by the structural capacity of that section.

1810A.3.1.3 Mislocation. The foundation or superstructure shall be designed to resist the effects of the mislocation of any deep foundation element by not less than 3 inches (76 mm). To resist the effects of mislocation, compressive overload of deep foundation elements to 110 percent of the allowable design load shall be permitted.

1810A.3.1.4 Driven piles. Driven piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by handling, driving and service loads.

1810A.3.1.5 Helical piles. Helical piles shall be designed and manufactured in accordance with accepted engineering practice to resist all stresses induced by installation into the ground and service loads.

1810A.3.1.5.1 Helical piles seismic requirements.

For structures assigned to Seismic Design Category D, E or F, capacities of helical piles shall be determined in accordance with Section 1810A.3.3 by at least two project-specific preproduction tests for each soil profile, size and depth of helical pile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1617A.1.15.

Helical piles shall satisfy corrosion resistance requirements of ICC-ES AC 358. In addition, all helical pile materials that are subject to corrosion shall include at least $1/10$ -inch corrosion allowance.

Helical piles shall not be considered as carrying any horizontal loads.

1810A.3.1.6 Casings. Temporary and permanent casings shall be of steel and shall be sufficiently strong to resist collapse and sufficiently watertight to exclude any foreign materials during the placing of concrete. Where a permanent casing is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1810A.3.2.5. Horizontal joints in the casing shall be spliced in accordance with Section 1810A.3.6.

1810A.3.2 Materials. The materials used in deep foundation elements shall satisfy the requirements of Sections 1810A.3.2.1 through 1810A.3.2.8, as applicable.

1810A.3.2.1 Concrete. Where concrete is cast in a steel pipe or where an enlarged base is formed by compact-

ing concrete, the maximum size for coarse aggregate shall be $\frac{3}{4}$ inch (19.1 mm). Concrete to be compacted shall have a zero slump.

1810A.3.2.1.1 Seismic hooks. For structures assigned to Seismic Design Category C, D, E or F, the ends of hoops, spirals and ties used in concrete deep foundation elements shall be terminated with seismic hooks, as defined in ACI 318, and shall be turned into the confined concrete core.

➔ **1810A.3.2.2 Prestressing steel.** Prestressing steel shall conform to ASTM A416.

1810A.3.2.3 Steel. Structural steel H-piles and structural steel sheet piling shall conform to the material requirements in ASTM A6. Steel pipe piles shall conform to the material requirements in ASTM A252. Fully welded steel piles shall be fabricated from plates that conform to the material requirements in ASTM A36, ASTM A283, ASTM A572, ASTM A588 or ASTM A690.

1810A.3.2.4 Timber. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

➔ **1810A.3.2.5 Protection of materials.** Where boring records or site conditions indicate possible deleterious action on the materials used in deep foundation

elements because of soil constituents, changing water levels or other factors, the elements shall be adequately protected by materials, methods or processes approved by the building official. Protective materials shall be applied to the elements so as not to be rendered ineffective by installation. The effectiveness of such protective measures for the particular purpose shall have been thoroughly established by satisfactory service records or other evidence.

1810A.3.2.6 Allowable stresses. The allowable stresses for materials used in deep foundation elements shall not exceed those specified in Table 1810A.3.2.6.

1810A.3.2.7 Increased allowable compressive stress for cased mandrell-driven cast-in-place elements. The allowable compressive stress in the concrete shall be permitted to be increased as specified in Table 1810A.3.2.6 for those portions of permanently cased cast-in-place elements that satisfy all of the following conditions:

1. The design shall not use the casing to resist any portion of the axial load imposed.
2. The casing shall have a sealed tip and be mandrel driven.

**TABLE 1810A.3.2.6
ALLOWABLE STRESSES FOR MATERIALS USED IN DEEP FOUNDATION ELEMENTS**

MATERIAL TYPE AND CONDITION	MAXIMUM ALLOWABLE STRESS ^a
1. Concrete or grout in compression ^b Cast-in-place with a permanent casing in accordance with Section 1810.3.2.7 or Section 1810.3.5.3.4 Cast-in-place in other permanent casing or rock Cast-in-place without a permanent casing Precast nonprestressed Precast prestressed	$0.4 f'_c$ $0.33 f'_c$ $0.3 f'_c$ $0.33 f'_c$ $0.33 f'_c - 0.27 f_{pc}$
2. Nonprestressed reinforcement in compression	$0.4 f_y \leq 30,000$ psi
3. Steel in compression Cores within concrete-filled pipes or tubes Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Pipes or tubes for micropiles Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.5 F_y \leq 32,000$ psi $0.4 F_y \leq 32,000$ psi $0.35 F_y \leq 24,000$ psi $0.6 F_y \leq 0.5 F_u$
4. Nonprestressed reinforcement in tension Within micropiles Other conditions For load combinations that do not include wind or seismic loads For load combinations that include wind or seismic loads	$0.6 f_y$ $0.5 f_y \leq 30,000$ psi $0.5 f_y \leq 40,000$ psi
5. Steel in tension Pipes, tubes or H-piles, where justified in accordance with Section 1810.3.2.8 Other pipes, tubes or H-piles Helical piles	$0.5 F_y \leq 32,000$ psi $0.35 F_y \leq 24,000$ psi $0.6 F_y \leq 0.5 F_u$
6. Timber	In accordance with the ANSI/AWC NDS

a. f'_c is the specified compressive strength of the concrete or grout; f_{pc} is the compressive stress on the gross concrete section due to effective prestress forces only; f_y is the specified yield strength of reinforcement; F_y is the specified minimum yield stress of steel; F_u is the specified minimum tensile stress of structural steel.

b. The stresses specified apply to the gross cross-sectional area of the concrete for precast prestressed piles and to the net cross-sectional area for all other piles. Where a temporary or permanent casing is used, the inside face of the casing shall be considered the outer edge of the concrete cross-section.

3. The thickness of the casing shall be not less than manufacturer's standard gage No.14 (0.068 inch) (1.75 mm).
4. The casing shall be seamless or provided with seams of strength equal to the basic material and be of a configuration that will provide confinement to the cast-in-place concrete.
5. The ratio of steel yield strength (F_y) to specified compressive strength (f'_c) shall be not less than six.
6. The nominal diameter of the element shall not be greater than 16 inches (406 mm).

1810A.3.2.8 Justification of higher allowable stresses. Use of allowable stresses greater than those specified in Section 1810.3.2.6 shall be permitted where supporting data justifying such higher stresses is filed with the building official. Such substantiating data shall include the following:

1. A geotechnical investigation in accordance with Section 1803A.
2. Load tests in accordance with Section 1810A.3.3.1.2, regardless of the load supported by the element.

The design and installation of the deep foundation elements shall be under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations who shall submit a report to the building official stating that the elements as installed satisfy the design criteria.

1810A.3.3 Determination of allowable loads. The allowable axial and lateral loads on deep foundation elements shall be determined by an approved formula, load tests or method of analysis.

1810A.3.3.1 Allowable axial load. The allowable axial load on a deep foundation element shall be determined in accordance with Sections 1810A.3.3.1.1 through 1810A.3.3.1.9.

Exception: Where approved by the building official, load testing is not required.

1810A.3.3.1.1 Driving criteria. The allowable compressive load on any driven deep foundation element where determined by the application of an approved driving formula shall not exceed 40 tons (356 kN). For allowable loads above 40 tons (356 kN), the wave equation method of analysis shall be used to estimate driveability for both driving stresses and net displacement per blow at the ultimate load. Allowable loads shall be verified by load tests in accordance with Section 1810A.3.3.1.2. The formula or wave equation load shall be determined for gravity-drop or power-actuated hammers and the hammer energy used shall be the maximum consistent with the size, strength and weight of the driven elements. The use of a follower is permitted only with the approval of the building official. The introduction of

fresh hammer cushion or pile cushion material just prior to final penetration is not permitted.

1810A.3.3.1.2 Load tests. Where design compressive loads are greater than those determined using the allowable stresses specified in Section 1810A.3.2.6, where the design load for any deep foundation element is in doubt, *where driven deep foundation elements are installed by means other than a pile hammer*, or where cast-in-place deep foundation elements have an enlarged base formed either by compacting concrete or by driving a precast base, control test elements shall be tested in accordance with ASTM D1143 *including Procedure G: Cyclic Loading Test* or ASTM D4945. One element or more shall be load tested in each area of uniform subsoil conditions. Where required by the building official, additional elements shall be load tested where necessary to establish the safe design capacity. The resulting allowable loads shall not be more than one-half of the ultimate axial load capacity of the test element as assessed by one of the published methods listed in Section 1810A.3.3.1.3 with consideration for the test type, duration and subsoil. The ultimate axial load capacity shall be determined by a registered design professional with consideration given to tolerable total and differential settlements at design load in accordance with Section 1810A.2.3. In subsequent installation of the balance of deep foundation elements, all elements shall be deemed to have a supporting capacity equal to that of the control element where such elements are of the same type, size and relative length as the test element; are installed using the same or comparable methods and equipment as the test element; are installed in similar subsoil conditions as the test element; and, for driven elements, where the rate of penetration (for example, net displacement per blow) of such elements is equal to or less than that of the test element driven with the same hammer through a comparable driving distance, *or where the downward pressure and torque on such elements is greater than or equal to that applied to the test element that determined the ultimate axial load capacity at a comparable driving distance.*

1810A.3.3.1.3 Load test evaluation methods. It shall be permitted to evaluate load tests of deep foundation elements using any of the following methods:

1. Davisson Offset Limit.
2. Brinch-Hansen 90-percent Criterion.
3. Butler-Hoy Criterion.
4. Other methods approved by the building official.

1810A.3.3.1.4 Allowable shaft resistance. The assumed shaft resistance developed by any uncased cast-in-place deep foundation element shall not exceed one-sixth of the bearing value of the soil material at minimum depth as set forth in Table 1806A.2, up to 500 psf (24 kPa), unless a greater

value is allowed by the building official on the basis of a geotechnical investigation as specified in Section 1803 or a greater value is substantiated by a load test in accordance with Section 1810A.3.3.1.2. Shaft resistance and end-bearing resistance shall not be assumed to act simultaneously unless determined by a geotechnical investigation in accordance with Section 1803A.

1810A.3.3.1.5 Uplift capacity of a single deep foundation element. Where required by the design, the uplift capacity of a single deep foundation element shall be determined by an approved method of analysis based on a minimum factor of safety of three or by load tests conducted in accordance with ASTM D3689. The maximum allowable uplift load shall not exceed the ultimate load capacity as determined in Section 1810A.3.3.1.2, using the results of load tests conducted in accordance with ASTM D3689, *including the cyclic loading procedure*, divided by a factor of safety of two.

Exception: Where uplift is due to wind or seismic loading, the minimum factor of safety shall be two where capacity is determined by an analysis and one and one-half where capacity is determined by load tests.

1810A.3.3.1.6 Allowable uplift load of grouped deep foundation elements. For grouped deep foundation elements subjected to uplift, the allowable uplift load for the group shall be calculated by a generally accepted method of analysis. Where the deep foundation elements in the group are placed at a center-to-center spacing less than three times the least horizontal dimension of the largest single element, the allowable uplift load for the group is permitted to be calculated as the lesser of:

1. The proposed individual allowable uplift load times the number of elements in the group.
2. Two-thirds of the effective weight of the group and the soil contained within a block defined by the perimeter of the group and the length of the element, plus two-thirds of the ultimate shear resistance along the soil block.

1810A.3.3.1.7 Load-bearing capacity. Deep foundation elements shall develop ultimate load capacities of not less than twice the design working loads in the designated load-bearing layers. Analysis shall show that soil layers underlying the designated load-bearing layers do not cause the load-bearing capacity safety factor to be less than two.

1810A.3.3.1.8 Bent deep foundation elements. The load-bearing capacity of deep foundation elements discovered to have a sharp or sweeping bend shall be determined by an approved method of analysis or by load testing a representative element.

1810A.3.3.1.9 Helical piles. The allowable axial design load, P_a , of helical piles shall be determined as follows:

$$P_a = 0.5 P_u \quad \text{(Equation 18A-4)}$$

where P_u is the least value of:

1. Base capacity plus shaft resistance of the helical pile. The base capacity is equal to the sum of the areas of the helical bearing plates times the ultimate bearing capacity of the soil or rock comprising the bearing stratum. The shaft resistance is equal to the area of the shaft above the uppermost helical bearing plate times the ultimate skin resistance.
2. Ultimate capacity determined from well-documented correlations with installation torque.
3. Ultimate capacity determined from load tests.
4. Ultimate axial capacity of pile shaft.
5. Ultimate axial capacity of pile shaft couplings.
6. Sum of the ultimate axial capacity of helical bearing plates affixed to pile.

1810A.3.3.2 Allowable lateral load. Where required by the design, the lateral load capacity of a single deep foundation element or a group thereof shall be determined by an approved method of analysis or by lateral load tests *in accordance with ASTM D3966, including the cyclic loading procedure*, to not less than twice the proposed design working load. The resulting allowable load shall not be more than one-half of the load that produces a gross lateral movement of 1 inch (25 mm) at the lower of the top of foundation element and the ground surface, unless it can be shown that the predicted lateral movement shall cause neither harmful distortion of, nor instability in, the structure, nor cause any element to be loaded beyond its capacity.

1810A.3.4 Subsiding soils or strata. Where deep foundation elements are installed through subsiding soils or other subsiding strata and derive support from underlying firmer materials, consideration shall be given to the downward frictional forces potentially imposed on the elements by the subsiding upper strata.

Where the influence of subsiding soils or strata is considered as imposing loads on the element, the allowable stresses specified in this chapter shall be permitted to be increased where satisfactory substantiating data are submitted.

1810A.3.5 Dimensions of deep foundation elements. The dimensions of deep foundation elements shall be in accordance with Sections 1810A.3.5.1 through 1810A.3.5.3, as applicable.

1810A.3.5.1 Precast. The minimum lateral dimension of precast concrete deep foundation elements shall be 8 inches (203 mm). Corners of square elements shall be chamfered.

1810A.3.5.2 Cast-in-place or grouted-in-place. Cast-in-place and grouted-in-place deep foundation elements shall satisfy the requirements of this section.

1810A.3.5.2.1 Cased. Cast-in-place or grouted-in-place deep foundation elements with a permanent casing shall have a nominal outside diameter of not less than 8 inches (203 mm).

1810A.3.5.2.2 Uncased. Cast-in-place or grouted-in-place deep foundation elements without a permanent casing shall have a specified diameter of not less than 12 inches (305 mm). The element length shall not exceed 30 times the specified diameter.

Exception: The length of the element is permitted to exceed 30 times the specified diameter, provided that the design and installation of the deep foundations are under the direct supervision of a registered design professional knowledgeable in the field of soil mechanics and deep foundations. The registered design professional shall submit a report to the building official stating that the elements were installed in compliance with the approved construction documents.

1810A.3.5.2.3 Micropiles. Micropiles shall have a nominal diameter of 12 inches (305 mm) or less. The minimum diameter set forth elsewhere in Section 1810A.3.5 shall not apply to micropiles.

1810A.3.5.3 Steel. Steel deep foundation elements shall satisfy the requirements of this section.

1810A.3.5.3.1 Structural steel H-piles. Sections of structural steel H-piles shall comply with the requirements for HP shapes in ASTM A6, or the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.
2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $\frac{3}{8}$ inch (9.5 mm).

For structures assigned to Seismic Design Category D, E or F, design and detailing of H-piles shall also conform to the requirements of AISC 341.

1810A.3.5.3.2 Fully welded steel piles fabricated from plates. Sections of fully welded steel piles fabricated from plates shall comply with the following:

1. The flange projections shall not exceed 14 times the minimum thickness of metal in either the flange or the web and the flange widths shall be not less than 80 percent of the depth of the section.

2. The nominal depth in the direction of the web shall be not less than 8 inches (203 mm).
3. Flanges and web shall have a minimum nominal thickness of $\frac{3}{8}$ inch (9.5 mm).

1810A.3.5.3.3 Structural steel sheet piling. Individual sections of structural steel sheet piling shall conform to the profile indicated by the manufacturer, and shall conform to the general requirements specified by ASTM A6.

Installation of sheet piling shall satisfy inspection, monitoring and observation requirements in Sections 1812A.6 and 1812A.7.

1810A.3.5.3.4 Steel pipes and tubes. Steel pipes and tubes used as deep foundation elements shall have a nominal outside diameter of not less than 8 inches (203 mm). Where steel pipes or tubes are driven open ended, they shall have not less than 0.34 square inch (219 mm²) of steel in cross section to resist each 1,000 foot-pounds (1356 Nm) of pile hammer energy, or shall have the equivalent strength for steels having a yield strength greater than 35,000 psi (241 MPa) or the wave equation analysis shall be permitted to be used to assess compression stresses induced by driving to evaluate if the pile section is appropriate for the selected hammer. Where a pipe or tube with wall thickness less than 0.179 inch (4.6 mm) is driven open ended, a suitable cutting shoe shall be provided. Concrete-filled steel pipes or tubes in structures assigned to Seismic Design Category C, D, E or F shall have a wall thickness of not less than $\frac{3}{16}$ inch (5 mm). The pipe or tube casing for socketed drilled shafts shall have a nominal outside diameter of not less than 18 inches (457 mm), a wall thickness of not less than $\frac{3}{8}$ inch (9.5 mm) and a suitable steel driving shoe welded to the bottom; the diameter of the rock socket shall be approximately equal to the inside diameter of the casing.

Exceptions:

1. There is no minimum diameter for steel pipes or tubes used in micropiles.
2. For mandrel-driven pipes or tubes, the minimum wall thickness shall be $\frac{1}{10}$ inch (2.5 mm).

1810A.3.5.3.5 Helical piles. Dimensions of the central shaft and the number, size and thickness of helical bearing plates shall be sufficient to support the design loads.

1810A.3.6 Splices. Splices shall be constructed so as to provide and maintain true alignment and position of the component parts of the deep foundation element during installation and subsequent thereto and shall be designed to resist the axial and shear forces and moments occurring at the location of the splice during driving and for design load combinations. Where deep foundation elements of

the same type are being spliced, splices shall develop not less than 50 percent of the bending strength of the weaker section. Where deep foundation elements of different materials or different types are being spliced, splices shall develop the full compressive strength and not less than 50 percent of the tension and bending strength of the weaker section. Where structural steel cores are to be spliced, the ends shall be milled or ground to provide full contact and shall be full-depth welded.

Splices occurring in the upper 10 feet (3048 mm) of the embedded portion of an element shall be designed to resist at allowable stresses the moment and shear that would result from an assumed eccentricity of the axial load of 3 inches (76 mm), or the element shall be braced in accordance with Section 1810A.2.2 to other deep foundation elements that do not have splices in the upper 10 feet (3048 mm) of embedment.

1810A.3.6.1 Seismic Design Categories C through F.

For structures assigned to Seismic Design Category C, D, E or F splices of deep foundation elements shall develop the lesser of the following:

1. The nominal strength of the deep foundation element.
2. The axial and shear forces and moments from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810A.3.7 Top of element detailing at cutoffs. Where a minimum length for reinforcement or the extent of closely spaced confinement reinforcement is specified at the top of a deep foundation element, provisions shall be made so that those specified lengths or extents are maintained after cutoff.

1810A.3.8 Precast concrete piles. Precast concrete piles shall be designed and detailed in accordance with ACI 318.

Exception: Where the axial load from seismic forces is amplified by the applicable overstrength factor, Ω_p , the axial load limits in Section 18.13.5.10.6 of ACI 318 may be increased by two times.

1810A.3.9 Cast-in-place deep foundations. Cast-in-place deep foundation elements shall be designed and detailed in accordance with Sections 1810A.3.9.1 through 1810A.3.9.6.

1810A.3.9.1 Design cracking moment. The design cracking moment (ϕM_n) for a cast-in-place deep foundation element not enclosed by a structural steel pipe or tube shall be determined using the following equation:

$$\phi M_n = 3 \sqrt{f'_c} S_m \quad (\text{Equation 18A-5})$$

$$\text{For SI: } \phi M_n = 0.25 \sqrt{f'_c} S_m$$

where:

f'_c = Specified compressive strength of concrete or grout, psi (MPa).

S_m = Elastic section modulus, neglecting reinforcement and casing, cubic inches (mm^3).

1810A.3.9.2 Required reinforcement. Where subject to uplift or where the required moment strength determined using the load combinations of ASCE 7, Section 2.3 exceeds the design cracking moment determined in accordance with Section 1810A.3.9.1, cast-in-place deep foundations not enclosed by a structural steel pipe or tube shall be reinforced.

1810A.3.9.3 Placement of reinforcement. Reinforcement where required shall be assembled and tied together and shall be placed in the deep foundation element as a unit before the reinforced portion of the element is filled with concrete.

Exceptions:

1. Steel dowels embedded 5 feet (1524 mm) or less shall be permitted to be placed after concreting, while the concrete is still in a semi-fluid state.
2. For deep foundation elements installed with a hollow-stem auger, tied reinforcement shall be placed after elements are concreted, while the concrete is still in a semifluid state. Longitudinal reinforcement without lateral ties shall be placed either through the hollow stem of the auger prior to concreting or after concreting, while the concrete is still in a semifluid state.
3. For Group R-3 and U occupancies not exceeding two stories of light-frame construction, reinforcement is permitted to be placed after concreting, while the concrete is still in a semifluid state, and the concrete cover requirement is permitted to be reduced to 2 inches (51 mm), provided that the construction method can be demonstrated to the satisfaction of the building official.

1810A.3.9.4 Seismic reinforcement. Where a structure is assigned to Seismic Design Category D, E or F, reinforcement shall be provided in accordance with Section 1810A.3.9.4.2.

Exceptions:

1. Isolated deep foundation elements supporting posts of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals, where detailed so the element is not subject to lateral loads and the soil provides adequate lateral support in accordance with Section 1810A.2.1.
2. Isolated deep foundation elements supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than one No. 4 bar, without ties or spirals,

where the lateral load, E , to the top of the element does not exceed 200 pounds (890 N) and the soil provides adequate lateral support in accordance with Section 1810A.2.1.

3. Deep foundation elements supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction shall be permitted to be reinforced as required by rational analysis but with not less than two No. 4 bars, without ties or spirals, where the design cracking moment determined in accordance with Section 1810A.3.9.1 exceeds the required moment strength determined using the load combinations with overstrength factor in Section 2.3.6 or 2.4.5 of ASCE 7 and the soil provides adequate lateral support in accordance with Section 1810A.2.1.
4. Closed ties or spirals where required by Section 1810A.3.9.4.2 shall be permitted to be limited to the top 3 feet (914 mm) of deep foundation elements 10 feet (3048 mm) or less in depth supporting Group R-3 and U occupancies of Seismic Design Category D, not exceeding two stories of light-frame construction.

1810A.3.9.4.1 Seismic reinforcement in Seismic Design Category C. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1810A.3.9.4.2 Seismic reinforcement in Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, cast-in-place deep foundation elements shall be reinforced as specified in this section. Reinforcement shall be provided where required by analysis.

Not fewer than four longitudinal bars, with a minimum longitudinal reinforcement ratio of 0.005, shall be provided throughout the minimum reinforced length of the element as defined in this section starting at the top of the element. The minimum reinforced length of the element shall be taken as the greatest of the following:

1. One-half of the element length.
2. A distance of 10 feet (3048 mm).
3. Three times the least element dimension.
4. The distance from the top of the element to the point where the design cracking moment determined in accordance with Section 1810A.3.9.1 exceeds the required moment strength determined using the load combinations of ASCE 7, Section 2.3.

Transverse reinforcement shall consist of closed ties or spirals not smaller than No. 3 bars for elements with a least dimension up to 20 inches (508 mm), and No. 4 bars for larger elements. Throughout the remainder of the reinforced length outside the regions with transverse confinement reinforcement, as specified in Section 1810A.3.9.4.2.1 or

1810A.3.9.4.2.2, the spacing of transverse reinforcement shall not exceed the least of the following:

1. 12 longitudinal bar diameters.
2. One-half the least dimension of the element.
3. 12 inches (305 mm).

Exceptions:

1. The requirements of this section shall not apply to concrete cast in structural steel pipes or tubes.
2. A spiral-welded metal casing of a thickness not less than manufacturer's standard No. 14 gage (0.068 inch) is permitted to provide concrete confinement in lieu of the closed ties or spirals. Where used as such, the metal casing shall be protected against possible deleterious action due to soil constituents, changing water levels or other factors indicated by boring records of site conditions.

1810A.3.9.4.2.1 Site Classes A through D. For Site Class A, B, C or D sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within three times the least element dimension *at the bottom* of the pile cap. A transverse spiral reinforcement ratio of not less than one-half of that required in Table 18.10.6.4(g) of ACI 318 shall be permitted *for concrete deep foundation elements*.

1810A.3.9.4.2.2 Site Classes E and F. For Site Class E or F sites, transverse confinement reinforcement shall be provided in the element in accordance with Sections 18.7.5.2, 18.7.5.3 and 18.7.5.4 of ACI 318 within seven times the least element dimension *at the bottom* of the pile cap and within seven times the least element dimension *at the interfaces of strata that are hard or stiff and strata that are liquefiable or are composed of soft- to medium-stiff clay*.

1810A.3.9.5 Belled drilled shafts. Where drilled shafts are belled at the bottom, the edge thickness of the bell shall be not less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1810A.3.9.6 Socketed drilled shafts. Socketed drilled shafts shall have a permanent pipe or tube casing that extends down to bedrock and an uncased socket drilled into the bedrock, both filled with concrete. Socketed drilled shafts shall have reinforcement or a structural steel core for the length as indicated by an approved method of analysis.

The depth of the rock socket shall be sufficient to develop the full load-bearing capacity of the element with a minimum safety factor of two, but the depth shall be not less than the outside diameter of the pipe or

tube casing. The design of the rock socket is permitted to be predicated on the sum of the allowable load-bearing pressure on the bottom of the socket plus bond along the sides of the socket.

Where a structural steel core is used, the gross cross-sectional area of the core shall not exceed 25 percent of the gross area of the drilled shaft.

1810A.3.10 Micropiles. Micropiles shall be designed and detailed in accordance with Sections 1810A.3.10.1 through 1810A.3.10.4.

1810A.3.10.1 Construction. Micropiles shall develop their load-carrying capacity by means of a bond zone in soil, bedrock or a combination of soil and bedrock. Micropiles shall be grouted and have either a steel pipe or tube or steel reinforcement at every section along the length. It shall be permitted to transition from deformed reinforcing bars to steel pipe or tube reinforcement by extending the bars into the pipe or tube section by not less than their development length in tension in accordance with ACI 318.

1810A.3.10.2 Materials. Reinforcement shall consist of deformed reinforcing bars in accordance with ASTM A615 Grade 60 or 75 or ASTM A722 Grade 150.

The steel pipe or tube shall have a minimum wall thickness of $\frac{3}{16}$ inch (4.8 mm). Splices shall comply with Section 1810A.3.6. The steel pipe or tube shall have a minimum yield strength of 45,000 psi (310 MPa) and a minimum elongation of 15 percent as shown by mill certifications or two coupon test samples per 40,000 pounds (18 160 kg) of pipe or tube.

1810A.3.10.3 Reinforcement. For micropiles or portions thereof grouted inside a temporary or permanent casing or inside a hole drilled into bedrock or a hole drilled with grout, the steel pipe or tube or steel reinforcement shall be designed to carry not less than 40 percent of the design compression load. Micropiles or portions thereof grouted in an open hole in soil without temporary or permanent casing and without suitable means of verifying the hole diameter during grouting shall be designed to carry the entire compression load in the reinforcing steel. Where a steel pipe or tube is used for reinforcement, the portion of the grout enclosed within the pipe is permitted to be included in the determination of the allowable stress in the grout.

1810A.3.10.4 Seismic requirements. *For structures assigned to Seismic Design Category D, E or F, a permanent steel casing having a minimum thickness of $\frac{3}{8}$ inch shall be provided from the top of the micropile down to a minimum of 120 percent of the point of zero curvature. Capacity of micropiles shall be determined in accordance with Section 1810A.3.3 by at least two project-specific preproduction tests for each soil profile, size and depth of micropile. At least two percent of all production piles shall be proof tested to the load determined in accordance with Section 1617A.1.15.*

Steel casing length in soil shall be considered as unbonded and shall not be considered as contributing to friction. Casing shall provide confinement at least equivalent to hoop reinforcing required by ACI 318 Section 18.13.5.

Reinforcement shall have Class 1 corrosion protection in accordance with PTI Recommendations for Prestressed Rock and Soil Anchors. Steel casing design shall include at least $\frac{1}{16}$ -inch corrosion allowance.

Micropiles shall not be considered as carrying any horizontal loads.

1810A.3.11 Pile caps. Pile caps shall conform with ACI 318 and this section. Pile caps shall be of reinforced concrete, and shall include all elements to which vertical deep foundation elements are connected, including grade beams and mats. The soil immediately below the pile cap shall not be considered as carrying any vertical load, with the exception of a combined pile raft. *A combined pile raft foundation shall be an alternate system.* The tops of vertical deep foundation elements shall be embedded not less than 3 inches (76 mm) into pile caps and the caps shall extend not less than 4 inches (102 mm) beyond the edges of the elements. The tops of elements shall be cut or chipped back to sound material before capping.

1810A.3.11.1 Seismic Design Categories C through F. For structures assigned to Seismic Design Category C, D, E or F, concrete deep foundation elements shall be connected to the pile cap in accordance with ACI 318.

For resistance to uplift forces, anchorage of steel pipes, tubes or H-piles to the pile cap shall be made by means other than concrete bond to the bare steel section. Concrete-filled steel pipes or tubes shall have reinforcement of not less than 0.01 times the cross-sectional area of the concrete fill developed into the cap and extending into the fill a length equal to two times the required cap embedment, but not less than the development length in tension of the reinforcement.

1810A.3.11.2 Seismic Design Categories D through F. For structures assigned to Seismic Design Category D, E or F, deep foundation element resistance to uplift forces or rotational restraint shall be provided by anchorage into the pile cap, designed considering the combined effect of axial forces due to uplift and bending moments due to fixity to the pile cap. Anchorage shall develop not less than 25 percent of the strength of the element in tension. Anchorage into the pile cap shall comply with the following:

1. In the case of uplift, the anchorage shall be capable of developing the least of the following:
 - 1.1. The nominal tensile strength of the longitudinal reinforcement in a concrete element.
 - 1.2. The nominal tensile strength of a steel element.

- 1.3. The frictional force developed between the element and the soil multiplied by 1.3.

Exception: The anchorage is permitted to be designed to resist the axial tension force resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

2. In the case of rotational restraint, the anchorage shall be designed to resist the axial and shear forces, and moments resulting from the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 or the anchorage shall be capable of developing the full axial, bending and shear nominal strength of the element.
3. The connection between the pile cap and the steel H-piles or unfilled steel pipe piles in structures assigned to Seismic Design Category D, E or F shall be designed for a tensile force of not less than 10 percent of the pile compression capacity.

Exceptions:

1. Connection tensile capacity need not exceed the strength required to resist seismic load effects including overstrength of ASCE 7, Section 12.4.3 or 12.14.3.2.

Where the vertical lateral-force-resisting elements are columns, the pile cap flexural strengths shall exceed the column flexural strength. The connection between batter piles and pile caps shall be designed to resist the nominal strength of the pile acting as a short column. Batter piles and their connection shall be designed to resist forces and moments that result from the application of seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7.

1810A.3.12 Grade beams. Grade beams shall comply with the provisions of ACI 318.

Exception: Grade beams designed to resist the seismic load effects including overstrength factor in accordance with Section 2.3.6 or 2.4.5 of ASCE 7 need not comply with Section 18.13.3 of ACI 318.

1810A.3.13 Seismic ties. Seismic ties shall comply with the provisions of ACI 318.

Exception: In Group R-3 and U occupancies of light-frame construction, deep foundation elements supporting foundation walls, isolated interior posts detailed so the element is not subject to lateral loads or exterior decks and patios are not subject to interconnection where the soils are of adequate stiffness, subject to the approval of the building official.

1810A.4 Installation. Deep foundations shall be installed in accordance with Section 1810A.4. Where a single deep foundation element comprises two or more sections of different materials or different types spliced together, each section shall satisfy the applicable conditions of installation.

1810A.4.1 Structural integrity. Deep foundation elements shall be installed in such a manner and sequence as to prevent distortion or damage that would adversely affect the structural integrity of adjacent structures or of foundation elements being installed or already in place and as to avoid compacting the surrounding soil to the extent that other foundation elements cannot be installed properly.

1810A.4.1.1 Compressive strength of precast concrete piles. A precast concrete pile shall not be driven before the concrete has attained a compressive strength of not less than 75 percent of the specified compressive strength (f'_c), but not less than the strength sufficient to withstand handling and driving forces.

1810A.4.1.2 Shafts in unstable soils. Where cast-in-place deep foundation elements are formed through unstable soils, the open hole shall be stabilized by a casing, slurry, or other approved method prior to placing the concrete. Where the casing is withdrawn during concreting, the level of concrete shall be maintained above the bottom of the casing at a sufficient height to offset any hydrostatic or lateral soil pressure. Driven casings shall be mandrel driven their full length in contact with the surrounding soil.

1810A.4.1.3 Driving near uncased concrete. Deep foundation elements shall not be driven within six element diameters center to center in granular soils or within one-half the element length in cohesive soils of an uncased element filled with concrete less than 48 hours old unless approved by the building official. If driving near uncased concrete elements causes the concrete surface in any completed element to rise or drop significantly or bleed additional water, the completed element shall be replaced.

1810A.4.1.4 Driving near cased concrete. Deep foundation elements shall not be driven within four and one-half average diameters of a cased element filled with concrete less than 24 hours old unless approved by the building official. Concrete shall not be placed in casings within heave range of driving.

1810A.4.1.5 Defective timber piles. *Not permitted by DSA-SS, DSA-SS/CC or OSHPD.*

1810A.4.2 Identification. Deep foundation materials shall be identified for conformity to the specified grade with this identity maintained continuously from the point of manufacture to the point of installation or shall be tested by an approved agency to determine conformity to the specified grade. The approved agency shall furnish an affidavit of compliance to the building official.

1810A.4.3 Location plan. A plan showing the location and designation of deep foundation elements by an identification system shall be filed with the building official prior to installation of such elements. Detailed records for elements shall bear an identification corresponding to that shown on the plan.

1810A.4.4 Preexcavation. The use of jetting, augering or other methods of preexcavation shall be subject to the

approval of the building official. Where permitted, preexcavation shall be carried out in the same manner as used for deep foundation elements subject to load tests and in such a manner that will not impair the carrying capacity of the elements already in place or damage adjacent structures. Element tips shall be advanced below the preexcavated depth until the required resistance or penetration is obtained.

1810A.4.5 Vibratory driving. Vibratory drivers shall only be used to install deep foundation elements where the element load capacity is verified by load tests in accordance with Section 1810A.3.3.1.2. The installation of production elements shall be controlled according to power consumption, rate of penetration or other approved means that ensure element capacities equal or exceed those of the test elements.

Exceptions:

1. The pile installation is completed by driving with an impact hammer in accordance with Section 1810A.3.3.1.1.
2. The pile is to be used only for lateral resistance.

1810A.4.6 Heaved elements. Deep foundation elements that have heaved during the driving of adjacent elements shall be redriven as necessary to develop the required capacity and penetration, or the capacity of the element shall be verified by load tests in accordance with Section 1810A.3.3.1.2.

1810A.4.7 Enlarged base cast-in-place elements. Enlarged bases for cast-in-place deep foundation elements formed by compacting concrete or by driving a precast base shall be formed in or driven into granular soils. Such elements shall be constructed in the same manner as successful prototype test elements driven for the project. Shafts extending through peat or other organic soil shall be encased in a permanent steel casing. Where a cased shaft is used, the shaft shall be adequately reinforced to resist column action or the annular space around the shaft shall be filled sufficiently to reestablish lateral support by the soil. Where heave occurs, the element shall be replaced unless it is demonstrated that the element is undamaged and capable of carrying twice its design load.

1810A.4.8 Hollow-stem augered, cast-in-place elements. Where concrete or grout is placed by pumping through a hollow-stem auger, the auger shall be permitted to rotate in a clockwise direction during withdrawal. As the auger is withdrawn at a steady rate or in increments not to exceed 1 foot (305 mm), concreting or grouting pumping pressures shall be measured and maintained high enough at all times to offset hydrostatic and lateral earth pressures. Concrete or grout volumes shall be measured to ensure that the volume of concrete or grout placed in each element is equal to or greater than the theoretical volume of the hole created by the auger. Where the installation process of any element is interrupted or a loss of concreting or grouting pressure occurs, the element shall be redrilled to 5 feet (1524 mm) below the elevation of the tip of the auger when the installation was interrupted or concrete or grout pressure was lost and reformed. Augered

cast-in-place elements shall not be installed within six diameters center to center of an element filled with concrete or grout less than 12 hours old, unless approved by the building official. If the concrete or grout level in any completed element drops due to installation of an adjacent element, the element shall be replaced.

1810A.4.9 Socketed drilled shafts. The rock socket and pipe or tube casing of socketed drilled shafts shall be thoroughly cleaned of foreign materials before filling with concrete. Steel cores shall be bedded in cement grout at the base of the rock socket.

1810A.4.10 Micropiles. Micropile deep foundation elements shall be permitted to be formed in holes advanced by rotary or percussive drilling methods, with or without casing. The elements shall be grouted with a fluid cement grout. The grout shall be pumped through a tremie pipe extending to the bottom of the element until grout of suitable quality returns at the top of the element. The following requirements apply to specific installation methods:

1. For micropiles grouted inside a temporary casing, the reinforcing bars shall be inserted prior to withdrawal of the casing. The casing shall be withdrawn in a controlled manner with the grout level maintained at the top of the element to ensure that the grout completely fills the drill hole. During withdrawal of the casing, the grout level inside the casing shall be monitored to verify that the flow of grout inside the casing is not obstructed.
2. For a micropile or portion thereof grouted in an open drill hole in soil without temporary casing, the minimum design diameter of the drill hole shall be verified by a suitable device during grouting.
3. For micropiles designed for end bearing, a suitable means shall be employed to verify that the bearing surface is properly cleaned prior to grouting.
4. Subsequent micropiles shall not be drilled near elements that have been grouted until the grout has had sufficient time to harden.
5. Micropiles shall be grouted as soon as possible after drilling is completed.
6. For micropiles designed with a full-length casing, the casing shall be pulled back to the top of the bond zone and reinserted or some other suitable means employed to ensure grout coverage outside the casing.

1810A.4.11 Helical piles. Helical piles shall be installed to specified embedment depth and torsional resistance criteria as determined by a registered design professional. The torque applied during installation shall not exceed the manufacturer's rated maximum installation torque resistance of the helical pile.

1810A.4.12 Special inspection. Special inspections in accordance with Sections 1705A.7 and 1705A.8 shall be provided for driven and cast-in-place deep foundation elements, respectively. Special inspections in accordance with Section 1705A.9 shall be provided for helical piles.

SECTION 1811A PRESTRESSED ROCK AND SOIL FOUNDATION ANCHORS

1811A.1 General. The requirements of this section address the use of vertical rock and soil anchors in resisting seismic or wind overturning forces resulting in tension on shallow foundations.

1811A.2 Adoption. Except for the modifications as set forth in Sections 1811A.3 and 1811A.4, all prestressed rock and soil foundation anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.

1811A.3 Geotechnical requirements. Geotechnical report for the prestressed rock and soil foundation anchors shall address the following:

1. Minimum diameter and minimum spacing for the anchors including consideration of group effects.
2. Maximum unbonded length and minimum bonded length of the tendon.
3. Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.
4. Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress.
5. Anchor axial tension stiffness recommendations at the anticipated anchor axial tension displacements, when required for structural analysis.
6. Minimum grout pressure for installation and post-grout pressure.
7. Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.
8. Performance test shall be at a minimum of 1.6 times the design loads, but shall not exceed 80 percent of the specified minimum tensile strength of the tendons. There shall be a minimum of two preproduction test anchors. Preproduction test anchors shall be tested to ultimate load or maximum of 0.80 times the specified minimum tensile strength of the tendon. A creep test is required for all prestressed anchors with greater than 10 kips of lock-off prestressing load.
9. Lock-off prestressing load requirements.
10. Acceptable drilling methods.
11. Geotechnical observation and monitoring requirements.

1811A.4 Structural Requirements.

1. Tendons shall be thread-bar anchors conforming to ASTM A722.
2. The anchors shall be placed vertical.
3. Design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60

percent of the specified minimum tensile strength of the tendons.

4. Ultimate load shall be based upon Section 1617A.1.16 and shall not exceed 80 percent of the specified minimum tensile strength of the tendons.
5. The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge by group effect.
6. Foundation design shall incorporate the effect of lock-off loads.
7. Design shall account for as-built locations of soil anchors considering all the acceptable construction tolerances.
8. Design shall account for both short and long term deformation.
9. Enforcement agency may require consideration of anchor deformation in evaluating deformation compatibility or building drift where it may be significant.

SECTION 1812A EARTH RETAINING SHORING

1812A.1 General. The requirements of this section shall apply to temporary and permanent earth retaining shoring using soldier piles and lagging with or without tie-back anchors in soil or rock, only when existing or new facilities are affected. Shoring used as construction means and methods only, which does not affect existing or new facilities, are not regulated by this section and shall satisfy the requirements of the authorities having jurisdiction.

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1812A.2 through 1812A.8.

1812A.2 Duration. Shoring shall be considered temporary when elements of the shoring will be exposed to site conditions for a period of less than or equal to 2 years, and shall be considered permanent otherwise. Permanent shoring shall account for the increase in lateral soil pressure due to earthquake. At the end of the construction period, the existing and new structures shall not rely on the temporary shoring for support in any way. Wood components shall not be used for permanent shoring lasting more than 2 years. Wood components of the temporary shoring that may affect the performance of permanent structure shall be removed after the shoring is no longer required.

All components of the shoring shall have corrosion protection or preservative treatment for their expected duration. Wood components of the temporary shoring that will not be removed shall be treated in accordance with AWWA U1 (Commodity Specification A, Use Category 4B and Section 5.2), and shall be identified in accordance with Section 2303.1.9.1.

1812A.3 Surcharge. Surcharge pressure due to footings, traffic or other sources shall be considered in design. If the footing surcharge is located within the semicircular distribution or bulb of earth pressure (when shoring is located close

to a footings), lagging shall be designed for lateral earth pressure due to footing surcharge. Soil arching effects may be considered in the design of lagging. Underpinning of the footing may be used in lieu of designing the shoring and lagging for surcharge pressure. Alternatively, continuously contacting drilled pier shafts near the footings shall be permitted. The lateral surcharge design pressure shall be derived using Boussinesq equations modified for the distribution of stresses in an elastic medium due to a uniform, concentrated or line surface load as appropriate and soil arching effects.

1812A.4 Design and testing: Except for the modifications as set forth in Sections 1812A.4.1 through 1812A.4.3, all Prestressed Rock and Soil Tie-back Anchors shall comply with PTI Recommendations for Prestressed Rock and Soil Anchors.

1812A.4.1 Geotechnical requirements: The geotechnical report for the earth retaining shoring shall address the following:

1. Minimum diameter and minimum spacing for the anchors including consideration of group effects.
2. Maximum unbonded length and minimum bonded length of the tie-back anchors.
3. Maximum recommended anchor tension capacity based upon the soil or rock strength/grout bond and anchor depth/spacing.
4. Allowable bond stress at the ground/grout interface and applicable factor of safety for ultimate bond stress for the anchor. For permanent anchors, a minimum factor of safety of 2.0 shall be applied to ground soil interface as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.6.
5. Minimum grout pressure for installation and post-grout pressure for the anchor. The presumptive post grout pressure of 300 psi may be used for all soil type.
6. Class I corrosion protection is required for all permanent and extended temporary anchors in service more than 2 years. A minimum of Class II corrosion protection is required for temporary anchors in service less than or equal to 2 years.
7. Performance test for the anchors shall be at a minimum of two (2) times the design loads and shall not exceed 80 percent of the specified minimum tensile strength of the anchor rod. A creep test is required for all prestressed anchors that are performance tested. All production anchors shall be tested at 150 percent of design loads and shall not be greater than 70 percent of the specified minimum tensile strength of the anchor rod.
8. Earth pressure, surcharge pressure and the seismic increment of earth pressure loading, when applicable.
9. Maximum recommended lateral deformation at the top of the soldier pile, at the tie-back anchor

locations and the drilled pier concrete shafts at the lowest grade level.

10. Allowable vertical soil bearing pressure friction resistance, and lateral passive soil resistance for the drilled pier concrete shafts and associated factors of safety for these allowable capacities.
11. Soil-pier shaft/pile interaction assumptions and lateral soil stiffness to be used in design for drilled pier concrete shaft or pile lateral loads.
12. Acceptable drilling methods.
13. Geotechnical observation and monitoring recommendations.

1812A.4.2 Structural requirements:

1. Tendons shall be thread-bar anchors conforming to ASTM A722.
2. Anchor design loads shall be based upon the load combinations in Section 2.4 of ASCE 7 and shall not exceed 60 percent of the specified minimum tensile strength of the tendons.
3. The anchor shall be designed to fail in grout bond to the soil or rock before pullout of the soil wedge.
4. Design of shoring system shall account for as-built locations of soil anchors considering all specified construction tolerances in Section 1812A.8.
5. Design of shoring system shall account for both short and long-term deformation.

1812A.4.3 Testing of tie-back anchors:

1. The geotechnical engineer shall keep a record at job site of all test loads, total anchor movement, and report their accuracy.
2. The shoring design engineer shall specify design loads for each anchor.

1812A.5 Construction. The construction procedure shall address the following:

1. Holes drilled for piles/tie-back anchors shall be done without detrimental loss of ground, sloughing or caving of materials and without endangering previously installed shoring members or existing foundations.
2. Drilling of earth anchor shafts for tie-backs shall occur when the drill bench reaches two to three feet below the level of the tie-back pockets.
3. Casing or other methods shall be used where necessary to prevent loss of ground and collapse of the hole.
4. The drill cuttings from earth anchor shaft shall be removed prior to anchor installation.
5. Unless tremie methods are used, all water and loose materials shall be removed from the holes prior to installing piles/tie-backs.
6. Tie-back anchor rods with attached centralizing devices shall be installed into the shaft or through the drill casing. Centralizing device shall not restrict movement of the grout.

7. After lagging installation, voids between lagging and soil shall be backfilled immediately to the full height of lagging.
8. The soldier piles shall be placed within specified tolerances in the drilled hole and braced against displacement during grouting. Fill shafts with concrete up to top of footing elevation, rest of the shaft can generally be filled with lean concrete. Excavation for lagging shall not be started until concrete has achieved sufficient strength for all anticipated loads as determined by the shoring design engineer.
9. Where boulders and/or cobbles have been identified in the geotechnical reports, contractor shall be prepared to address boulders and/or cobbles that may be encountered during the drilling of soldier piles and tie-back anchors.
10. The grouting equipment shall produce grout free of lumps and indispensed cement. The grouting equipment shall be sized to enable the grout to be pumped in continuous operation. The mixer shall be capable of continuously agitating the grout.
11. The quantity of grout and grout pressure shall be recorded. The grout pressure shall be controlled to prevent excessive heave in soils or fracturing rock formations.
12. If post-grouting is required, post-grouting operation shall be performed after initial grout has set for 24 hours in the bond length only. Tie-backs shall be grouted over a sufficient length (anchor bond length) to transfer the maximum anchor force to the anchor grout.
13. Testing of anchors in accordance with Section 1812A.4.1, Item 7 may be performed after post-grouting operations, provided grout has reached strength of 3,000 psi as required by PTI Recommendations for Prestressed Rock and Soil Anchors Section 6.11.
14. Anchor rods shall be tensioned straight and true. Excavation directly below the anchors shall not continue before those anchors are tested.
15. If a tie-back anchor initially fails the testing requirements, the anchor shall be permitted to be regouted and retested. If anchor continues to fail, the followings steps shall be taken:
 - a. The contractor shall determine the cause of failure—variations of the soil conditions, installation methods, materials, etc.
 - b. The contractor shall propose a solution to remedy the problem. The proposed solution will need to be reviewed and approved by the geotechnical engineer, shoring design engineer and building official.
16. After a satisfactory test, each anchor shall be locked-off in accordance with Section 8.4 of PTI Recommendations for Prestressed Rock and Soil Anchors.

1812A.6 Inspection, survey monitoring and observation.

1. The shoring design engineer or his designee shall make periodic visits to the job site for the purpose of observing the installation of shoring system, testing of tie-back anchors and monitoring of survey.
2. Testing, inspection and observation shall be in accordance with testing, inspection and observation requirements approved by the building official. The following activities and materials shall be tested, inspected or observed by the special inspector and geotechnical engineer:
 - a. Sampling and testing of concrete in soldier pile and tie-back anchor shafts.
 - b. Fabrication of tie-back anchor pockets on soldier beams
 - c. Installation and testing of tie-back anchors.
 - d. Survey monitoring of soldier pile and tie-back load cells.
 - e. Survey monitoring of existing buildings.
3. A complete and accurate record of all soldier pile locations, depths, concrete strengths, tie-back locations and lengths, tie-back grout strength, quantity of concrete per pile, quantity of grout per tie-back and applied tie-back loads shall be maintained by the special inspector and geotechnical engineer. The shoring design engineer shall be notified of any unusual conditions encountered during installation.
4. Calibration data for each test jack, pressure gauge and master pressure gauge shall be verified by the special inspector and geotechnical engineer. The calibration tests shall be performed by an independent testing laboratory and within 120 calendar days of the data submitted.
5. Monitoring points shall be established at the top and at the anchor heads of selected soldier piles and at intermediate intervals as considered appropriate by the geotechnical engineer.
6. Control points shall be established outside the area of influence of the shoring system to ensure the accuracy of the monitoring readings.
7. The periodic basis of shoring monitoring, as a minimum, shall be as follows:
 - a. Initial monitoring shall be performed prior to any excavation.
 - b. Once excavation has begun, the periodic readings shall be taken weekly until excavation reaches the estimated subgrade elevation and the permanent foundation is complete.
 - c. If performance of the shoring is within established guidelines, shoring design engineer may permit the periodic readings to be bi-weekly. Once initiated, bi-weekly readings shall continue until the building slab at ground floor level is

completed and capable of transmitting lateral loads to the permanent structure. Thereafter, readings can be monthly.

- d. Where the building has been designed to resist lateral earth pressures, the periodic monitoring of the soldier piles and adjacent structure can be discontinued once the ground floor diaphragm and subterranean portion of the structure is capable of resisting lateral soil loads and approved by the shoring design engineer, geotechnical engineer and building official.
 - e. Additional readings shall be taken when requested by the special inspector, shoring design engineer, geotechnical engineer or building official.
8. Monitoring reading shall be submitted to the shoring design engineer, engineer in responsible charge and building official within three working days after they are conducted. Monitoring readings shall be accurate to within 0.01 feet. Results are to be submitted in tabular form showing at least the initial date of monitoring and reading, current monitoring date and reading and difference between the two readings.
 9. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $\frac{1}{2}$ inch or soldier piles reaches 1 inch all excavation activities shall be suspended. The geotechnical and shoring design engineer shall determine the cause of movement, if any, and recommend corrective measures, if necessary, before excavation continues.
 10. If the total cumulative horizontal or vertical movement (from start of construction) of the existing buildings reaches $\frac{3}{4}$ inch or soldier piles reaches $1\frac{1}{2}$ inches all excavation activities shall be suspended until the causes, if any, can be determined. Supplemental shoring shall be devised to eliminate further movement and the building official shall review and approve the supplemental shoring before excavation continues.
 11. Monitoring of tie-back anchor loads:
 - a. Load cells shall be installed at the tie-back heads adjacent to buildings at maximum interval of 50 feet, with a minimum of one load cells per wall.
 - b. Load cell readings shall be taken once a day during excavation and once a week during the remainder of construction.
 - c. Load cell readings shall be submitted to the geotechnical engineer, shoring design engineer, engineer in responsible charge and building official.
 - d. Load cell readings can be terminated once the temporary shoring no longer provides support for the buildings.

> **1812A.7 Monitoring of existing structures.**

1. The contractor shall complete a written and photographic log of all existing structures within 100 ft or three times depth of shoring, prior to construction. A

licensed surveyor shall document all existing substantial cracks in adjacent existing structures.

2. The contractor shall document existing condition of wall cracks adjacent to shoring walls prior to start of construction.
3. The contractor shall monitor existing walls for movement or cracking that may result from adjacent shoring.
4. If excessive movement or visible cracking occurs, the contractor shall stop work and shore/reinforce excavation and contact the shoring design engineer and building official.
5. Monitoring of the existing structure shall be at reasonable intervals as required by the registered design professional subject to approval of the building official. Monitoring shall be performed by a licensed surveyor and shall consist of vertical and lateral movement of the existing structures. Prior to starting shoring installation a preconstruction meeting shall take place between the contractor, shoring design engineer, surveyor, geotechnical engineer and building official to identify monitoring locations on existing buildings.
6. If in the opinion of the building official or shoring design engineer, monitoring data indicate excessive movement or other distress, all excavation shall cease until the geotechnical engineer and shoring design engineer investigate the situation and make recommendations for remediation or continuing.
7. All reading and measurements shall be submitted to the building official and shoring design engineer.

1812A.8 Tolerances. The following tolerances shall be specified on the construction documents.

1. Soldier piles:
 - i. Horizontal and vertical construction tolerances for the soldier pile locations.
 - ii. Soldier pile plumbness requirements (angle with vertical line).
2. Tie-back anchors:
 - i. Allowable deviation of anchor projected angle from specified vertical and horizontal design projected angle.
 - ii. Anchor clearance to the existing/new utilities and structures.

SECTION 1813A VIBRO STONE COLUMNS FOR GROUND IMPROVEMENT

1813A.1 General. This section shall apply to vibro stone columns (VSCs) for ground improvement using unbounded aggregate materials. Vibro stone column provisions in this section are intended to increase bearing capacity, reduce settlements and mitigate liquefaction for shallow foundations. These requirements shall not be used for grouted or bonded stone columns, ground improvement for deep foundation elements or changing site class. VSCs shall not be considered a deep foundation element. Ground improvement shall be

installed under the entire building/structure footprint and not under isolated foundation elements only. Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 1813A.2 through 1813A.5.

1813A.2 Geotechnical report. The geotechnical report shall specify vibro stone column requirements to ensure uniformity in total and differential immediate settlement, long term settlement and earthquake induced settlement.

1. Soil compaction shall be in accordance with California Geological Survey (CGS) Special Publication 117A (SP-117A): Guidelines for Evaluating and Mitigating Seismic Hazard in California.
2. Area replacement ratio for the compaction elements and the basis of its determination shall be explained. Minimum factor of safety for soil compaction shall be in accordance with SP-117A.
3. Depth of soil compaction elements and extent beyond the footprint of structures/foundation shall be defined. Extent beyond the foundation shall be half the depth of the VSCs with a minimum of 10 ft or an approved alternative.
4. Minimum diameter and maximum spacing of soil compaction elements shall be specified. VSCs shall not be less than 2 feet in diameter, and center to center spacing shall not exceed 8 feet.
5. The modulus of subgrade reactions for shallow foundations shall account for the presence of compaction elements.
6. The modulus of subgrade reactions, long-term settlement and post-earthquake settlement shall be specified along with expected total and differential settlements for design.
7. The acceptance criteria for Friction Cone and Piezocone Penetration Testing in accordance with ASTM D5778 complemented by the standard penetration test (SPT) in accordance with ASTM D1586, if necessary, to verify soil improvement shall be specified.
8. The requirements for special inspection and observation by the geotechnical engineer shall be specified.
9. A final verified report (FVR) documenting the installation of the ground improvement system and confirming that the ground improvement acceptance criteria have been met shall be prepared by the geotechnical engineer and submitted to the enforcement agency for review and approval.

1813A.3 Shallow foundations. VSCs under the shallow foundation shall be located symmetrically around the centroid of the footing or load.

1. There shall be a minimum of four stone columns under each isolated or continuous/combined footing or approved equivalent.

2. The VSCs shall not be used to resist tension or overturning uplift from the shallow foundations.
3. The foundation design for the shallow foundation shall consider the increased vertical stiffness of the VSCs as point supports for analysis, unless it is substantiated that the installation of the VSCs result in improvement of the surrounding soils such that the modulus of subgrade reaction, long term settlement and post-earthquake settlement can be considered uniform throughout.

1813A.4 Installation. VSCs shall be installed with vibratory probes. Vertical columns of compacted unbounded aggregate shall be formed through the soils to be improved by adding gravel near the tip of the vibrator and progressively raising and repenetrating the vibrator which will result in the gravel being pushed into the surrounding soil. Gravel aggregate for VSCs shall be well graded with a maximum size of 6 inches and not more than 10 percent smaller than $\frac{3}{8}$ inch after compaction.

1813A.5 Construction documents. Construction documents for VSCs, as a minimum, shall include the following:

1. Size, depth and location of VSCs.
2. Extent of soil improvements along with building/structure foundation outlines.
3. Field verification requirements and acceptance criteria using CPT/SPT.
4. The locations where CPT/SPT shall be performed.
5. The testing, inspection and observation (TIO) program shall indicate the inspection and observation required for the VSCs.
6. A note indicating foundation construction shall not commence until the final verified report specified in Section 1813A.2 Item 9 has been submitted to and approved by the enforcement agency.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 19 – CONCRETE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter													X										
Adopt entire chapter as amended (amended sections listed below)	X			X	X				X		X	X			X								
Adopt only those sections that are listed below																							
Chapter / Section																							
1901.1.1								X		X	X			X									
1901.1.2								X		X	X			X									
1901.1.3								X		X	X			X									
1901.1.4								X		X	X			X									
1901.3.1										X	X			X									
1901.3.2										X	X			X									
1901.3.3										X	X			X									
1901.3.4										X	B			X									
1901.3.4 Exception 6											B												
1901.3.4.2										X	X			X									
1901.3.4.5 Exception										X	X			X									
1903.2										X	X			X									
1903.4										X	X			X									
1903.5										X	X			X									
1903.7										X	X			X									
1903.8										X	X			X									
1905.1.2	X																						
1905.1.3	X																						
1905.1.7										X	B			X									
1905.1.8	X																						
1906										X	X			X									
1907.1.1				X																			
1908.1										X	B			X									
1908.2										X	B			X									
1908.3										X	B			X									
1908.5										X	X			X									
1908.7										X	X			X									
1908.9										X	X			X									
1908.10.2										X	X			X									
1909									X														
1910										X	B			X									
1911										X	X			X									

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 19

CONCRETE

Italics are used for text within Sections 1903 through 1905 of this code to indicate model code provisions that differ from ACI 318. State of California amendments in these sections are shown in italics and underlined.

User notes:

About this chapter: Chapter 19 provides minimum accepted practices for the design and construction of buildings and structural components using concrete—both plain and reinforced. Chapter 19 relies primarily on the reference to American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete. Structural concrete must be designed and constructed to comply with this code and all listed standards. There are also specific provisions addressing concrete slabs and shotcrete.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 1901 GENERAL

1901.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901.1.1 Application. [DSA-SS/CC, OSHPD] *The scope of application of Chapter 19 is as follows:*

1. *Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.*
2. *Office of Statewide Health Planning and Development Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings.*

1901.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] *DSA-SS/CC adopts this chapter and all amendments.*

Exceptions: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect—Structural Safety/Community Colleges:*
[DSA-SS/CC] *For applications listed in Section 1.9.2.2.*
2. *Office of Statewide Health Planning and Development*
[OSHPD 1R] *– For applications listed in Section 1.10.1.*
[OSHPD 2] *– For applications listed in Section 1.10.2.*
[OSHPD 5] *– For applications listed in Section 1.10.5.*

1901.1.3 Reference to other chapters. [DSA-SS/CC] *Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.*

1901.1.4 Amendments. [DSA-SS/CC, OSHPD]

1. [OSHPD 1R, 2 & 5] *See Section 1910 for additional requirements applicable to hospital buildings that have been removed from acute care service, skilled nursing and intermediate care facility buildings, and acute psychiatric hospital buildings.*
2. [DSA-SS/CC] *See Section 1909 for additional requirements applicable to community colleges.*

1901.2 Plain and reinforced concrete. Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905 of this code. Except for the provisions of Sections 1904 and 1907, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.

1901.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as amended in Section 1905, and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, screw, and adhesive anchors.

1901.3.1 Power actuated fasteners. [OSHPD 1R, 2 & 5] *Power actuated fasteners qualified in accordance with ICC-ES AC 70 shall be deemed to satisfy the requirements of ASCE 7, Section 13.4.5.*

Power actuated fasteners shall be permitted in seismic shear for components exempt from construction documents review by ASCE 7, Section 13.1.4 and for interior non-bearing non-shear wall partitions only. Power actuated fastener shall not be used to anchor seismic bracing, exterior cladding or curtain wall systems.

Exception: *Power actuated fasteners in steel to steel connections prequalified for seismic application by*

cyclic tests in accordance with ICC-ES AC 70 shall be permitted for seismic design.

1901.3.2 Mechanical anchors and specialty inserts. [OSHPD 1R, 2 & 5] Mechanical anchors qualified in accordance with ICC-ES AC 193 shall be deemed to satisfy the requirements of this section.

Specialty inserts, including cast-in-place specialty inserts, tested in accordance with ICC-ES AC 232 or AC 446 shall be deemed to satisfy the requirements of this section.

1901.3.3 Post-installed adhesive anchors. [OSHPD 1R, 2 & 5] Adhesive anchors qualified in accordance with ICC-ES AC 308 shall be deemed to satisfy the requirements of this section.

1901.3.4 Tests for post-installed anchors in concrete. [OSHPD 1R, 2B & 5] When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency and acceptance criteria shall be in accordance with this section.

1901.3.4.1 General. Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1901.3.4.2 Testing procedure. The test procedure shall be as permitted by an approved evaluation report using criteria adopted in this code. All post-installed anchors shall be tension tested. [OSHPD 1R, 2 & 5] Tension testing to verify proper installation shall be performed in accordance with ASTM E3121.

Exception: Torque controlled post installed anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

Alternatively, manufacturer's recommendation for testing may be approved by the enforcement agency based on an approved evaluation report using criteria adopted in this code.

1901.3.4.3 Test frequency. When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural components, such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a

report of the test results shall be submitted to the enforcement agency.

Exceptions:

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the design tension on anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all of the following conditions are met:
 - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
 - b. The number of dowels in any one member equals or exceeds twelve (12).
 - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.
6. [OSHPD 2B] In state detention and correctional facilities, tension testing is not required for post-installed anchors used for attaching nonstructural components, such as grab bars and shower seats, to concrete walls if the components do not contribute to security/detainment, life safety and the continuous operation of the institution following an event of extreme environmental loading from flood, wind, snow or earthquakes, as determined by the enforcing agency.

1901.3.4.4 Test loads. Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter (1¹/₄) times the maximum design strength of anchors as provided in approved evaluation report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).

2. The manufacturer's recommended installation torque based on approved evaluation report using criteria adopted in this code.

1901.3.4.5 Test acceptance criteria. Acceptance criteria for post-installed anchors shall be based on approved evaluation report using criteria adopted in this code. Field test shall satisfy following minimum requirements.

1. Hydraulic ram method:

Anchors tested with a hydraulic jack or spring loaded devices shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

The testing device shall not restrict the concrete shear cone type failure mechanism from occurring.

Exception: When denoted accordingly on the approved construction documents, adhesive anchors complying with ACI 318 Equation 17.8.2a and for which concrete breakout does not control the design tensile strength may be tested with apparatus support locations closer than 1.5 times the anchor embedment depth.

2. Torque wrench method:

Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $1/2$ turn of the nut; or one-quarter ($1/4$) turn of the nut for a $3/8$ -inch sleeve anchor only.

1901.4 Composite structural steel and concrete structures. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with Section 2206 of this code.

1901.5 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.

9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.

1901.6 Special inspections and tests. Special inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17.

1901.7 Tolerances for structural concrete. Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section.

1901.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

SECTION 1902 COORDINATION OF TERMINOLOGY

1902.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Sections 1902.1.1 and 1902.1.2.

1902.1.1 Design displacement. Design displacement at each level shall be the total lateral deflection at the level calculated for the design earthquake using the procedures defined in Section 12.8.6 of ASCE 7.

1902.1.2 Special structural wall. Special structural walls made of cast-in-place or precast concrete shall comply with the requirements of Sections 18.2.4 through 18.2.8, 18.10 and 18.11 of ACI 318, as applicable, in addition to the requirements for ordinary reinforced concrete structural walls or ordinary precast structural walls, as applicable. Where ASCE 7 refers to a "special reinforced concrete shear wall," it shall be deemed to mean a "special structural wall."

SECTION 1903 SPECIFICATIONS FOR TESTS AND MATERIALS

1903.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

Exception: The following standards as referenced in Chapter 35 shall be permitted to be used.

1. ASTM C150

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2. ASTM C595
3. ASTM C1157

1903.2 Special inspections. *Where required, special inspections and tests shall be in accordance with Chapter 17, IOSHPD IR, 2 & 51 and Section 1901.*

1903.3 Glass fiber-reinforced concrete. *Glass fiber-reinforced concrete (GFRG) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

1903.4 Flat wall insulating concrete form (ICF) systems. IOSHPD IR, 2 & 51 *Not Permitted by OSHPD.* *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634.*

1903.5 Aggregates - IOSHPD IR, 2 & 51 *Modify ACI 318 Section 26.4.1.2.1(a).(1) as follows:*

- (1) **Normal weight aggregate:** *Aggregate shall be non-reactive as determined by one of the methods in ASTM C33 Appendix X1: Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix X1 of ASTM C33, when approved by the building official.*

1903.6 Limits on Cementitious Materials. IOSHPD IR, 2 & 51 *Modify ACI 318 Section 26.4.2.2(b) and Table 26.4.2.2(b) as follows:*

The maximum percentage of pozzolans, including fly ash and silica fume, and slag cement in concrete assigned to all exposure categories shall be in accordance with Table 26.4.2.2(b) and Section 26.4.2.2(b) Items (1) and (2).

Where pozzolans are used as cementitious materials, duration for minimum specified compressive strength of concrete (f'_c) that exceeds 28 days shall be considered an alternative system.

1903.7 Steel fiber reinforcement - IOSHPD IR, 2 & 51 *Not permitted by OSHPD.*

1903.8 Welding of reinforcing bars - IOSHPD IR, 2 & 51 *Modify ACI 318 Section 26.6.4.1(b) by adding the following:*

Subject to prior approval of the enforcing agency, longitudinal holding wires conforming to ASTM A1064, of maximum wire size W5, that are machine resistance welded to stirrup/tie cage (or spiral assemblies) consisting of low alloy steel reinforcing conforming to ASTM A706 are permitted when performed under continuous competent control in a fabrication shop. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Holding wire weld locations shall not occur on any longitudinal or primary reinforcing nor on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3 for the extents specified in AWS D1.4 Section 4.2.6.

Quality control tests shall be performed on shop welded specimens by the fabricator. Reinforcing steel specimens containing the holding wire shall be tested for yield and ten-

ile strength at the frequency required by Section 1910.2. Test reports shall be available on request to the approved agency, design professional and enforcement agency.

SECTION 1904 DURABILITY REQUIREMENTS

1904.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

Exception: *For Group R-2 and R-3 occupancies not more than three stories above grade plane, the specified compressive strength, f'_c , for concrete in basement walls, foundation walls, exterior walls and other vertical surfaces exposed to the weather shall be not less than 3,000 psi (20.7 MPa).*

1904.2 Nonstructural concrete. *The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f'_c , of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.*

SECTION 1905 MODIFICATIONS TO ACI 318

1905.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905.1.1 through 1905.1.8.

1905.1.1 ACI 318, Section 2.3. Modify existing definitions and add the following definitions to ACI 318, Section 2.3.

DETAILED PLAIN CONCRETE STRUCTURAL WALL. A wall complying with the requirements of Chapter 14, including 14.6.2.

ORDINARY PRECAST STRUCTURAL WALL. A precast wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

ORDINARY REINFORCED CONCRETE STRUCTURAL WALL. A cast-in-place wall complying with the requirements of Chapters 1 through 13, 15, 16 and 19 through 26.

ORDINARY STRUCTURAL PLAIN CONCRETE WALL. A wall complying with the requirements of Chapter 14, excluding 14.6.2.

1905.1.2 ACI 318, Section 18.2.1. Modify ACI 318 Sections 18.2.1.2 and 18.2.1.6 to read as follows:

- 18.2.1.2 – Structures assigned to Seismic Design Category A shall satisfy requirements of Chapters 1 through 17 and 19 through 26; Chapter 18 does not apply. Structures assigned to Seismic Design Category B, C, D, E or F shall satisfy 18.2.1.3 through 18.2.1.7, as applicable. Except for structural elements of plain concrete complying with Section 1905.1.7 of the California Building Code, structural

elements of plain concrete are prohibited in structures assigned to Seismic Design Category C, D, E or F.

- 18.2.1.6 – Structural systems designated as part of the seismic force-resisting system shall be restricted to those permitted by ASCE 7. Except for Seismic Design Category A, for which Chapter 18 does not apply, the following provisions shall be satisfied for each structural system designated as part of the seismic force-resisting system, regardless of the seismic design category:
 - (a) Ordinary moment frames shall satisfy 18.3.
 - (b) Ordinary reinforced concrete structural walls and ordinary precast structural walls need not satisfy any provisions in Chapter 18.
 - (c) Intermediate moment frames shall satisfy 18.4.
 - (d) Intermediate precast structural walls shall satisfy 18.5.
 - (e) Special moment frames shall satisfy 18.6 through 18.9.
 - (f) Special structural walls shall satisfy 18.10.
 - (g) Special structural walls constructed using precast concrete shall satisfy 18.11.

Special moment frames and special structural walls shall also satisfy 18.2.4 through 18.2.8.

1905.1.3 ACI 318, Section 18.5. Modify ACI 318, Section 18.5 by adding new Section 18.5.2.2 and renumbering existing Sections 18.5.2.2 and 18.5.2.3 to become 18.5.2.3 and 18.5.2.4, respectively.

18.5.2.2 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at the deformation induced by the design displacement or shall use Type 2 mechanical splices.

18.5.2.3 – Elements of the connection that are not designed to yield shall develop at least $1.5 S_y$.

18.5.2.4 – In structures assigned to SDC D, E or F, wall piers shall be designed in accordance with 18.10.8 or 18.14 in ACI 318.

1905.1.4 ACI 318, Section 18.11. Modify ACI 318, Section 18.11.2.1 to read as follows:

18.11.2.1 – Special structural walls constructed using precast concrete shall satisfy all the requirements of 18.10 for cast-in-place special structural walls in addition to 18.5.2.

1905.1.5 ACI 318, Section 18.13.1.1. Modify ACI 318, Section 18.13.1.1 to read as follows:

18.13.1.1 – Foundations resisting earthquake-induced forces or transferring earthquake-induced forces between a structure and ground shall comply with the requirements of 18.13 and other applicable provisions of ACI 318 unless modified by Chapter 18 of the California Building Code.

1905.1.6 ACI 318, Section 14.6. Modify ACI 318, Section 14.6 by adding new Section 14.6.2 to read as follows:

14.6.2 – Detailed plain concrete structural walls.

14.6.2.1 – Detailed plain concrete structural walls are walls conforming to the requirements of ordinary structural plain concrete walls and 14.6.2.2.

14.6.2.2 – Reinforcement shall be provided as follows:

- Vertical reinforcement of at least 0.20 square inch (129 mm²) in cross-sectional area shall be provided continuously from support to support at each corner, at each side of each opening and at the ends of walls. The continuous vertical bar required beside an opening is permitted to substitute for one of the two No. 5 bars required by 14.6.1.
- Horizontal reinforcement at least 0.20 square inch (129 mm²) in cross-sectional area shall be provided:
 1. Continuously at structurally connected roof and floor levels and at the top of walls.
 2. At the bottom of load-bearing walls or in the top of foundations where doweled to the wall.
 3. At a maximum spacing of 120 inches (3048 mm).

Reinforcement at the top and bottom of openings, where used in determining the maximum spacing specified in Item 3 above, shall be continuous in the wall.

1905.1.7 ACI 318, Section 14.1.4. Delete ACI 318, Section 14.1.4 and replace with the following:

[OSHPD 1R, 2B & 5] Plain concrete shall not be permitted for a structure assigned to Seismic Design Category (SDC) D, E and F.

14.1.4 – Plain concrete in structures assigned to Seismic Design Category C, D, E or F.

14.1.4.1 – Structures assigned to Seismic Design Category C, D, E or F shall not have elements of structural plain concrete, except as follows:

- Structural plain concrete basement, foundation or other walls below the base as defined in ASCE 7 are permitted in detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls. In dwellings assigned to Seismic Design Category D or E, the height of the wall shall not exceed 8 feet (2438 mm), the thickness shall be not less than 7½ inches (190 mm), and the wall shall retain no more than 4 feet (1219 mm) of unbalanced fill. Walls shall have reinforcement in accordance with 14.6.1.
- Isolated footings of plain concrete supporting pedestals or columns are permitted, provided the projection of the footing beyond the face of the

supported member does not exceed the footing thickness.

Exception: In detached one- and two-family dwellings three stories or less in height, the projection of the footing beyond the face of the supported member is permitted to exceed the footing thickness.

- Plain concrete footings supporting walls are permitted, provided the footings have at least two continuous longitudinal reinforcing bars. Bars shall not be smaller than No. 4 and shall have a total area of not less than 0.002 times the gross cross-sectional area of the footing. For footings that exceed 8 inches (203 mm) in thickness, a minimum of one bar shall be provided at the top and bottom of the footing. Continuity of reinforcement shall be provided at corners and intersections.

Exceptions:

1. In Seismic Design Categories A, B and C, detached one- and two-family dwellings three stories or less in height constructed with stud-bearing walls are permitted to have plain concrete footings without longitudinal reinforcement.
2. For foundation systems consisting of a plain concrete footing and a plain concrete stemwall, a minimum of one bar shall be provided at the top of the stemwall and at the bottom of the footing.
3. Where a slab on ground is cast monolithically with the footing, one No. 5 bar is permitted to be located at either the top of the slab or bottom of the footing.

1905.1.8 ACI 318, Section 17.2.3. Modify ACI 318 Sections 17.10.5.2, 17.10.5.3(d) and 17.10.6.2 to read as follows:

- 17.10.5.2 – Where the tensile component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.5.3. The anchor design tensile strength shall be determined in accordance with 17.10.5.4.

Exception: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7 Equation 12.11-1 or 12.14-10 shall be deemed to satisfy Section 17.10.5.3(d).

- 17.10.5.3(d) – The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E, with E increased by Ω_0 . The anchor design tensile strength shall be calculated from 17.10.5.4.

- 17.10.6.2 – Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.6.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7.

Exceptions:

1. For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:

1.1. The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.

1.2. The maximum anchor nominal diameter is $5/8$ inch (16 mm).

1.3. Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).

1.4. Anchor bolts are located a minimum of $1\frac{3}{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the wood sill plate.

1.5. Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

1.6. The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.

2. For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:

2.1. The maximum anchor nominal diameter is $5/8$ inch (16 mm).

2.2. Anchors are embedded into concrete a minimum of 7 inches (178 mm).

- 2.3. Anchors are located a minimum of $1\frac{3}{4}$ inches (45 mm) from the edge of the concrete parallel to the length of the track.
- 2.4. Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.
- 2.5. The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.

- 3. In light-frame construction bearing or non-bearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

SECTION 1906

FOOTINGS FOR LIGHT-FRAME CONSTRUCTION

[OSHPD 1R, 2 & 5] Not permitted by OSHPD.

1906.1 Plain concrete footings. For Group R-3 occupancies and buildings of other occupancies less than two stories above grade plane of light-frame construction, the required thickness of plain concrete footings is permitted to be 6 inches (152 mm), provided that the footing does not extend more than 4 inches (102 mm) on either side of the supported wall.

SECTION 1907 MINIMUM SLAB PROVISIONS

1907.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than $3\frac{1}{2}$ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

- 1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
- 2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
- 3. For buildings of other occupancies where migration of moisture through the slab from below will not be detrimental to the intended occupancy of the building.

- 4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
- 5. Where approved based on local site conditions.

1907.1.1 [HCD 1] Capillary break. When a vapor retarder is required, a capillary break shall be installed in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.

SECTION 1908 SHOTCRETE

1908.1 General. Shotcrete shall be in accordance with the requirements of ACI 318 [OSHPD 1R, 2B & 5] and the provisions of ACI 506R. The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T.

1908.2 Tests and inspections. [OSHPD 1R, 2B & 5] Pre-construction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705.3.9.

1908.3 Forms and ground wires for shotcrete. [OSHPD 1R, 2B & 5] Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

SECTION 1909 ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

1909.1 General.

1909.1.1 Construction documents. Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.

1909.2 Tests and materials. Where required, special inspections and tests shall be in accordance with Chapter 17A and this section.

1909.2.1 Aggregates - Modify ACI 318 Section 26.4.1.2.1(a).(1) as follows:

(1) **Normal weight aggregate:** Aggregate shall be non-reactive as determined by one of the methods in ASTM C33 Appendix XI Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official.

1909.2.2 Steel fiber reinforcement - Not permitted.

1909.2.3 Cementitious material. The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.

1909.2.4 Tests of reinforcing bars. Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2½ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or non-building structures provided they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1909.2.5 Tests for prestressing steel and anchorage. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.
4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

1909.2.6 Composite construction cores. Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465 m²) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1909.2.7 Tests for post-installed anchors in concrete. When post-installed anchors are used in lieu of cast-in-place bolts, the installation verification test loads frequency and acceptance criteria shall be in accordance with this section.

1909.2.7.1 General. Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1909.2.7.2 Testing procedure. The test procedure shall be as permitted by an approved evaluation report using

criteria adopted in this code. All post-installed anchors shall be tension tested.

Exception: Torque-controlled post-installed anchors and screw type anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

Alternatively, the manufacturer's recommendation for testing may be approved by the enforcement agency based on approved evaluation report using criteria adopted in this code.

1909.2.7.3 Test frequency. When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural applications such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

Exceptions:

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the design tension on anchors is less than 100 pounds and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all the following conditions are met:
 - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
 - b. The number of dowels in any one member equals or exceeds 12.
 - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-

shear wall partitions for shear only where there are at least three fasteners per segment of track.

1909.2.7.4 Test loads. Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter ($1\frac{1}{4}$) times the maximum design strength of anchors as provided in an approved test report using criteria adopted in this code or determined in accordance with Chapter 17 of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8 A_{se} f_{ya}$).

2. The manufacturer's recommended installation torque based on an approved test report using criteria adopted in this code.

1909.2.7.5 Test acceptance criteria. Acceptance criteria for post-installed anchors shall be based on an approved test report using criteria adopted in this code. Field tests shall satisfy the following minimum requirements.

1. Hydraulic ram method:

Anchors tested with a hydraulic jack or spring loaded apparatus shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

The testing apparatus support locations shall not be within 1.5 times the anchor's embedment depth to avoid restricting the concrete shear cone type failure mechanism from occurring.

Exception: When denoted accordingly on the approved construction documents, adhesive anchors complying with ACI 318 Equation 17.8.2a and for which concrete breakout does not control the design tensile strength may be tested with apparatus support locations closer than 1.5 times the anchor embedment depth.

2. Torque wrench method:

Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $\frac{1}{2}$ turn of the nut; or one-quarter ($\frac{1}{4}$) turn of the nut for a $\frac{3}{8}$ -inch sleeve anchor only.

Screw-type anchors tested with a calibrated torque wrench shall attain the specified torque within one-quarter ($\frac{1}{4}$) turn of the screw after initial seating of the screw head.

1909.2.8 Flat wall insulating concrete form (ICF) systems. ICF systems shall be considered alternative systems. Concrete constructed using ICF systems and attachments to ICF shall be designed for loads in accordance with this code and shall comply with manufacturer's instructions and industry standards deter-

mined applicable by the enforcement agency. Calculations and drawings shall be submitted to the enforcement agency for review and approval prior to construction.

1909.3 Modifications to ACI 318

1909.3.1 ACI 318, Section 11.9. Modify ACI 318 by adding Section 11.9 as follows:

11.9 - Foundation walls. Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318 Section 11.6 and 11.7.

1909.3.2 ACI 318, Section 12.7.3. Add Section 12.7.3.4 to ACI 318 as follows:

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1909.3.3 ACI 318, Chapter 14. Plain concrete is not permitted.

1909.3.4 ACI 318, Section 18.10.6.5. Modify ACI 318, Section 18.10.6.5 by adding the following:

Where boundary members are not required by ACI 318 Section 18.10.6.2 or 18.10.6.3, minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per lineal foot of wall. Horizontal extent of boundary element shall be per ACI 318 Section 18.10.6.4 (a), (b) and (c).

1909.3.5 ACI 318, Section 18.12.6. Add Section 18.12.6.2 to ACI 318 as follows:

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or $6d_b$ thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1909.3.6 ACI 318, Table 21.2.2. Replace Table 21.2.2 as follows:

**TABLE 21.2.2
STRENGTH REDUCTION FACTOR ϕ FOR MOMENT,
AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE**

NET TENSILE STRAIN ϵ_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < (\epsilon_{ty} + 0.003)$	Transition ^{1,2}	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(d)
$\epsilon_t \geq (\epsilon_{ty} + 0.003)$	Tension-controlled ³	0.9	(e)	0.9	(f)

- For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
- ϵ_t^* is the greater of net tensile strain calculated for $P_n = 0.1A_s f_c'$ and $(\epsilon_{ty} + 0.003)$.
- For sections with factored axial compression force $P_n \geq 0.1A_s f_c'$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.

1909.3.7 ACI 318, Section 25.2.10. Modify ACI 318 Section 25.2.10 as follows:

25.2.10 - For ties and hoops in columns to be placed with shotcrete, minimum clear spacing shall be 3 in. Shotcrete shall not be applied to spirally tied columns.

1909.3.8 ACI 318, Section 26.5.2. Modify ACI 318 Section 26.5.2.1 by replacing Items (l), (m) and (n) and adding item (q) as follows:

(l) Shotcrete surfaces intended to receive subsequent shotcrete placement following an interruption of 30 minutes or more shall be roughened to a full amplitude of approximately $1/4$ in. before the shotcrete has reached final set. The film of laitance which forms on the surface of the shotcrete shall be removed within approximately 2 hours after application by brushing with a stiff broom. If this film is not removed within 2 hours, it shall be removed by thorough wire brushing or a mechanical method acceptable to the enforcement agency.

(m) Before placing additional material onto hardened shotcrete, laitance shall be removed, joints shall be cleaned and the surface shall be dampened. Construction joints over 8 hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.

(n) In-place fresh concrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets, or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.

(q) Surface preparation: Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a mechanical method acceptable to the enforcement agency, and just prior to receiving shotcrete, shall be thoroughly cleaned of all

debris, dirt and dust. Concrete and masonry shall be brought to a saturated surface-dry (SSD) before shotcrete is deposited.

1909.3.9 ACI 318, Section 26.12.2.1(a). Replace ACI 318 Section 26.12.2.1(a) by the following:

26.12.2.1(a) - Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (38.2 m³) of concrete, or not less than once for each 2,000 square feet (186 m²) of surface area for slabs or walls. Additional samples for seven-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

1909.4 Shotcrete.

1909.4.1 General. Shotcrete shall also conform to the provisions of ACI 506.2 and ACI 506R. The specified compressive strength of shotcrete shall not be less than 4,000 psi (27.6 MPa). The use of a shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7.1 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 is subject to the approval of the building official. Tolerances for shotcrete construction shall be defined by the construction documents.

1909.4.2 Tests and inspections. Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705A.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705A.3.9.

1909.4.3 Forms and ground wires for shotcrete. Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodded to these wires.

1909.5 Existing concrete structures. The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m²) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed ³/₄ inch (19 mm).

**SECTION 1910
ADDITIONAL REQUIREMENTS FOR SKILLED
NURSING FACILITIES, INTERMEDIATE CARE
FACILITIES, ACUTE PSYCHIATRIC AND NON-GAC
BUILDINGS [OSHPD 1R, 2B & 5]**

1910.1 General.

1910.1.1 Construction documents. Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.

1910.2 Tests and materials. Where required, special inspections and tests shall be in accordance with Chapter 17 and this section.

1910.2.1 Cementitious material. The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for Portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's certificate of compliance that represents the materials used by date of shipment for concrete. Cementitious materials without certification of compliance shall not be used.

1910.2.2 Tests of reinforcing bars. Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2½ tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the building official for one-story buildings or nonbuilding structures, provided that they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910.2.3 Tests for prestressing steel and anchorage. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the job site. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or job site

shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with the anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the prestressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.
4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

1910.2.4 Composite construction cores. Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465 m²) of area of composite concrete construction and not fewer than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1910.3 Modifications to ACI 318

1910.3.1 ACI 318, Section 12.7.3. Add Section 12.7.3.4 to ACI 318 as follows:

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1910.3.2 ACI 318, Section 18.12.6. Add Section 18.12.6.2 to ACI 318 as follows:

Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1910.3.3 ACI 318, Table 19.2.1.1. Modify ACI 318 Table 19.2.1.1 as follows:

For concrete designed and constructed in accordance with this chapter, f'_c shall not be less than 3,000 psi (20.7 MPa). Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.

1910.3.4 ACI 318, Table 21.2.2. Replace Table 21.2.2 as follows:

**TABLE 21.2.2
STRENGTH REDUCTION FACTOR ϕ FOR MOMENT,
AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE**

NET TENSILE STRAIN ϵ_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < \epsilon_{ty} + 0.003$	Transition ^{1, 2}	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(d)
$\epsilon_t \geq \epsilon_{ty} + 0.003$	Tension-controlled ³	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. ϵ_t^* is the greater of net tensile strain calculated for $P_u = 0.1A_g f'_c$ and $\epsilon_{ty} + 0.003$.
3. For sections with factored axial compression force $P_u \geq 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.

SECTION 1911

EXISTING CONCRETE STRUCTURES [OSHPD 1R, 2 & 5]

1911.1 Concrete Core Sampling. Where concrete cores are required to be taken for material property determination, cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is closely spaced and the coarse aggregate does not exceed 3/4 inch (19 mm).

1911.2 Crack repair by epoxy injection. Crack Repair of concrete and masonry member by epoxy injection shall conform to all requirements of ACI 503.7.

1911.3 Concrete strengthening by externally bonded fiber reinforced polymer (FRP). Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.

Exceptions:

1. Near-Surface Mounted (NSM) FRP bars shall not be permitted.
2. Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.

Design capacities, reliability and serviceability of FRP materials shall be permitted to be established in accordance with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 19A – CONCRETE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter								X		X					X								
Adopt entire chapter as amendeded (amended sections listed below)				X	X																		
Adopt only those sections that are listed below																							
Chapter / Section																							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 19A

CONCRETE

Italics are used for text within Sections 1903A through 1905A of this code to indicate model code provisions that differ from ACI 318. State of California amendments in these sections are shown in italics and underlined.

SECTION 1901A GENERAL

1901A.1 Scope. The provisions of this chapter shall govern the materials, quality control, design and construction of concrete used in structures.

1901A.1.1 Application. *The scope of application of Chapter 19A is as follows:*

- 1. Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
- 2. Applications listed in Sections 1.10.1 and 1.10.4, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

1901A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

- 1. Division of the State Architect-Structural Safety:
[DSA-SS] For applications listed in Section 1.9.2.1.*
- 2. Office of Statewide Health Planning and Development.
[OSHPD 1] – For applications listed in Section 1.10.1.
[OSHPD 4] – For applications listed in Section 1.10.4.*

>| **1901A.2 Reinforced concrete.** Structural concrete shall be designed and constructed in accordance with the requirements of this chapter and ACI 318 as amended in Section 1905A of this code, *except that plain concrete is not permitted.* Except for the provisions of Sections 1904A and 1907A, the design and construction of slabs on grade shall not be governed by this chapter unless they transmit vertical loads or lateral forces from other parts of the structure to the soil.

1901A.3 Anchoring to concrete. Anchoring to concrete shall be in accordance with ACI 318 as amended in Section 1905A,

and applies to cast-in (headed bolts, headed studs and hooked J- or L-bolts), post-installed expansion (torque-controlled and displacement-controlled), undercut, screw, and adhesive anchors.

1901A.4 Composite structural steel and concrete structures. Systems of structural steel acting compositely with reinforced concrete shall be designed in accordance with Section 2206A of this code.

1901A.5 Construction documents. The construction documents for structural concrete construction shall include:

1. The specified compressive strength of concrete at the stated ages or stages of construction for which each concrete element is designed.
2. The specified strength or grade of reinforcement.
3. The size and location of structural elements, reinforcement and anchors.
4. Provision for dimensional changes resulting from creep, shrinkage and temperature.
5. The magnitude and location of prestressing forces.
6. Anchorage length of reinforcement and location and length of lap splices.
7. Type and location of mechanical and welded splices of reinforcement.
8. Details and location of contraction or isolation joints specified for plain concrete.
9. Minimum concrete compressive strength at time of posttensioning.
10. Stressing sequence for posttensioning tendons.
11. For structures assigned to Seismic Design Category D, E or F, a statement if slab on grade is designed as a structural diaphragm.
12. *Openings larger than 12 inches (305 mm) in any dimension shall be detailed on the structural drawings.*

1901A.6 Special inspections and tests. Special inspections and tests of concrete elements of buildings and structures and concreting operations shall be as required by Chapter 17A and Section 1910A.

1901A.7 Tolerances for structural concrete. Where not indicated in construction documents, structural tolerances for concrete structural elements shall be in accordance with this section.

1901A.7.1 Cast-in-place concrete tolerances. Structural tolerances for cast-in-place concrete structural elements shall be in accordance with ACI 117.

Exceptions:

1. Group R-3 detached one- or two-family dwellings are not required to comply with this section.
2. Shotcrete is not required to comply with this section. *[DSA-SS] Tolerances for shotcrete construction shall be defined by the construction documents.*

1901A.7.2 Precast concrete tolerances. Structural tolerances for precast concrete structural elements shall be in accordance with ACI ITG-7.

Exception: Group R-3 detached one- or two-family dwellings are not required to comply with this section.

**SECTION 1902A
COORDINATION OF TERMINOLOGY**

1902A.1 General. Coordination of terminology used in ACI 318 and ASCE 7 shall be in accordance with Sections 1902A.1.1 and 1902A.1.2.

1902A.1.1 Design displacement. Design displacement at each level shall be the total lateral deflection at the level calculated for the design earthquake using the procedures defined in Section 12.8.6 of ASCE 7.

1902A.1.2 Special structural wall. Special structural walls made of cast-in-place or precast concrete shall comply with the requirements of Sections 18.2.4 through 18.2.8, 18.10 and 18.11 of ACI 318, as applicable, in addition to the requirements for *ordinary reinforced concrete structural walls or ordinary precast structural walls*, as applicable. Where ASCE 7 refers to a “special reinforced concrete shear wall,” it shall be deemed to mean a “special structural wall.”

**SECTION 1903A
SPECIFICATIONS FOR TESTS AND MATERIALS**

1903A.1 General. Materials used to produce concrete, concrete itself and testing thereof shall comply with the applicable standards listed in ACI 318.

1903A.2 Special inspections. *Where required, special inspections and tests shall be in accordance with Chapter 17A and Section 1910A.*

1903A.3 Glass fiber-reinforced concrete. *Glass fiber-reinforced concrete (GFRC) and the materials used in such concrete shall be in accordance with the PCI MNL 128 standard.*

1903A.4 Flat wall insulating concrete form (ICF) systems. *Insulating concrete form material used for forming flat concrete walls shall conform to ASTM E2634. [OSHPD 1 & 4] Not Permitted by OSHPD. [DSA-SS] ICF systems shall be considered alternative systems. Concrete constructed using ICF systems and attachments to ICF shall be designed for*

loads in accordance with this code and shall comply with manufacturer’s instructions and industry standards determined applicable by the enforcement agency. Calculations and drawings shall be submitted to the enforcement agency for review and approval prior to construction.

1903A.5 Aggregates – Modify ACI 318 Section 26.4.1.2.1(a).1 as follows:

(1) Normal weight aggregate: Aggregate shall be non-reactive as determined by one of the methods in ASTM C33 Appendix XI: Methods for Evaluating Potential for Deleterious Expansion Due to Alkali Reactivity of an Aggregate. Aggregates deemed to be deleterious or potentially deleterious may be used with the addition of a material that has been shown to prevent harmful expansion in accordance with Appendix XI of ASTM C33, when approved by the building official.

1903A.6 [OSHPD 1 & 4] Limits on cementitious materials. *Modify ACI 318 Section 26.4.2.2(b) and Table 26.4.2.2(b) as follows:*

The maximum percentage of pozzolans, including fly ash and silica fume, and slag cement in concrete assigned to all exposure categories shall be in accordance with Table 26.4.2.2(b) and Section 26.4.2.2(b) Items (1) and (2).

Where pozzolans are used as cementitious materials, duration for minimum specified compressive strength of concrete (f'_c) that exceeds 28 days shall be considered an alternative system.

1903A.7 Steel fiber reinforcement – Not permitted

1903A.8 Welding of reinforcing bars - Modify ACI 318 Section 26.6.4.2(b) by adding the following:

Subject to prior approval of the enforcing agency, longitudinal holding wires, conforming to ASTM A1064 of maximum wire size W5, that are machine resistance welded to stirrup/tie cage (or spiral assemblies) consisting of low alloy steel reinforcing conforming to ASTM A706 are permitted when performed under continuous competent control in a fabrication shop. Tack welding of primary reinforcing bars together or to stirrups/ties is not permitted. Holding wire weld locations shall not occur on any longitudinal or primary reinforcing nor on any portion of a reinforcing bar that is or will be bent in accordance with ACI 318 Section 25.3 for the extents specified in AWS D1.4 Section 4.2.6.

[DSA-SS] Exception: Mat reinforcing for slabs or isolated footings shall be permitted to have holding wires located no more than six bar diameters from the free end of reinforcing. Such free ends shall not be associated with any welded splices, couplers or other free-end modifications involving reinforcement development.

Quality control tests shall be performed on shop-welded specimens by the fabricator. Reinforcing steel specimens containing the holding wire shall be tested for yield and tensile strength at the frequency required by Section 1910A.2. Test reports shall be available on request to the approved agency, design professional and enforcement agency.

SECTION 1904A DURABILITY REQUIREMENTS

1904A.1 Structural concrete. Structural concrete shall conform to the durability requirements of ACI 318.

1904A.2 Nonstructural concrete. *The registered design professional shall assign nonstructural concrete a freeze-thaw exposure class, as defined in ACI 318, based on the anticipated exposure of nonstructural concrete. Nonstructural concrete shall have a minimum specified compressive strength, f'_c , of 2,500 psi (17.2 MPa) for Class F0; 3,000 psi (20.7 MPa) for Class F1; and 3,500 psi (24.1 MPa) for Classes F2 and F3. Nonstructural concrete shall be air entrained in accordance with ACI 318.*

SECTION 1905A MODIFICATIONS TO ACI 318

1905A.1 General. The text of ACI 318 shall be modified as indicated in Sections 1905A.1.1 through 1905A.1.17.

1905A.1.1 ACI 318, Section 4.12.2.2. Modify ACI 318, Section 4.12.2.2 by adding the following:

Where prestressed concrete elements are restrained from movement, an analysis of the stresses in the prestressed elements and loads in the adjoining structural system induced by the above-described effects shall be made in accordance with PCI Design Handbook.

1905A.1.2 ACI 318, Section 4.12.2.3. Modify ACI 318, Section 4.12.2.3 by adding the following:

For prestressed concrete members with recessed or dapped ends, an analysis of the connections shall be made in accordance with procedures given in PCI Design Handbook.

1905A.1.3 ACI 318, Section 9.6.1.3. Modify ACI 318, Section 9.6.1.3 by adding the following:

This section shall not be used for members that resist seismic loads, except for either of the following conditions:

- 1. Foundation members for one-story wood-frame or one-story light steel buildings.*
- 2. Foundation members designed for seismic load combinations including the overstrength factor. [OSHPD 1 & 4] The A_c provided shall not be less than that required by 1.2 times the cracking load based upon f_c defined in Section 19.2.3.*

1905A.1.4 ACI 318, Section 11.2.4.1. Replace ACI 318, Section 11.2.4.1 as follows:

11.2.4.1 – Walls shall be anchored to intersecting elements such as floors or roofs; or to columns, pilasters, buttresses, of intersecting walls and footings with reinforcement at least equivalent to No. 4 bars at 12 inches (305 mm) on center for each layer of reinforcement.

1905A.1.5 ACI 318, Section 11.7. Add Section 11.7.6 to ACI 318.1 as follows:

*11.7.6 – **Reinforcement.** Perimeters of precast walls shall be reinforced continuously with a minimum of one*

No. 5 bar extending the full height and width of the wall panel. Where wall panels do not connect to columns or other wall panels to develop at least 75 percent of the horizontal wall steel as noted below, vertical perimeter bars shall be retained by hooked wall bars.

A continuous tie or bond beam shall be provided at the roof line either as a part of the roof structure or part of the wall panels as described in the next paragraph below. This tie may be designed as the edge member of the roof diaphragm but, in any case, shall not be less than equivalent to two No. 6 bars continuous. A continuous tie equivalent to two No. 5 bars minimum shall also be provided either in the footing or with an enlarged section of the floor slab.

Wall panels of shear wall buildings shall be connected to columns or to each other in such a manner as to develop at least 75 percent of the horizontal wall steel. No more than half of this continuous horizontal reinforcing shall be concentrated in bond or tie beams at the top and bottom of the walls and at points of intermediate lateral support. If possible, cast-in-place joints with reinforcing bars extending from the panels into the joint a sufficient distance to meet the splice requirements of ACI 318, Section 25.5.2, for Class A shall be used. The reinforcing bars or welded tie details shall not be spaced over eight times the wall thickness vertically nor fewer than four used in the wall panel height. Where wall panels are designed for their respective overturning forces, the panel connections need not comply with the requirements of this paragraph.

Exception: *Nonbearing, nonshear panels such as nonstructural architectural cladding panels or column covers are not required to meet the provisions of this section.*

1905A.1.6 ACI 318, Section 11.9. Modify ACI 318 by adding Section 11.9 as follows:

*11.9 – **Foundation walls.** Horizontal reinforcing of concrete foundation walls for wood-frame or light-steel buildings shall consist of the equivalent of not less than one No. 5 bar located at the top and bottom of the wall. Where such walls exceed 3 feet (914 mm) in height, intermediate horizontal reinforcing shall be provided at spacing not to exceed 2 feet (610 mm) on center. Minimum vertical reinforcing shall consist of No. 3 bars at 24 inches (610 mm) on center.*

Where concrete foundation walls or curbs extend above the floor line and support wood-frame or light-steel exterior, bearing or shear walls, they shall be doweled to the foundation wall below with a minimum of No. 3 bars at 24 inches (610 mm) on center. Where the height of the wall above the floor line exceeds 18 inches (457 mm), the wall above and below the floor line shall meet the requirements of ACI 318, Section 11.6 and 11.7.

1905A.1.7 ACI 318, Section 12.7.3. Add Section 12.7.3.4 to ACI 318 as follows:

12.7.3.4 – At least two No. 5 bars in diaphragms having two layers of reinforcement in both directions and one

No. 5 bar in diaphragms having a single layer of reinforcement in both directions shall be provided around openings larger than 12 inches in any dimension in addition to the minimum reinforcement required by Section 12.6.

1905A.1.8 ACI 318, Section 17.10. Modify ACI 318 Sections 17.10.5.2, 17.10.5.3(d) and 17.10.6.2 to read as follows:

- 17.10.5.2 – Where the tensile component of the strength-level earthquake-induced force applied to anchors exceeds 20 percent of the total factored anchor tensile force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.5.3. The anchor design tensile strength shall be determined in accordance with 17.10.5.4.

Exception: Anchors designed to resist wall out-of-plane forces with design strengths equal to or greater than the force determined in accordance with ASCE 7, Equation 12.11-1 or 12.14-10, and Section 1604A.8.2 of this code shall be deemed to satisfy Section 17.10.5.3(d).

- 17.10.5.3(d) – The anchor or group of anchors shall be designed for the maximum tension obtained from design load combinations that include E , with E increased by Ω_0 . The anchor design tensile strength shall be calculated in accordance with 17.10.5.4.
- 17.10.6.2 – Where the shear component of the strength-level earthquake force applied to anchors exceeds 20 percent of the total factored anchor shear force associated with the same load combination, anchors and their attachments shall be designed in accordance with 17.10.6.3. The anchor design shear strength for resisting earthquake forces shall be determined in accordance with 17.7.

Exceptions:

- For the calculation of the in-plane shear strength of anchor bolts attaching wood sill plates of bearing or nonbearing walls of light-frame wood structures to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:
 - The allowable in-plane shear strength of the anchor is determined in accordance with ANSI/AWC NDS Table 12E for lateral design values parallel to grain.
 - The maximum anchor nominal diameter is $5/8$ inch (16 mm).
 - Anchor bolts are embedded into concrete a minimum of 7 inches (178 mm).
 - Anchor bolts are located a minimum of $1\ 3/4$ inches (45 mm) from the edge

of the concrete parallel to the length of the wood sill plate.

- Anchor bolts are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the wood sill plate.

- The sill plate is 2-inch (51 mm) or 3-inch (76 mm) nominal thickness.

- For the calculation of the in-plane shear strength of anchor bolts attaching cold-formed steel track of bearing or nonbearing walls of light-frame construction to foundations or foundation stem walls, the in-plane shear strength in accordance with 17.7.2 and 17.7.3 need not be computed and 17.10.6.3 shall be deemed to be satisfied provided all of the following are met:
 - The maximum anchor nominal diameter is $5/8$ inch (16 mm).
 - Anchors are embedded into concrete a minimum of 7 inches (178 mm).
 - Anchors are located a minimum of $1\ 3/4$ inches (45 mm) from the edge of the concrete parallel to the length of the track.
 - Anchors are located a minimum of 15 anchor diameters from the edge of the concrete perpendicular to the length of the track.
 - The track is 33 to 68 mil (0.84 mm to 1.73 mm) designation thickness.

Allowable in-plane shear strength of exempt anchors, parallel to the edge of concrete, shall be permitted to be determined in accordance with AISI S100 Section J3.3.1.

- In light-frame construction bearing or nonbearing walls, shear strength of concrete anchors less than or equal to 1 inch [25 mm] in diameter attaching sill plate or track to foundation or foundation stem wall need not satisfy 17.10.6.3(a) through (c) when the design strength of the anchors is determined in accordance with 17.7.2.1(c).

1905A.1.9 ACI 318, Section 18.5. [DSA-SS] Modify ACI 318, Section 18.5, by replacing Section 18.5.2.1, adding new Section 18.5.2.2 and renumbering existing Sections 18.5.2.2 and 18.5.2.3 to become 18.5.2.3 and 18.5.2.4, respectively:

18.5.2.1 – In connections between wall panels, yielding shall be restricted to steel elements or reinforcement. In connections between wall panels and the foundation, they shall be designed per Section 1617A.1.16.

18.5.2.2 – Connections that are designed to yield shall be capable of maintaining 80 percent of their design strength at deformation induced by the design displacement or shall use type 2 mechanical splices.

18.5.2.3 – Elements of the connection that are not designed to yield shall develop at least 1.5 S_y .

18.5.2.4 – In structures assigned to SDC D, E or F, wall piers shall be designed in accordance with 18.10.8 or 18.14 in ACI 318.

1905A.1.10 ACI 318, Section 18.10.6.5. Modify ACI 318, Section 18.10.6.5 by adding the following:

(c) Where boundary members are not required by ACI 318 Section 18.10.6.2 or 18.10.6.3 minimum reinforcement parallel to the edges of all structural walls and the boundaries of all openings shall consist of twice the cross-sectional area of the minimum shear reinforcement required per linear foot of wall. Horizontal extent of boundary element shall be in accordance with ACI 318 Section 18.10.6.4 (a), (b) and (c).

1905A.1.11 ACI 318, Section 18.12.6. Add Section 18.12.6.2 to ACI 318 as follows:

18.12.6.2 – Collector and boundary elements in topping slabs placed over precast floor and roof elements shall not be less than 3 inches (76 mm) or 6 d_b thick, where d_b is the diameter of the largest reinforcement in the topping slab.

1905A.1.12 ACI 318, Section 19.2.1.1 and Table 19.2.1.1. Modify ACI 318, Section 19.2.1.1 and Table 19.2.1.1 as follows:

19.2.1.1 The value of f'_c shall be in be in accordance with (a) through (e):

- (a) Limits for f'_c in Table 19.2.1.1. Limits apply to both normalweight and lightweight concrete.
- (b) Durability requirements in Table 19.3.2.1.
- (c) Structural strength requirements.
- (d) f'_c for lightweight concrete in special moment frames and special structural walls, and their foundations, shall not exceed 5000 psi, unless demonstrated by experimental evidence that members made with lightweight concrete provide strength and toughness equal to or exceeding those of comparable members made with normalweight concrete of the same strength.
- (e) *Reinforced normal weight concrete with specified compressive strength higher than 8,000 psi (55 MPa) shall require prior approval of structural design method and acceptance criteria by the enforcement agency.*

APPLICATION	MINIMUM f'_c , psi
General	<u>3000</u>
Special moment frames	3000
Special structural walls with Grade 60 or 80 reinforcement	3000
Special structural walls with Grade 100 reinforcement	5000
Precast-nonprestressed driven piles	4000
Drilled shafts	4000
Precast-prestressed driven piles	5000
<i>Shotcrete</i>	<u>4000</u>

1905A.1.13 ACI 318, Table 21.2.2. Replace Table 21.2.2 as follows:

**TABLE 21.2.2
STRENGTH REDUCTION FACTOR ϕ FOR MOMENT,
AXIAL FORCE, OR COMBINED MOMENT AND AXIAL FORCE**

NET TENSILE STRAIN ϵ_t	CLASSIFICATION	ϕ			
		Type of transverse reinforcement			
		Spirals conforming to 25.7.3		Other	
$\epsilon_t \leq \epsilon_{ty}$	Compression-controlled	0.75	(a)	0.65	(b)
$\epsilon_{ty} < \epsilon_t < \epsilon_{ty} + 0.003$	Transition ^{1,2}	$0.75 + 0.15 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(c)	$0.65 + 0.25 \frac{\epsilon_t - \epsilon_{ty}}{\epsilon_t^* - \epsilon_{ty}}$	(d)
$\epsilon_t \geq \epsilon_{ty} + 0.003$	Tension-controlled ³	0.9	(e)	0.9	(f)

1. For sections classified as transition, it shall be permitted to use ϕ corresponding to compression-controlled sections.
2. ϵ_t^* is the greater of net tensile strain calculated for $P_u = 0.1A_g f'_c$ and $\epsilon_{ty} + 0.003$.
3. For sections with factored axial compression force $P_u \geq 0.1A_g f'_c$, ϕ shall be calculated using equation (c) or (d) for sections classified as transition, as applicable.

1905A.1.14 ACI 318, Section 24.2.1. Add Section 24.2.1.1 to ACI 318 as follows:

24.2.1.1 – Span to depth ratio. Prestressed beam and slab span to depth ratios for continuous prestressed concrete members shall not exceed the following, except when calculations of deflections and vibration effects prove that greater values may be used without adverse effects:

- Beams..... 30*
- One-way slabs..... 40*
- Two-way floor slabs..... 40*
- Two-way roof slabs..... 44*

These ratios should be decreased for special conditions such as heavy loads and simple spans.

Maximum deflection criteria shall be in accordance with ACI 318 Section 24.2.2.

1905A.1.15 ACI 318, Section 25.2.10. Replace ACI 318 Section 25.2.10 by the following:

25.2.10 For ties and hoops in columns to be placed with shotcrete, minimum clear spacing shall be 3 in. *Shotcrete shall not be applied to spirally tied columns.*

1905A.1.16 ACI 318, Section 26.5.2. Modify ACI 318 Section 26.5.2.1 by replacing items (l), (m) and (n) and adding item (q) as follows:

- (l) Shotcrete surfaces intended to receive subsequent shotcrete placement *following an interruption of 30 minutes or more* shall be roughened to a full amplitude of approximately 1/4 in. before the shotcrete has reached final set. *The film of laitance which forms on the surface of the shotcrete shall be removed within approximately 2 hours after application by brushing with a stiff broom. If this film is not removed within 2 hours, it shall be removed by thorough wire brushing or a mechanical method acceptable to the enforcement agency.*

- (m) Before placing additional material onto hardened shotcrete, laitance shall be removed, joints shall be cleaned, and the surface shall be dampened. Construction joints over 8 hours old shall be thoroughly cleaned with air and water prior to receiving shotcrete.
- (n) In-place fresh concrete that exhibits sags, sloughs, segregation, honeycombing, sand pockets, or other obvious defects shall be removed and replaced. Shotcrete above sags and sloughs shall be removed and replaced while still plastic.
- (q) Surface preparation: Concrete or masonry to receive shotcrete shall have the entire surface thoroughly cleaned and roughened by a mechanical method acceptable to the enforcement agency, and just prior to receiving shotcrete shall be thoroughly cleaned of all debris, dirt and dust. Concrete and masonry shall be brought to a saturated surface-dry (SSD) condition before shotcrete is deposited.

1905A.1.17 ACI 318, Section 26.12.2.1(a). Replace ACI 318 Section 26.12.2.1(a) by the following:

26.12.2.1(a) Samples for strength tests of each class of concrete placed each day shall be taken not less than once a day, or not less than once for each 50 cubic yards (345 m³) of concrete, or not less than once for each 2,000 square feet (186 m²) of surface area for slabs or walls. Additional samples for 7-day compressive strength tests shall be taken for each class of concrete at the beginning of the concrete work or whenever the mix or aggregate is changed.

SECTION 1906A FOOTINGS FOR LIGHT-FRAME CONSTRUCTION

Not permitted by OSHPD and DSA-SS.

SECTION 1907A MINIMUM SLAB PROVISIONS

1907A.1 General. The thickness of concrete floor slabs supported directly on the ground shall be not less than 3¹/₂ inches (89 mm). A 6-mil (0.006 inch; 0.15 mm) polyethylene vapor retarder with joints lapped not less than 6 inches (152 mm) shall be placed between the base course or subgrade and the concrete floor slab, or other approved equivalent methods or materials shall be used to retard vapor transmission through the floor slab.

Exception: A vapor retarder is not required:

1. For detached structures accessory to occupancies in Group R-3, such as garages, utility buildings or other unheated facilities.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports attached to occupancies in Group R-3.
3. For buildings of other occupancies where migration of moisture through the slab from below will not be

detrimental to the intended occupancy of the building.

4. For driveways, walks, patios and other flatwork that will not be enclosed at a later date.
5. Where approved based on local site conditions.

SECTION 1908A SHOTCRETE

1908A.1 General. Shotcrete shall be in accordance with the requirements of ACI 318 and the provisions of ACI 506R. [OSHPD 1 & 4] The evaluation of the shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7 or contact lap splices in accordance with ACI 318 Section 25.5.1.7 shall be in accordance with the requirements of ACI 506.4R with a core quality category of Very Good given in ACI 506.6T. [DSA-SS] The use of a shotcrete mockup panel to qualify bar clearance dimensions in accordance with ACI 318 Section 25.2.7.1 or contact lap splices in accordance with ACI 318 Section 25.5.1.7, is subject to the approval of the building official.

[DSA-SS] Exception: The reference to ACI 506R shall be to ACI 506.2, unless otherwise approved by the enforcing agent.

1908A.2 Tests and inspections. Preconstruction tests of one or more shotcrete mockup panels prepared in accordance with Section 1705A.3.9.2 are required. In addition to testing requirements in ACI 318, special inspection and testing shall be in accordance with Section 1705A.3.9.

1908A.3 Forms and ground wires for shotcrete. Forms for shotcrete shall be substantial and rigid. Forms shall be built and placed so as to permit the escape of air and rebound.

Adequate ground wires, which are to be used as screeds, shall be placed to establish the thickness, surface planes and form of the shotcrete work. All surfaces shall be rodged to these wires.

SECTION 1909A RESERVED

SECTION 1910A CONCRETE, REINFORCEMENT AND ANCHOR TESTING

1910A.1 Cementitious material. The concrete supplier shall furnish to the enforcement agency certification that the cement proposed for use on the project has been manufactured and tested in compliance with the requirements of ASTM C150 for portland cement and ASTM C595 or ASTM C1157 for blended hydraulic cement, whichever is applicable. When a mineral admixture or ground granulated blast-furnace slag is proposed for use, the concrete supplier shall furnish to the enforcement agency certification that they have been manufactured and tested in compliance with ASTM C618 or ASTM C989, whichever is applicable. The concrete producer shall provide copies of the cementitious material supplier's Certificate of Compliance that represents the materials used by date of shipment for

concrete. Cementitious materials without Certification of Compliance shall not be used.

1910A.2 Tests of reinforcing bars. Samples shall be taken from bundles as delivered from the mill, with the bundles identified as to heat number and the accompanying mill certificate. One tensile test and one bend test shall be made from a sample from each 10 tons (9080 kg) or fraction thereof of each size of reinforcing steel.

Where positive identification of the heat number cannot be made or where random samples are to be taken, one series of tests shall be made from each 2 1/2 tons (2270 kg) or fraction thereof of each size of reinforcing steel.

Tests of reinforcing bars may be waived by the structural engineer with the approval of the Building Official for one-story buildings or non-building structures provided they are identified in the construction documents and certified mill test reports are provided to the inspector of record for each shipment of such reinforcement.

1910A.3 Tests for prestressing steel and anchorage. All wires or bars of each size from each mill heat and all strands from each manufactured reel to be shipped to the site shall be assigned an individual lot number and shall be tagged in such a manner that each lot can be accurately identified at the jobsite. Each lot of tendon and anchorage assemblies and bar couplers to be installed shall be likewise identified.

The following samples of materials and tendons selected by the engineer or the designated testing laboratory from the prestressing steel at the plant or jobsite shall be furnished by the contractor and tested by an approved independent testing agency:

1. For wire, strand or bars, 7-foot-long (2134 mm) samples shall be taken of the coil of wire or strand reel or rods. A minimum of one random sample per 5,000 pounds (2270 kg) of each heat or lot used on the job shall be selected.
2. For prefabricated prestressing tendons other than bars, one completely fabricated tendon 10 feet (3048 mm) in length between grips with anchorage assembly at one end shall be furnished for each size and type of tendon and anchorage assembly.

Variations of the bearing plate size need not be considered.

The anchorages of unbonded tendons shall develop at least 95 percent of the minimum specified ultimate strength of the pre-stressing steel. The total elongation of the tendon under ultimate load shall not be less than 2 percent measured in a minimum gage length of 10 feet (3048 mm).

Anchorages of bonded tendons shall develop at least 90 percent of the minimum specified strength of the prestressing steel tested in an unbonded state. All couplings shall develop at least 95 percent of the minimum specified strength of the prestressing steel and shall not reduce the elongation at rupture below the requirements of the tendon itself.

3. If the prestressing tendon is a bar, one 7-foot (2134 mm) length complete with one end anchorage shall be furnished and, in addition, if couplers are to be used with the bar, two 4-foot (1219 mm) lengths of bar fabricated to fit and equipped with one coupler shall be furnished.

4. Mill tests of materials used for end anchorages shall be furnished. In addition, at least one Brinnell hardness test shall be made of each thickness of bearing plate.

1910A.4 Composite construction cores. Cores of the completed composite concrete construction shall be taken to demonstrate the shear strength along the contact surfaces. The cores shall be tested when the cast-in-place concrete is approximately 28 days old and shall be tested by a shear loading parallel to the joint between the precast concrete and the cast-in-place concrete. The minimum unit shear strength of the contact surface area of the core shall not be less than 100 psi (689 kPa).

At least one core shall be taken from each building for each 5,000 square feet (465m²) of area of composite concrete construction and not less than three cores shall be taken from each project. The architect or structural engineer in responsible charge of the project or his or her representative shall designate the location for sampling.

1910A.5 Tests for post-installed anchors in concrete. When post-installed anchors are used in lieu of cast-in place bolts, the installation verification test loads, frequency and acceptance criteria shall be in accordance with this section.

1910A.5.1 General. Test loads or torques and acceptance criteria shall be shown on the construction documents.

If any anchor fails testing, all anchors of the same type shall be tested, which are installed by the same trade, not previously tested until twenty (20) consecutive anchors pass, then resume the initial test frequency.

1910A.5.2 Testing procedure. The test procedure shall be as permitted by an approved evaluation report using criteria adopted in this code. All post-installed anchors shall be tension tested. [OSHPD 1 & 4] Tension testing to verify proper installation shall be performed in accordance with ASTM E3121.

Exception: [OSHPD 1 & 4] Torque-controlled post-installed anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

Exception: [DSA-SS] Torque-controlled post-installed anchors and screw type anchors shall be permitted to be tested using torque based on an approved evaluation report using criteria adopted in this code.

Alternatively, manufacturer's recommendation for testing may be approved by the enforcement agency, based on an approved test report using criteria adopted in this code.

1910A.5.3 Test frequency. When post-installed anchors are used for sill plate bolting applications, 10 percent of the anchors shall be tested.

When post-installed anchors are used for other structural applications, all such anchors shall be tested.

When post-installed anchors are used for nonstructural components, such as equipment anchorage, 50 percent or alternate bolts in a group, including at least one-half the anchors in each group, shall be tested.

The testing of the post-installed anchors shall be done in the presence of the special inspector and a report of the test results shall be submitted to the enforcement agency.

Exceptions:

1. Undercut anchors that allow visual confirmation of full set shall not require testing.
2. Where the design tension on anchors is less than 100 lbs and those anchors are clearly noted on the approved construction documents, only 10 percent of those anchors shall be tested.
3. Where adhesive anchor systems are used to install reinforcing dowel bars in hardened concrete, only 25 percent of the dowels shall be tested if all of the following conditions are met:
 - a. The dowels are used exclusively to transmit shear forces across joints between existing and new concrete.
 - b. The number of dowels in any one member equals or exceeds 12.
 - c. The dowels are uniformly distributed across seismic force resisting members (such as shear walls, collectors and diaphragms).

Anchors to be tested shall be selected at random by the special inspector/inspector of record (IOR).

4. Testing of shear dowels across cold joints in slabs on grade, where the slab is not part of the lateral force-resisting system shall not be required.
5. Testing is not required for power actuated fasteners used to attach tracks of interior non-shear wall partitions for shear only, where there are at least three fasteners per segment of track.
6. [OSHPD 4] In state detention and correctional facilities, tension testing is not required for post-installed anchors used for attaching nonstructural components, such as grab bars and shower seats, to concrete walls if the components do not contribute to security/detainment, life safety and the continuous operation of the institution following an event of extreme environmental loading from flood, wind, snow or earthquakes, as determined by the enforcing agency.

1910A.5.4 Test loads. Required test loads shall be determined by one of the following methods:

1. Twice the maximum allowable tension load or one and a quarter ($1\frac{1}{4}$) times the maximum design strength of anchors as provided in an approved evaluation report using criteria adopted in this code

or determined in accordance with Chapter 17 of ACI 318.

Tension test load need not exceed 80 percent of the nominal yield strength of the anchor element ($= 0.8 A_{se}f_{ya}$).

2. The manufacturer's recommended installation torque based on an approved evaluation report using criteria adopted in this code.

1910A.5.5 Test acceptance criteria. Acceptance criteria for post-installed anchors shall be based on an approved evaluation report using criteria adopted in this code. Field tests shall satisfy the following minimum requirements.

1. Hydraulic ram method:

Anchors tested with a hydraulic jack or spring loaded apparatus shall maintain the test load for a minimum of 15 seconds and shall exhibit no discernible movement during the tension test, e.g., as evidenced by loosening of the washer under the nut.

The testing apparatus support locations shall not be within 1.5 times the anchor's embedment depth to avoid restricting the concrete shear cone type failure mechanism from occurring.

Exception: When denoted accordingly on the approved construction documents, adhesive anchors complying with ACI 318 Equation 17.8.2a and for which concrete breakout does not control the design tensile strength may be tested with apparatus support locations closer than 1.5 times the anchor embedment depth.

2. Torque wrench method:

Torque-controlled post-installed anchors tested with a calibrated torque wrench shall attain the specified torque within $\frac{1}{2}$ turn of the nut; or one-quarter ($\frac{1}{4}$) turn of the nut for a $\frac{3}{8}$ inch sleeve anchor only.

[DSA-SS] Screw-type anchors tested with a calibrated torque wrench shall attain the specified torque within one-quarter ($\frac{1}{4}$) turn of the screw after initial seating of the screw head.

**SECTION 1911A
EXISTING CONCRETE STRUCTURES**

1911A.1 Existing concrete structures.

The structural use of existing concrete with a core strength less than 1,500 psi (10.3MPa) is not permitted in rehabilitation work.

For existing concrete structures, sufficient cores shall be taken at representative locations throughout the structure, as designated by the architect or structural engineer, so that knowledge will be had of the in-place strength of the concrete. At least three cores shall be taken from each building for each 4,000 square feet (372 m²) of floor area, or fraction thereof. Cores shall be at least 4 inches (102 mm) in diameter. Cores as small as 2.75 inches (70 mm) in diameter may be allowed by the enforcement agency when reinforcement is

closely spaced and the coarse aggregate does not exceed $\frac{3}{4}$ inch (19 mm).

1911A.2 Crack repair by epoxy injection. *Crack repair of concrete and masonry member by epoxy injection, shall conform to all requirements of ACI 503.7.*

1911A.3 Concrete strengthening by externally bonded fiber reinforced polymer (FRP). *Design and construction of externally bonded FRP systems for strengthening concrete structures shall be in accordance with ACI 440.2R.*

Exceptions:

- 1. Near-Surface Mounted (NSM) FRP bars shall not be permitted.*
- 2. Strengthening of shear walls and diaphragms (including chords and collectors) shall be considered as an alternative system.*

Design capacities, reliability, serviceability of FRP materials shall be permitted to be established in accordance with ICC-ES AC 125. Minimum inspection requirements of FRP composite systems shall be in accordance with ICC-ES AC 178.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 20 – ALUMINUM

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X			X	X								X									
Adopt entire chapter as amendedd (amended sections listed below)								X	X	X	X	X		X	X							
Adopt only those sections that are listed below																						
Chapter / Section																						
2001.1.1								X	X	X	X	X		X	X							
2001.1.2								X	X	X	X	X		X	X							
2002								X	X	X	X	X		X	X							
2003								X	X	X	X	X		X	X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 20

ALUMINUM

User notes:

About this chapter: Chapter 20 contains standards for the use of aluminum in building construction. Only the structural applications of aluminum are addressed so it would not apply to the use of aluminum in specialty products such as storefront or window framing or architectural hardware. The use of aluminum in heating, ventilating or air-conditioning systems is addressed in the California Mechanical Code®. This chapter references national standards from the Aluminum Association for use of aluminum in building construction, AA ASM 35, Aluminum Sheet Metal Work in Building Construction, and AA ADM, Aluminum Design Manual.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2001 GENERAL

2001.1 Scope. This chapter shall govern the quality, design, fabrication and erection of aluminum.

2001.1.1 Application. [DSA-SS, DSA-SS/CC, OSHPD] The scope of application of Chapter 20 is as follows:

1. Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.
2. Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 [DSA-SS] and 1.9.2.2 [DSA-SS/CC]. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

2001.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] DSA-SS, DSA-SS/CC and OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. [OSHPD 1, 1R, 2, 4 & 5] Office of Statewide Health Planning and Development (OSHPD) amendments appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 4] - For applications listed in Section 1.10.4.

[OSHPD 5] - For applications listed in Section 1.10.5.

2. Division of the State Architect - Structural Safety:

[DSA-SS] - For applications listed in Section 1.9.2.1.

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

SECTION 2002 MATERIALS

2002.1 General. Aluminum used for structural purposes in buildings and structures shall comply with AA ASM 35 and AA ADM. The nominal loads shall be the minimum design loads required by Chapter 16.

Exception: [DSA – SS] The reference to Chapter 16 shall be to Chapter 16A.

SECTION 2003 TESTING AND INSPECTION

2003.1 Testing and Inspection. [DSA-SS, DSA-SS/CC, OSHPD 1 & 4] Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17A, except references to AWS D1.1 shall be to AWS D1.2.

[OSHPD 1R, 2 & 5] Testing and inspection of aluminum shall be required in accordance with the requirements for steel in Chapter 17, except references to AWS D1.1 shall be to AWS D1.2.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 21 – MASONRY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X			X	X								X									
Adopt entire chapter as amendeded (amended sections listed below)									X		X	X			X							
Adopt only those sections that are listed below			X																X			
Chapter / Section																						
2101.1.1									X													
2101.1.2									X	X					X							
2101.1.3									X													
2101.1.4									X													
2101.2										X	X				X							
2101.2.2										X	B				X							
2103.4										X	B				X							
2103.5										X	B				X							
2104.1										X	B				X							
2104.2										X	B				X							
2104.3										X	X				X							
2105.2										X	B				X							
2105.3										X	B				X							
2105.4										X	B				X							
2106.1.1										X	B				X							
2106.1.2										X	B				X							
2106.1.3										X	B				X							
2107.1										X	B				X							
2107.4										X	X				X							
2107.5										X	B				X							
2107.6										X	X				X							
2107.7										X	B				X							
Table 2107.5										X	X				X							
2108.4										X	B				X							
2109										X	X				X							
2109.2.4.8.2																			X			
2110.1										X	X				X							
2113.9.2			X																			
2115									X													

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 21

MASONRY

User notes:

About this chapter: Chapter 21 establishes minimum requirements for masonry construction. The provisions address: material specifications and test methods; types of wall construction; criteria for engineered and empirical designs; and required details of construction, including the execution of construction. The provisions provide a framework for applying applicable standards to the design and construction of masonry structures. Masonry design methodologies including allowable stress design, strength design and empirical design are covered by the provisions of this chapter. Also addressed are masonry fireplaces and chimneys, masonry heaters and glass unit masonry.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2101 GENERAL

2101.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

2101.1.1 Application. [DSA-SS/CC, OSHPD] The scope of application of Chapter 21 is as follows:

1. Structures regulated by the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC) which include those applications listed in Section 1.9.2.2.
2. Office of Statewide health planning and development (OSHPD). Buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by OSHPD. Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5.

2101.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] DSA-SS/CC, OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the acronym of the adopting agency, as follows:

1. [DSA-SS/CC] – For applications listed in Section 1.9.2.2.
2. Office of Statewide Health Planning and Development:

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 5] - For applications listed in Section 1.10.5.

2101.1.3 Reference to other chapters. [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

2101.1.4 Amendments. [DSA-SS/CC] See Section 2115 for additional requirements.

2101.2 Design methods. Masonry shall comply with the provisions of TMS 402, TMS 403 or TMS 404 as well as applicable requirements of this chapter. [OSHPD 1R, 2 & 5] TMS 403 Not permitted by OSHPD.

2101.2.1 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14.

2101.2.2 Prohibition. [OSHPD 1R, 2B & 5] The following design methods, systems and materials in TMS402/602 are not permitted by OSHPD:

1. Unreinforced masonry.
2. Autoclaved Aerated Concrete (AAC) Masonry.
3. Empirical design of masonry and prescriptive design of masonry partition walls.
4. Adobe construction.
5. Ordinary reinforced masonry shear walls.
6. Intermediate reinforced masonry shear walls.
7. Prestressed masonry shear walls.
8. Direct design of masonry.

2101.3 Special inspection. The special inspection of masonry shall be as defined in Chapter 17, or an itemized testing and inspection program shall be provided that meets or exceeds the requirements of Chapter 17.

SECTION 2102 NOTATIONS

2102.1 General. The following notations are used in the chapter:

NOTATIONS.

d_b = Diameter of reinforcement, inches (mm).

F_s = Allowable tensile or compressive stress in reinforcement, psi (MPa).

f_r = Modulus of rupture, psi (MPa).

f'_{AAC} = Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in TMS 602, psi (MPa).

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- f'_m = Specified compressive strength of masonry at age of 28 days, psi (MPa).
- f'_{mi} = Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).
- K = The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times db, inches (mm).
- L_s = Distance between supports, inches (mm).
- l_d = Required development length or lap length of reinforcement, inches (mm).
- P = The applied load at failure, pounds (N).
- S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).
- S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

SECTION 2103 MASONRY CONSTRUCTION MATERIALS

2103.1 Masonry units. Concrete masonry units, clay or shale masonry units, stone masonry units, glass unit masonry and AAC masonry units shall comply with Article 2.3 of TMS 602. Architectural cast stone shall conform to ASTM C1364 and TMS 504. Adhered manufactured stone masonry veneer units shall conform to ASTM C1670. *[OSHPD 1R, 2B & 5] Architectural cast stone construction shall be considered as an alternative system.*

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Table 705.5.

2103.1.1 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103.2 Mortar. Mortar for masonry construction shall comply with Section 2103.2.1, 2103.2.2, 2103.2.3 or 2103.2.4.

2103.2.1 Masonry mortar. Mortar for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103.2.2 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

2103.2.3 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103.2.3.

2103.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI

A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

**TABLE 2103.2.3
CERAMIC TILE MORTAR COMPOSITIONS**

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $\frac{1}{5}$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $\frac{1}{2}$ hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $\frac{1}{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $\frac{1}{2}$ hydrated lime; $2\frac{1}{2}$ dry sand or 3 damp sand

2103.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103.2.3.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103.2.4 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 for Type N or S, or shall comply with ANSI A118.4 for latex-modified Portland cement mortar.

2103.3 Grout. Grout shall comply with Article 2.2 of TMS 602.

2103.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement [OSHPD 1R, 2B & 5], or bar reinforcement without mill certification, is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work. [OSHPD 1R, 2B & 5] Alternatively, the frequency of sampling for unidentifiable reinforcing bars specified in Section 1910.2 can be used.

2103.5 Air entrainment. [OSHPD 1R, 2B & 5] Air-entraining materials or air-entraining admixtures shall not be used in grout.

SECTION 2104 CONSTRUCTION

2104.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104.1.1 and 2104.1.2 and with the requirements of either TMS 602 or TMS 604.

2104.1.1 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.12.

2104.1.2 Molded cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

2104.2 Reinforced Grouted masonry. [OSHPD 1R, 2B & 5]

2104.2.1 TMS 602, Article 3.3 B Placing mortar and units. Modify TMS 602, Article 3.3 B.2.c as follows:

- c. Remove masonry protrusions extending greater than $\frac{1}{4}$ inch (6.4 mm) into cells or cavities to be grouted.

2104.2.2 TMS 602, Article 3.4 B Reinforcement. Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. Reinforcement and embedded items shall be clean, properly positioned and securely anchored against movement prior to grouting. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.
3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $\frac{1}{4}$ inch (6.4 mm) for fine grout and $\frac{1}{2}$ inch (12.7 mm) for coarse grout, and the space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter, except where cross

webs of hollow units are used as supports for horizontal reinforcement. Reinforcement, embedded items and bolts shall be solidly embedded in grout.

2104.2.3 TMS 602, Article 3.4 D Anchor bolts. Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:

3. Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $\frac{1}{2}$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $\frac{1}{4}$ inch (6.4 mm) when using fine grout and at least $\frac{1}{2}$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.
5. Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $\frac{1}{2}$ -inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, $\frac{3}{4}$ -inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, $\frac{7}{8}$ -inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.
6. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.

2104.2.4 TMS 602, Article 3.5 C Grout pour height. Add to TMS 602, Article 3.5 C the following:

1. For grout pours not greater than 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry, the top of grout pour shall be at the top of constructed masonry, or within 8 inches (200 mm) of the top of the constructed masonry. After construction of each grout lift height of wall, column, pier or beam, masonry cells or cavities shall be inspected prior to placement of grout. Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.e.
2. Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to approval of the enforcement agency.
 - a. Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to the following:

Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry.
 - b. An approved admixture of a type that reduces early water loss and produces an expansive action shall be used.

- c. The grouting of any section of a wall between control barriers shall be completed in 1 day with no interruptions greater than 1 hour.
- d. For multiple grout lifts within a grout pour, each grout lift height of wall, column, pier or beam shall be inspected before placement of additional units.
- e. Cleanout openings shall be provided at the bottom of each pour of grout.

2104.2.5 TMS 602, Article 3.5 F.1 Grout key. Replace TMS 602, Article 3.5 F.1 as follows:

- 1. Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of 1½ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of ½ inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above reinforcing steel for each grout pour.

2104.3 Aluminum equipment. [OSHPD 1R, 2 & 5] Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.

SECTION 2105 QUALITY ASSURANCE

2105.1 General. A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the approved construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17 and TMS 602.

2105.2 Compressive strength, f'_m . [OSHPD 1R, 2B & 5] The minimum specified compressive strength, f'_m in the design shall be 1,500 psi (10.34 MPa) for all structural masonry construction using materials and details of construction required herein. Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.

Exception: Where values of f'_m greater than 2,000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow-unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 submitted by the architect or engineer to the enforcement agency which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength exceed 3,000 psi (20.7MPa).

The architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using the prism test method in accordance with TMS 602, Article

1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105.3 Mortar and grout tests. [OSHPD 1R, 2B & 5] TMS 602, Article 1.4 B Compressive strength determination. Modify TMS 602, Article 1.4 B as follows by adding:

5. Additional testing requirements:

- a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests.
- b. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet (464.5 m²) of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2 or greater as specified.
- c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.
- d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

Exception: For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet (3658 mm) above top of foundation, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.

2105.4 Masonry core testing. [OSHPD 1R, 2B & 5] Not less than two cores shall be taken from each building for each 5,000 square feet (465 m²) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.

Core samples shall comply with the following:

- 1. Cored no sooner than 7 days after grouting of the selected area;
- 2. Be a minimum of 3¾ inch (95.25 mm) nominal diameter; and
- 3. Sampled in such a manner as to exclude any masonry unit webs, mortar joint or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect voids or delamination shall be selected

by the registered design professional and approved by the building official.

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear tests of both joints between the grout core and the outside wythes or face shell of the masonry shall be made 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or nonabsorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than $2.5 \sqrt{f'_m}$ psi.

All cores shall be submitted to an approved agency for examination, even where the core specimens failed during the cutting operation. The approved agency shall report the location where each core was taken, report the findings of their visual examination of each core, identify which cores were selected for shear testing, and report the results of the shear tests.

Exceptions:

1. Core sampling and testing is not required for non-bearing nonshear masonry walls, not exceeding total wall height of 12 feet above the top of the foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79MPa).
2. An infrared thermographic survey or other nondestructive test procedures shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in conjunction with reduced core sampling and testing. A minimum of two cores shall be taken from each building for each 10,000 square feet (930 m²) of the wall.

**SECTION 2106
SEISMIC DESIGN**

2106.1 Seismic design requirements for masonry. Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402 depending on the structure's seismic design category.

2106.1.1 [OSHPD 1R, 2B & 5] TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b). Replace TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b) as follows:

- a. Ties shall be at least $\frac{3}{8}$ inch (9.525 mm) in diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.
- b. The spacing of column ties shall be as follows: not greater than eight bar diameters, one half the least

dimension of the column for the full column height, or 8 inches (203 mm).

2106.1.2 [OSHPD 1R, 2B & 5] TMS 402, Chapter 5. Add TMS 402, Section 5.6 as follows:

5.6 – Lateral Support of Members

5.6.1 – Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally, or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.

2106.1.3 [OSHPD 1R, 2B & 5] TMS 402, Sections 7.4.4.1 and 7.4.5.1. Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:

7.4.4.1 Minimum reinforcement requirements for masonry walls. The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.

All cells shall be solidly filled with grout.

Exception: Reinforced hollow-unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4'-0" on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.

7.4.4.1.1 The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.

7.4.4.1.2 Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

7.4.4.1.3 In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.

7.4.4.1.4 When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

7.4.4.1.5 Joint reinforcement shall not be used as principal reinforcement in masonry.

**SECTION 2107
ALLOWABLE STRESS DESIGN**

2107.1 General. The design of masonry structures using allowable stress design shall comply with Section 2106 and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107.2 through 2107.3. [OSHPD IR, 2B & 5] through 2107.7.

2107.2 TMS 402, Section 6.1.6.1.1, lap splices. As an alternative to Section 6.1.6.1.1, it shall be permitted to design lap splices in accordance with Section 2107.2.1.

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d , shall be:

$$l_d = 0.002d_b f_s \quad \text{(Equation 21-1)}$$

For SI: $l_d = 0.29d_b f_s$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters, where:

d_b = Diameter of reinforcement, inches (mm)

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s , the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b . Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107.3 TMS 402, Section 6.1.6.1, splices of reinforcement. Modify Section 6.1.6.1 as follows:

6.1.6.1 – Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M

#29) shall be spliced using mechanical connections in accordance with Section 6.1.6.1.3.

2107.4 [OSHPD IR, 2 & 5] TMS 402, Section 8.3.7, maximum bar size. [OSHPD IR, 2 & 5] Add the following to Chapter 8:

8.3.7 – Maximum bar size. The maximum bar diameter shall conform to the requirements of TMS 402, Section 9.3.3.1.

2107.5 [OSHPD IR, 2B & 5] TMS 402, Section 8.3.4.4 Walls. Modify TMS 402 by adding Section 8.3.4.4 as follows by adding:

8.3.4.4.1 The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.

8.3.4.4.2 The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio or the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.

8.3.4.4.3 Every pier or wall section with a width less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section with a width between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.

**TABLE 8.3.4.4
MINIMUM THICKNESS OF MASONRY WALLS^{1,2}**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS ^{2,3}	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
NONBEARING WALLS:		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

- For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
- In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
- Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

2107.6 [OSHPD IR, 2 & 5] Modify TMS 402, Section 8.3.4.4 by the following:

Reinforced masonry walls, columns, pilasters, beams and lintels that are subjected to in-plane forces shall have a maximum flexural tensile reinforcement ratio, ρ_{max} , not greater than that computed by Equation 8-20.

2107.7 Masonry Compressive Strength. [OSHPD 1R, 2B & 5] The specified compressive strength of structural masonry, f'_m , shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.

**SECTION 2108
STRENGTH DESIGN OF MASONRY**

2108.1 General. The design of masonry structures using strength design shall comply with Section 2106 and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108.2 through 2108.4.

2108.2 TMS 402, Section 6.1.5.1.1, development. Modify the second paragraph of Section 6.1.5.1.1 as follows:

The required development length of reinforcement shall be determined by Equation (6-1), but shall be not less than 12 inches (305 mm) and need not be greater than $72 d_b$.

2108.3 TMS 402, Section 6.1.6.1.1, splices. Modify Sections 6.1.6.1.2 and 6.1.6.1.3 as follows:

6.1.6.1.2 – A welded splice shall have the bars butted and welded to develop not less than 125 percent of the yield strength, f_y , of the bar in tension or compression, as required. Welded splices shall be of ASTM A706 steel reinforcement. Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.

6.1.6.1.3 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls. Type 2 mechanical splices are permitted in any location within a member.

2108.4 [OSHPD 1R, 2B & 5] TMS 402, Section 9.1.9.1.1. Modify TMS 402, Section 9.1.9.1.1 as follows:

9.1.9.1.1 Masonry Compressive Strength. The specified compressive strength of structural masonry, f'_m , shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength values in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.

**SECTION 2109
EMPIRICAL DESIGN OF ADOBE MASONRY**

[OSHPD 1R, 2 & 5] Not permitted by OSHPD.

2109.1 General. Empirically designed adobe masonry shall conform to the requirements of Appendix A of TMS 402, except where otherwise noted in this section.

2109.1.1 Limitations. The use of empirical design of adobe masonry shall be limited as noted in Section A.1.2 of TMS 402. In buildings that exceed one or more of the

limitations of Section A.1.2 of TMS 402, masonry shall be designed in accordance with the engineered design provisions of Section 2101.2 or the foundation wall provisions of Section 1807.1.5.

Section A.1.2.2 of TMS 402 shall be modified as follows:

A.1.2.2 – *Wind.* Empirical requirements shall not apply to the design or construction of masonry for buildings, parts of buildings, or other structures to be located in areas where V_{asd} as determined in accordance with Section 1609.3.1 of the *California Building Code* exceeds 110 mph.

2109.2 Adobe construction. Adobe construction shall comply with this section and shall be subject to the requirements of this code for Type V construction, Appendix A of TMS 402, and this section.

2109.2.1 Unstabilized adobe. Unstabilized adobe shall comply with Sections 2109.2.1.1 through 2109.2.1.4.

2109.2.1.1 Compressive strength. Adobe units shall have an average compressive strength of 300 psi (2068 kPa) when tested in accordance with ASTM C67. Five samples shall be tested and individual units are not permitted to have a compressive strength of less than 250 psi (1724 kPa).

2109.2.1.2 Modulus of rupture. Adobe units shall have an average modulus of rupture of 50 psi (345 kPa) when tested in accordance with the following procedure. Five samples shall be tested and individual units shall not have a modulus of rupture of less than 35 psi (241 kPa).

2109.2.1.2.1 Support conditions. A cured unit shall be simply supported by 2-inch-diameter (51 mm) cylindrical supports located 2 inches (51 mm) in from each end and extending the full width of the unit.

2109.2.1.2.2 Loading conditions. A 2-inch-diameter (51 mm) cylinder shall be placed at midspan parallel to the supports.

2109.2.1.2.3 Testing procedure. A vertical load shall be applied to the cylinder at the rate of 500 pounds per minute (37 N/s) until failure occurs.

2109.2.1.2.4 Modulus of rupture determination. The modulus of rupture shall be determined by the equation:

$$f_r = 3 PL_s / [2 S_w (S_t^2)] \quad \text{(Equation 21-2)}$$

where, for the purposes of this section only:

S_w = Width of the test specimen measured parallel to the loading cylinder, inches (mm).

f_r = Modulus of rupture, psi (MPa).

L_s = Distance between supports, inches (mm).

S_t = Thickness of the test specimen measured parallel to the direction of load, inches (mm).

P = The applied load at failure, pounds (N).

2109.2.1.3 Moisture content requirements. Adobe units shall have a moisture content not exceeding 4 percent by weight.

2109.2.1.4 Shrinkage cracks. Adobe units shall not contain more than three shrinkage cracks and any single shrinkage crack shall not exceed 3 inches (76 mm) in length or 1/8 inch (3.2 mm) in width.

2109.2.2 Stabilized adobe. Stabilized adobe shall comply with Section 2109.2.1 for unstabilized adobe in addition to Sections 2109.2.2.1 and 2109.2.2.2.

2109.2.2.1 Soil requirements. Soil used for stabilized adobe units shall be chemically compatible with the stabilizing material.

2109.2.2.2 Absorption requirements. A 4-inch (102 mm) cube, cut from a stabilized adobe unit dried to a constant weight in a ventilated oven at 212°F to 239°F (100°C to 115°C), shall not absorb more than 2 1/2 percent moisture by weight when placed on a constantly water-saturated, porous surface for seven days. Not fewer than five specimens shall be tested and each specimen shall be cut from a separate unit.

2109.2.3 Allowable stress. The allowable compressive stress based on gross cross-sectional area of adobe shall not exceed 30 psi (207 kPa).

2109.2.3.1 Bolts. Bolt values shall not exceed those set forth in Table 2109.2.3.1.

2109.2.4 Detailed requirements. Adobe construction shall comply with Sections 2109.2.4.1 through 2109.2.4.9.

2109.2.4.1 Number of stories. Adobe construction shall be limited to buildings not exceeding one story, except that two-story construction is allowed where designed by a registered design professional.

2109.2.4.2 Mortar. Mortar for adobe construction shall comply with Sections 2109.2.4.2.1 and 2109.2.4.2.2.

2109.2.4.2.2 Mortar joints. Adobe units shall be laid with full head and bed joints and in full running bond.

2109.2.4.3 Parapet walls. Parapet walls constructed of adobe units shall be waterproofed.

2109.2.4.4 Wall thickness. The minimum thickness of exterior walls in one-story buildings shall be 10 inches (254 mm). The walls shall be laterally supported at intervals not exceeding 24 feet (7315 mm). The minimum thickness of interior load-bearing walls shall be 8 inches (203 mm). The unsupported height of any wall constructed of adobe units shall not exceed 10 times the thickness of such wall.

2109.2.4.5 Foundations. Foundations for adobe construction shall be in accordance with Sections 2109.2.4.5.1 and 2109.2.4.5.2.

2109.2.4.5.1 Foundation support. Walls and partitions constructed of adobe units shall be supported by foundations or footings that extend not less than 6 inches (152 mm) above adjacent ground surfaces and are constructed of solid masonry (excluding adobe) or concrete. Footings and foundations shall comply with Chapter 18.

2109.2.4.5.2 Lower course requirements. Stabilized adobe units shall be used in adobe walls for the first 4 inches (102 mm) above the finished first-floor elevation.

2109.2.4.6 Isolated piers or columns. Adobe units shall not be used for isolated piers or columns in a load-bearing capacity. Walls less than 24 inches (610 mm) in length shall be considered to be isolated piers or columns.

2109.2.4.7 Tie beams. Exterior walls and interior load-bearing walls constructed of adobe units shall have a continuous tie beam at the level of the floor or roof bearing and meeting the following requirements.

2109.2.4.7.1 Concrete tie beams. Concrete tie beams shall be 6 inches (152 mm) or more in depth and 10 inches (254 mm) or more in width. Concrete tie beams shall be continuously reinforced with not fewer than two No. 4 reinforcing bars. The specified compressive strength of concrete shall be not less than 2,500 psi (17.2 MPa).

2109.2.4.7.2 Wood tie beams. Wood tie beams shall be solid or built up of lumber having a nominal thickness of not less than 1 inch (25 mm), and shall have a depth of not less than 6 inches (152 mm) and a width of not less than 10 inches (254 mm). Joints in wood tie beams shall be spliced not less than 6 inches (152 mm). Splices shall not be allowed within 12 inches (305 mm) of an opening. Wood used in tie beams shall be approved naturally decay-resistant or preservative-treated wood.

2109.2.4.8 Exterior finish. Exterior finishes applied to adobe masonry walls shall be of any type permitted by this section or Chapter 14, except where stated otherwise in this section.

**TABLE 2109.2.3.1
ALLOWABLE SHEAR ON BOLTS IN ADOBE MASONRY**

DIAMETER OF BOLTS (inches)	MINIMUM EMBEDMENT (inches)	SHEAR (pounds)
1/2	—	—
5/8	12	200
3/4	15	300
7/8	18	400
1	21	500
1 1/8	24	600

For SI: 1 inch = 25.4 mm, 1 pound = 4.448 N.

2109.2.4.2.1 General. Mortar for adobe units shall be in accordance with Section 2103.2.1, or be composed of adobe soil of the same composition and stabilization as the adobe brick units. Unstabilized adobe soil mortar is permitted in conjunction with unstabilized adobe brick units.

2109.2.4.8.1 Where required. Unstabilized adobe masonry walls shall receive a weather protective exterior finish in accordance with Section 2109.2.4.8.

2109.2.4.8.2 Vapor permeance. Plaster and finish assemblies shall have a vapor permeance of not less than 5 perms.

Exception: Insulation products applied to the exterior of stabilized adobe masonry walls in Climate Zones 2B, 3B, 4B and 5B shall not have a vapor permeance requirement. *Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.*

2109.2.4.8.3 Plaster thickness and coats. Plaster applied to adobe masonry shall be not less than $\frac{7}{8}$ inch (22 mm) and not greater than 2 inches (51 mm) thick. Plaster shall be applied in not less than two coats.

2109.2.4.8.4 Plaster application. Where plaster is applied directly to adobe masonry walls, no intermediate membrane shall be used.

2109.2.4.8.5 Lath for plaster. Lath shall be provided for all plasters, except where not required elsewhere in Section 2109.2.4.8. Fasteners shall be corrosion resistant and spaced at a maximum of 16 inches (406 mm) on center with a minimum $1\frac{1}{2}$ -inch (38 mm) penetration into the adobe wall. Metal lath shall comply with ASTM C1063, as modified by this section, and shall be corrosion resistant. Plastic lath shall comply with ASTM C1788, as modified by this section. Wood substrates shall be protected with No. 15 asphalt felt, an approved wood preservative or other protective coating prior to lath application.

2109.2.4.8.6 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Chapter 25, except that the proportion of lime in plaster coats shall be not less than 1 part lime to 4 parts cement. The combined thickness of cement plaster coats shall not exceed 1 inch (25 mm).

2109.2.4.8.7 Lime plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide, including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime, or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

2109.2.4.8.8 Cement-lime plaster. Cement-lime plaster shall be any plaster mix type CL, F or FL, as described in ASTM C926.

2109.2.4.8.9 Clay plaster. Clay plaster shall comply with this section.

2109.2.4.8.9.1 General. Clay plaster shall be any plaster having a clay or clay subsoil binder. Such

plaster shall contain sufficient clay to fully bind the aggregate and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal, and animal hair.

2109.2.4.8.9.2 Clay subsoil requirements. The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

2109.2.4.8.9.3 Weather-exposed locations. Clay plaster exposed to water from direct or wind-driven rain or snow shall be finished with an approved erosion-resistant finish. The use of clay plasters shall not be permitted on weather-exposed parapets.

2109.2.4.8.9.4 Prohibited finish coat. Plaster containing Portland cement shall not be permitted as a finish over clay plaster.

2109.2.4.8.9.5 Conditions where lathing is not required. For unstabilized adobe walls finished with unstabilized clay plaster, lathing shall not be required.

2109.2.4.9 Lintels. Lintels shall be considered to be structural members and shall be designed in accordance with the applicable provisions of Chapter 16.

SECTION 2110 GLASS UNIT MASONRY

2110.1 General. *[OSHPD IR, 2 & 5]* Masonry glass block walls or panels shall be designed for seismic forces. Stresses in glass block shall not be utilized. Glass unit masonry construction shall comply with Chapter 13 of TMS 402 and this section.

2110.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $\frac{3}{4}$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

**SECTION 2111
MASONRY FIREPLACES**

2111.1 General. The construction of masonry fireplaces, consisting of concrete or masonry, shall be in accordance with this section.

2111.2 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

2111.3 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2111.3.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111.4 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry fireplaces shall be reinforced and anchored in accordance with Sections 2111.4.1, 2111.4.2 and 2111.5. In structures assigned to Seismic Design Category E or F, masonry fireplaces shall be reinforced in accordance with the requirements of Sections 2101 through 2108.

2111.4.1 Vertical reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.3. For fireplaces with chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2111.4.2 Horizontal reinforcing. Vertical reinforcement shall be placed enclosed within $\frac{1}{4}$ -inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2111.5 Seismic anchorage. Masonry fireplaces and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked

around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not fewer than four floor joists with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2111.6 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Where a lining of firebrick not less than 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and side-walls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall be not greater than $\frac{1}{4}$ inch (6.4 mm). Where a lining is not provided, the total minimum thickness of back and side-walls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C27 or ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199.

2111.6.1 Steel fireplace units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided that they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $\frac{1}{4}$ inch (6.4 mm) in thickness, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111.7 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) in depth. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, and the throat is not less than 12 inches (305 mm) above the lintel, and not less than $\frac{1}{20}$ the cross-sectional area of the fireplace opening.

2111.8 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the top of the fireplace opening.

2111.8.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111.9 Smoke chamber walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than 5/8 inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

2111.9.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall be not greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111.10 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. Combustible material shall not remain against the underside of hearths or hearth extensions after construction.

2111.10.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

2111.10.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than 3/8-inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

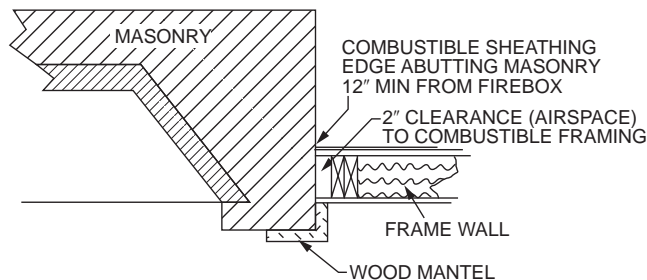
2111.11 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of, and not less than 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m²) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of, and not less than 12 inches (305 mm) beyond, each side of the fireplace opening.

2111.12 Fireplace clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces

and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111.13.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and dry-wall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111.12, provided that such combustible trim or sheathing is not less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided that such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than 1/8 inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than 1 1/2 inches (38 mm) from the face of the fireplace shall have an additional clearance equal to the projection.



Note: 1 inch = 25.4 mm

FIGURE 2111.12
ILLUSTRATION OF EXCEPTION TO
FIREPLACE CLEARANCE PROVISION

2111.13 Fireplace fireblocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid

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across the spaces between combustible material and the chimney.

2111.14 Exterior air. Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111.14.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

2111.14.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

2111.14.3 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of 1/4-inch (6.4 mm) mesh.

2111.14.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

2111.14.5 Passageway. The combustion air passageway shall be not less than 6 square inches (3870 mm²) and not more than 55 square inches (0.035 m²), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

2111.14.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

SECTION 2112 MASONRY HEATERS

2112.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as "masonry," which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in either a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

2112.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E1602.

2. Masonry heaters shall be listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

2112.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113.2.

2112.4 Seismic reinforcing. In structures assigned to Seismic Design Category D, E or F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113.

2112.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) or the distance of the allowed reduction method from the outside surface of a masonry heater in accordance with NFPA 211, Section 12.6, and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. Where the masonry heater wall thickness is not less than 8 inches (203 mm) of solid masonry and the wall thickness of the heat exchange channels is not less than 5 inches (127 mm) of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of not less than 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
2. Masonry heaters listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer's instructions.

SECTION 2113 MASONRY CHIMNEYS

2113.1 General. The construction of masonry chimneys consisting of solid masonry units, hollow masonry units grouted solid, stone or concrete shall be in accordance with this section.

2113.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2113.3 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is

not required. In structures assigned to Seismic Design Category C or D, masonry chimneys shall be reinforced and anchored in accordance with Sections 2113.3.1, 2113.3.2 and 2113.4. In structures assigned to Seismic Design Category E or F, masonry chimneys shall be reinforced in accordance with the requirements of Sections 2101 through 2108 and anchored in accordance with Section 2113.4.

2113.3.1 Vertical reinforcement. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103.3. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2113.3.2 Horizontal reinforcement. Vertical reinforcement shall be placed enclosed within $\frac{1}{4}$ -inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2113.4 Seismic anchorage. Masonry chimneys and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor joists with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2113.5 Corbeling. Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

2113.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113.5.

2113.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

2113.9 Termination. Chimneys shall extend not less than 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall be not less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

2113.9.1 Chimney caps. Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C1283.

2113.9.2 Spark arrestors. *[SFM] All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester.* The spark arrester shall meet all of the following requirements:

1. *The net free area of the spark arrester shall not be less than four times the net free area of the outlet of the chimney.*
2. *The spark arrester screen shall have heat and corrosion resistance equivalent to 12-gage wire, 19-gage galvanized steel or 24-gage stainless steel.*
3. *Openings shall not permit the passage of spheres having a diameter greater than $\frac{1}{2}$ inch (13 mm) nor block the passage of spheres having a diameter less than $\frac{3}{8}$ inch (9.5 mm).*
4. The spark arrester shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

2113.9.3 Rain caps. Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2113.10 Wall thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

2113.10.1 Masonry veneer chimneys. Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

2113.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of

appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

2113.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

2113.11.1.1 Flue linings for specific appliances. Flue linings other than those covered in Section 2113.11.1 intended for use with specific appliances shall comply with Sections 2113.11.1.2 through 2113.11.1.4, 2113.11.2 and 2113.11.3.

2113.11.1.2 Gas appliances. Flue lining systems for gas appliances shall be in accordance with the *California Mechanical Code*.

2113.11.1.3 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113.11.1.5 for marking).

2113.11.1.4 Oil-fired appliances approved for use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining systems complying with Section 2113.11.1 and listed chimney liners complying with UL 641 (see Section 2113.11.1.5 for marking).

2113.11.1.5 Notice of usage. When a flue is relined with a material not complying with Section 2113.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: "This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances."

2113.11.2 Concrete and masonry chimneys for medium-heat appliances. Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113.11.2.1 through 2113.11.2.5.

2113.11.2.1 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls not less than 8 inches (203 mm) thick, or with stone masonry not less than 12 inches (305 mm) thick.

2113.11.2.2 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick not less than 4½ inches (114 mm) thick laid on

the 4½-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

2113.11.2.3 Multiple passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

2113.11.2.4 Termination height. Concrete and masonry chimneys for medium-heat appliances shall extend not less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113.11.2.5 Clearance. A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113.11.3 Concrete and masonry chimneys for high-heat appliances. Concrete and masonry chimneys for high-heat appliances shall comply with 2113.11.3.1 through 2113.11.3.4.

2113.11.3.1 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be not less than 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

2113.11.3.2 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, not less than 4½ inches (114 mm) thick laid on the 4½-inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113.11.3.3 Termination height. Concrete and masonry chimneys for high-heat appliances shall extend not less than 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

2113.11.3.4 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

2113.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope not greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwater-soluble refractory mortar conforming to ASTM C199 with tight mortar joints left smooth on the inside and installed to maintain an airspace or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be sup-

ported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113.13 Additional requirements.

2113.13.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer’s instructions.

2113.13.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer’s instructions.

2113.14 Multiple flues. Where two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be not less than 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: Where venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered not less than 4 inches (102 mm).

2113.15 Flue area (appliance). Chimney flues shall not be smaller in area than the area of the connector from the appli-

ance. Chimney flues connected to more than one appliance shall be not less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

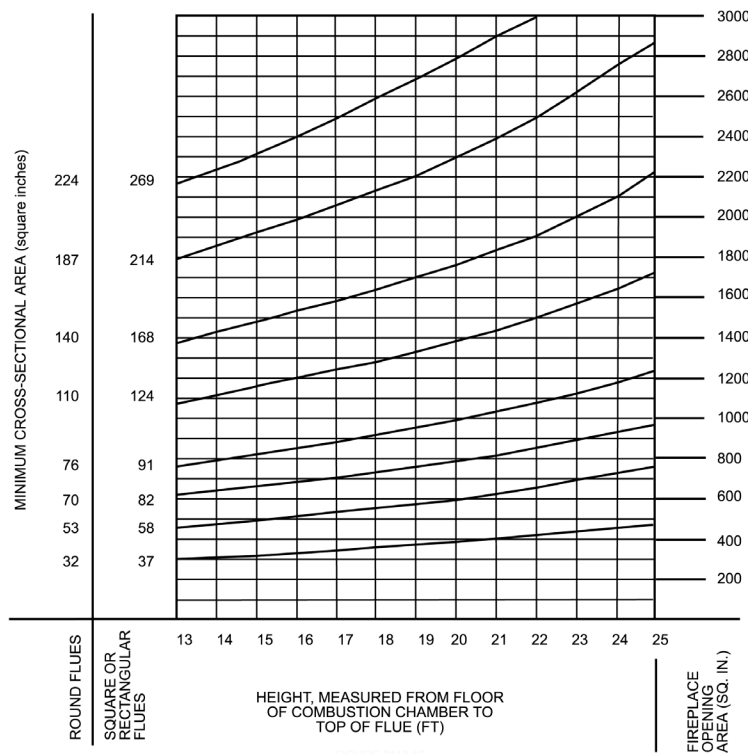
Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *California Mechanical Code*.

2113.16 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113.16.1 or 2113.16.2.

2113.16.1 Minimum area. Round chimney flues shall have a minimum net cross-sectional area of not less than $\frac{1}{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of not less than $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of not less than $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of not less than $\frac{1}{8}$ of the fireplace opening.

2113.16.2 Determination of minimum area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113.16. A flue size



Note: 1 inch = 25.4 mm, 1 square inch = 645 mm².

FIGURE 2113.16
FLUE SIZES FOR MASONRY CHIMNEYS

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providing not less than the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113.16(1) and 2113.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

**TABLE 2113.16(1)
NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES^a**

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 ³ / ₄	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².
a. Flue sizes are based on ASTM C315.

**TABLE 2113.16(2)
NET CROSS-SECTIONAL AREA OF
SQUARE AND RECTANGULAR FLUE SIZES**

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

2113.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

2113.18 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper

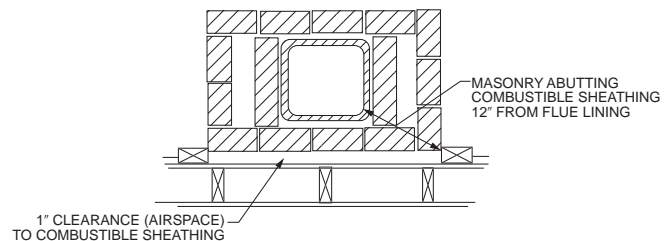
edge of the cleanout shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be not less than 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

2113.19 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113.20.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer’s instructions, are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113.19, provided that such combustible trim or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).



**FIGURE 2113.19
ILLUSTRATION OF EXCEPTION THREE
CHIMNEY CLEARANCE PROVISION**

2113.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

**SECTION 2114
DRY-STACK MASONRY**

2114.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114.2 through 2114.5.

2114.2 Limitations. Dry-stack masonry shall be prohibited in Risk Category IV structures.

2114.3 Materials. Concrete masonry units complying with ASTM C90 shall be used.

2114.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2114.4. Allowable stresses not specified in Table 2114.4 shall comply with the requirements of Chapter 8 of TMS 402.

**TABLE 2114.4
GROSS CROSS-SECTIONAL AREA
ALLOWABLE STRESS FOR DRY-STACK MASONRY**

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension	
Horizontal span	30
Vertical span	18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

**SECTION 2115
ADDITIONAL REQUIREMENTS
FOR COMMUNITY COLLEGES [DSA-SS/CC]**

2115.1 General. In addition to the provisions of this chapter, the following requirements shall apply to community college buildings regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC).

2115.1.1 Prohibitions. The following design, systems and materials in TMS 402/602 are not permitted by DSA:

1. Unreinforced masonry.
2. Autoclaved aerated concrete (AAC) masonry.
3. Empirical design of masonry and prescriptive design of masonry partition walls.
4. Ordinary reinforced masonry shear walls.
5. Intermediate reinforced masonry shear walls.
6. Prestressed masonry shear walls.
7. Direct design of masonry.

2115.2 Metal reinforcement and accessories. The frequency of sampling for unidentifiable reinforcing bars may alternatively be in accordance with Section 1909.2.4.

2115.3 Air entrainment. Air-entraining substances shall not be used in grout.

2115.4 Masonry construction. Architectural cast stone construction shall be considered as an alternative system.

2115.5 Reinforced grouted masonry.

2115.5.1 TMS 602, Article 3.3 B Placing mortar and units. Modify TMS 602, Article 3.3 B.2.c as follows:

- c. Remove masonry protrusions extending greater than 1/4 inch (6.4 mm) into cells or cavities to be grouted.

2115.5.2 TMS 602, Article 3.4 B Reinforcement. Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.
3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least 1/4 inch (6.4 mm) for fine grout and 1/2 inch (12.7 mm) for coarse grout, except where cross webs of hollow units are used as supports for horizontal reinforcement. Reinforcement and embedded items shall be solidly embedded in grout.

2115.5.3 TMS 602, Article 3.4 D Anchor bolts. Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:

3. Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of 1/2 inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least 1/4 inch (6.4 mm) when using fine grout and at least 1/2 inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.
5. Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be 1/2-inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, 3/4-inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, 7/8-inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.
6. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.

2115.5.4 TMS 602, Article 3.5 A Placing time. Modify TMS 602, Article 3.5 A by adding Article 3.5 A.3 as follows:

3. The grouting of any section of a wall between control barriers shall be completed in one day with no interruptions greater than one hour.

2115.5.5 TMS 602, Article 3.5 B Confinement. Add the following to TMS 602, Article 3.5 B:

2. All cells shall be solidly filled with grout in reinforced hollow unit masonry.

Exception: Reinforced hollow-unit masonry laid in running bond used for freestanding site walls or interior nonbearing non-shear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.

2115.5.6 TMS 602, Article 3.5 E Consolidation. Modify TMS 602, Article 3.5 E.1.b as follows:

- b. Consolidate pours exceeding 12 in. (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, but before plasticity is lost.

2115.5.7 TMS 602, Article 3.5 F.1 Grout key. Replace TMS 602, Article 3.5 F.1 as follows:

1. Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of 1½ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of ½ inch (12.7 mm) below the mortar joint.

2115.6 TMS 602, Article 3.5 Grout placement. Add the following to TMS 602, Article 3.5:

3.5 I. Additional grouting requirements:

1. Grout shall be placed by pumping or an approved alternate method before initial set of hardening occurs.
2. Grout shall be placed so that all spaces to be grouted do not contain voids.
3. Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be used that there will be no deleterious effect on the strength of the grout.

2115.7 Compressive strength, f'_m . The minimum specified compressive strength, f'_m , in the design shall be not less than 1,500 psi (10.34 MPa) for all structural masonry construction using materials and details of construction required herein. The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.

2115.8 Additional testing requirements.

2115.8.1 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. Modify TMS 602, Article 1.4 B as follows by adding:

5. Additional testing requirements:

- a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on three successive working days and at least at one-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.

- b. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. The grout shall meet the minimum strength requirement given in ASTM C476/TMS 602 Section 2.2, or greater as specified.

- c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

- d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

Exception: For nonbearing nonshear masonry walls not exceeding total wall height of 12 feet above the top of the foundation, mortar test shall be permitted to be limited to those at the beginning of masonry work for each mix design.

2115.8.2 Masonry core testing. Not less than two cores shall be taken from each building for each 5,000 square feet (465 m²) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.

Core samples shall comply with the following:

1. Cored no sooner than 7 days after grouting of the selected area;
2. Be a minimum of 3¾ inches (96 mm) in nominal diameter; and

3. Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing steel. If all cells contain reinforcement, alternate core locations or means to detect void or delamination shall be selected by the registered design professional and approved by the building official.

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear test shall test both joints between the grout core and the outside wythes or face shell of the masonry 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or non-absorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of the cores shall not be less than $2.5 \sqrt{f'_m}$ psi.

All cores shall be submitted to an approved agency for examination, even where the core specimens failed during the cutting operation. The approved agency shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests.

Exceptions:

1. Core sampling and testing is not required for nonbearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79 MPa).
2. An infrared thermographic survey or other non-destructive test procedures, shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in-lieu of core sampling and testing.

2115.9 Modifications to TMS 402.

2115.9.1 TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b). Replace TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b) as follows:

- a. Ties shall be at least $\frac{3}{8}$ inch (10 mm) in diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.
- b. The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column, or 8 inches (203 mm) for the full column height.

2115.9.2 2106A.1.3 TMS 402, Sections 7.4.4.1 and 7.4.5.1. Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:

7.4.4.1 Minimum reinforcement requirements for masonry walls. The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center.

Exception: Reinforced hollow-unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4'-0" on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.

7.4.4.1.1 The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.

7.4.4.1.2 Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

7.4.4.1.3 In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.

7.4.4.1.4 When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

7.4.4.1.5 Joint reinforcement shall not be used as principal reinforcement in masonry.

2115.10 Additional requirements for allowable stress design.

2115.10.1 TMS 402. Section 8.3.4.4 Walls. Modify TMS 402, Section 8.3.4.4 as follows by adding:

8.3.8 – Walls and piers.

Thickness of walls. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.

The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio nor be less than the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.

Piers. Every pier or wall section which width is less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section which width is between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.

2115.11 Glass unit masonry construction. Masonry glass block walls or panels shall be designated for seismic forces. Stresses in glass block shall not be utilized.

**TABLE 8.3.4.4
MINIMUM THICKNESS OF MASONRY WALLS^{1,2}**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS ^{2,3}	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
NONBEARING WALLS:		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

- For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
- In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
- Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 21A – MASONRY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X		X												
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						
2113A.9.2																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 21A

MASONRY

SECTION 2101A GENERAL

2101A.1 Scope. This chapter shall govern the materials, design, construction and quality of masonry.

2101A.1.1 Application. *The scope of application of Chapter 21A is as follows:*

1. *Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.*
2. *Applications listed in Sections 1.10.1 and 1.10.4 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals and correctional treatment centers.*

2101A.1.2 Amendments in this chapter. *DSA-SS and OSHPD 1 & 4 adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

1. *Division of the State Architect-Structural Safety:*
[DSA-SS] *For applications listed in Section 1.9.2.1.*
2. *Office of Statewide Health Planning and Development:*
[OSHPD 1] *- For applications listed in Section 1.10.1.*
[OSHPD 4] *- For applications listed in Section 1.10.4.*

2101A.1.3 Prohibition. *The following design methods, systems and materials in TMS 402/602 are not permitted by DSA-SS and OSHPD:*

1. *Unreinforced masonry.*
2. *Autoclaved aerated concrete (AAC) masonry.*
3. *Empirical design of masonry and prescriptive design of masonry partition walls.*
4. *Adobe construction.*
5. *Ordinary reinforced masonry shear walls.*
6. *Intermediate reinforced masonry shear walls.*
7. *Prestressed masonry shear walls.*
8. *Direct design of masonry.*

2101A.2 Design methods. Masonry shall comply with the provisions of TMS 402 or TMS 404 as well as applicable requirements of this chapter.

2101A.2.1 Masonry veneer. Masonry veneer shall comply with the provisions of Chapter 14.

2101A.3 Special inspection. The special inspection of masonry shall be as defined in Chapter 17A, or an itemized testing and inspection program shall be provided that meets or exceeds the requirements of Chapter 17A.

SECTION 2102A NOTATIONS

2102A.1 General. The following notations are used in the chapter:

NOTATIONS.

d_b	= Diameter of reinforcement, inches (mm).
F_s	= Allowable tensile or compressive stress in reinforcement, psi (MPa).
f_r	= Modulus of rupture, psi (MPa).
f'_{AAC}	= Specified compressive strength of AAC masonry, the minimum compressive strength for a class of AAC masonry as specified in TMS 602, psi (MPa).
f'_m	= Specified compressive strength of masonry at age of 28 days, psi (MPa).
f'_{mi}	= Specified compressive strength of masonry at the time of prestress transfer, psi (MPa).
K	= The lesser of the masonry cover, clear spacing between adjacent reinforcement, or five times d_b , inches (mm).
L_s	= Distance between supports, inches (mm).
l_d	= Required development length or lap length of reinforcement, inches (mm).
P	= The applied load at failure, pounds (N).
S_t	= Thickness of the test specimen measured parallel to the direction of load, inches (mm).
S_w	= Width of the test specimen measured parallel to the loading cylinder, inches (mm).

SECTION 2103A MASONRY CONSTRUCTION MATERIALS

2103A.1 Masonry units. Concrete masonry units, clay or shale masonry units, stone masonry units and glass unit masonry shall comply with Article 2.3 of TMS 602. Architectural cast stone shall conform to ASTM C1364 and TMS 504. Adhered manufactured stone masonry veneer units shall conform to ASTM C1670. *Architectural cast stone construction shall be considered as an alternative system.*

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength specifications. The fire-resistance rating shall be deter-

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mined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Table 705.5.

2103A.1.1 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

2103A.2 Mortar. Mortar for masonry construction shall comply with Section 2103A.2.1, 2103A.2.2, 2103A.2.3 or 2103A.2.4.

2103A.2.1 Masonry mortar. Mortar for use in masonry construction shall conform to Articles 2.1 and 2.6 A of TMS 602.

2103A.2.2 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

2103A.2.3 Mortars for ceramic wall and floor tile. Portland cement mortars for installing ceramic wall and floor tile shall comply with ANSI A108.1A and ANSI A108.1B and be of the compositions indicated in Table 2103A.2.3.

**TABLE 2103A.2.3
CERAMIC TILE MORTAR COMPOSITIONS**

LOCATION	MORTAR	COMPOSITION
Walls	Scratchcoat	1 cement; $\frac{1}{5}$ hydrated lime; 4 dry or 5 damp sand
	Setting bed and leveling coat	1 cement; $\frac{1}{2}$ hydrated lime; 5 damp sand to 1 cement; 1 hydrated lime, 7 damp sand
Floors	Setting bed	1 cement; $\frac{1}{10}$ hydrated lime; 5 dry or 6 damp sand; or 1 cement; 5 dry or 6 damp sand
Ceilings	Scratchcoat and sand bed	1 cement; $\frac{1}{2}$ hydrated lime; $2\frac{1}{2}$ dry sand or 3 damp sand

2103A.2.3.1 Dry-set Portland cement mortars. Premixed prepared Portland cement mortars, which require only the addition of water and are used in the installation of ceramic tile, shall comply with ANSI A118.1. The shear bond strength for tile set in such mortar shall be as required in accordance with ANSI A118.1. Tile set in dry-set Portland cement mortar shall be installed in accordance with ANSI A108.5.

2103A.2.3.2 Latex-modified Portland cement mortar. Latex-modified Portland cement thin-set mortars in which latex is added to dry-set mortar as a replacement for all or part of the gauging water that are used for the installation of ceramic tile shall comply with ANSI A118.4. Tile set in latex-modified Portland cement shall be installed in accordance with ANSI A108.5.

2103A.2.3.3 Epoxy mortar. Ceramic tile set and grouted with chemical-resistant epoxy shall comply with ANSI A118.3. Tile set and grouted with epoxy shall be installed in accordance with ANSI A108.6.

2103A.2.3.4 Furan mortar and grout. Chemical-resistant furan mortar and grout that are used to install ceramic tile shall comply with ANSI A118.5. Tile set and grouted with furan shall be installed in accordance with ANSI A108.8.

2103A.2.3.5 Modified epoxy-emulsion mortar and grout. Modified epoxy-emulsion mortar and grout that are used to install ceramic tile shall comply with ANSI A118.8. Tile set and grouted with modified epoxy-emulsion mortar and grout shall be installed in accordance with ANSI A108.9.

2103A.2.3.6 Organic adhesives. Water-resistant organic adhesives used for the installation of ceramic tile shall comply with ANSI A136.1. The shear bond strength after water immersion shall be not less than 40 psi (275 kPa) for Type I adhesive and not less than 20 psi (138 kPa) for Type II adhesive when tested in accordance with ANSI A136.1. Tile set in organic adhesives shall be installed in accordance with ANSI A108.4.

2103A.2.3.7 Portland cement grouts. Portland cement grouts used for the installation of ceramic tile shall comply with ANSI A118.6. Portland cement grouts for tile work shall be installed in accordance with ANSI A108.10.

2103A.2.4 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 for Type N or S, or shall comply with ANSI A118.4 for latex-modified Portland cement mortar.

2103A.3 Grout. Grout shall comply with Article 2.2 of TMS 602.

2103A.3.1 Aggregate. Coarse grout shall be used in grout spaces between wythes of 2 inches (51 mm) or more in width as determined in accordance with TMS 602 Table 6, footnote 3, and in all grouted cells of hollow unit masonry construction.

2103A.4 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602. Where unidentified reinforcement, or bar reinforcement without mill certification, is approved for use, not less than three tension and three bending tests shall be made on representative specimens of the reinforcement from each shipment and grade of reinforcing steel proposed for use in the work. Alternatively, the frequency of sampling for unidentified reinforcing bars specified in Section 1910A.2 can be used.

2103A.5 Air entrainment. Air-entraining substances shall not be used in grout.

SECTION 2104A CONSTRUCTION

2104A.1 Masonry construction. Masonry construction shall comply with the requirements of Sections 2104A.1.1 through 2104A.1.3 and with the requirements of either TMS 602 or TMS 604.

2104A.1.1 Support on wood. Masonry shall not be supported on wood girders or other forms of wood construction except as permitted in Section 2304.13.

2104A.1.2 Molded cornices. Unless structural support and anchorage are provided to resist the overturning moment, the center of gravity of projecting masonry or molded cornices shall lie within the middle one-third of the supporting wall. Terra cotta and metal cornices shall be provided with a structural frame of approved noncombustible material anchored in an approved manner.

2104A.1.3 Reinforced grouted masonry.

2104A.1.3.1 TMS 602, Article 3.2 F Cleanouts. Replace TMS 602, Article 3.2 F with the following:

1. Cleanout openings in hollow unit masonry shall be provided in every cell at the bottom of each pour of grout. Alternatively, if the course at the bottom of the pour is constructed entirely of inverted double open-end bond beam units, cleanout openings need only be provided for access to every reinforced cell at the bottom of each pour of grout.
2. Cleanouts in multi-wythe masonry shall be provided for each pour by leaving out every other unit in the bottom wythe of the section being poured or by cleanout openings in the foundation.
3. The foundation or other horizontal construction joints at the cleanouts shall be cleaned of all loose material and mortar droppings before each pour. The cleanouts shall be sealed after inspection and before grouting.

2104A.1.3.2 TMS 602, Article 3.3 B Placing mortar and units. Modify TMS 602, Article 3.3 B.2.c as follows:

- c. Remove masonry protrusions extending greater than $\frac{1}{4}$ inch (6.4 mm) into cells or cavities to be grouted.

2104A.1.3.3 TMS 602, Article 3.4 B Reinforcement. Modify TMS 602, Article 3.4 B.1 and Article 3.4 B.3 as follows:

1. Support reinforcement to prevent displacement caused by construction loads or by placement of grout or mortar, beyond the allowable tolerances. Reinforcement and embedded items shall be clean, properly positioned and securely anchored against moving prior to grouting.
3. Maintain a clear distance between reinforcing bars and the interior of masonry unit or formed surface of at least $\frac{1}{4}$ inch (6.4 mm) for fine grout and $\frac{1}{2}$ inch (12.7 mm) for coarse grout, and the space between masonry unit surfaces and reinforcement shall be a minimum of one bar diameter, except where cross webs of hollow units are used as supports for horizontal reinforcement.

Reinforcement and embedded items shall be solidly embedded in grout.

2104A.1.3.4 TMS 602, Article 3.4 D Anchor bolts. Replace TMS 602, Article 3.4 D.3 and add Articles 3.4 D.5 and 3.4 D.6 as follows:

3. Anchor bolts in the wythe or face shells of hollow masonry units shall be positioned to maintain a minimum of $\frac{1}{2}$ inch (12.7 mm) of grout between the bolt circumference, the wythe or the face shell. For the portion of the bolt that is within the grouted cell, maintain a clear distance between the bolt and the face of masonry unit and between the head of the bolt and the formed surface of grout of at least $\frac{1}{4}$ inch (6.4 mm) when using fine grout and at least $\frac{1}{2}$ inch (12.7 mm) when using coarse grout. Bolts shall be solidly embedded in grout.
5. Bent bar anchor bolts shall not be allowed. The maximum size anchor shall be $\frac{1}{2}$ -inch (13 mm) diameter for 6-inch (152 mm) nominal masonry, $\frac{3}{4}$ -inch (19 mm) diameter for 8-inch (203 mm) nominal masonry, $\frac{7}{8}$ -inch (22 mm) diameter for 10-inch (254 mm) nominal masonry, and 1-inch (25 mm) diameter for 12-inch (304.8 mm) nominal masonry.
6. Bolts shall be accurately set with templates or by approved equivalent means and held in place to prevent dislocation during grouting.

2104A.1.3.5 TMS 602, Article 3.5 C Grout pour height. Add to TMS 602, Article 3.5 C the following:

1. For grout pours not greater than 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry, the top of grout pour shall be at the top of constructed masonry, or within 8 inches (200 mm) of the top of the constructed masonry. Grout pours not terminated at the top of constructed masonry shall comply with TMS 602, Articles 3.5 C.3.a through 3.5 C.3.e. [OSHPD 1 & 4] After construction of each grout lift height of wall, column, pier or beam, masonry cells or cavities shall be inspected prior to placement of grout.
2. Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to approval of the enforcement agency.
3. Grout pours in excess of 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry shall be subject to the following:
 - a. Grouting shall be done in a continuous pour in lifts not exceeding 4 feet (1219 mm) or 5 feet 4 inches (1651 mm) for 10-inch (254 mm) nominal or wider hollow unit masonry.

- b. An approved admixture of a type that reduces early water loss and produces an expansive action shall be used.
- c. The grouting of any section of wall shall be completed in one day with no interruptions greater than one hour.
- d. For multiple grout lifts within a grout pour, each grout lift height of wall, column, pier or beam shall be inspected before placement of additional units.
- e. Cleanout openings shall be provided at the bottom of each pour of grout.

2104A.1.3.6 TMS 602, Article 3.5 D Grout lift height.
 Modify TMS 602, Article 3.5 D as follows:

- 3. In no case shall lifts exceed 4 feet (1219 mm) in height.

Exception: The 4 feet (1219 mm) maximum lift height may be increased to 5 feet 4 inches (1625.6 mm) for 10-inch (254 mm) nominal and larger hollow-unit masonry.

2104A.1.3.7 TMS 602, Article 3.5 E Consolidation.
 Modify TMS 602, Article 3.5 E.1.b as follows:

- b. Consolidate pours exceeding 12 inch (305 mm) in height by mechanical vibration, and reconsolidate by mechanical vibration after initial water loss and settlement has occurred, but before plasticity is lost.

2104A.1.3.8 TMS 602, Article 3.5 F.1 Grout key.
 Replace TMS 602, Article 3.5 F.1 as follows:

- 1. Between grout pours or where grouting has been stopped more than an hour, a horizontal construction joint shall be formed by terminating grout a minimum of 1½ inches (38 mm) below a mortar joint, except at the top of the wall. Where bond beams occur, the grout pour shall be terminated a minimum of ½ inch (12.7 mm) below the mortar joint. Horizontal reinforcement shall be placed in bond beam units with a minimum grout cover of 1 inch (25 mm) above reinforcing steel for each grout pour.

2104A.1.3.9 TMS 602, Article 3.5 Grout placement.
 Add the following to TMS 602, Article 3.5:

3.5 I. Additional grouting requirements:

- 1. Grout shall be placed by pumping or an approved alternate method before initial set of hardening occurs.
- 2. Grout shall be placed so that all spaces to be grouted do not contain voids.
- 3. Grout shall not be handled nor pumped utilizing aluminum equipment unless it can be demonstrated with the materials and equipment to be

used that there will be no deleterious effect on the strength of the grout.

2104A.1.3.10 Reinforced grouted multi-wythe masonry.

2104A.1.3.10.1 General. Reinforced grouted multi-wythe masonry is that form of composite construction made with clay or shale brick or made with solid concrete building brick in which interior spaces of masonry are filled by pouring grout around reinforcement therein as the work progresses.

2104A.1.3.10.2 TMS 402, Section 5.1.4.2.2 Masonry headers. Replace TMS 402, Section 5.1.4.2.2 as follows:

5.1.4.2.2 Masonry headers shall not project into the grout space and shall not be permitted to bond wythes of masonry.

2104A.1.3.10.3 TMS 602, Article 3.3 B.5 Placing masonry units – Solid units. Add the following to TMS 602, Article 3.3 B.5:

- d. Tothing of masonry walls is prohibited. Racking is to be held to a minimum.

2104A.1.3.10.4 TMS 602, Article 3.4 C.2 Wall ties.
 Replace TMS 602, Article 3.4 C.2 as follows:

- 2. The two wythes shall be bonded together with wall ties. Ties shall not be less than No. 9 (W1.7) wire in the form of rectangles 4 inches (102 mm) wide and 2 inches (51 mm) in length less than the overall wall thickness. Kinks, water drips or deformations shall not be permitted in the ties. One wythe of the wall shall be built up not more than 16 inches (406 mm) ahead of the other wythe. Ties shall be laid not to exceed 24 inches (610 mm) on center horizontally and 16 inches (406 mm) on center vertically for running bond, and not more than 24 inches (610 mm) on center horizontally and 12 inches (305 mm) on center vertically for stack bond.

2104A.1.3.10.5 TMS 602, Article 3.5 B Confinement. Add the following to TMS 602, Article 3.5 B:

- 1. Vertical grout barriers or dams of solid masonry shall be built across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall be spaced not more than 30 feet (9144 mm) apart.

2104A.1.3.10.6 TMS 602, Article 3.5 C Grout pour height. Add the following to TMS 602, Article 3.5 C:

- 4. The minimum clear width of grout space for multi-wythe masonry for pours not exceeding 4 feet (1.2 m) shall be 2½ inches (64 mm). The clear width of grout space for pours exceeding 4 feet (1.2 m) shall be a minimum of 3½ inches (89 mm).

2104A.1.3.11 Reinforced hollow-unit masonry.

2104A.1.3.11.1 TMS 602, Article 2.3 A & 2.3 B Masonry unit materials. Add the following to TMS 602, Articles 2.3 A and 2.3 B:

1. The depth of the bond beam channel below the top of the unit in hollow-unit masonry shall be 1½ inches (38 mm) minimum and the width shall be 3 inches (76 mm) minimum.

2104A.1.3.11.2 TMS 602, Article 3.5 B Confinement. Add the following to TMS 602, Article 3.5 B:

1. All cells shall be solidly filled with grout in reinforced hollow-unit masonry [OSHPD 1 & 4] and shall be constructed using single or double open-end units, except single open-end units shall be used at wall intersections, corners and similar conditions.

Exception: Reinforced hollow-unit masonry laid in running bond used for freestanding site walls or interior nonbearing non-shear wall partitions may be grouted only in cells containing vertical and horizontal reinforcement.

2. Vertical cells to be filled shall have vertical alignment sufficient to maintain a clear grout space dimension of not less than that given in Section 2103A.3.1.

prism test method in accordance with TMS 602, Article 1.4 B.3. Verification of compliance with the specified compressive strength prior to the start of construction shall be obtained by using the prism test method in accordance with TMS 602, Article 1.4 B.3.

2105A.3 Mortar and grout tests. TMS 602, Article 1.4 B Compressive Strength Determination. Modify TMS 602, Article 1.4 B as follows by adding:

5. Additional testing requirements:

- a. At the beginning of all masonry work, at least one test sample of the mortar shall be taken on 3 successive working days and at least at 1-week intervals thereafter. Where mortar is based on a proportion specification, mortar shall be sampled and tested during construction in accordance with ASTM C780, including Annex 4, to verify the proportions specified in ASTM C270, Table 2. Where mortar is based on a property specification, mortar shall be laboratory prepared and tested prior to construction in accordance with ASTM C780 to verify the properties specified in ASTM C270, Table 1 and field sampled and tested during construction in accordance with ASTM C780 to verify the proportions with the laboratory tests. [DSA-SS] Mortar sampling and testing is not required for preblended mortars in conformance with ASTM C270 with a valid evaluation report.

- b. Samples of grout shall be taken for each mix design, each day grout is placed, and not less than every 5,000 square feet of masonry wall area. They shall meet the minimum strength requirement given in ASTM C476/TMS 602, Section 2.2, or greater as specified.

- c. Additional samples shall be taken whenever any change in materials or job conditions occur, as determined by the building official.

- d. Test specimens for mortar and grout shall be made as set forth in ASTM C780/C1586 and ASTM C1019. When the prism test method is used in accordance with TMS 602, Article 1.4 B.3 during construction, the tests in this section are not required.

Exception: For nonbearing non-shear masonry walls not exceeding total wall height of 12 feet above top of foundation, mortar tests shall be permitted to be limited to those at the beginning of masonry work for each mix design.

2105A.4 Masonry core testing. Not less than two cores shall be taken from each building for each 5,000 square feet (465 m²) of the masonry wall area or fraction thereof. The approved agency shall perform or observe the coring of the masonry walls and sample locations shall be subject to approval of the registered design professional.

Core samples shall comply with the following:

1. Cored no sooner than 7 days after grouting of the selected area;
2. Be a minimum of 3¾ inches in nominal diameter; and
3. Sampled in such a manner as to exclude any masonry unit webs, mortar joint, or reinforcing

**SECTION 2105A
QUALITY ASSURANCE**

2105A.1 General. A quality assurance program shall be used to ensure that the constructed masonry is in compliance with the approved construction documents.

The quality assurance program shall comply with the inspection and testing requirements of Chapter 17A and TMS 602 and Sections 2105A.2 through 2105A.4.

2105A.2 Compressive strength, f'_m . The minimum specified compressive strength, f'_m in the design shall be 1,500 psi (10.34 MPa) for all structural masonry construction using materials and details of construction required herein. Testing of masonry shall be provided in accordance with TMS 602, Article 1.4 B.

Exception: Where values of f'_m greater than 2000 psi (13.79 MPa) are used in the design of reinforced grouted multi-wythe masonry and reinforced hollow-unit masonry, they shall be based on prism test results in accordance with TMS 602, Article 1.4 B.3 submitted by the architect or engineer to the enforcement agency which demonstrate the ability of the proposed construction to meet prescribed performance criteria for strength.

The architect or structural engineer shall establish a method of quality control of the masonry construction acceptable to the enforcement agency which shall be described in the contract documents. Verification of compliance with the requirements for the specified strength of masonry during construction shall be provided using

steel. If all cells contain reinforcement, alternate core locations or means to detect void or delamination shall be selected by the registered design professional and approved by the building official.

Visual examination of all cores shall be made by an approved agency and the condition of the cores reported as required by the California Administrative Code. Shear test both joints between the grout core and the outside wythes or face shell of the masonry 28 days after grouting of the sample area using a shear test apparatus acceptable to the enforcement agency. Core samples shall not be soaked before testing. Core samples to be tested shall be stored in sealed plastic bags or non-absorbent containers immediately after coring and for at least 5 days prior to testing. The average unit shear value for each pair of cores (4 shear tests) from each 5,000 square feet of wall area (or less) on the cross section of core shall not be less than $2.5 \sqrt{f'_m}$ psi.

All cores shall be submitted to an approved agency for examination, even where the core specimens failed during the cutting operation. The approved agency shall report the location where each core was taken, the findings of their visual examination of each core, identify which cores were selected for shear testing, and the results of the shear tests.

Exceptions:

1. Core sampling and testing is not required for non-bearing nonshear masonry walls, not exceeding a total wall height of 12 feet above top of foundation, built with single-wythe hollow unit concrete masonry that attaches opposite face shells using webs cast as single unit, when designed using an f'_m not exceeding 2,000 psi (13.79 MPa).
2. An infrared thermographic survey or other nondestructive test procedures, shall be permitted to be approved as an alternative system to detect voids or delamination in grouted masonry in-lieu of core sampling and testing. [OSHPD 1 & 4] Infrared thermographic surveys or other nondestructive test procedures shall also include core tests with a minimum of two cores taken from each building for each 10,000 square feet (930 m²) of the wall.

**SECTION 2106A
SEISMIC DESIGN**

2106A.1 Seismic design requirements for masonry. Masonry structures and components shall comply with the requirements in Chapter 7 of TMS 402 depending on the structure's seismic design category.

2106A.1.1 TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b). Replace TMS 402, Sections 5.3.1.4(a) and 5.3.1.4(b) as follows:

- a. Ties shall be at least $\frac{3}{8}$ inch (10 mm) in diameter and shall be embedded in grout. Top tie shall be within 2 inches (51 mm) of the top of the column or of the bottom of the horizontal bar in the supported beam.

- b. The spacing of column ties shall be as follows: not greater than 8 bar diameters, 24 tie diameters, or one half the least dimension of the column, or 8 inches (203 mm) for the full column height.

2106A.1.2 TMS 402, Chapter 5. Add TMS 402, Section 5.6 as follows:

5.6 – Lateral Support of Members

5.6.1 – Lateral support of masonry may be provided by cross walls, columns, pilasters, counterforts or buttresses where spanning horizontally, or by floors, beams, girts or roofs where spanning vertically. Where walls are supported laterally by vertical elements, the stiffness of each vertical element shall exceed that of the tributary area of the wall.

2106A.1.3 TMS 402, Sections 7.4.4.1 and 7.4.5.1. Replace TMS 402, Section 7.4.4.1 as follows and delete Section 7.4.5.1:

7.4.4.1 Minimum reinforcement requirements for masonry walls. The total area of reinforcement in reinforced masonry walls shall not be less than 0.003 times the sectional area of the wall. Neither the horizontal nor the vertical reinforcement shall be less than one third of the total. Horizontal and vertical reinforcement shall be spaced at not more than 24 inches (610 mm) center to center. Where stack bond is used in reinforced hollow-unit masonry, the open-end type of unit shall be used with vertical reinforcement spaced a maximum of 16 inches (406 mm) on center.

Exception: Reinforced hollow-unit masonry used for freestanding site walls or interior nonbearing nonshear wall partitions shall have horizontal reinforcing spaced not more than 4'-0" on center, except for locations in Seismic Design Category F, and may be grouted only in cells containing vertical and horizontal reinforcement.

7.4.4.1.1 The minimum reinforcing shall be No. 4, except that No. 3 bars may be used for ties and stirrups. Vertical wall reinforcement shall have dowels of equal size and equally matched spacing in all footings. Reinforcement shall be continuous around wall corners and through intersections. Only reinforcement which is continuous in the wall shall be considered in computing the minimum area of reinforcement. Reinforcement with splices conforming to TMS 402 shall be considered as continuous reinforcement.

7.4.4.1.2 Horizontal reinforcing bars in bond beams shall be provided in the top of footings, at the top of wall openings, at roof and floor levels, and at the top of parapet walls. For walls 12 inches (nominal) (305 mm) or more in thickness, horizontal and vertical reinforcement shall be equally divided into two layers, except where designed as retaining walls. Where reinforcement is added above the minimum requirements, such additional reinforcement need not be so divided.

7.4.4.1.3 In bearing walls of every type of reinforced masonry, there shall be trim reinforcement of not less

than one No. 5 bar or two No. 4 bars on all sides of, and adjacent to, every opening which exceeds 16 inches (406 mm) in either direction, and such bars shall extend not less than 48 diameters, but in no case less than 24 inches (610 mm) beyond the corners of the opening. The bars required by this paragraph shall be in addition to the minimum reinforcement required elsewhere.

7.4.4.1.4 When the reinforcement in bearing walls is designed, placed and anchored in position as for columns, the allowable stresses shall be as for columns.

7.4.4.1.5 Joint reinforcement shall not be used as principal reinforcement in masonry.

**SECTION 2107A
ALLOWABLE STRESS DESIGN**

2107A.1 General. The design of masonry structures using allowable stress design shall comply with Section 2106A and the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2107A.2 through 2107A.6.

2107A.2 TMS 402, Section 6.1.6.1.1, lap splices. As an alternative to Section 6.1.6.1.1, it shall be permitted to design lap splices in accordance with Section 2107A.2.1.

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d , shall be:

$$l_d = 0.002d_b f_s \quad \text{(Equation 21A-1)}$$

For SI: $l_d = 0.29d_b f_s$

but not less than 12 inches (305 mm). The length of the lapped splice shall be not less than 40 bar diameters, where:

d_b = Diameter of reinforcement, inches (mm)

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s , the lap length of splices shall be increased not less than 50 percent of the minimum required length, but need not be greater than 72 d_b . Other equivalent means of stress transfer to accomplish the same 50 percent increase shall be permitted. Where epoxy coated bars are used, lap length shall be increased by 50 percent.

2107A.3 TMS 402, Section 6.1.6.1, splices of reinforcement. Modify Section 6.1.6.1 as follows:

6.1.6.1 – Splices of reinforcement. Lap splices, welded splices or mechanical splices are permitted in accordance with the provisions of this section. Welding shall conform to AWS D1.4. Welded splices shall be of ASTM A706 steel reinforcement. Reinforcement larger than No. 9 (M #29) shall be spliced using mechanical connections in accordance with Section 6.1.6.1.3.

2107A.4 TMS 402, Section 8.3.4.4 Walls. Modify TMS 402, Section 8.3.4.4 as follows by adding:

8.3.4.4.1 The minimum thickness of walls is given in this section. Stresses shall be determined on the basis of the net thickness of the masonry, with consideration for reduction, such as raked joints.

8.3.4.4.2 The thickness of masonry walls shall be designed so that allowable maximum stresses specified in this chapter are not exceeded. Masonry walls shall not exceed the height or length-to-thickness ratio nor be less than the minimum thickness as specified in this chapter and as set forth in Table 8.3.4.4.

8.3.4.4.3 Every pier or wall section with a width less than three times its thickness shall be designed and constructed as required for columns if such pier is a structural member. Every pier or wall section with a width between three and five times its thickness or less than one half the height of adjacent openings shall have all horizontal steel in the form of ties except that in walls 12 inches (305 mm) or less in thickness such steel may be in the form of hair-pins.

**TABLE 8.3.4.4
MINIMUM THICKNESS OF MASONRY WALLS^{1,2}**

TYPE OF MASONRY	MAXIMUM RATIO UNSUPPORTED HEIGHT OR LENGTH TO THICKNESS ^{2,3}	NOMINAL MINIMUM THICKNESS (inches)
BEARING OR SHEAR WALLS:		
1. Stone masonry	14	16
2. Reinforced grouted masonry	25	6
3. Reinforced hollow-unit masonry	25	6
NONBEARING WALLS:		
4. Exterior reinforced walls	30	6
5. Interior partitions reinforced	36	4

- For walls of varying thickness, use the least thickness when determining the height or length to thickness ratio.
- In determining the height or length-to-thickness ratio of a cantilevered wall, the dimension to be used shall be twice the dimension of the end of the wall from the lateral support.
- Cantilevered walls not part of a building and not carrying applied vertical loads need not meet these minimum requirements but their design must comply with stress and overturning requirements.

2107A.5 [OSHPD 1 & 4] Modify TMS402, Section 8.3.4.4 by the following:

All reinforced masonry components that are subjected to in-plane forces shall have a maximum reinforcement ratio, ρ_{max} , not greater than that computed by Equation 8-20.

2107A.6 Masonry Compressive Strength. The specified compressive strength of structural masonry, f'_m , shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength value in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.

SECTION 2108A STRENGTH DESIGN OF MASONRY

2108A.1 General. The design of masonry structures using strength design shall comply with Section 2106A and the requirements of Chapters 1 through 7 and Chapter 9 of TMS 402, except as modified by Sections 2108A.2 through 2108A.3.

2108A.2 TMS 402, Section 6.1.5.1.1, development. Modify the second paragraph of Section 6.1.5.1.1 as follows:

The required development length of reinforcement shall be determined by Equation (6-1), but shall be not less than 12 inches (305 mm) and need not be greater than $72 d_b$.

2108A.3 TMS 402, Section 6.1.6.1.1, splices. Modify Sections 6.1.6.1.2 and 6.1.6.1.3 as follows:

6.1.6.1.2 – A welded splice shall have the bars butted and welded to develop not less than 125 percent of the yield strength, f_y , of the bar in tension or compression, as required. Welded splices shall be of ASTM A706 steel reinforcement. Welded splices shall not be permitted in plastic hinge zones of intermediate or special reinforced walls.

6.1.6.1.3 – Mechanical splices shall be classified as Type 1 or 2 in accordance with Section 18.2.7.1 of ACI 318. Type 1 mechanical splices shall not be used within a plastic hinge zone or within a beam-column joint of intermediate or special reinforced masonry shear walls. Type 2 mechanical splices are permitted in any location within a member.

2108A.4 TMS 402, Section 9.1.9.1.1. Modify TMS 402, Section 9.1.9.1.1 as follows:

9.1.9.1.1 Masonry compressive strength. The specified compressive strength of structural masonry, f'_m , shall be equal to or exceed 1,500 psi (10.34 MPa). The value of f'_m used to determine nominal strength values in this chapter shall not exceed 3,000 psi (20.7 MPa) for concrete masonry and shall not exceed 4,500 psi (31.03 MPa) for clay masonry.

SECTION 2109A EMPIRICAL DESIGN OF ADOBE MASONRY

Not permitted by OSHPD and DSA.

SECTION 2110A GLASS UNIT MASONRY

2110A.1 General. Glass unit masonry construction shall comply with Chapter 13 of TMS 402 and this section.

Masonry glass block walls or panels shall be designed for seismic forces. Stresses in glass block shall not be utilized.

2110A.1.1 Limitations. Solid or hollow approved glass block shall not be used in fire walls, party walls, fire barriers, fire partitions or smoke barriers, or for load-bearing construction. Such blocks shall be erected with mortar and reinforcement in metal channel-type frames, structural frames, masonry or concrete recesses, embedded panel

anchors as provided for both exterior and interior walls or other approved joint materials. Wood strip framing shall not be used in walls required to have a fire-resistance rating by other provisions of this code.

Exceptions:

1. Glass-block assemblies having a fire protection rating of not less than $\frac{3}{4}$ hour shall be permitted as opening protectives in accordance with Section 716 in fire barriers, fire partitions and smoke barriers that have a required fire-resistance rating of 1 hour or less and do not enclose exit stairways and ramps or exit passageways.
2. Glass-block assemblies as permitted in Section 404.6, Exception 2.

SECTION 2111A MASONRY FIREPLACES

2111A.1 General. The construction of masonry fireplaces, consisting of concrete or masonry, shall be in accordance with this section.

2111A.2 Fireplace drawings. The construction documents shall describe in sufficient detail the location, size and construction of masonry fireplaces. The thickness and characteristics of materials and the clearances from walls, partitions and ceilings shall be indicated.

2111A.3 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (153 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2111A.3.1 Ash dump cleanout. Cleanout openings, located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed, except when in use. Cleanouts shall be accessible and located so that ash removal will not create a hazard to combustible materials.

2111A.4 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry fireplaces shall be reinforced and anchored in accordance with Sections 2111A.4.1, 2111A.4.2 and 2111A.5. In structures assigned to Seismic Design Category E or F, masonry fireplaces shall be reinforced in accordance with the requirements of Sections 2101 through 2108A.

2111A.4.1 Vertical reinforcing. For fireplaces with chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103A.3. For fireplaces with chim-

neys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2111A.4.2 Horizontal reinforcing. Vertical reinforcement shall be placed enclosed within $\frac{1}{4}$ -inch (6.4 mm) ties or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete; or placed in the bed joints of unit masonry at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2111A.5 Seismic anchorage. Masonry fireplaces and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two $\frac{3}{16}$ -inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not fewer than four floor joists with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2111A.6 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Where a lining of firebrick not less than 2 inches (51 mm) in thickness or other approved lining is provided, the minimum thickness of back and sidewalls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall be not greater than $\frac{1}{4}$ inch (6.4 mm). Where a lining is not provided, the total minimum thickness of back and sidewalls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C27 or ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199.

2111A.6.1 Steel fireplace units. Steel fireplace units are permitted to be installed with solid masonry to form a masonry fireplace provided that they are installed according to either the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $\frac{1}{4}$ inch (6.4 mm) in thickness, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts employed with steel fireplace units shall be constructed of metal or masonry.

2111A.7 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a minimum depth of 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) in depth. The cross-sectional

area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, and the throat is not less than 12 inches (305 mm) above the lintel, and not less than $\frac{1}{20}$ the cross-sectional area of the fireplace opening.

2111A.8 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the top of the fireplace opening.

2111A.8.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or at the top of the flue venting the fireplace, and shall be operable from the room containing the fireplace. Damper controls shall be permitted to be located in the fireplace.

2111A.9 Smoke chamber walls. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and sidewalls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than $\frac{5}{8}$ inch (15.9 mm) thick, is provided, the total minimum thickness of front, back and sidewalls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

2111A.9.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall be not greater than the inside width of the fireplace opening. The inside surface of the smoke chamber shall not be inclined more than 45 degrees (0.76 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

2111A.10 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. Combustible material shall not remain against the underside of hearths or hearth extensions after construction.

2111A.10.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

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2111A.10.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $\frac{3}{8}$ -inch-thick (9.5 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

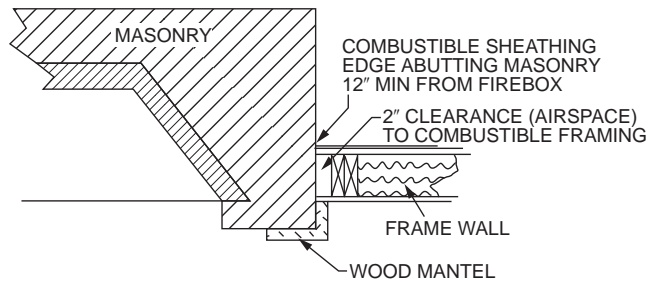
2111A.11 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of, and not less than 8 inches (203 mm) beyond, each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.557 m²) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of, and not less than 12 inches (305 mm) beyond, each side of the fireplace opening.

2111A.12 Fireplace clearance. Any portion of a masonry fireplace located in the interior of a building or within the exterior wall of a building shall have a clearance to combustibles of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section 2111A.13.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry fireplaces are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, flooring and drywall, are permitted to abut the masonry fireplace sidewalls and hearth extension, in accordance with Figure 2111.12, provided that such combustible trim or sheathing is not less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
4. Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening, provided that such combustible materials shall not be placed within 6 inches (153 mm) of a fireplace opening. Combustible material directly above and within 12 inches (305 mm) of the fireplace opening shall not project more than $\frac{1}{8}$ inch (3.2 mm) for each 1-inch (25 mm) distance from such opening. Combustible materials located along the sides of the fireplace opening that project more than $1\frac{1}{2}$ inches (38 mm)

from the face of the fireplace shall have an additional clearance equal to the projection.



Note: 1 inch = 25.4 mm

**FIGURE 2111A.12
ILLUSTRATION OF EXCEPTION TO
FIREPLACE CLEARANCE PROVISION**

2111A.13 Fireplace fireblocking. All spaces between fireplaces and floors and ceilings through which fireplaces pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be to a depth of 1 inch (25 mm) and shall only be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

2111A.14 Exterior air. Factory-built or masonry fireplaces covered in this section shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

2111A.14.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be listed components of the fireplace, and installed according to the fireplace manufacturer's instructions.

2111A.14.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed according to the terms of their listing and manufacturer's instructions.

2111A.14.3 Exterior air intake. The exterior air intake shall be capable of providing all combustion air from the exterior of the dwelling. The exterior air intake shall not be located within a garage, attic, basement or crawl space of the dwelling nor shall the air intake be located at an elevation higher than the firebox. The exterior air intake shall be covered with a corrosion-resistant screen of $\frac{1}{4}$ -inch (6.4 mm) mesh.

2111A.14.4 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

2111A.14.5 Passageway. The combustion air passageway shall be not less than 6 square inches (3870 mm²) and not more than 55 square inches (0.035 m²), except that combustion air systems for listed fireplaces or for fireplaces tested for emissions shall be constructed according to the fireplace manufacturer's instructions.

2111A.14.6 Outlet. The exterior air outlet is permitted to be located in the back or sides of the firebox chamber or within 24 inches (610 mm) of the firebox opening on or near the floor. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

**SECTION 2112A
MASONRY HEATERS**

2112A.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as “masonry,” which is designed to absorb and store heat from a solid fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in either a horizontal or downward direction before entering the chimney and which delivers heat by radiation from the masonry surface of the heater.

2112A.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

1. Masonry heaters shall comply with the requirements of ASTM E1602.
2. Masonry heaters shall be listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer’s instructions.

2112A.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section 2113A.2.

2112A.4 Seismic reinforcing. In structures assigned to Seismic Design Category D, E or F, masonry heaters shall be anchored to the masonry foundation in accordance with Section 2113A.3. Seismic reinforcing shall not be required within the body of a masonry heater with a height that is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section 2113A.

2112A.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) or the distance of the allowed reduction method from the outside surface of a masonry heater in accordance with NFPA 211, Section 12.6, and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

1. Where the masonry heater wall thickness is not less than 8 inches (203 mm) of solid masonry and the wall thickness of the heat exchange channels is not less than 5 inches (127 mm) of solid masonry, combustible materials shall not be placed within 4 inches

(102 mm) of the outside surface of a masonry heater. A clearance of not less than 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.

2. Masonry heaters listed and labeled in accordance with UL 1482 or EN 15250 and installed in accordance with the manufacturer’s instructions.

**SECTION 2113A
MASONRY CHIMNEYS**

2113A.1 General. The construction of masonry chimneys consisting of solid masonry units, hollow masonry units grouted solid, stone or concrete shall be in accordance with this section.

2113A.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

2113A.3 Seismic reinforcement. In structures assigned to Seismic Design Category A or B, seismic reinforcement is not required. In structures assigned to Seismic Design Category C or D, masonry chimneys shall be reinforced and anchored in accordance with Sections 2113A.3.1, 2113A.3.2 and 2113A.4. In structures assigned to Seismic Design Category E or F, masonry chimneys shall be reinforced in accordance with the requirements of Sections 2101 through 2108 and anchored in accordance with Section 2113A.4.

2113A.3.1 Vertical reinforcement. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars anchored in the foundation shall be placed in the concrete between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section 2103A.3. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys greater than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional 40 inches (1016 mm) in width or fraction thereof.

2113A.3.2 Horizontal reinforcement. Vertical reinforcement shall be placed enclosed within 1/4-inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be provided at each bend in the vertical bars.

2113A.4 Seismic anchorage. Masonry chimneys and foundations shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade with two 3/16-inch by 1-inch (4.8 mm by 25 mm) straps embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond

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the bend. Each strap shall be fastened to not less than four floor joists with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

Exception: Seismic anchorage is not required for the following:

1. In structures assigned to Seismic Design Category A or B.
2. Where the masonry fireplace is constructed completely within the exterior walls.

2113A.5 Corbeling. Masonry chimneys shall not be corbeled more than half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) in thickness unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls is permitted to equal the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

2113A.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

2113A.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section 2113.5.

2113A.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Masonry chimneys are permitted to be constructed as part of the masonry walls or concrete walls of the building.

2113A.9 Termination. Chimneys shall extend not less than 2 feet (610 mm) higher than any portion of the building within 10 feet (3048 mm), but shall be not less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

2113A.9.1 Chimney caps. Masonry chimneys shall have a concrete, metal or stone cap, sloped to shed water, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C1283.

2113A.9.2 Spark arrestors. *[SFM] All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrestor.* Where a spark arrestor is installed on a masonry chimney, the spark arrestor shall meet all of the following requirements:

1. The net free area of the arrestor shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2. The arrestor screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter greater than $\frac{1}{2}$ inch (12.7 mm) nor block the passage of spheres having a diameter less than $\frac{3}{8}$ inch (9.5 mm).
4. The spark arrestor shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

2113A.9.3 Rain caps. Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall be not less than four times the net free area of the outlet of the chimney flue it serves.

2113A.10 Wall thickness. Masonry chimney walls shall be constructed of concrete, solid masonry units or hollow masonry units grouted solid with not less than 4 inches (102 mm) nominal thickness.

2113A.10.1 Masonry veneer chimneys. Where masonry is used as veneer for a framed chimney, through flashing and weep holes shall be provided as required by Chapter 14.

2113A.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, according to the terms of the appliance listing and the manufacturer's instructions.

2113.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C315.
2. Listed chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

2113A.11.1.1 Flue linings for specific appliances. Flue linings other than those covered in Section 2113A.11.1 intended for use with specific appliances shall comply with Sections 2113A.11.1.2 through 2113A.11.1.4, 2113A.11.2 and 2113A.11.3.

2113A.11.1.2 Gas appliances. Flue lining systems for gas appliances shall be in accordance with the *California Mechanical Code*.

2113A.11.1.3 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to flue lining systems complying with Section 2113A.11.1 and pellet vents listed for installation within masonry chimneys (see Section 2113A.11.1.5 for marking).

2113A.11.1.4 Oil-fired appliances approved for use with L-vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to flue lining

systems complying with Section 2113A.11.1 and listed chimney liners complying with UL 641 (see Section 2113.11.1.5 for marking).

2113A.11.1.5 Notice of usage. When a flue is relined with a material not complying with Section 2113A.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language: “This chimney is for use only with (type or category of appliance) that burns (type of fuel). Do not connect other types of appliances.”

2113A.11.2 Concrete and masonry chimneys for medium-heat appliances. Concrete and masonry chimneys for medium-heat appliances shall comply with Sections 2113A.11.2.1 through 2113A.11.2.5.

2113A.11.2.1 Construction. Chimneys for medium-heat appliances shall be constructed of solid masonry units or of concrete with walls not less than 8 inches (203 mm) thick, or with stone masonry not less than 12 inches (305 mm) thick.

2113A.11.2.2 Lining. Concrete and masonry chimneys shall be lined with an approved medium-duty refractory brick not less than 4 1/2 inches (114 mm) thick laid on

the 4 1/2-inch bed (114 mm) in an approved medium-duty refractory mortar. The lining shall start 2 feet (610 mm) or more below the lowest chimney connector entrance. Chimneys terminating 25 feet (7620 mm) or less above a chimney connector entrance shall be lined to the top.

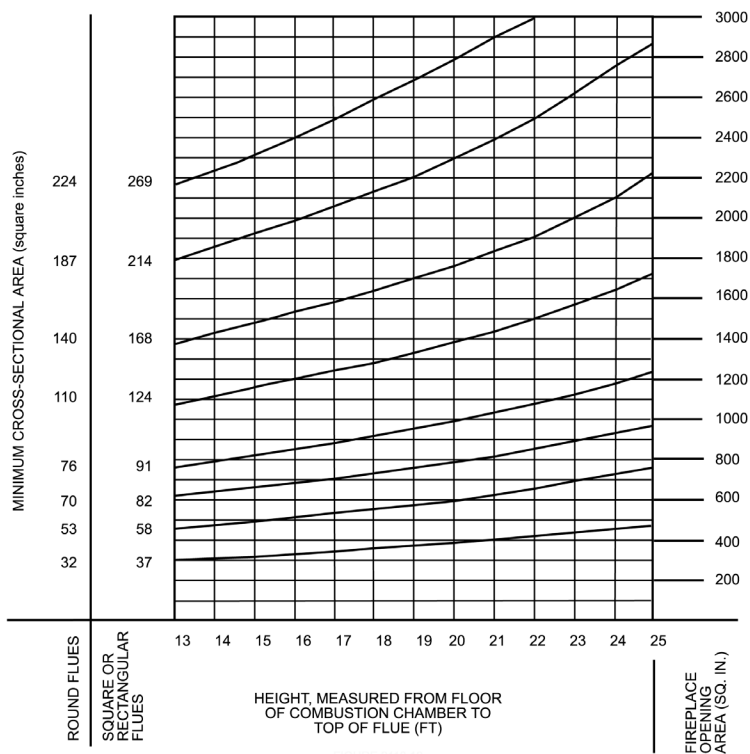
2113A.11.2.3 Multiple passageway. Concrete and masonry chimneys containing more than one passageway shall have the liners separated by a minimum 4-inch-thick (102 mm) concrete or solid masonry wall.

2113A.11.2.4 Termination height. Concrete and masonry chimneys for medium-heat appliances shall extend not less than 10 feet (3048 mm) higher than any portion of any building within 25 feet (7620 mm).

2113A.11.2.5 Clearance. A minimum clearance of 4 inches (102 mm) shall be provided between the exterior surfaces of a concrete or masonry chimney for medium-heat appliances and combustible material.

2113A.11.3 Concrete and masonry chimneys for high-heat appliances. Concrete and masonry chimneys for high-heat appliances shall comply with 2113A.11.3.1 through 2113A.11.3.4.

2113A.11.3.1 Construction. Chimneys for high-heat appliances shall be constructed with double walls of solid masonry units or of concrete, each wall to be not



Note: 1 inch = 25.4 mm, 1 square inch = 645 mm².

FIGURE 2113A.16
FLUE SIZES FOR MASONRY CHIMNEYS

less than 8 inches (203 mm) thick with a minimum airspace of 2 inches (51 mm) between the walls.

2113A.11.3.2 Lining. The inside of the interior wall shall be lined with an approved high-duty refractory brick, not less than $4\frac{1}{2}$ inches (114 mm) thick laid on the $4\frac{1}{2}$ -inch bed (114 mm) in an approved high-duty refractory mortar. The lining shall start at the base of the chimney and extend continuously to the top.

2113A.11.3.3 Termination height. Concrete and masonry chimneys for high-heat appliances shall extend not less than 20 feet (6096 mm) higher than any portion of any building within 50 feet (15 240 mm).

2113A.11.3.4 Clearance. Concrete and masonry chimneys for high-heat appliances shall have approved clearance from buildings and structures to prevent overheating combustible materials, permit inspection and maintenance operations on the chimney and prevent danger of burns to persons.

2113A.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a maximum slope not greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty nonwater-soluble refractory mortar conforming to ASTM C199 with tight mortar joints left smooth on the inside and installed to maintain an airspace or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue lining shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

2113A.13 Additional requirements.

2113A.13.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

2113A.13.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

2113A.14 Multiple flues. Where two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be not less than 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: Where venting only one appliance, two flues are permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered not less than 4 inches (102 mm).

2113A.15 Flue area (appliance). Chimney flues shall not be smaller in area than the area of the connector from the appliance. Chimney flues connected to more than one appliance shall be not less than the area of the largest connector plus 50 percent of the areas of additional chimney connectors.

Exceptions:

1. Chimney flues serving oil-fired appliances sized in accordance with NFPA 31.
2. Chimney flues serving gas-fired appliances sized in accordance with the *California Mechanical Code*.

2113A.16 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section 2113A.16.1 or 2113A.16.2.

2113A.16.1 Minimum area. Round chimney flues shall have a minimum net cross-sectional area of not less than $\frac{1}{12}$ of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of not less than $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of not less than $\frac{1}{10}$ of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of not less than $\frac{1}{8}$ of the fireplace opening.

2113A.16.2 Determination of minimum area. The minimum net cross-sectional area of the flue shall be determined in accordance with Figure 2113A.16. A flue size providing not less than the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are as provided in Tables 2113A.16(1) and 2113A.16(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the fire-box floor to the top of the chimney flue.

2113A.17 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

2113A.18 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be not less than 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces, where cleaning is possible through the fireplace opening.

**TABLE 2113A.16(1)
NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES^a**

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 ³ / ₄	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

a. Flue sizes are based on ASTM C315.

**TABLE 2113A.16(2)
NET CROSS-SECTIONAL AREA OF
SQUARE AND RECTANGULAR FLUE SIZES**

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

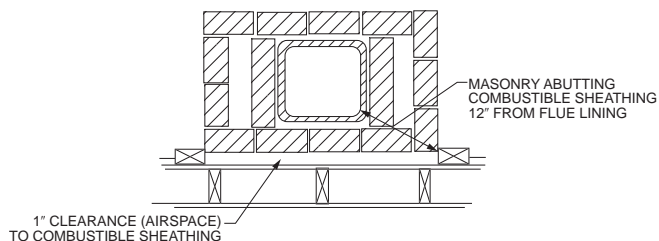
2113A.19 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fireblocking in accordance with Section 2113A.20.

Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in con-

tact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer’s instructions, are permitted to have combustible material in contact with their exterior surfaces.

2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding, are permitted to abut the masonry chimney sidewalls, in accordance with Figure 2113A.19, provided that such combustible trim or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest flue lining. Combustible material and trim shall not overlap the corners of the chimney by more than 1 inch (25 mm).



**FIGURE 2113A.19
ILLUSTRATION OF EXCEPTION THREE
CHIMNEY CLEARANCE PROVISION**

2113A.20 Chimney fireblocking. All spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

**SECTION 2114A
DRY-STACK MASONRY**

2114A.1 General. The design of dry-stack masonry structures shall comply with the requirements of Chapters 1 through 8 of TMS 402 except as modified by Sections 2114A.2 through 2114A.5.

2114A.2 Limitations. Dry-stack masonry shall be prohibited in Risk Category IV structures.

2114A.3 Materials. Concrete masonry units complying with ASTM C90 shall be used.

2114A.4 Strength. Dry-stack masonry shall be of adequate strength and proportions to support all superimposed loads without exceeding the allowable stresses listed in Table 2114A.4. Allowable stresses not specified in Table 2114A.4 shall comply with the requirements of Chapter 8 of TMS 402.

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TABLE 2114A.4
GROSS CROSS-SECTIONAL AREA
ALLOWABLE STRESS FOR DRY-STACK MASONRY

DESCRIPTION	MAXIMUM ALLOWABLE STRESS (psi)
Compression	45
Flexural tension	
Horizontal span	30
Vertical span	18
Shear	10

For SI: 1 pound per square inch = 0.006895 MPa.

2114A.5 Construction. Construction of dry-stack masonry shall comply with ASTM C946.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 22 – STEEL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X			X	X									X								
Adopt entire chapter as amendedd (amended sections listed below)									X		X	X			X							
Adopt only those sections that are listed below																						
Chapter / Section																						
2201.1.1									X		X	X			X							
2201.1.2									X		X	X			X							
2201.1.3									X													
2201.1.4									X		X	X			X							
2204.1.1											X	X			X							
2204.4											X	X			X							
2205.1											X	X			X							
2205.2.1.2											X	X			X							
2205.3											X	X			X							
2205.4											X	X			X							
2206.2.1											X	X			X							
2207.4											X	X			X							
2207.6											X	X			X							
2208.1											X	X			X							
2210.1.1.2											X	X			X							
2210.2											X	X			X							
2211.1.1.2											X	X			X							
2211.1.3											X	X			X							
2211.2											X	X			X							
2212																						
2213											X	X			X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 22

STEEL

User notes:

About this chapter: Chapter 22 provides the minimum requirements for the design and construction of structural steel (including composite construction), cold-formed steel, steel joists, steel cable structures and steel storage racks. This chapter specifies appropriate design and construction standards for these types of structures. It also provides a road map of the applicable technical requirements for steel structures. Chapter 22 requires that the design and use of steel structures and components be in accordance with the applicable specifications and standards of the American Institute of Steel Construction, the American Iron and Steel Institute, the Steel Joist Institute and the American Society of Civil Engineers.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2201 GENERAL

2201.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201.1.1 Application. [DSA-SS/CC, OSHPD] The scope of application of Chapter 22 is as follows:

1. Office of Statewide Health Planning and Development (OSHPD).

Buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings and acute psychiatric hospital buildings regulated by OSHPD. Applications listed in Sections 1.10.1, 1.10.2 and 1.10.5.

2. Structures regulated by the Division of the State Architect-Structural Safety/Community Colleges (DSA-SS/CC), which include those applications listed in Section 1.9.2.2.

2201.1.2 Amendments in this chapter. [DSA-SS/CC, OSHPD] DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Office of Statewide Health Planning and Development:

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 5] - For applications listed in Section 1.10.5

2. Division of the State Architect - Structural Safety/Community Colleges:

[DSA-SS/CC] - For applications listed in Section 1.9.2.2

2201.1.3 Reference to other chapters. [DSA-SS/CC] Where reference within this chapter is made to sections in Chapter 17, the provisions in Chapter 17A shall apply instead.

2201.1.4 Amendments. [DSA-SS/CC, OSHPD] See Section 2212 for additional requirements.

[OSHPD 1R, 2 & 5] See Section 2213 for additional requirements.

SECTION 2202 IDENTIFICATION OF STEEL FOR STRUCTURAL PURPOSES

2202.1 General. Identification of structural steel elements shall be in accordance with AISC 360. Identification of cold-formed steel members shall be in accordance with AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S240 or AISI S220, as applicable. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

SECTION 2203 PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203.1 General. Painting of structural steel elements shall be in accordance with AISC 360. Painting of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall be in accordance with AISI S240 or AISI S220, as applicable.

SECTION 2204 CONNECTIONS

2204.1 Welding. The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in

Sections 2205, 2206, 2207, 2208, 2210 and 2211. For special inspection of welding, see Section 1705.2.

2204.1.1 Restrained welded connections. [OSHPD 1R, 2 & 5] *Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2204.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of Sections 2205, 2206, 2207, 2210 and 2211. For special inspection of the installation of high-strength bolts, see Section 1705.2.

2204.3 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts but shall not be greater than the length of the threads on the bolts.

2204.4 Column base plate. [OSHPD 1R, 2 & 5] *When shear and / or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than 1/8 inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.*

SECTION 2205 STRUCTURAL STEEL

2205.1 General. The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions: [OSHPD 1R, 2 & 5]

1. For members designed on the basis of tension, the slenderness ratio (L/r) shall not exceed 300, except for the design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.
2. For members designed on the basis of compression, the slenderness ratio (KL/r) shall not exceed 200, except for the design of hangers and bracing in accordance with NFPA 13.

2205.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2205.2.1 or 2205.2.2, as applicable.

2205.2.1 Structural steel seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems shall be in accordance with the provisions of Section 2205.2.1.1 or 2205.2.1.2, as applicable.

2205.2.1.1 Seismic Design Category B or C. Structures assigned to Seismic Design Category B or C shall be of any construction permitted in Section 2205. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1, is used for the design of structures assigned to Seismic Design Category B or C, the structures shall be designed and detailed in accordance with the requirements of AISC 341. Beam-to-column moment connections in special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

Exception: The response modification coefficient, R , designated for “Steel systems not specifically detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISC 360, and need not be designed and detailed in accordance with AISC 341.

2205.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341, except as permitted in ASCE 7, Table 15.4-1. Beam-to-column moment connections in special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358. [OSHPD 1R, 2 & 5] *All structural steel seismic force-resisting systems in ASCE 7 Table 15.4-1 shall be designed in accordance with AISC 341.*

2205.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems other than those covered in Section 2205.2.1, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341 where either of the following applies:

1. The structure is assigned to Seismic Design Category D, E or F, except as permitted in ASCE 7, Table 15.4-1.
2. A response modification coefficient, R , greater than 3 in accordance with ASCE 7, Table 12.2-1, is used for the design of the structure assigned to Seismic Design Category B or C.

2205.3 Modifications to AISC 341. [OSHPD 1R, 2 & 5]

2205.3.1 Section A4. Replace Section A4.1 Item (c) as follows:

(c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner’s designated representative shall re-mark the protected zones as they are designated on the construction

documents. Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2205.3.2 Section I2. Replace Section I2.1 item (d) as follows:

(d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone, except power-actuated fasteners up to 0.18 in. diameter are permitted, provided that the penetration is less than 85% of beam flange thickness.

2205.4 Modifications to AISC 358. [OSHPD IR, 2 & 5]

2205.4.1 Design Requirements, 2.1 Special and Intermediate Moment Frame Connection Types, Table 2-1 Prequalified Moment Connections modifications. The prequalified bolted moment connections are not permitted in buildings.

Exceptions:

1. Erection bolts are permitted.
2. The approved bolted moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206.2 and AISC 358-16 Supplement No. 1, Chapter 11.
3. Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2205.4.2 Moment Connection - Chapter 11. The welded sideplate steel moment connection shall be permitted provided:

1. The beams shall consist of either rolled or built-up wide flange sections.
2. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.
3. For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_H/d , shall be greater than or equal to 5.
4. The width-to-thickness ratios for beam flanges shall not be less than 3.
5. The spacing for lateral bracing of wide flange beams, L_b , shall include the length of the side plate at beam ends.
6. The extension of the side plates beyond the face of the column shall be within the range of $0.77d$ to $1.0d$.
7. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
8. Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.

2205.4.3 Bolted Moment Connection - Chapter 11, Supplement No. 1. The bolted sideplate steel moment connec-

tion in accordance with AISC 358-16 Supplement No. 1 shall be permitted provided:

1. A linear analysis procedure shall be used for design of the SMF and IMF systems using the bolted sideplate connection when permitted in accordance with ASCE 7. Nonlinear procedures will be considered as an alternative system.
2. The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of $3/4$ inch (19 mm), or satisfy the requirements of width-to-thickness ratios of highly ductile members in AISC 341-16.
3. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.
4. For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the k dimension extension. The k dimension extension length is defined as beam depth $d/6$, rounded to the nearest $1/2$ inch (12.7 mm).
5. The hinge-to-hinge span to beam depth, L_H/d , shall be greater than or equal to 4.5.
6. The width-to-thickness ratios for beam flanges shall not be less than 3.5.

Exception: For width-to-thickness ratios less than 3.5 the C_{pr} shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.

7. The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.
8. The extension of the side plates beyond the face of the column shall be within the range of $0.65d$ to $1.5d$.
9. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
10. Demand Critical fillet welds {2}, {5}, {5a} and {8} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.
11. The connection specific factor to account for peak connection strength, C_{pr} , shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.
12. For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connec-

tions in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ($V_u + V_g$) and moment (M_{pr}) demands, of at least 1.2 times the M_{pr} at the plastic hinge location when the axial load, as determined by ASCE 7, Section 12.10.2.1 without Ω_p , exceeds $0.1 F_y A_g$ of the sideplate beam.

13. A complete frame analysis for gravity and design wind loading using LFRD load combinations in Section 1605.1 shall be performed including Demand/Capacity Ratios. Frame beam member nominal moment strengths (M_n) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as $0.80F_y Z$ for frame beams up to 300 plf and $0.60F_y Z$ for frame beams greater than 300 plf.
14. For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.
15. Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.
16. Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.
17. For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).

SECTION 2206 COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

2206.1 General. Systems of structural steel elements acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.

2206.2 Seismic design. Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206.2.1.

2206.2.1 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1, is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341.

[OSHPD 1R, 2 & 5] Seismic requirements for composite structural steel and concrete construction shall be considered as an alternative system.

Exception:

Steel and concrete composite special moment frame with the approved moment connection in accor-

dance with AISC 358 Chapter 10 shall be permitted provided:

- a. Beams are provided with Reduced Beam Sections (RBS);
- b. Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $1/4$ inch fillet weld; and
- c. The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $1/2$ inch.

SECTION 2207 STEEL JOISTS

2207.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with either SJI 100 or SJI 200, as applicable.

2207.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205.2 or 2211.1.1.

2207.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from the specifications listed in Section 2207.1; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from the SJI specifications listed in Section 2207.1, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
 - 1.1. Concentrated loads.
 - 1.2. Nonuniform loads.
 - 1.3. Net uplift loads.
 - 1.4. Axial loads.
 - 1.5. End moments.
 - 1.6. Connection forces.
2. Special considerations including:
 - 2.1. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
 - 2.2. Oversized or other nonstandard web openings.
 - 2.3. Extended ends.
3. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.

2207.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with the SJI specifications listed in Section 2207.1 to support the load requirements of Section 2207.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calcula-

tions as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from the SJI specifications listed in Section 2207.1, such as cantilevered conditions and net uplift.
2. Connection design for:
 - 2.1. Connections that differ from the SJI specifications listed in Section 2207.1, such as flush-framed or framed connections.
 - 2.2. Field splices.
 - 2.3. Joist headers.

2207.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
3. Connection requirements for:
 - 3.1. Joist supports.
 - 3.2. Joist girder supports.
 - 3.3. Field splices.
 - 3.4. Bridging attachments.
4. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
5. Size, location and connections for bridging.
6. Joist headers.

Steel joist placement plans do not require the seal and signature of the joist manufacturer's registered design professional. *[OSHPD 1R, 2 & 5] Not permitted by OSHPD.*

2207.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704.5 stating that work was performed in accordance with approved construction documents and with SJI specifications listed in Section 2207.1.

2207.6 Joist chord bracing. *[OSHPD 1R, 2 & 5] The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208 STEEL CABLE STRUCTURES

2208.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

2208.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19.

[OSHPD 1R, 2 & 5] Steel cables with glass or polymer fabric material acting as a tensile membrane structure is an alternative system.

SECTION 2209 STEEL STORAGE RACKS

2209.1 Steel storage racks. The design, testing and utilization of steel storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.2 Steel cantilevered storage racks. The design, testing and utilization of steel cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of steel cantilevered storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209.3 Certification. For rack storage structures that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

SECTION 2210 COLD-FORMED STEEL

2210.1 General. The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall comply with Section 2211. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210.2.

[OSHPD 1R, 2 & 5] Modify AISI S100 Chapter J (Connections and Joints, Section J7.2) by the following: Power-actuated fastener allowable design strength shall not exceed that permitted in the evaluation report qualified by ICC AC 70 or ASCE 7, Section 13.4.5.

2210.1.1 Steel decks. The design and construction of cold-formed steel decks shall be in accordance with this section.

2210.1.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be

designed and constructed in accordance with ANSI/SDI-NC1.0.

2210.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. *[OSHPD 1R, 2 & 5] The base material thickness of the steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: *For single-story, nonbuilding structures similar to buildings, the minimum deck thickness need not apply if the steel roof deck is not being used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

2210.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

2210.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100, ASCE 8, or, for cold-formed steel special-bolted moment frames, AISI S400. *[OSHPD 1R, 2 & 5] Cold-formed steel structures shall be designed and detailed in accordance with the requirements of AISI S100 and AISI S400. Cold-formed steel special bolted moment frames are not permitted by OSHPD.*

SECTION 2211 COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2211.1.1 through 2211.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2211.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2211.1.1.1 or 2211.1.1.2, as applicable.

2211.1.1.1 Seismic Design Categories B and C. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1 is used for the design of cold-formed steel light-frame construction assigned to Seismic Design Category B or C, the seismic force-resisting system shall be designed and detailed in accordance with the requirements of AISI S400.

Exception: The response modification coefficient, R , designated for “Steel systems not specifically

detailed for seismic resistance, excluding cantilever column systems” in ASCE 7, Table 12.2-1, shall be permitted for systems designed and detailed in accordance with AISI S240 and need not be designed and detailed in accordance with AISI S400

2211.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400.

[OSHPD 1R, 2 & 5]:

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI S400 are not permitted within the seismic force-resisting system of buildings.*

2211.1.2 Prescriptive framing. Detached one- and two-family dwellings and townhouses, less than or equal to three stories above grade plane, shall be permitted to be constructed in accordance with AISI S230 subject to the limitations therein.

2211.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2211.1.3.1. through 2211.1.3.3.

[OSHPD 1R, 2 & 5] Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.

2211.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing.

2211.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner’s authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705.2.

2211.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704.2.5 and 1705.2, as applicable.

2211.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220. [OSHPD IR, 2 & 5] for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.

SECTION 2212 ADDITIONAL REQUIREMENTS FOR COMMUNITY COLLEGES [DSA-SS/CC]

2212.1 Connections.

2212.1.1 Column base plate. When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than $1/8$ inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.

2212.2 Modifications to AISC 341.

2212.2.1 Section B5. Modify Section B5.2(a) as follows:

(a) The forces specified in this section need not be applied to the diagonal members of the truss diaphragms and their connections, where each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where these members and connections conform to the requirements of Sections F2.4a, F2.5a, F2.5b and F2.6c. Braces in K- or V- configurations and braces supporting gravity loads other than self-weight are not permitted under this exception.

2212.2.2 Section D2. Modify Section D2.6c(b)(2) as follows:

(2) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

2212.3 Seismic requirements for composite structural steel and concrete construction. In addition to the requirements of Section 2206.2, steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted provided:

1. Beams are provided with reduced beam sections (RBS);
2. Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $1/4$ -inch fillet weld; and
3. The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $1/2$ inch.

2212.4 Steel joists.

2212.4.1 Design approval. Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with Title 24, Part 1. Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.

2212.4.2 Joist chord bracing. The chords of all joists shall be laterally supported at all points where the chords change direction.

2212.5 Cold-formed steel light-frame construction.

2212.5.1 Trusses.

2212.5.1.1 Analysis submittals. Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required the test report shall be submitted with the truss design drawings and engineering analysis to the enforcement agency.

2212.5.1.2 Deferred submittals. Deferred submittal per Section 11.4.2 of AISI 202 is not permitted by DSA-SS/CC.

2212.5.2 Anchorage for shear. Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.

2212.5.3 Limitations on shear wall assemblies. Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI-S400 are not permitted within the seismic force-resisting system of buildings or structures assigned to Risk Category II, III, IV or buildings designed to be relocatable. ||

2212.6 Testing.

2212.6.1 Tests of high-strength bolts, nuts and washers. High-strength bolts, nuts and washers shall be sampled and tested in accordance with Section 1705A.2.6. |K

2212.6.2 Tests of end-welded studs. End-welded studs shall be sampled and tested in accordance with the requirements of the AWS D1.1.

**SECTION 2213
TESTING AND FIELD VERIFICATION
[OSHPD 1R, 2 & 5]**

2213.1 Tests of high-strength bolts, nuts and washers. High-strength bolts, nuts and washers shall be sampled and tested by an approved agency for conformance with the requirements of applicable ASTM standards.

A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.

2213.2 Tests of end-welded studs. End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Sections 7.7 and 7.8.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 22A – STEEL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X		X												
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 22A

STEEL

SECTION 2201A GENERAL

2201A.1 Scope. The provisions of this chapter govern the quality, design, fabrication and erection of steel construction.

2201A.1.1 Application. *The scope of application of Chapter 22A is as follows:*

- 1. Structures regulated by the Division of the State Architect-Structural Safety (DSA-SS), which include those applications listed in Section 1.9.2.1. These applications include public elementary and secondary schools, community colleges and state- owned or state-leased essential services buildings.*
- 2. Structures regulated by the Office of Statewide Health Planning and Development (OSHPD), which include those applications listed in Sections 1.10.1 and 1.10.4. These applications include hospitals and correctional treatment centers.*

2201A.1.2 Amendments in this chapter. *DSA-SS and OSHPD adopt this chapter and all amendments.*

Exception: *Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:*

- 1. Division of the State Architect-Structural Safety: [DSA-SS] For applications listed in Section 1.9.2.1.*
- 2. Office of Statewide Health Planning and Development:*

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 4] - For applications listed in Section 1.10.4.

SECTION 2202A IDENTIFICATION OF STEEL FOR STRUCTURAL PURPOSES

2202A.1 General. Identification of structural steel elements shall be in accordance with AISC 360. Identification of cold-formed steel members shall be in accordance with AISI S100. Identification of cold-formed steel light-frame construction shall also comply with the requirements contained in AISI S240 or AISI S220, as applicable. Other steel furnished for structural load-carrying purposes shall be properly identified for conformity to the ordered grade in accordance with the specified ASTM standard or other specification and the provisions of this chapter. Where the steel grade is not readily identifiable from marking and test records, the steel shall be tested to verify conformity to such standards.

SECTION 2203A PROTECTION OF STEEL FOR STRUCTURAL PURPOSES

2203A.1 General. Painting of structural steel elements shall be in accordance with AISC 360. Painting of open-web steel joists and joist girders shall be in accordance with SJI 100 and SJI 200. Individual structural members and assembled panels of cold-formed steel construction shall be protected against corrosion in accordance with the requirements contained in AISI S100. Protection of cold-formed steel light-frame construction shall be in accordance with AISI S240 or AISI S220, as applicable.

SECTION 2204A CONNECTIONS

2204A.1 Welding. The details of design, workmanship and technique for welding and qualification of welding personnel shall be in accordance with the specifications listed in Sections 2205A, 2206A, 2207A, 2208A, 2210A and 2211A. For special inspection of welding, see Section 1705A.2.

2204A.1.1 Restrained welded connections. *[OSHPD 1 & 4] Welded structural steel connections having a medium or high level of restraint, as defined by AWS D1.1 Annex H, shall have a minimum pre-heat temperature of not less than 150°F (66°C). Welded structural steel connections with welds to flange, web, wall or plate having a high level of restraint shall maintain a post-heat temperature of 300°F (149°C) for a minimum of 1 hour after completion of welding.*

2204A.2 Bolting. The design, installation and inspection of bolts shall be in accordance with the requirements of Sections 2205A, 2206A, 2207A, 2210A and 2211A. For special inspection of the installation of high-strength bolts, see Section 1705A.2.

2204A.3 Anchor rods. Anchor rods shall be set in accordance with the approved construction documents. The protrusion of the threaded ends through the connected material shall fully engage the threads of the nuts but shall not be greater than the length of the threads on the bolts.

2204A.4 Column base plate. *When shear and/or tensile forces are intended to be transferred between column base plates and anchor bolts, provisions shall be made in the design to eliminate the effects of oversized holes permitted in base plates by AISC 360 by use of shear lugs into the reinforced concrete foundation element and/or welded shear transfer plates or other means acceptable to the enforcement agency, when the oversized holes are larger than the anchor bolt by more than 1/8 inch (3.2 mm). When welded shear transfer plates and shear lugs or other means acceptable to the enforcement agency are not used, the anchor bolts shall be checked for the induced bending stresses in combination with the shear stresses.*

SECTION 2205A STRUCTURAL STEEL

2205A.1 General. The design, fabrication and erection of structural steel elements in buildings, structures and portions thereof shall be in accordance with AISC 360.

Exceptions: [OSHPD 1 & 4]

1. For members designed on the basis of tension, the slenderness ratio (L/r) shall not exceed 300, except for design of hangers and bracing in accordance with NFPA 13 and for rod hangers in tension.
2. For members designed on the basis of compression, the slenderness ratio (KL/r) shall not exceed 200, except for design of hangers and bracing in accordance with NFPA 13.

2205A.2 Seismic design. Where required, the seismic design, fabrication and erection of buildings, structures and portions thereof shall be in accordance with Section 2205A.2.1 or 2205A.2.2, as applicable.

2205A.2.1 Structural steel seismic force-resisting systems. The design, detailing, fabrication and erection of structural steel seismic force-resisting systems shall be in accordance with the provisions of Section 2205A.2.1.1 or 2205A.2.1.2, as applicable.

2205A.2.1.1 Seismic Design Category B or C. Not permitted by DSA-SS and OSHPD.

2205A.2.1.2 Seismic Design Category D, E or F. Structures assigned to Seismic Design Category D, E or F shall be designed and detailed in accordance with AISC 341. Beam-to-column moment connections in special moment frames and intermediate moment frames shall be prequalified in accordance with AISC 341, Section K1, qualified by testing in accordance with AISC 341, Section K2, or shall be prequalified in accordance with AISC 358.

2205A.2.2 Structural steel elements. The design, detailing, fabrication and erection of structural steel elements in seismic force-resisting systems other than those covered in Section 2205A.2.1, including struts, collectors, chords and foundation elements, shall be in accordance with AISC 341.

2205A.3 Modifications to AISC 341. [DSA-SS]

2205A.3.1 Section B5. Modify Section B5.2(a) as follows:

- (a) The forces specified in this section need not be applied to the diagonal members of the truss diaphragms and their connections, where *each diagonal bracing member resists no more than 30 percent of the diaphragm shear at each line of resistance and where these members and connections conform to the requirements of Sections F2.4a, F2.5a, F2.5b and F2.6c.* Braces in K- or V- configurations and braces supporting gravity loads other than self-weight are not permitted under this exception.

2205A.3.2 Section D2. Modify Section D2.6c(b)(2) as follows:

- (2) the moment calculated using the load combinations of the applicable building code, including the amplified seismic load, provided the connection or other mechanism within the column base is designed to have the ductility necessary to accommodate the column base rotation resulting from the design story drift.

2205A.4 Modifications to AISC 341. [OSHPD 1 and 4]

2205A.4.1 Glossary. Modify glossary by adding the following:

Inelastic Rotation: The permanent or plastic portion of the rotation angle between a beam and the column, or between a link and the column of the test specimen, measured in radians. The inelastic rotation shall be computed based upon an analysis of the test specimen deformations. Sources of inelastic rotation include yielding of members and connectors, yielding of connection elements and slip between members and connection elements. For beam-to-column moment connections in special moment frames, the inelastic rotation is represented by the plastic chord rotation angle calculated as the plastic deflection of the beam or girder, at the center of its span divided by the distance between the center of the beam span and the centerline of the panel zone of the beam-column connection. For link-to-column connections in eccentrically braced frames, inelastic rotation shall be computed based upon the assumption that inelastic action is concentrated at a single point located at the intersection of the centerline of the link with the face of the column.

2205A.4.2 Section A4. Replace Section A4.1 Item (c) as follows:

- (c) Locations and dimensions of protected zones. The fabricator shall permanently mark protected zones of structural elements in the seismic force-resisting system in the building that are designated on the construction documents. If these markings are obscured during construction, such as after the application of fire protection, the owner's designated representative shall re-mark the protected zones as they are designated on the construction documents. [OSHPD 1 & 4] Primers or paints used to mark protected zones on steel surfaces, which are to receive sprayed fire-resistance material, shall comply with California Building Code Section 704.13.3.2.

2205A.4.3 Section I2. [OSHPD 1 & 4] Replace Section I2.1 Item (d) as follows:

- (d) Decking attachments that penetrate the beam flange shall not be placed on beam flanges within the protected zone, except power-actuated fasteners up to 0.18 inch in diameter are permitted, provided that the penetration is less than 85 percent of beam flange thickness.

2205A.4.4 Section E2. Replace Section E2.6c Item (a) by the following:

- (a) Use of IMF connections designed in accordance with ANSI/AISC 358 shall be as modified in Section 2205A.5.2.

2205A.4.5 Section E3. Replace Section E3.6b Item (a) by the following:

- (a) The connection shall be capable of sustaining an interstory drift angle of at least 0.04 radians and an inelastic rotation of 0.03 radians.

2205A.4.6 Section E3. Replace Section E3.6c Item (a) by the following:

- (a) Use of SMF connections designed in accordance with ANSI/AISC 358 shall be as modified in Section 2205A.5.

2205A.4.7 Section F2. Special concentrically braced frames (SCBF) modifications

5b. Diagonal braces, Add a new section as follows.

- (d) The use of rectangular or square HSS are not permitted for bracing members, unless filled solid with cement grout having a minimum compressive strength of 3000 psi at 28 days. The effects of composite action in the filled composite brace shall be considered in the sectional properties of the system where it results in the more severe loading condition or detailing.

2205A.4.8 Section F3. Modify Section F3.6e Item 2 as follows:

Exception is not permitted.

2205A.4.9 Section K2. Replace Section K2.3b as follows:

The size of the beam or link used in the test specimen shall be within the following limits:

1. The test beams or links shall be no less than 100 percent of the depth of the prototype beam or link.
2. The test beams or links shall be no less than 100 percent of the weight per foot of the prototype beam or link.

The size of the column used in the test specimen shall properly represent the inelastic action in the column, as per the requirements in Section K2.3a. In addition, the depth of the test column shall be no less than 90 percent of the depth of the prototype column.

Extrapolation beyond the limitations stated in this section shall be permitted subject to peer review and approval by the enforcement agency.

2205A.4.10 Section K2. Modify Section K2.8 by the following:

The test specimen must sustain the required inter-story drift angle, or link rotation angle, and inelastic rotation for at least two complete loading cycles.

2205A.5 Modifications to AISC 358. [OSHPD 1 and 4]

2205A.5.1. Design Requirements, 2.1 Special and Intermediate Moment Frame Connection Types, Table 2-1 Prequalified Moment Connections modifications.

The prequalified bolted moment connections are not permitted in buildings.

Exceptions:

1. Erection bolts are permitted.
2. The approved bolted moment connection in accordance with AISC 358 Chapter 10 as permitted by the exception to Section 2206A.2 and AISC 358-16 Supplement No. 1, Chapter 11.

2205A.5.2 Moment Connection - Chapter 11. The welded side plate steel moment connection shall be permitted provided:

1. The beams shall consist of either rolled or built-up wide flange sections.
2. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.
3. For SMF and IMF systems, U-shaped cover plates shall be used and the hinge-to-hinge span to beam depth, L_h/d , shall be greater than or equal to 5.
4. The width-to-thickness ratios for beam flanges shall not be less than 3.
5. The spacing for lateral bracing of wide flange beams, L_{br} , shall include the length of the side plate at beam ends.
6. The extension of the side plates beyond the face of the column shall be within the range of 0.77d to 1.0d.
7. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
8. Demand critical fillet welds {2}, {5}, {5a} and {7} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches on either side of the start/stop location.

2205A.5.3 Bolted Moment Connection - Chapter 11, Supplement No. 1. The bolted sideplate steel moment connection in accordance with AISC 358-16 Supplement No. 1 shall be permitted provided:

1. A linear analysis procedure shall be used for design of the SMF and IMF systems using the bolted sideplate connection when permitted in accordance with ASCE 7. Nonlinear procedures will be considered as an alternative system.
2. The beams shall consist of either rolled or built-up wide flange sections. Columns shall consist of rolled or built-up wide flange sections or noncomposite built-up box or HSS with a minimum wall thickness of $\frac{3}{4}$ inch (19 mm), or satisfy the requirements of width-to-thickness ratios of highly ductile members in AISC 341-16.
3. The biaxial dual-strong axis and column minor axis configurations of the moment connection shall be considered as an alternative system.

4. For SMF and IMF systems, on the sideplate standard or configuration A the U-shaped cover plates shall be used with the k dimension extension. The k dimension extension length is defined as beam depth $d_f/6$, rounded to the nearest $1/2$ inch (12.7 mm).
5. The hinge-to-hinge span to beam depth, L_H/d , shall be greater than or equal to 4.5.
6. The width-to-thickness ratios for beam flanges shall not be less than 3.5.

Exception: For width-to-thickness ratios less than 3.5 the C_{pr} shall be calculated in accordance with that for welded sideplate connections but in no case shall the width-to-thickness ratio be less than 3.0.
7. The minimum bolt-to-bolt spacing shall not be less than 3 bolt diameters.
8. The extension of the side plates beyond the face of the column shall be within the range of $0.65d$ to $1.5d$.
9. The gap-to-side plate thickness ratio shall range from 2.1 to 2.3.
10. Demand Critical fillet welds {2}, {5}, {5a} and {8} shall have Magnetic Particle Testing (MT) in accordance with AWS D1.1 for procedure, technique and acceptance. Inspect the beginning and end of these welds for a 6-inch (152 mm) length, plus any location along the length of the weld where a start and restart is visually noted for a distance of 6 inches (152 mm) on either side of the start/stop location.
11. The connection specific factor to account for peak connection strength, C_{pr} , shall be between 1.15 and 1.35. Calculations shall be submitted to OSHPD for review and approval.
12. For in-plane collectors transferring axial loads into the sideplate connection, coordination between sideplate and the registered design professional in responsible charge will be required to confirm the collector connection is sufficient to transfer the load into the moment frame system. This requirement shall be satisfied by designing the sideplate connections in the first bay of a multi-bay sideplate moment frame or an end bay to have a minimum connection capacity, including combined shear ($V_u + V_g$) and moment (M_{pr}) demands, of at least 1.2 times the M_{pr} at the plastic hinge location when the axial load, as determined by ASCE 7, Section 12.10.2.1 without Ω_p , exceeds $0.1 F_y A_g$ of the sideplate beam.
13. A complete frame analysis for gravity and design wind loading using LFRD load combinations in Section 1605A.1 shall be performed including Demand/Capacity Ratios. Frame beam member nominal moment strengths (M_n) used for gravity and design wind loading for the bolted sideplate connection using Class A or Class B faying surfaces shall be taken as $0.80 F_y Z$ for frame beams up to 300 plf and $0.60 F_y Z$ for frame beams greater than 300 plf.

14. For moment frame beams with maximum beam shear greater than 90 percent of the vertical bolt shear capacity, a secondary check is to be provided to confirm the vertical bolt shear capacities are sufficient.
15. Bolted sideplate connections used on heavy-shallow frame beams for beams greater than 200 plf and shallower than 24 inches (610 mm) in depth shall be considered as an alternative system.
16. Skewed beams shall utilize the link-beam fabrication method with CJP welded splices for skew angles. The skew angle shall be less than 15 degrees.
17. For two-sided bolted sideplate connections sharing the same side plates at the same height and depth across the column, the vertical offset in the beams shall not exceed 10 inches (254 mm).

SECTION 2206A COMPOSITE STRUCTURAL STEEL AND CONCRETE STRUCTURES

2206A.1 General. Systems of structural steel elements acting compositely with reinforced concrete shall be designed in accordance with AISC 360 and ACI 318, excluding ACI 318 Chapter 14.

2206A.2 Seismic design. Where required, the seismic design, fabrication and erection of composite steel and concrete systems shall be in accordance with Section 2206A.2.1.

2206A.2.1 Seismic requirements for composite structural steel and concrete construction. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1, is used for the design of systems of structural steel acting compositely with reinforced concrete, the structures shall be designed and detailed in accordance with the requirements of AISC 341 and shall be considered as an alternative system.

Exception: Steel and concrete composite special moment frame with the approved moment connections in accordance with AISC 358 Chapter 10 shall be permitted, provided:

1. Beams are provided with reduced beam sections (RBS);
2. Web extension to beam web two-sided fillet welds are sized to develop expected strength of the beam web and shall not be less than a $1/4$ inch fillet weld; and
3. The built-up box column wall thickness shall not be less than 1.25 inches and the HSS column wall thickness shall not be less than $1/2$ inch.

SECTION 2207A STEEL JOISTS

2207A.1 General. The design, manufacture and use of open-web steel joists and joist girders shall be in accordance with either SJI 100 or SJI 200, as applicable.

2207A.1.1 Seismic design. Where required, the seismic design of buildings shall be in accordance with the additional provisions of Section 2205A.2 or 2211A.1.1.

2207A.2 Design. The registered design professional shall indicate on the construction documents the steel joist and steel joist girder designations from the specifications listed in Section 2207A.1; and shall indicate the requirements for joist and joist girder design, layout, end supports, anchorage, bridging design that differs from the SJI specifications listed in Section 2207A.1, bridging termination connections and bearing connection design to resist uplift and lateral loads. These documents shall indicate special requirements as follows:

1. Special loads including:
 - 1.1. Concentrated loads.
 - 1.2. Nonuniform loads.
 - 1.3. Net uplift loads.
 - 1.4. Axial loads.
 - 1.5. End moments.
 - 1.6. Connection forces.
2. Special considerations including:
 - 2.1. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207A.1.
 - 2.2. Oversized or other nonstandard web openings.
 - 2.3. Extended ends.
3. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207A.1.

2207A.3 Calculations. The steel joist and joist girder manufacturer shall design the steel joists and steel joist girders in accordance with the SJI specifications listed in Section 2207A.1 to support the load requirements of Section 2207A.2. The registered design professional shall be permitted to require submission of the steel joist and joist girder calculations as prepared by a registered design professional responsible for the product design. Where requested by the registered design professional, the steel joist manufacturer shall submit design calculations with a cover letter bearing the seal and signature of the joist manufacturer's registered design professional. In addition to the design calculations submitted under seal and signature, the following shall be included:

1. Bridging design that differs from the SJI specifications listed in Section 2207A.1, such as cantilevered conditions and net uplift.
2. Connection design for:
 - 2.1. Connections that differ from the SJI specifications listed in Section 2207A.1, such as flush-framed or framed connections.
 - 2.2. Field splices.
 - 2.3. Joist headers.

2207A.4 Steel joist drawings. Steel joist placement plans shall be provided to show the steel joist products as specified on the approved construction documents and are to be utilized for field installation in accordance with specific project requirements as stated in Section 2207A.2. Steel joist placement plans shall include, at a minimum, the following:

1. Listing of applicable loads as stated in Section 2207A.2 and used in the design of the steel joists and joist girders as specified in the approved construction documents.
2. Profiles for joist and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207.1.
3. Connection requirements for:
 - 3.1. Joist supports.
 - 3.2. Joist girder supports.
 - 3.3. Field splices.
 - 3.4. Bridging attachments.
4. Live and total load deflection criteria for joists and joist girder configurations that differ from those defined by the SJI specifications listed in Section 2207A.1.
5. Size, location and connections for bridging.
6. Joist headers.

2207A.4.1 Design approval. *[DSA-SS] Joist and joist girder design calculations and profiles with member sizes and connection details, and joist placement plans shall be provided to the enforcement agency and approved prior to joist fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Joist and joist girder design calculations and profiles with member sizes and connection details shall bear the signature and stamp or seal of the registered engineer or licensed architect responsible for the joist design. Alterations to the approved joist and joist girder design calculations and profiles with member sizes and connection details, or to fabricated joists are subject to the approval of the enforcement agency.*

2207A.5 Certification. At completion of manufacture, the steel joist manufacturer shall submit a certificate of compliance to the owner or the owner's authorized agent for submittal to the building official as specified in Section 1704A.5 stating that work was performed in accordance with approved construction documents and with SJI specifications listed in Section 2207A.1.

2207A.6 Joist chord bracing. *The chords of all joists shall be laterally supported at all points where the chords change direction.*

SECTION 2208A STEEL CABLE STRUCTURES

2208A.1 General. The design, fabrication and erection including related connections, and protective coatings of steel cables for buildings shall be in accordance with ASCE 19. *Steel cables with glass or polymer fabric material acting as a tensile membrane structure is an alternative system.*

SECTION 2209A STEEL STORAGE RACKS

2209A.1 Steel storage racks. The design, testing and utilization of steel storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.1. Where required by ASCE 7, the seismic design of steel storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209A.2 Steel cantilevered storage racks. The design, testing and utilization of steel cantilevered storage racks made of cold-formed or hot-rolled steel structural members shall be in accordance with RMI ANSI/MH 16.3. Where required by ASCE 7, the seismic design of steel cantilevered storage racks shall be in accordance with Section 15.5.3 of ASCE 7.

2209A.3 Certification. For rack storage structures that are 8 feet (2438 mm) in height or greater to the top load level and assigned to Seismic Design Category D, E, or F at completion of the storage rack installation, a certificate of compliance shall be submitted to the owner or the owner's authorized agent stating that the work was performed in accordance with approved construction documents.

SECTION 2210A COLD-FORMED STEEL

2210A.1 General. [DSA-SS, OSHPD 1 & 4] The design of cold-formed carbon and low-alloy steel structural members shall be in accordance with AISI S100. The design of cold-formed stainless-steel structural members shall be in accordance with ASCE 8. Cold-formed steel light-frame construction shall comply with Section 2211A. Where required, the seismic design of cold-formed steel structures shall be in accordance with the additional provisions of Section 2210A.2.

Modify AISI S100 Chapter J (Connections and Joints, Section J7.2) by the following: Power-actuated fastener available strength shall not exceed those strengths determined in accordance with Section 1617A.1.20 of this code.

2210A.1.1 Steel decks. The design and construction of cold-formed steel decks shall be in accordance with this section.

2210A.1.1.1 Noncomposite steel floor decks. Noncomposite steel floor decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-NC1.0.

2210A.1.1.2 Steel roof deck. Steel roof decks shall be permitted to be designed and constructed in accordance with ANSI/SDI-RD1.0. *The base material thickness of steel deck shall not be less than 0.0359 inch (0.9 mm) (20 gage).*

Exception: [DSA-SS] *For single-story open structures, the minimum deck thickness may be waived if the steel roof deck need not be used as the diaphragm and there are no suspended hangers or bracing for nonstructural components attached to the deck.*

2210A.1.1.3 Composite slabs on steel decks. Composite slabs of concrete and steel deck shall be permitted to be designed and constructed in accordance with SDI-C.

2210A.2 Seismic requirements for cold-formed steel structures. Where a response modification coefficient, R , in accordance with ASCE 7, Table 12.2-1, is used for the design of cold-formed steel structures, the structures shall be designed and detailed in accordance with the requirements of AISI S100 and AISI S400.

SECTION 2211A COLD-FORMED STEEL LIGHT-FRAME CONSTRUCTION

2211A.1 Structural framing. For cold-formed steel light-frame construction, the design and installation of the following structural framing systems, including their members and connections, shall be in accordance with AISI S240, and Sections 2211A.1.1 through 2211A.1.3, as applicable:

1. Floor and roof systems.
2. Structural walls.
3. Shear walls, strap-braced walls and diaphragms that resist in-plane lateral loads.
4. Trusses.

2211A.1.1 Seismic requirements for cold-formed steel structural systems. The design of cold-formed steel light-frame construction to resist seismic forces shall be in accordance with the provisions of Section 2211A.1.1.1 or 2211A.1.1.2, as applicable.

2211A.1.1.1 Seismic Design Categories B and C. *Not permitted by DSA-SS and OSHPD.*

2211A.1.1.2 Seismic Design Categories D through F. In cold-formed steel light-frame construction assigned to Seismic Design Category D, E or F, the seismic force-resisting system shall be designed and detailed in accordance with AISI S400. *The following additional requirements apply:*

1. *Cold-formed steel stud foundation plates or sills shall be bolted or fastened to the foundation or foundation wall in accordance with Section 2304.3.4, Item 2.*
2. *Shear wall assemblies in accordance with Sections E5, E6 and E7 of AISI 400 are not permitted within the seismic force-resisting system of buildings.*

2211A.1.2 Prescriptive framing. *Not permitted by DSA-SS and OSHPD.*

2211A.1.3 Truss design. Cold-formed steel trusses shall comply with the additional provisions of Sections 2211.1A.3.1. through 2211A.1.3.3.

Complete engineering analysis and truss design drawings shall accompany the construction documents submitted to the enforcement agency for approval. When load testing is required, the test report shall be submitted with

the truss design drawings and engineering analysis to the enforcement agency.

2211A.1.3.1 Truss design drawings. The truss design drawings shall conform to the requirements of Section I1 of AISI S202 and shall be provided with the shipment of trusses delivered to the job site. The truss design drawings shall include the details of permanent individual truss member restraint/bracing in accordance with Section I1.6 of AISI S202 where these methods are utilized to provide restraint/bracing. *Deferred submittal per Section I1.4.2 is not permitted by DSA-SS.*

2211A.1.3.2 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with a registered design professional for the design of the temporary installation restraint/bracing and the permanent individual truss member restraint/bracing for trusses with clear spans 60 feet (18 288 mm) or greater. Special inspection of trusses over 60 feet (18 288 mm) in length shall be in accordance with Section 1705A.2.

2211A.1.3.3 Truss quality assurance. Trusses not part of a manufacturing process that provides requirements for quality control done under the supervision of a third-party quality control agency in accordance with AISI S240 Chapter D shall be fabricated in compliance with Sections 1704A.2.5 and 1705A.2, as applicable.

2211A.2 Nonstructural members. For cold-formed steel light-frame construction, the design and installation of nonstructural members and connections shall be in accordance with AISI S220 *for noncomposite assembly design. Where nonstructural members do not qualify for design under AISI S220, the design and installation of nonstructural members and connections shall be in accordance with AISI S240 or S100.*

SECTION 2212A [DSA-SS] LIGHT MODULAR STEEL MOMENT FRAMES FOR PUBLIC ELEMENTARY AND SECONDARY SCHOOLS, AND COMMUNITY COLLEGES

2212A.1 General.

2212A.1.1 Configuration. Light modular steel moment frame buildings shall be constructed of factory-assembled modules comprising a single-story moment-resisting space frame supporting a floor and roof. Individual modules shall not exceed a width of 14 feet (4.25 m) nor a length of 72 feet (22 m). All connections of beams to corner columns shall be designed as moment-resisting in accordance with the criteria of Section 2212A.2. Modules may be stacked to form multistory structures not exceeding 35 feet or two stories in height. When stacked modules are evaluated separately, seismic forces on each module shall be distributed in accordance with Section 12.8.3 of ASCE 7, considering the modules in the stacked condition. See Section 2212A.2.5 of this code.

2212A.1.2 Design, fabrication and erection. The design, fabrication and erection of light modular steel moment-

frame buildings shall be in accordance with the AISC Specification for Structural Steel Buildings (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100), as applicable, and the requirements of this section. The maximum dead load of the roof and elevated floor shall not exceed 25 psf and 50 psf (1197 Pa and 2394 Pa), respectively. The maximum dead load of the exterior walls shall not exceed 45 psf (2155 Pa).

2212A.2 Seismic requirements. In addition to the other requirements of this code, the design, materials and workmanship of light modular steel moment frames shall comply with the requirements of this section. The response modification coefficient R shall be equal to $3^{1/2}$. C_d and Ω_0 shall be equal to 3.0.

2212A.2.1 Base materials. Beams, columns and connection materials shall be limited to those materials permitted under the AISC Specification for Structural Members (ANSI/AISC 360) and the AISI North American Specification for the Design of Cold-Formed Steel Structural Members (AISI S100).

2212A.2.2 Beam-to-column strength ratio. At each moment-resisting connection the following shall apply:

$$\frac{\sum S_{bi} F_{ybi}}{\sum S_{cj} F_{ycj}} \geq 1.4 \quad (\text{Equation 22A-1})$$

where:

F_{ybi} = The specified yield stress of beam "i."

F_{ycj} = The specified yield stress of column "j."

S_{bi} = The flexural section modulus of each beam "i" that is moment connected to the column "j" at the connection.

S_{cj} = The flexural section modulus of each column "j" that is moment connected to the beam "i" at the connection.

Exceptions:

1. Beam-to-column connections at the floor level beams of first or second-story modules need not comply with this requirement.
2. Beam-to-column strength ratios less than 1.4 are allowed if proven to be acceptable by analysis or testing.

2212A.2.3 Welding. Weld filler metals shall be capable of producing weld metal with a minimum Charpy V-Notch toughness of 20 ft-lb at 0°F. Where beam bottom flanges attach to columns with complete joint penetration groove welds and weld backing is used at the bottom surface of the beam flange, such backing shall be removed and the root pass back-gouged, repaired and reinforced with a minimum $3/16$ inch (5 mm) fillet weld.

2212A.2.4 Connection design. Connections of beams to columns shall have the design strength to resist the maximum seismic load effect, E_m , calculated in accordance with Section 12.4.3 of ASCE 7.

2212A.2.5 Multistory assemblies. Analysis of multistory assemblies shall be permitted to consider the stacked modules as a single assembly, with restraint conditions between the stacked units that represent the actual method of attachment. Alternatively, it shall be permitted to analyze the individual modules of stacked assemblies independently, with lateral and vertical reactions from modules above applied as concentrated loads at the top of the supporting module.

**SECTION 2213A
TESTING AND FIELD VERIFICATION**

2213A.1 Tests of high-strength bolts, nuts and washers. High-strength bolts, nuts and washers shall be sampled and tested in accordance with Section 1705A.2.6 [OSHPD 1 & 4] and this section.

[OSHPD 1 and 4] A minimum of nine samples per lot, as defined in the ASTM standards for bolts [not nuts and washers], shall be tested for tensile properties in accordance with ASTM F606, but need not exceed three samples per 400 bolts.

2213A.2 Tests of end-welded studs. End-welded studs shall be tested in accordance with the requirements of the AWS D1.1, Sections 7.7 and 7.8.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 23 – WOOD

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X												X									
Adopt entire chapter as amendeded (amended sections listed below)				X	X			X	X	X	X	X		X	X							
Adopt only those sections that are listed below			X																	X		
Chapter / Section																						
2301.1				X																		
2301.1.1								X	X	X	X	X		X	X							
2301.1.2								X	X	X	X	X		X	X							
2301.1.3								X	X	X				X								
2301.1.3.1								X		X				X								
2301.1.3.2									X													
2301.1.4								X	X	X	X	X		X	X							
2303.1.3.1								X	X	X	X	X		X	X							
2303.1.4.1								X	X	X	X	X		X	X							
2303.2 – 2303.2.9			X																			
2303.4.1.4.1, <i>Exception 3</i>								X	X	X	X	X		X	X							
2303.4.3.1								X	X	X	X	X		X	X							
2304.3.1.1				X																		
2304.3.4								X	X	X	X	X		X	X							
2304.4.1								X	X	X	X	X			X							
2304.10.2.1								X		X	X	B		X	X							
2304.12.1.1.1																					X	
2304.12.1.2, <i>Exception</i>								X		X	X	X		X	X							
2304.12.1.4.1								X		X	X	X		X	X							
2304.12.8																					X	
2304.12.9																					X	
2305.1.2								X	X	X	X	X		X	X							
2308.2.7								X	X		X				X							
2309.1.1								X	X		X	X			X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 23

WOOD

User notes:

About this chapter: Chapter 23 provides minimum requirements for the design of buildings and structures that use wood and wood-based products. The chapter is organized around three design methodologies: allowable stress design (ASD), load and resistance factor design (LRFD) and conventional light-frame construction. In addition it allows the use of the American Wood Council Wood Frame Construction Manual for a limited range of structures. Included in the chapter are references to design and manufacturing standards for various wood and wood-based products; general construction requirements; design criteria for lateral force-resisting systems and specific requirements for the application of the three design methods.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2301 GENERAL

2301.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of wood members and their fasteners.

[HCD 1] For limited-density owner-built rural dwellings, owner-produced or used materials and appliances may be utilized unless found not to be of sufficient strength or durability to perform the intended function; owner-produced or used lumber, or shakes and shingles may be utilized unless found to contain dry rot, excessive splitting or other defects obviously rendering the material unfit in strength or durability for the intended purpose.

2301.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] The scope of application of Chapter 23 is as follows:

1. Structures regulated by the Division of the State Architect-Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.
2. Applications listed in Section 1.10, regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, skilled nursing facilities, intermediate care facilities and correctional treatment centers.

Exception: For applications listed in Section 1.10.3 (Licensed Clinics), the provisions of this chapter without OSHPD amendments identified in accordance with Section 2301.1.2 shall apply.

2301.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] DSA-SS, DSA-SS/CC and OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. Division of the State Architect - Structural Safety:

[DSA-SS] - For applications listed in Section 1.9.2.1.

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

2. Office of Statewide Health Planning and Development:

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 4] - For applications listed in Section 1.10.4.

[OSHPD 5] - For applications listed in Section 1.10.5.

2301.1.3 Reference to other chapters.

2301.1.3.1 [DSA-SS and OSHPD 1 & 4] Where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 and 22, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A, respectively shall apply instead.

2301.1.3.2 [DSA-SS/CC] Where reference within this chapter is made to sections in Chapters 17 and 18, the provisions in Chapters 17A and 18A respectively shall apply instead.

2301.1.4 Prohibition. [DSA-SS & DSA-SS/CC & OSHPD 1, 1R, 2, 4 & 5] The following design methods, systems and materials are not permitted by DSA and OSHPD:

1. Straight-sheathed horizontal lumber diaphragms.
2. Gypsum-based sheathing shear walls and portland cement plaster shear walls.
3. Shear wall foundation anchor bolt washers in accordance with exception to AWC SDPWS Section 4.3.6.4.3.
4. Wood structural panel shear walls and diaphragms using staples as fasteners.
5. Unblocked shear walls.

6. Any wood structural panel sheathing used for diaphragms and shear walls that are part of the seismic force-resisting system, not applied directly to framing members.
7. Single and double diagonally sheathed lumber walls used to resist seismic forces.
8. Log structures in accordance with ICC 400.
9. Cross-laminated timber used as part of the seismic force-resisting system, unless approved as an alternative system in accordance with Section 104.11.

2301.2 Nominal sizes. For the purposes of this chapter, where dimensions of lumber are specified, they shall be deemed to be nominal dimensions unless specifically designated as actual dimensions (see Section 2304.2).

SECTION 2302 DESIGN REQUIREMENTS

2302.1 General. The design of structural elements or systems, constructed partially or wholly of wood or wood-based products, shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305 and 2306.
2. Load and resistance factor design in accordance with Sections 2304, 2305 and 2307.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.
4. AWC WFCM in accordance with Section 2309.
5. The design and construction of log structures in accordance with the provisions of ICC 400.

SECTION 2303 MINIMUM STANDARDS AND QUALITY

2303.1 General. Structural sawn lumber; end-jointed lumber; prefabricated wood I-joists; structural glued-laminated timber; wood structural panels; fiberboard sheathing (where used structurally); hardboard siding (where used structurally); particleboard; preservative-treated wood; structural log members; structural composite lumber; round timber poles and piles; fire-retardant-treated wood; hardwood plywood; wood trusses; joist hangers; nails; and staples shall conform to the applicable provisions of this section.

2303.1.1 Sawn lumber. Sawn lumber used for load-supporting purposes, including end-jointed or edge-glued lumber, machine stress-rated or machine-evaluated lumber, shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20 or equivalent. Grading practices and identification shall comply with rules published by an agency approved in accordance with the procedures of DOC PS 20 or equivalent procedures.

2303.1.1.1 Certificate of inspection. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspec-

tion agency meeting the requirements of this section is permitted to be accepted for precut, remanufactured or rough-sawn lumber and for sizes larger than 3 inches (76 mm) nominal thickness.

2303.1.1.2 End-jointed lumber. Approved end-jointed lumber is permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required to have a fire-resistance rating shall have the designation “Heat Resistant Adhesive” or “HRA” included in its grade mark.

2303.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.

2303.1.3 Structural glued-laminated timber. Glued-laminated timbers shall be manufactured and identified as required in ANSI/APA 190.1 and ASTM D3737.

2303.1.3.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, IR, 2, 4 & 5] The construction documents shall indicate the following:

1. Dry or wet service conditions.
2. Laminating combinations and stress requirements.
3. Species group.
4. Preservative material and retention, when preservative treatment is required.
5. Provisions for protection during shipping and field handling, such as sealing and wrapping in accordance with AITC 111.

When mechanical reinforcement such as radial tension reinforcement is required, such reinforcement shall comply with AITC 404 and shall be detailed accordingly in the construction documents. Construction documents shall specify that the moisture content of laminations at the time of manufacture shall not exceed 12 percent for dry conditions of use.

The design of fasteners and connections shall comply with AITC 117, Section 1, Item 6 (Connection Design), and NDS Appendix E.

2303.1.4 Structural glued cross-laminated timber. Cross-laminated timbers shall be manufactured and identified in accordance with ANSI/APA PRG 320.

2303.1.4.1 Additional requirements. [DSA-SS & DSA-SS/CC & OSHPD 1, IR, 2, 4 & 5] Requirements in Section 2303.1.3.1 shall apply to glued cross-laminated timber.

2303.1.5 Wood structural panels. Wood structural panels, where used structurally (including those used for siding, roof and wall sheathing, subflooring, diaphragms and built-up members), shall conform to the requirements for their type in DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Each panel or member shall be identified for grade, bond classification, and Performance Category by the trademarks of an approved testing and grading agency. The Performance Category value shall be used as the “nominal panel thickness” or “panel thickness” whenever

referenced in this code. Wood structural panel components shall be designed and fabricated in accordance with the applicable standards listed in Section 2306.1 and identified by the trademarks of an approved testing and inspection agency indicating conformance to the applicable standard. In addition, wood structural panels where permanently exposed in outdoor applications shall be of exterior type, except that wood structural panel roof sheathing exposed to the outdoors on the underside is permitted to be Exposure 1 type.

2303.1.6 Fiberboard. Fiberboard for its various uses shall conform to ASTM C208. Fiberboard sheathing, where used structurally, shall be identified by an approved agency as conforming to ASTM C208.

2303.1.6.1 Jointing. To ensure tight-fitting assemblies, edges shall be manufactured with square, shiplapped, beveled, tongue-and-groove or U-shaped joints.

2303.1.6.2 Roof insulation. Where used as roof insulation in all types of construction, fiberboard shall be protected with an approved roof covering.

2303.1.6.3 Wall insulation. Where installed and fire-blocked to comply with Chapter 7, fiberboards are permitted as wall insulation in all types of construction. In fire walls and fire barriers, unless treated to comply with Section 803.1 for Class A materials, the boards shall be cemented directly to the concrete, masonry or other noncombustible base and shall be protected with an approved noncombustible veneer anchored to the base without intervening airspaces.

2303.1.6.3.1 Protection. Fiberboard wall insulation applied on the exterior of foundation walls shall be protected below ground level with a bituminous coating.

2303.1.7 Hardboard. Hardboard siding shall conform to the requirements of ANSI A135.6 and, where used structurally, shall be identified by the label of an approved agency. Hardboard underlayment shall meet the strength requirements of $\frac{7}{32}$ -inch (5.6 mm) or $\frac{1}{4}$ -inch (6.4 mm) service class hardboard planed or sanded on one side to a uniform thickness of not less than 0.200 inch (5.1 mm). Prefinished hardboard paneling shall meet the requirements of ANSI A135.5. Other basic hardboard products shall meet the requirements of ANSI A135.4. Hardboard products shall be installed in accordance with manufacturer's recommendations.

2303.1.8 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency. Particleboard shall not be utilized for applications other than indicated in this section unless the particleboard complies with the provisions of Section 2306.3.

2303.1.8.1 Floor underlayment. Particleboard floor underlayment shall conform to Type PBU of ANSI A208.1. Type PBU underlayment shall be not less than $\frac{1}{4}$ -inch (6.4 mm) thick and shall be installed in accordance with the instructions of the Composite Panel Association.

2303.1.9 Preservative-treated wood. Lumber, timber, plywood, piles and poles supporting permanent structures required by Section 2304.12 to be preservative treated shall conform to AWPA U1 and M4. Lumber and plywood used in permanent wood foundation systems shall conform to Chapter 18.

2303.1.9.1 Identification. Wood required by Section 2304.12 to be preservative treated shall bear the quality mark of an inspection agency that maintains continuing supervision, testing and inspection over the quality of the preservative-treated wood. Inspection agencies for preservative-treated wood shall be listed by an accreditation body that complies with the requirements of the American Lumber Standards Treated Wood Program, or equivalent. The quality mark shall be on a stamp or label affixed to the preservative-treated wood, and shall include the following information:

1. Identification of treating manufacturer.
2. Type of preservative used.
3. Minimum preservative retention (pcf).
4. End use for which the product is treated.
5. AWPA standard to which the product was treated.
6. Identity of the accredited inspection agency.

2303.1.9.2 Moisture content. Where preservative-treated wood is used in enclosed locations where drying in service cannot readily occur, such wood shall be at a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other materials.

2303.1.10 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

2303.1.11 Structural log members. Stress grading of structural log members of nonrectangular shape, as typically used in log buildings, shall be in accordance with ASTM D3957. Such structural log members shall be identified by the grade mark of an approved lumber grading or inspection agency. In lieu of a grade mark on the material, a certificate of inspection as to species and grade issued by a lumber grading or inspection agency meeting the requirements of this section shall be permitted.

2303.1.12 Round timber poles and piles. Round timber poles and piles shall comply with ASTM D3200 and ASTM D25, respectively.

2303.1.13 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

2303.2 Fire-retardant-treated wood. Fire-retardant-treated wood is any wood product that, when impregnated with

chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less. Additionally, the ASTM E84 or UL 723 test shall be continued for a 20-minute period and the flame front shall not progress more than 10¹/₂ feet (3200 mm) beyond the centerline of the burners at any time during the test.

2303.2.1 Pressure process. For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (345 kPa).

2303.2.2 Other means during manufacture. For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required in this section.

2303.2.3 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of 1/8 inch (3.2 mm).

2303.2.4 Labeling. In addition to the labels required in Section 2303.1.1 for sawn lumber and Section 2303.1.5 for wood structural panels, each piece of fire-retardant-treated lumber and wood structural panels shall be labeled. The label shall contain the following items:

1. The identification mark of an approved agency in accordance with Section 1703.5.
2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread and smoke-developed index.
6. Method of drying after treatment.
7. Conformance with appropriate standards in accordance with Sections 2303.2.5 through 2303.2.8.
8. For fire-retardant-treated wood exposed to weather, damp or wet locations, include the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D2898).

2303.2.5 Strength adjustments. Design values for untreated lumber and wood structural panels, as specified in Section 2303.1, shall be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

2303.2.5.1 Wood structural panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM

D5516 shall be used to develop adjustment factors, maximum loads and spans, or both, for untreated plywood design values in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for its treatment.

2303.2.5.2 Lumber. For each species of wood that is treated, the effects of the treatment, the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

2303.2.6 Exposure to weather, damp or wet locations. Where fire-retardant-treated wood is exposed to weather, or damp or wet locations, it shall be identified as “Exterior” to indicate there is no increase in the listed flame spread index as defined in Section 2303.2 when subjected to ASTM D2898.

2303.2.7 Interior applications. Interior fire-retardant-treated wood shall have moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section 2303.2.5.1 or 2303.2.5.2. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

2303.2.8 Moisture content. Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln-dried after treatment (KDAT), the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section 2303.2.5.1 for plywood and 2303.2.5.2 for lumber.

2303.2.9 Types I and II construction applications. See Section 603.1 for limitations on the use of fire-retardant-treated wood in buildings of Type I or II construction.

2303.3 Hardwood and plywood. Hardwood and decorative plywood shall be manufactured and identified as required in HPVA HP-1.

2303.4 Trusses. Wood trusses shall comply with Sections 2303.4.1 through 2303.4.7.

2303.4.1 Design. Wood trusses shall be designed in accordance with the provisions of this code and accepted engineering practice. Members are permitted to be joined by nails, glue, bolts, timber connectors, metal connector plates or other approved framing devices.

2303.4.1.1 Truss design drawings. The written, graphic and pictorial depiction of each individual truss

shall be provided to the building official for approval prior to installation. Truss design drawings shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the following information:

1. Slope or depth, span and spacing.
2. Location of all joints and support locations.
3. Number of plies if greater than one.
4. Required bearing widths.
5. Design loads as applicable, including:
 - 5.1. Top chord live load.
 - 5.2. Top chord dead load.
 - 5.3. Bottom chord live load.
 - 5.4. Bottom chord dead load.
 - 5.5. Additional loads and locations.
 - 5.6. Environmental design criteria and loads (such as wind, rain, snow, seismic).
6. Other lateral loads, including drag strut loads.
7. Adjustments to wood member and metal connector plate design value for conditions of use.
8. Maximum reaction force and direction, including maximum uplift reaction forces where applicable.
9. Joint connection type and description, such as size and thickness or gage, and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
10. Size, species and grade for each wood member.
11. Truss-to-truss connections and truss field assembly requirements.
12. Calculated span-to-deflection ratio and maximum vertical and horizontal deflection for live and total load as applicable.
13. Maximum axial tension and compression forces in the truss members.
14. Required permanent individual truss member restraint location and the method and details of restraint and diagonal bracing to be used in accordance with Section 2303.4.1.2.

2303.4.1.2 Permanent individual truss member restraint (PITMR) and permanent individual truss member diagonal bracing (PITMDB). Where the truss design drawings designate the need for permanent individual truss member restraint, it shall be accomplished by one of the following methods:

1. *PITMR* and *PITMDB* installed using standard industry lateral restraint and diagonal bracing details in accordance with TPI 1, Section 2.3.3.1.1, accepted engineering practice, or Figures 2303.4.1.2(1), (3), and (5).
2. Individual truss member reinforcement in place of the specified lateral restraints (i.e., buckling

reinforcement such as T-reinforcement, L-reinforcement, proprietary reinforcement, etc.) such that the buckling of any individual truss member is resisted internally by the individual truss. The buckling reinforcement of individual truss members shall be installed as shown on the truss design drawing, on supplemental truss member buckling reinforcement details provided by the truss designer or in accordance with Figures 2303.4.1.2 (2) and (4).

3. A project-specific *PITMR* and *PITMDB* design provided by any registered design professional.

2303.4.1.2.1 Trusses installed without a diaphragm. Trusses installed without a diaphragm on the top or bottom chord shall require a project specific *PITMR* and *PITMDB* design prepared by a registered design professional.

Exception: Group U occupancies.

2303.4.1.3 Trusses spanning 60 feet or greater. The owner or the owner's authorized agent shall contract with any qualified registered design professional for the design of the temporary installation restraint and diagonal bracing and the *PITMR* and *PITMDB* for all trusses with clear spans 60 feet (18 288 mm) or greater.

2303.4.1.4 Truss designer. The individual or organization responsible for the design of trusses.

2303.4.1.4.1 Truss design drawings. Where required by the registered design professional, the building official or the statutes of the jurisdiction in which the project is to be constructed, each individual truss design drawing shall bear the seal and signature of the truss designer.

Exceptions:

1. Where a cover sheet and truss index sheet are combined into a single sheet and attached to the set of truss design drawings, the single cover/truss index sheet is the only document required to be signed and sealed by the truss designer.
2. Where a cover sheet and a truss index sheet are separately provided and attached to the set of truss design drawings, the cover sheet and the truss index sheet are the only documents required to be signed and sealed by the truss designer.
3. *[DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] Exceptions 1 and 2 are not permitted by DSA and OSHPD.*

2303.4.2 Truss placement diagram. The truss manufacturer shall provide a truss placement diagram that identifies the proposed location for each individually designated truss and references the corresponding truss design drawing. The truss placement diagram shall be provided as part of the truss submittal package, and with the shipment of trusses delivered to the job site. Truss placement diagrams that serve only as a guide for installation and do not deviate

from the permit submittal drawings shall not be required to bear the seal or signature of the truss designer.

2303.4.3 Truss submittal package. The truss submittal package provided by the truss manufacturer shall consist of each individual truss design drawing, the truss placement diagram, the permanent individual truss member restraint/bracing method and details and any other structural details germane to the trusses; and, as applicable, the cover/truss index sheet.

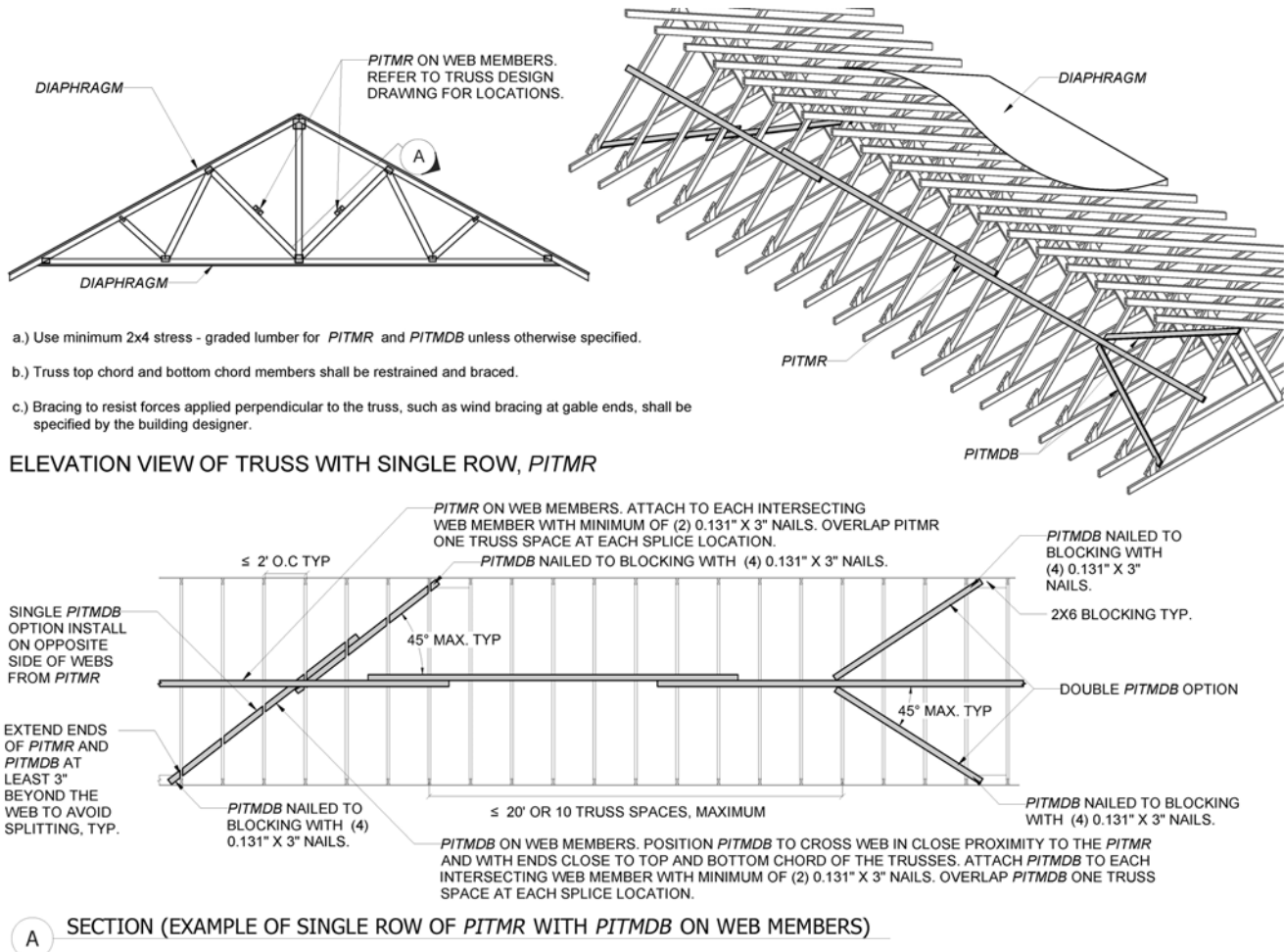
2303.4.3.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] In addition to Sections 2303.4.1 and 2303.4.2, the following requirements apply:

1. **Construction documents.** The construction documents prepared by the registered engineer or licensed architect for the project shall indicate all requirements for the truss design, including:
 - 1.1 Deflection criteria.
 - 1.2 Connection details to structural and non-structural elements (e.g. non-bearing partitions).

2. **Requirements for approval.** The truss design drawings and engineering analysis shall be provided to the enforcement agency and approved prior to truss fabrication, in accordance with the California Administrative Code (Title 24, Part 1). Alterations to the approved truss design drawings or manufactured trusses are subject to the approval of the enforcement agency.

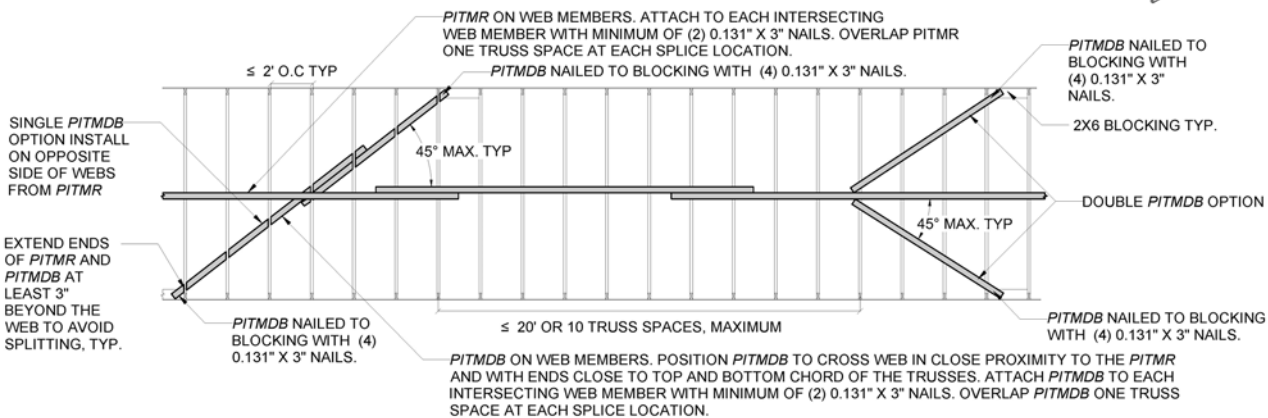
2303.4.4 Anchorage. The design for the transfer of loads and anchorage of each truss to the supporting structure is the responsibility of the registered design professional.

2303.4.5 Alterations to trusses. Truss members and components shall not be cut, notched, drilled, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (for example, HVAC equipment, piping, additional roofing or insulation) shall not be permitted without verification that the truss is capable of supporting such additional loading.



- a.) Use minimum 2x4 stress - graded lumber for PITMR and PITMDB unless otherwise specified.
- b.) Truss top chord and bottom chord members shall be restrained and braced.
- c.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.

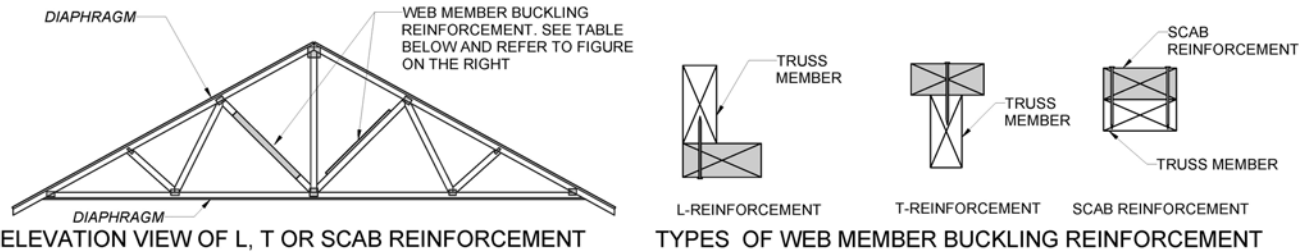
ELEVATION VIEW OF TRUSS WITH SINGLE ROW, PITMR



A SECTION (EXAMPLE OF SINGLE ROW OF PITMR WITH PITMDB ON WEB MEMBERS)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 2303.4.1.2 (1)
PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING ONE ROW OF PITMR**



- a.) Truss top chord and bottom chord members shall be restrained and braced.
- b.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.
- c.) Use the table below unless project specific web member reinforcement is provided on the truss design drawing or supplemental truss buckling reinforcement details are provided by the truss designer.

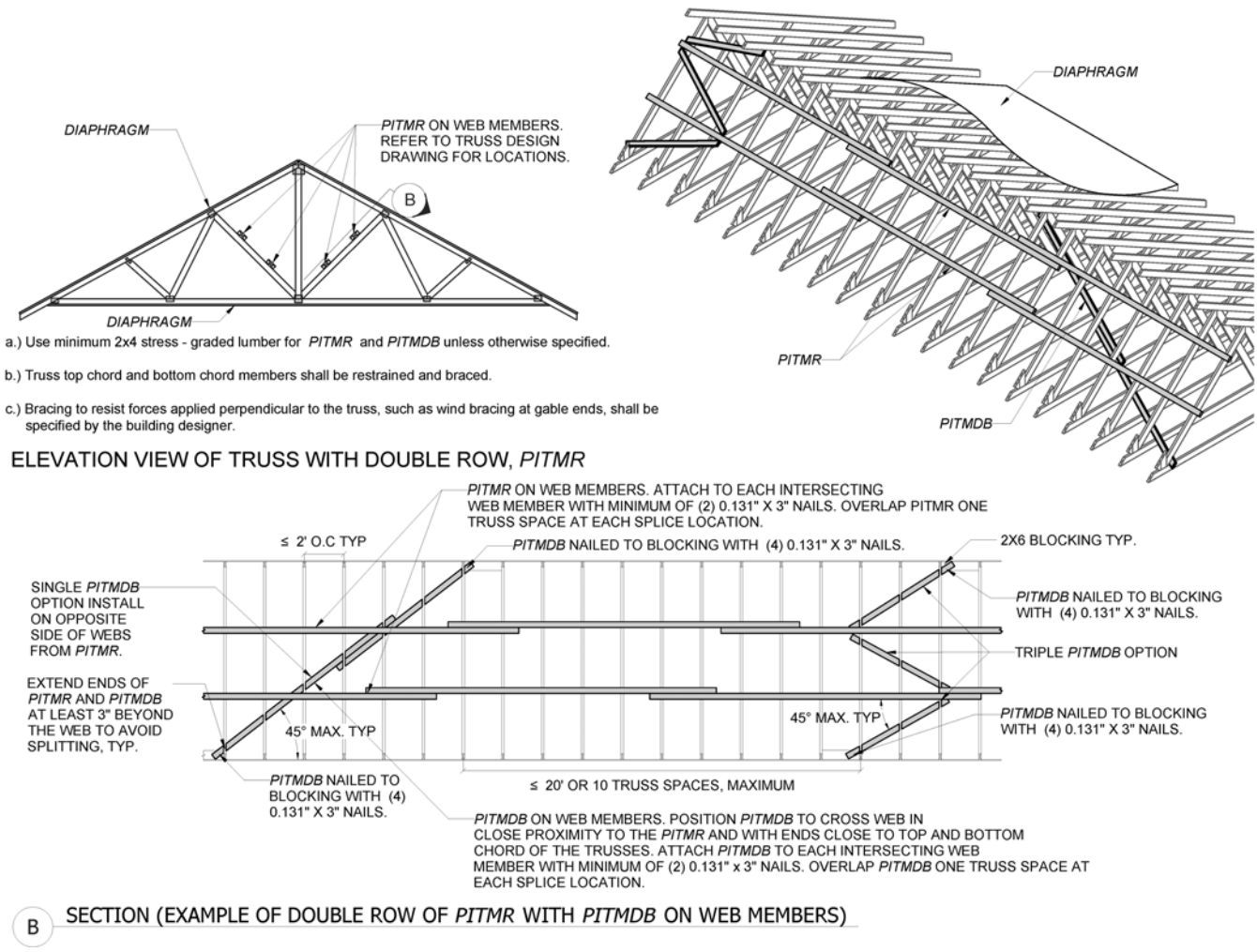
NUMBER OF ROWS OF PITMR SPECIFIED ON WEB MEMBER	SIZE OF TRUSS WEB	TYPE AND SIZE OF WEB REINFORCEMENT ¹ FOR T, L OR SCAB ²	GRADE OF WEB REINFORCEMENT	MINIMUM LENGTH OF WEB REINFORCEMENT	MINIMUM CONNECTION OF WEB REINFORCEMENT TO WEB
ONE	2x4	2x4	Same species and grade or better than web member	90% of web or extend to within 6" of end of web member, whichever is greater	(0.131" x 3") nails at 6" on-center ²
	2x6	2x6			
	2x8	2x8			

¹Maximum allowable web length is 14'

²Attach Scab reinforcement to web with two rows of minimum 0.131" x 3" nails at 6" on-center

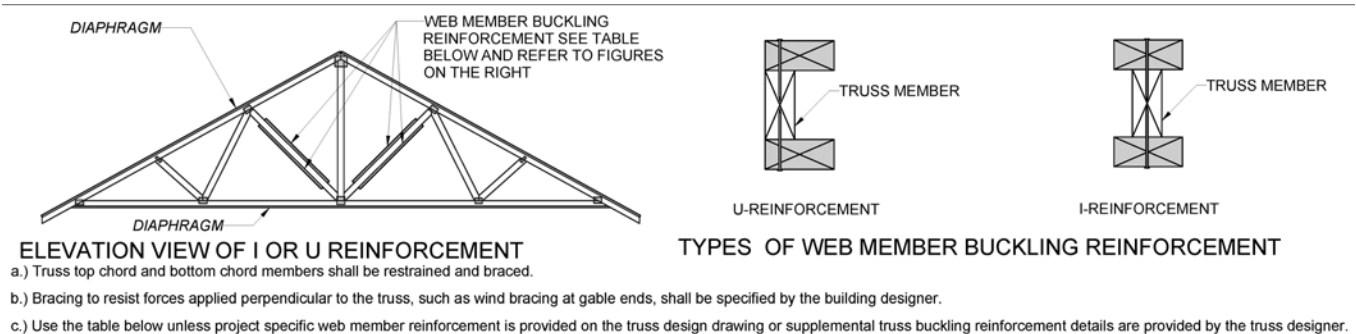
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(2)
ALTERNATIVE INSTALLATION USING BUCKLING REINFORCEMENT FOR TRUSS WEB MEMBERS IN LIEU OF ONE ROW OF PITMR



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(3)
PITMR AND PITMDB FOR TRUSS WEB MEMBERS REQUIRING TWO ROWS OF PITMR



NUMBER OF ROWS OF PITMR SPECIFIED ON WEB MEMBER	SIZE OF TRUSS WEB	TYPE AND SIZE OF WEB FOR I OR U REINFORCEMENT ¹	GRADE OF WEB REINFORCEMENT	MINIMUM LENGTH OF WEB REINFORCEMENT	MINIMUM CONNECTION OF WEB REINFORCEMENT TO WEB
TWO	2x4	(2) -2x4	Same species and grade or better than web member	90% of web or extend to within 6" of end of web member, whichever is greater	(0.131" x 3") nails at 6" on-center
	2x6	(2) -2x6			
	2x8	(2) -2x8			

¹Maximum allowable web length is 14'

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2303.4.1.2(4)
ALTERNATIVE INSTALLATION USING BUCKLING REINFORCEMENT FOR TRUSS WEB MEMBERS IN LIEU OF TWO ROWS OF PITMR

WOOD

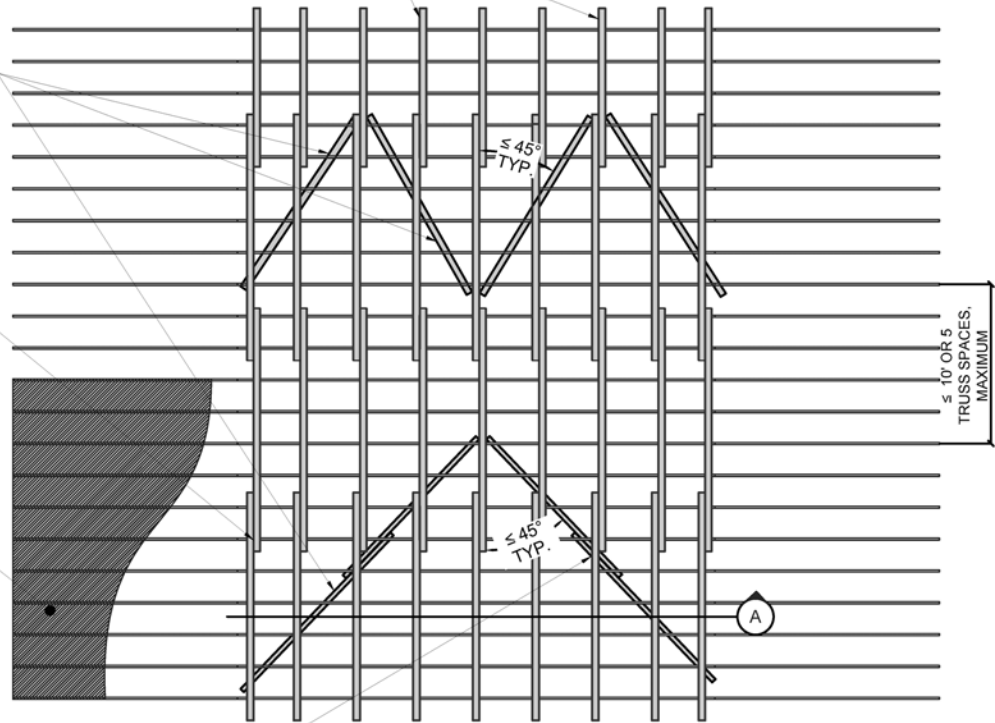
PITMR INSTALLED ON TOP CHORD OF SUPPORTING TRUSSES. REFER TO TRUSS DESIGN DRAWINGS FOR SPACING AND LOCATION. ATTACH TO EACH TOP CHORD WITH MINIMUM (2) 0.131" X 3" NAILS. LAP *PITMR* AT LEAST ONE TRUSS SPACE AT EACH SPLICE LOCATION.

PITMDB INSTALLED ON BOTTOM EDGE OF TOP CHORD OF THE SUPPORTING TRUSSES. ATTACH TO EACH TOP CHORD WITH MINIMUM (2) 0.131" X 3" NAILS. REPEAT *PITMDB* AT ≤ 10' OR 5 TRUSS SPACES MAXIMUM.

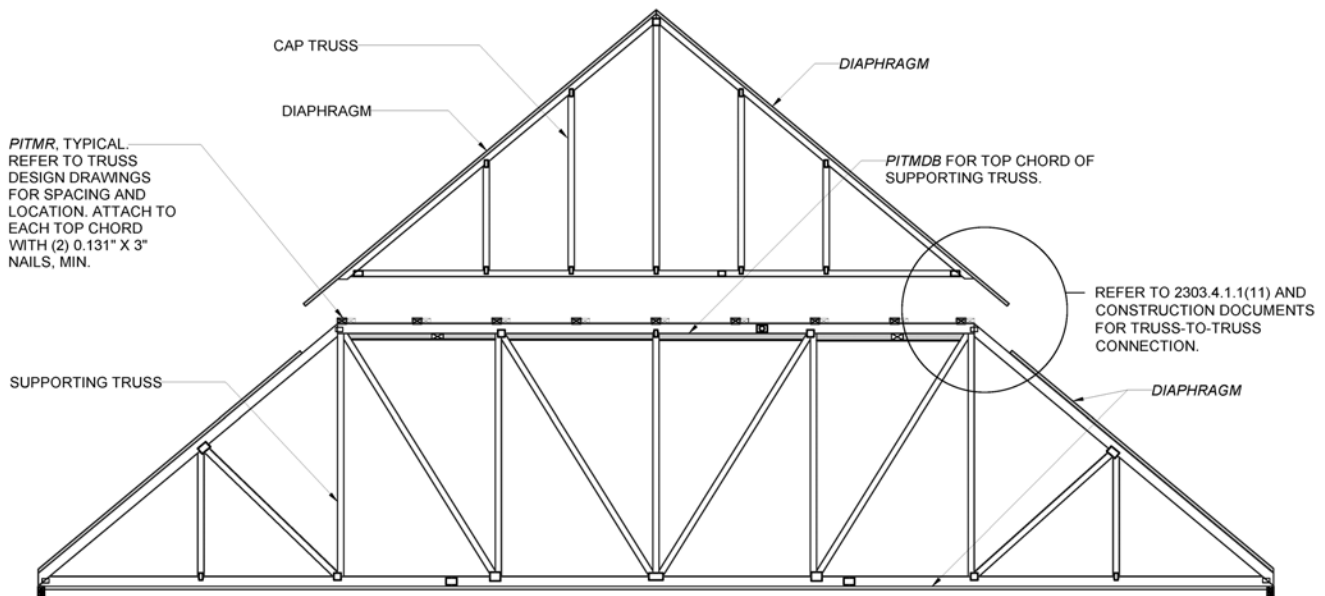
EXTEND ENDS OF *PITMR* AND *PITMDB* AT LEAST 3" BEYOND THE TOP CHORD TO AVOID SPLITTING, TYP.

DIAPHRAGM

LAP *PITMDB* AT LEAST ONE TRUSS SPACE AT EACH SPLICE LOCATION.



PLAN VIEW



PITMR, TYPICAL. REFER TO TRUSS DESIGN DRAWINGS FOR SPACING AND LOCATION. ATTACH TO EACH TOP CHORD WITH (2) 0.131" X 3" NAILS, MIN.

PITMDB FOR TOP CHORD OF SUPPORTING TRUSS.

REFER TO 2303.4.1.1(11) AND CONSTRUCTION DOCUMENTS FOR TRUSS-TO-TRUSS CONNECTION.

- a.) Use minimum 2x4 stress - graded lumber for *PITMR* and *PITMDB* unless otherwise specified.
- b.) Web *PITMR* and *PITMDB* not shown for clarity.
- c.) Truss top chord and bottom chord members shall be restrained and braced.
- d.) Bracing to resist forces applied perpendicular to the truss, such as wind bracing at gable ends, shall be specified by the building designer.

SECTION AT A

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 2303.4.1.2(5)
PITMR AND PITMDB FOR FLAT PORTION OF TOP CHORD IN A PIGGYBACK ASSEMBLY**

2303.4.6 TPI 1 specifications. In addition to Sections 2303.4.1 through 2303.4.5, the design, manufacture and quality assurance of metal-plate-connected wood trusses shall be in accordance with TPI 1. Job-site inspections shall be in compliance with Section 110.4, as applicable.

2303.4.7 Truss quality assurance. Trusses not part of a manufacturing process in accordance with either Section 2303.4.6 or a referenced standard, which provides requirements for quality control done under the supervision of a third-party quality control agency, shall be manufactured in compliance with Sections 1704.2.5 and 1705.5, as applicable.

2303.5 Test standard for joist hangers. Joist hangers shall be in accordance with ASTM D7147.

2303.6 Nails and staples. Nails and staples shall conform to requirements of ASTM F1667, including Supplement 1. Nails used for framing and sheathing connections shall have minimum average bending yield strengths as follows: 80 kips per square inch (ksi) (551 MPa) for shank diameters larger than 0.177 inch (4.50 mm) but not larger than 0.254 inch (6.45 mm), 90 ksi (620 MPa) for shank diameters larger than 0.142 inch (3.61 mm) but not larger than 0.177 inch (4.50 mm) and 100 ksi (689 MPa) for shank diameters of not less than 0.099 inch (2.51 mm) but not larger than 0.142 inch (3.61 mm). Staples used for framing and sheathing connections shall have minimum average bending moments as follows: 3.6 in.-lbs (0.41 N-m) for No. 16 gage staples, 4.0 in.-lbs (0.45 N-m) for No. 15 gage staples, and 4.3 in.-lbs (0.49 N-m) for No. 14 gage staples.

2303.7 Shrinkage. Consideration shall be given in design for the effects of wood cross-grain dimensional changes that occur as a result of changes in the wood moisture content after installation.

SECTION 2304 GENERAL CONSTRUCTION REQUIREMENTS

2304.1 General. The provisions of this section apply to design methods specified in Section 2302.1.

2304.2 Size of structural members. Computations to determine the required sizes of members shall be based on the net dimensions (actual sizes) and not nominal sizes.

2304.3 Wall framing. The framing of exterior and interior walls shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.3.1 Bottom plates. Studs shall have full bearing on a 2-inch-thick (actual 1½-inch, 38 mm) or larger plate or sill having a width not less than equal to the width of the studs.

2304.3.1.1 [HCD 1] Rodent proofing. Annular spaces around pipes, electric cables, conduits or other openings in bottom/sole plates at exterior walls shall be protected against the passage of rodents by closing such openings in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.4.

2304.3.2 Framing over openings. Headers, double joists, trusses or other approved assemblies that are of adequate size to transfer loads to the vertical members shall be provided over window and door openings in load-bearing walls and partitions.

2304.3.3 Shrinkage. Wood walls and bearing partitions shall not support more than two floors and a roof unless an analysis satisfactory to the building official shows that shrinkage of the wood framing will not have adverse effects on the structure or any plumbing, electrical or mechanical systems or other equipment installed therein due to excessive shrinkage or differential movements caused by shrinkage. The analysis shall show that the roof drainage system and the foregoing systems or equipment will not be adversely affected or, as an alternate, such systems shall be designed to accommodate the differential shrinkage or movements.

2304.3.4 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] The following additional requirements apply:

1. Engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2302.1, Item 1 or 2.
2. Construction documents shall include detailing of sill plate anchorage to supporting masonry or concrete for all exterior and interior bearing, nonbearing and shear walls. Unless specifically designed in accordance with Item 1 above, sills under exterior walls, bearing walls and shear walls shall be bolted to masonry or concrete with 5/8 inch diameter by 12-inch (16 mm by 305 mm) bolts spaced not more than four (4) feet (1219 mm) on center, with a minimum of two (2) bolts for each piece of sill plate. Anchor bolts shall have a 4 inch minimum and a 12-inch maximum clearance to the end of the sill plate, and 7-inch minimum embedment into concrete or masonry.

Unless specifically designed in accordance with Item 1 above, sill plates under nonbearing interior partitions on concrete floor slabs shall be anchored at not more than four (4) feet (1219 mm) on center to resist a minimum allowable stress shear of 100 pounds per linear foot (1.4 kN/m) acting either parallel or perpendicular to the wall.

3. Construction documents shall include detailing and limitations for notches and bored holes in wall studs, plates and sills.

2304.4 Floor and roof framing. The framing of wood-joisted floors and wood-framed roofs shall be in accordance with the provisions specified in Section 2308 unless a specific design is furnished.

2304.4.1 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] The following additional requirements apply:

1. Engineering analysis shall be furnished that demonstrates compliance of floor, roof and ceiling framing elements and connections with Section 2302.1, Items 1 or 2.

WOOD

2. Construction documents shall include detailing and limitations for notches and bored holes in floor and roof framing members.

2304.5 Framing around flues and chimneys. Combustible framing shall be not less than 2 inches (51 mm), but shall be not less than the distance specified in Sections 2111 and 2113 and the *California Mechanical Code*, from flues, chimneys and fireplaces, and 6 inches (152 mm) away from flue openings.

2304.6 Exterior wall sheathing. Wall sheathing on the outside of exterior walls, including gables, and the connection of the sheathing to framing shall be designed in accordance with the general provisions of this code and shall be capable of resisting wind pressures in accordance with Section 1609.

2304.6.1 Wood structural panel sheathing. Where wood structural panel sheathing is used as the exposed finish on the outside of exterior walls, it shall have an exterior exposure durability classification. Where wood structural panel sheathing is used elsewhere, but not as the exposed finish, it shall be of a type manufactured with exterior glue (Exposure 1 or Exterior). Wood structural panel sheathing, connections and framing spacing shall be in accordance with Table 2304.6.1 for the applicable wind speed and exposure category where used in enclosed buildings with a mean roof height not greater than 30 feet (9144 mm) and a topographic factor ($K_{z,t}$) of 1.0.

2304.7 Interior paneling. Softwood wood structural panels used for interior paneling shall conform to the provisions of Chapter 8 and shall be installed in accordance with Table 2304.10.2. Panels shall comply with DOC PS 1, DOC PS 2 or ANSI/APA PRP 210. Prefinished hardboard paneling shall meet the requirements of ANSI A135.5. Hardwood plywood shall conform to HPVA HP-1.

2304.8 Floor and roof sheathing. Structural floor sheathing and structural roof sheathing shall comply with Sections 2304.8.1 and 2304.8.2, respectively.

2304.8.1 Structural floor sheathing. Structural floor sheathing shall be designed in accordance with the general provisions of this code.

Floor sheathing conforming to the provisions of Table 2304.8(1), 2304.8(2), 2304.8(3) or 2304.8(4) shall be deemed to meet the requirements of this section.

2304.8.2 Structural roof sheathing. Structural roof sheathing shall be designed in accordance with the general provisions of this code and the special provisions in this section.

Roof sheathing conforming to the provisions of Table 2304.8(1), 2304.8(2), 2304.8(3) or 2304.8(5) shall be deemed to meet the requirements of this section. Wood structural panel roof sheathing shall be of a type manufactured with exterior glue (Exposure 1 or Exterior).

2304.9 Lumber decking. Lumber decking shall be designed and installed in accordance with the general provisions of this code and Sections 2304.9.1 through 2304.9.5.3. Other lumber decking patterns and connection designs shall be substantiated through engineering analysis.

2304.9.1 General. Each piece of lumber decking shall be square-end trimmed. Where random lengths are furnished, each piece shall be square end trimmed across the face so that not less than 90 percent of the pieces are within 0.5 degrees (0.00873 rad) of square. The ends of the pieces shall be permitted to be beveled up to 2 degrees (0.0349 rad) from the vertical with the exposed face of the piece slightly longer than the opposite face of the piece. Tongue-and-groove decking shall be installed with the tongues up on sloped or pitched roofs with pattern faces down.

TABLE 2304.6.1
MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V_{asd} PERMITTED FOR
WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES^{a, b, c}

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		MAXIMUM ALLOWABLE STRESS DESIGN WIND SPEED, V_{asd} (MPH)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d common (2.0" × 0.113")	1.5	24/0	3/8	16	6	12	110	90	85
		24/16	7/16	16	6	12	110	100	90
						6	150	125	110
8d common (2.5" × 0.131")	1.75	24/16	7/16	16	6	12	130	110	105
						6	150	125	110
				24	6	12	110	90	85
						6	110	90	85

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. Panel strength axis shall be parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.
- b. The table is based on wind pressures acting toward and away from building surfaces in accordance with Section 30.7 of ASCE 7. Lateral requirements shall be in accordance with Section 2305 or 2308.
- c. Wood structural panels with span ratings of wall-16 or wall-24 shall be permitted as an alternative to panels with a 24/0 span rating. Plywood siding rated 16 on center or 24 on center shall be permitted as an alternative to panels with a 24/16 span rating. Wall-16 and plywood siding 16 on center shall be used with studs spaced not more than 16 inches on center.
- d. V_{asd} shall be determined in accordance with Section 1609.3.1.

TABLE 2304.8(1)
ALLOWABLE SPANS FOR LUMBER FLOOR AND ROOF SHEATHING

SPAN (inches)	MINIMUM NET THICKNESS (inches) OF LUMBER PLACED			
	Perpendicular to supports		Diagonally to supports	
	Surfaced dry ^a	Surfaced unseasoned	Surfaced dry ^a	Surfaced unseasoned
Floors				
24	$\frac{3}{4}$	$\frac{25}{32}$	$\frac{3}{4}$	$\frac{25}{32}$
16	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{5}{8}$	$\frac{11}{16}$
Roofs				
24	$\frac{5}{8}$	$\frac{11}{16}$	$\frac{3}{4}$	$\frac{25}{32}$

For SI: 1 inch = 25.4 mm.

a. Maximum 19-percent moisture content.

TABLE 2304.8(2)
SHEATHING LUMBER, MINIMUM GRADE REQUIREMENTS: BOARD GRADE

SOLID FLOOR OR ROOF SHEATHING	SPACED ROOF SHEATHING	GRADING RULES
Utility	Standard	NLGA, WCLIB, WWPA
4 common or utility	3 common or standard	NLGA, WCLIB, WWPA, NSLB or NELMA
No. 3	No. 2	SPIB
Merchantable	Construction common	RIS

TABLE 2304.8(3)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANEL SHEATHING AND SINGLE-FLOOR GRADES CONTINUOUS OVER TWO OR MORE SPANS WITH STRENGTH AXIS PERPENDICULAR TO SUPPORTS^a

SHEATHING GRADES		ROOF ^b				FLOOR ^c
Panel span rating roof/floor span	Panel thickness (inches)	Maximum span (inches)		Load ^d (psf)		Maximum span (inches)
		With edge support ^e	Without edge support	Total load	Live load	
16/0	$\frac{3}{8}$	16	16	40	30	0
20/0	$\frac{3}{8}$	20	20	40	30	0
24/0	$\frac{3}{8}, \frac{7}{16}, \frac{1}{2}$	24	20 ^f	40	30	0
24/16	$\frac{7}{16}, \frac{1}{2}$	24	24	50	40	16
32/16	$\frac{15}{32}, \frac{1}{2}, \frac{5}{8}$	32	28	40	30	16 ^g
40/20	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}, \frac{7}{8}$	40	32	40	30	20 ^{g,h}
48/24	$\frac{23}{32}, \frac{3}{4}, \frac{7}{8}$	48	36	45	35	24
54/32	$\frac{7}{8}, 1$	54	40	45	35	32
60/32	$\frac{7}{8}, 1\frac{1}{8}$	60	48	45	35	32
SINGLE FLOOR GRADES		ROOF ^b				FLOOR ^c
Panel span rating	Panel thickness (inches)	Maximum span (inches)		Load ^e (psf)		Maximum span (inches)
		With edge support ^e	Without edge support	Total load	Live load	
16 o.c.	$\frac{1}{2}, \frac{19}{32}, \frac{5}{8}$	24	24	50	40	16 ^g
20 o.c.	$\frac{19}{32}, \frac{5}{8}, \frac{3}{4}$	32	32	40	30	20 ^{g,h}
24 o.c.	$\frac{23}{32}, \frac{3}{4}$	48	36	35	25	24
32 o.c.	$\frac{7}{8}, 1$	48	40	50	40	32
48 o.c.	$1\frac{3}{32}, 1\frac{1}{8}$	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

- Applies to panels 24 inches or wider.
- Uniform load deflection limitations $\frac{1}{180}$ of span under live load plus dead load, $\frac{1}{240}$ under live load only.
- Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking unless $\frac{1}{4}$ -inch minimum thickness underlayment or $1\frac{1}{2}$ inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is $\frac{3}{4}$ -inch wood strip. Allowable uniform load based on deflection of $\frac{1}{360}$ of span is 100 pounds per square foot except the span rating of 48 inches on center is based on a total load of 65 pounds per square foot.
- Allowable load at maximum span.
- Tongue-and-groove edges, panel edge clips (one midway between each support, except two equally spaced between supports 48 inches on center), lumber blocking or other. Only lumber blocking shall satisfy blocked diaphragm requirements.
- For $\frac{1}{2}$ -inch panel, maximum span shall be 24 inches.
- Span is permitted to be 24 inches on center where $\frac{3}{4}$ -inch wood strip flooring is installed at right angles to joist.
- Span is permitted to be 24 inches on center for floors where $1\frac{1}{2}$ inches of cellular or lightweight concrete is applied over the panels.

TABLE 2304.8(4)
ALLOWABLE SPAN FOR WOOD STRUCTURAL PANEL COMBINATION SUBFLOOR-UNDERLAYMENT (SINGLE FLOOR)^a
(Panels Continuous Over Two or More Spans and Strength Axis Perpendicular to Supports)

IDENTIFICATION	MAXIMUM SPACING OF JOISTS (inches)				
	16	20	24	32	48
Species group ^b	Thickness (inches)				
1	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	—	—
2, 3	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	—	—
4	$\frac{3}{4}$	$\frac{7}{8}$	1	—	—
Single floor span rating ^c	16 o.c.	20 o.c.	24 o.c.	32 o.c.	48 o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

- a. Spans limited to value shown because of possible effects of concentrated loads. Allowable uniform loads based on deflection of $\frac{1}{360}$ of span is 100 pounds per square foot except allowable total uniform load for $1\frac{1}{8}$ -inch wood structural panels over joists spaced 48 inches on center is 65 pounds per square foot. Panel edges shall have approved tongue-and-groove joints or shall be supported with blocking, unless $\frac{1}{4}$ -inch minimum thickness underlayment or $1\frac{1}{2}$ inches of approved cellular or lightweight concrete is placed over the subfloor, or finish floor is $\frac{3}{4}$ -inch wood strip.
- b. Applicable to all grades of sanded exterior-type plywood. See DOC PS 1 for plywood species groups.
- c. Applicable to Underlayment grade, C-C (Plugged) plywood, and Single Floor grade wood structural panels.

TABLE 2304.8(5)
ALLOWABLE LOAD (PSF) FOR WOOD STRUCTURAL PANEL ROOF SHEATHING CONTINUOUS
OVER TWO OR MORE SPANS AND STRENGTH AXIS PARALLEL TO SUPPORTS
(Plywood structural panels are five-ply, five-layer unless otherwise noted)^a

PANEL GRADE	THICKNESS (inch)	MAXIMUM SPAN (inches)	LOAD AT MAXIMUM SPAN (psf)	
			Live	Total
Structural I sheathing	$\frac{7}{16}$	24	20	30
	$\frac{15}{32}$	24	35 ^b	45 ^b
	$\frac{1}{2}$	24	40 ^b	50 ^b
	$\frac{19}{32}, \frac{5}{8}$	24	70	80
	$\frac{23}{32}, \frac{3}{4}$	24	90	100
Sheathing, other grades covered in DOC PS 1 or DOC PS 2	$\frac{7}{16}$	16	40	50
	$\frac{15}{32}$	24	20	25
	$\frac{1}{2}$	24	25	30
	$\frac{19}{32}$	24	40 ^b	50 ^b
	$\frac{5}{8}$	24	45 ^b	55 ^b
	$\frac{23}{32}, \frac{3}{4}$	24	60 ^b	65 ^b

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kN/m².

- a. Uniform load deflection limitations $\frac{1}{180}$ of span under live load plus dead load, $\frac{1}{240}$ under live load only. Edges shall be blocked with lumber or other approved type of edge supports.
- b. For composite and four-ply plywood structural panel, load shall be reduced by 15 pounds per square foot.

2304.9.2 Layup patterns. Lumber decking is permitted to be laid up following one of five standard patterns as defined in Sections 2304.9.2.1 through 2304.9.2.5.

2304.9.2.1 Simple span pattern. All pieces shall be supported on their ends (in other words, by two supports).

2304.9.2.2 Two-span continuous pattern. All pieces shall be supported by three supports, and all end joints shall occur in line on alternating supports. Supporting members shall be designed to accommodate the load redistribution caused by this pattern.

2304.9.2.3 Combination simple and two-span continuous pattern. Courses in end spans shall be alternating simple-span pattern and two-span continu-

ous pattern. End joints shall be staggered in adjacent courses and shall bear on supports.

2304.9.2.4 Cantilevered pieces intermixed pattern. The decking shall extend across not fewer than three spans. Pieces in each starter course and every third course shall be simple span pattern. Pieces in other courses shall be cantilevered over the supports with end joints at alternating quarter or third points of the spans. Each piece shall bear on one support or more.

2304.9.2.5 Controlled random pattern. The decking shall extend across not fewer than three spans. End joints of pieces within 6 inches (152 mm) of the end joints of the adjacent pieces in either direction shall be

separated by not fewer than two intervening courses. In the end bays, each piece shall bear on one support or more. Where an end joint occurs in an end bay, the next piece in the same course shall continue over the first inner support for not less than 24 inches (610 mm). The details of the controlled random pattern shall be as specified for each decking material in Section 2304.9.3.3, 2304.9.4.3 or 2304.9.5.3.

Decking that cantilevers beyond a support for a horizontal distance greater than 18 inches (457 mm), 24 inches (610 mm) or 36 inches (914 mm) for 2-inch (51 mm), 3-inch (76 mm) and 4-inch (102 mm) nominal thickness decking, respectively, shall comply with the following:

1. The maximum cantilevered length shall be 30 percent of the length of the first adjacent interior span.
2. A structural fascia shall be fastened to each decking piece to maintain a continuous, straight line.
3. End joints shall not be in the decking between the cantilevered end of the decking and the centerline of the first adjacent interior span.

2304.9.3 Mechanically laminated decking. Mechanically laminated decking shall comply with Sections 2304.9.3.1 through 2304.9.3.3.

2304.9.3.1 General. Mechanically laminated decking consists of square-edged dimension lumber laminations set on edge and nailed to the adjacent pieces and to the supports.

2304.9.3.2 Nailing. The length of nails connecting laminations shall be not less than two and one-half times the net thickness of each lamination. Where decking supports are 48 inches (1219 mm) on center or less, side nails shall be installed not more than 30 inches (762 mm) on center alternating between top and bottom edges, and staggered one-third of the spacing in adjacent laminations. Where supports are spaced more than 48 inches (1219 mm) on center, side nails shall be installed not more than 18 inches (457 mm) on center alternating between top and bottom edges and staggered one-third of the spacing in adjacent laminations. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, nailing in accordance with Table 2304.9.3.2 shall be permitted. Two side nails shall be installed at each end of butt-jointed pieces.

Laminations shall be toenailed to supports with 20d or larger common nails. Where the supports are 48 inches (1219 mm) on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches (1219 mm) on center, alternate laminations shall be toenailed to every support. For mechanically laminated decking constructed with laminations of 2-inch (51 mm) nominal thickness, toenailing in accordance with Table 2304.9.3.2 shall be permitted.

2304.9.3.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring

**TABLE 2304.9.3.2
FASTENING SCHEDULE FOR MECHANICALLY LAMINATED DECKING USING LAMINATIONS OF 2-INCH NOMINAL THICKNESS**

MINIMUM NAIL SIZE (Length x Diameter) (inches)	MAXIMUM SPACING BETWEEN FACE NAILS ^{a, b} (inches)		NUMBER OF TOENAILS INTO SUPPORTS ^c
	Decking Supports ≤ 48 inches o.c.	Decking Supports > 48 inches o.c.	
4 × 0.192	30	18	1
4 × 0.162	24	14	2
4 × 0.148	22	13	2
3½ × 0.162	20	12	2
3½ × 0.148	19	11	2
3½ × 0.135	17	10	2
3 × 0.148	11	7	2
3 × 0.128	9	5	2
2¾ × 0.148	10	6	2
2¾ × 0.131	9	6	3
2¾ × 0.120	8	5	3

For SI: 1 inch = 25.4 mm

- a. Nails shall be driven perpendicular to the lamination face, alternating between top and bottom edges.
- b. Where nails penetrate through two laminations and into the third, they shall be staggered one-third of the spacing in adjacent laminations. Otherwise, nails shall be staggered one-half of the spacing in adjacent laminations.
- c. Where supports are 48 inches on center or less, alternate laminations shall be toenailed to alternate supports; where supports are spaced more than 48 inches on center, alternate laminations shall be toenailed to every support.

on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

2304.9.4 Two-inch sawn tongue-and-groove decking. Two-inch (51 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.4.1 through 2304.9.4.3.

2304.9.4.1 General. Two-inch (51 mm) decking shall have a maximum moisture content of 15 percent. Decking shall be machined with a single tongue-and-groove pattern. Each decking piece shall be nailed to each support.

2304.9.4.2 Nailing. Each piece of decking shall be toenailed at each support with one 16d common nail through the tongue and face-nailed with one 16d common nail.

2304.9.4.3 Controlled random pattern. There shall be a minimum distance of 24 inches (610 mm) between end joints in adjacent courses. The pieces in the first and second courses shall bear on not fewer than two supports with end joints in these two courses occurring on alternate supports. Not more than seven intervening courses shall be permitted before this pattern is repeated.

2304.9.5 Three- and four-inch sawn tongue-and-groove decking. Three- and four-inch (76 mm and 102 mm) sawn tongue-and-groove decking shall comply with Sections 2304.9.5.1 through 2304.9.5.3.

2304.9.5.1 General. Three-inch (76 mm) and four-inch (102 mm) decking shall have a maximum moisture content of 19 percent. Decking shall be machined with a double tongue-and-groove pattern. Decking pieces shall be interconnected and nailed to the supports.

2304.9.5.2 Nailing. Each piece shall be toenailed at each support with one 40d common nail and face-nailed with one 60d common nail. Courses shall be spiked to each other with 8-inch (203 mm) spikes at maximum intervals of 30 inches (762 mm) through predrilled edge holes penetrating to a depth of approximately 4 inches (102 mm). One spike shall be installed at a distance not exceeding 10 inches (254 mm) from the end of each piece.

2304.9.5.3 Controlled random pattern. There shall be a minimum distance of 48 inches (1219 mm) between end joints in adjacent courses. Pieces not bearing on a support are permitted to be located in interior bays provided that the adjacent pieces in the same course continue over the support for not less than 24 inches (610 mm). This condition shall not occur more than once in every six courses in each interior bay.

2304.10 Connectors and fasteners. Connectors and fasteners shall comply with the applicable provisions of Sections 2304.10.1 through 2304.10.8.

2304.10.1 Connection fire-resistance rating. Fire-resistance ratings for connections in Type IV-A, IV-B, or IV-C construction shall be determined by one of the following:

1. Testing in accordance with Section 703.2 where the connection is part of the fire resistance test.
2. Engineering analysis that demonstrates that the temperature rise at any portion of the connection is limited to an average temperature rise of 250°F (139°C), and a maximum temperature rise of 325°F (181°C), for a time corresponding to the required fire-resistance rating of the structural element being connected. For the purposes of this analysis, the connection includes connectors, fasteners, and portions of wood members included in the structural design of the connection.

2304.10.2 Fastener requirements. Connections for wood members shall be designed in accordance with the appropriate methodology in Section 2302.1. The number and size of fasteners connecting wood members shall be not less than that set forth in Table 2304.10.2.

2304.10.2.1 Additional requirements. [DSA-SS and OSHPD 1, 1R, 2B, 4 & 5] Fasteners used for the attachment of exterior wall coverings shall be of hot-dipped zinc-coated galvanized steel, mechanically deposited zinc-coated steel, stainless steel, silicon bronze or copper. The coating weights for hot-dipped zinc-coated fasteners shall be in accordance with ASTM A153. The coating weights for mechanically deposited zinc coated fasteners shall be in accordance with ASTM B695, Class 55 minimum.

2304.10.3 Sheathing fasteners. Sheathing nails or other approved sheathing connectors shall be driven so that their head or crown is flush with the surface of the sheathing.

2304.10.4 Joist hangers and framing anchors. Connections depending on joist hangers or framing anchors, ties and other mechanical fastenings not otherwise covered are permitted where approved. The vertical load-bearing capacity, torsional moment capacity and deflection characteristics of joist hangers shall be determined in accordance with ASTM D7147.

2304.10.5 Other fasteners. Clips, staples, glues and other approved methods of fastening are permitted where approved.

2304.10.6 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with preservative-treated and fire-retardant-treated wood shall be in accordance with Sections 2304.10.6.1 through 2304.10.6.4. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

**TABLE 2304.10.2
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^a	SPACING AND LOCATION
Roof		
1. Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each end, toenail
Blocking between rafters or truss not at the wall top plate, to rafter or truss	2-8d common (2½" x 0.131") 2-3" x 0.131" nails 2-3" 14 gage staples	Each end, toenail
	2-16 d common (3½" x 0.162") 3-3" x 0.131" nails 3-3" 14 gage staples	End nail
Flat blocking to truss and web filler	16d common (3½" x 0.162") @ 6" o.c. 3" x 0.131" nails @ 6" o.c. 3" x 14 gage staples @ 6" o.c	Face nail
2. Ceiling joists to top plate	4-8d box (2½" x 0.113"); or 3-8d common (2½" x 0.131"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Each joist, toenail
3. Ceiling joist not attached to parallel rafter, laps over partitions (no thrust) (see Section 2308.7.3.1, Table 2308.7.3.1)	3-16d common (3½" x 0.162"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
4. Ceiling joist attached to parallel rafter (heel joint) (see Section 2308.7.3.1, Table 2308.7.3.1)	Per Table 2308.7.3.1	Face nail
5. Collar tie to rafter	3-10d common (3" x 0.148"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Face nail
6. Rafter or roof truss to top plate (See Section 2308.7.5, Table 2308.7.5)	3-10 common (3" x 0.148"); or 3-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131 nails; or 4-3" 14 gage staples, 7/16" crown	2 toenails on one side and 1 toenail on opposite side of rafter or truss ^c
7. Roof rafters to ridge valley or hip rafters; or roof rafter to 2-inch ridge beam	2-16d common (3½" x 0.162"); or 3-16d box (3½" x 0.135"); or 3-10d box (3" x 0.128"); or 3-3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	End nail
	3-10d common (3½" x 0.148"); or 4-16d box (3½" x 0.135"); or 4-10d box (3" x 0.128"); or 4-3" x 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Toenail
Wall		
8. Stud to stud (not at braced wall panels)	16d common (3½" x 0.162");	24" o.c. face nail
	10d box (3" x 0.128"); or 3" x 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	16" o.c. face nail

(continued)

**TABLE 2304.10.2—continued
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ⁹	SPACING AND LOCATION
Wall		
9. Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d common (3 ¹ / ₂ " × 0.162")	16" o.c. face nail
	16d box (3 ¹ / ₂ " × 0.135"); or 3" × 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	12" o.c. face nail
10. Built-up header (2" to 2" header)	16d common (3 ¹ / ₂ " × 0.162")	16" o.c. each edge, face nail
	16d box (3 ¹ / ₂ " × 0.135")	12" o.c. each edge, face nail
11. Continuous header to stud	4-8d common (2 ¹ / ₂ " × 0.131"); or 4-10d box (3" × 0.128"); or 5-8d box (2 ¹ / ₂ " × 0.113")	Toenail
12. Top plate to top plate	16d common (3 ¹ / ₂ " × 0.162")	16" o.c. face nail
	10d box (3" × 0.128"); or 3" × 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
13. Top plate to top plate, at end joints	8-16d common (3 ¹ / ₂ " × 0.162"); or 12-16d box (3 ¹ / ₂ " × 0.135"); or 12-10d box (3" × 0.128"); or 12-3" × 0.131" nails; or 12-3" 14 gage staples, 7/16" crown	Each side of end joint, face nail (minimum 24" lap splice length each side of end joint)
14. Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3 ¹ / ₂ " × 0.162")	16" o.c. face nail
	16d box (3 ¹ / ₂ " × 0.135"); or 3" × 0.131" nails; or 3" 14 gage staples, 7/16" crown	12" o.c. face nail
15. Bottom plate to joist, rim joist, band joist or blocking at braced wall panels	2-16d common (3 ¹ / ₂ " × 0.162"); or 3-16d box (3 ¹ / ₂ " × 0.135"); or 4-3" × 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	16" o.c. face nail
16. Stud to top or bottom plate	3-16d box (3 ¹ / ₂ " × 0.135"); or 4-8d common (2 ¹ / ₂ " × 0.131"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails; or 4-8d box (2 ¹ / ₂ " × 0.113"); or 4-3" 14 gage staples, 7/16" crown	Toenail
	2-16d common (3 ¹ / ₂ " × 0.162"); or 3-16d box (3 ¹ / ₂ " × 0.135"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	End nail
17. Top plates, laps at corners and intersections	2-16d common (3 ¹ / ₂ " × 0.162"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Face nail
18. 1" brace to each stud and plate	3-8d box (2 ¹ / ₂ " × 0.113"); or 2-8d common (2 ¹ / ₂ " × 0.131"); or 2-10d box (3" × 0.128"); or 2-3" × 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Face nail
19. 1" × 6" sheathing to each bearing	3-8d box (2 ¹ / ₂ " × 0.113"); or 2-8d common (2 ¹ / ₂ " × 0.131"); or 2-10d box (3" × 0.128"); or 2-1 ³ / ₄ " 16 gage staples, 1" crown	Face nail

(continued)

**TABLE 2304.10.2—continued
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^a	SPACING AND LOCATION
Wall		
20. 1" × 8" and wider sheathing to each bearing	3-8d common (2½" × 0.131"); or 3-8d box (2½" × 0.113"); or 3-10d box (3" × 0.128"); or 3-1¾" 16 gage staples, 1" crown	Face nail
	Wider than 1" × 8" 3-8d common (2½" × 0.131"); or 4-8d box (2½" × 0.113"); or 3-10d box (3" × 0.128"); or 4-1¾" 16 gage staples, 1" crown	
Floor		
21. Joist to sill, top plate, or girder	4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or floor 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Toenail
22. Rim joist, band joist, or blocking to top plate, sill or other framing below	8d box (2½" × 0.113")	4" o.c., toenail
	8d common (2½" × 0.131"); or 10d box (3" × 0.128"); or 3" × 0.131" nails; or 3" 14 gage staples, 7/16" crown	6" o.c., toenail
23. 1" × 6" subfloor or less to each joist	3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 2-1¾" 16 gage staples, 1" crown	Face nail
24. 2 subfloor to joist or girder	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	Blind and face nail
25. 2" planks (plank & beam – floor & roof)	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	Each bearing, face nail
26. Built-up girders and beams, 2" lumber layers	20d common (4" × 0.192")	32" o.c., face nail at top and bottom staggered on opposite sides
	10d box (3" × 0.128"); or 3" × 0.131" nails; or 3" 14 gage staples, 7/16" crown	24" o.c. face nail at top and bottom staggered on opposite sides
	And: 2-20d common (4" × 0.192"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails; or 3-3" 14 gage staples, 7/16" crown	Ends and at each splice, face nail
27. Ledger strip supporting joists or rafters	3-16d common (3½" × 0.162"); or 4-16d box (3½" × 0.135"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	Each joist or rafter, face nail
28. Joist to band joist or rim joist	3-16d common (3½" × 0.162"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails; or 4-3" 14 gage staples, 7/16" crown	End nail
29. Bridging or blocking to joist, rafter or truss	2-8d common (2½" × 0.131"); or 2-10d box (3" × 0.128"); or 2-3" × 0.131" nails; or 2-3" 14 gage staples, 7/16" crown	Each end, toenail

(continued)

**TABLE 2304.10.2—continued
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^a	SPACING AND LOCATION	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
30. $\frac{3}{8}$ " – $\frac{1}{2}$ "	6d common or deformed ($2" \times 0.113"$); or $2\frac{3}{8}" \times 0.113"$ nail (subfloor and wall)	6	12
	8d common or deformed ($2\frac{1}{2}" \times 0.131" \times 0.281"$ head) (roof) or RSRS-01 ($2\frac{3}{8}" \times 0.113"$) nail (roof) ^d	6 ^e	6 ^e
	$1\frac{3}{4}"$ 16 gage staple, $\frac{7}{16}"$ crown (subfloor and wall)	4	8
	$2\frac{3}{8}" \times 0.113" \times 0.266"$ head nail (roof)	3 ^f	3 ^f
	$1\frac{3}{4}"$ 16 gage staple, $\frac{7}{16}"$ crown (roof)	3 ^f	3 ^f
31. $\frac{19}{32}"$ – $\frac{3}{4}"$	8d common ($2\frac{1}{2}" \times 0.131"$); or deformed ($2" \times 0.113"$) (subfloor and wall)	6	12
	8d common or deformed ($2\frac{1}{2}" \times 0.131" \times 0.281"$ head) (roof) or RSRS-01 ($2\frac{3}{8}" \times 0.113"$) nail (roof) ^d	6 ^e	6 ^e
	$2\frac{3}{8}" \times 0.113" \times 0.266"$ head nail; or 2" 16 gage staple, $\frac{7}{16}"$ crown	4	8
32. $\frac{7}{8}"$ – $1\frac{1}{4}"$	10d common ($3" \times 0.148"$); or deformed ($2\frac{1}{2}" \times 0.131" \times 0.281"$ head)	6	12
Other exterior wall sheathing			
33. $\frac{1}{2}"$ fiberboard sheathing ^b	$1\frac{1}{2}" \times 0.120"$, galvanized roofing nail ($\frac{7}{16}"$ head diameter); or $1\frac{1}{4}"$ 16 gage staple with $\frac{7}{16}"$ or 1" crown	3	6
34. $\frac{25}{32}"$ fiberboard sheathing ^b	$1\frac{3}{4}" \times 0.120"$ galvanized roofing nail ($\frac{7}{16}"$ diameter head); or $1\frac{1}{2}"$ 16 gage staple with $\frac{7}{16}"$ or 1" crown	3	6
Wood structural panels, combination subfloor underlayment to framing			
35. $\frac{3}{4}"$ and less	8d common ($2\frac{1}{2}" \times 0.131"$); or deformed ($2" \times 0.113"$); or deformed ($2" \times 0.120"$)	6	12
36. $\frac{7}{8}"$ – 1"	8d common ($2\frac{1}{2}" \times 0.131"$); or deformed ($2\frac{1}{2}" \times 0.131"$); or deformed ($2\frac{1}{2}" \times 0.120"$)	6	12
37. $1\frac{1}{8}"$ – $1\frac{1}{4}"$	10d common ($3" \times 0.148"$); or deformed ($2\frac{1}{2}" \times 0.131"$); or deformed ($2\frac{1}{2}" \times 0.120"$)	6	12
Panel siding to framing			
38. $\frac{1}{2}"$ or less	6d corrosion-resistant siding ($1\frac{7}{8}" \times 0.106"$); or 6d corrosion-resistant casing ($2" \times 0.099"$)	6	12
39. $\frac{5}{8}"$	8d corrosion-resistant siding ($2\frac{3}{8}" \times 0.128"$); or 8d corrosion-resistant casing ($2\frac{1}{2}" \times 0.113"$)	6	12

(continued)

**TABLE 2304.10.2—continued
FASTENING SCHEDULE**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^a	SPACING AND LOCATION	
Wood structural panels (WSP), subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing ^a			
		Edges (inches)	Intermediate supports (inches)
Interior paneling			
40. $\frac{1}{4}$ "	4d casing ($1\frac{1}{2}$ " \times 0.080"); or 4d finish ($1\frac{1}{2}$ " \times 0.072")	6	12
41. $\frac{3}{8}$ "	6d casing (2" \times 0.099"); or 6d finish (2" \times 0.092") (Panel supports at 24 inches)	6	12

For SI: 1 inch = 25.4 mm.

- Nails spaced at 6 inches at intermediate supports where spans are 48 inches or more. For nailing of wood structural panel and particleboard diaphragms and shear walls, refer to Section 2305. Nails for wall sheathing are permitted to be common, box or casing.
- Spacing shall be 6 inches on center on the edges and 12 inches on center at intermediate supports for nonstructural applications. Panel supports at 16 inches (20 inches if strength axis in the long direction of the panel, unless otherwise marked).
- Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule and the ceiling joist is fastened to the top plate in accordance with this schedule, the number of toenails in the rafter shall be permitted to be reduced by one nail.
- RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.
- Tabulated fastener requirements apply where the ultimate design wind speed is less than 140 mph. For wood structural panel roof sheathing attached to gable-end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C. Spacing exceeding 6 inches on center at intermediate supports shall be permitted where the fastening is designed per the AWC NDS.
- Fastening is only permitted where the ultimate design wind speed is less than or equal to 110 mph.
- Nails and staples are carbon steel meeting the specifications of ASTM F1667. Connections using nails and staples of other materials, such as stainless steel, shall be designed by acceptable engineering practice or approved under Section 104.11.

2304.10.6.1 Fasteners and connectors for preservative-treated wood. Fasteners, including nuts and washers, in contact with preservative-treated wood shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Connectors that are used in exterior applications and in contact with preservative-treated wood shall have coating types and weights in accordance with the treated wood or connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653, Type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exception: Plain carbon steel fasteners, including nuts and washers, in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

2304.10.6.2 Fastenings for wood foundations. Fastenings, including nuts and washers, for wood foundations shall be as required in AWC PWF.

2304.10.6.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners, including nuts and washers, for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Fasteners other than nails, staples, timber rivets, wood

screws and lag screws shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.

2304.10.6.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners, including nuts and washers, for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of manufacturer's recommendations, Section 2304.10.6.3 shall apply.

2304.10.7 Load path. Where wall framing members are not continuous from the foundation sill to the roof, the members shall be secured to ensure a continuous load path. Where required, sheet metal clamps, ties or clips shall be formed of galvanized steel or other approved corrosion-resistant material not less than 0.0329-inch (0.836 mm) base metal thickness.

2304.10.8 Framing requirements. Wood columns and posts shall be framed to provide full end bearing. Alternatively, column-and-post end connections shall be designed to resist the full compressive loads, neglecting end-bearing capacity. Column-and-post end connections shall be fastened to resist lateral and net induced uplift forces.

2304.11 Heavy timber construction. Where a structure, portion thereof or individual structural elements are required by provisions of this code to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or

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in Sections 2304.11.2 through 2304.11.4. Lumber decking shall be in accordance with Section 2304.9.

2304.11.1 Details of heavy timber structural members.

Heavy timber structural members shall be detailed and constructed in accordance with Sections 2304.11.1 through 2304.11.1.3.

2304.11.1.1 Columns. Minimum dimensions of columns shall be in accordance with Table 2304.11. Columns shall be continuous or superimposed throughout all stories and connected in an approved manner. Girders and beams at column connections shall be closely fitted around columns and adjoining ends shall be cross tied to each other, or intertied by caps or ties, to transfer horizontal loads across joints. Wood bolsters shall not be placed on tops of columns unless the columns support roof loads only. Where traditional heavy timber detailing is used, connections shall be by means of reinforced concrete or metal caps with brackets, by properly designed steel or iron caps, with pintles and base plates, by timber splice plates affixed to the columns by metal connectors housed within the contact faces, or by other approved methods.

2304.11.1.2 Floor framing. Minimum dimensions of floor framing shall be in accordance with Table 2304.11. Approved wall plate boxes or hangers shall be provided where wood beams, girders or trusses rest on masonry or concrete walls. Where intermediate beams are used to support a floor, they shall rest on top of girders, or shall be supported by an approved metal hanger into which the ends of the beams shall be closely fitted. Where traditional heavy timber detailing is used, these connections shall be permitted to be

supported by ledgers or blocks securely fastened to the sides of the girders.

2304.11.1.3 Roof framing. Minimum dimensions of roof framing shall be in accordance with Table 2304.11. Every roof girder and not less than every alternate roof beam shall be anchored to its supporting member to resist forces as required in Chapter 16.

2304.11.2 Partitions and walls. Partitions and walls shall comply with Section 2304.11.2.1 or 2304.11.2.2.

2304.11.2.1 Exterior walls. Exterior walls shall be permitted to be cross-laminated timber not less than 4 inches (102 mm) in thickness meeting the requirements of Section 2303.1.4.

2304.11.2.2 Interior walls and partitions. Interior walls and partitions shall be of solid wood construction formed by not less than two layers of 1-inch (25 mm) matched boards or laminated construction 4 inches (102 mm) thick, or of 1-hour fire-resistance-rated construction.

2304.11.3 Floors. Floors shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Wood floors shall be constructed in accordance with Section 2304.11.3.1 or 2304.11.3.2.

2304.11.3.1 Cross-laminated timber floors. Cross-laminated timber shall be not less than 4 inches (102 mm) in actual thickness. Cross-laminated timber shall be continuous from support to support and mechanically fastened to one another. Cross-laminated timber shall be permitted to be connected to walls without a shrinkage gap providing swelling or shrinking is

**TABLE 2304.11
MINIMUM DIMENSIONS OF HEAVY TIMBER STRUCTURAL MEMBERS**

SUPPORTING	HEAVY TIMBER STRUCTURAL ELEMENTS	MINIMUM NOMINAL SOLID SAWN SIZE		MINIMUM GLUED-LAMINATED NET SIZE		MINIMUM STRUCTURAL COMPOSITE LUMBER NET SIZE	
		Width, inch	Depth, inch	Width, inch	Depth, inch	Width, inch	Depth, inch
Floor loads only or combined floor and roof loads	Columns; Framed sawn or glued-laminated timber arches that spring from the floor line; Framed timber trusses	8	8	6 ³ / ₄	8 ¹ / ₄	7	7 ¹ / ₂
	Wood beams and girders	6	10	5	10 ¹ / ₂	5 ¹ / ₄	9 ¹ / ₂
Roof loads only	Columns (roof and ceiling loads); Lower half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	8	5	8 ¹ / ₄	5 ¹ / ₄	7 ¹ / ₂
	Upper half of: wood-frame or glued-laminated arches that spring from the floor line or from grade	6	6	5	6	5 ¹ / ₄	5 ¹ / ₂
	Framed timber trusses and other roof framing; ^a Framed or glued-laminated arches that spring from the top of walls or wall abutments	4 ^b	6	3 ^b	6 ⁷ / ₈	3 ¹ / ₂ ^b	5 ¹ / ₂

For SI: 1 inch = 25.4 mm.

- a. Spaced members shall be permitted to be composed of two or more pieces not less than 3 inches nominal in thickness where blocked solidly throughout their intervening spaces or where spaces are tightly closed by a continuous wood cover plate of not less than 2 inches nominal in thickness secured to the underside of the members. Splice plates shall be not less than 3 inches nominal in thickness.
- b. Where protected by approved automatic sprinklers under the roof deck, framing members shall be not less than 3 inches nominal in width.

considered in the design. Corbelling of masonry walls under the floor shall be permitted to be used.

2304.11.3.2 Sawn or glued-laminated plank floors. Sawn or glued-laminated plank floors shall be one of the following:

1. Sawn or glued-laminated planks, splined or tongue-and-groove, of not less than 3 inches (76 mm) nominal in thickness covered with 1-inch (25 mm) nominal dimension tongue-and-groove flooring, laid crosswise or diagonally, $1\frac{5}{32}$ -inch (12 mm) wood structural panel or $\frac{1}{2}$ -inch (12.7 mm) particleboard.
2. Planks not less than 4 inches (102 mm) nominal in width set on edge close together and well spiked and covered with 1-inch (25 mm) nominal dimension flooring or $1\frac{5}{32}$ -inch (12 mm) wood structural panel or $\frac{1}{2}$ -inch (12.7 mm) particleboard.

The lumber shall be laid so that continuous lines of joints will occur only at points of support. Floors shall not extend closer than $\frac{1}{2}$ inch (12.7 mm) to walls. Such $\frac{1}{2}$ -inch (12.7 mm) space shall be covered by a molding fastened to the wall and so arranged that it will not obstruct the swelling or shrinkage movements of the floor. Corbelling of masonry walls under the floor shall be permitted to be used in place of molding.

2304.11.4 Roof decks. Roofs shall be without concealed spaces or with concealed spaces complying with Section 602.4.4.3. Roof decks shall be constructed in accordance with Section 2304.11.4.1 or 2304.11.4.2. Other types of decking shall be an alternative that provides equivalent fire resistance and structural properties. Where supported by a wall, roof decks shall be anchored to walls to resist forces determined in accordance with Chapter 16. Such anchors shall consist of steel bolts, lags, screws or approved hardware of sufficient strength to resist prescribed forces.

2304.11.4.1 Cross-laminated timber roofs. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness and shall be continuous from support to support and mechanically fastened to one another.

2304.11.4.2 Sawn, wood structural panel, or glued-laminated plank roofs. Sawn, wood structural panel, or glued-laminated plank roofs shall be one of the following:

1. Sawn or glued laminated, splined or tongue-and-groove plank, not less than 2 inches (51 mm) nominal in thickness.
2. $1\frac{1}{8}$ -inch-thick (32 mm) wood structural panel (exterior glue).
3. Planks not less than 3 inches (76 mm) nominal in width, set on edge close together and laid as required for floors.

2304.12 Protection against decay and termites. Wood shall be protected from decay and termites in accordance with the

applicable provisions of Sections 2304.12.1 through 2304.12.4.

2304.12.1 Locations requiring waterborne preservatives or naturally durable wood. Wood used above ground in the locations specified in Sections 2304.12.1.1 through 2304.12.1.5 shall be naturally durable wood or preservative-treated wood using waterborne preservatives, in accordance with AWPA U1 for above-ground use.

2304.12.1.1 Joists, girders and subfloor. Wood joists or wood structural floors that are closer than 18 inches (457 mm) or wood girders that are closer than 12 inches (305 mm) to the exposed ground in crawl spaces or unexcavated areas located within the perimeter of the building foundation shall be of naturally durable or preservative-treated wood.

2304.12.1.1.1 [SPCB] *There shall be a clearance of at least 18 inches (457 mm) between the underside of wood floor joists and the finished surface of the ground, and at least 12 inches (305 mm) between the underside of any other wood horizontal framing member and the finished surface of the ground. The ground underneath floor joists shall be leveled or smoothed off so as to maintain a reasonably even surface.*

Exception: *For purposes of structural pest control inspection, a minimum of 12 inches (305 mm) of clearance under-floor joists shall be considered adequate except that such clearance shall not be necessary where the subarea soil is of such a nature as to prevent excavation or where excavation would create a hazard from shifting soil or other causes.*

2304.12.1.2 Wood supported by exterior foundation walls. Wood framing members, including wood sheathing, that are in contact with exterior foundation walls and are less than 8 inches (203 mm) from exposed earth shall be of naturally durable or preservative-treated wood.

Exception: *[DSA-SS and OSHPD 1, 1R, 2, 4 & 5] At exterior walls where the earth is paved with an asphalt or concrete slab at least 18 inches (457 mm) wide and draining away from the building, the bottom of sills are permitted to be 6 inches (152 mm) above the top of such slab. Other equivalent means of termite and decay protection may be accepted by the enforcement agency.*

2304.12.1.3 Exterior walls below grade. Wood framing members and furring strips in direct contact with the interior of exterior masonry or concrete walls below grade shall be of naturally durable or preservative-treated wood.

2304.12.1.4 Sleepers and sills. Sleepers and sills on a concrete or masonry slab that is in direct contact with earth shall be of naturally durable or preservative-treated wood.

2304.12.1.4.1 Additional requirements. *[DSA-SS and OSHPD 1, 1R, 2, 4 & 5] Stud walls or parti-*

tions at shower or toilet rooms with more than two plumbing fixtures, excluding floor drains, and stud walls adjacent to unroofed paved areas shall rest on a concrete curb extending at least 6 inches (152 mm) above finished floor and pavement level.

2304.12.1.5 Wood siding. Clearance between wood siding and earth on the exterior of a building shall be not less than 6 inches (152 mm) or less than 2 inches (51 mm) vertical from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather except where siding, sheathing and wall framing are of naturally durable or preservative-treated wood.

2304.12.2 Other locations. Wood used in the locations specified in Sections 2304.12.2.1 through 2304.12.2.8 shall be naturally durable wood or preservative-treated wood in accordance with AWP A U1. Preservative-treated wood used in interior locations shall be protected with two coats of urethane, shellac, latex epoxy or varnish unless waterborne preservatives are used. Prior to application of the protective finish, the wood shall be dried in accordance with the manufacturer's recommendations.

2304.12.2.1 Girder ends. The ends of wood girders entering exterior masonry or concrete walls shall be provided with a 1/2-inch (12.7 mm) airspace on top, sides and end, unless naturally durable or preservative-treated wood is used.

2304.12.2.2 Posts or columns. Posts or columns supporting permanent structures and supported by a concrete or masonry slab or footing that is in direct contact with the earth shall be of naturally durable or preservative-treated wood.

Exception: Posts or columns that meet all of the following:

1. Are not exposed to the weather, or are protected by a roof, eave, overhang, or other covering if exposed to the weather.
2. Are supported by concrete piers or metal pedestals projected not less than 1 inch (25 mm) above the slab or deck and are separated from the concrete pier by an impervious moisture barrier.
3. Are located not less than 8 inches (203 mm) above exposed earth.

2304.12.2.3 Supporting member for permanent appurtenances. Naturally durable or preservative-treated wood shall be utilized for those portions of wood members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where such members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering to prevent moisture or water accumulation on the surface or at joints between members.

Exception: Sawn lumber in buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to

use durable materials where the structure is exposed to the weather.

2304.12.2.4 Supporting members for permeable floors and roofs. Wood structural members that support moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, shall be of naturally durable or preservative-treated wood unless separated from such floors or roofs by an impervious moisture barrier. The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.

2304.12.2.5 Ventilation beneath balcony or elevated walking surfaces. Enclosed framing in exterior balconies and elevated walking surfaces that have weather-exposed surfaces shall be provided with openings that provide a net free cross-ventilation area not less than 1/150 of the area of each separate space.

2304.12.2.6 Wood in contact with the ground or fresh water. Wood used in contact with exposed earth shall be naturally durable for both decay and termite resistance or preservative treated in accordance with AWP A U1 for soil or fresh water use.

Exception: Untreated wood is permitted where such wood is continuously and entirely below the ground-water level or submerged in fresh water.

2304.12.2.6.1 Posts or columns. Posts and columns that are supporting permanent structures and embedded in concrete that is exposed to the weather or in direct contact with the earth shall be of preservative-treated wood.

2304.12.2.7 Termite protection. In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing in the locations specified in Section 2304.12.1.1 and exposed framing of exterior decks or balconies shall be of naturally durable species (termite resistant) or preservative treated in accordance with AWP A U1 for the species, product preservative and end use or provided with approved methods of termite protection.

2304.12.2.8 Wood used in retaining walls and cribs. Wood installed in retaining or crib walls shall be preservative treated in accordance with AWP A U1 for soil and fresh water use.

2304.12.3 Attic ventilation. For attic ventilation, see Section 1202.2.2.

2304.12.4 Under-floor ventilation (crawl space). For under-floor ventilation (crawl space), see Section 1202.4.

2304.12.8 Separate wood framing. [SPCB] Correct the conditions in frame and stucco walls and similar appurtenant construction so that the wood framing is separate from the main structure by a complete concrete or masonry plug with no voids that will allow infestations to enter the structure from the wall. If there is no plug, the foundation shall be 2 inches (51 mm) or more above the grade levels and at least as high as the adjoining slabs or 4-inch (102 mm) concrete barrier seat off installed.

2304.12.9 Earth fills. [SPCB] Separate the earth fills such as under porches or paving from all woodwork by concrete, masonry, good quality cement plaster or other material approved by local building codes. Chemical treatment of earth fills is considered adequate if the foundation adjoining the fill meets standards of the current building codes.

2304.13 Long-term loading. Wood members supporting concrete, masonry or similar materials shall be checked for the effects of long-term loading using the provisions of the ANSI/AWC NDS. The total deflection, including the effects of long-term loading, shall be limited in accordance with Section 1604.3.1 for these supported materials.

Exception: Horizontal wood members supporting masonry or concrete nonstructural floor or roof surfacing not more than 4 inches (102 mm) thick need not be checked for long-term loading.

SECTION 2305 GENERAL DESIGN REQUIREMENTS FOR LATERAL FORCE-RESISTING SYSTEMS

2305.1 General. Structures using wood-frame shear walls or wood-frame diaphragms to resist wind, seismic or other lateral loads shall be designed and constructed in accordance with AWC SDPWS and the applicable provisions of Sections 2305, 2306 and 2307.

2305.1.1 Openings in shear panels. Openings in shear panels that materially affect their strength shall be detailed on the plans and shall have their edges adequately reinforced to transfer all shearing stresses.

2305.1.2 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] See Section 2301.1.4 for modifications to AWC SDPWS.

2305.2 Diaphragm deflection. The deflection of wood-frame diaphragms shall be determined in accordance with AWC SDPWS. The deflection (Δ_{dia}) of a blocked wood structural panel diaphragm uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-1. If not uniformly fastened, the constant 0.188 (For SI: 1/1627) in the third term shall be modified by an approved method.

$$\Delta_{dia} = 5vL^3/8EAW + vL/4Gt + 0.188Le_n + \Sigma(x\Delta_c)/2W \quad \text{(Equation 23-1)}$$

$$\text{For SI: } \Delta_{dia} = 0.052vL^3/EAW + vL/4Gt + Le_n/1627 + \Sigma(x\Delta_c)/2W$$

where:

A = Area of chord cross section, in square inches (mm^2).

E = Modulus of elasticity of diaphragm chords, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

L = Diaphragm length (dimension perpendicular to the direction of the applied load), in feet (mm).

v = Induced unit shear in pounds per linear foot (plf) (N/mm).

W = Diaphragm width [in the direction of applied force, in feet (mm)].

x = Distance from chord splice to nearest support, in feet (mm).

Δ_c = Diaphragm chord splice slip at the induced unit shear, in inches (mm).

Δ_{dia} = Maximum mid-span diaphragm deflection determined by elastic analysis, in inches (mm).

TABLE 2305.2(1)
 e_n VALUES (inches) FOR USE IN CALCULATING DIAPHRAGM AND SHEAR WALL DEFLECTION DUE TO FASTENER SLIP (Structural I)^{a, c}

LOAD PER FASTENER ^b (pounds)	FASTENER DESIGNATIONS
	14-Ga staple x 2 inches long
60	0.011
80	0.018
100	0.028
120	0.04
140	0.053
160	0.068

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

a. Increase e_n values 20 percent for plywood grades other than Structural I.

b. Load per fastener = maximum shear per foot divided by the number of fasteners per foot at interior panel edges.

c. Decrease e_n values 50 percent for seasoned lumber (moisture content < 19 percent).

2305.3 Shear wall deflection. The deflection of wood-frame shear walls shall be determined in accordance with AWC SDPWS. The deflection (Δ_{sw}) of a blocked wood structural panel shear wall uniformly fastened throughout with staples is permitted to be calculated in accordance with Equation 23-2.

$$\Delta_{sw} = 8vh^3/EAb + vh/4Gt + 0.75he_n + d_a h/b \quad \text{(Equation 23-2)}$$

$$\text{For SI: } \Delta_{sw} = vh^3/3EAb + vh/Gt + \frac{he_n}{407.6} + d_a h/b$$

where:

A = Area of end-post cross section in square inches (mm^2).

b = Shear wall length, in feet (mm).

d_a = Total vertical elongation of wall anchorage system (such as fastener slip, device elongation, rod elongation) in inches (mm), at the induced unit shear in the shear wall (v).

E = Modulus of elasticity of end posts, in pounds per square inch (N/mm^2).

e_n = Staple slip, in inches (mm) [see Table 2305.2(1)].

Gt = Panel rigidity through the thickness, in pounds per inch (N/mm) of panel width or depth [see Table 2305.2(2)].

h = Shear wall height, in feet (mm).

v = Induced unit shear, in pounds per linear foot (N/mm).

Δ_{sw} = Maximum shear wall deflection determined by elastic analysis, in inches (mm).

TABLE 2305.2(2)
VALUES OF G_t FOR USE IN CALCULATING DEFLECTION OF WOOD STRUCTURAL PANEL SHEAR WALLS AND DIAPHRAGMS

PANEL TYPE	SPAN RATING	VALUES OF G_t (lb/in. panel depth or width)							
		Structural Sheathing				Structural I			
		Plywood			OSB	Plywood			OSB
		3-ply	4-ply	5-ply ^a		3-ply	4-ply	5-ply ^a	
Sheathing	24/0	25,000	32,500	37,500	77,500	32,500	42,500	41,500	77,500
	24/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	32/16	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	40/20	28,500	37,000	43,000	88,500	37,000	48,000	47,500	88,500
	48/24	31,000	40,500	46,500	96,000	40,500	52,500	51,000	96,000
Single Floor	16 o.c.	27,000	35,000	40,500	83,500	35,000	45,500	44,500	83,500
	20 o.c.	28,000	36,500	42,000	87,000	36,500	47,500	46,000	87,000
	24 o.c.	30,000	39,000	45,000	93,000	39,000	50,500	49,500	93,000
	32 o.c.	36,000	47,000	54,000	110,000	47,000	61,000	59,500	110,000
	48 o.c.	50,500	65,500	76,000	155,000	65,500	85,000	83,500	155,000

	Thickness (in.)	Structural Sheathing			Structural I		
		A-A, A-C	Marine	All Other Grades	A-A, A-C	Marine	All Other Grades
Sanded Ply-wood	$\frac{1}{4}$	24,000	31,000	24,000	31,000	31,000	31,000
	$\frac{11}{32}$	25,500	33,000	25,500	33,000	33,000	33,000
	$\frac{3}{8}$	26,000	34,000	26,000	34,000	34,000	34,000
	$\frac{15}{32}$	38,000	49,500	38,000	49,500	49,500	49,500
	$\frac{1}{2}$	38,500	50,000	38,500	50,000	50,000	50,000
	$\frac{19}{32}$	49,000	63,500	49,000	63,500	63,500	63,500
	$\frac{5}{8}$	49,500	64,500	49,500	64,500	64,500	64,500
	$\frac{23}{32}$	50,500	65,500	50,500	65,500	65,500	65,500
	$\frac{3}{4}$	51,000	66,500	51,000	66,500	66,500	66,500
	$\frac{7}{8}$	52,500	68,500	52,500	68,500	68,500	68,500
	1	73,500	95,500	73,500	95,500	95,500	95,500
$1\frac{1}{8}$	75,000	97,500	75,000	97,500	97,500	97,500	

For SI: 1 inch = 25.4 mm, 1 pound/inch = 0.1751 N/mm.

a. 5-ply applies to plywood with five or more layers. For 5-ply plywood with three layers, use values for 4-ply panels.

SECTION 2306 ALLOWABLE STRESS DESIGN

2306.1 Allowable stress design. The design and construction of wood elements in structures using allowable stress design shall be in accordance with the applicable standards listed in Table 2306.1.

2306.1.1 Joists and rafters. The design of rafter spans is permitted to be in accordance with the AWC STJR.

2306.1.2 Plank and beam flooring. The design of plank and beam flooring is permitted to be in accordance with the AWC Wood Construction Data No. 4.

2306.1.3 Treated wood stress adjustments. The allowable unit stresses for preservative-treated wood need not be adjusted for treatment, but are subject to other adjustments.

The allowable unit stresses for fire-retardant-treated wood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which

the fire-retardant-treated wood will be subjected, the type of treatment and the redrying process. Other adjustments are applicable except that the impact load duration shall not apply.

2306.1.4 Lumber decking. The capacity of lumber decking arranged according to the patterns described in Section 2304.9.2 shall be the lesser of the capacities determined for moment and deflection according to the formulas in Table 2306.1.4.

2306.2 Wood-frame diaphragms. Wood-frame diaphragms shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.2(1) or 2306.2(2) shall be permitted. The allowable shear values in Tables 2306.2(1) and 2306.2(2) are permitted to be increased 40 percent for wind design.

2306.2.1 Gypsum board diaphragm ceilings. Gypsum board diaphragm ceilings shall be in accordance with Section 2508.6.

**TABLE 2306.1
STANDARDS FOR DESIGN AND
CONSTRUCTION OF WOOD ELEMENTS
IN STRUCTURES USING ALLOWABLE STRESS DESIGN**

STANDARDS PROMULGATOR	STANDARD	TITLE
American Wood Council		
	ANSI/AWC NDS	National Design Specification for Wood Construction
	SDPWS	Special Design Provisions for Wind and Seismic
American Society of Agricultural and Biological Engineers		
	ASABE EP 484.3	Diaphragm Design of Metal-clad, Wood-Frame Rectangular Buildings
	ASABE EP 486.3	Shallow Post and Pier Foundation Design
	ASABE EP 559.1	Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies
APA—The Engineered Wood Association		
	ANSI 117	Standard Specifications for Structural Glued Laminated Timber of Softwood Species
	ANSI A190.1	Structural Glued Laminated Timber Panel Design Specification
		Plywood Design Specification Supplement 1—Design & Fabrication of Plywood Curved Panel
		Plywood Design Specification Supplement 2—Design & Fabrication of Glued Plywood-lumber Beams
		Plywood Design Specification Supplement 3—Design & Fabrication of Plywood Stressed-skin Panels
		Plywood Design Specification Supplement 4—Design & Fabrication of Plywood Sandwich Panels
		Plywood Design Specification Supplement 5—Design & Fabrication of All-plywood Beams
	APA T300	Glulam Connection Details
	APA S560	Field Notching and Drilling of Glued Laminated Timber Beams
	APA S475	Glued Laminated Beam Design Tables
	APA X450	Glulam in Residential Construction
	APA X440	Product and Application Guide: Glulam
	APA R540	Builders Tips: Proper Storage and Handling of Glulam Beams
Truss Plate Institute, Inc.		
	TPI 1	National Design Standard for Metal Plate Connected Wood Truss Construction
West Coast Lumber Inspection Bureau		
	AITC 104	Typical Construction Details
	AITC 110	Standard Appearance Grades for Structural Glued Laminated Timber
	AITC 113	Standard for Dimensions of Structural Glued Laminated Timber
	AITC 119	Standard Specifications for Structural Glued Laminated Timber of Hardwood Species
	AITC 200	Inspection Manual

**TABLE 2306.1.4
ALLOWABLE LOADS FOR LUMBER DECKING**

PATTERN	ALLOWABLE AREA LOAD ^a	
	Moment	Deflection
Simple span	$w_b = \frac{8F_b'd^2}{l^26}$	$w_\Delta = \frac{384\Delta E'd^3}{5l^4 12}$
Two-span continuous	$w_b = \frac{8F_b'd^2}{l^26}$	$w_\Delta = \frac{185\Delta E'd^3}{l^4 12}$
Combination simple- and two-span continuous	$w_b = \frac{8F_b'd^2}{l^26}$	$w_\Delta = \frac{131\Delta E'd^3}{l^4 12}$
Cantilevered pieces intermixed	$w_b = \frac{20F_b'd^2}{3l^26}$	$w_\Delta = \frac{105\Delta E'd^3}{l^4 12}$
Controlled random layout		
Mechanically laminated decking	$w_b = \frac{20F_b'd^2}{3l^26}$	$w_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
2-inch decking	$w_b = \frac{20F_b'd^2}{3l^26}$	$w_\Delta = \frac{100\Delta E'd^3}{l^4 12}$
3-inch and 4-inch decking	$w_b = \frac{8F_b'd^2}{l^26}$	$w_\Delta = \frac{116\Delta E'd^3}{l^4 12}$

For SI: 1 inch = 25.4 mm.

- a. w_b = Allowable total uniform load limited by moment.
 w_Δ = Allowable total uniform load limited by deflection.
 d = Actual decking thickness.
 l = Span of decking.
 F_b' = Allowable bending stress adjusted by applicable factors.
 E' = Modulus of elasticity adjusted by applicable factors.

2306.3 Wood-frame shear walls. Wood-frame shear walls shall be designed and constructed in accordance with AWC SDPWS. Where panels are fastened to framing members with staples, requirements and limitations of AWC SDPWS shall be met and the allowable shear values set forth in Table 2306.3(1), 2306.3(2) or 2306.3(3) shall be permitted. The allowable shear values in Tables 2306.3(1) and 2306.3(2) are permitted to be increased 40 percent for wind design. Panels complying with ANSI/APA PRP-210 shall be permitted to use design values for Plywood Siding in the AWC SDPWS.

TABLE 2306.2(1)
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL DIAPHRAGMS
UTILIZING STAPLES WITH FRAMING OF DOUGLAS FIR-LARCH, OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^f

PANEL GRADE	STAPLE LENGTH AND GAGE ^d	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBERS AT ADJOINING PANEL EDGES AND BOUNDARIES ^g (inches)	BLOCKED DIAPHRAGMS				UNBLOCKED DIAPHRAGMS	
					Fastener spacing (inches) at diaphragm boundaries (all cases) at continuous panel edges parallel to load (Cases 3, 4), and at all panel edges (Cases 5, 6) ^b				Fasteners spaced 6 inches max. at supported edges ^p	
					6	4	2 1/2 ^c	2 ^c	Case 1 (No unblocked edges or continuous joints parallel to load)	All other configurations (Cases 2, 3, 4, 5 and 6) ^q
					Fastener spacing (inches) at other panel edges (Cases 1, 2, 3 and 4) ^p					
6	6	4	3							
Structural I grades	1 1/2 16 gage	1	3/8	2	175	235	350	400	155	115
				3	200	265	395	450	175	130
			15/32	2	175	235	350	400	155	120
				3	200	265	395	450	175	130
Sheathing, single floor and other grades covered in DOC PS 1 and PS 2	1 1/2 16 gage	1	3/8	2	160	210	315	360	140	105
				3	180	235	355	400	160	120
			7/16	2	165	225	335	380	150	110
				3	190	250	375	425	165	125
			15/32	2	160	210	315	360	140	105
				3	180	235	355	405	160	120
			19/32	2	175	235	350	400	155	115
				3	200	265	395	450	175	130

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- a. For framing of other species: (1) Find specific gravity for species of lumber in ANSI/AWC NDS. (2) For staples find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- b. Space fasteners maximum 12 inches on center along intermediate framing members (6 inches on center where supports are spaced 48 inches on center).
- c. Framing at adjoining panel edges shall be 3 inches nominal or wider.
- d. Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members.
- e. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- f. For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.
- g. For Case 1 through 6 descriptions see Figure 2306.2(1).

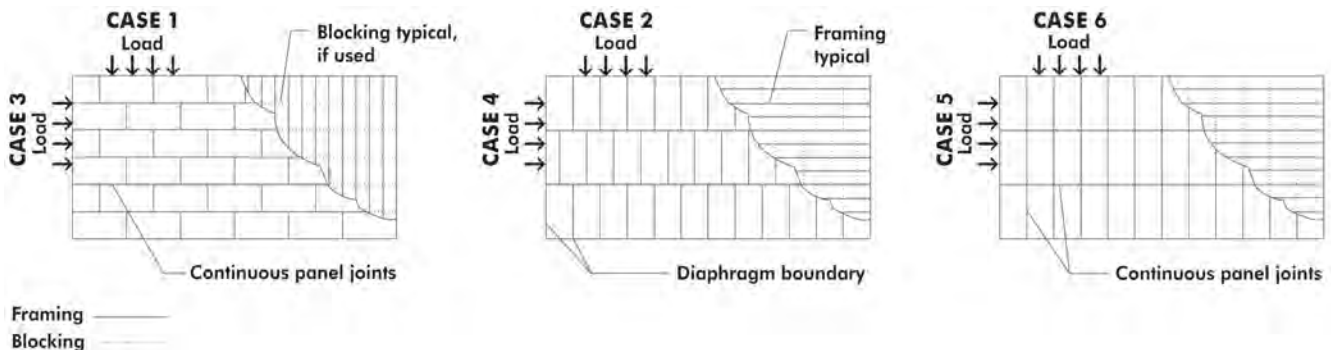


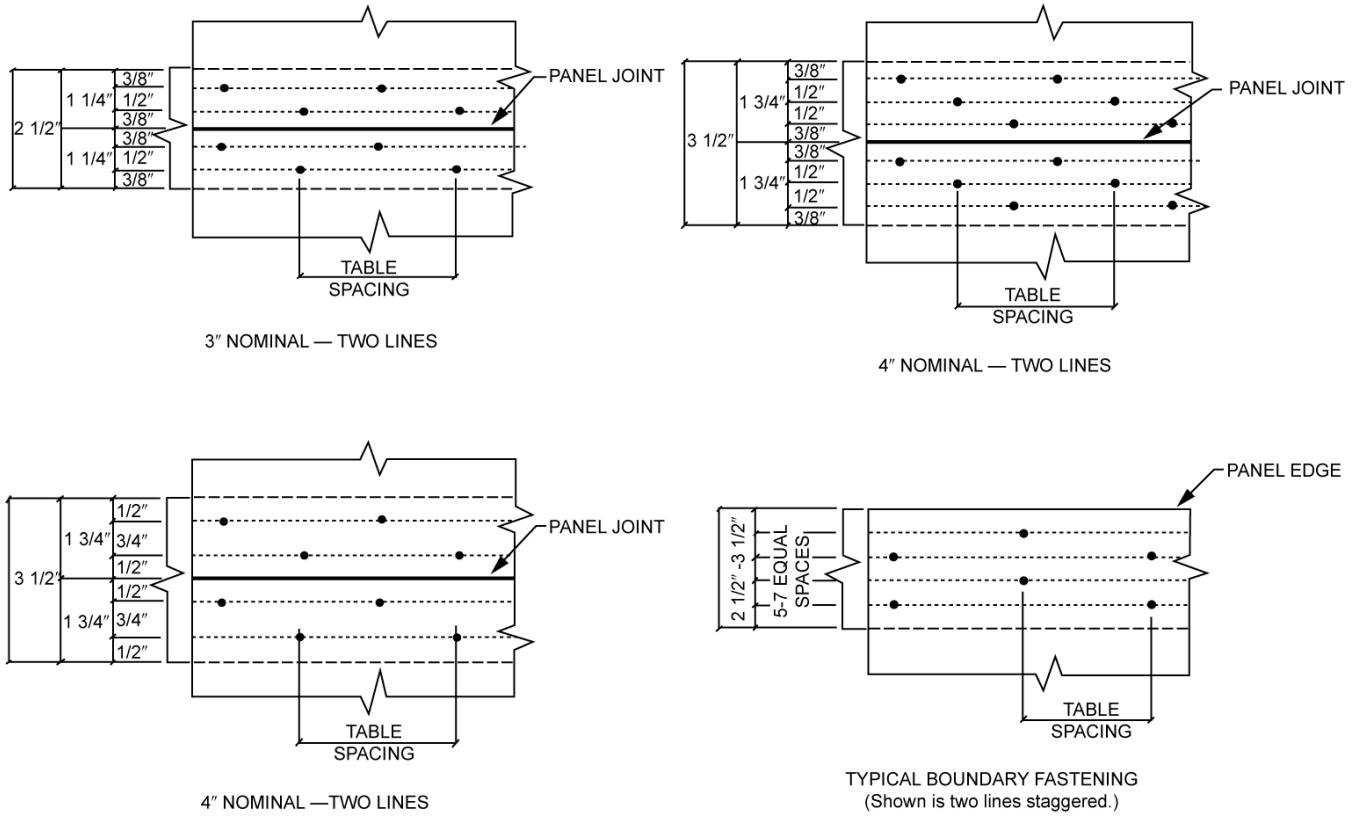
FIGURE 2306.2(1)
CASES 1 THROUGH 6 FOR USE WITH TABLE 2306.2(1)

TABLE 2306.2(2)
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL BLOCKED DIAPHRAGMS
UTILIZING MULTIPLE ROWS OF STAPLES (HIGH-LOAD DIAPHRAGMS) WITH FRAMING OF
DOUGLAS FIR-LARCH OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^{b, g, h}

PANEL GRADE ^c	STAPLE GAGE ⁱ	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM NOMINAL WIDTH OF FRAMING MEMBER AT ADJOINING PANEL EDGES AND BOUNDARIES ^e	LINES OF FASTENERS	BLOCKED DIAPHRAGMS					
						Cases 1 and 2 ^d					
						Fastener Spacing Per Line at Boundaries (inches) ⁱ					
						4	2 ¹ / ₂	2			
						Fastener Spacing Per Line at Other Panel Edges (inches) ⁱ					
						6	4	4	3	3	2
Structural I grades	14 gage staples	2	1 ⁵ / ₃₂	3	2	600	600	860	960	1,060	1,200
				4	3	860	900	1,160	1,295	1,295	1,400
			1 ⁹ / ₃₂	3	2	600	600	875	960	1,075	1,200
				4	3	875	900	1,175	1,440	1,475	1,795
Sheathing single floor and other grades covered in DOC PS 1 and PS 2	14 gage staples	2	1 ⁵ / ₃₂	3	2	540	540	735	865	915	1,080
				4	3	735	810	1,005	1,105	1,105	1,195
			1 ⁹ / ₃₂	3	2	600	600	865	960	1,065	1,200
				4	3	865	900	1,130	1,430	1,370	1,485
			2 ³ / ₃₂	4	3	865	900	1,130	1,490	1,430	1,545

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of framing lumber in ANSI/AWC NDS. (2) For staples, find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Fastening along intermediate framing members: Space fasteners not greater than 12 inches on center, except 6 inches on center for spans greater than 32 inches.
- Panels conforming to DOC PS 1 or PS 2.
- This table gives shear values for Cases 1 and 2 as shown in Table 2306.2(1). The values shown are applicable to Cases 3, 4, 5 and 6 as shown in Table 2306.2(1), providing fasteners at all continuous panel edges are spaced in accordance with the boundary fastener spacing.
- The minimum nominal depth of framing members shall be 3 inches nominal. The minimum nominal width of framing members not located at boundaries or adjoining panel edges shall be 2 inches.
- Staples shall have a minimum crown width of ⁷/₁₆ inch, and shall be installed with their crowns parallel to the long dimension of the framing members.
- High-load diaphragms shall be subject to special inspection in accordance with Section 1705.5.1.
- For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.
- For fastener spacing diagrams see Figure 2306.2(2).



NOTE: SPACE PANEL END AND EDGE JOINT 1/8-INCH. REDUCE SPACING BETWEEN LINES OF NAILS AS NECESSARY TO MAINTAIN MINIMUM 3/8-INCH FASTENER EDGE MARGINS, MINIMUM SPACING BETWEEN LINES IS 3/8-INCH

For SI: 1 inch = 25.4 mm.

FIGURE 2306.2(2)
FASTENER SPACING DIAGRAMS FOR USE WITH TABLE 2306.2(2)

TABLE 2306.3(1)
ALLOWABLE SHEAR VALUES (POUNDS PER FOOT) FOR WOOD STRUCTURAL PANEL SHEAR WALLS UTILIZING STAPLES WITH FRAMING OF DOUGLAS FIR-LARCH OR SOUTHERN PINE^a FOR WIND OR SEISMIC LOADING^{b, f, g, i}

PANEL GRADE	MINIMUM NOMINAL PANEL THICKNESS (inch)	MINIMUM FASTENER PENETRATION IN FRAMING (inches)	PANELS APPLIED DIRECT TO FRAMING	PANELS APPLIED OVER 1/2" OR 5/8" GYPSUM SHEATHING									
				Staple length and gage ^h (inches)	Fastener spacing at panel edges (inches)				Staple length and gage ^h (inches)	Fastener spacing at panel edges (inches)			
					6	4	3	2 ^d		6	4	3	2 ^d
Structural I sheathing	3/8	1	1 1/2 16 Gage	2 16 Gage	155	235	315	400	155	235	310	400	
	7/16				170	260	345	440	155	235	310	400	
	15/32				185	280	375	475	155	235	300	400	
Sheathing, plywood siding ^e except Group 5 Species, ANSI/APA PRP 210siding ^e	5/16 ^c or 1/4 ^c	1	1 1/2 16 Gage	2 16 Gage	145	220	295	375	110	165	220	285	
	3/8				140	210	280	360	140	210	280	360	
	7/16				155	230	310	395	140	210	280	360	
	15/32				170	255	335	430	140	210	280	360	
	19/32		1 3/4 16 Gage	—	—	—	—	—	—	—	—	—	

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- For framing of other species: (1) Find specific gravity for species of lumber in ANSI/AWC NDS. (2) For staples find shear value from table for Structural I panels (regardless of actual grade) and multiply value by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Panel edges backed with 2-inch nominal or wider framing. Install panels either horizontally or vertically. Space fasteners maximum 6 inches on center along intermediate framing members for 3/8-inch and 7/16-inch panels installed on studs spaced 24 inches on center. For other conditions and panel thickness, space fasteners maximum 12 inches on center on intermediate supports.
- 3/8-inch panel thickness or siding with a span rating of 16 inches on center is the minimum recommended where applied directly to framing as exterior siding. For grooved panel siding, the nominal panel thickness is the thickness of the panel measured at the point of fastening.
- Framing at adjoining panel edges shall be 3 inches nominal or wider.
- Values apply to all-veneer plywood. Thickness at point of fastening on panel edges governs shear values.
- Where panels are applied on both faces of a wall and fastener spacing is less than 6 inches on center on either side, panel joints shall be offset to fall on different framing members, or framing shall be 3 inches nominal or thicker at adjoining panel edges.
- In Seismic Design Category D, E or F, where shear design values exceed 350 pounds per linear foot, all framing members receiving edge fastening from abutting panels shall be not less than a single 3-inch nominal member, or two 2-inch nominal members fastened together in accordance with Section 2306.1 to transfer the design shear value between framing members. Wood structural panel joint and sill plate nailing shall be staggered at all panel edges. See AWC SDPWS for sill plate size and anchorage requirements.
- Staples shall have a minimum crown width of 7/16 inch and shall be installed with their crowns parallel to the long dimension of the framing members.
- For shear loads of normal or permanent load duration as defined by the ANSI/AWC NDS, the values in the table shall be multiplied by 0.63 or 0.56, respectively.

TABLE 2306.3(2)
ALLOWABLE SHEAR VALUES (plf) FOR WIND OR SEISMIC LOADING ON SHEAR WALLS OF FIBERBOARD SHEATHING BOARD CONSTRUCTION UTILIZING STAPLES FOR TYPE V CONSTRUCTION ONLY^{a, b, c, d, e}

THICKNESS AND GRADE (inches)	STAPLE GAGE AND DIMENSIONS	ALLOWABLE SHEAR VALUE (pounds per linear foot) STAPLE SPACING AT PANEL EDGES (inches) ^a		
		4	3	2
1/2 or 25/32 Structural	No. 16 gage galvanized staple, 7/16" crown 1 3/4 inches long	150	200	225
	No. 16 gage galvanized staple, 1" crown 1 3/4 inches long	220	290	325

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

- Fiberboard sheathing shall not be used to brace concrete or masonry walls.
- Panel edges shall be backed with 2-inch or wider framing of Douglas Fir-larch or Southern pine. For framing of other species: (1) Find specific gravity for species of framing lumber in ANSI/AWC NDS. (2) For staples, multiply the shear value from the table by 0.82 for species with specific gravity of 0.42 or greater, or 0.65 for all other species.
- Values shown are for fiberboard sheathing on one side only with long panel dimension either parallel or perpendicular to studs.
- Fastener shall be spaced 6 inches on center along intermediate framing members.
- Values are not permitted in Seismic Design Category D, E or F.

TABLE 2306.3(3)
ALLOWABLE SHEAR VALUES FOR WIND OR SEISMIC FORCES FOR SHEAR WALLS OF LATH AND
PLASTER OR GYPSUM BOARD WOOD FRAMED WALL ASSEMBLIES UTILIZING STAPLES

TYPE OF MATERIAL	THICKNESS OF MATERIAL	WALL CONSTRUCTION	STAPLE SPACING ^b MAXIMUM (inches)	SHEAR VALUE ^{a, c} (plf)	MINIMUM STAPLE SIZE ^{f, g}
1. Expanded metal or woven wire lath and Portland cement plaster	$\frac{7}{8}$ "	Unblocked	6	180	No. 16 gage galv. staple, $\frac{7}{8}$ " legs
2. Gypsum lath, plain or perforated	$\frac{3}{8}$ " lath and $\frac{1}{2}$ " plaster	Unblocked	5	100	No. 16 gage galv. staple, $1\frac{1}{8}$ " long
3. Gypsum sheathing	$\frac{1}{2}$ " \times 2' \times 8'	Unblocked	4	75	No. 16 gage galv. staple, $1\frac{3}{4}$ " long
	$\frac{1}{2}$ " \times 4'	Blocked ^d	4	175	
4. Gypsum board, gypsum veneer base or water-resistant gypsum backing board	$\frac{1}{2}$ "	Unblocked ^d	7	75	No. 16 gage galv. staple, $1\frac{1}{2}$ " long
		Unblocked ^d	4	110	
		Unblocked	7	100	
		Unblocked	4	125	
		Blocked ^e	7	125	
		Blocked ^e	4	150	
	$\frac{5}{8}$ "	Unblocked ^d	7	115	No. 16 gage galv. staple, $1\frac{5}{8}$ " long
			4	145	
		Blocked ^e	7	145	
			4	175	
Blocked ^e Two-ply	Base ply: 9 Face ply: 7	250	No. 16 gage galv. staple $1\frac{5}{8}$ " long No. 15 gage galv. staple, $2\frac{1}{4}$ " long		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per foot = 14.5939 N/m.

- These shear walls shall not be used to resist loads imposed by masonry or concrete walls (see AWC SDPWS). Values shown are for short-term loading due to wind or seismic loading. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7. Values shown shall be reduced 25 percent for normal loading.
- Applies to fastening at studs, top and bottom plates and blocking.
- Except as noted, shear values are based on a maximum framing spacing of 16 inches on center.
- Maximum framing spacing of 24 inches on center.
- All edges are blocked, and edge fastening is provided at all supports and all panel edges.
- Staples shall have a minimum crown width of $\frac{7}{16}$ inch, measured outside the legs, and shall be installed with their crowns parallel to the long dimension of the framing members.
- Staples for the attachment of gypsum lath and woven-wire lath shall have a minimum crown width of $\frac{3}{4}$ inch, measured outside the legs.

SECTION 2307 LOAD AND RESISTANCE FACTOR DESIGN

2307.1 Load and resistance factor design. The design and construction of wood elements and structures using load and resistance factor design shall be in accordance with ANSI/AWC NDS and AWC SDPWS.

SECTION 2308 CONVENTIONAL LIGHT-FRAME CONSTRUCTION

2308.1 General. The requirements of this section are intended for conventional light-frame construction. Other construction methods are permitted to be used, provided that a satisfactory design is submitted showing compliance with other provisions of this code. Interior nonload-bearing partitions, ceilings and curtain walls of conventional light-frame construction are not subject to the limitations of Section 2308.2.

2308.1.1 Portions exceeding limitations of conventional light-frame construction. Where portions of a building of otherwise conventional light-frame construction exceed the limits of Section 2308.2, those portions and the supporting load path shall be designed in accordance with accepted engineering practice and the provisions of this code. For the purposes of this section, the term “portions” shall mean parts of buildings containing volume and area such as a room or a series of rooms. The extent of such design need only demonstrate compliance of the nonconventional light-framed elements with other applicable provisions of this code and shall be compatible with the performance of the conventional light-framed system.

2308.1.2 Connections and fasteners. Connectors and fasteners used in conventional construction shall comply with the requirements of Section 2304.10.

2308.2 Limitations. Buildings are permitted to be constructed in accordance with the provisions of conventional light-frame construction, subject to the limitations in Sections 2308.2.1 through 2308.2.6.

2308.2.1 Stories. Structures of conventional light-frame construction shall be limited in story height in accordance with Table 2308.2.1.

**TABLE 2308.2.1
ALLOWABLE STORY HEIGHT**

SEISMIC DESIGN CATEGORY	ALLOWABLE STORY ABOVE GRADE PLANE
A and B	Three stories
C	Two stories
D and E ^a	One story

For SI: 1 inch = 25.4 mm.

a. For the purposes of this section, for buildings assigned to Seismic Design Category D or E, cripple walls shall be considered to be a story unless cripple walls are solid blocked and do not exceed 14 inches in height.

2308.2.2 Allowable floor-to-floor height. Maximum floor-to-floor height shall not exceed 11 feet, 7 inches (3531 mm). Exterior bearing wall and interior braced wall heights shall not exceed a stud height of 10 feet (3048 mm).

2308.2.3 Allowable loads. Loads shall be in accordance with Chapter 16 and shall not exceed the following:

1. Average dead loads shall not exceed 15 psf (718 N/m²) for combined roof and ceiling, exterior walls, floors and partitions.

Exceptions:

1. Subject to the limitations of Section 2308.6.10, stone or masonry veneer up to the less of 5 inches (127 mm) thick or 50 pounds per square foot (2395 N/m²) and installed in accordance with Chapter 14 is permitted to a height of 30 feet (9144 mm) above a noncombustible foundation, with an additional 8 feet (2439) permitted for gable ends.
2. Concrete or masonry fireplaces, heaters and chimneys shall be permitted in accordance with the provisions of this code.
2. Live loads shall not exceed 40 psf (1916 N/m²) for floors.

Exception: Live loads for concrete slab-on-ground floors in Risk Categories I and II shall be not more than 125 psf.
3. Ground snow loads shall not exceed 50 psf (2395 N/m²).

2308.2.4 Basic wind speed. *V* shall not exceed 130 miles per hour (57 m/s) (3-second gust).

Exceptions:

1. *V* shall not exceed 140 mph (63 m/s) (3-second gust) for buildings in Exposure Category B that are not located in a hurricane-prone region.
2. Where *V* exceeds 130 mph (3-second gust), the provisions of either AWC WFCM or ICC 600 are permitted to be used.

2308.2.5 Allowable roof span. Ceiling joist and rafter framing constructed in accordance with Section 2308.7 and trusses shall not span more than 40 feet (12 192 mm) between points of vertical support. A ridge board in accordance with Section 2308.7 or 2308.7.3.1 shall not be considered a vertical support.

2308.2.6 Risk category limitation. The use of the provisions for conventional light-frame construction in this section shall not be permitted for Risk Category IV buildings assigned to Seismic Design Category B, C, D or F.

2308.2.7 Additional requirements [DSA-SS & DSA-SS/CC and OSHPD 1R, 2 & 5] The use of conventional light-frame construction provisions in this section is permitted, subject to the following conditions:

1. The design and construction shall also comply with Section 2304 and Section 2305.
2. In conjunction with the use of provisions in Section 2308.6 (Wall bracing), engineering analysis shall be furnished that demonstrates compliance of lateral-force-resisting systems with Section 2305.

3. In addition to the use of provisions in Section 2308.4 (Floor framing), engineering analysis shall be furnished that demonstrates compliance of floor framing elements and connections with Section 2302.1, Item 1 or 2.
4. In addition to the use of provisions in Section 2308.5 (Wall construction), engineering analysis shall be furnished that demonstrates compliance of wall framing elements and connections with Section 2302.1, Item 1 or 2.
5. In addition to the use of provisions in Section 2308.7 (Roof and Ceiling Framing), engineering analysis shall be furnished demonstrating compliance of roof and ceiling framing elements and connections with Section 2302.1, Item 1 or 2.

2308.3 Foundations and footings. Foundations and footings shall be designed and constructed in accordance with Chapter 18. Connections to foundations and footings shall comply with this section.

2308.3.1 Foundation plates or sills. Foundation plates or sills resting on concrete or masonry foundations shall comply with Section 2304.3.1. Foundation plates or sills shall be bolted or anchored to the foundation with not less than $\frac{1}{2}$ -inch-diameter (12.7 mm) steel bolts or approved anchors spaced to provide equivalent anchorage as the steel bolts. Bolts shall be embedded not less than 7 inches (178 mm) into concrete or masonry. The bolts shall be located in the middle third of the width of the plate. Bolts shall be spaced not more than 6 feet (1829 mm) on center and there shall be not less than two bolts or anchor straps per piece with one bolt or anchor strap located not more than 12 inches (305 mm) or less than 4 inches (102 mm) from each end of each piece. Bolts in sill plates of braced wall lines in structures over two stories above grade shall be spaced not more than 4 feet (1219 mm) on center. A properly sized nut and washer shall be tightened on each bolt to the plate.

2308.3.1.1 Braced wall line sill plate anchorage in Seismic Design Category D. Sill plates along braced wall lines in buildings assigned to Seismic Design Category D shall be anchored with not less than $\frac{1}{2}$ -inch (12.7 mm) diameter anchor bolts with steel plate washers between the foundation sill plate and the nut, or approved anchor straps load-rated in accordance with Section 2304.10.4 and spaced to provide equivalent anchorage. Plate washers shall be not less than 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $\frac{3}{16}$ inch (4.76 mm) larger than the bolt diameter and a slot length not to exceed $1\frac{3}{4}$ inches (44 mm), provided that a standard cut washer is placed between the plate washer and the nut.

2308.3.1.2 Braced wall line sill plate anchorage in Seismic Design Category E. Sill plates along braced wall lines in buildings assigned to Seismic Design Category E shall be anchored with not less than $\frac{5}{8}$ -inch diameter (15.9 mm) anchor bolts with steel plate washers between the foundation sill plate and the nut, or

approved anchor straps load-rated in accordance with Section 2304.10.4 and spaced to provide equivalent anchorage. Plate washers shall be not less than 0.229 inch by 3 inches by 3 inches (5.82 mm by 76 mm by 76 mm) in size. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $\frac{3}{16}$ inch (4.76 mm) larger than the bolt diameter and a slot length not to exceed $1\frac{3}{4}$ inches (44 mm), provided that a standard cut washer is placed between the plate washer and the nut.

2308.4 Floor framing. Floor framing shall comply with this section.

2308.4.1 Girders. Girders for single-story construction or girders supporting loads from a single floor shall be not less than 4 inches by 6 inches (102 mm by 152 mm) for spans 6 feet (1829 mm) or less, provided that girders are spaced not more than 8 feet (2438 mm) on center. Other girders shall be designed to support the loads specified in this code. Girder end joints shall occur over supports.

Where a girder is spliced over a support, an adequate tie shall be provided. The ends of beams or girders supported on masonry or concrete shall not have less than 3 inches (76 mm) of bearing.

2308.4.1.1 Allowable girder spans. The allowable spans of girders that are fabricated of dimension lumber shall not exceed the values set forth in Table 2308.4.1.1(1) or 2308.4.1.1(2).

2308.4.2 Floor joists. Floor joists shall comply with this section.

2308.4.2.1 Span. Spans for floor joists shall be in accordance with Table 2308.4.2.1(1), Table 2308.4.2.1(2) or the AWC STJR.

2308.4.2.2 Bearing. The ends of each joist shall have not less than $1\frac{1}{2}$ inches (38 mm) of bearing on wood or metal, or not less than 3 inches (76 mm) on masonry, except where supported on a 1-inch by 4-inch (25 mm by 102 mm) ribbon strip and nailed to the adjoining stud.

2308.4.2.3 Framing details. Joists shall be supported laterally at the ends and at each support by solid blocking except where the ends of the joists are nailed to a header, band or rim joist or to an adjoining stud or by other means. Solid blocking shall be not less than 2 inches (51 mm) in thickness and the full depth of the joist. Joist framing from opposite sides of a beam, girder or partition shall be lapped not less than 3 inches (76 mm) or the opposing joists shall be tied together in an approved manner. Joists framing into the side of a wood girder shall be supported by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

2308.4.2.4 Notches and holes. Notches on the ends of joists shall not exceed one-fourth the joist depth. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist and the diameter of any such hole shall not exceed one-third the depth of the joist.

TABLE 2308.4.1.1(1)
HEADER AND GIRDER SPANS^{a, b} FOR EXTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) ^e																	
		30						50						70					
		Building width ^c (feet)																	
		12		24		36		12		24		36		12		24		36	
Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d		
Roof ceiling and	1-2 x 6	4-0	1	3-1	2	2-7	2	3-5	1	2-8	2	2-3	2	3-0	2	2-4	2	2-0	2
	1-2 x 8	5-1	2	3-11	2	3-3	2	4-4	2	3-4	2	2-10	2	3-10	2	3-0	2	2-6	3
	1-2 x 10	6-0	2	4-8	2	3-11	2	5-2	2	4-0	2	3-4	3	4-7	2	3-6	3	3-0	3
	1-2 x 12	7-1	2	5-5	2	4-7	3	6-1	2	4-8	3	3-11	3	5-5	2	4-2	3	3-6	3
	2-2 x 4	4-0	1	3-1	1	2-7	1	3-5	1	2-7	1	2-2	1	3-0	1	2-4	1	2-0	1
	2-2 x 6	6-0	1	4-7	1	3-10	1	5-1	1	3-11	1	3-3	2	4-6	1	3-6	2	2-11	2
	2-2 x 8	7-7	1	5-9	1	4-10	2	6-5	1	5-0	2	4-2	2	5-9	1	4-5	2	3-9	2
	2-2 x 10	9-0	1	6-10	2	5-9	2	7-8	2	5-11	2	4-11	2	6-9	2	5-3	2	4-5	2
	2-2 x 12	10-7	2	8-1	2	6-10	2	9-0	2	6-11	2	5-10	2	8-0	2	6-2	2	5-2	3
	3-2 x 8	9-5	1	7-3	1	6-1	1	8-1	1	6-3	1	5-3	2	7-2	1	5-6	2	4-8	2
	3-2 x 10	11-3	1	8-7	1	7-3	2	9-7	1	7-4	2	6-2	2	8-6	1	6-7	2	5-6	2
	3-2 x 12	13-2	1	10-1	2	8-6	2	11-3	2	8-8	2	7-4	2	10-0	2	7-9	2	6-6	2
	4-2 x 8	10-11	1	8-4	1	7-0	1	9-4	1	7-2	1	6-0	1	8-3	1	6-4	1	5-4	2
	4-2 x 10	12-11	1	9-11	1	8-4	1	11-1	1	8-6	1	7-2	2	9-10	1	7-7	2	6-4	2
4-2 x 12	15-3	1	11-8	1	9-10	2	13-0	1	10-0	2	8-5	2	11-7	1	8-11	2	7-6	2	
Roof, ceiling and center-bearing floor	1-2 x 6	3-3	1	2-7	2	2-2	2	3-0	2	2-4	2	2-0	2	2-9	2	2-2	2	1-10	2
	1-2 x 8	4-1	2	3-3	2	2-9	2	3-9	2	3-0	2	2-6	3	3-6	2	2-9	2	2-4	3
	1-2 x 10	4-11	2	3-10	2	3-3	3	4-6	2	3-6	3	3-0	3	4-1	2	3-3	3	2-9	3
	1-2 x 12	5-9	2	4-6	3	3-10	3	5-3	2	4-2	3	3-6	3	4-10	3	3-10	3	3-3	4
	2-2 x 4	3-3	1	2-6	1	2-2	1	3-0	1	2-4	1	2-0	1	2-8	1	2-2	1	1-10	1
	2-2 x 6	4-10	1	3-9	1	3-3	2	4-5	1	3-6	2	3-0	2	4-1	1	3-3	2	2-9	2
	2-2 x 8	6-1	1	4-10	2	4-1	2	5-7	2	4-5	2	3-9	2	5-2	2	4-1	2	3-6	2
	2-2 x 10	7-3	2	5-8	2	4-10	2	6-8	2	5-3	2	4-5	2	6-1	2	4-10	2	4-1	2
	2-2 x 12	8-6	2	6-8	2	5-8	2	7-10	2	6-2	2	5-3	3	7-2	2	5-8	2	4-10	3
	3-2 x 8	7-8	1	6-0	1	5-1	2	7-0	1	5-6	2	4-8	2	6-5	1	5-1	2	4-4	2
	3-2 x 10	9-1	1	7-2	2	6-1	2	8-4	1	6-7	2	5-7	2	7-8	2	6-1	2	5-2	2
	3-2 x 12	10-8	2	8-5	2	7-2	2	9-10	2	7-8	2	6-7	2	9-0	2	7-1	2	6-1	2
	4-2 x 8	8-10	1	6-11	1	5-11	1	8-1	1	6-4	1	5-5	2	7-5	1	5-11	1	5-0	2
	4-2 x 10	10-6	1	8-3	2	7-0	2	9-8	1	7-7	2	6-5	2	8-10	1	7-0	2	6-0	2
4-2 x 12	12-4	1	9-8	2	8-3	2	11-4	2	8-11	2	7-7	2	10-4	2	8-3	2	7-0	2	
Roof, ceiling and one clear span floor	1-2 x 6	2-11	2	2-3	2	1-11	2	2-9	2	2-1	2	1-9	2	2-7	2	2-0	2	1-8	2
	1-2 x 8	3-9	2	2-10	2	2-5	3	3-6	2	2-8	2	2-3	3	3-3	2	2-6	3	2-2	3
	1-2 x 10	4-5	2	3-5	3	2-10	3	4-2	2	3-2	3	2-8	3	3-11	2	3-0	3	2-6	3
	1-2 x 12	5-2	2	4-0	3	3-4	3	4-10	3	3-9	3	3-2	4	4-7	3	3-6	3	3-0	4
	2-2 x 4	2-11	1	2-3	1	1-10	1	2-9	1	2-1	1	1-9	1	2-7	1	2-0	1	1-8	1
	2-2 x 6	4-4	1	3-4	2	2-10	2	4-1	1	3-2	2	2-8	2	3-10	1	3-0	2	2-6	2
	2-2 x 8	5-6	2	4-3	2	3-7	2	5-2	2	4-0	2	3-4	2	4-10	2	3-9	2	3-2	2
	2-2 x 10	6-7	2	5-0	2	4-2	2	6-1	2	4-9	2	4-0	2	5-9	2	4-5	2	3-9	3
	2-2 x 12	7-9	2	5-11	2	4-11	3	7-2	2	5-7	2	4-8	3	6-9	2	5-3	3	4-5	3
	3-2 x 8	6-11	1	5-3	2	4-5	2	6-5	1	5-0	2	4-2	2	6-1	1	4-8	2	4-0	2
	3-2 x 10	8-3	2	6-3	2	5-3	2	7-8	2	5-11	2	5-0	2	7-3	2	5-7	2	4-8	2
	3-2 x 12	9-8	2	7-5	2	6-2	2	9-0	2	7-0	2	5-10	2	8-6	2	6-7	2	5-6	3
	4-2 x 8	8-0	1	6-1	1	5-1	2	7-5	1	5-9	2	4-10	2	7-0	1	5-5	2	4-7	2
	4-2 x 10	9-6	1	7-3	2	6-1	2	8-10	1	6-10	2	5-9	2	8-4	1	6-5	2	5-5	2
4-2 x 12	11-2	2	8-6	2	7-2	2	10-5	2	8-0	2	6-9	2	9-10	2	7-7	2	6-5	2	

(continued)

TABLE 2308.4.1.1(1)—continued
HEADER AND GIRDER SPANS^{a, b} FOR EXTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) ^e																	
		30						50						70					
		Building width ^c (feet)																	
		12		24		36		12		24		36		12		24		36	
Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d		
Roof, ceiling and two center-bearing floors	1-2 × 6	2-8	2	2-1	2	1-10	2	2-7	2	2-0	2	1-9	2	2-5	2	1-11	2	1-8	2
	1-2 × 8	3-5	2	2-8	2	2-4	3	3-3	2	2-7	2	2-2	3	3-1	2	2-5	3	2-1	3
	1-2 × 10	4-0	2	3-2	3	2-9	3	3-10	2	3-1	3	2-7	3	3-8	2	2-11	3	2-5	3
	1-2 × 12	4-9	3	3-9	3	3-2	4	4-6	3	3-7	3	3-1	4	4-3	3	3-5	3	2-11	4
	2-2 × 4	2-8	1	2-1	1	1-9	1	2-6	1	2-0	1	1-8	1	2-5	1	1-11	1	1-7	1
	2-2 × 6	4-0	1	3-2	2	2-8	2	3-9	1	3-0	2	2-7	2	3-7	1	2-10	2	2-5	2
	2-2 × 8	5-0	2	4-0	2	3-5	2	4-10	2	3-10	2	3-3	2	4-7	2	3-7	2	3-1	2
	2-2 × 10	6-0	2	4-9	2	4-0	2	5-8	2	4-6	2	3-10	3	5-5	2	4-3	2	3-8	3
	2-2 × 12	7-0	2	5-7	2	4-9	3	6-8	2	5-4	3	4-6	3	6-4	2	5-0	3	4-3	3
	3-2 × 8	6-4	1	5-0	2	4-3	2	6-0	1	4-9	2	4-1	2	5-8	2	4-6	2	3-10	2
	3-2 × 10	7-6	2	5-11	2	5-1	2	7-1	2	5-8	2	4-10	2	6-9	2	5-4	2	4-7	2
	3-2 × 12	8-10	2	7-0	2	5-11	2	8-5	2	6-8	2	5-8	3	8-0	2	6-4	2	5-4	3
	4-2 × 8	7-3	1	5-9	1	4-11	2	6-11	1	5-6	2	4-8	2	6-7	1	5-2	2	4-5	2
4-2 × 10	8-8	1	6-10	2	5-10	2	8-3	2	6-6	2	5-7	2	7-10	2	6-2	2	5-3	2	
4-2 × 12	10-2	2	8-1	2	6-10	2	9-8	2	7-8	2	6-7	2	9-2	2	7-3	2	6-2	2	
Roof, ceiling and two clear span floors	1-2 × 6	2-3	2	1-9	2	1-5	2	2-3	2	1-9	2	1-5	3	2-2	2	1-8	2	1-5	3
	1-2 × 8	2-10	2	2-2	3	1-10	3	2-10	2	2-2	3	1-10	3	2-9	2	2-1	3	1-10	3
	1-2 × 10	3-4	2	2-7	3	2-2	3	3-4	3	2-7	3	2-2	4	3-3	3	2-6	3	2-2	4
	1-2 × 12	4-0	3	3-0	3	2-7	4	4-0	3	3-0	4	2-7	4	3-10	3	3-0	4	2-6	4
	2-2 × 4	2-3	1	1-8	1	1-4	1	2-3	1	1-8	1	1-4	1	2-2	1	1-8	1	1-4	2
	2-2 × 6	3-4	1	2-6	2	2-2	2	3-4	2	2-6	2	2-2	2	3-3	2	2-6	2	2-1	2
	2-2 × 8	4-3	2	3-3	2	2-8	2	4-3	2	3-3	2	2-8	2	4-1	2	3-2	2	2-8	3
	2-2 × 10	5-0	2	3-10	2	3-2	3	5-0	2	3-10	2	3-2	3	4-10	2	3-9	3	3-2	3
	2-2 × 12	5-11	2	4-6	3	3-9	3	5-11	2	4-6	3	3-9	3	5-8	2	4-5	3	3-9	3
	3-2 × 8	5-3	1	4-0	2	3-5	2	5-3	2	4-0	2	3-5	2	5-1	2	3-11	2	3-4	2
	3-2 × 10	6-3	2	4-9	2	4-0	2	6-3	2	4-9	2	4-0	2	6-1	2	4-8	2	4-0	3
	3-2 × 12	7-5	2	5-8	2	4-9	3	7-5	2	5-8	2	4-9	3	7-2	2	5-6	3	4-8	3
	4-2 × 8	6-1	1	4-8	2	3-11	2	6-1	1	4-8	2	3-11	2	5-11	1	4-7	2	3-10	2
4-2 × 10	7-3	2	5-6	2	4-8	2	7-3	2	5-6	2	4-8	2	7-0	2	5-5	2	4-7	2	
4-2 × 12	8-6	2	6-6	2	5-6	2	8-6	2	6-6	2	5-6	2	8-3	2	6-4	2	5-4	3	

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine fir.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.

f. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

TABLE 2308.4.1.1(2)
HEADER AND GIRDER SPANS^{a, b} FOR INTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING WIDTH ^c (feet)					
		12		24		36	
		Span ^e	NJ ^d	Span ^e	NJ ^d	Span ^e	NJ ^d
One floor only	2-2 × 4	4-1	1	2-10	1	2-4	1
	2-2 × 6	6-1	1	4-4	1	3-6	1
	2-2 × 8	7-9	1	5-5	1	4-5	2
	2-2 × 10	9-2	1	6-6	2	5-3	2
	2-2 × 12	10-9	1	7-7	2	6-3	2
	3-2 × 8	9-8	1	6-10	1	5-7	1
	3-2 × 10	11-5	1	8-1	1	6-7	2
	3-2 × 12	13-6	1	9-6	2	7-9	2
	4-2 × 8	11-2	1	7-11	1	6-5	1
	4-2 × 10	13-3	1	9-4	1	7-8	1
4-2 × 12	15-7	1	11-0	1	9-0	2	
Two floors	2-2 × 4	2-7	1	1-11	1	1-7	1
	2-2 × 6	3-11	1	2-11	2	2-5	2
	2-2 × 8	5-0	1	3-8	2	3-1	2
	2-2 × 10	5-11	2	4-4	2	3-7	2
	2-2 × 12	6-11	2	5-2	2	4-3	3
	3-2 × 8	6-3	1	4-7	2	3-10	2
	3-2 × 10	7-5	1	5-6	2	4-6	2
	3-2 × 12	8-8	2	6-5	2	5-4	2
	4-2 × 8	7-2	1	5-4	1	4-5	2
	4-2 × 10	8-6	1	6-4	2	5-3	2
4-2 × 12	10-1	1	7-5	2	6-2	2	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Spans are given in feet and inches.

b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine and spruce-pine fir.

c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.

d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.

e. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

TABLE 2308.4.2.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 (Residential sleeping areas, live load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	
12	Douglas Fir-Larch	SS	12-6	16-6	21-0	25-7	12-6	16-6	21-0	25-7
	Douglas Fir-Larch	#1	12-0	15-10	20-3	24-8	12-0	15-7	19-0	22-0
	Douglas Fir-Larch	#2	11-10	15-7	19-10	23-0	11-6	14-7	17-9	20-7
	Douglas Fir-Larch	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Hem-Fir	SS	11-10	15-7	19-10	24-2	11-10	15-7	19-10	24-2
	Hem-Fir	#1	11-7	15-3	19-5	23-7	11-7	15-2	18-6	21-6
	Hem-Fir	#2	11-0	14-6	18-6	22-6	11-0	14-4	17-6	20-4
	Hem-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Southern Pine	SS	12-3	16-2	20-8	25-1	12-3	16-2	20-8	25-1
	Southern Pine	#1	11-10	15-7	19-10	24-2	11-10	15-7	18-7	22-0
	Southern Pine	#2	11-3	14-11	18-1	21-4	10-9	13-8	16-2	19-1
	Southern Pine	#3	9-2	11-6	14-0	16-6	8-2	10-3	12-6	14-9
	Spruce-Pine-Fir	SS	11-7	15-3	19-5	23-7	11-7	15-3	19-5	23-7
	Spruce-Pine-Fir	#1	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#2	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-Pine-Fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
16	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-0
	Douglas Fir-Larch	#1	10-11	14-5	18-5	21-4	10-8	13-6	16-5	19-1
	Douglas Fir-Larch	#2	10-9	14-1	17-2	19-11	9-11	12-7	15-5	17-10
	Douglas Fir-Larch	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	20-9	10-4	13-1	16-0	18-7
	Hem-Fir	#2	10-0	13-2	16-10	19-8	9-10	12-5	15-2	17-7
	Hem-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-9	14-2	18-0	21-4	10-9	13-9	16-1	19-1
	Southern Pine	#2	10-3	13-3	15-8	18-6	9-4	11-10	14-0	16-6
	Southern Pine	#3	7-11	10-10	12-1	14-4	7-1	8-11	10-10	12-10
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-4
	Spruce-Pine-Fir	#1	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-Pine-Fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6

(continued)

TABLE 2308.4.2.1(1)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
(Residential sleeping areas, live load = 30 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	21-0
	Douglas Fir-Larch	#1	10-4	13-7	16-9	19-6	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	10-1	12-10	15-8	18-3	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Hem-Fir	SS	10-1	13-4	17-0	20-8	10-1	13-4	17-0	20-7
	Hem-Fir	#1	9-10	13-0	16-4	19-0	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-5	12-5	15-6	17-1	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Southern Pine	#1	10-1	13-4	16-5	19-6	9-11	12-7	14-8	17-5
	Southern Pine	#2	9-6	12-1	14-4	16-10	8-6	10-10	12-10	15-1
	Southern Pine	#3	7-3	9-1	11-0	13-1	6-5	8-2	9-10	11-8
	Spruce-Pine-Fir	SS	9-10	13-0	16-7	20-2	9-10	13-0	16-7	19-6
	Spruce-Pine-Fir	#1	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
24	Douglas Fir-Larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	16-2	18-9
	Douglas Fir-Larch	#1	9-7	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Hem-Fir	SS	9-4	12-4	15-9	19-2	9-4	12-4	15-9	18-5
	Hem-Fir	#1	9-2	12-0	14-8	17-0	8-6	10-9	13-1	15-2
	Hem-Fir	#2	8-9	11-4	13-10	16-1	8-0	10-2	12-5	14-4
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Southern Pine	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-8
	Southern Pine	#1	9-4	12-4	14-8	17-5	8-10	11-3	13-1	15-7
	Southern Pine	#2	8-6	10-10	12-10	15-1	7-7	9-8	11-5	13-6
	Southern Pine	#3	6-5	8-2	9-10	11-8	5-9	7-3	8-10	10-5
	Spruce-Pine-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-0	17-5
	Spruce-Pine-Fir	#1	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#2	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

TABLE 2308.4.2.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 (Residential living areas, live load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	
12	Douglas Fir-Larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas Fir-Larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas Fir-Larch	#2	10-9	14-2	17-9	20-7	10-6	13-3	16-3	18-10
	Douglas Fir-Larch	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Hem-Fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-Fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	16-11	19-7
	Hem-Fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern Pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern Pine	#1	10-9	14-2	18-0	21-11	10-9	14-2	16-11	20-1
	Southern Pine	#2	10-3	13-6	16-2	19-1	9-10	12-6	14-9	17-5
	Southern Pine	#3	8-2	10-3	12-6	14-9	7-5	9-5	11-5	13-6
	Spruce-Pine-Fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-Pine-Fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-Pine-Fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas Fir-Larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-0
	Douglas Fir-Larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas Fir-Larch	#2	9-9	12-7	15-5	17-10	9-1	11-6	14-1	16-3
	Douglas Fir-Larch	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Hem-Fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-Fir	#1	9-6	12-7	16-0	18-7	9-6	12-0	14-8	17-0
	Hem-Fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern Pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern Pine	#1	9-9	12-10	16-1	19-1	9-9	12-7	14-8	17-5
	Southern Pine	#2	9-4	11-10	14-0	16-6	8-6	10-10	12-10	15-1
	Southern Pine	#3	7-1	8-11	10-10	12-10	6-5	8-2	9-10	11-8
	Spruce-Pine-Fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-Pine-Fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-Pine-Fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4

(continued)

TABLE 2308.4.2.1(2)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES
 (Residential living areas, live load = 40 psf, L/Δ = 360)

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	
19.2	Douglas Fir-Larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-2
	Douglas Fir-Larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas Fir-Larch	#2	9-1	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Douglas Fir-Larch	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Hem-Fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-Fir	#1	9-0	11-10	14-8	17-0	8-8	10-11	13-4	15-6
	Hem-Fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern Pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern Pine	#1	9-2	12-1	14-8	17-5	9-0	11-5	13-5	15-11
	Southern Pine	#2	8-6	10-10	12-10	15-1	7-9	9-10	11-8	13-9
	Southern Pine	#3	6-5	8-2	9-10	11-8	5-11	7-5	9-0	10-8
	Spruce-Pine-Fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-Pine-Fir	#	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-Pine-Fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas Fir-Larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	14-9	17-1
	Douglas Fir-Larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas Fir-Larch	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Douglas Fir-Larch	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Hem-Fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10 ^a
	Hem-Fir	#1	8-4	10-9	13-1	15-2	7-9	9-9	11-11	13-10
	Hem-Fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern Pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-0
	Southern Pine	#1	8-6	11-3	13-1	15-7	8-1	10-3	12-0	14-3
	Southern Pine	#2	7-7	9-8	11-5	13-6	7-0	8-10	10-5	12-4
	Southern Pine	#3	5-9	7-3	8-10	10-5	5-3	6-8	8-1	9-6
	Spruce-Pine-Fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-Pine-Fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-Pine-Fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

a. End bearing length shall be increased to 2 inches.

2308.4.3 Engineered wood products. Engineered wood products shall be installed in accordance with manufacturer's recommendations. Cuts, notches and holes bored in trusses, structural composite lumber, structural glued-laminated members or I-joists are not permitted except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.4.4 Framing around openings. Trimmer and header joists shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header joists more than 6 feet (1829 mm) in length shall be supported by framing anchors or joist hangers unless bearing on a beam, partition or wall. Tail joists over 12 feet (3658 mm) in length shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

2308.4.4.1 Openings in floor diaphragms in Seismic Design Categories B, C, D and E. Openings in horizontal diaphragms in Seismic Design Categories B, C, D and E with a dimension that is greater than 4 feet (1219 mm) shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.4.4.1(1). Metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] in thickness by 1½ inches (38 mm) in width and shall have a yield stress not less than 33,000 psi (227 Mpa). Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer's instructions but with not

less than eight 16d common nails on each side of the header-joist intersection.

Openings in floor diaphragms in Seismic Design Categories D and E shall not have any dimension exceeding 50 percent of the distance between braced wall lines or an area greater than 25 percent of the area between orthogonal pairs of braced wall lines [see Figure 2308.4.4.1(2)]; or the portion of the structure containing the opening shall be designed in accordance with accepted engineering practice to resist the forces specified in Chapter 16, to the extent such irregular opening affects the performance of the conventional framing system.

2308.4.4.2 Vertical offsets in floor diaphragms in Seismic Design Categories D and E. In Seismic Design Categories D and E, portions of a floor level shall not be vertically offset such that the framing members on either side of the offset cannot be lapped or tied together in an approved manner in accordance with Figure 2308.4.4.2 unless the portion of the structure containing the irregular offset is designed in accordance with accepted engineering practice.

Exception: Framing supported directly by foundations need not be lapped or tied directly together.

2308.4.5 Joists supporting bearing partitions. Bearing partitions parallel to joists shall be supported on beams, girders, doubled joists, walls or other bearing partitions. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

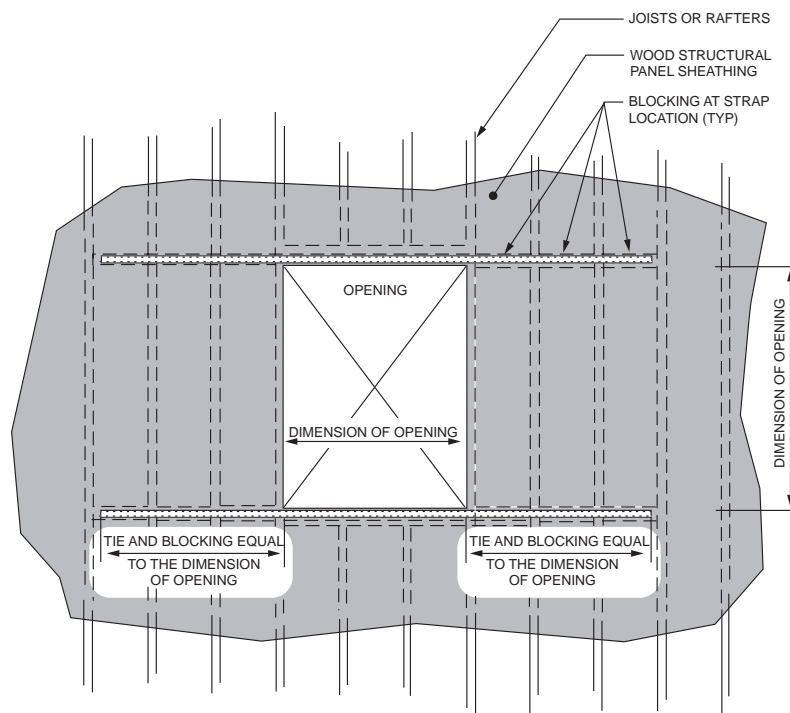


FIGURE 2308.4.4.1(1)
OPENINGS IN FLOOR AND ROOF DIAPHRAGMS

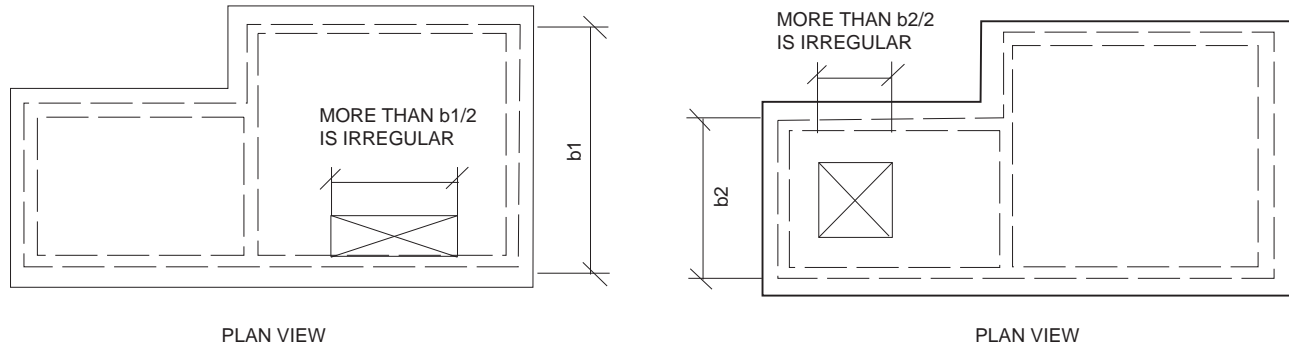


FIGURE 2308.4.4.1(2)
OPENING LIMITATIONS FOR FLOOR AND ROOF DIAPHRAGMS

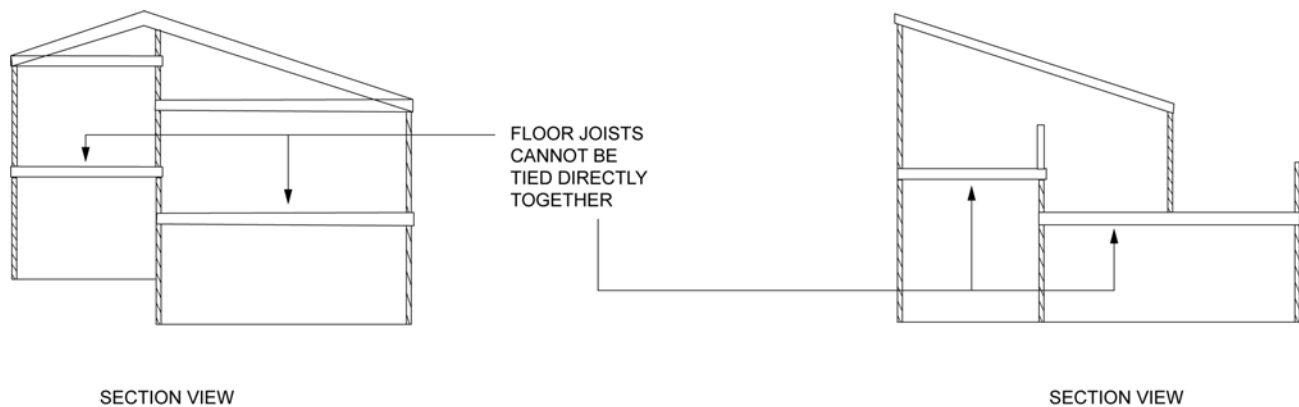


FIGURE 2308.4.4.2
PORTIONS OF FLOOR LEVEL OFFSET VERTICALLY

2308.4.6 Lateral support. Floor and ceiling framing with a nominal depth-to-thickness ratio not less than 5 to 1 shall have one edge held in line for the entire span. Where the nominal depth-to-thickness ratio of the framing member exceeds 6 to 1, there shall be one line of bridging for each 8 feet (2438 mm) of span, unless both edges of the member are held in line. The bridging shall consist of not less than 1-inch by 3-inch (25 mm by 76 mm) lumber, double nailed at each end, or equivalent metal bracing of equal rigidity, full-depth solid blocking or other approved means. A line of bridging shall be required at supports where equivalent lateral support is not otherwise provided.

2308.4.7 Structural floor sheathing. Structural floor sheathing shall comply with the provisions of Section 2304.8.1.

2308.4.8 Under-floor ventilation. For under-floor ventilation, see Section 1202.4.

2308.4.9 Floor framing supporting braced wall panels. Where braced wall panels are supported by cantilevered floors or are set back from the floor joist support, the floor framing shall comply with Section 2308.6.7.

2308.4.10 Anchorage of exterior means of egress components in Seismic Design Categories D and E.

Exterior egress balconies, exterior stairways and ramps and similar means of egress components in structures assigned to Seismic Design Category D or E shall be positively anchored to the primary structure at not more than 8 feet (2438 mm) on center or shall be designed for lateral forces. Such attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

2308.5 Wall construction. Walls of conventional light-frame construction shall be in accordance with this section.

2308.5.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table 2308.5.1.

Studs shall be continuous from a support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Table 2308.4.1.1(1) or 2308.4.1.1(2).

2308.5.2 Framing details. Studs shall be placed with their wide dimension perpendicular to the wall. Not less than

three studs shall be installed at each corner of an exterior wall.

Exceptions:

1. In interior nonbearing walls and partitions, studs are permitted to be set with the long dimension parallel to the wall.
2. At corners, two studs are permitted, provided that wood spacers or backup cleats of $\frac{3}{8}$ -inch-thick (9.5 mm) wood structural panel, $\frac{3}{8}$ -inch (9.5 mm) Type M “Exterior Glue” particleboard, 1-inch-thick (25 mm) lumber or other approved devices that will serve as an adequate backing for the attachment of facing materials are used. Where fire-resistance ratings or shear values are involved, wood spacers, backup cleats or other devices shall not be used unless specifically approved for such use.

2308.5.3 Plates and sills. Studs shall have plates and sills in accordance with this section.

2308.5.3.1 Bottom plate or sill. Studs shall have full bearing on a plate or sill. Plates or sills shall be not less than 2 inches (51 mm) nominal in thickness and have a width not less than the width of the wall studs.

2308.5.3.2 Top plates. Bearing and exterior wall studs shall be capped with double top plates installed to provide overlapping at corners and at intersections with other partitions. End joints in double top plates shall be offset not less than 48 inches (1219 mm), and shall be nailed in accordance with Table 2304.10.2. Plates shall be a nominal 2 inches (51 mm) in depth and have a width not less than the width of the studs.

Exception: A single top plate is permitted, provided that the plate is adequately tied at corners and intersecting walls by not less than the equivalent of 3-inch by 6-inch (76 mm by 152 mm) by 0.036-inch-thick (0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by six 8d [2 $\frac{1}{2}$ ” × 0.113” (64-mm by 2.87 mm)] box nails or equivalent on each side of the joint. For the butt-joint splice

between adjacent single top plates, not less than the equivalent of a 3-inch by 12-inch (76 mm by 304 mm) by 0.036-inch-thick (0.914 mm) galvanized steel plate that is nailed to each wall or segment of wall by 12 8d [2 $\frac{1}{2}$ -inch × 0.113-inch (64 mm by 2.87 mm)] box nails on each side of the joint shall be required, provided that the rafters, joists or trusses are centered over the studs with a tolerance of not more than 1 inch (25 mm). The top plate shall not be required over headers that are in the same plane and in line with the upper surface of the adjacent top plates and are tied to adjacent wall sections as required for the butt joint splice between adjacent single top plates.

Where bearing studs are spaced at 24-inch (610 mm) intervals, top plates are less than two 2-inch by 6-inch (51 mm by 152 mm) or two 3-inch by 4-inch (76 mm by 102 mm) members and the floor joists, floor trusses or roof trusses that they support are spaced at more than 16-inch (406 mm) intervals, such joists or trusses shall bear within 5 inches (127 mm) of the studs beneath or a third plate shall be installed.

2308.5.4 Nonload-bearing walls and partitions. In nonload-bearing walls and partitions, that are not part of a braced wall panel, studs shall be spaced not more than 24 inches (610 mm) on center. In interior nonload-bearing walls and partitions, studs are permitted to be set with the long dimension parallel to the wall. Where studs are set with the long dimensions parallel to the wall, use of utility grade lumber or studs exceeding 10 feet (3048 mm) is not permitted. Interior nonload-bearing partitions shall be capped with not less than a single top plate installed to provide overlapping at corners and at intersections with other walls and partitions. The plate shall be continuously tied at joints by solid blocking not less than 16 inches (406 mm) in length and equal in size to the plate or by $\frac{1}{2}$ -inch by 1 $\frac{1}{2}$ -inch (12.7 mm by 38 mm) metal ties with spliced sections fastened with two 16d nails on each side of the joint.

**TABLE 2308.5.1
SIZE, HEIGHT AND SPACING OF WOOD STUDS^c**

STUD SIZE (inches)	BEARING WALLS				NONBEARING WALLS	
	Laterally unsupported stud height ^a (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Laterally unsupported stud height ^a (feet)	Spacing (inches)
2 × 3 ^b	—	—	—	—	10	16
2 × 4	10	24	16	—	14	24
3 × 4	10	24	24	16	14	24
2 × 5	10	24	24	—	16	24
2 × 6	10	24	24	16	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Increases in unsupported height are permitted where justified by an analysis.
- b. Shall not be used in exterior walls.
- c. Utility-grade studs shall not be spaced more than 16 inches on center or support more than a roof and ceiling, or exceed 8 feet in height for exterior walls and load-bearing walls or 10 feet for interior nonload-bearing walls.

2308.5.5 Openings in walls and partitions. Openings in exterior and interior walls and partitions shall comply with Sections 2308.5.5.1 through 2308.5.5.3.

2308.5.5.1 Openings in exterior bearing walls. Headers shall be provided over each opening in exterior bearing walls. The size and spans in Table 2308.4.1.1(1) are permitted to be used for one- and two-family dwellings. Headers for other buildings shall be designed in accordance with Section 2302.1, Item 1 or 2. Headers of two or more pieces of nominal 2-inch (51 mm) framing lumber set on edge shall be permitted in accordance with Table 2308.4.1.1(1) and nailed together in accordance with Table 2304.10.2 or of solid lumber of equivalent size.

Single-member headers of nominal 2-inch (51 mm) thickness shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures 2308.5.5.1(1) and 2308.5.5.1(2) and face nailed to the top and bottom of the header with 10d box nails [3 inches \times 0.128 inches (76 mm \times 3.3 mm)] spaced 12 inches (305 mm) on center.

Wall studs shall support the ends of the header in accordance with Table 2308.4.1.1(1). Each end of a lintel or header shall have a bearing length of not less than 1½ inches (38 mm) for the full width of the lintel.

2308.5.5.2 Openings in interior bearing partitions. Headers shall be provided over each opening in interior bearing partitions as required in Section 2308.5.5.1. The spans in Table 2308.4.1.1(2) are permitted to be used. Wall studs shall support the ends of the header in accordance with Table 2308.4.1.1(1) or 2308.4.1.1(2), as applicable.

2308.5.5.3 Openings in interior nonbearing partitions. Openings in nonbearing partitions are permitted to be framed with single studs and headers. Each end of a lintel or header shall have a bearing length of not less than 1½ inches (38 mm) for the full width of the lintel.

2308.5.6 Cripple walls. Foundation cripple walls shall be framed of studs that are not less than the size of the studding above. Exterior cripple wall studs shall be not less than 14 inches (356 mm) in length, or shall be framed of solid blocking. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story. See Section 2308.6.6 for cripple wall bracing.

2308.5.7 Bridging. Unless covered by interior or exterior wall coverings or sheathing meeting the minimum requirements of this code, stud partitions or walls with studs having a height-to-least-thickness ratio exceeding 50 shall have bridging that is not less than 2 inches (51 mm) in thickness and of the same width as the studs fitted snugly and nailed thereto to provide adequate lateral support. Bridging shall be placed in every stud cavity and at a frequency such that studs so braced shall not have a height-to-least-thickness ratio exceeding 50 with the height of the stud measured between horizontal framing and bridging or between bridging, whichever is greater.

2308.5.8 Pipes in walls. Stud partitions containing plumbing, heating or other pipes shall be framed and the joists underneath spaced to provide proper clearance for the piping. Where a partition containing piping runs parallel to the floor joists, the joists underneath such partitions shall be doubled and spaced to permit the passage of pipes and shall be bridged. Where plumbing, heating or other pipes are placed in, or partly in, a partition, necessitating the cutting of the soles or plates, a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and 1½ inches (38 mm) in width shall be fastened to each plate across and to each side of the opening with not less than six 16d nails.

2308.5.9 Cutting and notching. In exterior walls and bearing partitions, a wood stud shall not be cut or notched in excess of 25 percent of its depth. In nonbearing partitions that do not support loads other than the weight of the partition, a stud shall not be cut or notched in excess of 40 percent of its depth.

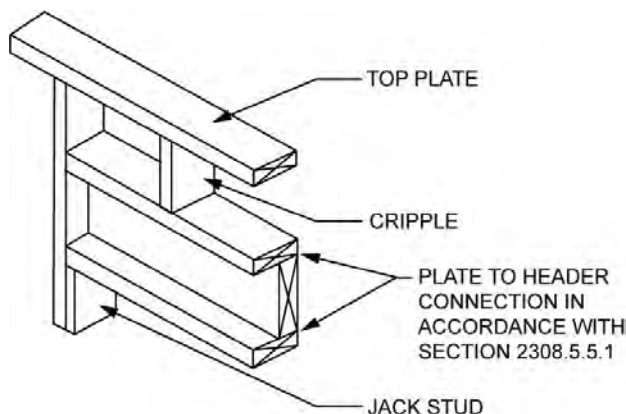


FIGURE 2308.5.5.1(1)
SINGLE-MEMBER HEADER IN EXTERIOR BEARING WALL

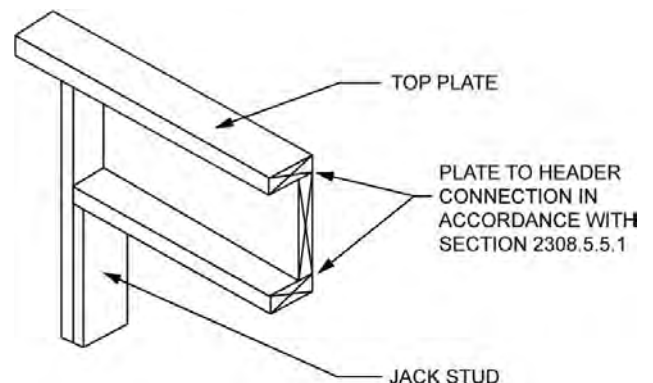


FIGURE 2308.5.5.1(2)
ALTERNATIVE SINGLE-MEMBER HEADER WITHOUT CRIPPLE

2308.5.10 Bored holes. The diameter of bored holes in wood studs shall not exceed 40 percent of the stud depth. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in nonbearing partitions. The diameter of bored holes in wood studs shall not exceed 60 percent of the stud depth in any wall where each stud is doubled, provided that not more than two such successive doubled studs are so bored. The edge of the bored hole shall not be closer than $\frac{5}{8}$ inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

2308.5.11 Exterior wall sheathing. Except where stucco construction that complies with Section 2510 is installed, the outside of exterior walls, including gables, of enclosed buildings shall be sheathed with one of the materials of the nominal thickness specified in Table 2308.5.11 with fasteners in accordance with the requirements of Section 2304.10 or fasteners designed in accordance with accepted engineering practice. Alternatively, sheathing materials and fasteners complying with Section 2304.6 shall be permitted.

2308.6 Wall bracing. Buildings shall be provided with exterior and interior braced wall lines as described in Sections 2308.6.1 through 2308.6.10.2.

2308.6.1 Braced wall lines. For the purpose of determining the amount and location of bracing required along each story level of a building, braced wall lines shall be designated as straight lines through the building plan in both the longitudinal and transverse direction and placed in accordance with Table 2308.6.1 and Figure 2308.6.1. Braced wall line spacing shall not exceed the distance specified in Table 2308.6.1. In structures assigned to Seismic Design Category D or E, braced wall lines shall intersect perpendicularly to each other.

2308.6.2 Braced wall panels. Braced wall panels shall be placed along braced wall lines in accordance with Table 2308.6.1 and Figure 2308.6.1 and as specified in Table 2308.6.3(1). A braced wall panel shall be located at each end of the braced wall line and at the corners of intersecting braced wall lines or shall begin within the maximum distance from the end of the braced wall line in accordance with Table 2308.6.1. Braced wall panels in a braced wall

line shall not be offset from each other by more than 4 feet (1219 mm). Braced wall panels shall be clearly indicated on the plans.

2308.6.3 Braced wall panel methods. Construction of braced wall panels shall be by one or a combination of the methods in Table 2308.6.3(1). Braced wall panel length shall be in accordance with Section 2308.6.4 or 2308.6.5.

2308.6.4 Braced wall panel construction. For Methods DWB, WSP, SFB, PBS, PCP and HPS, each panel must be not less than 48 inches (1219 mm) in length, covering three stud spaces where studs are spaced 16 inches (406 mm) on center and covering two stud spaces where studs are spaced 24 inches (610 mm) on center. Braced wall panels less than 48 inches (1219 mm) in length shall not contribute toward the amount of required bracing. Braced wall panels that are longer than the required length shall be credited for their actual length. For Method GB, each panel must be not less than 96 inches (2438 mm) in length where applied to one side of the studs or 48 inches (1219 mm) in length where applied to both sides.

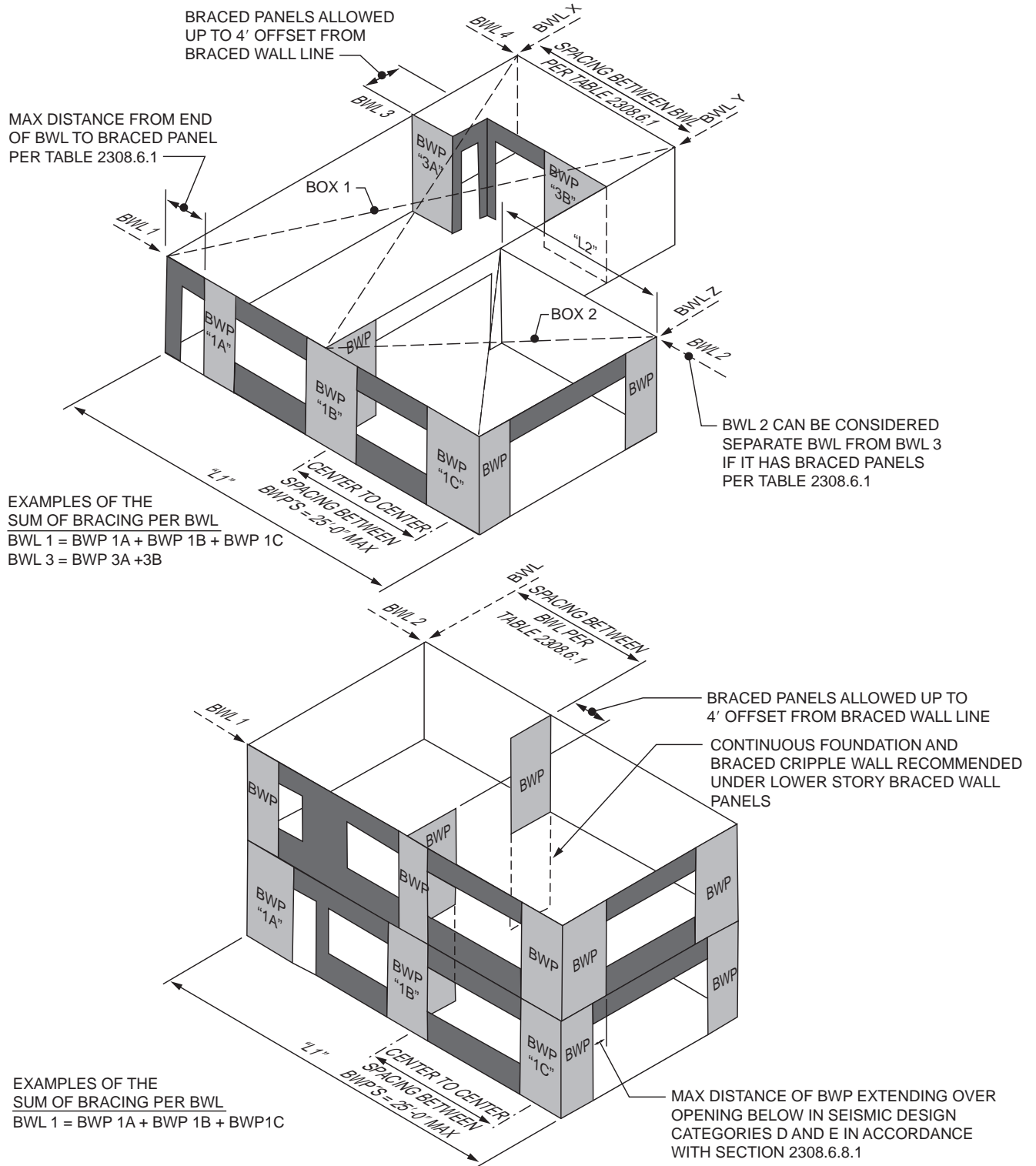
Vertical joints of panel sheathing shall occur over studs and adjacent panel joints shall be nailed to common framing members. Horizontal joints shall occur over blocking or other framing equal in size to the studding except where waived by the installation requirements for the specific sheathing materials. Sole plates shall be nailed to the floor framing in accordance with Section 2308.6.7 and top plates shall be connected to the framing above in accordance with Section 2308.6.7.2. Where joists are perpendicular to braced wall lines above, blocking shall be provided under and in line with the braced wall panels.

2308.6.5 Alternative bracing. An alternate braced wall (ABW) or a portal frame with hold-downs (PFH) described in this section is permitted to substitute for a 48-inch (1219 mm) braced wall panel of Method DWB, WSP, SFB, PBS, PCP or HPS. For Method GB, each 96-inch (2438 mm) section (applied to one face) or 48-inch (1219 mm) section (applied to both faces) or portion thereof required by Table 2308.6.1 is permitted to be replaced by one panel constructed in accordance with Method ABW or PFH.

**TABLE 2308.5.11
MINIMUM THICKNESS OF WALL SHEATHING**

SHEATHING TYPE	MINIMUM THICKNESS	MAXIMUM WALL STUD SPACING
Diagonal wood boards	$\frac{5}{8}$ inch	24 inches on center
Structural fiberboard	$\frac{1}{2}$ inch	16 inches on center
Wood structural panel	In accordance with Tables 2308.6.3(2) and 2308.6.3(3)	—
M-S “Exterior Glue” and M-2 “Exterior Glue” particleboard	In accordance with Section 2306.3 and Table 2308.6.3(4)	—
Gypsum sheathing	$\frac{1}{2}$ inch	16 inches on center
Reinforced cement mortar	1 inch	24 inches on center
Hardboard panel siding	In accordance with Table 2308.6.3(5)	—

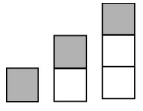
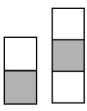
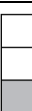



For SI: 1 inch = 25.4 mm.



For SI: 1 foot = 304.8 mm.

FIGURE 2308.6.1
BASIC COMPONENTS OF THE LATERAL BRACING SYSTEM

**TABLE 2308.6.1
WALL BRACING REQUIREMENTS^a**

SEISMIC DESIGN CATEGORY	STORY CONDITION (SEE SECTION 2308.2)	MAXIMUM SPACING OF BRACED WALL LINES	BRACED PANEL LOCATION, SPACING (O.C.) AND MINIMUM PERCENTAGE (X)			MAXIMUM DISTANCE OF BRACED WALL PANELS FROM EACH END OF BRACED WALL LINE
			Bracing method ^b			
			LIB	DWB, WSP	SFB, PBS, PCP, HPS, GB ^{c, d}	
A and B		35' - 0"	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	12' - 6"
		35' - 0"	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	12' - 6"
		35' - 0"	NP	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	12' - 6"
C		35' - 0"	NP	Each end and ≤ 25' - 0" o.c.	Each end and ≤ 25' - 0" o.c.	12' - 6"
		35' - 0"	NP	Each end and ≤ 25' - 0" o.c. (minimum 25% of wall length) ^e	Each end and ≤ 25' - 0" o.c. (minimum 25% of wall length) ^e	12' - 6"
D and E		25' - 0"	NP	$S_{DS} < 0.50$: Each end and ≤ 25' - 0" o.c. (minimum 21% of wall length) ^e	$S_{DS} < 0.50$: Each end and ≤ 25' - 0" o.c. (minimum 43% of wall length) ^e	8' - 0"
				$0.5 \leq S_{DS} < 0.75$: Each end and ≤ 25' - 0" o.c. (minimum 32% of wall length) ^e	$0.5 \leq S_{DS} < 0.75$: Each end and ≤ 25' - 0" o.c. (minimum 59% of wall length) ^e	
				$0.75 \leq S_{DS} \leq 1.00$: Each end and ≤ 25' - 0" o.c. (minimum 37% of wall length) ^e	$0.75 \leq S_{DS} \leq 1.00$: Each end and ≤ 25' - 0" o.c. (minimum 75% of wall length)	
				$S_{DS} > 1.00$: Each end and ≤ 25' - 0" o.c. (minimum 48% of wall length) ^e	$S_{DS} > 1.00$: Each end and ≤ 25' - 0" o.c. (minimum 100% of wall length) ^e	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NP = Not Permitted.

a. This table specifies minimum requirements for braced wall panels along interior or exterior braced wall lines.



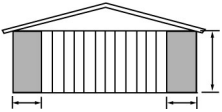

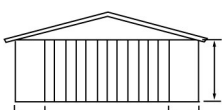
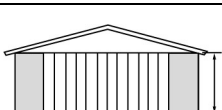


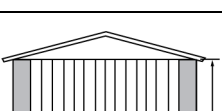

b. See Section 2308.6.3 for full description of bracing methods.

c. For Method GB, gypsum wallboard applied to framing supports that are spaced at 16 inches on center.

d. The required lengths shall be doubled for gypsum board applied to only one face of a braced wall panel.

e. Percentage shown represents the minimum amount of bracing required along the building length (or wall length if the structure has an irregular shape).

**TABLE 2308.6.3(1)
BRACING METHODS**

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a	
			Fasteners	Spacing
LIB^a Let-in-bracing	1" × 4" wood or approved metal straps attached at 45° to 60° angles to studs at maximum of 16" o.c.		Table 2304.10.2	Wood: per stud plus top and bottom plates
			Metal strap: installed in accordance with manufacturer's recommendations	Metal strap: installed in accordance with manufacturer's recommendations
DWB Diagonal wood boards	3/4" thick (1" nominal) × 6" minimum width to studs at maximum of 24" o.c.		Table 2304.10.2	Per stud
WSP Wood structural panel	3/8" in accordance with Table 2308.6.3(2) or 2308.6.3(3)		Table 2304.10.2	6" edges 12" field
SFB Structural fiber-board sheathing	1/2" in accordance with Table 2304.10.2 to studs at maximum 16" o.c.		Table 2304.10.2	3" edges 6" field
GB Gypsum board (Double sided)	1/2" or 5/8" by not less than 4" wide to studs at maximum of 24" o.c.		Section 2506.2 for exterior and interior sheathing: 5d annual ringed cooler nails (1 5/8" × 0.086") or 1 1/4" screws (Type W or S) for 1/2" gypsum board or 1 5/8" screws (Type W or S) for 5/8" gypsum board	For all braced wall panel locations: 7" o.c. along panel edges (including top and bottom plates) and 7" o.c. in the field
PBS Particleboard sheathing	3/8" or 1/2" in accordance with Table 2308.6.3(4) to studs at maximum of 16" o.c.		6d common (2" long × 0.113" dia.) nails for 3/8" thick sheathing or 8d common (2 1/2" long × 0.131" dia.) nails for 1/2" thick sheathing	3" edges 6" field
PCP Portland cement plaster	Section 2510 to studs at maximum of 16" o.c.		1 1/2" long, 11 gage, 0.120" dia., 7/16" dia. head nails or 7/8" long, 16 gage staples	6" o.c. on all framing members
HPS Hardboard panel siding	7/16" in accordance with Table 2308.6.3(5)		Table 2304.10.2	4" edges 8" field
ABW Alternate braced wall	3/8"		Figure 2308.6.5.1 and Section 2308.6.5.1	Figure 2308.6.5.1
PFH Portal frame with hold-downs	3/8"		Figure 2308.6.5.2 and Section 2308.6.5.2	Figure 2308.6.5.2

For SI: 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

a. Method LIB shall have gypsum board fastened to one or more side(s) with nails or screws

WOOD

**TABLE 2308.6.3(2)
EXPOSED PLYWOOD PANEL SIDING**

MINIMUM THICKNESS ^a (inch)	MINIMUM NUMBER OF PLYS	STUD SPACING (inches)
		Plywood siding applied directly to studs or over sheathing
$\frac{3}{8}$	3	16 ^b
$\frac{1}{2}$	4	24

For SI: 1 inch = 25.4 mm.

- a. Thickness of grooved panels is measured at bottom of grooves.
- b. Spans are permitted to be 24 inches if plywood siding applied with face grain perpendicular to studs or over one of the following: 1-inch board sheathing; $\frac{7}{16}$ -inch wood structural panel sheathing; or $\frac{3}{8}$ -inch wood structural panel sheathing with strength axis (which is the long direction of the panel unless otherwise marked) of sheathing perpendicular to studs.

**TABLE 2308.6.3(3)
WOOD STRUCTURAL PANEL WALL SHEATHING^b
(Not exposed to the weather, strength axis parallel or perpendicular to studs except as indicated)**

MINIMUM THICKNESS (inch)	PANEL SPAN RATING	STUD SPACING (inches)		
		Siding nailed to studs	Nailable sheathing	
			Sheathing parallel to studs	Sheathing perpendicular to studs
$\frac{3}{8}, \frac{15}{32}, \frac{1}{2}$	16/0, 20/0, 24/0, 32/16 Wall—24" o.c.	24	16	24
$\frac{7}{16}, \frac{15}{32}, \frac{1}{2}$	24/0, 24/16, 32/16 Wall—24" o.c.	24	24 ^a	24

For SI: 1 inch = 25.4 mm.

- a. Plywood shall consist of four or more plies.
- b. Blocking of horizontal joints shall not be required except as specified in Section 2308.6.4.

**TABLE 2308.6.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING
(Not exposed to the weather, long dimension of the panel parallel or perpendicular to studs)**

GRADE	THICKNESS (inch)	STUD SPACING (inches)	
		Siding nailed to studs	Sheathing under coverings specified in Section 2308.6.3 parallel or perpendicular to studs
M-S "Exterior Glue" and M-2 "Exterior Glue"	$\frac{3}{8}$	16	—
	$\frac{1}{2}$	16	16

For SI: 1 inch = 25.4 mm.

**TABLE 2308.6.3(5)
HARDBOARD SIDING**

SIDING	MINIMUM NOMINAL THICKNESS (inch)	2 x 4 FRAMING MAXIMUM SPACING	NAIL SIZE ^{a, b, d}	NAIL SPACING	
				General	Bracing panels ^c
1. Lap siding					
Direct to studs	$\frac{3}{8}$	16" o.c.	8d	16" o.c.	Not applicable
Over sheathing	$\frac{3}{8}$	16" o.c.	10d	16" o.c.	Not applicable
2. Square edge panel siding					
Direct to studs	$\frac{3}{8}$	24" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	$\frac{3}{8}$	24" o.c.	8d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
3. Shiplap edge panel siding					
Direct to studs	$\frac{3}{8}$	16" o.c.	6d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports
Over sheathing	$\frac{3}{8}$	16" o.c.	8d	6" o.c. edges; 12" o.c. at intermediate supports	4" o.c. edges; 8" o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

a. Nails shall be corrosion resistant.

b. Minimum acceptable nail dimensions:

	Panel Siding (inch)	Lap Siding (inch)
Shank diameter	0.092	0.099
Head diameter	0.225	0.240

c. Where used to comply with Section 2308.6.

d. Nail length must accommodate the sheathing and penetrate framing $1\frac{1}{2}$ inches.

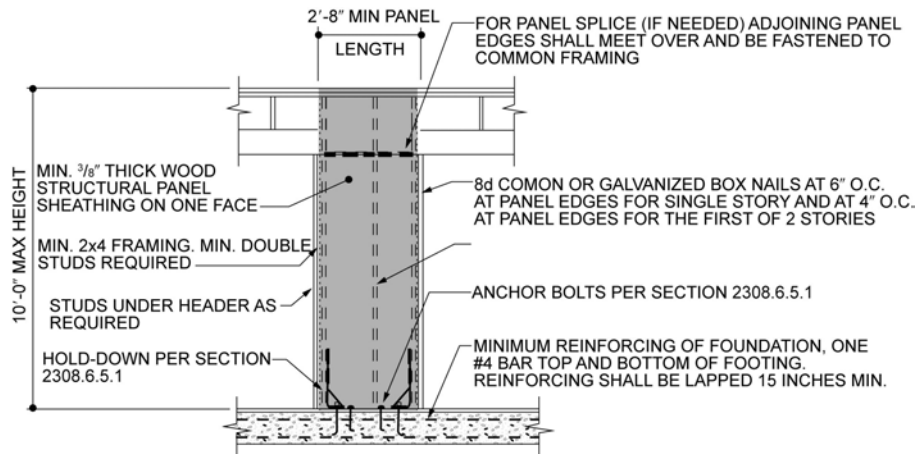
2308.6.5.1 Alternate braced wall (ABW). An ABW shall be constructed in accordance with this section and Figure 2308.6.5.1. In one-story buildings, each panel shall have a length of not less than 2 feet 8 inches (813 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with $\frac{3}{8}$ -inch (3.2 mm) minimum-thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Table 2304.10.2 and blocked at wood structural panel edges. Two anchor bolts installed in accordance with Section 2308.3.1 shall be provided in each panel. Anchor bolts shall be placed at each panel outside quarter points. Each panel end stud shall have a hold-down device fastened to the foundation, capable of providing an approved uplift capacity of not less than 1,800 pounds (8006 N). The hold-down device shall be installed in accordance with the manufacturer's recommendations. The ABW shall be supported directly on a foundation or on floor framing supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom. Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned-down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned-down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped 15 inches (381 mm) with the reinforcement

required in the continuous foundation located directly under the braced wall line.

Where the ABW is installed at the first story of two-story buildings, the wood structural panel sheathing shall be provided on both faces, three anchor bolts shall be placed at one-quarter points and tie-down device uplift capacity shall be not less than 3,000 pounds (13 344 N).

2308.6.5.2 Portal frame with hold-downs (PFH). A PFH shall be constructed in accordance with this section and Figure 2308.6.5.2. The adjacent door or window opening shall have a full-length header.

In one-story buildings, each panel shall have a length of not less than 16 inches (406 mm) and a height of not more than 10 feet (3048 mm). Each panel shall be sheathed on one face with a single layer of $\frac{3}{8}$ -inch (9.5 mm) minimum-thickness wood structural panel sheathing nailed with 8d common or galvanized box nails in accordance with Figure 2308.6.5.2. The wood structural panel sheathing shall extend up over the solid sawn or glued-laminated header and shall be nailed in accordance with Figure 2308.6.5.2. A built-up header consisting of not fewer than two 2-inch by 12-inch (51 mm by 305 mm) boards, fastened in accordance with Item 24 of Table 2304.10.2 shall be permitted to be used. A spacer, if used, shall be placed on the side of the built-up beam opposite the wood structural panel sheathing. The header shall extend between the inside faces of the first full-length outer studs of each panel.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE 2308.6.5.1
ALTERNATE BRACED WALL PANEL (ABW)**

The clear span of the header between the inner studs of each panel shall be not less than 6 feet (1829 mm) and not more than 18 feet (5486 mm) in length. A strap with an uplift capacity of not less than 1,000 pounds (4,400 N) shall fasten the header to the inner studs opposite the sheathing. One anchor bolt not less than $\frac{5}{8}$ inch (15.9 mm) diameter and installed in accordance with Section 2308.3.1 shall be provided in the center of each sill plate. The studs at each end of the panel shall have a hold-down device fastened to the foundation with an uplift capacity of not less than 3,500 pounds (15 570 N).

Where a panel is located on one side of the opening, the header shall extend between the inside face of the first full-length stud of the panel and the bearing studs at the other end of the opening. A strap with an uplift capacity of not less than 1,000 pounds (4400 N) shall fasten the header to the bearing studs. The bearing studs shall have a hold-down device fastened to the foundation with an uplift capacity of not less than 1,000 pounds (4400 N). The hold-down devices shall be an embedded strap type, installed in accordance with the manufacturer's recommendations. The PFH panels shall be supported directly on a foundation that is continuous across the entire length of the braced wall line. This foundation shall be reinforced with not less than one No. 4 bar top and bottom. Where the continuous foundation is required to have a depth greater than 12 inches (305 mm), a minimum 12-inch by 12-inch (305 mm by 305 mm) continuous footing or turned-down slab edge is permitted at door openings in the braced wall line. This continuous footing or turned-down slab edge shall be reinforced with not less than one No. 4 bar top and bottom. This reinforcement shall be lapped not less than 15 inches (381 mm) with the reinforcement required in the continuous foundation located directly under the braced wall line.

Where a PFH is installed at the first *story* of two-story buildings, each panel shall have a length of not less than 24 inches (610 mm).

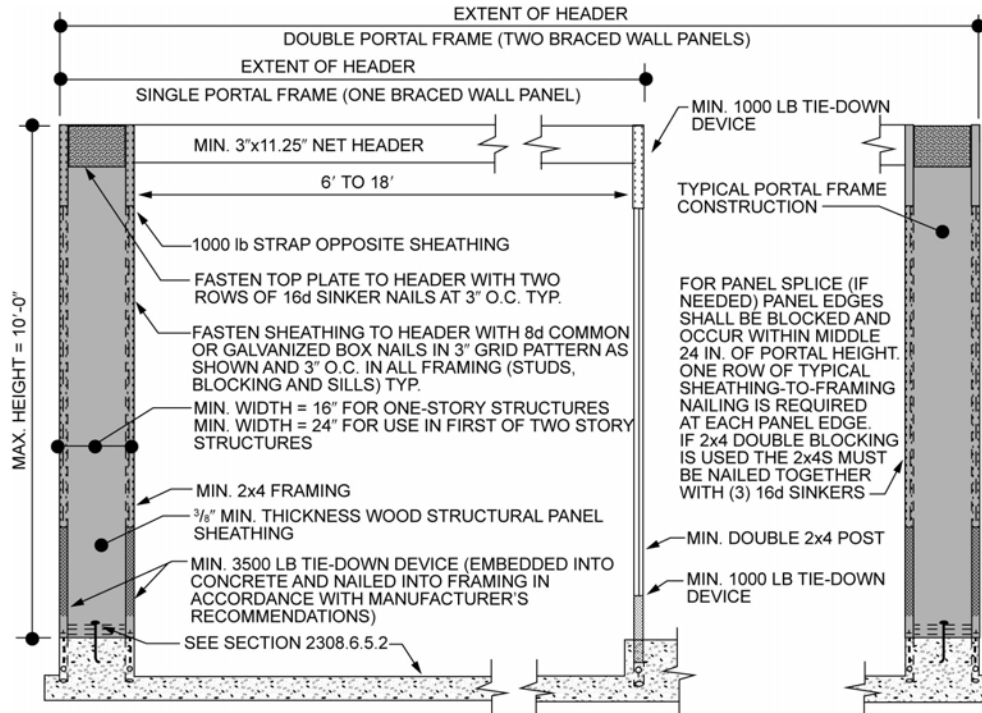
2308.6.6 Cripple wall bracing. Cripple walls shall be braced in accordance with Section 2308.6.6.1 or 2308.6.6.2.

2308.6.6.1 Cripple wall bracing in Seismic Design Categories A, B and C. For the purposes of this section, cripple walls in Seismic Design Categories A, B and C having a stud height exceeding 14 inches (356 mm) shall be considered to be a story and shall be braced in accordance with Table 2308.6.1. Spacing of edge nailing for required cripple wall bracing shall not exceed 6 inches (152 mm) on center along the foundation plate and the top plate of the cripple wall. Nail size, nail spacing for field nailing and more restrictive boundary nailing requirements shall be as required elsewhere in the code for the specific bracing material used.

2308.6.6.2 Cripple wall bracing in Seismic Design Categories D and E. For the purposes of this section, cripple walls in Seismic Design Categories D and E shall not have a stud height exceeding 14 inches (356 mm), and studs shall be solid blocked in accordance with Section 2308.5.6 for the full dwelling perimeter and for the full length of interior braced walls lines supported on foundations, excepting ventilation and access openings.

2308.6.7 Connections of braced wall panels. Braced wall panel joints shall occur over studs or blocking. Braced wall panels shall be fastened to studs, top and bottom plates and at panel edges. Braced wall panels shall be applied to nominal 2-inch-wide [actual $1\frac{1}{2}$ -inch (38 mm)] or larger stud framing.

2308.6.7.1 Bottom plate connection. Braced wall line bottom plates shall be connected to joists or full-depth blocking below in accordance with Table 2304.10.2, or to foundations in accordance with Section 2308.6.7.3.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N.

FIGURE 2308.6.5.2
PORTAL FRAME WITH HOLD-DOWNS (PFH)

2308.6.7.2 Top plate connection. Where joists or rafters are used, braced wall line top plates shall be fastened over the full length of the braced wall line to joists, rafters, rim boards or full-depth blocking above in accordance with Table 2304.10.2, as applicable, based on the orientation of the joists or rafters to the braced wall line. Blocking shall be not less than 2 inches (51 mm) in nominal thickness and shall be fastened to the braced wall line top plate as specified in Table 2304.10.2. Notching or drilling of holes in blocking in accordance with the requirements of Section 2308.4.2.4 or 2308.7.4 shall be permitted.

At exterior gable end walls, braced wall panel sheathing in the top story shall be extended and fastened to the roof framing where the spacing between parallel exterior braced wall lines is greater than 50 feet (15 240 mm).

Where roof trusses are used and are installed perpendicular to an exterior braced wall line, lateral forces shall be transferred from the roof diaphragm to the braced wall over the full length of the braced wall line by blocking of the ends of the trusses or by other approved methods providing equivalent lateral force transfer. Blocking shall be not less than 2 inches (51 mm) in nominal thickness and equal to the depth of the truss at the wall line and shall be fastened to the braced wall line top plate as specified in Table 2304.10.2. Notching or drilling of holes in blocking in accordance

with the requirements of Section 2308.4.2.4 or 2308.7.4 shall be permitted.

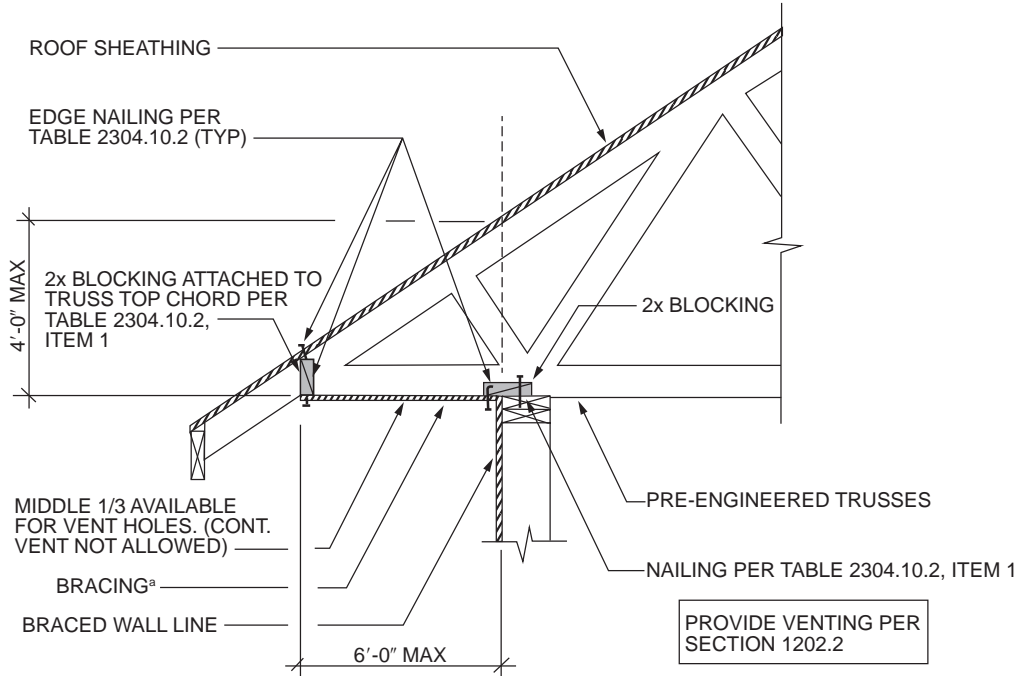
Exception: Where the roof sheathing is greater than $9\frac{1}{4}$ inches (235 mm) above the top plate, solid blocking is not required where the framing members are connected using one of the following methods:

1. In accordance with Figure 2308.6.7.2(1).
2. In accordance with Figure 2308.6.7.2(2).
3. Full-height engineered blocking panels designed for values listed in AWC WFCM.
4. A design in accordance with accepted engineering methods.

2308.6.7.3 Sill anchorage. Where foundations are required by Section 2308.6.8, braced wall line sills shall be anchored to concrete or masonry foundations. Such anchorage shall conform to the requirements of Section 2308.3. The anchors shall be distributed along the length of the braced wall line. Other anchorage devices having equivalent capacity are permitted.

2308.6.7.4 Anchorage to all-wood foundations. Where all-wood foundations are used, the force transfer from the braced wall lines shall be determined based on calculation and shall have a capacity that is not less than the connections required by Section 2308.3.

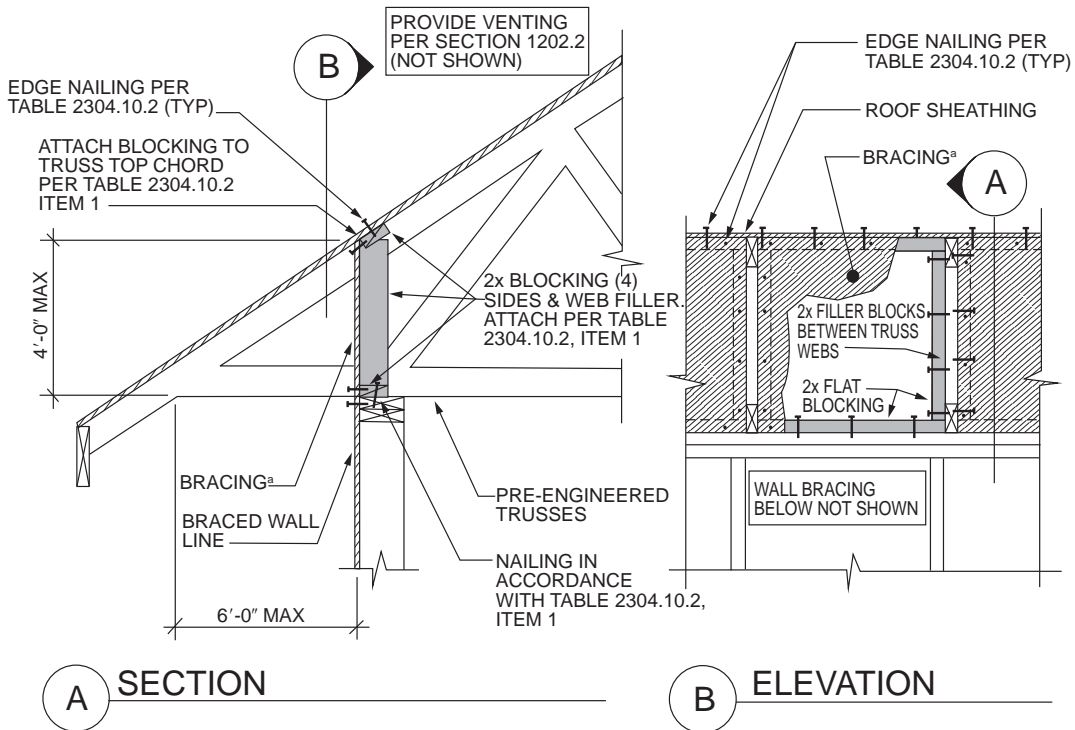
2308.6.8 Braced wall line and diaphragm support. Braced wall lines and floor and roof diaphragms shall be supported in accordance with this section.



For SI:1 foot = 304.8 mm.

a.Methods of bracing shall be as described in Table 2308.6.3(1) DWB, WSP, SFB, GB, PBS, PCP or HPS.

**FIGURE 2308.6.7.2(1)
BRACED WALL LINE TOP PLATE CONNECTION**



For SI:1 foot = 304.8 mm.

a.Methods of bracing shall be as described in Table 2308.6.3(1) DWB, WSP, SFB, GB, PBS, PCP or HPS.

**FIGURE 2308.6.7.2(2)
BRACED WALL PANEL TOP PLATE CONNECTION**

2308.6.8.1 Foundation requirements. Braced wall lines shall be supported by continuous foundations.

Exception: For structures with a maximum plan dimension not more than 50 feet (15 240 mm), continuous foundations are required at exterior walls only.

For structures in Seismic Design Categories D and E, exterior braced wall panels shall be in the same plane vertically with the foundation or the portion of the structure containing the offset shall be designed in accordance with accepted engineering practice and Section 2308.1.1.

Exceptions:

1. Exterior braced wall panels shall be permitted to be located not more than 4 feet (1219 mm) from the foundation below where supported by a floor constructed in accordance with all of the following:
 - 1.1. Cantilevers or setbacks shall not exceed four times the nominal depth of the floor joists.
 - 1.2. Floor joists shall be 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
 - 1.3. The ratio of the back span to the cantilever shall be not less than 2 to 1.
 - 1.4. Floor joists at ends of braced wall panels shall be doubled.
 - 1.5. A continuous rim joist shall be connected to the ends of cantilevered joists. The rim joist is permitted to be spliced using a metal tie not less than 0.058 inch (1.47 mm) (16 galvanized gage) and 1½ inches (38 mm) in width fastened with six 16d common nails on each side. The metal tie shall have a yield stress not less than 33,000 psi (227 MPa).
 - 1.6. Joists at setbacks or the end of cantilevered joists shall not carry gravity loads from more than a single story having uniform wall and roof loads nor carry the reactions from headers having a span of 8 feet (2438 mm) or more.
2. The end of a required braced wall panel shall be allowed to extend not more than 1 foot (305 mm) over an opening in the wall below. This requirement is applicable to braced wall panels offset in plane and braced wall panels offset out of plane as permitted by Exception 1.

Braced wall panels are permitted to extend over an opening not more than 8 feet (2438 mm) in width where the header is a 4-inch by 12-inch (102 mm by 305 mm) or larger member.

2308.6.8.2 Floor and roof diaphragm support in Seismic Design Categories D and E. In structures assigned to Seismic Design Categories D or E, floor and roof diaphragms shall be laterally supported by braced wall lines on all edges and connected in accordance with Section 2308.6.7 [see Figure 2308.6.8.2(1)].

Exception: Portions of roofs or floors that do not support braced wall panels above are permitted to extend up to 6 feet (1829 mm) beyond a braced wall line [see Figure 2308.6.8.2(2)] provided that the framing members are connected to the braced wall line below in accordance with Section 2308.6.7.

2308.6.8.3 Stepped footings in Seismic Design Categories B, C, D and E. In Seismic Design Categories B, C, D and E, where the height of a required braced wall panel extending from foundation to floor above varies more than 4 feet (1219 mm), the following construction shall be used:

1. Where the bottom of the footing is stepped and the lowest floor framing rests directly on a sill bolted to the footings, the sill shall be anchored as required in Section 2308.3.
2. Where the lowest floor framing rests directly on a sill bolted to a footing not less than 8 feet (2438 mm) in length along a line of bracing, the line shall be considered to be braced. The double plate of the cripple stud wall beyond the segment of footing extending to the lowest framed floor shall be spliced to the sill plate with metal ties, one on each side of the sill and plate. The metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] by 1½ inches (38 mm) in width by 48 inches (1219 mm) with eight 16d common nails on each side of the splice location (see Figure 2308.6.8.3). The metal tie shall have a yield stress not less than 33,000 pounds per square inch (psi) (227 MPa).
3. Where cripple walls occur between the top of the footing and the lowest floor framing, the bracing requirements for a story shall apply.

2308.6.9 Attachment of sheathing. Fastening of braced wall panel sheathing shall be not less than that prescribed in Tables 2308.6.1 and 2304.10.2. Wall sheathing shall not be attached to framing members by adhesives.

2308.6.10 Limitations of concrete or masonry veneer. Concrete or masonry veneer shall comply with Chapter 14 and this section.

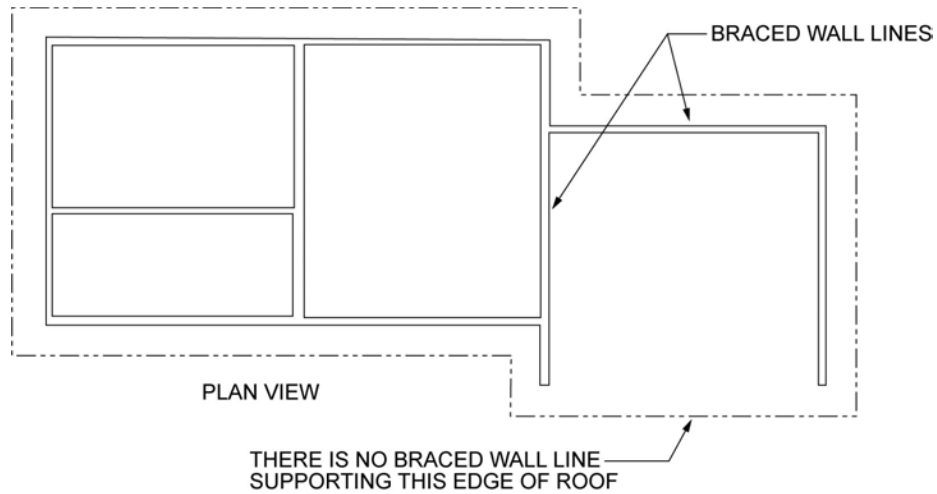


FIGURE 2308.6.8.2(1)
ROOF IN SDC D OR E NOT SUPPORTED ON ALL EDGES

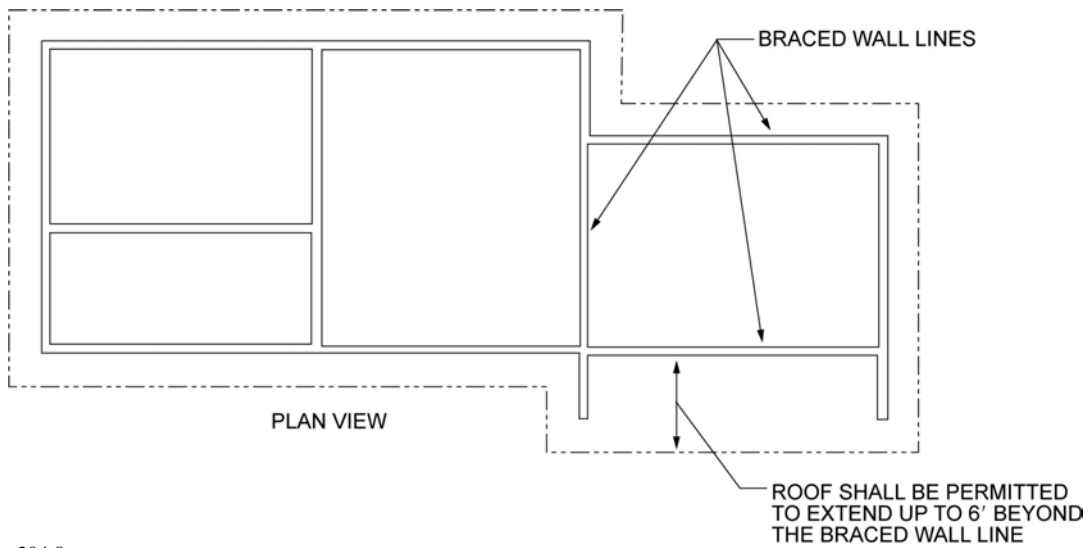
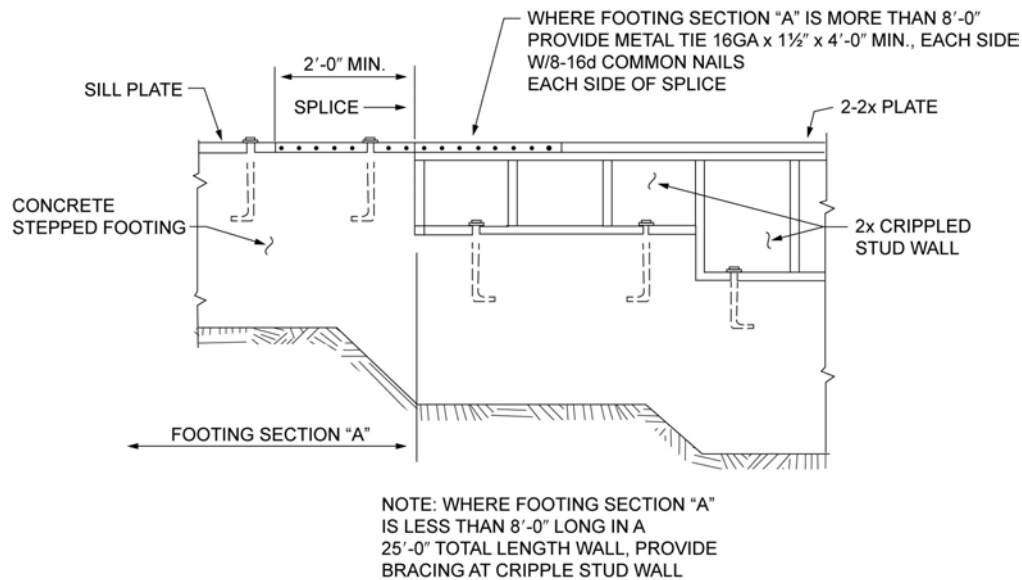


FIGURE 2308.6.8.2(2)
ROOF EXTENSION IN SDC D OR E BEYOND BRACED WALL LINE

For SI: 1 foot = 304.8 mm.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE 2308.6.8.3
STEPPED FOOTING CONNECTION DETAILS

2308.6.10.1 Limitations of concrete or masonry veneer in Seismic Design Category B or C. In Seismic Design Categories B and C, concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

Exceptions:

1. In structures assigned to Seismic Design Category B, stone and masonry veneer is permitted to be used in the first two stories above grade plane or the first three stories above grade plane where the lowest story has concrete or masonry walls, provided that wood structural panel wall bracing is used and the length of bracing provided is one and one-half times the required length specified in Table 2308.6.1.
2. Stone and masonry veneer is permitted to be used in the first story above grade plane or the first two stories above grade plane where the lowest story has concrete or masonry walls.
3. Stone and masonry veneer is permitted to be used in both stories of buildings with two stories above grade plane, provided that the following criteria are met:
 - 3.1. Type of brace in accordance with Section 2308.6.1 shall be WSP and the allowable shear capacity in accordance with Section 2306.3 shall be not less than 350 plf (5108 N/m).
 - 3.2. Braced wall panels in the second story shall be located in accordance with Section 2308.6.1 and not more than 25 feet (7620 mm) on center, and the total length of braced wall

panels shall be not less than 25 percent of the braced wall line length. Braced wall panels in the first story shall be located in accordance with Section 2308.6.1 and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 45 percent of the braced wall line length.

- 3.3. Hold-down connectors with an allowable capacity of 2,000 pounds (8896 N) shall be provided at the ends of each braced wall panel for the second story to the first story connection. Hold-down connectors with an allowable capacity of 3,900 pounds (17 347 N) shall be provided at the ends of each braced wall panel for the first story to the foundation connection. In all cases, the hold-down connector force shall be transferred to the foundation.

- 3.4. Cripple walls shall not be permitted.

2308.6.10.2 Limitations of concrete or masonry in Seismic Design Categories D and E. In Seismic Design Categories D and E, concrete or masonry walls and stone or masonry veneer shall not extend above a basement.

Exception: In structures assigned to Seismic Design Category D, stone and masonry veneer is permitted to be used in the first story above grade plane, provided that the following criteria are met:

1. Type of brace in accordance with Section 2308.6.1 shall be WSP and the allowable shear

capacity in accordance with Section 2306.3 shall be not less than 350 plf (5108 N/m).

2. The braced wall panels in the first story shall be located at each end of the braced wall line and not more than 25 feet (7620 mm) on center, and the total length of braced wall panels shall be not less than 45 percent of the braced wall line length.
3. Hold-down connectors shall be provided at the ends of braced walls for the first floor to foundation with an allowable capacity of 2,100 pounds (9341 N).
4. Cripple walls shall not be permitted.

2308.7 Roof and ceiling framing. The framing details required in this section apply to roofs having a slope of not less than three units vertical in 12 units horizontal (25-percent slope). Where the roof slope is less than three units vertical in 12 units horizontal (25-percent slope), members supporting rafters and ceiling joists such as ridge board, hips and valleys shall be designed as beams.

2308.7.1 Ceiling joist spans. Spans for ceiling joists shall be in accordance with Table 2308.7.1(1) or 2308.7.1(2). For other grades and species, and other loading conditions, refer to the AWC STJR.

2308.7.2 Rafter spans. Spans for rafters shall be in accordance with Table 2308.7.2(1), 2308.7.2(2), 2308.7.2(3), 2308.7.2(4), 2308.7.2(5) or 2308.7.2(6). For other grades and species and other loading conditions, refer to the AWC STJR. The span of each rafter shall be measured along the horizontal projection of the rafter.

2308.7.3 Ceiling joist and rafter framing. Rafters shall be framed directly opposite each other at the ridge. There shall be a ridge board not less than 1-inch (25 mm) nominal thickness at ridges and not less in depth than the cut end of the rafter. At valleys and hips, there shall be a single valley or hip rafter not less than 2-inch (51 mm) nominal thickness and not less in depth than the cut end of the rafter.

2308.7.3.1 Ceiling joist and rafter connections. Ceiling joists and rafters shall be nailed to each other and the assembly shall be nailed to the top wall plate in accordance with Tables 2304.10.2 and 2308.7.5. Ceiling joists shall be continuous or securely joined where they meet over interior partitions and be fastened to adjacent rafters in accordance with Tables 2304.10.2 and 2308.7.3.1 to provide a continuous rafter tie across the building where such joists are parallel to the rafters. Ceiling joists shall have a bearing surface of not less than 1½ inches (38 mm) on the top plate at each end.

Where ceiling joists are not parallel to rafters, an equivalent rafter tie shall be installed in a manner to provide a continuous tie across the building, at a spacing of not more than 4 feet (1219 mm) on center. The connections shall be in accordance with Tables 2308.7.3.1 and 2304.10.2, or connections of equivalent capacities shall be provided. Where ceiling joists or rafter ties are not provided at the top of the rafter support walls, the ridge formed by these rafters shall be supported by a girder

conforming to Section 2308.8. Rafter ties shall be spaced not more than 4 feet (1219 mm) on center.

Rafter tie connections shall be based on the equivalent rafter spacing in Table 2308.7.3.1. Rafter-to-ceiling joist connections and rafter tie connections shall be of sufficient size and number to prevent splitting from nailing.

Roof framing member connection to braced wall lines shall be in accordance with Section 2308.6.7.2.

2308.7.4 Notches and holes. Notching at the ends of rafters or ceiling joists shall not exceed one-fourth the depth. Notches in the top or bottom of the rafter or ceiling joist shall not exceed one-sixth the depth and shall not be located in the middle one-third of the span, except that a notch not more than one-third of the depth is permitted in the top of the rafter or ceiling joist not further from the face of the support than the depth of the member. Holes bored in rafters or ceiling joists shall not be within 2 inches (51 mm) of the top and bottom and their diameter shall not exceed one-third the depth of the member.

2308.7.5 Wind uplift. The roof construction shall have rafter and truss ties to the wall below. Resultant uplift loads shall be transferred to the foundation using a continuous load path. The rafter or truss to wall connection shall comply with Tables 2304.10.2 and 2308.7.5.

2308.7.6 Framing around openings. Trimmer and header rafters shall be doubled, or of lumber of equivalent cross section, where the span of the header exceeds 4 feet (1219 mm). The ends of header rafters that are more than 6 feet (1829 mm) in length shall be supported by framing anchors or rafter hangers unless bearing on a beam, partition or wall.

2308.7.6.1 Openings in roof diaphragms in Seismic Design Categories B, C, D and E. In buildings classified as Seismic Design Category B, C, D or E, openings in horizontal diaphragms with a dimension that is greater than 4 feet (1219 mm) shall be constructed with metal ties and blocking in accordance with this section and Figure 2308.4.4.1(1). Metal ties shall be not less than 0.058 inch [1.47 mm (16 galvanized gage)] in thickness by 1½ inches (38 mm) in width and shall have a yield stress not less than 33,000 psi (227 Mpa). Blocking shall extend not less than the dimension of the opening in the direction of the tie and blocking. Ties shall be attached to blocking in accordance with the manufacturer's instructions but with not less than eight 16d common nails on each side of the header-joist intersection.

2308.7.7 Purlins. Purlins to support roof loads are permitted to be installed to reduce the span of rafters within allowable limits and shall be supported by struts to bearing walls. The maximum span of 2-inch by 4-inch (51 mm by 102 mm) purlins shall be 4 feet (1219 mm). The maximum span of the 2-inch by 6-inch (51 mm by 152 mm) purlin shall be 6 feet (1829 mm), but the purlin shall not be smaller than the supported rafter. Struts shall be not less than 2-inch by 4-inch (51 mm by 102 mm) members. The unbraced length of struts shall not exceed 8 feet (2438

mm) and the slope of the struts shall be not less than 45 degrees (0.79 rad) from the horizontal.

2308.7.8 Blocking. Roof rafters and ceiling joists shall be supported laterally to prevent rotation and lateral displacement in accordance with Section 2308.4.6 and connected to braced wall lines in accordance with Section 2308.6.7.2.

2308.7.9 Engineered wood products. Prefabricated wood I-joists, structural glued-laminated timber and structural composite lumber shall not be notched or drilled except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

2308.7.10 Roof sheathing. Roof sheathing shall be in accordance with Tables 2304.8(3) and 2304.8(5) for wood structural panels, and Tables 2304.8(1) and 2304.8(2) for lumber and shall comply with Section 2304.8.2.

2308.7.11 Joints. Joints in lumber sheathing shall occur over supports unless approved end-matched lumber is used, in which case each piece shall bear on not fewer than two supports.

2308.7.12 Roof planking. Planking shall be designed in accordance with the general provisions of this code.

In lieu of such design, 2-inch (51 mm) tongue-and-groove planking is permitted in accordance with Table 2308.7.12. Joints in such planking are permitted to be randomly spaced, provided that the system is applied to not

less than three continuous spans, planks are center matched and end matched or splined, each plank bears on one support or more, and joints are separated by not less than 24 inches (610 mm) in adjacent pieces.

2308.7.13 Wood trusses. Wood trusses shall be designed in accordance with Section 2303.4. Connection to braced wall lines shall be in accordance with Section 2308.6.7.2.

2308.7.14 Attic ventilation. For attic ventilation, see Section 1202.2.1.

2308.8 Design of elements. Combining of engineered elements or systems and conventionally specified elements or systems shall be permitted subject to the limits of Sections 2308.8.1 and 2308.8.2.

2308.8.1 Elements exceeding limitations of conventional construction. Where a building of otherwise conventional construction contains structural elements exceeding the limits of Section 2308.2, these elements and the supporting *load* path shall be designed in accordance with accepted engineering practice and the provisions of this code.

2308.8.2 Structural elements or systems not described herein. Where a building of otherwise conventional construction contains structural elements or systems not described in Section 2308, these elements or systems shall be designed in accordance with accepted engineering practice and the provisions of this code. The extent of such design need only demonstrate compliance of the noncon-

TABLE 2308.7.5
REQUIRED RATING OF APPROVED UPLIFT CONNECTORS (pounds)^{a, b, c, e, f, g, h}

NOMINAL DESIGN WIND SPEED, V_{asd}	ROOF SPAN (feet)							OVERHANGS (pounds/feet) ^d
	12	20	24	28	32	36	40	
85	-72	-120	-145	-169	-193	-217	-241	-38.55
90	-91	-151	-181	-212	-242	-272	-302	-43.22
100	-131	-281	-262	-305	-349	-393	-436	-53.36
110	-175	-292	-351	-409	-467	-526	-584	-64.56

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.61 km/hr, 1 pound = 0.454 Kg, 1 pound/foot = 14.5939 N/m.

a. The uplift connection requirements are based on a 30-foot mean roof height located in Exposure B. For Exposure C or D and for other mean roof heights, multiply the loads by the following adjustment coefficients:

EXPOSURE	Mean Roof Height (feet)									
	15	20	25	30	35	40	45	50	55	60
B	1.00	1.00	1.00	1.00	1.05	1.09	1.12	1.16	1.19	1.22
C	1.21	1.29	1.35	1.40	1.45	1.49	1.53	1.56	1.59	1.62
D	1.47	1.55	1.61	1.66	1.70	1.74	1.78	1.81	1.84	1.87

b. The uplift connection requirements are based on the framing being spaced 24 inches on center. Multiply by 0.67 for framing spaced 16 inches on center and multiply by 0.5 for framing spaced 12 inches on center.

c. The uplift connection requirements include an allowance for 10 pounds of dead load.

d. The uplift connection requirements do not account for the effects of overhangs. The magnitude of the loads shall be increased by adding the overhang loads found in the table. The overhang loads are based on framing spaced 24 inches on center. The overhang loads given shall be multiplied by the overhang projection and added to the roof uplift value in the table.

e. The uplift connection requirements are based on wind loading on end zones as defined in Figure 28.5-1 of ASCE 7. Connection loads for connections located a distance of 20 percent of the least horizontal dimension of the building from the corner of the building are permitted to be reduced by multiplying the table connection value by 0.7 and multiplying the overhang load by 0.8.

f. For wall-to-wall and wall-to-foundation connections, the capacity of the uplift connector is permitted to be reduced by 100 pounds for each full wall above. (For example, if a 500-pound rated connector is used on the roof framing, a 400-pound rated connector is permitted at the next floor level down).

g. Interpolation is permitted for intermediate values of V_{asd} and roof spans.

h. The rated capacity of approved tie-down devices is permitted to include up to a 60-percent increase for wind effects where allowed by material specifications.

i. V_{asd} shall be determined in accordance with Section 1609.3.1.

WOOD

ventional elements with other applicable provisions of this code and shall be compatible with the performance of the conventionally framed system.

the limitations of Section 1.1.3 of the AWC WFCM and the load assumptions contained therein. Structural elements beyond these limitations shall be designed in accordance with accepted engineering practice.

2309.1.1 Additional requirements. [DSA-SS, DSA-SS/CC, OSHPD IR, 2 & 5] The use of the AWC WFCM is permitted provided the design and construction also comply with Sections 2304, 2305 and 2302.1, Item 1 or 2, and engineering analysis is furnished demonstrating compliance.

**SECTION 2309
WOOD FRAME CONSTRUCTION MANUAL**

2309.1 Wood Frame Construction Manual. Structural design in accordance with the AWC WFCM shall be permitted for buildings assigned to Risk Category I or II subject to

**TABLE 2308.7.1(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)**

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	13-2	20-8	Note a	Note a
	Douglas Fir-Larch	#1	12-8	19-11	Note a	Note a
	Douglas Fir-Larch	#2	12-5	19-6	25-8	Note a
	Douglas Fir-Larch	#3	10-10	15-10	20-1	24-6
	Hem-Fir	SS	12-5	19-6	25-8	Note a
	Hem-Fir	#1	12-2	19-1	25-2	Note a
	Hem-Fir	#2	11-7	18-2	24-0	Note a
	Hem-Fir	#3	10-10	15-10	20-1	24-6
	Southern Pine	SS	12-11	20-3	Note a	Note a
	Southern Pine	#1	12-5	19-6	25-8	Note a
	Southern Pine	#2	11-10	18-8	24-7	Note a
	Southern Pine	#3	10-1	14-11	18-9	22-9
	Spruce-Pine-Fir	SS	12-2	19-1	25-2	Note a
	Spruce-Pine-Fir	#1	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#2	11-10	18-8	24-7	Note a
	Spruce-Pine-Fir	#3	10-10	15-10	20-1	24-6
16	Douglas Fir-Larch	SS	11-11	18-9	24-8	Note a
	Douglas Fir-Larch	#1	11-6	18-1	23-10	Note a
	Douglas Fir-Larch	#2	11-3	17-8	23-0	Note a
	Douglas Fir-Larch	#3	9-5	13-9	17-5	21-3
	Hem-Fir	SS	11-3	17-8	23-4	Note a
	Hem-Fir	#1	11-0	17-4	22-10	Note a
	Hem-Fir	#2	10-6	16-6	21-9	Note a
	Hem-Fir	#3	9-5	13-9	17-5	21-3
	Southern Pine	SS	11-9	18-5	24-3	Note a
	Southern Pine	#1	11-3	17-8	23-4	Note a
	Southern Pine	#2	10-9	16-11	21-7	25-7
	Southern Pine	#3	8-9	12-11	16-3	19-9
	Spruce-Pine-Fir	SS	11-0	17-4	22-10	Note a
	Spruce-Pine-Fir	#1	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#2	10-9	16-11	22-4	Note a
	Spruce-Pine-Fir	#3	9-5	13-9	17-5	21-3

(continued)

TABLE 2308.7.1(1)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics without storage, live load = 10 psf, L/A = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	11-3	17-8	23-3	Note a
	Douglas Fir-Larch	#1	10-10	17-0	22-5	Note a
	Douglas Fir-Larch	#2	10-7	16-7	21-0	25-8
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5
	Hem-Fir	SS	10-7	16-8	21-11	Note a
	Hem-Fir	#1	10-4	16-4	21-6	Note a
	Hem-Fir	#2	9-11	15-7	20-6	25-3
	Hem-Fir	#3	8-7	12-6	15-10	19-5
	Southern Pine	SS	11-0	17-4	22-10	Note a
	Southern Pine	#1	10-7	16-8	22-0	Note a
	Southern Pine	#2	10-2	15-7	19-8	23-5
	Southern Pine	#3	8-0	11-9	14-10	18-0
	Spruce-Pine-Fir	SS	10-4	16-4	21-6	Note a
	Spruce-Pine-Fir	#1	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#2	10-2	15-11	21-0	25-8
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5
24	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	9-10	15-6	20-5	24-0
	Southern Pine	#2	9-3	13-11	17-7	20-11
	Southern Pine	#3	7-2	10-6	13-3	16-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Span exceeds 26 feet in length.

TABLE 2308.7.1(2)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note a
	Douglas Fir-Larch	#1	10-0	15-9	20-1	24-6
	Douglas Fir-Larch	#2	9-10	14-10	18-9	22-11
	Douglas Fir-Larch	#3	7-8	11-2	14-2	17-4
	Hem-Fir	SS	9-10	15-6	20-5	Note a
	Hem-Fir	#1	9-8	15-2	19-7	23-11
	Hem-Fir	#2	9-2	14-5	18-6	22-7
	Hem-Fir	#3	7-8	11-2	14-2	17-4
	Southern Pine	SS	10-3	16-1	21-2	Note a
	Southern Pine	#1	9-10	15-6	20-5	24-0
	Southern Pine	#2	9-3	13-11	17-7	20-11
	Southern Pine	#3	7-2	10-6	13-3	16-1
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5
	Spruce-Pine-Fir	#1	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#2	9-5	14-9	18-9	22-11
	Spruce-Pine-Fir	#3	7-8	11-2	14-2	17-4
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0
	Douglas Fir-Larch	#1	9-1	13-9	17-5	21-3
	Douglas Fir-Larch	#2	8-9	12-10	16-3	19-10
	Douglas Fir-Larch	#3	6-8	9-8	12-4	15-0
	Hem-Fir	SS	8-11	14-1	18-6	23-8
	Hem-Fir	#1	8-9	13-5	16-10	20-8
	Hem-Fir	#2	8-4	12-8	16-0	19-7
	Hem-Fir	#3	6-8	9-8	12-4	15-0
	Southern Pine	SS	9-4	14-7	19-3	24-7
	Southern Pine	#1	8-11	14-0	17-9	20-9
	Southern Pine	#2	8-0	12-0	15-3	18-1
	Southern Pine	#3	6-2	9-2	11-6	14-0
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1
	Spruce-Pine-Fir	#1	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#2	8-7	12-10	16-3	19-10
	Spruce-Pine-Fir	#3	6-8	9-8	12-4	15-0

(continued)

TABLE 2308.7.1(2)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES
(Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-4
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8
	Hem-Fir	SS	8-5	13-3	17-5	22-3
	Hem-Fir	#1	8-3	12-3	15-6	18-11
	Hem-Fir	#2	7-10	11-7	14-8	17-10
	Hem-Fir	#3	6-1	8-10	11-3	13-8
	Southern Pine	SS	8-9	13-9	18-2	23-1
	Southern Pine	#1	8-5	12-9	16-2	18-11
	Southern Pine	#2	7-4	11-0	13-11	16-6
	Southern Pine	#3	5-8	8-4	10-6	12-9
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-8
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8
24	Douglas Fir-Larch	SS	8-3	13-0	17-1	20-11
	Douglas Fir-Larch	#1	7-8	11-2	14-2	17-4
	Douglas Fir-Larch	#2	7-2	10-6	13-3	16-3
	Douglas Fir-Larch	#3	5-5	7-11	10-0	12-3
	Hem-Fir	SS	7-10	12-3	16-2	20-6
	Hem-Fir	#1	7-6	10-11	13-10	16-11
	Hem-Fir	#2	7-1	10-4	13-1	16-0
	Hem-Fir	#3	5-5	7-11	10-0	12-3
	Southern Pine	SS	8-1	12-9	16-10	21-6
	Southern Pine	#1	7-8	11-5	14-6	16-11
	Southern Pine	#2	6-7	9-10	12-6	14-9
	Southern Pine	#3	5-1	7-5	9-5	11-5
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	19-5
	Spruce-Pine-Fir	#1	7-2	10-6	13-3	16-3
Spruce-Pine-Fir	#2	7-2	10-6	13-3	16-3	
Spruce-Pine-Fir	#3	5-5	7-11	10-0	12-3	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Span exceeds 26 feet in length.

TABLE 2308.7.2(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-5	Note b	Note b
	Douglas Fir-Larch	#1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas Fir-Larch	#2	10-10	16-7	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-Fir	#1	10 -7	16-8	21-10	Note b	Note b	10-3	14-11	18-11	23-2	Note b
	Hem-Fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern Pine	#1	10-10	17-0	22-5	26-0	26-0	10-6	15-8	19-10	23-2	Note b
	Southern Pine	#2	10-4	15-7	19-8	23-5	26-0	9-0	13-6	17-1	20-3	23-10
	Southern Pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-Pine-Fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-Pine-Fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-0	20-3	24-9	Note b
	Douglas Fir-Larch	#1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	9-10	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-Fir	#1	9-8	14-11	18-11	23-2	Note b	8-10	12-11	16-5	20-0	23-3
	Hem-Fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	25-7	Note b
	Southern Pine	#1	9-10	15-6	19-10	23-2	26-0	9-1	13-7	17-2	20-1	23-10
	Southern Pine	#2	9-0	13-6	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern Pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-Pine-Fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

TABLE 2308.7.2(1)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	9-10	15-5	20-4	25-11	Note b	9-10	14-7	18-6	22-7	Note b
	Douglas Fir-Larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-11	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-Fir	#1	9-1	13-8	17-4	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-7	23-4	Note b
	Southern Pine	#1	9-3	14-3	18-1	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern Pine	#2	8-2	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern Pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7
	Spruce-Pine-Fir	SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-Pine-Fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5	
24	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-4	Note b	8-11	13-1	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-Fir	#1	8-4	12-3	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	13-10	17-6	20-10	24-8
	Southern Pine	#1	8-7	12-9	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern Pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern Pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).
- b. Span exceeds 26 feet in length.

TABLE 2308.7.2(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-4	21-7	Note b	Note b
	Douglas Fir-Larch	#1	10-0	15-9	20-10	Note b	Note b	10-0	15-4	19-5	23-9	Note b
	Douglas Fir-Larch	#2	9-10	15-6	20-5	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Douglas Fir-Larch	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Hem-Fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Hem-Fir	#1	9-8	15-2	19-11	25-5	Note b	9-8	14-11	18-11	23-2	Note b
	Hem-Fir	#2	9-2	14-5	19-0	24-3	Note b	9-2	14-2	17-11	21-11	25-5
	Hem-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern Pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern Pine	#1	9-10	15-6	20-5	26-0	26-0	9-10	15-6	19-10	23-2	26-0
	Southern Pine	#2	9-5	14-9	19-6	23-5	26-0	9-0	13-6	17-1	20-3	23-10
	Southern Pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-Pine-Fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Spruce-Pine-Fir	#1	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#2	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-Pine-Fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas Fir-Larch	SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	24-9	Note b
	Douglas Fir-Larch	#1	9-1	14-4	18-11	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas Fir-Larch	#2	8-11	14-1	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Douglas Fir-Larch	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Hem-Fir	#1	8-9	13-9	18-1	23-1	Note b	8-9	12-11	16-5	20-0	23-3
	Hem-Fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern Pine	SS	9-4	14-7	19-3	24-7	Note b	9-4	14-7	19-3	24-7	Note b
	Southern Pine	#1	8-11	14-1	18-6	23-2	26-0	8-11	13-7	17-2	20-1	23-10
	Southern Pine	#2	8-7	13-5	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern Pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-Pine-Fir	SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-0	Note b
	Spruce-Pine-Fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-Pine-Fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

TABLE 2308.7.2(2)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Roof live load = 20 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	22-7	Note b
	Douglas Fir-Larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas Fir-Larch	#2	8-5	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Douglas Fir-Larch	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	25-9
	Hem-Fir	#1	8-3	12-11	17-1	21-1	24-6	8-1	11-10	15-0	18-4	21-3
	Hem-Fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern Pine	SS	8-9	13-9	18-2	23-1	Note b	8-9	13-9	18-2	23-1	Note b
	Southern Pine	#1	8-5	13-3	17-5	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern Pine	#2	8-1	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern Pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7
	Spruce-Pine-Fir	SS	8-3	12-11	17-1	21-9	Note b	8-3	12-11	17-1	21-0	24-4
	Spruce-Pine-Fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-Pine-Fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	16-7	20-3	23-5
	Douglas Fir-Larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas Fir-Larch	#2	7-10	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Douglas Fir-Larch	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-Fir	#1	7-8	12-0	15-6	18-11	21-11	7-3	10-7	13-5	16-4	19-0
	Hem-Fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern Pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	20-10	24-8
	Southern Pine	#1	7-10	12-3	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern Pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern Pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-Pine-Fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-Pine-Fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).
- b. Span exceeds 26 feet in length.

TABLE 2308.7.2(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 30 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	20-1	24-6	Note b
	Douglas Fir-Larch	#1	9-8	14-9	18-8	22-9	Note b	9-0	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	9-5	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	9-6	14-10	19-7	25-0	Note b	9-6	14-10	19-7	24-1	Note b
	Hem-Fir	#1	9-3	14-4	18-2	22-2	25-9	8-9	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	25-4	Note b
	Southern Pine	#1	9-6	14-10	19-0	22-3	26-0	9-0	13-5	17-0	19-11	23-7
	Southern Pine	#2	8-7	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern Pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-Pine-Fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-7	18-8	22-9	Note b
	Spruce-Pine-Fir	#1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas Fir-Larch	SS	9-1	14-4	18-10	23-9	Note b	9-1	13-9	17-5	21-3	24-8
	Douglas Fir-Larch	#1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-1	20-10	24-2
	Hem-Fir	#1	8-5	12-5	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-5	21-11	25-11
	Southern Pine	#1	8-7	13-0	16-6	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern Pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern Pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-Pine-Fir	#1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6

(continued)

TABLE 2308.7.2(3)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 30 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	8-7	13-6	17-9	21-8	25-2	8-7	12-6	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-Fir	#1	7-9	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	16-10	20-0	23-7
	Southern Pine	#1	8-0	11-10	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern Pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern Pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-Pine-Fir	SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-11	12-6	15-10	19-5	22-6	7-8	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern Pine	SS	7-10	12-3	16-2	20-0	23-7	7-10	11-10	15-0	17-11	21-2
	Southern Pine	#1	7-1	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-Pine-Fir	SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7	
Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).
- b. Span exceeds 26 feet in length.

TABLE 2308.7.2(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-0	20-9	24-0
	Douglas Fir-larch	#1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas Fir-larch	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-Fir	#1	7-10	11-9	14-10	18-1	21-0	7-5	10-10	13-9	16-9	19-5
	Hem-Fir	#2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	8-4	13-1	17-2	21-11	Note b	8-4	13-1	17-2	21-5	25-3
	Southern Pine	#1	8-0	12-3	15-6	18-2	21-7	7-7	11-4	14-5	16-10	20-0
	Southern Pine	#2	7-0	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern Pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5
	Spruce-Pine-Fir	SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-Pine-Fir	#1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-8	12-1	15-10	19-5	22-6	7-8	11-7	14-8	17-11	20-10
	Douglas Fir-Larch	#1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-Fir	#1	6-11	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	7-6	11-10	15-7	19-11	23-7	7-6	11-10	15-7	18-6	21-10
	Southern Pine	#1	7-1	10-7	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	15-11	19-4
	Spruce-Pine-Fir	#1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

TABLE 2308.7.2(4)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	7-3	11-4	14-6	17-8	20-6	7-3	10-7	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-Fir	#1	6-4	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern Pine	SS	7-1	11-2	14-8	18-3	21-7	7-1	11-2	14-2	16-11	20-0
	Southern Pine	#1	6-6	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern Pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern Pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-Pine-Fir	SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-8	10-3	13-0	15-10	18-4	6-6	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-7	10-4	13-8	16-4	19-3	6-7	10-0	12-8	15-2	17-10
	Southern Pine	#1	5-10	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern Pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern Pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-Pine-Fir	SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).
- Span exceeds 26 feet in length.

WOOD

TABLE 2308.7.2(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans*									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	9-1	14-4	18-10	24-1	Note b	9-1	14-4	18-10	24-1	Note b
	Douglas Fir-Larch	#1	8-9	13-9	18-2	22-9	Note b	8-9	13-2	16-8	20-4	23-7
	Douglas Fir-Larch	#2	8-7	13-6	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Douglas Fir-Larch	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Hem-Fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-10	22-9	Note b
	Hem-Fir	#1	8-5	13-3	17-5	22-2	25-9	8-5	12-10	16-3	19-10	23-0
	Hem-Fir	#2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern Pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern Pine	#1	8-7	13-6	17-10	22-3	Note b	8-7	13-5	17-0	19-11	23-7
	Southern Pine	#2	8-3	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern Pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-Pine-Fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	Note b
	Spruce-Pine-Fir	#1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-Pine-Fir	#2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
Spruce-Pine-Fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8	
16	Douglas Fir-Larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	17-2	21-3	24-8
	Douglas Fir-Larch	#1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas Fir-Larch	#2	7-10	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Douglas Fir-Larch	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Hem-Fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-Fir	#1	7-8	12-0	15-9	19-3	22-3	7-7	11-1	14-1	17-2	19-11
	Hem-Fir	#2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern Pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	25-11
	Southern Pine	#1	7-10	12-3	16-2	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern Pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern Pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9
	Spruce-Pine-Fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-Pine-Fir	#1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-Pine-Fir	#2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
Spruce-Pine-Fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6	

(continued)

TABLE 2308.7.2(5)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 30 psf, ceiling attached to rafters, L/A = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	15-10	19-5	22-6
	Douglas Fir-Larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#2	7-4	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Douglas Fir-Larch	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Hem-Fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-Fir	#1	7-2	11-4	14-4	17-7	20-4	6-11	10-2	12-10	15-8	18-2
	Hem-Fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern Pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-0	23-7
	Southern Pine	#1	7-4	11-7	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern Pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern Pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-Pine-Fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-Pine-Fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-Pine-Fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas Fir-Larch	SS	7-3	11-4	15-0	19-1	22-6	7-3	11-3	14-2	17-4	20-1
	Douglas Fir-Larch	#1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas Fir-Larch	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Hem-Fir	SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9
	Hem-Fir	#1	6-8	10-2	12-10	15-8	18-2	6-2	9-1	11-6	14-0	16-3
	Hem-Fir	#2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern Pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	17-11	21-2
	Southern Pine	#1	6-10	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-Pine-Fir	SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).
- b. Span exceeds 26 feet in length.

TABLE 2308.7.2(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
12	Douglas Fir-Larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-0
	Douglas Fir-Larch	#1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas Fir-Larch	#2	7-3	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Douglas Fir-Larch	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Hem-Fir	SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-Fir	#1	7-1	11-2	14-8	18-1	21-0	7-1	10-10	13-9	16-9	19-5
	Hem-Fir	#2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern Pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern Pine	#1	7-3	11-5	15-0	18-2	21-7	7-3	11-4	14-5	16-10	20-0
	Southern Pine	#2	6-11	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern Pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5
	Spruce-Pine-Fir	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-Pine-Fir	#1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-Pine-Fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas Fir-Larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	17-11	20-10
	Douglas Fir-Larch	#1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas Fir-Larch	#2	6-7	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Douglas Fir-Larch	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Hem-Fir	SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-Fir	#1	6-5	10-2	12-10	15-8	18-2	6-5	9-5	11-11	14-6	16-10
	Hem-Fir	#2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern Pine	SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	21-10
	Southern Pine	#1	6-7	10-4	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern Pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern Pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-Pine-Fir	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-Pine-Fir	#1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-Pine-Fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

TABLE 2308.7.2(6)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES
 (Ground snow load = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)	(ft. - in.)
19.2	Douglas Fir-Larch	SS	6-7	10-4	13-7	17-4	20-6	6-7	10-4	13-5	16-5	19-0
	Douglas Fir-Larch	#1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas Fir-Larch	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Douglas Fir-Larch	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Hem-Fir	SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-Fir	#1	6-1	9-3	11-9	14-4	16-7	5-10	8-7	10-10	13-3	15-5
	Hem-Fir	#2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern Pine	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-11	20-0
	Southern Pine	#1	6-2	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern Pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern Pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-Pine-Fir	SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-Pine-Fir	#1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-Pine-Fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas Fir-Larch	SS	6-1	9-7	12-7	15-10	18-4	6-1	9-6	12-0	14-8	17-0
	Douglas Fir-Larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas Fir-Larch	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Douglas Fir-Larch	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Hem-Fir	SS	5-9	9-1	11-11	15-2	18-0	5-9	9-1	11-9	14-5	15-11
	Hem-Fir	#1	5-8	8-3	10-6	12-10	14-10	5-3	7-8	9-9	11-10	13-9
	Hem-Fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern Pine	SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-2	17-10
	Southern Pine	#1	5-9	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern Pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern Pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-Pine-Fir	SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-Pine-Fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-Pine-Fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table 2308.7.2(7).

TABLE 2308.7.2(7)
RAFTER SPAN ADJUSTMENT FACTOR

H_C/H_R^a	RAFTER SPAN ADJUSTMENT FACTOR
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

- a. H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls;
 H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

**TABLE 2308.7.3.1
RAFTER TIE CONNECTIONS¹**

RAFTER SLOPE	TIE SPACING (inches)	LIVE LOAD ONLY ^a			GROUND SNOW LOAD (pounds per square foot)					
					30 pounds per square foot			50 pounds per square foot		
		Roof span (feet)								
		12	24	36	12	24	36	12	24	36
Required number of 16d common (3 1/2" x 0.162") nails per connection ^{a, b, c, d, e, f, h}										
3:12	12	3	5	8	3	6	9	5	9	13
	16	4	7	10	4	8	12	6	12	17
	19.2	4	8	12	5	10	14	7	14	21
	24	5	10	15	6	12	18	9	17	26
	32	7	13	20	8	16	24	12	23	34
	48	10	20	29	12	24	35	17	34	51
4:12	12	3	4	6	3	5	7	4	7	10
	16	3	5	8	3	6	9	5	9	13
	19.2	3	6	9	4	7	11	6	11	16
	24	4	8	11	5	9	13	7	13	19
	32	5	10	15	6	12	18	9	17	26
	48	8	15	22	9	18	26	13	26	38
5:12	12	3	3	5	3	4	6	3	6	8
	16	3	4	6	3	5	7	4	7	11
	19.2	3	5	7	3	6	9	5	9	13
	24	3	6	9	4	7	11	6	11	16
	32	4	8	12	5	10	14	7	14	21
	48	6	12	18	7	14	21	11	21	31
7:12	12	3	3	4	3	3	4	3	4	6
	16	3	3	5	3	4	5	3	5	8
	19.2	3	4	5	3	4	6	3	6	9
	24	3	5	7	3	5	8	4	8	11
	32	3	6	9	4	7	10	5	10	15
	48	5	9	13	5	10	15	8	15	22
9:12	12	3	3	3	3	3	3	3	3	5
	16	3	3	4	3	3	4	3	4	6
	19.2	3	3	4	3	4	5	3	5	7
	24	3	4	5	3	4	6	3	6	9
	32	3	5	7	3	6	8	4	8	12
	48	4	7	10	4	8	12	6	12	17
12:12	12	3	3	3	3	3	3	3	3	4
	16	3	3	3	3	3	3	3	3	5
	19.2	3	3	3	3	3	4	3	4	6
	24	3	3	4	3	3	5	3	5	7
	32	3	4	5	3	4	6	3	6	9
	48	3	5	8	3	6	9	5	9	13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.8 N/m².

- a. 10d common (3" x 0.148") nails shall be permitted to be substituted for 16d common (3 1/2" x 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.
- b. Rafter tie heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
- c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements are permitted to be reduced proportionally to the reduction in span.
- d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
- e. Connected members shall be of sufficient size to prevent splitting due to nailing.
- f. For snow loads less than 30 pounds per square foot, the required number of nails is permitted to be reduced by multiplying by the ratio of actual snow load plus 10 divided by 40, but not less than the number required for no snow load.
- g. Applies to roof live load of 20 psf or less.
- h. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 2308.7.3.1(1).
- i. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

TABLE 2308.7.3.1(1)
HEEL JOINT CONNECTION ADJUSTMENT FACTORS

$H_c/H_r^{a,b}$	HEEL JOINT CONNECTION ADJUSTMENT FACTOR
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

- a. H_c = Height of ceiling joists or rafter ties measured vertically from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties;
 H_r = Height of roof ridge measured vertically from the top of the rafter support walls to the bottom of the roof ridge.
- b. Where H_c/H_r exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

TABLE 2308.7.12
ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING

SPAN ^a (feet)	LIVE LOAD (pounds per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pounds per square inch)	MODULUS OF ELASTICITY (E) (pounds per square inch)
Roofs				
4	20	1/240	160	170,000
		1/360		256,000
	30	1/240	210	256,000
		1/360		384,000
	40	1/240	270	340,000
		1/360		512,000
4.5	20	1/240	200	242,000
		1/360		305,000
	30	1/240	270	363,000
		1/360		405,000
	40	1/240	350	484,000
		1/360		725,000
5.0	20	1/240	250	332,000
		1/360		500,000
	30	1/240	330	495,000
		1/360		742,000
	40	1/240	420	660,000
		1/360		1,000,000
5.5	20	1/240	300	442,000
		1/360		660,000
	30	1/240	400	662,000
		1/360		998,000
	40	1/240	500	884,000
		1/360		1,330,000
6.0	20	1/240	360	575,000
		1/360		862,000
	30	1/240	480	862,000
		1/360		1,295,000
	40	1/240	600	1,150,000
		1/360		1,730,000

(continued)

WOOD

TABLE 2308.7.12—continued
ALLOWABLE SPANS FOR 2-INCH TONGUE-AND-GROOVE DECKING

SPAN ^a (feet)	LIVE LOAD (pounds per square foot)	DEFLECTION LIMIT	BENDING STRESS (f) (pounds per square inch)	MODULUS OF ELASTICITY (E) (pounds per square inch)
Roofs				
6.5	20	1/240	420	595,000
		1/360		892,000
	30	1/240	560	892,000
		1/360		1,340,000
	40	1/240	700	1,190,000
		1/360		1,730,000
7.0	20	1/240	490	910,000
		1/360		1,360,000
	30	1/240	650	1,370,000
		1/360		2,000,000
	40	1/240	810	1,820,000
		1/360		2,725,000
7.5	20	1/240	560	1,125,000
		1/360		1,685,000
	30	1/240	750	1,685,000
		1/360		2,530,000
	40	1/240	930	2,250,000
		1/360		3,380,000
8.0	20	1/240	640	1,360,000
		1/360		2,040,000
	30	1/240	850	2,040,000
		1/360		3,060,000
Floors				
4	40	1/360	840	1,000,000
4.5			950	1,300,000
5.0			1,060	1,600,000

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kN/m², 1 pound per square inch = 0.00689 N/mm².

a. Spans are based on simple beam action with 10 pounds per square foot dead load and provisions for a 300-pound concentrated load on a 12-inch width of decking. Random layup is permitted in accordance with the provisions of Section 2308.7.12. Lumber thickness is 1½ inches nominal.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 24 – GLASS AND GLAZING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X		X	X	X								X									
Adopt entire chapter as amendeded (amended sections listed below)								X	X	X	X	X		X	X							
Adopt only those sections that are listed below																						
Chapter / Section																						
2401.1.1								X	X	X	X	X		X	X							
2401.1.2								X	X													
2401.1.2, Exception 1										X	X	X		X	X							
2403.2.1								X	X	X	X	X		X	X							
Table 2403.2.1								X	X	X	X	X		X	X							
2410.1, Exception												X										
2410								X	X	X	X	B		X	X							
2411										X	X	X		X	X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

(A & B) – OSHPD (HCAI) delineates that OSHPD 2 is either designated as an OSHPD 2A or 2B. See Ch. 1, Div. I, Section 1.10 for additional information.

CHAPTER 24

GLASS AND GLAZING

User notes:

About this chapter: Chapter 24 establishes regulations for glass and glazing used in buildings and structures. Engineering and design requirements are included in the chapter for glazing that is subjected to wind and snow loads. Another concern of this chapter is glass and glazing used in areas where it is likely to be impacted by the occupants. Section 2406 identifies hazardous locations where glazing must either be safety glazing or protected to prevent impacts by occupants. Safety glazing must meet stringent standards and be appropriately marked or identified. Additional requirements are provided for glass and glazing in guards, handrails, elevator hoistways and elevator cars, as well as in athletic facilities.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2401 GENERAL

2401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures. Light-transmitting plastic glazing shall also meet the applicable requirements of Chapter 26.

2401.1.1 Application. [DSA-SS, DSA-SS/CC, OSHPD] The scope of application of Chapter 24 is as follows:

1. Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.
2. Applications listed in Sections 1.9.2.1 and 1.9.2.2, regulated by the Division of the State Architect-Structural Safety (DSA-SS and DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

2401.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. OSHPD amendments appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 4] - For applications listed in Section 1.10.4.

[OSHPD 5] - For applications listed in Section 1.10.5.

2. Division of the State Architect - Structural Safety:

[DSA-SS] - For applications listed in Section 1.9.2.1.

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

SECTION 2402 GLAZING REPLACEMENT

2402.1 General. The installation of replacement glass shall be as required for new installations.

SECTION 2403 GENERAL REQUIREMENTS FOR GLASS

2403.1 Identification. Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. The identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.3.

Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

Tempered spandrel glass shall be provided with a removable paper marking by the manufacturer.

2403.2 Glass supports. Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data ensuring safe performance for the specific installation shall be prepared by a registered design professional.

2403.2.1 Additional Requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of Section 2403.2, glass supports shall comply with the following:

1. The construction documents and analysis or test data required per Section 2403.2 shall be submitted to the enforcement agency for approval.
2. Glass firmly supported on all four edges shall be glazed with minimum laps and edge clearances set forth in Table 2403.2.1.

Exception: Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2403.3 Glass framing. To be considered firmly supported, the framing members for each individual pane of glass shall be designed so that the deflection of the edge of the glass perpendicular to the glass pane does not exceed $\frac{1}{175}$ of the glass edge length where the glass edge length is not more than 13 feet 6 inches (4115 mm), or $\frac{1}{240}$ of the glass edge length + $\frac{1}{4}$ inch (6.4 mm) where the glass edge length is greater than 13 feet 6 inches (4115 mm), when subjected to the larger of the positive or negative load where loads are combined as specified in Section 1605.

2403.4 Interior glazed areas. Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall be not greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

2403.5 Louvered windows or jalousies. Float, wired and patterned glass in louvered windows and jalousies shall be not thinner than nominal $\frac{3}{16}$ inch (4.8 mm) and not longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or jalousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

SECTION 2404 WIND, SNOW, SEISMIC AND DEAD LOADS ON GLASS

2404.1 Vertical glass. Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads due to basic design wind speed, V, in Section 1609 for components and cladding. Glass in glazed curtain walls, glazed storefronts and glazed partitions shall meet the seismic requirements of ASCE 7, Section 13.5.9. The load resistance of glass under uniform load shall be determined in accordance with ASTM E1300.

The design of vertical glazing shall be based on Equation 24-1.

$$0.6F_{gw} \leq F_{ga} \tag{Equation 24-1}$$

where:

F_{gw} = Wind load on the glass due to basic design wind speed, V, computed in accordance with Section 1609.

F_{ga} = Short duration load on the glass as determined in accordance with ASTM E1300.

**TABLE 2403.2.1
MINIMUM GLAZING REQUIREMENTS**

FIXED WINDOWS AND OPENABLE WINDOWS OTHER THAN HORIZONTAL SIDING					
Glass Area	Up to 6 sq. ft.	6 to 14 sq. ft.	14 to 32 sq. ft.	32 to 50 sq. ft.	Over 50 sq. ft.
× 0.0929 for m², × 25.4 for mm					
1. Minimum Frame Lap	$\frac{1}{4}$ "	$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{1}{2}$ "
2. Minimum Glass Edge Clearance	$\frac{1}{8}$ " ^{1,2}	$\frac{1}{8}$ " ^{1,2}	$\frac{3}{16}$ " ¹	$\frac{1}{4}$ "	$\frac{1}{4}$ " ¹
3. Continuous Glazing Rabbet and Glass Retainer ³	Required				
4. Resilient Setting Material ⁴	Not Required		Required		
SLIDING DOORS AND HORIZONTAL SLIDING WINDOWS					
Glass Area		Up to 14 sq. ft.	14 to 32 sq. ft.	32 to 50 sq. ft.	Over 50 sq. ft.
× 0.0929 for m², × 25.4 for mm					
5. Minimum Glass Frame Lap		$\frac{1}{4}$ "	$\frac{5}{16}$ "	$\frac{3}{8}$ "	$\frac{1}{2}$ "
6. Minimum Glass Edge Clearance		$\frac{1}{8}$ " ²	$\frac{3}{16}$ "	$\frac{1}{4}$ "	$\frac{1}{4}$ "
7. Continuous Glazing Rabbet and Glass Retainer ³		Required above third story		Required	
8. Resilient Setting Material ⁴		Not Required		Required	

1. Glass edge clearance in fixed openings shall not be less than required to provide for wind and earthquake drift.
2. Glass edge clearance at all sides of pane shall be a minimum of $\frac{3}{16}$ inch (4.8 mm) where height of glass exceeds 3 feet (914 mm).
3. Glass retainers such as metal, wood or vinyl face stops, glazing beads, gaskets, glazing clips and glazing channels shall be of sufficient strength and fixation to serve this purpose.
4. Resilient setting material shall include preformed rubber or vinyl plastic gaskets or other materials which are proved to the satisfaction of the building official to remain resilient.

2404.2 Sloped glass. Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical combinations of loads determined by Equations 24-2, 24-3 and 24-4.

$$F_g = 0.6W_o - D \quad \text{(Equation 24-2)}$$

$$F_g = 0.6W_i + D + 0.5 S \quad \text{(Equation 24-3)}$$

$$F_g = 0.3 W_i + D + S \quad \text{(Equation 24-4)}$$

where:

D = Glass dead load psf (kN/m²).

For glass sloped 30 degrees (0.52 rad) or less from horizontal,

$$= 13 t_g \text{ (For SI: } 0.0245 t_g \text{)}.$$

For glass sloped more than 30 degrees (0.52 rad) from horizontal,

$$= 13 t_g \cos \theta \text{ (For SI: } 0.0245 t_g \cos \theta \text{)}.$$

F_g = Total load, psf (kN/m²) on glass.

S = Snow load, psf (kN/m²) as determined in Section 1608.

t_g = Total glass thickness, inches (mm) of glass panes and plies.

W_i = Inward wind force, psf (kN/m²) due to basic design wind speed, V , as calculated in Section 1609.

W_o = Outward wind force, psf (kN/m²) due to basic design wind speed, V , as calculated in Section 1609.

θ = Angle of slope from horizontal.

Exception: The performance grade rating of unit skylights and tubular daylighting devices shall be determined in accordance with Section 2405.5.

The design of sloped glazing shall be based on Equation 24-5.

$$F_g \leq F_{ga} \quad \text{(Equation 24-5)}$$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and 24-4.

F_{ga} = Short duration load resistance of the glass as determined in accordance with ASTM E1300 for Equations 24-2 and 24-3; or the long duration load resistance of the glass as determined in accordance with ASTM E1300 for Equation 24-4.

2404.3 Wired, patterned and sandblasted glass.

2404.3.1 Vertical wired glass. Wired glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$$0.6F_{gw} < 0.5 F_{ge} \quad \text{(Equation 24-6)}$$

where:

F_{gw} = Wind load on the glass due to basic design wind speed, V , computed in accordance with Section 1609.

F_{ge} = Nonfactored load from ASTM E1300 using a thickness designation for monolithic glass that is not greater than the thickness of wired glass.

2404.3.2 Sloped wired glass. Wired glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$$F_g < 0.5 F_{ge} \quad \text{(Equation 24-7)}$$

For Equation 24-4:

$$F_g < 0.3 F_{ge} \quad \text{(Equation 24-8)}$$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and 24-4.

F_{ge} = Nonfactored load in accordance with ASTM E1300.

2404.3.3 Vertical patterned glass. Patterned glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to Equation 24-9.

$$F_{gw} < 1.0 F_{ge} \quad \text{(Equation 24-9)}$$

where:

F_{gw} = Wind load on the glass due to basic design wind speed, V , computed in accordance with Section 1609.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between nonfactored load charts in ASTM E1300 shall be permitted.

2404.3.4 Sloped patterned glass. Patterned glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$$F_g < 1.0 F_{ge} \quad \text{(Equation 24-10)}$$

For Equation 24-4:

$$F_g < 0.6 F_{ge} \quad \text{(Equation 24-11)}$$

where:

F_g = Total load on the glass as determined by Equations 24-2, 24-3 and 24-4.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between the nonfactored load charts in ASTM E1300 shall be permitted.

2404.3.5 Vertical sandblasted glass. Sandblasted glass sloped 15 degrees (0.26 rad) or less from vertical in

windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to Equation 24-12.

$$0.6F_{gw} < 0.5 F_{ge} \quad (\text{Equation 24-12})$$

where:

F_g = Wind load on the glass due to basic design wind speed, V , computed in accordance with Section 1609.

F_{ge} = Nonfactored load in accordance with ASTM E1300. The value for sandblasted glass is for moderate levels of sandblasting.

2404.4 Other designs. For designs outside the scope of this section, an analysis or test data for the specific installation shall be prepared by a registered design professional.

SECTION 2405 SLOPED GLAZING AND SKYLIGHTS

2405.1 Scope. This section applies to the installation of glass and other transparent, translucent or opaque glazing material installed at a slope of more than 15 degrees (0.26 rad) from the vertical plane, including glazing materials in skylights, roofs and sloped walls.

2405.2 Allowable glazing materials and limitations. Sloped glazing shall be any of the following materials, subject to the listed limitations.

1. For monolithic glazing systems, the glazing material of the single light or layer shall be laminated glass with a minimum 30-mil (0.76 mm) polyvinyl butyral (or equivalent) interlayer, wired glass, light-transmitting plastic materials meeting the requirements of Section 2607, heat-strengthened glass or fully tempered glass.
2. For multiple-layer glazing systems, each light or layer shall consist of any of the glazing materials specified in Item 1.

Annealed glass is permitted to be used as specified in Exceptions 2 and 3 of Section 2405.3.

Laminated glass and plastic materials described in Items 1 and 2 shall not require the screening or height restrictions provided in Section 2405.3.

For additional requirements for plastic skylights, see Section 2610. Glass-block construction shall conform to the requirements of Section 2110.1.

2405.3 Screening. Where used in monolithic glazing systems, annealed, heat-strengthened, fully tempered and wired glass shall have broken glass retention screens installed below the glazing material. The screens and their fastenings shall be: capable of supporting twice the weight of the glazing; firmly and substantially fastened to the framing members; and installed within 4 inches (102 mm) of the glass. The screens shall be constructed of a noncombustible material not thinner than No. 12 B&S gage (0.0808 inch) with mesh not larger than 1 inch by 1 inch (25 mm by 25 mm). In a corrosive atmosphere, structurally equivalent noncorrosive screen materials shall be used. Annealed, heat-

strengthened, fully tempered and wired glass, where used in multiple-layer glazing systems as the bottom glass layer over the walking surface, shall be equipped with screening that conforms to the requirements for monolithic glazing systems.

Exception: In monolithic and multiple-layer sloped glazing systems, the following applies:

1. Fully tempered glass installed without protective screens where glazed between intervening floors at a slope of 30 degrees (0.52 rad) or less from the vertical plane shall have the highest point of the glass 10 feet (3048 mm) or less above the walking surface.
2. Screens are not required below any glazing material, including annealed glass, where the walking surface below the glazing material is permanently protected from the risk of falling glass or the area below the glazing material is not a walking surface.
3. Any glazing material, including annealed glass, is permitted to be installed without screens in the sloped glazing systems of commercial or detached noncombustible greenhouses used exclusively for growing plants and not open to the public, provided that the height of the greenhouse at the ridge does not exceed 30 feet (9144 mm) above grade.
4. Screens shall not be required in individual dwelling units in Groups R-2, R-3 and R-4 where fully tempered glass is used as single glazing or as both panes in an insulating glass unit, and the following conditions are met:
 - 4.1. Each pane of the glass is 16 square feet (1.5 m²) or less in area.
 - 4.2. The highest point of the glass is 12 feet (3658 mm) or less above any walking surface or other accessible area.
 - 4.3. The glass thickness is $\frac{3}{16}$ inch (4.8 mm) or less.
5. Screens shall not be required for laminated glass with a 15-mil (0.38 mm) polyvinyl butyral (or equivalent) interlayer used in individual dwelling units in Groups R-2, R-3 and R-4 within the following limits:
 - 5.1. Each pane of glass is 16 square feet (1.5 m²) or less in area.
 - 5.2. The highest point of the glass is 12 feet (3658 mm) or less above a walking surface or other accessible area.

2405.4 Framing. In Types I and II construction, sloped glazing and skylight frames shall be constructed of noncombustible materials. In structures where acid fumes deleterious to metal are incidental to the use of the buildings, approved pressure-treated wood or other approved noncorrosive materials are permitted to be used for sash and frames. Framing supporting sloped glazing and skylights shall be designed to resist the tributary roof loads in Chapter 16. Skylights set at an angle of less than 45 degrees (0.79 rad) from the horizontal plane shall be mounted not less than 4 inches (102 mm) above the plane of the roof on a curb

constructed as required for the frame. Skylights shall not be installed in the plane of the roof where the roof pitch is less than 45 degrees (0.79 rad) from the horizontal.

Exception: Installation of a skylight without a curb shall be permitted on roofs with a minimum slope of 14 degrees (three units vertical in 12 units horizontal) in Group R-3 occupancies. Unit skylights installed in a roof with a pitch flatter than 14 degrees (0.25 rad) shall be mounted not less than 4 inches (102 mm) above the plane of the roof on a curb constructed as required for the frame unless otherwise specified in the manufacturer's installation instructions.

2405.5 Unit skylights and tubular daylighting devices. Unit skylights and tubular daylighting devices shall be tested and labeled as complying with AAMA/WDMA/CSA 101/I.S./A440. The label shall state the name of the manufacturer, the approved labeling agency, the product designation and the performance grade rating as specified in AAMA/WDMA/CSA 101/I.S.2/A440. Where the product manufacturer has chosen to have the performance grade of the skylight rated separately for positive and negative design pressure, then the label shall state both performance grade ratings as specified in AAMA/WDMA/CSA 101/I.S.2/A440 and the skylight shall comply with Section 2405.5.2. Where the skylight is not rated separately for positive and negative pressure, then the performance grade rating shown on the label shall be the performance grade rating determined in accordance with AAMA/WDMA/CSA 101/I.S.2/A440 for both positive and negative design pressure and the skylight shall conform to Section 2405.5.1.

2405.5.1 Skylights rated for the same performance grade for both positive and negative design pressure. The design of skylights shall be based on Equation 24-13.

$$F_g \leq PG \quad (\text{Equation 24-13})$$

where:

F_g = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

PG = Performance grade rating of the skylight.

2405.5.2 Skylights rated for separate performance grades for positive and negative design pressure. The design of skylights rated for performance grade for both positive and negative design pressures shall be based on Equations 24-14 and 24-15.

$$F_{gi} \leq PG_{Pos} \quad (\text{Equation 24-14})$$

$$F_{go} \leq PG_{Neg} \quad (\text{Equation 24-15})$$

where:

PG_{Pos} = Performance grade rating of the skylight under positive design pressure;

PG_{Neg} = Performance grade rating of the skylight under negative design pressure; and

F_{gi} and F_{go} are determined in accordance with the following:

For $0.6W_o \geq D$,

where:

W_o = Outward wind force, psf (kN/m²) due to basic design wind speed, V , as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m²) as determined in Section 2404.2 for glass, or by the weight of the plastic, psf (kN/m²) for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-3 and 24-4 in Section 2404.2.

F_{go} = Maximum load on the skylight determined from Equation 24-2.

For $0.6W_o < D$,

where:

W_o = The outward wind force, psf (kN/m²) due to basic design wind speed, V , as calculated in Section 1609.

D = The dead weight of the glazing, psf (kN/m²) as determined in Section 2404.2 for glass, or by the weight of the plastic for plastic glazing.

F_{gi} = Maximum load on the skylight determined from Equations 24-2 through 24-4 in Section 2404.2.

F_{go} = 0.

SECTION 2406 SAFETY GLAZING

2406.1 Human impact loads. Individual glazed areas, including glass mirrors, in hazardous locations as defined in Section 2406.4 shall comply with Sections 2406.1.1 through 2406.1.4.

Exception: Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.

2406.1.1 Impact test. Except as provided in Sections 2406.1.2 through 2406.1.4, all glazing shall pass the impact test requirements of Section 2406.2.

2406.1.2 Plastic glazing. Plastic glazing shall meet the weathering requirements of ANSI Z97.1.

2406.1.3 Glass block. Glass-block walls shall comply with Section 2110.

2406.1.4 Louvered windows and жалousies. Louvered windows and жалousies shall comply with Section 2403.5.

2406.2 Impact test. Where required by other sections of this code, glazing shall be tested in accordance with CPSC 16 CFR Part 1201. Glazing shall comply with the test criteria for Category II, unless otherwise indicated in Table 2406.2(1).

Exception: Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A, unless otherwise indicated in Table 2406.2(2).

TABLE 2406.2(1)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING CPSC 16 CFR PART 1201

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category class)	GLAZING IN DOORS (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5 (Category class)	SLIDING GLASS DOORS PATIO TYPE (Category class)
9 square feet or less	I	I	No requirement	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m².

TABLE 2406.2(2)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING ANSI Z97.1

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZED PANELS REGULATED BY SECTION 2406.4.3 (Category class)	GLAZED PANELS REGULATED BY SECTION 2406.4.2 (Category class)	DOORS AND ENCLOSURES REGULATED BY SECTION 2406.4.5 ^a (Category class)
9 square feet or less	No requirement	B	A
More than 9 square feet	A	A	A

For SI: square foot = 0.0929 m².

a. Use is only permitted by the exception to Section 2406.2.

2406.3 Identification of safety glazing. Except as indicated in Section 2406.3.1, each pane of safety glazing installed in hazardous locations shall be identified by a manufacturer's designation specifying who applied the designation, the manufacturer or installer and the safety glazing standard with which it complies, as well as the information specified in Section 2403.1. The designation shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that once applied, cannot be removed without being destroyed. A label meeting the requirements of this section shall be permitted in lieu of the manufacturer's designation.

Exceptions:

1. For other than tempered glass, manufacturer's designations are not required, provided that the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation.

2406.3.1 Multipane assemblies. Multipane glazed assemblies having individual panes not exceeding 1 square foot (0.09 m²) in exposed areas shall have one pane or more in the assembly marked as indicated in Section 2406.3. Other panes in the assembly shall be marked "CPSC 16 CFR Part 1201" or "ANSI Z97.1," as appropriate.

2406.4 Hazardous locations. The locations specified in Sections 2406.4.1 through 2406.4.7 shall be considered to be specific hazardous locations requiring safety glazing materials.

2406.4.1 Glazing in doors. Glazing in all fixed and operable panels of swinging, sliding and bifold doors shall be considered to be a hazardous location.

Exceptions:

1. Glazed openings of a size through which a 3-inch-diameter (76 mm) sphere is unable to pass.

2. Decorative glazing.
3. Glazing materials used as curved glazed panels in revolving doors.
4. Commercial refrigerated cabinet glazed doors.

2406.4.2 Glazing adjacent to doors. Glazing in an individual fixed or operable panel adjacent to a door where the nearest vertical edge of the glazing is within a 24-inch (610 mm) arc of either vertical edge of the door in a closed position and where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the walking surface shall be considered to be a hazardous location.

Exceptions:

1. Decorative glazing.
2. Where there is an intervening wall or other permanent barrier between the door and glazing.
3. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with Section 2406.4.3.
4. Glazing in walls on the latch side of and perpendicular to the plane of the door in a closed position in one- and two-family dwellings or within dwelling units in Group R-2.

2406.4.3 Glazing in windows. Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered to be a hazardous location:

1. The exposed area of an individual pane is greater than 9 square feet (0.84 m²).
2. The bottom edge of the glazing is less than 18 inches (457 mm) above the floor.
3. The top edge of the glazing is greater than 36 inches (914 mm) above the floor.

4. One or more walking surface(s) are within 36 inches (914 mm), measured horizontally and in a straight line, of the plane of the glazing.

Exceptions:

1. Decorative glazing.
2. Where a horizontal rail is installed on the accessible side(s) of the glazing 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and be not less than 1½ inches (38 mm) in cross-sectional height.
3. Outboard panes in insulating glass units or multiple glazing where the bottom exposed edge of the glass is 25 feet (7620 mm) or more above any grade, roof, walking surface or other horizontal or sloped (within 45 degrees of horizontal) (0.79 rad) surface adjacent to the glass exterior.

2406.4.4 Glazing in guards and railings. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered to be a hazardous location.

2406.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or facing hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered to be a hazardous location. This shall apply to single glazing and all panes in multiple glazing.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally and in a straight line, from the water's edge of a bathtub, hot tub, spa, whirlpool or swimming pool.

2406.4.6 Glazing adjacent to stairways and ramps. Glazing where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered to be a hazardous location.

Exceptions:

1. The side of a stairway, landing or ramp that has a guard complying with the provisions of Sections 1015 and 1607.9, and the plane of the glass is greater than 18 inches (457 mm) from the railing.
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.

2406.4.7 Glazing adjacent to the bottom stairway landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 60 inches (1524 mm) above the landing and within a 60-inch (1524 mm) horizontal arc that is less than 180 degrees (3.14 rad) from

the bottom tread nosing shall be considered to be a hazardous location.

Exception: Glazing that is protected by a guard complying with Sections 1015 and 1607.9 where the plane of the glass is greater than 18 inches (457 mm) from the guard.

2406.5 Fire department access panels. Fire department glass access panels shall be of tempered glass. For insulating glass units, all panes shall be tempered glass.

SECTION 2407**GLASS IN HANDRAILS AND GUARDS**

2407.1 Materials. Glass used in a handrail or a guard shall be laminated glass constructed of fully tempered or heat-strengthened glass and shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1. Glazing in a handrail or a guard shall be of an approved safety glazing material that conforms to the provisions of Section 2406.1.1. For all glazing types, the minimum nominal thickness shall be ¼ inch (6.4 mm).

Exception: Single fully tempered glass complying with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1 shall be permitted to be used in handrails and guards where there is no walking surface beneath them or the walking surface is permanently protected from the risk of falling glass.

2407.1.1 Loads. Glass handrails and guards and their support systems shall be designed to withstand the loads specified in Section 1607.9. Glass handrails and guards shall be designed using a factor of safety of four.

2407.1.2 Guards with structural glass balusters. Guards with structural glass balusters, whether vertical posts, columns or panels, shall be installed with an attached top rail or handrail. The top rail or handrail shall be supported by not fewer than three glass balusters, or shall be otherwise supported to remain in place should one glass baluster fail.

Exception: An attached top rail or handrail is not required where the glass baluster panels are laminated glass with two or more glass plies of equal thickness and of the same glass type. The balusters shall be tested to remain in place as a barrier following impact or glass breakage in accordance with ASTM E2353.

2407.1.3 Parking garages. Glazing materials shall not be installed in handrails or guards in parking garages except for pedestrian areas not exposed to impact from vehicles.

2407.1.4 Glazing in windborne debris regions. Glazing installed in exterior handrails or guards in windborne debris regions shall be laminated glass complying with Category II of CPSC 16 CFR 1201 or Class A of ANSI Z97.1. Where the top rail is supported by glass, the assembly shall be tested according to the impact requirements of Section 1609.2 and the top rail shall remain in place after impact.

SECTION 2408 GLAZING IN ATHLETIC FACILITIES

2408.1 General. Glazing in athletic facilities and similar uses subject to impact loads, which forms whole or partial wall sections or which is used as a door or part of a door, shall comply with this section.

2408.2 Racquetball and squash courts.

2408.2.1 Testing. Test methods and loads for individual glazed areas in racquetball and squash courts subject to impact loads shall conform to those of CPSC 16 CFR Part 1201 or ANSI Z97.1 with impacts being applied at a height of 59 inches (1499 mm) above the playing surface to an actual or simulated glass wall installation with fixtures, fittings and methods of assembly identical to those used in practice.

Glass walls shall comply with the following conditions:

1. A glass wall in a racquetball or squash court, or similar use subject to impact loads, shall remain intact following a test impact.
2. The deflection of such walls shall be not greater than $1\frac{1}{2}$ inches (38 mm) at the point of impact for a drop height of 48 inches (1219 mm).

Glass doors shall comply with the following conditions:

1. Glass doors shall remain intact following a test impact at the prescribed height in the center of the door.
2. The relative deflection between the edge of a glass door and the adjacent wall shall not exceed the thickness of the wall plus $\frac{1}{2}$ inch (12.7 mm) for a drop height of 48 inches (1219 mm).

2408.3 Gymnasiums and basketball courts. Glazing in multipurpose gymnasiums, basketball courts and similar athletic facilities subject to human impact loads shall comply with Category II of CPSC 16 CFR Part 1201 or Class A of ANSI Z97.1.

SECTION 2409 GLASS IN WALKWAYS, ELEVATOR HOISTWAYS AND ELEVATOR CARS

2409.1 Glass walkways. Glass installed as a part of a floor/ceiling assembly as a walking surface and constructed with laminated glass shall comply with ASTM E2751 or with the load requirements specified in Chapter 16. Such assemblies shall comply with the fire-resistance rating and marking requirements of this code where applicable.

2409.2 Glass in elevator hoistway enclosures. Glass in elevator hoistway enclosures and hoistway doors shall be laminated glass conforming to ANSI Z97.1 or CPSC 16 CFR Part 1201.

2409.2.1 Fire-resistance-rated hoistways. Glass installed in hoistways and hoistway doors where the hoistway is required to have a fire-resistance rating shall comply with Section 716.

2409.2.2 Glass hoistway doors. The glass in glass hoistway doors shall be not less than 60 percent of the total visible door panel surface area as seen from the landing side.

2409.3 Vision panels in elevator hoistway doors. Glass in vision panels in elevator hoistway doors shall be permitted to be any transparent glazing material not less than $\frac{1}{4}$ inch (6.4 mm) in thickness conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201. The area of any single vision panel shall be not less than 24 square inches (15 484 mm²) and the total area of one or more vision panels in any hoistway door shall be not more than 85 square inches (54 839 mm²).

2409.4 Glass in elevator cars. Glass in elevator cars shall be in accordance with this section.

2409.4.1 Glass types. Glass in elevator car enclosures, glass elevator car doors and glass used for lining walls and ceilings of elevator cars shall be laminated glass conforming to Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201.

Exception: Tempered glass shall be permitted to be used for lining walls and ceilings of elevator cars provided that:

1. The glass is bonded to a nonpolymeric coating, sheeting or film backing having a physical integrity to hold the fragments when the glass breaks.
2. The glass is not subjected to further treatment such as sandblasting; etching; heat treatment or painting that could alter the original properties of the glass.
3. The glass is tested to the acceptance criteria for laminated glass as specified for Class A in accordance with ANSI Z97.1 or Category II in accordance with CPSC 16 CFR Part 1201.

2409.4.2 Surface area. The glass in glass elevator car doors shall be not less than 60 percent of the total visible door panel surface area as seen from the car side of the doors.

SECTION 2410 [DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] STRUCTURAL SEALANT GLAZING (SSG)

2410.1 General. The requirements of this section address the use of structural sealant glazing (SSG). These requirements shall not be used for butt joint glazing, point supported glass and glass fins.

Design, construction, testing and inspection shall satisfy the requirements of this code except as modified in Sections 2410.1.1 through 2410.1.4.

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2410.1.1 Design. Design of SSG shall satisfy the following requirements:

1. SSG shall be weather tight and serviceable, as defined in AAMA 501.4, under design story drifts associated with the design earthquake and no glass fallout shall occur at the drifts determined by ASCE 7, Section 13.5.9.
2. The sealant utilized in the insulated glass units used in SSG shall be designed in accordance with ASTM C1249. The insulated glass unit design shall be in accordance with ASTM C1249, Section 6.7.2.
3. Allowable stress for SSG shall not exceed 20 psi and shall have a minimum factor of safety of 5 as required by ASTM C1401.
4. Design methodology shall address seismic movement in accordance with ASTM C1401, Section 30.3.4.
5. SSG systems shall be supported for self-weight and lateral loading at each floor level of the building.
6. Unitized SSG framing shall be anchored to the building floor bearing plate by screws or bolts and shall not rely upon gravity or frictional forces for attachment.
7. Framing shall satisfy the out-of-plane deflection requirements of this code.

2410.1.2 Testing and inspection. Testing and inspection of SSG shall satisfy the following requirements:

1. The seismic drift capability of SSG shall be determined by tests in accordance with AAMA 501.6 and AAMA 501.4. Analysis as an alternative to testing is not acceptable for the purposes of satisfying the seismic drift requirements of the SSG system.

Exception: [DSA-SS, DSA-SS/CC] In Risk Category I, II and III buildings the seismic drift capacity can be determined by engineering analysis in accordance with ASCE 7, Section 13.5.9 for two-sided SSG systems in which the other two sides of each glazing unit are mechanically captured by mullions such that glass fallout is prevented even in the event of the structural sealant failure.

2. The applicability of the specific AAMA 501.6 and AAMA 501.4 testing shall be subject to approval by the building official.
3. The panel test specimens used in the AAMA 501.6 and AAMA 501.4 testing shall include all glass types (annealed, heat strengthened, laminated, tempered) and insulated glass units that comprise more than 5 percent of the total glass curtain wall area used in the building.
4. AAMA 501.4 test specimen shall include the same materials, sections, connections and attachment details to the test apparatus as used in the building.
5. Serviceability tests of SSG test specimen shall be performed in accordance with AAMA 501.4 after seismic displacement tests to the design story drift.

6. The window wall system using structural sealant by different manufacturer/product category shall be qualified in accordance with AAMA 501.6 and AAMA 501.4 testing for the seismic drift required.
7. Where unitized SSG is used with horizontal stack joints at each floor level and split vertical mullions that can move independently, only a story height single unit need to be tested under AAMA 501.6. Where continuous horizontal bands of SSG are used in the building, either two or four sided, the aspect ratio (height-to-length) of the test specimen shall be less than 1.0, contain not less than two interior vertical joints and all joints (vertical in the case of two sided), including the perimeter of the glass, shall be glazed with SSG.
8. Where SSG continues around corners, the AAMA 501.4 test specimen shall include one corner panel to verify the kinematics of the corner condition under seismic drift.
9. Quality assurance and inspection requirements shall include formalized post-installation tests using the point load testing procedure in accordance with ASTM C1392. The point load tests shall be done after the initial installation.
10. Where the SSG is field assembled, hand pull tab tests in accordance with ASTM C1401, Section X2.1, one test every 100 linear feet, but not less than one test for each building elevation view shall be required.

Existing AAMA 501.4 and 501.6 test results satisfying the requirements of this section shall be permitted, in lieu of project specific tests, when approved by the building official.

2410.1.3 Monitoring. Short- and long-term periodic performance monitoring shall be provided in accordance with ASTM C1401, C1392 and C1394. Inspection frequencies recommended in ASTM C1394 shall be followed.

2410.1.4 Construction documents. Complete design of the SSG system for gravity, wind and seismic forces shall be subject to review by the enforcement agency. Construction documents shall show descriptive notes and structural details of glass and curtain wall system including:

1. A design narrative explaining how the SSG is supported by the building and the mechanism used to accommodate seismic racking.
2. Type of SSG and whether field or shop built.
3. The means of supporting the glass during structural sealant curing time.
4. Typical curtain wall panel elevation, plan view and sections.
5. Details of building corner joint to verify how the corner vertical mullion will move to accommodate the seismic drift.
6. Joints between panel and floors at top and bottom.

7. Joints between panels, including vertical and horizontal stack joints at intermediate and edge mullion.
8. Member sizes for curtain wall panels.
9. Glass pane sizes, thickness and type of glass.
10. Contact width and thickness of structural sealant and sealant materials for shop and field installation/reglazing.
11. Glass to aluminum joints (including primers, if any).
12. Maximum roof/floor dead and live load deflection of the roof/floor framing members supporting the exterior curtain wall system.
13. Required seismic separation or gap distance between the SSG curtain wall and other adjacent cladding units.
14. Mitigation of galvanic reactions between the roof/floor slab anchors, steel screw connections of aluminum sections and the aluminum anchorage components, if any.
15. Monitoring requirements per Section 2410.1.3.

SECTION 2411 [OSHPD 1, 1R, 2, 4 & 5] THERMAL BARRIERS IN ALUMINUM MULLION SYSTEMS

2411.1 General. The requirements of this section address the use of thermal barriers composite in aluminum mullion systems. The thermal barriers shall consist of either poured and debrided or mechanically locked pre-formed construction. The thermal barrier systems used shall be those tested and complying with AAMA TIR-A8. The thermal barrier manufacturer, formulation number or insulating strut size/material and aluminum extrusions shall be consistent between testing, design and construction.

Exception: Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2411.1.1 Structural Design. Structural design of thermal barrier mullions shall satisfy the following requirements:

1. The allowable design stresses for thermal barrier materials composite with aluminum extrusions shall be determined by AAMA TIR-A8 testing for in-plane shear, tension and eccentric load at a minimum of ambient and high temperature using a factor of safety determined by AAMA TIR-A8 Section 6.7.
2. The shear modulus, G_c , of the thermal barrier in similar composite aluminum extrusions shall be determined by AAMA TIR-A8 testing for flexure in AAMA TIR-A8 Section 7.2 at a minimum of ambient and high temperature.
3. The aluminum extrusions used to determine allowable stresses in the thermal barriers and the shear modulus, G_c , shall be from a specific aluminum extrusion manufacturer and the aluminum sections used in the project. The similarity of the composite aluminum extrusions shall be subject to approval by the building official.
4. The effective moment of inertia of the in-plane composite thermal barrier-aluminum section used in flexural design, based upon the tested G_c , shall not exceed 85 percent of the moment of inertia of the combined unbridged aluminum portions of the composite section, unless substantiated and approved by the building official.
5. A high temperature of not less than 120°F shall be used for composite section flexure design for wind pressure where the historical high temperature exceeds 100°F. The minimum high temperature for in-plane shear, tension and eccentric load thermal barrier design shall be determined by AAMA TIR-A8 Section 6.5.
6. The lowest allowable stress value and shear modulus, G_c , from the ambient and high temperature testing shall be used for design.
7. Structural analysis and design for loads on pour and debrided thermal barriers with skip-debriding that has not been tested under AAMA TIR-A8 with skip-debrided test specimens for the specific actions or load direction shall be based upon the relative stiffness between the remaining aluminum bridge and the thermal barrier material and size.
8. Reactions on supporting thermal barrier mullions where the thermal barrier resists the concentrated load, the load shall not be assumed to be distributed over a length greater than 12 inches (305 mm) on the supporting mullion.
9. Mechanically locked, preformed thermal barriers shall be designed and used in pairs.

2411.1.2 Testing and Inspection. Testing and Inspection of thermal barrier mullions shall satisfy the following requirements:

1. Thermal barrier material properties shall be tested in accordance with AAMA TIR-A8 Section 6.1 by the manufacturer. All other testing shall done by an approved testing laboratory or agency.
2. Testing shall include AAMA TIR-A8 Section 7.2 for the flexural tests using the composite section under ambient and high temperature. Thermocouples shall be placed on the outside and interior surfaces and in the middle of the thermal barrier for high temperature testing. Test cycles shall be in accordance with AAMA TIR-A8 Section 7.2.3.
3. Testing shall include AAMA TIR-A8 Section 7.3 for in-plane shear, tension and eccentric load using the composite section under ambient and high temperature.
4. The flexural test for the composite section shall include a span length of 12 feet (3660 mm). The maximum P load in the test shall generate close to a L/175 deflection, where L is the span length, center to center of supports, but shall not exceed the allowable design stresses for the aluminum composite

- section in meeting that deflection. Permanent deflection shall not exceed the requirement in AAMA TIR-A8 Section 7.2.2.5.
5. A minimum of two different simple span lengths shall be used to determine G_c under the flexural test. The span lengths tested shall include a short span.
 6. The shear modulus, G_s , of the thermal barrier shall be determined using the lowest average I_{et} from the flexural testing for each composite aluminum extrusion, temperature and span length tested.
 7. Each different composite aluminum extrusion in the project shall be tested to the requirements of AAMA TIR-A8. The magnitude of eccentricity of load on the thermal barrier shall be considered in selecting composite aluminum extrusions for testing.
 8. The applicability of existing AAMA TIR-A8 testing of thermal barrier mullions that satisfy the requirements of this section shall be permitted, in lieu of project-specific tests, when approved by the building official.
 9. Periodic special inspection to ensure compliance with the AAMA TIR-A8 processing for the thermal isolator material shall be performed. Inspections shall include tests of thermal barrier material properties per the manufacturer's recommendation and AAMA TIR-A8 Section 6.1 and composite performance requirements per AAMA TIR-A8 Sections 7.2 and 7.3.
 10. Periodic special inspection of pour and debridge thermal barrier shall include:
 - a. Verification that the thermal barrier formulation being used matches that in the design and construction documents.
 - b. Verification that poured wet or dry shrinkage as set forth in AAMA TIR-A8 Section 4.1.3.1 does not occur.
 - c. Proper adhesion of poured thermal barrier material per AAMA TIR-A8 Section 4.2.1.
 - d. Confirmation of proper manufacturing process per the manufacturer's recommendations and AAMA TIR-A8 Section 4.3.
 - e. Inspection of fabrication and handling practices in accordance with AAMA TIR-A8 Sections 4.3 and 4.4.
 - f. Testing for thermal barrier material properties per the manufacturer's recommendation and AAMA TIR-A8 Section 6.1.
 - g. Periodic special inspection of the removal of the temporary thermal bridge shall be provided to ensure that no thermal barrier material is removed in the process.
 11. Periodic special inspection of mechanically locked, preformed thermal barriers shall include:
 - a. Verification that the insulating struts being used match those in the design and construction documents.
 - b. Verification that the mechanical lock cavity distortion and locking distortion does not exist as set forth in AAMA TIR-A8 Sections 4.1.3.3 and 4.1.3.4.
 - c. Verification of proper knurling of the aluminum and crimping of the insulating struts per AAMA TIR-A8 Section 4.2.2.
 - d. Confirmation of proper manufacturing process per the manufacturer's recommendations and AAMA TIR-A8 Section 4.5.
 - e. Inspection of fabrication and handling practices in accordance with AAMA TIR-A8 Sections 4.5 and 4.6.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 25 – GYPSUM BOARD, GYPSUM PANEL PRODUCTS AND PLASTER

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X			X	X								X									
Adopt entire chapter as amendeded (amended sections listed below)								X	X	X	X	X		X	X							
Adopt only those sections that are listed below																			X			
Chapter / Section																						
2501.1.1								X	X	X	X	X		X	X							
2501.1.2								X	X	X	X	X		X	X							
2501.1.3								X	X	X	X	X		X	X							
2503.2								X	X	X	X	X		X	X							
2503.2, Exception											X											
2504.2								X	X	X	X	X		X	X							
2504.2.1, Exception											X											
2505.3								X	X	X	X	X		X	X							
2505.3, Exception											X											
2507.3								X	X	X	X	X		X	X							
2507.3, Exception											X											
2508.6.6								X	X	X	X	X		X	X							
2508.6.6, Exception											X											
2510.6.3																			X			
2514.1 Exception								X		X	X	X		X	X							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 25

GYPSON BOARD, GYPSON PANEL PRODUCTS AND PLASTER

User notes:

About this chapter: Chapter 25 contains the provisions and referenced standards that regulate the design, construction and quality of gypsum board, gypsum panel products and plaster and, in addition, addresses reinforced gypsum concrete. These materials are some of the most commonly used interior and exterior finish materials in the building industry. This chapter primarily addresses quality-control-related issues with regard to material specifications and installation requirements. Most products are manufactured in accordance with industry standards. The building official or inspector needs to verify that the appropriate product is used and properly installed for the intended use and location. Proper design and installation of these materials are necessary to provide weather resistance and required fire protection for both structural and nonstructural building components.

Code development reminder: Code change proposals to this chapter will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 2501 GENERAL

2501.1 Scope. Provisions of this chapter shall govern the materials, design, construction and quality of gypsum board, gypsum panel products, lath, gypsum plaster, cement plaster and reinforced gypsum concrete.

2501.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD] The scope of application of Chapter 25 is as follows:

1. Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of State-wide Health Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.
2. Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings

2501.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC, OSHPD] DSA-SS, DSA-SS/CC, OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. OSHPD amendments appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 4] - For applications listed in Section 1.10.4.

[OSHPD 5] - For applications listed in Section 1.10.5.

2. Division of the State Architect - Structural Safety:

[DSA-SS] - For applications listed in Section 1.9.2.1.

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

2501.1.3 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] Details of attachment for wall and ceiling coverings which are not provided for in this code shall be detailed in the approved construction documents.

Exception: Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2501.2 Other materials. Other approved wall or ceiling coverings shall be permitted to be installed in accordance with the recommendations of the manufacturer and the conditions of approval.

SECTION 2502 PERFORMANCE

2502.1 General. Lathing, plastering and gypsum board and gypsum panel product construction shall be done in the manner and with the materials specified in this chapter and, where required for fire protection, shall comply with the provisions of Chapter 7.

SECTION 2503 INSPECTION

2503.1 Inspection. Lath, gypsum board and gypsum panel products shall be inspected in accordance with Section 110.3.6.

2503.2 Additional requirements for inspection and testing. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5]

1. Lath, gypsum board and gypsum panel products shall be inspected in accordance with Chapter 17A and the California Administrative Code.
2. No lath, gypsum board and gypsum panel products or their attachments shall be covered or finished until it has been inspected and approved by the inspector of record and/or special inspector.
3. The enforcement agency may require tests in accordance with Table 2506.2 to determine compliance with the provisions of this code.
4. The testing of gypsum board and gypsum panel products shall conform with standards listed in Table 2506.2

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

SECTION 2504

VERTICAL AND HORIZONTAL ASSEMBLIES

2504.1 Scope. The following requirements shall be met where construction involves gypsum board, gypsum panel products or lath and plaster in vertical and horizontal assemblies.

2504.1.1 Wood framing. Wood supports for lath, gypsum board or gypsum panel products, as well as wood stripping or furring, shall be not less than 2 inches (51 mm) nominal thickness in the least dimension.

Exception: The minimum nominal dimension of wood furring strips installed over solid backing shall be not less than 1 inch by 2 inches (25 mm by 51 mm).

2504.1.2 Studless partitions. The minimum thickness of vertically erected studless solid plaster partitions of $\frac{3}{8}$ -inch (9.5 mm) and $\frac{3}{4}$ -inch (19.1 mm) rib metal lath, $\frac{1}{2}$ -inch-thick (12.7 mm) gypsum lath, gypsum board or gypsum panel product shall be 2 inches (51 mm).

2504.2 Additional requirements. [DSA-SS, DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of this section, the horizontal and vertical assemblies of plaster, gypsum board or gypsum panel products shall be designed to resist the loads specified in this code.

2504.2.1 Wood furring strips. Wood furring strips for ceilings fastened to floor or ceiling joist shall be nailed at each bearing with two common wire nails, one of which shall be a slant nail and the other a face nail, or by one nail having spirally grooved or annular grooved shanks approved by the enforcement agency for this purpose. All stripping nails shall penetrate not less than $1\frac{3}{4}$ inches (44.5 mm) into the member receiving the point. Holes in stripping at joints shall be subdrilled to prevent splitting.

Where common wire nails are used to support horizontal wood stripping for plaster ceilings, such stripping shall be wire tied to the joists 4 feet (1219 mm) on center with two strands of No. 18 W&M gage galvanized annealed wire to an 8d common wire nail driven into

each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist, and the ends of the wire secured together with three twists of the wire.

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

SECTION 2505

SHEAR WALL CONSTRUCTION

2505.1 Resistance to shear (wood framing). Wood-frame shear walls sheathed with gypsum board, gypsum panel products or lath and plaster shall be designed and constructed in accordance with Section 2306.3 and are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

2505.2 Resistance to shear (steel framing). Cold-formed steel-frame shear walls sheathed with gypsum board or gypsum panel products and constructed in accordance with the materials and provisions of Section 2211.1.1 are permitted to resist wind and seismic loads. Walls resisting seismic loads shall be subject to the limitations in Section 12.2.1 of ASCE 7.

2505.3 [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] Section 2505.1 and 2505.2 are not permitted.

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

SECTION 2506

GYPSUM BOARD AND GYPSUM PANEL PRODUCT MATERIALS

2506.1 General. Gypsum board, gypsum panel products and accessories shall be identified by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored to protect such materials from the weather.

2506.2 Standards. Gypsum board and gypsum panel products shall conform to the appropriate standards listed in Table 2506.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

2506.2.1 Other materials. Metal suspension systems for acoustical and lay-in panel ceilings shall comply with ASTM C635 listed in Chapter 35 and Section 13.5.6 of ASCE 7 for installation in high seismic areas.

SECTION 2507

LATHING AND PLASTERING

2507.1 General. Lathing and plastering materials and accessories shall be marked by the manufacturer's designation to indicate compliance with the appropriate standards referenced in this section and stored in such a manner to protect them from the weather.

**TABLE 2506.2
GYPSUM BOARD AND GYPSUM PANEL PRODUCTS MATERIALS AND ACCESSORIES**

MATERIAL	STANDARD
Accessories for gypsum board	ASTM C1047
Adhesives for fastening gypsum board	ASTM C557
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, nonstructural	AISI S220
Elastomeric joint sealants	ASTM C920
Expandable foam adhesives for fastening gypsum wallboard	ASTM D6464
Factory-laminated gypsum panel products	ASTM C1766
Fiber-reinforced gypsum panels	ASTM C1278
Glass mat gypsum backing panel	ASTM C1178
Glass mat gypsum panel 5	ASTM C1658
Glass mat gypsum substrate	ASTM C1177
Joint reinforcing tape and compound	ASTM C474; C475
Nails for gypsum boards	ASTM C514, F547, F1667
Steel screws	ASTM C954; C1002
Standard specification for gypsum board	ASTM C1396
Testing gypsum and gypsum products	ASTM C22; C472; C473

2507.2 Standards. Lathing and plastering materials shall conform to the standards listed in Table 2507.2 and Chapter 35 and, where required for fire protection, shall conform to the provisions of Chapter 7.

2507.3 Lath attachment to horizontal wood supports. [DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] Where interior or exterior lath is attached to horizontal wood supports, either of the following attachments shall be used in addition to the methods of attachment described in referenced standards listed in Table 2507.2.

1. Secure lath to alternate supports with ties consisting of a double strand of No. 18 W & M gage galvanized annealed wire at one edge of each sheet of lath. Wire ties shall be installed not less than 3 inches (76 mm) back from the edge of each sheet and shall be looped around stripping, or attached to an 8d common wire nail driven into each side of the joist 2 inches (51 mm) above the bottom of the joist or to each end of a 16d common wire nail driven horizontally through the joist 2 inches (51 mm) above the bottom of the joist and the ends of the wire secured together with three twists of the wire.
2. Secure lath to each support with 1/2-inch-wide (12.7 mm), 1 1/2-inch-long (38mm) No. 9 W & M gage, ring shank, hook staple placed around a 10d common nail laid flat under the surface of the lath not more than 3 inches (76 mm) from edge of each sheet. Such staples may be placed over ribs of 3/8-inch (9.5 mm) rib lath or over back wire of welded wire fabric or other approved lath, omitting the 10d nails.

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

**SECTION 2508
GYPSUM CONSTRUCTION**

2508.1 General. Gypsum board, gypsum panel products and gypsum plaster construction shall be of the materials listed in Tables 2506.2 and 2507.2. These materials shall be assembled and installed in compliance with the appropriate standards listed in Tables 2508.1 and 2511.1.1 and Chapter 35.

**TABLE 2508.1
INSTALLATION OF GYPSUM CONSTRUCTION**

MATERIAL	STANDARD
Gypsum board and gypsum panel products	GA 216; ASTM C840
Gypsum sheathing and gypsum panel products	ASTM C1280
Gypsum veneer base	ASTM C844
Interior lathing and furring	ASTM C841
Steel framing for gypsum board and gypsum panel products	ASTM C754; C1007

2508.2 Limitations. Gypsum wallboard or gypsum plaster shall not be used in any exterior surface where such gypsum construction will be exposed directly to the weather. Gypsum wallboard shall not be used where there will be direct exposure to water or continuous high humidity conditions. Gypsum sheathing shall be installed on exterior surfaces in accordance with ASTM C1280.

2508.2.1 Weather protection. Gypsum wallboard, gypsum lath or gypsum plaster shall not be installed until weather protection for the installation is provided.

**TABLE 2507.2
LATH, PLASTERING MATERIALS AND ACCESSORIES**

MATERIAL	STANDARD
Accessories for gypsum veneer base	ASTM C1047
Blended cement	ASTM C595
Cold-formed steel studs and track, structural	AISI S240
Cold-formed steel studs and track, nonstructural	AISI S220
Exterior plaster bonding compounds	ASTM C932
Hydraulic cement	ASTM C1157; C1600
Gypsum casting and molding plaster	ASTM C59
Gypsum Keene's cement	ASTM C61
Gypsum plaster	ASTM C28
Gypsum veneer plaster	ASTM C587
Interior bonding compounds, gypsum	ASTM C631
Lime plasters	ASTM C5; C206
Masonry cement	ASTM C91
Metal lath	ASTM C847
Plaster aggregates	
Sand	ASTM C35; C897
Perlite	ASTM C35
Vermiculite	ASTM C35
Plastic cement	ASTM C1328
Portland cement	ASTM C150
Steel screws	ASTM C1002; C954
Welded wire lath	ASTM C933
Woven wire plaster base	ASTM C1032

2508.3 Single-ply application. Edges and ends of gypsum board and gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Edges and ends of gypsum board and gypsum panel products shall be in moderate contact except in concealed spaces where fire-resistance-rated construction, shear resistance or diaphragm action is not required.

2508.3.1 Floating angles. Fasteners at the top and bottom plates of vertical assemblies, or the edges and ends of horizontal assemblies perpendicular to supports, and at the wall line are permitted to be omitted except on shear resisting elements or fire-resistance-rated assemblies. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.

2508.4 Adhesives. Gypsum board and gypsum panel products secured to framing with adhesives in ceiling assemblies shall be attached using an approved fastening schedule. Expandable foam adhesives for fastening gypsum wallboard shall conform to ASTM D6464. Other adhesives for the installation of gypsum wallboard shall conform to ASTM C557.

2508.5 Joint treatment. Gypsum board and gypsum panel product fire-resistance-rated assemblies shall have joints and fasteners treated.

Exception: Joint and fastener treatment need not be provided where any of the following conditions occur:

1. Where the gypsum board or the gypsum panel product is to receive a decorative finish such as wood paneling,

battens, acoustical finishes or any similar application that would be equivalent to joint treatment.

2. On single-layer systems where joints occur over wood framing members.
3. Square edge or tongue-and-groove edge gypsum board (V-edge), gypsum panel products, gypsum backing board or gypsum sheathing.
4. On multilayer systems where the joints of adjacent layers are offset.
5. Assemblies tested without joint treatment.

2508.6 Horizontal gypsum board or gypsum panel product diaphragm ceilings. Gypsum board or gypsum panel products shall be permitted to be used on wood joists to create a horizontal diaphragm ceiling in accordance with Table 2508.6.

2508.6.1 Diaphragm proportions. The maximum allowable diaphragm proportions shall be 1¹/₂:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted.

2508.6.2 Installation. Gypsum board or gypsum panel products used in a horizontal diaphragm ceiling shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of gypsum board shall not occur on the same joist.

**TABLE 2508.6
SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAME GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES**

MATERIAL	THICKNESS OF MATERIAL (MINIMUM) (inches)	SPACING OF FRAMING MEMBERS (inches)	SHEAR VALUE ^{a, b} (PLF OF CEILING)	MINIMUM FASTENER SIZE
Gypsum board or gypsum panel product	1/2	16 o.c.	90	5d cooler or wallboard nail; 1 ⁵ / ₈ -inch long; 0.086-inch shank; 1 ⁵ / ₆₄ -inch head ^c
Gypsum board or gypsum panel product	1/2	24 o.c.	70	5d cooler or wallboard nail; 1 ⁵ / ₈ -inch long; 0.086-inch shank; 1 ⁵ / ₆₄ -inch head ^c

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.59 N/m.

- a. Values are not cumulative with other horizontal diaphragm values and are for short-term wind or seismic loading. Values shall be reduced 25 percent for normal loading.
- b. Values shall be reduced 50 percent in Seismic Design Categories D, E and F.
- c. 1¹/₄-inch, No. 6 Type S or W screws are permitted to be substituted for the listed nails.

2508.6.3 Blocking of perimeter edges. Perimeter edges shall be blocked using a wood member not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board or gypsum panel product.

2508.6.4 Fasteners. Fasteners used for the attachment of gypsum board or gypsum panel products to a horizontal diaphragm ceiling shall be as defined in Table 2508.6. Fasteners shall be spaced not more than 7 inches (178 mm) on center at all supports, including perimeter blocking, and not more than 3/8 inch (9.5 mm) from the edges and ends of the gypsum board or gypsum panel product.

2508.6.5 Lateral force restrictions. Gypsum board or gypsum panel products shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction.

2508.6.6 Diaphragm ceiling connection to partitions. *[DSA-SS & DSA-SS/CC and OSHPD 1, 1R, 2, 4 & 5] Gypsum board shall not be used in diaphragm ceilings to resist lateral forces imposed by partitions. Connection of diaphragm ceiling to the vertical lateral force resisting elements shall be designed and detailed to transfer lateral forces.*

Exception: [OSHPD 2] Single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

**SECTION 2509
SHOWERS AND WATER CLOSETS**

2509.1 Wet areas. Showers and public toilet walls shall conform to Section 1210.2.

2509.2 Base for tile. Materials used as a base for wall tile in tub and shower areas and wall and ceiling panels in shower areas shall be of materials listed in Table 2509.2 and installed in accordance with the manufacturer’s recommendations. Water-resistant gypsum backing board shall be used as a base for tile in water closet compartment walls when installed in accordance with GA 216 or ASTM C840 and the manufacturer’s recommendations. Regular gypsum wallboard is permitted under tile

or wall panels in other wall and ceiling areas when installed in accordance with GA 216 or ASTM C840.

**TABLE 2509.2
BACKERBOARD MATERIALS**

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Nonasbestos fiber-cement backer board	ASTM C1288 or ISO 8336, Category C
Nonasbestos fiber-mat reinforced cementitious backer unit	ASTM C1325

2509.3 Limitations. Water-resistant gypsum backing board shall not be used in the following locations:

- 1. Over a vapor retarder in shower or bathtub compartments.
- 2. Where there will be direct exposure to water or in areas subject to continuous high humidity.

**SECTION 2510
LATHING AND FURRING FOR CEMENT PLASTER (STUCCO)**

2510.1 General. Exterior and interior cement plaster and lathing shall be done with the appropriate materials listed in Table 2507.2 and Chapter 35.

2510.2 Weather protection. Materials shall be stored in such a manner as to protect them from the weather.

2510.3 Installation. Installation of these materials shall be in compliance with ASTM C926 and ASTM C1063.

2510.4 Corrosion resistance. Metal lath and lath attachments shall be of corrosion-resistant material.

2510.5 Backing. Backing or a lath shall provide sufficient rigidity to permit plaster applications.

2510.5.1 Support of lath. Where lath on vertical surfaces extends between rafters or other similar projecting members, solid backing shall be installed to provide support for lath and attachments.

2510.5.2 Use of gypsum backing board. Gypsum backing for cement plaster shall be in accordance with Section 2510.5.2.1 or 2510.5.2.2.

2510.5.2.1 Gypsum board as a backing board. Gypsum lath or gypsum wallboard shall not be used as a backing for cement plaster.

Exception: Gypsum lath or gypsum wallboard is permitted, with a water-resistive barrier, as a backing for self-furred metal lath or self-furred wire fabric lath and cement plaster where either of the following conditions occur:

1. On horizontal supports of ceilings or roof soffits.
2. On interior walls.

2510.5.2.2 Gypsum sheathing backing. Gypsum sheathing is permitted as a backing for metal or wire fabric lath and cement plaster on walls. A water-resistive barrier shall be provided in accordance with Section 2510.6.

2510.5.3 Backing not required. Wire backing is not required under expanded metal lath or paperbacked wire fabric lath.

2510.6 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section 1403.2 and, where applied over wood-based sheathing, shall comply with Section 2510.6.1 or 2510.6.2.

2510.6.1 Dry climates. One of the following shall apply for dry (B) climate zones:

1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane and any flashing, installed in accordance with Section 1404.4 and intended to drain to the water-resistive barrier, is directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other nonwater absorbing layer, or a drainage space.

2510.6.2 Moist or marine climates. In moist (A) or marine (C) climate zones, water-resistive barrier shall comply with one of the following:

1. In addition to complying with Item 1 or 2 of Section 2510.6.1, a space or drainage material not less than $\frac{3}{16}$ inch (4.8 mm) in depth shall be applied to the exterior side of the water-resistive barrier.
2. In addition to complying with Item 2 of Section 2510.6.1, drainage on the exterior side of the water-resistive barrier shall have a minimum drainage efficiency of 90 percent as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

2510.6.3 California Energy Code and International Energy Conservation Code Climate Zones. The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Chapter 12, Table 1202.3.1.

2510.7 Preparation of masonry and concrete. Surfaces shall be clean, free from efflorescence, sufficiently damp and rough for proper bond. If the surface is insufficiently rough, approved bonding agents or a Portland cement dash bond coat mixed in proportions of not more than two parts volume of sand to one part volume of Portland cement or plastic cement shall be applied. The dash bond coat shall be left undisturbed and shall be moist cured not less than 24 hours.

**SECTION 2511
INTERIOR PLASTER**

2511.1 General. Plastering gypsum plaster or cement plaster shall be not less than three coats where applied over metal lath or wire fabric lath and not less than two coats where applied over other bases permitted by this chapter.

Exception: Gypsum veneer plaster and cement plaster specifically designed and approved for one-coat applications.

2511.1.1 Installation. Installation of lathing and plaster materials shall conform to Table 2511.1.1 and Section 2507.

**TABLE 2511.1.1
INSTALLATION OF PLASTER CONSTRUCTION**

MATERIAL	STANDARD
Cement plaster	ASTM C926
Gypsum plaster	ASTM C842
Gypsum veneer plaster	ASTM C843
Interior lathing and furring (gypsum plaster)	ASTM C841
Lathing and furring (cement plaster)	ASTM C1063
Steel framing	ASTM C754; C1007

2511.2 Limitations. Plaster shall not be applied directly to fiber insulation board. Cement plaster shall not be applied directly to gypsum lath or gypsum plaster except as specified in Sections 2510.5.1 and 2510.5.2.

2511.3 Grounds. Where installed, grounds shall ensure the minimum thickness of plaster as set forth in ASTM C842 and ASTM C926. Plaster thickness shall be measured from the face of lath and other bases.

2511.4 Interior masonry or concrete. Condition of surfaces shall be as specified in Section 2510.7. Approved specially prepared gypsum plaster designed for application to concrete surfaces or approved acoustical plaster is permitted. The total thickness of base coat plaster applied to concrete ceilings shall be as set forth in ASTM C842 or ASTM C926. Should

ceiling surfaces require more than the maximum thickness permitted in ASTM C842 or ASTM C926, metal lath or wire fabric lath shall be installed on such surfaces before plastering.

2511.5 Wet areas. Showers and public toilet walls shall conform to Sections 1210.2 and 1210.3. Where wood frame walls and partitions are covered on the interior with cement plaster or tile of similar material and are subject to water splash, the framing shall be protected with an approved moisture barrier.

**SECTION 2512
EXTERIOR PLASTER**

2512.1 General. Plastering with cement plaster shall be not less than three coats where applied over metal lath or wire fabric lath or gypsum board backing as specified in Section 2510.5 and shall be not less than two coats where applied over masonry or concrete. If the plaster surface is to be completely covered by veneer or other facing material, or is completely concealed by another wall, plaster application need only be two coats, provided that the total thickness is as set forth in ASTM C926.

2512.1.1 On-grade floor slab. On wood frame or steel stud construction with an on-grade concrete floor slab system, exterior plaster shall be applied in such a manner as to cover, but not to extend below, the lath and paper. The application of lath, paper and flashing or drip screeds shall comply with ASTM C1063.

2512.1.2 Weep screeds. A minimum 0.019-inch (0.48 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed with a minimum vertical attachment flange of 3½ inches (89 mm) shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C926. The weep screed shall be placed not less than 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and be of a type that will allow trapped water to drain to the exterior of the building. The water-resistive barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

2512.2 Plasticity agents. Only approved plasticity agents and approved amounts thereof shall be added to Portland cement or blended cements. Where plastic cement or masonry cement is used, additional lime or plasticizers shall not be added. Hydrated lime or the equivalent amount of lime putty used as a plasticizer is permitted to be added to cement plaster or cement and lime plaster in an amount not to exceed that set forth in ASTM C926.

2512.3 Limitations. Gypsum plaster shall not be used on exterior surfaces.

2512.4 Cement plaster. Plaster coats shall be protected from freezing for a period of not less than 24 hours after set has occurred. Plaster shall be applied when the ambient temperature is higher than 40°F (4°C), unless provisions are made to keep cement plaster work above 40°F (4°C) during application and 48 hours thereafter.

2512.5 Second-coat application. The second coat shall be brought out to proper thickness, rodded and floated sufficiently rough to provide adequate bond for the finish coat. The second coat shall not have variations greater than ¼ inch (6.4 mm) in any direction under a 5-foot (1524 mm) straight edge.

2512.6 Curing and interval. First and second coats of *cement plaster* shall be applied and moist cured as set forth in ASTM C926 and Table 2512.6.

**TABLE 2512.6
CEMENT PLASTERS**

COAT	MINIMUM PERIOD MOIST CURING	MINIMUM INTERVAL BETWEEN COATS
First	48 hours ^a	48 hours ^b
Second	48 hours	7 days ^c
Finish	—	Note c

- a. The first two coats shall be as required for the first coats of exterior plaster, except that the moist-curing time period between the first and second coats shall be not less than 24 hours. Moist curing shall not be required where job and weather conditions are favorable to the retention of moisture in the cement plaster for the required time period.
- b. Twenty-four-hour minimum interval between coats of interior cement plaster. For alternative method of application, see Section 2512.8.
- c. Finish coat plaster is permitted to be applied to interior cement plaster base coats after a 48-hour period.

2512.7 Application to solid backings. Where applied over gypsum backing as specified in Section 2510.5 or directly to unit masonry surfaces, the second coat is permitted to be applied as soon as the first coat has attained sufficient hardness.

2512.8 Alternate method of application. The second coat is permitted to be applied as soon as the first coat has attained sufficient rigidity to receive the second coat.

2512.8.1 Admixtures. Where using this method of application, calcium aluminate cement up to 15 percent of the weight of the Portland cement is permitted to be added to the mix.

2512.8.2 Curing. Curing of the first coat is permitted to be omitted and the second coat shall be cured as set forth in ASTM C926 and Table 2512.6.

2512.9 Finish coats. Cement plaster finish coats shall be applied over base coats that have been in place for the time periods set forth in ASTM C926. The third or finish coat shall be applied with sufficient material and pressure to bond and to cover the brown coat and shall be of sufficient thickness to conceal the brown coat.

**SECTION 2513
EXPOSED AGGREGATE PLASTER**

2513.1 General. Exposed natural or integrally colored aggregate is permitted to be partially embedded in a natural or colored bedding coat of cement plaster or gypsum plaster, subject to the provisions of this section.

2513.2 Aggregate. The aggregate shall be applied manually or mechanically and shall consist of marble chips, pebbles or

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similar durable, moderately hard (three or more on the Mohs hardness scale), nonreactive materials.

2513.3 Bedding coat proportions. The bedding coat for interior or exterior surfaces shall be composed of one part Portland cement and one part Type S lime; or one part blended cement and one part Type S lime; or masonry cement; or plastic cement and not more than three parts of graded white or natural sand by volume. The bedding coat for interior surfaces shall be composed of 100 pounds (45.4 kg) of neat gypsum plaster and not more than 200 pounds (90.8 kg) of graded white sand. A factory-prepared bedding coat for interior or exterior use is permitted. The bedding coat for exterior surfaces shall have a minimum compressive strength of 1,000 pounds per square inch (6895 kPa).

2513.4 Application. The bedding coat is permitted to be applied directly over the first (scratch) coat of plaster, provided that the ultimate overall thickness is not less than $\frac{7}{8}$ inch (22 mm), including lath. Over concrete or masonry surfaces, the overall thickness shall be not less than $\frac{1}{2}$ inch (12.7 mm).

2513.5 Bases. Exposed aggregate plaster is permitted to be applied over concrete, masonry, cement plaster base coats or gypsum plaster base coats installed in accordance with Section 2511 or 2512.

2513.6 Preparation of masonry and concrete. Masonry and concrete surfaces shall be prepared in accordance with the provisions of Section 2510.7.

2513.7 Curing of base coats. Cement plaster base coats shall be cured in accordance with ASTM C926. Cement plaster bedding coats shall retain sufficient moisture for hydration (hardening) for 24 hours minimum or, where necessary, shall be kept damp for 24 hours by light water spraying.

SECTION 2514 REINFORCED GYPSUM CONCRETE

2514.1 General. Reinforced gypsum concrete shall comply with the requirements of ASTM C317 and ASTM C956.

Exception: [DSA-SS and OSHPD 1, 1R, 2, 4 & 5] Reinforced gypsum concrete shall be considered as an alternative system, except for [OSHPD 2] single-story Type V skilled nursing or intermediate care facilities utilizing wood-frame or light-steel-frame construction.

2514.2 Minimum thickness. The minimum thickness of reinforced gypsum concrete shall be 2 inches (51 mm) except the minimum required thickness shall be reduced to $1\frac{1}{2}$ inches (38 mm), provided that the following conditions are satisfied:

1. The overall thickness, including the formboard, is not less than 2 inches (51 mm).
2. The clear span of the gypsum concrete between supports does not exceed 33 inches (838 mm).
3. Diaphragm action is not required.
4. The design live load does not exceed 40 pounds per square foot (psf) (1915 Pa).

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 26 – PLASTIC

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X		X	X	X								X									
Adopt entire chapter as amendeded (amended sections listed below)								X	X	X	X	X		X	X							
Adopt only those sections that are listed below																						
Chapter / Section																						
2601.1.1								X	X	X	X	X		X	X							
2601.1.2								X	X	X	X	X		X	X							
2603.11.1								X	X	X	X	X		X	X							
2603.12.3								X	X	X	X	X		X	X							
2603.13.3								X	X	X	X	X		X	X							

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The state agency does not adopt sections identified with the following symbol: †
The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 26

PLASTIC

User note:

About this chapter: The use of plastics in building construction and components is addressed in Chapter 26. This chapter provides standards addressing foam plastic insulation, foam plastics used as interior finish and trim, and other plastic veneers used on the inside or outside of a building. This chapter addresses the use of light-transmitting plastics in various configurations such as walls, roof panels, skylights, signs and glazing. Requirements for the use of fiber-reinforced polymers, fiberglass-reinforced polymers and reflective plastic core insulation are also contained in this chapter. Additionally, requirements specific to the use of wood-plastic composites and plastic lumber are contained in this chapter.

SECTION 2601 GENERAL

2601.1 Scope. These provisions shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim, light-transmitting plastics and plastic composites, including plastic lumber.

2601.1.1 Application. [DSA-SS, DSA-SS/CC & OSHPD] The scope of application of Chapter 26 is as follows:

1. Applications listed in Sections 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). These applications include hospitals, hospital buildings removed from general acute care service, skilled nursing facility buildings, intermediate care facility buildings, correctional treatment centers and acute psychiatric hospital buildings.
2. Structures regulated by the Division of the State Architect—Structural Safety, which include those applications listed in Section 1.9.2.1 (DSA-SS) and 1.9.2.2 (DSA-SS/CC). These applications include public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings

2601.1.2 Amendments in this chapter. [DSA-SS, DSA-SS/CC & OSHPD] DSA-SS, DSA-SS/CC and OSHPD adopt this chapter and all amendments.

Exception: Amendments adopted by only one agency appear in this chapter preceded with the appropriate acronym of the adopting agency, as follows:

1. OSHPD amendments appear in this chapter preceded with the appropriate acronym, as follows:

[OSHPD 1] - For applications listed in Section 1.10.1.

[OSHPD 1R] - For applications listed in Section 1.10.1.

[OSHPD 2] - For applications listed in Section 1.10.2.

[OSHPD 4] - For applications listed in Section 1.10.4.

[OSHPD 5] - For applications listed in Section 1.10.5.

2. Division of the State Architect - Structural Safety:

[DSA-SS] - For applications listed in Section 1.9.2.1.

[DSA-SS/CC] - For applications listed in Section 1.9.2.2.

SECTION 2602 FINISH AND TRIM

2602.1 Exterior wall covering and architectural trim. See Chapter 14 for requirements for exterior wall covering and architectural trim.

2602.2 Interior finish and trim. See Section 2604 for requirements for interior finish and trim.

SECTION 2603 FOAM PLASTIC INSULATION

2603.1 General. The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.

2603.1.1 Spray-applied foam plastic. Single- and multi-component spray-applied foam plastic insulation shall comply with the provisions of Section 2603 and ICC 1100-2018.

2603.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2603.2.1 Labeling of polystyrene foam insulation without flame retardants. In addition to the requirements of Section 2603.2, polystyrene foam insulation boards manufac-

ured with no flame retardants added shall be labeled in accordance with this section.

1. Each board shall be labeled on each face every 8 square feet in red 1/2-inch text with the following information:

WARNING - FIRE HAZARD

This product is required to be installed below a minimum 3.5-inch-thick concrete slab on grade.

NOT FOR VERTICAL OR ABOVE-GRADE APPLICATIONS

This product contains NO flame retardants.

Not tested for flame spread or smoke development requirements of the model building codes

2. Each package shall be labeled on at least two sides in red 1/2-inch text with the following information:

WARNING – COMBUSTIBLE MATERIAL

Keep away from ignition sources.

Maintain code required separation between product storage and structures under construction (minimum 30 feet).

2603.3 Surface-burning characteristics. Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread and smoke-developed indices.

Exceptions:

1. Smoke-developed index for interior trim as provided for in Section 2604.2.
2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plastic insulation where tested in a thickness of 4 inches (102 mm) shall be permitted in a thickness up to 10 inches (254 mm) where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.
3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided that the assembly with the foam plastic insulation satisfactorily passes NFPA 276 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided that the end use is approved in accordance with Section 2603.9 using the maximum thickness and density intended for use.

5. Flame spread and smoke-developed indices for foam plastic interior signs in covered and open mall buildings provided that the signs comply with Section 402.6.4.

6. Polystyrene foam insulation boards with a maximum thickness of 2 inches when installed below a minimum 3.5-inch-thick concrete slab on grade.

2603.4 Thermal barrier. Except as provided for in Sections 2603.4.1 and 2603.9, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 1/2-inch (12.7 mm) gypsum wallboard, heavy timber in accordance with Section 602.4 or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275. Combustible concealed spaces shall comply with Section 718.

2603.4.1 Thermal barrier not required. The thermal barrier specified in Section 2603.4 is not required under the conditions set forth in Sections 2603.4.1.1 through 2603.4.1.14.

2603.4.1.1 Masonry or concrete construction. A thermal barrier is not required for foam plastic installed in a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by not less than 1-inch (25 mm) thickness of masonry or concrete.

2603.4.1.2 Cooler and freezer walls. Foam plastic installed in a maximum thickness of 10 inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4-inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.
3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system in accordance with Section 903.3.1.1. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

2603.4.1.3 Walk-in coolers. In nonsprinklered buildings, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m²) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

2603.4.1.4 Exterior walls, one-story buildings. For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than 4 inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2603.4.1.5 Roofing. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly that is installed in accordance with the code and the manufacturer's instructions and is either constructed as described in Item 1 or tested as described in Item 2.

1. The roof assembly is separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints, other approved type of edge support or an equivalent material.
2. The assembly with the foam plastic insulation satisfactorily passes NFPA 276 or UL 1256.

2603.4.1.6 Attics and crawl spaces. Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by 1½-inch-thick (38 mm) mineral fiber insulation; ¼-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; ⅜-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm); 1½-inch-thick (38 mm) self-supported spray-applied cellulose insulation in attic spaces only or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

2603.4.1.7 Doors not required to have a fire protection rating. Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of aluminum not less than 0.032 inch (0.8 mm) in thickness or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2603.4.1.8 Exterior doors in buildings of Group R-2 or R-3. In occupancies classified as Group R-2 or R-3, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with aluminum, steel, fiberglass, wood or other approved materials.

2603.4.1.9 Garage doors. Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall

be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described in this section shall be tested in accordance with, and meet the acceptance criteria of, DASMA 107.

Exception: Garage doors using foam plastic insulation complying with Section 2603.3 in detached and attached garages associated with one- and two-family dwellings need not be provided with a thermal barrier.

2603.4.1.10 Siding backer board. Foam plastic insulation of not more than 2,000 British thermal units per square foot (Btu/sq. ft.) (22.7 MJ/m²) as determined by NFPA 259 shall be permitted as a siding backer board with a maximum thickness of ½ inch (12.7 mm), provided that it is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation or equivalent or where applied as insulation with re-siding over existing wall construction.

2603.4.1.11 Interior trim. Foam plastic used as interior trim in accordance with Section 2604 shall be permitted without a thermal barrier.

2603.4.1.12 Interior signs. Foam plastic used for interior signs in covered mall buildings in accordance with Section 402.6.4 shall be permitted without a thermal barrier. Foam plastic signs that are not affixed to interior building surfaces shall comply with Chapter 8 of the *California Fire Code*.

2603.4.1.13 Type V construction. Foam plastic spray applied to a sill plate, joist header and rim joist in Type V construction is subject to all of the following:

1. The maximum thickness of the foam plastic shall be ¾ inches (82.6 mm).
2. The density of the foam plastic shall be in the range of 1.5 to 2.0 pcf (24 to 32 kg/m³).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.

2603.4.1.14 Floors. The thermal barrier specified in Section 2603.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation where the foam plastic is covered by a minimum nominal ½-inch-thick (12.7 mm) wood structural panel or approved equivalent. The thermal barrier specified in Section 2603.4 is required on the underside of the structural floor system that contains foam plastic insulation where the underside of the structural floor system is exposed to the interior of the building.

Exception: Foam plastic used as part of an interior floor finish.

2603.5 Exterior walls of buildings of any height. Exterior walls of buildings of Type I, II, III or IV construction of any height shall comply with Sections 2603.5.1 through 2603.5.7. Exterior walls of cold storage buildings required to be constructed of noncombustible materials, where the building is more than one story in height, shall comply with the provisions of Sections 2603.5.1 through 2603.5.7. Exterior walls of buildings of Type V construction shall comply with Sections 2603.2, 2603.3 and 2603.4. Fireblocking shall be in accordance with Section 718.2.

2603.5.1 Fire-resistance-rated walls. Where the wall is required to have a fire-resistance rating, data based on tests conducted in accordance with ASTM E119 or UL 263 shall be provided to substantiate that the fire-resistance rating is maintained.

2603.5.2 Thermal barrier. Any foam plastic insulation shall be separated from the building interior by a thermal barrier meeting the provisions of Section 2603.4, unless special approval is obtained on the basis of Section 2603.9.

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.3 Potential heat. The potential heat of foam plastic insulation in any portion of the wall or panel shall not exceed the potential heat expressed in Btu per square feet (mJ/m^2) of the foam plastic insulation contained in the wall assembly tested in accordance with Section 2603.5.5. The potential heat of the foam plastic insulation shall be determined by tests conducted in accordance with NFPA 259 and the results shall be expressed in Btu per square feet (mJ/m^2).

Exception: One-story buildings complying with Section 2603.4.1.4.

2603.5.4 Flame spread and smoke-developed indices. Foam plastic insulation, exterior coatings and facings shall be tested separately in the thickness intended for use, but not to exceed 4 inches (102 mm), and shall each have a flame spread index of 25 or less and a smoke-developed index of 450 or less as determined in accordance with ASTM E84 or UL 723.

Exception: Prefabricated or factory-manufactured panels having minimum 0.020-inch (0.51 mm) aluminum facings and a total thickness of $1/4$ inch (6.4 mm) or less are permitted to be tested as an assembly where the foam plastic core is not exposed in the course of construction.

2603.5.5 Vertical and lateral fire propagation. The exterior wall assembly shall be tested in accordance with and comply with the acceptance criteria of NFPA 285.

Exceptions:

1. One-story buildings complying with Section 2603.4.1.4.
2. Wall assemblies where the foam plastic insulation is covered on each face by not less than 1-inch (25 mm) thickness of masonry or concrete and meeting one of the following:
 - 2.1. There is no airspace between the insulation and the concrete or masonry.

- 2.2. The insulation has a flame spread index of not more than 25 as determined in accordance with ASTM E84 or UL 723 and the maximum airspace between the insulation and the concrete or masonry is not more than 1 inch (25 mm).

2603.5.6 Label required. The edge or face of each piece, package or container of foam plastic insulation shall bear the label of an approved agency. The label shall contain the manufacturer's or distributor's identification, model number, serial number or definitive information describing the product or materials' performance characteristics and approved agency's identification.

2603.5.7 Ignition. Exterior walls shall not exhibit sustained flaming where tested in accordance with NFPA 268. Where a material is intended to be installed in more than one thickness, tests of the minimum and maximum thickness intended for use shall be performed.

Exception: Assemblies protected on the outside with one of the following:

1. A thermal barrier complying with Section 2603.4.
2. A minimum 1-inch (25 mm) thickness of concrete or masonry.
3. Glass-fiber-reinforced concrete panels of a minimum thickness of $3/8$ inch (9.5 mm).
4. Metal-faced panels having minimum 0.019-inch-thick (0.48 mm) aluminum or 0.016-inch-thick (0.41 mm) corrosion-resistant steel outer facings.
5. A minimum $7/8$ -inch (22.2 mm) thickness of stucco complying with Section 2510.
6. A minimum $1/4$ -inch (6.4 mm) thickness of fiber-cement lap, panel or shingle siding complying with Section 1404.16 and Section 1404.16.1 or 1404.16.2.

2603.6 Roofing. Foam plastic insulation meeting the requirements of Sections 2603.2, 2603.3 and 2603.4 shall be permitted as part of a roof-covering assembly, provided that the assembly with the foam plastic insulation is a Class A, B or C roofing assembly where tested in accordance with ASTM E108 or UL 790.

2603.7 Foam plastic in plenums as interior finish or interior trim. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 25 or less and a smoke-developed index of 50 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, and shall be tested in accordance with NFPA 286 and meet the acceptance criteria of Section 803.1.1. As an alternative to testing to NFPA 286, the foam plastic shall be approved based on tests conducted in accordance with Section 2603.9.

Exceptions:

1. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with

ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by a thermal barrier complying with Section 2603.4.

2. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by corrosion-resistant steel having a base metal thickness of not less than 0.0160 inch (0.4 mm).
3. Foam plastic in plenums used as interior wall or ceiling finish, or interior trim, shall exhibit a flame spread index of 75 or less and a smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723 at the maximum thickness and density intended for use, where it is separated from the airflow in the plenum by not less than a 1-inch (25 mm) thickness of masonry or concrete.

2603.8 Protection against termites. In areas where the probability of termite infestation is very heavy in accordance with Figure 2603.8, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152 mm).

Exceptions:

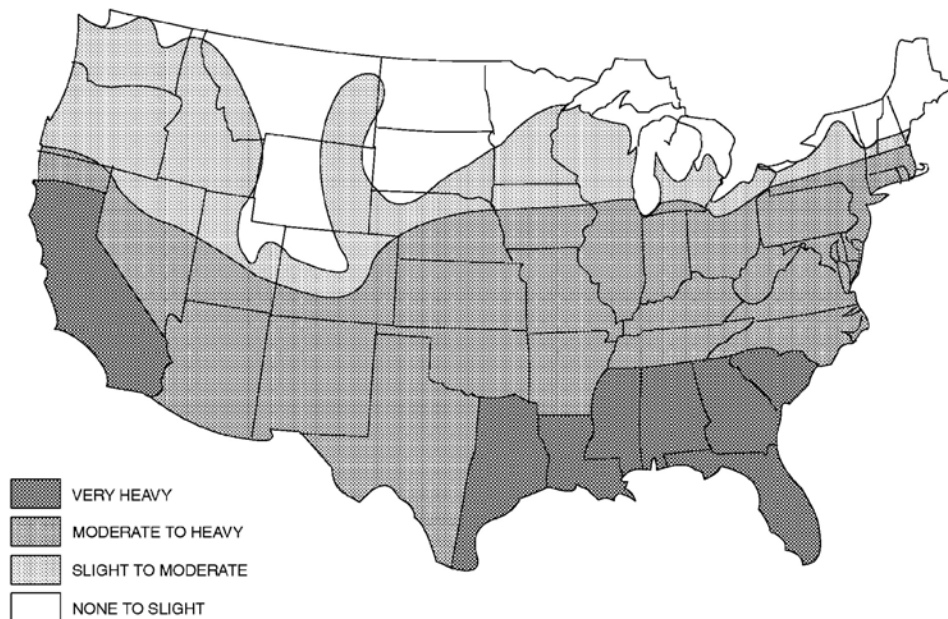
1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or preservative-treated wood.

2. An approved method of protecting the foam plastic and structure from subterranean termite damage is provided.
3. On the interior side of basement walls.

2603.9 Special approval. Foam plastic shall not be required to comply with the requirements of Section 2603.4 or those of Section 2603.6 where specifically approved based on large-scale tests such as, but not limited to, NFPA 286 (with the acceptance criteria of Section 803.1.1.1), FM 4880, UL 1040 or UL 1715. Such testing shall be related to the actual end-use configuration and be performed on the finished manufactured foam plastic assembly in the maximum thickness intended for use. Foam plastics that are used as interior finish on the basis of special tests shall conform to the flame spread and smoke-developed requirements of Chapter 8. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

[BS] 2603.10 Wind resistance. Foam plastic insulation complying with ASTM C578 and ASTM C1289 and used as exterior wall sheathing on framed wall assemblies shall comply with ANSI/FS 100 for wind pressure resistance.

[BS] 2603.11 Cladding attachment over foam sheathing to masonry or concrete wall construction. Cladding shall be specified and installed in accordance with Chapter 14 and the cladding manufacturer’s installation instructions or an approved design. Foam sheathing shall be attached to masonry or concrete construction in accordance with the insulation manufacturer’s installation instructions or an approved design. Furring and furring attachments through foam sheathing shall be designed to resist design loads determined in accordance with Chapter 16, including support of cladding weight as applicable. Fasteners used to attach clad-



**FIGURE 2603.8
TERMITE INFESTATION PROBABILITY MAP**

PLASTIC

ding or furring through foam sheathing to masonry or concrete substrates shall be approved for application into masonry or concrete material and shall be installed in accordance with the fastener manufacturer’s installation instructions.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing and connection to a masonry or concrete substrate, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section 1407.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section 1404.

2603.11.1 Additional requirements. [OSHPD 1, 1R, 2, 4 & 5, DSA-SS, DSA-SS/CC] In addition to the requirements of Section 2603.11, cladding and foam sheathing supports and attachments shall be designed and submitted to the enforcement agency for approval.

[BS] 2603.12 Cladding attachment over foam sheathing to cold-formed steel framing. Cladding shall be specified and installed in accordance with Chapter 14 and the cladding manufacturer’s approved installation instructions, including any limitations for use over foam plastic sheathing, or an approved design. Where used, furring and furring attachments shall be designed to resist design loads determined in accordance with Chapter 16. In addition, the cladding or furring attachments through foam sheathing to cold-formed steel framing shall meet or exceed the minimum fastening requirements of Sections 2603.12.1 and

2603.12.2, or an approved design for support of cladding weight.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section 1407.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section 1404.

[BS] 2603.12.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table 2603.12.1.

[BS] 2603.12.2 Furred cladding attachment. Where steel or wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table 2603.12.2. Where placed horizontally, wood furring shall be preservative-treated wood in accordance with Section 2303.1.9 or naturally durable wood and fasteners shall be corrosion resistant in accordance Section 2304.10.6. Steel furring shall have a minimum G60 galvanized coating.

2603.12.3 Additional requirements. [OSHPD 1, 1R, 2, 4 & 5, DSA-SS, DSA-SS/CC] In addition to the requirements of Section 2603.12, 2603.12.1 and 2603.12.2, cladding and foam sheathing supports and attachments shall be designed and submitted to the enforcement agency for approval.

**[BS]TABLE 2603.12.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT
ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^a**

CLADDING FASTENER THROUGH FOAM SHEATHING INTO:	CLADDING FASTENER TYPE AND MINIMUM SIZE ^b	CLADDING FASTENER VERTICAL SPACING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^c (inches)							
			16" o.c. fastener horizontal spacing				24" o.c. fastener horizontal spacing			
			Cladding weight				Cladding weight			
			3 psf	11 psf	18 psf	25 psf	3 psf	11 psf	18 psf	25 psf
Cold-formed steel framing (minimum penetration of steel thickness plus 3 threads)	#8 screw into 33 mil steel or thicker	6	3.00	2.95	2.20	1.45	3.00	2.35	1.25	DR
		8	3.00	2.55	1.60	0.60	3.00	1.80	DR	DR
		12	3.00	1.80	DR	DR	3.00	0.65	DR	DR
	#10 screw into 33 mil steel	6	4.00	3.50	2.70	1.95	4.00	2.90	1.70	0.55
		8	4.00	3.10	2.05	1.00	4.00	2.25	0.70	DR
		12	4.00	2.25	0.70	DR	3.70	1.05	DR	DR
	#10 screw into 43 mil steel or thicker	6	4.00	4.00	4.00	3.60	4.00	4.00	3.45	2.70
		8	4.00	4.00	3.70	3.00	4.00	3.85	2.80	1.80
		12	4.00	3.85	2.80	1.80	4.00	3.05	1.50	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa, 1 pound per square inch = 0.00689 MPa.

DR = design required, o.c. = on center.

a. Cold-formed steel framing shall be minimum 33 ksi steel for 33 mil and 43 mil steel and 50 ksi steel for 54 mil steel or thicker.

b. Screws shall comply with the requirements of AISI S240.

c. Foam sheathing shall have a minimum compressive strength of 15 pounds per square inch in accordance with ASTM C578 or ASTM C1289.

**[BS]TABLE 2603.12.2
FURRING MINIMUM FASTENING REQUIREMENTS FOR
APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^a**

FURRING MATERIAL	FRAMING MEMBER	FASTENER TYPE AND MINIMUM SIZE ^b	MINIMUM PENETRATION INTO WALL FRAMING (inches)	FASTENER SPACING IN FURRING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^d (inches)							
					16" o.c. furring ^e				24" o.c. furring ^e			
					Cladding weight				Cladding weight			
					3 psf	11 psf	18 psf	25 psf	3 psf	11 psf	18 psf	25 psf
Minimum 33 mil steel furring or minimum 1x wood furring ^c	33 mil cold-formed steel stud	#8 screw	Steel thickness plus 3 threads	12	3.00	1.80	DR	DR	3.00	0.65	DR	DR
				16	3.00	1.00	DR	DR	2.85	DR	DR	DR
				24	2.85	DR	DR	DR	2.20	DR	DR	DR
		#10 screw	Steel thickness plus 3 threads	12	4.00	2.25	0.70	DR	3.70	1.05	DR	DR
				16	3.85	1.45	DR	DR	3.40	DR	DR	DR
				24	3.40	DR	DR	DR	2.70	DR	DR	DR
	43 mil or thicker cold-formed steel stud	#8 Screw	Steel thickness plus 3 threads	12	3.00	1.80	DR	DR	3.00	0.65	DR	DR
				16	3.00	1.00	DR	DR	2.85	DR	DR	DR
				24	2.85	DR	DR	DR	2.20	DR	DR	DR
		#10 screw	Steel thickness plus 3 threads	12	4.00	3.85	2.80	1.80	4.00	3.05	1.50	DR
				16	4.00	3.30	1.95	0.60	4.00	2.25	DR	DR
				24	4.00	2.25	DR	DR	4.00	0.65	DR	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa, 1 pound per square inch = 0.00689 MPa.
DR = Design Required, o.c. = on center.

- a. Wood furring shall be spruce-pine-fir or any softwood species with a specific gravity of 0.42 or greater. Steel furring shall be minimum 33 ksi steel. Coldformed steel studs shall be minimum 33 ksi steel for 33 mil and 43 mil thickness and 50 ksi steel for 54 mil steel or thicker.
- b. Screws shall comply with the requirements of AISI S240.
- c. Where the required cladding fastener penetration into wood material exceeds 3/4 inch and is not more than 1 1/2 inches, a minimum 2-inch nominal wood furring or an approved design shall be used.
- d. Foam sheathing shall have a minimum compressive strength of 15 pounds per square inch in accordance with ASTM C578 or ASTM C1289.
- e. Furring shall be spaced not more than 24 inches on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch and 12-inch fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches and 24 inches on center, respectively.

[BS] 2603.13 Cladding attachment over foam sheathing to wood framing. Cladding shall be specified and installed in accordance with Chapter 14 and the cladding manufacturer’s installation instructions. Where used, furring and furring attachments shall be designed to resist design loads determined in accordance with Chapter 16. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section 2603.13.1 or 2603.13.2, or an approved design for support of cladding weight.

Exceptions:

- 1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
- 2. For exterior insulation and finish systems, refer to Section 1407.
- 3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section 1404.

[BS] 2603.13.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, minimum fastening requirements to support the cladding weight shall be as specified in Table 2603.13.1.

[BS] 2603.13.2 Furred cladding attachment. Where wood furring is used to attach cladding over foam

sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table 2603.13.2. Where placed horizontally, wood furring shall be preservative-treated wood in accordance with Section 2303.1.9 or naturally durable wood and fasteners shall be corrosion resistant in accordance with Section 2304.10.6.

2603.13.3 Additional requirements. *[DSA-SS, DSA-SS/CC, OSHPD 1, 1R, 2, 4 & 5] In addition to the requirements of Section 2603.13, 2603.13.1 and 2603.13.2, cladding and foam sheathing supports and attachments shall be designed and submitted to the enforcement agency for approval.*

**SECTION 2604
INTERIOR FINISH AND TRIM**

2604.1 General. Plastic materials installed as interior finish or trim shall comply with Chapter 8. Foam plastics shall only be installed as interior finish where approved in accordance with the special provisions of Section 2603.9. Foam plastics that are used as interior finish shall meet the flame spread and smoke-developed index requirements for interior finish in accordance with Chapter 8. Foam plastics installed as interior trim shall comply with Section 2604.2.

**[BS]TABLE 2603.13.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR DIRECT
ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^a**

CLADDING FASTENER THROUGH FOAM SHEATHING INTO:	CLADDING FASTENER TYPE AND MINIMUM SIZE ^b	CLADDING FASTENER VERTICAL SPACING (INCHES)	MAXIMUM THICKNESS OF FOAM SHEATHING ^c (INCHES)							
			16" o.c. fastener horizontal spacing				24" o.c. fastener horizontal spacing			
			Cladding weight:				Cladding weight:			
			3 psf	11 psf	18 psf	25 psf	3 psf	11 psf	18 psf	25 psf
Wood Framing (minimum 1 1/4-inch penetration)	0.113" diameter nail	6	2.00	1.45	0.75	DR	2.00	0.85	DR	DR
		8	2.00	1.00	DR	DR	2.00	0.55	DR	DR
		12	2.00	0.55	DR	DR	1.85	DR	DR	DR
	0.120" diameter nail	6	3.00	1.70	0.90	0.55	3.00	1.05	0.50	DR
		8	3.00	1.20	0.60	DR	3.00	0.70	DR	DR
		12	3.00	0.70	DR	DR	2.15	DR	DR	DR
	0.131" diameter nail	6	4.00	2.15	1.20	0.75	4.00	1.35	0.70	DR
		8	4.00	1.55	0.80	DR	4.00	0.90	DR	DR
		12	4.00	0.90	DR	DR	2.70	0.50	DR	DR
	0.162" diameter nail	6	4.00	3.55	2.05	1.40	4.00	2.25	1.25	0.80
		8	4.00	2.55	1.45	0.95	4.00	1.60	0.85	0.50
		12	4.00	1.60	0.85	0.50	4.00	0.95	DR	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa.

DR = Design Required, o.c. = on center.

- a. Wood framing shall be spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with ANSI/AWC NDS.
- b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
- c. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.

**[BS]TABLE 2603.13.2
FURRING MINIMUM FASTENING REQUIREMENTS FOR
APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^{a, b}**

FURRING MATERIAL	FRAMING MEMBER	FASTENER TYPE AND MINIMUM SIZE	MINIMUM PENETRATION INTO WALL FRAMING (INCHES)	FASTENER SPACING IN FURRING (INCHES)	MAXIMUM THICKNESS OF FOAM SHEATHING ^d (INCHES)							
					16" o.c. furring ^e				24" o.c. furring ^e			
					Siding weight:				Siding weight:			
					3 psf	11 psf	18 psf	25 psf	3 psf	11 psf	18 psf	25 psf
Minimum 1x Wood Furring ^c	Minimum 2x Wood Stud	0.131" diameter nail	1 1/4	8	4.00	2.45	1.45	0.95	4.00	1.60	0.85	DR
				12	4.00	1.60	0.85	DR	4.00	0.95	DR	DR
				16	4.00	1.10	DR	DR	3.05	0.60	DR	DR
		0.162" diameter nail	1 1/4	8	4.00	4.00	2.45	1.60	4.00	2.75	1.45	0.85
				12	4.00	2.75	1.45	0.85	4.00	1.65	0.75	DR
				16	4.00	1.90	0.95	DR	4.00	1.05	DR	DR
		No. 10 wood screw	1	12	4.00	2.30	1.20	0.70	4.00	1.40	0.60	DR
				16	4.00	1.65	0.75	DR	4.00	0.90	DR	DR
				24	4.00	0.90	DR	DR	2.85	DR	DR	DR
		1/4" lag screw	1 1/2	12	4.00	2.65	1.50	0.90	4.00	1.65	0.80	DR
				16	4.00	1.95	0.95	0.50	4.00	1.10	DR	DR
				24	4.00	1.10	DR	DR	3.25	0.50	DR	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot (psf) = 0.0479 kPa, 1 pound per square inch = 0.00689 MPa.

DR = Design Required, o.c. = on center.

- a. Wood framing and furring shall be spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with ANSI/AWC NDS.
- b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
- c. Where the required cladding fastener penetration into wood material exceeds 3/4 inch and is not more than 1 1/2 inches, a minimum 2-inch nominal wood furring or an approved design shall be used.
- d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.
- e. Furring shall be spaced not greater than 24 inches on center in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch and 12-inch fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches and 24 inches on center, respectively.

2604.1.1 Plenums. Foam plastics installed in plenums as interior wall or ceiling finish shall comply with Section 2603.7. Foam plastics installed in plenums as interior trim shall comply with Sections 2604.2 and 2603.7.

[F] 2604.2 Interior trim. Foam plastic used as interior trim shall comply with Sections 2604.2.1 through 2604.2.4.

[F] 2604.2.1 Density. The minimum density of the interior trim shall be 20 pcf (320 kg/m³).

[F] 2604.2.2 Thickness. The maximum thickness of the interior trim shall be 1/2 inch (12.7 mm) and the maximum width shall be 8 inches (204 mm).

[F] 2604.2.3 Area limitation. The interior trim shall not constitute more than 10 percent of the specific wall or ceiling areas to which it is attached.

[F] 2604.2.4 Flame spread. The flame spread index shall not exceed 75 where tested in accordance with ASTM E84 or UL 723. The smoke-developed index shall not be limited.

Exception: Where the interior trim material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.1.1, it shall not be required to be tested for flame spread index in accordance with ASTM E84 or UL 723.

SECTION 2605 PLASTIC VENEER

2605.1 Interior use. Where used within a building, plastic veneer shall comply with the interior finish requirements of Chapter 8.

2605.2 Exterior use. Exterior plastic veneer, other than plastic siding, shall be permitted to be installed on the exterior walls of buildings of any type of construction in accordance with all of the following requirements:

1. Plastic veneer shall comply with Section 2606.4.
2. Plastic veneer shall not be attached to any exterior wall to a height greater than 50 feet (15 240 mm) above grade.
3. Sections of plastic veneer shall not exceed 300 square feet (27.9 m²) in area and shall be separated by not less than 4 feet (1219 mm) vertically.

Exception: The area and separation requirements and the smoke-density limitation are not applicable to plastic veneer applied to buildings constructed of Type VB construction, provided that the walls are not required to have a fire-resistance rating.

2605.3 Plastic siding. Plastic siding shall comply with the requirements of Sections 1403 and 1404.

SECTION 2606 LIGHT-TRANSMITTING PLASTICS

2606.1 General. The provisions of this section and Sections 2607 through 2611 shall govern the quality and methods of application of light-transmitting plastics for use as light-

transmitting materials in buildings and structures. Foam plastics shall comply with Section 2603. Light-transmitting plastic materials that meet the other code requirements for walls and roofs shall be permitted to be used in accordance with the other applicable chapters of the code.

2606.2 Approval for use. Sufficient technical data shall be submitted to substantiate the proposed use of any light-transmitting material, as approved by the building official and subject to the requirements of this section.

2606.3 Identification. Each unit or package of light-transmitting plastic shall be identified with a mark or decal satisfactory to the building official, which includes identification as to the material classification.

2606.4 Specifications. Light-transmitting plastics, including thermoplastic, thermosetting or reinforced thermosetting plastic material, shall have a self-ignition temperature of 650°F (343°C) or greater where tested in accordance with ASTM D1929; a smoke-developed index not greater than 450 where tested in the manner intended for use in accordance with ASTM E84 or UL 723, or a maximum average smoke density rating not greater than 75 where tested in the thickness intended for use in accordance with ASTM D2843 and shall conform to one of the following combustibility classifications:

Class CC1: Plastic materials that have a burning extent of 1 inch (25 mm) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

Class CC2: Plastic materials that have a burning rate of 2 1/2 inches per minute (1.06 mm/s) or less where tested at a nominal thickness of 0.060 inch (1.5 mm), or in the thickness intended for use, in accordance with ASTM D635.

[BS] 2606.5 Structural requirements. Light-transmitting plastic materials in their assembly shall be of adequate strength and durability to withstand the loads indicated in Chapter 16. Technical data shall be submitted to establish stresses, maximum unsupported spans and such other information for the various thicknesses and forms used as deemed necessary by the building official.

[BS] 2606.6 Fastening. Fastening shall be adequate to withstand the loads in Chapter 16. Proper allowance shall be made for expansion and contraction of light-transmitting plastic materials in accordance with accepted data on the coefficient of expansion of the material and other material in conjunction with which it is employed.

2606.7 Light-diffusing systems. Unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, light-diffusing systems shall not be installed in the following occupancies and locations:

1. Group A with an occupant load of 1,000 or more.
2. Theaters with a stage and proscenium opening and an occupant load of 700 or more.
3. Group I-2.
4. Group I-3.
5. Interior exit stairways and ramps and exit passageways.

2606.7.1 Support. Light-transmitting plastic diffusers shall be supported directly or indirectly from ceiling or roof construction by use of noncombustible hangers. Hangers shall be not less than No. 12 steel-wire gage (0.106 inch) galvanized wire or equivalent.

2606.7.2 Installation. Light-transmitting plastic diffusers shall comply with Chapter 8 unless the light-transmitting plastic diffusers will fall from the mountings before igniting, at an ambient temperature of not less than 200°F (111°C) below the ignition temperature of the panels. The panels shall remain in place at an ambient room temperature of 175°F (79°C) for a period of not less than 15 minutes.

2606.7.3 Size limitations. Individual panels or units shall not exceed 10 feet (3048 mm) in length nor 30 square feet (2.79 m²) in area.

2606.7.4 Automatic sprinkler system. In buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, plastic light-diffusing systems shall be protected both above and below unless the sprinkler system has been specifically approved for installation only above the light-diffusing system, or the light-diffusing system is listed and labeled in accordance with UL 723S. Areas of light-diffusing systems that are protected in accordance with this section shall not be limited.

2606.7.5 Electrical luminaires. Light-transmitting plastic panels and light-diffuser panels that are installed in approved electrical luminaires shall comply with the requirements of Chapter 8 unless the light-transmitting plastic panels conform to the requirements of Section 2606.7.2. The area of approved light-transmitting plastic materials that is used in required exits or corridors shall not exceed 30 percent of the aggregate area of the ceiling in which such panels are installed, unless the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2606.8 Partitions. Light-transmitting plastics used in or as partitions shall comply with the requirements of Chapters 6 and 8.

2606.9 Bathroom accessories. Light-transmitting plastics shall be permitted as glazing in shower stalls, shower doors, bathtub enclosures and similar accessory units. Safety glazing shall be provided in accordance with Chapter 24.

2606.10 Awnings, patio covers and similar structures. Awnings constructed of light-transmitting plastics shall be constructed in accordance with the provisions specified in Section 3105 and Chapter 32 for projections. Patio covers constructed of light-transmitting plastics shall comply with Section 2606. Light-transmitting plastics used in canopies at motor fuel-dispensing facilities shall comply with Section 2606, except as modified by Section 406.7.2.

2606.11 Greenhouses. Light-transmitting plastics shall be permitted in lieu of glass in greenhouses.

2606.12 Solar collectors. Light-transmitting plastic covers on solar collectors having noncombustible sides and bottoms

shall be permitted on buildings not over three stories above grade plane or 9,000 square feet (836.1 m²) in total floor area, provided that the light-transmitting plastic cover does not exceed 33.33 percent of the roof area for CC1 materials or 25 percent of the roof area for CC2 materials.

Exception: Light-transmitting plastic covers having a thickness of 0.010 inch (0.3 mm) or less shall be permitted to be of any plastic material provided that the area of the solar collectors does not exceed 33.33 percent of the roof area.

SECTION 2607

LIGHT-TRANSMITTING PLASTIC WALL PANELS

2607.1 General. Light-transmitting plastics shall not be used as wall panels in exterior walls in occupancies in Groups A-1, A-2, H, I-2 and I-3. In other groups, light-transmitting plastics shall be permitted to be used as wall panels in exterior walls, provided that the walls are not required to have a fire-resistance rating and the installation conforms to the requirements of this section. Such panels shall be erected and anchored on a foundation, waterproofed or otherwise protected from moisture absorption and sealed with a coat of mastic or other approved waterproof coating. Light-transmitting plastic wall panels shall comply with Section 2606.

2607.2 Installation. Exterior wall panels installed as provided for herein shall not alter the type of construction classification of the building.

2607.3 Height limitation. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade plane.

2607.4 Area limitation and separation. The maximum area of a single wall panel and minimum vertical and horizontal separation requirements for exterior light-transmitting plastic wall panels shall be as provided for in Table 2607.4. The maximum percentage of wall area of any story in light-transmitting plastic wall panels shall not exceed that indicated in Table 2607.4 or the percentage of unprotected openings permitted by Section 705.8, whichever is smaller.

Exceptions:

1. In structures provided with approved flame barriers extending 30 inches (760 mm) beyond the exterior wall in the plane of the floor, a vertical separation is not required at the floor except that provided by the vertical thickness of the flame barrier projection.
2. Veneers of approved weather-resistant light-transmitting plastics used as exterior siding in buildings of Type V construction in compliance with Section 1405.
3. The area of light-transmitting plastic wall panels in exterior walls of greenhouses shall be exempt from the area limitations of Table 2607.4 but shall be limited as required for unprotected openings in accordance with Section 705.8.

**TABLE 2607.4
AREA LIMITATION AND SEPARATION REQUIREMENTS FOR LIGHT-TRANSMITTING PLASTIC WALL PANELS^a**

FIRE SEPARATION DISTANCE (feet)	CLASS OF PLASTIC	MAXIMUM PERCENTAGE AREA OF EXTERIOR WALL IN PLASTIC WALL PANELS	MAXIMUM SINGLE AREA OF PLASTIC WALL PANELS (square feet)	MINIMUM SEPARATION OF PLASTIC WALL PANELS (feet)	
				Vertical	Horizontal
Less than 6	—	Not Permitted	Not Permitted	—	—
6 or more but less than 11	CC1	10	50	8	4
	CC2	Not Permitted	Not Permitted	—	—
11 or more but less than or equal to 30	CC1	25	90	6	4
	CC2	15	70	8	4
Over 30	CC1	50	Not Limited	3 ^b	0
	CC2	50	100	6 ^b	3

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

a. For combinations of plastic glazing and plastic wall panel areas permitted, see Section 2607.6.

b. For reductions in vertical separation allowed, see Section 2607.4.

2607.5 Automatic sprinkler system. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum percentage area of exterior wall in any story in light-transmitting plastic wall panels and the maximum square footage of a single area given in Table 2607.4 shall be increased 100 percent, but the area of light-transmitting plastic wall panels shall not exceed 50 percent of the wall area in any story, or the area permitted by Section 705.8 for unprotected openings, whichever is smaller. These installations shall not be installed more than 75 feet (22 860 mm) above grade plane.

2607.6 Combinations of glazing and wall panels. Combinations of light-transmitting plastic glazing and light-transmitting plastic wall panels shall be subject to the area, height and percentage limitations and the separation requirements applicable to the class of light-transmitting plastic as prescribed for light-transmitting plastic wall panel installations.

**SECTION 2608
LIGHT-TRANSMITTING PLASTIC GLAZING**

2608.1 Buildings of Type VB construction. Openings in the exterior walls of buildings of Type VB construction, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic. Light-transmitting plastic glazing shall comply with Section 2606.

2608.2 Buildings of other types of construction. Openings in the exterior walls of buildings of types of construction other than Type VB, where not required to be protected by Section 705, shall be permitted to be glazed or equipped with light-transmitting plastic in accordance with Section 2606 and all of the following:

1. The aggregate area of light-transmitting plastic glazing shall not exceed 25 percent of the area of any wall face of the story in which it is installed. The area of a single pane of glazing installed above the first story above grade plane shall not exceed 16 square feet (1.5 m²) and

the vertical dimension of a single pane shall not exceed 4 feet (1219 mm).

Exception: Where an automatic sprinkler system is provided throughout in accordance with Section 903.3.1.1, the area of allowable glazing shall be increased to not more than 50 percent of the wall face of the story in which it is installed with no limit on the maximum dimension or area of a single pane of glazing.

2. Approved flame barriers extending 30 inches (762 mm) beyond the exterior wall in the plane of the floor, or vertical panels not less than 4 feet (1219 mm) in height, shall be installed between glazed units located in adjacent stories.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

3. Light-transmitting plastics shall not be installed more than 75 feet (22 860 mm) above grade level.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

**SECTION 2609
LIGHT-TRANSMITTING PLASTIC ROOF PANELS**

2609.1 General. Light-transmitting plastic roof panels shall comply with this section and Section 2606. Light-transmitting plastic roof panels shall not be installed in Groups H, I-2 and I-3. In all other groups, light-transmitting plastic roof panels shall comply with any one of the following conditions:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The roof construction is not required to have a fire-resistance rating by Table 601.
3. The roof panels meet the requirements for roof coverings in accordance with Chapter 15.

2609.2 Separation. Individual roof panels shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. The separation between roof panels is not required in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The separation between roof panels is not required in low-hazard occupancy buildings complying with the conditions of Section 2609.4, Exception 2 or 3.

2609.3 Location. Where exterior wall openings are required to be protected by Section 705.8, a roof panel shall not be installed within 6 feet (1829 mm) of such exterior wall.

2609.4 Area limitations. Roof panels shall be limited in area and the aggregate area of panels shall be limited by a percentage of the floor area of the room or space sheltered in accordance with Table 2609.4.

Exceptions:

1. The area limitations of Table 2609.4 shall be permitted to be increased by 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. Low-hazard occupancy buildings, such as swimming pool shelters, shall be exempt from the area limitations of Table 2609.4, provided that the buildings do not exceed 5,000 square feet (465 m²) in area and have a minimum fire separation distance of 10 feet (3048 mm).
3. Greenhouses that are occupied for growing or maintaining plants, without public access, shall be exempt from the area limitations of Table 2609.4 provided that they have a minimum fire separation distance of 4 feet (1220 mm).
4. Roof coverings over terraces and patios in occupancies in Group R-3 shall be exempt from the area limitations of Table 2609.4 and shall be permitted with light-transmitting plastics.

**TABLE 2609.4
AREA LIMITATIONS FOR
LIGHT-TRANSMITTING PLASTIC ROOF PANELS**

CLASS OF PLASTIC	MAXIMUM AREA OF INDIVIDUAL ROOF PANELS (square feet)	MAXIMUM AGGREGATE AREA OF ROOF PANELS (percent of floor area)
CC1	300	30
CC2	100	25

For SI: 1 square foot = 0.0929 m².

**SECTION 2610
LIGHT-TRANSMITTING
PLASTIC SKYLIGHT GLAZING**

2610.1 Light-transmitting plastic glazing of skylight assemblies. Skylight assemblies glazed with light-transmitting plastic shall conform to the provisions of this section and Section 2606.

Exception: Skylights in which the light-transmitting plastic conforms to the required roof-covering class in accordance with Section 1505.

2610.1.1 Unit skylights. Unit skylights glazed with light-transmitting plastic shall comply with Section 2405.5.

2610.2 Mounting. The light-transmitting plastic shall be mounted above the plane of the roof on a curb constructed in accordance with the requirements for the type of construction classification, but not less than 4 inches (102 mm) above the plane of the roof. Edges of the light-transmitting plastic skylights or domes shall be protected by metal or other approved noncombustible material, or the light transmitting plastic dome or skylight shall be shown to be able to resist ignition where exposed at the edge to a flame from a Class B brand as described in ASTM E108 or UL 790. The Class B brand test shall be conducted on a skylight that is elevated to a height as specified in the manufacturer’s installation instructions, but not less than 4 inches (102 mm).

Exceptions:

1. Curbs shall not be required for skylights used on roofs having a minimum slope of three units vertical in 12 units horizontal (25-percent slope) in occupancies in Group R-3 and on buildings with a nonclassified roof covering.
2. The metal or noncombustible edge material is not required where nonclassified roof coverings are permitted.

2610.3 Slope. Flat or corrugated light-transmitting plastic skylights shall slope not less than four units vertical in 12 units horizontal (4:12). Dome-shaped skylights shall rise above the mounting flange a minimum distance equal to 10 percent of the maximum width of the dome but not less than 3 inches (76 mm).

Exception: Skylights that pass the Class B Burning Brand Test specified in ASTM E108 or UL 790.

2610.4 Maximum area of skylights. Each skylight shall have a maximum area within the curb of 100 square feet (9.3 m²).

Exception: The area limitation shall not apply where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.5 Aggregate area of skylights. The aggregate area of skylights shall not exceed 33¹/₃ percent of the floor area of the room or space sheltered by the roof in which such skylights are installed where Class CC1 materials are utilized, and 25 percent where Class CC2 materials are utilized.

Exception: The aggregate area limitations of light-transmitting plastic skylights shall be increased 100 percent beyond the limitations set forth in this section where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or the building is equipped with smoke and heat vents in accordance with Section 910.

2610.6 Separation. Skylights shall be separated from each other by a distance of not less than 4 feet (1219 mm) measured in a horizontal plane.

Exceptions:

1. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2. In Group R-3, multiple skylights located above the same room or space with a combined area not exceeding the limits set forth in Section 2610.4.

2610.7 Location. Where exterior wall openings are required to be protected in accordance with Section 705, a skylight shall not be installed within 6 feet (1829 mm) of such exterior wall.

2610.8 Combinations of roof panels and skylights. Combinations of light-transmitting plastic roof panels and skylights shall be subject to the area and percentage limitations and separation requirements applicable to roof panel installations.

SECTION 2611

LIGHT-TRANSMITTING PLASTIC INTERIOR SIGNS

2611.1 General. Light-transmitting plastic interior signs shall be limited as specified in Sections 2606 and 2611.2 through 2611.4.

Exception: Light-transmitting plastic interior wall signs in covered and open mall buildings shall comply with Section 402.6.4.

2611.2 Maximum area. The aggregate area of all light-transmitting plastics shall not exceed 24 square feet (2.23 m²).

Exception: In buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the aggregate area of light-transmitting plastics shall not exceed 100 square feet (9.29 m²), provided that all plastics are Class CC1 in accordance with Section 2606.4.

2611.3 Separation. Signs exceeding the aggregate area of Section 2611.2 shall be separated from each other by not less than 4 feet (1219 mm) horizontally and 8 feet (2438 mm) vertically.

2611.4 Encasement. Backs of wall-mounted signs and non-illuminated portions of all signs regulated by this section shall be fully encased in metal.

SECTION 2612 PLASTIC COMPOSITES

[BS] 2612.1 General. Plastic composites shall consist of either wood/plastic composites or plastic lumber. Plastic composites shall comply with the provisions of this code and with the additional requirements of Section 2612.

[BS] 2612.2 Labeling. Plastic composite deck boards and stair treads, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic composite handrails and guards, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032.

2612.3 Flame spread index. Plastic composite deck boards, stair treads, handrails and guards shall exhibit a flame spread index not exceeding 200 when tested in accordance with

ASTM E84 or UL 723 with the test specimen remaining in place during the test.

Exception: Materials determined to be noncombustible in accordance with Section 703.3.

[BS] 2612.4 Termite and decay resistance. Where required by Section 2304.12, plastic composite deck boards, stair treads, handrails and guards containing wood, cellulosic or any other biodegradable materials shall be termite and decay resistant as determined in accordance with ASTM D7032.

[BS] 2612.5 Construction requirements. Plastic composites meeting the requirements of Section 2612 shall be permitted to be used as exterior deck boards, stair treads, handrails and guards where combustible construction is permitted.

[BS] 2612.5.1 Span rating. Plastic composites used as exterior deck boards shall have a span rating determined in accordance with ASTM D7032.

[BS] 2612.6 Plastic composite deck boards, stair treads, handrails and guards. Plastic composite deck boards, stair treads, handrails and guards shall be installed in accordance with this code and the manufacturer's instructions.

SECTION 2613 FIBER-REINFORCED POLYMER

2613.1 General. The provisions of this section shall govern the requirements and uses of fiber-reinforced polymer in and on buildings and structures.

2613.2 Labeling and identification. Packages and containers of fiber-reinforced polymer and their components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2613.3 Interior finishes. Fiber-reinforced polymer used as interior finishes, decorative materials or trim shall comply with Chapter 8.

2613.3.1 Foam plastic cores. Fiber-reinforced polymer used as interior finish and that contains foam plastic cores shall comply with Chapter 8 and this chapter.

2613.4 Light-transmitting materials. Fiber-reinforced polymer used as light-transmitting materials shall comply with Sections 2606 through 2611 as required for the specific application.

2613.5 Exterior use. Fiber-reinforced polymer shall be permitted to be installed on the exterior walls of buildings of any type of construction where such polymers meet the requirements of Section 2603.5. Fireblocking shall be installed in accordance with Section 718.

Exceptions:

1. Compliance with Section 2603.5 is not required where all of the following conditions are met:
 - 1.1. The fiber-reinforced polymer shall not exceed an aggregate total of 20 percent of the area of the specific wall to which it is attached, and single architectural elements

shall not exceed 10 percent of the area of the specific wall to which it is attached, and no contiguous sets of architectural elements shall not exceed 10 percent of the area of the specific wall to which they are attached.

- 1.2. The fiber-reinforced polymer shall have a flame spread index of 25 or less. The flame spread index requirement shall not be required for coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.
 - 1.3. Fireblocking complying with Section 718.2.6 shall be installed.
 - 1.4. The fiber-reinforced polymer shall be installed directly to a noncombustible substrate or be separated from the exterior wall by one of the following materials: corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm) at any point, aluminum having a minimum thickness of 0.019 inch (0.5 mm) or other approved noncombustible material.
2. Compliance with Section 2603.5 is not required where the fiber-reinforced polymer is installed on buildings that are 40 feet (12 190 mm) or less above grade and the following conditions are met:
- 2.1. The fiber-reinforced polymer shall meet the requirements of Section 1405.1.
 - 2.2. Where the fire separation distance is 5 feet (1524 mm) or less, the area of the fiber-reinforced polymer shall not exceed 10 percent of the wall area. Where the fire separation distance is greater than 5 feet (1524 mm), the area of the exterior wall coverage using fiber-reinforced polymer shall not be limited.
 - 2.3. The fiber-reinforced polymer shall have a flame spread index of 200 or less. The flame spread index requirements do not apply to coatings or paints having a thickness of less than 0.036 inch (0.9 mm) that are applied directly to the surface of the fiber-reinforced polymer.
 - 2.4. Fireblocking complying with Section 718.2.6 shall be installed.

SECTION 2614 REFLECTIVE PLASTIC CORE INSULATION

2614.1 General. The provisions of this section shall govern the requirements and uses of reflective plastic core insulation in buildings and structures. Reflective plastic core insulation shall comply with the requirements of Section 2614 and of Section 2614.3 or 2614.4.

2614.2 Identification. Packages and containers of reflective plastic core insulation delivered to the job site shall show the manufacturer's or supplier's name, product identification and information sufficient to determine that the end use will comply with the code requirements.

2614.3 Surface-burning characteristics. Reflective plastic core insulation shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 when tested in accordance with ASTM E84 or UL 723. The reflective plastic core insulation shall be tested at the maximum thickness intended for use. Test specimen preparation and mounting shall be in accordance with ASTM E2599.

2614.4 Room corner test heat release. Reflective plastic core insulation shall comply with the acceptance criteria of Section 803.1.1.1 when tested in accordance with NFPA 286 or UL 1715 in the manner intended for use and at the maximum thickness intended for use.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 27 – ELECTRICAL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
Chapter / Section																						
2702.1.2			X																			
2702.2.11			X																			
2702.2.12.1			X																			
2702.2.13			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 27

ELECTRICAL

User note:

About this chapter: *Electrical systems and components are integral to most structures; therefore, it is necessary for the code to address their installation and protection. Structures depend on electricity for the operation of many life safety systems including fire alarm, smoke control and exhaust, fire suppression, fire command and communication systems. Since power supply to these systems is essential, Chapter 27 addresses where standby and emergency power must be provided.*

SECTION 2701 GENERAL

2701.1 Scope. The provisions of this chapter and *the California Electrical Code* shall govern the design, construction, erection and installation of the electrical components, appliances, equipment and systems used in buildings and structures covered by this code. The *California Fire Code*, the *International Property Maintenance Code* and the *California Electrical Code* shall govern the use and maintenance of electrical components, appliances, equipment and systems. The *California Existing Building Code* and the *California Electrical Code* shall govern the alteration, repair, relocation, replacement and addition of electrical components, appliances, or equipment and systems.

SECTION 2702 EMERGENCY AND STANDBY POWER SYSTEMS

[F] 2702.1 General. Emergency power systems and standby power systems shall comply with Sections 2702.1.1 through 2702.1.8.

[F] 2702.1.1 Stationary generators. Stationary emergency and standby power generators required by this code shall be listed in accordance with UL 2200.

[F] 2702.1.2 Fuel-line piping protection. Fuel lines supplying a generator set inside a high-rise building or new Group I-2 occupancy having occupied floors located more than 75 feet (23 m) above the lowest level of fire department vehicle access shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.
2. An assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required fire-resistance rating shall be reduced to 1 hour.

3. Other approved methods.

[F] 2702.1.3 Installation. Emergency power systems and standby power systems required by this code or the *California Fire Code* shall be installed in accordance with the *California Fire Code*, the *California Electrical Code*, NFPA 110 and NFPA 111.

[F] 2702.1.4 Load transfer. Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

[F] 2702.1.5 Load duration. Emergency power systems and standby power systems shall be designed to provide the required power for a minimum duration of 2 hours without being refueled or recharged, unless specified otherwise in this code.

[F] 2702.1.6 Uninterruptable power source. An uninterrupted source of power shall be provided for equipment where required by the manufacturer's instructions, the listing, this code or applicable referenced standards.

[F] 2702.1.7 Interchangeability. Emergency power systems shall be an acceptable alternative for installations that require standby power systems.

[F] 2702.1.8 Group I-2 occupancies. In Group I-2 occupancies located in flood hazard areas established in Section 1612.3, where new essential electrical systems are installed, and where new essential electrical system generators are installed, the systems and generators shall be located and installed in accordance with ASCE 24. Where connections for hookup of temporary generators are provided, the connections shall be located at or above the elevation required in ASCE 24.

[F] 2702.2 Where required. Emergency and standby power systems shall be provided where required by Sections 2702.2.1 through 2702.2.19.

[F] 2702.2.1 Ambulatory care facilities. Essential electrical systems for ambulatory care facilities shall comply with Section 422.6.

[F] 2702.2.2 Elevators and platform lifts. Standby power shall be provided for elevators and platform lifts as

required in Sections 1009.4.1, 1009.5, 3003.1, 3007.8 and 3008.8.

[F] **2702.2.3 Emergency responder communication coverage systems.** Standby power shall be provided for in-building 2-way emergency responder communication coverage systems required in Section 918 and the *California Fire Code*. The standby power supply shall be capable of operating the in-building 2-way emergency responder communication coverage system at 100-percent system operation capacity for a duration of not less than 12 hours.

[F] **2702.2.4 Emergency voice/alarm communication systems.** Standby power shall be provided for emergency voice/alarm communication systems in accordance with NFPA 72.

[F] **2702.2.5 Exhaust systems.** Standby power shall be provided for common exhaust systems for domestic kitchens located in multistory structures as required in Section 505.5 of the *California Mechanical Code*. Standby power shall be provided for common exhaust systems for clothes dryers located in multistory structures as required in Section 504.11 of the *California Mechanical Code* and Section 614.11 of the *International Fuel Gas Code*.

[F] **2702.2.6 Exit signs.** Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] **2702.2.7 Gas detection system.** Emergency or standby power shall be provided for gas detection systems in accordance with the *California Fire Code*.

[F] **2702.2.8 Group I-2 occupancies.** Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.11.

[F] **2702.2.9 Group I-3 occupancies.** Emergency power shall be provided for power-operated doors and locks in Group I-3 occupancies as required in Section 408.4.2.

[F] **2702.2.10 Hazardous materials.** Emergency or standby power shall be provided in occupancies with hazardous materials where required by the *California Fire Code*.

[F] **2702.2.11 High-rise buildings.** Emergency and standby power shall be provided in high-rise buildings as required in Section 403.4.8.

[F] **2702.2.12 Hydrogen fuel gas rooms.** Standby power shall be provided for hydrogen fuel gas rooms as required by the *California Fire Code*.

2702.2.12.1 Group L Occupancy. Secondary power shall be provided in Group L occupancies in accordance with this chapter and Section 453.4.6 and 453.4.6.1.

[F] **2702.2.13 Laboratory suites.** Standby or emergency power shall be provided in accordance with Section 5004.7 of the *California Fire Code* where laboratory suites are located above the sixth story above grade plane or located in a story below grade plane.

[F] **2702.2.14 Means of egress illumination.** Emergency power shall be provided for means of egress illumination as required in Section 1008.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

[F] **2702.2.15 Membrane structures.** Standby power shall be provided for auxiliary inflation systems in permanent membrane structures as required in Section 3102.8.2. Standby power shall be provided for a duration of not less than 4 hours. Auxiliary inflation systems in temporary air-supported and air-inflated membrane structures shall be provided in accordance with Section 3103.10.4 of the *California Fire Code*.

[F] **2702.2.16 Semiconductor fabrication facilities.** Emergency power shall be provided for semiconductor fabrication facilities as required in Section 415.11.11.

[F] **2702.2.17 Smoke control systems.** Standby power shall be provided for smoke control systems as required in Sections 404.7, 909.11, 909.20.7.2 and 909.21.5.

[F] **2702.2.18 Special purpose horizontal sliding, accordion or folding doors.** Standby power shall be provided for special purpose horizontal sliding, accordion or folding doors as required in Section 1010.3.3. The standby power supply shall have a capacity to operate not fewer than 50 closing cycles of the door.

[F] **2702.2.19 Underground buildings.** Emergency and standby power shall be provided in underground buildings as required in Section 405.

[F] **2702.3 Critical circuits.** Required critical circuits shall be protected using one of the following methods:

1. Cables, used for survivability of required critical circuits, that are listed in accordance with UL 2196 and have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems having a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems are installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.

[F] **2702.4 Maintenance.** Emergency and standby power systems shall be maintained and tested in accordance with the *California Fire Code*.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 28 – MECHANICAL SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
Chapter / Section																						
2802			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 28

MECHANICAL SYSTEMS

User note:

About this chapter: Mechanical systems are a key element of any building. Chapter 28 regulates such systems by linking to the California Mechanical Code and International Fuel Gas Code®, where details of mechanical system requirements are provided.

SECTION 2801 GENERAL

[M] 2801.1 Scope. The provisions of this chapter, the *California Mechanical Code* and the *International Fuel Gas Code* shall govern the design, construction, erection and installation of mechanical appliances, equipment and systems used in buildings and structures covered by this code. Masonry chimneys, fireplaces and barbecues shall comply with the *California Mechanical Code* and Chapter 21 of this code. The *California Fire Code*, the *International Property Maintenance Code*, the *California Mechanical Code* and the *International Fuel Gas Code* shall govern the use and maintenance of mechanical components, appliances, equipment and systems. The *California Existing Building Code*, the *California Mechanical Code* and the *International Fuel Gas Code* shall govern the alteration, repair, relocation, replacement and addition of mechanical components, appliances, equipment and systems.

2802 Spark Arrestor. [SFM] All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester. The spark arrester shall meet all of the following requirements:

1. The net free area of the spark arrester shall be not less than four times the net free area of the outlet of the chimney.
2. The spark arrester screen shall have heat and corrosion resistance equivalent to 19-gage galvanized steel or 24-gage stainless steel.
3. Openings shall not permit the passage of spheres having a diameter larger than $\frac{1}{2}$ inch (12.7 mm) nor block the passage of spheres having a diameter of less than $\frac{3}{8}$ inch (9.5 mm).
4. The spark arrester shall be accessible for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

CHAPTER 29

PLUMBING SYSTEMS

(Not Adopted by the State of California)

Refer to California Plumbing Code, Title 24, Part 5

User note:

About this chapter: Plumbing systems are another key element of any building. Chapter 29 provides the necessary number of plumbing fixtures, including water closets, lavatories, bathtubs and showers. The quality and design of each fixture must be in accordance with the California Plumbing Code.

SECTION 2901 GENERAL

[P] 2901.1 Scope. The provisions of this chapter and the *California Plumbing Code* shall govern the design, construction, erection and installation of plumbing components, appliances, equipment and systems used in buildings and structures covered by this code. Toilet and bathing rooms shall be constructed in accordance with Section 1210. Private sewage disposal systems shall conform to the *International Private Sewage Disposal Code*. The *California Fire Code*, the *International Property Maintenance Code* and the *California Plumbing Code* shall govern the use and maintenance of plumbing components, appliances, equipment and systems. The *California Existing Building Code* and the *California Plumbing Code* shall govern the alteration, repair, relocation, replacement and addition of plumbing components, appliances, equipment and systems.

For minimum plumbing fixture requirements, see Table 422.1 of the California Plumbing Code.

SECTION 2902 MINIMUM PLUMBING FACILITIES

[P] 2902.1 Minimum number of fixtures. Plumbing fixtures shall be provided in the minimum number as shown in Table 2902.1 based on the actual use of the building or space. Uses not shown in Table 2902.1 shall be considered individually by the code official. The number of occupants shall be determined by this code.

[P] 2902.1.1 Fixture calculations. To determine the occupant load of each sex, the total occupant load shall be divided in half. To determine the required number of fixtures, the fixture ratio or ratios for each fixture type shall be applied to the occupant load of each sex in accordance with Table 2902.1. Fractional numbers resulting from applying the fixture ratios of Table 2902.1 shall be rounded up to the next whole number. For calculations involving multiple occupancies, such fractional numbers

for each occupancy shall first be summed and then rounded up to the next whole number.

Exceptions:

1. The total occupant load shall not be required to be divided in half where approved statistical data indicates a distribution of the sexes of other than 50 percent of each sex.
2. Where multiple-user facilities are designed to serve all genders, the minimum fixture count shall be calculated 100 percent, based on total occupant load. In such multiple-user user facilities, each fixture type shall be in accordance with ICC A117.1 and each urinal that is provided shall be located in a stall.
3. Distribution of the sexes is not required where single-user water closets and bathing room fixtures are provided in accordance with Section 2902.1.2.

[P] 2902.1.2 Single-user toilet and bathing room fixtures. The plumbing fixtures located in single-user toilet and bathing rooms, including family or assisted-use toilet and bathing rooms that are required by Section 1110.2.1, shall contribute toward the total number of required plumbing fixtures for a building or tenant space. Single-user toilet and bathing rooms, and family or assisted-use toilet rooms and bathing rooms shall be identified as being available for use by all persons regardless of their sex.

The total number of fixtures shall be permitted to be based on the required number of separate facilities or based on the aggregate of any combination of single-user or separate facilities.

[P] 2902.1.3 Lavatory distribution. Where two or more toilet rooms are provided for each sex, the required number of lavatories shall be distributed proportionately to the required number of water closets.

[P] TABLE 2902.1

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES^a (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)		LAVATORIES		BATHTUBS/ SHOWERS	DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)	OTHER
			Male	Female	Male	Female			
1	Assembly	Theaters and other buildings for the performing arts and motion pictures ^d	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
		Nightclubs, bars, taverns, dance halls and buildings for similar purposes ^d	1 per 40	1 per 40	1 per 75		—	1 per 500	1 service sink
		Restaurants, banquet halls and food courts ^d	1 per 75	1 per 75	1 per 200		—	1 per 500	1 service sink
		Casino gaming areas	1 per 100 for the first 400 and 1 per 250 for the remainder exceeding 400	1 per 50 for the first 400 and 1 per 150 for the remainder exceeding 400	1 per 250 for the first 750 and 1 per 500 for the remainder exceeding 750		—	1 per 1,000	1 service sink
		Auditoriums without permanent seating, art galleries, exhibition halls, museums, lecture halls, libraries, arcades and gymnasiums ^d	1 per 125	1 per 65	1 per 200		—	1 per 500	1 service sink
		Passenger terminals and transportation facilities ^d	1 per 500	1 per 500	1 per 750		—	1 per 1,000	1 service sink
		Places of worship and other religious services ^d	1 per 150	1 per 75	1 per 200		—	1 per 1,000	1 service sink
		Coliseums, arenas, skating rinks, pools and tennis courts for indoor sporting events and activities	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	1 per 1,000	1 service sink
Stadiums, amusement parks, bleachers and grandstands for outdoor sporting events and activities ^f	1 per 75 for the first 1,500 and 1 per 120 for the remainder exceeding 1,500	1 per 40 for the first 1,520 and 1 per 60 for the remainder exceeding 1,520	1 per 200	1 per 150	—	1 per 1,000	1 service sink		

(continued)

[P] TABLE 2902.1—continued
 MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES^a (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)		LAVATORIES		BATHTUBS/ SHOWERS	DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)	OTHER
			Male	Female	Male	Female			
2	Business	Buildings for the trans- action of business, pro- fessional services, other services involving mer- chandise, office build- ings, banks, light industrial, ambulatory care and similar uses	1 per 25 for the first 50 and 1 per 50 for the remainder exceeding 50		1 per 40 for the first 80 and 1 per 80 for the remainder exceeding 80		—	1 per 100	1 service sink ^e
3	Educational	Educational facilities	1 per 50		1 per 50		—	1 per 100	1 service sink
4	Factory and industrial	Structures in which occupants are engaged in work fabricating, assembly or processing of products or materials	1 per 100		1 per 100		—	1 per 400	1 service sink
5	Institutional	Custodial care facilities	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		Medical care recipients in hospitals and nursing homes ^b	1 per room ^c		1 per room ^c		1 per 15	1 per 100	1 service sink
		Employees in hospitals and nursing homes ^b	1 per 25		1 per 35		—	1 per 100	—
		Visitors in hospitals and nursing homes	1 per 75		1 per 100		—	1 per 500	—
		Prisons ^b	1 per cell		1 per cell		1 per 15	1 per 100	1 service sink
		Reformatories, deten- tion centers and correc- tional centers ^b	1 per 15		1 per 15		1 per 15	1 per 100	1 service sink
		Employees in reformi- tories, detention centers and correctional cen- ters ^b	1 per 25		1 per 35		—	1 per 100	—
Adult day care and child day care	1 per 15		1 per 15		1	1 per 100	1 service sink		
6	Mercantile	Retail stores, service stations, shops, sales- rooms, markets and shopping centers	1 per 500		1 per 750		—	1 per 1,000	1 service sink ^e

(continued)

[P] TABLE 2902.1—continued

MINIMUM NUMBER OF REQUIRED PLUMBING FIXTURES^a (See Sections 2902.1.1 and 2902.2)

No.	CLASSIFICATION	DESCRIPTION	WATER CLOSETS (URINALS SEE SECTION 424.2 OF THE INTERNATIONAL PLUMBING CODE)		LAVATORIES		BATHTUBS/ SHOWERS	DRINKING FOUNTAINS (SEE SECTION 410 OF THE INTERNATIONAL PLUMBING CODE)	OTHER
			Male	Female	Male	Female			
7	Residential	Hotels, motels, boarding houses (transient)	1 per sleeping unit		1 per sleeping unit		1 per sleeping unit	—	1 service sink
		Dormitories, fraternities, sororities and boarding houses (not transient)	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
		Apartment house	1 per dwelling unit		1 per dwelling unit		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per 20 dwelling units
		One- and two-family dwellings and lodging houses with five or fewer guestrooms	1 per dwelling unit		1 per 10		1 per dwelling unit	—	1 kitchen sink per dwelling unit; 1 automatic clothes washer connection per dwelling unit
		Congregate living facilities with 16 or fewer persons	1 per 10		1 per 10		1 per 8	1 per 100	1 service sink
8	Storage	Structures for the storage of goods, warehouses, storehouses and freight depots, low and moderate hazard	1 per 100		1 per 100		—	1 per 1,000	1 service sink

- a. The fixtures shown are based on one fixture being the minimum required for the number of persons indicated or any fraction of the number of persons indicated. The number of occupants shall be determined by this code.
- b. Toilet facilities for employees shall be separate from facilities for inmates or care recipients.
- c. A single-occupant toilet room with one water closet and one lavatory serving not more than two adjacent patient sleeping units shall be permitted, provided that each patient sleeping unit has direct access to the toilet room and provisions for privacy for the toilet room user are provided.
- d. The occupant load for seasonal outdoor seating and entertainment areas shall be included when determining the minimum number of facilities required.
- e. For business and mercantile classifications with an occupant load of 15 or fewer, a service sink shall not be required.
- f. The required number and type of plumbing fixtures for outdoor swimming pools shall be in accordance with Section 609 of the *International Swimming Pool and Spa Code*.

[P] 2902.2 Separate facilities. Where plumbing fixtures are required, separate facilities shall be provided for each sex.

Exceptions:

1. Separate facilities shall not be required for dwelling units and sleeping units.
2. Separate facilities shall not be required in structures or tenant spaces with a total occupant load, including both employees and customers, of 15 or fewer.
3. Separate facilities shall not be required in mercantile occupancies in which the maximum occupant load is 100 or fewer.
4. Separate facilities shall not be required in business occupancies in which the maximum occupant load is 25 or fewer.
5. Separate facilities shall not be required to be designated by sex where single-user toilets rooms are provided in accordance with Section 2902.1.2.
6. Separate facilities shall not be required where rooms having both water closets and lavatory fixtures are designed for use by both sexes and privacy for water closets are installed in accordance with Section 405.3.4 of the *California Plumbing Code*. Urinals shall be located in an area visually separated from the remainder of the facility or each urinal that is provided shall be located in a stall.

[P] 2902.2.1 Family or assisted-use toilet facilities serving as separate facilities. Where a building or tenant space requires a separate toilet facility for each sex and each toilet facility is required to have only one water closet, two family or assisted-use toilet facilities shall be permitted to serve as the required separate facilities. Family or assisted-use toilet facilities shall not be required to be identified for exclusive use by either sex as required by Section 2902.4.

[P] 2902.3 Employee and public toilet facilities. For structures and tenant spaces intended for public utilization, customers, patrons and visitors shall be provided with public toilet facilities. Employees associated with structures and tenant spaces shall be provided with toilet facilities. The number of plumbing fixtures located within the required toilet facilities shall be provided in accordance with Section 2902 for all users. Employee toilet facilities shall be either separate or combined employee and public toilet facilities.

Exception: Public toilet facilities shall not be required for:

1. Parking garages where operated without parking attendants.
2. Structures and tenant spaces intended for quick transactions, including takeout, pickup and drop-off, having a public access area less than or equal to 300 square feet (28 m²).

[P] 2902.3.1 Access. The route to the public toilet facilities required by Section 2902.3 shall not pass through kitchens, storage rooms or closets. Access to the required facilities shall be from within the building or from the exterior of the building. The public shall have access to the

required toilet facilities at all times that the building is occupied.

[P] 2902.3.2 Prohibited toilet room location. Toilet rooms shall not open directly into a room used for the preparation of food for service to the public.

[P] 2902.3.3 Location of toilet facilities in occupancies other than malls. In occupancies other than covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 500 feet (152 m).

Exceptions:

1. The location and maximum distances of travel to required employee facilities in factory and industrial *occupancies* shall be permitted to exceed that required by this section, provided that the location and maximum distances of travel are approved.
2. The location and maximum distances of travel to required public and employee facilities in Group S occupancies shall be permitted to exceed that required by this section, provided that the location and maximum distances of travel are approved.

[P] 2902.3.4 Location of toilet facilities in malls. In covered and open mall buildings, the required public and employee toilet facilities shall be located not more than one story above or below the space required to be provided with toilet facilities, and the path of travel to such facilities shall not exceed a distance of 300 feet (91 m). In mall buildings, the required facilities shall be based on total square footage (m²) within a covered mall building or within the perimeter line of an open mall building, and facilities shall be installed in each individual store or in a central toilet area located in accordance with this section. The maximum distance of travel to central toilet facilities in mall buildings shall be measured from the main entrance of any store or tenant space. In mall buildings, where employees' toilet facilities are not provided in the individual store, the maximum distance of travel shall be measured from the employees' work area of the store or tenant space.

[P] 2902.3.5 Pay facilities. Where pay facilities are installed, such facilities shall be in excess of the required minimum facilities. Required facilities shall be free of charge.

[P] 2902.3.6 Door locking. Where a toilet room is provided for the use of multiple occupants, the egress door for the room shall not be lockable from the inside of the room. This section does not apply to family or assisted-use toilet rooms.

[P] 2902.4 Signage. Required public facilities shall be provided with signs that designate the sex as required by Section 2902.2. Signs shall be readily visible and located near the entrance to each toilet facility. Signs for accessible toilet facilities shall comply with Section 1112.

[P] **2902.4.1 Directional signage.** Directional signage indicating the route to the required public toilet facilities shall be posted in a lobby, corridor, aisle or similar space, such that the sign can be readily seen from the main entrance to the building or tenant space.

[P] **2902.5 Drinking fountain location.** Drinking fountains shall not be required to be located in individual tenant spaces provided that public drinking fountains are located within a distance of travel of 500 feet (152 m) of the most remote location in the tenant space and not more than one story above or below the tenant space. Where the tenant space is in a covered or open mall, such distance shall not exceed 300 feet (91 m).

[P] **2902.6 Small occupancies.** Drinking fountains shall not be required for an occupant load of 15 or fewer.

[P] **2902.7 Service sink location.** Service sinks shall not be required to be located in individual tenant spaces in a covered mall provided that service sinks are located within a distance of travel of 300 feet (91 m) of the most remote location in the tenant space and not more than one story above or below the tenant space. Service sinks shall be located on an accessible route.

**[P] SECTION 2903
INSTALLATION OF FIXTURES**

[P] **2903.1 Setting.** Fixtures shall be set level and in proper alignment with reference to adjacent walls.

[P] **2903.1.1 Water closets, urinals, lavatories and bidets.** A water closet, urinal, lavatory or bidet shall not be set closer than 15 inches (381 mm) from its center to any side wall, partition, vanity or other obstruction. Where partitions or other obstructions do not separate adjacent fixtures, fixtures shall not be set closer than 30 inches (762 mm) center to center between adjacent fixtures. There shall be not less than a 21-inch (533 mm) clearance in front of a water closet, urinal, lavatory or bidet to any wall, fixture or door. Water closet compartments shall be not less than 30 inches (762 mm) in width and not less than 60 inches (1524 mm) in depth for floor-mounted water closets and not less than 30 inches (762 mm) in width and 56 inches (1422 mm) in depth for wall-hung water closets.

Exception: An accessible children’s water closet shall be set not closer than 12 inches (305 mm) from its center to the required partition or to the wall on one side.

[P] **2903.1.2 Public lavatories.** In employee and public toilet rooms, the required lavatory shall be located in the same room as the required water closet.

[P] **2903.1.3 Location of fixtures and piping.** Piping, fixtures or equipment shall not be located in such a manner as to interfere with the normal operation of windows, doors or other means of egress openings.

[P] **2903.1.4 Water closet compartment.** Each water closet utilized by the public or employees shall occupy a separate compartment with walls or partitions and a door enclosing the fixtures to ensure privacy.

Exceptions:

1. Water closet compartments shall not be required in a single-occupant toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more water closets shall be permitted to have one water closet without an enclosing compartment.
3. This provision is not applicable to toilet areas located within Group I-3 housing areas.

[P] **2903.1.5 Urinal partitions.** Each urinal utilized by the public or employees shall occupy a separate area with walls or partitions to provide privacy. The horizontal dimension between walls or partitions at each urinal shall be not less than 30 inches (762 mm). The walls or partitions shall begin at a height not greater than 12 inches (305 mm) from and extend not less than 60 inches (1524 mm) above the finished floor surface. The walls or partitions shall extend from the wall surface at each side of the urinal not less than 18 inches (457 mm) or to a point not less than 6 inches (152 mm) beyond the outermost front lip of the urinal measured from the finished backwall surface, whichever is greater.

Exceptions:

1. Urinal partitions shall not be required in a single-occupant or family/assisted-use toilet room with a lockable door.
2. Toilet rooms located in child day care facilities and containing two or more urinals shall be permitted to have one urinal without partitions.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 30 – ELEVATORS AND CONVEYING SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X							X	X		X	X	X	X	X							
Adopt entire chapter as amendeded (amended sections listed below)			X							X												
Adopt only those sections that are listed below						X	X															
Chapter / Section																						
3001.3			X																			
3001.4			X			X	X															
3001.5			X																			
3001.6			X																			
3002.4a – 3002.4.6a			X																			
3002.5			X																			
3002.6.1			X																			
3002.9			X																			
3002.10 – 3002.11			X																			
3003.1			X																			
3003.1.5			X																			
3003.2			X																			
3003.2.1.2			X																			
3003.4 – 3003.4.4			X																			
3005.1 – 3005.2			X																			
3005.4.1			X																			
3006.2			X																			
3006.3			X																			
3007.1			X																			
3007.6.1			X																			
3008.1			X																			
3008.2.1			X																			
3008.7.1			X																			
3009										X												

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 30

ELEVATORS AND CONVEYING SYSTEMS

User note:

About this chapter: Chapter 30 contains the provisions that regulate vertical and horizontal transportation and material-handling systems installed in buildings. This chapter also provides several elements that protect occupants and assist emergency responders during fires.

SECTION 3001 GENERAL

3001.1 Scope. This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

3001.2 Emergency elevator communication systems for the deaf, hard of hearing and speech impaired. An emergency two-way communication system shall be provided. The system shall provide visible text and audible modes that meet all of the following requirements:

1. When operating in each mode, include a live interactive system that allows back and forth conversation between the elevator occupants and emergency personnel.
2. Is operational when the elevator is operational.
3. Allows elevator occupants to select the text-based or audible mode depending on their communication needs to interact with emergency personnel.

3001.3 Referenced standards. Except as otherwise provided for in this code, the design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*, and the applicable standard specified in Table 3001.3 and ASCE 24 for construction in flood hazard areas established in Section 1612.3.

**TABLE 3001.3
ELEVATORS AND CONVEYING SYSTEMS AND COMPONENTS**

TYPE	STANDARD
Automotive lifts	ALI ALCTV
Belt manlifts	ASME A90.1
Conveyors and related equipment	ASME B20.1
Elevators, escalators, dumbwaiters, moving walks, material lifts	ASME A17.1/CSA B44, ASME A17.7/CSA B44.7
Industrial scissor lifts	ANSI MH29.1
Platform lifts, stairway chairlifts, wheelchair lifts	ASME A18.1

3001.4 Accessibility. Passenger elevators and platform (wheelchair) lifts required to be accessible or to serve as part of an accessible means of egress shall comply with Sections

1009 and either Chapter 11A for applications listed in Section 1.8.2.1.2 regulated by the Department of Housing and Community Development or Chapter 11B for applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance.

3001.5 Change in use. A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

3001.6 Elevators utilized to transport hazardous materials. Elevators utilized to transport hazardous materials shall also comply with the *California Fire Code Sections 5003.10.2.2, 5003.10.4 through 5003.10.7*.

SECTION 3002 HOISTWAY ENCLOSURES

3002.1 Hoistway enclosure protection. Elevator, dumbwaiter and other hoistway enclosures shall be shaft enclosures complying with Sections 712 and 713.

3002.1.1 Opening protectives. Openings in hoistway enclosures shall be protected as required in Chapter 7.

Exception: The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

3002.1.2 Hardware. Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

3002.2 Number of elevator cars in a hoistway. Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in not fewer than two separate hoistways. Not more than four elevator cars shall be located in any single hoistway enclosure.

3002.3 Emergency signs. An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign

shall read: IN CASE OF FIRE, ELEVATORS ARE OUT OF SERVICE. USE EXIT STAIRS.

Exceptions:

1. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1009.4.
2. The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008.

3002.4 Elevator car to accommodate ambulance stretcher. Where elevators are provided in buildings four or more stories above, or four or more stories below, grade plane, not fewer than one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate an ambulance stretcher 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-inch (127 mm) radius corners, in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall be not less than 3 inches (76 mm) in height and shall be placed inside on both sides of the hoistway door frame.

The following California sections replace the corresponding model code section for applications specified in section 1.11 for the Office of the State Fire Marshal.

3002.4a General stretcher requirements. All buildings and structures with one or more passenger service elevators shall be provided with not less than one medical emergency service elevator to all landings meeting the provisions of Section 3002.4a. The medical emergency service elevator(s) shall be identified in the construction documents specified in Section 107 or the California Administrative Code.

Exceptions:

1. Elevators in structures used only by maintenance and operating personnel.
2. Elevators in jails and penal institutions.
3. Elevators in buildings or structures where each landing is at ground level or is accessible at grade level or by a ramp.
4. Elevator(s) in two-story buildings or structures equipped with stairs of a configuration that will accommodate the carrying of the gurney or stretcher as permitted by the local jurisdictional authority.
5. Elevators in buildings or structures less than four stories in height for which the local jurisdictional authority has granted an exception in the form of a written document.

3002.4.1a Gurney size. The medical emergency service elevator shall accommodate the loading and transport of two emergency personnel, each requiring a minimum clear 21-inch (533 mm) diameter circular area and an ambulance gurney or stretcher [minimum size 24 inches by 84 inches (610 mm by 2134 mm) with not less than 5-

inch (127 mm) radius corners] in the horizontal, open position.

3002.4.2a Hoistway doors. The hoistway landing openings shall be provided with power-operated doors.

3002.4.3a Elevator recall. The elevator(s) designated the medical emergency elevator shall be equipped with a key switch to recall the elevator nonstop to the main floor. For the purpose of this section, elevators in compliance with Section 3003.2 shall be acceptable.

3002.4.4a Designation. Medical emergency elevators shall be identified by the international symbol (Star of Life) for emergency medical services.

3002.4.5a Symbol size. The symbol shall not be less than 3 inches (76 mm) in size.

3002.4.6a Symbol location. A symbol shall be permanently attached to each side of the hoistway door frame on the portion of the frame at right angles to the hallway or landing area. Each symbol shall be not less than 78 inches (1981 mm) and not more than 84 inches (2134 mm) above the floor level at the threshold.

3002.5 Emergency doors. Where an elevator is installed in a single blind hoistway or on the outside of a building, emergency doors shall be in conformance with the California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

3002.6 Prohibited doors. Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.

3002.6.1 Prohibited hoistway access doors and panels. The following types of access doors and panels are prohibited in accordance with the California Code Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders:

1. Access panels or doors to working platforms in the line of movement of the car counterweight in the hoistway.
2. Access panels or doors in the hoistway for access to car or hoistway transparent enclosures.

3002.7 Common enclosure with stairway. Elevators shall not be in a common shaft enclosure with a stairway.

Exception: Elevators within open parking garages need not be separated from stairway enclosures.

3002.8 Glass in elevator enclosures. Glass in elevator enclosures shall comply with Section 2409.2.

3002.9 Plumbing and mechanical systems. Plumbing and mechanical systems shall not be located in an elevator hoistway enclosure unless permitted by California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

Exception: Floor drains and sumps shall be permitted at the base of the hoistway enclosure provided that they are indirectly connected to the plumbing system. ←

3002.10 Photoelectric tube bypass switch.

3002.10.1 Elevators equipped with photoelectric tube devices which control the closing of automatic, power-operated car or hoistway doors, or both, shall have a switch in the car which, when actuated, will render the photoelectric tube device ineffective.

3002.10.2 The switch shall be constant-pressure type, requiring not less than 10 pounds (44.5N) or more than 15 pounds (66.7 N) pressure to actuate.

3002.10.3 The switch shall be located not less than 6 feet (1829 mm) or more than 6 feet 6 inches (1981 mm) above the car floor and shall be located in or adjacent to the operating panel.

3002.10.4 The switch shall be clearly labeled **TO BE USED IN CASE OF FIRE ONLY**.

3002.10.5 Switches shall be kept in working order or be removed when existing installations are arranged to comply with Section 3002.10.5, Exception 1 or 2.

Exceptions:

1. Elevators installed and maintained in compliance with Section 3003.
2. Where alternate means acceptable to the fire authority having jurisdiction are provided that will ensure the doors can close under adverse smoke conditions.

3002.11 Pit access door. Where separate pit access door(s) are required for access to pit(s) located below the bottom hoistway door landing, permanent stairway access shall be provided to the access door.

SECTION 3003 EMERGENCY OPERATIONS

[F] 3003.1 Standby power. In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with Section 1203 of the California Fire Code and Sections 3003.1.1 through 3003.1.5 of this code.

[F] 3003.1.1 Manual transfer. Standby power shall be manually transferable to all elevators in each bank.

[F] 3003.1.2 One elevator. Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

[F] 3003.1.3 Two or more elevators. Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, not less

than one elevator shall remain operable from the standby power source.

[F] 3003.1.4 Temperature and humidity control. Where standby power is connected to elevators, the machine room machine space, control room and control space ventilation or air conditioning system shall be connected to the standby power source.

3003.1.5 Emergency hoistway venting. Where standby power is connected to elevators, the emergency hoistway ventilation system, if required, shall be connected to the standby power source.

[F] 3003.2 Fire fighters' emergency operation. Elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

3003.2.1 Floor numbers. Elevator hoistways shall have a floor number not less than 4 inches (102 mm) in height, placed on the walls and/or doors of the hoistway at intervals such that a person in a stalled elevator, upon opening the car door, can determine the floor position.

3003.2.1.1 Fire signs. All automatic elevators shall have not less than one sign at each landing printed on a contrasting background in letters not less than 1/2 inch (12.7 mm) high to read: **IN CASE OF FIRE USE STAIRWAY FOR EXIT. DO NOT USE ELEVATOR.**

3003.2.1.2 Call and car operation buttons. Automatic passenger elevators shall have call and car operation buttons within 60 inches (1524 mm) of the floor. Emergency telephones shall also be within 60 inches (1524 mm) of the floor.

[F] 3003.3 Standardized fire service elevator keys. All elevators shall be equipped to operate with a standardized fire service elevator key in accordance with the California Fire Code.

3003.4 Emergency hoistway venting. Elevator hoistways containing the driving machine shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.

3003.4.1 Location of vents. Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air.

3003.4.2 Area of vents. Except as provided for in Section 3003.1.4.4, the area of the vents shall be not less than 3 1/2 percent of the area of the hoistway nor less than 3 square feet (0.28 m²) for each elevator car.

3003.4.3 Operation of vents. Vent openings shall automatically open upon detection of smoke in the elevator hoistway and upon activation of a manual override control. The manual override control shall be capable of opening and closing the vents and shall be located in an approved location. Smoke detectors provided in elevator hoistways to activate the hoistway ventilation system, shall also be required to activate the elevator Phase I emergency recall operation function in accordance with Cali-

California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

3003.4.4 Reduced vent area. Where mechanical ventilation conforming to the California Mechanical Code is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:

1. The vents required by Section 3003.1.4.1 of the California Building Code do not have outside exposure.
2. The hoistway does not extend to the top of the building.
3. The hoistway exhaust fan is automatically reactivated by thermostatic means.
4. Equivalent venting of the hoistway is accomplished.

SECTION 3004 CONVEYING SYSTEMS

3004.1 General. Escalators, moving walks, conveyors, personnel hoists and material hoists shall comply with the provisions of Sections 3004.2 through 3004.4.

3004.2 Escalators and moving walks. Escalators and moving walks shall be constructed of approved noncombustible and fire-retardant materials. This requirement shall not apply to electrical equipment, wiring, wheels, handrails and the use of $\frac{1}{28}$ -inch (0.9 mm) wood veneers on balustrades backed up with noncombustible materials.

3004.2.1 Enclosure. Escalator floor openings shall be enclosed with shaft enclosures complying with Section 713.

3004.2.2 Escalators. Where provided in below-grade transportation stations, escalators shall have a clear width of not less than 32 inches (815 mm).

3004.3 Conveyors. Conveyors and conveying systems shall comply with ASME B20.1.

3004.3.1 Enclosure. Conveyors and related equipment connecting successive floors or levels shall be enclosed with shaft enclosures complying with Section 713.

3004.3.2 Conveyor safeties. Power-operated conveyors, belts and other material-moving devices shall be equipped with automatic limit switches that will shut off the power in an emergency and automatically stop all operation of the device.

3004.4 Personnel and material hoists. Personnel and material hoists shall be designed utilizing an approved method that accounts for the conditions imposed during the intended operation of the hoist device. The design shall include, but is not limited to, anticipated loads, structural stability, impact, vibration, stresses and seismic restraint. The design shall account for the construction, installation, operation and inspection of the hoist tower, car, machinery and control equipment, guide members and hoisting mechanism. Additionally, the design of personnel hoists shall include provisions for field testing and maintenance that will demonstrate that the hoist device functions in accordance with the design. Field tests shall be conducted upon the completion of an installation or following a major alteration of a personnel hoist.

SECTION 3005 MACHINE ROOMS

3005.1 Access. A permanent and approved means of access shall be provided to elevator machine rooms, control rooms, control spaces and machinery spaces.

3005.2 Temperature and humidity control. Elevator machine rooms, machinery spaces that contain the driving machine, and control rooms or spaces that contain the operation or motion controller for elevator operation shall be provided with an independent ventilation or air-conditioning system to protect against the overheating of the electrical equipment. The system shall maintain the temperature and humidity within the range established by the manufacturer of the elevator equipment.

3005.3 Pressurization. The elevator machine room, control rooms or control space with openings into a pressurized elevator hoistway shall be pressurized upon activation of a heat or smoke detector located in the elevator machine room, control room or control space.

3005.4 Machine rooms, control rooms, machinery spaces, and control spaces. The following rooms and spaces shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both:

1. Machine rooms
2. Control rooms
3. Control spaces
4. Machinery spaces outside of the hoistway enclosure

The fire-resistance rating shall be not less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors.

Exceptions:

1. For other than fire service access elevators and occupant evacuation elevators, where machine rooms, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, shall be permitted to be reduced to a 1-hour fire-resistance rating.
2. For other than fire service access elevators and occupant evacuation elevators, in buildings four stories or less above grade plane where machine room, machinery spaces, control rooms and control spaces do not abut and do not have openings to the hoistway enclosure they serve, the machine room, machinery spaces, control rooms and control spaces are not required to be fire-resistance rated.

3005.4.1 Automatic sprinkler system. Automatic sprinklers shall not be required to be installed in the elevator hoistway, elevator machine room, elevator machinery

space, elevator control space or elevator control room where all the following are met:

1. The requirements of NFPA 13, Section 8.15.5.3.
2. The elevator machine room, elevator machinery space, elevator control space or elevator control room shall be enclosed with fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both. The fire-resistance rating shall not be less than the required rating of the hoistway enclosure served by the machinery. Openings in the fire barriers shall be protected with assemblies having a fire protection rating not less than that required for the hoistway enclosure doors. The exceptions to Section 3005.4 shall not apply.

3005.5 Shunt trip. Where elevator hoistways, elevator machine rooms, control rooms and control spaces containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with Section 21.4 of NFPA 72 shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of automatic sprinklers outside the hoistway, machine room, machinery space, control room or control space shall not disconnect the main line power supply.

3005.6 Plumbing systems. Plumbing systems shall not be located in elevator equipment rooms.

SECTION 3006 ELEVATOR LOBBIES AND HOISTWAY OPENING PROTECTION

3006.1 General. Elevator hoistway openings and enclosed elevator lobbies shall be provided in accordance with the following:

1. Where hoistway opening protection is required by Section 3006.2, such protection shall be in accordance with Section 3006.3.
2. Where enclosed elevator lobbies are required for underground buildings, such lobbies shall comply with Section 405.4.3.
3. Where an area of refuge is required and an enclosed elevator lobby is provided to serve as an area of refuge, the enclosed elevator lobby shall comply with Section 1009.6.
4. Where fire service access elevators are provided, enclosed elevator lobbies shall comply with Section 3007.6.
5. Where occupant evacuation elevators are provided, enclosed elevator lobbies shall comply with Section 3008.6.

3006.2 Hoistway opening protection required. Elevator hoistway door openings shall be protected in accordance with Section 3006.3 where an elevator hoistway connects more than two stories in Group A, E, H, I, L, R-1, R-2, R-2.1 and R-2.2 occupancies, high-rise buildings and other applications

listed in Section 1.11 regulated by the Office of the State Fire Marshal, and more than three stories for all other occupancies. Hoistway opening protection is required to be enclosed within a shaft enclosure in accordance with Section 712.1.1 and any of the following conditions apply:

1. The building is not protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Group A occupancies.
3. Group E occupancies.
4. Group H occupancies.
5. Group I occupancies.
6. Group L occupancies.
7. Group R-1, R-2, R-2.1 and R-2.2 occupancies.
8. High-rise buildings.

See Section 403.6 for additional requirements for high-rise buildings.

Exceptions:

1. Protection of elevator hoistway door openings is not required where the elevator serves only open parking garages in accordance with Section 406.5.
2. Protection of elevator hoistway door openings is not required at the level(s) of exit discharge, provided that the level(s) of exit discharge is equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Enclosed elevator lobbies and protection of elevator hoistway door openings are not required on levels where the elevator hoistway opens to the exterior.

3006.2.1 Rated corridors. Where corridors are required to be fire-resistance rated in accordance with Section 1020.2, elevator hoistway openings shall be protected in accordance with Section 3006.3.

3006.3 Hoistway opening protection. Where Section 3006.2 requires protection of the elevator hoistway door opening, the protection shall be provided by one of the following:

1. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by fire partitions in accordance with Section 708. In addition, doors protecting openings in the elevator lobby enclosure walls shall comply with Section 716.2.2.1 as required for corridor walls. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be protected as required for corridors in accordance with Section 717.5.4.1.
2. An enclosed elevator lobby shall be provided at each floor to separate the elevator hoistway shaft enclosure doors from each floor by smoke partitions in accordance with Section 710 where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. In addition, doors protecting openings in the smoke partitions shall comply with Sections 710.5.2.2, 710.5.2.3 and 716.2.6.1. Penetrations of the enclosed elevator lobby by ducts and air transfer openings shall be pro-

tected as required for corridors in accordance with Section 717.5.4.1.

3. Additional doors shall be provided at each elevator hoistway door opening in accordance with Section 3002.6. Such door shall comply with the smoke and draft control door assembly requirements in Section 716.2.2.1.1 when tested in accordance with UL 1784 without an artificial bottom seal.
4. *[SFM]* When approved, in other than Group I-2 occupancies elevator hoistway shall be pressurized in accordance with Section 909.21.
5. *[SFM]* Enclosed elevator lobbies are not required where the hoistway door has a fire-protection rating as required by Section 708.6 and the hoistway door opening is also protected by a listed and labeled smoke containment system complying with ICC ES AC 77.

3006.4 Means of egress. Elevator lobbies shall be provided with not less than one means of egress complying with Chapter 10 and other provisions in this code. Egress through an enclosed elevator lobby shall be permitted in accordance with Item 1 of Section 1016.2.

SECTION 3007 FIRE SERVICE ACCESS ELEVATOR

3007.1 General. Where required by Section 403.6.1, every floor shall be served by fire service access elevators complying with Sections 3007.1 through 3007.9. Except as modified in this section, fire service access elevators shall be installed in accordance with this chapter and *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.*

Exceptions:

1. *Below grade* parking garage floors shall not be required to be served by fire service access elevators.
2. The elevator shall not be required to serve the top floor of a building where that floor is utilized only for equipment for building systems.

3007.2 Automatic sprinkler system. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3007.2.1.

3007.2.1 Prohibited locations. Automatic sprinklers shall not be installed in machine rooms, elevator machinery spaces, control rooms, control spaces and elevator hoistways of fire service access elevators.

3007.2.2 Sprinkler system monitoring. The sprinkler system shall have a sprinkler control valve supervisory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

3007.3 Water protection. Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

3007.4 Shunt trip. Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for fire service access elevators.

3007.5 Hoistway enclosures. The fire service access elevator hoistway shall be located in a shaft enclosure complying with Section 713.

3007.5.1 Structural integrity of hoistway enclosures. The fire service access elevator hoistway enclosure shall comply with Sections 403.2.2.1 through 403.2.2.4.

3007.5.2 Hoistway lighting. When fire-fighters' emergency operation is active, the entire height of the hoistway shall be illuminated at not less than 1 footcandle (11 lux) as measured from the top of the car of each fire service access elevator.

3007.6 Fire service access elevator lobby. The fire service access elevator shall open into an enclosed fire service access elevator lobby in accordance with Sections 3007.6.1 through 3007.6.5. Egress is permitted through the enclosed elevator lobby in accordance with Item 1 of Section 1016.2.

Exception: Where a fire service access elevator has two entrances onto a floor, the second entrance shall be permitted to be protected in accordance with Section 3006.3.

3007.6.1 Access to smokeproof enclosure. The enclosed fire service access elevator lobby shall have direct access from the enclosed elevator lobby to a smokeproof enclosure complying with Section 909.20.

Exception: Access to a smokeproof enclosure shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.

3007.6.2 Lobby enclosure. The fire service access elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3007.6.3.

Exception: Enclosed fire service access elevator lobbies are not required at the levels of exit discharge.

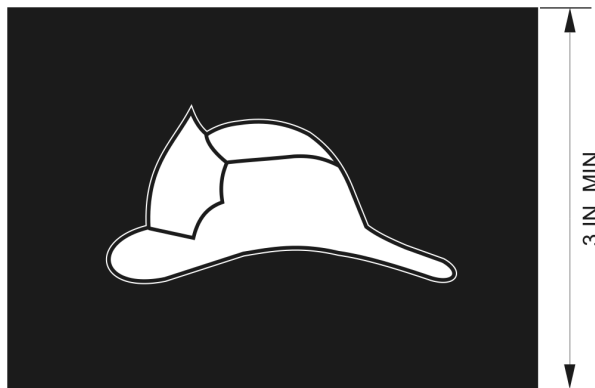
3007.6.3 Lobby doorways. Other than doors to the hoistway, elevator control room or elevator control space, each doorway to an enclosed fire service access elevator lobby shall be provided with a ³/₄-hour fire door assembly complying with Section 716. The fire door assembly shall comply with the smoke and draft control door assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

3007.6.4 Lobby size. Regardless of the number of fire service access elevators served by the same elevator lobby, the enclosed fire service access elevator lobby shall be not less than 150 square feet (14 m²) in an area with a dimension of not less than 8 feet (2440 mm).

3007.6.5 Fire service access elevator symbol. A pictorial symbol of a standardized design designating which elevators are fire service access elevators shall be installed on each side of the hoistway door frame on the portion of the

frame at right angles to the fire service access elevator lobby. The fire service access elevator symbol shall be designed as shown in Figure 3007.6.5 and shall comply with the following:

1. The fire service access elevator symbol shall be not less than 3 inches (76 mm) in height.
2. The helmet shall contrast with the background, with either a light helmet on a dark background or a dark helmet on a light background.
3. The vertical center line of the fire service access elevator symbol shall be centered on the hoistway door frame. Each symbol shall be not less than 78 inches (1981 mm), and not more than 84 inches (2134 mm) above the finished floor at the threshold.



For S.I. 1 inch = 25.4 mm.

**FIGURE 3007.6.5
FIRE SERVICE ACCESS ELEVATOR SYMBOL**

3007.7 Elevator system monitoring. The fire service access elevator shall be continuously monitored at the fire command center by a standard emergency service interface system meeting the requirements of NFPA 72.

3007.8 Electrical power. The following features serving each fire service access elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Elevator hoistway lighting.
3. Ventilation and cooling equipment for elevator machine rooms, control rooms, machine spaces and control spaces.
4. Elevator car lighting.

3007.8.1 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway and machine room and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to fire service access elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and

shall have a fire-resistance rating of not less than 2 hours.

2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

Exception: Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operations.

3007.9 Standpipe hose connection. A Class I standpipe hose connection in accordance with Section 905 shall be provided in the interior exit stairway and ramp having direct access from the enclosed fire service access elevator lobby.

3007.9.1 Access. The exit enclosure containing the standpipe shall have access to the floor without passing through the enclosed fire service access elevator lobby.

SECTION 3008 OCCUPANT EVACUATION ELEVATORS

3008.1 General. Where elevators are to be used for occupant self-evacuation during fires, all passenger elevators for general public use shall comply with Sections 3008.1 through 3008.10. Where other elevators are used for occupant self-evacuation, those elevators shall comply with these sections.

3008.1.1 Reserved.

3008.1.2 Additional exit stairway. Where an additional means of egress is required in accordance with Section 403.5.2, an additional exit stairway shall not be required to be installed in buildings provided with occupant evacuation elevators complying with Section 3008.1.

3008.1.3 Fire safety and evacuation plan. The building shall have an approved fire safety and evacuation plan in accordance with the applicable requirements of Section 404 of the *California Fire Code*. The fire safety and evacuation plan shall incorporate specific procedures for the occupants using evacuation elevators.

3008.1.4 Operation. The occupant evacuation elevators shall be used for occupant self-evacuation in accordance with the occupant evacuation operation requirements in ASME A17.1/CSA B44 and the building's fire safety and evacuation plan.

3008.2 Automatic sprinkler system. The building shall be equipped throughout with an approved, electrically supervised automatic sprinkler system in accordance with Section 903.3.1.1, except as otherwise permitted by Section 903.3.1.1.1 and as prohibited by Section 3008.2.1.

3008.2.1 Prohibited locations. Automatic sprinklers shall not be installed in elevator machine rooms, machinery spaces, control rooms, control spaces and elevator hoistways of occupant evacuation elevators *in accordance with this section and Section 3005.4.1*.

3008.2.2 Sprinkler system monitoring. The automatic sprinkler system shall have a sprinkler control valve super-

ELEVATORS AND CONVEYING SYSTEMS

visory switch and water-flow-initiating device provided for each floor that is monitored by the building's fire alarm system.

3008.3 Water protection. Water from the operation of an automatic sprinkler system outside the enclosed lobby shall be prevented from infiltrating into the hoistway enclosure in accordance with an approved method.

3008.4 Shunt trip. Means for elevator shutdown in accordance with Section 3005.5 shall not be installed on elevator systems used for occupant evacuation elevators.

3008.5 Hoistway enclosure protection. Occupant evacuation elevator hoistways shall be located in shaft enclosures complying with Section 713.

3008.5.1 Structural integrity of hoistway enclosures. Occupant evacuation elevator hoistway enclosures shall comply with Sections 403.2.2.1 through 403.2.2.4.

3008.6 Occupant evacuation elevator lobby. Occupant evacuation elevators shall open into an enclosed elevator lobby in accordance with Sections 3008.6.1 through 3008.6.6. Egress is permitted through the elevator lobby in accordance with Item 1 of Section 1016.2.

3008.6.1 Access to interior exit stairway or ramp. The occupant evacuation elevator lobby shall have direct access from the enclosed elevator lobby to an interior exit stairway or ramp.

Exceptions:

1. Access to an interior exit stairway or ramp shall be permitted to be through a protected path of travel that has a level of fire protection not less than the elevator lobby enclosure. The protected path shall be separated from the enclosed elevator lobby through an opening protected by a smoke and draft control assembly in accordance Section 716.2.2.1.
2. Elevators that only service an open parking garage and the lobby of the building shall not be required to provide direct access.

3008.6.2 Lobby enclosure. The occupant evacuation elevator lobby shall be enclosed with a smoke barrier having a fire-resistance rating of not less than 1 hour, except that lobby doorways shall comply with Section 3008.6.3.

Exception: Enclosed occupant evacuation elevator lobbies are not required at the levels of exit discharge.

3008.6.3 Lobby doorways. Other than the doors to the hoistway, elevator machine rooms, machinery spaces, control rooms and control spaces within the lobby enclosure smoke barrier, each doorway to an occupant evacuation elevator lobby shall be provided with a $3/4$ -hour fire door assembly complying with Section 716. The fire door assembly shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1.1 and be tested in accordance with UL 1784 without an artificial bottom seal.

3008.6.3.1 Vision panel. A vision panel shall be installed in each fire door assembly protecting the lobby doorway. The vision panel shall consist of fire-protection-rated glazing, shall comply with the requirements of Section 716 and shall be located to furnish clear vision of the occupant evacuation elevator lobby.

3008.6.3.2 Door closing. Each fire door assembly protecting the lobby doorway shall be automatic-closing upon receipt of any fire alarm signal from the emergency voice/alarm communication system serving the building.

3008.6.4 Lobby size. Each occupant evacuation elevator lobby shall have minimum floor area as follows:

1. The occupant evacuation elevator lobby floor area shall accommodate, at 3 square feet (0.28 m²) per person, not less than 25 percent of the occupant load of the floor area served by the lobby.
2. The occupant evacuation elevator lobby floor area shall accommodate one wheelchair space of 30 inches by 52 inches (760 mm by 1320 mm) for each 50 persons, or portion thereof, of the occupant load of the floor area served by the lobby.

Exception: The size of lobbies serving multiple banks of elevators shall have the minimum floor area approved on an individual basis and shall be consistent with the building's fire safety and evacuation plan.

3008.6.5 Signage. An approved sign indicating elevators are suitable for occupant self-evacuation shall be posted on all floors adjacent to each elevator call station serving occupant evacuation elevators.

3008.6.6 Two-way communication system. A two-way communication system shall be provided in each occupant evacuation elevator lobby for the purpose of initiating communication with the fire command center or an alternate location approved by the fire department. The two-way communication system shall be designed and installed in accordance with Sections 1009.8.1 and 1009.8.2.

3008.7 Elevator system monitoring. The occupant evacuation elevators shall be continuously monitored at the fire command center or a central control point approved by the fire department and arranged to display all of the following information:

1. Floor location of each elevator car.
2. Direction of travel of each elevator car.
3. Status of each elevator car with respect to whether it is occupied.
4. Status of normal power to the elevator equipment, elevator machinery and electrical apparatus cooling equipment where provided, elevator machine room, control room and control space ventilation and cooling equipment.
5. Status of standby or emergency power system that provides backup power to the elevator equipment, elevator machinery and electrical cooling equipment where pro-

vided, elevator machine room, control room and control space ventilation and cooling equipment.

6. Activation of any fire alarm initiating device in any elevator lobby, elevator machine room, machine space containing a motor controller or electric driving machine, control space, control room or elevator hoistway.

3008.7.1 Elevator recall. The fire command center or an alternate location approved by the fire department shall be provided with the means to manually initiate a Phase I Emergency Recall of the occupant evacuation elevators in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

3008.8 Electrical power. The following features serving each occupant evacuation elevator shall be supplied by both normal power and Type 60/Class 2/Level 1 standby power:

1. Elevator equipment.
2. Ventilation and cooling equipment for elevator machine rooms, control rooms, machinery spaces and control spaces.
3. Elevator car lighting.

3008.8.1 Determination of standby power load. Standby power loads shall be based on the determination of the number of occupant evacuation elevators in Section 3008.1.1.

3008.8.2 Protection of wiring or cables. Wires or cables that are located outside of the elevator hoistway, machine room, control room and control space and that provide normal or standby power, control signals, communication with the car, lighting, heating, air conditioning, ventilation and fire-detecting systems to occupant evacuation elevators shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 2 hours.

Exception: Wiring and cables to control signals are not required to be protected provided that wiring and cables do not serve Phase II emergency in-car operation.

3008.9 Emergency voice/alarm communication system. The building shall be provided with an emergency voice/alarm communication system. The emergency voice/alarm communication system shall be accessible to the fire department. The system shall be provided in accordance with Section 907.5.2.2.

3008.9.1 Notification appliances. Not fewer than one audible and one visible notification appliance shall be installed within each occupant evacuation elevator lobby.

3008.10 Hazardous material areas. Building areas shall not contain hazardous materials exceeding the maximum allowable quantities per control area as addressed in Section 414.2.

SECTION 3009 SPECIAL REQUIREMENTS FOR ELEVATORS IN HOSPITALS

3009.1 General. [OSHPD 1] In hospital buildings, all elevators shall comply with the provisions of this section.

3009.1.1 Seismic switch. The seismic switch, as required by ASME A17.1, shall be connected to the essential electrical system.

3009.1.2 Annunciator. Either a visible or an audible annunciator shall be connected to the essential electrical system and be located in the elevator machine room. The annunciator will indicate if the seismic switch is inoperative due to a loss of power. If a visual annunciator is used, it shall be clearly visible in the room.

3009.1.3 Travel speed. After a seismic switch has been triggered, the elevator shall have the ability to operate at a “go slow” speed until the elevator can be inspected. “Go slow” speed is defined as a travel speed of not more than 150 feet per minute (45.72 meters per minute).

3009.1.4 Cable-operated elevators. For cable-operated elevators, an additional sensor switch shall be installed on the governor rope/sheave. The sensor shall prevent car movement when the governor tail sheave is dislodged from its normal position.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 31 – SPECIAL CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter										X	X	X	X	X	X							
Adopt entire chapter as amendeded (amended sections listed below)				X	X			X	X													
Adopt only those sections that are listed below	X		X			X	X															
Chapter / Section																						
3101			X																			
3102.1			X																			
3102.3	X		X																			
3102.3.1			X																			
3102.6.1.1	X		X																			
3103			X																			
3104			X																			
3104.2, <i>Exception 2</i>						X	X															
3105			X																			
3106			X																			
3109				†	†																	
3109.1								X	X													
3109.2, <i>Note</i>	X																					
3110			X																			
3111			X																			
3111.1.1				X	X																	
3111.1.1, <i>Exception</i>				X	X			X	X													
3111.3								X	X													
3111.3.5 - 3111.3.5.2			X																			
3111.3.6 – 3111.3.6.1			X																			
3112.2				X																		
3112.3, <i>Exception</i>								X	X													
3113				†	†																	
3113.1				X	X			X	X													
3113.1.1								X	X													
3113.2, <i>Exception</i>								X	X													
3113.3, <i>Exception</i>								X	X													
3113.4, <i>Exception</i>								X	X													
3115			X							†	†	†	†	†	†							
3115.1, <i>Exception</i>				X	X			X	X													
3115.6, <i>Exception</i>								X	X													
3115.8.2								X	X													
3115.8.4.1 – 3115.8.4.3								X	X													
3115.8.5								X	X													
3115.9								X	X													

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 31

SPECIAL CONSTRUCTION

User notes:

About this chapter: Chapter 31 provides regulations for unique buildings and building elements. Those include buildings such as membrane structures, greenhouses and relocatable buildings. Special elements include pedestrian walkways and tunnels, awnings, canopies and marquees, vehicular gates, solar energy systems, public use restrooms in flood hazard areas, and intermodal shipping containers.

Code development reminder: Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 3101 GENERAL

3101.1 Scope. The provisions of this chapter shall govern special building construction including membrane structures, temporary structures, pedestrian walkways and tunnels, automatic vehicular gates, awnings and canopies, marquees, signs, towers, antennas, relocatable buildings, swimming pool enclosures and safety devices, solar energy systems, public use restroom buildings on publicly owned lands in flood hazard areas and intermodal shipping containers.

SECTION 3102 MEMBRANE STRUCTURES

3102.1 General. The provisions of Sections 3102.1 through 3102.8 shall apply to air-supported, air-inflated, membrane-covered cable, membrane-covered frame and tensile membrane structures, collectively known as membrane structures, erected for a period of 180 days or longer. Those erected for a shorter period of time shall comply with the *California Fire Code*. Membrane structures covering water storage facilities, water clarifiers, water treatment plants, sewage treatment plants, greenhouses and similar facilities not used for human occupancy are required to meet only the requirements of Sections 3102.3.1 and 3102.7. Membrane structures erected on a building, balcony, deck or other structure for any period of time shall comply with this section.

3102.2 Tensile membrane structures and air-supported structures. Tensile membrane structures and air-supported structures, including permanent and temporary structures, shall be designed and constructed in accordance with ASCE 55. The provisions in Sections 3102.3 through 3102.6 shall apply.

3102.3 Type of construction. Noncombustible membrane structures shall be classified as Type IIB construction. Noncombustible frame or cable-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be classified as Type IIB construction. Heavy timber frame-supported structures covered by an approved membrane in accordance with Section 3102.3.1 shall be clas-

sified as Type IV-HT construction. Other membrane structures shall be classified as Type V construction.

Exception: Plastic less than 30 feet (9144 mm) above any floor used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.3.1 Membrane and interior liner material. Membranes and interior liners shall be either noncombustible as set forth in Section 703.3 *shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8. Tops and sidewalls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).*

Exception: Plastic less than 20 mil (0.5 mm) in thickness used in greenhouses, where occupancy by the general public is not authorized, and for aquaculture pond covers is not required to meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.

3102.4 Allowable floor areas. The area of a membrane structure shall not exceed the limitations specified in Section 506.

3102.5 Maximum height. Membrane structures shall not exceed one story nor shall such structures exceed the height limitations in feet specified in Section 504.3.

Exception: Noncombustible membrane structures serving as roofs only.

3102.6 Mixed construction. Membrane structures shall be permitted to be utilized as specified in this section as a portion of buildings of other types of construction. Height and area limits shall be as specified for the type of construction and occupancy of the building.

3102.6.1 Noncombustible membrane. A noncombustible membrane shall be permitted for use as the roof or as a skylight of any building or atrium of a building of any type

of construction provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

3102.6.1.1 Membrane. A membrane meeting the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall be permitted to be used as the roof or as a skylight on buildings of Type IIB, III, IV-HT and V construction, provided that the membrane is not less than 20 feet (6096 mm) above any floor, balcony or gallery.

3102.7 Engineering design. The structure shall be designed and constructed to sustain dead loads; loads due to tension or inflation; live loads including wind, snow or flood and seismic loads and in accordance with Chapter 16.

3102.7.1 Lateral restraint. For membrane-covered frame structures, the membrane shall not be considered to provide lateral restraint in the calculation of the capacities of the frame members.

3102.8 Inflation systems. Air-supported and air-inflated structures shall be provided with primary and auxiliary inflation systems to meet the minimum requirements of Sections 3102.8.1 through 3102.8.3.

3102.8.1 Equipment requirements. The inflation system shall consist of one or more blowers and shall include provisions for automatic control to maintain the required inflation pressures. The system shall be so designed as to prevent overpressurization of the system.

3102.8.1.1 Auxiliary inflation system. In addition to the primary inflation system, in buildings larger than 1,500 square feet (140 m²) in area, an auxiliary inflation system shall be provided with sufficient capacity to maintain the inflation of the structure in case of primary system failure. The auxiliary inflation system shall operate automatically when there is a loss of internal pressure and when the primary blower system becomes inoperative.

3102.8.1.2 Blower equipment. Blower equipment shall meet all of the following requirements:

1. Blowers shall be powered by continuous-rated motors at the maximum power required for any flow condition as required by the structural design.
2. Blowers shall be provided with inlet screens, belt guards and other protective devices as required by the building official to provide protection from injury.
3. Blowers shall be housed within a weather-protecting structure.
4. Blowers shall be equipped with backdraft check dampers to minimize air loss when inoperative.
5. Blower inlets shall be located to provide protection from air contamination. The location of inlets shall be approved.

3102.8.2 Standby power. Wherever an auxiliary inflation system is required, an approved standby power-generating

system shall be provided. The system shall be equipped with a suitable means for automatically starting the generator set upon failure of the normal electrical service and for automatic transfer and operation of all of the required electrical functions at full power within 60 seconds of such service failure. Standby power shall be capable of operating independently for not less than 4 hours.

3102.8.3 Support provisions. A system capable of supporting the membrane in the event of deflation shall be provided for in air-supported and air-inflated structures having an occupant load of 50 or more or where covering a swimming pool regardless of occupant load. The support system shall be capable of maintaining membrane structures used as a roof for Type I construction not less than 20 feet (6096 mm) above floor or seating areas. The support system shall be capable of maintaining other membranes not less than 7 feet (2134 mm) above the floor, seating area or surface of the water.

SECTION 3103 TEMPORARY STRUCTURES

3103.1 General. The provisions of Sections 3103.1 through 3103.4 shall apply to structures erected for a period of less than 180 days. Special event structures, tents, umbrella structures and other membrane structures erected for a period of less than 180 days shall also comply with the *California Fire Code*. Those erected for a longer period of time shall comply with applicable sections of this code.

3103.1.1 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure public health, safety and general welfare.

3103.1.2 Permit required. Temporary structures that cover an area greater than 120 square feet (11.16 m²), including connecting areas or spaces with a common means of egress or entrance that are used or intended to be used for the gathering together of 10 or more persons, shall not be erected, operated or maintained for any purpose without obtaining a permit from the building official.

3103.2 Construction documents. A permit application and construction documents shall be submitted for each installation of a temporary structure. The construction documents, shall include a site plan indicating the location of the temporary structure and information delineating the means of egress and the occupant load.

3103.3 Location. Temporary structures shall be located in accordance with the requirements of Table 705.5 based on the fire-resistance rating of the exterior walls for the proposed type of construction.

3103.4 Means of egress. Temporary structures shall conform to the means of egress requirements of Chapter 10 and shall have an exit access travel distance of 100 feet (30 480 mm) or less.

SECTION 3104 PEDESTRIAN WALKWAYS AND TUNNELS

3104.1 General. This section shall apply to connections between buildings such as pedestrian walkways or tunnels, located at, above or below grade level, that are used as a means of travel by persons. The pedestrian walkway shall not contribute to the building area or the number of stories or height of connected buildings.

3104.1.1 Application. Pedestrian walkways shall be designed and constructed in accordance with Sections 3104.2 through 3104.9. Tunnels shall be designed and constructed in accordance with Sections 3104.2 and 3104.10.

3104.2 Separate structures. Buildings connected by pedestrian walkways or tunnels shall be considered to be separate structures.

Exceptions:

1. Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.
2. *[DSA-AC and HCD I-AC] For purposes of accessibility in residential facilities as required by Chapters 11A and 11B, structurally connected buildings, buildings connected by stairs, walkways or roofs, and buildings with multiple wings shall be considered one structure.*

3104.3 Construction. The pedestrian walkway shall be of noncombustible construction.

Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. Fire-retardant-treated wood, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the pedestrian walkway where connected buildings are not less than Type I or II construction.

3104.4 Contents. Only materials and decorations approved by the building official shall be located in the pedestrian walkway.

3104.5 Connections of pedestrian walkways to buildings. The connection of a pedestrian walkway to a building shall comply with Section 3104.5.1, 3104.5.2, 3104.5.3 or 3104.5.4.

Exception: Buildings that are on the same lot and considered as portions of a single building in accordance with Section 503.1.2.

3104.5.1 Fire barriers. Pedestrian walkways shall be separated from the interior of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 and Sections 3104.5.1.1 through 3104.5.1.3.

3104.5.1.1 Exterior walls. Exterior walls of buildings connected to pedestrian walkways shall be 2-hour fire-resistance rated. This protection shall extend not less

than 10 feet (3048 mm) in every direction surrounding the perimeter of the pedestrian walkway.

3104.5.1.2 Openings in exterior walls of connected buildings. Openings in exterior walls required to be fire-resistance rated in accordance with Section 3104.5.1.1 shall be equipped with opening protectives providing a not less than $\frac{3}{4}$ -hour fire protection rating in accordance with Section 716.

3104.5.1.3 Supporting construction. The fire barrier shall be supported by construction as required by Section 707.5.1.

3104.5.2 Alternative separation. The wall separating the pedestrian walkway and the building shall comply with Section 3104.5.2.1 or 3104.5.2.2 where:

1. The distance between the connected buildings is more than 10 feet (3048 mm).
2. The pedestrian walkway and connected buildings are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, and the roof of the walkway is not more than 55 feet (16 764 mm) above grade connecting to the fifth, or lower, story above grade plane, of each building.

Exception: Open parking garages need not be equipped with an automatic sprinkler system.

3104.5.2.1 Passage of smoke. The wall shall be capable of resisting the passage of smoke.

3104.5.2.2 Glass. The wall shall be constructed of a tempered, wired or laminated glass and doors separating the interior of the building from the pedestrian walkway. The glass shall be protected by an automatic sprinkler system in accordance with Section 903.3.1.1 that, when actuated, shall completely wet the entire surface of interior sides of the wall or glass. Obstructions shall not be installed between the sprinkler heads and the wall or glass. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.

3104.5.3 Open sides on walkway. Where the distance between the connected buildings is more than 10 feet (3048 mm), the walls at the intersection of the pedestrian walkway and each building need not be fire-resistance rated provided that both sidewalls of the pedestrian walkway are not less than 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and toxic gases. The roof of the walkway shall be located not more than 40 feet (12 160 mm) above grade plane, and the walkway shall only be permitted to connect to the third or lower story of each building.

Exception: Where the pedestrian walkway is protected with an automatic sprinkler system in accordance with Section 903.3.1.1, the roof of the walkway shall be located not more than 55 feet (16 764 mm) above grade plane and the walkway shall only be permitted to connect to the fifth or lower story of each building.

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3104.5.4 Exterior walls greater than 2 hours. Where exterior walls of connected buildings are required by Section 705 to have a fire-resistance rating greater than 2 hours, the walls at the intersection of the pedestrian walkway and each building need not be fire-resistance rated provided:

1. The pedestrian walkway is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. The roof of the walkway is not located more than 55 feet (16 764 mm) above grade plane and the walkway connects to the fifth, or lower, story above grade plane of each building.

3104.6 Public way. Pedestrian walkways over a public way shall comply with Chapter 32.

3104.7 Egress. Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

3104.8 Width. The unobstructed width of pedestrian walkways shall be not less than 36 inches (914 mm). The total width shall be not greater than 30 feet (9144 mm).

3104.9 Exit access travel. The length of exit access travel shall be 200 feet (60 960 mm) or less.

Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be 250 feet (76 200 mm) or less.
2. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open shall be 300 feet (91 440 mm) or less.
3. Exit access travel distance on a pedestrian walkway constructed with both sides not less than 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, shall be 400 feet (122 m) or less.

3104.10 Tunneled walkway. Separation between the tunneled walkway and the building to which it is connected shall be not less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Section 716.

SECTION 3105 AWNINGS AND CANOPIES

3105.1 General. Awnings and canopies shall comply with the requirements of Sections 3105.2 and 3105.3 and other applicable sections of this code.

3105.2 Design and construction. Awnings and canopies shall be designed and constructed to withstand wind or other lateral loads and live loads as required by Chapter 16 with due allowance for shape, open construction and similar features that relieve the pressures or loads. Structural members shall be protected to prevent deterioration. Awnings shall have frames of noncombustible material, fire-retardant-treated wood, heavy timber complying with Section 2304.11,

or 1-hour construction with combustible or noncombustible covers and shall be either fixed, retractable, folding or collapsible.

3105.3 Awnings and canopy materials. Awnings and canopies shall be provided with an approved covering that complies with one of the following:

1. The fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
2. Has a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723.
3. Meets all of the following criteria when tested in accordance with NFPA 286:
 - 3.1. During the 40 kW exposure, flames shall not spread to the ceiling.
 - 3.2. Flashover, as defined in NFPA 286, shall not occur.
 - 3.3. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
 - 3.4. The peak heat release rate throughout the test shall not exceed 800 kW.

All fabrics and all interior decorative fabrics or materials shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8. Tops and side-walls shall be made either from fabric that has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame resistant fabric approved and listed by the State Fire Marshal (see CCR, Title 19, Division 1, Chapter 8).

Exception: The fire propagation performance and flame spread index requirements shall not apply to awnings installed on detached one- and two-family dwellings.

SECTION 3106 MARQUEES

3106.1 General. Marquees shall comply with Sections 3106.2 through 3106.5 and other applicable sections of this code.

3106.2 Thickness. The height or thickness of a *marquee* measured vertically from its lowest to its highest point shall be not greater than 3 feet (914 mm) where the marquee projects more than two-thirds of the distance from the lot line to the curb line, and shall be not greater than 9 feet (2743 mm) where the marquee is less than two-thirds of the distance from the lot line to the curb line.

3106.3 Roof construction. Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

3106.4 Location prohibited. Every marquee shall be so located as not to interfere with the operation of any exterior standpipe, and such that the marquee does not obstruct the

clear passage of stairways or exit discharge from the building or the installation or maintenance of street lighting.

3106.5 Construction. A marquee shall be supported entirely from the building and constructed of noncombustible materials. Marquees shall be designed as required in Chapter 16. Structural members shall be protected to prevent deterioration.

SECTION 3107 SIGNS

3107.1 General. Signs shall be designed, constructed and maintained in accordance with this code.

SECTION 3108 TELECOMMUNICATION AND BROADCAST TOWERS

[BS] 3108.1 General. Towers shall be designed and constructed in accordance with the provisions of TIA 222. Towers shall be designed for seismic loads; exceptions related to seismic design listed in Section 2.7.3 of TIA 222 shall not apply. In Section 2.6.6.2 of TIA 222, the horizontal extent of Topographic Category 2, escarpments, shall be 16 times the height of the escarpment.

Exception: Single free-standing poles used to support antennas not greater than 75 feet (22 860 mm), measured from the top of the pole to grade, shall not be required to be noncombustible.

[BS] 3108.2 Location and access. Towers shall be located such that guy wires and other accessories shall not cross or encroach on any street or other public space, or over above-ground electric utility lines, or encroach on any privately owned property without the written consent of the owner of the encroached-upon property, space or above-ground electric utility lines. Towers shall be equipped with climbing and working facilities in compliance with TIA 222. Access to the tower sites shall be limited as required by applicable OSHA, FCC and EPA regulations.

SECTION 3109 SWIMMING POOLS, SPAS AND HOT TUBS

3109.1 General. The design and construction of swimming pools, spas and hot tubs shall comply with the *International Swimming Pool and Spa Code*. *[DSA-SS and DSA-SS/CC] Swimming pools utilized for public school purposes shall also be designed, constructed and inspected in accordance with this code.*

3109.2 California swimming pool safety act (statewide).

NOTE: These regulations are subject to local government modification. You should verify the applicable local government requirements at the time of application for a building permit.

The following text in this section contains the statutory language in the Swimming Pool Safety Act (HS Code, §§ 115920 – 115929) that is required to be duplicated and published in

California Code of Regulations, Title 24. As such, the section numbers reflect those within the Health and Safety Code.

115920. *This act shall be known and may be cited as the Swimming Pool Safety Act.*

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115921. *As used in this article the following terms have the following meanings:*

(a) *“Swimming pool” or “pool” means any structure intended for swimming or recreational bathing that contains water over 18 inches deep. “Swimming pool” includes in-ground and aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas and nonportable wading pools.*

(b) *“Public swimming pool” means a swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club. Public swimming pool does not include a swimming pool located on the grounds of a private single-family home.*

(c) *“Enclosure” means a fence, wall or other barrier that isolates a swimming pool from access to the home.*

(d) *“Approved safety pool cover” means a manually or power-operated safety pool cover that meets all of the performance standards of the American Society for Testing and Materials (ASTM), in compliance with standard F1346-91.*

(e) *“Exit alarms” means devices that make audible, continuous alarm sounds when any door or window, that permits access from the residence to the pool area that is without any intervening enclosure, is opened or is left ajar. Exit alarms may be battery operated or may be connected to the electrical wiring of the building.*

(f) *“ANSI/APSP performance standard” means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).*

(g) *“Suction outlet” means a fitting or fixture typically located at the bottom or on the sides of a swimming pool that conducts water to a recirculating pump.*

[Amended by Stats. 2012, Ch. 679, Sec. 1. (AB 2114) Effective January 1, 2013.]

115922. (a) *Except as provided in Section 115925, when a building permit is issued for the construction of a new swimming pool or spa or the remodeling of an existing swimming pool or spa at a private single-family home, the respective swimming pool or spa shall be equipped with at least two of the following seven drowning prevention safety features:*

(1) *An enclosure that meets the requirements of Section 115923 and isolates the swimming pool or spa from the private single-family home.*

(2) *Removable mesh fencing that meets American Society for Testing and Materials (ASTM) Specifications F2286 standards in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device.*

(3) An approved safety pool cover, as defined in subdivision (d) of Section 115921.

(4) Exit alarms on the private single-family home's doors that provide direct access to the swimming pool or spa. The exit alarm may cause either an alarm noise or a verbal warning, such as a repeating notification that "the door to the pool is open."

(5) A self-closing, self-latching device with a release mechanism placed no lower than 54 inches above the floor on the private single-family home's doors providing direct access to the swimming pool or spa.

(6) An alarm that, when placed in a swimming pool or spa, will sound upon detection of accidental or unauthorized entrance into the water. The alarm shall meet and be independently certified to the ASTM Standard F2208 "Standard Safety Specification for Residential Pool Alarms," which includes surface motion, pressure, sonar, laser and infrared type alarms. A swimming protection alarm feature designed for individual use, including an alarm attached to a child that sounds when the child exceeds a certain distance or becomes submerged in water, is not a qualifying drowning prevention safety feature.

(7) Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the features set forth above and has been independently verified by an approved testing laboratory as meeting standards for those features established by the ASTM or the American Society of Mechanical Engineers (ASME).

(b) Before the issuance of a final approval for the completion of permitted construction or remodeling work, the local building code official shall inspect the drowning safety prevention features required by this section and, if no violations are found, shall give final approval.

[Amended by Stats. 2017, Ch. 670, Sec. 4. (SB 442) Effective January 1, 2018.]

115923. An enclosure shall have all of the following characteristics:

(a) Any access gates through the enclosure open away from the swimming pool, and are self-closing with a self-latching device placed no lower than 60 inches above the ground.

(b) A minimum height of 60 inches.

(c) A maximum vertical clearance from the ground to the bottom of the enclosure of two inches.

(d) Gaps or voids, if any, do not allow passage of a sphere equal to or greater than four inches in diameter.

(e) An outside surface free of protrusions, cavities or other physical characteristics that would serve as handholds or footholds that could enable a child below the age of five years to climb over.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115924. (a) Any person entering into an agreement to build a swimming pool or spa, or to engage in permitted work on a

pool or spa covered by this article, shall give the consumer notice of the requirements of this article.

(b) Pursuant to existing law, the Department of Health Services shall have available on the department's Web site, commencing January 1, 2007, approved pool safety information available for consumers to download. Pool contractors are encouraged to share this information with consumers regarding the potential dangers a pool or spa poses to toddlers. Additionally, pool contractors may provide the consumer with swimming pool safety materials produced from organizations such as the United States Consumer Product Safety Commission, Drowning Prevention Foundation, California Coalition for Children's Safety & Health, Safe Kids Worldwide, Association of Pool and Spa Professionals, or the American Academy of Pediatrics.

(Amended by Stats. 2006, Ch. 478, Sec. 3. Effective January 1, 2007.)

115925. The requirements of this article do not apply to any of the following:

(a) Public swimming pools.

(b) Hot tubs or spas with locking safety covers that comply with the American Society for Testing and Materials (ASTM F1346).

(c) An apartment complex or any residential setting other than a single-family home.

[Amended by Stats. 2017, Ch. 670, Sec. 5. (SB 442) Effective January 1, 2018.]

115926. This article does not apply to any facility regulated by the State Department of Social Services even if the facility is also used as the private residence of the operator. Pool safety in those facilities shall be regulated pursuant to regulations adopted therefor by the State Department of Social Services.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115927. Notwithstanding any other provision of law, this article shall not be subject to further modification or interpretation by any regulatory agency of the state, this authority being reserved exclusively to local jurisdictions, as provided for in paragraph (7) subdivision (a) of Section 115922 and subdivision (c) of Section 115925.

(Amended by Stats. 2018, Ch. 957, Sec. 13. (SB 1078) Effective January 1, 2019.)

115928. Whenever a building permit is issued for the construction of a new swimming pool or spa, the pool or spa shall meet all of the following requirements:

(a) (1) The suction outlets of the pool or spa for which the permit is issued shall be equipped to provide circulation throughout the pool or spa as prescribed in paragraphs (2) and (3).

(2) The swimming pool or spa shall either have at least two circulation suction outlets per pump that shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets, or be designed to use

alternatives to suction outlets, including, but not limited to, skimmers or perimeter overflow systems to conduct water to the recirculation pump.

(3) The circulation system shall have the capacity to provide a complete turnover of pool water, as specified in Section 3124B of Chapter 31B of the California Building Standards Code (Title 24 of the California Code of Regulations).

(b) Suction outlets shall be covered with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or successor standard designated by the federal Consumer Product Safety Commission, that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.

(c) Any backup safety system that an owner of a new swimming pool or spa may choose to install in addition to the requirements set forth in subdivisions (a) and (b) shall meet the standards as published in the document, "Guidelines for Entrapment Hazards: Making Pools and Spas Safer," Publication Number 363, March 2005, United States Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 2. (AB 2114) Effective January 1, 2013.]

115928.5. Whenever a building permit is issued for the remodel or modification of an existing swimming pool, toddler pool or spa, the permit shall require that the suction outlet or suction outlets of the existing swimming pool, toddler pool or spa be upgraded so as to be equipped with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or a successor standard designated by the federal Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 3. (AB 2114) Effective January 1, 2013.]

115929. (a) The Legislature encourages a private entity, in consultation with the Epidemiology and Prevention for Injury Control Branch of the department, to produce an informative brochure or booklet, for consumer use, explaining the child drowning hazards of, possible safety measures for, and appropriate drowning hazard prevention measures for, home swimming pools and spas, and to donate the document to the department.

(b) The Legislature encourages the private entity to use existing documents from the United States Consumer Product Safety Commission on pool safety.

(c) If a private entity produces the document described in subdivisions (a) and (b) and donates it to the department, the department shall review and approve the brochure or booklet.

(d) Upon approval of the document by the department, the document shall become the property of the state and a part of the public domain. The department shall place the document on its Web site in a format that is readily available for downloading and for publication. The department shall review the document in a timely and prudent fashion

and shall complete the review within 18 months of receipt of the document from a private entity.

(Added by Stats. 2003, Ch. 422, Sec. 3. Effective January 1, 2004.)

SECTION 3110 AUTOMATIC VEHICULAR GATES

3110.1 General. Automatic vehicular gates shall comply with the requirements of Sections 3110.2 and 3110.3 and other applicable sections of this code.

3110.2 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

3110.3 Vehicular gate openers. Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

SECTION 3111 SOLAR ENERGY SYSTEMS

3111.1 General. Solar energy systems shall comply with the requirements of this section.

3111.1.1 Wind resistance. Rooftop-mounted photovoltaic (PV) panel systems and solar thermal collectors shall be designed in accordance with Section 1609.

Exception: [DSA-SS, DSA-SS/CC, HCD-1, HCD-2] Rooftop-mounted photovoltaic (PV) panel systems and solar thermal collectors shall be designed in accordance with Section 1511.9 of this code.

3111.1.2 Roof live load. Roof structures that provide support for solar energy systems shall be designed in accordance with Section 1607.14.4.

3111.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with this section, the California Plumbing Code, the California Mechanical Code and the California Fire Code. Where light-transmitting plastic covers are used, solar thermal collectors shall be designed in accordance with Section 2606.12.

3111.2.1 Equipment. Solar thermal systems and components shall be listed and labeled in accordance with ICC 900/SRCC 300 and ICC 901/SRCC 100.

3111.3 Photovoltaic solar energy systems. Photovoltaic solar energy systems shall be designed and installed in accordance with this section, the California Fire Code, the California Electrical Code and the manufacturer's installation instructions.

3111.3.1 Equipment. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction.

3111.3.2 Fire classification. Rooftop-mounted photovoltaic (PV) panel systems shall have a fire classification in accordance with Section 1505.9. Building-integrated

photovoltaic (BIPV) systems installed as roof coverings shall have a fire classification in accordance with Section 1505.8.

3111.3.3 Building-integrated photovoltaic (BIPV) systems. BIPV systems installed as roof coverings shall be designed and installed in accordance with Section 1507.

3111.3.4 Access and pathways. Roof access, pathways and spacing requirements shall be provided in accordance with Section 1205 of the *California Fire Code*.

3111.3.5 Elevated photovoltaic (PV) support structures. *Elevated PV support structures shall comply with either 3111.3.5.1 or 3111.3.5.2.*

Exception: Elevated PV support structures that are installed over agricultural use.

3111.3.5.1 PV panels installed over open grid framing or noncombustible deck. *Elevated PV support structures with PV panels installed over open grid framing or over a noncombustible deck shall have PV panels tested, listed and labeled with a fire type rating in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Photovoltaic panels marked “not fire rated” shall not be installed on elevated PV support structures.*

3111.3.5.2 PV panels installed over a roof assembly. *Elevated PV support structures with a PV panel system installed over a roof assembly shall have a fire classification in accordance with Section 1505.9.*

3111.3.6 Ground-mounted photovoltaic (PV) panel systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with Chapter 16 and the *California Fire Code*.

3111.3.6.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the fire separation distance requirements determined by the local jurisdiction.

SECTION 3112 GREENHOUSES

3112.1 General. The provisions of this section shall apply to greenhouses that are designed and used for the cultivation, maintenance, or protection of plants.

3112.2 Accessibility. Greenhouses shall be accessible in accordance with Chapter 11. *[HCD 1] Greenhouses accessory to covered multifamily dwellings, as defined in Chapter 2, used as a common use facility, shall be on an accessible route in accordance with Chapter 11A.*

3112.3 Structural design. Greenhouses shall comply with the structural design requirements for greenhouses in Chapter 16.

Exception: [DSA-SS and DSA-SS/CC] Greenhouses considered to be school buildings shall comply with the structural design requirements in Chapter 16A and in accordance with Part 1, California Administrative Code, Title 24, CCR.

3112.4 Glass and glazing. Glass and glazing used in greenhouses shall comply with Section 2405.

3112.5 Light-transmitting plastics. Light-transmitting plastics shall be permitted in lieu of plain glass in greenhouses and shall comply with Section 2606.

3112.6 Membrane structures. Greenhouses that are membrane structures shall comply with Section 3102.

3112.6.1 Plastic film. Plastic films used in greenhouses shall comply with Section 3102.3.

SECTION 3113 RELOCATABLE BUILDINGS

3113.1 General. The provisions of this section shall apply to relocatable buildings. Relocatable buildings manufactured after the effective date of this code shall comply with the applicable provisions of this code. *[DSA-SS and DSA-SS/CC] as enforced by the enforcement agency.*

Exception: This section shall not apply to manufactured housing used as dwellings.

[HCD] The provisions of Section 3113 are not applicable to commercial modulares, manufactured homes, mobilehomes, multi-unit manufactured housing and special purpose commercial modulares as defined in Health and Safety Code Sections 18001.8, 18007, 18008, 18008.7 and 18012.5, respectively. These structures are subject to installation/reinstallation requirements specified in the Mobile-home Parks Act (Health and Safety Code Section 18200 et seq.) and the California Code of Regulations, Title 25, Division 1, Chapter 2. Manufactured homes must meet unit identification (data plate) and certification label requirements as specified in the Code of Federal Regulations, Title 24, Subtitle B, Chapter XX, Part 3280 and Health and Safety Code Section 18032. Commercial modulares and special purpose commercial modulares must meet identification requirements in the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 2.

3113.1.1 Compliance. A newly constructed relocatable building shall comply with the requirements of this code for new construction. *[DSA-SS and DSA-SS/CC] as enforced by the enforcement agency.* An existing relocatable building that is undergoing alteration, addition, change of occupancy or relocation shall comply with Chapter 14 of the *California Existing Building Code*.

Exception: [DSA-SS and DSA-SS/CC] An existing relocatable public school building that is undergoing alteration, addition or change of occupancy shall comply with Chapter 3 of the California Existing Building Code.

3113.2 Supplemental information. Supplemental information specific to a relocatable building shall be submitted to the authority having jurisdiction. It shall, as a minimum, include the following in addition to the information required by Section 105:

Exception: [DSA-SS and DSA-SS/CC] Supplemental information specific to a relocatable building shall be submitted to the enforcement agency. It shall, as a minimum,

include the following in addition to the information required by Section 1603A:

1. Manufacturer's name and address.
2. Date of manufacture.
3. Serial number of module.
4. Manufacturer's design drawings.
5. Type of construction in accordance with Section 602.
6. Design loads including: roof live load, roof snow load, floor live load, wind load and seismic site class, use group and design category.
7. Additional building planning and structural design data.
8. Site-built structure or appurtenance attached to the relocatable building.

3113.3 Manufacturer's data plate. Each relocatable module shall have a data plate that is permanently attached on or adjacent to the electrical panel, and shall include the following information:

1. Occupancy group.
2. Manufacturer's name and address.
3. Date of manufacture.
4. Serial number of module.
5. Design roof live load, design floor live load, snow load, wind and seismic design.
6. Approved quality assurance agency or approved inspection agency.
7. Codes and standards of construction.
8. Envelope thermal resistance values.
9. Electrical service size.
10. Fuel-burning equipment and size.
11. Special limitations if any.

Exception: [DSA-SS and DSA-SS/CC] Each relocatable module shall have two metal identification labels permanently attached to the structure as enforced by the enforcement agency.

3113.4 Inspection agencies. The building official is authorized to accept reports of inspections conducted by approved inspection agencies during off-site construction of the relocatable building, and to satisfy the applicable requirements of Sections 110.3 through 110.3.12.1.

Exception: [DSA-SS and DSA-SS/CC] Each relocatable module shall be inspected during construction and installation at the project site by project inspectors acceptable to the enforcement agency in accordance with Part 1, California Administrative Code, Title 24, CCR.

SECTION 3114 PUBLIC USE RESTROOM BUILDINGS IN FLOOD HAZARD AREAS

3114.1 General. For the purpose of this section, public restroom buildings are located on publicly owned lands in

flood hazard areas and intended for public use. Public restroom buildings and portions of other buildings that contain public restrooms are limited to toilet rooms, bathrooms, showers and changing rooms. Public restroom buildings and portions of buildings that contain public restrooms shall comply with the requirements of this section. Public-use restrooms that are not elevated or dry flood-proofed in accordance with Section 1612 shall comply with Section 3114.2. Portions of buildings that include uses other than public-use toilet rooms, bathrooms, showers and changing rooms shall comply with Section 1612.

3114.2 Flood resistance. Public-use restrooms on publicly owned lands in flood hazard areas shall comply with the requirements of ASCE 24, except for elevation requirements, and shall comply with all of the following criteria:

1. The building footprint is not more than 1,500 square feet (139 m²).
2. Located, designed and constructed to resist the effects of flood hazards and flood loads to minimize flood damage from a combination of wind and water loads associated with the base flood.
3. Anchored to prevent flotation, collapse or lateral movement resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy during conditions of the base flood.
4. Constructed of flood-damage-resistant materials.
5. Where enclosed by walls, the walls have flood openings.
6. Mechanical and electrical systems are located above the base flood elevation.
7. Plumbing fixtures and plumbing connections are located above the base flood elevation.
8. An emergency plan, approved by the jurisdiction, is submitted to the building official and includes building design documents specifying implementation of protection measures prior to the onset of flooding conditions.

Exceptions:

1. Minimum necessary electric equipment required to address health, life safety and electric code requirements is permitted below the base flood elevation in accordance with ASCE 24 provisions for electric elements installed below the minimum elevations.
2. Plumbing fixtures and connections are permitted below the base flood elevation provided that the fixtures and connections are designed and installed to minimize or eliminate infiltration of floodwaters into the sanitary sewage system and discharges from sanitary sewage systems into floodwaters.

SECTION 3115 INTERMODAL SHIPPING CONTAINERS

Not permitted by OSHPD.

3115.1 General. The provisions of Section 3115 and other applicable sections of this code shall apply to intermodal

shipping containers that are repurposed for use as buildings or structures, or as a part of buildings or structures.

Exceptions: *[DSA-SS & DSA-SS/CC] Not permitted by DSA.*

1. Intermodal shipping containers previously approved as existing relocatable buildings complying with Chapter 14 of the *California Existing Building Code*.
2. Stationary storage battery arrays located in intermodal shipping containers complying with Chapter 12 of the *California Fire Code*.
3. Intermodal shipping containers that are listed as equipment complying with the standard for equipment, such as air chillers, engine generators, modular data centers, and other similar equipment.
4. Intermodal shipping containers housing or supporting experimental equipment are exempt from the requirements of Section 3115, provided that they comply with all of the following:
 - 4.1. Such units shall be single stand-alone units supported at grade level and used only for occupancies as specified under Risk Category I in Table 1604.5.
 - 4.2. Such units are located a minimum of 8 feet (2438 mm) from adjacent structures, and are not connected to a fuel gas system or fuel gas utility.
 - 4.3. In hurricane-prone regions and flood hazard areas, such units are designed in accordance with the applicable provisions of Chapter 16.
5. *[HCD] Shipping containers constructed or converted off-site that meet the definition of Factory-built Housing in Health and Safety Code Section 19971 or Commercial Modular(s) as defined in Health and Safety Code Section 18001.8 shall be approved by the Department of Housing and Community Development.*

3115.2 Construction documents. The construction documents shall contain information to verify the dimensions and establish the physical properties of the steel components and wood floor components of the intermodal shipping container, in addition to the information required by Sections 107 and 1603.

3115.3 Intermodal shipping container information. Intermodal shipping containers shall bear an existing data plate containing the following information as required by ISO 6346 and verified by an approved agency. A report of the verification process and findings shall be provided to the building owner.

1. Manufacturer's name or identification number.
2. Date manufactured.
3. Safety approval number.
4. Identification number.
5. Maximum operating gross mass or weight (kg) (lbs).

6. Allowable stacking load for 1.8G (kg) (lbs).
7. Transverse racking test force (Newtons).
8. Valid maintenance examination date.

Where approved by the building official, the markings and existing data plate are permitted to be removed from the intermodal shipping containers before they are repurposed for use as buildings or structures or as a part of buildings or structures.

3115.4 Protection against decay and termites. Wood structural floors of intermodal shipping containers shall be protected from decay and termites in accordance with the applicable provisions of Section 2304.12.1.1.

3115.5 Under-floor ventilation. The space between the bottom of the floor joists and the earth under any intermodal shipping container, except spaces occupied by basements and cellars, shall be provided with ventilation in accordance with Section 1202.4.

3115.6 Roof assemblies. Intermodal shipping container roof assemblies shall comply with the applicable requirements of Chapter 15.

Exception: Single-unit, stand-alone intermodal shipping containers not attached to, or stacked vertically over, other intermodal shipping containers, buildings or structures. *[DSA-SS & DSA-SS/CC] Not permitted by DSA.*

3115.7 Joints and voids. Joints and voids that create concealed spaces between connected or stacked intermodal shipping containers at fire-resistance-rated walls, floor or floor/ceiling assemblies and roofs or roof/ceiling assemblies shall be protected by an approved fire-resistant joint system in accordance with Section 715.

3115.8 Structural. Intermodal shipping containers that conform to ISO 1496-1 and are repurposed for use as buildings or structures, or as a part of buildings or structures, shall be designed in accordance with Chapter 16 and this section.

3115.8.1 Foundations. Intermodal shipping containers repurposed for use as a permanent building or structure shall be supported on foundations or other supporting structures designed and constructed in accordance with Chapters 16 through 23.

3115.8.1.1 Anchorage. Intermodal shipping containers shall be anchored to foundations or other supporting structures as necessary to provide a continuous load path for all applicable design and environmental loads in accordance with Chapter 16.

3115.8.2 Welds. New welds and connections shall be equal to or greater than the original connections.

[DSA-SS & DSA-SS/CC] The strength of new welds and connections shall be no less than the strength provided by the original connections. All new welds and connections shall be designed and constructed in accordance with Chapters 16, 17 and 22.

3115.8.3 Structural design. The structural design for the intermodal shipping containers repurposed for use as a building or structure, or as part of a building or structure, shall comply with Section 3115.8.4 or 3115.8.5.

3115.8.4 Detailed design procedure. A structural analysis meeting the requirements of this section shall be provided to the building official to demonstrate the structural adequacy of the intermodal shipping containers.

Exception: Intermodal shipping containers designed in accordance with Section 3115.8.5.

3115.8.4.1 Material properties. Structural material properties for existing intermodal shipping container steel components shall be established by material testing where the steel grade and composition cannot be identified by the manufacturer's designation as to manufacture and mill test. *[DSA-SS & DSA-SS/CC] Not permitted by DSA.*

3115.8.4.2 Seismic design parameters. The seismic force-resisting system shall be designed and detailed in accordance with *[DSA-SS & DSA-SS/CC] ASCE 7 and* one of the following:

1. Where all or portions of the corrugated steel container sides are considered to be the seismic force-resisting system, design and detailing shall be in accordance with the ASCE 7, Table 12.2-1 requirements for light-frame bearing-wall systems with shear panels of all other materials. *[DSA-SS & DSA-SS/CC] Not permitted by DSA.*
2. Where portions of the corrugated steel container sides are retained, but are not considered to be the seismic force-resisting system, an independent seismic force-resisting system shall be selected, designed and detailed in accordance with ASCE 7, Table 12.2-1.
3. Where portions of the corrugated steel container sides are retained and integrated into a seismic force-resisting system other than as permitted by Item 1, seismic design parameters shall be developed from testing and analysis in accordance with Section 104.11 and ASCE 7, Section 12.2.1.1 or 12.2.1.2.

3115.8.4.3 Allowable shear value. The allowable shear values for the intermodal shipping container corrugated steel sheet panel side walls and end walls shall be demonstrated by testing and analysis in accordance with Section 104.11. Where penetrations are made in the side walls or end walls designated as part of the lateral force-resisting system, the penetrations shall be substantiated by rational analysis.

3115.8.5 Simplified structural design of single-unit containers. Single-unit intermodal shipping containers conforming to the limitations of Section 3115.8.5.1 shall be permitted to be designed in accordance with the simplified structural design provisions of Section 3115.8.5.2. *[DSA-SS and DSA-SS/CC] Not permitted by DSA.*

3115.8.5.1 Limitations. The use of Section 3115.8.5 is subject to the following limitations:

1. The intermodal shipping container shall be a single-unit, stand-alone unit supported on a foundation and shall not be in contact with or supporting any other shipping container or other structure.

2. The intermodal shipping container top and bottom rails, corner castings, and columns or any portion thereof shall not be notched, cut, or removed in any manner.
3. The intermodal shipping container shall be erected in a level and horizontal position with the floor located at the bottom.
4. The intermodal shipping container shall be located in Seismic Design Category A, B, C or D.

3115.8.5.2 Simplified structural design. Where permitted by Section 3115.8.5.1, single-unit, stand-alone intermodal shipping containers shall be designed using the following assumptions for the corrugated steel shear walls:

1. The appropriate detailing requirements contained in Chapters 16 through 23.
2. Response modification coefficient, $R = 2$.
3. Overstrength factor, $\Omega_0 = 2.5$.
4. Deflection amplification factor, $C_d = 2$.
5. Limits on structural height, $h_n = 9.5$ feet (2900 mm).

3115.8.5.3 Allowable shear. The allowable shear for the corrugated steel side walls (longitudinal) and end walls (transverse) for wind design and seismic design using the coefficients of Section 3115.8.5.2 shall be in accordance with Table 3115.8.5.3, provided that all of the following conditions are met:

1. The total linear length of all openings in any individual side wall or end wall shall be limited to not more than 50 percent of the length of that side wall or end wall, as shown in Figure 3115.8.5.3(1).
2. Any full-height wall length, or portion thereof, less than 4 feet (305 mm) shall not be considered as a portion of the lateral force-resisting system, as shown in Figure 3115.8.5.3(2).
3. All side walls or end walls used as part of the lateral force-resisting system shall have an existing or new boundary element on all sides to form a continuous load path, or paths, with adequate strength and stiffness to transfer all forces from the point of application to the final point of resistance, as shown in Figure 3115.8.5.3(3).
4. Where openings are made in container walls, floors or roofs, for doors, windows and other openings:
 - 4.1 The openings shall be framed with steel elements that are designed in accordance with Chapters 16 and 22.
 - 4.2 The cross section and material grade of any new steel element shall be equal to or greater than the steel element removed.

5. A maximum of one penetration not greater than 6 inches (152 mm) in diameter for conduits, pipes, tubes or vents, or not greater than 16 square inches (10 323 mm²) for electrical boxes, is permitted for each individual 8-foot (2438 mm) length of lateral force-resisting wall. Penetrations located in walls that are not part of the lateral force-resisting system shall not be limited in size or quantity. Existing intermodal shipping container vents shall not be considered a penetration, as shown in Figure 3115.8.5.3(4).
6. End wall doors designated as part of the lateral force-resisting system shall be welded closed.

3115.9 Additional requirements. [DSA-SS and DSA-SS/CC]

3115.9.1 General.

1. Intermodal shipping containers shall not have been manufactured earlier than 24 months from the date of DSA approval of the site-specific or stockpile building design drawings.
2. Intermodal shipping containers shall be undamaged and have no previous repairs. The acceptable tolerances shall not exceed those given in the ANSI/AISC 303—16: Code of Standard Practice for Steel Buildings and Bridges.
3. Intermodal shipping container type shall be standard dry cargo container, used for the transportation of dry goods only. Containers shall not have

been used for transporting hazardous materials. Containers shall not have been painted with paint containing lead.

4. All structural elements and details shall be justified through engineering calculations in accordance with the California Administrative Code (Title 24, Part 1, CCR) Section 4-317(d).

3115.9.2 Structural integrity verification. Each intermodal shipping container shall have selection, structural integrity verification, general condition assessment, inspection and testing as enforced by the enforcement agency.

3115.9.3 Seismic design requirements.

1. The container steel frame contribution to the lateral force resistance shall be neglected even in cases where the container siding is removed.
2. Deformation compatibility of structural elements that are not included in the seismic force-resisting system shall be considered in the analysis and when evaluating stiffness irregularities.
3. The total length of siding (less openings) along a line in a lower story shall not be less than 80 percent of the total length of siding (less openings) along the same line in the story immediately above.

**TABLE 3115.8.5.3
ALLOWABLE SHEAR VALUES FOR INTERMODAL
SHIPPING CONTAINER CORRUGATED STEEL WALLS FOR WIND OR SEISMIC LOADING**

CONTAINER DESIGNATION ^b	CONTAINER DIMENSION (nominal length)	CONTAINER DIMENSION (nominal height)	ALLOWABLE SHEAR VALUES (PLF) ^{a, c}	
			Side Wall	End Wall
IEEE	45 feet	9.5 feet	75	843
IEE		8.5 feet		
IAAA	40 feet	9.5 feet	84	
IAA		8.5 feet		
IA		8.0 feet		
1AX		< 8.0 feet		
1BBB	30 feet	9.5 feet	112	
1BB		8.5 feet		
1B		8.0 feet		
1BX		< 8.0 feet		
1CC	20 feet	8.5 feet	168	
1C		8.0 feet		
1CX		< 8.0 feet		
1D	10 feet	8.0 feet	337	
1DX		< 8.0 feet		

For SI: 1 foot = 304.8 mm.

- a. The allowable strength shear for the side walls and end walls of the intermodal shipping containers are derived from ISO 1496-1 and reduced by a factor of safety of 5.
- b. Container designation type is derived from ISO 668.
- c. Limitations of Section 3115.8.5.1 shall apply.

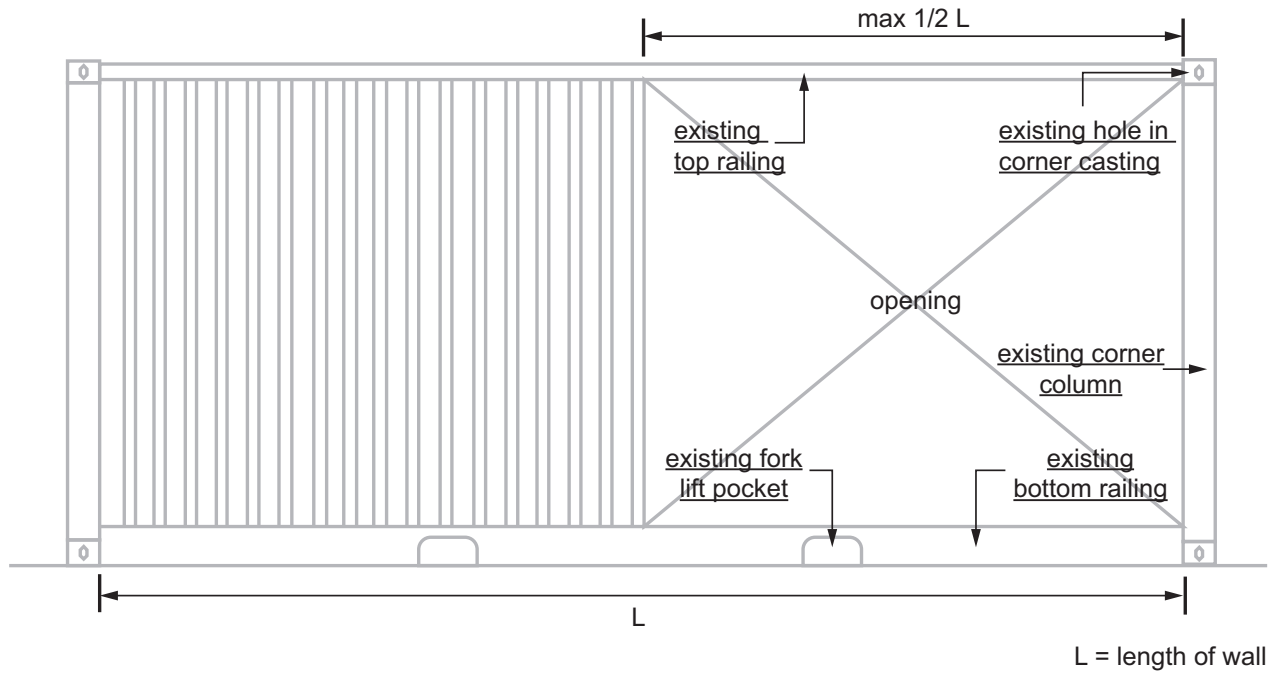


FIGURE 3115.8.5.3(1)
BRACING UNIT DISTRIBUTION—MAXIMUM LINEAR LENGTH

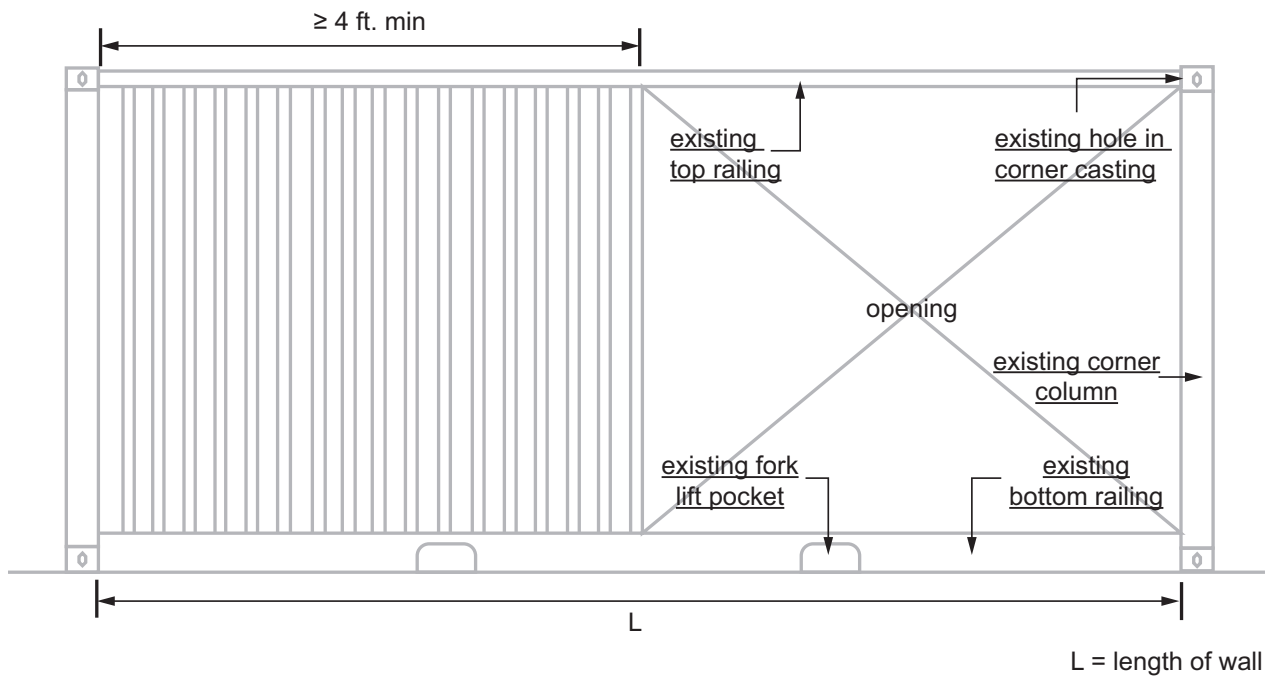


FIGURE 3115.8.5.3(2)
BRACING UNIT DISTRIBUTION—MINIMUM LINEAR LENGTH

For SI: 1 foot = 304.8 mm.

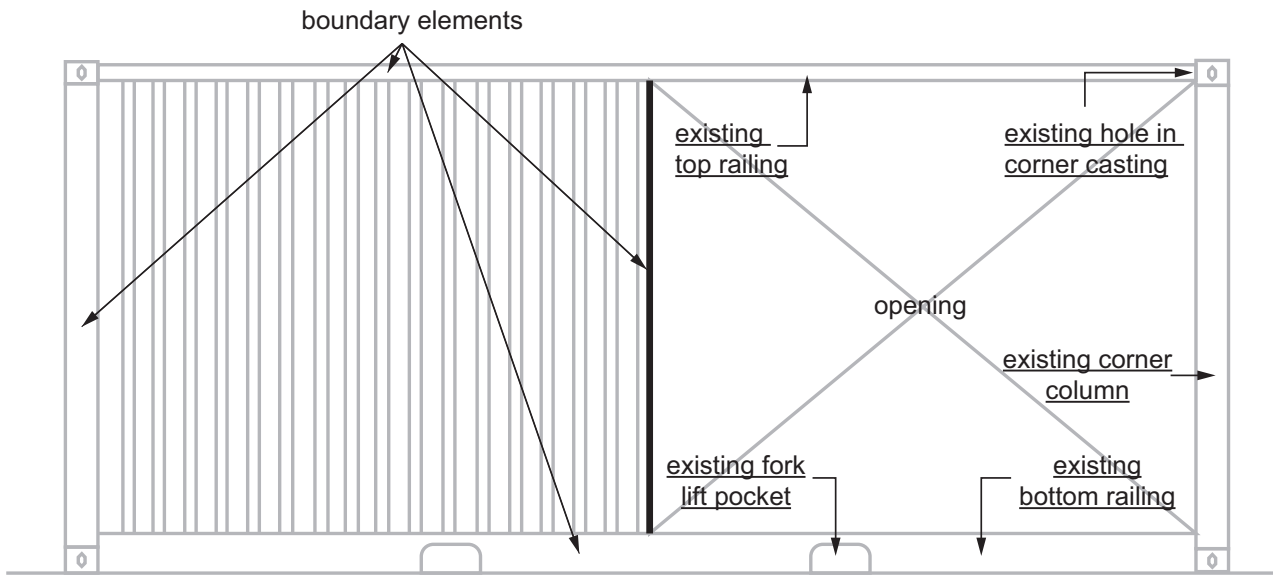


FIGURE 3115.8.5.3(3)
BRACING UNIT DISTRIBUTION—BOUNDARY ELEMENTS

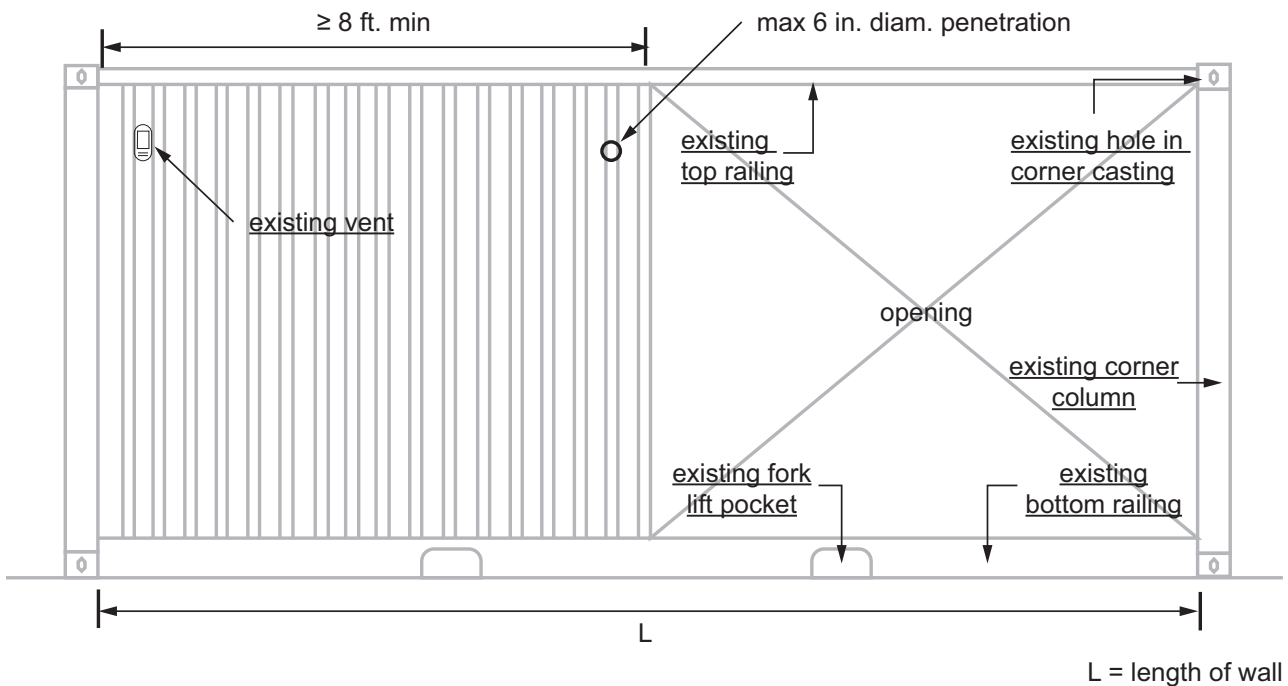


FIGURE 3115.8.5.3(4)
BRACING UNIT DISTRIBUTION—PENETRATION LIMITATIONS

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

CHAPTER 31A

**SYSTEMS FOR WINDOW CLEANING OR
EXTERIOR BUILDING MAINTENANCE**

*See Title 8, California Code of Regulations, Division 1, Chapter 4, Subchapter 7,
General Industry Safety Orders, Group 1, Articles 5 and 6.*

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 31B – PUBLIC POOLS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																X						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below					X		X															
Chapter / Section																						
3101B					X																	
3101B (last paragraph only)							X															
3102B					X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 31B [DPH]

PUBLIC POOLS

Division I—GENERAL

SECTION 3101B SCOPE

The provisions of this chapter shall apply to the construction, installation, renovation, alteration, addition, relocation, replacement or use of any public pool and to its ancillary facilities, mechanical equipment and related piping. Public pools include those located in or designated as the following: commercial building, hotel, motel, resort, recreational vehicle or mobile home park, campground, apartment house, condominium, townhouse, homeowner association, club, community building or area, public or private school, health club or establishment, water park, swim school, medical facility, bed and breakfast, licensed day-care facility, recreation and park district and municipal pools.

[HCD 2] This chapter, as specified, shall apply to swimming pools in Mobilehome Parks as defined in Health and Safety Code Section 18214 and Special Occupancy Parks as defined in Health and Safety Code Section 18862.43.

Note: Existing law limits application of building standards. Please see Health and Safety Code Sections 18938.5 and 116050.

[DSA-AC] Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.

SECTION 3102B DEFINITIONS

ANCILLARY FACILITY is any area used in conjunction with or for the operation of a pool such as public dressing rooms, lockers, shower or bathroom areas, drinking fountains, equipment room, pool deck area, pool enclosure or building space that is intended to be used by pool users.

BACKWASH is the process of reversing the flow of water through the filter to thoroughly clean the filter media and/or elements and remove the debris from the contents of the filter vessel.

CANTILEVERED DECKING is the part of the deck which extends over a top edge of a pool or spa.

CLEAN POOL WATER is pool water that is free of dirt, oils, scum, algae, floating materials or visible organic and inorganic materials that would pollute the water.

CLEAR POOL WATER is pool water that is free from cloudiness and is transparent.

COPING is a slip-resistant cap installed on the top edge of a pool or spa.

CORROSION RESISTANT is capable of maintaining original surface characteristics under the prolonged influence of the use environment.

DECK is an area surrounding a pool which is specifically constructed or installed for use by pool users.

DIATOMACEOUS EARTH is a filtering media consisting of microscopic fossilized skeletons of diatoms.

EASILY CLEANABLE is a characteristic of a surface or material that allows removal of dirt, stains or residue by normal cleaning methods.

EFFECTIVE PARTICLE SIZE is the theoretical size of a sieve in mm that will pass 10 percent by weight of sand.

ENFORCING AGENT is the health officer, director of environmental health, registered environmental health specialist or environmental health specialist trainee.

[HCD 2] ENFORCING AGENT OR ENFORCING AGENCY is the Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and Safety Code, Division 13, Part 2.1 commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3 commencing with Section 18860 for special occupancy parks.

EQUIPMENT AREA is an area where the recirculation system and all related appurtenances are located.

HANDHOLD is a structure located at or above the water line around the perimeter of the pool wall that allows a pool user to hold onto the poolside for support.

INLET is a fitting or fixture through which recirculated water enters the pool.

LADDER is a series of vertically separate treads or rungs either connected by vertical rail members or independently fastened to an adjacent vertical pool wall.

LIVING UNIT is any building or portion thereof that contains living facilities including provisions for sleeping.

MAIN DRAIN is a submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump.

MEDICAL POOL is a special-purpose pool used by a State-recognized medical institution engaged in the healing arts under the direct supervision of licensed medical personnel for treatment of the infirm.

OUTLET is a fitting or fixture through which recirculated water is removed from the pool which may or may not be connected to the pump.

PERFORMANCE STANDARD is a standard that is accredited and published. Products compliant with a standard may be listed by any authorized nationally recognized testing laboratory.

PERIMETER OVERFLOW SYSTEM is a system which includes perimeter-type overflow gutters, surge basin or similar surface water collective system components and their interconnecting piping.

PERMISSIBLE EXPOSURE LIMIT is the maximum amount or concentration of a chemical that a worker may be exposed to under United States Occupational Safety and Health Administration regulations.

POOL OR PUBLIC POOL is an artificial basin, chamber or tank constructed or prefabricated with impermeable surfaces that is used, or intended to be used, for public swimming, diving or recreational activities but does not include individual therapeutic tubs or baths where the main purpose is the cleaning of the body. Any manmade lake or swimming lagoon with a sand beach or sand bottom is not a public pool.

POOL OPERATOR or OPERATOR is a person who is responsible for maintaining compliance with all requirements relating to pool operation, maintenance and safety of pool users.

POOL USER is a person using a pool and ancillary facilities for the purpose of water activities such as diving, swimming or wading.

RADIUS OF CURVATURE is the radius arc which denotes the curved surface from the point of departure from the springline of the pool to the pool bottom.

READILY ACCESSIBLE is capable of being reached easily for cleaning, repair, replacement or inspection without the necessity of removing a panel, door or similar obstruction and without requiring a person to climb over or remove obstacles or to use devices such as portable ladders.

READILY DISASSEMBLED means capable of being taken apart by hand or by using only simple tools such as a screwdriver, pliers or open-end wrench.

RECESSED STEPS are a series of vertically spaced cavities in the pool wall creating riser and tread areas for pool ingress and egress.

RECIRCULATION SYSTEM is the system of hydraulic components designed to remove, filter, disinfect and return water to the pool.

RIM FLOW GUTTER is a perimeter overflow system in which the overflow rim is at the same elevation with the deck.

SKIMMER EQUALIZER LINE is a submerged suction outlet located below the waterline and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir or the skimmer is blocked by debris. A skimmer equalizer line is not a main drain.

SLIP RESISTANT is a rough finish that is not abrasive to the bare foot.

SPA POOL OR SPA is a pool that incorporates a water jet system, an aeration system or a combination of the two systems used in conjunction with heated water.

SPECIAL PURPOSE POOL is a pool constructed exclusively for a specific purpose, such as instruction, diving, competition or medical treatment.

SPLASH ZONE is the maximum distance the water from a spray ground can project horizontally.

SPRAY GROUND is a pool with no standing water in the splash zone and consists of a surge basin with a recirculation system from which water is directed through water features for contact with pool users.

SPRINGLINE is the point from which the pool wall breaks from vertical and begins its arc in the radius of curvature.

STAIRS are a series of two or more steps.

STEP is a riser and tread.

SUCTION OUTLET is any outlet that is connected to the pump through which water is removed from the pool.

SURGE BASIN is a reservoir or surge trench open to the atmosphere that receives water via gravity flow from the main drain, spray ground or perimeter overflow system and from which the recirculation system operates.

TEMPERED WATER is water between 100°F and 110°F.

TURNOVER TIME is the maximum time allowed to circulate one complete volume of the pool water through the recirculation system.

UNIFORMITY COEFFICIENT is the ratio of the theoretical size of a sieve in mm that will pass 60 percent of the sand to the theoretical size of a sieve in mm that will pass 10 percent of the sand.

WADING POOL is a pool intended to be used for wading by small children and having a maximum water depth of 18 inches (457 mm) at the deepest point.

WATER FEATURE means an interactive device or structure through which water is directed to the pool user such as a water fountain, water spray, dancing water jet, waterfall, dumping bucket or shooting water cannon.

WATERLINE shall be defined as one of the following:

1. Skimmer system. The waterline shall be the midpoint of the operating range of the skimmers.
2. Overflow system. The waterline shall be the top edge of the overflow rim.

PLAN REVIEW, PERMITS, CONSTRUCTION AND FIELD INSPECTIONS

SECTION 3103B PLAN REVIEW

3103B.1 A person proposing to construct, renovate or alter a pool, ancillary facilities or equipment and appurtenances shall submit plans and specifications detailing compliance with this chapter to the enforcing agent for review and written approval prior to commencing construction and shall first be cleared by the enforcing agent before substitution if not an exact duplicate of the units being changed or replaced. A local building department shall not issue a permit for a public pool or ancillary facility until the plans have been approved by the enforcing agent.

3103B.2 Plans submitted for approval pursuant to this section shall be drawn to a scale of $\frac{1}{4}$ inch (6.4 mm) equals 1 foot (305 mm), except that plans for spa pools shall be drawn to a scale of 1 inch (25 mm) equals 1 foot (305 mm), unless otherwise approved by the enforcing agent.

3103B.3 The enforcing agent shall notify the person submitting the plans and specifications of approval or disapproval.

3103B.4 The enforcing agent shall retain one copy of the approved plans and specifications and any subsequent changes or modifications. The approved plans shall be valid for a period of two years from the date of approval or as extended by the enforcing agent.

SECTION 3104B CONSTRUCTION

Pools and all ancillary facilities, equipment and appurtenances shall be constructed, renovated or altered in compliance with plans approved pursuant to Section 3103B.

SECTION 3105B PLAN COMPLIANCE INSPECTIONS

3105B The pool owner, operator or designated agent shall notify the enforcing agent prior to scheduling the following inspections:

1. Exposed plumbing; and
2. Prior to applying pneumatically placed concrete; and
3. Prior to applying the final surface to the pool shell; and
4. At the completion of construction. No pool shall be opened to the public without the written approval of the enforcing agent.

POOL STRUCTURE

SECTION 3106B SPECIAL REQUIREMENTS FOR SPRAY GROUNDS

3106B *Spray grounds.* All applicable provisions of this chapter shall apply to a spray ground unless specifically addressed in this section.

3106B.1 All parts of the spray ground shall be designed and constructed so that there are no safety hazards.

3106B.2 *Walking surface.* A minimum 4-foot wide walking surface shall extend around the perimeter of the splash zone of a spray ground.

3106B.3 The recirculation system shall be in operation at all times that the spray ground is open for use and shall have a minimum of four turnover cycles prior to opening for proper disinfection and filtration.

3106B.4 There shall be no standing water within the splash zone.

3106B.5 Nozzles that spray from the ground level shall be flush with the ground with openings no greater than $\frac{1}{2}$ inch.

Spray ground water features that extend above the ground must be clearly visible.

3106B.6 The splash zone shall be sloped so that only water from the spray ground water feature flows back to the surge basin. Areas adjacent to the splash zone shall be sloped away from the spray ground to deck drains or other surface water disposal systems.

3106B.7 All foggers and misters that produce finely atomized mists shall be supplied directly from a potable water source and not from the surge basin.

3106B.8 When multiple pumps are used the control systems for the spray ground water feature pump and recirculation system pump shall be electrically interconnected so that when the recirculation pump is off the spray ground water feature pump also is off.

3106B.9 The spray ground shall have a surge basin or treatment tank constructed of materials which are inert, corrosion resistant, nontoxic and watertight including materials such as concrete, fiberglass, high density polyethylene, stainless steel or other materials as approved by the enforcing agent which can withstand all anticipated loadings under full and empty conditions as determined by an engineer or architect who has experience working on public pools.

3106B.10 The total volume of the surge basin shall be at least 4,000 gallons or a minimum of three times the gallons per minute flow rate of all the spray ground pumps and the recirculation pump combined, whichever is higher.

3106B.11 The turnover time shall be one-half hour or less.

3106B.12 The suction intake for the spray ground or water feature pump in the surge basin shall be located adjacent to the recirculation return line.

3106B.13 When separate pumps are used, the suction intake for the recirculation pump shall be located in the lowest portion of the surge basin and on the opposite side from the suction intake for the spray ground pump.

3106B.14 The surge basin shall be designed to have easy access for cleaning and inspection. The basin shall have at least one ladder access and shall have at least one 3-foot by 3-foot access opening. Lids shall be locked or require a tool to open.

3106B.15 The surge basin shall be equipped with an automatic make up water fill device through an air gap or be protected by an approved backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.

3106B.16 Ultraviolet light disinfection shall be used to supplement disinfection methods required in this chapter unless another treatment process is provided that has been determined by a nationally recognized testing laboratory to be capable of providing at least the equivalent level of reduction of cryptosporidium as the ultraviolet light disinfection system specified in this section. The ultraviolet light disinfection unit shall comply with the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

3106B.17 An accurately calibrated ultraviolet light intensity meter that has been properly filtered to restrict its sensitivity

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to the disinfection spectrum shall be installed in the wall of the disinfection chamber at the point of greatest water depth from the light source.

3106B.18 The ultraviolet light unit shall be located on the recirculation system and shall be installed to provide treated water directly to the spray features.

3106B.19 The ultraviolet light disinfection system must be equipped with an automatic shutdown system that inactivates the water feature pump if the ultraviolet dosage rate drops below 40 mJ/cm².

3106B.20 Artificial lighting shall be provided at all spray ground pads which are used at night or which do not have adequate natural lighting so that all portions of the spray pad and deck may be seen easily. Lighting that may be exposed to the feature pool water shall be installed in accordance with the manufacturer's specifications and the California Electrical Code.

3106B.21 A means of diverting runoff from the splash zone shall be installed on the spray ground drainage piping before the surge basin to divert water to the storm drainage system when the spray ground is not in operation.

3106B.22 A removable and cleanable catch screen or basket shall be installed on the spray ground drainage system before it enters the reservoir to prevent larger debris from collecting in the surge basin.

SECTION 3107B ALTERNATIVE EQUIPMENT, MATERIALS AND METHODS OF CONSTRUCTION

3107B.1 The enforcing agent may approve an alternative equipment, material or method of construction provided it finds that the proposed design is satisfactory and complies with the provisions of this chapter, that the equipment, material, method or work offered is, for the purpose intended, at least equivalent to that prescribed in suitability, strength, effectiveness, fire resistance, durability, safety and sanitation or that the methods of installation proposed conform to other acceptable nationally recognized standards.

3107B.2 The enforcing agent shall require that sufficient evidence or proof be submitted to substantiate claims that may be made regarding the use of alternative equipment, material or method of construction.

3107B.3 Whenever there is insufficient evidence of compliance with the provisions of this chapter, the enforcing agent may require tests as proof of compliance to be made at no expense to the enforcing agent. Tests shall be made in accordance with approved standards, but in the absence of such standards the enforcing agent may specify the test procedure.

SECTION 3108B POOL CONSTRUCTION

3108B.1 Pool shell. The pool shall be built of reinforced concrete or material equivalent in strength, watertight and able to withstand anticipated stresses under both full and empty conditions taking into consideration factors such as climatic

effects, geological conditions and integration of the pool with other structures.

3108B.2 Finish. The finished pool shell shall be lined with a smooth waterproof interior finish that will withstand repeated brushing, scrubbing and cleaning procedures. The interior pool finish shall completely line the pool to the tile lines, coping or cantilevered deck.

3108B.3 Finish color. The finish color shall be white except for the following which shall be of contrasting color:

1. Lane and other required pool markings described in Section 3110B; and
2. The top surface edges of benches in spa pools; and
3. The edge of pool steps; and
4. Tiles installed at the waterline; and
5. Tiles installed at the 4¹/₂-foot (1372 mm) depth line.

Exception: A spa pool may be finished in a light color other than white when approved by the enforcing agent.

3108B.4 Projections and recessed areas. The pool shell shall not have projections or recessed areas except for pool inlets and outlets as specified in Section 3137B.

Exception: This section shall not apply to handholds, recessed steps, ladders, stairs, handrails, skimmers or perimeter overflow systems.

SECTION 3109B POOL GEOMETRY

3109B.1 General. A pool shall conform to the appropriate criteria in Figures 31B-1 through 31B-7.

Exception: A special purpose pool may be exempted from construction standards that are not applicable to the proposed use.

3109B.2 Dimensional tolerances. A construction tolerance shall be permitted on all dimensions in Figures 31B-1 through 31B-3 not to exceed 2 inches (51 mm) except that the tolerance of the water level of a pool with a nonadjustable overflow system shall not exceed ¹/₈ inch (3.2 mm).

3109B.3 Bottom slope break. Any portion of a pool having a water depth of 4¹/₂ feet (1372 mm) or less shall have a uniform slope that shall not exceed 1 foot (305 mm) of vertical in 10 feet (3050 mm) of horizontal. In pools with water depths greater than 4¹/₂ feet (1372 mm) the slope shall meet the requirements in Figures 31B-1 through 31B-3. There shall be a uniform water depth along the entire base of the stairs.

SECTION 3110B PERMANENT MARKINGS

3110B.1 General. No markings, designs or lettering shall be permitted on the pool shell except for slip resistant lane markings, depth marking lines and safety markings.

3110B.2 Lane markings. Slip resistant lane lines at the bottom of the pool shall not exceed 12 inches (305 mm) in width.

3110B.3 Depth marking line. There shall be installed a straight line of slip resistant tile a minimum of 4 inches (102 mm) and not greater than 6 inches (152 mm) wide of a color contrasting with the background of the pool shell across the bottom of the pool where the water depth is 4½ feet (1372 mm).

Exception: Pools having a maximum water depth of 5 feet (1524 mm) or less shall not be required to have a depth marking line.

3110B.4 Water depth markers.

3110B.4.1 Location. The water depth shall be clearly marked at the following locations:

1. Maximum depth; and
2. Minimum depth; and
3. Each end; and
4. Both sides at the shallowest and deepest part of the pool; and
5. At the break in the bottom slope between the shallow and deep portions of the pool (see also Section 3109B.3); and
6. Along the perimeter of the pool at distances not to exceed 25 feet (7620 mm).

Exception: A spa or wading pool shall have a minimum of two depth markers indicating the maximum depth.

Note: For an illustration diagram pertaining to this section see Figure 31B-8.

3110B.4.2 Position. Where required by Section 3110B.4.1, depth markers shall be located in the following positions:

1. On the coping or on the deck, the depth markers shall be placed as close as possible but no more than 3 feet (914 mm) from the pool water; and
2. For pools with skimmer systems the depth markers shall be high at the waterline which typically will result in the depth markers being submerged approximately 50 percent; or
3. For pools with perimeter overflow systems where coping cantilevers over the gutter depth markers may be positioned at the face of the cantilevered coping, the back wall above the gutter or immediately below the waterline which will result in the depth markers being completely submerged; or
4. For pools with rim flow gutters, depth markers shall be positioned immediately below the waterline which will result in the depth markers being completely submerged.

3110B.4.3 Tolerance. Depth markers shall be positioned to indicate the water depth accurate to the nearest 6 inches (152 mm) as measured at the waterline.

3110B.4.4 Size of markers. Depth markers shall:

1. Have numerals a minimum of 4 inches (102 mm) in height and of a color contrasting with the back-

ground and be marked in units of feet and inches. Abbreviations of FT and IN may be used in lieu of feet and inches; and

2. Be made of a durable material that is resistant to weathering; and
3. Be slip resistant when they are located on the pool deck.

3110B.5 No diving markers. For pool water depths 6 feet (1830 mm) or less no diving markers with the universal symbol of no diving, which is a red circle with a slash through it superimposed over the image of a diver, shall be installed on the deck directly adjacent to the depth markers required by Section 3110B.4.1. No diving markers shall comply with Section 3110B.4.4(2-3).

SECTION 3111B

STEPS, RECESSED STEPS, LADDERS AND STAIRS

3111B.1 Construction. A means of entry and exit to and from the pool shall consist of steps, recessed steps, ladders, stairs, ramps or a combination of these. Stairs or ramps shall be provided in the shallowest portion of a pool if the vertical distance from the bottom of the pool to the deck is over 1 foot (305 mm). In pools with more than one shallow end, stairs or ramps shall be provided at a minimum at one shallow end. A second means of entry and exit shall be provided in the deep portion of a pool having a depth greater than 4½ feet (1372 mm). Where the width of the pool exceeds 30 feet (9144 mm), such means of entry and exit shall be provided at each side, not more than 100 feet (30,480 mm) apart.

Note: For illustrated diagrams pertaining to this section see Figures 31B-6 and 31B-7.

3111B.2 Ladders. Ladders shall be corrosion resistant and shall be equipped with slip resistant tread surfaces. Ladders shall be rigidly installed and shall provide a clearance of not less than 3 inches (76 mm) or more than 5 inches (127 mm) between any part of the ladder and the pool wall.

3111B.3 Stairs. Each step of a stair shall have a tread in accordance with Figure 31B-7. Risers shall conform to Figure 31B-7. At least one hand rail shall be provided extending from the deck to not less than a point above the top of the lowest step installed in accordance with Figure 31B-7.

3111B.4 Ladder and recessed step dimensions. Ladder treads and recessed steps shall have a minimum tread of 5 inches (127 mm) and a width of 14 inches (356 mm) and shall be designed to be readily cleaned. Step risers shall be uniform and shall not exceed 12 inches (305 mm) in height. The first riser shall be measured from the deck.

3111B.5 Handrails for ladders and recessed steps. Handrails shall be provided at the top of both sides of each ladder and recessed steps and shall extend over the coping or edge of the deck.

3111B.6 Handrails for spas. Two hand rails shall be provided extending from the deck to not less than a point above the top of the lowest step in accordance with Figure 31B-7. The steps shall be located where the deck is at least 4 feet (1219 mm) wide.

3111B.7 Dimensional tolerances. Finished step tread and riser construction tolerances shall be + 1/2 inch (12.5 mm).

[DSA-AC] Additional requirements may apply. Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.

SECTION 3112B HANDHOLDS

3112B.1 General. Every pool shall be provided with handholds (perimeter overflow system, bull-nosed coping or cantilevered decking) around the entire perimeter installed not greater than 9 inches (229 mm) above the waterline.

Exception: Handholds are not required for wading pools.

3112B.2 For special purpose pools used for instruction or competitive swimming, a handhold at water level similar to the rim of a perimeter overflow system is required.

3112B.3 Where perimeter overflow systems are not provided, a bull-nosed coping or cantilevered decking of reinforced concrete, or material equivalent in strength and durability, with rounded slip resistant edges shall be provided. The overhang for either bull-nosed coping or cantilevered decking shall not exceed 2 inches (51 mm) or be less than 1 inch (25 mm) and shall not exceed 2 1/2 inches (64 mm) in thickness.

Exception: The enforcing agent may accept other handholds for spa pools.

SECTION 3113B DIVING BOARDS AND PLATFORMS

3113B.1 General. Diving boards and platforms shall be anchored to the pool deck, constructed of corrosion resistant material, designed and constructed to be easily cleanable and finished with a durable slip resistant material.

3113B.2 Rails and steps. Diving boards or platforms greater than 18 inches (456 mm) in height above the deck shall be provided with a ladder or stairs for access. Hand rails shall be provided at all ladders and stairs leading to diving boards or platforms more than 1 meter above the water. Diving boards and platforms that are over 1 meter above the water shall have guard rails on both sides of the diving board or platform that extend to a point on the platform directly above the water's edge. Guard rails shall be 36 inches (914 mm) above the diving board or platform.

3113B.3 Dimensions. Dimensions and clearances for the use of diving boards or platforms shall conform to those shown in Figures 31B-1 and 31B-2. Platforms and diving boards shall conform to the USA Diving Rules and Codes, Part 1, Subpart A and Appendix B, effective January 1, 2010.

SECTION 3114B POOL DECKS

3114B.1 General. A minimum continuous and unobstructed 4-foot wide (1219 mm) slip resistant, cleanable, nonabrasive

deck area of concrete or like material shall be provided flush with the top of the pool coping extending completely around the pool, and the deck area shall further extend 4 feet (1219 mm) on both sides and rear of any diving board, fixed disabled access assistance device or slide and their appurtenances. The deck width shall be measured from the poolside edge of the coping lip.

Exception: A deck at least 4 feet (1219 mm) in width shall extend around a continuous 50 percent or more of the perimeter of a spa pool.

3114B.2 Deck between pools and/or spas. Where multiple pools and/or spas are built adjacent to each other, the deck width separating them shall be a minimum of 6 feet (1830 mm).

3114B.3 Deck slope. The pool's deck surface shall have a slope of no less than 1 percent (1/8 inch per foot) but no more than 2 percent (1/4 inch per foot) away from the pool to a deck drainage system and shall be constructed and finished to prevent standing water.

3114B.4 Deck covering. Deck coverings or other materials that are not equivalent to concrete in strength, durability and slip resistance and are not able to withstand repeated brushing, scrubbing or cleaning procedures shall not be installed or used within 4 feet (1219 mm) of the pool.

3114B.5 Unpaved areas. Landscape plants, flower beds or similar unpaved areas shall not be located within 4 feet (1219 mm) of a spa pool.

SECTION 3115B POOL LIGHTING

3115B.1 General. Pools shall have underwater and deck lighting such that lifeguards or other persons may observe, without interference from direct and reflected glare from the lighting sources, every part of the underwater area and pool surface, all diving boards or other pool appurtenances. If underwater or deck surface lighting is not operational, the operator of the pool shall secure the pool area and not permit any use of the pool after dark and shall post the same sign as required in Section 3120B.9.

Note: See Part 3, Article 3-680, Title 24, California Code of Regulations for electrical installation requirements.

3115B.2 Nighttime use. Pools used at night shall be equipped with underwater lighting fixtures that will provide complete illumination to all underwater areas of the pool with no blind spots. Illumination shall enable a lifeguard or other persons to determine whether:

1. A pool user is lying on the bottom of the pool; and
2. The pool water conforms to the definition of "clear pool water."

Exception: Pools provided with a system of overhead lighting fixtures where it can be demonstrated to the enforcing agent that the system is equivalent to the underwater lighting fixture system.

3115B.3 Deck area lighting. When the pool is to be used at night, pool deck areas and emergency egress areas shall be

provided with lighting so that persons walking on the deck can identify hazards. Lighting fixtures shall be aimed towards the deck area and away from the pool surface insofar as practical.

ANCILLARY FACILITIES

SECTION 3116B

DRESSING, SHOWER AND TOILET FACILITIES

3116B.1 Shower and dressing facilities shall be provided for users of a pool.

Exceptions:

1. Shower and dressing facilities may not be required when pool users have access to such facilities in adjacent living quarters.
2. Public toilet facilities may be omitted when pool users have access to toilet facilities either in living quarters located not more than 300 feet (91,440 mm) in travel distance from the pool or in an adjacent building such as a recreational facility, clubhouse or cabana.

3116B.2 Number of sanitary facilities. For the purpose of this subsection, one pool user shall be considered for every 15 square feet (1.39 m²) of pool water surface area and/or spray ground splash zone area.

3116B.2.1 Showers. One shower shall be provided for every 50 pool users.

3116B.2.2 Toilets. Separate toilet facilities shall be provided for each sex. One toilet shall be provided for every 60 women or less and one toilet plus one urinal for every 75 men or less.

3116B.2.3 Lavatories. One lavatory shall be provided for every 80 pool users.

3116B.3 Construction.

3116B.3.1 Floors. Floors shall have a hard, nonabsorbent surface, such as portland cement concrete, ceramic tile or other approved material, which extends upwards onto the wall at least 5 inches (127 mm) with a coved base. Floors which may be walked on by a wet pool user shall be slip resistant. Floors shall be sloped not less than 1/4 inch (6.4 mm) per foot to floor drains or other approved surface water disposal areas. Carpeting and other similar artificial floor covering shall not be permitted on shower and toilet room floors.

3116B.3.2 Interior surfaces. The materials used in the walls, except for structural elements, shall be of a type which is not adversely affected by moisture.

3116B.3.3 Privacy. All doors and windows shall be arranged to prevent viewing of the interior from any portion of the building used by the opposite sex and from view from the outdoors. View screens shall be permitted for this purpose.

3116B.4 Water supply.

3116B.4.1 Showers and lavatories shall be provided with hot and cold water faucets.

3116B.4.2 Tempered water shall be permitted in lieu of individual hot and cold water faucets.

3116B.4.3 A means to limit the hot water to 110°F (43°C) maximum shall be provided to prevent scalding. This temperature limit control shall not be adjustable by the pool user.

SECTION 3117B

DRINKING FOUNTAINS

One guarded jet drinking fountain shall be provided for the first 250 pool users and an additional fountain shall be provided for each additional 200 pool users or fraction thereof. The number of pool users shall be determined according to Section 3116B.2.

Exception: Drinking fountains shall not be required when drinking water is available at adjacent living quarters, or in an adjacent building such as a bathhouse, cabana, clubhouse or recreational facility.

SECTION 3118B

HOSE BIBBS

Potable water outlets with hose attachments shall be protected by a nonremovable hose bibb backflow preventer, a nonremovable hose bibb vacuum breaker or by an atmospheric vacuum breaker installed not less than 6 inches (152 mm) above the highest point of usage located on the discharge side of the last valve as required by the California Plumbing Code. In climates where freezing temperatures occur, a listed self-draining frost-proof hose bibb with an integral backflow preventer or vacuum breaker shall be used. Hose bibbs shall be provided so that all portions of the pool deck area may be reached with a 75 foot length of hose attached to the hose bibb. A hose bibb shall be provided in the equipment area. Hose bibbs shall be located so that they do not constitute a hazard.

SECTION 3119B

POOL ENCLOSURE

3119B.1 Enclosure. The pool shall be enclosed by one or a combination of the following: a fence, portion of a building, wall or other approved durable enclosure. Doors, openable windows, gates of living units or associated private premises shall not be permitted as part of the pool enclosure. The enclosure, doors and gates shall meet all of the following specifications:

1. The enclosure shall have a minimum effective perpendicular height of 5 feet (1524 mm) as measured from the outside as depicted in Figure 31B-4; and
2. Openings, holes or gaps in the enclosure, doors and/or gates shall not allow the passage of a 4-inch (102 mm) diameter sphere. The enclosure shall be constructed over a hard and permanent material equivalent to concrete; and
3. The enclosure shall be designed and constructed so that it cannot be readily climbed by small children.

Horizontal and diagonal member designs which might serve as a ladder for small children are prohibited. Horizontal members shall be spaced at least 48 inches (1219 mm) apart. No planters or other structures that can be climbed shall be permitted within 5 feet (1524 mm) of the outside of the pool enclosure or within a 5 foot (1524 mm) arc as depicted in Figure 31B-5. The area 5 feet (1524 mm) outside of the pool enclosure shall be a common area open to the public; and

4. Chain link may be used, provided that the openings are not greater than 1³/₄ inches (44 mm) measured horizontally.

3119B.2 Gates. Gates and doors opening into the pool enclosure also shall meet the following specifications:

1. Gates and doors shall be equipped with self-closing and self-latching devices. The self-latching device shall keep the gate or door securely closed. Gates and doors shall open outwardly away from the pool except where otherwise prohibited by law. Hand activated door or gate opening hardware shall be located at a height no lower than 42 inches (1067 mm) but no higher than 44 inches (1179 mm) above the deck or walkway; and
2. Gates and doors shall be capable of being locked during times when the pool is closed. Exit doors which comply with Chapter 10, Title 24, California Code of Regulations shall be considered as meeting these requirements; and
3. The pool enclosure shall have at least one means of egress without a key for emergency purposes. Unless all gates or doors are so equipped, those gates and/or doors which will allow egress without a key shall have a sign in letters at least 4 inches (102 mm) high stating **EMERGENCY EXIT**; and
4. The enclosure shall be constructed so that all persons will be required to pass through common pool enclosure gates or doors in order to gain access to the pool area. All gates and doors exiting the pool area shall open into a public area or a walkway accessible by all patrons of the pool.

3119B.3 Retroactivity. Sections 3119B.1 and 3119B.2 shall apply only to public pool enclosures constructed on or after July 1, 1994. Notwithstanding the foregoing effective date, no fence enclosure shall be less than 4 feet (1219 mm) in height.

3119B.4 Enclosure of pools constructed prior to July 1, 1994. The enforcing agent may allow the installation of an enclosure which reduces the pool deck to less than 4 feet (1219 mm) in width when the physical characteristics of a site preclude providing a 4-foot (1219 mm) wide deck around the perimeter of an existing pool.

SECTION 3120B REQUIRED SIGNS

3120B.1 General. All signs shall have clearly legible letters or numbers not less than 4 inches (102 mm) high, unless oth-

erwise required in this section, affixed to a wall, pole, gate or similar permanent structure in a location visible to all pool users.

3120B.2 Pool user capacity sign. A sign shall indicate the maximum number of pool users permitted for each pool.

3120B.2.1 Spa pool. The pool user capacity of a spa pool shall be based on one pool user for every 10 square feet (0.929 m²) of pool water surface area.

3120B.2.2 Other pools. The pool user capacity for all other pools shall be based on one pool user for every 20 square feet (1.858 m²) of pool water surface area.

Exception: Pool user capacity requirements do not apply to wading pools or spray grounds.

3120B.3 No diving sign. Signs shall be posted in conspicuous places and shall state, "NO DIVING" at pools with a maximum water depth of 6 feet or less.

3120B.4 No lifeguard sign. Where no lifeguard service is provided, a sign shall be posted stating, "NO LIFEGUARD ON DUTY." The sign also shall state in letters at least 1 inch (25 mm) high, "Children should not use pool without adult supervision."

Exception: "No lifeguard sign" requirement does not apply to spray grounds that have no standing water.

3120B.5 Artificial respiration and cardiopulmonary resuscitation sign. An illustrated diagram with text at least 1/4 inch (6 mm) high of artificial respiration and cardiopulmonary resuscitation procedures shall be posted.

3120B.6 Emergency sign. The emergency telephone number 911 with numbers not less than 4 inches (102 mm), the number of the nearest emergency services and the name and street address of the pool facility with numbers and text not less than 1 inch (25 mm) shall be posted.

3120B.7 Warning sign for a spa pool. A warning sign for spa pools shall be posted stating, "CAUTION" and shall include the following language in letters at least 1 inch (25 mm) high:

1. Elderly persons, pregnant women, infants and those with health conditions requiring medical care should consult with a physician before entering the spa.
2. Children should not use spa without adult supervision.
3. Hot water immersion while under the influence of alcohol, narcotics, drugs or medicines may lead to serious consequences and is not recommended.
4. Do not use alone.
5. Long exposure may result in hyperthermia, nausea, dizziness or fainting.

3120B.8 Emergency shut off. In letters at least one inch (25 mm) high a sign shall be posted at the spa emergency shut off switch stating, "EMERGENCY SHUT OFF SWITCH."

3120B.9 No use after dark. Where pools were constructed for which lighting was not required, a sign shall be posted at each pool entrance on the outside of the gate(s) stating, "NO USE OF POOL ALLOWED AFTER DARK."

3120B.10 Keep closed. A sign shall be posted on the exterior side of gates and doors leading into the pool enclosure area stating, “KEEP GATE CLOSED.” or “KEEP DOOR CLOSED.”

[DSA-AC] Additional requirements may apply. Refer to Chapter 11B for accessibility provisions applicable to public accommodations, commercial buildings and public housing.

3120B.11 Diarrhea. The pool operator shall post at the entrance area of a public pool a sign in letters at least 1 inch (25 mm) high that clearly states that persons with diarrhea and persons who have had diarrhea within the prior 14 days shall not enter the pool water.

3120B.12 Wave pools. A sign in letters at least 1 inch (25 mm) high shall be posted that describes the requirements for wave pools as described in Section 115952, Health and Safety Code.

3120B.13 Spray ground sign. A sign shall be posted at each spray ground and be visible from any part of the spray ground that states, “CAUTION: WATER IS RECIRCULATED. DO NOT DRINK.”

3120B.14 Exit. Where automatic gaseous chlorine chemical feeders are used, a sign shall be posted at the pool area entrance which shows in a diagrammatic form an emergency evacuation procedure. Designated emergency exits shall be marked “EXIT.”

3120B.15 Gaseous oxidizer. Where automatic gaseous chlorine chemical feeders are used, a warning sign with the appropriate hazard identification symbol shall be posted on the exterior side of the door entering the chemical feeder room or area. The sign shall state, “DANGER: GASEOUS OXIDIZER - (specific chemical name)” or as otherwise required by the California Fire Code.

3120B.16 Turn on before entering. Where automatic gaseous chemical feeders are used, a sign shall be posted at the switch to the light and ventilation system for the gaseous chemical feeder room stating, “TURN ON BEFORE ENTERING,” or as otherwise required by the California Fire Code or the California Electrical Code.

3120B.17 Direction of flow.

3120B.17.1. The direction of flow for the recirculation equipment shall be labeled clearly with directional symbols such as arrows on all piping in the equipment area.

3120B.17.2. Where the recirculation equipment for more than one pool is located on site, the equipment shall be marked as to which pool the system serves.

3120B.17.3. Valves and plumbing lines shall be labeled clearly with the source or destination descriptions.

SECTION 3121B INDOOR POOL VENTILATION

Indoor pools, dressing rooms and toilet rooms shall be ventilated according to the requirements in Chapter 4 of the California Mechanical Code.

SECTION 3122B POOL EQUIPMENT ENCLOSURE

For pools constructed on or after January 1, 2013, pool equipment shall be enclosed as follows:

1. All equipment installed for recirculation, filtration and disinfection of pool water shall be installed so that access is limited to persons authorized by the pool owner or operator; and
2. Pool equipment shall be mounted on a continuous slab of concrete or other equivalent easily cleanable and nonabsorbent material; and
3. Floors shall be sloped a minimum of $\frac{1}{4}$ inch (6.4 mm) per foot to a drain.

SECTION 3123B GENERAL REQUIREMENTS

3123B.1 System description. Each pool shall be provided with a separate recirculation system designed for the continuous recirculation, filtration and disinfection of the pool water. The system shall consist of pumps, filters, chemical feeders, skimmers or perimeter overflow systems, valves, pipes, connections, fittings and appurtenances.

Exception: Pools using fresh water equivalent in flow to the requirements of Section 3124B.

Note: Fresh makeup pool water shall conform to the water quality standards of Section 65531, Chapter 20, Title 22, California Code of Regulations.

3123B.2 Equipment. All pumps, filters, chemical feeders, skimmers and supplemental equipment shall comply with the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

3123B.3 Installation. All equipment related to pool operations shall be installed and maintained according to this chapter and in accordance with the equipment manufacturer’s written instructions.

3123B.4 Equipment access. All filters, valves, pumps, strainers and equipment shall be readily accessible for repair and replacement.

SECTION 3124B TURNOVER TIME

The recirculation system shall have the capacity to provide a complete turnover of pool water in:

1. One-half hour or less for a spa pool; and
2. One-half hour or less for a spray ground; and
3. One hour or less for a wading pool; and
4. Two hours or less for a medical pool; and
5. Six hours or less for all other types of public pools.

SECTION 3125B RECIRCULATION PIPING SYSTEM AND COMPONENTS

3125B.1 Line sizes. Pipes shall be sized so flow velocity of piping systems including all pipes and fittings other than inlet devices or venturi throats shall not exceed 6 feet per second (1.829 m/s) in any suction or copper piping and 8 feet per second (2.438 m/s) in any portion of the return system.

3125B.1.1 Materials. All piping, tubing and fittings shall comply with the applicable standards for potable water system materials set forth in Chapter 6 of the California Plumbing Code.

3125B.2 Gauges. A pressure and vacuum gauge shall be provided for each pump system. Each gauge shall have a scale range approximately $1\frac{1}{4}$ times the maximum anticipated working pressure or vacuum and shall be accurate within 2 percent of scale. The pressure gauge located on the filter shall be marked with the clean start up pressure reading.

3125B.3 Flow meter. A flow meter shall be provided on each recirculation system accurate to within 10 percent of flow and installed according to the manufacturer's written instructions with increments in the range of normal flow.

3125B.4 Basket strainer. A basket strainer shall be provided on the suction side of the recirculation pump. A basket strainer will not be required on pumps connected to vacuum filters where the filter elements are not removed for cleaning.

3125B.5 Backwash piping. Piping, including necessary valves conforming to Section 3125B.1, shall be provided for each filter vessel or element which requires periodic backwashing.

3125B.6 Valves. Valves shall not be located in any deck area surrounding a pool. Valves shall be installed on all recirculation, backwashing and drain system lines which require shut-off isolation, adjustment or control of the rate of flow. Each valve shall be installed in the equipment area and labeled as to its purpose.

SECTION 3126B RECIRCULATION PUMP CAPACITY

3126B.1 Pool recirculation pumps shall have the following total dynamic head capacities:

1. **Pressure diatomaceous earth filters.** At least 60 feet (18,288 mm); and
2. **Vacuum diatomaceous earth filters.** Twenty inches (508 mm) vacuum on the suction side and 40 feet (12,192 mm) total dynamic head; and
3. **Rapid sand filters.** At least 45 feet (13,716 mm); and
4. **High rate sand filters.** At least 60 feet (18,288 mm); and
5. **Cartridge filters.** At least 60 feet (18,288 mm).

3126B.2. Pumps with other total dynamic head capacities shall be permitted provided the turnover times are maintained as required in Section 3124B.

SECTION 3127B WATER SUPPLY INLETS

3127B.1 General. Each pool shall be supplied with potable water by means of a permanently installed pipeline from a public water supply system holding a permit from the California Department of Public Health or from a source approved by the enforcing agent.

3127B.2 Backflow prevention. There shall be no direct connection between any potable water supply system and the pool or its piping system unless protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code.

3127B.3 Makeup water. Automatic makeup water flow controls with a manual override control shall be provided to maintain the proper pool water level.

SECTION 3128B FILTERS (ALL TYPES)

3128B.1 General requirements. All filters, regardless of type, shall be designed and constructed according to the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

3128B.2 Installation. Each filter vessel shall be installed, piped and provided with valves so that it can be isolated from the recirculation system for repairs and backwashing.

SECTION 3129B RAPID SAND PRESSURE FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to rapid sand pressure filters.

3129B.1 Flow rates. The filtration rate shall not exceed 3 gallons per minute per square foot (122.24 L/m per m²) of filter area. The backwash rate shall not be less than 15 gallons per minute per square foot (611.2 L/m per m²) of filter area.

3129B.2 Filter media. The filter shall contain not less than a 20-inch (508 mm) depth of media and not less than a 10-inch (254 mm) depth of filter gravel above the underdrain system.

3129B.2.1 The filter media shall have an effective particle size between 0.40 and 0.55 millimeters and a uniformity coefficient not exceeding 1.75.

3129B.2.2 The filter gravel shall be sized and placed to provide uniform flow distribution from the underdrain system and to support the bed of filter sand without loss of sand to the pool or without development of jet streams or channeling in the filtration media.

SECTION 3130B DIATOMACEOUS EARTH FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following applies to diatomaceous earth filters.

3130B.1 Flow rates. The filtration rate for both pressure and vacuum diatomaceous earth filters shall not exceed 2 gallons per minute per square foot (81.49 L/m per m²) of filter area.

SECTION 3131B HIGH-RATE SAND FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to high rate sand filters.

3131B.1 Flow rates. Maximum and minimum flow rates for backwash and filtration shall be maintained according to the applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010.

3131B.2 The filter media shall have an effective particle size between 0.40 and 0.55 mm and a uniformity coefficient not exceeding 1.75.

3131B.3 The backwash rate for a high rate sand filter shall be a minimum of 15 gallons per minute per square foot of filter area.

SECTION 3132B CARTRIDGE FILTERS

In addition to the requirements for all filters as indicated in Section 3128B, the following apply to cartridge filters.

3132B.1 The filtration rate shall not exceed 0.375 gallons per minute per square foot of filter area.

3132B.2 An approved wash down area equipped with potable water shall be provided in the pool equipment area with permanently installed drainage piping discharging to the public sewer or wastewater system approved by the enforcing wastewater agency. The filter vessel shall be capable of being drained and shall be equipped with an indirect drain for the purpose of draining the entire contents of the filter vessel. Drainage and backwash piping shall be considered indirect waste and installed in accordance with the requirements of Chapter 8 of the California Plumbing Code.

3132B.3 An additional set of filter elements shall be available for installation while the existing filter elements are cleaned.

SECTION 3133B CHEMICAL FEEDERS

All chemical feeders including disinfectant feeders and the auxiliary feeders used for solutions, slurries or solids, along with components such as pumps, strainers, tubing connections, tanks and injection fittings shall comply with the provisions of this section.

3133B.1 General design requirements. The chemical feeder equipment shall:

1. Be maintained and repaired according to manufacturers' specifications; and
2. Be constructed with an adjustable output rate device to permit repeated adjustments without loss of output rate

accuracy and adjusted by an automatic chemical monitoring and control system that regulates, at a minimum, pH and disinfectant; and

3. Meet the applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

3133B.2 Piping. Piping used for the chemical feeder and its auxiliary equipment shall be resistant to corrosion or chemical deterioration.

3133B.3 Installation. Chemical feeders and associated components shall be constructed and installed to prevent uncontrolled discharge or siphoning of chemicals and fumes directly into the pool, its recirculation system, the pool area or ancillary facilities.

SECTION 3134B DISINFECTANT FEEDERS

Disinfectant feeders shall comply with applicable requirements established by the NSF/ANSI 50-2010 performance standard effective August 2010 for disinfectant feeders. In addition to the requirements for chemical feeders as indicated in Section 3133B, the following apply to disinfectant feeders.

3134B.1 Minimum capacity. All feeders shall be capable of supplying not less than the equivalent of 3 pounds (1 kg) of 100 percent available chlorine per day per 10,000 gallons (37,850 L) of pool water capacity.

3134B.2 Rate of flow adjustment. A visible means of determining the rate of flow through the device shall be provided for each disinfectant feeder.

3134B.3 Compressed chlorine gas disinfectant equipment. Chlorine gas shall not be dispensed directly into the water of a pool except as an aqueous solution through the return line of the recirculation system.

3134B.3.1 Compressed gas containers. Each container or cylinder shall be secured to prevent accidental movement. A valve protection cap shall be provided to cover the discharge valve at all times when the cylinder is not connected to the dispensing system.

3134B.3.2 Container scale. Compressed gas chlorine containers in use shall be on a scale in the gas chlorinator room.

3134B.3.3 Chlorine feeding device. The chlorine feeding device shall be capable of delivering chlorine in an aqueous solution at the maximum design rate. The device shall not allow the backflow of pool water into the chlorine container. The device shall not allow the release of chlorine gas to the atmosphere under normal operating conditions. The device shall be designed and installed to conduct chlorine gas leaks to the outdoors during a release of chlorine gas or an interruption of the water supply.

3134B.3.4 Piping. Piping carrying chlorine gas under pressure shall not be located outside the gas chlorination equipment room.

PUBLIC POOLS

LONGITUDINAL SECTION

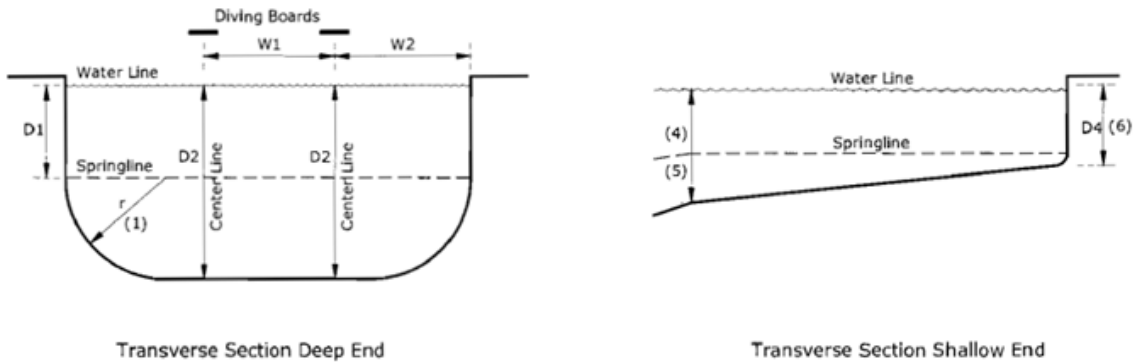
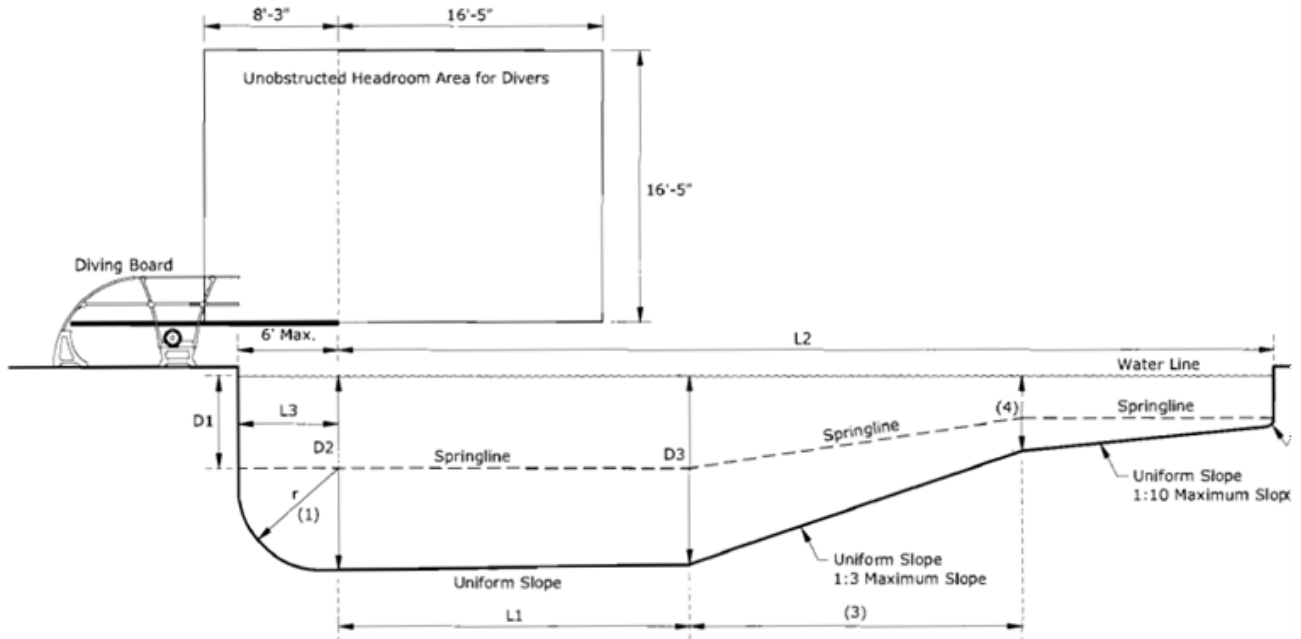


FIGURE 31B-1

DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS GREATER THAN 30 INCHES (762 mm) ABOVE THE WATER LINE

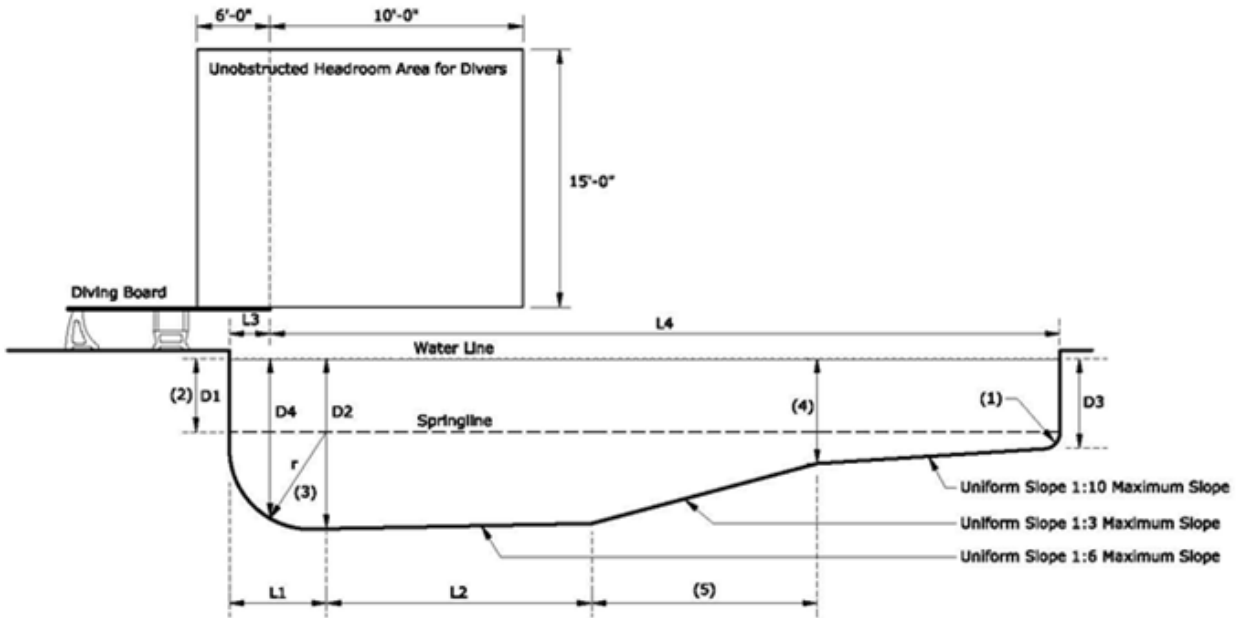
TABLE 31B-1

BOARDS AND PLATFORMS	DEPTH OF WATER					LENGTH OF SECTION				
	DIM	D1	D2	D3	D4	L1	L2	L3	W1	W2
1-meter board	Min.	5'-6"	11'-6"	11'-2"	0'-0"	16'-5"	29'-7"	5'-11"	7'-11"	8'-3"
3-meter board	Min.	6'-6"	12'-6"	12'-2"	0'-0"	19'-9"	33'-8"	5'-11"	8'-7"	11'-6"

Notes for Figure 31B-1 and Table 31B-1:

1. Maximum radius shall equal D2 minus D1 dimensions.
2. Radius at the shallow end shall not be more than 12 inches.
3. The length of a section is based on the maximum slope and other maximum and minimum dimensions.
4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
5. The springline depth at (4) shall not be more than 4'-0".
6. The maximum water depth shall be 3'-6".
7. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

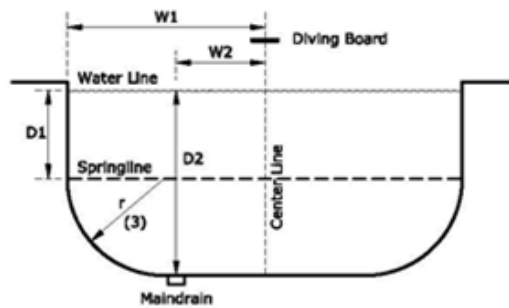


FIGURE 31B-2
DEPTHS AND CLEARANCES FOR POOLS WITH DIVING BOARDS 30 INCHES (762 MM) OR LESS ABOVE THE WATER LINE

TABLE 31B-2

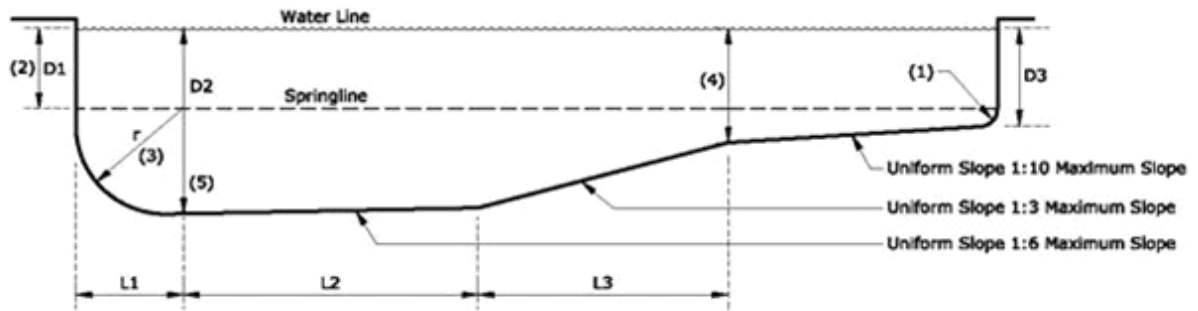
DIMENSION	DEPTH OF WATER				LENGTH OF SECTION					
	D1	D2	D3	D4	L1	L2	L3		W1	W2
Minimum	2'-6"	8'-6"	0'-0"	7'-0"	6'-0"	6'-0"	2'-6"	30'-0"	9'-0"	3'-0"
Maximum	—	—	3'-6"	—	10'-0"	—	4'-0"	—	—	—

Notes for Figure 31B-2 and Table 31B-2:

1. Radius at the shallow end shall be a maximum of 1'-0".
2. Springline D1 shall extend to the break in slope between the shallow area and the deep area.
3. Maximum radius shall equal D2 minus D1 dimensions.
4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
5. Length of section is based on maximum slope and other maximum or minimum dimensions.
6. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.

PUBLIC POOLS

LONGITUDINAL SECTION



TRANSVERSE SECTION AT D2

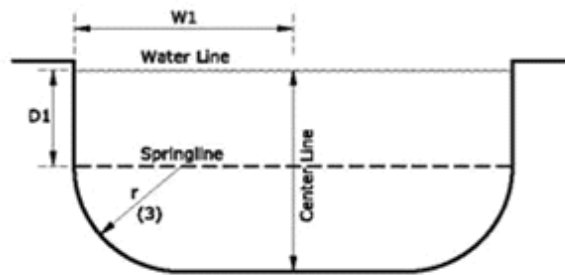


FIGURE 31B-3 DEPTHS AND CLEARANCES FOR POOLS WITHOUT DIVING BOARDS

TABLE 31B-3A POOLS WITH MAXIMUM WATER DEPTH ≤ 6'0"

DIMENSION	DEPTH OF WATER			LENGTH OF SECTION			
	D1	D2	D3	L1	L2	L3	W1
Minimum	2'-6"	—	0'-0"	3'-6"	3'-0"	3'-0"	6'-0"
Maximum	—	6'-0"	3'-6"	—	—	—	—

TABLE 31B-3B POOLS WITH MAXIMUM WATER DEPTH > 6'0"

DIMENSION	DEPTH OF WATER			LENGTH OF SECTION		
	D1	D2	D3	L1	L2	W1
Minimum	2'-6"	> 6'-0"	0'-0"	3'-6"	3'-0"	7'-6"
Maximum	—	—	3'-6"	—	—	—

Notes for Figure 31B-3 and Tables 31B-3a and 31B-3b.

1. Radius at the shallow end shall be a maximum of 1'-0".
2. Springline D1 shall extend to the break in slope between the shallow area and deep area.
3. Maximum radius shall equal D2 minus D1 dimensions.
4. Where there is a break in slope, the break shall be located at a water depth equal to 4'-6".
5. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of the pool that conducts water to a recirculating pump.

SECTION 3135B GAS CHLORINATION EQUIPMENT ROOM

Compressed chlorine gas storage containers and auxiliary components shall be installed indoors in a separate room of not less than 1-hour fire resistant construction and shall comply with the California Fire Code and all of the following.

3135B.1 Location. The gas chlorination equipment room shall not be located in any habitable building, above the first floor or below ground level.

3135B.2. Exit. Required exit doors shall swing in the direction of exit of travel and shall not open directly toward the pool or pool deck.

3135B.3 Ventilation. Mechanical exhaust ventilation systems shall be in compliance with the California Mechanical Code.

3135B.4 Alarm. An audible and visible chlorine detection alarm system shall be located in the room containing the gas chlorine equipment. The sensor shall be located within 6 inches (152 mm) of the floor level. The system shall continually monitor the room and shall activate when chlorine concentrations in the room exceed a Permissible Exposure Limit of 0.5 ppm. Activation of the alarm shall shut off the chlorine at the source and turn on the lights and ventilation system. The alarm system shall consist of the following:

1. An audible alarm capable of producing a sound level of at least 90 decibels; and
2. A visible alarm consisting of a strobe light which is mounted directly over the entrance to the chlorine equipment room. The light shall be visible during daylight hours.

3135B.5 Illumination. Artificial illumination of at least 50 footcandles as measured 30 inches (750 mm) from the floor shall be provided in the room.

3135B.6 Switches. Switches for the control of mechanical ventilation and lighting fixtures shall be located adjacent to the entry door outside the room.

3135B.7 Equipment interlocks. The gas chlorine feeding device shall be interlocked with the pool recirculating pump so that the gas chlorine feeding device shall not operate when the recirculating pump is off or during the filter backwash.

3135B.8 Storage. The gas chlorine room shall not be used for the storage of items not related to the use of the gas chlorine equipment.

SECTION 3136B POOL SKIMMING SYSTEMS

The pool shall be equipped with one or more skimming methods to provide continuous skimming of the pool water and shall be capable of continually withdrawing not less than 100 percent of the flow rate.

3136B.1 Surface skimmers. Each surface skimmer shall comply with the following provisions:

1. The skimmer shall be recessed into the pool wall; and

2. The skimmer shall be individually adjustable for the rate of flow with either an external or internal device; and
3. If used, a skimmer equalizer suction outlet shall be connected to at least two suction grate assemblies that meet the ANSI/APSP-16 2011 performance standard and are located at least 3 feet (915 mm) apart in any dimension between the suction outlets; and
4. The skimmer weir shall automatically adjust to variations in the pool water level over a range of not less than 4 inches (102 mm); and
5. Each skimmer shall be provided with a removable and cleanable screen or basket to trap objects. The screen or basket shall be accessible through an opening in the deck above the skimmer; and
6. There shall be a minimum of one skimmer for every 500 square feet or less of pool water surface area or an adequate number to meet 100 percent of pump flow at the manufacturer's maximum flow rating, whichever is greater; and
7. Each skimmer shall be located in relation to pool inlets to aid recirculation and surface skimming; and
8. All surface skimmers shall comply with applicable requirements established by the NSF/ANSI 50-2012 performance standard effective September 2012.

3136B.2 Perimeter overflow systems. A perimeter overflow system shall be required in pools whose water surface area equals or exceeds 5,000 square feet (464.52 m²). Perimeter overflow systems shall be designed by an engineer or architect who has experience working on public pools and shall comply with the following provisions:

1. **Location.** The overflow system shall be integrated with the pool structure and extend completely around the pool parallel to the pool deck except where an entry or exit may require interruption; and
2. **Channel detail.** The overflow channel shall be not less than 3 inches (76 mm) deep, the section shall not diverge with depth of the channel, and the width of the bottom shall be not less than 3 inches (76 mm). The opening beneath the coping into the overflow system shall be a minimum of 4 inches (102 mm) beneath the coping in any direction measured radially from the inner edge of the overflow channel lip; and
3. **Channel lip.** The overflow channel lip shall be not more than 12 inches (305 mm) below the level of the coping or deck. The lip edge shall be rounded and shall be not thicker than 2¹/₂ inches (64 mm) or thinner than 1 inch (25 mm) for the top 2 inches (51 mm); and
4. **Channel covering.** Covered overflow channels shall be permitted provided the openings do not exceed 1/2 inch in the smaller dimension; and
5. **Channel outlets.** Channel outlet spacing and channel bottom slope shall be hydraulically designed by an engineer or architect who has experience working on public pools; and

6. **Channel outlet covers.** Overflow channel outlet covers shall be accessible for cleaning and maintenance. Openings of the channel outlet covers shall not pass a $\frac{1}{2}$ inch (13 mm) sphere in the smaller dimension; and
7. **Channel drain piping.** Channel drain piping shall provide drainage of the overflow system, carry overflow water to a surge basin and return to skimming within 10 minutes after being flooded by a sudden displacement of the pool water by pool users; and
8. **Surge storage capacity.** A perimeter overflow system shall be provided with a minimum surge storage capacity of not less than 1 gallon per square foot (40.75 L/m²) of pool water surface area. Surge storage shall be permitted in the surge basin, perimeter overflow channel and in the channel drain piping returning to the surge basin.

SECTION 3137B POOL FITTINGS

3137B.1 Outlets. Each pool shall be provided with a main drain submerged suction outlet typically located at the bottom of a pool that conducts water to a recirculating pump. Suction outlets shall comply with all of the following provisions:

1. Each pump on a pool system shall be connected to at least two suction outlets. The suction outlets shall be hydraulically balanced and symmetrically plumbed through one or more "T" fittings and shall be separated by a distance of at least 3 feet (915 mm) in any dimension between the suction outlets; and
2. All suction outlets shall be equipped with suction fittings that meet the ANSI/APSP-16 2011 performance standard; and
3. The velocity of the suction piping installed between the suction outlets shall not exceed 3 feet per second (.91 mps) under normal operation, or 6 feet per second (1.82 mps) if one outlet is blocked; and
4. Hydrostatic relief devices. In areas with a high ground-water table, or as required by local plumbing codes, a hydrostatic relief device shall be installed. When used in conjunction with a safety vacuum release system, the hydrostatic relief device must meet the manufacturer's installation requirements for the safety vacuum release system.

Exception: Alternative outlet locations that have been designed by a licensed engineer who has experience working on public pools may be used if approved by the enforcing agent.

3137B.2 Inlet fittings. Each pool shall be provided with not less than two recirculation system inlets for the first 10,000 gallon (37,850 L) capacity and one additional inlet for each additional 10,000 gallon (37,850 L) or less capacity.

3137B.2.1 Construction. Inlet fittings shall not protrude greater than $1\frac{1}{4}$ inches (32 mm) into the pool and shall be shaped, rounded and smooth.

3137B.2.2 Location. Inlet fittings shall be located no less than 18 inches (457 mm) below the waterline, except for a

spa pool or wading pool. Inlet fittings shall be separated by at least 10 feet (3048 mm) and shall be located so as to ensure uniform circulation.

3137B.2.3 Adjustment. Provisions shall be made for adjusting the volume of flow through each inlet. Wall inlets shall be capable of adjusting the direction of flow and to produce sufficient velocity to impart a substantial circulatory movement to the pool water.

3137B.2.4 Floor inlets. Pools that are greater than 40 feet (12,192 mm) in width or 3,000 square feet (278.7 m²) in surface area shall have floor-mounted return inlets. The number of floor inlets shall be in compliance with Section 3137B.2. All floor inlet fittings shall be located to provide uniform circulation and shall be installed so as to be flush with the surface of the pool bottom.

SECTION 3138B SPA POOL SPECIAL REQUIREMENTS

3138B.1 Aeration system. A spa pool aeration and/or jet system shall be completely separate from the recirculation system and shall not be interconnected with any other pool.

3138B.2 Maximum operating temperature. The allowable water temperature of a spa pool shall not exceed 104° F (40° C).

3138B.3 Surface area. The water surface area of a spa pool shall not exceed 250 square feet (23.23 m²).

3138B.4 Maximum depth. The water depth in a spa pool shall not exceed 4 feet (1220 mm).

3138B.5 Emergency shut off switch. A clearly labeled emergency shut off switch for the control of both the recirculation system and the aeration and/or jet system shall be installed adjacent to the spa pool.

SECTION 3139B SOLAR HEATING INSTALLATIONS

3139B.1 Solar heating systems shall comply with the following:

1. Solar heating system suction outlets shall comply with Section 3137B; and
2. Solar heating system suction outlets shall be located no closer than 5 feet (1525 mm) to any pool inlet fitting; and
3. The installation of a solar heating system on a new or existing pool shall not interfere with the required turnover rate as specified in Section 3124B nor exceed the pipe flow velocities as specified in Section 3125B.1.

SECTION 3140B CLEANING SYSTEMS

A vacuum cleaning system shall be available which is capable of removing sediment from all parts of the pool floor. A cleaning system using potable water shall be protected by a backflow prevention device in accordance with Chapter 6 of the California Plumbing Code. No cleaning system shall operate in the pool when the pool is open or available for use by pool users. Built-in vacuum suction lines shall not be installed in the pool.

**SECTION 3141B
WASTEWATER DISPOSAL**

3141B.1 General requirements. Material cleaned from filters and backwash water from any recirculation system shall be disposed in a manner that is acceptable to the local wastewater agency and will not create a nuisance. Backwash water shall not be returned to a pool. Pipes carrying wastewater from pools including pool drainage and backwash from filters shall be installed as an indirect waste in accordance with the requirements of Chapter 8 of the California Plumbing Code. Where a pump is used to discharge waste pool water to the drainage system, the pump discharge shall be installed as an indirect waste.

3141B.2 Diatomaceous earth filters. The backwash from a diatomaceous earth filter shall discharge into a separation tank that has been installed to collect the waste diatomaceous earth mixture. The wastewater from the separation tank shall discharge into a sanitary sewer or other disposal system acceptable to the local wastewater agency.

3141B.3 Piping. Sumps and drain piping shall have sufficient capacity to receive recirculation system backwash without overflow of the sump receiver. The sump shall not permit sewage to enter the surge basin or the pool in the event of a sewage backup

3141B.4 Visual indicator. Where direct observation of the backwash discharge is not visible to the operator during backwash operations, a sight glass shall be installed on the wastewater discharge line.

3141B.5 Prohibited connection. There shall be no direct connection between the pool, its recirculation system or overflow drain to any sanitary sewer, storm drain or drainage system.

**SECTION 3142B
Reserved**

**SECTION 3143B
Reserved**

**SECTION 3144B
Reserved**

**SECTION 3145B
Reserved**

**SECTION 3146B
Reserved**

**SECTION 3147B
Reserved**

**SECTION 3148B
Reserved**

**SECTION 3149B
Reserved**

**SECTION 3150B
Reserved**

**SECTION 3151B
Reserved**

**SECTION 3152B
Reserved**

**SECTION 3153B
Reserved**

**SECTION 3154B
Reserved**

**SECTION 3155B
Reserved**

**SECTION 3156B
Reserved**

**SECTION 3157B
Reserved**

**SECTION 3158B
Reserved**

**SECTION 3159B
Reserved**

Division II – PUBLIC SWIMMING POOLS

Note: These building standards are in statute but have not been adopted through the regulatory process. Enforcement of these standards set forth in this section does not depend upon adoption of regulations; therefore, enforcement agencies shall enforce the standards pursuant to the timeline set forth in this section prior to adoption of related regulations.

**SECTION 3160B
GROUND FAULT CIRCUIT INTERRUPTERS**

1. "Public swimming pool," as used in this section, means any swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club, including any swimming pool located on the grounds of a hotel, motel, inn, an apartment complex or any residential setting other than a single-family home. For purposed of this section, "public swimming pool" shall not include a swimming pool located on the grounds of a

private single-family home, or a swimming pool owned or operated by the state or any local governmental entity as set forth in Section 116049 of the Health and Safety Code.

2. All dry-niche light fixtures, and all underwater wet-niche light fixtures operating at more than 15 volts in public swimming pools, as defined in this section, shall be protected by a ground fault circuit interrupter in the branch circuit, and all light fixtures in public swimming pools shall have encapsulated terminals.
3. Any public swimming pool that does not meet the requirements specified in Item 2 by January 1, 1998, shall be retrofitted to comply with these requirements by July 1, 1998.
4. The ground-fault circuit interrupter required pursuant to this section shall comply with Underwriter's Laboratory standards.
5. The owner or operator of a public swimming pool shall have its public swimming pool inspected by a qualified inspector on or before September 1, 1998, to determine compliance with this section.
6. All electrical work required for compliance with this section shall be performed by an electrician licensed pursuant to Chapter 9 (commencing with Section 7000) of Division 3 of the Business and Professions Code.

Authority: Health and Safety Code Section 116064 (e)
 Reference: Health and Safety Code Section 116049 SB 1360, (Statutes 1995, c. 415).

**SECTION 3161B
 WADING POOLS**

1. "Public wading pool" means a pool that meets all of the following criteria:
 - 1.1. It has a maximum water depth not exceeding 18 inches (457 mm).
 - 1.2. It is a pool other than a pool that is located on the premises of a one-unit or two-unit residence, intended solely for the use of the residents or guests.
2. "Public wading pool" includes, but is not limited to, a pool owned or operated by private persons or agencies, or by state or local governmental agencies.
3. "Public wading pool" includes, but is not limited to, a pool located in an apartment house, hotel or similar setting that is intended for the use of residents or guests.
4. "Alteration" means any of the following:
 - 4.1. To change, modify or rearrange the structural parts or the design.
 - 4.2. To enlarge.
 - 4.3. To move the location of.
 - 4.4. To install a new water circulation system.

4.5. To make any repairs costing fifty dollars (\$50) or more to an existing circulation system.

5. A public wading pool shall have at least two circulation drains per pump that are hydraulically balanced and symmetrically plumbed through one or more T fittings, and are separated by a distance of at least 3 feet (914 mm) in any dimension between drains.
6. All public wading pool main drain suction outlets that are under 12 inches (305 mm) across shall be covered with antivortex grates or similar protective devices. All main drain suction outlets shall be covered with grates or antivortex plates that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.
7. The maximum velocity in the pump suction hydraulic system shall not exceed 6 feet per second (1.8 m/s) when 100 percent of the pump's flow comes from the main drain system and any main drain suction fitting in the system is completely blocked.
8. On or after January 1, 1998, all newly constructed public wading pools shall be constructed in compliance with this section.
9. Commencing January 1, 1998, whenever a construction permit is issued for alteration of an existing public wading pool, it shall be retrofitted so as to be in compliance with this section.
10. By January 1, 2000, every public wading pool, regardless of the date of original construction, shall be retrofitted to comply with this section.

Authority: Health and Safety Code Section 116064 (e)
 Reference: Health and Safety Code Section 116064 AB 2114, (Statutes 1995, c. 415).

**SECTION 3162B
 ANTI-ENTRAPMENT DEVICES AND SYSTEMS**

1. The Legislature finds and declares that the public health interest requires that there be uniform state-wide health and safety standards for public swimming pools to prevent physical entrapment and serious injury to children and adults. It is the intent of the Legislature to occupy the whole field of health and safety standards for public swimming pools and the requirements established in this article and the regulations adopted pursuant to this article shall be exclusive of all local health and safety standards relating to public swimming pools.
2. As used in this section, the following words have the following meanings:
 - (a) "ANSI/APSP performance standard" means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).

- (b) “ASME/ANSI performance standard” means a standard that is accredited by the American National Standards Institute and published by the American Society of Mechanical Engineers.
- (c) “ASTM performance standard” means a standard that is developed and published by ASTM International.
- (d) “Public swimming pool” means an outdoor or indoor structure, whether in-ground or above-ground, intended for swimming or recreational bathing, including a swimming pool, hot tub, spa or nonportable wading pool, that is any of the following:
- (i) Open to the public generally, whether for a fee or free of charge.
 - (ii) Open exclusively to members of an organization and their guests, residents of a multiunit apartment building, apartment complex, residential real estate development or other multi-family residential area, or patrons of a hotel or other public accommodations facility.
 - (iii) Located on the premises of an athletic club, or public or private school.
- (e) “Qualified individual” means a contractor who holds a current valid license issued by the State of California or a professional engineer licensed in the State of California who has experience working on public swimming pools.
- (f) “Safety vacuum release system” means a vacuum release system that ceases operation of the pump, reverses the circulation flow, or otherwise provides a vacuum release at a suction outlet when a blockage is detected.
- (g) “Skimmer equalizer line” means a suction outlet located below the waterline, typically on the side of the pool, and connected to the body of a skimmer that prevents air from being drawn into the pump if the water level drops below the skimmer weir. However, a skimmer equalizer line is not a suction outlet for purposes of Subdivisions (4) and (6).
- (h) “Suction outlet” means a fitting or fixture of a swimming pool that conducts water to a recirculating pump.
- (i) “Unblockable suction outlet” means a suction outlet, including the sump, that has a perforated (open) area that cannot be shadowed by the area of the 18-inch by 23-inch body blocking element of the ANSI/APSP-16 performance standard, and that the rated flow through any portion of the remaining open area cannot create a suction force in excess of the removal force values in Table 1 of that standard.
3. Subject to Subdivision (6), every public swimming pool shall be equipped with anti-entrapment devices or systems that comply with ANSI/APSP-16 performance standard or successor standard designated by the Federal Consumer Product Safety Commission.
- a. A public swimming pool that has a suction outlet in any location other than on the bottom of the pool shall be designed so that the recirculation system shall have the capacity to provide a complete turnover of pool water within the following time:
 - (i) One-half hour or less for a spa pool.
 - (ii) One-half hour or less for a spray ground.
 - (iii) One hour or less for a wading pool.
 - (iv) Two hours or less for a medical pool.
 - (v) Six hours or less for all other types of public pools.
4. Subject to Subdivisions (5) and (6), every public swimming pool with a single suction outlet that is not an unblockable suction outlet shall be equipped with at least one or more of the following devices or systems that are designed to prevent physical entrapment by pool drains:
- (a) A safety vacuum release system that has been tested by a nationally recognized testing laboratory and found to conform to ASME/ANSI Performance Standard A112.19.17, as in effect on December 31, 2009, or ASTM Performance Standard F2387, as in effect on December 31, 2009.
 - (b) A suction-limiting vent system with a tamper-resistant atmospheric opening, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.
 - (c) A gravity drainage system that utilizes a collector tank, provided that it conforms to any applicable ASME/ANSI or ASTM performance standard.
 - (d) An automatic pump shut-off system tested by a department-approved independent third party and found to conform to any applicable ASME/ANSI or ASTM performance standard.
 - (e) Any other system that is deemed, in accordance with federal law, to be equally effective as, or more effective than, the systems described in paragraph (a) at preventing or eliminating the risk of injury or death associated with the circulation system of the pool and suction outlets.
5. Every public swimming pool constructed on or after January 1, 2010, shall have at least two suction outlets per pump that are hydraulically balanced and symmetrically plumbed through one or more “T” fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets. A public swimming pool constructed on or after January 1, 2010, that meets the requirements of this subdivision, shall be exempt from the requirements of Subdivision (4).

6. A public swimming pool constructed prior to January 1, 2010, shall be retrofitted to comply with Subdivisions (3) and (4) by no later than July 1, 2010, except that no further retrofitting is required for a public swimming pool that completed a retrofit between December 19, 2007, and January 1, 2010, that complied with the Virginia Graeme Baker Pool and Spa Safety Act (15 U.S.C. Sec. 8001 et seq.) as in effect on the date of issue of the construction permit, or for a nonportable wading pool that completed a retrofit prior to January 1, 2010, that complied with state law on the date of issue of the construction permit. A public swimming pool owner who meets the exception described in this subdivision shall do one of the following prior to September 30, 2010:
- a. File the form issued by the department pursuant to subdivision (g), as otherwise provided in subdivision (h).
 - b. File a signed statement attesting that the required work has been completed.
 - c. Provide a document containing the name and license number of the qualified individual who completed the required work.
 - d. Provide either a copy of the final building permit, if required by the local agency, or a copy of one of the following documents if no permit was required:
 - (i) A document that describes the modification in a manner that provides sufficient information to document the work that was done to comply with federal law.
 - (ii) A copy of the final paid invoice. The amount paid for the services may be omitted or redacted from the final invoice prior to submission.
7. Prior to March 31, 2010, the department shall issue a form for use by an owner of a public swimming pool to indicate compliance with this section. The department shall consult with county health officers and directors of departments of environmental health in developing the form and shall post the form on the department's Internet Web site. The form shall be completed by the owner of a public swimming pool prior to filing the form with the appropriate city, county, or city and county department of environmental health. The form shall include, but not be limited to, the following information:
- a. A statement of whether the pool operates with a single suction outlet or multiple suction outlets that comply with Subdivision (5).
 - b. Identification of the type of anti-entrapment devices or systems that have been installed pursuant to Subdivision (4) and the date or dates of installation.
 - c. Identification of the type of devices or systems designed to prevent physical entrapment that have been installed pursuant to Subdivision (4) in a public swimming pool with a single suction outlet that is not an unblockable suction outlet and the date or dates of installation or the reason why the requirement is not applicable.
 - d. A signature and license number of a qualified individual who certifies that the factual information provided on the form in response to paragraphs (a) to (c), inclusive, is true to the best of his or her knowledge.
8. A qualified individual who improperly certifies information pursuant to Paragraph (d) of Subdivision (7) shall be subject to potential disciplinary action at the discretion of the licensing authority.
9. Except as provided in Subdivision (6), each public swimming pool owner shall file a completed copy of the form issued by the department pursuant to this section with the city, county, or city and county department of environmental health in the city, county, or city and county in which the swimming pool is located. The form shall be filed within 30 days following the completion of the swimming pool construction or installation required pursuant to this section or, if the construction or installation is completed prior to the date that the department issues the form pursuant to this section, within 30 days of the date that the department issues the form. The public swimming pool owner or operator shall not make a false statement, representation, certification, record, report or otherwise falsify information that he or she is required to file or maintain pursuant to this section.
10. In enforcing this section, health officers and directors of city, county, or city and county departments of environmental health shall consider documentation filed on or with the form issued pursuant to this section by the owner of a public swimming pool as evidence of compliance with this section. A city, county, or city and county department of environmental health may verify the accuracy of the information filed on or with the form.
11. To the extent that the requirements for public wading pools imposed by Section 116064 conflict with this section, the requirements of this section shall prevail.
12. The department shall have no authority to take any enforcement action against any person for violation of this section and has no responsibility to administer or enforce the provisions of this section.

Authority: Health and Safety Code Section 116064 (e)
 Reference: Health and Safety Code Section 116064.2 AB 2114, (Statutes 2012, c. 679).

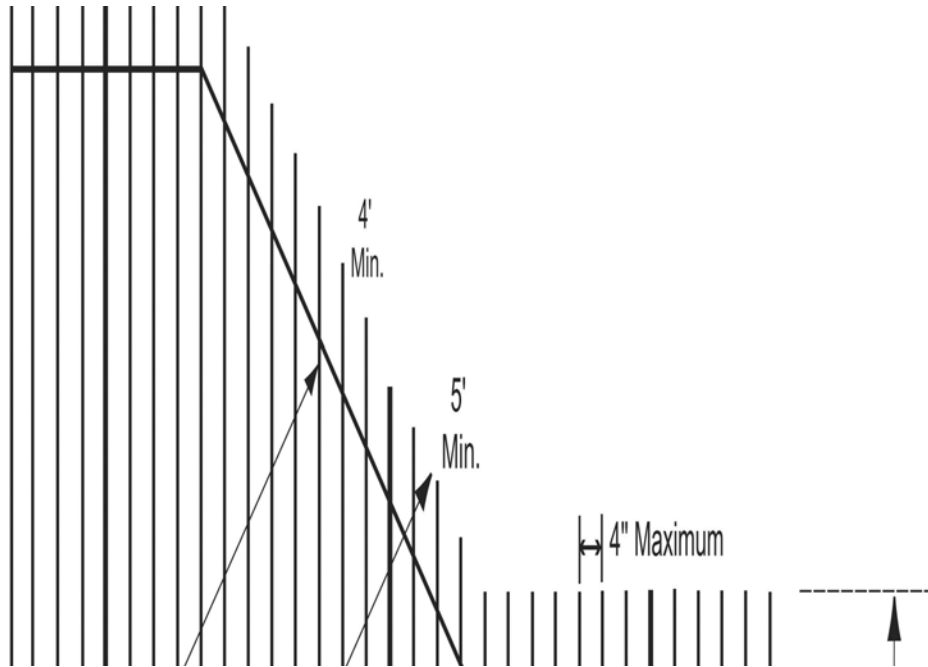


FIGURE 31B-4
PERPENDICULAR FENCING DIMENSIONS ON SLOPING GROUND

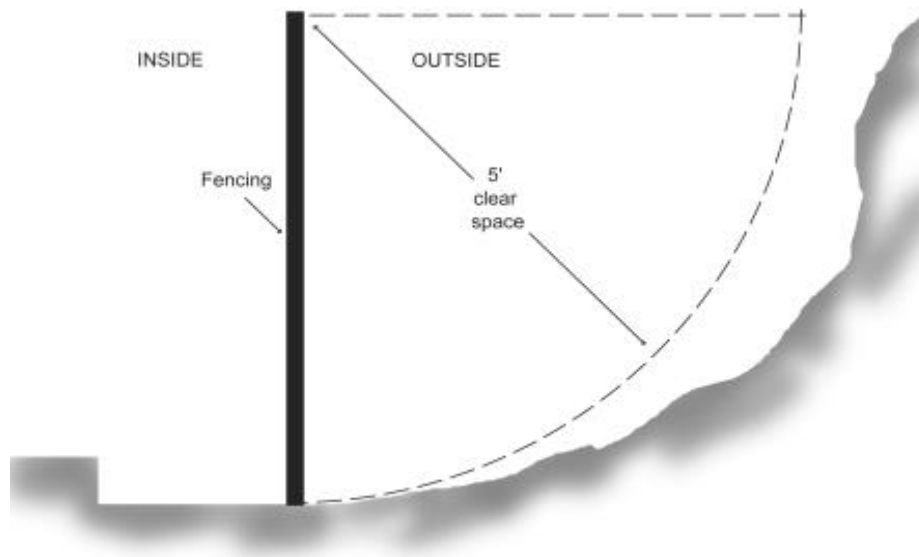
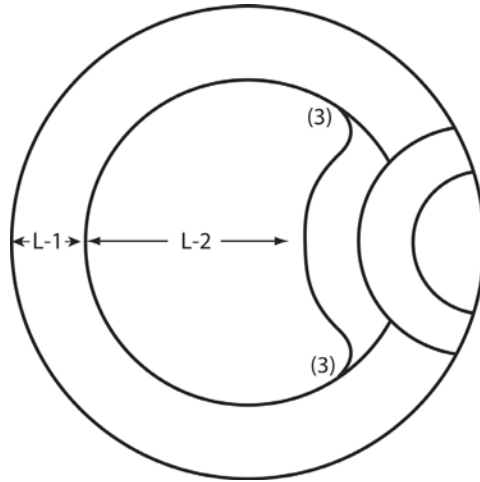


FIGURE 31B-5
EFFECTIVE FENCING HEIGHT

TOP VIEW



TRANSVERSE SECTION

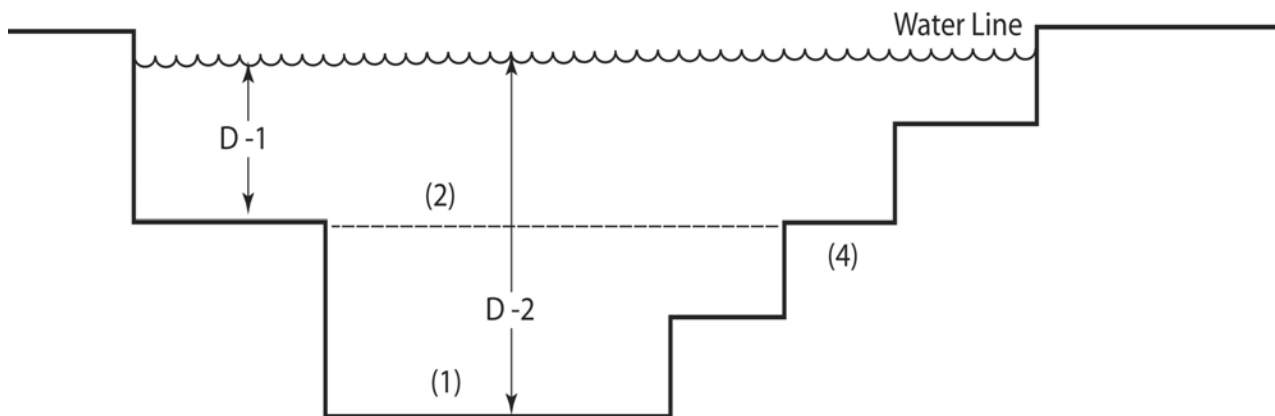


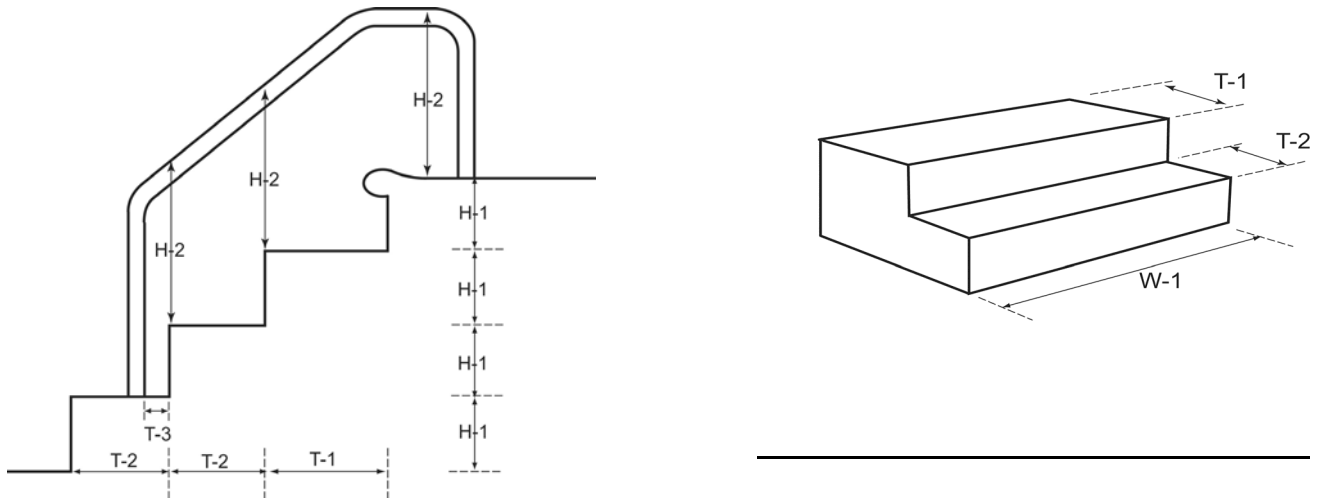
FIGURE 31B-6
DEPTHS AND DIMENSIONS FOR SPA POOLS

TABLE 31B-6

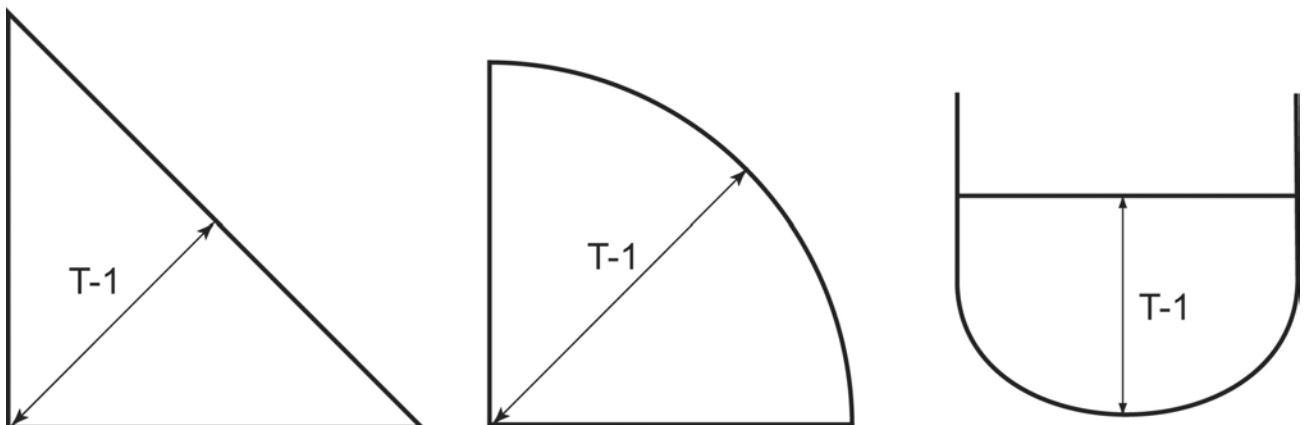
DIMENSION	DEPTH OF WATER		LENGTH OF SECTION	
	D1	D2	L1	L2
Minimum	—	24"	12"	24"
Maximum	24"	—	24"	—

Notes for Figure 31B-6 and Table 31B-6:

1. Bottom slope shall not exceed 1:10 and must be uniform.
2. Bench ramping shall not exceed 1:10 uniform slope, measured at the inner circumference of the bench.
3. Six inch minimum radius at "pinch points."
4. See Section 3111B for step and handrail dimensions.



Standard Step



Triangular Step

Corner Step

Concave Step

FIGURE 31B-7
STAIR AND HANDRAIL DIMENSIONS

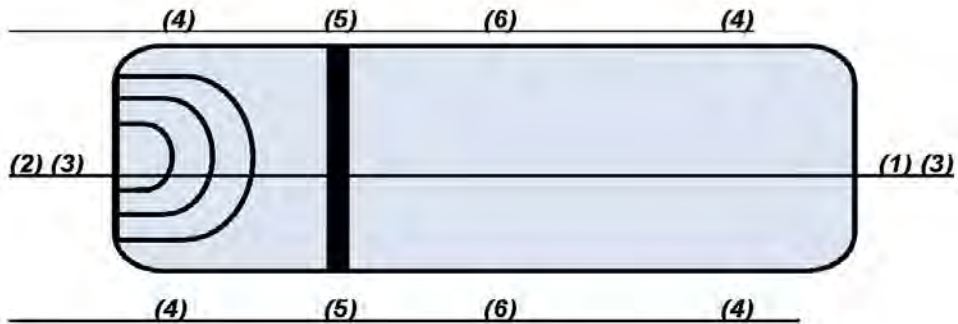
PUBLIC POOLS

TABLE 31B-7

DIMENSION	T-1 STANDARD	T-1 TRIANGULAR, CONCAVE, CONVEX	T-2	T-3	W-1	H-1	H-2
<i>Minimum</i>	14"	21"	12"	3"	24"	6"	28"
<i>Maximum</i>	18"	24"	16"	—	—	12"	36"

Note for Table 31B-7:

1. Six-inch minimum radius at "pinch points".



**FIGURE 31B-8
DEPTH MARKER LOCATIONS**

Notes:

1. Maximum depth.
2. Minimum depth.
3. Each end of pool.
4. Both sides at the shallowest and deepest parts of pool.
5. At the break in the bottom slope between the shallow and deep end.
6. Along the perimeter of the pool at distances not to exceed 25 feet.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 31C – RADIATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																X						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						
2113A.9.2																						

CHAPTER 31C [DPH]

RADIATION

SECTION 3101C SCOPE

For the purpose of this chapter, the following terms shall have the meaning indicated:

PRIMARY PROTECTIVE BARRIER is a barrier to attenuate the useful beam.

SECONDARY PROTECTIVE BARRIER is a barrier to attenuate stray radiation.

STRAY RADIATION is radiation not serving any useful purpose, which includes leakage and scattered radiation.

USEFUL BEAM is the radiation which passes through the window, aperture, cone or other collimating device of the tube housing.

SECTION 3102C RADIATION SHIELDING BARRIERS

All radiation shielding barriers in rooms and enclosures housing machines shall meet the requirements of Section 12-31C-101, Chapter 12-31C, Part 12, California Referenced Standards Code. The Department of Health Services is the only agency that may grant a variance or exception to these standards.

SECTION 3103C MEDICAL RADIOGRAPHIC AND PHOTOFLUOROGRAPHIC INSTALLATIONS

3103C.1 Operator station. The operator's station at the control shall be behind a protective barrier either in a separate room, in a protected booth or behind a shield which will intercept the useful beam and any radiation which has been scattered only once.

3103C.2 Patient observation and communication. Provision shall be made for the operator to observe and communicate with the patient without leaving the shielded position at the control panel. When an observation window is used, it must provide radiation attenuation equal to that required in the surrounding barrier.

SECTION 3104C MEDICAL THERAPEUTIC X-RAY INSTALLATIONS

3104C.1 General. All wall, floor and ceiling areas that can be struck by the useful beam, plus a border of 1 foot (305 mm), shall be provided with primary protective barriers.

3104C.2 Equipment operating above 50 kVp. Equipment operating above 50 kVp shall conform with the following:

1. The control station shielding shall either be an integral part of the building or anchored to the building.
2. The control station shall be provided with a window having radiation attenuation equal to that required by the adjacent barrier, or a mirror system, or a closed-circuit television viewing screen. The patient area must be visible to the operator without having to leave the protected area during exposure.

3104C.3 Equipment operating above 150 kVp. Equipment operating above 150 kVp shall conform to the following:

1. The treatment room shall be provided with interlocks so that when any door of the treatment room is opened, either the machine will shut off automatically or the radiation level within the room will be reduced to an average of not more than 2 milliroentgens per hour and a maximum of 10 milliroentgens per hour at a distance of one meter in any direction from the target. After such shutoff or reduction in output, it shall be possible to restore the machine to full operation only from the control panel.
2. The control station shall be within a protective booth or in an adjacent room.

3104C.4 A minimum of one door shall be provided with an auxiliary means for being opened in case of power failure or mechanical breakdown, where large power-driven doors offer the only access to the room.

3104C.5 A flashing red warning signal light energized only when the useful beam is on shall be located adjacent to the entrance(s) to a therapy room with equipment capable of operating above 500 kVp.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 31D – FOOD ESTABLISHMENTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter								X	X	X					X							
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						
2113A.9.2																						

CHAPTER 31D [DPH]
FOOD ESTABLISHMENTS

SECTION 3101D
SCOPE

The provisions of this chapter shall apply to the construction of commissaries serving mobile food preparation units.

SECTION 3102D
DEFINITION

For the purpose of this chapter, the following term shall have the meaning indicated:

COMMISSARIES SERVING MOBILE FOOD PREPARATION UNITS are food establishments in which food, containers, equipment or supplies are stored or handled for use in vehicles, mobile food preparation units, food carts or vending machines.

SECTION 3103D
BUILDINGS AND STRUCTURES

3103D.1 Light. Ten foot candles (107.6 lux) of uniformly distributed light as measured 30 inches (762 mm) above the floor shall be provided in all rooms and areas in commissaries serving mobile food preparation units.

CHAPTER 31E
RESERVED

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 31F – MARINE OIL TERMINALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						X
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 31F [SLC]

MARINE OIL TERMINALS

Division I

SECTION 3101F [SLC] INTRODUCTION

3101F.1 Authority. The Lempert-Keene-Seastrand oil spill prevention and response act of 1990 (act), as amended, authorizes the California State Lands Commission (SLC) to regulate marine terminals, herein referred to as marine oil terminals (MOTs), in order to protect public health, safety and the environment. The authority for this regulation is contained in Sections 8750 through 8760 of the California Public Resources Code. This act defines “oil” as any kind of petroleum, liquid hydrocarbons, or petroleum products or any fraction or residues thereof, including but not limited to, crude oil, bunker fuel, gasoline, diesel fuel, aviation fuel, oil sludge, oil refuse, oil mixed with waste and liquid distillates from unprocessed natural gas. The provisions of this chapter regulate onshore and offshore MOTs as defined under this act, including marine terminals that transfer liquefied natural gas (LNG).

The Marine Environmental Protection Division (Division) administers this code on behalf of the SLC.

3101F.2 Purpose. The purpose of this code is to establish minimum engineering, inspection and maintenance criteria for MOTs in order to prevent oil spills and to protect public health, safety and the environment. This code does not specifically address terminal siting, systems onboard vessels, processing facilities or operational requirements. Relevant provisions from existing codes, industry standards, recommended practices, regulations and guidelines have been incorporated directly or through reference, as part of this code.

Where there are differing requirements between this code and/or references cited herein, the choice of application shall be subject to Division approval.

In circumstances where technologies proposed for use are not covered by this code and/or references cited herein, prevention of oil spills and equivalent or better protection of the public health, safety and the environment must be demonstrated, and the choice of application shall be subject to Division approval.

3101F.3 Applicability. The provisions of this chapter are applicable to the evaluation of existing MOTs and design of new MOTs in California. Each provision is classified as New (N), Existing (E), or Both (N/E) and shall be applied accordingly. If no classification is indicated, the classification shall be considered to be (N/E).

Existing (E) requirements apply to MOTs that were in operation on the date this code became effective (February 6, 2006). For these MOTs, equivalent or in-kind replacement of existing equipment, short pipeline sections or minor modification of existing components shall also be subject to the existing (E) requirements.

New (N) requirements apply to:

1. A MOT or berthing system (Subsection 3102F.1.3) that commences or recommences operation with a new or modified operations manual after adoption of this code.
2. Addition of new structural components or systems at an existing MOT that are structurally independent of existing components or systems.
3. Addition of new (nonreplacement) equipment, piping, pipelines, components or systems to an existing MOT.
4. Major repairs or substantially modified in-place systems.
5. Any associated major installations or modifications.

3101F.4 Overview. This Code ensures that a MOT can be safely operated within its inherent structural and equipment-related constraints.

Section 3102F defines minimum requirements for audit, inspection and evaluation of the structural, electrical and mechanical systems on a prescribed periodic basis, or following a significant, potentially damage-causing event.

Section 3103F, 3104F and 3107F provide criteria for structural loading, deformation and performance-based evaluation considering earthquake, wind, wave, current, seiche and tsunami effects.

Section 3105F provides requirements for the safe mooring and berthing of tank vessels and barges.

Section 3106F describes requirements for geotechnical hazards and foundation analyses, including consideration of slope stability and soil failure.

Section 3108F provides requirements for fire prevention, detection and suppression including appropriate water and foam volumes.

Sections 3109F through 3111F provide requirements for piping/ pipelines, mechanical and electrical equipment and electrical systems.

Section 3112F provides requirements specific to marine terminals that transfer LNG.

Generally, English units are typically prescribed herein; however, System International (SI) units are utilized in Section 3112F and in many of the references.

3101F.5 Spill prevention. Each MOT shall utilize up-to-date Risk and Hazards Analysis results developed per CCPS “Guidelines for Hazard Evaluation Procedures” [1.1] and [1.2], to identify the hazards associated with operations at the MOT, including operator error, the use of the facility by various types of vessels (e.g., multi-use transfer operations), equipment failure and external events likely to cause an oil spill.

If there are changes made to the built MOT or subsequently any new hazard is identified with significant impact, the updated Risk and Hazards Analysis shall be used.

MARINE OIL TERMINALS

Assessed magnitude of potential oil spill releases and consequences shall be mitigated by implementing appropriate designs using best achievable technologies, subject to Division approval. The residual risks are addressed by operational and administrative means via 2 CCR 2385 [1.3].

Risk and Hazards Analysis requirements specific to marine terminals that transfer LNG are discussed in Section 3112F.2.

3101F.6 Oil spill exposure classification. Each MOT shall be categorized into one of three oil spill exposure classifications (high, medium or low) as shown in Table 31F-1-1, based on all of the following:

1. Exposed total volume of oil (V_T) during transfer.
2. Maximum number of oil transfer operations per berthing system (defined in Section 3102F.1.3) per year.
3. Maximum vessel size (DWT capacity) that may call at the MOT.

During a pipeline leak, a quantity of oil is assumed to spill at the maximum cargo flow rate until the ESD is fully effective. The total volume (V_T) of potential exposed oil is equal to the sum of the stored and flowing volumes ($V_S + V_F$) at the MOT, prior to the emergency shutdown (ESD) system(s) stopping the flow of oil. All potential spill scenarios shall be evaluated and the governing scenario clearly identified. The stored volume (V_S) is the non-flowing oil. The flowing volume (V_F) shall be calculated as follows:

$$V_F = Q_C \times \Delta t \times (1/3,600) \tag{1-1}$$

where:

V_F = Flowing volume of potential exposed oil [bbl]

Q_C = Maximum cargo transfer rate [bbl/hr]

Δt = For MOTs that first transferred oil on or before January 1, 2017, Δt may be taken as (ESD time, 30 or 60 seconds). For MOTs that first transfer oil after January 1, 2017, Δt shall be taken as ((ESD closure time) + (time required to activate ESD)) [seconds].

If spill reduction strategies, (e.g. pipeline segmentation devices, system flexibility and spill containment devices) are adopted, such that the maximum volume of exposed oil during transfer is less than 1,200 barrels, the spill classification of the facility may be lowered.

This classification does not apply to marine terminals that transfer LNG.

3101F.7 Management of Change. Whenever physical changes are made to the built MOT that significantly impact operations, a Management of Change (MOC) process shall be followed per Section 6.6 of API Standard 2610 [1.4].

3101F.8 Review requirements.

3101F.8.1 Quality assurance. All audits, inspections, engineering analyses or design shall be reviewed by a professional having similar or higher qualifications as the person who performed the work, to ensure quality assurance. This review may be performed in-house and shall include a concluding statement of compliance with this code.

3101F.8.2 Peer review. The Division may require peer review of advanced engineering analyses and designs, including, but not limited to, nonlinear dynamic structural analyses, alternative lateral force procedures, complex geotechnical evaluations, subsea pipeline analyses and designs and fatigue analyses. Peer review shall be performed by an external independent source to maintain the integrity of the process.

The peer reviewer(s) and their affiliated organization shall have no other involvement in the project, except in a review capacity. The peer reviewer(s) shall be a California registered engineer(s) familiar with regulations governing the work and have technical expertise in the subject matter to a degree of at least that needed for the original work. The peer reviewer(s)' credentials shall be presented to the Division for approval prior to commencement of the review.

Upon completion of the review process, the peer reviewer(s) shall submit a written report directly to the Division that covers all aspects of the review process, including, but not limited to:

1. Scope, extent and limitations of the review.
2. Status of the documents reviewed at each stage (i.e. revision number and date).
3. Findings.
4. Recommended corrective actions and resolutions, if necessary.
5. Conclusions.
6. Certification by the peer reviewer(s), including whether or not the final reviewed work meets the requirements of this code.

**TABLE 31F-1-1
MOT OIL SPILL EXPOSURE CLASSIFICATION**

SPILL CLASSIFICATION	EXPOSED TOTAL VOLUME OF OIL (V_T) (bbls)	MAXIMUM NUMBER OF TRANSFERS PER BERTHING SYSTEM PER YEAR	MAXIMUM VESSEL SIZE (DWT×1,000)
High	≥ 1200	N.A.	N.A.
Moderate	< 1200	≥ 90	≥ 30
Low	< 1200	< 90	< 30

7. Formal documentation of important peer review correspondence, including requests for information and written responses.

The owner and operator shall cooperate in the review process, but shall not influence the peer review. If the original work requires modification after completion of the peer review, the final analyses and designs shall be submitted to the Division.

3101F.8.3 Division review. The following will be subject to review for compliance with this code by the Division or its authorized representative(s):

1. Any audit, inspection, analysis or evaluation of MOTs.
2. Any significant change, modification or re-design of a structural, mooring, fire, piping/pipelines, mechanical or electrical system at an MOT, prior to use or reuse.
3. Engineering analysis and design for any new MOT prior to construction. Also see Section 3102F.3.3.1.
4. Construction inspection team and the construction inspection report(s).

3101F.9 Alternatives. In special circumstances where certain requirements of these standards cannot be met, alternatives that provide an equal or better protection of the public health, safety and the environment shall be subject to Division Chief approval with concurrence of the Division's lead engineer in responsible charge.

3101F.10 Symbols.

DWT = Dead weight tonnage

Q_C = Maximum cargo transfer rate [bbl/hr]

V_F = Flowing volume of potential exposed oil [bbl]

V_S = Stored volume of potential exposed oil [bbl]

V_T = Total volume of potential exposed oil [bbl]

Δt = ESD closure and activation time (if applicable)
[sec]

3101F.11 References.

[1.1]Center for Chemical Process Safety (CCPS), 2008, "Guidelines for Hazard Evaluation Procedures", 3rd ed., New York.

[1.2]California Code of Regulations (CCR), Title 14, Division 1, Chapter 3, Oil Spill Contingency Plans (14 CCR 815.01 through 818.03), Section 817.02(c)(1) – Risk and Hazard Analysis.

[1.3]California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)

[1.4]American Petroleum Institute (API), 2005, API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code. Section 8670.28(a)(7), Government Code.

Division 2

**SECTION 3102F
AUDIT AND INSPECTION**

3102F.1 General.

3102F.1.1 Purpose. Section 3102F defines minimum requirements for audit, inspection and evaluation of the structural, mechanical and electrical components and systems.

3102F.1.2 Audit and inspections types. The audit and inspections described in this Chapter (31F) are:

1. Annual compliance inspection
2. Audits
3. Post-event inspection

Each has a distinct purpose and is conducted either at a defined interval (see Table 31F-2-1 and Section 3102F.3.3), for a significant change in operations, or as a result of a significant, potentially damage-causing event. In the time between audits and inspections, operators are expected to conduct periodic walk-down examinations of the MOT to detect potentially unsafe conditions.

3102F.1.3 Berthing systems. For the purpose of assigning structural ratings and documenting the condition of mechanical and electrical systems, an MOT shall be divided into independent “berthing systems.” A berthing system consists of the wharf and supporting structure, mechanical and electrical components that serve the berth and pipeline systems.

For example, a MOT consisting of wharves with three berths adjacent to the shoreline could contain three independent “berthing systems” if the piping does not route through adjacent berths. Therefore, a significant defect that would restrict the operation of one berth would have

no impact on the other two berths. Conversely, if a T-head Pier, with multiple berths sharing a trestle that supports all piping to the shoreline, had a significant deficiency on the common trestle, the operation of all berths could be adversely impacted. This configuration is classified as a single berthing system.

The physical boundaries of a berthing system may exclude unused sections of a structure. Excluded sections must be physically isolated from the berthing system. Expansion joints may provide this isolation.

3102F.1.4 Records. All MOTs shall have records reflecting current, “as-built” conditions for all berthing systems. Records shall include, but not be limited to modifications and/or replacement of structural components, electrical or mechanical equipment or relevant operational changes, new construction including design drawings, calculations, engineering analyses, soil borings, equipment manuals, specifications, shop drawings, technical and maintenance manuals and documents.

Chronological records and reports of annual inspections, audits and post-event inspections and documentation of equipment or structural changes shall be maintained.

Records shall be indexed and be readily accessible to the Division (see 2 CCR Section 2320 (c) (2)) [2.1].

3102F.1.5 Baseline assessment. If “as-built” or subsequent modification drawings are not available, incomplete or inaccurate, a baseline inspection is required to gather data in sufficient detail for adequate evaluation.

The level of detail required shall be such that structural member sizes, connection and reinforcing details are documented, if required in the structural analysis. In addition,

**TABLE 31F-2-1
MAXIMUM INTERVAL BETWEEN UNDERWATER INSPECTIONS (YEARS)¹**

INSPECTION CONDITION ASSESSMENT RATING (ICAR) ⁶	CONSTRUCTION MATERIAL				CHANNEL BOTTOM OR MUDLINE—SCOUR ⁴	
	Unwrapped Timber or Unprotected Steel (no coating or cathodic protection) ⁴		Concrete, Wrapped Timber, Protected Steel or Composite Materials (FRP, plastic, etc.) ⁴		Benign ² Environment	Aggressive ³ Environment
	Benign ² Environment	Aggressive ³ Environment	Benign ² Environment	Aggressive ³ Environment		
6 (Good)	6	4	6	5	6	5
5 (Satisfactory)	6	4	6	5	6	5
4 (Fair)	5	3	5	4	6	5
3 (Poor)	4	3	5	4	6	5
2 (Serious)	2	1	2	2	2	2
1 (Critical)	N/A ⁵	N/A ⁵	N/A ⁵	N/A ⁵	N/A ⁵	N/A ⁵

1. The maximum interval between Underwater Inspections shall be changed as appropriate, with the approval of the Division, based on the extent of deterioration observed on a structure, the rate of further anticipated deterioration or other factors.

2. Benign environments include fresh water and maximum current velocities less than 1.5 knots for the majority of the days in a calendar year.

3. Aggressive environments include brackish or salt water, polluted water or waters with current velocities greater than 1.5 knots for the majority of the days in the calendar year.

4. For most structures, two maximum intervals will be shown in this table, one for the assessment of construction material (timber, concrete, steel, etc.) and one for scour (last 2 columns). The shorter interval of the two should dictate the maximum interval used.

5. MOTs rated “Critical” will not be operational; and Emergency Action shall be required in accordance with Table 31F-2-6.

6. ICARs shall be assigned in accordance with Table 31F-2-4.

the strength and/or ductility characteristics of construction materials shall be determined, as appropriate. Nondestructive testing, partially destructive testing and/or laboratory testing methods may be used.

All fire, piping, mechanical and electrical systems shall be documented as to location, capacity, operating limits and physical conditions in the equipment layout diagram(s).

3102F.2 Annual compliance inspection. The Division may carry out annual inspections to determine the compliance status of the MOT with this code, based on the terminal's audit and inspection findings and action plan implementation (see Section 3102F.3.9).

These inspections may include a visual and tactile assessment of structural, mechanical and electrical systems of the topside and underside areas of the dock, including the splash zone. Subject to operating procedures, a boat shall be provided to facilitate the inspection of the dock undersides and piles down to the splash zone.

3102F.3 Audits.

3102F.3.1 Objective. The objective of the audit is to review structural, mechanical and electrical systems on a prescribed periodic basis to verify that each berthing system is fit for its specific defined purpose. The audit includes above water and underwater inspections, engineering evaluation, documentation and recommended follow-up actions.

3102F.3.2 Overview. The audit shall include above water and underwater inspections, and structural, electrical and mechanical systems evaluations, with supporting documentation, drawings and follow-up actions. Structural systems shall include seismic, operational, mooring, berthing and geotechnical considerations. Mechanical systems shall include fire, piping/pipelines and mechanical equipment considerations. The audit is performed by a multidisciplinary team of engineers, qualified inspectors and may include Division representatives.

The above water inspection involves an examination of all structural, mechanical and electrical components above the waterline. Structural defects and their severity shall be documented, but the exact size and location of each deficiency is typically not required.

The underwater inspection involves an examination of all structural, mechanical and electrical components below the waterline. A rational and representative underwater sampling of piles may be acceptable with Division approval, for cases of limited visibility, heavy marine growth, restricted inspection times because of environmental factors (currents, water temperatures, etc.) or a very large number of piles.

Global operational structural assessment rating(s) (OSAR), global seismic structural assessment rating(s) (SSAR) and global inspection condition assessment rating(s) (ICAR) shall be assigned to each structure and overall berthing system, where appropriate (Table 31F-2-4).

Remedial action priorities (RAP) shall be assigned for component deficiencies (Table 31F-2-5). Recommenda-

tions for remediation and/or upgrading shall be prescribed as necessary.

An audit is not considered complete until the audit report is received (in electronic and hard copy formats) by the Division.

3102F.3.3 Schedule.

3102F.3.3.1 Initial audit. For a new MOT or new berthing system(s), the initial audit of the "as-built" systems(s) shall be performed prior to commencement of operations.

3102F.3.3.2 Subsequent audits. A subsequent audit of each terminal shall be completed concurrently with the inspections (see Section 3102F.3.5). The audit team leader shall recommend either: (1) a default subsequent audit interval of 4 years, or (2) an alternate interval, based on assessments of the structural, mechanical and electrical systems, and consideration of:

1. The extent of the latest deterioration and/or disrepair,
2. The rate of future anticipated deterioration and/or disrepair,
3. The underwater inspection guidance provided in Table 31F-2-1, and
4. Other specified factors.

Based on independent assessment of these factors, the Division may accept the audit team leader's recommendation or require a different subsequent audit interval.

If there are no changes in the defined purpose (see Section 3102F.3.6.1) of the berthing system(s), relevant prior analyses may be referenced. However, if there is a significant change in the operations or condition of berthing system(s), a new analysis may be required.

The Division may require an audit, inspection or supplemental evaluations to justify changes in the use of the berthing system(s).

3102F.3.4 Audit team.

3102F.3.4.1 Project manager. The audit shall be conducted by a multidisciplinary team under the direction of a project manager representing the MOT. The project manager shall have specific knowledge of the MOT and may serve other roles on the audit team.

3102F.3.4.2 Audit team leader. The audit team leader shall lead the on-site audit team and shall be responsible for directing field activities, including the inspection of all structural, mechanical and electrical systems. The team leader shall be a California registered civil or structural engineer and may serve other roles on the audit team.

3102F.3.4.3 Structural inspection team. The structural inspection shall be conducted under the direction of a registered civil or structural engineer.

All members of the structural inspection team shall be graduates of a 4-year civil/structural engineering,

or closely related (ocean/coastal) engineering curriculum, and shall have been certified as an Engineer-in-Training; or shall be technicians who have completed a course of study in structural inspections. The minimum acceptable course in structural inspections shall include 80 hours of instruction specifically related to structural inspection, followed by successful completion of a comprehensive examination. An example of an acceptable course is the U.S. Department of Transportation's "Safety Inspection of In-Service Bridges." Certification as a Level IV Bridge Inspector by the National Institute of Certification in Engineering Technologies (NICET) shall also be acceptable [2.2].

For underwater inspections, the registered civil or structural engineer directing the underwater structural inspection shall also be a commercially trained diver or equivalent and shall actively participate in the inspection, by personally conducting a minimum of 25 percent of the underwater examination [2.2].

Each underwater team member shall also be a commercially trained diver, or equivalent. Divers performing manual tasks such as cleaning or supporting the diving operation, but not conducting or reporting on inspections, may have lesser technical qualifications [2.2].

3102F.3.4.4 Structural analyst. A California registered civil or structural engineer shall be in responsible charge of the structural evaluations.

3102F.3.4.5 Electrical inspection team. A registered electrical engineer shall direct the on-site team performing the inspection and evaluation of electrical components and systems.

3102F.3.4.6 Mechanical inspection team. A registered engineer shall direct the on-site team performing the inspection and evaluation of piping/pipeline, mechanical and fire components and systems, except the Fire Protection Assessment in accordance with Section 3108F.2.2.

3102F.3.4.7 Corrosion specialist. The corrosion specialist shall be a chemical engineer, corrosion engineer, chemist or other professional with expertise in the types and causes of corrosion, and available means to prevent, monitor and mitigate associated damage. The specialist shall perform the corrosion assessment (Section 3102F.3.6.5) and may be directly involved in corrosion inspection (Section 3102F.3.5.4).

3102F.3.4.8 Geotechnical analyst. A California registered civil engineer with a California authorization as a geotechnical engineer shall perform the geotechnical evaluation required for the audit and all other geotechnical evaluations.

3102F.3.4.9 Division representation. The Division representative(s) may participate in any audit or inspection as observer(s). The Division shall be notified in advance of audit-related inspections.

3102F.3.5 Scope of inspections.

3102F.3.5.1 Structural inspections.

3102F.3.5.1.1 Above water structural inspection. The above water inspection shall include all accessible components above and below deck that are reachable without the need for excavation or extensive removal of materials that may impair visual inspection. The above water inspection shall include, but not be limited to, the following:

1. Piles
2. Pile caps
3. Beams
4. Deck soffit
5. Bracing
6. Retaining walls and bulkheads
7. Connections
8. Seawalls
9. Slope protection
10. Deck topsides and curbing
11. Expansion joints
12. Fender system components
13. Dolphins and deadmen
14. Mooring points and hardware
15. Navigation aids
16. Platforms, ladders, stairs, handrails and gangways
17. Backfill (sinkholes/differential settlement)

3102F.3.5.1.2 Underwater structural inspection. The underwater inspection shall include all components below deck to the mudline, including the slope and slope protection, in areas immediately surrounding the MOT. The water depth at the berth(s) shall be evaluated, verifying the maximum or loaded draft specified in the MOT's Operations Manual (2 CCR 2385) [2.1].

The underwater structural inspection shall include the Level I, II and III inspection efforts, as shown in Tables 31F-2-2 and 31F-2-3. The underwater inspection levels of effort are described below, per [2.2]:

Level I—Includes a close visual examination, or a tactile examination using large sweeping motions of the hands where visibility is limited. Although the Level I effort is often referred to as a "swim-by" inspection, it must be detailed enough to detect obvious major damage or deterioration due to overstress or other severe deterioration. It should confirm the continuity of the full length of all members and detect undermining or exposure of normally buried elements. A Level I effort may also include limited probing of the substructure and adjacent channel bottom.

Level II—A detailed inspection which requires marine growth removal from a representative sampling of components within the structure. For piles, a 12-inch high band shall be cleaned at designated locations, generally near the low waterline, at the

mudline, and midway between the low waterline and the mudline. On a rectangular pile, the marine growth removal should include at least three sides; on an octagon pile, at least six sides; on a round pile, at least three-fourths of the perimeter. On large diameter piles, 3 ft or greater, marine growth removal should be effected on 1 ft by 1 ft areas at four locations approximately equally spaced around the perimeter, at each elevation. On large solid faced elements such as retaining structures, marine growth removal should be effected on 1 ft by 1 ft areas at the three specified elevations. The inspection should also focus on typical areas of weakness, such as attachment points and welds. The Level II effort is intended

to detect and identify damaged and deteriorated areas that may be hidden by surface biofouling. The thoroughness of marine growth removal should be governed by what is necessary to discern the condition of the underlying structural material. Removal of all biofouling staining is generally not required.

Level III—A detailed inspection typically involving nondestructive or partially-destructive testing, conducted to detect hidden or interior damage, or to evaluate material homogeneity. Level III testing is generally limited to key structural areas, areas which are suspect or areas which may be representative of the underwater structure.

**TABLE 31F-2-2
UNDERWATER INSPECTION LEVELS OF EFFORT [2.2]**

LEVEL	PURPOSE	DETECTABLE DEFECTS			
		Steel	Concrete	Timber	Composite
I	General visual/tactile inspection to confirm as-built condition and detect severe damage	Extensive corrosion, holes Severe mechanical damage	Major spalling and cracking Severe reinforcement corrosion Broken piles	Major loss of section Broken piles and bracings Severe abrasion or marine borer attack	Permanent deformation Broken piles Major cracking or mechanical damage
II	To detect surface defects normally obscured by marine growth	Moderate mechanical damage Corrosion pitting and loss of section	Surface cracking and spalling Rust staining Exposed reinforcing steel and/or prestressing strands	External pile damage due to marine borers Splintered piles Loss of bolts and fasteners Rot or insect infestation	Cracking Delamination Material degradation
III	To detect hidden or interior damage, evaluate loss of cross-sectional area or evaluate material homogeneity	Thickness of material Electrical potentials for cathodic protection	Location of reinforcing steel Beginning of corrosion of reinforcing steel Internal voids Change in material strength	Internal damage due to marine borers (internal voids) Decrease in material strength	N/A

**TABLE 31F-2-3
SCOPE OF UNDERWATER INSPECTION [2.2]**

LEVEL		SAMPLE SIZE AND METHODOLOGY ¹							
		Steel		Concrete		Timber		Composite	Slope Protection, Channel Bottom or Mudline-Scour
		Piles	Bulkheads/Retaining Walls	Piles	Bulkheads/Retaining Walls	Piles	Bulkheads/Retaining Walls	Piles	
I	Sample Size: Method:	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile	100% Visual/Tactile
II	Sample Size: Method:	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	Every 100 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth on 3 bands Measurement: Remaining diameter	Every 50 LF Visual: Removal of marine growth in 1 SF areas	10% Visual: Removal of marine growth in 3 bands	As necessary
III	Sample Size: Method:	5% Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	Every 200 LF Remaining thickness measurement; electrical potential measurement; corrosion profiling as necessary	0% N/A	0% N/A	5% Internal marine borer infestation evaluation	Every 100 LF Internal marine borer infestation evaluation	0%	Sonar imaging as necessary

1. The minimum inspection sampling size for small structures shall include at least two components.
LF = Linear Feet; SF = Square Feet; N/A = Not Applicable

3102F.3.5.2 Special inspection considerations.

3102F.3.5.2.1 Coated components. For coated steel components, Level I and Level II efforts should focus on the evaluation of the integrity and effectiveness of the coating. The piles should be inspected without damaging the coating. Level III efforts should include ultrasonic thickness measurements without removal of the coating, where feasible.

3102F.3.5.2.2 Encased components. For steel, concrete or timber components that have been encased, the Level I and II efforts should focus on the evaluation of the integrity of the encasement. If evidence of significant damage to the encasement is present, or if evidence of significant deterioration of the underlying component is present, then the damage evaluation should consider whether the encasement was provided for protection and/or structural capacity. Encasements should not typically be removed for an audit.

For encasements on which the formwork has been left in place, the inspection should focus on the integrity of the encasement, not the formwork. Level I and Level II efforts in such cases should concentrate on the top and bottom of the encasement. For concrete components, if deterioration, loss of bonding or other significant problems with the encasement are suspected, it may be necessary to conduct a special inspection, including coring of the encasement and laboratory evaluation of the materials.

3102F.3.5.2.3 Wrapped components. For steel, concrete or timber components that have been wrapped, the Level I and II efforts should focus on the evaluation of the integrity of the wrap. Since the effectiveness of a wrap may be compromised by removal, and since the removal and re-installation of wraps is time-consuming, it should not be routinely done. However, if evidence of significant damage exists, or if the effectiveness of the wraps is in question, then samples should be removed to facilitate the inspection and evaluation. The samples may be limited to particular zones or portions of members if damage is suspected, based on the physical evidence of potential problems. A minimum sample size of three members should be used. A five-percent sample size, up to 30 total members, may be adequate as an upper limit.

For wrapped timber components, Level III efforts should consist of removal of the wraps from a representative sample of components in order to evaluate the condition of the timber beneath the wrap. The sample may be limited to particular zones or portions of the members if damage is suspected (e.g., at the mudline/ bottom of wrap or in the tidal zone). The sample size should be determined based on the physical evidence of potential problems and the aggressiveness of the environment. A minimum sample size of three members should be used. A five-

percent sample size, up to 30 total members, may be adequate as an upper limit.

3102F.3.5.3 Mechanical and electrical inspections. The mechanical and electrical inspections shall include but not be limited to the following:

1. Loading arms
2. Cranes and lifting equipment, including cables
3. Piping/manifolds and supports
4. Oil transfer hoses
5. Fire detection and suppression systems
6. Vapor control system
7. Sumps/sump tanks
8. Vent systems
9. Pumps and pump systems
10. Lighting
11. Communications equipment
12. Gangways
13. Electrical switches and junction boxes
14. Emergency power equipment
15. Air compressors
16. Meters
17. Cathodic protection systems
18. Winches
19. ESD and other control systems
20. Ladders

All alarms, limit switches, load cells, current meters, anemometers, leak detection equipment, etc., shall be operated and/or tested to the extent feasible, to ensure proper function.

Utility, auxiliary and fire protection piping shall have external visual inspections, similar to that defined in Section 10.1 of API RP 574 [2.3] (N/E).

3102F.3.5.4 Corrosion inspection. During each audit, a comprehensive corrosion inspection shall be performed by a qualified engineer or technician. This inspection shall include all steel and metallic components, and any installed cathodic protection system (CPS). CPS inspection during the audit is not intended to substitute for required testing and maintenance performed on a more frequent schedule per Section 3111F.10. All inspection results shall be documented, and shall be used in the corrosion assessment (Section 3102F.3.6.5).

Submerged wharf structures and associated cathodic protection equipment (if installed) shall be inspected per [2.2]. Above water structures, ancillary equipment, supports and hardware shall be visually inspected. Corrosion inspection of utility, auxiliary and fire pipelines shall be done per Section 3102F.3.5.3.

For oil pipelines in an API 570 [2.4] inspection program, a corrosion inspection is not required as part

of the audit; however, the latest inspection results, calculations and conclusions shall be reviewed, and any significant results shall be included in the corrosion assessment.

3102F.3.6 Evaluation and assessment.

3102F.3.6.1 Terminal operating limits. The physical boundaries of the facility shall be defined by the berthing system operating limits, along with the vessel size limits and environmental conditions.

The audit shall include “Terminal Operating Limits” (TOLs) diagrams, which provide a concise statement of the purpose of each berthing system in terms of operating limits for representative vessel size ranges and mooring configurations approved to call and/or conduct transfer operations at the MOT. This description shall include, the minimum and maximum vessel sizes, including Length Overall (LOA), beam and maximum draft with associated displacement (see Figure 31F-2-1).

In establishing limits for both the minimum and maximum vessel sizes, due consideration shall be given to water depths, dolphin spacing, fender system limitations, manifold height and hose/loading arm reach, with allowances for tidal fluctuations, surge and drift.

Maximum wind, current or wave conditions, or combinations thereof, shall be clearly defined as limiting conditions for vessels at each berth, both with and without active product transfer.

The TOLs shall be explicitly presented to facilitate implementation by the MOT operator, such as through incorporation in the MOT’s Operations Manual (2 CCR 2385 [2.1]). The TOLs shall allow for direct comparison of operating limits and output from monitoring systems and instrumentation (i.e., anemometers, current meters, tension monitoring systems, velocity monitoring systems). Design and implementation considerations shall include, but not be limited to:

1. Units of measurement (i.e., English vs. System International units)
2. Directionality (i.e., current restrictions “to”, wind restrictions “from”, true or magnetic north)
3. Parameters of monitoring systems and instrumentation (i.e., duration/averaging of readings, elevation/depth of readings, distance/location of readings)

3102F.3.6.2 Mooring and berthing. Mooring and berthing analyses shall be performed in accordance with Section 3105F. The analyses shall be consistent with the terminal operating limits and the structural configuration of the wharf and/or dolphins and associated hardware.

Based on inspection results, analyses and engineering judgment, mooring and berthing OSARs shall be assigned on a global basis, independently for each

structure and overall berthing system. The OSARs defined in Table 31F-2-4 shall be used for this purpose. The mooring and berthing OSARs document the berthing system(s) fitness-for-purpose.

3102F.3.6.3 Structure. A structural evaluation, including a seismic analysis, shall be performed in accordance with Sections 3103F through 3107F. Such evaluation shall consider local or global reduction in capacity, as determined from the inspection.

Based on inspection results, structural analyses and engineering judgment, OSARs (for operational loading) and SSARs shall be assigned on a global basis, independently for each structure, structural system(s) and berthing system(s), as appropriate. The OSARs and SSARs defined in Table 31F-2-4 shall be used for this purpose and document the structural and/or berthing system(s) fitness-for-purpose.

Based on inspection results and engineering judgment, ICARs shall be assigned on a global basis, independently for each above and underwater structure, structural system and berthing system, as appropriate. The ICARs defined in Table 31F-2-4 shall be used for this purpose.

Structural component deficiencies assigned RAPs as per Table 31F-2-5 shall be considered in the OSARs, SSARs and ICARs. The assigned ratings shall remain in effect until all the significant corrective action has been completed to the satisfaction of the Division, or until completion of the next audit.

3102F.3.6.4 Mechanical and electrical systems. An evaluation of all mechanical and electrical systems and components shall be performed in accordance with Sections 3108F through 3111F of these standards. Forces and imposed seismic displacements resulting from the structural analysis shall be considered in the pipeline stress analyses (Section 3109F.3), and the piping/pipelines shall be assigned SSARs in Table 31F-2-7B. Mechanical and electrical component deficiencies shall be assigned ratings from Table 31F-2-5.

3102F.3.6.5 Corrosion assessment (N/E). A comprehensive assessment shall be performed by the corrosion specialist (Section 3102F.3.4.7), to determine the existing and potential corrosion using “as-built” drawings and specifications. This assessment shall comprise all steel and metallic components, including the structure, pipelines, supports and other MOT ancillary equipment. This assessment shall also include prestressed and reinforced concrete structures.

If cathodic protection is installed to protect wharf structures and/or pipelines, the following records shall be evaluated for each system:

1. CPS equipment condition and maintenance
2. Impressed current readings (as applicable)
3. Potential survey results

**TABLE 31F-2-4
ASSESSMENT RATINGS**

RATING		DESCRIPTION OF STRUCTURE(S) AND/OR SYSTEMS ⁴	
		OSAR ¹ and SSAR ²	ICAR ³
6	Good	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	No problems or only minor problems noted. Structural elements may show very minor deterioration, but no overstressing observed. No repairs or upgrades are required.
5	Satisfactory	The capacity of the structure or system meets the requirements of this standard. The structure or system should be considered fit-for-purpose. No repairs or upgrades are required.	Limited minor to moderate defects or deterioration observed, but no overstressing observed. No repairs or upgrades are required.
4	Fair	The capacity of the structure or system is no more than 15 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system should be considered as marginal. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.	All primary structural elements are sound, but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present, but do not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. Facility may remain operational, provided a plan and schedule for remedial action is presented to and accepted by the Division.
3	Poor	The capacity of the structure or system is no more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration or overstressing observed on widespread portions of the structure, but does not significantly reduce the load bearing capacity of the structure. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
2	Serious	The capacity of the structure or system is more than 25 percent below the requirements of this standard, as determined from an engineering evaluation. The structure or system is not fit-for-purpose. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.	Advanced deterioration, overstressing or breakage may have significantly affected the load bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by the Division.
1	Critical	The capacity of the structure or system is critically deficient relative to the requirements of this standard. The structure or system is not fit-for-purpose. The facility shall cease operations until deficiencies are corrected and accepted by the Division.	Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur and load restrictions should be implemented as necessary. The facility shall cease operations until deficiencies are corrected and accepted by the Division.

1. OSAR = Operational Structural Assessment Ratings
2. SSAR = Seismic Structural Assessment Ratings
3. ICAR = Inspection Condition Assessment Ratings [2.2]; Ratings shall be assigned comparing the observed condition to the as-built condition.
4. Structural, mooring or berthing systems

**TABLE 31F-2-5
COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP)**

REMEDIAL PRIORITIES	DESCRIPTION AND REMEDIAL ACTIONS
P1	Specified whenever a condition that poses an immediate threat to public health, safety or the environment is observed. <u>Emergency Actions</u> may consist of barricading or closing all or portions of the berthing system, evacuating product lines and ceasing transfer operations. The berthing system is not fit-for-purpose. <u>Immediate remedial actions</u> are required prior to the continuance of normal operations.
P2	Specified whenever defects or deficiencies pose a potential threat to public health, safety and the environment. Actions may consist of limiting or restricting operations until remedial measures have been completed. The berthing system is not fit-for-purpose. This priority requires investigation, evaluation and <u>urgent action</u> .
P3	Specified whenever systems require upgrading in order to comply with the requirement of these standards or current applicable codes. These deficiencies <u>do not require emergency or urgent actions</u> . The MOT may have limitations placed on its operational status.
P4	Specified whenever damage or defects requiring repair are observed. The berthing system is fit-for-purpose. <u>Repair can be performed during normal maintenance cycles, but not to exceed one year</u> .
R	Recommended action is a good engineering/maintenance practice, but not required by these standards. The berthing system is fit-for-purpose.

**TABLE 31F-2-6
FOLLOW-UP ACTIONS [2.2]**

FOLLOW-UP ACTION	DESCRIPTION
<i>Emergency Action</i>	<i>Specified whenever a condition which poses an immediate threat to public health, safety or the environment is observed. Emergency Actions may consist of barricading or closing all or portions of the berthing system, limiting vessel size, placing load restrictions, evacuating product lines, ceasing transfer operations, etc.</i>
<i>Engineering Evaluation</i>	<i>Specified whenever damage or deficiencies are observed which require further investigation or evaluation to determine appropriate follow-up actions.</i>
<i>Repair Design Inspection</i>	<i>Specified whenever damage or defects requiring repair are observed. The repair design inspection is performed to the level of detail necessary to prepare appropriate repair plans, specifications and estimates.</i>
<i>Upgrade Design and Implementation</i>	<i>Specified whenever the system requires upgrading in order to comply with the requirements of these standards and current applicable codes.</i>
<i>Special Inspection</i>	<i>Typically specified to determine the cause or significance of nontypical deterioration, usually prior to designing repairs. Special testing, laboratory analysis, monitoring or investigation using nonstandard equipment or techniques are typically required.</i>
<i>Develop and Implement Repair Plans</i>	<i>Specified when the Repair Design Inspection and required Special Inspections have been completed. Indicates that the structure is ready to have repair plans prepared and implemented.</i>
<i>No Action</i>	<i>Specified when no further action is necessary until the next scheduled audit or inspection.</i>

3102F.3.7 Follow-up actions. Follow-up actions per Table 31F-2-6 shall be prescribed by the audit team. Multiple follow-up actions may be assigned; however, guidance shall be provided as to the order in which the follow-up actions should be carried out.

If an assessment rating of “1”, “2” or “3” (Table 31F-2-4) or a RAP of “P1” or “P2” (Table 31F-2-5) or “Emergency Action” using Table 31F-2-6, is assigned to a structure, berthing system or critical component, the Division shall be notified immediately. The Executive Summary Table ES-2 (see Example Table 31F-2-8) shall include implementation schedules for all follow-up and remedial actions. Follow-up and remedial actions and implementation schedules are subject to Division approval.

For action plan implementation between audits, see Section 3102F.3.9.

3102F.3.8 Documentation and reporting. The audit reports shall be signed and stamped by the audit team leader. The inspection and other reports and drawings shall be signed and stamped by the engineers in responsible charge.

Each audit and inspection, whether partial or complete, shall be adequately documented. Partial inspections cover only specific systems or equipment examined. The resulting reports shall summarize and reference relevant previous ratings and deficiencies. Inspection reports shall be included in subsequent audits.

The contents of the audit and inspection reports for each berthing system shall, at a minimum, include the following as appropriate:

Executive summary—a concise narrative of the audit or inspection results and analyses conclusions. It shall include summary information for each berthing system, including an overview of the assigned follow-up actions. The Executive Summary Tables shall also be included (see Example Tables 31F-2-7A through 31F-2-7C and 31F-2-8).

Table of contents

Introduction—a brief description of the purpose and scope of the audit or inspection, as well as a description of the inspection/evaluation methodology used.

Existing conditions—a description, along with a summary, of the observed conditions. Subsections shall be used to describe the above water structure, underwater structure, fire, piping/pipeline, mechanical and electrical systems, to the extent each are included in the scope of the audit. Photos, plan views and sketches shall be utilized as appropriate to describe the structure and the observed conditions. Details of the inspection results such as test data, measurements data, etc., shall be documented in an appendix.

Evaluation and assessment—assessment ratings shall be assigned to all structures and/or berthing systems. Also, see Section 3102F.3.6. All supporting calculations, as-built drawings and documentation shall be included in appendices as appropriate to substantiate the ratings. However, the results and recommendations of the engineering analyses shall be included in this section. Component deficiencies shall be described and a corresponding RAP assigned.

Follow-up actions—Specific follow-up actions (Table 31F-2-6) shall be documented (Table 31F-2-8), and remedial schedules included, for each audited system. Audit team leaders shall specify which follow-up actions require a California registered engineer to certify that the completion is acceptable.

Appendices—When appropriate, the following appendices shall be included:

1. Background data on the terminal - description of the service environment (wind/waves/currents), extent and type of marine growth, unusual environmental conditions, etc.
2. Inspection/testing data

3. Mooring and berthing analyses
4. Structural and seismic analyses and calculations
5. Geotechnical report
6. MOT Fire Protection Assessment
7. Pipeline stress and displacement analyses
8. Mechanical and electrical system documentation
9. Corrosion assessment
10. Photographs, sketches and supporting data shall be included to document typical conditions and referenced deficiencies, and to justify the assessment ratings and the remedial action priorities RAPs assigned.

3102F.3.9 Action plan implementation between audits. The operator is responsible for correction of deficiencies between audits. Prior to implementation, projects shall be submitted for Division review in accordance with Section 3101F.8.3. During project implementation, the Division shall be informed of any significant changes. After project completion, “as-built” documentation, including drawings, calculations and analyses, shall be submitted to the Division.

Executive Summary Tables shall be updated by the operator and submitted to the Division at least annually.

3102F.4 Post-event notification and inspection. A post-event inspection is a focused inspection following a significant, potentially damage-causing event such as an earthquake, storm, vessel impact, fire, explosion, construction incident or tsunami. The primary purpose is to assess the integrity of structural, mechanical and electrical systems. This assessment will determine the operational status and/or any remedial measures required.

3102F.4.1 Notification and action plan. Notification as per 2 CCR 2325(e) [2.1] shall be provided to the local area Division field office. The notification shall include, as a minimum:

1. Brief description of the event
2. Brief description of the nature, extent and significance of any damage observed as a result of the event
3. Operational status and any required restrictions
4. Statement as to whether a Post-Event inspection will be carried out

The Division may carry out or cause to be carried out, a post-event inspection. In the interim, the Division may direct a change in the operations manual, per 2 CCR 2385 (f)(3) [2.1].

If a post-event inspection is required, an action plan shall be submitted to the Division within five (5) days after the event. This deadline may be extended in special circumstances. The action plan shall include the scope of the inspection (above water, underwater, electrical, mechanical systems, physical limits, applicable berthing systems, etc.) and submission date of the final report. The action plan is subject to Division approval.

3102F.4.2 Inspection team. The qualifications of the inspection team shall be the same as those prescribed in Section 3102F.3.4. Division representatives may participate in any post-event inspection, as observers, and may provide guidance.

3102F.4.3 Scope. The post-event inspection shall focus on the possible damage caused by the event. General observations of long-term or preexisting deterioration such as significant corrosion-related damage or other deterioration should be made as appropriate, but should not be the focus of the inspection. The inspection shall always include an above-water assessment of structural, mechanical and electrical components.

The inspection team leader shall determine the need for, and methodology of, an underwater structural assessment, in consultation with the Division. Above water observations, such as shifting or differential settlement, misalignments, significant cracking or spalling, bulging, etc., shall be used to determine whether or not an underwater assessment is required. Similarly, the inspection team leader shall determine, in consultation with the Division, the need for, and methodology of, any supplemental inspections (e.g., special inspections (see Section 3102F.3.5.3)).

The following information may be important in determining the need for, and methodology of, the post-event inspection:

1. Earthquakes or vessel or debris impact typically cause damage both above and below the waterline. Following a major earthquake, the inspection should focus on components likely to attract highest lateral loads (batter or shorter piles in the rear of the structure, etc.). In case of vessel or debris impact, the inspection effort should focus on components in the path of the impact mass.
2. Major floods or tsunamis may cause undermining of the structure and/or scouring at the mudline.
3. Fire damage varies significantly with the type of construction materials but all types may be adversely affected. Special inspections (sampling and laboratory testing) shall be conducted, as determined by the inspection team leader, in order to determine the nature and extent of damage.
4. High wind or wave events often cause damage both above and below the waterline. An underwater inspection may be required if damage is visible above the waterline. Structural damage may be potentially increased if a vessel was at the berth during the event. The effects of high wind may be most prevalent on equipment and connections of such equipment to the structure.

The methodology of conducting an underwater post-event inspection should be established with due consideration of the structure type and type of damage anticipated. Whereas slope failures or scour may be readily apparent in waters of adequate visibility, overstressing cracks on

piles covered with marine growth will not be readily apparent. Where such hidden damage is suspected, marine growth removal should be performed on a representative sampling of components in accordance with the Level II effort requirements described in Section 3102F.3.5.2. The cause of the event will determine the appropriate sample size and locations.

3102F.4.4 Post-event ratings. A post-event rating [2.2] shall be assigned to each berthing system upon completion of the inspection (see Table 31F-2-9). All observations of the above and under water structure, mechanical and electrical components and systems shall be considered in assigning a post-event rating.

Ratings should consider only damage that was likely caused by the event. Pre-existing deterioration such as corrosion damage should not be considered unless the structural integrity is immediately threatened or safety systems or protection of the environment may be compromised.

Assignment of ratings should reflect an overall characterization of the berthing system being rated. The rating shall consider both the severity of the deterioration and the extent to which it is widespread throughout the facility. The fact that the facility was designed for loads that are lower than the current standards for design should have no influence upon the ratings.

3102F.4.5 Follow-up actions. Follow-up actions shall be assigned upon completion of the post-event inspection of each berthing system. Table 31F-2-5 specifies remedial action priorities for deficiencies. Table 31F-2-6 specifies various follow-up actions. Multiple follow-up actions may be assigned; however, guidance should be provided as to the order in which the follow-up actions should be carried out. Follow-up actions shall be subject to Division approval.

3102F.4.6 Documentation and reporting. Documentation of the specific attributes of each defect shall not be required during a post-event inspection. However, a narrative description of significant damage shall be used. The description shall be consistent with and shall justify the post-event rating assigned.

A report shall be prepared and submitted to the Division upon completion of the post-event inspection and shall, at a minimum, include:

1. Brief description of the facility including the physical limits of the structure, type of construction material(s), and the mechanical and electrical systems present
2. Brief description of the event triggering the inspection
3. Scope of the inspection (above water, underwater, electrical or mechanical)
4. Date of the inspection
5. Names and affiliations of inspection team
6. Description of the nature, extent and significance of any observed damage resulting from the event

7. Photographs should be provided to substantiate the descriptions and justify the condition rating
8. Assignment of a post-event rating
9. Statement regarding whether the facility is fit to resume operations and, if so, under what conditions
10. Assignment of follow-up action(s)
11. Inspection data, drawings, calculations and other relevant engineering materials
12. Signature and stamp of team leader(s)

3102F.4.7 Action Plan Report. Upon completion of all actions delineated in the action plan, a final report shall be submitted to the Division to document the work completed. Supporting documentation such as calculations or other relevant data shall be provided in appendices.

3102F.5 References.

- [2.1] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)
- [2.2] Childs, K.M., editor, 2001, “Underwater Investigations - Standard Practice Manual,” American Society of Civil Engineers, Reston, VA.
- [2.3] American Petroleum Institute (API), 2009, API Recommended Practice 574 (API RP 574), “Inspection Practices for Piping System Components,” 3rd ed., Washington, D.C.
- [2.4] American Petroleum Institute (API), 2009, API 570, “Piping Inspection Code: In-service Inspection, Rating, Repair, and Alteration of Piping Systems,” 3rd ed., Washington, D.C.

Authority: Sections 8750 through 8760, Public Resources Code

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

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TABLE 31F-2-7A

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1A) GLOBAL OPERATIONAL STRUCTURAL ASSESSMENT RATINGS (OSAR)									REV. # MM/YYYY
	Berthing system	Berth(s) ¹	Structure(s) ¹	Type of analysis ²	OSAR rating ⁴	Last audit date (MM/YYYY)	Next audit due date (MM/YYYY)	Last analysis date (MM/YYYY) ⁵	Repair/replacement due date (MM/YYYY) ⁶	Fit-for-purpose (Y/N)
North Wharf	Berth 1	Wharfhead	O	5	08/2008	08/2011	02/2008	N/A	Y	None
North Wharf	Berth 1	Mooring Dolphin	M	3	08/2008	08/2011	05/2008	12/2008	N	Hook capacity inadequate
North Wharf	Berth 1	Breasting Dolphin	B	2	08/2008	08/2011	06/2008	02/2010	N	Berthing velocity restrictions required. Velocity monitoring system operational. Fender system to be upgraded. See Terminal Operating Limits.
North Wharf	Berth 1	Overall	O	4	08/2008	08/2011	02/2008	N/A	Y	None
North Wharf	Berth 1	Dolphins, Trestles, Catwalks, Bulkhead walls, etc.			08/2008	08/2011				
South Wharf	Berth 2				08/2008	08/2011				

TABLE 31F-2-7B

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1B) GLOBAL SEISMIC STRUCTURAL ASSESSMENT RATINGS (SSAR)									REV. # MM/YYYY
	Berthing system	Berth(s) ¹	Structure(s) ¹	SSAR rating ⁴	Last audit date (MM/YYYY)	Next audit due date (MM/YYYY)	Last analysis date (MM/YYYY) ⁵	Repair/replacement due date (MM/YYYY) ⁶	Fit-for-purpose (Y/N)	Description or comments ⁷
North Wharf	Berth 1	Wharfhead	2	08/2008	08/2011	05/2008	02/2010	N	Level 1 – OK; SAP2000 Pushover Analysis Level 2 – NG; SAP2000 Pushover Analysis displacements too large and liquefaction	
North Wharf	Berth 1	Trestle	5	08/2008	08/2011	05/2008	N/A	Y	Level 1 – OK; SAP2000 Linear Analysis Level 2 – OK; SAP2000 Linear Analysis	
North Wharf	Berth 1	30" Crude line	5	08/2008	08/2011	05/2008	N/A	Y	Level 1 – N/A Level 2 – OK; CAESAR Analysis	
North Wharf	Overall	Overall								
North Wharf	Berth 1	Dolphins, Pipeline, Trestles, Bulkhead walls, etc.								
South Wharf	Berth 2									

TABLE 31F-2-7C

EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-1C) GLOBAL INSPECTION CONDITION ASSESSMENT RATINGS (ICAR) ⁸							REV. # MM/YYYY
	Berthing system	Berth(s) ¹	Structure(s) ¹	Type of inspection ³	ICAR rating ^{4,9}	Last inspection date (MM/YYYY) ¹⁰	Inspection interval (YRS.)	Next inspection due date (MM/YYYY) ¹⁰
North Wharf	Berth 1	Wharfhead	AW	5	02/2008	3	02/2011	General satisfactory condition. See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Wharfhead	UW	4	02/2008	5	02/2013	Pile damage; 10 severe, 15 minor See RAPs in Table ES-2 for details.
North Wharf	Berth 1	Breasting Dolphin BD-1	AW	6	02/2008	3	02/2011	See RAPs in Table ES-2
North Wharf	Berth 1	Breasting Dolphin BD-1	UW	5	02/2008	5	02/2013	See RAPs in Table ES-2
North Wharf	Berth 1	Dolphins, Trestle, Catwalks, Bulkhead walls, etc.						
South Wharf	Berth 2							

These notes apply to Tables 31F-2-7A through 7C:

1. The term "Overall" shall be input in this field when the assessment ratings are summarized for a berth.
2. "Types of Analyses": "O" = Operational Loading Analysis, "M" = Mooring Analysis, "B" = Berthing Analysis
3. "Types of Inspections": "AW" = Above Water Inspection, "UW" = Underwater Inspection
4. All assessment ratings shall be assigned in accordance with Table 31F-2-4.
5. The "Analysis Dates" are defined by the month and year in which the final design package is submitted to the Division.
6. The "Repair/Replacement Dates" are defined by the month and year in which the repair/replacement is to be completed and operational.
7. The "Description or Comments" shall reference all MOT operating limits. For OSARs, this includes berthing velocity restrictions, load limits, etc. For SSARs, this includes a brief list of the findings for each Seismic Performance Level.
8. Inspection findings may trigger a structural reassessment (see Tables 31F-2-7A and 31F-2-7B).
9. Ratings shall be assigned comparing the observed condition to the as-built condition.
10. The "Inspection Dates" are defined by the month and year in which the last day of formal field inspection is conducted.

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TABLE 31F-2-8

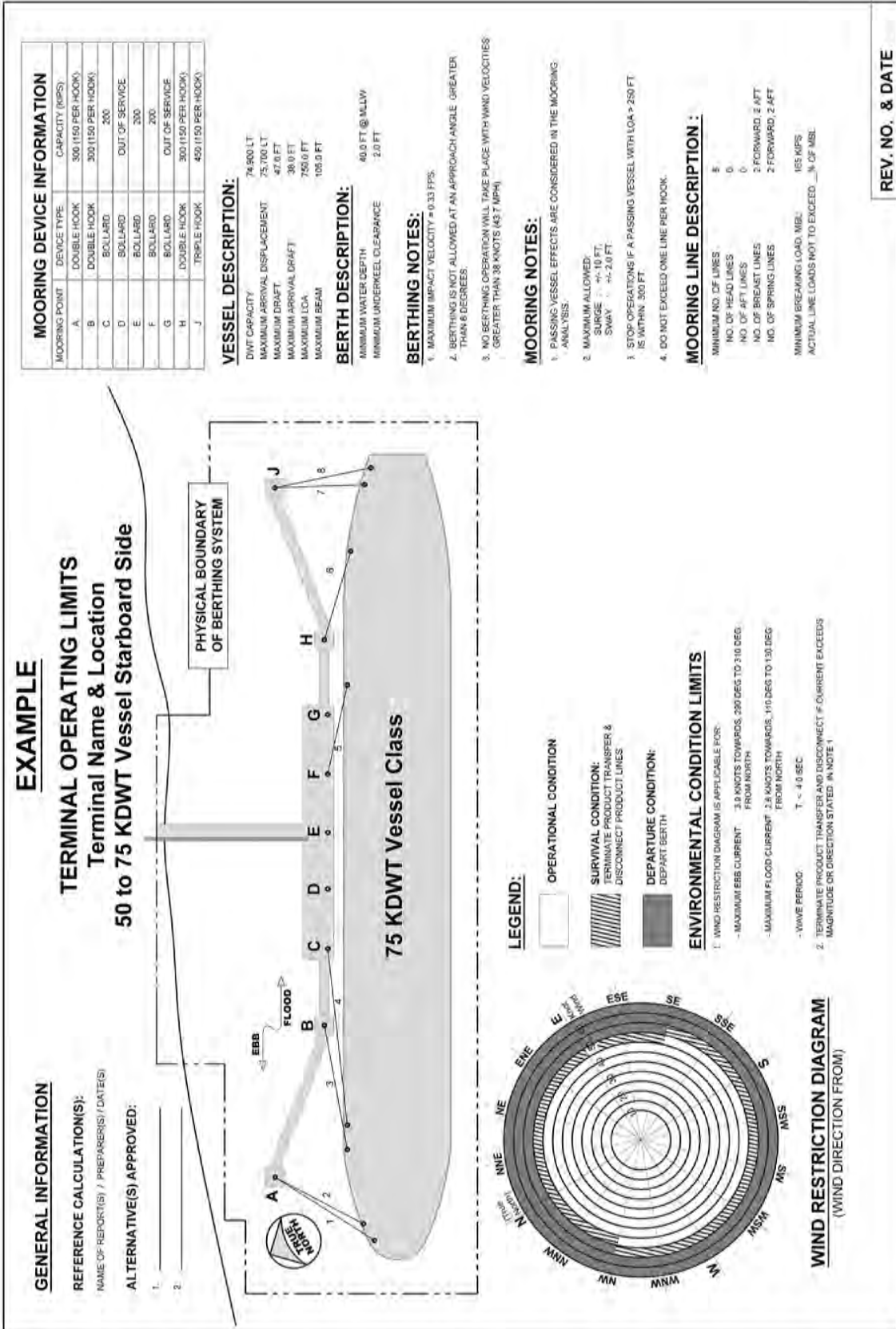
EXAMPLE	EXECUTIVE SUMMARY TABLE (ES-2) COMPONENT DEFICIENCY REMEDIAL ACTION PRIORITIES (RAP) ¹											REV. # MM/YYYY
	Berthing system	Berth(s)	Structure(s) or location(s)	Deficiency item label ²	Component: deficiency description	Remedial action priority (RAP) ³	CBC section reference	Audit checklist reference (optional)	Description of planned remedial action	P.E. review required? (Y/N) ⁴	Repair/replacement due date (MM/YYYY)	Completion date (MM/YYYY)
North Wharf	Berth 1	Wharfhead	02.0001.001	Piles: 10 piles have severe damage; 15 piles have minor damage.	P2	3102F.3.5.2		Replace 10 severe piles. Monitor 15 minor piles.	Y	05/2008	04/2008	10 piles replaced
North Wharf	Berth 1	Mooring Dolphin MD-1	02.0001.002	Curb: Spalling of concrete curb w/o exposed reinforcement.	R	3102F.3.5.2		Repair concrete curbs.	N	02/2009		
North Wharf	Berth 1	Wharfhead	08.0001.002	International Shore Fire Connection: Connections available, but not connected.	P3	3108F.6.3.4	8.6.22	Install International Shore Fire Connections.	N	10/2008		
North Wharf	Berth 1	Wharfhead	11.0001.001	Conduit Seals near Manifold: Conduit seals inadequate for Class 1, Division 1 location.	P1	3111F.2		Replace conduit seals with seals adequate for Class 1, Division 1 location within 30 days.	Y	04/2008	04/2008	Seals replaced
North Wharf	Berth 1	Wharfhead	11.0001.001	Pressurized Instrumentation Panel near Shelter: Pressure gauge reads "low" and will not hold pressure in Class 1, Division 2 location.	P2	3111F.2	3111F.4.5	Repair pressurized instrumentation panel in Class 1, Division 2 Location within 60 days.	Y	05/2008	05/2008	Pressurized instrumentation panel could not be repaired and was replaced.

These notes apply to Table 31F-2-8:

1. After a deficiency is corrected/completed, the row of text corresponding to that deficiency may be grayed out in subsequent ES-2 tables, and removed entirely in the subsequent audit.
2. The "Deficiency Item Labels" shall be assigned in the format shown above with the first series of numbers representing the Code Division/Section number ("XX"), a period (".") for separation, the second series of numbers representing the deficiency item number ("XXXX"), a period (".") for separation, and the third series of numbers representing the ES-2 table revision number ("XXX") in which the deficiency was first reported. Note that the deficiency item numbering will start from "0001" for the first deficiency in each section of the audit, and will increase consecutively in all future ES-2 tables.
3. RAPs shall be assigned in accordance with Table 31F-2-5.
4. Professional engineering review required in accordance with Section 3102F.3.8 under "Follow-up Actions."

TABLE 31F-2-9
POST-EVENT RATINGS AND REMEDIAL ACTIONS [2.2]

RATING	SUMMARY OF DAMAGE	REMEDIAL ACTIONS
A	No significant event-induced damage observed.	No further action required. The berthing system may continue operations.
B	Minor to moderate event-induced damage observed but all primary structural elements and electrical/mechanical systems are sound.	Repairs or mitigation may be required to remain operational. The berthing system may continue operations.
C	Moderate to major event-induced damage observed which may have significantly affected the load bearing capacity of primary structural elements or the functionality of key electrical/mechanical systems.	Repairs or mitigation may be necessary to resume or remain operational. The berthing system may be allowed to resume limited operations.
D	Major event-induced damage has resulted in localized or widespread failure of primary structural components; or the functionality of key electrical/mechanical systems has been significantly affected. Additional failures are possible or likely to occur.	The berthing system may not resume operations until the deficiencies are corrected.



MOORING DEVICE INFORMATION

MOORING POINT	DEVICE TYPE	CAPACITY (KIPS)
A	DOUBLE HOOK	300 (150 PER HOOK)
B	DOUBLE HOOK	300 (150 PER HOOK)
C	BOLLARD	200
D	BOLLARD	OUT OF SERVICE
E	BOLLARD	200
F	BOLLARD	200
G	BOLLARD	OUT OF SERVICE
H	DOUBLE HOOK	300 (150 PER HOOK)
J	TRIPLE HOOK	450 (150 PER HOOK)

VESSEL DESCRIPTION:

DWT CAPACITY: 74,500 LT
 MAXIMUM ARRIVAL DISPLACEMENT: 75,700 LT
 MAXIMUM DRAFT: 47.0 FT
 MAXIMUM ARRIVAL DRAFT: 38.0 FT
 MAXIMUM LCA: 750.0 FT
 MAXIMUM BEAM: 105.0 FT

BERTH DESCRIPTION:

MINIMUM WATER DEPTH: 40.0 FT @ MLLW
 MINIMUM UNDERKEEL CLEARANCE: 2.0 FT

BERTHING NOTES:

- MAXIMUM IMPACT VELOCITY = 0.33 FPS.
- BERTHING IS NOT ALLOWED AT AN APPROACH ANGLE GREATER THAN 6 DEGREES.
- NO BERTHING OPERATION WILL TAKE PLACE WITH WIND VELOCITIES GREATER THAN 38 KNOTS (43.7 MPH).

MOORING NOTES:

- PASSING VESSEL EFFECTS ARE CONSIDERED IN THE MOORING ANALYSIS.
- MAXIMUM ALLOWED:
 SURGE: +/- 10 FT.
 SWAY: +/- 2.0 FT.
- STOP OPERATIONS IF A PASSING VESSEL WITH LCA > 250 FT IS WITHIN 300 FT.
- DO NOT EXCEED ONE LINE PER HOOK.

MOORING LINE DESCRIPTION:

MINIMUM NO. OF LINES: 8
 NO. OF HEAD LINES: 0
 NO. OF AFT LINES: 0
 NO. OF BREAST LINES: 2 FORWARD, 2 AFT
 NO. OF SPRING LINES: 2 FORWARD, 2 AFT

MINIMUM BREAKING LOAD, MEL: 155 KIPS
 ACTUAL LINE LOADS NOT TO EXCEED ___% OF MBL

REV. NO. & DATE

FIGURE 31F-2-1

Division 3

**SECTION 3103F
STRUCTURAL LOADING CRITERIA**

3103F.1 General. Section 3103F establishes the environmental and operating loads acting on the marine oil terminal (MOT) structures and on moored vessel(s). The analysis procedures are presented in Sections 3104F – 3107F.

3103F.2 Dead loads.

3103F.2.1 General. Dead loads shall include the weight of the entire structure, including permanent attachments such as loading arms, pipelines, deck crane, fire monitor tower, gangway structure, vapor control equipment and mooring hardware. Unit weights specified in Section 3103F.2.2 may be used for MOT structures if actual weights are not available.

3103F.2.2 Unit weights. The unit weights in Table 31F-3-1 may be used for both existing and new MOTs.

**TABLE 31F-3-1
UNIT WEIGHTS**

MATERIAL	UNIT WEIGHT (pcf)*
Steel or cast steel	490
Cast iron	450
Aluminum alloys	175
Timber (untreated)	40-50
Timber (treated)	45-60
Concrete, reinforced (normal weight)	145-160
Concrete, reinforced (lightweight)	90-120
Asphalt paving	150

* pounds per cubic foot

3103F.2.3 Equipment and piping area loads. The equipment and piping area loads in Table 31F-3-2 may be used, as a minimum, in lieu of detailed as-built data.

**TABLE 31F-3-2
EQUIPMENT AND PIPING AREA LOADS**

LOCATION	AREA LOADS (psf)***
Open areas	20*
Areas containing equipment and piping	35**
Trestle roadway	20*

* Allowance for incidental items such as railings, lighting, miscellaneous equipment, etc.

**35 psf is for miscellaneous general items such as walkways, pipe supports, lighting and instrumentation. Major equipment weight shall be established and added into this weight for piping manifold, valves, deck crane, fire monitor tower, gangway structure and similar ma/or equipment.

*** pounds per square foot

3103F.3 Live loads and buoyancy. The following vertical live loading shall be considered, where appropriate: uniform loading, truck loading, crane loading and buoyancy. Additionally, MOT specific, nonpermanent equipment shall be identified and used in loading computations.

3103F.4 Earthquake loads.

3103F.4.1 General. Earthquake loads are described in terms of Peak Ground Acceleration (PGA), spectral acceleration and earthquake magnitude. The required seismic analysis procedures (Tables 31F-4-1 and 31F-4-2) are dependent on the spill classification obtained from Table 31F-1-1.

3103F.4.2 Design earthquake motion parameters. The earthquake ground motion parameters of peak ground acceleration, spectral acceleration and earthquake magnitude are modified for site amplification and near fault directivity effects. The resulting values are the Design Peak Ground Acceleration (DPGA), Design Spectral Acceleration (DSA) and Design Earthquake Magnitude (DEM).

For Site Classes A through E (Section 3103F.4.2.1), peak ground and design spectral accelerations shall be obtained from:

1. U.S. Geological Survey (USGS) published data as discussed in Section 3103F.4.2.2, or
2. A site-specific probabilistic seismic hazard analysis (PSHA) as discussed in Section 3103F.4.2.3.

Site-specific PSHA is required for Site Class F.

Unless stated otherwise, the DSA values are for 5 percent damping; values at other levels may be obtained as per Section 3103F.4.2.9.

The appropriate probability levels associated with DPGA and DSA for different seismic performance levels are provided in Table 31F-4-1. Deterministic earthquake motions, which are used only for comparison to the probabilistic results, are addressed in Section 3103F.4.2.7.

The evaluation of Design Earthquake Magnitude (DEM), is discussed in Section 3103F.4.2.8. This parameter is required when acceleration time histories (Section 3103F.4.2.10) are addressed or if liquefaction potential (Section 3106F.4) is being evaluated.

3103F.4.2.1 Site classes. The following Site Classes, defined in Section 3106F.2.1, shall be used in developing values of DSA and DPGA:

A, B, C, D, E and F

For Site Class F, a site-specific response analysis is required per Section 3103F.4.2.5.

3103F.4.2.2 Earthquake motions from USGS maps. Earthquake ground motion parameters can be obtained directly from the US Seismic Design Maps tool available at the USGS website (<http://earthquake.usgs.gov>) for the site condition(s) appropriate for the MOT site and the selected probability of exceedance. For this purpose, select the ASCE/SEI 41 [3.1] as the design code reference document, and specify the appropriate custom parameters, including but not limited to, location, required Probability of Exceedance (in 50 years), and appropriate Site Soil Classification(s) for the MOT

site. The USGS tool directly provides the peak ground and spectral accelerations for the selected hazard level and site condition(s).

The alternative method of obtaining earthquake ground motion parameters, from the most current USGS data for selected hazard level and site condition(s), is permitted. If needed, the data for appropriate probability of exceedance may be obtained using the procedure described in Chapter 1 of FEMA 356 [3.2], and corrected for the MOT site as discussed in Section 3103F.4.2.4 or Section 3103F.4.2.5.

3103F.4.2.3 Earthquake motions from site-specific probabilistic seismic hazard analyses. Site-specific Probabilistic Seismic Hazard Analysis (PSHA) shall use appropriate seismic sources and their characterization, attenuation relationships, probability of exceedance and site soil conditions. Site-specific PSHA shall be conducted by a qualified California registered civil engineer with a California authorization as a geotechnical engineer per Section 3102F.3.4.8.

If site-specific PSHA is used for Site Classes A, B, C, D or E, results from the site-specific PSHA shall be compared with those from the USGS published data as described in Section 3103F.4.2.2. If the two sets of values differ significantly, a justification for using the characterization chosen shall be provided. If DPGA and DSA from site-specific PSHA are less than 80 percent of the values from USGS data, a peer review may be required.

3103F.4.2.4 Simplified evaluation of site amplification effects. When the MOT site class is different from the Site Classes B to C boundary, site amplification effects shall be incorporated in peak ground accelerations and spectral accelerations. This may be accomplished using a simplified method or a site-specific evaluation (Section 3103F.4.2.5).

For a given site class, the following procedure from Chapter 1 of FEMA 356 [3.2] presents a simplified method that may be used to incorporate the site amplification effects for peak ground acceleration and spectral acceleration computed for the Site Classes B and C boundary.

1. Calculate the spectral acceleration values at 0.20 and 1.0 second period:

$$S_{XS} = F_a S_S \quad (3-1)$$

$$S_{X1} = F_v S_1 \quad (3-2)$$

where:

F_a = site coefficient obtained from Table 31F-3-3

F_v = site coefficient obtained from Table 31F-3-4

S_S = short period (usually at 0.20 seconds) spectral acceleration value (for the boundary of Site Classes B and C) obtained using Section 3103F.4.2.2, or at

the period corresponding to the peak in spectral acceleration values when obtained from Section 3103F.4.2.3

S_1 = spectral acceleration value (for the boundary of Site Classes B and C) at 1.0 second period

S_{XS} = spectral acceleration value obtained using the short period S_S and factored by Table 31F-3-3 for the site class under consideration.

S_{X1} = spectral acceleration value obtained using the 1.0 second period S_1 and factored by Table 31F-3-4 for the site class under consideration.

$$2. \text{ Set } PGA_x = 0.4S_{XS} \quad (3-3)$$

where:

PGA_x = peak ground acceleration corresponding to the site class under consideration.

When the value of PGA_x is less than the peak ground acceleration obtained following Section 3103F.4.2.2 or Section 3103F.4.2.3, an explanation of the results shall be provided.

3. PGA_x , S_{XS} and S_{X1} constitute three spectral acceleration values for the site class under consideration corresponding to periods of 0, S_S (usually 0.2 seconds), and 1.0 second, respectively.
4. The final response spectra, without consideration for near-fault directivity effects, values of S_a for the site class under consideration may be obtained using the following equations (for 5 percent critical damping):

For $0 < T < 0.2T_0$

$$S_a = (S_{XS})(0.4 + 3T/T_0) \quad (3-4)$$

where:

T = Period corresponding to calculated S_a

T_0 = Period at which the constant acceleration and constant velocity regions of the design spectrum intersect

For $0.2T_0 < T < T_0$

$$S_a = S_{XS} \quad (3-5)$$

For $T > T_0$

$$S_a = S_{X1}/T \quad (3-6)$$

where:

$$T_0 = S_{X1}/S_{XS} \quad (3-7)$$

The resulting PGA_x is the DPGA. However, the S_a shall be modified for near-fault directivity effects, per Section 3103F.4.2.6 to obtain the final DSAs.

**TABLE 3103F-3-3
VALUES OF F_a**

SITE CLASS	S_s				
	< 0.25	0.5	0.75	1.0	> 1.25
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.2	1.2	1.1	1.0	1.0
D	1.6	1.4	1.2	1.1	1.0
E	2.5	1.7	1.2	0.9	0.9
F	*	*	*	*	*

Note: Linear interpolation can be used to estimate values of F_a for intermediate values of S_s .

* Site-specific dynamic site response analysis shall be performed.

**TABLE 3103F-3-4
VALUES OF F_v**

SITE CLASS	S_I				
	< 0.1	0.2	0.3	0.4	> 0.5
A	0.8	0.8	0.8	0.8	0.8
B	1.0	1.0	1.0	1.0	1.0
C	1.7	1.6	1.5	1.4	1.3
D	2.4	2.0	1.8	1.6	1.5
E	3.5	3.2	2.8	2.4	2.4
F	*	*	*	*	*

Note: Linear interpolation can be used to estimate values of F_v for intermediate values of S_I .

* Site-specific dynamic site response analysis shall be performed.

3103F.4.2.5 Site-specific evaluation of amplification effects. As an alternative to the procedure presented in Section 3103F.4.2.4, a site-specific response analysis may be performed. For Site Class F a site-specific response analysis is required. The analysis shall be either an equivalent linear or nonlinear analysis. Appropriate acceleration time histories as discussed in Section 3103F.4.2.10 shall be used.

In general, an equivalent linear analysis using, for example, SHAKE91 [3.3] is acceptable when the strength and stiffness of soils are unlikely to change significantly during the seismic shaking and the level of shaking is not large. A nonlinear analysis should be used when the strength and/or stiffness of soils could significantly change during the seismic shaking or significant nonlinearity of soils is expected because of high seismic shaking levels.

The choice of the method used in site response analysis shall be justified considering the expected stress-strain behavior of soils under the shaking level considered in the analysis.

Site-specific site response analysis may be performed using one-dimensional analysis. However, to the extent that MOTs often involve slopes or earth retaining structures, the one-dimensional analysis should be used judiciously. When one-dimensional analysis cannot be justified or is not adequate, two-dimensional equivalent linear or nonlinear response

analysis shall be performed. Site-specific response analysis results shall be compared to those based on the simplified method of Section 3103F.4.2.4 for reasonableness.

The peak ground accelerations obtained from this site-specific evaluation are DPGAs and the spectral accelerations are DSAs as long as the near-fault directivity effects addressed in Section 3103F.4.2.6 are appropriately incorporated into the time histories (Section 3103F.4.2.10).

3103F.4.2.6 Directivity effects. When the site is 15 km (9.3 miles) or closer to a seismic source that can significantly affect the site, near-fault directivity effects shall be reflected in the spectral acceleration values and in the deterministic spectral acceleration values of Section 3103F.4.2.7.

Two methods are available for incorporating directivity effects:

1. Directivity effects may be reflected in the spectral acceleration values in a deterministic manner by using well established procedures such as that described in Somerville, et al. [3.4]. The critical seismic sources and their characterization developed as part of the deterministic ground motion parameters (Section 3103F.4.2.7) should be used to evaluate the directivity effects. The resulting adjustments in spectral acceleration values may be applied in the probabilistic spectral acceleration values developed per Section 3103F.4.2.4 or 3103F.4.2.5. Such adjustment can be independent of the probability levels of spectral accelerations.
2. Directivity effects may be incorporated in the results of site specific PSHA per Section 3103F.4.2.3. In this case, the directivity effects will also depend on the probability level of spectral accelerations.

If spectral accelerations are obtained in this manner, the effects of site amplification using either Section 3103F.4.2.4, 3103F.4.2.5 or an equivalent method (if justified) shall be incorporated.

3103F.4.2.7 Deterministic earthquake motions. Deterministic ground motions from “scenario” earthquakes may be used for comparison purposes. Deterministic peak ground accelerations and spectral accelerations may be obtained using the “Critical Seismic Source” with maximum earthquake magnitude and its closest appropriate distance to the MOT. “Critical Seismic Source” is that which results in the largest computed median peak ground acceleration and spectral acceleration values when appropriate attenuation relationships are used. The values obtained from multiple attenuation relationships should be used to calculate the median peak ground acceleration and spectral acceleration values.

For comparison, the values of peak ground accelerations and spectral accelerations may be obtained from

the USGS maps, corresponding to the Maximum Considered Earthquake (MCE). In this case, the median values of peak ground acceleration and spectral acceleration values shall be 2/3 (see Section 1.6 of FEMA 356 [3.2]) of the values shown on the USGS maps.

3103F.4.2.8 Design Earthquake Magnitude. The Design Earthquake Magnitude used in developing site-specific acceleration time histories (Section 3103F.4.2.10) or liquefaction assessment (Section 3106F.4) is obtained using either of the following two methods:

1. The design earthquake may be selected as the largest earthquake magnitude associated with the critical seismic source. The distance shall be taken as the closest distance from the source to the site. The resulting design earthquake shall be associated with all DPGA values for the site, irrespective of probability levels.
2. The design earthquake (DEQ) may be obtained for each DPGA or DSA value and associated probability level by determining the corresponding dominant distance and magnitude. These are the values of the distance and magnitude that contribute the most to the mean seismic hazards estimates for the probability of interest. They are usually determined by locating the summits of the 3-D surface of contribution of each small interval of magnitude and distance to the total mean hazards estimate. If this 3-D surface shows several modes with approximate weight of more than 20 percent of the total, several DEQs may be considered, and the DEQ leading to the most conservative design parameters shall be used.

3103F.4.2.9 Design Spectral Acceleration for various damping values. Design Spectral Acceleration (DSA) values at damping other than 5 percent shall be obtained by using a procedure given in Chapter 1 of FEMA 356 [3.2], and is denoted as DSA_d . The following procedure does not include near-fault directivity effects.

$$\text{For } 0 < T < 0.2 T_0$$

$$DSA_d = S_{XS} [(5/B_S - 2) T/T_0 + 0.4] \quad (3-8)$$

$$\text{For } 0.2 T_0 < T < T_0$$

$$DSA_d = DSA/B_S \quad (3-9)$$

$$\text{For } T > T_0$$

$$DSA_d = S_1 / (B_1 T) \quad (3-10)$$

where:

$$T = \text{period}$$

$$T_0 = S_{X1} / S_{XS}$$

B_S = Coefficient used to adjust the short period spectral response, for the effect of viscous damping.

B_1 = Coefficient used to adjust one-second period spectral response, for the effect of viscous damping

Values of B_S and B_1 are obtained from Table 31F-3-5.

Such a procedure shall incorporate the near-fault directivity effects when the MOT is 15 km (9.3 miles) or closer to a significant seismic source.

**TABLE 31F-3-5
VALUES OF B_S AND B_1 [3.2]**

DAMPING (%)	B_S	B_1
< 2	0.8	0.8
5	1.0	1.0
10	1.3	1.2
20	1.8	1.5
30	2.3	1.7
40	2.7	1.9
> 50	3.0	2.0

Note: Linear interpolation should be used for damping values not specifically listed.

3103F.4.2.10 Development of acceleration time histories. When acceleration time histories are utilized, target spectral acceleration values shall be initially selected corresponding to the DSA values at appropriate probability levels. For each set of target spectral acceleration values corresponding to one probability level, at least three sets of horizontal time histories (one or two horizontal acceleration time histories per set) shall be developed.

Initial time histories shall consider magnitude, distance and the type of fault that are reasonably similar to those associated with the conditions contributing most to the probabilistic DSA values. Preferred initial time histories should have their earthquake magnitude and distance to the seismic source similar to the mode-magnitude and mode-distance derived from the PSHA or from appropriate maps. When an adequate number of recorded time histories are not available, acceleration time histories from simulations may be used as supplements.

Scaling or adjustments, either in the frequency domain or in the time domain (preferably), prior to generating acceleration time histories should be kept to a minimum. When the target spectral accelerations include near-fault directivity effects (Section 3103F.4.2.6), the initial time histories should exhibit directivity effects.

When three sets of time histories are used in the analysis, the envelope of the spectral acceleration values from each time history shall be equal to or higher than the target spectral accelerations. If the envelope values fall below the target values, adjustments shall be made to ensure that the spectral acceleration envelope is higher than target spectral accelerations. If the envelope is not higher, then a justification shall be provided.

When seven or more sets of time histories are used, the average of the spectral acceleration values from the

set of time histories shall be equal or higher than the target spectral acceleration values. If the average values fall below the target values, adjustments shall be made to ensure that average values are higher than the target spectral accelerations. If this is not the case, then an explanation for the use of these particular spectral acceleration values shall be provided.

When three sets of time histories are used in the analysis, the maximum value of each response parameter shall be used in the design, evaluation and rehabilitation. When seven or more sets of time histories are used in the analysis, the average value of each response parameter may be used.

3103F.5 Mooring loads on vessels.

3103F.5.1 General. Forces acting on a moored vessel may be generated by wind, waves, current, tidal variations, tsunamis, seiches and hydrodynamic effects of passing vessels. Forces from wind and current acting directly on the MOT structure (not through the vessel in the form of mooring and/or breasting loads) shall be determined in Section 3103F.7.

The vessel's moorings shall be strong enough to hold during all expected environmental and passing vessel conditions (see Section 3105F), while adequately accommodating changes in draft, surge, sway, yaw and tide.

3103F.5.2 Wind loads. Wind loads on a vessel, moored at a MOT, shall be determined using procedures described in this section. Wind speed measured at an elevation of 33 feet (10 meters) above the water surface, with duration of 30 seconds shall be used to determine the design wind speed and wind limits for moored vessels. If these conditions are not met, adjustment factors shall be applied per Sections 3103F.5.2.2.

3103F.5.2.1 Design wind speed. For new MOTs, the 25-year return period shall be used to establish the design wind speed for each direction. The design wind speed is the maximum wind speed of 30-second duration used in the mooring analysis (see Section 3105F). The 30-second duration wind speed shall be determined from the annual maximum wind data. Average annual summaries cannot be used. Maximum wind speed data for a minimum of eight directions (45-degree increments) shall be obtained. If other duration wind data is available, it shall be adjusted to a 30-second duration, in accordance with Equation (3-12).

3103F.5.2.2 Wind limits for moored vessels. Wind loads shall be calculated for each of the load cases identified in Section 3105F.2. Wind velocity limits for moored vessels shall be presented in the Terminal Operating Limits (see Section 3102F.3.6.1 and Figure 31F-2-1) for each of the conditions given below.

3103F.5.2.2.1 Operational condition. The operational condition is defined as the wind envelope in which a vessel may conduct transfer operations, as determined from the mooring analysis (Section 3105F). Transfer operations shall cease when the wind exceeds the maximum velocity of the envelope.

3103F.5.2.2.2 Survival condition. The survival condition is defined as the state wherein a vessel can remain safely moored at the berth during severe winds; however, loading arms and hoses shall be disconnected (see Sections 3110F.2 and 3110F.3 regarding movement limits of loading arms and hoses, respectfully). The survival condition is the wind zone between the operational condition and the departure condition (defined in Section 3103F.5.2.2). In this wind zone, the vessel must prepare to depart the berth.

3103F.5.2.2.3 Departure condition. The departure condition is defined as the wind state above which a vessel can no longer remain safely moored at the berth during severe winds, as determined from the mooring analysis (Section 3105F). For a new MOT, the departure condition threshold is the maximum wind velocity, for a 30-second gust and a 25-year return period, obtained from historical data. If the wind rises above these levels, the vessel must depart the berth.

3103F.5.2.3 Wind speed corrections. Wind speed measured at an elevation of 33 feet (10 meters) above the water surface, with duration of 30 seconds shall be used to determine the design wind speed. If these conditions are not met, the following corrections shall be applied.

The correction for elevation is obtained from the equation:

$$V_w = V_h \left(\frac{33}{h} \right)^{1/7} \quad (3-11)$$

where:

V_w = wind speed at elevation 33 ft. (10 m.)

V_h = wind speed at elevation h

h = elevation above water surface of wind data [feet]

The available wind duration shall be adjusted to a 30-second value, using the following formula:

$$V_{t=30\text{ sec}} = \frac{V_t}{c_t} \quad (3-12)$$

where:

$V_{t=30\text{ sec}}$ = wind speed for a 30-second duration

V_t = wind speed over a given duration

c_t = conversion factor from Figure 31F-3-1

If wind data is available over land only, the following equation shall be used to convert the wind speed from over-land to over-water conditions [3.5]:

$$V_w = 1.10 V_L \quad (3-13)$$

where:

V_w = over water wind speed

V_L = over land wind speed

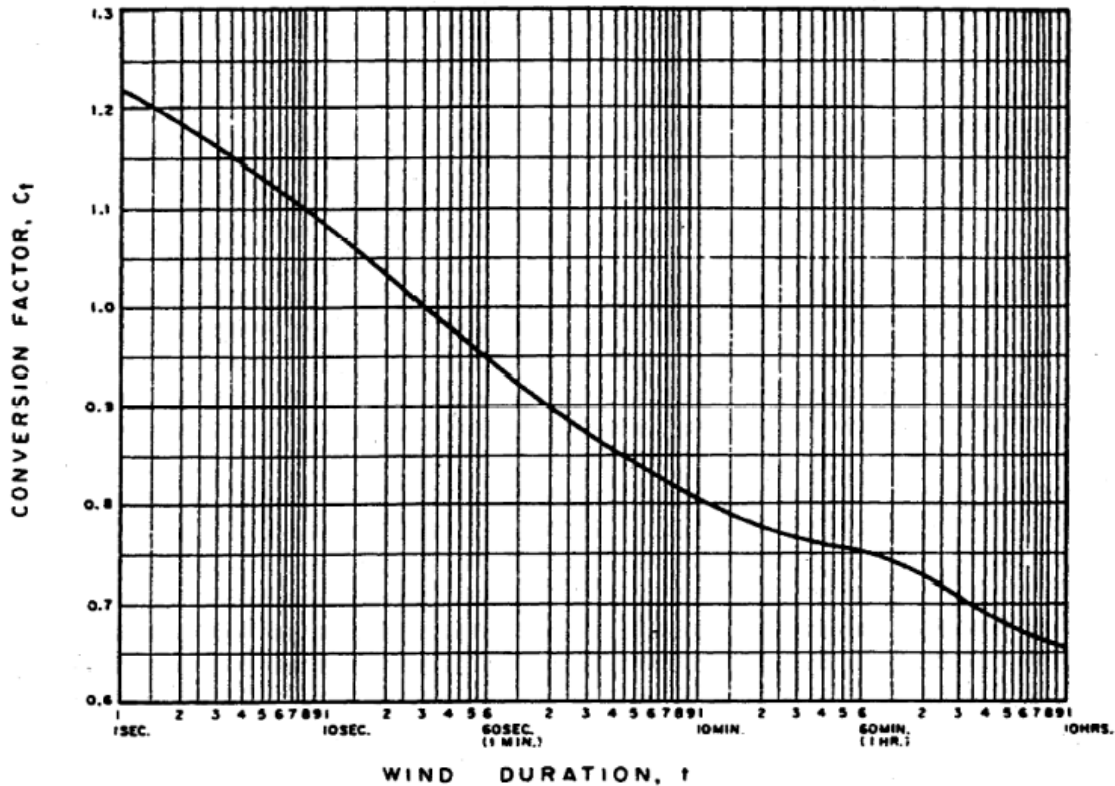


FIGURE 31F-3-1 WIND SPEED CONVERSION FACTOR [3.5]

3103F.5.2.4 Static wind loads on vessels. The OCIMF MEG3 [3.6] shall be used to determine the wind loads for all tank vessels.

Alternatively, wind loads for any type of vessel may be calculated using the guidelines in Ferritto et al. [3.7].

3103F.5.3 Current loads.

3103F.5.3.1 Design current velocity. Maximum ebb and flood currents, annual river runoffs and controlled releases shall be considered when establishing the design current velocities for both existing and new MOTs.

Local current velocities may be obtained from NOAA [3.8] or other sources, but must be supplemented by site-specific data, if the current velocity is higher than 1.5 knots.

Site-specific data shall be obtained by real time measurements over a one-year period. If this information is not available, a safety factor of 1.25 shall be applied to the best available data until real time measurements are obtained.

If the facility is not in operation during annual river runoffs and controlled releases, the current loads may be adjusted.

Operational dates need to be clearly stated in the definition of the Terminal Operating Limits (see Section 3102F.3.6.1 and Figure 31F-2-1).

3103F.5.3.2 Current velocity adjustment factors. An average current velocity (V_c) shall be used to compute

forces and moments. If the current velocity profile is known, the average current velocity can be obtained from the following equation:

$$V_c^2 = (1/T) \int_0^T (v_c)^2 ds \quad (3-14)$$

where:

V_c = average current velocity (knots)

T = draft of vessel

v_c = current velocity as a function of depth (knots)

s = water depth measured from the surface

If the velocity profile is not known, the velocity at a known water depth shall be adjusted by the factors provided in Figure 31F-3-2 to obtain the equivalent average velocity over the draft of the vessel.

3103F.5.3.3 Static current loads. The OCIMF MEG3 [3.6] or the UFC 4-159-03 [3.9] procedures shall be used to determine current loads for moored tank vessels.

3103F.5.3.4 Sea level rise (SLR). All MOTs shall consider the predicted SLR over the remaining life of the terminal, due to subsidence or climate change combined with maximum high tide and storm surge. Consideration shall include but not be limited to variation in fender locations, additional berthing loads (deeper draft vessels) and any components near the splash zone.

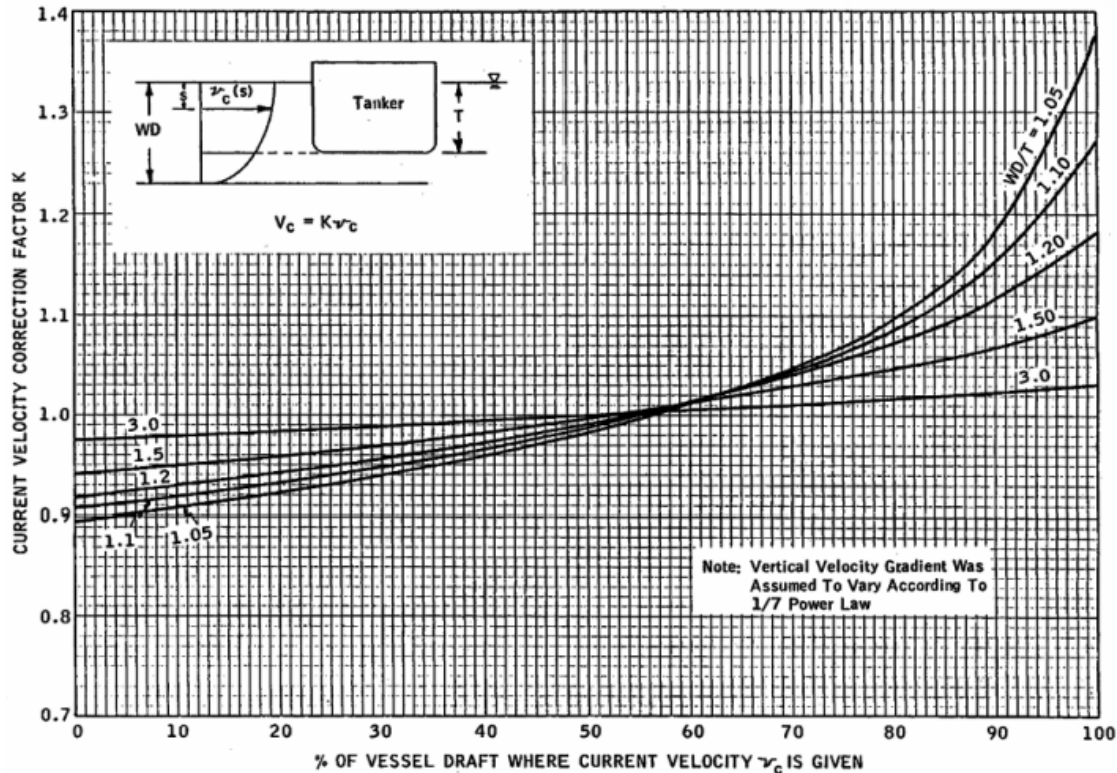


FIGURE 31F-3-2 CURRENT VELOCITY CORRECTION FACTOR (p. 23 [3.6])

3103F.5.4 Wave loads. When the significant wave period, T_s , is greater than 4 seconds (see Section 3105F.3.1), the transverse wave induced vessel reactions shall be calculated using a simplified dynamic mooring analysis described below.

The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The water particle accelerations shall then be used to calculate the wave excitation forces to determine the static displacement of the vessel. The Froude-Krylov method discussed in Chakrabarti's Chapter 7 [3.10] may be used to calculate the wave excitation forces, by conservatively approximating the vessel as a rectangular box with dimensions similar to the actual dimensions of the vessel. The horizontal water particle accelerations shall be calculated for the various wave conditions, taken at the mid-depth of the loaded vessel draft. The computed excitation force assumes a 90-degree incidence angle with the longitudinal axis of the vessel, which will result in forces that are significantly greater than the forces that will actually act upon the vessel from quartering seas. A load reduction factor may be used to account for the design wave incidence angle from the longitudinal axis of the ship. The overall excursion of the vessel shall be determined for each of the wave conditions by calculating the dynamic response of the linear spring mass system.

3103F.5.5 Passing vessels. When required in Section 3105F.3, the sway and surge forces, as well as yaw

moment, on a moored vessel, due to passing vessels, shall be established considering the following:

1. Ratio of length of moored vessel to length of passing vessel.
2. Distance from moored vessel to passing vessel.
3. Ratio of midship section areas of the moored and passing vessels.
4. Underkeel clearances of the moored and passing vessels.
5. Draft and trim of the moored vessel and draft of the passing vessel.
6. Mooring line tensions.

The passing vessel's speed should take into consideration the ebb or flood current. Normal operating wind and current conditions can be assumed when calculating forces due to a passing vessel. Either method of Kriebel [3.11] or Wang [3.12] may be used to determine forces on a moored vessel. Kriebel's recent wave tank study improves on an earlier work of Seelig [3.13].

3103F.5.6 Seiche. The penetration of long period low amplitude waves into a harbor can result in resonant standing wave systems, when the wave forcing frequency coincides with a natural frequency of the harbor. The resonant standing waves can result in large surge motions if this frequency is close to the natural frequency of the mooring system. Section 3105F.3.3 prescribes the procedure for the evaluation of these effects.

3103F.5.7 Tsunamis. A tsunami may be generated by an earthquake or a subsea or coastal landslide, which may induce large wave heights and excessive currents. The large wave or surge and the excessive currents are potentially damaging, especially if there is a tank vessel moored alongside the MOT wharf.

Tsunamis can be generated either by a distant or near source. A tsunami generated by a distant source (far field event) may allow operators to have an adequate warning for mitigating the risk by allowing the vessels to depart the MOT and go into deep water. For near-field events, with sources less than 500 miles away, the vessel may not have adequate time to depart. Each MOT shall have a “tsunami plan” describing what actions will be performed, in the event of a distant tsunami.

Recent tsunami studies have been completed for both Southern and Northern California. For the Ports of Los Angeles and Long Beach, one of these recent studies focused on near field tsunamis with predicted return periods of 5,000 to 10,000 years [3.14]. These maximum water levels (run-up) would not normally be used for MOT design. However, because the study also provides actual tidal records from recent distant tsunamis, it should be used for design.

The run-up value for Port Hueneme was obtained from an earlier study by Synolakis et al. [3.15].

Run up-values: Port of Los Angeles and Long Beach = 8 ft.

Port Hueneme = 11 ft.

For the San Francisco Bay, a recent study provides the maximum credible tsunami water levels and current speeds. These results are deterministic and are based on the most severe seismic sources that could reasonably impact MOTs in the San Francisco Bay [3.16]. Table 31F-3-6 provides values for the marine oil terminal locations within San Francisco Bay. Water levels could be positive or negative and current velocities may vary in direction. In order to determine the maximum run-up at a MOT, the largest values should be added to the mean high tide. Further details are available in [3.16].

Loads from tsunami-induced waves can be calculated for various structural configurations [3.17]. Tsunami wave heights in shallow water and particle kinematics can also be obtained. Other structural considerations include uplift and debris impact.

TABLE 31F-3-6

Tsunami Run-up Values (ft) and Current Speeds (ft/sec) in the San Francisco Bay Area (After [3.16])

S.F. BAY LOCALE	MAXIMUM WATER LEVELS (ft.)	CURRENT VELOCITY (ft/sec)
Richmond, outer	7.5	4.9
Richmond, inner	7.9	8.9
Martinez	2.3	1.3
Selby	2.6	1.6
Rodeo	2.6	2.0
Benicia	2.0	1.0

3103F.6 Berthing Loads.

3103F.6.1 General. Berthing loads are quantified in terms of transfer of kinetic energy of the vessel into potential energy dissipated by the fender(s). The terms and equations below are based on those in UFC 4-152-01 [3.18] and PIANC [3.19].

Kinetic energy shall be calculated from the following equation:

$$E_{vessel} = \frac{1}{2} \cdot \frac{W}{g} \cdot V_n^2 \tag{3-15}$$

where:

E_{vessel} = Berthing energy of vessel [ft-lbs]

W = Total weight of vessel and cargo in pounds [long tons × 2240]

g = Acceleration due to gravity [32.2 ft/sec²]

V_n = Berthing velocity normal to the berth [ft/sec]

The following correction factors shall be used to modify the actual energy to be absorbed by the fender system for berthing operations:

$$E_{fender} = F_A \cdot C_b \cdot C_m \cdot E_{vessel} \tag{3-16}$$

where:

E_{fender} = Energy to be absorbed by the fender system

F_A = Accidental factor accounting for abnormal conditions such as human error, malfunction, adverse environmental conditions or a combination of these factors. For existing berthing systems, F_A may be taken as 1.0. For new berthing systems, F_A shall be determined in accordance with Section 5-1.5.3 of UFC 4-152-01 [3.18] or PIANC Section 4.2.8 [3.19].

C_b = Berthing Coefficient

C_m = Effective mass or virtual mass coefficient (see Section 3103F.6.6)

The berthing coefficient, C_b , is given by:

$$C_b = C_e \cdot C_g \cdot C_d \cdot C_c \tag{3-17}$$

where:

C_e = Eccentricity Coefficient

C_c = Configuration Coefficient

C_g = Geometric Coefficient

C_d = Deformation Coefficient

These coefficients are defined in Sections 3103F.6.2 through 3103F.6.5.

The approximate displacement of the vessel (when only partially loaded) at impact, DT , can be determined from an extension of an equation from Gaythwaite [3.20]:

$$DT = 1.25 DWT(d_{actual}/d_{max}) \tag{3-18}$$

where:

DWT = Dead Weight Tonnage (in long tons)

d_{actual} = Actual arrival draft of the vessel

d_{max} = Maximum loaded vessel draft

The berthing load shall be based on the fender reaction due to the kinetic berthing energy. The structural capacity shall be established based on allowable concrete, steel or timber properties in the structural components, as defined in Section 3107F.

For fender system selection, Section 3105F.4.5 shall be followed.

3103F.6.2 Eccentricity coefficient (C_e). During the berthing maneuver, when the vessel is not parallel to the berthing line (usually the wharf face), not all the kinetic energy of the vessel will be transmitted to the fenders. Due to the reaction from the fender(s), the vessel will start to rotate around the contact point, thus dissipating part of its energy. Treating the vessel as a rigid rod of negligible width in the analysis of the energy impact on the fenders leads to the equation:

$$C_e = \frac{k^2}{a^2 + k^2} \quad (3-19)$$

where:

- k = Longitudinal radius of gyration of the vessel [ft]
- a = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]

3103F.6.3 Geometric coefficient (C_g). The geometric coefficient, C_g , depends upon the geometric configuration of the ship at the point of impact. It varies from 0.85 for an increasing convex curvature to 1.25 for concave curvature. Generally, 0.95 is recommended for the impact point at or beyond the quarter points of the ship, and 1.0 for broadside berthing in which contact is made along the straight side [3.18].

3103F.6.4 Deformation coefficient (C_d). This accounts for the energy reduction effects due to local deformation of the ships hull and deflection of the whole ship along its longitudinal axis. The energy absorbed by the ship depends on the relative stiffness of the ship and the obstruction. The deformation coefficient varies from 0.9 for a nonresilient fender to nearly 1.0 for a flexible fender. For larger ships on energy-absorbing fender systems, little or no deformation of the ship takes place; therefore, a coefficient of 1.0 is recommended.

3103F.6.5 Configuration coefficient (C_c). This factor accounts for the difference between an open pier or wharf and a solid pier or wharf. In the first case, the movements of the water surrounding the berthing vessel is not (or is

hardly) affected by the berth. In the second case, the water between the berthing vessel and the structure introduces a cushion effect that represents an extra force on the vessel away from the berth and reduces the energy to be absorbed by the fender system.

For open berth and corners of solid piers, $C_c = 1.0$

For solid piers with parallel approach, $C_c = 0.8$

For berths with different conditions, C_c may be interpolated between these values [3.18].

3103F.6.6 Effective mass or virtual mass coefficient (C_m). In determining the kinetic energy of a berthing vessel, the effective or the virtual mass is the sum of vessel mass and hydrodynamic mass. The hydrodynamic mass does not necessarily vary with the mass of the vessel, but is closely related to the projected area of the vessel at right angles to the direction of motion.

Other factors, such as the form of vessel, water depth, berthing velocity and acceleration or deceleration of the vessel, will have some effect on the hydrodynamic mass. Taking into account both model and prototype experiments, the effective or virtual mass coefficient can be estimated as:

$$C_m = 1 + 2 \cdot \frac{d_{actual}}{B} \quad (3-20)$$

where:

- d_{actual} = Actual arrival draft of the vessel
- B = Beam of vessel

The value of C_m for use in design should be a minimum of 1.5 and need not exceed 2.0 [3.18].

3103F.6.7 Berthing velocity and angle. The berthing velocity, V_n , is influenced by a large number of factors such as environmental conditions of the site (wind, current and wave), method of berthing (with or without tugboat assistance), condition of the vessel during berthing (ballast or fully laden) and human factors (experience of the tugboat captain).

The berthing velocity, normal to berth, shall be in accordance with Table 31F-3-7. Site condition is determined from Table 31F-3-8.

Subject to Division approval, if an existing MOT can demonstrate lower velocities by utilizing velocity monitoring equipment, then such a velocity may be used temporarily until the berthing system is compliant with this Code.

TABLE 31F-3-7
BERTHING VELOCITY V_n (NORMAL TO BERTH)¹

VESSEL SIZE (DWT)	TUG BOAT ASSISTANCE	SITE CONDITIONS		
		Unfavorable	Moderate	Favorable
≤10,000	No	1.31 ft/sec	0.98 ft/sec	0.53 ft/sec
≤10,000	Yes	0.78 ft/sec	0.66 ft/sec	0.33 ft/sec
50,000	Yes	0.53 ft/sec	0.39 ft/sec	0.26 ft/sec
≥100,000	Yes	0.39 ft/sec	0.33 ft/sec	0.26 ft/sec

1. For vessel sizes not shown, interpolation between velocities may be used.

**TABLE 31F-3-8
SITE CONDITIONS**

SITE CONDITIONS	DESCRIPTION	WIND SPEED ¹	SIGNIFICANT WAVE HEIGHT	CURRENT SPEED ²
Unfavorable	Strong Wind Strong Currents High Waves	> 38 knots	> 6.5 ft	> 2 knots
Moderate	Strong Wind Moderate Current Moderate Waves	≥ 38 knots	≤ 6.5 ft	≤ 2 knots
Favorable	Moderate Wind Moderate Current Moderate Waves	< 38 knots	< 6.5 ft	< 2 knots

1. A 30-second duration measured at a height of 33 ft.

2. Taken at 0.5 x water depth

In order to obtain the normal berthing velocity, V_n , an approach angle, defined as the angle formed by the fender line and the longitudinal axis of the vessel must be determined. The berthing angles, used to compute the normal berthing velocity, for various vessel sizes are shown in Table 31F-3-9.

**TABLE 31F-3-9
BERTHING ANGLE**

VESSEL SIZE (DWT)	ANGLE (degrees)
Barge	15
< 10,000	10
10,000-50,000	8
> 50,000	6

3103F.7 Wind and current loads on structures.

3103F.7.1 General. This section provides methods to determine the wind and current loads acting on the structure directly, as opposed to wind and current forces acting on the structure from a moored vessel.

3103F.7.2 Wind loads. Chapter 29 of ASCE/SEI 7 [3.21] shall be used to establish minimum wind loads on the structure. Additional information about wind loads may be obtained from Simiu and Scanlan [3.22].

3103F.7.3 Current loads. The current forces acting on the structure may be established using the current velocities, per Section 3103F.5.3.

3103F.8 Load combinations. As a minimum, each component of the structure shall be analyzed for all applicable load combinations given in Table 31F-3-10 or Table 31F-3-11, depending on component type. For additional load combinations, see UFC 4-152-01 [3.18].

The “vacant condition” is the case wherein there is no vessel at the berth. The “mooring and breasting condition” exists after the vessel is securely tied to the wharf. The “berthing condition” occurs as the vessel impacts the wharf, and the “earthquake condition” assumes no vessel is at the berth, and there is no wind or current forces on the structure.

The use of various load types is discussed below:

3103F.8.1 Dead load (D). Upper and lower bound values of dead load are applied for the vacant condition to

check the maximum moment and shear with minimum axial load.

3103F.8.2 Live load (L). Typically, the live load on MOTs is small and may be neglected for combinations including earthquake loads. However, in some cases, a higher value of live load may be warranted depending on MOT use, and an appropriate value of live load shall be considered for combinations including earthquake loads.

3103F.8.3 Buoyancy load (B). Buoyancy forces shall be considered for any submerged or immersed substructures (including pipelines, sumps and structural components).

3103F.8.4 Wind (W) and current (C) on the structure. Wind and currents on the vessel are included in the mooring and breasting condition. The wind and current loads acting on the structure are therefore additional loads that can act simultaneously with the mooring, breasting and/or berthing loads.

3103F.8.5 Earth pressure on the structure (H). The soil pressure on end walls, typically concrete cut-off walls, steel sheet pile walls on wharf type structures and/or piles shall be considered.

3103F.8.6 Mooring line/breasting loads (M). Mooring line and breasting loads can occur simultaneously or individually, depending on the combination of wind and current. Multiple load cases for operating and survival conditions may be required (see Sections 3103F.5.2 and 3105F.2). In addition, loads caused by passing vessels shall be considered for the “mooring and breasting condition.” Refer to Sections 3105F.2 and 3105F.3 for the determination of mooring line and breasting loads.

3103F.8.7 Berthing load (B). Berthing is a frequent occurrence, and shall be considered as a normal operating load. No increase in allowable stresses shall be applied for ASD.

3103F.8.8 Earthquake loads (E). Performance based seismic analysis methodology requires that the actual displacement demand be limited to defined strains in concrete, steel and timber. For the deck and pile evaluation, two cases of dead load (upper and lower bound) shall be considered in combination with the seismic load.

TABLE 31F-3-10
LRFD LOAD FACTORS FOR LOAD COMBINATIONS [3.18]

LOAD TYPE	VACANT CONDITION		MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION ²	
Dead Load (D)	1.2	0.9	1.2	1.2	$1.2 + k^1$	$0.9-k^1$
Live Load (L)	1.6	—	1.6^2	1.0	1.0	—
Buoyancy (B)	1.2	0.9	1.2	1.2	1.2^1	0.9^1
Wind on Structure (W)	1.6	1.6	1.6	1.6	—	—
Current on Structure (C)	1.2	0.9	1.2	1.2	1.2	0.9
Earth Pressure on the Structure (H)	1.6	1.6	1.6	1.6	1.6^4	1.6^4
Mooring/Breasting Load (M)	—	—	1.6	—	—	—
Berthing Load (B _e)	—	—	—	1.6	—	—
Earthquake Load (E)	—	—	—	—	1.0	1.0

1. $k = 0.50$ (PGA) The k factor ($k=0.5$ (PGA)) and buoyancy (B) shall be applied to the vertical dead load (D) only, and not to the inertial mass of the structure.
2. The load factor for live load (L) may be reduced to 1.3 for the maximum outrigger float load from a truck crane.
3. For Level 1 and 2 earthquake conditions with strain levels defined in Division 7, the current on structure (C) may not be required.
4. An earth pressure on the Structure factor (H) of 1.0 may be used for pile or bulkhead structures.

TABLE 31F-3-11
SERVICE OR ASD LOAD FACTORS FOR LOAD COMBINATIONS [3.18]

LOAD TYPE	VACANT CONDITION	MOORING & BREASTING CONDITION	BERTHING CONDITION	EARTHQUAKE CONDITION	
Dead Load (D)	1.0	1.0	1.0	$1 + 0.7k^1$	$1 - 0.7k^1$
Live Load (L)	1.0	1.0	0.75	0.75	—
Buoyancy (B)	1.0	1.0	1.0	1.0	0.6
Wind on Structure (W)	1.0	1.0	0.75	—	—
Current on Structure (C)	1.0	1.0	1.0	—	—
Earth Pressure on the Structure (H)	1.0	1.0	1.0	1.0	1.0
Mooring/Breasting Load (M)	—	1.0	—	—	—
Berthing Load (B _e)	—	—	1.0	—	—
Earthquake Load (E)	—	—	—	0.7	0.7
% Allowable Stress	100	100	100	100 ²	

1. $k = 0.5$ (PGA)
2. Increase in allowable stress shall not be used with these load combinations unless it can be demonstrated that such increase is justified by structural behavior caused by rate or duration of load. See ASCE/SEI 7 [3.21]

3103F.9 Miscellaneous loads. Handrails and guardrails shall be designed for 25 plf with a 200-pound minimum concentrated load in any location or direction.

3103F.10 Symbols.

- a = Distance between the vessel's center of gravity and the point of contact on the vessel's side, projected onto the vessel's longitudinal axis [ft]
- A = Site Class A as defined in Table 31F-6-1
- B = Beam of vessel
- B = Site Class B as defined in Table 31F-6-1
- B_1 = Coefficient used to adjust one-second period spectral response, for the effect of viscous damping
- B_s = Coefficient used to adjust the short period spectral response, for the effect of viscous damping.
- C = Site Class C as defined in Table 31F-6-1
- C_b = Berthing Coefficient

- C_c = Configuration Coefficient
- C_g = Geometric Coefficient
- C_d = Deformation Coefficient
- C_e = Eccentricity Coefficient
- C_m = Effective mass or virtual mass coefficient
- C_t = Windspeed conversion factor
- D = Site Class D as defined in Table 31F-6-1
- DSA = Design Spectral Acceleration
- DSA_d = DSA values at damping other than 5 percent
- DT = Displacement of vessel
- DWT = Dead weight tons
- d_{actual} = Arrival maximum draft of vessel at berth
- d_{max} = Maximum vessel draft (in open seas)
- E = Site Class E as defined in Table 31F-6-1

E_{fender} = Energy to be absorbed by the fender system
 E_{vessel} = Berthing energy of vessel [ft-lbs]
 F = Site Class F as defined in Table 31F-6-1
 F_a, F_v = Site coefficients from Tables 31F-3-3 and 31F-3-4, respectively
 F_A = Accidental factor accounting for abnormal conditions
 g = Acceleration due to gravity [32.2 ft/sec²]
 h = Elevation above water surface [feet]
 k = Radius of longitudinal gyration of the vessel [ft]
 K = Current velocity correction factor (Fig 31F-3-2)
 PGA_x = Peak ground acceleration corresponding to the site class under consideration.
 s = Water depth measured from the surface
 S_a = Spectral acceleration
 S_1 = Spectral acceleration value (for the boundary of Site Classes B and C) at 1.0 second
 S_S = Spectral acceleration value (for the boundary of Site Classes B and C) at 0.2 seconds
 S_{X1} = Spectral acceleration value at 1.0 second corresponding to the period of S_1 and the site class under consideration
 S_{XS} = Spectral acceleration value at 0.2 seconds corresponding to the period of S_S and the site class under consideration
 T = Draft of vessel (see Figure 31F-3-2)
 T = Period [sec]
 T_0 = Period at which the constant acceleration and constant velocity regions of the design spectrum intersect
 V_c = Average current velocity [knots]
 v_c = Current velocity as a function of depth [knots]
 V_h = Wind speed (knots) at elevation h
 V_L = Over land wind speed
 V_n = Berthing velocity normal to the berth [ft/sec]
 v_t = Velocity over a given time period
 $V_{t=30sec}$ = Wind speed for a 30 second interval
 V_w = Wind speed at 33-foot (10 m) elevation [knots]
 W = Total weight of vessel and cargo in pounds [displacement tonnage \times 2240]
 WD = Water Depth (Figure 31F-3-2)

3103F.11 References.

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Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 4

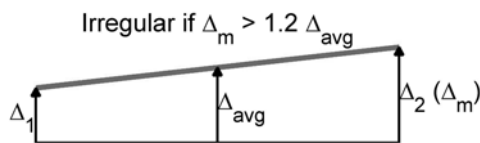
**SECTION 3104F
SEISMIC ANALYSIS
AND STRUCTURAL PERFORMANCE**

3104F.1 General.

3104F.1.1 Purpose. The purpose of this section is to establish minimum standards for seismic analysis and structural performance. Seismic performance is evaluated at two criteria levels. Level 1 requirements define a performance criterion to ensure MOT functionality. Level 2 requirements safeguard against major damage, collapse or major oil spill.

3104F.1.2 Applicability. Section 3104F applies to all new and existing MOTs. Structures supporting loading arms, pipelines, oil transfer and storage equipment, critical systems and vessel mooring structures, such as mooring and breasting dolphins are included. Catwalks and similar components that are not part of the lateral load carrying system and do not support oil transfer equipment may be excluded.

3104F.1.3 Configuration classification of MOT structure. Each MOT structure shall be designated as regular or irregular based on torsional irregularity criteria presented in ASCE/SEI 7 [4.1]. An MOT structure is defined to be irregular when maximum displacement at one end of the MOT structure transverse to an axis is more than 1.2 times the average of the displacement at the two ends of the MOT structure, as described in Figure 31F-4-1. For MOTs with multiple segments separated by expansion joints, each segment shall be designated as regular or irregular using criteria in this section. Expansion joints in this context are defined as joints that separate each structural segment in such a manner that each segment will move independently during an earthquake.



**FIGURE 31F-4-1
DEFINITION OF IRREGULAR MOT**

3104F.2 Existing MOTs

3104F.2.1 Seismic Performance Criteria. Two levels of seismic performance shall be considered, except for critical systems (Section 3104F.5.1). These levels are defined as follows:

Level 1 Seismic Performance:

- Minor or no structural damage
- Temporary or no interruption in operations

Level 2 Seismic Performance:

- Controlled inelastic behavior with repairable damage

- Prevention of collapse
- Temporary loss of operations, restorable within months
- Prevention of major spill (≥ 1200 bbls)

The Level 1 and Level 2 seismic performance criteria are defined in Table 31F-4-1.

3104F.2.2 Basis for evaluation. Component capacities shall be based on existing conditions, calculated as “best estimates,” taking into account the mean material strengths, strain hardening and degradation overtime. The capacity of components with little or no ductility, which may lead to brittle failure scenarios, shall be calculated based on lower bound material strengths. Methods to establish component strength and deformation capacities for typical structural materials and components are provided in Section 3107F. Geotechnical considerations are discussed in Section 3106F.

3104F.2.3 Analytical procedures. The objective of the seismic analysis is to verify that the displacement capacity of the structure is greater than the displacement demand, for each performance level defined in Table 31F-4-1. For this purpose, the displacement capacity of each element of the structure shall be checked against its displacement demand including the orthogonal effects of Section 3104F.4.2. The required analytical procedures are summarized in Table 31F-4-2.

The displacement capacity of the structure shall be calculated using the nonlinear static (pushover) procedure. For the nonlinear static (pushover) procedure, the pushover load shall be applied at the target node defined as the center of mass (CM) of the MOT structure. It is also acceptable to use a nonlinear dynamic procedure for capacity evaluation, subject to peer review in accordance with Section 3101F.8.2.

Methods used to calculate the displacement demand are linear modal, nonlinear static and nonlinear dynamic.

Mass to be included in the displacement demand calculation shall include mass from self-weight of the structure, weight of the permanent equipment, and portion of the live load that may contribute to inertial mass during earthquake loading, such as a minimum of 25% of the floor live load in areas used for storage.

Any rational method, subject to the Division’s approval, can be used in lieu of the required analytical procedures shown in Table 31F-4-2.

3104F.2.3.1 Nonlinear static capacity procedure (pushover). To assess displacement capacity, two-dimensional nonlinear static (pushover) analyses shall be performed; three-dimensional analyses are optional. A model that incorporates the nonlinear load deformation characteristics of all components for the lateral force-resisting system shall be used in the pushover analysis.

**TABLE 31F-4-1
SEISMIC PERFORMANCE CRITERIA^{1,2}**

SPILL CLASSIFICATION ³	SEISMIC PERFORMANCE LEVEL	PROBABILITY OF EXCEEDANCE	RETURN PERIOD
High	Level 1	50% in 50 years	72 years
	Level 2	10% in 50 years	475 years
Medium	Level 1	65% in 50 years	48 years
	Level 2	15% in 50 years	308 years
Low	Level 1	75% in 50 years	36 years
	Level 2	20% in 50 years	224 years

1. For new MOTs, see Section 3104F.3.
2. For marine terminals transferring LNG, return periods of 72 and 475 years shall be used for Levels 1 and 2, respectively.
3. See Section 3101F.6 for spill classification.

**TABLE 31F-4-2
MINIMUM REQUIRED ANALYTICAL PROCEDURES**

SPILL CLASSIFICATION ¹	CONFIGURATION	SUBSTRUCTURE MATERIAL	DISPLACEMENT DEMAND PROCEDURE	DISPLACEMENT CAPACITY PROCEDURE
High/Medium	Irregular	Concrete/Steel	Linear Modal	Nonlinear Static
High/Medium	Regular	Concrete/Steel	Nonlinear Static ²	Nonlinear Static
Low	Regular/Irregular	Concrete/Steel	Nonlinear Static	Nonlinear Static
High/Medium/Low	Regular/Irregular	Timber	Nonlinear Static	Nonlinear Static

1. See Section 3101F.6 for spill classification.
2. Linear modal demand procedure may be required for cases where more than one mode is expected to contribute to the displacement demand.

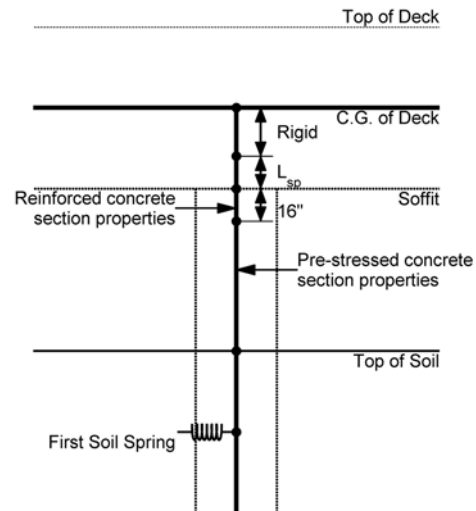
Alternatively, displacement capacity of a pile in the MOT structure may be estimated from pushover analysis of an individual pile with appropriate axial load and pile-to-deck connection.

The displacement capacity of a pile from the pushover analysis shall be defined as the displacement that can occur at the top of the pile without exceeding plastic rotation (or material strain) limits, either at the pile-deck hinge or in-ground hinge, as defined in Section 3107F. If pile displacement has components along two axes, as may be the case for irregular MOTs, the pile displacement capacity shall be defined as the resultant of its displacement components along the two axes.

3104F.2.3.1.1 Modeling. A series of nonlinear pushover analyses may be required depending on the complexity of the MOT structure. At a minimum, pushover analysis of a two-dimensional model shall be conducted in both the longitudinal and transverse directions. The piles shall be represented by nonlinear elements that capture the moment-curvature/rotation relationships for components with expected inelastic behavior in accordance with Section 3107F. The effects of connection flexibility shall be considered in pile-to-deck connection modeling. For prestressed concrete piles, Figure 31F-4-2 may be used. A nonlinear element is not required to represent each pile location. Piles with similar lateral force-deflection behavior may be lumped in fewer larger springs, provided that the overall torsional effects are captured.

Linear material component behavior is acceptable where nonlinear response will not occur. All components shall be based on effective moment of

inertia calculated in accordance with Section 3107F. Specific requirements for timber pile structures are discussed in the next section.



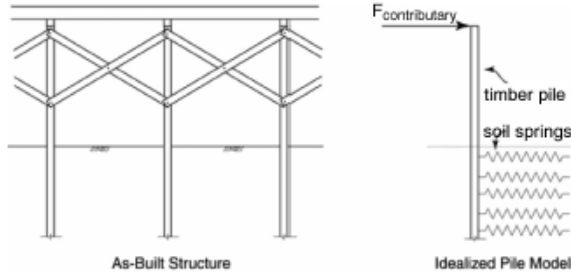
**FIGURE 31F-4-2
PILE-DECK CONNECTION MODELING FOR
PRESTRESSED CONCRETE PILE (ADAPTED FROM [4.2])**

3104F.2.3.1.2 Timber pile supported structures. For all timber pile supported structures, linear elastic procedures may be used. Alternatively, the nonlinear static procedure may be used to estimate the target displacement demand, Δ_p .

A simplified single pile model for a typical timber pile supported structure is shown in Figure 31F-4-3. The pile-deck connections may be assumed to be “pinned.” The lateral bracing can often be

ignored if it is in poor condition. These assumptions shall be used for the analysis, unless a detailed condition assessment and lateral analysis indicate that the existing bracing and connections may provide reliable lateral resistance.

A series of single pile analyses may be sufficient to establish the nonlinear springs required for the pushover analysis.



**FIGURE 31F-4-3
SIMPLIFIED SINGLE PILE MODEL OF A
TIMBER PILE SUPPORTED STRUCTURE**

3104F.2.3.2 Nonlinear static demand procedure. A nonlinear static procedure shall be used to determine the displacement demand for all concrete and steel structures, with the exception of irregular configurations with high or moderate spill classifications. A linear modal procedure is required for irregular structures with high or moderate spill classifications, and may be used for all other classifications in lieu of the nonlinear static procedure.

In the nonlinear static demand procedure, deformation demand in each element shall be computed at the target node displacement demand. The analysis shall be conducted in each of the two orthogonal directions and results combined as described in Section 3104F.4.2.

The target displacement demand of the structure, Δ_d , shall be calculated from:

$$\Delta_d = S_A(T_e^2/4\pi^2) \tag{4-1}$$

where:

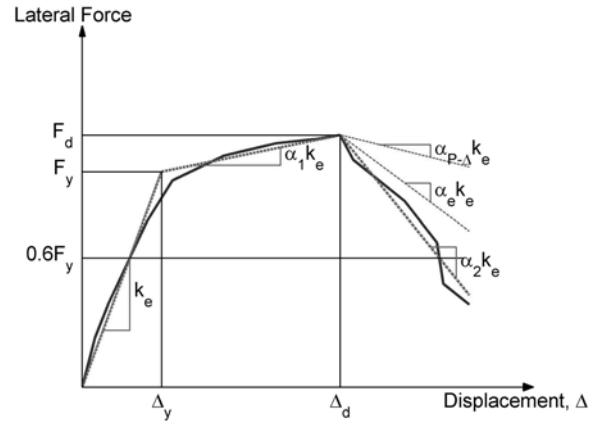
T_e = effective elastic structural period defined in Equation (4-3) or Equation (4-9)

S_A = spectral response acceleration corresponding to T_e

If $T_e < T_0$, where T_0 is the period corresponding to the peak of the acceleration response spectrum, a refined analysis (see Section 3104F.2.3.2.1 or 3104F.2.3.2.2) shall be used to calculate the displacement demand. In the refined analysis, the target node displacement demand may be computed from the Coefficient Method (Section 3104F.2.3.2.1) or the Substitute Structure Method (Section 3104F.2.3.2.2). Both of these methods utilize the pushover curve developed in Section 3104F.2.3.1.

3104F.2.3.2.1 Coefficient Method. The Coefficient Method is based on the procedures presented in ASCE/SEI 41 [4.3] and FEMA 440 [4.4].

The first step in the Coefficient Method requires idealization of the pushover curve to calculate the effective elastic lateral stiffness, k_e , and effective yield strength, F_y , of the structure as shown in Figure 31F-4-4.



**FIGURE 31F-4-4
IDEALIZATION OF PUSHOVER
CURVE (ADAPTED FROM [4.3])**

The first line segment of the idealized pushover curve shall begin at the origin and have a slope equal to the effective elastic lateral stiffness, k_e . The effective elastic lateral stiffness, k_e , shall be taken as the secant stiffness calculated at the lateral force equal to 60 percent of the effective yield strength, F_y , of the structure. The effective yield strength, F_y , shall not be taken as greater than the maximum lateral force at any point along the pushover curve.

The second line segment shall represent the positive post-yield slope ($\alpha_1 k_e$) determined by a point (F_d, Δ_d) and a point at the intersection with the first line segment such that the area above and below the actual curve area approximately balanced. (F_d, Δ_d) shall be a point on the actual pushover curve at the calculated target displacement, or at the displacement corresponding to the maximum lateral force, whichever is smaller.

The third line segment shall represent the negative post-yield slope ($\alpha_2 k_e$), determined by the point at the end of the positive post-yield slope (F_d, Δ_d) and the point at which the lateral force degrades to 60 percent of the effective yield strength.

The target displacement shall be calculated from:

$$\Delta_d = C_1 C_2 S_A \frac{T_e^2}{4\pi^2} \tag{4-2}$$

where:

S_A = spectral acceleration of the linear-elastic system at vibration period, which is computed from:

$$T_e = 2\pi \sqrt{\frac{m}{k_e}} \tag{4-3}$$

where:

m = seismic mass as defined in Section 3104F.2.3

k_e = effective elastic lateral stiffness from idealized pushover

C_1 = modification factor to relate maximum inelastic displacement to displacement calculated for linear elastic response. For period less than 0.2 s, C_1 need not be taken greater than the value at $T_e = 0.2$ s. For period greater than 1.0 s, $C_1 = 1.0$. For all other periods:

$$C_1 = 1 + \frac{\mu_{\text{strength}} - 1}{aT_e^2} \quad (4-4)$$

where:

a = Site class factor
 = 130 for Site Class A or B,
 = 90 for Site Class C, and
 = 60 for Site Class D, E or F.

μ_{strength} = ratio of elastic strength demand to yield strength coefficient calculated in accordance with Equation (4-6). The Coefficient Method is not applicable where μ_{strength} exceeds μ_{max} computed from Equation (4-7). μ_{strength} shall not be taken as less than 1.0.

C_2 = modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation and strength deterioration on the maximum displacement response. For periods greater than 0.7s, $C_2 = 1.0$. For all other periods:

$$C_2 = 1 + \frac{1}{800} \left(\frac{\mu_{\text{strength}} - 1}{T_e} \right)^2 \quad (4-5)$$

The strength ratio μ_{strength} shall be computed from:

$$\mu_{\text{strength}} = \frac{mS_A}{F_y} \quad (4-6)$$

where:

F_y = effective yield strength of the structure in the direction under consideration from the idealized pushover curve.

For structures with negative post-yield stiffness, the maximum strength ratio μ_{max} shall be computed from:

$$\mu_{\text{max}} = \frac{\Delta_d}{\Delta_y} + \frac{|\alpha_d|^{-h}}{4} \quad (4-7)$$

where:

Δ_d = larger of target displacement or displacement corresponding to the maximum pushover force,

Δ_y = displacement at effective yield strength

$$h = 1 + 0.15 \ln T_e \quad (4-8)$$

α_e = effective negative post-yield slope ratio which shall be computed from:

$$\alpha_e = \alpha_{P-\Delta} + \lambda(\alpha_2 - \alpha_{P-\Delta}) \quad (4-9)$$

where:

$\alpha_{P-\Delta}$ and the maximum negative post-elastic stiffness ratio, α_2 , are estimated from the idealized force-deformation curve, and λ is a near-field effect factor equal to 0.8 for sites with 1 second spectral value, S_1 greater than or equal to 0.6g and equal to 0.2 for sites with 1 second spectral value, S_1 less than 0.6g.

3104F.2.3.2.2 Substitute Structure Method. The Substitute Structure Method is based on the procedure presented in Priestley et al. [4.5] and ASCE/COPRI 61 [4.2]. This method is summarized below.

1. Idealize the pushover curve from nonlinear pushover analysis, as described in Section 3104F.2.3.2.1, and estimate the effective yield strength, F_y , and yield displacement, Δ_y .
2. Compute the effective elastic lateral stiffness, k_e , as the effective yield strength, F_y , divided by the yield displacement, Δ_y .
3. Compute the structural period in the direction under consideration from:

$$T_e = 2\pi \sqrt{\frac{m}{k_e}} \quad (4-10)$$

where:

m = seismic mass as defined in Section 3104F.2.3

k_e = effective elastic lateral stiffness in direction under consideration

4. Determine target displacement, Δ_d , of the effective linear elastic system from:

$$\Delta_d = S_A \frac{T_e^2}{4\pi^2} \quad (4-11)$$

where:

S_A = the 5 percent damped spectral displacement corresponding to the linear elastic structural period, T_e

Select the initial estimate of the displacement demand as $\Delta_{d,i} = \Delta_d$.

5. The ductility level, $\mu_{\Delta,i}$, is found from $\Delta_{d,i} / \Delta_y$. Use the appropriate relationship between ductility and damping, for the component undergoing inelastic deformation, to estimate the effective structural damping, $\xi_{\text{eff},i}$. In lieu of more detailed analysis, Equation (4-12) may be used for concrete and steel piles connected to the deck through dowels embedded in the concrete. Note that the idealized pushover curves in Figure 31F-4-4 shall be utilized in Figure 31F-4-5, which illustrates the iterative procedure.

$$\xi_{eff,i} = 0.05 + \frac{1}{\pi} \left(1 - \frac{1 - \alpha_1}{\sqrt{\mu_{\Delta,i}}} - \alpha_1 \sqrt{\mu_{\Delta,i}} \right) \quad (4-12)$$

where:

α_1 = ratio of second slope over elastic slope (see Figures 31F-4-4 and 31F-4-5)

Equation (4-12) for effective damping was developed by Kowalsky et al. [4.6] for the Takeda hysteresis model of system's force-displacement relationship.

6. Compute the force, $F_{d,i}$, on the force-deformation relationship associated with the estimated displacement, $\Delta_{d,i}$ (see Figure 31F-4-5).
7. Compute the effective stiffness, $k_{eff,i}$ as the secant stiffness from:

$$k_{eff,i} = \frac{F_{d,i}}{\Delta_{d,i}} \quad (4-13)$$

8. Compute the effective period, $T_{eff,i}$ from:

$$T_{eff,i} = 2\pi \sqrt{\frac{m}{k_{eff,i}}} \quad (4-14)$$

where:

m = seismic mass as defined in Section 3104F.2.3

9. For the effective structural period, $T_{eff,i}$ and the effective structural damping, $\xi_{eff,i}$, compute the spectral acceleration $S_A(T_{eff,i}, \xi_{eff,i})$ from an appropriately damped design acceleration response spectrum.
10. Compute the new estimate of the displacement, $\Delta_{d,j}$ from:

$$\Delta_{d,j} = \frac{T_{eff,i}^2 S_A(T_{eff,i}, \xi_{eff,i})}{4\pi^2} \quad (4-15)$$

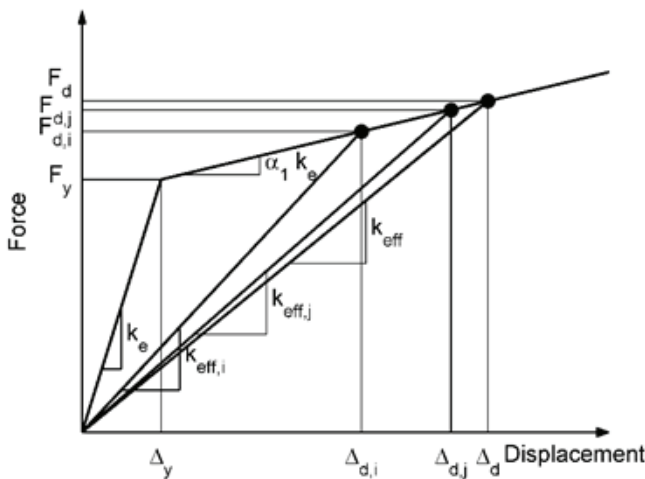


FIGURE 31F-4-5
EFFECTIVE STIFFNESS FOR
SUBSTITUTE STRUCTURE METHOD

11. Repeat steps 5 to 10 with $\Delta_{d,i} = \Delta_{d,j}$ until displacement, $\Delta_{d,j}$ computed in step 10 is sufficiently close to the starting displacement, $\Delta_{d,i}$ in step 5 (Figure 31F-4-5).

3104F.2.3.3 Linear modal demand procedure. For irregular concrete/steel structures with moderate or high spill classifications, a linear modal analysis is required to predict the global displacement demands. A 3-D linear elastic response analysis shall be used, with effective moment of inertia applied to components to establish lateral displacement demands, to compute displacement components of an element along each axis of the system.

Sufficient modes shall be included in the analysis such that 90 percent of the participating mass is captured in each of the principal horizontal directions for the structure. For modal combinations, the Complete Quadratic Combination rule shall be used. Multidirectional excitation shall be accounted for in accordance with Section 3104F.4.2.

The lateral stiffness of the linear elastic response model shall be based on the initial stiffness of the nonlinear pushover curve as shown in Figure 31F-4-6 (also see Section 3106F.9). The p-y springs shall be adjusted based on the secant method approach. Most of the p-y springs will typically be based on their initial stiffness; no iteration is required.

If the fundamental period is $T < T_0$, where T_0 is the period corresponding to the peak of the acceleration response spectrum, the displacement demand from the linear modal analysis shall be amplified to account for nonlinear system behavior by an amplification factor. The amplification factor shall be equal to either $C_1 \times C_2$ per Section 3104F.2.3.2.1, or the ratio of the final target displacement and the initial elastic displacement of Equation (4-11) per Section 3104F.2.3.2.2.

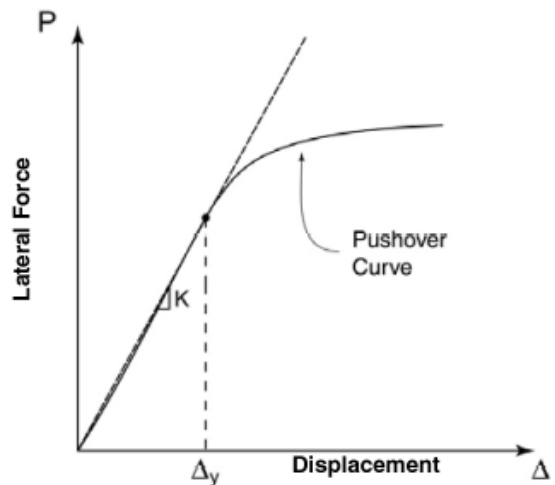


FIGURE 31F-4-6
STIFFNESS FOR LINEAR MODAL ANALYSIS

3104F.2.3.4 Nonlinear dynamic analysis. Nonlinear dynamic time history analysis is optional, and if performed, a peer review is required (see Section 3101F.8.2). Multiple acceleration records shall be used, as explained in Section 3103F.4.2.10. The following assumptions may be made:

1. Equivalent “super piles” can represent groups of piles.
2. If the deck has sufficient rigidity (both in-plane and out-of-plane) to justify its approximation as a rigid element, a 2-D plan simulation may be adequate.

A time-history analysis should always be compared with a simplified approach to ensure that results are reasonable. Displacements calculated from the nonlinear time history analyses may be used directly in design, but shall not be less than 80 percent of the values obtained from Section 3104F.2.3.2.

3104F.2.3.5 Alternative procedures. Alternative lateral-force procedures using rational analyses based on well-established principles of mechanics may be used in lieu of those prescribed in these provisions. As per Section 3101F.8.2, peer review is required.

3104F.3 New MOTs. The analysis and design requirements described in Section 3104F.2 shall also apply to new MOTs. However, new MOTs shall comply with the seismic performance criteria for high spill classification, as defined in Table 31F-4-1. Additional requirements are as follows:

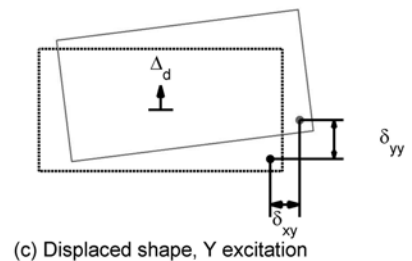
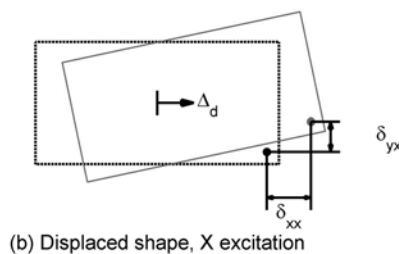
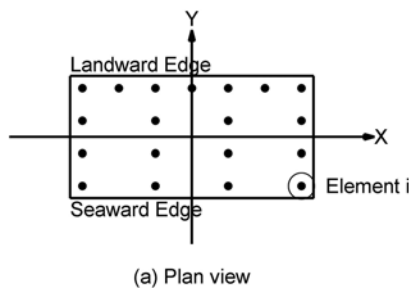
1. Site-specific response spectra analysis (see Section 3103F.4.2.3).
2. Soil parameters based on site-specific and new borings (see Section 3106F.2.2).

3104F.4 General analysis and design requirements.

3104F.4.1 Load combinations. Earthquake loads shall be used in the load combinations described in Section 3103F.8.

3104F.4.2 Combination of orthogonal seismic effects. The design displacement demand at an element, δ_d , shall be calculated by combining the longitudinal, δ_x , and transverse, δ_y , displacements in the horizontal plane (Figure 31F-4-7):

$$\delta_d = \sqrt{\delta_x^2 + \delta_y^2} \tag{4-16}$$



**FIGURE 31F-4-7
PLAN VIEW OF WHARF SEGMENT UNDER X AND Y SEISMIC EXCITATIONS**

where:

$$\delta_x = \delta_{xy} + 0.3\delta_{xx} \tag{4-17}$$

and

$$\delta_y = 0.3\delta_{yx} + \delta_{yy} \tag{4-18}$$

OR

$$\delta_y = \delta_{yx} + 0.3\delta_{yy} \tag{4-19}$$

and

$$\delta_x = 0.3\delta_{xy} + \delta_{xx} \tag{4-20}$$

whichever results in the greater design displacement demand.

3104F.4.3 P-Δ Effects. The P-Δ effect (i.e., the additional moment induced by the total vertical load multiplied by the lateral deck deflection) shall be considered unless the following relationship is satisfied (see Figure 31F-4-8):

$$\frac{V}{W} \geq 4 \frac{\Delta_d}{H} \tag{4-21}$$

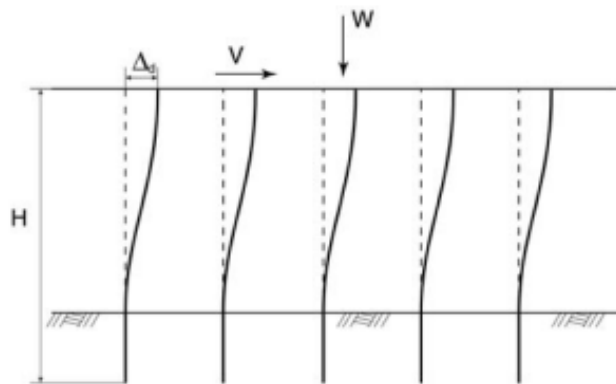
where:

V = base shear strength of the structure obtained from a plastic analysis

W = dead load of the frame

Δ_d = displacement demand

H = distance from the location of maximum in-ground moment to center of gravity of the deck



**FIGURE 31F-4-8
P-Δ EFFECT**

For wharf structures where the lateral displacement is limited by almost fully embedded piles, P - Δ effects may be ignored; however, the individual stability of the piles shall be checked in accordance with Section 3107F.2.5.2.

If the landside batter piles are allowed to fail in a Level 2 evaluation, the remaining portion of the wharf shall be checked for P - Δ effects.

3104F.4.4 Expansion joints. The effect of expansion joints shall be considered in the seismic analysis.

3104F.4.5 Shear key forces. Shear force across shear keys connecting adjacent wharf segments, V_{sk} (approximate upper bound to the shear key force [4.7]) shall be calculated as follows:

$$V_{sk} = 1.5(e/L_1)V_{\Delta T} \quad (4-22)$$

where:

$V_{\Delta T}$ = total segment lateral force found from a push-over analysis

L_1 = segment length

e = eccentricity between the center of rigidity and the center of mass

3104F.4.6 Connections. For an existing wharf, the deteriorated conditions at the junction between the pile top and pile cap shall be considered in evaluating the moment capacity. Connection detail between the vertical pile and pile cap shall be evaluated to determine whether full or partial moment capacity can be developed under seismic action.

For new MOTs, the connection details shall develop the full moment capacities.

The modeling shall simulate the actual moment capacity (full or partial) of the joint in accordance with Section 3107F.2.7.

3104F.4.7 Batter piles. Batter piles primarily respond to earthquakes by developing large axial compression or tension forces. Bending moments are generally of secondary importance. Failure in compression may be dictated by the deck-pile connection (most common type), material compression, buckling or by excessive local shear in deck members adjacent to the batter pile. Failure in tension may be dictated by connection strength or by pile pull out (p. 3-83 of Ferritto et al. [4.7]).

When the controlling failure scenario is reached and the batter pile fails, the computer model shall be adjusted to consist of only the vertical pile acting either as a full or partial moment frame based on the connection details between the pile top and pile cap. The remaining displacement capacity, involving vertical piles, before the secondary failure stage develops, shall then be established (see Section 3107F.2.8).

Axial p - z curves shall be modeled. In compression, displacement capacity should consider the effect of the reduction in pile modulus of elasticity at high loads and the increase in effective length for friction piles. This procedure allows the pile to deform axially before reaching ultimate loads, thereby increasing the displacement ductility [4.7].

Horizontal nonlinear p - y springs are only applied to batter piles with significant embedment, such as for landside batter piles in a wharf structure. Moment fixity can be assumed for batter piles that extend well above the ground such as waterside batter piles in a wharf structure or batter piles in a pier type structure.

3104F.5 Nonstructural components, nonbuilding structures and building structures. Nonstructural components, nonbuilding structures and building structures at MOTs shall be assessed for Level 2 seismic performance (see Section 3104F.2.1). Consideration shall be given to the adequacy and condition of supports and attachments (or anchorage), strength, flexibility, relative displacement, P -delta effects, and seismically-induced interaction with other components and structures.

3104F.5.1 General. Nonstructural components are mechanical, electrical and architectural components (such as piping/pipelines, loading arms, lifting equipment (winches and cranes), spill prevention equipment, pumps, instrumentation and storage cabinets, and lighting fixtures) that may be required to resist the effects of earthquake.

Nonbuilding structures (such as gangways, hose towers and racks) are self-supporting structures that carry gravity loads and may be required to resist the effects of earthquake, but are not building structures (such as control rooms). For building structures, see Section 3104F.5.6.

Critical systems are nonstructural components, nonbuilding structures or building structures that shall remain operational or those whose failure could impair emergency operations following an earthquake, to prevent major oil spills and to protect public health, safety and the environment. A seismic assessment of the survivability and continued operation (related to personnel safety, oil spill prevention or response) during a Level 2 earthquake (see Table 31F-4-1) shall be performed for critical systems, including but not limited to, fire protection, emergency shutdown and electrical power systems.

3104F.5.2 Seismic assessment. For existing (E) nonstructural components, nonbuilding structures and building structures and their supports and attachments, seismic assessment shall be performed in accordance with CalARP [4.8] or ASCE Guidelines [4.9], except for piping/pipelines which shall be evaluated per Section 3109F. If seismic evaluation and/or strengthening are required, it shall be performed in accordance with Section 3104F.5.2.1.

For new (N) nonstructural components, nonbuilding structures and building structures and their supports and attachments, seismic evaluation and design shall be performed in accordance with Section 3104F.5.2.1, except for piping/pipelines which shall be evaluated per Section 3109F.

3104F.5.2.1 Seismic evaluation, strengthening and design. For evaluation, strengthening and design of nonstructural components, nonbuilding structures and building structures, seismic forces (demands) shall be obtained from Section 3104F.5. The seismic adequacy

of nonstructural components shall be demonstrated as specified in ASCE/SEI 7 [4.1]. Structures shall be analyzed in accordance with Section 3107F.5. Supports and attachments shall be assessed in accordance with Sections 3107F.7.

3104F.5.3 Contribution to global response of MOT structures. Nonstructural components, nonbuilding structures and building structures permanently attached to MOT structures, including, but not limited to, pipelines, loading arms, hose towers/racks, raised platforms, control rooms and vapor control equipment, may affect the global structural response. In such cases, the seismic characteristics (mass and/or stiffness) of the nonstructural components, nonbuilding structures and building structures shall be considered in computing global seismic response of the MOT structures. If the seismic response of nonstructural components is determined to be out of phase (e.g. pipelines) with the global structural response, then the mass contribution can be neglected in the seismic structural analysis.

3104F.5.4 Nonstructural components and nonbuilding structures permanently attached to MOT structures. This section covers nonstructural components and nonbuilding structures having a significant mass and/or importance to the operability and safety of the MOT, and that are permanently attached to MOT structures (e.g., wharves, trestles, dolphins). The weight of nonstructural components and nonbuilding structures shall be included in the dead load of the structure per Section 3103F.2.

Computation of seismic effects shall consider:

1. Amplification of acceleration from ground to location of attachment of the nonstructural component or nonbuilding structure to the deck due to flexibility of the MOT structure, and
2. Amplification of acceleration due to flexibility of the nonstructural component or nonbuilding structure.

The following are not covered in this section and shall be assessed using rational approach that includes consideration of strength, stiffness, ductility and seismic interaction with all other connected components and with the supporting structures or systems, subject to Division approval:

1. Nonstructural component supported by other nonstructural system permanently attached to MOT structure;
2. Nonstructural component or nonbuilding structure supported by other structure permanently attached to MOT structure;
3. Nonstructural component or nonbuilding structure attached to multiple MOT structures;
4. Nonstructural component or nonbuilding structure attached to structure and ground.

3104F.5.4.1 Seismic loads. This section specifies the procedure to compute seismic loads on nonstructural components and nonbuilding structures permanently attached to a MOT structure.

The following nonstructural components are exempt from the requirements of this section:

1. Temporary or movable equipment unless part of a critical system (Section 3104F.5.1);
2. Mechanical and electrical components that are attached to the MOT structure and have flexible connections to associated piping and conduit; and either:
 - (a) The component weighs 400 lb or less, the center of mass is located 4 ft or less above the MOT deck, and the component Importance Factor, I_p is equal to 1.0; or
 - (b) The component weighs 20 lb or less, or in the case of a distributed system, 5 lb/ft or less.

3104F.5.4.1.1 Simplified Procedure. The Simplified Procedure may be used to estimate seismic loads on nonstructural components and nonbuilding structures permanently attached to a MOT structure. The Simplified Procedure shall not be used if any of the following apply:

1. Mass of the nonstructural component or nonbuilding structure exceeds 25 percent of the combined mass of the MOT structure plus nonstructural component or nonbuilding structure;
2. Multiple nonstructural components or nonbuilding structures of similar type (or natural period) when their combined mass exceeds 25 percent of the total mass of the MOT structure plus nonstructural components or nonbuilding structures;
3. Concrete/Steel MOT structure with irregular configuration (Section 3104F.1.3 and Table 31F-4-2) and high or medium spill exposure classification.

The horizontal seismic force, F_p , shall be computed as follows [4.10]:

$$F_p = \frac{1.2S_{xs}a_pI_pW_p}{R_p} \quad (4-23)$$

$$0.3S_{xs}I_pW_p \leq F_p \leq 1.6S_{xs}I_pW_p$$

where:

S_{xs} = spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5

a_p = amplification factor for nonstructural component or nonbuilding structure (Table 31F-4-3)

I_p = importance factor for nonstructural component or nonbuilding structure (Table 31F-4-4)

W_p = weight of the nonstructural component or nonbuilding structure

R_p = response modification factor for nonstructural component or nonbuilding structure (Table 31F-4-5)

Alternatively, when dynamic properties of the MOT structure are available, the horizontal seismic force, F_p , may be computed from [4.10]:

$$F_p = \frac{a_p S_A I_p A_x W_p}{R_p} \quad (4-24)$$

$$0.3S_{xs} I_p W_p \leq F_p \leq 1.6S_{xs} I_p W_p$$

where:

S_A = spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5, at the period equal to the elastic fundamental period of the MOT structure, T , in direction under consideration

A_x = torsional amplification factor given by:

$$A_x = \left(\frac{\Delta_m}{1.2\Delta_{avg}} \right)^2 \quad (4-25)$$

$$1 \leq A_x \leq 3$$

where:

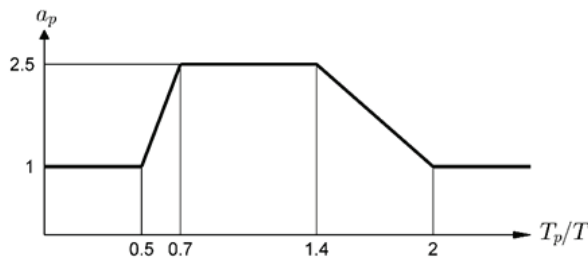
Δ_m = maximum displacement at one end of the MOT structure transverse to an axis

Δ_{avg} = average of the displacements at the extreme points of the MOT structure (see Figure 31F-4-1)

**TABLE 31F-4-3
AMPLIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES**

COMPONENT OR STRUCTURE	$a_p^{1,2}$
Rigid components or structures (period less than 0.06 seconds)	1.0
Rigidly attached components or structures	1.0
Flexible components or structures (period longer than 0.06 seconds)	2.5
Flexibly attached components or structures	2.5

1. A lower value shall not be used unless justified by detailed dynamic analysis, and shall in no case be less than 1.0.
2. If the fundamental period of the MOT structure, T , and the period of the flexible nonstructural component or nonbuilding structure, T_p , is known, a_p may be estimated from Figure 31F-4-9.



**FIGURE 31F-4-9
AMPLIFICATION FACTOR, a_p [4.10]**

**TABLE 31F-4-4
IMPORTANCE FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES**

COMPONENT OR STRUCTURE	I_p
Critical ^{1,2}	1.5
Other	1.0

1. See Section 3104F.5.1 for definition of critical system.
2. A lower value may be utilized, subject to Division approval.

**TABLE 31F-4-5
RESPONSE MODIFICATION FACTORS FOR NONSTRUCTURAL COMPONENTS AND NONBUILDING STRUCTURES**

COMPONENT OR STRUCTURE	R_p^1
Loading arms	3.0
Piping/pipelines (welded)	12.0
Pining/pipelines (threaded or flanged)	6.0
Pumps	2.5
Skids	2.5
Tanks and totes	2.5
Light fixtures (or luminaries)	1.5
Electrical conduits and cable trays	6.0
Mooring hardware	2.5
Velocity monitoring equipment	2.5
Instrumentation or storage cabinets	6.0
Cranes	2.5
Gangway (column systems)	3.0
Gangways (truss systems)	Use R_p from frame systems
Hose towers and racks	Use R_p from frame systems
Frame systems:	
Steel special concentrically braced frames	6.0
Steel ordinary concentrically braced frames	3.5
Steel special moment frames	8.0
Steel intermediate moment frames	4.5
Steel ordinary moment frames	3.5
Lightframe wood sheathed with wood structural panels	6.5
Lightframe cold-formed steel sheathed with wood structural panels	6.5
Lightframe walls with shear panels of other materials	2.0
Other	Subject to Division approval

1. A higher value may be utilized, subject to Division approval.

The horizontal seismic force, F_p , in the direction under consideration shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure.

The horizontal seismic force, F_p , shall be applied independently in at least two orthogonal horizontal directions in combination with service or operating loads associated with the nonstructural component or nonbuilding structure, as appropriate. For vertically cantilevered systems, however, F_p shall be assumed to act in any horizontal direction.

The concurrent vertical seismic force, F_v , shall be applied at the center of gravity and distributed relative to the mass distribution of the nonstructural component or nonbuilding structure, as follows:

$$F_v = \pm 0.2 S_{ss} W_p \quad (4-26)$$

3104F.5.4.1.2 Linear modal demand procedure. The linear modal demand procedure (Section 3104F.2.3.3) may always be used and shall be used to estimate seismic forces when the Simplified Procedure (Section 3104F.5.4.1.1) is not permitted. The MOT structure and nonstructural components and/or nonbuilding structures shall be modeled explicitly. The seismic forces obtained from the linear modal demand procedure shall be adjusted for appropriate importance factors and response modification factors as specified in Table 31F-4-4 and Table 31F-4-5.

3104F.5.5 Nonstructural components and nonbuilding structures permanently attached to the ground. The seismic load shall be computed using the procedures in ASCE/SEI 7 [4.1], except that Level 2 design earthquake motion parameters defined in Section 3103F.4 shall be used in lieu of those specified in ASCE/SEI 7 [4.1].

3104F.5.6 Building structures. For buildings permanently attached to MOT structure, Section 3104F.5.4.1 shall be used to compute seismic loads. Computation of seismic effects shall consider:

1. Amplification of acceleration from ground to location of attachment of the building to the deck due to flexibility of the MOT structure, and
2. Amplification of acceleration due to flexibility of the building.

For buildings permanently attached to the ground, seismic loads shall be computed using the procedures in ASCE/SEI 7 [4.1], as amended by the local enforcing agency requirements, subject to Division approval.

3104F.6 Symbols.

a	= Site class factor	F_p	= Horizontal seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT
a_p	= Amplification factor for nonstructural component or nonbuilding structure	F_v	= Vertical seismic force on nonstructural component, nonbuilding structure or building structure supported on MOT
A_x	= Torsional amplification factor	F_y	= Effective yield strength
C_1	= Modification factor to relate expected maximum inelastic displacement to displacement calculated for linear elastic response	H	= Distance from maximum in-ground moment to center of gravity of the deck
C_2	= Modification factor to represent the effects of pinched hysteresis shape, cyclic stiffness degradation and strength deterioration on the maximum displacement response	I_p	= Importance factor for nonstructural component or nonbuilding structure
e	= Eccentricity between center of mass and center of rigidity	k_e	= Effective elastic lateral stiffness
$F_{d,i}$	= Force at step i of iteration	$k_{eff,i}$	= Effective secant lateral stiffness at step i of iteration
$F_{d,j}$	= Force at step j of iteration	$k_{eff,j}$	= Effective secant lateral stiffness at step j of iteration
		L_1	= Longitudinal length between wharf expansion joints
		m	= Seismic mass
		R_p	= Response modification factor for nonstructural component or nonbuilding structure
		S_A	= Spectral response acceleration at T
		S_{ss}	= Spectral acceleration in Section 3103F.4.2.4 or Section 3103F.4.2.5
		S_1	= 1-second spectral response acceleration
		T	= Fundamental period of the elastic structure
		T_e	= Effective elastic structural period
		$T_{eff,i}$	= Effective structural period at step i of iteration
		T_p	= Period of flexible nonstructural component or nonbuilding structure
		T_0	= Period at peak of the acceleration response spectrum
		V	= Base shear strength of the structure obtained from a plastic analysis
		V_{sk}	= Shear force across shear keys
		$V_{\Delta T}$	= Total segment lateral force
		W	= Dead load of the frame
		W_p	= Weight of the nonstructural component or nonbuilding structure
		Δ_d	= Target displacement demand
		$\Delta_{d,i}$	= Target displacement demand at step i of iteration
		$\Delta_{d,j}$	= Target displacement demand at step j of iteration
		α_1	= Positive post-yield slope ratio equal to positive post-yield stiffness divided by the effective stiffness

α_2	= Negative post-yield slope ratio equal to negative post-yield stiffness divided by the effective stiffness
α_e	= Effective negative post-yield slope ratio equal to effective post-yield negative stiffness divided by the effective stiffness
$\alpha_{P-\Delta}$	= Negative slope ratio caused by $P-\Delta$ effects
Δ_{avg}	= Average of displacements, Δ_1 and Δ_2 , at ends of the MOT transverse to an axis
Δ_d	= Target displacement
Δ_m	= Maximum of displacements, Δ_1 and Δ_2 , at ends of the MOT transverse to an axis
Δ_y	= Displacement at yield strength
Δ_1, Δ_2	= Displacement at ends of the MOT transverse to an axis
δ_d	= Design displacement demand at an element
δ_x	= Displacement of an element in X direction
δ_y	= Displacement of an element in Y direction
δ_{xx}	= X displacement under X direction excitation
δ_{xy}	= X displacement under Y direction excitation
δ_{yx}	= Y displacement under X direction excitation
δ_{yy}	= Y displacement under Y direction excitation
λ	= Near-field effect factor
μ_{max}	= Maximum strength ratio
$\mu_{strength}$	= Ratio of elastic strength demand to yield strength
$\mu_{\Delta,t}$	= Initial ductility level
$\xi_{eff,i}$	= Effective structural damping at step i of iteration

3104F.7 References.

- [4.1] American Society of Civil Engineers (ASCE), 2016, ASCE/SEI 7-16 (ASCE/SEI 7), "Minimum Design Loads and Associates Criteria for Buildings and Other Structures," Reston, VA.
- [4.2] American Society of Civil Engineers (ASCE), 2014, ASCE/COPRI 61-14 (ASCE/COPRI 61), "Seismic Design of Piers and Wharves," Reston, VA.
- [4.3] American Society of Civil Engineers (ASCE), 2017, ASCE/SEI 41-17 (ASCE/SEI 41), "Seismic Evaluation and Retrofit of Existing Buildings," Reston, VA.
- [4.4] Federal Emergency Management Agency (FEMA), June 2005, FEMA 440, "Improvement of Nonlinear Static Seismic Analysis Procedures," Redwood City, CA.
- [4.5] Priestley, M.J.N., Seible, F., Calvi, G.M., 1996, "Seismic Design and Retrofit of Bridges," John Wiley & Sons, Inc., New York.
- [4.6] Kowalsky, M.J., Priestley, M.J.N., MacRae, G.A., 1994, "Displacement-Based Design – A Methodology for Seismic Design Applied to Single Degree of Freedom Reinforced Concrete Structures," Report

No. SSRP – 94/16, University of California, San Diego.

- [4.7] Ferritto, J., Dickenson, S., Priestley N., Werner, S., Taylor, C., Burke, D., Seelig, W., and Kelly, S., 1999, "Seismic Criteria for California Marine Oil Terminals," Vol. 1 and Vol. 2, Technical Report TR-2103-SHR, Naval Facilities Engineering Service Center, Port Hueneme, CA.
- [4.8] CalARP Program Seismic Guidance Committee, December 2013, "Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.
- [4.9] American Society of Civil Engineers, 2011, "Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," 2nd ed., New York.
- [4.10] Goel, R. K., 2017, "Estimating Seismic Forces in Ancillary Components and Nonbuilding Structures Supported on Piers, Wharves, and Marine Oil Terminals," *Earthquake Spectra*, <https://doi.org/10.1193/041017EQS068M>.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 5

SECTION 3105F MOORING AND BERTHING ANALYSIS AND DESIGN

3105F.1 General.

3105F.1.1 Purpose. This section establishes minimum standards for safe mooring and berthing of vessels at MOTs.

3105F.1.2 Applicability. This section applies to onshore MOTs; Figure 31F-5-1 shows typical pier and wharf configurations.

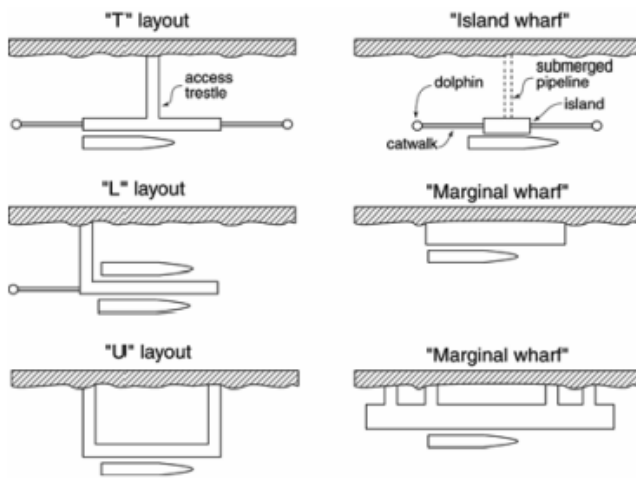


FIGURE 31F-5-1
TYPICAL PIER AND WHARF CONFIGURATIONS

3105F.1.3 Mooring/berthing requirements. Multiple berth MOTs shall use the same environmental input conditions for each berth unless it can be demonstrated that there are significant differences.

MOTs shall have the following equipment in operation:

1. An anemometer (N/E).
2. A current meter in high velocity current (>1.5 knots) areas (N/E).
3. Remote reading tension load devices in high velocity current (>1.5 knots) areas and/or with passing vessel effects for new MOTs.
4. Mooring hardware in accordance with Section 3105F.8 (N/E).

Berthing systems shall be in accordance with Section 3105F.4 (N/E).

Monitoring systems and instrumentation shall be implemented considering the parameters in Section 3102F.3.6.1, and shall be installed, maintained and calibrated in accordance with Section 3111F.9.3.

3105F.1.4 New MOTs. Quick release hooks are required at all new MOTs, except for spring line fittings. Quick release hooks shall be sized in accordance with Section 3105F.8 To avoid accidental release, the freeing mechanism shall be activated by a two-step process. Quick

release hooks shall be insulated electrically from the mooring structure, and shall be supported so as not to contact the deck.

Section 3105F.5 and the OCIMF guidelines [5.4] shall be used in designing the mooring layout.

3105F.1.5 Analysis and design of mooring components. The existing condition of the MOT shall be used in the mooring analysis (see Section 3102F). Structural characteristics of the MOT, including type and configuration of mooring fittings such as bollards, bits, hooks and capstans and material properties and condition, shall be determined in accordance with Sections 3107F.7 and 3105F.8.

The analysis and design of mooring components shall be based on the loading combinations and safety factors defined in Sections 3103F.8, 3105F.7 and 3105F.8, and in accordance with ACI 318 [5.1], AISC 325 [5.2] and ANSI/AWC NDS [5.3], as applicable.

3105F.2 Mooring analyses. A mooring analysis shall be performed for each berthing system, to justify the safe mooring of the various vessels at the MOT. Review of vessels calling at the MOT shall be performed to identify representative vessel size ranges and mooring configurations. Vessels analyzed shall be representative of the upper bound of each vessel size range defined by DWT capacity (see Section 3101F.6). The Terminal Operating Limits (TOLs) shall be generated based on the mooring analyses (see Section 3102F.3.6.1 and Figure 31F-2-1).

The forces acting on a moored vessel shall be determined in accordance with Section 3103F.5. Mooring line and breasting load combinations shall be in accordance with Section 3103F.8.

Two procedures, manual and numerical, are available for performing mooring analyses. These procedures shall conform to either the OCIMF (MEG 3) [5.4] or UFC 4-159-03 [5.5]. The manual procedure (Section 3105F.2.1) may be used for barges. In order to simplify the analysis for barges (or other small vessels), they may be considered to be solid free-standing walls (Chapter 29 of ASCE/SEI 7 [5.6]). This will eliminate the need to perform a computer assisted mooring analysis.

A new mooring assessment shall be performed when conditions change, such as any modification in the mooring configuration, vessel size or new information indicating greater wind, current or other environmental loads.

The most severe combination of the environmental loads and limiting conditions shall be justified based on site-specific evaluation, and considered in the mooring analyses. At a minimum, the following shall be considered and documented:

1. Two current directions (maximum ebb and flood; See Section 3103F.5.3)
2. Two tide levels (highest high and lowest low)
3. Two vessel loading conditions (ballast and maximum draft at the terminal)

4. Eight wind directions (45 degree increments)
5. Vessel motion limits (as applicable)
6. Fender properties
7. Mooring hardware capacities
8. Minimum mooring line properties (such as MBL of the weakest line permitted for vessel size range)
9. Passing vessel forces

In general, vessels shall remain in contact with the breasting or fendering system. Vessel motion (sway) of up to 2 feet off the breasting structure may be allowed under the most severe environmental loads, unless greater movement can be justified by an appropriate mooring analysis that accounts for potential dynamic effects. The allowable movement shall be consistent with mooring analysis results, indicating that forces in the mooring lines and their supports are within the allowable safety factors. Also, a check shall be made as to whether the movement is within the limitations of the cargo transfer equipment.

The mooring analyses outputs define the wind load and other limitations.

Upon completion of the mooring analyses, the following shall be checked, as applicable:

1. The fender system compression/deflection performance.
2. Anchorage capacity of each mooring hardware component.
3. Capacity of supporting structure(s) exceed each mooring line demand.
4. Maximum allowable capacities for mooring lines.
5. Vessel motion does not exceed the maximum allowable extension limits of the loading arms and/or hoses.

3105F.2.1 Manual procedure. Simplified calculations may be used to determine the mooring forces for barges with Favorable Site Conditions (see Table 31F-3-8) and no passing vessel effects (see Section 3105F.3.2), except if any of the following conditions exist (Figures 31F-5-2 and 31F-5-3).

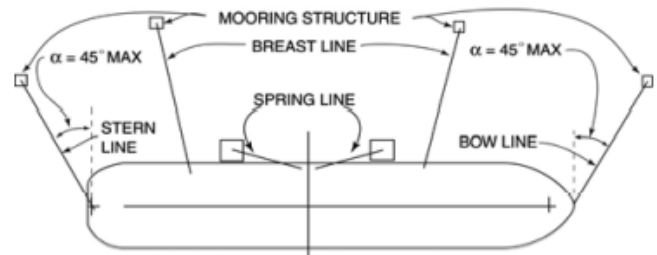
1. Mooring layout is significantly asymmetrical
2. Horizontal mooring line angles (α) on bow and stern exceed 45 degrees
3. Horizontal breast mooring line angles exceed 15 normal to the hull
4. Horizontal spring mooring line angles exceed 10 degrees from a line parallel to the hull
5. Vertical mooring line angles (θ) exceed 25 degrees
6. Mooring lines for lateral loads not grouped at bow and stern

When the forces have been determined and the distance between the bow and stern mooring points is known, the yaw moment can be resolved into lateral loads at the bow and stern. The total environmental loads on a moored vessel are comprised of the lateral load at the vessel bow, the

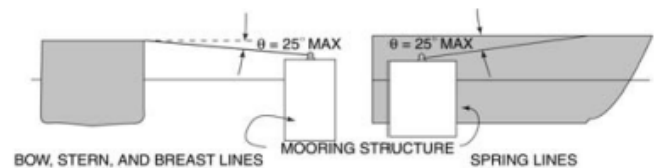
lateral load at the vessel stern and the longitudinal load. Line pretension loads must be added.

Four load cases shall be considered:

1. Entire load is taken by mooring lines
2. Entire load is taken by breasting structures
3. Load is taken by combination of mooring lines and breasting structures
4. Longitudinal load is taken only by spring lines



**FIGURE 31F-5-2
HORIZONTAL LINE ANGLES [5.4]**



**FIGURE 31F-5-3
VERTICAL LINE ANGLES [5.4]**

3105F.2.2 Numerical procedure. A numerical procedure is required to obtain mooring forces for MOTs that cannot use manual procedure. Computer program(s) shall be based on mooring analysis procedures that consider the characteristics of the mooring system, calculate the environmental loads and provide resulting mooring line forces and vessel motions (surge and sway).

3105F.3 Wave, passing vessel, seiche and tsunami.

3105F.3.1 Wind waves. MOTs are generally located in sheltered waters such that typical wind waves can be assumed not to affect the moored vessel if the significant wave period, T_s , is less than 4 seconds. However, if the period is equal to or greater than 4 seconds, then a simplified dynamic analysis (See Section 3103F.5.4) is required. The wave period shall be established based on a 1-year significant wave height, H_s . For MOTs within a harbor basin, the wave period shall be based on the locally generated waves with relatively short fetch.

3105F.3.2 Passing vessels. These forces generated by passing vessels are due to pressure gradients associated with the flow pattern. These pressure gradients cause the moored vessel to sway, surge and yaw, thus imposing forces on the mooring lines.

Passing vessel analysis shall be conducted when all of the following conditions exist (See Figure 31F-5-4):

1. Passing vessel size is greater than 25,000 DWT.

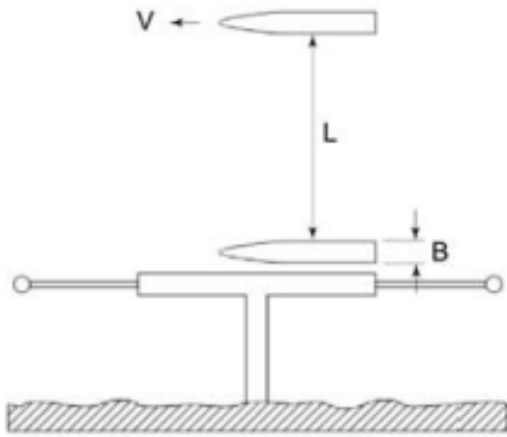
2. Distance L is 500 feet or less
3. Vessel speed V is greater than V_{crit}

where:

$$V_{crit} = 1.5 + \frac{L - 2B}{500 - 2B} 4.5(\text{knots}) \quad (5-1)$$

Exception: If $L \leq 2B$, passing vessel loads shall be considered.

L and B are shown in Figure 31F-5-4, in units of feet. V is defined as the speed of vessel over land minus the current velocity, when traveling with the current, or the speed of vessel over land plus the current velocity, when traveling against the current.



**FIGURE 31F-5-4
PASSING VESSEL**

When such conditions (1, 2 and 3 above) exist, the surge and sway forces and the yaw moment acting on the moored vessel shall, as a minimum, be established in accordance with Section 3103F.5.5 or by dynamic analysis.

For MOTs located in ports, the passing distance, L , may be established based on channel width and vessel traffic patterns. The guidelines established in Figure 5-17 of UFC 4-150-06 [5.7] for interior channels may be used. The “vertical bank” in Figure 5-17 of UFC 4-150-06 [5.7] shall be replaced by the side of the moored vessel when establishing the distance, “ L .”

For MOTs, not located within a port, the distance, “ L ,” must be determined from observed traffic patterns.

The following passing vessel positions shall be investigated:

1. Passing vessel is centered on the moored ship. This position produces maximum sway force.
2. The midship of the passing vessel is fore or aft of the centerline of the moored ship by a distance of 0.40 times the length of the moored ship. This position is assumed to produce maximum surge force and yaw moment at the same time.

The mooring loads due to a passing vessel shall be added to the mooring loads due to wind and current.

3105F.3.3 Seiche. A seiche analysis is required for existing MOTs located within a harbor basin and which have historically experienced seiche. A seiche analysis is required for new MOTs inside a harbor basin prone to penetration of ocean waves.

The standing wave system or seiche is characterized by a series of “nodes” and “antinodes.” Seiche typically has wave periods ranging from 20 seconds up to several hours, with wave heights in the range of 0.1 to 0.4 ft [5.7].

The following procedure may be used, as a minimum, in evaluating the effects of seiche within a harbor basin. In more complex cases where the assumptions below are not applicable, dynamic methods are required.

1. Calculate the natural period of oscillation of the basin. The basin may be idealized as rectangular, closed or open at the seaward end. Use Chapter 2 of UFC 4-150-06 [5.7] to calculate the wave period and length for different modes. The first three modes shall be considered in the analysis.
2. Determine the location of the moored ship with respect to the antinode and node of the first three modes to determine the possibility of resonance.
3. Determine the natural period of the vessel and mooring system. The calculation shall be based on the total mass of the system and the stiffness of the mooring lines in surge. The surge motion of the moored vessel is estimated by analyzing the vessel motion as a harmonically forced linear single degree of freedom spring mass system. Methods outlined in a paper by F.A. Kilner [5.8] can be used to calculate the vessel motion.
4. Vessels are generally berthed parallel to the channel; therefore, only longitudinal (surge) motions shall be considered, with the associated mooring loads in the spring lines. The loads on the mooring lines (spring lines) are then determined from the computed vessel motion and the stiffness of those mooring lines.

3105F.3.4 Tsunami. Run-up and current velocity shall be considered in the tsunami assessment. Section 3103F.5.7 and Table 31F-3-6 provides run-up values for the San Francisco Bay area, Los Angeles/Long Beach Harbors and Port Hueneme.

3105F.4 Berthing analysis and design. The analysis and design of berthing components shall be based on the loading combinations and safety factors defined in Sections 3103F.8 and 3105F.7, and in accordance with ACI 318 [5.1], AISC 325 [5.2] and ANSI/AWC NDS [5.3], as applicable.

3105F.4.1 Berthing energy demand. The kinetic berthing energy demand shall be determined in accordance with Section 3103F.6.

3105F.4.2 Berthing energy capacity. For existing MOTs, the berthing energy capacity shall be calculated as the area under the force-deflection curve for the combined structure

and fender system as indicated in Figure 31F-5-5. Fender piles may be included in the lateral analysis to establish the total force-deflection curve for the berthing system. Load-deflection curves for other fender types shall be obtained from manufacturer's data. The condition of fenders shall be taken into account when performing the analysis.

When batter piles are present, the fender system typically absorbs most of the berthing energy. This can be established by comparing the force-deflection curves for the fender system and batter piles. In this case only the fender system energy absorption shall be considered.

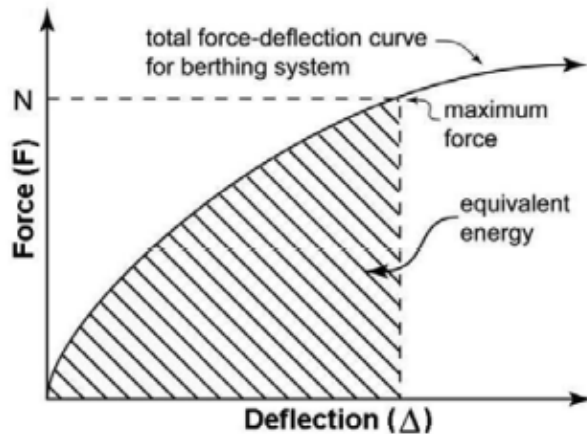


FIGURE 31F-5-5
BERTHING ENERGY CAPACITY

3105F.4.3 Tanker contact length.

3105F.4.3.1 Continuous fender system. A continuous fender system consists of fender piles, chocks, wales, and rubber or spring fender units.

The contact length of a ship during berthing depends on the spacing of the fender piles and fender units, and the connection details of the chocks and wales to the fender piles.

The contact length, L_c , can be calculated using rational analysis considering curvature of the bow and berthing angle.

In lieu of detailed analysis to determine the contact length, Table 31F-5-1 may be used. The contact length for a vessel within the range listed in the table can be obtained by interpolation.

TABLE 31F-5-1
CONTACT LENGTH

VESSEL SIZE (DWT)	CONTACT LENGTH
330	25 ft
1,000 to 2,500	35 ft
5,000 to 26,000	40 ft
35,000 to 50,000	50 ft
65,000	60 ft
100,000 to 125,000	70 ft

3105F.4.3.2 Discrete fender system. For discrete fender systems (i.e., not continuous), one fender unit or breasting dolphin shall be able to absorb the entire berthing energy.

3105F.4.4 Longitudinal and vertical berthing forces. The longitudinal and vertical components of the horizontal berthing force shall be calculated using appropriate coefficients of friction between the vessel and the fender. In lieu of as-built data, the values in Table 31F-5-2 may be used for typical fender/vessel materials:

TABLE 31F-5-2
COEFFICIENT OF FRICTION

CONTACT MATERIALS	FRICTION COEFFICIENT
Timber to Steel	0.4 to 0.6
Urethane to Steel	0.4 to 0.6
Steel to Steel	0.25
Rubber to Steel	0.6 to 0.7
UHMW* to Steel	0.1 to 0.2

*Ultra-high molecular weight plastic rubbing strips.

Longitudinal and vertical forces shall be determined by:

$$F = \mu N \quad (5-3)$$

where:

F = longitudinal or vertical component of horizontal berthing force

μ = coefficient of friction of contact materials

N = maximum horizontal berthing force (normal to fender)

3105F.4.5 Design and selection of new fender systems. For guidelines on new fender designs, refer to UFC 4-152-01 [5.9] and PIANC [5.10]. Velocity and temperature factors, contact angle effects and manufacturing tolerances shall be considered (see Appendices A and B of PIANC [5.10]). Also, see Section 3103F.6.

3105F.5 Layout of new MOTs. Guidelines for layout of new MOTs are provided in OCIMF MEG3 [5.4]. The final layout of the mooring and breasting dolphins shall be determined based on the results of the mooring analysis that provides optimal mooring line and breasting forces for the range of vessels to be accommodated.

3105F.6 Offshore moorings. Offshore MOT moorings shall be designed and analyzed considering the site water depth, metocean environment and class of vessels calling per OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5].

3105F.6.1 Mooring analyses. Analysis procedures shall conform to the OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5], and the following:

1. A mooring analysis shall be performed for the range of tanker classes and barges calling at each offshore berth.
2. Forces acting on moored vessels shall be determined according to Section 3103F.5 and analysis shall consider all possible vessel movements, contri-

bution of buoys, sinkers, catenaries affecting mooring line stiffness and anchorages.

3. Correlation of winds, waves and currents shall be considered. The correlation may be estimated by probabilistic analysis of metocean data.
4. The actual expected displacement of the vessels shall be used in the analysis.
5. Underwater inspections and bathymetry shall be considered.
6. Both fully laden and ballast conditions shall be considered.
7. Dynamic analysis shall be used to evaluate moorings performance.

3105F.6.2 Design of mooring components. Design of mooring components shall be based on loading combinations and safety factors defined in Sections 3103F.8, 3105F.7 and 3105F.8 and follow the guidelines provided in either the OCIMF MEG3 [5.4] or UFC 4-159-03 [5.5].

3105F.7 Safety factors for mooring lines. Safety factors for different material types of mooring lines are given in Table 31F-5-3. The safety factors should be applied to the minimum number of lines specified by the mooring analysis, using the highest loads calculated for the environmental conditions. The minimum breaking load (MBL) of new ropes is obtained from the certificate issued by the manufacturer. If polyamide tails are used in combination with wire mooring lines, the safety factor shall be based on the weaker of the two ropes.

**TABLE 31F-5-3
SAFETY FACTORS FOR ROPES [5.4]**

Steel Wire Rope	1.82
Polyamide	2.22
Other Synthetic	2.00
Polyamide Tail for Wire Mooring Lines	2.50
Other Synthetic Tail for Wire Mooring Lines	2.28
Polyamide Tail for Synthetic Mooring Lines	2.75
Other Synthetic Tail for Synthetic Mooring Lines	2.50
Joining Shackles	2.00

3105F.8 Mooring hardware (N/E). Mooring hardware shall include, but not be limited to, bollards, quick release hooks, other mooring fittings and base bolts. All mooring hardware shall be clearly marked with their safe working loads (or allowable working loads) [5.4]. The certificate issued by the manufacturer normally defines the safe working loads of this hardware.

3105F.8.1 Quick release hooks. For new MOTs or berthing systems, a minimum of three quick release hooks are required for each breasting line location for tankers greater than or equal to 50,000 DWT. At least two hooks at each location shall be provided for breasting lines for tankers less than 50,000 DWT. Remote release may be considered for emergency situations.

All hooks and supporting structures shall withstand the minimum breaking load (MBL) of the strongest line with a

safety factor of 1.2 or greater. Only one mooring line shall be placed on each quick release hook (N/E).

For multiple quick release hooks, the minimum horizontal load for the design of the tie-down shall be:

$$F_d = 1.2 \times MBL \times [1 + 0.75 (n-1)] \quad (5-4)$$

where:

F_d = Minimum factored demand for assembly tie-down.

n = Number of hooks on the assembly.

The capacity of the supporting structures must be larger than F_d (See Section 3107F.6).

3105F.8.2 Other fittings. Other fittings include cleats, bitts and bollards.

If the allowable working loads for existing fittings are not available, the values listed in Table 31F-5-4 may be used for typical sizes, bolt patterns and layout. The allowable working loads are defined for mooring line angles up to 60 degrees from the horizontal. The combination of vertical and horizontal loads shall be considered.

**TABLE 31F-5-4
ALLOWABLE WORKING LOADS**

TYPE OF FITTINGS	NO. OF BOLTS	BOLT SIZE (in)	WORKING LOAD (kips)
30 inch Cleat	4	1 ¹ / ₈	20
42 inch Cleat	6	1 ¹ / ₈	40
Low Bitt	10	1 ⁵ / ₈	60 per column
High Bitt	10	1 ³ / ₄	75 per column
44 ¹ / ₂ inch Fit. Bollard	4	1 ³ / ₄	70
44 ¹ / ₂ inch Fit. Bollard	8	2 ¹ / ₄	200
48 inch Fit. Bollard	12	2 ³ / ₄	450

Note: This table is modified from Table 6-11 of UFC 4-159-03 [5.5]

3105F.8.3 Base bolts. Base bolts are subjected to both shear and uplift. Forces on bolts shall be determined using the following factors:

1. Height of load application on bitts or bollards.
2. Actual vertical angles of mooring lines for the highest and lowest tide and vessel draft conditions, for all sizes of vessels at each particular berth.
3. Actual horizontal angles from the mooring line configurations, for all vessel sizes and positions at each particular berth.
4. Simultaneous loads from more than one vessel.

For existing MOTs, the deteriorated condition of the base bolts and supporting members shall be considered in determining the capacity of the fitting.

3105F.9 Symbols.

- α = Horizontal mooring line angles
- Δ = Deflection
- θ = Vertical mooring line angles
- B = Beam of vessel

DWT = Dead Weight Tonnage
 F = Longitudinal or vertical component of horizontal normal berthing force
 F_d = Minimum factored demand for assembly tie-down
 L = Distance between passing and moored vessels
 MBL = Minimum breaking load
 n = Number of hooks on the assembly
 N = Maximum horizontal berthing force
 μ = Coefficient of friction of contact materials
 V = Ground speed (knots)
 V_c = Maximum current (knots).
 V_{crit} = Ground speed (knots) above which passing loads must be considered

[5.10] Permanent International Association of Navigation Congresses (PIANC), 2002, "Guidelines for the Design of Fender Systems: 2002," Brussels.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

3105F.10 References.

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- [5.2] American Institute of Steel Construction, Inc. (AISC), 2017, AISC 325-17 (AISC 325), "Steel Construction Manual," 15th ed., Chicago, IL.
- [5.3] American Wood Council (AWC), 2017, ANSI/AWC NDS-2018 (ANSI/AWC NDS), "National Design Specification (NDS) for Wood Construction," Washington, D.C.
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- [5.6] American Society of Civil Engineers (ASCE), 2016, ASCE/SEI 7-16 (ASCE/SEI 7), "Minimum Design Loads and Associated Criteria for Buildings and Other Structures," Reston, VA.
- [5.7] Department of Defense, 12 December 2001 (Change 1, 19 October 2010), Unified Facilities Criteria (UFC) 4-150-06, "Military Harbors and Coastal Facilities," Washington D.C.
- [5.8] Kilner F.A., 1961, "Model Tests on the Motion of Moored Ships Placed on Long Waves." Proceedings of 7th Conference on Coastal Engineering, August 1960, The Hague, Netherlands, published by the Council on Wave Research - The Engineering Foundation.
- [5.9] Department of Defense, 24 January 2017, Unified Facilities Criteria (UFC) 4-152-01, "Design: Piers and Wharves," Washington D.C.

Division 6

**SECTION 3106F
GEOTECHNICAL HAZARDS AND FOUNDATIONS**

3106F.1 General.

3106F.1.1 Purpose. This section provides minimum standards for analyses and evaluation of geotechnical hazards and foundations under static and seismic conditions.

3106F.1.2 Applicability. The requirements provided herein apply to all new and existing MOTs.

3106F.1.3 Loading. The loading for geotechnical hazard assessment and foundation analyses under static and seismic conditions is provided in Sections 3103F and 3104F.

3106F.2 Site characterization. Site characterization shall be based on site-specific geotechnical information. If existing information is used, the geotechnical engineer of record shall provide adequate justification.

3106F.2.1 Site classes. Each MOT shall be assigned at least one site class. Site Classes A, B, C, D and E are defined in Table 31F-6-1, and Site Class F is defined by any of the following:

1. Soils vulnerable to significant potential loss of stiffness, strength and/or volume under seismic loading due to liquefiable soils, quick and highly sensitive clays and/or collapsible weakly cemented soils.
2. Peats and/or highly organic clays, where the thickness of peat or highly organic clay exceeds 10 feet.
3. Very high plasticity clays with a plasticity index (PI) greater than 75, where the thickness of clay exceeds 25 feet.
4. Very thick soft/medium stiff clays with undrained shear strength less than 1,000 psf, where the thickness of clay exceeds 120 feet.

3106F.2.2 Site-specific information.

1. Site-specific investigations shall include adequate borings and/or cone penetration tests (CPTs) and other appropriate field methods, to enable the determination of geotechnical parameters.

2. Adequate coverage of subsurface data, both horizontally and vertically, shall be obtained to develop geotechnical parameters.
3. Exploration shall be deep enough to characterize subsurface materials that are affected by embankment behavior and shall extend to depth of at least 20 feet below the deepest foundation depth.
4. During field exploration, particular attention shall be given to the presence of continuous low-strength layers or thin soil layers that could liquefy or weaken during the design earthquake shaking.
5. CPTs provide continuous subsurface profile and shall be used to complement exploratory borings. When CPTs are performed, at least one boring shall be performed next to one of the CPT soundings to check that the CPT-soil behavior type interpretations are reasonable for the site. Any difference between CPT interpretation and subsurface condition obtained from borings shall be reconciled.
6. Quantitative site soil stratigraphy is required to a depth of 100 feet for assigning a site class (see Table 31F-6-1).
7. Laboratory tests may be necessary to supplement the borings and insitu field tests.

3106F.3 Seismic loads for geotechnical evaluations. Section 3103F.4 defines the earthquake loads to be used for structural and geotechnical evaluations in terms of design Peak Ground Accelerations (PGA), spectral accelerations and design earthquake magnitude. Values used for analyses are based on Probabilistic Seismic Hazard Analyses (PSHA) using two levels of seismic performance criteria (Section 3104F.2.1 and Table 31F-4-1).

3106F.4 Liquefaction potential. The liquefaction potential of the soils in the immediate vicinity of or beneath each MOT, and associated slopes, embankments or rock dikes shall be evaluated for the PGAs associated with seismic performance Levels 1 and 2. Liquefaction potential evaluation should fol-

**TABLE 31F-6-1
SITE CLASSES**

SITE CLASS	SOIL PROFILE	AVERAGE VALUES FOR TOP 100 FEET OF SOIL PROFILE ³		
		Shear Wave Velocity, V _s [ft/sec]	Standard Penetration Test, SPT [blows/ft]	Undrained Shear Strength, S _u [psf]
A	Hard Rock	> 5,000		
B	Rock	2,500 to 5,000		
C	Very Stiff/Very Dense Soil and Soft Rock	1,200 to 2,500	> 50	> 2,000
D	Soft/Dense Soil Profile	600 to 1,200	15 to 50	1,000 to 2,000
E ^{1, 2}	Soft/Loose Soil Profile	< 600	< 15	< 1,000
F	Defined in Section 3106F.2.1			

1. Site Class E also includes any soil profile with more than 10 feet of soft clay (defined as a soil with a plasticity index, PI > 20, water content > 40 percent and S_u < 500 psf).

2. The plasticity index, PI, and the moisture content shall be determined in accordance with ASTM D4318 [6.1] and ASTM D2216 [6.2], respectively.

3. Conversion of CPT data to estimate equivalent V_s, SPT blow count, or S_u is allowed.

low the procedures outlined in NCEER report [6.3], SCEC [6.4] and CGS Special Publication 117A [6.5].

If liquefaction is shown to be initiated in the above evaluations, the particular liquefiable strata and their thicknesses shall be clearly shown on site profiles. Resulting hazards associated with liquefaction shall be addressed including translational or rotational deformations of slopes or embankment systems and post liquefaction settlement of slopes or embankment systems and underlying foundation soils, as noted below. If such analyses indicate the potential for partial or gross (flow) failure of a slope or embankment, adequate evaluations shall be performed to confirm such a condition exists, together with analyses to evaluate potential slope displacements (lateral spreads). In these situations and for projects where more detailed numerical analyses are performed, a peer review (see Section 3101F.8.2) may be required.

3106F.5 Slope or embankment stability and seismically induced lateral spreading. Slope or embankment stability related to the MOT facility, shall be evaluated for static and seismic loading conditions.

3106F.5.1 Static slope stability. Static stability analysis using conventional limit equilibrium methods shall be performed for site related slope or embankment systems. Live load surcharge shall be considered in analyses based on project-specific information. The long-term static factor of safety of the slope or embankment shall not be less than 1.5.

3106F.5.2 Pseudo-static seismic slope stability. Pseudo-static seismic slope or embankment stability analyses shall be performed to estimate the horizontal yield acceleration for the slope for the Level 1 and Level 2 earthquakes. During the seismic event, appropriate live load surcharge shall be considered.

If liquefaction and/or strength loss of the site soils is likely, the following shall be used in the analyses, as appropriate:

1. Residual strength of liquefied soils
2. Strengths compatible with the pore-pressure generation of potentially liquefiable soils
3. Potential strength reduction of clays

The residual strength of liquefied soils shall be estimated using guidelines outlined in SCEC [6.4] or other appropriate documents as noted in CGS Special Publication 117A [6.5].

Pseudo-static analysis shall be performed without considering the presence of the foundation system. Using a horizontal seismic coefficient of one-half of the PGA, if the estimated factor of safety is greater than or equal to 1.1, then no further evaluation of lateral spreading or kinematic loading from lateral spreading is required.

3106F.5.3 Post-earthquake static slope stability. The static factor of safety immediately following a design earthquake event shall not be less than 1.1 when any of the following are used in static stability analysis:

1. Post-earthquake residual strength of liquefied soils

2. Strengths compatible with the pore-pressure generation of potentially liquefiable soils

3. Potential strength reduction of clays

3106F.5.4 Lateral spreading – Free field. The earthquake-induced lateral deformations of the slope or embankment and associated foundations soils shall be determined for the Level 1 and Level 2 earthquakes using the associated PGA at the ground surface (not modified for liquefaction). If liquefaction and/or strength loss of the site soils is likely, the following shall be used in the analyses, as appropriate:

1. Residual strength of liquefied soils
2. Strengths compatible with the pore-pressure generation of potentially liquefiable soils
3. Potential strength reduction of clays

The presence of the foundation system shall not be included in the “free field” evaluations.

Initial lateral spread estimates shall be made using the Newmark displacement approach documented in NCHRP Report 611 [6.6] or other appropriate but similar procedures.

3106F.6 Seismically induced settlement. Seismically induced settlement shall be evaluated. Based on guidelines outlined in SCEC [6.4] or other appropriate documents such as CGS Special Publication 117A [6.5]. If seismically induced settlement is anticipated, the resulting design impacts shall be considered, including the potential development of downdrag loads on piles.

3106F.7 Earth pressures. Both static and seismic earth pressures acting on MOT structures shall be evaluated.

3106F.7.1 Earth pressures under static loading. The effect of static active earth pressures on structures resulting from static loading of backfill soils shall be considered where appropriate. Backfill sloping configuration, if applicable, and backland loading conditions shall be considered in the evaluations. The loading considerations shall be based on project-specific information. The earth pressures under static loading should be based on guidelines outlined in NAVFAC DM7-02 [6.7] or other appropriate documents.

3106F.7.2 Earth pressures under seismic loading. The effect of earth pressures on structures resulting from seismic loading of backfill soils, including the effect of pore-water pressure build-up in the backfill, shall be considered. The seismic coefficients used for this analysis shall be based on the Level 1 and Level 2 earthquake PGA values.

Evaluation of earth pressures under seismic loading, should be based on NCHRP Report 611 [6.6] or other appropriate methods.

3106F.8 Pile axial behavior.

3106F.8.1 Axial pile capacity. Axial geotechnical capacity of piles under static loading shall be evaluated using guidelines for estimating axial pile capacities provided in POLB WDC [6.8] or other appropriate documents. A min-

imum factor of safety of 2.0 shall be achieved on the ultimate capacity of the pile using appropriate MOT loading.

If liquefaction or seismically-induced settlement is anticipated, the ultimate axial geotechnical capacity of piles under seismic conditions shall be evaluated for the effects of liquefaction and/or downdrag forces on the pile. The ultimate geotechnical capacity of the pile during liquefaction shall be determined on the basis of the residual strength of the soil for those layers where the factor of safety for liquefaction is determined to be less than 1.0.

When seismically-induced settlements are predicted to occur during design earthquakes, the downdrag loads shall be computed, and the combination of downdrag load and static load determined. Only the tip resistance of the pile and the side friction resistance below the lowest layer contributing to the downdrag shall be used in the capacity evaluation. The ultimate axial geotechnical capacity of the pile shall not be less than the combination of the seismically induced downdrag force and the maximum static load.

3106F.8.2 Axial springs for piles. The geotechnical analyst (see Section 3102F.3.4.8) shall coordinate with the structural analyst (see Section 3102F.3.4.4) and develop axial springs (T-z) for piles. The T-z springs may be developed either at the top or at the tip of the pile (see Figure 31F-6-1). If the springs are developed at the pile tip, the tip shall include both the friction resistance along the pile (i.e., side springs [t-z]) and tip resistance at the pile tip (i.e. tip springs [q-w]), as illustrated in Figure 31F-6-1. If T-z springs are developed at the pile top, the appropriate elastic shortening of the pile shall be included in the springs. Linear or nonlinear springs may be developed if requested by the structural analyst.

Due to the uncertainties associated with the development of axial springs, such as the axial soil capacities, load distributions along the piles and simplified spring stiffnesses, both upper-bound and lower-bound limits shall be estimated and utilized in the analyses.

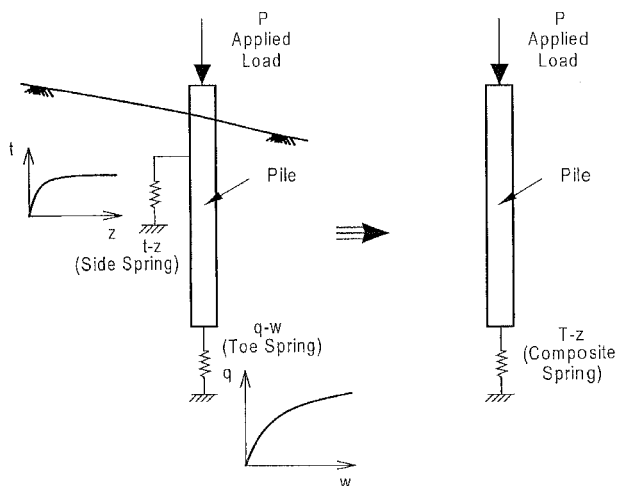


FIGURE 31F-6-1
AXIAL SOIL SPRINGS [6.8]

3106F.9 Soil springs for lateral pile loading. For design of piles under loading associated with the inertial response of the superstructure, level-ground inelastic lateral springs (p-y) shall be developed. The lateral springs within the shallow portion of the piles (generally within 10 pile diameters below the ground surface) tend to dominate the inertial behavior. Geotechnical parameters for developing lateral soil springs shall follow guidelines provided in API RP 2A-WSD [6.9] or other appropriate documents.

Due to uncertainties associated with the development of p-y curves for dike structures, upper-bound and lower-bound p-y springs shall be developed for use in superstructure inertial response analyses.

3106F.10 Soil-pile interaction. Two separate loading conditions for the piles shall be considered:

1. Inertial loading under seismic conditions
2. Kinematic loading from lateral ground spreading

Inertial loading is associated with earthquake-induced lateral loading on a structure, while kinematic loading refers to loading on foundation piles from earthquake induced lateral deformations of the slope/embankment/dike system. Simultaneous application of these loading conditions shall be evaluated with due consideration of the phasing and locations of these loads on foundation elements. The foundation shall be designed such that the structural performance is acceptable when subjected to both inertial and kinematic loadings.

3106F.10.1 Inertial loading under seismic conditions.

The lateral soil springs shall be used in inertial loading response analyses. The evaluation of inertial loading can be performed by ignoring potential slope/embankment/dike system deformations (i.e., one end of the lateral soil spring at a given depth is attached to the corresponding pile node and the other end is assumed fixed).

3106F.10.2 Kinematic loading from lateral spreading.

Kinematic pile loading from permanent lateral spread ground deformation in deep seated levels of slope/embankment/dike foundation soils shall be evaluated. The lateral deformations shall be restricted such that the structural performance of foundation piles is not compromised.

The lateral deformation of the embankment or dike and associated piles and foundation soils shall be determined using analytical methods as follows:

1. Initial estimates of free field lateral spread deformations (in the absence of piles) may be determined using the simplified Newmark sliding block method as described in Section 3106F.5.4. The geotechnical analyst shall provide the structural analyst with level-ground p-y curves for the weak soil layer controlling the lateral spread and soil layers above and below the weak layer. Appropriate overburden pressures shall be used in simplified pushover analyses, to estimate the pile displacement capacities and corresponding pile shear within the weak soil zone.
2. For the pushover analysis, the estimated displacements may be uniformly distributed within the thickness of the weak soil layer (i.e., zero at and below the bottom of the layer to the maximum value at and

above the top of the weak layer). The thickness of the weak soil layer used in the analysis (failure zone) shall not be more than five times the pile diameter or 10 feet, whichever is smaller.

3. For a simplified analysis (see Figure 31F-6-2), the pile shall be fixed against rotation and translation relative to the soil displacement at some distance above and below the weak soil layer. Between these two points, lateral soil springs are provided, which allow deformation of the pile relative to the deformed soil profile.

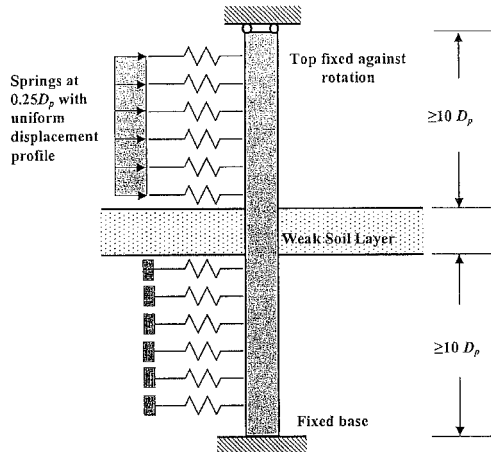


FIGURE 31F-6-2
SLIDING LAYER MODEL [6.8]

3106F.11 Soil-structure interaction – Shallow foundations and underground structures.

3106F.11.1 Shallow foundations. Shallow foundations shall be assumed to move with the ground. Springs and dashpots may be evaluated as per Gazetas [6.10].

3106F.11.2 Underground structures. Buried flexible structures or buried portions of flexible structures including piles and pipelines shall be assumed to deform with estimated ground movement at depth.

As the soil settles, it shall be assumed to apply shear forces to buried structures or buried portions of structures including deep foundations.

3106F.12 Underwater seafloor pipelines. Geotechnical evaluations of underwater pipelines shall include static stability of the seafloor ground supporting the pipeline and settlement and lateral deformation of the ground under earthquakes. If the pipeline is buried, the potential for uplift of the pipeline under earthquakes shall also be evaluated.

3106F.13 Symbols.

- A = Site Class A as defined in Table 31F-6-1
 B = Site Class B as defined in Table 31F-6-1
 C = Site Class C as defined in Table 31F-6-1
 CPT = Cone Penetration Test
 D = Site Class D as defined in Table 31F-6-1
 D_p = Pile diameter

E = Site Class E as defined in Table 31F-6-1

F = Site Class F as defined in Table 31F-6-1

P = Applied load

PI = Plasticity index

p-y = Lateral soil spring

S_U = Undrained shear strength

SPT = Standard Penetration Test

t-z = Axial soil spring along the side of pile

T-z = Composite axial soil spring at pile tip

q-w = Axial soil spring at pile tip

V_s = Shear wave velocity

3106F.14 References.

- [6.1] American Society for Testing and Materials (ASTM), 2014, ASTM D4318-10 (ASTM D4318), "Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils," West Conshohocken, PA.
- [6.2] American Society for Testing and Materials (ASTM), 2014, ASTM D2216-10 (ASTM D2216), "Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass," West Conshohocken, PA.
- [6.3] Youd, T.L., Idriss, I.M., Andrus, R.D., Arango, I., Castro, G. Christian, J.T., Dobry, R., Finn, W.D.L., Harder, L.F. Jr., Hynes, M.E., Ishihara, K., Koester, J.P., Liao, S.S.C., Marcuson, W.F., III, Martin, G.R., Mitchell, J.K., Moriwaki, Y., Power, M.S., Robertson, P.K., Seed, R.B., and Stokoe, K.H., II, 2001, "Liquefaction Resistance of Soils: Summary Report from the 1996 NCEER and 1998 NCEER/NSF Workshops on Evaluation of Liquefaction Resistance of Soils," Journal of Geotechnical and Geoenvironmental Engineering, ASCE, Volume 127, No. 10, p. 817-833.
- [6.4] Southern California Earthquake Center (SCEC), March 1999, "Recommended Procedures for Implementation of DMG Special Publication 117 Guidelines for Analyzing and Mitigating Liquefaction in California," University of Southern California, Los Angeles.
- [6.5] California Department of Conservation, California Geological Survey (CGS), 11 September 2008, "Guidelines for Evaluating and Mitigating Seismic Hazards in California," Special Publication 117A, Revised Release.
- [6.6] National Cooperative Highway Research Program (NCHRP), 2008, "NCHRP Report 611: Seismic Analysis and Design of Retaining Walls, Buried Structures, Slopes, and Embankments," Washington, D.C.
- [6.7] Naval Facilities Engineering Command (NAVFAC), 1986, NAVFAC DM7-02, "Foundation and Earth Structures," Alexandria, VA.

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[6.8] *Port of Long Beach (POLB)*, 2012 February 29, "Wharf Design Criteria (WDC)," Version 3.0, Long Beach, CA.

[6.9] *American Petroleum Institute (API)*, November 2014, *API Recommended Practice 2A-WSD (API RP 2A-WSD)*, "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms – Working Stress Design," 22nd ed., Washington, D.C.

[6.10] *Gazetas, G.*, September 1991, "Formulas and Charts for Impedances of Surface and Embedded Foundations," *Journal of Geotechnical Engineering, ASCE*, Vol. 117, No. 9.

Authority: Sections 8750 through 8760, *Public Resources Code*.

Reference: Sections 8750, 8751, 8755 and 8757, *Public Resources Code*.

Division 7

**SECTION 3107F
STRUCTURAL ANALYSIS AND
DESIGN OF COMPONENTS**

3107F.1 General.

3107F.1.1 Purpose. This section establishes the minimum performance standards for structural and nonstructural components. Evaluation procedures for seismic performance, strength and deformation characteristics of concrete, steel and timber components are prescribed herein. Analytical procedures for seismic assessment are presented in Section 3104F.

3107F.1.2 Applicability. This section addresses MOT structures constructed using the following structural components:

1. Reinforced concrete decks supported by batter and/or vertical concrete piles
2. Reinforced concrete decks supported by batter and/or vertical steel piles, including pipe piles filled with concrete
3. Reinforced concrete decks supported by batter and/or vertical timber piles
4. Timber decks supported by batter or vertical timber, concrete or steel pipe piles
5. Retaining structures constructed of steel, concrete sheet piles or reinforced concrete

Additionally, this section addresses structural and nonstructural components, nonbuilding structures and building structures comprised of steel, concrete or timber.

3107F.2 Concrete deck with concrete or steel piles.

3107F.2.1 Component strength. The following parameters shall be established in order to compute the component strength:

1. Specified concrete compressive strengths
2. Concrete and steel modulus of elasticity
3. Yield and tensile strength of mild reinforcing and prestressed steel and corresponding strains
4. Confinement steel strength and corresponding strains
5. Embedment length
6. Concrete cover
7. Yield and tensile strength of structural steel
8. Ductility

In addition, for “existing” components, the following conditions shall be considered:

9. Environmental effects, such as reinforcing steel corrosion, concrete spalling, cracking and chemical attack
10. Fire damage

11. Past and current loading effects, including overload, fatigue or fracture
12. Earthquake damage
13. Discontinuous components
14. Construction deficiencies

3107F.2.1.1 Material properties. Material properties of existing components, not determined from testing procedures, and of new components, shall be established using the following methodology.

The strength of structural components shall be evaluated based on the following values (Section 5.3 of [7.1] and pp. 3-73 and 3-74 of [7.2]):

Specified material strength shall be used for non-ductile components (shear controlled), all mechanical, electrical and mooring equipment (attachments to the deck) and for all non seismic load combinations:

$$f'_c = 1.0 f'_c \quad (7-1a)$$

$$f_y = 1.0 f_y \quad (7-1b)$$

$$f_p = 1.0 f_p \quad (7-1c)$$

In addition, these values (7-1a, 7-1b and 7-1c) may be used conservatively as alternatives to determine the nominal strength of ductile components (N).

Expected lower bound estimates of material strength shall be used for determination of moment-curvature relations and nominal strength of all ductile components:

$$f'_c = 1.3 f'_c \quad (7-2a)$$

$$f_y = 1.1 f_y \quad (7-2b)$$

$$f_p = 1.0 f_p \quad (7-2c)$$

Upper bound estimates of material strength shall be used for the determination of moment-curvature relations, to obtain the feasible maximum demand on capacity protected members:

$$f'_c = 1.7 f'_c \quad (7-3a)$$

$$f_y = 1.3 f_y \quad (7-3b)$$

$$f_p = 1.1 f_p \quad (7-3c)$$

where:

f'_c = Specified compressive strength of concrete

f_y = Specified yield strength of reinforcement or specified minimum yield stress steel

f_p = Specified yield strength of prestress strands

“Capacity Design” (Section 5.3 of [7.1]) ensures that the strength at protected components (such as pile caps and decks), joints and actions (such as shear), is greater than the maximum feasible demand (over strength), based on realistic upper bound estimates of plastic hinge flexural strength. An additional series of nonlinear analyses using moment curvature characteristics of pile hinges may be required.

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Alternatively, if a moment-curvature analysis is performed that takes into account the strain hardening of the steel, the demands used to evaluate the capacity protected components may be estimated by multiplying the moment-curvature values by 1.25.

Based on a historical review of the building materials used in the twentieth century, guidelines for tensile and yield properties of concrete reinforcing bars and the compressive strength of structural concrete have been established (see Tables 10-2 to 10-4 of ASCE/SEI 41 [7.3]). The values shown in these tables can be used as default properties, only if as-built information is not available and testing is not performed. The values in Tables 31F-7-1 and 31F-7-2, are adjusted according to Equations (7-1) through (7-3).

3107F.2.1.2 Knowledge factor (k). Knowledge factor, k, shall be applied on a component basis.

The following information is required, at a minimum, for a component strength assessment:

1. Original construction records, including drawings and specifications.
2. A set of “as-built” drawings and/or sketches, documenting both gravity and lateral systems (Section 3102F.1.5) and any postconstruction modification data.
3. A visual condition survey, for structural components including identification of the size, location and connections of these components.

**TABLE 31F-7-1
COMPRESSIVE STRENGTH OF STRUCTURAL CONCRETE (psi)¹**

TIME FRAME	PILING	BEAMS	SLABS
1900-1919	2,500-3,000	2,000-3,000	1,500-3,000
1920-1949	3,000-4,000	2,000-3,000	2,000-3,000
1950-1965	4,000-5,000	3,000-4,000	3,000-4,000
1966-present	5,000-6,000	3,000-5,000	3,000-5,000

1. Concrete strengths are likely to be highly variable for an older structure.

**TABLE 31F-7-2
TENSILE AND YIELD PROPERTIES OF REINFORCING BARS FOR VARIOUS ASTM SPECIFICATIONS AND PERIODS
(after Table 6-2 of [7.3])**

ASTM	STEEL TYPE	YEAR RANGE ³	GRADE	STRUCTURAL ¹	INTERMEDIATE ¹	HARD ¹			
				33	40	50	60	70	75
			Minimum Yield ² (psi)	33,000	40,000	50,000	60,000	70,000	75,000
Minimum Tensile ² (psi)	55,000	70,000	80,000	90,000	95,000	100,000			
A15	Billet	1911-1966		X	X	X			
A16	Rail ⁴	1913-1966				X			
A61	Rail ⁴	1963-1966					X		
A160	Axle	1936-1964		X	X	X			
A160	Axle	1965-1966		X	X	X	X		
A408	Billet	1957-1966		X	X	X			
A431	Billet	1959-1966							X
A432	Billet	1959-1966					X		
A615	Billet	1968-1972			X		X		X
A615	Billet	1974-1986			X		X		
A615	Billet	1987-1997			X		X		X
A616	Rail ⁴	1968-1997					X		
A617	Axle	1968-1997			X		X		
A706	Low-Alloy ⁵	1974-1997						X	
A955	Stainless	1996-1997			X		X		X

General Note: An entry “X” indicates that grade was available in those years.

1. The terms structural, intermediate and hard became obsolete in 1968.
2. Actual yield and tensile strengths may exceed minimum values.
3. Until about 1920, a variety of proprietary reinforcing steels were used. Yield strengths are likely to be in the range from 33,000 psi to 55,000 psi, but higher values are possible. Plain and twisted square bars were sometimes used between 1900 and 1949.
4. Rail bars should be marked with the letter “R.”
5. ASTM steel is marked with the letter “W.”

4. In the absence of material properties, values from limited in-situ testing or conservative estimates of material properties (Tables 31F-7-1 and 31F-7-2).
5. Assessment of component conditions, from an in-situ evaluation, including any observable deterioration.
6. Detailed geotechnical information, based on recent test data, including risk of liquefaction, lateral spreading and slope stability.

The knowledge factor, *k*, is 1.0 when comprehensive knowledge as specified above is utilized. Otherwise, the knowledge factor shall be 0.75 (see Section 5.2.6 of ASCE/SEI 41 [7.3]).

3107F.2.2 Component stiffness. Stiffness that takes into account the stress and deformation levels experienced by the component shall be used. Nonlinear load-deformation relations shall be used to represent the component load-deformation response. However, in lieu of using nonlinear methods to establish the stiffness and moment curvature relation of structural components, the equations of Table 31F-7-3 may be used to approximate the effective elastic stiffness, EI_e , for lateral analyses (see Section 3107F.8 for definition of symbols).

**TABLE 31F-7-3
EFFECTIVE ELASTIC STIFFNESS**

CONCRETE COMPONENT	EI_e/EI_g
Reinforced Pile	$0.3 + N/(f'_c A_g)$
Pile/Deck Dowel Connection ¹	$0.3 + N/(f'_c A_g)$
Prestressed Pile ¹	$0.6 < EI_e/EI_g < 0.75$
Steel Pile	1.0
Concrete w/ Steel Casing	$\frac{E_s I_s + 0.25 E_c I_c}{(E_s I_s + E_c I_c)}$
Deck	0.5

1. The pile/deck connection and prestressed pile may also be approximated as one member with an average stiffness of $0.42 EI_e/EI_g$ (Ferritto et al, 1999 [7.2])

- N* = is the axial load level.
- E_s* = Young's modulus for steel
- I_s* = Moment of inertia for steel section
- E_c* = Young's modulus for concrete
- I_c* = Moment of inertia for uncracked concrete section

3107F.2.3 Deformation capacity of flexural members. Stress-strain models for confined and unconfined concrete, mild and prestressed steel presented in Section 3107F.2.4 shall be used to perform the moment-curvature analysis.

The stress-strain characteristics of steel piles shall be based on the actual steel properties. If as-built information is not available, the stress-strain relationship may be obtained per Section 3107F.2.4.2.

For concrete in-filled steel piles, the stress-strain model for confined concrete shall be in accordance with Section 3107F.2.4.1.

Each structural component expected to undergo inelastic deformation shall be defined by its moment-curvature

relation. The displacement demand and capacity shall be calculated per Sections 3104F.2 and 3104F.3, as appropriate.

The moment-rotation relationship for concrete components shall be derived from the moment-curvature analysis per Section 3107F.2.5.4 and shall be used to determine lateral displacement limitations of the design. Connection details shall be examined per Section 3107F.2.7.

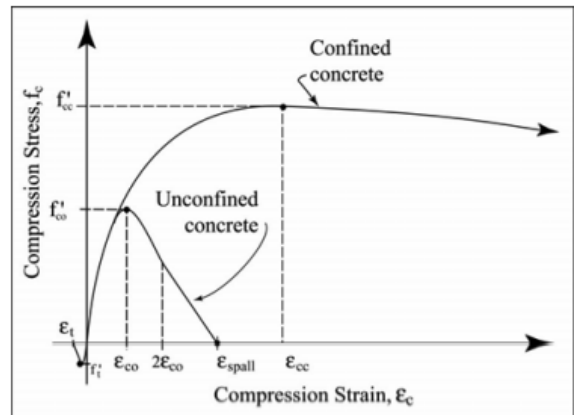
3107F.2.4 Stress-Strain models.

3107F.2.4.1 Concrete. The stress-strain model and terms for confined and unconfined concrete are shown in Figure 31F-7-1.

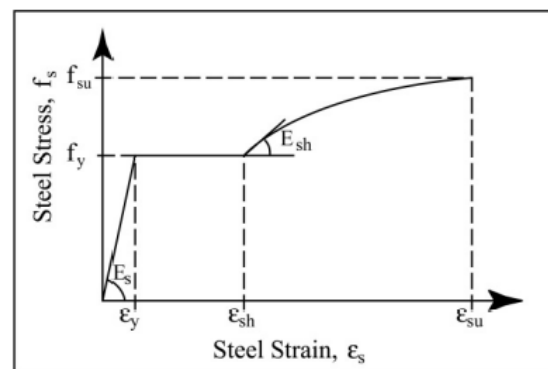
3107F.2.4.2 Reinforcement steel and structural steel. The stress-strain model and terms for reinforcing and structural steel are shown in Figure 31F-7-2.

3107F.2.4.3 Prestressed steel. The stress-strain model of Blakeley and Park [7.4] may be used for prestressed steel. The model and terms are illustrated in Figure 31F-7-3.

3107F.2.4.4 Alternative stress-strain models. Alternative stress-strain models are acceptable if adequately documented and supported by test results, subject to Division approval.



**FIGURE 31F-7-1
STRESS-STRAIN CURVES FOR CONFINED
AND UNCONFINED CONCRETE [7.1]**



**FIGURE 31F-7-2
STRESS-STRAIN CURVE FOR MILD REINFORCING
STEEL OR STRUCTURAL STEEL [7.1]**

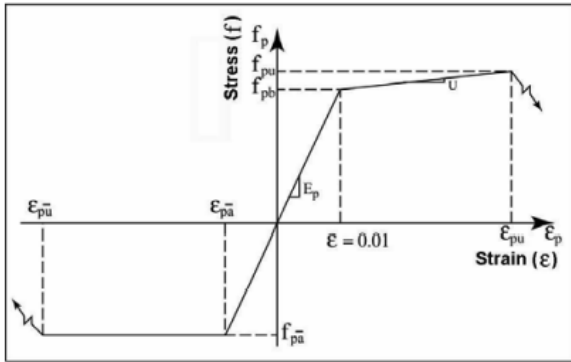


FIGURE 31F-7-3
STRESS-STRAIN CURVE FOR PRESTRESSED STEEL [7.4]

3107F.2.5 Concrete piles.

3107F.2.5.1 General. The capacity of concrete piles is based on permissible concrete and steel strains corresponding to the desired performance criteria.

Different values may apply for plastic hinges forming at in-ground and pile-top locations. These procedures are applicable to circular, octagonal, rectangular and square pile cross sections.

3107F.2.5.2 Stability. Stability considerations are important to pier-type structures. The moment-axial load interaction shall consider effects of high slenderness ratios (kl/r). An additional bending moment due to axial load eccentricity shall be incorporated unless:

$$e/h \leq 0.10 \tag{7-4}$$

where:

e = eccentricity of axial load

h = width of pile in considered direction

3107F.2.5.3 Plastic hinge length. The plastic hinge length is required to convert the moment-curvature relationship into a moment-plastic rotation relationship for the nonlinear pushover analysis.

The pile's plastic hinge length, L_p (above ground) for reinforced concrete piles, when the plastic hinge forms against a supporting member is:

$$L_p = 0.08L + 0.15 f_{ye} d_b \geq 0.3 f_{ye} d_b \tag{7-5}$$

where:

L = distance from the critical section of the plastic hinge to the point of contraflexure

d_b = diameter of the longitudinal reinforcement or dowel, whichever is used to develop the connection

f_{ye} = design yield strength of longitudinal reinforcement or dowel, whichever is used to develop the connection (ksi)

If a large reduction in moment capacity occurs due to spalling, then the plastic hinge length shall be:

$$L_p = 0.3 f_{ye} d_b \tag{7-6}$$

The plastic hinge length, L_p (above ground), for pre-stressed concrete piles may also be computed from Table 31F-7-4 for permitted pile-to-deck connections as described in ASCE/COPRI 61 [7.5].

When the plastic hinge forms in-ground, the plastic hinge length may be determined using Equation (7-7) [7.5]:

$$L_p = 2D \tag{7-7}$$

where:

D = pile diameter or least cross-sectional dimension

TABLE 31F-7-4
PLASTIC HINGE LENGTH FOR
PRESTRESSED CONCRETE PILES [7.5]

CONNECTION TYPE	L_p AT DECK (in.)
Pile Buildup	$0.15f_{ye}d_b \leq L_p \leq 0.30f_{ye}d_b$
Extended Strand	$0.20f_{pye}d_{st}$
Embedded Pile	$0.5D$
Dowelled	$0.25f_{ye}d_b$
Hollow Dowelled	$0.20f_{ye}d_b$
External Confinement	$0.30f_{ye}d_b$
Isolated Interface	$0.25f_{ye}d_b$

d_b = diameter of the prestressing strand or dowel, whichever is used to develop the connection (in.)

f_{ye} = design yield strength of prestressing strand or dowel, as appropriate (ksi)

D = pile diameter or least cross-sectional dimension

d_{st} = diameter of the prestressing strand (in.)

f_{pye} = design yield strength of prestressing strand (ksi)

3107F.2.5.4 Plastic rotation. The plastic rotation is:

$$\theta_p = L_p \phi_p = L_p (\phi_m - \phi_y) \tag{7-8}$$

where:

L_p = plastic hinge length

ϕ_p = plastic curvature

ϕ_m = maximum curvature

ϕ_y = yield curvature

The maximum curvature, ϕ_m shall be determined by the concrete or steel strain limit state at the prescribed performance level, whichever comes first.

Alternatively, the maximum curvature, ϕ_m may be calculated as:

$$\phi_m = \frac{\epsilon_{cm}}{c_u} \tag{7-9}$$

where:

ϵ_{cm} = maximum limiting compression strain for the prescribed performance level (Table 31F-7-5)

c_u = neutral-axis depth, at ultimate strength of section

**TABLE 31F-7-5
LIMITS OF STRAIN**

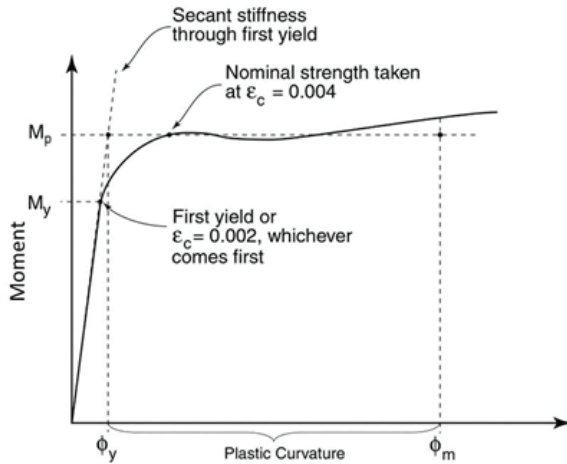
COMPONENT STRAIN	LEVEL 1	LEVEL 2
MCCS Pile/deck hinge	$\epsilon_c \leq 0.004$	$\epsilon_c \leq 0.025$
MCCS In-ground hinge	$\epsilon_c \leq 0.004$	$\epsilon_c \leq 0.008$
MRSTS Pile/deck hinge	$\epsilon_s \leq 0.01$	$\epsilon_s \leq 0.05$
MRSTS In-ground hinge	$\epsilon_s \leq 0.01$	$\epsilon_s \leq 0.025$
MPSTS In-ground hinge	$\epsilon_p \leq 0.005$ (incremental)	$\epsilon_p \leq 0.025$ (total strain)

MCCS = Maximum Concrete Compression Strain, ϵ_c
 MRSTS = Maximum Reinforcing Steel Tension Strain, ϵ_s
 MPSTS = Maximum Prestressing Steel Tension Strain, ϵ_p

Either Method A or B may be used for idealization of the moment-curvature curve.

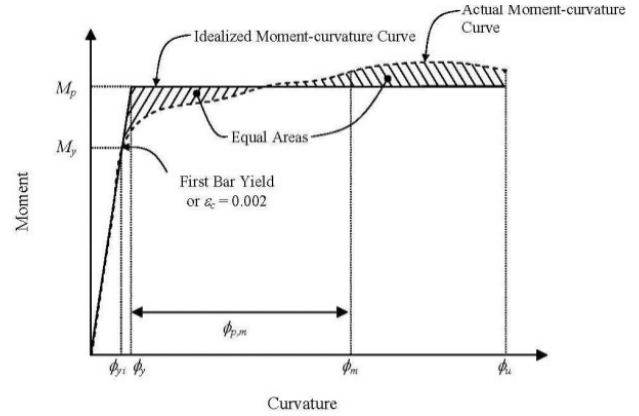
3107F.2.5.4.1 Method A. For Method A, the yield curvature, ϕ_y is the curvature at the intersection of the secant stiffness, EI_c through first yield and the nominal strength, ($\epsilon_c = 0.004$).

$$\phi_y = \frac{M_y}{EI_c} \quad (7-10)$$



**FIGURE 31F-7-4
METHOD A – MOMENT CURVATURE ANALYSIS**

3107F.2.5.4.2 Method B. For Method B, the elastic portion of the idealized moment-curvature curve is the same as in Method A (see Section 3107F.2.5.4.1). However, the idealized plastic moment capacity, M_p , and the yield curvature, ϕ_y , is obtained by balancing the areas between the actual and the idealized moment-curvature curves beyond the first yield point (see Figure 31F-7-5). Method B applies to moment-curvature curves that do not experience reduction in section moment capacity.



**FIGURE 31F-7-5
METHOD B – MOMENT CURVATURE ANALYSIS [7.6]**

3107F.2.5.5 Ultimate concrete and steel flexural strains. Strain values computed in the nonlinear push-over analysis shall be compared to the following limits.

3107F.2.5.5.1 Unconfined concrete piles: An unconfined concrete pile is defined as a pile having no confinement steel or one in which the spacing of the confinement steel exceeds 12 inches.

Ultimate concrete compressive strain:

$$\epsilon_{cu} = 0.005 \quad (7-11)$$

3107F.2.5.5.2 Confined concrete piles: Ultimate concrete compressive strain [7.1]:

$$\epsilon_{cu} = 0.004 + (1.4\rho_s f_{yh} \epsilon_{sm}) / f'_{cc} \geq 0.005 \quad (7-12)$$

$$\epsilon_{cu} \leq 0.025$$

where:

- ρ_s = effective volume ratio of confining steel
- f_{yh} = yield stress of confining steel
- ϵ_{sm} = strain at peak stress of confining reinforcement, 0.15 for grade 40, 0.10 for grade 60
- f'_{cc} = confined strength of concrete approximated by $1.5 f'_c$

3107F.2.5.6 Component acceptance/damage criteria. The maximum allowable concrete strains may not exceed the ultimate values defined in Section 3107F.2.5.5. The limiting values (Table 31F-7-5) apply for each performance level for both existing and new structures. The “Level 1 or 2” refer to the seismic performance criteria (see Section 3104F.2.1).

For all non-seismic loading combinations, concrete components shall be designed in accordance with the ACI 318 [7.7] requirements.

Note that for existing facilities, the pile/deck hinge may be controlled by the capacity of the dowel reinforcement in accordance with Section 3107F.2.7.

3107F.2.5.7 Shear design. If expected lower bound of material strength Section 3107F.2.1.1 Equations (7-2a, 7-2b, 7-2c) are used in obtaining the nominal shear strength, a new nonlinear analysis utilizing the upper bound estimate of material strength Section 3107F.2.1.1 Equations (7-3a, 7-3b, 7-3c) shall be used to obtain the plastic hinge shear demand. An alternative conservative approach is to multiply the maximum shear demand, V_{max} from the original analysis by 1.4 (Section 8.16.4.4.2 of ATC-32 [7.8]):

$$V_{design} = 1.4V_{max} \tag{7-13}$$

If moment curvature analysis that takes into account strain-hardening, an uncertainty factor of 1.25 may be used:

$$V_{design} = 1.25V_{max} \tag{7-14}$$

Shear capacity shall be based on nominal material strengths, and reduction factors according to ACI 318 [7.7].

As an alternative, the method of Kowalski and Priestley [7.9] may be used. Their method is based on a three-parameter model with separate contributions to shear strength from concrete (V_c), transverse reinforcement (V_s), and axial load (V_p) to obtain nominal shear strength (V_n):

$$V_n = V_c + V_s + V_p \tag{7-15}$$

A shear strength reduction factor of 0.85 shall be applied to the nominal strength, V_n to determine the design shear strength. Therefore:

$$V_{design} \leq 0.85V_n \tag{7-16}$$

The equations to determine V_c , V_s and V_p are:

$$V_c = k\sqrt{f'_c}A_e \tag{7-17}$$

where:

k = factor dependent on the curvature ductility $\mu_\phi = \frac{\phi}{\phi_y}$, within the plastic hinge region, from Figure 31F-7-6. For regions greater than $2D_p$ (see Equation 7-18) from the plastic hinge location, the strength can be based on $m_f = 1.0$ (see Ferritto et. al. [7.2]).

f'_c = concrete compressive strength

$A_e = 0.8A_g$ is the effective shear area

Circular spirals or hoops [7.2]:

$$V_s = \frac{\pi A_{sp} f_{yh} (D_p - c - c_o) \cot(\theta)}{s} \tag{7-18}$$

where:

A_{sp} = spiral or hoop cross section area

f_{yh} = yield strength of transverse or hoop reinforcement

D_p = pile diameter or gross depth (in case of a rectangular pile with spiral confinement)

c = depth from extreme compression fiber to neutral axis (N.A.) at flexural strength (see Figure 31F-7-7)

c_o = distance from concrete cover to center of hoop or spiral (see Figure 31F-7-7)

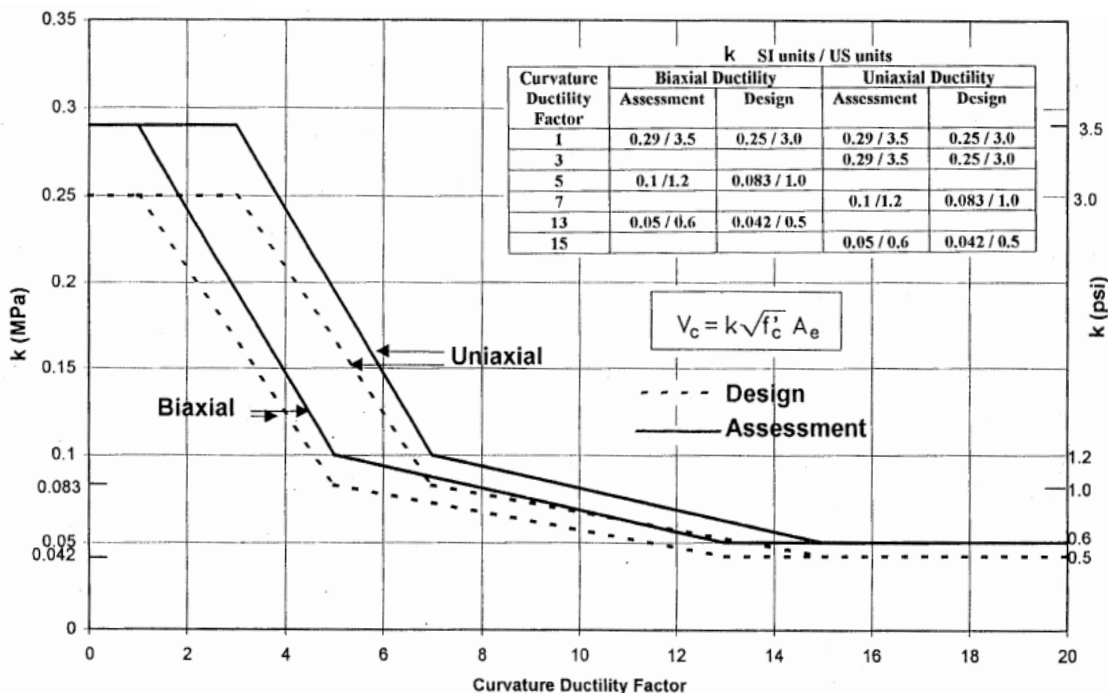
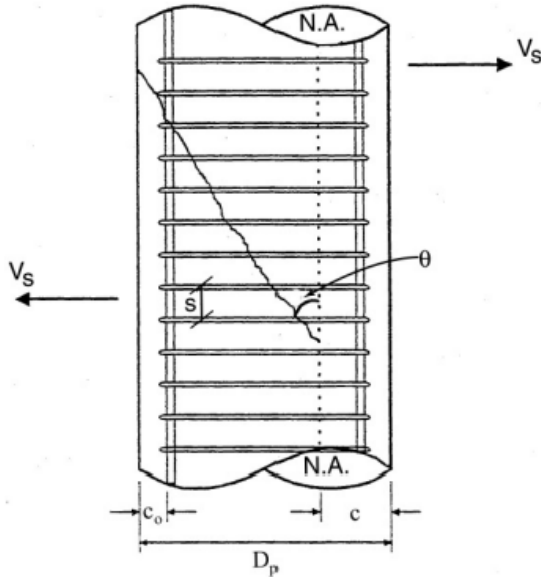


FIGURE 31F-7-6
CONCRETE SHEAR MECHANISM
(from Fig. 3-30 of [7.2])

θ = angle of critical crack to the pile axis (see Figure 31F-7-7) taken as 30° for existing structures, and 35° for new design
 s = spacing of hoops or spiral along the pile axis



**FIGURE 31F-7-7
TRANSVERSE SHEAR MECHANISM**

Rectangular hoops or spirals [7.2]:

$$V_s = \frac{A_h f_{yh} (D_p - c - c_o) \cot(\theta)}{s} \quad (7-19)$$

where:

A_h = total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack

Shear strength from axial mechanism, V_p (see Figure 31F-7-8):

$$V_p = \Phi (N_u + F_p) \tan \alpha \quad (7-20)$$

where:

N_u = external axial compression on pile including seismic load. Compression is taken as positive; tension as negative

F_p = prestress compressive force in pile

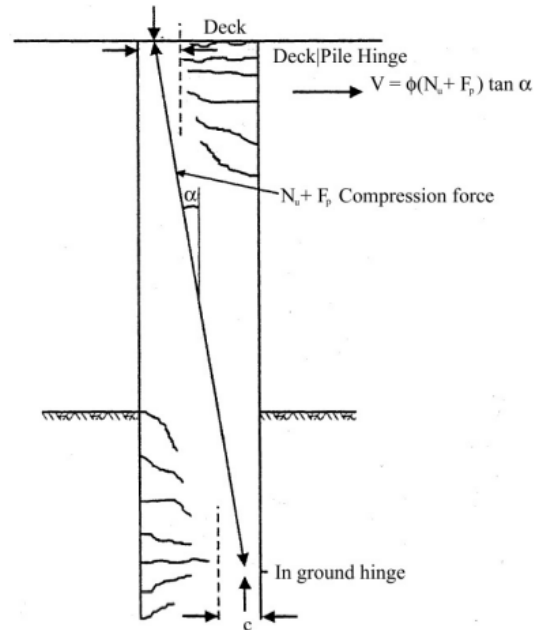
α = angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis

Φ = 1.0 for existing structures, and 0.85 for new design

3107F.2.6 Steel piles.

3107F.2.6.1 General. The capacity of steel piles is based on allowable strains corresponding to the desired performance criteria and design earthquake.

3107F.2.6.2 Stability. Section 3107F.2.5.2 applies to steel piles.



**FIGURE 31F-7-8
AXIAL FORCE SHEAR MECHANISM**

3107F.2.6.3 Plastic hinge length. The plastic hinge length, L_p (above ground), for steel piles may be computed from Table 31F-7-6 for pile-to-deck connections.

When the plastic hinge forms in-ground, the plastic hinge length may be determined using Equation (7-21) [7.5]:

$$L_p = 2D \quad (7-21)$$

where:

D = pile diameter

**TABLE 31F-7-6
PLASTIC HINGE LENGTH FOR STEEL PILES [7.5]**

CONNECTION TYPE	L_p AT DECK (in.)
Embedded Pile	0.5D
Concrete Plug	$0.30f_{ye}d_b$
Isolated Shell	$0.30f_{ye}d_b + g$
Welded Embed	0.5D

d_b = diameter of the dowel (in.)

f_{ye} = design yield strength of dowel (ksi)

D = pile diameter (in.)

g = gap distance from bottom of the deck to edge of pipe pile or external confinement (in.)

3107F.2.6.4 Ultimate flexural strain capacity. The following limiting value applies:

Strain at extreme-fiber, $\epsilon_u \leq 0.035$

3107F.2.6.5 Component acceptance/damage criteria. The maximum allowable strain may not exceed the ultimate value defined in Section 3107F.2.6.4. Table 31F-7-7 provides limiting strain values for each performance level, for both new and existing structures.

Steel components for noncompact hollow piles ($D_p/t < 0.07 \times E/f_y$) and for all nonseismic loading combinations shall be designed in accordance with AISC 325 [7.10].

**TABLE 31F-7-7
STRUCTURAL STEEL STRAIN LIMITS, ϵ_u**

COMPONENTS	LEVEL 1	LEVEL 2
Concrete Filled Pipe	0.008	0.030
Hollow Pipe	0.008	0.025

Level 1 or 2 refer to the seismic performance criteria (Section 3104F.2.1)

3107F.2.6.6 Shear design. The procedures of Section 3107F.2.5.7, which are used to establish V_{design} are applicable to steel piles.

The shear capacity shall be established from the AISC 325 [7.10]. For concrete filled pipe, Equation (7-15) may be used to determine shear capacity; however, V_{pile} must be substituted for V_s .

$$V_{pile} = (\pi/2) t f_{y,pile} (D_p - c - c_o) \cot \theta \quad (7-22)$$

where:

- t = steel pile wall thickness
- $f_{y,pile}$ = yield strength of steel pile
- c_o = distance from outside of steel pipe to center of hoop or spiral

[All other terms are as listed for Equation (7-18)].

3107F.2.7 Pile/deck connection strength.

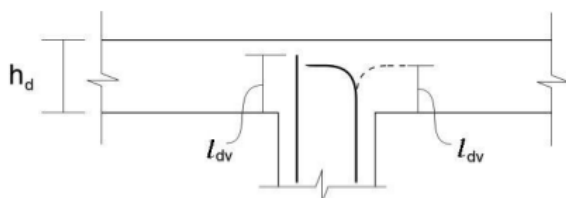
3107F.2.7.1 Joint shear capacity. The joint shear capacity shall be computed in accordance with ACI 318 [7.7]. For existing MOTs, the method [7.1, 7.2] given below may be used:

1. Determine the nominal shear stress in the joint region corresponding to the pile plastic moment capacity.

$$v_j = \frac{0.9M_o}{\sqrt{2}l_{dv}D_p^2} \quad (7-23)$$

where:

- v_j = Nominal shear stress
- M_o = Overstrength moment demand of the plastic hinge (the maximum possible moment in the pile) as determined from the procedure of Section 3107F.2.5.7.
- l_{dv} = Vertical development length, see Figure 31F-7-9
- D_p = Diameter of pile



**FIGURE 31F-7-9
DEVELOPMENT LENGTH**

2. Determine the nominal principal tension p_t stress in the joint region:

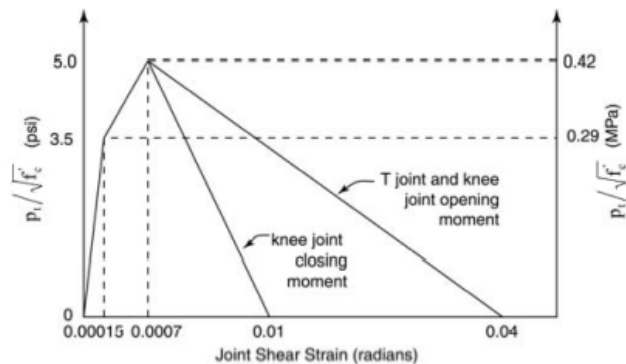
$$p_t = \frac{-f_a}{2} + \sqrt{\left(\frac{f_a}{2}\right)^2 + v_j^2} \quad (7-24)$$

where:

$$f_a = \frac{N}{(D_p + h_d)^2} \quad (7-25)$$

is the average compressive stress at the joint center caused by the pile axial compressive force N and h_d is the deck depth. Note, if the pile is subjected to axial tension under seismic load, the value of N , and f_a will be negative.

If $p_t > 5.0 \sqrt{f'_c}$, psi, joint failure will occur at a lower moment than the column plastic moment capacity M_p . In this case, the maximum moment that can be developed at the pile/deck interface will be limited by the joint principal tension stress capacity, which will continue to degrade as the joint rotation increases, as shown in Figure 31F-7-10. The moment capacity of the connection at which joint failure initiates can be established from Equations (7-27) and (7-28).



**FIGURE 31F-7-10
DEGRADATION OF EFFECTIVE
PRINCIPAL TENSION STRENGTH WITH JOINT
SHEAR STRAIN (rotation) [7.1, pg. 564]**

For $p_t = 5.0 \sqrt{f'_c}$, determine the corresponding joint shear stress, v_j :

$$v_j = \sqrt{p_t(p_t - f_a)} \quad (7-26)$$

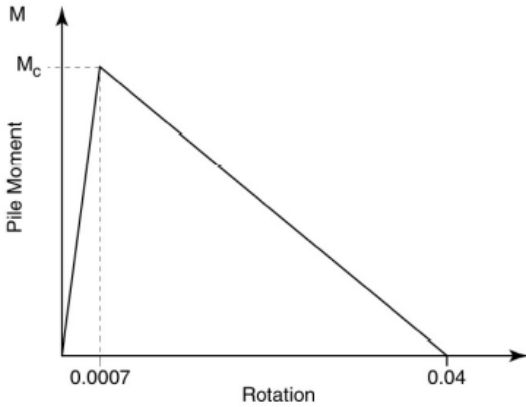
3. The moment capacity of the connection can be approximated as:

$$M_c = \left(\frac{1}{0.9}\right) \sqrt{2} v_j l_{dv} D_p^2 \leq M_o \quad (7-27)$$

This will result in a reduced strength and effective stiffness for the pile in a pushover analysis. The maximum displacement capacity of the pile should be based on a drift angle of 0.04 radians.

If no mechanisms are available to provide residual strength, the moment capacity will decrease to zero as the joint shear strain

increases to 0.04 radians, as shown in Figure 31F-7-11.



**FIGURE 31F-7-11
REDUCED PILE MOMENT CAPACITY**

If deck stirrups are present within $h_d/2$ of the face of the pile, the moment capacity, $M_{c,r}$ at the maximum plastic rotation of 0.04 radians may be increased from zero to the following (see Figure 31F-7-12):

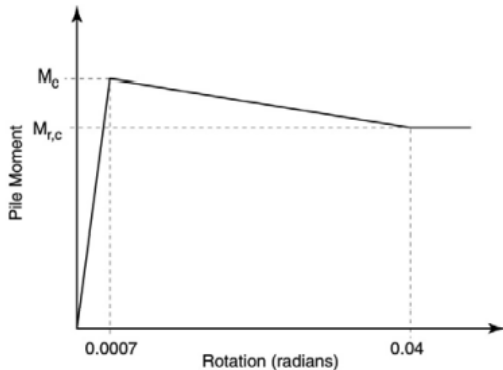
$$M_{c,r} = 2A_s f_y (h_d - d_c) + N \left(\frac{D_p}{2} - d_c \right) \quad (7-28)$$

where:

- A_s = Area of slab stirrups on one side of joint
- h_d = See Figure 31F-7-9 (deck thickness)
- d_c = Depth from edge of concrete to center of main reinforcement

In addition, the bottom deck steel ($A_{s, deckbottom}$) area within $h_d/2$ of the face of the pile shall satisfy:

$$A_{s, deckbottom} \geq 0.5 \cdot A_s \quad (7-29)$$



**FIGURE 31F-7-12
JOINT ROTATION**

4. Using the same initial stiffness as in Section 3107F.2.5.4, the moment-curvature relationship established for the pile top can now be adjusted to account for the joint degradation.

The adjusted yield curvature, ϕ'_y , can be found from:

$$\phi'_y = \frac{\phi_y M_c}{M_p} \quad (7-30)$$

where:

M_p = Idealized plastic moment capacity from Method A or B (see Figure 31F-7-4 or 31F-7-5, respectively)

The plastic curvature, ϕ_p , corresponding to a joint rotation of 0.04 can be calculated as:

$$\phi_p = \frac{0.04}{L_p} \quad (7-31)$$

where:

L_p = Plastic hinge length as determined from Equation (7-5)

The adjusted ultimate curvature, ϕ'_u , can now be calculated as:

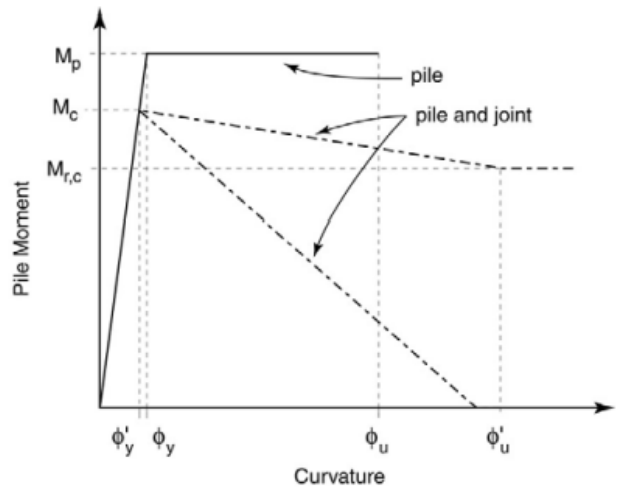
$$\phi'_u = \phi_p + \frac{\phi_y M_{c,r}}{M_p} \quad (7-32)$$

where:

M_p = Idealized plastic moment capacity from Method A or B (see Figure 31F-7-4 or 31F-7-5, respectively)

$M_{c,r} = 0$, unless deck stirrups are present as discussed above.

Examples of adjusted moment curvature relationships are shown in Figure 31F-7-13.



**FIGURE 31F-7-13
EQUIVALENT PILE CURVATURE**

3107F.2.7.2 Development length. The minimum development length, l_{dc} , is:

$$l_{dc} \geq \frac{0.025 \cdot d_b \cdot f_{ye}}{\sqrt{f'_c}} \quad (7-33)$$

where:

d_b = dowel bar diameter

f_{ye} = expected yield strength of dowel

f'_c = compressive strength of concrete

In assessing existing details, actual or estimated values for f_{ye} and f'_c rather than nominal strength should be used in accordance with Section 3107F.2.1.1.

When the development length is less than that calculated by the Equation (7-33), the moment capacity shall be calculated using a proportionately reduced yield strength, $f_{ye,r}$, for the vertical pile reinforcement:

$$f_{ye,r} = f_{ye} \cdot \frac{l_d}{l_{dc}} \quad (7-34)$$

where:

l_d = actual development length

f_{ye} = expected yield strength of dowel

3107F.2.8 Batter piles.

3107F.2.8.1 Existing ordinary batter piles. Wharves or piers with ordinary (not fused, plugged or having a seismic release mechanism) batter piles typically have a very stiff response when subjected to lateral loads in the direction of the batter. The structure often maintains most of its initial stiffness all the way to failure of the first row of batter piles. Since batter piles most likely will fail under a Level 2 seismic event, the following method may be used to evaluate the post-failure behavior of the wharf or pier:

1. Identify the failure mechanism of the batter pile-deck connection (refer to Section 3104F.4.7) for typical failure scenarios) and the corresponding lateral displacement.
2. Release the lateral load between the batter pile and the deck when the lateral failure displacement is reached.
3. Push on the structure until subsequent failure(s) have been identified.

As an example, following these steps will result in a force-displacement (pushover) curve similar to the one

shown in Figure 31F-7-14 for a wharf supported by one row of batter piles.

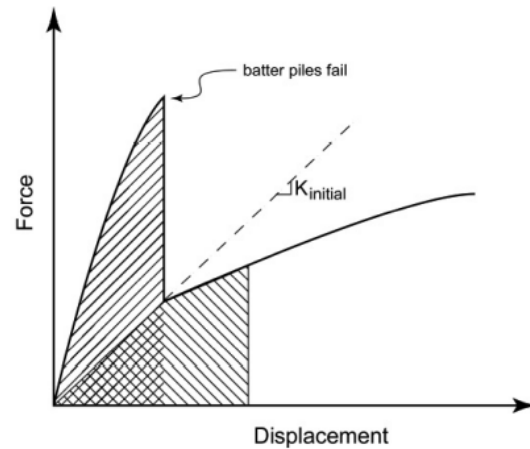


FIGURE 31F-7-14
PUSHOVER CURVE FOR ORDINARY BATTER PILES

When the row of batter piles fail in tension or shear, stored energy will be released. The structure will therefore experience a lateral displacement demand following the nonductile pile failures. If the structure can respond to this displacement demand without exceeding other structural limitations, it may be assumed that the structure is stable and will start to respond to further shaking with a much longer period and corresponding lower seismic demands. The wharf structure may therefore be able to sustain larger seismic demands following the loss of the pile capacity, because of a much softer seismic response.

The area under the pushover curve before the batter pile failures is compared to the equivalent area under the post failure pushover curve (refer to Figure 31F-7-14). If no other structural limitations are reached with the new displacement demand, it is assumed that the structure is capable of absorbing the energy. It should be noted that even though the shear failure is nonductile, it is expected that energy will be absorbed and the damping will increase during the damage of the piles. The above method is, therefore, considered conservative.

Following the shear failure of a batter pile row, the period of the structure increases such that equal displacement can be assumed when estimating the post-failure displacement demand. The new period may be estimated from the initial stiffness of the post-failure system as shown in Figure 31F-7-14. A new displacement demand can then be calculated in accordance with Section 3104F.2.

3107F.2.8.2 Nonordinary batter piles. For the case of a plugged batter pile system, an appropriate displacement force relationship considering plug friction may be used in modeling the structural system.

For fused and seismic release mechanism batter pile systems, a nonlinear modeling procedure shall be used and peer reviewed (Section 3101F.8.2).

3107F.2.9 Concrete pile caps with concrete deck. Pile caps and decks are capacity protected components. Use the procedure of Section 3107F.2.5.7 to establish the over strength demand of the plastic hinges. Component capacity shall be based on nominal material strengths, and reduction factors according to ACI 318 [7.7].

3107F.2.9.1 Component acceptance/damage criteria.

For new pile caps and deck, Level 1 seismic performance shall utilize the design methods in ACI 318 [7.7]; Level 2 seismic performance shall be limited to the following strains:

Deck/pile cap: $\epsilon_c \leq 0.005$

Reinforcing steel tension strain: $\epsilon_s \leq 0.01$

For existing pile caps and deck, the limiting strain values are defined in Table 31F-7-5.

Concrete components for all nonseismic loading combinations shall be designed in accordance with ACI 318 [7.7].

3107F.2.9.2 Shear capacity (strength). Shear capacity shall be based on nominal material strengths; reduction factors shall be in accordance with ACI 318 [7.7].

3107F.2.10 Concrete detailing. For new MOTs, the required development splice length, cover and detailing shall conform to ACI 318 [7.7], with the following exceptions:

1. For pile/deck dowels, the development length may be calculated in accordance with Section 3107F.2.7.2.
2. The minimum concrete cover for prestressed concrete piles shall be three inches, unless corrosion inhibitors are used, in which case a cover of two-and-one-half inches is acceptable.
3. The minimum concrete cover for wharf beams and slabs, and all concrete placed against soil shall be three inches, except for headed reinforcing bars (pile dowels or shear stirrups) the cover may be reduced to two-and-one-half inch cover at the top surface only. If corrosion inhibitors are used, a cover of two-and-one-half inches is acceptable.

3107F.3 Timber piles and deck components.

3107F.3.1 Component strength. The following parameters shall be established in order to assess component strength:

New and existing components:

1. Modulus of rupture
2. Modulus of elasticity
3. Type and grade of timber

Existing components only:

1. Original cross-section shape and physical dimensions
2. Location and dimension of braced frames
3. Current physical condition of members including visible deformation
4. Degradation may include environmental effects (e.g., decay, splitting, fire damage, biological and chemical attack) including its effect on the moment of inertia, I
5. Loading and displacement effects (e.g., overload, damage from earthquakes, crushing and twisting)

Section 3104F.2.2 discusses existing material properties. At a minimum, the type and grade of wood shall be established. The adjusted reference design values per Section 6 of ANSI/AWC NDS [7.11] may be used.

For deck components, the adjusted design stresses shall be limited to the values of ANSI/AWC NDS [7.11]. Piling deformation limits shall be calculated based on the strain limits in accordance with Section 3107F.3.3.3.

The values shown in the ANSI/AWC NDS [7.11] are not developed specifically for MOTs and can be used as default properties only if as-built information is not available, the member is not damaged and testing is not performed. To account for the inherent uncertainty in establishing component capacities for existing structures with limited knowledge about the actual material properties, a reduction (knowledge) factor of $k = 0.75$ shall be included in the component strength and deformation capacity analyses in accordance with Section 3107F.2.1.2.

The modulus of elasticity shall be based on tests or Section 4 for deck components and Section 6 for timber piles of ANSI/AWC NDS [7.11].

3107F.3.2 Deformation capacity of flexural members. The displacement demand and capacity of existing timber structures may be established per Section 3104F.2.

The soil spring requirements for the lateral pile analysis shall be in accordance with Section 3106F.

A linear curvature distribution may be assumed along the full length of a timber pile.

The displacement capacity of a timber pile can then be established per Section 3107F.3.3.2.

3107F.3.3 Timber piles.

3107F.3.3.1 Stability. Section 3107F.2.5.2 shall apply to timber piles.

3107F.3.3.2 Displacement capacity. A distinction shall be made between a pier-type pile, with a long unsupported length and a wharf-landside-type pile with a short unsupported length between the deck and soil. The effective length, L , is the distance between the pinned deck/pile connection and in-ground fixity as shown in Figure 31F-7-15. For pier-type (long unsupported length) vertical piles, three simplified proce-

dures to determine fixity or displacement capacity are described in UFC 4-151-10 [7.12], UFC 3-220-01 [7.13] and Chai [7.14].

In order to determine fixity in soft soils, another alternative is to use Table 31F-7-8.

The displacement capacity, Δ , for a pile pinned at the top, with effective length, L , (see Table 31F-7-8 and UFC 4-151-10 [7.12]), and moment, M , is:

$$\Delta = \frac{ML^2}{3EI} \quad (7-35)$$

where:

E = Modulus of elasticity

I = Moment of inertia

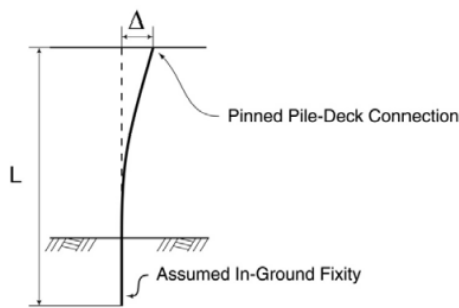


FIGURE 31F-7-15 ASSUMED IN-GROUND FIXITY

TABLE 31F-7-8 DISTANCE BELOW GROUND TO POINT OF FIXITY

PILE EI_p	SOFT CLAYS	LOOSE GRANULAR & MEDIUM CLAYS
$< 10^{10} \text{ lb in}^2$	10 feet	8 feet
$> 10^{10} \text{ lb in}^2$	12 feet	10 feet

Assuming linear curvature distribution along the pile, the allowable curvature, ϕ_a , can be established from:

$$\phi_a = \frac{\epsilon_a}{c} \quad (7-36)$$

where:

ϵ_a = allowable strain limit according to Section 3107F.3.3.3

c = distance to neutral axis which can be taken as $D_p/2$, where D_p is the diameter of the pile

The curvature is defined as:

$$\phi = \frac{M}{EI} \quad (7-37)$$

The maximum allowable moment therefore becomes:

$$M = \frac{2\epsilon_a EI}{D_p} \quad (7-38)$$

The displacement capacity is therefore given by:

$$\Delta = \frac{2\epsilon_a L^2}{3D_p} \quad (7-39)$$

3107F.3.3.3 Component acceptance/damage criteria. The following limiting strain values apply for each seismic performance level for existing structures:

TABLE 31F-7-9 LIMITING STRAIN VALUES FOR TIMBER

EARTHQUAKE LEVEL	MAX. TIMBER STRAIN
Level 1	0.002
Level 2	0.004

For new and alternatively, for existing structures ANSI/AWC NDS [7.11] may be used.

Timber components for all non-seismic loading combinations shall be designed in accordance with ANSI/AWC NDS [7.11].

3107F.3.3.4 Shear design. To account for material strength uncertainties, the maximum shear demand, V_{max} , established from the single pile lateral analysis shall be multiplied by 1.2:

$$V_{demand} = 1.2V_{max} \quad (7-40)$$

The factored maximum shear stress demand τ_{max} in a circular pile can then be determined:

$$\tau_{max} = \frac{10V_{demand}}{9\pi \cdot r^2} \quad (7-41)$$

where:

r = radius of pile

For the seismic load combinations, the maximum allowable shear stress, $\tau_{capacity}$, is the design shear strength, τ_{design} , from the ANSI/AWC NDS [7.11] multiplied by a factor of 2.8.

$$\tau_{capacity} = 2.8\tau_{design} \quad (7-42)$$

The shear capacity must be greater than the maximum demand.

3107F.4 Retaining structures. Retaining structures constructed of steel or concrete shall conform to AISC 325 [7.10] or ACI 318 [7.7], respectively. For the determination of static and seismic loads on the sheet pile and sheet pile behavior, the following references are acceptable: Ebeling and Morrison [7.15], Strom and Ebeling [7.16], and PIANC TC-7 (Technical Commentary - 7) [7.17]. The applied loads and analysis methodology shall be determined by a California registered geotechnical engineer, and may be subject to peer review.

3107F.5 Nonbuilding structures and building structures. The analysis of nonbuilding structures and building structures shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The component strength in nonbuilding structures and building structures shall be established in accordance with AISC [7.10], ACI-318 [7.7] and ANSI/AWC NDS [7.11], accounting for existing condition with knowledge factors applied, as appropriate. For strength evaluation of supports and attachments, see Section 3107F.7.

3107F.6 Mooring and berthing components. Mooring components include bitts, bollards, cleats, pelican hooks, capstans, mooring dolphins and quick release hooks. The maximum mooring line forces (demand) shall be established per Section 3105F. Applicable safety factors to be applied to the demand are provided in Section 3105F.8. Multiple lines may be attached to the mooring component at varying horizontal and vertical angles. Mooring components shall therefore be checked for all mooring analysis load cases.

Berthing components include fender piles and fenders, which may be camels, fender panels or wales. The maximum berthing forces (demand) on breasting dolphins and fender piles shall be established according to Section 3105F.

Mooring and berthing components analyses shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The component strength shall account for existing condition with knowledge factors applied, as appropriate. For strength evaluation of supports and attachments, see Section 3107F.7.

Mooring and berthing component capacities may be governed by the strength of the deck, structure and/or soil. Therefore, a check of the deck, structural and geotechnical capacities to withstand component loads shall be performed, as appropriate.

3107F.7 Supports and attachments (or anchorage). The evaluation of supports and attachments for nonstructural components, nonbuilding structures and building structures shall be based on the load combinations defined in Section 3103F.8 with seismic assessment per Section 3104F.5. The strength of supports and attachments for nonstructural components, nonbuilding structures and building structures shall be assessed in accordance with AISC [7.10], ACI-318 [7.7] and ANSI/AWC NDS [7.11], accounting for existing condition with knowledge factors applied, as appropriate. The following parameters shall be established to calculate strength:

New and existing components:

1. Yield and tensile strength of structural steel
2. Structural steel modulus of elasticity
3. Yield and tensile strength of bolts
4. Concrete infill compressive strength
5. Concrete infill modulus of elasticity

Additional parameters for existing components:

1. Condition of steel including corrosion
2. Effective cross-sectional areas
3. Condition of embedment material such as concrete slab or timber deck

The analysis and design shall include the load transfer to supporting deck/pile structures or foundation elements. A check of the deck capacity to withstand support and attachment loads shall be performed for all nonstructural components, nonbuilding structures and building structures.

3107F.8 Symbols.

A_e = Effective shear area

A_g = Uncracked, gross section area

A_h = Total area of transverse reinforcement, parallel to direction of applied shear cut by an inclined shear crack

A_s = Area of slab stirrups on one side of joint

$A_{s, \text{deckbottom}}$ = Area of bottom deck steel

A_{sp} = Spiral or hoop cross section area

c = Depth from extreme compression fiber to neutral axis at flexural strength

c_0 = Distance from outside of steel pipe to center of hoop or spiral, or distance from concrete cover to center of hoop or spiral

c_u = Neutral axis depth at ultimate strength of section

d_b = Diameter of the longitudinal reinforcement, prestressing strand or dowel, as appropriate

d_c = Depth from edge of concrete to center of main reinforcement

d_{st} = Diameter of the prestressing strand (in)

D = Pile diameter or least cross-sectional dimension

D_p = Pile diameter or gross depth (in case of a rectangular pile with spiral confinement)

e = Eccentricity of axial load

ϵ_a = Allowable strain limit

ϵ_c = Concrete compressive strain

ϵ_{cm} = Maximum extreme fiber compression strain

ϵ_{cu} = Ultimate concrete compressive strain

ϵ_p = Prestressing steel tension strain

ϵ_s = Reinforcing steel tension strain

ϵ_{sm} = Strain at peak stress of confining reinforcement

ϵ_u = Ultimate steel strain

E = Modulus of elasticity

E_c = Modulus of elasticity for concrete

E_s = Modulus of elasticity for steel

f'_c = Concrete compression strength

f'_{cc} = Confined strength of concrete

F_p = Prestress compression force in pile

f_p = Yield strength of prestressing strand

f_{pye} = Design yield strength of prestressing strand (ksi)

f_y = Yield strength of steel

f_{ye} = Design yield strength of longitudinal reinforcement, prestressing strand or dowel, as appropriate (ksi)

f_{yh} = Yield stress of confining steel

f_{yh} = Yield strength of transverse or hoop reinforcement

$f_{y,pile}$ = Yield strength of steel pile

$f_{ye,r}$ = Reduced dowel yield strength

g = Gap distance from bottom of the deck to edge of pipe pile or external confinement (in.)

h = Width of pile in considered direction

h_d = Deck depth
 I = Moment of inertia
 I_c = Moment of inertia of uncracked section
 I_e = Effective moment of inertia
 I_g = Gross moment of inertia
 I_s = Moment of inertia for steel section
 k = Factor dependent on the curvature ductility $\mu_\phi = \phi/\phi_y$, within the plastic hinge region
 k = Knowledge factor
 L = Distance from the critical section of the plastic hinge to the point of contraflexure (Section 3107F.2.5.3), or effective length (Section 3107F.3.3.2)
 L_p = Plastic hinge length
 l_{dc} = Minimum development length
 l_d = Actual development length
 l_{dv} = Vertical development length
 M = Maximum allowable moment
 M_c = Moment capacity of the connection
 $M_{c,r}$ = Moment capacity at maximum plastic rotation
 M_o = Overstrength moment demand of the plastic hinge (Section 3107F.2.7)
 M_p = Idealized plastic moment capacity from Method A or B (Section 3107F.2.5)
 M_y = Moment at first yield
 N = Pile axial compressive force
 N_u = External axial compression on pile including seismic load
 ρ_s = Effective volume ratio of confining steel
 p_t = Nominal principal tension
 r = Radius of circular pile
 s = Spacing of hoops or spiral along the pile axis
 t = Steel pile wall thickness
 Δ = Displacement capacity
 θ = Angle of critical crack to the pile axis
 θ_p = Plastic rotation
 α = Angle between line joining centers of flexural compression in the deck/pile and in-ground hinges, and the pile axis
 ϕ_a = Allowable curvature
 ϕ_m = Maximum curvature
 $\phi_p, \phi_{p,m}$ = Plastic curvature
 ϕ_u = Ultimate curvature
 ϕ'_u = Adjusted ultimate curvature
 ϕ_y = Yield curvature
 ϕ'_y = Adjusted yield curvature

$\tau_{capacity}$ = Maximum allowable shear stress
 τ_{design} = Design shear strength
 τ_{max} = Maximum shear stress
 V_c = Concrete shear strength
 v_j = Nominal joint shear stress
 V_{design} = Design shear strength
 V_{max} = Maximum shear demand
 V_n = Nominal shear strength
 V_p = Contribution to shear strength from axial loads
 V_s = Transverse reinforcement shear strength
 V_{pile} = Shear strength of steel pile

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Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 8

**SECTION 3108F
FIRE PREVENTION, DETECTION
AND SUPPRESSION**

3108F.1 General. This section provides minimum standards for fire prevention, detection and suppression at MOTs. See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

3108F.2 Hazard assessment and risk analysis.

3108F.2.1 Fire hazard assessment and risk analysis (N/E). A fire hazard assessment and risk analysis shall be performed, considering the loss of commercial power, earthquake and other relevant events.

3108F.2.2 Fire Protection Assessment (N/E). A site-specific Fire Protection Assessment shall be prepared by a registered engineer or a competent fire protection professional. The assessment shall consider the hazards and risks identified per Section 3108F.2.1 and shall include, but not be limited to, the elements of pre-fire planning as discussed in Section 9 of API RP 2001 [8.1] and Chapter 19 of ISGOTT [8.2]. MOT operational and training requirements, as related to fire protection, shall be considered (see 2 CCR 2385 [8.3]). The Fire Protection Assessment shall include goals, resources, organization, strategy and tactics, including the following:

1. MOT characteristics (e.g., tanker/manifold, product pipelines, etc.)
2. Product types and fire scenarios, including products not regulated by the Division that may impact development of fire scenarios
3. Possible collateral fire damage to adjacent facilities
4. Firefighting capabilities, including availability of water (flow rates and pressure), foam type and associated shelf life, proportioning equipment and vehicular access
5. The selection of appropriate extinguishing agents
6. Calculation of water and foam capacities, as applicable, consistent with area coverage requirements
7. Coordination of emergency efforts
8. Emergency escape routes
9. Requirements for fire drills, training of personnel, and the use of equipment
10. Life safety
11. Rescue for terminal and vessel personnel
12. Cooling water for pipelines and valves exposed to the heat
13. Contingency planning when supplemental fire support is not available. Mutual aid agreements can apply to water and land based support.
14. Consideration of adverse conditions, such as electrical power failure, steam failure, fire pump failure,

ure, an earthquake or other damage to the fire water system.

The audit team shall review and field verify the firefighting equipment locations and condition to ensure operability.

3108F.2.3 Cargo liquid volatility ratings and fire hazard classifications (N/E). The cargo liquid volatility ratings are defined in Table 31F-8-1, as either High (H_C) or Low (L_C), depending on the flash point.

Fire hazard classifications (Low, Medium or High) are defined in Table 31F-8-2, and are based on the cargo liquid volatility ratings and the sum of all stored and flowing volumes (V_T), prior to the emergency shutdown (ESD) system stopping the flow of oil.

The stored (V_S) volume is the sum of the H_C and L_C volumes (V_{SH} and V_{SL} , respectively).

During a leak, a quantity of oil is assumed to spill at the maximum cargo flow rate until the ESD is fully effective. The ESD valve closure time shall conform with 2 CCR 2380 [8.3]. The flowing volume (V_F), calculated in Equation (1-1), is the sum of the H_C and L_C liquid volumes (V_{FH} and V_{FL} , respectively).

3108F.3 Fire prevention.

3108F.3.1 Ignition source control.

3108F.3.1.1 Protection from ignition by static electricity, lightning or stray currents shall be in accordance with API RP 2003 [8.4](N/E).

3108F.3.1.2 Requirements to prevent electrical arcing shall be in conformity with 2 CCR 2341 [8.3] (N/E).

3108F.3.1.3 Multi-berth terminal piers shall be constructed so as to provide a minimum of 100 ft between adjacent manifolds (N).

3108F.3.2 Emergency shutdown (ESD) systems. Emergency shutdown systems are essential to oil spill and fire prevention. These systems may include, but are not limited to, ESD valves, shore isolation valves (SIVs), automatic pump shutdown, controls, actuators and alarms. The ESD systems shall conform to 2 CCR 2380 [8.3] and 33 CFR 154.550 [8.5], and provide:

1. Remote actuation stations strategically located, so that ESD valve(s) may be shut within required times (N).
2. Multiple actuation stations installed at strategic locations, so that one such station is located more than 100 ft from areas classified as Class I, Group D, Division 1 or 2 per the California Electrical Code [8.6]. Actuation stations shall be wired in parallel to achieve redundancy and arranged so that fire damage to one station will not disable the ESD system (N).
3. Communications or control circuits to synchronize simultaneous closure of the shore isolation valves (SIVs) with the shutdown of loading pumps (N).

**TABLE 31F-8-1
CARGO LIQUID VOLATILITY RATINGS**

VOLATILITY RATING	CRITERION	REFERENCE	EXAMPLES
Low (L_C)	Flash Point ¹ $\geq 140^\circ\text{F}$	ISGOTT (Chapter 1), [8.2]—Nonvolatile	#6 Heavy Fuel Oil, residuals, bunker
High (H_C)	Flash Point ¹ $< 140^\circ\text{F}$	ISGOTT (Chapter 1), [8.2]—Volatile	Gasoline, JP4, crude oils

1. Flash Point is defined per ISGOTT [8.2].

**TABLE 31F-8-2
FIRE HAZARD CLASSIFICATIONS**

FIRE HAZARD CLASSIFICATION	STORED VOLUME (bbls)			FLOWING VOLUME (bbls)		CRITERIA (bbls)*
	Stripped	V_{SL}	V_{SH}	V_{FL}	V_{FH}	
LOW	y	n	n	y	y	$V_{FL} \geq V_{FH}$ and $V_T \leq 1200$
LOW	n	y	n	y	n	$V_{SL} + V_{FL} \leq 1200$
MEDIUM	n	n	y	n	y	$V_{SH} + V_{FH} \leq 1200$
MEDIUM	y	n	n	y	y	$V_{FH} > V_{FL}$ and $V_T \leq 1200$
HIGH	y	n	n	y	y	$V_T > 1200$
HIGH	n	y	y	y	y	$V_T > 1200$
HIGH	n	y	n	y	n	$V_{SL} + V_{FL} > 1200$
HIGH	n	n	y	n	y	$V_{SH} + V_{FH} > 1200$

y = yes

n = no

Stripped = product purged from pipeline following product transfer event.

V_{SL} = stored volume of low volatility product

V_{SH} = stored volume of high volatility product

V_{FL} = volume of low volatility product flowing through transfer line during ESD.

V_{FH} = volume of high volatility product flowing through transfer line during ESD.

$V_T = V_{SL} + V_{SH} + V_{FL} + V_{FH}$ = Total Volume (stored and flowing)

* Quantities are based on maximum flow rate, including simultaneous transfers.

4. A manual reset to restore the ESD system to an operational state after each initiation (N).
 5. An alarm to indicate failure of the primary power source (N).
 6. A secondary (emergency) power source (N).
 7. Periodic testing of the system (N/E).
 8. Fire proofing of motors and control-cables that are installed in areas classified as Class I, Group D, Division 1 or 2 per the California Electrical Code [8.6]. Fire proofing shall, at a minimum, comply with the recommendations in Section 6 of API RP 2218 [8.7] (N).
- 3108F.3.2.1 Emergency shutdown (ESD) valves.** ESD valves shall conform to the requirements in Section 3109F.5, as applicable, and the following:
1. Be located near the dock manifold connection or loading arm (N/E).
 2. Have “Local” and “Remote” actuation capabilities (N).

3108F.3.2.2 Shore isolation valves (SIVs). Shore isolation valve(s) shall conform to the requirements in Section 3109F.5, as applicable, and the following:

1. Be located onshore for each cargo pipeline. All SIVs shall be clustered together, for easy access (N).

2. Be clearly identified together with associated pipeline (N/E).
3. Have adequate lighting (N/E).
4. Be provided with communications or control circuits to synchronize simultaneous closure of the ESD system with the shutdown of loading pumps (N).
5. Have a manual reset to restore the SIV system to an operational state after each shut down event (N).
6. Be provided with thermal expansion relief to accommodate expansion of the liquid when closed. Thermal relief piping shall be properly sized and routed around the SIV, into the downstream segment of the pipeline or into other containment (N/E).
7. SIVs installed in pipelines carrying H_C liquids, or at a MOT with a spill classification “Medium” or “High” (see Table 31F-1-1), shall be equipped with “Local” and “Remote” actuation capabilities. Local control SIVs may be motorized and/or operated manually (N).

3108F.4 Automated fire detection system. An MOT shall have a permanently installed automated fire detection or sensing system (N).

Fire detection systems shall be tested and maintained per the manufacturer or the local enforcing agency requirements.

MARINE OIL TERMINALS

Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

3108F.5 Fire alarms. Automatic and manual fire alarms shall be provided at strategic locations. The fire alarm system shall be arranged to provide a visual and audible alarm that can be readily discerned by all personnel at the MOT and vessel personnel involved in the transfer operations. Additionally, visual and audible alarms shall be displayed at the MOT’s control center (N/E).

If the fire alarm system is integrated with the ESD system, the operation shall be coordinated with the closure of SIVs, block valves and pumps to avoid adverse hydraulic conditions (N/E).

Fire alarms shall be tested and maintained in accordance with NFPA 72 [8.8] or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

3108F.6 Fire suppression. Table 31F-8-3 gives the minimum provisions for fire-water flow rates and fire extinguishers. The table includes consideration of the fire hazard classification (Low, Medium or High), the cargo liquid volatility rating (Low or High) and the vessel or barge size. The minimum provisions may have to be augmented for multi-berth terminals or those conducting simultaneous transfers, in accordance with the risks identified in the Fire Protection Assessment. For fire water and foam piping and fittings, see Section 3109F.7.

3108F.6.1 Coverage (N/E). The fire suppression system shall provide coverage for:

1. Marine structures including the pier/wharf and approach trestle

2. Terminal cargo manifold
3. Cargo transfer system including loading arms, hoses and hose racks
4. Vessel manifold
5. Sumps
6. Pipelines
7. Control stations

3108F.6.2 Fire hydrants. Hydrants shall be located not greater than 150 ft apart, along the wharf and not more than 300 ft apart on the approach trestle [8.2] (N).

Additional hose connections shall be provided at the base of fixed monitors and upstream of the water and foam isolation valves. Connections shall be accessible to fire trucks or mutual aid equipment as identified in the Fire Protection Assessment (N/E).

Hydrants and hoses shall be capable of applying two independent water streams covering the cargo manifold, transfer system, sumps and vessel manifold (N/E).

3108F.6.3 Fire water. The source of fire water shall be reliable and provide sufficient rated capacity as determined in the Fire Protection Assessment. Water-based fire protection systems shall be tested and maintained per California NFPA 25 [8.9], as adopted and amended by the State Fire Marshal, or the local enforcing agency requirements. Specifications shall be retained. The latest testing and maintenance records shall be readily accessible to the Division (N/E).

1. All wet systems shall be kept pressurized (jockey pump or other means) (N/E).
2. Wet system headers shall be equipped with a low-pressure alarm wired to the control room (N).

**TABLE 31F-8-3
MINIMUM FIRE SUPPRESSION PROVISIONS (N/E)**

FIRE HAZARD CLASSIFICATION (From Table 31F-8-2)	VESSEL AND CARGO LIQUID VOLATILITY RATING (From Table 31F-8-1)	MINIMUM PROVISIONS
LOW	Barge with L_C (including drums)	500 gpm of water 2 x 20 lb portable dry chemical extinguishers or the equivalent. 2 x 110 lb wheeled dry chemical extinguishers or the equivalent.
	Barge with H_C (including drums) Tankers < 50 KDWT, handling L_C or H_C	1,500 gpm of water 2 x 20 lb portable dry chemical extinguishers or the equivalent. 2 x 165 lb wheeled dry chemical extinguishers or the equivalent
MEDIUM	Tankers < 50 KDWT handling L_C	1,500 gpm of water 2 x 20 lb portable dry chemical extinguishers or the equivalent. 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
	Tankers < 50 KDWT, handling H_C	2,000 gpm of water 4 x 20 lb portable dry chemical extinguishers or the equivalent. 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
HIGH	Tankers < 50 KDWT, handling L_C or H_C	3,000 gpm of water 4 x 20 lb portable dry chemical extinguishers or the equivalent. 2 x 165 lb wheeled dry chemical extinguishers or the equivalent.
LOW, MEDIUM, HIGH	Tankers > 50 KDWT, handling L_C or H_C	3,000 gpm of water 6 x 20 lb portable dry chemical extinguishers or the equivalent. 4 x 165 lb wheeled dry chemical extinguishers or the equivalent.

Notes: L_C and H_C are defined in Table 31F-8-1. KDWT = Dead Weight Tons (Thousands)

3. Fire pumps shall be installed at a distance of at least 100 ft from the nearest cargo manifold area (N).
4. Hose connections for fireboats or tugboats shall be provided on the MOT fire water line, and at least one connection shall be an international shore fire connection at each berth [8.2]. Connections shall be installed at a safe access distance from the sumps, manifolds and loading arms (N/E).

3108F.6.4 Foam supply (N/E). Product flammability, foam type, water flow rates and application duration shall be considered in foam supply calculations.

Fixed foam proportioning equipment shall be located at a distance of at least 100 ft from the sumps, manifolds and loading arms, except where hydraulic limits of the foam delivery system require closer proximity.

MOTs shall have a program to ensure that foam is replaced according to the manufacturer's recommendations.

3108F.6.5 Fire monitor systems. Fire monitors shall be located to provide coverage of MOT cargo manifolds, loading arms, hoses and vessel manifold areas. This coverage shall provide at least two independent streams of water/foam. Monitors shall be located to provide an unobstructed path between the monitor and the target area (N/E).

If the vessel manifold is more than 30 ft above the wharf deck, the following factors shall be considered, in order to determine if monitors located on elevated masts or towers are required (N/E):

1. Maximum tanker freeboard
2. Tidal variations
3. Pier/wharf/loading platform elevation
4. Winds
5. Fire water line pressure

Sprinklers and/or remotely controlled water/foam monitors shall be installed to protect personnel, escape routes, shelter locations and the fire water system (N).

Isolation valves shall be installed in the fire water and the foam lines in order to segregate damaged sections without disabling the entire system. Readily accessible isolation valves shall be installed 100–150 ft from the manifold and the loading arm/hose area (N).

3108F.6.6 Supplemental fire suppression systems (E). A supplemental system is an external waterborne or land-based source providing suppressant and equipment. Supplemental systems may not provide more than one-quarter of the total water requirements specified in the Fire Protection Assessment.

Additionally, supplementary systems shall not be considered in a Fire Protection Assessment, unless available within 20 minutes following the initiation of a fire alarm. Mutual aid may be considered as part of the supplemental system.

3108F.7 Fire systems seismic assessment (N/E). Fire detection and protection systems, and emergency shutdown systems shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.

For firewater piping and pipeline systems, see Section 3109F.7.

3108F.8 References.

- [8.1] American Petroleum Institute (API), 2012, *API Recommended Practice 2001 (API RP 2001)*, "Fire Protection in Refineries," 9th ed., Washington, D.C.
- [8.2] International Chamber of Shipping (ICS), *Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH)*, 2006, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.
- [8.3] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)
- [8.4] American Petroleum Institute (API), 2008, *API Recommended Practice 2003 (API RP 2003)*, "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," 7th ed., Washington, D.C.
- [8.5] Code of Federal Regulations (CFR), Title 33, Section 154.550 – Emergency Shutdown (33 CFR 154.550)
- [8.6] California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code (Article 500),
- [8.7] American Petroleum Institute (API), 2013, *API Recommended Practice 2218 (API RP 2218)*, "Fireproofing Practices in Petroleum and Petrochemical Processing Plants," 3rd ed., Washington, D.C.
- [8.8] National Fire Protection Association (NFPA), NFPA 72, "National Fire Alarm and Signaling Code," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.
- [8.9] National Fire Protection Association (NFPA), California NFPA 25, "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems," California ed., Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 9

SECTION 3109F
PIPING AND PIPELINES

3109F.1 General. This section provides minimum engineering standards for piping, pipelines, valves, supports and related appurtenances at MOTs. This section applies to piping and pipelines used for transferring:

1. Oil (see Section 3101F.1) to or from tank vessels or barges
2. Oil within the MOT
3. Vapors, including Volatile Organic Compounds (VOCs)
4. Inerting or enriching gases to vapor control systems

Additionally, it also applies to piping or pipelines providing services, which includes stripping, sampling, venting, vapor control and fire water.

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

3109F.2 Oil piping and pipeline systems. All pressure piping and pipelines for oil service shall conform to the provisions of API Standard 2610 [9.1], ASME B31.3 [9.2] or B31.4 [9.3] as appropriate, including the following:

1. All piping/pipelines shall be documented on current P&IDs (N/E).
2. Piping and pipeline systems shall be installed above deck (N).
3. The systems shall be arranged in a way not to obstruct access to and removal of other piping components and equipment (N).
4. Flexibility shall be achieved through adequate expansion loops or joints (N/E).
5. A guide or lateral restraint shall be provided just past the elbow where a pipe changes direction in order to minimize excessive axial stress (N).
6. Piping shall be routed to allow for movement due to thermal expansion and seismic displacement, without exceeding the allowable stresses in the supports, and anchor connections (see Section 3109F.3) (N/E).
7. Plastic piping shall not be used unless designated for oil service (N/E).
8. If a flanged connection exists within 20 pipe diameters from the end of any replaced section, the pipe shall be replaced up to and including the flange.
9. Pipelines shall be seamless, electric-resistance-welded or electric-fusion-welded (N).
10. Piping greater than 2 inches in diameter shall be butt-welded. Piping 2 inches and smaller shall be socket welded or threaded.

11. Pipeline connections directly over the water shall be welded (N). Flanged connections not over water shall have secondary containment (N).

12. Pipelines that do not have a valid and certified Static Liquid Pressure Test (SLPT) [9.4] shall be marked “OUT OF SERVICE.” Out-of-service piping and pipelines shall be purged, gas-freed and physically isolated from sources of oil.

13. If a pipeline is “out-of-service” for 3 or more years, it will require a valid and certified Static Liquid Pressure Test (SLPT) and API 570 inspection [9.4] prior to Division approval for re-use (E).

14. New piping and pipeline systems require a valid and certified Static Liquid Pressure Test (SLPT) [9.4] and Division approval, prior to operation.

3109F.3 Pipeline stress analysis (N/E). Pipeline stress analysis shall be performed for:

1. New piping and pipelines
2. Significant rerouting/relocation of existing piping
3. Any replacement of “not in-kind” piping
4. Any significant rearrangement or replacement of “not in-kind” anchors and/or supports
5. Significant seismic displacements calculated from the structural and/or geotechnical assessments

Pipeline stress analysis shall be performed in accordance with ASME B31.4 [9.3], considering all relevant loads and corresponding displacements determined from the structural analysis and/or geotechnical analysis described in Sections 3104F and 3106F, respectively. Seismic loading of above-grade pipelines may be analyzed in accordance with ASME B31.E [9.5] with seismic loads computed from Section 3104F.5.4.1.

For pipelines spanning between seismically isolated structures (Section 3104F.1.3) and/or varying geotechnical conditions, evaluation of the relative movement of pipelines and supports and varying seismic accelerations shall be considered, including phase differences.

Flexibility analysis for piping, considering supports, shall be performed in accordance with ASME B31.4 [9.3] by using the largest temperature differential imposed by normal operation, start-up, shutdown or abnormal conditions. Thermal loads shall be based upon maximum and minimum local temperatures; heat traced piping shall use the maximum attainable temperature of the heat tracing system.

Section 3106F.12 provides additional considerations for underwater seafloor pipelines.

To determine forces at sliding surfaces, the coefficients of static friction shown in Table 31F-9-1 shall be used.

**TABLE 3109F-9-1
COEFFICIENTS OF STATIC FRICTION**

SLIDING SURFACE MATERIALS	COEFFICIENT OF STATIC FRICTION
Teflon on Teflon	0.10
Plastic on Steel	0.35
Steel on Steel	0.40
Steel on Concrete	0.45
Steel on Timber	0.49

3109F.4 Piping and pipelines supports and attachments (or anchorage). Supports and attachments shall conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 2610 [9.1] and the ASCE Guidelines [9.6] (N).

A seismic assessment shall be performed for existing supports and attachments using recommendations in Section 7 of CalARP [9.7], as appropriate (E).

For strength evaluation of supports and attachments, see Section 3107F.7. If a pipeline analysis has been performed and support reactions are available, they may be used to determine the forces on the support structure.

3109F.5 Appurtenances.

3109F.5.1 Valves and fittings. Valves and fittings shall meet the following requirements:

1. Conform to ASME B31.3 [9.2], ASME B31.4 [9.3], API Standard 609 [9.8] and ASME B16.34 [9.9], as appropriate, based on their service (N).
2. Conform to Section 10 of API Standard 2610 [9.1] (N/E).
3. Stems shall be oriented in a way not to pose a hazard in operation or maintenance (N/E).
4. Nonductile iron, cast iron and low-melting temperature metals shall not be used in any hydrocarbon service (N/E).
5. Double-block and bleed valves shall be used for manifold valves (N/E).
6. Isolation valves shall be fire-safe in accordance with API Standard 607 [9.10] (N).
7. Swing check valves shall not be installed in vertical down-flow piping (N/E).
8. Pressure relief devices shall be used in any closed piping system that has the possibility of being overpressurized due to temperature increase (thermal relief valves) (N/E).
9. Pressure relief devices shall be used in any piping system that has the possibility of being overpressurized due to surging, considering all plausible normal and abnormal operational scenarios in accordance with ASME B31.4 [9.3] (N/E).
10. Pressure relief devices shall be sized in accordance with API RP 520 [9.11] (N). Set pressures and accumulating pressures shall be in accordance with API RP 520 [9.11] (N/E).

11. Discharge from pressure relief valves shall be directed into lower pressure piping for recycling or proper disposal. Discharge shall never be directed into the open environment, unless secondary containment is provided (N/E).

12. Threaded, socket-welded, flanged and welded fittings shall conform to Section 8 of API Standard 2610 [9.1] (N/E).

13. ESD valves and SIVs shall also conform to the requirements of Sections 3108F.3.2.1 and 3108F.3.2.2.

3109F.5.2 Valve actuators (N/E).

1. Actuators shall have a readily accessible, manually operated overriding device to operate the valve during a power loss.
2. Torque switches shall be set to stop the motor closing operation at a specified torque setting.
3. Limit switches shall be set to stop the motor opening operation at a specified limit switch setting.
4. Critical valves shall be provided with thermal insulation. The insulation shall be inspected and maintained at periodic intervals. Records of thermal insulation inspections and condition shall be maintained for at least 6 years.
5. Electrical insulation for critical valves shall be measured for resistance following installation and retested periodically. These records shall be maintained for at least 6 years.
6. ESD valve and SIV actuators shall also conform to the requirements of Section 3108F.3.2.

3109F.6 Utility and auxiliary piping and pipeline systems. Utility and auxiliary piping includes service for:

1. Stripping and sampling
2. Vapor control
3. Natural gas
4. Compressed air, venting and nitrogen

Stripping and sampling piping shall conform to Section 3109F.2 (N/E).

Vapor return lines and VOC vapor inerting and enriching (natural gas) piping shall conform to 33 CFR 154.2100(b) [9.12] (N/E).

Compressed air, venting and nitrogen piping and fittings shall conform to ASME B31.3 [9.2] (N).

3109F.7 Fire piping and pipeline systems. Firewater and foam piping and fittings shall meet the following requirements:

1. Conform to NFPA 11 [9.13], NFPA 24 [9.14] and ASME B16.5 [9.15] (N/E).
2. Fire mains shall be carbon steel pipe (N/E).
3. High density polyethylene (HDPE) piping may be used for buried pipelines (N/E).

4. Piping and appurtenances shall be color-coded per local jurisdiction requirements or per ASME A13.1 [9.16] (N/E).
5. Pipeline stress analysis shall be performed for firewater piping and pipelines per Section 3109F.3 (N/E).
6. Firewater piping and pipelines supports and attachments shall be assessed per Section 3109F.4.
7. External visual inspection shall be performed per Section 3102F.3.5.3 (N/E).

3109F.8 References.

- [9.1] American Petroleum Institute (API), 2005, *API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.*
- [9.2] American Society of Mechanical Engineers (ASME), 2015, *ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.*
- [9.3] American Society of Mechanical Engineers (ASME), 2012, *ASME B31.4-2012 (ASME B31.4), "Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids," New York.*
- [9.4] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5.5 – Marine Terminal Oil Pipelines (2 CCR 2560 et seq.)
- [9.5] American Society of Mechanical Engineers (ASME), 2008, *ASME B31E, "Standard for the Seismic Design and Retrofit of Above-Ground Piping Systems," New York.*
- [9.6] American Society of Civil Engineers, 2011, *"Guidelines for Seismic Evaluation and Design of Petrochemical Facilities," 2nd ed., New York.*
- [9.7] CalARP Program Seismic Guidance Committee, December 2013, *"Guidance for California Accidental Release Prevention (CalARP) Program Seismic Assessments," Sacramento, CA.*
- [9.8] American Petroleum Institute (API), 2009, *API Standard 609, "Butterfly Valves: Double Flanged, Lug- and Wafer-Type," 7th ed., Washington, D.C.*
- [9.9] American Society of Mechanical Engineers (ASME), 2013, *ASME B16.34-2013 (ASME B16.34), "Valves Flanged Threaded and Welding End," New York.*
- [9.10] American Petroleum Institute (API), 2010, *API Standard 607, "Fire Test for Quarter-Turn Valves and Valves Equipped with Nonmetallic Seats," 6th ed., Washington, D.C.*
- [9.11] American Petroleum Institute (API), *API Recommended Practice 520 P1 and P2 (API 520), "Sizing, Selection, and Installation of Pressure-relieving Devices, Part 1 —Sizing and Selection," 2014, 9th ed., and "Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries – Part 2 – Installation," 2015, 6th ed., Washington, D.C.*
- [9.12] Code of Federal Regulations (CFR), Title 33, Section 154.2100 – Vapor Control System, General (33 CFR 154.2100)
- [9.13] National Fire Protection Association (NFPA), *NFPA 11, "Standard for Low-, Medium-, and High-Expansion Foam," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*
- [9.14] National Fire Protection Association (NFPA), *NFPA 24, "Standard for the Installation of Private Fire Service Mains and Their Appurtenances," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*
- [9.15] American Society of Mechanical Engineers (ASME), 2013, *ASME B16.5-2013 (ASME B16.5), "Pipe Flanges and Flanged Fittings," New York.*
- [9.16] American Society of Mechanical Engineers (ASME), 2007, *ASME A13.1-2007 (R2013) (ASME A13.1), "Scheme for the Identification of Piping Systems," New York.*

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 10

SECTION 3110F

MECHANICAL AND ELECTRICAL EQUIPMENT

3110F.1 General. This section provides the minimum standards for mechanical and electrical equipment at MOTs.

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

3110F.2 Marine loading arms.

3110F.2.1 General criteria. Marine loading arms and ancillary systems shall conform to ASME B31.3 [10.1], 33 CFR 154.510 [10.2] and OCIMF “Design and Construction Specification for Marine Loading Arms” [10.3]. Each loading arm used for transferring oil shall have a means of being drained or closed before being disconnected.

The following shall be considered when determining the loading arm maximum allowable extension limits:

1. Vessel sizes and manifold locations
2. Lowest-low water level (datum)
3. Highest-high water level
4. Maximum vessel surge and sway
5. Maximum width of fendering system

For each loading arm, the maximum allowable movement envelope limits shall comply with 2 CCR 2380 [10.4].

Loading arms and ancillary systems shall have a seismic assessment in accordance with Section 3104F.5. For seismic evaluation, design and strengthening of loading arms and ancillary equipment, seismic loads shall be computed per Section 3104F.5.4.1 and the procedure in Section 8.5.3 of ASCE/COPRI 61 [10.5]. For strength evaluation of supports and attachments, see Section 3107F.7.

3110F.2.2 Electrical and hydraulic power systems.

3110F.2.2.1 Pressure and control systems (N).

1. Pressure gauges shall be mounted in accordance with ASME B40.100 [10.6].
2. The hydraulic drive cylinders shall be mounted and meet either the mounting requirements of NFPA T3.6.7 R3 [10.7] or equivalent.
3. In high velocity current (>1.5 knots) areas, all new marine loading arms shall be fitted with quick disconnect couplers and emergency quick release systems in conformance with Sections 6.0 and 7.0 of [10.3]. In complying with this requirement, attention shall be paid to the commentary and guidelines in Part III of reference [10.3].
4. Out-of-limit, balance and the approach of out-of-limit alarms shall be located at or near the loading arm console.

3110F.2.2.2 Electrical components (N). The following criteria shall be implemented:

1. Equipment shall be provided with a safety disconnecting device to isolate the entire electrical system from the electrical mains in accordance with Article 430 of the California Electrical Code [10.8].
2. Motor controllers and 3-pole motor overload protection shall be installed and sized in accordance with Article 430 of the California Electrical Code [10.8].
3. Control circuits shall be limited to 120 volts and shall comply with Articles 500 and 501 of the California Electrical Code [10.8]. Alternatively, intrinsically safe wiring and controls may be provided in accordance with Article 504 of the California Electrical Code [10.8] and UL Std. No. 913 [10.9].
4. Grounding and bonding shall comply with the requirements of Article 430 of the California Electrical Code [10.8] and Section 3111F.

Section 3111F includes requirements for electrical equipment, wiring, cables, controls and electrical auxiliaries located in hazardous areas.

3110F.2.2.3 Remote operation. The remote control system, where provided, shall conform to the recommendations of the OCIMF [10.3]. The remote operation shall be facilitated by either a pendant control system or by a hand-held radio controller (N).

The pendant control system shall be equipped with a plug-in capability to an active connector located either in the vicinity of the loading arms, or at the loading arm outboard end on the triple swivel, and hard-wired into the control console. The umbilical cord running from the triple swivel to the control console shall be attached to the loading arm. Other umbilical cords shall have sufficient length to reach the maximum operational limits (N).

The radio controller if installed shall comply with 2 CCR 2370 [10.4] and 47 CFR Part 15 [10.10] requirements for transmitters operating in an industrial environment (N/E).

3110F.3 Oil transfer hoses (N/E). Hoses for oil transfer service shall be in compliance with 2 CCR 2380 [10.4] and 33 CFR 154.500 [10.11].

Hoses with nominal diameters of 6 inches or larger shall have flanges that meet ASME B16.5 [10.12], or hoses with nominal diameters of 6 inches or less may have quick disconnect fittings provided that they meet ASTM F1122 [10.13].

The minimum hose length shall safely accommodate the vessel’s size and maximum movements during transfer operations and mooring (see Section 3105F.2).

3110F.4 Lifting equipment: winches and cranes. Lifting equipment for oil service activities, other activities (if operation or failure could cause an oil release) or spill response,

shall conform to the provisions in Sections 3110F.4.1 and 3110F.4.2.

Lifting equipment inspection and maintenance shall conform to ASME B30.4 [10.14], ASME B30.7 [10.15] and ASME HST-4 [10.16], as applicable. Inspections by qualified personnel shall be performed annually. Inspection and maintenance records shall be retained.

3110F.4.1 Winches.

1. Winches and ancillary equipment shall be suitable for a marine environment (N/E).
2. Winches shall be provided with a fail-safe braking system, capable of holding the load under all conditions, including a power failure (N/E).
3. Winches shall be fully reversible (N).
4. Shock, transient and abnormal loads shall be considered when selecting winch systems (N).
5. Winches shall have limit switches and automatic trip devices to prevent over-travel of the drum in either direction. Limit switches shall be tested and demonstrated to function correctly under operating conditions without inducing undue tensions or slack in the winch cables (N/E).
6. Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums (N/E).
7. Moving winch parts which present caught-in hazards to personnel shall be guarded (N/E).
8. Winches shall have clearly identifiable and readily accessible stop controls (N/E).

3110F.4.2 Cranes (N/E).

1. Cranes shall not be loaded in excess of the manufacturer's rating except during performance tests.
2. Drums on load-hoisting equipment shall be equipped with positive holding devices.
3. Under all operating conditions, there shall be at least two full turns of cable on grooved drums, and at least three full turns on ungrooved drums.
4. Braking equipment shall be capable of stopping, lowering and holding a load of at least the full test load.
5. When not in use, crane booms shall be lowered to ground level or secured to a rest support against displacement by wind loads or other outside forces.
6. Safety systems including devices that affect the safe lifting and handling, such as interlocks, limit switches, load/moment and overload indicators with shutdown capability [10.17], emergency stop switches, radius and locking indicators, shall be provided.

3110F.5 Shore-to-vessel access for personnel. This section applies to shore-to-vessel means of access for personnel and equipment provided by the terminal. This includes ancillary

structures and equipment, which support, supplement, deploy and maneuver such vessel access systems.

Shore-to-vessel access for personnel shall conform to 29 CFR 1918.22 [10.18], Sections 19.B and 21.E of USACE EM 385-1-1 [10.19], Chapter 16.4 of ISGOTT [10.20] and the following:

1. Shore-to-vessel access systems shall be designed to withstand the forces from dead, live, wind, vibration, impact loads and the appropriate combination of these loads. The design shall consider all the critical positions of the system in the stored, maintenance, maneuvering and deployed positions, where applicable (N).
2. The minimum live load shall be 50 psf on walkways and 25 plf with a 200 pounds minimum concentrated load in any location or direction on handrails (N).
3. The walkway shall be not less than 36 inches in width (N) and not less than 20 inches for existing walkways (E).
4. The shore-to-vessel access system shall be positioned so as to not interfere with the safe passage or evacuation of personnel (N/E).
5. Guardrails shall be provided on both sides of the access systems with a clearance between the inner most surfaces of the guardrails of not less than 36 inches and shall be maintained for the full length of the walkway (N).
6. Guardrails shall be at a height not less than 33 inches above the walkway surface and shall include an intermediate rail located midway between the walkway surface and the top rail (N/E).
7. The walkway surface, including self-leveling treads, if so equipped, shall be finished with a safe nonslip footing accommodating all operating gangway inclinations (N/E).
8. The undersides of aluminum gangways shall be protected with hard plastic or wooden strips to prevent being dragged or rubbed across any steel deck or component (N/E).

3110F.6 Oil sumps and ancillary equipment. Oil sumps and ancillary equipment shall conform to the following:

1. Sumps for oil drainage shall be equipped with pressure/vacuum vents, automatic draining pumps and shall be tightly covered (N/E).
2. Sumps which provide drainage for more than one berth should be equipped with liquid seals so that a fire on one berth does not spread via the sump (N/E).
3. Sumps shall be located at least 25 ft from the manifolds, base of the loading arms or hose towers (N).
4. Conduct periodic integrity testing of the sump containers and periodic integrity and leak testing of the related valves and piping.

3110F.7 Vapor control systems. Vapor control systems shall conform to 33 CFR 154.2000 through 154.2181 [10.21] and API Standard 2610 [10.22]. The effects of seismic, wind, dead, live and other loads shall be considered in the analysis

and design of individual tie-downs of components, such as of steel skirt, vessels, controls and detonation arresters.

3110F.8 Spill prevention equipment and systems maintenance (N/E). Mechanical and electrical equipment critical to oil spill prevention and safety, such as, but not limited to: mooring line quick release and loading arm quick disconnect systems, shall be maintained and tested as per the manufacturer's recommendations (N/E). The latest records shall be readily accessible to the Division (N/E).

3110F.9 Pumps (N/E). Specification information for all MOT pumps providing oil and fire water service to wharf pipeline systems shall be retained. Information shall include, but not be limited to, pump make and model, motor make and model, flow rate, pressure rating and pump performance curves.

Hydrocarbon pumps that serve the oil transfer operations at the berthing system must be maintained per API Standard 2610 [10.22]. Firewater pumps providing the wharf fire protection shall be maintained in accordance with Section 3108F.6.3.

3110F.10 Mechanical and electrical equipment seismic assessment (N/E). Mechanical and electrical equipment shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.

3110F.11 References.

- [10.1] American Society of Mechanical Engineers (ASME), 2015, ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.
- [10.2] Code of Federal Regulations (CFR), Title 33, Section 154.510 – Loading Arms (33 CFR 154.510)
- [10.3] Oil Companies International Marine Forum (OCIMF), 1999, "Design and Construction Specification for Marine Loading Arms," 3rd ed., Witherby, London.
- [10.4] California Code of Regulations (CCR), Title 2, Division 3, Chapter 1, Article 5 – Marine Terminals Inspection and Monitoring (2 CCR 2300 et seq.)
- [10.5] American Society of Civil Engineers (ASCE), 2014, ASCE/COPRI 61-14 (ASCE/COPRI 61), "Seismic Design of Piers and Wharves", Reston, VA.
- [10.6] American Society of Mechanical Engineers (ASME), 2013, ASME B40.100-2013 (ASME B40.100), "Pressure Gauges and Gauge Attachments," New York.
- [10.7] National Fluid Power Association (NFPA), 2009, NFPA T3.6.7 R3-2009 (R2017) (NFPA T3.6.7 R3), "Fluid Power Systems and Products —Square Head Industrial Cylinders - Mounting Dimensions," Milwaukee, WI.
- [10.8] California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code.
- [10.9] Underwriters Laboratory, Inc., 2013, UL Standard No. 913, "Standard for Intrinsically Safe Apparatus and Associated Apparatus for Use in Class I, II, III, Division 1, Hazardous (Classified) Locations," 8th ed., Northbrook, IL.
- [10.10] Code of Federal Regulations (CFR), Title 47, Part 15 – Radio Frequency Devices (47 CFR 15)
- [10.11] Code of Federal Regulations (CFR), Title 33, Section 154.500 – Hose Assemblies (33 CFR 154.500)
- [10.12] American Society of Mechanical Engineers (ASME), 2013, ASME B16.5-2013 (ASME B16.5), "Pipe Flanges and Flanged Fittings," 13th ed., New York.
- [10.13] American Society for Testing and Materials (ASTM), 2010, ASTM F1122-04(2010) (ASTM F1122), "Standard Specification for Quick Disconnect Couplings (6 in. NPS and Smaller)," 4th ed., West Conshohocken, PA.
- [10.14] American Society of Mechanical Engineers (ASME), 2010, ASME B30.4-2010 (ASME B30.4), "Portal Tower and Pedestal Cranes," 10th ed., New York.
- [10.15] American Society of Mechanical Engineers (ASME), 2011, ASME B30.7-2011 (ASME B30.7), "Winches," 11th ed., New York.
- [10.16] American Society of Mechanical Engineers (ASME) 1999, ASME HST-1999 (R2010) (ASME HST-4), "Performance Standard for Overhead Electric Wire Rope Hoists," New York.
- [10.17] Code of Federal Regulations (CFR), Title 29, Section 1917.46 – Load Indicating Devices (29 CFR 1917.46)
- [10.18] Code of Federal Regulations (CFR), Title 29, Section 1918.22 – Gangways (29 CFR 1918.22)
- [10.19] US Army Corps of Engineers (USACE), 2008 (05 Jul 11), EM 385-1-1, "Safety and Health Requirements Manual, Sections 19.B and 21.E, Washington, D.C.
- [10.20] International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2010, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.
- [10.21] Code of Federal Regulations (CFR), Title 33, Sections 154.2000 through 154.2250 – Vapor Control Systems (33 CFR 154.2000 et. seq.)
- [10.22] American Petroleum Institute (API), 2005, API Standard 2610 (R2010), "Design, Construction, Operation, Maintenance, and Inspection of Terminal and Tank Facilities," 2nd ed., Washington, D.C.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

Division 11

SECTION 3111F ELECTRICAL SYSTEMS

3111F.1 General. This section provides minimum standards for electrical systems at marine oil terminals.

Electrical systems include the incoming electrical service and components, the electrical distribution system, branch circuit cables and the connections, including, but not limited to:

1. Lighting, for operations, security and navigation
2. Controls for mechanical and electrical equipment
3. Supervision and instrumentation systems for mechanical and electrical equipment
4. Grounding and bonding
5. Corrosion protection through cathodic protection
6. Communications and data handling systems
7. Fire detection systems
8. Fire alarm systems
9. Emergency shutdown systems (ESD)

All electrical systems shall conform to API RP 540 [11.1] and the California Electrical Code [11.2].

See Section 3101F.3 for definitions of “new” (N) and “existing” (E).

3111F.2 Hazardous area designations and plans (N/E). Area classifications shall be determined in accordance with API RP 500 [11.3], API RP 540 [11.1] and Articles 500, 501, 504, 505 and 515 of the California Electrical Code [11.2]. A marine oil terminal shall have a current set of scaled plan drawings, with clearly designated areas showing the hazard class, division and group. The plan view shall be supplemented with sections, elevations and details to clearly delineate the area classification at all elevations starting from low water level. The drawings shall be certified by a professional electrical engineer. The plans shall be reviewed and revised when modifications to the structure, product or equipment change hazardous area identifications or boundaries.

3111F.3 Identification and tagging. All electrical equipment, cables and conductors shall be clearly identified by means of tags, plates, color coding or other effective means to facilitate troubleshooting and improve safety, and shall conform to the identification carried out for the adjacent on-shore facilities (N). Topics for such identification are found in Articles 110, 200, 210, 230, 384, 480 and 504 of the California Electrical Code [11.2]. Existing electrical equipment (E) shall be tagged.

Where identification is necessary for the proper and safe operation of the equipment, the marking shall be clearly visible and illuminated (N/E). A coded identification system shall apply to all circuits, carrying low or high voltage power, control, supervisory or communication (N).

3111F.4 Purged or pressurized enclosures for equipment in hazardous locations (N/E). Purged or pressurized enclo-

tures shall be capable of preventing the entry of combustible gases into such spaces, in accordance with NFPA 496 [11.4]. Special emphasis shall be placed on reliability and ease of operation. The pressurizing equipment shall be electrically monitored and alarms shall be provided to indicate failure of the pressurizing or purging systems.

Pressurized control rooms shall conform to Chapter 7 of NFPA 496 [11.4].

3111F.5 Electrical service. Where critical circuits are used for spill prevention, fire control or life safety, an alternative service derived from a separate source and conduit system, shall be located at a safe distance from the main power service. A separate feeder from a double-ended substation or other source backed up by emergency generators will meet this requirement. A stored energy emergency power system (SEEPS) shall be provided for control and supervisory circuits associated with ESD systems (N), see Section 3111F.5.1.

1. Electrical, instrument and control systems used to activate equipment needed to control a fire or mitigate its consequences shall be protected from fire and remain operable for 15 minutes in a 2000°F fire, unless designed to fail-safe during fire exposure. The temperature around these critical components shall not exceed 200°F during 15 minutes of fire exposure (N).
2. Wiring in fireproofed conduits shall be derated 15 percent to account for heat buildup during normal operation. Type MI (mineral insulated, metal sheathed per the California Electrical Code [11.2]) cables may be used in lieu of fireproofing of wiring (N).
3. Emergency cables and conductors shall be located where they are protected from damage caused by traffic, corrosion or other sources (N).
4. Allowance shall be made for electrical faults, overvoltages and other abnormalities (N).

Where solid state motor controls are used for starting and speed control, corrective measures shall be incorporated for mitigating the possible generation of harmonic currents that may affect the ESD or other critical systems (N).

3111F.5.1 Emergency power systems. Emergency power systems shall be installed (N) and maintained (N/E) per NFPA 110 [11.5]. This does not include stored energy systems. Stored energy emergency power systems (SEEPS) shall be installed (N) when necessary to maintain continuous uninterruptable power to critical systems. SEEPS shall be installed (N) and maintained (N/E) per NFPA 111 [11.6].

3111F.6 Grounding and bonding (N/E).

1. All electrical equipment shall be effectively grounded as per Article 250 of the California Electrical Code [11.2]. All noncurrent carrying metallic equipment, structures, piping and other elements shall also be effectively grounded.

2. Grounding shall be considered in any active corrosion protection system for on-shore piping, submerged support structures or other systems. Insulation barriers, including flanges or nonconducting hoses shall be used to isolate cathodic protection systems from other electrical/static sources. None of these systems shall be compromised by grounding or bonding arrangements that may interconnect the corrosion protection systems or interfere with them in any way that would reduce their effectiveness.
3. Bonding of vessels to the MOT structure is not permitted.
4. Whenever flanges of pipelines with cathodic protection are to be opened for repair or other work, the flanges shall be bonded prior to separation.
5. Direct wiring to ground shall be provided from all towers, loading arms or other high structures that are susceptible to lightning surges or strikes.

3111F.7 Equipment specifications (N). All electrical systems and components shall conform to National Electrical Manufacturers Association (NEMA) standards or be certified by a Nationally Recognized Testing Laboratory (NRTL).

3111F.8 Illumination (N/E).

3111F.8.1 Illumination Locations. At a minimum, MOTs shall provide fixed lighting (or luminaires) that illuminates the following areas:

1. Transfer connection points on the MOT
2. Transfer connection points on any barge moored at the MOT that may transfer oil
3. Transfer operations work areas on the MOT
4. Transfer operations work areas on any barge moored at the MOT that may transfer oil
5. Areas defined in Sections 17.4 and 24.6.4 of ISGOTT [11.7], as appropriate

Lighting shall be located or shielded so as not to mislead or otherwise interfere with off-site areas as governed by federal, state and local agency requirements.

3111F.8.2 Illumination Levels. The minimum illumination levels shall be as follows:

1. 5.0 footcandles (54 lux) at transfer connection points
2. 1.0 footcandle (11 lux) in transfer operations work and other areas

Where the illumination appears to the Division to be inadequate, the Division may require verification by instrument of the levels of illumination. The illumination levels shall be verified by measurement at the locations defined in Section 3111F.8.1, if required. All measurements shall be taken on a horizontal plane, 3 feet above the MOT and barge deck or walking surface (33 CFR 154.570 (b) [11.8]).

3111F.8.3 Emergency Power for Illumination (N). In the event of power supply failure, the emergency power system (Section 3111F.5.1) shall automatically illuminate all

of the areas defined in Section 3111F.8.1, and fire pump, hydrant, monitor, foam and hose connection points on the MOT. The emergency power system shall provide power for a duration of not less than 60 minutes at a level of not less than an average of 0.5 footcandle (5.5 lux).

3111F.9 Communications, control and monitoring systems.

3111F.9.1 Communication systems (N/E). Communications systems shall comply with 2 CCR 2370 [11.7] and Section 6 of OCIMF "Guide on Marine Terminal Fire Protection and Emergency Evacuation" [11.9].

3111F.9.2 Overfill monitoring and controls (N/E). Overfill protection systems shall conform to Appendix C of API Standard 2350 [11.10]. These systems shall be tested before each transfer operation or monthly, whichever is less frequent. Where vessel or barge overfill sensors and alarms are provided, they shall comply with 33 CFR 154.2102 [11.11].

All sumps shall be provided with level sensing devices to initiate an alarm to alert the operator at the approach of a high level condition. A second alarm shall be initiated at a high-high level to alert the operator. Unless gravity drainage is provided, sumps must have an automatic pump, programmed to start at a predetermined safe level.

3111F.9.3 Monitoring systems (N/E). All monitoring systems and instrumentation such as, but not limited to: velocity monitoring systems, tension monitoring systems, anemometers and current meters, shall be installed, maintained and calibrated per the manufacturer's recommendations. Specifications shall be retained. The latest records shall be readily accessible to the Division.

3111F.10 Cathodic Protection Systems (CPS) (N/E). CPS operating, testing and maintenance criteria for underwater structures shall conform to UFC 3-570-01 [11.12]. Structure-to-electrolyte potential measurements shall be taken at least annually. CPS operating, testing and maintenance criteria for buried and submerged pipelines shall conform to API 570 [11.13].

All electrical insulating and isolating devices for protection against static, stray and impressed currents shall be tested in accordance with 2 CCR 2341 and 2380 [11.7].

CPS design criteria and location of anodes, electrical leads and rectifiers shall be documented and retained. Periodic CPS measurements, test data and inspection findings shall be retained.

3111F.11 Electrical systems seismic assessment (N/E). Electrical systems shall have a seismic assessment per Section 3104F.5. For strength evaluation of supports and attachments, see Section 3107F.7.

3111F.12 References.

- [11.1] American Petroleum Institute (API), 1999, API Recommended Practice 540 (R2004) (API RP 540), "Electrical Installations in Petroleum Processing Plants," 4th ed., Washington, D.C.
- [11.2] California Code of Regulations (CCR), Title 24, Part 3, California Electrical Code.

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- [11.3] *American Petroleum Institute (API), 2012 (Errata January 2014), API Recommended Practice 500 (API RP 500), "Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2," 3rd ed., Washington, D.C.*
- [11.4] *National Fire Protection Association (NFPA), 2012, NFPA 496, "Standard for Purged and Pressurized Enclosures for Electrical Equipment," 2013 ed., Quincy, MA.*
- [11.5] *National Fire Protection Association (NFPA), NFPA 110, "Standard for Emergency and Standby Power Systems," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*
- [11.6] *National Fire Protection Association (NFPA), NFPA 111, "Standard on Stored Electrical Energy Emergency and Standby Power Systems," Quincy, MA. For edition, see California Code of Regulations (CCR), Title 24, Part 2, Chapter 35 – Referenced Standards.*
- [11.7] *International Chamber of Shipping (ICS), Oil Companies International Marine Forum (OCIMF), International Association of Ports and Harbors (IAPH), 2006, "International Safety Guide for Oil Tankers and Terminals (ISGOTT)," 5th ed., Witherby, London.*
- [11.8] *Code of Federal Regulations (CFR), Title 33, Section 154.570 – Lighting (33 CFR 154.570)*
- [11.9] *Oil Companies International Marine Forum (OCIMF), 1987, "Guide on Marine Terminal Fire Protection and Emergency Evacuation," 1st ed., Witherby, London.*
- [11.10] *American Petroleum Institute (API), 2012, API Standard 2350, "Overfill Protection for Storage Tanks in Petroleum Facilities," 4th ed., Washington, D.C.*
- [11.11] *Code of Federal Regulations (CFR), Title 33, Section 154.2102 – Facility Requirements for Vessel Liquid Overfill Protection (33 CFR 154.2102)*
- [11.12] *Department of Defense, 28 November 2016, Unified Facilities Criteria (UFC) 3-570-01, "Cathodic Protection," Washington, D.C.*
- [11.13] *American Petroleum Institute (API), 2009, API 570, "Piping Inspection Code: In-service Inspection, Repair, and Alteration of Piping Systems," 3rd ed., Washington, D.C.*

Authority: Sections 8750 through 8760, *Public Resources Code*.

Reference: Sections 8750, 8751, 8755 and 8757, *Public Resources Code*.

Division 12

SECTION 3112F REQUIREMENTS SPECIFIC TO MARINE TERMINALS THAT TRANSFER LNG

3112F.1 Purpose and applicability. Section 3112F provides minimum requirements specific to onshore marine terminals that transfer LNG. Sections 3101F through 3111F are also applicable, as appropriate. Offshore marine terminals that transfer LNG are subject to a case-by-case review and approval by the Division.

3112F.2 Risk and Hazards Analyses.

1. Prior to LNG transfer at marine terminal, a hazards identification exercise shall be carried out to isolate potential internal and external events that may cause a spill and/or impact to public health, safety and the environment.
2. Hazards analysis shall consider every component, part of a structure, equipment item, and system, whose failure could cause a major accident, result in unacceptable incident escalation beyond the design basis, or adversely affect the potential for the passive and active systems to control or shutdown the facility. Safety Critical Components and Safety Critical Systems shall be identified.
3. Consequence models shall be developed for credible scenarios to identify Lower Flammability Limit (LFL) hazard regions. Release diameters shall include, at a minimum, 3mm, 10mm and 50 mm sizes. Scenarios involving the marine loading arms shall consider a full bore release.
4. Consequence models shall develop radiant heat zones from jet and pool fires for the 25 kW/m², 12.5 kW/m², 5 kW/m² and 1.6 kW/m² thermal endpoints.
5. A Cryogenic Exposure Analysis (CEA) shall be conducted to identify equipment and structures susceptible to cryogenic spray and pool exposure due to LNG releases from different size holes.
6. A Facility Essential Systems Survivability Assessment (ESSA) shall be conducted to determine the survivability of the Safety Critical Components.
7. Impact on Safety Critical Components and Systems shall be mitigated.

3112F.3 Specific berthing and mooring considerations. In addition to the minimum design requirements for berthing and mooring in Sections 3103F, 3105F and 3107F of this code, the following shall be satisfied:

1. Wind force and moment coefficients for LNG vessels shall be used in accordance with Appendix A of OCIMF MEG 3 [12.1], as appropriate.
2. The limiting environmental criteria for which the LNG carrier may safely remain berthed at the terminal shall be determined using dynamic mooring analysis.

3. Real time monitoring and recording of environmental conditions including wind, current and waves shall be conducted to assist in mooring system management.
4. Vessel hull pressure shall be considered in fender analyses and design.

3112F.4 Fire protection. A Fire and Explosion Hazard Analysis (FEHA) for potential pool fires, jet fires and flash fires, considering LNG releases from different size holes, as specified in Section 3112F.2, shall be conducted and result in recommendations regarding:

1. Type, quantity and location of fire and gas detection devices to detect potential fires and/or gas releases in a specified time frame
2. Fire suppression coverage, including fixed and portable systems, and equipment necessary to allow the design scenarios to be mitigated and/or extinguished
3. Design application rates for required fire protection systems
4. Firefighting requirements, including an analysis of the capability of response by other facilities, USCG and federal, state and local agencies

Critical structural supports and equipment within the fire exposed areas identified in the FEHA shall be provided with passive fire protection designed for the duration identified in the analysis.

Emergency shutdown (ESD) systems shall be provided, in accordance with API RP 14C [12.2] and Section 12.3 of NFPA 59A [12.3], to shut down the flow of LNG to/from the terminal and shut down equipment whose continued operation could add to or prolong an emergency event.

The ESD system shall be of a failsafe design or shall be otherwise installed, located or protected to minimize the possibility that it becomes inoperative in the event of an emergency or failure at the primary control system. ESD system components that may be exposed to fire effects shall be evaluated to confirm that the actuator operation will not be impaired.

3112F.5 LNG pipelines.

1. All pipe specified for use in cryogenic service shall be furnished in accordance with Paragraph 323.2.2A and Table A-1 of ASME B31.3 [12.4]. The extreme thickness of insulation on cryogenic piping shall be taken into consideration during piping design.
2. All piping materials, including gaskets and thread compounds, shall be selected appropriate to the range of temperatures to which subjected. Piping that may be exposed to the low temperature of LNG or to the heat of an ignited spill, during an emergency where such exposure could result in a failure of the piping, shall comply with at least one of the following:
 - (a) Made of material(s) that can withstand both the normal operating temperature and extreme

temperature to which the piping may be subjected during the emergency

- (b) Protected by insulation or other means to delay failure due to extreme temperatures until corrective action can be taken by the operator.
 - (c) Capable of being isolated and having the flow stopped where piping is exposed only to the heat of an ignited spill during the emergency
3. LNG pipelines shall be designed for cool-down with liquid nitrogen where the use of LNG is not possible.
 4. All LNG drains should be located within a containment area or piped to a collection system or containment area.
 5. LNG lines shall be analyzed for a start-up case where the top of the pipe is 90 degrees F warmer than the bottom of the pipe. The upward bowing of the pipe shall be limited to 1.25 inches.
 6. Pipe supports, including any insulation systems used to support pipe whose stability is essential, shall be resistant to or protected against fire exposure, escaping cold liquid, or both if they are subject to such exposure.
 7. Pipe supports for cold lines shall be designed to minimize excessive heat transfer, which can result in piping failure by ice formations or embrittlement of supporting steel. If icing up of piping and components is unavoidable, the weight of the accumulated ice shall be considered during piping and support design.
 8. Valves shall comply with ASME B31.5 [12.5].
 9. Cryogenic valves in liquid cryogenic service shall not be installed in vertical lines. Valves in liquid cryogenic service shall be installed in horizontal lines with the stem in the vertical position or at least 45 degrees vertically from the horizontal centerline of the pipe.
 10. All cryogenic valves (except butterfly valves, check valves and globe valves) shall have a body cavity relief to the "safe" side of the valve. All cryogenic valves with a body cavity relief shall be marked on the exterior of the body with a letter "V" and an arrow pointing to the direction of the venting side.
 11. Thermal relief valves shall be installed to protect the equipment and piping from over pressuring as a result of ambient heat input to blocked in LNG or other light hydrocarbon liquids.
 12. Cryogenic subsea pipeline designs shall be qualified by a certifying agency, acceptable to the Division, in a qualification program that demonstrates that the system has been designed, fabricated and can function as intended with safeguards provided as determined to be necessary.

3112F.6 Mechanical components and systems.

1. The CEA analysis shall be used to recommend acceptable cryogenic exposure durations for Safety Critical Components to produce CEA drawings.

2. ESD system components, which are exposed to cryogenic effects, shall be evaluated to confirm that the actuators will not be impaired by the potential exposures, thereby preventing the components from failing to a safe position.
3. Critical structural supports and equipment within the cryogenically exposed areas shall be provided with cryogenic insulation. The cryogenic insulation and passive fire protection shall be designed for sufficient incident duration.
4. For marine loading arms in LNG service, ice formation on non-insulated arms and hoses must be taken into account. Mechanisms for venting, apex venting, purging and cool down of the marine loading arms shall be identified on the P&IDs.
5. Areas beneath marine arms shall have restricted access during and after product transfer, until there is no longer danger of falling ice.

3112F.7 References.

- [12.1] Oil Companies International Marine Forum (OCIMF), 2008, "Mooring Equipment Guidelines (MEG3)," 3rd ed., London, England.
- [12.2] American Petroleum Institute (API), 2001 (Reaffirmed 2007), API Recommended Practice 14C (API RP 14C), "Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms," 7th ed., Washington, D.C.
- [12.3] National Fire Protection Association (NFPA), 2012, NFPA 59A, "Standard for the Production, Storage, and Handling of Liquefied Natural Gas (LNG)," 2013 ed., Quincy, MA.
- [12.4] American Society of Mechanical Engineers (ASME), 2015, ASME B31.3-2014 (ASME B31.3), "Process Piping," New York.
- [12.5] American Society of Mechanical Engineers (ASME), 2013, ASME B31.5-2013 (ASME B31.5), "Refrigeration Piping and Heat Transfer Components," New York.

Authority: Sections 8750 through 8760, Public Resources Code.

Reference: Sections 8750, 8751, 8755 and 8757, Public Resources Code.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 32 – ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X		X	X	X			X	X	X					X							X
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 32

ENCROACHMENTS INTO THE PUBLIC RIGHT-OF-WAY

User note:

About this chapter: From time to time it is necessary or appropriate for a portion of a building to encroach onto an adjoining public right-of-way. Chapter 32 establishes parameters for such encroachments not only at grade but also above and below grade.

SECTION 3201 GENERAL

3201.1 Scope. The provisions of this chapter shall govern the encroachment of structures into the public right-of-way.

3201.2 Measurement. The projection of any structure or portion thereof shall be the distance measured horizontally from the *lot line* to the outermost point of the projection.

3201.3 Other laws. The provisions of this chapter shall not be construed to permit the violation of other laws or ordinances regulating the use and occupancy of public property.

3201.4 Drainage. Drainage water collected from a roof, awning, canopy or marquee, and condensate from mechanical equipment shall not flow over a public walking surface.

SECTION 3202 ENCROACHMENTS

3202.1 Encroachments below grade. Encroachments below grade shall comply with Sections 3202.1.1 through 3202.1.3.

3202.1.1 Structural support. A part of a building erected below grade that is necessary for structural support of the building or structure shall not project beyond the lot lines, except that the footings of street walls or their supports that are located not less than 8 feet (2438 mm) below grade shall not project more than 12 inches (305 mm) beyond the street lot line.

3202.1.2 Vaults and other enclosed spaces. The construction and utilization of vaults and other enclosed spaces below grade shall be subject to the terms and conditions of the applicable governing authority.

3202.1.3 Areaways. Areaways shall be protected by grates, guards or other approved means.

3202.2 Encroachments above grade and below 8 feet in height. Encroachments into the public right-of-way above grade and below 8 feet (2438 mm) in height shall be prohibited except as provided for in Sections 3202.2.1 through 3202.2.3. Doors and windows shall not open or project into the public right-of-way.

3202.2.1 Steps. Steps shall not project more than 12 inches (305 mm) and shall be guarded by approved devices not less than 3 feet (914 mm) in height, or shall be located between columns or pilasters.

3202.2.2 Architectural features. Columns or pilasters, including bases and moldings, shall not project more than

12 inches (305 mm). Belt courses, lintels, sills, architraves, pediments and similar architectural features shall not project more than 4 inches (102 mm).

3202.2.3 Awnings. The vertical clearance from the public right-of-way to the lowest part of any awning, including valances, shall be not less than 7 feet (2134 mm).

3202.3 Encroachments 8 feet or more above grade. Encroachments 8 feet (2438 mm) or more above grade shall comply with Sections 3202.3.1 through 3202.3.4.

3202.3.1 Awnings, canopies, marquees and signs. Awnings, canopies, marquees and signs shall be constructed so as to support applicable loads as specified in Chapter 16. Awnings, canopies, marquees and signs with less than 15 feet (4572 mm) of clearance above the sidewalk shall not extend into or occupy more than two-thirds the width of the sidewalk measured from the building. Stanchions or columns that support awnings, canopies, marquees and signs shall be located not less than 2 feet (610 mm) in from the curb line.

3202.3.2 Windows, balconies, architectural features and mechanical equipment. Where the vertical clearance above grade to projecting windows, balconies, architectural features or mechanical equipment is more than 8 feet (2438 mm), 1 inch (25 mm) of encroachment is permitted for each additional 1 inch (25 mm) of clearance above 8 feet (2438 mm), but the maximum encroachment shall be 4 feet (1219 mm).

3202.3.3 Encroachments 15 feet or more above grade. Encroachments 15 feet (4572 mm) or more above grade shall not be limited.

3202.3.4 Pedestrian walkways. The installation of a pedestrian walkway over a public right-of-way shall be subject to the approval of the applicable governing authority. The vertical clearance from the public right-of-way to the lowest part of a pedestrian walkway shall be not less than 15 feet (4572 mm).

3202.4 Temporary encroachments. Where allowed by the applicable governing authority, vestibules and storm enclosures shall not be erected for a period of time exceeding 7 months in any 1 year and shall not encroach more than 3 feet (914 mm) nor more than one-fourth of the width of the sidewalk beyond the street lot line. Temporary entrance awnings shall be erected with a clearance of not less than 7 feet (2134 mm) to the lowest portion of the hood or awning where supported on removable steel or other approved noncombustible support.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 33 – SAFEGUARDS DURING CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X		X					X	X	X	X	X	X	X								
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below				X	X		X															
Chapter / Section																						
3301				X	X																	
3302				X	X																	
3303				X	X																	
3304				X	X																	
3304.1.5				X																		
3305				X	X																	
3306				X	X																	
3306.2				X			X															
3307				X	X																	
3307.1, Note				X	X																	
3308				X	X																	
3310																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 33

SAFEGUARDS DURING CONSTRUCTION

User notes:

About this chapter: While the balance of the chapters in this code specify how a building is to be designed and constructed in order to be in compliance with the code, Chapter 33 looks to the actual construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. This chapter also addresses the need for a fire watch during nonworking hours for certain buildings once the construction has progressed significantly. Issues such as how to provide egress while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed.

Code development reminder: Code change proposals to sections preceded by the designation [BS] will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION 3301 GENERAL

3301.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

3301.2 Storage and placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

** [BS] **3301.2.1 Structural and construction loads.** Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

SECTION 3302 CONSTRUCTION SAFEGUARDS

3302.1 Alterations, repairs and additions. Required *exits*, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during alterations, repairs or additions to any building or structure.

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the existing building is not occupied.

3302.2 Manner of removal. Waste materials shall be removed in a manner that prevents injury or damage to persons, adjoining properties and public rights-of-way.

3302.3 Fire safety during construction. Fire safety during construction shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *California Fire Code*.

SECTION 3303 DEMOLITION

3303.1 Construction documents. Construction documents and a schedule for demolition shall be submitted where required by the building official. Where such information is required, work shall not be done until such construction documents or schedule, or both, are approved.

3303.2 Pedestrian protection. The work of demolishing any building shall not be commenced until pedestrian protection is in place as required by this chapter.

3303.3 Means of egress. A horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

3303.4 Vacant lot. Where a structure has been demolished or removed, the vacant lot shall be filled and maintained to the existing grade or in accordance with the ordinances of the jurisdiction having authority.

3303.5 Water accumulation. Provision shall be made to prevent the accumulation of water or damage to any foundations on the premises or the adjoining property.

3303.6 Utility connections. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the applicable governing authority.

3303.7 Fire safety during demolition. Fire safety during demolition shall comply with the applicable requirements of this code and the applicable provisions of Chapter 33 of the *California Fire Code*.

SECTION 3304 SITE WORK

3304.1 Excavation and fill. Excavation and fill for buildings and structures shall be constructed or protected so as not to endanger life or property. Stumps and roots shall be removed

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from the soil to a depth of not less than 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building. Wood forms that have been used in placing concrete, if within the ground or between foundation sills and the ground, shall be removed before a building is occupied or used for any purpose. Before completion, loose or casual wood shall be removed from direct contact with the ground under the building.

3304.1.1 Slope limits. Slopes for permanent fill shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Cut slopes for permanent excavations shall be not steeper than one unit vertical in two units horizontal (50-percent slope). Deviation from the foregoing limitations for cut slopes shall be permitted only upon the presentation of a soil investigation report acceptable to the building official.

3304.1.2 Surcharge. Fill or other surcharge loads shall not be placed adjacent to any building or structure unless such building or structure is capable of withstanding the additional loads caused by the fill or surcharge. Existing footings or foundations that can be affected by any excavation shall be underpinned adequately or otherwise protected against settlement and shall be protected against lateral movement.

3304.1.3 Footings on adjacent slopes. For footings on adjacent slopes, see Chapter 18.

3304.1.4 Fill supporting foundations. Fill to be used to support the foundations of any building or structure shall comply with Section 1804.6. Special inspections of compacted fill shall be in accordance with Section 1705.6.

3304.1.5 [HCD 1] Storm water drainage and retention during construction. *Projects which disturb less than one acre of soil and are not part of a larger common plan of development which in total disturbs one acre or more, shall manage storm water drainage during construction in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.1.*

SECTION 3305 SANITARY

3305.1 Facilities required. Sanitary facilities shall be provided during construction, remodeling or demolition activities in accordance with the *California Plumbing Code*.

SECTION 3306 PROTECTION OF PEDESTRIANS

[BS] 3306.1 Protection required. Pedestrians shall be protected during construction, remodeling and demolition activities as required by this chapter and Table 3306.1. Signs shall be provided to direct pedestrian traffic.

[BS] 3306.2 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a building entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface. Walkways shall be accessible in accordance with Chapter 11A or 11B as applicable, and shall be designed to support all imposed loads, and the design live load shall be not less than 150 pounds per square foot (psf) (7.2 kN/m²).

[BS] 3306.3 Directional barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

[BS] 3306.4 Construction railings. Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

[BS] 3306.5 Barriers. Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.

[BS] 3306.6 Barrier design. Barriers shall be designed to resist loads required in Chapter 16 unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be boards not less than $\frac{3}{4}$ -inch (19.1 mm) thick or wood structural panels not less than $\frac{1}{4}$ -inch (6.4 mm) thick.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.

TABLE 3306.1
PROTECTION OF PEDESTRIANS

HEIGHT OF CONSTRUCTION	DISTANCE FROM CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

4. Wood structural use panels $\frac{1}{4}$ inch (6.4 mm) or $\frac{5}{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.
5. Wood structural use panels $\frac{3}{8}$ inch (9.5 mm) or $\frac{1}{2}$ inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center provided that a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.
6. Wood structural use panels $\frac{5}{8}$ inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

[BS] 3306.7 Covered walkways. Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. The design live load shall be not less than 150 psf (7.2 kN/m²) for the entire structure.

Exception: Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6kN/m²) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge upon the posts.
4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an exterior exposure durability classification not less than $\frac{23}{32}$ inch (18.3 mm) thick nailed to the joists.
6. Each post shall be knee braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

[BS] 3306.8 Repair, maintenance and removal. Pedestrian protection required by this chapter shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

[BS] 3306.9 Adjacent to excavations. Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16.

SECTION 3307 PROTECTION OF ADJOINING PROPERTY

[BS] 3307.1 Protection required. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work. Protection shall be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

[BS] 3307.2 Excavation retention systems. Where a retention system is used to provide support of an excavation for protection of adjacent structures, the system shall conform to the requirements in Sections 3307.2.1 through 3307.2.3.

[BS] 3307.2.1 Excavation retention system design. Excavation retention systems shall be designed by a registered design professional to provide vertical and lateral support.

[BS] 3307.2.2 Excavation retention system monitoring. The retention system design shall include requirements for monitoring of the system and adjacent structures for horizontal and vertical movement.

[BS] 3307.2.3 Retention system removal. Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by backfill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.

[HCD 1 & HCD 2] Note: See Civil Code Section 832 for additional requirements related to adjoining properties and excavations.

SECTION 3308 TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

3308.1 Storage and handling of materials. The temporary use of streets or public property for the storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

3308.1.1 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access

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to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

3308.2 Utility fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 3309 FIRE EXTINGUISHERS

[F] 3309.1 Where required. Structures under construction, alteration or demolition shall be provided with not fewer than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 3309.2 Fire hazards. The provisions of this code and the *California Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 3310 MEANS OF EGRESS

3310.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3310.2 Maintenance of means of egress. Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

Exception: Existing means of egress need not be maintained where approved temporary means of egress systems and facilities are provided.

SECTION 3311 STANDPIPES

[F] 3311.1 Where required. In buildings required to have standpipes by Section 905.3.1, not fewer than one standpipe shall be provided for use during construction. Such stand-

pipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to *stairways* complying with Section 3310.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 3311.2 Buildings being demolished. Where a building is being demolished and a standpipe exists within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 3311.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 as to capacity, outlets and materials.

SECTION 3312 AUTOMATIC SPRINKLER SYSTEM

[F] 3312.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 111.3.

[F] 3312.2 Operation of valves. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 3313 WATER SUPPLY FOR FIRE PROTECTION

[F] 3313.1 Where required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] 3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per

minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] 3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] 3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] 3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] 3313.4 Vertical construction, Types I and II construction. If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] 3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3311, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

SECTION 3314 FIRE WATCH DURING CONSTRUCTION

[F] 3314.1 Fire watch during combustible construction. A fire watch shall be provided during nonworking hours for construction that exceeds 40 feet (12 192 mm) in height above the lowest adjacent grade at any point along the building perimeter, for new multistory construction with an aggregate area exceeding 50,000 square feet (4645 m²) per story or as required by the fire code official.

CHAPTER 34

RESERVED

Note: Provisions of former Chapter 34, Existing Structures, are now located in Part 10, California Existing Building Code. This change is in keeping with modifications to the 2021 editions of the International Building Code and International Existing Building Code by the International Code Council. See Section 101.4.7.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 35 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X													X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X							
Adopt only those sections that are listed below							X															X
Chapter/Section																						
AAMA 501.4-18								X	X	X	X	X		X	X							
AAMA 501.6-18								X	X	X	X	X		X	X							
AAMA TIR A8-16								X	X	X	X	X		X	X							
ACI 355.2-19								X	X	X	X	X		X	X							
ACI 355.4-19								X	X	X	X	X		X	X							
ACI 440.2R-08								X	X	X	X	X		X	X							
ACI 503.7-07								X	X	X	X	X		X	X							
ACI 506R-16								X	X	X	X	X		X	X							
ACI 506.2-13								X	X	†	†	†		†	†							
ACI 506.4R-94								†	†	X	X	X		X	X							
ACI 506.6T-17								†	†	X	X	X		X	X							
AISC 358-16/s1-18/s2-20								X	X													
ANSI/DASMA 103-2017				X	X																	
ANSI S3.41			X																			
ASCE/SEI 7-16								X	X	X	X	X		X	X							
ASCE/SEI 19-10										X	X	X		X	X							
ASCE/SEI 41-13								†	†	X	X	X		X	X							
ASCE/SEI 41-17								X	X	†	†	†		†	†							
ASME A17.1/CSA B44			X				X															
ASME A18.1-2014							X															
ASME BPE-2009			X																			
ASTM A227/A227M-17				X	X																	
ASTM A229/A229M-17				X	X																	
ASTM A722/A722M-15										X	X	X		X	X							
ASTM A1064-17								X	X	X	X	X		X	X							
ASTM C618-15								†	†	X	X	X		X	X							
ASTM C618-19								X	X	†	†	†		†	†							
ASTM C635/C635M-13a								†	†	X	X	X		X	X							
ASTM C636/C636M-17								X	X													
ASTM C989-16e1								†	†	X	X	X		X	X							
ASTM C989-18a								X	X	†	†	†		†	†							
ASTM C1019-16								X	X	X	X	X		X	X							
ASTM C1249-18								X	X	X	X	X		X	X							
ASTM C1392-20								X	X	X	X	X		X	X							
ASTM C1394-20								X	X	X	X	X		X	X							
ASTM C1401-14								X	X	X	X	X		X	X							

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued**

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X												X									
Adopt entire chapter as amendeded (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X							
Adopt only those sections that are listed below							X															X
Chapter / Section																						
ASTM C1586-05 (2011)								X	X	X	X	X		X	X							
ASTM D1586-20								X	X	X	X	X		X	X							
ASTM D3966-07 (2013)								X	X	X	X	X		X	X							
ASTM D5778-20								X	X	X	X	X		X	X							
ASTM E580/E580M-17								X	X	X	X	X		X	X							
ASTM E662-17a			X					X	X													
ASTM E2632/E2632M-13			X																			
ASTM E2707-15			X																			
ASTM E2726/E2726-12a			X																			
ASTM E3121-17								†	†	X	X	X		X	X							
ASTM F606/F606M-16								X	X	X	X	X		X	X							
ASTM F1292-99							X															
ASTM F1292-04							X															
ASTM F1487-01							X															
ASTM F1951-99							X															
ASTM F2374			X																			
AWS D1.1/D1.1M-15								X	X	X	X	X		X	X							
AWS D1.2/D1.2M-14								X	X	X	X	X		X	X							
AWS D1.3/D1.3M-08								X	X	X	X	X		X	X							
AWS D1.8/D1.8M-16								X	X	X	X	X		X	X							
AWS QCI-16								X	X	X	X	X		X	X							
BHMA A156.10-2011							X															
BHMA A156.19-2013							X															
FEMA P-2082-1								†	†	X	X	X		X	X							
FM 1950-16								X	X	X	X	X		X	X							
FM 3011-99			X																			
FM 3260-00			X																			
FM 4430-80			X																			
ICC-ES AC01-21*								X	X	X	X	X		X	X							
ICC-ES AC58-21*								X	X	X	X	X		X	X							
ICC-ES AC70-21*								X	X	X	X	X		X	X							
ICC-ES AC77			X																			
ICC-ES AC106-21*								X	X	X	X	X		X	X							
ICC-ES AC125-21*								X	X	X	X	X		X	X							
ICC-ES AC156-21*								X	X	X	X	X		X	X							
ICC-ES AC178-21*								X	X	X	X	X		X	X							
ICC-ES AC193-21*								X	X	X	X	X		X	X							
ICC-ES AC232-21*								X	X	X	X	X		X	X							
ICC-ES AC308-21*								X	X	X	X	X		X	X							

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued**

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X												X									
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X							
Adopt only those sections that are listed below							X															X
Chapter / Section																						
ICC ES AC331			X																			
ICC-ES AC358-21*								X	X	X	X	X		X	X							
ICC-ES AC446-21*								X	X	X	X	X		X	X							
ISO 9001-15								X	X	X	X	X		X	X							
NFPA 10-21			X																			
NFPA 11-16																						X
NFPA 13-22			X																			
NFPA 13D-22			X																			
NFPA 13R-22			X																			
NFPA 14-19			X																			
NFPA 24-19			X																			X
NFPA 25-13CA			X																			X
NFPA 32-16			X																			
NFPA 37-18			X																			
NFPA 54-18			X																			
NFPA 72-22			X				X															X
NFPA 110-16																						X
NFPA 111-13																						X
NFPA 130-20			X																			
NFPA 502-20			X																			
NFPA 1124-17			X																			
NFPA 2001-18			X																			
PCI MNL 120-17								X	X	X	X	X		X	X							
PTI DC35.1-14								X	X	X	X	X		X	X							
SFM 12-3			X																			
SFM 12-7-3			X																			
SFM 12-7A-1			X																			
SFM 12-7A-2			X																			
SFM 12-7A-3			X																			
SFM 12-7A-4			X																			
SFM 12-7A-4A			X																			
SFM 12-7A-5			X																			
SFM 12-8-100			X																			
SFM 12-10-1			X																			
SFM 12-10-2			X																			
SFM 12-10-3			X																			
UBC 15-2			X																			
UBC 15-3			X																			
UBC 15-4			X																			
UL 13-96			X																			
UL 38-99			X																			

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**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 35 – REFERENCED STANDARDS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DHS	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter	X													X								
Adopt entire chapter as amended (amended sections listed below)			X	X	X	X		X	X	X	X	X		X	X							
Adopt only those sections that are listed below							X															X
Chapter / Section																						
UL 193-04			X																			
UL 199-95			X																			
UL 228-97			X																			
UL 260-04			X																			
UL 262-04			X																			
UL 268A-09			X																			
UL 312-04			X																			
UL 346-05			X																			
UL 464-03			X																			
UL 497B-04			X																			
UL 521-99			X																			
UL 539-00			X																			
UL 632-00			X																			
UL 753-04			X																			
UL 813-96			X																			
UL 857-13								†	†	X	X	X		X	X							
UL 864-2014			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 35

REFERENCED STANDARDS

User note:

About this chapter: The California Building Code contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Chapter 1, Scope and Administration, Division 1, Sections 1.1.5 and 1.1.7, and in Chapter 1, Scope and Administration, Division II, Section 102.4, as applicable.

[DSA-SS, DSA-SS/CC & OSHPD 1 & 4] Reference to other chapters. *In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 16A, 17A, 18A, 19A, 21A and 22A.*

AA

Aluminum Association
1400 Crystal Drive, Suite 430
Arlington, VA 22202

ADM—2020: Aluminum Design Manual
1604.3.5, 2002.1

ASM 35—00: Aluminum Sheet Metal Work in Building Construction (Fourth Edition)
2002.1

AAMA

American Architectural Manufacturers Association
1900 E Golf Road, Suite 1250
Schaumburg, IL 60173

711—20: Voluntary Specification for Self Adhering Flashing Used for Installation of Exterior Wall Fenestration Products
1404.4

714—19: Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings
1404.4

1402—09: Standard Specifications for Aluminum Siding, Soffit and Fascia
1403.5.1

2502—19: Comparative Analysis Procedure for Window and Door Products
1709.5

AAMA/WDMA/CSA 101/1.S.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Skylights
1709.5.1, 2405.5

501.4-18: Recommended Static Test Method for Evaluating Curtain Wall and Storefront Systems Subjected to Seismic and Wind Induced Interstory Drifts | |
2410.1

501.6-18: Recommended Dynamic Test Method for Determining the Seismic Drift Causing Glass Fallout from a Wall System | |
2410.1

TIR A8-16: Structural Performance of Composite Thermal Barrier Framing Systems
2411.1

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331-3439

117—10: Specification for Tolerances for Concrete Construction and Materials

1901.7.1

216.1—14: Code Requirements for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

Table 721.1(2), 722.1

318—19: Building Code Requirements for Structural Concrete

722.2.4.3, 1604.3.2, 1616.2.1, 1616.3.1, 1704.5, Table 1705.3, 1705.3.2, *Table 1705A.2.1*, *Table 1705A.3*, 1808.8.2, Table 1808.8.2, 1808.8.5, 1808.8.6, 1810.1.3, 1810.2.4.1, 1810.3.2.1.1, 1810.3.2.1.2, 1810.3.8, 1810.3.9.4.2.1, 1810.3.9.4.2.2, 1810.3.10.1, 1810.3.11, 1810.3.11.1, 1810.3.12, 1810.3.13, *1810A.3.10.4*, 1901.2, 1901.3, *1901.3.4.4*, 1902.1, *1903A*, 1903.1, *1904A*, 1904.1, 1904.2, *1905A*, 1905.1, 1905.1.1, 1905.1.2, 1905.1.3, 1905.1.4, 1905.1.5, 1905.1.6, 1905.1.7, 1905.1.8, 1908.1, *1909.2*, *1909.3*, *1910A.5.4*, 2108.3, 2206.1

355.2—19: Qualification of Post-Installed Mechanical Anchors in Concrete and Commentary

1617A.1.19, 1901.3.2

355.4—19: Qualification of Post-Installed Adhesive Anchors in Concrete and Commentary

1617A.1.19, 1901.3.3

440.2R-08: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures

1911.3, *1911A.3*

503.7—07: Specification for Crack Repair by Epoxy Injection

1911.2, *1911A.2*

506R—16: Guide to Shotcrete

1908.1, *1908A.1*

506.2—13: [DSA-SS, DSA-SS/CC] Guide to Shotcrete

1908A.1, *1908A.9*

506.4R—94: [OSHPD] Guide for the Evaluation of Shotcrete

1908.1, *1908A.1*

506.6T—17: [OSHPD] Visual Shotcrete Core Quality Evaluation

1908.1, *1908A.1*

550.5—18: Code Requirements for the Design of Precast Concrete Diaphragms for Earthquake Motions

Table 1705.3

ITG—7-09: Specification for Tolerances for Precast Concrete

1901.7.2

AISC

American Institute of Steel
130 East Randolph Street, Suite 2000
Chicago, IL 60601-6219

ANSI/AISC 341—16: Seismic Provisions for Structural Steel Buildings

1705.13.1.1, 1705.13.1.2, 1705.14.1.1, 1705.14.1.2, *1705A.2.1*, *1705A.2.5*, 1810.3.5.3.1, *2205A*, 2205.2.1.1, 2205.2.1.2, 2205.2.2, *2205.3*, *2206A*, 2206.2.1, *2212.2*

ANSI/AISC 358—16/s1—18: Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications, Including Supplement No. 1

1705A.2.1, *2205A*, 2205.2.1.1, 2205.2.1.2, *2205.4*, *2206A.2*, *2206.2.1*

ANSI/AISC 358—16/s1—18/s2—20: [DSA-SS, DSA-SS/CC] Prequalified Connections for Special and Intermediate Steel Moment Frames for Seismic Applications, Including Supplement No. 1 and No. 2

1705A.2.1, *2205A*, 2205.2.1.1, 2205.2.1.2, *2206A.2*, *2212.3*

ANSI/AISC 360—16: Specification for Structural Steel Buildings

722.5.2.2.1, 1604.3.3, 1705.2.1, *1705A.2.1*, *Table 1705A.2.1*, *1705A.2.5*, 2202.1, 2203.1, *2204.4*, *2204A.4*, 2205.1, 2205.2.1.1, 2206.1, *2212.1.1*, *2212A.1.2*, *2212A.2.1*

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001

AISI S100—16(2020) w/S2—20: North American Specification for the Design of Cold-Formed Steel Structural Members, 2016 Edition (Reaffirmed 2020), with Supplement 2, 2020 Edition

1604.3.3, 1905.1.8, 2202.1, 2203.1, 2210.1, 2210.2, 2211A.2

AISI S202—20: Code of Standard Practice for Cold-formed Steel Framing, 2020

2211.1.3.1

AISI S220—20: North American Standard for Cold-Formed Steel Nonstructural Framing

2202.1, 2203.1, 2211.2, Table 2506.2, Table 2507.2

AISI S230—2019: Standard for Cold-formed Steel Framing—Prescriptive Method for One- and Two-family Dwellings, 2019

1609.1.1, 1609.1.1.1, 2211.1.2

AISI S240—20: North American Standard for Cold-Formed Steel Structuring Framing, 2020

2202.1, 2203.1, 2211.1, 2211.1.1.1, 2211.1.3.3, Table 2506.2, Table 2507.2, Table 2603.12.1, Table 2603.12.2

AISI S400—20: North American Standard for Seismic Design of Cold-formed Steel Structural Systems, 2020

2210.2, 2211.1.1.1, 2211.1.1.2

ALI

Automotive Lift Institute, Inc.
P.O. Box 85
Cortland, NY 13045

ALI ALCTV—2017: Standard for Automotive Lifts—Safety Requirements for Construction, Testing and Validation (ANSI)

Table 3001.3

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004

540—13: Test Method for Louvers Impacted by Wind Borne Debris

1609.2.1

ANSI

American National Standards Institute
25 West 43rd Street, Fourth Floor
New York, NY 10036

A13.1—2020: Scheme for the Identification of Piping Systems

415.11.7.5

A108.1A—17: Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar

2103.2.3

A108.1B—17: Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex-Portland Mortar

2103.2.3

A108.4—09: Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive

2103.2.3.6

A108.5—19: Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-Portland Cement Mortar

2103.2.3.1, 2103.2.3.2

A108.6—99 (reaffirmed 2019): Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy

2103.2.3.3

A108.8—99 (reaffirmed 2019): Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout

2103.2.3.4

A108.9—19: Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout

2103.2.3.5

A108.10—17: Installation of Grout in Tilework

2103.2.3.7

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ANSI—continued

- A118.1—18: American National Standard Specifications for Dry-set Portland Cement Mortar**
2103.2.3.1
- A118.3—13: American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive**
2103.2.3.3
- A118.4—18: American National Standard Specifications for Modified Dry-set Cement Mortar**
2103.2.3.2, 2103.2.4
- A118.5—99: American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation**
2103.2.3.4
- A118.6—19: American National Standard Specifications for Cement Grouts for Tile Installation**
2103.2.3.7
- A118.8—99: American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout**
2103.2.3.5
- A136.1—20: American National Standard Specifications for the Installation of Ceramic Tile**
2103.2.3.6
- A137.1—19: American National Standard Specifications for Ceramic Tile**
202
- A137.3—17: American National Standard Specifications for Gauged Porcelain Tiles and Gauged Porcelain Tile Panel/Slabs**
202
- S3.41: American National Standard Specifications for Audible Emergency Evacuation Signal*
907.5.2.1.3
- Z 97.1—14: Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test**
2406.1.2, 2406.2, Table 2406.2(2), 2406.3.1, 2407.1, 2407.1.4, 2408.2.1, 2408.3, 2409.2, 2409.3, 2409.4.1

APA

APA - Engineered Wood Association
7011 South 19th Street
Tacoma, WA 98466-7400

- ANSI 117—2020: Standard Specification for Structural Glued Laminated Timber of Softwood Species**
2306.1
- ANSI/APA A190.1—2017: Structural Glued Laminated Timber**
1705.5.5, 2303.1.3, 2306.1
- ANSI/APA PRG 320—2019: Standard for Performance-rated Cross-laminated Timber**
602.4, 2303.1.4
- ANSI/APA PRP 210—2019: Standard for Performance-Rated Engineered Wood Siding**
2303.1.5, 2304.7, 2306.3, Table 2306.3(1)
- ANSI/APA PRR 410—16: Standard for Performance-Rated Engineered Wood Rim Boards**
2303.1.13
- APA PDS Supplement 1—12: Design and Fabrication of Plywood Curved Panels (revised 2013)**
2306.1
- APA PDS Supplement 2—12: Design and Fabrication of Plywood-lumber Beams (revised 2013)**
2306.1
- APA PDS Supplement 3—12: Design and Fabrication of Plywood Stressed-skin Panels (revised 2013)**
2306.1
- APA PDS Supplement 4—12: Design and Fabrication of Plywood Sandwich Panels (revised 2013)**
2306.1
- APA PDS Supplement 5—16: Design and Fabrication of All-plywood Beams (revised 2013)**
2306.1
- APA PDS—20: Panel Design Specification**
2306.1
- APA R540—19: Builder Tips: Proper Storage and Handling of Glulam Beams**
2306.1
- APA S475—20: Glued Laminated Beam Design Tables**
2306.1

APA—continued

- APA S560—20: Field Notching and Drilling of Glued Laminated Timber Beams**
2306.1
- APA T300—16: Glulam Connection Details**
2306.1
- APA X440—17: Product Guide: Glulam**
2306.1
- APA X450—18: Glulam in Residential Construction—Building—Construction Guide**
2306.1

ASABE

American Society of Agricultural and Biological Engineers
2950 Niles Road
St. Joseph, MI 49085

- EP 484.3 DEC2017: Diaphragm Design of Metal-clad, Wood-frame Rectangular Buildings**
2306.1
- EP 486.3 SEP2017: Shallow-post and Pier Foundation Design**
2306.1
- EP 559.1 AUG2010(R2019): Design Requirements and Bending Properties for Mechanically Laminated Wood Assemblies**
2306.1

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191

- 7—16 with Supplements 1, 2 and 3: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
104.11, 202, Table 1504.2, Table 1504.8, 1510.7.1, 1602.1, 1603A.1.5, 1603A.2, Table 1604.3, 1604.4, 1604A.4, 1604.5, Table 1604.5, 1604.8.2, 1604.9, 1605.1, 1605.1.1, 1605.2, 1606.3, 1607.9.1, 1607.9.1.1, 1607.9.1.2, 1607.10, 1607.14.1, 1607.17, 1608.1, 1608.2, Figure 1608.2(1), 1608.3, 1609.1.1, 1609.2, 1609.3, Figure 1609.3(5), Figure 1609.3(6), Figure 1609.3(7), Figure 1609.3(8), Figure 1609.3(9), Figure 1609.3(10), Figure 1609.3(11), Figure 1609.3(12), 1609.5.1, 1609.5.3, 1611.1, 1611.2, 1612.2, 1613.1, 1613.2.2, 1613.2.3, Table 1613.2.3(1), Table 1613.2.3(2), 1613.2.5, 1613.2.5.1, 1613.2.5.2, 1613.3, 1614.1, 1615.1, 1617, 1617A, 1705.13, 1705.13.1.1, 1705.13.1.2, 1705.13.4, 1705.14.1.1, 1705.14.1.2, 1705.14.2, 1705.14.3, 1705.14.4, 1709.5, 1709.5.3.1, 1802.1, 1803.5.12, 1803A.6, 1806.1, 1807A.2.5, 1811A.4, 1808.3, 1808.3.1, 1809.13, 1810.3.1.1, 1810.3.6.1, 1810.3.8, 1810.3.9.2, 1810.3.9.4, 1810.3.9.4.1, 1810.3.9.4.2, 1810.3.11.2, 1810.3.12, 1811A.4, 1902.1, 1905.1.2, 1905.1.7, 1905.1.8, 2205.2.1.1, 2205.2.1.2, 2205.2.2, 2206.2.1, 2209.1, 2209.2, 2210.2, 2210A.2, 2211.1.1.1, 2212A.1.1, 2212A.2.4, Table 2304.6.1, Table 2306.3(3), Table 2308.7.5, 2404.1, 2410.1.1, 2410.1.2, 2505.1, 2505.2, 2506.2.1, 3115.8.4.2
- 8—02: Standard Specification for the Design of Cold-formed Stainless Steel Structural Members**
1604.3.3, 2210.1, 2210.2
- 19—16: Structural Applications of Steel Cables for Buildings**
2208.1
- 24—14: Flood Resistant Design and Construction**
1202.4.2, 1202.4.4, 1612.2, 1612.4, 2702.1.8, 3001.3
- 29—17: Standard Calculation Methods for Structural Fire Protection**
722.1
- 32—01: Design and Construction of Frost Protected Shallow Foundations**
1809.5
- 41—13: [OSHPD] Seismic Evaluation and Retrofit of Existing Buildings**
1603A.2
- 41—17: [DSA-SS, DSA-SS/CC] Seismic Evaluation and Retrofit of Existing Buildings**
1603A.2
- 49—12: Wind Tunnel Testing for Buildings and Other Structures**
1609.1.1

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ASCE/SEI—continued

55—16: Tensile Membrane Structures
3102.2

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329USA

170—2017: Ventilation of Health Care Facilities
1020.6

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016

> **A17.1—2019/CSA B44: the edition as referenced in: California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders Safety Code for Elevators and Escalators**

907.3.3, 911.1.6, 1009.4.1, 11B-407.1, 11B-407.1.1, 11B-407.4.9, 11B-408.1, 11B-409.1, 11B-411.1,
11B-810.9, 1607.11.1, 3001.2, Table 3001.3, 3001.4, 3001.5, 3002.5, 3003.2, 3007.1, 3008.1.4, 3008.7.1

A17.7—2007/CSA B44—07(R2017): Performance-based Safety Code for Elevators and Escalators

Table 3001.3, 3001.5, 3002.5

A18.1—2020: Safety Standard for Platform Lifts and Stairway Chairlifts

1110.9, Table 3001.3

A90.1—2015: Safety Standard for Belt Manlifts

Table 3001.3

B16.18—2018: Cast Copper Alloy Solder Joint Pressure Fittings

909.13.1

B16.22—2018: Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

909.13.1

B20.1—2021: Safety Standard for Conveyors and Related Equipment

Table 3001.3, 3004.3

BPE—2009: Bio-processing Equipment Standard

B31.3—2014: [SLC] Process Piping

415.11.6

B31.3—2020: Process Piping

415.11.7

ASSP

American Society of Safety Professionals
520 N. Northwest Highway
Park Ridge, IL 60068

ANSI/ASSE Z359.1—2020: The Fall Protection Code

1015.6, 1015.7

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

A6/A6M—2017A: Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes and Sheet Piling

1810.3.2.3, 1810.3.5.3.1, 1810.3.5.3.3

A36/A36M—14: Specification for Carbon Structural Steel

1810.3.2.3

A153/A153M—2016A: Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware

2304.10.2.1, 2304.10.6

A227/A227M—17: Standard Specification for Steel Wire, Cold-Drawn for Mechanical Springs

1211.1.1

ASTM—continued

- A229/A229M—17: Standard Specification for Steel Wire, Quenched and Tempered for Mechanical Springs**
1211.1.1
- A240/A240M—17: Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications**
Table 1507.4.3(1)
- A252—2010(2018): Specification for Welded and Seamless Steel Pipe Piles**
1810.3.2.3
- A283/A283M—2018: Specification for Low and Intermediate Tensile Strength Carbon Steel Plates**
1810.3.2.3
- A416/A416M—2017A: Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete**
1810.3.2.2
- A463/A463M—15: Standard Specification for Steel Sheet, Aluminum-coated, by the Hot-dip Process**
Table 1507.4.3(2)
- A572/A572M—2018: Specification for High-strength Low-alloy Columbium-Vanadium Structural Steel**
1810.3.2.3
- A588/A588M—15: Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 MPa) Minimum Yield Point with Atmospheric Corrosion Resistance**
1810.3.2.3
- A615/A615M—15ae1: Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement**
1704.5, 1810.3.10.2
- A653/A653M—2017: Specification for Steel Sheet, Zinc-coated Galvanized or Zinc-iron Alloy-coated Galvannealed by the Hot-dip Process**
Table 1507.4.3(1), Table 1507.4.3(2), 2304.10.6.1
- A690/A690M—13a(2018): Standard Specification for High-strength Low-alloy Nickel, Copper, Phosphorus Steel H-piles and Sheet Piling with Atmospheric Corrosion Resistance for Use in Marine Environments**
1810.3.2.3
- A706/A706M—2016: Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement**
1704.5, Table 1705.3, 2107.3, 2108.3
- A722/A722M—2015: [OSHPD]: Specification for High-strength Steel Bars for Prestressed Concrete**
1810.3.10.2, 1811.4, 1811A.4, 1812.4.2, 1812A.4.2
- A722/A722M—2018: Specification for High-strength Steel Bars for Prestressed Concrete**
1810.3.10.2
- A755/A755M—2016E1: Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products**
Table 1507.4.3(1), Table 1507.4.3(2)
- A792/A792M—10(2015): Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process**
Table 1507.4.3(1), Table 1507.4.3(2)
- A875/A875M—13: Standard Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-coated by the Hot-dip Process**
Table 1507.4.3(2)
- A924/A924M—2017A: Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process**
Table 1507.4.3(1)
- A1064—17: Standard Specification for Carbon-steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete**
1903.8, 1903A.8
- B42—2015A: Specification for Seamless Copper Pipe, Standard Sizes**
909.13.1
- B43—15: Specification for Seamless Red Brass Pipe, Standard Sizes**
909.13.1
- B68/B68M—11: Specification for Seamless Copper Tube, Bright Annealed (Metric)**
909.13.1
- B88—2016: Specification for Seamless Copper Water Tube**
909.13.1
- B101—12: Specification for Lead-coated Copper Sheet and Strip for Building Construction**
1403.5.3, Table 1507.2.8.2, Table 1507.4.3(1)

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- B209—14: Specification for Aluminum and Aluminum Alloy Steel and Plate**
Table 1507.4.3(1)
- B251—2017: Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube**
909.13.1
- B280—2018: Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service**
909.13.1
- B370—12: Specification for Copper Sheet and Strip for Building Construction**
1403.5.2, Table 1507.2.8.2, Table 1507.4.3(1)
- B695—2004(2016): Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel Strip for Building Construction**
2304.10.2.1, 2304.10.6.1, 2304.10.6.3
- C5—2018: Specification for Quicklime for Structural Purposes**
2109.2.4.8.7, Table 2507.2
- C22/C22M—2015: Specification for Gypsum**
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- C27—1998(2018): Specification for Classification of Fireclay and High-alumina Refractory Brick**
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- C28/C28M—10(2015): Specification for Gypsum Plasters**
Table 2507.2
- C31/C31M—2018B: Practice for Making and Curing Concrete Test Specimens in the Field**
Table 1705.3
- C33/C33M—2018: Specification for Concrete Aggregates**
722.3.1.4, 722.4.1.1.3
- C35/C35—01(2014): Specification for Inorganic Aggregates for Use in Gypsum Plaster**
Table 2507.2
- C55—2017: Specification for Concrete Building Brick**
Table 722.3.2
- C59/C59M—00(2015): Specification for Gypsum Casting Plaster and Molding Plaster**
Table 2507.2
- C61/C61M—00(2015): Specification for Gypsum Keene’s Cement**
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AWC

American Wood Council
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

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AWCI

Association of the Wall and Ceiling Industry
513 West Broad Street, Suite 210
Falls Church, VA 22046

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AWPA

American Wood Protection Association
P.O. Box 361784
Birmingham, AL 35236-1784

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AWS

American Welding Society
8669 NW 36 Street, #130
Miami, FL 33166-6672

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BHMA

Builders Hardware Manufacturers' Association
355 Lexington Avenue, 15th Floor
New York, NY 10017

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CEN

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Rue de la Science 23
Brussels, Belgium 1000

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CPA

Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176

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CPSC

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4330 East/West Highway
Bethesda, MD 20814

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CSA

Canadian Standards Association
8501 East Pleasant Valley Road
Cleveland, OH 44131

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CSSB

Cedar Shake & Shingle Bureau
P. O. Box 1178
Sumas, WA 98295-1178

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DASMA

Door & Access Systems Manufacturers Association International
1300 Sumner Avenue
Cleveland, OH 44115

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DHA

Decorative Hardwoods Association
42777 Trade West Dr
Sterling, VA 20166

ANSI/HPVA HP-1—2016: American National Standard for Hardwood and Decorative Plywood

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DOC

U.S. Department of Commerce
National Institute of Standards and Technology
100 Bureau Drive
Gaithersburg, MD 20899

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DOL

U.S. Department of Labor
Occupational Safety and Health Administration
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20210

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DOTn

U.S. Department of Transportation
Office of Hazardous Material Safety
1200 New Jersey Avenue, SE
East Building, 2nd Floor
Washington, DC 20590

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EN

European Committee for Standardization
Rue de la Science 23 B
Brussels, Belgium 1040 Belgium

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FEMA

Federal Emergency Management Agency
500 C Street S.W.
Washington, DC 20472

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FM

FM Approvals
Headquarters Office
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

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GA

Gypsum Association
962 Wayne Avenue, Suite 620
Silver Spring, MD 20910

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ICC

International Code Council, Inc.
500 New Jersey Ave NW 6th Floor
Washington, DC 20001

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- ICC-ES AC 358—21*: *Acceptance Criteria for Helical Foundation Systems and Devices* 1810A.3.1.5.1, 1810.3.1.5.1
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- ICC 1100—18: **Standard for Spray-applied Foam Plastic Insulation** 2603.1.1
- ICC A117.1—17: **Accessible and Usable Buildings and Facilities** 202, 907.5.2.3.3, 1009.8.2, 1009.9, 1009.11, 1010.2.13.1, 1012.1, 1012.6.5, 1012.10, 1013.4, 1023.9, 1102.1, 1108.2, 1110.1, 1110.2, 1110.5.1, 1110.5.2, 1112.3, 1112.4, 1112.5, 1112.5.2, 1207.1
- SBCCI SSTD 11—97: **Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles** 1504.3.1.1, 1504.3.1.2, 1504.3.1.3 ←

* Refers to International Building Code, 2021 as a reference standard.

ISO

International Organization for Standardization
 Chemin de Blandonnet 8
 CP 401 1214 Vernier
 Geneva, Switzerland

- ISO 668—2013: **Series 1 Freight Containers—Classifications, Dimensions and Ratings** Table 3115.8.5.3
- ISO 1496-1—2013: **Series 1 Freight Containers—Specification and Testing - Part 1: General Cargo Containers for General Purposes** 3115.8, Table 3115.8.5.3
- ISO 6346—1995: **Freight Containers—Code, Identification and Marking with Amendment 3 - 2012** 3115.3
- ISO 8115—86: **Cotton Bales—Dimensions and Density** Table 307.1(1), Table 415.11.1.1.1
- ISO 8336—09: **Fiber-cement Flat Sheets—Product Specification and Test Methods** 1403.10, 1404.16.1, 1404.16.2, Table 2509.2
- ISO 9001—15: *Quality Management Systems - Requirements* 1705A.14.3 ||

MHI

Material Handling Institute
 8720 Red Oak Blvd. Suite 201
 Charlotte, NC 28217

- ANSI MH29.1—08: **Safety Requirements for Industrial Scissors Lifts** Table 3001.3
- ANSI/MH16.1—12: **Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks** Table 1705.13.7

REFERENCED STANDARDS

NAAMM

National Association of Architectural Metal Manufacturers
800 Roosevelt Road, Bldg. C, Suite 312
Glen Ellyn, IL 60137

FP 1001—07: Guide Specifications for Design of Metal Flag Poles
1609.1.1

NCMA

National Concrete Masonry Association
13750 Sunrise Valley
Herndon, VA 20171

TEK 5—8B(2005): Details for Concrete Masonry Fire Walls
Table 721.1(2)

NEHRP

*Building Seismic Safety Council
National Institute of Building Sciences
1090 Vermont Avenue NW
Suite 700
Washington, DC 20005*

FEMA P-2082—1: Recommended Seismic Provisions for New Building and Other Structures, Volume 1, September 2020
1617A.1.3

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

04—21: Standard for Integrated Fire Protection and Life Safety System Testing
901.6.2.1, 901.6.2.2

10—21: Standard for Portable Fire Extinguishers
906.2, Table 906.3(1), Table 906.3(2), 906.3.2, 906.3.4

11—16: Standard for Low-, Medium, and High Expansion Foam
904.7, 3109F

12—15: Standard on Carbon Dioxide Extinguishing Systems
904.8, 904.13

12A—18: Standard on Halon 1301 Fire Extinguishing Systems
904.9

13—22: Standard for Installation of Sprinkler Systems as amended*
403.3.3, 712.1.3.1, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.13, 905.3.4, 907.6.4, 1019.3

**NFPA 13, Amended Sections as follows:*

**Revise Section 2.2 and add publications as follows:
2.2 NFPA Publications.**

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Revise Section 6.4.3.1.1* as follows:

6.4.3.1.1* Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.

Exceptions:

2. Where allowed in accordance with Section 6.4.3.1.

3. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Delete Sections 8.15.5.1 and 8.15.5.2

8.15.5.1* Reserved.

8.15.5.2 Reserved.

NFPA—continued

Revise Section 9.2.1.16 as follows:

9.2.1.16 Exterior columns under 10 ft² (0.93m²) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.

Revise Section 9.2.3.1* as follows:

9.2.3.1* Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, portecocheres, balconies, decks or similar projections are constructed with materials that are noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials.

Delete Section A.9.2.3.1 of Annex

Revise Section 9.2.3.2

9.2.3.2 Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks or similar projections are combustible construction, provided the exposed finish material on the roof, or canopy is noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials, and the roofs or canopies contains only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:

- (1) Combustible concealed spaces filled entirely with noncombustible insulation.
- (2) Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft³ (4.5 m³) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic [See 11.2.3.1.5.2(9)].
- (3) Concealed spaces over isolated small roofs or canopies not exceeding 55 ft² (5.1 m²).

Delete language to section 9.2.3.3 and reserve section number.

9.2.3.3 Reserved.

Revise Section 9.3.6.1 as follows:

9.3.6.1 Automatic fire sprinklers shall not be required in elevator machine rooms, elevator machinery spaces, control spaces or hoistways of traction elevators installed in accordance with the applicable provisions in *the California Building Code*, where all of the following conditions are met:

- (1) The elevator machine room, machinery space, control room, control space or hoistway of traction elevator is dedicated to elevator equipment only.
- (2) The elevator machinery space, control room, control space or hoistway of traction elevators is separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire resistance rating of not less than that specified by the applicable building code.
- (3) No materials unrelated to elevator equipment are permitted to be stored in elevator machine rooms, machinery spaces, control rooms, control spaces or hoistways of traction elevators.
- (4) The elevator machinery is not of the hydraulic type.

Add new Section 9.3.6.1.1 as follows:

9.3.6.1.1 The sprinkler required at the top and bottom of the elevator hoistway by 8.15.5.6 shall not be required where permitted by Chapter 30 of the *California Building Code*.

Revise Section 9.3.19.1* as follows:

9.3.19.1* Unless the requirements of 9.2.3.1 or 9.2.3.2 are met, sprinklers shall be installed under exterior roofs, canopies, portecochere, balconies, decks or similar projections exceeding 4 ft (1.2 m) in width.

Revise Annex Section A9.3.19.2 as follows:

A9.3.19.2 The presence of planters, newspaper machines and similar items, should not be considered storage.

Add Section 9.3.19.3 as follows:

9.3.19.3 Sprinklers may be omitted for following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

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Add new Sections 16.9.3.1.3.4 and 16.9.3.1.3.5 as follows:

16.9.3.1.3.4 Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area.

16.9.3.1.3.5 Control valves, check valves, drain valves, antifreeze valves shall be readily accessible for inspection, testing and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.

Add new Sections 16.9.10.5, 16.9.10.5.1, 16.9.10.5.1.1, 16.9.10.5.1.2, 16.9.10.5.1.3, 16.9.10.5.1.4, 16.9.10.5.2 as follows:

16.9.10.5 Sectional Valves.

16.9.10.5.1 Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.

16.9.10.5.1.1 Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

16.9.10.5.1.2 Sectional control valves shall be indicating valves in accordance with Section 16.9.3.2.

16.9.10.5.1.3 Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser, and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.

16.9.10.5.1.4 The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

16.9.10.5.2 A valve shall be provided on each bank where a main crosses a body of water or outside the building foundation(s) where the main or section of main runs under a building.

Add new Section 17.2.2.9.1 as follows:

17.2.2.9.1 Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic design Categories C, D, E and F.

Revise Section 18.5.11.4 as follows:

18.5.11.4 Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.

Replace Section 18.5.12.5 as follows:

18.5.12.5 Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.

Replace Section 18.5.12.6.1 as follows:

18.5.12.6.1 Fastening methods other than those identified in 9.3.5.12 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 18.5.9. Calculations shall be submitted to the authority having jurisdiction.

Revise Section 18.5.12.7.4 as follows:

18.5.12.7.4 Concrete anchors when identified in 18.5.11.11 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

Revise Section 18.6.1(3) as follows:

18.6.1*(3) No. 12, 440 lb (200 Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.

Revise Section 19.2.3.1.5.2(9) as follows:

19.2.3.1.5.2(9) Exterior columns under 10 ft² (0.93m²) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system.

Revise Section 19.2.3.2.3.1 as follows:

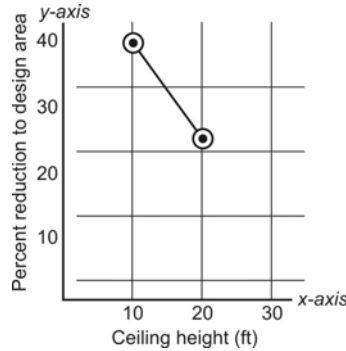
19.2.3.2.3.1 Where listed quick-response sprinklers, excluding extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 19.2.3.2.3.1 when all of the following conditions are satisfied:

- (1) Wet pipe system
- (2) Light hazard occupancy

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- (3) 20 ft (6.1 m) maximum ceiling height
- (4) There are no unprotected ceiling pockets as allowed by 10.2.9 and 11.2.7 exceeding 32 ft² (3 m²)

FIGURE 19.2.3.2.3.1
DESIGN AREA REDUCTION FOR QUICK-RESPONSE SPRINKLERS



Note: $y = \frac{-3x}{2} + 55$

For ceiling height ≥ 10 ft and ≤ 20 ft, $y = \frac{-3x}{2} + 55$

For ceiling height < 10 ft, $y = 40$

For ceiling height > 20 ft, $y = 0$

For SI units, 1 ft = 0.31 m.

Revise Section 19.2.3.2.3.2 as follows:

19.2.3.2.3.2 The number of sprinklers in the design area shall never be less than seven.

Revise Section 20.9.5.2 as follows:

20.9.5.2 Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a standard-response operating mechanism with a minimum temperature rating of 360°F (182°C) or 100°F (56°C) above the operating temperature of the sprinklers, whichever is higher.

23.8.1.2 Positive Alarm Sequence

23.8.1.2.1 Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.

Add Section 28.1.3(18)(e) as follows:

28.1.3(18)(e) Where a waterflow test is used for the purposes of system design, the test shall be conducted no more than 6 months prior to working plan submittal unless otherwise approved by the authority having jurisdiction.

Revise Section 29.1 as follows:

29.1 Approval of Sprinkler Systems and Private Fire Service Mains. The installing contractor shall do the following:

- (1) Notify the authority having jurisdiction and the property owner or property owner’s authorized representative of the time and date testing will be performed.
- (2) Perform all required testing (see Section 29.2).
- (3) Complete and sign the appropriate contractor’s material and test certificate(s) (see Figure A.29.1).
- (4) Remove all caps and straps prior to placing the sprinkler system in service.
- (5) Upon system acceptance by the authority having jurisdiction a label prescribed by Title 19 California Code of Regulations, Chapter 5 shall be affixed to each system riser.

Revise Section 29.3 as follows:

29.3 Instructions. The installing contractor shall provide the property owner or the property owner’s authorized representative with the following:

- (1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.
- (2) NFPA 25, *Standard for the Inspection, testing, and maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*
- (3) Title 19, California Code of Regulations, Chapter 5, “Fire Extinguishing Systems.”

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Revise Section 29.4.1 as follows:

29.4.1 *The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area. Pipe schedule systems shall be provided with a sign indicating that the system was designed and installed as a pipe schedule system and the hazard classification(s) included in the design.*

Revise Section 29.4.3 as follows:

29.4.3 *The sign shall include the following information:*

- (1) Location of the design area or areas
- (2) Discharge densities over the design area or areas
- (3) *Required flow and pressure of the system at the base of the riser.*
- (4) Occupancy classification or commodity classification and maximum permitted storage height and configuration
- (5) Hose stream allowance included in addition to the sprinkler demand
- (6) The name of the installing contractor
- (7) Required flow and pressure of the system at the water supply source.
- (8) Required flow and pressure of the system at the discharge side of the fire pump where a fire pump is installed.
- (9) Type or types and number of sprinklers or nozzles installed including the orifice size, temperature rating, orientation, K-Factor, sprinkler identification number (SIN) for sprinkler heads when applicable, and response type.
- (10) The minimum discharge flow rate and pressure required from the hydraulically most demanding sprinkler.
- (11) The required pressure settings for pressure reducing valves.
- (12) For deluge sprinkler systems, the required flow and pressure at the hydraulically most demanding sprinkler or nozzle.
- (13) The protection area per sprinkler based on the hydraulic calculations.
- (14) The edition of NFPA 13 to which the system was designed and installed.

Revise Section 29.6.1 as follows:

29.6.1 *The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*

13D—22: Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes, as amended*
903.3.1.3

***NFPA 13D, Amended Sections as follows:**

Revise Section 6.2.2 to read as follows:

6.2.2 *Where a well, pump, tank or combination thereof is the source of supply for a fire sprinkler system, the configuration for the system shall be one of the following:*

- (1) *The water supply shall serve both domestic and fire sprinkler systems.*
 - (a) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
 - (b) Any disconnecting means for the pump shall be approved.
 - (c) A method for refilling the tank shall be piped to the tank.
 - (d) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (e) The pump shall not be permitted to sit directly on the floor.
- (2) A stand-alone tank is permitted if the following conditions are met:
 - (a) The pump shall be connected to a 220-volt circuit breaker shared with a common household appliance (e.g., range, oven, dryer),
 - (b) The pump shall be a stainless steel 240-volt pump,
 - (c) A valve shall be provided to exercise the pump. The discharge of the exercise valve shall drain to the tank, and
 - (d) A sign shall be provided stating: “Valve must be opened monthly for 5 minutes.”
 - (e) A means for automatically refilling the tank level, so that the tank capacity will meet the required water supply duration in minutes, shall be provided.
 - (f) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
 - (g) Any disconnecting means for the pump shall be approved.
 - (h) A method for refilling the tank shall be piped to the tank.
 - (i) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (j) The pump shall not be permitted to sit directly on the floor.

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Add new Section 6.2.2.1 as follows:

6.2.2.1 Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.

Add new Section 6.2.4 as follows:

6.2.4 Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.

Revise Section 8.3.4 as follows:

8.3.4* Sprinklers shall not be required in detached garages, open attached porches, carports with no habitable space above, and similar structures.

Add new Sections 8.3.11 and 8.3.11.1 as follows:

8.3.11 Solar photovoltaic panel structures

8.3.11.1 Sprinklers shall be permitted to be omitted from the following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

13R—22: Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies, as amended*

903.3.1.2, 903.3.5.2, 903.4

***NFPA 13R, Amended Sections as follows:**

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2013 California edition.

Add new Sections 6.6.10 and 6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures

6.6.10.1 Sprinklers shall be permitted to be omitted from the following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

- (1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.
- (2) NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems* 2013 California Edition and Title 19, *California Code of Regulations*, Chapter 5.
- (3) Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, *California Code of Regulations*, Chapter 5, shall be affixed to each system riser.

14—19: Standard for the Installation of Standpipe and Hose System, as amended*

905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

***NFPA 14, Amended Sections as follows:**

Replace Section 6.3.7.1

6.3.7.1 System water supply valves, isolation control valves and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:

- (1) Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:
 - (a) a central station, proprietary or remote supervising station, or
 - (b) a local signaling service that initiates an audible signal at a constantly attended location.

REFERENCED STANDARDS

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- (2) Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:
- (a) Locking the valves in the open position, or
 - (b) Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

16—19: Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems

904.7, 904.13

17—21: Standard for Dry Chemical Extinguishing Systems

904.6, 904.13

17A—21: Standard for Wet Chemical Extinguishing Systems

904.5, 904.13

20—19: Standard for the Installation of Stationary Pumps for Fire Protection

412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

24—19: Standard for Installation of Private Fire Service Mains and Their Appurtenances, as amended*

3109F

**NFPA 24, Amended Sections as follows:*

Amend Section 4.2.1 as follows:

Section 4.2.1. Installation work shall be done by fully experienced and responsible contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.

Revise Section 4.2.2 as follows:

4.2.2 Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and as approved by the authority having jurisdiction.

Add Sections 6.6.1.1, 6.6.1.2, 6.6.1.3 and 6.6.1.4 as follows:

6.6.1.1 Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

6.6.1.2 Sectional control valves shall be indicating valves in accordance with NFPA 13, Section 6.7.1.3.

6.6.1.3 Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.

6.6.1.4 The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

Revise Section 10.4.3.1.1 as follows:

10.4.3.1.1 Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.

Exceptions:

1. Where allowed in accordance with 10.4.3.2.
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 10.9.1 as follows:

10.9.1 Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement. Backfill shall consist of clean fill sand or pea gravel to a minimum 6" below and to a minimum of 12" above the pipe and shall contain no ashes, cinders, refuse, organic matter or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.

25—13CA: California NFPA 25 Edition (Based on the 2011 Edition) Inspection, Testing and Maintenance of Water-based Fire Protection Systems
Chapter 31F, 3108F

30—21: Flammable and Combustible Liquids Code

415.6.1, 415.6.2, 507.8.1.1.1, 507.8.1.1.2

30A—21: Code for Motor Fuel Dispensing Facilities and Repair Garages

406.2.9.2

NFPA—continued

31—20: Standard for the Installation of Oil-burning Equipment

2113.15

32—16: Standard for Dry Cleaning Facilities, as amended*

415.9.3, 2101.1.1

**NFPA 32, Amended Sections as follows:*

Delete the following publications from Section 2.2:

2.2 NFPA Publications.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2010 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2011 edition.

NFPA 70, *National Electrical Code*®, 2011 edition.

NFPA 101®, *Life Safety Code*®, 2009 edition.

NFPA 5000®, *Building Construction and Safety Code*®, 2009 edition.

Revise Section 4.4.1.1 as follows:

4.4.1.1 General building and structure design and construction shall be in accordance with *California Building Code*.

Delete language to Sections 4.4.1.2 and 4.4.1.3 and reserve section numbers.

4.4.1.2 Reserved

4.4.1.3 Reserved

Revise Section 4.4.4 as follows:

4.4.4 Means of Egress. Means of egress shall conform with the provisions of *the California Building Code*.

Revise Section 4.6.2 as follows:

4.6.2 Automatic Sprinkler Systems. Where required by this standard, automatic sprinkler systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and periodically inspected, tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

Revise Section 4.6.4 as follows:

4.6.4 Portable Fire Extinguishers. Suitable numbers and types of portable fire extinguishers shall be installed and maintained throughout the drycleaning plant in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

Revise Section 7.3.2 as follows:

7.3.2 Electrical Installations. Electrical equipment and wiring in a Type II drycleaning room shall comply with the provisions of *California Electrical Code*, for use in Class I, Division 2 hazardous locations.

37—18: Installation and Use of Stationary Combustion Engines and Gas Turbines

40—19: Standard for the Storage and Handling of Cellulose Nitrate Film

409.1

54—18: National Fuel Gas Code

58—20: Liquefied Petroleum Gas Code

415.9.2

61—20: Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities

426.1

68—13: Standard on Explosion Protection by Deflagration Venting

Table 414.5.1

70—20: National Electrical Code

108.3, 406.2.7, 406.2.9, 412.5.7, 415.11.1.8, Table 509.1, 904.3.1, 907.6.1, 909.12.2, 909.16.3, 910.4.6, 1204.4.1, 2701.1, 2702.1.3, 3111.3

72—22: National Fire Alarm and Signaling Code, as amended*

407.4.4.5, 407.4.4.5.1, 901.6, 903.4.1, 904.3.5, 907.1.2, 907.2, 907.2.6, 907.2.9.3, 907.2.11, 907.2.13.2, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.2, 907.5.2.2.5, 907.6, 907.6.1, 907.6.2, 907.6.6, 907.7, 907.7.1, 907.7.2, 911.1.6, 915.4.1, 915.5.2, 915.7, 917.1, 2702.2.4, 3005.5, 3007.7, 3108F

NFPA—continued

*NFPA 72, Amended Sections as follows:

Revise Section 10.3.1 as follows:

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

Revise Section 10.3.3 as follows:

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be *California State Fire Marshal* listed for use with the control unit.

Revise Section 12.3.8.1 as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure or raceway only under the following conditions:

- (1) For a distance not to exceed 10 ft (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance or control unit enclosures.
- (2) Single drops installed in the raceway to individual devices or appliances.
- (3)*In a single room not exceeding 1000 ft² (93 m²) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices.
- (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire-resistive rating.

Revise Section 14.4.6.1 as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in accordance with the manufacturer's published instructions according to the methods of Table 14.4.3.2.

Revise Section 17.16 as follows:

17.16 Fire Extinguisher Electronic Monitoring Device. A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by *California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2 (c) and California Fire Code to a fire alarm control unit.*

Delete the amendments to Section 21.3.6 and adopt the model text.

Revise Section 12.3.8 as follows:

12.3.8 (5) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

23.8.1.2 Positive Alarm Sequence

23.8.1.2.1 *Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.*

Revise Section 23.8.5.1.2 as follows:

23.8.5.1.2* Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring *as permitted in Section 17.15 of NFPA 72.*

Revise Section 23.8.5.4.1 as follows:

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

- (1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.
- (2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 by more than 30 seconds.
- (3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 without additional delay.
- (4) The current status of the alarm verification feature is shown on the record of completion (*see Figure 7.8.2(a), Item 4.3*).
- (5) *Operation of a patient room smoke detector in I-2 and R-2.1 occupancies shall not include an alarm verification feature.*

Revise Section 29.3.1 as follows:

29.3.1 All devices, combinations of devices and equipment to be installed in conformity with this chapter shall be approved *and* listed by the *California State Fire Marshal* for the purposes for which they are intended.

NFPA—continued

Revise Section 29.8.2.1.1 as follows:

29.8.2.1.1* Smoke and Heat Alarms. *Where connected to a supervising station unless exempted by applicable laws, codes or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.*

Note: Exception to 29.8.2.1.1 not adopted by the SFM.

Add Section 29.10.2.1 as follows:

29.10.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Add Section 29.10.6.8.1 as follows:

29.10.6.8.1 *The alarm verification feature shall not be used for household fire warning equipment.*

80—19: Standard for Fire Doors and Other Opening Protectives

410.2.5, 509.4.2, 716.1, 716.2.5.1, 716.2.6.4, 716.2.9, 716.3.4.1, 716.3.5, 716.4.3, 1010.3.3

82—19: Standard on Incinerators and Waste and Linen Handling Systems and Equipment

713.13

85—19: Boiler and Combustion System Hazards Code

426.1

92—18: Standard for Smoke Control Systems

909.7, 909.8

99—21: Health Care Facilities Code

407.11, 422.6, 425.1

101—21: Life Safety Code

1030.6.2

105—19: Standard for Smoke Door Assemblies and Other Opening Protectives

405.4.2, 710.5.2.2, 716.2.10, 909.20.4.1

110—19: Standard for Emergency and Standby Power Systems

2702.1.3, 3111F

111—19: Standard on Stored Electrical Energy Emergency and Standby Power Systems

2702.1.3, 3111F

120—20: Standard for Fire Prevention and Control in Coal Mines

426.1

130—20: Standard for Fixed Guideway Transit and Passenger Rail Systems: 443

**NFPA 130, Amended Sections as follows:*

Amend Section 2.2 and amend publications to read as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Amend Section 3.3.44.2 and amend publications to read as follows:

3.3.44.2* Open Station. A station that is constructed such that it is directly open to the atmosphere and smoke and heat are allowed to disperse directly into the atmosphere.

The following enclosed areas in open stations are permitted:

1. *Ticket/pass booths not exceeding 150 square feet (13.9 m²) in area.*
2. *Mechanical and electrical spaces typically not used for human occupancy and necessary for the operation of a fixed guideway transit system. Such spaces shall be limited to two per level.*
3. *Restrooms not exceeding 150 square feet (13.9 m²) in area. A maximum of four restrooms are permitted per level.*

Add a new definition as 3.3.44.3 to read as follows:

3.3.44.1.1 Underground Station. *A station or portion thereof that is located beneath the surface of the earth or of the water.*

Amend Section 5.2.2.1 to read as follows:

5.2.2.1 Building construction for all new enclosed stations shall be not less than *Type IA, Type IB or Type IIA construction and shall not exceed in area or height the limits specified in the California Building Code Table 503, for the station configuration or as determined by fire hazard analysis of potential fire exposure hazards to the structure.*

NFPA—continued

Add Section 5.2.2.1.1–5.2.2.1.3 to read as follows:

5.2.2.1.1 *Underground stations shall be a minimum Type IA or Type IB constructions.*

5.2.2.1.2 *Open stations may be of Type IIB construction and shall not exceed in area or height as required by Table 503 for Type IIA.*

5.2.2.1.3 *Open at grade stations may be of any construction type allowed by the California Building Code.*

Delete Section 5.2.2.2.

Amend Section 5.2.4.3 to read as follows:

5.2.4.3 Ancillary Spaces. Fire resistance ratings of separations between ancillary occupancies shall be established as required by the California Building Code.

Amend Section 5.2.4.3.1 to read as follows:

5.2.4.3.1 *The following areas shall be separated by a two-hour fire barrier:*

1. *Electrical control rooms, auxiliary electrical rooms and associated battery rooms*
2. *Trash rooms*
3. *Train control rooms and associated battery rooms*
4. *Fan rooms*
5. *Emergency generator rooms*

Amend Section 5.2.4.5 to read as follows:

5.2.4.5* Separation Between System and Nonsystem Occupancies. All station public areas shall be fire separated from adjacent non-system occupancies by a one hour fire barrier, unless otherwise required by other provisions of the California Building Code.

Amend Section 5.3.1.1 to read as follows:

5.3.1.1 The provisions for means of egress for a station shall comply with Chapter 10 of the California Building Code, except as herein modified.

Amend Section 5.3.2.1 to read as follows:

5.3.2.1* The occupant load for a station shall be based on the train load of trains simultaneously entering the station on all tracks in normal traffic direction plus the simultaneous entraining load awaiting trains.

- (1) The train load shall consider only one train at any one track.
- (2) The basis for calculating train and entraining loads shall be the peak period ridership figures as projected for design of a new system or as updated for an operating system.
- (3) *Exiting shall be provided for occupant loads recalculated upon increase in service and/ or every five years.*

Amend Section 5.3.3.5 to read as follows:

5.3.3.5 Travel Distance. The maximum travel distance on the platform to a point at which a means of egress route leaves the platform shall not exceed 91 440 mm (300 feet).

Amend Section 5.3.3.7 to read as follows:

5.3.3.7 Alternate Egress. At least two means of egress remote from each other shall be provided from each station platform as follows:

- (1)*A means of egress used as a public circulation route shall be permitted to provide more than 50 percent of the required egress capacity from a station platform or other location.
- (2) Means of egress from separate platforms shall be permitted to converge.
- (3) Where means of egress routes from separate platforms converge, the subsequent capacity of the egress route shall be sufficient to maintain the required evacuation time from the incident platform.
- (4) *Enclosed station platforms shall have a minimum of one exit within 2.5 times the least width of the enclosed station platform up to a maximum of 50 feet (insert mm) from each end.*
- (5) *Routes from platform ends into the underground guideway shall not be considered as exits for calculating exiting requirements.*

Amend Section 5.3.11.1 to read as follows:

5.3.11.1 Illumination of the means of egress in stations, including escalators that are considered a means of egress, shall be in accordance with Chapter 10 of the California Building Code.

Amend Section 5.3.11.2 to read as follows:

5.3.11.2 Means of egress, including escalators considered as means of egress, shall be provided with a system of emergency lighting in accordance with Chapter 10 of the California Building Code.

NFPA—continued

Amend Section 5.4.1.1 to read as follows:

5.4.1.1 Enclosed stations shall be provided with a fire command center in accordance with *Section 911.1.1 through 911.5 of the California Building Code.*

Amend Section 5.4.4.1 to read as follows:

5.4.4.1* An automatic sprinkler protection system shall be provided *where required by Section 903 of the California Building Code.*

Delete Section 5.4.4.2.

Amend Section 5.4.5.1 to read as follows:

5.4.5.1* Class I standpipes shall be installed *where required by Chapter 9 of the California Building Code* in accordance with NFPA 14 except as modified herein.

Amend Section 7.3.2.1 to read as follows:

7.3.2.1 The fan inlet airflow hot temperature shall be determined by an engineering analysis, however, this temperature shall not be less than 482°C (250°F). *Ventilation fans and related components shall be capable of withstanding the maximum anticipated plus/minus pressure transients induced by train operations.*

Add Section 7.6.1.1 to read as follows:

7.6.1.1 *Ventilation of stations shall not terminate at grade on any vehicle roadway.*

Amend Section 7.7.1 to read as follows:

7.7.1 Operation of the emergency ventilation system components shall be *capable of automatic and manual initiation in accordance with 909.12.3 of the California Building Code.*

Amend Section 7.8.1 to read as follows:

7.8.1 The design of the power for the emergency ventilation system shall comply with the requirements of Article 700 of the *California Electrical Code and Section 909 of the California Building Code.*

170—18: Standard for Fire Safety and Emergency Symbols

1025.2.6.1

211—19: Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances

2112.5

221—21: Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls

706.2, Table 716.1(2)

252—17: Standard Methods of Fire Tests of Door Assemblies

Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.1.2, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

253—19: Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source

406.2.4, 424.2, 804.2, 804.3

257—17: Standard for Fire Test for Window and Glass Block Assemblies

Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4

NFPA—continued

259—18: Standard Test Method for Potential Heat of Building Materials

2603.4.1.10, 2603.5.3

265—19: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls

803.5.1, 803.5.1.1

268—19: Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source

1405.1.1.1, 1405.1.1.1.1, 1405.1.1.1.2, 2603.5.7

275—17: Standard Method of Fire Tests for the Evaluation of Thermal Barriers

508.4.4.1, 509.4.1.1, 1406.10.2, 1408.10.2, 2603.4

276—19: Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components

1508.1, 2603.3, 2603.4.1.5

285—19: Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components

718.2.6, 1402.5, 1406.10.3, 1408.10.4, 1511.6.2, 2603.5.5

REFERENCED STANDARDS

NFPA—continued

286—15: Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth
402.6.4.4, 424.2, 803.1.1, 803.1.1.1, 803.11, 803.12, 803.13, 1406.10.2, 1408.10.3, 2603.7, 2603.9,
2604.2.4, 2614.4, 3105.3

288—17: Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal in Fire-resistance-rated Floor Systems
712.1.13.1

| | **289—19: Standard Method of Fire Test for Individual Fuel Packages**
402.6.2, 402.6.4.5, 424.2, 806.4

409—16: Standard for Aircraft Hangars
412.3.6, Table 412.3.6, 412.3.6.1, 412.5.5

418—16: Standard for Heliports
412.7.4

484—19: Standard for Combustible Metals
426.1

| | **502—20: Standard for Road Tunnels, Bridges, and Other Limited Access Highways**
429

652—19: Standard on the Fundamentals of Combustible Dust
426.1

654—20: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
426.1

655—17: Standard for the Prevention of Sulfur Fires and Explosions
426.1

664—20: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities
426.1

701—19: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films
410.2.6, 424.2, 806.4, 3102.3, 3102.3.1, 3102.6.1.1, 3105.3

704—17: Standard System for the Identification of the Hazards of Materials for Emergency Response
202, 415.5.2

➔ **750—19: Standard on Water Mist Fire Protection Systems**
202, 904.11.1.1, 904.13

1124—17: Code for the Manufacture, Transportation and Storage and Retail Sales of Fireworks and Pyrotechnic Articles
415.6.4.1

2001—18: Standard on Clean Agent Fire Extinguishing Systems, as amended*
904.10

**NFPA 2001, Amended Sections as follows:*

Add Sections 4.3.5.1.1 and 4.3.5.2.1 to read as follows:

4.3.5.1.1 Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.

4.3.5.2.1 The lens on visual appliances shall be “red” in color.

Exception: Other lens colors are permitted where approved by the enforcing agency.

2010—20: Standard for Fixed Aerosol Fire-extinguishing Systems
904.12

PCI

Precast Prestressed Concrete Institute
8770 West Bryn Mawr, Suite 1150
Chicago, IL 60631-3517

PCI 124—18: Specification for Fire Resistance of Precast Prestressed Concrete
722.1, 722.2.3.1

PCI 128—19: Specification for Glass Fiber Reinforced Concrete Panels
1903.3

MNL 120—17: PCI Design Handbook 8th Edition
1905A.1.1, 1905A.1.2

PTI

Post-Tensioning Institute
38800 Country Club Drive
Farmington Hills, MI 48331

PTI DC35.1—14: Recommendations for Prestressed Rock and Soil Anchors

1810A.3.10.4, 1811A.2, 1812A.4, 1812A.5, 1810.3.10.4.1, 1811.2, 1812.4, 1812.5, 1813.2

PTI DC—10.5-19: Standard Requirements for Design and Analysis of Shallow Post-Tensioned Concrete Foundations on Expansive and Stable Soils

1808.6.2

RMI

Rack Manufacturers Institute
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

ANSI/MH16.1—12: Specification for Design, Testing and Utilization of Industrial Steel Storage Racks

2209.1

ANSI/MH16.3—16: Specification for the Design, Testing and Utilization of Industrial Steel Cantilevered Storage Racks

2209.2

SBCA

Structural Building Components Association
6300 Enterprise Lane
Madison, WI 53719

ANSI/FS 100—12(R2018): Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies

2603.10

SDI

Steel Deck Institute
2661 Clearview Road #3
Allison Park, PA 15101

SDI NC—2017: Standard for Noncomposite Steel Floor Deck

2210.1.1.1

SDI—continued

SDI RD—2017: Standard for Steel Roof Deck

2210.1.1.2

SDI-C—2017: Standard for Composite Steel Floor Deck—Slabs

2210.1.1.3

SDI-QA/QC—2017: Standard for Quality Control and Quality Assurance for Installation of Steel Deck

1705.2.2

SFM

State of California
Department of Forestry and Fire Protection
Office of the State Fire Marshal
P.O. Box 944246
Sacramento, CA 94246-2460

12-3: Releasing Systems for Security Bars in Dwellings

1029.4

12-7-3: Fire-testing Furnaces

NA

12-7A-1: Exterior Wall Siding and Sheathing

703A.7, 707A.2

12-7A-2: Exterior Window

703A.7, 708A.2.1

12-7A-3: Under Eave

703A.7, 707A.8

REFERENCED STANDARDS

SFM—continued

12-7A-4: Decking

703A.7, 709A.3

12-7A-4A: Decking Alternate Method A

703A.7, 709A.3

12-7A-5: Ignition Resistant Building Material

703A.7, 709A.3

12-8-100: Room Fire Tests for Wall and Ceiling Materials

NA

12-10-1: Power Operated Exit Doors

NA

12-10-2: Single Point Latching or Locking Devices

NA

12-10-3: Emergency Exit and Panic Hardware

NA

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)

SJI

Steel Joist Institute
140 Evans Street, Suite 203
Florence, SC 29501

SJI 100—20: 45th Edition Standard Specifications, Load Tables and Weight Tables for K-Series, LH-Series, DLH-Series and Joist Girders

1604.3.3, 2203.1, 2207.1

SJI 200—15: 2nd Edition Standard Specifications, Weight Tables and Bridging Tables for CJ-Series Composite Steel Joists

1604.3.3, 2203.1, 2207.1

SPRI

Single-Ply Roofing Institute
465 Waverly Oaks Road, Suite 421
Waltham, MA 02452

ANSI/SPRI RP-4—19: Wind Design Guide for Ballasted Single-ply Roofing Systems

1504.5

ANSI/SPRI VF-1—17: External Fire Design Standard for Vegetative Roofs

1505.10

ANSI/SPRI/FM 4435-ES-1—17: Wind Test Design Standard for Edge Systems Used with Low Slope Roofing Systems

1504.6

ANSI/SPRI GT-1—2016: Test Standard for Gutter Systems

1504.6.1

SRCC

Solar Rating & Certification Corporation
400 High Point Drive, Suite 400
Cocoa, FL 32926

ICC 900/SRCC 300—2020: Solar Thermal System Standard

3111.2.1

ICC 901/SRCC 100—2020: Solar Thermal Collector Standard

3111.2.1

TIA

Telecommunications Industry Association
1320 N. Courthouse Road #200
Arlington, VA 22201

ANSI/TIA 222-H—2017: Structural Standard for Antenna Supporting Structures, Antennas and Small Wind Turbine Support Structures

1609.1.1, 3108.1, 3108.2

TMS

The Masonry Society
105 South Sunset Street, Suite Q
Longmont, CO 80501-6172

216—2014: Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies

Table 721.1(2), 722.1

302—2018: Standard Method for Determining the Sound Transmission Class Rating for Masonry Walls

1208.2.1

402—2016: Building Code for Masonry Structures

1404.6, 1404.6.2, 1404.10, 1410.2.1, 1604.3.4, 1705.4, 1807.1.6.3.2, 1808.9, 2101.2, 2101.2.2, 2101A.1.3, 2104A.1.3, 2106.1, 2106A.1, 2107.1, 2107.2, 2107.3, 2107.4, 2107A.4, 2107.5, 2107A.5, 2107.6, 2108.1, 2108.2, 2108.3, 2108.4, 2108A.4, 2109.1, 2109.1.1, 2109.2, 2110.1, 2114.1, 2114.4, 2115.1.1

403—2017: Direct Design Handbook for Masonry Structures

2101.2

404—2016: Standard for the Design of Architectural Cast Stone

2101.2

504—2016: Standard for the Fabrication of Architectural Cast Stone

2103.1

602—2016: Specification for Masonry Structures

1404.6.1, 1705.4, 1705A.4, 1705.4.1, 1807.1.6.3, 2101.2.2, 2101A.1.3, 2103.1, 2103.2.1, 2103.3, 2103A.3.1, 2103.4, 2104.1, 2104.2, 2104A.1, 2105.1, 2105A.1, 2105.2, 2105A.2, 2105.3, 2105A.3, 2106.6, 2115.1.1, 2115.8

604—2016: Standard for the Installation of Architectural Cast Stone

2104.1

TPI

Truss Plate Institute
2670 Crain Highway, Suite 203
Waldorf, MD 20601

TPI 1—2014: National Design Standard for Metal-plate-connected Wood Truss Construction

2303.4.6, 2306.1

UBC

International Code Council, Inc.
500 New Jersey Avenue, NW 6th Floor
Washington, DC 20001

UBC Standard 15-2: Test Standard for Determining the Fire Retardancy of Roof-Covering Materials

1505.6

UBC Standard 15-3: Wood Shakes

1505.6

UBC Standard 15-4: Wood Shingles

1505.6

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

9—2009: Fire Tests of Window Assemblies—with Revisions through February 2015

Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.2.1.3, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4, 1013.5

10A—2009: Tin Clad Fire Doors—with Revisions through July 2018

716.2.1

10B—2008: Fire Tests of Door Assemblies—with Revisions through February 2015

Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.2, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1

10C—2016: Positive Pressure Fire Tests of Door Assemblies

Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1, 1010.2.9.3

REFERENCED STANDARDS

UL—continued

10D—2017: Standard for Fire Tests of Fire Protective Curtain Assemblies

716.4

13—96: Power-limited Circuit Cables

14B—2008: Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors—with Revisions through July 2017

716.2.1

14C—2006: Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs—with Revisions through July 2017

716.2.1

38—99: Manually Actuated Signaling Boxes—with Revisions through February 2, 2005, as amended.*

**Amend Section 14.1.5 as follows:*

14.1.5 A signaling box having a glass panel, disc, rod or similar part that must be broken to operate it for a signal or for access to its actuating means shall satisfactorily complete five part-breaking operations using the means provided with the box, without jamming of the mechanism or other interference by broken particles. It shall be practicable to remove and replace the broken parts. A signaling box shall not have a glass panel, disc, rod or similar part requiring a striking action by grasping a tool to operate it for a signal. The force required to activate controls shall be no greater than 5 pounds (22 N) of force.

**Add Appendix B chapter to UL 38 (1999) as follows:*

Appendix B,

14.1.5 Operation. *Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.*

55A—2004: Materials for Built-up Roof Coverings

1507.10.2

103—2010: Factory-built Chimneys, for Residential Type and Building Heating Appliances—with Revisions through March 2017

718.2.5.1

127—2011: Factory-built Fireplaces—with Revisions through July 2016

718.2.5.1, 2111.12

193—04: Alarm Valves for Fire-Protection Service

199—95: Automatic Sprinklers for Fire Protection Service—with Revisions through August 19, 2005

199E—2004: Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers

904.13.4.1

217—2015: Single and Multiple Station Smoke Alarms—with Revisions through November 2016

907.2.11

228—97: Door Closers/ HOLDERS, with or without Integral Smoke Detectors—with Revisions through January 26, 2006

260—04: Dry Pipe and Deluge Valves for Fire Protection Service

262—04: Gate Valves for Fire Protection Service

263—11: Fire Tests of Building Construction and Materials—with Revisions through March 2018

703.2, 703.2.1.3, 703.2.1.5, 703.2.2, 703.4, 703.4, 704.12, 705.7, 705.8.5, 707.6, 712.1.13.2, 714.4.1, 714.5.1, 715.3, Table 716.1(1), Table 716.1(3), 716.1.2.3, 716.2.5.1.1, 716.2.5.4, 716.3.2.1.1, 717.3.1, 717.5.2, 717.5.3, 717.6.1, 717.6.2, Table 721.1(1), 2103.1, 2603.5.1

268—2016: Smoke Detectors for Fire Alarm Systems-with revisions through July 2016

407.9, 907.2.6.2, 907.2.11.7

268A—09: Smoke Detectors for Duct Application—with Revisions through October 22, 2003

294—2018: Access Control System Units—with Revisions through October 2018

1010.2.11, 1010.2.12, 1010.2.13.1, 1010.2.14

300—2005(R2010): Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment—with Revisions through December 2014

904.13

300A—2006: Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces

904.14.1.1

305—2012: Panic Hardware—with Revisions through March 2017

1010.2.9.3

312—04: Check Valves for Fire-Protection Service

325—2017: Door, Drapery, Gate, Louver and Window Operations and Systems

406.2.1, 3110.3

UL—continued

- 346—05: *Waterflow Indicators for Fire Protective Signaling Systems*
- 464—03: *Audible Signal Appliances—with Revisions through October 10, 2003*
- 497B—04: *Protectors for Data Communication and Fire Alarm Circuits*
- 521—99: *Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005*
- 539—00: *Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005*
- 555—2006: *Fire Dampers—with Revisions through October 2016*
717.3.1
- 555C—2014: *Ceiling Dampers—with Revisions through May 2017*
717.3.1
- 555S—2014: *Smoke Dampers—with Revisions through October 2016*
717.3.1
- 580—2006: *Test for Uplift Resistance of Roof Assemblies—with Revisions through October 2018*
1504.4.1, 1504.4.2
- 632—00: *Electrically Actuated Transmitters*
- 641—2010: *Type L Low-temperature Venting Systems—with Revisions through April 2018*
2113.11.1.4
- 710B—2011: *Recirculating Systems—with Revisions through August 2014*
904.13
- 723—2018: *Test for Surface Burning Characteristics of Building Materials*
202, 402.6.4.4, 406.7.2, 720.1, 720.4, 803.1.2, 803.5.2, 803.10, 803.11, 803.12, 803.13, 806.7, 1402.5, 1403.12.1, 1406.9, 1406.10.1, 1408.9, 1408.10.1, 1511.6.2, 1511.6.3, 2303.2, 2603.3, 2603.4.1.13, 2603.5.4, 2603.5.5, 2603.7, 2604.2.4, 2606.4, 2612.3, 2614.3, 3105.3
- 723S—2006: *Drop-Out Ceilings Installed Beneath Automatic Sprinklers*
2606.7.4
- 753—04: *Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service*
- 790—2004: *Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through October 2018*
1505.1, 2603.6, 2610.2, 2610.3
- 793—2008: *Automatically Operated Roof Vents for Smoke and Heat—with Revisions through March 2017*
910.3.1
- 813—96: *Commercial Audio Equipment—with Revisions through December 7, 1999*
- 857—13: *Busways*
1705A.14.3.1
- 864—2014: *Control Units and Accessories for Fire Alarm Systems as amended*—with Revisions through March 2018*
909.12

**Amend No. 55.1 as follows:*

RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS —No alarm obtained from control unit. Maximum permissible time is 30 seconds.

**Amend Section 55.2.2 as follows:*

Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).

**Add Section 55.2.9 as follows:*

Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.

Exception: Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.

**Amend Section 89.1.10 as follows:*

The existing text of this section is to remain as printed with one editorial amendment as follows:

THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.

(The balance of the section text is to remain unchanged).

REFERENCED STANDARDS

UL—continued

- 924—2016: Safety Emergency Lighting and Power Equipment—with Revisions through May 2018**
1013.5
- 1040—1996: Fire Test of Insulated Wall Construction—with Revisions through April 2017**
1406.10.2, 2603.9
- 1256—02: Fire Test of Roof Deck Construction—with Revisions through August 2018**
1508.1, 2603.3, 2603.4.1.5
- 1479—2015: Fire Tests of Penetration Firestops**
202, 714.4.1.2, 714.4.2, 714.5.1.2, 714.5.4
- 1482—2011: Solid-fuel Type Room Heaters—with Revisions through August 2015**
2112.2, 2112.5
- 1489—2016: Fire Resistant Pipe Protection Systems Carrying Combustible Liquids**
403.4.8.2
- 1703—2002: Flat-plate Photovoltaic Modules and Panels—with Revisions through September 2018**
1507.17.5, 3111.3.1
- 1715—97: Fire Test of Interior Finish Material—with Revisions through April 2017**
1406.10.2, 2603.9, 2614.4
- 1741—2010: Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources—with Revisions through February 2018**
3111.3.1
- 1777—2007: Chimney Liners—with Revisions through April 2014**
2113.11.1, 2113.19
- 1784—2015: Air Leakage Tests of Door Assemblies**
405.4.3, 710.5.2.2, 710.5.2.2.1, 716.2.1.4, 716.2.9.1, 716.2.9.3, 3006.3, 3007.6.3, 3008.6.3
- 1897—2015: Uplift Tests for Roof Covering Systems**
1504.4.1, 1504.4.3
- 1975—06: Fire Tests for Foamed Plastics Used for Decorative Purposes**
402.6.2, 402.6.4.5, 424.2
- 1994—2015: Luminous Egress Path Marking Systems**
411.6, 1008.2.1, 1025.2.1, 1025.2.3, 1025.2.4, 1025.2.5, 1025.4
- 2034—2017: Single- and Multiple-station Carbon Monoxide Alarms—with Revisions through September 2018**
915.4.2, 915.4.4
- 2075—2013: Standard for Gas and Vapor Detectors and Sensors—with Revisions through December 2017**
915.5.1, 915.5.3
- 2079—2015: Tests for Fire Resistance of Building Joint Systems**
202, 715.3.1, 715.8
- 2196—2017: Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control and Data Cables**
909.20.7.1, 913.2.2, 2702.3, 3007.8.1, 3008.8.2
- 2200—2012: Stationary Engine Generator Assemblies—with Revisions through October 2015**
2702.1.1
- 2202—2009: Electric Vehicle (EV) Charging System Equipment—with Revisions through February 2018**
406.2.7
- 2594—2016: Electric Vehicle Supply Equipment**
406.2.7
- 2703—2014: Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-plate Photovoltaic Modules and Panels—with Revisions through December 2019**
1505.9
- 7103—19: Outline of Investigation for Building-Integrated Photovoltaic Roof Coverings**
Table 1504.2, 1507.16.6
- 61730-1—2017: Photovoltaic (PV) Module Safety Qualification - Part 1: Requirements for Construction**
1507.16.6, 1507.17.5, 1511.9, 3111.3.1
- 61730-2—2017: Photovoltaic (PV) Module Safety Qualification - Part 2: Requirements for Testing**
1507.16.6, 1507.17.5, 1511.9, 3111.3.1

ULC

Underwriters Laboratories of Canada
13775 Commerce Parkway
Richmond, BC V6V 2V4

CAN/ULC S 102.2—2018: Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies

720.2, 720.3, 720.4

USC

United States Code
732 North Capitol Street NW
Washington, DC 20401-0003

18 USC Part 1, Ch. 40: Importation, Manufacture, Distribution and Storage of Explosive Materials

202

WCLIB

West Coast Lumber Inspection Bureau
P.O. Box 23145
Portland, OR 97223

AITC 104—03: Typical Construction Details

2306.1

AITC 110—01: Standard Appearance Grades for Structural Glued Laminated Timber

2306.1

AITC 111—05: Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection

2303.1.3.1

AITC 113—10: Standard for Dimensions of Structural Glued Laminated Timber

2306.1

WCLIB—continued

AITC 119—96: Standard Specifications for Structural Glued Laminated Timber of Hardwood Species

2306.1

AITC 200—09: Manufacturing Quality Control Systems Manual for Structural Glued Laminated Timber

2306.1

AITC 404—05: Standard for Radially Reinforcing Curved Glued Laminated Timber Members to Resist Radial Tension

2303.1.3.1

WDMA

Window and Door Manufacturers Association
2025 M Street NW, Suite 800
Washington, DC 20006

AAMA/WDMA/CSA 101/I.S.2/A440—17: Specifications for Windows, Doors and Unit Skylights

1709.5.1, 2405.5

WRI

Wire Reinforcement Institute, Inc.
942 Main Street, Suite 300
Hartford, CT 06103

WRI/CRSI—81: Design of Slab-on-ground Foundations—with 1996 Update

1808.6.2

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX A – EMPLOYEE QUALIFICATIONS

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX A

EMPLOYEE QUALIFICATIONS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix A provides optional criteria for the qualifications for jurisdictions to consider when hiring personnel to enforce the building code. Criteria for the building official, plan reviewers and inspectors are provided.

Code development reminder: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION A101 BUILDING OFFICIAL QUALIFICATIONS

[A] A101.1 Building official. The building official shall have not fewer than 10 years’ experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, 5 years of which shall have been supervisory experience. The building official should be certified as a building official through a recognized certification program. The building official shall be appointed or hired by the applicable governing authority.

[A] A101.2 Chief inspector. The building official can designate supervisors to administer the provisions of this code and the *California Mechanical and Plumbing Codes* and *International Fuel Gas Code*. Each supervisor shall have not fewer than 10 years experience or equivalent as an architect, engineer, inspector, contractor or superintendent of construction, or any combination of these, 5 years of which shall have been in a supervisory capacity. They shall be certified through a recognized certification program for the appropriate trade.

[A] A101.3 Inspector and plans examiner. The building official shall appoint or hire such number of officers, inspectors, assistants and other employees as shall be authorized by the jurisdiction. A person who has fewer than 5 years of experience as a contractor, engineer, architect, or as a superintendent, foreman or competent mechanic in charge of construction shall not be appointed or hired as inspector of

construction or plans examiner. The inspector or plans examiner shall be certified through a recognized certification program for the appropriate trade.

[A] A101.4 Termination of employment. Employees in the position of building official, chief inspector or inspector shall not be removed from office except for cause after full opportunity has been given to be heard on specific charges before such applicable governing authority.

SECTION A102 REFERENCED STANDARDS

[A] A102.1 General. See Table A102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE A102.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	<i>California Building Code</i>	A101.2
CMC—22	<i>California Mechanical Code</i>	A101.2
CPC—22	<i>California Plumbing Code</i>	A101.2
IFGC—21	<i>International Fuel Gas Code</i>	A101.2

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX B – BOARD OF APPEALS

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX B

BOARD OF APPEALS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix B provides criteria for Board of Appeals members. Also provided are procedures by which the Board of Appeals should conduct its business.

Code development reminder: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION B101 GENERAL

[A] B101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 113. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

[A] B101.2 Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

[A] B101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] B101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

[A] B101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for **[INSERT NUMBER OF YEARS]** years or until a successor has been appointed. The board members' terms shall be staggered at intervals, so as to provide continuity. The building official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] B101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

[A] B101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

[A] B101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

[A] B101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

[A] B101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the

board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] B101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] B101.3.7 Compensation of members. Compensation of members shall be determined by law.

[A] B101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

[A] B101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

[A] B101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

[A] B101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

B101.5.2 Quorum. Three members of the board shall constitute a quorum.

[A] B101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

[A] B101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

[A] B101.7 Board decision. The board shall only modify or reverse the decision of the building official by a concurring vote of three or more members.

[A] B101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the *building official* within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the *building official*.

[A] B101.7.2 Administration. The *building official* shall take immediate action in accordance with the decision of the board.

[A] B101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX C – GROUP U – AGRICULTURAL BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

APPENDIX C

GROUP U—AGRICULTURAL BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Agricultural buildings are given special consideration in Appendix C. Often such buildings have unique uses and structural needs. Where an agricultural building is surrounded by 60 feet of open area on all sides, size limits are waived. Automatic sprinkler protection may be required.

SECTION C101 GENERAL

C101.1 Scope. The provisions of this appendix shall apply exclusively to agricultural buildings. Such buildings shall be classified as Group U and shall include the following uses:

1. Livestock shelters or buildings, including shade structures and milking barns.
2. Poultry buildings or shelters.
3. Barns.
4. Storage of equipment and machinery used exclusively in agriculture.

5. Horticultural structures, including detached production greenhouses and crop protection shelters.
6. Sheds.
7. Grain silos.
8. Stables.

SECTION C102 ALLOWABLE HEIGHT AND AREA

C102.1 General. Buildings classified as Group U Agricultural shall not exceed the area or height limits specified in Table C102.1.

**TABLE C102.1
BASIC ALLOWABLE AREA FOR A GROUP U, ONE STORY IN HEIGHT AND MAXIMUM HEIGHT OF SUCH OCCUPANCY**

I		II		III and IV		V	
A	B	A	B	III A and IV	III B	A	B
ALLOWABLE AREA (square feet)^a							
Unlimited	60,000	27,100	18,000	27,100	18,000	21,100	12,000
MAXIMUM HEIGHT IN STORIES							
Unlimited	12	4	2	4	2	3	2
MAXIMUM HEIGHT IN FEET							
Unlimited	160	65	55	65	55	50	40

For SI: 1 square foot = 0.0929 m².

a. See Section C102 for unlimited area under certain conditions.

C102.2 One-story unlimited area. The area of a one-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width.

C102.3 Two-story unlimited area. The area of a two-story Group U agricultural building shall not be limited if the building is surrounded and adjoined by public ways or yards not less than 60 feet (18 288 mm) in width and is provided with an approved automatic sprinkler system throughout in accordance with Section 903.3.1.1.

SECTION C103 MIXED OCCUPANCIES

C103.1 Mixed occupancies. Mixed occupancies shall be protected in accordance with Section 508.

SECTION C104 EXITS

C104.1 Exit facilities. Exits shall be provided in accordance with *Chapter 11A or 11B as applicable*.

Exceptions:

1. The maximum travel distance from any point in the building to an approved exit shall not exceed 300 feet (91 440 mm).
2. One exit is required for each 15,000 square feet (1393.5 m²) of area or fraction thereof.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX D – FIRE DISTRICTS
 (Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX D
FIRE DISTRICTS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix D establishes a framework by which a jurisdiction can establish a portion of a jurisdiction as a fire district. Fire districts are often designated in a more densely developed portion of a city where limiting the potential spread of fire is a key consideration. Specific construction types and users are prohibited in a fire district.

SECTION D101
GENERAL

D101.1 Scope. The fire district shall include such territory or portion as outlined in an ordinance or law entitled “An Ordinance (Resolution) Creating and Establishing a Fire District.” Wherever, in such ordinance creating and establishing a fire district, reference is made to the fire district, it shall be construed to mean the fire district designated and referred to in this appendix.

D101.1.1 Mapping. The fire district complying with the provisions of Section D101.1 shall be shown on a map that shall be available to the public.

D101.2 Establishment of area. For the purpose of this code, the fire district shall include that territory or area as described in Sections D101.2.1 through D101.2.3.

D101.2.1 Adjoining blocks. Two or more adjoining blocks, exclusive of intervening streets, where not less than 50 percent of the ground area is built upon and more than 50 percent of the built-on area is devoted to hotels and motels of Group R-1; Group B occupancies; theaters, nightclubs, restaurants of Group A-1 and A-2 occupancies; garages, express and freight depots, warehouses and storage buildings used for the storage of finished products (not located with and forming a part of a manufactured or industrial plant); or Group S occupancy. Where the average height of a building is two and one-half stories or more, a block should be considered if the ground area built upon is not less than 40 percent.

D101.2.2 Buffer zone. Where four contiguous blocks or more comprise a fire district, there shall be a buffer zone of 200 feet (60 960 mm) around the perimeter of such district. Streets, rights-of-way and other open spaces not subject to building construction can be included in the 200-foot (60 960 mm) buffer zone.

D101.2.3 Developed blocks. Where blocks adjacent to the fire district have developed to the extent that not less than 25 percent of the ground area is built upon and 40 percent or more of the built-on area is devoted to the occupancies specified in Section D101.2.1, they can be considered for inclusion in the fire district, and can form all or a portion of the 200-foot (60 960 mm) buffer zone required in Section D101.2.2.

SECTION D102
BUILDING RESTRICTIONS

D102.1 Types of construction permitted. Within the fire district every building hereafter erected shall be Type I, II, III or IV, except as permitted in Section D104.

D102.2 Other specific requirements.

D102.2.1 Exterior walls. Exterior walls of buildings located in the fire district shall comply with the requirements in Table 601 except as required in Section D102.2.6.

D102.2.2 Group H prohibited. Group H occupancies shall be prohibited from location within the fire district.

D102.2.3 Construction type. Every building shall be constructed as required based on the type of construction indicated in Chapter 6.

D102.2.4 Roof covering. Roof covering in the fire district shall conform to the requirements of Class A or B roof coverings as defined in Section 1505.

D102.2.5 Structural fire rating. Walls, floors, roofs and their supporting structural members shall be not less than 1-hour fire-resistance-rated construction.

Exceptions:

1. Buildings of Type IV-HT construction.
2. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
3. Automobile parking structures.
4. Buildings surrounded on all sides by a permanently open space of not less than 30 feet (9144 mm).
5. Partitions complying with Section 603.1, Item 11.

D102.2.6 Exterior walls. Exterior load-bearing walls of Type II buildings shall have a fire-resistance rating of 2 hours or more where such walls are located within 30 feet (9144 mm) of a common property line or an assumed property line. Exterior nonload-bearing walls of Type II buildings located within 30 feet (9144 mm) of a common property line or an assumed property line shall have fire-resistance ratings as required by Table 601, but not less than 1 hour. Exterior walls located more than 30 feet (9144 mm) from a common property line or an assumed property line shall comply with Table 601.

Exception: In the case of one-story buildings that are 2,000 square feet (186 m²) or less in area, exterior walls located more than 15 feet (4572 mm) from a common property line or an assumed property line need only comply with Table 601.

D102.2.7 Architectural trim. Architectural trim on buildings located in the fire district shall be constructed of approved noncombustible materials or fire-retardant-treated wood.

D102.2.8 Permanent canopies. Permanent canopies are permitted to extend over adjacent open spaces provided that all of the following are met:

1. The canopy and its supports shall be of noncombustible material, fire-retardant-treated wood, Type IV construction or of 1-hour fire-resistance-rated construction.

Exception: Any textile covering for the canopy shall be flame resistant as determined by tests conducted in accordance with NFPA 701 after

both accelerated water leaching and accelerated weathering.

2. Any canopy covering, other than textiles, shall have a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723 in the form intended for use.
3. The canopy shall have one long side open.
4. The maximum horizontal width of the canopy shall be not greater than 15 feet (4572 mm).
5. The fire resistance of exterior walls shall not be reduced.

D102.2.9 Roof structures. Structures, except aerial supports 12 feet (3658 mm) high or less, flagpoles, water tanks and cooling towers, placed above the roof of any building within the fire district shall be of noncombustible material and shall be supported by construction of noncombustible material.

D102.2.10 Plastic signs. The use of plastics complying with Section 2611 for signs is permitted provided that the structure of the sign in which the plastic is mounted or installed is noncombustible.

D102.2.11 Plastic veneer. Exterior plastic *veneer* is not permitted in the fire district.

**SECTION D103
CHANGES TO BUILDINGS**

D103.1 Existing buildings within the fire district. An existing building shall not be increased in height or area unless it is of a type of construction permitted for new buildings within the fire district or is altered to comply with the requirements for such type of construction. Nor shall any existing building be extended on any side, nor square footage or floors added within the existing building unless such modifications are of a type of construction permitted for new buildings within the fire district.

D103.2 Other alterations. Nothing in Section D103.1 shall prohibit other alterations within the fire district provided that such alterations do not create a change of occupancy that is otherwise prohibited or increase the fire hazard.

D103.3 Moving buildings. Buildings shall not hereafter be moved into the fire district or to another lot in the fire district unless the building is of a type of construction permitted in the fire district.

**SECTION D104
BUILDINGS LOCATED
PARTIALLY IN THE FIRE DISTRICT**

D104.1 General. Any building located partially in the fire district shall be of a type of construction required for the fire district, unless the major portion of such building lies outside of the fire district and all portions of it extend not more than 10 feet (3048 mm) inside the boundaries of the fire district.

**SECTION D105
EXCEPTIONS TO
RESTRICTIONS IN FIRE DISTRICT**

D105.1 General. The preceding provisions of this appendix shall not apply in the following instances:

1. Temporary buildings used in connection with duly authorized construction.
2. A private garage used exclusively as such, not more than one story in height, nor more than 650 square feet (60 m²) in area, located on the same lot with a dwelling.
3. Fences not over 8 feet (2438 mm) high.
4. Coal tipples, material bins and trestles of Type IV construction.
5. Water tanks and cooling towers conforming to Sections 1510.3 and 1510.4.
6. Greenhouses less than 15 feet (4572 mm) high.
7. Porches on dwellings not over one story in height, and not over 10 feet (3048 mm) wide from the face of the building, provided that such porch does not come within 5 feet (1524 mm) of any property line.
8. Sheds open on a long side not over 15 feet (4572 mm) high and 500 square feet (46 m²) in area.
9. One- and two-family dwellings where of a type of construction not permitted in the fire district can be extended 25 percent of the floor area existing at the time of inclusion in the fire district by any type of construction permitted by this code.
10. Wood decks less than 600 square feet (56 m²) where constructed of 2-inch (51 mm) nominal wood, pressure treated for exterior use.
11. Wood veneers on exterior walls conforming to Section 1404.5.
12. Exterior plastic veneer complying with Section 2605.2 where installed on exterior walls required to have a fire-resistance rating not less than 1 hour, provided that the exterior plastic veneer does not exhibit sustained flaming as defined in NFPA 268.

**SECTION D106
REFERENCED STANDARDS**

D106.1 General. See Table D106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE D106.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM E84—2018B	<i>Test Method for Surface Burning Characteristics of Building Materials</i>	D102.2.8
NFPA 268—17	<i>Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source</i>	D105.1
NFPA 701—19	<i>Methods of Fire Tests for Flame-Propagation of Textiles and Films</i>	D102.2.8
UL 723—2018	<i>Standard for Test for Surface Burning Characteristics of Building Materials</i>	D102.2.8

APPENDIX E
RESERVED

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX F – RODENTPROOFING

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX F

RODENTPROOFING

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: The provisions of Appendix F are minimum mechanical methods to prevent the entry of rodents into a building. These standards, when used in conjunction with cleanliness and maintenance programs, can significantly reduce the potential of rodents invading a building.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION F101 GENERAL

F101.1 General. Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or food-stuffs are stored, prepared, processed, served or sold, shall be constructed in accordance with the provisions of this section.

F101.2 Foundation wall ventilation openings. Foundation wall ventilation openings shall be covered for their height and width with perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick, expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick, cast-iron grills or grating, extruded aluminum load-bearing vents or with hardware cloth of 0.035 inch (0.89 mm) wire or heavier. The openings therein shall not exceed 1/4 inch (6.4 mm).

F101.3 Foundation and exterior wall sealing. Annular spaces around pipes, electric cables, conduits or other openings in the walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or noncorrosive metal.

F101.4 Doors. Doors on which metal protection has been applied shall be hinged so as to be free swinging. When closed, the maximum clearance between any door, door jambs and sills shall be not greater than 3/8 inch (9.5 mm).

F101.5 Windows and other openings. Windows and other openings for the purpose of light or ventilation located in exterior walls within 2 feet (610 mm) above the existing ground level immediately below such opening shall be covered for their entire height and width, including frame, with hardware cloth of not less than 0.035-inch (0.89 mm) wire or heavier.

F101.5.1 Rodent-accessible openings. Windows and other openings for the purpose of light and ventilation in the exterior walls not covered in this chapter, accessible to rodents by way of exposed pipes, wires, conduits and other appurtenances, shall be covered with wire cloth of at least 0.035-inch (0.89 mm) wire. In lieu of wire cloth covering, said pipes, wires, conduits and other appurtenances shall be blocked from rodent usage by installing solid sheet metal guards 0.024 inch (0.61 mm) thick or heavier. Guards shall be fitted around pipes, wires, conduits or other appurtenances. In addition, they shall be fastened securely to and shall extend perpendicularly from the exterior wall for not less than 12 inches (305 mm) beyond and on either side of pipes, wires, conduits or appurtenances.

F101.6 Pier and wood construction.

F101.6.1 Sill less than 12 inches above ground. Buildings not provided with a continuous foundation shall be

APPENDIX F—RODENTPROOFING

provided with protection against rodents at grade by providing either an apron in accordance with Section F101.6.1.1 or a floor slab in accordance with Section F101.6.1.2.

F101.6.1.1 Apron. Where an apron is provided, the apron shall be not less than 8 inches (203 mm) above, nor less than 24 inches (610 mm) below, grade. The apron shall not terminate below the lower edge of the siding material. The apron shall be constructed of an approved nondecayable, water-resistant rodentproofing material of required strength and shall be installed around the entire perimeter of the building. Where constructed of masonry or concrete materials, the apron shall be not less than 4 inches (102 mm) in thickness.

F101.6.1.2 Grade floors. Where continuous concrete-grade floor slabs are provided, open spaces shall not be left between the slab and walls, and openings in the slab shall be protected.

F101.6.2 Sill at or above 12 inches above ground. Buildings not provided with a continuous foundation and that have sills 12 inches (305 mm) or more above ground level shall be provided with protection against rodents at grade in accordance with any of the following:

1. Section F101.6.1.1 or F101.6.1.2.
2. By installing solid sheet metal collars not less than 0.024 inch (0.6 mm) thick at the top of each pier or pile and around each pipe, cable, conduit, wire or other item that provides a continuous pathway from the ground to the floor.
3. By encasing the pipes, cables, conduits or wires in an enclosure constructed in accordance with Section F101.6.1.1.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX G – FLOOD-RESISTANT CONSTRUCTION
 (Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX G
FLOOD-RESISTANT CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix G is intended to provide the additional flood-plain management and administrative requirements of the National Flood Insurance Program (NFIP) that are not included in the code. Communities that adopt the International Building Code® and Appendix G will meet the minimum requirements of NFIP as set forth in Title 44 of the Code of Federal Regulations.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION G101
ADMINISTRATION

G101.1 Purpose. The purpose of this appendix is to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific flood hazard areas through the establishment of comprehensive regulations for management of flood hazard areas designed to:

1. Prevent unnecessary disruption of commerce, access and public service during times of flooding.
2. Manage the alteration of natural flood plains, stream channels and shorelines.
3. Manage filling, grading, dredging and other development that may increase flood damage or erosion potential.
4. Prevent or regulate the construction of flood barriers that will divert floodwaters or that can increase flood hazards.
5. Contribute to improved construction techniques in the flood plain.

G101.2 Objectives. The objectives of this appendix are to protect human life, minimize the expenditure of public

money for flood control projects, minimize the need for rescue and relief efforts associated with flooding, minimize prolonged business interruption, minimize damage to public facilities and utilities, help maintain a stable tax base by providing for the sound use and development of flood-prone areas, contribute to improved construction techniques in the flood plain and ensure that potential owners and occupants are notified that property is within flood hazard areas.

G101.3 Scope. The provisions of this appendix shall apply to all proposed development in a flood hazard area established in Section 1612 of this code, including certain building work exempt from permit under Section 105.2.

G101.4 Violations. Any violation of a provision of this appendix, or failure to comply with a permit or variance issued pursuant to this appendix or any requirement of this appendix, shall be handled in accordance with Section 114.

G101.5 Designation of floodplain administrator. The [INSERT JURISDICTION'S SELECTED POSITION TITLE] is designated as the floodplain administrator and is authorized and directed to enforce the provisions of this appendix. The floodplain administrator is authorized to delegate performance of certain duties to other employees of the jurisdiction. Such designation shall not alter any duties and powers of the building official.

SECTION G102 DEFINITIONS

G102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

DEVELOPMENT. Any man-made change to improved or unimproved real estate, including but not limited to, buildings or other structures, temporary structures, temporary or permanent storage of materials, mining, dredging, filling, grading, paving, excavations, operations and other land-disturbing activities.

FUNCTIONALLY DEPENDENT FACILITY. A facility that cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities necessary for the loading or unloading of cargo or passengers, and shipbuilding and ship repair facilities. The term does not include long-term storage, manufacture, sales or service facilities.

MANUFACTURED HOME. A structure that is transportable in one or more sections, built on a permanent chassis, designed for use with or without a permanent foundation when attached to the required utilities, and constructed to the Federal Manufactured Home Construction and Safety Standards and rules and regulations promulgated by the U.S. Department of Housing and Urban Development. The term also includes mobile homes, park trailers, travel trailers and similar transportable structures that are placed on a site for 180 consecutive days or longer.

MANUFACTURED HOME PARK OR SUBDIVISION. A parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

RECREATIONAL VEHICLE. A vehicle that is built on a single chassis, 400 square feet (37.16 m²) or less when measured at the largest horizontal projection, designed to be self-propelled or permanently towable by a light-duty truck, and designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel or seasonal use. A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect-type utilities and security devices and has no permanently attached additions.

VARIANCE. A grant of relief from the requirements of this section that permits construction in a manner otherwise prohibited by this section where specific enforcement would result in unnecessary hardship.

VIOLATION. A development that is not fully compliant with this appendix or Section 1612, as applicable.

SECTION G103 APPLICABILITY

G103.1 General. This appendix, in conjunction with this code, provides minimum requirements for development located in flood hazard areas, including:

1. The subdivision of land.
2. Site improvements and installation of utilities.

3. Placement and replacement of manufactured homes.
4. Placement of recreational vehicles.
5. New construction and repair, reconstruction, rehabilitation or additions to new construction.
6. Substantial improvement of existing buildings and structures, including restoration after damage.
7. Installation of tanks.
8. Temporary structures.
9. Temporary or permanent storage, utility and miscellaneous Group U buildings and structures.
10. Certain building work exempt from permit under Section 105.2 and other buildings and development activities.

G103.2 Establishment of flood hazard areas. Flood hazard areas are established in Section 1612.3 of this code, adopted by the applicable governing authority on [INSERT DATE].

SECTION G104 POWERS AND DUTIES

G104.1 Permit applications. All applications for permits shall comply with the following:

1. The floodplain administrator shall review all permit applications to determine whether proposed development is located in flood hazard areas established in Section G103.2.
2. Where a proposed development site is in a flood hazard area, all development to which this appendix is applicable as specified in Section G103.1 shall be designed and constructed with methods, practices and materials that minimize flood damage and that are in accordance with this code and ASCE 24.

G104.2 Other permits. It shall be the responsibility of the floodplain administrator to ensure that approval of a proposed development shall not be given until proof that necessary permits have been granted by federal or state agencies having jurisdiction over such development.

G104.3 Determination of design flood elevations. If design flood elevations are not specified, the floodplain administrator is authorized to require the applicant to meet one of the following:

1. Obtain, review and reasonably utilize data available from a federal, state or other source.
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering techniques. Such analyses shall be performed and sealed by a registered design professional. Studies, analyses and computations shall be submitted in sufficient detail to allow review and approval by the floodplain administrator. The accuracy of data submitted for such determination shall be the responsibility of the applicant.

G104.4 Activities in riverine flood hazard areas. In riverine flood hazard areas where design flood elevations are

specified but floodways have not been designated, the floodplain administrator shall not permit any new construction, substantial improvement or other development, including fill, unless the applicant submits an engineering analysis prepared by a registered design professional, demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated flood hazard area encroachment, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the community.

G104.5 Floodway encroachment. Prior to issuing a permit for any floodway encroachment, including fill, new construction, substantial improvements and other development or land-disturbing activity, the floodplain administrator shall require submission of a certification, prepared by a registered design professional, along with supporting technical data, demonstrating that such development will not cause any increase of the base flood level.

G104.5.1 Floodway revisions. A floodway encroachment that increases the level of the base flood is authorized if the applicant has applied for a conditional *Flood Insurance Rate Map* (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

G104.6 Watercourse alteration. Prior to issuing a permit for any alteration or relocation of any watercourse, the floodplain administrator shall require the applicant to provide notification of the proposal to the appropriate authorities of all adjacent government jurisdictions, as well as appropriate state agencies. A copy of the notification shall be maintained in the permit records and submitted to FEMA.

G104.6.1 Engineering analysis. The floodplain administrator shall require submission of an engineering analysis, prepared by a registered design professional, demonstrating that the flood-carrying capacity of the altered or relocated portion of the watercourse will not be decreased. Such watercourses shall be maintained in a manner that preserves the channel's flood-carrying capacity.

G104.7 Alterations in coastal areas. Prior to issuing a permit for any alteration of sand dunes and mangrove stands in coastal high-hazard areas and coastal A zones, the floodplain administrator shall require submission of an engineering analysis, prepared by a registered design professional, demonstrating that the proposed alteration will not increase the potential for flood damage.

G104.8 Records. The floodplain administrator shall maintain a permanent record of all permits issued in flood hazard areas, including supporting certifications and documentation required by this appendix and copies of inspection reports, design certifications and documentation of elevations required in Section 1612 of this code and Section R322 of the *California Residential Code*.

G104.9 Inspections. Development for which a permit under this appendix is required shall be subject to inspection. The floodplain administrator or the floodplain administrator's designee shall make, or cause to be made, inspections of all development in flood hazard areas authorized by issuance of a permit under this appendix.

G104.10 Use of changed technical data. The floodplain administrator and the applicant shall not use changed flood hazard area boundaries or base flood elevations for proposed buildings or developments unless the floodplain administrator or applicant has applied for a conditional *Flood Insurance Rate Map* (FIRM) revision and has received the approval of the Federal Emergency Management Agency (FEMA).

SECTION G105 PERMITS

G105.1 Required. Any person, owner or owner's authorized agent who intends to conduct any development in a flood hazard area shall first make application to the floodplain administrator and shall obtain the required permit.

G105.2 Application for permit. The applicant shall file an application in writing on a form furnished by the floodplain administrator. Such application shall:

1. Identify and describe the development to be covered by the permit.
2. Describe the land on which the proposed development is to be conducted by legal description, street address or similar description that will readily identify and definitely locate the site.
3. Include a site plan showing the delineation of flood hazard areas, floodway boundaries, flood zones, design flood elevations, ground elevations, proposed fill and excavation and drainage patterns and facilities.
4. Include in subdivision proposals and other proposed developments with more than 50 lots or larger than 5 acres (20 234 m²), base flood elevation data in accordance with Section 1612.3.1 if such data are not identified for the flood hazard areas established in Section G103.2.
5. Indicate the use and occupancy for which the proposed development is intended.
6. Be accompanied by construction documents, grading and filling plans and other information deemed appropriate by the floodplain administrator.
7. State the valuation of the proposed work.
8. Be signed by the applicant or the applicant's authorized agent.

G105.3 Validity of permit. The issuance of a permit under this appendix shall not be construed to be a permit for, or approval of, any violation of this appendix or any other ordinance of the jurisdiction. The issuance of a permit based on submitted documents and information shall not prevent the floodplain administrator from requiring the correction of errors. The floodplain administrator is authorized to prevent occupancy or use of a structure or site that is in violation of this appendix or other ordinances of this jurisdiction.

G105.4 Expiration. A permit shall become invalid if the proposed development is not commenced within 180 days after its issuance, or if the work authorized is suspended or abandoned for a period of 180 days after the work commences. Extensions shall be requested in writing and

justifiable cause demonstrated. The floodplain administrator is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each.

G105.5 Suspension or revocation. The floodplain administrator is authorized to suspend or revoke a permit issued under this appendix wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or code of this jurisdiction.

SECTION G106 VARIANCES

G106.1 General. The board of appeals established pursuant to Section 113, or other established or designed board, shall hear and decide requests for variances. The board shall base its determination on technical justifications, and has the right to attach such conditions to variances as it deems necessary to further the purposes and objectives of this appendix and Section 1612.

G106.2 Records. The floodplain administrator shall maintain a permanent record of all variance actions, including justification for their issuance.

G106.3 Historic structures. A variance is authorized to be issued for the repair or rehabilitation of a historic structure upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure, and the variance is the minimum necessary to preserve the historic character and design of the structure.

Exception: Within flood hazard areas, historic structures that do not meet one or more of the following designations:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
2. Determined by the Secretary of the U.S. Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

G106.4 Functionally dependent facilities. A variance is authorized to be issued for the construction or substantial improvement of a functionally dependent facility provided that the criteria in Section 1612.1 are met and the variance is the minimum necessary to allow the construction or substantial improvement, and that all due consideration has been given to methods and materials that minimize flood damages during the design flood and do not create additional threats to public safety.

G106.5 Restrictions. The board shall not issue a variance for any proposed development in a floodway if any increase in flood levels would result during the base flood discharge.

G106.6 Considerations. In reviewing applications for variances, the board shall consider all technical evaluations, all relevant factors, all other portions of this appendix and the following:

1. The danger that materials and debris may be swept onto other lands resulting in further injury or damage.
2. The danger to life and property due to flooding or erosion damage.
3. The susceptibility of the proposed development, including contents, to flood damage and the effect of such damage on current and future owners.
4. The importance of the services provided by the proposed development to the community.
5. The availability of alternate locations for the proposed development that are not subject to flooding or erosion.
6. The compatibility of the proposed development with existing and anticipated development.
7. The relationship of the proposed development to the comprehensive plan and flood plain management program for that area.
8. The safety of access to the property in times of flood for ordinary and emergency vehicles.
9. The expected heights, velocity, duration, rate of rise and debris and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site.
10. The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical and water systems, streets and bridges.

G106.7 Conditions for issuance. Variances shall only be issued by the board where all of the following criteria are met:

1. A technical showing of good and sufficient cause that the unique characteristics of the size, configuration or topography of the site renders the elevation standards inappropriate.
2. A determination that failure to grant the variance would result in exceptional hardship by rendering the lot undevelopable.
3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, nor create nuisances, cause fraud on or victimization of the public or conflict with existing local laws or ordinances.
4. A determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.
5. Notification to the applicant in writing over the signature of the floodplain administrator that the issuance of a variance to construct a structure below the base flood level will result in increased premium rates for flood insurance up to amounts as high as \$25 for \$100 of insurance coverage, and that such construction below the base flood level increases risks to life and property.

SECTION G107 SUBDIVISIONS

G107.1 General. Any subdivision proposal, including proposals for manufactured home parks and subdivisions, or other proposed new development in a flood hazard area shall be reviewed to verify all of the following:

1. Such proposals are consistent with the need to minimize flood damage.
2. Public utilities and facilities, such as sewer, gas, electric and water systems, are located and constructed to minimize or eliminate flood damage.
3. Adequate drainage is provided to reduce exposure to flood hazards.

G107.2 Subdivision requirements. The following requirements shall apply in the case of any proposed subdivision, including proposals for manufactured home parks and subdivisions, any portion of which lies within a flood hazard area:

1. The flood hazard area, including floodways, coastal high-hazard areas and coastal A zones, as appropriate, shall be delineated on tentative and final subdivision plats.
2. Design flood elevations shall be shown on tentative and final subdivision plats.
3. Residential building lots shall be provided with adequate buildable area outside the floodway.
4. The design criteria for utilities and facilities set forth in this appendix and appropriate International Codes shall be met.

SECTION G108 SITE IMPROVEMENT

G108.1 Development in floodways. Development or land-disturbing activity shall not be authorized in the floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice, and prepared by a registered design professional, that the proposed encroachment will not result in any increase in the base flood level.

G108.2 Coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones:

1. New buildings and buildings that are substantially improved shall only be authorized landward of the reach of mean high tide.
2. The use of fill for structural support of buildings is prohibited.

G108.3 Sewer facilities. All new or replaced sanitary sewer facilities, private sewage treatment plants (including all pumping stations and collector systems) and on-site waste disposal systems shall be designed in accordance with Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the facilities and discharge from the facilities

into floodwaters, or impairment of the facilities and systems.

G108.4 Water facilities. All new or replacement water facilities shall be designed in accordance with the provisions of Chapter 7, ASCE 24, to minimize or eliminate infiltration of floodwaters into the systems.

G108.5 Storm drainage. Storm drainage shall be designed to convey the flow of surface waters to minimize or eliminate damage to persons or property.

G108.6 Streets and sidewalks. Streets and sidewalks shall be designed to minimize potential for increasing or aggravating flood levels.

SECTION G109 MANUFACTURED HOMES

G109.1 Elevation. All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be elevated such that the lowest floor of the manufactured home is elevated to or above the design flood elevation.

G109.2 Foundations. All new and replacement manufactured homes, including substantial improvement of existing manufactured homes, shall be placed on a permanent, reinforced foundation that is designed in accordance with Section R322 of the *California Residential Code*.

G109.3 Anchoring. All new and replacement manufactured homes to be placed or substantially improved in a flood hazard area shall be installed using methods and practices that minimize flood damage. Manufactured homes shall be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement. Methods of anchoring are authorized to include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

G109.4 Protection of mechanical equipment and outside appliances. Mechanical equipment and outside appliances shall be elevated to or above the design flood elevation.

Exception: Where such equipment and appliances are designed and installed to prevent water from entering or accumulating within their components and the systems are constructed to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding up to the elevation required by Section R322 of the *California Residential Code*, the systems and equipment shall be permitted to be located below the elevation required by Section R322 of the *California Residential Code*. Electrical wiring systems shall be permitted below the design flood elevation provided that they conform to the provisions of the *California Electrical Code*.

G109.5 Enclosures. Fully enclosed areas below elevated manufactured homes shall comply with the requirements of Section R322 of the *California Residential Code*.

SECTION G110 RECREATIONAL VEHICLES

G110.1 Placement prohibited. The placement of recreational vehicles shall not be authorized in coastal high-hazard areas and in floodways.

G110.2 Temporary placement. Recreational vehicles in flood hazard areas shall be fully licensed and ready for highway use, or shall be placed on a site for less than 180 consecutive days.

G110.3 Permanent placement. Recreational vehicles that are not fully licensed and ready for highway use, or that are to be placed on a site for more than 180 consecutive days, shall meet the requirements of Section G109 for manufactured homes.

SECTION G111 TANKS

G111.1 Tanks. Underground and above-ground tanks shall be designed, constructed, installed and anchored in accordance with ASCE 24.

SECTION G112 OTHER BUILDING WORK

G112.1 Garages and accessory structures. Garages and accessory structures shall be designed and constructed in accordance with ASCE 24.

G112.2 Fences. Fences in floodways that have the potential to block the passage of floodwaters, such as stockade fences and wire mesh fences, shall meet the requirement of Section G104.5.

G112.3 Oil derricks. Oil derricks located in flood hazard areas shall be designed in conformance with the flood loads in Sections 1603.1.7 and 1612.

G112.4 Retaining walls, sidewalks and driveways. Retaining walls, sidewalks and driveways shall meet the requirements of Section 1804.5.

G112.5 Swimming pools. Swimming pools shall be designed and constructed in accordance with ASCE 24. Above-ground swimming pools, on-ground swimming pools and in-ground swimming pools that involve placement of fill in *floodways* shall also meet the requirements of Section G104.5.

G112.6 Decks, porches, and patios. Decks, porches and patios shall be designed and constructed in accordance with ASCE 24.

G112.7 Nonstructural concrete slabs in coastal high-hazard areas and coastal A zones. In coastal high-hazard areas and coastal A zones, nonstructural concrete slabs used as parking pads, enclosure floors, landings, decks, walkways, patios and similar nonstructural uses are permitted beneath or adjacent to buildings and structures provided that the concrete slabs shall be constructed in accordance with ASCE 24.

G112.8 Roads and watercourse crossings in regulated floodways. Roads and watercourse crossings that encroach

into regulated floodways, including roads, bridges, culverts, low-water crossings and similar means for vehicles or pedestrians to travel from one side of a watercourse to the other, shall meet the requirement of Section G104.5.

SECTION G113 TEMPORARY STRUCTURES AND TEMPORARY STORAGE

G113.1 Temporary structures. Temporary structures shall be erected for a period of less than 180 days. Temporary structures shall be anchored to prevent flotation, collapse or lateral movement resulting from hydrostatic loads, including the effects of buoyancy, during conditions of the design flood. Fully enclosed temporary structures shall have flood openings that are in accordance with ASCE 24 to allow for the automatic entry and exit of floodwaters.

G113.2 Temporary storage. Temporary storage includes storage of goods and materials for a period of less than 180 days. Stored materials shall not include hazardous materials.

G113.3 Floodway encroachment. Temporary structures and temporary storage in floodways shall meet the requirements of G104.5.

SECTION G114 UTILITY AND MISCELLANEOUS GROUP U

G114.1 Utility and miscellaneous Group U. Utility and miscellaneous Group U includes buildings that are accessory in character and miscellaneous structures not classified in any specific occupancy in this code, including, but not limited to, agricultural buildings, aircraft hangars (accessory to a one- or two-family residence), barns, carports, fences more than 6 feet (1829 mm) high, grain silos (accessory to a residential occupancy), greenhouses, livestock shelters, private garages, retaining walls, sheds, stables and towers.

G114.2 Flood loads. Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be anchored to prevent flotation, collapse or lateral movement resulting from flood loads, including the effects of buoyancy, during conditions of the design flood.

G114.3 Elevation. Utility and miscellaneous Group U buildings and structures, including substantial improvement of such buildings and structures, shall be elevated such that the lowest floor, including basement, is elevated to or above the design flood elevation in accordance with Section 1612 of this code.

G114.4 Enclosures below design flood elevation. Fully enclosed areas below the design flood elevation shall be constructed in accordance with ASCE 24.

G114.5 Flood-damage-resistant materials. Flood-damage-resistant materials shall be used below the design flood elevation.

G114.6 Protection of mechanical, plumbing and electrical systems. Mechanical, plumbing and electrical systems,

including plumbing fixtures, shall be elevated to or above the design flood elevation.

Exception: Electrical systems, equipment and components; heating, ventilating, air conditioning and plumbing appliances; plumbing fixtures, duct systems and other service equipment shall be permitted to be located below the design flood elevation provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the design flood elevation in compliance with the flood-resistant construction requirements of this code. Electrical wiring systems shall be permitted to be located below the design flood elevation provided that they conform to the provisions of the *California Electrical Code*.

**SECTION G115
REFERENCED STANDARDS**

G115.1 General. See Table G115.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix referenced in the standard.

**TABLE G115.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASCE 24—14	<i>Flood Resistant Design and Construction</i>	G104.1, G108.3, G108.4, G111.1, G112.1, G112.5, G112.6, G112.7, G113.1, G114.4
HUD 24 CFR Part 3285 (2008)	<i>Manufactured Home Construction and Safety Standards</i>	G102
CBC—22	<i>California Building Code</i>	G103.2, G114.1, G114.3
CRC—22	<i>California Residential Code</i>	G109.2, G109.4, G109.5
NFPA 70—20	<i>California Electrical Code</i>	G109.4, G114.6

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX H – SIGNS

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX H

SIGNS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix H gathers in one place the various standards that regulate the construction and protection of outdoor signs. Wherever possible, the appendix provides standards in performance language, thus allowing the widest possible application.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION H101 GENERAL

H101.1 General. A sign shall not be erected in a manner that would confuse or obstruct the view of or interfere with exit signs required by Chapter 10 or with official traffic signs, signals or devices. Signs and sign support structures, together with their supports, braces, guys and anchors, shall be kept in repair and in proper state of preservation. The display surfaces of signs shall be kept neatly painted or posted at all times.

H101.2 Signs exempt from permits. The following signs are exempt from the requirements to obtain a permit before erection:

1. Painted nonilluminated signs.
2. Temporary signs announcing the sale or rent of property.
3. Signs erected by transportation authorities.
4. Projecting signs not exceeding 2.5 square feet (0.23 m²).
5. The changing of moveable parts of an approved sign that is designed for such changes, or the repainting or repositioning of display matter shall not be deemed an alteration.

SECTION H102 DEFINITIONS

H102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

COMBINATION SIGN. A sign incorporating any combination of the features of pole, projecting and roof signs.

DISPLAY SIGN. The area made available by the sign structure for the purpose of displaying the advertising message.

ELECTRIC SIGN. A sign containing electrical wiring, but not including signs illuminated by an exterior light source.

GROUND SIGN. A billboard or similar type of sign that is supported by one or more uprights, poles or braces in or upon the ground other than a combination sign or pole sign, as defined by this code.

POLE SIGN. A sign wholly supported by a sign structure in the ground.

PORTABLE DISPLAY SURFACE. A display surface temporarily fixed to a standardized advertising structure that is regularly moved from structure to structure at periodic intervals.

PROJECTING SIGN. A sign other than a wall sign that projects from and is supported by a wall of a building or structure.

ROOF SIGN. A sign erected on or above a roof or parapet of a building or structure.

SIGN. Any letter, figure, character, mark, plane, point, marquee sign, design, poster, pictorial, picture, stroke, stripe, line, trademark, reading matter or illuminated service, which shall be constructed, placed, attached, painted, erected, fastened or manufactured in any manner whatsoever, so that the same shall be used for the attraction of the public to any place, subject, person, firm, corporation, public performance, article, machine or merchandise, whatsoever, which is displayed in any manner outdoors. Every sign shall be classified and conform to the requirements of that classification as set forth in this chapter.

SIGN STRUCTURE. Any structure that supports or is capable of supporting a sign as defined in this code. A sign structure is permitted to be a single pole and is not required to be an integral part of the building.

WALL SIGN. Any sign attached to or erected against the wall of a building or structure, with the exposed face of the sign in a plane parallel to the plane of said wall.

SECTION H103 LOCATION

H103.1 Location restrictions. Signs shall not be erected, constructed or maintained so as to obstruct any fire escape or any window or door or opening used as a means of egress or so as to prevent free passage from one part of a roof to any other part thereof. A sign shall not be attached in any form, shape or manner to a fire escape, nor be placed in such manner as to interfere with any opening required for ventilation.

SECTION H104 IDENTIFICATION

H104.1 Identification. Every outdoor advertising display sign hereafter erected, constructed or maintained, for which a permit is required, shall be plainly marked with the name of the person, firm or corporation erecting and maintaining such sign and shall have affixed on the front thereof the permit number issued for said sign or other method of identification approved by the building official.

SECTION H105 DESIGN AND CONSTRUCTION

H105.1 General requirements. Signs shall be designed and constructed to comply with the provisions of this code for use of materials, loads and stresses.

H105.2 Permits, drawings and specifications. Where a permit is required, as provided in Chapter 1, construction documents shall be required. These documents shall show the dimensions, material and required details of construction, including loads, stresses and anchors.

H105.3 Wind load. Signs shall be designed and constructed to withstand wind pressure as provided for in Chapter 16.

H105.4 Seismic load. Signs designed to withstand wind pressures shall be considered capable of withstanding earthquake loads, except as provided for in Chapter 16.

H105.5 Working stresses. In outdoor advertising display signs, the allowable working stresses shall conform to the requirements of Chapter 16. The working stresses of wire rope and its fastenings shall not exceed 25 percent of the ultimate strength of the rope or fasteners.

Exceptions:

1. The allowable working stresses for steel and wood shall be in accordance with the provisions of Chapters 22 and 23.
2. The working strength of chains, cables, guys or steel rods shall not exceed one-fifth of the ultimate strength of such chains, cables, guys or steel.

H105.6 Attachment. Signs attached to masonry, concrete or steel shall be safely and securely fastened by means of metal anchors, bolts or approved expansion screws of sufficient size and anchorage to safely support the loads applied.

SECTION H106 ELECTRICAL

H106.1 Illumination. A sign shall not be illuminated by other than electrical means, and electrical devices and wiring shall be installed in accordance with the requirements of *the California Electrical Code*. Any open spark or flame shall not be used for display purposes unless specifically approved.

H106.1.1 Internally illuminated signs. Except as provided for in Section 2611, where internally illuminated signs have facings of wood or of approved plastic complying with the requirements of Section 2606.4, the area of such facing section shall be not more than 120 square feet (11.16 m²) and the wiring for electric lighting shall be entirely enclosed in the sign cabinet with a clearance of not less than 2 inches (51 mm) from the facing material. The dimensional limitation of 120 square feet (11.16 m²) shall not apply to sign facing sections made from flame-resistant-coated fabric (ordinarily known as “flexible sign face plastic”) that weighs less than 20 ounces per square yard (678 g/m²) and that, when tested in accordance with NFPA 701, meets the fire propagation performance requirements of both Test 1 and Test 2 or that, when tested in accordance with an approved test method, exhibits an average burn time of 2 seconds or less and a burning extent of 5.9 inches (150 mm) or less for 10 specimens.

H106.2 Electrical service. Signs that require electrical service shall comply with NFPA 70.

SECTION H107 COMBUSTIBLE MATERIALS

H107.1 Use of combustibles. Wood, plastics complying with the requirements of Section H107.1.1 or plastic *vener* panels as provided for in Chapter 26, or other materials of combustible characteristics similar to wood, used for moldings,

cappings, nailing blocks, letters and latticing, shall comply with Section H109.1 and shall not be used for other ornamental features of signs, unless approved.

H107.1.1 Plastic materials. Notwithstanding any other provisions of this code, plastics that burn at a rate not faster than 2.5 inches per minute (64 mm/s) when tested in accordance with ASTM D635 shall be approved for use as the display surface material and for the letters, decorations and facings on signs and outdoor display structures.

H107.1.2 Electric sign faces. Individual plastic facings of electric signs shall not exceed 200 square feet (18.6 m²) in area.

H107.1.3 Area limitation. If the area of a display surface exceeds 200 square feet (18.6 m²), the area occupied or covered by plastics complying with the requirements of Section H107.1.1 shall be limited to 200 square feet (18.6 m²) plus 50 percent of the difference between 200 square feet (18.6 m²) and the area of display surface. The area of plastic on a display surface shall not in any case exceed 1,100 square feet (102 m²).

H107.1.4 Plastic appurtenances. Letters and decorations mounted on a plastic facing or display surface can be made of plastics complying with the requirements of Section H107.1.1.

SECTION H108 ANIMATED DEVICES

H108.1 Fail-safe device. Signs that contain moving sections or ornaments shall have fail-safe provisions to prevent the section or ornament from releasing and falling or shifting its center of gravity more than 15 inches (381 mm). The fail-safe device shall be in addition to the mechanism and the mechanism's housing that operate the movable section or ornament. The fail-safe device shall be capable of supporting the full dead weight of the section or ornament when the moving mechanism releases.

SECTION H109 GROUND SIGNS

H109.1 Height restrictions. The structural frame of ground signs shall not be erected of combustible materials to a height of more than 35 feet (10 668 mm) above the ground. Ground signs constructed entirely of noncombustible material shall not be erected to a height of greater than 100 feet (30 480 mm) above the ground. Greater heights are permitted where approved and located so as not to create a hazard or danger to the public.

H109.2 Required clearance. The bottom coping of every ground sign shall be not less than 3 feet (914 mm) above the ground or street level, which space can be filled with platform decorative trim or light wooden construction.

H109.3 Wood anchors and supports. Where wood anchors or supports are embedded in the soil, the wood shall be pressure treated with an approved preservative.

SECTION H110 ROOF SIGNS

H110.1 General. Roof signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1. Provisions shall be made for electric grounding of metallic parts. Where combustible materials are permitted in letters or other ornamental features, wiring and tubing shall be kept free and insulated therefrom. Roof signs shall be so constructed as to leave a clear space of not less than 6 feet (1829 mm) between the roof level and the lowest part of the sign and shall have not less than 5 feet (1524 mm) clearance between the vertical supports thereof. Roof sign structures shall not project beyond an exterior wall.

Exception: Signs on flat roofs with every part of the roof accessible.

H110.2 Bearing plates. The bearing plates of roof signs shall distribute the load directly to or on masonry walls, steel roof girders, columns or beams. The building shall be designed to avoid overstress of these members.

H110.3 Height of solid signs. A roof sign having a solid surface shall not exceed, at any point, a height of 24 feet (7315 mm) measured from the roof surface.

H110.4 Height of open signs. Open roof signs in which the uniform open area is not less than 40 percent of total gross area shall not exceed a height of 75 feet (22 860 mm) on buildings of Type 1 or Type 2 construction. On buildings of other construction types, the height shall not exceed 40 feet (12 192 mm). Such signs shall be thoroughly secured to the building on which they are installed, erected or constructed by iron, metal anchors, bolts, supports, chains, stranded cables, steel rods or braces and they shall be maintained in good condition.

H110.5 Height of closed signs. A closed roof sign shall not be erected to a height greater than 50 feet (15 240 mm) above the roof of buildings of Type 1 or 2 construction or more than 35 feet (10 668 mm) above the roof of buildings of Type 3, 4 or 5 construction.

SECTION H111 WALL SIGNS

H111.1 Materials. Wall signs that have an area exceeding 40 square feet (3.72 m²) shall be constructed of metal or other approved noncombustible material, except for nailing rails and as provided for in Sections H106.1.1 and H107.1.

H111.2 Exterior wall mounting details. Wall signs attached to exterior walls of solid masonry, concrete or stone shall be safely and securely attached by means of metal anchors, bolts or expansion screws of not less than $\frac{3}{8}$ inch (9.5 mm) diameter and shall be embedded not less than 5 inches (127 mm). Wood blocks shall not be used for anchorage, except in the case of wall signs attached to buildings with walls of wood. A wall sign shall not be supported by anchorages secured to an unbraced parapet wall.

H111.3 Extension. Wall signs shall not extend above the top of the wall or beyond the ends of the wall to which the signs are attached unless such signs conform to the requirements for roof signs, projecting signs or ground signs.

**SECTION H112
PROJECTING SIGNS**

H112.1 General. Projecting signs shall be constructed entirely of metal or other noncombustible material and securely attached to a building or structure by metal supports such as bolts, anchors, supports, chains, guys or steel rods. Staples or nails shall not be used to secure any projecting sign to any building or structure. The dead load of projecting signs not parallel to the building or structure and the load due to wind pressure shall be supported with chains, guys or steel rods having net cross-sectional dimension of not less than $\frac{3}{8}$ inch (9.5 mm) diameter. Such supports shall be erected or maintained at an angle of not less than 45 percent (0.78 rad) with the horizontal to resist the dead load and at angle of 45 percent (0.78 rad) or more with the face of the sign to resist the specified wind pressure. If such projecting sign exceeds 30 square feet (2.8 m²) in one facial area, there shall be provided not fewer than two such supports on each side not more than 8 feet (2438 mm) apart to resist the wind pressure.

H112.2 Attachment of supports. Supports shall be secured to a bolt or expansion screw that will develop the strength of the supporting chains, guys or steel rods, with a minimum $\frac{5}{8}$ -inch (15.9 mm) bolt or lag screw, by an expansion shield. Turnbuckles shall be placed in chains, guys or steel rods supporting projecting signs.

H112.3 Wall mounting details. Chains, cables, guys or steel rods used to support the live or dead load of projecting signs are permitted to be fastened to solid masonry walls with expansion bolts or by machine screws in iron supports, but such supports shall not be attached to an unbraced parapet wall. Where the supports must be fastened to walls made of wood, the supporting anchor bolts must go through the wall and be plated or fastened on the inside in a secure manner.

H112.4 Height limitation. A projecting sign shall not be erected on the wall of any building so as to project above the roof or cornice wall or, on buildings without a cornice wall, above the roof level except that a sign erected at a right angle to the building, the horizontal width of which sign is perpendicular to such a wall and does not exceed 18 inches (457 mm), is permitted to be erected to a height not exceeding 2 feet (610 mm) above the roof or cornice wall or above the roof level where there is no cornice wall. A sign attached to a corner of a building and parallel to the vertical line of such corner shall be deemed to be erected at a right angle to the building wall.

H112.5 Additional loads. Projecting sign structures that will be used to support an individual on a ladder or other servicing device, whether or not specifically designed for the servicing device, shall be capable of supporting the anticipated addi-

tional *load*, but not less than a 100-pound (445 N) concentrated horizontal load and a 300-pound (1334 N) concentrated vertical load applied at the point of assumed or most eccentric loading. The building component to which the projecting sign is attached shall be designed to support the additional loads.

**SECTION H113
MARQUEE SIGNS**

H113.1 Materials. Marquee signs shall be constructed entirely of metal or other approved noncombustible material except as provided for in Sections H106.1.1 and H107.1.

H113.2 Attachment. Marquee signs shall be attached to approved marquees that are constructed in accordance with Section 3106.

H113.3 Dimensions. Marquee signs, whether on the front or side, shall not project beyond the perimeter of the marquee.

H113.4 Height limitation. Marquee signs shall not extend more than 6 feet (1829 mm) above, or 1 foot (305 mm) below such marquee. Signs shall not have a vertical dimension greater than 8 feet (2438 mm).

**SECTION H114
PORTABLE SIGNS**

H114.1 General. Portable signs shall conform to requirements for ground, roof, projecting, flat and temporary signs where such signs are used in a similar capacity. The requirements of this section shall not be construed to require portable signs to have connections to surfaces, tie-downs or foundations where provisions are made by temporary means or configuration of the structure to provide stability for the expected duration of the installation.

**SECTION H115
THICKNESS OF SIGNS**

H115.1 General. Tables H115.1(1) and H115.1(2) provide requirements for the size, thicknesses and types of glass panels and projection signs, respectively.

**TABLE H115.1(1)
SIZE, THICKNESS AND TYPE OF GLASS PANELS IN SIGNS**

MAXIMUM SIZE OF EXPOSED PANEL		MINIMUM THICKNESS OF GLASS (inches)	TYPE OF GLASS
Any dimension (inches)	Area (square inches)		
30	500	$\frac{1}{8}$	Plain, plate or wired
45	700	$\frac{3}{16}$	Plain, plate or wired
144	3,600	$\frac{1}{4}$	Plain, plate or wired
> 144	> 3,600	$\frac{1}{4}$	Wired glass

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

TABLE H115.1(2)
THICKNESS OF PROJECTION SIGN

PROJECTION (feet)	MAXIMUM THICKNESS (feet)
5	2
4	2.5
3	3
2	3.5
1	4

For SI: 1 foot = 304.8 mm.

SECTION H116
REFERENCED STANDARDS

H116.1 General. See Table H115.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE H116.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM D635—14	<i>Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position</i>	H107.1.1
NFPA 70—20	<i>California Electrical Code</i>	H106.1, H106.2
NFPA 701—19	<i>Methods of Fire Test for Flame Propagation of Textiles and Films</i>	H106.1.1

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX I – PATIO COVERS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter			X																			
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below			X																			
Chapter / Section																						
I101			X																			
I102			X																			
I103			X																			

APPENDIX I

PATIO COVERS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix I provides standards applicable to the construction and use of patio covers. It is limited in application to patio covers accessory to dwelling units. Covers of patios and other outdoor areas associated with restaurants, mercantile buildings, offices, nursing homes or other nondwelling occupancies would be subject to standards in the main code and not this appendix.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION I101 GENERAL

I101.1 General. Patio covers shall be permitted to be detached from or attached to dwelling units. Patio covers shall be used only for recreational, outdoor living purposes and not as carports, garages, storage rooms or habitable rooms.

SECTION I102 DEFINITION

I102.1 General. The following term shall, for the purposes of this appendix, have the meaning shown herein. Refer to Chapter 2 of this code for general definitions.

PATIO COVER. A structure with open or glazed walls that is used for recreational, outdoor living purposes associated with a dwelling unit.

SECTION I103 EXTERIOR WALLS AND OPENINGS

I103.1 Enclosure walls. Enclosure walls shall be permitted to be of any configuration, provided that the open or glazed area of the longer wall and one additional wall is equal to not less than 65 percent of the area below not less than 6 feet 8 inches (2032 mm) of each wall, measured from the floor. Openings shall be permitted to be enclosed with insect screening, translucent or transparent plastic conforming to the provisions of Sections 2606 through 2610, glass conforming to the provisions of Chapter 24 or any combination of the foregoing.

I103.2 Light, ventilation and emergency egress. Exterior openings of the dwelling unit required for light and ventilation shall be permitted to open into a patio structure. However, the patio structure shall be unenclosed if such openings are serving as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as

APPENDIX I—PATIO COVERS

an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of Chapter 10.

SECTION I104 HEIGHT

I104.1 Height. Patio covers shall be limited to one-story structures not more than 12 feet (3657 mm) in height.

SECTION I105 STRUCTURAL PROVISIONS

I105.1 Design loads. Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a minimum vertical live load of 10 pounds per square foot (0.48 kN/m²) except that snow loads shall be used where such snow loads exceed this minimum. Such patio covers shall be designed to resist the minimum wind and seismic loads set forth in this code.

I105.2 Footings. In areas with a frost depth of zero, a patio cover shall be permitted to be supported on a concrete slab on grade without footings, provided that the slab conforms to the provisions of Chapter 19 of this code and is not less than 3½ inches (89 mm) thick, and the columns do not support loads in excess of 750 pounds (3.36 kN) per column.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX J – GRADING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
J104.1				X	X																	

APPENDIX J

GRADING

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix J provides standards for the grading of properties. The appendix also provides standards for the administration and enforcement of a grading program, including permit and inspection requirements. Appendix J was originally developed in the 1960s and used for many years in jurisdictions throughout the western United States. It is intended to provide consistent and uniform code requirements anywhere grading is considered an issue.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION J101 GENERAL

J101.1 Scope. The provisions of this chapter apply to grading, excavation and earthwork construction, including fills and embankments. Where conflicts occur between the technical requirements of this chapter and the geotechnical report, the geotechnical report shall govern.

J101.2 Flood hazard areas. Unless the applicant has submitted an engineering analysis, prepared in accordance with standard engineering practice by a registered design professional, that demonstrates the proposed work will not result in any increase in the level of the base flood, grading, excavation and earthwork construction, including fills and embankments, shall not be permitted in floodways that are in flood hazard areas established in Section 1612.3 or in flood hazard areas where design flood elevations are specified but floodways have not been designated.

SECTION J102 DEFINITIONS

J102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

BENCH. A relatively level step excavated into earth material on which fill is to be placed.

COMPACTION. The densification of a fill by mechanical means.

CUT. See “Excavation.”

DOWN DRAIN. A device for collecting water from a swale or ditch located on or above a slope, and safely delivering it to an approved drainage facility.

EROSION. The wearing away of the ground surface as a result of the movement of wind, water or ice.

EXCAVATION. The removal of earth material by artificial means, also referred to as a cut.

FILL. Deposition of earth materials by artificial means.

GRADE. The vertical location of the ground surface.

GRADE, EXISTING. The grade prior to grading.

GRADE, FINISHED. The grade of the site at the conclusion of all grading efforts.

GRADING. An excavation or fill or combination thereof.

KEY. A compacted fill placed in a trench excavated in earth material beneath the toe of a slope.

SLOPE. An inclined surface, the inclination of which is expressed as a ratio of horizontal distance to vertical distance.

TERRACE. A relatively level step constructed in the face of a graded slope for drainage and maintenance purposes.

SECTION J103 PERMITS REQUIRED

J103.1 Permits required. Except as exempted in Section J103.2, grading shall not be performed without first having obtained a permit therefor from the building official. A grading permit does not include the construction of retaining walls or other structures.

J103.2 Exemptions. A grading permit shall not be required for the following:

1. Grading in an isolated, self-contained area, provided that the public is not endangered and that such grading will not adversely affect adjoining properties.
2. Excavation for construction of a structure permitted under this code.
3. Cemetery graves.
4. Refuse disposal sites controlled by other regulations.
5. Excavations for wells, or trenches for utilities.
6. Mining, quarrying, excavating, processing or stockpiling rock, sand, gravel, aggregate or clay controlled by other regulations, provided that such operations do not affect the lateral support of, or significantly increase stresses in, soil on adjoining properties.
7. Exploratory excavations performed under the direction of a registered design professional.

Exemption from the permit requirements of this appendix shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction.

SECTION J104 PERMIT APPLICATION AND SUBMITTALS

J104.1 Submittal requirements. In addition to the provisions of Sections 105.3 and 1.8.4, as applicable, the applicant shall state the estimated quantities of excavation and fill.

J104.2 Site plan requirements. In addition to the provisions of Section 107, a grading plan shall show the existing grade and finished grade in contour intervals of sufficient clarity to

indicate the nature and extent of the work and show in detail that it complies with the requirements of this code. The plans shall show the existing grade on adjoining properties in sufficient detail to identify how grade changes will conform to the requirements of this code.

J104.3 Geotechnical report. A geotechnical report prepared by a registered design professional shall be provided. The report shall contain not less than the following:

1. The nature and distribution of existing soils.
2. Conclusions and recommendations for grading procedures.
3. Soil design criteria for any structures or embankments required to accomplish the proposed grading.
4. Where necessary, slope stability studies, and recommendations and conclusions regarding site geology.

Exception: A geotechnical report is not required where the building official determines that the nature of the work applied for is such that a report is not necessary.

J104.4 Liquefaction study. For sites with mapped maximum considered earthquake spectral response accelerations at short periods (S_s) greater than 0.5g as determined by Section 1613, a study of the liquefaction potential of the site shall be provided and the recommendations incorporated in the plans.

Exception: A liquefaction study is not required where the building official determines from established local data that the liquefaction potential is low.

SECTION J105 INSPECTIONS

J105.1 General. Inspections shall be governed by Section 110, Chapter 1, Division II of this code.

J105.2 Special inspections. The special inspection requirements of Section 1705.6 shall apply to work performed under a grading permit where required by the building official.

SECTION J106 EXCAVATIONS

J106.1 Maximum slope. The slope of cut surfaces shall be not steeper than is safe for the intended use, and shall be not more than one unit vertical in two units horizontal (50-percent slope) unless the owner or the owner's authorized agent furnishes a geotechnical report justifying a steeper slope.

Exceptions:

1. A cut surface shall be permitted to be at a slope of 1.5 units horizontal to 1 unit vertical (67-percent slope) provided that all of the following are met:
 - 1.1. It is not intended to support structures or surcharges.
 - 1.2. It is adequately protected against erosion.

- 1.3. It is not more than 8 feet (2438 mm) in height.
- 1.4. It is approved by the building code official.
- 1.5. Ground water is not encountered.
- 2. A cut surface in bedrock shall be permitted to be at a slope of 1 unit horizontal to 1 unit vertical (100-percent slope).

**SECTION J107
FILLS**

J107.1 General. Unless otherwise recommended in the geotechnical report, fills shall comply with the provisions of this section.

J107.2 Surface preparation. The ground surface shall be prepared to receive fill by removing vegetation, topsoil and other unsuitable materials, and scarifying the ground to provide a bond with the fill material.

J107.3 Benching. Where existing grade is at a slope steeper than one unit vertical in five units horizontal (20-percent slope) and the depth of the fill exceeds 5 feet (1524 mm) benching shall be provided in accordance with Figure J107.3. A key shall be provided that is not less than 10 feet (3048 mm) in width and 2 feet (610 mm) in depth.

J107.4 Fill material. Fill material shall not include organic, frozen or other deleterious materials. Rock or similar irreducible material greater than 12 inches (305 mm) in any dimension shall not be included in fills.

J107.5 Compaction. All fill material shall be compacted to 90 percent of maximum density as determined by ASTM

D1557, Modified Proctor, in lifts not exceeding 12 inches (305 mm) in depth.

J107.6 Maximum slope. The slope of fill surfaces shall be not steeper than is safe for the intended use. Fill slopes steeper than one unit vertical in two units horizontal (50-percent slope) shall be justified by a geotechnical report or engineering data.

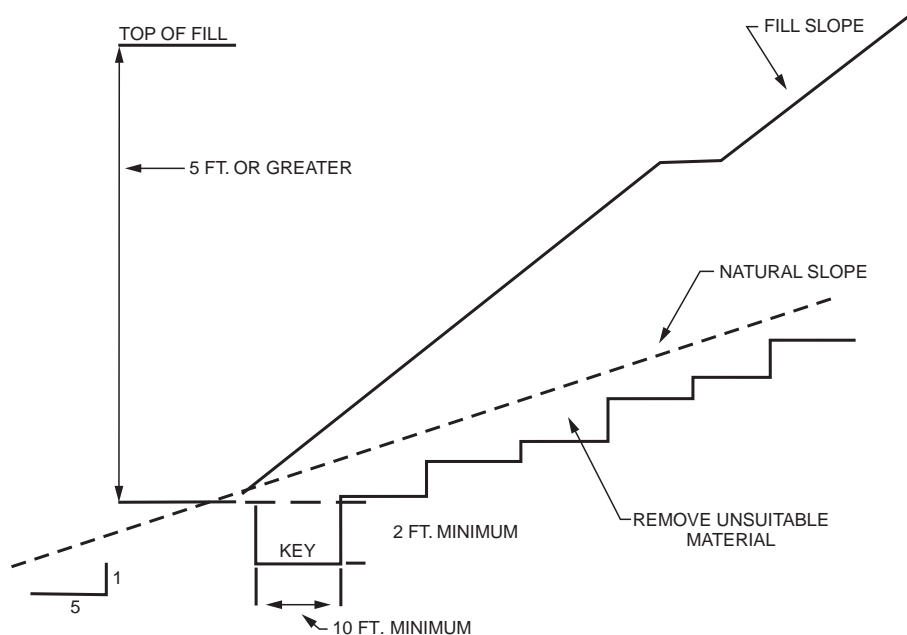
**SECTION J108
SETBACKS**

J108.1 General. Cut and fill slopes shall be set back from the property lines in accordance with this section. Setback dimensions shall be measured perpendicular to the property line and shall be as shown in Figure J108.1, unless substantiating data is submitted justifying reduced setbacks.

J108.2 Top of slope. The setback at the top of a cut slope shall be not less than that shown in Figure J108.1, or than is required to accommodate any required interceptor drains, whichever is greater.

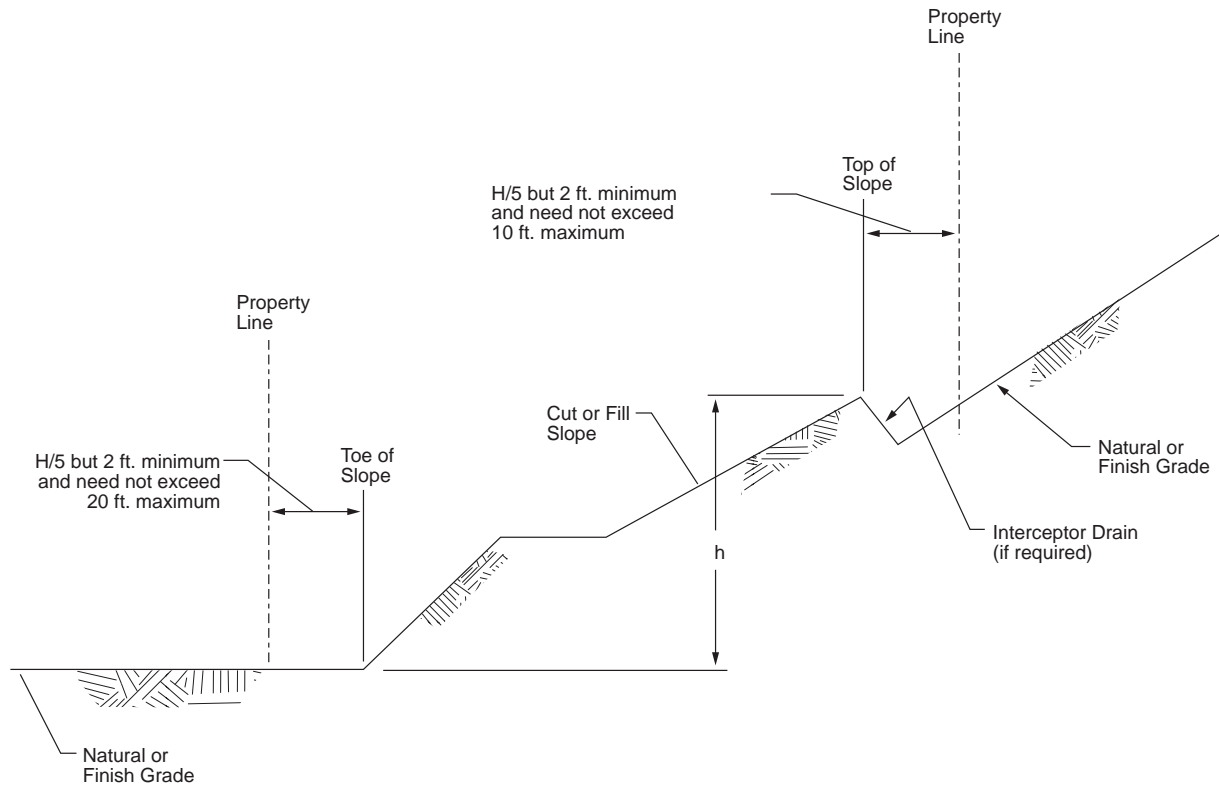
J108.3 Slope protection. Where required to protect adjacent properties at the toe of a slope from adverse effects of the grading, additional protection, approved by the building official, shall be included. Examples of such protection include but are not be limited to:

- 1. Setbacks greater than those required by Figure J108.1.
- 2. Provisions for retaining walls or similar construction.
- 3. Erosion protection of the fill slopes.
- 4. Provision for the control of surface waters.



For SI: 1 foot = 304.8 mm.

**FIGURE J107.3
BENCHING DETAILS**



For SI: 1 foot = 304.8 mm.

FIGURE J108.1
DRAINAGE DIMENSIONS

SECTION J109 DRAINAGE AND TERRACING

J109.1 General. Unless otherwise recommended by a registered design professional, drainage facilities and terracing shall be provided in accordance with the requirements of this section.

Exception: Drainage facilities and terracing need not be provided where the ground slope is not steeper than one unit vertical in three units horizontal (33-percent slope).

J109.2 Terraces. Terraces not less than 6 feet (1829 mm) in width shall be established at not more than 30-foot (9144 mm) vertical intervals on all cut or fill slopes to control surface drainage and debris. Suitable access shall be provided to allow for cleaning and maintenance.

Where more than two terraces are required, one terrace, located at approximately mid-height, shall be not less than 12 feet (3658 mm) in width.

Swales or ditches shall be provided on terraces. They shall have a minimum gradient of one unit vertical in 20 units horizontal (5-percent slope) and shall be paved with concrete not less than 3 inches (76 mm) in thickness, or with other materials suitable to the application. They shall have a

depth not less than 12 inches (305 mm) and a width not less than 5 feet (1524 mm).

A single run of swale or ditch shall not collect runoff from a tributary area exceeding 13,500 square feet (1256 m²) (projected) without discharging into a down drain.

J109.3 Interceptor drains. Interceptor drains shall be installed along the top of cut slopes receiving drainage from a tributary width greater than 40 feet (12 192 mm), measured horizontally. They shall have a minimum depth of 1 foot (305 mm) and a minimum width of 3 feet (915 mm). The slope shall be approved by the building official, but shall be not less than one unit vertical in 50 units horizontal (2-percent slope). The drain shall be paved with concrete not less than 3 inches (76 mm) in thickness, or by other materials suitable to the application. Discharge from the drain shall be accomplished in a manner to prevent erosion and shall be approved by the building official.

J109.4 Drainage across property lines. Drainage across property lines shall not exceed that which existed prior to grading. Excess or concentrated drainage shall be contained on site or directed to an approved drainage facility. Erosion of the ground in the area of discharge shall be prevented by installation of nonerosive down drains or other devices.

SECTION J110 EROSION CONTROL

J110.1 General. The faces of cut and fill slopes shall be prepared and maintained to control erosion. This control shall be permitted to consist of effective planting.

Exception: Erosion control measures need not be provided on cut slopes not subject to erosion due to the erosion-resistant character of the materials.

Erosion control for the slopes shall be installed as soon as practicable and prior to calling for final inspection.

J110.2 Other devices. Where necessary, check dams, cribbing, riprap or other devices or methods shall be employed to control erosion and provide safety.

SECTION J111 REFERENCED STANDARDS

J111.1 General. See Table J111.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE J111.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM D1557—12E1	<i>Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort [56,000 ft-lb/ft³ (2,700 kN-m/m³)]</i> .	J107.5

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX K – GROUP R-3 AND GROUP R-3.1 OCCUPANCIES
PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC		
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5	
Adopt entire chapter													X											
Adopt entire chapter as amended (amended sections listed below)																								
Adopt only those sections that are listed below																								
Chapter / Section																								

**APPENDIX K
GROUP R-3 AND GROUP R-3.1 OCCUPANCIES
PROTECTED BY THE FACILITIES OF THE CENTRAL
VALLEY FLOOD PROTECTION PLAN**

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

**SECTION K101
SCOPE**

K101.1 General. The provisions of this section shall apply to new construction, changes of use and to substantial improvement and restoration of substantial damage as defined in Section 1612, of Group R-3 and R-3.1 Occupancies in areas protected by the facilities of the Central Valley Flood Protection Plan where flood levels are anticipated to exceed three feet for the 200-year flood event. Except as specifically required by this section, buildings and structures shall meet applicable provisions of this code.

Exception: Changes of use of Group R-3 to Group R-3.1 Occupancies, including any substantial improvement done under the same permit.

K101.1.1 Construction documents. If the land on which the proposed work is to be constructed is located in an area protected by the facilities of the Central Valley Flood Protection Plan, the construction documents shall include the WSEL200 and the elevation(s) of the floor(s), and, as applicable, the elevation(s) and slopes of roofs, of the building or structure.

**SECTION K102
DEFINITIONS**

K102.1 General. The following words and terms shall, for the purposes of this section, have the meanings shown.

AREAS PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN WHERE

FLOOD LEVELS ARE ANTICIPATED TO EXCEED THREE FEET FOR THE 200-YEAR FLOOD EVENT. Geographical areas identified by the state as “Areas Protected by the Facilities of the Central Valley Flood Protection Plan where Flood Levels are Anticipated to Exceed Three Feet for the 200-Year Flood Event” in accordance with Health and Safety Code Section 50465. Published data from the California Department of Water Resources can be obtained online at the following website: [www.water.ca.gov/ BuildingCodes](http://www.water.ca.gov/BuildingCodes).

Note: The facilities of the Central Valley Flood Protection Plan are identified in the following counties: Butte, Colusa, Fresno, Glenn, Lake, Madera, Merced, Plumas, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo and Yuba. Determination of additional facilities is ongoing.

CENTRAL VALLEY. Any lands in the bed or along or near the banks of the Sacramento River and the San Joaquin River, and any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow therefrom. The following counties and the incorporated municipalities within these counties, in whole or in part, are in the Central Valley: Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Benito, San Joaquin, Shasta, Sierra, Siskiyou, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo and Yuba. A map that delineates the Central Valley can be

obtained online at the following website: www.water.ca.gov/BuildingCodes.

EVACUATION LOCATION. A location no less than one (1) foot (0.30 meter) above the WSEL200 where occupants are expected to congregate pending evacuation and from which occupants may be evacuated during conditions of flooding, such as a space within the building that has an exit door or operable window; a deck, balcony, porch, rooftop platform or rooftop area, or combinations thereof.

FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN. The facilities referenced herein include the facilities of State Plan of Flood Control and other flood management facilities in the Central Valley evaluated under the Central Valley Flood Protection Plan, which will be completed in 2012 and updated every 5 years thereafter. The facilities of State Plan of Flood Control include the state and federal flood control works (levees, weirs, channels and other features) of the Sacramento River Flood Control Project described in Water Code Section 8350, and flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Water Code section 12648) of Chapter 2 of Part 6 of Division 6 for which the Central Valley Flood Protection Board or the Department of Water Resources has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Water Code Section 8361.

ROUTE TO THE EVACUATION LOCATION. The path through and along which occupants move from the habitable areas of a building or structure that are below the WSEL200 to the evacuation location.

WSEL200. The water surface elevation (WSEL) of the 200-year flood event that is identified by the state when it identifies areas that receive protection from the facilities of the Central Valley Flood Protection Plan.

SECTION K103 STRUCTURAL STABILITY

K103.1 General. Portions of buildings and structures supporting evacuation locations shall be designed, constructed, connected and anchored to resist flotation, collapse or permanent lateral movement resulting from the hydrostatic loads anticipated during conditions of flooding anticipated for the 200-year flood event.

K103.2 Determination of loads. Hydrostatic loads, based on the depth of water determined by the WSEL200, shall be determined in accordance with Chapter 5 of ASCE 7. Reduction of hydrostatic loads may be accomplished by allowing for the automatic entry and exit of floodwaters to minimize unbalanced loads. Such means shall be designed by a registered design professional and include, but are not limited to, openings, valves and panels designed to yield under load.

Exception: When two flood vents are installed on opposite sides of the building or structure, one on each side, that comply with Figure K103.1.

SECTION K104 EVACUATION LOCATIONS

K104.1 General. An evacuation location and a route to the evacuation location shall be provided for Group R-3 and R-3.1 Occupancies.

K104.2 Route to evacuation location. A route shall be allowed through any number of intervening rooms or spaces. Doors along the route shall be openable without the use of a key or lock, special knowledge or effort.

Exception: Doors in individual dwelling or sleeping units having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.

K104.2.1 Group R-3.1 Occupancies. The route to an evacuation location shall meet the accessibility requirements of Chapter 11A or 11B as applicable.

K104.3 Minimum size requirements. Evacuation locations shall provide a minimum gross floor area of 7 square feet (0.65 m²) per occupant, based on the occupant load of the portions of the building that are below the WSEL200. The area provided shall be adequate to accommodate the occupant load of the upper levels as well as the anticipated occupant load from the area below the WSEL200.

SECTION K105 SPACE WITHIN THE BUILDING

K105.1 General. If the evacuation location is a space within a building, the evacuation location shall be provided with a means for occupants to be evacuated out of the building specified in Sections K105.1.1, K105.1.2 or K105.1.3.

K105.1.1 Windows, minimum size and dimensions. A minimum of one window shall be provided that meets the minimum size, minimum dimensions and operational constraints of Section 1026. The number of such windows shall be appropriate for the occupancy or occupancies of the portions of the building that are below the WSEL200.

Note: It is the intent of this section that windows are of sufficient number, sizes and dimensions to reasonably accommodate the needs and limitations of the occupants of the building. Reasonable judgment in the application of this requirement must be exercised by the building official.

K105.1.2 Exterior doors to decks, balconies and porches. Exterior doors to decks, balconies and porches shall be sized in accordance with Section 1008.

Exception: In Group R-3.1 Occupancies that are subject to the requirements of Chapters 11A or 11B, doors to decks, balconies or porches shall comply with Section 1132A.1.

K105.1.3 Means of escape to rooftops from spaces within a building. The means of escape to rooftops shall be permitted to be provided by a stairway, ramp, alternating

tread device, fixed ladder or other means approved by the building official.

Exception: In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such accessibility requirements shall apply to the means of escape to rooftops.

SECTION K106 DECKS AND BALCONIES THAT ARE EVACUATION LOCATIONS

K106.1 General. Decks and balconies that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations. When a deck or balcony used as an evacuation location is not at the same level as a floor within the building, it shall be permitted to be accessed by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

K106.2 Live load. Decks and balconies that are evacuation locations shall be designed for the live load required for the occupancy as required in Table 1607.2.

K106.3 Evacuation route. Evacuation routes to decks and balconies that are evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

Exception: In Group R-3.1 Occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to decks and balconies.

SECTION K107 ROOFTOP EVACUATION LOCATIONS

K107.1 General. Rooftop evacuation locations shall be permitted to include rooftop platforms and rooftop areas provided that they are no less than one (1) foot (0.30 meter) above the WSEL200. A minimum horizontal distance of three (3) feet (0.91 meter) shall be provided between the lower edge of the rooftop evacuation location access point and the evacuation location lower perimeter.

K107.2 Rooftop platforms required. A rooftop platform shall be provided if the roof covering materials are:

1. Clay tile, concrete tile, slate shingles, wood shingles or wood shakes, and the roof slope is three units vertical in 12 units horizontal (25 percent slope) or greater.
2. Metal roof panels or metal roof shingles, and the roof slope is one unit vertical in 12 units horizontal (8.33 percent slope) or greater.

K107.3 Roof live loads. Roof areas that are rooftop evacuation locations and roofs that support rooftop platforms that are evacuation locations shall be designed for the roof live load required for the occupancy as required in Table 1607.2.

K107.4 Evacuation routes to rooftop evacuation locations. Evacuation routes to rooftop evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

Exception: In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to rooftops.

K107.5 Perimeter protection. For Group R-3 and R-3.1 occupancies, the perimeter of rooftop evacuation locations shall be protected by:

1. Guards per Section 1013 if a rooftop platform is provided; or
2. A railing that is 12 inches (305 mm) in height if a sloped roof is provided.

K107.6 Utility/equipment buffer zone. A separation of 48 inches shall be provided between a rooftop evacuation location and any mechanical equipment, photovoltaic system, utility service drop or other utility line. Electrical service lines shall not pass over evacuation locations.

SECTION K108 ATTICS THAT ARE EVACUATION LOCATIONS

K108.1 General. Attics that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations.

K108.2 Headroom. When an attic is used as an evacuation location, the minimum headroom of the required area shall be 30 inches (762 mm) with 50 percent of the required area having a headroom of 60 inches (1524 mm).

K108.3 Attic flooring. The required area of the evacuation location shall be solidly sheathed.

K108.4 Attic live loads. Attic areas that are used as evacuation locations shall be designed for the floor live load required for the occupancy as required in Table 1607.2.

K108.5 Evacuation routes to attic evacuation locations. Evacuation routes to attic evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

Exception: In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to attics.

K108.6 Means of escape from attics. The means of escape from attics shall comply with Section K105.

SECTION K109 ALTERNATE MEANS OF PROTECTION

K109.1 Request for approval of alternate means of protection. Requests for approval to use an alternative means of protection shall be made in writing to the building official by the owner or the owner's authorized representative. The request shall be accompanied by a full statement of the conditions and sufficient evidence that the proposed alternate means of protection provides reasonable protection to occupants. The building official shall require the owner to obtain a written statement from the applicable emergency management authority regarding plans and processes related to notification of anticipated conditions of flooding, warnings, evacuations and other pertinent conditions relative to the

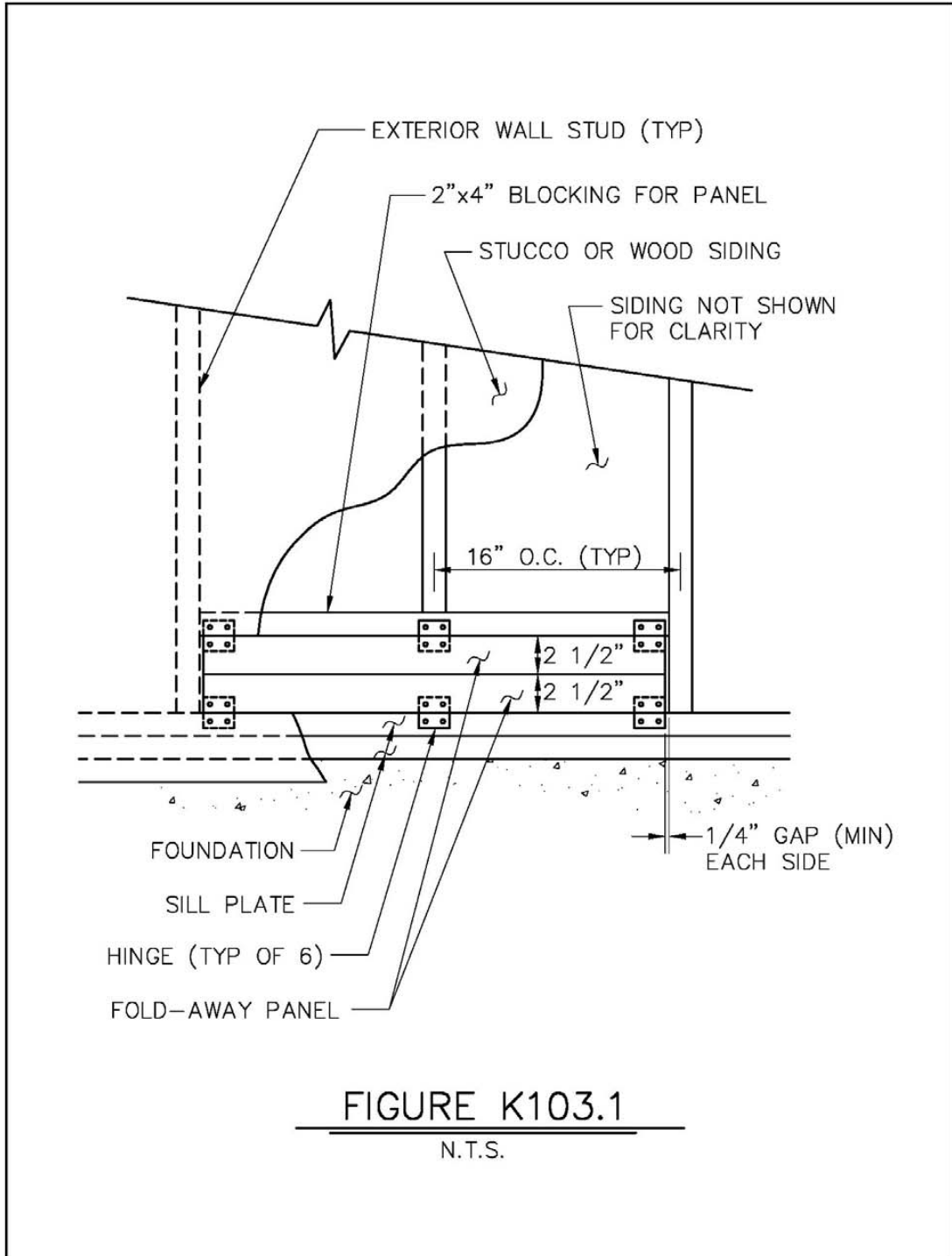
APPENDIX K—GROUP R-3 AND GROUP R-3.1 OCCUPANCIES PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

proximity of nearby levees. The building official shall also require the owner to obtain a written statement and findings from the entity that has jurisdiction over the management, maintenance, monitoring and control of flood protection works in the vicinity of the location of the owner's property; such statement shall comment on the viability of the proposed alternate means of protection. The building official may request written statements from the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency.

Approval of a request for use of an alternative means of protection made pursuant to these provisions shall be limited to the particular case covered by the request and shall not be construed as establishing any precedent for any future request except in substantially equivalent situations.

***Note:** Contact information for the California Department of Water Resources and the Department's Directory of Flood Officials, which includes levee and reclamation district boundary maps, is available on-line at the following web site: www.water.ca.gov/BuildingCodes. The Department of Water Resources Building Code Project Engineer can be contacted at 916-574-1451. The Central Valley Flood Control Board Chief Engineer can be contacted at 916- 574-0609. The California Emergency Management Agency Inland Region Program Manager can be contacted at 916-845-8488.*

***K109.2 Appeals.** When a request for an alternate means of protection has been denied by the building official, the applicant may file a written appeal with the board of appeals. In considering such appeal, the board of appeals may provide additional information to, and request additional written statements from, the Central Valley Flood Protection Board, the California Department of Water Resources, and the California Emergency Management Agency. If such additional written statements are provided, the board of appeals shall consider those statements.*



APPENDIX K—GROUP R-3 AND GROUP R-3.1 OCCUPANCIES PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

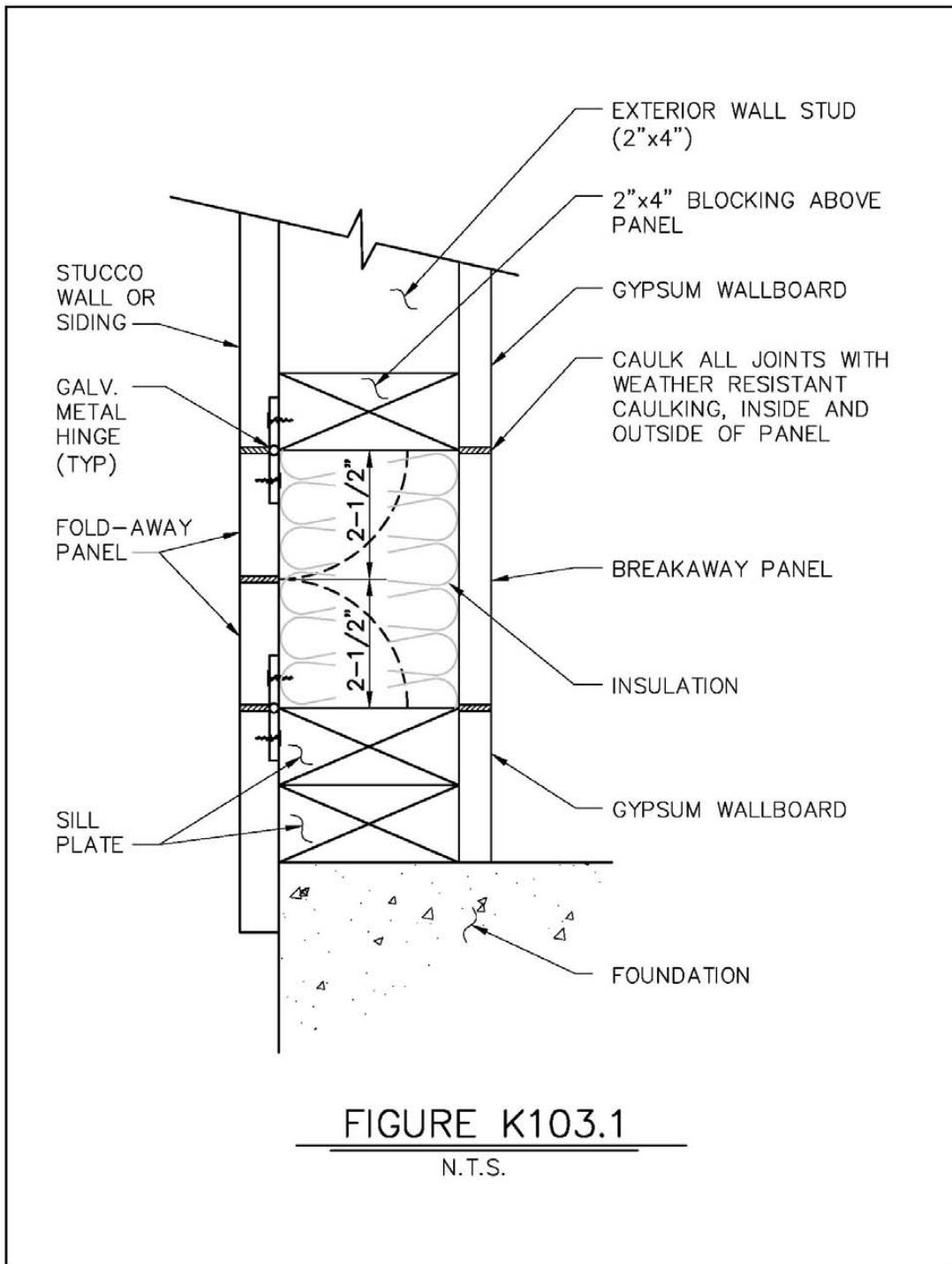


FIGURE K103.1

N.T.S.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX L – EARTHQUAKE RECORDING INSTRUMENTATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)										X				X								
Adopt only those sections that are listed below																						
Chapter / Section																						
L101.1										X				X								
L101.2										X				X								
L101.3										X												

APPENDIX L

EARTHQUAKE RECORDING INSTRUMENTATION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: The purpose of Appendix L is to foster the collection of ground motion data, particularly from strong-motion earthquakes. When this ground motion data is synthesized, it may be useful in developing future improvements to the earthquake provisions of the code.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION L101 GENERAL

L101.1 General. Every structure located where the 1-second spectral response acceleration, S_1 , determined in accordance with Section 1613.2, is greater than 0.40 and either exceeds six stories in height with an aggregate floor area of 60,000 square feet (5574 m²) or more, or exceeds 10 stories in height regardless of floor area, shall be equipped with not fewer than three approved recording accelerographs. The accelerographs shall be interconnected for common start and common timing.

[OSHPD 1 & 4] There shall be a sufficient number of instruments to characterize the response of the building during an earthquake and shall include at least one tri-axial free field instrument or equivalent.

L101.2 Location. As a minimum, instruments shall be located at the lowest level, mid-height, and near the top of the structure. Each instrument shall be located so that access is maintained at all times and is unobstructed by room contents. A sign stating “MAINTAIN CLEAR ACCESS TO THIS INSTRUMENT” in 1-inch (25 mm) block letters shall be posted in a conspicuous location.

[OSHPD 1 & 4] A proposal for instrumentation and equipment specifications shall be forwarded to the enforcement agency for review and approval.

L101.3 Maintenance. Maintenance and service of the instrumentation shall be provided by the owner of the structure. Data produced by the instrument shall be made available to the building official on request.

Maintenance and service of the instruments shall be performed annually by an approved testing agency. The owner shall file with the building official a written report from an approved testing agency certifying that each instrument has been serviced and is in proper working condition. This report shall be submitted when the instruments are installed and annually thereafter. Each instrument shall have affixed to it an externally visible tag specifying the date of the last maintenance or service and the printed name and address of the testing agency.

[OSHPD 1] Data retrieval from the instrument and processing of the records shall be the responsibility of the enforcement agency.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX M – TSUNAMI-GENERATED FLOOD HAZARD
 (Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX M
TSUNAMI-GENERATED FLOOD HAZARDS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix M allows the adoption of guidelines for constructing vertical evacuation refuge structures within areas that are considered tsunami hazard zones.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION M101
REFUGE STRUCTURES FOR VERTICAL
EVACUATION FROM TSUNAMI-GENERATED
FLOOD HAZARDS

M101.1 General. The purpose of this appendix is to provide tsunami vertical evacuation planning criteria for those coastal communities that have a tsunami hazard as shown in a *Tsunami Design Zone Map*.

M101.2 Definitions. The following term shall, for the purposes of this appendix, have the meaning shown herein. Refer to Chapter 2 of this code for general definitions.

TSUNAMI DESIGN ZONE MAP. A map that designates the extent of inundation by a Maximum Considered Tsunami, as defined by Chapter 6 of ASCE 7.

M101.3 Establishment of tsunami design zone. Where applicable, the *Tsunami Design Zone Map* shall meet or exceed the inundation limit given by the ASCE 7 *Tsunami Design Geodatabase*.

M101.4 Planning of tsunami vertical evacuation refuge structures within the tsunami design zone. Tsunami Vertical Evacuation Refuge Structures located within a tsunami hazard design zone shall be planned, sited, and developed in general accordance with the planning criteria of the FEMA P646 guidelines.

Exception: These criteria shall not be considered mandatory for evaluation of existing buildings for evacuation planning purposes.

SECTION M102
REFERENCED STANDARDS

M102.1 General. See Table M102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

TABLE M102.1
REFERENCED STANDARDS

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASCE 7—16 with Supplement 1	<i>Minimum Design Load and Associated Criteria for Buildings and Other Structures</i>	M101.2, M101.3
FEMA P646—12	<i>Guidelines for Design of Structures for Vertical Evacuation from Tsunamis</i>	M101.4

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX N – REPLICABLE BUILDINGS

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX N

REPLICABLE BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix N provides jurisdictions with a means of incorporating guidelines for replicable buildings into their building code adoption process. The intent of these provisions is to give jurisdictions a means of streamlining their document review process while verifying code compliance.

Code development reminder: Code change proposals to this appendix will be considered by the IBC—Structural Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION N101 ADMINISTRATION

N101.1 Purpose. The purpose of this appendix is to provide a format and direction regarding the implementation of a replicable building program.

N101.2 Objectives. Such programs allow a jurisdiction to recover from a natural disaster faster and allow for consistent application of the codes for replicable building projects. It will result in faster turnaround for the end user, and a quicker turnaround through the plan review process.

SECTION N102 DEFINITIONS

N102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein.

REPLICABLE BUILDING. A building or structure utilizing a replicable design.

REPLICABLE DESIGN. A prototypical design developed for application in multiple locations with minimal variation or modification.

SECTION N103 REPLICABLE DESIGN REQUIREMENTS

N103.1 Prototypical construction documents. A replicable design shall establish prototypical construction documents for application at multiple locations. The construction documents shall include details appropriate to each wind region, seismic design category, and climate zone for locations in which the replicable design is intended for application. Application of replicable design shall not vary with regard to the following, except for allowable variations in accordance with Section N106.

1. Use and occupancy classification.
2. Building heights and area limitations.
3. Type of construction classification.
4. Fire-resistance ratings.
5. Interior finishes.
6. Fire protection system.
7. Means of egress.
8. Accessibility.
9. Structural design criteria.
10. Energy efficiency.
11. Type of mechanical and electrical systems.
12. Type of plumbing system and number of fixtures.

SECTION N104 REPLICABLE DESIGN SUBMITTAL REQUIREMENTS

N104.1 General. A summary description of the replicable design and related construction documents shall be submitted to an approved agency. Where approval is requested for elements of the replicable design that is not within the scope of the *California Building Code*, the construction documents shall specifically designate the codes for which review is sought. Construction documents shall be signed, sealed and dated by a registered design professional.

N104.1.1 Architectural plans and specifications. Where approval of the architectural requirements of the replicable design is sought, the submittal documents shall include architectural plans and specifications as follows:

1. Description of uses and the proposed occupancy groups for all portions of the building.
2. Proposed type of construction of the building.
3. Fully dimensioned drawings to determine building areas and height.
4. Adequate details and dimensions to evaluate means of egress, including occupant loads for each floor, exit arrangement and sizes, corridors, doors and stairs.
5. Exit signs and means of egress lighting, including power supply.
6. Accessibility scoping provisions.
7. Description and details of proposed special occupancies such as a covered mall, high-rise, mezzanine, atrium and public garage.
8. Adequate details to evaluate fire-resistance-rated construction requirements, including data substantiating required ratings.
9. Details for plastics, insulation and safety glazing installation.
10. Details of required fire protection systems.
11. Material specifications demonstrating fire-resistance criteria.

N104.1.2 Structural plans, specifications and engineering details. Where approval of the structural requirements of the replicable design is sought, the submittal documents shall include details for each wind region, seismic design category and climate zone for which approval is sought; and shall include the following:

1. Signed and sealed structural design calculations that support the member sizes on the drawings.
2. Design load criteria, including: frost depth, live loads, snow loads, wind loads, earthquake design date, and other special loads
3. Details of foundations and superstructure.
4. Provisions for special inspections.

N104.1.3 Energy conservation details. Where approval of the energy conservation requirements of the replicable design is sought, the submittal documents shall include details for each climate zone for which approval is sought; and shall include the following:

1. Climate zones for which approval is sought.
2. Building envelope details.
3. Building mechanical system details.
4. Details of electrical power and lighting systems.
5. Provisions for system commissioning.

SECTION N105 REVIEW AND APPROVAL OF REPLICABLE DESIGN

N105.1 General. Proposed replicable designs shall be reviewed by an approved agency. The review shall be applicable only to the replicable design features submitted in accordance with Section N104. The review shall determine compliance with this code and additional codes specified in Section N104.1.

N105.2 Documentation. The results of the review shall be documented indicating compliance with the code requirements.

N105.3 Deficiencies. Where the review of the submitted construction documents identifies elements where the design is deficient and will not comply with the applicable code requirements, the approved agency shall notify the proponent of the replicable design, in writing, of the specific areas of noncompliance and request correction.

N105.4 Approval. Where the review of the submitted construction documents determines that the design is in compliance with the codes designated in Section N104.1, and where deficiencies identified in Section N105.3 have been corrected the approved agency shall issue a summary report of Approved Replicable Design. The summary report shall include any limitations on the approved replicable design including, but not limited to climate zones, wind regions and seismic design categories.

SECTION N106 SITE-SPECIFIC APPLICATION OF APPROVED REPLICABLE DESIGN

N106.1 General. Where site-specific application of a replicable design that has been approved under the provisions of Section N105 is sought, the construction documents submitted to the building official shall comply with this section.

N106.2 Submittal documents. A summary description of the replicable design and related construction document shall be submitted. Construction documents shall be signed, sealed and dated by the registered design professional. A statement, signed, sealed and dated by the registered design professional, that the replicable design submitted for local review is the same as the replicable design reviewed by the approved agency, shall be submitted.

N106.2.1 Architectural plans and specifications. Architectural plans and specifications shall include the following:

1. Construction documents for variations from the replicable design.
2. Construction for portions that are not part of the replicable design.
3. Documents for local requirements as identified by the building official.
4. Construction documents detailing the foundation system.

SECTION N107 SITE-SPECIFIC REVIEW AND APPROVAL OF REPLICABLE DESIGN

N107.1 General. Proposed site-specific application of replicable design shall be submitted to the building official in accordance with the provisions of Chapter 1 and Appendix N.

N107.2 Site-specific review and approval of replicable design. The building official shall verify that the replicable design submitted for site-specific application is the same as the approved replicable design reviewed by the approved agency. In addition, the building official shall review the following for code compliance.

1. Construction documents for variations from the replicable design.
2. Construction for portions of the building that are not part of the replicable design.
3. Documents for local requirements as identified by the building official.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX O – PERFORMANCE-BASED APPLICATION

(Not adopted by state agencies)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

[A] APPENDIX O

PERFORMANCE-BASED APPLICATION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User notes:

About this appendix: Appendix O provides an optional design, review and approval framework for use by the building official. Typical uses would include cases of alternate methods in Chapter 1, select areas of the code that require a rational analysis such as Section 909 and elsewhere. It simply extracts the relevant administrative provisions from the ICC Performance Code into a more concise, usable appendix format for a jurisdiction confronted with such a need. Currently there are multiple, varying jurisdictional rules and procedures in many communities regarding procedure and none in even more. The building official is often left alone to reach decisions not just on the merits of a design, but must first also decide on the submittal and review process. As an appendix, the provisions herein are entirely optional to a jurisdiction. This appendix can be adopted, adopted with local modifications, or even used on a case-by-case basis as part of a Memorandum of Understanding or similar legal agreement between the jurisdiction and the owner/design team. It simply represents another tool for the jurisdiction to reach for in cases of need; it neither encourages nor creates any additional opportunity for performance-based design.

Code development reminder: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

[A] SECTION O101 GENERAL

O101.1 Introduction. The following administrative provisions are excerpted from the *ICC Performance Code for Buildings and Facilities* and can be used in conjunction with the Alternate Methods provisions in Chapter 1, or for a review of submittals requiring a rational analysis or performance-based design. These provisions provide an established framework for the building official in terms of the design expertise needed, the necessary submittals, a review framework and related items.

O101.2 Qualifications. Registered design professionals shall possess the knowledge, skills and abilities necessary to demonstrate compliance with this code.

O101.3 Construction document preparation. Construction documents required by this code shall be prepared in adequate detail and submitted for review and approval in accordance with Section 107.

O101.3.1 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions in accordance with Section 107.

O101.4 Construction. Construction shall comply with the approved construction documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.1 Facility operating policies and procedures. Policies, operations, training and procedures shall comply with approved documents submitted in accordance with this code, and shall be verified and approved to demonstrate compliance with this code.

O101.4.2 Maintenance. Maintenance of the performance-based design shall be ensured throughout the life of the building or portion thereof.

O101.4.3 Changes. The owner or the owner’s authorized agent shall be responsible to ensure that any change to the facility, process, or system does not increase the hazard

level beyond that originally designed without approval and that changes shall be documented in accordance with the code.

O101.5 Documentation. The registered design professional shall prepare appropriate documentation for the project, clearly detailing the approach and rationale for the design submittal, the construction and the future use of the building, facility or process.

O101.5.1 Reports and manuals. The design report shall document the steps taken in the design analysis, clearly identifying the criteria, parameters, inputs, assumptions, sensitivities and limitations involved in the analysis. The design report shall clearly identify bounding conditions, assumptions and sensitivities that clarify the expected uses and limitations of the performance analysis. This report shall verify that the design approach is in compliance with the applicable codes and acceptable methods and shall be submitted for concurrence by the building official prior to the construction documents being completed. The report shall document the design features to be incorporated based on the analysis.

The design report shall address the following:

1. Project scope.
2. Goals and objectives.
3. Performance criteria.
4. Hazard scenarios.
5. Design fire loads and hazards.
6. Final design.
7. Evaluation.
8. Bounding conditions and critical design assumptions.
9. Critical design features.
10. System design and operational requirements.
11. Operational and maintenance requirements.
12. Commissioning testing requirements and acceptance criteria.
13. Frequency of certificate renewal.
14. Supporting documents and references.
15. Preliminary site and floor plans.

O101.5.2 Design submittal. Applicable construction documents shall be submitted to the building official for review. The documents shall be submitted in accordance with the jurisdiction's procedures and in sufficient detail to obtain appropriate permits.

O101.6 Review. Construction documents submitted in accordance with this code shall be reviewed for code compliance with the appropriate code provisions.

O101.6.1 Peer review. The owner or the owner's authorized agent shall be responsible for retaining and furnishing the services of a registered design professional or recognized expert, who will perform as a peer reviewer, where required and approved by the building official.

O101.6.2 Costs. The costs of special services, including contract review, where required by the building official, shall be borne by the owner or the owner's authorized agent.

O101.7 Permits. Prior to the start of construction, appropriate permits shall be obtained in accordance with the jurisdiction's procedures and applicable codes.

O101.8 Verification of compliance. Upon completion of the project, documentation shall be prepared that verifies performance and prescriptive code provisions have been met. Where required by the building official, the registered design professional shall file a report that verifies bounding conditions are met.

O101.9 Extent of documentation. Approved construction documents, the operations and maintenance manual, inspection and testing records, and certificates of occupancy with conditions shall be included in the project documentation of the building official's records.

O101.10 Analysis of change. The registered design professional shall evaluate the existing building, facilities, premises, processes, and contents, and the applicable documentation of the proposed change as it affects portions of the building, facility, premises, processes and contents that were previously designed for compliance under a performance-based code. Prior to any change that was not documented in a previously approved design, the registered design professional shall examine the applicable design documents, bounding conditions, operation and maintenance manuals, and deed restrictions.

CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE

APPENDIX P – EMERGENCY HOUSING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter				X	X																	
Adopt entire chapter as amendeded (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX P

EMERGENCY HOUSING

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION P101 GENERAL

P101.1 Scope. This appendix shall be applicable to emergency housing and emergency housing facilities, as defined in Section P102.

SECTION P102 DEFINITIONS

P102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

DECLARATION OF SHELTER CRISIS. The duly proclaimed existence of a situation in which a significant number of persons are without the ability to obtain shelter, resulting in a threat to their health and safety. (See Government Code Section 8698.)

DEPENDENT UNIT. Emergency housing not equipped with a kitchen area, toilet and sewage disposal system. Recreational vehicles that are not self-contained and without utility service connections shall be considered dependent units.

EMERGENCY HOUSING. Housing in a permanent or temporary structure(s), occupied during a declaration of state of emergency, local emergency or shelter crisis. Emergency housing may include, but is not limited to, buildings and structures constructed in accordance with the California Building Standards Code; and emergency sleeping cabins, emergency transportable housing units and tents constructed in accordance with this appendix.

EMERGENCY HOUSING FACILITIES. On-site common use facilities supporting emergency housing. Emergency housing facilities include, but are not limited to, kitchen areas, toilets, showers and bathrooms with running water. The use of

emergency housing facilities is limited exclusively to the occupants of the emergency housing, personnel involved in operating the housing and other emergency personnel.

EMERGENCY HOUSING SITE. A site containing emergency housing and emergency housing facilities supporting the emergency housing.

EMERGENCY SLEEPING CABIN. Relocatable hard-sided structure constructed in accordance with this appendix, which may be occupied only for emergency housing if allowed by the enforcing agency.

EMERGENCY TRANSPORTABLE HOUSING UNIT. A single- or multiple-section prefabricated structure that is transportable by a vehicle and that can be installed on a permanent or temporary site in response to a need for emergency housing. Emergency transportable housing units include, but are not limited to, manufactured homes, mobile-homes, multifamily manufactured homes, recreational vehicles and park trailers. For the purposes of this appendix, emergency transportable housing units may also include commercial modulars as defined in the Health and Safety Code Section 18001.8, if approved by the enforcing agency.

Emergency transportable housing units do not include factory-built housing as defined in the Health and Safety Code Section 19971.

LANDING PLATFORM. A landing provided as the top step of a stairway accessing a loft.

LOCAL EMERGENCY. Local Emergency as defined in the Government Code, Section 8558.

LOFT. A floor level located more than 30 inches (762 mm) above the main floor and open to it on at least one side with a ceiling height of less than 6 feet 8 inches (2032 mm), used as a living or sleeping space.

MANUFACTURED HOME. A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18007.

MEMBRANE STRUCTURE. An air-inflated, air-supported, cable or frame-covered structure, not otherwise defined as a tent. (See Chapter 31 of this code.)

MOBILEHOME. A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18008.

MULTIFAMILY MANUFACTURED HOME. A structure designed to contain not less than two dwelling units, as defined in the Health and Safety Code, Section 18008.7.

PARK TRAILER. A trailer designed for human habitation that meets all requirements in the Health and Safety Code, Section 18009.3.

RECREATIONAL VEHICLE. A motor home, travel trailer, truck camper or camping trailer, with or without motive power, designed for human habitation, that meets all requirements in the Health and Safety Code, Section 18010.

STATE OF EMERGENCY. State of Emergency as defined in the Government Code, Section 8558.

TENT. A structure, enclosure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported by any manner except by air or the contents that it protects.

SECTION P103 EMERGENCY HOUSING

P103.1 General. Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and/or assembled in accordance with this appendix, shall be occupied only during declaration of state of emergency, local emergency or shelter crisis.

Buildings and structures constructed in accordance with the California Building Standards Code, used as emergency housing, shall be permitted to be permanently occupied.

P103.2 Existing buildings. Existing residential and nonresidential buildings or structures shall be permitted to be used as emergency housing and emergency housing facilities provided such buildings or structures comply with the building code provisions and/or other regulations in effect at the time of original construction and/or alteration. Existing buildings or structures used as emergency housing shall not become or continue to be substandard buildings, as determined by the enforcing agency.

P103.2.1 New additions, alterations and change of occupancy. New additions, alterations and change of occupancy to existing buildings shall comply with the requirements of the California Building Standards Code effective at the time of addition, alteration or change of occupancy. The requirements shall apply only to and/or within the specific area of the addition, alteration or change of occupancy.

Exception: Existing buildings and structures used for emergency housing and emergency housing facilities may not be required to comply with the California Energy Code, as determined by the enforcing agency.

P103.3 Occupant load. Except as otherwise stated in this appendix, the maximum occupant load allowed in buildings and structures used as emergency housing shall be determined by the enforcing agency, but the interior floor area shall not be less than 70 square feet (6.5 m²) for one occupant. Where more than one person occupies the building/structure, the required floor area shall be increased at the rate of 50 square feet (4.65 m²) for each occupant in excess of one.

Exceptions:

1. Tents.
2. Recreational vehicles and park trailers designed for human habitation that meet the requirements in the Health and Safety Code, Sections 18009.3 and 18010, as applicable.
3. For emergency housing, including emergency sleeping cabins, the minimum interior floor area may be reduced to 53 square feet (4.9 m²) if the enforcing agency determines that 53 square feet (4.9 m²) is adequate space for a single-occupancy sleeping unit.

P103.4 Fire and life safety requirements not addressed in this appendix. If not otherwise addressed in this appendix, fire and life safety measures, including, but not limited to, means of egress, fire separation, fire sprinklers, smoke alarms and carbon monoxide alarms, shall be determined and enforced by the enforcing agency.

P103.5 Privacy. Emergency housing shall be provided with a privacy lock on each entrance door and all windows for use by the occupants.

P103.6 Heating. All sleeping areas shall be provided with adequate heating as determined by the enforcing agency.

SECTION P104 EMERGENCY SLEEPING CABINS

P104.1 General. Emergency sleeping cabins shall have an interior floor area of not less than 70 square feet (6.5 m²) for one occupant. Where more than one person occupies the cabin, the required floor area shall be increased at the rate of 50 square feet (4.65 m²) for each occupant in excess of one. The interior floor area shall not exceed 400 square feet (37 m²), excluding lofts.

P104.2 Live loads. Emergency sleeping cabins shall be designed to resist intrusion of wind, rain, and to support the following live loads:

1. Floor live loads not less than 40 pounds per square foot (1.92 kPa) of floor area.
2. Horizontal live loads not less than 15 pounds per square foot (718 Pa) of vertical wall and roof area.
3. Roof live loads not less than 20 pounds per square foot (958 Pa) of horizontal roof area.
4. In areas where snow loads are greater than 20 pounds per square foot (958 Pa), the roof shall be designed and constructed to resist these additional loads.

P104.3 Minimum ceiling height. Habitable space and hallways in emergency sleeping cabins shall have a ceiling height of not less than 80 inches (2032 mm). Bathrooms, toilet rooms and kitchens, if provided, shall have a ceiling height of not less than 76 inches (1930 mm). Obstructions

shall not extend below these minimum ceiling heights including beams, girders, ducts, lighting and other obstructions.

Exception: Ceiling heights in lofts constructed in accordance with Section P108 are permitted to be less than 80 inches (2032 mm).

P104.4 Means of egress. Emergency sleeping cabins shall be provided with at least two forms of egress placed remotely from each other. One form of egress may be an egress window complying with Section P104.4.1. When a loft is provided, one form of egress shall be an egress window complying with Section P104.4.1, provided in the loft space.

P104.4.1 Egress window. The bottom of the clear opening of the egress window shall not be more than 44 inches (1118 mm) above the floor. The egress window shall have a minimum net clear opening height of 24 inches (610 mm), and a minimum net clear opening width of 20 inches (508 mm). The egress window shall have a minimum net clear opening area of 5 square feet (0.465 m²).

P104.5 Plumbing and gas service. If an emergency sleeping cabin contains plumbing or gas service, it shall comply with all applicable requirements of the California Plumbing Code and the California Mechanical Code.

P104.6 Electrical. Emergency sleeping cabins shall be provided with all of the following installed in compliance with the California Electrical Code:

1. Continuous source of electricity.

Exception: The source of electricity may be an emergency generator or renewable source of power such as solar or wind power.

2. At least one interior lighting fixture.
3. Electrical heating equipment listed for residential use and a dedicated receptacle outlet for the electrical heating equipment.

Exception: Electrical heating equipment and a dedicated receptacle outlet for the electrical heating equipment are not required if a nonelectrical source of heating is provided.

4. At least one GFCI-protected receptacle outlet for use by the occupant(s).

P104.7 Ventilation. Emergency sleeping cabins shall be provided with means of ventilation (natural and/or mechanical) allowing for adequate air replacement, as determined by the enforcing agency.

P104.8 Smoke alarms. Emergency sleeping cabins shall be provided with at least one smoke alarm installed in accordance with the California Residential Code, Section R314.

P104.9 Carbon monoxide alarms. If an emergency sleeping cabin contains a fuel-burning appliance(s) or a fireplace(s), a carbon monoxide alarm shall be installed in accordance with the California Residential Code, Section R315.

SECTION P105 EMERGENCY TRANSPORTABLE HOUSING UNITS

P105.1 General. In addition to the requirements in this appendix, manufactured homes, mobilehomes, multifamily manufactured homes, commercial modulars, recreational vehicles and park trailers used as emergency transportable housing shall comply with all applicable requirements in the Health and Safety Code, Division 13, Part 2; and Title 25, Division 1, Chapter 3, Subchapter 2.

SECTION P106 TENTS AND MEMBRANE STRUCTURES

P106.1 General. Tents shall not be used to house occupants for more than 7 days unless such tents are maintained with tight wooden floors raised at least 4 inches (101.6 mm) above the ground level and are equipped with baseboards on all sides to a height of at least 6 inches (152.4 mm). Tents may be maintained with concrete slabs with the finished surface at least 4 inches (101.6 mm) above grade and equipped with curbs on all sides at least 6 inches (152.4 mm) high.

A tent shall not be considered a suitable sleeping place when it is found necessary to provide heating facilities in order to maintain a minimum temperature of 50 degrees Fahrenheit (10 degrees Celsius) within such tent during the period of occupancy.

Membrane structures installed and/or assembled in accordance with Chapter 31 of this code, may be permitted to be used as emergency housing and emergency housing facilities, as determined by the enforcing agency.

SECTION P107 ACCESSIBILITY

P107.1 General. Emergency housing shall comply with the applicable requirements in Chapter 11B and/or the US Access Board Final Guidelines for Emergency Transportable Housing.

Note: The Architectural and Transportation Barriers Compliance Board (US Access Board) issued the Final Guidelines for Emergency Transportable Housing on May 7, 2014. The final guidelines amended the 2004 ADA Accessibility Guidelines (2004 ADAAG) and the 2004 Architectural Barriers Act (ABA) Accessibility Guidelines (2004 ABAAG) to specifically address emergency transportable housing units provided to disaster survivors by entities subject to the ADA or ABA. The final rule ensures that the emergency transportable housing units are readily accessible to and usable by disaster survivors with disabilities.

SECTION P108 LOFTS IN EMERGENCY HOUSING

P108.1 Minimum loft area and dimensions. Lofts used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections P108.1.1 through P108.1.3.

P108.1.1 Minimum area. Lofts shall have a floor area of not less than 35 square feet (3.25 m²).

P108.1.2 Minimum dimensions. Lofts shall be not less than 5 feet (1524 mm) in any horizontal dimension.

P108.1.3 Height effect on loft area. Portions of a loft with a sloping ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.

Exception: Under gable roofs with a minimum slope of 6:12, portions of a loft with a sloping ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.

P108.2 Loft access. The access to and primary egress from lofts shall be any type described in Sections P108.2.1 through P108.2.4.

P108.2.1 Stairways. Stairways accessing lofts shall comply with the California Residential Code or with Sections P108.2.1.1 through P108.2.1.6.

P108.2.1.1 Width. Stairways accessing a loft shall not be less than 17 inches (432 mm) in clear width at or above the handrail. The minimum width below the handrail shall be not less than 20 inches (508 mm).

P108.2.1.2 Headroom. The headroom in stairways accessing a loft shall be not less than 74 inches (1880 mm), as measured vertically, from a sloped line connecting the tread or landing platform nosings in the middle of their width.

P108.2.1.3 Treads and risers. Risers for stairs accessing a loft shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:

1. The tread depth shall be 20 inches (508 mm) minus 4/3 of the riser height, or
2. The riser height shall be 15 inches (381 mm) minus 3/4 of the tread depth.

P108.2.1.4 Landing platforms. The top step of stairways accessing lofts shall be constructed as a landing platform where the loft ceiling height is less than 74 inches (1880 mm). The landing platform shall be 18 inches (457 mm) to 22 inches (559 mm) in depth measured from the nosing of the landing platform to the edge of the loft, and 16 inches (406 mm) to 18 inches (457 mm) in height measured from the landing platform to the loft floor.

P108.2.1.5 Handrails. Handrails shall comply with the California Residential Code, Section R311.7.8.

P108.2.1.6 Stairway guards. Guards at open sides of stairways shall comply with the California Residential Code, Section R312.1.

P108.2.2 Ladders. Ladders accessing lofts shall comply with Sections P108.2.2.1 and P108.2.2.2.

P108.2.2.1 Size and capacity. Ladders accessing lofts shall have a rung width of not less than 12 inches (305

mm), and 10 inches (254 mm) to 14 inches (356 mm) spacing between rungs. Ladders shall be capable of supporting a 200 pound (90.7 kg) load on any rung. Rung spacing shall be uniform within ³/₈ inch (9.5 mm).

P108.2.2.2 Incline. Ladders shall be installed at 70 to 80 degrees from horizontal.

P108.2.3 Alternating tread devices. Alternating tread devices are acceptable as allowed by the enforcing agency.

P108.2.4 Loft guards. Loft guards shall be located along the open side of lofts. Loft guards shall not be less than 36 inches (914 mm) in height or one-half of the clear height to the ceiling, whichever is less. Loft guards shall not have openings from the walking surface to the required guard height that allow passage of a sphere 4 inches (102 mm) in diameter.

SECTION P109

LOCATION, MAINTENANCE AND IDENTIFICATION

P109.1 Maintenance. Emergency housing and emergency housing facilities shall be maintained in a safe and sanitary condition, and free from vermin, vectors and other matter of an infectious or contagious nature. The grounds within emergency housing sites shall be kept clean and free from accumulation of debris, filth, garbage and deleterious matter. Emergency housing and emergency housing facilities shall not be occupied if a substandard condition exists, as determined by the enforcing agency.

P109.1.1 Fire hazards. Dangerous materials or materials that create a fire hazard, as determined by the enforcing agency, shall not be allowed on the grounds within emergency housing sites.

P109.2 Identification. Emergency housing shall be designated by address numbers, letters or other suitable means of identification. The identification shall be in a conspicuous location facing the street or driveway fronting the building or structure. Each identification character shall be not less than 4 inches (102 mm) in height and not less than 0.5 inch (12.7 mm) in width, installed/painted on a contrasting background.

SECTION P110

EMERGENCY HOUSING FACILITIES

P110.1 Drinking water. Potable drinking water shall be provided for all occupants of emergency housing.

P110.2 Kitchens. Where occupants of dependent units are permitted or required to cook for themselves, a separate area shall be equipped and maintained as a common use kitchen. Refrigerated storage shall be provided for safe storage of food.

P110.3 Toilet and bathing facilities. When dependent units are used as emergency housing, the emergency housing site shall be provided with one toilet and one bathing facility for every 15 occupants of each gender. The enforcing agency may permit different types and ratios of toilet and bathing facilities. The approval shall be based upon a finding that the type and ratio of toilet and bathing facilities are sufficient to process the anticipated volume of sewage and waste water,

while maintaining sanitary conditions for the occupants of the emergency housing.

Bathing facilities shall be provided with heating equipment which shall be capable of maintaining a temperature of 70 degrees F (21.0 degrees Celsius) within such facilities.

Lavatories with running water shall be installed and maintained in the toilet facilities or adjacent to the toilet facilities.

P110.4 Garbage, waste and rubbish disposal. *All garbage, kitchen waste and rubbish shall be deposited in approved covered receptacles, which shall be emptied when filled and the contents shall be disposed of in a sanitary manner acceptable to the enforcing agency.*

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HISTORY NOTE APPENDIX

2022 California Building Code California Code of Regulations, Title 24, Part 2 Volume 2

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Building Code* 2019 Triennial Edition, effective January 1, 2020.

1. (BSC 05/21, CEC 03/21, HCD 05/21, DSA/AC 01/21, DSA-SS/CC 05/21, SFM 04/21, OSHPD 04/21 and OSHPD 06/21)—Adoption by reference of the 2021 *International Building Code* with necessary amendments to become the 2022 *California Building Code*, and repeal of the 2018 edition of the *International Building Code*; effective on January 1, 2023.



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CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 2.5

Based on the 2021 International Residential Code®

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Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is Part 2.5 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Residential Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

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For questions on California state agency amendments, please refer to the contact list on page v.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073
Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916
State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300
Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312
Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200
Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100
Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210
Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041
Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188
Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220
Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov
Meat & Poultry Packing Plant Standards
Rendering & Collection Center Standards (916) 900-5004
Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356
Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks
(916) 445-3338
Factory-Built Housing, Manufactured Housing &
Commercial Modular
Mobilehome—Permits & Inspections
Northern Region—(916) 255-2501
Southern Region—(951) 782-4431
(800) 952-8356
Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661
Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards
Essential Services Building Standards
Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development

AKA: California Department of Health Care

Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300
Hospital Standards
Skilled Nursing Facility Standards &
Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800
Code Development and Analysis
Fire Safety Standards

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption, and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

Legend of Acronyms of Adopting State Agencies

BSC	California Building Standards Commission (see Section 1.2)
BSC-CG	California Building Standards Commission-CALGreen (see Section 1.2.2)
BSCC	Board of State and Community Corrections (see Section 1.3)
SFM	Office of the State Fire Marshal (see Section 1.11)
HCD 1	Department of Housing and Community Development (see Section 1.8.2.1.1)
HCD 2	Department of Housing and Community Development (see Section 1.8.2.1.3)
HCD 1/AC	Department of Housing and Community Development (see Section 1.8.2.1.2)
DSA-AC	Division of the State Architect-Access Compliance (see Section 1.9.1)
DSA-SS	Division of the State Architect-Structural Safety (see Section 1.9.2)
DSA-SS/CC	Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)
OSHPD 1	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 1R	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 2	Office of Statewide Health Planning and Development (see Section 1.10.2)
OSHPD 3	Office of Statewide Health Planning and Development (see Section 1.10.3)
OSHPD 4	Office of Statewide Health Planning and Development (see Section 1.10.4)
OSHPD 5	Office of Statewide Health Planning and Development (see Section 1.10.5)
DPH	Department of Public Health (see Section 1.7)
AGR	Department of Food and Agriculture (see Section 1.6)
CEC	California Energy Commission (see Section 100 in Part 6, the California Energy Code)
CA	Department of Consumer Affairs (see Section 1.4): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Household Goods & Services Structural Pest Control Board (SPCB)
SL	State Library (see Section 1.12)
SLC	State Lands Commission (see Section 1.14)
DWR	Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages vii and viii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency’s statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies’ adoption as follows:

Adopt the entire IRC chapter without state amendments.

If there is an “X” under a particular state agency’s acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA RESIDENTIAL CODE-MATRIX ADOPTION TABLE
(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.
See Chapter 1 for state agency authority and building applications.)

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter			X																			
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter/Section																						

Adopt the entire IRC chapter as amended, state-amended sections are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an “X” in the column, by that particular section, under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below								S	A	M	P	L	E									
Chapter 1																						
202			X																			

Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below					X	X		S	A	M	P	L	E									
Chapter 1																						
202					X	X		S	A	M	P	L	E									
202					X	X			C	O	N	T.										
203					X	X																
203					X	X																

Marginal Markings

Symbols in the margin indicate the status of code changes as follows:

- || This symbol indicates that a change has been made to a California amendment.
- > This symbol indicates deletion of California amendment language.
- | This symbol indicates that a change has been made to International Code Council model language.
- ➔ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2021 edition of the *International Residential Code*.

RELOCATIONS

2021 LOCATION	2018 LOCATION
Table N1102.1.2	Table N1102.1.4
Table N1102.1.3	Table N1102.1.2
N1103.3.2	N1103.3.7
N1103.3.3	N1103.3.6
N1103.3.3.1	N1103.3.6.1
N1103.3.4	N1103.3.2
N1103.3.4.1	N1103.3.2.1
N1103.3.5	N1103.3.3
N1103.3.6	N1103.3.4
N1103.3.7	N1103.3.5
N1107.2	N1101.13.1

Maintenance

The IRC is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate.

The ICC Code Development Process reflects principles of openness, transparency, balance, due process and consensus, the principles embodied in OMB Circular A-119, which governs the federal government's use of private-sector standards. The ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the ICC's cloud-based app, *cdpAccess*®. A broad cross section of interests are represented in the ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC's important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- National Association of Home Builders (NAHB)
- National Council of Structural Engineers Association (NCSEA)

The code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the ICC.

The maintenance process for the fuel gas provisions is based on the process used to maintain the IFGC, in conjunction with the AGA. The maintenance process for the electrical provisions is undertaken by the NFPA.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. The ICC does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

In each code development cycle, proposed changes to this code are considered at the Committee Action Hearings by the applicable International Code Development Committee as follows:

[RB] = IRC—Building Code Development Committee

[RE] = International Residential Energy Conservation Code Development Committee;

[MP] = IRC—Mechanical/Plumbing Code Development Committee

The [RE] committee is also responsible for the IECC—Residential Provisions.

For the development of the 2024 edition of the I-Codes, there will be two groups of code development committees and they will meet in separate years, as shown in the following Code Development Hearings Table.

Code change proposals submitted for IRC Chapters 1 and 3 through 10, Appendices AE, AF, AH, AJ, AK, AL, AM, AN, AO, AQ, AR, AS, AT, AU, AV and AW, and definitions designated [RB] are heard by the IRC—Building Committee during the Group B (2022) cycle code development hearing. Code change proposals submitted for Chapter 11 are heard by the International Energy Conservation Code Development Committee during the Group B (2022) cycle code development hearing. Proposed changes to all other chapters are heard by the IRC Plumbing and Mechanical Committee during the Group A (2021) code development cycle.

It is very important that anyone submitting code change proposals understand which code development committee is responsible for the section of the code that is the subject of the code change proposal. For further information on the code development committee responsibilities, please visit the ICC website at www.iccsafe.org/current-code-development-cycle.

Group A Codes (Heard in 2021, Code Change Proposals Deadline: January 11, 2021)	Group B Codes (Heard in 2022, Code Change Proposals Deadline: January 10, 2022)
International Building Code – Egress (Chapters 10, 11, Appendix E) – Fire Safety (Chapters 7, 8, 9, 14, 26) – General (Chapters 2–6, 12, 27–33, Appendices A, B, C, D, K, N)	Administrative Provisions (Chapter 1 of all codes except IECC, IRC and IgCC; IBC Appendix O; the appendices titled “Board of Appeals” for all codes except IECC, IRC, IgCC, ICCPC and IZC; administrative updates to currently referenced standards; and designated definitions)
International Fire Code	International Building Code – Structural (Chapters 15–25, Appendices F, G, H, I, J, L, M)
International Fuel Gas Code	International Existing Building Code
International Mechanical Code	International Energy Conservation Code— Commercial
International Plumbing Code	International Energy Conservation Code— Residential – IECC—Residential – IRC—Energy (Chapter 11)
International Property Maintenance Code	International Green Construction Code (Chapter 1)
International Private Sewage Disposal Code	International Residential Code – IRC—Building (Chapters 1–10, Appendices AE, AF, AH, AJ, AK, AL, AM, AO, AQ, AR, AS, AT, AU, AV, AW)
International Residential Code – IRC—Mechanical (Chapters 12–23) – IRC—Plumbing (Chapters 25–33, Appendices AG, AI, AN, AP)	
International Swimming Pool and Spa Code	
International Wildland-Urban Interface Code	
International Zoning Code	

Note: Proposed changes to the ICCPC will be heard by the code development committee noted in brackets [] in the text of the ICCPC.

Effective Use of the International Residential Code

The IRC was created to serve as a complete, comprehensive code regulating the construction of single-family houses, two-family houses (duplexes) and buildings consisting of three or more townhouse units. All buildings within the scope of the IRC are limited to three stories above grade plane. For example, a four-story single-family house would fall within the scope of the IBC, not the IRC. The benefits of devoting a separate code to residential construction include the fact that the user need not navigate through a multitude of code provisions that do not apply to residential construction in order to locate that which is applicable. A separate code also allows for residential and nonresidential code provisions to be distinct and tailored to the structures that fall within the appropriate code's scopes.

The IRC contains coverage for all components of a house or townhouse, including structural components, fireplaces and chimneys, thermal insulation, mechanical systems, fuel gas systems, plumbing systems and electrical systems.

The IRC is a prescriptive-oriented (specification) code with some examples of performance code language. It has been said that the IRC is the complete cookbook for residential construction. Section R301.1, for example, is written in performance language, but states that the prescriptive requirements of the code will achieve such performance.

It is important to understand that the IRC contains coverage for what is conventional and common in residential construction practice. While the IRC will provide all of the needed coverage for most residential construction, it might not address construction practices and systems that are atypical or rarely encountered in the industry. Sections such as R301.1.3, R301.2.2.1.1, R320.1, M1301.1, G2401.1 and P2601.1 refer to other codes either as an alternative to the provisions of the IRC or where the IRC lacks coverage for a particular type of structure, design, system, appliance or method of construction. In other words, the IRC is meant to be all inclusive for typical residential construction and it relies on other codes only where alternatives are desired or where the code lacks coverage for the uncommon aspect of residential construction. Of course, the IRC constantly evolves to address new technologies and construction practices that were once uncommon, but are now common.

The IRC is unique in that much of it, including Chapters 3 through 9 and Chapters 34 through 43, is presented in an ordered format that is consistent with the normal progression of construction, starting with the design phase and continuing through the final trim-out phase. This is consistent with the "cookbook" philosophy of the IRC.

ARRANGEMENT AND FORMAT OF THE 2021 IRC

The IRC is divided into nine main parts, specifically: Part I—Administrative, Part II—Definitions, Part III—Building Planning and Construction, Part IV—Energy Conservation, Part V—Mechanical, Part VI—Fuel Gas, Part VII—Plumbing, Part VIII—Electrical and Part IX—Referenced Standards.

The following provides a brief description of the content of each chapter and appendix of the IRC:

Chapter 1 Scope and Administration

This chapter contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. Chapter 1 is largely concerned with maintaining “due process of law” in enforcing the building criteria contained in the body of the code. Only through careful observation of the administrative provisions can the building official reasonably expect to demonstrate that “equal protection under the law” has been provided.

Chapter 2 Definitions

Terms defined in the code are listed alphabetically in Chapter 2. It is important to note that three chapters have their own definitions sections: Chapter 11 for the defined terms unique to energy conservation, Chapter 24 for the defined terms unique to fuel gas and Chapter 35 for the terms applicable to electrical Chapters 34 through 43. Where Chapter 24 or 35 defines a term differently than it is defined in Chapter 2, the definition applies in that chapter only. Chapter 2 definitions apply in all other locations in the code.

Where understanding a term’s definition is key to or necessary for understanding a particular code provision, the term is shown in italics where it appears in the code. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding not only tense, gender and plurality of defined terms, but also terms not defined in this code, is provided.

Chapter 3 Building Planning

Chapter 3 provides guidelines for a minimum level of structural integrity, life safety, fire safety and livability for inhabitants of dwelling units regulated by this code. Chapter 3 is a compilation of the code requirements specific to the building planning sector of the design and construction process. This chapter sets forth code requirements dealing with light, ventilation, sanitation, minimum room size, ceiling height and environmental comfort. Chapter 3 establishes life-safety provisions including limitations on glazing used in hazardous areas, specifications on stairways, use of guards at elevated surfaces, window and fall protection, and rules for means of egress. Snow, wind and seismic design live and dead loads and flood-resistant construction, as well as solar energy systems, and swimming pools, spas and hot tubs, are addressed in this chapter.

Chapter 4 Foundations

Chapter 4 provides the requirements for the design and construction of foundation systems for buildings regulated by this code. Provisions for seismic load, flood load and frost protection are contained in this chapter. A foundation system consists of two interdependent components: the foundation structure itself and the supporting soil.

The prescriptive provisions of this chapter provide requirements for constructing footings and walls for foundations of wood, masonry, concrete and precast concrete. In addition to a foundation's ability to support the required design loads, this chapter addresses several other factors that can affect foundation performance. These include controlling surface water and subsurface drainage, requiring soil tests where conditions warrant and evaluating proximity to slopes and minimum depth requirements. The chapter also provides requirements to minimize adverse effects of moisture, decay and pests in basements and crawl spaces.

Chapter 5 Floors

Chapter 5 provides the requirements for the design and construction of floor systems that will be capable of supporting minimum required design loads. This chapter covers four different types: wood floor framing, wood floors on the ground, cold-formed steel floor framing and concrete slabs on the ground. Allowable span tables are provided that greatly simplify the determination of joist, girder and sheathing sizes for raised floor systems of wood framing and cold-formed steel framing. This chapter also contains prescriptive requirements for wood-framed exterior decks and their attachment to the main building.

Chapter 6 Wall Construction

Chapter 6 contains provisions that regulate the design and construction of walls. The wall construction covered in Chapter 6 consists of five different types: wood framed, cold-formed steel framed, masonry, concrete and structural insulated panel (SIP). The primary concern of this chapter is the structural integrity of wall construction and transfer of all imposed loads to the supporting structure. This chapter provides the requirements for the design and construction of wall systems that are capable of supporting the minimum design vertical loads (dead, live and snow loads) and lateral loads (wind or seismic loads). This chapter contains the prescriptive requirements for wall bracing and/or shear walls to resist the imposed lateral loads due to wind and seismic activity.

Chapter 6 also regulates exterior windows and doors installed in walls. This chapter contains criteria for the performance of exterior windows and doors and includes provisions for testing and labeling, garage doors, windborne debris protection and anchorage details.

Chapter 7 Wall Covering

Chapter 7 contains provisions for the design and construction of interior and exterior wall coverings. This chapter establishes the various types of materials, materials standards and methods of application permitted for use as interior coverings, including interior plaster, gypsum board, ceramic tile, wood veneer paneling, hardboard paneling, wood shakes and wood shingles. Chapter 7 also contains requirements for the use of vapor retarders for moisture control in walls.

Exterior wall coverings provide the weather-resistant exterior envelope that protects the building's interior from the elements. Chapter 7 provides the requirements for wind resistance and water-resistive barrier for exterior wall coverings. This chapter prescribes the exterior wall coverings as well as the water-resistive barrier required beneath the exterior materials. Exterior wall coverings regulated by this section include aluminum, stone and masonry veneer, wood, hardboard, particleboard, wood structural panel siding, wood shakes and shingles, exterior plaster, steel, vinyl, fiber cement and exterior insulation finish systems.

Chapter 8 Roof-ceiling Construction

Chapter 8 regulates the design and construction of roof-ceiling systems. This chapter contains two roof-ceiling framing systems: wood framing and cold-formed steel framing. Allowable span tables are provided to simplify the selection of rafter and ceiling joist size for wood roof framing and cold-formed steel framing. Chapter 8 also provides requirements for the application of ceiling finishes, the proper ventilation of concealed spaces in roofs (e.g., enclosed attics and rafter spaces), unvented attic assemblies and attic access.

Chapter 9 Roof Assemblies

Chapter 9 regulates the design and construction of roof assemblies. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings.

The types of roof covering materials and installation regulated by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.

Chapter 10 Chimneys and Fireplaces

Chapter 10 contains requirements for the safe construction of masonry chimneys and fireplaces and establishes the standards for the use and installation of factory-built chimneys, fireplaces and masonry heaters. Chimneys and fireplaces constructed of masonry rely on prescriptive requirements for the details of their construction; the factory-built type relies on the listing and labeling method of approval. Chapter 10 provides the requirements for seismic reinforcing and anchorage of masonry fireplaces and chimneys.

Chapter 11 [RE] Energy Efficiency

Chapter 11 is not adopted in California. See California Energy Code, Title 24, Part 6.

Chapter 12 Mechanical Administration

Chapter 12 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 13 General Mechanical System Requirements

Chapter 13 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 14 Heating and Cooling Equipment and Appliances

Chapter 14 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 15 Exhaust Systems

Chapter 15 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 16 Duct Systems

Chapter 16 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 17 Combustion Air

Chapter 17 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 18 Chimneys and Vents

Chapter 18 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 19 Special Appliances, Equipment and Systems

Chapter 19 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 20 Boilers and Water Heaters

Chapter 20 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 21 Hydronic Piping

Chapter 21 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 22 Special Piping and Storage Systems

Chapter 22 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 23 Solar Thermal Energy Systems

Chapter 23 is not adopted in California. See California Mechanical Code, Title 24, Part 4.

Chapter 24 Fuel Gas

Chapter 24 is not adopted in California. See California Mechanical Code and California Plumbing Code, Title 24, Parts 4 and 5.

Chapter 25 Plumbing Administration

Chapter 25 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 26 General Plumbing Requirements

Chapter 26 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 27 Plumbing Fixtures

Chapter 27 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 28 Water Heaters

Chapter 28 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 29 Water Supply and Distribution

Chapter 29 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 30 Sanitary Drainage

Chapter 30 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 31 Vents

Chapter 31 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 32 Traps

Chapter 32 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 33 Storm Drainage

Chapter 33 is not adopted in California. See California Plumbing Code, Title 24, Part 5.

Chapter 34 General Requirements

Chapter 34 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 35 Electrical Definitions

Chapter 35 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 36 Services

Chapter 36 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 37 Branch Circuit and Feeder Requirements

Chapter 37 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 38 Wiring Methods

Chapter 38 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 39 Power and Lighting Distribution

Chapter 39 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 40 Devices and Luminaires

Chapter 40 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 41 Appliance Installation

Chapter 41 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 42 Swimming Pools

Chapter 42 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 43 Class 2 Remote-control, Signaling and Power-limited Circuits

Chapter 43 is not adopted in California. See California Electrical Code, Title 24, Part 3.

Chapter 44 Referenced Standards

The code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 44 contains a comprehensive list of all standards that are referenced in the code. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the code official, contractor, designer and owner.

Chapter 44 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards, alphabetically, by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based upon the standard identification. The list also contains the title of the standard; the edition (date) of the standard referenced; any addenda included as part of the ICC adoption; and the section or sections of this code that reference the standard.

Appendix AA Reserved

Appendix AB Reserved

Appendix AC Reserved

Appendix AD Reserved

Appendix AE Reserved

Appendix AF Radon Control Methods

Radon comes from the natural (radioactive) decay of the element radium in soil, rock and water and finds its way into the air. Appendix AF contains requirements to mitigate the transfer of radon gases from the soil into the dwelling. The provisions of this appendix regulate the design and construction of radon-resistant measures intended to reduce the entry of radon gases into the living space of residential buildings.

Appendix AG Reserved

Appendix AH Patio Covers

Appendix AH sets forth the regulations and limitations for patio covers. The provisions address those uses permitted in patio cover structures, the minimum design loads to be assigned for structural purposes, and the effect of the patio cover on egress and emergency escape or rescue from sleeping rooms. This appendix also contains the special provisions for aluminum screen enclosures in hurricane-prone regions.

Appendix AI Private Sewage Disposal

Appendix AI simply provides the opportunity to utilize the International Private Sewage Disposal Code for the design and installation of private sewage disposal in one- and two-family dwellings.

Appendix AJ Existing Buildings and Structures

Appendix AJ contains the provisions for the repair, renovation, alteration and reconstruction of existing buildings and structures that are within the scope of this code. To accomplish this objective and to make the rehabilitation process more available, this appendix allows for a controlled departure from full code compliance without compromising minimum life safety, fire safety, structural and environmental features of the rehabilitated existing building or structure.

Appendix AK Sound Transmission

Appendix AK regulates the sound transmission of wall and floor-ceiling assemblies separating dwelling units and townhouse units. Airborne sound insulation is required for walls. Airborne sound insulation and impact sound insulation are required for floor-ceiling assemblies. The provisions in Appendix AK set forth a minimum Sound Transmission Class (STC) rating for common walls and floor-ceiling assemblies between dwelling units. In addition, a minimum Impact Insulation Class (IIC) rating is also established to limit structureborne sound through common floor-ceiling assemblies separating dwelling units.

Appendix AL Permit Fees

Appendix AL provides guidance to jurisdictions for setting appropriate permit fees. This appendix will aid many jurisdictions to assess permit fees that will assist to fairly and properly administer the code. This appendix can be used for informational purposes only or may be adopted when specifically referenced in the adopting ordinance.

Appendix AM Reserved

Appendix AN Reserved

Appendix AO Automatic Vehicular Gates

Appendix AO provides the requirements for the design and construction of automatic vehicular gates. The provisions are for where automatic gates are installed for use at a vehicular entrance or exit on the lot of a one- or two-family dwelling. The requirements provide protection for individuals from potential entrapment between an automatic gate and a stationary object or surface.

Appendix AP Reserved

Appendix AQ Tiny Houses

For dwelling units that are 400 square feet (37 m²) or less in floor area, excluding lofts, Appendix AQ provides relaxed provisions as compared to those in the body of the code. These provisions primarily address reduced ceiling heights for loft areas and specific stair and ladder detail requirements that allow for more compact designs where accessing lofts.

Appendix AR Light Straw-clay Construction

This appendix regulates the use of light straw-clay as a construction material. It is limited in application to nonbearing wall infill systems.

Appendix AS Strawbale Construction

This appendix provides prescriptive requirements for the use of strawbale as a construction material. It is limited in application to the walls of one-story structures, except where additional engineering is provided.

Appendix AT Solar-ready Provisions—Detached One- and Two-family Dwellings and Townhouses

This appendix provides requirements for preparation of a house for future installation of solar equipment for electrical power or heating. Given the growing popularity of solar power and the possible need for the equipment in the future, this appendix, if adopted, would require an area be provided on the building roof that would accommodate solar equipment. In addition, pathways for routing of plumbing and conduit need to be provided.

Appendix AU Cob Construction (Monolithic Adobe)

This appendix provides prescriptive requirements for the use of natural cob (monolithic adobe) as a construction material. It is limited in application to the walls of one-story structures, except where additional engineering is provided.

Appendix AV Board of Appeals

This appendix provides criteria for Board of Appeals members and procedures by which the Board of Appeals should conduct its business.

Appendix AW 3D-printed Building Construction

Appendix AW provides for the design, construction and inspection of buildings, structures and building elements fabricated by 3D-printed construction techniques.

Appendix AX Swimming Pool Safety Act

Appendix AX provides the language of the Swimming Pool Safety Act for the code user's convenience.

Appendix AY Areas Protected by the Facilities of the Central Valley Flood Protection Plan

Appendix AY provides the provisions for areas protected by the facilities of the Central Valley Flood Protection Plan.

Appendix AZ Emergency Housing

Appendix AZ provides the provisions for emergency housing and emergency housing facilities.

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CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 1 – SCOPE AND APPLICATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/C C	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below	X		X	X																			
Chapter / Section																							
Division I California Administration																							
1.1 through 1.1.12			X	X																			
1.8 through 1.8.10.2				X																			
1.11 through 1.11.11			X																				
Division II Administration																							
R101.2			X																				
R104.2 - R104.4			X																				
R104.9 - R104.9.1			X																				
R105.1			X																				
R105.5.1	X																						
R105.2			X	X																			
Building: Items 1 - 10																							
Electrical:				†																			
Gas:				†																			
Mechanical:				†																			
Plumbing:				†																			
R105.2.1 - R105.2.2			X																				
R105.3 - R105.3.1			X																				
R105.4			X																				
R105.6			X																				
R105.7			X																				
R106 - R106.5			X																				
R106.1				X																			
R106.1.1				X																			
R106.1.3				X																			
R106.1.4				X																			
R106.1.5				X																			
R106.2				X																			
R107 - R107.4			X																				
R109.1			X	X																			
R109.1.1				X																			
R109.1.1.1				X																			
R109.1.2				†																			
R109.1.3				X																			
R109.1.4			X	X																			
R109.1.4.1				X																			
R109.1.4.2				X																			

(continued)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
CHAPTER 1 – SCOPE AND APPLICATION—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/C C	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X	X																		
Chapter / Section																						
R109.1.5			X	X																		
R109.1.5.1			X	X																		
<i>R109.1.5.2</i>				X																		
<i>R109.1.5.3</i>				X																		
R109.1.6			X	X																		
R109.1.6.1				X																		
<i>R109.1.6.2</i>				X																		
R109.2 - R109.4			X																			
R110 - R110.5			X																			
R111 - R111.3			X																			
R113 - R113.2			X																			
R114 - R114.3			X																			

The state agency does not adopt sections identified with the following symbol: †

Part I—Administrative

CHAPTER 1 SCOPE AND APPLICATION DIVISION I CALIFORNIA ADMINISTRATION

SECTION 1.1 GENERAL

1.1.1 Title. *These regulations shall be known as the California Residential Code, may be cited as such and will be referred to herein as “this code.” The California Residential Code is Part 2.5 of thirteen parts of the official compilation and publication of the adoption, amendment and repeal of building regulations to the California Code of Regulations, Title 24, also referred to as the California Building Standards Code. This part incorporates by adoption the 2021 International Residential Code of the International Code Council with necessary California amendments.*

1.1.2 Purpose. *The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation and energy conservation; safety to life and property from fire and other hazards attributed to the built environment; and to provide safety to fire fighters and emergency responders during emergency operations.*

1.1.3 Scope. *The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every detached one- and two-family dwelling and townhouse not more than three stories above grade plane in height with a separate means of egress and structures accessory thereto throughout the State of California.*

Exceptions:

- 1. Live/work units complying with the requirements of Section 419 of the California Building Code shall be permitted to be constructed as one- and two-family dwellings or townhouses in accordance with this code, as applicable. Fire suppression required by Section 419.5 of the California Building Code when constructed under the California Residential Code for one- and two-family dwellings shall conform to Section 903.3.1.3 of the California Building Code.*
- 2. Owner-occupied lodging houses with five or fewer guestrooms shall be permitted to be constructed in accordance with the California Residential Code for one- and two-family dwellings when equipped with a fire sprinkler system in accordance with Section R313.*

1.1.3.1 Classification. *Structures or portions of structures shall be classified with respect to occupancy in one or more of the groups listed in Chapter 3 of the California Building Code. A room or space that is intended to be occupied at different times for different purposes shall comply with all of the requirements that are applicable to each of the purposes for which the room or space will be occupied. Structures with multiple occupancies or uses shall comply with Section 508 of the California Building Code. Where a structure is proposed for a purpose that is not specifically provided for in this code, such structure shall be classified in the group that the occupancy most nearly resembles, according to the fire safety and relative hazard involved in accordance with this code or the California Building Code.*

Note: *Live/work units complying with the requirements of Section 419 of the California Building Code are classified as a Group R-2 occupancy and are permitted to be constructed as one- and two-family dwellings or townhouses in accordance with this code.*

1.1.3.1.1 Utility and Miscellaneous Group U. *Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:*

- Agricultural buildings*
- Aircraft hangars, accessory to a one- or two-family residence (see Section 412.5 of the California Building Code)*
- Barns*
- Carports*
- Fences more than 7 feet (2134 mm) high*
- Grain silos, accessory to a residential occupancy*
- Greenhouses*
- Livestock shelters*
- Private garages*
- Retaining walls*
- Sheds*
- Stables*
- Tanks*
- Towers*

1.1.3.2 Regulated buildings, structures and applications.

The model code, state amendments to the model code and/or state amendments where there are no relevant model code provisions shall apply to detached one- and two-family dwellings, lodging houses, live/work units, townhouses and structures accessory thereto. State agencies with regulatory authority as specified in Sections 1.2 through 1.14, except where modified by local ordinance pursuant to Section 1.1.8. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.

Note: See “How to Distinguish Between Model Code Language and California Amendments” following the Preface.

1. One- and two-family dwellings, townhouses, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with common toilets or cooking facilities. See Section 1.8.2.1.1.
2. Permanent buildings and permanent accessory buildings or structures constructed within mobile-home parks and special occupancy parks regulated by the Department of Housing and Community Development. See Section 1.8.2.1.3.
3. Applications regulated by the Office of the State Fire Marshal include, but are not limited to, the following in accordance with Section 1.11:
 - 3.1. Buildings or structures used or intended for use as a/an:
 1. Home for the elderly, children’s nursery, children’s home or institution, school or any similar occupancy of any capacity
 2. Small family day-care homes, large family day-care homes, residential facilities and residential facilities for the elderly, residential care facilities
 3. State institutions or other state-owned or state-occupied buildings
 4. Residential structures
 5. Tents, awnings or other fabric enclosures used in connection with any occupancy
 6. Fire alarm devices, equipment and systems in connection with any occupancy
 7. Wildland-urban interface fire areas

1.1.4 Appendices. Provisions contained in the appendices of this code shall not apply unless specifically adopted by a state agency or adopted by a local enforcing agency in compliance with Health and Safety Code Section 18901 et seq. for Building Standards Law, Health and Safety Code Section 17950 for State Housing Law and Health and Safety Code Section 13869.7 for Fire Protection Districts. See Section 1.1.8 of this code.

1.1.5 Referenced codes. The codes, standards and publications adopted and set forth in this code, including other

codes, standards and publications referred to therein are, by title and date of publication, hereby adopted as standard reference documents of this code. When this code does not specifically cover any subject related to building design and construction, recognized architectural or engineering practices shall be employed. The National Fire Codes, standards and the Fire Protection Handbook of the National Fire Protection Association are permitted to be used as authoritative guides in determining recognized fire prevention engineering practices.

1.1.6 Nonbuilding standards, orders and regulations.

Requirements contained in the International Residential Code, or in any other referenced standard, code or document, which are not building standards as defined in Health and Safety Code Section 18909, shall not be construed as part of the provisions of this code. For nonbuilding standards, orders and regulations, see other titles of the California Code of Regulations.

1.1.7 Order of precedence and use.

1.1.7.1 Differences. In the event of any differences between these building standards and the standard reference documents, the text of these building standards shall govern.

1.1.7.2 Specific provisions. Where a specific provision varies from a general provision, the specific provision shall apply.

1.1.7.3 Conflicts. When the requirements of this code conflict with the requirements of any other part of the California Building Standards Code, Title 24, the most restrictive requirements shall prevail.

1.1.7.3.1 Detached one- and two-family dwellings.

Detached one- and two-family dwellings, lodging houses, live/work units, townhouses not more than three stories above grade plane in height with a separate means of egress, and their accessory structures may be designed and constructed in accordance with this code or the California Building Code, but not both, unless the proposed structure(s) or element(s) exceed the design limitations established in this code, and the code user is specifically directed by this code to use the California Building Code.

1.1.8 City, county, or city and county amendments, additions or deletions.

The provisions of this code do not limit the authority of a city, county, or city and county governments to establish more restrictive and reasonably necessary differences to the provisions contained in this code pursuant to complying with Section 1.1.8.1. The effective date of amendments, additions or deletions to this code by a city, county, or city and county filed pursuant to Section 1.1.8.1 shall be the date filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with Health and Safety Code Section 18941.5 for Building Standards Law, Health and Safety Code Section 17958 for State Housing Law or Health and Safety Code Section 13869.7 for Fire Protection Districts.

1.1.8.1 Findings and filings.

1. The city, county, or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geological conditions.

Exception: Hazardous building ordinances and programs mitigating unreinforced masonry buildings.

2. The city, county, or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties and fire departments shall file the amendments, additions or deletions, and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.

3. Findings prepared by fire protection districts shall be ratified by the local city, county, or city and county and filed with the California Department of Housing and Community Development, Division of Codes and Standards, P.O. Box 278180, Sacramento, CA 95827-8180 or 9342 Tech Center Drive Suite #500, Sacramento, CA 95826-2582.

1.1.9 Effective date of this code. Only those standards approved by the California Building Standards Commission that are effective at the time an application for building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the History Note page of this code.

Exceptions:

- (1.) (HCD 1 & HCD 2) Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.
- (2.) (HCD 1 & HCD 2) Plans approved by the Department of Housing and Community Development or a Department-approved design approval agency for factory-built housing as defined by Health and Safety Code Section 19971. Approved plans, pursuant to the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, Article 3, Section 3048 remain valid for a period of 36 months from the date of plan approval.

1.1.10 Availability of codes. At least one complete copy each of Titles 8, 19, 20, 24 and 25 with all revisions shall be maintained in the office of the building official responsible for the administration and enforcement of this code. Each state department concerned and each city, county, or city and county shall have an up-to-date copy of the code available for public inspection. See Health and Safety Code Section 18942(e) (1) and (2).

1.1.11 Format. This part fundamentally adopts the International Residential Code by reference on a chapter-by-chapter basis. When a specific chapter of the International Residential Code is not printed in the code and is marked “Reserved,” such chapter of the International Residential Code is not adopted as a portion of this code. When a specific

chapter of the International Residential Code is marked “Not adopted by the State of California” but appears in the code, it may be available for adoption by local ordinance.

Note: Matrix Adoption Tables at the front of each chapter may aid the code user in determining which chapter or sections within a chapter are applicable to buildings under the authority of a specific state agency, but they are not to be considered regulatory.

1.1.12 Validity. If any chapter, section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, contrary to statute, exceeding the authority of the state as stipulated by statutes or otherwise inoperative, such decision shall not affect the validity of the remaining portion of this code.

**SECTION 1.2
Reserved**

**SECTION 1.3
Reserved**

**SECTION 1.4
Reserved**

**SECTION 1.5
Reserved**

**SECTION 1.6
Reserved**

**SECTION 1.7
Reserved**

**SECTION 1.8
DEPARTMENT OF HOUSING
AND COMMUNITY DEVELOPMENT (HCD)**

1.8.1 Purpose. The purpose of this code is to establish the minimum requirements necessary to protect the health, safety and general welfare of the occupants and the public by governing accessibility, erection, construction, reconstruction, enlargement, conversion, alteration, repair, moving, removal, demolition, occupancy, use, height, court, area, sanitation, ventilation, maintenance and safety to life and property from fire and other hazards attributed to the built environment.

**SECTION 1.8.2
AUTHORITY AND ABBREVIATIONS**

1.8.2.1 General. The Department of Housing and Community Development is authorized by law to promulgate and adopt building standards and regulations for several types of building applications. The applications under the authority of the Department of Housing and Community Development are listed in Sections 1.8.2.1.1 through 1.8.2.1.3.

1.8.2.1.1 Housing construction.

Application—Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities including accessory buildings, facilities and uses thereto. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 1.”

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Business and Professions Code, Division 5; Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 832, 1101.4, 1101.5, 1954.201, 1954.202 and 5551; Government Code Sections 8698.4, 12955.1 and 12955.1.1; and California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.2 Housing accessibility.

Application—Covered multifamily dwellings as defined in Chapter 2 of the California Building Code including, but not limited to, lodging houses, dormitories, timeshares, condominiums, shelters for homeless persons, congregate residences, apartments, dwellings, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities.

Sections of this code identified by the abbreviation “HCD 1-AC” require specific accommodations for persons with disabilities as defined in Chapter 2 of the California Building Code. The application of such provisions shall be in conjunction with other requirements of the Building Standards Code and apply only to newly constructed covered multifamily dwellings as defined in Chapter 2 of the California Building Code. “HCD 1-AC” applications include, but are not limited to, the following:

1. All newly constructed covered multifamily dwellings as defined in Chapter 2 of the California Building Code.
2. New common use areas as defined in Chapter 2 of the California Building Code serving existing covered multifamily dwellings.
3. Additions to existing buildings, where the addition alone meets the definition of covered multifamily dwellings as defined in Chapter 2 of the California Building Code.
4. New common use areas serving new covered multifamily dwellings.

5. Where any portion of a building’s exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of California Building Code, Chapter 11A.

“HCD 1-AC” building standards generally do not apply to public use areas or public accommodations such as hotels and motels and public housing. Public use areas, public accommodations and public housing, as defined in Chapter 2 of the California Building Code, are subject to the Division of the State Architect (DSA-AC) in Chapter 11B and are referenced in California Building Code Section 1.9.1.

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Sections 12955.1 and 12955.11.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 1101.4, 1101.5, 1954.201 and 1954.202; Government Code Sections 12955.1 and 12955.1.1; and California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.3 Permanent buildings in mobilehome parks and special occupancy parks.

Application—Permanent buildings, and permanent accessory buildings or structures, constructed within mobilehome parks and special occupancy parks that are under the control and ownership of the park operator. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 2.”

Enforcing agency—The Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 for special occupancy parks.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17926, 17927, 17928, 17958.12, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1 through 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code

Sections 1101.4, 1101.5 and 1954.201; Government Code Sections 12955.1 and 12955.1.1; and California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

**SECTION 1.8.3
LOCAL ENFORCING AGENCY**

1.8.3.1 Duties and powers. The building department of every city, county, or city and county shall enforce all the provisions of law, this code, and the other rules and regulations promulgated by the Department of Housing and Community Development pertaining to the installation, erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

The provisions regulating the erection and construction of dwellings and appurtenant structures shall not apply to existing structures as to which construction is commenced or approved prior to the effective date of these regulations. Requirements relating to use, maintenance and occupancy shall apply to all dwellings and appurtenant structures approved for construction or constructed before or after the effective date of this code.

For additional information regarding the use and occupancy of existing buildings and appurtenant structures, see California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Article 1, Section 1.

For additional requirements regarding additions, alterations or repairs to existing buildings and appurtenant structures, see the California Existing Building Code.

1.8.3.2 Laws, rules and regulations. Other than the building standards contained in this code, and notwithstanding other provisions of law, the statutory authority and location of the laws, rules and regulations to be enforced by local enforcing agencies are listed by statute in Sections 1.8.3.2.1 through 1.8.3.2.5 below:

1.8.3.2.1 State Housing Law. Refer to the State Housing Law, California Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1, for the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

1.8.3.2.2 Mobilehome Parks Act. Refer to the Mobilehome Parks Act, California Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000 for mobilehome park administrative and enforcement authority, permits, plans, fees, violations, inspections and penalties both within and outside mobilehome parks.

Exception: Mobilehome parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.3 Special Occupancy Parks Act. Refer to the Special Occupancy Parks Act, California Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000 for special occupancy park administrative and enforcement authority, permits, fees, violations, inspections and penalties both within and outside of special occupancy parks.

Exception: Special occupancy parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.4 Employee Housing Act. Refer to the Employee Housing Act, California Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600 for employee housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

1.8.3.2.5 Factory-Built Housing Law. Refer to the Factory-Built Housing Law, California Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000 for factory-built housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

**SECTION 1.8.4
PERMITS, FEES,
APPLICATIONS AND INSPECTIONS**

1.8.4.1 Permits. A written construction permit shall be obtained from the enforcing agency prior to the erection, construction, reconstruction, installation, moving or alteration of any building or structure.

Exceptions:

1. Work exempt from permits as specified in Chapter 1, Scope and Application, Division II, Administration, Section R105.2.
2. Changes, alterations or repairs of a minor nature not affecting structural features, egress, sanitation, safety or accessibility as determined by the enforcing agency.
3. Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.

Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of other provisions of law or this code.

1.8.4.2 Fees. Subject to other provisions of law, the governing body of any city, county, or city and county may prescribe fees to defray the cost of enforcement of rules and regulations promulgated by the Department of Housing and Community Development. The amount of the fees shall not exceed the amount reasonably necessary to administer or process per-

mits, certificates, forms or other documents, or to defray the costs of enforcement. For additional information, see State Housing Law, Health and Safety Code, Division 13, Part 1.5, Section 17951 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, Article 3, commencing with Section 6.

1.8.4.3 Plan review and time limitations. Subject to other provisions of law, provisions related to plan checking, prohibition of excessive delays and contracting with or employment of private parties to perform plan checking are set forth in State Housing Law, Health and Safety Code Section 17960.1, and for employee housing, in Health and Safety Code Section 17021.

1.8.4.3.1 Retention of plans. The building department of every city, county or city and county shall maintain an official copy, microfilm, electronic or other type of photographic copy of the plans of every building, during the life of the building, for which the department issued a building permit.

Exceptions:

1. Single or multiple dwellings not more than two stories and basement in height.
2. Garages and other structures appurtenant to buildings listed in Exception 1.
3. Farm or ranch buildings appurtenant to buildings listed in Exception 1.
4. Any one-story building where the span between bearing walls does not exceed 25 feet (7620 mm), except a steel frame or concrete building.

All plans for common interest developments as defined in Section 4100 of the California Civil Code shall be retained. For additional information regarding plan retention and reproduction of plans by an enforcing agency, see Health and Safety Code Sections 19850 through 19852.

1.8.4.4 Inspections. Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or other regulations of the Department of Housing and Community Development. Required inspections are listed in Chapter 1, Scope and Application, Division II, Administration, Sections R109.1.1, R109.1.1.1, R109.1.3, R109.1.4, R109.1.4.1, R109.1.4.2, R109.1.5, R109.1.5.1, R109.1.5.2, R109.1.5.3, R109.1.6, R109.1.6.1 and R109.1.6.2.

SECTION 1.8.5

RIGHT OF ENTRY FOR ENFORCEMENT

1.8.5.1 General. Subject to other provisions of law, officers and agents of the enforcing agency may enter and inspect public and private properties to secure compliance with the rules and regulations promulgated by the Department of Housing and Community Development. For limitations and

additional information regarding enforcement, see the following:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this Code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Sections 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

SECTION 1.8.6

LOCAL MODIFICATION BY ORDINANCE OR REGULATION

1.8.6.1 General. Subject to other provisions of law, a city, county or city and county may make changes to the provisions adopted by the Department of Housing and Community Development. If any city, county or city and county does not amend, add or repeal by local ordinances or regulations the provisions published in this code or other regulations promulgated by the Department of Housing and Community Development, those provisions shall be applicable and shall become effective 180 days after publication by the California Building Standards Commission. Amendments, additions and deletions to this code adopted by a city, county or city and county pursuant to California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, together with all applicable portions of this code, shall also become effective 180 days after publication of the California Building Standards Code by the California Building Standards Commission.

1.8.6.2 Findings, filings and rejections of local modifications. Prior to making any modifications or establishing more restrictive building standards, the governing body shall make express findings and filings, as required by California Health and Safety Code Section 17958.7, showing that such modifi-

cations are reasonably necessary due to local climatic, geological or topographical conditions. No modification shall become effective or operative unless the following requirements are met:

1. The express findings shall be made available as a public record.
2. A copy of the modification and express finding, each document marked to cross-reference the other, shall be filed with the California Building Standards Commission for a city, county or city and county and with the Department of Housing and Community Development for fire protection districts.
3. The California Building Standards Commission has not rejected the modification or change.

Nothing in this section shall limit the authority of fire protection districts pursuant to California Health and Safety Code Section 13869.7(a).

**SECTION 1.8.7
ALTERNATE MATERIALS, DESIGNS,
TESTS AND METHODS OF CONSTRUCTION**

1.8.7.1 General. The provisions of this code, as adopted by the Department of Housing and Community Development, are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, design or method of construction not specifically prescribed by this code. Consideration and approval of alternates shall comply with Section 1.8.7.2 for local building departments and Section 1.8.7.3 for the Department of Housing and Community Development.

1.8.7.2 Local building departments. The building department of any city, county or city and county may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses, dwellings or accessory structures, except for the following:

1. Structures located in mobilehome parks as defined in California Health and Safety Code Section 18214.
2. Structures located in special occupancy parks as defined in California Health and Safety Code Section 18862.43.
3. Factory-built housing as defined in California Health and Safety Code Section 19971.

1.8.7.2.1 Approval of alternates. The consideration and approval of alternates by a local building department shall comply with the following procedures and limitations:

1. The approval shall be granted on a case-by-case basis.
2. Evidence shall be submitted to substantiate claims that the proposed alternate, in performance, safety and protection of life and health, conforms to, or is at least equivalent to, the standards contained in this code and other rules and regulations promulgated

by the Department of Housing and Community Development.

3. The local building department may require tests performed by an approved testing agency at the expense of the owner or owner's agent as proof of compliance.
4. If the proposed alternate is related to accessibility in covered multifamily dwellings or in facilities serving covered multifamily dwellings as defined in CBC Chapter 2, the proposed alternate must also meet the threshold set for equivalent facilitation as defined in Chapter 2 of the California Building Code.

For additional information regarding approval of alternates by a building department pursuant to the State Housing Law, see California Health and Safety Code Section 17951(e) and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

1.8.7.3 Department of Housing and Community Development. The Department of Housing and Community Development may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal or demolition of apartments, condominiums, hotels, motels, lodging houses, dwellings, or an accessory thereto and permanent buildings in mobilehome parks and special occupancy parks. The consideration and approval of alternates shall comply with the following:

1. The department may require tests at the expense of the owner or owner's agent to substantiate compliance with the California Building Standards Code.
2. The approved alternate shall, for its intended purpose, be at least equivalent in performance and safety to the materials, designs, tests or methods of construction prescribed by this code.

**SECTION 1.8.8
APPEALS BOARD**

1.8.8.1 General. Every city, county or city and county shall establish a process to hear and decide appeals of orders, decisions and determinations made by the enforcing agency relative to the application and interpretation of this code and other regulations governing construction, use, maintenance and change of occupancy. The governing body of any city, county or city and county may establish a local appeals board and a housing appeals board to serve this purpose. Members of the appeals board(s) shall not be employees of the enforcing agency and shall be knowledgeable in the applicable building codes, regulations and ordinances as determined by the governing body of the city, county or city and county.

Where no such appeals boards or agencies have been established, the governing body of the city, county or city and county shall serve as the local appeals board or housing appeals board as specified in California Health and Safety Code Sections 17920.5 and 17920.6.

1.8.8.2 Definitions. *The following terms shall for the purposes of this section have the meaning shown.*

HOUSING APPEALS BOARD. *The board or agency of a city, county or city and county which is authorized by the governing body of the city, county or city and county to hear appeals regarding the requirements of the city, county or city and county relating to the use, maintenance and change of occupancy of buildings and structures, including requirements governing alteration, additions, repair, demolition and moving. In any area in which there is no such board or agency, “Housing Appeals Board” means the local appeals board having jurisdiction over the area.*

LOCAL APPEALS BOARD. *The board or agency of a city, county or city and county which is authorized by the governing body of the city, county or city and county to hear appeals regarding the building requirements of the city, county or city and county. In any area in which there is no such board or agency, “Local Appeals Board” means the governing body of the city, county or city and county having jurisdiction over the area.*

1.8.8.3 Appeals. *Except as otherwise provided in law, any person, firm or corporation adversely affected by a decision, order or determination by a city, county or city and county relating to the application of building standards published in the California Building Standards Code, or any other applicable rule or regulation adopted by the Department of Housing and Community Development, or any lawfully enacted ordinance by a city, county or city and county, may appeal the issue for resolution to the local appeals board or housing appeals board as appropriate.*

The local appeals board shall hear appeals relating to new building construction, and the housing appeals board shall hear appeals relating to existing buildings.

SECTION 1.8.9 UNSAFE BUILDINGS OR STRUCTURES

1.8.9.1 Authority to enforce. *Subject to other provisions of law, the administration, enforcement, actions, proceedings, abatement, violations and penalties for unsafe buildings and structures are contained in the following statutes and regulations:*

1. *For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1. For enforcement related to accessory dwelling units, see Health and Safety Code Section 17980.12 operative until January 1, 2035.*
2. *For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of*

Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.

3. *For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.*
4. *For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.*
5. *For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.*

1.8.9.2 Actions and proceedings. *Subject to other provisions of law, punishments, penalties and fines for violations of building standards are contained in the following statutes and regulations:*

1. *For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.*
2. *For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.*
3. *For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to the Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.*
4. *For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.*
5. *For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.*

**SECTION 1.8.10
OTHER BUILDING REGULATIONS**

1.8.10.1 Existing structures. Notwithstanding other provisions of law, the replacement, retention and extension of original materials, and the use of original methods of construction for any existing building or accessory structure, or portions thereof, shall be permitted in accordance with the provisions of this code and the California Existing Building Code, as adopted by the Department of Housing and Community Development. For additional information, see California Health and Safety Code, Sections 17912, 17920.3, 17922 and 17958.8.

1.8.10.2 Moved structures. Subject to the requirements of California Health and Safety Code Sections 17922, 17922.3 and 17958.9, local ordinances or regulations relating to a moved residential building or accessory structure thereto, shall permit the replacement, retention and extension of original materials, and the use of original methods of construction so long as the structure does not become or continue to be a substandard building.

**SECTION 1.9
Reserved**

**SECTION 1.10
Reserved**

**SECTION 1.11
OFFICE OF THE STATE FIRE MARSHAL**

1.11.1 SFM—Office of the State Fire Marshal. Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application. Institutional, educational or any similar occupancy. Any building or structure used or intended for use as an asylum, jail, prison, mental hospital, hospital, sanitarium, home for the elderly, children’s nursery, children’s home or institution, school or any similar occupancy of any capacity.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Assembly or similar place of assemblage. Any theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Small family day-care homes.

Authority cited—Health and Safety Code Sections 1597.45, 1597.54, 13143 and 17921.

Reference—Health and Safety Code Section 13143.

Large family day-care homes.

Authority cited—Health and Safety Code Sections 1597.46, 1597.54 and 17921.

Reference—Health and Safety Code Section 13143.

Residential facilities and residential facilities for the elderly.

Authority cited—Health and Safety Code Section 13133.

Reference—Health and Safety Code Section 13143.

Any state institution or other state-owned or specified state-occupied building.

Specified state-occupied buildings. Any building, structure or area that meets any of the following criteria:

1. A building where the state has contracted into a build-to-suit lease.
2. A courthouse holding facility or trial court with a detention area.
3. A building used by the Department of Corrections and Rehabilitation (CDCR) as a community correctional reentry center.
4. 100 percent state occupied.
5. State-occupied areas in a state-leased building that is a high-rise and is 75 percent of the net area floor space or more occupied by state entities.
6. State-occupied areas in a building that contains 5,000 square feet (465 m²) or more space of state-leased Group H or Group L occupancy.
7. A state-leased building with facilities with the primary purpose of housing state records and/or state artifacts of historical significance.
8. Properties leased by California State University (CSU) or University of California (UC).
9. State institutions and their real property.
10. CAL FIRE occupied areas in leased buildings.
11. State-leased facilities where the governing body’s fire protection services rely on an all-volunteer fire department.

Except as provided in Items 1 through 11, buildings shall become the responsibility of the local jurisdiction.

Authority cited—Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921.

Reference—Health and Safety Code Sections 13108, 13143, 13145, 13146, 16022.5 and 17921.

High-rise structures.

Authority cited—Health and Safety Code Section 13211.

Reference—Health and Safety Code Section 13143.

Motion picture production studios.

Authority cited—Health and Safety Code Section 13143.1.

Reference—Health and Safety Code Section 13143.

Organized camps.

Authority cited—Health and Safety Code Section 18897.3.

Reference—Health and Safety Code Section 13143.

Residential. All hotels, motels, lodging houses, apartment houses and dwellings, including congregate residences and buildings and structures accessory thereto. Multiple-story structures existing on January 1, 1975, let for human habitation, including and limited to, hotels, motels and apartment houses, less than 75 feet (22 860 mm) above the lowest floor level having building access, wherein rooms used for sleeping are let above the ground floor.

Authority cited—Health and Safety Code Sections 13143.2 and 17921.

Reference—Health and Safety Code Section 13143.

Residential care facilities. Certified family care homes, out-of-home placement facilities, halfway houses, drug and/or alcohol rehabilitation facilities and any building or structure used or intended for use as a home or institution for the housing of any person of any age when such person is referred to or placed within such home or institution for protective social care and supervision services by any governmental agency.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Tents, awnings or other fabric enclosures used in connection with any occupancy.

Authority cited—Health and Safety Code Section 13116.

Reference—Health and Safety Code Section 13143.

Fire alarm devices, equipment and systems in connection with any occupancy.

Authority cited—Health and Safety Code Section 13114.

Reference—Health and Safety Code Section 13143.

Hazardous materials.

Authority cited—Health and Safety Code Section 13143.9.

Reference—Health and Safety Code Section 13143.

Flammable and combustible liquids.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Public school automatic fire detection, alarm and sprinkler systems.

Authority cited—Health and Safety Code Section 13143 and California Education Code Article 7.5, Sections 17074.50, 17074.52 and 17074.54.

Reference—Government Code Section 11152.5, Health and Safety Code Section 13143 and California Education Code Chapter 12.5, Leroy F. Greene School Facilities Act of 1998, Article 1.

Wildland-Urban interface fire area.

Authority cited—Health and Safety Code Sections 13143, 13108.5(a) and 18949.2(b) and (c) and Government Code Section 51189.

Reference—Health and Safety Code Sections 13143, Government Code Sections 51176, 51177, 51178 and 51179 and Public Resources Code Sections 4201 through 4204.

1.11.1.1 Adopting agency identification. The provisions of this code applicable to buildings identified in this Sub-section 1.11.1 will be identified in the Matrix Adoption Tables under the acronym SFM.

1.11.2 Duties and powers of the enforcing agency.

1.11.2.1 Enforcement.

1.11.2.1.1 The responsibility for enforcement of building standards adopted by the State Fire Marshal and published in the California Building Standards Code relating to fire and panic safety and other regulations of the State Fire Marshal shall except as provided in Section 1.11.2.1.2 be as follows:

1. The city, county or city and county with jurisdiction in the area affected by the standard or regulation shall delegate the enforcement of the building standards relating to fire and panic safety and other regulations of the State Fire Marshal as they relate to Group R-3 occupancies, as described in Section 1.1.3.1 or CCR, Part 2 California Building Code, Section 310.1, to either of the following:
 - 1.1. The chief of the fire authority of the city, county or city and county, or an authorized representative.
 - 1.2. The chief building official of the city, county or city and county, or an authorized representative.
2. The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.
3. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.
4. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.
5. Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.

1.11.2.1.2 Pursuant to Health and Safety Code Section 13108, and except as otherwise provided in this section, building standards adopted by the State Fire Mar-

shal published in the California Building Standards Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings and state institutions throughout the state. Upon the written request of the chief fire official of any city, county or fire protection district, the State Fire Marshal may authorize such chief fire official and his or her authorized representatives, in their geographical area of responsibility, to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.

Pursuant to Health and Safety Code Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

1.11.2.1.3 Pursuant to Health and Safety Code Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than \$100.00 or more than \$500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

1.11.2.2 Right of entry. The fire chief of any city, county or fire protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of prepar-

ing a fire suppression preplanning program or for the purpose of investigating any fire in a state-occupied building.

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department or fire protection district and his or her authorized representatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

1.11.2.3 More restrictive fire and panic safety building standards.

1.11.2.3.1 Any fire protection district organized pursuant to Health and Safety Code Part 2.7 (commencing with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to Section 1.1.8.1.

1.11.2.3.2 Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 1.11.2.3.1, to the city, county or city and county where the ordinance will apply. The city, county or city and county may provide the district with written comments, which shall become part of the fire protection district's public hearing record.

1.11.2.3.3 The fire protection district shall transmit the adopted ordinance to the city, county or city and county where the ordinance will apply. The legislative body of the city, county or city and county may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county or city and county shall file a copy of the findings of the district, and any findings of the city, county or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 1.1.8.1:3.

1.11.2.4 Request for alternate means of protection. Requests for approval to use an alternative material,

assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in Title 19, California Code of Regulation, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

1.11.2.5 Appeals. When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.

1.11.3 Construction documents.

1.11.3.1 Public schools. Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.

1.11.3.2 Movable walls and partitions. Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.

1.11.3.3 New construction high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.
2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both

such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to perform such services. Administration of the work of construction shall be under the charge of the responsible architect or engineer except that where plans and specifications involve alterations or repairs, such work of construction may be administered by an engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 65700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications and estimates and work of construction are applicable.

This section shall not be construed as preventing the design of fire-extinguishing systems by persons holding a C-16 license issued pursuant to Division 3, Chapter 9, Business and Professions Code. In such instances, however, the responsibility charge of this section shall prevail.

1.11.3.4 Existing high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required by Chapter 11 of the California Fire Code and the California Existing Building Code for existing high-rise buildings. Such plans or specifications shall be submitted to the enforcing agency having jurisdiction.
2. When new construction is required to conform with the provisions of these regulations, complete plans or specifications, or both, shall be prepared in accordance with the provisions of this subsection. As used in this section, "new construction" is not intended to include repairs, replacements or minor alterations which do not disrupt or appreciably add to or affect the structural aspects of the building.

1.11.3.5 Retention of plans. Refer to Building Standards Law, Health and Safety Code Sections 19850 and 19851 for permanent retention of plans.

1.11.4 Fees.

1.11.4.1 Other fees. Pursuant to Health and Safety Code Section 13146.2, a city, county or district which inspects a hotel, motel, lodging house or apartment house may charge and collect a fee for the inspection from the owner of the structure in an amount, as determined by the city, county or district, sufficient to pay its costs of that inspection.

1.11.4.2 Large family day-care. Pursuant to Health and Safety Code Section 1597.46, Large Family Day-Care Homes, the local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process.

1.11.4.3 High-rise. Pursuant to Health and Safety Code Section 13217, High-rise Structure Inspection: Fees and costs, a local agency which inspects a high-rise structure pursuant to Health and Safety Code Section 13217 may charge and collect a fee for the inspection from the owner of the high-rise structure in an amount, as determined by the local agency, sufficient to pay its costs of that inspection.

1.11.4.4 Fire clearance preinspection. Pursuant to Health and Safety Code Section 13235, Fire Clearance Preinspection, fee, upon receipt of a request from a prospective licensee of a community care facility, as defined in Section 1502, of a residential care facility for the elderly, as defined in Section 1569.2, or of a child day-care facility, as defined in Section 1596.750, the local fire enforcing agency, as defined in Section 13244, or State Fire Marshal, whichever has primary jurisdiction, shall conduct a preinspection of the facility prior to the final fire clearance approval. At the time of the preinspection, the primary fire enforcing agency shall price consultation and interpretation of the fire safety regulations and shall notify the prospective licensee of the facility in writing of the specific fire safety regulations which shall be enforced in order to obtain fire clearance approval. A fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility with a capacity to serve 25 or fewer persons. A fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for a preinspection of a facility.

1.11.4.5 Care facilities. The primary fire enforcing agency shall complete the final fire clearance inspection for a community care facility, residential care facility for the elderly, or child day-care facility within 30 days of receipt of the request for the final inspection, or as of the date the prospective facility requests the final preclicensure inspection by the State Department of Social Services, whichever is later.

Pursuant to Health and Safety Code Section 13235, a preinspection fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility.

Pursuant to Health and Safety Code Section 13131.5, a reasonable final inspection fee, not to exceed the actual cost of inspection services necessary to complete a final inspection may be charged for occupancies classified as residential care facilities for the elderly (RCFE).

Pursuant to Health and Safety Code Section 1569.84, neither the State Fire Marshal nor any local public entity shall charge any fee for enforcing fire inspection regulations pursuant to state law or regulation or local ordinance, with respect to residential care facilities for the elderly (RCFE) which service six or fewer persons.

1.11.4.6 Requests of the Office of the State Fire Marshal. Whenever a local authority having jurisdiction requests that the State Fire Marshal perform plan review and/or inspection services related to a building permit, the applicable fees for such shall be payable to the Office of the State Fire Marshal.

1.11.5 Inspections. Work performed subject to the provisions of this code shall comply with the inspection requirements of Sections R109.1 through R109.1.6.

1.11.5.1 Existing Group I -1 or R occupancies. Licensed 24-hour care in a Group I-1 or R occupancy in existence and originally classified under previously adopted state codes shall be reinspected under the appropriate previous

code, provided there is no change in the use or character which would place the facility in a different occupancy group.

1.11.6 Certificate of occupancy. A certificate of occupancy shall be issued as specified in Section R110.

1.11.7 Temporary structures and uses. See Section R107.

1.11.8 Service utilities. See Section R111.

1.11.9 Stop work order. See Section R114.

1.11.10 Unsafe buildings, structures and equipment. See Title 24, Part 2, California Building Code, Section 115.

1.11.11 Adopting agency identification. The provisions of this code applicable to buildings identified in this Section 1.11 will be identified in the Matrix Adoption Tables under the acronym SFM.

**SECTION 1.12
Reserved**

**SECTION 1.13
Reserved**

**SECTION 1.14
Reserved**

DIVISION II ADMINISTRATION

Division II is not adopted by the Department of Housing and Community Development except where specifically indicated.
Note: Specific sections of Chapter 1, Division II adopted by the State Fire Marshal will be indicated in the Matrix Adoption Table.

User note:

About this chapter: Chapter 1 Division II establishes the limits of applicability of this code and describes how the code is to be applied and enforced. Chapter 1 Division II is in two parts: Part 1—Scope and Application (Sections R101–R102) and Part 2—Administration and Enforcement (Sections R103–R114). Section R101 identifies which buildings and structures come under its purview and references other I-Codes as applicable. Standards and codes are scoped to the extent referenced (see Section R102.4).

The one- and two-family dwelling code is intended to be adopted as a legally enforceable document, and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the building official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

PART 1—SCOPE AND APPLICATION

SECTION R101 SCOPE AND GENERAL REQUIREMENTS

R101.1 Title. These provisions shall be known as the *Residential Code for One- and Two-family Dwellings* of [NAME OF JURISDICTION], and shall be cited as such and will be referred to herein as “this code.”

R101.2 Scope. The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, removal and demolition of detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures not more than three stories above grade plane in height.

Exception: The following shall be permitted to be constructed in accordance with this code where provided with an automatic sprinkler system complying with Section R313:

1. Live/work units located in townhouses and complying with the requirements of Section 508.5 of the *California Building Code*.
2. Owner-occupied lodging houses with five or fewer guestrooms.
3. A care facility with five or fewer persons receiving custodial care within a dwelling unit.
4. A care facility with five or fewer persons receiving medical care within a dwelling unit.
5. A care facility for five or fewer persons receiving care that are within a single-family dwelling.

R101.3 Purpose. The purpose of this code is to establish minimum requirements to provide a reasonable level of safety, health and general welfare through affordability, structural strength, means of egress, stability, sanitation, light and ventilation, energy conservation and safety to life and

property from fire and other hazards and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

SECTION R102 APPLICABILITY

R102.1 General. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

R102.2 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

R102.3 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

R102.4 Referenced codes and standards. The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections R102.4.1 and R102.4.2.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the equipment or appliance, the conditions of the listing and manufacturer’s instructions shall apply.

R102.4.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

R102.4.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

R102.5 Appendices. Provisions in the appendices shall not apply unless specifically referenced in the adopting ordinance.

R102.6 Partial invalidity. In the event any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

R102.7 Existing structures. The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *International Property Maintenance Code* or the *California Fire Code*, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.

R102.7.1 Additions, alterations or repairs. Additions, alterations or repairs to any structure shall conform to the requirements for a new structure without requiring the existing structure to comply with the requirements of this code, unless otherwise stated. Additions, alterations, repairs and relocations shall not cause an existing structure to become less compliant with the provisions of this code than the existing building or structure was prior to the addition, alteration or repair. An existing building together with its additions shall comply with the height limits of this code. Where the alteration causes the use or occupancy to be changed to one not within the scope of this code, the provisions of the *California Existing Building Code* shall apply.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION R103 DEPARTMENT OF BUILDING SAFETY

R103.1 Creation of enforcement agency. The department of building safety is hereby created and the official in charge thereof shall be known as the building official.

R103.2 Appointment. The building official shall be appointed by the jurisdiction.

R103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the building official shall have the authority to appoint a deputy building official, the related technical officers, inspectors, plan examiners and other employees. Such employees shall have powers as delegated by the building official.

SECTION R104 DUTIES AND POWERS OF THE BUILDING OFFICIAL

R104.1 General. The building official is hereby authorized and directed to enforce the provisions of this code. The building official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent

and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.

R104.2 Applications and permits. The building official shall receive applications, review construction documents and issue permits for the erection and alteration of buildings and structures, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

R104.3 Notices and orders. The building official shall issue necessary notices or orders to ensure compliance with this code.

R104.4 Inspections. The building official shall make the required inspections, or the building official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The building official is authorized to engage such expert opinion as deemed necessary to report on unusual technical issues that arise, subject to the approval of the appointing authority.

R104.5 Identification. The building official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

R104.6 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the building official has reasonable cause to believe that there exists in a structure or upon a premises a condition that is contrary to or in violation of this code that makes the structure or premises unsafe, dangerous or hazardous, the building official or designee is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises is unoccupied, the building official shall first make a reasonable effort to locate the owner, the owner's authorized agent, or other person having charge or control of the structure or premises and request entry. If entry is refused, the building official shall have recourse to the remedies provided by law to secure entry.

R104.7 Department records. The building official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for the retention of public records.

R104.8 Liability. The building official, member of the board of appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

R104.8.1 Legal defense. Any suit or criminal complaint instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representatives of the jurisdiction until the final termination of the proceedings. The building official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

R104.9 Approved materials and equipment. Materials, equipment and devices approved by the building official shall be constructed and installed in accordance with such approval.

R104.9.1 Used materials and equipment. Used materials, equipment and devices shall not be reused unless approved by the building official.

R104.10 Modifications. Where there are practical difficulties involved in carrying out the provisions of this code, the building official shall have the authority to grant modifications for individual cases, provided the building official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in compliance with the intent and purpose of this code and that such modification does not lessen health, life and fire safety or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the department of building safety.

R104.10.1 Flood hazard areas. The building official shall not grant modifications to any provisions required in flood hazard areas as established by Table R301.2 unless a determination has been made that:

1. There is good and sufficient cause showing that the unique characteristics of the size, configuration or topography of the site render the elevation standards of Section R322 inappropriate.
2. Failure to grant the modification would result in exceptional hardship by rendering the lot undevelopable.
3. The granting of modification will not result in increased flood heights, additional threats to public safety, extraordinary public expense, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. The modification is the minimum necessary to afford relief, considering the flood hazard.
5. Written notice specifying the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation and stating that construction below the design flood elevation increases risks to life and property, has been submitted to the applicant.

R104.11 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not speci-

cally prescribed by this code. The building official shall have the authority to approve an alternative material, design or method of construction upon application of the owner or the owner's authorized agent. The building official shall first find that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Compliance with the specific performance-based provisions of the *California Codes* shall be an alternative to the specific requirements of this code. Where the alternative material, design or method of construction is not approved, the building official shall respond in writing, stating the reasons why the alternative was not approved.

R104.11.1 Tests. Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

SECTION R105 PERMITS

R105.1 Required. Any owner or owner's authorized agent who intends to construct, enlarge, alter, repair, move, demolish or change the occupancy of a building or structure, or to erect, install, enlarge, alter, repair, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be performed, shall first make application to the building official and obtain the required permit.

R105.2 Work exempt from permit. Exemption from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Permits shall not be required for the following:

Building:

1. Other than storm shelters, one-story detached accessory structures, provided that the floor area does not exceed 120 square feet (11.15 m²). It is permissible that these structures still be regulated by Section 710A, despite exemption from permit.
2. Fences not over 7 feet (2134 mm) high.
3. Retaining walls that are not over 4 feet (1219 mm) in height measured from the bottom of the footing to the top of the wall, unless supporting a surcharge.

DIVISION II ADMINISTRATION

4. Water tanks supported directly upon grade if the capacity does not exceed 5,000 gallons (18 927 L) and the ratio of height to diameter or width does not exceed 2 to 1.
5. Sidewalks and driveways.
6. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
7. Prefabricated swimming pools that are less than 24 inches (610 mm) deep.
8. Swings and other playground equipment.
9. Window awnings supported by an exterior wall that do not project more than 54 inches (1372 mm) from the exterior wall and do not require additional support.
10. Decks not exceeding 200 square feet (18.58 m²) in area, that are not more than 30 inches (762 mm) above grade at any point, are not attached to a dwelling and do not serve the exit door required by Section R311.4.

Electrical:

1. Listed cord-and-plug connected temporary decorative lighting.
2. Reinstallation of attachment plug receptacles but not the outlets therefor.
3. Replacement of branch circuit overcurrent devices of the required capacity in the same location.
4. Electrical wiring, devices, appliances, apparatus or equipment operating at less than 25 volts and not capable of supplying more than 50 watts of energy.
5. Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.

Gas:

1. Portable heating, cooking or clothes drying appliances.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.
3. Portable-fuel-cell appliances that are not connected to a fixed piping system and are not interconnected to a power grid.

Mechanical:

1. Portable heating appliances.
2. Portable ventilation appliances.
3. Portable cooling units.
4. Steam, hot- or chilled-water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.
6. Portable evaporative coolers.

7. Self-contained refrigeration systems containing 10 pounds (4.54 kg) or less of refrigerant or that are actuated by motors of 1 horsepower (746 W) or less.
8. Portable-fuel-cell appliances that are not connected to a fixed piping system and are not interconnected to a power grid.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work and a permit shall be obtained and inspection made as provided in this code.
2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

R105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the building official.

R105.2.2 Repairs. Application or notice to the building official is not required for ordinary repairs to structures, replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or cutting of any structural beam or load-bearing support, or the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall ordinary repairs include addition to, alteration of, replacement or relocation of any water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, electric wiring or mechanical or other work affecting public health or general safety.

R105.2.3 Public service agencies. A permit shall not be required for the installation, alteration or repair of generation, transmission, distribution, metering or other related equipment that is under the ownership and control of public service agencies by established right.

R105.3 Application for permit. To obtain a permit, the applicant shall first file an application therefor in writing on a form furnished by the department of building safety for that purpose. Such application shall:

1. Identify and describe the work to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use and occupancy for which the proposed work is intended.

4. Be accompanied by construction documents and other information as required in Section R106.1.
5. State the valuation of the proposed work.
6. Be signed by the applicant or the applicant’s authorized agent.
7. Give such other data and information as required by the building official.

R105.3.1 Action on application. The building official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the building official shall reject such application in writing stating the reasons therefor. If the building official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the building official shall issue a permit therefor as soon as practicable.

R105.3.1.1 Determination of substantially improved or substantially damaged existing buildings in flood hazard areas. For applications for reconstruction, rehabilitation, addition, alteration, repair or other improvement of existing buildings or structures located in a flood hazard area as established by Table R301.2, the building official shall examine or cause to be examined the construction documents and shall make a determination with regard to the value of the proposed work. For buildings that have sustained damage of any origin, the value of the proposed work shall include the cost to repair the building or structure to its predamaged condition. If the building official finds that the value of proposed work equals or exceeds 50 percent of the market value of the building or structure before the damage has occurred or the improvement is started, the proposed work is a substantial improvement or repair of substantial damage and the building official shall require existing portions of the entire building or structure to meet the requirements of Section R322.

For the purpose of this determination, a substantial improvement shall mean any repair, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the building or structure before the improvement or repair is started. Where the building or structure has sustained substantial damage, repairs necessary to restore the building or structure to its predamaged condition shall be considered substantial improvements regardless of the actual repair work performed. The term shall not include either of the following:

1. Improvements to a building or structure that are required to correct existing health, sanitary or safety code violations identified by the building official and that are the minimum necessary to ensure safe living conditions.
2. Any alteration of a historic building or structure, provided that the alteration will not preclude the

continued designation as a historic building or structure. For the purposes of this exclusion, a historic building shall be any of the following:

- 2.1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
- 2.2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
- 2.3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

R105.3.2 Time limitation of application. An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing unless such application has been pursued in good faith or a permit has been issued; except that the building official is authorized to grant one or more extensions of time for additional periods not exceeding 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

R105.4 Validity of permit. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the building official from requiring the correction of errors in the construction documents and other data. The building official is authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.

R105.5 Expiration. Every permit issued shall become invalid unless the work authorized by such permit is commenced within 180 days after its issuance or after commencement of work if more than 180 days pass between inspections. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

R105.5.1 Expiration. [BSC] *On or after January 1, 2019, every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 12 months after its issuance or if the work authorized on the site by such permit is suspended or abandoned for a period of 12 months after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time, for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. (See Health and Safety Code Section 18938.5 and 18938.6.)*

R105.6 Suspension or revocation. The building official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or regulation or any of the provisions of this code.

R105.7 Placement of permit. The building permit or a copy shall be kept on the site of the work until the completion of the project.

R105.8 Responsibility. It shall be the duty of every person who performs work for the installation or repair of building, structure, electrical, gas, mechanical or plumbing systems, for which this code is applicable, to comply with this code.

R105.9 Preliminary inspection. Before issuing a permit, the building official is authorized to examine or cause to be examined buildings, structures and sites for which an application has been filed.

SECTION R106 CONSTRUCTION DOCUMENTS

R106.1 Submittal documents. Submittal documents consisting of construction documents, and other data shall be submitted in two or more sets, or in a digital format where allowed by the building official, with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the building official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The building official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that reviewing of construction documents is not necessary to obtain compliance with this code.

R106.1.1 Information on construction documents. Construction documents shall be drawn upon suitable material. Electronic media documents are permitted to be submitted where approved by the building official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the building official.

R106.1.2 Manufacturer’s installation instructions. Manufacturer’s installation instructions, as required by this code, shall be available on the job site at the time of inspection.

R106.1.3 Information on braced wall design. For buildings and structures utilizing braced wall design, and where required by the building official, braced wall lines shall be identified on the construction documents. Pertinent information including, but not limited to, bracing methods, location and length of braced wall panels and foundation

requirements of braced wall panels at top and bottom shall be provided.

R106.1.4 Information for construction in flood hazard areas. For buildings and structures located in whole or in part in flood hazard areas as established by Table R301.2, construction documents shall include:

1. Delineation of flood hazard areas, floodway boundaries and flood zones and the design flood elevation, as appropriate.
2. The elevation of the proposed lowest floor, including basement; in areas of shallow flooding (AO Zones), the height of the proposed lowest floor, including basement, above the highest adjacent grade.
3. The elevation of the bottom of the lowest horizontal structural member in coastal high-hazard areas (V Zone) and in Coastal A Zones where such zones are delineated on flood hazard maps identified in Table R301.2 or otherwise delineated by the jurisdiction.
4. If design flood elevations are not included on the community’s Flood Insurance Rate Map (FIRM), the building official and the applicant shall obtain and reasonably utilize any design flood elevation and floodway data available from other sources.

R106.1.5 Information on storm shelters. Construction documents for storm shelters shall include the information required in ICC 500.

R106.1.6 Exterior balconies and elevated walking surfaces. *Where balconies or other elevated walking surfaces are exposed to water from direct or blowing rain, snow or irrigation, and the structural framing is protected by an impervious moisture barrier, the construction documents shall include details for all elements of the impervious moisture barrier system. The construction documents shall include manufacturer’s installation instructions.*

R106.2 Site plan or plot plan. The construction documents submitted with the application for permit shall be accompanied by a site plan showing the size and location of new construction and existing structures on the site and distances from lot lines. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The building official is authorized to waive or modify the requirement for a site plan where the application for permit is for alteration or repair or where otherwise warranted.

R106.3 Examination of documents. The building official shall examine or cause to be examined construction documents for code compliance.

R106.3.1 Approval of construction documents. Where the building official issues a permit, the construction documents shall be approved in writing or by a stamp that states “REVIEWED FOR CODE COMPLIANCE.” One set of construction documents so reviewed shall be retained by the building official. The other set shall be returned to the applicant, shall be kept at the site of work

and shall be open to inspection by the building official or a duly authorized representative.

R106.3.2 Previous approvals. This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been heretofore issued or otherwise lawfully authorized, and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

R106.3.3 Phased approval. The building official is authorized to issue a permit for the construction of foundations or any other part of a building or structure before the construction documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such permit for the foundation or other parts of a building or structure shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure will be granted.

R106.4 Amended construction documents. Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

R106.5 Retention of construction documents. One set of approved construction documents shall be retained by the building official for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws.

SECTION R107 TEMPORARY STRUCTURES AND USES

R107.1 General. The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause.

R107.2 Conformance. Temporary structures and uses shall conform to the structural strength, fire safety, means of egress, light, ventilation and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.

R107.3 Temporary power. The building official is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in *the California Electrical Code*.

R107.4 Termination of approval. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

SECTION R108 FEES

R108.1 Payment of fees. A permit shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

R108.2 Schedule of permit fees. On buildings, structures, electrical, gas, mechanical and plumbing systems or alterations requiring a permit, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

R108.3 Building permit valuations. Building permit valuation shall include total value of the work for which a permit is being issued, such as electrical, gas, mechanical, plumbing equipment and other permanent systems, including materials and labor.

R108.4 Related fees. The payment of the fee for the construction, alteration, removal or demolition for work done in connection to or concurrently with the work authorized by a building permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

R108.5 Refunds. The building official is authorized to establish a refund policy.

R108.6 Work commencing before permit issuance. Any person who commences work requiring a permit on a building, structure, electrical, gas, mechanical or plumbing system before obtaining the necessary permits shall be subject to a fee established by the applicable governing authority that shall be in addition to the required permit fees.

SECTION R109 INSPECTIONS

R109.1 Types of inspections. For on-site construction, from time to time the building official, upon notification from the permit holder or his agent, shall make or cause to be made any necessary inspections and shall either approve that portion of the construction as completed or shall notify the permit holder or his or her agent wherein the same fails to comply with this code. *The enforcing agency upon notification of the permit holder or their agent shall within a reasonable time make the inspections set forth in Sections R109.1.1, R109.1.1.1, R109.1.3, R109.1.4, R109.1.4.1, R109.1.4.2, R109.1.5, R109.1.5.1, R109.1.5.2, R109.1.5.3, R109.1.6, R109.1.6.1 and R109.1.6.2.*

Note: Reinforcing steel or structural framework of any part of any building or structure shall not be covered or concealed without first obtaining the approval of the enforcing agency.

R109.1.1 Foundation inspection. Inspection of the foundation and footings shall be made after poles or piers are set or trenches or basement areas are excavated and any required forms erected and any required reinforcing steel is in place and supported prior to the placing of concrete. The foundation or footings inspection shall include excavations for thickened slabs intended for the support of bearing walls, partitions, structural supports or equipment

and special requirements for wood foundations. *Materials for the foundation shall be on the job site except where concrete is ready-mixed in accordance with ASTM C94. Under this circumstance, concrete is not required to be at the job site.*

R109.1.1.1 Concrete slab and under-floor inspection. *Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduits, piping or other ancillary building trade products or equipment are installed, but before any concrete is placed or floor sheathing is installed, including the subfloor.*

R109.1.2 Plumbing, mechanical, gas and electrical systems inspection. Rough inspection of plumbing, mechanical, gas and electrical systems shall be made prior to covering or concealment, before fixtures or appliances are set or installed, and prior to framing inspection.

Exception: Backfilling of ground-source heat pump loop systems tested in accordance with Section M2105.28 prior to inspection shall be permitted.

R109.1.3 Floodplain inspections. For construction in flood hazard areas as established by Table R301.2, upon placement of the lowest floor, including basement, and prior to further vertical construction, the building official shall require submission of documentation, prepared and sealed by a registered design professional, of the elevation of the lowest floor, including basement, required in Section R322.

R109.1.4 Frame and masonry inspection. Inspection of framing and masonry construction shall be made after the roof, masonry, framing, firestopping, draftstopping and bracing are in place and after *chimneys and vents to be concealed are completed and the rough electrical, plumbing, heating, wires, pipes and ducts* are approved.

R109.1.4.1 Moisture content verification. *Moisture content of framing members shall be verified in accordance with the California Green Building Standards Code, Chapter 4, Division 4.5.*

R109.1.4.2 Lath and gypsum board inspection. *Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place, but before any plastering is applied or gypsum board joints and fasteners are taped and finished.*

R109.1.5 Other inspections. In addition to inspections in Sections R109.1.1 through R109.1.4.2, the building official shall have the authority to make or require any other inspections to ascertain compliance with this code and other laws enforced by the building official.

R109.1.5.1 Fire-resistance-rated construction inspection. Where fire-resistance-rated construction is required between dwelling units or due to location on property, the building official shall require an inspection of such construction after lathing or gypsum board or gypsum panel products are in place, but before any plaster is applied, or before board or panel joints and fasteners are taped and finished. *Protection of joints and penetrations in fire-resistance-rated assemblies*

shall not be concealed from view until inspected and approved.

R109.1.5.2 Special inspections. For special inspections, see California Building Code, Chapter 17.

R109.1.5.3 Weather-exposed balcony and walking surface waterproofing. *Where balconies or other elevated walking surfaces are exposed to water from direct or blowing rain, snow or irrigation, and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and approved.*

Exception: *Where special inspections are provided in accordance with California Building Code Section 1705.1.1, Item 3.*

R109.1.6 Final inspection. Final inspection shall be made after the permitted work is complete and prior to occupancy.

R109.1.6.1 Elevation documentation. If located in a flood hazard area, the documentation of elevations required in Section R322.1.10 shall be submitted to the building official prior to the final inspection.

R109.1.6.2 Operation and maintenance manual. *At the time of final inspection, a manual, compact disc, web-based reference or other media acceptable to the enforcing agency shall be placed in the building in accordance with the California Green Building Standards Code, Chapter 4, Division 4.4.*

R109.2 Inspection agencies. The building official is authorized to accept reports of approved agencies, provided such agencies satisfy the requirements as to qualifications and reliability.

R109.3 Inspection requests. It shall be the duty of the permit holder or their agent to notify the building official that such work is ready for inspection. It shall be the duty of the person requesting any inspections required by this code to provide access to and means for inspection of such work.

R109.4 Approval required. Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the building official.

SECTION R110 CERTIFICATE OF OCCUPANCY

R110.1 Use and change of occupancy. A building or structure shall not be used or occupied in whole or in part, and a change of occupancy of a building or structure or portion thereof shall not be made, until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed

as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid.

Exceptions:

1. Certificates of occupancy are not required for work exempt from permits under Section R105.2.
2. Accessory buildings or structures.

R110.2 Change in use. Changes in the character or use of an existing structure shall not be made except as specified in *Chapter 11 of the California Fire Code and California Existing Building Code*.

R110.3 Certificate issued. After the building official inspects the building or structure and does not find violations of the provisions of this code or other laws that are enforced by the department, the building official shall issue a certificate of occupancy containing the following:

1. The permit number.
2. The address of the structure.
3. The name and address of the owner or the owner’s authorized agent.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code.
6. The name of the building official.
7. The edition of the code under which the permit was issued.
8. Where an automatic sprinkler system is provided and whether the sprinkler system is required.
9. Any special stipulations and conditions of the building permit.

R110.4 Temporary occupancy. The building official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The building official shall set a time period during which the temporary certificate of occupancy is valid.

R110.5 Revocation. The building official is authorized to suspend or revoke a certificate of occupancy issued under the provisions of this code, in writing, wherever the certificate is issued in error, or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of the provisions of this code or other ordinance of the jurisdiction.

**SECTION R111
SERVICE UTILITIES**

R111.1 Connection of service utilities. A person shall not make connections from a utility, a source of energy, fuel, or power to any building or system that is regulated by this code

for which a permit is required, until approved by the building official.

R111.2 Temporary connection. The building official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel or power.

R111.3 Authority to disconnect service utilities. The building official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards set forth in Section R102.4 in case of emergency where necessary to eliminate an immediate hazard to life or property or where such utility connection has been made without the approval required by Section R111.1 or R111.2. The building official shall notify the serving utility and where possible the owner or the owner’s authorized agent and occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnection, the *owner*, the owner’s authorized agent or occupant of the building, structure or service system shall be notified in writing as soon as practical thereafter.

**SECTION R112
BOARD OF APPEALS**

R112.1 General. In order to hear and decide appeals of orders, decisions or determinations made by the building official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The building official shall be an ex officio member of said board but shall not have a vote on any matter before the board. The board of appeals shall be appointed by the governing body and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business, and shall render decisions and findings in writing to the appellant with a duplicate copy to the building official.

R112.2 Limitations on authority. An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The board shall not have authority to waive requirements of this code.

R112.3 Qualifications. The board of appeals shall consist of members who are qualified by experience and training to pass judgment on matters pertaining to building construction and are not employees of the jurisdiction.

R112.4 Administration. The building official shall take immediate action in accordance with the decision of the board.

**SECTION R113
VIOLATIONS**

R113.1 Unlawful acts. It shall be unlawful for any person, firm or corporation to erect, construct, alter, extend, repair, move, remove, demolish or occupy any building, structure or equip-

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ment regulated by this code, or cause same to be done, in conflict with or in violation of any of the provisions of this code.

R113.2 Notice of violation. The building official is authorized to serve a notice of violation or order on the person responsible for the erection, construction, alteration, extension, repair, moving, removal, demolition or occupancy of a building or structure in violation of the provisions of this code, or in violation of a detail statement or a plan approved thereunder, or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

R113.3 Prosecution of violation. If the notice of violation is not complied with in the time prescribed by such notice, the building official is authorized to request the legal counsel of the jurisdiction to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation, or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant thereto.

R113.4 Violation penalties. Any person who violates a provision of this code or fails to comply with any of the requirements thereof or who erects, constructs, alters or repairs a building or structure in violation of the approved construction documents or directive of the building official, or of a permit or certificate issued under the provisions of this code, shall be subject to penalties as prescribed by law.

SECTION R114 STOP WORK ORDER

R114.1 Authority. Where the building official finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the building official is authorized to issue a stop work order.

R114.2 Issuance. The stop work order shall be in writing and shall be given to the owner of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume.

R114.3 Emergencies. Where an emergency exists, the building official shall not be required to give a written notice prior to stopping the work.

R114.4 Failure to comply. Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the authority having jurisdiction.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R201			X																			
R201.1			X																			
R201.2			X																			
R201.3			X	X																		
R201.4			X																			
ACCESSORY DWELLING UNIT				X	X																	
ACCESSORY STRUCTURE			X																			
ADDITION			X	X																		
AGED HOME OR INSTITUTION			X																			
AIR-IMPERMEABLE INSULATION				X																		
ALTERATION			X	X																		
APPROVED			X	X																		
APPROVED AGENCY			X	X																		
APPROVED LISTING AGENCY			X	X																		
APPROVED TESTING AGENCY			X	X																		
ATTIC			X																			
ATTIC, HABITABLE			X																			
BASEMENT			X																			
BEDRIDDEN PERSON			X																			
BUILDING			X	X																		
BUILDING OFFICIAL			X	X																		
BUILT-UP ROOF COVERING			X																			
CARE AND SUPERVISION			X																			
CATASTROPHICALLY INJURED			X																			
CEILING HEIGHT			X																			
CHILD CARE			X																			
CHILD-CARE CENTER			X																			
CHILD OR CHILDREN			X																			
CHRONICALLY ILL			X																			
CLOSET			X																			
COMBUSTIBLE MATERIAL			X																			
CONGREGATE LIVING HEALTH-FACILITY (CLHF)			X																			
CONGREGATE RESIDENCE			X																			
CONSTRUCTION DOCUMENTS			X																			

(continued)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/C C	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below			X																			
Chapter / Section																						
DAY-CARE			X																			
DAY-CARE HOME, FAMILY			X																			
DAY-CARE HOME, LARGE FAMILY			X																			
DAY-CARE HOME, SMALL FAMILY			X																			
DEPARTMENT				X																		
DESIGN PROFESSIONAL			X																			
DRAFT STOP			X																			
DUCT SYSTEM				X																		
DWELLING			X																			
DWELLING UNIT			X	X																		
EMERGENCY ESCAPE AND RESCUE OPENING			X																			
ENERGY STORAGE SYSTEMS (ESS)			X																			
ENFORCEMENT				X																		
ENFORCEMENT AGENCY				X																		
ENFORCING AGENCY			X	X																		
ENTRY LEVEL				X																		
EXTERIOR WALL			X																			
EXTERIOR WALL ASSEMBLY			X																			
EXTERIOR WALL COVERING			X																			
FAMILY				X																		
FENESTRATION				X																		
FENESTRATION, VERTICAL				X																		
FIREBLOCKING			X																			
FIRE-RETARDANT-TREATED WOOD			X																			
FIRE SEPARATION DISTANCE			X																			
FLAME SPREAD			X																			
FLAME SPREAD INDEX			X																			
FULL-TIME CARE			X																			
GRADE			X																			
GRADE FLOOR OPENING			X																			
GRADE PLANE			X																			
GUARD OR GUARDRAIL				X																		
HABITABLE SPACE			X																			
HANDRAIL			X																			
HAZARDOUS LOCATION			X																			

(continued)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below			X																			
Chapter / Section																						
HEIGHT, BUILDING			X																			
HEIGHT, STORY			X																			
IGNITION SOURCE			X																			
INFANT			X																			
INFLATABLE AMUSEMENT DEVICE			X																			
INSULATING SHEATHING				X																		
LABEL			X																			
LABELED			X	X																		
LIMITED-DENSITY OWNER-BUILT RURAL DWELLINGS				X																		
LISTED			X	X																		
LISTING AGENCY				X	X																	
LIVE/WORK UNIT				X																		
LIVING SPACE			X																			
LODGING HOUSE				X																		
LOT			X																			
LOT LINE			X																			
MARK			X																			
MASONRY UNIT				X																		
METAL ROOF PANEL			X																			
METAL ROOF SHINGLE			X																			
MEZZANINE, LOFT			X																			
MULTIPLE STATION SMOKE ALARM			X																			
NONAMBULATORY PERSONS			X																			
NONCOMBUSTIBLE MATERIAL			X																			
OCCUPIED SPACE			X																			
OWNER			X																			
PASSIVE SOLAR ENERGY COLLECTOR				X																		
PERSONS WITH INTELLECTUAL DISABILITIES, PROFOUNDLY OR SEVERELY			X																			
PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND MOUNTED			X																			
PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED			X																			
PROTECTIVE SOCIAL CARE FACILITY			X																			
PUBLIC WAY			X																			
RAMP			X																			

(continued)

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 2 – DEFINITIONS—continued

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below			X																			
Chapter / Section																						
REPAIR			X	X																		
REROOFING			X	X																		
RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI)			X																			
RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE)			X																			
RESIDENTIAL FACILITY (RF)			X																			
RESTRAINT			X																			
ROOF ASSEMBLY			X																			
ROOF COVERING			X																			
ROOF COVERING SYSTEM			X																			
ROOFDECK			X																			
ROOF RECOVER			X	X																		
ROOF REPAIR			X	X																		
ROOF REPLACEMENT				X																		
ROOFTOP STRUCTURE			X																			
SHALL			X																			
SINGLE STATION SMOKE ALARM			X																			
SKYLIGHTS AND SLOPED GLAZING				X																		
SMOKE-DEVELOPED INDEX			X																			
STAIR			X																			
STAIRWAY			X																			
STATE-OWNED/LEASED BUILDING			X																			
STORY			X																			
STORY ABOVE GRADE PLANE			X																			
STRUCTURE			X																			
SUNROOM				X																		
TERMINALLY ILL			X																			
TESTING AGENCY				X																		
TODDLER			X																			
TOWNHOUSE			X																			
VENTILATION				X																		
WILDLAND-URBAN INTERFACE (WUI)			X																			

The state agency does not adopt sections identified with the following symbol: †

Part II—Definitions

CHAPTER 2 DEFINITIONS

User notes:

About this chapter: Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.

Code development reminder: Code change proposals to definitions in this chapter preceded by a bracketed letter are considered by the IRC—Building Code Development Committee [RB], the IRC—Mechanical/Plumbing Code Development Committee [MP] or the IECC—Residential Code Development Committee [RE] during the Group B (2022) Code Development Cycle.

SECTION R201 GENERAL

R201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings indicated in this chapter.

R201.2 Interchangeability. Words used in the present tense include the future; words in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

R201.3 Terms defined in other codes. Where terms are not defined in this code such terms shall have the meanings ascribed in *the California Building Standards Code, Title 24, California Code of Regulations*.

R201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies. Webster’s Third New International Dictionary of the English Language, Unabridged, shall be considered as providing ordinarily accepted meanings.

SECTION R202 DEFINITIONS

➔ **[RB] ACCESS (TO).** That which enables a device, an appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, door or similar obstruction.

➔ **ACCESSORY DWELLING UNIT. [HCD 1 & HCD 2]** *An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. Accessory dwelling units shall include permanent provisions for living, sleeping, eating, cooking and sanitation on the same parcel as the single-family or*

multifamily dwelling is or will be situated. (See Government Code Section 65852.2)

[RB] ACCESSORY STRUCTURE. A structure that is accessory to and incidental to that of the dwelling(s) and that is located on the same lot.

[RB] ADDITION. An extension or increase in floor area, number of stories or height of a building or structure. ←

[RB] ADHERED STONE OR MASONRY VENEER. Stone or masonry veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

AGED HOME OR INSTITUTION. *A facility used for the housing of persons 65 years of age or older in need of care and supervision. (See definition of “care and supervision.”)*

➔ **[RB] AIR-IMPERMEABLE INSULATION.** An insulation having an air permeance equal to or less than 0.02 L/s-m² at 75 Pa pressure differential as tested in accordance with ASTM E283 or E2178.

[RB] ALTERATION. Any construction, retrofit or renovation to an existing structure other than repair or addition that requires a permit. Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit. ←

[RB] ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

[RB] ANCHORED STONE OR MASONRY VENEER. Stone or masonry veneer secured with approved mechanical fasteners to an approved backing.

[RB] APPROVED. Acceptable to the building official. ←

APPROVED. (HCD 1) *Meeting the approval of the enforcing agency, except as otherwise provided by law, when used in connection with any system, material, type of construction, fixture or appliance as the result of investigations and tests conducted by the agency, or by reason of accepted principles*

DEFINITIONS

or tests by national authorities or technical, health or scientific organizations or agencies.

Notes:

1. See Health and Safety Code Section 17920 for “Approved” as applied to residential construction and buildings or structures accessory thereto, as referenced in Section 1.8.2.1.1.
2. See Health and Safety Code Section 17921.1 for “Approved” as applied to the use of hotplates in residential construction referenced in Section 1.8.2.1.1.
3. See Health and Safety Code Section 19966 for “Approved” as applied to factory-built housing as referenced in Section 1.8.3.2.5.
4. See Health and Safety Code Section 18201 for “Approved” as applied to mobilehome parks as referenced in Section 1.8.3.2.2.
5. See Health and Safety Code Section 18862.1 for “Approved” as applied to special occupancy parks as referenced in Section 1.8.3.2.3.

[RB] APPROVED AGENCY. An established and recognized agency that is regularly engaged in conducting tests, furnishing inspection services or furnishing product certification, and has been approved by the building official. (*HCD 1*) “Approved agency” shall mean “Listing agency” and “Testing agency.”

APPROVED LISTING AGENCY. Any agency approved by the enforcing agency, unless otherwise provided by statute, which is in the business of listing and labeling and which makes available at least an annual published report of such listings in which specific information is included that the product has been tested to recognized standards and found to comply.

[MP] APPROVED SOURCE. An independent person, firm or corporation, approved by the building official, who is competent and experienced in the application of engineering principles to materials, methods or systems analyses.

APPROVED TESTING AGENCY. Any agency which is determined by the enforcing agency, except as otherwise provided by statute, to have adequate personnel and expertise to carry out the testing of systems, materials and construction fixtures or appliances.

[RB] ASPECT RATIO. The ratio of longest to shortest perpendicular dimensions, or for wall sections, the ratio of height to length.

[RB] ATTIC. The unfinished space between the ceiling assembly and the roof assembly.

[RB] ATTIC, HABITABLE. A finished or unfinished habitable space within an attic.

[RB] BASEMENT. A story that is not a story above grade plane (see “Story above grade plane”).

[RB] BASIC WIND SPEED. Three-second gust speed at 33 feet (10 058 mm) above the ground in Exposure C (see Section R301.2.1) as given in Figure R301.2(5)A.

BEDRIDDEN PERSON. A person, requiring assistance in turning and repositioning in bed, or being unable to independently transfer to and from bed, except in facilities with appropriate and sufficient care staff, mechanical devices if necessary and safety precautions as determined in Title 22 regulations, by the Director of Social Services or his or her designated representative. Persons who are unable to independently transfer to and from bed, but who do not need assistance to turn or reposition in bed, shall be considered nonambulatory.

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of persons with developmental disabilities, in consultation with the Director of Developmental Services or his or her designated representative.

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of all other persons with disabilities who are not developmentally disabled.

[RB] BOND BEAM. A horizontal grouted element within masonry in which reinforcement is embedded.

[RB] BRACED WALL LINE. A straight line through the building plan that represents the location of the lateral resistance provided by the wall bracing.

[RB] BRACED WALL LINE, CONTINUOUSLY SHEATHED. A braced wall line with structural sheathing applied to all sheathable surfaces including the areas above and below openings.

[RB] BRACED WALL PANEL. A full-height section of wall constructed to resist in-plane shear loads through interaction of framing members, sheathing material and anchors. The panel’s length meets the requirements of its particular bracing method and contributes toward the total amount of bracing required along its braced wall line in accordance with Section R602.10.1.

[RB] BUILDING. Any one- or two-family dwelling or townhouse, or portion thereof, used or intended to be used for human habitation, for living, sleeping, cooking or eating purposes or any combination thereof, or any accessory structure.

Exceptions: For applications listed in Section 1.8.2 regulated by the Department of Housing and Community Development, “Building” shall not include the following:

1. Any mobilehome as defined in Health and Safety Code Section 18008.
2. Any manufactured home as defined in Health and Safety Code Section 18007.
3. Any commercial modular as defined in Health and Safety Code Section 18001.8 or any special purpose commercial modular as defined in Section 18012.5.

4. Any recreational vehicle as defined in Health and Safety Code Section 18010.

5. Any multifamily manufactured home as defined in Health and Safety Code Section 18008.7.

For additional information, see Health and Safety Code Section 18908.

Note: Building shall have the same meaning as defined in Health and Safety Code Sections 17920 and 18908 for the applications specified in Section 1.11.

[RB] BUILDING, EXISTING. Existing building is a building erected prior to the adoption of this code, or one for which a legal building permit has been issued.

[RB] BUILDING LINE. The line established by law, beyond which a building shall not extend, except as specifically provided by law.

[RB] BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.

[RB] BUILDING-INTEGRATED PHOTOVOLTAIC PRODUCT. A building product that incorporates photovoltaic modules and functions as a component of the building envelope.

[RB] BUILDING-INTEGRATED PHOTOVOLTAIC ROOF PANEL (BIPV Roof Panel). A photovoltaic panel that functions as a component of the building envelope.

[RB] BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

[RB] CAP PLATE. The top plate of the double top plates used in structural insulated panel (SIP) construction. The cap plate is cut to match the panel thickness such that it overlaps the wood structural panel facing on both sides.

[RB] CARBON MONOXIDE ALARM. A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

[RB] CARBON MONOXIDE DETECTOR. A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

CARE AND SUPERVISION. Any one or more of the following activities provided by a person or facility to meet the needs of the clients:

Assistance in dressing, grooming, bathing and other personal hygiene

Assistance with taking medication

Central storing and/or distribution of medications

Arrangement of and assistance with medical and dental care

Maintenance of house rules for the protection of clients

Supervision of client schedules and activities

Maintenance and/or supervision of client cash resources or property

Monitoring food intake or special diets

Providing basic services required by applicable law and regulation to be provided by the licensee in order to obtain and maintain a community-care facility license

CATASTROPHICALLY INJURED. A person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined by the Department of Health Services Certification and Licensing that active rehabilitation would be beneficial.

[RB] CEILING HEIGHT. The clear vertical distance from the finished floor to the finished ceiling.

[RB] CEMENT PLASTER. A mixture of Portland or blended cement, Portland cement or blended cement and hydrated lime, masonry cement or plastic cement and aggregate and other approved materials as specified in this code.

[RB] CHANGE OF OCCUPANCY. A change in the use of a building or portion of a building that involves a change in the application of the requirements of this code.

CHILD CARE. For the purposes of these regulations, child care means the care of children during any period of a 24-hour day where permanent sleeping accommodations are not provided. The time-period shall not be more than 24 hours. Note: "Child care" shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

CHILD OR CHILDREN. A person or persons under the age of 18 years.

CHILD-CARE CENTER. Any facility of any capacity other than a large or small family day-care home as defined in these regulations in which less than 24-hour-per-day nonmedical supervision is provided for children in a group setting.

[MP] CHIMNEY. A primary vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

CHRONICALLY ILL. See "TERMINALLY ILL."

[RB] CLADDING. The exterior materials that cover the surface of the building envelope that is directly loaded by the wind.

[RB] CLOSET. A small room or chamber used for storage.

[RB] COLLAPSIBLE SOILS. Soils that exhibit volumetric reduction in response to partial or full wetting under load.

[RB] COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

[MP] COMBUSTION AIR. The air provided to fuel-burning equipment including air for fuel combustion, draft hood dilution and ventilation of the equipment enclosure.

[RB] COMPRESSIBLE SOILS. Soils that exhibit volumetric reduction in response to the application of load even in the absence of wetting or drying.

DEFINITIONS

[MP] CONDENSATE. The liquid that separates from a gas due to a reduction in temperature; for example, water that condenses from flue gases and water that condenses from air circulating through the cooling coil in air conditioning equipment.

[RB] CONDITIONED AIR. Air treated to control its temperature, relative humidity or quality.

CONGREGATE LIVING HEALTH FACILITY (CLHF) means a residential home with a capacity, except as provided in paragraph (3), of no more than 12 beds, that provides inpatient care, including the following basic services: medical supervision, 24-hour skilled nursing and supportive care, pharmacy, dietary, social, recreational and at least one type of service specified in paragraph (1). The primary need of congregate living health facility residents shall be for availability of skilled nursing care on a recurring, intermittent, extended or continuous basis. This care is generally less intense than that provided in general acute care hospitals but more intense than that provided in skilled nursing facilities.

(1) Congregate living health facilities shall provide one of the following services:

(A) Services for persons who are mentally alert, persons with physical disabilities, who may be ventilator dependent.

(B) Services for persons who have a diagnosis of terminal illness, a diagnosis of a life-threatening illness, or both. Terminal illness means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon. A “life-threatening illness” means the individual has an illness that can lead to a possibility of a termination of life within five years or less as stated in writing by his or her attending physician and surgeon.

(C) Services for persons who are catastrophically and severely disabled. A person who is catastrophically and severely disabled means a person whose origin of disability was acquired through trauma or non-degenerative neurologic illness, for whom it has been determined that active rehabilitation would be beneficial and to whom these services are being provided. Services offered by a congregate living health facility to a person who is catastrophically disabled shall include, but not be limited to, speech, physical and occupational therapy.

(2) A congregate living health facility license shall specify which of the types of persons described in paragraph (1) to whom a facility is licensed to provide services.

(3)(A) A facility operated by a city and county for the purposes of delivering services under this section may have a capacity of 59 beds.

(B) A congregate living health facility not operated by a city and county servicing persons who are terminally ill, persons who have been diagnosed with a life-threatening illness, or both, that is located in a

county with a population of 500,000 or more persons, or located in a county of the 16th class pursuant to Section 28020 of the Government Code, may have not more than 25 beds for the purpose of serving persons who are terminally ill.

(C) A congregate living health facility not operated by a city and county serving persons who are catastrophically and severely disabled, as defined in subparagraph (C) of paragraph (1) that is located in a county of 500,000 or more persons may have not more than 12 beds for the purpose of serving persons who are catastrophically and severely disabled.

(4) A congregate living health facility shall have a non-institutional, homelike environment.

CONGREGATE RESIDENCE. Any building or portion thereof that contains facilities for living, sleeping and sanitation, as required by this code and may include facilities for eating and cooking, for occupancy by other than a family. A congregate residence may be a shelter, convent, monastery, dormitory, fraternity or sorority house, but does not include jails, hospitals, nursing homes, hotels or lodging houses.

[RB] CONSTRUCTION DOCUMENTS. Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction drawings shall be drawn to an appropriate scale.

[RB] CORE. The lightweight middle section of a structural insulated panel, composed of foam plastic insulation, that provides the link between the two facing shells.

[RB] CORROSION RESISTANCE. The ability of a material to withstand deterioration of its surface or its properties where exposed to its environment.

[RB] COURT. A space, open and unobstructed to the sky, located at or above grade level on a lot and bounded on three or more sides by walls or a building.

[RB] CRAWL SPACE. An underfloor space that is not a basement.

[RB] CRIPPLE WALL. A framed wall extending from the top of the foundation to the underside of the floor framing of the first story above grade plane.

[RB] CRIPPLE WALL CLEAR HEIGHT. The vertical height of a cripple wall from the top of the foundation to the underside of floor framing above.

[RB] CROSS-LAMINATED TIMBER. A prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross-oriented and bonded with structural adhesive to form a solid wood element.

[RB] DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DAY-CARE shall, for the purposes of these regulations, mean the care of persons during any period of a 24-hour day where permanent sleeping accommodations are not provided.

|| The time-period shall not be more than 24 hours.

Note: “Day-care” shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

DAY-CARE HOME, FAMILY. A home that regularly provides care, protection and supervision for 14 or fewer children, in the provider’s own home, for periods of less than 24 hours per day, while the parents or guardians are away and is either a large family day-care home or a small family day-care home.

DAY-CARE HOME, LARGE FAMILY. A provider’s own home which is licensed to provide day care for periods less than 24 hours per day for nine to 14 persons, including children under the age of 10 years who reside at the home.

DAY-CARE HOME, SMALL FAMILY. A home which provides family day-care to eight or fewer children, including children under the age of 10 years who reside at the home, in the provider’s own home, for periods of less than 24 hours per day. Small family day-care homes are exempted from state fire and life safety regulations other than those state and local standards applicable to Group R-3 Occupancies. [See Health and Safety Code, Section 13143 (b).]

[RB] DEAD LOADS. The weight of the materials of construction incorporated into the building, including but not limited to walls, floors, roofs, ceilings, stairways, built-in partitions, finishes, cladding and other similarly incorporated architectural and structural items, and fixed service equipment.

[RB] DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material with a purpose that is decorative or artistic, not functional; with coloring, texture or other design qualities or components that cannot be removed without destroying the glazing material; and with a surface, or assembly into which it is incorporated, that is divided into segments.

➔ **DEPARTMENT.** The Department of Housing and Community Development.

[MP] DESIGN PROFESSIONAL. See “Registered design professional.”

➔ **[MP] DIAMETER.** Unless specifically stated, the term “diameter” is the nominal diameter as designated by the approved material standard.

[RB] DIAPHRAGM. A horizontal or nearly horizontal system acting to transmit lateral forces to the vertical resisting elements. Where the term “diaphragm” is used, it includes horizontal bracing systems.

➔ **[RB] DRAFT STOP.** A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor-ceiling assemblies, roof-ceiling assemblies and attics.

➔ **[MP] DUCT SYSTEM.** All ducts, duct fittings, plenums and fans when assembled to form a continuous passageway for the distribution of air.

[RB] DWELLING. Any building that contains one or two dwelling units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes.

[RB] DWELLING UNIT. A single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

[RB] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency. (See also “Grade floor emergency escape and rescue opening.”)

[RB] ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

ENFORCEMENT. Notwithstanding other provisions of law, the applicable section of the Health and Safety Code, Section 17920, is repeated here for clarity:

“Enforcement” means diligent effort to secure compliance, including review of plans and permit applications, response to complaints, citation of violations and other legal process. Except as otherwise provided in this part, “enforcement” may, but need not, include inspections of existing buildings on which no complaint or permit application has been filed, and effort to secure compliance as to these existing buildings.

ENFORCEMENT AGENCY. See “ENFORCING AGENCY.”

ENFORCING AGENCY. The designated department or agency as specified by statute or regulation.

[RB] ENGINEERED WOOD RIM BOARD. A full-depth structural composite lumber, wood structural panel, structural glued laminated timber or prefabricated wood I-joist member designed to transfer horizontal (shear) and vertical (compression) loads, provide attachment for diaphragm sheathing, siding and exterior deck ledgers and provide lateral support at the ends of floor or roof joists or rafters.

ENTRY LEVEL. For the purposes of Section R327, entry level is the floor or level of the dwelling unit on which an entry is located.

[RB] ESCARPMENT. With respect to topographic wind effects, a cliff or steep slope generally separating two levels or gently sloping areas.

[RB] EXPANSIVE SOILS. Soils that exhibit volumetric increase or decrease (swelling or shrinking) in response to partial or full wetting or drying under load.

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS). EIFS are nonstructural, nonload-bearing exterior wall cladding systems that consist of an insulation board attached either adhesively or mechanically, or both, to the substrate; an integrally reinforced base coat; and a textured protective finish coat.

DEFINITIONS

[RB] EXTERIOR INSULATION AND FINISH SYSTEMS (EIFS) WITH DRAINAGE. An EIFS that incorporates a means of drainage applied over a water-resistive barrier.

EXTERIOR WALL ASSEMBLY. A system or assembly of exterior wall components, including exterior wall covering materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

[RB] FACING. The wood structural panel facings that form the two outmost rigid layers of the structural insulated panel.

[MP] FACTORY-BUILT CHIMNEY. A listed and labeled chimney composed of factory-made components assembled in the field in accordance with the manufacturer's instructions and the conditions of the listing.

FAMILY. (HCD 1) An individual or two or more persons who are related by blood or marriage; or otherwise live together in a dwelling unit.

[RE] FENESTRATION. See "Fenestration Product" as defined in the California Energy Code.

[RE] FENESTRATION, VERTICAL. Windows that are fixed or movable, opaque doors, glazed doors, glazed block and combination opaque and glazed doors installed in a wall at less than 15 degrees (0.26 rad) from vertical.

[RB] FIBER-CEMENT (BACKERBOARD, SIDING, SOFFIT, TRIM AND UNDERLAYMENT) PRODUCTS. Manufactured thin section composites of hydraulic cementitious matrices and discrete nonasbestos fibers.

[RB] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. To the closest interior lot line.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings on the lot.

The distance shall be measured at a right angle from the face of the wall.

[RB] FIREBLOCKING. Building materials or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

[RB] FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided with a chimney, for use with solid fuels.

Factory-built fireplace. A listed and labeled fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

[MP] FIREPLACE STOVE. A free-standing, chimney-connected solid-fuel-burning heater designed to be operated with the fire chamber doors in either the open or closed position.

[RB] FIREPLACE THROAT. The opening between the top of the firebox and the smoke chamber.

[RB] FIRE-RETARDANT-TREATED WOOD. Wood products that, when impregnated with chemicals by a pressure process or other means during manufacture, exhibit reduced surface burning characteristics and resist propagation of fire.

Other means during manufacture. A process where the wood raw material is treated with a fire-retardant formulation while undergoing creation as a finished product.

Pressure process. A process for treating wood using an initial vacuum followed by the introduction of pressure above atmospheric.

[RB] FLAME SPREAD. The propagation of flame over a surface.

[RB] FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.

[RB] FLIGHT. A continuous run of rectangular treads or winders or combination thereof from one landing to another.

[RB] FOAM BACKER BOARD. Foam plastic used in siding applications where the foam plastic is a component of the siding.

[RB] FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustic purposes and that has a density less than 20 pounds per cubic foot (320 kg/m³) unless it is used as interior trim.

[RB] FOAM PLASTIC INTERIOR TRIM. Exposed foam plastic used as picture molds, chair rails, crown moldings, baseboards, handrails, ceiling beams, door trim and window trim and similar decorative or protective materials used in fixed applications.

[RB] FUEL CELL POWER SYSTEM, STATIONARY. A stationary energy generation system that converts the chemical energy of a fuel and oxidant to electric energy (DC or AC electricity) by an electrochemical process.

Field-fabricated fuel cell power system. A stationary fuel cell power system that is assembled at the job site and is not a preengineered or prepackaged factory-assembled fuel cell power system.

Preengineered fuel cell power system. A stationary fuel cell power system consisting of components and modules that are produced in a factory, and shipped to the job site for assembly.

Prepackaged fuel cell power system. A stationary fuel cell power system that is factory assembled as a single, complete unit and shipped as a complete unit for installation at the job site.

➔ **FULL-TIME CARE** shall mean the establishment and routine care of persons on an hourly, daily, weekly, monthly, yearly or permanent basis, whether for 24-hours per day or less, and where sleeping accommodations are provided.

[RB] **GLASS MAT GYPSUM PANEL.** A gypsum panel consisting of a noncombustible core primarily of gypsum, surfaced with glass mat partially or completely embedded in the core.

[RB] **GLAZING AREA.** The interior surface area of all glazed fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Includes the area of glazed fenestration assemblies in walls bounding conditioned basements.

[RB] **GRADE.** The finished ground level adjoining the building at all exterior walls.

➔ [RB] **GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING.** An emergency escape and rescue opening located such that the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening. (See also “Emergency escape and rescue opening.”)

[RB] **GRADE PLANE.** A reference plane representing the average of the finished ground level adjoining the building at all exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building between the structure and a point 6 feet (1829 mm) from the building.

➔ [RB] **GROSS AREA OF EXTERIOR WALLS.** The normal projection of all exterior walls, including the area of all windows and doors installed therein.

➔ [RB] **GUARD OR GUARDRAIL.** A building component or a system of building components located near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to the lower level.

[RB] **GUESTROOM.** Any room or rooms used or intended to be used by one or more guests for living or sleeping purposes.

[RB] **GYPSUM BOARD.** The generic name for a family of sheet products consisting of a noncombustible core primarily of gypsum with paper surfacing. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board and water-resistant gypsum backing board complying with the standards listed in Section R702.3 and Part IX of this code are types of gypsum board.

[RB] **GYPSUM PANEL PRODUCT.** The general name for a family of sheet products consisting essentially of gypsum.

[RB] **GYPSUM SHEATHING.** Gypsum panel products specifically manufactured with enhanced water resistance for use as a substrate for exterior surface materials.

[RB] **GYPSUM WALLBOARD.** A gypsum board used primarily as interior surfacing for building structures.

[RB] **HABITABLE SPACE.** A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

[RB] **HANDRAIL.** A horizontal or sloping rail intended for grasping by the hand for guidance or support.

[RB] **HEIGHT, BUILDING.** The vertical distance from grade plane to the average height of the highest roof surface.

[RB] **HEIGHT, STORY.** The vertical distance from top to top of two successive tiers of beams or finished floor surfaces; and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

[RB] **HILL.** With respect to topographic wind effects, a land surface characterized by strong relief in any horizontal direction.

[RB] **HURRICANE-PRONE REGIONS.** Areas vulnerable to hurricanes, defined as the US Atlantic Ocean and Gulf of Mexico coasts where the ultimate design wind speed, V_{ult} , is greater than 115 miles per hour (51 m/s), and Hawaii, Puerto Rico, Guam, Virgin Islands and America Samoa.

[RB] **IMPACT PROTECTIVE SYSTEM.** Construction that has been shown by testing to withstand the impact of test missiles and that is applied, attached, or locked over exterior glazing.

INFANT, for the purpose of these regulations, shall mean any child who because of age only, is unable to walk and requires the aid of another person to evacuate the building. In no case shall the term “infant” mean a child 2 years of age or older.

INFLATABLE AMUSEMENT DEVICE. A device made of flexible fabric or other combustible materials that is inflated by one or more air-blowers providing internal air pressure to maintain its shape. Such a device is designed for recreational activities that allow occupants to bounce, climb, slide, negotiate an obstacle course or participate in interactive play.

[RB] **INSULATED SIDING.** A type of continuous insulation, with manufacturer-installed insulating material as an integral part of the cladding product, having a minimum R-value of R-2.

[RB] **INSULATED VINYL SIDING.** A vinyl cladding product, with manufacturer-installed foam plastic insulating material as an integral part of the cladding product, having a thermal resistance of not less than R-2.

[RB] **INSULATING CONCRETE FORM (ICF).** A concrete forming system using stay-in-place forms of rigid foam plastic insulation, a hybrid of cement and foam insulation, a hybrid of cement and wood chips or other insulating material for constructing cast-in-place concrete walls.

[RB] **INSULATING SHEATHING.** A rigid panel or board insulation material having a thermal resistance of not less than R-2 of the core material with properties suitable for use on walls, floors, roofs or foundations.

DEFINITIONS

[RB] INTERMODAL SHIPPING CONTAINER. A six-sided steel unit originally constructed as a general cargo container used for the transport of goods and materials.

[RB] JURISDICTION. The governmental unit that has adopted this code.

[RB] KITCHEN. An area used, or designated to be used, for the preparation of food.

[RB] LABEL. An identification applied on a product by the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that the representative sample of the product or material has been tested and evaluated by an approved agency. (See also “Manufacturer’s designation” and “Mark.”)

[RB] LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of such labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LABELED. (HCD 1) Labeled means equipment or materials to which has been attached a label, symbol or other identifying mark of an organization, approved by the Department, that maintains a periodic inspection program of production of labeled products, installations, equipment or materials and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

[RB] LIGHT-FRAME CONSTRUCTION. Construction whose vertical and horizontal structural elements are primarily formed by a system of repetitive wood or cold-formed steel framing members.

LIMITED-DENSITY OWNER-BUILT RURAL DWELLINGS. Any structure consisting of one or more habitable rooms intended or designed to be occupied by one family with facilities for living or sleeping, with use restricted to rural areas designated by local jurisdiction. Notwithstanding other sections of law, the applicable section of Health and Safety Code Section 17958.2 is repeated here for clarification purposes.

Section 17958.2. (a) Notwithstanding Section 17958, regulations of the department adopted for limited-density owner-built rural dwellings, which are codified in Article 8 (commencing with Section 74) of Subchapter 1 of Chapter 1 of Title 25 of the California Code of Regulations, shall not become operative within any city or county unless and until the governing body of the city or county makes an express finding that the application of those regulations within the city or county is reasonably necessary because of local conditions and the city or county files a copy of that finding with the department.

(b) In adopting ordinances or regulations for limited-density owner-built rural dwellings, a city or county may make such changes or modifications in the requirements

contained in Article 8 (commencing with Section 74) of Subchapter 1 of Chapter 1 of Title 25 of the California Code of Regulations that it determines are reasonably necessary because of local conditions, if the city or county files a copy of the changes or modifications and the express findings for the changes or modifications with the department. No change or modification of that type shall become effective or operative for any purpose until the finding and the change or modification has been filed with the department.

LISTED. (HCD 1) All products that appear in a list published by an approved testing or listing agency. For additional information, see Health and Safety Code Section 17920(h).

[RB] LISTED. (SFM) Equipment, materials, products or services included in a list published by an organization acceptable to the code official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose. For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, “listed” shall also mean equipment or materials accepted by the state fire marshal as conforming to the provisions of the State Fire Marshal’s regulations and which are included in a list published by the State Fire Marshal.

LISTING AGENCY. (HCD 1 & HCD 2) An agency approved by the department that is in the business of listing and labeling products, materials, equipment and installations tested by an approved testing agency, and that maintains a periodic inspection program on current production of listed products, equipment and installations, and that, at least annually, makes available a published report of these listings. For additional information, see Health and Safety Code Section 17920(i).

[RB] LIVE LOADS. Those loads produced by the use and occupancy of the building or other structure and do not include construction or environmental loads such as wind load, snow load, rain load, earthquake load, flood load or dead load.

[RB] LIVE/WORK UNIT. A dwelling unit or sleeping unit in which a significant portion of the space includes a non-residential use that is operated by the tenant or building owner.

[MP] LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

[MP] LOCAL EXHAUST. An exhaust system that uses one or more fans to exhaust air from a specific room or rooms within a dwelling.

[RB] LODGING HOUSE. (HCD 1) Any building or portion thereof containing not more than five guest rooms where rent is paid in money, goods, labor or otherwise, and that is occupied by the proprietor as the residence of such proprietor.

[RB] LOT. A measured portion or parcel of land considered as a unit having fixed boundaries.

[RB] LOT LINE. The line that bounds a plot of ground described as a lot in the title to the property.

[RB] MANUFACTURER'S DESIGNATION. An identification applied on a product by the manufacturer indicating that a product or material complies with a specified standard or set of rules. (See also "Mark" and "Label.")

[RB] MANUFACTURER'S INSTALLATION INSTRUCTIONS. Printed instructions included with equipment as part of the conditions of their listing and labeling.

[RB] MARK. An identification applied on a product by the manufacturer indicating the name of the manufacturer and the function of a product or material. (See also "Manufacturer's designation" and "Label.")

[RB] MASONRY, SOLID. Masonry consisting of solid masonry units laid contiguously with the joints between the units filled with mortar.

[RB] MASONRY CHIMNEY. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

[RB] MASONRY HEATER. A masonry heater is a solid fuel burning heating appliance constructed predominantly of concrete or solid masonry having a mass of not less than 1,100 pounds (500 kg), excluding the chimney and foundation. It is designed to absorb and store a substantial portion of heat from a fire built in the firebox by routing exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes not less than one 180-degree (3.14-rad) change in flow direction before entering the chimney and that deliver heat by radiation through the masonry surface of the heater.

[RB] MASONRY UNIT. Brick, tile, stone, architectural cast stone, glass block or concrete block conforming to the requirements specified in Section 2103 of the *California Building Code*.

Clay. A building unit larger in size than a brick, composed of burned clay, shale, fire clay or mixtures thereof.

Concrete. A building unit or block larger in size than 12 inches by 4 inches by 4 inches (305 mm by 102 mm by 102 mm) made of cement and suitable aggregates.

Glass. Nonload-bearing masonry composed of glass units bonded by mortar.

Hollow. A masonry unit with a net cross-sectional area in any plane parallel to the loadbearing surface that is less than 75 percent of its gross cross-sectional area measured in the same plane.

Solid. A masonry unit with a net cross-sectional area in every plane parallel to the loadbearing surface that is 75 percent or more of its cross-sectional area measured in the same plane.

[RB] MEAN ROOF HEIGHT. The average of the roof eave height and the height to the highest point on the roof surface, except that eave height shall be used for roof angle of less than or equal to 10 degrees (0.18 rad).

[RB] METAL ROOF PANEL. An interlocking metal sheet having an installed weather exposure of not less than 3 square feet (0.28 m²) per sheet.

[RB] METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.28 m²) per sheet.

[RB] MEZZANINE. An intermediate level or levels between the floor and ceiling of any story.

MEZZANINE, LOFT. *An intermediate level or levels between the floor and ceiling of any story with an aggregate floor area of not more than one-third of the area of the room or space in which the level or levels are located.*

[RB] MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

[RB] MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes all integral or separate audible alarms to operate.

[RB] NAILABLE SUBSTRATE. A product or material such as framing, sheathing or furring, composed of wood or wood-based materials or other materials and fasteners providing equivalent fastener withdrawal resistance.

[RB] NATURALLY DURABLE WOOD. The heartwood of the following species with the exception that an occasional piece with corner sapwood is permitted if 90 percent or more of the width of each side on which it occurs is heartwood.

Decay resistant. Redwood, cedar, black locust and black walnut.

Termite resistant. Alaska yellow cedar, redwood, Eastern red cedar and Western red cedar including all sapwood of Western red cedar.

NONAMBULATORY PERSONS *are persons unable to leave a building unassisted under emergency conditions. It includes, but is not limited to, persons who depend on mechanical aids such as crutches, walkers and wheelchairs and any person who is unable to physically and mentally respond to a sensory signal approved by the state fire marshal or an oral instruction relating to fire danger.*

The determination of ambulatory or nonambulatory status of persons with developmental disabilities shall be made by the Director of Social Services or his or her designated representative, in consultation with the director of Developmental Services or his or her designated representative. The determination of ambulatory or nonambulatory status of all other disabled persons placed after January 1, 1984, who are not developmentally disabled shall be made by the Director of Social Services or his or her designated representative.

[RB] NONCOMBUSTIBLE MATERIAL. *Noncombustible as applied to building construction material means a material which, in the form in which it is used, is either one of the following:*

1. *Material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E136 shall be considered noncombustible.*

DEFINITIONS

2. Material having a structural base of noncombustible material as defined in Item 1 above, with a surfacing material not over $\frac{1}{8}$ inch (3.2 mm) thick which has a flame-spread index of 50 or less.

“Noncombustible” does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread index, beyond the limits herein established, through the effects of age, moisture or other atmospheric condition.

[RB] NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

[RB] OCCUPIED SPACE. The total area of all buildings or structures on any lot or parcel of ground projected on a horizontal plane, excluding permitted projections as allowed by this code.

[RB] OWNER. Any person, agent, firm or corporation having a legal or equitable interest in the property.

[RB] PAN FLASHING. Corrosion-resistant flashing at the base of an opening that is integrated into the building exterior wall to direct water to the exterior and is premanufactured, fabricated, formed or applied at the job site.

[RB] PANEL THICKNESS. Thickness of core plus two layers of structural wood panel facings.

PASSIVE SOLAR ENERGY COLLECTOR. Uses architectural components, rather than mechanical components, to provide heating or cooling for a building interior.

[MP] PELLET FUEL-BURNING APPLIANCE. A closed combustion, vented appliance equipped with a fuel feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

[RB] PERFORMANCE CATEGORY. A designation of wood structural panels as related to the panel performance used in Chapters 4, 5, 6 and 8.

[RB] PERMIT. An official document or certificate issued by the building official that authorizes performance of a specified activity.

[RB] PERSON. An individual, heirs, executors, administrators or assigns, and a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

PERSONS WITH INTELLECTUAL DISABILITIES, PROFOUNDLY OR SEVERELY. Shall mean any persons with intellectual disabilities who is unable to evacuate a building unassisted during emergency conditions.

Note: The determination as to such incapacity shall be made by the Director of the State Department of Public Health or his or her designated representative pursuant to Health and Safety Code Section 13131.3.

[RB] PHOTOVOLTAIC MODULE. A complete, environmentally protected unit consisting of solar cells, optics and other components, exclusive of a tracker, designed to generate DC power where exposed to sunlight.

[RB] PHOTOVOLTAIC PANEL. A collection of photovoltaic modules mechanically fastened together, wired and designed to provide a field-installable unit.

[RB] PHOTOVOLTAIC PANEL SYSTEM. A system that incorporates discrete photovoltaic panels that convert solar radiation into electricity, including rack support systems.

PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND-MOUNTED. An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.

PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED. An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.

[RB] PHOTOVOLTAIC SHINGLES. A roof covering that resembles shingles and that incorporates photovoltaic modules.

[RB] PLASTIC COMPOSITE. A generic designation that refers to wood-plastic composites and plastic lumber.

[RB] PLATFORM CONSTRUCTION. A method of construction by which floor framing bears on load bearing walls that are not continuous through the story levels or floor framing.

[MP] PLENUM. A chamber that forms part of an air-circulation system other than the occupied space being conditioned.

[RB] POLYPROPYLENE SIDING. A shaped material, made principally from polypropylene homopolymer, or copolymer, that in some cases contains fillers or reinforcements, that is used to clad exterior walls or buildings.

[RB] POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for the loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

[RB] PRECAST CONCRETE. A structural concrete element cast elsewhere than its final position in the structure.

[RB] PRECAST CONCRETE FOUNDATION WALLS. Preengineered, precast concrete wall panels that are designed to withstand specified stresses and used to build below-grade foundations.

PROTECTIVE SOCIAL CARE FACILITY. A facility housing persons, who are referred, placed or caused to be placed in the facility, by any governmental agency and for whom the services, or a portion thereof, are paid for by any governmental agency. These occupancies shall include, but are not limited to, those commonly referred to as “assisted living facilities,” “social rehabilitation facilities,” “certified family care homes,” “out-of-home placement facilities” and “halfway houses.”

[RB] PUBLIC WAY. Any street, alley or other parcel of land open to the outside air leading to a public street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and that has a clear width and height of not less than 10 feet (3048 mm).

[MP] PUSH-FIT FITTING. A mechanical fitting that joins pipes or tubes and achieves a seal by mating the pipe or tube into the fitting.

[RB] RAMP. A walking surface that has a running slope steeper than 1 unit vertical in 20 units horizontal (5-percent slope).

[RB] READY ACCESS (TO). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel, door or similar obstruction.

[RB] REGISTERED DESIGN PROFESSIONAL. An individual who is registered or licensed to practice their respective design profession as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

[RB] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

[RB] REROOFING. The process of recovering or replacing an existing roof covering. See “Roof recover.”

RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI), as termed, means a housing arrangement with a maximum capacity of 25 residents that provides a range of services to residents who have chronic, life-threatening illnesses.

RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE), as defined in Health and Safety Code Section 1569.2, shall mean a facility with a housing arrangement chosen voluntarily by persons 60 years of age or over, or their authorized representative, where varying levels and intensities of care and supervision, protective supervision or personal care are provided, based on their varying needs, as determined in order to be admitted and to remain in the facility. Persons under 60 years of age with compatible needs, as determined by the Department of Social Services in regulations, may be allowed to be admitted or retained in a residential-care facility for the elderly. Pursuant to Health and Safety Code Section 13133, regulations of the State Fire Marshal pertaining to Group R, Division 2 Occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is in consistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the State Fire Marshal that are reasonably necessary to accommodate local climate, geological or topographical

conditions relating to roof coverings for Residential-care Facilities for the Elderly.

RESIDENTIAL FACILITY (RF), as defined in Section 1502 of the Health and Safety Code, shall mean any family home, group care facility or similar facility determined by the director of Social Services, for 24-hour nonmedical care of persons in need of personal services, supervision or assistance essential for sustaining the activities of daily living or for the protection of the individual. Such facilities include small family homes and social rehabilitation facilities. Pursuant to Health and Safety Code Section 13133, regulations of the State Fire Marshal pertaining to Group R Occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is in consistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the State Fire Marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential-care Facilities for the Elderly.

RESTRAINT. The physical retention of a person within a room, cell or cell block by any means, or within the exterior walls of a building by means of locked doors inoperable by the person restrained. Restraint shall also mean the physical binding, strapping or similar restriction of any person in a chair, walker, bed or other contrivance for the purpose of deliberately restricting the free movement of ambulatory persons. Restraint shall not be construed to include nonambulatory persons nor shall it include the use of bandage material, strip sheeting or other fabrics or materials (soft ties) used to restrain persons in hospital-type beds or wheelchairs to prevent injury, provided an approved method of quick release is maintained. Facilities employing the use of soft ties, however, shall be classified as a building used to house nonambulatory persons. Restraint shall not be practiced in licensed facilities classified as Group R-3.1 and R-4 occupancies unless constructed as a Group I-3 occupancy. For Group I-3 Occupancies see Section 308.5 of the California Building Code.

[RB] RIDGE. With respect to topographic wind effects, an elongated crest of a hill characterized by strong relief in two directions.

[RB] RISER (STAIR). The vertical component of a step or stair.

[RB] ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly can include an underlayment, thermal barrier, ignition barrier, insulation or a vapor retarder.

DEFINITIONS

[RB] ROOF COATING. A fluid-applied, adhered coating used for roof maintenance or roof repair, or as a component of a roof covering system or roof assembly.

[RB] ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

[RB] ROOF COVERING SYSTEM. See “Roof assembly.”

[RB] ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

[RB] ROOF RECOVER. The process of installing an additional roof covering over an existing roof covering without removing the existing roof covering.

[RB] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

[RB] ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

[RB] RUNNING BOND. The placement of masonry units such that head joints in successive courses are horizontally offset not less than one-quarter the unit length.

[RB] SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

[RB] SEISMIC DESIGN CATEGORY (SDC). A classification assigned to a structure based on its occupancy category and the severity of the design earthquake ground motion at the site.

[RB] SHALL. The term, where used in the code, is construed as mandatory.

[RB] SHEAR WALL. A general term for walls that are designed and constructed to resist racking from seismic and wind by use of masonry, concrete, cold-formed steel or wood framing in accordance with Chapter 6 of this code and the associated limitations in Section R301.2 of this code.

[RB] SHINGLE FASHION. A method of installing roof or wall coverings, water-resistive barriers, flashing or other building components such that upper layers of material are placed overlapping lower layers of material to provide drainage and protect against water intrusion at unsealed penetrations and joints or in combination with sealed joints.

[RB] SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

[RB] SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, control equipment and alarm sounding device in one unit that is operated from a power supply either in the unit or obtained at the point of installation.

[RB] SKYLIGHT, UNIT. A factory assembled, glazed fenestration unit, containing one panel of glazing material, that allows for natural daylighting through an opening in the roof assembly while preserving the weather-resistant barrier of the roof.

[RB] SKYLIGHTS AND SLOPED GLAZING. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Unit

skylights, tubular daylighting devices and glazing materials in solariums, sunrooms, roofs and sloped walls are included in this definition.

[RB] SLEEPING UNIT. A single unit that provides rooms or spaces for one or more persons, includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

[RB] SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84 or UL 723.

[RB] SOLAR ENERGY SYSTEM. A system that converts solar radiation to usable energy, including photovoltaic panel systems and solar thermal systems.

[MP] SOLAR THERMAL COLLECTOR. Components in a solar thermal system that collect and convert solar radiation to thermal energy.

[MP] SOLAR THERMAL SYSTEM. A system that converts solar radiation to thermal energy for use in heating or cooling.

[RB] SOLID MASONRY. Load-bearing or nonload-bearing construction using masonry units where the net cross-sectional area of each unit in any plane parallel to the bearing surface is not less than 75 percent of its gross cross-sectional area. Solid masonry units shall conform to ASTM C55, C62, C73, C145 or C216.

[RB] SPLINE. A strip of wood structural panel cut from the same material used for the panel facings, used to connect two structural insulated panels. The strip (spline) fits into a groove cut into the vertical edges of the two structural insulated panels to be joined. Splines are used behind each facing of the structural insulated panels being connected as shown in Figure R610.8.

[RB] STACK BOND. The placement of masonry units in a bond pattern is such that head joints in successive courses are vertically aligned. For the purpose of this code, requirements for stack bond shall apply to all masonry laid in other than running bond.

[RB] STAIR. A change in elevation, consisting of one or more risers.

[RB] STAIRWAY. One or more flights of stairs, either interior or exterior, with the necessary landings and connecting platforms to form a continuous and uninterrupted passage from one level to another.

[RB] STAIRWAY, SPIRAL. A stairway with a plan view of closed circular form and uniform section-shaped treads radiating from a minimum-diameter circle.

STATE-OWNED/LEASED BUILDING. A building or portion of a building that is owned, leased or rented by the state. State-leased buildings shall include all required exits to a public way serving such leased area or space. Portions of state-leased buildings that are not leased or rented by the state shall not be included within the scope of this section

unless such portions present an exposure hazard to the state-leased area or space.

➔ **[RB] STORM SHELTER.** A building, structure or portion thereof, constructed in accordance with ICC 500 and designated for use during a severe wind storm event, such as a hurricane or tornado.

[RB] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above.

[RB] STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is either of the following:

1. More than 6 feet (1829 mm) above grade plane.
2. More than 12 feet (3658 mm) above the finished ground level at any point.

[RB] STRUCTURAL COMPOSITE LUMBER. Structural members manufactured using wood elements bonded together with exterior adhesives.

Examples of structural composite lumber are:

Laminated strand lumber (LSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths are not less than 150 times the least dimension of the wood strand elements.

Laminated veneer lumber (LVL). A composite of wood veneer elements with wood fibers primarily oriented along the length of the member, where the veneer element thicknesses are 0.25 inch (6.4 mm) or less.

Oriented strand lumber (OSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.10 inch (2.54 mm) or less and their average lengths are not less than 75 times and less than 150 times the least dimension of the wood strand elements.

Parallel strand lumber (PSL). A composite of wood strand elements with wood fibers primarily oriented along the length of the member, where the least dimension of the wood strand elements is 0.25 inch (6.4 mm) or less and their average lengths are not less than 300 times the least dimension of the wood strand elements.

[RB] STRUCTURAL INSULATED PANEL (SIP). A structural sandwich panel that consists of a lightweight foam plastic core securely laminated between two thin, rigid wood structural panel facings.

➔ **[RB] STRUCTURE.** That which is built or constructed.

➔ **[RB] SUNROOM.** A one-story structure attached to a dwelling with a glazing area in excess of 40 percent of the gross area of the structure's exterior walls and roof.

TERMINALLY ILL, as termed for an individual, means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon.

[RB] TERMITE-RESISTANT MATERIAL. Pressure-preservative-treated wood in accordance with the AWP standards in Section R317.1, naturally durable termite-resistant wood, steel, concrete, masonry or other approved material.

TESTING AGENCY. An agency approved by the department as qualified and equipped for testing of products, materials, equipment and installations in accordance with nationally recognized standards. For additional information, see Health and Safety Code Section 17920(m).

TODDLER. Any child between 18 months and 36 months of age.

[RB] TOWNHOUSE. A building that contains three or more attached townhouse units.

[RB] TOWNHOUSE UNIT. A single-family dwelling unit in a townhouse that extends from foundation to roof and that has a yard or public way on not less than two sides.

[RB] TRIM. Picture molds, chair rails, baseboards, handrails, door and window frames and similar decorative or protective materials used in fixed applications.

[RB] TRUSS DESIGN DRAWING. The graphic depiction of an individual truss, that describes the design and physical characteristics of the truss.

[RB] TUBULAR DAYLIGHTING DEVICE (TDD). A nonoperable fenestration unit primarily designed to transmit daylight from a roof surface to an interior ceiling via a tubular conduit. The basic unit consists of an exterior glazed weathering surface, a light-transmitting tube with a reflective interior surface and an interior-sealing device such as a translucent ceiling panel. The unit may be factory assembled, or field assembled from a manufactured kit.

[MP] TYPE L VENT. A listed and labeled vent conforming to UL 641 for venting oil-burning appliances listed for use with Type L vents or with gas appliances listed for use with Type B vents.

[RB] UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt, or other approved material over which a roof covering, with a slope of 2 units vertical in 12 units horizontal (17-percent slope) or greater, is applied.

[RB] VAPOR DIFFUSION PORT. An assembly constructed or installed within a roof assembly at an opening in the roof deck to convey water vapor from an unvented attic to the outside atmosphere.

[RB] VAPOR PERMEABLE. The property of having a moisture vapor permeance rating of 5 perms (2.9×10^{-10} kg/Pa \times s \times m²) or greater, where tested in accordance with Procedure A or Procedure B of ASTM E96. A vapor permeable material permits the passage of moisture vapor.

DEFINITIONS

[RB] VAPOR RETARDER CLASS. A measure of the ability of a material or assembly to limit the amount of moisture that passes through that material or assembly. Vapor retarder class shall be defined using the desiccant method with Procedure A of ASTM E96 as follows:

Class I: ≤ 0.1 perm rating

Class II: > 0.1 to ≤ 1.0 perm rating

Class III: > 1.0 to ≤ 10 perm rating

[MP] VENT. A passageway for conveying flue gases from fuel-fired appliances, or their vent connectors, to the outside atmosphere.

➔ **[RB] VENTILATION.** The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

➔ **[MP] VENTING.** Removal of combustion products to the outdoors.

➔ **[RB] VINYL SIDING.** A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used to cover exterior walls of buildings.

➔ **[RB] WALL, RETAINING.** A wall not laterally supported at the top, that resists lateral soil load and other imposed loads.

[RB] WALLS. Walls shall be defined as follows:

Load-bearing wall. A wall supporting any vertical load in addition to its own weight.

Nonbearing wall. A wall which does not support vertical loads other than its own weight.

➔ **[RB] WATER-RESISTIVE BARRIER.** A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

➔ **WILDLAND-URBAN INTERFACE (WUI).** *A geographical area identified by the state as a "Fire Hazard Severity Zone" in accordance with the Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189, or other areas designated by the enforcing agency to be a significant risk from wildfires.*

[RB] WINDER. A tread with nonparallel edges.

[RB] WOOD STRUCTURAL PANEL. A panel manufactured from veneers; or wood strands or wafers; bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are plywood, orientated strand board (OSB) or composite panels.

[RB] YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by this code, on the lot on which a building is situated.

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CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 3 – BUILDING PLANNING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R300				X																		
R300.1				X																		
R300.2				X																		
R301.1			X																			
R301.1.1.1				X																		
R301.1.3.1				X																		
R301.1.3.2				X																		
R301.1.3.3				X																		
R301.2.2.1.1																						
R301.2.2.1.2																						
R301.2.2.10				X																		
Table 301.5				X																		
R302.1 - R302.14			X																			
R302.1			X	X																		
Table 302.1(2)				X																		
R302.2.2				X																		
R302.2.6			X	X																		
R302.3			X	X																		
R302.6				X																		
R302.13				X																		
R303.1				X																		
R303.3				X																		
R303.3.1				X																		
R303.4				X																		
R303.5.1				X																		
R303.7 - R308.1			X																			
R303.9.1.1				X																		
R303.10				X																		
R304.2				X																		
R307.1				X																		
Figure R307.1				†																		
R308.3 - R308.4			X																			
R309.4				X																		
R309.5			X																			
R309.6			X																			
R309.7				X																		
R309.8				X																		
R310			X																			

(continued)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
CHAPTER 3 – BUILDING PLANNING—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R311 - R311.8.3.3			X																			
R312 - R312.2.2			X																			
R312.1.2				X																		
R313.1 - R313.3.8.2			X	◆																		
R314 - R314.8.3			X																			
R315.1.1				X																		
R315.2				X																		
R315.2.1				X																		
R315.2.2				X																		
R315.3				X																		
R315.4				X																		
R315.5				X																		
R315.6				X																		
R315.7.2				X																		
R315.7.4				X																		
R316			X																			
R316.2.1			X																			
R316.3 Exception 2			X																			
R317.1				X																		
R317.1.6				X																		
R319			X																			
R320.1				X																		
R320.1.1				†																		
R320.2				X																		
R321			X																			
R321.3				X																		
R322.1.6				X																		
R322.1.7				X																		
R322.1.9				†																		
R324			X																			
R324.2				X																		
R324.3				X																		
R324.6				X																		
R324.6.2.1			X	X																		
R324.6.3				X																		
R324.7.1				X																		
R324.8 – R324.8.2			X																			
R325.3				X																		

(continued)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
CHAPTER 3 – BUILDING PLANNING—continued**

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R326				X																		
R326.3			X																			
<i>R327 through R327.1.4</i>				X																		
328.1 – 328.12			X																			
R328.1				X																		
R328.6				X																		
R328.9				X																		
R328.10				X																		
R329.2				X																		
<i>R334</i>				X																		
<i>R334.1</i>				X																		
<i>R335 - R335.9</i>			X																			
<i>R336 - R336.8</i>			X																			
R337.1.1			X																			
<i>R337 - R337.10.4</i>			X																			
R337.5.1 - R337.5.2			X																			
R337.6.2 - R337.6.3			X																			
R337.9.1.1			X																			
R337.9.3			X																			
<i>R338 - R338.4</i>			X																			
<i>R340</i>				X																		
<i>R340.1</i>				X																		

The state agency does not adopt sections identified with the following symbol: †

The ♦ designation indicates that the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures subject to HCD 1.

Part III—Building Planning and Construction

CHAPTER 3

BUILDING PLANNING

User note:

About this chapter: Chapter 3 contains a wide array of building planning requirements that are critical to designing a safe and usable building. This includes, but is not limited to, requirements related to general structural design, fire-resistant construction, light, ventilation, sanitation, plumbing fixture clearances, minimum room area and ceiling height, safety glazing, means of egress, automatic fire sprinkler systems, smoke and carbon monoxide alarm systems, accessibility, solar energy systems, swimming pools, spas and hot tubs.

SECTION R300 SITE DRAINAGE

R300.1 Storm water drainage and retention during construction. Projects which disturb less than one acre of soil and are not part of a larger common plan of development which in total disturbs one acre or more, shall manage storm water drainage during construction in accordance with the California Green Building Standards Code, Chapter 4, Division 4.1.

R300.2 Grading and paving. Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings in accordance with the California Green Building Standards Code, Chapter 4, Division 4.1.

SECTION R301 DESIGN CRITERIA

R301.1 Application. Buildings and structures, and parts thereof, shall be constructed to safely support all loads, including dead loads, live loads, roof loads, flood loads, snow loads, wind loads and seismic loads as prescribed by this code. The construction of buildings and structures in accordance with the provisions of this code shall result in a system that provides a complete load path that meets the requirements for the transfer of loads from their point of origin through the load-resisting elements to the foundation. Buildings and structures constructed as prescribed by this code are deemed to comply with the requirements of this section.

Existing buildings housing existing protective social care homes or facilities established prior to 1972 (see Chapter 11 of the California Fire Code and the California Existing Building Code).

R301.1.1 Alternative provisions. As an alternative to the requirements in Section R301.1, the following standards are permitted subject to the limitations of this code and the limitations therein. Where engineered design is used in conjunction with these standards, the design shall comply with the California Building Code.

1. AWC Wood Frame Construction Manual (WFCM).
2. AISI Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings (AISI S230).

3. ICC Standard on the Design and Construction of Log Structures (ICC 400).

R301.1.1.1 Alternative provisions for limited-density owner-built rural dwellings. The purpose of this subsection is to permit alternatives that provide minimum protection of life, limb, health, property, safety and welfare of the general public and the owners and occupants of limited-density owner-built rural dwellings as defined in Chapter 2 of this code. For additional information see Chapter 1, Subchapter 1, Article 8, of Title 25, California Code of Regulations, commencing with Section 74.

To meet compliance with the requirements of this code, provisions of Section R301.1.1.1, Items 1 through 5 may be utilized for limited-density owner-built rural dwellings when the materials, methods of construction or appliances are determined appropriate or suitable for their intended purpose by the local enforcing agency.

1. A limited-density owner-built rural dwelling may be of any type of construction which will provide for a sound structural condition. Structural hazards which result in an unsound condition and which may constitute a substandard building are delineated in Section 17920.3 of the Health and Safety Code.
2. There shall be no requirements for room dimensions as required in Chapter 3, provided there is adequate light and ventilation and means of egress.
3. There shall be no specified requirement for heating capacity or for temperature maintenance. The use of solid-fuel or solar heating devices shall be deemed as complying with the requirements of Chapter 3. If nonrenewable fuel is used in these dwellings, rooms so heated shall meet current installation standards.
4. Pier foundations, stone masonry footings and foundations, pressure-treated lumber, poles or equivalent foundation materials or designs may be used provided that bearing is sufficient.
5. Owner-produced or used materials and appliances may be utilized unless found not to be of sufficient strength or durability to perform the intended function. Owner-produced or used lumber, or shakes

and shingles may be utilized unless found to contain dry rot, excessive splitting or other defects obviously rendering the material unfit in strength or durability for the intended purpose.

R301.1.2 Construction systems. The requirements of this code are based on platform and balloon-frame construction for light-frame buildings. The requirements for concrete and masonry buildings are based on a balloon framing system. Other framing systems must have equivalent detailing to ensure force transfer, continuity and compatible deformations.

R301.1.3 Engineered design. Where a building of otherwise conventional construction contains structural elements exceeding the limits of Section R301 or otherwise not conforming to this code, these elements shall be designed in accordance with accepted engineering practice. The extent of such design need only demonstrate compliance of nonconventional elements with other applicable provisions and shall be compatible with the performance of the conventional framed system. Engineered design in accordance with the *California Building Code* is permitted for buildings and structures, and parts thereof, included in the scope of this code.

R301.1.3.1 California licensed architect or engineer. *When any portion of any structure deviates from substantial compliance with conventional framing requirements for woodframe construction found in this code, the building official shall require the construction documents to be approved and stamped by a California licensed architect or engineer for that irregular or non-conforming portion of work. Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537 and 6737.1.*

R301.1.3.2 Woodframe structures greater than two-stories. *The building official shall require construction documents to be approved and stamped by a California licensed architect or engineer for all dwellings of wood-frame construction more than two stories and basement in height. Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537 and 6737.1.*

R301.1.3.3 Structures other than woodframe. *The building official shall require floor, wall or roof-ceiling structural elements in dwellings designed of cold-formed steel, concrete, masonry or structural insulated panels prescribed by this code to be approved and stamped by a California licensed architect or engineer. Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537 and 6737.1.*

R301.1.4 Intermodal shipping containers. Intermodal shipping containers that are repurposed for use as buildings or structures shall be designed in accordance with the structural provisions in Section 3115 of the *California Building Code*.

R301.2 Climatic and geographic design criteria. Buildings shall be constructed in accordance with the provisions of this code as limited by the provisions of this section. Additional

criteria shall be established by the local jurisdiction and set forth in Table R301.2.

R301.2.1 Wind design criteria. Buildings and portions thereof shall be constructed in accordance with the wind provisions of this code using the ultimate design wind speed in Table R301.2 as determined from Figure R301.2(2). The structural provisions of this code for wind loads are not permitted where wind design is required as specified in Section R301.2.1.1. Where different construction methods and structural materials are used for various portions of a building, the applicable requirements of this section for each portion shall apply. Where not otherwise specified, the wind loads listed in Table R301.2.1(1) adjusted for height and exposure using Table R301.2.1(2) shall be used to determine design load performance requirements for wall coverings, curtain walls, roof coverings, exterior windows, skylights, garage doors and exterior doors. Asphalt shingles shall be designed for wind speeds in accordance with Section R905.2.4. Metal roof shingles shall be designed for wind speeds in accordance with Section R905.4.4. A continuous load path shall be provided to transmit the applicable uplift forces in Section R802.11 from the roof assembly to the foundation. Where ultimate design wind speeds in Figure R301.2(2) are less than the lowest wind speed indicated in the prescriptive provisions of this code, the lowest wind speed indicated in the prescriptive provisions of this code shall be used.

R301.2.1.1 Wind limitations and wind design required. The wind provisions of this code shall not apply to the design of buildings where wind design is required in accordance with Figure R301.2.1.1, or where the ultimate design wind speed, V_{ult} , in Figure R301.2(2) equals or exceeds 140 miles per hour (225 kph) in a special wind region.

Exceptions:

1. For concrete construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R404 and R608.
2. For structural insulated panels, the wind provisions of this code shall apply in accordance with the limitations of Section R610.
3. For cold-formed steel light-frame construction, the wind provisions of this code shall apply in accordance with the limitations of Sections R505, R603 and R804.

In regions where wind design is required in accordance with Figure R301.2.1.1 or where the ultimate design wind speed, V_{ult} , in Figure R301.2(2) equals or exceeds 140 miles per hour (225 kph) in a special wind region, the design of buildings for wind loads shall be in accordance with one or more of the following methods:

1. AWC *Wood Frame Construction Manual* (WFCM).
2. ICC *Standard for Residential Construction in High-Wind Regions* (ICC 600).
3. ASCE *Minimum Design Loads for Buildings and Other Structures* (ASCE 7).

4. *AISI Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings* (AISI S230).

5. *California Building Code*.

The elements of design not addressed by the methods in Items 1 through 5 shall be in accordance with the provisions of this code.

Where ASCE 7 or the *California Building Code* is used for the design of the building, the wind speed map and exposure category requirements as specified in ASCE 7 and the *California Building Code* shall be used.

R301.2.1.1.1 Sunrooms. Sunrooms shall comply with AAMA/NPEA/NSA 2100. For the purpose of applying the criteria of AAMA/NPEA/NSA 2100 based on the intended use, sunrooms shall be identified as one of the following categories by the permit applicant, design professional or the property owner or owner's agent in the construction documents. Component and cladding pressures shall be used for the design of elements that do not qualify as main windforce-resisting systems. Main windforce-resisting system pressures shall be used for the design of elements assigned to provide support and stability for the overall sunroom.

Category I: A thermally isolated sunroom with walls that are open or enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is nonhabitable and unconditioned.

Category II: A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The space is nonhabitable and unconditioned.

Category III: A thermally isolated sunroom with enclosed walls. The openings are enclosed with translucent or transparent plastic or glass. The sunroom fenestration complies with additional requirements for air infiltration resistance and water penetration resistance. The space is nonhabitable and unconditioned.

Category IV: A thermally isolated sunroom with enclosed walls. The sunroom is designed to be heated or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is nonhabitable and conditioned.

Category V: A sunroom with enclosed walls. The sunroom is designed to be heated or cooled and is open to the main structure. The sunroom fenestration complies with additional requirements for water penetration resistance, air infiltration resistance and thermal performance. The space is habitable and conditioned.

R301.2.1.2 Protection of openings. Exterior glazing in buildings located in windborne debris regions shall be protected from windborne debris. Glazed opening protection for windborne debris shall meet the requirements of the Large Missile Test of ASTM E1886 and ASTM E1996 as modified in Section 301.2.1.2.1. Garage door glazed opening protection for windborne debris shall meet the requirements of an approved impact-resisting standard or ANSI/DASMA 115.

Exception: Wood structural panels with a thickness of not less than $\frac{7}{16}$ inch (11 mm) and a span of not more than 8 feet (2438 mm) shall be permitted for opening protection. Panels shall be precut and attached to the framing surrounding the opening containing the product with the glazed opening. Panels shall be predrilled as required for the anchorage method and shall be secured with the attachment hardware provided. Attachments shall be designed to resist the component and cladding loads determined in accordance with either Table R301.2.1(1) or ASCE 7, with the permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table R301.2.1.2 is permitted for buildings with a mean roof height of 45 feet (13 728 mm) or less where the ultimate design wind speed, V_{ult} is 180 mph (290 kph) or less.

R301.2.1.2.1 Application of ASTM E1996. The text of Section 2.2 of ASTM E1996 shall be substituted as follows:

2.2 ASCE Standard:

ASCE 7-10 American Society of Civil Engineers
Minimum Design Loads for Buildings and Other Structures

The text of Section 6.2.2 of ASTM E1996 shall be substituted as follows:

6.2.2 Unless otherwise specified, select the wind zone based on the ultimate design wind speed, V_{ult} , as follows:

6.2.2.1 Wind Zone 1–130 mph \leq ultimate design wind speed, $V_{ult} < 140$ mph.

6.2.2.2 Wind Zone 2–140 mph \leq ultimate design wind speed, $V_{ult} < 150$ mph at greater than 1 mile (1.6 km) from the coastline. The coastline shall be measured from the mean high-water mark.

6.2.2.3 Wind Zone 3–150 mph (67 m/s) \leq ultimate design wind speed, $V_{ult} \leq 170$ mph (76 m/s), or 140 mph (54 m/s) \leq ultimate design wind speed, $V_{ult} \leq 170$ mph (76 m/s) and within 1 mile (1.6 km) of the coastline. The coastline shall be measured from the mean high-water mark.

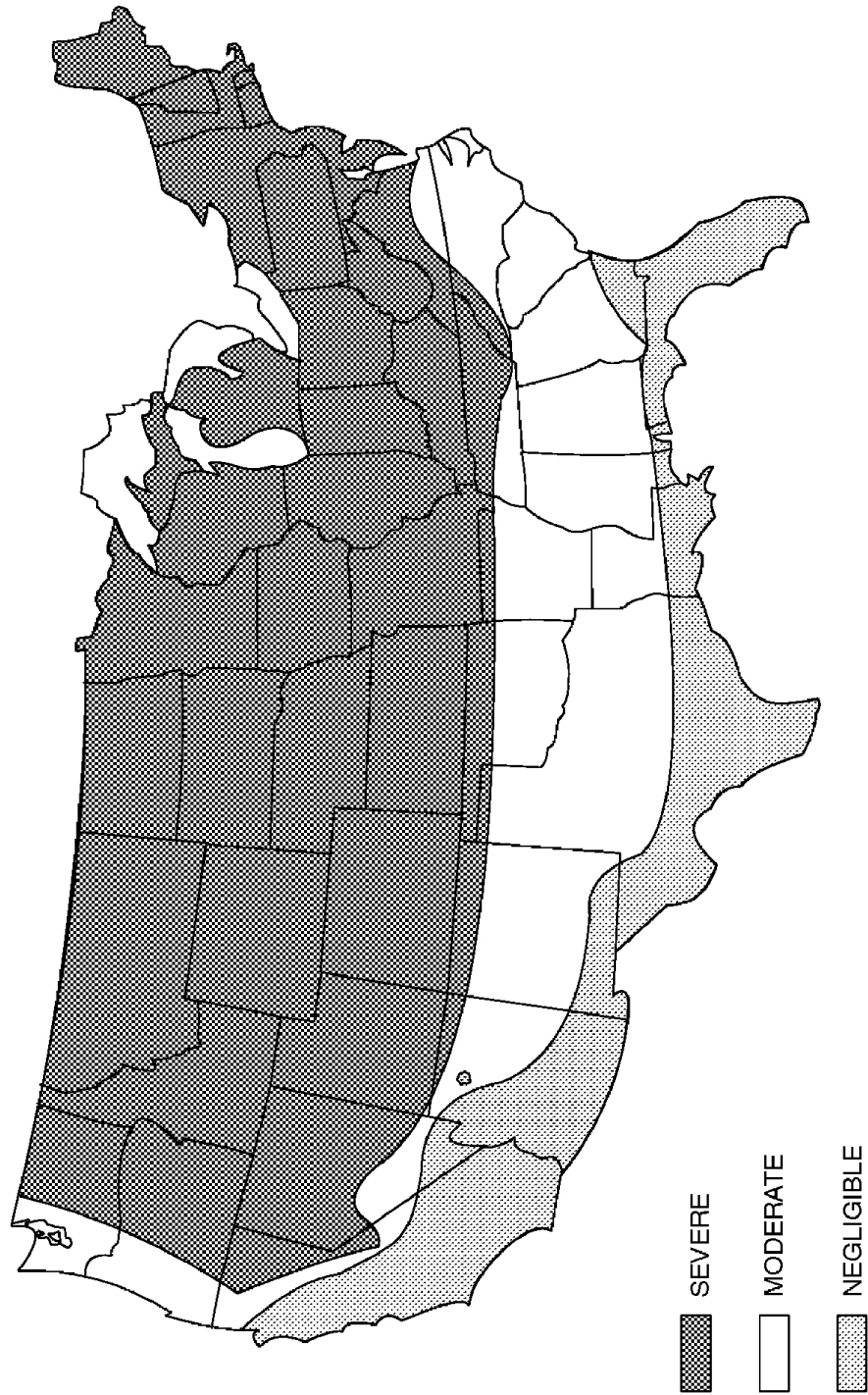
6.2.2.4 Wind Zone 4–ultimate design wind speed, $V_{ult} > 170$ mph (76 m/s).

**TABLE R301.2
CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA**

GROUND SNOW LOAD°	WIND DESIGN			SEISMIC DESIGN CATEGORY ^f	SUBJECT TO DAMAGE FROM			ICE BARRIER UNDERLAYMENT REQUIRED ^h	FLOOD HAZARDS ^g	AIR FREEZING INDEX ⁱ	MEANANNUAL TEMP ^l
	Speed ^d (mph)	Topographic effects ^k	Special wind region ^l		Windborne debris zone ^m	Weathering ^a	Frost line depth ^b				
—	—	—	—	—	—	—	—	—	—	—	—
MANUAL J DESIGN CRITERIAⁿ											
Elevation	Altitude correction factor ^e		Coincident wet bulb	Indoor winter design dry-bulb temperature	Indoor winter design dry-bulb temperature	Indoor winter design dry-bulb temperature	Outdoor winter design dry-bulb temperature		Heating temperature difference		
Latitude	Daily range		Indoor summer design relative humidity	Indoor summer design relative humidity	Indoor summer design relative humidity	Indoor summer design dry-bulb temperature	Outdoor summer design dry-bulb temperature		Cooling temperature difference		

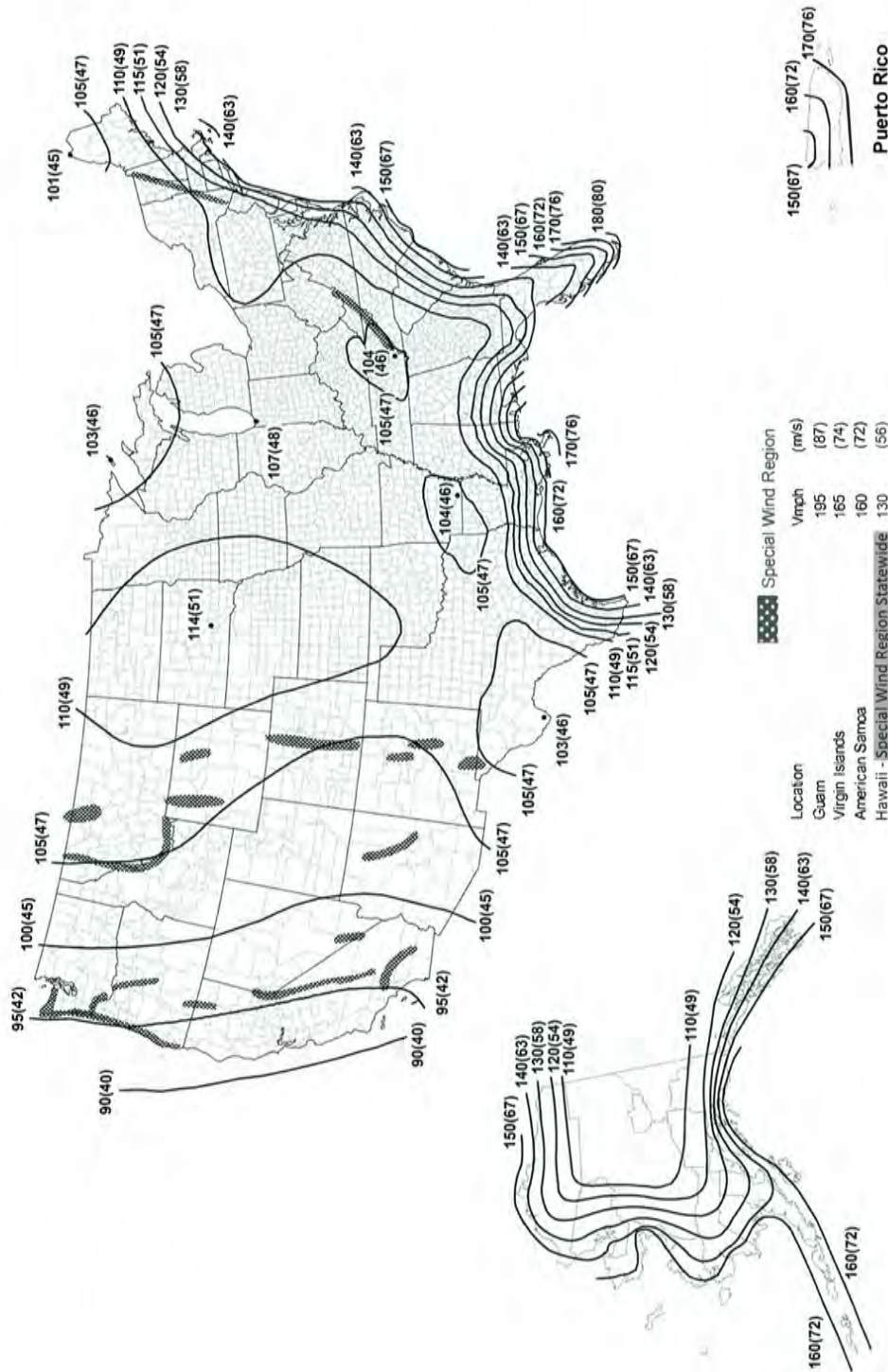
For SI: 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

- a. Where weathering requires a higher strength concrete or grade of masonry than necessary to satisfy the structural requirements of this code, the frost line depth strength required for weathering shall govern. The weathering column shall be filled in with the weathering index, “negligible,” “moderate,” or “severe” for concrete as determined from Figure R301.2(1). The grade of masonry units shall be determined from ASTM C34, ASTM C55, ASTM C62, ASTM C73, ASTM C90, ASTM C129, ASTM C145, ASTM C216 or ASTM C652.
- b. Where the frost line depth requires deeper footings than indicated in Figure R403.1(1), the frost line depth strength required for weathering shall govern. The jurisdiction shall fill in the frost line depth column with the minimum depth of footing below finish grade.
- c. The jurisdiction shall fill in this part of the table to indicate the need for protection depending on whether there has been a history of local subterranean termite damage.
- d. The jurisdiction shall fill in this part of the table with the wind speed from the basic wind speed map [Figure R301.2(2)]. Wind exposure category shall be determined on a site-specific basis in accordance with Section R301.2.1.4.
- e. The jurisdiction shall fill in this section of the table to establish the design criteria using Table 10A from ACCA Manual J or established criteria determined by the jurisdiction.
- f. The jurisdiction shall fill in this part of the table with the seismic design category determined from Section R301.2.2.1.
- g. The jurisdiction shall fill in this part of the table with: the date of the jurisdiction’s entry into the National Flood Insurance Program (date of adoption of the first code or ordinance for management of flood hazard areas); and the title and date of the currently effective Flood Insurance Study or other flood hazard study and maps adopted by the authority having jurisdiction, as amended.
- h. In accordance with Sections R905.1.2, R905.4.3.1, R905.5.3.1, R905.6.3.1, R905.7.3.1, R905.8.3.1, R905.9.3.1, and R905.9.4.1, where there has been a history of local damage from the effects of ice damming, the jurisdiction shall fill in this part of the table with “YES.” Otherwise, the jurisdiction shall fill in this part of the table with “NO.”
- i. The jurisdiction shall fill in this part of the table with the 100-year return period air freezing index (BF-days) from Figure R403.3(2) or from the 100-year (99 percent) value on the National Climatic Data Center data table “Air Freezing Index-USA Method (Base 32°F).”
- j. The jurisdiction shall fill in this part of the table with the mean annual temperature from the National Climatic Data Center data table “Air Freezing Index-USA Method (Base 32°F).”
- k. In accordance with Section R301.2.1.5, where there is local historical data documenting structural damage to buildings due to topographic wind speed-up effects, the jurisdiction shall fill in this part of the table with “YES.” Otherwise, the jurisdiction shall indicate “NO” in this part of the table.
- l. In accordance with Figure R301.2(2), where there is local historical data documenting unusual wind conditions, the jurisdiction shall fill in this part of the table with “YES” and identify any specific requirements. Otherwise, the jurisdiction shall indicate “NO” in this part of the table.
- m. In accordance with Section R301.2.1.2 the jurisdiction shall indicate the wind-borne debris wind zone(s). Otherwise, the jurisdiction shall indicate “NO” in this part of the table.
- n. The jurisdiction shall fill in these sections of the table to establish the design criteria using Table 1a or 1b from ACCA Manual J or established criteria determined by the jurisdiction.
- o. The jurisdiction shall fill in this section of the table using the Ground Snow Loads in Figures R301.2(3) and R301.2(4).



a. Alaska and Hawaii are classified as severe and negligible, respectively.
 b. Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by region classification. A severe classification is where weather conditions result in significant snowfall combined with extended periods during which there is little or no natural thawing, causing deicing salts to be used extensively.

FIGURE R301.2(1)
 WEATHERING PROBABILITY MAP FOR CONCRETE^{a,b}



- Notes:
- Values are nominal design 3-second gust wind speeds in miles per hour (mph) at 33 ft (10m) above ground for Exposure C category.
 - Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
 - Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
 - Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
 - Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MIRI = 700 Years).
 - Location-specific basic wind speeds shall be determined using www.atccouncil.org/windspeed

FIGURE R301.2(2)
ULTIMATE DESIGN WIND SPEEDS



For SI: 1 foot = 34.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile = 1.61 km.

a. In CS areas, site-specific case studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

b. Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.

FIGURE R301.2(3)
GROUND SNOW LOADS, P_g , FOR THE UNITED STATES (lb/ft²)

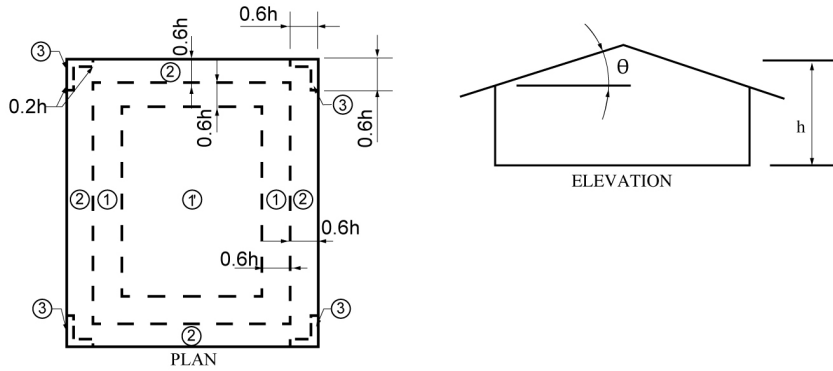


For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile = 1.61 km.

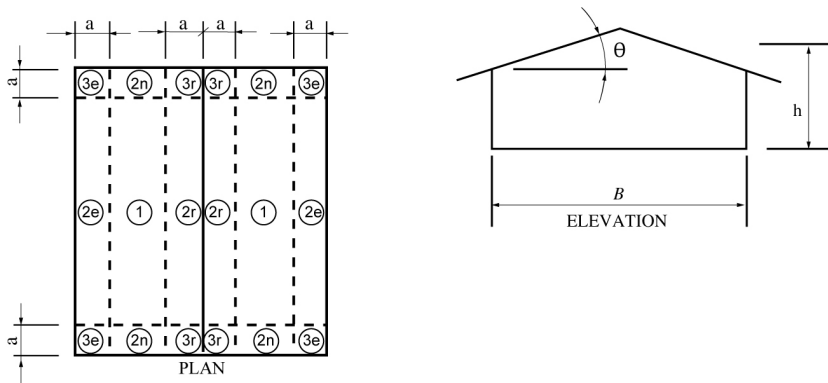
a. In CS areas, site-specific case studies are required to establish ground snow loads. Extreme local variations in ground snow loads in these areas preclude mapping at this scale.

b. Numbers in parentheses represent the upper elevation limits in feet for the ground snow load values presented below. Site-specific case studies are required to establish ground snow loads at elevations not covered.

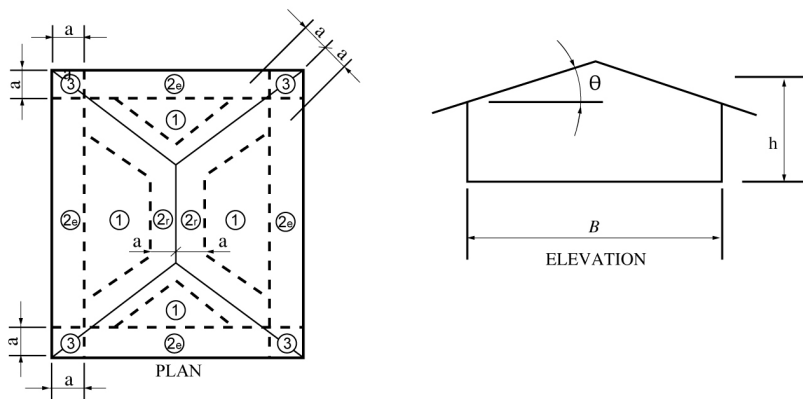
FIGURE R301.2(4)
GROUND SNOW LOADS, P_g , FOR THE UNITED STATES (lb/ft²)



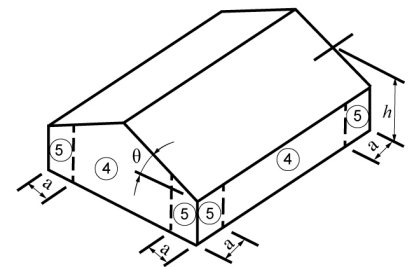
Gable and Flat Roofs $\theta \leq 7^\circ$



Gable and Flat Roofs $7^\circ < \theta \leq 45^\circ$



Hip Roofs $7^\circ < \theta \leq 45^\circ$



Walls

For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

Note: a = 4 feet in all cases.

FIGURE R301.2.1
COMPONENT AND CLADDING PRESSURE ZONES

TABLE R301.2.1(1)—continued
COMPONENT AND CLADDING LOADS FOR A BUILDING WITH A MEAN ROOF HEIGHT OF 30 FEET LOCATED IN EXPOSURE B (ASD) (psf) a,b,c,d,e,f,g

ZONE	EFFECTIVE WIND AREAS (square feet)	ULTIMATE DESIGN WIND SPEED, V_{ult}																									
		90.0		95.0		105.0		115.0		130.0		150.0		170.0		95.0		105.0		115.0		130.0		150.0		170.0	
		Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg	Pos	Neg
1	10.0	6.2	-12.4	6.9	-13.9	7.7	-15.4	8.5	-16.9	9.3	-18.6	10.2	-20.3	11.1	-22.1	13.0	-26.0	15.1	-30.1	17.3	-34.6	19.7	-39.3	22.2	-44.4	24.9	-49.8
	20.0	5.4	-11.0	6.0	-12.3	6.7	-13.6	7.4	-15.0	8.1	-16.5	8.9	-18.0	9.6	-19.6	11.3	-23.0	13.1	-26.7	15.1	-30.7	17.1	-34.9	19.4	-39.4	21.7	-44.2
	50.0	4.4	-9.2	4.9	-10.2	5.4	-11.3	5.9	-12.5	6.5	-13.7	7.1	-15.0	7.7	-16.3	9.1	-19.2	10.5	-22.2	12.1	-25.5	13.8	-29.0	15.5	-32.8	17.4	-36.7
	100.0	3.6	-7.8	4.0	-8.7	4.4	-9.6	4.8	-10.6	5.3	-11.6	5.8	-12.7	6.3	-13.8	7.4	-16.2	8.6	-18.8	9.9	-21.6	11.2	-24.6	12.7	-27.8	14.2	-31.1
	2e	6.2	-14.8	6.9	-16.5	7.7	-18.3	8.5	-20.2	9.3	-22.1	10.2	-24.2	11.1	-26.3	13.0	-30.9	15.1	-35.9	17.3	-41.2	19.7	-46.8	22.2	-52.9	24.9	-59.3
	2e	5.4	-11.7	6.0	-13.0	6.7	-14.5	7.4	-15.9	8.1	-17.5	8.9	-19.1	9.6	-20.8	11.3	-24.4	13.1	-28.3	15.1	-32.5	17.1	-37.0	19.4	-41.8	21.7	-46.8
	2e	4.4	-7.3	4.9	-8.1	5.4	-9.0	5.9	-9.9	6.5	-10.8	7.1	-11.9	7.7	-12.9	9.1	-15.1	10.5	-17.6	12.1	-20.2	13.8	-22.9	15.5	-25.9	17.4	-29.0
	2e	3.6	-7.3	4.0	-8.1	4.4	-9.0	4.8	-9.9	5.3	-10.8	5.8	-11.9	6.3	-12.9	7.4	-15.1	8.6	-17.6	9.9	-20.2	11.2	-22.9	12.7	-25.9	14.2	-29.0
	2r	6.2	-18.7	6.9	-20.9	7.7	-23.1	8.5	-25.5	9.3	-28.0	10.2	-30.6	11.1	-33.3	13.0	-39.1	15.1	-45.4	17.3	-52.1	19.7	-59.2	22.2	-66.9	24.9	-75.0
	2r	5.4	-15.7	6.0	-17.5	6.7	-19.4	7.4	-21.4	8.1	-23.5	8.9	-25.7	9.6	-28.0	11.3	-32.8	13.1	-38.1	15.1	-43.7	17.1	-49.8	19.4	-56.2	21.7	-63.0
2r	4.4	-11.7	4.9	-13.1	5.4	-14.5	5.9	-16.0	6.5	-17.5	7.1	-19.2	7.7	-20.9	9.1	-24.5	10.5	-28.4	12.1	-32.6	13.8	-37.1	15.5	-41.9	17.4	-47.0	
2r	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0	
3	10.0	6.2	-20.0	6.9	-22.3	7.7	-24.7	8.5	-27.2	9.3	-29.9	10.2	-32.7	11.1	-35.6	13.0	-41.7	15.1	-48.4	17.3	-55.6	19.7	-63.2	22.2	-71.4	24.9	-80.0
3	20.0	5.4	-15.0	6.0	-16.8	6.7	-18.6	7.4	-20.5	8.1	-22.5	8.9	-24.6	9.6	-26.7	11.3	-31.4	13.1	-36.4	15.1	-41.8	17.1	-47.5	19.4	-53.7	21.7	-60.2
3	50.0	4.4	-8.7	4.9	-9.7	5.4	-10.8	5.9	-11.9	6.5	-13.1	7.1	-14.3	7.7	-15.5	9.1	-18.2	10.5	-21.2	12.1	-24.3	13.8	-27.6	15.5	-31.2	17.4	-35.0
3	100.0	3.6	-8.7	4.0	-9.7	4.4	-10.8	4.8	-11.9	5.3	-13.1	5.8	-14.3	6.3	-15.5	7.4	-18.2	8.6	-21.2	9.9	-24.3	11.2	-27.6	12.7	-31.2	14.2	-35.0
4	10.0	8.7	-9.5	9.7	-10.6	10.8	-11.7	11.9	-12.9	13.1	-14.2	14.3	-15.5	15.5	-16.9	18.2	-19.8	21.2	-22.9	24.3	-26.3	27.6	-30.0	31.2	-33.8	35.0	-37.9
4	20.0	8.3	-9.1	9.3	-10.1	10.3	-11.2	11.4	-12.4	12.5	-13.6	13.6	-14.8	14.8	-16.2	17.4	-19.0	20.2	-22.0	23.2	-25.3	26.4	-28.7	29.8	-32.4	33.4	-36.4
4	50.0	7.8	-8.6	8.7	-9.5	9.7	-10.6	10.7	-11.7	11.7	-12.8	12.8	-14.0	13.9	-15.2	16.3	-17.9	18.9	-20.7	21.7	-23.8	24.7	-27.1	27.9	-30.6	31.3	-34.3
4	100.0	7.4	-8.2	8.3	-9.1	9.2	-10.1	10.1	-11.1	11.1	-12.2	12.1	-13.3	13.2	-14.5	15.5	-17.1	18.0	-19.8	20.6	-22.7	23.5	-25.8	26.5	-29.2	29.7	-32.7
4	500.0	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.5	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0
5	10.0	8.7	-11.7	9.7	-13.0	10.8	-14.5	11.9	-15.9	13.1	-17.5	14.3	-19.1	15.5	-20.8	18.2	-24.4	21.2	-28.3	24.3	-32.5	27.6	-37.0	31.2	-41.8	35.0	-46.8
5	20.0	8.3	-10.9	9.3	-12.2	10.3	-13.5	11.4	-14.9	12.5	-16.3	13.6	-17.8	14.8	-19.4	17.4	-22.8	20.2	-26.4	23.2	-30.3	26.4	-34.5	29.8	-39.0	33.4	-43.7
5	50.0	7.8	-9.9	8.7	-11.0	9.7	-12.2	10.7	-13.4	11.7	-14.7	12.8	-16.1	13.9	-17.5	16.3	-20.6	18.9	-23.9	21.7	-27.4	24.7	-31.2	27.9	-35.2	31.3	-39.5
5	100.0	7.4	-9.1	8.3	-10.1	9.2	-11.2	10.1	-12.4	11.1	-13.6	12.1	-14.8	13.2	-16.1	15.5	-19.0	18.0	-22.0	20.6	-25.2	23.5	-28.7	26.5	-32.4	29.7	-36.3
5	500.0	6.5	-7.3	7.3	-8.1	8.0	-9.0	8.9	-9.9	9.7	-10.8	10.6	-11.9	11.6	-12.9	13.6	-15.1	15.8	-17.6	18.1	-20.2	20.6	-22.9	23.3	-25.9	26.1	-29.0

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

- The effective wind area shall be equal to the span length multiplied by an effective width. This width shall be not less than one-third the span length. For cladding fasteners, the effective wind areas shall not be greater than the area that is tributary to an individual fastener.
- For effective areas between those given, the load shall be interpolated or the load associated with the lower effective areas shall be used.
- Table values shall be adjusted for height and exposure by multiplying by the adjustment coefficient in Table R301.2.1(2).
- See Figure R318.4 for locations of terminate infestation probability zones.
- Plus and minus signs signify pressures acting toward and away from the building surfaces.
- Positive and negative design wind pressures shall not be less than 10 psf.
- Where the ratio of the building mean roof height to the building length or width is less than 0.8, uplift loads shall be permitted to be calculated in accordance with ASCE 7.

TABLE R301.2.1(2)
HEIGHT AND EXPOSURE ADJUSTMENT COEFFICIENTS FOR Table R301.2.1(1)

MEAN ROOF HEIGHT	EXPOSURE		
	B	C	D
15	0.82	1.21	1.47
20	0.89	1.29	1.55
25	0.94	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

R301.2.1.3 Wind speed conversion. Where referenced documents are based on nominal design wind speeds and do not provide the means for conversion between ultimate design wind speeds and nominal design wind speeds, the ultimate design wind speeds, V_{ult} , of Figure R301.2(2) shall be converted to nominal design wind speeds, V_{asd} , using Table R301.2.1.3.

R301.2.1.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. For a site located in the transition zone between categories, the category resulting in the largest wind forces shall apply. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features. For a site where multiple detached one- and two-family dwellings, townhouses or other structures are to be constructed as part of a subdivision or master-planned community, or are otherwise designated as a developed area by the authority having jurisdiction, the exposure category for an individual structure shall be based on the site conditions that will exist at the time when all adjacent structures on the site have been constructed, provided that their construction is expected to begin within 1 year of the start of construction for the structure for which the exposure category is determined. For any given wind direction, the exposure in which a specific building or other structure is sited shall be assessed as being one of the following categories:

1. Exposure B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger. Exposure B shall be assumed unless the site meets the definition of another type exposure.
2. Exposure C. Open terrain with scattered obstructions, including surface undulations or other irregularities, having heights generally less than 30 feet (9144 mm) extending more than 1,500 feet (457 m) from the building site in any quadrant. This exposure shall apply to any building located within Exposure B type terrain where the building is directly adjacent to open areas of Exposure C type terrain in any quadrant for a dis-

tance of more than 600 feet (183 m). This category includes flat, open country and grasslands.

3. Exposure D. Flat, unobstructed areas exposed to wind flowing over open water, smooth mud flats, salt flats and unbroken ice for a distance of not less than 5,000 feet (1524 m). This exposure shall apply only to those buildings and other structures exposed to the wind coming from over the unobstructed area. Exposure D extends downwind from the edge of the unobstructed area a distance of 600 feet (183 m) or 20 times the height of the building or structure, whichever is greater.

R301.2.1.5 Topographic wind effects. In areas designated in Table R301.2 as having local historical data documenting structural damage to buildings caused by wind speed-up at isolated hills, ridges and escarpments that are abrupt changes from the general topography of the area, topographic wind effects shall be considered in the design of the building in accordance with Section R301.2.1.5.1 or in accordance with the provisions of ASCE 7. See Figure R301.2.1.5.1(1) for topographic features for wind speed-up effect.

In these designated areas, topographic wind effects shall apply only to buildings sited on the top half of an isolated hill, ridge or escarpment where all of the following conditions exist:

1. The average slope of the top half of the hill, ridge or escarpment is 10 percent or greater.
2. The hill, ridge or escarpment is 60 feet (18 288 mm) or greater in height for Exposure B, 30 feet (9144 mm) or greater in height for Exposure C, and 15 feet (4572 mm) or greater in height for Exposure D.
3. The hill, ridge or escarpment is isolated or unobstructed by other topographic features of similar height in the upwind direction for a distance measured from its high point of 100 times its height or 2 miles (3.2 km), whichever is less. See Figure R301.2.1.5.1(3) for upwind obstruction.
4. The hill, ridge or escarpment protrudes by a factor of two or more above the height of other upwind topographic features located in any quadrant within a radius of 2 miles (3.2 km) measured from its high point.

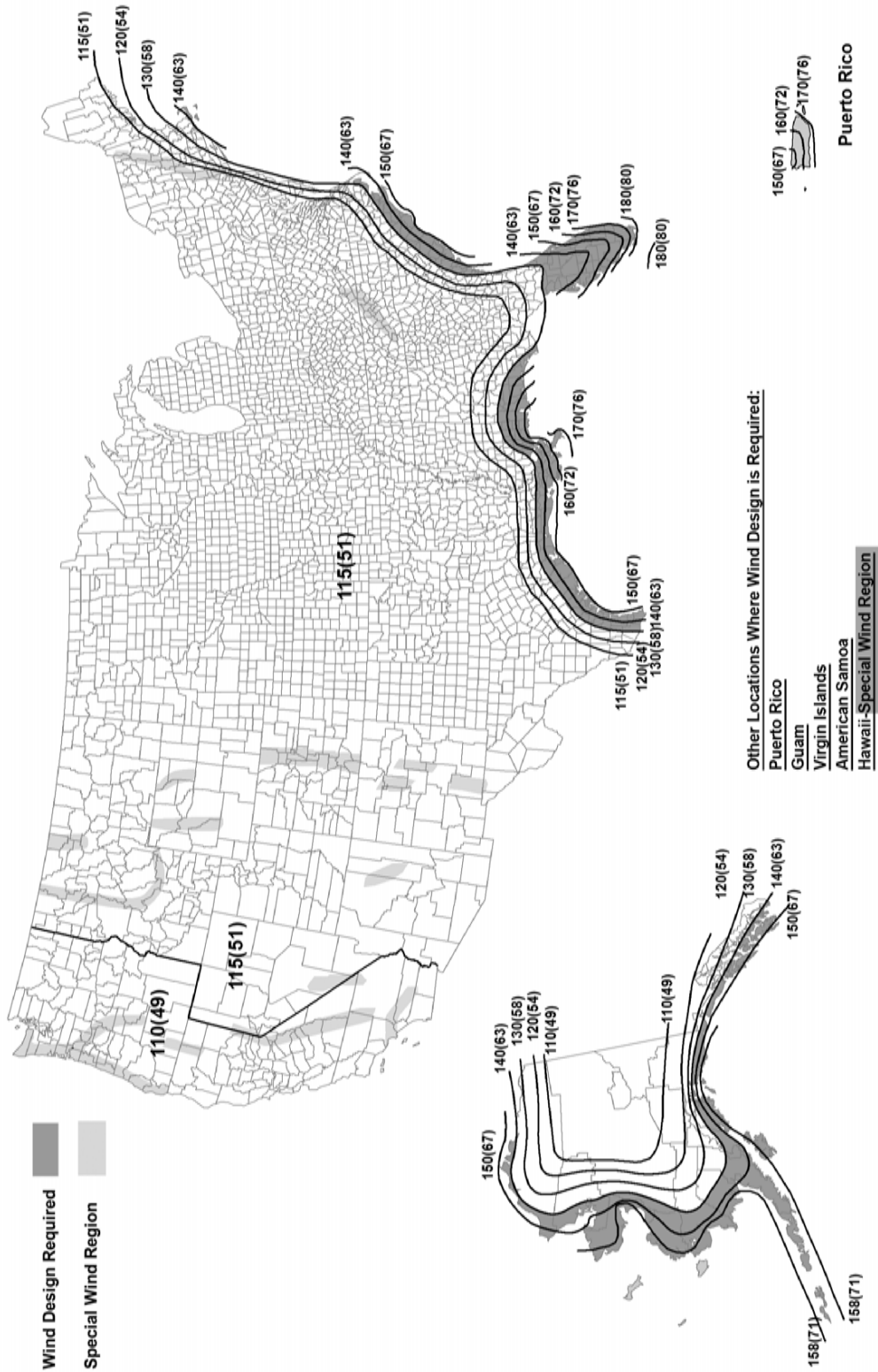


FIGURE R301.2.1.1
REGIONS WHERE WIND DESIGN IS REQUIRED

R301.2.1.5.1 Simplified topographic wind speed-up method. As an alternative to the ASCE 7 topographic wind provisions, the provisions of Section R301.2.1.5.1 shall be permitted to be used to design for wind speed-up effects, where required by Section R301.2.1.5.

Structures located on the top half of isolated hills, ridges or escarpments meeting the conditions of Section R301.2.1.5 shall be designed for an increased basic wind speed as determined by Table R301.2.1.5.1. On the high side of an escarpment, the increased basic wind speed shall extend horizontally downwind from the edge of the escarpment 1.5 times the horizontal length of the upwind slope (1.5L) or 6 times the height of the escarpment (6H), whichever is greater. See Figure R301.2.1.5.1(2) for where wind speed increase is applied.

R301.2.2 Seismic provisions. Buildings in *Seismic Design Categories C, D₀, D₁ and D₂* shall be constructed in accordance with the requirements of this section and other seismic requirements of this code. The seismic provisions of this code shall apply as follows:

1. Townhouses in *Seismic Design Categories C, D₀, D₁ and D₂*.
2. Detached one- and two-family dwellings in *Seismic Design Categories, D₀, D₁ and D₂*.

Buildings in Seismic Design Category E shall be designed to resist seismic loads in accordance with the *California Building Code*, except where the seismic design category is reclassified to a lower seismic design category in accordance with Section R301.2.2.1. Components of buildings not required to be designed to resist seismic loads shall be constructed in accordance with the provisions of this code.

TABLE R301.2.1.2
WINDBORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS^{a, b, c, d}

FASTENER TYPE	FASTENER SPACING (inches) ^{a, b}		
	Panel span ≤ 4 feet	4 feet < panel span ≤ 6 feet	6 feet < panel span ≤ 8 feet
No. 8 wood-screw-based anchor with 2-inch embedment length	16	10	8
No. 10 wood-screw-based anchor with 2-inch embedment length	16	12	9
1/4-inch lag-screw-based anchor with 2-inch embedment length	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.448 N, 1 mile per hour = 0.447 m/s.

- a. This table is based on 180 mph ultimate design wind speeds, V_{ult} , and a 45-foot mean roof height.
- b. Fasteners shall be installed at opposing ends of the wood structural panel. Fasteners shall be located not less than 1 inch from the edge of the panel.
- c. Anchors shall penetrate through the exterior wall covering with an embedment length of not less than 2 inches into the building frame. Fasteners shall be located not less than 2 1/2 inches from the edge of concrete block or concrete.
- d. Panels attached to masonry or masonry/stucco shall be attached using vibration-resistant anchors having an ultimate withdrawal capacity of not less than 1,500 pounds.

TABLE R301.2.1.3
WIND SPEED CONVERSIONS^a

V_{ult}	110	115	120	130	140	150	160	170	180	190	200
V_{asd}	85	89	93	101	108	116	124	132	139	147	155

For SI: 1 mile per hour = 0.447 m/s.

- a. Linear interpolation is permitted.

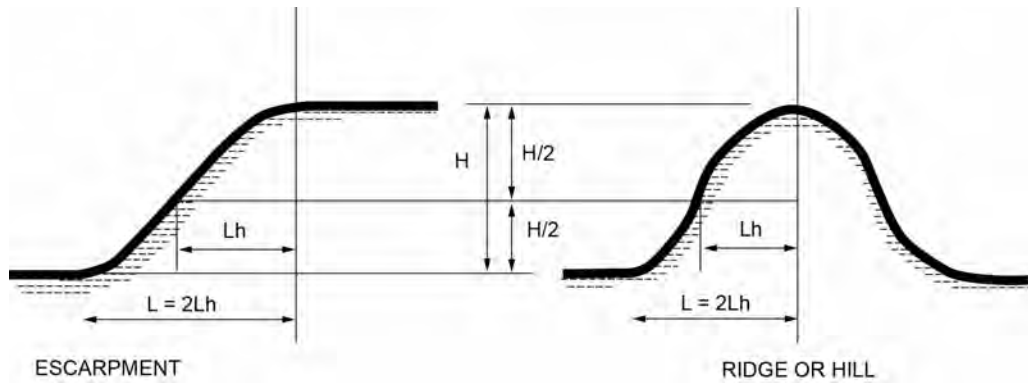
TABLE R301.2.1.5.1
ULTIMATE DESIGN WIND SPEED MODIFICATION FOR TOPOGRAPHIC WIND EFFECT^{a, b}

ULTIMATE DESIGN WIND SPEED FROM FIGURE R301.2(2) (mph)	AVERAGE SLOPE OF THE TOP HALF OF HILL, RIDGE OR ESCARPMENT (percent)						
	0.10	0.125	0.15	0.175	0.20	0.23	0.25
	Required ultimate design wind speed-up, modified for topographic wind speed-up (mph)						
95	114	119	123	127	131	137	140
100	120	125	129	134	138	144	147
105	126	131	135	141	145	151	154
110	132	137	142	147	152	158	162
115	138	143	148	154	159	165	169
120	144	149	155	160	166	172	176
130	156	162	168	174	179	NA	NA
140	168	174	181	NA	NA	NA	NA
150	180	NA	NA	NA	NA	NA	NA

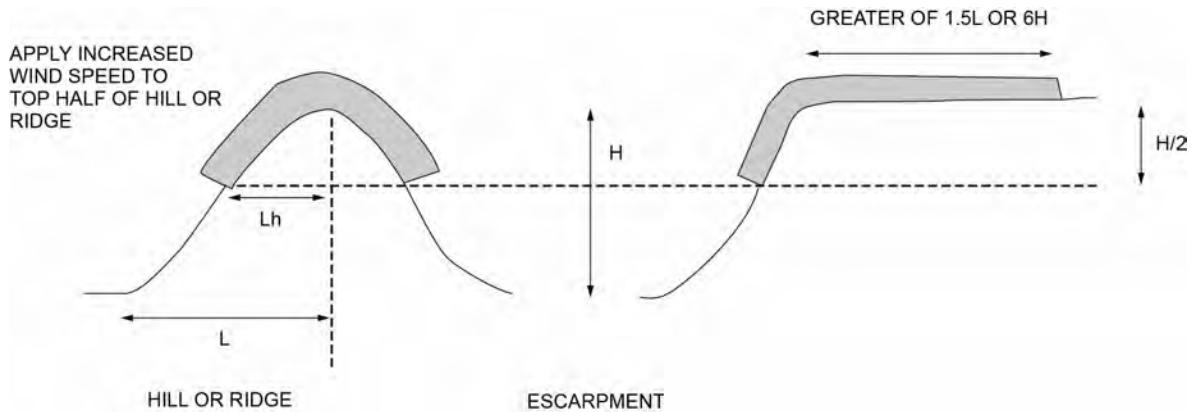
For SI: 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

NA = Not Applicable.

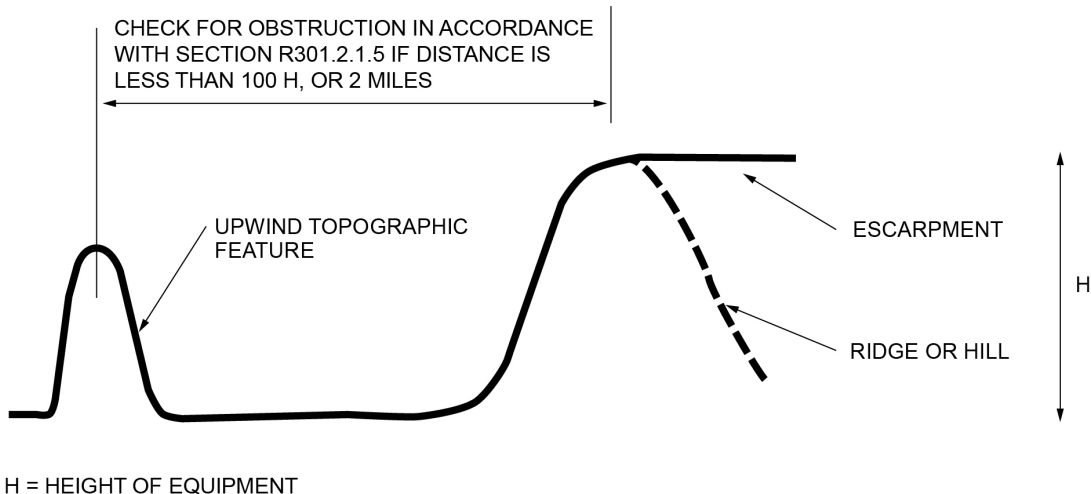
- a. Table applies to a feature height of 500 feet or less and dwellings sited a distance equal or greater than half the feature height.
- b. Where the ultimate design wind speed as modified by Table R301.2.1.5.1 equals or exceeds 140 miles per hour, the building shall be considered as “wind design required” in accordance with Section R301.2.1.1.



**FIGURE R301.2.1.5.1(1)
TOPOGRAPHIC FEATURES FOR WIND SPEED-UP EFFECT**



**FIGURE R301.2.1.5.1(2)
ILLUSTRATION OF WHERE ON A TOPOGRAPHIC FEATURE, WIND SPEED INCREASE IS APPLIED**



**FIGURE R301.2.1.5.1(3)
UPWIND OBSTRUCTION**

R301.2.2.1 Determination of seismic design category. Buildings shall be assigned a seismic design category in accordance with Figures R301.2.2.1(1) through R301.2.2.1(6).

R301.2.2.1.1 Alternate determination of seismic design category. If soil conditions are determined by the building official to be Site Class A, B, or D, the seismic design category and short-period design spectral response accelerations, S_{DS} , for a site shall be allowed to be determined in accordance with Figures R301.2.2.1.1(1) through R301.2.2.1.1(6), or Section 1613.2 of the *California Building Code*. The value of S_{DS} determined in accordance with Section 1613.2 of the *California Building Code* is permitted to be used to set the seismic design category in accordance with Table R301.2.2.1.1, and to interpolate between values in Tables R602.10.3(3) and R603.9.2(1) and other seismic design requirements of this code.

R301.2.2.1.2 Alternative determination of Seismic Design Category E. Buildings located in Seismic Design Category E in accordance with Figures R301.2.2.1(1) through R301.2.2.1(6), or Figures R301.2.2.1.1(1) through R301.2.2.1.1(6) where applicable, are permitted to be reclassified as being in Seismic Design Category D_2 provided that one of the following is done:

1. A more detailed evaluation of the seismic design category is made in accordance with the provisions and maps of the *California Building Code*. Buildings located in Seismic Design Category E in accordance with Table R301.2.2.1.1, but located in Seismic Design Category D in accordance with the *California Building Code*, shall be permitted to be designed using the Seismic Design Category D_2 requirements of this code.
2. Buildings located in Seismic Design Category E that conform to the following additional restrictions are permitted to be constructed in accordance with the provisions for Seismic Design Category D_2 of this code:
 - 2.1. All exterior shear wall lines or braced wall panels are in one plane vertically from the foundation to the uppermost story.
 - 2.2. Floors shall not cantilever past the exterior walls.
 - 2.3. The building is within the requirements of Section R301.2.2.6 for being considered as regular.

R301.2.2.2 Weights of materials. Average dead loads shall not exceed 15 pounds per square foot (720 Pa) for the combined roof and ceiling assemblies (on a horizontal projection) or 10 pounds per square foot (480 Pa) for floor assemblies, except as further limited by Section R301.2.2. Dead loads for walls above grade shall not exceed:

1. Fifteen pounds per square foot (720 Pa) for exterior light-frame wood walls.
2. Fourteen pounds per square foot (670 Pa) for exterior light-frame cold-formed steel walls.
3. Ten pounds per square foot (480 Pa) for interior light-frame wood walls.
4. Five pounds per square foot (240 Pa) for interior light-frame cold-formed steel walls.
5. Eighty pounds per square foot (3830 Pa) for 8-inch-thick (203 mm) masonry walls.
6. Eighty-five pounds per square foot (4070 Pa) for 6-inch-thick (152 mm) concrete walls.
7. Ten pounds per square foot (480 Pa) for SIP walls.

Exceptions:

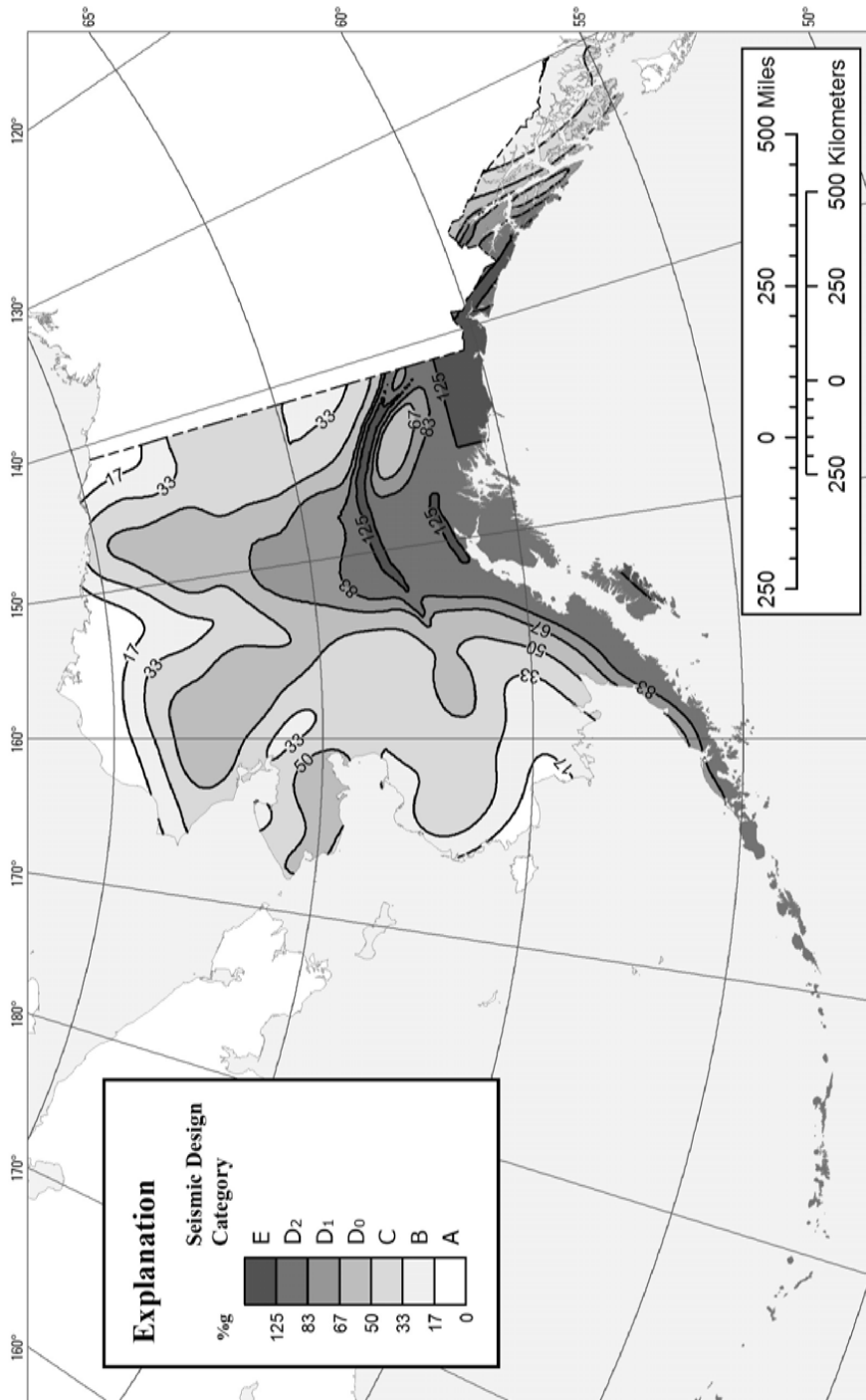
1. Roof and ceiling dead loads not exceeding 25 pounds per square foot (1190 Pa) shall be permitted provided that the wall bracing amounts in Section R602.10.3 are increased in accordance with Table R602.10.3(4).
2. Light-frame walls with stone or masonry veneer shall be permitted in accordance with the provisions of Sections R702.1 and R703.
3. Fireplaces and chimneys shall be permitted in accordance with Chapter 10.

R301.2.2.3 Stone and masonry veneer. Anchored stone and masonry veneer shall comply with the requirements of Sections R702.1 and R703.

R301.2.2.4 Masonry construction. Masonry construction in *Seismic Design Categories* D_0 and D_1 shall comply with the requirements of Section R606.12.1. Masonry construction in Seismic Design Category D_2 shall comply with the requirements of Section R606.12.4.

R301.2.2.5 Concrete construction. Buildings with exterior above-grade concrete walls shall comply with PCA 100 or shall be designed in accordance with ACI 318.

Exception: Detached one- and two-family dwellings in Seismic Design Category C with exterior above-grade concrete walls are allowed to comply with the requirements of Section R608.



prepared by U.S. Geological Survey in collaboration with the Federal Emergency Management Agency (FEMA) Alaska Building Safety Council (BSSC) Code Resource Support Committee (CRSC).

REFERENCES

Building Seismic Safety Council. 2015. NEHRP Recommended Seismic Provisions for New Buildings and Other Structures. FEMA P-1050. Federal Emergency Management Agency, Washington, DC.

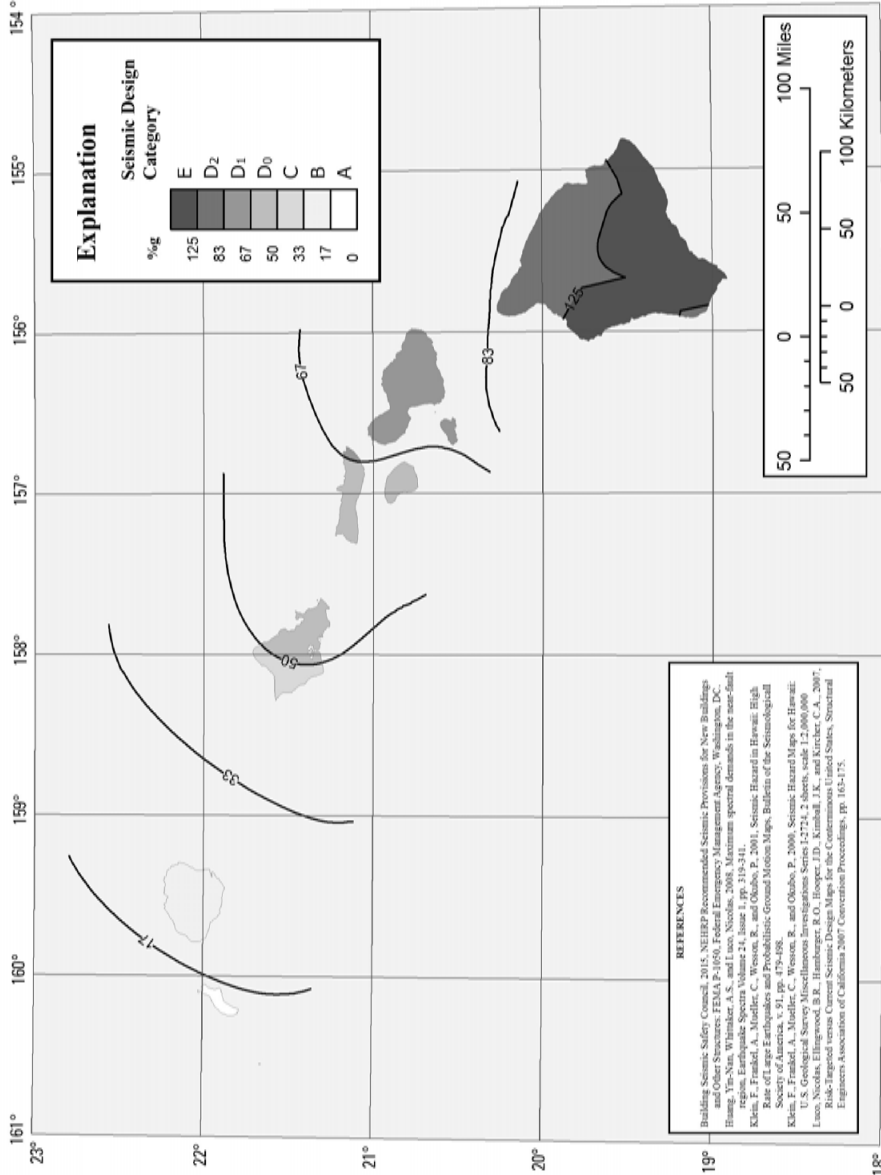
Huang, Yin-Nan, Whitaker, A.S., and Luco, Nicolas. 2008. Maximum spectral demands in the near-fault region. Earthquake Spectra Volume 24, Issue 1, pp. 319-341.

Luco, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007. Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States. Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Wesson, Robert L., Boyd, Oliver S., Mueller, Charles S., Bufo, Charles G., Frankel, Arthur D., Petersen, Mark D., 2007. Revision of time-independent probabilistic seismic hazard maps for Alaska. U.S. Geological Survey Open-File Report 2007-1043.

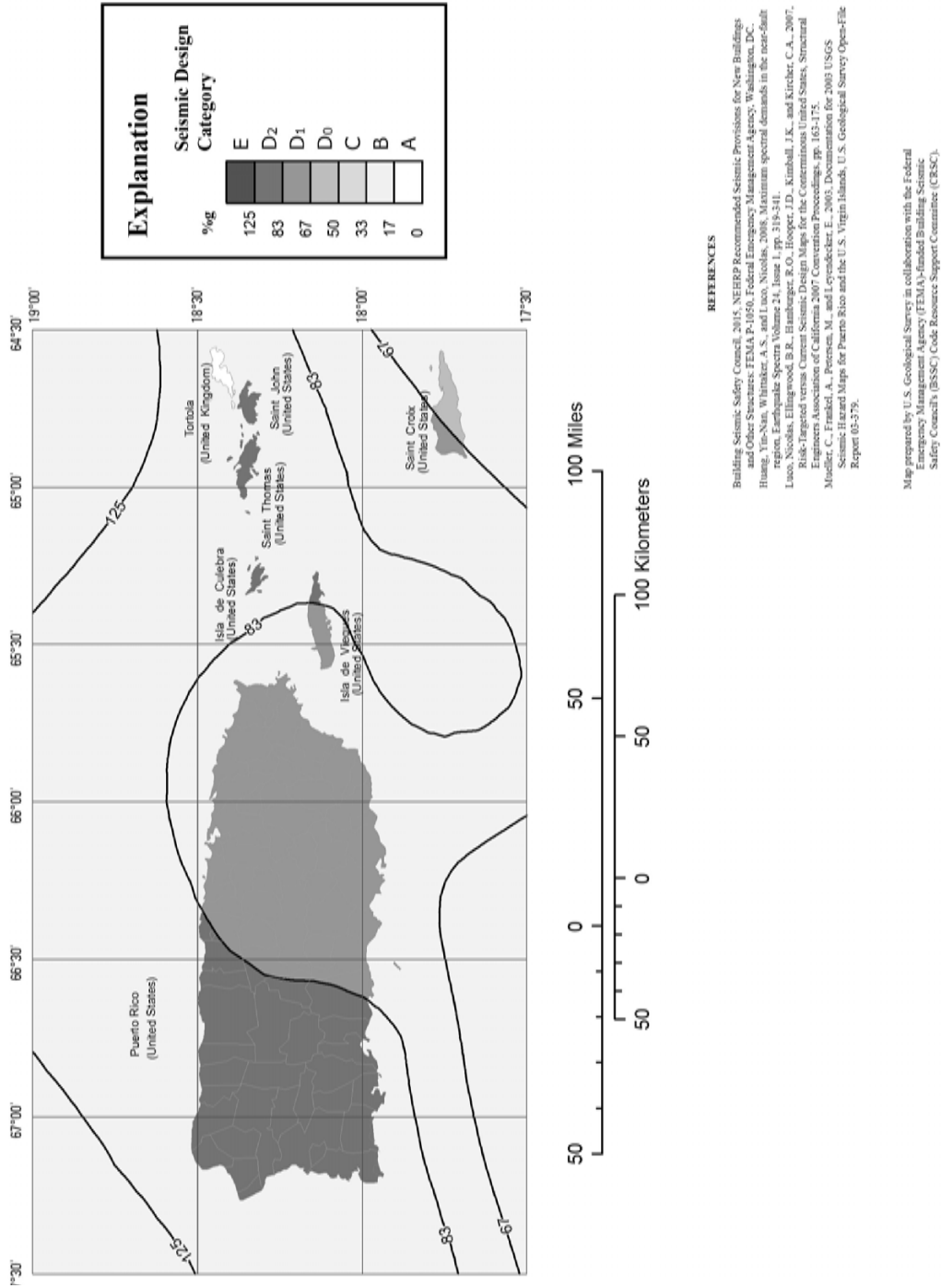
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through R301.2.2.1(6) are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

FIGURE R301.2.2.1(1)
SEISMIC DESIGN CATEGORIES—ALASKA^a



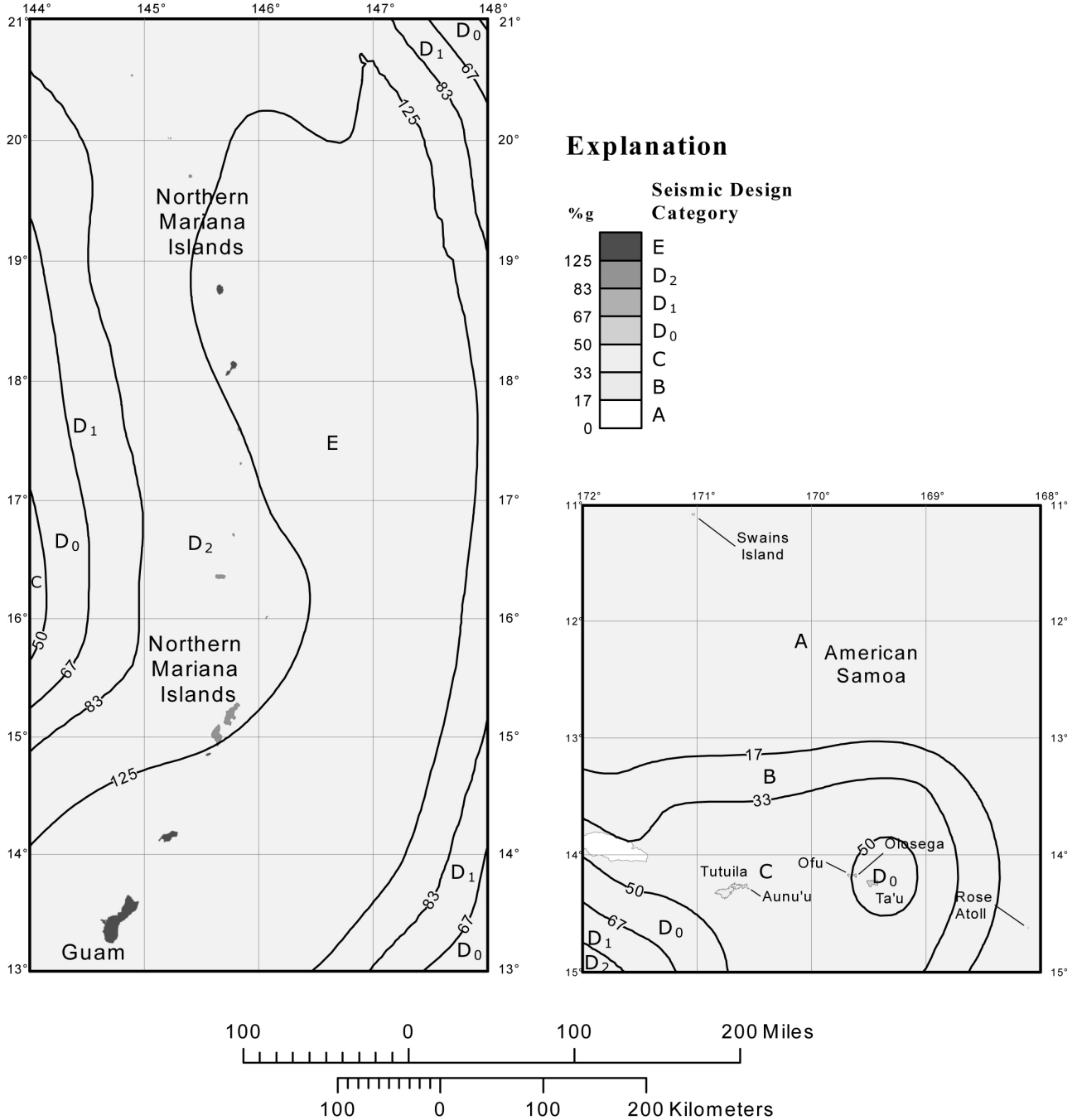
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through 301.2.2.1(6) are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

**FIGURE R301.2.2.1(2)
SEISMIC DESIGN CATEGORIES—HAWAII^a**



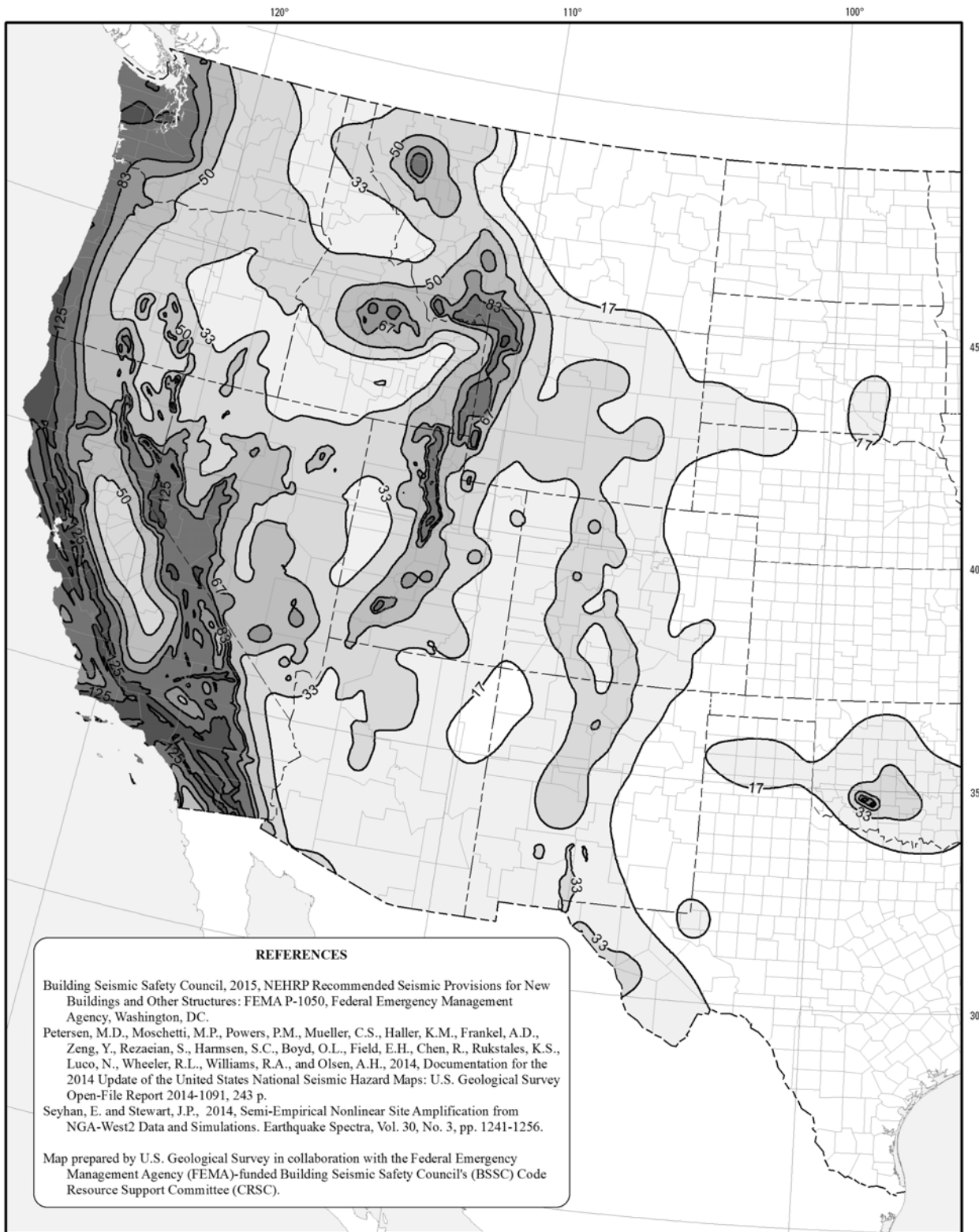
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through 301.2.2.1(6) are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

**FIGURE R301.2.2.1(3)
SEISMIC DESIGN CATEGORIES—PUERTO RICO^a**



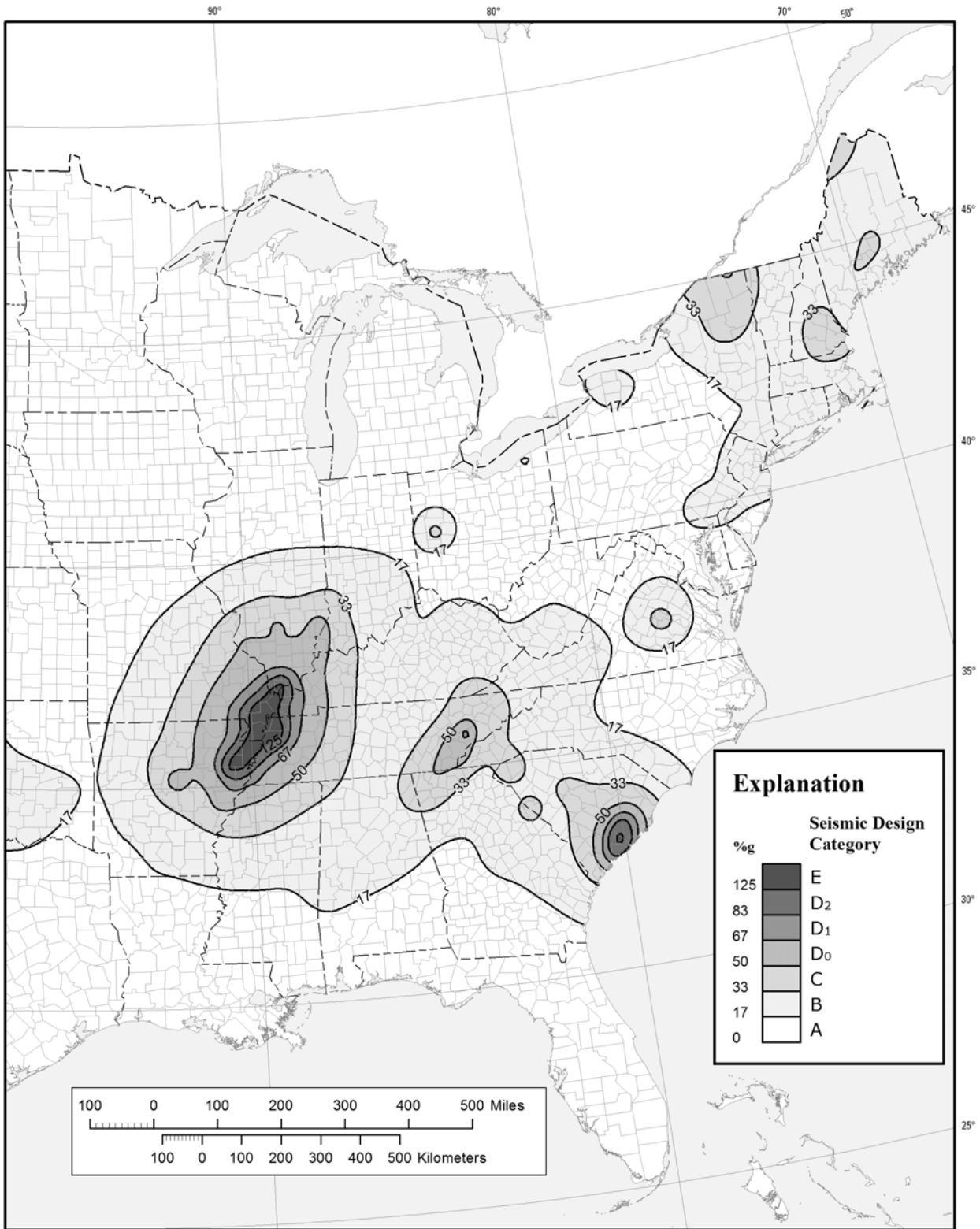
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through 301.2.2.1(6) are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

FIGURE R301.2.2.1(4)
SEISMIC DESIGN CATEGORIES—NORTHERN MARIANA ISLANDS AND AMERICAN SAMOA^a



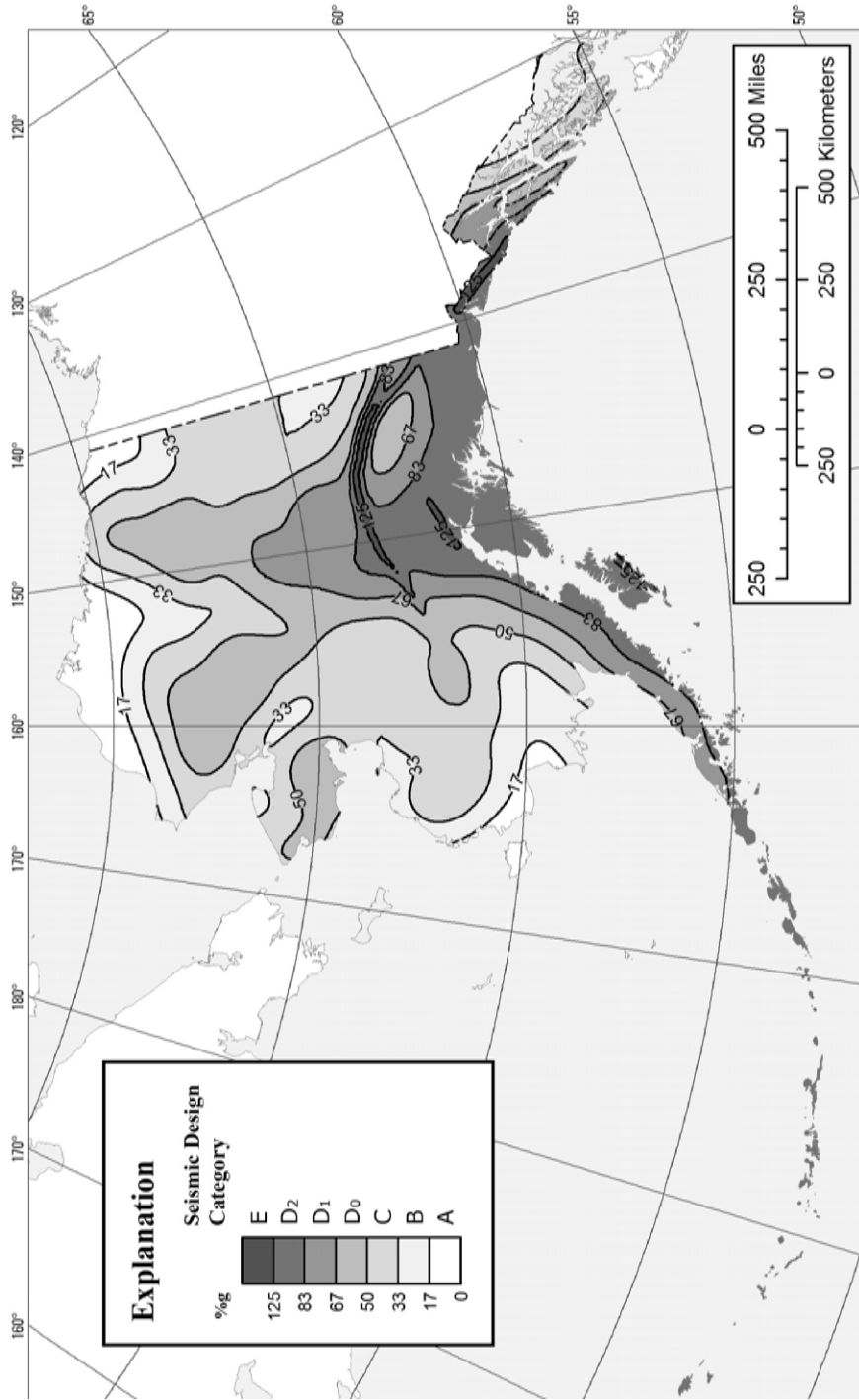
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through 301.2.2.1(6) are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

**FIGURE R301.2.2.1(5)
SEISMIC DESIGN CATEGORIES—UNITED STATES^a**



a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1(1) through 301.2.2.1(6), are based on soil Site Class D, used as an assumed default, as defined in Section 1613.2.2 of the *California Building Code*.

FIGURE R301.2.2.1(6)
SEISMIC DESIGN CATEGORIES—UNITED STATES^a



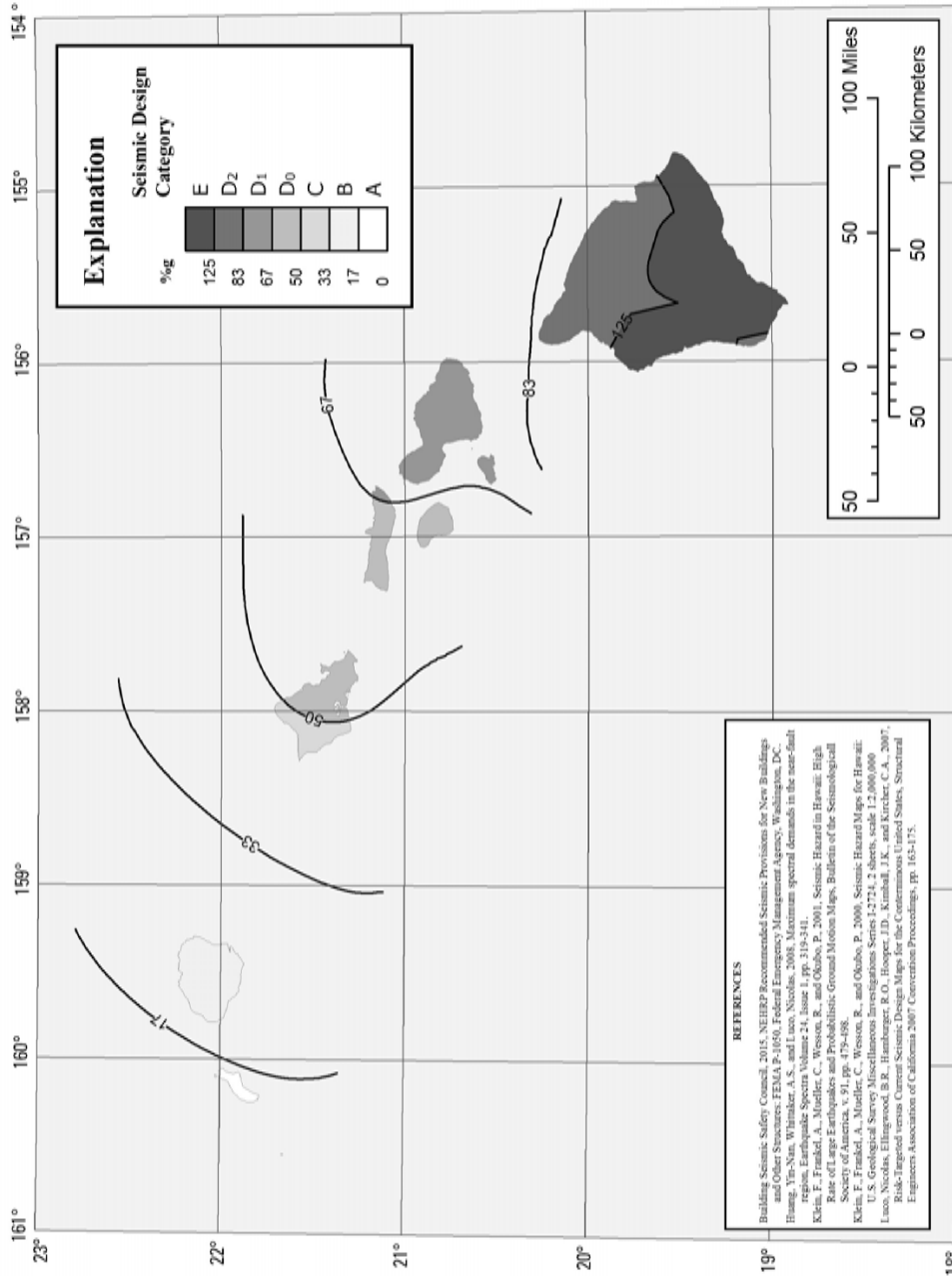
Map prepared by U.S. Geological Survey in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council's (BSSC) Code Resource Support Committee (CRSC).

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 Huang, Yin-Nan, Whitaker, A.S., and Luco, Nicolas, 2008, Maximum spectral demands in the near-fault region, Earthquake Spectra Volume 24, Issue 1, pp. 319-341.
 Luco, Nicolas, Ellingwood, B.E., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007, Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States, Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.
 Wesson, Robert L., Boyd, Omer S., Almaraz, Charles S., Bluff, Charles G., Frankel, Arthur D., Grant, Alan R., 2007, Review of nine alternative probabilistic seismic hazard maps for Alaska, U.S. Geological Survey Open-File Report 2007-1043.

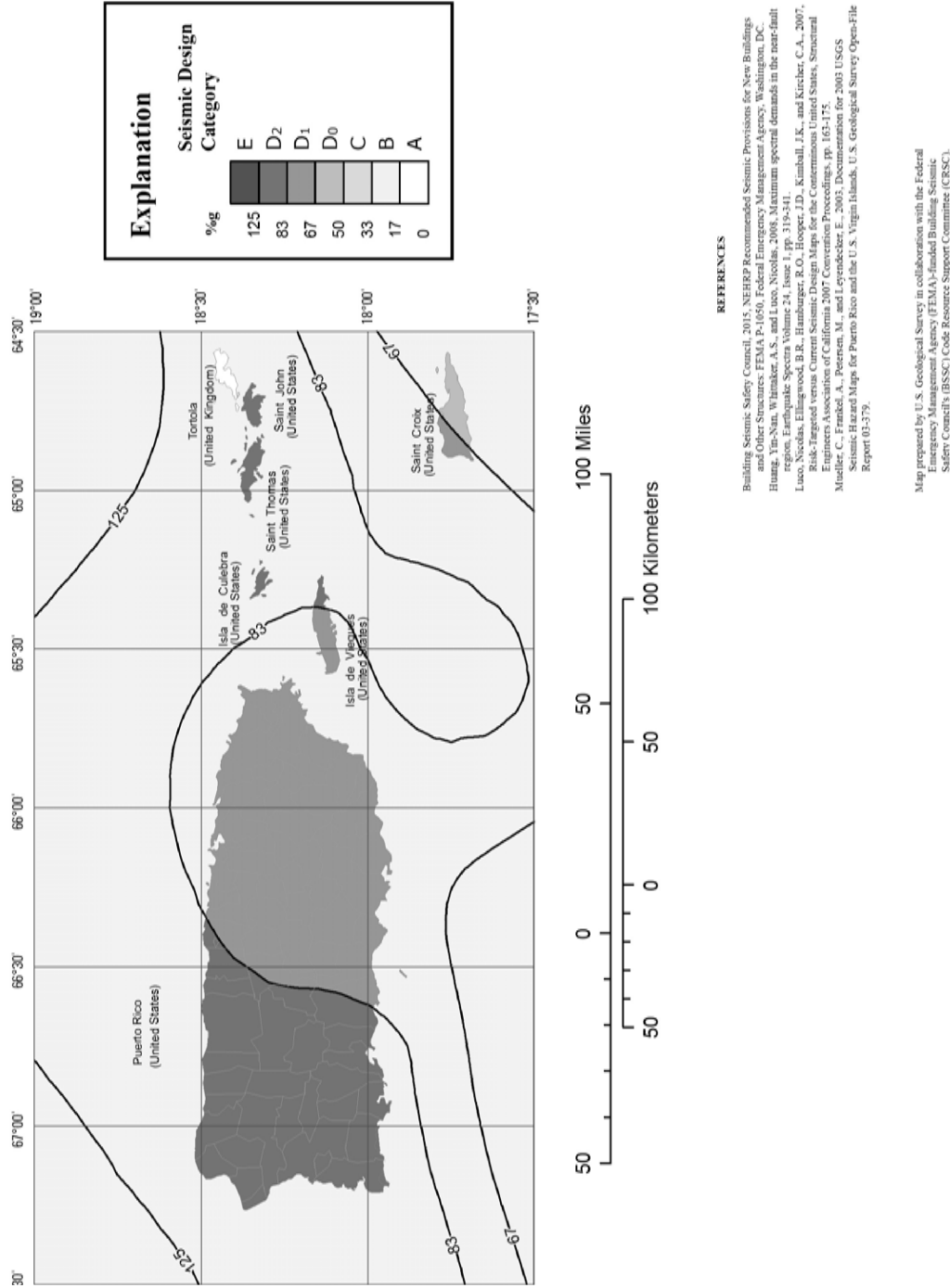
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1.1(1) through 301.2.2.1.1(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

**FIGURE R301.2.2.1.1(1)
ALTERNATE SEISMIC DESIGN CATEGORIES—ALASKA^a**



a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1.1.(1) through 301.2.2.1.1.(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

FIGURE R301.2.2.1.1(2)
ALTERNATE SEISMIC DESIGN CATEGORIES—HAWAII^a



REFERENCES

Building Seismic Safety Council. 2015. NEHRP Recommended Seismic Provisions for New Buildings and Other Structures. FEMA P-1050. Federal Emergency Management Agency, Washington, DC.

Huang, Y.H., Smith, W.H., Baker, A.S., and Li, Y. 2013. "Minimum spectral demands in the near-fault region." *Earthquake Engineering and Structural Dynamics*, pp. 19-34.

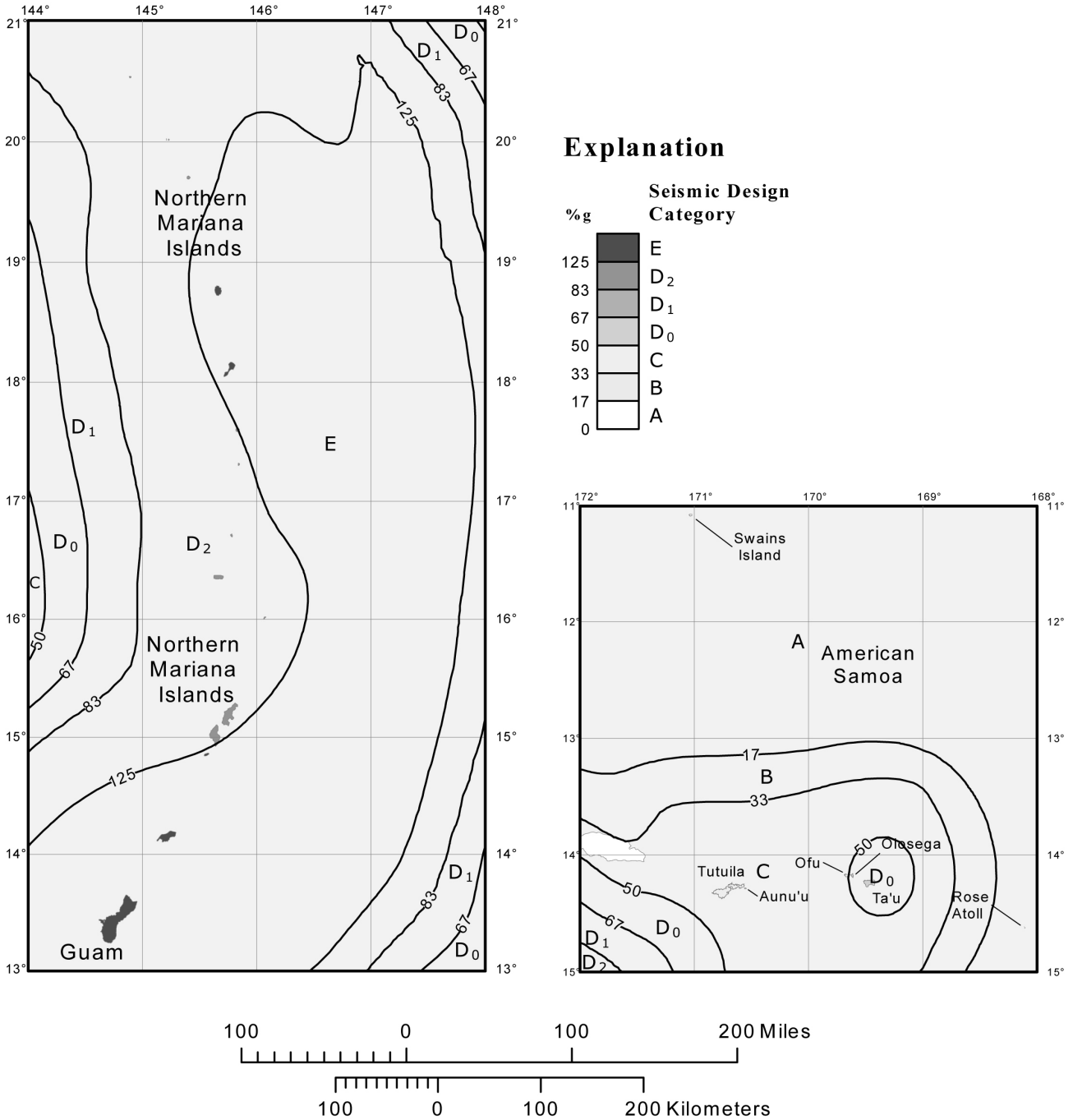
Luzo, Nicolas, Ellingwood, B.R., Hamburger, R.O., Hooper, J.D., Kimball, J.K., and Kircher, C.A., 2007. Risk-Targeted versus Current Seismic Design Maps for the Conterminous United States. Structural Engineers Association of California 2007 Convention Proceedings, pp. 163-175.

Mueller, C., Frankel, A., Petersen, M., and Leyendecker, E., 2003. Documentation for 2003 USGS Seismic Hazard Maps for Puerto Rico and the U.S. Virgin Islands. U.S. Geological Survey Open-File Report 03-379.

Map prepared by U.S. Geological Survey in collaboration with the Federal Emergency Management Agency (FEMA)-funded Building Seismic Safety Council's (BSSC) Code Resource Support Committee (CRSC).

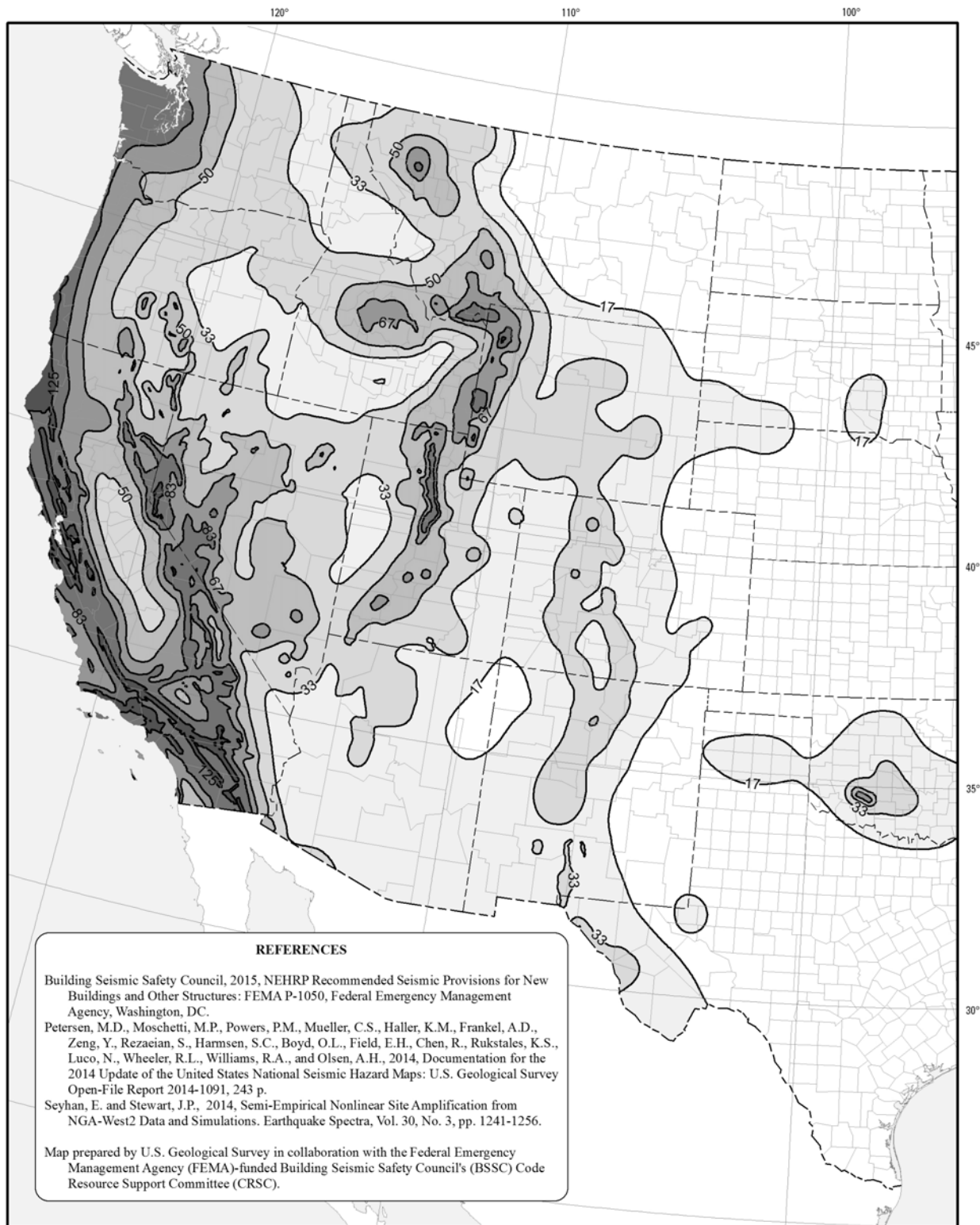
a. The seismic design categories and corresponding short-period design spectral response accelerations, $S_{D,S}$ shown in Figures R301.2.2.1.1(1) through 301.2.2.1.1(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

FIGURE R301.2.2.1.1(3)
ALTERNATE SEISMIC DESIGN CATEGORIES—PUERTO RICO^a



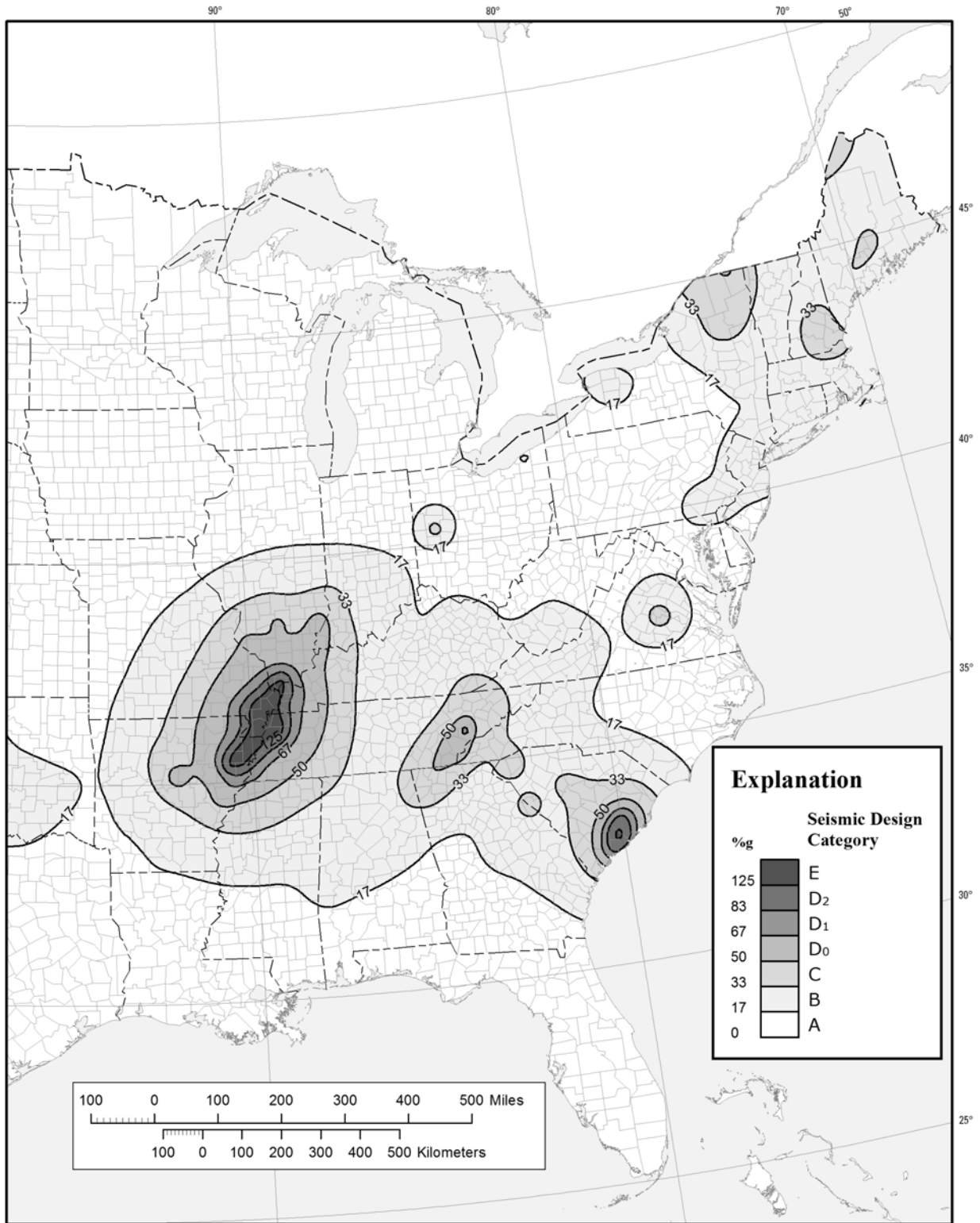
a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1.1(1) through 301.2.2.1.1(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

FIGURE R301.2.2.1.1(4)
ALTERNATE SEISMIC DESIGN CATEGORIES—NORTHERN MARIANA ISLANDS AND AMERICAN SAMOA^a



a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1.1(1) through 301.2.2.1.1(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

**FIGURE R301.2.2.1.1(5)
ALTERNATE SEISMIC DESIGN CATEGORIES—UNITED STATES^a**



a. The seismic design categories and corresponding short-period design spectral response accelerations, S_{DS} , shown in Figures R301.2.2.1.1(1) through 301.2.2.1.1(6) are permitted to be used where soil conditions are determined by the building official to be Site Class A, B or D.

FIGURE R301.2.2.1.1(6)
ALTERNATE SEISMIC DESIGN CATEGORIES—UNITED STATES^a

TABLE R301.2.2.1.1
SEISMIC DESIGN CATEGORY DETERMINATION

CALCULATED S_{DS}	SEISMIC DESIGN CATEGORY
$S_{DS} \leq 0.17g$	A
$0.17g < S_{DS} \leq 0.33g$	B
$0.33g < S_{DS} \leq 0.50g$	C
$0.50g < S_{DS} \leq 0.67g$	D_0
$0.67g < S_{DS} \leq 0.83g$	D_1
$0.83g < S_{DS} \leq 1.25g$	D_2
$1.25g < S_{DS}$	E

R301.2.2.6 Irregular buildings. The seismic provisions of this code shall not be used for structures, or portions thereof, located in *Seismic Design Categories* C, D_0 , D_1 and D_2 and considered to be irregular in accordance with this section. A building or portion of a building shall be considered to be irregular where one or more of the conditions defined in Items 1 through 8 occur. Irregular structures, or irregular portions of structures, shall be designed in accordance with accepted engineering practice to the extent the irregular features affect the performance of the remaining structural system. Where the forces associated with the irregularity are resisted by a structural system designed in accordance with accepted engineering practice, the remainder of the building shall be permitted to be designed using the provisions of this code.

1. Shear wall or braced wall offsets out of plane.

Conditions where exterior shear wall lines or braced wall panels are not in one plane vertically from the foundation to the uppermost story in which they are required.

Exception: For wood light-frame construction, floors with cantilevers or setbacks not exceeding four times the nominal depth of the wood floor joists are permitted to support braced wall panels that are out of plane with braced wall panels below provided that all of the following are satisfied:

1. Floor joists are nominal 2 inches by 10 inches (51 mm by 254 mm) or larger and spaced not more than 16 inches (406 mm) on center.
2. The ratio of the back span to the cantilever is not less than 2 to 1.
3. Floor joists at ends of braced wall panels are doubled.
4. For wood-frame construction, a continuous rim joist is connected to ends of cantilever joists. Where spliced, the rim joists shall be spliced using a galvanized metal tie not less than 0.058 inch (1.5 mm) (16 gage) and 1½ inches (38 mm) wide fastened with six 16d

nails on each side of the splice; or a block of the same size as the rim joist and of sufficient length to fit securely between the joist space at which the splice occurs, fastened with eight 16d nails on each side of the splice.

5. Gravity loads carried at the end of cantilevered joists are limited to uniform wall and roof loads and the reactions from headers having a span of 8 feet (2438 mm) or less.

2. Lateral support of roofs and floors. Conditions where a section of floor or roof is not laterally supported by shear walls or braced wall lines on all edges.

Exception: Portions of floors that do not support shear walls, braced wall panels above, or roofs shall be permitted to extend not more than 6 feet (1829 mm) beyond a shear wall or braced wall line.

3. Shear wall or braced wall offsets in plane.

Conditions where the end of a braced wall panel occurs over an opening in the wall below and extends more than 1 foot (305 mm) horizontally past the edge of the opening. This provision is applicable to shear walls and braced wall panels offset in plane and to braced wall panels offset out of plane in accordance with the exception to Item 1.

Exception: For wood light-frame wall construction, one end of a braced wall panel shall be permitted to extend more than 1 foot (305 mm) over an opening not more than 8 feet (2438 mm) in width in the wall below provided that the opening includes a header in accordance with all of the following:

1. The building width, loading condition and framing member species limitations of Table R602.7(1) shall apply.
2. The header is composed of:
 - 2.1. Not less than one 2 × 12 or two 2 × 10 for an opening not more than 4 feet (1219 mm) wide.

- 2.2. Not less than two 2 × 12 or three 2 × 10 for an opening not more than 6 feet (1829 mm) in width.
- 2.3. Not less than three 2 × 12 or four 2 × 10 for an opening not more than 8 feet (2438 mm) in width.
3. The entire length of the braced wall panel does not occur over an opening in the wall below.
4. **Floor and roof opening.** Conditions where an opening in a floor or roof exceeds the lesser of 12 feet (3658 mm) or 50 percent of the least floor or roof dimension.
5. **Floor level offset.** Conditions where portions of a floor level are vertically offset.

Exceptions:

1. Framing supported directly by continuous foundations at the perimeter of the building.
2. For wood light-frame construction, floors shall be permitted to be vertically offset where the floor framing is lapped or tied together as required by Section R502.6.1.
6. **Perpendicular shear wall and wall bracing.** Conditions where shear walls and braced wall lines do not occur in two perpendicular directions.
7. **Wall bracing in stories containing masonry or concrete construction.** Conditions where stories above grade plane are partially or completely braced by wood wall framing in accordance with Section R602 or cold-formed steel wall framing in accordance with Section R603 include masonry or concrete construction. Where this irregularity applies, the entire story shall be designed in accordance with accepted engineering practice.

Exceptions: Fireplaces, chimneys and masonry veneer in accordance with this code.

8. **Hillside light-frame construction.** Conditions in which all of the following apply:
 - 8.1. The grade slope exceeds 1 unit vertical in 5 units horizontal where averaged across the full length of any side of the dwelling.
 - 8.2. The tallest cripple wall clear height exceeds 7 feet (2134 mm), or where a post and beam system occurs at the dwelling perimeter, the post and beam system tallest post clear height exceeds 7 feet (2134 mm).

- 8.3. Of the total plan area below the lowest framed floor, whether open or enclosed, less than 50 percent is living space having interior wall finishes conforming to Section R702.

Where Item 8 is applicable, design in accordance with accepted engineering practice shall be provided for the floor immediately above the cripple walls or post and beam system and all structural elements and connections from this diaphragm down to and including connections to the foundation and design of the foundation to transfer lateral loads from the framing above.

Exception: Light-frame construction in which the lowest framed floor is supported directly on concrete or masonry walls over the full length of all sides except the downhill side of the dwelling need not be considered an irregular dwelling under Item 8.

R301.2.2.7 Height limitations. Wood-framed buildings shall be limited to three stories above grade plane or the limits given in Table R602.10.3(3). Wood-framed buildings in Seismic Design Category D₂ exceeding two stories shall be designed for wind and seismic loads in accordance with accepted engineering practice. Cold-formed steel-framed buildings shall be limited to less than or equal to three stories above grade plane in accordance with AISI S230. Mezzanines as defined in Section R202 that comply with Section R325 shall not be considered as stories. Structural insulated panel buildings shall be limited to two stories above grade plane.

R301.2.2.8 Cold-formed steel framing in Seismic Design Categories D₀, D₁ and D₂. In *Seismic Design Categories D₀, D₁ and D₂* in addition to the requirements of this code, cold-formed steel framing shall comply with the requirements of AISI S230.

R301.2.2.9 Masonry chimneys. In *Seismic Design Categories D₀, D₁ and D₂*, masonry chimneys shall be reinforced and anchored to the building in accordance with Sections R1003.3 and R1003.4.

R301.2.2.10 Anchorage of water heaters. Water heaters and thermal storage units shall be anchored against movement and overturning in accordance with *the California Plumbing Code*.

R301.2.3 Snow loads. Wood-framed construction, cold-formed, steel-framed construction and masonry and concrete construction, and structural insulated panel construction in regions with ground snow loads 70 pounds per square foot (3.35 kPa) or less, shall be in accordance with Chapters 5, 6 and 8. Buildings in regions with ground snow loads greater than 70 pounds per square foot (3.35 kPa) shall be designed in accordance with accepted engineering practice.

R301.2.4 Floodplain construction. Buildings and structures constructed in whole or in part in flood hazard areas (including A or V Zones) as established in Table R301.2, and substantial improvement and repair of substantial

damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with Section R322. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R301.2.4.1 Alternative provisions. As an alternative to the requirements in Section R322, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R301.3 Story height. The wind and seismic provisions of this code shall apply to buildings with story heights not exceeding the following:

1. For wood wall framing, the story height shall not exceed 11 feet 7 inches (3531 mm) and the laterally unsupported bearing wall stud height permitted by Table R602.3(5).

Exception: A story height not exceeding 13 feet 7 inches (4140 mm) is permitted provided that the maximum wall stud clear height does not exceed 12 feet (3658 mm), the wall studs are in accordance with Exception 2 or 3 of Section R602.3.1 or an engineered design is provided for the wall framing members, and wall bracing for the building is in accordance with Section R602.10. Studs shall be laterally supported at the top and bottom plate in accordance with Section R602.3.

2. For cold-formed steel wall framing, the story height shall be not more than 11 feet 7 inches (3531 mm) and the unsupported bearing wall stud height shall be not more than 10 feet (3048 mm).
3. For masonry walls, the story height shall be not more than 13 feet 7 inches (4140 mm) and the bearing wall clear height shall be not more than 12 feet (3658 mm).

Exception: An additional 8 feet (2438 mm) of bearing wall clear height is permitted for gable end walls.

4. For insulating concrete form walls, the maximum story height shall not exceed 11 feet 7 inches (3531 mm) and the maximum unsupported wall height per story as permitted by Section R608 tables shall not exceed 10 feet (3048 mm).
5. For structural insulated panel (SIP) walls, the story height shall be not more than 11 feet 7 inches (3531 mm) and the bearing wall height per story as permitted by Section R610 tables shall not exceed 10 feet (3048 mm).

For walls other than wood-framed walls, individual walls or wall studs shall be permitted to exceed these limits as permitted by Chapter 6, provided that the story heights of this section are not exceeded. An engineered design shall be provided for the wall or wall framing members where the limits of Chapter 6 are exceeded. Where the story height limits of this section are exceeded, the design of the building, or the noncompliant portions

thereof, to resist wind and seismic loads shall be in accordance with the *California Building Code*.

R301.4 Dead load. The actual weights of materials and construction shall be used for determining dead load with consideration for the dead load of fixed service equipment.

R301.5 Live load. The minimum uniformly distributed live load shall be as provided in Table R301.5.

R301.6 Roof load. The roof shall be designed for the live load indicated in Table R301.6 or the ground snow load indicated in Table R301.2, whichever is greater.

R301.7 Deflection. The allowable deflection of any structural member under the live load listed in Sections R301.5 and R301.6 or wind loads determined by Section R301.2.1 shall not exceed the values in Table R301.7.

R301.8 Nominal sizes. For the purposes of this code, dimensions of lumber specified shall be deemed to be nominal dimensions unless specifically designated as actual dimensions.

SECTION R302 FIRE-RESISTANT CONSTRUCTION

R302.1 Exterior walls. Construction, projections, openings and penetrations of exterior walls of dwellings and accessory buildings shall comply with Table R302.1(1); or dwellings *and accessory buildings* equipped throughout with an automatic sprinkler system installed in accordance with Section R313 shall comply with Table R302.1(2).

Exceptions:

1. Walls, projections, openings or penetrations in walls perpendicular to the line used to determine the fire separation distance.
2. Walls of individual dwelling units and their accessory structures located on the same lot.
3. Detached tool sheds and storage sheds, playhouses and similar structures exempted from permits are not required to provide wall protection based on location on the lot. Projections beyond the exterior wall shall not extend over the lot line.
4. Detached garages accessory to a dwelling located within 2 feet (610 mm) of a lot line are permitted to have roof eave projections not exceeding 4 inches (102 mm).
5. Foundation vents installed in compliance with this code are permitted.

R302.2 Townhouses. Walls separating townhouse units shall be constructed in accordance with Section R302.2.1 or R302.2.2 and shall comply with Sections 302.2.3 through 302.2.5.

R302.2.1 Double walls. Each townhouse unit shall be separated from other townhouse units by two 1-hour fire-resistance-rated wall assemblies tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *California Building Code*.

**TABLE R301.5
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS (in pounds per square foot)**

USE	UNIFORM LOAD (psf)	CONCENTRATED LOAD (lb)
Uninhabitable attics without storage ^b	10	—
Uninhabitable attics with limited storage ^{b, g}	20	—
Habitable attics and attics served with fixed stairs	30	—
Balconies (exterior) and decks ^e	60	—
Fire escapes	40	—
Guards	—	200 ^{h, i}
Guard in-fill components ^f	—	50 ^h
Handrail ^d	200 ^h	—
Passenger vehicle garages	50	2,000 ^a
Areas other than sleeping areas	40	—
Sleeping areas	30	—
Stairs	40 ^c	300 ^c

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 square inch = 645 mm², 1 pound = 4.45 N.

- a. Elevated garage floors shall be capable of supporting the uniformly distributed live load or a 2,000-pound concentrated load applied on an area of 4½ inches by 4½ inches, whichever produces the greater stresses.
- b. Uninhabitable attics without storage are those where the clear height between joists and rafters is not more than 42 inches, or where there are not two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses. This live load need not be assumed to act concurrently with any other live load requirements.
- c. Individual stair treads shall be capable of supporting the uniformly distributed live load or a 300-pound concentrated load applied on an area of 2 inches by 2 inches, whichever produces the greater stresses.
- d. A single concentrated load applied in any direction at any point along the top. For a guard not required to serve as a handrail, the load need not be applied to the top element of the guard in a direction parallel to such element.
- e. See Section R507.1 for decks attached to exterior walls.
- f. Guard in-fill components (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds on an area equal to 1 square foot. This load need not be assumed to act concurrently with any other live load requirement.
- g. Uninhabitable attics with limited storage are those where the clear height between joists and rafters is 42 inches or greater, or where there are two or more adjacent trusses with web configurations capable of accommodating an assumed rectangle 42 inches in height by 24 inches in width, or greater, within the plane of the trusses.
 - The live load need only be applied to those portions of the joists or truss bottom chords where all of the following conditions are met:
 1. The attic area is accessed from an opening not less than 20 inches in width by 30 inches in length that is located where the clear height in the attic is not less than 30 inches.
 2. The slopes of the joists or truss bottom chords are not greater than 2 units vertical in 12 units horizontal.
 3. Required insulation depth is less than the joist or truss bottom chord member depth.
 The remaining portions of the joists or truss bottom chords shall be designed for a uniformly distributed concurrent live load of not less than 10 pounds per square foot.
- h. Glazing used in handrail assemblies and guards shall be designed with a load adjustment factor of 4. The load adjustment factor shall be applied to each of the concentrated loads applied to the top of the rail, and to the load on the in-fill components. These loads shall be determined independent of one another, and loads are assumed not to occur with any other live load.
- i. Where the top of a guard system is not required to serve as a handrail, the single concentrated load shall be applied at any point along the top, in the vertical downward direction and in the horizontal direction away from the walking surface. Where the top of a guard is also serving as the handrail, a single concentrated load shall be applied in any direction at any point along the top. Concentrated loads shall not be applied concurrently.

**TABLE R301.6
MINIMUM ROOF LIVE LOADS IN POUNDS-FORCE PER SQUARE FOOT OF HORIZONTAL PROJECTION**

ROOF SLOPE	TRIBUTARY LOADED AREA IN SQUARE FEET FOR ANY STRUCTURAL MEMBER		
	0 to 200	201 to 600	Over 600
Flat or rise less than 4 inches per foot (1:3)	20	16	12
Rise 4 inches per foot (1:3) to less than 12 inches per foot (1:1)	16	14	12
Rise 12 inches per foot (1:1) and greater	12	12	12

For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa, 1 inch per foot = 83.3 mm/m.

**TABLE R301.7
ALLOWABLE DEFLECTION OF STRUCTURAL MEMBERS^{b, c}**

STRUCTURAL MEMBER	ALLOWABLE DEFLECTION
Rafters having slopes greater than 3:12 with finished ceiling not attached to rafters	$L/180$
Interior walls and partitions	$H/180$
Floors	$L/360$
Ceilings with brittle finishes (including plaster and stucco)	$L/360$
Ceilings with flexible finishes (including gypsum board)	$L/240$
All other structural members	$L/240$
Exterior walls—wind loads ^a with plaster or stucco finish	$H/360$
Exterior walls—wind loads ^a with other brittle finishes	$H/240$
Exterior walls—wind loads ^a with flexible finishes	$H/120^d$
Lintels supporting masonry veneer walls ^e	$L/600$

Note: L = span length, H = span height.

- a. For the purpose of the determining deflection limits herein, the wind load shall be permitted to be taken as 0.7 times the component and cladding (ASD) loads obtained from Table R301.2.1(1).
- b. For cantilever members, L shall be taken as twice the length of the cantilever.
- c. For aluminum structural members or panels used in roofs or walls of sunroom additions or patio covers, not supporting edge of glass or sandwich panels, the total load deflection shall not exceed $L/60$. For continuous aluminum structural members supporting edge of glass, the total load deflection shall not exceed $L/175$ for each glass lite or $L/60$ for the entire length of the member, whichever is more stringent. For sandwich panels used in roofs or walls of sunroom additions or patio covers, the total load deflection shall not exceed $L/120$.
- d. Deflection for exterior walls with interior gypsum board finish shall be limited to an allowable deflection of $H/180$.
- e. Refer to Section R703.8.2. The dead load of supported materials shall be included when calculating the deflection of these members.

**TABLE R302.1(1)
EXTERIOR WALLS**

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.3 of the <i>California Building Code</i> with exposure from both sides	0 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{a, b}	≥ 2 feet to < 5 feet
	Not fire-resistance rated	0 hours	≥ 5 feet
Openings in walls	Not allowed	NA	< 3 feet
	25% maximum of wall area	0 hours	3 feet
	Unlimited	0 hours	5 feet
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.

TABLE R302.1(2)
EXTERIOR WALLS—DWELLINGS AND ACCESSORY BUILDINGS WITH AUTOMATIC RESIDENTIAL FIRE SPRINKLER PROTECTION

EXTERIOR WALL ELEMENT		MINIMUM FIRE-RESISTANCE RATING	MINIMUM FIRE SEPARATION DISTANCE
Walls	Fire-resistance rated	1 hour—tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the <i>California Building Code</i> with exposure from the outside	0 feet
	Not fire-resistance rated	0 hours	3 feet ^a
Projections	Not allowed	NA	< 2 feet
	Fire-resistance rated	1 hour on the underside, or heavy timber, or fire-retardant-treated wood ^{b, c}	2 feet ^a
	Not fire-resistance rated	0 hours	3 feet
Openings in walls	Not allowed	NA	< 3 feet
	Unlimited	0 hours	3 feet ^a
Penetrations	All	Comply with Section R302.4	< 3 feet
		None required	3 feet ^a

For SI: 1 foot = 304.8 mm.

NA = Not Applicable.

- a. For residential subdivisions where all dwellings are equipped throughout with an automatic sprinkler system installed in accordance with Section R313, the fire separation distance for exterior walls not fire-resistance rated and for fire-resistance-rated projections shall be permitted to be reduced to 0 feet, and unlimited unprotected openings and penetrations shall be permitted, where the adjoining lot provides an open setback yard that is 6 feet or more in width on the opposite side of the property line.
- b. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the eave overhang if fireblocking is provided from the wall top plate to the underside of the roof sheathing.
- c. The fire-resistance rating shall be permitted to be reduced to 0 hours on the underside of the rake overhang where gable vent openings are not installed.

R302.2.2 Common walls. Common walls separating townhouse units shall be assigned a fire-resistance rating in accordance with Item 1 or 2 and shall be rated for fire exposure from both sides. Common walls shall extend to and be tight against the exterior sheathing of the exterior walls, or the inside face of exterior walls without stud cavities, and the underside of the roof sheathing. The common wall shared by two townhouse units shall be constructed without plumbing or mechanical equipment, ducts or vents, other than water-filled fire sprinkler piping in the cavity of the common wall. Electrical installations shall be in accordance with *the California Electrical Code*. Penetrations of the membrane of common walls for electrical outlet boxes shall be in accordance with Section R302.4.

1. Where an automatic sprinkler system in accordance with Section R313 is provided, the common wall shall be not less than a 1-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *California Building Code*.
2. Where an automatic sprinkler system in accordance with Section R313 is not provided, the common wall shall be not less than a 2-hour fire-resistance-rated wall assembly tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *California Building Code*.

Exception: Common walls are permitted to extend to and be tight against the inside of the exterior walls if the cavity between the end of the common wall and the

exterior sheathing is filled with a minimum of two 2-inch nominal thickness wood studs.

R302.2.3 Continuity. The fire-resistance-rated wall or assembly separating townhouse units shall be continuous from the foundation to the underside of the roof sheathing, deck or slab. The fire-resistance rating shall extend the full length of the wall or assembly, including wall extensions through and separating attached enclosed accessory structures.

R302.2.4 Parapets for townhouses. Parapets constructed in accordance with Section R302.2.5 shall be constructed for townhouses as an extension of exterior walls or common walls separating townhouse units in accordance with the following:

1. Where roof surfaces adjacent to the wall or walls are at the same elevation, the parapet shall extend not less than 30 inches (762 mm) above the roof surfaces.
2. Where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is not more than 30 inches (762 mm) above the lower roof, the parapet shall extend not less than 30 inches (762 mm) above the lower roof surface.

Exception: A parapet is not required in the preceding two cases where the roof covering complies with a minimum Class C rating as tested in accordance with ASTM E108 or UL 790 and the roof decking or sheathing is of noncombustible materials or fire-retardant-treated wood for a distance of 4 feet (1219 mm)

on each side of the wall or walls, or one layer of $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board is installed directly beneath the roof decking or sheathing, supported by not less than nominal 2-inch (51 mm) ledgers attached to the sides of the roof framing members, for a distance of not less than 4 feet (1219 mm) on each side of the wall or walls and any openings or penetrations in the roof are not within 4 feet (1219 mm) of the common walls. Fire-retardant-treated wood shall meet the requirements of Sections R802.1.5 and R803.2.1.2.

3. A parapet is not required where roof surfaces adjacent to the wall or walls are at different elevations and the higher roof is more than 30 inches (762 mm) above the lower roof. The common wall construction from the lower roof to the underside of the higher roof deck shall have not less than a 1-hour fire-resistance rating. The wall shall be rated for exposure from both sides.

R302.2.5 Parapet construction. Parapets shall have the same fire-resistance rating as that required for the supporting wall or walls. On any side adjacent to a roof surface, the parapet shall have noncombustible faces for the uppermost 18 inches (457 mm), to include counterflashing and coping materials. Where the roof slopes toward a parapet at slopes greater than 2 units vertical in 12 units horizontal (16.7-percent slope), the parapet shall extend to the same height as any portion of the roof within a distance of 3 feet (914 mm), and the height shall be not less than 30 inches (762 mm).

R302.2.6 Structural independence. Each townhouse unit shall be structurally independent.

Exceptions:

1. Foundations supporting exterior walls or common walls.
2. Structural roof and wall sheathing from each unit fastened to the common wall framing.
3. Nonstructural wall and roof coverings.
4. Flashing at termination of roof covering over common wall.
5. Townhouse units separated by a common wall as provided in Section R302.2.2, Item 1 or 2.
6. Townhouse units protected by a fire sprinkler system complying with *Section R313* or NFPA 13D.

R302.3 Two-family dwellings. Dwelling units in two-family dwellings shall be separated from each other by wall and floor assemblies having not less than a 1-hour fire-resistance rating where tested in accordance with ASTM E119, UL 263 or Section 703.2.2 of the *California Building Code*. Such separation shall be provided regardless of whether a lot line exists between the two dwelling units or not. Fire-resistance-rated floor/ceiling and wall assemblies shall extend to and be tight against the exterior wall, and wall assemblies shall

extend from the foundation to the underside of the roof sheathing.

Exceptions:

1. A fire-resistance rating of $\frac{1}{2}$ hour shall be permitted in buildings equipped throughout with an automatic sprinkler system installed in accordance with *Section R313*.
2. Wall assemblies need not extend through attic spaces where the ceiling is protected by not less than $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum board, an attic draft stop constructed as specified in Section R302.12.1 is provided above and along the wall assembly separating the dwellings and the structural framing supporting the ceiling is protected by not less than $\frac{1}{2}$ -inch (12.7 mm) gypsum board or equivalent.

R302.3.1 Supporting construction. Where floor assemblies are required to be fire-resistance rated by Section R302.3, the supporting construction of such assemblies shall have an equal or greater fire-resistance rating.

R302.4 Dwelling unit rated penetrations. Penetrations of wall or floor-ceiling assemblies required to be fire-resistance rated in accordance with Section R302.2 or R302.3 shall be protected in accordance with this section.

R302.4.1 Through penetrations. Through penetrations of fire-resistance-rated wall or floor assemblies shall comply with Section R302.4.1.1 or R302.4.1.2.

Exceptions:

1. Where the penetrating items are steel, ferrous or copper pipes, tubes or conduits, the annular space shall be protected as follows:
 - 1.1. In concrete or masonry wall or floor assemblies, concrete, grout or mortar shall be permitted where installed to the full thickness of the wall or floor assembly or the thickness required to maintain the fire-resistance rating, provided that both of the following are complied with:
 - 1.1.1. The nominal diameter of the penetrating item is not more than 6 inches (152 mm).
 - 1.1.2. The area of the opening through the wall does not exceed 144 square inches (92 900 mm²).
 - 1.2. The material used to fill the annular space shall prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E119 or UL 263 time temperature fire conditions under a positive pressure differential of not less than 0.01 inch of water (3 Pa) at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

2. The annular space created by the penetration of water-filled fire sprinkler piping, provided that the annular space is filled using a material complying with Item 1.2 of Exception 1.

R302.4.1.1 Fire-resistance-rated assembly. Penetrations shall be installed as tested in the approved fire-resistance-rated assembly.

R302.4.1.2 Penetration firestop system. Penetrations shall be protected by an approved penetration firestop system installed as tested in accordance with ASTM E814 or UL 1479, with a positive pressure differential of not less than 0.01 inch of water (3 Pa) and shall have an F rating of not less than the required fire-resistance rating of the wall or floor-ceiling assembly penetrated.

R302.4.2 Membrane penetrations. Membrane penetrations shall comply with Section R302.4.1. Where walls are required to have a fire-resistance rating, recessed fixtures shall be installed so that the required fire-resistance rating will not be reduced.

Exceptions:

1. Membrane penetrations of not more than 2-hour fire-resistance-rated walls and partitions by steel electrical boxes that do not exceed 16 square inches (0.0103 m²) in area provided that the aggregate area of the openings through the membrane does not exceed 100 square inches (0.0645 m²) in any 100 square feet (9.29 m²) of wall area. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm). Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 1.1. By a horizontal distance of not less than 24 inches (610 mm) where the wall or partition is constructed with individual noncommunicating stud cavities.
 - 1.2. By a horizontal distance of not less than the depth of the wall cavity where the wall cavity is filled with cellulose loose-fill, rockwool or slag mineral wool insulation.
 - 1.3. By solid fireblocking in accordance with Section R302.11.
 - 1.4. By protecting both boxes with listed putty pads.
 - 1.5. By other listed materials and methods.
2. Membrane penetrations by listed electrical boxes of any materials provided that the boxes have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing. The annular space between the wall membrane and the box shall not exceed 1/8 inch (3.1 mm) unless listed otherwise. Such boxes on opposite sides of the wall shall be separated by one of the following:
 - 2.1. By the horizontal distance specified in the listing of the electrical boxes.
 - 2.2. By solid fireblocking in accordance with Section R302.11.
 - 2.3. By protecting both boxes with listed putty pads.
 - 2.4. By other listed materials and methods.
3. The annular space created by the penetration of a fire sprinkler or water-filled fire sprinkler piping, provided that the annular space is covered by a metal escutcheon plate.
4. Ceiling membrane penetrations by listed luminaires or by luminaires protected with listed materials that have been tested for use in fire-resistance-rated assemblies and are installed in accordance with the instructions included in the listing.

R302.5 Dwelling-garage opening and penetration protection. Openings and penetrations through the walls or ceilings separating the dwelling from the garage shall be in accordance with Sections R302.5.1 through R302.5.3.

R302.5.1 Opening protection. Openings from a private garage directly into a room used for sleeping purposes shall not be permitted. Other openings between the garage and residence shall be equipped with solid wood doors not less than 1 3/8 inches (35 mm) in thickness, solid or honeycomb-core steel doors not less than 1 3/8 inches (35 mm) thick, or 20-minute fire-rated doors. Doors shall be self-latching and equipped with a self-closing or automatic-closing device.

Exception: Where the residence and the private garage are protected by an automatic residential fire sprinkler system in accordance with Sections R309.6 and R313, other door openings between the private garage and the residence need only be self-closing and self-latching. This exception shall not apply to rooms used for sleeping purposes.

R302.5.2 Duct penetration. Ducts in the garage and ducts penetrating the walls or ceilings separating the dwelling from the garage shall be constructed of a minimum No. 26 gage (0.48 mm) sheet steel or other approved material and shall not have openings into the garage.

R302.5.3 Other penetrations. Penetrations through the separation required in Section R302.6 shall be protected as required by Section R302.11, Item 4.

R302.6 Dwelling-garage and/or carport fire separation. The garage and/or carport shall be separated as required by Table R302.6. Openings in garage walls shall comply with Section R302.5. Attachment of gypsum board shall comply with Table R702.3.5. The wall separation provisions of Table R302.6 shall not apply to garage walls that are perpendicular to the adjacent dwelling unit wall. A separation is not required between the dwelling unit and a carport, provided the carport is entirely open on two or more sides and there are not enclosed areas above.

R302.7 Under-stair protection. Enclosed space under stairs that is accessed by a door or access panel shall have walls,

**TABLE R302.6
DWELLING-GARAGE AND/OR CARPORT SEPARATION**

SEPARATION	MATERIAL
From the residence and attics	Not less than 1/2-inch gypsum board or equivalent applied to the garage side
From habitable rooms above the garage <i>or carport</i>	Not less than 5/8-inch Type X gypsum board or equivalent
Structure(s) supporting floor/ceiling assemblies used for separation required by this section	Not less than 1/2-inch gypsum board or equivalent
Garages located less than 3 feet from a dwelling unit on the same lot	Not less than 1/2-inch gypsum board or equivalent applied to the interior side of exterior walls that are within this area

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

under-stair surface and any soffits protected on the enclosed side with 1/2-inch (12.7 mm) gypsum board.

R302.8 Foam plastics. For requirements for foam plastics, see Section R316.

R302.8.1 Interior finish. Foam plastics used as interior finishes shall comply with Section R316.5.10.

R302.9 Flame spread index and smoke-developed index for wall and ceiling finishes. Flame spread and smoke-developed indices for wall and ceiling finishes shall be in accordance with Sections R302.9.1 through R302.9.4.

R302.9.1 Flame spread index. Wall and ceiling finishes shall have a flame spread index of not greater than 200.

Exception: Flame spread index requirements for finishes shall not apply to trim defined as picture molds, chair rails, baseboards and handrails; to doors and windows or their frames; or to materials that are less than 1/28 inch (0.91 mm) in thickness cemented to the surface of walls or ceilings if these materials exhibit flame spread index values not greater than those of paper of this thickness cemented to a noncombustible backing.

R302.9.2 Smoke-developed index. Wall and ceiling finishes shall have a smoke-developed index of not greater than 450.

R302.9.3 Testing. Tests shall be made in accordance with ASTM E84 or UL 723.

R302.9.4 Alternative test method. As an alternative to having a flame spread index of not greater than 200 and a smoke-developed index of not greater than 450 where tested in accordance with ASTM E84 or UL 723, wall and ceiling finishes shall be permitted to be tested in accordance with NFPA 286. Materials tested in accordance with NFPA 286 shall meet the following criteria:

The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.

5. The total smoke released throughout the test shall not exceed 1,000 m².

R302.9.5 Stability. Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

R302.9.5 High-density polyethylene (HDPE) and polypropylene (PP). Where high-density polyethylene or polypropylene is used as an interior finish material, it shall be tested in accordance with NFPA 286 and comply with the criteria in Section R302.9.4.

R302.10 Flame spread index and smoke-developed index for insulation. Flame spread and smoke-developed index for insulation shall be in accordance with Sections R302.10.1 through R302.10.5.

R302.10.1 Insulation. Insulating materials installed within floor-ceiling assemblies, roof-ceiling assemblies, wall assemblies, crawl spaces and attics shall comply with the requirements of this section. They shall exhibit a flame spread index not to exceed 25 and a smoke-developed index not to exceed 450 where tested in accordance with ASTM E84 or UL 723. Insulating materials, where tested in accordance with the requirements of this section, shall include facings, where used, such as vapor retarders, vapor permeable membranes and similar coverings.

Exceptions:

1. Where such materials are installed in concealed spaces, the flame spread index and smoke-developed index limitations do not apply to the facings, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor or wall finish.
2. Cellulose fiber loose-fill insulation that is not spray applied and that complies with the requirements of Section R302.10.3 shall not be required to meet the flame spread index requirements but shall be required to meet a smoke-developed index of not more than 450 where tested in accordance with CAN/ULC S102.2.
3. Foam plastic insulation shall comply with Section R316.

R302.10.2 Loose-fill insulation. Loose-fill insulation materials that cannot be mounted in the ASTM E84 or UL 723 apparatus without a screen or artificial supports shall comply with the flame spread and smoke-developed limits of Section R302.10.1 where tested in accordance with CAN/ULC S102.2.

Exception: Cellulosic fiber loose-fill insulation shall not be required to be tested in accordance with CAN/ULC S102.2, provided that such insulation complies with the requirements of Sections R302.10.1 and R302.10.3.

R302.10.3 Cellulosic fiber loose-fill insulation. Cellulosic fiber loose-fill insulation shall comply with CPSC 16 CFR, Parts 1209 and 1404. Each package of such insulating material shall be clearly labeled in accordance with CPSC 16 CFR, Parts 1209 and 1404.

R302.10.4 Exposed attic insulation. Exposed insulation materials installed on attic floors shall have a critical radiant flux of not less than 0.12 watt per square centimeter.

R302.10.5 Testing. Tests for critical radiant flux shall be made in accordance with ASTM E970.

R302.11 Fireblocking. In combustible construction, fireblocking shall be provided to cut off both vertical and horizontal concealed draft openings and to form an effective fire barrier between stories, and between a top story and the roof space.

Fireblocking shall be provided in wood-framed construction in the following locations:

1. In concealed spaces of stud walls and partitions, including furred spaces and parallel rows of studs or staggered studs, as follows:
 - 1.1. Vertically at the ceiling and floor levels.
 - 1.2. Horizontally at intervals not exceeding 10 feet (3048 mm).
2. At interconnections between concealed vertical and horizontal spaces such as occur at soffits, drop ceilings and cove ceilings.
3. In concealed spaces between stair stringers at the top and bottom of the run. Enclosed spaces under stairs shall comply with Section R302.7.
4. At openings around vents, pipes, ducts, cables and wires at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion. The material filling this annular space shall not be required to meet the ASTM E136 requirements.
5. For the fireblocking of chimneys and fireplaces, see Section R1003.19.
6. Fireblocking of cornices of a two-family dwelling is required at the line of dwelling unit separation.

R302.11.1 Fireblocking materials. Except as provided in Section R302.11, Item 4, fireblocking shall consist of the following materials.

1. Two-inch (51 mm) nominal lumber.

2. Two thicknesses of 1-inch (25.4 mm) nominal lumber with broken lap joints.
3. One thickness of $\frac{23}{32}$ -inch (18.3 mm) wood structural panels with joints backed by $\frac{23}{32}$ -inch (18.3 mm) wood structural panels.
4. One thickness of $\frac{3}{4}$ -inch (19.1 mm) particleboard with joints backed by $\frac{3}{4}$ -inch (19.1 mm) particleboard.
5. One-half-inch (12.7 mm) gypsum board.
6. One-quarter-inch (6.4 mm) cement-based millboard.
7. Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.
8. Cellulose insulation installed as tested in accordance with ASTM E119 or UL 263, for the specific application.

R302.11.1.1 Batts or blankets of mineral or glass fiber. Batts or blankets of mineral or glass fiber or other approved nonrigid materials shall be permitted for compliance with the 10-foot (3048 mm) horizontal fireblocking in walls constructed using parallel rows of studs or staggered studs.

R302.11.1.2 Unfaced fiberglass. Unfaced fiberglass batt insulation used as fireblocking shall fill the entire cross section of the wall cavity to a height of not less than 16 inches (406 mm) measured vertically. Where piping, conduit or similar obstructions are encountered, the insulation shall be packed tightly around the obstruction.

R302.11.1.3 Loose-fill insulation material. Loose-fill insulation material shall not be used as a fireblock unless specifically tested in the form and manner intended for use to demonstrate its ability to remain in place and to retard the spread of fire and hot gases.

R302.11.2 Fireblocking integrity. The integrity of fireblocks shall be maintained.

R302.12 Draftstopping. In combustible construction where there is usable space both above and below the concealed space of a floor-ceiling assembly, draftstops shall be installed so that the area of the concealed space does not exceed 1,000 square feet (92.9 m²). Draftstopping shall divide the concealed space into approximately equal areas. Where the assembly is enclosed by a floor membrane above and a ceiling membrane below, draftstopping shall be provided in floor-ceiling assemblies under the following circumstances:

1. Ceiling is suspended under the floor framing.
2. Floor framing is constructed of truss-type open-web or perforated members.

R302.12.1 Materials. Draftstopping materials shall be not less than $\frac{1}{2}$ -inch (12.7 mm) gypsum board, $\frac{3}{8}$ -inch (9.5 mm) wood structural panels or other approved materials adequately supported. Draftstopping shall be installed parallel to the floor framing members unless otherwise approved by the building official. The integrity of the draftstops shall be maintained.

R302.13 Fire protection of floors. Floor assemblies that are not required elsewhere in this code to be fire-resistance rated, shall be provided with a 1/2-inch (12.7 mm) gypsum wall-board membrane, 5/8-inch (16 mm) wood structural panel membrane, or equivalent on the underside of the floor framing member. Penetrations or openings for ducts, vents, electrical outlets, lighting, devices, luminaires, wires, speakers, drainage, piping and similar openings or penetrations shall be permitted.

Exceptions:

1. Floor assemblies located directly over a space protected by an automatic sprinkler system in accordance with Section R313, NFPA 13D, or other approved equivalent sprinkler system.
2. Floor assemblies located directly over a crawl space not intended for storage or for the installation of fuel-fired or electric-powered heating appliances.
3. Portions of floor assemblies shall be permitted to be unprotected where complying with the following:
 - 3.1. The aggregate area of the unprotected portions does not exceed 80 square feet (7.4 m²) per story.
 - 3.2. Fireblocking in accordance with Section R302.11.1 is installed along the perimeter of the unprotected portion to separate the unprotected portion from the remainder of the floor assembly.
4. Wood floor assemblies using dimension lumber or structural composite lumber equal to or greater than 2-inch by 10-inch (50.8 mm by 254 mm) nominal dimension, or other approved floor assemblies demonstrating equivalent fire performance.

R302.14 Combustible insulation clearance. Combustible insulation shall be separated not less than 3 inches (76 mm) from recessed luminaires, fan motors and other heat-producing devices.

Exception: Where heat-producing devices are listed for lesser clearances, combustible insulation complying with the listing requirements shall be separated in accordance with the conditions stipulated in the listing.

Recessed luminaires installed in the building thermal envelope shall meet or exceed the requirements of Section N1102.4.5 of this code.

**SECTION R303
LIGHT, VENTILATION AND HEATING**

R303.1 Habitable rooms. Habitable rooms shall have an aggregate glazing area of not less than 8 percent of the floor area of such rooms. Natural ventilation shall be through windows, skylights, doors, louvers or other approved openings to the outdoor air. Such openings shall be provided with ready access or shall otherwise be readily controllable by the

building occupants. The openable area to the outdoors shall be not less than 4 percent of the floor area being ventilated.

Exceptions:

1. For habitable rooms other than kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a whole-house mechanical ventilation system or a mechanical ventilation system capable of producing 0.35 air changes per hour in the habitable rooms is installed in accordance with *the California Mechanical Code*.
2. For kitchens, the glazed areas need not be openable where the opening is not required by Section R310 and a local exhaust system is installed in accordance with *the California Mechanical Code*.
3. The glazed areas need not be installed in rooms where Exception 1 is satisfied and artificial light is provided that is capable of producing an average illumination of 6 footcandles (65 lux) over the area of the room at a height of 30 inches (762 mm) above the floor level.
4. Use of sunroom and patio covers, as defined in Section R202, shall be permitted for natural ventilation if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening.
5. *The windows, doors, louvers and other approved closeable openings not required by Section R310 may open into a passive solar energy collector for ventilation required by this section. The area of ventilation openings to the outside of the passive solar energy collector shall be increased to compensate for the openings required by the interior space.*
6. *Glazed openings may open into a passive solar energy collector provided the area of exterior glazed opening(s) into the passive solar energy collector is increased to compensate for the area required by the interior space.*

R303.2 Adjoining rooms. For the purpose of determining light and ventilation requirements, rooms shall be considered to be a portion of an adjoining room where not less than one-half of the area of the common wall is open and unobstructed and provides an opening of not less than one-tenth of the floor area of the interior room and not less than 25 square feet (2.3 m²).

Exception: Openings required for light or ventilation shall be permitted to open into a sunroom with thermal isolation or a patio cover, provided that there is an openable area between the adjoining room and the sunroom or patio cover of not less than one-tenth of the floor area of the interior room and not less than 20 square feet (2 m²). The minimum openable area to the outdoors shall be based on the total floor area being ventilated.

R303.3 Bathrooms. Bathrooms, water closet compartments and other similar rooms shall be provided with aggregate glazing area in windows of not less than 3 square feet (0.3 m²), one-half of which shall be openable.

Exception: The glazed areas shall not be required where artificial light and a local exhaust system are provided. The minimum local exhaust rates shall be *50 cubic feet per minute (25 L/s) for intermittent ventilation or 20 cubic feet per minute (10 L/s) for continuous ventilation* in accordance with the *California Mechanical Code, Chapter 4*. Exhaust air from the space shall be exhausted directly to the outdoors.

R303.3.1 Bathroom exhaust fans. *Each bathroom containing a bathtub, shower or tub/shower combination shall be mechanically ventilated for purposes of humidity control in accordance with the California Mechanical Code, Chapter 4; and the California Green Building Standards Code, Chapter 4, Division 4.5.*

Note: *Window operation is not a permissible method of providing bathroom exhaust for humidity control.*

R303.4 Ventilation. *Ventilation air rates shall be in compliance with the California Mechanical Code.*

R303.5 Opening location. Outdoor intake and exhaust openings shall be located in accordance with Sections R303.5.1 and R303.5.2.

R303.5.1 Intake openings. Mechanical and gravity outdoor air intake openings shall be located not less than 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, streets, alleys, parking lots and loading docks.

For the purpose of this section, the exhaust from dwelling unit toilet rooms, bathrooms and kitchens shall not be considered as hazardous or noxious.

Exceptions:

1. The 10-foot (3048 mm) separation is not required where the intake opening is located 3 feet (914 mm) or greater below the contaminant source.
2. Vents and chimneys serving fuel-burning appliances shall be terminated in accordance with the applicable provisions of the *California Mechanical Code*.
3. Clothes dryer exhaust ducts shall be terminated in accordance with the *California Mechanical Code*.

R303.5.2 Exhaust openings. Exhaust air shall not be directed onto walkways.

R303.6 Outside opening protection. Air exhaust and intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles having an opening size of not less than $\frac{1}{4}$ inch (6 mm) and a maximum opening size of $\frac{1}{2}$ inch (13 mm), in any dimension. Openings shall be protected against local weather conditions. Outdoor air exhaust and intake openings shall meet the provisions for exterior wall opening protectives in accordance with this code.

R303.7 Interior stairway illumination. Interior stairways shall be provided with an artificial light source to illuminate the landings and treads. The light source shall be capable of illuminating treads and landings to levels of not less than 1 footcandle (11 lux) as measured at the center of treads and landings. There shall be a wall switch at each floor level to control the light source where the stairway has six or more risers.

Exception: A switch is not required where remote, central or automatic control of lighting is provided.

R303.8 Exterior stairway illumination. Exterior stairways shall be provided with an artificial light source located at the top landing of the stairway. Exterior stairways providing access to a basement from the outdoor grade level shall be provided with an artificial light source located at the bottom landing of the stairway.

R303.9 Required glazed openings. Required glazed openings shall open directly onto a street or public alley, or a yard or court located on the same lot as the building.

Exceptions:

1. Required glazed openings that face into a roofed porch where the porch abuts a street, yard or court and the longer side of the porch is not less than 65 percent unobstructed and the ceiling height is not less than 7 feet (2134 mm).
2. Eave projections shall not be considered as obstructing the clear open space of a yard or court.
3. Required glazed openings that face into the area under a deck, balcony, bay or floor cantilever where a clear vertical space not less than 36 inches (914 mm) in height is provided.

R303.9.1 Sunroom additions. Required glazed openings shall be permitted to open into sunroom additions or patio covers that abut a street, yard or court if in excess of 40 percent of the exterior sunroom walls are open, or are enclosed only by insect screening, and the ceiling height of the sunroom is not less than 7 feet (2134 mm).

R303.9.1.1 Passive solar energy collectors. *When a passive solar energy collector is designed as a conditioned area it shall comply with the California Energy Code. Nonconditioned passive solar energy collectors are exempt from the California Energy Code.*

R303.10 Required heating. Where the winter design temperature in Table R301.2 is below 60°F (16°C), every dwelling unit shall be provided with heating facilities capable of maintaining a room temperature of not less than 68°F (20°C) at a point 3 feet (914 mm) above the floor and 2 feet (610 mm) from exterior walls in habitable rooms at the design temperature. The installation of one or more portable space heaters shall not be used to achieve compliance with this section.

Note: *See Section R301.1.1.1 for limited-density owner-built rural dwellings.*

**SECTION R304
MINIMUM ROOM AREAS**

R304.1 Minimum area. Habitable rooms shall have a floor area of not less than 70 square feet (6.5 m²).

Exception: Kitchens.

R304.2 Minimum dimensions. Habitable rooms shall be not less than 7 feet (2134 mm) in any horizontal dimension.

Exceptions:

1. Kitchens.
2. *Limited-density owner-built rural dwellings. See Section R301.1.1.1.*

R304.3 Height effect on room area. Portions of a room with a sloping ceiling measuring less than 5 feet (1524 mm) or a furred ceiling measuring less than 7 feet (2134 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required habitable area for that room.

**SECTION R305
CEILING HEIGHT**

R305.1 Minimum height. Habitable space, hallways and portions of basements containing these spaces shall have a ceiling height of not less than 7 feet (2134 mm). Bathrooms, toilet rooms and laundry rooms shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exceptions:

1. For rooms with sloped ceilings, the required floor area of the room shall have a ceiling height of not less than 5 feet (1524 mm) and not less than 50 percent of the required floor area shall have a ceiling height of not less than 7 feet (2134 mm).
2. The ceiling height above bathroom and toilet room fixtures shall be such that the fixture is capable of being used for its intended purpose. A shower or tub equipped with a showerhead shall have a ceiling height of not less than 6 feet 8 inches (2032 mm) above an area of not less than 30 inches (762 mm) by 30 inches (762 mm) at the showerhead.
3. Beams, girders, ducts or other obstructions in basements containing habitable space shall be permitted to project to within 6 feet 4 inches (1931 mm) of the finished floor.
4. Beams and girders spaced apart not less than 36 inches (914 mm) in clear finished width shall project not more than 78 inches (1981 mm) from the finished floor.

R305.1.1 Basements. Portions of basements that do not contain habitable space or hallways shall have a ceiling height of not less than 6 feet 8 inches (2032 mm).

Exception: At beams, girders, ducts or other obstructions, the ceiling height shall be not less than 6 feet 4 inches (1931 mm) from the finished floor.

**SECTION R306
SANITATION**

R306.1 Toilet facilities. Every dwelling unit shall be provided with a water closet, lavatory, and a bathtub or shower.

R306.2 Kitchen. Each dwelling unit shall be provided with a kitchen area and every kitchen area shall be provided with a sink.

R306.3 Sewage disposal. Plumbing fixtures shall be connected to a sanitary sewer or to an approved private sewage disposal system.

R306.4 Water supply to fixtures. Plumbing fixtures shall be connected to an approved water supply. Kitchen sinks, lavatories, bathtubs, showers, bidets, laundry tubs and washing machine outlets shall be provided with hot and cold water.

**SECTION R307
TOILET, BATH AND SHOWER SPACES**

R307.1 Space required. Fixtures shall be spaced in accordance with the *California Plumbing Code*. ←

R307.2 Bathtub and shower spaces. Bathtub and shower floors and walls above bathtubs with installed shower heads and in shower compartments shall be finished with a nonabsorbent surface. Such wall surfaces shall extend to a height of not less than 6 feet (1829 mm) above the floor. ←

**SECTION R308
GLAZING**

R308.1 Identification. Except as indicated in Section R308.1.1 each pane of glazing installed in hazardous locations as defined in Section R308.4 shall be provided with a manufacturer's designation specifying who applied the designation, the type of glass and the safety glazing standard with which it complies, and that is visible in the final installation. The designation shall be acid etched, sandblasted, ceramic-fired, laser etched, embossed, or be of a type that once applied cannot be removed without being destroyed. A label shall be permitted in lieu of the manufacturer's designation.

Exceptions:

1. For other than tempered glass, manufacturer's designations are not required provided that the building official approves the use of a certificate, affidavit or other evidence confirming compliance with this code.
2. Tempered spandrel glass is permitted to be identified by the manufacturer with a removable paper designation.

R308.1.1 Identification of multiple assemblies. Multipane assemblies having individual panes not exceeding 1 square foot (0.09 m²) in exposed area shall have not less than one pane in the assembly identified in accordance with Section R308.1. Other panes in the assembly shall be labeled "CPSC 16 CFR 1201" or "ANSI Z97.1" as appropriate.

R308.2 Louvered windows or жалousies. Regular, float, wired or patterned glass in жалousies and louvered windows shall be not less than nominal $\frac{3}{16}$ inch (5 mm) thick and not more than 48 inches (1219 mm) in length. Exposed glass edges shall be smooth.

R308.2.1 Wired glass prohibited. Wired glass with wire exposed on longitudinal edges shall not be used in жалousies or louvered windows.

R308.3 Human impact loads. Individual glazed areas, including glass mirrors in hazardous locations such as those indicated as defined in Section R308.4, shall pass the test requirements of Section R308.3.1.

Exceptions:

1. Louvered windows and жалousies shall comply with Section R308.2.
2. Mirrors and other glass panels mounted or hung on a surface that provides a continuous backing support.
3. Glass unit masonry complying with Section R607.

R308.3.1 Impact test. Where required by other sections of the code, glazing shall be tested in accordance with CPSC 16 CFR 1201. Glazing shall comply with the test criteria for Category II unless otherwise indicated in Table R308.3.1(1).

Exception: Glazing not in doors or enclosures for hot tubs, whirlpools, saunas, steam rooms, bathtubs and showers shall be permitted to be tested in accordance with ANSI Z97.1. Glazing shall comply with the test criteria for Class A unless otherwise indicated in Table R308.3.1(2).

R308.4 Hazardous locations. The locations specified in Sections R308.4.1 through R308.4.7 shall be considered to be specific hazardous locations for the purposes of glazing.

R308.4.1 Glazing in doors. Glazing in fixed and operable panels of swinging, sliding and bifold doors shall be considered to be a hazardous location.

Exceptions:

1. Glazed openings of a size through which a 3-inch-diameter (76 mm) sphere is unable to pass.
2. Decorative glazing.

R308.4.2 Glazing adjacent to doors. Glazing in an individual fixed or operable panel adjacent to a door shall be considered to be a hazardous location where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) above the floor or walking surface and it meets either of the following conditions:

1. Where the glazing is within 24 inches (610 mm) of either side of the door in the plane of the door in a closed position.
2. Where the glazing is on a wall less than 180 degrees (3.14 rad) from the plane of the door in a closed position and within 24 inches (610 mm) of the hinge side of an in-swinging door.

Exceptions:

1. Decorative glazing.
2. Where there is an intervening wall or other permanent barrier between the door and the glazing.
3. Where access through the door is to a closet or storage area 3 feet (914 mm) or less in depth. Glazing in this application shall comply with Section R308.4.3.
4. Glazing that is adjacent to the fixed panel of patio doors.

**TABLE R308.3.1(1)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING CPSC 16 CFR 1201**

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZING IN STORM OR COMBINATION DOORS (Category Class)	GLAZING INDOORS (Category Class)	GLAZED PANELS REGULATED BY SECTION R308.4.3 (Category Class)	GLAZED PANELS REGULATED BY SECTION R308.4.2 (Category Class)	GLAZING INDOORS AND ENCLOSURES REGULATED BY SECTION 308.4.5 (Category Class)	SLIDING GLASS DOORS PATIO TYPE (Category Class)
9 square feet or less	I	I	NR	I	II	II
More than 9 square feet	II	II	II	II	II	II

For SI: 1 square foot = 0.0929 m².

NR = No Requirement.

**TABLE R308.3.1(2)
MINIMUM CATEGORY CLASSIFICATION OF GLAZING USING ANSI Z97.1**

EXPOSED SURFACE AREA OF ONE SIDE OF ONE LITE	GLAZED PANELS REGULATED BY SECTION R308.4.3 (Category Class)	GLAZED PANELS REGULATED BY SECTION R308.4.2 (Category Class)	DOORS AND ENCLOSURES REGULATED BY SECTION R308.4.5 ^a (Category Class)
9 square feet or less	No requirement	B	A
More than 9 square feet	A	A	A

For SI: 1 square foot = 0.0929 m².

a. Use is permitted only by the exception to Section R308.3.1.

R308.4.3 Glazing in windows. Glazing in an individual fixed or operable panel that meets all of the following conditions shall be considered to be a hazardous location:

1. The exposed area of an individual pane is larger than 9 square feet (0.836 m²).
2. The bottom edge of the glazing is less than 18 inches (457 mm) above the floor.
3. The top edge of the glazing is more than 36 inches (914 mm) above the floor.
4. One or more walking surfaces are within 36 inches (914 mm), measured horizontally and in a straight line, of the glazing.

Exceptions:

1. Decorative glazing.
2. Where glazing is adjacent to a walking surface and a horizontal rail is installed 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and have a cross-sectional height of not less than 1½ inches (38 mm).
3. Outboard panes in insulating glass units and other multiple glazed panels where the bottom edge of the glass is 25 feet (7620 mm) or more above grade, a roof, walking surfaces or other horizontal [within 45 degrees (0.79 rad) of horizontal] surface adjacent to the glass exterior.

R308.4.4 Glazing in guards and railings. Glazing in guards and railings, including structural baluster panels and nonstructural in-fill panels, regardless of area or height above a walking surface shall be considered to be a hazardous location.

R308.4.4.1 Structural glass baluster panels. Guards with structural glass baluster panels shall be installed with an attached top rail or handrail. The top rail or handrail shall be supported by not less than three glass baluster panels, or shall be otherwise supported to remain in place should one glass baluster panel fail.

Exception: An attached top rail or handrail is not required where the glass baluster panels are laminated glass with two or more glass plies of equal thickness and of the same glass type.

R308.4.5 Glazing and wet surfaces. Glazing in walls, enclosures or fences containing or adjacent to hot tubs, spas, whirlpools, saunas, steam rooms, bathtubs, showers and indoor or outdoor swimming pools where the bottom exposed edge of the glazing is less than 60 inches (1524 mm) measured vertically above any standing or walking surface shall be considered to be a hazardous location. This shall apply to single glazing and each pane in multiple glazing.

Exception: Glazing that is more than 60 inches (1524 mm), measured horizontally, from the water's edge of a bathtub, hot tub, spa, whirlpool or swimming pool or from the edge of a shower, sauna or steam room.

R308.4.6 Glazing adjacent to stairs and ramps. Glazing where the bottom exposed edge of the glazing is less than 36 inches (914 mm) above the plane of the adjacent walking surface of stairways, landings between flights of stairs and ramps shall be considered to be a hazardous location.

Exceptions:

1. Where glazing is adjacent to a walking surface and a horizontal rail is installed at 34 to 38 inches (864 to 965 mm) above the walking surface. The rail shall be capable of withstanding a horizontal load of 50 pounds per linear foot (730 N/m) without contacting the glass and have a cross-sectional height of not less than 1½ inches (38 mm).
2. Glazing 36 inches (914 mm) or more measured horizontally from the walking surface.

R308.4.7 Glazing adjacent to the bottom stair landing. Glazing adjacent to the landing at the bottom of a stairway where the glazing is less than 36 inches (914 mm) above the landing and within a 60-inch (1524 mm) horizontal arc less than 180 degrees (3.14 rad) from the bottom tread nosing shall be considered to be a hazardous location. (See Figure R308.4.7.)

Exception: Where the glazing is protected by a guard complying with Section R312 and the plane of the glass is more than 18 inches (457 mm) from the guard.

R308.5 Site-built windows. Site-built windows shall comply with Section 2404 of the *California Building Code*.

R308.6 Skylights and sloped glazing. Skylights and sloped glazing shall comply with the following sections.

R308.6.1 Definitions. The following terms are defined in Chapter 2:

SKYLIGHT, UNIT.

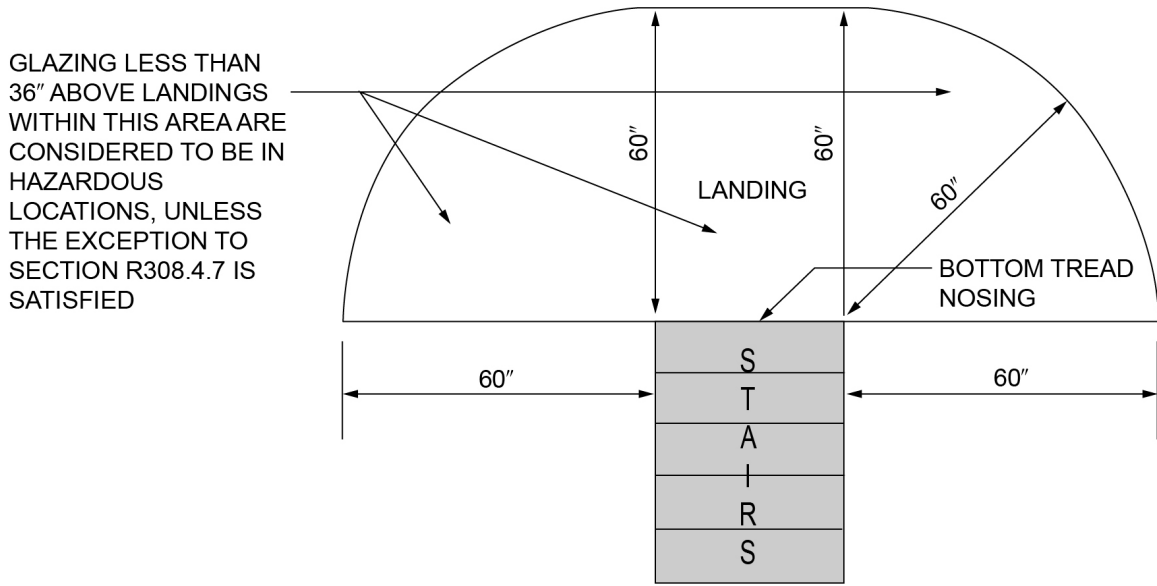
SKYLIGHTS AND SLOPED GLAZING.

TUBULAR DAYLIGHTING DEVICE (TDD).

R308.6.2 Materials. Glazing materials shall be limited to the following:

1. Laminated glass with not less than a 0.015-inch (0.38 mm) polyvinyl butyral interlayer for glass panes 16 square feet (1.5 m²) or less in area located such that the highest point of the glass is not more than 12 feet (3658 mm) above a walking surface; for higher or larger sizes, the interlayer thickness shall be not less than 0.030 inch (0.76 mm).
2. Fully tempered glass.
3. Heat-strengthened glass.
4. Wired glass.
5. Approved rigid plastics.

R308.6.3 Screens, general. For fully tempered or heat-strengthened glass, a broken glass retention screen meeting the requirements of Section R308.6.7 shall be installed below the full area of the glass, except for fully tempered glass that meets Condition 1 or 2 listed in Section R308.6.5.



For SI: 1 inch = 25.4 mm.

FIGURE R308.4.7
HAZARDOUS GLAZING LOCATIONS AT BOTTOM STAIR LANDINGS

R308.6.4 Screens with multiple glazing. Where the inboard pane is fully tempered, heat-strengthened or wired glass, a broken glass retention screen meeting the requirements of Section R308.6.7 shall be installed below the full area of the glass, except for Condition 1 or 2 listed in Section R308.6.5. Other panes in the multiple glazing shall be of any type listed in Section R308.6.2.

R308.6.5 Screens not required. Screens shall not be required where laminated glass complying with Item 1 of Section R308.6.2 is used as single glazing or the inboard pane in multiple glazing. Screens shall not be required where fully tempered glass is used as single glazing or the inboard pane in multiple glazing and either of the following conditions is met:

1. The glass area is 16 square feet (1.49 m²) or less; the highest point of glass is not more than 12 feet (3658 mm) above a walking surface; the nominal glass thickness is not more than ³/₁₆ inch (4.8 mm); and for multiple glazing only the other pane or panes are fully tempered, laminated or wired glass.
2. The glass area is greater than 16 square feet (1.49 m²); the glass is sloped 30 degrees (0.52 rad) or less from vertical; and the highest point of glass is not more than 10 feet (3048 mm) above a walking surface.

R308.6.6 Glass in greenhouses. Any glazing material is permitted to be installed without screening in the sloped areas of greenhouses, provided that the greenhouse height at the ridge does not exceed 20 feet (6096 mm) above grade.

R308.6.7 Screen characteristics. The screen and its fastenings shall: be capable of supporting twice the weight

of the glazing; be firmly and substantially fastened to the framing members; be installed within 4 inches (102 mm) of the glass; and have a mesh opening of not greater than 1 inch by 1 inch (25 mm by 25 mm).

R308.6.8 Curbs for skylights. Unit skylights installed in a roof with a pitch of less than three units vertical in 12 units horizontal (25-percent slope) shall be mounted on a curb extending not less than 4 inches (102 mm) above the plane of the roof, unless otherwise specified in the manufacturer’s installation instructions.

R308.6.9 Testing and labeling. Unit skylights and tubular daylighting devices shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance grade rating and approved inspection agency to indicate compliance with the requirements of AAMA/WDMA/CSA 101/I.S.2/A440.

R308.6.9.1 Comparative analysis for glass-glazed unit skylights. Structural wind load design pressures for glass-glazed unit skylights different than the size tested in accordance with Section R308.6.9 shall be permitted to be different than the design value of the tested unit where determined in accordance with one of the following comparative analysis methods:

1. Structural wind load design pressures for glass-glazed unit skylights smaller than the size tested in accordance with Section R308.6.9 shall be permitted to be higher than the design value of the tested unit provided that such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Such calculated design pressures shall be validated by an additional test

of the glass-glazed unit skylight having the highest allowable design pressure.

2. In accordance with WDMA I.S.11.

SECTION R309 GARAGES AND CARPORTS

R309.1 Floor surface. Garage floor surfaces shall be of approved noncombustible material.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

R309.2 Carports. Carports shall be open on not less than two sides. Carport floor surfaces shall be of approved noncombustible material. Carports not open on two or more sides shall be considered to be a garage and shall comply with the provisions of this section for garages.

The area of floor used for parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway.

Exception: Asphalt surfaces shall be permitted at ground level in carports.

R309.3 Flood hazard areas. Garages and carports located in flood hazard areas as established by Table R301.2 shall be constructed in accordance with Section R322.

R309.4 Automatic garage door openers. Automatic garage door openers, if provided, shall be listed and labeled in accordance with UL 325. See *Health and Safety Code Sections 19890, 19891 and 19892 for additional provisions for residential garage door openers.*

R309.5 Fire sprinklers location on property. Private garages shall be protected by fire sprinklers where the garage wall has been designed based on Table R302.1(2), Note a. Sprinklers in garages shall be connected to an automatic sprinkler system that complies with Section R313. Garage sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a density of 0.05 gpm/ft². Garage doors shall not be considered obstructions with respect to sprinkler placement.

R309.6 Fire sprinklers, attached garages and carports with habitable space above. Attached garages and carports with habitable space above shall be protected by fire sprinklers in accordance with this section and Section R313. Protection shall be provided in accordance with one of the following:

1. Residential sprinklers installed in accordance with their listing.
2. Extended coverage sprinklers discharging water not less than their listed flow rate for Light Hazard in accordance with NFPA 13.
3. Quick-response spray sprinklers at light hazard spacing in accordance with NFPA 13 designed to discharge at 0.05 gpm/ft² density (minimum).

The system demand shall be permitted to be limited to the number of sprinklers in the compartment but shall not exceed two sprinklers for hydraulic calculation purposes. Garage

doors shall not be considered obstructions and shall be permitted to be ignored for placement and calculation of sprinklers.

Exception: An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing carports and/or garages that do not have an automatic residential fire sprinkler system installed in accordance with this section.

R309.7 Extension garage door springs. Every extension garage door spring sold or offered for sale, whether new or sold as a replacement, or installed in any garage or carport which is accessory to a dwelling covered by this code, shall conform to the requirements for garage door springs located in Section 1210 of the California Building Code.

R309.8 Electric vehicle (EV) charging infrastructure. Newly constructed one- and two-family dwellings and townhouses with attached private garages shall comply with EV infrastructure requirements in accordance with the California Green Building Standards Code, Chapter 4, Division 4.1.

SECTION R310 EMERGENCY ESCAPE AND RESCUE OPENINGS

R310.1 Emergency escape and rescue opening required. Basements, habitable attics and every sleeping room shall have not less than one operable emergency escape and rescue opening. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in each sleeping room. Emergency escape and rescue openings shall open directly into a public way.

Exceptions [SFM]:

1. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
2. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior egress balcony that opens to a public way.
3. Basements without habitable spaces and having not more than 200 square feet (18.6 m²) in floor area shall not be required to have emergency escape and rescue openings.
4. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
5. Where the dwelling unit or townhouse unit is equipped with an automatic sprinkler system installed in accordance with Section R313, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 5.1. One means of egress complying with Section R311 and one emergency escape and rescue opening.
 - 5.2. Two means of egress complying with Section R311.

R310.1.1 Operational constraints and opening control devices. Emergency escape and rescue openings shall be *maintained free of any obstructions other than those allowed by this section and shall be operational* from the inside of the room without the use of keys, tools or special knowledge. Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening and shall be not more than 70 inches (178 cm) above the finished floor. *The release mechanism shall be maintained operable at all times.*

Such bars, grills, grates or any similar devices shall be equipped with an approved exterior release device for use by the fire department only when required by the authority having jurisdiction.

Where security bars (burglar bars) are installed on emergency egress and rescue windows or doors, on or after July 1, 2000, such devices shall comply with California Building Standards Code, Part 12, Chapter 12-3 and other applicable provisions of this code.

R310.2 Emergency escape and rescue openings. Emergency escape and rescue openings shall have minimum dimensions in accordance with Sections R310.2.1 through R310.2.4.

R310.2.1 Minimum size. Emergency escape and rescue openings shall have a net clear opening of not less than 5.7 square feet (0.530 m²).

Exception: The minimum net clear opening for grade-floor emergency escape and rescue openings shall be 5 square feet (0.465 m²).

R310.2.2 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

R310.2.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) *measured from the floor.*

R310.2.4 Emergency escape and rescue openings under decks, porches and cantilevers. Emergency escape and rescue openings installed under decks, porches and cantilevers shall be fully openable and provide a path not less than 36 inches (914 mm) in height and 36 inches (914 mm) in width to a yard or court.

R310.3 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be a side-hinged door or a sliding door.

R310.4 Area wells. An emergency escape and rescue opening where the bottom of the clear opening is below the adjacent grade shall be provided with an area well in accordance with Sections R310.4.1 through R310.4.4.

R310.4.1 Minimum size. The horizontal area of the area well shall be not less than 9 square feet (0.9 m²), with a

horizontal projection and width of not less than 36 inches (914 mm). The size of the area well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section R310.4.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

R310.4.2 Ladder and steps. Area wells with a vertical depth greater than 44 inches (1118 mm) shall be equipped with an approved, permanently affixed ladder or steps. The ladder or steps shall not be obstructed by the emergency escape and rescue opening where the window or door is in the open position. Ladders or steps required by this section shall not be required to comply with Section R311.7.

R310.4.2.1 Ladders. Ladders and rungs shall have an inside width of not less than 12 inches (305 mm), shall project not less than 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center vertically for the full height of the area well.

R310.4.2.2 Steps. Steps shall have an inside width of not less than 12 inches (305 mm), a minimum tread depth of 5 inches (127 mm) and a maximum riser height of 18 inches (457 mm) for the full height of the area well.

R310.4.3 Drainage. Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section R405.1.

Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, as detailed in Table R405.1.

R310.4.4 Bars, grilles, covers and screens. Where bars, grilles, covers, screens or similar devices are placed over emergency escape and rescue openings, bulkhead enclosures or area wells that serve such openings, the minimum net clear opening size shall comply with Sections R310.2 through R310.2.2 and R310.4.1. Such devices shall be releasable or removable from the inside without the use of a key or tool or force greater than that required for the normal operation of the escape and rescue opening. *The release mechanism shall be maintained operable at all times.*

Such bars, grills, grates or any similar devices shall be equipped with an approved exterior release device for use by the fire department only when required by the authority having jurisdiction.

Where security bars (burglar bars) are installed on emergency egress and rescue windows or doors, on or after July 1, 2000, such devices shall comply with California Building Standards Code, Part 12, Chapter 12-3 and other applicable provisions of this code.

R310.5 Replacement windows for emergency escape and rescue openings. Replacement windows installed in buildings meeting the scope of this code shall be exempt from

Sections R310.2 and R310.4.4, provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window is of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. The replacement window is not part of a change of occupancy.

R310.6 Dwelling additions. Where dwelling additions contain sleeping rooms, an emergency escape and rescue opening shall be provided in each new sleeping room. Where dwelling additions have basements, an emergency escape and rescue opening shall be provided in the new basement.

Exceptions:

1. An emergency escape and rescue opening is not required in a new basement that contains a sleeping room with an emergency escape and rescue opening.
2. An emergency escape and rescue opening is not required in a new basement where there is an emergency escape and rescue opening in an existing basement that is accessed from the new basement.
3. An operable window complying with Section 310.7.1 shall be acceptable as an emergency escape and rescue opening.

R310.7 Alterations or repairs of existing basements. New sleeping rooms created in an existing basement shall be provided with emergency escape and rescue openings in accordance with Section R310.1. Other than new sleeping rooms, where existing basements undergo alterations or repairs, an emergency escape and rescue opening is not required.

Exception: An operable window complying with Section 310.7.1 shall be acceptable as an emergency escape and rescue opening.

R310.7.1 Existing emergency escape and rescue openings. Where a change of occupancy would require an emergency escape and rescue opening in accordance with Section 310.1, operable windows serving as the emergency escape and rescue opening shall comply with the following:

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m²) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
 - 2.1. The replacement window meets the size requirements in Item 1.
 - 2.2. The replacement window is the manufacturer's largest standard-size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operat-

ing style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

SECTION R311 MEANS OF EGRESS

R311.1 Means of egress. Dwellings shall be provided with a means of egress in accordance with this section. The means of egress shall provide a continuous and unobstructed path of vertical and horizontal egress travel from all portions of the dwelling to the required egress door without requiring travel through a garage. The required egress door shall open directly into a public way or to a yard or court that opens to a public way.

R311.2 Egress door. Not less than one egress door shall be provided for each dwelling unit. The egress door shall be side-hinged, and shall provide a clear width of not less than 32 inches (813 mm) where measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). The clear height of the door opening shall be not less than 78 inches (1981 mm) in height measured from the top of the threshold to the bottom of the stop. Other doors shall not be required to comply with these minimum dimensions. Egress doors shall be readily openable from inside the dwelling without the use of a key or special knowledge or effort.

R311.3 Floors and landings at exterior doors. There shall be a landing or floor on each side of each exterior door. The width of each landing shall be not less than the door served. Landings shall have a dimension of not less than 36 inches (914 mm) measured in the direction of travel. The slope at exterior landings shall not exceed $\frac{1}{4}$ unit vertical in 12 units horizontal (2 percent).

Exception: Exterior balconies less than 60 square feet (5.6 m²) and only accessed from a door are permitted to have a landing that is less than 36 inches (914 mm) measured in the direction of travel.

R311.3.1 Floor elevations at the required egress doors. Landings or finished floors at the required egress door shall be not more than $1\frac{1}{2}$ inches (38 mm) lower than the top of the threshold.

Exception: The landing or floor on the exterior side shall be not more than $7\frac{3}{4}$ inches (196 mm) below the top of the threshold provided that the door does not swing over the landing or floor.

Where exterior landings or floors serving the required egress door are not at grade, they shall be provided with access to grade by means of a ramp in accordance with Section R311.8 or a stairway in accordance with Section R311.7.

R311.3.2 Floor elevations at other exterior doors. Doors other than the required egress door shall be provided with landings or floors not more than $7\frac{3}{4}$ inches (196 mm) below the top of the threshold.

Exception: A top landing is not required where a stairway of not more than two risers is located on the

exterior side of the door, provided that the door does not swing over the stairway.

R311.3.3 Storm and screen doors. Storm and screen doors shall be permitted to swing over exterior stairs and landings.

R311.4 Vertical egress. Egress from habitable levels including habitable attics and basements that are not provided with an egress door in accordance with Section R311.2 shall be by *one or more ramps* in accordance with Section R311.8 or *one or more stairways* in accordance with Section R311.7 or both. *For habitable levels or basements located more than one story above or more than one story below an egress door, the maximum travel distance from any occupied point to a stairway or ramp that provides egress from such habitable level or basement, shall not exceed 50 feet (15 240 mm).*

R311.5 Landing, deck, balcony and stair construction and attachment. Exterior landings, decks, balconies, stairs and similar facilities shall be positively anchored to the primary structure to resist both vertical and lateral forces or shall be designed to be self-supporting. Attachment shall not be accomplished by use of toenails or nails subject to withdrawal.

R311.6 Hallways. The width of a hallway shall be not less than 3 feet (914 mm).

R311.7 Stairways. Where required by this code or provided, stairways shall comply with this section.

Exceptions:

1. Stairways not within or serving a building, porch or deck.
2. Stairways leading to nonhabitable attics.
3. Stairways leading to crawl spaces.

R311.7.1 Width. Stairways shall be not less than 36 inches (914 mm) in clear width at all points above the permitted handrail height and below the required headroom height. The clear width of stairways at and below the handrail height, including treads and landings, shall be not less than 31½ inches (787 mm) where a handrail is installed on one side and 27 inches (698 mm) where handrails are installed on both sides.

Exception: The width of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.2 Headroom. The headroom in stairways shall be not less than 6 feet 8 inches (2032 mm) measured vertically from the sloped line adjoining the tread nosing or from the floor surface of the landing or platform on that portion of the stairway.

Exceptions:

1. Where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall not project horizontally into the required headroom more than 4¾ inches (121 mm).
2. The headroom for spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.3 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet 7 inches (3835 mm) between floor levels or landings.

R311.7.4 Walkline. The walkline across winder treads and landings shall be concentric to the turn and parallel to the direction of travel entering and exiting the turn. The walkline shall be located 12 inches (305 mm) from the inside of the turn. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface. Where winders are adjacent within a flight, the point of the widest clear stair width of the adjacent winders shall be used.

R311.7.5 Stair treads and risers. Stair treads and risers shall meet the requirements of this section. For the purposes of this section, dimensions and dimensioned surfaces shall be exclusive of carpets, rugs or runners.

R311.7.5.1 Risers. The riser height shall be not more than 7¾ inches (196 mm). The riser height shall be measured vertically between leading edges of the adjacent treads. The greatest riser height within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm). Risers shall be vertical or sloped from the underside of the nosing of the tread above at an angle not more than 30 degrees (0.51 rad) from the vertical. At open risers, openings located more than 30 inches (762 mm), as measured vertically, to the floor or grade below shall not permit the passage of a 4-inch-diameter (102 mm) sphere.

Exceptions:

1. The opening between adjacent treads is not limited on spiral stairways.
2. The riser height of spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.2 Treads. The tread depth shall be not less than 10 inches (254 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's leading edge. The greatest tread depth within any flight of stairs shall not exceed the smallest by more than ¾ inch (9.5 mm).

R311.7.5.2.1 Winder treads. Winder treads shall have a tread depth of not less than 10 inches (254 mm) measured between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline. Winder treads shall have a tread depth of not less than 6 inches (152 mm) at any point within the clear width of the stair. Within any flight of stairs, the largest winder tread depth at the walkline shall not exceed the smallest winder tread by more than ¾ inch (9.5 mm). Consistently shaped winders at the walkline shall be allowed within the same flight of stairs as rectangular treads and shall not be required to be within ¾ inch (9.5 mm) of the rectangular tread depth.

Exception: The tread depth at spiral stairways shall be in accordance with Section R311.7.10.1.

R311.7.5.3 Nosings. Nosings at treads, landings and floors of stairways shall have a radius of curvature at the nosing not greater than $\frac{9}{16}$ inch (14 mm) or a bevel not greater than $\frac{1}{2}$ inch (12.7 mm). A nosing projection not less than $\frac{3}{4}$ inch (19 mm) and not more than $1\frac{1}{4}$ inches (32 mm) shall be provided on stairways. The greatest nosing projection shall not exceed the smallest nosing projection by more than $\frac{3}{8}$ inch (9.5 mm) within a stairway.

Exception: A nosing projection is not required where the tread depth is not less than 11 inches (279 mm).

R311.7.5.4 Exterior plastic composite stair treads. Plastic composite exterior stair treads shall comply with the provisions of this section and Section R507.2.2.

R311.7.6 Landings for stairways. There shall be a floor or landing at the top and bottom of each stairway. The width perpendicular to the direction of travel shall be not less than the width of the flight served. For landings of shapes other than square or rectangular, the depth at the walk line and the total area shall be not less than that of a quarter circle with a radius equal to the required landing width. Where the stairway has a straight run, the depth in the direction of travel shall be not less than 36 inches (914 mm).

Exception: A floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided that a door does not swing over the stairs.

R311.7.7 Stairway walking surface. The walking surface of treads and landings of stairways shall be sloped not steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

Exception: Where the surface of a landing is required elsewhere in the code to drain surface water, the walking surface of the landing shall be sloped not steeper than 1 unit vertical in 20 units horizontal (5-percent slope) in the direction of travel.

R311.7.8 Handrails. Handrails shall be provided on not less than one side of each flight of stairs with four or more risers.

R311.7.8.1 Height. Handrail height, measured vertically from the sloped plane adjoining the tread nosing, or finish surface of ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

Exceptions:

1. The use of a volute, turnout or starting easing shall be allowed over the lowest tread.
2. Where handrail fittings or bendings are used to provide continuous transition between flights, transitions at winder treads, the transition from handrail to guard, or used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed 38 inches (965 mm).

R311.7.8.2 Handrail projection. Handrails shall not project more than $4\frac{1}{2}$ inches (114 mm) on either side of the stairway.

Exception: Where nosings of landings, floors or passing flights project into the stairway reducing the clearance at passing handrails, handrails shall project not more than $6\frac{1}{2}$ inches (165 mm) into the stairway, provided that the stair width and handrail clearance are not reduced to less than that required.

R311.7.8.3 Handrail clearance. Handrails adjacent to a wall shall have a space of not less than $1\frac{1}{2}$ inches (38 mm) between the wall and the handrails.

R311.7.8.4 Continuity. Handrails shall be continuous for the full length of the flight, from a point directly above the top riser of the flight to a point directly above the lowest riser of the flight. Handrail ends shall be returned toward a wall, guard walking surface continuous to itself, or terminate to a post.

Exceptions:

1. Handrail continuity shall be permitted to be interrupted by a newel post at a turn in a flight with winders, at a landing, or over the lowest tread.
2. A volute, turnout or starting easing shall be allowed to terminate over the lowest tread and over the top landing.

R311.7.8.5 Grip size. Required handrails shall be of one of the following types or provide equivalent graspability.

1. Type I. Handrails with a circular cross section shall have an outside diameter of not less than $1\frac{1}{4}$ inches (32 mm) and not greater than 2 inches (51 mm). If the handrail is not circular, it shall have a perimeter of not less than 4 inches (102 mm) and not greater than $6\frac{1}{4}$ inches (160 mm) and a cross section of not more than $2\frac{1}{4}$ inches (57 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).
2. Type II. Handrails with a perimeter greater than $6\frac{1}{4}$ inches (160 mm) shall have a graspable finger recess area on both sides of the profile. The finger recess shall begin within $\frac{3}{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and have a depth of not less than $\frac{5}{16}$ inch (8 mm) within $\frac{7}{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $\frac{3}{8}$ inch (10 mm) to a level that is not less than $1\frac{3}{4}$ inches (45 mm) below the tallest portion of the profile. The width of the handrail above the recess shall be not less than $1\frac{1}{4}$ inches (32 mm) and not more than $2\frac{3}{4}$ inches (70 mm). Edges shall have a radius of not less than 0.01 inch (0.25 mm).

R311.7.8.6 Exterior plastic composite handrails. Plastic composite exterior handrails shall comply with the requirements of Section R507.2.2.

R311.7.9 Illumination. Stairways shall be provided with illumination in accordance with Sections R303.7 and R303.8.

R311.7.10 Special stairways. Spiral stairways and bulkhead enclosure stairways shall comply with the requirements of Section R311.7 except as specified in Sections R311.7.10.1 and R311.7.10.2.

R311.7.10.1 Spiral stairways. The clear width at and below the handrails at spiral stairways shall be not less than 26 inches (660 mm) and the walkline radius shall be not greater than 24½ inches (622 mm). Each tread shall have a depth of not less than 6¾ inches (171 mm) at the walkline. Treads shall be identical, and the rise shall be not more than 9½ inches (241 mm). Headroom shall be not less than 6 feet 6 inches (1982 mm).

R311.7.10.2 Bulkhead enclosure stairways. Stairways serving bulkhead enclosures, not part of the required building egress, providing access from the outside grade level to the basement shall be exempt from the requirements of Sections R311.3 and R311.7 where the height from the basement finished floor level to grade adjacent to the stairway is not more than 8 feet (2438 mm) and the grade level opening to the stairway is covered by a bulkhead enclosure with hinged doors or other approved means.

R311.7.11 Alternating tread devices. Alternating tread devices shall not be used as an element of a means of egress. Alternating tread devices shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).

Exception: Alternating tread devices are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m²) or less where such devices do not provide exclusive access to a kitchen or bathroom.

R311.7.11.1 Treads of alternating tread devices. Alternating tread devices shall have a tread depth of not less than 5 inches (127 mm), a projected tread depth of not less than 8½ inches (216 mm), a tread width of not less than 7 inches (178 mm) and a riser height of not more than 9½ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

R311.7.11.2 Handrails of alternating tread devices. Handrails shall be provided on both sides of alternating tread devices and shall comply with Sections R311.7.8.2 through R311.7.8.6. Handrail height shall

be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

R311.7.12 Ship's ladders. Ship's ladders shall not be used as an element of a means of egress. Ship's ladders shall be permitted provided that a required means of egress stairway or ramp serves the same space at each adjoining level or where a means of egress is not required. The clear width at and below the handrails shall be not less than 20 inches (508 mm).

Exception: Ship's ladders are allowed to be used as an element of a means of egress for lofts, mezzanines and similar areas of 200 gross square feet (18.6 m²) or less that do not provide exclusive access to a kitchen or bathroom.

R311.7.12.1 Treads of ship's ladders. Treads shall have a depth of not less than 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is not less than 8½ inches (216 mm). The riser height shall be not more than 9½ inches (241 mm).

R311.7.12.2 Handrails of ship's ladders. Handrails shall be provided on both sides of ship's ladders and shall comply with Sections R311.7.8.2 through R311.7.8.6. Handrail height shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

R311.8 Ramps. Where required by this code or provided, ramps shall comply with this section.

Exception: Ramps not within or serving a building, porch or deck.

R311.8.1 Maximum slope. Ramps serving the egress door required by Section R311.2 shall have a slope of not more than 1 unit vertical in 12 units horizontal (8.3-percent slope).

Other ramps shall have a maximum slope of 1 unit vertical in 8 units horizontal (12.5 percent).

Exception: Where it is technically infeasible to comply because of site constraints, ramps shall have a slope of not more than 1 unit vertical in 8 units horizontal (12.5 percent).

R311.8.2 Landings required. There shall be a floor or landing at the top and bottom of each ramp, where doors open onto ramps, and where ramps change directions. The width of the landing perpendicular to the ramp slope shall be not less than the width of the ramp. The depth of the landing in the direction of the ramp slope shall be not less than 36 inches (914 mm).

R311.8.3 Handrails required. Handrails shall be provided on not less than one side of ramps exceeding a slope of 1 unit vertical in 12 units horizontal (8.33-percent slope).

R311.8.3.1 Height. Handrail height, measured above the finished surface of the ramp slope, shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm).

R311.8.3.2 Grip size. Handrails on ramps shall comply with Section R311.7.8.5.

R311.8.3.3 Continuity. Handrails where required on ramps shall be continuous for the full length of the ramp. Handrail ends shall be returned or shall terminate in newel posts or safety terminals. Handrails adjacent to a wall shall have a space of not less than 1½ inches (38 mm) between the wall and the handrails.

SECTION R312 GUARDS AND WINDOW FALL PROTECTION

R312.1 Guards. Guards shall be provided in accordance with Sections R312.1.1 through R312.1.4.

R312.1.1 Where required. Guards shall be provided for those portions of open-sided walking surfaces, including floors, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Insect screening shall not be considered as a guard.

R312.1.2 Height. Required guards at open-sided walking surfaces, including stairs, porches, balconies or landings, shall be not less than 42 inches (1067 mm) in height as measured vertically above the adjacent walking surface or the line connecting the nosings.

Exceptions:

1. Guards on the open sides of stairs shall have a height of not less than 34 inches (864 mm) measured vertically from a line connecting the nosings.
2. Where the top of the guard serves as a handrail on the open sides of stairs, the top of the guard shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) as measured vertically from a line connecting the nosings.

R312.1.3 Opening limitations. Required guards shall not have openings from the walking surface to the required guard height that allow passage of a sphere 4 inches (102 mm) in diameter.

Exceptions:

1. The triangular openings at the open side of stair, formed by the riser, tread and bottom rail of a guard, shall not allow passage of a sphere 6 inches (153 mm) in diameter.
2. Guards on the open side of stairs shall not have openings that allow passage of a sphere 4¾ inches (111 mm) in diameter.

R312.1.4 Exterior plastic composite guards. Plastic composite exterior guards shall comply with the requirements of Section R317.4.

R312.2 Window fall protection. Window fall protection shall be provided in accordance with Sections R312.2.1 and R312.2.2.

R312.2.1 Window opening height. In dwelling units, where the bottom of the clear opening of an operable

window opening is located less than 24 inches (610 mm) above the finished floor and greater than 72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, the operable window shall comply with one of the following:

1. Operable window openings will not allow a 4-inch-diameter (102 mm) sphere to pass through where the openings are in their largest opened position.
2. Operable windows are provided with window opening control devices or fall prevention devices that comply with ASTM F2090.

R312.2.2 Emergency escape and rescue openings. Where an operable window serves as an emergency escape and rescue opening, a window opening control device or fall prevention device, after operation to release the control device or fall prevention device allowing the window to fully open, shall not reduce the net clear opening area of the window unit to less than the area required by Sections R310.2.1 and R310.2.2.

SECTION R313 AUTOMATIC FIRE SPRINKLER SYSTEMS

R313.1 Townhouse automatic fire sprinkler systems. An automatic sprinkler system shall be installed in townhouses.

Exception: An automatic sprinkler system shall not be required where additions or alterations are made to existing townhouses that do not have an automatic sprinkler system installed.

R313.1.1 Design and installation. Automatic sprinkler systems for townhouses shall be designed and installed in accordance with Section R313 or NFPA 13D.

R313.2 One- and two-family dwellings automatic sprinkler systems. An automatic sprinkler system shall be installed in one- and two-family dwellings.

Exceptions:

1. An automatic residential fire sprinkler system shall not be required for additions or alterations to existing buildings that are not already provided with an automatic residential sprinkler system.
2. *Accessory Dwelling Unit, provided that all of the following are met:*
 - 2.1. *The unit meets the definition of an Accessory Dwelling Unit as defined in the Government Code Section 65852.2.*
 - 2.2. *The existing primary residence does not have automatic fire sprinklers.*
 - 2.3. *The accessory detached dwelling unit does not exceed 1,200 square feet in size.*
 - 2.4. *The unit is on the same lot as the primary residence.*

R313.2.1 Design and installation. Automatic sprinkler systems shall be designed and installed in accordance with Section R313 or NFPA 13D.

R313.3 Dwelling unit fire sprinkler systems.

R313.3.1 General. The design and installation of residential fire sprinkler systems shall be in accordance with NFPA 13D or Section R313.3, which shall be considered equivalent to NFPA 13D. Partial residential sprinkler systems shall be permitted to be installed only in buildings not required to be equipped with a residential sprinkler system. Section R313.3 shall apply to stand-alone and multipurpose wet-pipe sprinkler systems that do not include the use of antifreeze. A multipurpose fire sprinkler system shall supply domestic water to both fire sprinklers and plumbing fixtures. A stand-alone sprinkler system shall be separate and independent from the water distribution system.

R313.3.1.1 Backflow protection. A backflow preventer shall not be required to separate a sprinkler system from the water distribution system, provided that:

1. The system complies with NFPA 13D or Section R313;
2. Piping materials are suitable for potable water in accordance with the California Plumbing Code; and
3. The system does not contain antifreeze or have a fire department connection.

R313.3.1.2 Required sprinkler locations. Sprinklers shall be installed to protect all areas of a dwelling unit.

Exceptions:

1. Attics, crawl spaces and normally unoccupied concealed spaces that do not contain fuel-fired appliances do not require sprinklers. In attics, crawl spaces and normally unoccupied concealed spaces that contain fuel-fired equipment, a sprinkler shall be installed above the equipment; however, sprinklers shall not be required in the remainder of the space.
2. Clothes closets, linen closets and pantries not exceeding 24 square feet (2.2 m²) in area, with the smallest dimension not greater than 3 feet (915 mm) and having wall and ceiling surfaces of gypsum board.
3. Bathrooms not more than 55 square feet (5.1 m²) in area.
4. Detached garages; carports with no habitable space above; open attached porches; unheated entry areas, such as mud rooms, that are adjacent to an exterior door; and similar areas.

R313.3.2 Sprinklers. Sprinklers shall be new listed residential sprinklers and shall be installed in accordance with the sprinkler manufacturer’s installation instructions.

R313.3.2.1 Temperature rating and separation from heat sources. Except as provided for in Section R313.3.2.2, sprinklers shall have a temperature rating of not less than 135°F (57°C) and not more than 225°F (107°C). Sprinklers shall be separated from heat

sources as required by the sprinkler manufacturer’s installation instructions.

R313.3.2.2 Intermediate temperature sprinklers. Sprinklers shall have an intermediate temperature rating not less than 175°F (79°C) and not more than 225°F (107°C) where installed in the following locations:

1. Directly under skylights, where the sprinkler is exposed to direct sunlight.
2. In attics.
3. In concealed spaces located directly beneath a roof.
4. Within the distance to a heat source as specified in Table R313.3.2.2.

R313.3.2.3 Freezing areas. Piping shall be protected from freezing as required by the California Plumbing Code or by using one of the following:

1. A dry-pipe automatic sprinkler system that is listed for residential occupancy applications.
2. Dry-sidewall or dry-pendent sprinklers extending from a nonfreezing area into a freezing area.
3. Where fire sprinkler piping cannot be adequately protected against freezing, the system shall be designed and installed in accordance with NFPA 13D.

**TABLE R313.3.2.2
LOCATIONS WHERE INTERMEDIATE
TEMPERATURE SPRINKLERS ARE REQUIRED**

HEAT SOURCE	RANGE OF DISTANCE FROM HEAT SOURCE WITHIN WHICH INTERMEDIATE TEMPERATURE SPRINKLERS ARE REQUIRED ^{a, b} (inches)
Coal and wood burning stove	12 to 42
Fireplace, front of recessed fireplace	36 to 60
Fireplace, side of open or recessed fireplace	12 to 36
Front of wall-mounted warm-air register	18 to 36
Heating duct, not insulated	9 to 18
Hot water pipe, not insulated	6 to 12
Kitchen range top	9 to 18
Luminaire up to 250 watts	3 to 6
Luminaire 250 watts up to 499 watts	6 to 12
Oven	9 to 18
Side of ceiling or wall warm-air register	12 to 24
Vent connector or chimney connector	9 to 18
Water heater, furnace or boiler	3 to 6

For SI: 1 inch = 25.4 mm.

- a. Sprinklers shall not be located at distances less than the minimum table distance unless the sprinkler listing allows a lesser distance.
- b. Distances shall be measured in a straight line from the nearest edge of the heat source to the nearest edge of the sprinkler.

R313.3.2.4 Sprinkler coverage. Sprinkler coverage requirements and sprinkler obstruction requirements shall be in accordance with Sections *R313.3.2.4.1* and *R313.3.2.4.2*.

R313.3.2.4.1 Coverage area limit. The area of coverage of a single sprinkler shall not exceed 400 square feet (37 m²) and shall be based on the sprinkler listing and the sprinkler manufacturer's installation instructions.

R313.3.2.4.2 Obstructions to coverage. Sprinkler discharge shall not be blocked by obstructions unless additional sprinklers are installed to protect the obstructed area. Additional sprinklers shall not be required where the sprinkler separation from obstructions complies with either the minimum distance indicated in Figure *R313.3.2.4.2* or the minimum distances specified in the sprinkler manufacturer's instructions where the manufacturer's instructions permit a lesser distance.

R313.3.2.4.2.1 Additional requirements for pendent sprinklers. Pendent sprinklers within 3 feet (915 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be installed.

R313.3.2.4.2.2 Additional requirements for sidewall sprinklers. Sidewall sprinklers within 5 feet (1524 mm) of the center of a ceiling fan, surface-mounted ceiling luminaire or similar object shall be considered to be obstructed, and additional sprinklers shall be installed.

R313.3.2.5 Sprinkler installation on systems assembled with solvent cement. The solvent cementing of threaded adapter fittings shall be completed and threaded adapters for sprinklers shall be verified as being clear of excess cement prior to the installation of sprinklers on systems assembled with solvent cement.

R313.3.2.6 Sprinkler modifications prohibited. Painting, caulking or modifying of sprinklers shall be prohibited. Sprinklers that have been painted, caulked, modified or damaged shall be replaced with new sprinklers.

R313.3.3 Sprinkler piping system. Sprinkler piping shall be supported in accordance with the requirements for cold water distribution piping. Sprinkler piping shall comply with all requirements for cold water distribution piping. For multipurpose piping systems, the sprinkler piping shall connect to and be a part of the cold water distribution piping system.

Exception: For plastic piping, it shall be permissible to follow the manufacturer's installation instructions.

R313.3.3.1 Nonmetallic pipe and tubing. Nonmetallic pipe and tubing, such as CPVC, PEX, and PE-RT shall be listed for use in residential fire sprinkler systems.

R313.3.3.1.1 Nonmetallic pipe protection. Nonmetallic pipe and tubing systems shall be protected from exposure to the living space by a layer of not

less than $\frac{3}{8}$ inch (9.5 mm) thick gypsum wallboard, $\frac{1}{2}$ inch thick plywood (13 mm), or other material having a 15-minute fire rating.

Exceptions:

1. Pipe protection shall not be required in areas that do not require protection with sprinklers as specified in Section *R313.3.1.2*.
2. Pipe protection shall not be required where exposed piping is permitted by the pipe listing.

R313.3.3.2 Shutoff valves prohibited. With the exception of shutoff valves for the entire water distribution system or a single master control valve for the automatic sprinkler system that is locked in the open position, valves shall not be installed in any location where the valve would isolate piping serving one or more sprinklers.

R313.3.3.3 Single dwelling limit. Piping beyond the service valve located at the beginning of the water distribution system shall not serve more than one dwelling.

R313.3.3.4 Drain. A means to drain the sprinkler system shall be provided on the system side of the water distribution shutoff valve.

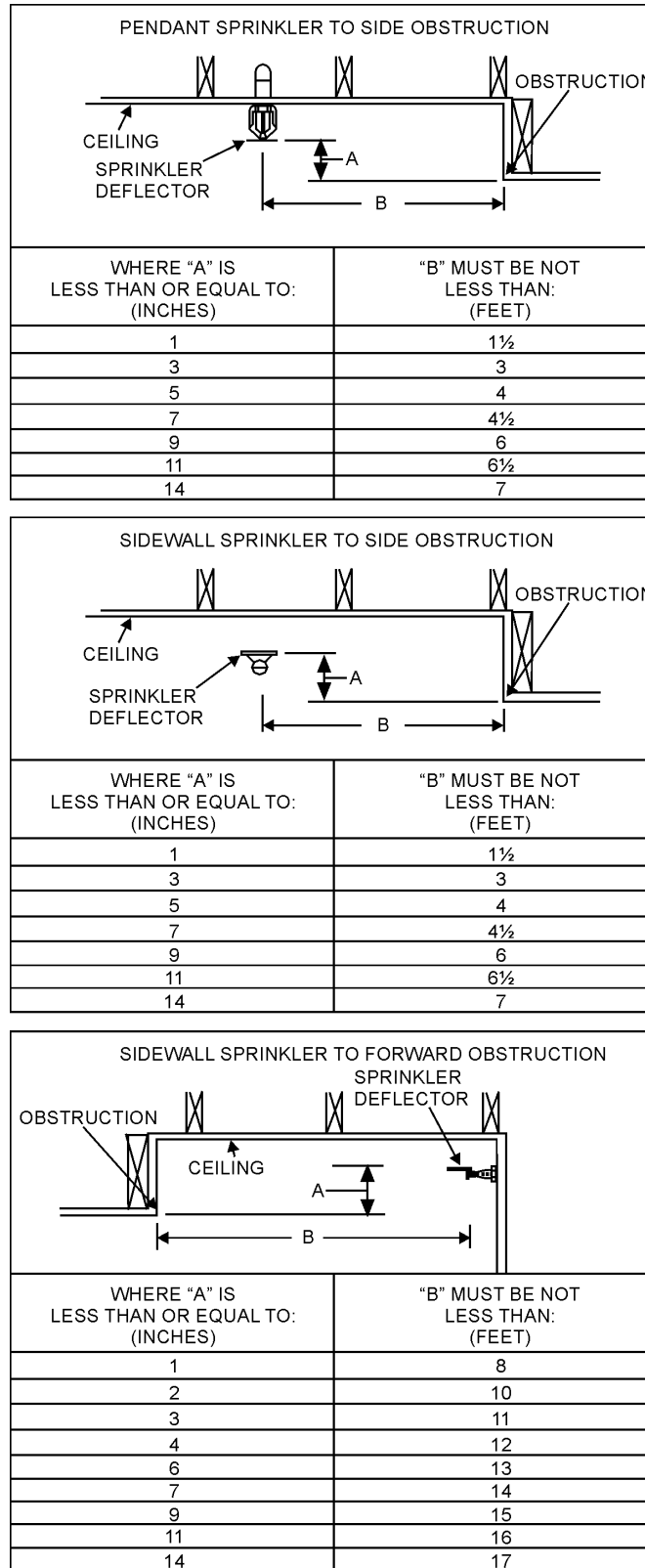
R313.3.4 Determining system design flow. The flow for sizing the sprinkler piping system shall be based on Sections *R313.3.4.1* and *R313.3.4.2*.

R313.3.4.1 Determining required flow rate for each sprinkler. The minimum required flow for each sprinkler shall be determined using the sprinkler manufacturer's published data for the specific sprinkler model based on all of the following:

1. The area of coverage.
2. The ceiling configuration, in accordance with Sections *R313.3.4.1.1* through *R313.3.4.1.3*.
3. The temperature rating.
4. Any additional conditions specified by the sprinkler manufacturer.

R313.3.4.1.1 Ceiling configurations. Manufacturer's published flow rates for sprinklers tested under a ceiling 8 feet (2438 mm) in height, in accordance with the sprinkler listing, shall be used for the following ceiling configurations, provided that the ceiling surface does not have significant irregularities, lumps or indentations and is continuous in a single plane.

1. Ceilings that are horizontal or that have a slope not exceeding 8 units vertical in 12 units horizontal (67 percent), without beams, provided that the ceiling height, measured to the highest point, does not exceed 24 feet (7315 mm) above the floor. Where the slope exceeds 2 units vertical in 12 units horizontal (17 percent), the highest sprinkler installed along the sloped portion of a ceiling shall be positioned above all communicating openings connecting the sloped ceiling compartment with an adjacent space.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE R313.3.2.4.2
MINIMUM ALLOWABLE DISTANCE BETWEEN SPRINKLER AND OBSTRUCTION**

2. Ceilings that are horizontal or that have a slope not exceeding 8 units vertical in 12 units horizontal (67 percent), with beams, provided that the ceiling height, measured to the highest point, does not exceed 24 feet (7315 mm) above the floor. Beams shall not exceed 14 inches (350 mm) in depth, and pendent sprinklers shall be installed under the beams as described at the end of this section. The compartment containing the beamed ceiling shall not exceed 600 square feet (56 m²) in area. Where the slope does not exceed 2 units vertical in 12 units horizontal (17 percent), the highest sprinkler in the compartment shall be above all communicating openings connecting the compartment with an adjacent space. Where the slope exceeds 2 units vertical in 12 units horizontal (17 percent), the highest sprinkler installed along the sloped portion of a ceiling shall be positioned above all communicating openings connecting the sloped ceiling compartment with an adjacent space.
3. Ceilings that have a slope exceeding 2 units vertical in 12 units horizontal (17 percent) but not exceeding 8 units vertical in 12 units horizontal (67 percent), with beams of any depth, provided that the ceiling height, measured to the highest point, does not exceed 24 feet (7315 mm) above the floor. Sidewall or pendent sprinklers shall be installed in each pocket formed by beams. The compartment containing the sloped, beamed ceiling shall not exceed 600 square feet (56 m²) in area.

Pendent, recessed pendent and flush-type pendent sprinklers installed directly under a beam having a maximum depth of 14 inches (356 mm) shall have the sprinkler deflector located not less than 1 inch (25 mm) or more than 2 inches (51 mm) below the bottom of the beam. Pendent sprinklers installed adjacent to the bottom of a beam having a maximum depth of 14 inches (356 mm) shall be positioned such that the vertical centerline of the sprinkler is not more than 2 inches (51 mm) from the edge of the beam, with the sprinkler deflector located not less than 1 inch (25 mm) or more than 2 inches (51 mm) below the bottom of the beam. Pendent sprinklers shall also be permitted to be installed less than 1 inch (25 mm) below the bottom of a beam where in accordance with manufacturer's instructions for installation of flush sprinklers.

R313.3.4.1.2 Ceiling configurations with special sprinkler listings. For ceiling configurations not specified in Section R313.3.4.1.1, the manufacturer's published flow rate for sprinklers that have been listed for protection of such configurations shall be used.

R313.3.4.1.3 Other ceiling configurations. For ceiling configurations not addressed by Section

R313.3.4.1.1 or R313.3.4.1.2, the flow rate shall be subject to approval by the code official.

R313.3.4.2 System design flow rate. The design flow rate for the system shall be based on the following:

1. The design flow rate for a room having only one sprinkler shall be the flow rate required for that sprinkler, as determined by Section R313.3.4.1.
2. The design flow rate for a room having two or more sprinklers shall be determined by identifying the sprinkler in that room with the highest required flow rate, based on Section R313.3.4.1, and multiplying that flow rate by 2.
3. Where the sprinkler manufacturer specifies different criteria for ceiling configurations that are not smooth, flat and horizontal, the required flow rate for that room shall comply with the sprinkler manufacturer's instructions.
4. The design flow rate for the sprinkler system shall be the flow required by the room with the largest flow rate, based on Items 1, 2 and 3.
5. For the purpose of this section, it shall be permissible to reduce the design flow rate for a room by subdividing the space into two or more rooms, where each room is evaluated separately with respect to the required design flow rate. Each room shall be bounded by walls and a ceiling. Openings in walls shall have a lintel not less than 8 inches (203 mm) in depth and each lintel shall form a solid barrier between the ceiling and the top of the opening.

R313.3.5 Water supply. The water supply shall provide not less than the required design flow rate for sprinklers in accordance with Section R313.3.4.2 at a pressure not less than that used to comply with Section R313.3.6. *Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multi-purpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.*

R313.3.5.1 Water supply from individual sources. Where a dwelling unit water supply is from a tank system, a private well system, a pump, or a combination of these, the available water supply shall be based on the minimum pressure control setting for the pump.

R313.3.5.2 Required capacity. The water supply shall have the capacity to provide the required design flow rate for sprinklers for a period of time as follows:

1. Seven minutes for dwelling units one story in height and less than 2,000 square feet (186 m²) in area. *For the purpose of determining the area of the dwelling unit, the area of attached*

garages and attached open carports, porches, balconies and patios shall not be included.

2. Ten minutes for dwelling units two or more stories in height or equal to or greater than 2,000 square feet (186 m²) in area. For the purpose of determining the area of the dwelling unit, the area of attached garages and attached open carports, porches, balconies and patios shall not be included.

R313.3.5.2.1 Where a well system, a water supply tank system, a pump, or a combination thereof, is used, the configuration for the system shall be one of the following:

1. The water supply shall serve both domestic and fire sprinkler systems. Any combination of well capacity and tank storage shall be permitted to meet the capacity requirement.
2. A stand-alone tank is permitted if the following conditions are met:
 - 2.1. The pump shall be connected to a 220-volt circuit breaker shared with a common household appliance (e.g., range, oven, dryer),
 - 2.2. The pump shall be a stainless steel 240-volt pump,
 - 2.3. A valve shall be provided to exercise the pump. The discharge of the exercise valve shall be piped to the tank, and
 - 2.4. A sign shall be provided stating "Valve must be opened monthly for 5 minutes."
 - 2.5. A means for automatically refilling the tank level so that the tank capacity will meet the required water supply duration in minutes shall be provided.

R313.3.5.3 Connections to automatic fire sprinkler systems. The potable water supply to automatic fire sprinkler shall be protected against backflow by a double check backflow prevention assembly, a double check fire protection backflow prevention assembly or a reduced pressure principle fire protection backflow prevention assembly.

Exception: Where permitted by Section R313.3.1.1, backflow protection for the water supply system shall not be required.

R313.3.5.3.1 Additives or nonpotable source. Where systems contain chemical additives or anti-freeze, or where systems are connected to a nonpotable secondary water supply, the potable water supply shall be protected against backflow by a reduced pressure principle backflow prevention assembly or a reduced pressure principle fire protection backflow prevention assembly. Where chemical additives or antifreeze is added to only a portion of an automatic fire sprinkler or standpipe

system, the reduced pressure principle fire protection backflow preventer shall be permitted to be located so as to isolate that portion of the system.

R313.3.6 Pipe sizing. The piping to sprinklers shall be sized for the flow required by Section R313.3.4.2. The flow required to supply the plumbing fixtures shall not be required to be added to the sprinkler design flow.

R313.3.6.1 Method of sizing pipe. Piping supplying sprinklers shall be sized using the prescriptive method in Section R313.3.6.2 or by hydraulic calculation in accordance with NFPA 13D. The minimum pipe size from the water supply source to any sprinkler shall be 3/4 inch (19 mm) nominal. Threaded adapter fittings at the point where sprinklers are attached to the piping shall be a minimum of 1/2 inch (13 mm) nominal.

R313.3.6.2 Prescriptive pipe sizing method. Pipe shall be sized by determining the available pressure to offset friction loss in piping and identifying a piping material, diameter and length using the equation in Section R313.3.6.2.1 and the procedure in Section R313.3.6.2.2.

R313.3.6.2.1 Available pressure equation. The pressure available to offset friction loss in the interior piping system (P_t) shall be determined in accordance with the Equation 29-1.

$$P_t = P_{sup} - PL_{svc} - PL_m - PL_d - PL_e - P_{sp} \quad \text{(Equation 29-1)}$$

where:

P_t = Pressure used in applying Tables R313.3.6.2(4) through R313.3.6.2(9).

P_{sup} = Pressure available from the water supply source.

PL_{svc} = Pressure loss in the water-service pipe.

PL_m = Pressure loss in the water meter.

PL_d = Pressure loss from devices other than the water meter.

PL_e = Pressure loss associated with changes in elevation.

P_{sp} = Maximum pressure required by a sprinkler.

R313.3.6.2.2 Calculation procedure. Determination of the required size for water distribution piping shall be in accordance with the following procedure:

Step 1 – Determine P_{sup}

Obtain the static supply pressure that will be available from the water main from the water purveyor, or for an individual source, the available supply pressure shall be in accordance with Section R313.3.5.1.

Step 2 – Determine PL_{svc}

Use Table R313.3.6.2(1) to determine the pressure loss in the water service pipe based on the selected size of the water service.

Step 3 – Determine PL_m

Use Table R313.3.6.2(2) to determine the pressure loss from the water meter, based on the selected water meter size.

Step 4 – Determine PL_d

Determine the pressure loss from devices other than the water meter installed in the piping system supplying sprinklers, such as pressure-reducing valves, backflow preventers, water softeners or water filters. Device pressure losses shall be based on the device manufacturer’s specifications. The flow rate used to determine pressure loss shall be the rate from Section R313.3.4.2, except that 5 gpm (0.3 L/S) shall be added where the device is installed in a water-service pipe that supplies more than one dwelling. As alternative to deducting pressure loss for a device, an automatic bypass valve shall be installed to divert flow around the device when a sprinkler activates.

Step 5 – Determine PL_e

Use Table R313.3.6.2(3) to determine the pressure loss associated with changes in elevation. The elevation used in applying the table shall be the difference between the elevation where the water source pressure was measured and the elevation of the highest sprinkler.

Step 6 – Determine P_{sp}

Determine the maximum pressure required by any individual sprinkler based on the flow rate from Sec-

tion R313.3.4.1. The required pressure is provided in the sprinkler manufacturer’s published data for the specific sprinkler model based on the selected flow rate.

Step 7 – Calculate P_f

Using Equation 29-1, calculate the pressure available to offset friction loss in water-distribution piping between the service valve and the sprinklers.

Step 8 – Determine the maximum allowable pipe length

Use Tables R313.3.6.2(4) through R313.3.6.2(9) to select a material and size for water distribution piping. The piping material and size shall be acceptable if the developed length of pipe between the service valve and the most remote sprinkler does not exceed the maximum allowable length specified by the applicable table. Interpolation of P_f between the tabular values shall be permitted.

The maximum allowable length of piping in Tables R313.3.6.2(4) through R313.3.6.2(9) incorporates an adjustment for pipe fittings, and no additional consideration of friction losses associated with pipe fittings shall be required.

**TABLE R313.3.6.2(1)
WATER SERVICE PRESSURE LOSS (PL_{svc})^{a, b}**

FLOW RATE ^c (gpm)	³ / ₄ -INCH WATER SERVICE PRESSURE LOSS (psi)				1-INCH WATER SERVICE PRESSURE LOSS (psi)				¹ / ₄ -INCH WATER SERVICE PRESSURE LOSS (psi)			
	Length of water service pipe (feet)				Length of water service pipe (feet)				Length of water service pipe (feet)			
	40 or less	41 to 75	76 to 100	101 to 150	40 or less	41 to 75	76 to 100	101 to 150	40 or less	41 to 75	76 to 100	101 to 150
8	5.1	8.7	11.8	17.4	1.5	2.5	3.4	5.1	0.6	1.0	1.3	1.9
10	7.7	13.1	17.8	26.3	2.3	3.8	5.2	7.7	0.8	1.4	2.0	2.9
12	10.8	18.4	24.9	NP	3.2	5.4	7.3	10.7	1.2	2.0	2.7	4.0
14	14.4	24.5	NP	NP	4.2	7.1	9.6	14.3	1.6	2.7	3.6	5.4
16	18.4	NP	NP	NP	5.4	9.1	12.4	18.3	2.0	3.4	4.7	6.9
18	22.9	NP	NP	NP	6.7	11.4	15.4	22.7	2.5	4.3	5.8	8.6
20	27.8	NP	NP	NP	8.1	13.8	18.7	27.6	3.1	5.2	7.0	10.4
22	NP	NP	NP	NP	9.7	16.5	22.3	NP	3.7	6.2	8.4	12.4
24	NP	NP	NP	NP	11.4	19.3	26.2	NP	4.3	7.3	9.9	14.6
26	NP	NP	NP	NP	13.2	22.4	NP	NP	5.0	8.5	11.4	16.9
28	NP	NP	NP	NP	15.1	25.7	NP	NP	5.7	9.7	13.1	19.4
30	NP	NP	NP	NP	17.2	NP	NP	NP	6.5	11.0	14.9	22.0
32	NP	NP	NP	NP	19.4	NP	NP	NP	7.3	12.4	16.8	24.8
34	NP	NP	NP	NP	21.7	NP	NP	NP	8.2	13.9	18.8	NP
36	NP	NP	NP	NP	24.1	NP	NP	NP	9.1	15.4	20.9	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 gallon per minute = 0.063 L/s, 1 pound per square inch = 6.895 kPa.

NP—Not permitted. Pressure loss exceeds reasonable limits.

- a. Values are applicable for underground piping materials listed in the *California Plumbing Code* and are based on an SDR of 11 and a Hazen Williams C Factor of 150.
- b. Values include the following length allowances for fittings: 25% length increase for actual lengths up to 100 feet and 15% length increase for actual lengths over 100 feet.
- c. Flow rate from Section R313.3.4.2. Add 5 gpm to the flow rate required by Section R313.3.4.2 where the water-service pipe supplies more than one dwelling.

TABLE R313.3.6.2(2)
MINIMUM WATER METER PRESSURE LOSS (PL_m)^a

FLOW RATE (gallons per minute, gpm) ^b	⁵ / ₈ -INCH METER PRESSURE LOSS (pounds per square inch, psi)	³ / ₄ -INCH METER PRESSURE LESS (pounds per square inch, psi)	1-INCH METER PRESSURE LOSS (pounds per square inch, psi)
8	3	3	1
10	3	3	1
12	4	3	1
14	6	5	1
16	7	6	1
18	9	7	2
20	11	9	2
23	14	11	3
26	18	14	3
31	26	22	4
39	38	35	6
52	NP	NP	10

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.063 L/s.

NP = Not permitted unless the actual water meter pressure loss is known.

- a. Table P2904.6.2(2) establishes conservative values for water meter pressure loss or installations where the water meter loss is unknown. Where the actual water meter pressure loss is published and available from the meter manufacturer, PL_m shall be the published pressure loss for the selected meter.
- b. Flow rate from Section P2904.4.2. Add 5 gpm to the flow rate required by Section P2904.4.2 where the water service pipe supplies more than one dwelling.

TABLE R313.3.6.2(3)
ELEVATION LOSS (PL_e)

ELEVATION (feet)	PRESSURE LOSS (psi)
5	2.2
10	4.4
15	6.5
20	8.7
25	10.9
30	13
35	15.2
40	17.4

For SI: 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa.

TABLE R313.3.6.2(4)
ALLOWABLE PIPE LENGTH FOR 3/4-INCH TYPE M COPPER WATER TUBING

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— <i>P_t</i> (psi)									
		15	20	25	30	35	40	45	50	55	60
Allowable length of pipe from service valve to farthest sprinkler (feet)											
8	3/4	217	289	361	434	506	578	650	723	795	867
9	3/4	174	232	291	349	407	465	523	581	639	697
10	3/4	143	191	239	287	335	383	430	478	526	574
11	3/4	120	160	200	241	281	321	361	401	441	481
12	3/4	102	137	171	205	239	273	307	341	375	410
13	3/4	88	118	147	177	206	235	265	294	324	353
14	3/4	77	103	128	154	180	205	231	257	282	308
15	3/4	68	90	113	136	158	181	203	226	248	271
16	3/4	60	80	100	120	140	160	180	200	220	241
17	3/4	54	72	90	108	125	143	161	179	197	215
18	3/4	48	64	81	97	113	129	145	161	177	193
19	3/4	44	58	73	88	102	117	131	146	160	175
20	3/4	40	53	66	80	93	106	119	133	146	159
21	3/4	36	48	61	73	85	97	109	121	133	145
22	3/4	33	44	56	67	78	89	100	111	122	133
23	3/4	31	41	51	61	72	82	92	102	113	123
24	3/4	28	38	47	57	66	76	85	95	104	114
25	3/4	26	35	44	53	61	70	79	88	97	105
26	3/4	24	33	41	49	57	65	73	82	90	98
27	3/4	23	30	38	46	53	61	69	76	84	91
28	3/4	21	28	36	43	50	57	64	71	78	85
29	3/4	20	27	33	40	47	53	60	67	73	80
30	3/4	19	25	31	38	44	50	56	63	69	75
31	3/4	18	24	29	35	41	47	53	59	65	71
32	3/4	17	22	28	33	39	44	50	56	61	67
33	3/4	16	21	26	32	37	42	47	53	58	63
34	3/4	NP	20	25	30	35	40	45	50	55	60
35	3/4	NP	19	24	28	33	38	42	47	52	57
36	3/4	NP	18	22	27	31	36	40	45	49	54
37	3/4	NP	17	21	26	30	34	38	43	47	51
38	3/4	NP	16	20	24	28	32	36	40	45	49
39	3/4	NP	15	19	23	27	31	35	39	42	46
40	3/4	NP	NP	18	22	26	29	33	37	40	44

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

NP—Not permitted

a. Flow rate from Section R313.3.4.2.

TABLE R313.3.6.2(5)
ALLOWABLE PIPE LENGTH FOR 1-INCH TYPE M COPPER WATER TUBING

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— P_a (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	1	806	1075	1343	1612	1881	2149	2418	2687	2955	3224
9	1	648	864	1080	1296	1512	1728	1945	2161	2377	2593
10	1	533	711	889	1067	1245	1422	1600	1778	1956	2134
11	1	447	586	745	894	1043	1192	1341	1491	1640	1789
12	1	381	508	634	761	888	1015	1142	1269	1396	1523
13	1	328	438	547	657	766	875	985	1094	1204	1313
14	1	286	382	477	572	668	763	859	954	1049	1145
15	1	252	336	420	504	588	672	756	840	924	1008
16	1	224	298	373	447	522	596	671	745	820	894
17	1	200	266	333	400	466	533	600	666	733	799
18	1	180	240	300	360	420	479	539	599	659	719
19	1	163	217	271	325	380	434	488	542	597	651
20	1	148	197	247	296	345	395	444	493	543	592
21	1	135	180	225	270	315	360	406	451	496	541
22	1	124	165	207	248	289	331	372	413	455	496
23	1	114	152	190	228	267	305	343	381	419	457
24	1	106	141	176	211	246	282	317	352	387	422
25	1	98	131	163	196	228	261	294	326	359	392
26	1	91	121	152	182	212	243	273	304	334	364
27	1	85	113	142	170	198	226	255	283	311	340
28	1	79	106	132	159	185	212	238	265	291	318
29	1	74	99	124	149	174	198	223	248	273	298
30	1	70	93	116	140	163	186	210	233	256	280
31	1	66	88	110	132	153	175	197	219	241	263
32	1	62	83	103	124	145	165	186	207	227	248
33	1	59	78	98	117	137	156	176	195	215	234
34	1	55	74	92	111	129	148	166	185	203	222
35	1	53	70	88	105	123	140	158	175	193	210
36	1	50	66	83	100	116	133	150	166	183	199
37	1	47	63	79	95	111	126	142	158	174	190
38	1	45	60	75	90	105	120	135	150	165	181
39	1	43	57	72	86	100	115	129	143	158	172
40	1	41	55	68	82	96	109	123	137	150	164

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

a. Flow rate from Section R313.3.4.2.

TABLE R313.3.6.2(6)
ALLOWABLE PIPE LENGTH FOR 3/4-INCH CPVC PIPE

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— <i>P</i> , (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	3/4	348	465	581	697	813	929	1045	1161	1278	1394
9	3/4	280	374	467	560	654	747	841	934	1027	1121
10	3/4	231	307	384	461	538	615	692	769	845	922
11	3/4	193	258	322	387	451	515	580	644	709	773
12	3/4	165	219	274	329	384	439	494	549	603	658
13	3/4	142	189	237	284	331	378	426	473	520	568
14	3/4	124	165	206	247	289	330	371	412	454	495
15	3/4	109	145	182	218	254	290	327	363	399	436
16	3/4	97	129	161	193	226	258	290	322	354	387
17	3/4	86	115	144	173	202	230	259	288	317	346
18	3/4	78	104	130	155	181	207	233	259	285	311
19	3/4	70	94	117	141	164	188	211	234	258	281
20	3/4	64	85	107	128	149	171	192	213	235	256
21	3/4	58	78	97	117	136	156	175	195	214	234
22	3/4	54	71	89	107	125	143	161	179	197	214
23	3/4	49	66	82	99	115	132	148	165	181	198
24	3/4	46	61	76	91	107	122	137	152	167	183
25	3/4	42	56	71	85	99	113	127	141	155	169
26	3/4	39	52	66	79	92	105	118	131	144	157
27	3/4	37	49	61	73	86	98	110	122	135	147
28	3/4	34	46	57	69	80	92	103	114	126	137
29	3/4	32	43	54	64	75	86	96	107	118	129
30	3/4	30	40	50	60	70	81	91	101	111	121
31	3/4	28	38	47	57	66	76	85	95	104	114
32	3/4	27	36	45	54	63	71	80	89	98	107
33	3/4	25	34	42	51	59	68	76	84	93	101
34	3/4	24	32	40	48	56	64	72	80	88	96
35	3/4	23	30	38	45	53	61	68	76	83	91
36	3/4	22	29	36	43	50	57	65	72	79	86
37	3/4	20	27	34	41	48	55	61	68	75	82
38	3/4	20	26	33	39	46	52	59	65	72	78
39	3/4	19	25	31	37	43	50	56	62	68	74
40	3/4	18	24	30	35	41	47	53	59	65	71

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

a. Flow rate from Section R313.3.4.2.

TABLE R313.3.6.2(7)
ALLOWABLE PIPE LENGTH FOR 1-INCH CPVC PIPE

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— <i>P</i> , (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	1	1049	1398	1748	2098	2447	2797	3146	3496	3845	4195
9	1	843	1125	1406	1687	1968	2249	2530	2811	3093	3374
10	1	694	925	1157	1388	1619	1851	2082	2314	2545	2776
11	1	582	776	970	1164	1358	1552	1746	1940	2133	2327
12	1	495	660	826	991	1156	1321	1486	1651	1816	1981
13	1	427	570	712	854	997	1139	1281	1424	1566	1709
14	1	372	497	621	745	869	993	1117	1241	1366	1490
15	1	328	437	546	656	765	874	983	1093	1202	1311
16	1	291	388	485	582	679	776	873	970	1067	1164
17	1	260	347	433	520	607	693	780	867	954	1040
18	1	234	312	390	468	546	624	702	780	858	936
19	1	212	282	353	423	494	565	635	706	776	847
20	1	193	257	321	385	449	513	578	642	706	770
21	1	176	235	293	352	410	469	528	586	645	704
22	1	161	215	269	323	377	430	484	538	592	646
23	1	149	198	248	297	347	396	446	496	545	595
24	1	137	183	229	275	321	366	412	458	504	550
25	1	127	170	212	255	297	340	382	425	467	510
26	1	118	158	197	237	276	316	355	395	434	474
27	1	111	147	184	221	258	295	332	368	405	442
28	1	103	138	172	207	241	275	310	344	379	413
29	1	97	129	161	194	226	258	290	323	355	387
30	1	91	121	152	182	212	242	273	303	333	364
31	1	86	114	143	171	200	228	257	285	314	342
32	1	81	108	134	161	188	215	242	269	296	323
33	1	76	102	127	152	178	203	229	254	280	305
34	1	72	96	120	144	168	192	216	240	265	289
35	1	68	91	114	137	160	182	205	228	251	273
36	1	65	87	108	130	151	173	195	216	238	260
37	1	62	82	103	123	144	165	185	206	226	247
38	1	59	78	98	117	137	157	176	196	215	235
39	1	56	75	93	112	131	149	168	187	205	224
40	1	53	71	89	107	125	142	160	178	196	214

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

a. Flow rate from Section R313.3.4.2.

TABLE R313.3.6.2(8)
ALLOWABLE PIPE LENGTH FOR 3/4-INCH PEX AND PE-RT TUBING

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— <i>P_t</i> (psi)									
		15	20	25	30	35	40	45	50	55	60
		Allowable length of pipe from service valve to farthest sprinkler (feet)									
8	3/4	93	123	154	185	216	247	278	309	339	370
9	3/4	74	99	124	149	174	199	223	248	273	298
10	3/4	61	82	102	123	143	163	184	204	225	245
11	3/4	51	68	86	103	120	137	154	171	188	205
12	3/4	44	58	73	87	102	117	131	146	160	175
13	3/4	38	50	63	75	88	101	113	126	138	151
14	3/4	33	44	55	66	77	88	99	110	121	132
15	3/4	29	39	48	58	68	77	87	96	106	116
16	3/4	26	34	43	51	60	68	77	86	94	103
17	3/4	23	31	38	46	54	61	69	77	84	92
18	3/4	21	28	34	41	48	55	62	69	76	83
19	3/4	19	25	31	37	44	50	56	62	69	75
20	3/4	17	23	28	34	40	45	51	57	62	68
21	3/4	16	21	26	31	36	41	47	52	57	62
22	3/4	NP	19	24	28	33	38	43	47	52	57
23	3/4	NP	17	22	26	31	35	39	44	48	52
24	3/4	NP	16	20	24	28	32	36	40	44	49
25	3/4	NP	NP	19	22	26	30	34	37	41	45
26	3/4	NP	NP	17	21	24	28	31	35	38	42
27	3/4	NP	NP	16	20	23	26	29	33	36	39
28	3/4	NP	NP	15	18	21	24	27	30	33	36
29	3/4	NP	NP	NP	17	20	23	26	28	31	34
30	3/4	NP	NP	NP	16	19	21	24	27	29	32
31	3/4	NP	NP	NP	15	18	20	23	25	28	30
32	3/4	NP	NP	NP	NP	17	19	21	24	26	28
33	3/4	NP	NP	NP	NP	16	18	20	22	25	27
34	3/4	NP	NP	NP	NP	NP	17	19	21	23	25
35	3/4	NP	NP	NP	NP	NP	16	18	20	22	24
36	3/4	NP	NP	NP	NP	NP	15	17	19	21	23
37	3/4	NP	NP	NP	NP	NP	NP	16	18	20	22
38	3/4	NP	NP	NP	NP	NP	NP	16	17	19	21
39	3/4	NP	NP	NP	NP	NP	NP	NP	16	18	20
40	3/4	NP	NP	NP	NP	NP	NP	NP	16	17	19

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.

NP— Not permitted.

a. Flow rate from Section R313.3.4.2.

TABLE R313.3.6.2(9)
ALLOWABLE PIPE LENGTH FOR 1-INCH PEX AND PE-RT TUBING

SPRINKLER FLOW RATE ^a (gpm)	WATER DISTRIBUTION SIZE (inch)	AVAILABLE PRESSURE— <i>P_i</i> (psi)									
		15	20	25	30	35	40	45	50	55	60
Allowable length of pipe from service valve to farthest sprinkler (feet)											
8	1	314	418	523	628	732	837	941	1046	1151	1255
9	1	252	336	421	505	589	673	757	841	925	1009
10	1	208	277	346	415	485	554	623	692	761	831
11	1	174	232	290	348	406	464	522	580	638	696
12	1	148	198	247	296	346	395	445	494	543	593
13	1	128	170	213	256	298	341	383	426	469	511
14	1	111	149	186	223	260	297	334	371	409	446
15	1	98	131	163	196	229	262	294	327	360	392
16	1	87	116	145	174	203	232	261	290	319	348
17	1	78	104	130	156	182	208	233	259	285	311
18	1	70	93	117	140	163	187	210	233	257	280
19	1	63	84	106	127	148	169	190	211	232	253
20	1	58	77	96	115	134	154	173	192	211	230
21	1	53	70	88	105	123	140	158	175	193	211
22	1	48	64	80	97	113	129	145	161	177	193
23	1	44	59	74	89	104	119	133	148	163	178
24	1	41	55	69	82	96	110	123	137	151	164
25	1	38	51	64	76	89	102	114	127	140	152
26	1	35	47	59	71	83	95	106	118	130	142
27	1	33	44	55	66	77	88	99	110	121	132
28	1	31	41	52	62	72	82	93	103	113	124
29	1	29	39	48	58	68	77	87	97	106	116
30	1	27	36	45	54	63	73	82	91	100	109
31	1	26	34	43	51	60	68	77	85	94	102
32	1	24	32	40	48	56	64	72	80	89	97
33	1	23	30	38	46	53	61	68	76	84	91
34	1	22	29	36	43	50	58	65	72	79	86
35	1	20	27	34	41	48	55	61	68	75	82
36	1	19	26	32	39	45	52	58	65	71	78
37	1	18	25	31	37	43	49	55	62	68	74
38	1	18	23	29	35	41	47	53	59	64	70
39	1	17	22	28	33	39	45	50	56	61	67
40	1	16	21	27	32	37	43	48	53	59	64

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 gallon per minute = 0.963 L/s.
 a. Flow rate from Section R313.3.4.2.

R313.3.7 Instructions and signs. An owner’s manual for the fire sprinkler system shall be provided to the owner. A sign or valve tag shall be installed at the main shutoff valve to the water distribution system stating the following: “Warning, the water system for this home supplies fire sprinklers that require certain flows and pressures to fight a fire. Devices that restrict the flow or decrease the pressure or automatically shut off the water to the fire sprinkler system, such as water softeners, filtration systems and automatic shutoff valves, shall not be added to this system without a review of the fire sprinkler system by a fire protection specialist. Do not remove this sign.”

R313.3.8 Inspections. The water distribution system shall be inspected in accordance with Sections *R313.3.8.1* and *R313.3.8.2*.

R313.3.8.1 Preconcealment inspection. The following items shall be verified prior to the concealment of any sprinkler system piping:

1. Sprinklers are installed in all areas as required by Section *R313.3.1.2*.
2. Where sprinkler water spray patterns are obstructed by construction features, luminaires or ceiling fans, additional sprinklers are installed as required by Section *R313.3.2.4.2*.
3. Sprinklers are the correct temperature rating and are installed at or beyond the required separation distances from heat sources as required by Sections *R313.3.2.1* and *R313.3.2.2*.
4. The pipe size equals or exceeds the size used in applying Tables *R313.3.6.2(4)* through *R313.3.6.2(9)* or, if the piping system was hydraulically calculated in accordance with Section *R313.3.6.1*, the size used in the hydraulic calculation.
5. The pipe length does not exceed the length permitted by Tables *R313.3.6.2(4)* through *R313.3.6.2(9)* or, if the piping system was hydraulically calculated in accordance with Section *R313.3.6.1*, pipe lengths and fittings do not exceed those used in the hydraulic calculation.
6. Nonmetallic piping that conveys water to sprinklers is listed for use with fire sprinklers.
7. Piping is supported in accordance with the pipe manufacturer’s and sprinkler manufacturer’s installation instructions.
8. The piping system is tested in accordance with the *California Plumbing Code*.

R313.3.8.2 Final inspection. The following items shall be verified upon completion of the system:

1. Sprinkler are not painted, damaged or otherwise hindered from operation.
2. Where a pump is required to provide water to the system, the pump starts automatically upon system water demand.

3. Pressure-reducing valves, water softeners, water filters or other impairments to water flow that were not part of the original design have not been installed.
4. The sign or valve tag required by Section *R313.3.7* is installed and the owner’s manual for the system is present.

SECTION R314 SMOKE ALARMS

R314.1 General. Smoke alarms shall comply with NFPA 72 and Section R314.

R314.1.1 Listings. Smoke alarms shall be listed in accordance with UL 217. Combination smoke and carbon monoxide alarms shall be listed in accordance with UL 217 and UL 2034. *Systems and components shall be California State Fire Marshal listed and approved in accordance with California Code of Regulations, Title 19, Division 1 for the purpose for which they are installed.*

R314.2 Where required. Smoke alarms shall be provided in accordance with this section.

R314.2.1 New construction. Smoke alarms shall be provided in dwelling units.

R314.2.2 Alterations, repairs and additions. Where alterations, repairs or additions requiring a permit occur, the individual dwelling unit shall be equipped with smoke alarms located as required for new dwellings.

Exceptions: *See Section R314.6.*

R314.3 Location. Smoke alarms shall be installed in the following locations:

1. In each sleeping room.
2. Outside each separate sleeping area in the immediate vicinity of the bedrooms.
3. On each additional story of the dwelling, including basements and habitable attics and not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. Not less than 3 feet (914 mm) horizontally from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by this section.
5. In the hallway and in the room open to the hallway in dwelling units where the ceiling height of a room open to a hallway serving bedrooms exceeds that of the hallway by 24 inches (610 mm) or more.

See Section R314.3.3 for specific location requirements.

R314.3.1 Installation near cooking appliances. See Section R314.3.3 for specific location requirements.

R314.3.2 Smoke alarms. Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms that no longer function shall be replaced.

R314.3.3 Specific location requirements.

Extract from NFPA 72 Section 29.8.3.4 Specific Location Requirements.*

This extract has been provided by NFPA as amended by the Office of the State Fire Marshal and adopted by reference as follows:

29.8.3.4 Specific location requirements. The installation of smoke alarms and smoke detectors shall comply with the following requirements:

- (1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.
- (2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).
- (3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.
- (4) Smoke alarms or smoke detectors shall be installed a minimum of 20 feet horizontal distance from a permanently installed cooking appliance.

Exception: Ionization smoke alarms with an alarm-silencing switch or Photoelectric smoke alarms shall be permitted to be installed 10 feet (3 m) or greater from a permanently installed cooking appliance.

Photoelectric smoke alarms shall be permitted to be installed greater than 6 feet (1.8 m) from a permanently installed cooking appliance where the kitchen or cooking area and adjacent spaces have no clear interior partitions and the 10 ft distances would prohibit the placement of a smoke alarm or smoke detector required by other sections of the code. Smoke alarms listed for use in close proximity to a permanently installed cooking appliance.

- (5) Installation near bathrooms. Smoke alarms shall be installed not less than a 3 foot (0.91 m) horizontal distance from the door or opening of a bathroom that contains a bathtub or shower unless this would prevent placement of a smoke alarm required by other sections of the code.
- (6) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the supply registers of a forced air heating or

cooling system and shall be installed outside of the direct airflow from those registers.

- (7) Smoke alarms and smoke detectors shall not be installed within a 36 in. (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan.
- (8) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.
- (9) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.
- (10) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 in. (300 mm) vertically down from the highest point.
- (11) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.7.3.2.4.
- (12) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of 17.6.3.

R314.4 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling or sleeping unit, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

Exceptions:

1. Interconnection is not required in buildings that are not undergoing alterations, repairs or construction of any kind.
2. Smoke alarms in existing areas are not required to be interconnected where alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for interconnection without the removal of interior finishes.
3. Smoke alarms are not required to be interconnected where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.
4. Smoke alarms are not required to be interconnected when work is limited to the installation, alteration or repairs of plumbing or mechanical systems or the installation, alteration or repair of electrical systems which do not result in the removal of interior wall or ceiling finishes exposing the structure.

R314.5 Combination alarms. Combination smoke and carbon monoxide alarms shall be permitted to be used in lieu of smoke alarms. *Systems and components shall be California State Fire Marshal listed and approved in accordance with California Code of Regulations, Title 19, Division 1 for the purpose for which they are installed.*

R314.6 Power source. *Smoke alarms shall receive their primary power from the building wiring provided that such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.*

Exceptions:

1. *Smoke alarms are permitted to be solely battery operated in existing buildings where no construction is taking place.*
2. *Smoke alarms are permitted to be solely battery operated in buildings that are not served from a commercial power source.*
3. *Smoke alarms are permitted to be solely battery operated in existing areas of buildings undergoing alterations or repairs that do not result in the removal of interior walls or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available which could provide access for building wiring without the removal of interior finishes.*
4. *Smoke alarms are permitted to be solely battery operated where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
5. *Smoke alarms are permitted to be solely battery operated when work is limited to the installation, alteration or repairs of plumbing or mechanical systems or the installation, alteration or repair of electrical systems which do not result in the removal of interior wall or ceiling finishes exposing the structure.*

R314.7 Fire alarm systems. Fire alarm systems shall be permitted to be used in lieu of smoke alarms and shall comply with Sections R314.7.1 through R314.7.4.

R314.7.1 General. Fire alarm systems shall comply with the provisions of this code and the household fire warning equipment provisions of NFPA 72. *Smoke detectors shall be listed in accordance with UL 268. Systems and components shall be California State Fire Marshal listed and approved in accordance with California Code of Regulations, Title 19, Division 1 for the purpose for which they are installed.*

R314.7.2 Location. Smoke detectors shall be installed in the locations specified in Section R314.3.

R314.7.3 Permanent fixture. Where a household fire alarm system is installed, it shall become a permanent fixture of the occupancy, owned by the homeowner.

R314.7.4 Combination detectors. Combination smoke and carbon monoxide detectors shall be permitted to be installed in fire alarm systems in lieu of smoke detectors, provided that they are listed in accordance with UL 268 and UL 2075.

R314.8 Existing Group R-3 occupancies.

R314.8.1 Existing buildings housing Group R-3 occupancies established prior to the effective date of these regulations may have their use continued if they conform or are made to conform to provisions of these regulations to the extent that reasonable and adequate life safety against the hazards of fire, panic and explosion is substantially provided. Additional means of egress, the installation of automatic sprinkler systems, automatic fire alarm system or other life safety measures, may be required to provide reasonable and adequate safety.

Note: *It is the intent of this section that every existing occupancy need not mandatorily conform with the requirements for new construction. Reasonable judgment in the application of requirements must be exercised by the enforcing agency.*

R314.8.2 For purposes of clarification, Health and Safety Code Section 13113.7 is repeated.

a. *Except as otherwise provided in this section, a smoke detector, approved and listed by the State Fire Marshal pursuant to Section 13114, shall be installed, in accordance with the manufacturer's instructions in each dwelling intended for human occupancy within the earliest applicable time period as follows:*

1. *For all dwelling units intended for human occupancy, upon the owner's application on or after January 1, 1985, for a permit for alterations, repairs, or additions, exceeding one thousand dollars (\$1,000).*
2. *For all other dwelling units intended for human occupancy on or after January 1, 1987.*

However, if any local rule, regulation or ordinance, adopted prior to the compliance dates specified in paragraphs (1) and (2) requires installation in a dwelling unit intended for human occupancy of smoke detector, which receive their power from the electrical system of the building and requires compliance with the local rule, regulation or ordinance at a date subsequent to the dates specified in this section, the compliance date specified in the rule, regulation or ordinance shall, but only with respect to the dwelling units specified in this section, take precedence over the dates specified in this section.

The State Fire Marshal may adopt regulations exempting dwellings intended for human

occupancy with fire sprinkler systems from the provisions of this section, if he or she determines that a smoke detector is not reasonably necessary for fire safety in the occupancy.

Unless prohibited by local rules, regulations or ordinances, a battery-operated smoke detector which otherwise meets the standards adopted pursuant to Section 13114 for smoke detectors, satisfies the requirements of this section.

- b. "Dwelling units intended for human occupancy," as used in this section, includes a duplex, lodging house, apartment complex, hotel, motel, condominium, stock cooperative, time-share project or dwelling unit of a multiple-unit dwelling complex. For the purpose of this part, "dwelling units intended for human occupancy" does not include manufactured homes as defined in Section 18007, mobile homes as defined in Section 18008, and commercial coaches as defined in Section 18001.8.
- c. The owner of each dwelling unit subject to this section shall supply and install smoke detectors required by this section in the locations and in the manner set forth in the manufacturer's instructions, as approved by the State Fire Marshal's regulations. In the case of apartment complexes and other multiple-dwelling complexes, a smoke detector shall be installed in the common stairwells. All fire alarm warning systems supplemental to the smoke detector shall also be listed by the State Fire Marshal.
- d. A high-rise structure, as defined in subdivision (b) of Section 13210 and regulated by Chapter 3 (commencing with Section 13210), and which is used for purposes other than as dwelling units intended for human occupancy, is exempt from the requirements of this section.
- e. The owner shall be responsible for testing and maintaining detectors in hotels, motels, lodging houses and common stairwells of apartment complexes and other multiple-dwelling complexes.

An owner or the owner's agent may enter any dwelling unit, efficiency dwelling unit, guest room and suite owned by the owner for the purpose of installing, repairing, testing and maintaining single station smoke detectors required by this section. Except in cases of emergency, the owner or owner's agent shall give the tenants of each such unit, room or suite reasonable notice in writing of the intention to enter and shall enter only during normal business hours. Twenty-four hours shall be presumed to be reasonable notice in absence of evidence to the contrary.

The smoke detector shall be operable at the time that the tenant takes possession. The apartment complex tenant shall be responsible for notifying the manager or owner if the tenant becomes aware of an inoperable smoke detector within his or her unit.

The owner or authorized agent shall correct any reported deficiencies in the smoke detector and shall not be in violation of this section for a deficient smoke detector when he or she has not received notice of the deficiency.

- f. A violation of this section is an infraction punishable by a maximum fine of two hundred dollars (\$200) for each offense.
- g. This section shall not affect any rights which the parties may have under any other provision of law because of the presence or absence of a smoke detector.
- h. This section shall not apply to the installation of smoke detectors in single-family dwellings or factory-built housing which is regulated by Section 13113.8, as added by Assembly Bill No. 2285 of the 1983-84 Regular Session.

R314.8.3 For purposes of clarification, Health and Safety Code Section 13113.8 is repeated.

- a. On and after January 1, 1986, every single-family dwelling and factory-built housing, as defined in Section 19971, which is sold shall have an operable smoke detector. The detector shall be approved and listed by the State Fire Marshal and installed in accordance with the State Fire Marshal's regulations. Unless prohibited by local rules, regulations or ordinances, a battery-operated smoke detector shall be deemed to satisfy the requirements of this section.
- b. On and after January 1, 1986, the transferor of any real property containing a single-family dwelling, as described in subdivision (a), whether the transfer is made by sale, exchange or real property sales contract, as defined in Section 2985 of the Civil Code, shall deliver to the transferee a written statement indicating that the transferor is in compliance with this section. The disclosure statement shall be either included in the receipt for deposit in a real estate transaction, an addendum attached thereto, or a separate document.
- c. The transferor shall deliver the statement referred to in subdivision (b) as soon as practicable before the transfer of title in the case of a sale or exchange, or prior to execution of the contract where the transfer is by a real property sales contract, as defined in Section 2985. For purposes of this subdivision, "delivery" means delivery in person or by mail to the transferee or transferor, or to any person authorized to act for him or her in the transaction, or to additional transferees who have requested delivery from the transferor in writing. Delivery to the spouse of a transferee or transferor shall be deemed delivery to a transferee or transferor, unless the contract states otherwise.
- d. This section does not apply to any of the following:
 - 1. Transfers which are required to be preceded by the furnishing to a prospective transferee of

a copy of a public report pursuant to Section 11018.1 of the Business and Professions Code.

2. Transfers pursuant to court order, including, but not limited to, transfers ordered by a probate court in the administration of an estate, transfers pursuant to a writ of execution, transfers by a trustee in bankruptcy, transfers by eminent domain or transfers resulting from a decree for specific performance.
 3. Transfers to a mortgagee by a mortgagor in default, transfers to a beneficiary of a deed of trust by a trustor in default, transfers by any foreclosure sale after default, transfers by any foreclosure sale after default in an obligation secured by a mortgage, or transfers by a sale under a power of sale after a default in an obligation secured by a deed of trust or secured by any other instrument containing a power of sale.
 4. Transfers by a fiduciary in the course of the administration of a decedent's estate, guardianship, conservatorship or trust.
 5. Transfers from one co-owner to one or more co-owners.
 6. Transfers made to a spouse, or to a person or persons in the lineal line of consanguinity of one or more of the transferors.
 7. Transfers between spouses resulting from a decree of dissolution of a marriage, from a decree of legal separation or from a property settlement agreement incidental to either of those decrees.
 8. Transfers by the Controller in the course of administering the Unclaimed Property Law provided for in Chapter 7 (commencing with Section 1500) of Title 10 of Part 3 of the Code of Civil Procedure.
 9. Transfers under the provisions of Chapter 7 (commencing with Section 3691) or Chapter 8 (commencing with Section 3771) of Part 6 of Division 1 of the Revenue and Taxation Code.
- e. No liability shall arise, nor any action be brought or maintained against, any agent of any party to a transfer of title, including any person or entity acting in the capacity of an escrow, for any error, inaccuracy or omission relating to the disclosure required to be made by a transferor pursuant to this section. However, this subdivision does not apply to a licensee, as defined in Section 10011 of the Business and Professions Code, where the licensee participates in the making of the disclosure required to be made pursuant to this section with actual knowledge of the falsity of the disclosure.
- f. Except as otherwise provided in this section, this section shall not be deemed to create or imply a duty upon a licensee, as defined in Section 10011 of the

Business and Professions Code, or upon any agent of any party to a transfer of title, including any person or entity acting in the capacity of an escrow, to monitor or ensure compliance with this section.

- g. No transfer of title shall be invalidated on the basis of a failure to comply with this section, and the exclusive remedy for the failure to comply with this section is an award of actual damages not to exceed one hundred dollars (\$100), exclusive of any court costs and attorney's fees.
- h. Local ordinances requiring smoke detectors in single-family dwellings may be enacted or amended. However, the ordinances shall satisfy the minimum requirements of this section.
- i. For the purposes of this section, "single-family dwelling" does not include a manufactured home as defined in Section 18007, a mobilehome as defined in Section 18008, or a commercial coach as defined in Section 18001.8.
- j. This section shall not apply to the installation of smoke detectors in dwellings intended for human occupancy, as defined in and regulated by Section 13113.7 of the Health and Safety Code, as added by Senate Bill No. 1448 in the 1983-84 Regular Session.

SECTION R315 CARBON MONOXIDE ALARMS

R315.1 General. Carbon monoxide alarms shall comply with Section R315.

R315.1.1 Listings. Carbon monoxide alarms shall be listed in accordance with UL 2034. Combination carbon monoxide and smoke alarms shall be listed in accordance with UL 217 and UL 2034.

No person shall install, market, distribute, offer for sale or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the Office of the State Fire Marshal.

R315.2 Where required. Carbon monoxide alarms shall be provided in accordance with Sections R315.2.1 and R315.2.2.

Pursuant to Health and Safety Code Section 17926, carbon monoxide devices shall be installed in all existing dwelling units as required in this section.

R315.2.1 Existing buildings and new construction. For existing buildings and new construction, carbon monoxide alarms shall be provided in dwelling units where either or both of the following conditions exist.

1. The dwelling unit contains a fuel-fired appliance or fireplace.
2. The dwelling unit has an attached garage with an opening that communicates with the dwelling unit.

R315.2.2 Alterations, repairs and additions. *Where an addition is made to an existing dwelling, or a fuel-burning heater, appliance or fireplace is added to an existing dwelling, not previously required to be provided with*

carbon monoxide alarms, new carbon monoxide alarms shall be installed in accordance with Section R315.

Exceptions:

1. Work involving the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.
2. Installation, alteration or repairs of plumbing systems.
3. Installation, alteration or repairs of mechanical systems that are not fuel fired.

R315.3 Location. Carbon monoxide alarms in dwelling units shall be installed *and maintained in accordance with the manufacturer's published instructions in the following locations:*

1. Outside of each separate sleeping area in the immediate vicinity of the bedrooms.
2. *On every occupiable level of a dwelling unit, including basements.*
3. Where a fuel-burning appliance is located within a bedroom or its attached bathroom, a carbon monoxide alarm shall be installed within the bedroom.

R315.4 Combination alarms. Combination carbon monoxide and smoke alarms shall be permitted to be used in lieu of carbon monoxide alarms.

Combination carbon monoxide/smoke alarms shall comply with Section R315 and all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

R315.5 Interconnectivity. Where more than one carbon monoxide alarm is required to be installed within an individual dwelling unit in accordance with Section R315.3, the alarm devices shall be interconnected in such a manner that the actuation of one alarm will activate all of the alarms in the individual dwelling unit. Physical interconnection of carbon monoxide alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.

Exception: Interconnection of carbon monoxide alarms in existing buildings built prior to January 1, 2011, shall not be required *under any of the following conditions:*

1. *Where alterations or repairs do not result in removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.*
2. *No construction is taking place.*
3. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
4. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical sys-*

tems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.

R315.6 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source and, where primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than those required for overcurrent protection.

Exceptions:

1. Carbon monoxide alarms shall be permitted to be battery operated where installed in buildings without commercial power.
2. Carbon monoxide alarms installed in accordance with Section R315.2.2 shall be permitted to be battery powered.
3. *Carbon monoxide alarms in Group R occupancies shall be permitted to receive their primary power from other power sources recognized for use by NFPA 72.*
4. *Carbon monoxide alarms in Group R occupancies shall be permitted to be battery-powered or plug-in with a battery backup in existing buildings built prior to January 1, 2011, under any of the following conditions:*
 - 4.1. *No construction is taking place.*
 - 4.2. *Repairs or alterations do not result in the removal of interior wall and ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*
 - 4.3. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
 - 4.4. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*

R315.7 Carbon monoxide detection systems. Carbon monoxide detection systems shall be permitted to be used in lieu of carbon monoxide alarms and shall comply with Sections R315.7.1 through R315.7.4.

R315.7.1 General. Household carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

R315.7.2 Location. Carbon monoxide detectors shall be installed *and maintained* in the locations specified in Section R315.3 or NFPA 72.

R315.7.3 Permanent fixture. Where a household carbon monoxide detection system is installed, it shall become a permanent fixture of the occupancy and owned by the homeowner.

R315.7.4 Combination detectors. Combination carbon monoxide and smoke detectors installed in carbon monoxide detection systems in lieu of carbon monoxide detectors shall be listed in accordance with UL 268 and UL 2075.

Combination carbon monoxide/smoke detectors shall comply with all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

SECTION R316 FOAM PLASTIC

R316.1 General. The provisions of this section shall govern the materials, design, application, construction and installation of foam plastic materials.

R316.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the requirements.

R316.2.1 Labeling of polystyrene foam insulation without flame retardants. *In addition to the requirements of Section 2603.2 of the California Building Code, polystyrene foam insulation boards manufactured with no flame retardants added shall be labeled in accordance with this section.*

1. *Each board shall be labeled on each face every 8 square feet in red 1/2-inch text with the following information:*

WARNING – FIRE HAZARD

This product is required to be installed below a minimum 3.5-inch thick concrete slab on grade

**NOT FOR VERTICAL OR
ABOVE GRADE APPLICATIONS**

*This product contains NO flame retardants.
Not tested for flame spread or smoke development requirements of the model building codes.*

2. *Each package shall be labeled on at least two sides in red 1/2-inch text with the following information:*

WARNING – COMBUSTIBLE MATERIAL

*Keep away from ignition sources.
Maintain code-required separation between product storage and structures under construction (minimum 30 feet).*

R316.3 Surface burning characteristics. Unless otherwise allowed in Section R316.5, foam plastic, or foam plastic cores used as a component in manufactured assemblies, used in building construction shall comply with Section R316.3.1 or R316.3.2. Loose-fill-type foam plastic insulation shall be

tested as board stock for the flame spread index and smoke-developed index.

Exceptions:

1. *Spray foam plastic insulation more than 4 inches (102 mm) in thickness shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 450 where tested at a thickness of 4 inches (102 mm) and at the density intended for use. Such spray foam plastic shall be separated from the interior of a building by 1/2-inch (12.7 mm) gypsum wallboard or by a material that has been tested in accordance with NFPA 275, and shall meet the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test.*
2. *Polystyrene foam insulation boards with a maximum thickness of 2 inches where installed below a minimum 3.5-inch thick concrete slab on grade.*

R316.3.1 Foam plastic insulation 4 inches thick or less.

Foam plastic insulation installed at 4 inches (102 mm) in thickness or less shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness and density intended for use in accordance with ASTM E84 or UL 723.

R316.3.2 Foam plastic insulation more than 4 inches thick.

Foam plastic insulation installed at more than 4 inches (102 mm) in thickness shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested at a thickness of 4 inches (102 mm) in accordance with ASTM E84 or UL 723, provided that the end use is approved in accordance with Section R316.6 using the thickness and density intended for use.

R316.4 Thermal barrier. Unless otherwise allowed in Section R316.5, foam plastic shall be separated from the interior of a building by an approved thermal barrier of not less than 1/2-inch (12.7 mm) gypsum wallboard, 23/32-inch (18.2 mm) wood structural panel or a material that is tested in accordance with and meets the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275.

R316.5 Specific requirements. The following requirements shall apply to these uses of foam plastic unless specifically approved in accordance with Section R316.6 or by other sections of the code or the requirements of Sections R316.2 through R316.4 have been met.

R316.5.1 Masonry or concrete construction. The thermal barrier specified in Section R316.4 is not required in a masonry or concrete wall, floor or roof where the foam plastic insulation is separated from the interior of the building by not less than a 1-inch (25 mm) thickness of masonry or concrete.

R316.5.2 Roofing. The thermal barrier specified in Section R316.4 is not required where the foam plastic in a roof assembly or under a roof covering is installed in

accordance with the code and the manufacturer's instructions and is separated from the interior of the building by tongue-and-groove wood planks or wood structural panel sheathing, in accordance with Section R803, that is not less than $1\frac{5}{32}$ inch (11.9 mm) thick bonded with exterior glue, identified as Exposure 1 and with edges supported by blocking or tongue-and-groove joints or an equivalent material. The smoke-developed index for roof applications shall not be limited.

R316.5.3 Attics. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. Attic access is required by Section R807.1.
2. The space is entered only for purposes of repairs or maintenance.
3. The foam plastic insulation has been tested in accordance with Section R316.6 or the foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
 - 3.1. $1\frac{1}{2}$ -inch-thick (38 mm) mineral fiber insulation.
 - 3.2. $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels.
 - 3.3. $\frac{3}{8}$ -inch (9.5 mm) particleboard.
 - 3.4. $\frac{1}{4}$ -inch (6.4 mm) hardboard.
 - 3.5. $\frac{3}{8}$ -inch (9.5 mm) gypsum board.
 - 3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).
 - 3.7. $1\frac{1}{2}$ -inch-thick (38 mm) cellulose insulation.
 - 3.8. $\frac{1}{4}$ -inch (6.4 mm) fiber-cement panel, soffit or backer board.

The ignition barrier is not required where the foam plastic insulation has been tested in accordance with Section R316.6.

R316.5.4 Crawl spaces. The thermal barrier specified in Section R316.4 is not required where all of the following apply:

1. Crawl space access is required by Section R408.4.
2. Entry is made only for purposes of repairs or maintenance.
3. The foam plastic insulation has been tested in accordance with Section R316.6 or the foam plastic insulation is protected against ignition using one of the following ignition barrier materials:
 - 3.1. $1\frac{1}{2}$ -inch-thick (38 mm) mineral fiber insulation.
 - 3.2. $\frac{1}{4}$ -inch-thick (6.4 mm) wood structural panels.
 - 3.3. $\frac{3}{8}$ -inch (9.5 mm) particleboard.
 - 3.4. $\frac{1}{4}$ -inch (6.4 mm) hardboard.
 - 3.5. $\frac{3}{8}$ -inch (9.5 mm) gypsum board.
 - 3.6. Corrosion-resistant steel having a base metal thickness of 0.016 inch (0.406 mm).

- 3.7. $\frac{1}{4}$ -inch (6.4 mm) fiber-cement panel, soffit or backer board.

R316.5.5 Foam-filled exterior doors. Foam-filled exterior doors are exempt from the requirements of Sections R316.3 and R316.4.

R316.5.6 Foam-filled garage doors. Foam-filled garage doors in attached or detached garages are exempt from the requirements of Sections R316.3 and R316.4.

R316.5.7 Foam backer board. The thermal barrier specified in Section R316.4 is not required where siding backer board foam plastic insulation has a thickness of not more than 0.5 inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/m²) when tested in accordance with NFPA 259 and it complies with one or more of the following:

1. The foam plastic insulation is separated from the interior of the building by not less than 2 inches (51 mm) of mineral fiber insulation.
2. The foam plastic insulation is installed over existing exterior wall finish in conjunction with re-siding.
3. The foam plastic insulation has been tested in accordance with Section R316.6.

R316.5.8 Re-siding. The thermal barrier specified in Section R316.4 is not required where the foam plastic insulation is installed over existing exterior wall finish in conjunction with re-siding provided that the foam plastic has a thickness of not more than 0.5 inch (12.7 mm) and a potential heat of not more than 2000 Btu per square foot (22 720 kJ/m²) when tested in accordance with NFPA 259.

R316.5.9 Interior trim. The thermal barrier specified in Section R316.4 is not required for exposed foam plastic interior trim, provided that all of the following are met:

1. The density is not less than 20 pounds per cubic foot (320 kg/m³).
2. The thickness of the trim is not more than 0.5 inch (12.7 mm) and the width is not more than 8 inches (204 mm).
3. The interior trim shall not constitute more than 10 percent of the aggregate wall and ceiling area of any room or space.
4. The flame spread index does not exceed 75 when tested in accordance with ASTM E84 or UL 723. The smoke-developed index is not limited.

R316.5.10 Interior finish. Foam plastics used as interior finishes shall comply with Section R316.6 and shall meet the flame spread index and smoke-developed index requirements of Sections R302.9.1 and R302.9.2.

R316.5.11 Sill plates and headers. Foam plastic spray applied to sill plates and headers or installed in the perimeter joist space without the thermal barrier specified in Section R316.4 shall comply with all of the following:

1. The thickness of the foam plastic shall be not more than $3\frac{1}{4}$ inches (83 mm).

2. The density of the foam plastic shall be in the range of 0.5 to 2.0 pounds per cubic foot (8 to 32 kg/m³).
3. The foam plastic shall have a flame spread index of 25 or less and an accompanying smoke-developed index of 450 or less when tested in accordance with ASTM E84 or UL 723.

R316.5.12 Sheathing. Foam plastic insulation used as sheathing shall comply with Section R316.3 and Section R316.4. Where the foam plastic sheathing is exposed to the attic space at a gable or kneewall, the provisions of Section R316.5.3 shall apply. Where foam plastic insulation is used as exterior wall sheathing on framed wall assemblies, it shall comply with Section R316.8.

R316.5.13 Floors. The thermal barrier specified in Section R316.4 is not required to be installed on the walking surface of a structural floor system that contains foam plastic insulation where the foam plastic is covered by not less than a nominal 1/2-inch-thick (12.7 mm) wood structural panel or equivalent. The thermal barrier specified in Section R316.4 is required on the underside of the structural floor system that contains foam plastic insulation where the underside of the structural floor system is exposed to the interior of the building.

R316.6 Specific approval. Foam plastic not meeting the requirements of Sections R316.3 through R316.5 shall be specifically approved on the basis of one of the following approved tests: NFPA 286 with the acceptance criteria of Section R302.9.4, FM 4880, UL 1040 or UL 1715, or fire tests related to actual end-use configurations. Approval shall be based on the actual end-use configuration and shall be performed on the finished foam plastic assembly in the maximum thickness intended for use. Assemblies tested shall include seams, joints and other typical details used in the installation of the assembly and shall be tested in the manner intended for use.

R316.7 Termite damage. The use of foam plastics in areas of “very heavy” termite infestation probability shall be in accordance with Section R318.4.

R316.8 Wind resistance. Foam plastic insulation complying with ASTM C578 and ASTM C1289 and used as exterior wall sheathing on framed wall assemblies shall comply with SBCA FS 100 for wind pressure resistance unless installed directly over a sheathing material that is separately capable of resisting the wind load or otherwise exempted from the scope of SBCA FS 100.

SECTION R317 PROTECTION OF WOOD AND WOOD-BASED PRODUCTS AGAINST DECAY

R317.1 Location required. Protection of wood and wood-based products from decay shall be provided in the following locations by the use of naturally durable wood or wood that is preservative-treated in accordance with AWPA U1.

1. In crawl spaces or unexcavated areas located within the periphery of the building foundation, wood joists or the bottom of a wood structural floor where closer than 18

inches (457 mm) to exposed ground, wood girders where closer than 12 inches (305 mm) to exposed ground, and wood columns where closer than 8 inches (204 mm) to exposed ground.

2. Wood framing members, including columns, that rest directly on concrete or masonry exterior foundation walls and are less than 8 inches (203 mm) from the exposed ground.
3. Sills and sleepers on a concrete or masonry slab that is in direct contact with the ground unless separated from such slab by an impervious moisture barrier.
4. The ends of wood girders entering exterior masonry or concrete walls having clearances of less than 1/2 inch (12.7 mm) on tops, sides and ends.
5. Wood siding, sheathing and wall framing on the exterior of a building having a clearance of less than 6 inches (152 mm) from the ground or less than 2 inches (51 mm) measured vertically from concrete steps, porch slabs, patio slabs and similar horizontal surfaces exposed to the weather.
6. Wood structural members supporting moisture-permeable floors or roofs that are exposed to the weather, such as concrete or masonry slabs, unless separated from such floors or roofs by an impervious moisture barrier. *The impervious moisture barrier system protecting the structure supporting floors shall provide positive drainage of water that infiltrates the moisture-permeable floor topping.*
7. Wood furring strips or other wood framing members attached directly to the interior of exterior masonry walls or concrete walls below grade except where an approved vapor retarder is applied between the wall and the furring strips or framing members.
8. Portions of wood structural members that form the structural supports of buildings, balconies, porches or similar permanent building appurtenances where those members are exposed to the weather without adequate protection from a roof, eave, overhang or other covering that would prevent moisture or water accumulation on the surface or at joints between members.

Exception: Sawn lumber used in buildings located in a geographical region where experience has demonstrated that climatic conditions preclude the need to use naturally durable or preservative-treated wood where the structure is exposed to the weather.

9. Wood columns in contact with basement floor slabs unless supported by concrete piers or metal pedestals projecting not less than 1 inch (25 mm) above the concrete floor and separated from the concrete pier by an impervious moisture barrier.

R317.1.1 Field treatment. Field-cut ends, notches and drilled holes of preservative-treated wood shall be treated in the field in accordance with AWPA M4.

R317.1.2 Ground contact. All wood in contact with the ground, embedded in concrete in direct contact with the ground or embedded in concrete exposed to the weather

that supports permanent structures intended for human occupancy shall be approved pressure-preservative-treated wood suitable for ground contact use, except that untreated wood used entirely below groundwater level or continuously submerged in fresh water shall not be required to be pressure-preservative treated.

R317.1.3 Ventilation required beneath balcony or elevated walking surfaces. Enclosed framing in exterior balconies and elevated walking surfaces that are exposed to rain, snow or drainage from irrigation shall be provided with openings that provide a net-free cross-ventilation area not less than $1/150$ of the area of each separate space.

R317.2 Quality mark. Lumber and plywood required to be pressure-preservative treated in accordance with Section R317.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

R317.2.1 Required information. The required quality mark on each piece of pressure-preservative-treated lumber or plywood shall contain the following information:

1. Identification of the treating plant.
2. Type of preservative.
3. The minimum preservative retention.
4. End use for which the product was treated.
5. Standard to which the product was treated.
6. Identity of the approved inspection agency.
7. The designation "Dry," if applicable.

Exception: Quality marks on lumber less than 1 inch (25 mm) nominal thickness, or lumber less than nominal 1 inch by 5 inches (25 mm by 127 mm) or 2 inches by 4 inches (51 mm by 102 mm) or lumber 36 inches (914 mm) or less in length shall be applied by stamping the faces of exterior pieces or by end labeling not less than 25 percent of the pieces of a bundled unit.

R317.3 Fasteners and connectors in contact with preservative-treated and fire-retardant-treated wood. Fasteners, including nuts and washers, and connectors in contact with preservative-treated wood and fire-retardant-treated wood shall be in accordance with this section. The coating weights for zinc-coated fasteners shall be in accordance with ASTM A153. Stainless steel driven fasteners shall be in accordance with the material requirements of ASTM F1667.

R317.3.1 Fasteners for preservative-treated wood. Fasteners, including nuts and washers, for preservative-treated wood shall be of hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Staples shall be of stainless steel. Coating types and weights for connectors in contact with preservative-treated

wood shall be in accordance with the connector manufacturer's recommendations. In the absence of manufacturer's recommendations, not less than ASTM A653 type G185 zinc-coated galvanized steel, or equivalent, shall be used.

Exceptions:

1. $1/2$ -inch-diameter (12.7 mm) or greater steel bolts.
2. Fasteners other than nails, staples and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.
3. Plain carbon steel fasteners in SBX/DOT and zinc borate preservative-treated wood in an interior, dry environment shall be permitted.

R317.3.2 Fastenings for wood foundations. Fastenings, including nuts and washers, for wood foundations shall be as required in AWC PWF.

R317.3.3 Fasteners for fire-retardant-treated wood used in exterior applications or wet or damp locations. Fasteners, including nuts and washers, for fire-retardant-treated wood used in exterior applications or wet or damp locations shall be of hot-dipped, zinc-coated galvanized steel, stainless steel, silicon bronze or copper. Fasteners other than nails, staples and timber rivets shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum.

R317.3.4 Fasteners for fire-retardant-treated wood used in interior applications. Fasteners, including nuts and washers, for fire-retardant-treated wood used in interior locations shall be in accordance with the manufacturer's recommendations. In the absence of the manufacturer's recommendations, Section R317.3.3 shall apply.

R317.4 Plastic composites. Plastic composite exterior deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall comply with the requirements of Section R507.2.2.

SECTION R318 PROTECTION AGAINST SUBTERRANEAN TERMITES

R318.1 Subterranean termite control methods. In areas subject to damage from termites as indicated by Table R301.2, protection shall be by one, or a combination, of the following methods:

1. Chemical termiticide treatment in accordance with Section R318.2.
2. Termite-baiting system installed and maintained in accordance with the *label*.
3. Pressure-preservative-treated wood in accordance with the provisions of Section R317.1.

4. Naturally durable termite-resistant wood.
5. Physical barriers in accordance with Section R318.3 and used in locations as specified in Section R317.1.
6. Cold-formed steel framing in accordance with Sections R505.2.1 and R603.2.1.

R318.1.1 Quality mark. Lumber and plywood required to be pressure-preservative treated in accordance with Section R318.1 shall bear the quality mark of an approved inspection agency that maintains continuing supervision, testing and inspection over the quality of the product and that has been approved by an accreditation body that complies with the requirements of the American Lumber Standard Committee treated wood program.

R318.1.2 Field treatment. Field-cut ends, notches and drilled holes of pressure-preservative-treated wood shall be retreated in the field in accordance with AWWA M4.

R318.2 Chemical termiticide treatment. Chemical termiticide treatment shall include soil treatment or field-applied wood treatment. The concentration, rate of application and method of treatment of the chemical termiticide shall be in strict accordance with the termiticide label.

R318.3 Barriers. Approved physical barriers, such as metal or plastic sheeting or collars specifically designed for termite prevention, shall be installed in a manner to prevent termites from entering the structure. Shields placed on top of an exterior foundation wall shall be used only if in combination with another method of protection.

R318.4 Foam plastic protection. In areas where the probability of termite infestation is “very heavy” as indicated in Figure R318.4, extruded and expanded polystyrene, polyisocyanurate and other foam plastics shall not be installed on the exterior face or under interior or exterior foundation walls or slab foundations located below grade. The clearance between foam plastics installed above grade and exposed earth shall be not less than 6 inches (152 mm).

Exceptions:

1. Buildings where the structural members of walls, floors, ceilings and roofs are entirely of noncombustible materials or pressure-preservative-treated wood.
2. Where in addition to the requirements of Section R318.1, an approved method of protecting the foam plastic and structure from subterranean termite damage is used.
3. On the interior side of basement walls.

**SECTION R319
SITE ADDRESS**

R319.1 Address identification. Buildings shall be provided with approved address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) in height with a stroke width of not less than 0.5 inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building address cannot be viewed from the public way, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

**SECTION R320
ACCESSIBILITY**

R320.1 Scope. *Dwelling units in a building consisting of three or more dwelling units or four or more condominium units shall meet the requirements of the California Building Code Chapter 11A. Covered Multifamily Dwellings include but are not limited to dwelling units listed in Section 1.8.2.1.2. Dwelling units within a single structure separated by firewalls do not constitute separate buildings.*

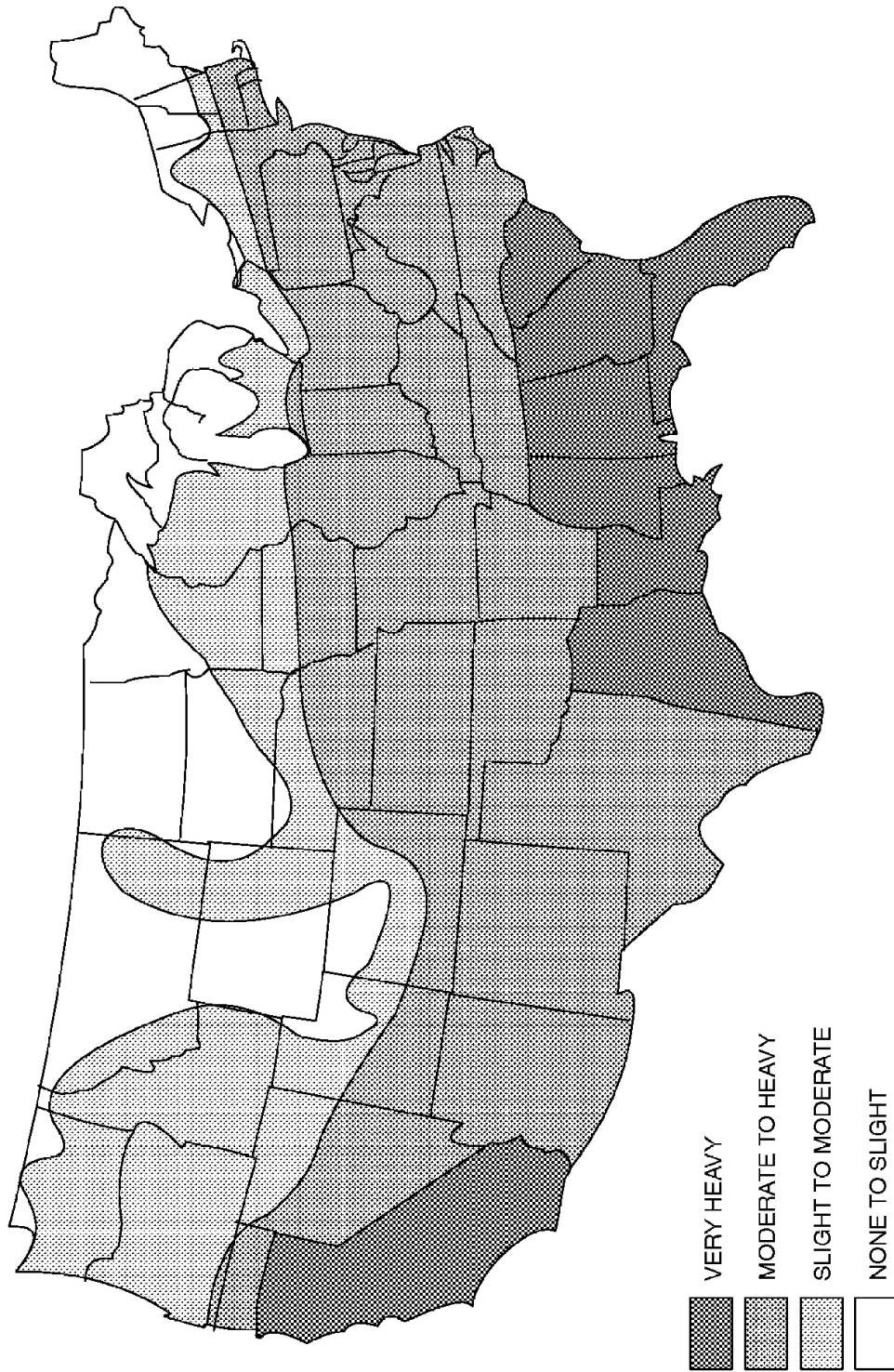
R320.2 Live/work units. In a structure where there are four or more live/work units, the dwelling portion of the live/work unit shall comply with *Chapter 11A of the California Building Code, as applicable. In a structure where there are one or more live/work units defined as public housing, the dwelling portion of the live/work unit shall comply with Chapter 11B of the California Building Code, as applicable. The work portion of the unit must comply with Chapter 11B if it is a public accommodation.*

**SECTION R321
ELEVATORS AND PLATFORM LIFTS**

R321.1 Elevators. Where provided, passenger elevators, limited-use and limited-application elevators or private residence elevators shall comply with ASME A17.1/CSA B44.

R321.2 Platform lifts. Where provided, platform lifts shall comply with ASME A18.1.

R321.3 Accessibility. Elevators or platform (*wheelchair*) lifts that are part of an accessible route required by Chapter 11A of the *California Building Code*, shall comply with *the requirements in Chapter 11A of the California Building Code.*



Note: Lines defining areas are approximate only. Local conditions may be more or less severe than indicated by the region classification.

FIGURE R318.4
TERMITE INFESTATION PROBABILITY MAP

SECTION R322 FLOOD-RESISTANT CONSTRUCTION

R322.1 General. Buildings and structures constructed in whole or in part in flood hazard areas, including A or V Zones and Coastal A Zones, as established in Table R301.2, and substantial improvement and repair of substantial damage of buildings and structures in flood hazard areas, shall be designed and constructed in accordance with the provisions contained in this section. Buildings and structures that are located in more than one flood hazard area shall comply with the provisions associated with the most restrictive flood hazard area. Buildings and structures located in whole or in part in identified floodways shall be designed and constructed in accordance with ASCE 24.

R322.1.1 Alternative provisions. As an alternative to the requirements in Section R322, ASCE 24 is permitted subject to the limitations of this code and the limitations therein.

R322.1.2 Structural systems. Structural systems of buildings and structures shall be designed, connected and anchored to resist flotation, collapse or permanent lateral movement due to structural loads and stresses from flooding equal to the design flood elevation.

R322.1.3 Flood-resistant construction. Buildings and structures erected in areas prone to flooding shall be constructed by methods and practices that minimize flood damage.

R322.1.4 Establishing the design flood elevation. The design flood elevation shall be used to define flood hazard areas. At a minimum, the design flood elevation shall be the higher of the following:

1. The base flood elevation at the depth of peak elevation of flooding, including wave height, that has a 1-percent (100-year flood) or greater chance of being equaled or exceeded in any given year.
2. The elevation of the design flood associated with the area designated on a flood hazard map adopted by the community, or otherwise legally designated.

R322.1.4.1 Determination of design flood elevations. If design flood elevations are not specified, the building official is authorized to require the applicant to comply with either of the following:

1. Obtain and reasonably use data available from a federal, state or other source.
2. Determine the design flood elevation in accordance with accepted hydrologic and hydraulic engineering practices used to define special flood hazard areas. Determinations shall be undertaken by a registered design professional who shall document that the technical methods used reflect currently accepted engineering practice. Studies, analyses and computations shall be submitted in sufficient detail to allow thorough review and approval.

R322.1.4.2 Determination of impacts. In riverine flood hazard areas where design flood elevations are specified but floodways have not been designated, the applicant shall demonstrate that the effect of the proposed buildings and structures on design flood elevations, including fill, when combined with other existing and anticipated flood hazard area encroachments, will not increase the design flood elevation more than 1 foot (305 mm) at any point within the jurisdiction.

R322.1.5 Lowest floor. The lowest floor shall be the lowest floor of the lowest enclosed area, including basement, and excluding any unfinished flood-resistant enclosure that is useable solely for vehicle parking, building access or limited storage provided that such enclosure is not built so as to render the building or structure in violation of this section.

R322.1.6 Protection of mechanical, plumbing and electrical systems. Electrical systems, equipment and components; heating, ventilating, air-conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall be located at or above the elevation required in Section R322.2 or R322.3. If replaced as part of a substantial improvement, electrical systems, equipment and components; heating, ventilating, air-conditioning and plumbing appliances and plumbing fixtures; duct systems; and other service equipment shall meet the requirements of this section. Systems, fixtures, and equipment and components shall not be mounted on or penetrate through walls intended to break away under flood loads.

Exception: Locating electrical systems, equipment and components; heating, ventilating, air-conditioning; plumbing appliances and plumbing fixtures; duct systems; and other service equipment is permitted below the elevation required in Section R322.2 or R322.3 provided that they are designed and installed to prevent water from entering or accumulating within the components and to resist hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the required elevation in accordance with ASCE 24. Electrical wiring systems are permitted to be located below the required elevation provided that they conform to the provisions of the *California Electrical Code* for wet conditions.

R322.1.7 Protection of water supply and sanitary sewage systems. *Water supply systems shall be designed to minimize or eliminate infiltration of floodwaters into the water supply and distribution systems. Sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters into sanitary drainage systems and discharges from sanitary drainage systems into floodwaters.*

R322.1.8 Flood-resistant materials. Building materials and installation methods used for flooring and interior and exterior walls and wall coverings below the elevation required in Section R322.2 or R322.3 shall be flood damage-resistant materials that conform to the provisions of FEMA TB-2.

R322.1.9 Manufactured homes. *(Not adopted in CA)*

R322.1.10 As-built elevation documentation. A registered design professional shall prepare and seal documentation of the elevations specified in Section R322.2 or R322.3.

R322.2 Flood hazard areas (including A Zones). Areas that have been determined to be prone to flooding and that are not subject to high-velocity wave action shall be designated as flood hazard areas. Flood hazard areas that have been delineated as subject to wave heights between 1½ feet (457 mm) and 3 feet (914 mm) or otherwise designated by the jurisdiction shall be designated as Coastal A Zones and are subject to the requirements of Section R322.3. Buildings and structures constructed in whole or in part in flood hazard areas shall be designed and constructed in accordance with Sections R322.2.1 through R322.2.4.

R322.2.1 Elevation requirements.

1. Buildings and structures in flood hazard areas, not including flood hazard areas designated as Coastal A Zones, shall have the lowest floors elevated to or above the base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
2. In areas of shallow flooding (AO Zones), buildings and structures shall have the lowest floor (including basement) elevated to a height above the highest adjacent grade of not less than the depth number specified in feet (mm) on the FIRM plus 1 foot (305 mm), or not less than 3 feet (915 mm) if a depth number is not specified.
3. Basement floors that are below grade on all sides shall be elevated to or above base flood elevation plus 1 foot (305 mm), or the design flood elevation, whichever is higher.
4. Garage and carport floors shall comply with one of the following:
 - 4.1. They shall be elevated to or above the elevations required in Item 1 or Item 2, as applicable.
 - 4.2. They shall be at or above grade on not less than one side. Where a garage or carport is enclosed by walls, the garage or carport shall be used solely for parking, building access or storage.

Exception: Enclosed areas below the elevation required in this section, including basements with floors that are not below grade on all sides, shall meet the requirements of Section R322.2.2.

R322.2.2 Enclosed area below required elevation. Enclosed areas, including *crawl spaces*, that are below the elevation required in Section R322.2.1 shall:

1. Be used solely for parking of vehicles, building access or storage.
2. Be provided with flood openings that meet the following criteria and are installed in accordance with Section R322.2.2.1:

- 2.1. The total net area of nonengineered openings shall be not less than 1 square inch (645 mm²) for each square foot (0.093 m²) of enclosed area where the enclosed area is measured on the exterior of the enclosure walls, or the openings shall be designed as engineered openings and the construction documents shall include a statement by a registered design professional that the design of the openings will provide for equalization of hydrostatic flood forces on exterior walls by allowing for the automatic entry and exit of floodwaters as specified in Section 2.7.2.2 of ASCE 24.
- 2.2. Openings shall be not less than 3 inches (76 mm) in any direction in the plane of the wall.
- 2.3. The presence of louvers, blades, screens and faceplates or other covers and devices shall allow the automatic flow of floodwater into and out of the enclosed areas and shall be accounted for in the determination of the net open area.

R322.2.2.1 Installation of openings. The walls of enclosed areas shall have openings installed such that:

1. There shall be not less than two openings on different sides of each enclosed area; if a building has more than one enclosed area, each area shall have openings.
2. The bottom of each opening shall be not more than 1 foot (305 mm) above the higher of the final interior grade or floor and the finished exterior grade immediately under each opening.
3. Openings shall be permitted to be installed in doors and windows; doors and windows without installed openings do not meet the requirements of this section.

R322.2.3 Foundation design and construction. Foundation walls for buildings and structures erected in flood hazard areas shall meet the requirements of Chapter 4.

Exception: Unless designed in accordance with Section R404:

1. The unsupported height of 6-inch (152 mm) plain masonry walls shall be not more than 3 feet (914 mm).
2. The unsupported height of 8-inch (203 mm) plain masonry walls shall be not more than 4 feet (1219 mm).
3. The unsupported height of 8-inch (203 mm) reinforced masonry walls shall be not more than 8 feet (2438 mm).

For the purpose of this exception, unsupported height is the distance from the finished grade of the under-floor space to the top of the wall.

R322.2.4 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under

conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.2.1 or shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood.

R322.3 Coastal high-hazard areas (including V Zones and Coastal A Zones, where designated). Areas that have been determined to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave action or wave-induced erosion shall be designated as coastal high-hazard areas. Flood hazard areas that have been designated as subject to wave heights between 1½ feet (457 mm) and 3 feet (914 mm) or otherwise designated by the jurisdiction shall be designated as Coastal A Zones. Buildings and structures constructed in whole or in part in coastal high-hazard areas and Coastal A Zones, where designated, shall be designed and constructed in accordance with Sections R322.3.1 through R322.3.10.

R322.3.1 Location and site preparation.

1. New buildings and buildings that are determined to be substantially improved pursuant to Section R105.3.1.1 shall be located landward of the reach of mean high tide.
2. For any alteration of sand dunes and mangrove stands, the building official shall require submission of an engineering analysis that demonstrates that the proposed alteration will not increase the potential for flood damage.

R322.3.2 Elevation requirements.

1. Buildings and structures erected within coastal high-hazard areas and Coastal A Zones, shall be elevated so that the bottom of the lowest horizontal structural members supporting the lowest floor, with the exception of piling, pile caps, columns, grade beams and bracing, is elevated to or above the base flood elevation plus 1 foot (305 mm) or the design flood elevation, whichever is higher.
2. Basement floors that are below grade on all sides are prohibited.
3. Garages used solely for parking, building access or storage, and carports shall comply with Item 1 or shall be at or above grade on not less than one side and, if enclosed with walls, such walls shall comply with Item 6.
4. The use of fill for structural support is prohibited.
5. Minor grading, and the placement of minor quantities of fill, shall be permitted for landscaping and for drainage purposes under and around buildings and for support of parking slabs, pool decks, patios and walkways.
6. Walls and partitions enclosing areas below the elevation required in this section shall meet the requirements of Sections R322.3.5 and R322.3.6.

R322.3.3 Foundations. Buildings and structures erected in coastal high-hazard areas and Coastal A Zones shall be supported on pilings or columns and shall be adequately

anchored to such pilings or columns and shall comply with the following:

1. The space below the elevated building shall be either free of obstruction or, if enclosed with walls, the walls shall meet the requirements of Section R322.3.5.
2. Pilings shall have adequate soil penetrations to resist the combined wave and wind loads (lateral and uplift) and pile embedment shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the piling.
3. Columns and their supporting foundations shall be designed to resist combined wave and wind loads, lateral and uplift, and shall include consideration of decreased resistance capacity caused by scour of soil strata surrounding the columns. Spread footing, mat, raft or other foundations that support columns shall not be permitted where soil investigations that are required in accordance with Section R401.4 indicate that soil material under the spread footing, mat, raft or other foundation is subject to scour or erosion from wave-velocity flow conditions. If permitted, spread footing, mat, raft or other foundations that support columns shall be designed in accordance with ASCE 24.
4. Flood and wave loads shall be those associated with the design flood. Wind loads shall be those required by this code.
5. Foundation designs and construction documents shall be prepared and sealed in accordance with Section R322.3.9.

Exception: In Coastal A Zones, stem wall foundations supporting a floor system above and backfilled with soil or gravel to the underside of the floor system shall be permitted provided that the foundations are designed to account for wave action, debris impact, erosion and local scour. Where soils are susceptible to erosion and local scour, stem wall foundations shall have deep footings to account for the loss of soil.

R322.3.4 Concrete slabs. Concrete slabs used for parking, floors of enclosures, landings, decks, walkways, patios and similar uses that are located beneath structures, or slabs that are located such that if undermined or displaced during base flood conditions could cause structural damage to the building foundation, shall be designed and constructed in accordance with one of the following:

1. To be structurally independent of the foundation system of the structure, to not transfer flood loads to the main structure, and to be frangible and break away under flood conditions prior to base flood conditions. Slabs shall be a maximum of 4 inches (102 mm) thick, shall not have turned-down edges, shall not contain reinforcing, shall have isolation joints at pilings and columns, and shall have control or construction joints in both directions spaced not more than 4 feet (1219 mm) apart.

- To be self-supporting, structural slabs capable of remaining intact and functional under base flood conditions, including erosion and local scour, and the main structure shall be capable of resisting any added flood loads and effects of local scour caused by the presence of the slabs.

R322.3.5 Walls below required elevation. Walls and partitions are permitted below the elevation required in Section R322.3.2, provided that such walls and partitions are not part of the structural support of the building or structure and:

- Electrical, mechanical and plumbing system components are not to be mounted on or penetrate through walls that are designed to break away under flood loads; and
- Are constructed with insect screening or open lattice; or
- Are designed to break away or collapse without causing collapse, displacement or other structural damage to the elevated portion of the building or supporting foundation system. Such walls, framing and connections shall have a resistance of not less than 10 (479 Pa) and not more than 20 pounds per square foot (958 Pa) as determined using allowable stress design; or
- Where wind loading values of this code exceed 20 pounds per square foot (958 Pa), as determined using allowable stress design, the construction documents shall include documentation prepared and sealed by a registered design professional that:
 - The walls and partitions below the required elevation have been designed to collapse from a water load less than that which would occur during the base flood.
 - The elevated portion of the building and supporting foundation system have been designed to withstand the effects of wind and flood loads acting simultaneously on structural and nonstructural building components. Water-loading values used shall be those associated with the design flood. Wind-loading values shall be those required by this code.
- Walls intended to break away under flood loads as specified in Item 3 or 4 have flood openings that meet the criteria in Section R322.2.2, Item 2.

R322.3.6 Enclosed areas below required elevation. Enclosed areas below the elevation required in Section R322.3.2 shall be used solely for parking of vehicles, building access or storage.

R322.3.6.1 Protection of building envelope. An exterior door that meets the requirements of Section R609 shall be installed at the top of stairs that provide access to the building and that are enclosed with walls designed to break away in accordance with Section R322.3.5.

R322.3.7 Stairways and ramps. Stairways and ramps that are located below the lowest floor elevations specified in Section R322.3.2 shall comply with one or more of the following:

- Be designed and constructed with open or partially open risers and guards.
- Stairways and ramps not part of the required means of egress shall be designed and constructed to break away during design flood conditions without causing damage to the building or structure, including foundation.
- Be retractable, or able to be raised to or above the lowest floor elevation, provided that the ability to be retracted or raised prior to the onset of flooding is not contrary to the means of egress requirements of the code.
- Be designed and constructed to resist flood loads and minimize transfer of flood loads to the building or structure, including foundation.

Areas below stairways and ramps shall not be enclosed with walls below the elevation required in Section R322.3.2 unless such walls are constructed in accordance with Section R322.3.5.

R322.3.8 Decks and porches. Attached decks and porches shall meet the elevation requirements of Section R322.3.2 and shall either meet the foundation requirements of this section or shall be cantilevered from or knee braced to the building or structure. Self-supporting decks and porches that are below the elevation required in Section R322.3.2 shall not be enclosed by solid, rigid walls, including walls designed to break away. Self-supporting decks and porches shall be designed and constructed to remain in place during base flood conditions or shall be frangible and break away under base flood conditions.

R322.3.9 Construction documents. The construction documents shall include documentation that is prepared and sealed by a registered design professional that the design and methods of construction to be used meet the applicable criteria of this section.

R322.3.10 Tanks. Underground tanks shall be anchored to prevent flotation, collapse and lateral movement under conditions of the base flood. Above-ground tanks shall be installed at or above the elevation required in Section R322.3.2. Where elevated on platforms, the platforms shall be cantilevered from or knee braced to the building or shall be supported on foundations that conform to the requirements of Section R322.3.

SECTION R323 STORM SHELTERS

R323.1 General. This section applies to storm shelters where constructed as separate detached buildings or where constructed as safe rooms within buildings for the purpose of providing refuge from storms that produce high winds, such as tornados and hurricanes. In addition to other applicable

requirements in this code, storm shelters shall be constructed in accordance with ICC 500.

R323.1.1 Sealed documentation. The construction documents for all structural components and impact protective systems of the storm shelter shall be prepared and sealed by a registered design professional indicating that the design meets the criteria of ICC 500.

Exception: Storm shelters, structural components and impact-protective systems that are listed and labeled to indicate compliance with ICC 500.

SECTION R324 SOLAR ENERGY SYSTEMS

R324.1 General. Solar energy systems shall comply with the provisions of this section.

R324.2 Solar thermal systems. Solar thermal systems shall be designed and installed in accordance with *the California Plumbing Code* and the *California Fire Code*.

R324.3 Photovoltaic systems. Photovoltaic (PV) systems shall be designed and installed in accordance with Sections R324.3.1 through R324.7.1 and the manufacturer's installation instructions. The electrical portion of solar PV systems shall be designed and installed in accordance with *the California Electrical Code*.

R324.3.1 Equipment listings. Photovoltaic panels and modules shall be listed and labeled in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Inverters shall be listed and labeled in accordance with UL 1741. Systems connected to the utility grid shall use inverters listed for utility interaction. Mounting systems listed and labeled in accordance with UL 2703 shall be installed in accordance with the manufacturer's installation instructions and their listings.

R324.4 Rooftop-mounted photovoltaic systems. Rooftop-mounted photovoltaic panel systems installed on or above the roof covering shall be designed and installed in accordance with this section.

R324.4.1 Structural requirements. Rooftop-mounted photovoltaic panel systems shall be designed to structurally support the system and withstand applicable gravity loads in accordance with Chapter 3. The roof on which these systems are installed shall be designed and constructed to support the loads imposed by such systems in accordance with Chapter 8.

R324.4.1.1 Roof load. Portions of roof structures not covered with photovoltaic panel systems shall be designed for dead loads and roof loads in accordance with Sections R301.4 and R301.6. Portions of roof structures covered with photovoltaic panel systems shall be designed for the following load cases:

1. Dead load (including photovoltaic panel weight) plus snow load in accordance with Table R301.2.
2. Dead load (excluding photovoltaic panel weight) plus roof live load or snow load, whichever is greater, in accordance with Section R301.6.

R324.4.1.2 Wind load. Rooftop-mounted photovoltaic panel or module systems and their supports shall be designed and installed to resist the component and cladding loads specified in Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

R324.4.2 Fire classification. Rooftop-mounted photovoltaic panel systems shall have the same fire classification as the roof assembly required in Section R902.

R324.4.3 Roof penetrations. Roof penetrations shall be flashed and sealed in accordance with Chapter 9.

R324.5 Building-integrated photovoltaic systems. Building-integrated photovoltaic (BIPV) systems that serve as roof coverings shall be designed and installed in accordance with Section R905.

R324.5.1 Photovoltaic shingles. Photovoltaic shingles shall comply with Section R905.16.

R324.5.2 Fire classification. Building-integrated photovoltaic systems shall have a fire classification in accordance with Section R902.3.

R324.5.3 BIPV roof panels. BIPV roof panels shall comply with Section R905.17.

R324.6 Roof access and pathways. Roof access, pathways and setback requirements shall be provided in accordance with Sections R324.6.1 through R324.6.2.1. Access and minimum spacing shall be required to provide emergency access to the roof, to provide pathways to specific areas of the roof, provide for smoke ventilation opportunity areas, and to provide emergency egress from the roof.

Exceptions:

1. Detached, nonhabitable structures, including but not limited to detached garages, parking shade structures, carports, solar trellises and similar structures, shall not be required to provide roof access.
2. Roof access, pathways and setbacks need not be provided where the *enforcing agency* has determined that rooftop operations will not be employed.
3. These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (17-percent slope) or less.
4. BIPV systems listed in accordance with Section 690.12(B)(2) of *the California Electrical Code*, where the removal or cutting away of portions of the BIPV system during fire-fighting operations has been determined to not expose a fire fighter to electrical shock hazards.

R324.6.1 Pathways. Not fewer than two pathways, on separate roof planes from lowest roof edge to ridge and not less than 36 inches (914 mm) wide, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, a pathway not less than 36 inches wide (914 mm) shall be provided from the lowest roof edge to ridge on the same roof plane as the photovoltaic array, on an adjacent roof plane, or straddling

the same and adjacent roof planes. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions such as vent pipes, conduit, or mechanical equipment.

R324.6.2 Setback at ridge. For photovoltaic arrays occupying not more than 33 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

R324.6.2.1 Alternative setback at ridge. Where an automatic sprinkler system is installed within the dwelling in accordance with NFPA 13D or Section R313, setbacks at ridges shall comply with one of the following:

1. For photovoltaic arrays occupying not more than 66 percent of the plan view total roof area, not less than an 18-inch (457 mm) clear setback is required on both sides of a horizontal ridge.
2. For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, not less than a 36-inch (914 mm) clear setback is required on both sides of a horizontal ridge.

R324.6.3 Emergency escape and rescue openings. Panels and modules installed on dwellings shall not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway not less than 36 inches (914 mm) wide shall be provided to the emergency escape and rescue opening.

Exception: BIPV systems listed in accordance with Section 690.12(B)(2) of the *California Electrical Code* where the removal or cutting away of portions of the BIPV system during fire-fighting operations has been determined to not expose a fire fighter to electrical shock hazards.

R324.7 Ground-mounted photovoltaic systems. Ground-mounted photovoltaic systems shall be designed and installed in accordance with Section R301.

R324.7.1 Fire separation distances. Ground-mounted photovoltaic systems shall be subject to the fire separation distance requirements determined by the *enforcing agency*.

R324.7.2 Ground-mounted photovoltaic arrays. *Ground mounted photovoltaic arrays shall comply with this section and the California Electrical Code. Setback requirements shall not apply to ground-mounted, free-standing photovoltaic arrays. A clear, brush-free area of 10 feet (3048 mm) shall be required for ground-mounted photovoltaic arrays.*

R324.7.3 Locations of DC conductors. *Conduit, wiring systems and raceways for photovoltaic circuits shall be*

located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays. DC wiring shall be installed in metallic conduit or raceways when located within enclosed spaces in a building. Conduit shall run along the bottom of load bearing members.

R324.8 Elevated photovoltaic (PV) support structures. *Elevated PV support structures shall comply with either Section R324.8.1 or R324.8.2.*

Exception: *Elevated PV support structures that are installed over agricultural use.*

R324.8.1 PV panels installed over open grid framing or noncombustible deck. *Elevated PV support structures with PV panels installed over open grid framing or over a noncombustible deck shall have PV panels tested, listed and labeled with a fire type rating in accordance with UL 1703 or with both UL 61730-1 and UL 61730-2. Photovoltaic panels marked "not fire rated" shall not be installed on elevated PV support structures.*

R324.8.2 PV panels installed over a roof assembly. *Elevated PV support structures with a PV panel system installed over a roof assembly shall have a fire classification in accordance with Section R324.4.*

SECTION R325 MEZZANINES

R325.1 General. Mezzanines shall comply with Sections R325 through R325.5.

R325.2 Mezzanines. The clear height above and below mezzanine floor construction shall be not less than 7 feet (2134 mm).

R325.3 Area limitation. The aggregate area of a mezzanine or mezzanines shall be not greater than one-third of the floor area of the room or space in which they are located. The enclosed portion of a room shall not be included in a determination of the floor area of the room in which the mezzanine is located.

Exception: The aggregate area of a mezzanine located within a dwelling unit equipped with an automatic sprinkler system in accordance with Section R313 shall not be greater than one-half of the floor area of the room, provided that the mezzanine meets all of the following requirements:

1. Except for enclosed closets and bathrooms, the mezzanine is open to the room in which such mezzanine is located.

2. The opening to the room is unobstructed except for walls not more than 42 inches (1067 mm) in height, columns and posts.
3. The exceptions to Section R325.5 are not applied.

R325.4 Means of egress. The means of egress for mezzanines shall comply with the applicable provisions of Section R311.

R325.5 Openness. Mezzanines shall be open and unobstructed to the room in which they are located except for walls not more than 36 inches (914 mm) in height, columns and posts.

Exceptions:

1. Mezzanines or portions thereof are not required to be open to the room in which they are located, provided that the aggregate floor area of the enclosed space is not greater than 10 percent of the mezzanine area.
2. In buildings that are not more than two stories above grade plane and equipped throughout with an automatic sprinkler system in accordance with Section R313, a mezzanine shall not be required to be open to the room in which the mezzanine is located.

**SECTION R326
HABITABLE ATTICS**

R326.1 General. Habitable attics shall comply with Sections R326.2 and R326.3.

R326.2 Minimum dimensions. A habitable attic shall have a floor area in accordance with Section R304 and a ceiling height in accordance with Section R305.

R326.3 Story above grade plane. A habitable attic shall be considered a story above grade plane.

Exceptions: A habitable attic shall not be considered to be a story above grade plane provided that the habitable attic meets all the following:

1. The aggregate area of the habitable attic is either of the following:
 - 1.1. Not greater than one-third of the floor area of the story below.
 - 1.2. Not greater than one-half of the floor area of the story below where the habitable attic is located within a dwelling unit equipped with a fire sprinkler system in accordance with Section R313.
2. The occupiable space is enclosed by the roof assembly above, knee walls, if applicable, on the sides and the floor-ceiling assembly below.
3. The floor of the habitable attic does not extend beyond the exterior walls of the story below.
4. Where a habitable attic is located above a third story, the dwelling unit or townhouse unit shall be equipped with a fire sprinkler system in accordance with Section R313.

R326.4 Means of egress. The means of egress for habitable attics shall comply with the applicable provisions of Section R311.

**SECTION R327
AGING-IN-PLACE DESIGN AND FALL PREVENTION**

R327.1 Aging-in-place design and fall prevention. Newly constructed dwellings subject to the requirements of this code shall be designed and constructed in accordance with Sections R327.1.1 through R327.1.4.

Exceptions:

1. Covered multifamily dwellings designed and constructed in accordance with Chapter 11A of the California Building Code.
2. Public housing and places of public accommodation required to comply with Chapter 11B of the California Building Code.

R327.1.1 Reinforcement for grab bars. At least one bathroom on the entry level shall be provided with reinforcement installed in accordance with this section. Where there is no bathroom on the entry level, at least one bathroom on the second or third floor of the dwelling shall comply with this section.

1. Reinforcement shall be solid lumber or other construction materials approved by the enforcing agency.
2. Reinforcement shall not be less than 2 by 8 inch (51 mm by 203 mm) nominal lumber. [1½ inch by 7¼ inch (38 mm by 184 mm) actual dimension] or other construction material providing equal height and load capacity. Reinforcement shall be located between 32 inches (812.8 mm) and 39¼ inches (997 mm) above the finished floor flush with the wall framing.
3. Water closet reinforcement shall be installed on both side walls of the fixture, or one side wall and the back wall.
4. Shower reinforcement shall be continuous where wall framing is provided.
5. Bathtub and combination bathtub/shower reinforcement shall be continuous on each end of the bathtub and the back wall. Additionally, back wall reinforcement for a lower grab bar shall be provided with the bottom edge located no more than 6 inches (152.4 mm) above the bathtub rim.

Exceptions:

1. Where the water closet is not placed adjacent to a side wall capable of accommodating a grab bar, the bathroom shall have provisions for installation of floor-mounted, foldaway or similar alternate grab bar reinforcements approved by the enforcing agency.
2. Reinforcement shall not be required in wall framing for pre-fabricated shower enclosures and bathtub wall panels with integral factory-

installed grab bars or when factory-installed reinforcement for grab bars is provided.

3. Shower enclosures that do not permit installation of reinforcement and/or grab bars shall be permitted, provided reinforcement for installation of floor-mounted grab bars or an alternate method is approved by the enforcing agency.
4. Bathtubs with no surrounding walls, or where wall panels do not permit the installation of reinforcement shall be permitted, provided reinforcement for installation of floor-mounted grab bars adjacent to the bathtub or an alternate method is approved by the enforcing agency.
5. Reinforcement of floors shall not be required for bathtubs and water closets installed on concrete slab floors.

R327.1.1.1 Documentation for grab bar reinforcement. Information and/or drawings identifying the location of grab bar reinforcement shall be placed in the operation and maintenance manual in accordance with the California Green Building Standards Code, Chapter 4, Division 4.4.

R327.1.2 Electrical receptacle outlet, switch and control heights. Electrical receptacle outlets, switches and controls (including controls for heating, ventilation and air conditioning) intended to be used by occupants shall be located no more than 48 inches (1219.2 mm) measured from the top of the outlet box and not less than 15 inches (381 mm) measured from the bottom of the outlet box above the finish floor.

Exceptions:

1. Dedicated receptacle outlets; floor receptacle outlets; controls mounted on ceiling fans and ceiling lights; and controls located on appliances.
2. Receptacle outlets required by the California Electrical Code on a wall space where the distance between the finished floor and a built-in feature above the finish floor, such as a window, is less than 15 inches (381 mm).

R327.1.3 Interior doors. Effective July 1, 2024, at least one bathroom and one bedroom on the entry level shall provide a doorway with a net clear opening of not less than 32 inches (812.8 mm), measured with the door positioned at an angle of 90 degrees from the closed position; or, in the case of a two- or three-story single family dwelling, on the second or third floor of the dwelling if a bathroom or bedroom is not located on the entry level.

R327.1.4 Doorbell buttons. Doorbell buttons or controls, when installed, shall not exceed 48 inches (1219.2 mm) above exterior floor or landing, measured from the top of the doorbell button assembly. Where doorbell buttons integrated with other features are required to be installed above 48 inches (1219.2 mm) measured from the exterior floor or landing, a standard doorbell button or control shall also be provided at a

height not exceeding 48 inches (1219.2 mm) above exterior floor or landing, measured from the top of the doorbell button or control.

SECTION R328 ENERGY STORAGE SYSTEMS

R328.1 General. Energy storage systems (ESS) shall comply with the provisions of this section.

Exceptions:

1. ESS listed and labeled in accordance with UL 9540 and marked "For use in residential dwelling units" where installed in accordance with the manufacturer's instructions and the California Electrical Code.
2. ESS less than 1 kWh (3.6 megajoules).

R328.2 Equipment listings. Energy storage systems (ESS) shall be listed and labeled in accordance with UL 9540.

Exception: Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached sheds located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.

R328.3 Installation. ESS shall be installed in accordance with the manufacturer's instructions and their listing.

R328.3.1 Spacing. Individual units shall be separated from each other by not less than 3 feet (914 mm) except where smaller separation distances are documented to be adequate based on large-scale fire testing complying with Section 1207.1.5 of the California Fire Code.

R328.4 Locations. ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space in accordance with Section R302.6.
3. Outdoors or on the exterior side of exterior walls located not less than 3 feet (914 mm) from doors and windows directly entering the dwelling unit.
4. Enclosed utility closets, basements, storage or utility spaces within dwelling units with finished or noncombustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than $\frac{5}{8}$ -inch (15.9 mm) Type X gypsum wall-board.

ESS shall not be installed in sleeping rooms, or closets or spaces opening directly into sleeping rooms or in habitable spaces of dwelling units.

R328.5 Energy ratings. Individual ESS units shall have a maximum rating of 20 kWh. The aggregate rating of the ESS shall not exceed:

1. 40 kWh within utility closets, basements and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.

3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Section 1207 of the *California Fire Code*.

R328.6 Electrical installation. ESS shall be installed in accordance with the *California Electrical Code*. Inverters shall be listed and labeled in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

R328.7 Fire detection. Rooms and areas within dwelling units, basements and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section R314. A heat detector, listed and interconnected to the smoke alarms, shall be installed in locations within dwelling units and attached garages where smoke alarms cannot be installed based on their listing.

[SFM] ESS installed in Group R-3 and townhomes shall comply with the following:

1. Rooms and areas within dwellings units, sleeping units, basements and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section R314.
2. A listed heat alarm interconnected to the smoke alarms shall be installed in locations within dwelling units, sleeping units and attached garages where smoke alarms cannot be installed based on their listing.

R328.8 Protection from impact. ESS installed in a location subject to vehicle damage in accordance with Section R328.8.1 or R328.8.2 shall be provided with impact protection in accordance with Section R328.8.3.

R328.8.1 Garages. Where an ESS is installed in the normal driving path of vehicle travel within a garage, impact protection complying with Section 1207.11.7.3 shall be provided. The normal driving path is a space between the garage vehicle opening and the interior face of the back wall to a height of 48 inches (1219 mm) above the finished floor. The width of the normal driving path shall be equal to the width of the garage door opening. Impact protection shall also be provided for ESS installed at either of the following locations (See Figure R328.8.1):

1. On the interior face of the back wall and located within 36 inches (914 mm) to the left or to the right of the normal driving path.
2. On the interior face of a side wall and located within 24 inches (609 mm) from the back wall and 36 inches (914 mm) of the normal driving path.

Exception: Where the clear height of the vehicle garage opening is 7 feet 6 inches (2286 mm) or less, ESS installed not less than 36 inches (914 mm) above finished floor are not subject to vehicle impact protection requirements.

R328.8.2 Other locations subject to vehicle impact. Where an ESS is installed in a location other than as defined in Section R328.8.1, and is subject to vehicle damage, impact protection shall be provided in accordance with Section R328.8.3.

R328.8.3 Impact protection options. Where ESS is required to be protected from impact in accordance with Section R328.8.1 or R328.8.2, such protection shall comply with one of the following:

1. Bollards constructed in accordance with one of the following:
 - 1.1. Minimum 48 inches (1219 mm) in length by 3 inches (76 mm) in diameter Schedule 80 steel pipe embedded in a concrete pier not less than 12 inches (304 mm) deep and 6 inches (152 mm) in diameter, with at least 36 inches (914 mm) of pipe exposed, filled with concrete and spaced at a maximum interval of 5 feet (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from an ESS.
 - 1.2. Minimum 36 inches (914 mm) in height by 3 inches (76 mm) in diameter Schedule 80 steel pipe fully welded to a minimum 8-inch (203 mm) by 1/4-inch (6.4 mm) thick steel plate and bolted to a concrete floor by means of 4 1/2 inch (113 mm) concrete anchors with 3-inch (76 mm) minimum embedment. Spacing shall be not greater than 60 inches (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.
 - 1.3. Pre-manufactured steel pipe bollards shall be filled with concrete and anchored in accordance with the manufacturer's installation instructions, with spacing not greater than 60 inches (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.
2. Wheel barriers constructed in accordance with one of the following:
 - 2.1. Four inches (102 mm) in height by 5 inches (127 mm) in width by 70 inches (1778 mm) in length wheel barrier made of concrete or polymer, anchored to the concrete floor not less than every 36 inches (914 mm) and located not less than 54 inches (1372 mm) from the ESS. Minimum 3 1/2-inch (89 mm) diameter concrete anchors with a 3-inch (76 mm) embedment per barrier shall be used. Spacing between barriers shall be no greater than 36 inches (914 mm).
 - 2.2. Pre-manufactured wheel barriers shall be anchored in accordance with the manufacturer's installation instructions.
3. Approved method designed to resist a 2000-lb. (8899 Newtons) impact in the direction of travel at 24 inches (608 mm) above grade.

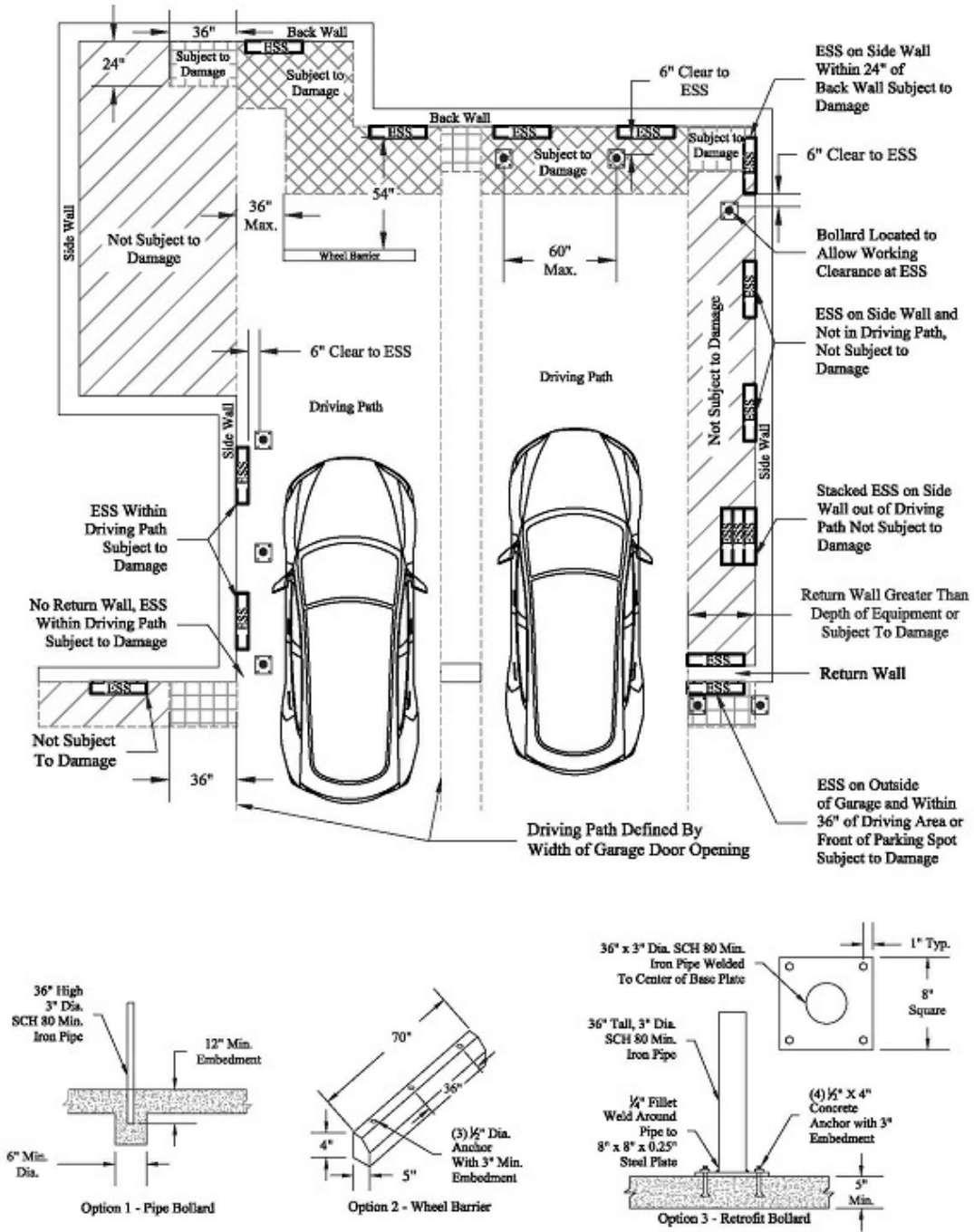


FIGURE R328.8.1
ESS VEHICLE IMPACT PROTECTION

R328.9 Ventilation. Indoor installations of ESS that produce hydrogen or other flammable gases during charging shall be provided with mechanical ventilation in accordance with *the California Mechanical Code*.

R328.10 Electric vehicle use. The temporary use of an owner or occupant’s electric-powered vehicle to power a dwelling unit while parked in an attached or detached garage or outdoors shall comply with the vehicle manufacturer’s instructions and *the California Electrical Code*.

R328.11 Documentation and labeling. The following information shall be provided:

1. A copy of the manufacturer’s installation, operation, maintenance and decommissioning instructions shall be provided to the owner or placed in a conspicuous location near the ESS equipment.
2. A label on the installed system containing the contact information for the qualified maintenance and service providers.

R328.12 Toxic and highly toxic gas. ESS that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall not be installed within Group R-3 or R-4 occupancies.

SECTION R329 STATIONARY ENGINE GENERATORS

R329.1 General. Stationary engine generators shall be listed and labeled in accordance with UL 2200 and shall comply with this section. The connection of stationary engine generators to the premise wiring system shall be by means of a listed transfer switch.

R329.2 Installation. The installation of stationary engine generators shall be in an approved location and in accordance with the listing, the manufacturer’s installation instructions and *the California Electrical Code*.

SECTION R330 STATIONARY FUEL CELL POWER SYSTEMS

R330.1 General. Stationary fuel cell power systems in new and existing buildings and structures shall comply with Section 1206 of the *California Fire Code*.

SECTION R334 CONSTRUCTION WASTE REDUCTION, DISPOSAL AND RECYCLING

R334.1 Construction waste management. Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with *the California Green Building Standards Code, Chapter 4, Division 4.4*.

SECTION R335 SPECIAL PROVISIONS FOR LICENSED 24-HOUR CARE FACILITIES IN A GROUP R-3.1

R335.1 Scope. The provisions of this section shall apply to 24-hour care facilities in a Group R-3.1 occupancy licensed by a governmental agency.

R335.2 General. The provisions in this section shall apply in addition to general requirements in this code.

R335.2.1 Restraint shall not be practiced in a Group R-3.1 occupancy.

Exception: Occupancies which meet all the requirements for a Group I-3 occupancy.

R335.2.2 Pursuant to Health and Safety Code Section 13133, regulations of the state fire marshal pertaining to Occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section 13143.5, or a fire protection district may pursuant to Health and Safety Code Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential-care Facilities for the Elderly.

Exception: Local regulations relating to roof coverings in facilities licensed as a Residential Care Facility for the Elderly (RCFE) per Health and Safety Code Section 13133.

R335.3 Building height and area provisions.

R335.3.1 Limitations six or less clients. Group R-3.1 occupancies where nonambulatory clients are housed above the first story, having more than two stories in height or having more than 3,000 square feet (279 m²) of floor area above the first story shall not be of less than one-hour fire-resistance-rated construction throughout.

In Group R-3.1 occupancies housing a bedridden client, the client sleeping room shall not be located above or below the first story.

Exception: Clients who become bedridden as a result of a temporary illness as defined in Health and Safety Code Sections 1566.45, 1568.0832 and 1569.72. A temporary illness is an illness which persists for 14 days or less. A bedridden client may be retained in excess of the 14 days upon approval by the Department of Social Services and may continue to be housed on any story in a Group R-3.1 occupancy classified as a licensed residential facility.

Every licensee admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

R335.3.2. Buildings housing protective social-care homes or in occupancies housing inmates who are not restrained need not be of one-hour fire-resistive construction when not more than two stories in height. In no case shall individual floor areas exceed 3,000 square feet (279 m²). The fire-resistive protection of the exterior walls shall not be less than one hour where such walls are located within 5 feet (1524 mm) of the property line. Openings within such walls are not permitted. Openings in exterior nonrated walls need not be protected.

R335.4 Interior finish provisions.

R335.4.1 Interior wall and ceiling finish. Group R-3.1 occupancies housing a bedridden client shall comply with Interior Wall and Ceiling Finish requirements specified for Group I-2 occupancies in Table 803.11 of the California Building Code.

R335.5 Fire protection system provisions.

R335.5.1 Automatic sprinkler systems in Group R-3.1 occupancies. An automatic sprinkler system shall be installed where required in Section R313.

Exceptions:

- Existing Group R-3 occupancies converted to Group R-3.1 occupancies not housing bedridden clients, not housing nonambulatory clients above the first floor, and not housing clients above the second floor.
- Existing Group R-3 occupancies converted to Group R-3.1 occupancies housing only one bedridden client and complying with Section R335.6.3.3.
- Pursuant to Health and Safety Code Section 13113 existing occupancies housing ambulatory children only, none of whom are mentally ill children or children with intellectual disabilities, and the buildings or portions thereof in which such children are housed are not more than two stories in height, and buildings or portions thereof housing such children have an automatic fire alarm system activated by approved smoke detectors.
- Pursuant to Health and Safety Code Section 13143.6 existing occupancies licensed for protective social care which house ambulatory clients only, none of whom is a child (under the age of 18 years), or who is elderly (65 years of age or over).

R335.5.2 Smoke alarms in Groups R-3.1 occupancies. Smoke alarms shall be installed where required in Section R314. In addition to the provisions set forth in Section R314 the following shall apply:

- Smoke alarms shall be provided throughout the habitable areas of the dwelling unit except kitchens.
- Facilities housing a bedridden client:

- Smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup.
- Smoke alarms shall be electrically interconnected so as to cause all smoke alarms to sound a distinctive alarm signal upon actuation of any single smoke alarm. Such alarm signal shall be audible throughout the facility at a minimal level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel, or be electrically supervised or provided with emergency power.

R335.5.2.1 Audible alarm signal. The audible signal shall be the standard fire alarm evacuation signal, ANSI S3.41 Audible Emergency Evacuation Signal, "three pulse temporal pattern," as described in NFPA 72.

R335.5.2.2 Hearing impaired. See Section 907.5.2.3 of the California Building Code.

R335.5.2.3 Visible alarms. Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.5 of the California Building Codes.

Exceptions:

- Visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.
- Visible alarm notification appliances shall not be required in enclosed exit stairways, exterior exit stairs and exterior exit ramps.
- Visible alarm notification appliances shall not be required in elevator cars.

R335.5.2.4 Group R-3.1. Protective social care facilities which house persons who are hearing impaired, shall be provided with notification appliances for the hearing impaired installed in accordance with NFPA 72 and which shall activated upon initiation of the fire alarm system or the smoke alarms.

Exception: The use of the existing evacuation signaling scheme shall be permitted where approved by the enforcing agency.

R335.6 Means of egress provisions.

R335.6.1 General. In addition to the general means of egress requirements of Chapter 10 of the California Building Code, this section shall apply to Group R-3.1 occupancies.

R335.6.2 Number of exits.

R335.6.2.1. Group R-3.1 occupancies shall have a minimum of two exits.

R335.6.3 Egress arrangements.

R335.6.3.1. Egress through adjoining dwelling units shall not be permitted.

R335.6.3.2 Group R-3.1 occupancies housing nonambulatory clients. In a Group R-3.1 occupancy, bedrooms used by nonambulatory clients shall have access to at least one of the required exits which shall conform to one of the following:

1. Egress through a hallway or area into a bedroom in the immediate area which has an exit directly to the exterior and the corridor/hallway is constructed consistent with the dwelling unit interior walls. The hallway shall be separated from common areas by a solid wood door not less than $1\frac{3}{8}$ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9 of the California Building Code.
2. Egress through a hallway which has an exit directly to the exterior. The hallway shall be separated from the rest of the house by a wall constructed consistent with the dwelling unit interior walls and opening protected by a solid wood door not less than $1\frac{3}{8}$ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9 of the California Building Code.
3. Direct exit from the bedroom to the exterior, such doors shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed, doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).
4. Egress through an adjoining bedroom which exits to the exterior.

R335.6.3.3 Group R-3.1 occupancies housing only one bedridden client. In Group R-3.1 occupancies housing a bedridden client and not provided with an approved automatic fire sprinkler system, all of the following shall apply:

1. In Group R-3.1 Occupancies housing a bedridden client, a direct exit to the exterior of the residence shall be provided from the client sleeping room.
2. Doors to a bedridden client's sleeping room shall be of a self-closing, positive latching $1\frac{3}{8}$ inch solid wood door. Such doors shall be provided with a gasket so installed as to provide a seal where the door meets the jam on both sides and across the top. Doors shall be maintained self-closing or shall be automatic closing by actuation of a smoke detector in accordance with Section 716.5.9 of the California Building Code.
3. Group R-3.1 Occupancies housing a bedridden client, shall not have a night latch, dead bolt, security chain or any similar locking device

installed on any interior door leading from a bedridden client's sleeping room to any interior area such as a corridor, hallway and or general use areas of the residence in accordance with Chapter 10 of the California Building Code.

4. The exterior exit door to a bedridden client's sleeping room shall be operable from both the interior and exterior of the residence.
5. Every required exit doorway from a bedridden client sleeping room shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed in exit doorways, exit doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).

Note: A sliding glass door can be used as an exterior exit doorway as long as it is operable from the inside and outside and the clear width of the exit way is not less than 32 inches (813 mm).

R335.6.3.4 Intervening rooms. A means of exit shall not pass through more than one intervening room. A means of egress shall not pass through kitchens, storerooms, closets, garages or spaces used for similar purposes.

Exception: Kitchens which do not form separate rooms by construction.

R335.6.4 Changes in level. In Group R-3.1 occupancies housing nonambulatory clients interior changes in level up to 0.25 inch (6 mm) may be vertical and without edge treatment. Changes in level between 0.25 inch (6 mm) and 0.5 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50% slope). Changes in level greater than 0.5 inch (12.7 mm) shall be accomplished by means of a ramp.

R335.6.5 Stairways. Group R-3.1 occupancies may continue to use existing stairways (except for winding and spiral stairways which are not permitted as a required means of egress) provided the stairs have a maximum rise of 8 inches (203 mm) with a minimum run of 9 inches (229 mm). The minimum stairway width may be 30 inches (762 mm).

R335.6.6 Floor separation. Group R-3.1 occupancies with non-ambulatory clients housed above the first floor shall be provided with a non-fire resistance constructed floor separation at stairs which will prevent smoke migration between floors. Such floor separation shall have equivalent construction of 0.5 inch (12.7 mm) gypsum wallboard on one side of wall framing.

Exceptions:

1. Occupancies with at least one exterior exit from floors occupied by clients.
2. Occupancies provided with automatic fire sprinkler systems complying with Chapter 9.

R335.6.6.1 Doors within floor separations. Doors within such floor separations shall be tight fitting solid wood at least $1\frac{3}{8}$ inches (35 mm) in thickness. Door glazing shall not exceed 1296 square inches (32 918 mm²) with no dimension greater than 54 inches (1372 mm). Such doors shall be positive latching, smoke gasketed and shall be automatic-closing by smoke detection.

R335.6.7 Fences and gates. Grounds of a Residential Care for the Elderly facility serving Alzheimer clients may be fenced and gates therein equipped with locks, provided safe dispersal areas are located not less than 50 feet (15 240 mm) from the buildings. Dispersal areas shall be sized to provide an area of not less than 3 square feet (0.28 m²) per occupant. Gates shall not be installed across corridors or passageways leading to such dispersal areas unless they comply with egress requirements.

R335.6.8 Basement exits. One exit is required to grade level when the basement is accessible to clients.

R335.6.9 Delayed egress locks. See Section 1010.1.9.7 of the California Building Code.

R335.7 Request for alternate means of protection for facilities housing bedridden clients. Request for alternate means of protection shall apply to Sections R335 through R335.7. Request for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment, or means of protection shall be made in writing to the local fire authority having jurisdiction by the facility, client or the client's authorized representative. Sufficient evidence shall be submitted to substantiate the need for an alternate means of protection.

The facility, client or the client's representative or the local fire authority having jurisdiction may request a written opinion from the State Fire Marshal concerning the interpretation of the regulations promulgated by the State Fire Marshal for a particular factual dispute. The State Fire Marshal shall issue the written opinion within 45 days following the request.

Approval of a request for use of an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment, or means of protection made pursuant to this section shall be limited to Group R-3.1 occupancies housing a bedridden client.

Approvals made by the local fire authority having jurisdiction and the written opinion by the State Fire Marshal shall be applicable only to the requesting facility and shall not be construed as establishing any precedent for any future request by that facility or any other facility.

R335.8 Temporarily bedridden clients. Clients who become temporarily bedridden as defined in Health and Safety Code Section 1569.72, as enforced by the Department of Social Services, may continue to be housed on any story in Group R-3.1 occupancies classified as Residential Care Facilities for the Elderly (RCFE). Every Residential Care Facility for the Elderly (RCFE) admitting or retaining a bedridden resident shall, within 48 hours of the resident's admission or retention in the facility, notify the local fire authority with jurisdiction

of the estimated length of time the resident will retain his or her bedridden status in the facility.

R335.9 Group R. Buildings housing protective social-care homes or in occupancies housing inmates who are not restrained need not be of one-hour fire-resistive construction when not more than two stories in height. In no case shall individual floor areas exceed 3,000 square feet (279 m²). The fire-resistive protection of the exterior walls shall not be less than one hour where such walls are located within 5 feet (1524 mm) of the property line. Openings within such walls are not permitted. Openings in exterior nonrated walls need not be protected.

SECTION R336 LARGE FAMILY DAY-CARE HOMES

R336.1 Large family day-care homes.

R336.2. Health and Safety Code Section 1597.46. For purposes of clarification, Health and Safety Code Section 1597.46 is repeated.

1597.46.

(a) A large family day-care home shall abide by all standards, in addition to the requirements of the State Uniform Building Standards Code, that are specifically designed to promote fire and life safety in large family day-care homes. The State Fire Marshal shall adopt separate building standards specifically relating to the subject of fire and life safety in family day-care homes, which shall be published in Title 24 of the California Code of Regulations. These standards shall apply uniformly throughout the state and shall include, but not be limited to, all of the following:

- (1) The requirement that a large family day-care home contain a fire extinguisher or smoke detector device, or both, that meets child care standards established by the State Fire Marshal.
- (2) Specification as to the number of required exits from the home.
- (3) Specification as to the floor or floors on which child care may be provided and the number of required exits on each floor.

(b) A large family day-care home for children shall have one or more carbon monoxide detectors in the facility that meet the standards established in Chapter 8 (commencing with Section 13260) of Part 2 of Division 12. The department shall account for the presence of these detectors during inspections.

(c) Enforcement of this section shall be in accordance with Sections 13145 and 13146. A city, county, city and county, or district shall not adopt or enforce a building ordinance or local rule or regulation relating to the subject of fire and life safety in large family day-care homes that is inconsistent with those standards adopted by the State Fire Marshal, except to the extent the building ordinance or local rule or regula-

tion applies to all residences with the same zoning designation in which child care is provided.

(Repealed and added by Stats. 2019, Ch. 244, Sec. 12. (SB 234) Effective January 1, 2020.)

R336.3 Smoke alarms. Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms. The number and placement of smoke alarms shall be determined by the enforcement authority.

R336.4 Fire extinguishers. Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A10BC rating.

R336.5 Fire alarm devices. Every large family day-care home shall be provided with at least one manual device at a location approved by the authority having jurisdiction. Such device shall actuate a fire alarm signal, which shall be audible throughout the facility at a minimum level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel or be electrically supervised or provided with emergency power. Such device or devices shall be attached to the structure and may be of any type acceptable to the enforcing agent, provided that such devices are distinctive in tone and are audible throughout the structure.

R336.6 Compliance. Every large family day-care home shall comply with the provisions for Group R-3 occupancies and, if appropriate, Section R336.1. For the purposes of Section R336.1, the first story shall be designated as the floor used for residential occupancy nearest to the street level which provides primary access to the building.

R336.7 Special hazards. Every unenclosed gas-fired water heater or furnace which is within the area used for child care in a large family day-care home shall be protected in such a way as to prevent children from making contact with those appliances.

Exception: This does not apply to kitchen stoves or ovens.

R336.8 Exiting. Every story or basement of a large family day-care home shall be provided with two exits which are remotely located from each other. Every required exit shall be of a size to permit the installation of a door not less than 32 inches (813mm) in clear width and not less than 6 feet 8 inches (2032 mm) in height. A manually operated horizontal sliding door may be used as one of the two required exits.

Where basements are used for day-care purposes, one of the two required exits shall provide access directly to the exterior without entering the first story. The second exit from the basement may either pass through the story above or exit directly to the exterior.

Rooms used for day-care purposes shall not be located above the first story.

Exception: Buildings equipped with an automatic sprinkler system throughout and which have at least one of the required exits providing access directly to the exterior. NFPA 13R may be used in large family day-care homes. The sprinkler omissions of NFPA 13R shall not apply unless approved by the enforcing agency.

Exit doors, including manually operated horizontal sliding doors, shall be openable from the inside without use of a key or any special knowledge or effort.

SECTION R337 MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

SECTION R337.1 SCOPE, PURPOSE AND APPLICATION

R337.1.1 Scope. Section R337 and all subsections apply to building materials, systems and or assemblies used in the exterior design and construction of new buildings located within a Wildland-Urban Interface (WUI) Fire Area as defined in Section R337.2.

R337.1.2 Purpose. The purpose of Section R337 is to establish minimum standards for the protection of life and property by increasing the ability of a building located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland-Urban Interface (WUI) Fire Area to resist the intrusion of flame or burning embers projected by a vegetation fire and contributes to a systematic reduction in conflagration losses.

R337.1.3 Application. New buildings located in any Fire Hazard Severity Zone or any Wildland-Urban Interface (WUI) Fire Area designated by the enforcing agency constructed after the application date shall comply with the provisions of this section. This shall include all new buildings with residential, commercial, educational, institutional or similar occupancy type use, which shall be referred to in this section as “applicable building” (see definition in Section R337.2), as well as new buildings and structures accessory to those applicable buildings (see Exceptions 1 and 4).

Exceptions:

1. Group U occupancy accessory buildings of any size located at least 50 feet (15 m) from an applicable building on the same lot.
2. Group U occupancy agricultural buildings, as defined in Section 202 of the California Building code, of any size located at least 50 feet (15 m) from an applicable building.
3. Group C occupancy special buildings conforming to the limitations specified in Section 450.4.1 of the California Building Code.
4. New accessory buildings and miscellaneous structures specified in Section R337.10 shall comply only with the requirements of that section.
5. Additions to and remodels of buildings originally constructed prior to July 1, 2008.

R337.1.3.1 Application date and where required. New buildings for which an application for a building permit is submitted on or after July 1, 2008, located in any Fire Hazard Severity Zone or Wildland Interface Fire

Area shall comply with all sections of this chapter, including all of the following areas:

1. All unincorporated lands designated by the State Board of Forestry and Fire Protection as State Responsibility Area (SRA) including:
 - 1.1. Moderate Fire Hazard Severity Zones
 - 1.2. High Fire Hazard Severity Zones
 - 1.3. Very-High Fire Hazard Severity Zones
2. Land designated as Very-High Fire Hazard Severity Zone by cities and other local agencies.
3. Land designated as Wildland Interface Fire Area by cities and other local agencies.

Exceptions:

1. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas, for which an application for a building permit is submitted on or after January 1, 2008, shall comply with all sections of this chapter.
2. New buildings located in any Fire Hazard Severity Zone within State Responsibility Areas or any Wildland Interface Fire Area designated by cities and other local agencies for which an application for a building permit is submitted on or after December 1, 2005 but prior to July 1, 2008, shall only comply with the following sections of this chapter:
 - 2.1. Section R337.5 – Roofing
 - 2.2. Section R337.6 – Vents

R337.1.4 Inspection and certification. Building permit applications and final completion approvals for buildings within the scope and application of this chapter shall comply with the following:

1. Building permit issuance. The local building official shall, prior to construction, provide the owner or applicant a certification that the building as proposed to be built complies with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a building permit by the local building official for the proposed building shall be considered as complying with this section.
2. Building permit final. The local building official shall, upon completion of construction, provide the owner or applicant with a copy of the final inspection report that demonstrates the building was constructed in compliance with all applicable state and local building standards, including those for materials and construction methods for wildfire exposure as described in this chapter. Issuance of a certificate of occupancy by the local building official for the proposed building shall be considered as complying with this section.

R337.1.5 Vegetation management compliance. Prior to building permit final approval, the property shall be in compliance with the vegetation management requirements prescribed in California Fire Code Section 4906 and 4907, including California Public Resources Code 4291 or California Government Code Section 51182. Acceptable methods of compliance inspection and documentation shall be determined by the enforcing agency and shall be permitted to include any of the following:

1. Local, state or federal fire authority or designee authorized to enforce vegetation management requirements.
2. Enforcing agency.
3. Third party inspection and certification authorized to enforce vegetation management requirements.
4. Property owner certification authorized by the enforcing agency.

**SECTION R337.2
DEFINITIONS**

For the purposes of Section R337, certain terms are defined below:

APPLICABLE BUILDING. A building that has residential, commercial, educational, institutional or similar occupancy type use.

DIRECTOR means the Director of the California Department of Forestry and Fire Protection (CAL FIRE).

EXTERIOR COVERING. The exposed siding or cladding material applied to the exterior side of an exterior wall, roof eave soffit, floor projection or exposed underfloor framing.

EXTERIOR WALL ASSEMBLY. A system or assembly of exterior wall components, including exterior wall covering materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

FIRE PROTECTION PLAN. A document prepared for a specific project or development proposed for a Wildland-Urban Interface (WUI) Fire Area. It describes ways to minimize and mitigate potential for loss from wildfire exposure. See the California Fire Code, Chapter 49, for required elements of a Fire Protection Plan.

FIRE HAZARD SEVERITY ZONES. Geographical areas designated pursuant to California Public Resources Codes Sections 4201 through 4204 and classified as Very-High, High or Moderate in State Responsibility Areas or as Local Responsibility Areas in Very-High Fire Hazard Severity

Zones designated pursuant to California Government Code Sections 51175 through 51189. See California Fire Code Chapter 49.

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as “Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California.”

FIRE-RESISTANT VEGETATION. Plants, shrubs, trees and other vegetation which exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.

[Note: The following sources contain examples of types of vegetation that can be considered as fire-resistant vegetation. (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)]

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section R337.4.

LOCAL RESPONSIBILITY AREA (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.

LOG WALL CONSTRUCTION. A type of construction in which exterior walls are constructed of solid wood members and where the smallest horizontal dimension of each solid wood member is at least 6 inches (152 mm).

RAFTER TAIL. The portion of roof rafter framing in a sloping roof assembly that projects beyond and overhangs an exterior wall.

ROOF EAVE. The lower portion of a sloping roof assembly that projects beyond and overhangs an exterior wall at the lower end of the rafter tails. Roof eaves may be either “open” or “enclosed.” Open roof eaves have exposed rafter tails and an unenclosed space on the underside of the roof deck. Enclosed roof eaves have a boxed-in roof eave soffit with a horizontal underside or sloping rafter tails with an exterior covering applied to the underside of the rafter tails.

ROOF EAVE SOFFIT. An enclosed boxed-in soffit under a roof eave with exterior covering material applied to the soffit framing creating a horizontal surface on the exposed underside.

STATE RESPONSIBILITY AREA (SRA). Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing forest fires is primarily the responsibility of the state.

WILDFIRE. Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property or resources as defined in Public Resources Code Sections 4103 and 4104.

WILDFIRE EXPOSURE. One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

WILDLAND-URBAN INTERFACE (WUI). A geographical area identified by the state as a “Fire Hazard Severity Zone” in accordance with the Public Resources Code Sections 4201 through 4204 and Government Code Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

**SECTION R337.3
STANDARDS OF QUALITY**

R337.3.1 General. Building material, systems, assemblies and methods of construction used in Section R337 shall be in accordance with Section R337.3.

R337.3.2 Qualification by testing. Material and material assemblies tested in accordance with the requirements of Section R337.3 shall be accepted for use when the results and conditions of those tests are met. Product evaluation testing of material and material assemblies shall be approved or listed by the State Fire Marshal, or identified in a current report issued by an approved agency.

R337.3.3 Approved agency. Product evaluation testing shall be performed by an approved agency as defined in Section 1702 of the California Building Code. The scope of accreditation for the approved agency shall include building product compliance with the California Building Code.

R337.3.4 Labeling. Material and material assemblies tested in accordance with the requirements of Section R337.3 shall bear an identification label showing the fire test results. That identification label shall be issued by a testing and/or inspecting agency approved by the State Fire Marshal.

1. Identification mark of the approved testing and/or inspecting agency.
2. Contact and identification information of the manufacturer.
3. Model number or identification of the product or material.
4. Pre-test weathering specified in this section.
5. Compliance standard as described under Section R337.3.7.

R337.3.5 Weathering and surface treatment protection.

R337.3.5.1 General. Material and material assemblies tested in accordance with the requirements of Section R337.3 shall maintain their fire test performance under conditions of use when installed in accordance with the manufacturers instructions.

R337.3.5.2 Weathering. Fire-retardant-treated wood and fire-retardant-treated wood shingles and shakes shall meet the fire test performance requirements of this section after being subjected to the weathering

conditions contained in the following standards, as applicable to the materials and the conditions of use.

R337.3.5.2.1 Fire-retardant-treated wood. Fire-retardant-treated wood shall be tested in accordance with ASTM D2898 (Method A), and the requirements of Section 2303.2 of the California Building Code.

R337.3.5.2.2 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shingles and shakes shall be approved and listed by the State Fire Marshal in accordance with Section 208(c), Title 19 California Code of Regulations.

R337.3.5.3 Surface treatment protection. The use of paints, coatings, stains or other surface treatments are not an approved method of protection as required in this section.

R337.3.6 Alternates for materials, design, tests and methods of construction. The enforcing agency is permitted to modify the provisions of this chapter for site-specific conditions in accordance with Section 1.11.2.4. When required by the enforcing agency for the purposes of granting modifications, a fire protection plan shall be submitted in accordance with the California Fire Code, Chapter 49.

R337.3.7 Standards of quality. The State Fire Marshal standards for exterior wildfire exposure protection listed below and as referenced in this chapter are located in the California Referenced Standards Code, Part 12 and Chapter 44 of this code.

SFM Standard 12-7A-1, Exterior Wall Siding and Sheathing. A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for a 10 minutes duration.

SFM Standard 12-7A-2, Exterior Windows. A fire resistance test standard consisting of a 150 kW intensity direct flame exposure for an 8-minute duration.

SFM Standard 12-7A-3, Horizontal Projection Under-side A fire resistance test standard consisting of a 300 kW intensity direct flame exposure for a 10 minute duration.

SFM Standard 12-7A-4, Decking. A two-part test consisting of a heat release rate (Part A) deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3 minute duration, and a (Part B) sustained deck assembly combustion test consisting of a deck upper surface burning ember exposure with a 12 mph wind for 40 minutes using a 2.2 lb (1 kg) burning “Class A” size 12” × 12” × 2.25” (300 mm x 300 mm x 57 mm) roof test brand.

SFM Standard 12-7A-4A, Decking Alternate Method A. A heat release rate deck assembly combustion test with an under deck exposure of 80 kW intensity direct flame for a 3 minute duration.

ASTM D2898, Standard Practice for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing

ASTM D3909/D3909M, Standard Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules

ASTM E84, Standard Test Method for Surface Burning Characteristics of Building Materials

ASTM E119, Standard Test Methods for Fire Tests of Building Construction and Materials

ASTM E2632/E2632M, Standard Test Method for Evaluating the Under-Deck Fire Test Response of Deck Materials

ASTM E2707, Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure

ASTM E2726/E2726M, Standard Test Method for Evaluating the Fire-Test-Response of Deck Structures to Burning Brands

ASTM E2768 Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30-minute Tunnel Test)

ASTM E2886/E2886M, Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement

ASTM E2957, Standard Test Method for Resistance to Wildfire Penetration of Eaves, Soffits and Other Projections

NFPA 257, Standard on Fire Test for Window and Glass Block Assemblies

UL 263, Standard for Fire Tests of Building Construction and Materials

UL 723, Standard for Test for Surface Burning Characteristics of Building Materials

**SECTION R337.4
IGNITION-RESISTANT CONSTRUCTION**

R337.4.1 General. The materials prescribed herein for ignition resistance shall conform to the requirements of Section R337.

R337.4.2 Ignition-resistant materials. Ignition-resistant materials shall comply with one of the following:

1. The requirements in Section R337.4.3 or
2. One of the alternative methods in Section R337.4.4.

R337.4.3 Conditions of acceptance for ignition-resistant materials. The material shall comply with the conditions of acceptance in Items 1 and 2 below or with the conditions of acceptance of ASTM E2768.

1. The material shall exhibit a listed flame spread index not exceeding 25 when tested in accordance with ASTM E84 or UL 723.
2. Additionally, the ASTM E84 or UL 723 test shall be continued for an additional 20-minute period, and the material shall exhibit a flame front that does not progress more than 10½ feet (3200 mm) beyond the centerline of the burner at any time during the test period.

R337.4.3.1 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of $\frac{1}{8}$ inch (3.2 mm).

R337.4.4 Alternative methods for determining ignition-resistant material. Any one of the following shall be accepted as meeting the definition of ignition-resistant material:

1. **Noncombustible material.** Material that complies with the definition for noncombustible materials in Section R202.
2. **Fire-retardant-treated wood.** Fire-retardant-treated wood identified for exterior use that complies with the requirements of Section 2303.2 of the California Building Code.
3. **Fire-retardant-treated wood shingles and shakes.** Fire-retardant-treated wood shingles and shakes, as defined in Section 1505.6 of the California Building Code and listed by State Fire Marshal for use as "Class B" roof covering, shall be accepted as an Ignition-resistant wall covering material when installed over solid sheathing.

SECTION R337.5 ROOFING

R337.5.1 General. Roofs shall comply with the requirements of Sections R337 and R902. Roofs shall have a roofing assembly installed in accordance with its listing and the manufacturer's installation instructions. Roof assemblies in the Fire Hazard Severity Zones shall be Class A rating when tested in accordance with ASTM E108 or UL790.

R337.5.2 Roof coverings. Where the roofing profile has an airspace under the roof covering, installed over a combustible deck, a 72 lb. (32.7kg) cap sheet complying with ASTM D3909 Standard Specification for "Asphalt Rolled Roofing (Glass Felt) Surfaced with Mineral Granules," shall be installed over the roof deck. Bird stops shall be used at the eaves when the profile fits, to prevent debris at the eave. Hip and ridge caps shall be mudded in to prevent intrusion of fire or embers.

Exception: Cap sheet is not required when no less than 1 inch of mineral wool board or other noncombustible material is located between the roofing material and wood framing or deck.

Alternately, a Class A fire rated roof underlayment, tested in accordance with ASTM E108, shall be permitted to be used. If the sheathing consists of exterior fire-retardant-treated wood, the underlayment shall not be required to comply with a Class A classification. Bird stops shall be used at the eaves when the profile fits, to prevent debris at the eave. Hip and ridge caps shall be mudded in to prevent intrusion of fire or embers.

R337.5.3 Roof valleys. Where valley flashing is installed, the flashing shall be not less than 0.019-inch (0.48 mm) No. 26 gage galvanized sheet corrosion-resistant metal installed over not less than one layer of minimum 72-pound (32.4 kg) mineral-surfaced nonper-

forated cap sheet complying with ASTM D3909, at least 36-inch-wide (914 mm) running the full length of the valley.

R337.5.4 Roof gutters. Roof gutters shall be provided with the means to prevent the accumulation of leaves and debris in the gutter.

SECTION R337.6 VENTS

R337.6.1 General. Where provided, ventilation openings for enclosed attics, gable ends, ridge ends, under eaves and cornices, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, underfloor ventilation, foundations and crawl spaces, or any other opening intended to permit ventilation, either in a horizontal or vertical plane, shall be in accordance with Section 1202 of the California Building Code and Sections R337.6.1 through R337.6.2 to resist building ignition from the intrusion of burning embers and flame through the ventilation openings.

R337.6.2 Requirements. Ventilation openings shall be fully covered with Wildfire Flame and Ember Resistant vents approved and listed by the California State Fire Marshal, or WUI vents tested to ASTM E2886 and listed, by complying with all of the following requirements:

1. There shall be no flaming ignition of the cotton material during the Ember Intrusion Test.
2. There shall be no flaming ignition during the Integrity Test portion of the Flame Intrusion Test.
3. The maximum temperature of the unexposed side of the vent shall not exceed 662°F (350°C).

R337.6.2.1 Off ridge and ridge vents. Vents that are installed on a sloped roof, such as dormer vents, shall comply with all the following:

1. Vents shall be covered with a mesh where the dimensions of the mesh therein shall be a minimum of $\frac{1}{16}$ inch (1.6 mm) and shall not exceed $\frac{1}{8}$ inch (3.2 mm) in diameter.
2. The mesh material shall be noncombustible.
3. The mesh material shall be corrosion resistant.

SECTION R337.7 EXTERIOR COVERING

R337.7.1 Scope. The provisions of this section shall govern the materials and construction methods used to resist building ignition and/or safeguard against the intrusion of flames resulting from small ember and short-term direct flame contact exposure.

R337.7.2 General. The following exterior covering materials and/or assemblies shall comply with this section:

1. Exterior wall coverings.
2. Exterior wall assemblies.

3. Exterior exposed underside of roof eave overhangs.
4. Exterior exposed underside of roof eave soffits.
5. Exposed underside of exterior porch ceilings.
6. Exterior exposed underside of floor projections.
7. Exterior underfloor areas.

Exceptions to Section R337.7.2:

1. Exterior wall architectural trim, embellishments, fascias and gutters.
2. Roof or wall top cornice projections and similar assemblies.
3. Deck walking surfaces shall comply with Section R337.9 only.

R337.7.3 Exterior wall coverings. The exterior wall covering shall comply with one or more of the following requirements, except as permitted for exterior wall assemblies complying with Section R337.7.4:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.4.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.

R337.7.3.1 Extent of exterior wall covering. Exterior wall coverings shall extend from the top of the foundation to the roof, and terminate at 2 inch (50.8 mm) nominal solid wood blocking between rafters at all roof overhangs, or in the case of enclosed eaves, terminate at the enclosure.

R337.7.4 Exterior wall assemblies. Exterior wall assemblies of buildings or structures shall be constructed using one or more of the following methods, unless they are covered by an exterior wall covering complying with Section R337.7.3:

1. Assembly of sawn lumber or glue-laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks splined, tongue-and-grove, or set close together and well spiked.
2. Log wall construction assembly.
3. Assembly that has been tested in accordance with the test procedures for a 10-minute direct flame contact exposure test set forth in ASTM E2707 with the conditions of acceptance shown in Section R337.7.4.1.
4. Assembly that meets the performance criteria in accordance with the test procedures for a 10-minute direct flame contact exposure test set forth in SFM Standard 12-7A-1.
5. Assembly suitable for exterior fire exposure with a 1-hour fire-resistance rating, rated from the exterior

side, as tested in accordance with ASTM E119 or UL 263.

6. Assembly suitable for exterior fire exposure containing one layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind the exterior wall covering or cladding on the exterior side of the framing.
7. Assembly suitable for exterior fire exposure containing any of the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual as complying with a 1-hour fire-resistance rating, as tested in accordance with ASTM E119 or UL 263.

R337.7.4.1 Conditions of acceptance when tested in accordance with ASTM E2707. The ASTM E2707 test shall be conducted on a minimum of three test specimens, and the conditions of acceptance in Items 1 and 2 below shall be met. If any one of the three tests do not meet the conditions of acceptance, three additional tests shall be run. All the additional tests shall meet the conditions of acceptance.

1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 70-minute test.

R337.7.5 Open roof eaves. The exposed roof deck on the underside of unenclosed roof eaves shall consist of one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section 704A.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the roof deck.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the roof deck designed for exterior fire exposure, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.

Exception to Section R337.7.5: The following materials do not require protection:

Fascia and other architectural trim boards.

R337.7.6 Enclosed roof eaves and roof eave soffits. The exposed underside of enclosed roof eaves having either a boxed-in roof eave soffit with a horizontal underside, or sloping rafter tails with an exterior covering applied to the underside of the rafter tails, shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.4.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind the exterior covering or cladding on the underside of the rafter tails or soffit.
6. The exterior portion of a 1-hour fire resistive exterior assembly applied to the underside of the rafter tails or soffit, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. Boxed-in roof eave soffit assemblies with a horizontal underside that meet the performance criteria in Section R337.7.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. Boxed-in roof eave soffit assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section R337.7.6: The following materials do not require protection:

Fascia and other architectural trim boards.

R337.7.7 Exterior porch ceilings. The exposed underside of exterior porch ceilings shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.4.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind the exterior covering on the underside of the ceiling.

6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119, applied to the underside of the ceiling assembly, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual
7. Porch ceiling assemblies with a horizontal underside that meet the performance criteria in Section R337.7.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. Porch ceiling assemblies with a horizontal underside that meet the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section R337.7.7: Architectural trim boards do not require protection.

R337.7.8 Floor projections. The exposed underside of a cantilevered floor projection where a floor assembly extends over an exterior wall shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.4.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the floor projection, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. The underside of a floor assembly that meets the performance criteria in Section R337.7.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. The underside of a floor assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section R337.7.8: Architectural trim boards do not require protection.

R337.7.9 Underfloor protection. The underfloor area of elevated or overhanging buildings shall be enclosed to grade in accordance with the requirements of this chapter

or the underside of the exposed underfloor shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.4.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.
5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the floor projection.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the floor, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. The underside of a floor assembly that meets the performance criteria in Section R337.7.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. The underside of a floor assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section R337.7.9: Structural columns and beams do not require protection when they are constructed with sawn lumber or glue laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks shall be splined, tongue-and-grove, or set close together and well spiked.

R337.7.10 Underside of appendages. When required by the enforcing agency the underside of overhanging appendages shall be enclosed to grade in accordance with the requirements of this chapter or the underside of the exposed underfloor shall be protected by one or more of the following:

1. Noncombustible material.
2. Ignition-resistant material. The ignition-resistant material shall be labeled for exterior use and shall meet the requirements of Section R337.7.2.
3. Fire-retardant-treated wood. The fire-retardant-treated wood shall be labeled for exterior use and shall meet the requirements of Section 2303.2 of the California Building Code.
4. Materials approved for not less than 1-hour fire-resistance-rated construction on the exterior side, as tested in accordance with ASTM E119 or UL 263.

5. One layer of 5/8-inch (16 mm) Type X gypsum sheathing applied behind an exterior covering on the underside of the appendage projection.
6. The exterior portion of a 1-hour fire-resistance-rated exterior assembly, as tested in accordance with ASTM E119 or UL 263, applied to the underside of the appendage, including assemblies using the gypsum panel and sheathing products listed in the Gypsum Association Fire Resistance Design Manual.
7. The underside of an appendage assembly that meets the performance criteria in Section R337.7.11 when tested in accordance with the test procedures set forth in ASTM E2957.
8. The underside of an appendage assembly that meets the performance criteria in accordance with the test procedures set forth in SFM Standard 12-7A-3.

Exception to Section R337.7.10: Structural columns and beams do not require protection when they are constructed with sawn lumber or glue-laminated wood with the smallest minimum nominal dimension of 4 inches (102 mm). Sawn or glue-laminated planks shall be splined, tongue-and-grove, or set close together and well spiked.

R337.7.11 Conditions of acceptance when tested in accordance with ASTM E2957. The test shall be conducted on a minimum of three test specimens and the conditions of acceptance in 1 through 3 below shall be met. If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Absence of flame penetration of the eaves or horizontal projection assembly at any time.
2. Absence of structural failure of the eaves or horizontal projection subassembly at any time.
3. Absence of sustained combustion of any kind at the conclusion of the 40-minute test.

SECTION R337.8 EXTERIOR WINDOWS, SKYLIGHTS AND DOORS

R337.8.1 General.

R337.8.2 Exterior glazing. The following exterior glazing materials and/or assemblies shall comply with this section:

1. Exterior windows.
2. Exterior glazed doors.
3. Glazed openings within exterior doors.
4. Glazed openings within exterior garage doors.
5. Exterior structural glass veneer.
6. Skylights.
7. Vents.

R337.8.2.1 Exterior windows, skylights and exterior glazed door assembly requirements. Exterior windows,

skylights and exterior glazed door assemblies shall comply with one of the following requirements:

1. Be constructed of multipane glazing with a minimum of one tempered pane meeting the requirements of Section R308 Safety Glazing, or
2. Be constructed of glass block units, or
3. Have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 257, or
4. Be tested to meet the performance requirements of SFM Standard 12-7A-2.

R337.8.2.2 Operable skylights. Operable skylights shall be protected by a noncombustible mesh screen where the dimensions of the openings in the screen shall not exceed $\frac{1}{8}$ inch (3.2 mm).

R337.8.2.3 Structural glass veneer. The wall assembly behind structural glass veneer shall comply with Section R337.7.3 Exterior walls.

R337.8.3 Exterior doors. Exterior doors shall comply with one of the following:

1. The exterior surface or cladding shall be of noncombustible material, or
2. The exterior surface or cladding shall be of ignition-resistant material, or
3. The exterior door shall be constructed of solid core wood that complies with the following requirements:
 - 3.1. Stiles and rails shall not be less than $1\frac{3}{8}$ inches thick
 - 3.2. Panels shall not be less than $1\frac{1}{4}$ inches thick, except for the exterior perimeter of the panel that shall be permitted to taper to a tongue not less than $\frac{3}{8}$ inch thick.
4. The exterior door assembly shall have a fire-resistance rating of not less than 20 minutes when tested according to NFPA 252.
5. The exterior surface or cladding shall be tested to meet the performance requirements of Section R337.7.3.1 when tested in accordance with ASTM E2707.
6. The exterior surface or cladding shall be tested to meet the performance requirements of SFM Standard 12-7A-1.

R337.8.3.1 Exterior door glazing. Glazing in exterior doors shall comply with Section R337.8.2.1.

R337.8.4 Garage door perimeter gap. Exterior garage doors shall resist the intrusion of embers from entering by preventing gaps between doors and door openings, at the bottom, sides and tops of doors, from exceeding $\frac{1}{8}$ inch (3.2 mm). Gaps between doors and door openings shall be controlled by one of the following methods:

1. Weather stripping products made of materials that:
 - (a) have been tested for tensile strength in accordance with ASTM D638 (Standard Test Method for Tensile Properties of Plastics) after exposure to ASTM G155 (Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-

Metallic Materials) for a period of 2,000 hours, where the maximum allowable difference in tensile strength values between exposed and nonexposed samples does not exceed 10 percent and (b) exhibit a V-2 or better flammability rating when tested to UL 94, Standard for Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

2. Door overlaps onto jambs and headers.
3. Garage door jambs and headers covered with metal flashing.

SECTION R337.9 DECKING

R337.9.1 General. The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section.

R337.9.1.1 Flashing. A minimum of a 6-inch (150 mm) metal flashing, applied vertically on the exterior of the wall, shall be installed at all deck-to-wall intersections.

R337.9.2 Where required. The walking surface material of decks, porches, balconies and stairs shall comply with the requirements of this section when any portion of such surface is within 10 feet (3048 mm) of the building.

R337.9.3 Decking surfaces. The walking surface material of decks, porches, balconies and stairs shall be constructed with one of the following materials:

1. Material that complies with the performance requirements of Section R337.9.4 when tested in accordance with both ASTM E2632 and ASTM E2726.
2. Ignition-resistant material that complies with the performance requirements of Section R337.9.4.
3. Material that complies with the performance requirements of both SFM Standard 12-7A-4 and Section R337.4.3.
4. Exterior fire-retardant-treated wood.
5. Noncombustible material.
6. Any material that complies with the performance requirements of SFM Standard 12-7A-4A when attached exterior wall covering is also composed of noncombustible or ignition-resistant material.

Exception: Wall material shall be permitted to be of any material that otherwise complies with this chapter when the decking surface material complies with the performance requirements ASTM E84 with a Class B flame spread index.

7. Any material that complies with the performance requirements of Section R337.9.5 when tested in accordance with ASTM E2632 and when attached exterior wall covering is also composed of only noncombustible or ignition-resistant materials.

Exception: Wall material shall be permitted to be of any material that otherwise complies with this chapter when the decking surface material com-

plies with the performance requirements ASTM E84 with a Class B flame spread index.

R337.9.4 Requirements for type of material in Section R337.9.3, Item 1. The material shall be tested in accordance with both ASTM E2632 and ASTM E2726 and shall comply with the conditions of acceptance in Sections R337.9.4.1 and R337.9.4.2. The material shall also be tested in accordance with ASTM E84 or UL 723 and comply with the performance requirements of Section R337.4.3.

R337.9.4.1 Conditions of acceptance for ASTM E2632. The ASTM E2632 test shall be conducted on a minimum of three test specimens and the conditions of acceptance in Items 1 through 3 below shall be met. If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Peak heat release rate of less than or equal to 25 kW/ft² (269 kW/m²).
2. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
3. Absence of falling particles that are still burning when reaching the burner or floor.

R337.9.4.2 Conditions of acceptance for ASTM E2726. The ASTM E2726 test shall be conducted, using a “Class A” size roof test brand, on a minimum of three test specimens and the conditions of acceptance in Items 1 and 2 below shall be met. If any one of the three test specimens does not meet the conditions of acceptance, three additional tests shall be run. All of the additional tests shall meet the conditions of acceptance.

1. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
2. Absence of falling particles that are still burning when reaching the burner or floor.

R337.9.5 Requirements for type of material in Section R337.9.3, Item 7. The material shall be tested in accordance with ASTM E2632 and shall comply with the following condition of acceptance. The ASTM E2632 test shall be conducted on a minimum of three test specimens and the peak heat release rate shall be less than or equal to 25 kW/ft² (269 kW/m²). If any one of the three tests does not meet the conditions of acceptance, three additional tests shall be run. All the additional tests shall meet the condition of acceptance.

**SECTION R337.10
ACCESSORY BUILDINGS
AND MISCELLANEOUS STRUCTURES**

R337.10.1 General. Group U occupancy accessory buildings and miscellaneous structures that have the potential to pose a significant exterior fire exposure hazard during

wildfires shall be constructed to conform to the ignition-resistance requirements of this section.

R337.10.2 Applicability. Unless otherwise addressed by the exceptions of Section R337.1.3, the provisions of this section shall apply to buildings accessory to an applicable building on the same lot. This section shall also apply to attached and detached miscellaneous structures that require a building permit, including but not limited to; trellises, arbors, patio covers, gazebos and similar structures.

Exceptions:

1. Decks shall comply with the requirements of Section R337.9.
2. Awnings and canopies shall comply with the requirements of Section 3105 of the California Building Code.
3. Exterior wall architectural trim, embellishments and fascia.

R337.10.3 Where required. Miscellaneous structures that require a permit, and accessory buildings of any size, when separated from an applicable building on the same lot by a distance of less than 3 feet (914 mm), shall comply with Section R337.10.3.1. Accessory buildings that are greater than 120 square feet (11 m²), when separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 m) shall comply with Section R337.10.3.2.

When required by the enforcing agency, miscellaneous structures that require a permit, and accessory buildings that are 120 square feet (11 m²) or less, when separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 m), shall comply with either Section R337.10.3.4 or Section R337.10.3.3, respectively.

No requirements shall apply to accessory buildings or miscellaneous structures when located 50 feet (15 m) or more from an applicable building on the same lot.

R337.10.3.1 Structures and accessory buildings within 3 feet (914 mm). Miscellaneous structures that require a permit, and accessory buildings attached to or separated from an applicable building on the same lot by a distance of less than 3 feet (914 mm) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section R337.4.2.

R337.10.3.2 Accessory buildings greater than 120 square feet (11 m²), located 3 feet (914 mm) or more but less than 50 feet (15 m). Accessory buildings that are greater than 120 square feet (11 m²) in size and separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 m) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section R337.4.2.

R337.10.3.3 Accessory buildings 120 square feet (11 m²) or less, located 3 feet (914 mm) or more but less than 50 feet (15 m). When required by the enforcing agency, accessory buildings 120 square feet (11 m²) or less and

separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 m) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section R337.4.2.

R337.10.3.4 Miscellaneous structures located 3 feet (914 mm) or more but less than 50 feet (15 m). When required by the enforcing agency, miscellaneous structures that require a permit and are separated from an applicable building on the same lot by a distance of 3 feet (914 mm) or more but less than 50 feet (15 m) shall be constructed of noncombustible materials or of ignition-resistant materials as described in Section R337.4.3.

R337.10.4 Roof construction. Roofs of accessory buildings required to be constructed entirely of noncombustible materials or of ignition-resistant materials shall comply with the requirements of Section 337 and Chapter 9. Roofs shall have a roofing assembly installed in accordance with its listing and the manufacturer's installation instructions. Roof assemblies in Fire Hazard Severity Zones shall comply with a Class A rating when tested in accordance with ASTM E108 or UL 790.

SECTION R338 ELECTRIC VEHICLE

R338.1 Electric vehicle. An automotive-type vehicle for highway use, such as passenger automobiles, buses, trucks, vans and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array or other source of electric current. For the purpose of this chapter, electric motorcycles and similar type vehicles and off-road self-propelled electric vehicles such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not included.

R338.2 Charging. In any building or interior area used for charging electric vehicles, electrical equipment shall be installed in accordance with the California Electrical Code.

R338.3 Ventilation. Mechanical exhaust ventilation, when required by the California Electrical Code shall be provided at a rate as required by Article 625 or as required by Section 1203 of the California Building Code whichever is greater. The ventilation system shall include both the supply and exhaust equipment and shall be permanently installed and located to intake supply air from the outdoors, and vent the exhaust directly to, the outdoors without conducting the exhaust air through other spaces within the building.

Exception: Positive pressure ventilation systems shall only be allowed in buildings or areas that have been designed and approved for that application.

R338.4 Electrical interface. The electrical supply circuit to electrically powered mechanical ventilation equipment shall be interlocked with the recharging equipment used to supply the vehicle(s) being charged, and shall remain energized

during the entire charging cycle. Electric vehicle recharging equipment shall be marked or labeled in accordance with the California Electrical Code.

Exceptions:

1. Exhaust ventilation shall not be required in areas with an approved engineered ventilation system, which maintains a hydrogen gas concentration at less than 25 percent of the lower flammability limit.
2. Mechanical exhaust ventilation for hydrogen shall not be required where the charging equipment utilized is installed and listed for indoor charging of electric vehicles without ventilation.

SECTION R340 POLLUTANT CONTROL

R340.1 Finish material pollutant control. Finish materials including adhesives, sealants, caulks, paints and coatings, aerosol paints and coatings, carpet systems, carpet cushion, carpet adhesive, resilient flooring systems and composite wood products shall meet the volatile organic compound (VOC) emission limits in accordance with the California Green Building Standards Code, Chapter 4, Division 4.5.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 4 – FOUNDATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/C C	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below																			X			
Chapter / Section																						
R401.2				X																		
R401.4.1.1 through R401.4.1.1.5				X																		
R404.5.1				X																		
R408.3				X																		
R408.4				X																		
R408.8																				X		

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The state agency does not adopt sections identified with the following symbol: †

CHAPTER 4

FOUNDATIONS

User note:

About this chapter: Chapter 4 provides requirements for constructing footings and walls for foundations of wood, masonry, concrete and precast concrete. In addition to a foundation's ability to support the required design loads, this chapter addresses several other factors that can affect foundation performance. These include controlling surface water and subsurface drainage, requiring soil tests where conditions warrant and evaluating proximity to slopes and minimum depth requirements. This chapter also provides requirements to minimize adverse effects of moisture, decay and pests in basements and crawl spaces.

SECTION R401 GENERAL

R401.1 Application. The provisions of this chapter shall control the design and construction of the foundation and foundation spaces for buildings. In addition to the provisions of this chapter, the design and construction of foundations in flood hazard areas as established by Table R301.2 shall meet the provisions of Section R322. Wood foundations shall be designed and installed in accordance with AWC PWF.

Exception: The provisions of this chapter shall be permitted to be used for wood foundations only in the following situations:

1. In buildings that have not more than two floors and a roof.
2. Where interior basement and foundation walls are constructed at intervals not exceeding 50 feet (15 240 mm).

Wood foundations in Seismic Design Category D₀, D₁ or D₂ shall be designed in accordance with accepted engineering practice.

R401.2 Requirements. Foundation construction shall be capable of accommodating all loads in accordance with Section R301 and of transmitting the resulting loads to the supporting soil. Fill soils that support footings and foundations shall be designed, installed and tested in accordance with accepted engineering practice.

Note: See Section R301.1.1.1 for limited-density owner-built rural dwellings.

R401.3 Drainage. Surface drainage shall be diverted to a storm sewer conveyance or other approved point of collection that does not create a hazard. Lots shall be graded to drain surface water away from foundation walls. The grade shall fall not fewer than 6 inches (152 mm) within the first 10 feet (3048 mm).

Exception: Where lot lines, walls, slopes or other physical barriers prohibit 6 inches (152 mm) of fall within 10 feet (3048 mm), drains or swales shall be constructed to ensure drainage away from the structure. Impervious surfaces within 10 feet (3048 mm) of the building foundation shall be sloped not less than 2 percent away from the building.

R401.4 Soil tests. Where quantifiable data created by accepted soil science methodologies indicate expansive soils, compressible soils, shifting soils or other questionable soil characteristics are likely to be present, the building official shall determine whether to require a soil test to determine the soil's characteristics at a particular location. This test shall be done by an approved agency using an approved method.

R401.4.1 Geotechnical evaluation. In lieu of a complete geotechnical evaluation, the load-bearing values in Table R401.4.1 shall be assumed.

**TABLE R401.4.1
PRESUMPTIVE LOAD-BEARING VALUES
OF FOUNDATION MATERIALS^a**

CLASS OF MATERIAL	LOAD-BEARING PRESSURE (pounds per square foot)
Crystalline bedrock	12,000
Sedimentary and foliated rock	4,000
Sandy gravel and/or gravel (GW and GP)	3,000
Sand, silty sand, clayey sand, silty gravel and clayey gravel (SW, SP, SM, SC, GM and GC)	2,000
Clay, sandy, silty clay, clayey silt, silt and sandy siltclay (CL, ML, MH and CH)	1,500 ^b

For SI: 1 pound per square foot = 0.0479 kPa.

- a. Where soil tests are required by Section R401.4, the allowable bearing capacities of the soil shall be part of the recommendations.
- b. Where the building official determines that in-place soils with an allowable bearing capacity of less than 1,500 psf are likely to be present at the site, the allowable bearing capacity shall be determined by a soils investigation.

R401.4.1.1 General and where required for applications listed in Section 1.8.2.1.1 regulated by the Department of Housing and Community Development. Foundations and soils investigations shall be conducted in conformance with Health and Safety Code Sections 17953 through 17957 as summarized below.

R401.4.1.1.1 Preliminary soil report. Each city, county, or city and county shall enact an ordinance which requires a preliminary soil report, prepared by a civil engineer who is registered by the state. The report shall be based upon adequate test bor-

ings or excavations, of every subdivision, where a tentative and final map is required pursuant to Section 66426 of the Government Code.

The preliminary soil report may be waived if the building department of the city, county or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of Section R401.4.1.1, shall determine that, due to the knowledge such department has as to the soil qualities of the soil of the subdivision or lot, no preliminary analysis is necessary.

R401.4.1.1.2 Soil investigation by lot, necessity, preparation and recommendations. *If the preliminary soil report indicates the presence of critically expansive soils or other soil problems which, if not corrected, would lead to structural defects, such ordinance shall require a soil investigation of each lot in the subdivision.*

The soil investigation shall be prepared by a civil engineer who is registered in this state. It shall recommend corrective action which is likely to prevent structural damage to each dwelling proposed to be constructed on the expansive soil.

R401.4.1.1.3 Approval, building permit conditions, appeal. *The building department of each city, county or city and county, or other enforcement agency charged with the administration and enforcement of the provisions of this code, shall approve the soil investigation if it determines that the recommended action is likely to prevent structural damage to each dwelling to be constructed. As a condition to the building permit, the ordinance shall require that the approved recommended action be incorporated in the construction of each dwelling. Appeal from such determination shall be to the local appeals board.*

R401.4.1.1.4 Liability. *A city, county, or city and county or other enforcement agency charged with the administration and enforcement of the provisions of Section R401.4.1.1, is not liable for any injury which arises out of any act or omission of the city, county or city and county, or other enforcement agency, or a public employee or any other person under Section R401.4.1.1.1, R401.4.1.1.2 or R401.4.1.1.3.*

R401.4.1.1.5 Alternate procedures. *The governing body of any city, county, or city and county may enact an ordinance prescribing an alternate procedure which is equal to or more restrictive than the procedures specified in Sections R401.4.1.1.1, R401.4.1.1.2 and R401.1.1.3.*

R401.4.2 Compressible or shifting soil. Instead of a complete geotechnical evaluation, where top or subsoils are compressible or shifting, they shall be removed to a depth and width sufficient to ensure stable moisture content in each active zone and shall not be used as fill or stabilized within each active zone by chemical, dewatering or presaturation.

SECTION R402 MATERIALS

R402.1 Wood foundations. Wood foundation systems shall be designed and installed in accordance with the provisions of this code.

R402.1.1 Fasteners. Fasteners used below grade to attach plywood to the exterior side of exterior basement or crawlspace wall studs, or fasteners used in knee wall construction, shall be of Type 304 or 316 stainless steel. Fasteners used above grade to attach plywood and all lumber-to-lumber fasteners except those used in knee wall construction shall be of Type 304 or 316 stainless steel, silicon bronze, copper, hot-dipped galvanized (zinc coated) steel nails, or hot-tumbled galvanized (zinc coated) steel nails. Electro-galvanized steel nails and galvanized (zinc coated) steel staples shall not be permitted.

R402.1.2 Wood treatment. Lumber and plywood shall be pressure-preservative treated and dried after treatment in accordance with AWWPA U1 (Commodity Specification A, Special Requirement 4.2), and shall bear the label of an accredited agency. Where lumber or plywood is cut or drilled after treatment, the treated surface shall be field treated with copper naphthenate, the concentration of which shall contain not less than 2-percent copper metal, by repeated brushing, dipping or soaking until the wood cannot absorb more preservative.

R402.2 Concrete. Concrete shall have a minimum specified compressive strength of f'_c , as shown in Table R402.2. Concrete subject to moderate or severe weathering as indicated in Table R301.2 shall be air entrained as specified in Table R402.2. The maximum weight of fly ash, other pozzolans, silica fume, slag or blended cements that is included in concrete mixtures for garage floor slabs and for exterior porches, carport slabs and steps that will be exposed to deicing chemicals shall not exceed the percentages of the total weight of cementitious materials specified in Section 19.3.3.4 of ACI 318. Materials used to produce concrete and testing thereof shall comply with the applicable standards listed in Chapters 19 and 20 of ACI 318 or ACI 332.

R402.2.1 Materials for concrete. Materials for concrete shall comply with the requirements of Section R608.5.1.

R402.3 Precast concrete. Precast concrete foundations shall be designed in accordance with Section R404.5 and shall be installed in accordance with the provisions of this code and the manufacturer's instructions.

R402.3.1 Precast concrete foundation materials. Materials used to produce precast concrete foundations shall meet the following requirements:

1. All concrete used in the manufacture of precast concrete foundations shall have a minimum compressive strength of 5,000 psi (34 470 kPa) at 28 days. Concrete exposed to a freezing and thawing environment shall be air entrained with a minimum total air content of 5 percent.
2. Structural reinforcing steel shall meet the requirements of ASTM A615, A706M or A996M. The minimum yield strength of reinforcing steel shall be

40,000 psi (Grade 40) (276 MPa). Steel reinforcement for precast concrete foundation walls shall have a minimum concrete cover of 3/4 inch (19.1 mm).

3. Panel-to-panel connections shall be made with Grade II steel fasteners.
4. The use of nonstructural fibers shall conform to ASTM C1116.
5. Grout used for bedding precast foundations placed on concrete footings shall meet ASTM C1107.

R402.4 Masonry. Masonry systems shall be designed and installed in accordance with this chapter and shall have a minimum specified compressive strength of 1,500 psi (10.3 MPa).

**TABLE R402.2
MINIMUM SPECIFIED COMPRESSIVE
STRENGTH OF CONCRETE**

TYPE OR LOCATION OF CONCRETE CONSTRUCTION	MINIMUM SPECIFIED COMPRESSIVE STRENGTH ^a (f _c)		
	Weathering Potential ^b		
	Negligible	Moderate	Severe
Basement walls, foundations and other concrete not exposed to the weather	2,500	2,500	2,500 ^c
Basement slabs and interior slabs on grade, except garage floor slabs	2,500	2,500	2,500 ^c
Basement walls, foundation walls, exterior walls and other vertical concrete work exposed to the weather	2,500	3,000 ^d	3,000 ^d
Porches, carport slabs and steps exposed to the weather, and garage floor slabs	2,500	3,000 ^{d, e, f}	3,500 ^{d, e, f}

For SI: 1 pound per square inch = 6.895 kPa.

- a. Strength at 28 days psi.
- b. See Table R301.2 for weathering potential.
- c. Concrete in these locations that is subject to freezing and thawing during construction shall be air-entrained concrete in accordance with Note d.
- d. Concrete shall be air-entrained. Total air content (percent by volume of concrete) shall be not less than 5 percent or more than 7 percent.
- e. See Section R402.2 for maximum cementitious materials content.
- f. For garage floors with a steel-troweled finish, reduction of the total air content (percent by volume of concrete) to not less than 3 percent is permitted if the specified compressive strength of the concrete is increased to not less than 4,000 psi.

**SECTION R403
FOOTINGS**

R403.1 General. All exterior walls shall be supported on continuous solid or fully grouted masonry or concrete footings, crushed stone footings, wood foundations, or other *approved* structural systems that shall be of sufficient design to accommodate all loads according to Section R301 and to transmit the resulting loads to the soil within the limitations as determined from the character of the soil. Footings shall be

supported on undisturbed natural soils or engineered fill. Concrete footing shall be designed and constructed in accordance with the provisions of Section R403 or in accordance with ACI 332.

R403.1.1 Minimum size. The minimum width, W, and thickness, T, for concrete footings shall be in accordance with Tables R403.1(1) through R403.1(3) and Figure R403.1(1) or R403.1.3, as applicable, but not less than 12 inches (305 mm) in width and 6 inches (152 mm) in depth. The footing width shall be based on the load-bearing value of the soil in accordance with Table R401.4.1. Footing projections, P, shall be not less than 2 inches (51 mm) and shall not exceed the thickness of the footing. Footing thickness and projection for fireplaces shall be in accordance with Section R1001.2. The size of footings supporting piers and columns shall be based on the tributary load and allowable soil pressure in accordance with Table R401.4.1. Footings for wood foundations shall be in accordance with the details set forth in Section R403.2, and Figures R403.1(2) and R403.1(3). Footings for precast foundations shall be in accordance with the details set forth in Section R403.4, Table R403.4, and Figures R403.4(1) and R403.4(2).

R403.1.2 Continuous footing in Seismic Design Categories D₀, D₁ and D₂. Exterior walls of buildings located in Seismic Design Categories D₀, D₁ and D₂ shall be supported by continuous solid or fully grouted masonry or concrete footings. Other footing materials or systems shall be designed in accordance with accepted engineering practice. Required interior braced wall panels in buildings located in Seismic Design Categories D₀, D₁ and D₂ with plan dimensions greater than 50 feet (15 240 mm) shall be supported by continuous solid or fully grouted masonry or concrete footings in accordance with Section R403.1.3.4, except for two-story buildings in Seismic Design Category D₂, in which all braced wall panels, interior and exterior, shall be supported on continuous foundations.

Exception: Two-story buildings shall be permitted to have interior braced wall panels supported on continuous foundations at intervals not exceeding 50 feet (15 240 mm) provided that:

1. The height of cripple walls does not exceed 4 feet (1219 mm).
2. First-floor braced wall panels are supported on doubled floor joists, continuous blocking or floor beams.
3. The distance between bracing lines does not exceed twice the building width measured parallel to the braced wall line.

R403.1.3 Footing and stem wall reinforcing in Seismic Design Categories D₀, D₁ and D₂. Concrete footings located in Seismic Design Categories D₀, D₁ and D₂, as established in Table R301.2, shall have minimum reinforcement in accordance with this section and Figure R403.1.3. Reinforcement shall be installed with support and cover in accordance with Section R403.1.3.5.

FOUNDATIONS

TABLE R403.1(1)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME CONSTRUCTION (inches)^{a, b, c, d}

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH LIGHT FRAME	LOAD-BEARING VALUE OF SOIL (psf)					
		1,500	2,000	2,500	3,000	3,500	4,000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
30 psf	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	16 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
50 psf	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	15 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	21 × 7	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	18 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
70 psf	1 story—slab-on-grade	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	17 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	22 × 7	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
3 story—plus basement	24 × 8	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m².

- a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.
- b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.
- c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
- d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.

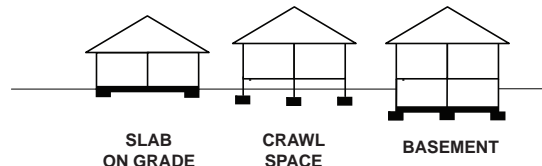
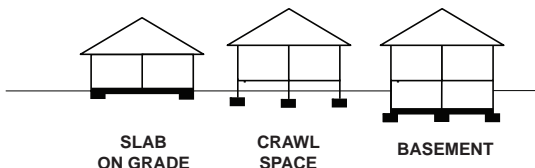


TABLE R403.1(2)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS FOR LIGHT-FRAME
CONSTRUCTION WITH BRICK VENEER OR LATH AND PLASTER (inches)^{a, b, c, d}

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH BRICK VENEER	LOAD-BEARING VALUE OF SOIL (psf)					
		1,500	2,000	2,500	3,000	3,500	4,000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	18 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	23 × 8	17 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 × 8	17 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	29 × 11	21 × 7	17 × 6	14 × 6	12 × 6	12 × 6
30 psf	1 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	24 × 8	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	23 × 8	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	3 story—with crawl space	26 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—plus basement	29 × 11	22 × 7	17 × 6	14 × 6	12 × 6	12 × 6
50 psf	1 story—slab-on-grade	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	20 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	22 × 7	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—with crawl space	27 × 10	21 × 7	16 × 6	14 × 6	12 × 6	12 × 6
	3 story—plus basement	31 × 12	23 × 8	18 × 6	15 × 6	13 × 6	12 × 6
70 psf	1 story—slab-on-grade	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	17 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on grade	21 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	24 × 8	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	27 × 10	20 × 6	16 × 6	13 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	27 × 10	20 × 6	16 × 6	13 × 6	12 × 6	12 × 6
	3 story—with crawl space	29 × 11	22 × 7	17 × 6	15 × 6	12 × 6	12 × 6
	3 story—plus basement	32 × 12	24 × 8	19 × 6	16 × 6	14 × 6	12 × 6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m².

- a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.
- b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.
- c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
- d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.



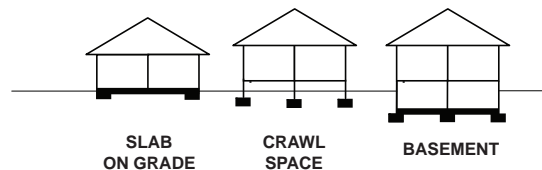
FOUNDATIONS

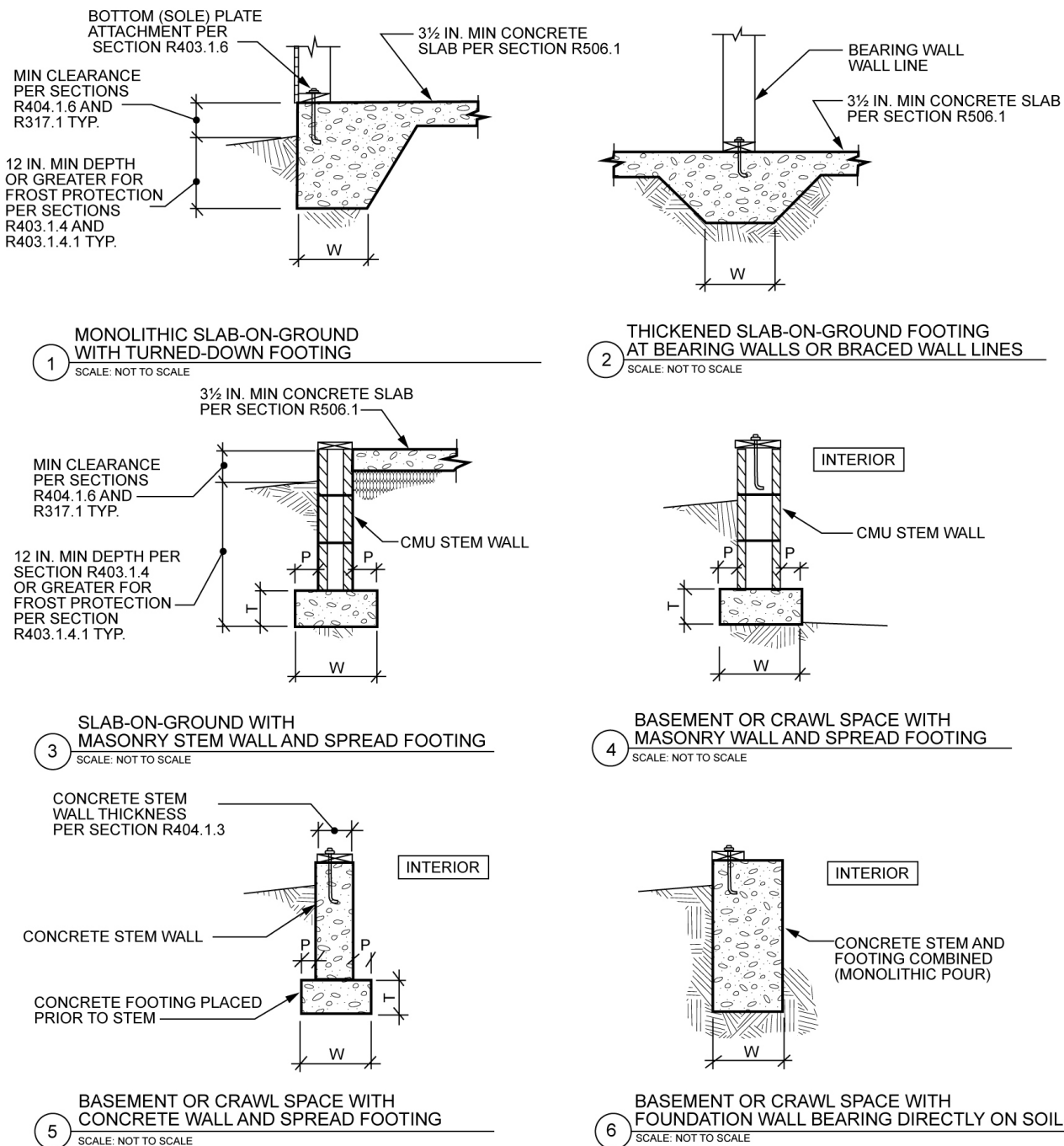
TABLE R403.1(3)
MINIMUM WIDTH AND THICKNESS FOR CONCRETE FOOTINGS WITH CAST-IN-PLACE
CONCRETE OR PARTIALLY GROUTED MASONRY WALL CONSTRUCTION (inches)^{a, b, c, d}

GROUND SNOW LOAD OR ROOF LIVE LOAD	STORY AND TYPE OF STRUCTURE WITH CMU OR CONCRETE	LOAD-BEARING VALUE OF SOIL (psf)					
		1,500	2,000	2,500	3,000	3,500	4,000
20 psf roof live load or 25 psf ground snow load	1 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	25 × 9	19 × 6	15 × 6	12 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—with crawl space	28 × 10	21 × 7	17 × 6	14 × 6	12 × 6	12 × 6
	3 story—plus basement	31 × 12	23 × 8	18 × 6	15 × 6	13 × 6	12 × 6
30 psf	1 story—slab-on-grade	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	19 × 7	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	19 × 6	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	22 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	25 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	26 × 9	19 × 6	15 × 6	13 × 6	12 × 6	12 × 6
	3 story—with crawl space	28 × 10	21 × 7	17 × 6	14 × 6	12 × 6	12 × 6
	3 story—plus basement	31 × 12	23 × 8	19 × 6	16 × 6	13 × 6	12 × 6
50 psf	1 story—slab-on-grade	15 × 6	12 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	18 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	21 × 7	16 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	21 × 7	16 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	24 × 8	18 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	27 × 10	20 × 6	16 × 6	13 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	27 × 10	20 × 6	16 × 6	14 × 6	12 × 6	12 × 6
	3 story—with crawl space	30 × 11	22 × 7	18 × 6	15 × 6	13 × 6	12 × 6
	3 story—plus basement	33 × 13	25 × 9	20 × 6	16 × 6	14 × 6	12 × 6
70 psf	1 story—slab-on-grade	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—with crawl space	19 × 6	14 × 6	12 × 6	12 × 6	12 × 6	12 × 6
	1 story—plus basement	22 × 7	17 × 6	13 × 6	12 × 6	12 × 6	12 × 6
	2 story—slab-on-grade	23 × 8	17 × 6	14 × 6	12 × 6	12 × 6	12 × 6
	2 story—with crawl space	25 × 9	19 × 6	15 × 6	12 × 6	12 × 6	12 × 6
	2 story—plus basement	28 × 10	21 × 7	17 × 6	14 × 6	12 × 6	12 × 6
	3 story—slab-on-grade	29 × 11	22 × 7	17 × 6	14 × 6	12 × 6	12 × 6
	3 story—with crawl space	31 × 12	23 × 8	19 × 6	16 × 6	13 × 6	12 × 6
	3 story—plus basement	34 × 13	26 × 9	21 × 7	17 × 6	15 × 6	13 × 6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.9 N/m².

- a. Linear interpolation of footing width is permitted between the soil bearing pressures in the table. Extrapolation is not permitted.
- b. The table is based on the following conditions and loads: building width, 32 feet; wall height, 9 feet; basement wall height, 8 feet; dead loads, 15 psf roof and ceiling assembly, 10 psf floor assembly, 12 psf wall assembly; live loads, roof and ground snow loads as listed, 40 psf first floor, 30 psf second and third floors. Footing sizes are calculated assuming a clear span roof/ceiling assembly and an interior bearing wall or beam at each floor.
- c. Where the building width perpendicular to the wall footing is greater than 32 feet, the footing width shall be increased by 2 inches and footing depth shall be increased by 1 inch for every 4 feet of increase in building width.
- d. Where the building width perpendicular to the wall footing is less than 32 feet, a 2-inch decrease in footing width and 1-inch decrease in footing depth is permitted for every 4 feet of decrease in building width provided that the minimum width is 12 inches and minimum depth is 6 inches.





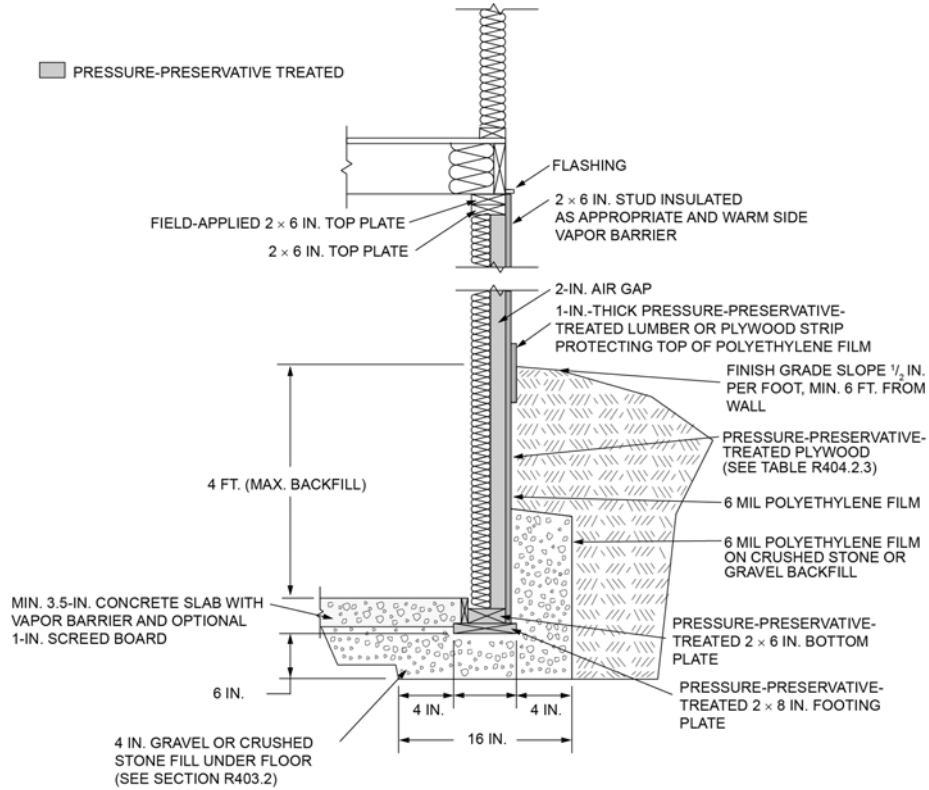
For SI: 1 inch = 25.4 mm.

W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1.

NOTES:

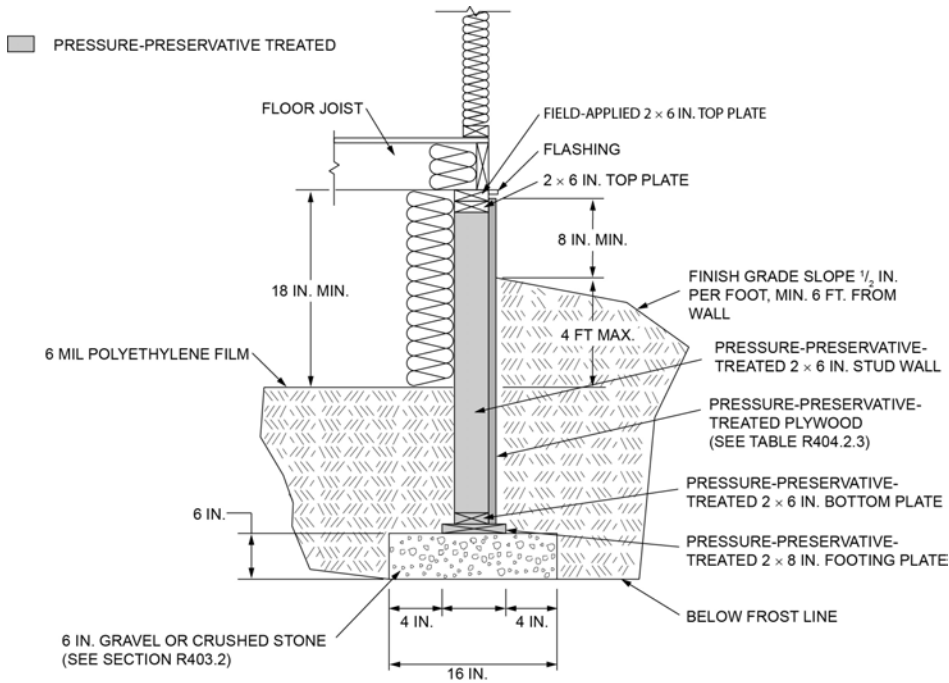
- a. See Section R404.3 for sill requirements.
- b. See Section R403.1.6 for sill attachment.
- c. See Section R506.2.3 for vapor barrier requirements.
- d. See Section R403.1 for base.
- e. See Figure R403.1.3 for additional footing requirements for structures in Seismic Design Categories D₀, D₁ and D₂ and townhouses in Seismic Design Category C.
- f. See Section R408 for under-floor ventilation and access requirements.

FIGURE R403.1(1)
PLAIN CONCRETE FOOTINGS WITH MASONRY AND CONCRETE STEM WALLS IN SEISMIC DESIGN CATEGORIES A, B AND C^{a, b, c, d, e, f}



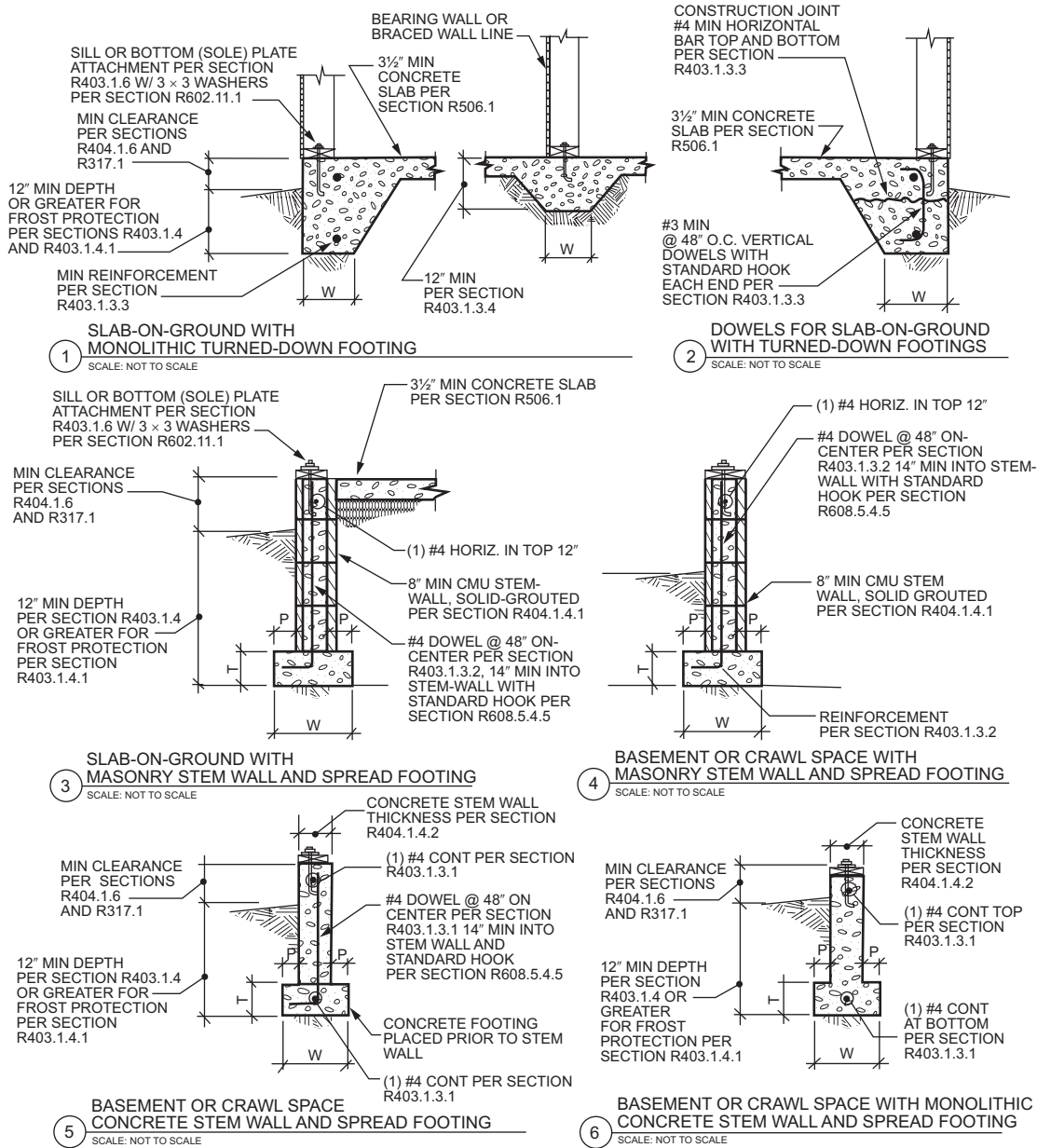
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE R403.1(2)
PERMANENT WOOD FOUNDATION BASEMENT WALL SECTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE R403.1(3)
PERMANENT WOOD FOUNDATION CRAWL SPACE SECTION



For SI: 1 inch = 25.4 mm.

W = Width of footing, T = Thickness of footing and P = Projection per Section R403.1.1.

NOTES:

- a. See Section R404.3 for sill requirements.
- b. See Section R403.1.6 for sill attachment.
- c. See Section R506.2.3 for vapor barrier requirements.
- d. See Section R403.1 for base.
- e. See Section R408 for under-floor ventilation and access requirements.
- f. See Section R403.1.3.5 for reinforcement requirements.

FIGURE R403.1.3
REINFORCED CONCRETE FOOTINGS AND MASONRY AND CONCRETE STEM WALLS IN SDC D₀, D₁ AND D₂^{a, b, c, d, e, f}

R403.1.3.1 Concrete stem walls with concrete footings. In Seismic Design Categories D_0 , D_1 and D_2 where a construction joint is created between a concrete footing and a concrete stem wall, not fewer than one No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend not less than 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R608.5.4.5. Not fewer than one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the stem wall and one No. 4 horizontal bar shall be located 3 to 4 inches (76 mm to 102 mm) from the bottom of the footing.

R403.1.3.2 Masonry stem walls with concrete footings. In Seismic Design Categories D_0 , D_1 and D_2 where a masonry stem wall is supported on a concrete footing, not fewer than one No. 4 vertical bar shall be installed at not more than 4 feet (1219 mm) on center. The vertical bar shall have a standard hook and extend to the bottom of the footing and shall have support and cover as specified in Section R403.1.3.5.3 and extend not less than 14 inches (357 mm) into the stem wall. Standard hooks shall comply with Section R608.5.4.5. Not fewer than one No. 4 horizontal bar shall be installed within 12 inches (305 mm) of the top of the wall and one No. 4 horizontal bar shall be located 3 to 4 inches (76 mm to 102 mm) from the bottom of the footing. Masonry stem walls shall be solid grouted.

R403.1.3.3 Slabs-on-ground with turned-down footings. In Seismic Design Categories D_0 , D_1 and D_2 , slabs-on-ground cast monolithically with turned-down footings shall have not fewer than one No. 4 bar at the top and the bottom of the footing or one No. 5 bar or two No. 4 bars in the middle third of the footing depth.

Where the slab is not cast monolithically with the footing, No. 3 or larger vertical dowels with standard hooks on each end shall be installed at not more than 4 feet (1219 mm) on center in accordance with Figure R403.1.3, Detail 2. Standard hooks shall comply with Section R608.5.4.5.

R403.1.3.4 Interior bearing and braced wall panel footings in Seismic Design Categories D_0 , D_1 and D_2 . In Seismic Design Categories D_0 , D_1 and D_2 , interior footings supporting bearing walls or braced wall panels, and cast monolithically with a slab on grade, shall extend to a depth of not less than 12 inches (305 mm) below the top of the slab.

R403.1.3.5 Reinforcement. Footing and stem wall reinforcement shall comply with Sections R403.1.3.5.1 through R403.1.3.5.4.

R403.1.3.5.1 Steel reinforcement. Steel reinforcement shall comply with the requirements of ASTM A615, A706M or A996M. ASTM A996 bars produced from rail steel shall be Type R. The minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa).

R403.1.3.5.2 Location of reinforcement in wall.

The center of vertical reinforcement in stem walls shall be located at the centerline of the wall. Horizontal and vertical reinforcement shall be located in footings and stem walls to provide the minimum cover required by Section R403.1.3.5.3.

R403.1.3.5.3 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system to prevent displacement during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (75 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be $1\frac{1}{2}$ inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be $\frac{3}{4}$ inch (19 mm).

R403.1.3.5.4 Lap splices. Vertical and horizontal reinforcement shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splice shall be in accordance with Table R608.5.4(1) and Figure R608.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm) [see Figure R608.5.4(1)].

R403.1.3.6 Isolated concrete footings. In detached one- and two-family dwellings that are three stories or less in height and constructed with stud bearing walls, isolated plain concrete footings supporting columns or pedestals are permitted.

R403.1.4 Minimum depth. Exterior footings shall be placed not less than 12 inches (305 mm) below the undisturbed ground surface. Where applicable, the depth of footings shall also conform to Section R403.1.4.1. Deck footings shall be in accordance with Section R507.3.

R403.1.4.1 Frost protection. Except where otherwise protected from frost, foundation walls, piers and other permanent supports of buildings and structures shall be protected from frost by one or more of the following methods:

1. Extended below the frost line specified in Table R301.2.
2. Constructed in accordance with Section R403.3.
3. Constructed in accordance with ASCE 32.
4. Erected on solid rock.

Footings shall not bear on frozen soil unless the frozen condition is permanent.

Exceptions:

1. Protection of free-standing accessory structures with an area of 600 square feet (56 m²) or less, of light-frame construction, with an eave

height of 10 feet (3048 mm) or less shall not be required.

2. Protection of free-standing accessory structures with an area of 400 square feet (37 m²) or less, of other than light-frame construction, with an eave height of 10 feet (3048 mm) or less shall not be required.

R403.1.5 Slope. The top surface of footings shall be level. The bottom surface of footings shall not have a slope exceeding 1 unit vertical in 10 units horizontal (10-percent slope). Footings shall be stepped where it is necessary to change the elevation of the top surface of the footings or where the slope of the bottom surface of the footings will exceed 1 unit vertical in 10 units horizontal (10-percent slope).

R403.1.6 Foundation anchorage. Wood sill plates and wood walls supported directly on continuous foundations shall be anchored to the foundation in accordance with this section.

Cold-formed steel framing shall be anchored directly to the foundation or fastened to wood sill plates in accordance with Section R505.3.1 or R603.3.1, as applicable. Wood sill plates supporting cold-formed steel framing shall be anchored to the foundation in accordance with this section.

Wood sole plates at all exterior walls on monolithic slabs, wood sole plates of braced wall panels at building interiors on monolithic slabs and all wood sill plates shall be anchored to the foundation with minimum 1/2-inch-diameter (12.7 mm) anchor bolts spaced not greater than 6 feet (1829 mm) on center or approved anchors or anchor straps spaced as required to provide equivalent anchorage to 1/2-inch-diameter (12.7 mm) anchor bolts. Bolts shall extend not less than 7 inches (178 mm) into concrete or grouted cells of concrete masonry units. The bolts shall be located in the middle third of the width of the plate. A nut and washer shall be tightened on each anchor bolt. There shall be not fewer than two bolts per plate section with one bolt located not more than 12 inches (305 mm) or less than seven bolt diameters from each end of the plate section. Interior bearing wall sole plates on monolithic slab foundation that are not part of a braced wall panel shall be positively anchored with approved fasteners. Sill plates and sole plates shall be protected against decay and termites where required by Sections R317 and R318. Anchor bolts shall be permitted to be located while concrete is still plastic and before it has set. Where anchor bolts resist placement or the consolidation of concrete around anchor bolts is impeded, the concrete shall be vibrated to ensure full contact between the anchor bolts and concrete.

Exceptions:

1. Walls 24 inches (610 mm) total length or shorter connecting offset braced wall panels shall be anchored to the foundation with not fewer than one anchor bolt located in the center third of the plate section and shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

2. Connection of walls 12 inches (305 mm) total length or shorter connecting offset braced wall panels to the foundation without anchor bolts shall be permitted. The wall shall be attached to adjacent braced wall panels at corners as shown in Item 9 of Table R602.3(1).

R403.1.6.1 Foundation anchorage in Seismic Design Categories C, D₀, D₁ and D₂. In addition to the requirements of Section R403.1.6, the following requirements shall apply to wood light-frame structures in Seismic Design Categories D₀, D₁ and D₂ and wood light-frame townhouses in Seismic Design Category C.

1. Plate washers conforming to Section R602.11.1 shall be provided for all anchor bolts over the full length of required braced wall lines except where approved anchor straps are used. Properly sized cut washers shall be permitted for anchor bolts in wall lines not containing braced wall panels.
2. Interior braced wall plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located within 12 inches (305 mm) of the ends of each plate section where supported on a continuous foundation.
3. Interior bearing wall sole plates shall have anchor bolts spaced at not more than 6 feet (1829 mm) on center and located within 12 inches (305 mm) of the ends of each plate section where supported on a continuous foundation.
4. The maximum anchor bolt spacing shall be 4 feet (1219 mm) for buildings over two stories in height.
5. Stepped cripple walls shall conform to Section R602.11.2.
6. Where continuous wood foundations in accordance with Section R404.2 are used, the force transfer shall have a capacity equal to or greater than the connections required by Section R602.11.1 or the braced wall panel shall be connected to the wood foundations in accordance with the braced wall panel-to-floor fastening requirements of Table R602.3(1).

R403.1.7 Footings on or adjacent to slopes. The placement of buildings and structures on or adjacent to slopes steeper than 1 unit vertical in 3 units horizontal (33.3-percent slope) shall conform to Sections R403.1.7.1 through R403.1.7.4.

R403.1.7.1 Building clearances from ascending slopes. In general, buildings below slopes shall be set a sufficient distance from the slope to provide protection from slope drainage, erosion and shallow failures. Except as provided in Section R403.1.7.4 and Figure R403.1.7.1, the following criteria will be assumed to provide this protection. Where the existing slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the toe of the slope shall be assumed to be at the intersection of a horizontal plane drawn from the top of the foundation and a plane drawn tangent to

the slope at an angle of 45 degrees (0.79 rad) to the horizontal. Where a retaining wall is constructed at the toe of the slope, the height of the slope shall be measured from the top of the wall to the top of the slope.

R403.1.7.2 Footing setback from descending slope surfaces. Footings on or adjacent to slope surfaces shall be founded in material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the footing without detrimental settlement. Except as provided for in Section R403.1.7.4 and Figure R403.1.7.1, the following setback is deemed adequate to meet the criteria. Where the slope is steeper than 1 unit vertical in 1 unit horizontal (100-percent slope), the required setback shall be measured from an imaginary plane 45 degrees (0.79 rad) to the horizontal, projected upward from the toe of the slope.

R403.1.7.3 Foundation elevation. On graded sites, the top of any exterior foundation shall extend above the elevation of the street gutter at point of discharge or the inlet of an approved drainage device not less than 12 inches (305 mm) plus 2 percent. Alternate elevations are permitted subject to the approval of the building official, provided that it can be demonstrated that required drainage to the point of discharge and away from the structure is provided at all locations on the site.

R403.1.7.4 Alternate setbacks and clearances. Alternate setbacks and clearances are permitted, subject to the approval of the building official. The building official is permitted to require an investigation and recommendation of a qualified engineer to demonstrate that the intent of this section has been satisfied. Such an investigation shall include consideration of material, height of slope, slope gradient, load intensity and erosion characteristics of slope material.

R403.1.8 Foundations on expansive soils. Foundation and floor slabs for buildings located on expansive soils shall be designed in accordance with Section 1808.6 of the *California Building Code*.

Exception: Slab-on-ground and other foundation systems that have performed adequately in soil conditions similar to those encountered at the building site

are permitted subject to the approval of the building official.

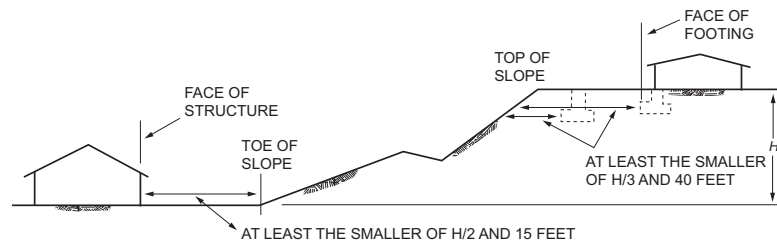
R403.1.8.1 Expansive soils classifications. Soils meeting all of the following provisions shall be considered to be expansive, except that tests to show compliance with Items 1, 2 and 3 shall not be required if the test prescribed in Item 4 is conducted:

1. Plasticity Index (PI) of 15 or greater, determined in accordance with ASTM D4318.
2. More than 10 percent of the soil particles pass a No. 200 sieve (75 μm), determined in accordance with ASTM D422.
3. More than 10 percent of the soil particles are less than 5 micrometers in size, determined in accordance with ASTM D422.
4. Expansion Index greater than 20, determined in accordance with ASTM D4829.

R403.2 Footings for wood foundations. Footings for wood foundations shall be in accordance with Figures R403.1(2) and R403.1(3). Gravel shall be washed and well graded. The maximum size stone shall not exceed 3/4 inch (19.1 mm). Gravel shall be free from organic, clayey or silty soils. Sand shall be coarse, not smaller than 1/16-inch (1.6 mm) grains and shall be free from organic, clayey or silty soils. Crushed stone shall have a maximum size of 1/2 inch (12.7 mm).

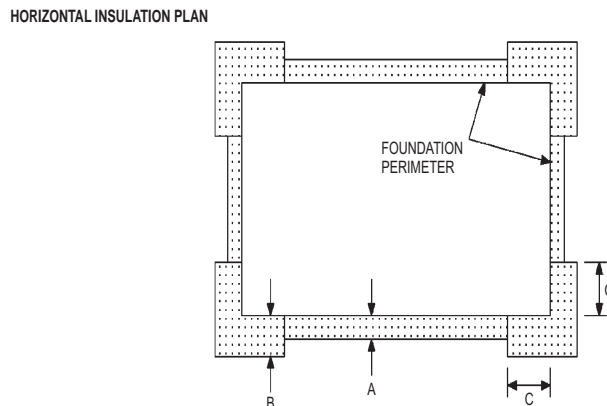
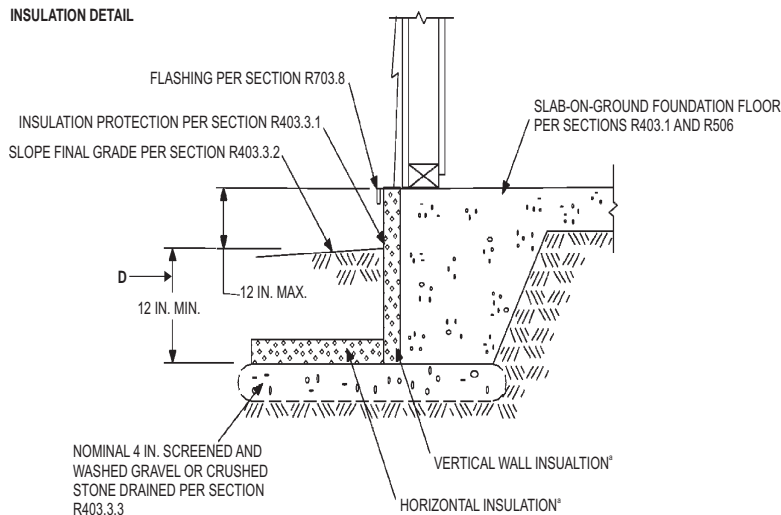
R403.3 Frost-protected shallow foundations. For buildings where the monthly mean temperature of the building is maintained at not less than 64°F (18°C), footings are not required to extend below the frost line where protected from frost by insulation in accordance with Figure R403.3(1) and Table R403.3(1). Foundations protected from frost in accordance with Figure R403.3(1) and Table R403.3(1) shall not be used for unheated spaces such as porches, utility rooms, garages and carports, and shall not be attached to basements or crawl spaces that are not maintained at a minimum monthly mean temperature of 64°F (18°C).

Materials used below grade for the purpose of insulating footings against frost shall be labeled as complying with ASTM C578.



For SI: 1 foot = 304.8 mm.

FIGURE R403.1.7.1
FOUNDATION CLEARANCE FROM SLOPES



For SI: 1 inch = 25.4 mm.

a. See Table R403.3(1) for required dimensions and *R*-values for vertical and horizontal insulation and minimum footing depth.

**FIGURE R403.3(1)
INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS**

**TABLE R403.3(1)
MINIMUM FOOTING DEPTH AND INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS^a**

AIR-FREEZING INDEX (°F days) ^b	MINIMUM FOOTING DEPTH, <i>D</i> (inches)	VERTICAL INSULATION <i>R</i> -VALUE ^{c, d}	HORIZONTAL INSULATION <i>R</i> -VALUE ^{c, e}		HORIZONTAL INSULATION DIMENSIONS PER Figure R403.3(1) (inches)		
			Along walls	At corners	A	B	C
1,500 or less	12	4.5	Not required	Not required	Not required	Not required	Not required
2,000	14	5.6	Not required	Not required	Not required	Not required	Not required
2,500	16	6.7	1.7	4.9	12	24	40
3,000	16	7.8	6.5	8.6	12	24	40
3,500	16	9.0	8.0	11.2	24	30	60
4,000	16	10.1	10.5	13.1	24	36	60

For SI: 1 inch = 25.4 mm, °C = [(°F) – 32]/1.8.

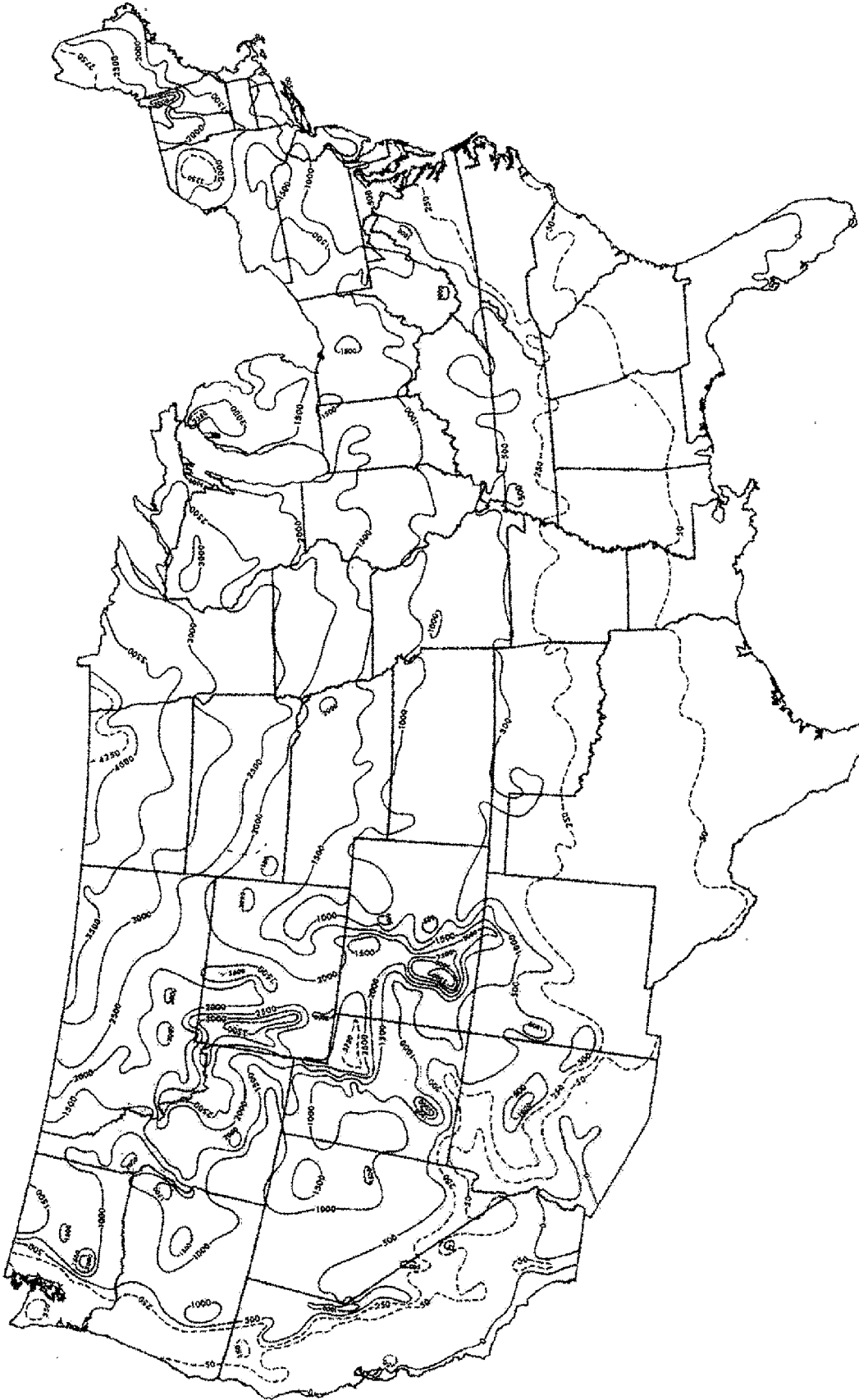
a. Insulation requirements are for protection against frost damage in heated buildings. Greater values could be required to meet energy conservation standards.

b. See Figure R403.3(2) or Table R403.3(2) for Air-Freezing Index values.

c. Insulation materials shall provide the stated minimum *R*-values under long-term exposure to moist, below-ground conditions in freezing climates. The following *R*-values shall be used to determine insulation thicknesses required for this application: Type II expanded polystyrene (EPS)-3.2 *R* per inch for vertical insulation and 2.6 *R* per inch for horizontal insulation; Type IX expanded polystyrene (EPS)-3.4 *R* per inch for vertical insulation and 2.8 *R* per inch for horizontal insulation; Types IV, V, VI, VII, and X extruded polystyrene (XPS)-4.5 *R* per inch for vertical insulation and 4.0 *R* per inch for horizontal insulation.

d. Vertical insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.

e. Horizontal insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.



For SI: $^{\circ}\text{C} = [(^{\circ}\text{F}) - 32]/1.8$.

Note: The air-freezing index is defined as cumulative degree days below 32°F . It is used as a measure of the combined magnitude and duration of air temperature below freezing. The index was computed over a 12-month period (July–June) for each of the 3,044 stations used in the above analysis. Dates from the 1951–80 period were fitted to a Weibull probability distribution to produce an estimate of the 100-year return period.

FIGURE R403.3(2)
AIR-FREEZING INDEX AN ESTIMATE OF THE 100-YEAR RETURN PERIOD

**TABLE R403.3(2)
AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY**

STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Alabama	All counties	—	—	—	—	—
Alaska	Ketchikan Gateway, Prince of Wales-Outer Ketchikan (CA), Sitka, Wrangell-Petersburg (CA)	—	Aleutians West (CA), Haines, Juneau, Skagway-Hoonah-Angoon (CA), Yakutat	—	—	All counties not listed
Arizona	All counties	—	—	—	—	—
Arkansas	All counties	—	—	—	—	—
California	All counties not listed	Nevada, Sierra	—	—	—	—
Colorado	All counties not listed	Archuleta, Custer, Fremont, Huerfano, Las Animas, Ouray, Pitkin, San Miguel	Clear Creek, Conejos, Costilla, Dolores, Eagle, La Plata, Park, Routt, San Juan, Summit	Alamosa, Grand, Jackson, Larimer, Moffat, Rio Blanco, Rio Grande	Chaffee, Gunnison, Lake, Saguache	Hinsdale, Mineral
Connecticut	All counties not listed	Hartford, Litchfield	—	—	—	—
Delaware	All counties	—	—	—	—	—
District of Columbia	All counties	—	—	—	—	—
Florida	All counties	—	—	—	—	—
Georgia	All counties	—	—	—	—	—
Hawaii	All counties	—	—	—	—	—
Idaho	All counties not listed	Adams, Bannock, Blaine, Clearwater, Idaho, Lincoln, Oneida, Power, Valley, Washington	Bingham, Bonneville, Camas, Carbou, Elmore, Franklin, Jefferson, Madison, Teton	Bear Lake, Butte, Custer, Fremont, Lemhi	Clark	—
Illinois	All counties not listed	Boone, Bureau, Cook, Dekalb, DuPage, Fulton, Grundy, Henderson, Henry, Iroquois, Jo Daviess, Kane, Kankakee, Kendall, Knox, La Salle, Lake, Lee, Livingston, Marshall, Mason, McHenry, McLean, Mercer, Peoria, Putnam, Rock Island, Stark, Tazewell, Warren, Whiteside, Will, Woodford	Carroll, Ogle, Stephenson, Winnebago	—	—	—

(continued)

FOUNDATIONS

TABLE R403.3(2)—continued
AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY

STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Indiana	All counties not listed	Allen, Benton, Cass, Fountain, Fulton, Howard, Jasper, Kosciusko, La Porte, Lake, Marshall, Miami, Newton, Porter, Pulaski, Starke, Steuben, Tippecanoe, Tipton, Wabash, Warren, White	—	—	—	—
Iowa	Appanoose, Davis, Fremont, Lee, Van Buren	All counties not listed	Allamakee, Black Hawk, Boone, Bremer, Buchanan, Buena Vista, Butler, Calhoun, Cerro Gordo, Cherokee, Chickasaw, Clay, Clayton, Delaware, Dubuque, Fayette, Floyd, Franklin, Grundy, Hamilton, Hancock, Hardin, Humboldt, Ida, Jackson, Jasper, Jones, Linn, Marshall, Palo Alto, Plymouth, Pocahontas, Poweshiek, Sac, Sioux, Story, Tama, Webster, Winnebago, Woodbury, Worth, Wright	Dickinson, Emmet, Howard, Kossuth, Lyon, Mitchell, O'Brien, Osceola, Winneshiek	—	—
Kansas	All counties	—	—	—	—	—
Kentucky	All counties	—	—	—	—	—
Louisiana	All counties	—	—	—	—	—
Maine	York	Knox, Lincoln, Sagadahoc	Androscoggin, Cumberland, Hancock, Kennebec, Waldo, Washington	Aroostook, Franklin, Oxford, Penobscot, Piscataquis, Somerset	—	—
Maryland	All counties	—	—	—	—	—
Massachusetts	All counties not listed	Berkshire, Franklin, Hampden, Worcester	—	—	—	—

(continued)

**TABLE R403.3(2)—continued
AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY**

STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Michigan	Berrien, Branch, Cass, Kalamazoo, Macomb, Ottawa, St. Clair, St. Joseph	All counties not listed	Alger, Charlevoix, Cheboygan, Chippewa, Crawford, Delta, Emmet, Iosco, Kalkaska, Lake, Luce, Mackinac, Menominee, Missaukee, Montmorency, Ogemaw, Osceola, Otsego, Roscommon, Schoolcraft, Wexford	Baraga, Dickinson, Iron, Keweenaw, Marquette	Gogebic, Houghton, Ontonagon	—
Minnesota	—	—	Houston, Winona	All counties not listed	Aitkin, Big Stone, Carlton, Crow Wing, Douglas, Itasca, Kanabec, Lake, Morrison, Pine, Pope, Stearns, Stevens, Swift, Todd, Wadena	Becker, Beltrami, Cass, Clay, Clearwater, Grant, Hubbard, Kittson, Koochiching, Lake of the Woods, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Red Lake, Roseau, St. Louis, Traverse, Wilkin
Mississippi	All counties	—	—	—	—	—
Missouri	All counties not listed	Atchison, Mercer, Nodaway, Putnam	—	—	—	—
Montana	Mineral	Broadwater, Golden Valley, Granite, Lake, Lincoln, Missoula, Ravalli, Sanders, Sweet Grass	Big Horn, Carbon, Jefferson, Judith Basin, Lewis and Clark, Meagher, Musselshell, Powder River, Powell, Silver Bow, Stillwater, Westland	Carter, Cascade, Deer Lodge, Falcon, Fergus, Flathead, Gallatin, Glacier, Madison, Park, Petroleum, Ponder, Rosebud, Teton, Treasure, Yellowstone	Beaverhead, Blaine, Chouteau, Custer, Dawson, Garfield, Liberty, McCone, Prairie, Toole, Wibaux	Daniels, Hill, Phillips, Richland, Roosevelt, Sheridan, Valley
Nebraska	Adams, Banner, Chase, Cheyenne, Clay, Deuel, Dundy, Fillmore, Franklin, Frontier, Furnas, Gage, Garden, Gosper, Harlan, Hayes, Hitchcock, Jefferson, Kimball, Morrill, Nemaha, Nuckolls, Pawnee, Perkins, Phelps, Red Willow, Richardson, Saline, Scotts Bluff, Seward, Thayer, Webster	All counties not listed	Boyd, Burt, Cedar, Cuming, Dakota, Dixon, Dodge, Knox, Thurston	—	—	—

(continued)

FOUNDATIONS

TABLE R403.3(2)—continued
AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY

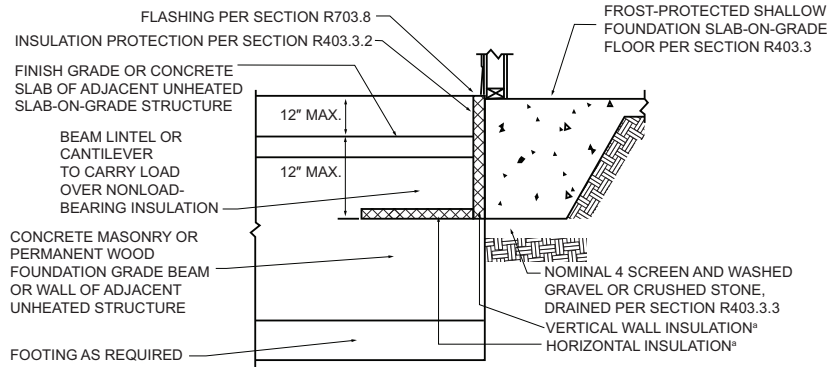
STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Nevada	All counties not listed	Elko, Eureka, Nye, Washoe, White Pine	—	—	—	—
New Hampshire	—	All counties not listed	—	—	—	Carroll, Coos, Grafton
New Jersey	All counties	—	—	—	—	—
New Mexico	All counties not listed	Rio Arriba	Colfax, Mora, Taos	—	—	—
New York	Albany, Bronx, Cayuga, Columbia, Cortland, Dutchess, Genessee, Kings, Livingston, Monroe, Nassau, New York, Niagara, Onondaga, Ontario, Orange, Orleans, Putnam, Queens, Richmond, Rockland, Seneca, Suffolk, Wayne, Westchester, Yates	All counties not listed	Clinton, Essex, Franklin, Hamilton, Herkimer, Jefferson, Lewis, St. Lawrence, Warren	—	—	—
North Carolina	All counties	—	—	—	—	—
North Dakota	—	—	—	Billings, Bowman	Adams, Dickey, Golden Valley, Hettinger, LaMoure, Oliver, Ransom, Sargent, Sioux, Slope, Stark	All counties not listed
Ohio	All counties not listed	Ashland, Crawford, Defiance, Holmes, Huron, Knox, Licking, Morrow, Paulding, Putnam, Richland, Seneca, Williams	—	—	—	—
Oklahoma	All counties	—	—	—	—	—
Oregon	All counties not listed	Baker, Crook, Grant, Harney	—	—	—	—
Pennsylvania	All counties not listed	Berks, Blair, Bradford, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Crawford, Elk, Forest, Huntingdon, Indiana, Jefferson, Lackawanna, Lycoming, McKean, Pike, Potter, Susquehanna, Tioga, Venango, Warren, Wayne, Wyoming	—	—	—	—

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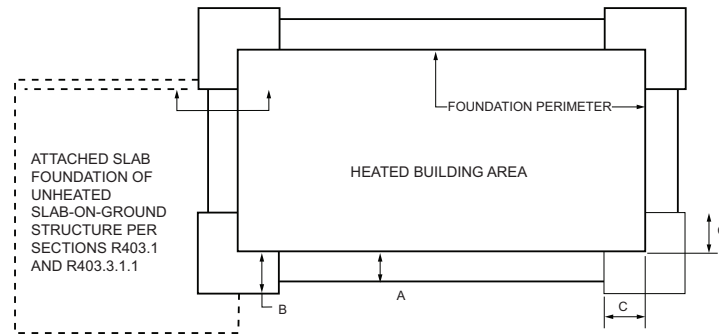
TABLE R403.3(2)—continued
AIR-FREEZING INDEX FOR US LOCATIONS BY COUNTY

STATE	AIR-FREEZING INDEX					
	1,500 or less	2,000	2,500	3,000	3,500	4,000
Rhode Island	All counties	—	—	—	—	—
South Carolina	All counties	—	—	—	—	—
South Dakota	—	Bennett, Custer, Fall River, Lawrence, Mellette, Shannon, Todd, Tripp	Bon Homme, Charles Mix, Davison, Douglas, Gregory, Jackson, Jones, Lyman	All counties not listed	Beadle, Brookings, Brown, Campbell, Codington, Corson, Day, Deuel, Edmunds, Faulk, Grant, Hamlin, Kingsbury, Marshall, McPherson, Perkins, Roberts, Spink, Walworth	—
Tennessee	All counties	—	—	—	—	—
Texas	All counties	—	—	—	—	—
Utah	All counties not listed	Box Elder, Morgan, Weber	Garfield, Salt Lake, Summit	Carbon, Daggett, Duchesne, Rich, Sanpete, Uintah, Wasatch	—	—
Vermont	—	Bennington, Grand Isle, Rutland, Windham	Addison, Chittenden, Franklin, Orange, Washington, Windsor	Caledonia, Essex, Lamoille, Orleans	—	—
Virginia	All counties	—	—	—	—	—
Washington	All counties not listed	Chelan, Douglas, Ferry, Okanogan	—	—	—	—
West Virginia	All counties	—	—	—	—	—
Wisconsin	—	Kenosha, Kewaunee, Racine, Sheboygan, Walworth	All counties not listed	Ashland, Barron, Burnett, Chippewa, Clark, Dunn, Eau Claire, Florence, Forest, Iron, Jackson, La Crosse, Langlade, Marathon, Monroe, Pepin, Polk, Portage, Price, Rust, St. Croix, Taylor, Trempealeau, Vilas, Wood	Bayfield, Douglas, Lincoln, Oneida, Sawyer, Washburn	—
Wyoming	Goshen, Platte	Converse, Crook, Laramie, Niobrara	Campbell, Carbon, Hot Springs, Johnson, Natrona, Sheridan, Uinta, Weston	Albany, Big Horn, Park, Washakie	Fremont, Teton	Lincoln, Sublette, Sweetwater

INSULATION DETAIL



HORIZONTAL INSULATION PLAN



For SI: 1 inch = 25.4 mm.

a. See Table R403.3(1) for required dimensions and *R*-values for vertical and horizontal insulation.

FIGURE R403.3(3)

INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO UNHEATED SLAB-ON-GROUND STRUCTURE

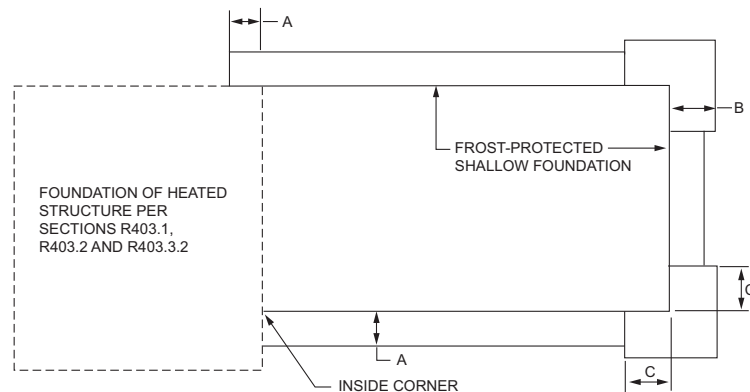


FIGURE R403.3(4)

INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO HEATED STRUCTURE

R403.3.1 Foundations adjoining frost-protected shallow foundations. Foundations that adjoin frost-protected shallow foundations shall be protected from frost in accordance with Section R403.1.4.

R403.3.1.1 Attachment to unheated slab-on-ground structure. Vertical wall insulation and horizontal insulation of frost-protected shallow foundations that adjoin a slab-on-ground foundation that does not have a monthly mean temperature maintained at not less than 64°F (18°C) shall be in accordance with Figure R403.3(3) and Table R403.3(1). Vertical wall insulation shall extend between the frost-protected shallow foundation and the adjoining slab foundation. Required horizontal insulation shall be continuous under the adjoining slab foundation and through any foundation walls adjoining the frost-protected shallow foundation. Where insulation passes through a foundation wall, it shall be either of a type complying with this section and having bearing capacity equal to or greater than the structural loads imposed by the building, or the building shall be designed and constructed using beams, lintels, cantilevers or other means of transferring building loads such that the structural loads of the building do not bear on the insulation.

R403.3.1.2 Attachment to heated structure. Where a frost-protected shallow foundation abuts a structure that has a monthly mean temperature maintained at not less than 64°F (18°C), horizontal insulation and vertical wall insulation shall not be required between the frost-protected shallow foundation and the adjoining structure. Where the frost-protected shallow foundation abuts the heated structure, the horizontal insulation and vertical wall insulation shall extend along the adjoining foundation in accordance with Figure R403.3(4) a distance of not less than Dimension A in Table R403.3(1).

Exception: Where the frost-protected shallow foundation abuts the heated structure to form an inside corner, vertical insulation extending along the adjoining foundation is not required.

R403.3.2 Protection of horizontal insulation below ground. Horizontal insulation placed less than 12 inches (305 mm) below the ground surface or that portion of horizontal insulation extending outward more than 24 inches (610 mm) from the foundation edge shall be protected against damage by use of a concrete slab or asphalt paving on the ground surface directly above the insulation or by cementitious board, plywood rated for below-ground use, or other approved materials placed below ground, directly above the top surface of the insulation.

R403.3.3 Drainage. Final grade shall be sloped in accordance with Section R401.3. In other than Group I Soils, as detailed in Table R405.1, gravel or crushed stone beneath

horizontal insulation below ground shall drain to daylight or into an approved sewer system.

R403.3.4 Termite protection. The use of foam plastic in areas of “very heavy” termite infestation probability shall be in accordance with Section R318.4.

R403.4 Footings for precast concrete foundations. Footings for precast concrete foundations shall comply with Section R403.4.

R403.4.1 Crushed stone footings. Clean crushed stone shall be free from organic, clayey or silty soils. Crushed stone shall be angular in nature and meet ASTM C33, with the maximum size stone not to exceed 1/2 inch (12.7 mm) and the minimum stone size not to be smaller than 1/16 inch (1.6 mm). Crushed stone footings for precast foundations shall be installed in accordance with Figure R403.4(1) and Table R403.4. Crushed stone footings shall be consolidated using a vibratory plate in not greater than 8-inch (203 mm) lifts. Crushed stone footings shall be limited to Seismic Design Categories A, B and C.

R403.4.2 Concrete footings. Concrete footings shall be installed in accordance with Section R403.1 and Figure R403.4(2).

SECTION R404 FOUNDATION AND RETAINING WALLS

R404.1 Concrete and masonry foundation walls. Concrete foundation walls shall be selected and constructed in accordance with the provisions of Section R404.1.3. Masonry foundation walls shall be selected and constructed in accordance with the provisions of Section R404.1.2.

R404.1.1 Design required. Concrete or masonry foundation walls shall be designed in accordance with accepted engineering practice where either of the following conditions exists:

1. Walls are subject to hydrostatic pressure from ground water.
2. Walls supporting more than 48 inches (1219 mm) of unbalanced backfill that do not have permanent lateral support at the top or bottom.

R404.1.2 Design of masonry foundation walls. Masonry foundation walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of TMS 402. Where TMS 402 or the provisions of this section are used to design masonry foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

FOUNDATIONS

**TABLE R403.4
MINIMUM DEPTH (D) AND WIDTH (W) OF CRUSHED STONE FOOTINGS^{a, b} (inches)**

NUMBER OF STORIES	UNIFORM WALL LOAD	DEPTH (D) AND WIDTH (W)	LOAD-BEARING VALUE OF SOIL (psf)																	
			1500			2000			2500			3000			3500			4000		
			MH, CH, CL, ML ^c			SC, GC, SM, GM, SP, SW ^c						GP, GW ^c								
			Wall width (inches)			Wall width (inches)			Wall width (inches)			Wall width (inches)			Wall width (inches)			Wall width (inches)		
8 10 12			8 10 12			8 10 12			8 10 12			8 10 12			8 10 12			8 10 12		
Conventional light-frame construction																				
1-story	1,100 plf	D	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		W	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17
2-story	1,800 plf	D	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		W	15	15	17	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17
3-story	2,900 plf	D	14	12	10	9	7	5	6	4	4	4	4	4	4	4	4	4	4	4
		W	25	24	24	19	19	18	15	15	17	13	15	17	13	15	17	13	15	17
4-inch brick veneer over light-frame or 8-inch hollow concrete masonry																				
1-story	1,500 plf	D	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		W	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17
2-story	2,700 plf	D	12	11	9	8	6	4	5	4	4	4	4	4	4	4	4	4	4	4
		W	22	23	23	18	17	17	14	15	17	13	15	17	13	15	17	13	15	17
3-story	4,000 plf	D	21	20	18	14	13	11	10	8	7	7	6	4	5	4	4	4	4	4
		W	33	34	33	25	26	25	20	20	21	17	17	17	14	15	17	13	15	17
8-inch solid or fully grouted masonry																				
1-story	2,000 plf	D	7	6	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		W	17	17	17	13	15	17	13	15	17	13	15	17	13	15	17	13	15	17
2-story	3,600 plf	D	19	17	15	12	11	9	9	7	5	6	4	4	4	4	4	4	4	4
		W	30	30	30	22	23	23	19	19	18	15	15	17	13	15	17	13	15	17
3-story	5,300 plf	D	30	29	27	21	19	18	16	14	12	12	10	8	9	8	6	7	6	4
		W	43	44	44	33	32	33	27	27	26	22	22	22	19	20	19	17	17	17

For SI: 1 inch = 25.4 mm, 1 plf = 14.6 N/m, 1 pound per square foot = 47.9 N/m².

a. Linear interpolation of stone depth between wall widths is permitted within each Load-Bearing Value of Soil (psf).

b. Crushed stone must be consolidated in 8-inch lifts with a plate vibrator.

c. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.

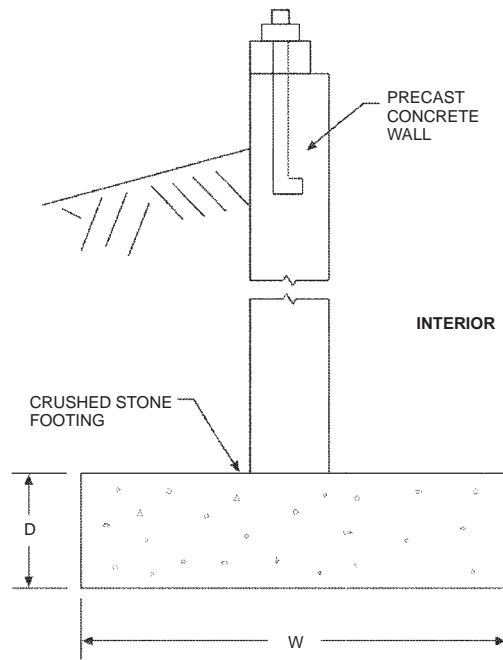


FIGURE R403.4(1)
BASEMENT OR CRAWL SPACE WITH PRECAST FOUNDATION WALL BEARING ON CRUSHED STONE

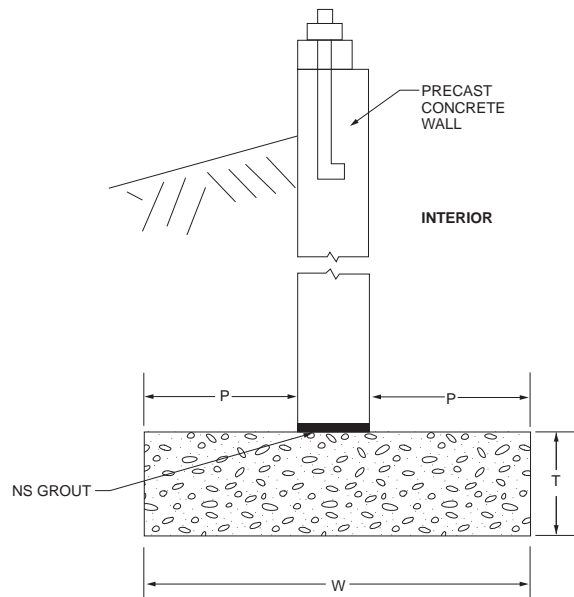


FIGURE R403.4(2)
BASEMENT OR CRAWL SPACE WITH PRECAST FOUNDATION WALL ON SPREAD FOOTING

FOUNDATIONS

**TABLE R404.1.1(1)
PLAIN MASONRY FOUNDATION WALLS^f**

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^c (feet)	PLAIN MASONRY ^a MINIMUM NOMINAL WALL THICKNESS (inches)		
		Soil classes ^b		
		GW, GP, SW and SP	GM, GC, SM, SM-SC and ML	SC, MH, ML-CL and inorganic CL
5	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
6	4	6 solid ^d or 8	6 solid ^d or 8	6 solid ^d or 8
	5	6 solid ^d or 8	8	10
	6	8	10	12
7	4	6 solid ^d or 8	8	8
	5	6 solid ^d or 8	10	10
	6	10	12	10 solid ^d
	7	12	10 solid ^d	12 solid ^d
8	4	6 solid ^d or 8	6 solid ^d or 8	8
	5	6 solid ^d or 8	10	12
	6	10	12	12 solid ^d
	7	12	12 solid ^d	Note e
	8	10 grout ^d	12 grout ^d	Note e
9	4	6 grout ^d or 8 solid ^d or 12	6 grout ^d or 8 solid ^d	8 grout ^d or 10 solid ^d
	5	6 grout ^d or 10 solid ^d	8 grout ^d or 12 solid ^d	8 grout ^d
	6	8 grout ^d or 12 solid ^d	10 grout ^d	10 grout ^d
	7	10 grout ^d	10 grout ^d	12 grout
	8	10 grout ^d	12 grout	Note e
	9	12 grout	Note e	Note e

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond. UngROUTED hollow masonry units are permitted except where otherwise indicated.
- b. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- c. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
- d. Solid indicates solid masonry unit; grout indicates grouted hollow units.
- e. Wall construction shall be in accordance with Table R404.1.1(2), R404.1.1(3) or R404.1.1(4), or a design shall be provided.
- f. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.1(2)
8-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE $d \geq 5$ INCHES^{a, c, f}

MAXIMUM UNSUPPORTED WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet 8 inches	#4 at 48	#5 at 48	#6 at 48
7 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet 4 inches	#5 at 48	#6 at 48	#6 at 40
8 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#4 at 48
	6 feet	#4 at 48	#5 at 48	#5 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#5 at 48	#6 at 48	#6 at 32
8 feet 8 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet 8 inches	#6 at 48	#6 at 32	#6 at 24
9 feet 4 inches	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 40
	8 feet	#6 at 48	#6 at 40	#6 at 24
	9 feet 4 inches	#6 at 40	#6 at 24	#6 at 16
10 feet	4 feet (or less)	#4 at 48	#4 at 48	#4 at 48
	5 feet	#4 at 48	#4 at 48	#5 at 48
	6 feet	#4 at 48	#5 at 48	#6 at 48
	7 feet	#5 at 48	#6 at 48	#6 at 32
	8 feet	#6 at 48	#6 at 32	#6 at 24
	9 feet	#6 at 40	#6 at 24	#6 at 16
	10 feet	#6 at 32	#6 at 16	#6 at 16

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B and C, and 48 inches in Seismic Design Categories D₀, D₁ and D₂.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be not less than 5 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
- f. The use of this table shall be prohibited for soil classifications not shown.

FOUNDATIONS

TABLE R404.1.1(3)
10-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE $d \geq 6.75$ INCHES^{a, c, f}

MAXIMUM UNSUPPORTED WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and later soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet 8 inches	#4 at 56	#5 at 56	#5 at 56
7 feet 4 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet 4 inches	#4 at 56	#5 at 56	#6 at 56
8 feet	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
	8 feet	#5 at 56	#6 at 56	#6 at 48
8 feet 8 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#4 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
	8 feet 8 inches	#5 at 56	#6 at 48	#6 at 32
9 feet 4 inches	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#5 at 56	#5 at 56
	7 feet	#4 at 56	#5 at 56	#6 at 56
	8 feet	#5 at 56	#6 at 56	#6 at 40
	9 feet 4 inches	#6 at 56	#6 at 40	#6 at 24
10 feet	4 feet (or less)	#4 at 56	#4 at 56	#4 at 56
	5 feet	#4 at 56	#4 at 56	#4 at 56
	6 feet	#4 at 56	#5 at 56	#5 at 56
	7 feet	#5 at 56	#6 at 56	#6 at 48
	8 feet	#5 at 56	#6 at 48	#6 at 40
	9 feet	#6 at 56	#6 at 40	#6 at 24
	10 feet	#6 at 48	#6 at 32	#6 at 24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B and C, and 48 inches in Seismic Design Categories D₀, D₁ and D₂.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be not less than 6.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground level. Where an interior concrete slab-on-grade is provided and is in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height from the exterior finish ground level to the top of the interior concrete slab is permitted.
- f. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.1(4)
12-INCH MASONRY FOUNDATION WALLS WITH REINFORCING WHERE $d \geq 8.75$ INCHES^{a, c, f}

MAXIMUM UNSUPPORTED WALL HEIGHT	HEIGHT OF UNBALANCED BACKFILL ^e	MINIMUM VERTICAL REINFORCEMENT AND SPACING (INCHES) ^{b, c}		
		Soil classes and lateral soil load ^d (psf per foot below grade)		
		GW, GP, SW and SP soils 30	GM, GC, SM, SM-SC and ML soils 45	SC, ML-CL and inorganic CL soils 60
6 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet 8 inches	#4 at 72	#4 at 72	#5 at 72
7 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet 4 inches	#4 at 72	#5 at 72	#6 at 72
8 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 64
8 feet 8 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#4 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet 8 inches	#5 at 72	#7 at 72	#6 at 48
9 feet 4 inches	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#5 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 56
	9 feet 4 inches	#6 at 72	#6 at 48	#6 at 40
10 feet	4 feet (or less)	#4 at 72	#4 at 72	#4 at 72
	5 feet	#4 at 72	#4 at 72	#4 at 72
	6 feet	#4 at 72	#5 at 72	#5 at 72
	7 feet	#4 at 72	#6 at 72	#6 at 72
	8 feet	#5 at 72	#6 at 72	#6 at 48
	9 feet	#6 at 72	#6 at 56	#6 at 40
	10 feet	#6 at 64	#6 at 40	#6 at 32

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.157 kPa/mm.

- a. Mortar shall be Type M or S and masonry shall be laid in running bond.
- b. Alternative reinforcing bar sizes and spacings having an equivalent cross-sectional area of reinforcement per lineal foot of wall shall be permitted provided the spacing of the reinforcement does not exceed 72 inches in Seismic Design Categories A, B and C, and 48 inches in Seismic Design Categories D₀, D₁ and D₂.
- c. Vertical reinforcement shall be Grade 60 minimum. The distance, *d*, from the face of the soil side of the wall to the center of vertical reinforcement shall be not less than 8.75 inches.
- d. Soil classes are in accordance with the Unified Soil Classification System and design lateral soil loads are for moist conditions without hydrostatic pressure. Refer to Table R405.1.
- e. Unbalanced backfill height is the difference in height between the exterior finish ground level and the lower of the top of the concrete footing that supports the foundation wall or the interior finish ground levels. Where an interior concrete slab-on-grade is provided and in contact with the interior surface of the foundation wall, measurement of the unbalanced backfill height is permitted to be measured from the exterior finish ground level to the top of the interior concrete slab is permitted.
- f. The use of this table shall be prohibited for soil classifications not shown.

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R404.1.2.1 Masonry foundation walls. Concrete masonry and clay masonry foundation walls shall be constructed as set forth in Table R404.1.1(1), R404.1.1(2), R404.1.1(3) or R404.1.1(4) and shall comply with applicable provisions of Section R606. In buildings assigned to Seismic Design Categories D₀, D₁ and D₂, concrete masonry and clay masonry foundation walls shall also comply with Section R404.1.4.1. Rubble stone masonry foundation walls shall be constructed in accordance with Sections R404.1.8 and R606.4.2. Rubble stone masonry walls shall not be used in Seismic Design Categories D₀, D₁ and D₂, or in townhouses in Seismic Design Category C.

**TABLE R404.1.2(1)
MINIMUM HORIZONTAL REINFORCEMENT
FOR CONCRETE BASEMENT WALLS^{a, b}**

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	LOCATION OF HORIZONTAL REINFORCEMENT
≤ 8	One No. 4 bar within 12 inches of the top of the wall story and one No. 4 bar near mid-height of the wall story.
> 8	One No. 4 bar within 12 inches of the top of the wall story and one No. 4 bar near third points in the wall story.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm,
1 pound per square inch = 6.895 kPa.

- a. Horizontal reinforcement requirements are for reinforcing bars with a minimum yield strength of 40,000 psi and concrete with a minimum concrete compressive strength of 2,500 psi.
- b. See Section R404.1.3.2 for minimum reinforcement required for foundation walls supporting above-grade concrete walls.

**TABLE R404.1.2(2)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS^{b, c, d, e, g, h, i, j, k}**

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	6 @ 39	6 @ 48
	6	5 @ 39	6 @ 48	6 @ 35
	7	6 @ 48	6 @ 34	6 @ 25
	8	6 @ 39	6 @ 25	6 @ 18
9	4	NR	NR	NR
	5	NR	5 @ 37	6 @ 48
	6	5 @ 36	6 @ 44	6 @ 32
	7	6 @ 47	6 @ 30	6 @ 22
	8	6 @ 34	6 @ 22	6 @ 16
10	9	6 @ 27	6 @ 17	DR
	4	NR	NR	NR
	5	NR	5 @ 35	6 @ 48
	6	6 @ 48	6 @ 41	6 @ 30
	7	6 @ 43	6 @ 28	6 @ 20
	8	6 @ 31	6 @ 20	DR
	9	6 @ 24	6 @ 15	DR
10	6 @ 19	DR	DR	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

NR = Not Required.

DR = Design Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. Deflection criterion is L/240, where L is the height of the basement wall in inches.
- e. Interpolation is not permitted.
- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. NR indicates vertical wall reinforcement is not required, except for 6-inch-nominal walls formed with stay-in-place forming systems in which case vertical reinforcement shall be No. 4@48 inches on center.
- h. See Section R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table R608.3 for tolerance from nominal thickness permitted for flat walls.
- j. DR means design is required in accordance with the applicable building code, or in the absence of a code, in accordance with ACI 318.
- k. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.2(3)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH (203 mm) NOMINAL FLAT CONCRETE BASEMENT WALLS^{b, c, d, e, f, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 37
	7	NR	6 @ 36	6 @ 35
	8	6 @ 41	6 @ 35	6 @ 26
9	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 35
	7	NR	6 @ 35	6 @ 32
	8	6 @ 36	6 @ 32	6 @ 23
	9	6 @ 35	6 @ 25	6 @ 18
10	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	6 @ 35
	7	NR	6 @ 35	6 @ 29
	8	6 @ 35	6 @ 29	6 @ 21
	9	6 @ 34	6 @ 22	6 @ 16
	10	6 @ 27	6 @ 17	6 @ 13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

NR = Not Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi, concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. NR indicates vertical reinforcement is not required.
- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- f. Interpolation is not permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. See Section R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table R608.3 for tolerance from nominal thickness permitted for flat walls.
- j. The use of this table shall be prohibited for soil classifications not shown.

FOUNDATIONS

TABLE R404.1.2(4)
MINIMUM VERTICAL REINFORCEMENT FOR 10-INCH NOMINAL FLAT CONCRETE BASEMENT WALLS^{b, c, d, e, f, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^a (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	NR
	8	6 @ 48	6 @ 35	6 @ 28
9	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	6 @ 31
	8	NR	6 @ 31	6 @ 28
10	9	6 @ 37	6 @ 28	6 @ 24
	4	NR	NR	NR
	5	NR	NR	NR
	6	NR	NR	NR
	7	NR	NR	6 @ 28
	8	NR	6 @ 28	6 @ 28
	9	6 @ 33	6 @ 28	6 @ 21
10	6 @ 28	6 @ 23	6 @ 17	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

NR = Not Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. NR indicates vertical reinforcement is not required.
- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- f. Interpolation is not permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. See Section R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table R608.3 for tolerance from nominal thickness permitted for flat walls.
- j. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.2(5)
MINIMUM VERTICAL WALL REINFORCEMENT FOR 6-INCH WAFFLE-GRID BASEMENT WALLS^{b, c, d, e, g, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ⁱ (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	4 @ 48	4 @ 46	6 @ 39
	5	4 @ 45	5 @ 46	6 @ 47
	6	5 @ 45	6 @ 40	DR
	7	6 @ 44	DR	DR
	8	6 @ 32	DR	DR
9	4	4 @ 48	4 @ 46	4 @ 37
	5	4 @ 42	5 @ 43	6 @ 44
	6	5 @ 41	6 @ 37	DR
	7	6 @ 39	DR	DR
	> 8	DR ⁱ	DR	DR
10	4	4 @ 48	4 @ 46	4 @ 35
	5	4 @ 40	5 @ 40	6 @ 41
	6	5 @ 38	6 @ 34	DR
	7	6 @ 36	DR	DR
	> 8	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- e. Interpolation is not permitted.
- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. See Section R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- h. See Table R608.3 for thicknesses and dimensions of waffle-grid walls.
- i. DR means design is required in accordance with the applicable building code, or in the absence of a code, in accordance with ACI 318.
- j. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.2(6)
MINIMUM VERTICAL REINFORCEMENT FOR 8-INCH WAFFLE-GRID BASEMENT WALLS^{b, c, d, e, f, h, i, j, k}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^g (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	NR	NR	NR
	5	NR	5 @ 48	5 @ 46
	6	5 @ 48	5 @ 43	6 @ 45
	7	5 @ 46	6 @ 43	6 @ 31
	8	6 @ 48	6 @ 32	6 @ 23
9	4	NR	NR	NR
	5	NR	5 @ 47	5 @ 46
	6	5 @ 46	5 @ 39	6 @ 41
	7	5 @ 42	6 @ 38	6 @ 28
	8	6 @ 44	6 @ 28	6 @ 20
	9	6 @ 34	6 @ 21	DR
10	4	NR	NR	NR
	5	NR	5 @ 46	5 @ 44
	6	5 @ 46	5 @ 37	6 @ 38
	7	5 @ 38	6 @ 35	6 @ 25
	8	6 @ 39	6 @ 25	DR
	9	6 @ 30	DR	DR
	10	6 @ 24	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

NR = Not Required.

DR = Design Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 (420 MPa) and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. NR indicates vertical reinforcement is not required.
- e. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- f. Interpolation shall not be permitted.
- g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- h. See Section R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- i. See Table R608.3 for thicknesses and dimensions of waffle-grid walls.
- j. DR means design is required in accordance with the applicable building code, or in the absence of a code, in accordance with ACI 318.
- k. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.2(7)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH (152 mm) SCREEN-GRID BASEMENT WALLS^{b, c, d, e, g, h, i, j}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ^f (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)		
		Soil classes ^a and design lateral soil (psf per foot of depth)		
		GW, GP, SW, SP 30	GM, GC, SM, SM-SC and ML 45	SC, ML-CL and inorganic CL 60
8	4	4 @ 48	4 @ 48	5 @ 43
	5	4 @ 48	5 @ 48	5 @ 37
	6	5 @ 48	6 @ 45	6 @ 32
	7	6 @ 48	DR	DR
	8	6 @ 36	DR	DR
9	4	4 @ 48	4 @ 48	4 @ 41
	5	4 @ 48	5 @ 48	6 @ 48
	6	5 @ 45	6 @ 41	DR
	7	6 @ 43	DR	DR
	> 8	DR	DR	DR
10	4	4 @ 48	4 @ 48	4 @ 39
	5	4 @ 44	5 @ 44	6 @ 46
	6	5 @ 42	6 @ 38	DR
	7	6 @ 40	DR	DR
	> 8	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

- a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.
- b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi, concrete with a minimum specified compressive strength of 2,500 psi and vertical reinforcement being located at the centerline of the wall. See Section R404.1.3.3.7.2.
- c. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches (12, 24, 36 and 48) that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).
- d. Deflection criterion is $L/240$, where L is the height of the basement wall in inches.
- e. Interpolation is not permitted.
- f. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.
- g. See Sections R404.1.3.2 for minimum reinforcement required for basement walls supporting above-grade concrete walls.
- h. See Table R608.3 for thicknesses and dimensions of screen-grid walls.
- i. DR means design is required in accordance with the applicable building code, or in the absence of a code, in accordance with ACI 318.
- j. The use of this table shall be prohibited for soil classifications not shown.

FOUNDATIONS

TABLE R404.1.2(8)
MINIMUM VERTICAL REINFORCEMENT FOR 6-, 8-, 10- AND 12-INCH NOMINAL FLAT BASEMENT WALLS^{b, c, d, e, f, h, i, k, n, o}

MAXIMUM UNSUPPORTED WALL HEIGHT (feet)	MAXIMUM UNBALANCED BACKFILL HEIGHT ⁹ (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches)											
		Soil classes ^a and design lateral soil (psf per foot of depth)											
		GW, GP, SW, SP 30				GM, GC, SM, SM-SC and ML 45				SC, ML-CL and inorganic CL 60			
		Minimum nominal wall thickness (inches)											
		6	8	10	12	6	8	10	12	6	8	10	12
5	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
6	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR ¹	NR	NR	4 @ 35	NR ¹	NR	NR
	6	NR	NR	NR	NR	5 @ 48	NR	NR	NR	5 @ 36	NR	NR	NR
7	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	NR	NR	NR	NR	5 @ 47	NR	NR	NR
	6	NR	NR	NR	NR	5 @ 42	NR	NR	NR	6 @ 43	5 @ 48	NR ¹	NR
	7	5 @ 46	NR	NR	NR	6 @ 42	5 @ 46	NR ¹	NR	6 @ 34	6 @ 48	NR	NR
8	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 38	NR ¹	NR	NR	5 @ 43	NR	NR	NR
	6	4 @ 37	NR ¹	NR	NR	5 @ 37	NR	NR	NR	6 @ 37	5 @ 43	NR ¹	NR
	7	5 @ 40	NR	NR	NR	6 @ 37	5 @ 41	NR ¹	NR	6 @ 34	6 @ 43	NR	NR
	8	6 @ 43	5 @ 47	NR ¹	NR	6 @ 34	6 @ 43	NR	NR	6 @ 27	6 @ 32	6 @ 44	NR
9	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 35	NR ¹	NR	NR	5 @ 40	NR	NR	NR
	6	4 @ 34	NR ¹	NR	NR	6 @ 48	NR	NR	NR	6 @ 36	6 @ 39	NR ¹	NR
	7	5 @ 36	NR	NR	NR	6 @ 34	5 @ 37	NR	NR	6 @ 33	6 @ 38	5 @ 37	NR ¹
	8	6 @ 38	5 @ 41	NR ¹	NR	6 @ 33	6 @ 38	5 @ 37	NR ¹	6 @ 24	6 @ 29	6 @ 39	4 @ 48 ^m
	9	6 @ 34	6 @ 46	NR	NR	6 @ 26	6 @ 30	6 @ 41	NR	6 @ 19	6 @ 23	6 @ 30	6 @ 39
10	4	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	5	NR	NR	NR	NR	4 @ 33	NR ¹	NR	NR	5 @ 38	NR	NR	NR
	6	5 @ 48	NR ¹	NR	NR	6 @ 45	NR	NR	NR	6 @ 34	5 @ 37	NR	NR
	7	6 @ 47	NR	NR	NR	6 @ 34	6 @ 48	NR	NR	6 @ 30	6 @ 35	6 @ 48	NR ¹
	8	6 @ 34	5 @ 38	NR	NR	6 @ 30	6 @ 34	6 @ 47	NR ¹	6 @ 22	6 @ 26	6 @ 35	6 @ 45 ^m
	9	6 @ 34	6 @ 41	4 @ 48	NR ¹	6 @ 23	6 @ 27	6 @ 35	4 @ 48 ^m	DR	6 @ 22	6 @ 27	6 @ 34
	10	6 @ 28	6 @ 33	6 @ 45	NR	DR ¹	6 @ 23	6 @ 29	6 @ 38	DR	6 @ 22	6 @ 22	6 @ 28

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot per foot = 0.1571 kPa²/m, 1 pound per square inch = 6.895 kPa.

NR = Not Required.

DR = Design Required.

a. Soil classes are in accordance with the Unified Soil Classification System. Refer to Table R405.1.

b. Table values are based on reinforcing bars with a minimum yield strength of 60,000 psi.

c. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R404.1.3.3.7.6 and Table R404.1.2(9).

d. NR indicates vertical wall reinforcement is not required, except for 6-inch nominal walls formed with stay-in-place forming systems in which case vertical reinforcement shall be No. 4@48 inches on center.

e. Allowable deflection criterion is $L/240$, where L is the unsupported height of the basement wall in inches.

f. Interpolation is not permitted.

g. Where walls will retain 4 feet or more of unbalanced backfill, they shall be laterally supported at the top and bottom before backfilling.

h. Vertical reinforcement shall be located to provide a cover of $1\frac{1}{4}$ inches measured from the inside face of the wall. The center of the steel shall not vary from the specified location by more than the greater of 10 percent of the wall thickness or $\frac{3}{8}$ inch.

i. Concrete cover for reinforcement measured from the inside face of the wall shall be not less than $\frac{3}{4}$ inch. Concrete cover for reinforcement measured from the outside face of the wall shall be not less than $1\frac{1}{2}$ inches for No. 5 bars and smaller, and not less than 2 inches for larger bars.

j. DR means design is required in accordance with the applicable building code, or in the absence of a code, in accordance with ACI 318.

k. Concrete shall have a specified compressive strength, f'_c , of not less than 2,500 psi at 28 days, unless a higher strength is required by Note l or m.

l. The minimum thickness is permitted to be reduced 2 inches, provided that the minimum specified compressive strength of concrete, f'_c , is 4,000 psi.

m. A plain concrete wall with a minimum nominal thickness of 12 inches is permitted, provided that the minimum specified compressive strength of concrete, f'_c , is 3,500 psi.

n. See Table R608.3 for tolerance from nominal thickness permitted for flat walls.

o. The use of this table shall be prohibited for soil classifications not shown.

TABLE R404.1.2(9)
MINIMUM SPACING FOR ALTERNATE BAR SIZE AND ALTERNATE GRADE OF STEEL^{a, b, c}

BAR SPACING FROM APPLICABLE TABLE IN SECTION R404.1.3.2 (inches)	BAR SIZE FROM APPLICABLE TABLE IN SECTION R404.1.3.2														
	#4					#5					#6				
	Alternate bar size and alternate grade of steel desired														
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
Maximum spacing for alternate bar size and alternate grade of steel (inches)															
8	12	18	5	8	12	5	11	3	5	8	4	6	2	4	5
9	14	20	6	9	13	6	13	4	6	9	4	6	3	4	6
10	16	22	7	10	15	6	14	4	7	9	5	7	3	5	7
11	17	24	7	11	16	7	16	5	7	10	5	8	3	5	7
12	19	26	8	12	18	8	17	5	8	11	5	8	4	6	8
13	20	29	9	13	19	8	18	6	9	12	6	9	4	6	9
14	22	31	9	14	21	9	20	6	9	13	6	10	4	7	9
15	23	33	10	16	22	10	21	6	10	14	7	11	5	7	10
16	25	35	11	17	23	10	23	7	11	15	7	11	5	8	11
17	26	37	11	18	25	11	24	7	11	16	8	12	5	8	11
18	28	40	12	19	26	12	26	8	12	17	8	13	5	8	12
19	29	42	13	20	28	12	27	8	13	18	9	13	6	9	13
20	31	44	13	21	29	13	28	9	13	19	9	14	6	9	13
21	33	46	14	22	31	14	30	9	14	20	10	15	6	10	14
22	34	48	15	23	32	14	31	9	15	21	10	16	7	10	15
23	36	48	15	24	34	15	33	10	15	22	10	16	7	11	15
24	37	48	16	25	35	15	34	10	16	23	11	17	7	11	16
25	39	48	17	26	37	16	35	11	17	24	11	18	8	12	17
26	40	48	17	27	38	17	37	11	17	25	12	18	8	12	17
27	42	48	18	28	40	17	38	12	18	26	12	19	8	13	18
28	43	48	19	29	41	18	40	12	19	26	13	20	8	13	19
29	45	48	19	30	43	19	41	12	19	27	13	20	9	14	19
30	47	48	20	31	44	19	43	13	20	28	14	21	9	14	20
31	48	48	21	32	45	20	44	13	21	29	14	22	9	15	21
32	48	48	21	33	47	21	45	14	21	30	15	23	10	15	21
33	48	48	22	34	48	21	47	14	22	31	15	23	10	16	22
34	48	48	23	35	48	22	48	15	23	32	15	24	10	16	23
35	48	48	23	36	48	23	48	15	23	33	16	25	11	16	23
36	48	48	24	37	48	23	48	15	24	34	16	25	11	17	24
37	48	48	25	38	48	24	48	16	25	35	17	26	11	17	25
38	48	48	25	39	48	25	48	16	25	36	17	27	12	18	25
39	48	48	26	40	48	25	48	17	26	37	18	27	12	18	26
40	48	48	27	41	48	26	48	17	27	38	18	28	12	19	27
41	48	48	27	42	48	26	48	18	27	39	19	29	12	19	27
42	48	48	28	43	48	27	48	18	28	40	19	30	13	20	28
43	48	48	29	44	48	28	48	18	29	41	20	30	13	20	29
44	48	48	29	45	48	28	48	19	29	42	20	31	13	21	29
45	48	48	30	47	48	29	48	19	30	43	20	32	14	21	30
46	48	48	31	48	48	30	48	20	31	44	21	32	14	22	31
47	48	48	31	48	48	30	48	20	31	44	21	33	14	22	31
48	48	48	32	48	48	31	48	21	32	45	22	34	15	23	32

For SI: 1 inch = 25.4 mm.

- a. This table is for use with tables in Section R404.1.3.2 that specify the minimum bar size and maximum spacing of vertical wall reinforcement for foundation walls and above-grade walls. Reinforcement specified in tables in Section R404.1.3.2 is based on Grade 60 steel reinforcement.
- b. Bar spacing shall not exceed 48 inches on center and shall be not less than one-half the nominal wall thickness.
- c. For Grade 50 steel bars (ASTM A996, Type R), use spacing for Grade 40 bars or interpolate between Grades 40 and 60.

R404.1.3 Concrete foundation walls. Concrete foundation walls that support light-frame walls shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100. Concrete foundation walls that support above-grade concrete walls that are within the applicability limits of Section R608.2 shall be designed and constructed in accordance with the provisions of this section, ACI 318, ACI 332 or PCA 100. Concrete foundation walls that support above-grade concrete walls that are not within the applicability limits of Section R608.2 shall be designed and constructed in accordance with the provisions of ACI 318, ACI 332 or PCA 100. Where ACI 318, ACI 332, PCA 100 or the provisions of this section are used to design concrete foundation walls, project drawings, typical details and specifications are not required to bear the seal of the architect or engineer responsible for design, unless otherwise required by the state law of the jurisdiction having authority.

R404.1.3.1 Concrete cross section. Concrete walls constructed in accordance with this code shall comply with the shapes and minimum concrete cross-sectional dimensions required by Table R608.3. Other types of forming systems resulting in concrete walls not in compliance with this section and Table R608.3 shall be designed in accordance with ACI 318.

R404.1.3.2 Reinforcement for foundation walls. Concrete foundation walls shall be laterally supported at the top and bottom. Horizontal reinforcement shall be provided in accordance with Table R404.1.2(1). Vertical reinforcement shall be provided in accordance with Table R404.1.2(2), R404.1.2(3), R404.1.2(4), R404.1.2(5), R404.1.2(6), R404.1.2(7) or R404.1.2(8). Vertical reinforcement for flat basement walls retaining 4 feet (1219 mm) or more of unbalanced backfill is permitted to be determined in accordance with Table R404.1.2(9). For basement walls supporting above-grade concrete walls, vertical reinforcement shall be the greater of that required by Tables R404.1.2(2) through R404.1.2(8) or by Section R608.6 for the above-grade wall. In buildings assigned to Seismic Design Category D₀, D₁ or D₂, concrete foundation walls shall also comply with Section R404.1.4.2.

R404.1.3.2.1 Concrete foundation stem walls supporting above-grade concrete walls. Foundation stem walls that support above-grade concrete walls shall be designed and constructed in accordance with this section.

1. Stem walls not laterally supported at top. Concrete stem walls that are not monolithic with slabs-on-ground or are not otherwise laterally supported by slabs-on-ground shall comply with this section. Where unbalanced backfill retained by the stem wall is less than or equal to 18 inches (457 mm), the stem wall and above-grade wall it supports shall be provided with vertical reinforcement in accordance with Section R608.6 and Table R608.6(1), R608.6(2) or R608.6(3) for above-grade walls.

Where unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the stem wall and above-grade wall it supports shall be provided with vertical reinforcement in accordance with Section R608.6 and Table R608.6(1).

2. Stem walls laterally supported at top. Concrete stem walls that are monolithic with slabs-on-ground or are otherwise laterally supported by slabs-on-ground shall be vertically reinforced in accordance with Section R608.6 and Table R608.6(1), R608.6(2) or R608.6(3) for above-grade walls. Where the unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the connection between the stem wall and the slab-on-ground, and the portion of the slab-on-ground providing lateral support for the wall shall be designed in accordance with PCA 100 or with accepted engineering practice. Where the unbalanced backfill retained by the stem wall is greater than 18 inches (457 mm), the minimum nominal thickness of the wall shall be 6 inches (152 mm).

R404.1.3.2.2 Concrete foundation stem walls supporting light-frame above-grade walls. Concrete foundation stem walls that support light-frame above-grade walls shall be designed and constructed in accordance with this section.

1. Stem walls not laterally supported at top. Concrete stem walls that are not monolithic with slabs-on-ground or are not otherwise laterally supported by slabs-on-ground and retain 48 inches (1219 mm) or less of unbalanced fill, measured from the top of the wall, shall be constructed in accordance with Section R404.1.3. Foundation stem walls that retain more than 48 inches (1219 mm) of unbalanced fill, measured from the top of the wall, shall be designed in accordance with Sections R404.1.1 and R404.4.
2. Stem walls laterally supported at top. Concrete stem walls that are monolithic with slabs-on-ground or are otherwise laterally supported by slabs-on-ground shall be constructed in accordance with Section R404.1.3. Where the unbalanced backfill retained by the stem wall is greater than 48 inches (1219 mm), the connection between the stem wall and the slab-on-ground, and the portion of the slab-on-ground providing lateral support for the wall, shall be designed in accordance with PCA 100 or in accordance with accepted engineering practice.

R404.1.3.3 Concrete, materials for concrete, and forms. Materials used in concrete, the concrete itself and forms shall conform to requirements of this section or ACI 318.

R404.1.3.3.1 Compressive strength. The minimum specified compressive strength of concrete, f'_c , shall comply with Section R402.2 and shall be not less than 2,500 psi (17.2 MPa) at 28 days in buildings assigned to Seismic Design Category A, B or C and 3,000 psi (20.5 MPa) in buildings assigned to Seismic Design Category D₀, D₁ or D₂.

R404.1.3.3.2 Concrete mixing and delivery. Mixing and delivery of concrete shall comply with ASTM C94 or ASTM C685.

R404.1.3.3.3 Maximum aggregate size. The nominal maximum size of coarse aggregate shall not exceed one-fifth the narrowest distance between sides of forms, or three-fourths the clear spacing between reinforcing bars or between a bar and the side of the form.

Exception: Where approved, these limitations shall not apply where removable forms are used and workability and methods of consolidation permit concrete to be placed without honeycombs or voids.

R404.1.3.3.4 Proportioning and slump of concrete. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding. Slump of concrete placed in removable forms shall not exceed 6 inches (152 mm).

Exception: Where approved, the slump is permitted to exceed 6 inches (152 mm) for concrete mixtures that are resistant to segregation, and are in accordance with the form manufacturer's recommendations.

Slump of concrete placed in stay-in-place forms shall exceed 6 inches (152 mm). Slump of concrete shall be determined in accordance with ASTM C143.

R404.1.3.3.5 Consolidation of concrete. Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration.

Exception: Where approved for concrete to be placed in stay-in-place forms, self-consolidating concrete mixtures with slumps equal to or greater than 8 inches (203 mm) that are specifically designed for placement without internal vibration need not be internally vibrated.

R404.1.3.3.6 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other approved material suitable for supporting and containing concrete. Forms shall be accurately positioned and

secured before placing concrete and shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

R404.1.3.3.6.1 Stay-in-place forms. Stay-in-place concrete forms shall comply with this section.

1. Surface burning characteristics. The flame-spread index and smoke-developed index of forming material, other than foam plastic, left exposed on the interior shall comply with Section R302. The surface burning characteristics of foam plastic used in insulating concrete forms shall comply with Section R316.3.
2. Interior covering. Stay-in-place forms constructed of rigid foam plastic shall be protected on the interior of the building as required by Section R316. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives in addition to mechanical fasteners is permitted.
3. Exterior wall covering. Stay-in-place forms constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an approved exterior wall covering complying with this code. Exterior surfaces of other stay-in-place forming systems shall be protected in accordance with this code.
4. Termite protection. In areas where the probability of termite infestation is "very heavy" as indicated by Table R301.2 or Figure R301.2.1, foam plastic insulation shall be permitted below grade on foundation walls in accordance with Section R318.4.
5. Flat ICF wall system forms shall conform to ASTM E2634.

R404.1.3.3.7 Reinforcement.

R404.1.3.3.7.1 Steel reinforcement. Steel reinforcement shall comply with the requirements of ASTM A615, A706M or A996. ASTM A996 bars produced from rail steel shall be Type R. In buildings assigned to Seismic Design Category A, B or C, the minimum yield strength of reinforcing steel shall be 40,000 psi (Grade 40) (276 MPa). In buildings assigned to Seismic Design Category D₀, D₁ or D₂, the minimum yield strength shall be 60,000 psi (Grade 60) (414 MPa).

R404.1.3.3.7.2 Location of reinforcement in wall. The center of vertical reinforcement in basement walls determined from Tables R404.1.2(2) through R404.1.2(7) shall be located at the centerline of the wall. Vertical reinforcement in basement walls determined from Table R404.1.2(8) shall be located to provide a maximum cover of $1\frac{1}{4}$ inches (32 mm) measured from the inside face of the wall. Regardless of the table used to determine vertical wall reinforcement, the center of the steel shall not vary from the specified location by more than the greater of 10 percent of the wall thickness and $\frac{3}{8}$ inch (10 mm). Horizontal and vertical reinforcement shall be located in foundation walls to provide the minimum cover required by Section R404.1.3.3.7.4.

R404.1.3.3.7.3 Wall openings. Vertical wall reinforcement required by Section R404.1.3.2 that is interrupted by wall openings shall have additional vertical reinforcement of the same size placed within 12 inches (305 mm) of each side of the opening.

R404.1.3.3.7.4 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system to prevent displacement during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (75 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be $1\frac{1}{2}$ inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be $\frac{3}{4}$ inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover or $\frac{3}{8}$ inch (10 mm).

R404.1.3.3.7.5 Lap splices. Vertical and horizontal wall reinforcement shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splice shall be in accordance with Table R608.5.4(1) and Figure R608.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm) [See Figure R608.5.4(1)].

R404.1.3.3.7.6 Alternate grade of reinforcement and spacing. Where tables in Section R404.1.3.2 specify vertical wall reinforcement based on minimum bar size and maximum spacing, which are based on Grade 60 (414 MPa) steel reinforcement, different size bars or bars made from a different grade of steel are permitted provided that an equivalent area of steel per linear foot of wall is provided. Use of Table

R404.1.2(9) is permitted to determine the maximum bar spacing for different bar sizes than specified in the tables or bars made from a different grade of steel. Bars shall not be spaced less than one-half the wall thickness, or more than 48 inches (1219 mm) on center.

R404.1.3.3.7.7 Standard hooks. Where reinforcement is required by this code to terminate with a standard hook, the hook shall comply with Section R608.5.4.5 and Figure R608.5.4(3).

R404.1.3.3.7.8 Construction joint reinforcement. Construction joints in foundation walls shall be made and located to not impair the strength of the wall. Construction joints in plain concrete walls, including walls required to have not less than No. 4 bars at 48 inches (1219 mm) on center by Sections R404.1.3.2 and R404.1.4.2, shall be located at points of lateral support, and not fewer than one No. 4 bar shall extend across the construction joint at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have not less than 12 inches (305 mm) embedment on both sides of the joint. Construction joints in reinforced concrete walls shall be located in the middle third of the span between lateral supports, or located and constructed as required for joints in plain concrete walls.

Exception: Use of vertical wall reinforcement required by this code is permitted in lieu of construction joint reinforcement provided that the spacing does not exceed 24 inches (610 mm), or the combination of wall reinforcement and No. 4 bars described in this section does not exceed 24 inches (610 mm).

R404.1.3.3.8 Exterior wall coverings. Requirements for installation of masonry veneer, stucco and other wall coverings on the exterior of concrete walls and other construction details not covered in this section shall comply with the requirements of this code.

R404.1.3.4 Requirements for Seismic Design Category C. Concrete foundation walls supporting above-grade concrete walls in townhouses assigned to Seismic Design Category C shall comply with ACI 318, ACI 332 or PCA 100 (see Section R404.1.3).

R404.1.4 Seismic Design Category D₀, D₁ or D₂.

R404.1.4.1 Masonry foundation walls. In buildings assigned to Seismic Design Category D₀, D₁ or D₂, as established in Table R301.2, masonry foundation walls shall comply with this section. In addition to the requirements of Table R404.1.1(1), plain masonry foundation walls shall comply with the following:

1. Wall height shall not exceed 8 feet (2438 mm).
2. Unbalanced backfill height shall not exceed 4 feet (1219 mm).

3. Minimum nominal thickness for plain masonry foundation walls shall be 8 inches (203 mm).
4. Masonry stem walls shall have a minimum vertical reinforcement of one No. 4 (No. 13) bar located not greater than 4 feet (1219 mm) on center in grouted cells. Vertical reinforcement shall be tied to the horizontal reinforcement in the footings.

Foundation walls, supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be constructed in accordance with Table R404.1.1(2), R404.1.1(3) or R404.1.1(4). Masonry foundation walls shall have two No. 4 (No. 13) horizontal bars located in the upper 12 inches (305 mm) of the wall.

R404.1.4.2 Concrete foundation walls. In buildings assigned to Seismic Design Category D_0 , D_1 or D_2 , as established in Table R301.2, concrete foundation walls that support light-frame walls shall comply with this section, and concrete foundation walls that support above-grade concrete walls shall comply with ACI 318, ACI 332 or PCA 100 (see Section R404.1.3). In addition to the horizontal reinforcement required by Table R404.1.2(1), plain concrete walls supporting light-frame walls shall comply with the following:

1. Wall height shall not exceed 8 feet (2438 mm).
2. Unbalanced backfill height shall not exceed 4 feet (1219 mm).
3. Minimum thickness for plain concrete foundation walls shall be 7.5 inches (191 mm) except that 6 inches (152 mm) is permitted where the maximum wall height is 4 feet, 6 inches (1372 mm).

Foundation walls less than 7.5 inches (191 mm) in thickness, supporting more than 4 feet (1219 mm) of unbalanced backfill or exceeding 8 feet (2438 mm) in height shall be provided with horizontal reinforcement in accordance with Table R404.1.2(1), and vertical reinforcement in accordance with Table R404.1.2(2), R404.1.2(3), R404.1.2(4), R404.1.2(5), R404.1.2(6), R404.1.2(7) or R404.1.2(8). Where Tables R404.1.2(2) through R404.1.2(8) permit plain concrete walls, not less than No. 4 (No. 13) vertical bars at a spacing not exceeding 48 inches (1219 mm) shall be provided.

R404.1.5 Foundation wall thickness based on walls supported. The thickness of masonry or concrete foundation walls shall be not less than that required by Section R404.1.5.1 or R404.1.5.2, respectively.

R404.1.5.1 Masonry wall thickness. Masonry foundation walls shall be not less than the thickness of the wall supported, except that masonry foundation walls of not less than 8-inch (203 mm) nominal thickness shall be permitted under brick veneered frame walls and under 10-inch-wide (254 mm) cavity walls where the total height of the wall supported, including gables, is not more than 20 feet (6096 mm), provided that the requirements of Section R404.1.1 are met.

R404.1.5.2 Concrete wall thickness. The thickness of concrete foundation walls shall be equal to or greater than the thickness of the wall in the story above. Concrete foundation walls with corbels, brackets or other projections built into the wall for support of masonry veneer or other purposes are not within the scope of the tables in this section.

Where a concrete foundation wall is reduced in thickness to provide a shelf for the support of masonry veneer, the reduced thickness shall be equal to or greater than the thickness of the wall in the story above. Vertical reinforcement for the foundation wall shall be based on Table R404.1.2(8) and located in the wall as required by Section R404.1.3.3.7.2 where that table is used. Vertical reinforcement shall be based on the thickness of the thinner portion of the wall.

Exception: Where the height of the reduced thickness portion measured to the underside of the floor assembly or sill plate above is less than or equal to 24 inches (610 mm) and the reduction in thickness does not exceed 4 inches (102 mm), the vertical reinforcement is permitted to be based on the thicker portion of the wall.

R404.1.5.3 Pier and curtain wall foundations. Use of pier and curtain wall foundations shall be permitted to support light-frame construction not more than two stories in height, provided that the following requirements are met:

1. All load-bearing walls shall be placed on continuous concrete footings placed integrally with the exterior wall footings.
2. The minimum actual thickness of a load-bearing masonry wall shall be not less than 4 inches (102 mm) nominal or $3\frac{3}{8}$ inches (92 mm) actual thickness, and shall be bonded integrally with piers spaced in accordance with Section R606.6.4.
3. Piers shall be constructed in accordance with Sections R606.7 and R606.7.1, and shall be bonded into the load-bearing masonry wall in accordance with Section R606.13.1 or R606.13.1.1.
4. The maximum height of a 4-inch (102 mm) load-bearing masonry foundation wall supporting wood-frame walls and floors shall be not more than 4 feet (1219 mm).
5. Anchorage shall be in accordance with Section R403.1.6, Figure R404.1.5.3, or as specified by engineered design accepted by the building official.
6. The unbalanced fill for 4-inch (102 mm) foundation walls shall not exceed 24 inches (610 mm) for solid masonry or 12 inches (305 mm) for hollow masonry.
7. In Seismic Design Categories D_0 , D_1 and D_2 , prescriptive reinforcement shall be provided in the horizontal and vertical direction. Provide minimum horizontal joint reinforcement of two No. 9

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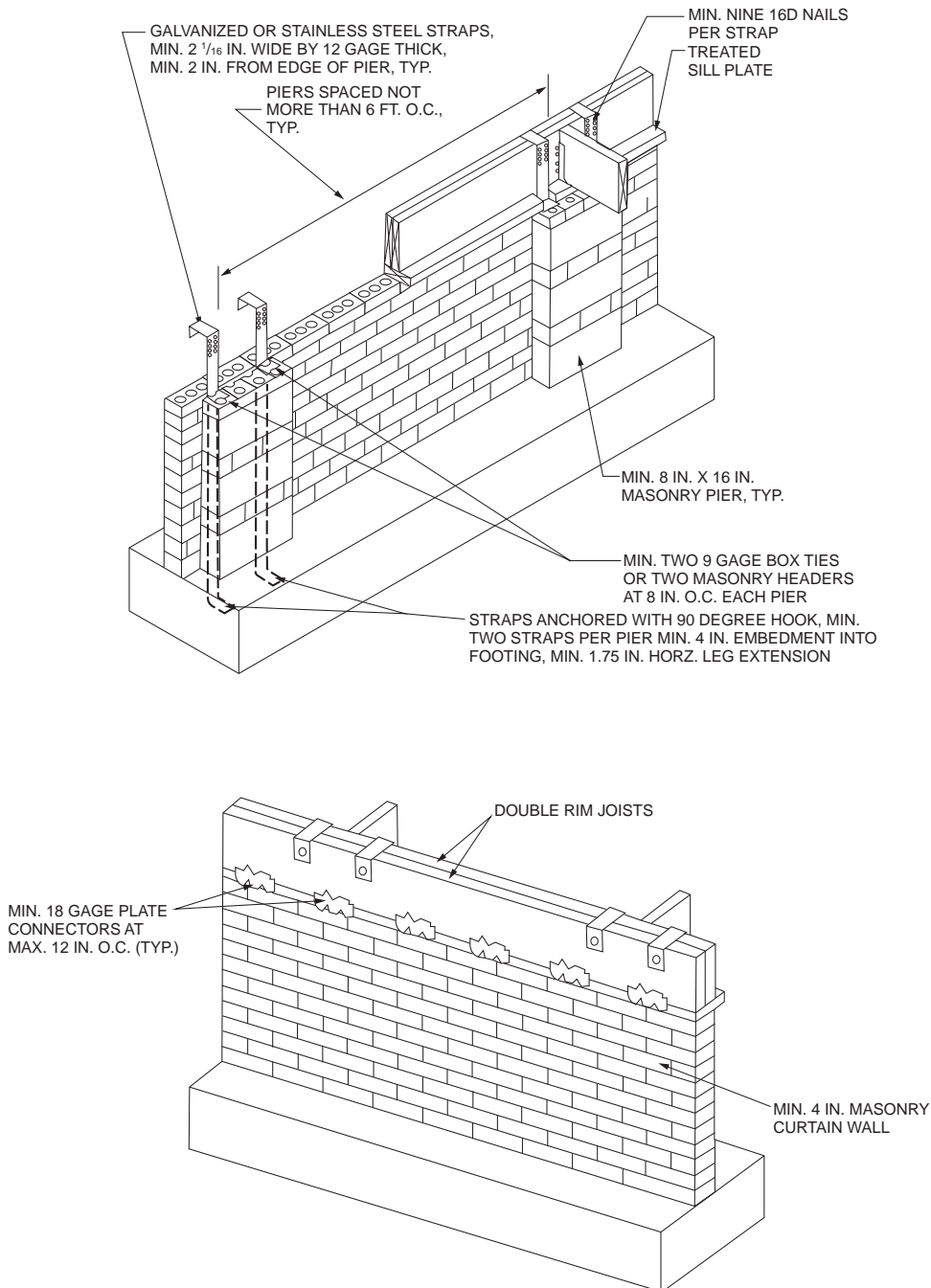
gage wires spaced not less than 6 inches (152 mm) or one 1/4-inch-diameter (6.4 mm) wire at 10 inches (254 mm) on center vertically. Provide minimum vertical reinforcement of one No. 4 bar at 48 inches (1220 mm) on center horizontally grouted in place.

R404.1.6 Height above finished grade. Concrete and masonry foundation walls shall extend above the finished grade adjacent to the foundation at all points not less than

4 inches (102 mm) where masonry veneer is used and not less than 6 inches (152 mm) elsewhere.

R404.1.7 Backfill placement. Backfill shall not be placed against the wall until the wall has sufficient strength and has been anchored to the floor above, or has been sufficiently braced to prevent damage by the backfill.

Exception: Bracing is not required for walls supporting less than 4 feet (1219 mm) of unbalanced backfill.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

FIGURE R404.1.5.3
FOUNDATION WALL CLAY MASONRY CURTAIN WALL WITH CONCRETE MASONRY PIERS

R404.1.8 Rubble stone masonry. Rubble stone masonry foundation walls shall have a minimum thickness of 16 inches (406 mm), shall not support an unbalanced backfill exceeding 8 feet (2438 mm) in height, shall not support a soil pressure greater than 30 pounds per square foot per foot (4.71 kPa/m), and shall not be constructed in Seismic Design Categories D_0 , D_1 , D_2 or townhouses in Seismic Design Category C, as established in Figure R301.2(2).

R404.1.9 Isolated masonry piers. Isolated masonry piers shall be constructed in accordance with this section and the general masonry construction requirements of Section R606. Hollow masonry piers shall have a minimum nominal thickness of 8 inches (203 mm), with a nominal height not exceeding four times the nominal thickness and a nominal length not exceeding three times the nominal thickness. Where hollow masonry units are solidly filled with concrete or grout, piers shall be permitted to have a nominal height not exceeding ten times the nominal thickness. Footings for isolated masonry piers shall be sized in accordance with Section R403.1.1.

R404.1.9.1 Pier cap. Hollow masonry piers shall be capped with 4 inches (102 mm) of solid masonry or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout. Where required, termite protection for the pier cap shall be provided in accordance with Section R318.

R404.1.9.2 Masonry piers supporting floor girders. Masonry piers supporting wood girders sized in accordance with Tables R602.7(1) and R602.7(2) shall be permitted in accordance with this section. Piers supporting girders for interior bearing walls shall have a minimum nominal dimension of 12 inches (305 mm) and a maximum height of 10 feet (3048 mm) from top of footing to bottom of sill plate or girder. Piers supporting girders for exterior bearing walls shall have a minimum nominal dimension of 12 inches (305 mm) and a maximum height of 4 feet (1220 mm) from top of footing to bottom of sill plate or girder. Girders and sill plates shall be anchored to the pier or footing in accordance with Section R403.1.6 or Figure R404.1.5.3. Floor girder bearing shall be in accordance with Section R502.6.

R404.1.9.3 Masonry piers supporting braced wall panels. Masonry piers supporting braced wall panels shall be designed in accordance with accepted engineering practice.

R404.1.9.4 Seismic design of masonry piers. Masonry piers in dwellings located in Seismic Design Category D_0 , D_1 or D_2 , and townhouses in Seismic Design Category C, shall be designed in accordance with accepted engineering practice.

R404.1.9.5 Masonry piers in flood hazard areas. Masonry piers for dwellings in flood hazard areas shall be designed in accordance with Section R322.

R404.2 Wood foundation walls. Wood foundation walls shall be constructed in accordance with the provisions of Sections R404.2.1 through R404.2.6 and with the details shown in Figures R403.1(2) and R403.1(3).

R404.2.1 Identification. Load-bearing lumber shall be identified by the grade mark of a lumber grading or inspection agency that has been approved by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted. Wood structural panels shall conform to DOC PS 1 or DOC PS 2 and shall be identified by a grade mark or certificate of inspection issued by an approved agency.

R404.2.2 Stud size. The studs used in foundation walls shall be 2-inch by 6-inch (51 mm by 152 mm) members. Where spaced 16 inches (406 mm) on center, a wood species with an F_b value of not less than 1,250 pounds per square inch (8619 kPa) as listed in ANSI AWC NDS shall be used. Where spaced 12 inches (305 mm) on center, an F_b of not less than 875 psi (6033 kPa) shall be required.

R404.2.3 Height of backfill. For wood foundations that are not designed and installed in accordance with AWC PWF, the height of backfill against a foundation wall shall not exceed 4 feet (1219 mm). Where the height of fill is more than 12 inches (305 mm) above the interior grade of a crawl space or floor of a basement, the thickness of the plywood sheathing shall meet the requirements of Table R404.2.3.

R404.2.4 Backfilling. Wood foundation walls shall not be backfilled until the basement floor and first floor have been constructed or the walls have been braced. For crawl space construction, backfill or bracing shall be installed on the interior of the walls prior to placing backfill on the exterior.

R404.2.5 Drainage and dampproofing. Wood foundation basements shall be drained and dampproofed in accordance with Sections R405 and R406, respectively.

R404.2.6 Fastening. Wood structural panel foundation wall sheathing shall be attached to framing in accordance with Table R602.3(1) and Section R402.1.1.

R404.3 Wood sill plates. Wood sill plates shall be not less than 2-inch by 4-inch (51 mm by 102 mm) nominal lumber. Sill plate anchorage shall be in accordance with Sections R403.1.6 and R602.11.

R404.4 Retaining walls. Retaining walls that are not laterally supported at the top and that retain in excess of 48 inches (1219 mm) of unbalanced fill, or retaining walls exceeding 24 inches (610 mm) in height that resist lateral loads in addition to soil, shall be designed in accordance with accepted engineering practice to ensure stability against overturning, sliding, excessive foundation pressure and water uplift. Retaining walls shall be designed for a safety factor of 1.5 against lateral sliding and overturning. This section shall not apply to foundation walls supporting buildings.

R404.5 Precast concrete foundation walls.

R404.5.1 Design. Precast concrete foundation walls shall be designed in accordance with accepted engineering practice. The design and manufacture of precast concrete foundation wall panels shall comply with the materials requirements of Section R402.3 or ACI 318. The panel design drawings shall be prepared by a registered design professional.

TABLE R404.2.3
PLYWOOD GRADE AND THICKNESS FOR WOOD FOUNDATION CONSTRUCTION (30 pcf equivalent-fluid weight soil pressure)

HEIGHT OF FILL (inches)	STUD SPACING (inches)	FACE GRAIN ACROSS STUDS			FACE GRAIN PARALLEL TO STUDS		
		Grade ^a	Minimum thickness (inches)	Span rating	Grade ^a	Minimum thickness (inches) ^{b, c}	Span rating
24	12	B	15/32	32/16	A	15/32	32/16
					B	15/32 ^c	32/16
	16	B	15/32	32/16	A	15/32 ^c	32/16
					B	19/32 ^c (4, 5 ply)	40/20
36	12	B	15/32	32/16	A	15/32	32/16
					B	15/32 ^c (4, 5 ply)	32/16
					B	19/32 ^c (4, 5 ply)	40/20
	16	B	15/32 ^c	32/16	A	19/32	40/20
					B	23/32	48/24
48	12	B	15/32	32/16	A	15/32 ^c	32/16
					B	19/32 ^c (4, 5 ply)	40/20
	16	B	19/32	40/20	A	19/32 ^c	40/20
					A	23/32	48/24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Plywood shall be of the following minimum grades in accordance with DOC PS 1 or DOC PS 2:

1. DOC PS 1 Plywood grades marked:
 - 1.1. Structural I C-D (Exposure 1).
 - 1.2. C-D (Exposure 1).
2. DOC PS 2 Plywood grades marked:
 - 2.1. Structural I Sheathing (Exposure 1).
 - 2.2. Sheathing (Exposure 1).
3. Where a major portion of the wall is exposed above ground and a better appearance is desired, the following plywood grades marked exterior are suitable:
 - 3.1. Structural I A-C, Structural I B-C or Structural I C-C (Plugged) in accordance with DOC PS 1.
 - 3.2. A-C Group 1, B-C Group 1, C-C (Plugged) Group 1 or MDO Group 1 in accordance with DOC PS 1.
 - 3.3. Single Floor in accordance with DOC PS 1 or DOC PS 2.

b. Minimum thickness 15/32 inch, except crawl space sheathing shall have not less than 3/8 inch for face grain across studs 16 inches on center and maximum 2-foot depth of unequal fill.

c. For this fill height, thickness and grade combination, panels that are continuous over less than three spans (across less than three stud spacings) require blocking 16 inches above the bottom plate. Offset adjacent blocks and fasten through studs with two 16d corrosion-resistant nails at each end.

R404.5.2 Precast concrete foundation design drawings.

Precast concrete foundation wall design drawings shall be submitted to the building official and approved prior to installation. Drawings shall include, at a minimum, the following information:

1. Design loading as applicable.
2. Footing design and material.
3. Concentrated loads and their points of application.
4. Soil bearing capacity.
5. Maximum allowable total uniform load.
6. Seismic design category.
7. Basic wind speed.

R404.5.3 Identification. Precast concrete foundation wall panels shall be identified by a certificate of inspection label issued by an approved third-party inspection agency.

SECTION R405
FOUNDATION DRAINAGE

R405.1 Concrete or masonry foundations. Drains shall be provided around concrete or masonry foundations that retain earth and enclose habitable or usable spaces located below grade. Drainage tiles, gravel or crushed stone drains, perforated pipe or other approved systems or materials shall be installed at or below the top of the footing or below the bottom of the slab and shall discharge by gravity or mechanical means into an approved drainage system. Gravel or crushed stone drains shall extend not less than 1 foot (305 mm) beyond the outside edge of the footing and 6 inches (152 mm) above the top of the footing and be covered with an approved filter membrane material. The top of open joints of drain tiles shall be protected with strips of building paper. Except where otherwise recommended by the drain manufacturer, perforated drains shall be surrounded with an approved filter membrane or the filter membrane shall cover the washed gravel or crushed rock covering the drain. Drainage

tiles or perforated pipe shall be placed on not less than 2 inches (51 mm) of washed gravel or crushed rock not less than one sieve size larger than the tile joint opening or perforation and covered with not less than 6 inches (152 mm) of the same material.

Exception: A drainage system is not required where the foundation is installed on well-drained ground or sand-gravel mixture soils according to the Unified Soil Classification System, Group I soils, as detailed in Table R405.1.

R405.1.1 Precast concrete foundation. Precast concrete walls that retain earth and enclose habitable or useable space located below-grade that rest on crushed stone footings shall have a perforated drainage pipe installed below the base of the wall on either the interior or exterior side of the wall, not less than 1 foot (305 mm) beyond the edge of the wall. If the exterior drainage pipe is used, an approved filter membrane material shall cover the pipe. The drainage system shall discharge into an approved sewer system or to daylight.

R405.2 Wood foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be adequately drained in accordance with Sections R405.2.1 through R405.2.3.

R405.2.1 Base. A porous layer of gravel, crushed stone or coarse sand shall be placed to a minimum thickness of 4 inches (102 mm) under the basement floor. Provision shall be made for automatic draining of this layer and the gravel or crushed stone wall footings.

R405.2.2 Vapor retarder. A 6-mil-thick (0.15 mm) polyethylene vapor retarder shall be applied over the porous layer with the basement floor constructed over the polyethylene.

R405.2.3 Drainage system. In other than Group I soils, a sump shall be provided to drain the porous layer and footings. The sump shall be not less than 24 inches (610 mm) in diameter or 20 inches square (0.0129 m²), shall extend not less than 24 inches (610 mm) below the bottom of the basement floor and shall be capable of positive gravity or mechanical drainage to remove any accumulated water. The drainage system shall discharge into an approved sewer system or to daylight.

SECTION R406 FOUNDATION WATERPROOFING AND DAMPPOOFING

R406.1 Concrete and masonry foundation dampproofing. Except where required by Section R406.2 to be waterproofed, foundation walls that retain earth and enclose interior spaces and floors below grade shall be dampproofed from the finished grade to the higher of the top of the footing or 6 inches (152 mm) below the top of the basement floor. Masonry walls shall have not less than $\frac{3}{8}$ -inch (9.5 mm) Portland cement parging applied to the exterior of the wall. The parging shall be dampproofed in accordance with one of the following:

1. Bituminous coating.

2. Three pounds per square yard (1.63 kg/m²) of acrylic modified cement.
3. One-eighth-inch (3.2 mm) coat of surface-bonding cement complying with ASTM C887.
4. Any material permitted for waterproofing in Section R406.2.
5. Other approved methods or materials.

Exception: Parging of unit masonry walls is not required where a material is approved for direct application to the masonry.

Concrete walls shall be dampproofed by applying any one of the listed dampproofing materials or any one of the waterproofing materials listed in Section R406.2 to the exterior of the wall.

R406.2 Concrete and masonry foundation waterproofing. In areas where a high water table or other severe soil-water conditions are known to exist, exterior foundation walls that retain earth and enclose interior spaces and floors below grade shall be waterproofed from the finished grade to the higher of the top of the footing or 6 inches (152 mm) below the top of the basement floor. Walls shall be waterproofed in accordance with one of the following:

1. Two-ply hot-mopped felts.
2. Fifty-five-pound (25 kg) roll roofing.
3. Forty-mil (1 mm) polymer-modified asphalt.
4. Sixty-mil (1.5 mm) flexible polymer cement.
5. One-eighth-inch (3 mm) cement-based, fiber-reinforced, waterproof coating.
6. Sixty-mil (1.5 mm) solvent-free liquid-applied synthetic rubber.

All joints in membrane waterproofing shall be lapped and sealed with an adhesive compatible with the membrane.

Exception: Organic-solvent-based products such as hydrocarbons, chlorinated hydrocarbons, ketones and esters shall not be used for ICF walls with expanded polystyrene form material. Use of plastic roofing cements, acrylic coatings, latex coatings, mortars and pargings to seal ICF walls is permitted. Cold-setting asphalt or hot asphalt shall conform to Type C of ASTM D449. Hot asphalt shall be applied at a temperature of less than 200°F (93°C).

R406.3 Dampproofing for wood foundations. Wood foundations enclosing habitable or usable spaces located below grade shall be dampproofed in accordance with Sections R406.3.1 through R406.3.4.

R406.3.1 Panel joint sealed. Plywood panel joints in the foundation walls shall be sealed full length with a caulking compound capable of producing a moistureproof seal under the conditions of temperature and moisture content at which it will be applied and used.

R406.3.2 Below-grade moisture barrier. A 6-mil-thick (0.15 mm) polyethylene film shall be applied over the below-grade portion of exterior foundation walls prior to backfilling. Joints in the polyethylene film shall be lapped 6 inches (152 mm) and sealed with adhesive. The top edge

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of the polyethylene film shall be bonded to the sheathing to form a seal. Film areas at grade level shall be protected from mechanical damage and exposure by a pressure-preservative treated lumber or plywood strip attached to the wall several inches above finished grade level and extending approximately 9 inches (229 mm) below grade. The joint between the strip and the wall shall be caulked full length prior to fastening the strip to the wall. Where approved, other coverings appropriate to the architectural treatment shall be permitted to be used. The polyethylene film shall extend down to the bottom of the wood footing plate but shall not overlap or extend into the gravel or crushed stone footing.

R406.3.3 Porous fill. The space between the excavation and the foundation wall shall be backfilled with the same material used for footings, up to a height of 1 foot (305 mm) above the footing for well-drained sites, or one-half the total backfill height for poorly drained sites. The porous fill shall be covered with strips of 30-pound (13.6 kg) asphalt paper or 6-mil (0.15 mm) polyethylene to permit water seepage while avoiding infiltration of fine soils.

R406.3.4 Backfill. The remainder of the excavated area shall be backfilled with the same type of soil as was removed during the excavation.

R406.4 Precast concrete foundation system dampproofing. Except where required by Section R406.2 to be waterproofed, precast concrete foundation walls enclosing habitable or useable spaces located below grade shall be dampproofed in accordance with Section R406.1.

R406.4.1 Panel joints sealed. Precast concrete foundation panel joints shall be sealed full height with a sealant meeting ASTM C920, Type S or M, Grade NS, Class 25, Use NT, M or A. Joint sealant shall be installed in accordance with the manufacturer's instructions.

SECTION R407 COLUMNS

R407.1 Wood column protection. Wood columns shall be protected against decay as set forth in Section R317.

R407.2 Steel column protection. All surfaces (inside and outside) of steel columns shall be given a shop coat of rust-inhibitive paint, except for corrosion-resistant steel and steel treated with coatings to provide corrosion resistance.

R407.3 Structural requirements. The columns shall be restrained to prevent lateral displacement at the bottom end. Wood columns shall be not less in nominal size than 4 inches by 4 inches (102 mm by 102 mm). Steel columns shall be not

**TABLE R405.1
PROPERTIES OF SOILS CLASSIFIED ACCORDING TO THE UNIFIED SOIL CLASSIFICATION SYSTEM**

SOIL GROUP	UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL	SOIL DESCRIPTION	DRAINAGE CHARACTERISTICS ^a	FROST HEAVE POTENTIAL	VOLUME CHANGE POTENTIAL EXPANSION ^b
Group I	GW	Well-graded gravels, gravel sand mixtures, little or no fines	Good	Low	Low
	GP	Poorly graded gravels or gravel sand mixtures, little or no fines	Good	Low	Low
	SW	Well-graded sands, gravelly sands, little or no fines	Good	Low	Low
	SP	Poorly graded sands or gravelly sands, little or no fines	Good	Low	Low
	GM	Silty gravels, gravel-sand-silt mixtures	Good	Medium	Low
	SM	Silty sand, sand-silt mixtures	Good	Medium	Low
Group II	GC	Clayey gravels, gravel-sand-clay mixtures	Medium	Medium	Low
	SC	Clayey sands, sand-clay mixture	Medium	Medium	Low
	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Medium	High	Low
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Medium	Medium	Medium to Low
Group III	CH	Inorganic clays of high plasticity, fat clays	Poor	Medium	High
	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	High	High
Group IV	OL	Organic silts and organic silty clays of low plasticity	Poor	Medium	Medium
	OH	Organic clays of medium to high plasticity, organic silts	Unsatisfactory	Medium	High
	Pt	Peat and other highly organic soils	Unsatisfactory	Medium	High

For SI: 1 inch = 25.4 mm.

- The percolation rate for good drainage is over 4 inches per hour, medium drainage is 2 inches to 4 inches per hour, and poor is less than 2 inches per hour.
- Soils with a low potential expansion typically have a plasticity index (PI) of 0 to 15, soils with a medium potential expansion have a PI of 10 to 35 and soils with a high potential expansion have a PI greater than 20.

less than 3-inch-diameter (76 mm) Schedule 40 pipe manufactured in accordance with ASTM A53/A53M Grade B or approved equivalent.

Exception: In Seismic Design Categories A, B and C, columns not more than 48 inches (1219 mm) in height on a pier or footing are exempt from the bottom end lateral displacement requirement within under-floor areas enclosed by a continuous foundation.

SECTION R408 UNDER-FLOOR SPACE

R408.1 Moisture control. The under-floor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement) shall comply with Section R408.2 or R408.3.

R408.2 Openings for under-floor ventilation. Ventilation openings through foundation or exterior walls surrounding the under-floor space shall be provided in accordance with this section. The minimum net area of ventilation openings shall be not less than 1 square foot (0.0929 m²) for each 150 square feet (14 m²) of under-floor area. One ventilation opening shall be within 3 feet (915 mm) of each external corner of the under-floor space. Ventilation openings shall be covered for their height and width with any of the following materials provided that the least dimension of the covering shall not exceed 1/4 inch (6.4 mm), and operational louvers are permitted:

1. Perforated sheet metal plates not less than 0.070 inch (1.8 mm) thick.
2. Expanded sheet metal plates not less than 0.047 inch (1.2 mm) thick.
3. Cast-iron grill or grating.
4. Extruded load-bearing brick vents.
5. Hardware cloth of 0.035 inch (0.89 mm) wire or heavier.
6. Corrosion-resistant wire mesh, with the least dimension being 1/8 inch (3.2 mm) thick.

Exceptions:

1. The total area of ventilation openings shall be permitted to be reduced to 1/1,500 of the under-floor area where the ground surface is covered with an approved Class I vapor retarder material.
2. Where the ground surface is covered with an approved Class I vapor retarder material, ventilation openings are not required to be within 3 feet (915 mm) of each external corner of the under-floor space provided that the openings are placed to provide cross ventilation of the space.

R408.3 Unvented crawl space. For unvented under-floor spaces, the following items shall be provided:

1. Exposed earth shall be covered with a continuous Class I vapor retarder. Joints of the vapor retarder shall over-

lap by 6 inches (152 mm) and shall be sealed or taped. The edges of the vapor retarder shall extend not less than 6 inches (152 mm) up the stem wall and shall be attached and sealed to the stem wall or insulation.

2. One of the following shall be provided for the under-floor space:

- 2.1. Continuously operated mechanical exhaust ventilation at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m²) of crawl space floor area, including an air pathway to the common area (such as a duct or transfer grille).
- 2.2. Conditioned air supply sized to deliver at a rate equal to 1 cubic foot per minute (0.47 L/s) for each 50 square feet (4.7 m²) of under-floor area, including a return air pathway to the common area (such as a duct or transfer grille).
- 2.3. Plenum in existing structures complying with *the California Mechanical Code*, if under-floor space is used as a plenum.
- 2.4. Dehumidification sized in accordance with manufacturer's specifications.

R408.4 Access. Access shall be provided to all under-floor spaces. Access openings through the floor shall be not smaller than 18 inches by 24 inches (457 mm by 610 mm). Openings through a perimeter wall shall be not less than 16 inches by 24 inches (407 mm by 610 mm). Where any portion of the through-wall access is below grade, an areaway not less than 16 inches by 24 inches (407 mm by 610 mm) shall be provided. The bottom of the areaway shall be below the threshold of the access opening. Through wall access openings shall not be located under a door to the residence. See *California Mechanical Code* for access requirements where mechanical equipment is located under floors.

R408.5 Removal of debris. The under-floor grade shall be cleaned of all vegetation and organic material. Wood forms used for placing concrete shall be removed before a building is occupied or used for any purpose. Construction materials shall be removed before a building is occupied or used for any purpose.

R408.6 Finished grade. The finished grade of under-floor surface shall be permitted to be located at the bottom of the footings; however, where there is evidence that the groundwater table can rise to within 6 inches (152 mm) of the finished floor at the building perimeter or where there is evidence that the surface water does not readily drain from the building site, the grade in the under-floor space shall be as high as the outside finished grade, unless an approved drainage system is provided.

R408.7 Flood resistance. For buildings located in flood hazard areas as established in Table R301.2:

1. Walls enclosing the under-floor space shall be provided with flood openings in accordance with Section R322.2.2.

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2. The finished ground level of the under-floor space shall be equal to or higher than the outside finished ground level on at least one side.

Exception: Under-floor spaces that meet the requirements of FEMA TB 11-1.

R408.8 Under-floor vapor retarder. In Climate Zones 1A, 2A and 3A below the warm-humid line, a continuous Class I or II vapor retarder shall be provided on the exposed face of air-permeable insulation installed between the floor joists and exposed to the grade in the under-floor space. The vapor retarder shall have a maximum water vapor permeance of 1.5 perms when tested in accordance with Procedure B of ASTM E96.

Exception: The vapor retarder shall not be required in unvented crawl spaces constructed in accordance with Section R408.3.

Note: The International Energy Conservation Code (IECC) climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Table R702.7(5).

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 5 – FLOORS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below																						
Chapter / Section																						
R502.1.1				X																		
R502.11.1				X																		
R506.2.3.1				X																		

The state agency does not adopt sections identified with the following symbol: †

CHAPTER 5

FLOORS

User note:

About this chapter: Chapter 5 provides the requirements for the design and construction of floor systems that will be capable of supporting minimum required design loads. This chapter covers wood floor framing, wood floors on the ground, cold-formed steel floor framing and concrete slabs on the ground. Allowable span tables are provided that greatly simplify the determination of joist, girder and sheathing sizes for raised floor systems of wood framing and cold-formed steel framing. This chapter also contains prescriptive requirements for wood-framed exterior decks and their attachment to the main building.

SECTION R501 GENERAL

R501.1 Application. The provisions of this chapter shall control the design and construction of the floors for buildings, including the floors of attic spaces used to house mechanical or plumbing fixtures and equipment.

R501.2 Requirements. Floor construction shall be capable of accommodating all loads in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

SECTION R502 WOOD FLOOR FRAMING

R502.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R502.1.1 Sawn lumber. Sawn lumber shall be identified by a grade mark of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

Note: See Section R301.1.1.1 for limited-density owner-built rural dwellings.

R502.1.1.1 Preservative-treated lumber. Preservative treated dimension lumber shall be identified as required by Section R317.2.

R502.1.1.2 End-jointed lumber. Approved end-jointed lumber identified by a grade mark conforming to Section R502.1.1 shall be permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a fire-resistance rating shall have the designation “Heat-Resistant Adhesive” or “HRA” included in its grade mark.

R502.1.2 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.

R502.1.3 Structural glued laminated timbers. Glued laminated timbers shall be manufactured and identified as required in ANSI A190.1, ANSI 117 and ASTM D3737.

R502.1.4 Structural log members. Structural log members shall comply with the provisions of ICC 400.

R502.1.5 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

R502.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R502.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

R502.2 Design and construction. Floors shall be designed and constructed in accordance with the provisions of this chapter, Figure R502.2 and Sections R317 and R318 or in accordance with ANSI AWC NDS.

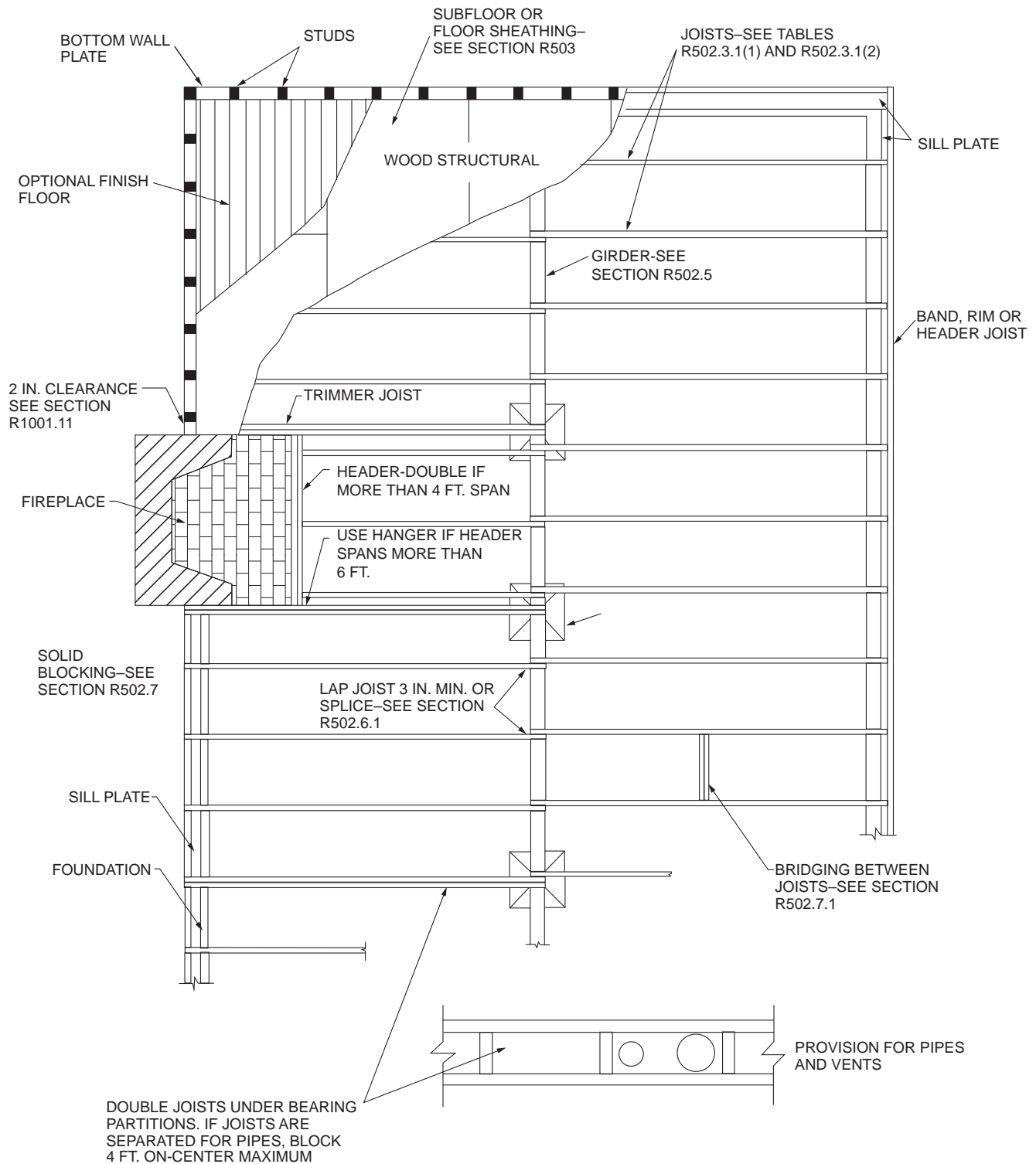
R502.2.1 Framing at braced wall lines. A load path for lateral forces shall be provided between floor framing and braced wall panels located above or below a floor, as specified in Section R602.10.8.

R502.2.2 Blocking and subflooring. Blocking for fastening panel edges or fixtures shall be not less than utility grade lumber. Subflooring shall be not less than utility grade lumber, No. 4 common grade boards or wood structural panels as specified in Section R503.2. Fireblocking shall be of any grade lumber.

R502.3 Allowable joist spans. Spans for floor joists shall be in accordance with Tables R502.3.1(1) and R502.3.1(2). For other grades and species and for other loading conditions, refer to the AWC STJR.

R502.3.1 Sleeping areas and attic joists. Table R502.3.1(1) shall be used to determine the maximum allowable span of floor joists that support sleeping areas and attics that are accessed by means of a fixed stairway in accordance with Section R311.7 provided that the design live load does not exceed 30 pounds per square foot (1.44 kPa) and the design dead load does not exceed 20 pounds per square foot (0.96 kPa). The allowable span of ceiling joists that support attics used for limited storage or no storage shall be determined in accordance with Section R802.5.

FLOORS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE R502.2
FLOOR CONSTRUCTION**

TABLE R502.3.1(1)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential sleeping areas, live load = 30 psf, L/Δ = 360)^a

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	
12	Douglas fir-larch	SS	12-6	16-6	21-0	25-7	12-6	16-6	21-0	25-7
	Douglas fir-larch	#1	12-0	15-10	20-3	24-8	12-0	15-7	19-0	22-0
	Douglas fir-larch	#2	11-10	15-7	19-10	23-4	11-8	14-9	18-0	20-11
	Douglas fir-larch	#3	9-11	12-7	15-5	17-10	8-11	11-3	13-9	16-0
	Hem-fir	SS	11-10	15-7	19-10	24-2	11-10	15-7	19-10	24-2
	Hem-fir	#1	11-7	15-3	19-5	23-7	11-7	15-3	18-9	21-9
	Hem-fir	#2	11-0	14-6	18-6	22-6	11-0	14-4	17-6	20-4
	Hem-fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Southern pine	SS	12-3	16-2	20-8	25-1	12-3	16-2	20-8	25-1
	Southern pine	#1	11-10	15-7	19-10	24-2	11-10	15-7	18-7	22-0
	Southern pine	#2	11-3	14-11	18-1	21-4	10-9	13-8	16-2	19-1
	Southern pine	#3	9-2	11-6	14-0	16-6	8-2	10-3	12-6	14-9
	Spruce-pine-fir	SS	11-7	15-3	19-5	23-7	11-7	15-3	19-5	23-7
	Spruce-pine-fir	#1	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-pine-fir	#2	11-3	14-11	19-0	23-0	11-3	14-7	17-9	20-7
	Spruce-pine-fir	#3	9-8	12-4	15-0	17-5	8-8	11-0	13-5	15-7
16	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch	#1	10-11	14-5	18-5	21-4	10-8	13-6	16-5	19-1
	Douglas fir-larch	#2	10-9	14-2	17-5	20-3	10-1	12-9	15-7	18-1
	Douglas fir-larch	#3	8-7	10-11	13-4	15-5	7-8	9-9	11-11	13-10
	Hem-fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir	#1	10-6	13-10	17-8	21-1	10-6	13-4	16-3	18-10
	Hem-fir	#2	10-0	13-2	16-10	19-8	9-10	12-5	15-2	17-7
	Hem-fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6
	Southern pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine	#1	10-9	14-2	18-0	21-4	10-9	13-9	16-1	19-1
	Southern pine	#2	10-3	13-3	15-8	18-6	9-4	11-10	14-0	16-6
	Southern pine	#3	7-11	10-0	11-1	14-4	7-1	8-11	10-10	12-10
	Spruce-pine-fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-4
	Spruce-pine-fir	#1	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-pine-fir	#2	10-3	13-6	17-2	19-11	9-11	12-7	15-5	17-10
	Spruce-pine-fir	#3	8-5	10-8	13-0	15-1	7-6	9-6	11-8	13-6

(continued)

FLOORS

TABLE R502.3.1(1)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential sleeping areas, live load = 30 psf, L/Δ = 360)^a

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	
19.2	Douglas fir-larch	SS	10-8	14-1	18-0	21-10	10-8	14-1	18-0	21-4
	Douglas fir-larch	#1	10-4	13-7	16-9	19-6	9-8	12-4	15-0	17-5
	Douglas fir-larch	#2	10-1	13-0	15-11	18-6	9-3	11-8	14-3	16-6
	Douglas fir-larch	#3	7-10	10-0	12-2	14-1	7-0	8-11	10-11	12-7
	Hem-fir	SS	10-1	13-4	17-0	20-8	10-1	13-4	17-0	20-7
	Hem-fir	#1	9-10	13-0	16-7	19-3	9-7	12-2	14-10	17-2
	Hem-fir	#2	9-5	12-5	15-6	17-1	8-11	11-4	13-10	16-1
	Hem-fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
	Southern pine	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Southern pine	#1	10-1	13-4	16-5	19-6	9-11	12-7	14-8	17-5
	Southern pine	#2	9-6	12-1	14-4	16-10	8-6	10-10	12-10	15-1
	Southern pine	#3	7-3	9-1	11-0	13-1	6-5	8-2	9-10	11-8
	Spruce-pine-fir	SS	9-10	13-0	16-7	20-2	9-10	13-0	16-7	19-6
	Spruce-pine-fir	#1	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#2	9-8	12-9	15-8	18-3	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#3	7-8	9-9	11-10	13-9	6-10	8-8	10-7	12-4
24	Douglas fir-larch	SS	9-11	13-1	16-8	20-3	9-11	13-1	16-5	19-1
	Douglas fir-larch	#1	9-7	12-4	15-0	17-5	8-8	11-0	13-5	15-7
	Douglas fir-larch	#2	9-3	11-8	14-3	16-6	8-3	10-5	12-9	14-9
	Douglas fir-larch	#3	7-0	8-11	10-11	12-7	6-3	8-0	9-9	11-3
	Hem-fir	SS	9-4	12-4	15-9	19-2	9-4	12-4	15-9	18-5
	Hem-fir	#1	9-2	12-1	14-10	17-2	8-7	10-10	13-3	15-5
	Hem-fir	#2	8-9	11-4	13-10	16-1	8-0	10-2	12-5	14-4
	Hem-fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0
	Southern pine	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-8
	Southern pine	#1	9-4	12-4	14-8	17-5	8-10	11-3	13-1	15-7
	Southern pine	#2	8-6	10-10	12-10	15-1	7-7	9-8	11-5	13-6
	Southern pine	#3	6-5	8-2	9-10	11-8	5-9	7-3	8-10	10-5
	Spruce-pine-fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-0	17-5
	Spruce-pine-fir	#1	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-pine-fir	#2	8-11	11-6	14-1	16-3	8-1	10-3	12-7	14-7
	Spruce-pine-fir	#3	6-10	8-8	10-7	12-4	6-2	7-9	9-6	11-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

a. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D₀, D₁ and D₂ shall be determined in accordance with Section R301.2.2.2.

TABLE R502.3.1(2)
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential living areas, live load = 40 psf, L/Δ = 360)^b

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
			(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)
12	Douglas fir-larch	SS	11-4	15-0	19-1	23-3	11-4	15-0	19-1	23-3
	Douglas fir-larch	#1	10-11	14-5	18-5	22-0	10-11	14-2	17-4	20-1
	Douglas fir-larch	#2	10-9	14-2	18-0	20-11	10-8	13-6	16-5	19-1
	Douglas fir-larch	#3	8-11	11-3	13-9	16-0	8-1	10-3	12-7	14-7
	Hem-fir	SS	10-9	14-2	18-0	21-11	10-9	14-2	18-0	21-11
	Hem-fir	#1	10-6	13-10	17-8	21-6	10-6	13-10	17-1	19-10
	Hem-fir	#2	10-0	13-2	16-10	20-4	10-0	13-1	16-0	18-6
	Hem-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Southern pine	SS	11-2	14-8	18-9	22-10	11-2	14-8	18-9	22-10
	Southern pine	#1	10-9	14-2	18-0	21-11	10-9	14-2	16-11	20-1
	Southern pine	#2	10-3	13-6	16-2	19-1	9-10	12-6	14-9	17-5
	Southern pine	#3	8-2	10-3	12-6	14-9	7-5	9-5	11-5	13-6
	Spruce-pine-fir	SS	10-6	13-10	17-8	21-6	10-6	13-10	17-8	21-6
	Spruce-pine-fir	#1	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#2	10-3	13-6	17-3	20-7	10-3	13-3	16-3	18-10
	Spruce-pine-fir	#3	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
16	Douglas fir-larch	SS	10-4	13-7	17-4	21-1	10-4	13-7	17-4	21-1
	Douglas fir-larch	#1	9-11	13-1	16-5	19-1	9-8	12-4	15-0	17-5
	Douglas fir-larch	#2	9-9	12-9	15-7	18-1	9-3	11-8	14-3	16-6
	Douglas fir-larch	#3	7-8	9-9	11-11	13-10	7-0	8-11	10-11	12-7
	Hem-fir	SS	9-9	12-10	16-5	19-11	9-9	12-10	16-5	19-11
	Hem-fir	#1	9-6	12-7	16-0	18-10	9-6	12-2	14-10	17-2
	Hem-fir	#2	9-1	12-0	15-2	17-7	8-11	11-4	13-10	16-1
	Hem-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4
	Southern pine	SS	10-2	13-4	17-0	20-9	10-2	13-4	17-0	20-9
	Southern pine	#1	9-9	12-10	16-1	19-1	9-9	12-7	14-8	17-5
	Southern pine	#2	9-4	11-10	14-0	16-6	8-6	10-10	12-10	15-1
	Southern pine	#3	7-1	8-11	10-10	12-10	6-5	8-2	9-10	11-8
	Spruce-pine-fir	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Spruce-pine-fir	#1	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#2	9-4	12-3	15-5	17-10	9-1	11-6	14-1	16-3
	Spruce-pine-fir	#3	7-6	9-6	11-8	13-6	6-10	8-8	10-7	12-4

(continued)

FLOORS

TABLE R502.3.1(2)—continued
FLOOR JOIST SPANS FOR COMMON LUMBER SPECIES (Residential living areas, live load = 40 psf, L/Δ = 360)^P

JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf				DEAD LOAD = 20 psf			
			2 x 6	2 x 8	2 x 10	2 x 12	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum floor joist spans							
		(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	(ft-in)	
19.2	Douglas fir-larch	SS	9-8	12-10	16-4	19-10	9-8	12-10	16-4	19-6
	Douglas fir-larch	#1	9-4	12-4	15-0	17-5	8-10	11-3	13-8	15-11
	Douglas fir-larch	#2	9-2	11-8	14-3	16-6	8-5	10-8	13-0	15-1
	Douglas fir-larch	#3	7-0	8-11	10-11	12-7	6-5	8-2	9-11	11-6
	Hem-fir	SS	9-2	12-1	15-5	18-9	9-2	12-1	15-5	18-9
	Hem-fir	#1	9-0	11-10	14-10	17-2	8-9	11-1	13-6	15-8
	Hem-fir	#2	8-7	11-3	13-10	16-1	8-2	10-4	12-8	14-8
	Hem-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
	Southern pine	SS	9-6	12-7	16-0	19-6	9-6	12-7	16-0	19-6
	Southern pine	#1	9-2	12-1	14-8	17-5	9-0	11-5	13-5	15-11
	Southern pine	#2	8-6	10-10	12-10	15-1	7-9	9-10	11-8	13-9
	Southern pine	#3	6-5	8-2	9-10	11-8	5-11	7-5	9-0	10-8
	Spruce-pine-fir	SS	9-0	11-10	15-1	18-4	9-0	11-10	15-1	17-9
	Spruce-pine-fir	#1	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#2	8-9	11-6	14-1	16-3	8-3	10-6	12-10	14-10
	Spruce-pine-fir	#3	6-10	8-8	10-7	12-4	6-3	7-11	9-8	11-3
24	Douglas fir-larch	SS	9-0	11-11	15-2	18-5	9-0	11-11	15-0	17-5
	Douglas fir-larch	#1	8-8	11-0	13-5	15-7	7-11	10-0	12-3	14-3
	Douglas fir-larch	#2	8-3	10-5	12-9	14-9	7-6	9-6	11-8	13-6
	Douglas fir-larch	#3	6-3	8-0	9-9	11-3	5-9	7-3	8-11	10-4
	Hem-fir	SS	8-6	11-3	14-4	17-5	8-6	11-3	14-4	16-10 ^a
	Hem-fir	#1	8-4	10-10	13-3	15-5	7-10	9-11	12-1	14-0
	Hem-fir	#2	7-11	10-2	12-5	14-4	7-4	9-3	11-4	13-1
	Hem-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1
	Southern pine	SS	8-10	11-8	14-11	18-1	8-10	11-8	14-11	18-0
	Southern pine	#1	8-6	11-3	13-1	15-7	8-1	10-3	12-0	14-3
	Southern pine	#2	7-7	9-8	11-5	13-6	7-0	8-10	10-5	12-4
	Southern pine	#3	5-9	7-3	8-10	10-5	5-3	6-8	8-1	9-6
	Spruce-pine-fir	SS	8-4	11-0	14-0	17-0	8-4	11-0	13-8	15-11
	Spruce-pine-fir	#1	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#2	8-1	10-3	12-7	14-7	7-5	9-5	11-6	13-4
	Spruce-pine-fir	#3	6-2	7-9	9-6	11-0	5-7	7-1	8-8	10-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Check sources for availability of lumber in lengths greater than 20 feet.

- a. End bearing length shall be increased to 2 inches.
- b. Dead load limits for townhouses in Seismic Design Category C and all structures in Seismic Design Categories D₀, D₁, and D₂ shall be determined in accordance with Section R301.2.2.2.

R502.3.2 Other floor joists. Table R502.3.1(2) shall be used to determine the maximum allowable span of floor joists that support other areas of the building, other than sleeping areas and *attics*, provided that the design *live load* does not exceed 40 pounds per square foot (1.92 kPa) and the design dead load does not exceed 20 pounds per square foot (0.96 kPa).

R502.3.3 Floor cantilevers. Floor cantilever spans shall not exceed the nominal depth of the wood floor joist. Floor cantilevers constructed in accordance with Table R502.3.3(1) shall be permitted where supporting a light-frame bearing wall and roof only. Floor cantilevers supporting an exterior balcony are permitted to be constructed in accordance with Table R502.3.3(2).

R502.4 Joists under bearing partitions. Joists under parallel bearing partitions shall be of adequate size to support the load. Double joists, sized to adequately support the load, that are separated to permit the installation of piping or vents shall be full-depth solid blocked with lumber not less than 2 inches (51 mm) in nominal thickness spaced not more than 4 feet (1219 mm) on center. Bearing partitions perpendicular to joists shall not be offset from supporting girders, walls or partitions more than the joist depth unless such joists are of sufficient size to carry the additional load.

R502.5 Allowable girder and header spans. The allowable spans of girders and headers fabricated of dimension lumber shall not exceed the values set forth in Tables R602.7(1), R602.7(2) and R602.7(3).

R502.6 Bearing. The ends of each joist, beam or girder shall have not less than 1½ inches (38 mm) of bearing on wood or metal, have not less than 3 inches of bearing (76 mm) on masonry or concrete or be supported by *approved* joist hangers. Alternatively, the ends of joists shall be supported on a 1-inch by 4-inch (25 mm by 102 mm) ribbon strip and shall be nailed to the adjacent stud. The bearing on masonry or concrete shall be direct, or a sill plate of 2-inch-minimum (51 mm) nominal thickness shall be provided under the joist, beam or girder. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 865 mm²).

R502.6.1 Floor systems. Joists framing from opposite sides over a bearing support shall lap not less than 3 inches (76 mm) and shall be nailed together with a minimum three 10d face nails. A wood or metal splice with strength equal to or greater than that provided by the nailed lap is permitted.

R502.6.2 Joist framing. Joists framing into the side of a wood girder shall be supported by *approved* framing anchors or on ledger strips not less than nominal 2 inches by 2 inches (51 mm by 51 mm).

TABLE R502.3.3(1)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING LIGHT-FRAME EXTERIOR BEARING WALL AND ROOF ONLY^{a, b, c, f, g, h}
 (Floor live load ≤ 40 psf, roof live load ≤ 20 psf)

MEMBER & SPACING	MAXIMUM CANTILEVER SPAN (uplift force at backspan support in lb) ^{d, e}											
	Ground Snow Load											
	≤ 20 psf			30 psf			50 psf			70 psf		
	Roof Width			Roof Width			Roof Width			Roof Width		
	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft	24 ft	32 ft	40 ft
2 × 8 @ 12"	20" (177)	15" (227)	—	18" (209)	—	—	—	—	—	—	—	—
2 × 10 @ 16"	29" (228)	21" (297)	16" (364)	26" (271)	18" (354)	—	20" (375)	—	—	—	—	—
2 × 10 @ 12"	36" (166)	26" (219)	20" (270)	34" (198)	22" (263)	16" (324)	26" (277)	—	—	19" (356)	—	—
2 × 12 @ 16"	—	32" (287)	25" (356)	36" (263)	29" (345)	21" (428)	29" (367)	20" (484)	—	23" (471)	—	—
2 × 12 @ 12"	—	42" (209)	31" (263)	—	37" (253)	27" (317)	36" (271)	27" (358)	17" (447)	31" (348)	19" (462)	—
2 × 12 @ 8"	—	48" (136)	45" (169)	—	48" (164)	38" (206)	—	40" (233)	26" (294)	36" (230)	29" (304)	18" (379)

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Tabulated values are for clear-span roof supported solely by exterior bearing walls.
- b. Spans are based on No. 2 Grade lumber of Douglas fir-larch, Southern pine, hem-fir and spruce-pine-fir for repetitive (three or more) members.
- c. Ratio of backspan to cantilever span shall be not less than 3:1.
- d. Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- e. Uplift force is for a backspan to cantilever span ratio of 3:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 3 divided by the actual backspan ratio provided (3/backspan ratio).
- f. See Section R301.2.2.6, Item 1, for additional limitations on cantilevered floor joists for detached one- and two-family dwellings in Seismic Design Category D₀, D₁ or D₂ and townhouses in Seismic Design Category C, D₀, D₁ or D₂.
- g. A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. Where the cantilever length is 24 inches or less and the building is assigned to Seismic Design Category A, B or C, solid blocking at the support for the cantilever shall not be required.
- h. Linear interpolation shall be permitted for building widths and ground snow loads other than shown.

TABLE R502.3.3(2)
CANTILEVER SPANS FOR FLOOR JOISTS SUPPORTING EXTERIOR BALCONY^{a, b, e, f}

MEMBER SIZE	SPACING	MAXIMUM CANTILEVER SPAN (uplift force at backspan support in lb) ^{c, d}		
		Ground Snow Load		
		≤ 30 psf	50 psf	70 psf
2 × 8	12"	42" (139)	39" (156)	34" (165)
2 × 8	16"	36" (151)	34" (171)	29" (180)
2 × 10	12"	61" (164)	57" (189)	49" (201)
2 × 10	16"	53" (180)	49" (208)	42" (220)
2 × 10	24"	43" (212)	40" (241)	34" (255)
2 × 12	16"	72" (228)	67" (260)	57" (268)
2 × 12	24"	58" (279)	54" (319)	47" (330)

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

- Spans are based on No. 2 Grade lumber of Douglas fir-larch, Southern pine, hem-fir, and spruce-pine-fir for repetitive (three or more) members.
- Ratio of backspan to cantilever span shall be not less than 2:1.
- Connections capable of resisting the indicated uplift force shall be provided at the backspan support.
- Uplift force is for a backspan to cantilever span ratio of 2:1. Tabulated uplift values are permitted to be reduced by multiplying by a factor equal to 2 divided by the actual backspan ratio provided (2/backspan ratio).
- A full-depth rim joist shall be provided at the unsupported end of the cantilever joists. Solid blocking shall be provided at the supported end. Where the cantilever length is 24 inches or less and the building is assigned to Seismic Design Category A, B or C, solid blocking at the support for the cantilever shall not be required.
- Linear interpolation shall be permitted for ground snow loads other than shown.

R502.7 Lateral restraint at supports. Joists shall be supported laterally at the ends by full-depth solid blocking not less than 2 inches (51 mm) nominal in thickness; or by attachment to a full-depth header, band or rim joist, or to an adjoining stud or shall be otherwise provided with lateral support to prevent rotation.

Exceptions:

- Trusses, structural composite lumber, structural glued-laminated members and I-joists shall be supported laterally as required by the manufacturer's recommendations.
- In Seismic Design Categories D₀, D₁ and D₂, lateral restraint shall be provided at each intermediate support.

R502.7.1 Bridging. Joists exceeding a nominal 2 inches by 12 inches (51 mm by 305 mm) shall be supported laterally by solid blocking, diagonal bridging (wood or metal), or a continuous 1-inch by 3-inch (25 mm by 76 mm) strip nailed across the bottom of joists perpendicular to joists at intervals not exceeding 8 feet (2438 mm).

Exception: Trusses, structural composite lumber, structural glued-laminated members and I-joists shall be supported laterally as required by the manufacturer's recommendations.

R502.8 Cutting, drilling and notching. Structural floor members shall not be cut, bored or notched in excess of the limitations specified in this section. See Figure R502.8.

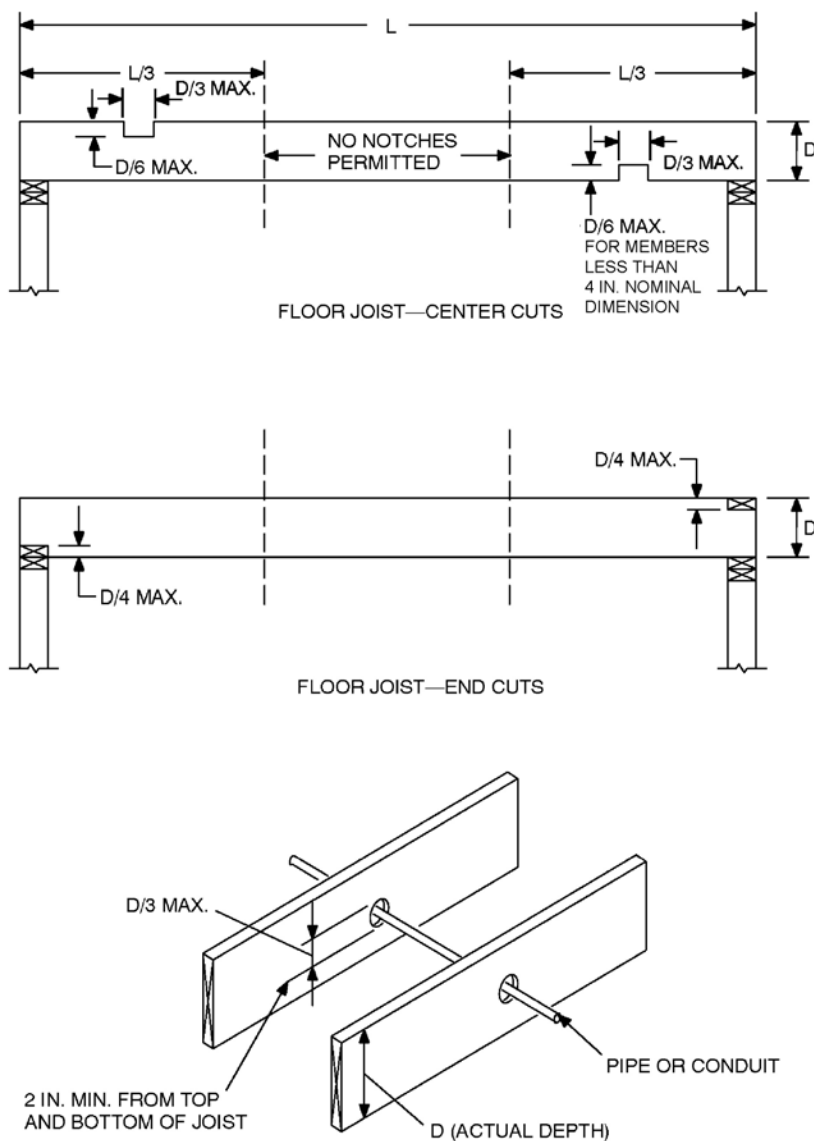
R502.8.1 Sawn lumber. Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span. Notches at the ends of the

member shall not exceed one-fourth the depth of the member. The tension side of members 4 inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed one-third the depth of the member. Holes shall not be closer than 2 inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is notched, the hole shall not be closer than 2 inches (51 mm) to the notch.

R502.8.2 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.

R502.9 Fastening. Floor framing shall be nailed in accordance with Table R602.3(1). Where posts and beam or girder construction is used to support floor framing, positive connections shall be provided to ensure against uplift and lateral displacement.

R502.10 Framing of openings. Openings in floor framing shall be framed with header and trimmer joists. Where the header joist span does not exceed 4 feet (1219 mm), the header joist shall be a single member the same size as the floor joist. Single trimmer joists shall be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. Where the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the floor joists framing into the header.



For SI: 1 inch = 25.4 mm.

FIGURE R502.8
CUTTING, NOTCHING AND DRILLING

R502.11 Wood trusses.

R502.11.1 Design. Wood trusses shall be designed in accordance with approved engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered design professional.

R502.11.2 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry prac-

tices, such as the SBCA *Building Component Safety Information (BCSI) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

R502.11.3 Alterations to trusses. Truss members and components shall not be cut, notched, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load that exceeds the design load for the truss, shall not be permitted without verification that the truss is capable of supporting the additional loading.

R502.11.4 Truss design drawings. Truss design drawings, prepared in compliance with Section R502.11.1,

shall be submitted to the building official and approved prior to installation. Truss design drawings shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the information specified as follows:

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable:
 - 4.1. Top chord *live load*.
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord *live load*.
 - 4.4. Bottom chord dead load.
 - 4.5. Concentrated loads and their points of application.
 - 4.6. Controlling wind and earthquake loads.
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description, such as size, thickness or gage, and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
 - 9.1. Truss-to-girder-truss.
 - 9.2. Truss ply-to-ply.
 - 9.3. Field splices.
10. Calculated deflection ratio, maximum description for live and total load, or both.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss drawing or on supplemental documents.
12. Required permanent truss member bracing location.

R502.12 Draftstopping required. Draftstopping shall be provided in accordance with Section R302.12.

R502.13 Fireblocking required. Fireblocking shall be provided in accordance with Section R302.11.

**SECTION R503
FLOOR SHEATHING**

R503.1 Lumber sheathing. Maximum allowable spans for lumber used as floor sheathing shall conform to Tables R503.1, R503.2.1.1(1) and R503.2.1.1(2).

**TABLE R503.1
MINIMUM THICKNESS OF LUMBER FLOOR SHEATHING**

JOIST OR BEAM SPACING (inches)	MINIMUM NET THICKNESS	
	Perpendicular to joist	Diagonal to joist
24	¹¹ / ₁₆	³ / ₄
16	⁵ / ₈	⁵ / ₈
48 ^a	1 ¹ / ₂ T & G	N/A
54 ^b		
60 ^c		

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 6.895 kPa.

N/A = Not Applicable.

- a. For this support spacing, lumber sheathing shall have a minimum F_b of 675 and minimum E of 1,100,000 (see ANSI AWC NDS).
- b. For this support spacing, lumber sheathing shall have a minimum F_b of 765 and minimum E of 1,400,000 (see ANSI AWC NDS).
- c. For this support spacing, lumber sheathing shall have a minimum F_b of 855 and minimum E of 1,700,000 (see ANSI AWC NDS).

R503.1.1 End joints. End joints in lumber used as subflooring shall occur over supports unless end-matched lumber is used, in which case each piece shall bear on not less than two joists. Subflooring shall be permitted to be omitted where joist spacing does not exceed 16 inches (406 mm) and a 1-inch (25 mm) nominal tongue-and-groove wood strip flooring is applied perpendicular to the joists.

R503.2 Wood structural panel sheathing.

R503.2.1 Identification and grade. Wood structural panel sheathing used for structural purposes shall conform to CSA O325, CSA O437 DOC PS 1 or DOC PS 2. Panels shall be identified for grade, bond classification and Performance Category by a grade mark or certificate of inspection issued by an approved agency. The Performance Category value shall be used as the “nominal panel thickness” or “panel thickness” wherever referenced in this code.

R503.2.1.1 Subfloor and combined subfloor underlayment. Where used as subflooring or combination subfloor underlayment, wood structural panels shall be of one of the grades specified in Table R503.2.1.1(1). Where sanded plywood is used as combination subfloor underlayment, the grade, bond classification, and Performance Category shall be as specified in Table R503.2.1.1(2).

TABLE R503.2.1.1(1)
ALLOWABLE SPANS AND LOADS FOR WOOD STRUCTURAL PANELS FOR ROOF AND
SUBFLOOR SHEATHING AND COMBINATION SUBFLOOR UNDERLAYMENT^{a, b, c}

SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inch)	ALLOWABLE LIVE LOAD (psf) ^{h, i}		MAXIMUM SPAN (inches)		LOAD (pounds per square foot, at maximum span)		MAXIMUM SPAN (inches)
		SPAN @ 16" o.c.	SPAN @ 24" o.c.	With edge support ^d	Without edge support	Total load	Live load	
Sheathing^o		Roof^f						Subfloorⁱ
16/0	3/8	30	—	16	16	40	30	0
20/0	3/8	50	—	20	20	40	30	0
24/0	3/8	100	30	24	20 ^e	40	30	0
24/16	7/16	100	40	24	24	50	40	16
32/16	15/32, 1/2	180	70	32	28	40	30	16 ^h
40/20	19/32, 5/8	305	130	40	32	40	30	20 ^{h, i}
48/24	23/32, 3/4	—	175	48	36	45	35	24
60/32	7/8	—	305	60	48	45	35	32
Underlayment, C-C plugged, single floor^o		Roof^f						Combination subfloor underlayment^k
16 o.c.	19/32, 5/8	100	40	24	24	50	40	16 ⁱ
20 o.c.	19/32, 5/8	150	60	32	32	40	30	20 ^{i, j}
24 o.c.	23/32, 3/4	240	100	48	36	35	25	24
32 o.c.	7/8	—	185	48	40	50	40	32
48 o.c.	1 3/32, 1 1/8	—	290	60	48	50	40	48

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

- The allowable total loads were determined using a dead load of 10 psf. If the dead load exceeds 10 psf, then the live load shall be reduced accordingly.
- Panels continuous over two or more spans with long dimension (strength axis) perpendicular to supports. Spans shall be limited to values shown because of possible effect of concentrated loads.
- Applies to panels 24 inches or wider.
- Lumber blocking, panel edge clips (one midway between each support, except two equally spaced between supports where span is 48 inches), tongue-and-groove panel edges, or other approved type of edge support.
- Includes Structural I panels in these grades.
- Uniform load deflection limitation: 1/180 of span under live load plus dead load, 1/240 of span under live load only.
- Maximum span 24 inches for 15/32- and 1/2-inch panels.
- Maximum span 24 inches where 3/4-inch wood finish flooring is installed at right angles to joists.
- Maximum span 24 inches where 1.5 inches of lightweight concrete or approved cellular concrete is placed over the subfloor.
- Unsupported edges shall have tongue-and-groove joints or shall be supported with blocking unless minimum nominal 1/4-inch-thick wood panel-type underlayment, fiber-cement underlayment with end and edge joints offset not less than 2 inches or 1 1/2 inches of lightweight concrete or approved cellular concrete is placed over the subfloor, or 3/4-inch wood finish flooring is installed at right angles to the supports. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span, based on deflection of 1/360 of span, is 100 psf.
- Unsupported edges shall have tongue-and-groove joints or shall be supported by blocking unless nominal 1/4-inch-thick wood panel-type underlayment, fiber-cement underlayment with end and edge joints offset not less than 2 inches or 3/4-inch wood finish flooring is installed at right angles to the supports. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span, based on deflection of 1/360 of span, is 100 psf, except panels with a span rating of 48 on center are limited to 65 psf total uniform load at maximum span.
- Allowable live load values at spans of 16 inches on center and 24 inches on center taken from referenced standard APA E30, *APA Engineered Wood Construction Guide*. Refer to referenced standard for allowable spans not listed in the table.

TABLE R503.2.1.1(2)
ALLOWABLE SPANS FOR SANDED
PLYWOOD COMBINATION SUBFLOOR UNDERLAYMENT^a

IDENTIFICATION	SPACING OF JOISTS (inches)		
	16	20	24
Species group ^b	—	—	—
1	1/2	5/8	3/4
2, 3	5/8	3/4	7/8
4	3/4	7/8	1

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

- a. Plywood continuous over two or more spans and face grain perpendicular to supports. Unsupported edges shall be tongue-and-groove or blocked except where nominal 1/4-inch-thick wood panel-type underlayment, fiber-cement underlayment or 3/4-inch wood finish floor is used. Fiber-cement underlayment shall comply with ASTM C1288 or ISO 8336 Category C. Allowable uniform live load at maximum span based on deflection of 1/360 of span is 100 psf.
- b. Applicable to all grades of sanded exterior-type plywood.

R503.2.2 Allowable spans. The maximum allowable span for wood structural panels used as subfloor or combination subfloor underlayment shall be as set forth in Table R503.2.1.1(1), or APA E30. The maximum span for sanded plywood combination subfloor underlayment shall be as set forth in Table R503.2.1.1(2).

R503.2.3 Installation. Wood structural panels used as subfloor or combination subfloor underlayment shall be attached to wood framing in accordance with Table R602.3(1) and shall be attached to cold-formed steel framing in accordance with Table R505.3.1(2).

R503.3 Particleboard.

R503.3.1 Identification and grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency.

R503.3.2 Floor underlayment. Particleboard floor underlayment shall conform to Type PBU and shall be not less than 1/4 inch (6.4 mm) in thickness.

R503.3.3 Installation. Particleboard underlayment shall be installed in accordance with the recommendations of the manufacturer and attached to framing in accordance with Table R602.3(1).

SECTION R504
PRESSURE PRESERVATIVE-TREATED
WOOD FLOORS (ON GROUND)

R504.1 General. Pressure preservative-treated wood basement floors and floors on ground shall be designed to withstand axial forces and bending moments resulting from lateral soil pressures at the base of the exterior walls and floor live and dead loads. Floor framing shall be designed to meet joist deflection requirements in accordance with Section R301.

R504.1.1 Unbalanced soil loads. Unless special provision is made to resist sliding caused by unbalanced lateral soil loads, wood basement floors shall be limited to applica-

tions where the differential depth of fill on opposite exterior foundation walls is 2 feet (610 mm) or less.

R504.1.2 Construction. Joists in wood *basement* floors shall bear tightly against the narrow face of studs in the foundation wall or directly against a band joist that bears on the studs. Plywood subfloor shall be continuous over lapped joists or over butt joints between in-line joists. Sufficient blocking shall be provided between joists to transfer lateral forces at the base of the end walls into the floor system.

R504.1.3 Uplift and buckling. Where required, resistance to uplift or restraint against buckling shall be provided by interior bearing walls or properly designed stub walls anchored in the supporting soil below.

R504.2 Site preparation. The area within the foundation walls shall have all vegetation, topsoil and foreign material removed, and any fill material that is added shall be free of vegetation and foreign material. The fill shall be compacted to ensure uniform support of the pressure preservative-treated wood floor sleepers.

R504.2.1 Base. A minimum 4-inch-thick (102 mm) granular base of gravel having a maximum size of 3/4 inch (19.1 mm) or crushed stone having a maximum size of 1/2 inch (12.7 mm) shall be placed over the compacted earth.

R504.2.2 Moisture barrier. Polyethylene sheeting of minimum 6-mil (0.15 mm) thickness shall be placed over the granular base. Joints shall be lapped 6 inches (152 mm) and left unsealed. The polyethylene membrane shall be placed over the pressure preservative-treated wood sleepers and shall not extend beneath the footing plates of the exterior walls.

R504.3 Materials. Framing materials, including sleepers, joists, blocking and plywood subflooring, shall be pressure-preservative treated and dried after treatment in accordance with AWPA U1 (Commodity Specification A, Special Requirement 4.2), and shall bear the *label* of an accredited agency.

SECTION R505
COLD-FORMED STEEL FLOOR FRAMING

R505.1 Cold-formed steel floor framing. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel floor framing members shall be in accordance with the requirements of this section.

R505.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel floor framing for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist span, not greater than 40 feet (12 192 mm) in width parallel to the joist span and less than or equal to three *stories* above *grade plane*. Cold-formed steel floor framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and

the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).

R505.1.1.1 Alternate applications. Cold-formed steel floor framing for buildings exceeding the applicability limits of Section R505.1.1 is permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.

R505.1.2 In-line framing. Where supported by cold-formed steel-framed walls in accordance with Section R603, cold-formed steel floor framing shall be constructed with floor joists located in-line with load-bearing studs located below the joists in accordance with the tolerances specified in AISI S240, Section B1.2.3.

R505.1.3 Floor trusses. Cold-formed steel trusses shall be designed, braced and installed in accordance with AISI S230, Section D8. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA *Cold-Formed Steel Building Component Safety Information (CFSBCSI), Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses*. Truss members shall not be notched, cut or altered in any manner without an approved design.

R505.2 Structural framing. Load-bearing cold-formed steel floor framing members shall be in accordance with this section.

R505.2.1 Material. Load-bearing cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of AISI S240, Section A3.

R505.2.2 Corrosion protection. Load-bearing cold-formed steel framing shall have a metallic coating complying with AISI S240, Section A4.

R505.2.3 Dimension, thickness and material grade. Load-bearing cold-formed steel floor framing members shall comply with AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.

R505.2.4 Identification. Load-bearing cold-formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.

R505.2.5 Fastening. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping, and shall conform to ASTM C1513. Floor sheathing shall be attached to cold-formed steel joists with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws attaching floor sheathing to cold-formed steel joists shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $\frac{3}{8}$ inch (9.5 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with

a bugle-head style and shall be installed in accordance with Section R702. For all connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have a rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

R505.2.6 Web holes, web hole reinforcing and web hole patching. Web holes in floor framing members shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in compliance with the conditions as prescribed in AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.

R505.3 Floor construction. Cold-formed steel floors shall be constructed in accordance with this section.

R505.3.1 Floor-to-foundation or load-bearing wall connections. Cold-formed steel-framed floors shall be anchored to foundations, wood sills or load-bearing walls in accordance with Table R505.3.1(1) and Figure R505.3.1(1), R505.3.1(2), R505.3.1(3), R505.3.1(4), R505.3.1(5) or R505.3.1(6). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Continuous cold-formed steel joists supported by interior load-bearing walls shall be constructed in accordance with Figure R505.3.1(7). Lapped cold-formed steel joists shall be constructed in accordance with Figure R505.3.1(8). End floor joists constructed on foundation walls parallel to the joist span shall be doubled unless a C-shaped bearing stiffener, sized in accordance with Section R505.3.4, is installed web-to-web with the floor joist beneath each supported wall stud, as shown in Figure R505.3.1(9). Fastening of cold-formed steel joists to other framing members shall be in accordance with Section R505.2.5 and Table R505.3.1(2).

R505.3.2 Minimum floor joist sizes. Floor joist size and thickness shall be determined in accordance with the limits set forth in Table R505.3.2 for single or continuous spans. Where continuous joist members are used, the interior bearing supports shall be located within 2 feet (610 mm) of midspan of the cold-formed steel joists, and the individual spans shall not exceed the spans in Table R505.3.2. Floor joists shall have a bearing support length of not less than $1\frac{1}{2}$ inches (38 mm) for exterior wall supports and $3\frac{1}{2}$ inches (89 mm) for interior wall supports. Tracks shall be not less than 33 mils (0.84 mm) thick except where used as part of a floor header or trimmer in accordance with Section R505.3.8. Bearing stiffeners shall be installed in accordance with Section R505.3.4.

R505.3.3 Joist bracing and blocking. Joist bracing and blocking shall be in accordance with this section.

R505.3.3.1 Joist top flange bracing. The top flanges of cold-formed steel joists shall be laterally braced by the application of floor sheathing fastened to the joists in accordance with Section R505.2.5 and Table R505.3.1(2).

FLOORS

R505.3.3.2 Joist bottom flange bracing/blocking. Floor joists with spans that exceed 12 feet (3658 mm) shall have the bottom flanges laterally braced in accordance with one of the following:

1. Gypsum board installed with minimum No. 6 screws in accordance with Section R702.
2. Continuous steel straps installed in accordance with Figure R505.3.3.2(1). Steel straps shall be spaced at not greater than 12 feet (3658 mm) on center and shall be not less than 1½ inches (38 mm) in width and 33 mils (0.84 mm) in thickness. Straps shall be fastened to the bottom flange of each joist with one No. 8 screw, fastened to blocking with two No. 8 screws, and fastened at each end (of strap) with two No. 8 screws. Blocking in accordance with Figure R505.3.3.2(1) or R505.3.3.2(2) shall be installed between joists at each end of the continuous strapping and at a maximum spacing of 12 feet (3658 mm) measured along the continuous strapping (perpendicular to the joist run). Blocking shall also be located at the termination of all straps. As an alternative to blocking at the ends, anchoring the strap to a stable building component with two No. 8 screws shall be permitted.

R505.3.3.3 Blocking at interior bearing supports. Blocking is not required for continuous back-to-back

floor joists at bearing supports. Blocking shall be installed between every other joist for single continuous floor joists across bearing supports in accordance with Figure R505.3.1(7). Blocking shall consist of C-shaped or track section with a minimum thickness of 33 mils (0.84 mm). Blocking shall be fastened to each adjacent joist through a 33-mil (0.84 mm) clip angle, bent web of blocking or flanges of web stiffeners with two No. 8 screws on each side. The minimum depth of the blocking shall be equal to the depth of the joist minus 2 inches (51 mm). The minimum length of the angle shall be equal to the depth of the joist minus 2 inches (51 mm).

R505.3.3.4 Blocking at cantilevers. Blocking shall be installed between every other joist over cantilever bearing supports in accordance with Figure R505.3.1(4), R505.3.1(5) or R505.3.1(6). Blocking shall consist of C-shaped or track section with minimum thickness of 33 mils (0.84 mm). Blocking shall be fastened to each adjacent joist through bent web of blocking, 33 mil clip angle or flange of web stiffener with two No. 8 screws at each end. The depth of the blocking shall be equal to the depth of the joist. The minimum length of the angle shall be equal to the depth of the joist minus 2 inches (51 mm). Blocking shall be fastened through the floor sheathing and to the support with three No. 8 screws (top and bottom).

**TABLE R505.3.1(1)
FLOOR-TO-FOUNDATION OR BEARING WALL CONNECTION REQUIREMENTS^{a, b}**

FRAMING CONDITION	BASIC ULTIMATE WIND SPEED (mph) AND EXPOSURE	
	110 mph Exposure Category C or less than 139 mph Exposure Category B	Less than 139 mph Exposure Category C
Floor joist to wall track of exterior wall in accordance with Figure R505.3.1(1)	2-No. 8 screws	3-No. 8 screws
Rim track or end joist to load-bearing wall top track in accordance with Figure R505.3.1(1)	1-No. 8 screw at 24 inches o.c.	1-No. 8 screw at 24 inches o.c.
Rim track or end joist to wood sill in accordance with Figure R505.3.1(2)	Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails
Rim track or end joist to foundation in accordance with Figure R505.3.1(3)	½-inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws	½-inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws
Cantilevered joist to foundation in accordance with Figure R505.3.1(4)	½-inch minimum diameter anchor bolt and clip angle spaced at 6 feet o.c. with 8-No. 8 screws	½-inch minimum diameter anchor bolt and clip angle spaced at 4 feet o.c. with 8-No. 8 screws
Cantilevered joist to wood sill in accordance with Figure R505.3.1(5)	Steel plate spaced at 4 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2 feet o.c. with 4-No. 8 screws and 4-10d or 6-8d common nails
Cantilevered joist to exterior load-bearing wall track in accordance with Figure R505.3.1(6)	2-No. 8 screws	3-No. 8 screws

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

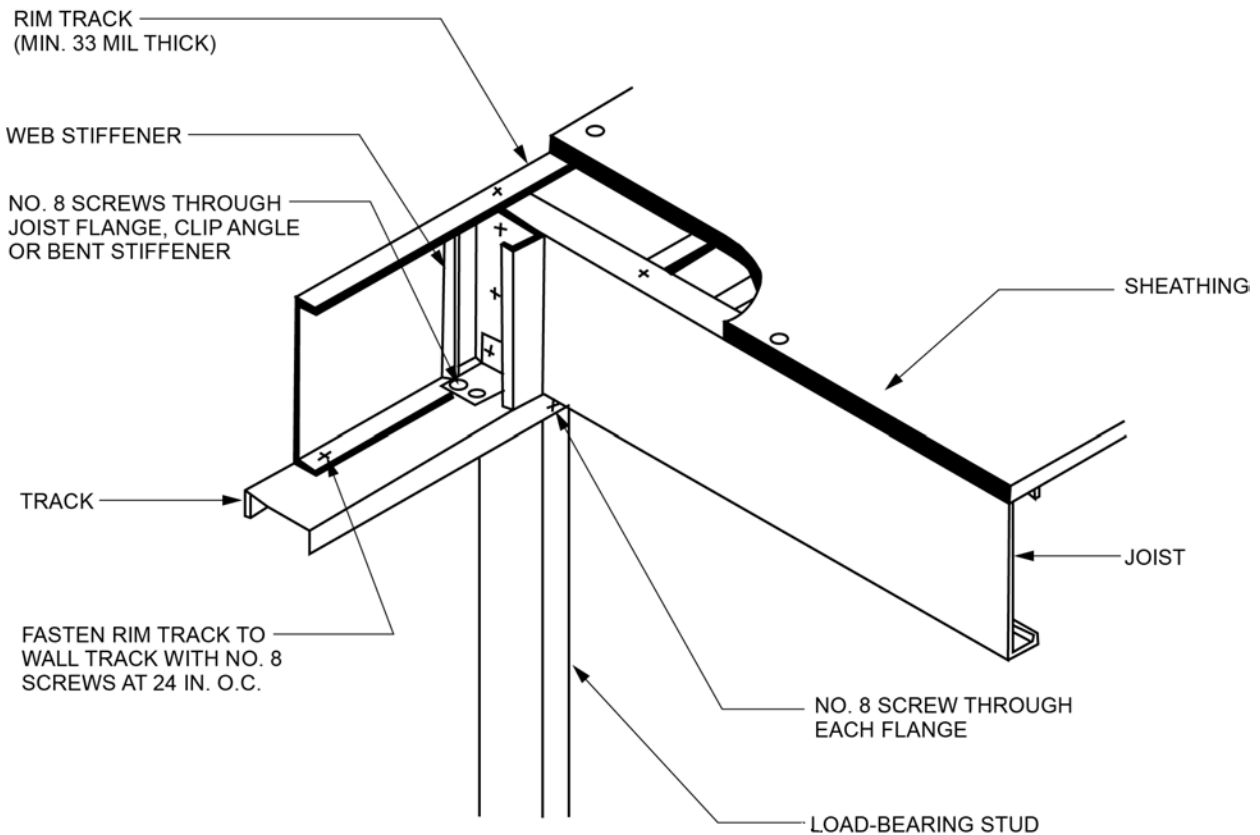
- Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks such as at door openings or corners. Bolts extend not less than 15 inches into masonry or 7 inches into concrete. Anchor bolts connecting cold-formed steel framing to the foundation structure are to be installed so that the distance from the center of the bolt hole to the edge of the connected member is not less than one and one-half bolt diameters.
- All screw sizes shown are minimum.

**TABLE R505.3.1(2)
FLOOR FASTENING SCHEDULE^a**

DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND SIZE OF FASTENERS	SPACING OF FASTENERS
Floor joist to track of an interior load-bearing wall in accordance with Figures R505.3.1(7) and R505.3.1(8)	2-No. 8 screws	Each joist
Floor joist to track at end of joist	2-No. 8 screws	One per flange or two per bearing stiffener
Subfloor to floor joists	No. 8 screws	6 in. o.c. on edges and 12 in. o.c. at intermediate supports

For SI: 1 inch = 25.4 mm.

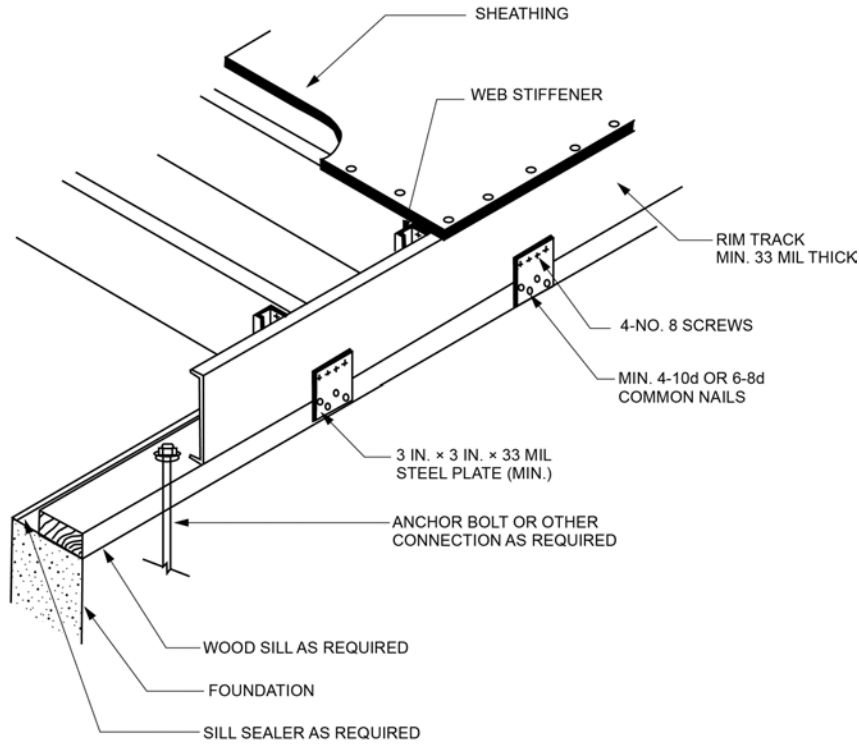
a. All screw sizes shown are minimum.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

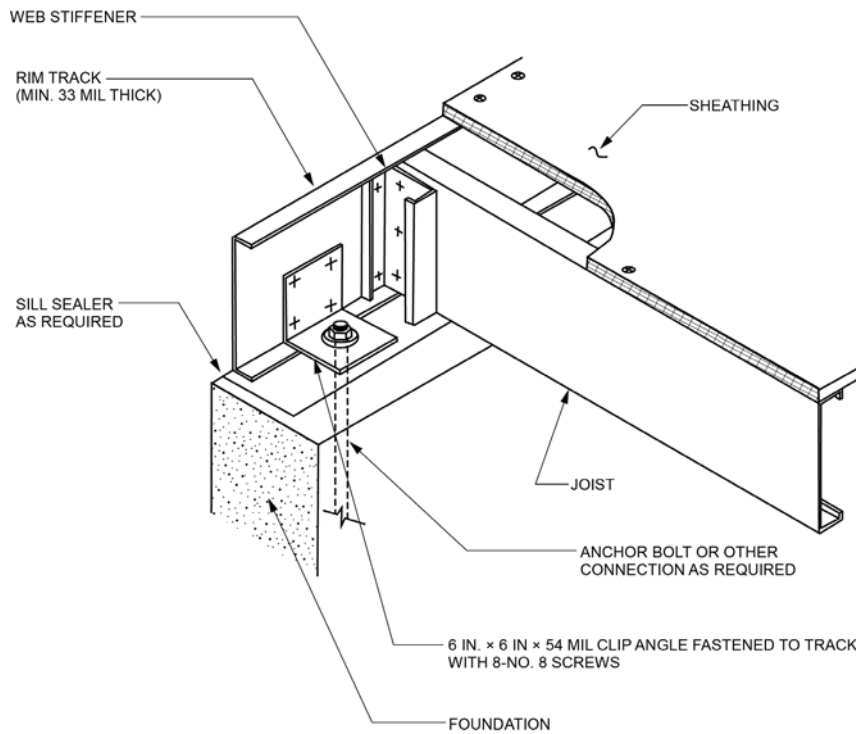
**FIGURE R505.3.1(1)
FLOOR-TO-EXTERIOR LOAD-BEARING WALL STUD CONNECTION**

FLOORS



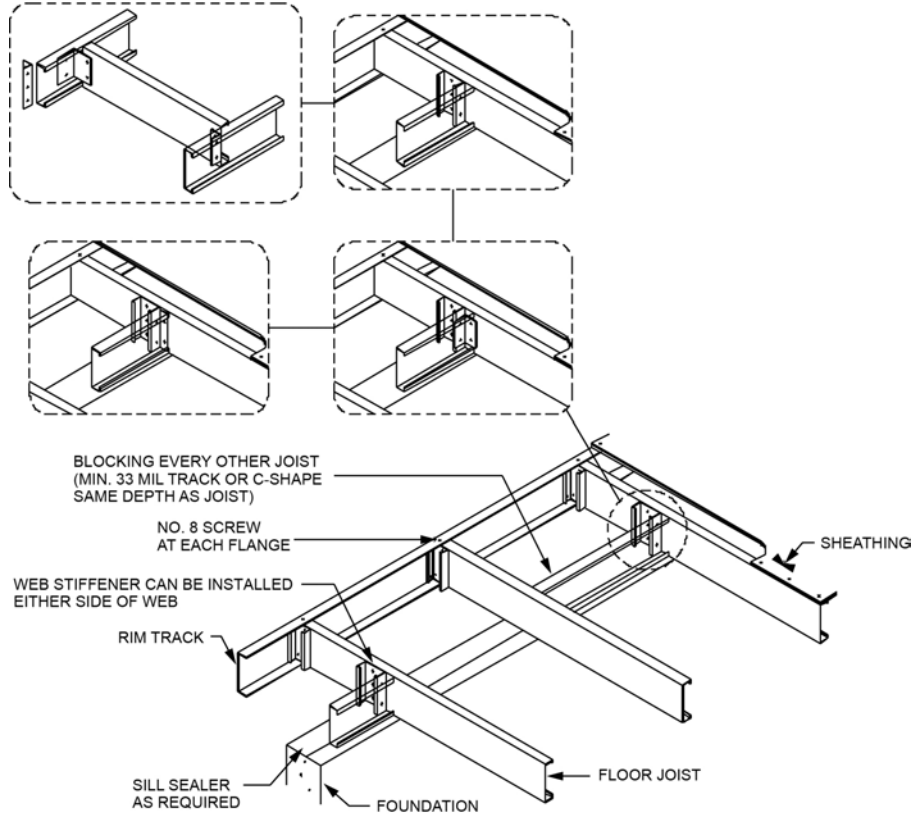
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE R505.3.1(2)
FLOOR-TO-WOOD-SILL CONNECTION



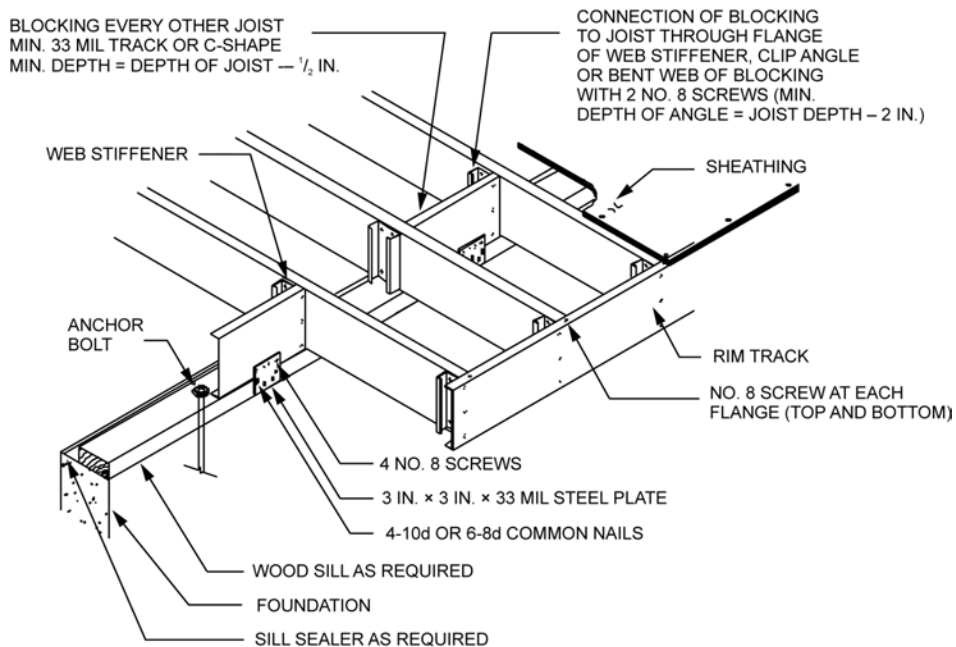
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE R505.3.1(3)
FLOOR-TO-FOUNDATION CONNECTION



For SI: 1 mil = 0.0254 mm.

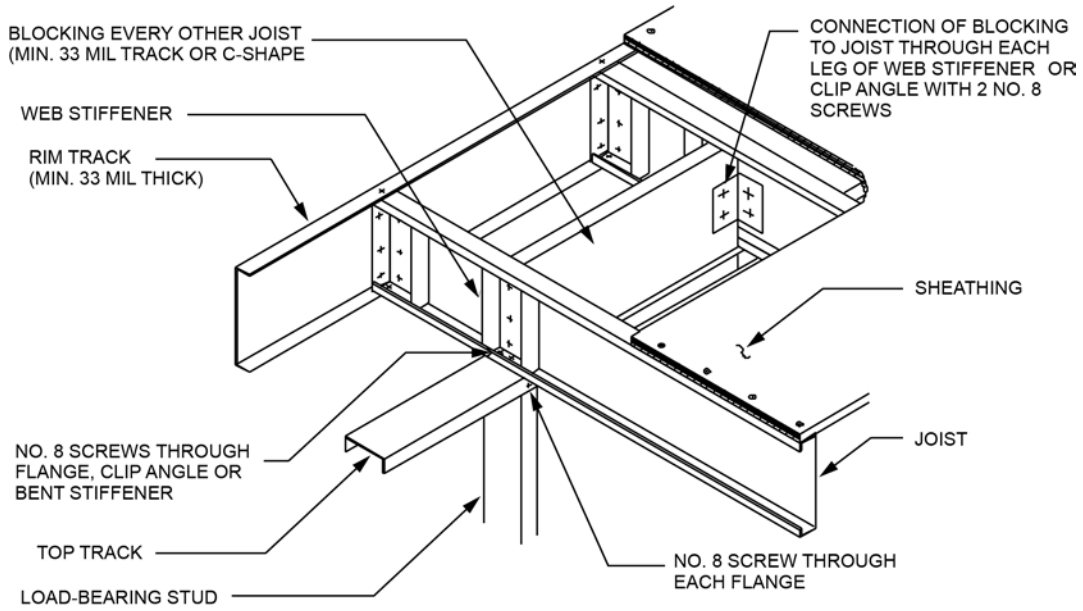
FIGURE R505.3.1(4)
CANTILEVERED FLOOR-TO-FOUNDATION CONNECTION



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

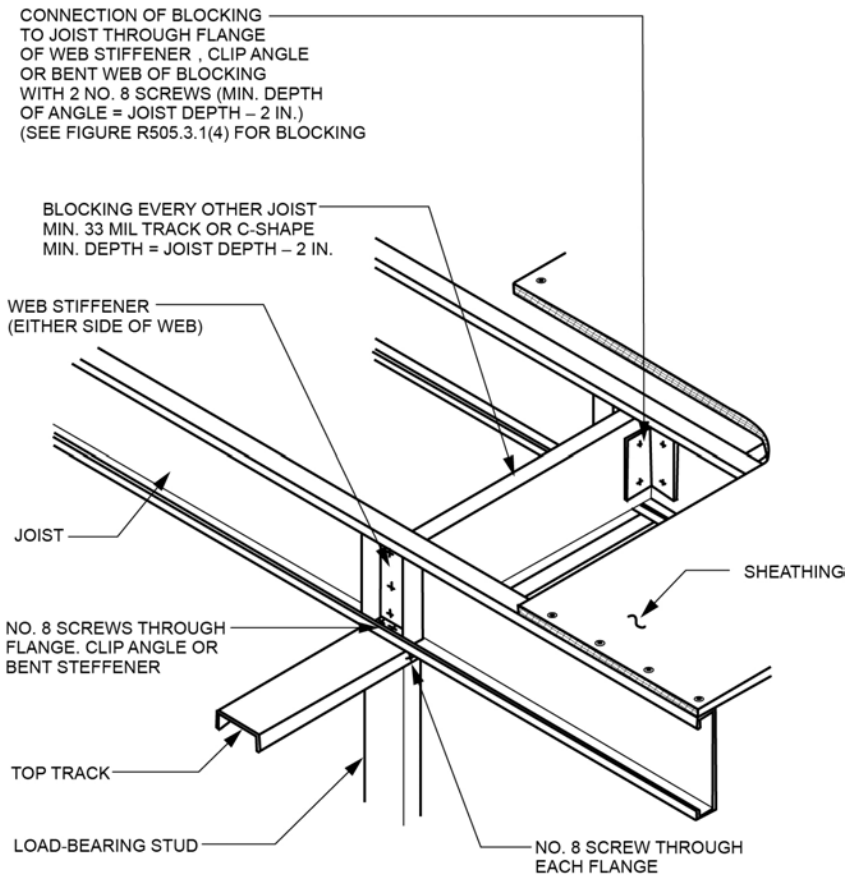
FIGURE R505.3.1(5)
CANTILEVERED FLOOR-TO-WOOD-SILL CONNECTION

FLOORS



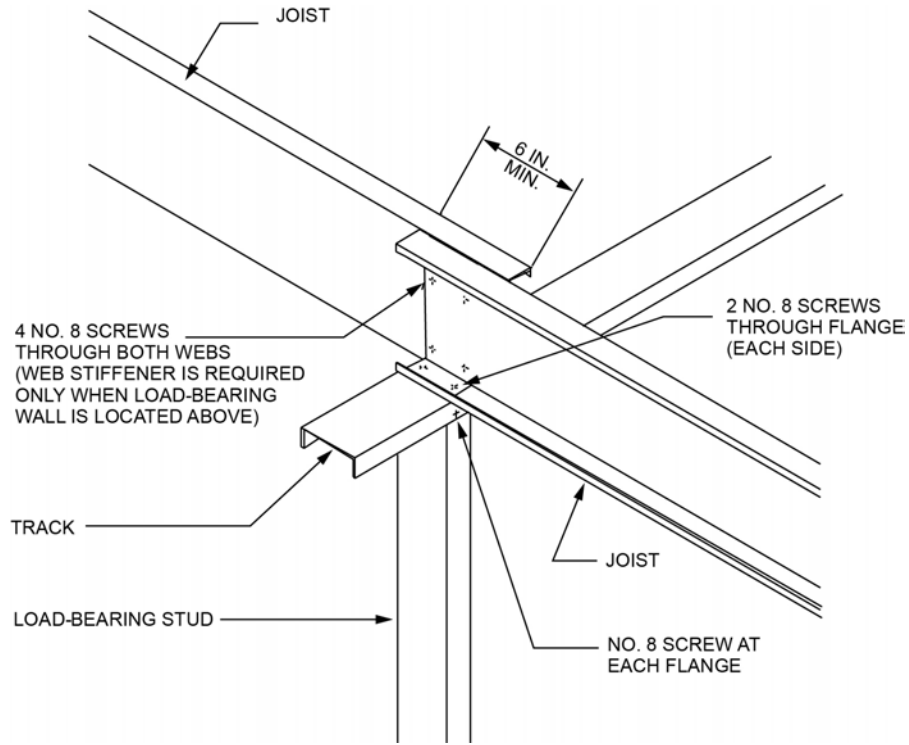
For SI: 1 mil = 0.0254 mm.

FIGURE R505.3.1(6)
CANTILEVERED FLOOR TO EXTERIOR LOAD-BEARING WALL CONNECTION



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

FIGURE R505.3.1(7)
CONTINUOUS SPAN JOIST SUPPORTED ON INTERIOR LOAD-BEARING WALL



For SI: 1 inch = 25.4 mm.

FIGURE R505.3.1(8)
LAPPED JOISTS SUPPORTED ON INTERIOR LOAD-BEARING WALL

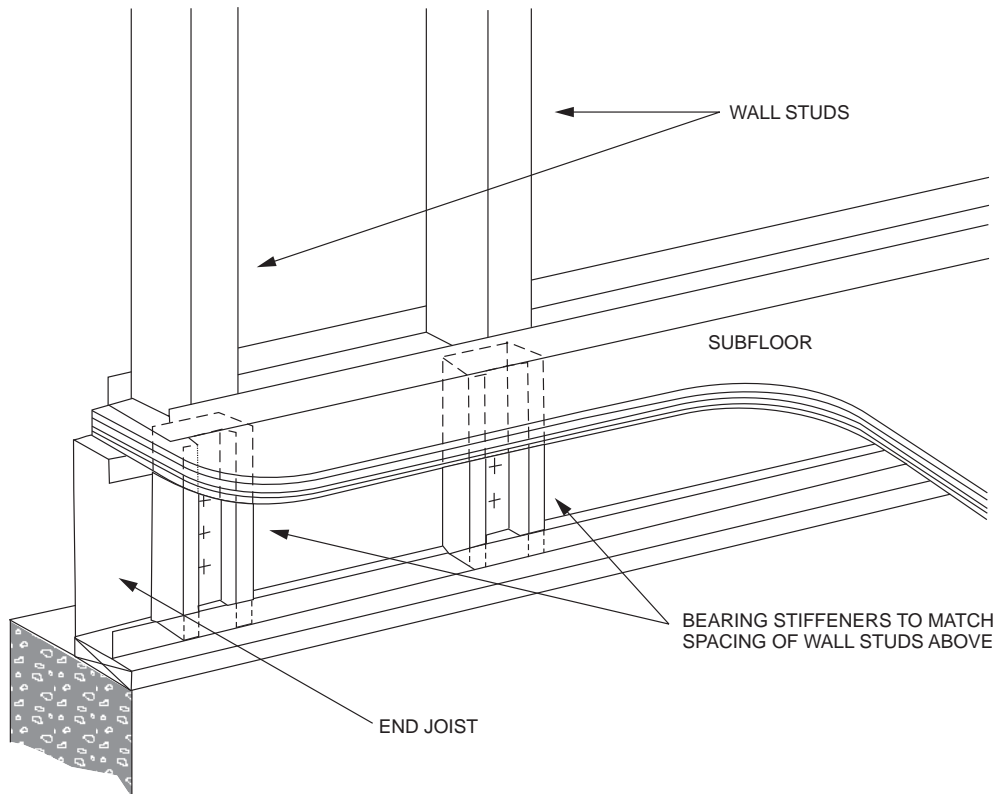


FIGURE R505.3.1(9)
BEARING STIFFENERS FOR END JOISTS

TABLE R505.3.2
ALLOWABLE SPANS FOR COLD-FORMED STEEL JOISTS—SINGLE OR CONTINUOUS SPANS^{a, b, c, d, e, f}

JOIST DESIGNATION	30 PSF LIVE LOAD				40 PSF LIVE LOAD			
	Spacing (inches)				Spacing (inches)			
	12	16	19.2	24	12	16	19.2	24
550S162-33	11'-8"	10'-4"	9'-5"	8'-5"	10'-7"	9'-2"	8'-5"	7'-6"
550S162-43	12'-8"	11'-6"	10'-8"	10'-5"	11'-6"	10'-4"	9'-10"	9'-3"
550S162-54	13'-7"	12'-4"	11'-7"	10'-9"	12'-4"	11'-3"	10'-7"	9'-10"
550S162-68	14'-7"	13'-3"	12'-6"	11'-7"	13'-3"	12'-0"	11'-4"	10'-6"
800S162-33	14'-6"	12'-6"	11'-5"	10'-3"	12'-10"	11'-1"	10'-2"	9'-1"
800S162-43	17'-0"	15'-1"	13'-9"	12'-4"	15'-5"	13'-5"	12'-3"	10'-11"
800S162-54	18'-3"	16'-7"	15'-8"	14'-6"	16'-7"	15'-1"	14'-2"	13'-2"
800S162-68	19'-9"	17'-11"	16'-11"	15'-8"	17'-11"	16'-3"	15'-4"	14'-3"
1000S162-43	19'-4"	16'-9"	15'-3"	13'-8"	17'-2"	14'-10"	13'-7"	12'-2"
1000S162-54	21'-9"	19'-9"	18'-7"	17'-3"	19'-9"	18'-0"	16'-11"	15'-8"
1000S162-68	23'-7"	21'-5"	20'-2"	18'-9"	21'-5"	19'-6"	18'-4"	17'-0"
1200S162-54	25'-1"	22'-10"	21'-6"	19'-9"	22'-10"	20'-9"	19'-6"	17'-6"
1200S162-68	27'-3"	24'-9"	23'-4"	21'-8"	24'-9"	22'-6"	21'-2"	19'-8"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.

- a. Deflection criteria: $L/480$ for live loads, $L/240$ for total loads.
- b. Floor dead load = 10 psf.
- c. Table provides the maximum clear span in feet and inches.
- d. Bearing stiffeners are to be installed at all support points and concentrated loads.
- e. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thickness. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thickness.
- f. Table R505.3.2 is not applicable for 800S162-33 and 1000S162-43 continuous joist members.

R505.3.4 Bearing stiffeners. Bearing stiffeners shall be installed at each joist bearing location in accordance with this section, except for joists lapped over an interior support not carrying a load-bearing wall above. Floor joists supporting jamb studs with multiple members shall have two bearing stiffeners in accordance with Figure R505.3.4(1). Bearing stiffeners shall be fabricated from a C-shaped, track or clip angle member in accordance with one of the following:

1. C-shaped bearing stiffeners:
 - 1.1. Where the joist is not carrying a load-bearing wall above, the bearing stiffener shall be a minimum 33 mil (0.84 mm) thickness.
 - 1.2. Where the joist is carrying a load-bearing wall above, the bearing stiffener shall be not less than the same designation thickness as the wall stud above.
2. Track bearing stiffeners:
 - 2.1. Where the joist is not carrying a load-bearing wall above, the bearing stiffener shall be a minimum 43 mil (1.09 mm) thickness.
 - 2.2. Where the joist is carrying a load-bearing wall above, the bearing stiffener shall be not

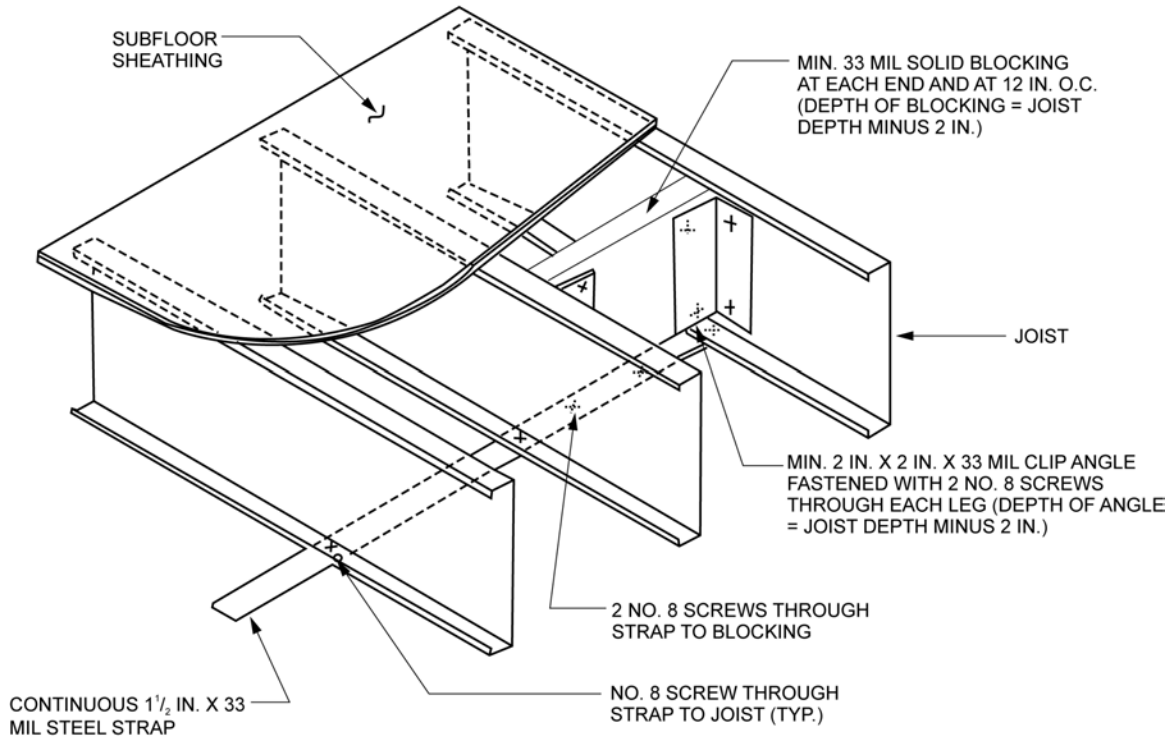
less than one designation thickness greater than the wall stud above.

The minimum length of a bearing stiffener shall be the depth of member being stiffened minus $\frac{3}{8}$ inch (9.5 mm). Each bearing stiffener shall be fastened to the web of the member it is stiffening as shown in Figure R505.3.4(2).

R505.3.5 Cutting and notching. Flanges and lips of load-bearing cold-formed steel floor framing members shall not be cut or notched.

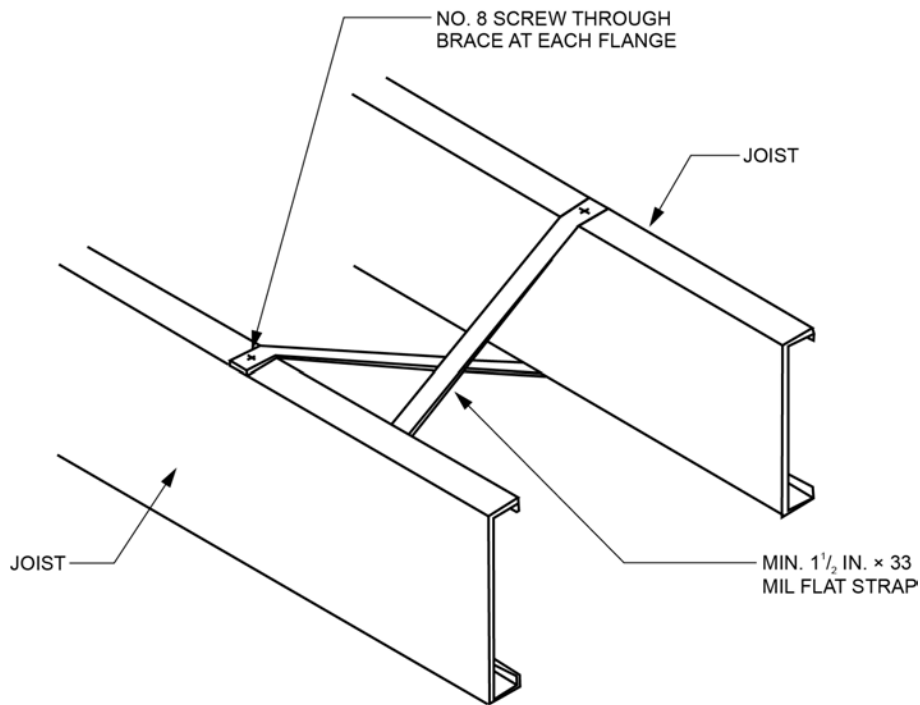
R505.3.6 Floor cantilevers. Floor cantilevers for the top floor of a two- or three-story building or the first floor of a one-story building shall not exceed 24 inches (610 mm). Cantilevers, not exceeding 24 inches (610 mm) and supporting two stories and roof (first floor of a two-story building), shall be permitted provided that all cantilevered joists are doubled (nested or back-to-back). The doubled cantilevered joists shall extend not less than 6 feet (1829 mm) toward the inside and shall be fastened with not less than two No. 8 screws spaced at 24 inches (610 mm) on center through the webs (for back-to-back) or flanges (for nested joists).

R505.3.7 Splicing. Joists and other structural members shall not be spliced without an approved design. Splicing of tracks shall conform to Figure R505.3.7.



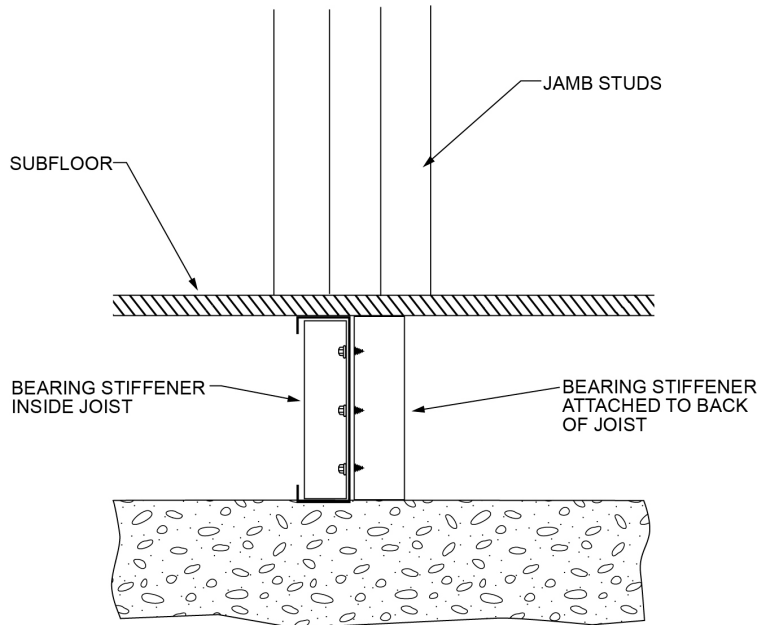
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

**FIGURE R505.3.3.2(1)
JOIST BLOCKING (SOLID)**

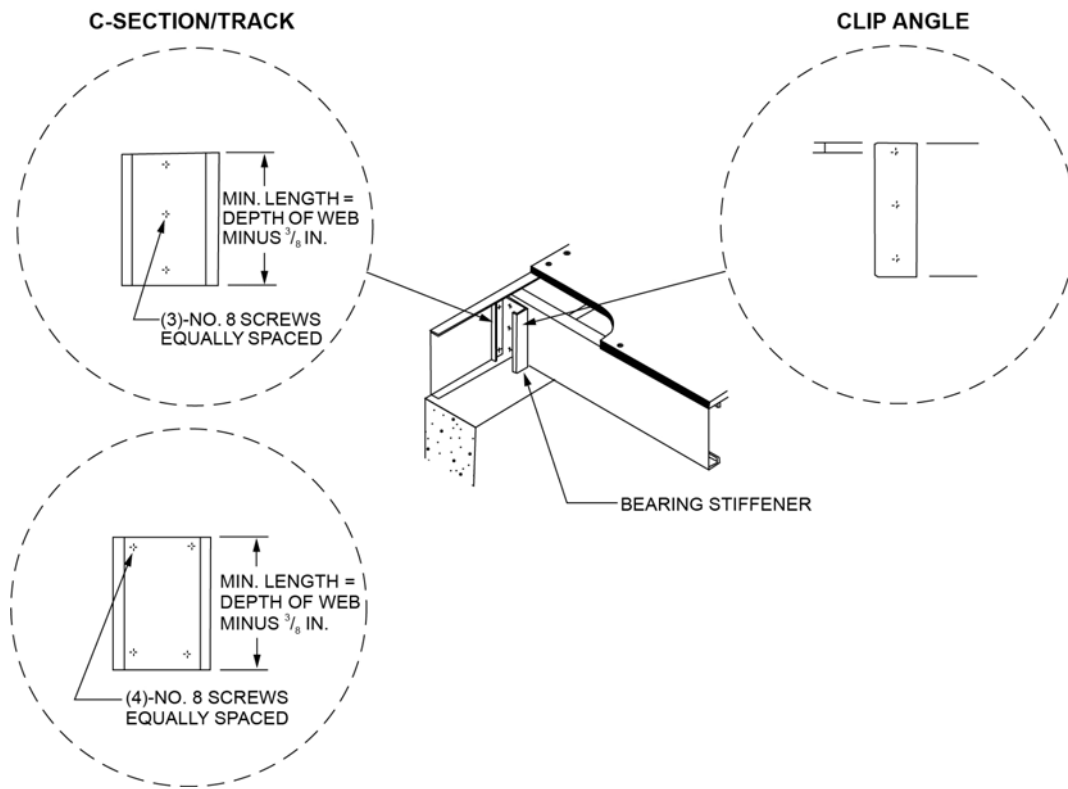


For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

**FIGURE R505.3.3.2(2)
JOIST BLOCKING (STRAP)**

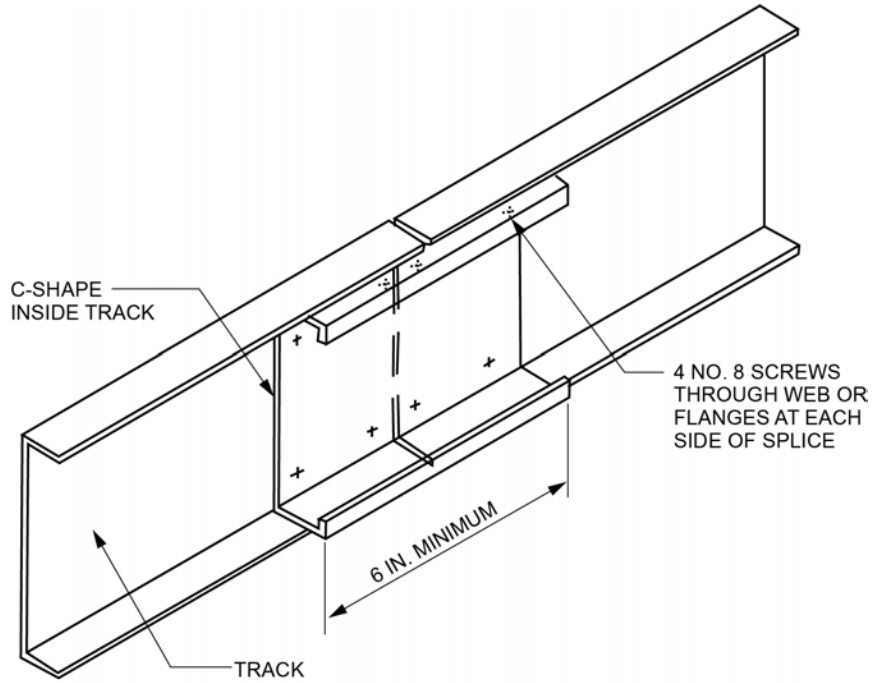


**FIGURE R505.3.4(1)
BEARING STIFFENERS UNDER JAMB STUDS**



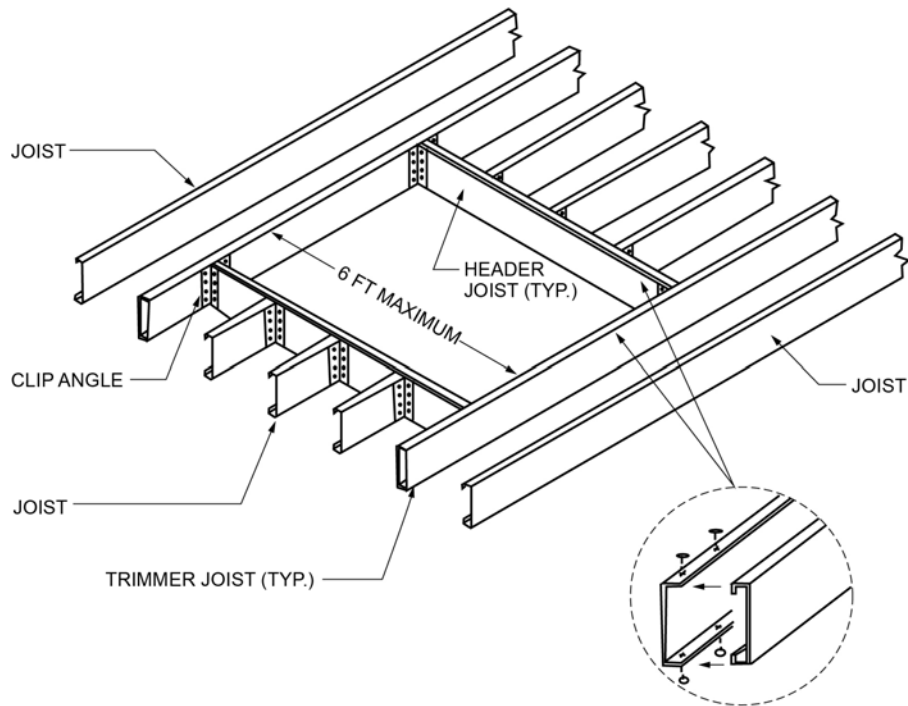
For SI: 1 inch = 25.4 mm.

**FIGURE R505.3.4(2)
BEARING STIFFENER**



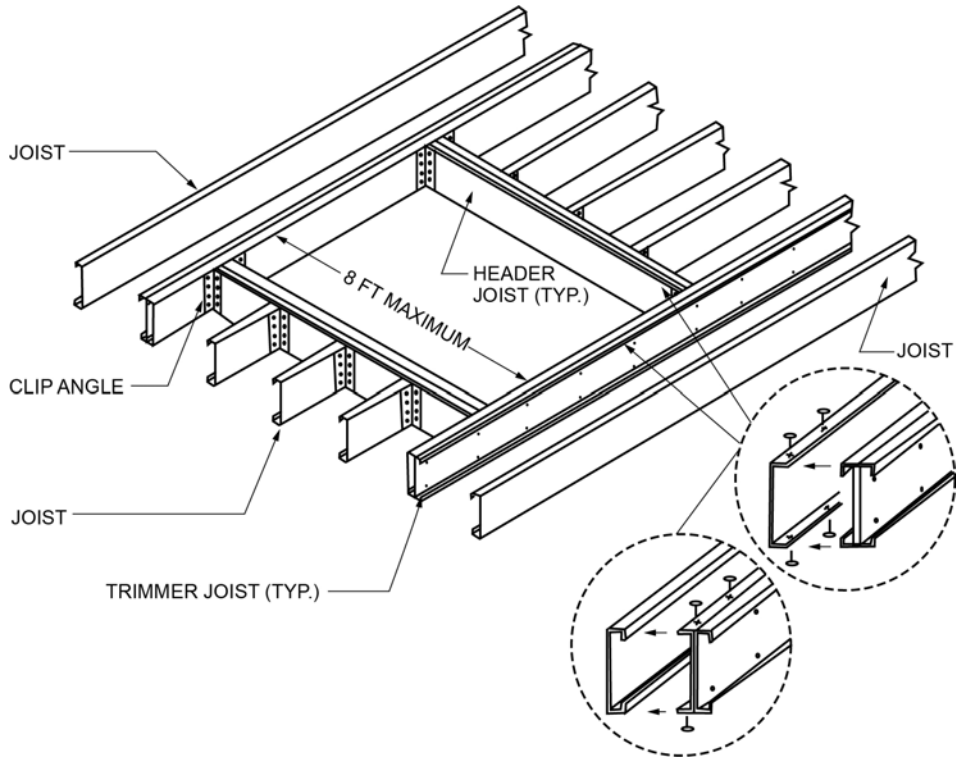
For SI: 1 inch = 25.4 mm.

FIGURE R505.3.7
TRACK SPLICE



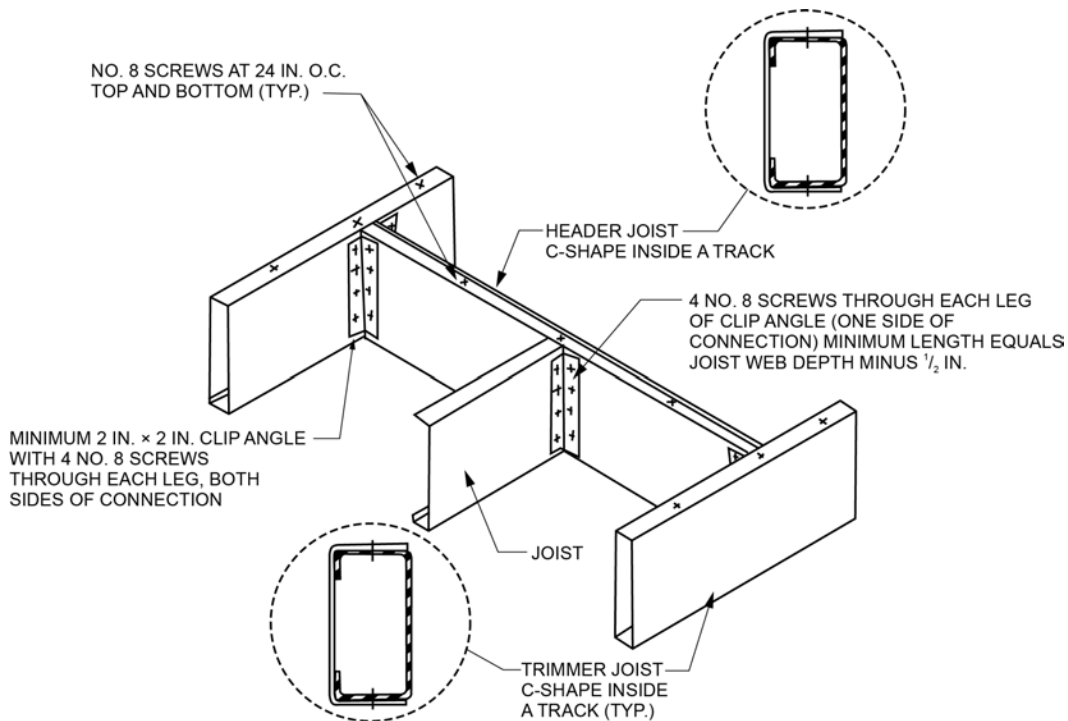
For SI: 1 foot = 304.8 mm.

FIGURE R505.3.8(1)
COLD-FORMED STEEL FLOOR CONSTRUCTION—6-FOOT FLOOR OPENING



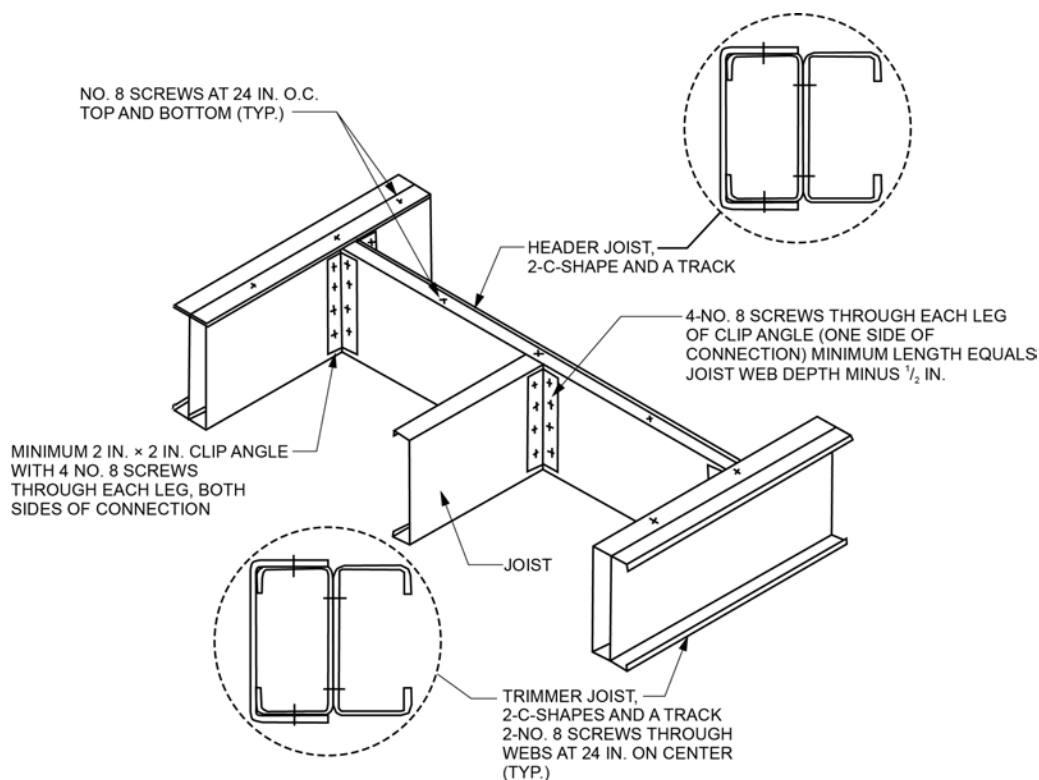
For SI: 1 foot = 304.8 mm.

FIGURE R505.3.8(2)
COLD-FORMED STEEL FLOOR CONSTRUCTION—8-FOOT FLOOR OPENING



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R505.3.8(3)
COLD-FORMED STEEL FLOOR CONSTRUCTION: FLOOR HEADER TO TRIMMER CONNECTION—6-FOOT OPENING



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R505.3.8(4)
COLD-FORMED STEEL FLOOR CONSTRUCTION: FLOOR HEADER TO TRIMMER CONNECTION—8-FOOT OPENING

R505.3.8 Framing of floor openings. Openings in floors shall be framed with header and trimmer joists. Header joist spans shall not exceed 6 feet (1829 mm) or 8 feet (2438 mm) in length in accordance with Figure R505.3.8(1) or R505.3.8(2), respectively. Header and trimmer joists shall be fabricated from joist and track members, having a minimum size and thickness at least equivalent to the adjacent floor joists, and shall be installed in accordance with Figures R505.3.8(1), R505.3.8(2), R505.3.8(3) and R505.3.8(4). Each header joist shall be connected to trimmer joists with four 2-inch by 2-inch (51-mm by 51-mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The clip angles shall have a thickness not less than that of the floor joist. Each track section for a built-up header or trimmer joist shall extend the full length of the joist (continuous).

SECTION R506 CONCRETE FLOORS (ON GROUND)

R506.1 General. Concrete slab-on-ground floors shall be designed and constructed in accordance with the provisions of this section or ACI 332. Floors shall be a minimum 3½ inches (89 mm) thick (for expansive soils, see Section

R403.1.8). The specified compressive strength of concrete shall be as set forth in Section R402.2.

R506.2 Site preparation. The area within the foundation walls shall have all vegetation, top soil and foreign material removed.

R506.2.1 Fill. Fill material shall be free of vegetation and foreign material. The fill shall be compacted to ensure uniform support of the slab, and except where approved, the fill depths shall not exceed 24 inches (610 mm) for clean sand or gravel and 8 inches (203 mm) for earth.

R506.2.2 Base. A 4-inch-thick (102 mm) base course consisting of clean graded sand, gravel, crushed stone, crushed concrete or crushed blast-furnace slag passing a 2-inch (51 mm) sieve shall be placed on the prepared subgrade where the slab is below grade.

Exception: A base course is not required where the concrete slab is installed on well-drained or sand-gravel mixture soils classified as Group I according to the United Soil Classification System in accordance with Table R405.1.

R506.2.3 Vapor retarder. A minimum 10-mil (0.010 inch; 0.254 mm) vapor retarder conforming to ASTM E1745 Class A requirements with joints lapped not less than 6 inches (152 mm) shall be placed between the

concrete floor slab and the base course or the prepared subgrade where a base course does not exist.

Exception: The vapor retarder is not required for the following:

1. Garages, utility buildings and other unheated accessory structures.
2. For unheated storage rooms having an area of less than 70 square feet (6.5 m²) and carports.
3. Driveways, walks, patios and other flatwork not likely to be enclosed and heated at a later date.
4. Where approved by the building official, based on local site conditions.

R506.2.3.1 Capillary break. *When a vapor retarder is required, a capillary break shall be installed in accordance with the California Green Building Standards Code, Chapter 4, Division 4.5.*

R506.2.4 Reinforcement support. Where provided in slabs-on-ground, reinforcement shall be supported to remain in place from the center to upper one-third of the slab for the duration of the concrete placement.

SECTION R507 EXTERIOR DECKS

R507.1 Decks. Wood-framed decks shall be in accordance with this section. Decks shall be designed for the live load required in Section R301.5 or the ground snow load indicated in Table R301.2, whichever is greater. For decks using materials and conditions not prescribed in this section, refer to Section R301.

R507.2 Materials. Materials used for the construction of decks shall comply with this section.

R507.2.1 Wood materials. Wood materials shall be No. 2 grade or better lumber, preservative-treated in accordance with Section R317, or approved, naturally durable lumber, and termite protected where required in accordance with Section R318. Where design in accordance with Section R301 is provided, wood structural members shall be designed using the wet service factor defined in AWC NDS. Cuts, notches and drilled holes of preservative-treated wood members shall be treated in accordance with Section R317.1.1. All preservative-treated wood products in contact with the ground shall be labeled for such usage.

R507.2.1.1 Engineered wood products. Engineered wood products shall be in accordance with Section R502.

R507.2.2 Plastic composite deck boards, stair treads, guards or handrails. Plastic composite exterior deck boards, stair treads, guards and handrails shall comply with the requirements of ASTM D7032 and this section.

R507.2.2.1 Labeling. Plastic composite deck boards and stair treads, or their packaging, shall bear a label that indicates compliance with ASTM D7032 and includes the allowable load and maximum allowable span determined in accordance with ASTM D7032. Plastic or composite handrails and guards, or their

packaging, shall bear a *label* that indicates compliance with ASTM D7032 and includes the maximum allowable span determined in accordance with ASTM D7032.

R507.2.2.2 Flame spread index. Plastic composite deck boards, stair treads, guards, and handrails shall exhibit a flame spread index not exceeding 200 when tested in accordance with ASTM E84 or UL 723 with the test specimen remaining in place during the test.

Exception: Plastic composites determined to be noncombustible.

R507.2.2.3 Decay resistance. Plastic composite deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall be decay resistant in accordance with ASTM D7032.

R507.2.2.4 Termite resistance. Where required by Section 318, plastic composite deck boards, stair treads, guards and handrails containing wood, cellulosic or other biodegradable materials shall be termite resistant in accordance with ASTM D7032.

R507.2.2.5 Installation of plastic composites. Plastic composite deck boards, stair treads, guards and handrails shall be installed in accordance with this code and the manufacturer's instructions.

R507.2.3 Fasteners and connectors. Metal fasteners and connectors used for all decks shall be in accordance with Section R317.3 and Table R507.2.3.

R507.2.4 Flashing. Flashing shall be corrosion-resistant metal of nominal thickness not less than 0.019 inch (0.48 mm) or approved nonmetallic material that is compatible with the substrate of the structure and the decking materials.

R507.2.5 Alternate materials. Alternative materials, including glass and metals, shall be permitted.

R507.3 Footings. Decks shall be supported on concrete footings or other approved structural systems designed to accommodate all loads in accordance with Section R301. Deck footings shall be sized to carry the imposed loads from the deck structure to the ground as shown in Figure R507.3.

Exceptions:

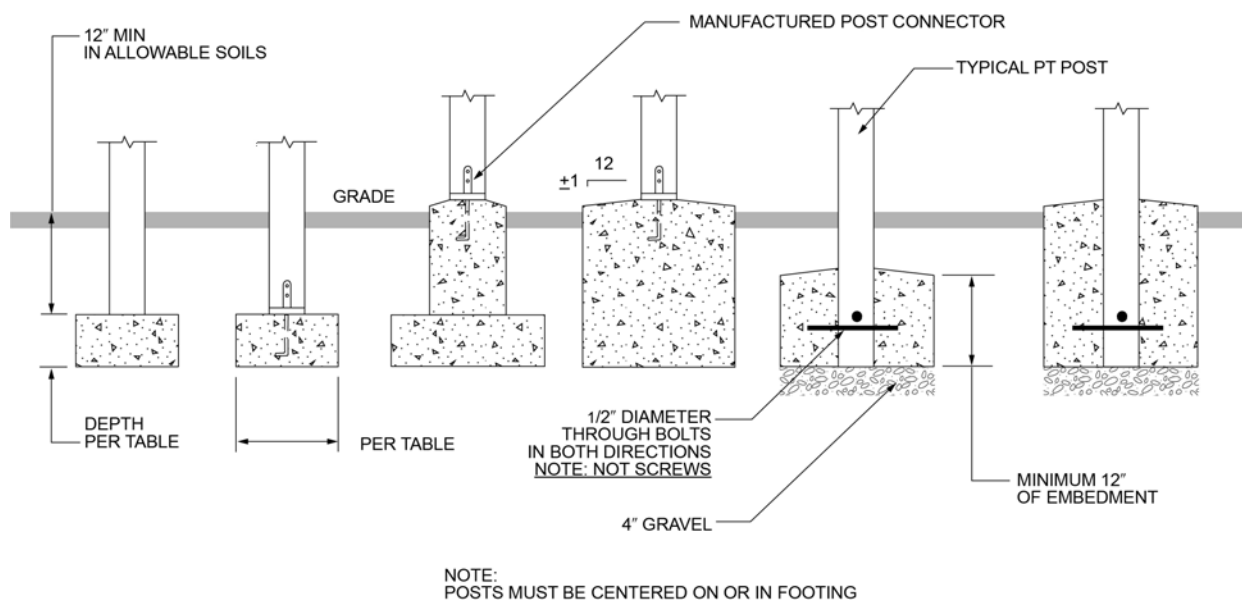
1. Footings shall not be required for free-standing decks consisting of joists directly supported on grade over their entire length.
2. Footings shall not be required for free-standing decks that meet all of the following criteria:
 - 2.1. The joists bear directly on precast concrete pier blocks at grade without support by beams or posts.
 - 2.2. The area of the deck does not exceed 200 square feet (18.6 m²).
 - 2.3. The walking surface is not more than 20 inches (508 mm) above grade at any point within 36 inches (914 mm) measured horizontally from the edge.

**TABLE R507.2.3
FASTENER AND CONNECTOR SPECIFICATIONS FOR DECKS^{a, b}**

ITEM	MATERIAL	MINIMUM FINISH/COATING	ALTERNATE FINISH/COATING ^c
Nails and glulam rivets	In accordance with ASTM F1667	Hot-dipped galvanized per ASTM A153, Class D for $\frac{3}{8}$ -inch diameter and less	Stainless steel, silicon bronze or copper
Bolts ^c	In accordance with ASTM A307 (bolts), ASTM A563 (nuts), ASTM F844 (washers)	Hot-dipped galvanized per ASTM A153, Class C (Class D for $\frac{3}{8}$ -inch diameter and less) or mechanically galvanized per ASTM B695, Class 55 or 410 stainless steel	Stainless steel, silicon bronze or copper
Lag screws ^d (including nuts and washers)			
Metal connectors	Per manufacturer's specification	ASTM A653 type G185 zinc-coated galvanized steel or post hot-dipped galvanized per ASTM A123 providing a minimum average coating weight of 2.0 oz./ft ² (total both sides)	Stainless steel

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Equivalent materials, coatings and finishes shall be permitted.
- b. Fasteners and connectors exposed to salt water or located within 300 feet of a salt water shoreline shall be stainless steel.
- c. Holes for bolts shall be drilled a minimum $\frac{1}{32}$ inch and a maximum $\frac{1}{16}$ inch larger than the bolt.
- d. Lag screws $\frac{1}{2}$ inch and larger shall be predrilled to avoid wood splitting per the *National Design Specification (NDS) for Wood Construction*.
- e. Stainless-steel-driven fasteners shall be in accordance with ASTM F1667.



For SI: 1 inch = 25.4 mm.

**FIGURE R507.3
DECK POSTS TO DECK FOOTING CONNECTION**

R507.3.1 Minimum size. The minimum size of concrete footings shall be in accordance with Table R507.3.1, based on the tributary area and allowable soil-bearing pressure in accordance with Table R401.4.1.

R507.3.2 Minimum depth. Deck footings shall be placed not less than 12 inches (305 mm) below the undisturbed ground surface.

R507.3.3 Frost protection. Where decks are attached to a frost-protected structure, deck footings shall be protected from frost by one or more of the following methods:

1. Extending below the frost line specified in Table R301.2.
2. Erecting on solid rock.

3. Other approved methods of frost protection.

R507.4 Deck posts. For single-level decks, wood post size shall be in accordance with Table R507.4.

R507.4.1 Deck post to deck footing connection. Where posts bear on concrete footings in accordance with Section R403 and Figure R507.3, lateral restraint shall be provided by manufactured connectors or a minimum post embedment of 12 inches (305 mm) in surrounding soils or concrete piers. Other footing systems shall be permitted.

Exception: Where expansive, compressible, shifting or other questionable soils are present, surrounding soils shall not be relied on for lateral support.

**TABLE R507.3.1
MINIMUM FOOTING SIZE FOR DECKS**

LIVE OR GROUND SNOW LOAD ^b (psf)	TRIBUTARY AREA (ft ²)	LOAD-BEARING VALUE OF SOILS ^{a, c, d} (psf)								
		1,500 ^e			2,000 ^e			≥ 3,000 ^e		
		Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches) ^f	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches) ^f	Side of a square footing (inches)	Diameter of a round footing (inches)	Thickness (inches) ^f
40	5	7	8	6	7	8	6	7	8	6
	20	10	12	6	9	9	6	7	8	6
	40	14	16	6	12	14	6	10	12	6
	60	17	19	6	15	17	6	12	14	6
	80	20	22	7	17	19	6	14	16	6
	100	22	25	8	19	21	6	15	17	6
	120	24	27	9	21	23	7	17	19	6
	140	26	29	10	22	25	8	18	21	6
160	28	31	11	24	27	9	20	22	7	
50	5	7	8	6	7	8	6	7	8	6
	20	11	13	6	10	11	6	8	9	6
	40	15	17	6	13	15	6	11	13	6
	60	19	21	6	16	18	6	13	15	6
	80	21	24	8	19	21	6	15	17	6
	100	24	27	9	21	23	7	17	19	6
	120	26	30	10	23	26	8	19	21	6
	140	28	32	11	25	28	9	20	23	7
160	30	34	12	26	30	10	21	24	8	
60	5	7	8	6	7	8	6	7	8	6
	20	12	14	6	11	12	6	9	10	6
	40	16	19	6	14	16	8	12	14	6
	60	20	23	7	17	20	6	14	16	6
	80	23	26	9	20	23	7	16	19	6
	100	26	29	10	22	25	8	18	21	6
	120	28	32	11	25	28	9	20	23	7
	140	31	35	12	27	30	10	22	24	8
160	33	37	13	28	32	11	23	26	9	
70	5	7	8	6	7	8	6	7	8	6
	20	12	14	6	11	13	6	9	10	6
	40	18	20	6	15	17	6	12	14	6
	60	21	24	8	19	21	6	15	17	6
	80	25	28	9	21	24	8	18	20	6
	100	28	31	11	24	27	9	20	22	7
	120	30	34	12	26	30	10	21	24	8
	140	33	37	13	28	32	11	23	26	9
160	35	40	15	30	34	12	25	28	9	

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

- a. Interpolation permitted, extrapolation not permitted.
- b. Based on highest load case: Dead + Live or Dead + Snow.
- c. Footing dimensions shall allow complete bearing of the post.
- d. If the support is a brick or CMU pier, the footing shall have a minimum 2-inch projection on all sides.
- e. Area, in square feet, of deck surface supported by post and footings.
- f. Minimum thickness shall only apply to plain concrete footings.

**TABLE R507.4
DECK POST HEIGHT**

LOADS (psf) ^b	POST SPECIES ^c	POST SIZE ^d	TRIBUTARY AREA (ft ²) ^{g, h}								
			20	40	60	80	100	120	140	160	
			MAXIMUM DECK POST HEIGHT ^a (feet-inches)								
40 live load	Southern pine	4 × 4	14-0	13-8	11-0	9-5	8-4	7-5	6-9	6-2	
		4 × 6	14-0	14-0	13-11	12-0	10-8	9-8	8-10	8-2	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	Douglas fir ^e Hem-fir ^e Spruce-pine-fir ^e	4 × 4	14-0	13-6	10-10	9-3	8-0	7-0	6-2	5-3	
		4 × 6	14-0	14-0	13-10	11-10	10-6	9-5	8-7	7-10	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	4 × 4	14-0	13-2	10-3	8-1	5-8	NP	NP	NP	
		4 × 6	14-0	14-0	13-6	11-4	9-9	8-4	6-9	4-7	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	13-7	9-7	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	50 ground snow load	Southern pine	4 × 4	14-0	12-2	9-10	8-5	7-5	6-7	5-11	5-4
			4 × 6	14-0	14-0	12-6	10-9	9-6	8-7	7-10	7-3
			6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	13-4
			8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
Douglas fir ^e Hem-fir ^e Spruce-pine-fir ^e		4 × 4	14-0	12-1	9-8	8-2	7-1	6-2	5-3	4-2	
		4 × 6	14-0	14-0	12-4	10-7	9-4	8-4	7-7	6-11	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	14-0	12-10	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f		4 × 4	14-0	11-8	9-0	6-10	3-7	NP	NP	NP	
		4 × 6	14-0	14-0	12-0	10-0	8-6	7-0	5-3	NP	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	10-8	2-4	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
60 ground snow load		Southern pine	4 × 4	14-0	11-1	8-11	7-7	6-7	5-10	5-2	4-6
			4 × 6	14-0	14-0	11-4	9-9	8-7	7-9	7-1	6-6
			6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	12-9	11-2
			8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas fir ^e Hem-fir ^e Spruce-pine-fir ^e	4 × 4	14-0	10-11	8-8	7-3	6-2	5-0	3-7	NP	
		4 × 6	14-0	13-11	11-2	9-7	8-4	7-5	6-8	5-11	
		6 × 6	14-0	14-0	14-0	14-0	14-0	14-0	12-2	10-2	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	4 × 4	14-0	10-6	7-9	4-7	NP	NP	NP	NP	
		4 × 6	14-0	13-7	10-9	8-9	7-0	4-9	NP	NP	
		6 × 6	14-0	14-0	14-0	14-0	14-0	9-9	NP	NP	
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0	

(continued)

**TABLE R507.4—continued
DECK POST HEIGHT**

LOADS (psf) ^b	POST SPECIES ^c	POST SIZE ^d	TRIBUTARY AREA (ft ²) ^{g,h}							
			20	40	60	80	100	120	140	160
			MAXIMUM DECK POST HEIGHT ^a (feet-inches)							
70 ground snow load	Southern pine	4 × 4	14-0	10-2	8-2	6-11	5-11	5-2	4-4	3-4
		4 × 6	14-0	12-11	10-5	8-11	7-10	7-1	6-5	5-10
		6 × 6	14-0	14-0	14-0	14-0	14-0	12-9	10-11	8-7
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Douglas fir ^e Hem-fir ^e Spruce-pine-fir ^e	4 × 4	14-0	10-1	7-11	6-6	5-3	3-7	NP	NP
		4 × 6	14-0	12-10	10-3	8-9	7-7	6-8	5-10	4-11
		6 × 6	14-0	14-0	14-0	14-0	14-0	12-2	9-9	5-9
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	4 × 4	14-0	9-5	6-5	NP	NP	NP	NP	NP
		4 × 6	14-0	12-6	9-8	7-7	5-3	NP	NP	NP
		6 × 6	14-0	14-0	14-0	14-0	10-8	NP	NP	NP
		8 × 8	14-0	14-0	14-0	14-0	14-0	14-0	14-0	14-0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Measured from the underside of the beam to the top of footing or pier.
- b. 10 psf dead load. Snow load not assumed to be concurrent with live load.
- c. No. 2 grade, wet service factor included.
- d. Notched deck posts shall be sized to accommodate beam size in accordance with Section R507.5.2.
- e. Includes incising factor.
- f. Incising factor not included.
- g. Area, in square feet, of deck surface supported by post and footings.
- h. Interpolation permitted. Extrapolation not permitted.

R507.5 Deck beams. Maximum allowable spans for wood deck beams, as shown in Figure R507.5, shall be in accordance with Tables R507.5(1) through R507.5(4). Beam plies shall be fastened together with two rows of 10d (3-inch × 0.128-inch) nails minimum at 16 inches (406 mm) on center along each edge. Beams shall be permitted to cantilever at each end up to one-fourth of the actual beam span. Deck beams of other materials shall be permitted where designed in accordance with accepted engineering practices.

R507.5.1 Deck beam bearing. The ends of beams shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) of bearing on concrete or masonry for the entire width of the beam. Where multiple-span beams bear on intermediate posts, each ply must have full bearing on the post in accordance with Figures R507.5.1(1) and R507.5.1(2).

R507.5.2 Deck beam connection to supports. Deck beams shall be attached to supports in a manner capable of transferring vertical loads and resisting horizontal displacement. Deck beam connections to wood posts shall be in accordance with Figures R507.5.1(1) and R507.5.1(2). Manufactured post-to-beam connectors shall be sized for the post and beam sizes. Bolts shall have washers under the head and nut.

R507.6 Deck joists. Maximum allowable spans for wood deck joists, as shown in Figure R507.6, shall be in accordance with Table R507.6. The maximum joist spacing shall be limited by the decking materials in accordance with Table R507.7.

R507.6.1 Deck joist bearing. The ends of joists shall have not less than 1½ inches (38 mm) of bearing on wood or

metal and not less than 3 inches (76 mm) of bearing on concrete or masonry over its entire width. Joists bearing on top of a multiple-ply beam or ledger shall be fastened in accordance with Table R602.3(1). Joists bearing on top of a single-ply beam or ledger shall be attached by a mechanical connector. Joist framing into the side of a beam or ledger board shall be supported by approved joist hangers.

R507.6.2 Deck joist lateral restraint. Joist ends and bearing locations shall be provided with lateral resistance to prevent rotation. Where lateral restraint is provided by joist hangers or blocking between joists, their depth shall equal not less than 60 percent of the joist depth. Where lateral restraint is provided by rim joists, they shall be secured to the end of each joist with not fewer than three 10d (3-inch by 0.128-inch) (76 mm by 3.3 mm) nails or three No. 10 x 3-inch-long (76 mm) wood screws.

R507.7 Decking. Maximum allowable spacing for joists supporting wood decking, excluding stairways, shall be in accordance with Table R507.7. Wood decking shall be attached to each supporting member with not less than two 8d threaded nails or two No. 8 wood screws. Maximum allowable spacing for joists supporting plastic composite decking shall be in accordance with Section R507.2. Other approved decking or fastener systems shall be installed in accordance with the manufacturer's installation requirements.

R507.8 Vertical and lateral supports. Where supported by attachment to an exterior wall, decks shall be positively anchored to the primary structure and designed for both vertical and lateral loads. Such attachment shall not be

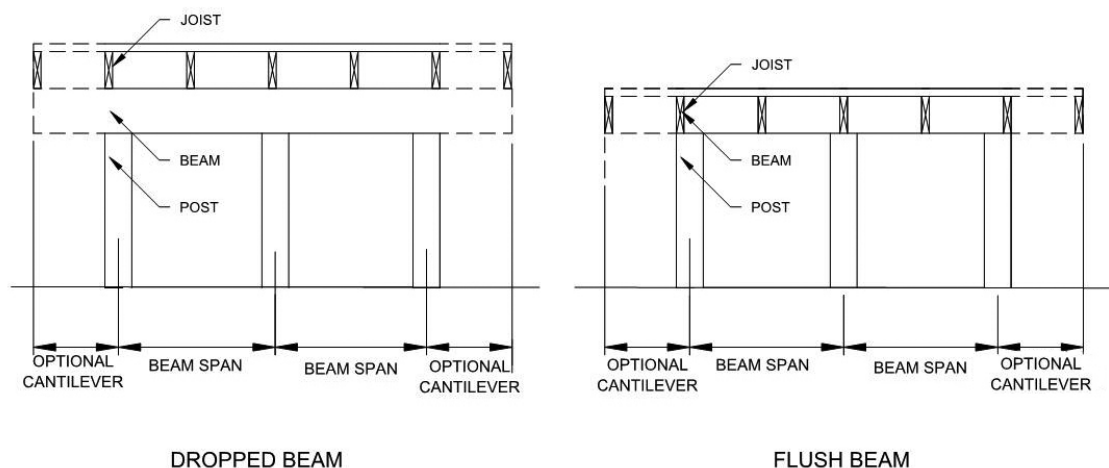


FIGURE R507.5
TYPICAL DECK JOIST SPANS

accomplished by the use of toenails or nails subject to withdrawal. For decks with cantilevered framing members, connection to exterior walls or other framing members shall be designed and constructed to resist uplift resulting from the full live load specified in Table R301.5 acting on the cantilevered portion of the deck. Where positive connection to the primary building structure cannot be verified during inspection, decks shall be self-supporting.

R507.9 Vertical and lateral supports at band joist. Vertical and lateral supports for decks shall comply with this section.

R507.9.1 Vertical supports. Vertical loads shall be transferred to band joists with ledgers in accordance with this section.

R507.9.1.1 Ledger details. Deck ledgers shall be a minimum 2-inch by 8-inch (51 mm by 203 mm) nominal, pressure-preservative-treated Southern pine, incised pressure-preservative-treated hem-fir, or approved, naturally durable, No. 2 grade or better lumber. Deck ledgers shall not support concentrated loads from beams or girders. Deck ledgers shall not be supported on stone or masonry veneer.

R507.9.1.2 Band joist details. Band joists supporting a ledger shall be a minimum 2-inch-nominal (51 mm), solid-sawn, spruce-pine-fir or better lumber or a minimum 1-inch (25 mm) nominal engineered wood rim boards in accordance with Section R502.1.7. Band joists shall bear fully on the primary structure capable of supporting all required loads.

R507.9.1.3 Ledger to band joist details. Fasteners used in deck ledger connections in accordance with Table R507.9.1.3(1) shall be hot-dipped galvanized or stainless steel and shall be installed in accordance with Table R507.9.1.3(2) and Figures R507.9.1.3(1) and R507.9.1.3(2).

R507.9.1.4 Alternate ledger details. Alternate framing configurations supporting a ledger constructed to meet the load requirements of Section R301.5 shall be permitted.

R507.9.2 Lateral connection. Lateral loads shall be transferred to the ground or to a structure capable of transmitting

them to the ground. Where the lateral load connection is provided in accordance with Figure R507.9.2(1), hold-down tension devices shall be installed in not less than two locations per deck, within 24 inches (610 mm) of each end of the deck. Each device shall have an allowable stress design capacity of not less than 1,500 pounds (6672 N). Where the lateral load connections are provided in accordance with Figure R507.9.2(2), the hold-down tension devices shall be installed in not less than four locations per deck, and each device shall have an allowable stress design capacity of not less than 750 pounds (3336 N).

R507.10 Exterior guards. Guards shall be constructed to meet the requirements of Sections R301.5 and R312, and this section.

R507.10.1 Support of guards. Where guards are supported on deck framing, guard loads shall be transferred to the deck framing with a continuous load path to the deck joists.

R507.10.1.1 Guards supported by side of deck framing. Where guards are connected to the interior or exterior side of a deck joist or beam, the joist or beam shall be connected to the adjacent joists to prevent rotation of the joist or beam. Connections relying only on fasteners in end grain withdrawal are not permitted.

R507.10.1.2 Guards supported on top of deck framing. Where guards are mounted on top of the decking, the guards shall be connected to the deck framing or blocking and installed in accordance with manufacturer's instructions to transfer the guard loads to the adjacent joists.

R507.10.2 Wood posts at deck guards. Where 4-inch by 4-inch (102 mm by 102 mm) wood posts support guard loads applied to the top of the guard, such posts shall not be notched at the connection to the supporting structure.

R507.10.3 Plastic composite guards. Plastic composite guards shall comply with the provisions of Section R507.2.2.

R507.10.4 Other guards. Other guards shall be in accordance with either manufacturer's instructions or accepted engineering principles.

TABLE R507.5(1)
MAXIMUM DECK BEAM SPAN—40 PSF LIVE LOAD^c

BEAM SPECIES ^d	BEAM SIZE ^e	EFFECTIVE DECK JOIST SPAN LENGTH ^{a, i, j} (feet)						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches) ^{a, b, f}						
Southern pine	1 – 2 × 6	4-7	4-0	3-7	3-3	3-0	2-10	2-8
	1 – 2 × 8	5-11	5-1	4-7	4-2	3-10	3-7	3-5
	1 – 2 × 10	7-0	6-0	5-5	4-11	4-7	4-3	4-0
	1 – 2 × 12	8-3	7-1	6-4	5-10	5-5	5-0	4-9
	2 – 2 × 6	6-11	5-11	5-4	4-10	4-6	4-3	4-0
	2 – 2 × 8	8-9	7-7	6-9	6-2	5-9	5-4	5-0
	2 – 2 × 10	10-4	9-0	8-0	7-4	6-9	6-4	6-0
	2 – 2 × 12	12-2	10-7	9-5	8-7	8-0	7-5	7-0
	3 – 2 × 6	8-6	7-5	6-8	6-1	5-8	5-3	4-11
	3 – 2 × 8	10-11	9-6	8-6	7-9	7-2	6-8	6-4
	3 – 2 × 10	13-0	11-2	10-0	9-2	8-6	7-11	7-6
	3 – 2 × 12	15-3	13-3	11-10	10-9	10-0	9-4	8-10
Douglas fir-larch ^g Hem-fir ^g Spruce-pine-fir	1 – 2 × 6	4-1	3-6	3-0	2-8	2-5	2-3	2-1
	1 – 2 × 8	5-6	4-8	4-0	3-6	3-2	2-11	2-9
	1 – 2 × 10	6-8	5-10	5-1	4-6	4-1	3-9	3-6
	1 – 2 × 12	7-9	6-9	6-0	5-6	5-0	3-9	3-6
	2 – 2 × 6	6-1	5-3	4-9	4-4	3-11	3-7	3-3
	2 – 2 × 8	8-2	7-1	6-4	5-9	5-2	4-8	4-4
	2 – 2 × 10	10-0	8-7	7-9	7-0	6-6	6-0	5-6
	2 – 2 × 12	11-7	10-0	8-11	8-2	7-7	7-1	6-8
	3 – 2 × 6	7-8	6-8	6-0	5-6	5-1	4-9	4-6
	3 – 2 × 8	10-3	8-10	7-11	7-3	6-8	6-3	5-11
	3 – 2 × 10	12-6	10-10	9-8	8-10	8-2	7-8	7-2
	3 – 2 × 12	14-6	12-7	11-3	10-3	9-6	8-11	8-5
Redwood ^h Western cedars ^h Ponderosa pine ^h Red pine ^h	1 – 2 × 6	4-2	3-7	3-1	2-9	2-6	2-3	2-2
	1 – 2 × 8	5-4	4-7	4-1	3-7	3-3	3-0	2-10
	1 – 2 × 10	6-6	5-7	5-0	4-7	4-2	3-10	3-7
	1 – 2 × 12	7-6	6-6	5-10	5-4	4-11	4-7	4-4
	2 – 2 × 6	6-2	5-4	4-10	4-5	4-0	3-8	3-4
	2 – 2 × 8	7-10	6-10	6-1	5-7	5-2	4-10	4-5
	2 – 2 × 10	9-7	8-4	7-5	6-9	6-3	5-10	5-6
	2 – 2 × 12	11-1	9-8	8-7	7-10	7-3	6-10	6-5
	3 – 2 × 6	7-8	6-9	6-0	5-6	5-1	4-9	4-6
	3 – 2 × 8	9-10	8-6	7-7	6-11	6-5	6-0	5-8
	3 – 2 × 10	12-0	10-5	9-4	8-6	7-10	7-4	6-11
	3 – 2 × 12	13-11	12-1	10-9	9-10	9-1	8-6	8-1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

- a. Interpolation permitted. Extrapolation not permitted.
- b. Beams supporting a single span of joists with or without cantilever.
- c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load is not assumed to be concurrent with live load.
- d. No. 2 grade, wet service factor included.
- e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.
- f. Beam cantilevers are limited to the adjacent beam's span divided by 4.
- g. Includes incising factor.
- h. Incising factor not included.
- i. Deck joist span as shown in Figure R507.5.
- j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).

TABLE R507.5(2)
MAXIMUM DECK BEAM SPAN—50 PSF GROUND SNOW LOAD^c

BEAM SPECIES ^d	BEAM SIZE ^e	EFFECTIVE DECK JOIST SPAN LENGTH (feet) ^{a, i, j}						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches) ^{a, b, f}						
Southern pine	1 – 2 × 6	4-6	3-11	3-6	3-2	2-11	2-9	2-7
	1 – 2 × 8	5-9	4-11	4-5	4-0	3-9	3-6	3-3
	1 – 2 × 10	6-9	5-10	5-3	4-9	4-5	4-2	3-11
	1 – 2 × 12	8-0	6-11	6-2	5-8	5-3	4-11	4-7
	2 – 2 × 6	6-8	5-9	5-2	4-9	4-4	4-1	3-10
	2 – 2 × 8	8-6	7-4	6-7	6-0	5-7	5-2	4-11
	2 – 2 × 10	10-1	8-9	7-10	7-1	6-7	6-2	5-10
	2 – 2 × 12	11-11	10-3	9-2	8-5	7-9	7-3	6-10
	3 – 2 × 6	7-11	7-2	6-6	5-11	5-6	5-1	4-10
	3 – 2 × 8	10-5	9-3	8-3	7-6	6-11	6-6	6-2
	3 – 2 × 10	12-8	10-11	9-9	8-11	8-3	7-9	7-3
3 – 2 × 12	14-11	12-11	11-6	10-6	9-9	9-1	8-7	
Douglas fir-larch ^g Hem-fir ^g Spruce-pine-fir ^g	1 – 2 × 6	4-0	3-5	2-11	2-7	2-4	2-2	2-0
	1 – 2 × 8	5-4	4-7	3-11	3-5	3-1	2-10	2-8
	1 – 2 × 10	6-7	5-8	4-11	4-5	4-0	3-8	3-5
	1 – 2 × 12	7-7	6-7	5-11	5-4	4-10	4-6	4-2
	2 – 2 × 6	6-0	5-2	4-7	4-2	3-10	3-5	3-2
	2 – 2 × 8	8-0	6-11	6-2	5-8	5-0	4-7	4-2
	2 – 2 × 10	9-9	8-5	7-7	6-11	6-4	5-10	5-4
	2 – 2 × 12	11-4	9-10	8-9	8-0	7-5	6-11	6-6
	3 – 2 × 6	7-6	6-6	5-9	5-3	4-11	4-7	4-4
	3 – 2 × 8	10-0	8-8	7-9	7-1	6-6	6-1	5-8
	3 – 2 × 10	12-3	10-7	9-6	8-8	8-0	7-6	7-0
3 – 2 × 12	14-3	12-4	11-0	10-1	9-4	8-9	8-3	
Redwood ^h Western cedars ^h Ponderosa pine ^h Red pine ^h	1 – 2 × 6	4-1	3-6	3-0	2-8	2-5	2-3	2-1
	1 – 2 × 8	5-2	4-6	4-0	3-6	3-2	2-11	2-9
	1 – 2 × 10	6-4	5-6	4-11	4-6	4-1	3-9	3-6
	1 – 2 × 12	7-4	6-4	5-8	5-2	4-10	4-6	4-3
	2 – 2 × 6	6-1	5-3	4-8	4-4	3-11	3-6	3-3
	2 – 2 × 8	7-8	6-8	5-11	5-5	5-0	4-8	4-3
	2 – 2 × 10	9-5	8-2	7-3	6-8	6-2	5-9	5-5
	2 – 2 × 12	10-11	9-5	8-5	7-8	7-2	6-8	6-3
	3 – 2 × 6	7-1	6-5	5-11	5-5	5-0	4-8	4-5
	3 – 2 × 8	9-4	8-4	7-5	6-10	6-0	5-11	5-7
	3 – 2 × 10	11-9	10-2	9-1	8-4	7-8	7-2	6-9
3 – 2 × 12	13-8	11-10	10-7	9-8	8-11	8-4	7-10	

For SI: 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor.

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5.

j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).

TABLE R507.5(3)
MAXIMUM DECK BEAM SPAN—60 PSF GROUND SNOW LOAD^c

BEAM SPECIES ^d	BEAM SIZE ^e	EFFECTIVE DECK JOIST SPAN LENGTH ^{a,i,j} (feet)						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches) ^{a,b,f}						
Southern pine	1 – 2 × 6	4-2	3-7	3-3	2-11	2-9	2-6	2-5
	1 – 2 × 8	5-3	4-7	4-1	3-9	3-5	3-3	3-0
	1 – 2 × 10	6-3	5-5	4-10	4-5	4-1	3-10	3-7
	1 – 2 × 12	7-5	6-5	5-9	5-3	4-10	4-6	4-3
	2 – 2 × 6	6-2	5-4	4-9	4-4	4-0	3-9	3-7
	2 – 2 × 8	7-10	6-10	6-1	5-7	5-2	4-10	4-6
	2 – 2 × 10	9-4	8-1	7-3	6-7	6-1	5-8	5-4
	2 – 2 × 12	11-0	9-6	8-6	7-9	7-2	6-9	6-4
	3 – 2 × 6	7-5	6-9	6-0	5-6	5-1	4-9	4-6
	3 – 2 × 8	9-9	8-6	7-8	6-11	6-5	6-0	5-8
	3 – 2 × 10	11-8	10-2	9-1	8-3	7-8	7-2	6-9
3 – 2 × 12	13-9	11-11	10-8	9-9	9-0	8-5	7-11	
Douglas fir-larch ^g Hem-fir ^g Spuce-pine-fir ^g	1 – 2 × 6	3-8	3-1	2-8	2-4	2-2	2-0	1-10
	1 – 2 × 8	5-0	4-1	3-6	3-1	2-10	2-7	2-5
	1 – 2 × 10	6-1	5-2	4-6	4-0	3-7	3-4	3-2
	1 – 2 × 12	7-1	6-1	5-5	4-10	4-5	4-1	3-10
	2 – 2 × 6	5-6	4-9	4-3	3-10	3-5	3-1	2-10
	2 – 2 × 8	7-5	6-5	5-9	5-0	4-6	4-1	3-9
	2 – 2 × 10	9-0	7-10	7-0	6-4	5-9	5-2	4-10
	2 – 2 × 12	10-6	9-1	8-1	7-5	6-10	6-4	5-10
	3 – 2 × 6	6-11	6-0	5-4	4-11	4-6	4-2	3-10
	3 – 2 × 8	9-3	8-0	7-2	6-6	6-1	5-6	5-0
	3 – 2 × 10	11-4	9-10	8-9	8-0	7-5	6-11	6-5
3 – 2 × 12	13-2	11-5	10-2	9-4	8-7	8-1	7-7	
Redwood ^h Western cedars ^h Ponderosa pine ^h Red pine ^h	1 – 2 × 6	3-9	3-2	2-9	2-5	2-2	2-0	1-11
	1 – 2 × 8	4-10	4-2	3-7	3-2	2-11	2-8	2-6
	1 – 2 × 10	5-10	5-1	4-6	4-1	3-8	3-5	3-3
	1 – 2 × 12	6-10	5-11	5-3	4-10	4-5	4-2	3-11
	2 – 2 × 6	5-7	4-10	4-4	3-11	3-6	3-2	2-11
	2 – 2 × 8	7-1	6-2	5-6	5-0	4-7	4-2	3-10
	2 – 2 × 10	8-8	7-6	6-9	6-2	5-8	5-4	4-11
	2 – 2 × 12	10-1	8-9	7-10	7-2	6-7	6-2	5-10
	3 – 2 × 6	6-8	6-1	5-5	5-0	4-7	4-3	3-11
	3 – 2 × 8	8-9	7-9	6-22	6-4	5-20	5-5	5-3
	3 – 2 × 10	10-11	9-5	8-5	7-8	7-3	6-8	6-3
3 – 2 × 12	12-8	10-11	9-9	8-11	8-3	7-9	7-3	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor.

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5.

j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).

TABLE R507.5(4)
MAXIMUM DECK BEAM SPAN—70 PSF GROUND SNOW LOAD^c

BEAM SPECIES ^d	BEAM SIZE ^e	EFFECTIVE DECK JOIST SPAN LENGTH (feet) ^{a, i, j}						
		6	8	10	12	14	16	18
		MAXIMUM DECK BEAM SPAN LENGTH (feet-inches) ^{a, b, f}						
Southern pine	1 – 2 × 6	3-11	3-4	3-0	2-9	2-6	2-4	2-3
	1 – 2 × 8	4-11	4-3	3-10	3-6	3-3	3-0	2-10
	1 – 2 × 10	5-10	5-1	4-6	4-2	3-10	3-7	3-4
	1 – 2 × 12	6-11	6-0	5-4	4-11	4-6	4-3	4-0
	2 – 2 × 6	5-9	5-0	4-6	4-1	3-9	3-6	3-4
	2 – 2 × 8	7-4	6-4	5-8	5-2	4-10	4-6	4-3
	2 – 2 × 10	8-9	7-7	6-9	6-2	5-8	5-4	5-0
	2 – 2 × 12	10-3	8-11	8-0	7-3	6-9	6-3	5-11
	3 – 2 × 6	7-0	6-3	5-7	5-1	4-9	4-5	4-2
	3 – 2 × 8	9-3	8-0	7-2	6-6	6-0	5-8	5-4
	3 – 2 × 10	10-11	9-6	8-6	7-9	7-2	6-8	6-4
3 – 2 × 12	12-11	11-2	10-0	9-1	8-5	7-11	7-5	
Douglas fir-larch ^g Hem-fir ^g Spruce-pine-fir ^g	1 – 2 × 6	3-5	2-10	2-5	2-2	2-0	1-10	1-9
	1 – 2 × 8	4-7	3-8	3-2	2-10	2-7	2-5	2-4
	1 – 2 × 10	5-8	4-9	4-1	3-8	3-4	3-1	2-11
	1 – 2 × 12	6-7	5-8	5-0	4-6	4-1	3-10	3-7
	2 – 2 × 6	5-2	4-6	4-0	3-5	3-1	2-10	2-7
	2 – 2 × 8	6-11	6-0	5-3	4-7	4-1	3-8	3-5
	2 – 2 × 10	8-5	7-4	6-6	5-10	5-2	4-9	4-5
	2 – 2 × 12	9-10	8-6	7-7	6-11	6-4	5-9	5-4
	3 – 2 × 6	6-6	5-7	5-0	4-7	4-2	3-9	3-5
	3 – 2 × 8	8-8	7-6	6-8	6-1	5-6	5-0	4-7
	3 – 2 × 10	10-7	9-2	8-2	7-6	6-11	6-4	5-10
3 – 2 × 12	12-4	10-8	9-7	8-9	8-1	7-7	7-1	
Redwood ^h Western cedars ^h Ponderosa pine ^h Red pine ^h	1 – 2 × 6	3-6	2-11	2-6	2-3	2-0	1-11	1-9
	1 – 2 × 8	4-6	3-10	3-3	2-11	2-8	2-6	2-4
	1 – 2 × 10	5-6	4-9	4-2	3-9	3-5	3-2	3-0
	1 – 2 × 12	6-4	5-6	4-11	4-6	4-2	3-11	3-8
	2 – 2 × 6	5-3	4-7	4-1	3-6	3-2	2-11	2-8
	2 – 2 × 8	6-8	5-9	5-2	4-8	4-2	3-10	3-6
	2 – 2 × 10	8-2	7-1	6-4	5-9	5-4	4-10	4-6
	2 – 2 × 12	9-5	8-2	7-4	6-8	6-2	5-9	5-5
	3 – 2 × 6	6-4	5-8	5-1	4-8	4-3	3-10	3-6
	3 – 2 × 8	8-4	7-3	6-5	5-11	5-5	5-1	4-8
	3 – 2 × 10	10-2	8-10	7-11	7-2	6-8	6-3	5-11
3 – 2 × 12	11-10	10-3	9-2	8-4	7-9	7-3	6-10	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

a. Interpolation allowed. Extrapolation is not allowed.

b. Beams supporting a single span of joists with or without cantilever.

c. Dead load = 10 psf, $L/\Delta = 360$ at main span, $L/\Delta = 180$ at cantilever. Snow load not assumed to be concurrent with live load.

d. No. 2 grade, wet service factor included.

e. Beam depth shall be equal to or greater than the depth of intersecting joist for a flush beam connection.

f. Beam cantilevers are limited to the adjacent beam's span divided by 4.

g. Includes incising factor.

h. Incising factor not included.

i. Deck joist span as shown in Figure R507.5.

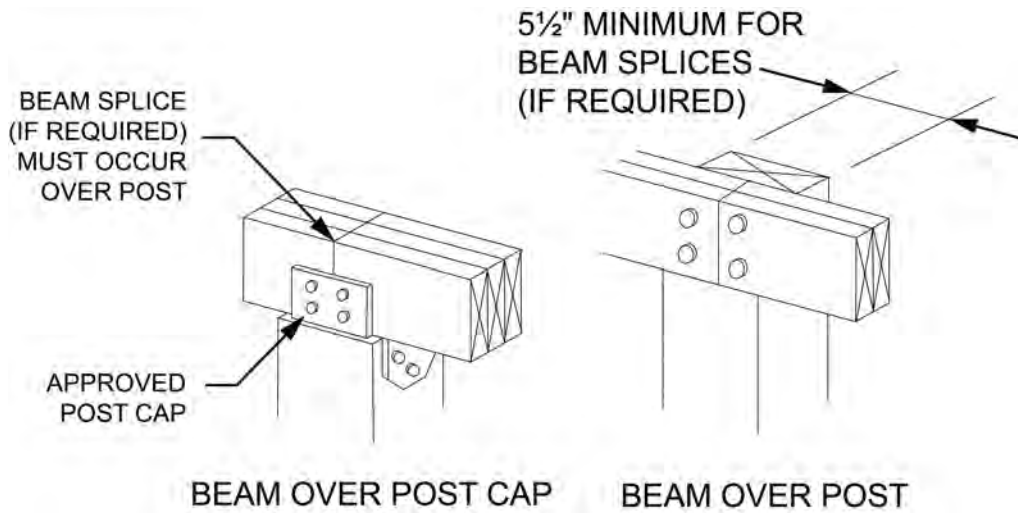
j. For calculation of effective deck joist span, the actual joist span length shall be multiplied by the joist span factor in accordance with Table R507.5(5).

TABLE R507.5(5)
JOIST SPAN FACTORS FOR CALCULATING EFFECTIVE DECK JOIST SPAN
 [for use with Note j in Tables R507.5(1), R507.5(2), R507.5(3) and R507.5(4)]

C/J ^a	JOIST SPAN FACTOR
0 (no cantilever)	0.66
1/12 (0.87)	0.72
1/10 (0.10)	0.80
1/8 (0.125)	0.84
1/6 (0.167)	0.90
1/4 (0.250)	1.00

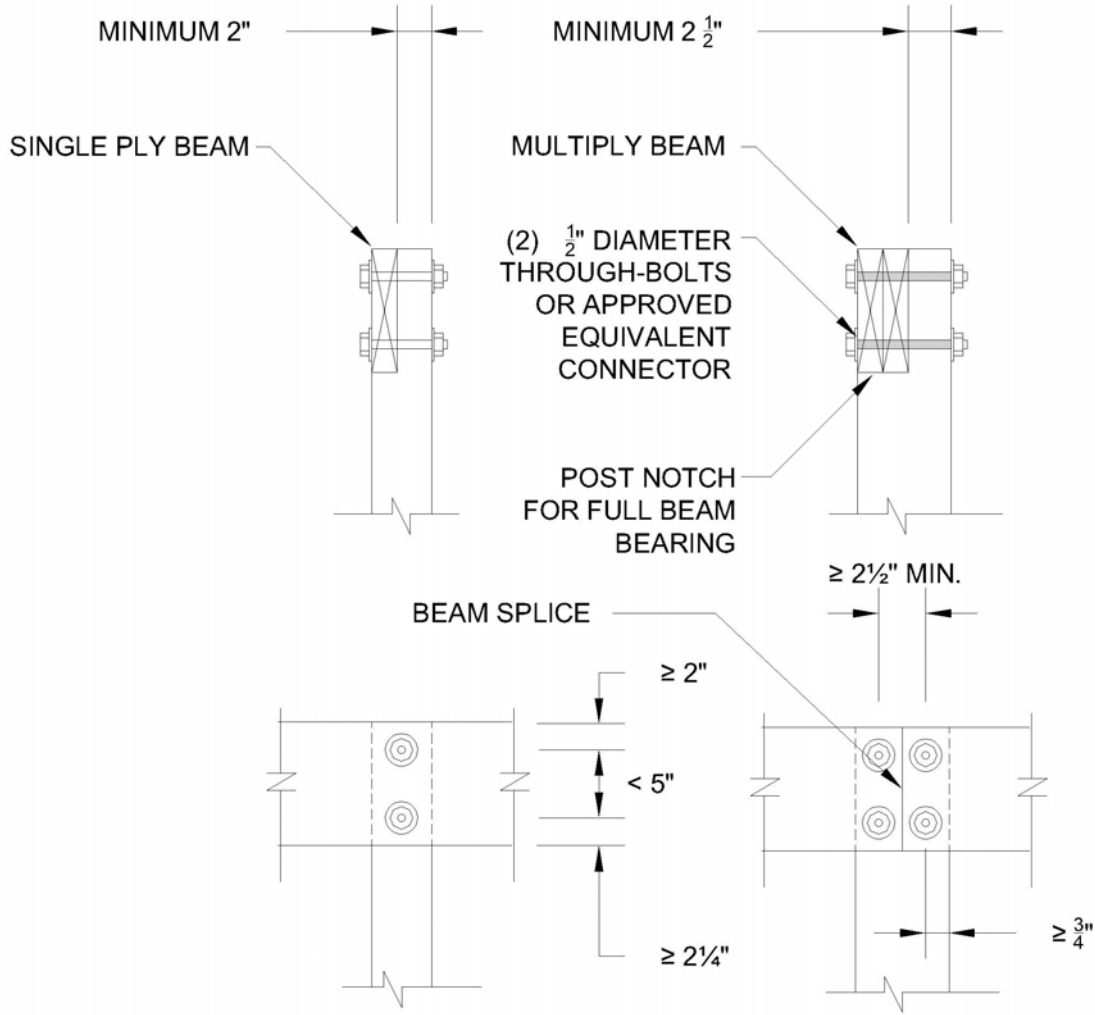
For SI: 1 foot = 304.8 mm.

a. C = actual joist cantilever length (feet); J = actual joist span length (feet).



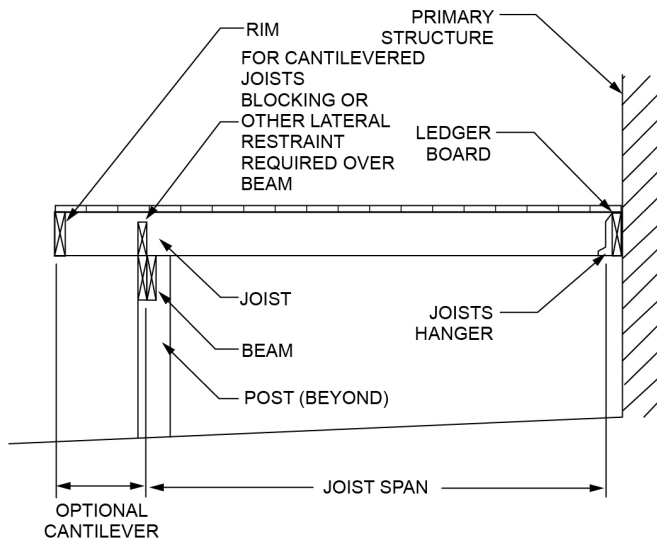
For SI: 1 inch = 25.4 mm.

FIGURE R507.5.1(1)
DECK BEAM TO DECK POST

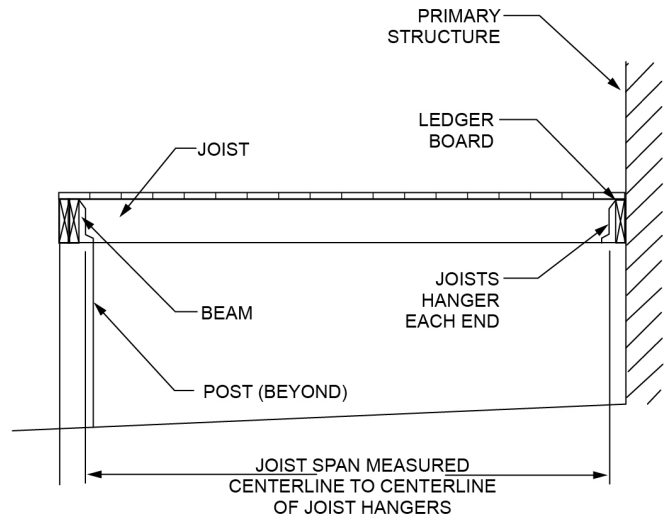


For SI: 1 inch = 25.4 mm.

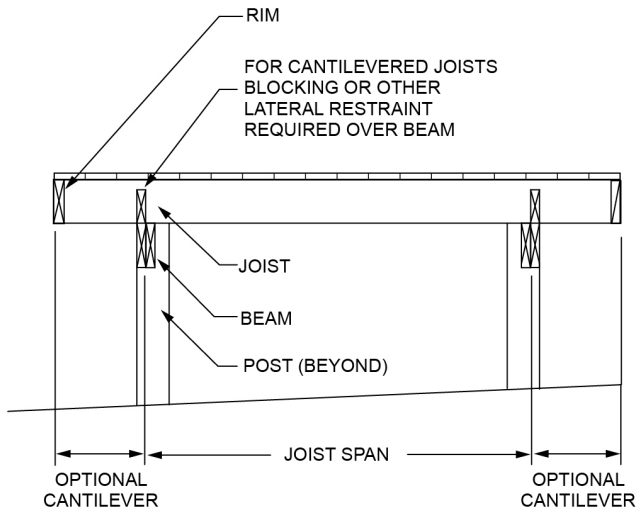
FIGURE R507.5.1(2)
NOTCHED POST-TO-BEAM CONNECTION



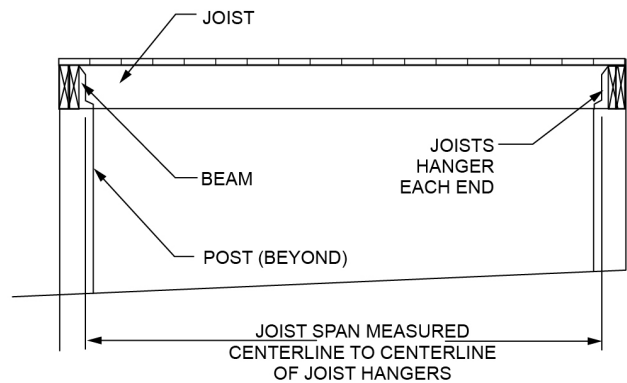
CANTILEVERED JOISTS WITH DROPPED BEAM



JOISTS WITH FLUSH BEAM



JOISTS ON FREE-STANDING DECK WITH DROPPED BEAM



JOISTS ON FREE-STANDING DECK WITH FLUSH BEAM

**FIGURE R507.6
TYPICAL DECK JOIST SPANS**

**TABLE R507.6
MAXIMUM DECK JOIST SPANS**

LOAD ^a (psf)	JOIST SPECIES ^b	JOIST SIZE	ALLOWABLE JOIST SPAN ^{b, c} (feet-inches)			MAXIMUM CANTILEVER ^{d, f} (feet-inches)							
			Joist spacing (inches)			Joist back span ^g (feet)							
			12	16	24	4	6	8	10	12	14	16	18
40 live load	Southern pine	2 × 6	9-11	9-0	7-7	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	13-1	11-10	9-8	1-0	1-6	2-0	2-6	2-3	NP	NP	NP
		2 × 10	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-4	3-4	NP
		2 × 12	18-0	16-6	13-6	1-0	1-6	2-0	2-6	3-0	3-6	4-0	4-1
	Douglas fir-larch ^e Hem-fir ^e Spruce-pine-fir ^e	2 × 6	9-6	8-4	6-10	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	12-6	11-1	9-1	1-0	1-6	2-0	2-3	2-0	NP	NP	NP
		2 × 10	15-8	13-7	11-1	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
		2 × 12	18-0	15-9	12-10	1-0	1-6	2-0	2-6	3-0	3-6	3-11	3-11
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	2 × 6	8-10	8-0	6-10	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2 × 8	11-8	10-7	8-8	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	14-11	13-0	10-7	1-0	1-6	2-0	2-6	3-0	2-9	NP	NP
		2 × 12	17-5	15-1	12-4	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
50 ground snow load	Southern pine	2 × 6	9-2	8-4	7-4	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	12-1	11-0	9-5	1-0	1-6	2-0	2-5	2-3	NP	NP	NP
		2 × 10	15-5	13-9	11-3	1-0	1-6	2-0	2-6	3-0	3-1	NP	NP
		2 × 12	18-0	16-2	13-2	1-0	1-6	2-0	2-6	3-0	3-6	3-10	3-10
	Douglas fir-larch ^e Hem-fir ^e Spruce-pine-fir ^e	2 × 6	8-10	8-0	6-8	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	11-7	10-7	8-11	1-0	1-6	2-0	2-3	NP	NP	NP	NP
		2 × 10	14-10	13-3	10-10	1-0	1-6	2-0	2-6	3-0	3-0	NP	NP
		2 × 12	17-9	15-5	12-7	1-0	1-6	2-0	2-6	3-0	3-6	3-8	NP
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	2 × 6	8-3	7-6	6-6	1-0	1-4	1-1	NP	NP	NP	NP	NP
		2 × 8	10-10	9-10	8-6	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	13-10	12-7	10-5	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2 × 12	16-10	14-9	12-1	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
60 ground snow load	Southern pine	2 × 6	8-8	7-10	6-10	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	11-5	10-4	8-9	1-0	1-6	2-0	2-4	NP	NP	NP	NP
		2 × 10	14-7	12-9	10-5	1-0	1-6	2-0	2-6	2-11	2-11	NP	NP
		2 × 12	17-3	15-0	12-3	1-0	1-6	2-0	2-6	3-0	3-6	3-7	NP
	Douglas fir-larch ^e Hem-fir ^e Spruce-pine-fir ^e	2 × 6	8-4	7-6	6-2	1-0	1-6	1-4	NP	NP	NP	NP	NP
		2 × 8	10-11	9-11	8-3	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2 × 10	13-11	12-4	10-0	1-0	1-6	2-0	2-6	2-10	NP	NP	NP
		2 × 12	16-6	14-3	11-8	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	2 × 6	7-9	7-0	6-2	1-0	1-4	NP	NP	NP	NP	NP	NP
		2 × 8	10-2	9-3	7-11	1-0	1-6	2-0	1-11	NP	NP	NP	NP
		2 × 10	13-0	11-9	9-7	1-0	1-6	2-0	2-6	2-7	NP	NP	NP
		2 × 12	15-9	13-8	11-2	1-0	1-6	2-0	2-6	3-0	3-2	NP	NP

(continued)

FLOORS

**TABLE R507.6—continued
MAXIMUM DECK JOIST SPANS**

LOAD ^a (psf)	JOIST SPECIES ^b	JOIST SIZE	ALLOWABLE JOIST SPAN ^{b, c} (feet-inches)			MAXIMUM CANTILEVER ^{d, f} (feet-inches)							
			Joist spacing (inches)			Joist back span ^g (feet)							
			12	16	24	4	6	8	10	12	14	16	18
70 ground snow load	Southern pine	2 × 6	8-3	7-6	6-5	1-0	1-6	1-5	NP	NP	NP	NP	NP
		2 × 8	10-10	9-10	8-2	1-0	1-6	2-0	2-2	NP	NP	NP	NP
		2 × 10	13-9	11-11	9-9	1-0	1-6	2-0	2-6	2-9	NP	NP	NP
		2 × 12	16-2	14-0	11-5	1-0	1-6	2-0	2-6	3-0	3-5	3-5	NP
	Douglas fir-larch ^c Hem-fir ^e Spruce-pine-fir ^e	2 × 6	7-11	7-1	5-9	1-0	1-6	NP	NP	NP	NP	NP	NP
		2 × 8	10-5	9-5	7-8	1-0	1-6	2-0	2-1	NP	NP	NP	NP
		2 × 10	13-3	11-6	9-5	1-0	1-6	2-0	2-6	2-8	NP	NP	NP
	Redwood ^f Western cedars ^f Ponderosa pine ^f Red pine ^f	2 × 12	15-5	13-4	10-11	1-0	1-6	2-0	2-6	3-0	3-3	NP	NP
		2 × 6	7-4	6-8	5-10	1-0	1-4	NP	NP	NP	NP	NP	NP
		2 × 8	9-8	8-10	7-4	1-0	1-6	1-11	NP	NP	NP	NP	NP
		2 × 10	12-4	11-0	9-0	1-0	1-6	2-0	2-6	2-6	NP	NP	NP
			2 × 12	14-9	12-9	10-5	1-0	1-6	2-0	2-6	3-0	3-0	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound = 0.454 kg.

NP = Not Permitted.

- a. Dead load = 10 psf. Snow load not assumed to be concurrent with live load.
- b. No. 2 grade, wet service factor included.
- c. $L/\Delta = 360$ at main span.
- d. $L/\Delta = 180$ at cantilever with a 220-pound point load applied to end.
- e. Includes incising factor.
- f. Incising factor not included.
- g. Interpolation allowed. Extrapolation is not allowed.

**TABLE R507.7
MAXIMUM JOIST SPACING FOR WOOD DECKING**

DECKING MATERIAL TYPE AND NOMINAL SIZE	DECKING PERPENDICULAR TO JOIST		DECKING DIAGONAL TO JOIST ^a	
	Single span ^c	Multiple span ^c	Single span ^c	Multiple span ^c
	Maximum on-center joist spacing (inches)			
1 1/4-inch-thick wood ^b	12	16	8	12
2-inch-thick wood	24	24	18	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.01745 rad.

- a. Maximum angle of 45 degrees from perpendicular for wood deck boards.
- b. Other maximum span provided by an accredited lumber grading or inspection agency also allowed.
- c. Individual wood deck boards supported by two joists shall be considered single span and three or more joists shall be considered multiple span.

**TABLE R507.9.1.3(1)
DECK LEDGER CONNECTION TO BAND JOIST**

LOAD ^c (psf)	JOIST SPAN ^a (feet)	ON-CENTER SPACING OF FASTENERS ^b (inches)		
		1/2-inch diameter lag screw with 1/2-inch maximum sheathing ^{d,e}	1/2-inch diameter bolt with 1/2-inch maximum sheathing ^e	1/2-inch diameter bolt with 1-inch maximum sheathing ^f
40 live load	6	30	36	36
	8	23	36	36
	10	18	34	29
	12	15	29	24
	14	13	24	21
	16	11	21	18
	18	10	19	16
50 ground snow load	6	29	36	36
	8	22	36	35
	10	17	33	28
	12	14	27	23
	14	12	23	20
	16	11	20	17
	18	9	18	15
60 ground snow load	6	25	36	36
	8	18	35	30
	10	15	28	24
	12	12	23	20
	14	10	20	17
	16	9	17	15
	18	8	15	13
70 ground snow load	6	22	36	35
	8	16	31	26
	10	13	25	21
	12	11	20	17
	14	9	17	15
	16	8	15	13
	18	7	13	11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

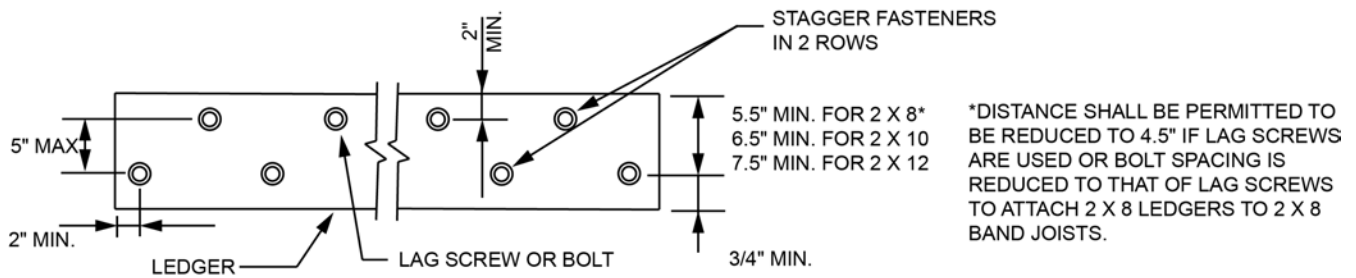
- a. Interpolation permitted. Extrapolation is not permitted.
- b. Ledgers shall be flashed in accordance with Section R703.4 to prevent water from contacting the house band joist.
- c. Dead Load = 10 psf. Snow load shall not be assumed to act concurrently with live load.
- d. The tip of the lag screw shall fully extend beyond the inside face of the band joist.
- e. Sheathing shall be wood structural panel or solid sawn lumber.
- f. Sheathing shall be permitted to be wood structural panel, gypsum board, fiberboard, lumber or foam sheathing. Up to 1/2-inch thickness of stacked washers shall be permitted to substitute for up to 1/2 inch of allowable sheathing thickness where combined with wood structural panel or lumber sheathing.

TABLE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN DECK LEDGERS AND BAND JOISTS

MINIMUM END AND EDGE DISTANCES AND SPACING BETWEEN ROWS				
	TOP EDGE	BOTTOM EDGE	ENDS	ROW SPACING
Ledger ^a	2 inches ^d	³ / ₄ inch	2 inches ^b	1 ⁵ / ₈ inches ^b
Band Joist ^c	³ / ₄ inch	2 inches	2 inches ^b	1 ⁵ / ₈ inches ^b

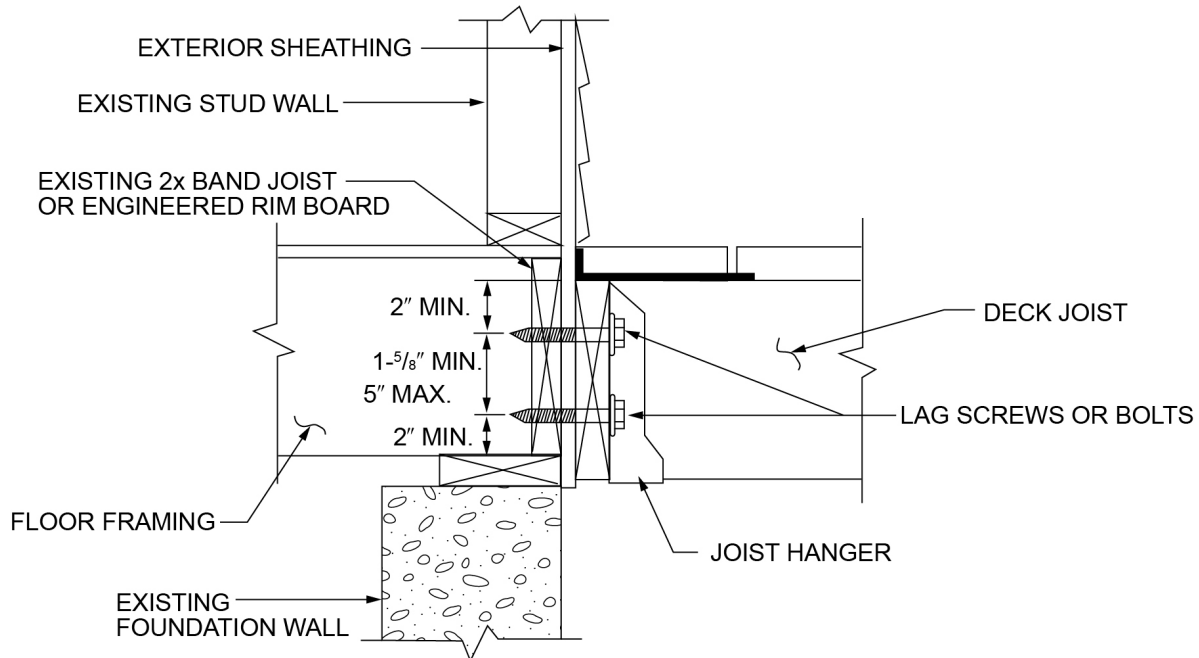
For SI: 1 inch = 25.4 mm.

- a. Lag screws or bolts shall be staggered from the top to the bottom along the horizontal run of the deck ledger in accordance with Figure R507.9.1.3(1).
- b. Maximum 5 inches.
- c. For engineered rim joists, the manufacturer's recommendations shall govern.
- d. The minimum distance from bottom row of lag screws or bolts to the top edge of the ledger shall be in accordance with Figure R507.9.1.3(1).



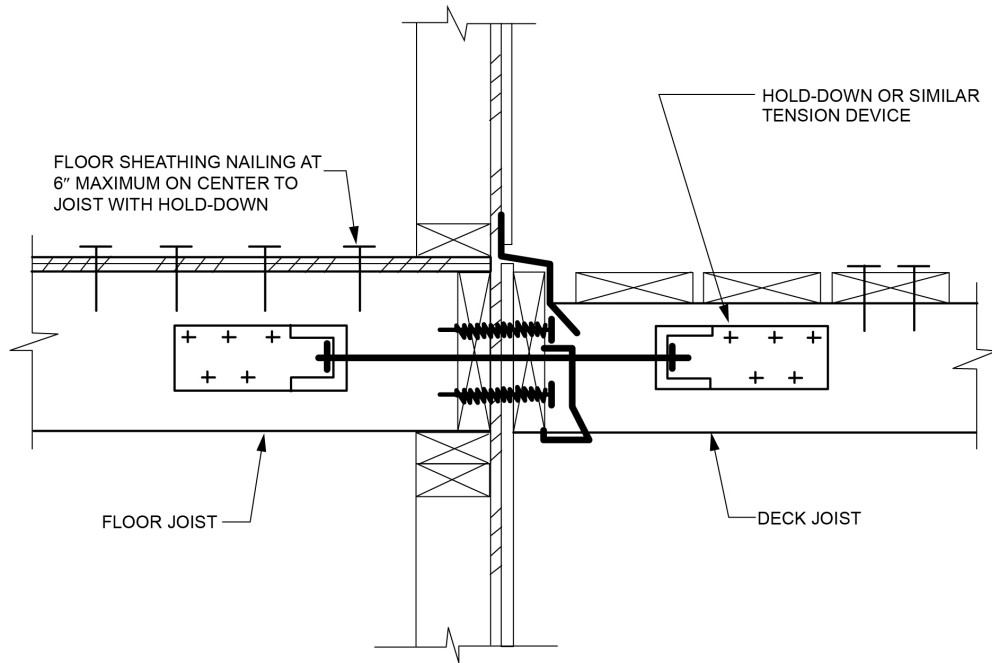
For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(1)
PLACEMENT OF LAG SCREWS AND BOLTS IN LEDGERS



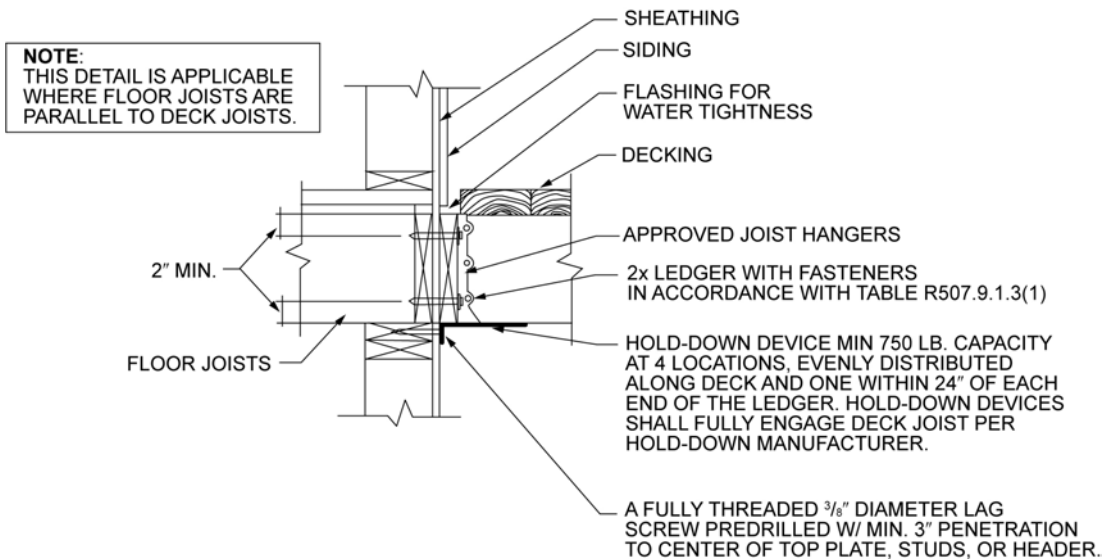
For SI: 1 inch = 25.4 mm.

FIGURE R507.9.1.3(2)
PLACEMENT OF LAG SCREWS AND BOLTS IN BAND JOISTS



For SI: 1 inch = 25.4 mm.

FIGURE R507.9.2(1)
DECK ATTACHMENT FOR LATERAL LOADS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R507.9.2(2)
DECK ATTACHMENT FOR LATERAL LOADS

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 6 – WALL CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
R602.1.1				X																		
<i>R602.3.4.1</i>				X																		
R606.1.1				X																		
R608.1				X																		
R610.1				X																		
R610.4 <i>Note</i>				X	X																	

The state agency does not adopt sections identified with the following symbol: †

CHAPTER 6

WALL CONSTRUCTION

User note:

About this chapter: Chapter 6 contains prescriptive provisions for the design and construction of walls. The wall construction covered in Chapter 6 consists of five different types: wood framed, cold-formed steel framed, masonry, concrete and structural insulated panel (SIP). The primary concern of this chapter is the structural integrity of wall construction and transfer of all imposed loads to the supporting structure.

SECTION R601 GENERAL

R601.1 Application. The provisions of this chapter shall control the design and construction of walls and partitions for buildings.

R601.2 Requirements. Wall construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

R601.2.1 Compressible floor-covering materials. Compressible floor-covering materials that compress more than $\frac{1}{32}$ inch (0.8 mm) when subjected to 50 pounds (23 kg) applied over 1 inch square (645 mm) of material and are greater than $\frac{1}{8}$ inch (3.2 mm) in thickness in the uncompressed state shall not extend beneath walls, partitions or columns, which are fastened to the floor.

SECTION R602 WOOD WALL FRAMING

R602.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R602.1.1 Sawn lumber. Sawn lumber shall be identified by a grade *mark* of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade *mark*, a certification of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

Note: See Section R301.1.1.1 for limited-density owner-built rural dwellings.

R602.1.2 End-jointed lumber. Approved end-jointed lumber identified by a grade mark conforming to Section R602.1 shall be permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a fire-resistance rating shall have the designation “Heat Resistant Adhesive” or “HRA” included in its grade mark.

R602.1.3 Structural glued-laminated timbers. Glued-laminated timbers shall be manufactured and identified as required in ANSI A190.1, ANSI 117 and ASTM D3737.

R602.1.4 Structural log members. Structural log members shall comply with the provisions of ICC 400.

R602.1.5 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

R602.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R602.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with either ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

R602.1.8 Wood structural panels. Wood structural panel sheathing shall conform to DOC PS 1, DOC PS 2 or, when manufactured in Canada, CSA O325 or CSA O437. Panels shall be identified for grade, bond classification, and performance category by a grade mark or certificate of inspection issued by an approved agency.

R602.1.9 Particleboard. Particleboard shall conform to ANSI A208.1. Particleboard shall be identified by the grade mark or certificate of inspection issued by an approved agency.

R602.1.10 Fiberboard. Fiberboard shall conform to ASTM C208. Fiberboard sheathing, where used structurally, shall be identified by an approved agency as conforming to ASTM C208.

R602.1.11 Structural insulated panels. Structural insulated panels shall be manufactured and identified in accordance with ANSI/APA PRS 610.1.

R602.2 Grade. Studs shall be a minimum No. 3, standard or stud grade lumber.

Exception: Bearing studs not supporting floors and nonbearing studs shall be permitted to be utility grade lumber, provided that the studs are spaced in accordance with Table R602.3(5).

R602.3 Design and construction. Exterior walls of wood-frame construction shall be designed and constructed in accordance with the provisions of this chapter and Figures R602.3(1) and R602.3(2), or in accordance with AWC NDS. Components of exterior walls shall be fastened in accordance with Tables R602.3(1) through R602.3(4). Wall sheathing

WALL CONSTRUCTION

shall be fastened directly to framing members and, where placed on the exterior side of an exterior wall, shall be capable of resisting the wind pressures listed in Table R301.2.1(1) adjusted for height and exposure using Table R301.2.1(2) and shall conform to the requirements of Table R602.3(3). Wall sheathing used only for exterior wall covering purposes shall comply with Section R703.

Studs shall be continuous from support at the sole plate to a support at the top plate to resist loads perpendicular to the wall. The support shall be a foundation or floor, ceiling or roof diaphragm or shall be designed in accordance with accepted engineering practice.

Exception: Jack studs, trimmer studs and cripple studs at openings in walls that comply with Tables R602.7(1) and R602.7(2).

R602.3.1 Stud size, height and spacing. The size, height and spacing of studs shall be in accordance with Table R602.3(5).

Exceptions:

1. Utility grade studs shall not be spaced more than 16 inches (406 mm) on center, shall not support more than a roof and ceiling, and shall not exceed 8 feet (2438 mm) in height for exterior walls and load-bearing walls or 10 feet (3048 mm) for interior nonload-bearing walls.
2. Where ground snow loads are less than or equal to 25 pounds per square foot (1.2 kPa), and the ultimate design wind speed is less than or equal to 130 mph (58.1 m/s), 2-inch by 6-inch (38 mm by 140 mm) studs supporting a roof load with not more than 6 feet (1829 mm) of tributary length shall have a maximum height of 18 feet (5486 mm) where spaced at 16 inches (406 mm) on center, or 20 feet (6096 mm) where spaced at 12 inches (305 mm) on center. Studs shall be No. 2 grade lumber or better.
3. Exterior load-bearing studs not exceeding 12 feet (3658 mm) in height provided in accordance with Table R602.3(6). The minimum number of full-height studs adjacent to openings shall be in accordance with Section R602.7.5. The building shall be located in Exposure B, the roof live load shall not exceed 20 psf (0.96 kPa), and the ground snow load shall not exceed 30 psf (1.4 kPa). Studs and plates shall be No. 2 grade lumber or better.

R602.3.2 Top plate. Wood stud walls shall be capped with a double top plate installed to provide overlapping at corners and intersections with bearing partitions. End joints in top plates shall be offset not less than 24 inches (610 mm). Joints in plates need not occur over studs. Plates shall be not less than 2-inches (51 mm) nominal thickness and have a width not less than the width of the studs.

Exception: A single top plate used as an alternative to a double top plate shall comply with the following:

1. The single top plate shall be tied at corners, intersecting walls, and at in-line splices in straight wall lines in accordance with Table R602.3.2.

2. The rafters or joists shall be centered over the studs with a tolerance of not more than 1 inch (25 mm).
3. Omission of the top plate is permitted over headers where the headers are adequately tied to adjacent wall sections in accordance with Table R602.3.2.

R602.3.3 Bearing studs. Where joists, trusses or rafters are spaced more than 16 inches (406 mm) on center and the bearing studs below are spaced 24 inches (610 mm) on center, such members shall bear within 5 inches (127 mm) of the studs beneath.

Exceptions:

1. The top plates are two 2-inch by 6-inch (38 mm by 140 mm) or two 3-inch by 4-inch (64 mm by 89 mm) members.
2. A third top plate is installed.
3. Solid blocking equal in size to the studs is installed to reinforce the double top plate.

R602.3.4 Bottom (sole) plate. Studs shall have full bearing on a nominal 2-by (51 mm) or larger plate or sill having a width not less than to the width of the studs.

R602.3.4.1 Rodent proofing. *Annular spaces around pipes, electric cables, conduits or other openings in bottom/sole plates at exterior walls shall be protected against the passage of rodents by closing such openings in accordance with the California Green Building Standards Code, Chapter 4, Division 4.4.*

R602.3.5 Braced wall panel uplift load path. Braced wall panels located at exterior walls that support roof rafters or trusses (including stories below top story) shall have the framing members connected in accordance with one of the following:

1. Fastening in accordance with Table R602.3(1) where:
 - 1.1. The ultimate design wind speed does not exceed 115 mph (51 m/s), the wind exposure category is B, the roof pitch is 5:12 or greater, and the roof span is 32 feet (9754 mm) or less.
 - 1.2. The net uplift value at the top of a wall does not exceed 100 plf (146 N/mm). The net uplift value shall be determined in accordance with Section R802.11 and shall be permitted to be reduced by 60 plf (86 N/mm) for each full wall above.
2. Where the net uplift value at the top of a wall exceeds 100 plf (146 N/mm), installing approved uplift framing connectors to provide a continuous load path from the top of the wall to the foundation or to a point where the uplift force is 100 plf (146 N/mm) or less. The net uplift value shall be as determined in Item 1.2.
3. Wall sheathing and fasteners designed to resist combined uplift and shear forces in accordance with accepted engineering practice.

**TABLE R602.3(1)
FASTENING SCHEDULE**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
Roof			
1	Blocking between ceiling joists, rafters or trusses to top plate or other framing below	4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	Toe nail
	Blocking between rafters or truss not at the wall top plates, to rafter or truss	2-8d common (2½" × 0.131"); or 2-3" × 0.131" nails	Each end toe nail
		2-16d common (3½" × 0.162"); or 3-3" × 0.131" nails	End nail
	Flat blocking to truss and web filler	16d common (3½" × 0.162"); or 3" × 0.131" nails	6" o.c. face nail
2	Ceiling joists to top plate	4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	Per joist, toe nail
3	Ceiling joist not attached to parallel rafter, laps over partitions [see Section R802.5.2 and Table R802.5.2(1)]	4-10d box (3" × 0.128"); or 3-16d common (3½" × 0.162"); or 4-3" × 0.131" nails	Face nail
4	Ceiling joist attached to parallel rafter (heel joint) [see Section R802.5.2 and Table R802.5.2(1)]	Table R802.5.2(1)	Face nail
5	Collar tie to rafter, face nail	4-10d box (3" × 0.128"); or 3-10d common (3" × 0.148"); or 4-3" × 0.131" nails	Face nail each rafter
6	Rafter or roof truss to plate	3-16d box (3½" × 0.135"); or 3-10d common (3" × 0.148"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	2 toe nails on one side and 1 toe nail on opposite side of each rafter or truss ⁱ
7	Roof rafters to ridge, valley or hip rafters or roof rafter to minimum 2" ridge beam	4-16d box (3½" × 0.135"); or 3-10d common (3" × 0.148"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	Toe nail
		3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	End nail
Wall			
8	Stud to stud (not at braced wall panels)	16d common (3½" × 0.162")	24" o.c. face nail
		10d box (3" × 0.128"); or 3" × 0.131" nails	16" o.c. face nail
9	Stud to stud and abutting studs at intersecting wall corners (at braced wall panels)	16d box (3½" × 0.135"); or 3" × 0.131" nails	12" o.c. face nail
		16d common (3½" × 0.162")	16" o.c. face nail
10	Built-up header (2" to 2" header with ½" spacer)	16d common (3½" × 0.162")	16" o.c. each edge face nail
		16d box (3½" × 0.135")	12" o.c. each edge face nail
11	Continuous header to stud	5-8d box (2½" × 0.113"); or 4-8d common (2½" × 0.131"); or 4-10d box (3" × 0.128")	Toe nail

(continued)

WALL CONSTRUCTION

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION
Wall			
12	Adjacent full-height stud to end of header	4-16d box (3½" × 0.135"); or 3-16d common (3½" × 0.162"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	End nail
13	Top plate to top plate	16d common (3½" × 0.162")	16" o.c. face nail
		10d box (3" × 0.128"); or 3" × 0.131" nails	12" o.c. face nail
14	Double top plate splice	8-16d common (3½" × 0.162"); or 12-16d box (3½" × 0.135"); or 12-10d box (3" × 0.128"); or 12-3" × 0.131" nails	Face nail on each side of end joint (minimum 24" lap splice length each side of end joint)
15	Bottom plate to joist, rim joist, band joist or blocking (not at braced wall panels)	16d common (3½" × 0.162")	16" o.c. face nail
		16d box (3½" × 0.135"); or 3" × 0.131" nails	12" o.c. face nail
Roof			
16	Bottom plate to joist, rim joist, band joist or blocking (at braced wall panel)	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162"); or 4-3" × 0.131" nails	16" o.c. face nail
17	Top or bottom plate to stud	4-8d box (2½" × 0.113"); or 3-16d box (3½" × 0.135"); or 4-8d common (2½" × 0.131"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	Toe nail
		3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	End nail
18	Top plates, laps at corners and intersections	3-10d box (3" × 0.128"); or 2-16d common (3½" × 0.162"); or 3-3" × 0.131" nails	Face nail
19	1" brace to each stud and plate	3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 2-10d box (3" × 0.128"); or 2 staples 1¾"	Face nail
20	1" × 6" sheathing to each bearing	3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 2-10d box (3" × 0.128"); or 2 staples, 1" crown, 16 ga., 1¾" long	Face nail
21	1" × 8" and wider sheathing to each bearing	3-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3 staples, 1" crown, 16 ga., 1¾" long	Face nail
		Wider than 1" × 8" 4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 4 staples, 1" crown, 16 ga., 1¾" long	

(continued)

**TABLE R602.3(1)—continued
FASTENING SCHEDULE**

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION	
Floor				
22	Joist to sill, top plate or girder	4-8d box (2½" × 0.113"); or 3-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	Toe nail	
23	Rim joist, band joist or blocking to sill or top plate (roof applications also)	8d box (2½" × 0.113") 8d common (2½" × 0.131"); or 10d box (3" × 0.128"); or 3" × 0.131" nails	4" o.c. toe nail 6" o.c. toe nail	
24	1" × 6" subfloor or less to each joist	3-8d box (2½" × 0.113"); or 2-8d common (2½" × 0.131"); or 3-10d box (3" × 0.128"); or 2 staples, 1" crown, 16 ga., 1¾" long	Face nail	
25	2" subfloor to joist or girder	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	Blind and face nail	
26	2" planks (plank & beam—floor & roof)	3-16d box (3½" × 0.135"); or 2-16d common (3½" × 0.162")	At each bearing, face nail	
27	Band or rim joist to joist	3-16d common (3½" × 0.162"); or 4-10 box (3" × 0.128"); or 4-3" × 0.131" nails; or 4-3" × 14 ga. staples, 7/16" crown	End nail	
28	Built-up girders and beams, 2-inch lumber layers	20d common (4" × 0.192"); or	Nail each layer as follows: 32" o.c. at top and bottom and staggered.	
		10d box (3" × 0.128"); or 3" × 0.131" nails	24" o.c. face nail at top and bottom staggered on opposite sides	
		And: 2-20d common (4" × 0.192"); or 3-10d box (3" × 0.128"); or 3-3" × 0.131" nails	Face nail at ends and at each splice	
29	Ledger strip supporting joists or rafters	4-16d box (3½" × 0.135"); or 3-16d common (3½" × 0.162"); or 4-10d box (3" × 0.128"); or 4-3" × 0.131" nails	At each joist or rafter, face nail	
30	Bridging or blocking to joist, rafter or truss	2-10d box (3" × 0.128"); or 2-8d common (2½" × 0.131"); or 2-3" × 0.131" nails	Each end, toe nail	
ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING OF FASTENERS	
			Edges ^b (inches)	Intermediate supports ^{c, e} (inches)
Wood structural panels, subfloor, roof and interior wall sheathing to framing and particleboard wall sheathing to framing [see Table R602.3(3) for wood structural panel exterior wall sheathing to wall framing]				
31	3/8" - 1/2"	6d common or deformed (2" × 0.113" × 0.266" head); or 2 ³ / ₈ " × 0.113" × 0.266" head nail (subfloor, wall) ⁱ	6	6 ^f
		8d common (2½" × 0.131") nail (roof); or RSRS-01 (2 ³ / ₈ " × 0.113") nail (roof) ^b	6	6 ^f
32	19/32" - 3/4"	8d common (2-2½" × 0.131") nail (subfloor, wall)	6	12
		8d common (2½" × 0.131") nail (roof); or RSRS-01; (2 ³ / ₈ " × 0.113") nail (roof) ^b	6	6 ^f
		Deformed 2 ³ / ₈ " × 0.113" × 0.266" head (wall or subfloor)	6	12
33	7/8" - 1¼"	10d common (3" × 0.148") nail; or (2½" × 0.131" × 0.281" head) deformed nail	6	12

(continued)

WALL CONSTRUCTION

TABLE R602.3(1)—continued
FASTENING SCHEDULE

ITEM	DESCRIPTION OF BUILDING ELEMENTS	NUMBER AND TYPE OF FASTENER ^{a, b, c}	SPACING AND LOCATION	
Other wall sheathing^g				
34	1/2" structural cellulosic fiberboard sheathing	1 1/2" x 0.120" galvanized roofing nail, 7/16" head diameter; or 1 1/4" long 16 ga. staple with 7/16" or 1" crown	3	6
35	25/32" structural cellulosic fiberboard sheathing	1 3/4" x 0.120" galvanized roofing nail, 7/16" head diameter; or 1 1/4" long 16 ga. staple with 7/16" or 1" crown	3	6
36	1/2" gypsum sheathing ^d	1 1/2" x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 1/4" long 16 ga.; staple galvanized, 1 1/2" long; 7/16" or 1" crown or 1 1/4" screws, Type W or S	7	7
37	5/8" gypsum sheathing ^d	1 3/4" x 0.120" galvanized roofing nail, 7/16" head diameter, or 1 1/4" long 16 ga.; staple galvanized, 1 1/2" long; 7/16" or 1" crown or 1 1/4" screws, Type W or S	7	7
Wood structural panels, combination subfloor underlayment to framing				
38	3/4" and less	Deformed (2" x 0.113") or Deformed (2" x 0.120") nail; or 8d common (2 1/2" x 0.131") nail	6	12
39	7/8" - 1"	8d common (2 1/2" x 0.131") nail; or Deformed (2" x 0.113"); or Deformed (2 1/2" x 0.120") nail	6	12
40	1 1/8" - 1 1/4"	10d common (3" x 0.148") nail; or Deformed (2" x 0.113"); or Deformed (2 1/2" x 0.120") nail	6	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s; 1 ksi = 6.895 MPa.

- a. Nails are smooth-common, box or deformed shanks except where otherwise stated. Nails used for framing and sheathing connections are carbon steel and shall have minimum average bending yield strengths as shown: 80 ksi for shank diameter of 0.192 inch (20d common nail), 90 ksi for shank diameters larger than 0.142 inch but not larger than 0.177 inch, and 100 ksi for shank diameters of 0.142 inch or less. Connections using nails and staples of other materials, such as stainless steel, shall be designed by accepted engineering practice or approved under Section R104.11.
- b. RSRS-01 is a Roof Sheathing Ring Shank nail meeting the specifications in ASTM F1667.
- c. Nails shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater.
- d. Four-foot by 8-foot or 4-foot by 9-foot panels shall be applied vertically.
- e. Spacing of fasteners not included in this table shall be based on Table R602.3(2).
- f. For wood structural panel roof sheathing attached to gable end roof framing and to intermediate supports within 48 inches of roof edges and ridges, nails shall be spaced at 4 inches on center where the ultimate design wind speed is greater than 130 mph in Exposure B or greater than 110 mph in Exposure C.
- g. Gypsum sheathing shall conform to ASTM C1396 and shall be installed in accordance with ASTM C1280 or GA 253. Fiberboard sheathing shall conform to ASTM C208.
- h. Spacing of fasteners on floor sheathing panel edges applies to panel edges supported by framing members and required blocking and at floor perimeters only. Spacing of fasteners on roof sheathing panel edges applies to panel edges supported by framing members and required blocking. Blocking of roof or floor sheathing panel edges perpendicular to the framing members need not be provided except as required by other provisions of this code. Floor perimeter shall be supported by framing members or solid blocking.
- i. Where a rafter is fastened to an adjacent parallel ceiling joist in accordance with this schedule, provide two toe nails on one side of the rafter and toe nails from the ceiling joist to top plate in accordance with this schedule. The toe nail on the opposite side of the rafter shall not be required.

**TABLE R602.3(2)
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)**

NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Intermediate supports (inches)
Wood structural panels subfloor, roof^g and wall sheathing to framing and particleboard wall sheathing to framing^f			
Up to 1/2	Staple 15 ga. 1 3/4	4	8
	0.097–0.099 Nail 2 1/4	3	6
	Staple 16 ga. 1 3/4	3	6
19/32 and 5/8	0.113 Nail 2	3	6
	Staple 15 and 16 ga. 2	4	8
	0.097–0.099 Nail 2 1/4	4	8
23/32 and 3/4	Staple 14 ga. 2	4	8
	Staple 15 ga. 1 3/4	3	6
	0.097–0.099 Nail 2 1/4	4	8
	Staple 16 ga. 2	4	8
1	Staple 14 ga. 2 1/4	4	8
	0.113 Nail 2 1/4	3	6
	Staple 15 ga. 2 1/4	4	8
	0.097–0.099 Nail 2 1/2	4	8
NOMINAL MATERIAL THICKNESS (inches)	DESCRIPTION ^{a, b} OF FASTENER AND LENGTH (inches)	SPACING ^c OF FASTENERS	
		Edges (inches)	Body of panel ^d (inches)
Floor underlayment; plywood-hardboard-particleboard^f-fiber-cement^h			
Fiber-cement			
1/4	1 1/4 long × 0.099" corrosion-resistant, ring shank nails (finished flooring other than tile)	3	6
	Staple 18 ga., 7/8 long, 1/4 crown (finished flooring other than tile)	3	6
	1 1/4 long × .121 shank × .375 head diameter corrosion-resistant (galvanized or stainless steel) roofing nails (for tile finish)	8	8
	1 1/4 long, No. 8 × .375 head diameter, ribbed wafer-head screws (for tile finish)	8	8
Plywood			
1/4 and 5/16	1 1/4 ring or screw shank nail-minimum 12 1/2 ga. (0.099") shank diameter	3	6
	Staple 18 ga., 7/8, 3/16 crown width	2	5
11/32, 3/8, 15/32 and 1/2	1 1/4 ring or screw shank nail-minimum 12 1/2 ga. (0.099") shank diameter	6	8 ^e
19/32, 5/8, 23/32 and 3/4	1 1/2 ring or screw shank nail-minimum 12 1/2 ga. (0.099") shank diameter	6	8
	Staple 16 ga. 1 1/2	6	8
Hardboard^f			
0.200	1 1/2 long × 0.080" ring-grooved shank underlayment nail	6	6
	1 3/8 long × 0.080" polymer cement-coated sinker nail	6	6
	Staple 18 ga., 7/8 long (plastic coated)	3	6
Particleboard			
1/4	1 1/2 long × 0.099" ring-grooved shank underlayment nail	3	6
	Staple 18 ga., 7/8 long, 3/16 crown	3	6
3/8	2 long × 0.120" ring-grooved shank underlayment nail	6	10
	Staple 16 ga., 1 1/8 long, 3/8 crown	3	6
1/2, 5/8	2 long × 0.120" ring-grooved shank underlayment nail	6	10
	Staple 16 ga., 1 5/8 long, 3/8 crown	3	6

(continued)

WALL CONSTRUCTION

**TABLE R602.3(2)—continued
ALTERNATE ATTACHMENTS TO TABLE R602.3(1)**

For SI: 1 inch = 25.4 mm.

- a. Nail is a general description and shall be permitted to be T-head, modified round head or round head.
- b. Staples shall have a minimum crown width of $\frac{7}{16}$ -inch except as noted.
- c. Nails or staples shall be spaced at not more than 6 inches on center at all supports where spans are 48 inches or greater. Nails or staples shall be spaced at not more than 12 inches on center at intermediate supports for floors.
- d. Fasteners shall be placed in a grid pattern throughout the body of the panel.
- e. For 5-ply panels, intermediate nails shall be spaced not more than 12 inches on center each way.
- f. Hardboard underlayment shall conform to CPA/ANSI A135.4.
- g. Alternate fastening is only permitted for roof sheathing where the ultimate design wind speed is less than or equal to 110 mph, and where fasteners are installed 3 inches on center at all supports.
- h. Fiber-cement underlayment shall conform to ASTM C1288 or ISO 8336, Category C.

**TABLE R602.3(3)
REQUIREMENTS FOR WOOD STRUCTURAL PANEL WALL SHEATHING USED TO RESIST WIND PRESSURES^{a, b, c}**

MINIMUM NAIL		MINIMUM WOOD STRUCTURAL PANEL SPAN RATING	MINIMUM NOMINAL PANEL THICKNESS (inches)	MAXIMUM WALL STUD SPACING (inches)	PANEL NAIL SPACING		ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		
Size	Penetration (inches)				Edges (inches o.c.)	Field (inches o.c.)	Wind exposure category		
							B	C	D
6d Common (2.0" × 0.113")	1.5	24/0	$\frac{3}{8}$	16	6	12	140	115	110
8d Common (2.5" × 0.131")	1.75	24/16	$\frac{7}{16}$	16	6	12	170	140	135
				24	6	12	140	115	110

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. Panel strength axis parallel or perpendicular to supports. Three-ply plywood sheathing with studs spaced more than 16 inches on center shall be applied with panel strength axis perpendicular to supports.
- b. Table is based on wind pressures acting toward and away from building surfaces in accordance with Section R301.2. Lateral bracing requirements shall be in accordance with Section R602.10.
- c. Wood structural panels with span ratings of Wall-16 or Wall-24 shall be permitted as an alternate to panels with a 24/0 span rating. Plywood siding rated 16 o.c. or 24 o.c. shall be permitted as an alternate to panels with a 24/16 span rating. Wall-16 and Plywood siding 16 o.c. shall be used with studs spaced not more than 16 inches on center.

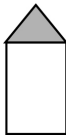



**TABLE R602.3(4)
ALLOWABLE SPANS FOR PARTICLEBOARD WALL SHEATHING^a**

THICKNESS (inch)	GRADE	STUD SPACING (inches)	
		Where siding is nailed to studs	Where siding is nailed to sheathing
$\frac{3}{8}$	M-1 Exterior glue	16	—
$\frac{1}{2}$	M-2 Exterior glue	16	16

For SI: 1 inch = 25.4 mm.

- a. Wall sheathing not exposed to the weather. If the panels are applied horizontally, the end joints of the panel shall be offset so that four panel corners will not meet. Panel edges must be supported. Leave a $\frac{1}{16}$ -inch gap between panels and nail not less than $\frac{3}{8}$ inch from panel edges.

**TABLE R602.3(5)
SIZE, HEIGHT AND SPACING OF WOOD STUDS^a**

STUD SIZE (inches)	BEARING WALLS					NONBEARING WALLS	
	Laterally unsupported stud height ^a (feet)	Maximum spacing where supporting a roof-ceiling assembly or a habitable attic assembly, only (inches)	Maximum spacing where supporting one floor, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting two floors, plus a roof-ceiling assembly or a habitable attic assembly (inches)	Maximum spacing where supporting one floor height ^a (inches)	Laterally unsupported stud height ^a (feet)	Maximum spacing (inches)
							
2 × 3 ^b	—	—	—	—	—	10	16
2 × 4	10	24 ^c	16 ^c	—	24	14	24
3 × 4	10	24	24	16	24	14	24
2 × 5	10	24	24	—	24	16	24
2 × 6	10	24	24	16	24	20	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Listed heights are distances between points of lateral support placed perpendicular to the plane of the wall. Bearing walls shall be sheathed on not less than one side or bridging shall be installed not greater than 4 feet apart measured vertically from either end of the stud. Increases in unsupported height are permitted where in compliance with Exception 2 of Section R602.3.1 or designed in accordance with accepted engineering practice.
- b. Shall not be used in exterior walls.
- c. A habitable attic assembly supported by 2 × 4 studs is limited to a roof span of 32 feet. Where the roof span exceeds 32 feet, the wall studs shall be increased to 2 × 6 or the studs shall be designed in accordance with accepted engineering practice.

**TABLE R602.3(6)
ALTERNATE WOOD BEARING WALL STUD SIZE, HEIGHT AND SPACING**

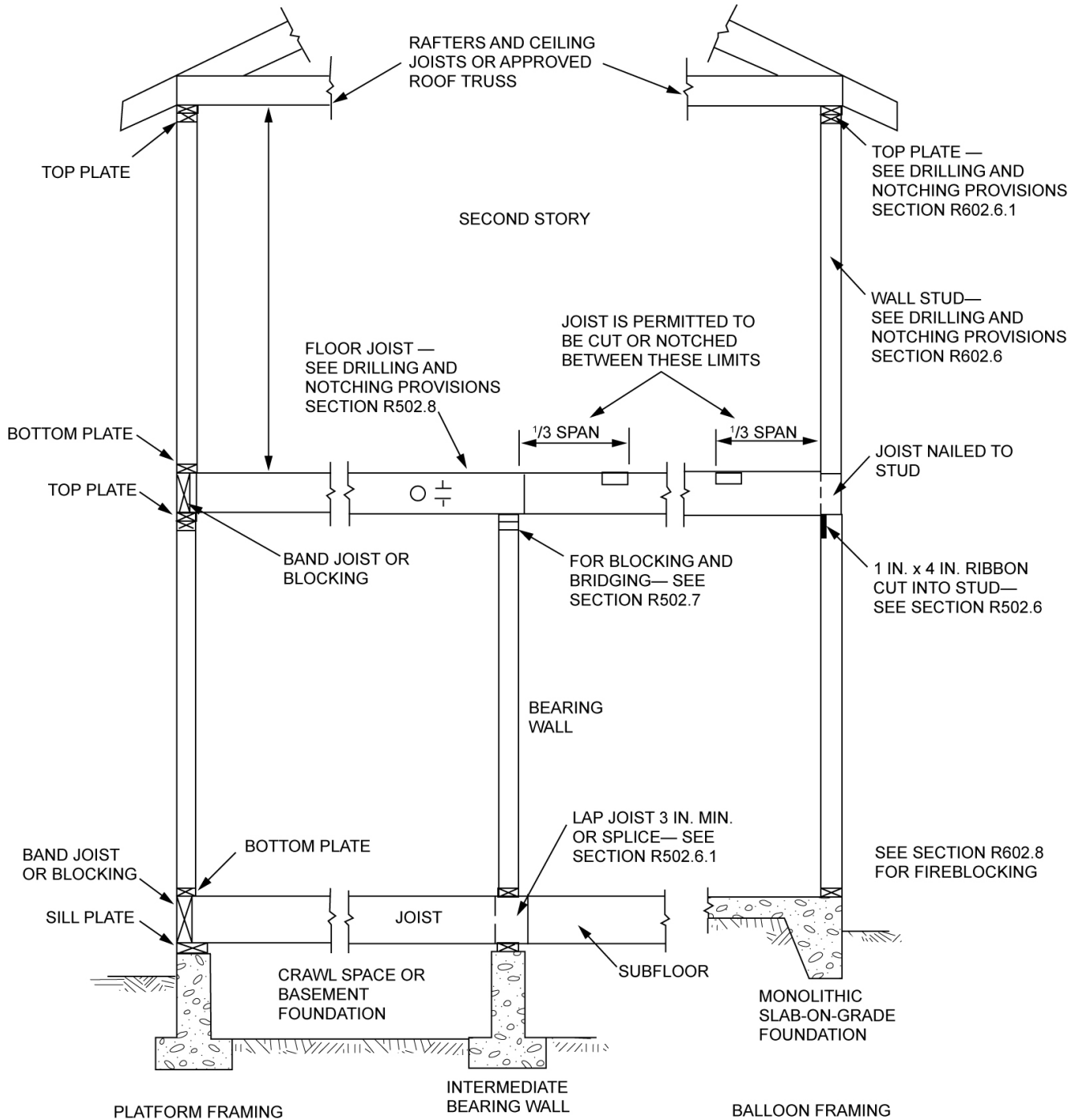
STUD HEIGHT	SUPPORTING	STUD SPACING ^a	ULTIMATE DESIGN WIND SPEED					
			115 mph		130 mph ^b		140 mph ^b	
			Maximum roof/floor span ^c		Maximum roof/floor span ^c		Maximum roof/floor span ^c	
			12 ft	24 ft	12 ft	24 ft	12 ft	24 ft
11 ft	Roof only	12 in	2 × 4	2 × 4	2 × 4	2 × 4	2 × 4	2 × 4
		16 in	2 × 4	2 × 4	2 × 4	2 × 6	2 × 4	2 × 6
		24 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
	Roof and one floor	12 in	2 × 4	2 × 6	2 × 4	2 × 6	2 × 4	2 × 6
		16 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
12 ft	Roof only	12 in	2 × 4	2 × 4	2 × 4	2 × 6	2 × 4	2 × 6
		16 in	2 × 4	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
	Roof and one floor	12 in	2 × 4	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		16 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6
		24 in	2 × 6	2 × 6	2 × 6	2 × 6	2 × 6	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mph = 0.447 m/s, 1 pound = 4.448 N.

DR = Design Required.

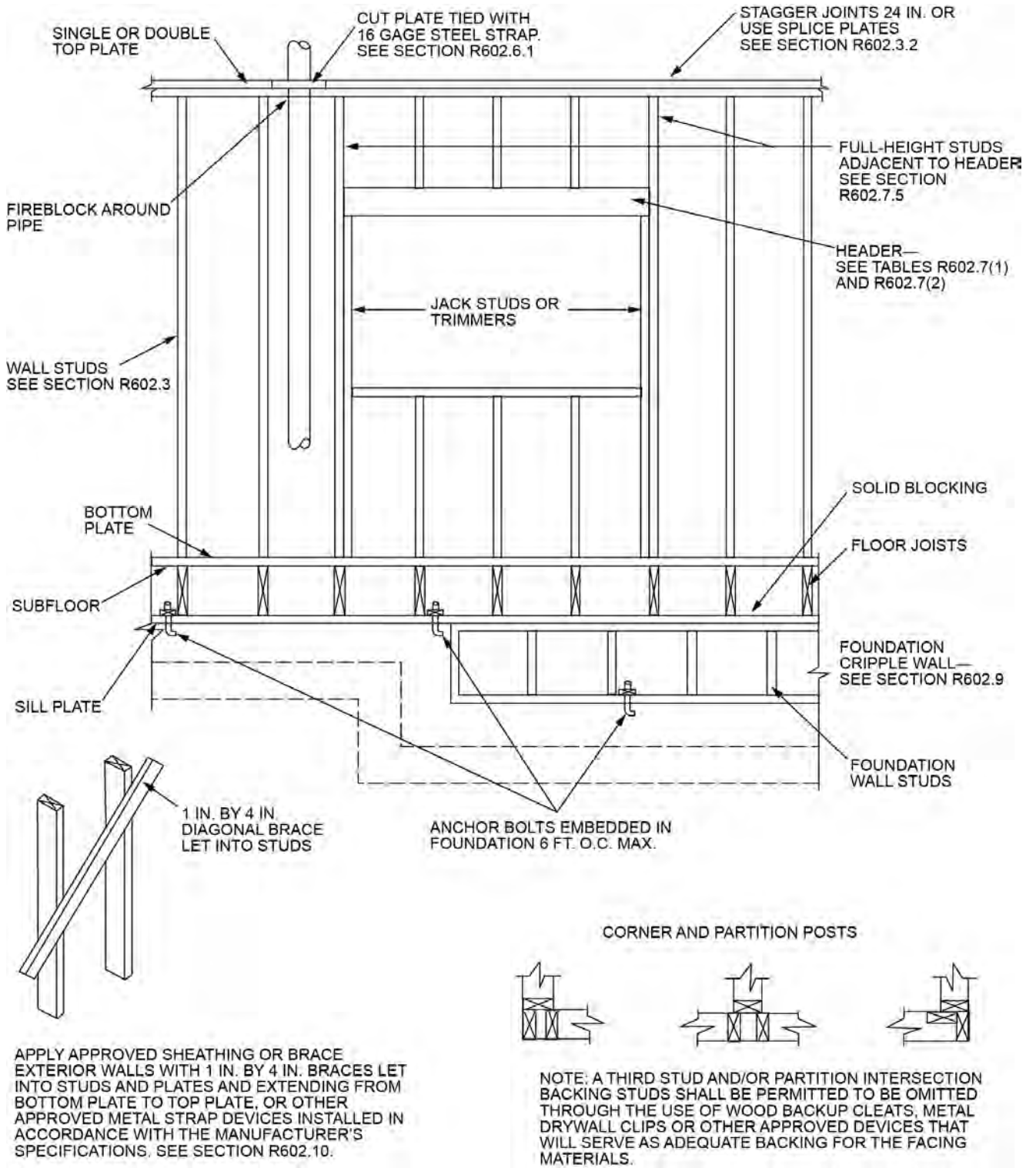
- a. Wall studs not exceeding 16 inches on center shall be sheathed with minimum 1/2-inch gypsum board on the interior and 3/8-inch wood structural panel sheathing on the exterior. Wood structural panel sheathing shall be attached with 8d (2.5" × 0.131") nails not greater than 6 inches on center along panel edges and 12 inches on center at intermediate supports, and all panel joints shall occur over studs or blocking.
- b. Where the ultimate design wind speed exceeds 115 mph, studs shall be attached to top and bottom plates with connectors having a minimum 300-pound lateral capacity.
- c. The maximum span is applicable to both single- and multiple-span roof and floor conditions. The roof assembly shall not contain a habitable attic.

WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

**FIGURE R602.3(1)
TYPICAL WALL, FLOOR AND ROOF FRAMING**



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R602.3(2)
FRAMING DETAILS

**TABLE R602.3.2
SINGLE TOP-PLATE SPLICE CONNECTION DETAILS**

CONDITION	TOP-PLATE SPLICE LOCATION			
	Corners and intersecting walls		Butt joints in straight walls	
	Splice plate size	Minimum nails each side of joint	Splice plate size	Minimum nails each side of joint
Structures in SDC A-C; and in SDC D ₀ , D ₁ and D ₂ with braced wall line spacing less than 25 feet	3" × 6" × 0.036" galvanized steel plate or equivalent	(6) 8d box (2½" × 0.113") nails	3" × 12" × 0.036" galvanized steel plate or equivalent	(12) 8d box (2½" × 0.113") nails
Structures in SDC D ₀ , D ₁ and D ₂ , with braced wall line spacing greater than or equal to 25 feet	3" × 8" × 0.036" galvanized steel plate or equivalent	(9) 8d box (2½" × 0.113") nails	3" × 16" × 0.036" galvanized steel plate or equivalent	(18) 8d box (2½" × 0.113") nails

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

R602.4 Interior load-bearing walls. Interior load-bearing walls shall be constructed, framed and fireblocked as specified for exterior walls.

R602.5 Interior nonbearing walls. Interior nonbearing walls shall be permitted to be constructed with 2-inch by 3-inch (51 mm by 76 mm) studs spaced 24 inches (610 mm) on center or, where not part of a braced wall line, 2-inch by 4-inch (51 mm by 102 mm) flat studs spaced at 16 inches (406 mm) on center. Interior nonbearing walls shall be capped with not less than a single top plate. Interior nonbearing walls shall be fireblocked in accordance with Section R602.8.

R602.6 Drilling and notching of studs. Drilling and notching of studs shall be in accordance with the following:

1. Notching. A stud in an exterior wall or bearing partition shall not be cut or notched to a depth exceeding 25 percent of its depth. Studs in nonbearing partitions shall not be notched to a depth exceeding 40 percent of a single stud depth.
2. Boring. The diameter of bored holes in studs shall not exceed 60 percent of the stud depth, the edge of the hole shall not be less than 5/8 inch (16 mm) from the edge of the stud, and the hole shall not be located in the same section as a cut or notch. Where the diameter of a bored hole in a stud located in exterior walls or bearing partitions is over 40 percent, such stud shall be doubled and not more than two successive doubled studs shall be so bored. See Figures R602.6(1) and R602.6(2).

Exception: Where approved, stud shoes are installed in accordance with the manufacturer's instructions.

R602.6.1 Drilling and notching of top plate. Where piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie not less than 0.054 inch thick (1.37 mm) (16 ga) and 1½ inches (38 mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 10d (0.148 inch diameter) nails having a minimum length of 1½ inches (38 mm) at each side or equivalent. The metal tie must extend not less than 6 inches past the opening. See Figure R602.6.1.

Exception: Where the entire side of the wall with the notch or cut is covered by wood structural panel sheathing.

R602.7 Headers. For header spans, see Tables R602.7(1), R602.7(2) and R602.7(3).

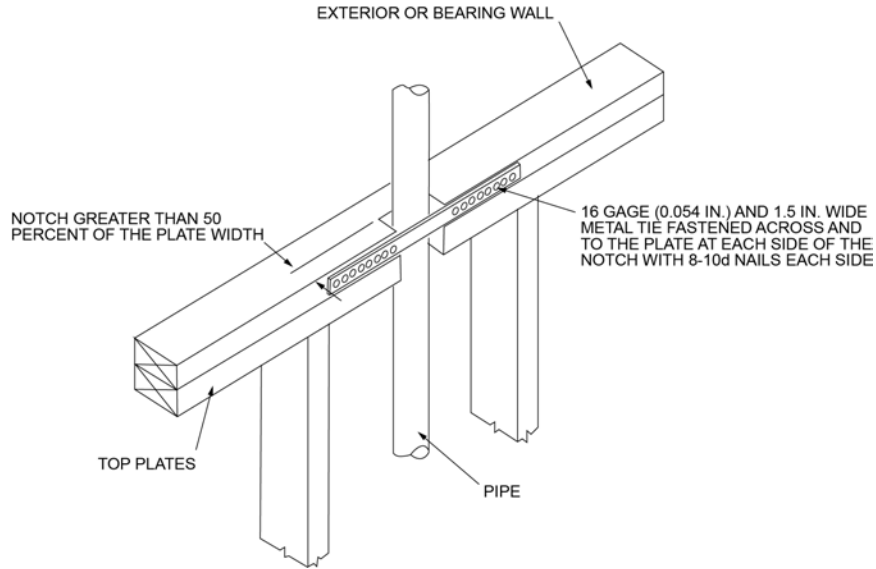
R602.7.1 Single member headers. Single headers shall be framed with a single flat 2-inch-nominal (51 mm) member or wall plate not less in width than the wall studs on the top and bottom of the header in accordance with Figures R602.7.1(1) and R602.7.1(2) and face nailed to the top and bottom of the header with 10d box nails (3 inches × 0.128 inches) spaced 12 inches on center.

R602.7.2 Rim board headers. Rim board header size, material and span shall be in accordance with Table R602.7(1). Rim board headers shall be constructed in accordance with Figure R602.7.2 and shall be supported at each end by full-height studs. The number of full-height studs at each end shall be not less than the number of studs displaced by half of the header span based on the maximum stud spacing in accordance with Table R602.3(5). Rim board headers supporting concentrated loads shall be designed in accordance with accepted engineering practice.

R602.7.3 Wood structural panel box headers. Wood structural panel box headers shall be constructed in accordance with Figure R602.7.3 and Table R602.7.3.

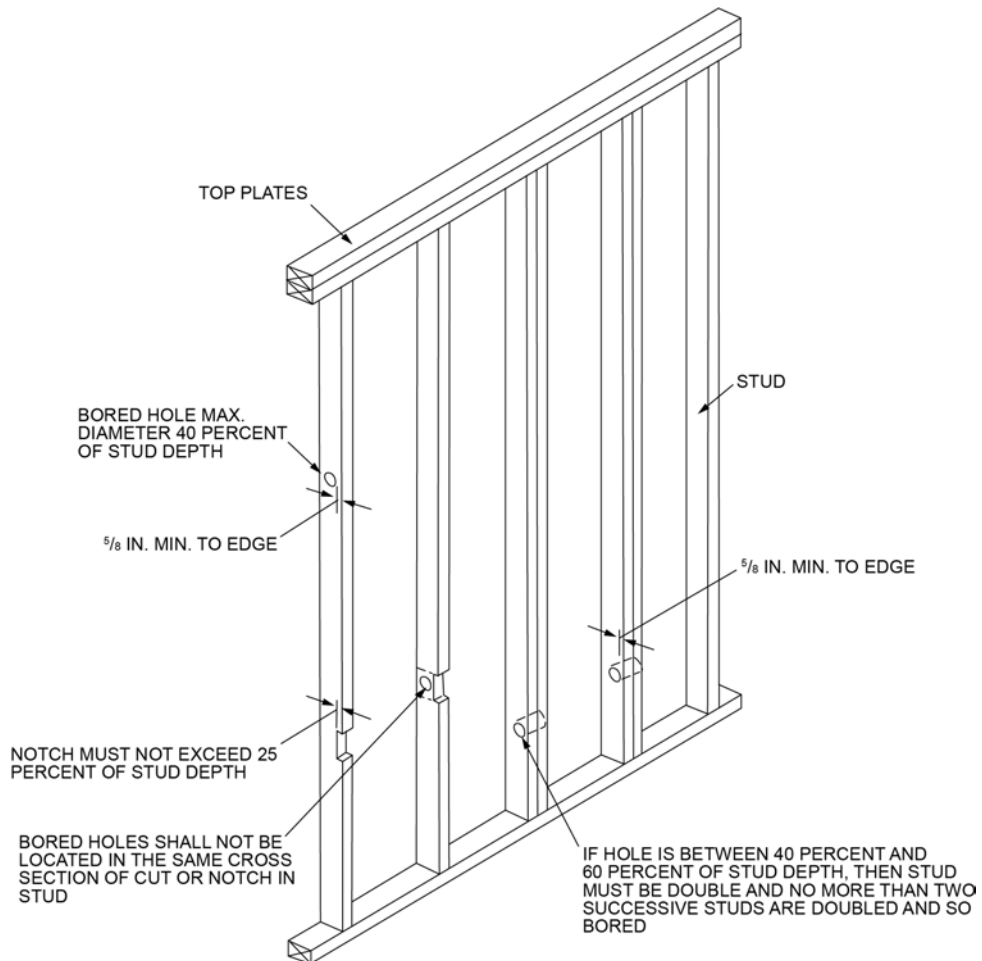
R602.7.4 Nonbearing walls. Load-bearing headers are not required in interior or exterior nonbearing walls. A single flat 2-inch by 4-inch (51 mm by 102 mm) member shall be permitted to be used as a header in interior or exterior nonbearing walls for openings up to 8 feet (2438 mm) in width if the vertical distance to the parallel nailing surface above is not more than 24 inches (610 mm). For such nonbearing headers, cripples or blocking are not required above the header.

R602.7.5 Supports for headers. Headers shall be supported on each end with one or more jack studs or with approved framing anchors in accordance with Table R602.7(1) or R602.7(2). The full-height stud adjacent to each end of the header shall be end nailed to each end of the header in accordance with Table R602.3(1). The minimum number of full-height studs at each end of a header shall be in accordance with Table R602.7.5.



For SI: 1 inch = 25.4 mm.

**FIGURE R602.6.1
TOP PLATE FRAMING TO ACCOMMODATE PIPING**



For SI: 1 inch = 25.4 mm.

Note: Condition for exterior and bearing walls.

**FIGURE R602.6(1)
NOTCHING AND BORED HOLE LIMITATIONS FOR EXTERIOR WALLS AND BEARING WALLS**

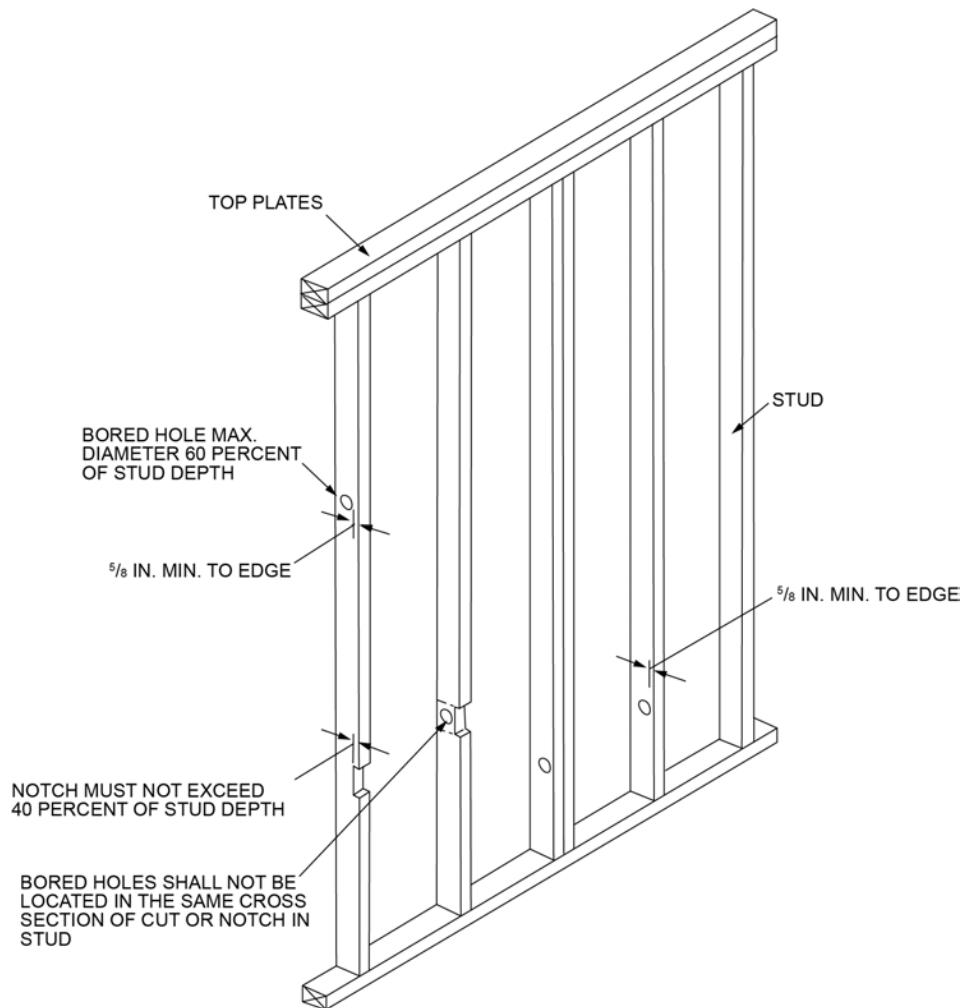
WALL CONSTRUCTION

**TABLE R602.7.5
MINIMUM NUMBER OF FULL-HEIGHT STUDS AT EACH END OF HEADERS IN EXTERIOR WALLS^a**

MAXIMUM HEADER SPAN (feet)	ULTIMATE DESIGN WIND SPEED AND EXPOSURE CATEGORY	
	< 140 mph, Exposure B or < 130 mph, Exposure C	≤ 115 mph, Exposure B ^b
4	1	1
6	2	1
8	2	1
10	3	2
12	3	2
14	3	2
16	4	2
18	4	2

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

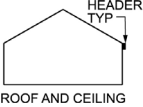
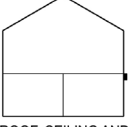
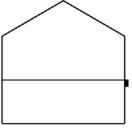
- a. For header spans between those given, use the minimum number of full-height studs associated with the larger header span.
- b. The tabulated minimum number of full-height studs is applicable where jack studs are provided to support the header at each end in accordance with Table R602.7(1). Where a framing anchor is used to support the header in lieu of a jack stud in accordance with Note d of Table R602.7(1), the minimum number of full-height studs at each end of a header shall be in accordance with requirements for wind speed < 140 mph, Exposure B.



For SI: 1 inch = 25.4 mm.

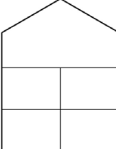
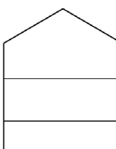
**FIGURE R602.6(2)
NOTCHING AND BORED HOLE LIMITATIONS FOR INTERIOR NONBEARING WALLS**

TABLE R602.7(1)
GIRDER SPANS^a AND HEADER SPANS^a FOR EXTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir^b and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) ^c																	
		30						50						70					
		Building width ^c (feet)																	
		12		24		36		12		24		36		12		24		36	
Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d		
Roof and ceiling 	1-2 x 6	4-0	1	3-1	2	2-7	2	3-5	1	2-8	2	2-3	2	3-0	2	2-4	2	2-0	2
	1-2 x 8	5-1	2	3-11	2	3-3	2	4-4	2	3-4	2	2-10	2	3-10	2	3-0	2	2-6	3
	1-2 x 10	6-0	2	4-8	2	3-11	2	5-2	2	4-0	2	3-4	3	4-7	2	3-6	3	3-0	3
	1-2 x 12	7-1	2	5-5	2	4-7	3	6-1	2	4-8	3	3-11	3	5-5	2	4-2	3	3-6	3
	2-2 x 4	4-0	1	3-1	1	2-7	1	3-5	1	2-7	1	2-2	1	3-0	1	2-4	1	2-0	1
	2-2 x 6	6-0	1	4-7	1	3-10	1	5-1	1	3-11	1	3-3	2	4-6	1	3-6	2	2-11	2
	2-2 x 8	7-7	1	5-9	1	4-10	2	6-5	1	5-0	2	4-2	2	5-9	1	4-5	2	3-9	2
	2-2 x 10	9-0	1	6-10	2	5-9	2	7-8	2	5-11	2	4-11	2	6-9	2	5-3	2	4-5	2
	2-2 x 12	10-7	2	8-1	2	6-10	2	9-0	2	6-11	2	5-10	2	8-0	2	6-2	2	5-2	3
	3-2 x 8	9-5	1	7-3	1	6-1	1	8-1	1	6-3	1	5-3	2	7-2	1	5-6	2	4-8	2
	3-2 x 10	11-3	1	8-7	1	7-3	2	9-7	1	7-4	2	6-2	2	8-6	1	6-7	2	5-6	2
	3-2 x 12	13-2	1	10-1	2	8-6	2	11-3	2	8-8	2	7-4	2	10-0	2	7-9	2	6-6	2
	4-2 x 8	10-11	1	8-4	1	7-0	1	9-4	1	7-2	1	6-0	1	8-3	1	6-4	1	5-4	2
	4-2 x 10	12-11	1	9-11	1	8-4	1	11-1	1	8-6	1	7-2	2	9-10	1	7-7	2	6-4	2
4-2 x 12	15-3	1	11-8	1	9-10	2	13-0	1	10-0	2	8-5	2	11-7	1	8-11	2	7-6	2	
Roof, ceiling and one center-bearing floor 	1-2 x 6	3-3	1	2-7	2	2-2	2	3-0	2	2-4	2	2-0	2	2-9	2	2-2	2	1-10	2
	1-2 x 8	4-1	2	3-3	2	2-9	2	3-9	2	3-0	2	2-6	3	3-6	2	2-9	2	2-4	3
	1-2 x 10	4-11	2	3-10	2	3-3	3	4-6	2	3-6	3	3-0	3	4-1	2	3-3	3	2-9	3
	1-2 x 12	5-9	2	4-6	3	3-10	3	5-3	2	4-2	3	3-6	3	4-10	3	3-10	3	3-3	4
	2-2 x 4	3-3	1	2-6	1	2-2	1	3-0	1	2-4	1	2-0	1	2-8	1	2-2	1	1-10	1
	2-2 x 6	4-10	1	3-9	1	3-3	2	4-5	1	3-6	2	3-0	2	4-1	1	3-3	2	2-9	2
	2-2 x 8	6-1	1	4-10	2	4-1	2	5-7	2	4-5	2	3-9	2	5-2	2	4-1	2	3-6	2
	2-2 x 10	7-3	2	5-8	2	4-10	2	6-8	2	5-3	2	4-5	2	6-1	2	4-10	2	4-1	2
	2-2 x 12	8-6	2	6-8	2	5-8	2	7-10	2	6-2	2	5-3	3	7-2	2	5-8	2	4-10	3
	3-2 x 8	7-8	1	6-0	1	5-1	2	7-0	1	5-6	2	4-8	2	6-5	1	5-1	2	4-4	2
	3-2 x 10	9-1	1	7-2	2	6-1	2	8-4	1	6-7	2	5-7	2	7-8	2	6-1	2	5-2	2
	3-2 x 12	10-8	2	8-5	2	7-2	2	9-10	2	7-8	2	6-7	2	9-0	2	7-1	2	6-1	2
	4-2 x 8	8-10	1	6-11	1	5-11	1	8-1	1	6-4	1	5-5	2	7-5	1	5-11	1	5-0	2
	4-2 x 10	10-6	1	8-3	2	7-0	2	9-8	1	7-7	2	6-5	2	8-10	1	7-0	2	6-0	2
4-2 x 12	12-4	1	9-8	2	8-3	2	11-4	2	8-11	2	7-7	2	10-4	2	8-3	2	7-0	2	
Roof, ceiling and one clear-span floor 	1-2 x 6	2-11	2	2-3	2	1-11	2	2-9	2	2-1	2	1-9	2	2-7	2	2-0	2	1-8	2
	1-2 x 8	3-9	2	2-10	2	2-5	3	3-6	2	2-8	2	2-3	3	3-3	2	2-6	3	2-2	3
	1-2 x 10	4-5	2	3-5	3	2-10	3	4-2	2	3-2	3	2-8	3	3-11	2	3-0	3	2-6	3
	1-2 x 12	5-2	2	4-0	3	3-4	3	4-10	3	3-9	3	3-2	4	4-7	3	3-6	3	3-0	4
	2-2 x 4	2-11	1	2-3	1	1-10	1	2-9	1	2-1	1	1-9	1	2-7	1	2-0	1	1-8	1
	2-2 x 6	4-4	1	3-4	2	2-10	2	4-1	1	3-2	2	2-8	2	3-10	1	3-0	2	2-6	2
	2-2 x 8	5-6	2	4-3	2	3-7	2	5-2	2	4-0	2	3-4	2	4-10	2	3-9	2	3-2	2
	2-2 x 10	6-7	2	5-0	2	4-2	2	6-1	2	4-9	2	4-0	2	5-9	2	4-5	2	3-9	3
	2-2 x 12	7-9	2	5-11	2	4-11	3	7-2	2	5-7	2	4-8	3	6-9	2	5-3	3	4-5	3
	3-2 x 8	6-11	1	5-3	2	4-5	2	6-5	1	5-0	2	4-2	2	6-1	1	4-8	2	4-0	2
	3-2 x 10	8-3	2	6-3	2	5-3	2	7-8	2	5-11	2	5-0	2	7-3	2	5-7	2	4-8	2
	3-2 x 12	9-8	2	7-5	2	6-2	2	9-0	2	7-0	2	5-10	2	8-6	2	6-7	2	5-6	3
	4-2 x 8	8-0	1	6-1	1	5-1	2	7-5	1	5-9	2	4-10	2	7-0	1	5-5	2	4-7	2
	4-2 x 10	9-6	1	7-3	2	6-1	2	8-10	1	6-10	2	5-9	2	8-4	1	6-5	2	5-5	2
4-2 x 12	11-2	2	8-6	2	7-2	2	10-5	2	8-0	2	6-9	2	9-10	2	7-7	2	6-5	2	

(continued)

TABLE R602.7(1)—continued
GIRDER SPANS^a AND HEADER SPANS^a FOR EXTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir^b and required number of jack studs)

GIRDERS AND HEADERS SUPPORTING	SIZE	GROUND SNOW LOAD (psf) ^e																	
		30						50						70					
		Building width ^c (feet)																	
		12		24		36		12		24		36		12		24		36	
Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d	Span ^f	NJ ^d		
Roof, ceiling and two center-bearing floors  ROOF, CEILING AND TWO FLOORS (CENTER BEARING)	1-2 × 6	2-8	2	2-1	2	1-10	2	2-7	2	2-0	2	1-9	2	2-5	2	1-11	2	1-8	2
	1-2 × 8	3-5	2	2-8	2	2-4	3	3-3	2	2-7	2	2-2	3	3-1	2	2-5	3	2-1	3
	1-2 × 10	4-0	2	3-2	3	2-9	3	3-10	2	3-1	3	2-7	3	3-8	2	2-11	3	2-5	3
	1-2 × 12	4-9	3	3-9	3	3-2	4	4-6	3	3-7	3	3-1	4	4-3	3	3-5	3	2-11	4
	2-2 × 4	2-8	1	2-1	1	1-9	1	2-6	1	2-0	1	1-8	1	2-5	1	1-11	1	1-7	1
	2-2 × 6	4-0	1	3-2	2	2-8	2	3-9	1	3-0	2	2-7	2	3-7	1	2-10	2	2-5	2
	2-2 × 8	5-0	2	4-0	2	3-5	2	4-10	2	3-10	2	3-3	2	4-7	2	3-7	2	3-1	2
	2-2 × 10	6-0	2	4-9	2	4-0	2	5-8	2	4-6	2	3-10	3	5-5	2	4-3	2	3-8	3
	2-2 × 12	7-0	2	5-7	2	4-9	3	6-8	2	5-4	3	4-6	3	6-4	2	5-0	3	4-3	3
	3-2 × 8	6-4	1	5-0	2	4-3	2	6-0	1	4-9	2	4-1	2	5-8	2	4-6	2	3-10	2
	3-2 × 10	7-6	2	5-11	2	5-1	2	7-1	2	5-8	2	4-10	2	6-9	2	5-4	2	4-7	2
	3-2 × 12	8-10	2	7-0	2	5-11	2	8-5	2	6-8	2	5-8	3	8-0	2	6-4	2	5-4	3
	4-2 × 8	7-3	1	5-9	1	4-11	2	6-11	1	5-6	2	4-8	2	6-7	1	5-2	2	4-5	2
	4-2 × 10	8-8	1	6-10	2	5-10	2	8-3	2	6-6	2	5-7	2	7-10	2	6-2	2	5-3	2
4-2 × 12	10-2	2	8-1	2	6-10	2	9-8	2	7-8	2	6-7	2	9-2	2	7-3	2	6-2	2	
Roof, ceiling, and two clear-span floors  ROOF, CEILING AND TWO FLOORS (CLEAR SPAN)	1-2 × 6	2-3	2	1-9	2	1-5	2	2-3	2	1-9	2	1-5	3	2-2	2	1-8	2	1-5	3
	1-2 × 8	2-10	2	2-2	3	1-10	3	2-10	2	2-2	3	1-10	3	2-9	2	2-1	3	1-10	3
	1-2 × 10	3-4	2	2-7	3	2-2	3	3-4	3	2-7	3	2-2	4	3-3	3	2-6	3	2-2	4
	1-2 × 12	4-0	3	3-0	3	2-7	4	4-0	3	3-0	4	2-7	4	3-10	3	3-0	4	2-6	4
	2-2 × 4	2-3	1	1-8	1	1-4	1	2-3	1	1-8	1	1-4	1	2-2	1	1-8	1	1-4	2
	2-2 × 6	3-4	1	2-6	2	2-2	2	3-4	2	2-6	2	2-2	2	3-3	2	2-6	2	2-1	2
	2-2 × 8	4-3	2	3-3	2	2-8	2	4-3	2	3-3	2	2-8	2	4-1	2	3-2	2	2-8	3
	2-2 × 10	5-0	2	3-10	2	3-2	3	5-0	2	3-10	2	3-2	3	4-10	2	3-9	3	3-2	3
	2-2 × 12	5-11	2	4-6	3	3-9	3	5-11	2	4-6	3	3-9	3	5-8	2	4-5	3	3-9	3
	3-2 × 8	5-3	1	4-0	2	3-5	2	5-3	2	4-0	2	3-5	2	5-1	2	3-11	2	3-4	2
	3-2 × 10	6-3	2	4-9	2	4-0	2	6-3	2	4-9	2	4-0	2	6-1	2	4-8	2	4-0	3
	3-2 × 12	7-5	2	5-8	2	4-9	3	7-5	2	5-8	2	4-9	3	7-2	2	5-6	3	4-8	3
	4-2 × 8	6-1	1	4-8	2	3-11	2	6-1	1	4-8	2	3-11	2	5-11	1	4-7	2	3-10	2
	4-2 × 10	7-3	2	5-6	2	4-8	2	7-3	2	5-6	2	4-8	2	7-0	2	5-5	2	4-7	2
4-2 × 12	8-6	2	6-6	2	5-6	2	8-6	2	6-6	2	5-6	2	8-3	2	6-4	2	5-4	3	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- Spans are given in feet and inches.
- Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.
- Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.
- Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

TABLE R602.7(2)
GIRDER SPANS^a AND HEADER SPANS^a FOR INTERIOR BEARING WALLS
 (Maximum spans for Douglas fir-larch, hem-fir, southern pine and spruce-pine-fir^b and required number of jack studs)

HEADERS AND GIRDERS SUPPORTING	SIZE	BUILDING Width ^c (feet)					
		12		24		36	
		Span ^e	NJ ^d	Span ^e	NJ ^d	Span ^e	NJ ^d
One floor only	2-2 × 4	4-1	1	2-10	1	2-4	1
	2-2 × 6	6-1	1	4-4	1	3-6	1
	2-2 × 8	7-9	1	5-5	1	4-5	2
	2-2 × 10	9-2	1	6-6	2	5-3	2
	2-2 × 12	10-9	1	7-7	2	6-3	2
	3-2 × 8	9-8	1	6-10	1	5-7	1
	3-2 × 10	11-5	1	8-1	1	6-7	2
	3-2 × 12	13-6	1	9-6	2	7-9	2
	4-2 × 8	11-2	1	7-11	1	6-5	1
	4-2 × 10	13-3	1	9-4	1	7-8	1
Two floors	2-2 × 4	2-7	1	1-11	1	1-7	1
	2-2 × 6	3-11	1	2-11	2	2-5	2
	2-2 × 8	5-0	1	3-8	2	3-1	2
	2-2 × 10	5-11	2	4-4	2	3-7	2
	2-2 × 12	6-11	2	5-2	2	4-3	3
	3-2 × 8	6-3	1	4-7	2	3-10	2
	3-2 × 10	7-5	1	5-6	2	4-6	2
	3-2 × 12	8-8	2	6-5	2	5-4	2
	4-2 × 8	7-2	1	5-4	1	4-5	2
	4-2 × 10	8-6	1	6-4	2	5-3	2
4-2 × 12	10-1	1	7-5	2	6-2	2	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Spans are given in feet and inches.
- b. Spans are based on minimum design properties for No. 2 grade lumber of Douglas fir-larch, hem-fir, Southern pine, and spruce-pine-fir.
- c. Building width is measured perpendicular to the ridge. For widths between those shown, spans are permitted to be interpolated.
- d. NJ = Number of jack studs required to support each end. Where the number of required jack studs equals one, the header is permitted to be supported by an approved framing anchor attached to the full-height wall stud and to the header.
- e. Spans are calculated assuming the top of the header or girder is laterally braced by perpendicular framing. Where the top of the header or girder is not laterally braced (for example, cripple studs bearing on the header), tabulated spans for headers consisting of 2 × 8, 2 × 10, or 2 × 12 sizes shall be multiplied by 0.70 or the header or girder shall be designed.

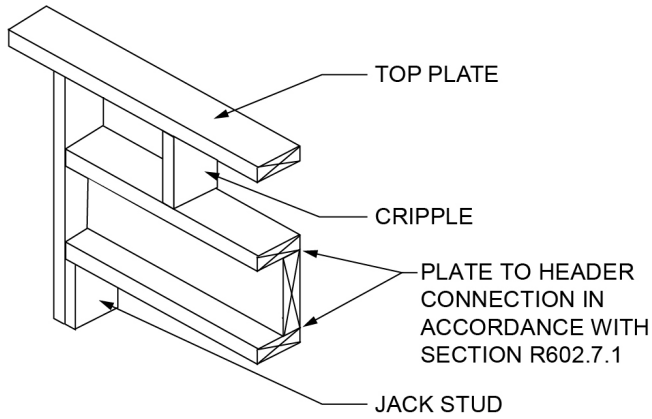
TABLE R602.7(3)
GIRDER AND HEADER SPANS^a FOR OPEN PORCHES
 (Maximum span for Douglas fir-larch, hem-fir, Southern pine and spruce-pine-fir^b)

SIZE	SUPPORTING ROOF						SUPPORTING FLOOR	
	Ground Snow Load (psf)							
	30		50		70			
	Depth of Porch ^c (feet)							
	8	14	8	14	8	14		
2-2 × 6	7-6	5-8	6-2	4-8	5-4	4-0	6-4	4-9
2-2 × 8	10-1	7-7	8-3	6-2	7-1	5-4	8-5	6-4
2-2 × 10	12-4	9-4	10-1	7-7	8-9	6-7	10-4	7-9
2-2 × 12	14-4	10-10	11-8	8-10	10-1	7-8	11-11	9-0

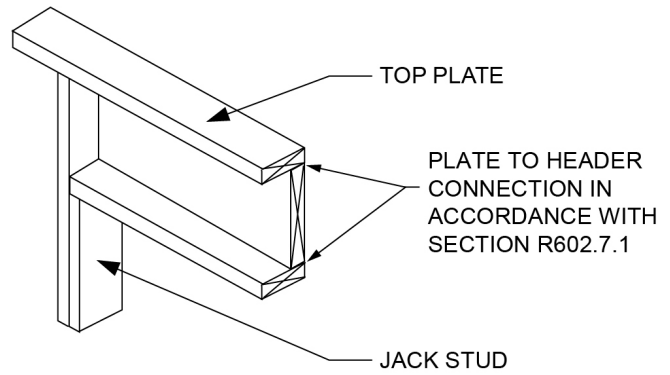
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Spans are given in feet and inches.
- b. Tabulated values assume No. 2 grade lumber, wet service and incising for refractory species. Use 30 psf ground snow load for cases in which ground snow load is less than 30 psf and the roof live load is equal to or less than 20 psf.
- c. Porch depth is measured horizontally from building face to centerline of the header. For depths between those shown, spans are permitted to be interpolated.

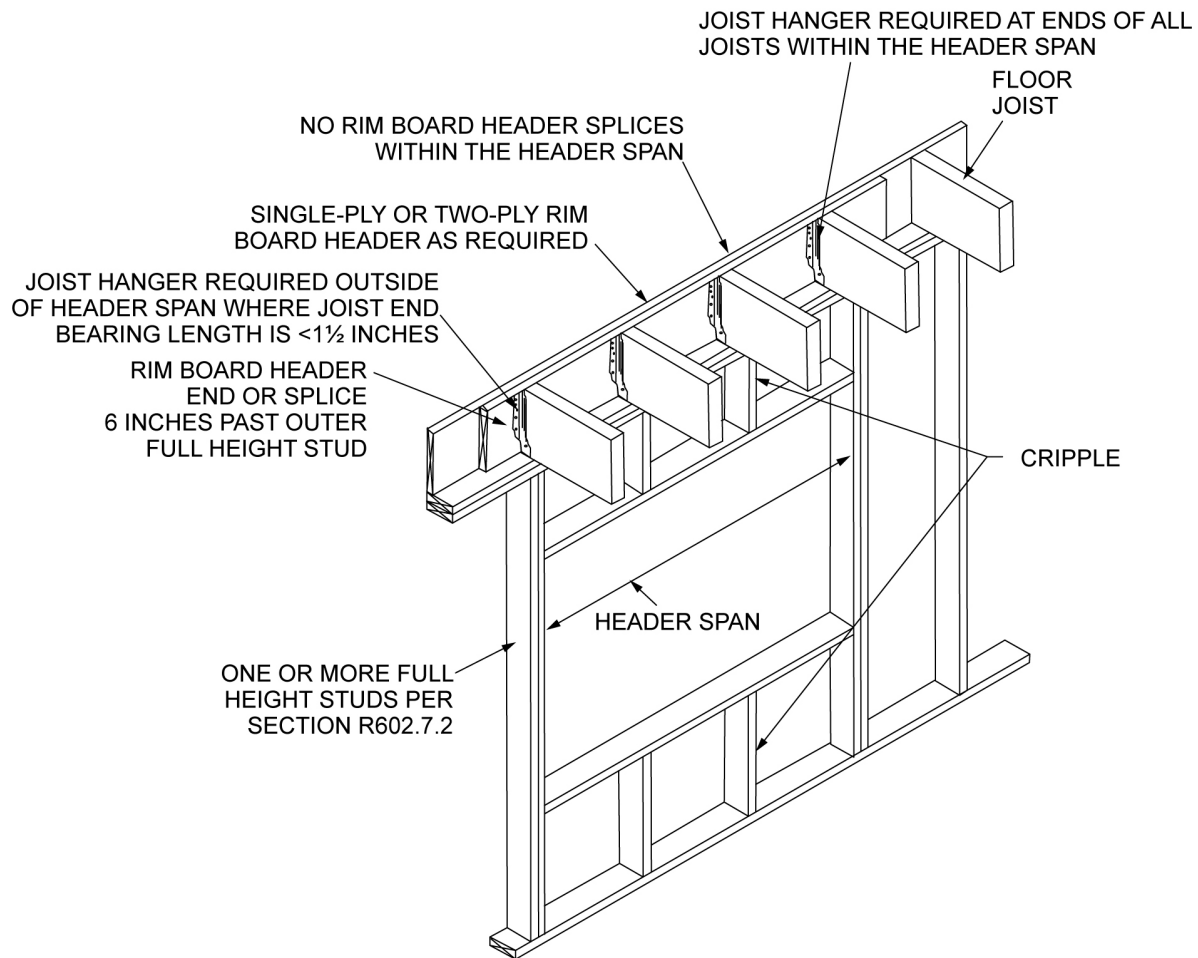
WALL CONSTRUCTION



**FIGURE R602.7.1(1)
SINGLE-MEMBER HEADER IN EXTERIOR BEARING WALL**



**FIGURE R602.7.1(2)
ALTERNATIVE SINGLE-MEMBER
HEADER WITHOUT CRIPPLE**



**FIGURE R602.7.2
RIM BOARD HEADER CONSTRUCTION**

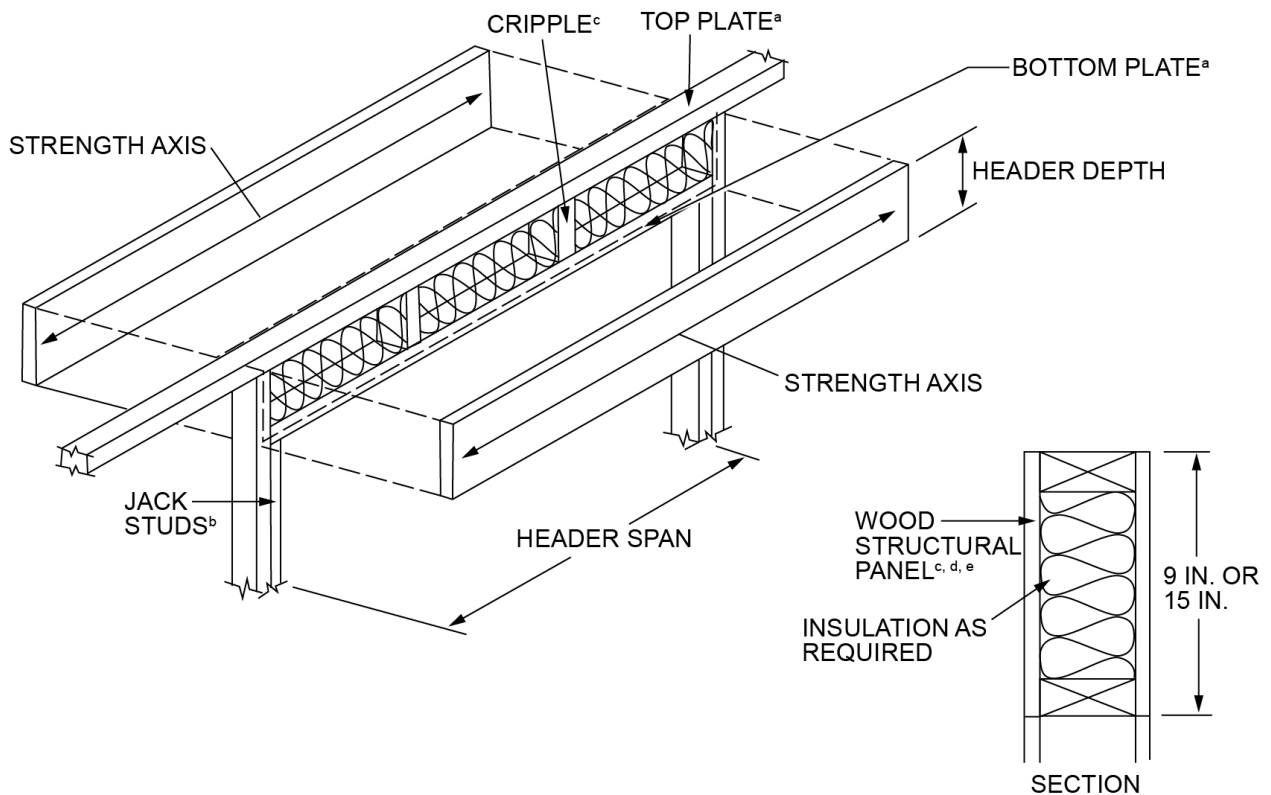
For SI: 25.4 mm = 1 inch.

**TABLE R602.7.3
MAXIMUM SPANS FOR WOOD STRUCTURAL PANEL BOX HEADERS^a**

HEADER CONSTRUCTION ^b	HEADER DEPTH (inches)	HOUSE DEPTH (feet)				
		24	26	28	30	32
Wood structural panel—one side	9	4	4	3	3	—
	15	5	5	4	3	3
Wood structural panel—both sides	9	7	5	5	4	3
	15	8	8	7	7	6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Spans are based on single story with clear-span trussed roof or two story with floor and roof supported by interior-bearing walls.
- b. See Figure R602.7.3 for construction details.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Notes:

- a. The top and bottom plates shall be continuous at header location.
- b. Jack studs shall be used for spans over 4 feet.
- c. Cripple spacing shall be the same as for studs.
- d. Wood structural panel faces shall be single pieces of ¹⁵/₃₂-inch-thick Exposure 1 (exterior glue) or thicker, installed on the interior or exterior or both sides of the header.
- e. Wood structural panel faces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 3 inches on center, staggering alternate nails 1/2 inch. Galvanized nails shall be hot-dipped or tumbled.

**FIGURE R602.7.3
TYPICAL WOOD STRUCTURAL PANEL BOX HEADER CONSTRUCTION**

WALL CONSTRUCTION

R602.8 Fireblocking required. Fireblocking shall be provided in accordance with Section R302.11.

R602.9 Cripple walls. Foundation cripple walls shall be framed of studs not smaller than the studding above. Where exceeding 4 feet (1219 mm) in height, such walls shall be framed of studs having the size required for an additional story.

Exterior cripple walls with a stud height less than 14 inches (356 mm) shall be continuously sheathed on one side with wood structural panels fastened to both the top and bottom plates in accordance with Table R602.3(1), or the cripple walls shall be constructed of solid blocking.

Cripple walls shall be supported on continuous foundations.

R602.10 Wall bracing. Buildings shall be braced in accordance with this section or, when applicable, Section R602.12. Where a building, or portion thereof, does not comply with one or more of the bracing requirements in this section, those portions shall be designed and constructed in accordance with Section R301.1.

R602.10.1 Braced wall lines. For the purpose of determining the amount and location of bracing required in each story level of a building, braced wall lines shall be designated as straight lines in the building plan placed in accordance with this section.

R602.10.1.1 Length of a braced wall line. The length of a braced wall line shall be the distance between its ends. The end of a braced wall line shall be the intersection with a perpendicular braced wall line, an angled braced wall line as permitted in Section R602.10.1.4 or an exterior wall as shown in Figure R602.10.1.1.

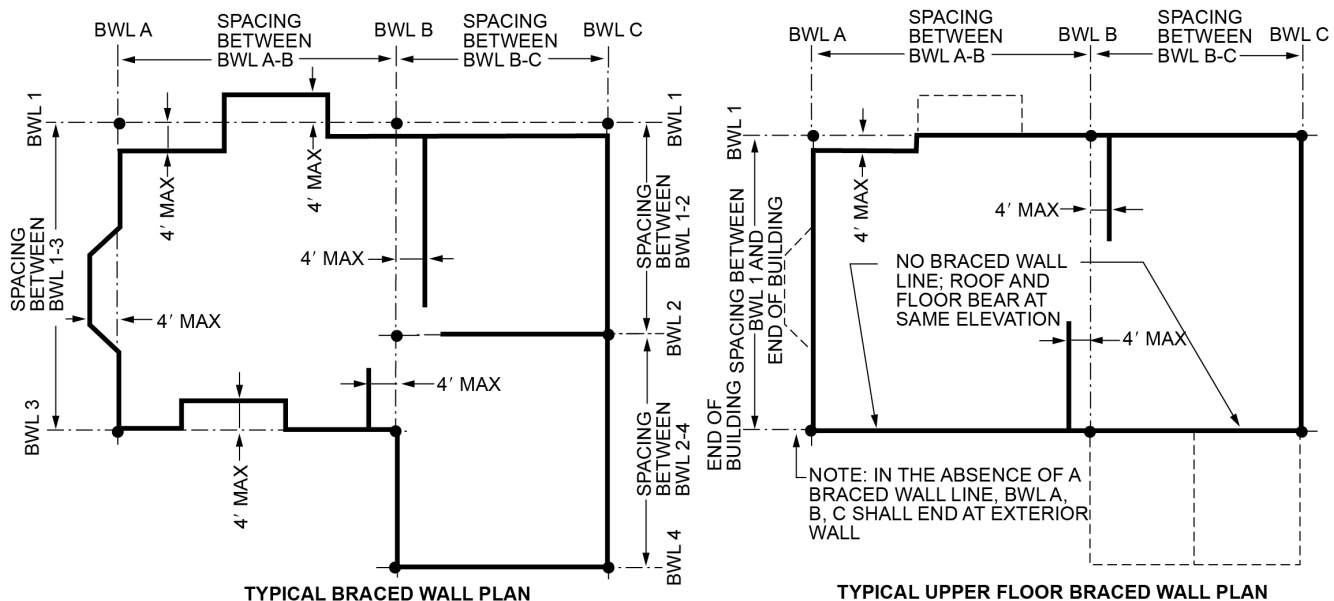
R602.10.1.2 Location of braced wall lines and permitted offsets. Each braced wall line shall be located such that no more than two-thirds of the required braced wall panel length is located to one side of the braced wall line. Braced wall panels shall be permitted to be offset up to 4 feet (1219 mm) from the designated braced wall line. Braced wall panels parallel to a braced wall line shall be offset not more than 4 feet (1219 mm) from the designated braced wall line location as shown in Figure R602.10.1.1.

Exterior walls parallel to a braced wall line shall be offset not more than 4 feet (1219 mm) from the designated braced wall line location as shown in Figure R602.10.1.1.

Interior walls used as bracing shall be offset not more than 4 feet (1219 mm) from a braced wall line through the interior of the building as shown in Figure R602.10.1.1.

R602.10.1.3 Spacing of braced wall lines. The spacing between parallel braced wall lines shall be in accordance with Table R602.10.1.3. Intermediate braced wall lines through the interior of the building shall be permitted.

R602.10.1.4 Angled walls. Any portion of a wall along a braced wall line shall be permitted to angle out of plane for a maximum diagonal length of 8 feet (2438 mm). Where the angled wall occurs at a corner, the length of the braced wall line shall be measured from the projected corner as shown in Figure R602.10.1.4. Where the diagonal length is greater than 8 feet (2438 mm), it shall be considered to be a separate braced wall line and shall be braced in accordance with Section R602.10.1.



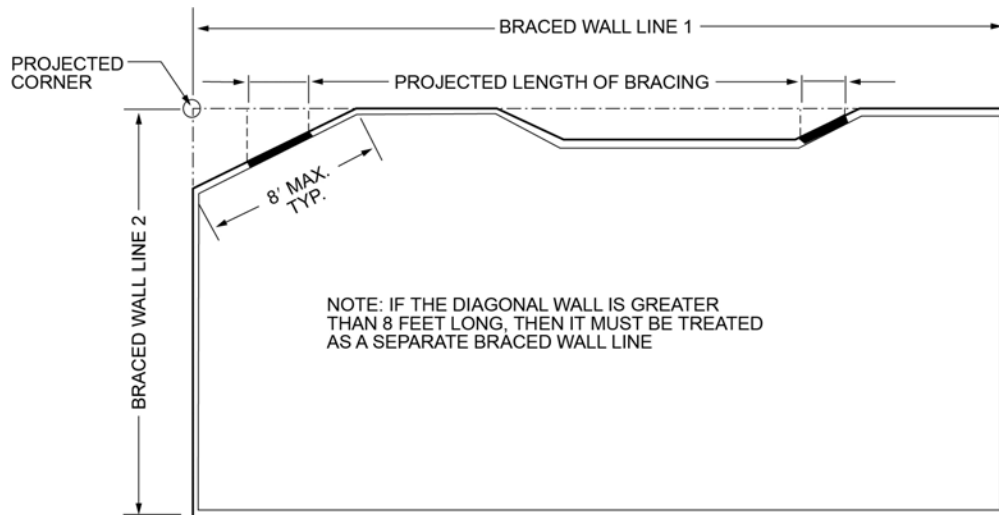
For SI: 1 foot = 304.8 mm.

**FIGURE R602.10.1.1
BRACED WALL LINES**

**TABLE R602.10.1.3
BRACED WALL LINE SPACING**

APPLICATION	CONDITION	BUILDING TYPE	BRACED WALL LINE SPACING CRITERIA	
			Maximum Spacing	Exception to Maximum Spacing
Wind bracing	Ultimate design wind speed < 140 mph	Detached, townhouse	60 feet	None
Seismic bracing	SDC A – C	Detached	Use wind bracing	
	SDC A – B	Townhouse	Use wind bracing	
	SDC C	Townhouse	35 feet	Up to 50 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).
	SDC D ₀ , D ₁ , D ₂	Detached, townhouses, one- and two-story only	25 feet	Up to 35 feet to allow for a single room not to exceed 900 square feet. Spacing of all other braced wall lines shall not exceed 25 feet.
	SDC D ₀ , D ₁ , D ₂	Detached, townhouse	25 feet	Up to 35 feet when length of required bracing per Table R602.10.3(3) is adjusted in accordance with Table R602.10.3(4).

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 0.447 m/s.



For SI: 1 foot = 304.8 mm.

**FIGURE R602.10.1.4
ANGLED WALLS**

R602.10.2 Braced wall panels. Braced wall panels shall be full-height sections of wall that shall not have vertical or horizontal offsets. Braced wall panels shall be constructed and placed along a braced wall line in accordance with this section and the bracing methods specified in Section R602.10.4.

R602.10.2.1 Braced wall panel uplift load path. The bracing lengths in Table R602.10.3(1) apply only when uplift loads are resisted in accordance with Section R602.3.5.

R602.10.2.2 Locations of braced wall panels. A braced wall panel shall begin within 10 feet (3810 mm)

from each end of a braced wall line as determined in Section R602.10.1.1. The distance between adjacent edges of braced wall panels along a braced wall line shall be not greater than 20 feet (6096 mm) as shown in Figure R602.10.2.2.

Exceptions:

1. Braced wall panels in Seismic Design Categories D₀, D₁ and D₂ shall comply with Section R602.10.2.2.1.
2. Braced wall panels with continuous sheathing in Seismic Design Categories A, B and C shall comply with Section R602.10.7.

R602.10.2.2.1 Location of braced wall panels in Seismic Design Categories D₀, D₁ and D₂. Braced wall panels shall be located at each end of a braced wall line.

Exceptions:

1. Braced wall panels constructed of Method WSP or BV-WSP and continuous sheathing methods as specified in Section R602.10.4 shall be permitted to begin not more than 10 feet (3048 mm) from each end of a braced wall line provided that each end complies with one of the following:
 - 1.1. A minimum 24-inch-wide (610 mm) panel for Methods WSP, CS-WSP, CS-G and CS-PF is applied to each side of the building corner as shown in End Condition 4 of Figure R602.10.7.
 - 1.2. The end of each braced wall panel closest to the end of the braced wall line shall have an 1,800-pound (8 kN) hold-down device fastened to the stud at the edge of the braced wall panel closest to the corner and to the foundation or framing below as shown in End Condition 5 of Figure R602.10.7.
2. Braced wall panels constructed of Method PFH or ABW, or of Method BV-WSP where a hold-down is provided in accordance with Table R602.10.6.5.4, shall be permitted to begin not more than 10 feet (3048 mm) from each end of a braced wall line.

R602.10.2.3 Minimum number of braced wall panels. Braced wall lines with a length of 16 feet (4877 mm) or less shall have not less than two braced wall panels of any length or one braced wall panel

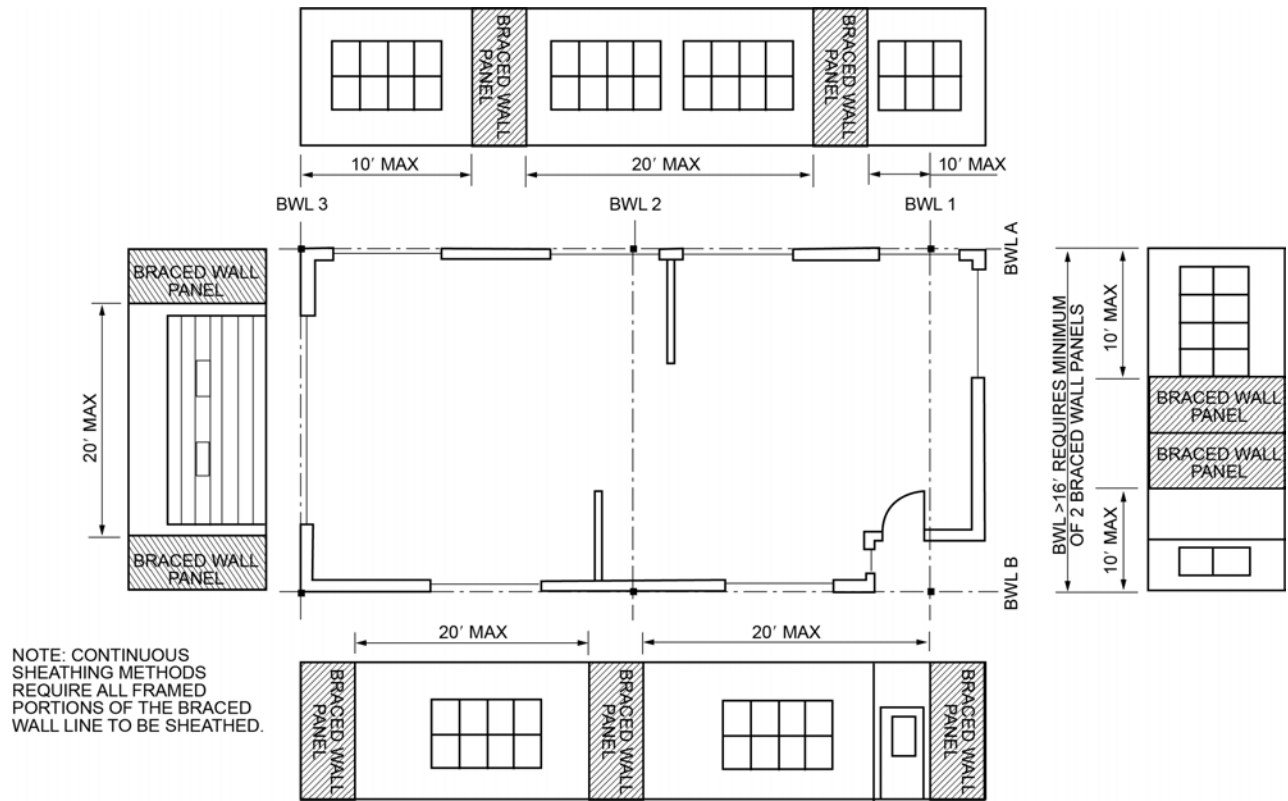
equal to 48 inches (1219 mm) or more. Braced wall lines greater than 16 feet (4877 mm) shall have not less than two braced wall panels.

R602.10.3 Required length of bracing. The required length of bracing along each braced wall line shall be determined as follows:

1. All buildings in Seismic Design Categories A and B shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
2. Detached buildings in Seismic Design Category C shall use Table R602.10.3(1) and the applicable adjustment factors in Table R602.10.3(2).
3. Townhouses in Seismic Design Category C shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.
4. All buildings in Seismic Design Categories D₀, D₁ and D₂ shall use the greater value determined from Table R602.10.3(1) or R602.10.3(3) and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively.

Only braced wall panels parallel to the braced wall line shall contribute toward the required length of bracing of that braced wall line. Braced wall panels along an angled wall meeting the minimum length requirements of Tables R602.10.5 and R602.10.5.2 shall be permitted to contribute its projected length toward the minimum required length of bracing for the braced wall line as shown in Figure R602.10.1.4. Any braced wall panel on an angled wall at the end of a braced wall line shall contribute its projected length for only one of the braced wall lines at the projected corner.

Exception: The length of wall bracing for dwellings in Seismic Design Categories D₀, D₁ and D₂ with stone or masonry veneer installed in accordance with Section R703.8 and exceeding the first-story height shall be in accordance with Section R602.10.6.5.



For SI: 1 foot = 304.8 mm.

**FIGURE R602.10.2.2
LOCATION OF BRACED WALL PANELS**

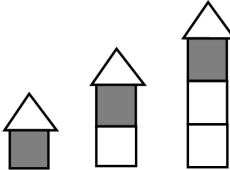
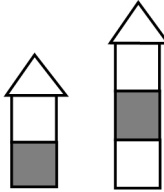


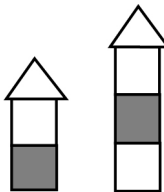
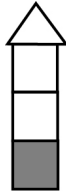
WALL CONSTRUCTION

**TABLE R602.10.3(1)
BRACING REQUIREMENTS BASED ON WIND SPEED**

<ul style="list-style-type: none"> • EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES 			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing ^c (feet)	Method LIB ^b	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB	Methods CS-WSP, CS-G, CS-PF
<div style="writing-mode: vertical-rl; transform: rotate(180deg);"> < 95 mph </div>		10	2.5	2.5	1.5	1.5
		20	4.5	4.5	2.5	2.5
		30	6.5	6.5	4.0	3.5
		40	8.5	8.5	5.0	4.0
		50	10.5	10.5	6.0	5.0
		60	12.5	12.5	7.0	6.0
		10	5.0	5.0	3.0	2.5
		20	8.5	8.5	5.0	4.5
		30	12.5	12.5	7.0	6.0
		40	16.0	16.0	9.5	8.0
		50	20.0	20.0	11.5	10.0
		60	23.5	23.5	13.5	11.5
		10	NP	7.0	4.0	3.5
		20	NP	13.0	7.5	6.5
		30	NP	18.5	10.5	9.0
		40	NP	24.0	13.5	11.5
		50	NP	29.5	17.0	14.5
		60	NP	35.0	20.0	17.0
<div style="writing-mode: vertical-rl; transform: rotate(180deg);"> ≤ 110 </div>		10	3.5	3.5	2.0	1.5
		20	6.0	6.0	3.5	3.0
		30	8.5	8.5	5.0	4.5
		40	11.5	11.5	6.5	5.5
		50	14.0	14.0	8.0	7.0
		60	16.5	16.5	9.5	8.0
		10	6.5	6.5	3.5	3.0
		20	11.5	11.5	6.5	5.5
		30	16.5	16.5	9.5	8.0
		40	21.5	21.5	12.5	10.5
		50	26.5	26.5	15.5	13.0
		60	31.5	31.5	18.0	15.5
		10	NP	9.5	5.5	4.5
		20	NP	17.0	10.0	8.5
		30	NP	24.5	14.0	12.0
		40	NP	32.0	18.5	15.5
		50	NP	39.5	22.5	19.0
		60	NP	46.5	26.5	23.0

(continued)

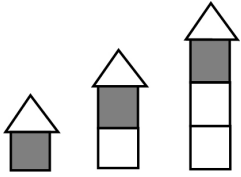
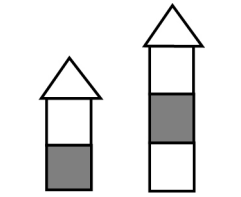
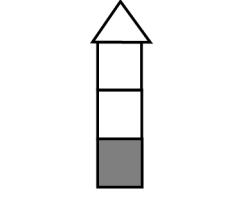
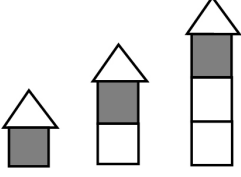
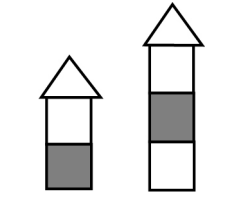
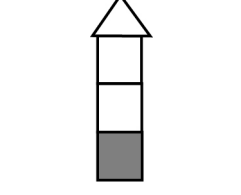
TABLE R602.10.3(1)—continued
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing ^c (feet)	Method LIB ^b	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB	Methods CS-WSP, CS-G, CS-PF
≤ 115		10	3.5	3.5	2.0	2.0
		20	6.5	6.5	3.5	3.5
		30	9.5	9.5	5.5	4.5
		40	12.5	12.5	7.0	6.0
		50	15.0	15.0	9.0	7.5
		60	18.0	18.0	10.5	9.0
		10	7.0	7.0	4.0	3.5
		20	12.5	12.5	7.5	6.5
		30	18.0	18.0	10.5	9.0
		40	23.5	23.5	13.5	11.5
		50	29.0	29.0	16.5	14.0
		60	34.5	34.5	20.0	17.0
		10	NP	10.0	6.0	5.0
		20	NP	18.5	11.0	9.0
		30	NP	27.0	15.5	13.0
		40	NP	35.0	20.0	17.0
		50	NP	43.0	24.5	21.0
		60	NP	51.0	29.0	25.0
≤ 120		10	4.0	4.0	2.5	2.0
		20	7.0	7.0	4.0	3.5
		30	10.5	10.5	6.0	5.0
		40	13.5	13.5	8.0	6.5
		50	16.5	16.5	9.5	8.0
		60	19.5	19.5	11.5	9.5
		10	7.5	7.5	4.5	3.5
		20	14.0	14.0	8.0	7.0
		30	20.0	20.0	11.5	9.5
		40	25.5	25.5	15.0	12.5
		50	31.5	31.5	18.0	15.5
		60	37.5	37.5	21.5	18.5
		10	NP	11.0	6.5	5.5
		20	NP	20.5	11.5	10.0
		30	NP	29.0	17.0	14.5
		40	NP	38.0	22.0	18.5
		50	NP	47.0	27.0	23.0
		60	NP	55.5	32.0	27.0

(continued)

WALL CONSTRUCTION

TABLE R602.10.3(1)—continued
BRACING REQUIREMENTS BASED ON WIND SPEED

• EXPOSURE CATEGORY B • 30-FOOT MEAN ROOF HEIGHT • 10-FOOT WALL HEIGHT • 2 BRACED WALL LINES			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^a			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing ^c (feet)	Method LIB ^b	Method GB	Methods DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP, ABW, PFH, PFC, CS-SFB	Methods CS-WSP, CS-G, CS-PF
≤ 130		10	4.5	4.5	2.5	2.5
		20	8.5	8.5	5.0	4.0
		30	12.0	12.0	7.0	6.0
		40	15.5	15.5	9.0	7.5
		50	19.5	19.5	11.0	9.5
		60	23.0	23.0	13.0	11.0
		10	8.5	8.5	5.0	4.5
		20	16.0	16.0	9.5	8.0
		30	23.0	23.0	13.5	11.5
		40	30.0	30.0	17.5	15.0
		50	37.0	37.0	21.5	18.0
		60	44.0	44.0	25.0	21.5
		10	NP	13.0	7.5	6.5
		20	NP	24.0	13.5	11.5
		30	NP	34.5	19.5	17.0
		40	NP	44.5	25.5	22.0
		50	NP	55.0	31.5	26.5
		60	NP	65.0	37.5	31.5
< 140		10	5.5	5.5	3.0	2.5
		20	10.0	10.0	5.5	5.0
		30	14.0	14.0	8.0	7.0
		40	18.0	18.0	10.5	9.0
		50	22.5	22.5	13.0	11.0
		60	26.5	26.5	15.0	13.0
		10	10.0	10.0	6.0	5.0
		20	18.5	18.5	11.0	9.0
		30	27.0	27.0	15.5	13.0
		40	35.0	35.0	20.0	17.0
		50	43.0	43.0	24.5	21.0
		60	51.0	51.0	29.0	25.0
		10	NP	15.0	8.5	7.5
		20	NP	27.5	16.0	13.5
		30	NP	39.5	23.0	19.5
		40	NP	51.5	29.5	25.0
		50	NP	63.5	36.5	31.0
		60	NP	75.5	43.0	36.5

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NP = Not Permitted.

a. Linear interpolation shall be permitted.

b. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.

c. Where three or more parallel braced wall lines are present and the distances between adjacent braced wall lines are different, the average dimension shall be permitted to be used for braced wall line spacing.

TABLE R602.10.3(2)
WIND ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY/SUPPORTING	CONDITION	ADJUSTMENT FACTOR ^{a, b} [multiply length from Table R602.10.3(1) by this factor]	APPLICABLE METHODS
1	Exposure category ^d	One-story structure	B	1.00	All methods
			C	1.20	
			D	1.50	
		Two-story structure	B	1.00	
			C	1.30	
			D	1.60	
		Three-story structure	B	1.00	
			C	1.40	
			D	1.70	
2	Roof eave-to-ridge height	Roof only	≤ 5 feet	0.70	All methods
			10 feet	1.00	
			15 feet	1.30	
			20 feet	1.60	
		Roof + 1 floor	≤ 5 feet	0.85	
			10 feet	1.00	
			15 feet	1.15	
			20 feet	1.30	
		Roof + 2 floors	≤ 5 feet	0.90	
			10 feet	1.00	
			15 feet	1.10	
			20 feet	Not permitted	
3	Story height (Section R301.3)	Any story	8 feet	0.90	All methods
			9 feet	0.95	
			10 feet	1.00	
			11 feet	1.05	
			12 feet	1.10	
4	Number of braced wall lines (per plan direction) ^c	Any story	2	1.00	All methods
			3	1.30	
			4	1.45	
			≥ 5	1.60	
5	Additional 800-pound hold-down device	Top story only	Fastened to the end studs of each braced wall panel and to the foundation or framing below	0.80	DWB, WSP, SFB, PBS, PCP, HPS
6	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.40	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
7	Gypsum board fastening	Any story	4 inches o.c. at panel edges, including top and bottom plates, and all horizontal joints blocked	0.7	GB
8	Horizontal blocking	Any story	Horizontal block is omitted	2.0	WSP, PBS, CS-WSP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.48 N.

- a. Linear interpolation shall be permitted.
- b. The total adjustment factor is the product of all applicable adjustment factors.
- c. The adjustment factor is permitted to be 1.0 when determining bracing amounts for intermediate braced wall lines provided the bracing amounts on adjacent braced wall lines are based on a spacing and number that neglects the intermediate braced wall line.
- d. The same adjustment factor shall be applied to all braced wall lines on all floors of the structure, based on the worst-case exposure category.

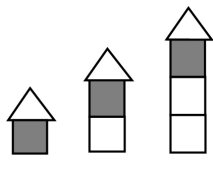
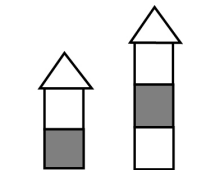
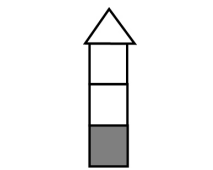
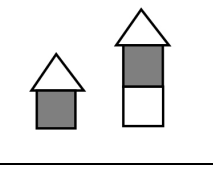
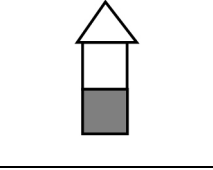
WALL CONSTRUCTION

TABLE R602.10.3(3)
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

<ul style="list-style-type: none"> • WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET 			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a,9}				
Seismic Design Category ^b	Story Location	Braced Wall Line Length (feet) ^c	Method LIB ^e	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB ^e	Methods WSP, ABW ⁱ , PFH ⁱ and PFG ^{e,f}	Methods CS-WSP, CS-G, CS-PF
C (townhouses only)		10	2.5	2.5	2.5	1.6	1.4
		20	5.0	5.0	5.0	3.2	2.7
		30	7.5	7.5	7.5	4.8	4.1
		40	10.0	10.0	10.0	6.4	5.4
		50	12.5	12.5	12.5	8.0	6.8
		10	NP	4.5	4.5	3.0	2.6
		20	NP	9.0	9.0	6.0	5.1
		30	NP	13.5	13.5	9.0	7.7
		40	NP	18.0	18.0	12.0	10.2
		50	NP	22.5	22.5	15.0	12.8
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
	D ₀		10	NP	2.8	2.8	1.8
20			NP	5.5	5.5	3.6	3.1
30			NP	8.3	8.3	5.4	4.6
40			NP	11.0	11.0	7.2	6.1
50			NP	13.8	13.8	9.0	7.7
		10	NP	5.3	5.3	3.8	3.2
		20	NP	10.5	10.5	7.5	6.4
		30	NP	15.8	15.8	11.3	9.6
		40	NP	21.0	21.0	15.0	12.8
		50	NP	26.3	26.3	18.8	16.0
		10	NP	7.3	7.3	5.3	4.5
		20	NP	14.5	14.5	10.5	9.0
		30	NP	21.8	21.8	15.8	13.4
		40	NP	29.0	29.0	21.0	17.9
		50	NP	36.3	36.3	26.3	22.3

(continued)

TABLE R602.10.3(3)—continued
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

• WALL HEIGHT = 10 FEET • 10 PSF FLOOR DEAD LOAD • 15 PSF ROOF/CEILING DEAD LOAD • BRACED WALL LINE SPACING ≤ 25 FEET			MINIMUM TOTAL LENGTH (FEET) OF BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a,9}				
Seismic Design Category ^b	Story Location	Braced Wall Line Length (feet) ^c	Method LIB ^d	Method GB	Methods DWB, SFB, PBS, PCP, HPS, CS-SFB ^e	Methods WSP, ABW ^f , PFH ^f and PFG ^{g,1}	Methods CS-WSP, CS-G, CS-PF
D ₁		10	NP	3.0	3.0	2.0	1.7
		20	NP	6.0	6.0	4.0	3.4
		30	NP	9.0	9.0	6.0	5.1
		40	NP	12.0	12.0	8.0	6.8
		50	NP	15.0	15.0	10.0	8.5
		10	NP	6.0	6.0	4.5	3.8
		20	NP	12.0	12.0	9.0	7.7
		30	NP	18.0	18.0	13.5	11.5
		40	NP	24.0	24.0	18.0	15.3
		50	NP	30.0	30.0	22.5	19.1
		10	NP	8.5	8.5	6.0	5.1
		20	NP	17.0	17.0	12.0	10.2
		30	NP	25.5	25.5	18.0	15.3
		40	NP	34.0	34.0	24.0	20.4
		50	NP	42.5	42.5	30.0	25.5
	D ₂ ^h		10	NP	4.0	4.0	2.5
20			NP	8.0	8.0	5.0	4.3
30			NP	12.0	12.0	7.5	6.4
40			NP	16.0	16.0	10.0	8.5
50			NP	20.0	20.0	12.5	10.6
		10	NP	7.5	7.5	5.5	4.7
		20	NP	15.0	15.0	11.0	9.4
		30	NP	22.5	22.5	16.5	14.0
		40	NP	30.0	30.0	22.0	18.7
		50	NP	37.5	37.5	27.5	23.4
Three-story dwelling		10	NP	NP	NP	NP	NP
		20	NP	NP	NP	NP	NP
		30	NP	NP	NP	NP	NP
		40	NP	NP	NP	NP	NP
		50	NP	NP	NP	NP	NP
Cripple wall below one- or two-story dwelling		10	NP	NP	NP	7.5	6.4
		20	NP	NP	NP	15.0	12.8
		30	NP	NP	NP	22.5	19.1
		40	NP	NP	NP	30.0	25.5
		50	NP	NP	NP	37.5	31.9

(continued)

WALL CONSTRUCTION

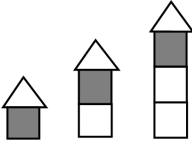
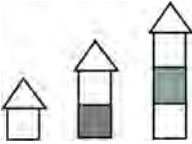
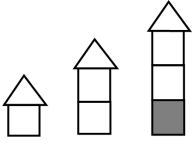
TABLE R602.10.3(3)—continued
BRACING REQUIREMENTS BASED ON SEISMIC DESIGN CATEGORY

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Linear interpolation shall be permitted.
- b. Interpolation of bracing length between the S_{ds} values associated with the seismic design categories shall be permitted when a site-specific S_{ds} value is determined in accordance with Section 1613.2 of the *California Building Code*.
- c. Where the braced wall line length is greater than 50 feet, braced wall lines shall be permitted to be divided into shorter segments having lengths of 50 feet or less, and the amount of bracing within each segment shall be in accordance with this table.
- d. Method LIB shall have gypsum board fastened to not less than one side with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum board. Spacing of fasteners at panel edges shall not exceed 8 inches.
- e. Methods PFG and CS-SFB do not apply in Seismic Design Categories D_0 , D_1 and D_2 .
- f. Methods PFH, PFG and ABW are only permitted on a single story or a first of two stories.
- g. Where more than one bracing method is used, mixing methods shall be in accordance with Section R602.10.4.1.
- h. One- and two-family dwellings in Seismic Design Category D_2 exceeding two stories shall be designed in accordance with accepted engineering practice.

TABLE R602.10.3(4)
SEISMIC ADJUSTMENT FACTORS TO THE REQUIRED LENGTH OF WALL BRACING

ITEM NUMBER	ADJUSTMENT BASED ON	STORY ^a	CONDITION	ADJUSTMENT FACTOR ^{a, b} [Multiply length from Table R602.10.3(3) by this factor]	APPLICABLE METHODS
1	Story height (Section 301.3)	Any story	≤ 10 feet	1.0	All methods
			> 10 feet and ≤ 12 feet	1.2	
2	Braced wall line spacing, townhouses in SDC C	Any story	≤ 35 feet	1.0	
			> 35 feet and ≤ 50 feet	1.43	
3	Braced wall line spacing, in SDC D ₀ , D ₁ , D ₂ ^c	Any story	> 25 feet and ≤ 30 feet	1.2	
			> 30 feet and ≤ 35 feet	1.4	
4	Wall dead load	Any story	> 8 psf and < 15 psf	1.0	
			< 8psf	0.85	
5	Roof/ceiling dead load for wall supporting	1-, 2- or 3-story building	≤ 15 psf	1.0	
		2- or 3-story building	> 15 psf and ≤ 25 psf	1.1	
		1-story building or top story	> 15 psf and ≤ 25 psf	1.2	
6	Walls with stone or masonry veneer, townhouses in SDC C ^{d, e}		1.0	All methods	
			1.5		
			1.5		
7	Walls with stone or masonry veneer, detached one- and two-family dwellings in SDC D ₀ – D ₂ ^{d, f}	Any story	See Section R602.10.6.5.4	BV-WSP	
8	Walls with stone or masonry veneer, detached one- and two-family dwellings in SDC D ₀ – D ₂ ^{d, f}	First and second story of two-story dwelling	Limited brick veneer on second story. See Section R602.10.6.5.3.	1.2	WSP, CS-WSP
9	Interior gypsum board finish (or equivalent)	Any story	Omitted from inside face of braced wall panels	1.5	DWB, WSP, SFB, PBS, PCP, HPS, CS-WSP, CS-G, CS-SFB
10	Horizontal blocking	Any story	Horizontal blocking omitted	2.0	WSP, PBS, CS-WSP

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Linear interpolation shall be permitted.
- b. The total length of bracing required for a given wall line is the product of all applicable adjustment factors.
- c. The length-to-width ratio for the floor/roof diaphragm shall not exceed 3:1.
- d. Applies to stone or masonry veneer exceeding the first story height.
- e. The adjustment factor for stone or masonry veneer shall be applied to all exterior braced wall lines and all braced wall lines on the interior of the building, backing or perpendicular to and laterally supporting veneered walls.
- f. See Section R602.10.6.5 for requirements where stone or masonry veneer does not exceed the first-story height.
- g. One- and two-family dwellings in Seismic Design Category D₂ exceeding two stories shall be designed in accordance with accepted engineering practice.

R602.10.4 Construction methods for braced wall panels. Intermittent and continuously sheathed braced wall panels shall be constructed in accordance with this section and the methods listed in Table R602.10.4.

R602.10.4.1 Mixing methods. Mixing of bracing methods shall be permitted as follows:

1. Mixing intermittent bracing and continuous sheathing methods from story to story shall be permitted.
2. Mixing intermittent bracing methods from braced wall line to braced wall line within a story shall be permitted. In regions within Seismic Design Categories A, B and C where the ultimate design wind speed is less than or equal to 130 mph (58m/s), mixing of intermittent bracing and continuous sheathing methods from braced wall line to braced wall line within a story shall be permitted.
3. Mixing intermittent bracing methods along a braced wall line shall be permitted in Seismic Design Categories A and B, and detached dwellings in Seismic Design Category C, provided that the length of required bracing in accordance with Table R602.10.3(1) or R602.10.3(3) is the highest value of all intermittent bracing methods used.
4. Mixing of continuous sheathing methods CS-WSP, CS-G and CS-PF along a braced wall line shall be permitted. Intermittent methods ABW, PFH and PFG shall be permitted to be used along a braced wall line with continuous sheathed methods, provided that the length of required bracing for that braced wall line is determined in accordance with Table R602.10.3(1) or R602.10.3(3) using the highest value of the bracing methods used.
5. In Seismic Design Categories A and B, and for detached one- and two-family dwellings in Seismic Design Category C, mixing of intermittent bracing methods along the interior portion of a braced wall line with continuous sheathing methods CS-WSP, CS-G and CS-PF along the exterior portion of the same braced wall line shall be permitted. The length of required bracing shall be the highest value of all intermittent bracing methods used in accordance with Table R602.10.3(1) or R602.10.3(3) as adjusted by Tables R602.10.3(2) and R602.10.3(4), respectively. The requirements of Section R602.10.7 shall apply to each end of the continuously sheathed portion of the braced wall line.

R602.10.4.2 Continuous sheathing methods. Continuous sheathing methods require structural panel sheathing to be used on all sheathable surfaces on one side of a braced wall line including areas above and below openings and gable end walls and shall meet the requirements of Section R602.10.7.

R602.10.4.3 Braced wall panel interior finish material. Braced wall panels shall have gypsum wall board installed on the side of the wall opposite the bracing material. Gypsum wall board shall be not less than $\frac{1}{2}$ inch (12.7 mm) in thickness and be fastened with nails or screws in accordance with Table R602.3(1) for exterior sheathing or Table R702.3.5 for interior gypsum wall board. Spacing of fasteners at panel edges for gypsum wall board opposite Method LIB bracing shall not exceed 8 inches (203 mm). Interior finish material shall not be glued in Seismic Design Categories D₀, D₁ and D₂.

Exceptions:

1. Interior finish material is not required opposite wall panels that are braced in accordance with Methods GB, BV-WSP, ABW, PFH, PFG and CS-PF, unless otherwise required by Section R302.6.
2. An approved interior finish material with an in-plane shear resistance equivalent to gypsum board shall be permitted to be substituted, unless otherwise required by Section R302.6.
3. Except for Method LIB, gypsum wall board is permitted to be omitted provided that the required length of bracing in Tables R602.10.3(1) and R602.10.3(3) is multiplied by the appropriate adjustment factor in Tables R602.10.3(2) and R602.10.3(4), respectively, unless otherwise required by Section R302.6.

R602.10.4.4 Panel joints. Vertical joints of panel sheathing shall occur over and be fastened to common studs. Horizontal joints of panel sheathing in braced wall panels shall occur over and be fastened to common blocking of a thickness of $1\frac{1}{2}$ inches (38 mm) or greater.

Exceptions:

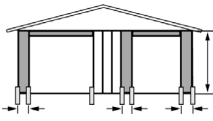
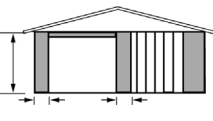
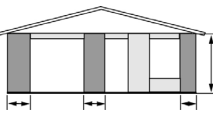
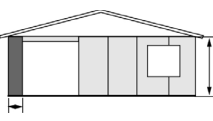
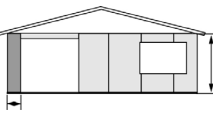
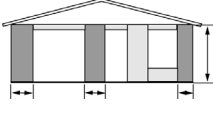
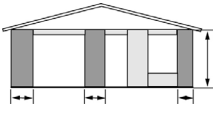
1. For methods WSP and CS-WSP, blocking of horizontal joints is permitted to be omitted when adjustment factor No. 8 of Table R602.10.3(2) or No. 9 of Table R602.10.3(4) is applied.
2. Vertical joints of panel sheathing shall be permitted to occur over double studs, where adjoining panel edges are attached to separate studs with the required panel edge fastening schedule, and the adjacent studs are attached together with two rows of 10d box nails [3 inches by 0.128 inch (76.2 mm by 3.25 mm)] at 10 inches o.c. (254 mm).
3. Blocking at horizontal joints shall not be required in wall segments that are not counted as braced wall panels.
4. Where Method GB panels are installed horizontally, blocking of horizontal joints is not required.

**TABLE R602.10.4
BRACING METHODS**

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a		
			Fasteners	Spacing	
Intermittent Bracing Methods	LIB Let-in-bracing	1 × 4 wood or approved metal straps at 45° to 60° angles for maximum 16" stud spacing		Wood: 2-8d common nails or 3-8d (2½" long × 0.113" dia.) nails Metal strap: per manufacturer	Wood: per stud and top and bottom plates Metal: per manufacturer
	DWB Diagonal wood boards	¾" (1" nominal) for maximum 24" stud spacing		2-8d (2½" long × 0.113" dia.) nails or 2-1¾" long staples	Per stud
	WSP Wood structural panel (See Section R604)	¾"		Exterior sheathing per Table R602.3(3)	6" edges 12" field
				Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	BV-WSP^e Wood structural panels with stone or masonry veneer (See Section R602.10.6.5)	7/16"	See Figure R602.10.6.5.2	8d common (2½" × 0.131) nails	4" at panel edges 12" at intermediate supports 4" at braced wall panel end posts
	SFB Structural fiberboard sheathing	½" or 25/32" for maximum 16" stud spacing		1½" long × 0.12" dia. (for ½" thick sheathing) 1¾" long × 0.12" dia. (for 25/32" thick sheathing) galvanized roofing nails	3" edges 6" field
	GB Gypsum board	½"		Nails or screws per Table R602.3(1) for exterior locations	For all braced wall panel locations: 7" edges (including top and bottom plates) 7" field
				Nails or screws per Table R702.3.5 for interior locations	
	PBS Particleboard sheathing (See Section R605)	¾" or ½" for maximum 16" stud spacing		For ¾", 6d common (2" long × 0.113" dia.) nails; For ½", 8d common (2½" long × 0.131" dia.) nails	3" edges 6" field
	PCP Portland cement plaster	See Section R703.6 for maximum 16" stud spacing		1½" long, 11 gage, 0.120" dia., 7/16" dia. head nails or 7/8" long, 16 gage staples	6" o.c. on all framing members
HPS Hardboard panel siding	7/16" for maximum 16" stud spacing		0.092" dia., 0.225" dia. head nails with length to accommodate 1½" penetration into studs	4" edges 8" field	
ABW Alternate braced wall	¾"		See Section R602.10.6.1	See Section R602.10.6.1	

(continued)

TABLE R602.10.4—continued
BRACING METHODS

METHODS, MATERIAL	MINIMUM THICKNESS	FIGURE	CONNECTION CRITERIA ^a	
			Fasteners	Spacing
Intermittent Bracing Methods PFH Portal frame with hold-downs PFG Portal frame at garage	$3/8$ "		See Section R602.10.6.2	See Section R602.10.6.2
	$7/16$ "		See Section R602.10.6.3	See Section R602.10.6.3
Continuous Sheathing Methods CS-WSP Continuously sheathed wood structural panel CS-G^{b,c} Continuously sheathed wood structural panel adjacent to garage openings CS-PF Continuously sheathed portal frame CS-SFB^d Continuously sheathed structural fiberboard	$3/8$ "		Exterior sheathing per Table R602.3(3)	6" edges 12" field
	$3/8$ "		Interior sheathing per Table R602.3(1) or R602.3(2)	Varies by fastener
	$3/8$ "		See Method CS-WSP	See Method CS-WSP
	$7/16$ "		See Section R602.10.6.4	See Section R602.10.6.4
	$1/2$ " or $25/32$ " for maximum 16" stud spacing		$1\ 1/2$ " long \times 0.12" dia. (for $1/2$ " thick sheathing) $1\ 3/4$ " long \times 0.12" dia. (for $25/32$ " thick sheathing) galvanized roofing nails	3" edges 6" field

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad, 1 pound per square foot = 47.8 N/m², 1 mile per hour = 0.447 m/s.

- a. Adhesive attachment of wall sheathing, including Method GB, shall not be permitted in Seismic Design Categories C, D₀, D₁ and D₂.
- b. Applies to panels next to garage door opening where supporting gable end wall or roof load only. Shall only be used on one wall of the garage. In Seismic Design Categories D₀, D₁ and D₂, roof covering dead load shall not exceed 3 psf.
- c. Garage openings adjacent to a Method CS-G panel shall be provided with a header in accordance with Table R602.7(1). A full-height clear opening shall not be permitted adjacent to a Method CS-G panel.
- d. Method CS-SFB does not apply in Seismic Design Categories D₀, D₁ and D₂.
- e. Method applies to detached one- and two-family dwellings in Seismic Design Categories D₀ through D₂ only.

R602.10.5 Minimum length of a braced wall panel. The minimum length of a braced wall panel shall comply with Table R602.10.5. For Methods CS-WSP and CS-SFB, the minimum panel length shall be based on the adjacent clear opening height in accordance with Table R602.10.5 and Figure R602.10.5. Where a panel has an opening on either side of differing heights, the taller opening height shall be used to determine the panel length.

R602.10.5.1 Contributing length. For purposes of computing the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), the contributing length of each braced wall panel shall be as specified in Table R602.10.5.

R602.10.5.2 Partial credit. For Methods DWB, WSP, SFB, PBS, PCP and HPS in Seismic Design Categories A, B and C, panels between 36 inches and 48 inches (914 mm and 1219 mm) in length shall be considered a braced wall panel and shall be permitted to partially contribute toward the required length of bracing in Tables R602.10.3(1) and R602.10.3(3), and the contributing length shall be determined from Table R602.10.5.2.

R602.10.6 Construction of Methods ABW, PFH, PFG, CS-PF and BV-WSP. Methods ABW, PFH, PFG, CS-PF and BV-WSP shall be constructed as specified in Sections R602.10.6.1 through R602.10.6.5.

R602.10.6.1 Method ABW: Alternate braced wall panels. Method ABW braced wall panels shall be constructed in accordance with Figure R602.10.6.1. The hold-down force shall be in accordance with Table R602.10.6.1.

R602.10.6.2 Method PFH: Portal frame with hold-downs. Method PFH braced wall panels shall be constructed in accordance with Figure R602.10.6.2.

R602.10.6.3 Method PFG: Portal frame at garage door openings in Seismic Design Categories A, B and C. Where supporting a roof or one story and a roof, a Method PFG braced wall panel constructed in accordance with Figure R602.10.6.3 shall be permitted on either side of garage door openings.

R602.10.6.4 Method CS-PF: Continuously sheathed portal frame. Continuously sheathed portal frame braced wall panels shall be constructed in accordance with Figure R602.10.6.4 and Table R602.10.6.4.

R602.10.6.5 Wall bracing for dwellings with stone and masonry veneer in Seismic Design Categories D₀, D₁ and D₂. Townhouses in Seismic Design Categories D₀, D₁ and D₂ with stone or masonry veneer exceeding the first-story height shall be designed in accordance with accepted engineering practice.

One- and two-family dwellings in Seismic Design Category D₂ exceeding two stories and having stone or masonry veneer shall be designed in accordance with accepted engineering practice.

Where stone and masonry veneer are installed in accordance with Section R703.8, wall bracing on exterior braced wall lines and braced wall lines on the interior of the building, backing or perpendicular to and laterally supporting veneered walls shall comply with this section.

R602.10.6.5.1 Veneer on first story only. Where dwellings in Seismic Design Categories D₀, D₁ and D₂ have stone or masonry veneer installed in accordance with Section R703.8 and the veneer does not exceed the first-story height, wall bracing shall be in accordance with Section R602.10, exclusive of Section R602.10.6.5.

R602.10.6.5.2 Veneer exceeding first-story height. Where detached one- or two-family dwellings in Seismic Design Categories D₀, D₁ and D₂ have stone or masonry veneer installed in accordance with Section R703.8, and the veneer exceeds the first-story height, wall bracing at exterior braced wall lines and braced wall lines on the interior of the building shall be constructed using Method BV-WSP in accordance with this section and Figure R602.10.6.5.2. Cripple walls shall not be permitted, and required interior braced wall lines shall be supported on continuous foundations.

R602.10.6.5.3 Limited veneer exceeding first-story height. Where detached one- or two-family dwellings in Seismic Design Categories D₀, D₁ and D₂ have exterior veneer installed in accordance with Section R703.8 and where brick veneer installed above the first-story height meets the following limitations, bracing in accordance with Method WSP or CS-WSP shall be permitted provided that the total length of braced wall panels specified by Table R602.10.3(3) is multiplied by 1.2 for each first- and second-story braced wall line.

1. The dwelling does not extend more than two stories above grade plane.
2. The veneer does not exceed 5 inches (127 mm) in thickness.
3. The height of veneer on gable-end walls does not extend more than 8 feet (2438 mm) above the bearing wall top plate elevation.
4. Where veneer is installed on multiple walls above the first story, the total area of the veneer on the second-story exterior walls shall not exceed 25 percent of the occupied second floor area.
5. Where the veneer is installed on one entire second-story exterior wall, including walls on bay windows and similar appurtenances, brick veneer shall not be installed on any of the other walls on that floor.

WALL CONSTRUCTION

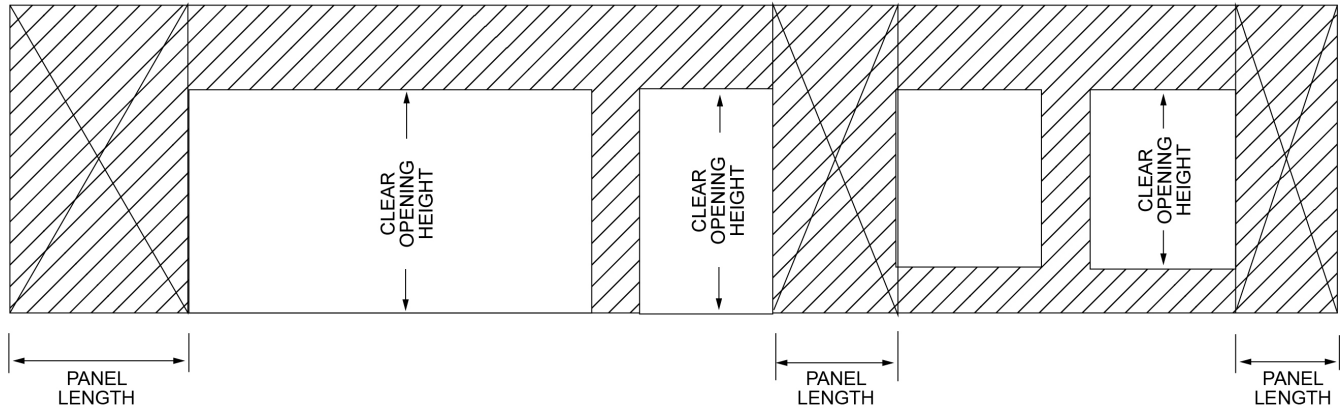
**TABLE R602.10.5
MINIMUM LENGTH OF BRACED WALL PANELS**

METHOD (See Table R602.10.4)		MINIMUM LENGTH ^a (inches)					CONTRIBUTING LENGTH (inches)
		Wall Height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
DWB, WSP, SFB, PBS, PCP, HPS, BV-WSP		48	48	48	53	58	Actual ^b
GB		48	48	48	53	58	Double sided = Actual Single sided = 0.5 × Actual
LIB		55	62	69	NP	NP	Actual ^b
ABW	SDC A, B and C, ultimate design wind speed < 140 mph	28	32	34	38	42	48
	SDC D ₀ , D ₁ and D ₂ , ultimate design wind speed < 140 mph	32	32	34	NP	NP	
CS-G		24	27	30	33	36	Actual ^b
CS-WSP, CS-SFB	Adjacent clear opening height (inches)						Actual ^b
	≤ 64	24	27	30	33	36	
	68	26	27	30	33	36	
	72	27	27	30	33	36	
	76	30	29	30	33	36	
	80	32	30	30	33	36	
	84	35	32	32	33	36	
	88	38	35	33	33	36	
	92	43	37	35	35	36	
	96	48	41	38	36	36	
	100	—	44	40	38	38	
	104	—	49	43	40	39	
	108	—	54	46	43	41	
	112	—	—	50	45	43	
	116	—	—	55	48	45	
	120	—	—	60	52	48	
	124	—	—	—	56	51	
	128	—	—	—	61	54	
	132	—	—	—	66	58	
136	—	—	—	—	62		
140	—	—	—	—	66		
144	—	—	—	—	72		
METHOD (See Table R602.10.4)		Portal header height					
		8 feet	9 feet	10 feet	11 feet	12 feet	
PFH	Supporting roof only	16	16	16	Note c	Note c	48
	Supporting one story and roof	24	24	24	Note c	Note c	
PFG		24	27	30	Note d	Note d	1.5 × Actual ^b
CS-PF	SDC A, B and C	16	18	20	Note e	Note e	1.5 × Actual ^b
	SDC D ₀ , D ₁ and D ₂	16	18	20	Note e	Note e	Actual ^b

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NP = Not Permitted.

- a. Linear interpolation shall be permitted.
- b. Use the actual length where it is greater than or equal to the minimum length.
- c. Maximum header height for PFH is 10 feet in accordance with Figure R602.10.6.2, but wall height shall be permitted to be increased to 12 feet with pony wall.
- d. Maximum header height for PFG is 10 feet in accordance with Figure R602.10.6.3, but wall height shall be permitted to be increased to 12 feet with pony wall.
- e. Maximum header height for CS-PF is 10 feet in accordance with Figure R602.10.6.4, but wall height shall be permitted to be increased to 12 feet with pony wall.



**FIGURE R602.10.5
BRACED WALL PANELS WITH CONTINUOUS SHEATHING**

**TABLE R602.10.5.2
PARTIAL CREDIT FOR BRACED WALL PANELS LESS THAN 48 INCHES IN ACTUAL LENGTH**

ACTUAL LENGTH OF BRACED WALL PANEL (inches)	CONTRIBUTING LENGTH OF BRACED WALL PANEL (inches) ^a	
	8-foot Wall Height	9-foot Wall Height
48	48	48
42	36	36
36	27	NA

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NA = Not Applicable.

a. Linear interpolation shall be permitted.

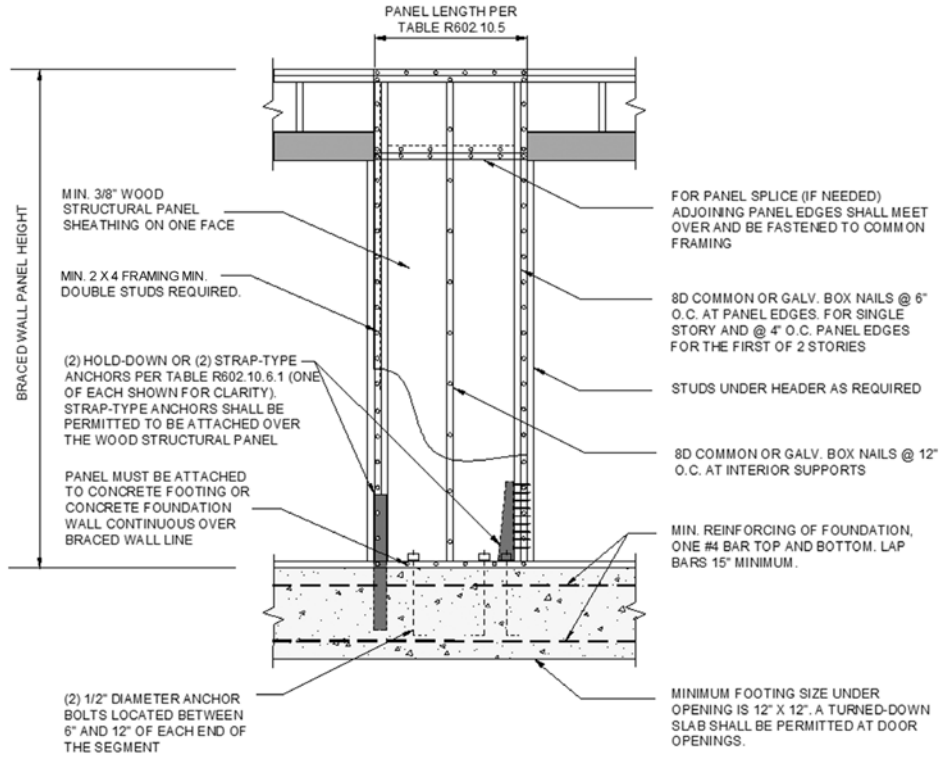
**TABLE R602.10.6.1
MINIMUM HOLD-DOWN FORCES FOR METHOD ABW BRACED WALL PANELS**

SEISMIC DESIGN CATEGORY AND WIND SPEED	SUPPORTING/STORY	HOLD-DOWN FORCE (pounds)				
		Height of Braced Wall Panel				
		8 feet	9 feet	10 feet	11 feet	12 feet
SDC A, B and C Ultimate design wind speed < 140 mph	One story	1,800	1,800	1,800	2,000	2,200
	First of two stories	3,000	3,000	3,000	3,300	3,600
SDC D ₀ , D ₁ and D ₂ Ultimate design wind speed < 140 mph	One story	1,800	1,800	1,800	NP	NP
	First of two stories	3,000	3,000	3,000	NP	NP

For SI: 1 foot = 304.8 mm, 1 pound = 4.45 N, 1 mile per hour = 0.447 m/s.

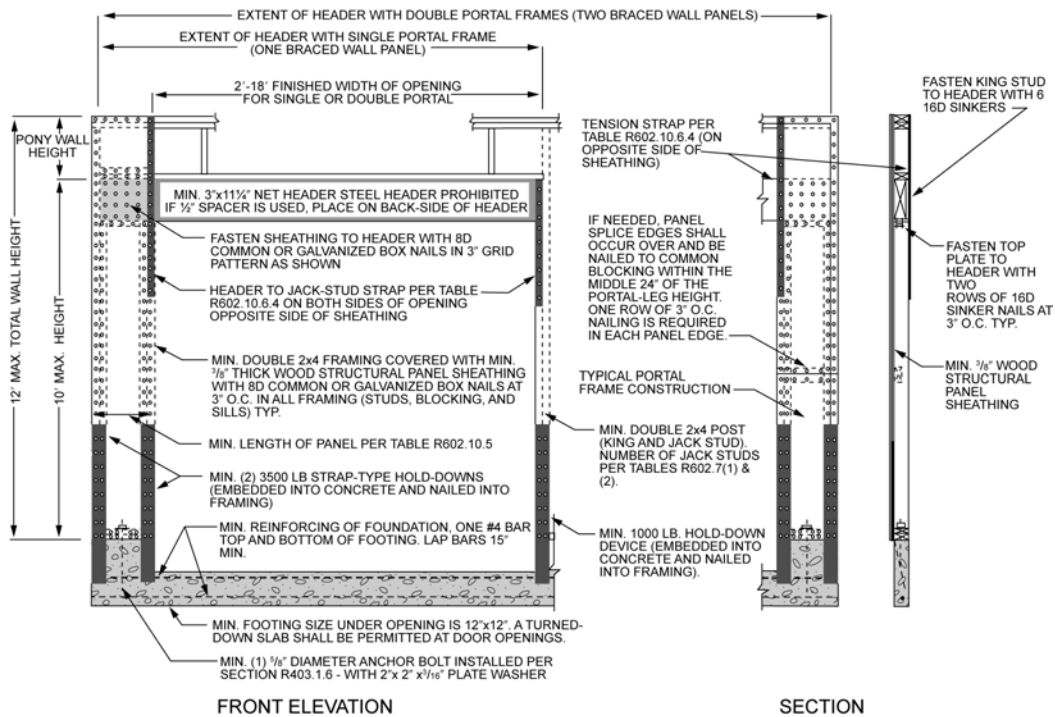
NP = Not Permitted.

WALL CONSTRUCTION



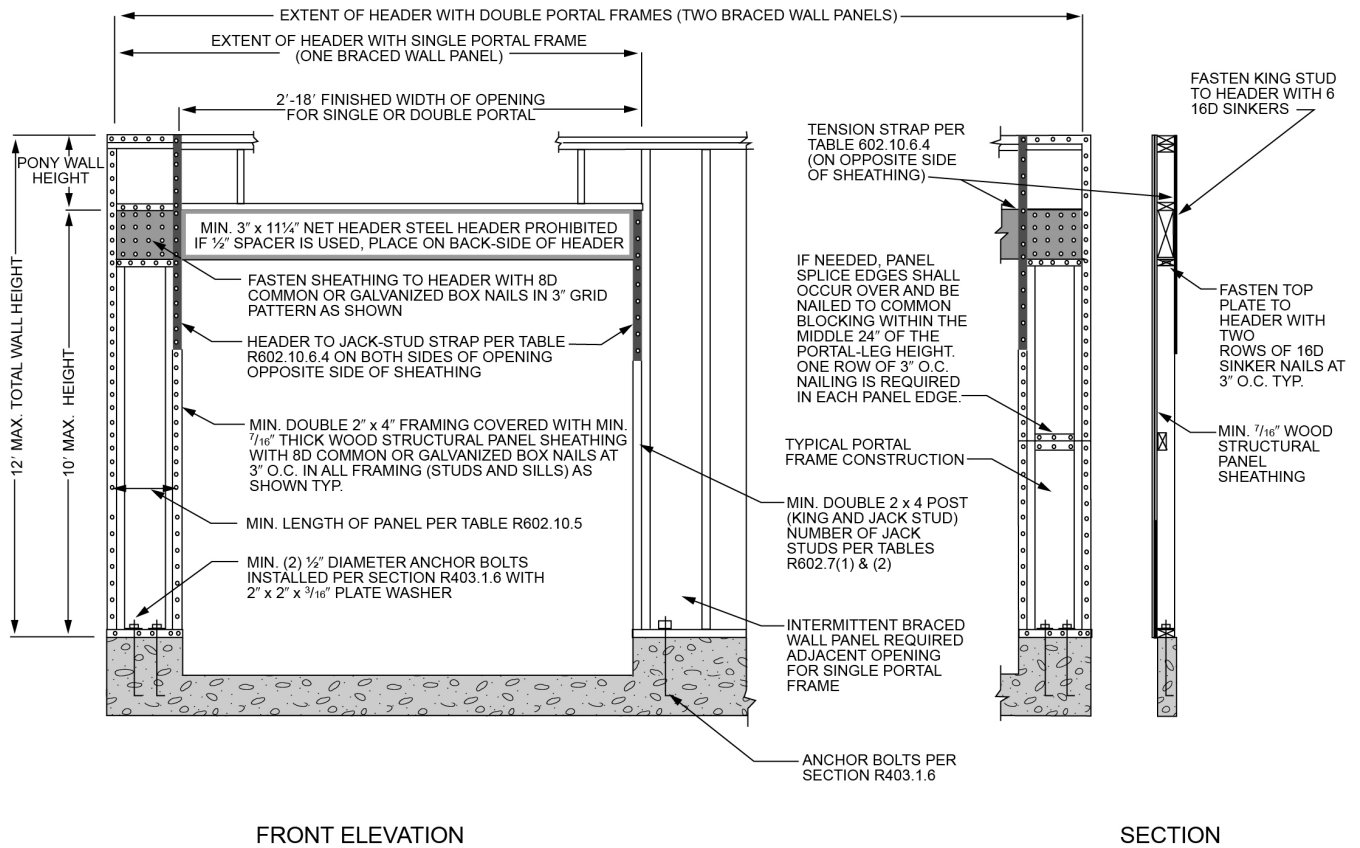
For SI: 1 inch = 25.4 mm.

FIGURE R602.10.6.1
METHOD ABW—ALTERNATE BRACED WALL PANEL



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R602.10.6.2
METHOD PFH—PORTAL FRAME WITH HOLD-DOWNS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R602.10.6.3
METHOD PFG—PORTAL FRAME AT GARAGE DOOR OPENINGS IN SEISMIC DESIGN CATEGORIES A, B AND C

WALL CONSTRUCTION

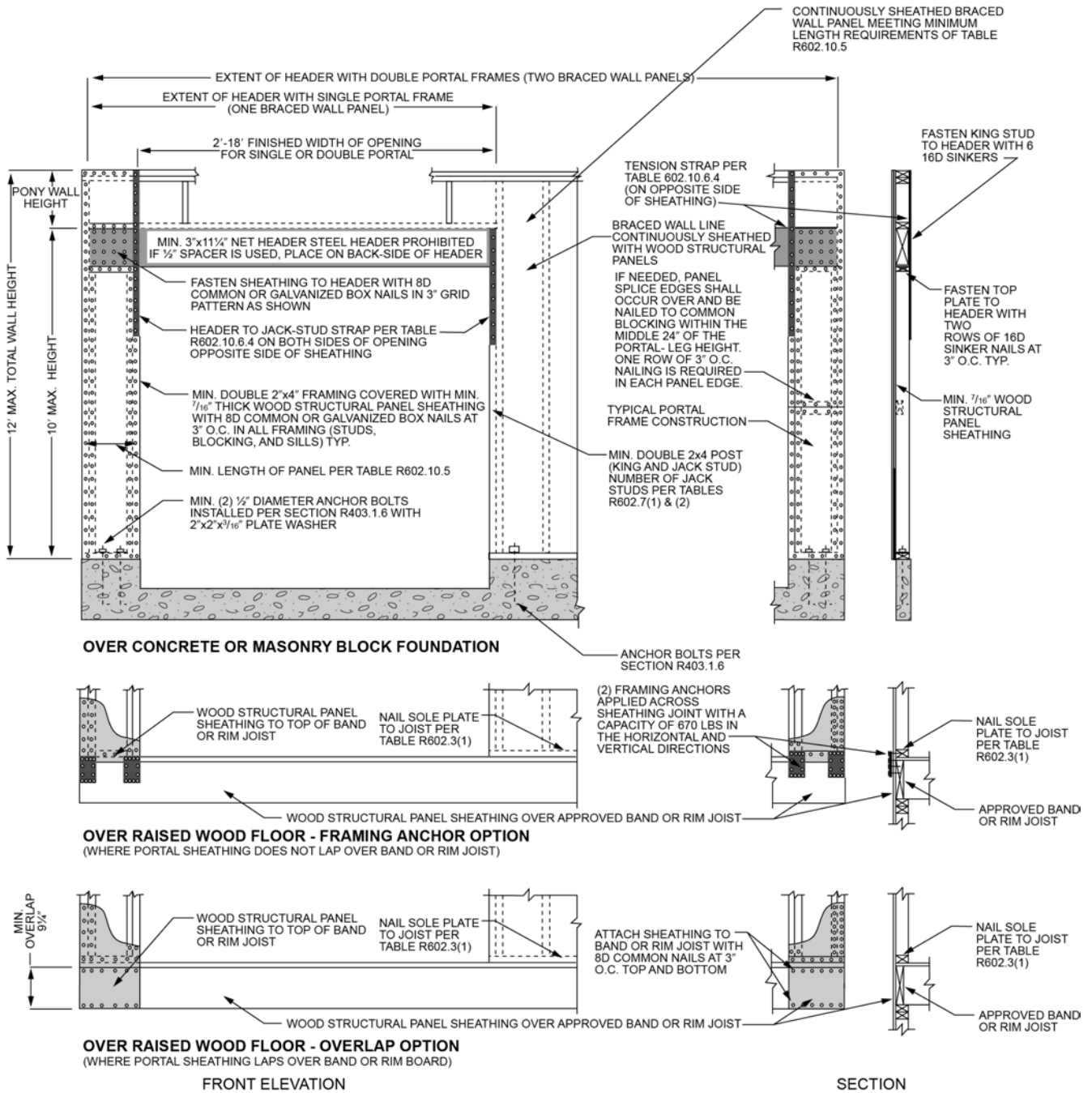
**TABLE R602.10.6.4
TENSION STRAP CAPACITY FOR RESISTING WIND PRESSURES
PERPENDICULAR TO METHODS PFH, PFG AND CS-PF BRACED WALL PANELS^a**

MINIMUM WALL STUD FRAMING NOMINAL SIZE AND GRADE	MAXIMUM PONY WALL HEIGHT (feet)	MAXIMUM TOTAL WALL HEIGHT (feet)	MAXIMUM OPENING WIDTH (feet)	TENSION STRAP CAPACITY REQUIRED (pounds) ^a						
				Ultimate Design Wind Speed V _{ult} (mph)						
				≤ 110	115	130	≤ 110	115	130	
				Exposure B			Exposure C			
2 × 4 No. 2 Grade	0	10	18	1,000	1,000	1,000	1,000	1,000	1,050	
			1	9	1,000	1,000	1,000	1,000	1,000	1,750
				16	1,000	1,025	2,050	2,075	2,500	3,950
	2	10	18	1,000	1,275	2,375	2,400	2,850	DR	
			2	9	1,000	1,000	1,475	1,500	1,875	3,125
				16	1,775	2,175	3,525	3,550	4,125	DR
	2	12	18	2,075	2,500	3,950	3,975	DR	DR	
			2	9	1,150	1,500	2,650	2,675	3,175	DR
				16	2,875	3,375	DR	DR	DR	DR
	4	12	18	3,425	3,975	DR	DR	DR	DR	
			2	9	2,275	2,750	DR	DR	DR	DR
				12	3,225	3,775	DR	DR	DR	DR
2 × 6 Stud Grade	2	12	9	1,000	1,000	1,700	1,700	2,025	3,050	
			16	1,825	2,150	3,225	3,225	3,675	DR	
			18	2,200	2,550	3,725	3,750	DR	DR	
	4	12	9	1,450	1,750	2,700	2,725	3,125	DR	
			16	2,050	2,400	DR	DR	DR	DR	
			18	3,350	3,800	DR	DR	DR	DR	

For SI: 1 foot = 304.8 mm, 1 pound = 4.45 N, 1 mile per hour = 0.447 m/s.

DR = Design Required.

a. Straps shall be installed in accordance with manufacturer's recommendations.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R602.10.6.4
METHOD CS-PF—CONTINUOUSLY SHEATHED PORTAL FRAME PANEL CONSTRUCTION

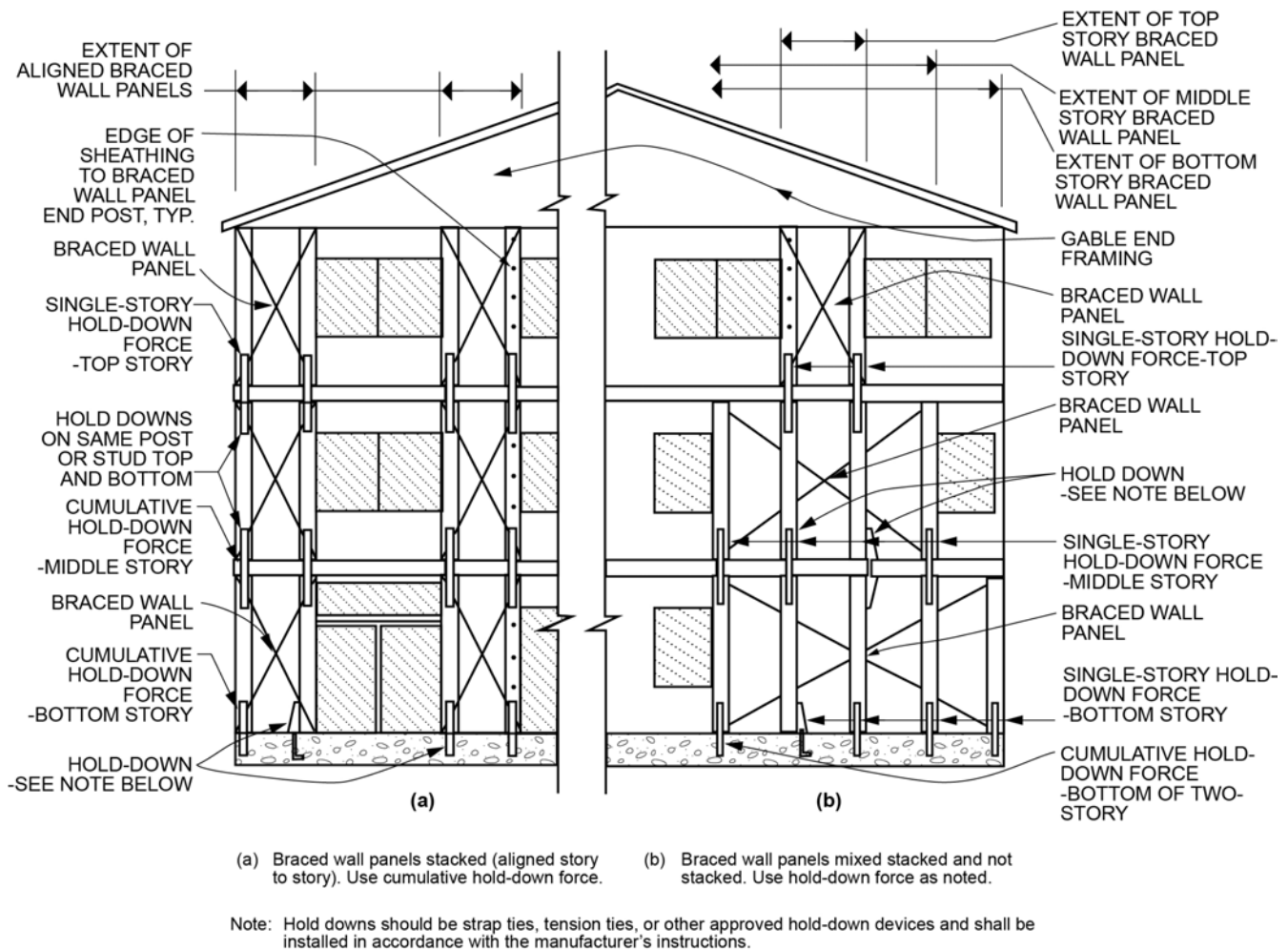


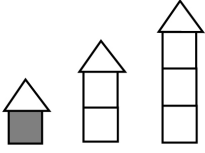
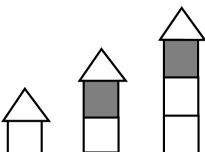
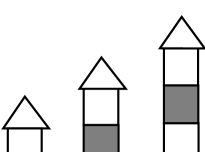

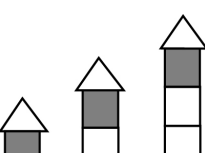
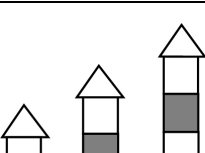

FIGURE R602.10.6.5.2
METHOD BV-WSP—WALL BRACING FOR DWELLINGS WITH STONE AND MASONRY VENEER IN SEISMIC DESIGN CATEGORIES D₀, D₁ and D₂

R602.10.6.5.4 Length of bracing. The length of bracing along each braced wall line shall be the greater of that required by the ultimate design wind speed and braced wall line spacing in accordance with Table R602.10.3(1) as adjusted by the factors in Table R602.10.3(2) or the seismic design category and braced wall line length in accordance either with Table R602.10.6.5.4 when using Method BV-WSP, or Table R602.10.3(3) as adjusted by the factors in Table R602.10.3(4) when using Method WSP or CS-WSP. Angled walls shall be permitted to be counted in accordance with Section R602.10.1.4, and braced wall panel location shall be in accordance with Section R602.10.2.2. Spacing between braced wall lines shall be in accordance with Table R602.10.1.3.

The seismic adjustment factors in Table R602.10.3(4) shall not be applied to the length of bracing determined using Table R602.10.6.5.4, except that the bracing amount increase for braced wall line spacing greater than 25 feet (7620 mm) in accordance with Table R602.10.1.3 shall be required. The minimum total length of bracing in a braced wall line, after all adjustments have been taken, shall be not less than 48 inches (1219 mm) total.

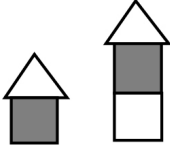
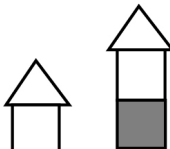
R602.10.7 Ends of braced wall lines with continuous sheathing. Each end of a braced wall line with continuous sheathing shall have one of the conditions shown in Figure R602.10.7.

**TABLE R602.10.6.5.4
METHOD BV-WSP WALL BRACING REQUIREMENTS^d**

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)					SINGLE-STORY HOLD-DOWN FORCE (pounds) ^b	CUMULATIVE HOLD-DOWN FORCE (pounds) ^c
		10	20	30	40	50		
		Minimum Total Length (feet) of Braced Wall Panels Required Along each Braced Wall Line						
D ₀		4.0	7.0	10.5	14.0	17.5	NA	—
		4.0	7.0	10.5	14.0	17.5	1,900	—
		4.5	9.0	13.5	18.0	22.5	3,500	5,400
		6.0	12.0	18.0	24.0	30.0	3,500	8,900
D ₁		4.5	9.0	13.5	18.0	22.5	2,100	—
		4.5	9.0	13.5	18.0	22.5	3,700	5,800
		6.0	12.0	18.0	24.0	30.0	3,700	9,500

(continued)

**TABLE R602.10.6.5.4—continued
METHOD BV-WSP WALL BRACING REQUIREMENTS^d**

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (FEET)					SINGLE-STORY HOLD-DOWN FORCE (pounds) ^b	CUMULATIVE HOLD-DOWN FORCE (pounds) ^c
		10	20	30	40	50		
		Minimum Total Length (feet) of Braced Wall Panels Required Along each Braced Wall Line						
D ₂ ^a		5.5	11.0	16.5	22.0	27.5	2,300	—
		5.5	11.0	16.5	22.0	27.5	3,900	6,200
	Three-story dwelling	NP	NP	NP	NP	NP	NA	NA

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.

NP = Not Permitted.

NA = Not Applicable.

- a. One- and two-family dwellings in Seismic Design Category D₂ exceeding two stories shall be designed in accordance with accepted engineering practices.
- b. Hold-down force is minimum allowable stress design load for connector providing uplift tie from wall framing at end of braced wall panel at the noted story to wall framing at end of braced wall panel at the story below, or to foundation or foundation wall. Use single-story hold-down force where edges of braced wall panels do not align; a continuous load path to the foundation shall be maintained.
- c. Where hold-down connectors from stories above align with stories below, use cumulative hold-down force to size middle- and bottom-story hold-down connectors.
- d. Interpolation between braced wall lengths is permitted.

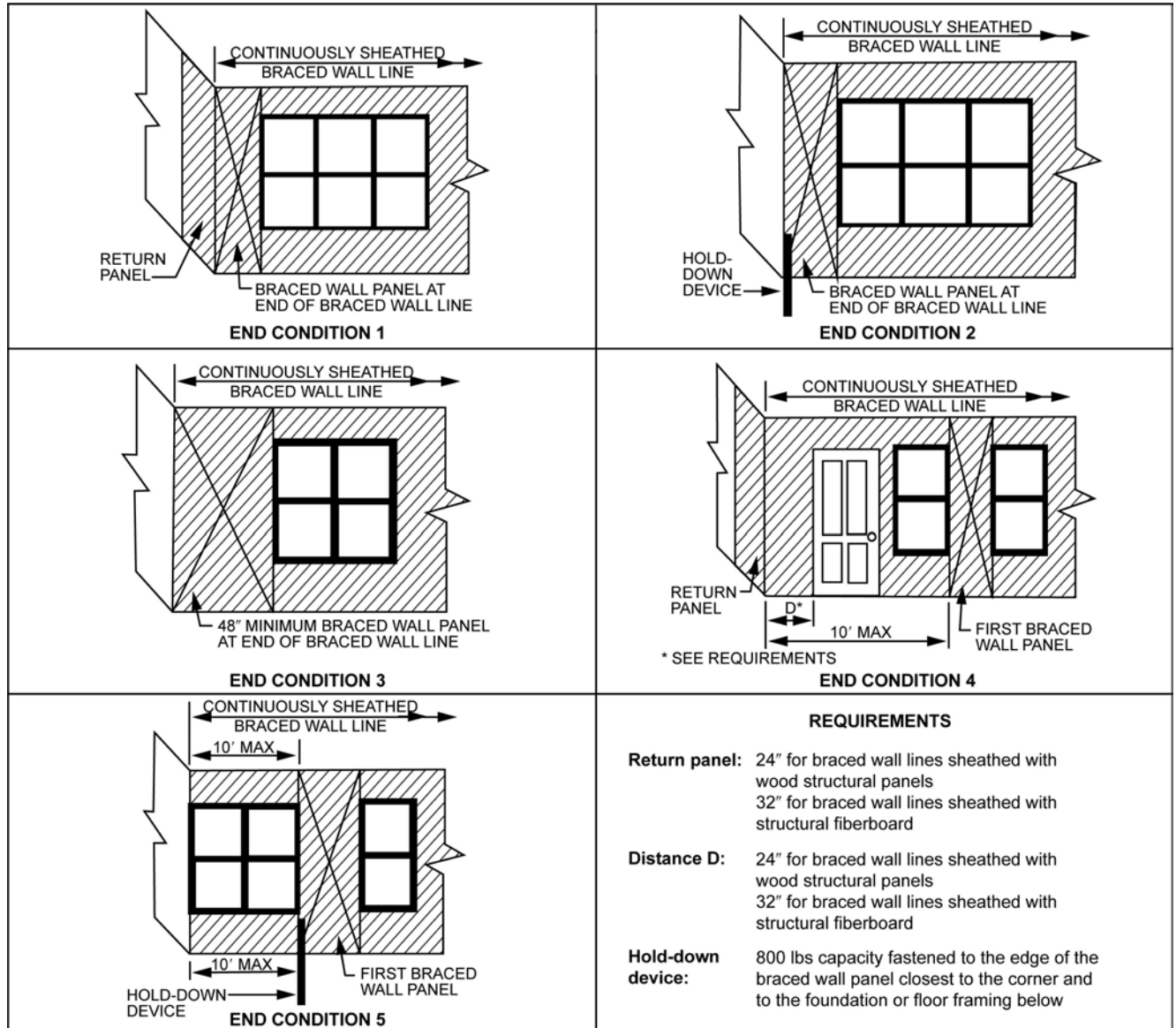
R602.10.8 Braced wall panel connections. Braced wall panels shall be connected to floor framing or foundations as follows:

1. Where joists are perpendicular to a braced wall panel above or below, a rim joist, band joist or blocking shall be provided along the entire length of the braced wall panel in accordance with Figure R602.10.8(1). Fastening of top and bottom wall plates to framing, rim joist, band joist or blocking shall be in accordance with Table R602.3(1).
2. Where joists are parallel to a braced wall panel above or below, a rim joist, end joist or other parallel framing member shall be provided directly above and below the braced wall panel in accordance with Figure R602.10.8(2). Where a parallel framing member cannot be located directly above and below the panel, full-depth blocking at 16-inch (406 mm) spacing shall be provided between the parallel framing members to each side of the braced wall panel in accordance with Figure R602.10.8(2). Fastening of blocking and wall plates shall be in accordance with Table R602.3(1) and Figure R602.10.8(2).
3. Connections of braced wall panels to concrete or masonry shall be in accordance with Section R403.1.6.

R602.10.8.1 Braced wall panel connections for Seismic Design Categories D₀, D₁ and D₂. Braced wall panels shall be fastened to required foundations in accordance with Section R602.11.1, and top plate lap splices shall be face-nailed with not less than eight 16d nails on each side of the splice.

R602.10.8.2 Connections to roof framing. Top plates of exterior braced wall panels shall be attached to rafters or roof trusses above in accordance with Table R602.3(1) and this section. Where required by this section, blocking between rafters or roof trusses shall be attached to top plates of braced wall panels and to rafters and roof trusses in accordance with Table R602.3(1). A continuous band, rim or header joist or roof truss parallel to the braced wall panels shall be permitted to replace the blocking required by this section. Blocking shall not be required over openings in continuously sheathed braced wall lines. In addition to the requirements of this section, lateral support shall be provided for rafters and ceiling joists in accordance with Section R802.8 and for trusses in accordance with Section R802.10.3. Roof ventilation shall be provided in accordance with Section R806.1.

1. For Seismic Design Categories A, B and C where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is 9¹/₄ inches (235 mm) or less, blocking between



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 4.45 N.

FIGURE R602.10.7
END CONDITIONS FOR BRACED WALL LINES WITH CONTINUOUS SHEATHING

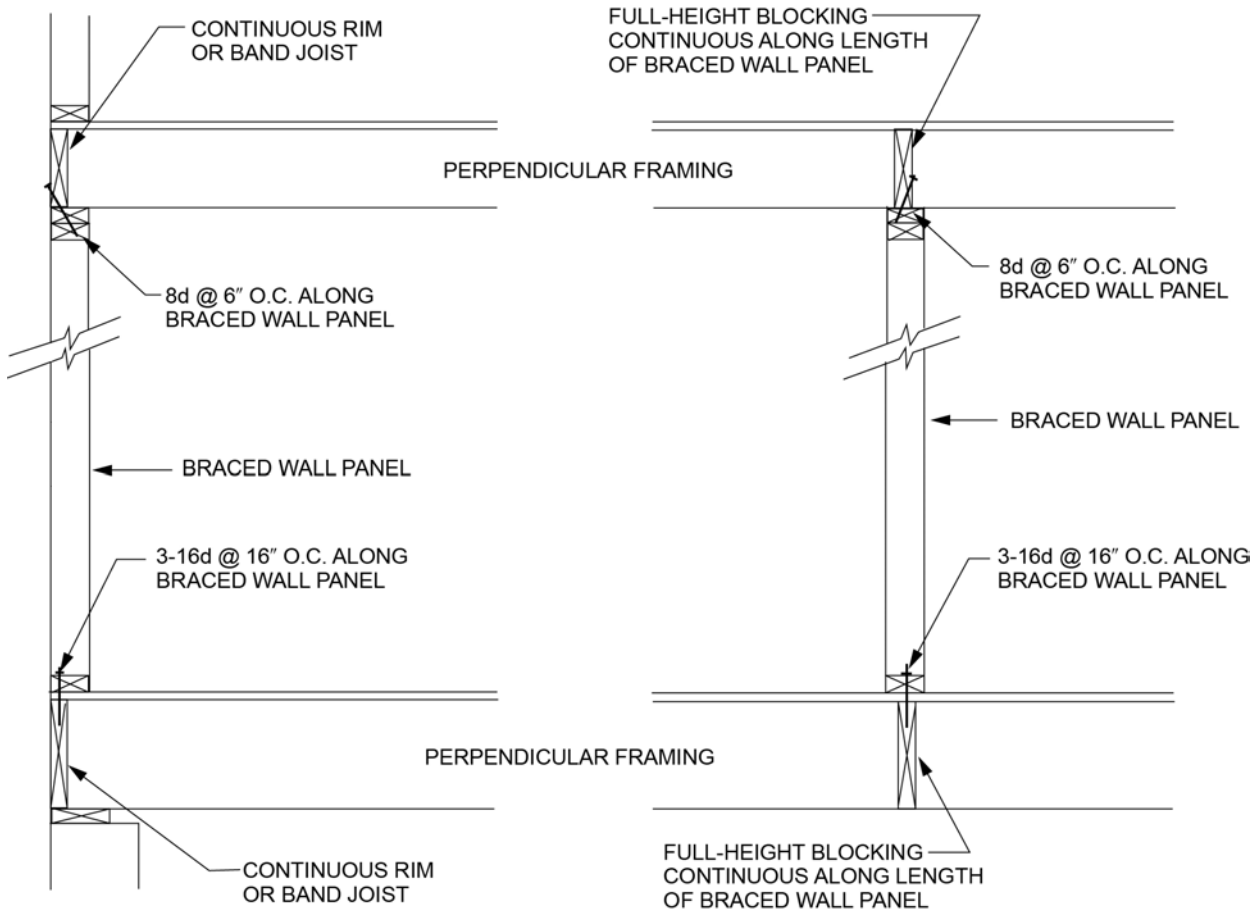
rafters or roof trusses shall not be required. Where the distance from the top of the braced wall panel to the top of the rafters or roof trusses above is between 9¹/₄ inches (235 mm) and 15¹/₄ inches (387 mm), blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).

Exception: Where the outside edge of truss vertical web members aligns with the outside face of the wall studs below, wood structural panel sheathing extending above the top plate as shown in Figure R602.10.8.2(3) shall be permitted to be fastened to each truss web

with three-8d nails (2¹/₂ inches × 0.131 inch) and blocking between the trusses shall not be required.

- For Seismic Design Categories D₀, D₁ and D₂, where the distance from the top of the braced wall panel to the top of the rafters or roof trusses is 15¹/₄ inches (387 mm) or less, blocking between rafters or roof trusses shall be provided above the braced wall panel in accordance with Figure R602.10.8.2(1).
- Where the distance from the top of the braced wall panel to the top of rafters or roof trusses exceeds 15¹/₄ inches (387 mm), the top plates of

WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

FIGURE R602.10.8(1)
BRACED WALL PANEL CONNECTION WHEN PERPENDICULAR TO FLOOR/CEILING FRAMING

the braced wall panel shall be connected to perpendicular rafters or roof trusses above in accordance with one or more of the following methods:

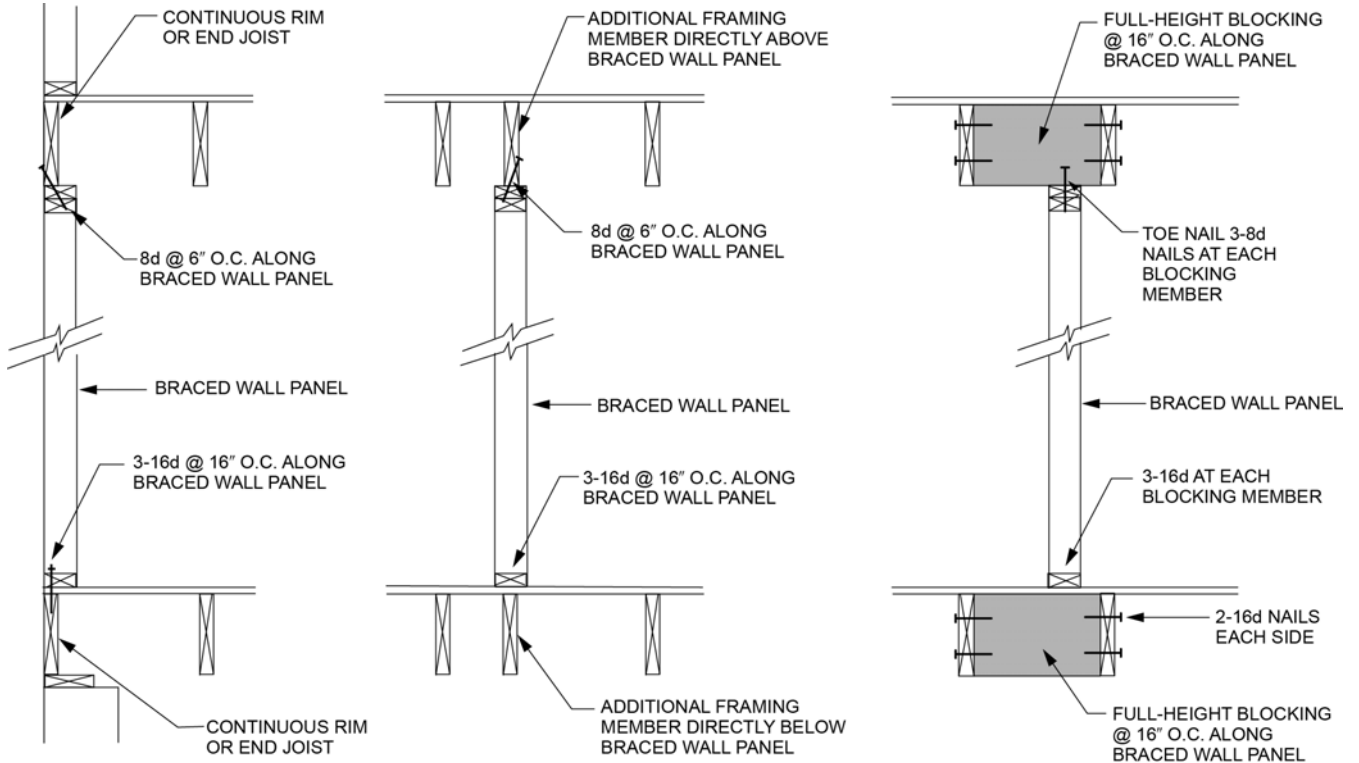
- 3.1. Soffit blocking panels constructed in accordance with Figure R602.10.8.2(2).
- 3.2. Vertical blocking panels constructed in accordance with Figure R602.10.8.2(3).
- 3.3. Blocking panels provided by the roof truss manufacturer and designed in accordance with Section R802.
- 3.4. Blocking, blocking panels or other methods of lateral load transfer designed in accordance with the AWC WFCM or accepted engineering practice.

R602.10.9 Braced wall panel support. Braced wall panel support shall be provided as follows:

1. Cantilevered floor joists complying with Section R502.3.3 shall be permitted to support braced wall panels.

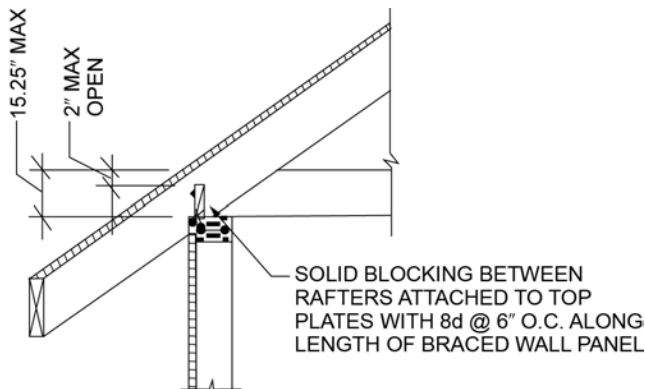
2. Raised floor system post or pier foundations supporting braced wall panels shall be designed in accordance with accepted engineering practice.
3. Masonry stem walls with a length of 48 inches (1219 mm) or less supporting braced wall panels shall be reinforced in accordance with Figure R602.10.9. Masonry stem walls with a length greater than 48 inches (1219 mm) supporting braced wall panels shall be constructed in accordance with Section R403.1 Methods ABW and PFH shall not be permitted to attach to masonry stem walls.
4. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall have reinforcement sized and located in accordance with Figure R602.10.9.

R602.10.9.1 Braced wall panel support for Seismic Design Categories D₀, D₁ and D₂. In Seismic Design Categories D₀, D₁ and D₂, braced wall panel footings shall be as specified in Section R403.1.2.



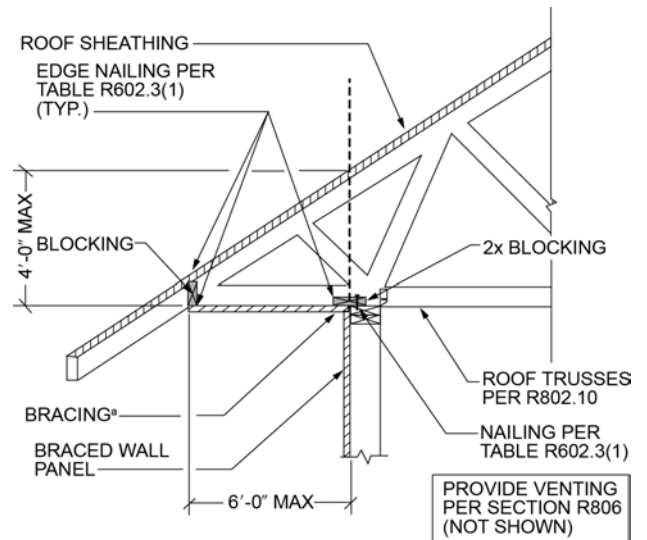
For SI: 1 inch = 25.4 mm.

FIGURE R602.10.8(2)
BRACED WALL PANEL CONNECTION WHEN PARALLEL TO FLOOR/CEILING FRAMING



For SI: 1 inch = 25.4 mm.

FIGURE R602.10.8.2(1)
BRACED WALL PANEL CONNECTION TO PERPENDICULAR RAFTERS

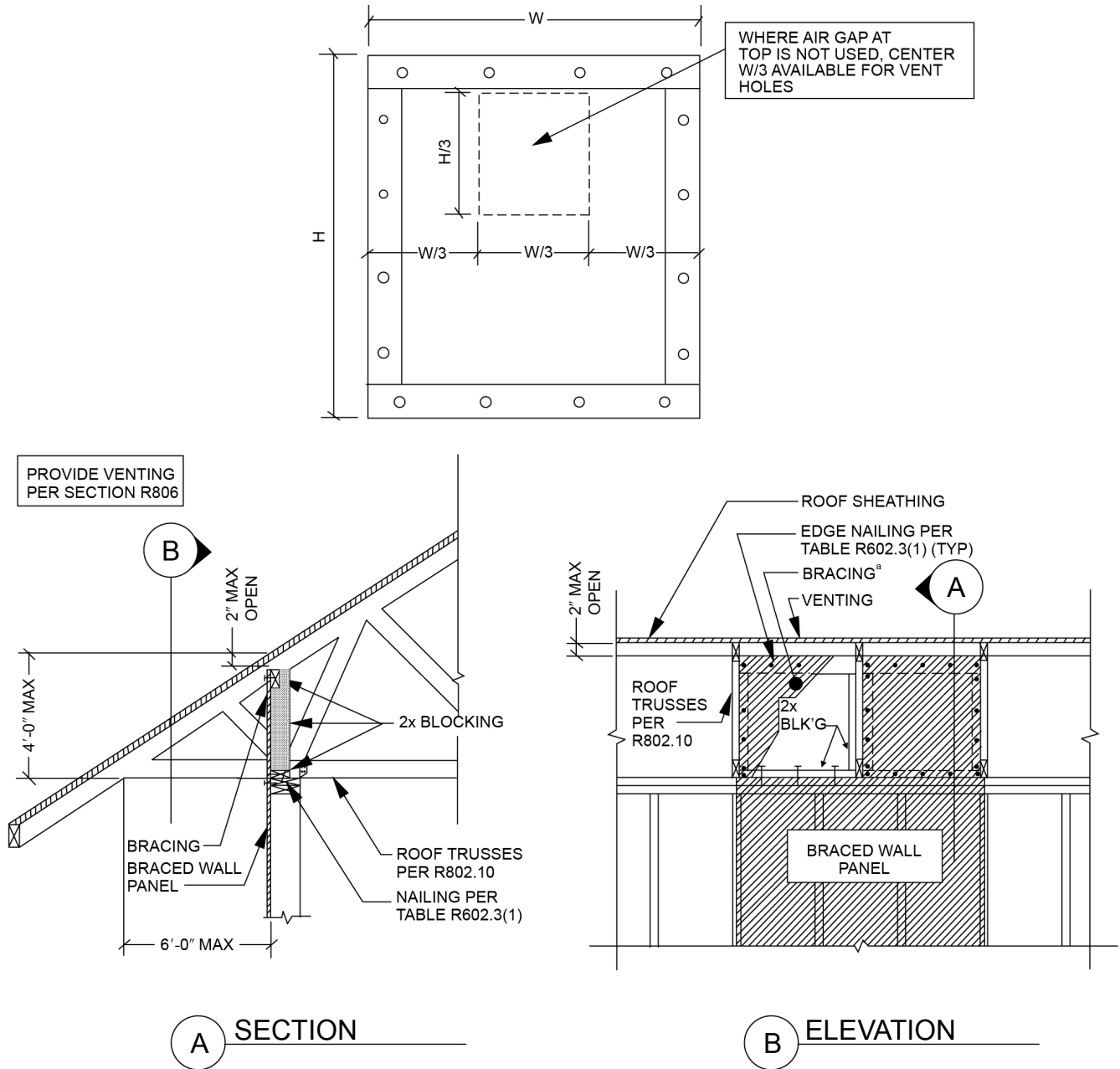


For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Methods of bracing shall be as described in Section R602.10.4.

FIGURE R602.10.8.2(2)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES

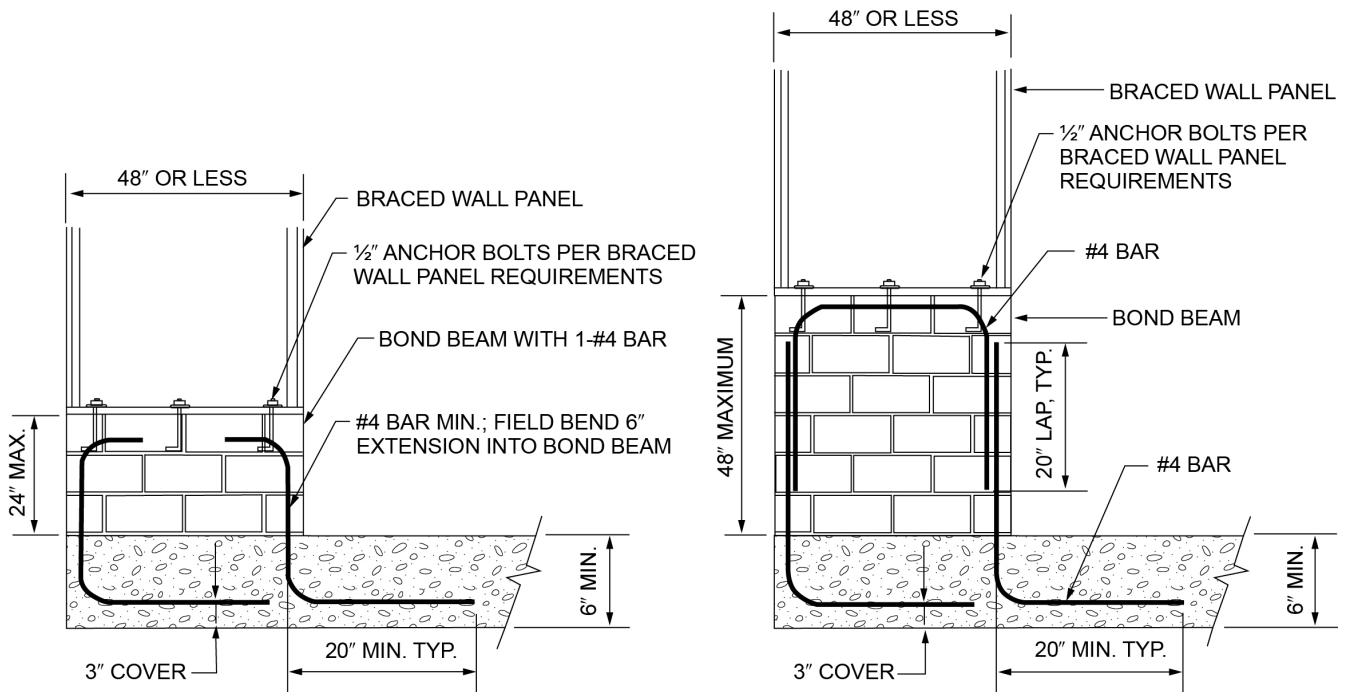
WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm

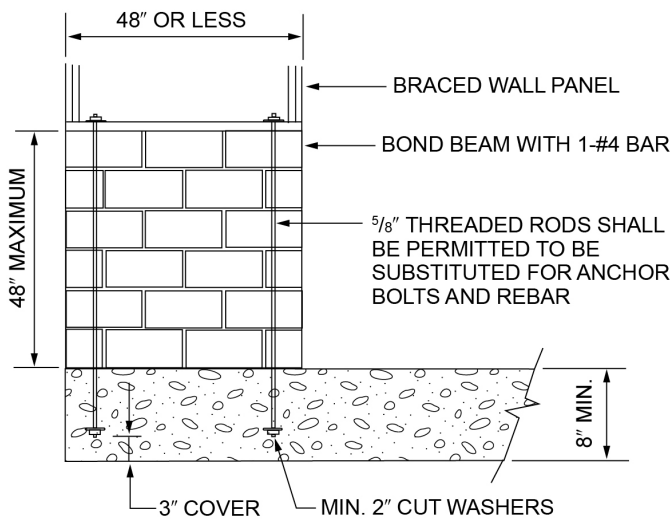
a. Methods of bracing shall be as described in Section R602.10.4.

**FIGURE R602.10.8.2(3)
BRACED WALL PANEL CONNECTION OPTION TO PERPENDICULAR RAFTERS OR ROOF TRUSSES**

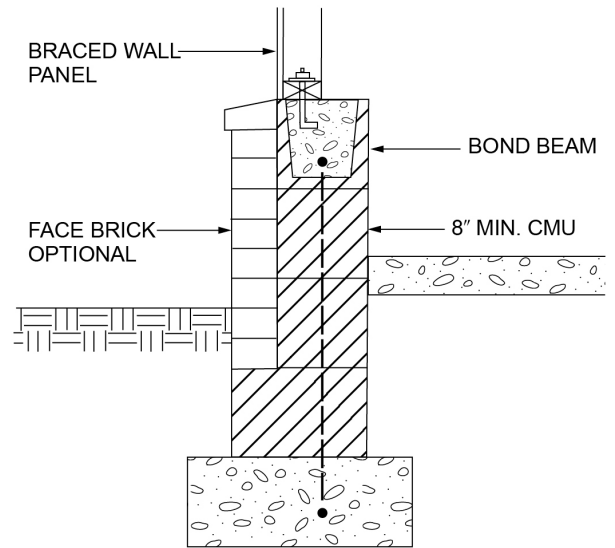


SHORT STEM WALL REINFORCEMENT

TALL STEM WALL REINFORCEMENT



OPTIONAL STEM WALL REINFORCEMENT



TYPICAL STEM WALL SECTION

NOTE: GROUT BOND BEAMS AND ALL CELLS THAT CONTAIN REBAR, THREADED RODS AND ANCHOR BOLTS.

For SI: 1 inch = 25.4 mm.

FIGURE R602.10.9
MASONRY STEM WALLS SUPPORTING BRACED WALL PANELS

R602.10.10 Cripple wall bracing. Cripple walls shall be constructed in accordance with Section R602.9 and braced in accordance with this section. Cripple walls shall be braced with the length and method of bracing used for the wall above in accordance with Tables R602.10.3(1) and R602.10.3(3), and the applicable adjustment factors in Table R602.10.3(2) or R602.10.3(4), respectively, except that the length of cripple wall bracing shall be multiplied by a factor of 1.15. Where gypsum wall board is not used on the inside of the cripple wall bracing, the length adjustments for the elimination of the gypsum wallboard, or equivalent, shall be applied as directed in Tables R602.10.3(2) and R602.10.3(4) to the length of cripple wall bracing required. This adjustment shall be taken in addition to the 1.15 increase.

R602.10.10.1 Cripple wall bracing for Seismic Design Categories D₀ and D₁ and townhouses in Seismic Design Category C. In addition to the requirements in Section R602.10.10, cripple wall bracing shall be limited to methods WSP and CS-WSP, and the distance between adjacent edges of braced wall panels for cripple walls along a braced wall line shall be 14 feet (4267 mm) maximum.

Where braced wall lines at interior walls are not supported on a continuous foundation below, the adjacent parallel cripple walls, where provided, shall be braced with Method WSP or Method CS-WSP in accordance with Section R602.10.4. The length of bracing required in accordance with Table R602.10.3(3) for the cripple walls shall be multiplied by 1.5. Where the cripple walls do not have sufficient length to provide the required bracing, the spacing of panel edge fasteners shall be reduced to 4 inches (102 mm) on center and the required bracing length adjusted by 0.7. If the required length can still not be provided, the cripple wall shall be designed in accordance with accepted engineering practice.

R602.10.10.2 Cripple wall bracing for Seismic Design Category D₂. In Seismic Design Category D₂, cripple walls shall be braced in accordance with Tables R602.10.3(3) and R602.10.3(4).

R602.10.10.3 Redesignation of cripple walls. Where all cripple wall segments along a braced wall line do not exceed 48 inches (1219 mm) in height, the cripple walls shall be permitted to be redesignated as a first-story wall for purposes of determining wall bracing requirements. Where any cripple wall segment in a braced wall line exceeds 48 inches (1219 mm) in height, the entire cripple wall shall be counted as an additional story. If the cripple walls are redesignated, the stories above the redesignated story shall be counted as the second and third stories, respectively.

R602.11 Wall anchorage. Braced wall line sills shall be anchored to concrete or masonry foundations in accordance with Sections R403.1.6 and R602.11.1.

R602.11.1 Wall anchorage for all buildings in Seismic Design Categories D₀, D₁ and D₂ and townhouses in

Seismic Design Category C. Plate washers, not less than 0.229 inch by 3 inches by 3 inches (5.8 mm by 76 mm by 76 mm) in size, shall be provided between the foundation sill plate and the nut except where approved anchor straps are used. The hole in the plate washer is permitted to be diagonally slotted with a width of up to $\frac{3}{16}$ inch (5 mm) larger than the bolt diameter and a slot length not to exceed $1\frac{3}{4}$ inches (44 mm), provided a standard cut washer is placed between the plate washer and the nut.

R602.11.2 Stepped foundations in Seismic Design Categories D₀, D₁ and D₂. In all buildings located in Seismic Design Categories D₀, D₁ or D₂, where the height of a required braced wall line that extends from foundation to floor above varies more than 4 feet (1219 mm), the braced wall line shall be constructed in accordance with the following:

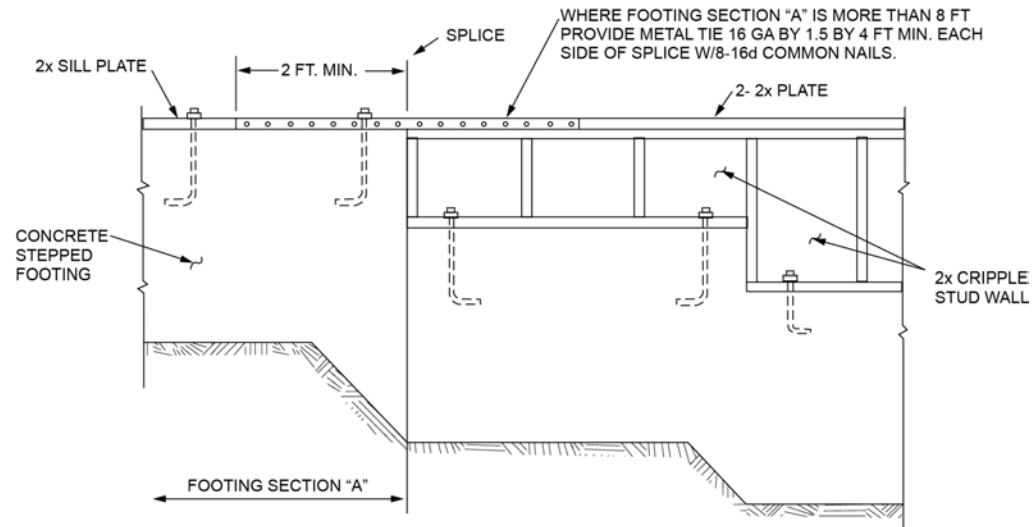
1. Where the lowest floor framing rests directly on a sill bolted to a foundation not less than 8 feet (2440 mm) in length along a line of bracing, the line shall be considered as braced. The double plate of the cripple stud wall beyond the segment of footing that extends to the lowest framed floor shall be spliced by extending the upper top plate not less than 4 feet (1219 mm) along the foundation. Anchor bolts shall be located not more than 1 foot and 3 feet (305 and 914 mm) from the step in the foundation. See Figure R602.11.2.
2. Where cripple walls occur between the top of the foundation and the lowest floor framing, the bracing requirements of Sections R602.10.10, R602.10.10.1 and R602.10.10.2 shall apply.
3. Where only the bottom of the foundation is stepped and the lowest floor framing rests directly on a sill bolted to the foundations, the requirements of Sections R403.1.6 and R602.11.1 shall apply.

R602.12 Simplified wall bracing. Buildings meeting all of the following conditions shall be permitted to be braced in accordance with this section as an alternative to the requirements of Section R602.10. The entire building shall be braced in accordance with this section; the use of other bracing provisions of Section R602.10, except as specified herein, shall not be permitted.

1. There shall be not more than three stories above the top of a concrete or masonry foundation or basement wall. Permanent wood foundations shall not be permitted.
2. Floors shall not cantilever more than 24 inches (607 mm) beyond the foundation or bearing wall below.
3. Wall height shall not be greater than 10 feet (3048 mm).
4. The building shall have a roof eave-to-ridge height of 15 feet (4572 mm) or less.
5. Exterior walls shall have gypsum board with a minimum thickness of $\frac{1}{2}$ inch (12.7 mm) installed on the interior side fastened in accordance with Table R702.3.5.

6. The structure shall be located where the ultimate design wind speed is less than or equal to 130 mph (58 m/s), and the exposure category is B or C.
7. The structure shall be located in Seismic Design Category A, B or C for detached one- and two-family dwellings or Seismic Design Category A or B for townhouses.
8. Cripple walls shall not be permitted in three-story buildings.

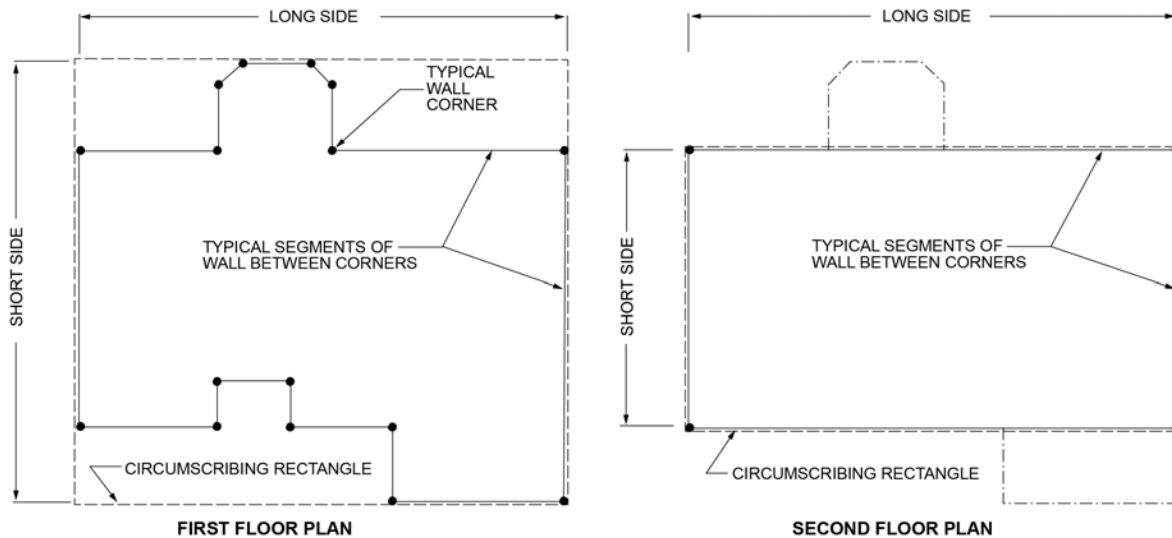
R602.12.1 Circumscribed rectangle. The bracing required for each building shall be determined by circumscribing a rectangle around the entire building on each floor as shown in Figure R602.12.1. The rectangle shall surround all enclosed offsets and projections such as sunrooms and attached garages. Open structures, such as carports and decks, shall be permitted to be excluded. The rectangle shall not have a side greater than 60 feet (18 288 mm), and the ratio between the long side and short side shall be not greater than 3:1.



For SI: 1 foot = 304.8 mm.

Note: Where footing Section "A" is less than 8 feet long in a 25-foot-long wall, install bracing at cripple stud wall.

**FIGURE R602.11.2
STEPPED FOUNDATION CONSTRUCTION**



**FIGURE R602.12.1
RECTANGLE CIRCUMSCRIBING AN ENCLOSED BUILDING**

WALL CONSTRUCTION

R602.12.2 Sheathing materials. The following sheathing materials installed on the exterior side of exterior walls shall be used to construct a bracing unit as defined in Section R602.12.3. Mixing materials is prohibited.

1. Wood structural panels with a minimum thickness of $\frac{3}{8}$ inch (9.5 mm) fastened in accordance with Table R602.3(3).
2. Structural fiberboard sheathing with a minimum thickness of $\frac{1}{2}$ inch (12.7 mm) fastened in accordance with Table R602.3(1).

R602.12.3 Bracing unit. A bracing unit shall be a full-height sheathed segment of the exterior wall without openings or vertical or horizontal offsets and a minimum length as specified herein. Interior walls shall not contribute toward the amount of required bracing. Mixing of Items 1 and 2 is prohibited on the same story.

1. Where all framed portions of all exterior walls are sheathed in accordance with Section R602.12.2, including wall areas between bracing units, above and below openings and on gable end walls, the minimum length of a bracing unit shall be 3 feet (914 mm).
2. Where the exterior walls are braced with sheathing panels in accordance with Section R602.12.2 and areas between bracing units are covered with other materials, the minimum length of a bracing unit shall be 4 feet (1219 mm).

R602.12.3.1 Multiple bracing units. Segments of wall compliant with Section R602.12.3 and longer than the minimum bracing unit length shall be considered as multiple bracing units. The number of bracing units shall be determined by dividing the wall segment length by the minimum bracing unit length. Full-height sheathed segments of wall narrower than the minimum bracing unit length shall not contribute toward a bracing unit except as specified in Section R602.12.6.

R602.12.4 Number of bracing units. Each side of the circumscribed rectangle, as shown in Figure R602.12.1, shall have, at a minimum, the number of bracing units in accordance with Table R602.12.4 placed on the parallel

exterior walls facing the side of the rectangle. Bracing units shall then be placed using the distribution requirements specified in Section R602.12.5.

R602.12.5 Distribution of bracing units. The placement of bracing units on exterior walls shall meet all of the following requirements as shown in Figure R602.12.5.

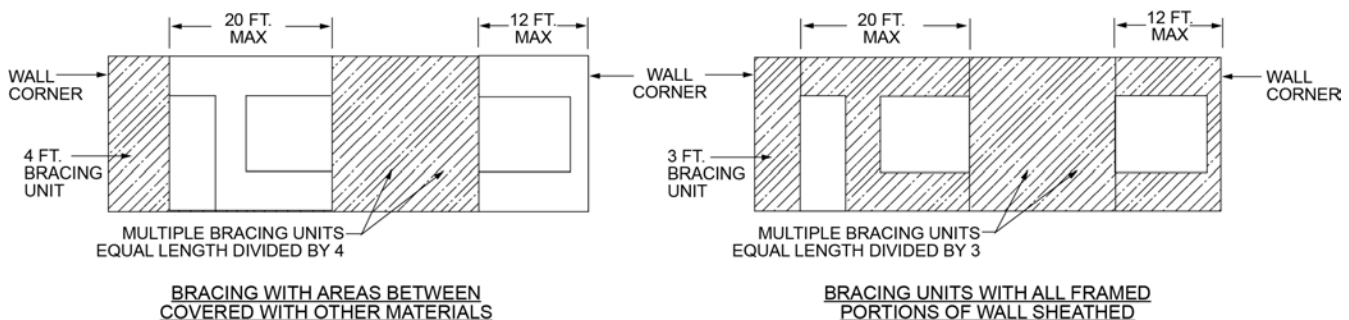
1. A bracing unit shall begin not more than 12 feet (3658 mm) from any wall corner.
2. The distance between adjacent edges of bracing units shall be not greater than 20 feet (6096 mm).
3. Segments of wall greater than 8 feet (2438 mm) in length shall have not less than one bracing unit.

R602.12.6 Narrow panels. The bracing methods referenced in Section R602.10 and specified in Sections R602.12.6.1 through R602.12.6.3 shall be permitted where using simplified wall bracing.

R602.12.6.1 Method CS-G. Braced wall panels constructed as Method CS-G in accordance with Tables R602.10.4 and R602.10.5 shall be permitted for one-story garages where all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-G panel shall be equivalent to 0.5 of a bracing unit. Segments of wall that include a Method CS-G panel shall meet the requirements of Section R602.10.4.2.

R602.12.6.2 Method CS-PF. Braced wall panels constructed as Method CS-PF in accordance with Section R602.10.6.4 shall be permitted where all framed portions of all exterior walls are sheathed with wood structural panels. Each CS-PF panel shall equal 0.75 bracing units. Segments of wall that include a Method CS-PF panel shall meet the requirements of Section R602.10.4.2.

R602.12.6.3 Methods ABW, PFH and PFG. Braced wall panels constructed as Method ABW, PFH and PFG shall be permitted where bracing units are constructed using wood structural panels applied either continuously or intermittently. Each ABW and PFH panel shall equal one bracing unit and each PFG panel shall be equal to 0.75 bracing unit.



For SI: 1 foot = 304.8 mm.

FIGURE R602.12.5
BRACING UNIT DISTRIBUTION

**TABLE R602.12.4
MINIMUM NUMBER OF BRACING UNITS ON EACH SIDE OF THE CIRCUMSCRIBED RECTANGLE**

ULTIMATE DESIGN WIND SPEED (mph)	STORY LEVEL	EAVE-TO-RIDGE HEIGHT (feet)	MINIMUM NUMBER OF BRACING UNITS ON EACH LONG SIDE ^{a, b, d}						MINIMUM NUMBER OF BRACING UNITS ON EACH SHORT SIDE ^{a, b, d}					
			Length of short side (feet) ^c						Length of long side (feet) ^c					
			10	20	30	40	50	60	10	20	30	40	50	60
115		10	1	2	2	2	3	3	1	2	2	2	3	3
			2	3	3	4	5	6	2	3	3	4	5	6
			2	3	4	6	7	8	2	3	4	6	7	8
		15	1	2	3	3	4	4	1	2	3	3	4	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	6	7	9	2	4	5	6	7	9
130		10	1	2	2	3	3	4	1	2	2	3	3	4
			2	3	4	5	6	7	2	3	4	5	6	7
			2	4	5	7	8	10	2	4	5	7	8	10
		15	2	3	3	4	4	6	2	3	3	4	4	6
			3	4	6	7	8	10	3	4	6	7	8	10
			3	6	7	10	11	13	3	6	7	10	11	13

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447m/s.

- a. Interpolation shall not be permitted.
- b. Cripple walls or wood-framed basement walls in a walk-out condition shall be designated as the first story and the stories above shall be redesignated as the second and third stories, respectively, and shall be prohibited in a three-story structure.
- c. Actual lengths of the sides of the circumscribed rectangle shall be rounded to the next highest unit of 10 when using this table.
- d. For Exposure Category C, multiply bracing units by a factor of 1.20 for a one-story building, 1.30 for a two-story building and 1.40 for a three-story building.

R602.12.7 Lateral support. For bracing units located along the eaves, the vertical distance from the outside edge of the top wall plate to the roof sheathing above shall not exceed 9.25 inches (235 mm) at the location of a bracing unit unless lateral support is provided in accordance with Section R602.10.8.2.

R602.12.8 Stem walls. Masonry stem walls with a height and length of 48 inches (1219 mm) or less supporting a bracing unit or a Method CS-G, CS-PF or PFG braced wall panel shall be constructed in accordance with Figure R602.10.9. Concrete stem walls with a length of 48 inches (1219 mm) or less, greater than 12 inches (305 mm) tall and less than 6 inches (152 mm) thick shall be reinforced sized and located in accordance with Figure R602.10.9.

SECTION R603 COLD-FORMED STEEL WALL FRAMING

R603.1 General. Elements shall be straight and free of any defects that would significantly affect structural performance. Cold-formed steel wall framing members shall be in accordance with the requirements of this section.

R603.1.1 Applicability limits. The provisions of this section shall control the construction of exterior cold-formed steel wall framing and interior load-bearing cold-formed steel wall framing for buildings not more than 60 feet (18 288 mm) long perpendicular to the joist or truss span, not more than 40 feet (12 192 mm) wide parallel to the joist or truss span, and less than or equal to three stories above grade plane. Exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Cold-formed steel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3.35 kPa).

R603.1.1.1 Alternate applications. Cold-formed steel wall framing for buildings exceeding the applicability limits of Section R603.1.1 are permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.

R603.1.2 In-line framing. Load-bearing cold-formed steel studs constructed in accordance with Section R603 shall be located in-line with joists, trusses and rafters in accordance with the tolerances specified in AISI S240, Section B1.2.3.

R603.2 Structural framing. Load-bearing cold-formed steel wall framing members shall be in accordance with this section.

R603.2.1 Material. Load-bearing cold-formed steel framing members shall be cold formed to shape from structural-quality sheet steel complying with the requirements of AISI 240, Section A3.

R603.2.2 Corrosion protection. Load-bearing cold-formed steel framing shall have a protective coating complying with AISI S240, Section A4.

R603.2.3 Dimension, thickness and material grade. Load-bearing cold-formed steel wall framing members shall comply with the dimensional and thickness requirements specified in AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.

R603.2.4 Identification. Load-bearing cold-formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.

R603.2.5 Fastening. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C1513. Structural sheathing shall be attached to cold-formed steel studs with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws for attaching structural sheathing to cold-formed steel wall framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $\frac{3}{8}$ inch (9.5 mm). Gypsum board shall be attached to cold-formed steel wall framing with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle-head style and shall be installed in accordance with Section R702. For connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.

R603.2.6 Web holes, web hole reinforcing and web hole patching. Web holes in wall studs shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in conformance to the conditions as prescribed in AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.

R603.3 Wall construction. Exterior cold-formed steel framed walls and interior load-bearing cold-formed steel framed walls shall be constructed in accordance with the provisions of this section.

R603.3.1 Wall to foundation or floor connection. Cold-formed steel framed walls shall be anchored to foundations or floors in accordance with Table R603.3.1 and Figure R603.3.1(1), R603.3.1(2), R603.3.1(3) or R603.3.1(4). Anchor bolts shall be located not more than 12 inches (305 mm) from corners or the termination of bottom tracks. Anchor bolts shall extend not less than 15 inches (381 mm) into masonry or 7 inches (178 mm) into concrete. Foundation anchor straps shall be permitted, in lieu of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

R603.3.1.1 Gable endwalls. Gable endwalls with heights greater than 10 feet (3048 mm) shall be anchored to foundations or floors in accordance with Table R603.3.1.1(1) or R603.3.1.1(2).

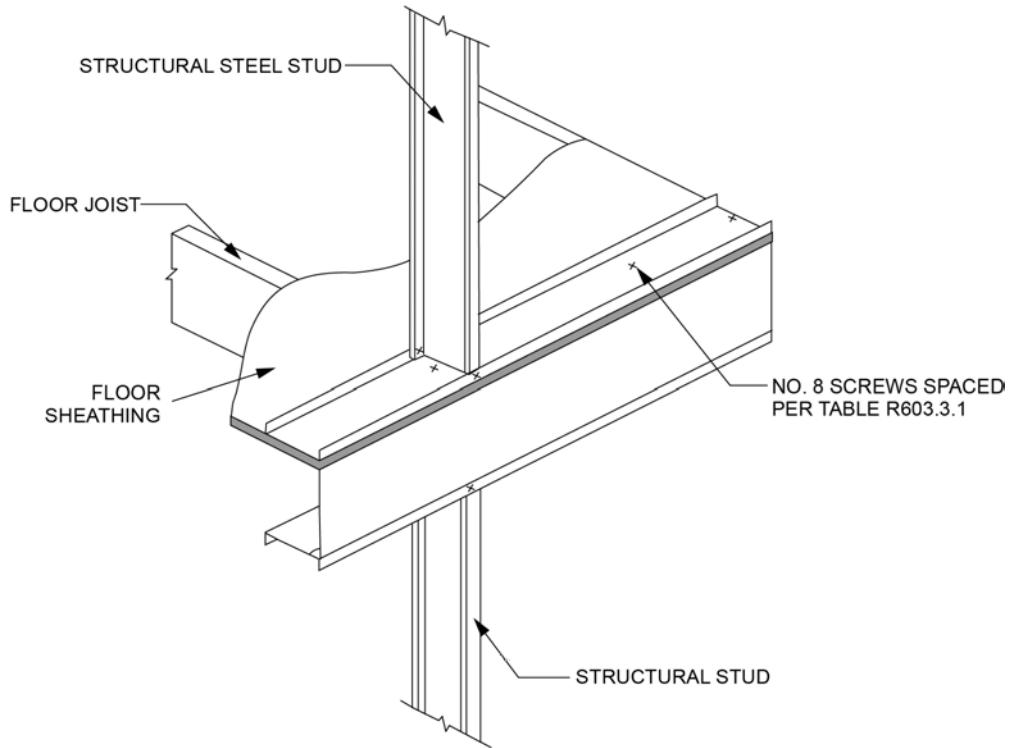
**TABLE R603.3.1
WALL TO FOUNDATION OR FLOOR CONNECTION REQUIREMENTS^{a, b}**

FRAMING CONDITION			ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)							
			115 B	120 B	130 B or 115 C	< 140 B or 120 C	130 C	< 140 C		
Wall bottom track to floor per Figure R603.3.1(1)			1-No. 8 screw at 12" o.c.	1-No. 8 screw at 8" o.c.	2-No. 8 screws at 8" o.c.	2-No. 8 screws at 6" o.c.	3-No. 8 screws at 8" o.c.	3-No. 8 screws at 6" o.c.		
Wall bottom track to foundation per Figure R603.3.1(2) ^d			1/2" minimum diameter anchor bolt at 6' o.c.	1/2" minimum diameter anchor bolt at 6' o.c.	1/2" minimum diameter anchor bolt at 4' o.c.	1/2" minimum diameter anchor bolt at 4' o.c.	1/2" minimum diameter anchor bolt at 3'-4" o.c.	1/2" minimum diameter anchor bolt at 2'-8" o.c.		
Wall bottom track to wood sill per Figure R603.3.1(3)			Steel plate spaced at 4' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 4' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 3' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 2' o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails	Steel plate spaced at 1'-4" o.c., with 4-No. 8 screws and 4-10d or 6-8d common nails		
Wind uplift connector strength (lb) ^{c, e}	Stud Spacing (inches)	Roof Span (feet)								
			16	24	NR	NR	NR	NR	NR	NR
				28	NR	NR	NR	NR	NR	339
				32	NR	NR	NR	NR	NR	382
				36	NR	NR	NR	NR	333	426
	40	NR		NR	NR	NR	368	470		
	24	24	NR	NR	NR	NR	343	443		
		28	NR	NR	NR	NR	395	508		
		32	NR	NR	NR	330	447	573		
		36	NR	NR	NR	371	500	639		
40		NR	NR	345	411	552	704			

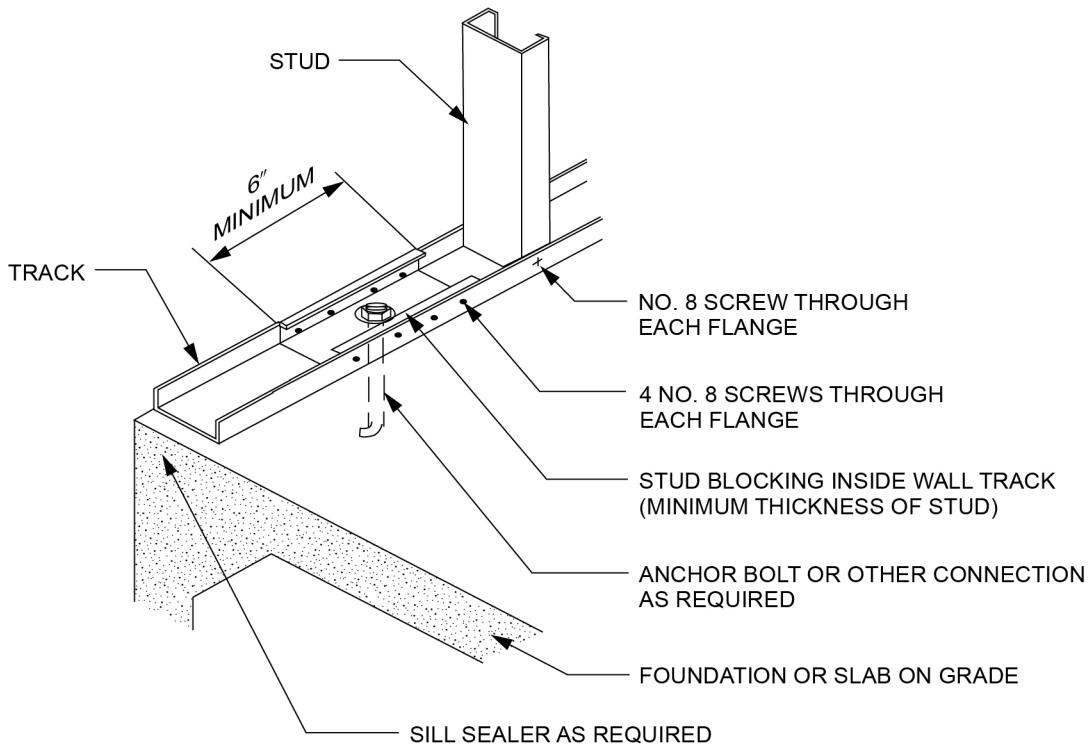
For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 pound = 4.45 N.

- a. Anchor bolts are to be located not more than 12 inches from corners or the termination of bottom tracks, such as at door openings or corners. Bolts are to extend not less than 15 inches into masonry or 7 inches into concrete.
- b. All screw sizes shown are minimum.
- c. NR = Uplift connector not required.
- d. Foundation anchor straps are permitted in place of anchor bolts, if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.
- e. See Figure R603.3.1(4) for details.

WALL CONSTRUCTION

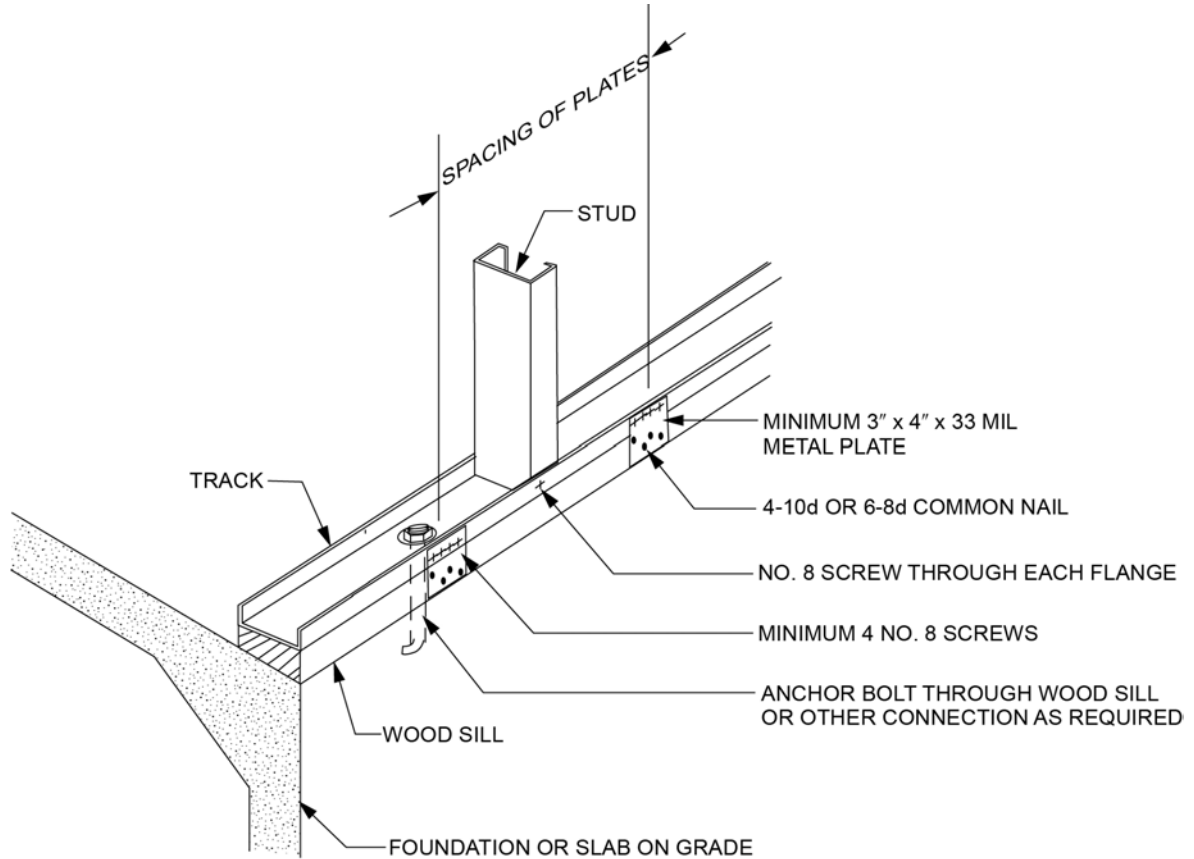


**FIGURE R603.3.1(1)
WALL TO FLOOR CONNECTION**



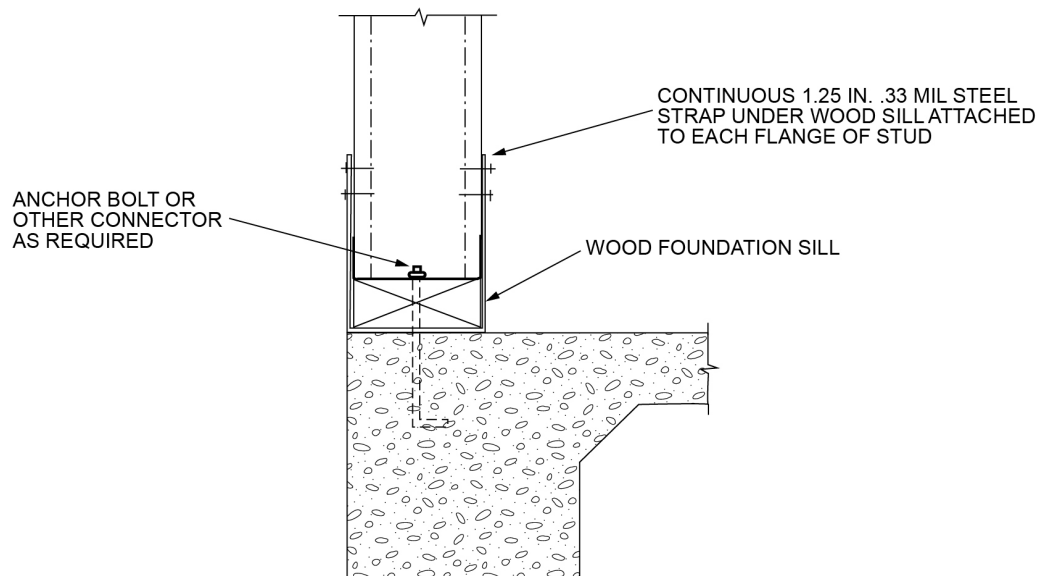
**FIGURE R603.3.1(2)
WALL TO FOUNDATION CONNECTION**

For SI: 1 inch = 25.4 mm.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

**FIGURE R603.3.1(3)
WALL TO WOOD SILL CONNECTION**



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm.

**FIGURE R603.3.1(4)
WIND UPLIFT CONNECTOR**

WALL CONSTRUCTION

R603.3.2 Minimum stud sizes. Cold-formed steel walls shall be constructed in accordance with Figure R603.3.1(1), R603.3.1(2) or R603.3.1(3), as applicable. Exterior wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16). Interior load-bearing wall stud size and thickness shall be determined in accordance with the limits set forth in Tables R603.3.2(2) through R603.3.2(16) based on an ultimate design wind speed of 115 miles per hour (51 m/s), Exposure Category B, and the building width, stud spacing and ground snow load, as appropriate. Fastening requirements shall be in accordance with Section R603.2.5 and Table R603.3.2(1). Top and bottom tracks shall have the same minimum thickness as the wall studs.

Exterior wall studs shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(16), but not less than 33 mils (0.84 mm), where both of the following conditions exist:

1. Minimum of $\frac{1}{2}$ -inch (12.7 mm) gypsum board is installed and fastened on the interior surface in accordance with Section R702.

2. Wood structural sheathing panels of minimum $\frac{7}{16}$ -inch-thick (11.1 mm) oriented strand board or $\frac{15}{32}$ -inch-thick (12 mm) plywood are installed and fastened in accordance with Section R603.9.1 and Table R603.3.2(1) on the outside surface.

Interior load-bearing walls shall be permitted to be reduced to the next thinner size, as shown in Tables R603.3.2(2) through R603.3.2(16), but not less than 33 mils (0.84 mm), where not less than $\frac{1}{2}$ -inch (12.7 mm) gypsum board is installed and fastened in accordance with Section R702 on both sides of the wall. The tabulated stud thickness for load-bearing walls shall be used where the attic load is 10 pounds per square foot (480 Pa) or less. A limited attic storage load of 20 pounds per square foot (960 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(16).

For two-story buildings, the tabulated stud thickness for walls supporting one floor, roof and ceiling shall be used where the second-floor live load is 30 pounds per square foot (1440 Pa). Second-floor live loads of 40 psf (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(2) through R603.3.2(11).

TABLE R603.3.1.1(1)
GABLE ENDWALL TO FLOOR CONNECTION REQUIREMENTS^{a, b, c}

ULTIMATE WIND SPEED (mph)		WALL BOTTOM TRACK TO FLOOR JOIST OR TRACK CONNECTION		
Exposure Category		Stud height, <i>h</i> (feet)		
B	C	10 < <i>h</i> ≤ 14	14 < <i>h</i> ≤ 18	18 < <i>h</i> ≤ 22
115	—	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.
120	—	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.
130	115	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	2-No. 8 screws @ 12" o.c.
< 140	120	1-No. 8 screw @ 12" o.c.	1-No. 8 screw @ 12" o.c.	2-No. 8 screws @ 12" o.c.
—	130	2-No. 8 screws @ 12" o.c.	1-No. 8 screw @ 8" o.c.	2-No. 8 screws @ 8" o.c.
—	< 140	2-No. 8 screws @ 12" o.c.	1-No. 8 screw @ 8" o.c.	2-No. 8 screws @ 8" o.c.

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

- Refer to Table R603.3.1.1(2) for gable endwall bottom track to foundation connections.
- Where attachment is not given, special design is required.
- Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.

TABLE R603.3.1.1(2)
GABLE ENDWALL BOTTOM TRACK TO FOUNDATION CONNECTION REQUIREMENTS^{a, b, c}

ULTIMATE WIND SPEED (mph)		MINIMUM SPACING FOR $\frac{1}{2}$ -INCH-DIAMETER ANCHOR BOLTS ^d		
Exposure Category		Stud height, <i>h</i> (feet)		
B	C	10 < <i>h</i> ≤ 14	14 < <i>h</i> ≤ 18	18 < <i>h</i> ≤ 22
115	—	6'- 0" o.c.	6'- 0" o.c.	6'- 0" o.c.
120	—	6'- 0" o.c.	5'- 7" o.c.	6'- 0" o.c.
130	115	5'- 0" o.c.	6'- 0" o.c.	6'- 0" o.c.
< 140	120	6'- 0" o.c.	5'- 6" o.c.	6'- 0" o.c.
—	130	5'- 3" o.c.	6'- 0" o.c.	6'- 0" o.c.
—	< 140	3'- 0" o.c.	3'- 0" o.c.	3'- 0" o.c.

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm.

- Refer to Table R603.3.1.1(1) for gable endwall bottom track to floor joist or track connection connections.
- Where attachment is not given, special design is required.
- Stud height, *h*, is measured from wall bottom track to wall top track or brace connection height.
- Foundation anchor straps are permitted in place of anchor bolts if spaced as required to provide equivalent anchorage to the required anchor bolts and installed in accordance with manufacturer's requirements.

For three-story buildings, the tabulated stud thickness for walls supporting one or two floors, roof and ceiling shall be used where the third-floor live load is 30 pounds per square foot (1440 Pa). Third-floor live loads of 40 pounds per square foot (1920 Pa) shall be permitted provided that the next higher snow load column is used to select the stud size from Tables R603.3.2(12) through R603.3.2(16).

R603.3.2.1 Gable endwalls. The size and thickness of gable endwall studs with heights less than or equal to 10 feet (3048 mm) shall be permitted in accordance with the limits set forth in Table R603.3.2.1(1). The size and thickness of gable endwall studs with heights greater than 10 feet (3048 mm) shall be determined in accordance with the limits set forth in Table R603.3.2.1(2).

**TABLE R603.3.2(1)
WALL FASTENING SCHEDULE^a**

DESCRIPTION OF BUILDING ELEMENT	NUMBER AND SIZE OF FASTENERS ^a	SPACING OF FASTENERS
Wall stud to top or bottom track	2-No. 8 screws	Each end of stud, one per flange
Structural sheathing to wall studs	No. 8 screws ^b	6" o.c. on edges and 12" o.c. at intermediate supports
1/2" gypsum board to framing	No. 6 screws	12" o.c.

For SI: 1 inch = 25.4 mm.

a. All screw sizes shown are minimum.

b. Screws for attachment of structural sheathing panels are to be bugle-head, flat-head, or similar head styles with a minimum head diameter of 0.29 inch.

**TABLE R603.3.2(2)
24-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c, d}**

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
				Ground Snow Load (psf)												
Exp. B	Exp. C		20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	33	33	33	33	33	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	43	43	43	43	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	33	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	33	33	33	43
< 140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	43	43	43	43	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	33	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	33	43	43	43	43	
			24	43	43	43	43	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	43	43	43	43	43	43	43	43	
—	< 140	350S162	16	33	33	33	33	43	43	43	43	43	43	43	43	
			24	43	43	43	54	54	54	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	43	43	43	43	43	43	43	43	43	43	43	43	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: L/240.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(3)
28-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	33	33	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
130	115	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	43	43	43	54	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	43
< 140	120	350S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	43	43	43	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	43	43	43	43	43
—	130	350S162	16	33	33	33	33	33	33	33	43	43	43	43	43	
			24	43	43	43	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	43	43	43	43	43	43	43	43	43
—	< 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43	
			24	43	43	43	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	43	43	43	43	43	43	43	43	43	43	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(4)
32-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
				8-foot Studs				9-foot Studs				10-foot Studs					
Exp. B	Exp. C			Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	54	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	33	33	43	54	43	43	43	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	33	33	43	
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43	
			24	33	33	43	54	43	43	43	54	43	43	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	33	43	33	33	33	43	43	
< 140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43	
			24	33	33	43	54	43	43	43	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	33	43	43	43	43	43	43	
—	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43		
			24	43	43	43	54	54	54	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	33	33	43	43	43	43	43	43	43	43	43	43		
—	< 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43		
			24	43	43	54	54	54	54	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	43	43	43	43	43	43	43	43	43	43	43	43		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection criterion: $L/240$.
- b. Design load assumptions:
 - Second-floor dead load is 10 psf.
 - Second-floor live load is 30 psf.
 - Roof/ceiling dead load is 12 psf.
 - Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(5)
36-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	33	33	43	54	43	43	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	33	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	33	33	43	54	43	43	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	33	33	33	43	43
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	43	43	54	43	43	43	54	43	43	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	33	33	33	43	43
< 140	120	350S162	16	33	33	33	43	33	33	33	33	33	33	33	43	
			24	43	43	43	54	43	43	43	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	43	43	43	43	54
—	130	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43	
			24	43	43	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	54	43	43	43	43	43	43	43	54	
—	< 140	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54	
			24	43	43	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	43	43	43	54	43	43	43	43	43	43	43	54	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(6)
40-FOOT-WIDE BUILDING SUPPORTING ROOF AND CEILING ONLY^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C			Ground Snow Load (psf)												
				20	30	50	70	20	30	50	70	20	30	50	70	
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	33	33	43	54	33	43	43	54	43	43	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	33
			24	33	33	43	54	33	33	43	43	43	33	33	43	54
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	33	43	43	54	33	43	43	54	43	43	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	33	33	43	54	33	33	43	43	43	33	33	43	54
130	115	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	43	43	54	54	43	43	54	54	43	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	33	33	43	54	33	33	43	54	33	33	43	54	
< 140	120	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	43	43	54	54	43	43	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	
			24	33	33	43	54	33	33	43	54	43	43	43	54	
—	130	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54	
			24	43	43	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	33	33	43	54	43	43	43	54	43	43	43	54	
—	< 140	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54	
			24	43	43	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43	
			24	43	43	43	54	43	43	43	54	43	43	43	54	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection criterion: $L/240$.
- b. Design load assumptions:
 - Second-floor dead load is 10 psf.
 - Second-floor live load is 30 psf.
 - Roof/ceiling dead load is 12 psf.
 - Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(7)
24-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)													
				8-foot Studs				9-foot Studs				10-foot Studs					
Exp. B	Exp. C			Ground Snow Load (psf)													
				20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	43	43	43	43	43	43	43	43	43	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	33	43	33	33	33	43	33	33	33	33	33	43
120	—	350S162	16	33	33	33	33	33	33	33	33	33	33	33	33	43	
			24	43	43	43	43	43	43	43	43	43	43	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	33	43	33	33	33	43	33	33	33	33	43	
130	115	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43		
			24	43	43	43	54	43	43	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	33	33	33	43	33	33	33	43	33	33	43	43		
< 140	120	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43		
			24	43	43	43	54	43	54	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	33	33	43	43	33	33	33	43	43	43	43	43		
—	130	350S162	16	33	33	33	43	43	43	43	43	43	43	43	54		
			24	43	43	54	54	54	54	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	33	33	43	43	43	43	43	43	43	43	43	43		
—	< 140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54		
			24	54	54	54	54	54	54	54	54	54	54	54			
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33		
			24	43	43	43	43	43	43	43	43	43	43	43	43		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(8)
28-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	43	43	43	54	43	43	43	54	43	43	54	54	
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	33
			24	33	33	43	43	33	33	43	43	33	33	43	43	
120	—	350S162	16	33	33	33	43	33	33	33	43	33	33	43	43	
			24	43	43	43	54	43	43	43	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	33	33	43	43	
130	115	350S162	16	33	33	33	43	33	33	43	43	43	43	43	43	
			24	43	43	43	54	43	54	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	43	43	43	43	
< 140	120	350S162	16	33	33	33	43	43	43	43	43	43	43	43	43	
			24	43	43	54	54	54	54	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	33	
			24	33	33	43	43	33	33	43	43	43	43	43	43	
—	130	350S162	16	33	33	43	43	43	43	43	43	43	43	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	33	33	43	43	43	43	43	43	43	43	43	43	
—	< 140	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54		
		550S162	16	33	33	33	33	33	33	33	33	33	33	33	43	
			24	43	43	43	43	43	43	43	43	43	43	43	54	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(9)
32-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	33	33	33	43	33	33	33	43	33	43	43	43	
			24	43	43	43	54	43	43	43	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43	43
120	—	350S162	16	33	33	33	43	33	33	33	43	43	43	43	43	
			24	43	43	43	54	43	43	43	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	33	33	43	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	43	
			24	43	43	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	33	33	33	33	43
			24	33	43	43	54	33	33	43	43	43	43	43	43	54
< 140	120	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54	
			24	43	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	43	33	33	33	43
			24	33	43	43	54	33	43	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	43	54	43	43	43	54
—	< 140	350S162	16	43	43	43	43	43	43	43	54	54	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	33	43	33	33	33	43
			24	43	43	43	54	43	43	43	43	54	43	43	43	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Second-floor live load is 30 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(10)
36-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	
			24	43	43	54	54	43	43	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	43	
			24	43	43	54	54	43	43	54	54	54	54	54	54	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
130	115	350S162	16	33	33	43	43	43	43	43	43	43	43	43	54	
			24	43	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
< 140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	33	43
			24	43	43	43	54	43	43	43	54	43	43	43	43	54
—	< 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43	43
			24	43	43	43	54	43	43	43	54	43	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection criterion: $L/240$.
- b. Design load assumptions:
 - Second-floor dead load is 10 psf.
 - Second-floor live load is 30 psf.
 - Roof/ceiling dead load is 12 psf.
 - Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(11)
40-FOOT-WIDE BUILDING SUPPORTING ONE FLOOR, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
Exp. B	Exp. C	Ground Snow Load (psf)													
		20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	43	43	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
120	—	350S162	16	33	33	43	43	33	33	43	43	43	43	43	54
			24	43	43	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	33	43	33	33	33	43	33	33	33	43
			24	43	43	54	54	43	43	43	54	43	43	43	54
130	115	350S162	16	43	43	43	54	43	43	43	43	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
< 140	120	350S162	16	43	43	43	54	43	43	43	54	43	43	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	130	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54
			24	54	54	54	68	54	54	54	54	54	54	68	68
		550S162	16	33	33	43	43	33	33	33	43	33	33	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54
—	< 140	350S162	16	43	43	43	54	43	43	54	54	54	54	54	54
			24	54	54	54	68	54	54	54	68	54	54	68	68
		550S162	16	33	33	43	43	33	33	43	43	33	43	43	43
			24	43	43	54	54	43	43	43	54	43	43	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection criterion: $L/240$.
- b. Design load assumptions:
 - Second-floor dead load is 10 psf.
 - Second-floor live load is 30 psf.
 - Roof/ceiling dead load is 12 psf.
 - Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(12)
24-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
Exp. B	Exp. C	Ground Snow Load (psf)													
		20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	43	43	43	43	33	33	33	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
120	—	350S162	16	43	43	43	43	33	33	43	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	54	
			24	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
< 140	120	350S162	16	43	43	43	43	43	43	43	43	43	43	54	
			24	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	43	43	54
—	< 140	350S162	16	43	43	43	43	43	43	54	54	54	54	54	
			24	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	33	33	43	43	33	33	33	33	33	33	33	43
			24	43	43	54	54	43	43	43	43	43	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(13)
28-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	43	43	43	43	43	43	43	43	43	
			24	54	54	54	54	54	54	54	54	54	54	54	54	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	43	43	43	43	43	43	43	54	54	
			24	54	54	54	54	54	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
< 140	120	350S162	16	43	43	43	43	43	43	43	43	43	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	54	54	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	43	43	43	43	43	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	54	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
—	< 140	350S162	16	43	43	43	54	54	54	54	54	54	54	54	54	54
			24	54	54	54	54	54	54	54	54	68	68	68	68	68
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection criterion: $L/240$.
- b. Design load assumptions:
 - Top- and middle-floor dead load is 10 psf.
 - Top-floor live load is 30 psf.
 - Middle-floor live load is 40 psf.
 - Roof/ceiling dead load is 12 psf.
 - Attic live load is 10 psf.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(14)
32-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)												
				8-foot Studs				9-foot Studs				10-foot Studs				
Exp. B	Exp. C	Ground Snow Load (psf)														
		20	30	50	70	20	30	50	70	20	30	50	70			
115	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54	
			24	54	54	54	68	54	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	43	43	43	54	43	43	43	43	43	43	43	54	
			24	54	54	54	68	54	54	54	54	54	54	54	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	43	43	43	54	43	43	43	43	54	54	54	54	
			24	54	54	54	68	54	54	54	54	54	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
< 140	120	350S162	16	43	43	43	54	43	43	43	54	54	54	54	54	
			24	54	54	54	68	54	54	54	54	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	43	43	43	54	43	54	54	54	54	54	54	54	
			24	54	54	54	68	54	54	54	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54
—	< 140	350S162	16	43	43	54	54	54	54	54	54	54	54	54	54	
			24	54	54	54	68	54	68	68	68	68	68	68	68	
		550S162	16	43	43	43	43	43	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

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TABLE R603.3.2(15)
36-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
Exp. B	Exp. C	Ground Snow Load (psf)													
		20	30	50	70	20	30	50	70	20	30	50	70		
115	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	68	54	54	54	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
120	—	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	68	54	54	54	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
130	115	350S162	16	54	54	54	54	43	43	43	54	54	54	54	
			24	68	68	68	68	54	54	54	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
< 140	120	350S162	16	54	54	54	54	43	43	54	54	54	54	54	
			24	68	68	68	68	54	54	54	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	130	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	68	68	68	68	54	54	68	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54
—	< 140	350S162	16	54	54	54	54	54	54	54	54	54	54	54	
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	43	43	43	54	43	43	43	43	43	43	43	43
			24	54	54	54	54	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2(16)
40-FOOT-WIDE BUILDING SUPPORTING TWO FLOORS, ROOF AND CEILING^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)											
				8-foot Studs				9-foot Studs				10-foot Studs			
Exp. B	Exp. C			Ground Snow Load (psf)											
				20	30	50	70	20	30	50	70	20	30	50	70
115	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	68
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
120	—	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
130	115	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
< 140	120	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
—	130	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54
—	< 140	350S162	16	54	54	54	54	54	54	54	54	54	54	54	54
			24	68	68	68	68	68	68	68	68	68	68	68	
		550S162	16	54	54	54	54	43	43	54	54	43	43	54	54
			24	54	54	54	68	54	54	54	54	54	54	54	54

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion: $L/240$.

b. Design load assumptions:

Top- and middle-floor dead load is 10 psf.

Top-floor live load is 30 psf.

Middle-floor live load is 40 psf.

Roof/ceiling dead load is 12 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

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TABLE R603.3.2.1(1)
ALL BUILDING WIDTHS GABLE ENDWALLS 8, 9 OR 10 FEET IN HEIGHT^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)		
Exp. B	Exp. C			8-foot Studs	9-foot Studs	10-foot Studs
115	—	350S162	16	33	33	33
			24	33	33	33
		550S162	16	33	33	33
			24	33	33	33
120	—	350S162	16	33	33	33
			24	33	33	43
		550S162	16	33	33	33
			24	33	33	33
130	115	350S162	16	33	33	33
			24	33	43	43
		550S162	16	33	33	33
			24	33	33	33
< 140	120	350S162	16	33	33	43
			24	33	43	54
		550S162	16	33	33	33
			24	33	33	33
—	130	350S162	16	33	33	43
			24	43	43	54
		550S162	16	33	33	33
			24	33	43	43
—	< 140	350S162	16	33	43	43
			24	43	54	54
		550S162	16	33	33	33
			24	43	43	43

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion $L/240$.

b. Design load assumptions:

- Ground snow load is 70 psf.
- Roof/ceiling dead load is 12 psf.
- Floor dead load is 10 psf.
- Floor live load is 40 psf.
- Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.3.2.1(2)
ALL BUILDING WIDTHS GABLE ENDWALLS OVER 10 FEET IN HEIGHT^{a, b, c, d}

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		MEMBER SIZE	STUD SPACING (inches)	MINIMUM STUD THICKNESS (mils)					
				Stud Height, <i>h</i> (feet)					
Exp. B	Exp. C			10 < <i>h</i> ≤ 12	12 < <i>h</i> ≤ 14	14 < <i>h</i> ≤ 16	16 < <i>h</i> ≤ 18	18 < <i>h</i> ≤ 20	20 < <i>h</i> ≤ 22
115	—	350S162	16	33	43	68	97	—	—
			24	43	68	—	—	—	—
		550S162	16	33	33	33	43	43	54
			24	33	43	43	54	68	97
120	—	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	43	54	68
			24	33	43	54	54	68	97
130	115	350S162	16	43	54	97	—	—	—
			24	54	97	—	—	—	—
		550S162	16	33	33	43	54	54	97
			24	43	43	54	68	97	97
< 140	120	350S162	16	43	68	—	—	—	—
			24	68	—	—	—	—	—
		550S162	16	33	43	43	54	68	97
			24	43	54	54	68	97	—
—	130	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	33	43	54	68	97	—
			24	43	54	54	97	—	—
—	< 140	350S162	16	54	97	—	—	—	—
			24	97	—	—	—	—	—
		550S162	16	43	43	54	97	97	—
			24	54	54	68	—	—	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criterion $L/240$.

b. Design load assumptions:

Ground snow load is 70 psf.

Roof/ceiling dead load is 12 psf.

Floor dead load is 10 psf.

Floor live load is 40 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the wall studs.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

WALL CONSTRUCTION

R603.3.3 Stud bracing. The flanges of cold-formed steel studs shall be laterally braced in accordance with one of the following:

1. Gypsum board on both sides, structural sheathing on both sides, or gypsum board on one side and structural sheathing on the other side of *load-bearing walls* with gypsum board installed with minimum No. 6 screws in accordance with Section R702 and structural sheathing installed in accordance with Section R603.9 and Table R603.3.2(1).
2. Horizontal steel straps fastened in accordance with Figure R603.3.3(1) on both sides at mid-height for 8-foot (2438 mm) walls, and at one-third points for 9-foot and 10-foot (2743 mm and 3048 mm) walls. Horizontal steel straps shall be not less than 1½ inches in width and 33 mils in thickness (38 mm by 0.84 mm). Straps shall be attached to the flanges of studs with one No. 8 screw. In-line blocking shall be installed between studs at the termination of straps and at 12-foot (3658 mm) intervals along the strap. Straps shall be fastened to the blocking with two No. 8 screws.
3. Sheathing on one side and strapping on the other side fastened in accordance with Figure R603.3.3(2). Sheathing shall be installed in accordance with Item 1. Steel straps shall be installed in accordance with Item 2.

R603.3.4 Cutting and notching. Flanges and lips of cold-formed steel studs and headers shall not be cut or notched.

R603.3.5 Splicing. Steel studs and other structural members shall not be spliced without an *approved* design.

Tracks shall be spliced in accordance with Figure R603.3.5.

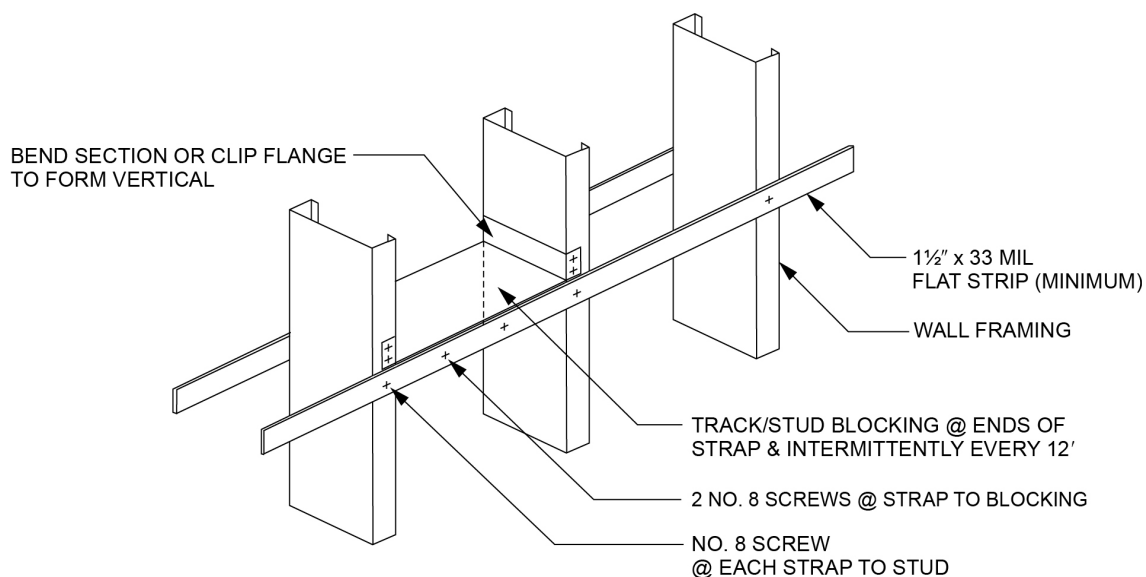
R603.4 Corner framing. In exterior walls, corner studs and the top tracks shall be installed in accordance with Figure R603.4.

R603.5 Exterior wall covering. The method of attachment of exterior wall covering materials to cold-formed steel stud wall framing shall conform to the manufacturer's installation instructions.

R603.6 Headers. Headers shall be installed above all wall openings in exterior walls and interior *load-bearing walls*. Box beam headers and back-to-back headers each shall be formed from two equal sized C-shaped members in accordance with Figures R603.6(1) and R603.6(2), respectively, and Tables R603.6(1) through R603.6(6). L-shaped headers shall be permitted to be constructed in accordance with AISI S230. Alternately, headers shall be permitted to be designed and constructed in accordance with AISI S240.

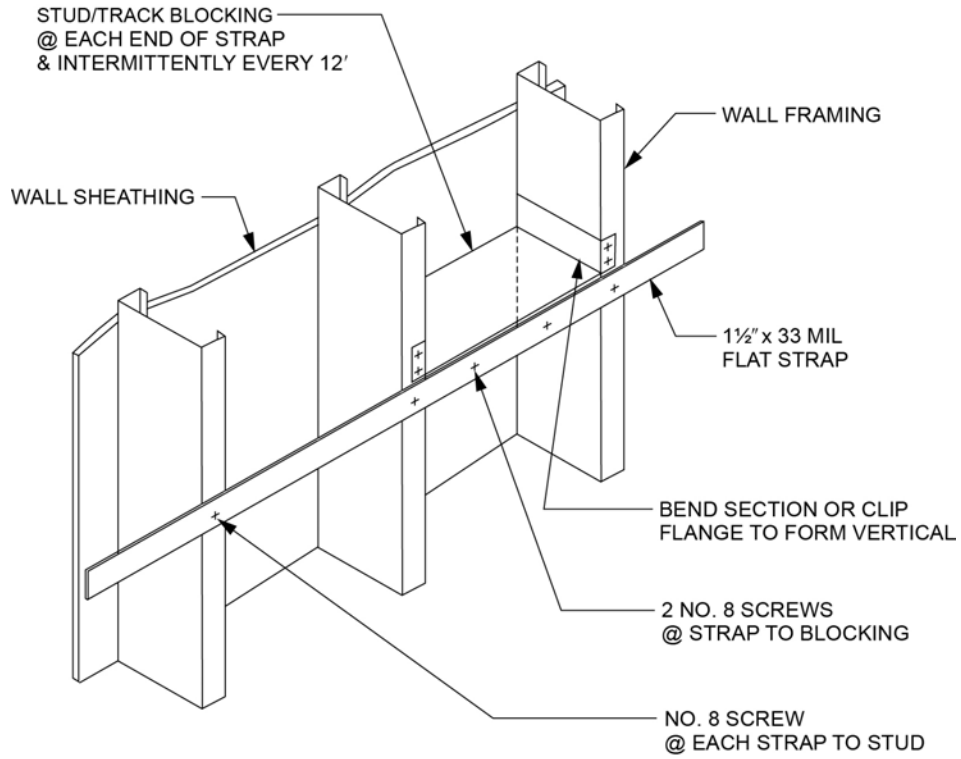
R603.6.1 Headers in gable endwalls. Box beam and back-to-back headers in gable endwalls shall be permitted to be constructed in accordance with Section R603.6 or with the header directly above the opening in accordance with Figures R603.6.1(1) and R603.6.1(2) and the following provisions:

1. Two 362S162-33 for openings less than or equal to 4 feet (1219 mm).
2. Two 600S162-43 for openings greater than 4 feet (1219 mm) but less than or equal to 6 feet (1829 mm).
3. Two 800S162-54 for openings greater than 6 feet (1829 mm) but less than or equal to 9 feet (2743 mm).



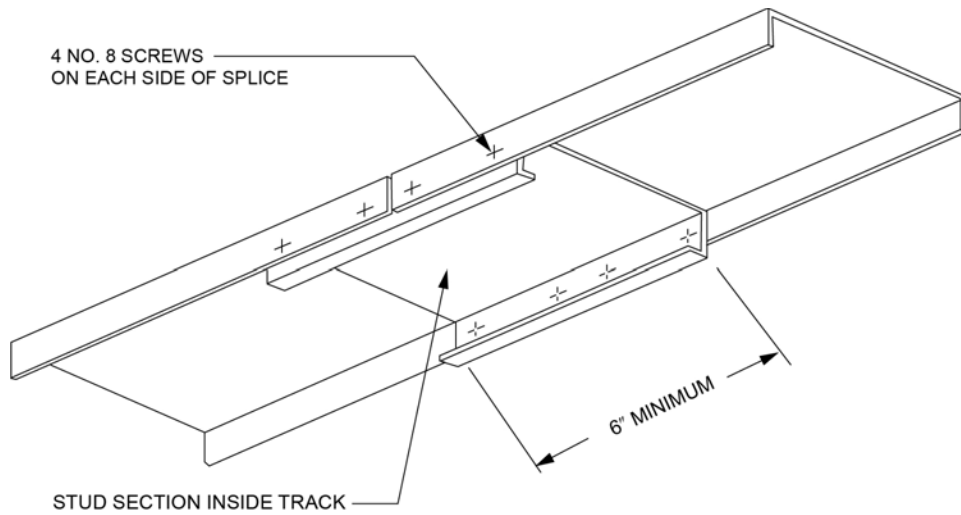
For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R603.3.3(1)
STUD BRACING WITH STRAPPING ONLY



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R603.3.3(2)
STUD BRACING WITH STRAPPING AND SHEATHING MATERIAL



For SI: 1 inch = 25.4 mm.

FIGURE R603.3.5
TRACK SPLICE

WALL CONSTRUCTION

R603.7 Jack and king studs. The number of jack and king studs installed on each side of a header shall comply with Table R603.7(1). King, jack and cripple studs shall be of the same dimension and thickness as the adjacent wall studs. Headers shall be connected to king studs in accordance with Table R603.7(2) and the following provisions:

1. For box beam headers, one-half of the total number of required screws shall be applied to the header and one-half to the king stud by use of C-shaped or track member in accordance with Figure R603.6(1). The track or C-shaped sections shall extend the depth of the header minus $\frac{1}{2}$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs.
2. For back-to-back headers, one-half the total number of screws shall be applied to the header and one-half to the king stud by use of a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle in accordance with Figure R603.6(2). The clip angle shall extend the depth of the header minus $\frac{1}{2}$ inch (12.7 mm) and shall have a minimum thickness not less than that of the wall studs. Jack and king studs shall be interconnected with structural sheathing in accordance with Figures R603.6(1) and R603.6(2).

R603.8 Head and sill track. Head track spans above door and window openings and sill track spans beneath window openings shall comply with Table R603.8. For openings less

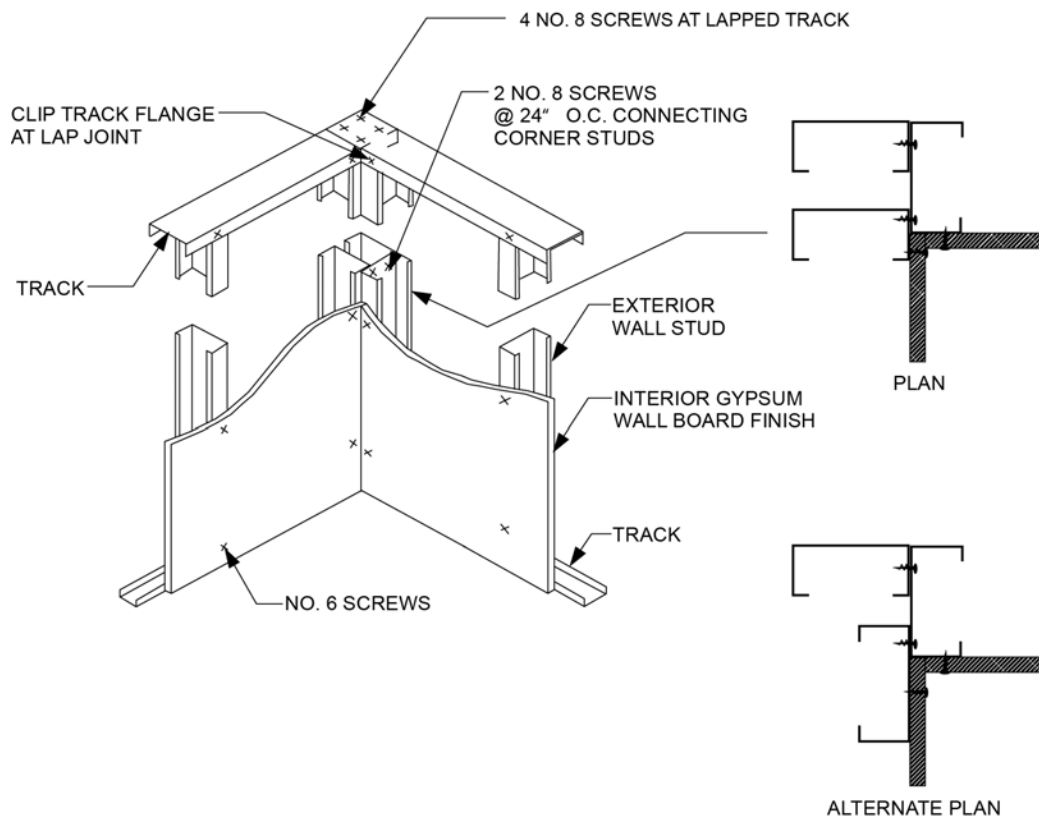
than 4 feet (1219 mm) in height that have both a head track and a sill track, multiplying the spans by 1.75 shall be permitted in Table R603.8. For openings less than or equal to 6 feet (1829 mm) in height that have both a head track and a sill track, multiplying the spans in Table R603.8 by 1.50 shall be permitted.

R603.9 Structural sheathing. Structural sheathing shall be installed in accordance with Figure R603.9 and this section on all sheathable exterior wall surfaces, including areas above and below openings.

R603.9.1 Sheathing materials. Structural sheathing panels shall consist of minimum $\frac{7}{16}$ -inch-thick (11 mm) oriented strand board or $\frac{15}{32}$ -inch-thick (12 mm) plywood.

R603.9.2 Determination of minimum length of full-height sheathing. The minimum length of full-height sheathing on each *braced wall line* shall be determined by multiplying the length of the *braced wall line* by the percentage obtained from Table R603.9.2(1) and by the plan aspect-ratio adjustment factors obtained from Table R603.9.2(2). The minimum length of full-height sheathing shall be not less than 20 percent of the *braced wall line* length.

To be considered full-height sheathing, structural sheathing shall extend from the bottom to the top of the wall without interruption by openings. Only sheathed, full-



For SI: 1 inch = 25.4 mm.

**FIGURE R603.4
CORNER FRAMING**

height wall sections, uninterrupted by openings, which are not less than 48 inches (1219 mm) wide, shall be counted toward meeting the minimum percentages in Table R603.9.2(1). In addition, structural sheathing shall comply with all of the following requirements:

1. Be installed with the long dimension parallel to the stud framing and shall cover the full vertical height of wall from the bottom of the bottom track to the top of the top track of each *story*. Installing the long dimension perpendicular to the stud framing or using shorter segments shall be permitted provided that the horizontal joint is blocked as described in Item 2.
2. Be blocked where the long dimension is installed perpendicular to the stud framing. Blocking shall be not less than 33 mil (0.84 mm) thickness. Each horizontal structural sheathing panel shall be fastened with No. 8 screws spaced at 6 inches (152 mm) on center to the blocking at the joint.

3. Be applied to each end (corners) of each of the exterior walls with a minimum 48-inch-wide (1219 mm) panel.

Exception: Where stone or masonry veneer is installed, the required length of full-height sheathing and overturning anchorage required shall be determined in accordance with Section R603.9.5.

R603.9.2.1 Full-height sheathing. The minimum percentage of full-height structural sheathing shall be multiplied by 1.10 for 9-foot-high (2743 mm) walls and multiplied by 1.20 for 10-foot-high (3048 mm) walls.

R603.9.2.2 Full-height sheathing in lowest story. In the lowest story of a dwelling, multiplying the percentage of full-height sheathing required in Table R603.9.2(1) by 0.6 shall be permitted where hold-down anchors are provided in accordance with Section R603.9.4.2.

TABLE R603.6(1)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	3'-3"	2'-8"	2'-2"	—	—	2'-8"	2'-2"	—	—	—
2-350S162-43	4'-2"	3'-9"	3'-4"	2'-11"	2'-7"	3'-9"	3'-4"	2'-11"	2'-7"	2'-2"
2-350S162-54	6'-2"	5'-10"	5'-8"	5'-3"	4'-10"	5'-11"	5'-8"	5'-2"	4'-10"	4'-6"
2-350S162-68	6'-7"	6'-3"	6'-0"	5'-10"	5'-8"	6'-4"	6'-1"	5'-10"	5'-8"	5'-6"
2-550S162-33	4'-8"	4'-0"	3'-6"	3'-0"	2'-6"	4'-1"	3'-6"	3'-0"	2'-6"	—
2-550S162-43	6'-0"	5'-4"	4'-10"	4'-4"	3'-11"	5'-5"	4'-10"	4'-4"	3'-10"	3'-5"
2-550S162-54	8'-9"	8'-5"	8'-1"	7'-9"	7'-3"	8'-6"	8'-1"	7'-8"	7'-2"	6'-8"
2-550S162-68	9'-5"	9'-0"	8'-8"	8'-4"	8'-1"	9'-1"	8'-8"	8'-4"	8'-1"	7'-10"
2-800S162-33	4'-5"	3'-11"	3'-5"	3'-1"	2'-10"	3'-11"	3'-6"	3'-1"	2'-9"	2'-3"
2-800S162-43	7'-3"	6'-7"	5'-11"	5'-4"	4'-10"	6'-7"	5'-11"	5'-4"	4'-9"	4'-3"
2-800S162-54	10'-10"	10'-2"	9'-7"	9'-0"	8'-5"	10'-2"	9'-7"	8'-11"	8'-4"	7'-9"
2-800S162-68	12'-8"	11'-10"	11'-2"	10'-7"	10'-1"	11'-11"	11'-2"	10'-7"	10'-0"	9'-6"
2-1000S162-43	7'-10"	6'-10"	6'-1"	5'-6"	5'-0"	6'-11"	6'-1"	5'-5"	4'-11"	4'-6"
2-1000S162-54	12'-3"	11'-5"	10'-9"	10'-2"	9'-6"	11'-6"	10'-9"	10'-1"	9'-5"	8'-9"
2-1000S162-68	14'-5"	13'-5"	12'-8"	12'-0"	11'-6"	13'-6"	12'-8"	12'-0"	11'-5"	10'-10"
2-1200S162-54	12'-11"	11'-3"	10'-0"	9'-0"	8'-2"	11'-5"	10'-0"	9'-0"	8'-1"	7'-4"
2-1200S162-68	15'-11"	14'-10"	14'-0"	13'-4"	12'-8"	15'-0"	14'-0"	13'-3"	12'-7"	11'-11"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Roof/ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

WALL CONSTRUCTION

TABLE R603.6(2)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Roof and Ceiling Only^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2'-4"	—	—	—	—	—	—	—	—	—
2-350S162-54	4'-8"	4'-2"	3'-9"	3'-5"	3'-1"	3'-7"	3'-2"	2'-9"	2'-5"	2'-0"
2-350S162-68	5'-7"	5'-2"	4'-9"	4'-4"	3'-11"	4'-7"	4'-1"	3'-7"	3'-2"	2'-10"
2-550S162-33	2'-2"	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-8"	3'-1"	2'-6"	—	—	2'-3"	—	—	—	—
2-550S162-54	6'-11"	6'-3"	5'-9"	5'-3"	4'-9"	5'-6"	4'-11"	4'-5"	3'-11"	3'-5"
2-550S162-68	8'-0"	7'-6"	6'-11"	6'-5"	5'-11"	6'-9"	6'-1"	5'-6"	5'-0"	4'-7"
2-800S162-33	2'-7"	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-6"	3'-9"	3'-1"	2'-5"	—	2'-10"	—	—	—	—
2-800S162-54	8'-0"	7'-3"	6'-8"	6'-1"	5'-7"	6'-5"	5'-9"	5'-1"	4'-7"	4'-0"
2-800S162-68	9'-9"	9'-0"	8'-3"	7'-8"	7'-1"	8'-0"	7'-3"	6'-7"	6'-0"	5'-6"
2-1000S162-43	4'-8"	4'-1"	3'-6"	2'-9"	—	3'-3"	2'-2"	—	—	—
2-1000S162-54	9'-1"	8'-2"	7'-3"	6'-7"	6'-0"	7'-0"	6'-2"	5'-6"	5'-0"	4'-6"
2-1000S162-68	11'-1"	10'-2"	9'-5"	8'-8"	8'-1"	9'-1"	8'-3"	7'-6"	6'-10"	6'-3"
2-1200S162-54	7'-8"	6'-9"	6'-1"	5'-6"	5'-0"	5'-10"	5'-1"	4'-7"	4'-1"	3'-9"
2-1200S162-68	12'-3"	11'-3"	10'-4"	9'-7"	8'-11"	10'-1"	9'-1"	8'-3"	7'-6"	6'-10"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Roof/ceiling dead load is 12 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(3)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	2'-2"	—	—	—	—	2'-1"	—	—	—	—
2-350S162-54	4'-4"	3'-10"	3'-5"	3'-1"	2'-9"	4'-3"	2'-9"	3'-4"	3'-0"	2'-8"
2-350S162-68	5'-0"	4'-9"	4'-7"	4'-2"	3'-9"	4'-11"	4'-8"	4'-6"	4'-1"	3'-9"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	3'-5"	2'-9"	2'-1"	—	—	3'-3"	2'-7"	—	—	—
2-550S162-54	6'-6"	5'-10"	5'-3"	4'-9"	4'-4"	6'-4"	5'-9"	5'-2"	4'-8"	4'-3"
2-550S162-68	7'-2"	6'-10"	6'-5"	5'-11"	5'-6"	7'-0"	6'-9"	6'-4"	5'-10"	5'-4"
2-800S162-33	2'-1"	—	—	—	—	—	—	—	—	—
2-800S162-43	4'-2"	3'-4"	2'-7"	—	—	4'-0"	3'-3"	2'-5"	—	—
2-800S162-54	7'-6"	6'-9"	6'-2"	5'-7"	5'-0"	7'-5"	6'-8"	6'-0"	5'-5"	4'-11"
2-800S162-68	9'-3"	8'-5"	7'-8"	7'-1"	6'-6"	9'-1"	8'-3"	7'-7"	7'-0"	6'-5"
2-1000S162-43	4'-4"	3'-9"	2'-11"	—	—	4'-3"	3'-8"	2'-9"	—	—
2-1000S162-54	8'-6"	7'-6"	6'-8"	6'-0"	5'-5"	8'-4"	7'-4"	6'-6"	5'-10"	5'-4"
2-1000S162-68	10'-6"	9'-7"	8'-9"	8'-0"	7'-5"	10'-4"	9'-5"	8'-7"	7'-11"	7'-3"
2-1200S162-54	7'-1"	6'-2"	5'-6"	5'-0"	4'-6"	6'-11"	6'-1"	5'-5"	4'-10"	4'-5"
2-1200S162-68	11'-7"	10'-7"	9'-8"	8'-11"	8'-2"	11'-5"	10'-5"	9'-6"	8'-9"	8'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Roof/ceiling dead load is 12 psf.

Second-floor live load is 30 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

WALL CONSTRUCTION

TABLE R603.6(4)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting One Floor, Roof and Ceiling^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	3'-5"	3'-0"	2'-7"	2'-2"	—	2'-8"	2'-2"	—	—	—
2-350S162-68	4'-6"	4'-1"	3'-8"	3'-3"	2'-11"	3'-9"	3'-3"	2'-10"	2'-5"	2'-1"
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	2'-0"	—	—	—	—	—	—	—	—	—
2-550S162-54	5'-3"	3'-8"	4'-1"	3'-8"	3'-2"	4'-3"	3'-8"	3'-1"	2'-7"	2'-0"
2-550S162-68	6'-5"	5'-10"	5'-3"	4'-9"	4'-4"	5'-5"	4'-9"	4'-3"	3'-9"	3'-4"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	2'-6"	—	—	—	—	—	—	—	—	—
2-800S162-54	6'-1"	5'-5"	4'-10"	4'-3"	3'-9"	4'-11"	4'-3"	3'-8"	3'-0"	2'-5"
2-800S162-68	7'-8"	6'-11"	6'-3"	5'-9"	5'-2"	6'-5"	5'-9"	5'-1"	4'-6"	4'-0"
2-1000S162-43	2'-10"	—	—	—	—	—	—	—	—	—
2-1000S162-54	6'-7"	5'-10"	5'-3"	4'-9"	4'-3"	5'-4"	4'-9"	4'-1"	3'-5"	2'-9"
2-1000S162-68	8'-8"	7'-10"	7'-2"	6'-6"	5'-11"	7'-4"	6'-6"	5'-9"	5'-1"	4'-6"
2-1200S162-54	5'-6"	4'-10"	4'-4"	3'-11"	3'-7"	4'-5"	3'-11"	3'-6"	3'-2"	2'-11"
2-1200S162-68	9'-7"	8'-8"	7'-11"	7'-2"	6'-6"	8'-1"	7'-2"	6'-4"	5'-8"	5'-0"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa,
 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Roof/ceiling dead load is 12 psf.

Second-floor live load is 30 psf.

Attic dead load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

TABLE R603.6(5)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (20 psf)					GROUND SNOW LOAD (30 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	2'-5"	—	—	—	—	2'-4"	—	—	—	—
2-350S162-68	3'-6"	3'-0"	2'-6"	2'-1"	—	3'-5"	2'-11"	2'-6"	2'-0"	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	3'-11"	3'-3"	2'-8"	2'-0"	—	3'-10"	3'-3"	2'-7"	—	—
2-550S162-68	5'-1"	4'-5"	3'-10"	3'-3"	2'-9"	5'-0"	4'-4"	3'-9"	3'-3"	2'-9"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	4'-7"	3'-10"	3'-1"	2'-5"	—	4'-6"	3'-9"	3'-0"	2'-4"	—
2-800S162-68	6'-0"	5'-3"	4'-7"	3'-11"	3'-4"	6'-0"	5'-2"	4'-6"	3'-11"	3'-3"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	5'-0"	4'-4"	3'-6"	2'-9"	—	4'-11"	4'-3"	3'-5"	2'-7"	—
2-1000S162-68	6'-10"	6'-0"	5'-3"	4'-6"	3'-10"	6'-9"	5'-11"	5'-2"	4'-5"	3'-9"
2-1200S162-54	4'-2"	3'-7"	3'-3"	2'-11"	—	4'-1"	3'-7"	3'-2"	2'-10"	—
2-1200S162-68	7'-7"	6'-7"	5'-9"	5'-0"	4'-2"	7'-6"	6'-6"	5'-8"	4'-10"	4'-1"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa, 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Roof/ceiling dead load is 12 psf.

Second-floor live load is 40 psf.

Third floor live load is 30 psf.

Attic live load is 10 psf.

c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

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TABLE R603.6(6)
BOX-BEAM AND BACK-TO-BACK HEADER SPANS
Headers Supporting Two Floors, Roof and Ceiling^{a, b, d}

MEMBER DESIGNATION	GROUND SNOW LOAD (50 psf)					GROUND SNOW LOAD (70 psf)				
	Building width ^c (feet)					Building width ^c (feet)				
	24	28	32	36	40	24	28	32	36	40
2-350S162-33	—	—	—	—	—	—	—	—	—	—
2-350S162-43	—	—	—	—	—	—	—	—	—	—
2-350S162-54	2'-2"	—	—	—	—	—	—	—	—	—
2-350S162-68	3'-3"	2'-9"	2'-3"	—	—	2'-11"	2'-5"	—	—	—
2-550S162-33	—	—	—	—	—	—	—	—	—	—
2-550S162-43	—	—	—	—	—	—	—	—	—	—
2-550S162-54	3'-7"	2'-11"	2'-3"	—	—	3'-3"	2'-7"	—	—	—
2-550S162-68	4'-9"	2'-1"	3'-6"	3'-0"	2'-5"	4'-4"	3'-9"	3'-2"	2'-8"	2'-1"
2-800S162-33	—	—	—	—	—	—	—	—	—	—
2-800S162-43	—	—	—	—	—	—	—	—	—	—
2-800S162-54	4'-3"	3'-5"	2'-8"	—	—	3'-9"	3'-0"	2'-3"	—	—
2-800S162-68	5'-8"	4'-11"	4'-2"	3'-7"	2'-11"	5'-3"	4'-6"	3'-10"	3'-3"	2'-7"
2-1000S162-43	—	—	—	—	—	—	—	—	—	—
2-1000S162-54	4'-8"	3'-11"	3'-1"	2'-2"	—	4'-3"	3'-5"	2'-7"	—	—
2-1000S162-68	6'-5"	5'-7"	4'-9"	4'-1"	3'-4"	5'-11"	5'-1"	4'-5"	3'-8"	2'-11"
2-1200S162-54	3'-11"	3'-5"	3'-0"	2'-4"	—	3'-7"	3'-2"	2'-10"	—	—
2-1200S162-68	7'-1"	6'-2"	5'-3"	4'-6"	3'-8"	6'-6"	5'-8"	4'-10"	4'-0"	3'-3"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa,
 1 ksi = 1,000 psi = 6.895 MPa.

a. Deflection criteria: $L/360$ for live loads, $L/240$ for total loads.

b. Design load assumptions:

Second-floor dead load is 10 psf.

Roof/ceiling dead load is 12 psf.

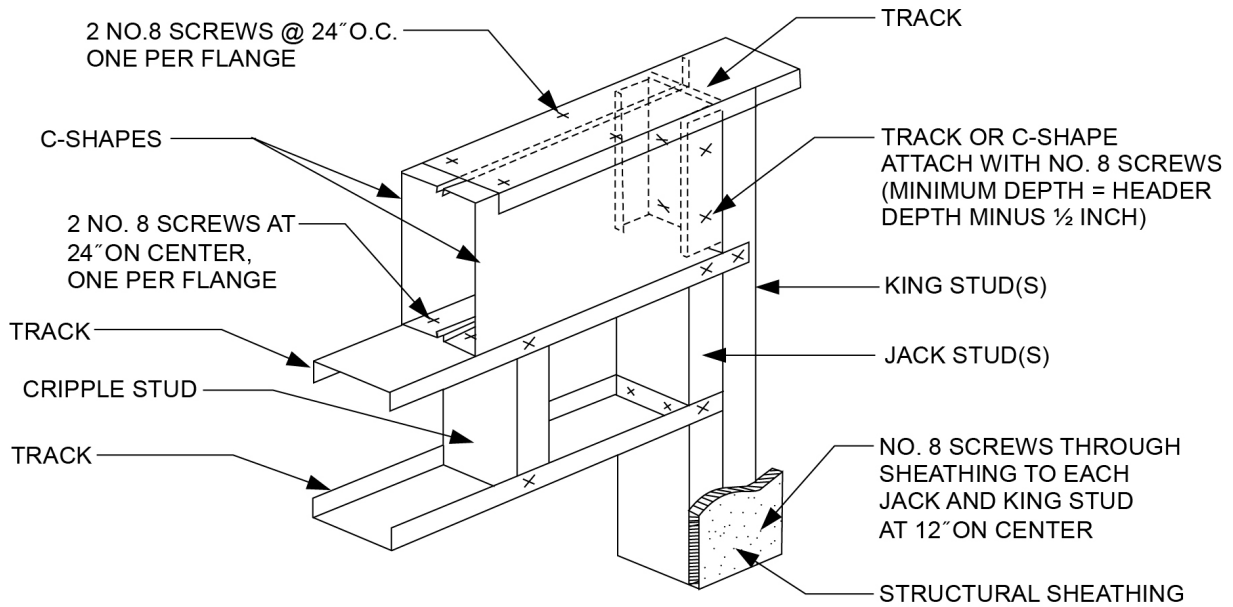
Second-floor live load is 40 psf.

Third floor live load is 30 psf.

Attic live load is 10 psf.

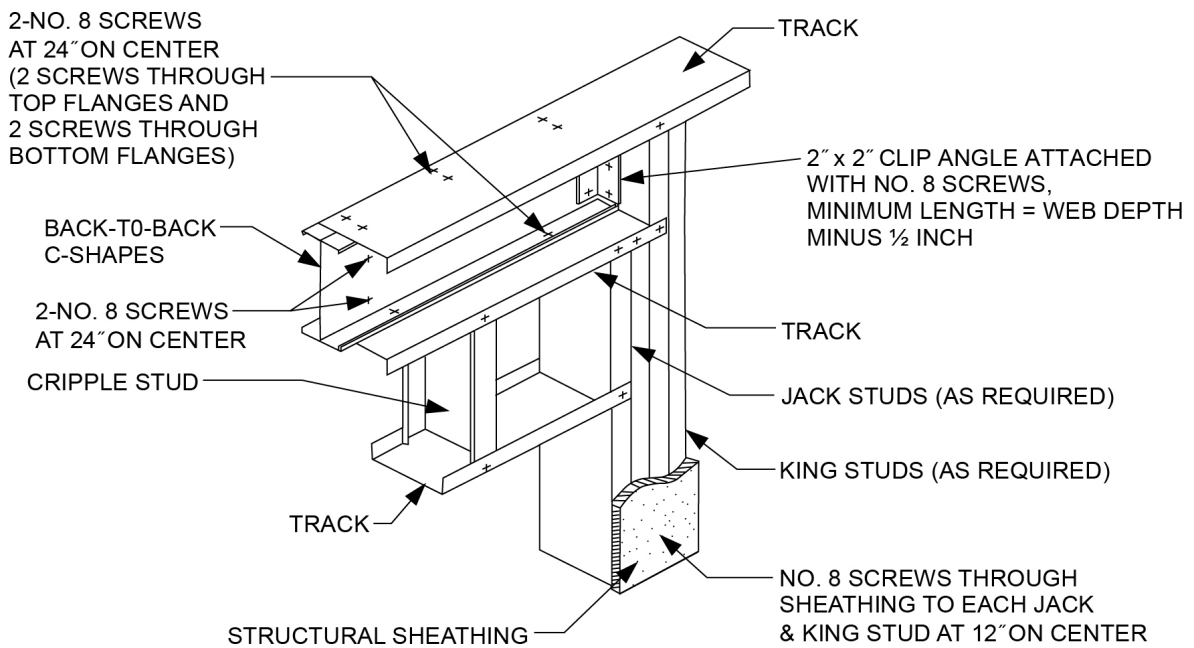
c. Building width is in the direction of horizontal framing members supported by the header.

d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.



For SI: 1 inch = 25.4 mm.

**FIGURE R603.6(1)
BOX BEAM HEADER**



For SI: 1 inch = 25.4 mm.

**FIGURE R603.6(2)
BACK-TO-BACK HEADER**

WALL CONSTRUCTION

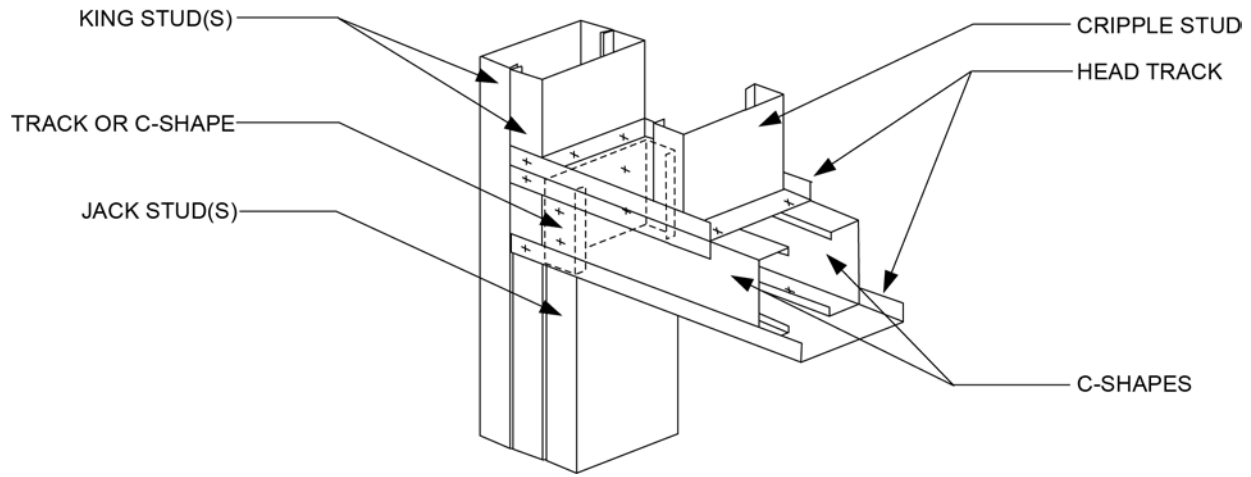


FIGURE R603.6.1(1)
BOX BEAM HEADER IN GABLE ENDWALL

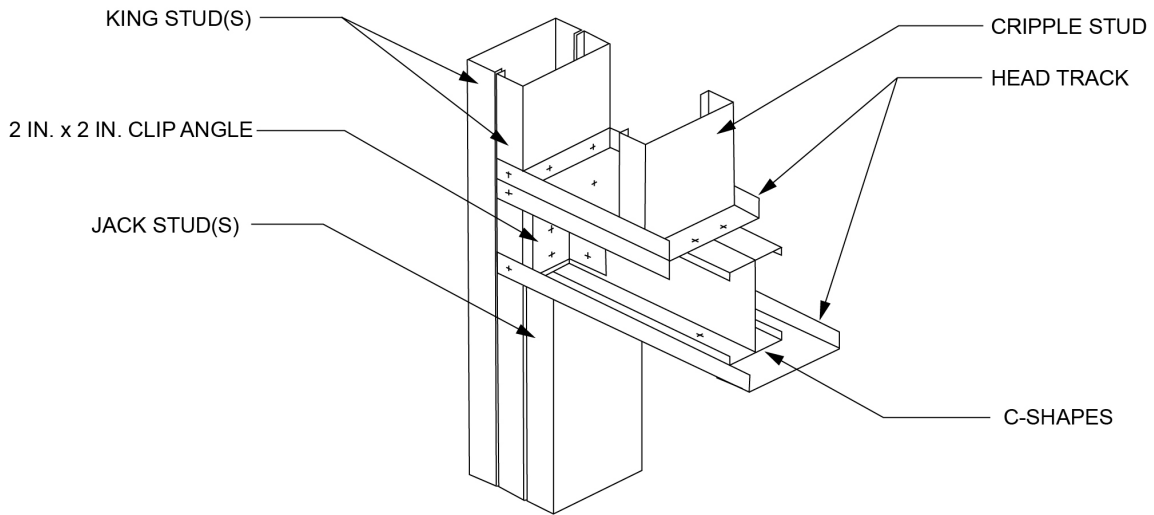


FIGURE R603.6.1(2)
BACK-TO-BACK HEADER IN GABLE ENDWALL

For SI: 1 inch = 25.4 mm.

TABLE R603.7(1)
TOTAL NUMBER OF JACK AND KING STUDS REQUIRED AT EACH END OF AN OPENING

SIZE OF OPENING (feet-inches)	24-INCH O.C. STUD SPACING		16-INCH O.C. STUD SPACING	
	No. of jack studs	No. of king studs	No. of jack studs	No. of king studs
Up to 3'-6"	1	1	1	1
> 3'-6" to 5'-0"	1	2	1	2
> 5'-0" to 5'-6"	1	2	2	2
> 5'-6" to 8'-0"	1	2	2	2
> 8'-0" to 10'-6"	2	2	2	3
> 10'-6" to 12'-0"	2	2	3	3
> 12'-0" to 13'-0"	2	3	3	3
> 13'-0" to 14'-0"	2	3	3	4
> 14'-0" to 16'-0"	2	3	3	4
> 16'-0" to 18'-0"	3	3	4	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

TABLE R603.7(2)
HEADER TO KING STUD CONNECTION REQUIREMENTS^{a, b, c, d}

HEADER SPAN (feet)	ULTIMATE WIND SPEED (mph), EXPOSURE CATEGORY					
	115 B	120 B	130 B	< 140 B	130 C	<140 C
			115 C	120 C		
≤ 4	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws	6-No. 8 screws
> 4 to 8	4-No. 8 screws	4-No. 8 screws	4-No. 8 screws	6-No. 8 screws	8-No. 8 screws	8-No. 8 screws
> 8 to 12	4-No. 8 screws	6-No. 8 screws	6-No. 8 screws	8-No. 8 screws	10-No. 8 screws	12-No. 8 screws
> 12 to 16	4-No. 8 screws	6-No. 8 screws	8-No. 8 screws	10-No. 8 screws	12-No. 8 screws	14-No. 8 screws

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 4.448 N.

- a. All screw sizes shown are minimum.
- b. For headers located on the first floor of a two-story building or the first or second floor of a three-story building, the total number of screws is permitted to be reduced by 2 screws, but the total number of screws shall be not less than four.
- c. For roof slopes of 6:12 or greater, the required number of screws shall be permitted to be reduced by half, but the total number of screws shall be not less than four.

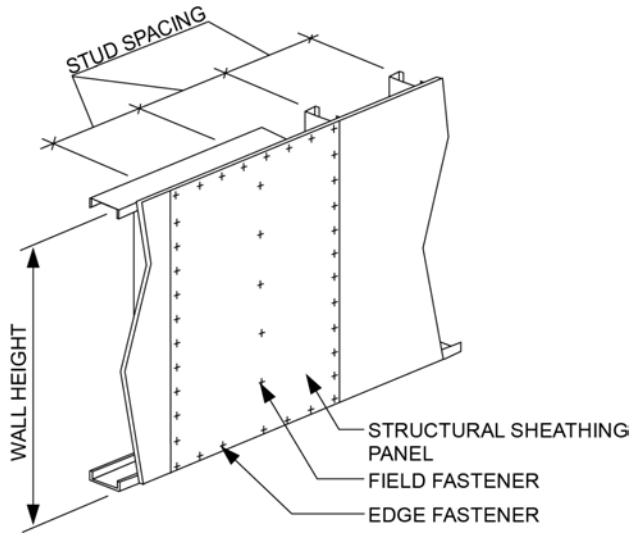
TABLE R603.8
HEAD AND SILL TRACK SPAN

ULTIMATE WIND SPEED AND EXPOSURE CATEGORY (mph)		ALLOWABLE HEAD AND SILL TRACK SPAN ^{a, b, c} (feet-inches)					
		TRACK DESIGNATION ^d					
B	C	350T125-33	350T125-43	350T125-54	550T125-33	550T125-43	550T125-54
115	—	5'-9"	6'-9"	9'-3"	7'-3"	9'-1"	12'-5"
120	—	5'-6"	6'-6"	8'-11"	7'-0"	8'-9"	11'-11"
130	115	4'-10"	5'-9"	7'-10"	6'-2"	7'-8"	10'-6"
< 140	120	4'-8"	5'-6"	7'-6"	5'-11"	7'-4"	10'-1"
—	130	4'-3"	5'-1"	6'-11"	5'-6"	6'-9"	9'-4"
—	< 140	4'-0"	4'-9"	6'-5"	5'-1"	6'-4"	8'-8"

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 ksi = 1,000 psi = 6.895 MPa.

- a. Deflection limit: $L/240$.
- b. Head and sill track spans are based on components and cladding wind pressures and 48-inch tributary span.
- c. For openings less than 4 feet in height that have both a head track and sill track, the spans are permitted to be multiplied by 1.75. For openings less than or equal to 6 feet in height that have both a head track and a sill track, the spans are permitted to be multiplied by a factor of 1.5.
- d. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

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**FIGURE R603.9
STRUCTURAL SHEATHING FASTENING PATTERN**

R603.9.3 Structural sheathing fastening. Edges and interior areas of structural sheathing panels shall be fastened to framing members and tracks in accordance with Figure R603.9 and Table R603.3.2(1). Screws for attachment of structural sheathing panels shall be bugle-head, flat-head, or similar head style with a minimum head diameter of 0.29 inch (8 mm).

For continuously sheathed braced wall lines using wood structural panels installed with No. 8 screws spaced 4 inches (102 mm) on center at all panel edges and 12 inches (304.8 mm) on center on intermediate framing members, the following shall apply:

1. Multiplying the percentages of full-height sheathing in Table R603.9.2(1) by 0.72 shall be permitted.

2. For bottom track attached to foundations or framing below, the bottom track anchor or screw connection spacing in Tables R505.3.1(1) and R603.3.1 shall be multiplied by two-thirds.

R603.9.4 Uplift connection requirements. Uplift connections shall be provided in accordance with this section.

R603.9.4.1 Ultimate design wind speeds greater than 130 mph. Where ultimate design wind speeds exceed 130 miles per hour (58 m/s), Exposure Category C walls shall be provided with direct uplift connections in accordance with AISI S230, Section E13.3, and AISI S230, Section F8.2, as required for 140 miles per hour (63 m/s), Exposure Category C.

R603.9.4.2 Hold-down anchor. Where the percentage of full-height sheathing is adjusted in accordance with Section R603.9.2.2, a hold-down anchor, with a strength of 4,300 pounds (19 kN), shall be provided at each end of each full-height sheathed wall section used to meet the minimum percent sheathing requirements of Section R603.9.2. Hold-down anchors shall be attached to back-to-back studs; structural sheathing panels shall have edge fastening to the studs, in accordance with Section R603.9.3 and AISI S230, Table E11-1.

A single hold-down anchor, installed in accordance with Figure R603.9.4.2, shall be permitted at the corners of buildings.

R603.9.5 Structural sheathing for stone and masonry veneer. Where stone and masonry veneer are installed in accordance with Section R703.8, the length of full-height sheathing for exterior and interior wall lines backing or perpendicular to and laterally supporting walls with veneer shall comply with this section.

**TABLE R603.9.2(1)
MINIMUM PERCENTAGE OF FULL-HEIGHT STRUCTURAL SHEATHING ON EXTERIOR WALLS^{a, b}**

WALL SUPPORTING	ROOF SLOPE	ULTIMATE WIND SPEED AND EXPOSURE (mph)					
		115 B	120 B	130 B	< 140 B	< 130 C	< 140 C
				115 C	120 C		
Roof and ceiling only (one story or top floor of two- or three-story building)	3:12	9	11	11	13	17	20
	6:12	13	15	17	22	28	35
	9:12	23	27	29	33	53	59
	12:12	32	39	40	44	70	76
One story, roof and ceiling (first floor of a two-story building or second floor of a three-story building)	3:12	26	32	34	39	53	67
	6:12	27	33	34	44	61	75
	9:12	38	45	46	61	78	92
	12:12	43	53	57	72	106	116
Two stories, roof and ceiling (first floor of a three-story building)	3:12	43	53	57	64	89	113
	6:12	41	51	51	67	95	114
	9:12	53	63	63	89	104	126
	12:12	54	67	74	100	142	157

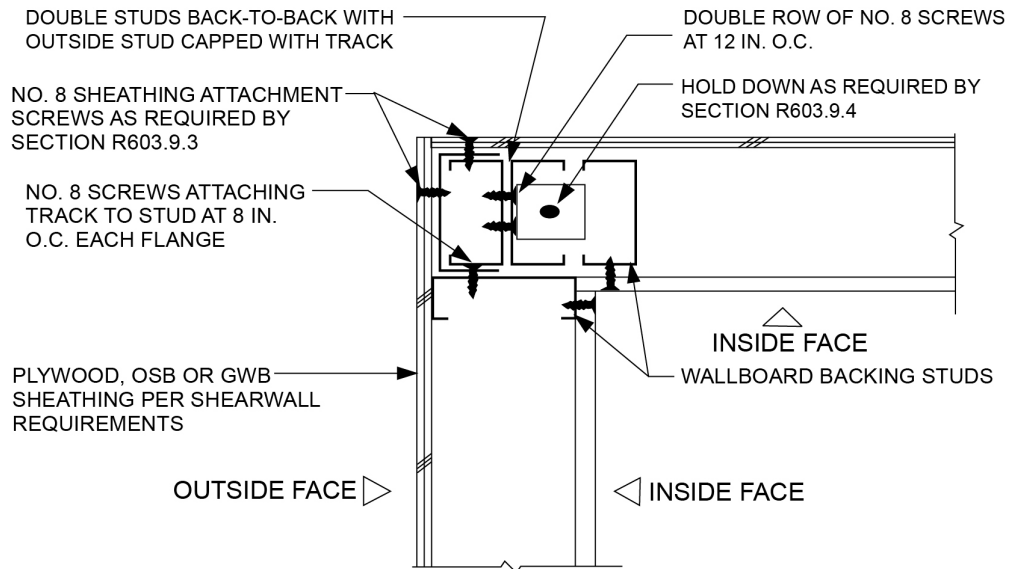
For SI: 1 mph = 0.447 m/s.

a. Linear interpolation is permitted.

b. For hip-roofed homes the minimum percentage of full-height sheathing, based on wind, is permitted to be multiplied by a factor of 0.95 for roof slopes not exceeding 7:12 and a factor of 0.9 for roof slopes greater than 7:12.

TABLE R603.9.2(2)
FULL-HEIGHT SHEATHING LENGTH ADJUSTMENT FACTORS

PLAN ASPECT RATIO	LENGTH ADJUSTMENT FACTORS	
	Short wall	Long wall
1:1	1.0	1.0
1.5:1	1.5	0.67
2:1	2.0	0.50
3:1	3.0	0.33
4:1	4.0	0.25



For SI: 1 inch = 25.4 mm.

FIGURE R603.9.4.2
CORNER STUD HOLD-DOWN DETAIL

R603.9.5.1 Seismic Design Category C. In Seismic Design Category C, the length of structural sheathing for walls supporting one story, roof and ceiling shall be the greater of the amounts required by Section R603.9.2, except Section R603.9.2.2 shall be permitted.

R603.9.5.2 Seismic Design Categories D₀, D₁ and D₂. In Seismic Design Categories D₀, D₁ and D₂, the required length of structural sheathing and overturning anchorage shall be determined in accordance with Tables R603.9.5(1), R603.9.5(2), R603.9.5(3), and R603.9.5(4). Overturning anchorage shall be installed on the doubled studs at the end of each full-height wall segment.

SECTION R604
WOOD STRUCTURAL PANELS

R604.1 Identification and grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2, ANSI/APA PRP

210, CSA O325 or CSA O437. Panels shall be identified by a grade mark or certificate of inspection issued by an approved agency.

R604.2 Allowable spans. The maximum allowable spans for wood structural panel wall sheathing shall not exceed the values set forth in Table R602.3(3).

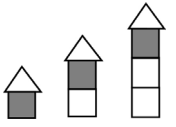
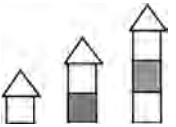

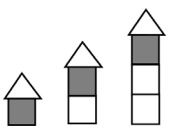


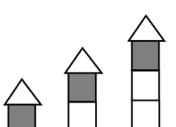
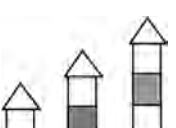

R604.3 Installation. Wood structural panel wall sheathing shall be attached to framing in accordance with Table R602.3(1) or R602.3(3).

SECTION R605
PARTICLEBOARD

R605.1 Identification and grade. Particleboard shall conform to ANSI A208.1 and shall be so identified by a grade mark or certificate of inspection issued by an approved agency. Particleboard shall comply with the grades specified in Table R602.3(4).

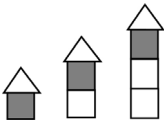
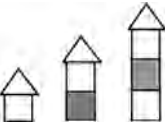
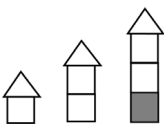
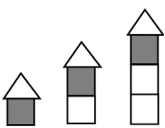
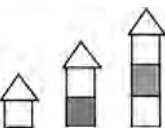

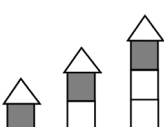


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TABLE R603.9.5(1)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE
FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED
STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (feet)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		Minimum total length of braced wall panels required along each braced wall line (feet)							
D ₀		3.3	4.7	6.1	7.4	8.8	10.2	3,360	—
		5.3	8.7	12.1	15.4	18.8	22.2	3,360	6,720
		7.3	12.7	18.0	23.4	28.8	34.2	3,360	10,080
D ₁		4.1	5.8	7.5	9.2	10.9	12.7	3,360	—
		6.6	10.7	14.9	19.1	23.3	27.5	3,360	6,720
		9.0	15.7	22.4	29.0	35.7	42.2	3,360	10,080
D ₂		5.7	8.2	10.6	13.0	15.4	17.8	3,360	—
		9.2	15.1	21.1	27.0	32.9	38.8	3,360	6,720
		12.7	22.1	31.5	40.9	50.3	59.7	3,360	10,080

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

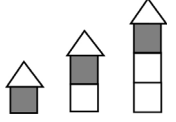



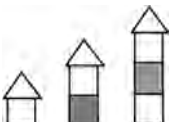

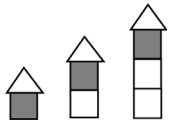
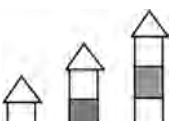

TABLE R603.9.5(2)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE
FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED
STEEL FRAMING AND 6-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (feet)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		Minimum total length of braced wall panels required along each braced wall line (feet)							
D ₀		2.8	4.0	5.1	6.3	7.5	8.7	3,960	—
		4.5	7.4	10.2	13.1	16.0	18.8	3,960	7,920
		6.2	10.7	15.3	19.9	24.4	29.0	3,960	11,880
D ₁		3.5	4.9	6.4	7.8	9.3	10.7	3,960	—
		5.6	9.1	12.7	16.2	19.8	23.3	3,960	7,920
		7.7	13.3	19.0	24.6	30.3	35.9	3,960	11,880
D ₂		4.9	6.9	9.0	11.0	13.1	15.1	3,960	—
		7.8	12.9	17.9	22.9	27.9	32.9	3,960	7,920
		10.8	18.8	26.7	34.7	42.7	50.7	3,960	11,880

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

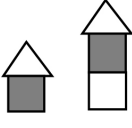
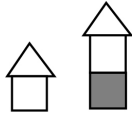
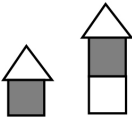
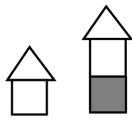
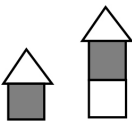
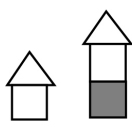
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TABLE R603.9.5(3)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE FOR
WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 33-MIL COLD-FORMED STEEL
FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (feet)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		Minimum total length of braced wall panels required along each braced wall line (feet)							
D ₀		2.5	3.6	4.6	5.7	6.8	7.8	4,392	—
		4.0	6.6	9.2	11.8	14.4	17.0	4,392	8,784
		5.6	9.7	13.8	17.9	22.0	26.2	4,392	13,176
D ₁		3.1	4.4	5.7	7.1	8.4	9.7	4,392	—
		5.0	8.2	11.4	14.6	17.8	21.0	4,392	8,784
		6.9	12.0	17.1	22.2	27.3	32.4	4,392	13,176
D ₂		4.4	6.2	8.1	10.0	11.8	13.7	4,392	—
		7.1	11.6	16.1	20.6	25.1	29.7	4,392	8,784
		9.7	16.9	24.1	31.3	38.5	45.7	4,392	13,176

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

TABLE R603.9.5(4)
REQUIRED LENGTH OF FULL-HEIGHT SHEATHING AND ASSOCIATED OVERTURNING ANCHORAGE
FOR WALLS SUPPORTING WALLS WITH STONE OR MASONRY VENEER AND USING 43-MIL COLD-FORMED STEEL
FRAMING AND 4-INCH SCREW SPACING ON THE PERIMETER OF EACH PANEL OF STRUCTURAL SHEATHING

SEISMIC DESIGN CATEGORY	STORY	BRACED WALL LINE LENGTH (feet)						SINGLE-STORY HOLD-DOWN FORCE (pounds)	CUMULATIVE HOLD-DOWN FORCE (pounds)
		10	20	30	40	50	60		
		Minimum total length of braced wall panels required along each braced wall line (feet)							
D ₀		1.9	2.7	3.4	4.2	5.0	5.8	5,928	—
		3.0	4.9	6.8	8.8	10.7	12.6	5,928	11,856
D ₁		2.3	3.3	4.3	5.2	6.2	7.2	5,928	—
		3.7	6.1	8.5	10.8	13.2	15.6	5,928	11,856
D ₂		3.3	4.6	6.0	7.4	8.7	10.1	5,928	—
		5.2	8.6	11.9	15.3	18.6	22.0	5,928	11,856

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

SECTION R606
GENERAL MASONRY CONSTRUCTION

R606.1 General. Masonry construction shall be designed and constructed in accordance with the provisions of this section, TMS 402, TMS 403 or TMS 404.

➔ **R606.1.1 Professional registration.** Where the empirical design provisions of Appendix A of TMS 402, the provisions of TMS 403, or the provisions of this section are used to design masonry, project drawings, typical details and specifications shall not exempt construction documents from the requirement to be stamped by a California licensed architect or engineer. Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537.1 and 6737.1.

R606.2 Masonry construction materials.

R606.2.1 Concrete masonry units. Concrete masonry units shall conform to the following standards: ASTM C55 for concrete brick; ASTM C73 for calcium silicate face brick; ASTM C90 for load-bearing concrete masonry

units; ASTM C744 for prefaced concrete and calcium silicate masonry units; or ASTM C1634 for concrete facing brick.

R606.2.2 Clay or shale masonry units. Clay or shale masonry units shall conform to the following standards: ASTM C34 for structural clay load-bearing wall tile; ASTM C56 for structural clay nonload-bearing wall tile; ASTM C62 for building brick (solid masonry units made from clay or shale); ASTM C126 for ceramic-glazed structural clay facing tile, facing brick and solid masonry units; ASTM C212 for structural clay facing tile; ASTM C216 for facing brick (solid masonry units made from clay or shale); ASTM C652 for hollow brick (hollow masonry units made from clay or shale); ASTM C1088 for solid units of thin veneer brick; or ASTM C1405 for glazed brick (single-fired solid brick units).

Exception: Structural clay tile for nonstructural use in fireproofing of structural members and in wall furring shall not be required to meet the compressive strength

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specifications. The fire-resistance rating shall be determined in accordance with ASTM E119 or UL 263 and shall comply with the requirements of Section R302.

R606.2.3 AAC masonry. AAC masonry units shall conform to ASTM C1691 and ASTM C1693 for the strength class specified.

R606.2.4 Stone masonry units. Stone masonry units shall conform to the following standards: ASTM C503 for marble building stone (exterior); ASTM C568 for limestone building stone; ASTM C615 for granite building stone; ASTM C616 for sandstone building stone; or ASTM C629 for slate building stone.

R606.2.5 Architectural cast stone. Architectural cast stone shall conform to ASTM C1364.

R606.2.6 Adhered manufactured stone masonry veneer units. Adhered manufactured stone masonry veneer units shall conform to ASTM C1670.

R606.2.7 Second-hand units. Second-hand masonry units shall not be reused unless they conform to the requirements of new units. The units shall be of whole, sound materials and free from cracks and other defects that will

interfere with proper laying or use. Old mortar shall be cleaned from the unit before reuse.

R606.2.8 Mortar. Except for mortars listed in Sections R606.2.9, R606.2.10 and R606.2.11, mortar for use in masonry construction shall meet the proportion specifications of Table R606.2.8 or the property specifications of ASTM C270. The type of mortar shall be in accordance with Sections R606.2.8.1, R606.2.8.2 and R606.2.8.3.

R606.2.8.1 Foundation walls. Mortar for masonry foundation walls constructed as set forth in Tables R404.1.1(1) through R404.1.1(4) shall be Type M or S mortar.

R606.2.8.2 Masonry in Seismic Design Categories A, B and C. Mortar for masonry serving as the lateral force-resisting system in Seismic Design Categories A, B and C shall be Type M, S or N mortar.

R606.2.8.3 Masonry in Seismic Design Categories D₀, D₁ and D₂. Mortar for masonry serving as the lateral-force-resisting system in Seismic Design Categories D₀, D₁ and D₂ shall be Type M or S Portland cement-lime or mortar cement.

**TABLE R606.2.8
MORTAR PROPORTIONS^{a, b}**

MORTAR	TYPE	PROPORTIONS BY VOLUME (cementitious materials)								Aggregate ratio (measured in damp, loose conditions)
		Portland cement or blended cement	Mortar cement			Masonry cement			Hydrated lime ^c or lime putty	
			M	S	N	M	S	N		
Cement-lime	M	1	—	—	—	—	—	—	1/4	Not less than 2 1/4 and not more than 3 times the sum of separate volumes of lime, if used, and cement
	S	1	—	—	—	—	—	—	over 1/4 to 1/2	
	N	1	—	—	—	—	—	—	over 1/2 to 1 1/4	
	O	1	—	—	—	—	—	—	over 1 1/4 to 2 1/2	
Mortar cement	M	1	—	—	1	—	—	—	—	
	M	—	1	—	—	—	—	—		
	S	1/2	—	—	1	—	—	—		
	S	—	—	1	—	—	—	—		
	N	—	—	—	1	—	—	—		
Masonry cement	O	—	—	—	1	—	—	—	—	
	M	1	—	—	—	—	—	1		
	M	—	—	—	—	1	—	—		
	S	1/2	—	—	—	—	—	1		
	S	—	—	—	—	—	1	—		
	N	—	—	—	—	—	—	1		
O	—	—	—	—	—	—	—	1		

For SI: 1 cubic foot = 0.0283 m³, 1 pound = 0.454 kg.

a. For the purpose of these specifications, the weight of 1 cubic foot of the respective materials shall be considered to be as follows:

- Hydrated lime = 40 pounds
- Lime putty (Quicklime) = 80 pounds
- Masonry cement = Weight printed on bag
- Mortar cement = Weight printed on bag
- Portland cement = 94 pounds
- Sand, damp and loose = 80 pounds of dry sand

b. Two air-entraining materials shall not be combined in mortar.
c. Hydrated lime conforming to the requirements of ASTM C207.

R606.2.9 Surface-bonding mortar. Surface-bonding mortar shall comply with ASTM C887. Surface bonding of concrete masonry units shall comply with ASTM C946.

R606.2.10 Mortar for AAC masonry. Thin-bed mortar for AAC masonry shall comply with Article 2.1 C.1 of TMS 602. Mortar used for the leveling courses of AAC masonry shall comply with Article 2.1 C.2 of TMS 602.

R606.2.11 Mortar for adhered masonry veneer. Mortar for use with adhered masonry veneer shall conform to ASTM C270 Type S or Type N or shall comply with ANSI A118.4 for latex-modified Portland cement mortar.

R606.2.12 Grout. Grout shall consist of cementitious material and aggregate in accordance with ASTM C476 or the proportion specifications of Table R606.2.12. Type M or Type S mortar to which sufficient water has been added to produce pouring consistency shall be permitted to be used as grout.

R606.2.13 Metal reinforcement and accessories. Metal reinforcement and accessories shall conform to Article 2.4 of TMS 602.

R606.3 Construction requirements.

R606.3.1 Bed and head joints. Unless otherwise required or indicated on the project drawings, head and bed joints shall be $\frac{3}{8}$ inch (9.5 mm) thick, except that the thickness of the bed joint of the starting course placed over foundations shall be not less than $\frac{1}{4}$ inch (6.4 mm) and not more than $\frac{3}{4}$ inch (19.1 mm). Mortar joint thickness for load-bearing masonry shall be within the following tolerances from the specified dimensions:

1. Bed joint: + $\frac{1}{8}$ inch (3.2 mm).
2. Head joint: - $\frac{1}{4}$ inch (6.4 mm), + $\frac{3}{8}$ inch (9.5 mm).
3. Collar joints: - $\frac{1}{4}$ inch (6.4 mm), + $\frac{3}{8}$ inch (9.5 mm).

R606.3.2 Masonry unit placement. The mortar shall be sufficiently plastic and units shall be placed with sufficient pressure to extrude mortar from the joint and produce a tight joint. Deep furrowing of bed joints that produces voids shall not be permitted. Any units disturbed to the extent that initial bond is broken after initial placement shall be removed and relaid in fresh mortar. Surfaces to be in contact with mortar shall be clean and free of deleterious materials.

R606.3.2.1 Solid masonry. Solid masonry units shall be laid with full head and bed joints and all interior vertical joints that are designed to receive mortar shall be filled.

R606.3.2.2 Hollow masonry. For hollow masonry units, head and bed joints shall be filled solidly with mortar for a distance in from the face of the unit not less than the thickness of the face shell.

R606.3.3 Installation of wall ties. The installation of wall ties shall be as follows:

1. The ends of wall ties shall be embedded in mortar joints. Wall ties shall have not less than $\frac{5}{8}$ -inch (15.9 mm) mortar coverage from the exposed face.
2. Wall ties shall not be bent after being embedded in grout or mortar.
3. For solid masonry units, solid grouted hollow units, or hollow units in anchored masonry veneer, wall ties shall be embedded in mortar bed not less than $1\frac{1}{2}$ inches (38 mm).
4. For hollow masonry units in other than anchored masonry veneer, wall ties shall engage outer face shells by not less than $\frac{1}{2}$ inch (13 mm).

R606.3.4 Protection for reinforcement. Bars shall be completely embedded in mortar or grout. Joint reinforcement embedded in horizontal mortar joints shall not have less than $\frac{5}{8}$ -inch (15.9 mm) mortar coverage from the exposed face. Other reinforcement shall have a minimum coverage of one bar diameter over all bars, but not less than $\frac{3}{4}$ inch (19 mm), except where exposed to weather or soil, in which case the minimum coverage shall be 2 inches (51 mm).

R606.3.4.1 Corrosion protection. Minimum corrosion protection of joint reinforcement, anchor ties and wire fabric for use in masonry wall construction shall conform to Table R606.3.4.1.

R606.3.5 Grouting requirements.

R606.3.5.1 Grout placement. Grout shall be a plastic mix suitable for pumping without segregation of the constituents and shall be mixed thoroughly. Grout shall be placed by pumping or by an approved alternate method and shall be placed before any initial set occurs and not more than $1\frac{1}{2}$ hours after water has been added. Grout shall be consolidated by puddling or mechanical vibrating during placing and reconsolidated after excess moisture has been absorbed but before plasticity is lost. Grout shall not be pumped through aluminum pipes.

Maximum pour heights and the minimum dimensions of spaces provided for grout placement shall conform to Table R606.3.5.1. Grout shall be poured in lifts with a maximum height of 8 feet (2438 mm). Where a total grout

TABLE R606.2.12
GROUT PROPORTIONS BY VOLUME FOR MASONRY CONSTRUCTION

TYPE	PORTLAND CEMENT OR BLENDED CEMENT SLAG CEMENT	HYDRATED LIME OR LIME PUTTY	AGGREGATE MEASURED IN A DAMP, LOOSE CONDITION	
			Fine	Coarse
Fine	1	0 to 1/10	$2\frac{1}{4}$ to 3 times the sum of the volumes of the cementitious materials	—
Coarse	1	0 to 1/10	$2\frac{1}{4}$ to 3 times the sum of the volumes of the cementitious materials	1 to 2 times the sum of the volumes of the cementitious materials

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pour exceeds 8 feet (2438 mm) in height, the grout shall be placed in lifts not exceeding 64 inches (1626 mm) and special inspection during grouting shall be required. If the work is stopped for 1 hour or longer, the horizontal construction joints shall be formed by stopping all tiers at the same elevation and with the grout 1 inch (25 mm) below the top.

R606.3.5.2 Cleanouts. Provisions shall be made for cleaning the space to be grouted. Mortar that projects more than $\frac{1}{2}$ inch (12.7 mm) into the grout space and any other foreign matter shall be removed from the grout space prior to inspection and grouting. Where required by the building official, cleanouts shall be provided in the bottom course of masonry for each grout pour where the grout pour height exceeds 64 inches (1626 mm). In solid grouted masonry, cleanouts shall be spaced horizontally not more than 32 inches (813 mm) on center. The cleanouts shall be sealed before grouting and after inspection.

R606.3.5.3 Construction. Requirements for grouted masonry construction shall be as follows:

1. Masonry shall be built to preserve the unobstructed vertical continuity of the cells or spaces to be filled. In partially grouted construction,

cross webs forming cells to be filled shall be full-bedded in mortar to prevent leakage of grout. Head and end joints shall be solidly filled with mortar for a distance in from the face of the wall or unit not less than the thickness of the longitudinal face shells.

2. Vertical reinforcement shall be held in position at top and bottom and at intervals not exceeding 200 diameters of the reinforcement.
3. Cells containing reinforcement shall be filled solidly with grout.
4. The thickness of grout or mortar between masonry units and reinforcement shall be not less than $\frac{1}{4}$ inch (6.4 mm), except that $\frac{1}{4}$ -inch (6.4 mm) bars shall be permitted to be laid in horizontal mortar joints not less than $\frac{1}{2}$ inch (12.7 mm) thick, and steel wire reinforcement shall be permitted to be laid in horizontal mortar joints not less than twice the thickness of the wire diameter.

R606.3.6 Grouted multiple-wythe masonry. Grouted multiple-wythe masonry shall conform to all the requirements specified in Section R606.3.5 and the requirements of this section.

**TABLE R606.3.4.1
MINIMUM CORROSION PROTECTION**

MASONRY METAL ACCESSORY	STANDARD
Joint reinforcement, interior walls	ASTM A641, Class 1
Wire ties or anchors in exterior walls completely embedded in mortar or grout	ASTM A641, Class 3
Wire ties or anchors in exterior walls not completely embedded in mortar or grout	ASTM A153, Class B-2
Joint reinforcement in exterior walls or interior walls exposed to moist environment	ASTM A153, Class B-2
Sheet metal ties or anchors exposed to weather	ASTM A153, Class B-2
Sheet metal ties or anchors completely embedded in mortar or grout	ASTM A653, Coating Designation G60
Stainless steel hardware for any exposure	ASTM A167, Type 304

**TABLE R606.3.5.1
GROUT SPACE DIMENSIONS AND POUR HEIGHTS**

GROUT TYPE	GROUT POUR MAXIMUM HEIGHT (feet)	MINIMUM WIDTH OF GROUT SPACES ^{a, b} (inches)	MINIMUM GROUT ^{b, c} SPACE DIMENSIONS FOR GROUTING CELLS OF HOLLOW UNITS (inches x inches)
Fine	1	0.75	1.5 x 2
	5	2	2 x 3
	12	2.5	2.5 x 3
	24	3	3 x 3
Coarse	1	1.5	1.5 x 3
	5	2	2.5 x 3
	12	2.5	3 x 3
	24	3	3 x 4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. For grouting between masonry wythes.

b. Grout space dimension is the clear dimension between any masonry protrusion and shall be increased by the horizontal projection of the diameters of the horizontal bars within the cross section of the grout space.

c. Area of vertical reinforcement shall not exceed 6 percent of the area of the grout space.

R606.3.6.1 Bonding of backup wythe. Where all interior vertical spaces are filled with grout in multiple-wythe construction, masonry headers shall not be permitted. Metal wall ties shall be used in accordance with Section R606.13.2 to prevent spreading of the wythes and to maintain the vertical alignment of the wall. Wall ties shall be installed in accordance with Section R606.13.2 where the backup wythe in multiple-wythe construction is fully grouted.

R606.3.6.2 Grout barriers. Vertical grout barriers or dams shall be built of solid masonry across the grout space the entire height of the wall to control the flow of the grout horizontally. Grout barriers shall be not more than 25 feet (7620 mm) apart. The grouting of any section of a wall between control barriers shall be completed in one day without interruptions greater than 1 hour.

R606.3.7 Masonry bonding pattern. Masonry laid in running and stack bond shall conform to Sections R606.3.7.1 and R606.3.7.2.

R606.3.7.1 Masonry laid in running bond. In each wythe of masonry laid in running bond, head joints in successive courses shall be offset by not less than one-fourth the unit length, or the masonry walls shall be reinforced longitudinally as required in Section R606.3.7.2.

R606.3.7.2 Masonry laid in stack bond. Where unit masonry is laid with less head joint offset than in Section R606.3.7.1, the minimum area of horizontal reinforcement placed in mortar bed joints or in bond beams spaced not more than 48 inches (1219 mm) apart shall be 0.0007 times the vertical cross-sectional area of the wall.

R606.4 Thickness of masonry. The nominal thickness of masonry walls shall conform to the requirements of Sections R606.4.1 through R606.4.4.

R606.4.1 Minimum thickness. The minimum thickness of masonry bearing walls more than one story high shall be 8 inches (203 mm). Solid masonry walls of one-story dwellings and garages shall be not less than 6 inches (152 mm) in thickness where not greater than 9 feet (2743 mm) in height, provided that where gable construction is used, an additional 6 feet (1829 mm) is permitted to the peak of the gable. Masonry walls shall be laterally supported in either the horizontal or vertical direction at intervals as required by Section R606.6.4.

R606.4.2 Rubble stone masonry wall. The minimum thickness of rough, random or coursed rubble stone masonry walls shall be 16 inches (406 mm).

R606.4.3 Change in thickness. Where walls of masonry of hollow units or masonry-bonded hollow walls are decreased in thickness, a course of solid masonry or masonry units filled with mortar or grout shall be constructed between the wall below and the thinner wall above, or special units or construction shall be used to transmit the loads from face shells or wythes above to those below.

R606.4.4 Parapet walls. Unreinforced *solid masonry* parapet walls shall be not less than 8 inches (203 mm) thick and their height shall not exceed four times their thickness. Unreinforced hollow unit masonry parapet walls shall be not less than 8 inches (203 mm) thick, and their height shall not exceed three times their thickness. Masonry parapet walls in areas subject to wind loads of 30 pounds per square foot (1.44 kPa) located in Seismic Design Category D₀, D₁ or D₂, or on townhouses in Seismic Design Category C shall be reinforced in accordance with Section R606.12.

R606.5 Corbeled masonry. Corbeled masonry shall be in accordance with Sections R606.5.1 through R606.5.3.

R606.5.1 Units. Solid masonry units or masonry units filled with mortar or grout shall be used for corbeling.

R606.5.2 Corbel projection. The maximum projection of one unit shall not exceed one-half the height of the unit or one-third the thickness at right angles to the wall. The maximum corbeled projection beyond the face of the wall shall not exceed:

1. One-half of the wall thickness for multiple-wythe walls bonded by mortar or grout and wall ties or masonry headers.
2. One-half the wythe thickness for single wythe walls, masonry-bonded hollow walls, multiple-wythe walls with open collar joints and veneer walls.

R606.5.3 Corbeled masonry supporting floor or roof-framing members. Where corbeled masonry is used to support floor or roof-framing members, the top course of the corbel shall be a header course or the top course bed joint shall have ties to the vertical wall.

R606.6 Support conditions. Bearing and support conditions shall be in accordance with Sections R606.6.1 through R606.6.4.

R606.6.1 Bearing on support. Each masonry wythe shall be supported by not less than two-thirds of the wythe thickness.

R606.6.2 Support at foundation. Cavity wall or masonry veneer construction shall be permitted to be supported on an 8-inch (203 mm) foundation wall, provided the 8-inch (203 mm) wall is corbeled to the width of the wall system above with masonry constructed of solid masonry units or masonry units filled with mortar or grout. The total horizontal projection of the corbel shall not exceed 2 inches (51 mm) with individual corbels projecting not more than one-third the thickness of the unit or one-half the height of the unit. The hollow space behind the corbeled masonry shall be filled with mortar or grout.

R606.6.3 Beam supports. Beams, girders or other concentrated loads supported by a wall or column shall have a bearing of not less than 3 inches (76 mm) in length measured parallel to the beam on solid masonry not less than 4 inches (102 mm) in thickness, or on a metal bearing plate of adequate design and dimensions to distribute the load safely, or on a continuous reinforced masonry member projecting not less than 4 inches (102 mm) from the face of the wall.

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R606.6.3.1 Joist bearing. Joists shall have a bearing of not less than $1\frac{1}{2}$ inches (38 mm), except as provided in Section R606.6.3, and shall be supported in accordance with Figure R606.11(1).

R606.6.4 Lateral support. Masonry walls shall be laterally supported in either the horizontal or the vertical direction. The maximum spacing between lateral supports shall not exceed the distances in Table R606.6.4. Lateral support shall be provided by cross walls, pilasters, buttresses or structural frame members where the limiting distance is taken horizontally, or by floors or roofs where the limiting distance is taken vertically.

**TABLE R606.6.4
SPACING OF LATERAL SUPPORT FOR MASONRY WALLS**

CONSTRUCTION	MAXIMUM WALL LENGTH TO THICKNESS OR WALL HEIGHT TO THICKNESS ^{a, b}
Bearing walls:	
Solid or solid grouted	20
All other	18
Nonbearing walls:	
Exterior	18
Interior	36

For SI: 1 foot = 304.8 mm.

- a. Except for cavity walls and cantilevered walls, the thickness of a wall shall be its nominal thickness measured perpendicular to the face of the wall. For cavity walls, the thickness shall be determined as the sum of the nominal thicknesses of the individual wythes. For cantilever walls, except for parapets, the ratio of height to nominal thickness shall not exceed 6 for solid masonry, or 4 for hollow masonry. For parapets, see Section R606.4.4.
- b. An additional unsupported height of 6 feet is permitted for gable end walls.

R606.6.4.1 Horizontal lateral support. Lateral support in the horizontal direction provided by intersecting masonry walls shall be provided by one of the methods in Section R606.6.4.1.1 or R606.6.4.1.2.

R606.6.4.1.1 Bonding pattern. Fifty percent of the units at the intersection shall be laid in an overlapping masonry bonding pattern, with alternate units having a bearing of not less than 3 inches (76 mm) on the unit below.

R606.6.4.1.2 Metal reinforcement. Interior nonload-bearing walls shall be anchored at their intersections, at vertical intervals of not more than 16 inches (406 mm) with joint reinforcement of not less than 9 gage [0.148 inch (4 mm)], or $\frac{1}{4}$ -inch (6 mm) galvanized mesh hardware cloth. Intersecting masonry walls, other than interior nonload-bearing walls, shall be anchored at vertical intervals of not more than 8 inches (203 mm) with joint reinforcement of not less than 9 gage (4 mm) and shall extend not less than 30 inches (762 mm) in each direction at the intersection. Other metal ties, joint reinforcement or anchors, if used, shall be spaced to provide equivalent area of anchorage to that required by this section.

R606.6.4.2 Vertical lateral support. Vertical lateral support of masonry walls in Seismic Design Category A, B or C shall be provided in accordance with one of the methods in Section R606.6.4.2.1 or R606.6.4.2.2.

R606.6.4.2.1 Roof structures. Masonry walls shall be anchored to roof structures with metal strap anchors spaced in accordance with the manufacturer's instructions, $\frac{1}{2}$ -inch (13 mm) bolts spaced not more than 6 feet (1829 mm) on center, or other approved anchors. Anchors shall be embedded not less than 16 inches (406 mm) into the masonry, or be hooked or welded to bond beam reinforcement placed not less than 6 inches (152 mm) from the top of the wall.

R606.6.4.2.2 Floor diaphragms. Masonry walls shall be anchored to floor diaphragm framing by metal strap anchors spaced in accordance with the manufacturer's instructions, $\frac{1}{2}$ -inch-diameter (13 mm) bolts spaced at intervals not to exceed 6 feet (1829 mm) and installed as shown in Figure R606.11(1), or by other approved methods.

R606.7 Piers. The unsupported height of masonry piers shall not exceed 10 times their least dimension. Where structural clay tile or hollow concrete masonry units are used for isolated piers to support beams and girders, the cellular spaces shall be filled solidly with grout or Type M or S mortar, except that unfilled hollow piers shall be permitted to be used if their unsupported height is not more than four times their least dimension. Where hollow masonry units are solidly filled with grout or Type M, S or N mortar, the allowable compressive stress shall be permitted to be increased as provided in Table R606.9.

R606.7.1 Pier cap. Hollow piers shall be capped with 4 inches (102 mm) of solid masonry or concrete, a masonry cap block, or shall have cavities of the top course filled with concrete or grout.

R606.8 Chases. Chases and recesses in masonry walls shall not be deeper than one-third the wall thickness. The maximum length of a horizontal chase or horizontal projection shall not exceed 4 feet (1219 mm) and shall have not less than 8 inches (203 mm) of masonry in back of the chases and recesses and between adjacent chases or recesses and the jambs of openings. Chases and recesses in masonry walls shall be designed and constructed so as not to reduce the required strength or required fire resistance of the wall and shall not be permitted within the required area of a pier. Masonry directly above chases or recesses wider than 12 inches (305 mm) shall be supported on noncombustible lintels.

R606.9 Allowable stresses. Allowable compressive stresses in masonry shall not exceed the values prescribed in Table R606.9. In determining the stresses in masonry, the effects of all loads and conditions of loading and the influence of all forces affecting the design and strength of the several parts shall be taken into account.

R606.9.1 Combined units. In walls or other structural members composed of different kinds or grades of units, materials or mortars, the maximum stress shall not exceed

TABLE R606.9
ALLOWABLE COMPRESSIVE STRESSES
FOR EMPIRICAL DESIGN OF MASONRY

CONSTRUCTION; COMPRESSIVE STRENGTH OF UNIT, GROSS AREA	ALLOWABLE COMPRESSIVE STRESSES ^a GROSS CROSS-SECTIONAL AREA ^b	
	Type M or S mortar	Type N mortar
Solid masonry of brick and other solid units of clay or shale; sand-lime or concrete brick:		
8,000 + psi	350	300
4,500 psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Grouted ^c masonry, of clay or shale; sand-lime or concrete:		
4,500 + psi	225	200
2,500 psi	160	140
1,500 psi	115	100
Solid masonry of solid concrete masonry units:		
3,000 + psi	225	200
2,000 psi	160	140
1,200 psi	115	100
Masonry of hollow load-bearing units:		
2,000 + psi	140	120
1,500 psi	115	100
1,000 psi	75	70
700 psi	60	55
Hollow walls (cavity or masonry bonded ^d) solid units:		
2,500 + psi	160	140
1,500 psi	115	100
Hollow units	75	70
Stone ashlar masonry:		
Granite	720	640
Limestone or marble	450	400
Sandstone or cast stone	360	320
Rubble stone masonry:		
Coarse, rough or random	120	100

For SI: 1 pound per square inch = 6.895 kPa.

- Linear interpolation shall be used for determining allowable stresses for masonry units having compressive strengths that are intermediate between those given in the table.
- Gross cross-sectional area shall be calculated on the actual rather than nominal dimensions.
- See Section R606.13.
- Where floor and roof loads are carried on one wythe, the gross cross-sectional area is that of the wythe under load; if both wythes are loaded, the gross cross-sectional area is that of the wall minus the area of the cavity between the wythes. Walls bonded with metal ties shall be considered as cavity walls unless the collar joints are filled with mortar or grout.

the allowable stress for the weakest of the combination of units, materials and mortars of which the member is composed. The net thickness of any facing unit that is used to resist stress shall be not less than 1½ inches (38 mm).

R606.10 Lintels. Masonry over openings shall be supported by steel lintels, reinforced concrete or masonry lintels or masonry arches, designed to support load imposed.

R606.11 Anchorage. Masonry walls shall be anchored to floor and roof systems in accordance with the details shown in Figure R606.11(1), R606.11(2) or R606.11(3). Footings shall be permitted to be considered as points of lateral support.

R606.12 Seismic requirements. The seismic requirements of this section shall apply to the design of masonry and the construction of masonry building elements located in Seismic Design Category D₀, D₁ or D₂. Townhouses in Seismic Design Category C shall comply with the requirements of Section R606.12.2. These requirements shall not apply to glass unit masonry conforming to Section R607, anchored masonry veneer conforming to Section R703.8 or adhered masonry veneer conforming to Section R703.12.

R606.12.1 General. Masonry structures and masonry elements shall comply with the requirements of Sections R606.12.2 through R606.12.4 based on the seismic design category established in Table R301.2.1(1). Masonry structures and masonry elements shall comply with the requirements of Section R606.12 and Figures R606.11(1), R606.11(2) and R606.11(3) or shall be designed in accordance with TMS 402 or TMS 403.

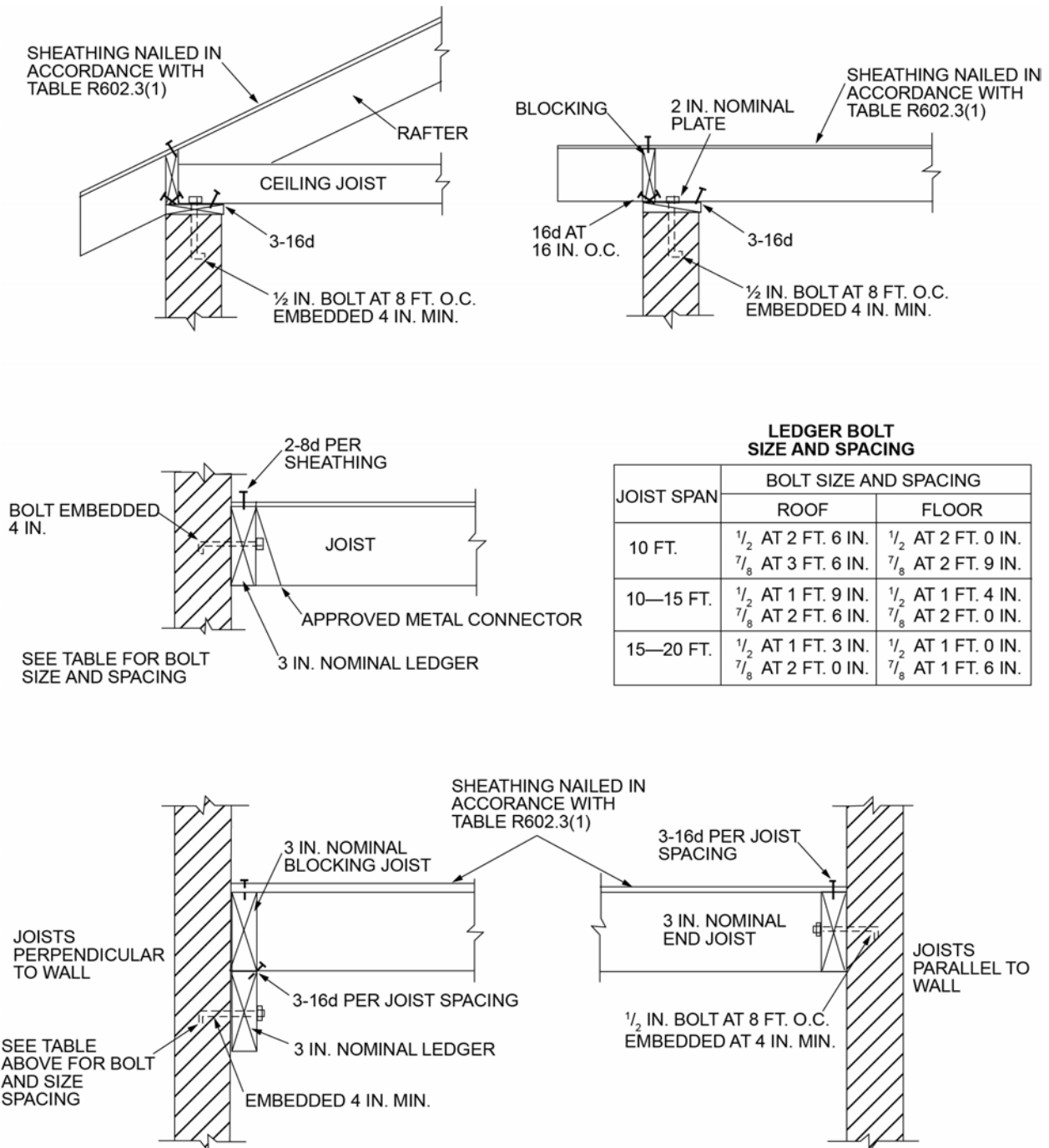
R606.12.1.1 Floor and roof diaphragm construction.

Floor and roof diaphragms shall be constructed of wood structural panels attached to wood framing in accordance with Table R602.3(1) or to cold-formed steel floor framing in accordance with Table R505.3.1(2) or to cold-formed steel roof framing in accordance with Table R804.3. Additionally, sheathing panel edges perpendicular to framing members shall be backed by blocking, and sheathing shall be connected to the blocking with fasteners at the edge spacing. For Seismic Design Categories C, D₀, D₁ and D₂, where the width-to-thickness dimension of the diaphragm exceeds 2-to-1, edge spacing of fasteners shall be 4 inches (102 mm) on center.

R606.12.2 Seismic Design Category C. Townhouses located in Seismic Design Category C shall comply with the requirements of this section.

R606.12.2.1 Minimum length of wall without openings. Table R606.12.2.1 shall be used to determine the minimum required solid wall length without openings at each masonry exterior wall. The provided percentage of solid wall length shall include only those wall segments that are 3 feet (914 mm) or longer. The maximum clear distance between wall segments included in determining the solid wall length shall not exceed 18 feet (5486 mm). Shear wall segments required to meet the minimum wall length shall be in accordance with Section R606.12.2.2.3.

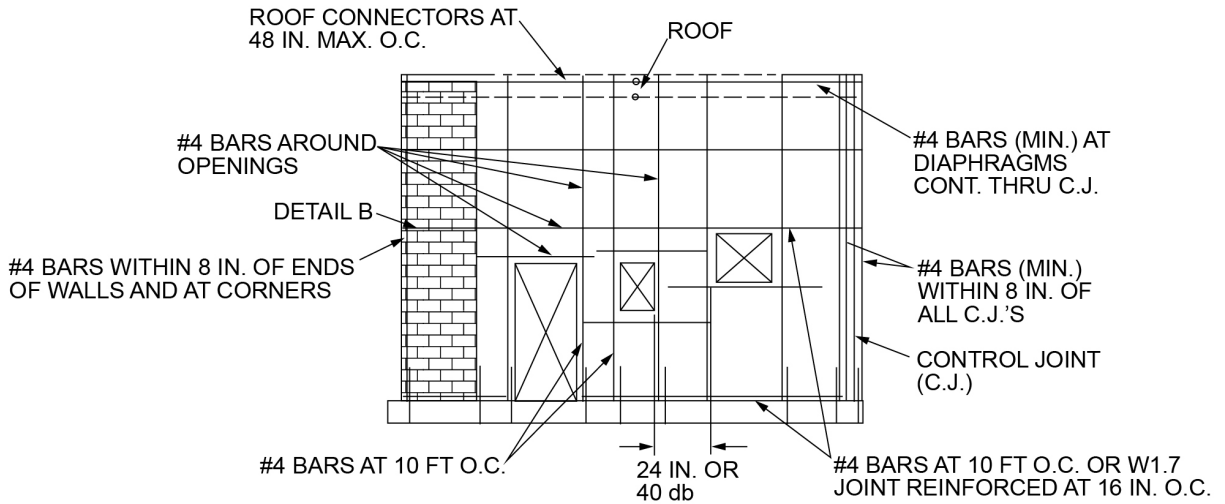
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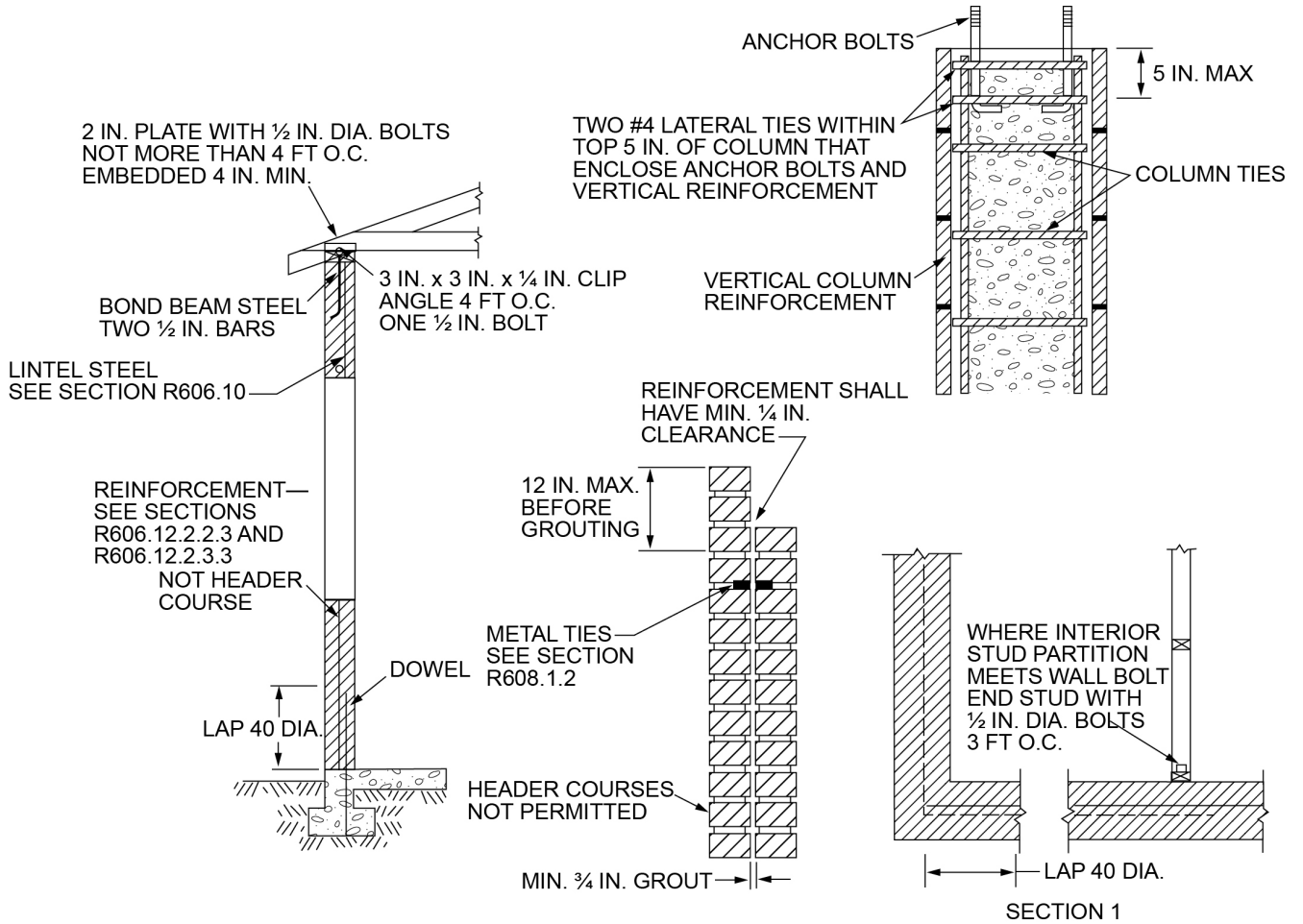
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

Note: Where bolts are located in hollow masonry, the cells in the courses receiving the bolt shall be grouted solid.

FIGURE R606.11(1)
ANCHORAGE REQUIREMENTS FOR MASONRY WALLS LOCATED IN
SEISMIC DESIGN CATEGORY A, B OR C AND WHERE WIND LOADS ARE LESS THAN 30 PSF



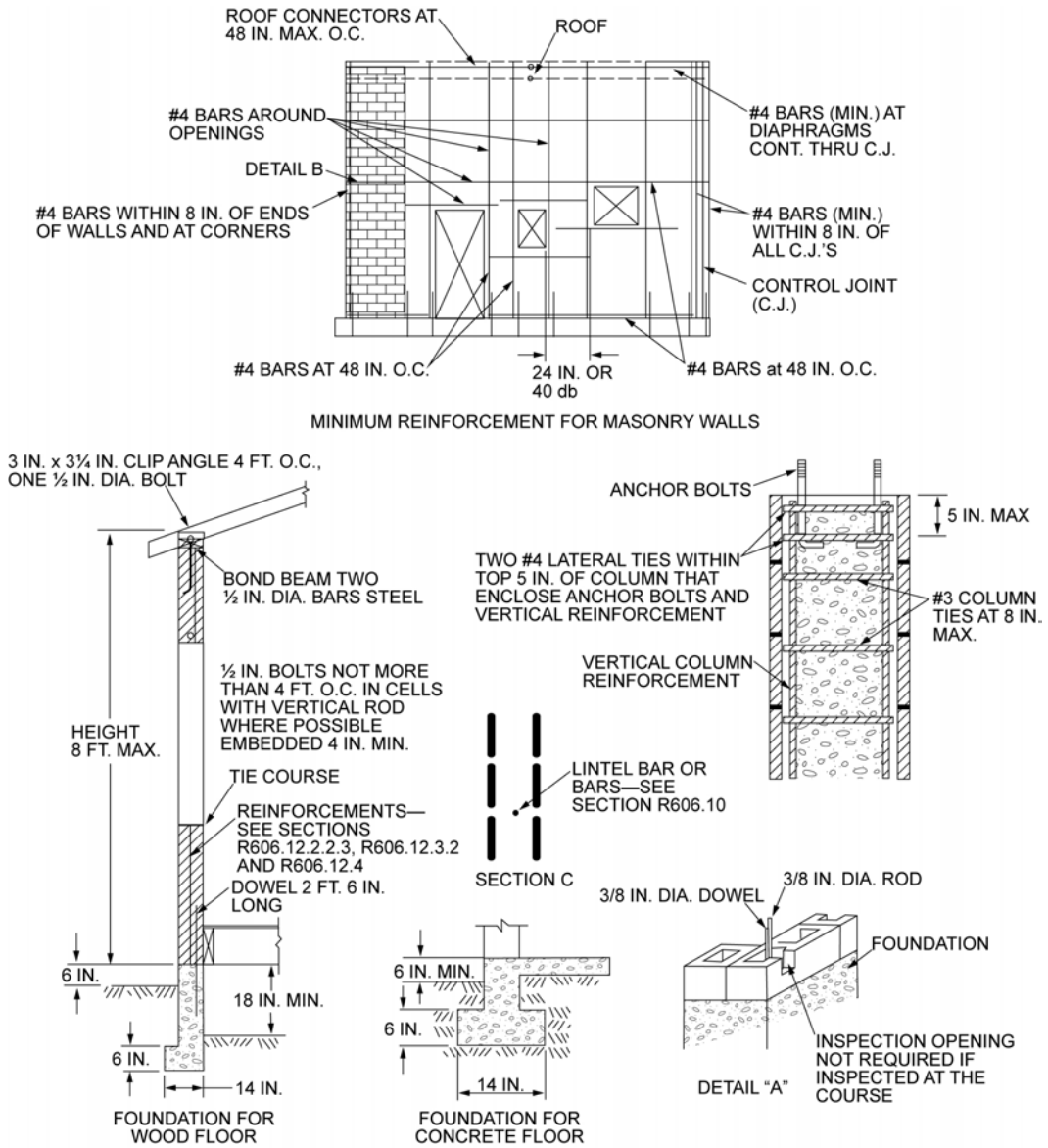
MINIMUM REINFORCEMENT FOR MASONRY WALLS



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

FIGURE R606.11(2)
REQUIREMENTS FOR REINFORCED GROUDED MASONRY CONSTRUCTION IN SEISMIC DESIGN CATEGORY C

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For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

Note: A full bed joint must be provided. Cells containing vertical bars are to be filled to the top of wall and provide inspection opening as shown on detail “A.” Horizontal bars are to be laid as shown on detail “B.” Lintel bars are to be laid as shown on Section C.

FIGURE R606.11(3)
REQUIREMENTS FOR REINFORCED MASONRY CONSTRUCTION IN SEISMIC DESIGN CATEGORY D₀, D₁ OR D₂

TABLE R606.12.2.1
MINIMUM SOLID WALL LENGTH ALONG EXTERIOR WALL LINES

SESMIC DESIGN CATEGORY	MINIMUM SOLID WALL LENGTH (percent) ^a		
	One story or top story of two story	Wall supporting light-frame second story and roof	Wall supporting masonry second story and roof
Townhouses in C	20	25	35
D ₀ or D ₁	25	NP	NP
D ₂	30	NP	NP

NP = Not Permitted, except with design in accordance with the *California Building Code*.

a. For all walls, the minimum required length of solid walls shall be based on the table percent multiplied by the dimension, parallel to the wall direction under consideration, of a rectangle inscribing the overall building plan.

R606.12.2.2 Design of elements not part of the lateral force-resisting system.**R606.12.2.2.1 Load-bearing frames or columns.**

Elements not part of the lateral force-resisting system shall be analyzed to determine their effect on the response of the system. The frames or columns shall be adequate for vertical load-carrying capacity and induced moment caused by the design *story* drift.

R606.12.2.2.2 Masonry partition walls. Masonry partition walls, masonry screen walls and other masonry elements that are not designed to resist vertical or lateral loads, other than those induced by their own weight, shall be isolated from the structure so that vertical and lateral forces are not imparted to these elements. Isolation joints and connectors between these elements and the structure shall be designed to accommodate the design *story* drift.

R606.12.2.2.3 Reinforcement requirements for masonry elements. Masonry elements listed in Section R606.12.2.2.2 shall be reinforced in either the horizontal or vertical direction as shown in Figure R606.11(2) and in accordance with the following:

1. Horizontal reinforcement. Horizontal joint reinforcement shall consist of not less than two longitudinal W1.7 wires spaced not more than 16 inches (406 mm) for walls greater than 4 inches (102 mm) in width and not less than one longitudinal W1.7 wire spaced not more than 16 inches (406 mm) for walls not exceeding 4 inches (102 mm) in width; or not less than one No. 4 bar spaced not more than 48 inches (1219 mm). Where two longitudinal wires of joint reinforcement are used, the space between these wires shall be the widest that the mortar joint will accommodate. Horizontal reinforcement shall be provided within 16 inches (406 mm) of the top and bottom of these masonry elements.
2. Vertical reinforcement. Vertical reinforcement shall consist of not less than one No. 4 bar spaced not more than 48 inches (1219 mm). Vertical reinforcement shall be located within 16 inches (406 mm) of the ends of masonry walls.

R606.12.2.3 Design of elements part of the lateral force-resisting system.

R606.12.2.3.1 Connections to masonry shear walls. Connectors shall be provided to transfer forces between masonry walls and horizontal elements in accordance with the requirements of Section 4.1.4 of TMS 402. Connectors shall be designed to transfer horizontal design forces acting either perpendicular or parallel to the wall, but not less than 200 pounds per linear foot (2919 N/m) of wall. The maximum spacing between connectors shall be 4 feet (1219 mm). Such anchorage mechanisms shall not induce tension stresses perpendicular to grain in ledgers or nailers.

R606.12.2.3.2 Connections to masonry columns.

Connectors shall be provided to transfer forces between masonry columns and horizontal elements in accordance with the requirements of Section 4.1.4 of TMS 402. Where anchor bolts are used to connect horizontal elements to the tops of columns, the bolts shall be placed within lateral ties. Lateral ties shall enclose both the vertical bars in the column and the anchor bolts. There shall be not less than two No. 4 lateral ties provided in the top 5 inches (127 mm) of the column.

R606.12.2.3.3 Minimum reinforcement requirements for masonry shear walls. Vertical reinforcement of not less than one No. 4 bar shall be provided at corners, within 16 inches (406 mm) of each side of openings, within 8 inches (203 mm) of each side of movement joints, within 8 inches (203 mm) of the ends of walls, and at a maximum spacing of 10 feet (3048 mm).

Horizontal joint reinforcement shall consist of not less than two wires of W1.7 spaced not more than 16 inches (406 mm); or bond beam reinforcement of not less than one No. 4 bar spaced not more than 10 feet (3048 mm) shall be provided. Horizontal reinforcement shall be provided at the bottom and top of wall openings and shall extend not less than 24 inches (610 mm) nor less than 40 bar diameters past the opening; continuously at structurally connected roof and floor levels; and within 16 inches (406 mm) of the top of walls.

R606.12.3 Seismic Design Category D₀ or D₁. Structures in Seismic Design Category D₀ or D₁ shall comply with the requirements of Seismic Design Category C and the additional requirements of this section. AAC masonry shall not be used for the design of masonry elements that are part of the lateral force-resisting system.

R606.12.3.1 Design requirements. Masonry elements other than those covered by Section R606.12.2.2.2 shall be designed in accordance with the requirements of Chapters 1 through 7 and Sections 8.1 and 8.3 of TMS 402 and shall meet the minimum reinforcement requirements contained in Sections R606.12.3.2 and R606.12.3.2.1. Otherwise, masonry shall be designed in accordance with TMS 403.

Exception: Masonry walls limited to one *story* in height and 9 feet (2743 mm) between lateral supports need not be designed provided they comply with the minimum reinforcement requirements of Sections R606.12.3.2 and R606.12.3.2.1.

R606.12.3.2 Minimum reinforcement requirements for masonry walls. Masonry walls other than those covered by Section R606.12.2.2.3 shall be reinforced in both the vertical and horizontal direction. The sum of the cross-sectional area of horizontal and vertical reinforcement shall be not less than 0.002 times the gross cross-sectional area of the wall, and the minimum cross-sectional area in each direction shall be not less than 0.0007 times the gross cross-sectional

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area of the wall. Reinforcement shall be uniformly distributed. Table R606.12.3.2 shows the minimum reinforcing bar sizes required for varying thicknesses of masonry walls. The maximum spacing of reinforcement shall be 48 inches (1219 mm) provided that the walls are solid grouted and constructed of hollow open-end units, hollow units laid with full head joints or two wythes of solid units. The maximum spacing of reinforcement shall be 24 inches (610 mm) for all other masonry.

R606.12.3.2.1 Shear wall reinforcement requirements. The maximum spacing of vertical and horizontal reinforcement shall be the smaller of one-third the length of the shear wall, one-third the height of the shear wall, or 48 inches (1219 mm). The minimum cross-sectional area of vertical reinforcement shall be one-third of the required shear reinforcement. Shear reinforcement shall be anchored around vertical reinforcing bars with a standard hook.

R606.12.3.3 Minimum reinforcement for masonry columns. Lateral ties in masonry columns shall be spaced not more than 8 inches (203 mm) on center and shall be not less than $\frac{3}{8}$ -inch (9.5 mm) diameter. Lateral ties shall be embedded in grout.

R606.12.3.4 Material restrictions. Type N mortar or masonry cement shall not be used as part of the lateral force-resisting system.

R606.12.3.5 Lateral tie anchorage. Standard hooks for lateral tie anchorage shall be either a 135-degree (2.4 rad) standard hook or a 180-degree (3.2 rad) standard hook.

R606.12.4 Seismic Design Category D₂. Structures in Seismic Design Category D₂ shall comply with the requirements of Seismic Design Category D₁ and to the additional requirements of this section.

R606.12.4.1 Design of elements not part of the lateral force-resisting system. Stack bond masonry that is not part of the lateral force-resisting system shall have a horizontal cross-sectional area of reinforcement of not less than 0.0015 times the gross cross-sectional area of masonry. Table R606.12.4.1 shows minimum

reinforcing bar sizes for masonry walls. The maximum spacing of horizontal reinforcement shall be 24 inches (610 mm). These elements shall be solidly grouted and shall be constructed of hollow open-end units or two wythes of solid units.

**TABLE R606.12.4.1
MINIMUM REINFORCING FOR STACKED BONDED
MASONRY WALLS IN SEISMIC DESIGN CATEGORY D₂**

NOMINAL WALL THICKNESS (inches)	MINIMUM BAR SIZE SPACED AT 24 INCHES
6	#4
8	#5
10	#5
12	#6

For SI: 1 inch = 25.4 mm.

R606.12.4.2 Design of elements part of the lateral force-resisting system. Stack bond masonry that is part of the lateral force-resisting system shall have a horizontal cross-sectional area of reinforcement of not less than 0.0025 times the gross cross-sectional area of masonry. Table R606.12.4.2 shows minimum reinforcing bar sizes for masonry walls. The maximum spacing of horizontal reinforcement shall be 16 inches (406 mm). These elements shall be solidly grouted and shall be constructed of hollow open-end units or two wythes of solid units.

**TABLE R606.12.4.2
MINIMUM REINFORCING FOR STACKED BONDED
MASONRY WALLS IN SEISMIC DESIGN CATEGORY D₂**

NOMINAL WALL THICKNESS (inches)	MINIMUM BAR SIZE SPACED AT 16 INCHES
6	#4
8	#5
10	#5
12	#6

For SI: 1 inch = 25.4 mm.

**TABLE R606.12.3.2
MINIMUM DISTRIBUTED WALL REINFORCEMENT FOR BUILDINGS ASSIGNED TO SEISMIC DESIGN CATEGORY D₀ or D₁**

NOMINAL WALL THICKNESS (inches)	MINIMUM SUM OF THE VERTICAL AND HORIZONTAL REINFORCEMENT AREAS ^a (square inches per foot)	MINIMUM REINFORCEMENT AS DISTRIBUTED IN BOTH HORIZONTAL AND VERTICAL DIRECTIONS ^b (square inches per foot)	MINIMUM BAR SIZE FOR REINFORCEMENT SPACED AT 48 INCHES
6	0.135	0.047	#4
8	0.183	0.064	#5
10	0.231	0.081	#6
12	0.279	0.098	#6

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square inch per foot = 2064 mm²/m.

a. Based on the minimum reinforcing ratio of 0.002 times the gross cross-sectional area of the wall.

b. Based on the minimum reinforcing ratio each direction of 0.0007 times the gross cross-sectional area of the wall.

R606.13 Multiple-wythe masonry. The facing and backing of multiple-wythe masonry walls shall be bonded in accordance with Section R606.13.1, R606.13.2 or R606.13.3. In cavity walls, neither the facing nor the backing shall be less than 3 inches (76 mm) nominal in thickness and the cavity shall be not more than 4 inches (102 mm) nominal in width. The backing shall not be less than the thickness of the facing.

Exception: Cavities shall be permitted to exceed the 4-inch (102 mm) nominal dimension provided that tie size and tie spacing have been established by calculation.

R606.13.1 Bonding with masonry headers. Bonding with solid or hollow masonry headers shall comply with Sections R606.13.1.1 and R606.13.1.2.

R606.13.1.1 Solid units. Where the facing and backing (adjacent wythes) of solid masonry construction are bonded by means of masonry headers, not less than 4 percent of the wall surface of each face shall be composed of headers extending not less than 3 inches (76 mm) into the backing. The distance between adjacent full-length headers shall not exceed 24 inches (610 mm) either vertically or horizontally. In walls in which a single header does not extend through the wall, headers from the opposite sides shall overlap not less than 3 inches (76 mm), or headers from opposite sides shall be covered with another header course overlapping the header below not less than 3 inches (76 mm).

R606.13.1.2 Hollow units. Where two or more hollow units are used to make up the thickness of a wall, the stretcher courses shall be bonded at vertical intervals not exceeding 34 inches (864 mm) by lapping not less than 3 inches (76 mm) over the unit below, or by lapping at vertical intervals not exceeding 17 inches (432 mm) with units that are not less than 50 percent thicker than the units below.

R606.13.2 Bonding with wall ties or joint reinforcement. Bonding with wall ties or joint reinforcement shall comply with Section R606.13.2.3.

R606.13.2.1 Bonding with wall ties. Bonding with wall ties, except as required by Section R607, where the facing and backing (adjacent wythes) of masonry walls are bonded with $\frac{3}{16}$ -inch-diameter (5 mm) wall ties embedded in the horizontal mortar joints, there shall be not less than one metal tie for each $4\frac{1}{2}$ square feet (0.418 m²) of wall area. Ties in alternate courses shall be staggered. The maximum vertical distance between ties shall not exceed 24 inches (610 mm), and the maximum horizontal distance shall not exceed 36 inches (914 mm). Rods or ties bent to rectangular shape shall be used with hollow masonry units laid with the cells vertical. In other walls, the ends of ties shall be bent to 90-degree (0.79 rad) angles to provide hooks not less than 2 inches (51 mm) long. Additional bonding ties shall be provided at all openings, spaced not more than 3 feet (914 mm) apart around the perimeter and within 12 inches (305 mm) of the opening.

R606.13.2.2 Bonding with adjustable wall ties. Where the facing and backing (adjacent wythes) of

masonry are bonded with adjustable wall ties, there shall be not less than one tie for each 2.67 square feet (0.248 m²) of wall area. Neither the vertical nor the horizontal spacing of the adjustable wall ties shall exceed 24 inches (610 mm). The maximum vertical offset of bed joints from one wythe to the other shall be 1.25 inches (32 mm). The maximum clearance between connecting parts of the ties shall be $\frac{1}{16}$ inch (2 mm). Where pintle legs are used, ties shall have not less than two $\frac{3}{16}$ -inch-diameter (5 mm) legs.

R606.13.2.3 Bonding with prefabricated joint reinforcement. Where the facing and backing (adjacent wythes) of masonry are bonded with prefabricated joint reinforcement, there shall be not less than one cross wire serving as a tie for each 2.67 square feet (0.248 m²) of wall area. The vertical spacing of the joint reinforcement shall not exceed 16 inches (406 mm). Cross wires on prefabricated joint reinforcement shall not be smaller than No. 9 gage. The longitudinal wires shall be embedded in the mortar.

R606.13.3 Bonding with natural or cast stone. Bonding with natural and cast stone shall conform to Sections R606.13.3.1 and R606.13.3.2.

R606.13.3.1 Ashlar masonry. In ashlar masonry, bonder units, uniformly distributed, shall be provided to the extent of not less than 10 percent of the wall area. Such bonder units shall extend not less than 4 inches (102 mm) into the backing wall.

R606.13.3.2 Rubble stone masonry. Rubble stone masonry 24 inches (610 mm) or less in thickness shall have bonder units with a maximum spacing of 3 feet (914 mm) vertically and 3 feet (914 mm) horizontally, and if the masonry is of greater thickness than 24 inches (610 mm), shall have one bonder unit for each 6 square feet (0.557 m²) of wall surface on both sides.

R606.14 Anchored and adhered masonry veneer.

R606.14.1 Anchored veneer. Anchored masonry veneer installed over a backing of wood or cold-formed steel shall meet the requirements of Section R703.8.

R606.14.2 Adhered veneer. Adhered masonry veneer shall be installed in accordance with the requirements of Section R703.12.

SECTION R607 GLASS UNIT MASONRY

R607.1 General. Panels of glass unit masonry located in load-bearing and nonload-bearing exterior and interior walls shall be constructed in accordance with this section.

R607.2 Materials. Hollow glass units shall be partially evacuated and have a minimum average glass face thickness of $\frac{3}{16}$ inch (5 mm). The surface of units in contact with mortar shall be treated with a polyvinyl butyral coating or latex-based paint. The use of reclaimed units is prohibited.

R607.3 Units. Hollow or solid glass block units shall be standard or thin units.

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R607.3.1 Standard units. The specified thickness of standard units shall be not less than $3\frac{7}{8}$ inches (98 mm).

R607.3.2 Thin units. The specified thickness of thin units shall be not less than $3\frac{1}{8}$ inches (79 mm) for hollow units and not less than 3 inches (76 mm) for solid units.

R607.4 Isolated panels. Isolated panels of glass unit masonry shall conform to the requirements of this section.

R607.4.1 Exterior standard-unit panels. The maximum area of each individual standard-unit panel shall be 144 square feet (13.4 m²) where the design wind pressure is 20 pounds per square foot (958 Pa). The maximum area of such panels subjected to design wind pressures other than 20 pounds per square foot (958 Pa) shall be in accordance with Figure R607.4.1. The maximum panel dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

R607.4.2 Exterior thin-unit panels. The maximum area of each individual thin-unit panel shall be 85 square feet (7.9 m²). The maximum dimension between structural supports shall be 15 feet (4572 mm) in width or 10 feet (3048 mm) in height. Thin units shall not be used in applications where the design wind pressure as stated in Table R301.2.1(1) exceeds 20 pounds per square foot (958 Pa).

R607.4.3 Interior panels. The maximum area of each individual standard-unit panel shall be 250 square feet (23.2 m²). The maximum area of each thin-unit panel shall be 150 square feet (13.9 m²). The maximum dimension between structural supports shall be 25 feet (7620 mm) in width or 20 feet (6096 mm) in height.

R607.4.4 Curved panels. The width of curved panels shall conform to the requirements of Sections R607.4.1, R607.4.2 and R607.4.3, except additional structural supports shall be provided at locations where a curved section joins a straight section, and at inflection points in multiple-curve walls.

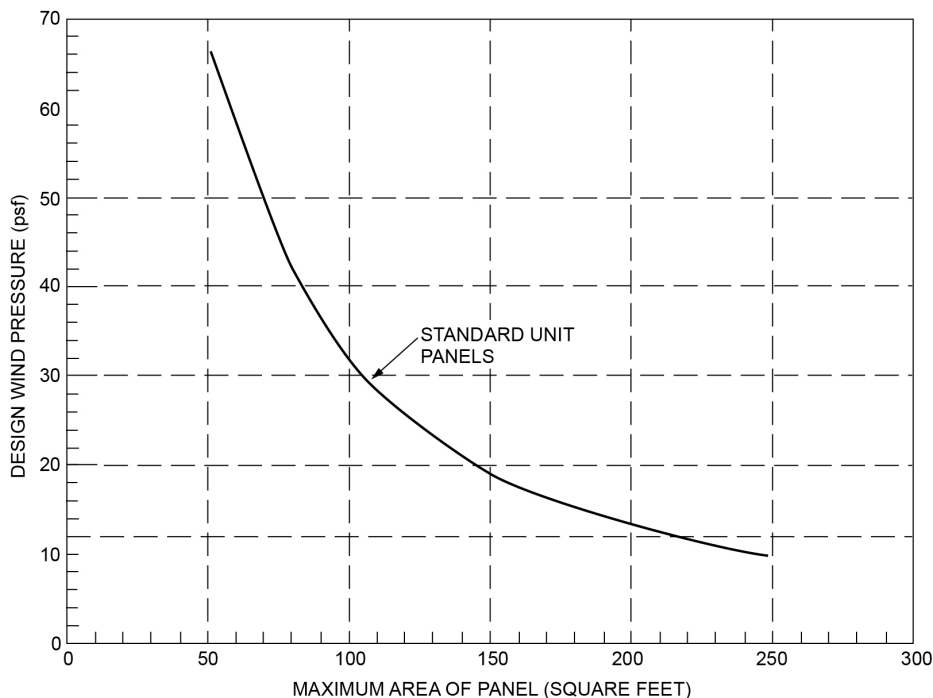
R607.5 Panel support. Glass unit masonry panels shall conform to the support requirements of this section.

R607.5.1 Deflection. The maximum total deflection of structural members that support glass unit masonry shall not exceed $\frac{1}{600}$.

R607.5.2 Lateral support. Glass unit masonry panels shall be laterally supported along the top and sides of the panel. Lateral supports for glass unit masonry panels shall be designed to resist not less than 200 pounds per lineal feet (2918 N/m) of panel, or the actual applied loads, whichever is greater. Except for single-unit panels, lateral support shall be provided by panel anchors along the top and sides spaced not greater than 16 inches (406 mm) on center or by channel-type restraints. Single-unit panels shall be supported by channel-type restraints.

Exceptions:

1. Lateral support is not required at the top of panels that are one unit wide.
2. Lateral support is not required at the sides of panels that are one unit high.



For SI: 1 square foot = 0.0929 m², 1 pound per square foot = 0.0479 kPa.

FIGURE R607.4.1
GLASS UNIT MASONRY DESIGN WIND LOAD RESISTANCE

R607.5.2.1 Panel anchor restraints. Panel anchors shall be spaced not greater than 16 inches (406 mm) on center in both jambs and across the head. Panel anchors shall be embedded not less than 12 inches (305 mm) and shall be provided with two fasteners so as to resist the loads specified in Section R607.5.2.

R607.5.2.2 Channel-type restraints. Glass unit masonry panels shall be recessed not less than 1 inch (25 mm) within channels and chases. Channel-type restraints shall be oversized to accommodate expansion material in the opening, packing and sealant between the framing restraints, and the glass unit masonry perimeter units.

R607.6 Sills. Before the bedding of glass units, the sill area shall be covered with a water-base asphaltic emulsion coating. The coating shall be not less than $\frac{1}{8}$ inch (3 mm) thick.

R607.7 Expansion joints. Glass unit masonry panels shall be provided with expansion joints along the top and sides at all structural supports. Expansion joints shall be not less than $\frac{3}{8}$ inch (10 mm) in thickness and shall have sufficient thickness to accommodate displacements of the supporting structure. Expansion joints shall be entirely free of mortar and other debris and shall be filled with resilient material.

R607.8 Mortar. Glass unit masonry shall be laid with Type S or N mortar. Mortar shall not be retempered after initial set. Mortar unused within $1\frac{1}{2}$ hours after initial mixing shall be discarded.

R607.9 Reinforcement. Glass unit masonry panels shall have horizontal joint reinforcement spaced not greater than 16 inches (406 mm) on center located in the mortar bed joint. Horizontal joint reinforcement shall extend the entire length of the panel but shall not extend across expansion joints. Longitudinal wires shall be lapped not less than 6 inches (152 mm) at splices. Joint reinforcement shall be placed in the bed joint immediately below and above openings in the panel. The reinforcement shall have not less than two parallel longitudinal wires of size W1.7 or greater, and have welded cross wires of size W1.7 or greater.

R607.10 Placement. Glass units shall be placed so head and bed joints are filled solidly. Mortar shall not be furrowed. Head and bed joints of glass unit masonry shall be $\frac{1}{4}$ inch (6.4 mm) thick, except that vertical joint thickness of radial panels shall be not less than $\frac{1}{8}$ inch (3 mm) or greater than $\frac{5}{8}$ inch (16 mm). The bed joint thickness tolerance shall be minus $\frac{1}{16}$ inch (1.6 mm) and plus $\frac{1}{8}$ inch (3 mm). The head joint thickness tolerance shall be plus or minus $\frac{1}{8}$ inch (3 mm).

SECTION R608 EXTERIOR CONCRETE WALL CONSTRUCTION

R608.1 General. Exterior concrete walls shall be designed and constructed in accordance with the provisions of this section or in accordance with the provisions of PCA 100, ACI 318 or ACI 332. Where PCA 100, ACI 318, ACI 332 or the provisions of this section are used to design concrete walls, project drawings, typical details and specifications shall not exempt construction documents from the requirement to be stamped by a California licensed architect or engineer.

Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537.1 and 6737.1.

R608.1.1 Interior construction. These provisions are based on the assumption that interior walls and partitions, both load-bearing and nonload-bearing, floors and roof/ceiling assemblies are constructed of light-frame construction complying with the limitations of this code and the additional limitations of Section R608.2. Design and construction of light-frame assemblies shall be in accordance with the applicable provisions of this code. Where second-story exterior walls are of light-frame construction, they shall be designed and constructed as required by this code.

Aspects of concrete construction not specifically addressed by this code, including interior concrete walls, shall comply with ACI 318.

R608.1.2 Other concrete walls. Exterior concrete walls constructed in accordance with this code shall comply with the shapes and minimum concrete cross-sectional dimensions of Table R608.3. Other types of forming systems resulting in concrete walls not in compliance with this section shall be designed in accordance with ACI 318.

R608.2 Applicability limits. The provisions of this section shall apply to the construction of exterior concrete walls for buildings not greater than 60 feet (18 288 mm) in plan dimensions, floors with clear spans not greater than 32 feet (9754 mm) and roofs with clear spans not greater than 40 feet (12 192 mm). Buildings shall not exceed 35 feet (10 668 mm) in mean roof height or two stories in height above grade. Floor/ceiling dead loads shall not exceed 10 pounds per square foot (479 Pa), roof/ceiling dead loads shall not exceed 15 pounds per square foot (718 Pa) and attic live loads shall not exceed 20 pounds per square foot (958 Pa). Roof overhangs shall not exceed 2 feet (610 mm) of horizontal projection beyond the exterior wall and the dead load of the overhangs shall not exceed 8 pounds per square foot (383 Pa).

Walls constructed in accordance with the provisions of this section shall be limited to buildings subjected to a maximum design wind speed of 160 mph (72 m/s) Exposure B, 136 mph (61 m/s) Exposure C and 125 mph (56 m/s) Exposure D. Walls constructed in accordance with the provisions of this section shall be limited to detached one- and two-family dwellings and townhouses assigned to Seismic Design Category A or B, and detached one- and two-family dwellings assigned to Seismic Design Category C.

Buildings that are not within the scope of this section shall be designed in accordance with PCA 100 or ACI 318.

R608.3 Concrete wall systems. Concrete walls constructed in accordance with these provisions shall comply with the shapes and minimum concrete cross-sectional dimensions of Table R608.3.

R608.3.1 Flat wall systems. Flat concrete wall systems shall comply with Table R608.3 and Figure R608.3(1) and have a minimum nominal thickness of 4 inches (102 mm).

R608.3.2 Waffle-grid wall systems. Waffle-grid wall systems shall comply with Table R608.3 and Figure R608.3(2) and shall have a minimum nominal thickness of

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6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core and web dimensions shall comply with Table R608.3. The maximum weight of waffle-grid walls shall comply with Table R608.3.

R608.3.3 Screen-grid wall systems. Screen-grid wall systems shall comply with Table R608.3 and Figure R608.3(3) and shall have a minimum nominal thickness of 6 inches (152 mm) for the horizontal and vertical concrete members (cores). The core dimensions shall comply with Table R608.3. The maximum weight of screen-grid walls shall comply with Table R608.3.

R608.4 Stay-in-place forms. Stay-in-place concrete forms shall comply with this section.

R608.4.1 Surface burning characteristics. The flame spread index and smoke-developed index of forming material, other than foam plastic, left exposed on the interior shall comply with Section R302.9. The surface burning characteristics of foam plastic used in insulating concrete forms shall comply with Section R316.3.

R608.4.2 Interior covering. Stay-in-place forms constructed of rigid foam plastic shall be protected on the interior of the building as required by Sections R316.4 and R702.3.4. Where gypsum board is used to protect the foam plastic, it shall be installed with a mechanical fastening system. Use of adhesives is permitted in addition to mechanical fasteners.

R608.4.3 Exterior wall covering. Stay-in-place forms constructed of rigid foam plastics shall be protected from sunlight and physical damage by the application of an approved exterior wall covering complying with this code.

Exterior surfaces of other stay-in-place forming systems shall be protected in accordance with this code.

Requirements for installation of masonry veneer, stucco and other finishes on the exterior of concrete walls and other construction details not covered in this section shall comply with the requirements of this code.

R608.4.4 Flat ICF wall systems. Flat ICF wall system forms shall conform to ASTM E2634.

R608.5 Materials. Materials used in the construction of concrete walls shall comply with this section.

R608.5.1 Concrete and materials for concrete. Materials used in concrete, and the concrete itself, shall conform to requirements of this section, PCA 100, ACI 318 or ACI 332.

R608.5.1.1 Cements. The following standards as referenced in Chapter 44 shall be permitted to be used:

1. ASTM C150
2. ASTM C595
3. ASTM C1157

R608.5.1.2 Concrete mixing and delivery. Mixing and delivery of concrete shall comply with ASTM C94 or ASTM C685.

R608.5.1.3 Maximum aggregate size. The nominal maximum size of coarse aggregate shall not exceed one-fifth the narrowest distance between sides of forms, or three-fourths the clear spacing between reinforcing bars or between a bar and the side of the form.

Exception: When approved, these limitations shall not apply where removable forms are used and work-

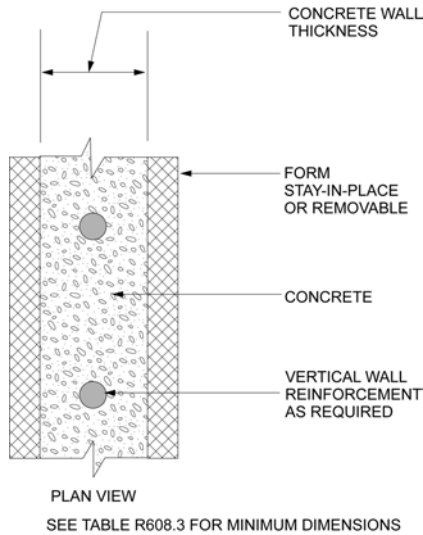
TABLE R608.3
DIMENSIONAL REQUIREMENTS FOR WALLS^a

WALL TYPE AND NOMINAL THICKNESS	MAXIMUM WALL WEIGHT ^b (psf)	MINIMUM WIDTH, W, OF VERTICAL CORES (inches)	MINIMUM THICKNESS, T, OF VERTICAL CORES (inches)	MAXIMUM SPACING OF VERTICAL CORES (inches)	MAXIMUM SPACING OF HORIZONTAL CORES (inches)	MINIMUM WEB THICKNESS (inches)
4" Flat ^c	50	NA	NA	NA	NA	NA
6" Flat ^c	75	NA	NA	NA	NA	NA
8" Flat ^c	100	NA	NA	NA	NA	NA
10" Flat ^c	125	NA	NA	NA	NA	NA
6" Waffle-grid	56	8 ^d	5.5 ^d	12	16	2
8" Waffle-grid	76	8 ^e	8 ^e	12	16	2
6" Screen-grid	53	6.25 ^f	6.25 ^f	12	12	NA

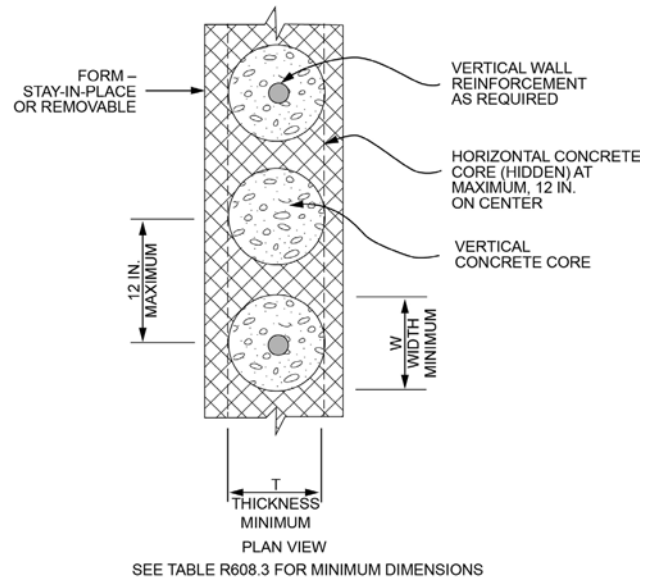
For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per cubic foot = 2402.77 kg/m³, 1 square inch = 645.16 mm², 1 inch⁴ = 42 cm⁴.

NA = Not Applicable.

- a. Width "W," thickness "T," spacing and web thickness, refer to Figures R608.3(2) and R608.3(3).
- b. Wall weight is based on a unit weight of concrete of 150 pcf. For flat walls the weight is based on the nominal thickness. The tabulated values do not include any allowance for interior and exterior finishes.
- c. Nominal wall thickness. The actual as-built thickness of a flat wall shall not be more than 1/2 inch less or more than 1/4 inch more than the nominal dimension indicated.
- d. Vertical core is assumed to be elliptical-shaped. Another shape of core is permitted provided the minimum thickness is 5 inches, the moment of inertia, *I*, about the centerline of the wall (ignoring the web) is not less than 65 inch⁴, and the area, *A*, is not less than 31.25 square inches. The width used to calculate *A* and *I* shall not exceed 8 inches.
- e. Vertical core is assumed to be circular. Another shape of core is permitted provided the minimum thickness is 7 inches, the moment of inertia, *I*, about the centerline of the wall (ignoring the web) is not less than 200 inch⁴, and the area, *A*, is not less than 49 square inches. The width used to calculate *A* and *I* shall not exceed 8 inches.
- f. Vertical core is assumed to be circular. Another shape of core is permitted provided the minimum thickness is 5.5 inches, the moment of inertia, *I*, about the centerline of the wall is not less than 76 inch⁴, and the area, *A*, is not less than 30.25 square inches. The width used to calculate *A* and *I* shall not exceed 6.25 inches.

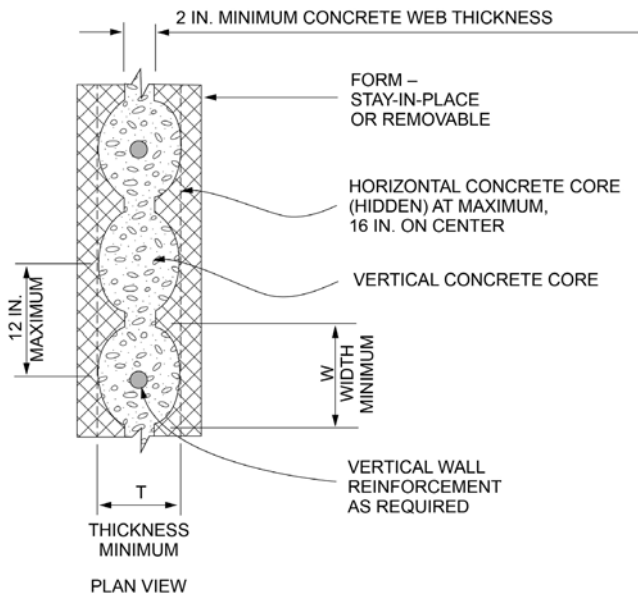


**FIGURE R608.3(1)
FLAT WALL SYSTEM**



**FIGURE R608.3(3)
SCREEN-GRID WALL SYSTEM**

For SI: 1 inch = 25.4 mm.



**FIGURE R608.3(2)
WAFFLE-GRID WALL SYSTEM**

For SI: 1 inch = 25.4 mm.

ability and methods of consolidation permit concrete to be placed without honeycombs or voids.

R608.5.1.4 Proportioning and slump of concrete. Proportions of materials for concrete shall be established to provide workability and consistency to permit concrete to be worked readily into forms and around reinforcement under conditions of placement to be employed, without segregation or excessive bleeding. Slump of concrete placed in removable forms shall not exceed 6 inches (152 mm).

Exception: When approved, the slump is permitted to exceed 6 inches (152 mm) for concrete mixtures that are resistant to segregation, and are in accordance with the form manufacturer’s recommendations.

Slump of concrete placed in stay-in-place forms shall exceed 6 inches (152 mm). Slump of concrete shall be determined in accordance with ASTM C143.

R608.5.1.5 Compressive strength. The minimum specified compressive strength of concrete, f'_c , shall comply with Section R402.2 and shall be not less than 2,500 pounds per square inch (17.2 MPa) at 28 days.

R608.5.1.6 Consolidation of concrete. Concrete shall be consolidated by suitable means during placement and shall be worked around embedded items and reinforcement and into corners of forms. Where stay-in-place forms are used, concrete shall be consolidated by internal vibration.

Exception: When approved, self-consolidating concrete mixtures with slumps equal to or greater than 8 inches (203 mm) that are specifically designed for placement without internal vibration need not be internally vibrated.

R608.5.2 Steel reinforcement and anchor bolts.

R608.5.2.1 Steel reinforcement. Steel reinforcement shall comply with ASTM A615, ASTM A706, or ASTM A996. ASTM A996 bars produced from rail steel shall be Type R.

R608.5.2.2 Anchor bolts. Anchor bolts for use with connection details in accordance with Figures R608.9(1) through R608.9(12) shall be bolts with heads complying with ASTM A307 or ASTM F1554. ASTM A307 bolts shall be Grade A with heads. ASTM F1554 bolts shall be Grade 36 minimum. Instead of bolts with heads, it is permissible to use rods with threads on both

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ends fabricated from steel complying with ASTM A36. The threaded end of the rod to be embedded in the concrete shall be provided with a hex or square nut.

R608.5.2.3 Sheet steel angles and tension tie straps. Angles and tension tie straps for use with connection details in accordance with Figures R608.9(1) through R608.9(12) shall be fabricated from sheet steel complying with ASTM A653 SS, ASTM A792 SS, or ASTM A875 SS. The steel shall be minimum Grade 33 unless a higher grade is required by the applicable figure.

R608.5.3 Form materials and form ties. Forms shall be made of wood, steel, aluminum, plastic, a composite of cement and foam insulation, a composite of cement and wood chips, or other approved material suitable for supporting and containing concrete. Forms shall provide sufficient strength to contain concrete during the concrete placement operation.

Form ties shall be steel, solid plastic, foam plastic, a composite of cement and wood chips, a composite of cement and foam plastic, or other suitable material capable of resisting the forces created by fluid pressure of fresh concrete.

R608.5.4 Reinforcement installation details.

R608.5.4.1 Support and cover. Reinforcement shall be secured in the proper location in the forms with tie wire or other bar support system such that displacement will not occur during the concrete placement operation. Steel reinforcement in concrete cast against the earth shall have a minimum cover of 3 inches (76 mm). Minimum cover for reinforcement in concrete cast in removable forms that will be exposed to the earth or weather shall be 1½ inches (38 mm) for No. 5 bars and smaller, and 2 inches (50 mm) for No. 6 bars and larger. For concrete cast in removable forms that will

not be exposed to the earth or weather, and for concrete cast in stay-in-place forms, minimum cover shall be ¾ inch (19 mm). The minus tolerance for cover shall not exceed the smaller of one-third the required cover and ¾ inch (10 mm). See Section R608.5.4.4 for cover requirements for hooks of bars developed in tension.

R608.5.4.2 Location of reinforcement in walls. For location of reinforcement in foundation walls and above-grade walls, see Sections R404.1.3.3.7.2 and R608.6.5, respectively.

R608.5.4.3 Lap splices. Vertical and horizontal wall reinforcement required by Sections R608.6 and R608.7 shall be the longest lengths practical. Where splices are necessary in reinforcement, the length of lap splices shall be in accordance with Table R608.5.4(1) and Figure R608.5.4(1). The maximum gap between noncontact parallel bars at a lap splice shall not exceed the smaller of one-fifth the required lap length and 6 inches (152 mm). See Figure R608.5.4(1).

R608.5.4.4 Development of bars in tension. Where bars are required to be developed in tension by other provisions of this code, development lengths and cover for hooks and bar extensions shall comply with Table R608.5.4(1) and Figure R608.5.4(2). The development lengths shown in Table R608.5.4(1) shall apply to bundled bars in lintels installed in accordance with Section R608.8.2.2.

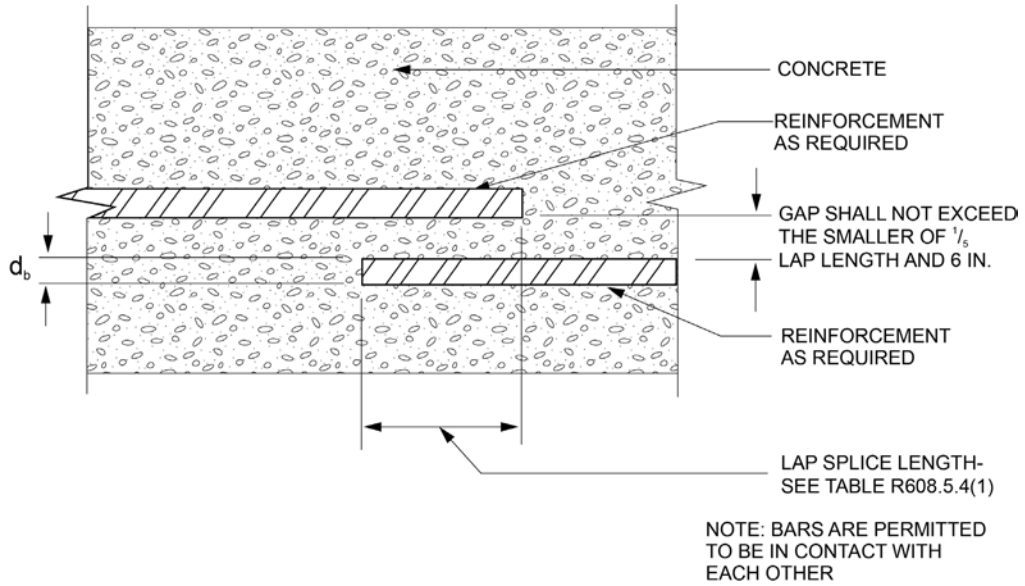
R608.5.4.5 Standard hooks. Where reinforcement is required by this code to terminate with a standard hook, the hook shall comply with Figure R608.5.4(3).

R608.5.4.6 Webs of waffle-grid walls. Reinforcement, including stirrups, shall not be placed in webs of waffle-grid walls, including lintels. Webs are permitted to have form ties.

TABLE R608.5.4(1)
LAP SPLICE AND TENSION DEVELOPMENT LENGTHS

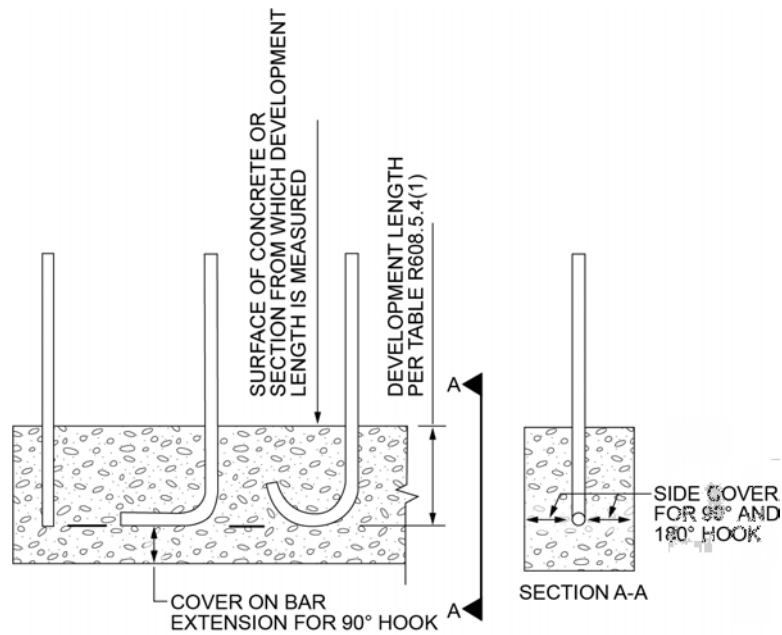
	BAR SIZE NO.	YIELD STRENGTH OF STEEL, f_y , psi (MPa)	
		40,000 (280)	60,000 (420)
		Splice length or tension development length (inches)	
Lap splice length-tension	4	20	30
	5	25	38
	6	30	45
Tension development length for straight bar	4	15	23
	5	19	28
	6	23	34
Tension development length for: a. 90-degree and 180-degree standard hooks with not less than 2½ inches of side cover perpendicular to plane of hook. b. 90-degree standard hooks with not less than 2 inches of cover on the bar extension beyond the hook.	4	6	9
	5	7	11
	6	8	13
Tension development length for bar with 90-degree or 180-degree standard hook having less cover than required in Items a and b.	4	8	12
	5	10	15
	6	12	18

For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad, 1 pound per square inch = 6.895 kPa.



For SI: 1 inch = 25.4 mm.

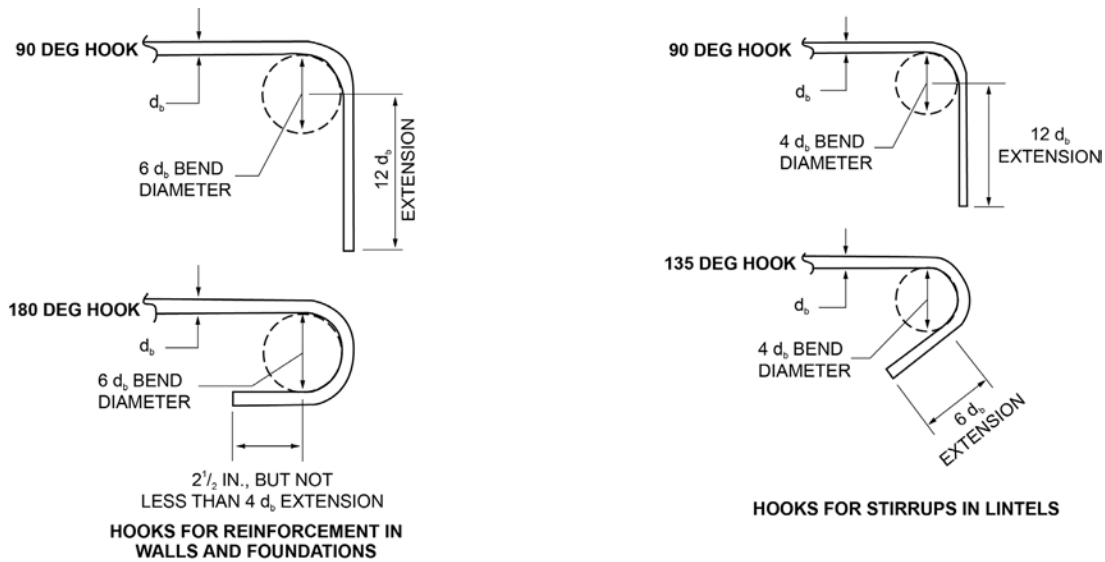
FIGURE R608.5.4(1)
LAP SPLICES



For SI: 1 degree = 0.0175 rad.

FIGURE R608.5.4(2)
DEVELOPMENT LENGTH AND COVER FOR HOOKS AND BAR EXTENSION

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For SI: 1 inch = 25.4 mm, 1 degree = 0.0175 rad.

**FIGURE R608.5.4(3)
STANDARD HOOKS**

R608.5.4.7 Alternate grade of reinforcement and spacing. Where tables in Sections R404.1.3 and R608.6 specify vertical wall reinforcement based on minimum bar size and maximum spacing, which are based on Grade 60 (420 MPa) steel reinforcement, different size bars or bars made from a different grade of steel are permitted provided an equivalent area of steel per linear foot of wall is provided. Use of Table R608.5.4(2) is permitted to determine the maximum bar spacing for different bar sizes than specified in the tables and bars made from a different grade of steel. Bars shall not be spaced less than one-half the wall thickness, or more than 48 inches (1219 mm) on center.

R608.5.5 Construction joints in walls. Construction joints shall be made and located to not impair the strength of the wall. Construction joints in plain concrete walls, including walls required to have not less than No. 4 bars at 48 inches (1219 mm) on center by Section R608.6, shall be located at points of lateral support, and not less than one No. 4 bar shall extend across the construction joint at a spacing not to exceed 24 inches (610 mm) on center. Construction joint reinforcement shall have not less than 12 inches (305 mm) of embedment on both sides of the joint. Construction joints in reinforced concrete walls shall be located in the middle third of the span between lateral supports, or located and constructed as required for joints in plain concrete walls.

Exception: Vertical wall reinforcement required by this code is permitted to be used in lieu of construction joint reinforcement, provided the spacing does not exceed 24 inches (610 mm), or the combination of wall reinforcement and No. 4 bars described in Section R608.5.5 does not exceed 24 inches (610 mm).

R608.6 Above-grade wall requirements.

R608.6.1 General. The minimum thickness of load-bearing and nonload-bearing above-grade walls and reinforcement shall be as set forth in the appropriate table in this section

based on the type of wall form to be used. The wall shall be designed in accordance with ACI 318 where the wall or building is not within the limitations of Section R608.2, where design is required by the tables in this section or where the wall is not within the scope of the tables in this section.

Above-grade concrete walls shall be constructed in accordance with this section and Figure R608.6(1), R608.6(2), R608.6(3) or R608.6(4). Above-grade concrete walls that are continuous with stem walls and not laterally supported by the slab-on-ground shall be designed and constructed in accordance with this section. Concrete walls shall be supported on continuous foundation walls or slabs-on-ground that are monolithic with the footing in accordance with Section R403. The minimum length of solid wall without openings shall be in accordance with Section R608.7. Reinforcement around openings, including lintels, shall be in accordance with Section R608.8. Lateral support for above-grade walls in the out-of-plane direction shall be provided by connections to the floor framing system, if applicable, and to ceiling and roof framing systems in accordance with Section R608.9. The wall thickness shall be equal to or greater than the thickness of the wall in the story above.

R608.6.2 Wall reinforcement for wind. Vertical wall reinforcement for resistance to out-of-plane wind forces shall be determined from Table R608.6(1), R608.6(2), R608.6(3) or R608.6(4). For the design of nonload-bearing walls, in Tables R608.6(1), R608.6(2) and R608.6(3) use the appropriate column labeled "Top." (see Sections R608.7.2.2.2 and R608.7.2.2.3). There shall be a vertical bar at corners of exterior walls. Unless more horizontal reinforcement is required by Section R608.7.2.2.1, the minimum horizontal reinforcement shall be four No. 4 bars [Grade 40 (280 MPa)] placed as follows: top bar within 12 inches (305 mm) of the top of the wall, bottom bar within 12 inches (305 mm) of the finish floor and one bar each at approximately one-third and two-thirds of the wall height.

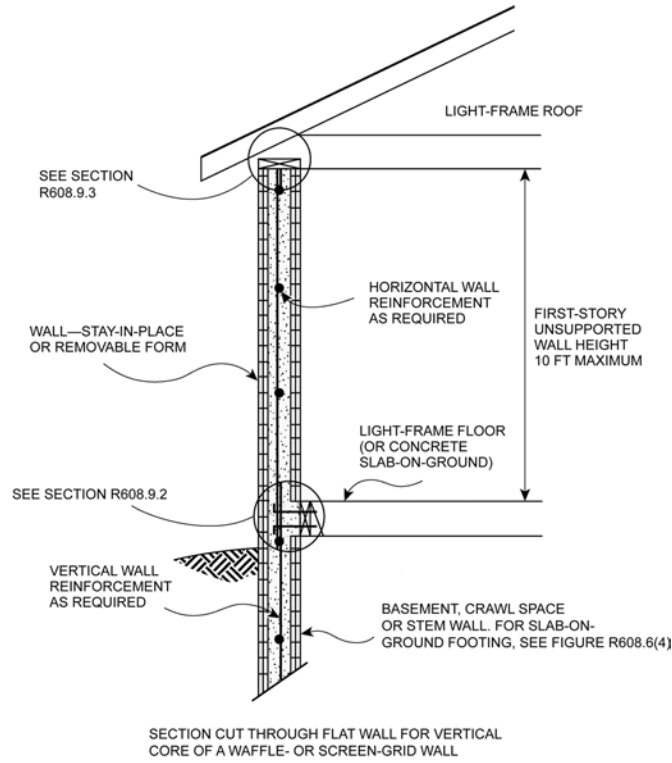
TABLE R608.5.4(2)
MAXIMUM SPACING FOR ALTERNATIVE BAR SIZE AND ALTERNATIVE GRADE OF STEEL^{a, b, c}

BAR SPACING FROM APPLICABLE TABLE IN SECTION R608.6 (inches)	BAR SIZE FROM APPLICABLE TABLE IN SECTION R608.6														
	#4					#5					#6				
	Alternative bar size and alternative grade of steel desired														
	Grade 60		Grade 40			Grade 60		Grade 40			Grade 60		Grade 40		
	#5	#6	#4	#5	#6	#4	#6	#4	#5	#6	#4	#5	#4	#5	#6
Maximum spacing for alternative bar size and alternative grade of steel (inches)															
8	12	18	5	8	12	5	11	3	5	8	4	6	2	4	5
9	14	20	6	9	13	6	13	4	6	9	4	6	3	4	6
10	16	22	7	10	15	6	14	4	7	9	5	7	3	5	7
11	17	24	7	11	16	7	16	5	7	10	5	8	3	5	7
12	19	26	8	12	18	8	17	5	8	11	5	8	4	6	8
13	20	29	9	13	19	8	18	6	9	12	6	9	4	6	9
14	22	31	9	14	21	9	20	6	9	13	6	10	4	7	9
15	23	33	10	16	22	10	21	6	10	14	7	11	5	7	10
16	25	35	11	17	23	10	23	7	11	15	7	11	5	8	11
17	26	37	11	18	25	11	24	7	11	16	8	12	5	8	11
18	28	40	12	19	26	12	26	8	12	17	8	13	5	8	12
19	29	42	13	20	28	12	27	8	13	18	9	13	6	9	13
20	31	44	13	21	29	13	28	9	13	19	9	14	6	9	13
21	33	46	14	22	31	14	30	9	14	20	10	15	6	10	14
22	34	48	15	23	32	14	31	9	15	21	10	16	7	10	15
23	36	48	15	24	34	15	33	10	15	22	10	16	7	11	15
24	37	48	16	25	35	15	34	10	16	23	11	17	7	11	16
25	39	48	17	26	37	16	35	11	17	24	11	18	8	12	17
26	40	48	17	27	38	17	37	11	17	25	12	18	8	12	17
27	42	48	18	28	40	17	38	12	18	26	12	19	8	13	18
28	43	48	19	29	41	18	40	12	19	26	13	20	8	13	19
29	45	48	19	30	43	19	41	12	19	27	13	20	9	14	19
30	47	48	20	31	44	19	43	13	20	28	14	21	9	14	20
31	48	48	21	32	45	20	44	13	21	29	14	22	9	15	21
32	48	48	21	33	47	21	45	14	21	30	15	23	10	15	21
33	48	48	22	34	48	21	47	14	22	31	15	23	10	16	22
34	48	48	23	35	48	22	48	15	23	32	15	24	10	16	23
35	48	48	23	36	48	23	48	15	23	33	16	25	11	16	23
36	48	48	24	37	48	23	48	15	24	34	16	25	11	17	24
37	48	48	25	38	48	24	48	16	25	35	17	26	11	17	25
38	48	48	25	39	48	25	48	16	25	36	17	27	12	18	25
39	48	48	26	40	48	25	48	17	26	37	18	27	12	18	26
40	48	48	27	41	48	26	48	17	27	38	18	28	12	19	27
41	48	48	27	42	48	26	48	18	27	39	19	29	12	19	27
42	48	48	28	43	48	27	48	18	28	40	19	30	13	20	28
43	48	48	29	44	48	28	48	18	29	41	20	30	13	20	29
44	48	48	29	45	48	28	48	19	29	42	20	31	13	21	29
45	48	48	30	47	48	29	48	19	30	43	20	32	14	21	30
46	48	48	31	48	48	30	48	20	31	44	21	32	14	22	31
47	48	48	31	48	48	30	48	20	31	44	21	33	14	22	31
48	48	48	32	48	48	31	48	21	32	45	22	34	15	23	32

For SI: 1 inch = 25.4 mm.

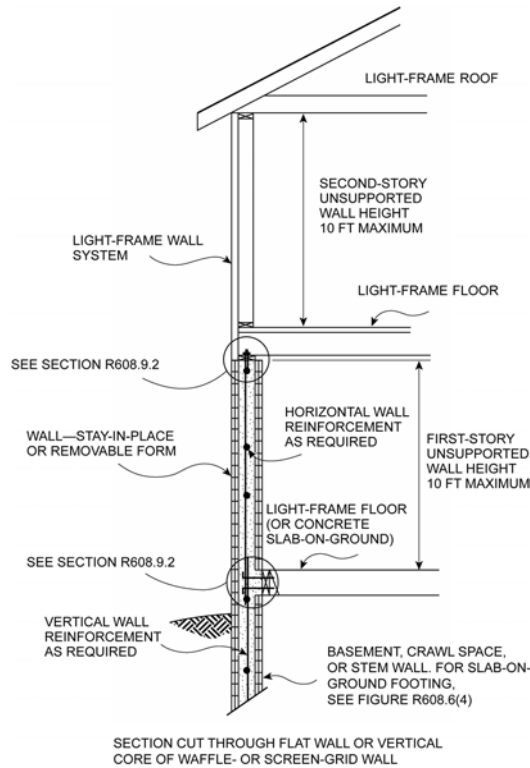
- a. This table is for use with tables in Section R608.6 that specify the minimum bar size and maximum spacing of vertical wall reinforcement for foundation walls and above-grade walls. Reinforcement specified in tables in Section R608.6 is based on Grade 60 (420 MPa) steel reinforcement.
- b. Bar spacing shall not exceed 48 inches on center and shall be not less than one-half the nominal wall thickness.
- c. For Grade 50 (350 MPa) steel bars (ASTM A996, Type R), use spacing for Grade 40 (280 MPa) bars or interpolate between Grade 40 (280 MPa) and Grade 60 (420 MPa).

WALL CONSTRUCTION



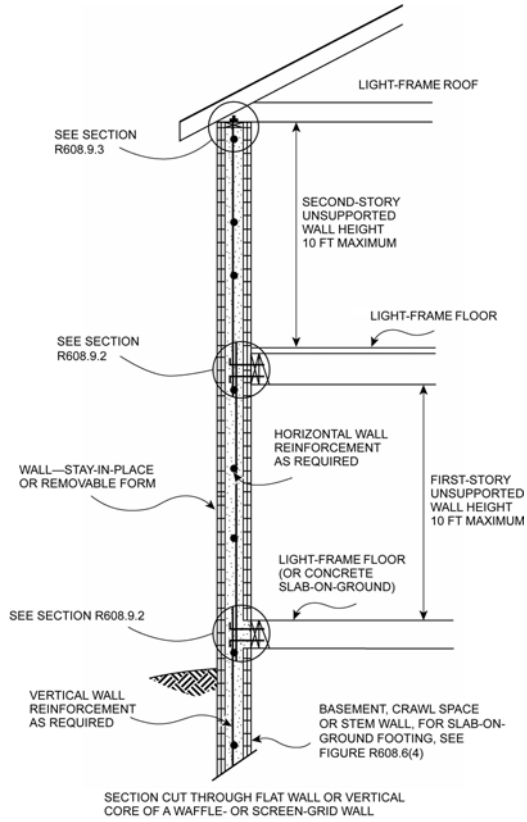
For SI: 1 foot = 304.8 mm.

**FIGURE R608.6(1)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION ONE STORY**



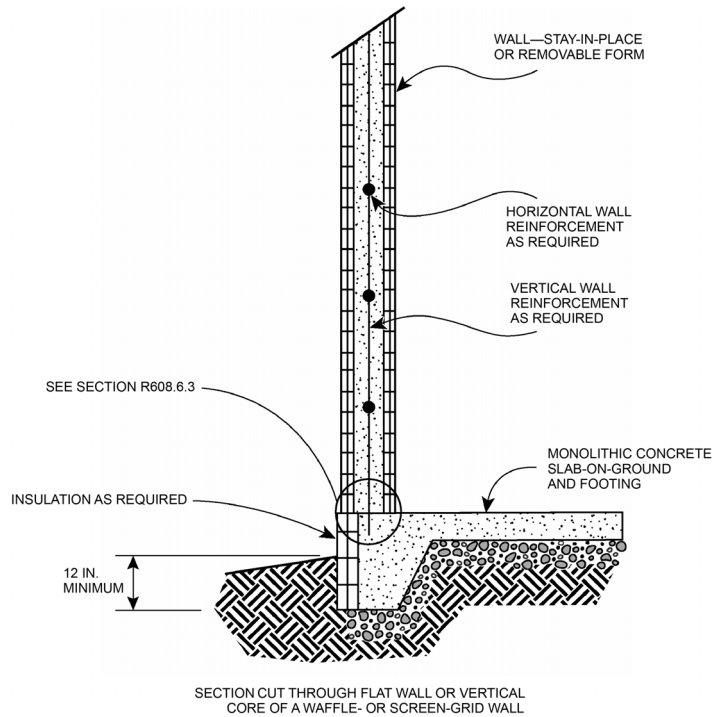
For SI: 1 foot = 304.8 mm.

**FIGURE R608.6(2)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION CONCRETE FIRST STORY AND LIGHT-FRAME SECOND STORY**



For SI: 1 foot = 304.8 mm.

FIGURE R608.6(3)
ABOVE-GRADE CONCRETE WALL CONSTRUCTION TWO-STORY



For SI: 1 foot = 304.8 mm.

FIGURE R608.6(4)
ABOVE-GRADE CONCRETE WALL SUPPORTED ON MONOLITHIC SLAB-ON-GROUND FOOTING

WALL CONSTRUCTION

TABLE R608.6(1)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) ^{f, g}							
				Nominal ^h wall thickness (inches)							
Exposure Category				4		6		8		10	
B	C	D		Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ
115	—	—	8	4@48	4@48	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@39	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@41	4@34	4@48	4@48	4@48	4@48	4@48	4@48
120	—	—	8	4@48	4@43	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@48	4@36	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
130	110	—	8	4@48	4@38	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@39	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
140	119	110	8	4@43	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@34	4@31	4@48	4@48	4@48	4@48	4@48	4@48
150	127	117	8	4@37	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@33	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@31	4@27	4@48	4@48	4@48	4@48	4@48	4@48
160	136	125	8	4@34	4@34	4@48	4@48	4@48	4@48	4@48	4@48
			9	4@34	4@29	4@48	4@48	4@48	4@48	4@48	4@48
			10	4@27	4@24	4@48	4@48	4@48	4@48	4@48	4@48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 1.895 kPa, 1 square foot = 0.0929 m².

- a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_z , equal to 1.0, and Risk Category II.
- b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
- c. See Section R608.6.5 for location of reinforcement in wall.
- d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
- e. Interpolation is not permitted.
- f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section R608.5.4.7 and Table R608.5.4(2).
- h. See Table R608.3 for tolerances on nominal thicknesses.
- i. “Top” means gravity load from roof or floor construction bears on top of wall. “Side” means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing walls where floor framing members span parallel to the wall, use of the “Top” bearing condition is permitted.

TABLE R608.6(2)
MINIMUM VERTICAL REINFORCEMENT FOR WAFFLE-GRID ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) ^{f, g}			
				Nominal ^h wall thickness (inches)			
Exposure Category				6		8	
B	C	D		Top ⁱ	Side ⁱ	Top ⁱ	Side ⁱ
115	—	—	8	4@48	4@48	4@48	4@48
			9	4@48	5@43	4@48	4@48
			10	5@47	5@37	4@48	4@48
120	—	—	8	4@48	5@48	4@48	4@48
			9	4@48	5@40	4@48	4@48
			10	5@43	5@37	4@48	4@48
130	110	—	8	4@48	5@42	4@48	4@48
			9	5@45	5@37	4@48	4@48
			10	5@37	5@37	4@48	4@48
140	119	110	8	4@48	5@38	4@48	4@48
			9	5@39	5@37	4@48	4@48
			10	5@37	5@35	4@48	4@48
150	127	117	8	5@43	5@37	4@48	4@48
			9	5@37	5@37	4@48	4@48
			10	5@36	6@44	4@48	4@48
160	136	125	8	5@38	5@37	4@48	4@48
			9	5@37	6@47	4@48	4@48
			10	6@45	6@39	4@48	6@46

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m².

- a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt} , equal to 1.0, and Risk Category II.
- b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
- c. See Section R608.6.5 for location of reinforcement in wall.
- d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
- e. Interpolation is not permitted.
- f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section R608.5.4.7 and Table R608.5.4(2).
- h. See Table R608.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.
- i. “Top” means gravity load from roof or floor construction bears on top of wall. “Side” means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing walls and where floor framing members span parallel to the wall, the “top” bearing condition is permitted to be used.

WALL CONSTRUCTION

TABLE R608.6(3)
MINIMUM VERTICAL REINFORCEMENT FOR 6-INCH SCREEN-GRID ABOVE-GRADE WALLS^{a, b, c, d, e}

MAXIMUM WIND SPEED (mph)			MAXIMUM UNSUPPORTED WALL HEIGHT PER STORY (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) ^{f, g}	
				Nominal ^h wall thickness (inches)	
Exposure Category				6	
B	C	D		Top ⁱ	Side ⁱ
115	—	—	8	4@48	4@48
			9	4@48	5@41
			10	4@48	6@48
120	—	—	8	4@48	4@48
			9	4@48	5@38
			10	5@42	6@48
130	110	—	8	4@48	5@41
			9	5@44	6@48
			10	5@35	6@48
140	119	110	8	4@48	5@36
			9	5@38	6@48
			10	6@48	6@48
150	127	117	8	5@42	6@48
			9	6@48	6@48
			10	6@48	6@42
160	136	125	8	5@37	6@48
			9	6@48	6@45
			10	6@44	6@38

- For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m².
- a. Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt} , equal to 1.0, and Risk Category II.
 - b. Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
 - c. See Section R608.6.5 for location of reinforcement in wall.
 - d. Deflection criterion is $L/240$, where L is the unsupported height of the wall in inches.
 - e. Interpolation is not permitted.
 - f. Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
 - g. Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. Where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi or bars of a different size than specified in the table are permitted in accordance with Section R608.5.4.7 and Table R608.5.4(2).
 - h. See Table R608.3 for minimum core dimensions and maximum spacing of horizontal and vertical cores.
 - i. “Top” means gravity load from roof or floor construction bears on top of wall. “Side” means gravity load from floor construction is transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. For nonload-bearing wall and where floor framing members span parallel to the wall, use of the “Top” bearing condition is permitted.

TABLE R608.6(4)
MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID
ABOVE-GRADE WALLS DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS^{a, b, c, d, e, k}

MAXIMUM WIND SPEED (mph)			HEIGHT OF STEM WALL ^{h, i} (feet)	MAXIMUM DESIGN LATERAL SOIL LOAD (psf/ft)	MAXIMUM UNSUPPORTED HEIGHT OF ABOVE- GRADE WALL (feet)	MINIMUM VERTICAL REINFORCEMENT-BAR SIZE AND SPACING (inches) ^{f, g}							
						Wall type and nominal thickness ^j (inches)							
Exposure Category			Flat	Waffle	Screen								
B	C	D				4	6	8	10	6	8	6	
115	—	—	3	30	8	4@30	4@48	4@48	4@48	4@22	4@26	4@21	
					10	4@23	5@43	4@48	4@48	4@17	4@20	4@16	
			6	30	10	10	4@19	5@37	4@48	4@48	4@14	4@17	4@14
						60	DR	5@21	6@35	4@48	DR	4@10	DR
						60	DR	5@12	6@25	6@28	DR	DR	DR
120	—	—	3	30	8	4@28	4@48	4@48	4@48	4@21	4@48	4@20	
					10	4@22	5@41	4@48	4@48	4@16	4@19	4@15	
			6	30	10	10	4@18	5@35	4@48	4@48	4@14	4@17	4@13
						60	DR	5@21	6@35	4@48	DR	4@10	DR
						60	DR	5@12	6@25	6@28	DR	DR	DR
130	110	—	3	30	8	4@25	4@48	4@48	4@48	4@18	4@22	4@18	
					10	4@19	5@36	4@48	4@48	4@14	4@17	4@13	
			6	30	10	10	4@16	5@34	4@48	4@48	4@12	4@17	4@12
						60	DR	5@19	6@35	4@48	DR	4@9	DR
						60	DR	5@12	6@24	6@28	DR	DR	DR
140	119	110	3	30	8	4@22	5@42	4@48	4@48	4@16	4@20	4@16	
					10	4@17	5@34	4@48	4@48	4@21	4@17	4@12	
			6	30	10	10	4@15	5@34	4@48	4@48	4@11	4@17	4@10
						60	DR	5@18	6@35	6@35	DR	4@48	DR
						60	DR	5@11	6@23	6@28	DR	DR	DR
150	127	117	3	30	8	4@20	5@37	4@48	4@48	4@15	4@18	4@14	
					10	4@15	5@34	4@48	4@48	4@11	4@17	4@11	
			6	30	10	10	4@13	5@34	4@48	4@48	4@10	4@16	4@9
						60	DR	5@17	6@33	6@32	DR	4@8	DR
						60	DR	DR	6@22	6@28	DR	DR	DR
160	136	125	3	30	8	4@18	5@34	4@48	4@48	4@13	4@17	4@13	
					10	4@13	5@34	4@48	4@48	4@10	4@16	4@9	
			6	30	10	10	4@11	5@31	6@45	4@48	4@9	4@14	4@8
						60	DR	5@15	6@31	6@30	DR	4@7	DR
						60	DR	DR	6@21	6@27	DR	DR	DR

(continued)

TABLE R608.6(4)—continued
MINIMUM VERTICAL REINFORCEMENT FOR FLAT, WAFFLE- AND SCREEN-GRID
ABOVE-GRADE WALLS DESIGNED CONTINUOUS WITH FOUNDATION STEM WALLS^{a, b, c, d, e, k}

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound per square inch = 6.895 kPa, 1 square foot = 0.0929 m².

DR = Design Required.

- Table is based on ASCE 7 components and cladding wind pressures for an enclosed building using a mean roof height of 35 feet, interior wall area 4, an effective wind area of 10 square feet, topographic factor, K_{zt} , equal to 1.0, and Risk Category II.
- Table is based on concrete with a minimum specified compressive strength of 2,500 psi.
- See Section R608.6.5 for location of reinforcement in wall.
- Deflection criterion is $L/240$, where L is the height of the wall in inches from the exterior finish ground level to the top of the above-grade wall.
- Interpolation is not permitted. For intermediate values of basic wind speed, heights of stem wall and above-grade wall, and design lateral soil load, use next higher value.
- Where No. 4 reinforcing bars at a spacing of 48 inches are specified in the table as indicated by shaded cells, use of bars with a minimum yield strength of 40,000 psi or 60,000 psi is permitted.
- Other than for No. 4 bars spaced at 48 inches on center, table values are based on reinforcing bars with a minimum yield strength of 60,000 psi. Maximum spacings shown are the values calculated for the specified bar size. In waffle and screen-grid walls where the bar used is Grade 60 and the size specified in the table, the actual spacing in the wall shall not exceed a whole-number multiple of 12 inches such as, 12, 24, 36 and 48, that is less than or equal to the tabulated spacing. Vertical reinforcement with a yield strength of less than 60,000 psi and bars of a different size than specified in the table are permitted in accordance with Section R608.5.4.7 and Table R608.5.4(2).
- Height of stem wall is the distance from the exterior finish ground level to the top of the slab-on-ground.
- Where the distance from the exterior finish ground level to the top of the slab-on-ground is equal to or greater than 4 feet, the stem wall shall be laterally supported at the top and bottom before backfilling. Where the wall is designed and constructed to be continuous with the above-grade wall, temporary supports bracing the top of the stem wall shall remain in place until the above-grade wall is laterally supported at the top by floor or roof construction.
- See Table R608.3 for tolerances on nominal thicknesses, and minimum core dimensions and maximum spacing of horizontal and vertical cores for waffle-and screen-grid walls.
- Tabulated values are applicable to construction where gravity loads bear on top of wall, and conditions where gravity loads from floor construction are transferred to wall from a wood ledger or cold-formed steel track bolted to side of wall. See Tables R608.6(1), R608.6(2) and R608.6(3).

R608.6.3 Continuity of wall reinforcement between stories. Vertical reinforcement required by this section shall be continuous between elements providing lateral support for the wall. Reinforcement in the wall of the *story* above shall be continuous with the reinforcement in the wall of the *story* below, or the foundation wall, if applicable. Lap splices, where required, shall comply with Section R608.5.4.3 and Figure R608.5.4(1). Where the above-grade wall is supported by a monolithic slab-on-ground and footing, dowel bars with a size and spacing to match the vertical above-grade concrete wall reinforcement shall be embedded in the monolithic slab-on-ground and footing the distance required to develop the dowel bar in tension in accordance with Section R608.5.4.4 and Figure R608.5.4(2) and lap-spliced with the above-grade wall reinforcement in accordance with Section R608.5.4.3 and Figure R608.5.4(1).

Where a construction joint in the wall is located below the level of the floor and less than the distance required to develop the bar in tension, the distance required to develop the bar in tension shall be measured from the top of the concrete below the joint. See Section R608.5.5.

Exception: Where reinforcement in the wall above cannot be made continuous with the reinforcement in the wall below, the bottom of the reinforcement in the wall above shall be terminated in accordance with one of the following:

- Extend below the top of the floor the distance required to develop the bar in tension in accordance with Section R608.5.4.4 and Figure R608.5.4(2).
- Lap-spliced in accordance with Section R608.5.4.3 and Figure R608.5.4(1) with a dowel bar that extends into the wall below the distance required to develop the bar in tension in accordance with Section R608.5.4.4 and Figure R608.5.4(2).

R608.6.4 Termination of reinforcement. Where indicated in Items 1 through 3, vertical wall reinforcement in the top-most *story* with concrete walls shall be terminated with a 90-degree (1.57 rad) standard hook complying with Section R608.5.4.5 and Figure R608.5.4(3).

- Vertical bars adjacent to door and window openings required by Section R608.8.1.2.
- Vertical bars at the ends of required solid wall segments (see Section R608.7.2.2.2).
- Vertical bars (other than end bars, see Item 2) used as shear reinforcement in required solid wall segments where the reduction factor for design strength, R_3 , used is based on the wall having horizontal and vertical shear reinforcement (see Section R608.7.2.2.3).

The bar extension of the hook shall be oriented parallel to the horizontal wall reinforcement and be within 4 inches (102 mm) of the top of the wall.

Horizontal reinforcement shall be continuous around the building corners by bending one of the bars and lap-splicing it with the bar in the other wall in accordance with Section R608.5.4.3 and Figure R608.5.4(1).

In required solid wall segments where the reduction factor for design strength, R_3 , is based on the wall having horizontal and vertical shear reinforcement in accordance with Section R608.7.2.2.1, horizontal wall reinforcement shall be terminated with a standard hook complying with Section R608.5.4.5 and Figure R608.5.4(3) or in a lap-splice, except at corners where the reinforcement shall be continuous as required.

Exception: In lieu of bending horizontal reinforcement at corners, separate bent reinforcing bars shall be permitted provided that the bent bar is lap-spliced with

the horizontal reinforcement in both walls in accordance with Section R608.5.4.3 and Figure R608.5.4(1).

R608.6.5 Location of reinforcement in wall. Except for vertical reinforcement at the ends of required solid wall segments, which shall be located as required by Section R608.7.2.2.2, the location of the vertical reinforcement shall not vary from the center of the wall by more than the greater of 10 percent of the wall thickness and $\frac{3}{8}$ -inch (10 mm). Horizontal and vertical reinforcement shall be located to provide not less than the minimum cover required by Section R608.5.4.1.

R608.7 Solid walls for resistance to lateral forces.

R608.7.1 Length of solid wall. Each exterior wall line in each *story* shall have a total length of solid wall required by Section R608.7.1.1. A solid wall is a section of flat, waffle-grid or screen-grid wall, extending the full *story height* without openings or penetrations, except those permitted by Section R608.7.2. Solid wall segments that contribute to the total length of solid wall shall comply with Section R608.7.2.

R608.7.1.1 Length of solid wall for wind. Buildings shall have solid walls in each exterior endwall line (the side of a building that is parallel to the span of the roof or floor framing) and sidewall line (the side of a building that is perpendicular to the span of the roof or floor framing) to resist lateral in-plane wind forces. The site-appropriate basic wind speed and exposure category shall be used in Tables R608.7.1.1(1) through (3) to determine the unreduced total length, *UR*, of solid wall required in each exterior endwall line and sidewall line. For buildings with a mean roof height of less than 35 feet (10 668 mm), the unreduced values determined from Tables R608.7.1.1(1) through (3) are permitted to be reduced by multiplying by the applicable factor, R_1 , from Table R608.7.1.1(4); however, reduced values shall be not less than the minimum values in Tables R608.7.1.1(1) through (3). Where the floor-to-ceiling height of a *story* is less than 10 feet (3048 mm), the unreduced values determined from Tables R608.7.1.1(1) through (3), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_2 , from Table R608.7.1.1(5). To account for different design strengths than assumed in determining the values in Tables R608.7.1.1(1) through (3), the unreduced lengths determined from Tables R608.7.1.1(1) through (3), including minimum values, are permitted to be reduced by multiplying by the applicable factor, R_3 , from Table R608.7.1.1(6). The reductions permitted by Tables R608.7.1.1(4), R608.7.1.1(5) and R608.7.1.1(6) are cumulative.

The total length of solid wall segments, *TL*, in a wall line that comply with the minimum length requirements of Section R608.7.2.1 [see Figure R608.7.1.1(1)] shall be equal to or greater than the product of the unreduced length of solid wall from Tables R608.7.1.1(1) through (3), *UR* and the applicable reduction factors, if any, from Tables R608.7.1.1(4), R608.7.1.1(5) and R608.7.1.1(6) as indicated by Equation R6-1.

$$TL \geq R_1 \times R_2 \times R_3 \times UR \quad \text{(Equation R6-1)}$$

where:

TL = Total length of solid wall segments in a wall line that comply with Section R608.7.2.1 [see Figure R608.7.1.1(1)].

R_1 = 1.0 or reduction factor for mean roof height from Table R608.7.1.1(4).

R_2 = 1.0 or reduction factor for floor-to-ceiling wall height from Table R608.7.1.1(5).

R_3 = 1.0 or reduction factor for design strength from Table R608.7.1.1(6).

UR = Unreduced length of solid wall from Tables R608.7.1.1(1) through (3).

The total length of solid wall in a wall line, *TL*, shall be not less than that provided by two solid wall segments complying with the minimum length requirements of Section R608.7.2.1.

To facilitate determining the required wall thickness, wall type, number and *grade* of vertical bars at each end of each solid wall segment, and whether shear reinforcement is required, use of Equation R6-2 is permitted.

$$R_3 \leq \frac{TL}{R_1 \times R_2 \times UR} \quad \text{(Equation R6-2)}$$

After determining the maximum permitted value of the reduction factor for design strength, R_3 , in accordance with Equation R6-2, select a wall type from Table R608.7.1.1(6) with R_3 less than or equal to the value calculated.

R608.7.2 Solid wall segments. Solid wall segments that contribute to the required length of solid wall shall comply with this section. Reinforcement shall be provided in accordance with Section R608.7.2.2 and Table R608.7.1.1(6). Solid wall segments shall extend the full *story-height* without openings, other than openings for the utilities and other building services passing through the wall. In flat walls and waffle-grid walls, such openings shall have an area of less than 30 square inches (19 355 mm²) without any dimension exceeding $6\frac{1}{4}$ inches (159 mm), and shall not be located within 6 inches (152 mm) of the side edges of the solid wall segment. In screen-grid walls, such openings shall be located in the portion of the solid wall segment between horizontal and vertical cores of concrete and opening size and location are not restricted provided there is not any concrete removed.

R608.7.2.1 Minimum length of solid wall segment and maximum spacing. Only solid wall segments equal to or greater than 24 inches (610 mm) in length shall be included in the total length of solid wall required by Section R608.7.1. In addition, not more than two solid wall segments equal to or greater than 24 inches (610 mm) in length and less than 48 inches (1219 mm) in length shall be included in the required total length of solid wall. The maximum clear opening width shall be 18 feet (5486 mm). See Figure R608.7.1.1(1).

WALL CONSTRUCTION

TABLE R608.7.1.1(1)
UNREDUCED LENGTH, *U_R*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL
FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO STORY^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>U_R</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)							
			Basic Wind Speed (mph) Exposure							Minimum ^b
			115B	120B	130B	140B	150B	160B		
			—	—	110C	119C	127C	136C		
—	—	—	110D	117D	125D					
15	15	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.92	
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.15	
		7:12	2.00	2.18	2.56	2.97	3.41	3.88	1.25	
		12:12	3.20	3.48	4.09	4.74	5.44	6.19	1.54	
	30	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	0.98	
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.43	
		7:12	2.78	3.03	3.56	4.13	4.74	5.39	1.64	
		12:12	5.17	5.63	6.61	7.67	8.80	10.01	2.21	
	45	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.04	
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	1.72	
		7:12	3.57	3.88	4.56	5.28	6.07	6.90	2.03	
		12:12	7.15	7.78	9.13	10.59	12.16	13.84	2.89	
	60	< 1:12	1.03	1.12	1.32	1.53	1.76	2.00	1.09	
		5:12	1.43	1.56	1.83	2.12	2.43	2.77	2.01	
		7:12	4.35	4.73	5.55	6.44	7.39	8.41	2.42	
		12:12	9.12	9.93	11.66	13.52	15.52	17.66	3.57	
30	15	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.82	
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.23	
		7:12	3.61	3.93	4.61	5.34	6.13	6.98	2.42	
		12:12	5.61	6.10	7.16	8.31	9.54	10.85	2.93	
	30	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	1.93	
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	2.75	
		7:12	4.92	5.35	6.28	7.29	8.37	9.52	3.12	
		12:12	8.92	9.71	11.39	13.22	15.17	17.26	4.14	
	45	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.03	
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.26	
		7:12	6.23	6.78	7.96	9.23	10.60	12.06	3.82	
		12:12	12.23	13.31	15.63	18.12	20.80	23.67	5.36	
	60	< 1:12	1.84	2.01	2.35	2.73	3.13	3.57	2.14	
		5:12	2.56	2.78	3.27	3.79	4.35	4.95	3.78	
		7:12	7.54	8.21	9.64	11.17	12.83	14.60	4.52	
		12:12	15.54	16.92	19.86	23.03	26.44	30.08	6.57	

(continued)

TABLE R608.7.1.1(1)—continued
UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL
FOR WIND PERPENDICULAR TO RIDGE ONE STORY OR TOP STORY OF TWO STORY^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>UR</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)						
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	Minimum ^b
—	—	110C	119C	127C	136C				
—	—	—	110D	117D	125D				
60	15	< 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.63
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	4.40
		7:12	6.76	7.36	8.64	10.02	11.51	13.09	4.75
		12:12	10.35	11.27	13.23	15.34	17.61	20.04	5.71
	30	< 1:12	3.42	3.72	4.36	5.06	5.81	6.61	3.83
		5:12	4.75	5.17	6.06	7.03	8.07	9.19	5.37
		7:12	9.12	9.93	11.66	13.52	15.52	17.66	6.07
		12:12	16.30	17.75	20.83	24.16	27.73	31.55	8.00
	45	< 1:12	3.55	3.87	4.54	5.27	6.05	6.88	4.03
		5:12	4.94	5.37	6.31	7.31	8.40	9.55	6.34
		7:12	11.71	12.75	14.97	17.36	19.93	22.67	7.39
		12:12	22.70	24.71	29.00	33.64	38.62	43.94	10.29
	60	< 1:12	3.68	4.01	4.71	5.46	6.27	7.13	4.23
		5:12	5.11	5.57	6.54	7.58	8.70	9.90	7.31
		7:12	14.38	15.66	18.37	21.31	24.46	27.83	8.71
		12:12	29.30	31.90	37.44	43.42	49.85	56.72	12.57

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound-force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

- a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt} , equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, UR , of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
- b. Tabulated lengths in the “minimum” column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R608.7.1.1.
- c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table R608.7.1.1(4). The reduced length shall be not less than the “minimum” value shown in the table.
- d. Tabulated lengths for “one story or top story of two story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table R608.1.1(2) or (3), or multiply the value in the table by the reduction factor, R_2 , from Table R608.7.1.1(5).
- e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table R608.7.1.1(6).
- f. The reduction factors, R_1 , R_2 and R_3 , in Tables R608.7.1.1(4), R608.7.1.1(5), and R608.7.1.1(6), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid wall segments in each wall line shall comply with Sections R608.7.1 and R608.7.2.1, respectively.
- g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

WALL CONSTRUCTION

TABLE R608.7.1.1(2)
UNREDUCED LENGTH, *U_R*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL
FOR WIND PERPENDICULAR TO RIDGE FIRST STORY OF TWO STORY^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>U_R</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)							
			Basic Wind Speed (mph) Exposure							Minimum ^b
			115B	120B	130B	140B	150B	160B		
			—	—	110C	119C	127C	136C		
—	—	—	110D	117D	125D					
15	15	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.54	
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	2.76	
		7:12	4.31	4.70	5.51	6.39	7.34	8.35	2.87	
		12:12	5.51	6.00	7.04	8.16	9.37	10.66	3.15	
	30	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.59	
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.05	
		7:12	5.09	5.55	6.51	7.55	8.67	9.86	3.26	
		12:12	7.48	8.15	9.56	11.09	12.73	14.49	3.83	
	45	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.65	
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.34	
		7:12	5.88	6.40	7.51	8.71	10.00	11.37	3.65	
		12:12	9.46	10.30	12.09	14.02	16.09	18.31	4.51	
	60	< 1:12	2.98	3.25	3.81	4.42	5.07	5.77	2.71	
		5:12	4.13	4.50	5.28	6.12	7.03	8.00	3.63	
		7:12	6.66	7.25	8.51	9.87	11.32	12.89	4.04	
		12:12	11.43	12.45	14.61	16.94	19.45	22.13	5.19	
30	15	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.06	
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.47	
		7:12	7.94	8.65	10.15	11.77	13.51	15.37	5.65	
		12:12	9.94	10.82	12.70	14.73	16.91	19.24	6.17	
	30	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.16	
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	5.98	
		7:12	9.25	10.07	11.82	13.71	15.74	17.91	6.35	
		12:12	13.25	14.43	16.93	19.64	22.54	25.65	7.38	
	45	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.27	
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	6.50	
		7:12	10.56	11.50	13.50	15.65	17.97	20.45	7.06	
		12:12	16.56	18.03	21.16	24.55	28.18	32.06	8.60	
	60	< 1:12	5.32	5.79	6.80	7.89	9.05	10.30	5.38	
		5:12	7.39	8.04	9.44	10.95	12.57	14.30	7.01	
		7:12	11.87	12.93	15.17	17.60	20.20	22.98	7.76	
		12:12	19.87	21.64	25.40	29.45	33.81	38.47	9.81	

(continued)

TABLE R608.7.1.1(2)—continued
UNREDUCED LENGTH, *UR*, OF SOLID WALL REQUIRED IN EACH EXTERIOR ENDWALL
FOR WIND PERPENDICULAR TO RIDGE FIRST STORY OF TWO STORY^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>UR</i> , OF SOLID WALL REQUIRED IN ENDWALLS FOR WIND PERPENDICULAR TO RIDGE (feet)							
			Basic Wind Speed (mph) Exposure							Minimum ^b
			115B	120B	130B	140B	150B	160B		
			—	—	110C	119C	127C	136C		
—	—	—	110D	117D	125D					
60	15	< 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.10	
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	10.87	
		7:12	15.08	16.42	19.27	22.35	25.66	29.20	11.22	
		12:12	18.67	20.33	23.86	27.67	31.77	36.14	12.19	
	30	< 1:12	9.87	10.74	12.61	14.62	16.79	19.10	10.30	
		5:12	13.71	14.93	17.52	20.32	23.33	26.54	11.85	
		7:12	17.44	18.99	22.29	25.85	29.67	33.76	12.54	
		12:12	24.62	26.81	31.46	36.49	41.89	47.66	14.48	
	45	< 1:12	10.27	11.18	13.12	15.21	17.47	19.87	10.50	
		5:12	14.26	15.52	18.22	21.13	24.26	27.60	12.82	
		7:12	20.21	22.01	25.83	29.95	34.39	39.12	13.86	
		12:12	31.20	33.97	39.87	46.23	53.07	60.39	16.76	
	60	< 1:12	10.64	11.59	13.60	15.77	18.11	20.60	10.70	
		5:12	14.77	16.09	18.88	21.90	25.14	28.60	13.79	
		7:12	23.05	25.09	29.45	34.15	39.21	44.61	15.18	
		12:12	37.97	41.34	48.52	56.27	64.60	73.49	19.05	

- For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.
- Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_z , equal to 1.0, and Risk Category II. For wind perpendicular to the ridge, the effects of a 2-foot overhang on each endwall are included. The design pressures were used to calculate forces to be resisted by solid wall segments in each endwall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, UR , of solid wall length required in each endwall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
 - Tabulated lengths in the “minimum” column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 1016 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R608.7.1.1.
 - For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table R608.7.1.1(4). The reduced length shall be not less than the “minimum” value shown in the table.
 - Tabulated lengths for “one story or top story of two story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table R608.7.1.1(1) or R608.7.1.1(3), or multiply the value in the table by the reduction factor, R_2 , from Table R608.7.1.1(5).
 - Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table R608.7.1.1(6).
 - The reduction factors, R_1 , R_2 and R_3 , in Tables R608.7.1.1(4), R608.7.1.1(5), and R608.7.1.1(6), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid wall segments in each wall line shall comply with Sections R608.7.1 and R608.7.2.1, respectively.
 - For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

WALL CONSTRUCTION

TABLE R608.7.1.1(3)
 UNREDUCED LENGTH, UR, OF SOLID WALL REQUIRED IN EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, UR, OF SOLID WALL REQUIRED IN SIDEWALLS FOR WIND PARALLEL TO RIDGE (feet)							
			Basic Wind Speed (mph) Exposure							Minimum ^b
			115B	120B	130B	140B	150B	160B		
			—	—	110C	119C	127C	136C		
—	—	—	110D	117D	125D					
One story or top story of two story										
< 30	15	< 1:12	1.08	1.18	1.39	1.61	1.84	2.10	0.90	
		5:12	1.29	1.40	1.65	1.91	2.19	2.49	1.08	
		7:12	1.38	1.50	1.76	2.04	2.35	2.67	1.17	
		12:12	1.63	1.78	2.09	2.42	2.78	3.16	1.39	
	30	< 1:12	2.02	2.20	2.59	3.00	3.44	3.92	1.90	
		5:12	2.73	2.97	3.48	4.04	4.64	5.28	2.62	
		7:12	3.05	3.32	3.89	4.51	5.18	5.89	2.95	
		12:12	3.93	4.27	5.02	5.82	6.68	7.60	3.86	
	45	< 1:12	3.03	3.30	3.87	4.49	5.15	5.86	2.99	
		5:12	4.55	4.96	5.82	6.75	7.74	8.81	4.62	
		7:12	5.24	5.71	6.70	7.77	8.92	10.15	5.36	
		12:12	7.16	7.79	9.14	10.61	12.17	13.85	7.39	
	60	< 1:12	4.11	4.47	5.25	6.09	6.99	7.96	4.18	
		5:12	6.78	7.39	8.67	10.05	11.54	13.13	7.07	
		7:12	8.00	8.71	10.22	11.85	13.61	15.48	8.38	
		12:12	11.35	12.36	14.51	16.82	19.31	21.97	12.00	
60	45	< 1:12	3.17	3.46	4.06	4.70	5.40	6.14	2.99	
		5:12	4.75	5.18	6.07	7.04	8.09	9.20	4.62	
		7:12	5.47	5.96	6.99	8.11	9.31	10.59	5.36	
		12:12	7.45	8.11	9.52	11.04	12.68	14.43	7.39	
	60	< 1:12	4.41	4.81	5.64	6.54	7.51	8.54	4.18	
		5:12	7.22	7.86	9.23	10.70	12.29	13.98	7.07	
		7:12	8.50	9.25	10.86	12.59	14.46	16.45	8.38	
		12:12	12.02	13.09	15.36	17.81	20.45	23.27	12.00	

(continued)

TABLE R608.7.1.1(3)—continued
UNREDUCED LENGTH, *U_R*, OF SOLID WALL REQUIRED IN EACH EXTERIOR SIDEWALL FOR WIND PARALLEL TO RIDGE^{a, c, d, e, f, g}

SIDEWALL LENGTH (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	UNREDUCED LENGTH, <i>U_R</i> , OF SOLID WALL REQUIRED IN SIDEWALLS FOR WIND PARALLEL TO RIDGE (feet)						Minimum ^b
			Basic Wind Speed (mph) Exposure						
			115B	120B	130B	140B	150B	160B	
			—	—	110C	119C	127C	136C	
			—	—	—	110D	117D	125D	
One story or top story of two story									
< 30	15	< 1:12	3.03	3.30	3.88	4.49	5.16	5.87	2.52
		5:12	3.24	3.52	4.14	4.80	5.51	6.26	2.70
		7:12	3.33	3.62	4.25	4.93	5.66	6.44	2.79
		12:12	3.58	3.90	4.58	5.31	6.10	6.94	3.01
	30	< 1:12	5.50	5.99	7.03	8.16	9.36	10.65	5.14
		5:12	6.21	6.76	7.93	9.20	10.56	12.01	5.86
		7:12	6.52	7.10	8.34	9.67	11.10	12.63	6.19
		12:12	7.41	8.06	9.46	10.97	12.60	14.33	7.10
	45	< 1:12	8.00	8.71	10.22	11.85	13.61	15.48	7.85
		5:12	9.52	10.37	12.17	14.11	16.20	18.43	9.48
		7:12	10.21	11.12	13.05	15.14	17.38	19.77	10.21
		12:12	12.13	13.20	15.50	17.97	20.63	23.47	12.25
	60	< 1:12	10.56	11.50	13.50	15.65	17.97	20.44	10.65
		5:12	13.24	14.41	16.91	19.62	22.52	25.62	13.54
		7:12	14.45	15.73	18.46	21.41	24.58	27.97	14.85
		12:12	17.80	19.38	22.75	26.38	30.29	34.46	18.48
60	45	< 1:12	8.39	9.14	10.72	12.44	14.28	16.25	7.85
		5:12	9.97	10.86	12.74	14.78	16.97	19.30	9.48
		7:12	10.69	11.64	13.66	15.84	18.19	20.69	10.21
		12:12	12.67	13.80	16.19	18.78	21.56	24.53	12.25
	60	< 1:12	11.37	12.38	14.53	16.85	19.35	22.01	10.65
		5:12	14.18	15.44	18.12	21.02	24.13	27.45	13.54
		7:12	15.46	16.83	19.75	22.91	26.29	29.92	14.85
		12:12	18.98	20.66	24.25	28.13	32.29	36.74	18.48

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound force per linear foot = 0.146 kN/m, 1 pound per square foot = 47.88 Pa.

- a. Tabulated lengths were derived by calculating design wind pressures in accordance with Figure 28.4-1 of ASCE 7 for a building with a mean roof height of 35 feet, topographic factor, K_{zt} , equal to 1.0, and Risk Category II. The design pressures were used to calculate forces to be resisted by solid wall segments in each sidewall. The forces to be resisted by each wall line were then divided by the default design strength of 840 pounds per linear foot of length to determine the unreduced length, U_R , of solid wall length required in each sidewall. The actual mean roof height of the building shall not exceed the least horizontal dimension of the building.
- b. Tabulated lengths in the “minimum” column are based on the requirement of Section 28.4.4 of ASCE 7 that the main windforce-resisting system be designed for a minimum pressure of 16 psf multiplied by the wall area of the building and 8 psf multiplied by the roof area of the building projected onto a vertical plane normal to the assumed wind direction. Tabulated lengths in shaded cells are less than the “minimum” value. Where the minimum controls, it is permitted to be reduced in accordance with Notes c, d and e. See Section R608.7.1.1.
- c. For buildings with a mean roof height of less than 35 feet, tabulated lengths are permitted to be reduced by multiplying by the appropriate factor, R_1 , from Table R608.7.1.1(4). The reduced length shall be not less than the “minimum” value shown in the table.
- d. Tabulated lengths for “one story or top story of two story” are based on a floor-to-ceiling height of 10 feet. Tabulated lengths for “first story of two story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor-to-ceiling heights less than assumed, use the lengths in this table or Table R608.7.1.1(1) or Table R608.7.1.1(2), or multiply the value in the table by the reduction factor, R_2 , from Table R608.7.1.1(5).
- e. Tabulated lengths are based on the default design shear strength of 840 pounds per linear foot of solid wall segment. The tabulated lengths are permitted to be reduced by multiplying by the applicable reduction factor for design strength, R_3 , from Table R608.7.1.1(6).
- f. The reduction factors, R_1 , R_2 and R_3 , in Table R608.7.1.1(4), Table R608.7.1.1(5), and Table R608.7.1.1(6), respectively, are permitted to be compounded, subject to the limitations of Note b. However, the minimum number and minimum length of solid walls segments in each wall line shall comply with Sections R608.7.1 and R608.7.2.1, respectively.
- g. For intermediate values of sidewall length, endwall length, roof slope and basic wind speed, use the next higher value, or determine by interpolation.

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**TABLE R608.7.1.1(4)
REDUCTION FACTOR, R_1 , FOR BUILDINGS WITH MEAN ROOF HEIGHT LESS THAN 35 FEET^a**

MEAN ROOF HEIGHT ^{b, c} (feet)	REDUCTION FACTOR R_1 , FOR MEAN ROOF HEIGHT		
	Exposure category		
	B	C	D
< 15	0.96	0.84	0.87
20	0.96	0.89	0.91
25	0.96	0.93	0.94
30	0.96	0.97	0.98
35	1.00	1.00	1.00

For SI: 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

- a. See Section R608.7.1.1 and Note c to Table R608.7.1.1(1) for application of reduction factors in this table. This reduction is not permitted for “minimum” values.
- b. For intermediate values of mean roof height, use the factor for the next greater height, or determine by interpolation.
- c. Mean roof height is the average of the roof eave height and height of the highest point on the roof surface, except that for roof slopes of less than or equal to $2\frac{1}{8}:12$ (10 degrees), the mean roof height is permitted to be taken as the roof eave height.

TABLE R608.7.1.1(5)
REDUCTION FACTOR, R_2 , FOR FLOOR-TO-CEILING WALL HEIGHTS LESS THAN 10 FEET^{a, b}

STORY UNDER CONSIDERATION	FLOOR-TO-CEILING HEIGHT ^c (feet)	ENDWALL LENGTH (feet)	ROOF SLOPE	REDUCTION FACTOR, R_2
Endwalls—for wind perpendicular to ridge				
One story or top story of two story	8	15	< 5:12	0.83
			7:12	0.90
			12:12	0.94
		60	< 5:12	0.83
			7:12	0.95
			12:12	0.98
First story of two story	16 combined first and second story	15	< 5:12	0.83
			7:12	0.86
			12:12	0.89
		60	< 5:12	0.83
			7:12	0.91
			12:12	0.95
Sidewalls—for wind parallel to ridge				
One story or top story of two story	8	15	< 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.89
		60	< 1:12	0.86
			5:12	0.92
			7:12	0.93
			12:12	0.95
First story of two story	16 combined first and second story	15	< 1:12	0.83
			5:12	0.84
			7:12	0.85
			12:12	0.86
		60	< 1:12	0.84
			5:12	0.87
			7:12	0.88
			12:12	0.90

For SI: 1 foot = 304.8 mm.

- a. See Section R608.7.1.1 and Note d to Table R608.7.1.1(1) for application of reduction factors in this table.
- b. For intermediate values of endwall length and roof slope, use the next higher value or determine by interpolation.
- c. Tabulated values in Tables R608.7.1.1(1) and R608.7.1.1(3) for “one story or top story of two story” are based on a floor-to-ceiling height of 10 feet. Tabulated values in Tables R608.7.1.1(2) and R608.7.1.1(3) for “first story of two story” are based on floor-to-ceiling heights of 10 feet each for the first and second story. For floor to ceiling heights between those shown in this table and those assumed in Table R608.7.1.1(1), R608.7.1.1(2) or R608.7.1.1(3), use the solid wall lengths in Table R608.7.1.1(1), R608.7.1.1(2) or R608.7.1.1(3), or determine the reduction factor by interpolating between 1.0 and the factor shown in this table.

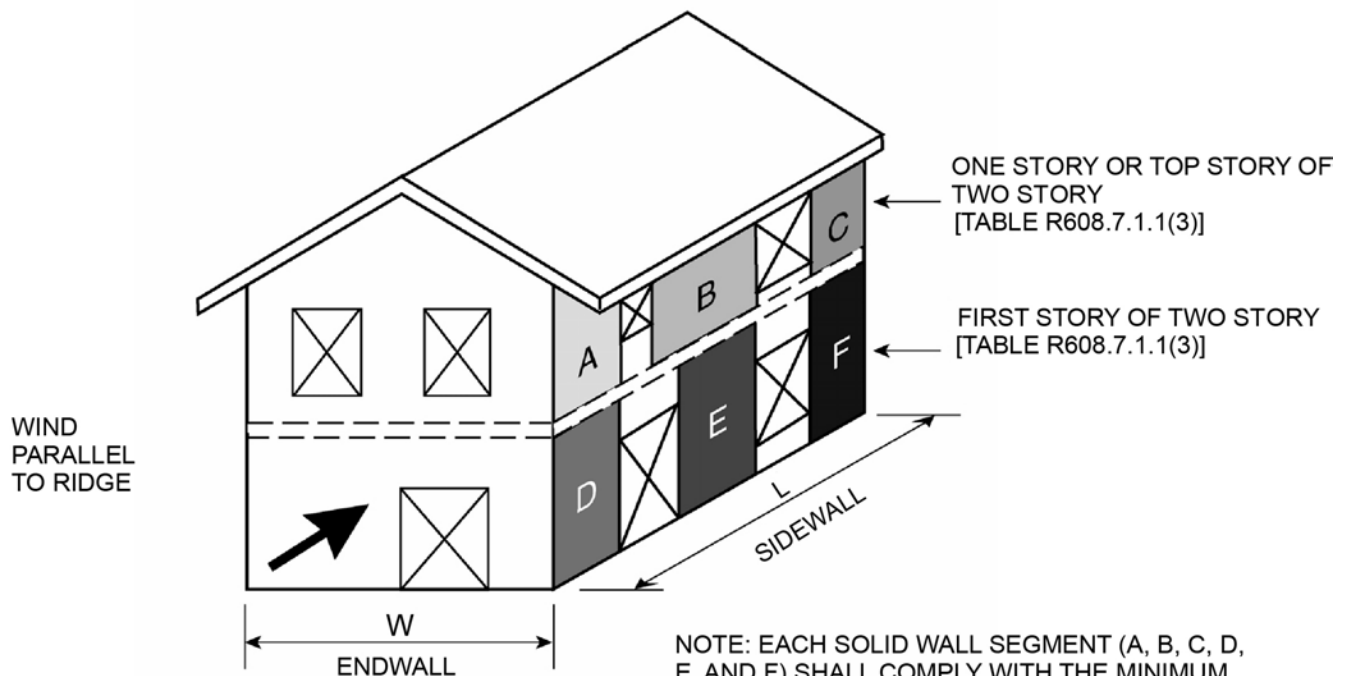
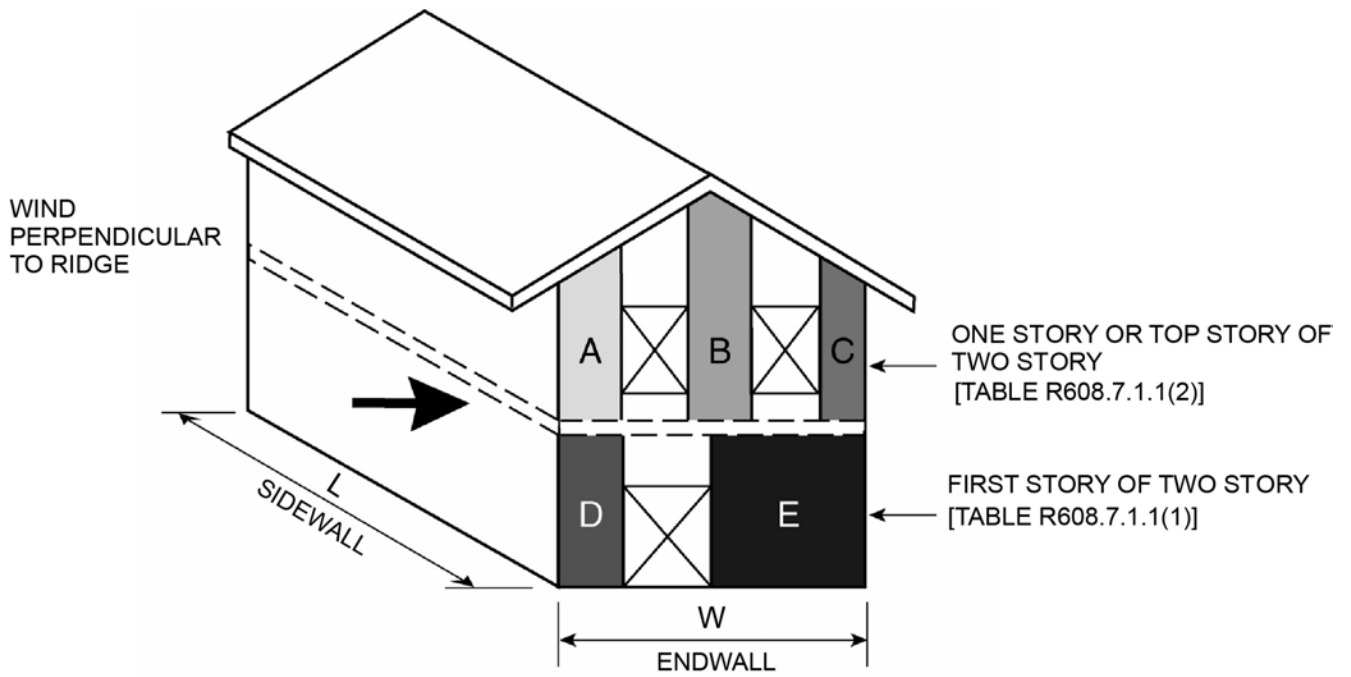
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TABLE R608.7.1.1(6)
REDUCTION FACTOR FOR DESIGN STRENGTH, R_3 , FOR FLAT, WAFFLE- AND SCREEN-GRID WALLS^{a, c}

NOMINAL THICKNESS OF WALL (inches)	VERTICAL BARS AT EACH END OF SOLID WALL SEGMENT		VERTICAL REINFORCEMENT LAYOUT DETAIL [see Figure R608.7.1.1(2)]	REDUCTION FACTOR, R_3 , FOR LENGTH OF SOLID WALL			
	Number of bars	Bar size		Horizontal and vertical shear reinforcement provided			
				No		Yes ^d	
				40,000 ^b	60,000 ^b	40,000 ^b	60,000 ^b
Flat walls							
4	2	4	1	0.74	0.61	0.74	0.50
	3	4	2	0.61	0.61	0.52	0.27
	2	5	1	0.61	0.61	0.48	0.25
	3	5	2	0.61	0.61	0.26	0.18
6	2	4	3	0.70	0.48	0.70	0.48
	3	4	4	0.49	0.38	0.49	0.33
	2	5	3	0.46	0.38	0.46	0.31
	3	5	4	0.38	0.38	0.32	0.16
8	2	4	3	0.70	0.47	0.70	0.47
	3	4	5	0.47	0.32	0.47	0.32
	2	5	3	0.45	0.31	0.45	0.31
	4	4	6	0.36	0.28	0.36	0.25
	3	5	5	0.31	0.28	0.31	0.16
	4	5	6	0.28	0.28	0.24	0.12
10	2	4	3	0.70	0.47	0.70	0.47
	2	5	3	0.45	0.30	0.45	0.30
	4	4	7	0.36	0.25	0.36	0.25
	6	4	8	0.25	0.22	0.25	0.13
	4	5	7	0.24	0.22	0.24	0.12
	6	5	8	0.22	0.22	0.12	0.08
Waffle-grid walls^e							
6	2	4	3	0.78	0.78	0.70	0.48
	3	4	4	0.78	0.78	0.49	0.25
	2	5	3	0.78	0.78	0.46	0.23
	3	5	4	0.78	0.78	0.24	0.16
8	2	4	3	0.78	0.78	0.70	0.47
	3	4	5	0.78	0.78	0.47	0.24
	2	5	3	0.78	0.78	0.45	0.23
	4	4	6	0.78	0.78	0.36	0.18
	3	5	5	0.78	0.78	0.23	0.16
	4	5	6	0.78	0.78	0.18	0.13
Screen-grid walls^e							
6	2	4	3	0.93	0.93	0.70	0.48
	3	4	4	0.93	0.93	0.49	0.25
	2	5	3	0.93	0.93	0.46	0.23
	3	5	4	0.93	0.93	0.24	0.16

For SI: 1 inch = 25.4 mm, 1,000 pounds per square inch = 6.895 MPa.

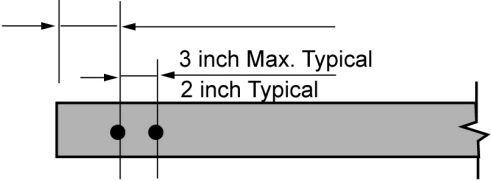
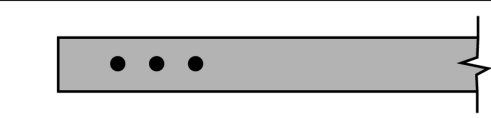
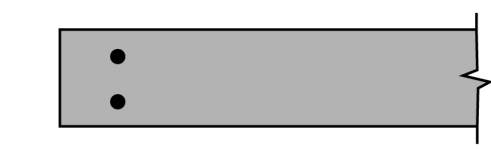
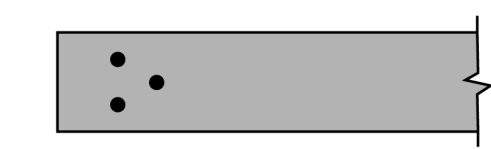
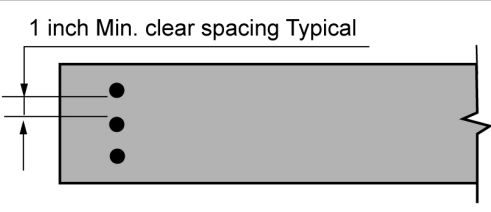
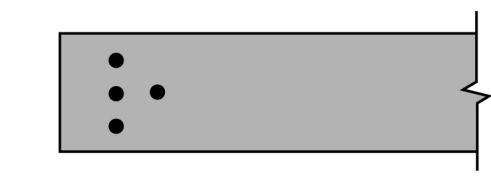

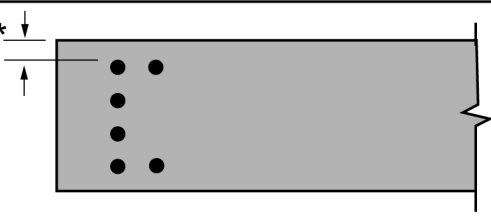
- a. See Note e to Table R608.7.1.1(1) for application of adjustment factors in this table.
- b. Yield strength in pounds per square inch of vertical wall reinforcement at ends of solid wall segments.
- c. Values are based on concrete with a specified compressive strength, f'_c , of 2,500 psi. Where concrete with f'_c of not less than 3,000 psi is used, values in shaded cells are permitted to be decreased by multiplying by 0.91.
- d. Horizontal and vertical shear reinforcement shall be provided in accordance with Section R608.7.2.2.
- e. Each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall be not less than 5½ inches for 6-inch-nominal waffle- and screen-grid walls, and not less than 7½ inches for 8-inch-nominal waffle-grid walls. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected from Figure R608.7.1.1(2) and provide the cover required by Section R608.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or use of flat wall forms is permitted.



NOTE: EACH SOLID WALL SEGMENT (A, B, C, D, E, AND F) SHALL COMPLY WITH THE MINIMUM SOLID WALL SEGMENT LENGTH IN ORDER TO BE APPLICABLE TO THE MINIMUM SOLID WALL LENGTH EQUATIONS SEE SECTION R608.7.2

FIGURE R608.7.1.1(1)
MINIMUM SOLID WALL LENGTH

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DETAIL NO.	NOM. WALL THICKNESS, IN.	REINFORCEMENT LAYOUT AT ENDS OF SOLID WALL SEGMENTS	NOTES
1	4		<p>For SI: 1 inch = 25.4 mm.</p> <ol style="list-style-type: none"> See Table R608.7(4) for use of details. Minimum length of solid wall segment and size and grade of reinforcement in each end of each solid wall segment shall be determined from Table R608.7.1.1(6). For minimum cover requirements, see Section R608.5.4.1. For details 3 - 8 where two or more bars are in the same row parallel to the end of the segment, place bars so that corner bars are as close to the sides of the wall segments as minimum cover requirements of Section R608.5.4.1 will permit. For waffle- and screen-grid walls, each end of each solid wall segment shall have rectangular flanges. In the through-the-wall dimension, the flange shall be not less than 5½ inches for 6-inch nominal waffle- and screen-grid forms, and not less than 7½ inches for 8-inch nominal waffle-grid forms. In the in-plane dimension, flanges shall be long enough to accommodate the vertical reinforcement required by the layout detail selected and provide the cover required by Section R608.5.4.1. If necessary to achieve the required dimensions, form material shall be removed or flat wall forms are permitted. See Table R608.7.1.1(6), Note e.
2	4		
3	6 8 10		
4	6		
5	8		
6	8		
7	10		
8	10		

* For minimum cover see Section R608.5.4.1

FIGURE R608.7.1.1(2)
VERTICAL REINFORCEMENT LAYOUT DETAIL

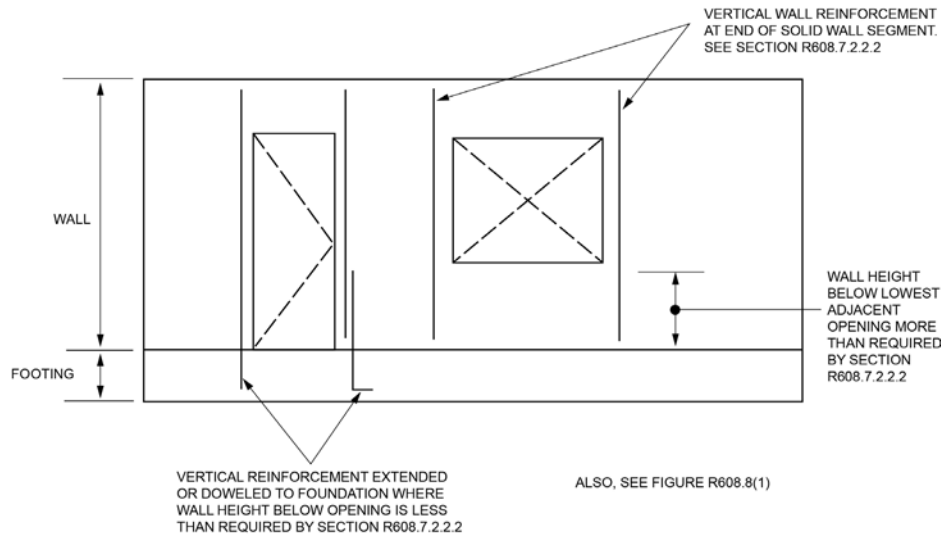


FIGURE R608.7.1.1(3)
VERTICAL WALL REINFORCEMENT ADJACENT TO WALL OPENINGS

R608.7.2.2 Reinforcement in solid wall segments.

R608.7.2.2.1 Horizontal shear reinforcement.

Where reduction factors for design strength, R_3 , from Table R608.7.1.1(6) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have horizontal reinforcement consisting of minimum No. 4 bars. Horizontal shear reinforcement shall be the same grade of steel required for the vertical reinforcement at the ends of solid wall segments by Section R608.7.2.2.2.

The spacing of horizontal reinforcement shall not exceed the smaller of one-half the length of the solid wall segment, minus 2 inches (51 mm), and 18 inches (457 mm). Horizontal shear reinforcement shall terminate in accordance with Section R608.6.4.

R608.7.2.2.2 Vertical reinforcement. Vertical reinforcement applicable to the reduction factor(s) for design strength, R_3 , from Table R608.7.1.1(6) that is used, shall be located at each end of each solid wall segment in accordance with the applicable detail in Figure R608.7.1.1(2). The No. 4 vertical bar required on each side of an opening by Section R608.8.1.2 is permitted to be used as reinforcement at the ends of solid wall segments where installed in accordance with the applicable detail in Figure R608.7.1.1(2). There shall be not less than two No. 4 bars at each end of solid wall segments located as required by the applicable detail in Figure R608.7.1.1(2). One of the bars at each end of solid wall segments shall be deemed to meet the requirements for vertical wall reinforcement required by Section R608.6.

The vertical wall reinforcement at each end of each solid wall segment shall be developed below the bottom of the adjacent wall opening [see Figure R608.7.1.1(3)] by one of the following methods:

1. Where the wall height below the bottom of the adjacent opening is equal to or greater than 22

inches (559 mm) for No. 4 or 28 inches (711 mm) for No. 5 vertical wall reinforcement, reinforcement around openings in accordance with Section R608.8.1 shall be sufficient.

2. Where the wall height below the bottom of the adjacent opening is less than required by Item 1, the vertical wall reinforcement adjacent to the opening shall extend into the footing far enough to develop the bar in tension in accordance with Section R608.5.4.4 and Figure R608.5.4(2), or shall be lap-spliced with a dowel that is embedded in the footing far enough to develop the dowel-bar in tension.

R608.7.2.2.3 Vertical shear reinforcement.

Where reduction factors for design strength, R_3 , from Table R608.7.1.1(6) based on horizontal and vertical shear reinforcement being provided are used, solid wall segments shall have vertical reinforcement consisting of minimum No. 4 bars. Vertical shear reinforcement shall be the same grade of steel required by Section R608.7.2.2.2 for the vertical reinforcement at the ends of solid wall segments. The spacing of vertical reinforcement throughout the length of the segment shall not exceed the smaller of one third the length of the segment, and 18 inches (457 mm). Vertical shear reinforcement shall be continuous between stories in accordance with Section R608.6.3, and shall terminate in accordance with Section R608.6.4. Vertical shear reinforcement required by this section is permitted to be used for vertical reinforcement required by Table R608.6(1), R608.6(2), R608.6(3) or R608.6(4), whichever is applicable.

R608.7.2.3 Solid wall segments at corners.

At all interior and exterior corners of exterior walls, a solid wall segment shall extend the full height of each wall *story*. The segment shall have the length required to develop the horizontal reinforcement above and below the adjacent opening in tension in accordance with Section

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R608.5.4.4. For an exterior corner, the limiting dimension is measured on the outside of the wall, and for an interior corner the limiting dimension is measured on the inside of the wall. See Section R608.8.1. The length of a segment contributing to the required length of solid wall shall comply with Section R608.7.2.1.

The end of a solid wall segment complying with the minimum length requirements of Section R608.7.2.1 shall be located not more than 6 feet (1829 mm) from each corner.

R608.8 Requirements for lintels and reinforcement around openings.

R608.8.1 Reinforcement around openings. Reinforcement shall be provided around openings in walls equal to or greater than 2 feet (610 mm) in width in accordance with this section and Figure R608.8(1), in addition to the minimum wall reinforcement required by Sections R404.1.3, R608.6 and R608.7. Vertical wall reinforcement required by this section is permitted to be used as reinforcement at the ends of solid wall segments required by Section R608.7.2.2.2 provided it is located in accordance with Section R608.8.1.2. Wall openings shall have a minimum depth of concrete over the width of the opening of 8 inches (203 mm) in flat walls and waffle-grid walls, and 12 inches (305 mm) in screen-grid walls. Wall openings in waffle-grid and screen-grid walls shall be located such that not less than one-half of a vertical core occurs along each side of the opening.

R608.8.1.1 Horizontal reinforcement. Lintels complying with Section R608.8.2 shall be provided above wall openings equal to or greater than 2 feet (610 mm) in width.

Openings equal to or greater than 2 feet (610 mm) in width shall have not less than one No. 4 bar placed within 12 inches (305 mm) of the bottom of the opening. See Figure R608.8(1).

Horizontal reinforcement placed above and below an opening shall extend beyond the edges of the opening the dimension required to develop the bar in tension in accordance with Section R608.5.4.4.

Exception: Continuous horizontal wall reinforcement placed within 12 inches (305 mm) of the top of the wall *story* as required in Sections R404.1.3.2 and R608.6.2 is permitted in lieu of top or bottom lintel reinforcement required by Section R608.8.2 provided that the continuous horizontal wall reinforcement meets the location requirements specified in Figures R608.8(2), R608.8(3), and R608.8(4) and the size requirements specified in Tables R608.8(2) through R608.8(10).

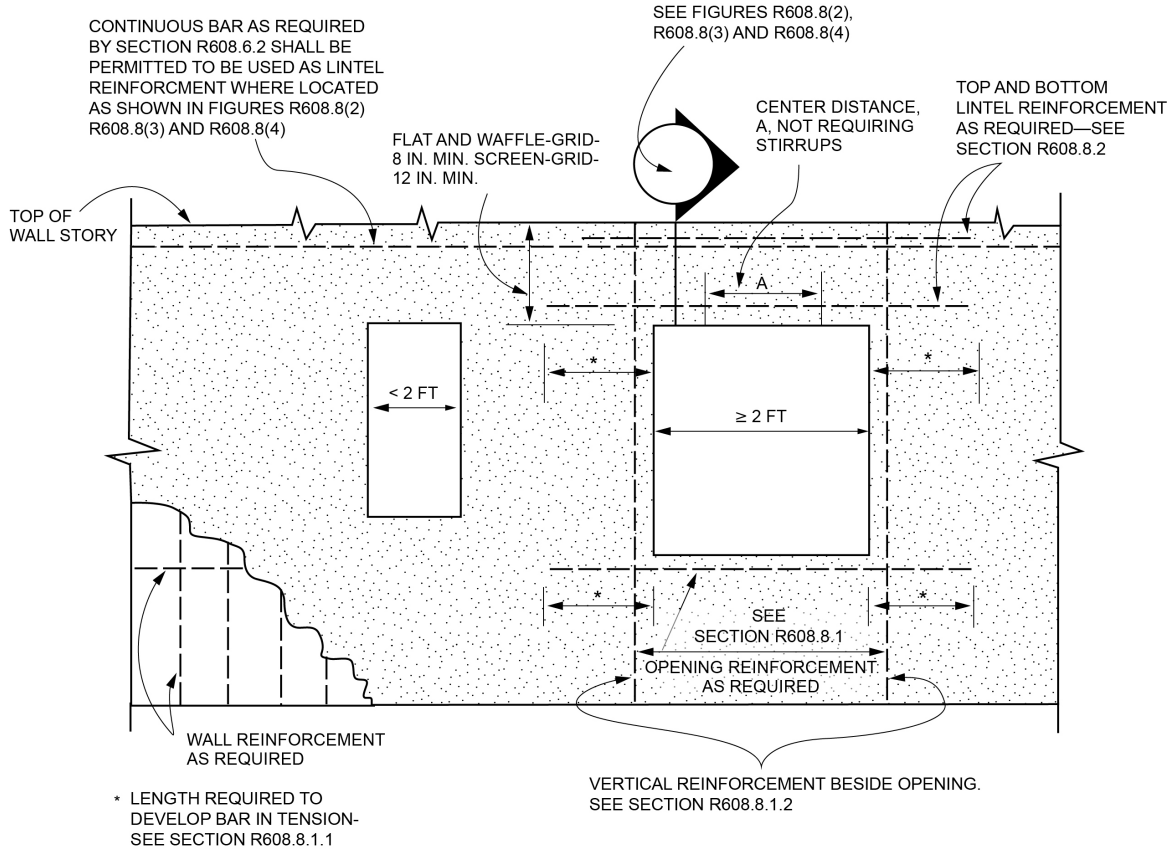
R608.8.1.2 Vertical reinforcement. Not less than one No. 4 bar [Grade 40 (280 MPa)] shall be provided on each side of openings equal to or greater than 2 feet (610 mm) in width. The vertical reinforcement required by this section shall extend the full height of the wall story and shall be located within 12 inches (305 mm) of each side of the opening. The vertical reinforcement required on

each side of an opening by this section is permitted to serve as reinforcement at the ends of solid wall segments in accordance with Section R608.7.2.2.2, provided it is located as required by the applicable detail in Figure R608.7.1.1(2). Where the vertical reinforcement required by this section is used to satisfy the requirements of Section R608.7.2.2.2 in waffle- and screen-grid walls, a concrete flange shall be created at the ends of the solid wall segments in accordance with Table R608.7.1.1(6), Note e. In the top-most story, the reinforcement shall terminate in accordance with Section R608.6.4.

R608.8.2 Lintels. Lintels shall be provided over all openings equal to or greater than 2 feet (610 mm) in width. Lintels with uniform loading shall conform to Sections R608.8.2.1 and R608.8.2.2, or Section R608.8.2.3. Lintels supporting concentrated loads, such as from roof or floor beams or girders, shall be designed in accordance with ACI 318.

R608.8.2.1 Lintels designed for gravity load-bearing conditions. Where a lintel will be subjected to gravity load conditions 1 through 5 of Table R608.8(1), the clear span of the lintel shall not exceed that permitted by Tables R608.8(2) through R608.8(8). The maximum clear span of lintels with and without stirrups in flat walls shall be determined in accordance with Tables R608.8(2) through R608.8(5), and constructed in accordance with Figure R608.8(2). The maximum clear span of lintels with and without stirrups in waffle-grid walls shall be determined in accordance with Tables R608.8(6) and R608.8(7), and constructed in accordance with Figure R608.8(3). The maximum clear span of lintels with and without stirrups in screen-grid walls shall be determined in accordance with Table R608.8(8), and constructed in accordance with Figure R608.8(4).

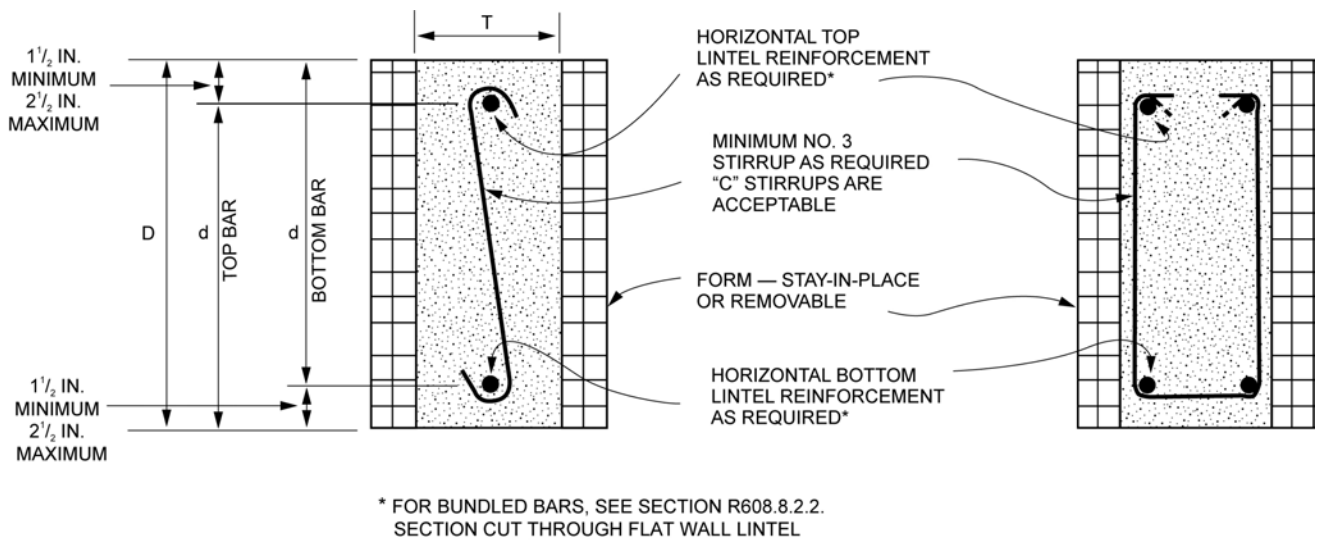
Where required by the applicable table, No. 3 stirrups shall be installed in lintels at a maximum spacing of $d/2$ where d equals the depth of the lintel, D , less the cover of the concrete as shown in Figures R608.8(2) through R608.8(4). The smaller value of d computed for the top and bottom bar shall be used to determine the maximum stirrup spacing. Where stirrups are required in a lintel with a single bar or two bundled bars in the top and bottom, they shall be fabricated like the letter “c” or “s” with 135-degree (2.36 rad) standard hooks at each end that comply with Section R608.5.4.5 and Figure R608.5.4(3) and installed as shown in Figures R608.8(2) through R608.8(4). Where two bars are required in the top and bottom of the lintel and the bars are not bundled, the bars shall be separated by not less than 1 inch (25 mm). The free end of the stirrups shall be fabricated with 90- or 135-degree (1.57 or 2.36 rad) standard hooks that comply with Section R608.5.4.5 and Figure R608.5.4(3) and installed as shown in Figures R608.8(2) and R608.8(3). For flat, waffle-grid and screen-grid lintels, stirrups are not required in the center distance, A , portion of spans in accordance with Figure R608.8(1) and Tables R608.8(2) through R608.8(8). See Section R608.8.2.2, Item 5, for requirement for stirrups through out lintels with bundled bars.



ELEVATION OF WALL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

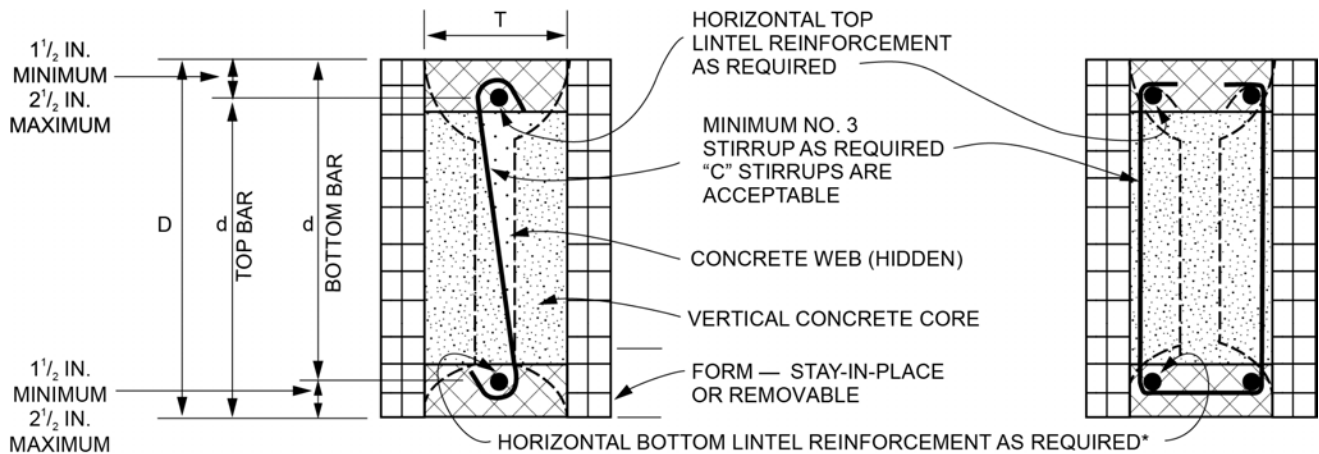
FIGURE R608.8(1)
REINFORCEMENT OF OPENINGS



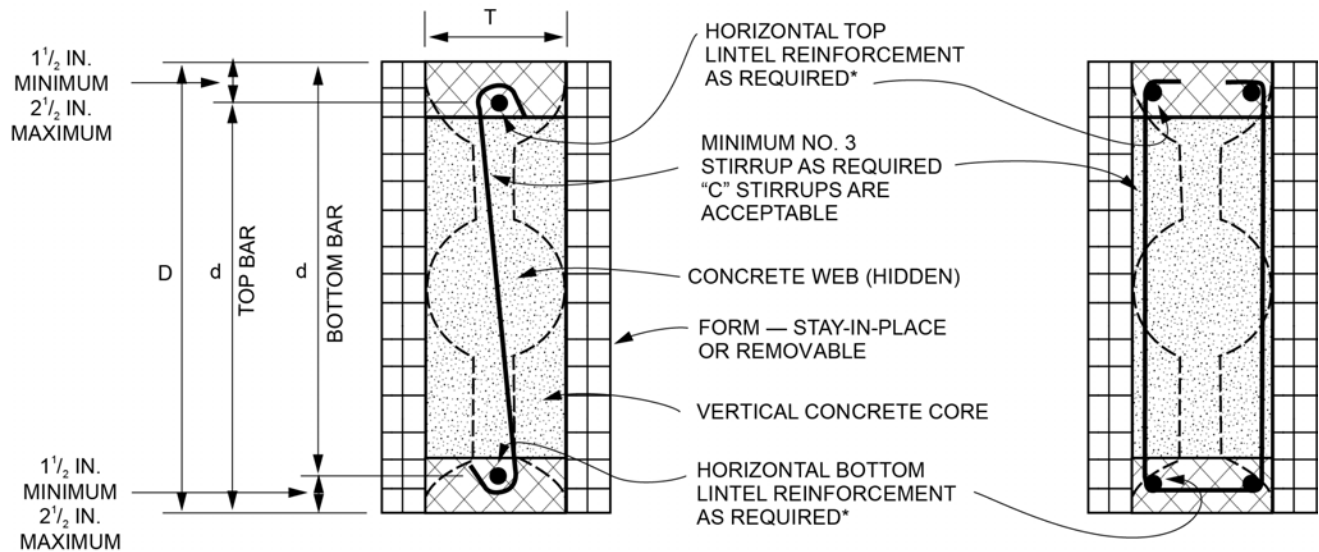
For SI: 1 inch = 25.4 mm.

FIGURE R608.8(2)
LINTEL FOR FLAT WALLS

WALL CONSTRUCTION



(a) SINGLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL



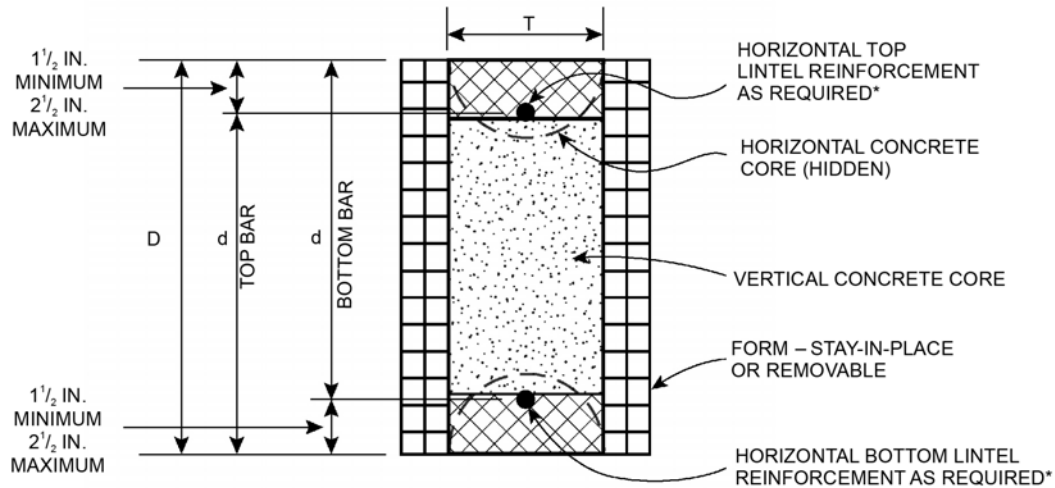
(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A WAFFLE-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION R608.8.2.2.

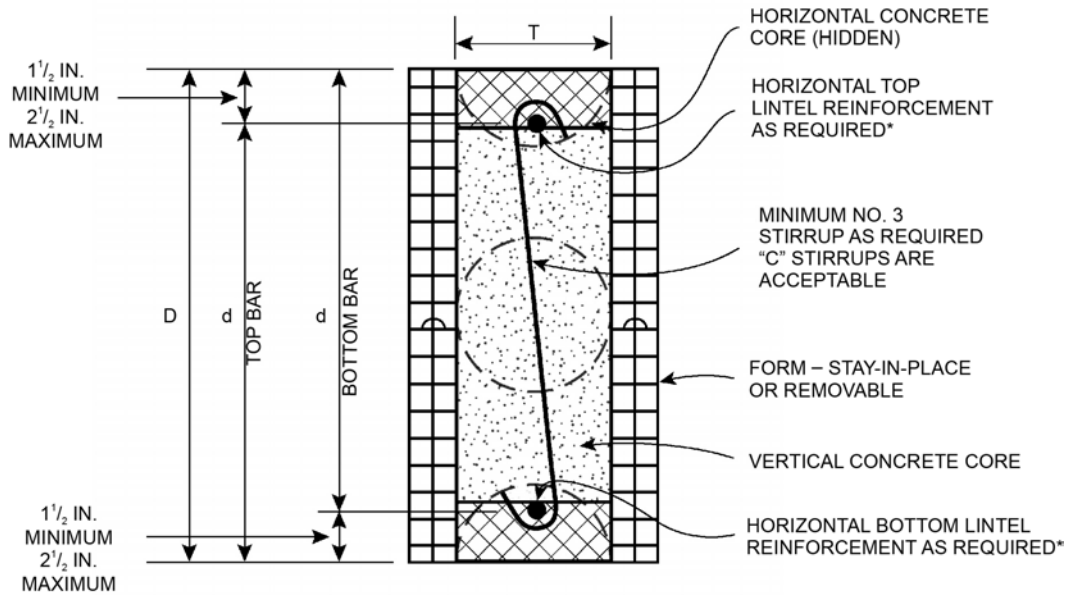
NOTE: CROSS HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED, IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES SHALL HAVE A MINIMUM THICKNESS OF 3 IN., AND A MINIMUM WIDTH OF 5 IN. AND 7 IN. IN 6 IN. NOMINAL AND 8 IN. NOMINAL WAFFLE-GRID WALLS, RESPECTIVELY. SEE NOTE a TO TABLES R608.8(6) AND R608.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE R608.8(3)
LINTELS FOR WAFFLE-GRID WALLS



(a) SINGLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A SCREEN-GRID LINTEL



(b) DOUBLE FORM HEIGHT SECTION CUT THROUGH VERTICAL CORE OF A SCREEN-GRID LINTEL

*FOR BUNDLED BARS, SEE SECTION R608.8.2.2

NOTE: CROSS HATCHING REPRESENTS THE AREA IN WHICH FORM MATERIAL SHALL BE REMOVED, IF NECESSARY, TO CREATE FLANGES CONTINUOUS THE LENGTH OF THE LINTEL. FLANGES SHALL HAVE A MINIMUM THICKNESS OF 2.5 IN. AND A MINIMUM WIDTH OF 5 IN. SEE NOTE a TO TABLES R608.8(8) AND R608.8(10).

For SI: 1 inch = 25.4 mm.

FIGURE R608.8(4)
LINTELS FOR SCREEN-GRID WALLS

WALL CONSTRUCTION

**TABLE R608.8(1)
LINTEL DESIGN LOADING CONDITIONS^{a, b, d}**

DESCRIPTION OF LOADS AND OPENINGS ABOVE INFLUENCING DESIGN OF LINTEL			DESIGN LOAD CONDITION ^c
Opening in wall of top story of two-story building, or first story of one-story building			
Wall supporting loads from roof, including attic floor, if applicable, and	Top of lintel equal to or less than W/2 below top of wall		2
	Top of lintel greater than W/2 below top of wall		NLB
Wall not supporting loads from roof or attic floor			NLB
Opening in wall of first story of two-story building where wall immediately above is of concrete construction, or opening in basement wall of one-story building where wall immediately above is of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above		1
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	4
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel			NLB
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above		NLB
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in basement wall of two-story building where walls of two stories above are of concrete construction			
LB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, and	Top of lintel greater than W/2 below bottom of opening in story above		1
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	1
		Opening is partially within the footprint of the opening in the story above	5
LB ledger board mounted to side of wall with bottom of ledger more than W/2 above top of lintel			NLB
NLB ledger board mounted to side of wall with bottom of ledger less than or equal to W/2 above top of lintel, or no ledger board, and	Top of lintel greater than W/2 below bottom of opening in story above		NLB
	Top of lintel less than or equal to W/2 below bottom of opening in story above, and	Opening is entirely within the footprint of the opening in the story above	NLB
		Opening is partially within the footprint of the opening in the story above	1
Opening in wall of first story of two-story building where wall immediately above is of light-frame construction, or opening in basement wall of one-story building where wall immediately above is of light-frame construction			
Wall supporting loads from roof, second floor and top-story wall of light-frame construction, and	Top of lintel equal to or less than W/2 below top of wall		3
	Top of lintel greater than W/2 below top of wall		NLB
Wall not supporting loads from roof or second floor			NLB

- a. LB means load bearing, NLB means nonload bearing, and W means width of opening.
- b. Footprint is the area of the wall below an opening in the story above, bounded by the bottom of the opening and vertical lines extending downward from the edges of the opening.
- c. For design loading condition “NLB” see Tables R608.8(9) and R608.8(10). For all other design loading conditions, see Tables R608.8(2) through R608.8(8).
- d. An NLB ledger board is a ledger attached to a wall that is parallel to the span of the floor, roof or ceiling framing that supports the edge of the floor, ceiling or roof.

TABLE R608.8(2)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 4-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8	Span without stirrups ^{i,j}		3-2	3-4	2-4	2-6	2-2	2-1	2-0	2-0	2-0
	1-#4	40,000	5-2	5-5	4-1	4-3	3-10	3-7	3-4	2-9	2-9
		60,000	6-2	6-5	4-11	5-1	4-6	4-2	3-8	2-11	2-10
	1-#5	40,000	6-3	6-7	5-0	5-2	4-6	4-2	3-8	2-11	2-10
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k,1}$			1-1	1-2	0-8	0-9	0-7	0-6	0-5	0-4	0-4
12	Span without stirrups ^{i,j}		3-4	3-7	2-9	2-11	2-8	2-6	2-5	2-2	2-2
	1-#4	40,000	6-7	7-0	5-4	5-7	5-0	4-9	4-4	3-8	3-7
		60,000	7-11	8-6	6-6	6-9	6-0	5-9	5-3	4-5	4-4
	1-#5	40,000	8-1	8-8	6-7	6-10	6-2	5-10	5-4	4-6	4-5
		60,000	9-8	10-4	7-11	8-2	7-4	6-11	6-2	4-10	4-8
	2-#4	40,000	9-1	9-8	7-4	7-8	6-10	6-6	6-0	4-10	4-8
	1-#6	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k,1}$			1-8	1-11	1-1	1-3	1-0	0-11	0-9	0-6	0-6
16	Span without stirrups ^{i,j}		4-7	5-0	3-11	4-0	3-8	3-7	3-4	3-1	3-0
	1-#4	40,000	6-8	7-3	5-6	5-9	5-2	4-11	4-6	3-10	3-8
		60,000	9-3	10-1	7-9	8-0	7-2	6-10	6-3	5-4	5-2
	1-#4	40,000	9-6	10-4	7-10	8-2	7-4	6-11	6-5	5-5	5-3
		60,000	11-5	12-5	9-6	9-10	8-10	8-4	7-9	6-6	6-4
	2-#4	40,000	10-7	11-7	8-10	9-2	8-3	7-9	7-2	6-1	5-11
	1-#6	60,000	12-9	13-10	10-7	11-0	9-10	9-4	8-7	6-9	6-6
	2-#5	40,000	13-0	14-1	10-9	11-2	9-11	9-2	8-2	6-6	6-3
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance $A^{k,1}$			2-3	2-8	1-7	1-8	1-4	1-3	1-0	0-9	0-8
20	Span without stirrups $A^{i,j}$		5-9	6-5	5-0	5-2	4-9	4-7	4-4	3-11	3-11
	1-#4	40,000	7-5	8-2	6-3	6-6	5-10	5-7	5-1	4-4	4-2
		60,000	9-0	10-0	7-8	7-11	7-1	6-9	6-3	5-3	5-1
	1-#5	40,000	9-2	10-2	7-9	8-1	7-3	6-11	6-4	5-4	5-2
		60,000	12-9	14-2	10-10	11-3	10-1	9-7	8-10	7-5	7-3
	2-#4	40,000	11-10	13-2	10-1	10-5	9-4	8-11	8-2	6-11	6-9
	1-#6	60,000	14-4	15-10	12-1	12-7	11-3	10-9	9-11	8-4	8-1
	2-#5	40,000	14-7	16-2	12-4	12-9	11-4	10-6	9-5	7-7	7-3
		60,000	17-5	19-2	14-9	15-3	13-5	12-4	11-0	8-8	8-4
	2-#6	40,000	16-4	18-11	12-7	13-3	11-4	10-6	9-5	7-7	7-3
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k,1}$			2-9	3-5	2-0	2-2	1-9	1-7	1-4	0-11	0-11

(continued)

TABLE R608.8(2)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 4-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
24	Span without stirrups ^{i, j}		6-11	7-9	6-1	6-3	5-9	5-7	5-3	4-9	4-8
	1-#4	40,000	8-0	9-0	6-11	7-2	6-5	6-2	5-8	4-9	4-8
		60,000	9-9	11-0	8-5	8-9	7-10	7-6	6-11	5-10	5-8
	1-#5	40,000	10-0	11-3	8-7	8-11	8-0	7-7	7-0	5-11	5-9
		60,000	13-11	15-8	12-0	12-5	11-2	10-7	9-10	8-3	8-0
	2-#4	40,000	12-11	14-6	11-2	11-6	10-5	9-10	9-1	7-8	7-5
		60,000	15-7	17-7	13-6	13-11	12-7	11-11	11-0	9-3	9-0
	2-#5	40,000	15-11	17-11	13-7	14-3	12-8	11-9	10-8	8-7	8-4
		60,000	19-1	21-6	16-5	17-1	15-1	14-0	12-6	9-11	9-7
	2-#6	40,000	17-7	21-1	14-1	14-10	12-8	11-9	10-8	8-7	8-4
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance $A^{k, 1}$			3-3	4-1	2-5	2-7	2-1	1-11	1-7	1-2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. See Table R608.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ -inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
 - l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(3)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8	Span without stirrups ^{i, j}		4-2	4-8	3-1	3-3	2-10	2-6	2-3	2-0	2-0
	1-#4	40,000	5-1	5-5	4-2	4-3	3-10	3-6	3-3	2-8	2-7
		60,000	6-2	6-7	5-0	5-2	4-8	4-2	3-11	3-3	3-2
	1-#5	40,000	6-3	6-8	5-1	5-3	4-9	4-3	4-0	3-3	3-2
		60,000	7-6	8-0	6-1	6-4	5-8	5-1	4-9	3-8	3-6
	2-#4	40,000	7-0	7-6	5-8	5-11	5-3	4-9	4-5	3-8	3-6
	1-#6	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k, l}$			1-7	1-10	1-1	1-2	0-11	0-9	0-8	0-5	0-5
12	Span without stirrups ^{i, j}		4-2	4-8	3-5	3-6	3-2	2-11	2-9	2-5	2-4
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11
		60,000	7-9	8-6	6-6	6-9	6-1	5-6	5-1	4-3	4-1
	1-#5	40,000	7-11	8-8	6-8	6-11	6-2	5-7	5-2	4-4	4-2
		60,000	9-7	10-6	8-0	8-4	7-6	6-9	6-3	5-2	5-1
	2-#4	40,000	8-11	9-9	7-6	7-9	6-11	6-3	5-10	4-10	4-8
	1-#6	60,000	10-8	11-9	8-12	9-4	8-4	7-6	7-0	5-10	5-8
	2-#5	40,000	10-11	12-0	9-2	9-6	8-6	7-8	7-2	5-6	5-3
		60,000	12-11	14-3	10-10	11-3	10-1	9-0	8-1	6-1	5-10
	2-#6	40,000	12-9	14-0	10-8	11-1	9-7	8-1	7-3	5-6	5-3
	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k, l}$			2-6	3-0	1-9	1-10	1-6	1-3	1-1	0-9	0-8
16	Span without stirrups ^{i, j}		5-7	6-5	4-9	4-11	4-5	4-0	3-10	3-4	3-4
	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6
		60,000	7-10	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4
		60,000	11-1	12-6	9-7	9-11	8-11	8-0	7-6	6-2	6-0
	2-#4	40,000	10-3	11-7	8-10	9-2	8-3	7-6	6-11	5-9	5-7
	1-#6	60,000	12-5	14-0	10-9	11-1	10-0	9-0	8-5	7-0	6-9
	2-#5	40,000	12-8	14-3	10-11	11-4	10-2	9-2	8-7	6-9	6-6
		60,000	15-2	17-1	13-1	13-7	12-3	11-0	10-3	7-11	7-7
	2-#6	40,000	14-11	16-9	12-8	13-4	11-4	9-8	8-8	6-9	6-6
	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{k, l}$			3-3	4-1	2-5	2-7	2-1	1-9	1-6	1-0	1-0

(continued)

TABLE R608.8(3)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^e (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
20	Span without stirrups ^{i, j}		6-11	8-2	6-1	6-3	5-8	5-2	4-11	4-4	4-3
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-5	9-9	8-10	8-0	7-5	6-2	6-0
	2-#4	40,000	9-11	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
		60,000	13-9	15-10	12-2	12-8	11-5	10-3	9-7	7-11	7-9
	2-#5	40,000	14-0	16-2	12-5	12-11	11-7	10-6	9-9	7-11	7-8
		60,000	16-11	19-6	15-0	15-6	14-0	12-7	11-9	9-1	8-9
	2-#6	40,000	16-7	19-1	14-7	15-3	13-1	11-3	10-2	7-11	7-8
		60,000	19-11	22-10	17-4	18-3	15-6	13-2	11-10	9-1	8-9
	Center distance <i>A</i> ^{k, 1}			3-11	5-2	3-1	3-3	2-8	2-2	1-11	1-4
24	Span without stirrups ^{i, j}		8-2	9-10	7-4	7-8	6-11	6-4	5-11	5-3	5-2
	1-#5	40,000	9-5	11-1	8-7	8-10	8-0	7-3	6-9	5-7	5-5
		60,000	11-6	13-6	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4	40,000	10-8	12-6	9-8	10-0	9-0	8-2	7-7	6-4	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	15-2	17-9	13-9	14-3	12-10	11-7	10-10	9-0	8-9
		60,000	18-4	21-6	16-7	17-3	15-6	14-0	13-1	10-4	10-0
	2-#6	40,000	18-0	21-1	16-4	16-11	14-10	12-9	11-8	9-2	8-11
		60,000	21-7	25-4	19-2	20-4	17-2	14-9	13-4	10-4	10-0
	Center distance <i>A</i> ^{k, 1}			4-6	6-2	3-8	4-0	3-3	2-8	2-3	1-7

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. See Table R608.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
 - 1. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(4)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^b , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8	Span without stirrups ^{i, j}		4-4	4-9	3-7	3-9	3-4	2-10	2-7	2-1	2-0
	1-#4	40,000	4-4	4-9	3-7	3-9	3-4	2-11	2-9	2-3	2-2
		60,000	6-1	6-7	5-0	5-3	4-8	4-0	3-9	3-1	3-0
	1-#5	40,000	6-2	6-9	5-2	5-4	4-9	4-1	3-10	3-2	3-1
		60,000	7-5	8-1	6-2	6-5	5-9	4-11	4-7	3-9	3-8
	2-#4	40,000	6-11	7-6	5-9	6-0	5-4	4-7	4-4	3-6	3-5
		1-#6	60,000	8-3	9-0	6-11	7-2	6-5	5-6	5-2	4-2
	2-#5	40,000	8-5	9-2	7-0	7-3	6-6	5-7	5-3	4-2	4-0
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance $A^{k, 1}$		2-1	2-6	1-5	1-6	1-3	0-11	0-10	0-6	0-6
12	Span without stirrups ^{i, j}		4-10	5-8	4-0	4-2	3-9	3-2	3-0	2-7	2-6
	1-#4	40,000	5-5	6-1	4-8	4-10	4-4	3-9	3-6	2-10	2-10
		60,000	6-7	7-5	5-8	5-11	5-4	4-7	4-3	3-6	3-5
	1-#5	40,000	6-9	7-7	5-9	6-0	5-5	4-8	4-4	3-7	3-6
		60,000	9-4	10-6	8-1	8-4	7-6	6-6	6-1	5-0	4-10
	2-#4	40,000	8-8	9-9	7-6	7-9	7-0	6-0	5-8	4-7	4-6
		1-#6	60,000	10-6	11-9	9-1	9-5	8-5	7-3	6-10	5-5
	2-#5	40,000	10-8	12-0	9-3	9-7	8-7	7-5	6-11	5-6	5-4
		60,000	12-10	14-5	11-1	11-6	10-4	8-11	8-4	6-7	6-4
	2-#6	40,000	12-7	14-2	10-10	11-3	10-2	8-3	7-6	5-6	5-4
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance $A^{k, 1}$		3-2	4-0	2-4	2-6	2-0	1-6	1-4	0-11	0-10	
16	Span without stirrups ^{i, j}		6-5	7-9	5-7	5-10	5-2	4-5	4-2	3-7	3-6
	1-#4	40,000	6-2	7-1	5-6	5-8	5-1	4-5	4-2	3-5	3-4
		60,000	7-6	8-8	6-8	6-11	6-3	5-5	5-1	4-2	4-0
	1-#5	40,000	7-8	8-10	6-10	7-1	6-4	5-6	5-2	4-3	4-1
		60,000	9-4	10-9	8-4	8-7	7-9	6-8	6-3	5-2	5-0
	2-#4	40,000	8-8	10-0	7-8	8-0	7-2	6-2	5-10	4-9	4-8
		1-#6	60,000	12-0	13-11	10-9	11-2	10-0	8-8	8-1	6-8
	2-#5	40,000	12-3	14-2	11-0	11-4	10-3	8-10	8-3	6-9	6-7
		60,000	14-10	17-2	13-3	13-8	12-4	10-8	10-0	7-11	7-8
	2-#6	40,000	14-6	16-10	13-0	13-5	12-1	10-1	9-2	6-11	6-8
60,000		17-5	20-2	15-7	16-1	14-6	11-10	10-8	7-11	7-8	
Center distance $A^{k, 1}$		4-1	5-5	3-3	3-6	2-10	2-1	1-10	1-3	1-2	

(continued)

TABLE R608.8(4)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^b (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^b , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
20	Span without stirrups ^{i, j}		7-10	9-10	7-1	7-5	6-7	5-8	5-4	4-7	4-6
	1-#5	40,000	8-4	9-11	7-8	8-0	7-2	6-3	5-10	4-9	4-8
		60,000	10-2	12-1	9-5	9-9	8-9	7-7	7-1	5-10	5-8
	2-#4	40,000	9-5	11-3	8-8	9-0	8-1	7-0	6-7	5-5	5-3
		60,000	11-6	13-8	10-7	11-0	9-11	8-7	8-0	6-7	6-5
	2-#5	40,000	11-9	13-11	10-10	11-2	10-1	8-9	8-2	6-8	6-7
		60,000	16-4	19-5	15-0	15-7	14-0	12-2	11-4	9-3	9-0
	2-#6	40,000	16-0	19-0	14-9	15-3	13-9	11-10	10-10	8-3	8-0
		60,000	19-3	22-11	17-9	18-5	16-7	13-7	12-4	9-3	9-0
	Center distance <i>A</i> ^{k, l}			4-10	6-10	4-1	4-5	3-7	2-8	2-4	1-7
24	Span without stirrups ^{i, j}		9-2	11-9	8-7	8-11	8-0	6-11	6-6	5-7	5-6
	1-#5	40,000	8-11	10-10	8-6	8-9	7-11	6-10	6-5	5-3	5-2
		60,000	10-11	13-3	10-4	10-8	9-8	8-4	7-10	6-5	6-3
	2-#4	40,000	10-1	12-3	9-7	9-11	8-11	7-9	7-3	6-0	5-10
		60,000	12-3	15-0	11-8	12-1	10-11	9-5	8-10	7-3	7-1
	2-#5	40,000	12-6	15-3	11-11	12-4	11-1	9-7	9-0	7-5	7-3
		60,000	17-6	21-3	16-7	17-2	15-6	13-5	12-7	10-4	10-1
	2-#6	40,000	17-2	20-11	16-3	16-10	15-3	13-2	12-4	9-7	9-4
		60,000	20-9	25-3	19-8	20-4	18-5	15-4	14-0	10-7	10-3
	Center distance <i>A</i> ^{k, l}			5-6	8-1	4-11	5-3	4-4	3-3	2-10	1-11

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups, as shown in shaded cells, shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

- a. See Table R608.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
 - l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(5)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 10-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8	Span without stirrups ^{i, j}		6-0	7-2	4-7	4-10	4-1	3-1	2-11	2-3	2-2
	1-#4	40,000	4-3	4-9	3-7	3-9	3-4	2-9	2-7	2-1	2-1
		60,000	5-11	6-7	5-0	5-3	4-8	3-10	3-8	2-11	2-11
	1-#5	40,000	6-1	6-9	5-2	5-4	4-9	3-11	3-9	3-0	2-11
		60,000	7-4	8-1	6-3	6-5	5-9	4-9	4-6	3-7	3-7
	2-#4	40,000	6-10	7-6	5-9	6-0	5-5	4-5	4-2	3-4	3-4
		1-#6	60,000	8-2	9-1	6-11	7-2	6-6	5-4	5-0	4-1
	2-#5	40,000	8-4	9-3	7-1	7-4	6-7	5-5	5-1	4-1	4-0
		60,000	9-11	11-0	8-5	8-9	7-10	6-6	6-1	4-8	4-6
	2-#6	40,000	9-9	10-10	8-3	8-7	7-9	6-4	5-10	4-1	4-0
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance $A^{k, 1}$		2-6	3-1	1-10	1-11	1-7	1-1	0-11	0-7	0-7	
12	Span without stirrups ^{i, j}		5-5	6-7	4-7	4-10	4-3	3-5	3-3	2-8	2-8
	1-#4	40,000	5-3	6-0	4-8	4-10	4-4	3-7	3-4	2-9	2-8
		60,000	6-5	7-4	5-8	5-10	5-3	4-4	4-1	3-4	3-3
	1-#5	40,000	6-6	7-6	5-9	6-0	5-5	4-5	4-2	3-5	3-4
		60,000	7-11	9-1	7-0	7-3	6-7	5-5	5-1	4-2	4-0
	2-#4	40,000	7-4	8-5	6-6	6-9	6-1	5-0	4-9	3-10	3-9
		1-#6	60,000	10-3	11-9	9-1	9-5	8-6	7-0	6-7	5-4
	2-#5	40,000	10-5	12-0	9-3	9-7	8-8	7-2	6-9	5-5	5-4
		60,000	12-7	14-5	11-2	11-6	10-5	8-7	8-1	6-6	6-4
	2-#6	40,000	12-4	14-2	10-11	11-4	10-2	8-5	7-8	5-7	5-5
60,000		14-9	17-0	13-1	13-6	12-2	10-0	9-1	6-6	6-4	
Center distance $A^{k, 1}$		3-9	4-11	2-11	3-2	2-7	1-9	1-7	1-0	1-0	
16	Span without stirrups ^{i, j}		7-1	9-0	6-4	6-8	5-10	4-9	4-6	3-9	3-8
	1-#4	40,000	5-11	7-0	5-5	5-8	5-1	4-3	4-0	3-3	3-2
		60,000	7-3	8-7	6-8	6-11	6-3	5-2	4-10	3-11	3-10
	1-#5	40,000	7-4	8-9	6-9	7-0	6-4	5-3	4-11	4-0	3-11
		60,000	9-0	10-8	8-3	8-7	7-9	6-5	6-0	4-11	4-9
	2-#4	40,000	8-4	9-11	7-8	7-11	7-2	5-11	5-7	4-6	4-5
		1-#6	60,000	10-2	12-0	9-4	9-8	8-9	7-3	6-10	5-6
	2-#5	40,000	10-4	12-3	9-6	9-10	8-11	7-4	6-11	5-8	5-6
		60,000	14-4	17-1	13-3	13-8	12-4	10-3	9-8	7-10	7-8
	2-#6	40,000	14-1	16-9	13-0	13-5	12-2	10-1	9-6	7-0	6-10
60,000		17-0	20-2	15-8	16-2	14-7	12-0	10-11	8-0	7-9	
Center distance $A^{k, 1}$		4-9	6-8	4-0	4-4	3-6	2-5	2-2	1-5	1-4	

(continued)

TABLE R608.8(5)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 10-INCH-NOMINAL THICK FLAT LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, m}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^f (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
20	Span without stirrups ^{i, j}		8-7	11-4	8-1	8-5	7-5	6-1	5-9	4-10	4-9
	1-#4	40,000	6-5	7-10	6-2	6-4	5-9	4-9	4-6	3-8	3-7
		60,000	7-10	9-7	7-6	7-9	7-0	5-10	5-6	4-5	4-4
	1-#5	40,000	8-0	9-9	7-8	7-11	7-2	5-11	5-7	4-6	4-5
		60,000	9-9	11-11	9-4	9-8	8-9	7-3	6-10	5-6	5-5
	2-#4	40,000	9-0	11-1	8-8	8-11	8-1	6-9	6-4	5-2	5-0
		60,000	11-0	13-6	10-6	10-11	9-10	8-2	7-9	6-3	6-2
	2-#5	40,000	11-3	13-9	10-9	11-1	10-0	8-4	7-10	6-5	6-3
		60,000	15-8	19-2	15-0	15-6	14-0	11-8	11-0	8-11	8-9
	2-#6	40,000	15-5	18-10	14-8	15-2	13-9	11-5	10-9	8-6	8-3
60,000		18-7	22-9	17-9	18-5	16-7	13-10	12-9	9-5	9-2	
Center distance <i>A</i> ^{k, l}			5-7	8-4	5-1	5-5	4-5	3-1	2-9	1-10	1-9
24	Span without stirrups ^{i, j}		9-11	13-7	9-9	10-2	9-0	7-5	7-0	5-10	5-9
	1-#5	40,000	8-6	10-8	8-5	8-8	7-10	6-6	6-2	5-0	4-11
		60,000	10-5	13-0	10-3	10-7	9-7	8-0	7-6	6-1	6-0
	2-#4	40,000	9-7	12-1	9-6	9-9	8-10	7-5	7-0	5-8	5-6
		60,000	11-9	14-9	11-7	11-11	10-10	9-0	8-6	6-11	6-9
	2-#5	40,000	12-0	15-0	11-9	12-2	11-0	9-2	8-8	7-1	6-11
		60,000	14-7	18-3	14-4	14-10	13-5	11-2	10-7	8-7	8-5
	2-#6	40,000	14-3	17-11	14-1	14-7	13-2	11-0	10-4	8-5	8-3
		60,000	19-11	25-0	19-7	20-3	18-4	15-3	14-5	10-10	10-7
	Center distance <i>A</i> ^{k, l}			6-3	9-11	6-1	6-6	5-4	3-9	3-4	2-2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

Note: Top and bottom reinforcement for lintels without stirrups, as shown in shaded cells, shall be equal to or greater than that required for lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups.

- a. See Table R608.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note j.
- c. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads and between lintel depths.
- f. DR indicates design required.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- j. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- k. Center distance, A , is the center portion of the clear span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- m. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel clear spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(6)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, o}
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR SPAN 32 FEET

LINTEL DEPTH, D^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^b , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8 ⁱ	Span without stirrups ^{k, l}		2-7	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	5-2	5-5	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	1-#5	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
		60,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	2-#4	40,000	5-9	6-3	4-0	4-3	3-7	3-3	2-11	2-4	2-3
	1-#6	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
Center distance $A^{m, n}$			0-9	0-10	0-6	0-6	0-5	0-5	0-4	STL	STL
12 ⁱ	Span without stirrups ^{k, l}		2-11	3-1	2-6	2-7	2-5	2-4	2-3	2-1	2-0
	1-#4	40,000	5-9	6-2	4-8	4-10	4-4	4-1	3-9	3-2	3-1
		60,000	8-0	8-7	6-6	6-9	6-0	5-5	4-11	3-11	3-10
	1-#5	40,000	8-1	8-9	6-8	6-11	6-0	5-5	4-11	3-11	3-10
		60,000	9-1	10-3	6-8	7-0	6-0	5-5	4-11	3-11	3-10
	2-#4	40,000	9-1	9-9	6-8	7-0	6-0	5-5	4-11	3-11	3-10
	1-#6	40,000	9-1	9-9	6-8	7-0	6-0	5-5	4-11	3-11	3-10
Center distance $A^{m, n}$			1-3	1-5	0-10	0-11	0-9	0-8	0-6	STL	STL
Span without stirrups ^{k, l}			4-0	4-4	3-6	3-7	3-4	3-3	3-1	2-10	2-10
16 ⁱ	1-#4	40,000	6-7	7-3	5-6	5-9	5-2	4-10	4-6	3-9	3-8
		60,000	8-0	8-10	6-9	7-0	6-3	5-11	5-5	4-7	4-5
	1-#5	40,000	8-2	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-6
		60,000	11-5	12-6	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#4	40,000	10-7	11-7	8-11	9-3	8-3	7-7	6-10	5-6	5-4
	1-#6	60,000	12-2	14-0	9-3	9-9	8-4	7-7	6-10	5-6	5-4
	2-#5	40,000	12-2	14-2	9-3	9-9	8-4	7-7	6-10	5-6	5-4
60,000		DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance $A^{m, n}$			1-8	2-0	1-2	1-3	1-0	0-11	0-9	STL	STL
20 ⁱ	Span without stirrups ^{k, l}		5-0	5-6	4-6	4-7	4-3	4-1	4-0	3-8	3-8
	1-#4	40,000	7-2	8-2	6-3	6-6	5-10	5-6	5-1	4-3	4-2
		60,000	8-11	9-11	7-8	7-11	7-1	6-8	6-2	5-2	5-0
	1-#5	40,000	9-1	10-2	7-9	8-1	7-3	6-10	6-4	5-4	5-2
		60,000	12-8	14-2	10-11	11-3	10-2	9-6	8-9	7-1	6-10
	2-#4	40,000	10-3	11-5	8-9	9-1	8-2	7-8	7-1	6-0	5-10
	1-#6	60,000	14-3	15-11	11-9	12-5	10-8	9-9	8-9	7-1	6-10
2-#5	40,000	14-6	16-3	11-6	12-1	10-4	9-6	8-6	6-11	6-8	
	60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR	
Center distance $A^{m, n}$			2-0	2-6	1-6	1-7	1-3	1-1	1-0	STL	STL

(continued)

TABLE R608.8(6)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, o}
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^{h, i} , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
24 ^{wj}	Span without stirrups ^{k, l}		6-0	6-8	5-5	5-7	5-3	5-0	4-10	4-6	4-5
	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-0	5-7	4-8	4-7
		60,000	9-8	10-11	8-5	8-9	7-10	7-4	6-10	5-9	5-7
	1-#5	40,000	9-10	11-2	8-7	8-11	8-0	7-6	7-0	5-10	5-8
		60,000	12-0	13-7	10-6	10-10	9-9	9-2	8-6	7-2	6-11
	2-#4	40,000	11-1	12-7	9-8	10-1	9-1	8-6	7-10	6-7	6-5
		60,000	15-6	17-7	13-6	14-0	12-8	11-10	10-8	8-7	8-4
	2-#5	40,000	15-6	17-11	12-8	13-4	11-6	10-7	9-7	7-10	7-7
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance <i>A</i> ^{m, n}		2-4	3-0	1-9	1-11	1-6	1-4	1-2	STL	STL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch-nominal waffle-grid forms and not less than 7 inches in width for 8-inch-nominal waffle-grid forms. See Figure R608.8(3). Flat form lintels shall be permitted in place of waffle-grid lintels. See Tables R608.8(2) through R608.8(5).
- b. See Table R608.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes l and n. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. DR indicates design required. STL indicates stirrups required throughout lintel.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables R608.8(2) through R608.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables R608.8(2) through R608.8(5).
- j. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.
- k. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- m. Center distance, A , is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(7)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, o}
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, D^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , f_y (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
8 ⁱ	Span without stirrups ^{k, l}		2-6	2-9	2-0	2-1	2-0	2-0	2-0	2-0	2-0
	1-#4	40,000	4-5	4-9	3-7	3-9	3-4	3-0	2-10	2-3	2-2
		60,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2
	1-#5	40,000	5-6	6-2	4-0	4-3	3-7	3-1	2-10	2-3	2-2
Center distance $A^{m, n}$			0-9	0-10	0-6	0-6	0-5	0-4	0-4	STL	STL
12 ⁱ	Span without stirrups ^{k, l}		2-10	3-1	2-6	2-7	2-5	2-3	2-2	2-0	2-0
	1-#4	40,000	5-7	6-1	4-8	4-10	4-4	3-11	3-8	3-0	2-11
		60,000	6-9	7-5	5-8	5-11	5-4	4-9	4-5	3-8	3-7
	1-#5	40,000	6-11	7-7	5-10	6-0	5-5	4-10	4-6	3-9	3-7
		60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7
	2-#4	40,000	8-8	9-10	6-7	7-0	5-11	5-2	4-8	3-9	3-7
	1-#6	60,000	8-8	10-1	6-7	7-0	5-11	5-2	4-8	3-9	3-7
Center distance $A^{m, n}$			1-2	1-5	0-10	0-11	0-9	0-7	0-6	STL	STL
16 ⁱ	Span without stirrups ^{k, l}		3-10	4-3	3-6	3-7	3-4	3-2	3-0	2-10	2-9
	1-#4	40,000	6-5	7-2	5-6	5-9	5-2	4-8	4-4	3-7	3-6
		60,000	7-9	8-9	6-9	7-0	6-3	5-8	5-3	4-4	4-3
	1-#5	40,000	7-11	8-11	6-10	7-1	6-5	5-9	5-4	4-5	4-4
		60,000	9-8	10-11	8-4	8-8	7-10	7-0	6-6	5-2	5-1
	2-#4	40,000	9-0	10-1	7-9	8-0	7-3	6-6	6-1	5-0	4-11
	1-#6	60,000	11-5	13-10	9-2	9-8	8-3	7-2	6-6	5-2	5-1
Center distance $A^{m, n}$			1-6	1-11	1-2	1-3	1-0	0-10	0-8	STL	STL
20 ⁱ	Span without stirrups ^{k, l}		4-10	5-5	4-5	4-7	4-3	4-0	3-11	3-7	3-7
	1-#4	40,000	7-0	8-1	6-3	6-5	5-10	5-3	4-11	4-1	3-11
		60,000	8-7	9-10	7-7	7-10	7-1	6-5	6-0	4-11	4-10
	1-#5	40,000	8-9	10-1	7-9	8-0	7-3	6-6	6-1	5-1	4-11
		60,000	10-8	12-3	9-6	9-10	8-10	8-0	7-5	6-2	6-0
	2-#4	40,000	9-10	11-4	8-9	9-1	8-2	7-4	6-10	5-8	5-7
	1-#6	60,000	12-0	13-10	10-8	11-0	9-11	9-0	8-4	6-8	6-6
	2-#5	40,000	12-3	14-1	10-10	11-3	10-2	8-11	8-1	6-6	6-4
60,000		14-0	17-6	11-8	12-3	10-6	9-1	8-4	6-8	6-6	
Center distance $A^{m, n}$			1-10	2-5	1-5	1-7	1-3	1-0	0-11	STL	STL

(continued)

TABLE R608.8(7)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR 8-INCH-THICK WAFFLE-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, o}
MAXIMUM ROOF CLEAR SPAN 40 FEET AND MAXIMUM FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^g (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
			Maximum clear span of lintel (feet-inches)								
24 ^j	Span without stirrups ^{k, l}		5-9	6-7	5-5	5-6	5-2	4-11	4-9	4-5	4-4
	1-#4	40,000	7-6	8-10	6-10	7-1	6-5	5-9	5-5	4-6	4-4
		60,000	9-2	10-9	8-4	8-8	7-10	7-1	6-7	5-6	5-4
	1-#5	40,000	9-5	11-0	8-6	8-10	8-0	7-2	6-8	5-7	5-5
		60,000	11-5	13-5	10-5	10-9	9-9	8-9	8-2	6-10	6-8
	2-#4	40,000	10-7	12-5	9-8	10-0	9-0	8-1	7-7	6-3	6-2
		60,000	12-11	15-2	11-9	12-2	11-0	9-11	9-3	7-8	7-6
	2-#5	40,000	13-2	15-6	12-0	12-5	11-2	9-11	9-2	7-5	7-3
		60,000	16-3	21-0	14-1	14-10	12-9	11-1	10-1	8-1	7-11
	2-#6	40,000	14-4	18-5	12-6	13-2	11-5	9-11	9-2	7-5	7-3
Center distance <i>A</i> ^{m, n}		2-1	2-11	1-9	1-10	1-6	1-3	1-1	STL	STL	

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch-nominal waffle-grid forms and not less than 7 inches in width for 8-inch-nominal waffle-grid forms. See Figure R608.8(3). Flat-form lintels shall be permitted in lieu of waffle-grid lintels. See Tables R608.8(2) through R608.8(5).
- b. See Table R608.3 for tolerances permitted from nominal thicknesses and minimum dimensions and spacing of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes l and n. Table values are based on uniform loading. See Section R608.8.2 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. STL indicates stirrups required throughout lintel.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Lintels less than 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables R608.8(2) through R608.8(5)], or, if necessary, form material shall be removed from waffle-grid forms so as to provide the required cover for stirrups. Allowable spans for lintels formed with flat-wall forms shall be determined from Tables R608.8(2) through R608.8(5).
- j. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.
- k. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than $d/2$.
- l. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- m. Center distance, A , is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- n. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- o. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

TABLE R608.8(8)
MAXIMUM ALLOWABLE CLEAR SPANS FOR 6-INCH-THICK SCREEN-GRID LINTELS IN LOAD-BEARING WALLS^{a, b, c, d, e, f, p}
ROOF CLEAR SPAN 40 FEET AND FLOOR CLEAR SPAN 32 FEET

LINTEL DEPTH, <i>D</i> ^p (inches)	NUMBER OF BARS AND BAR SIZE IN TOP AND BOTTOM OF LINTEL	STEEL YIELD STRENGTH ^h , <i>f_y</i> (psi)	DESIGN LOADING CONDITION DETERMINED FROM Table R608.8(1)								
			1	2		3		4		5	
			Maximum ground snow load (psf)								
			—	30	70	30	70	30	70	30	70
Maximum clear span of lintel (feet-inches)											
12 ^{i, j}	Span without stirrups		2-9	2-11	2-4	2-5	2-3	2-3	2-2	2-0	2-0
16 ^{i, j}	Span without stirrups		3-9	4-0	3-4	3-5	3-2	3-1	3-0	2-9	2-9
20 ^{i, j}	Span without stirrups		4-9	5-1	4-3	4-4	4-1	4-0	3-10	3-7	3-7
24 ^k	Span without stirrups ^{l, m}		5-8	6-3	5-2	5-3	5-0	4-10	4-8	4-4	4-4
	1-#4	40,000	7-11	9-0	6-11	7-2	6-5	6-1	5-8	4-9	4-7
		60,000	9-9	11-0	8-5	8-9	7-10	7-5	6-10	5-9	5-7
	1-#5	40,000	9-11	11-2	8-7	8-11	8-0	7-7	7-0	5-11	5-9
		60,000	12-1	13-8	10-6	10-10	9-9	9-3	8-6	7-2	7-0
	2-#4	40,000	11-2	12-8	9-9	10-1	9-1	8-7	7-11	6-8	6-6
		60,000	15-7	17-7	12-8	13-4	11-6	10-8	9-8	7-11	7-8
	2-#5	40,000	14-11	18-0	12-2	12-10	11-1	10-3	9-4	7-8	7-5
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	DR
	Center distance <i>A</i> ^{n, o}			2-0	2-6	1-6	1-7	1-4	1-2	1-0	STL

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, 1 pound per square foot = 0.0479 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure R608.8(4). Flat-form lintels shall be permitted in lieu of screen-grid lintels. See Tables R608.8(2) through R608.8(5).
- b. See Table R608.3 for tolerances permitted from nominal thickness and minimum dimensions and spacings of cores.
- c. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Notes m and o. Table values are based on uniform loading. See Section R608.7.2.1 for lintels supporting concentrated loads.
- d. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- e. Linear interpolation is permitted between ground snow loads.
- f. DR indicates design required. STL indicates stirrups required throughout lintel.
- g. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- h. Stirrups shall be fabricated from reinforcing bars with the same yield strength as that used for the main longitudinal reinforcement.
- i. Stirrups are not required for lintels less than 24 inches in depth fabricated from screen-grid forms. Top and bottom reinforcement shall consist of a No. 4 bar having a yield strength of 40,000 psi or 60,000 psi.
- j. Lintels between 12 and 24 inches in depth with stirrups shall be formed from flat-wall forms [see Tables R608.8(2) through R608.8(5)], or form material shall be removed from screen-grid forms to provide a concrete section comparable to that required for a flat wall. Allowable spans for flat lintels with stirrups shall be determined from Tables R608.8(2) through R608.8(5).
- k. Where stirrups are required for 24-inch-deep lintels, the spacing shall not exceed 12 inches on center.
- l. Allowable clear span without stirrups applicable to all lintels of the same depth, D . Top and bottom reinforcement for lintels without stirrups shall be not less than the least amount of reinforcement required for a lintel of the same depth and loading condition with stirrups. All other spans require stirrups spaced at not more than 12 inches.
- m. Where concrete with a minimum specified compressive strength of 3,000 psi is used, clear spans for lintels without stirrups shall be permitted to be multiplied by 1.05. If the increased span exceeds the allowable clear span for a lintel of the same depth and loading condition with stirrups, the top and bottom reinforcement shall be equal to or greater than that required for a lintel of the same depth and loading condition that has an allowable clear span that is equal to or greater than that of the lintel without stirrups that has been increased.
- n. Center distance, A , is the center portion of the span where stirrups are not required. This is applicable to all longitudinal bar sizes and steel yield strengths.
- o. Where concrete with a minimum specified compressive strength of 3,000 psi is used, center distance, A , shall be permitted to be multiplied by 1.10.
- p. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information only.

WALL CONSTRUCTION

TABLE R608.8(9)
MAXIMUM ALLOWABLE CLEAR SPANS FOR FLAT LINTELS WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS^{a, b, c, d, e, g}

LINTEL DEPTH, <i>D</i> (inches)	NUMBER OF BARS AND BAR SIZE	STEEL YIELD STRENGTH, <i>f_y</i> (psi)	NOMINAL WALL THICKNESS (inches)								
			4		6		8		10		
			Lintel Supporting								
			Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	
Maximum Clear Span of Lintel (feet-inches)											
8	1-#4	40,000	10-11	11-5	9-7	11-2	7-10	9-5	7-3	9-2	
		60,000	12-5	11-7	10-11	13-5	9-11	13-2	9-3	12-10	
	1-#5	40,000	12-7	11-7	11-1	13-8	10-1	13-5	9-4	13-1	
		60,000	DR	DR	12-7	16-4	11-6	14-7	10-9	14-6	
	2-#4	40,000	DR	DR	12-0	15-3	10-11	15-0	10-2	14-8	
		60,000	DR	DR	DR	DR	12-2	15-3	11-7	15-3	
	2-#5	40,000	DR	DR	DR	DR	12-7	16-7	11-9	16-7	
		60,000	DR	DR	DR	DR	DR	DR	13-3	16-7	
	2-#6	40,000	DR	DR	DR	DR	DR	DR	13-2	17-8	
		60,000	DR	DR	DR	DR	DR	DR	DR	DR	
	12	1-#4	40,000	11-5	9-10	10-6	12-0	9-6	11-6	8-9	11-1
			60,000	11-5	9-10	11-8	13-3	10-11	14-0	10-1	13-6
1-#5		40,000	11-5	9-10	11-8	13-3	11-1	14-4	10-3	13-9	
		60,000	11-5	9-10	11-8	13-3	11-10	16-0	11-9	16-9	
2-#4		40,000	DR	DR	11-8	13-3	11-10	16-0	11-2	15-6	
		60,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4	
2-#5		40,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4	
		60,000	DR	DR	11-8	13-3	11-10	16-0	11-11	18-4	
16		1-#4	40,000	13-6	13-0	11-10	13-8	10-7	12-11	9-11	12-4
			60,000	13-6	13-0	13-8	16-7	12-4	15-9	11-5	15-0
	1-#5	40,000	13-6	13-0	13-10	17-0	12-6	16-1	11-7	15-4	
		60,000	13-6	13-0	13-10	17-1	14-0	19-7	13-4	18-8	
	2-#4	40,000	13-6	13-0	13-10	17-1	13-8	18-2	12-8	17-4	
		60,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—	
	2-#5	40,000	13-6	13-0	13-10	17-1	14-0	20-3	14-1	—	
		60,000	DR	DR	13-10	17-1	14-0	20-3	14-1	—	
20	1-#4	40,000	14-11	15-10	13-0	14-10	11-9	13-11	10-10	13-2	
		60,000	15-3	15-10	14-11	18-1	13-6	17-0	12-6	16-2	
	1-#5	40,000	15-3	15-10	15-2	18-6	13-9	17-5	12-8	16-6	
		60,000	15-3	15-10	15-8	20-5	15-9	—	14-7	20-1	
	2-#4	40,000	15-3	15-10	15-8	20-5	14-11	—	13-10	—	
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—	
	2-#5	40,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—	
		60,000	15-3	15-10	15-8	20-5	15-10	—	15-11	—	

(continued)

TABLE R608.8(9)—continued
MAXIMUM ALLOWABLE CLEAR SPANS FOR FLAT LINTELS WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS^{a, b, c, d, e, g}

LINTEL DEPTH, <i>D</i> (inches)	NUMBER OF BARS AND BAR SIZE	STEEL YIELD STRENGTH, <i>f_y</i> (psi)	NOMINAL WALL THICKNESS (inches)							
			4		6		8		10	
			Lintel Supporting							
			Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable
Maximum Clear Span of Lintel (feet-inches)										
24	1-#4	40,000	16-1	17-1	13-11	15-10	12-7	14-9	11-8	13-10
		60,000	16-11	18-5	16-1	19-3	14-6	18-0	13-5	17-0
	1-#5	40,000	16-11	18-5	16-3	19-8	14-9	18-5	13-8	17-4
		60,000	16-11	18-5	17-4	—	17-0	—	15-8	—
	2-#4	40,000	16-11	18-5	17-4	—	16-1	—	14-10	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-1	—
	1-#6	40,000	16-11	18-5	17-4	—	17-6	—	17-4	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-8	—
	2-#5	40,000	16-11	18-5	17-4	—	17-6	—	17-4	—
		60,000	16-11	18-5	17-4	—	17-6	—	17-8	—

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

DR = Design Required.

- a. See Table R608.3 for tolerances permitted from nominal thickness.
- b. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note e.
- c. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- d. Linear interpolation between lintels depths, D , is permitted provided the two cells being used to interpolate are shaded.
- e. Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in cells that are shaded shall be permitted to be multiplied by 1.05.
- f. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.
- g. The maximum clear opening width between two solid wall segments shall be 18 feet. See Section R608.7.2.1. Lintel spans in the table greater than 18 feet are shown for interpolation and information purposes only.

TABLE R608.8(10)
MAXIMUM ALLOWABLE CLEAR SPANS FOR WAFFLE-GRID AND SCREEN-GRID LINTELS WITHOUT STIRRUPS IN NONLOAD-BEARING WALLS^{c, d, e, f, g}

LINTEL DEPTH ^h , <i>D</i> (inches)	FORM TYPE AND NOMINAL WALL THICKNESS (inches)					
	6-inch Waffle-grid ^a		8-inch Waffle-grid ^a		6-inch Screen-grid ^b	
	Lintel supporting					
	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable	Concrete Wall	Light-frame Gable
	Maximum Clear Span of Lintel (feet-inches)					
8	10-3	8-8	8-8	8-3	—	—
12	9-2	7-6	7-10	7-1	8-8	6-9
16	10-11	10-0	9-4	9-3	—	—
20	12-5	12-2	10-7	11-2	—	—
24	13-9	14-2	11-10	12-11	13-0	12-9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, Grade 40 = 280 MPa, Grade 60 = 420 MPa.

- a. Where lintels are formed with waffle-grid forms, form material shall be removed, if necessary, to create top and bottom flanges of the lintel that are not less than 3 inches in depth (in the vertical direction), are not less than 5 inches in width for 6-inch waffle-grid forms and not less than 7 inches in width for 8-inch waffle-grid forms. See Figure R608.8(3). Flat-form lintels shall be permitted in lieu of waffle-grid lintels. See Tables R608.8(2) through R608.8(5).
- b. Where lintels are formed with screen-grid forms, form material shall be removed if necessary to create top and bottom flanges of the lintel that are not less than 5 inches in width and not less than 2.5 inches in depth (in the vertical direction). See Figure R608.8(4). Flat-form lintels shall be permitted in lieu of screen-grid lintels. See Tables R608.8(2) through R608.8(5).
- c. See Table R608.3 for tolerances permitted from nominal thickness and minimum dimensions and spacing of cores.
- d. Table values are based on concrete with a minimum specified compressive strength of 2,500 psi. See Note g.
- e. Deflection criterion is $L/240$, where L is the clear span of the lintel in inches, or $1/2$ inch, whichever is less.
- f. Top and bottom reinforcement shall consist of a No. 4 bar having a minimum yield strength of 40,000 psi.
- g. Where concrete with a minimum specified compressive strength of 3,000 psi is used, spans in shaded cells shall be permitted to be multiplied by 1.05.
- h. Lintel depth, D , is permitted to include the available height of wall located directly above the lintel, provided that the increased lintel depth spans the entire length of the lintel.

R608.8.2.2 Bundled bars in lintels. It is permitted to bundle two bars in contact with each other in lintels if all of the following are observed:

1. Bars equal to or less than No. 6 are bundled.
2. Where the wall thickness is not sufficient to provide not less than 3 inches (76 mm) of clear space beside bars (total on both sides) oriented horizontally in a bundle, the bundled bars shall be oriented in a vertical plane.
3. Where vertically oriented bundled bars terminate with standard hooks to develop the bars in tension beyond the support (see Section R608.5.4.4), the hook extensions shall be staggered to provide not less than 1 inch (25 mm) clear spacing between the extensions.
4. Bundled bars shall not be lap spliced within the lintel span and the length on each end of the lintel that is required to develop the bars in tension.
5. Bundled bars shall be enclosed within stirrups throughout the length of the lintel. Stirrups and the installation thereof shall comply with Section R608.8.2.1.

R608.8.2.3 Lintels without stirrups designed for nonload-bearing conditions. The maximum clear span of lintels without stirrups designed for nonload-bearing conditions of Table R608.8(1) shall be determined in accordance with this section. The maximum clear span of lintels without stirrups in flat walls shall be determined in accordance with Table R608.8(9), and the maximum clear span of lintels without stirrups in walls of waffle-grid or screen-grid construction shall be determined in accordance with Table R608.8(10).

R608.9 Requirements for connections—general. Concrete walls shall be connected to footings, floors, ceilings and roofs in accordance with this section.

R608.9.1 Connections between concrete walls and light-frame floor, ceiling and roof systems. Connections between concrete walls and light-frame floor, ceiling and roof systems using the prescriptive details of Figures R608.9(1) through R608.9(12) shall comply with this section and Sections R608.9.2 and R608.9.3.

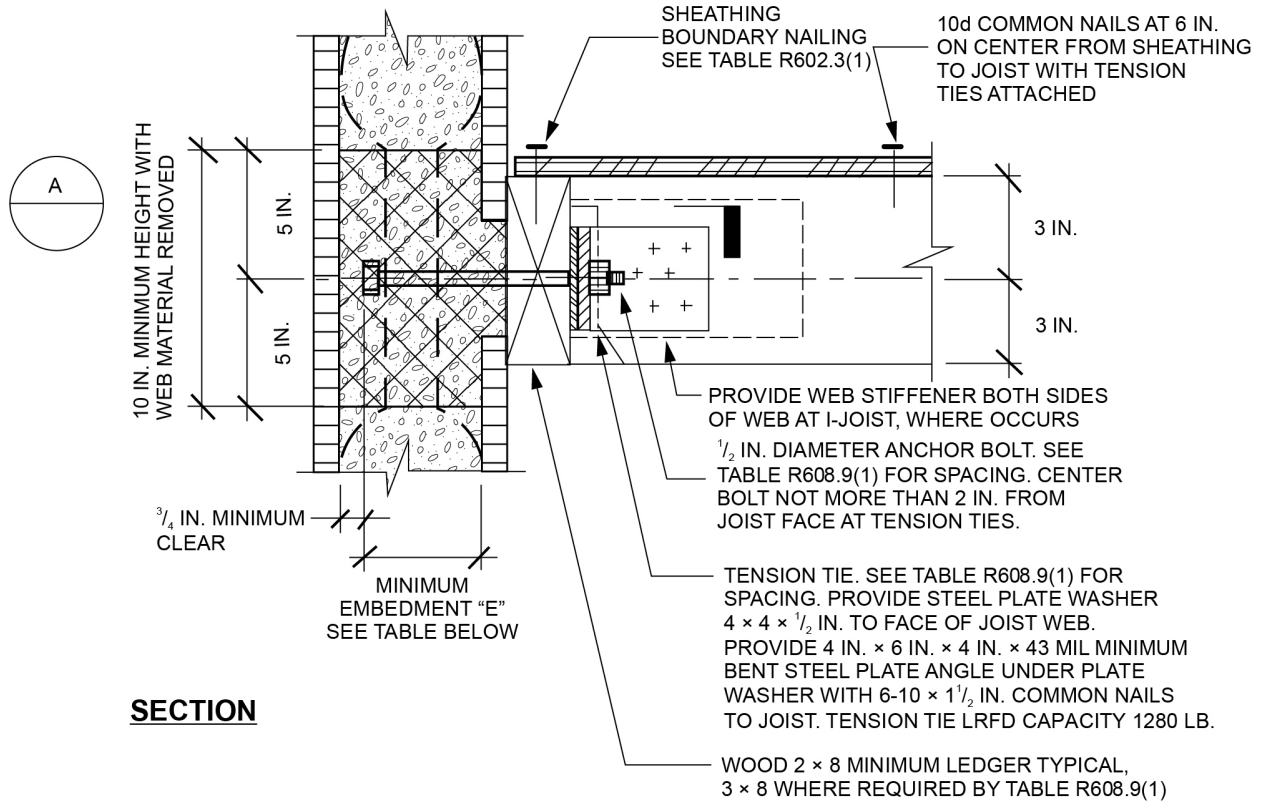
R608.9.1.1 Anchor bolts. Anchor bolts used to connect light-frame floor, ceiling and roof systems to concrete walls in accordance with Figures R608.9(1) through R608.9(12) shall have heads, or shall be rods with threads on both ends with a hex or square nut on the end embedded in the concrete. Bolts and threaded rods shall comply with Section R608.5.2.2. Anchor bolts with J- or L-hooks shall not be used where the connection details in these figures are used.

R608.9.1.2 Removal of stay-in-place form material at bolts. Holes in stay-in-place forms for installing bolts for attaching face-mounted wood ledger boards to the wall shall be not less than 4 inches (102 mm) in diameter for forms not greater than 1½ inches (38 mm) in thickness, and increased 1 inch (25 mm) in diameter for each ½-inch (12.7 mm) increase in form thickness. Holes in stay-in-place forms for installing bolts for attaching face-mounted cold-formed steel tracks to the wall shall be not less than 4 inches (102 mm) square. The wood ledger board or steel track shall be in direct contact with the concrete at each bolt location.

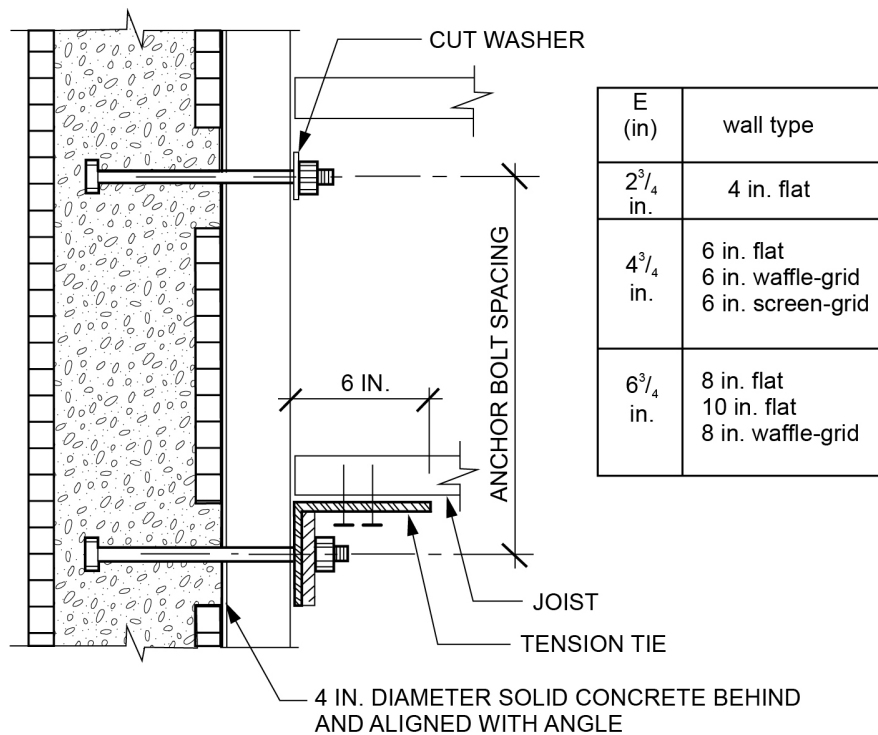
Exception: A vapor retarder or other material less than or equal to 1/16 inch (1.6 mm) in thickness is permitted to be installed between the wood ledger or cold-formed track and the concrete.

R608.9.2 Connections between concrete walls and light-frame floor systems. Connections between concrete walls and light-frame floor systems shall be in accordance with one of the following:

1. For floor systems of wood-framed construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(1) through R608.9(4), where permitted by the tables accompanying those figures. Portions of connections of wood-framed floor systems not noted in the figures shall be in accordance with Section R502, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
2. For floor systems of cold-formed steel construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(5) through R608.9(8), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed floor systems not noted in the figures shall be in accordance with Section R505, or AISI S230, if applicable.
3. Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
4. An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
5. An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction or AISI S100 for cold-formed steel frame construction.



SECTION



DETAIL A - PLAN VIEW

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

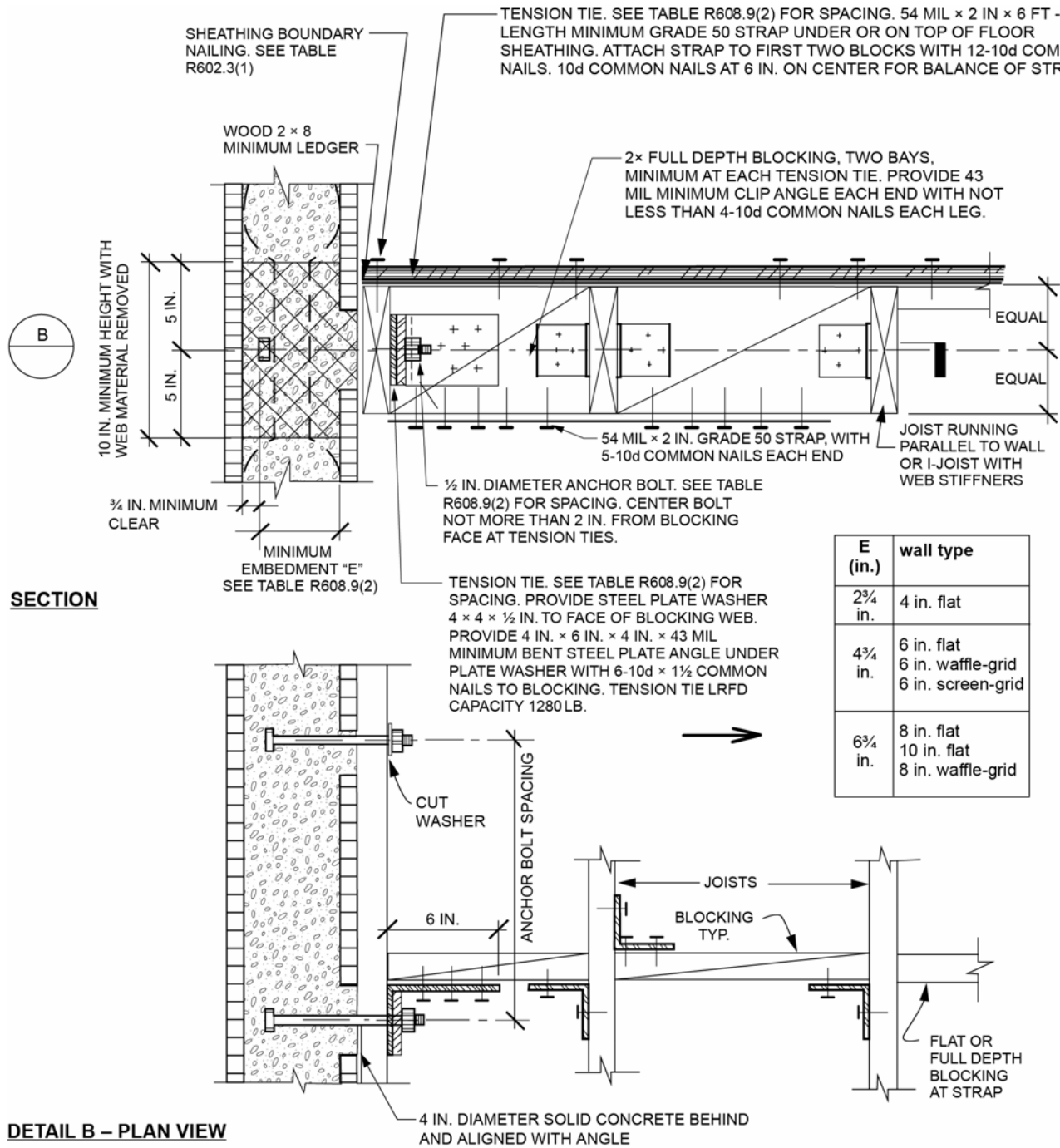
WALL CONSTRUCTION

**TABLE R608.9(1)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b}**

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph)					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(1). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.
- b. Wall design per other provisions of Section R608 is required.



For SI: 1 mil = 0.254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(2)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL

WALL CONSTRUCTION

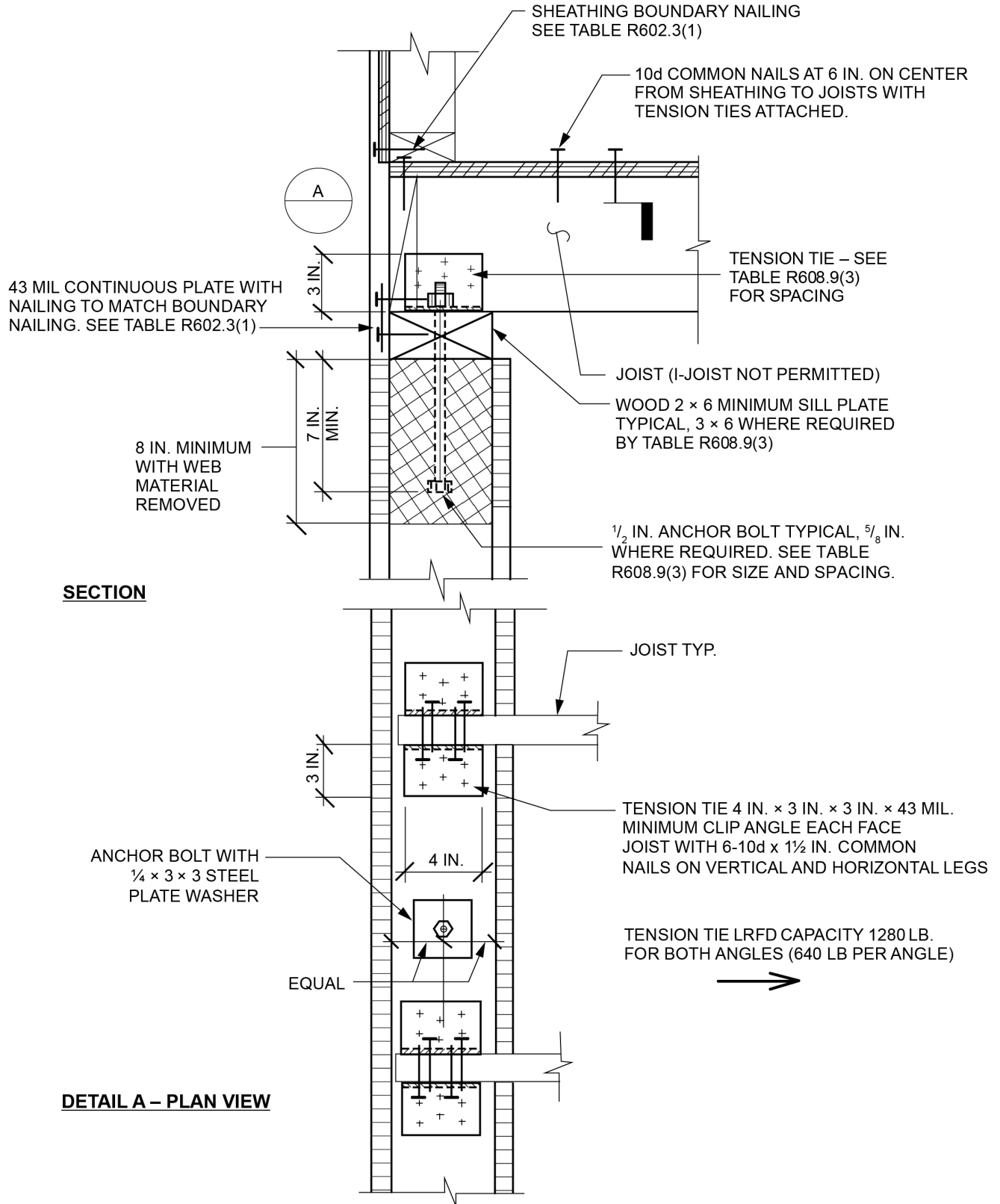
**TABLE R608.9(2)
WOOD-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL^{a, b}**

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

a. This table is for use with the detail in Figure R608.9(2). Use of this detail is permitted where a cell is not shaded and prohibited where shaded.

b. Wall design per other provisions of Section R608 is required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(3)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

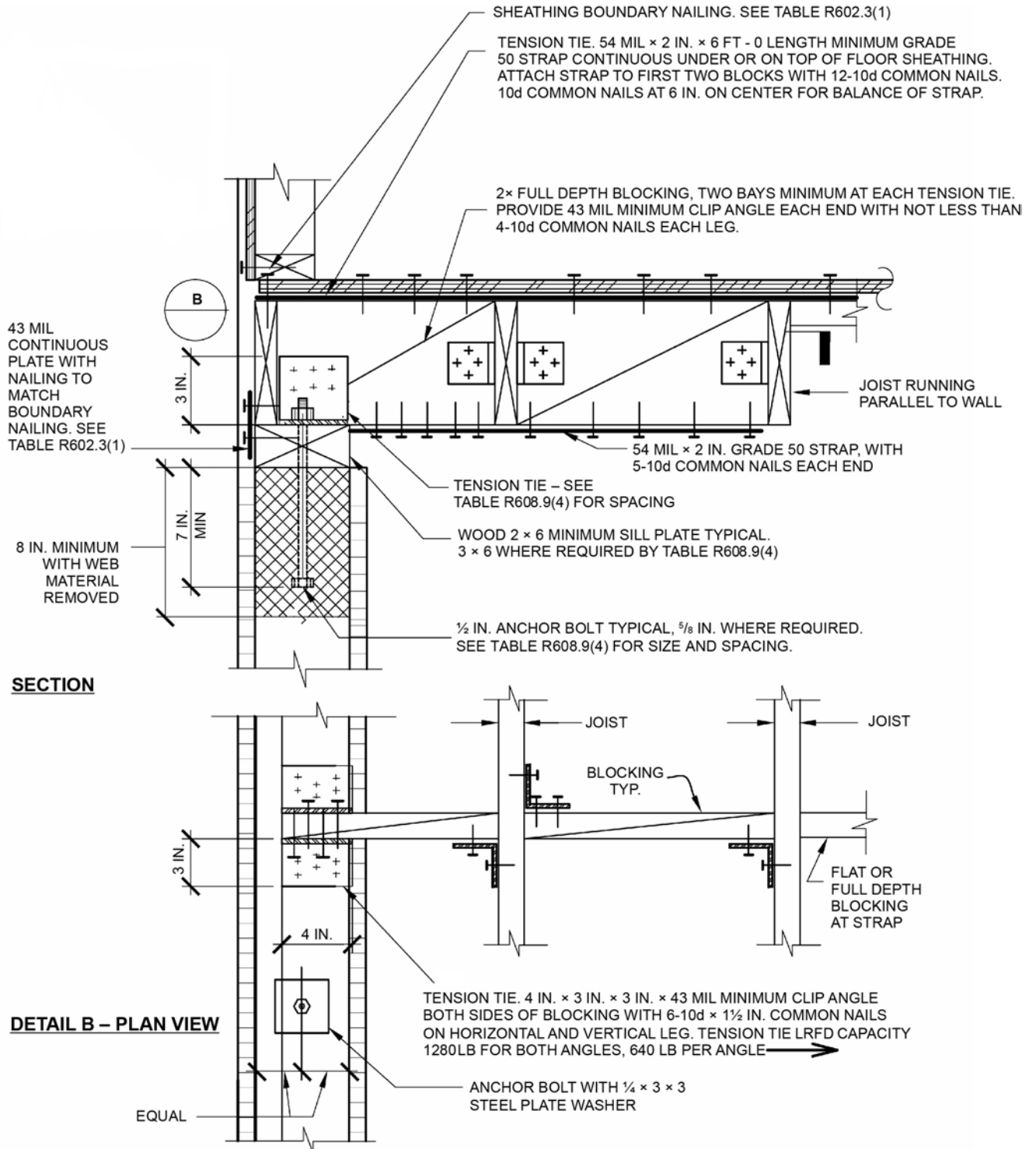
WALL CONSTRUCTION

TABLE R608.9(3)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(3). Use of this detail is permitted where cell is not shaded.
- b. Wall design per other provisions in Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(3). For the remainder of the wall, see Note b.
- e. Letter “A” indicates that a minimum nominal 3 × 6 sill plate is required. Letter “B” indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(4)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL

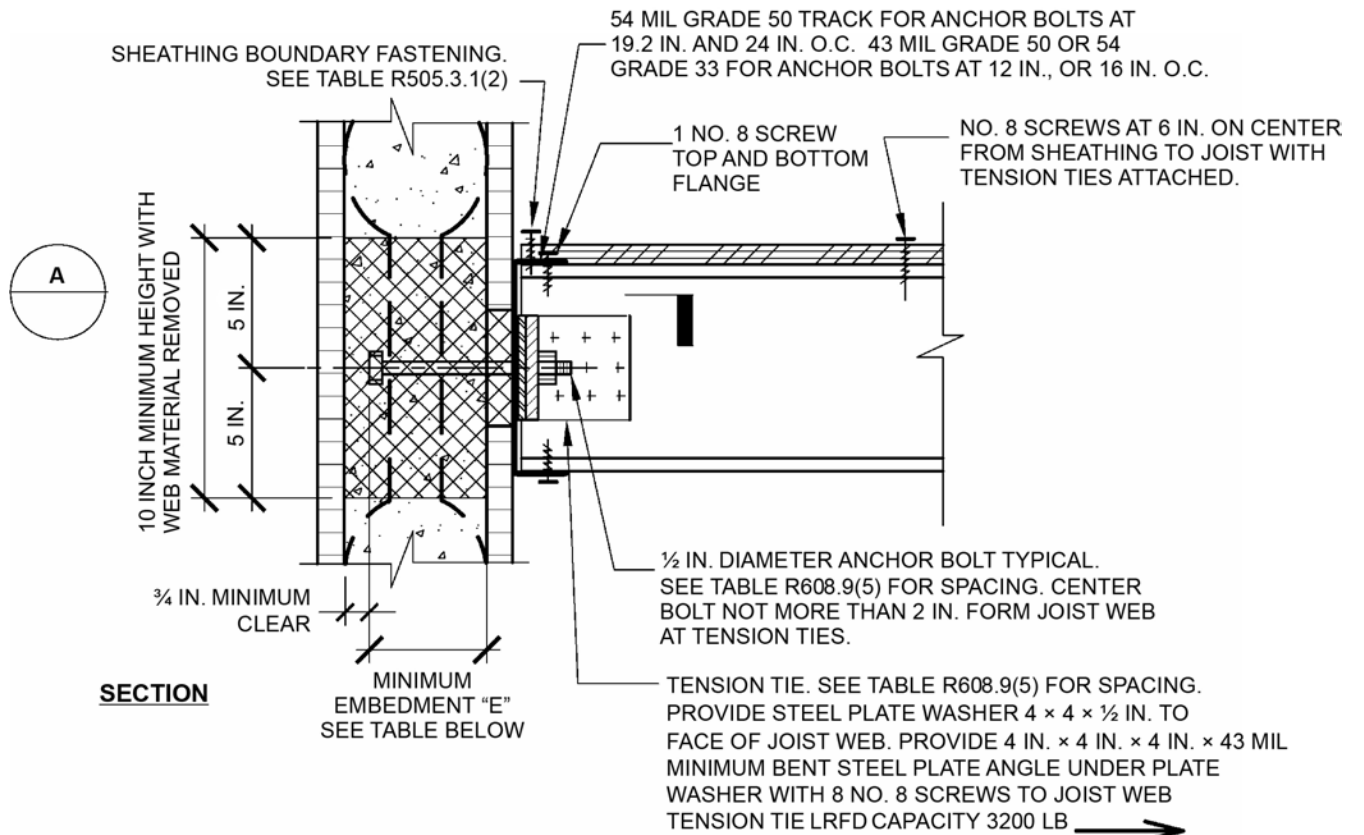
WALL CONSTRUCTION

TABLE R608.9(4)
WOOD-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL ^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24					6	6
12	36					6	6
12	48				6	6	6
16	16					6	6A
16	32				6	6	6A
16	48			6	6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B
24	48		6	6A	6B	6B	8B

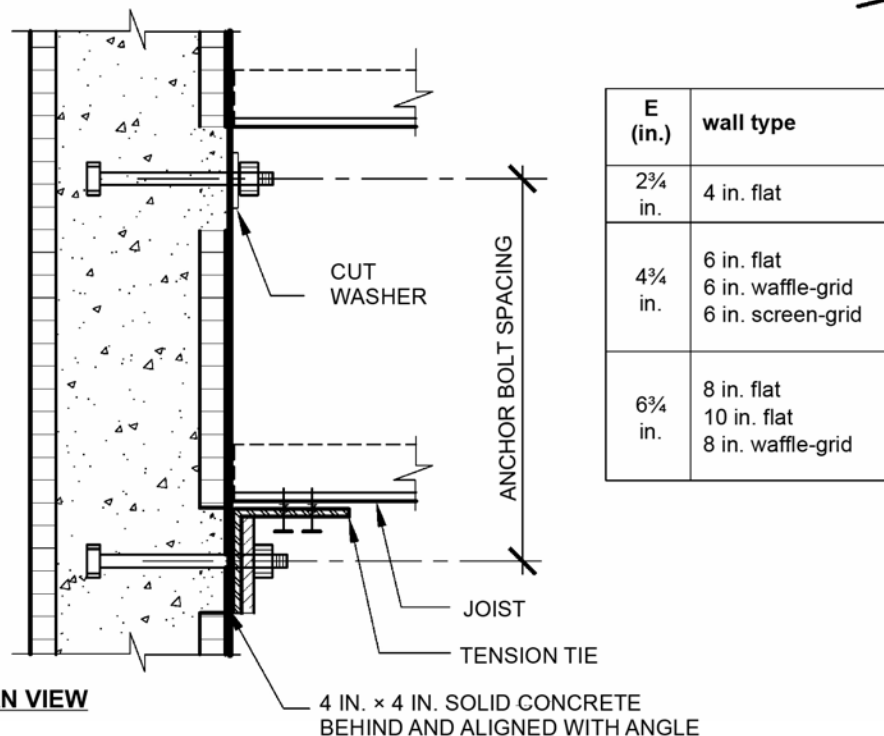
For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(4). Use of this detail is permitted where a cell is not shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(4). For the remainder of the wall, see Note b.
- e. Letter “A” indicates that a minimum nominal 3 × 6 sill plate is required. Letter “B” indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



SECTION

DETAIL A – PLAN VIEW



E (in.)	wall type
2 3/4 in.	4 in. flat
4 3/4 in.	6 in. flat 6 in. waffle-grid 6 in. screen-grid
6 3/4 in.	8 in. flat 10 in. flat 8 in. waffle-grid

For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(5)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR

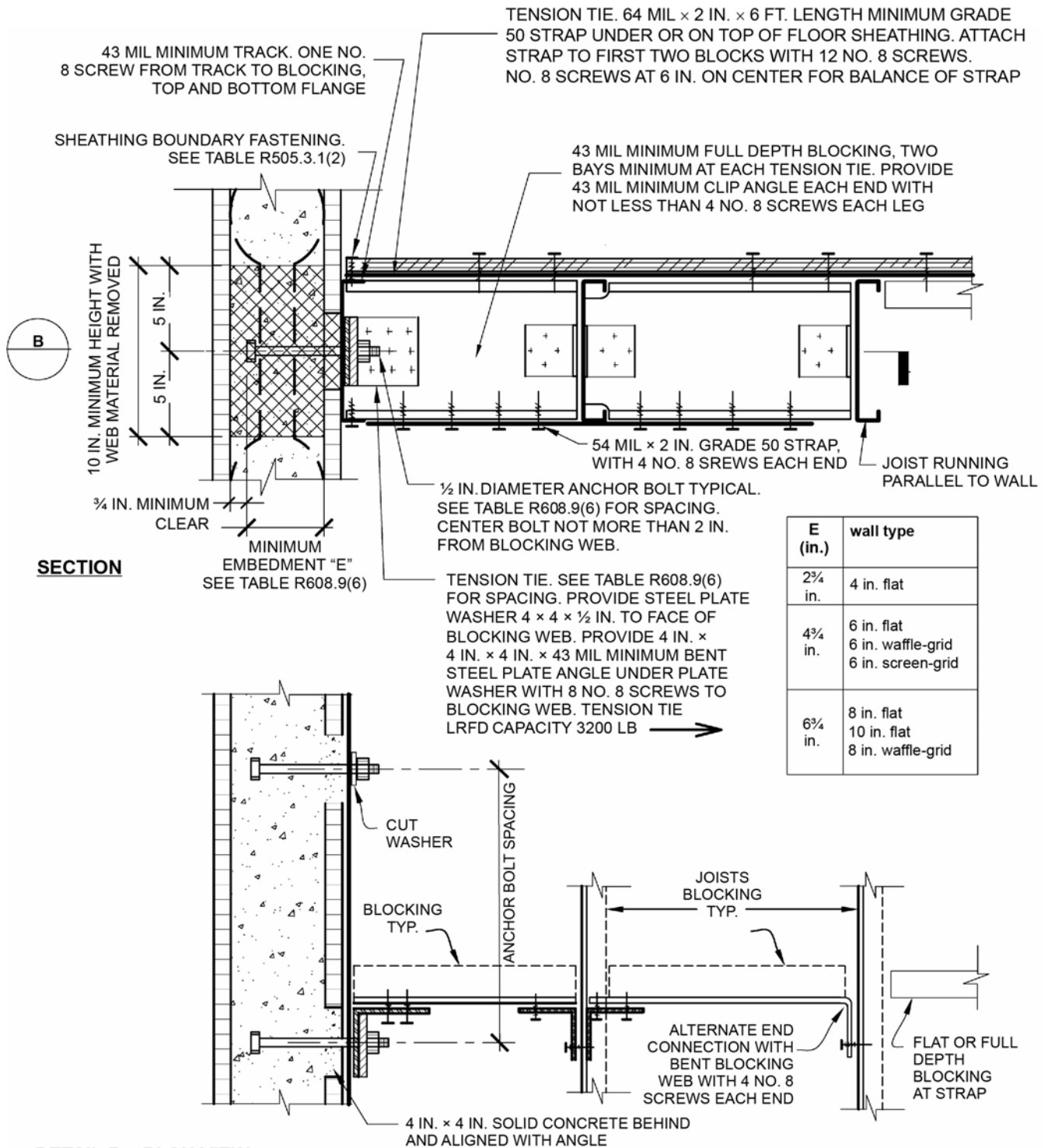
WALL CONSTRUCTION

**TABLE R608.9(5)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c}**

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.4470 m/s.

- a. This table is for use with the detail in Figure R608.9(5). Use of this detail is permitted where a cell is not shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(6)
COLD-FORMED STEEL FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL

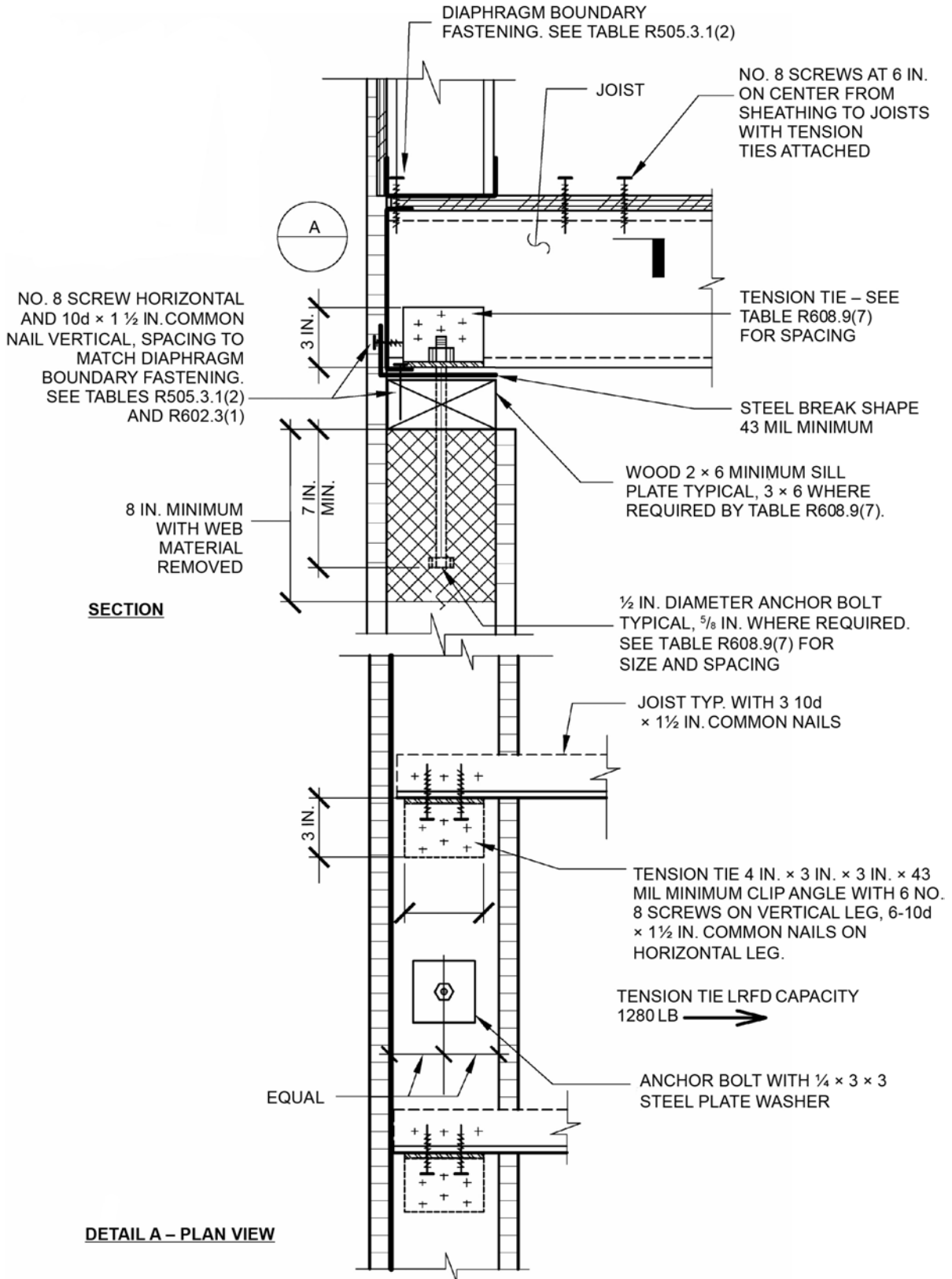
WALL CONSTRUCTION

TABLE R608.9(6)
COLD-FORMED STEEL-FRAMED FLOOR TO SIDE OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						
12	24						
12	36						
12	48						
16	16						
16	32						
16	48						
19.2	19.2						
19.2	38.4						
24	24						
24	48						

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(6). Use of this detail is permitted where a cell is not shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(7)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

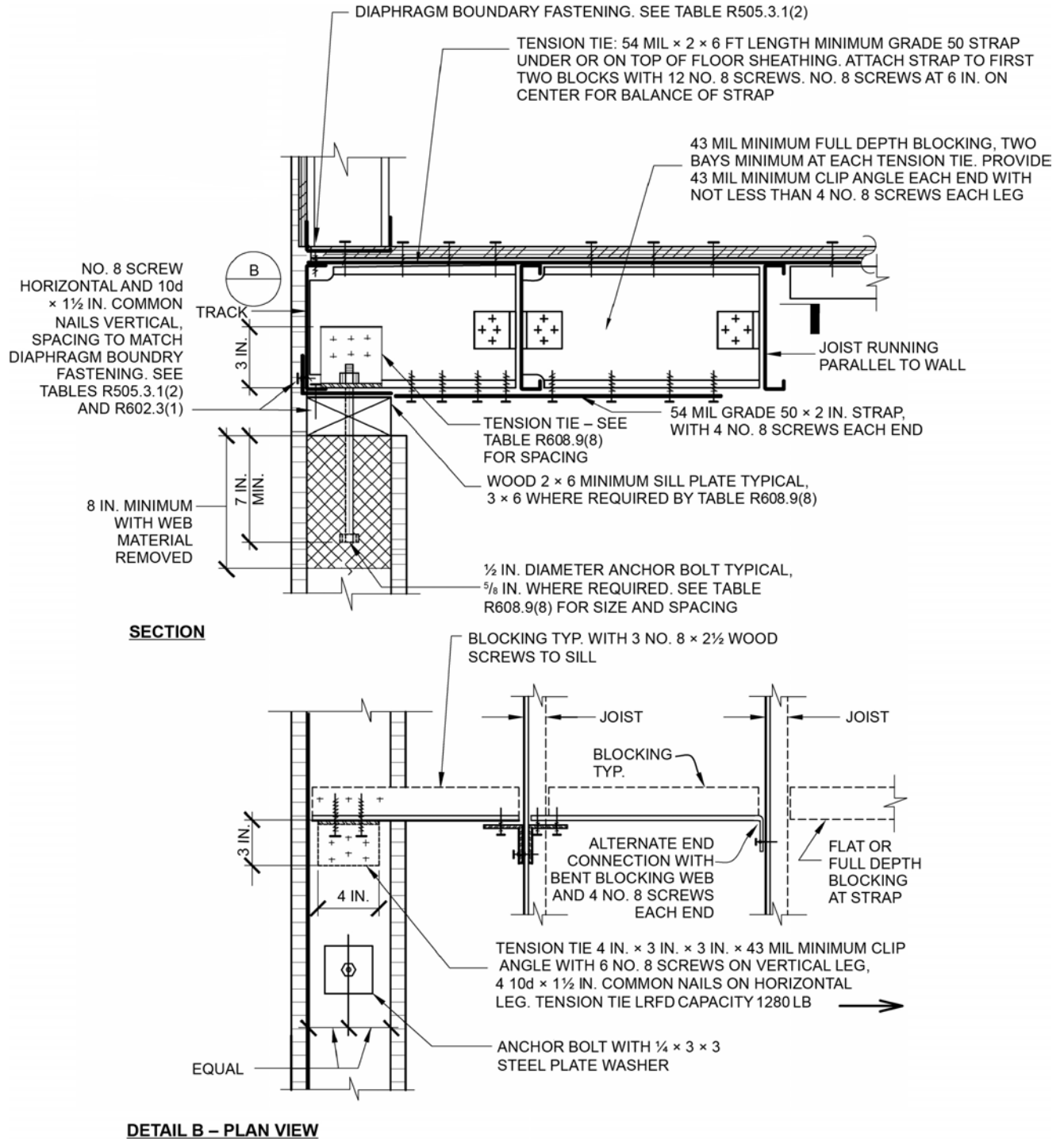
WALL CONSTRUCTION

TABLE R608.9(7)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED AND WIND EXPOSURE CATEGORY (mph)					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24					6	6
16	16					6	6A
16	32				6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure R608.9(7). Use of this detail is permitted where a cell is not shaded.
- Wall design per other provisions of Section R608 is required.
- For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(7). For the remainder of the wall, see Note b.
- Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a ⁵/₈-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(8)
COLD-FORMED STEEL FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL

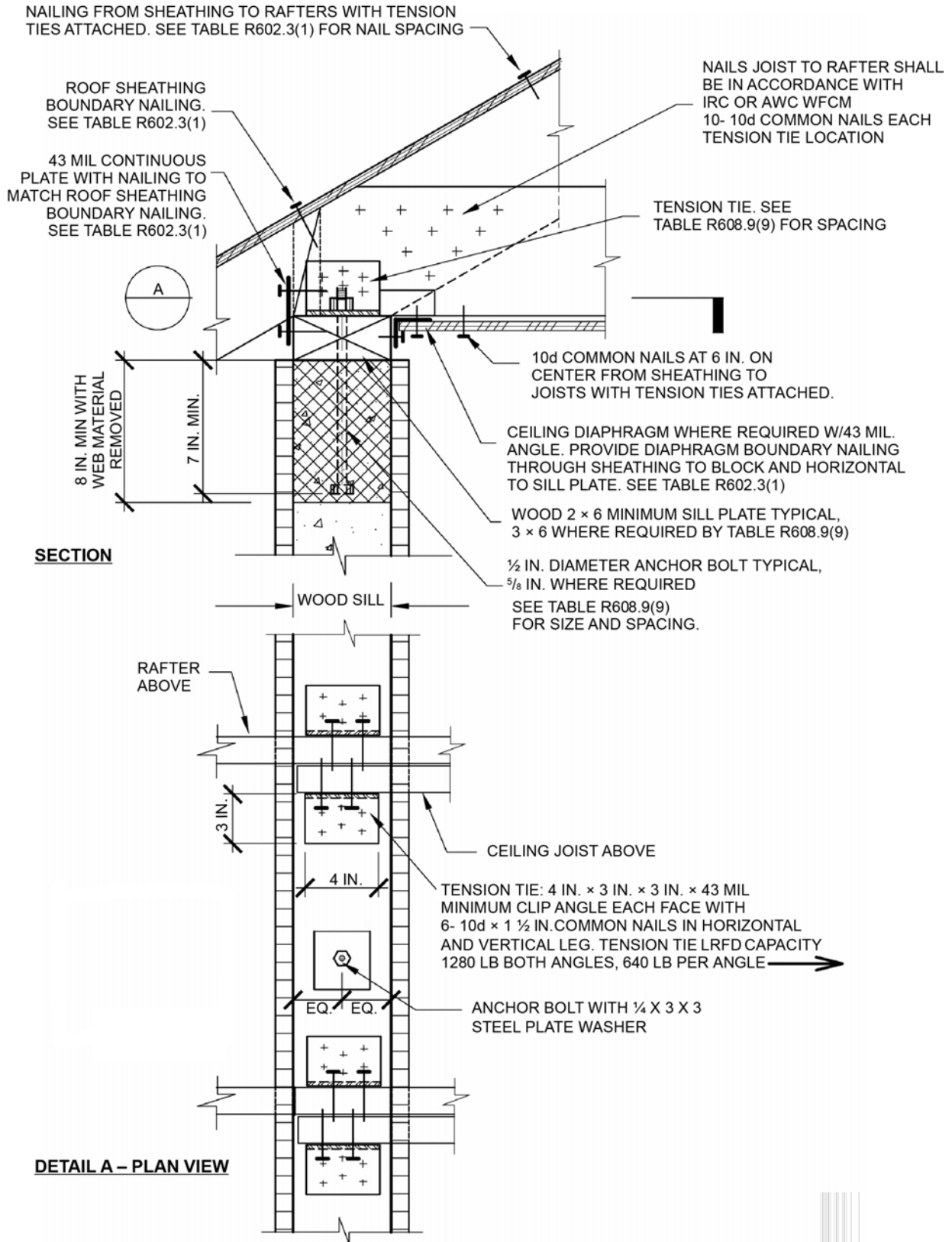
WALL CONSTRUCTION

TABLE R608.9(8)
COLD-FORMED STEEL-FRAMED FLOOR TO TOP OF CONCRETE WALL, FRAMING PARALLEL^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED AND WIND EXPOSURE CATEGORY (mph)					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24					6	6
16	16					6	6A
16	32				6	6	6A
19.2	19.2				6A	6A	6B
19.2	38.4			6	6A	6A	6B
24	24			6A	6B	6B	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(8). Use of this detail is permitted where a cell is not shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(8). For the remainder of the wall, see Note b.
- e. Letter "A" indicates that a minimum nominal 3 × 6 sill plate is required. Letter "B" indicates that a ⁵/₈-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(9)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

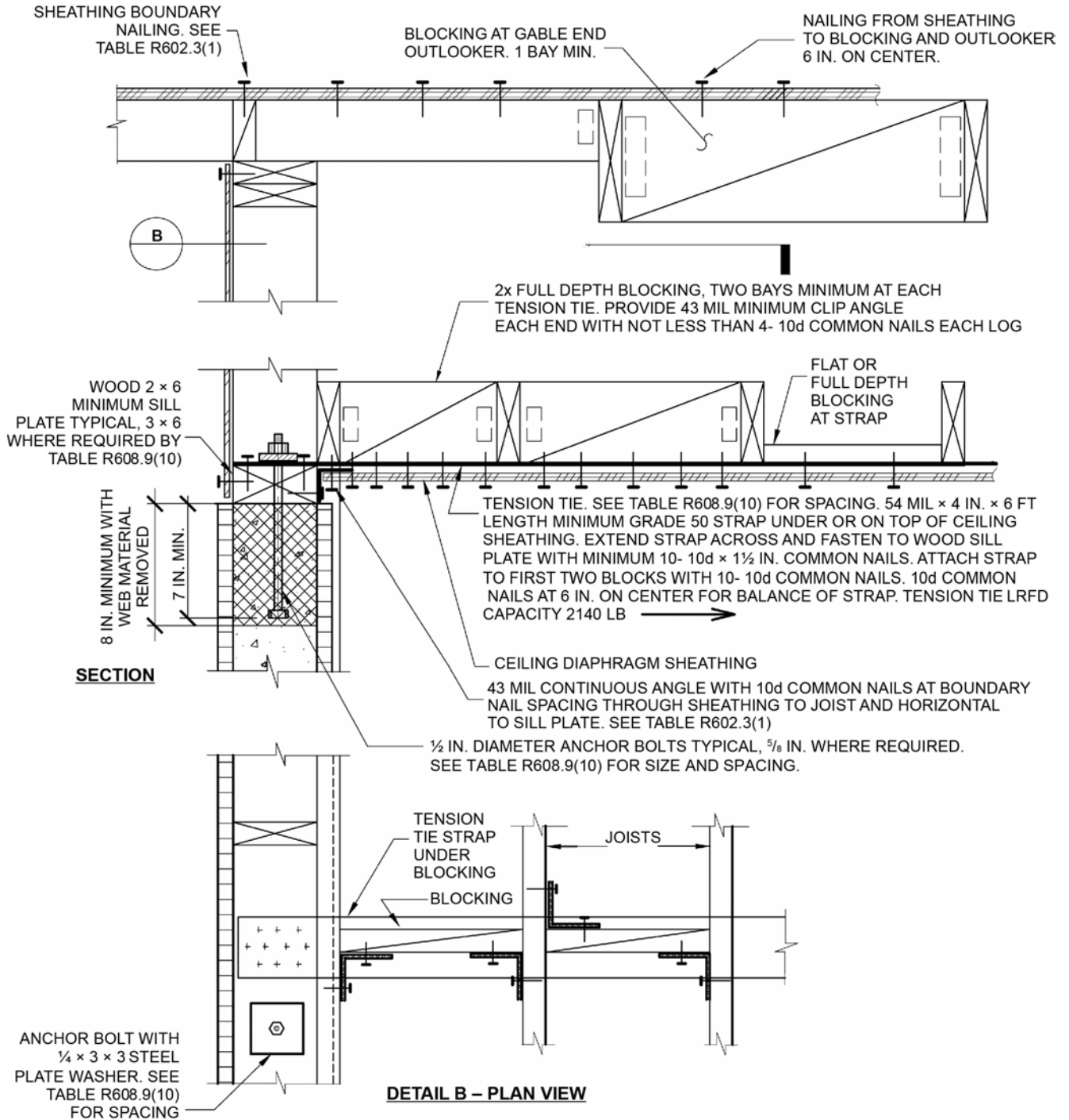
WALL CONSTRUCTION

TABLE R608.9(9)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
12	36					6	6
12	48				6	6	6
16	16					6	6
16	32					6	6
16	48				6	6	6
19.2	19.2					6	6
19.2	38.4				6	6	
24	24				6		
24	48			6	8B		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(9). Use of this detail is permitted where a cell is not shaded, and prohibited where shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(9). For the remainder of the wall, see Note b.
- e. Letter “B” indicates that a 5/8-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(10)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL

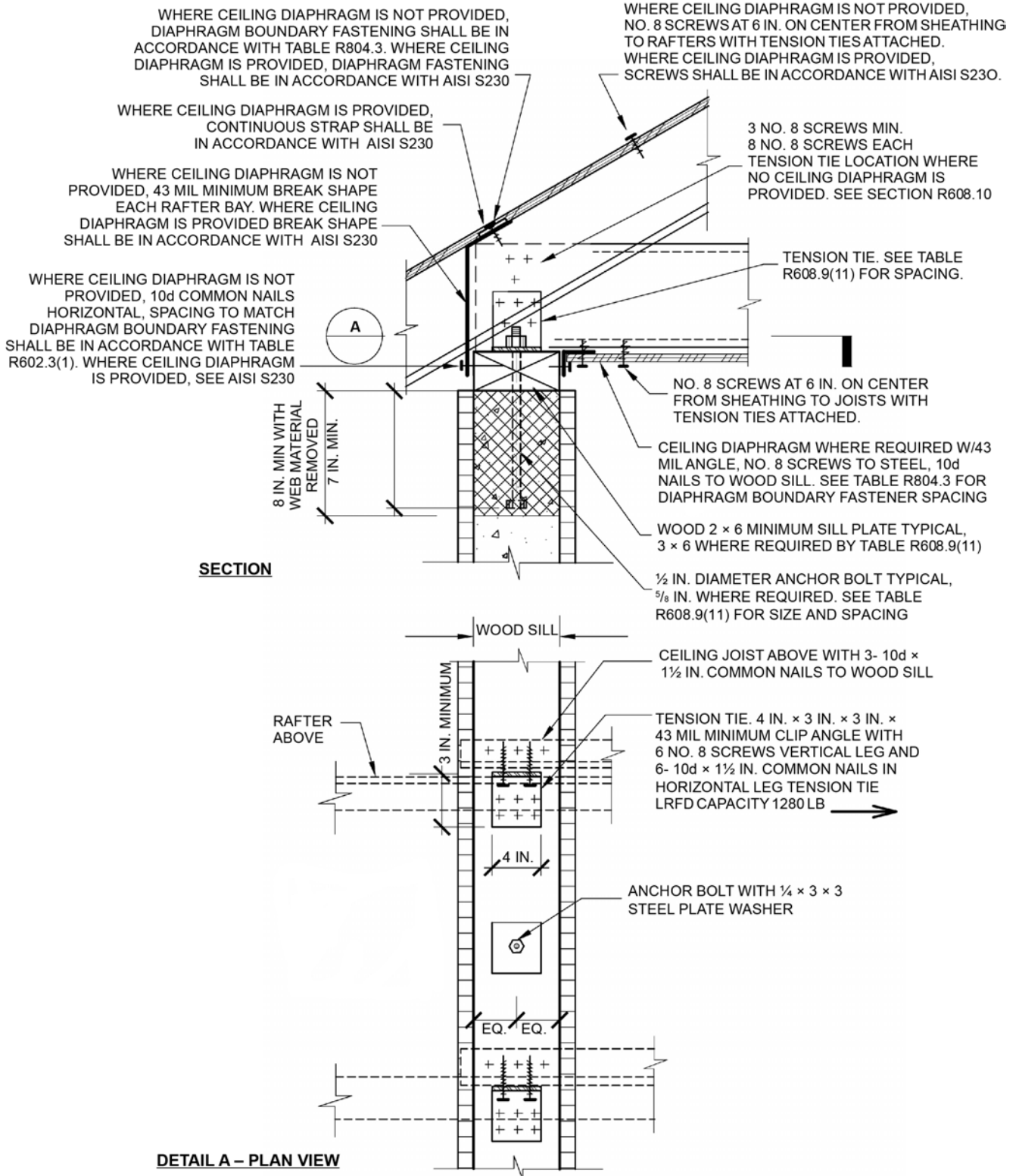
WALL CONSTRUCTION

TABLE R608.9(10)
WOOD-FRAMED ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL ^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
12	36					6	6
12	48				6	6	6
16	16					6	6
16	32					6	6
16	48				6	6	6
19.2	19.2					6	6
19.2	38.4				6	6	
24	24				6		
24	48			6	8B		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(10). Use of this detail is permitted where a cell is not shaded, and prohibited where shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in cells that do not contain a number.
- d. Numbers 6 and 8 indicate minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(10). For the remainder of the wall, see Note b.
- e. Letter “B” indicates that a ⁵/₈-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR

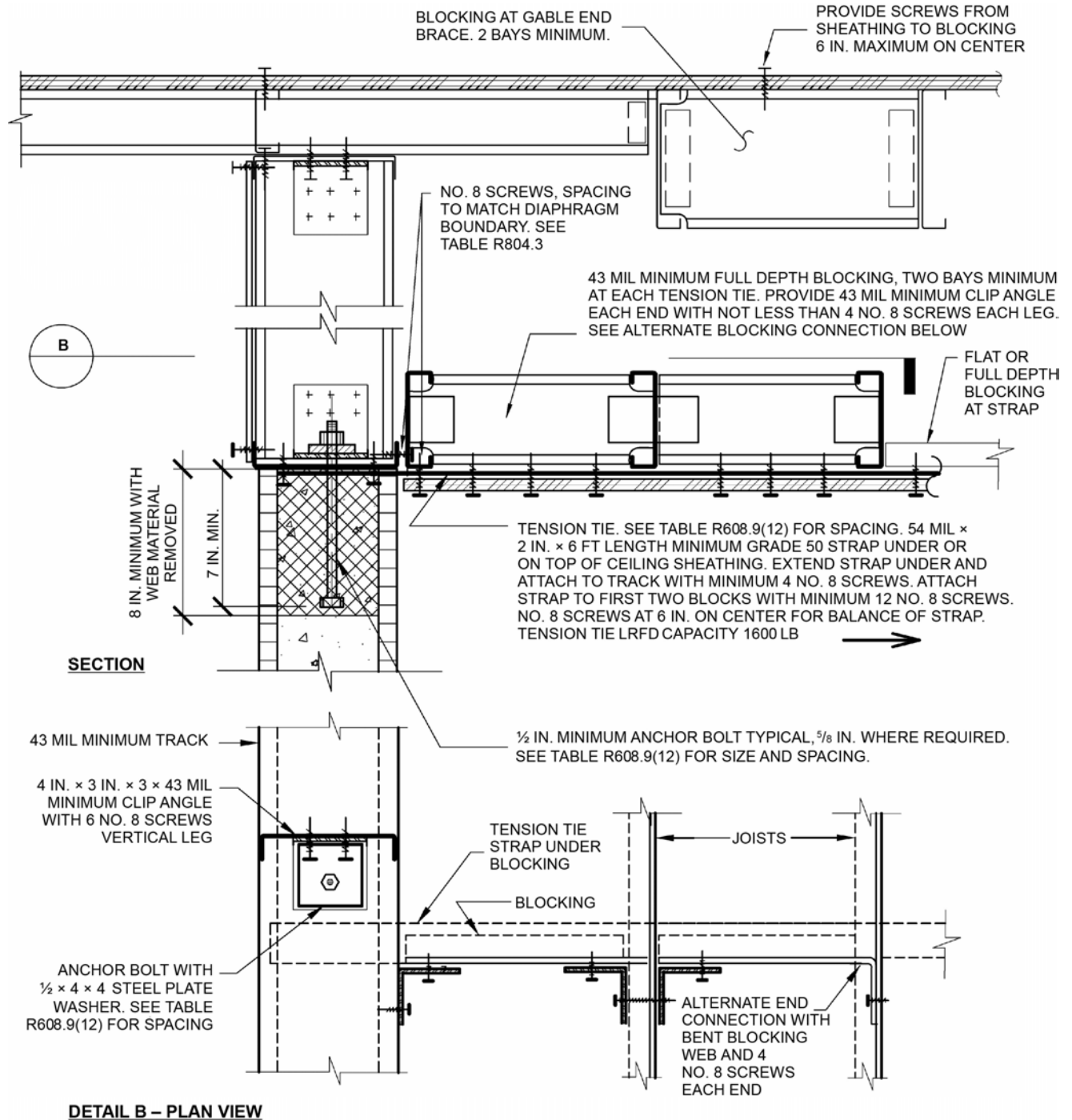
WALL CONSTRUCTION

TABLE R608.9(11)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PERPENDICULAR^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
16	16					6	6
16	32					6	6
19.2	19.2					6	6
19.2	38.4				6	6	6
24	24				6	6A	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- a. This table is for use with the detail in Figure R608.9(11). Use of this detail is permitted where a cell is not shaded.
- b. Wall design per other provisions of Section R608 is required.
- c. For wind design, minimum 4-inch-nominal wall is permitted in unshaded cells that do not contain a number.
- d. Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(11). For the remainder of the wall, see Note b.
- e. Letter “A” indicates that a minimum nominal 3 × 6 sill plate is required. Letter “B” indicates that a ⁵/₈-inch-diameter anchor bolt and a minimum nominal 3 × 6 sill plate are required.



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 pound-force = 4.448 N.

FIGURE R608.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL

TABLE R608.9(12)
COLD-FORMED STEEL ROOF TO TOP OF CONCRETE WALL, FRAMING PARALLEL ^{a, b, c, d, e}

ANCHOR BOLT SPACING (inches)	TENSION TIE SPACING (inches)	BASIC WIND SPEED (mph) AND WIND EXPOSURE CATEGORY					
		115B	120B	130B	140B	150B	160B
		—	—	110C	119C	127C	136C
		—	—	—	110D	117D	125D
12	12						6
12	24						6
16	16					6	6
16	32					6	6
19.2	19.2					6	6
19.2	38.4				6	6	6
24	24				6	6	6B

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

- This table is for use with the detail in Figure R608.9(12). Use of this detail is permitted where a cell is not shaded.
- Wall design per other provisions of Section R608 is required.
- For wind design, minimum 4-inch-nominal wall is permitted in cells that do not contain a number.
- Number 6 indicates minimum permitted nominal wall thickness in inches necessary to develop required strength (capacity) of connection. As a minimum, this nominal thickness shall occur in the portion of the wall indicated by the cross hatching in Figure R608.9(12). For the remainder of the wall, see Note b.
- Letter "B" indicates that a $5/8$ -inch-diameter anchor bolt is required.

R608.9.3 Connections between concrete walls and light-frame ceiling and roof systems. Connections between concrete walls and light-frame ceiling and roof systems shall be in accordance with one of the following:

- For ceiling and roof systems of wood-framed construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(9) and R608.9(10), where permitted by the tables accompanying those figures. Portions of connections of wood-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R802, or AWC WFCM, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.
- For ceiling and roof systems of cold-formed steel construction, the provisions of Section R608.9.1 and the prescriptive details of Figures R608.9(11) and R608.9(12), where permitted by the tables accompanying those figures. Portions of connections of cold-formed steel-framed ceiling and roof systems not noted in the figures shall be in accordance with Section R804, or AISI S230, if applicable.
- Proprietary connectors selected to resist loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
- An engineered design using loads and load combinations in accordance with Appendix A (ASD) or Appendix B (LRFD) of PCA 100.
- An engineered design using loads and material design provisions in accordance with this code, or in accordance with ASCE 7, ACI 318, and AWC NDS for wood-framed construction or AISI S100 for cold-formed steel-framed construction.

R608.10 Floor, roof and ceiling diaphragms. Floors and roofs in buildings with exterior walls of concrete shall be

designed and constructed as diaphragms. Where gable-end walls occur, ceilings shall be designed and constructed as diaphragms. The design and construction of floors, roofs and ceilings of wood framing or cold-formed-steel framing serving as diaphragms shall comply with the applicable requirements of this code, or AWC WFCM or AISI S230, if applicable. Wood framing members shall be of a species having a specific gravity equal to or greater than 0.42.

SECTION R609
EXTERIOR WINDOWS AND DOORS

R609.1 General. This section prescribes performance and construction requirements for exterior windows and doors installed in walls. Windows and doors shall be installed in accordance with the fenestration manufacturer's written instructions. Window and door openings shall be flashed in accordance with Section R703.4. Written installation instructions shall be provided by the fenestration manufacturer for each window or door.

R609.2 Performance. Exterior windows and doors shall be capable of resisting the design wind loads specified in Table R301.2.1(1) adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7 using the allowable stress design load combinations of ASCE 7. For exterior windows and doors tested in accordance with Sections R609.3 and R609.5, required design wind pressures determined from ASCE 7 using the ultimate strength design (USD) are permitted to be multiplied by 0.6. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *California Building Code*. Design wind loads for exterior glazing not part of a labeled assembly shall be permitted to be determined in accordance with Chapter 24 of the *California Building Code*.

R609.3 Testing and labeling. Exterior windows and sliding doors shall be tested by an approved independent laboratory, and bear a label identifying manufacturer, performance characteristics and approved inspection agency to indicate compliance with AAMA/WDMA/CSA 101/I.S.2/A440. Exterior side-hinged doors shall be tested and labeled as conforming to AAMA/WDMA/CSA 101/I.S.2/A440 or AMD 100, or comply with Section R609.5.

Exception: Decorative glazed openings.

R609.3.1 Comparative analysis. Structural wind load design pressures for window and door units different than the size tested in accordance with Section R609.3 shall be permitted to be different than the design value of the tested unit where determined in accordance with one of the following comparative analysis methods:

1. Structural wind load design pressures for window and door units smaller than the size tested in accordance with Section R609.3 shall be permitted to be higher than the design value of the tested unit provided such higher pressures are determined by accepted engineering analysis. Components of the smaller unit shall be the same as those of the tested unit. Where such calculated design pressures are used, they shall be validated by an additional test of the window or door unit having the highest allowable design pressure.
2. In accordance with WDMA I.S.11.

R609.4 Garage doors. Garage doors shall be tested in accordance with either ASTM E330 or ANSI/DASMA 108, and shall meet the pass/fail criteria of ANSI/DASMA 108.

R609.4.1 Garage door labeling. Garage doors shall be labeled with a permanent label provided by the garage door manufacturer. The label shall identify the garage door manufacturer, the garage door model/series number, the positive and negative design wind pressure rating, the installation instruction drawing reference number, and the applicable test standard.

R609.5 Other exterior window and door assemblies. Exterior windows and door assemblies not included within the scope of Section R609.3 or R609.4 shall be tested in accordance with ASTM E330. Glass in assemblies covered by this section shall comply with Section R308.5.

R609.6 Windborne debris protection. Protection of exterior windows, glass doors and doors with glass in buildings located in windborne debris regions shall be in accordance with Section R301.2.1.2.

R609.6.1 Fenestration testing and labeling. Fenestration shall be tested by an approved independent laboratory, listed by an approved entity, and bear a label identifying the manufacturer, performance characteristics and an approved inspection agency to indicate compliance with the requirements of the following specification(s):

1. ASTM E1886 and ASTM E1996; or
2. AAMA 506.

R609.6.2 Impact protective systems testing and labeling. Impact protective systems shall be tested for impact resistance by an approved independent laboratory for compliance with ASTM E1886 and ASTM E1996. Impact protective systems shall be tested for design wind pressure by an approved independent laboratory for compliance with ASTM E330. Required design wind pressures shall be determined in accordance with Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2) or determined in accordance with ASCE 7. For the purposes of this section, design wind pressures determined in accordance with ASCE 7 are permitted to be multiplied by 0.6.

Impact protective systems bear a label identifying the manufacturer, performance characteristics and an approved inspection agency. Impact protective systems shall have a permanent label providing traceability to the manufacturer, product designation and performance characteristics. The permanent label shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed.

R609.7 Anchorage methods. The methods cited in this section apply only to anchorage of window and glass door assemblies to the main force-resisting system.

R609.7.1 Anchoring requirements. Window and glass door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

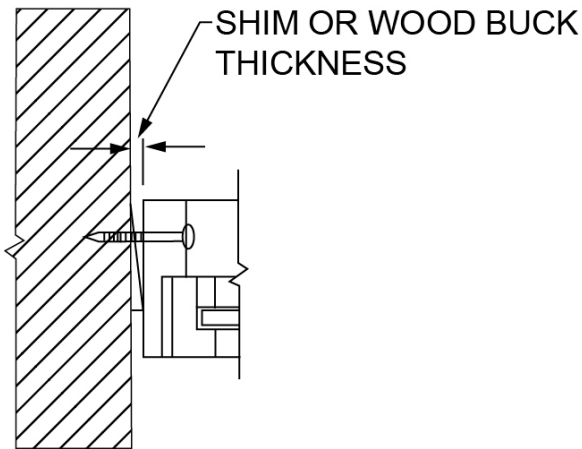
R609.7.2 Anchorage details. Products shall be anchored in accordance with the minimum requirements illustrated in Figures R609.7.2(1), R609.7.2(2), R609.7.2(3), R609.7.2(4), R609.7.2(5), R609.7.2(6), R609.7.2(7) and R609.7.2(8).

R609.7.2.1 Masonry, concrete or other structural substrate. Where the wood shim or buck thickness is less than 1½ inches (38 mm), window and glass door assemblies shall be anchored through the jamb, or by jamb clip and anchors shall be embedded directly into the masonry, concrete or other substantial substrate material. Anchors shall adequately transfer load from the window or door frame into the rough opening substrate [see Figures R609.7.2(1) and R609.7.2(2)].

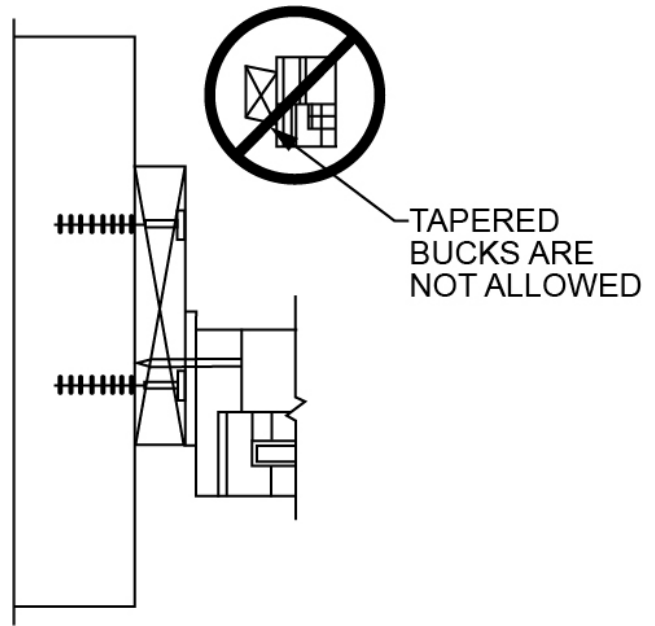
Where the wood shim or buck thickness is 1½ inches (38 mm) or more, the buck is securely fastened to the masonry, concrete or other substantial substrate, and the buck extends beyond the interior face of the window or door frame, window and glass door assemblies shall be anchored through the jamb, or by jamb clip, or through the flange to the secured wood buck. Anchors shall be embedded into the secured wood buck to adequately transfer load from the window or door frame assembly [see Figures R609.7.2(3), R609.7.2(4) and R609.7.2(5)].

WALL CONSTRUCTION

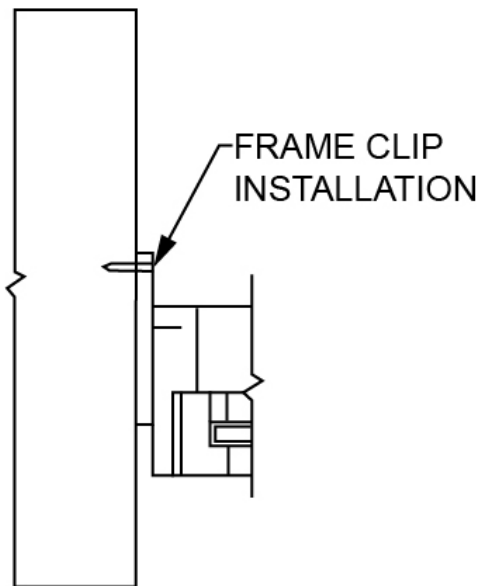
R609.7.2.2 Wood or other approved framing material. Where the framing material is wood or other approved framing material, window and glass door assemblies shall be anchored through the frame, or by frame clip, or through the flange. Anchors shall be embedded into the frame construction to adequately transfer load [see Figures R609.7.2(6), R609.7.2(7) and R609.7.2(8)].



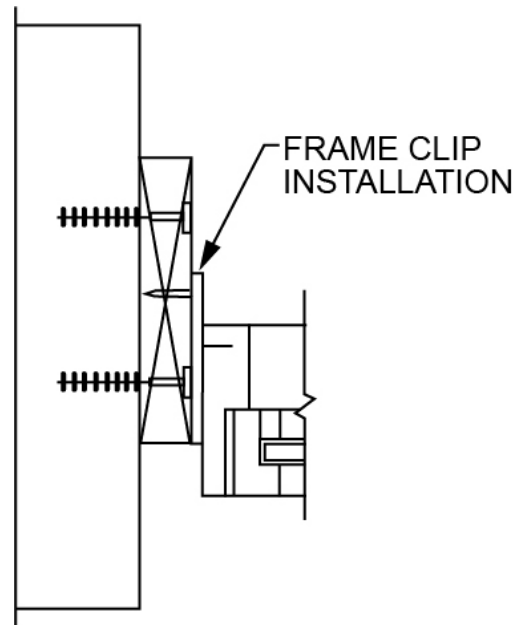
**FIGURE R609.7.2(1)
THROUGH THE FRAME**



**FIGURE R609.7.2(3)
THROUGH THE FRAME**



**FIGURE R609.7.2(2)
FRAME CLIP**



**FIGURE R609.7.2(4)
FRAME CLIP**

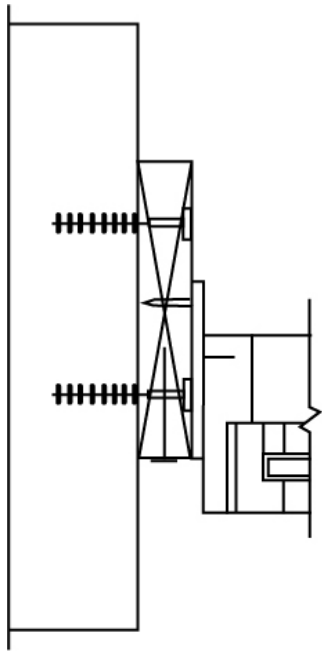


FIGURE R609.7.2(5)
THROUGH THE FLANGE

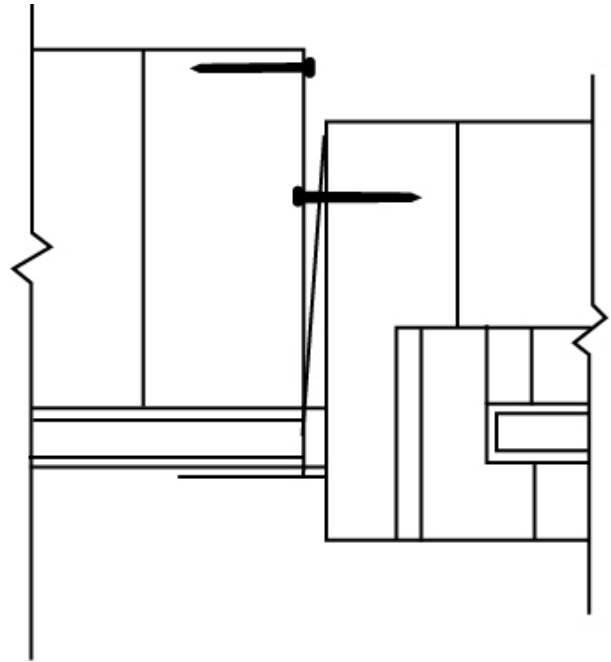


FIGURE R609.7.2(7)
FRAME CLIP

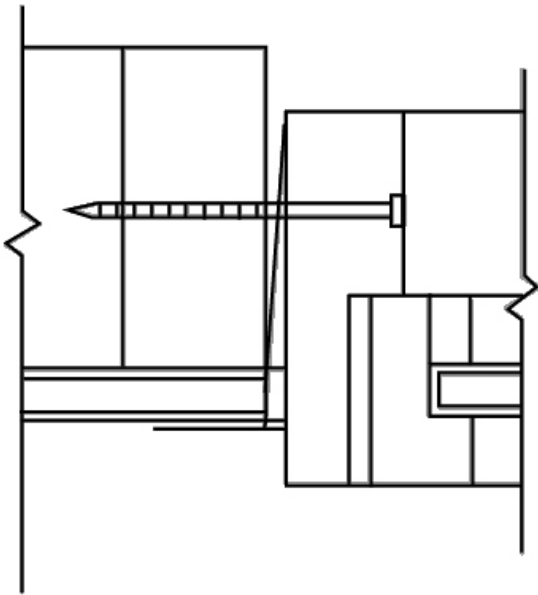


FIGURE R609.7.2(6)
THROUGH THE FLANGE

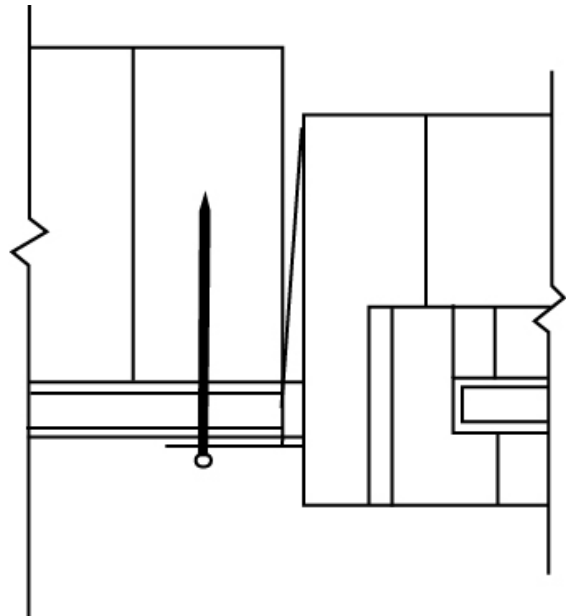


FIGURE R609.7.2(8)
THROUGH THE FLANGE

WALL CONSTRUCTION

R609.8 Mullions. Mullions shall be tested by an approved testing laboratory in accordance with AAMA 450, or be engineered in accordance with accepted engineering practice. Mullions tested as stand-alone units or qualified by engineering shall use performance criteria cited in Sections R609.8.1, R609.8.2 and R609.8.3. Mullions qualified by an actual test of an entire assembly shall comply with Sections R609.8.1 and R609.8.3.

R609.8.1 Load transfer. Mullions shall be designed to transfer the design pressure loads applied by the window and door assemblies to the rough opening substrate.

R609.8.2 Deflection. Mullions shall be capable of resisting the design pressure loads applied by the window and door assemblies to be supported without deflecting more than $L/175$, where L is the span of the mullion in inches.

R609.8.3 Structural safety factor. Mullions shall be capable of resisting a load of 1.5 times the design pressure loads applied by the window and door assemblies to be supported without exceeding the appropriate material stress levels. If tested by an approved laboratory, the 1.5 times the design pressure load shall be sustained for 10 seconds, and the permanent deformation shall not exceed 0.4 percent of the mullion span after the 1.5 times design pressure load is removed.

SECTION R610 STRUCTURAL INSULATED PANEL WALL CONSTRUCTION

R610.1 General. Structural insulated panel (SIP) walls shall be designed in accordance with the provisions of this section. Where the provisions of this section are used to design structural insulated panel walls, project drawings, typical details and specifications shall not exempt construction documents from the requirement to be stamped by a California licensed architect or engineer. Notwithstanding other sections of law, the law establishing these provisions is found in Business and Professions Code Sections 5537.1 and 6737.1.

R610.2 Applicability limits. The provisions of this section shall control the construction of exterior structural insulated panel walls and interior load-bearing structural insulated panel walls for buildings not greater than 60 feet (18 288 mm) in length perpendicular to the joist or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist or truss span and not greater than two stories in height with each wall not greater than 10 feet (3048 mm) high. Exterior walls installed in accordance with the provisions of this section shall be considered as load-bearing walls. Structural insulated panel walls constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed (V_{ult}) is not greater than 155 miles per hour (69 m/s) in Exposure B or 140 miles per hour (63 m/s) in Exposure C, the ground snow load is not greater than 70 pounds per square foot (3.35 kPa), and the seismic design category is A, B or C.

R610.3 Materials. SIPs shall comply with the requirements of ANSI/APA PRS 610.1.

R610.3.1 Lumber. The minimum lumber framing material used for SIPs prescribed in this document is NLGA graded No. 2 Spruce-pine-fir. Substitution of other wood species/grades that meet or exceed the mechanical properties and specific gravity of No. 2 Spruce-pine-fir shall be permitted.

R610.3.2 SIP screws. Screws used for the erection of SIPs as specified in Section R610.5 shall be fabricated from steel, shall be provided by the SIP manufacturer and shall be sized to penetrate the wood member to which the assembly is being attached by not less than 1 inch (25 mm). The screws shall be corrosion resistant and have a minimum shank diameter of 0.188 inch (4.7 mm) and a minimum head diameter of 0.620 inch (15.5 mm).

R610.3.3 Nails. Nails specified in Section R610 shall be common or galvanized box unless otherwise stated.

R610.4 SIP wall panels. SIPs shall comply with Figure R610.4 and shall have minimum panel thickness in accordance with Tables R610.5(1) and R610.5(2) for above-grade walls. SIPs shall be identified by grade mark or certificate of inspection issued by an approved agency in accordance with ANSI/APA PRS 610.1.

(HCD 1 and HCD 2) Note: See the California Factory-Built Housing Law, Health and Safety Code Section 19960 et seq.; and the California Code of Regulations, Title 25, Division 1, Chapter 3; which require building components as addressed in the definition of "factory-built housing" to bear insignia of approval issued by the Department of Housing and Community Development, as specified.

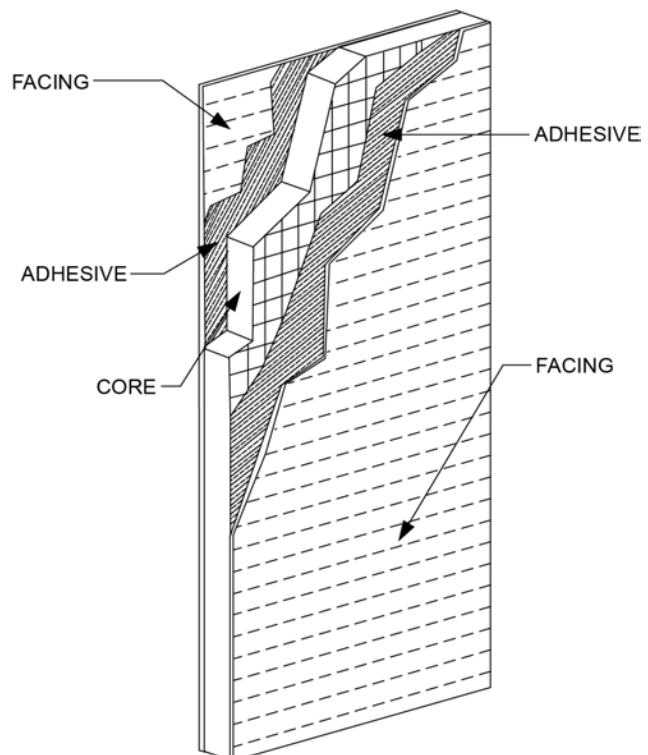


FIGURE R610.4
SIP WALL PANEL

R610.5 Wall construction. Exterior walls of SIP construction shall be designed and constructed in accordance with the provisions of this section and Tables R610.5(1) and R610.5(2) and Figures R610.5(1) through R610.5(5). SIP walls shall be fastened to other wood building components in accordance with Tables R602.3(1) through R602.3(4).

Framing shall be attached in accordance with Table R602.3(1) unless otherwise provided for in Section R610.

R610.5.1 Top plate connection. SIP walls shall be capped with a double top plate installed to provide overlapping at corner, intersections and splines in accordance with Figure R610.5.1. The double top plates shall be made up of a single 2-by (nominal 2-inch) top plate having a width equal to the width of the panel core, and shall be recessed into the SIP below. Over this top plate a cap plate shall be placed. The cap plate width shall match the SIP thickness and overlap the facers on both sides of the panel. End joints in top plates shall be offset not less than 24 inches (610 mm).

R610.5.2 Bottom (sole) plate connection. SIP walls shall have full bearing on a sole plate having a width equal to the nominal width of the foam core. Where SIP walls are supported directly on continuous foundations, the wall wood sill plate shall be anchored to the foundation in accordance with Figure R610.5.2 and Section R403.1.

R610.5.3 Panel-to-panel connection. SIPs shall be connected at vertical in-plane joints in accordance with Figure R610.8 or by other approved methods.

R610.5.4 Corner framing. Corner framing of SIP walls shall be constructed in accordance with Figure R610.5.4.

R610.5.5 Wall bracing. SIP walls shall be braced in accordance with Section R602.10. SIP walls shall be considered continuous wood structural panel sheathing (bracing Method CS-WSP) for purposes of computing

required bracing. SIP walls shall meet the requirements of Section R602.10.4.2 except that SIP corners shall be fabricated as shown in Figure R610.8. Where SIP walls are used for wall bracing, the SIP bottom plate shall be attached to wood framing below in accordance with Table R602.3(1).

R610.5.6 Thermal barrier. SIP walls shall be separated from the interior of a building by an approved thermal barrier in accordance with Section R316.4.

R610.6 Interior load-bearing walls. Interior *load-bearing walls* shall be constructed as specified for exterior walls.

R610.7 Drilling and notching. The maximum vertical chase penetration in SIPs shall have a maximum side dimension of 2 inches (51 mm) centered in the panel. Vertical chases shall have a minimum spacing of 24 inches (610 mm) on center. Not more than two horizontal chases shall be permitted in each wall panel, one at 14 inches (360 mm) plus or minus 2 inches (51 mm) from the bottom of the panel and one at 48 inches (1220 mm) plus or minus 2 inches (51 mm) from the bottom edge of the SIP's panel. Additional penetrations are permitted where justified by analysis.

R610.8 Headers. SIP headers shall be designed and constructed in accordance with Table R610.8 and Figure R610.5.1. SIP headers shall be continuous sections without *splines*. Headers shall be not less than $11\frac{7}{8}$ inches (302 mm) deep. Headers longer than 4 feet (1219 mm) shall be constructed in accordance with Section R602.7. The strength axis of the factors on the header shall be oriented horizontally.

R610.8.1 Wood structural panel box headers. Wood structural panel box headers shall be allowed where SIP headers are not applicable. Wood structural panel box headers shall be constructed in accordance with Figure R602.7.3 and Table R602.7.3.

WALL CONSTRUCTION

TABLE R610.5(1)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ROOF ONLY (inches)^a

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		GROUND SNOW LOAD (psf)	BUILDING WIDTH (ft)																		
			24			28			32			36			40						
			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)						
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10				
110	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5			
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5		
115	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5		
		50	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	
		70	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	
130	110	20	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	
		30	4.5	4.5	6.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	
		50	4.5	4.5	DR	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	
		70	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR
140	120	20	4.5	6.5	DR	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	
		30	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	4.5	DR	DR	
		50	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR
		70	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

DR = Design Required.

a. Design assumptions:

- Maximum deflection criteria: L/240.
- Maximum roof dead load: 10 psf.
- Maximum roof live load: 70 psf.
- Maximum ceiling dead load: 5 psf.
- Maximum ceiling live load: 20 psf.
- Wind loads based on Table R301.2.1(1).
- Strength axis of facing material applied vertically.

TABLE R610.5(2)
MINIMUM THICKNESS FOR SIP WALL SUPPORTING SIP OR LIGHT-FRAME ONE STORY AND ROOF ONLY (inches)^a

ULTIMATE DESIGN WIND SPEED V_{ult} (mph)		GROUND SNOW LOAD (psf)	BUILDING WIDTH (ft)															
			24			28			32			36			40			
			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			Wall Height (feet)			
Exp. B	Exp. C		8	9	10	8	9	10	8	9	10	8	9	10	8	9	10	
110	—	20	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR
		30	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR
		50	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR
		70	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR
115	—	20	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR	
		30	4.5	4.5	4.5	4.5	4.5	6.5	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR	
		50	4.5	4.5	6.5	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	
		70	4.5	4.5	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	
120	—	20	4.5	4.5	6.5	4.5	4.5	DR	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	
		30	4.5	4.5	DR	4.5	4.5	DR	4.5	6.5	DR	4.5	DR	DR	DR	DR	DR	
		50	4.5	4.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	
		70	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	
130	110	20	4.5	6.5	DR	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	
		30	4.5	DR	DR	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	
		50	4.5	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	
		70	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	DR	

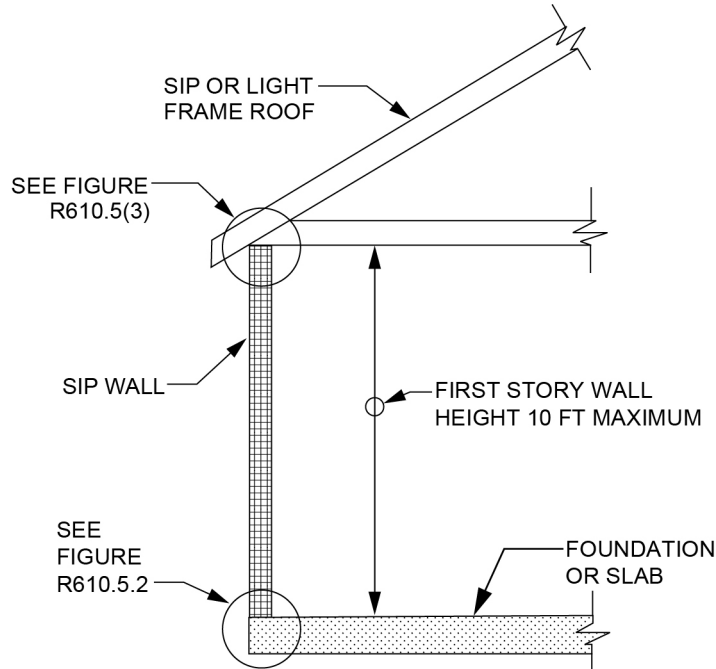
For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mile per hour = 0.447 m/s.

DR = Design Required.

a. Design assumptions:

- Maximum deflection criteria: $L/240$.
- Maximum roof dead load: 10 psf.
- Maximum roof live load: 70 psf.
- Maximum ceiling dead load: 5 psf.
- Maximum ceiling live load: 20 psf.
- Maximum second-floor dead load: 10 psf.
- Maximum second-floor live load: 30 psf.
- Maximum second-floor dead load from walls: 10 psf.
- Maximum first-floor dead load: 10 psf.
- Maximum first-floor live load: 40 psf.
- Wind loads based on Table R301.2.1(1).
- Strength axis of facing material applied vertically.

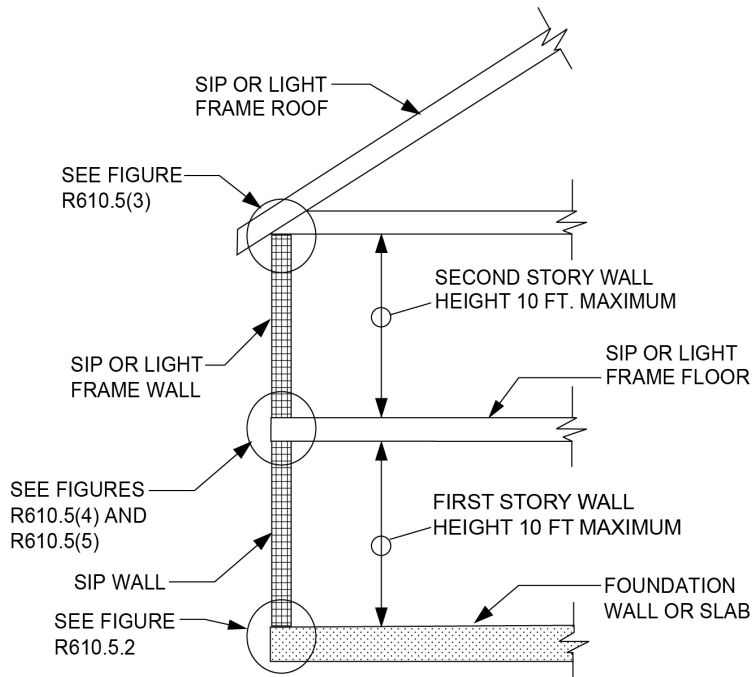
WALL CONSTRUCTION



For SI: 1 foot = 304.8 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and R602.3(2), as appropriate.

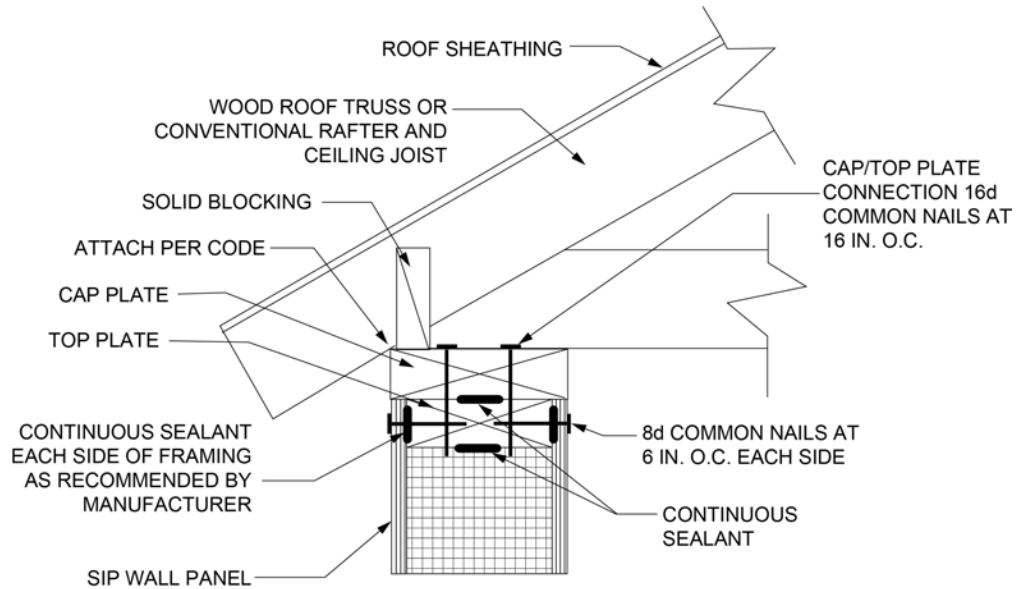
**FIGURE R610.5(1)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS**



For SI: 1 foot = 304.8 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and R602.3(2), as appropriate.

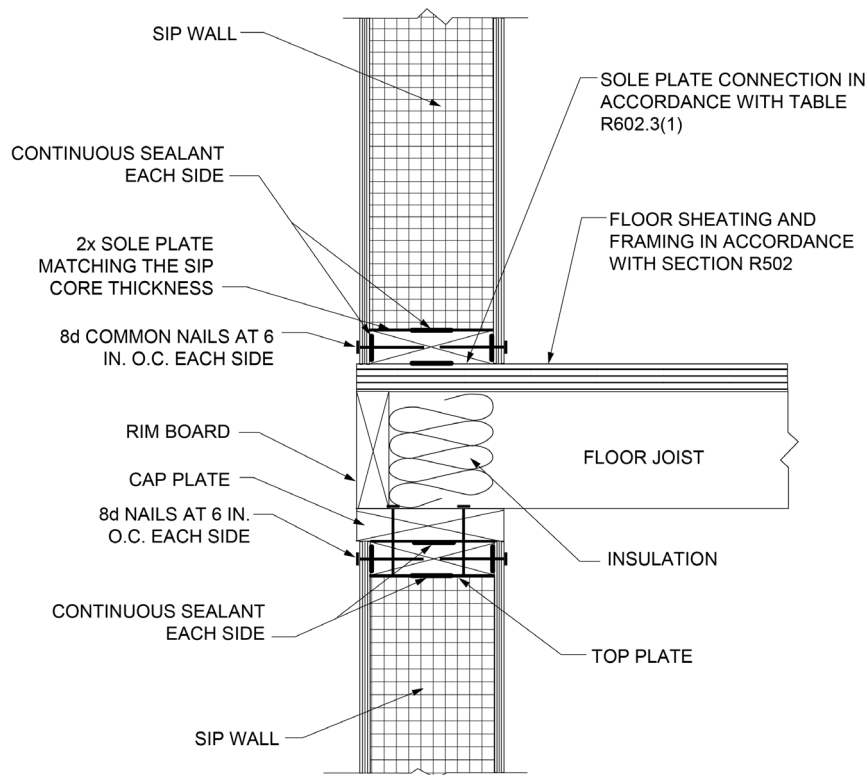
**FIGURE R610.5(2)
MAXIMUM ALLOWABLE HEIGHT OF SIP WALLS**



For SI: 1 inch = 25.4 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and R602.3(2), as appropriate.

FIGURE R610.5(3)
TRUSSED ROOF TO TOP PLATE CONNECTION

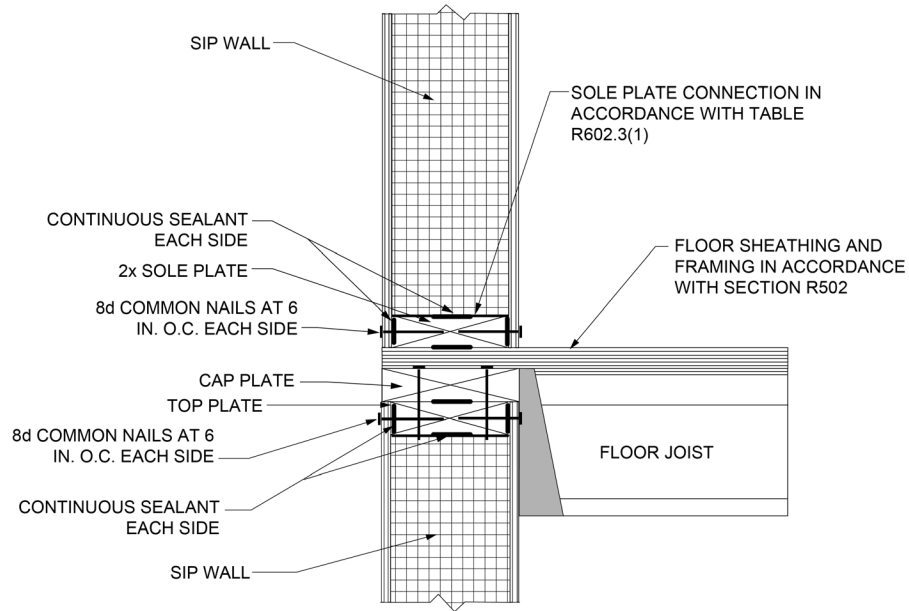


For SI: 1 inch = 25.4 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and R602.3(2), as appropriate.

FIGURE R610.5(4)
SIP WALL-TO-WALL PLATFORM FRAME CONNECTION

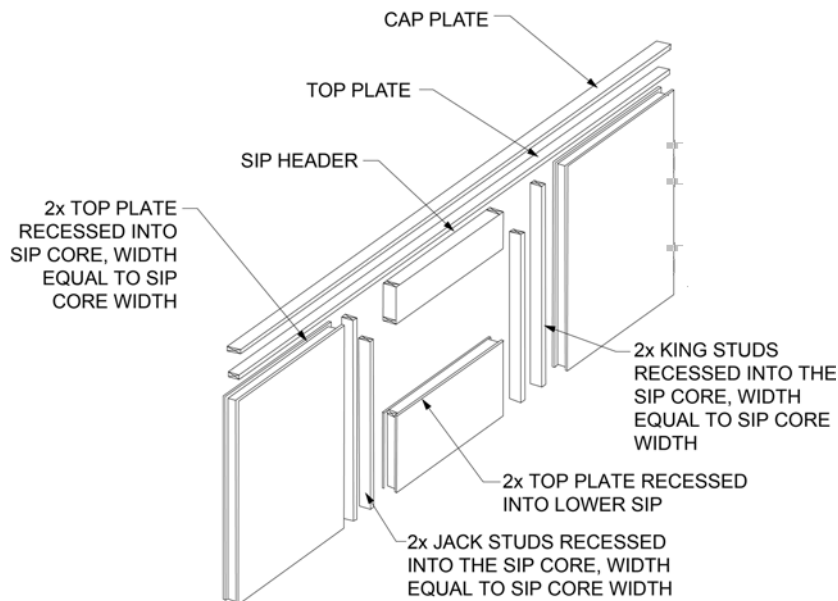
WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

Note: Figure illustrates SIP-specific attachment requirements. Other connections shall be made in accordance with Tables R602.3(1) and R602.3(2), as appropriate.

FIGURE R610.5(5)
SIP WALL-TO-WALL HANGING FLOOR FRAME CONNECTION
(I-Joist floor shown for illustration only)

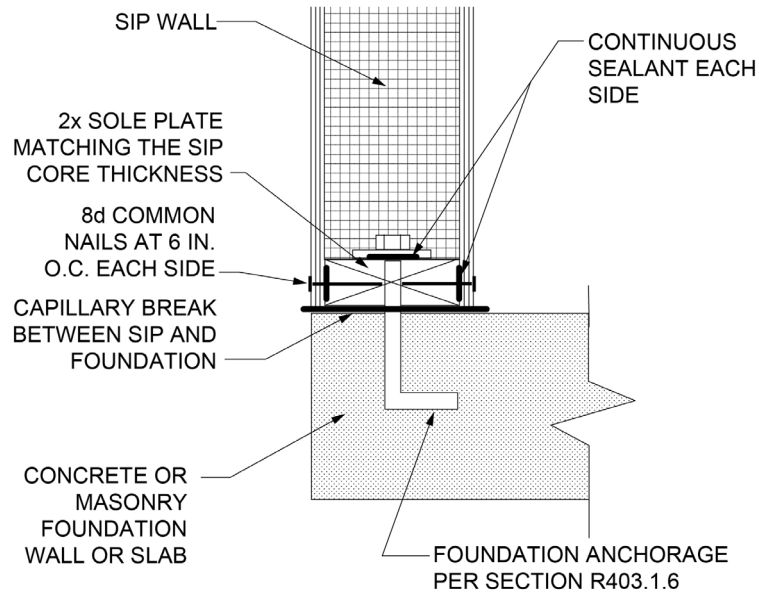


For SI: 1 inch = 25.4 mm.

Notes:

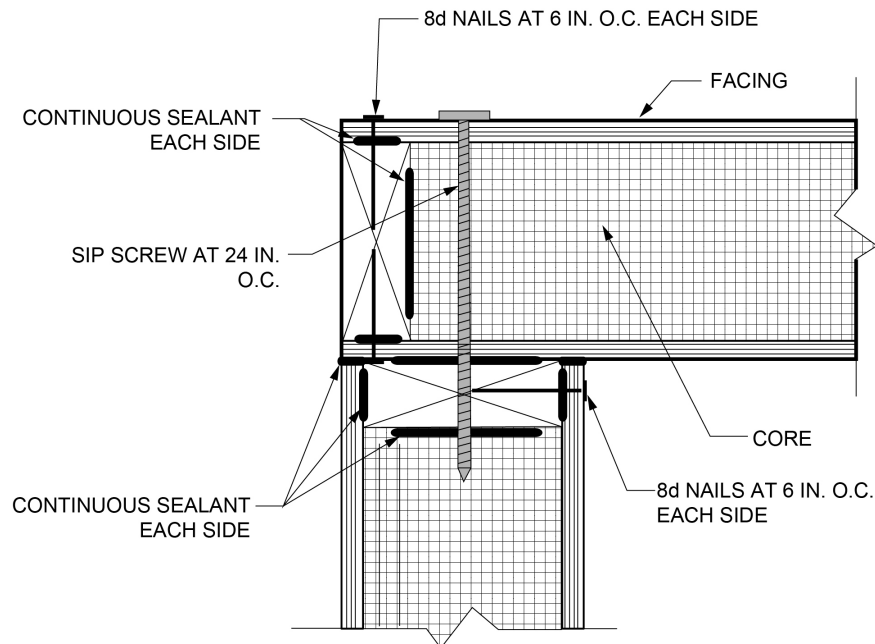
1. Top plates shall be continuous over header.
2. Lower 2x top plate shall have a width equal to the SIP core width and shall be recessed into the top edge of the panel. Cap plate shall be placed over the recessed top plate and shall have a width equal to the SIP's width.
3. SIP facing surfaces shall be nailed to framing and cripples with 8d common or galvanized box nails spaced 6 inches on center.

FIGURE R610.5.1
SIP WALL FRAMING CONFIGURATION



For SI: 1 inch = 25.4 mm.

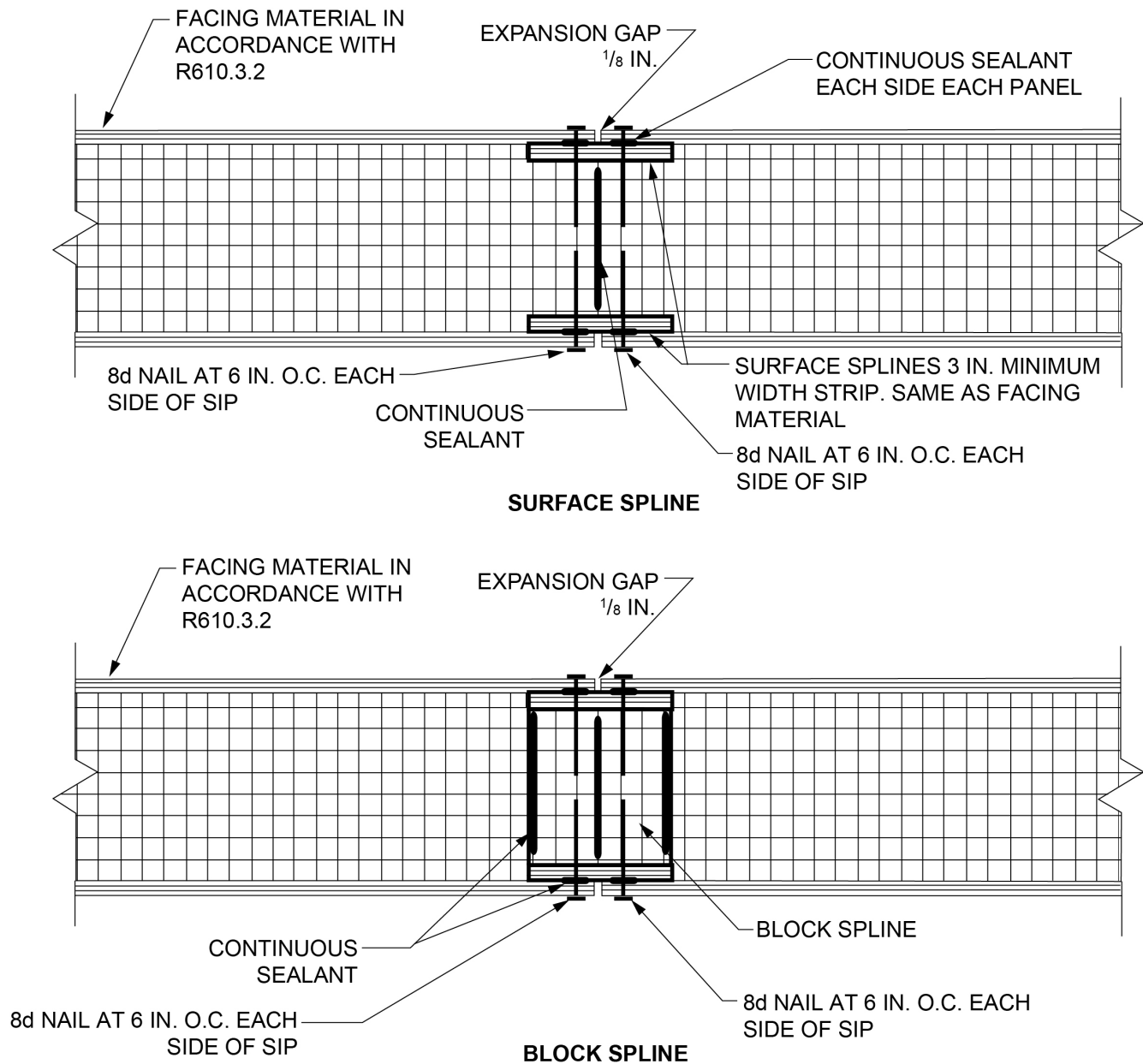
FIGURE R610.5.2
SIP WALL TO CONCRETE SLAB FOR FOUNDATION WALL ATTACHMENT



For SI: 1 inch = 25.4 mm.

FIGURE R610.5.4
SIP CORNER FRAMING DETAIL

WALL CONSTRUCTION



For SI: 1 inch = 25.4 mm.

FIGURE R610.8
TYPICAL SIP WALL PANEL-TO-PANEL CONNECTION DETAILS

TABLE R610.8
MAXIMUM SPANS FOR 11⁷/₈-INCH OR DEEPER SIP HEADERS (feet)^{a, c, d}

LOAD CONDITION	GROUND SNOW LOAD (psf)	BUILDING ^b width (feet)				
		24	28	32	36	40
Supporting roof only	20	4	4	4	4	2
	30	4	4	4	2	2
	50	2	2	2	2	2
	70	2	2	2	DR	DR
Supporting roof and one-story	20	2	2	DR	DR	DR
	30	2	2	DR	DR	DR
	50	2	DR	DR	DR	DR
	70	DR	DR	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

DR = Design Required.

a. Design assumptions:

- Maximum deflection criterion: $L/240$.
- Maximum roof dead load: 10 psf.
- Maximum ceiling load: 5 psf.
- Maximum ceiling live load: 20 psf
- Maximum second-floor live load: 30 psf.
- Maximum second-floor dead load: 10 psf.
- Maximum second-floor dead load from walls: 10 psf.
- Maximum first floor dead load: 10 psf.
- Wind loads based on Table R301.2.1(1).
- Strength axis of facing material applied horizontally.

b. Building width is in the direction of horizontal framing members supported by the header.

c. The table provides for roof slopes between 3:12 and 12:12.

d. The maximum roof overhang is 24 inches (610 mm).

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 7 – WALL COVERING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below																			X			
Chapter / Section																						
R702.7				X																		
Table R702.7 (3)				†																		
R702.7.2																				X		
Table R702.7(5)																				X		

The state agency does not adopt sections identified with the following symbol: †

CHAPTER 7

WALL COVERING

User note:

About this chapter: Chapter 7 establishes the various types of materials, materials standards and methods of application permitted as interior and exterior wall coverings. Interior coverings include interior plaster, gypsum board, ceramic tile, wood veneer paneling, hardboard paneling, wood shakes and wood shingles. Exterior wall coverings regulated by this section include aluminum, stone and masonry veneer, wood, hardboard, particleboard, wood structural panel siding, wood shakes and shingles, exterior plaster, steel, vinyl, fiber cement and exterior insulation finish systems. This chapter also contains requirements for the use of vapor retarders for moisture control in walls; wind resistance and water-resistive barriers for exterior wall coverings; and the water-resistive barrier required beneath exterior materials.

SECTION R701 GENERAL

R701.1 Application. The provisions of this chapter shall control the design and construction of the interior and exterior wall covering for buildings.

R701.2 Installation. Products sensitive to adverse weather shall not be installed until adequate weather protection for the installation is provided. Exterior sheathing shall be dry before applying exterior cover.

SECTION R702 INTERIOR COVERING

R702.1 General. Interior coverings or wall finishes shall be installed in accordance with this chapter and Tables R702.1(1), R702.1(2), R702.1(3) and R702.3.5. Interior masonry veneer shall comply with the requirements of

Section R703.7.1 for support and Section R703.7.4 for anchorage, except an airspace is not required. Interior finishes and materials shall conform to the flame spread and smoke-development requirements of Section R302.9.

R702.2 Interior plaster.

R702.2.1 Gypsum plaster. Gypsum plaster materials shall conform to ASTM C5, C22, C28, C35, C59, C61, C587, C631, C847, C933, C1032 and C1047, and shall be installed or applied in compliance with ASTM C841, C842 and C843. Gypsum lath or gypsum base for veneer plaster shall conform to ASTM C1396 and shall be installed in compliance with ASTM C844. Plaster shall be not less than three coats where applied over metal lath and not less than two coats where applied over other bases permitted by this section, except that veneer plaster shall be applied in one coat not to exceed $\frac{3}{16}$ inch (4.76 mm) thickness, provided the total thickness is in accordance with Table R702.1(1).

**TABLE R702.1(1)
THICKNESS OF PLASTER**

PLASTER BASE	FINISHED THICKNESS OF PLASTER FROM FACE OF LATH, MASONRY, CONCRETE (inches)	
	Gypsum Plaster	Cement Plaster
Expanded metal lath	$\frac{5}{8}$, minimum ^a	$\frac{5}{8}$, minimum ^a
Wire lath	$\frac{5}{8}$, minimum ^a	$\frac{3}{4}$, minimum (interior) ^b
		$\frac{7}{8}$, minimum (exterior) ^b
Gypsum lath ^g	$\frac{1}{2}$, minimum	$\frac{3}{4}$, minimum (interior) ^b
Masonry walls ^c	$\frac{1}{2}$, minimum	$\frac{1}{2}$, minimum
Monolithic concrete walls ^{c, d}	$\frac{5}{8}$, maximum	$\frac{7}{8}$, maximum
Monolithic concrete ceilings ^{c, d}	$\frac{3}{8}$, maximum ^e	$\frac{1}{2}$, maximum
Gypsum veneer base ^{f, g}	$\frac{1}{16}$, minimum	$\frac{3}{4}$, minimum (interior) ^b
Gypsum sheathing ^g	—	$\frac{3}{4}$, minimum (interior) ^b
		$\frac{7}{8}$, minimum (exterior) ^b

For SI: 1 inch = 25.4 mm.

- a. Where measured from back plane of expanded metal lath, exclusive of ribs, or self-furring lath, plaster thickness shall be $\frac{3}{4}$ inch minimum.
- b. Where measured from face of support or backing.
- c. Because masonry and concrete surfaces vary in plane, thickness of plaster need not be uniform.
- d. Where applied over a liquid bonding agent, finish coat shall be permitted to be applied directly to concrete surface.
- e. Approved acoustical plaster shall be permitted to be applied directly to concrete or over base coat plaster, beyond the maximum plaster thickness shown.
- f. Attachment shall be in accordance with Table R702.3.5.
- g. Where gypsum board is used as a base for cement plaster, a water-resistive barrier complying with Section R703.2 shall be provided.

WALL COVERING

TABLE R702.1(2)
GYPSUM PLASTER PROPORTIONS^a

NUMBER	COAT	PLASTER BASE OR LATH	MAXIMUM VOLUME AGGREGATE PER 100 POUNDS NEAT PLASTER ^b (cubic feet)	
			Damp Loose Sand ^a	Pelite or Vermiculite ^c
Two-coat work	Base coat	Gypsum lath	2.5	2
	Base coat	Masonry	3	3
Three-coat work	First coat	Lath	2 ^d	2
	Second coat	Lath	3 ^d	2 ^e
	First and second coats	Masonry	3	3

For SI: 1 inch = 25.4 mm, 1 cubic foot = 0.0283 m³, 1 pound = 0.454 kg.

- a. Wood-fibered gypsum plaster shall be mixed in the proportions of 100 pounds of gypsum to not more than 1 cubic foot of sand where applied on masonry or concrete.
- b. Where determining the amount of aggregate in set plaster, a tolerance of 10 percent shall be allowed.
- c. Combinations of sand and lightweight aggregate shall be permitted to be used, provided the volume and weight relationship of the combined aggregate to gypsum plaster is maintained.
- d. If used for both first and second coats, the volume of aggregate shall be permitted to be 2.5 cubic feet.
- e. Where plaster is 1 inch or more in total thickness, the proportions for the second coat may be increased to 3 cubic feet.

TABLE R702.1(3)
CEMENT PLASTER PROPORTIONS, PARTS BY VOLUME

COAT	CEMENT PLASTER TYPE	CEMENTITIOUS MATERIALS				VOLUME OF AGGREGATE PER SUM OF SEPARATE VOLUMES OF CEMENTITIOUS MATERIALS ^b
		Portland Cement Type I, II or III; Blended Hydraulic Cement Type IP, I (S < 70), IL, or IT (S < 70); or Hydraulic Cement Type GU, HE, MS, HS or MH	Plastic Cement	Masonry Cement Type M, S or N	Lime	
First	Portland or blended	1	—	—	3/4-1 1/2 ^a	2 1/2-4
	Masonry	—	—	1	—	2 1/2-4
	Plastic	—	1	—	—	2 1/2-4
Second	Portland or blended	1	—	—	3/4-1 1/2	3-5
	Masonry	—	—	1	—	3-5
	Plastic	—	1	—	—	3-5
Finish	Portland or blended	1	—	—	1 1/2-2	1 1/2-3
	Masonry	—	—	1	—	1 1/2-3
	Plastic	—	1	—	—	1 1/2-3

- a. Lime by volume of 0 to 3/4 shall be used where the plaster will be placed over low-absorption surfaces such as dense clay tile or brick.
- b. The same or greater sand proportion shall be used in the second coat than used in the first coat.

R702.2.2 Cement plaster. Cement plaster materials shall conform to ASTM C91 (Type M, S or N), C150 (Types I, II and III), C595 [Types IP, I (PM), IS and I (SM)], C847, C897, C933, C1032, C1047 and C1328, and shall be installed or applied in compliance with ASTM C926 and C1063. Gypsum lath shall conform to ASTM C1396. Plaster shall be not less than three coats where applied over metal lath and not less than two coats where applied over other bases permitted by this section.

R702.2.2.1 Application. Each coat shall be kept in a moist condition for not less than 24 hours prior to application of the next coat.

Exception: Applications installed in accordance with ASTM C926.

R702.2.2.2 Curing. The finish coat for two-coat cement plaster shall not be applied sooner than 48 hours after application of the first coat. For three-coat cement plaster, the second coat shall not be applied sooner than 24 hours after application of the first coat. The finish coat for three-coat cement plaster shall not be applied sooner than 48 hours after application of the second coat.

R702.2.3 Support. Support spacing for gypsum or metal lath on walls or ceilings shall not exceed 16 inches (406 mm) for 3/8-inch-thick (9.5 mm) or 24 inches (610 mm) for 1/2-inch-thick (12.7 mm) plain gypsum lath. Gypsum lath shall be installed at right angles to support framing with end joints in adjacent courses staggered by not less than one framing space.

R702.3 Gypsum board and gypsum panel products.

R702.3.1 Materials. Gypsum board and gypsum panel product materials and accessories shall conform to ASTM C22, C475, C514, C1002, C1047, C1177, C1178, C1278, C1396, C1658 or C1766 and shall be installed in accordance with the provisions of this section. Adhesives for the installation of gypsum board and gypsum panel products shall conform to ASTM C557.

R702.3.1.1 Adhesives. Expandable foam adhesives for the installation of gypsum board and gypsum panel products shall conform to ASTM D6464. Other adhesives for the installation of gypsum board and gypsum panel products shall conform to ASTM C557. Supports and fasteners used to attach gypsum board and gypsum panel products shall comply with Table R702.3.5 or other approved method.

R702.3.2 Wood framing. Wood framing supporting gypsum board and gypsum panel products shall be not less than 2 inches (51 mm) nominal thickness in the least dimension except that wood furring strips not less than 1-inch by 2-inch (25 mm by 51 mm) nominal dimension shall be permitted to be used over solid backing or framing spaced not more than 24 inches (610 mm) on center.

R702.3.3 Cold-formed steel framing. Cold-formed steel framing supporting gypsum board and gypsum panel products shall be not less than 1¹/₄ inches (32 mm) wide in the least dimension. Nonload-bearing cold-formed steel framing shall comply with AISI S220. Load-bearing cold-formed steel framing shall comply with AISI S240.

R702.3.4 Insulating concrete form walls. Foam plastics for insulating concrete form walls constructed in accordance with Sections R404.1.2 and R608 on the interior of habitable spaces shall be protected in accordance with Section R316.4. Use of adhesives in conjunction with mechanical fasteners is permitted. Adhesives used for interior and exterior finishes shall be compatible with the insulating form materials.

R702.3.5 Application. Supports and fasteners used to attach gypsum board and gypsum panel products shall comply with Table R702.3.5. Gypsum sheathing shall be attached to exterior walls in accordance with Table R602.3(1). Gypsum board and gypsum panel products shall be applied at right angles or parallel to framing members. All edges and ends of gypsum board and gypsum panel products shall occur on the framing members, except those edges and ends that are perpendicular to the framing members. Interior gypsum board shall not be installed where it is directly exposed to the weather or to water.

R702.3.5.1 Screw fastening. Screws for attaching gypsum board and gypsum panel products to wood framing shall be Type W or Type S in accordance with ASTM C1002 and shall penetrate the wood not less than ⁵/₈ inch (15.9 mm). Gypsum board and gypsum panel products shall be attached to cold-formed steel framing with minimum No. 6 screws. Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing less than 0.033 inch (1 mm) thick shall be Type S in accordance with ASTM C1002 or bugle head style in accordance with ASTM C1513 and shall penetrate the steel not less than ³/₈ inch (9.5 mm). Screws for attaching gypsum board and gypsum panel products to cold-formed steel framing 0.033 inch to 0.112 inch (1 mm to 3 mm) thick shall be in accordance with ASTM C954 or bugle head style in accordance with ASTM C1513. Screws for attaching gypsum board and gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than ⁷/₁₆ inch (11.1 mm).

R702.3.6 Horizontal gypsum board diaphragm ceilings. Gypsum board and gypsum panel products shall be permitted on wood joists to create a horizontal diaphragm in accordance with Table R702.3.6. Gypsum board and gypsum panel products shall be installed perpendicular to ceiling framing members. End joints of adjacent courses of board and panels shall not occur on the same joist. The maximum allowable diaphragm proportions shall be 1¹/₂:1 between shear resisting elements. Rotation or cantilever conditions shall not be permitted. Gypsum board or gypsum panel products shall not be used in diaphragm ceilings to resist lateral forces imposed by masonry or concrete construction. Perimeter edges shall be blocked using wood members not less than 2-inch by 6-inch (51 mm by 152 mm) nominal dimension. Blocking material shall be installed flat over the top plate of the wall to provide a nailing surface not less than 2 inches (51 mm) in width for the attachment of the gypsum board or gypsum panel product.

R702.3.7 Water-resistant gypsum backing board. Gypsum board used as the base or backer for adhesive application of ceramic tile or other required nonabsorbent finish material shall conform to ASTM C1178, C1278 or C1396. Use of water-resistant gypsum backing board shall be permitted on ceilings. Water-resistant gypsum board shall not be installed over a Class I or II vapor retarder in a shower or tub compartment. Cut or exposed edges, including those at wall intersections, shall be sealed as recommended by the manufacturer.

R702.3.7.1 Limitations. Water-resistant gypsum backing board shall not be used where there will be direct exposure to water, or in areas subject to continuous high humidity.

**TABLE R702.3.5
MINIMUM THICKNESS AND APPLICATION OF GYPSUM BOARD AND GYPSUM PANEL PRODUCTS**

THICKNESS OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS (inches)	APPLICATION	ORIENTATION OF GYPSUM BOARD OR GYPSUM PANEL PRODUCTS TO FRAMING	MAXIMUM SPACING OF FRAMING MEMBERS (inches o.c.)	MAXIMUM SPACING OF FASTENERS (inches)		SIZE OF NAILS FOR APPLICATION TO WOOD FRAMING ^c	
				Nails ^a	Screws ^b		
Application without adhesive							
3/8	Ceiling ^d	Perpendicular	16	7	12	13 gage, 1 1/4" long, 19/64" head; 0.098" diameter, 1 1/4" long, ring shank; or 4d cooler nail, 0.080" diameter, 1 3/8" long, 7/32" head.	
	Wall	Either direction	16	8	16		
1/2	Ceiling	Either direction	16	7	12	13 gage, 1 3/8" long, 19/64" head; 0.098" diameter, 1 1/4" long, ring shank; 5d cooler nail, 0.086" diameter, 1 5/8" long, 15/64" head; or gypsum board nail, 0.086" diameter, 1 5/8" long, 9/32" head.	
	Ceiling ^d	Perpendicular	24	7	12		
	Wall	Either direction	24	8	12		
5/8	Wall	Either direction	16	8	16	13 gage, 1 5/8" long, 19/64" head; 0.098" diameter, 1 3/8" long, ring shank; 6d cooler nail, 0.092" diameter, 1 7/8" long, 1/4" head; or gypsum board nail, 0.0915" diameter, 1 7/8" long, 19/64" head.	
	Ceiling	Either direction	16	7	12		
	Ceiling	Perpendicular	24	7	12		
	Type X at garage ceiling beneath habitable rooms	Perpendicular	24	6	6		1 7/8" long 0.099" diameter galvanized nails or equivalent drywall screws. Screws shall comply with Section R702.3.5.1.
	Wall	Either direction	24	8	12		
Wall	Either direction	16	8	16			
Application with adhesive							
3/8	Ceiling ^d	Perpendicular	16	16	16	Same as above for 3/8" gypsum board and gypsum panel products.	
	Wall	Either direction	16	16	24		
1/2 or 5/8	Ceiling	Either direction	16	16	16	Same as above for 1/2" and 5/8" gypsum board and gypsum panel products, respectively.	
	Ceiling ^d	Perpendicular	24	12	16		
	Wall	Either direction	24	16	24		
Two 3/8 layers	Ceiling	Perpendicular	16	16	16	Base ply nailed as above for 1/2" gypsum board and gypsum panel products; face ply installed with adhesive.	
	Wall	Either direction	24	24	24		

For SI: 1 inch = 25.4 mm.

- a. For application without adhesive, a pair of nails spaced not less than 2 inches apart or more than 2 1/2 inches apart shall be permitted to be used with the pair of nails spaced 12 inches on center.
- b. Screws shall be in accordance with Section R702.3.5.1. Screws for attaching gypsum board or gypsum panel products to structural insulated panels shall penetrate the wood structural panel facing not less than 7/16 inch.
- c. Where cold-formed steel framing is used with a clinching design to receive nails by two edges of metal, the nails shall be not less than 5/8 inch longer than the gypsum board or gypsum panel product thickness and shall have ringed shanks. Where the cold-formed steel framing has a nailing groove formed to receive the nails, the nails shall have barbed shanks or be 0.086-inch diameter, 1 5/8 inches long, 15/64-inch head for 1/2-inch gypsum board or gypsum panel product; and 0.099-inch diameter, 1 7/8 inches long, 15/64-inch head for 5/8-inch gypsum board or gypsum panel product.
- d. Three-eighths-inch-thick single-ply gypsum board or gypsum panel product shall not be used on a ceiling where a water-based textured finish is to be applied, or where it will be required to support insulation above a ceiling. On ceiling applications to receive a water-based texture material, either hand or spray applied, the gypsum board or gypsum panel product shall be applied perpendicular to framing. Where applying a water-based texture material, the minimum gypsum board thickness shall be increased from 3/8 inch to 1/2 inch for 16-inch on center framing, and from 1/2 inch to 5/8 inch for 24-inch on center framing or 1/2-inch sag-resistant gypsum ceiling board shall be used.

**TABLE R702.3.6
SHEAR CAPACITY FOR HORIZONTAL WOOD-FRAMED GYPSUM BOARD DIAPHRAGM CEILING ASSEMBLIES**

MATERIAL	THICKNESS OF MATERIAL (min.) (inch)	SPACING OF FRAMING MEMBERS (max.) (inch)	SHEAR VALUE ^{a, b} (plf of ceiling)	MINIMUM FASTENER SIZE ^{c, d}
Gypsum board or gypsum panel product	1/2	16 o.c.	90	5d cooler or wallboard nail; 1 ⁵ / ₈ -inch long; 0.086-inch shank; 1 ⁵ / ₆₄ -inch head
Gypsum board or gypsum panel product	1/2	24 o.c.	70	5d cooler or wallboard nail; 1 ⁵ / ₈ -inch long; 0.086-inch shank; 1 ⁵ / ₆₄ -inch head

For SI: 1 inch = 25.4 mm, 1 pound per linear foot = 1.488 kg/m.

- Values are not cumulative with other horizontal diaphragm values and are for short-term loading caused by wind or seismic loading. Values shall be reduced 25 percent for normal loading.
- Values shall be reduced 50 percent in Seismic Design Categories D₀, D₁, D₂ and E.
- 1/4-inch, No. 6 Type S or W screws shall be permitted to be substituted for the listed nails.
- Fasteners shall be spaced not more than 7 inches on center at all supports, including perimeter blocking, and not less than 3/8 inch from the edges and ends of the gypsum board.

R702.4 Ceramic tile.

R702.4.1 General. Ceramic tile surfaces shall be installed in accordance with ANSI A108.1, A108.4, A108.5, A108.6, A108.11, A118.1, A118.3, A136.1 and A137.1.

R702.4.2 Backer boards. Materials used as backers for wall tile in tub and shower areas and wall panels in shower areas shall be of materials listed in Table R702.4.2, and installed in accordance with the manufacturer's recommendations.

**TABLE R702.4.2
BACKER BOARD MATERIALS**

MATERIAL	STANDARD
Glass mat gypsum backing panel	ASTM C1178
Fiber-reinforced gypsum panels	ASTM C1278
Nonasbestos fiber-cement backer board	ASTM C1288 or ISO 8336, Category C
Nonasbestos fiber mat-reinforced cementitious backer units	ASTM C1325

R702.5 Other finishes. Wood veneer paneling and hardboard paneling shall be placed on wood or cold-formed steel framing spaced not more than 16 inches (406 mm) on center. Wood veneer and hard board paneling less than 1/4-inch (6 mm) nominal thickness shall not have less than a 3/8-inch (10 mm) gypsum board or gypsum panel product backer. Wood veneer paneling not less than 1/4-inch (6 mm) nominal thickness shall conform to ANSI/HPVA HP-1. Hardboard paneling shall conform to CPA/ANSI A135.5.

R702.6 Wood shakes and shingles. Wood shakes and shingles shall conform to CSSB *Grading Rules for Wood Shakes and Shingles* and shall be permitted to be installed directly to the studs with maximum 24 inches (610 mm) on-center spacing.

R702.6.1 Attachment. Nails, staples or glue are permitted for attaching shakes or shingles to the wall, and attachment of the shakes or shingles directly to the surface shall be permitted provided the fasteners are appropriate for the

type of wall surface material. Where nails or staples are used, two fasteners shall be provided and shall be placed so that they are covered by the course above.

R702.6.2 Furring strips. Where furring strips are used, they shall be 1 inch by 2 inches or 1 inch by 3 inches (25 mm by 51 mm or 25 mm by 76 mm), spaced a distance on center equal to the desired exposure, and shall be attached to the wall by nailing through other wall material into the studs.

R702.7 Vapor retarders. Vapor retarder materials shall be classified in accordance with Table R702.7(1). A vapor retarder shall be provided on the interior side of frame walls of the class indicated in Table R702.7(2), including compliance with Table R702.7(3) or R702.7(4) where applicable. An approved design using accepted engineering practice for hygrothermal analysis shall be permitted as an alternative. The climate zone shall be determined in accordance with Section N1101.7.

Exceptions:

- Basement walls.
- Below-grade portion of any wall.
- Construction where accumulation, condensation or freezing of moisture will not damage the materials.
- A vapor retarder shall not be required in Climate Zones 1, 2 and 3.

R702.7.1 Spray foam plastic insulation for moisture control with Class II and III vapor retarders. For purposes of compliance with Tables R702.7(3) and R702.7(4), spray foam with a maximum permeance of 1.5 perms at the installed thickness applied to the interior side of wood structural panels, fiberboard, insulating sheathing or gypsum shall be deemed to meet the continuous insulation moisture control requirement in accordance with one of the following conditions:

- The spray foam *R*-value is equal to or greater than the specified continuous insulation *R*-value.

- The combined *R*-value of the spray foam and continuous insulation is equal to or greater than the specified continuous insulation *R*-value.

R702.7.2 California Energy Code and International Energy Conservation Code Climate Zones. *The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Table R702.7(5).*

**SECTION R703
EXTERIOR COVERING**

R703.1 General. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing as described in Section R703.4.

Exception: Log walls designed and constructed in accordance with the provisions of ICC 400.

R703.1.1 Water resistance. The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior cladding as required by Section R703.2 and a means of draining to the exterior water that penetrates the exterior cladding.

Exceptions:

- A weather-resistant exterior wall envelope shall not be required over concrete or masonry walls designed in accordance with Chapter 6 and

flushed in accordance with Section R703.4 or R703.8.

- Compliance with the requirements for a means of drainage, and the requirements of Sections R703.2 and R703.4, shall not be required for an exterior wall envelope that has been demonstrated to resist wind-driven rain through testing of the exterior wall envelope, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E331 under the following conditions:
 - Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.
 - Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.
 - Exterior wall assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (299 Pa).
 - Exterior wall envelope assemblies shall be subjected to the minimum test exposure for a minimum of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings penetration or intersections of terminations with dissimilar materials.

**TABLE R702.7(1)
VAPOR RETARDER MATERIALS AND CLASSES**

CLASS	ACCEPTABLE MATERIALS
I	Sheet polyethylene, nonperforated aluminum foil or other approved materials with a perm rating less than or equal to 0.1.
II	Kraft-faced fiberglass batts, vapor retarder paint or other approved materials applied in accordance with the manufacturer’s installation instructions for a perm rating greater than 0.1 and less than or equal to 1.0.
III	Latex paint, enamel paint or other approved materials applied in accordance with the manufacturer’s installation instructions for a perm rating greater than 1.0 and less than or equal to 10.0.

**TABLE R702.7(2)
VAPOR RETARDER OPTIONS**

CLIMATE ZONE	VAPOR RETARDER CLASS		
	CLASS I ^a	CLASS II ^a	CLASS III
1, 2	Not Permitted	Not Permitted	Permitted
3, 4 (except Marine 4)	Not Permitted	Permitted ^c	Permitted
Marine 4, 5, 6, 7, 8	Permitted ^b	Permitted ^c	See Table R702.7(3)

- Class I and II vapor retarders with vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B) shall be allowed on the interior side of any frame wall in all climate zones.
- Use of a Class I interior vapor retarder in frame walls with a Class I vapor retarder on the exterior side shall require an approved design.
- Where a Class II vapor retarder is used in combination with foam plastic insulating sheathing installed as continuous insulation on the exterior side of frame walls, the continuous insulation shall comply with Table R702.7(4) and the Class II vapor retarder shall have a vapor permeance greater than 1 perm when measured by ASTM E96 water method (Procedure B).

**TABLE R702.7(3)
CLASS III VAPOR RETARDERS**

CLIMATE ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR: ^{a, b}
Marine 4	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with R -value ≥ 2.5 over 2×4 wall.
	Continuous insulation with R -value ≥ 3.75 over 2×6 wall.
5	Vented cladding over wood structural panels.
	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with R -value ≥ 5 over 2×4 wall.
	Continuous insulation with R -value ≥ 7.5 over 2×6 wall.
6	Vented cladding over fiberboard.
	Vented cladding over gypsum.
	Continuous insulation with R -value ≥ 7.5 over 2×4 wall.
	Continuous insulation with R -value ≥ 11.25 over 2×6 wall.
7	Continuous insulation with R -value ≥ 10 over 2×4 wall.
	Continuous insulation with R -value ≥ 15 over 2×6 wall.
8	Continuous insulation with R -value ≥ 12.5 over 2×4 wall.
	Continuous insulation with R -value ≥ 20 over 2×6 wall.

- a. Vented cladding shall include vinyl, polypropylene, or horizontal aluminum siding, brick veneer with a clear airspace as specified in Table R703.8.4(1), and other approved vented claddings.
- b. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class III vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

**TABLE R702.7(4)
CONTINUOUS INSULATION WITH CLASS II VAPOR RETARDER**

CLIMATE ZONE	CLASS II VAPOR RETARDERS PERMITTED FOR: ^a
3	Continuous insulation with R -value ≥ 2 .
4, 5 and 6	Continuous insulation with R -value ≥ 3 over 2×4 wall.
	Continuous insulation with R -value ≥ 5 over 2×6 wall.
7	Continuous insulation with R -value ≥ 5 over 2×4 wall.
	Continuous insulation with R -value ≥ 7.5 over 2×6 wall.
8	Continuous insulation with R -value ≥ 7.5 over 2×4 wall.
	Continuous insulation with R -value ≥ 10 over 2×6 wall.

- a. The requirements in this table apply only to insulation used to control moisture in order to permit the use of Class II vapor retarders. The insulation materials used to satisfy this option also contribute to but do not supersede the thermal envelope requirements of Chapter 11.

TABLE R702.7(5)
IECC VS. CALIFORNIA ENERGY CODE CLIMATE ZONE COMPARISON

IECC ^a	CALIFORNIA ENERGY CODE	DESCRIPTION ^b
6	16	Includes Alpine, Mono Counties
5	11, 12, 16	Includes Siskiyou, Modoc, Lassen, Plumas, Sierra, Nevada Counties
4 (marine)	1, 2, 16	Includes Del Norte and Humboldt Counties
4	2, 12, 13, 16	Includes Inyo, Trinity, Lake, El Dorado, Amador, Calaveras, Tuolumne, Mariposa Counties
3	8, 9, 10, 11, 12, 13, 14, 15, 16	Includes Shasta, Tehama, Butte, Glenn, Colusa, Yuba, Contra Costa, Sutter, Yolo, Sacramento, Placer, San Joaquin, Solano, Stanislaus, Merced, Madera, Fresno, Kings, Tulare, Kern, Ventura, Los Angeles, Orange, San Bernardino, Riverside Counties
3 (marine)	1, 2, 3, 4, 5, 6, 9, 12, 16	Includes Mendocino, Sonoma, Marin, San Francisco, San Mateo, Alameda, Santa Cruz, Monterey, San Benito, San Luis Obispo, Santa Barbara, Ventura, San Diego Counties
2	14, 16	Includes Imperial County

a. IECC Climate Zones 1, 7 and 8 do not occur in California, nor do any IECC moist climate zones.

b. IECC boundaries are defined by county political boundary lines. California Energy Code boundaries are based on metes and bounds specifications aligned with climate-affecting geographic features, which often do not coincide with county lines.

R703.1.2 Wind resistance. Wall coverings, backing materials and their attachments shall be capable of resisting wind loads in accordance with Tables R301.2.1(1) and R301.2.1(2). Wind-pressure resistance of the siding, soffit and backing materials shall be determined by ASTM E330 or other applicable standard test methods. Where wind-pressure resistance is determined by design analysis, data from approved design standards and analysis conforming to generally accepted engineering practice shall be used to evaluate the siding, soffit and backing material and its fastening. All applicable failure modes including bending rupture of siding, fastener withdrawal and fastener head pull-through shall be considered in the testing or design analysis. Where the wall covering, soffit and backing material resist wind load as an assembly, use of the design capacity of the assembly shall be permitted.

R703.2 Water-resistive barrier. Not fewer than one layer of water-resistive barrier shall be applied over studs or sheathing of all exterior walls with flashing as indicated in Section R703.4, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer. The water-resistive barrier material shall be continuous to the top of walls and terminated at penetrations and building appendages in a manner to meet the requirements of the exterior wall envelope as described in Section R703.1. Water-resistive barrier materials shall comply with one of the following:

1. No. 15 felt complying with ASTM D226, Type 1.
2. ASTM E2556, Type 1 or 2.
3. ASTM E331 in accordance with Section R703.1.1.
4. Other approved materials in accordance with the manufacturer's installation instructions.

No.15 asphalt felt and water-resistive barriers complying with ASTM E2556 shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2

inches (51 mm), and where joints occur, shall be lapped not less than 6 inches (152 mm).

R703.3 Wall covering nominal thickness and attachments. The nominal thickness and attachment of exterior wall coverings shall be in accordance with Table R703.3(1), the wall covering material requirements of this section, and the wall covering manufacturer's installation instructions. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15 through R703.17. Nominal material thicknesses in Table R703.3(1) are based on a maximum stud spacing of 16 inches (406 mm) on center. Where specified by the siding manufacturer's instructions and supported by a test report or other documentation, attachment to studs with greater spacing is permitted. Fasteners for exterior wall coverings attached to wood framing shall be in accordance with Section R703.3.3 and Table R703.3(1). Exterior wall coverings shall be attached to cold-formed steel light frame construction in accordance with the cladding manufacturer's installation instructions, the requirements of Table R703.3(1) using screw fasteners substituted for the nails specified in accordance with Table R703.3(2), or an approved design.

R703.3.1 Soffit installation. Soffits shall comply with Section R704.

R703.3.2 Wind limitations. Where the design wind pressure exceeds 30 psf or where the limits of Table R703.3.2 are exceeded, the attachment of wall coverings and soffits shall be designed to resist the component and cladding loads specified in Table R301.2.1(1) for walls, adjusted for height and exposure in accordance with Table R301.2.1(2). For the determination of wall covering and soffit attachment, component and cladding loads shall be determined using an effective wind area of 10 square feet (0.93 m²).

**TABLE R703.3(1)
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS**

SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS						
			Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud ^l	Direct to studs	Number or spacing of fasteners	
Anchored veneer: brick, concrete, masonry or stone (see Section R703.8)	2	Section R703.8	Section R703.8						
Adhered veneer: concrete, stone or masonry (see Section R703.12)	—	Section R703.12	Section R703.12						
Fiber cement siding	Panel siding (see Section R703.10.1)	5/16	Section R703.10.1	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	4d common (1 1/2" × 0.099")	6" panel edges 12" inter. sup.
	Lap siding (see Section R703.10.2)	5/16	Section R703.10.2	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113")	6d common (2" × 0.113") or 11 gage roofing nail	Note f
Hardboard panel siding (see Section R703.5)	7/16	—	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	6" panel edges 12" inter. sup. ^d
Hardboard lap siding (see Section R703.5)	7/16	Note e	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	Same as stud spacing 2 per bearing
Horizontal aluminum ^a	Without insulation	0.019 ^b	Lap	Siding nail 1 1/2" × 0.120"	Siding nail 2" × 0.120"	Siding nail 2" × 0.120"	Siding nail ^h 1 1/2" × 0.120"	Not allowed	Same as stud spacing
		0.024	Lap	Siding nail 1 1/2" × 0.120"	Siding nail 2" × 0.120"	Siding nail 2" × 0.120"	Siding nail ^h 1 1/2" × 0.120"	Not allowed	
	With insulation	0.019	Lap	Siding nail 1 1/2" × 0.120"	Siding nail 2 1/2" × 0.120"	Siding nail 2 1/2" × 0.120"	Siding nail ^h 1 1/2" × 0.120"	Siding nail 1 1/2" × 0.120"	
Insulated vinyl siding ^j	0.035 (vinyl siding layer only)	Lap	0.120 nail (shank) with a 0.313 head or 16-gage crown ^{h,i}	0.120 nail (shank) with a 0.313 head or 16-gage crown ^h	0.120 nail (shank) with a 0.313 head or 16-gage crown ^h	0.120 nail (shank) with a 0.313 head or 16-gage crown ^h	0.120 nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or specified by manufacturer instructions, test report or other sections of this code
Particleboard panels	3/8	—	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	Not allowed	6" panel edges 12" inter. sup.
	1/2	—	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	
	5/8	—	6d box nail (2" × 0.099")	8d box nail (2 1/2" × 0.113")	8d box nail (2 1/2" × 0.113")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	6d box nail (2" × 0.099")	
Polypropylene siding ^k	Not applicable	Lap	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Not allowed	As specified by the manufacturer instructions, test report or other sections of this code
Steel ^c	29 ga.	Lap	Siding nail (1 3/4" × 0.113") Staple-1 3/4	Siding nail (2 3/4" × 0.113") Staple-2 1/2	Siding nail (2 1/2" × 0.113") Staple-2 1/4	Siding nail (1 3/4" × 0.113") Staple-1 3/4	Not allowed	Same as stud spacing	

(continued)

**TABLE R703.3(1)—continued
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS**

SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS						
			Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud ^f	Direct to studs	Number or spacing of fasteners	
Vinyl siding (see Section R703.11)	0.035	Lap	0.120" nail (shank) with a 0.313" head or 16-gage staple with 3/8- to 1/2-inch crown ^{h,i}	0.120" nail (shank) with a 0.313" head or 16-gage staple with 3/8- to 1/2-inch crown ^h	0.120" nail (shank) with a 0.313" head or 16-gage staple with 3/8- to 1/2-inch crown ^h	0.120" nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or as specified by the manufacturer instructions or test report	
Wood siding (see Section R703.5)	Wood rustic, drop	3/8 min.	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	6d box or siding nail (2" × 0.099")	8d box or siding nail (2 1/2" × 0.113") Staple-2"	Face nailing up to 6" widths, 1 nail per bearing; 8" width sand over, 2 nails per bearing	
	Shiplap	19/32 average							Lap
	Bevel	7/16							Lap
	Butt tip	3/16							Lap
Wood structural panel ANSI/APA PRP-210 siding (exterior grade) (see Section R703.5)	3/8 - 1/2	Note e	2" × 0.099" siding nail	2 1/2" × 0.113" siding nail	2 1/2" × 0.113" siding nail	2 1/2" × 0.113" siding nail	2" × 0.099" siding nail	6" panel edges 12" inter. sup.	
Wood structural panel lap siding (see Section R703.5)	3/8 - 1/2	Note e Note g	2" × 0.099" siding nail	2 1/2" × 0.113" siding nail	2 1/2" × 0.113" siding nail	2 1/2" × 0.113" siding nail	2" × 0.099" siding nail	8" along bottom edge	

For SI: 1 inch = 25.4 mm.

- a. Aluminum nails shall be used to attach aluminum siding.
- b. Aluminum (0.019 inch) shall be unbacked only where the maximum panel width is 10 inches and the maximum flat area is 8 inches. The tolerance for aluminum siding shall be +0.002 inch of the nominal dimension.
- c. Shall be of approved type.
- d. Where used to resist shear forces, the spacing must be 4 inches at panel edges and 8 inches on interior supports.
- e. Vertical end joints shall occur at studs and shall be covered with a joint cover or shall be caulked.
- f. Face nailing: one 6d common nail through the overlapping planks at each stud. Concealed nailing: one 11-gage 1 1/2-inch-long galv. roofing nail through the top edge of each plank at each stud in accordance with the manufacturer's installation instructions.
- g. Vertical joints, if staggered, shall be permitted to be away from studs if applied over wood structural panel sheathing.
- h. Minimum fastener length must be sufficient to penetrate sheathing other nailable substrate and framing a total of a minimum of 1 1/4 inches or in accordance with the manufacturer's installation instructions.
- i. Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report, without penetrating into framing.
- j. Insulated vinyl siding shall comply with ASTM D7793.
- k. Polypropylene siding shall comply with ASTM D7254.
- l. Cladding attachment over foam sheathing shall comply with the additional requirements and limitations of Sections R703.15, R703.16 and R703.17.

R703.3.3 Fasteners. Exterior wall coverings and roof overhang soffits shall be securely fastened with aluminum, galvanized, stainless steel or rust-preventative coated nails or staples in accordance with Table R703.3(1) or with other approved corrosion-resistant fasteners in accordance with the wall covering manufacturer's installation instructions. Nails and staples shall comply with ASTM F1667. Nails shall be T-head, modified round head, or round head with smooth or deformed shanks. Staples shall have a minimum crown width of 7/16 inch (11.1 mm) outside diameter and be manufactured of minimum 16-gage wire. Where fiberboard, gypsum, or foam plastic sheathing backing is used, nails or staples shall be driven into the studs. Where wood or wood structural panel sheathing is used, fasteners shall be driven into studs unless otherwise permitted to be driven into sheathing in accordance with either the siding manufacturer's installation instructions or Table R703.3.3.

R703.3.4 Minimum fastener length and penetration. Fasteners shall have the greater of the minimum length specified in Table R703.3(1) or as required to provide a minimum penetration into framing as follows:

1. Fasteners for horizontal aluminum siding, steel siding, particleboard panel siding, wood structural panel siding in accordance with ANSI/APA-PRP 210, fiber-cement panel siding and fiber-cement lap siding installed over foam plastic sheathing shall penetrate not less than 1 1/2 inches (38 mm) into framing or shall be in accordance with the manufacturer's installation instructions.
2. Fasteners for hardboard panel and lap siding shall penetrate not less than 1 1/2 inches (38 mm) into framing.
3. Fasteners for vinyl siding and insulated vinyl siding installed over wood or wood structural panel sheathing shall penetrate not less than 1 1/4 inches (32 mm) into

sheathing and framing combined. Vinyl siding and insulated vinyl siding shall be permitted to be installed with fasteners penetrating into or through wood or wood structural sheathing of minimum thickness as specified by the manufacturer’s instructions or test report, with or without penetration into the framing. Where the fastener penetrates fully through the sheathing, the end of the fastener shall extend not less than 1/4 inch (6.4 mm) beyond the opposite face of the sheathing. Fasteners for vinyl siding and insulated vinyl siding installed over foam plastic sheathing shall be in accordance with Section R703.11.2. Fasteners for vinyl siding and insulated vinyl siding installed over fiberboard or gypsum sheathing shall penetrate not less than 1 1/4 inches (32 mm) into framing.

4. Fasteners for vertical or horizontal wood siding shall penetrate not less than 1 1/2 inches (38 mm) into studs, studs and wood sheathing combined, or blocking.
5. Fasteners for siding material installed over foam plastic sheathing shall have sufficient length to accommodate foam plastic sheathing thickness and to penetrate framing or sheathing and framing combined, as specified in Items 1 through 4.

TABLE R703.3(2)
SCREW FASTENER SUBSTITUTION FOR SIDING ATTACHMENT TO COLD-FORMED STEEL LIGHT FRAME CONSTRUCTION^{a, b, c, d, e}

NAIL DIAMETER PER TABLE R703.3(1)	MINIMUM SCREW FASTENER SIZE
0.099"	No. 6
0.113"	No. 7
0.120"	No. 8

For SI: 1 inch = 25.4 mm.

- a. Screws shall comply with ASTM C1513 and shall penetrate a minimum of three threads through minimum 33 mil (20 gage) cold-formed steel frame construction.
- b. Screw head diameter shall be not less than the nail head diameter required by Table R703.3(1).
- c. Number and spacing of screw fasteners shall comply with Table R703.3(1).
- d. Pan head, hex washer head, modified truss head or other screw head types with a flat attachment surface under the head shall be used for vinyl siding attachment.
- e. Aluminum siding shall not be fastened directly to cold-formed steel light frame construction.

TABLE R703.3.3
OPTIONAL SIDING ATTACHMENT SCHEDULE FOR FASTENERS WHERE NO STUD PENETRATION NECESSARY

APPLICATION	NUMBER AND TYPE OF FASTENER	SPACING OF FASTENERS ^b
Exterior wall covering (weighing 3 psf or less) attachment to wood structural panel sheathing, either direct or over foam sheathing a maximum of 2 inches thick. ^a Note: Does not apply to vertical siding.	Ring shank roofing nail (0.120" min. dia.)	12" o.c.
	Ring shank nail (0.148" min. dia.)	15" o.c.
	No. 6 screw (0.138" min. dia.)	12" o.c.
	No. 8 screw (0.164" min. dia.)	16" o.c.

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.479 kPa.

- a. Fastener length shall be sufficient to penetrate the back side of the wood structural panel sheathing by at least 1/4 inch. The wood structural panel sheathing shall be not less than 7/16 inch in thickness.
- b. Spacing of fasteners is per 12 inches of siding width. For other siding widths, multiply "Spacing of Fasteners" above by a factor of 12/s, where "s" is the siding width in inches. Fastener spacing shall never be greater than the manufacturer’s minimum recommendations.

TABLE R703.3.2
LIMITS FOR ATTACHMENT PER Table R703.3(1)

Ultimate Wind Speed (mph 3-second gust)	MAXIMUM MEAN ROOF HEIGHT		
	Exposure		
	B	C	D
95	NL	NL	NL
100	NL	NL	NL
105	NL	NL	NL
110	NL	NL	40'
115	NL	50'	20'
120	NL	30'	DR
130	60'	15'	DR
140	35'	DR	DR

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NL = Not Limited by Table R703.3.2, DR = Design Required.

R703.4 Flashing. Approved corrosion-resistant flashing shall be applied shingle-fashion in a manner to prevent entry of water into the wall cavity or penetration of water to the building structural framing components. Self-adhered membranes used as flashing shall comply with AAMA 711. Fluid-applied membranes used as flashing in exterior walls shall comply with AAMA 714. The flashing shall extend to the surface of the exterior wall finish. Approved corrosion-resistant flashings shall be installed at the following locations:

1. Exterior window and door openings. Flashing at exterior window and door openings shall be installed in accordance with Section R703.4.1.
2. At the intersection of chimneys or other masonry construction with frame or stucco walls, with projecting lips on both sides under stucco copings.
3. Under and at the ends of masonry, wood or metal copings and sills.
4. Continuously above all projecting wood trim.
5. Where exterior porches, decks or stairs attach to a wall or floor assembly of wood-frame construction.
6. At wall and roof intersections.
7. At built-in gutters.

R703.4.1 Flashing installation at exterior window and door openings. Flashing at exterior window and door openings shall extend to the surface of the exterior wall finish or to a water-resistive barrier complying with Section 703.2 for subsequent drainage. Air sealing shall be installed around all window and door openings on the interior side of the rough opening gap. Mechanically attached flexible flashings shall comply with AAMA 712. Flashing at exterior window and door openings shall be installed in accordance with one or more of the following:

1. The fenestration manufacturer’s installation and flashing instructions, or for applications not addressed in the fenestration manufacturer’s instructions, in accordance with the flashing manufacturer’s instructions. Where flashing instructions or details are not provided, pan flashing shall be installed at the sill of exterior window and door openings. Pan flashing shall be sealed or sloped in such a manner as to direct water to the surface of the exterior wall finish or to the water-resistive barrier for subsequent drainage. Openings using pan flashing shall incorporate flashing or protection at the head and sides.
2. In accordance with the flashing design or method of a registered design professional.
3. In accordance with other approved methods.

R703.5 Wood, hardboard and wood structural panel siding. Wood, hardboard and wood structural panel siding shall be installed in accordance with this section and Table R703.3(1). Hardboard siding shall comply with ANSI A135.5.

R703.5.1 Vertical wood siding. Wood siding applied vertically shall be nailed to horizontal nailing strips or blocking set not more than 24 inches (610 mm) on center.

R703.5.2 Panel siding. Three-eighths-inch (9.5 mm) wood structural panel siding shall not be applied directly to studs spaced more than 16 inches (406 mm) on center where long dimension is parallel to studs. Wood structural panel siding $\frac{7}{16}$ inch (11.1 mm) or thinner shall not be applied directly to studs spaced more than 24 inches (610 mm) on center. The stud spacing shall not exceed the panel span rating provided by the manufacturer unless the panels are installed with the face grain perpendicular to the studs or over sheathing approved for that stud spacing.

Joints in wood, hardboard or wood structural panel siding shall be made as follows unless otherwise approved. Vertical joints in panel siding shall occur over framing members, unless wood or wood structural panel sheathing is used, and shall be shiplapped or covered with a batten. Horizontal joints in panel siding shall be lapped not less than 1 inch (25 mm) or shall be shiplapped or flashed with Z-flashing and occur over solid blocking, wood or wood structural panel sheathing.

R703.5.3 Horizontal wood siding. Horizontal lap siding shall be installed in accordance with the manufacturer’s recommendations. Where there are no recommendations the siding shall be lapped not less than 1 inch (25 mm), or $\frac{1}{2}$ inch (12.7 mm) if rabbeted, and shall have the ends

caulked, covered with a batten or sealed and installed over a strip of flashing.

R703.6 Wood shakes and shingles. Wood shakes and shingles shall conform to CSSB.

R703.6.1 Application. Wood shakes or shingles shall be applied either single course or double course over nominal $\frac{1}{2}$ -inch (12.7 mm) wood-based sheathing or to furring strips over $\frac{1}{2}$ -inch (12.7 mm) nominal nonwood sheathing. A water-resistive barrier shall be provided over all sheathing, with horizontal overlaps in the membrane of not less than 2 inches (51 mm) and vertical overlaps of not less than 6 inches (152 mm). Where horizontal furring strips are used, they shall be 1 inch by 3 inches or 1 inch by 4 inches (25 mm by 76 mm or 25 mm by 102 mm) and shall be fastened to the studs with minimum 7d or 8d box nails and shall be spaced a distance on center equal to the actual weather exposure of the shakes or shingles, not to exceed the maximum exposure specified in Table R703.6.1. When installing shakes or shingles over a nonpermeable water-resistive barrier, furring strips shall be placed first vertically over the barrier and in addition, horizontal furring strips shall be fastened to the vertical furring strips prior to attaching the shakes or shingles to the horizontal furring strips. The spacing between adjacent shingles to allow for expansion shall be $\frac{1}{8}$ inch (3.2 mm) to $\frac{1}{4}$ inch (6.4 mm) apart, and between adjacent shakes shall be $\frac{3}{8}$ inch (9.5 mm) to $\frac{1}{2}$ inch (12.7 mm) apart. The offset spacing between joints in adjacent courses shall be not less than $1\frac{1}{2}$ inches (38 mm).

**TABLE R703.6.1
MAXIMUM WEATHER EXPOSURE FOR
WOOD SHAKES AND SHINGLES ON EXTERIOR WALLS^{a, b, c}
(Dimensions are in inches)**

LENGTH	EXPOSURE FOR SINGLE COURSE	EXPOSURE FOR DOUBLE COURSE
Shingles^a		
16	7	12 ^b
18	8	14 ^c
24	10 $\frac{1}{2}$	16 ^d
Shakes^a		
18	8	14
24	10 $\frac{1}{2}$	18

For SI: 1 inch = 25.4 mm.

- a. Dimensions given are for No. 1 grade.
- b. A maximum 9-inch exposure is permitted for No. 2 grade.
- c. A maximum 10-inch exposure is permitted for No. 2 grade.
- d. A maximum 14-inch exposure is permitted for No. 2 grade.

R703.6.2 Weather exposure. The maximum weather exposure for shakes and shingles shall not exceed that specified in Table R703.6.1.

R703.6.3 Attachment. Wood shakes or shingles shall be installed according to this chapter and the manufacturer’s instructions. Each shake or shingle shall be held in place by two stainless steel Type 304, Type 316 or hot-dipped zinc-coated galvanized corrosion-resistant box nails in accordance with Table R703.6.3(1) or R703.6.3(2). The hot-dipped zinc-coated galvanizing shall be in compliance with ASTM A153, 1.0 ounce per square foot. Alterna-

tively, 16-gage stainless steel Type 304 or Type 316 staples with crown widths $\frac{7}{16}$ inch (11 mm) minimum, $\frac{3}{4}$ inch (19 mm) maximum, shall be used and the crown of the staple shall be placed parallel with the butt of the shake or the shingle. In single-course application, the fasteners shall be concealed by the course above and shall be driven approximately 1 inch (25 mm) above the butt line of the succeeding course and $\frac{3}{4}$ inch (19 mm) from the edge. In double-course applications, the exposed shake or shingle shall be face-nailed with two fasteners, driven approximately 2 inches (51 mm) above the butt line and $\frac{3}{4}$ inch (19 mm) from each edge. Fasteners installed within 15 miles (24 km) of saltwater coastal areas shall be stainless steel Type 316. Fasteners for fire-retardant-treated shakes or shingles in accordance with Section R902 or pressure-impregnated-preservative-treated shakes or shingles in accordance with AWPA U1 shall be stainless steel Type 316. The fasteners shall penetrate the sheathing or furring strips by not less than $\frac{1}{2}$ inch (13 mm) and shall not be overdriven. Fasteners for untreated (natural) and treated products shall comply with ASTM F1667.

R703.6.4 Bottom courses. The bottom courses shall be doubled.

R703.7 Exterior plaster (stucco). Installation of exterior plaster shall be in compliance with ASTM C926, ASTM C1063 and the provisions of this code.

R703.7.1 Lath. Lath and lath attachments shall be of corrosion-resistant materials in accordance with ASTM C1063. Expanded metal, welded wire, or woven wire lath shall be attached to wood framing members or furring. Where the exterior plaster is serving as wall bracing in accordance with Table R602.10.4, the lath shall be attached directly to framing. The lath shall be attached with $\frac{1}{2}$ -inch-long (38 mm), 11-gage nails having a $\frac{7}{16}$ -inch (11.1 mm) head, or $\frac{7}{8}$ -inch-long (22.2 mm), 16-gage staples, spaced not more than 7 inches (178 mm) on center along framing members or furring and not more than 24 inches (610 mm) on center between framing members or furring, or as otherwise approved. Additional fastening between wood framing members shall not be prohibited. Lath attachments to cold-formed steel framing or to masonry, stone, or concrete substrates shall be in accordance with ASTM C1063. Where lath is installed directly over foam sheathing, lath connections shall also be in accordance with Section R703.15, R703.16 or R703.17. Where lath is attached to furring

TABLE R703.6.3(1)
SINGLE-COURSE SIDEWALL FASTENERS

PRODUCT TYPE	NAIL TYPE, MINIMUM LENGTH AND SHANK DIAMETER (inches)
R & R and sanded shingles	
16" and 18" shingles	3d box $1\frac{1}{4} \times 0.076$
24" shingles	4d box $1\frac{1}{2} \times 0.076$
Grooved shingles	
16" and 18" shingles	3d box $1\frac{1}{4} \times 0.076$
24" shingles	4d box $1\frac{1}{2} \times 0.076$
Split and sawn shakes	
18" straight-split shakes	5d box $1\frac{3}{4} \times 0.080$
18" and 24" handsplit shakes	6d box 2×0.099
24" tapersplit shakes	5d box $1\frac{3}{4} \times 0.080$
18" and 24" tapersawn shakes	6d box 2×0.099

For SI: 1 inch = 25.4 mm.

TABLE R703.6.3(2)
DOUBLE-COURSE SIDEWALL FASTENERS

PRODUCT TYPE	NAIL TYPE, MINIMUM LENGTH AND SHANK DIAMETER (inches)
R & R and sanded shingles	
16", 8" and 24" shingles	5d box $1\frac{3}{4} \times 0.08$ or 5d casing nails $1\frac{3}{4} \times 0.080$
Grooved shingles	
16", 18" and 24" shingles	5d box $1\frac{3}{4} \times 0.080$
Split and sawn shakes	
18" straight-split shakes	7d box $2\frac{1}{4} \times 0.099$ or 8d box $2\frac{1}{2} \times 0.113$
18" and 24" handsplit shakes	7d box $2\frac{1}{4} \times 0.099$ or 8d box $2\frac{1}{2} \times 0.113$
24" tapersplit shakes	7d box $2\frac{1}{4} \times 0.099$ or 8d box $2\frac{1}{2} \times 0.113$
18" and 24" tapersawn shakes	7d box $2\frac{1}{4} \times 0.099$ or 8d box $2\frac{1}{2} \times 0.113$

For SI: 1 inch = 25.4 mm.

shall be in accordance with Section R703.15, R703.16 or R703.17.

Exception: Lath is not required over masonry, cast-in-place concrete, precast concrete or stone substrates prepared in accordance with ASTM C1063.

703.7.1.1 Furring. Where provided, furring shall consist of wood furring strips not less than 1 inch by 2 inches (25 mm by 51 mm), minimum $\frac{3}{4}$ -inch (19 mm) metal channels, or self-furring lath, and shall be installed in accordance with ASTM C1063. Furring shall be spaced not greater than 24 inches (600 mm) on center and, where installed over wood or cold-formed steel framing, shall be fastened into framing members.

R703.7.2 Plaster. Plastering with cement plaster shall be in accordance with ASTM C926. Cement materials shall be in accordance with one of the following:

1. Masonry cement conforming to ASTM C91, Type M, S or N.
2. Portland cement conforming to ASTM C150, Type I, II or III.
3. Blended hydraulic cement conforming to ASTM C595, Type IP, IS (< 70), IL, or IT (S < 70).
4. Hydraulic cement conforming to ASTM C1157, Type GU, HE, MS, HS or MH.
5. Plastic (stucco) cement conforming to ASTM C1328.

Plaster shall be not less than three coats where applied over metal lath or wire lath and shall be not less than two coats where applied over masonry, concrete, pressure-preserved-treated wood or decay-resistant wood as specified in Section R317.1 or gypsum backing. If the plaster surface is completely covered by veneer or other facing material or is completely concealed, plaster application need be only two coats, provided the total thickness is as set forth in Table R702.1(1).

On wood-frame construction with an on-grade floor slab system, exterior plaster shall be applied to cover, but not extend below, lath, paper and screed.

The proportion of aggregate to cementitious materials shall be as set forth in Table R702.1(3).

R703.7.2.1 Weep screeds. A minimum 0.019-inch (0.5 mm) (No. 26 galvanized sheet gage), corrosion-resistant weep screed or plastic weep screed, with a minimum vertical attachment flange of $3\frac{1}{2}$ inches (89 mm), shall be provided at or below the foundation plate line on exterior stud walls in accordance with ASTM C926. The weep screed shall be placed not less than 4 inches (102 mm) above the earth or 2 inches (51 mm) above paved areas and shall be of a type that will allow trapped water to drain to the exterior of the building. The weather-resistant barrier shall lap the attachment flange. The exterior lath shall cover and terminate on the attachment flange of the weep screed.

R703.7.3 Water-resistive barriers. Water-resistive barriers shall be installed as required in Section R703.2 and, where applied over wood-based sheathing, shall comply with Section R703.7.3.1 or R703.7.3.2.

R703.7.3.1 Dry climates. In Dry (B) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. The water-resistive barrier shall be two layers of 10-minute Grade D paper or have a water resistance equal to or greater than two layers of a water-resistive barrier complying with ASTM E2556, Type I. The individual layers shall be installed independently such that each layer provides a separate continuous plane. Flashing installed in accordance with Section R703.4 and intended to drain to the water-resistive barrier shall be directed between the layers.
2. The water-resistive barrier shall be 60-minute Grade D paper or have a water resistance equal to or greater than one layer of a water-resistive barrier complying with ASTM E2556, Type II. The water-resistive barrier shall be separated from the stucco by a layer of foam plastic insulating sheathing or other non-water-absorbing layer, or a designed drainage space.

R703.7.3.2 Moist or marine climates. In the Moist (A) or Marine (C) climate zones indicated in Figure N1101.7, water-resistive barriers shall comply with one of the following:

1. In addition to complying with Section R703.7.3.1, a space or drainage material not less than $\frac{3}{16}$ inch (5 mm) in depth shall be added to the exterior side of the water-resistive barrier.
2. In addition to complying with Section R703.7.3.1, Item 2, drainage on the exterior of the water-resistive barrier shall have a drainage efficiency of not less than 90 percent, as measured in accordance with ASTM E2273 or Annex A2 of ASTM E2925.

R703.7.4 Application. Each coat shall be kept in a moist condition for at least 48 hours prior to application of the next coat.

Exception: Applications installed in accordance with ASTM C926.

R703.7.5 Curing. The finish coat for two-coat cement plaster shall not be applied sooner than seven days after application of the first coat. For three-coat cement plaster, the second coat shall not be applied sooner than 48 hours after application of the first coat. The finish coat for three-coat cement plaster shall not be applied sooner than seven days after application of the second coat.

R703.8 Anchored stone and masonry veneer, general. Anchored stone and masonry veneer shall be installed in accordance with this chapter, Table R703.3(1) and Figures R703.8(1) and R703.8(2). These veneers installed over a backing of wood or cold-formed steel shall be limited to the first story above grade plane and shall not exceed 5 inches (127 mm) in thickness. See Section R602.10 for wall bracing requirements for masonry veneer for wood-framed construction and Section R603.9.5 for wall bracing require-

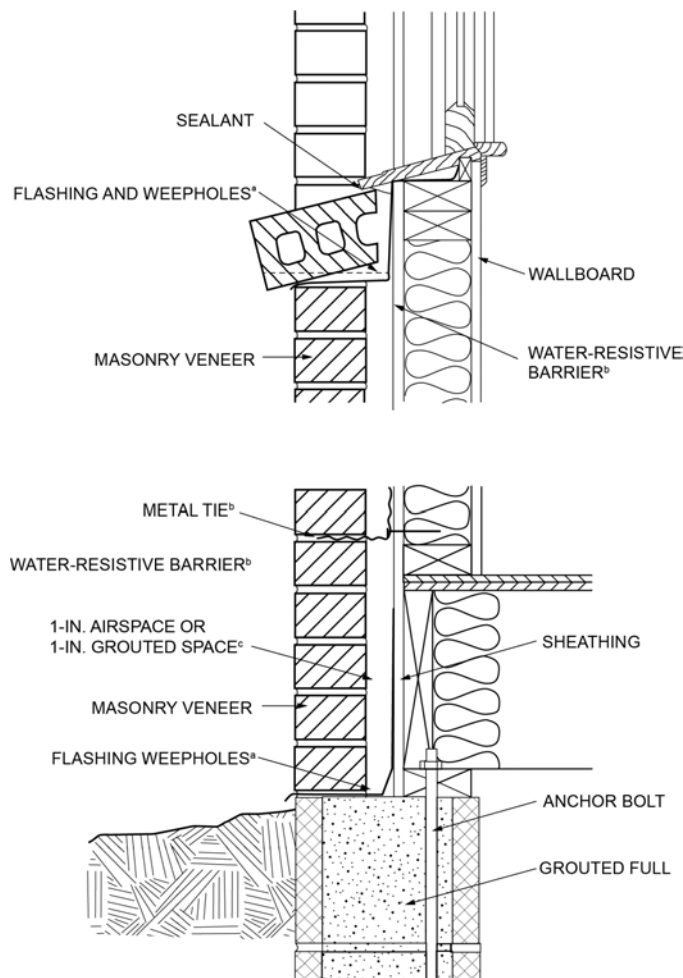
ments for masonry veneer for cold-formed steel construction.

Exceptions:

1. For buildings in Seismic Design Categories A, B and C, exterior stone or masonry veneer, as specified in Table R703.8(1), with a backing of wood or steel framing shall be permitted to the height specified in Table R703.8(1) above a noncombustible foundation.
2. For detached one- or two-family dwellings in Seismic Design Categories D₀, D₁ and D₂, exterior stone or masonry veneer, as specified in Table R703.8(2), with a backing of wood framing shall be permitted to the height specified in Table R703.8(2) above a noncombustible foundation.

R703.8.1 Interior veneer support. Veneers used as interior wall finishes shall be permitted to be supported on wood or cold-formed steel floors that are designed to support the loads imposed.

R703.8.2 Exterior veneer support. Except in Seismic Design Categories D₀, D₁ and D₂, exterior masonry veneers having an installed weight of 40 pounds per square foot (195 kg/m²) or less shall be permitted to be supported on wood or cold-formed steel construction. Where masonry veneer supported by wood or cold-formed steel construction adjoins masonry veneer supported by the foundation, there shall be a movement joint between the veneer supported by the wood or cold-formed steel construction and the veneer supported by the foundation. The wood or cold-formed steel construction supporting the masonry veneer shall be designed to limit the deflection to 1/600 of the span for the supporting members. The design of



For SI: 1 inch = 25.4 mm.

- a. See Sections R703.4, R703.8.5 and R703.8.6.
- b. See Sections R703.2 and R703.8.4.
- c. See Table R703.8.4(1) and Section R703.8.4.2.

d. Figures R703.8(1) and R703.8(2) illustrate typical construction details for a masonry veneer wall. For the actual mandatory requirements of this code, see the indicated sections of text. Other details of masonry veneer wall construction shall be permitted provided the requirements of the indicated sections of text are met.

FIGURE R703.8(1)
TYPICAL MASONRY VENEER WALL DETAILS^d

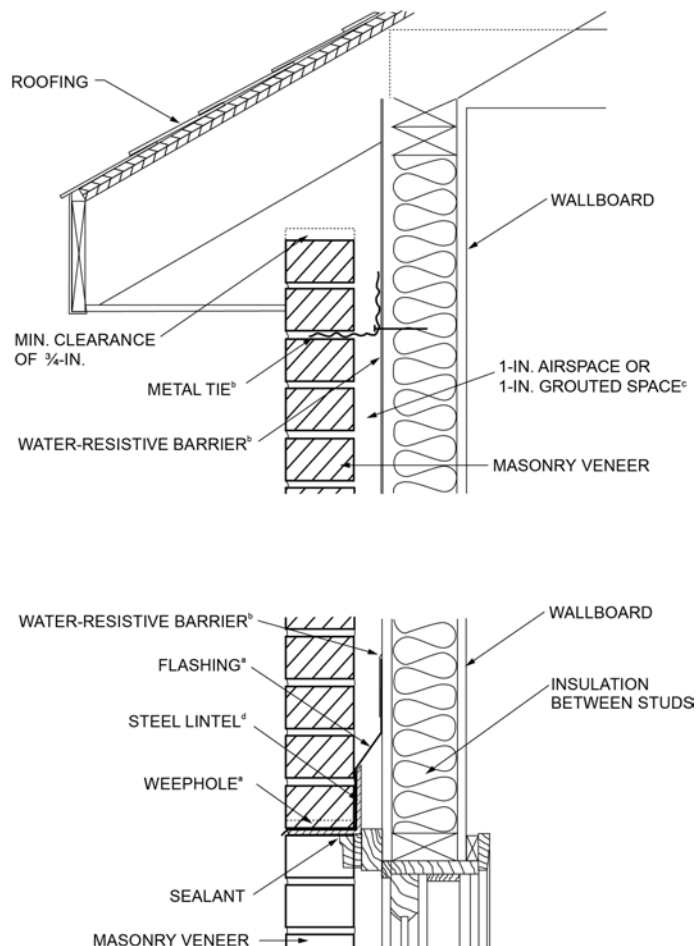
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the wood or cold-formed steel construction shall consider the weight of the veneer and any other loads.

R703.8.2.1 Support by steel angle. A minimum 6-inch by 4-inch by $\frac{5}{16}$ -inch (152 mm by 102 mm by 8 mm) steel angle, with the long leg placed vertically, shall be anchored to double 2-inch by 4-inch (51 mm by 102 mm) wood studs or double 350S162 cold-formed steel studs at a maximum on-center spacing of 16 inches (406 mm). Anchorage of the steel angle at every double stud spacing shall be not less than two $\frac{7}{16}$ -inch-diameter (11 mm) by 4-inch (102 mm) lag screws for wood construction or two $\frac{7}{16}$ -inch (11.1 mm) bolts with washers for cold-formed steel construction. The steel angle shall have a minimum clearance to underlying construction of $\frac{1}{16}$ inch (1.6 mm). Not less than two-thirds the width of the masonry veneer thickness shall bear on the steel

angle. Flashing and weep holes shall be located in the masonry veneer in accordance with Figure R703.8.2.1. The maximum height of masonry veneer above the steel angle support shall be 12 feet 8 inches (3861 mm). The airspace separating the masonry veneer from the wood backing shall be in accordance with Sections R703.8.4 and R703.8.4.2. The method of support for the masonry veneer on wood construction shall be constructed in accordance with Figure R703.8.2.1.

The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3-inch by 3-inch by $\frac{1}{4}$ -inch (76 mm by 76 mm by 6.4 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.



For SI: 1 inch = 25.4 mm.

a. See Sections R703.4, R703.8.5 and R703.8.6.

b. See Sections R703.2 and R703.8.4.

c. See Table R703.8.4(1) and Section R703.8.4.2.

d. See Section R703.8.3.

e. Figures R703.8(1) and R703.8(2) illustrate typical construction details for a masonry veneer wall. For the actual mandatory requirements of this code, see the indicated sections of text. Other details of masonry veneer wall construction shall be permitted provided that the requirements of the indicated sections of text are met.

FIGURE R703.8(2)
TYPICAL MASONRY VENEER WALL DETAILS^e

TABLE R703.8(1)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS,
WOOD OR STEEL FRAMING, SEISMIC DESIGN CATEGORIES A, B AND C

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD- OR STEEL-FRAMED STORIES	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION ^a (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf) ^b	WOOD- OR STEEL-FRAMED STORY
A or B	Steel: 1 or 2 Wood: 1, 2 or 3	30	5	50	all
C	1	30	5	50	1 only
	2	30	5	50	top
					bottom
	Wood only: 3	30	5	50	top
					middle
bottom					

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa.

- a. An additional 8 feet is permitted for gable end walls. See also story height limitations of Section R301.3.
b. Maximum weight is installed weight and includes weight of mortar, grout, lath and other materials used for installation. Where veneer is placed on both faces of a wall, the combined weight shall not exceed that specified in this table.

TABLE R703.8(2)
STONE OR MASONRY VENEER LIMITATIONS AND REQUIREMENTS,
ONE- AND TWO-FAMILY DETACHED DWELLINGS, SEISMIC DESIGN CATEGORIES D₀, D₁ AND D₂

SEISMIC DESIGN CATEGORY	NUMBER OF WOOD-FRAMED STORIES ^a	MAXIMUM HEIGHT OF VENEER ABOVE NONCOMBUSTIBLE FOUNDATION OR FOUNDATION WALL (feet)	MAXIMUM NOMINAL THICKNESS OF VENEER (inches)	MAXIMUM WEIGHT OF VENEER (psf) ^b
D ₀	1	20 ^c	4	40
	2	20 ^c	4	40
	3	30 ^d	4	40
D ₁	1	20 ^c	4	40
	2	20 ^c	4	40
	3	20 ^c	4	40
D ₂	1	20 ^c	3	30
	2	20 ^c	3	30

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.479 kPa, 1 pound-force = 4.448 N.

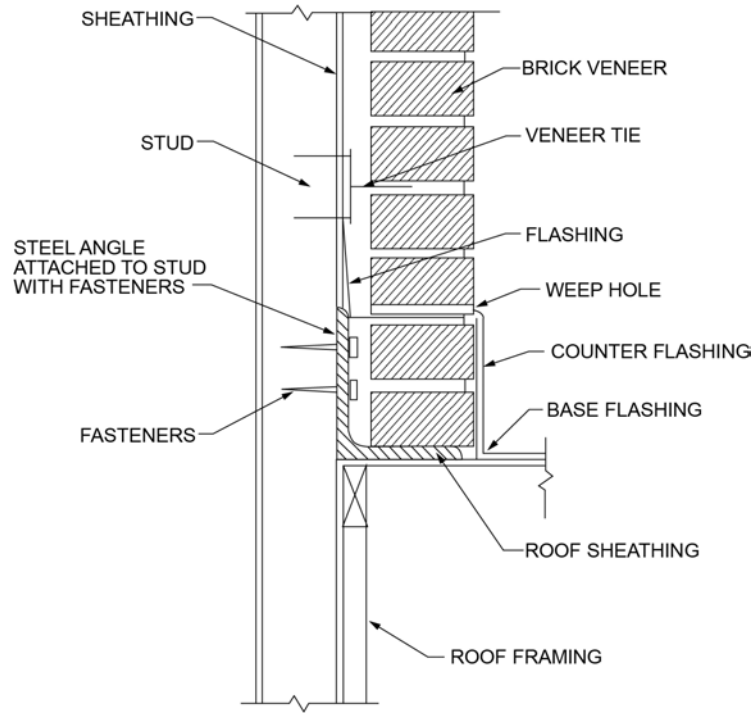
- a. Cripple walls are not permitted in Seismic Design Categories D₀, D₁ and D₂.
b. Maximum weight is installed weight and includes weight of mortar, grout and lath, and other materials used for installation.
c. The veneer shall not exceed 20 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls, or 30 feet in height with an additional 8 feet for gable end walls where the lower 10 feet have a backing of concrete or masonry wall. See story height limitations of Section R301.3.
d. The veneer shall not exceed 30 feet in height above a noncombustible foundation, with an additional 8 feet permitted for gable end walls. See story height limitations of Section R301.3.

R703.8.2.2 Support by roof construction. A steel angle shall be placed directly on top of the roof construction. The roof supporting construction for the steel angle shall consist of not fewer than three 2-inch by 6-inch (51 mm by 152 mm) wood members for wood construction or three 550S162 cold-formed steel members for cold-formed steel light frame construction. A wood member abutting the vertical wall stud construction shall be anchored with not fewer than three ⁵/₈-inch (15.9 mm) diameter by 5-inch (127 mm) lag screws to every wood stud spacing. Each additional wood roof member shall be anchored by the use of two 10d nails at every wood stud spacing. A cold-formed steel member abutting the vertical wall stud shall be anchored with not fewer than nine No. 8 screws to every cold-formed steel stud. Each additional cold-formed steel roof member shall be anchored to the adjoining roof member using two No.

8 screws at every stud spacing. Not less than two-thirds the width of the masonry veneer thickness shall bear on the steel angle. Flashing and weep holes shall be located in the masonry veneer wythe in accordance with Figure R703.8.2.2. The maximum height of the masonry veneer above the steel angle support shall be 12 feet 8 inches (3861 mm). The airspace separating the masonry veneer from the wood backing shall be in accordance with Sections R703.8.4 and R703.8.4.2. The support for the masonry veneer shall be constructed in accordance with Figure R703.8.2.2.

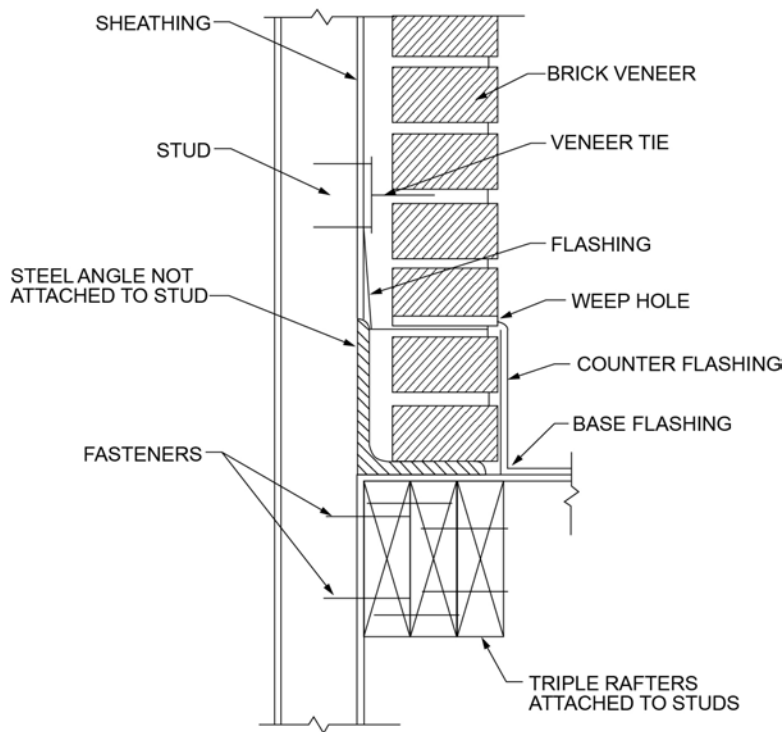
The maximum slope of the roof construction without stops shall be 7:12. Roof construction with slopes greater than 7:12 but not more than 12:12 shall have stops of a minimum 3-inch by 3-inch by ¹/₄-inch (76 mm by 76 mm by 6.4 mm) steel plate welded to the angle at 24 inches (610 mm) on center along the angle or as approved by the building official.

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SUPPORT BY STEEL ANGLE

**FIGURE R703.8.2.1
EXTERIOR MASONRY VENEER SUPPORT BY STEEL ANGLES**



SUPPORT BY ROOF MEMBERS

**FIGURE R703.8.2.2
EXTERIOR MASONRY VENEER SUPPORT BY ROOF MEMBERS**

R703.8.3 Lintels. Masonry veneer shall not support any vertical load other than the dead load of the veneer above. Veneer above openings shall be supported on lintels of noncombustible materials. The lintels shall have a length of bearing not less than 4 inches (102 mm). Steel lintels shall be shop coated with a rust-inhibitive paint, except for lintels made of corrosion-resistant steel or steel treated with coatings to provide corrosion resistance. Construction of openings shall comply with either Section R703.8.3.1 or 703.8.3.2.

R703.8.3.1 Allowable span. The allowable span shall not exceed the values set forth in Table R703.8.3.1.

R703.8.3.2 Maximum span. The allowable span shall not exceed 18 feet 3 inches (5562 mm) and shall be constructed to comply with Figure R703.8.3.2 and the following:

1. Provide a minimum length of 18 inches (457 mm) of masonry veneer on each side of opening as shown in Figure R703.8.3.2.
2. Provide a minimum 5-inch by 3½-inch by 5/16-inch (127 mm by 89 mm by 7.9 mm) steel angle above the opening and shore for a minimum of 7 days after installation.
3. Provide double-wire joint reinforcement extending 12 inches (305 mm) beyond each side of the opening. Lap splices of joint reinforcement not less than 12 inches (305 mm). Comply with one of the following:
 - 3.1. Double-wire joint reinforcement shall be 3/16-inch (4.8 mm) diameter and shall be placed in the first two bed joints above the opening.
 - 3.2. Double-wire joint reinforcement shall be 9 gauge (0.144 inch or 3.66 mm diameter) and shall be placed in the first three bed joints above the opening.
4. Provide the height of masonry veneer above opening, in accordance with Table R703.8.3.2.

**TABLE R703.8.3.2
HEIGHT OF MASONRY VENEER ABOVE OPENING**

MINIMUM HEIGHT OF MASONRY VENEER ABOVE OPENING (inches)	MAXIMUM HEIGHT OF MASONRY VENEER ABOVE OPENING (feet)
13	< 5
24	5 to < 12
60	12 to height above support allowed by Section R703.8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

R703.8.4.1 Size and spacing. Veneer ties, if strand wire, shall be not less in thickness than No. 9 U.S. gage [(0.148 inch) (4 mm)] wire and shall have a hook embedded in the mortar joint, or if sheet metal, shall be not less than No. 22 U.S. gage by [(0.0299 inch) (0.76 mm)] 7/8 inch (22 mm) corrugated. Each tie shall support not more than 2.67 square feet (0.25 m²) of wall area and shall be spaced not more than 32 inches (813 mm) on center horizontally and 24 inches (635 mm) on center vertically.

Exception: In Seismic Design Category D₀, D₁ or D₂ or townhouses in Seismic Design Category C or in wind areas of more than 30 pounds per square foot pressure (1.44 kPa), each tie shall support not more than 2 square feet (0.2 m²) of wall area.

R703.8.4.1.1 Veneer ties around wall openings. Additional metal ties shall be provided around wall openings greater than 16 inches (406 mm) in either dimension. Metal ties around the perimeter of openings shall be spaced not more than 3 feet (914 mm) on center and placed within 12 inches (305 mm) of the wall opening.

R703.8.4.2 Grout fill. As an alternative to the airspace required by Table R703.8.4(1), grout shall be permitted to fill the airspace. Where the airspace is filled with grout, a water-resistive barrier is required over studs or sheathing. Where the airspace is filled, replacing the sheathing and water-resistive barrier with a wire mesh and approved water-resistive barrier or an approved water-resistive barrier-backed reinforcement attached directly to the studs is permitted.

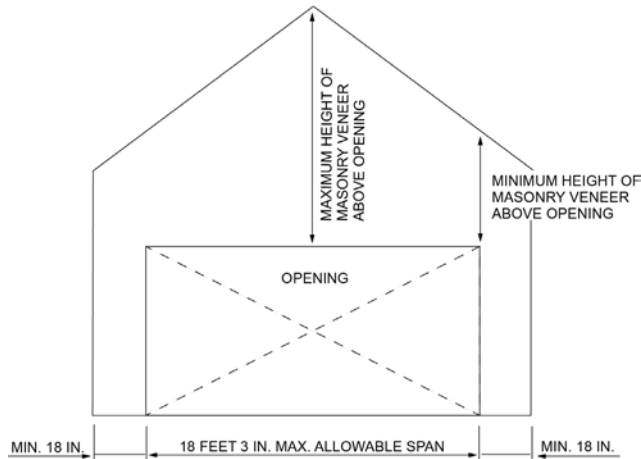
**TABLE R703.8.3.1
ALLOWABLE SPANS FOR LINTELS SUPPORTING MASONRY VENEER^{a, b, c, d}**

SIZE OF STEEL ANGLE ^{a, c, d} (inches)	NO STORY ABOVE	ONE STORY ABOVE	TWO STORIES ABOVE	NO. OF 1/2-INCH OR EQUIVALENT REINFORCING BARS IN REINFORCED LINTEL ^{b, d}
3 × 3 × 1/4	6'-0"	4'-6"	3'-0"	1
4 × 3 × 1/4	8'-0"	6'-0"	4'-6"	1
5 × 3½ × 5/16	10'-0"	8'-0"	6'-0"	2
6 × 3½ × 5/16	14'-0"	9'-6"	7'-0"	2
2-6 × 3½ × 5/16	20'-0"	12'-0"	9'-6"	4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Long leg of the angle shall be placed in a vertical position.
- b. Depth of reinforced lintels shall be not less than 8 inches and all cells of hollow masonry lintels shall be grouted solid. Reinforcing bars shall extend not less than 8 inches into the support.
- c. Steel members indicated are adequate typical examples; other steel members meeting structural design requirements shall be permitted to be used.
- d. Either steel angle or reinforced lintel shall span opening.

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For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE R703.8.3.2
MASONRY VENEER OPENING**

R703.8.5 Flashing. Flashing shall be located beneath the first course of masonry above finished ground level above the foundation wall or slab and at other points of support, including structural floors, shelf angles and lintels where masonry veneers are designed in accordance with Section R703.8. See Section R703.4 for additional requirements.

R703.8.6 Weepholes. Weepholes shall be provided in the outside wythe of masonry walls at a maximum spacing of 33 inches (838 mm) on center. Weepholes shall be not less than $\frac{3}{16}$ inch (5 mm) in diameter. Weepholes shall be located immediately above the flashing.

R703.9 Exterior insulation and finish system (EIFS)/EIFS with drainage. Exterior insulation and finish systems (EIFS) shall comply with this chapter and Section R703.9.1. EIFS with drainage shall comply with this chapter and Section R703.9.2.

R703.9.1 Exterior insulation and finish systems (EIFS). EIFS shall comply with the following:

1. ASTM E2568.
2. EIFS shall be limited to applications over substrates of concrete or masonry wall assemblies.
3. Flashing of EIFS shall be provided in accordance with the requirements of Section R703.4.
4. EIFS shall be installed in accordance with the manufacturer's instructions.
5. EIFS shall terminate not less than 6 inches (152 mm) above the finished ground level.
6. Decorative trim shall not be face-nailed through the EIFS.

**TABLE R703.8.4(1)
TIE ATTACHMENT AND AIRSPACE REQUIREMENTS**

BACKING AND TIE	MINIMUM TIE	MINIMUM TIE FASTENER ^a	AIRSPACE ^b	
Wood stud backing with corrugated sheet metal	22 U.S. gage (0.0299 in.) × $\frac{7}{8}$ in. wide	8d common nail ^c (2½ in. × 0.131 in.)	Nominal 1 in. between sheathing and veneer	
Wood stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	8d common nail ^c (2½ in. × 0.131 in.)	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 $\frac{5}{8}$ in. between backing and veneer
Wood stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e, f}	8d common nail ^c (2½ in. × 0.131 in.)	Greater than 4 $\frac{5}{8}$ in. between backing and veneer	Maximum 6 $\frac{5}{8}$ in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W1.7 (No. 9 U.S. gage; 0.148 in. dia.) with hook embedded in mortar joint ^d	No. 10 screw extending through the steel framing a minimum of three exposed threads	Minimum nominal 1 in. between sheathing and veneer	Maximum 4 $\frac{5}{8}$ in. between backing and veneer
Cold-formed steel stud backing with adjustable metal strand wire	W2.8 (0.187 in. dia.) with hook embedded in mortar joint ^{e, f}	No. 10 screw extending through the steel framing a minimum of three exposed threads	Greater than 4 $\frac{5}{8}$ in. between backing and veneer	Maximum 6 $\frac{5}{8}$ in. between backing and veneer

For SI: 1 inch = 25.4 mm.

- a. All fasteners shall have rust-inhibitive coating suitable for the installation in which they are being used, or be manufactured from material not susceptible to corrosion.
- b. An airspace that provides drainage shall be permitted to contain mortar from construction.
- c. In Seismic Design Category D₀, D₁ or D₂, the minimum tie fastener shall be an 8d ring-shank nail (2½ in. × 0.131 in.).
- d. Adjustable tie pintles shall include not fewer than 1 pintle leg of wire size W2.8 (MW18) with a maximum offset of 1¼ inches.
- e. Adjustable tie pintles shall include not fewer than 2 pintle legs with a maximum offset of 1¼ inches. Distance between inside face of brick and end of pintle shall be a maximum of 2 inches.
- f. Adjustable tie backing attachment components shall consist of one of the following: eyes with minimum wire W2.8 (MW18), barrel with minimum ¼-inch outside diameter, or plate with minimum thickness of 0.074 inch and minimum width of 1¼ inches.

TABLE R703.8.4(2)
REQUIRED BRICK TIE SPACING FOR DIRECT APPLICATION TOWOOD STRUCTURAL PANEL SHEATHING^{a, b, c}

FASTENER TYPE ^d	SIZE (DIA. OR SCREW #)	REQUIRED BRICK-TIE SPACING (VERTICAL-TIE SPACING/HORIZONTAL-TIE SPACING) (inches/inches)															
		110 mph V _{ult}				115 mph V _{ult}				130 mph V _{ult}				140 mph V _{ult}			
		Zone 5, Exposure B	Zone 5, Exposure C	Zone 5, Exposure D	Zone 5, Exposure B	Zone 5, Exposure C	Zone 5, Exposure D	Zone 5, Exposure B	Zone 5, Exposure C	Zone 5, Exposure D	Zone 5, Exposure B	Zone 5, Exposure C	Zone 5, Exposure D	Zone 5, Exposure B	Zone 5, Exposure C	Zone 5, Exposure D	
Ring Shank Nails	0.091	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/12,	12/16,	12/12	
		16/12,	12/16,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/12,	12/16,	12/12	
		12/16,	12/12		24/16,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12
		12/12			16/24,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12	16/16,	16/12,	12/12
Screws	#6	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	
		16/24,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	
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		16/12,	12/16,	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	
Screws	#8	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	
		16/24,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	
		16/16,	16/12,	12/16,	16/12,	16/12,	12/16,	16/12,	16/12,	12/16,	16/12,	16/12,	12/16,	16/12,	16/12,	12/16,	
		16/12,	12/16,	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	
Screws	#10	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	
		16/24,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	16/16,	16/12,	12/16,	
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		16/12,	12/16,	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	
Screws	#14	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	24/16,	16/16,	16/12,	12/12	16/16,	16/12,	12/12	
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		16/12,	12/16,	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	12/16,	12/12	12/12	

For SI: 1 inch = 25.4 mm, 1 mph = 0.447 m/s.

a. This table is based on attachment of brick ties directly to wood structural panel sheathing only. Additional attachment of the brick tie to lumber framing is not required. The brick ties shall be permitted to be placed over any insulating sheathing, not to exceed 2 inches in thickness. Wood structural panel sheathing shall be a minimum 7/16 performance category. The table is based on a building height of 30 feet or less.

b. Wood structural panels shall have a specific gravity of 0.42 or greater in accordance with NDS.

c. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.

d. Fasteners shall be sized such that the tip of the fastener passes completely through the wood structural panel sheathing by not less than 1/4 inch.

R703.9.2 Exterior insulation and finish system (EIFS) with drainage. EIFS with drainage shall comply with the following:

1. ASTM E2568.
2. EIFS with drainage shall be required over all wall assemblies with the exception of substrates of concrete or masonry wall assemblies.
3. EIFS with drainage shall have an average minimum drainage efficiency of 90 percent when tested in accordance with ASTM E2273.
4. The water-resistive barrier shall comply with Section R703.2 or ASTM E2570.
5. The water-resistive barrier shall be applied between the EIFS and the wall sheathing.
6. Flashing of EIFS with drainage shall be provided in accordance with the requirements of Section R703.4.
7. EIFS with drainage shall be installed in accordance with the manufacturer's instructions.
8. EIFS with drainage shall terminate not less than 6 inches (152 mm) above the finished ground level.
9. Decorative trim shall not be face-nailed through the EIFS with drainage.

R703.10 Fiber cement siding.

R703.10.1 Panel siding. Fiber-cement panels shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Panels shall be installed with the long dimension either parallel or perpendicular to framing. Vertical and horizontal joints shall occur over framing members and shall be protected with caulking, or with battens or flashing, or be vertical or horizontal shiplap, or otherwise designed to comply with Section R703.1. Panel siding shall be installed with fasteners in accordance with Table R703.3(1) or the approved manufacturer's instructions.

R703.10.2 Lap siding. Fiber-cement lap siding having a maximum width of 12 inches (305 mm) shall comply with the requirements of ASTM C1186, Type A, minimum Grade II or ISO 8336, Category A, minimum Class 2. Lap siding shall be lapped a minimum of 1¹/₄ inches (32 mm) and lap siding not having tongue-and-groove end joints shall have the ends protected with caulking, covered with an H-section joint cover, located over a strip of flashing, or shall be designed to comply with Section R703.1. Lap siding courses shall be installed with the fastener heads exposed or concealed, in accordance with Table R703.3(1) or approved manufacturer's instructions.

R703.11 Vinyl siding. Vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D3679 by an approved quality control agency.

R703.11.1 Installation. Vinyl siding, soffit and accessories shall be installed in accordance with the manufacturer's instructions.

R703.11.1.1 Fasteners. Unless specified otherwise by the manufacturer's instructions, fasteners for vinyl

siding shall be 0.120-inch (3 mm) shank diameter nail with a 0.313-inch (8 mm) head or 16-gage staple with a ³/₈-inch (9.5 mm) to ¹/₂-inch (12.7 mm) crown.

R703.11.1.2 Penetration depth. Unless specified otherwise by the manufacturer's instructions, fasteners shall penetrate into building framing. The total penetration into sheathing, furring framing or other nailable substrate shall be a minimum 1¹/₄ inches (32 mm). Where specified by the manufacturer's instructions and supported by a test report, fasteners are permitted to penetrate into or fully through nailable sheathing or other nailable substrate of minimum thickness specified by the instructions or test report without penetrating into framing. Where the fastener penetrates fully through the sheathing, the end of the fastener shall extend a minimum of ¹/₄ inch (6.4 mm) beyond the opposite face of the sheathing or nailable substrate.

R703.11.1.3 Spacing. Unless specified otherwise by the manufacturer's instructions, the maximum spacing between fasteners for horizontal siding shall be 16 inches (406 mm), and for vertical siding 12 inches (305 mm) both horizontally and vertically. Where specified by the manufacturer's instructions and supported by a test report, greater fastener spacing is permitted.

R703.11.2 Installation over foam plastic sheathing. Where vinyl siding or insulated vinyl siding is installed over foam plastic sheathing, the vinyl siding shall comply with Section R703.11 and shall have a wind load design pressure rating in accordance with Table R703.11.2.

Exceptions:

1. Where the foam plastic sheathing is applied directly over wood structural panels, fiberboard, gypsum sheathing or other approved backing capable of independently resisting the design wind pressure, the vinyl siding shall be installed in accordance with Sections R703.3.3 and R703.11.1.
2. Where the vinyl siding manufacturer's product specifications provide an approved wind load design pressure rating for installation over foam plastic sheathing, use of this wind load design pressure rating shall be permitted and the siding shall be installed in accordance with the manufacturer's installation instructions.
3. Where the foam plastic sheathing and its attachment have a design wind pressure resistance complying with Sections R316.8 and R301.2.1, the vinyl siding shall be installed in accordance with Sections R703.3.3 and R703.11.1.

R703.12 Adhered masonry veneer installation. Adhered masonry veneer shall comply with the requirements of Section R703.7.3 and the requirements in Sections 12.1 and 12.3 of TMS 402. Adhered masonry veneer shall be installed in accordance with Section R703.7.1, Article 3.3C of TMS 602 or the manufacturer's instructions.

TABLE R703.11.2
REQUIRED MINIMUM WIND LOAD DESIGN PRESSURE RATING FOR
VINYL SIDING INSTALLED OVER FOAM PLASTIC SHEATHING ALONE

ULTIMATE DESIGN WIND SPEED (MPH)	ADJUSTED MINIMUM DESIGN WIND PRESSURE (ASD) (PSF) ^{a, b}					
	Case 1: With interior gypsum wallboard ^c			Case 2: Without interior gypsum wallboard ^c		
	Exposure			Exposure		
	B	C	D	B	C	D
≤ 95	-30.0	-33.2	-39.4	-33.9	-47.4	-56.2
100	-30.0	-36.8	-43.6	-37.2	-52.5	-62.2
105	-30.0	-40.5	-48.1	-41.4	-57.9	-68.6
110	-31.8	-44.5	-52.8	-45.4	-63.5	-75.3
115	-35.5	-49.7	-59.0	-50.7	-71.0	-84.2
120	-37.4	-52.4	-62.1	-53.4	-74.8	-88.6
130	-44.9	-62.8	-74.5	-64.1	-89.7	-106
> 130	See Note d					

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

a. Linear interpolation is permitted.

b. The table values are based on a maximum 30-foot mean roof height, and effective wind area of 10 square feet Wall Zone 5 (corner), and the ASD design component and cladding wind pressure from Table R301.2.1(1), adjusted for exposure in accordance with Table R301.2.1(2), multiplied by the following adjustment factors: 1.87 (Case 1) and 2.67 (Case 2).

c. Gypsum wallboard, gypsum panel product or equivalent.

d. For the indicated wind speed condition and where foam sheathing is the only sheathing on the exterior of a frame wall with vinyl siding, the wall assembly shall be capable of resisting an impact without puncture at least equivalent to that of a wood frame wall with minimum $\frac{7}{16}$ -inch OSB sheathing as tested in accordance with ASTM E1886. The vinyl siding shall comply with an adjusted design wind pressure requirement in accordance with Note b, using an adjustment factor of 2.67.

R703.12.1 Clearances. On exterior stud walls, adhered masonry veneer shall be installed:

1. Minimum of 4 inches (102 mm) above the earth;
2. Minimum of 2 inches (51 mm) above paved areas; or
3. Minimum of $\frac{1}{2}$ inch (12.7 mm) above exterior walking surfaces that are supported by the same foundation that supports the exterior wall.

R703.12.2 Flashing at foundation. A corrosion-resistant screed or flashing of a minimum 0.019-inch (0.48 mm) or 26-gage galvanized or plastic with a minimum vertical attachment flange of $3\frac{1}{2}$ inches (89 mm) shall be installed to extend a minimum of 1 inch (25 mm) below the foundation plate line on exterior stud walls in accordance with Section R703.4.

R703.12.3 Water-resistive barrier. A water-resistive barrier shall be installed as required by Section R703.2 and shall comply with the requirements of Section R703.7.3. The water-resistive barrier shall lap over the exterior of the attachment flange of the screed or flashing provided in accordance with Section R703.12.2.

R703.13 Insulated vinyl siding. Insulated vinyl siding shall be certified and labeled as conforming to the requirements of ASTM D7793 by an approved quality control agency.

R703.13.1 Insulated vinyl siding and accessories. Insulated vinyl siding and accessories shall be installed in accordance with the manufacturer's installation instructions.

R703.14 Polypropylene siding. Polypropylene siding shall be certified and labeled as conforming to the requirements of ASTM D7254, and those of Section R703.14.2 or Section R703.14.3, by an approved quality control agency.

R703.14.1 Polypropylene siding and accessories. Polypropylene siding and accessories shall be installed in accordance with manufacturer's installation instructions.

R703.14.1.1 Installation. Polypropylene siding shall be installed over and attached to wood structural panel sheathing with minimum thickness of $\frac{7}{16}$ inch (11.1 mm), or other substrate, composed of wood or wood-based material and fasteners having equivalent withdrawal resistance.

R703.14.1.2 Fastener requirements. Unless otherwise specified in the approved manufacturer's instructions, nails shall be corrosion resistant, with a minimum 0.120-inch (3 mm) shank and minimum 0.313-inch (8 mm) head diameter. Nails shall be a minimum of $1\frac{1}{4}$ inches (32 mm) long or as necessary to penetrate sheathing or substrate not less than $\frac{3}{4}$ inch (19.1 mm). Where the nail fully penetrates the sheathing or nailable substrate, the end of the fastener shall extend not less than $\frac{1}{4}$ inch (6.4 mm) beyond the opposite face of the sheathing or substrate. Staples are not permitted.

R703.14.2 Fire separation. Polypropylene siding shall not be installed on walls with a fire separation distance of less than 5 feet (1524 mm) and walls closer than 10 feet (3048 mm) to a building on another lot.

Exception: Walls perpendicular to the line used to determine the fire separation distance.

R703.14.3 Flame spread index. The certification of the flame spread index shall be accompanied by a test report stating that all portions of the test specimen ahead of the flame front remained in position during the test in accordance with ASTM E84 or UL 723.

WALL COVERING

R703.15 Cladding attachment over foam sheathing to wood framing. Cladding shall be specified and installed in accordance with Section R703, the cladding manufacturer’s approved instructions, including any limitations for use over foam plastic sheathing, or an approved design. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section R703.15.1, Section R703.15.2, or an approved design for support of cladding weight.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.8.

R703.15.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table R703.15.1.

R703.15.2 Furred cladding attachment. Where wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the

cladding weight shall be as specified in Table R703.15.2. Where placed horizontally, wood furring shall be preservative-treated wood in accordance with Section R317.1 or naturally durable wood and fasteners shall be corrosion resistant in accordance Section R317.3.

R703.16 Cladding attachment over foam sheathing to cold-formed steel framing. Cladding shall be specified and installed in accordance with Section R703, the cladding manufacturer’s approved instructions, including any limitations for use over foam plastic sheathing, or an approved design. In addition, the cladding or furring attachments through foam sheathing to framing shall meet or exceed the minimum fastening requirements of Section R703.16.1, Section R703.16.2 or an approved design for support of cladding weight.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.8.

**TABLE R703.15.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR
DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^a**

CLADDING FASTENER THROUGH FOAM SHEATHING ^b	CLADDING FASTENER TYPE AND MINIMUM SIZE ^c	CLADDING FASTENER VERTICAL SPACING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^d (inches)									
			16" o.c. Fastener Horizontal Spacing					24" o.c. Fastener Horizontal Spacing				
			Cladding Weight:					Cladding Weight:				
			3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf
Wood framing (minimum 1 ¹ / ₄ -inch penetration)	0.113" diameter nail	6	2.00	1.45	1.00	0.75	DR	2.00	0.85	0.55	DR	DR
		8	2.00	1.00	0.65	DR	DR	2.00	0.55	DR	DR	DR
		12	2.00	0.55	DR	DR	DR	1.85	DR	DR	DR	DR
	0.120" diameter nail	6	3.00	1.70	1.15	0.90	0.55	3.00	1.05	0.65	0.50	DR
		8	3.00	1.20	0.80	0.60	DR	3.00	0.70	DR	DR	DR
		12	3.00	0.70	DR	DR	DR	2.15	DR	DR	DR	DR
	0.131" diameter nail	6	4.00	2.15	1.50	1.20	0.75	4.00	1.35	0.90	0.70	DR
		8	4.00	1.55	1.05	0.80	DR	4.00	0.90	0.55	DR	DR
		12	4.00	0.90	0.55	DR	DR	2.70	0.50	DR	DR	DR
	0.162" diameter nail	6	4.00	3.55	2.50	2.05	1.40	4.00	2.25	1.55	1.25	0.80
		8	4.00	2.55	1.80	1.45	0.95	4.00	1.60	1.10	0.85	0.50
		12	4.00	1.60	1.10	0.85	0.50	4.00	0.95	0.60	DR	DR

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

o.c. = On Center.

- a. Wood framing shall be Spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with AWC NDS.
- b. The thickness of wood structural panels complying with the specific gravity requirement of Note a shall be permitted to be included in satisfying the minimum penetration into framing. For cladding connections to wood structural panels, refer to Table R703.3.3. For brick veneer tie connections to wood structural panels, refer to Table R703.8.4(2).
- c. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
- d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.

**TABLE R703.15.2
FURRING MINIMUM FASTENING REQUIREMENTS FOR APPLICATION
OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^{a, b}**

FURRING MATERIAL	FRAMING MEMBER	FASTENER TYPE AND MINIMUM SIZE	MINIMUM PENETRATION INTO WALL FRAMING (inches) ^c	FASTENER SPACING IN FURRING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^e (inches)										
					16" o.c. Furring ^f					24" o.c. Furring ^f					
					Siding Weight:					Siding Weight:					
					3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf	
Minimum 1× wood furring ^d	Minimum 2× wood stud	0.131" diameter nail	1 1/4	8	4.00	2.45	1.75	1.45	0.95	4.00	1.60	1.10	0.85	DR	
				12	4.00	1.60	1.10	0.85	DR	4.00	0.95	0.55	DR	DR	
				16	4.00	1.10	0.70	DR	DR	3.05	0.60	DR	DR	DR	
		0.162" diameter nail	1 1/4	8	4.00	4.00	3.05	2.45	1.60	4.00	2.75	1.85	1.45	0.85	
				12	4.00	2.75	1.85	1.45	0.85	4.00	1.65	1.05	0.75	DR	
				16	4.00	1.90	1.25	0.95	DR	4.00	1.05	0.60	DR	DR	
		No.10 wood screw	1	12	4.00	2.30	1.60	1.20	0.70	4.00	1.40	0.85	0.60	DR	
				16	4.00	1.65	1.05	0.75	DR	4.00	0.90	DR	DR	DR	
				24	4.00	0.90	DR	DR	DR	2.85	DR	DR	DR	DR	
		1/4" lag screw	1 1/2	12	4.00	2.65	1.90	1.50	0.90	4.00	1.65	1.05	0.80	DR	
				16	4.00	1.95	1.25	0.95	0.50	4.00	1.10	0.65	DR	DR	
				24	4.00	1.10	0.65	DR	DR	3.25	0.50	DR	DR	DR	

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

o.c. = On Center.

- a. Wood framing and furring shall be Spruce-pine-fir or any wood species with a specific gravity of 0.42 or greater in accordance with AWC NDS.
- b. Nail fasteners shall comply with ASTM F1667, except nail length shall be permitted to exceed ASTM F1667 standard lengths.
- c. The thickness of wood structural panels complying with the specific gravity requirements of Note a shall be permitted to be included in satisfying the minimum required penetration into framing.
- d. Where the required cladding fastener penetration into wood material exceeds 3/4 inch and is not more than 1 1/2 inches, a minimum 2× wood furring or an approved design shall be used.
- e. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.
- f. Furring shall be spaced not more than 24 inches on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch and 12-inch fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches and 24 inches on center, respectively.

**TABLE R703.16.1
CLADDING MINIMUM FASTENING REQUIREMENTS FOR
DIRECT ATTACHMENT OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^{a, b}**

CLADDING FASTENER THROUGH FOAM SHEATHING INTO:	CLADDING FASTENER TYPE AND MINIMUM SIZE ^c	CLADDING FASTENER VERTICAL SPACING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^d (inches)									
			16" o.c. Fastener Horizontal Spacing					24" o.c. Fastener Horizontal Spacing				
			Cladding Weight:					Cladding Weight:				
			3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf
Steel framing (minimum penetration of steel thickness + 3 threads)	No. 8 screw into 33-mil steel or thicker	6	3.00	2.95	2.50	2.20	1.45	3.00	2.35	1.75	1.25	DR
		8	3.00	2.55	2.00	1.60	0.60	3.00	1.80	0.90	DR	DR
		12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR
	No. 10 screw into 33-mil steel	6	4.00	3.50	3.05	2.70	1.95	4.00	2.90	2.20	1.70	0.55
		8	4.00	3.10	2.50	2.05	1.00	4.00	2.25	1.35	0.70	DR
		12	4.00	2.25	1.35	0.70	DR	3.70	1.05	DR	DR	DR
	No. 10 screw into 43-mil steel or thicker	6	4.00	4.00	4.00	4.00	3.60	4.00	4.00	3.80	3.45	2.70
		8	4.00	4.00	4.00	3.70	3.00	4.00	3.85	3.25	2.80	1.80
		12	4.00	3.85	3.25	2.80	1.80	4.00	3.05	2.15	1.50	DR

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

o.c. = On Center.

- a. Steel framing shall be minimum 33-ksi steel for 33-mil and 43-mil steel, and 50-ksi steel for 54-mil steel or thicker.
- b. Where cladding is attached to wood structural panel sheathing only, fastening requirements shall be in accordance with Table R703.3.3.
- c. Screws shall comply with the requirements of ASTM C1513.
- d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.

**TABLE R703.16.2
FURRING MINIMUM FASTENING REQUIREMENTS FOR
APPLICATION OVER FOAM PLASTIC SHEATHING TO SUPPORT CLADDING WEIGHT^a**

FURRING MATERIAL	FRAMING MEMBER	FASTENER TYPE AND MINIMUM SIZE ^b	MINIMUM PENETRATION INTO WALL FRAMING (inches)	FASTENER SPACING IN FURRING (inches)	MAXIMUM THICKNESS OF FOAM SHEATHING ^d (inches)									
					16" o.c. Furring ^e					24" o.c. Furring ^e				
					Cladding Weight:					Cladding Weight:				
					3 psf	11 psf	15 psf	18 psf	25 psf	3 psf	11 psf	15 psf	18 psf	25 psf
Minimum 33-mil steel furring or minimum 1x wood furring ^c	33-mil steel stud	No. 8 screw	Steel thickness + 3 threads	12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR
				16	3.00	1.00	DR	DR	DR	2.85	DR	DR	DR	DR
				24	2.85	DR	DR	DR	DR	2.20	DR	DR	DR	DR
		No. 10 screw	Steel thickness + 3 threads	12	4.00	2.25	1.35	0.70	DR	3.70	1.05	DR	DR	DR
				16	3.85	1.45	DR	DR	DR	3.40	DR	DR	DR	DR
				24	3.40	DR	DR	DR	DR	2.70	DR	DR	DR	DR
	43-mil or thicker steel stud	No. 8 Screw	Steel thickness + 3 threads	12	3.00	1.80	0.95	DR	DR	3.00	0.65	DR	DR	DR
				16	3.00	1.00	DR	DR	DR	2.85	DR	DR	DR	DR
				24	2.85	DR	DR	DR	DR	2.20	DR	DR	DR	DR
		No. 10 screw	Steel thickness + 3 threads	12	4.00	3.85	3.25	2.80	1.80	4.00	3.05	2.15	1.50	DR
				16	4.00	3.30	2.55	1.95	0.60	4.00	2.25	1.05	DR	DR
				24	4.00	2.25	1.05	DR	DR	4.00	0.65	DR	DR	DR

For SI: 1 inch = 25.4 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa, 1 pound per square inch = 6.895 kPa.

DR = Design Required.

o.c. = On Center.

- a. Wood furring shall be Spruce-pine-fir or any softwood species with a specific gravity of 0.42 or greater. Steel furring shall be minimum 33-ksi steel. Steel studs shall be minimum 33-ksi steel for 33-mil and 43-mil thickness, and 50-ksi steel for 54-mil steel or thicker.
- b. Screws shall comply with the requirements of ASTM C1513.
- c. Where the required cladding fastener penetration into wood material exceeds 3/4 inch and is not more than 1 1/2 inches, a minimum 2-inch nominal wood furring or an approved design shall be used.
- d. Foam sheathing shall have a minimum compressive strength of 15 psi in accordance with ASTM C578 or ASTM C1289.
- e. Furring shall be spaced not more than 24 inches (610 mm) on center, in a vertical or horizontal orientation. In a vertical orientation, furring shall be located over wall studs and attached with the required fastener spacing. In a horizontal orientation, the indicated 8-inch and 12-inch fastener spacing in furring shall be achieved by use of two fasteners into studs at 16 inches and 24 inches on center, respectively.

R703.16.1 Direct attachment. Where cladding is installed directly over foam sheathing without the use of furring, cladding minimum fastening requirements to support the cladding weight shall be as specified in Table R703.16.1.

R703.16.2 Furred cladding attachment. Where steel or wood furring is used to attach cladding over foam sheathing, furring minimum fastening requirements to support the cladding weight shall be as specified in Table R703.16.2. Where placed horizontally, wood furring shall be preservative-treated wood in accordance with Section R317.1 or naturally durable wood and fasteners shall be corrosion resistant in accordance with Section R317.3. Steel furring shall have a minimum G60 galvanized coating.

R703.17 Cladding attachment over foam sheathing to masonry or concrete wall construction. Cladding shall be specified and installed in accordance with Section 703.3 and the cladding manufacturer's instructions or an approved design. Foam sheathing shall be attached to masonry or concrete construction in accordance with the insulation manufacturer's installation instructions or an approved design. Furring and furring attachments through foam sheathing into concrete or masonry substrate shall be designed to resist design loads determined in accordance with Section R301, including support of cladding weight as applicable. Fasteners used to attach cladding or furring through foam sheathing to masonry or concrete substrates shall be approved for application into masonry or concrete material and shall be installed in accordance with the fastener manufacturer's instructions.

Exceptions:

1. Where the cladding manufacturer has provided approved installation instructions for application over foam sheathing and connection to a masonry or concrete substrate, those requirements shall apply.
2. For exterior insulation and finish systems, refer to Section R703.9.
3. For anchored masonry or stone veneer installed over foam sheathing, refer to Section R703.8.

SECTION R704 SOFFITS

R704.1 General wind limitations. Where the design wind pressure is 30 pounds per square foot (1.44 kPa) or less, soffits shall comply with Section R704.2. Where the design wind pressure exceeds 30 pounds per square foot (1.44 kPa), soffits shall comply with Section R704.3. The design wind pressure on soffits shall be determined using the component and cladding loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.93 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

R704.2 Soffit installation where the design wind pressure is 30 psf or less. Where the design wind pressure is 30 pounds per square foot (1.44 kPa) or less, soffit installation shall comply with Section R704.2.1, R704.2.2, R704.2.3 or

R704.2.4. Soffit materials not addressed in Sections R704.2.1 through R704.2.4 shall be in accordance with the manufacturer's installation instructions.

R704.2.1 Vinyl soffit panels. Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia or subfascia component in accordance with Figure R704.2.1(1). Where the unsupported span of soffit panels is greater than 16 inches (406 mm), intermediate nailing strips shall be provided in accordance with Figure R704.2.1(2). Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

R704.2.2 Fiber-cement soffit panels. Fiber-cement soffit panels shall be a minimum of $\frac{1}{4}$ inch (6.4 mm) in thickness and shall comply with the requirements of ASTM C1186, Type A, minimum Grade II, or ISO 8336, Category A, minimum Class 2. Panel joints shall occur over framing or over wood structural panel sheathing. Soffit panels shall be installed with spans and fasteners in accordance with the manufacturer's installation instructions.

R704.2.3 Hardboard soffit panels. Hardboard soffit panels shall be not less than $\frac{7}{16}$ inch (11.11 mm) in thickness and shall be fastened to framing or nailing strips with $2\frac{1}{2}$ -inch by 0.113-inch (64 mm by 2.9 mm) siding nails spaced not more than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) on center at intermediate supports.

R704.2.4 Wood structural panel soffit. The minimum nominal thickness for wood structural panel soffits shall be $\frac{3}{8}$ inch (9.5 mm) and shall be fastened to framing or nailing strips with 2-inch by 0.099-inch (51 mm by 2.5 mm) nails. Fasteners shall be spaced not less than 6 inches (152 mm) on center at panel edges and 12 inches (305 mm) on center at intermediate supports.

R704.3 Soffit installation where the design wind pressure exceeds 30 psf. Where the design wind pressure is greater than 30 psf, soffit installation shall comply with Section R704.3.1, R704.3.2, R704.3.3 or R704.3.4. Soffit materials not addressed in Sections R704.3.1 through R704.3.4 shall be in accordance with the manufacturer's installation instructions.

R704.3.1 Vinyl soffit panels. Vinyl soffit panels and their attachments shall be capable of resisting wind loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2). Vinyl soffit panels shall be installed using fasteners specified by the manufacturer and shall be fastened at both ends to a supporting component such as a nailing strip, fascia or subfascia component in accordance with Figure R704.2.1(1). Where the unsupported span of soffit panels is greater than 12 inches (305 mm), intermediate nailing strips shall be provided in accordance with Figure

R704.2.1(2). Vinyl soffit panels shall be installed in accordance with the manufacturer's installation instructions. Fascia covers shall be installed in accordance with the manufacturer's installation instructions.

R704.3.2 Fiber-cement soffit panels. Fiber-cement soffit panels shall comply with Section R704.2.2 and shall be capable of resisting wind loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

R704.3.3 Hardboard soffit panels. Hardboard soffit panels shall comply with the manufacturer's installation instructions and shall be capable of resisting wind loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2).

R704.3.4 Wood structural panel soffit. Wood structural panel soffits shall be capable of resisting wind loads specified in Table R301.2.1(1) for walls using an effective wind area of 10 square feet (0.929 m²) and adjusted for height and exposure in accordance with Table R301.2.1(2). Alternatively, wood structural panel soffits shall be installed in accordance with Table R704.3.4.

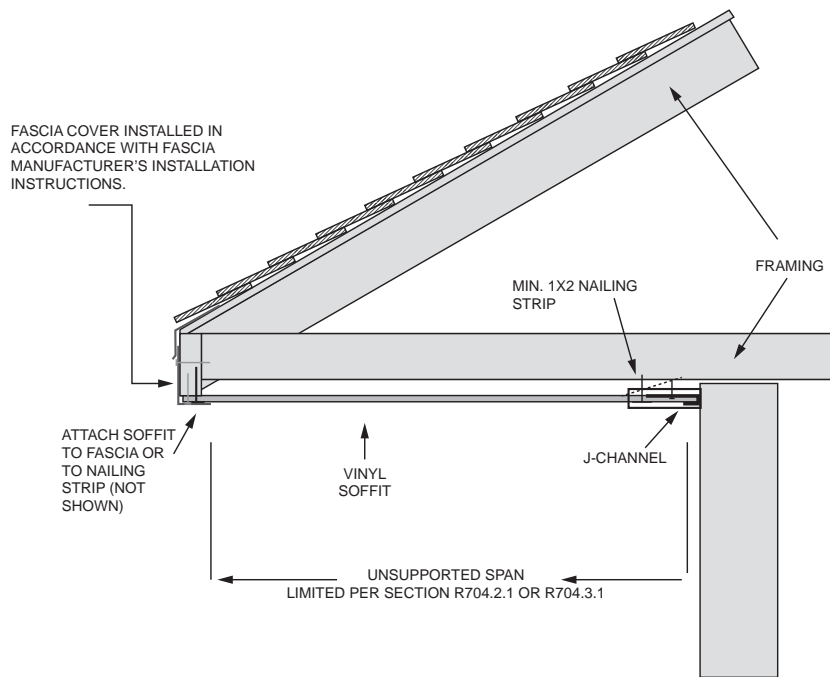


FIGURE R704.2.1(1)
TYPICAL SINGLE-SPAN VINYL SOFFIT PANEL SUPPORT

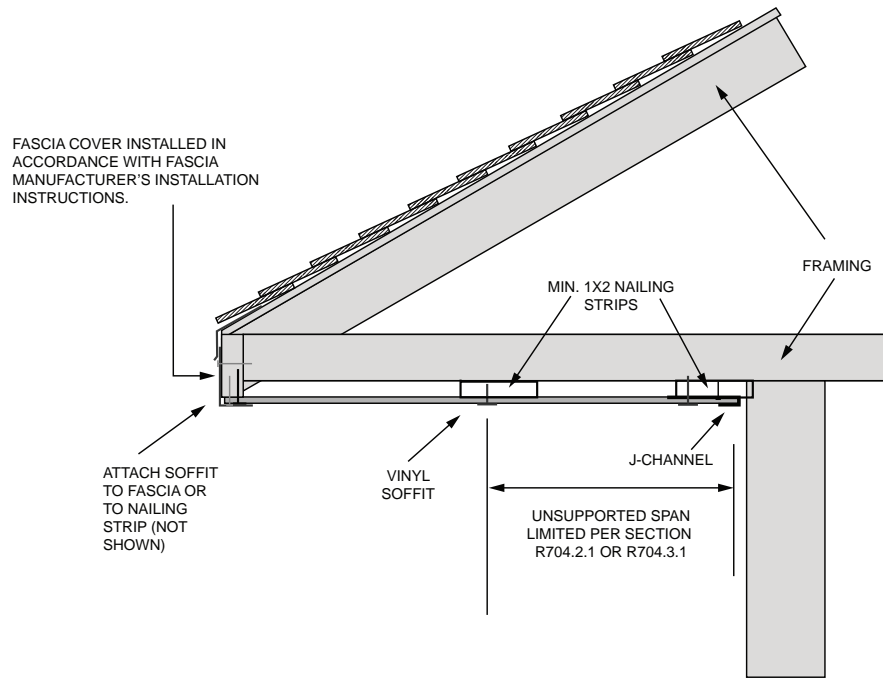


FIGURE R704.2.1(2)
TYPICAL DOUBLE-SPAN VINYL SOFFIT PANEL SUPPORT

TABLE R704.3.4
PRESCRIPTIVE ALTERNATIVE FOR WOOD STRUCTURAL PANEL SOFFIT ^{b, c, d, e}

MAXIMUM DESIGN PRESSURE (+ or - psf)	MINIMUM PANEL SPAN RATING	MINIMUM PANEL PERFORMANCE CATEGORY	NAIL TYPE AND SIZE	FASTENER ^a SPACING ALONG EDGES AND INTERMEDIATE SUPPORTS	
				Galvanized Steel	Stainless Steel
30	24/0	3/8	6d box (2 × 0.099 × 0.266 head diameter)	6 ^f	4
40	24/0	3/8	6d box (2 × 0.099 × 0.266 head diameter)	6	4
50	24/0	3/8	6d box (2 × 0.099 × 0.266 head diameter)	4	4
			8d common (2½ × 0.131 × 0.281 head diameter)	6	6
60	24/0	3/8	6d box (2 × 0.099 × 0.266 head diameter)	4	3
			8d common (2½ × 0.131 × 0.281 head diameter)	6	4
70	24/16	7/16	8d common (2½ × 0.131 × 0.281 head diameter)	4	4
			10d box (3 × 0.128 × 0.312 head diameter)	6	4
80	24/16	7/16	8d common (2½ × 0.131 × 0.281 head diameter)	4	4
			10d box (3 × 0.128 × 0.312 head diameter)	6	4
90	32/16	15/32	8d common (2½ × 0.131 × 0.281 head diameter)	4	3
			10d box (3 × 0.128 × 0.312 head diameter)	6	4

For SI: 1 inch = 25.4 mm, 1 pound per square foot = 0.0479 kPa.

a. Fasteners shall comply with Sections R703.3.2 and R703.3.3.

b. Maximum spacing of soffit framing members shall not exceed 24 inches.

c. Wood structural panels shall be of an exterior exposure grade.

d. Wood structural panels shall be installed with strength axis perpendicular to supports with not fewer than two continuous spans.

e. Wood structural panels shall be attached to soffit framing members with specific gravity of at least 0.42. Framing members shall be minimum 2 × 3 nominal with the larger dimension in the cross section aligning with the length of fasteners to provide sufficient embedment depths.

f. Spacing at intermediate supports shall be not greater than 12 inches on center.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 8 – ROOF-CEILING CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																X			
Chapter / Section																						
R802.1.1 <i>Note</i>				X																		
R802.1.5 - R802.1.5.10			X																			
R802.10.2				X																		
R806 <i>Note</i>																			X			
<i>R806.1.1</i>			X	X																		
R807.1				X																		

The state agency does not adopt sections identified with the following symbol: †

CHAPTER 8

ROOF-CEILING CONSTRUCTION

User note:

About this chapter: Chapter 8 addresses the design and construction of roof-ceiling systems. This chapter contains two roof-ceiling framing systems: wood framing and cold-formed steel framing. Allowable span tables are provided to simplify the selection of rafter and ceiling joist size for wood roof framing and cold-formed steel framing. Chapter 8 also provides requirements for the application of ceiling finishes, the proper ventilation of concealed spaces in roofs (for example, enclosed attics and rafter spaces), unvented attic assemblies and attic access.

SECTION R801 GENERAL

R801.1 Application. The provisions of this chapter shall control the design and construction of the roof-ceiling system for buildings.

R801.2 Requirements. Roof and ceiling construction shall be capable of accommodating all loads imposed in accordance with Section R301 and of transmitting the resulting loads to the supporting structural elements.

R801.3 Roof drainage. In areas where expansive soils or collapsible soils are known to exist, all dwellings shall have a controlled method of water disposal from roofs that will collect and discharge roof drainage to the ground surface not less than 5 feet (1524 mm) from foundation walls or to an approved drainage system.

SECTION R802 WOOD ROOF FRAMING

R802.1 General. Wood and wood-based products used for load-supporting purposes shall conform to the applicable provisions of this section.

R802.1.1 Sawn lumber. Sawn lumber shall be identified by a grade mark of an accredited lumber grading or inspection agency and have design values certified by an accreditation body that complies with DOC PS 20. In lieu of a grade mark, a certificate of inspection issued by a lumber grading or inspection agency meeting the requirements of this section shall be accepted.

Note: See Section R301.1.1.1 for limited-density owner-built rural dwellings.

R802.1.1.1 End-jointed lumber. Approved end-jointed lumber identified by a grade mark conforming to Section R802.1.1 shall be permitted to be used interchangeably with solid-sawn members of the same species and grade. End-jointed lumber used in an assembly required elsewhere in this code to have a fire-resistance rating shall have the designation “Heat-Resistant Adhesive” or “HRA” included in its grade mark.

R802.1.2 Structural glued-laminated timbers. Glued-laminated timbers shall be manufactured and identified as required in ANSI A190.1, ANSI 117 and ASTM D3737.

R802.1.3 Structural log members. Structural log members shall comply with the provisions of ICC 400.

R802.1.4 Structural composite lumber. Structural capacities for structural composite lumber shall be established and monitored in accordance with ASTM D5456.

R802.1.5 Fire-retardant-treated wood. Fire-retardant-treated wood (FRTW) is any wood product that, when impregnated with chemicals by a pressure process or other means during manufacture, shall have, when tested in accordance with ASTM E84 or UL 723, a listed flame spread index of 25 or less. In addition, the ASTM E84 or UL 723 test shall be continued for an additional 20-minute period and the flame front shall not progress more than 10.5 feet (3200 mm) beyond the center line of the burners at any time during the test.

R802.1.5.1 Pressure process. For wood products impregnated with chemicals by a pressure process, the process shall be performed in closed vessels under pressures not less than 50 pounds per square inch gauge (psig) (344.7 kPa).

R802.1.5.2 Other means during manufacture. For wood products impregnated with chemicals by other means during manufacture, the treatment shall be an integral part of the manufacturing process of the wood product. The treatment shall provide permanent protection to all surfaces of the wood product. The use of paints, coating, stains or other surface treatments is not an approved method of protection as required by this section.

R802.1.5.3 Testing. For fire-retardant-treated wood products, the front and back faces of the wood product shall be tested in accordance with and produce the results required in Section R802.1.5.

R802.1.5.3.1 Fire testing of wood structural panels. Wood structural panels shall be tested with a ripped or cut longitudinal gap of $\frac{1}{8}$ inch (3.2 mm).

R802.1.5.4 Labeling. In addition to the labels required by Section 802.1.1 for sawn lumber and Section 803.2.1 for wood structural panels, each piece of fire-retardant-treated lumber and wood structural panel shall be labeled. The label shall contain:

1. The identification mark of an approved agency in accordance with Section 1703.5 of the *California Building Code*.

2. Identification of the treating manufacturer.
3. The name of the fire-retardant treatment.
4. The species of wood treated.
5. Flame spread index and smoke-developed index.
6. Method of drying after treatment.
7. Conformance to applicable standards in accordance with Sections R802.1.5.5 through R802.1.5.10.
8. For FRTW exposed to weather, or a damp or wet location, the words “No increase in the listed classification when subjected to the Standard Rain Test” (ASTM D2898).

R802.1.5.5 Strength adjustments. Design values for untreated lumber and wood structural panels as specified in Section R802.1 shall be adjusted for fire-retardant-treated wood. Adjustments to design values shall be based on an approved method of investigation that takes into consideration the effects of the anticipated temperature and humidity to which the fire-retardant-treated wood will be subjected, the type of treatment and redrying procedures.

R802.1.5.6 Wood structural panels. The effect of treatment and the method of redrying after treatment, and exposure to high temperatures and high humidities on the flexure properties of fire-retardant-treated softwood plywood shall be determined in accordance with ASTM D5516. The test data developed by ASTM D5516 shall be used to develop adjustment factors, maximum loads and spans, or both for untreated plywood design values in accordance with ASTM D6305. Each manufacturer shall publish the allowable maximum loads and spans for service as floor and roof sheathing for their treatment.

R802.1.5.7 Lumber. For each species of wood treated, the effect of the treatment and the method of redrying after treatment and exposure to high temperatures and high humidities on the allowable design properties of fire-retardant-treated lumber shall be determined in accordance with ASTM D5664. The test data developed by ASTM D5664 shall be used to develop modification factors for use at or near room temperature and at elevated temperatures and humidity in accordance with ASTM D6841. Each manufacturer shall publish the modification factors for service at temperatures of not less than 80°F (27°C) and for roof framing. The roof framing modification factors shall take into consideration the climatological location.

R802.1.5.8 Exposure to weather. Where fire-retardant-treated wood is exposed to weather or damp or wet locations, it shall be identified as “Exterior” to indicate there is not an increase in the *listed* flame spread index as defined in Section R802.1.5 when subjected to ASTM D2898.

R802.1.5.9 Interior applications. Interior fire-retardant-treated wood shall have a moisture content of not over 28 percent when tested in accordance with ASTM D3201 procedures at 92-percent relative humidity. Interior fire-retardant-treated wood shall be tested in accordance with Section R802.1.5.6 or R802.1.5.7. Interior fire-retardant-treated wood designated as Type A shall be tested in accordance with the provisions of this section.

R802.1.5.10 Moisture content. Fire-retardant-treated wood shall be dried to a moisture content of 19 percent or less for lumber and 15 percent or less for wood structural panels before use. For wood kiln dried after treatment (KDAT) the kiln temperatures shall not exceed those used in kiln drying the lumber and plywood submitted for the tests described in Section R802.1.5.6 for plywood and R802.1.5.7 for lumber.

R802.1.6 Cross-laminated timber. Cross-laminated timber shall be manufactured and identified as required by ANSI/APA PRG 320.

R802.1.7 Engineered wood rim board. Engineered wood rim boards shall conform to ANSI/APA PRR 410 or shall be evaluated in accordance with ASTM D7672. Structural capacities shall be in accordance with ANSI/APA PRR 410 or established in accordance with ASTM D7672. Rim boards conforming to ANSI/APA PRR 410 shall be marked in accordance with that standard.

R802.1.8 Prefabricated wood I-joists. Structural capacities and design provisions for prefabricated wood I-joists shall be established and monitored in accordance with ASTM D5055.

R802.2 Design and construction. The roof and ceiling assembly shall provide continuous ties across the structure to prevent roof thrust from being applied to the supporting walls. The assembly shall be designed and constructed in accordance with the provisions of this chapter and Figures R606.11(1), R606.11(2) and R606.11(3) or in accordance with AWC NDS.

R802.3 Ridge. A ridge board used to connect opposing rafters shall be not less than 1 inch (25 mm) nominal thickness and not less in depth than the cut end of the rafter. Where ceiling joist or rafter ties do not provide continuous ties across the structure as required by Section R802.5.2, the ridge shall be supported by a wall or ridge beam designed in accordance with accepted engineering practice and supported on each end by a wall or column.

R802.4 Rafters. Rafters shall be in accordance with this section.

R802.4.1 Rafter size. Rafters shall be sized based on the rafter spans in Tables R802.4.1(1) through R802.4.1(8). Rafter spans shall be measured along the horizontal projection of the rafter. For other grades and species and for other loading conditions, refer to the AWC STJR.

TABLE R802.4.1(1)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling not attached to rafters, L/A = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
12	Douglas fir-larch	SS	11-6	18-0	23-9	Note b	Note b	11-6	18-0	23-9	Note b	Note b
	Douglas fir-larch	#1	11-1	17-4	22-5	Note b	Note b	10-6	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	10-10	16-10	21-4	26-0	Note b	10-0	14-7	18-5	22-6	26-0
	Douglas fir-larch	#3	8-9	12-10	16-3	19-10	23-0	7-7	11-1	14-1	17-2	19-11
	Hem-fir	SS	10-10	17-0	22-5	Note b	Note b	10-10	17-0	22-5	Note b	Note b
	Hem-fir	#1	10-7	16-8	22-0	Note b	Note b	10-4	15-2	19-2	23-5	Note b
	Hem-fir	#2	10-1	15-11	20-8	25-3	Note b	9-8	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	11-3	17-8	23-4	Note b	Note b	11-3	17-8	23-4	Note b	Note b
	Southern pine	#1	10-10	17-0	22-5	Note b	Note b	10-6	15-8	19-10	23-2	Note b
	Southern pine	#2	10-4	15-7	19-8	23-5	Note b	9-0	13-6	17-1	20-3	23-10
	Southern pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-pine-fir	SS	10-7	16-8	21-11	Note b	Note b	10-7	16-8	21-9	Note b	Note b
	Spruce-pine-fir	#1	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#2	10-4	16-3	21-0	25-8	Note b	9-10	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-3	20-7	25-2	Note b
	Douglas fir-larch	#1	10-0	15-4	19-5	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#2	9-10	14-7	18-5	22-6	26-0	8-7	12-7	16-0	19-6	22-7
	Douglas fir-larch	#3	7-7	11-1	14-1	17-2	19-11	6-7	9-8	12-12	14-11	17-3
	Hem-fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-11	24-4	Note b
	Hem-fir	#1	9-8	15-2	19-2	23-5	Note b	9-0	13-1	16-7	20-4	23-7
	Hem-fir	#2	9-2	14-2	17-11	21-11	25-5	8-5	12-3	15-6	18-11	22-0
	Hem-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	25-7	Note b
	Southern pine	#1	9-10	15-6	19-10	23-2	Note b	9-1	13-7	17-2	20-1	23-10
	Southern pine	#2	9-0	13-6	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	14-10	18-10	23-0	Note b
	Spruce-pine-fir	#1	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#2	9-5	14-4	18-2	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(1)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
19.2	Douglas fir-larch	SS	9-10	15-5	20-4	25-11	Note b	9-10	14-10	18-10	23-0	Note b
	Douglas fir-larch	#1	9-5	14-0	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch	#2	9-1	13-3	16-10	20-7	23-10	7-10	11-6	14-7	17-10	20-8
	Douglas fir-larch	#3	6-11	10-2	12-10	15-8	18-3	6-0	8-9	11-2	12-7	15-9
	Hem-fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-4	18-2	22-3	25-9
	Hem-fir	#1	9-1	13-10	17-6	21-5	24-10	8-2	12-0	15-2	18-6	21-6
	Hem-fir	#2	8-8	12-11	16-4	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-7	23-4	Note b
	Southern pine	#1	9-3	14-3	18-1	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern pine	#2	8-2	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7
	Spruce-pine-fir	SS	9-1	14-3	18-9	23-11	Note b	9-1	13-7	17-2	21-0	24-4
	Spruce-pine-fir	#1	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#2	8-10	13-1	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
24	Douglas fir-larch	SS	9-1	14-4	18-10	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch	#2	8-2	11-11	15-1	18-5	21-4	7-0	10-4	13-0	15-11	18-6
	Douglas fir-larch	#3	6-2	9-1	11-6	14-1	16-3	5-4	7-10	10-0	12-2	14-1
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	12-10	16-3	19-10	23-0
	Hem-fir	#1	8-5	12-4	15-8	19-2	22-2	7-4	10-9	13-7	16-7	19-3
	Hem-fir	#2	7-11	11-7	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	13-10	17-6	20-10	24-8
	Southern pine	#1	8-7	12-9	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1
	Spruce-pine-fir	SS	8-5	13-3	17-5	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).
- b. Span exceeds 26 feet in length.

TABLE R802.4.1(2)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
		(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	
12	Douglas fir-larch	SS	10-5	16-4	21-7	Note b	Note b	10-5	16-4	21-7	Note b	Note b
	Douglas fir-larch	#1	10-0	15-9	20-10	Note b	Note b	10-0	15-4	19-5	23-9	Note b
	Douglas fir-larch	#2	9-10	15-6	20-5	26-0	Note b	9-10	14-7	18-5	22-6	26-0
	Douglas fir-larch	#3	8-9	12-10	16-3	19-10	23-0	7-7	11-1	14-1	17-2	19-11
	Hem-fir	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	Note b	Note b
	Hem-fir	#1	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-2	23-5	Note b
	Hem-fir	#2	9-2	14-5	19-0	24-3	Note b	9-2	14-2	17-11	21-11	25-5
	Hem-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Southern pine	SS	10-3	16-1	21-2	Note b	Note b	10-3	16-1	21-2	Note b	Note b
	Southern pine	#1	9-10	15-6	20-5	Note b	Note b	9-10	15-6	19-10	23-2	Note b
	Southern pine	#2	9-5	14-9	19-6	23-5	Note b	9-0	13-6	17-1	20-3	23-10
	Southern pine	#3	8-0	11-9	14-10	18-0	21-4	6-11	10-2	12-10	15-7	18-6
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5	Note b	9-8	15-2	19-11	25-5	Note b
	Spruce-pine-fir	#1	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#2	9-5	14-9	19-6	24-10	Note b	9-5	14-4	18-2	22-3	25-9
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0	Note b	9-6	14-11	19-7	25-0	Note b
	Douglas fir-larch	#1	9-1	14-4	18-11	23-9	Note b	9-1	13-3	16-10	20-7	23-10
	Douglas fir-larch	#2	8-11	14-1	18-5	22-6	26-0	8-7	12-7	16-0	19-6	22-7
	Douglas fir-larch	#3	7-7	11-1	14-1	17-2	19-11	6-7	9-8	12-2	14-11	17-3
	Hem-fir	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Hem-fir	#1	8-9	13-9	18-1	23-1	Note b	8-9	13-1	16-7	20-4	23-7
	Hem-fir	#2	8-4	13-1	17-3	21-11	25-5	8-4	12-3	15-6	18-11	22-0
	Hem-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10
	Southern pine	SS	9-4	14-7	19-3	24-7	Note b	9-4	14-7	19-3	24-7	Note b
	Southern pine	#1	8-11	14-1	18-6	23-2	Note b	8-11	13-7	17-2	20-1	23-10
	Southern pine	#2	8-7	13-5	17-1	20-3	23-10	7-9	11-8	14-9	17-6	20-8
	Southern pine	#3	6-11	10-2	12-10	15-7	18-6	6-0	8-10	11-2	13-6	16-0
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1	Note b	8-9	13-9	18-1	23-0	Note b
	Spruce-pine-fir	#1	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#2	8-7	13-5	17-9	22-3	25-9	8-6	12-5	15-9	19-3	22-4
	Spruce-pine-fir	#3	7-5	10-10	13-9	16-9	19-6	6-5	9-5	11-11	14-6	16-10

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(2)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Roof live load = 20 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-7	Note b	8-11	14-0	18-5	23-0	Note b
	Douglas fir-larch	#1	8-7	13-6	17-9	21-8	25-2	8-4	12-2	15-4	18-9	21-9
	Douglas fir-larch	#2	8-5	13-3	16-10	20-7	23-10	7-10	11-6	14-7	17-10	20-8
	Douglas fir-larch	#3	6-11	10-2	12-10	15-8	18-3	6-0	8-9	11-2	13-7	15-9
	Hem-fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	25-9
	Hem-fir	#1	8-3	12-11	17-1	21-5	24-10	8-2	12-0	15-2	18-6	21-6
	Hem-fir	#2	7-10	12-4	16-3	20-0	23-2	7-8	11-2	14-2	17-4	20-1
	Hem-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5
	Southern pine	SS	8-9	13-9	18-2	23-1	Note b	8-9	13-9	18-2	23-1	Note b
	Southern pine	#1	8-5	13-3	17-5	21-2	25-2	8-4	12-4	15-8	18-4	21-9
	Southern pine	#2	8-1	12-3	15-7	18-6	21-9	7-1	10-8	13-6	16-0	18-10
	Southern pine	#3	6-4	9-4	11-9	14-3	16-10	5-6	8-1	10-2	12-4	14-7
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-9	Note b	8-3	12-11	17-1	21-0	24-4
	Spruce-pine-fir	#1	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
	Spruce-pine-fir	#2	8-1	12-8	16-7	20-3	23-6	7-9	11-4	14-4	17-7	20-4
Spruce-pine-fir	#3	6-9	9-11	12-7	15-4	17-9	5-10	8-7	10-10	13-3	15-5	
24	Douglas fir-larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	16-10	20-7	23-10
	Douglas fir-larch	#1	8-0	12-6	15-10	19-5	22-6	7-5	10-10	13-9	16-9	19-6
	Douglas fir-larch	#2	7-10	11-11	15-1	18-5	21-4	7-0	10-4	13-0	15-11	18-6
	Douglas fir-larch	#3	6-2	9-1	11-6	14-1	16-3	5-4	7-10	10-0	12-2	14-1
	Hem-fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	19-10	23-0
	Hem-fir	#1	7-8	12-0	15-8	19-2	22-2	7-4	10-9	13-7	16-7	19-3
	Hem-fir	#2	7-3	11-5	14-8	17-10	20-9	6-10	10-0	12-8	15-6	17-11
	Hem-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9
	Southern pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	20-10	24-8
	Southern pine	#1	7-10	12-3	16-2	18-11	22-6	7-5	11-1	14-0	16-5	19-6
	Southern pine	#2	7-4	11-0	13-11	16-6	19-6	6-4	9-6	12-1	14-4	16-10
	Southern pine	#3	5-8	8-4	10-6	12-9	15-1	4-11	7-3	9-1	11-0	13-1
	Spruce-pine-fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-4	18-9	21-9
	Spruce-pine-fir	#1	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
	Spruce-pine-fir	#2	7-6	11-9	14-10	18-2	21-0	6-11	10-2	12-10	15-8	18-3
Spruce-pine-fir	#3	6-1	8-10	11-3	13-8	15-11	5-3	7-8	9-9	11-10	13-9	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).
- b. Span exceeds 26 feet in length.

TABLE R802.4.1(3)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 30 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
12	Douglas fir-larch	SS	10-0	15-9	20-9	Note b	Note b	10-0	15-9	20-5	24-11	Note b
	Douglas fir-larch	#1	9-8	14-9	18-8	22-9	Note b	9-0	13-2	16-8	20-4	23-7
	Douglas fir-larch	#2	9-6	14-0	17-8	21-7	25-1	8-6	12-6	15-10	19-4	22-5
	Douglas fir-larch	#3	7-3	10-8	13-6	16-6	19-2	6-6	9-6	12-1	14-9	17-1
	Hem-fir	SS	9-6	14-10	19-7	25-0	Note b	9-6	14-10	19-7	24-1	Note b
	Hem-fir	#1	9-3	14-6	18-5	22-6	26-0	8-11	13-0	16-6	20-1	23-4
	Hem-fir	#2	8-10	13-7	17-2	21-0	24-4	8-4	12-2	15-4	18-9	21-9
	Hem-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine	SS	9-10	15-6	20-5	Note b	Note b	9-10	15-6	20-5	25-4	Note b
	Southern pine	#1	9-6	14-10	19-0	22-3	Note b	9-0	13-5	17-0	19-11	23-7
	Southern pine	#2	8-7	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-pine-fir	SS	9-3	14-7	19-2	24-6	Note b	9-3	14-7	18-8	22-9	Note b
	Spruce-pine-fir	#1	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#2	9-1	13-9	17-5	21-4	24-8	8-5	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas fir-larch	SS	9-1	14-4	18-10	24-1	Note b	9-1	14-0	17-8	21-7	25-1
	Douglas fir-larch	#1	8-9	12-9	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch	#2	8-3	12-1	15-4	18-9	21-8	7-5	10-10	13-8	16-9	19-5
	Douglas fir-larch	#3	6-4	9-3	11-8	14-3	16-7	5-8	8-3	10-6	12-9	14-10
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-1	20-10	24-2
	Hem-fir	#1	8-5	12-7	15-11	19-6	22-7	7-8	11-3	14-3	17-5	20-2
	Hem-fir	#2	8-0	11-9	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-5	1-11	25-11
	Southern pine	#1	8-7	13-0	16-6	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9
	Spruce-pine-fir	SS	8-5	13-3	17-5	22-1	25-7	8-5	12-9	16-2	19-9	22-10
	Spruce-pine-fir	#1	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#2	8-2	11-11	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(3)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 30 psf, ceiling not attached to rafters, L/A = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
19.2	Douglas fir-larch	SS	8-7	13-6	17-9	22-1	25-7	8-7	12-9	16-2	19-9	22-10
	Douglas fir-larch	#1	7-11	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#2	7-7	11-0	14-0	17-1	19-10	6-9	9-10	12-6	15-3	17-9
	Douglas fir-larch	#3	5-9	8-5	10-8	13-1	15-2	5-2	7-7	9-7	11-8	13-6
	Hem-fir	SS	8-1	12-9	16-9	21-4	24-8	8-1	12-4	15-7	19-1	22-1
	Hem-fir	#1	7-10	11-6	14-7	17-9	20-7	7-0	10-3	13-0	15-11	18-5
	Hem-fir	#2	7-4	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	16-10	20-0	23-7
	Southern pine	#1	8-0	11-10	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-pine-fir	SS	7-11	12-5	16-5	20-2	23-4	7-11	11-8	14-9	18-0	20-11
	Spruce-pine-fir	#1	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir	#2	7-5	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
Spruce-pine-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2	
24	Douglas fir-larch	SS	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch	#2	6-9	9-10	12-6	15-3	17-9	6-0	8-10	11-2	13-8	15-10
	Douglas fir-larch	#3	5-2	7-7	9-7	11-8	13-6	4-7	6-9	8-7	10-5	12-1
	Hem-fir	SS	7-6	11-10	15-7	19-1	22-1	7-6	11-0	13-11	17-0	19-9
	Hem-fir	#1	7-0	10-3	13-0	15-11	18-5	6-3	9-2	11-8	14-3	16-6
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern pine	SS	7-10	12-3	16-2	20-0	23-7	7-10	11-10	15-0	17-11	21-2
	Southern pine	#1	7-1	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-pine-fir	SS	7-4	11-7	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).
- b. Span exceeds 26 feet in length.

TABLE R802.4.1(4)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
12	Douglas fir-larch	SS	9-1	14-4	18-10	24-1	Note b	9-1	14-4	18-10	24-1	Note b
	Douglas fir-larch	#1	8-9	13-9	18-2	22-9	Note b	8-9	13-2	16-8	20-4	23-7
	Douglas fir-larch	#2	8-7	13-6	17-8	21-7	25-1	8-6	12-6	15-10	19-4	22-5
	Douglas fir-larch	#3	7-3	10-8	13-6	16-6	19-2	6-6	9-6	12-1	14-9	17-1
	Hem-fir	SS	8-7	13-6	17-10	22-9	Note b	8-7	13-6	17-10	22-9	Note b
	Hem-fir	#1	8-5	13-3	17-5	22-3	26-0	8-5	13-0	16-6	20-1	23-4
	Hem-fir	#2	8-0	12-7	16-7	21-0	24-4	8-0	12-2	15-4	18-9	21-9
	Hem-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Southern pine	SS	8-11	14-1	18-6	23-8	Note b	8-11	14-1	18-6	23-8	Note b
	Southern pine	#1	8-7	13-6	17-10	22-3	Note b	8-7	13-5	17-0	19-11	23-7
	Southern pine	#2	8-3	12-11	16-4	19-5	22-10	7-8	11-7	14-8	17-4	20-5
	Southern pine	#3	6-7	9-9	12-4	15-0	17-9	5-11	8-9	11-0	13-5	15-10
	Spruce-pine-fir	SS	8-5	13-3	17-5	22-3	Note b	8-5	13-3	17-5	22-3	Note b
	Spruce-pine-fir	#1	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#2	8-3	12-11	17-0	21-4	24-8	8-3	12-4	15-7	19-1	22-1
	Spruce-pine-fir	#3	7-1	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
16	Douglas fir-larch	SS	8-3	13-0	17-2	21-10	Note b	8-3	13-0	17-2	21-7	25-1
	Douglas fir-larch	#1	8-0	12-6	16-2	19-9	22-10	7-10	11-5	14-5	17-8	20-5
	Douglas fir-larch	#2	7-10	12-1	15-4	18-9	21-8	7-5	10-10	13-8	16-9	19-5
	Douglas fir-larch	#3	6-4	9-3	11-8	14-3	16-7	5-8	8-3	10-6	12-9	14-10
	Hem-fir	SS	7-10	12-3	16-2	20-8	25-1	7-10	12-3	16-2	20-8	24-2
	Hem-fir	#1	7-8	12-0	15-10	19-6	22-7	7-8	11-3	14-3	17-5	20-2
	Hem-fir	#2	7-3	11-5	14-11	18-2	21-1	7-2	10-6	13-4	16-3	18-10
	Hem-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6
	Southern pine	SS	8-1	12-9	16-10	21-6	Note b	8-1	12-9	16-10	21-6	25-11
	Southern pine	#1	7-10	12-3	16-2	19-3	22-10	7-10	11-7	14-9	17-3	20-5
	Southern pine	#2	7-6	11-2	14-2	16-10	19-10	6-8	10-0	12-8	15-1	17-9
	Southern pine	#3	5-9	8-6	10-8	13-0	15-4	5-2	7-7	9-7	11-7	13-9
	Spruce-pine-fir	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	19-9	22-10
	Spruce-pine-fir	#1	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#2	7-6	11-9	15-1	18-5	21-5	7-3	10-8	13-6	16-6	19-2
	Spruce-pine-fir	#3	6-2	9-0	11-5	13-11	16-2	5-6	8-1	10-3	12-6	14-6

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(4)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 30 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
19.2	Douglas fir-larch	SS	7-9	12-3	16-1	20-7	25-0	7-9	12-3	16-1	19-9	22-10
	Douglas fir-larch	#1	7-6	11-8	14-9	18-0	20-11	7-1	10-5	13-2	16-1	18-8
	Douglas fir-larch	#2	7-4	11-0	14-0	17-1	19-10	6-9	9-1	12-6	15-3	17-9
	Douglas fir-larch	#3	5-9	8-5	10-8	13-1	15-2	5-2	7-7	9-7	11-8	13-6
	Hem-fir	SS	7-4	11-7	15-3	19-5	23-7	7-4	11-7	15-3	19-1	22-1
	Hem-fir	#1	7-2	11-4	14-7	17-9	20-7	7-0	16-3	13-0	15-11	18-5
	Hem-fir	#2	6-10	10-9	13-7	16-7	19-3	6-7	9-7	12-2	14-10	17-3
	Hem-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
	Southern pine	SS	7-8	12-0	15-10	20-2	24-7	7-8	12-0	15-10	20-0	23-7
	Southern pine	#1	7-4	11-7	15-1	17-7	20-11	7-1	10-7	13-5	15-9	18-8
	Southern pine	#2	6-10	10-2	12-11	15-4	18-1	6-1	9-2	11-7	13-9	16-2
	Southern pine	#3	5-3	7-9	9-9	11-10	14-0	4-8	6-11	8-9	10-7	12-6
	Spruce-pine-fir	SS	7-2	11-4	14-11	19-0	23-1	7-2	11-4	14-9	18-0	20-11
	Spruce-pine-fir	#1	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir	#2	7-0	10-11	13-9	16-10	19-6	6-8	9-9	12-4	15-1	17-6
	Spruce-pine-fir	#3	5-7	8-3	10-5	12-9	14-9	5-0	7-4	9-4	11-5	13-2
24	Douglas fir-larch	SS	7-3	11-4	15-0	19-1	22-10	7-3	11-4	14-5	17-8	20-5
	Douglas fir-larch	#1	7-0	10-5	13-2	16-1	18-8	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch	#2	6-9	9-10	12-6	15-3	17-9	6-0	8-10	11-2	13-8	15-10
	Douglas fir-larch	#3	5-2	7-7	9-7	11-8	13-6	4-7	6-9	8-7	10-5	12-1
	Hem-fir	SS	6-10	10-9	14-2	18-0	21-11	6-10	10-9	13-11	17-0	19-9
	Hem-fir	#1	6-8	10-3	13-0	15-11	18-5	6-3	9-2	11-8	14-3	16-6
	Hem-fir	#2	6-4	9-7	12-2	14-10	17-3	5-10	8-7	10-10	13-3	15-5
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10
	Southern pine	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	17-11	21-2
	Southern pine	#1	6-10	10-7	13-5	15-9	18-8	6-4	9-6	12-0	14-1	16-8
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-5	8-2	10-4	12-3	14-6
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-2	6-2	7-10	9-6	11-2
	Spruce-pine-fir	SS	6-8	10-6	13-10	17-8	20-11	6-8	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#1	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir	#2	6-6	9-9	12-4	15-1	17-6	5-11	8-8	11-0	13-6	15-7
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-6	6-7	8-4	10-2	11-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).
- b. Span exceeds 26 feet in length.

TABLE R802.4.1(5)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 50 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
12	Douglas fir-larch	SS	8-5	13-3	17-6	22-4	26-0	8-5	13-3	17-3	21-1	24-5
	Douglas fir-larch	#1	8-2	12-0	15-3	18-7	21-7	7-7	11-2	14-1	17-3	20-0
	Douglas fir-larch	#2	7-10	11-5	14-5	17-8	20-5	7-3	10-7	13-4	16-4	18-11
	Douglas fir-larch	#3	6-0	8-9	11-0	13-6	15-7	5-6	8-1	10-3	12-6	14-6
	Hem-fir	SS	8-0	12-6	16-6	21-1	25-6	8-0	12-6	16-6	20-4	23-7
	Hem-fir	#1	7-10	11-10	15-0	18-4	21-3	7-6	11-0	13-11	17-0	19-9
	Hem-fir	#2	7-5	11-1	14-0	17-2	19-11	7-0	10-3	13-0	15-10	18-5
	Hem-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine	SS	8-4	13-1	17-2	21-11	Note b	8-4	13-1	17-2	21-5	25-3
	Southern pine	#1	8-0	12-3	15-6	18-2	21-7	7-7	11-4	14-5	16-10	20-0
	Southern pine	#2	7-0	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5
	Spruce-pine-fir	SS	7-10	12-3	16-2	20-8	24-1	7-10	12-3	15-9	19-3	22-4
	Spruce-pine-fir	#1	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#2	7-8	11-3	14-3	17-5	20-2	7-1	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas fir-larch	SS	7-8	12-1	15-11	19-9	22-10	7-8	11-10	14-11	18-3	21-2
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch	#2	6-9	9-10	12-6	15-3	17-9	6-3	9-2	11-7	14-2	16-5
	Douglas fir-larch	#3	5-2	7-7	9-7	11-18	13-6	4-9	7-0	8-10	10-10	12-6
	Hem-fir	SS	7-3	11-5	15-0	19-1	22-1	7-3	11-5	14-5	17-8	20-5
	Hem-fir	#1	7-0	10-3	13-0	15-11	18-5	6-6	9-6	12-1	14-9	17-1
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine	SS	7-6	11-10	15-7	19-11	23-7	7-6	11-10	15-7	18-6	21-10
	Southern pine	#1	7-1	10-7	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-pine-fir	SS	7-1	11-2	14-8	18-0	20-11	7-1	10-9	13-8	15-11	19-4
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(5)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 50 psf, ceiling not attached to rafters, $L/\Delta = 180$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
19.2	Douglas fir-larch	SS	7-3	11-4	14-9	18-0	20-11	7-3	10-9	13-8	16-8	19-4
	Douglas fir-larch	#1	6-6	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch	#2	6-2	9-0	11-5	13-11	16-2	5-8	8-4	10-9	12-11	15-0
	Douglas fir-larch	#3	4-8	6-11	8-9	10-8	12-4	4-4	6-4	8-1	9-10	11-5
	Hem-fir	SS	6-10	10-9	14-2	17-5	20-2	6-10	10-5	13-2	16-1	18-8
	Hem-fir	#1	6-5	9-5	11-11	14-6	16-10	8-11	8-8	11-0	13-5	15-7
	Hem-fir	#2	6-0	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine	SS	7-1	11-2	14-8	18-3	21-7	7-1	11-2	14-2	16-11	20-0
	Southern pine	#1	6-6	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-pine-fir	SS	6-8	10-6	13-5	16-5	19-1	6-8	9-10	12-5	15-3	17-8
	Spruce-pine-fir	#1	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir	#2	6-1	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
Spruce-pine-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2	
24	Douglas fir-larch	SS	6-8	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch	#2	5-6	8-1	10-3	12-6	14-6	5-1	7-6	9-5	11-7	13-5
	Douglas fir-larch	#3	4-3	6-2	7-10	9-6	11-1	3-11	5-8	7-3	8-10	10-3
	Hem-fir	SS	6-4	9-11	12-9	15-7	18-0	6-4	9-4	11-9	14-5	16-8
	Hem-fir	#1	5-9	8-5	10-8	13-0	15-1	8-4	7-9	9-10	12-0	13-11
	Hem-fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine	SS	6-7	10-4	13-8	16-4	19-3	6-7	10-0	12-8	15-2	17-10
	Southern pine	#1	5-10	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-pine-fir	SS	6-2	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Spruce-pine-fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
Spruce-pine-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0	

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).
- b. Span exceeds 26 feet in length.

TABLE R802.4.1(6)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 50 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
12	Douglas fir-larch	SS	7-8	12-1	15-11	20-3	24-8	7-8	12-1	15-11	20-3	24-5
	Douglas fir-larch	#1	7-5	11-7	15-3	18-7	21-7	7-5	11-2	14-1	17-3	20-0
	Douglas fir-larch	#2	7-3	11-5	14-5	17-8	20-5	7-3	10-7	13-4	16-4	18-11
	Douglas fir-larch	#3	6-0	8-9	11-0	13-6	15-7	5-6	8-1	10-3	12-6	14-6
	Hem-fir	SS	7-3	11-5	15-0	19-2	23-4	7-3	11-5	15-0	19-2	23-4
	Hem-fir	#1	7-1	11-2	14-8	18-4	21-3	7-1	11-0	13-11	17-0	19-9
	Hem-fir	#2	6-9	10-8	14-0	17-2	19-11	6-9	10-3	13-0	15-10	18-5
	Hem-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Southern pine	SS	7-6	11-10	15-7	19-11	24-3	7-6	11-10	15-7	19-11	24-3
	Southern pine	#1	7-3	11-5	15-0	18-2	21-7	7-3	11-4	14-5	16-10	20-0
	Southern pine	#2	6-11	10-6	13-4	15-10	18-8	6-6	9-9	12-4	14-8	17-3
	Southern pine	#3	5-5	8-0	10-1	12-3	14-6	5-0	7-5	9-4	11-4	13-5
	Spruce-pine-fir	SS	7-1	11-2	14-8	18-9	22-10	7-1	11-2	14-8	18-9	22-4
	Spruce-pine-fir	#1	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#2	6-11	10-11	14-3	17-5	20-2	6-11	10-5	13-2	16-1	18-8
	Spruce-pine-fir	#3	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
16	Douglas fir-larch	SS	7-0	11-0	14-5	18-5	22-5	7-0	11-0	14-5	18-3	21-2
	Douglas fir-larch	#1	6-9	10-5	13-2	16-1	18-8	6-7	9-8	12-2	14-11	17-3
	Douglas fir-larch	#2	6-7	9-10	12-6	15-3	17-9	6-3	9-2	11-7	14-2	16-5
	Douglas fir-larch	#3	5-2	7-7	9-7	11-8	13-6	4-9	7-0	8-10	10-10	12-6
	Hem-fir	SS	6-7	10-4	13-8	17-5	21-2	6-7	10-4	13-8	17-5	20-5
	Hem-fir	#1	6-5	10-2	13-0	15-11	18-5	6-5	9-6	12-1	14-9	17-1
	Hem-fir	#2	6-2	9-7	12-2	14-10	17-3	6-1	8-11	11-3	13-9	15-11
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3
	Southern pine	SS	6-10	10-9	14-2	18-1	22-0	6-10	10-9	14-2	18-1	21-10
	Southern pine	#1	6-7	10-4	13-5	15-9	18-8	6-7	9-10	12-5	14-7	17-3
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-8	8-5	10-9	12-9	15-0
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-4	6-5	8-1	9-10	11-7
	Spruce-pine-fir	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-8	19-4
	Spruce-pine-fir	#1	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#2	6-4	9-9	12-4	15-1	17-6	6-2	9-0	11-5	13-11	16-2
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-8	6-10	8-8	10-6	12-3

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(6)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 50 psf, ceiling attached to rafters, $L/\Delta = 240$)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
19.2	Douglas fir-larch	SS	6-7	10-4	13-7	17-4	20-11	6-7	10-4	13-7	16-8	19-4
	Douglas fir-larch	#1	6-4	9-6	12-0	14-8	17-1	6-0	8-10	11-2	13-7	15-9
	Douglas fir-larch	#2	6-2	9-0	11-5	13-11	16-2	5-8	8-4	10-7	12-11	15-0
	Douglas fir-larch	#3	4-8	6-11	8-9	10-8	12-4	4-4	6-4	8-1	9-10	11-5
	Hem-fir	SS	6-2	9-9	12-10	16-5	19-11	6-2	9-9	12-10	16-1	18-8
	Hem-fir	#1	6-1	9-5	11-11	14-6	16-10	5-11	8-8	11-0	13-5	15-7
	Hem-fir	#2	5-9	8-9	11-1	13-7	15-9	5-7	8-1	10-3	12-7	14-7
	Hem-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
	Southern pine	SS	6-5	10-2	13-4	17-0	20-9	6-5	10-2	13-4	16-11	20-0
	Southern pine	#1	6-2	9-8	12-3	14-4	17-1	6-0	9-0	11-4	13-4	15-9
	Southern pine	#2	5-7	8-4	10-7	12-6	14-9	5-2	7-9	9-9	11-7	13-8
	Southern pine	#3	4-3	6-4	8-0	9-8	11-5	4-0	5-10	7-4	8-11	10-7
	Spruce-pine-fir	SS	6-1	9-6	12-7	16-0	19-1	6-1	9-6	12-5	15-3	17-8
	Spruce-pine-fir	#1	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir	#2	5-11	8-11	11-3	13-9	15-11	5-7	8-3	10-5	12-9	14-9
	Spruce-pine-fir	#3	4-7	6-9	8-6	10-5	12-1	4-3	6-3	7-11	9-7	11-2
24	Douglas fir-larch	SS	6-1	9-7	12-7	16-1	18-8	6-1	9-7	12-2	14-11	17-3
	Douglas fir-larch	#1	5-10	8-6	10-9	13-2	15-3	5-5	7-10	10-0	12-2	14-1
	Douglas fir-larch	#2	5-6	8-1	10-3	12-6	14-6	5-1	7-6	9-5	11-7	13-5
	Douglas fir-larch	#3	4-3	6-2	7-10	9-6	11-1	3-11	5-8	7-3	8-10	10-3
	Hem-fir	SS	5-9	9-1	11-11	15-2	18-0	5-9	9-1	11-9	14-5	15-11
	Hem-fir	#1	5-8	8-5	10-8	13-0	15-1	5-4	7-9	9-10	12-0	13-11
	Hem-fir	#2	5-4	7-10	9-11	12-1	14-1	4-11	7-3	9-2	11-3	13-0
	Hem-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0
	Southern pine	SS	6-0	9-5	12-5	15-10	19-3	6-0	9-5	12-5	15-2	17-10
	Southern pine	#1	5-9	8-8	11-0	12-10	15-3	5-5	8-0	10-2	11-11	14-1
	Southern pine	#2	5-0	7-5	9-5	11-3	13-2	4-7	6-11	8-9	10-5	12-3
	Southern pine	#3	3-10	5-8	7-1	8-8	10-3	3-6	5-3	6-7	8-0	9-6
	Spruce-pine-fir	SS	5-8	8-10	11-8	14-8	17-1	5-8	8-10	11-2	13-7	15-9
	Spruce-pine-fir	#1	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#2	5-5	7-11	10-1	12-4	14-3	5-0	7-4	9-4	11-5	13-2
	Spruce-pine-fir	#3	4-1	6-0	7-7	9-4	10-9	3-10	5-7	7-1	8-7	10-0

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).

TABLE R802.4.1(7)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 70 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum Rafter Spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
12	Douglas fir-larch	SS	7-7	11-10	15-8	19-9	22-10	7-7	11-10	15-3	18-7	21-7
	Douglas fir-larch	#1	7-1	10-5	13-2	16-1	18-8	6-8	9-10	12-5	15-2	17-7
	Douglas fir-larch	#2	6-9	9-10	12-6	15-3	17-9	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch	#3	5-2	7-7	9-7	11-8	13-6	4-10	7-1	9-0	11-0	12-9
	Hem-fir	SS	7-2	11-3	14-9	18-10	22-1	7-2	11-3	14-8	18-0	20-10
	Hem-fir	#1	7-0	10-3	13-0	15-11	18-5	6-7	9-8	12-3	15-0	17-5
	Hem-fir	#2	6-7	9-7	12-2	14-10	17-3	6-2	9-1	11-5	14-0	16-3
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Southern pine	SS	7-5	11-8	15-4	19-7	23-7	7-5	11-8	15-4	18-10	22-3
	Southern pine	#1	7-1	10-7	13-5	15-9	18-8	6-9	10-0	12-8	14-10	17-7
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-9	8-7	10-11	12-11	15-3
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-5	6-6	8-3	10-0	11-10
	Spruce-pine-fir	SS	7-0	11-0	14-6	18-0	20-11	7-0	11-0	13-11	17-0	19-8
	Spruce-pine-fir	#1	6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#2	6-8	9-9	12-4	15-1	17-6	6-3	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
16	Douglas fir-larch	SS	6-10	10-9	14-0	17-1	19-10	6-10	10-5	13-2	16-1	18-8
	Douglas fir-larch	#1	6-2	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch	#2	5-10	8-7	10-10	13-3	15-4	5-6	8-1	10-3	12-6	14-6
	Douglas fir-larch	#3	4-6	6-6	8-3	10-1	11-9	4-3	6-2	7-10	9-6	11-1
	Hem-fir	SS	6-6	10-2	13-5	16-6	19-2	6-6	10-1	12-9	15-7	18-0
	Hem-fir	#1	6-1	8-11	11-3	13-9	16-0	5-9	8-5	10-8	13-0	15-1
	Hem-fir	#2	5-8	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1
	Hem-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Southern pine	SS	6-9	10-7	14-0	17-4	20-5	6-9	10-7	13-9	16-4	19-3
	Southern pine	#1	6-2	9-2	11-8	13-8	16-2	5-10	8-8	11-0	12-10	15-3
	Southern pine	#2	5-3	7-11	10-0	11-11	14-0	5-0	7-5	9-5	11-3	13-2
	Southern pine	#3	4-1	6-0	7-7	9-2	10-10	3-10	5-8	7-1	8-8	10-3
	Spruce-pine-fir	SS	6-4	10-0	12-9	15-7	18-1	6-4	9-6	12-0	14-8	17-1
	Spruce-pine-fir	#1	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#2	5-9	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(7)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 70 psf, ceiling not attached to rafters, L/Δ = 180)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum Rafter Spans ^a									
		(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	
19.2	Douglas fir-larch	SS	6-6	10-1	12-9	15-7	18-1	6-6	9-6	12-0	14-8	17-1
	Douglas fir-larch	#1	5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11
	Douglas fir-larch	#2	5-4	7-10	9-11	12-1	14-0	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch	#3	4-1	6-0	7-7	9-3	10-8	3-10	5-7	7-1	8-8	10-1
	Hem-fir	SS	6-1	9-7	12-4	15-1	17-4	6-1	9-2	11-8	14-2	15-5
	Hem-fir	#1	5-7	8-2	10-3	12-7	14-7	5-3	7-8	9-8	11-10	13-9
	Hem-fir	#2	5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10
	Hem-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Southern pine	SS	6-4	10-0	13-2	15-10	18-8	6-4	9-10	12-6	14-11	17-7
	Southern pine	#1	5-8	8-5	10-8	12-5	14-9	5-4	7-11	10-0	11-9	13-11
	Southern pine	#2	4-10	7-3	9-2	10-10	12-9	4-6	6-10	8-8	10-3	12-1
	Southern pine	#3	3-8	5-6	6-11	8-4	9-11	3-6	5-2	6-6	7-11	9-4
	Spruce-pine-fir	SS	6-0	9-2	11-8	14-3	16-6	5-11	8-8	11-0	13-5	15-7
	Spruce-pine-fir	#1	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
24	Douglas fir-larch	SS	6-0	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch	#1	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch	#2	4-9	7-0	8-10	10-10	12-6	4-6	6-7	8-4	10-2	11-10
	Douglas fir-larch	#3	3-8	5-4	6-9	8-3	9-7	3-5	5-0	6-4	7-9	9-10
	Hem-fir	SS	5-8	8-8	11-0	13-6	13-11	5-7	8-3	10-5	12-4	12-4
	Hem-fir	#1	5-0	7-3	9-2	11-3	13-0	4-8	6-10	8-8	10-7	12-4
	Hem-fir	#2	4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine	SS	5-11	9-3	11-11	14-2	16-8	5-11	8-10	11-2	13-4	15-9
	Southern pine	#1	5-0	7-6	9-6	11-1	13-2	4-9	7-1	9-0	10-6	12-5
	Southern pine	#2	4-4	6-5	8-2	9-9	11-5	4-1	6-1	7-9	9-2	10-9
	Southern pine	#3	3-4	4-11	6-2	7-6	8-10	3-1	4-7	5-10	7-1	8-4
	Spruce-pine-fir	SS	5-6	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	12-11
	Spruce-pine-fir	#1	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).

TABLE R802.4.1(8)
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 70 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 x 4	2 x 6	2 x 8	2 x 10	2 x 12	2 x 4	2 x 6	2 x 8	2 x 10	2 x 12
			Maximum rafter spans ^a									
			(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)	(feet inches)
12	Douglas fir-larch	SS	6-10	10-9	14-3	18-2	22-1	6-10	10-9	14-3	18-2	21-7
	Douglas fir-larch	#1	6-7	10-5	13-2	16-1	18-8	6-7	9-10	12-5	15-2	17-7
	Douglas fir-larch	#2	6-6	9-10	12-6	15-3	17-9	6-4	9-4	11-9	14-5	16-8
	Douglas fir-larch	#3	5-2	7-7	9-7	11-8	13-6	4-10	7-1	9-0	11-0	12-9
	Hem-fir	SS	6-6	10-2	13-5	17-2	20-10	6-6	10-2	13-5	17-2	20-10
	Hem-fir	#1	6-4	10-0	13-0	15-11	18-5	6-4	9-8	12-3	15-0	17-5
	Hem-fir	#2	6-1	9-6	12-2	14-10	17-3	6-1	9-1	11-5	14-0	16-3
	Hem-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Southern pine	SS	6-9	10-7	14-0	17-10	21-8	6-9	10-7	14-0	17-10	21-8
	Southern pine	#1	6-6	10-2	13-5	15-9	18-8	6-6	10-0	12-8	14-10	17-7
	Southern pine	#2	6-1	9-2	11-7	13-9	16-2	5-9	8-7	10-11	12-11	15-3
	Southern pine	#3	4-8	6-11	8-9	10-7	12-6	4-5	6-6	8-3	10-0	11-10
	Spruce-pine-fir	SS	6-4	10-0	13-2	16-9	20-5	6-4	10-0	13-2	16-9	19-8
	Spruce-pine-fir	#1	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#2	6-2	9-9	12-4	15-1	17-6	6-2	9-2	11-8	14-2	16-6
	Spruce-pine-fir	#3	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
16	Douglas fir-larch	SS	6-3	9-10	12-11	16-6	19-10	6-3	9-10	12-11	16-1	18-8
	Douglas fir-larch	#1	6-0	9-0	11-5	13-11	16-2	5-10	8-6	10-9	13-2	15-3
	Douglas fir-larch	#2	5-10	8-7	10-10	13-3	15-4	5-6	8-1	10-3	12-6	14-6
	Douglas fir-larch	#3	4-6	6-6	8-3	10-1	11-9	4-3	6-2	7-10	9-6	11-1
	Hem-fir	SS	5-11	9-3	12-2	15-7	18-11	5-11	9-3	12-2	15-7	18-0
	Hem-fir	#1	5-9	8-11	11-3	13-9	16-0	5-9	8-5	10-8	13-0	15-1
	Hem-fir	#2	5-6	8-4	10-6	12-10	14-11	5-4	7-10	9-11	12-1	14-1
	Hem-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9
	Southern pine	SS	6-1	9-7	12-8	16-2	19-8	6-1	9-7	12-8	16-2	19-3
	Southern pine	#1	5-11	9-2	11-8	13-8	16-2	5-10	8-8	11-0	12-10	15-3
	Southern pine	#2	5-3	7-11	10-0	11-11	14-0	5-0	7-5	9-5	11-3	13-2
	Southern pine	#3	4-1	6-0	7-7	9-2	10-10	3-10	5-8	7-1	8-8	10-3
	Spruce-pine-fir	SS	5-9	9-1	11-11	15-3	18-1	5-9	9-1	11-11	14-8	17-1
	Spruce-pine-fir	#1	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#2	5-8	8-5	10-8	13-1	15-2	5-5	7-11	10-1	12-4	14-3
	Spruce-pine-fir	#3	4-4	6-4	8-1	9-10	11-5	4-1	6-0	7-7	9-4	10-9

(continued)

ROOF-CEILING CONSTRUCTION

TABLE R802.4.1(8)—continued
RAFTER SPANS FOR COMMON LUMBER SPECIES (Ground snow load = 70 psf, ceiling attached to rafters, L/Δ = 240)

RAFTER SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf					DEAD LOAD = 20 psf				
			2 × 4	2 × 6	2 × 8	2 × 10	2 × 12	2 × 4	2 × 6	2 × 8	2 × 10	2 × 12
			Maximum rafter spans ^a									
			(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)	(feet/inches)
19.2	Douglas fir-larch	SS	5-10	9-3	12-2	15-6	18-1	5-10	9-3	12-0	14-8	17-1
	Douglas fir-larch	#1	5-7	8-3	10-5	12-9	14-9	5-4	7-9	9-10	12-0	13-11
	Douglas fir-larch	#2	5-4	7-10	9-11	12-1	14-0	5-0	7-4	9-4	11-5	13-2
	Douglas fir-larch	#3	4-1	6-0	7-7	9-3	10-8	3-10	5-7	7-1	8-8	10-1
	Hem-fir	SS	5-6	8-8	11-6	14-8	17-4	5-6	8-8	11-6	14-2	15-5
	Hem-fir	#1	5-5	8-2	10-3	12-7	14-7	5-3	7-8	9-8	11-10	13-9
	Hem-fir	#2	5-2	7-7	9-7	11-9	13-7	4-11	7-2	9-1	11-1	12-10
	Hem-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
	Southern pine	SS	5-9	9-1	11-11	15-3	18-6	5-9	9-1	11-11	14-11	17-7
	Southern pine	#1	5-6	8-5	10-8	12-5	14-9	5-4	7-11	10-0	11-9	13-11
	Southern pine	#2	4-10	7-3	9-2	10-10	12-9	4-6	6-10	8-8	10-3	12-1
	Southern pine	#3	3-8	5-6	6-11	8-4	9-11	3-6	5-2	6-6	7-11	9-4
	Spruce-pine-fir	SS	5-5	8-6	11-3	14-3	16-6	5-5	8-6	11-0	13-5	15-7
	Spruce-pine-fir	#1	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#2	5-3	7-8	9-9	11-11	13-10	5-0	7-3	9-2	11-3	13-0
	Spruce-pine-fir	#3	4-0	5-10	7-4	9-0	10-5	3-9	5-6	6-11	8-6	9-10
24	Douglas fir-larch	SS	5-5	8-7	11-3	13-11	16-2	5-5	8-6	10-9	13-2	15-3
	Douglas fir-larch	#1	5-0	7-4	9-4	11-5	13-2	4-9	6-11	8-9	10-9	12-5
	Douglas fir-larch	#2	4-9	7-0	8-10	10-10	12-6	4-6	6-7	8-4	10-2	11-10
	Douglas fir-larch	#3	3-8	5-4	6-9	8-3	9-7	3-5	5-0	6-4	7-9	9-0
	Hem-fir	SS	5-2	8-1	10-8	13-6	13-11	5-2	8-1	10-5	12-4	12-4
	Hem-fir	#1	5-0	7-3	9-2	11-3	13-0	4-8	6-10	8-8	10-7	12-4
	Hem-fir	#2	4-8	6-9	8-7	10-6	12-2	4-4	6-5	8-1	9-11	11-6
	Hem-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10
	Southern pine	SS	5-4	8-5	11-1	14-2	16-8	5-4	8-5	11-1	13-4	15-9
	Southern pine	#1	5-0	7-6	9-6	11-1	13-2	4-9	7-1	9-0	10-6	12-5
	Southern pine	#2	4-4	6-5	8-2	9-9	11-5	4-1	6-1	7-9	9-2	10-9
	Southern pine	#3	3-4	4-11	6-2	7-6	8-10	3-1	4-7	5-10	7-1	8-4
	Spruce-pine-fir	SS	5-0	7-11	10-5	12-9	14-9	5-0	7-9	9-10	12-0	12-11
	Spruce-pine-fir	#1	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#2	4-8	6-11	8-9	10-8	12-4	4-5	6-6	8-3	10-0	11-8
	Spruce-pine-fir	#3	3-7	5-2	6-7	8-1	9-4	3-4	4-11	6-3	7-7	8-10

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. The tabulated rafter spans assume that ceiling joists are located at the bottom of the attic space or that some other method of resisting the outward push of the rafters on the bearing walls, such as rafter ties, is provided at that location. Where ceiling joists or rafter ties are located higher in the attic space, the rafter spans shall be multiplied by the adjustment factors in Table R802.4.1(9).

TABLE R802.4.1(9)
RAFTER SPAN ADJUSTMENT FACTOR

H_C/H_R^a	RAFTER SPAN ADJUSTMENT FACTOR
1/3	0.67
1/4	0.76
1/5	0.83
1/6	0.90
1/7.5 or less	1.00

a. H_C = Height of ceiling joists or rafter ties measured vertically above the top of the rafter support walls; H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

R802.4.2 Framing details. Rafters shall be framed opposite from each other to a ridge board, shall not be offset more than 1 1/2 inches (38 mm) from each other and shall be connected with a collar tie or ridge strap in accordance with Section R802.4.6 or directly opposite from each other to a gusset plate in accordance with Table R602.3(1). Rafters shall be nailed to the top wall plates in accordance with Table R602.3(1) unless the roof assembly is required to comply with the uplift requirements of Section R802.11.

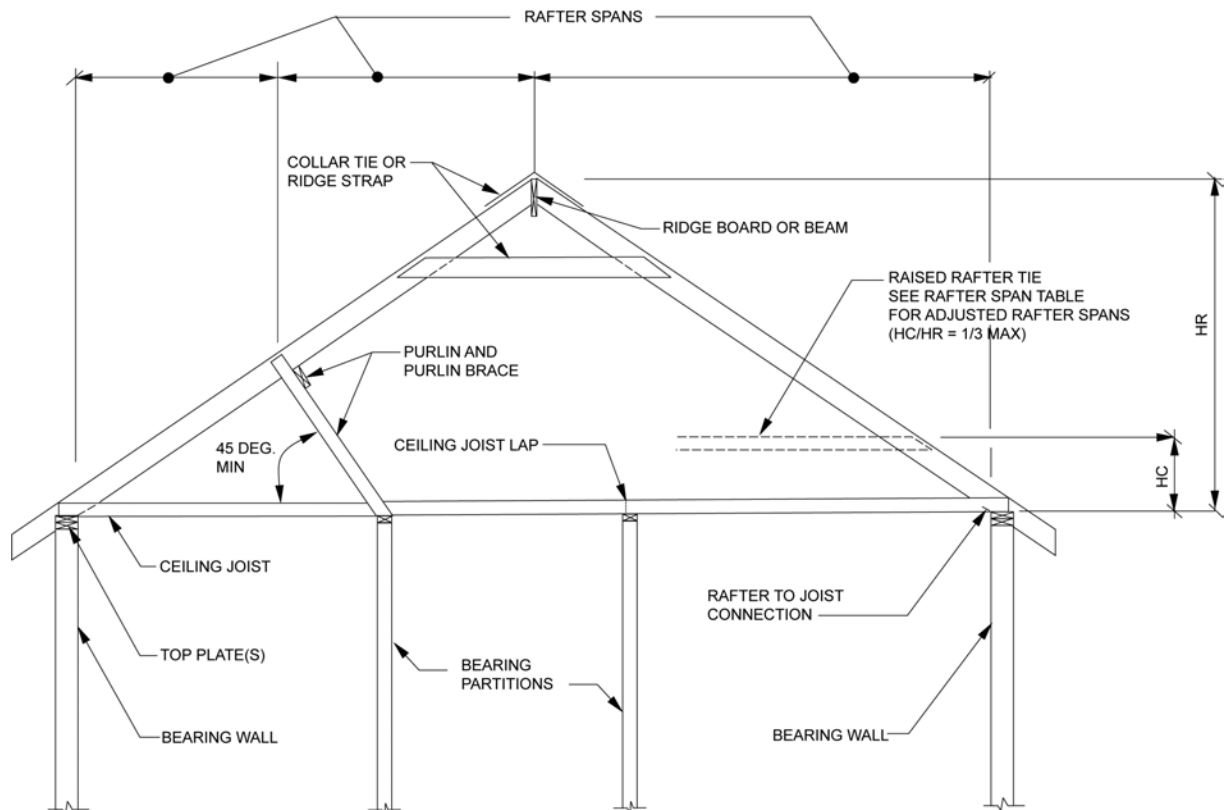
R802.4.3 Hips and valleys. Hip and valley rafters shall be not less than 2 inches (51 mm) nominal in thickness and not less in depth than the cut end of the rafter. Hip and

valley rafters shall be supported at the ridge by a brace to a bearing partition or be designed to carry and distribute the specific load at that point.

R802.4.4 Rafter supports. Where the roof pitch is less than 3:12 (25-percent slope), structural members that support rafters, such as ridges, hips and valleys, shall be designed as beams, and bearing shall be provided for rafters in accordance with Section R802.6.

R802.4.5 Purlins. Installation of purlins to reduce the span of rafters is permitted as shown in Figure R802.4.5. Purlins shall be sized not less than the required size of the rafters that they support. Purlins shall be continuous and shall be supported by 2-inch by 4-inch (51 mm by 102 mm) braces installed to bearing walls at a slope not less than 45 degrees (0.79 rad) from the horizontal. The braces shall be spaced not more than 4 feet (1219 mm) on center and the unbraced length of braces shall not exceed 8 feet (2438 mm).

R802.4.6 Collar ties. Where collar ties are used to connect opposing rafters, they shall be located in the upper third of the attic space and fastened in accordance with Table R602.3(1). Collar ties shall be not less than 1 inch by 4 inches (25 mm x 102 mm) nominal, spaced not more than 4 feet (1219 mm) on center. Ridge straps shall be permitted to replace collar ties. Ridge straps shall be not



For SI: 1 degree = 0.018 rad.

H_C = Height of ceiling joists or rafter ties measured vertically above the top of rafter support walls.

H_R = Height of roof ridge measured vertically above the top of the rafter support walls.

FIGURE R802.4.5
BRACED RAFTER CONSTRUCTION

ROOF-CEILING CONSTRUCTION

less than 1¹/₄-inch (32 mm) × 20 gage and shall be nailed to the top edge of each rafter with not fewer than three 10d common (3" × 0.148") nails with the closest nail not closer than 2³/₈ inches (60.3 mm) from the end of the rafter.

R802.5 Ceiling joists. Ceiling joists shall be continuous across the structure or securely joined where they meet over interior partitions in accordance with Section R802.5.2.1. Ceiling joists shall be fastened to the top plate in accordance with Table R602.3(1).

R802.5.1 Ceiling joist size. Ceiling joists shall be sized based on the joist spans in Tables R802.5.1(1) and R802.5.1(2). For other grades and species and for other loading conditions, refer to the AWC STJR.

R802.5.2 Ceiling joist and rafter connections. Where ceiling joists run parallel to rafters and are located in the bottom third of the rafter height, they shall be installed in accordance with Figure R802.4.5 and fastened to rafters in accordance with Table R802.5.2(1). Where the ceiling joists are installed above the bottom third of the rafter height, the ridge shall be designed as a beam in accordance with Section R802.3. Where ceiling joists do not run parallel to rafters, rafters shall be tied across the structure with a rafter tie in accordance with Section R802.5.2.2, or the ridge shall be designed as a beam in accordance with Section R802.3.

TABLE R802.5.1(1)
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Douglas fir-larch	SS	13-2	20-8	Note a	Note a
	Douglas fir-larch	#1	12-8	19-11	Note a	Note a
	Douglas fir-larch	#2	12-5	19-6	25-8	Note a
	Douglas fir-larch	#3	11-1	16-3	20-7	25-2
	Hem-fir	SS	12-5	19-6	25-8	Note a
	Hem-fir	#1	12-2	19-1	25-2	Note a
	Hem-fir	#2	11-7	18-2	24-0	Note a
	Hem-fir	#3	10-10	15-10	20-1	24-6
	Southern pine	SS	12-11	20-3	Note a	Note a
	Southern pine	#1	12-5	19-6	25-8	Note a
	Southern pine	#2	11-10	18-8	24-7	Note a
	Southern pine	#3	10-1	14-11	18-9	22-9
	Spruce-pine-fir	SS	12-2	19-1	25-2	Note a
	Spruce-pine-fir	#1	11-10	18-8	24-7	Note a
	Spruce-pine-fir	#2	11-10	18-8	24-7	Note a
	Spruce-pine-fir	#3	10-10	15-10	20-1	24-6
16	Douglas fir-larch	SS	11-11	18-9	24-8	Note a
	Douglas fir-larch	#1	11-6	18-1	23-10	Note a
	Douglas fir-larch	#2	11-3	17-8	23-4	Note a
	Douglas fir-larch	#3	9-7	14-1	17-10	21-9
	Hem-fir	SS	11-3	17-8	23-4	Note a
	Hem-fir	#1	11-0	17-4	22-10	Note a
	Hem-fir	#2	10-6	16-6	21-9	Note a
	Hem-fir	#3	9-5	13-9	17-5	21-3
	Southern pine	SS	11-9	18-5	24-3	Note a
	Southern pine	#1	11-3	17-8	23-10	Note a
	Southern pine	#2	10-9	16-11	21-7	25-7
	Southern pine	#3	8-9	12-11	16-3	19-9
	Spruce-pine-fir	SS	11-0	17-4	22-10	Note a
	Spruce-pine-fir	#1	10-9	16-11	22-4	Note a
	Spruce-pine-fir	#2	10-9	16-11	22-4	Note a
	Spruce-pine-fir	#3	9-5	13-9	17-5	21-3

(continued)

TABLE R802.5.1(1)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics without storage, live load = 10 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 5 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
19.2	Douglas fir-larch	SS	11-3	17-8	23-3	Note a
	Douglas fir-larch	#1	10-10	17-0	22-5	Note a
	Douglas fir-larch	#2	10-7	16-8	21-4	26-0
	Douglas fir-larch	#3	8-9	12-10	16-3	19-10
	Hem-fir	SS	10-7	16-8	21-11	Note a
	Hem-fir	#1	10-4	16-4	21-6	Note a
	Hem-fir	#2	9-11	15-7	20-6	25-3
	Hem-fir	#3	8-7	12-6	15-10	19-5
	Southern -pine	SS	11-0	17-4	22-10	Note a
	Southern pine	#1	10-7	16-8	22-0	Note a
	Southern pine	#2	10-2	15-7	19-8	23-5
	Southern pine	#3	8-0	11-9	14-10	18-0
	Spruce-pine-fir	SS	10-4	16-4	21-6	Note a
	Spruce-pine-fir	#1	10-2	15-11	21-0	25-8
	Spruce-pine-fir	#2	10-2	15-11	21-0	25-8
	Spruce-pine-fir	#3	8-7	12-6	15-10	19-5
24	Douglas fir-larch	SS	10-5	16-4	21-7	Note a
	Douglas fir-larch	#1	10-0	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	15-0	19-1	23-3
	Douglas fir-larch	#3	7-10	11-6	14-7	17-9
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-10	24-3
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	9-10	15-6	20-5	24-0
	Southern pine	#2	9-3	13-11	17-7	20-11
	Southern pine	#3	7-2	10-6	13-3	16-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Span exceeds 26 feet in length.

ROOF-CEILING CONSTRUCTION

TABLE R802.5.1(2)

CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 x 4	2 x 6	2 x 8	2 x 10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
12	Douglas fir-larch	SS	10-5	16-4	21-7	Note a
	Douglas fir-larch	#1	10-0	15-9	20-1	24-6
	Douglas fir-larch	#2	9-10	15-0	19-1	23-3
	Douglas fir-larch	#3	7-10	11-6	14-7	17-9
	Hem-fir	SS	9-10	15-6	20-5	Note a
	Hem-fir	#1	9-8	15-2	19-10	24-3
	Hem-fir	#2	9-2	14-5	18-6	22-7
	Hem-fir	#3	7-8	11-2	14-2	17-4
	Southern pine	SS	10-3	16-1	21-2	Note a
	Southern pine	#1	9-10	15-6	20-5	24-0
	Southern pine	#2	9-3	13-11	17-7	20-11
	Southern pine	#3	7-2	10-6	13-3	16-1
	Spruce-pine-fir	SS	9-8	15-2	19-11	25-5
	Spruce-pine-fir	#1	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#2	9-5	14-9	18-9	22-11
	Spruce-pine-fir	#3	7-8	11-2	14-2	17-4
16	Douglas fir-larch	SS	9-6	14-11	19-7	25-0
	Douglas fir-larch	#1	9-1	13-9	17-5	21-3
	Douglas fir-larch	#2	8-11	13-0	16-6	20-2
	Douglas fir-larch	#3	6-10	9-11	12-7	15-5
	Hem-fir	SS	8-11	14-1	18-6	23-8
	Hem-fir	#1	8-9	13-7	17-2	21-0
	Hem-fir	#2	8-4	12-8	16-0	19-7
	Hem-fir	#3	6-8	9-8	12-4	15-0
	Southern pine	SS	9-4	14-7	19-3	24-7
	Southern pine	#1	8-11	14-0	17-9	20-9
	Southern pine	#2	8-0	12-0	15-3	18-1
	Southern pine	#3	6-2	9-2	11-6	14-0
	Spruce-pine-fir	SS	8-9	13-9	18-1	23-1
	Spruce-pine-fir	#1	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#2	8-7	12-10	16-3	19-10
	Spruce-pine-fir	#3	6-8	9-8	12-4	15-0

(continued)

TABLE R802.5.1(2)—continued
CEILING JOIST SPANS FOR COMMON LUMBER SPECIES (Uninhabitable attics with limited storage, live load = 20 psf, L/Δ = 240)

CEILING JOIST SPACING (inches)	SPECIES AND GRADE		DEAD LOAD = 10 psf			
			2 × 4	2 × 6	2 × 8	2 × 10
			Maximum ceiling joist spans			
			(feet-inches)	(feet-inches)	(feet-inches)	(feet-inches)
19.2	Douglas fir-larch	SS	8-11	14-0	18-5	23-7
	Douglas fir-larch	#1	8-7	12-6	15-10	19-5
	Douglas fir-larch	#2	8-2	11-11	15-1	18-5
	Douglas fir-larch	#3	6-2	9-1	11-6	14-1
	Hem-fir	SS	8-5	13-3	17-5	22-3
	Hem-fir	#1	8-3	12-4	15-8	19-2
	Hem-fir	#2	7-10	11-7	14-8	17-10
	Hem-fir	#3	6-1	8-10	11-3	13-8
	Southern pine	SS	8-9	13-9	18-2	23-1
	Southern pine	#1	8-5	12-9	16-2	18-11
	Southern pine	#2	7-4	11-0	13-11	16-6
	Southern pine	#3	5-8	8-4	10-6	12-9
	Spruce-pine-fir	SS	8-3	12-11	17-1	21-8
	Spruce-pine-fir	#1	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#2	8-0	11-9	14-10	18-2
	Spruce-pine-fir	#3	6-1	8-10	11-3	13-8
24	Douglas fir-larch	SS	8-3	13-0	17-2	21-3
	Douglas fir-larch	#1	7-8	11-2	14-2	17-4
	Douglas fir-larch	#2	7-3	10-8	13-6	16-5
	Douglas fir-larch	#3	5-7	8-1	10-3	12-7
	Hem-fir	SS	7-10	12-3	16-2	20-6
	Hem-fir	#1	7-7	11-1	14-0	17-1
	Hem-fir	#2	7-1	10-4	13-1	16-0
	Hem-fir	#3	5-5	7-11	10-0	12-3
	Southern pine	SS	8-1	12-9	16-10	21-6
	Southern pine	#1	7-8	11-5	14-6	16-11
	Southern pine	#2	6-7	9-10	12-6	14-9
	Southern pine	#3	5-1	7-5	9-5	11-5
	Spruce-pine-fir	SS	7-8	12-0	15-10	19-5
	Spruce-pine-fir	#1	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#2	7-2	10-6	13-3	16-3
	Spruce-pine-fir	#3	5-5	7-11	10-0	12-3

Check sources for availability of lumber in lengths greater than 20 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Span exceeds 26 feet in length.

**TABLE R802.5.2(1)
RAFTER/CEILING JOIST HEEL JOINT CONNECTIONS⁹**

RAFTER SLOPE	RAFTER SPACING (inches)	GROUND SNOW LOAD (psf)											
		20°			30			50			70		
		Roof span (feet)											
		12	24	36	12	24	36	12	24	36	12	24	36
Required number of 16d common nails per heel joint splices ^{a, b, c, d, f}													
3:12	12	3	5	8	3	6	9	5	9	13	6	12	17
	16	4	7	10	4	8	12	6	12	17	8	15	23
	19.2	4	8	12	5	10	14	7	14	21	9	18	27
	24	5	10	15	6	12	18	9	17	26	12	23	34
4:12	12	3	4	6	3	5	7	4	7	10	5	9	13
	16	3	5	8	3	6	9	5	9	13	6	12	17
	19.2	3	6	9	4	7	11	6	11	16	7	14	21
	24	4	8	11	5	9	13	7	13	19	9	17	26
5:12	12	3	3	5	3	4	6	3	6	8	4	7	11
	16	3	4	6	3	5	7	4	7	11	5	9	14
	19.2	3	5	7	3	6	9	5	9	13	6	11	17
	24	3	6	9	4	7	11	6	11	16	7	14	21
7:12	12	3	3	4	3	3	4	3	4	6	3	5	8
	16	3	3	5	3	4	5	3	5	8	4	7	10
	19.2	3	4	5	3	4	6	3	6	9	4	8	12
	24	3	5	7	3	5	8	4	8	11	5	10	15
9:12	12	3	3	3	3	3	3	3	3	5	3	4	6
	16	3	3	4	3	3	4	3	4	6	3	5	8
	19.2	3	3	4	3	4	5	3	5	7	3	6	9
	24	3	4	5	3	4	6	3	6	9	4	8	12
12:12	12	3	3	3	3	3	3	3	3	4	3	3	5
	16	3	3	3	3	3	3	3	3	5	3	4	6
	19.2	3	3	3	3	3	4	3	4	6	3	5	7
	24	3	3	4	3	3	5	3	5	7	3	6	9

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. 10d common (3" × 0.148") nails shall be permitted to be substituted for 16d common (3 1/2" × 0.162") nails where the required number of nails is taken as 1.2 times the required number of 16d common nails, rounded up to the next full nail.
- b. Heel joint connections are not required where the ridge is supported by a load-bearing wall, header or ridge beam.
- c. Where intermediate support of the rafter is provided by vertical struts or purlins to a load-bearing wall, the tabulated heel joint connection requirements shall be permitted to be reduced proportionally to the reduction in span.
- d. Equivalent nailing patterns are required for ceiling joist to ceiling joist lap splices.
- e. Applies to roof live load of 20 psf or less.
- f. Tabulated heel joint connection requirements assume that ceiling joists or rafter ties are located at the bottom of the attic space. Where ceiling joists or rafter ties are located higher in the attic, heel joint connection requirements shall be increased by the adjustment factors in Table 802.5.2(2).
- g. Tabulated requirements are based on 10 psf roof dead load in combination with the specified roof snow load and roof live load.

**TABLE R802.5.2(2)
HEEL JOINT CONNECTION ADJUSTMENT FACTORS**

H_C/H_R ^{a, b}	HEEL JOINT CONNECTION ADJUSTMENT FACTOR
1/3	1.5
1/4	1.33
1/5	1.25
1/6	1.2
1/10 or less	1.11

- a. H_C = Height of ceiling joists or rafter ties measured vertically from the top of the rafter support walls to the bottom of the ceiling joists or rafter ties; H_R = Height of roof ridge measured vertically from the top of the rafter support walls to the bottom of the roof ridge.
- b. Where H_C/H_R exceeds 1/3, connections shall be designed in accordance with accepted engineering practice.

R802.5.2.1 Ceiling joists lapped. Ends of ceiling joists shall be lapped not less than 3 inches (76 mm) or butted over bearing partitions or beams and toenailed to the bearing member. Where ceiling joists are used to provide the continuous tie across the building, lapped joists shall be nailed together in accordance with Table R802.5.2(1) and butted joists shall be tied together with a connection of equivalent capacity. Laps in joists that do not provide the continuous tie across the building shall be permitted to be nailed in accordance with Table R602.3(1).

R802.5.2.2 Rafter ties. Wood rafter ties shall be not less than 2 inches by 4 inches (51 mm × 102 mm) installed in accordance with Table R802.5.2(1) at a

maximum of 24 inches (610 mm) on center. Other approved rafter tie methods shall be permitted.

R802.5.2.3 Blocking. Blocking shall be not less than utility grade lumber.

R802.6 Bearing. The ends of each rafter or ceiling joist shall have not less than 1½ inches (38 mm) of bearing on wood or metal and not less than 3 inches (76 mm) on masonry or concrete. The bearing on masonry or concrete shall be direct, or a sill plate of 2-inch (51 mm) minimum nominal thickness shall be provided under the rafter or ceiling joist. The sill plate shall provide a minimum nominal bearing area of 48 square inches (30 968 mm²). Where the roof pitch is greater than or equal to 3 units vertical in 12 units horizontal (25-percent slope), and ceiling joists or rafter ties are connected to rafters to provide a continuous tension tie in accordance with Section R802.5.2, vertical bearing of the top of the rafter against the ridge board shall satisfy this bearing requirement.

R802.6.1 Finished ceiling material. If the finished ceiling material is installed on the ceiling prior to the attachment of the ceiling to the walls, such as in construction at a factory, a compression strip of the same thickness as the finished ceiling material shall be installed directly above the top plate of bearing walls if the compressive strength of the finished ceiling material is less than the loads it will be required to withstand. The compression strip shall cover the entire length of such top plate and shall be not less than one-half the width of the top plate. It

shall be of material capable of transmitting the loads transferred through it.

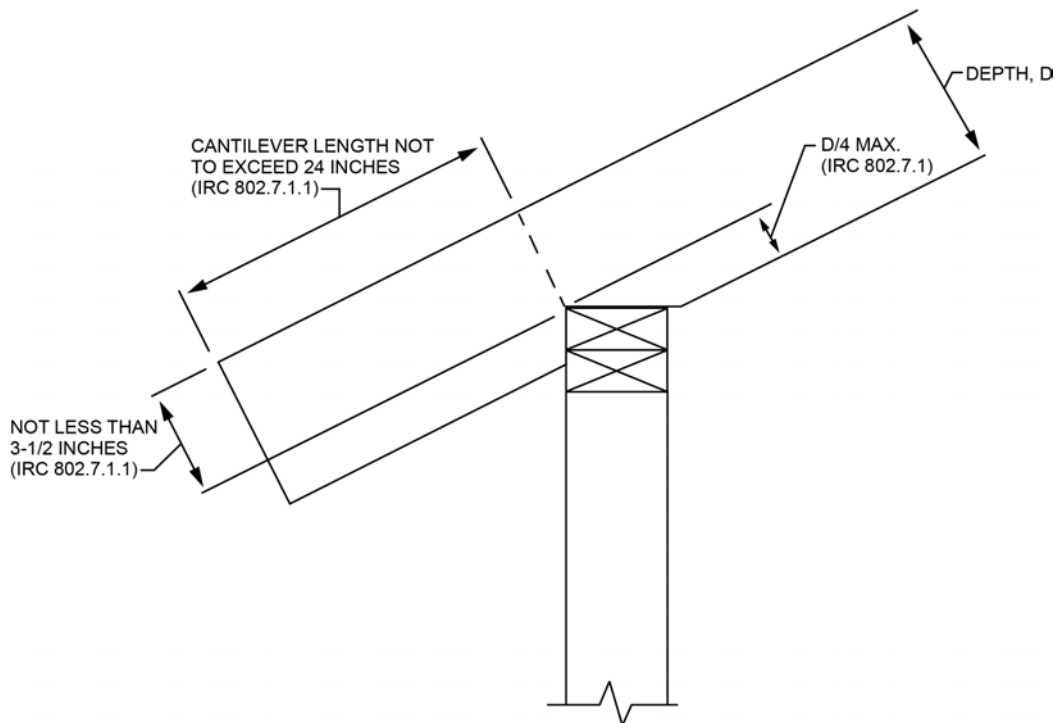
R802.7 Cutting, drilling and notching. Structural roof members shall not be cut, bored or notched in excess of the limitations specified in this section.

R802.7.1 Sawn lumber. Cuts, notches and holes in solid lumber joists, rafters, blocking and beams shall comply with the provisions of Section R502.8.1 except that cantilevered portions of rafters shall be permitted in accordance with Section R802.7.1.1.

R802.7.1.1 Cantilevered portions of rafters. Notches on cantilevered portions of rafters are permitted provided the dimension of the remaining portion of the rafter is not less than 3½ inches (89 mm) and the length of the cantilever does not exceed 24 inches (610 mm) in accordance with Figure R802.7.1.1.

R802.7.1.2 Ceiling joist taper cut. Taper cuts at the ends of the ceiling joist shall not exceed one-fourth the depth of the member in accordance with Figure R802.7.1.2.

R802.7.2 Engineered wood products. Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members or I-joists are prohibited except where permitted by the manufacturer’s recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional.



For SI: 1 inch = 25.4 mm.

FIGURE R802.7.1.1
RAFTER NOTCH

ROOF-CEILING CONSTRUCTION

R802.8 Lateral support. Roof framing members and ceiling joists having a depth-to-thickness ratio exceeding 5 to 1 based on nominal dimensions shall be provided with lateral support at points of bearing to prevent rotation. For roof rafters with ceiling joists attached in accordance with Table R602.3(1), the depth-to-thickness ratio for the total assembly shall be determined using the combined thickness of the rafter plus the attached ceiling joist.

Exception: Roof trusses shall be braced in accordance with Section R802.10.3.

R802.8.1 Bridging. Rafters and ceiling joists having a depth-to-thickness ratio exceeding 6 to 1 based on nominal dimensions shall be supported laterally by solid blocking, diagonal bridging (wood or metal) or a continuous 1-inch by 3-inch (25 mm by 76 mm) wood strip nailed across the rafters or ceiling joists at intervals not exceeding 8 feet (2438 mm).

R802.9 Framing of openings. Openings in roof and ceiling framing shall be framed with header and trimmer joists. Where the header joist span does not exceed 4 feet (1219 mm), the header joist shall be permitted to be a single member the same size as the ceiling joist or rafter. Single trimmer joists shall be permitted to be used to carry a single header joist that is located within 3 feet (914 mm) of the trimmer joist bearing. Where the header joist span exceeds 4 feet (1219 mm), the trimmer joists and the header joist shall be doubled and of sufficient cross section to support the ceiling

joists or rafter framing into the header. Approved hangers shall be used for the header joist to trimmer joist connections where the header joist span exceeds 6 feet (1829 mm). Tail joists over 12 feet (3658 mm) long shall be supported at the header by framing anchors or on ledger strips not less than 2 inches by 2 inches (51 mm by 51 mm).

R802.10 Wood trusses.

R802.10.1 Truss design drawings. Truss design drawings, prepared in conformance to Section R802.10.1, shall be provided to the building official and approved prior to installation. Truss design drawings shall be provided with the shipment of trusses delivered to the job site. Truss design drawings shall include, at a minimum, the following information:

1. Slope or depth, span and spacing.
2. Location of all joints.
3. Required bearing widths.
4. Design loads as applicable.
 - 4.1. Top chord live load (as determined from Section R301.6).
 - 4.2. Top chord dead load.
 - 4.3. Bottom chord live load.
 - 4.4. Bottom chord dead load.

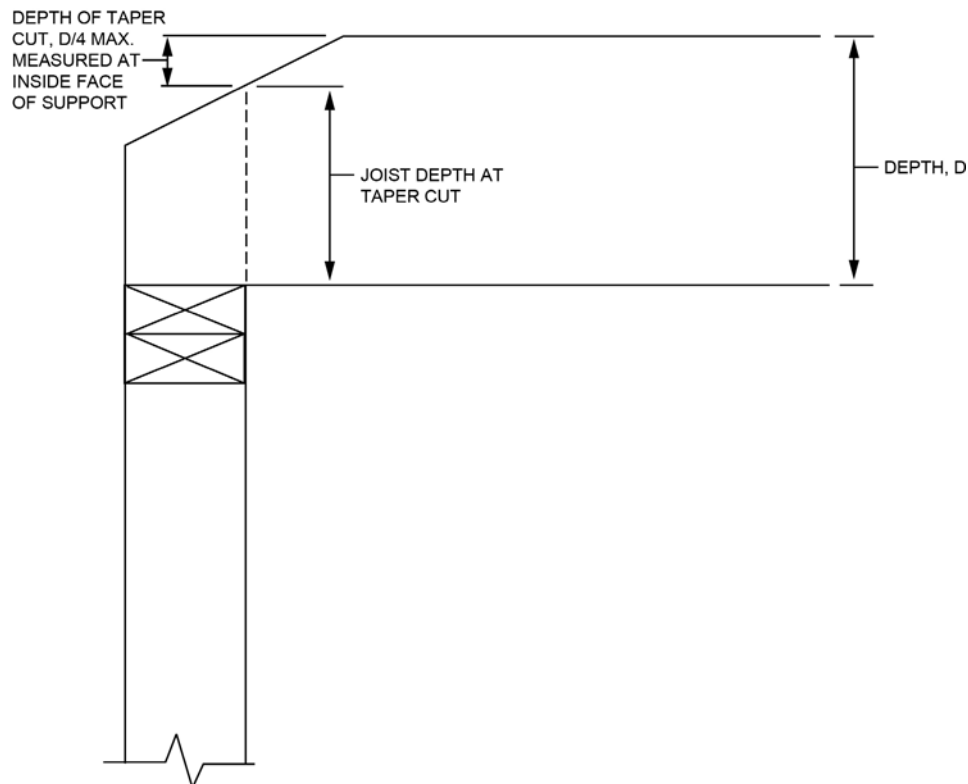


FIGURE R802.7.1.2
CEILING JOIST TAPER CUT

- 4.5. Concentrated loads and their points of application.
- 4.6. Controlling wind and earthquake loads.
5. Adjustments to lumber and joint connector design values for conditions of use.
6. Each reaction force and direction.
7. Joint connector type and description such as size, thickness or gage and the dimensioned location of each joint connector except where symmetrically located relative to the joint interface.
8. Lumber size, species and grade for each member.
9. Connection requirements for:
 - 9.1. Truss to girder-truss.
 - 9.2. Truss ply to ply.
 - 9.3. Field splices.
10. Calculated deflection ratio or maximum description for live and total load.
11. Maximum axial compression forces in the truss members to enable the building designer to design the size, connections and anchorage of the permanent continuous lateral bracing. Forces shall be shown on the truss design drawing or on supplemental documents.
12. Required permanent truss member bracing location.

R802.10.2 Design. Wood trusses shall be designed in accordance with accepted engineering practice. The design and manufacture of metal-plate-connected wood trusses shall comply with ANSI/TPI 1. The truss design drawings shall be prepared by a registered design professional.

R802.10.2.1 Applicability limits. The provisions of this section shall control the design of truss roof framing where snow controls for buildings that are not greater than 60 feet (18 288 mm) in length perpendicular to the joist, rafter or truss span, not greater than 36 feet (10 973 mm) in width parallel to the joist, rafter or truss span, not more than three stories above grade plane in height, and have roof slopes not smaller than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Truss roof framing constructed in accordance with the provisions of this section shall be limited to sites subjected to a maximum design wind speed of 140 miles per hour (63 m/s), Exposure B or C, and a maximum ground snow load of 70 psf (3352 Pa). For consistent loading of all truss types, roof snow load is to be computed as: $0.7 p_g$.

R802.10.3 Bracing. Trusses shall be braced to prevent rotation and provide lateral stability in accordance with the requirements specified in the construction documents for the building and on the individual truss design drawings. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practice such as the SBCA *Building Component Safety Information (BCSI) Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses*.

R802.10.4 Alterations to trusses. Truss members shall not be cut, notched, drilled, spliced or otherwise altered in any way without the approval of a registered design professional. Alterations resulting in the addition of load such as HVAC equipment water heater that exceeds the design load for the truss shall not be permitted without verification that the truss is capable of supporting such additional loading.

R802.11 Roof tie uplift resistance. Roof assemblies shall have uplift resistance in accordance with Sections R802.11.1 and R802.11.2.

Exceptions: Rafters or trusses shall be permitted to be attached to their supporting wall assemblies in accordance with Table R602.3(1) where either of the following occur:

1. Where the uplift force per rafter or truss does not exceed 200 pounds (90.8 kg) as determined by Table R802.11.
2. Where the basic wind speed does not exceed 115 miles per hour (51.4 m/s), the wind exposure category is B, the roof pitch is 5 units vertical in 12 units horizontal (42-percent slope) or greater, the roof span is 32 feet (9754 mm) or less, and rafters and trusses are spaced not more than 24 inches (610 mm) on center.

R802.11.1 Truss uplift resistance. Trusses shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as specified on the truss design drawings for the ultimate design wind speed as determined by Figure R301.2(2) and listed in Table R301.2 or as shown on the construction documents. Uplift forces shall be permitted to be determined as specified by Table R802.11, if applicable, or as determined by accepted engineering practice.

R802.11.2 Rafter uplift resistance. Individual rafters shall be attached to supporting wall assemblies by connections capable of resisting uplift forces as determined by Table R802.11 or as determined by accepted engineering practice. Connections for beams used in a roof system shall be designed in accordance with accepted engineering practice.

ROOF-CEILING CONSTRUCTION

TABLE R802.11
RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD) (POUNDS PER CONNECTION)^{a, b, c, d, e, f, g, h}

RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B									
		Ultimate Design Wind Speed V_{ULT} (mph)									
		110		115		120		130		140	
		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch	
		< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12
12" o.c.	12	48	43	59	53	70	64	95	88	122	113
	18	59	52	74	66	89	81	122	112	157	146
	24	71	62	89	79	108	98	149	137	192	178
	28	79	69	99	88	121	109	167	153	216	200
	32	86	75	109	97	134	120	185	170	240	222
	36	94	82	120	106	146	132	203	186	264	244
	42	106	92	135	120	166	149	230	211	300	278
	48	118	102	151	134	185	166	258	236	336	311
16" o.c.	12	64	57	78	70	93	85	126	117	162	150
	18	78	69	98	88	118	108	162	149	209	194
	24	94	82	118	105	144	130	198	182	255	237
	28	105	92	132	117	161	145	222	203	287	266
	32	114	100	145	129	178	160	246	226	319	295
	36	125	109	160	141	194	176	270	247	351	325
	42	141	122	180	160	221	198	306	281	399	370
	48	157	136	201	178	246	221	343	314	447	414
24" o.c.	12	96	86	118	106	140	128	190	176	244	226
	18	118	104	148	132	178	162	244	224	314	292
	24	142	124	178	158	216	196	298	274	384	356
	28	158	138	198	176	242	218	334	306	432	400
	32	172	150	218	194	268	240	370	340	480	444
	36	188	164	240	212	292	264	406	372	528	488
	42	212	184	270	240	332	298	460	422	600	556
	48	236	204	302	268	370	332	516	472	672	622
		EXPOSURE C									
12" o.c.	12	95	88	110	102	126	118	161	151	198	186
	18	121	111	141	131	163	151	208	195	257	242
	24	148	136	173	160	200	185	256	239	317	298
	28	166	152	195	179	225	208	289	269	358	335
	32	184	168	216	199	249	231	321	299	398	373
	36	202	185	237	219	274	254	353	329	438	411
	42	229	210	269	248	312	289	402	375	499	468
	48	256	234	302	278	349	323	450	420	560	524
16" o.c.	12	126	117	146	136	168	157	214	201	263	247
	18	161	148	188	174	217	201	277	259	342	322
	24	197	181	230	213	266	246	340	318	422	396
	28	221	202	259	238	299	277	384	358	476	446
	32	245	223	287	265	331	307	427	398	529	496
	36	269	246	315	291	364	338	469	438	583	547
	42	305	279	358	330	415	384	535	499	664	622
	48	340	311	402	370	464	430	599	559	745	697

(continued)

TABLE R802.11—continued
RAFTER OR TRUSS UPLIFT CONNECTION FORCES FROM WIND (ASD) (POUNDS PER CONNECTION)^{a, b, c, d, e, f, g, h}

RAFTER OR TRUSS SPACING	ROOF SPAN (feet)	EXPOSURE B									
		Ultimate Design Wind Speed V_{ULT} (mph)									
		110		115		120		130		140	
		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch		Roof Pitch	
		< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12	< 5:12	≥ 5:12
24" o.c.	12	190	176	220	204	252	236	322	302	396	372
	18	242	222	282	262	326	302	416	390	514	484
	24	296	272	346	320	400	370	512	478	634	596
	28	332	304	390	358	450	416	578	538	716	670
	32	368	336	432	398	498	462	642	598	796	746
	36	404	370	474	438	548	508	706	658	876	822
	42	458	420	538	496	624	578	804	750	998	936
	48	512	468	604	556	698	646	900	840	1,120	1,048

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s, 1 pound = 0.454 kg, 1 pound per square foot = 47.9 N/m²,
 1 pound per linear foot = 14.6 N/m.

- a. The uplift connection forces are based on a maximum 33-foot mean roof height and Wind Exposure Category B or C. For Exposure D, the uplift connection force shall be selected from the Exposure C portion of the table using the next highest tabulated ultimate design wind speed. The adjustment coefficients in Table R301.2.1(2) shall not be used to multiply the tabulated forces for Exposures C and D or for other mean roof heights.
- b. The uplift connection forces include an allowance for roof and ceiling assembly dead load of 15 psf.
- c. The tabulated uplift connection forces are limited to a maximum roof overhang of 24 inches.
- d. The tabulated uplift connection forces shall be permitted to be multiplied by 0.75 for connections not located within 8 feet of building corners.
- e. For buildings with hip roofs with 5:12 and greater pitch, the tabulated uplift connection forces shall be permitted to be multiplied by 0.70. This reduction shall not be combined with any other reduction in tabulated forces.
- f. For wall-to-wall and wall-to-foundation connections, the uplift connection force shall be permitted to be reduced by 60 pounds per linear foot for each full wall above.
- g. Linear interpolation between tabulated roof spans and wind speeds shall be permitted.
- h. The tabulated forces for a 12-inch on-center spacing shall be permitted to be used to determine the uplift load in pounds per linear foot.

**SECTION R803
ROOF SHEATHING**

R803.1 Lumber sheathing. Allowable spans for lumber used as roof sheathing shall conform to Table R803.1. Spaced lumber sheathing for wood shingle and shake roofing shall conform to the requirements of Sections R905.7 and R905.8. Spaced lumber sheathing is not allowed in Seismic Design Category D₂.

**TABLE R803.1
MINIMUM THICKNESS OF LUMBER ROOF SHEATHING**

RAFTER OR BEAM SPACING (inches)	MINIMUM NET THICKNESS (inches)
24	$\frac{5}{8}$
48 ^a	1½ T & G
60 ^b	
72 ^c	

For SI: 1 inch = 25.4 mm.

a. Minimum 270F_b, 340,000E.

b. Minimum 420F_b, 660,000E.

c. Minimum 600F_b, 1,150,000E.

R803.2 Wood structural panel sheathing.

R803.2.1 Identification and grade. Wood structural panels shall conform to DOC PS 1, DOC PS 2, CSA O325 or CSA O437, and shall be identified for grade, bond classification and performance category by a grade mark or certificate of inspection issued by an approved agency. Wood structural panels shall comply with the grades specified in Table R503.2.1.1(1).

R803.2.1.1 Exposure durability. Wood structural panels, when designed to be permanently exposed in outdoor applications, shall be of an exterior exposure durability. Wood structural panel roof sheathing exposed to the underside shall be permitted to be of interior type bonded with exterior glue, identified as Exposure 1.

R803.2.1.2 Fire-retardant-treated plywood. The allowable unit stresses for fire-retardant-treated plywood, including fastener values, shall be developed from an approved method of investigation that considers the effects of anticipated temperature and humidity to which the fire-retardant-treated plywood will be subjected, the type of treatment and redrying process. The fire-retardant-treated plywood shall be graded by an approved agency.

R803.2.2 Allowable spans. The maximum allowable spans for wood structural panel roof sheathing shall not exceed the values set forth in Table R503.2.1.1(1) or APA E30.

R803.2.3 Installation. Wood structural panel used as roof sheathing shall be installed with joints staggered or not staggered in accordance with Table R602.3(1), APA E30 for wood roof framing or with Table R804.3 for cold-formed steel roof framing. Wood structural panel roof sheathing in

accordance with Table R503.2.1.1(1) shall not cantilever more than 9 inches (229 mm) beyond the gable endwall unless supported by gable overhang framing.

**SECTION R804
COLD-FORMED STEEL ROOF FRAMING**

R804.1 General. Elements shall be straight and free of any defects that would significantly affect their structural performance. Cold-formed steel roof framing members shall be in accordance with the requirements of this section.

R804.1.1 Applicability limits. The provisions of this section shall control the construction of cold-formed steel roof framing for buildings not greater than 60 feet (18 288 mm) perpendicular to the joist, rafter or truss span, not greater than 40 feet (12 192 mm) in width parallel to the joist span or truss, less than or equal to three stories above grade plane and with roof slopes not less than 3:12 (25-percent slope) or greater than 12:12 (100-percent slope). Cold-formed steel roof framing constructed in accordance with the provisions of this section shall be limited to sites where the ultimate design wind speed is less than 140 miles per hour (63 m/s), Exposure Category B or C, and the ground snow load is less than or equal to 70 pounds per square foot (3350 Pa).

R804.1.1.1 Alternate applications. Cold-formed steel roof and ceiling framing for buildings exceeding the applicability limits of Section R804.1.1 is permitted to be designed and constructed in accordance with AISI S230, subject to the limits therein.

R804.1.2 In-line framing. Cold-formed steel roof framing constructed in accordance with Section R804 shall be located in line with the tolerances specified in AISI S240, Section B1.2.3.

R804.2 Structural framing. Load-bearing, cold-formed steel roof framing members shall be in accordance with this section.

R804.2.1 Material. Load-bearing, cold-formed steel framing members shall be cold formed to shape from structural quality sheet steel complying with the requirements of AISI S240, Section A3.

R804.2.2 Corrosion protection. Load-bearing, cold-formed steel framing shall have a protective coating complying with AISI S240, Section A4.

R804.2.3 Dimension, thickness and material grade. Load-bearing, cold-formed steel roof framing members shall comply with AISI S230, Section A4.3 and material grade requirements as specified in AISI S230, Section A4.4.

R804.2.4 Identification. Load-bearing, cold-formed steel framing members shall meet the product identification requirements of AISI S240, Section A5.5.

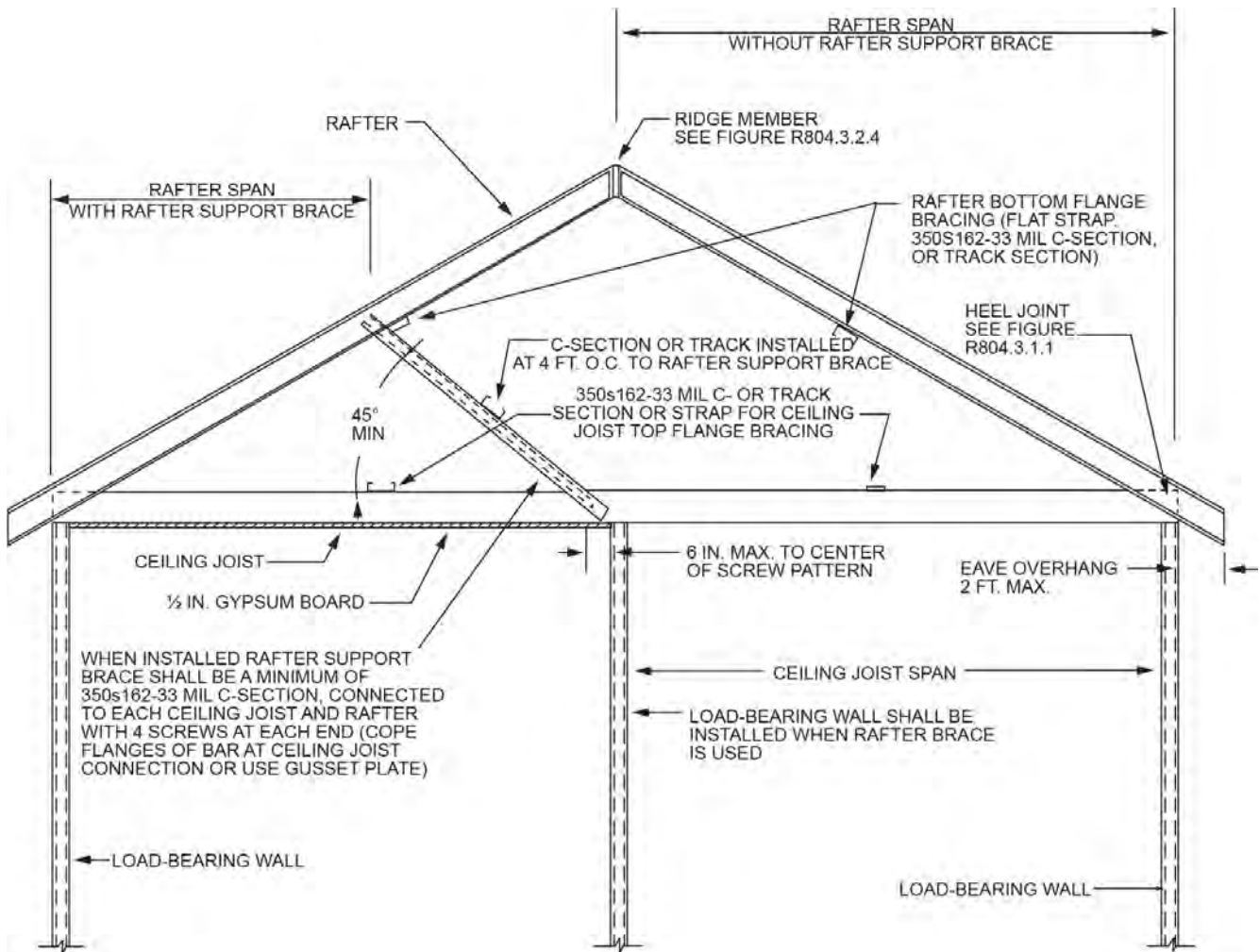
R804.2.5 Fastening requirements. Screws for steel-to-steel connections shall be installed with a minimum edge distance and center-to-center spacing of $\frac{1}{2}$ inch (12.7 mm), shall be self-drilling tapping and shall conform to ASTM C1513. Structural sheathing shall be attached to cold-formed steel roof rafters with minimum No. 8 self-drilling tapping screws that conform to ASTM C1513. Screws for attaching structural sheathing to cold-formed steel roof framing shall have a minimum head diameter of 0.292 inch (7.4 mm) with countersunk heads and shall be installed with a minimum edge distance of $\frac{3}{8}$ inch (9.5 mm). Gypsum board ceilings shall be attached to cold-formed steel joists with minimum No. 6 screws conforming to ASTM C954 or ASTM C1513 with a bugle-head style and shall be installed in accordance with Section R805. For all connections, screws shall extend through the steel not fewer than three exposed threads. Fasteners shall have rust-inhibitive coating suitable for the installation in

which they are being used, or be manufactured from material not susceptible to corrosion.

R804.2.6 Web holes, web hole reinforcing and web hole patching. Web holes in roof or ceiling joists shall comply with the conditions as prescribed in AISI S230, Section A4.5. Web holes not in conformance to the conditions of AISI S230, Section A4.5 shall be reinforced in accordance with the provisions of AISI S230, Section A4.6 or patched in accordance with the provisions of AISI S230, Section A4.7.

R804.3 Roof construction. Cold-formed steel roof systems constructed in accordance with the provisions of this section shall consist of both ceiling joists and rafters in accordance with Figure R804.3 and fastened in accordance with Table R804.3.

R804.3.1 Ceiling joists. Cold-formed steel ceiling joists shall be in accordance with this section.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

FIGURE R804.3
COLD-FORMED STEEL ROOF CONSTRUCTION

**TABLE R804.3
ROOF FRAMING FASTENING SCHEDULE^{a, b}**

DESCRIPTION OF BUILDING ELEMENTS			NUMBER AND SIZE OF FASTENERS ^a				SPACING OF FASTENERS		
Roof sheathing (oriented strand board or plywood) to rafter			No. 8 screws				6" o.c. on edges and 12" o.c. at interior supports. 6" o.c. at gable end truss.		
Gypsum board to ceiling joists			No. 6 screws				12" o.c.		
Gable end truss to endwall top track			No. 10 screws				12" o.c.		
Rafter to ceiling joist and to ridge member			Minimum No. 10 screws, in accordance with Table R804.3.1.1(3)				Evenly spaced, not less than 1/2" from all edges.		
Ceiling joist or roof truss to top track of bearing wall ^b	Ceiling joist or truss spacing (in.)	Roof Span (ft)	Ultimate Design Wind Speed (mph) and Exposure Category				Each ceiling joist or roof truss.		
			130 B 115 C	< 139 B 120 C	130 C	< 139 C			
			16	24	3	3		4	5
				28	3	3		4	5
				32	3	4		5	6
	36	4		4	5	6			
	24	40	4	4	6	7			
		24	4	5	6	7			
		28	4	5	6	8			
		32	4	6	7	8			
36		4	6	8	9				
		40	6	6	8	10			

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa, 1 mil = 0.0254 mm.

a. Screws are a minimum No. 10 unless noted otherwise.

b. Indicated number of screws shall be applied through the flanges of the truss or ceiling joist or through each leg of a 54 mil clip angle. See Section R804.3.8 for additional requirements to resist uplift forces.

R804.3.1.1 Minimum ceiling joist size. Ceiling joist size and thickness shall be determined in accordance with the limits set forth in Tables R804.3.1.1(1) and R804.3.1.1(2). When determining the size of ceiling joists, the lateral support of the top flange shall be classified as unbraced, braced at midspan or braced at third points in accordance with Section R804.3.1.3. Where sheathing material is attached to the top flange of ceiling joists or where the bracing is spaced closer than at third points of the joists, the “third point” values from Tables R804.3.1.1(1) and R804.3.1.1(2) shall be used.

Ceiling joists shall have a bearing support length of not less than 1½ inches (38 mm) and shall be connected to roof rafters (heel joint) with No. 10 screws in accordance with Figure R804.3.1.1 and Table R804.3.1.1(3).

Where continuous joists are framed across interior bearing supports, the interior bearing supports shall be located within 24 inches (610 mm) of midspan of the ceiling joist, and the individual spans shall not exceed

the applicable spans in Tables R804.3.1.1(1) and R804.3.1.1(2).

Where the attic is to be used as an occupied space, the ceiling joists shall be designed in accordance with Section R505.

R804.3.1.2 Ceiling joist bottom flange bracing. The bottom flanges of ceiling joists shall be laterally braced by the application of gypsum board or continuous steel straps installed perpendicular to the joist run in accordance with one of the following:

1. Gypsum board shall be fastened with No. 6 screws in accordance with Section R702.
2. Steel straps with a minimum size of 1½ inches by 33 mils (38 mm by 0.84 mm) shall be installed at a maximum spacing of 4 feet (1219 mm). Straps shall be fastened to the bottom flange at each joist with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between joists at a maximum spacing of 12 feet (3658 mm) measured along a line of continuous strapping (perpendicular to the joist run), and at the termination of all straps.

TABLE R804.3.1.1(1)
CEILING JOIST SPANS 10 PSF LIVE LOAD (NO ATTIC STORAGE)^{a, b, c, d}

MEMBER DESIGNATION	ALLOWABLE SPAN (feet-inches)					
	Lateral Support of Top (Compression) Flange					
	Unbraced		Midspan Bracing		Third-point Bracing	
	Ceiling Joist Spacing (inches)					
	16	24	16	24	16	24
350S162-33	9'-6"	8'-6"	11'-10"	9'-10"	11'-10"	10'-4"
350S162-43	10'-4"	9'-3"	12'-10"	11'-3"	12'-10"	11'-3"
350S162-54	11'-1"	9'-11"	13'-9"	12'-0"	13'-9"	12'-0"
350S162-68	12'-2"	10'-10"	14'-9"	12'-10"	14'-9"	12'-10"
550S162-33	10'-11"	9'-10"	15'-7"	12'-0"	16'-10"	12'-0"
550S162-43	11'-8"	10'-6"	16'-10"	14'-10"	18'-4"	16'-0"
550S162-54	12'-7"	11'-3"	18'-0"	16'-2"	19'-4"	17'-2"
550S162-68	13'-7"	12'-1"	19'-3"	17'-3"	20'-6"	18'-5"
800S162-33	—	—	—	—	—	—
800S162-43	13'-1"	11'-9"	18'-9"	16'-9"	21'-2"	18'-7"
800S162-54	13'-11"	12'-6"	20'-1"	18'-1"	21'-5"	20'-5"
800S162-68	14'-11"	13'-4"	21'-4"	19'-2"	22'-9"	21'-9"
1000S162-43	—	—	—	—	—	—
1000S162-54	14'-10"	13'-4"	21'-4"	19'-2"	22'-8"	21'-8"
1000S162-68	15'-10"	14'-3"	22'-9"	20'-5"	24'-3"	23'-3"
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	16'-8"	14'-11"	23'-11"	21'-7"	25'-5"	24'-5"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa.

- a. Deflection criterion: $L/240$ for total loads.
- b. Ceiling dead load = 5 psf.
- c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.
- d. Listed allowable spans are not applicable for 350S162-33, 550S162-33, 550S162-43 and 800S162-43 continuous joist members.

ROOF-CEILING CONSTRUCTION

TABLE R804.3.1.1(2)
CEILING JOIST SPANS 20 PSF LIVE LOAD (LIMITED ATTIC STORAGE)^{a, b, c, d}

MEMBER DESIGNATION	ALLOWABLE SPAN (feet-inches)					
	Lateral Support of Top (Compression) Flange					
	Unbraced		Midspan Bracing		Third-point Bracing	
	Ceiling Joist Spacing (inches)					
	16	24	16	24	16	24
350S162-33	8'-0"	6'-5"	9'-2"	7'-5"	9'-11"	7'-5"
350S162-43	8'-11"	7'-8"	10'-9"	8'-9"	10'-0"	9'-6"
350S162-54	9'-7"	8'-7"	11'-7"	10'-2"	11'-7"	10'-2"
350S162-68	10'-4"	9'-3"	12'-5"	10'-10"	12'-5"	10'-10"
550S162-33	9'-5"	6'-11"	10'-5"	6'-11"	10'-5"	6'-11"
550S162-43	10'-2"	9'-2"	14'-2"	11'-8"	15'-2"	11'-8"
550S162-54	10'-10"	9'-9"	15'-7"	14'-0"	16'-7"	14'-5"
550S162-68	11'-8"	10'-5"	16'-7"	14'-10"	17'-9"	15'-6"
800S162-33	—	—	—	—	—	—
800S162-43	11'-4"	10'-2"	16'-1"	11'-0"	16'-6"	11'-0"
800S162-54	12'-0"	10'-10"	17'-4"	15'-7"	18'-7"	17'-7"
800S162-68	12'-10"	11'-6"	18'-6"	16'-7"	19'-11"	18'-11"
1000S162-43	—	—	—	—	—	—
1000S162-54	12'-10"	11'-7"	18'-5"	16'-6"	19'-8"	18'-8"
1000S162-68	13'-8"	12'-3"	19'-8"	17'-9"	21'-1"	20'-1"
1200S162-43	—	—	—	—	—	—
1200S162-54	—	—	—	—	—	—
1200S162-68	14'-5"	12'-11"	20'-9"	18'-7"	22'-0"	21'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mil = 0.0254 mm, 1 pound per square foot = 0.0479 kPa.

a. Deflection criterion: $L/240$ for total loads.

b. Ceiling dead load = 5 psf.

c. Minimum Grade 33 ksi steel shall be used for 33 mil and 43 mil thicknesses. Minimum Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

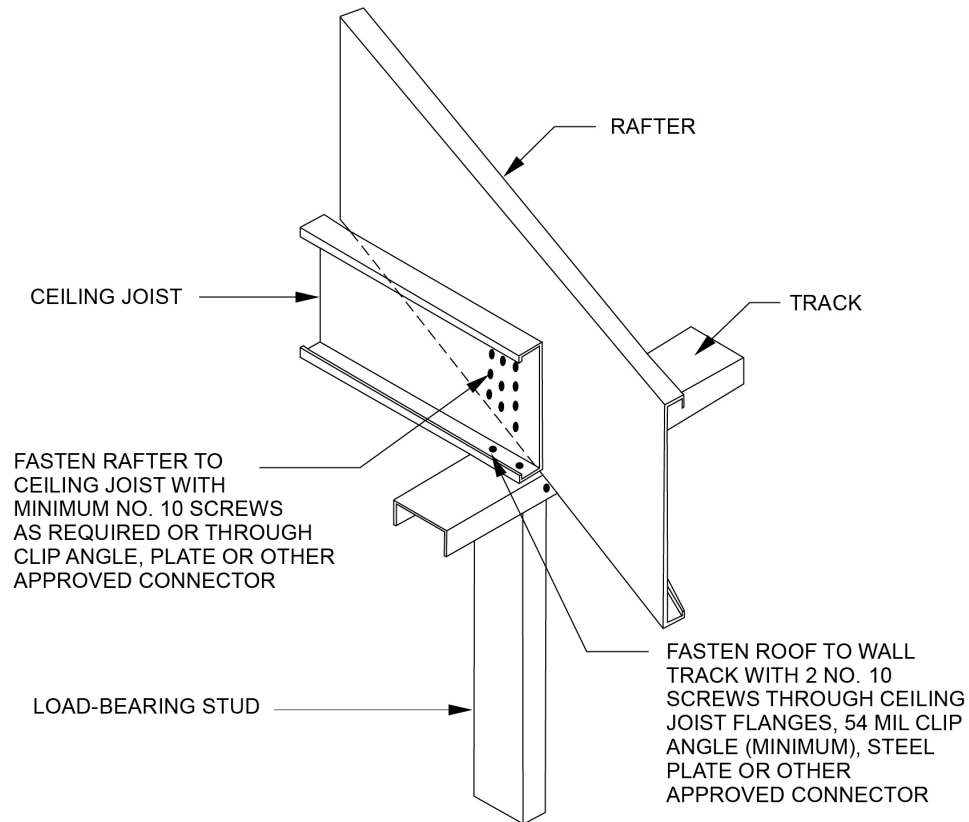
d. Listed allowable spans are not applicable for 350S162-33, 350S162-43, 550S162-33, 550S162-43 and 800S162-43 continuous joist members.

TABLE R804.3.1.1(3)
NUMBER OF SCREWS REQUIRED FOR CEILING JOIST TO ROOF RAFTER CONNECTION^a

ROOF SLOPE	NUMBER OF SCREWS																			
	Building width (feet)																			
	24				28				32				36				40			
	Ground snow load (psf)																			
	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70	20	30	50	70
3/12	5	6	9	11	5	7	10	13	6	8	11	15	7	8	13	17	8	9	14	19
4/12	4	5	7	9	4	5	8	10	5	6	9	12	5	7	10	13	6	7	11	14
5/12	3	4	6	7	4	4	6	8	4	5	7	10	5	5	8	11	5	6	9	12
6/12	3	3	5	6	3	4	6	7	4	4	6	8	4	5	7	9	4	5	8	10
7/12	3	3	4	6	3	3	5	7	3	4	6	7	4	4	6	8	4	5	7	9
8/12	2	3	4	5	3	3	5	6	3	4	5	7	3	4	6	8	4	4	6	8
9/12	2	3	4	5	3	3	4	6	3	3	5	6	3	4	5	7	3	4	6	8
10/12	2	2	4	5	2	3	4	5	3	3	5	6	3	3	5	7	3	4	6	7
11/12	2	2	3	4	2	3	4	5	3	3	4	6	3	3	5	6	3	4	5	7
12/12	2	2	3	4	2	3	4	5	2	3	4	5	3	3	5	6	3	4	5	7

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479kPa.

a. Screws shall be No. 10.



For SI: 1 mil = 0.0254 mm.

FIGURE R804.3.1.1
JOIST TO RAFTER CONNECTION

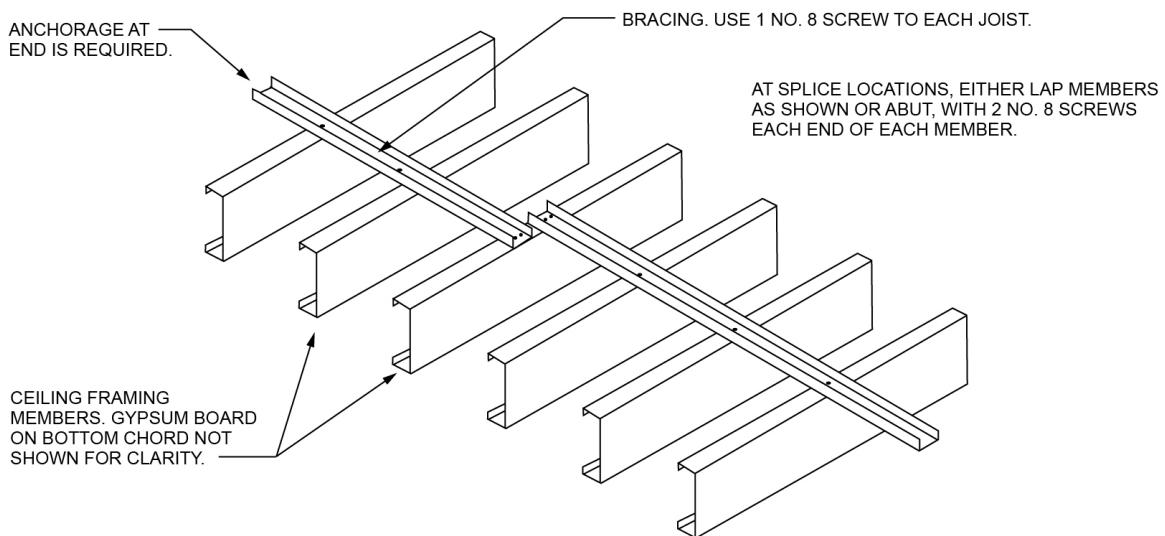
ROOF-CEILING CONSTRUCTION

R804.3.1.3 Ceiling joist top flange bracing. The top flanges of ceiling joists shall be laterally braced as required by Tables R804.3.1.1(1) and R804.3.1.1(2), in accordance with one of the following:

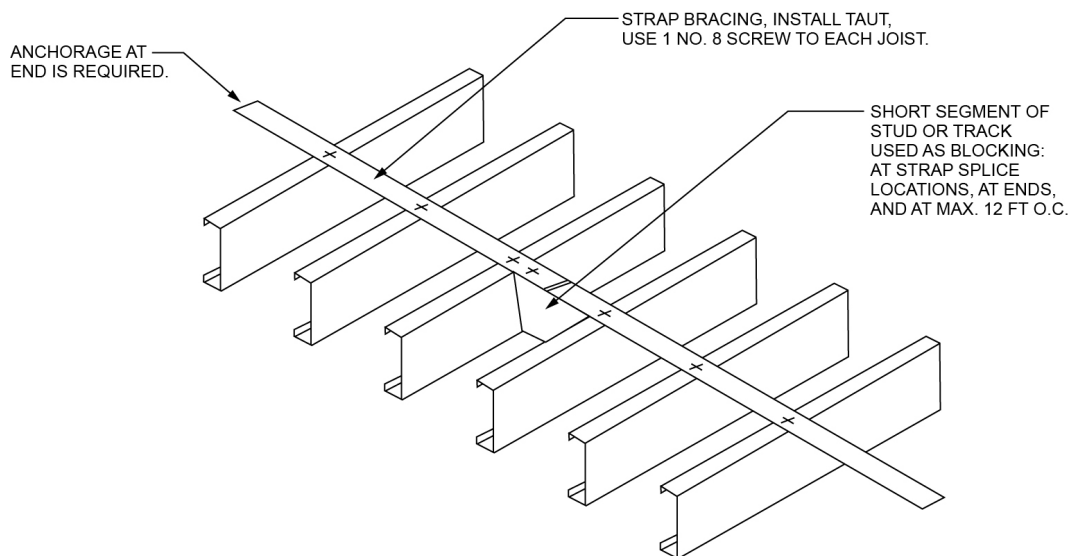
1. Minimum 33-mil (0.84 mm) C-shaped member in accordance with Figure R804.3.1.3(1).
2. Minimum 33-mil (0.84 mm) track section in accordance with Figure R804.3.1.3(1).
3. Minimum 33-mil (0.84 mm) hat section in accordance with Figure R804.3.1.3(1).
4. Minimum 54-mil (1.37 mm) 1½-inch (38 mm) cold-rolled channel section in accordance with Figure R804.3.1.3(1).

5. Minimum 1½-inch by 33-mil (38 mm by 0.84 mm) continuous steel strap in accordance with Figure R804.3.1.3(2).

Lateral bracing shall be installed perpendicular to the ceiling joists and shall be fastened to the top flange of each joist with one No. 8 screw. Blocking shall be installed between joists in line with bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the joists. Ends of lateral bracing shall be attached to blocking or anchored to a stable building component with two No. 8 screws.



**FIGURE R804.3.1.3(1)
CEILING JOIST TOP FLANGE BRACING WITH C-SHAPED, TRACK OR COLD-ROLLED CHANNEL**



**FIGURE R804.3.1.3(2)
CEILING JOIST TOP FLANGE BRACING WITH CONTINUOUS STEEL STRAP AND BLOCKING**

For SI: 1 foot = 304.8 mm.

R804.3.1.4 Ceiling joist splicing. Splices in ceiling joists shall be permitted, if ceiling joist splices are supported at interior bearing points and are constructed in accordance with Figure R804.3.1.4. The number of screws on each side of the splice shall be the same as required for the heel joint connection in Table R804.3.1.1(3).

R804.3.2 Roof rafters. Cold-formed steel roof rafters shall be in accordance with this section.

R804.3.2.1 Minimum roof rafter sizes. Roof rafter size and thickness shall be determined in accordance with the limits set forth in Table R804.3.2.1(1) based on the horizontal projection of the roof rafter span. For determination of roof rafter sizes, reduction of roof spans shall be permitted where a roof rafter support brace is installed in accordance with Section R804.3.2.2. The reduced roof rafter span shall be taken as the larger of the distances from the roof rafter support brace to the ridge or to the heel measured horizontally.

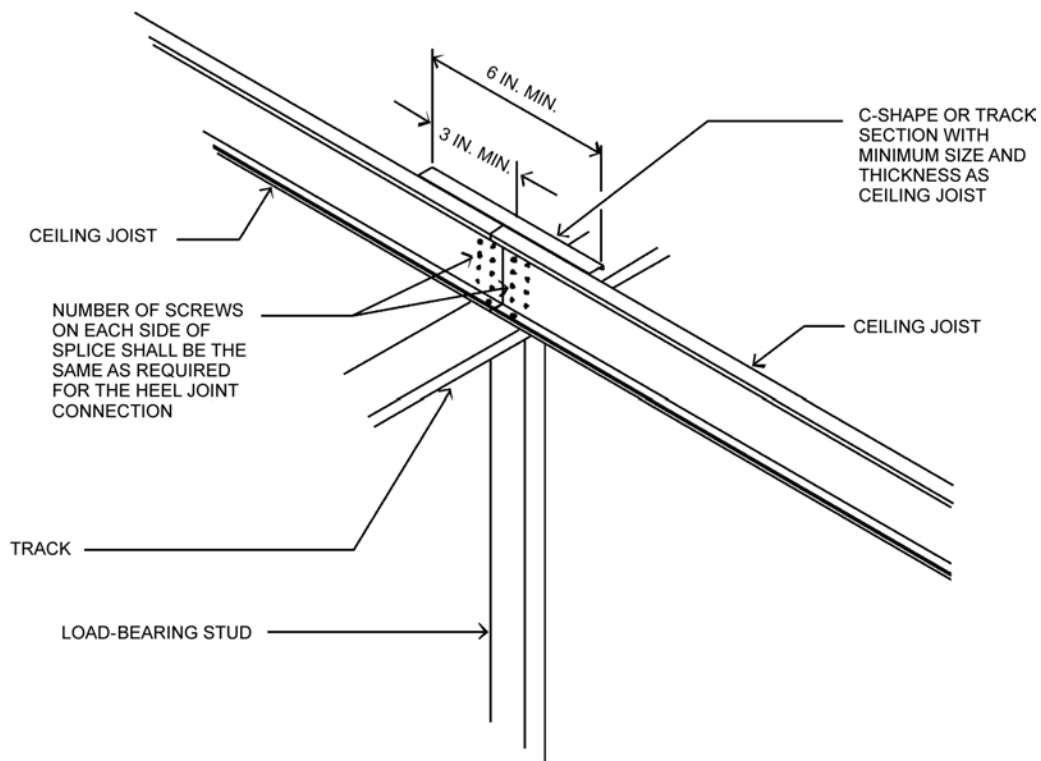
For the purpose of determining roof rafter sizes in Table R804.3.2.1(1), ultimate design wind speeds shall be converted to equivalent ground snow loads in accordance with Table R804.3.2.1(2). Roof rafter sizes shall be based on the higher of the ground snow load or the equivalent snow load converted from the ultimate design wind speed.

R804.3.2.1.1 Eave overhang. Eave overhangs shall not exceed 24 inches (610 mm) measured horizontally.

R804.3.2.1.2 Rake overhangs. Rake overhangs shall not exceed the limitations provided for Option 1 or 2 in Figure R804.3.2.1.2. Outlookers at gable endwalls shall be installed in accordance with Figure R804.3.2.1.2. The required strength for uplift connectors required for Option 1 shall be determined in accordance with AISI S230, Table F3-4.

R804.3.2.2 Roof rafter support brace. Where used to reduce roof rafter spans in determining roof rafter sizes, a roof rafter support brace shall meet all of the following conditions:

1. Minimum 350S162-33 C-shaped brace member with maximum length of 8 feet (2438 mm).
2. Minimum brace member slope of 45 degrees (0.785 rad) to the horizontal.
3. Minimum connection of brace to a roof rafter and ceiling joist with four No.10 screws at each end.
4. Maximum 6 inches (152 mm) between brace/ceiling joist connection and load-bearing wall below.
5. Each roof rafter support brace greater than 4 feet (1219 mm) in length, shall be braced with a supplemental brace having a minimum size of 350S162-33 or 350T162-33 such that the maximum unsupported length of the roof rafter support brace is 4 feet (1219 mm). The supplemental brace shall be continuous and shall be connected to each roof rafter support brace using two No. 8 screws.



For SI: 1 foot = 304.8 mm.

**FIGURE R804.3.1.4
SPLICED CEILING JOISTS**

ROOF-CEILING CONSTRUCTION

**TABLE R804.3.2.1(1)
ROOF RAFTER SPANS^{a, b, c, d}**

MEMBER DESIGNATION	ALLOWABLE SPAN MEASURED HORIZONTALLY (feet-inches)							
	Ground snow load (psf)							
	20		30		50		70	
	Rafter spacing (inches)							
	16	24	16	24	16	24	16	24
550S162-33	13'-11"	11'-4"	11'-9"	9'-7"	9'-5"	7'-8"	8'-1"	6'-7"
550S162-43	15'-9"	13'-8"	14'-3"	11'-8"	11'-4"	9'-3"	9'-9"	7'-11"
550S162-54	16'-11"	14'-10"	15'-3"	13'-4"	13'-3"	11'-7"	12'-0"	10'-6"
550S162-68	18'-2"	15'-10"	16'-5"	14'-4"	14'-3"	12'-5"	12'-11"	11'-3"
800S162-33	16'-4"	13'-4"	13'-11"	11'-4"	11'-1"	9'-0"	9'-6"	6'-7"
800S162-43	19'-7"	16'-0"	16'-8"	13'-7"	13'-4"	10'-10"	11'-5"	9'-4"
800S162-54	22'-9"	19'-11"	20'-7"	17'-11"	17'-10"	4'-9"	15'-6"	12'-7"
800S162-68	24'-7"	21'-6"	22'-2"	19'-5"	19'-3"	16'-10"	17'-5"	14'-8"
1000S162-43	22'-2"	18'-1"	18'-10"	15'-4"	15'-1"	12'-4"	12'-11"	10'-7"
1000S162-54	27'-1"	23'-8"	24'-6"	20'-9"	20'-5"	16'-8"	17'-6"	14'-3"
1000S162-68	29'-5"	25'-8"	26'-6"	23'-2"	23'-0"	19'-6"	20'-6"	16'-9"
1200S162-54	31'-3"	27'-0"	28'-1"	22'-11"	22'-6"	18'-4"	19'-4"	15'-9"
1200S162-68	34'-0"	29'-8"	30'-8"	26'-9"	26'-6"	21'-7"	22'-8"	18'-6"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

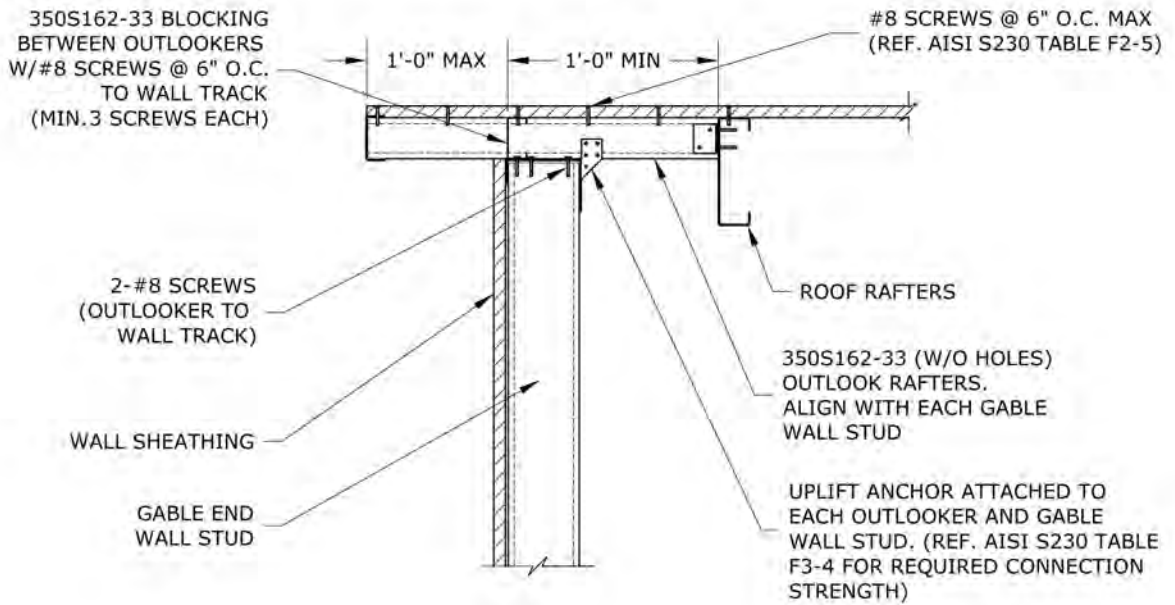
- a. Table provides maximum horizontal rafter spans in feet and inches for slopes between 3:12 and 12:12.
- b. Deflection criteria: $L/240$ for live loads and $L/180$ for total loads.
- c. Roof dead load = 12 psf.
- d. Grade 33 ksi steel is permitted to be used for 33 mil and 43 mil thicknesses. Grade 50 ksi steel shall be used for 54 and 68 mil thicknesses.

**TABLE R804.3.2.1(2)
ULTIMATE DESIGN WIND SPEED TO EQUIVALENT SNOW LOAD CONVERSION**

ULTIMATE WIND SPEED AND EXPOSURE		EQUIVALENT GROUND SNOW LOAD (psf)									
		Roof slope									
Exposure	Wind speed (mph)	3:12	4:12	5:12	6:12	7:12	8:12	9:12	10:12	11:12	12:12
B	115	20	20	20	20	20	20	20	20	20	20
	120	20	20	20	20	20	20	20	20	20	20
	130	20	20	20	20	20	20	20	20	20	20
	< 140	20	20	20	20	20	20	20	30	30	30
C	115	20	20	20	20	20	20	20	20	30	30
	120	20	20	20	20	20	20	20	30	30	50
	130	20	20	30	30	30	30	30	30	50	50
	< 140	30	30	50	50	30	30	50	50	50	50

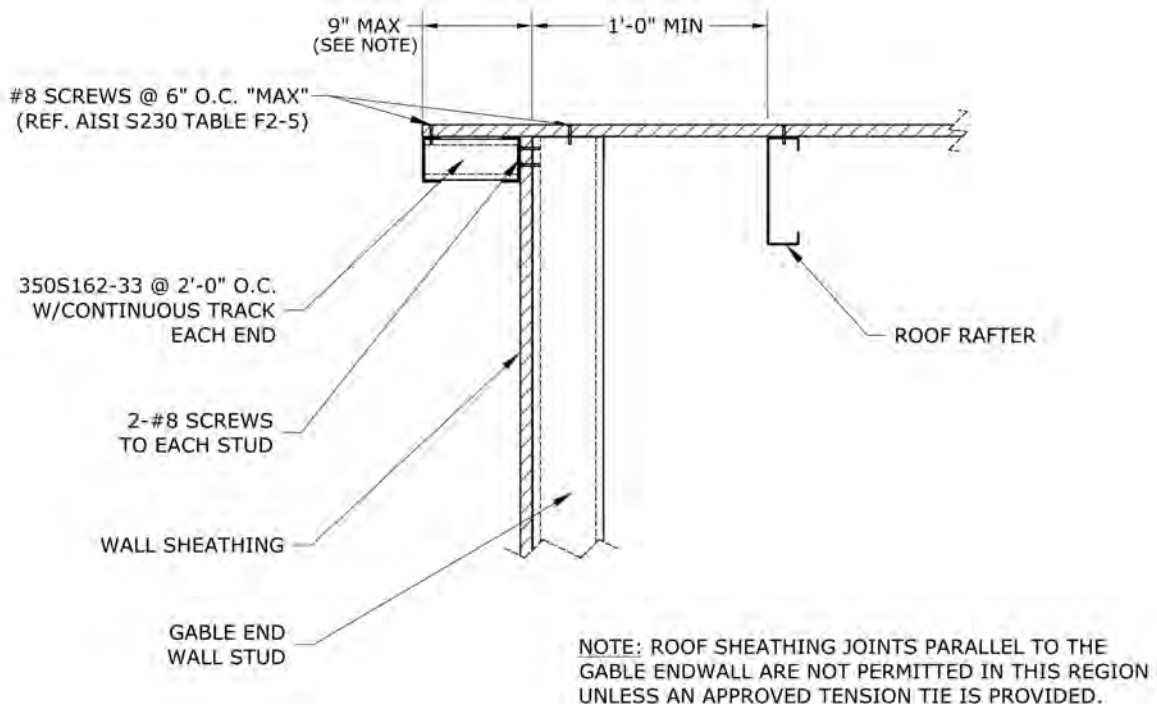
For SI: 1 mile per hour = 0.447 m/s, 1 pound per square foot = 0.0479 kPa.

OPTION #1



OPTION #2

(NOT APPLICABLE FOR WIND SPEEDS > 130 mph)



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 1.6 kph.

**FIGURE R804.3.2.1.2
GABLE ENDWALL OVERHANG DETAILS**

ROOF-CEILING CONSTRUCTION

R804.3.2.3 Roof rafter splice. Roof rafters shall not be spliced.

R804.3.2.4 Roof rafter to ceiling joist and ridge member connection. Roof rafters shall be connected to a parallel ceiling joist to form a continuous tie between exterior walls in accordance with Figure R804.3.1.1 and Table R804.3.1.1(3). Ceiling joists shall be connected to the top track of the load-bearing wall in accordance with Table R804.3, either with the required number of No. 10 screws applied through the flange of the ceiling joist or by using a 54-mil (1.37 mm) clip angle with the required number of No. 10 screws in each leg. Roof rafters shall be connected to a ridge member with a minimum 2-inch by 2-inch (51 mm by 51 mm) clip angle fastened with No. 10 screws to the ridge member in accordance with Figure R804.3.2.4 and Table R804.3.2.4. The clip angle shall have a steel thickness equivalent to or greater than the roof rafter thickness and shall extend the depth of the roof rafter member to the extent possible. The ridge member shall be fabricated from a C-shaped member and a track section that shall have a minimum size and steel thickness equivalent to or greater than that of adjacent roof rafters and shall be installed in accordance with Figure R804.3.2.4. The ridge member shall extend the full depth of the sloped roof rafter cut.

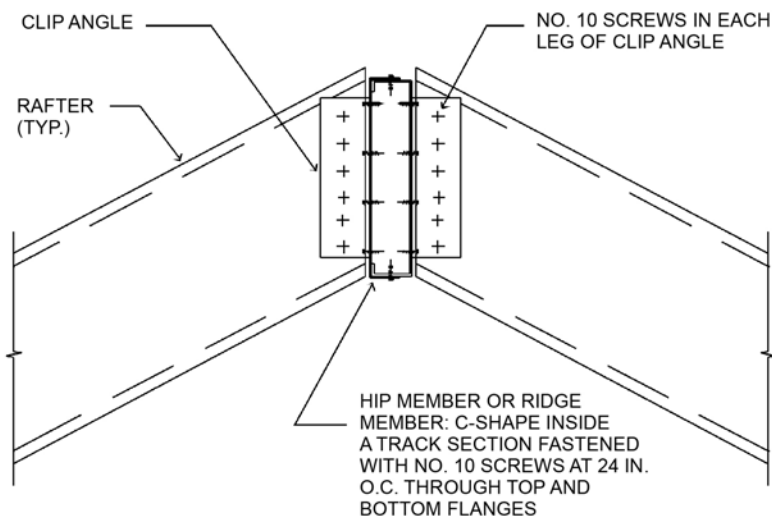
R804.3.2.5 Roof rafter bottom flange bracing. The bottom flanges of roof rafters shall be continuously braced, at a maximum spacing of 4 feet (1219 mm) as measured parallel to the roof rafters, with one of the following members:

1. Minimum 33-mil (0.84 mm) C-shaped member.
2. Minimum 33-mil (0.84 mm) track section.
3. Minimum 1½-inch by 33-mil (38 mm by 0.84 mm) steel strap.

The bracing element shall be fastened to the bottom flange of each roof rafter with one No. 8 screw and shall be fastened to blocking with two No. 8 screws. Blocking shall be installed between roof rafters in-line with the continuous bracing at a maximum spacing of 12 feet (3658 mm) measured perpendicular to the roof rafters. The ends of continuous bracing shall be fastened to blocking or anchored to a stable building component with two No. 8 screws.

R804.3.3 Cutting and notching. Flanges and lips of load-bearing, cold-formed steel roof framing members shall not be cut or notched.

R804.3.4 Headers. Roof-ceiling framing above wall openings shall be supported on headers. The allowable spans for headers in load-bearing walls shall not exceed the values set forth in Section R603.6 and Tables R603.6(1) through R603.6(6).



For SI: 1 inch = 25.4 mm.

**FIGURE R804.3.2.4
RIDGE MEMBER CONNECTION**

**TABLE R804.3.2.4
SCREWS REQUIRED AT EACH LEG OF CLIP ANGLE FOR ROOF RAFTER TO RIDGE MEMBER CONNECTION^a**

BUILDING WIDTH (feet)	NUMBER OF SCREWS			
	Ground snow load (psf)			
	0 to 20	21 to 30	31 to 50	51 to 70
24	2	2	3	4
28	2	3	4	5
32	2	3	4	5
36	3	3	5	6
40	3	4	5	7

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

a. Screws shall be No. 10 minimum.

R804.3.5 Framing of openings in roofs and ceilings.

Openings in roofs and ceilings shall be framed with header and trimmer joists. Header joist spans shall not exceed 4 feet (1219 mm) in length. Header and trimmer joists shall be fabricated from joist and track members having a minimum size and thickness equivalent to the adjacent ceiling joists or roof rafters and shall be installed in accordance with Figures R804.3.5(1) and R804.3.5(2). Each header joist shall be connected to trimmer joists with not less than four 2-inch by 2-inch (51 by 51 mm) clip angles. Each clip angle shall be fastened to both the header and trimmer joists with four No. 8 screws, evenly spaced, through each leg of the clip angle. The steel thickness of the clip angles shall be not less than that of the ceiling joist or roof rafter. Each track section for a built-up header or trimmer joist shall extend the full length of the joist (continuous).

R804.3.6 Roof trusses. Cold-formed steel trusses shall be designed and installed in accordance with AISI S230, Section F6. In the absence of specific bracing requirements, trusses shall be braced in accordance with accepted industry practices, such as the SBCA *Cold-Formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-Formed Steel Trusses*. Trusses shall be connected to the top track of the load-bearing wall in accordance with Table R804.3, either with the required number of No. 10 screws applied through the flange of the truss or by using a 54-mil (1.37 mm) clip angle with the required number of No. 10 screws in each leg.

R804.3.7 Ceiling and roof diaphragms. Ceiling and roof diaphragms shall be in accordance with this section.

R804.3.7.1 Ceiling diaphragms. At gable endwalls a ceiling diaphragm shall be provided by attaching a minimum 1/2-inch (12.7 mm) gypsum board or a minimum 3/8-inch (9.5 mm) wood structural panel sheathing, that complies with Section R803, to the

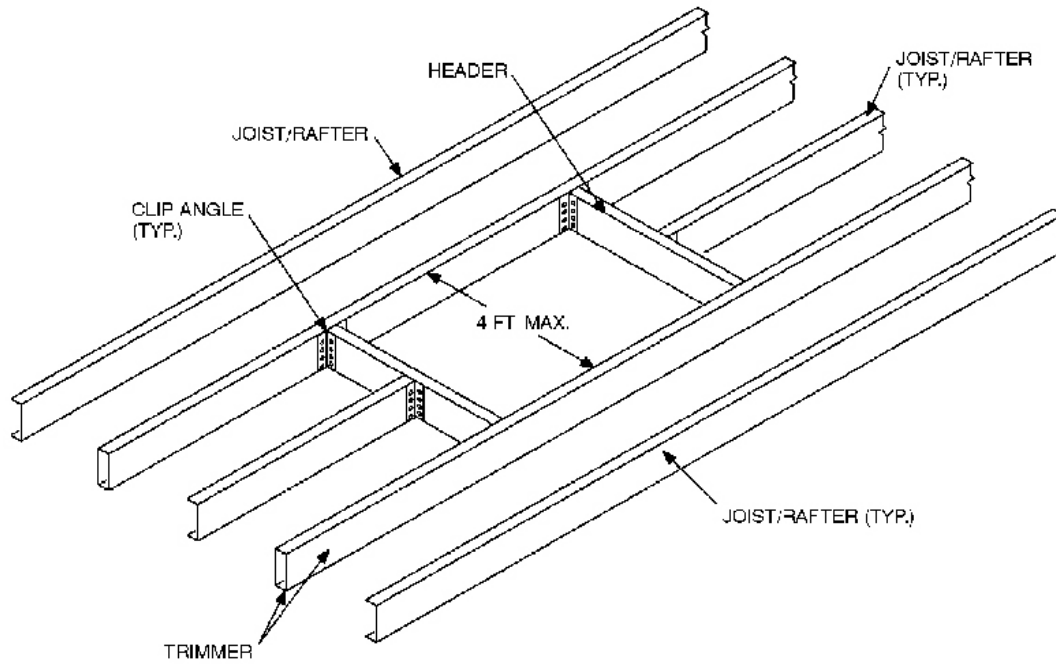
bottom of ceiling joists or roof trusses and connected to wall framing in accordance with Figures R804.3.7.1(1) and R804.3.7.1(2), unless studs are designed as full height without bracing at the ceiling. Flat blocking shall consist of C-shaped or track section with a minimum thickness of 33 mils (0.84 mm). For a gypsum board sheathed ceiling, the diaphragm length shall be in accordance with Table R804.3.7.1. For a wood structural panel sheathed ceiling, the diaphragm length shall be not less than 12 feet (3658 mm) for building widths less than 36 feet (10 973 mm), or not less than 14 feet (4267 mm) for building widths greater than or equal to 36 feet (10 973 mm).

The ceiling diaphragm shall be secured with screws spaced at a maximum 6 inches (152 mm) o.c. at panel edges and a maximum 12 inches (305 mm) o.c. in the field. The required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms shall be permitted to be multiplied by 0.35 if all panel edges are blocked. Multiplying the required lengths in Table R804.3.7.1 for gypsum board sheathed ceiling diaphragms by 0.9 shall be permitted if all panel edges are secured with screws spaced at 4 inches (102 mm) o.c.

R804.3.7.2 Roof diaphragm. A roof diaphragm shall be provided by attaching not less than 3/8-inch (9.5 mm) wood structural panel that complies with Section R803 to roof rafters or truss top chords in accordance with Table R804.3. Buildings with 3:1 or larger plan aspect ratio and with roof rafter slope (pitch) of 9:12 or larger shall have the roof rafters and ceiling joists blocked in accordance with Figure R804.3.7.2.

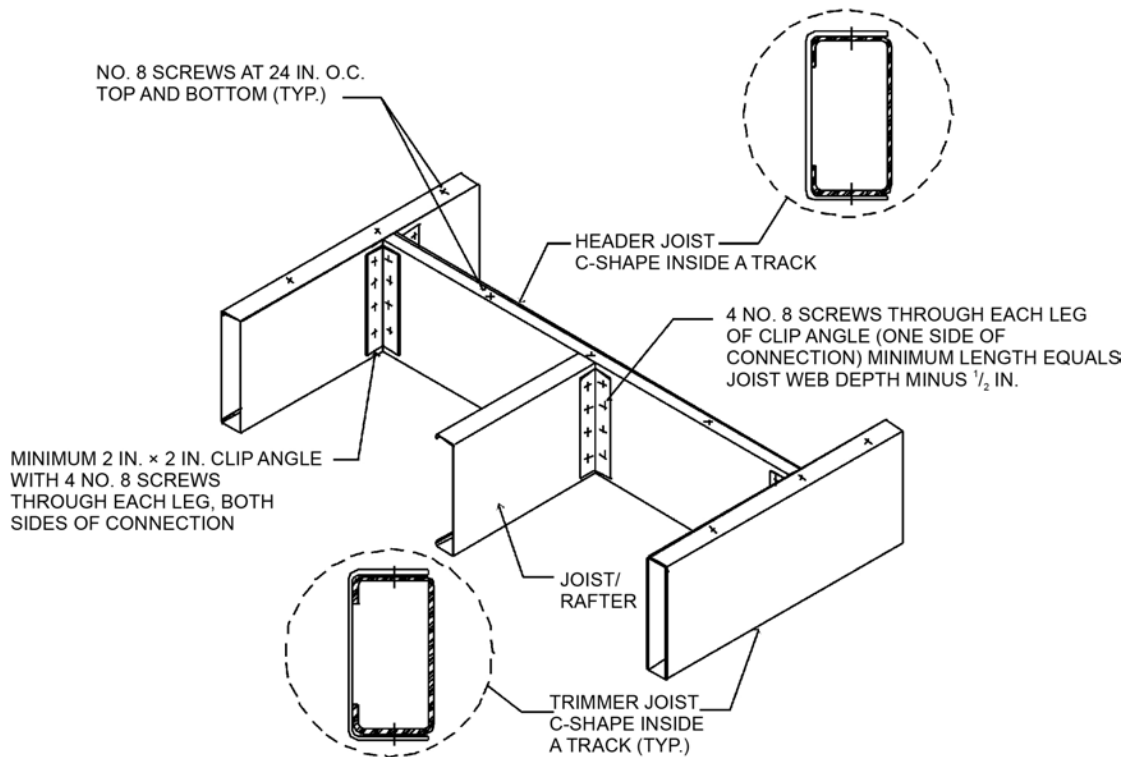
R804.3.8 Roof tie-down. Roof assemblies shall be connected to walls below in accordance with Table R804.3. A continuous load path shall be provided to transfer uplift loads to the foundation.

ROOF-CEILING CONSTRUCTION



For SI: 1 foot = 304.8 mm.

FIGURE R804.3.5(1)
ROOF OR CEILING OPENING



For SI: 1 inch = 25.4 mm.

FIGURE R804.3.5(2)
HEADER TO TRIMMER CONNECTION

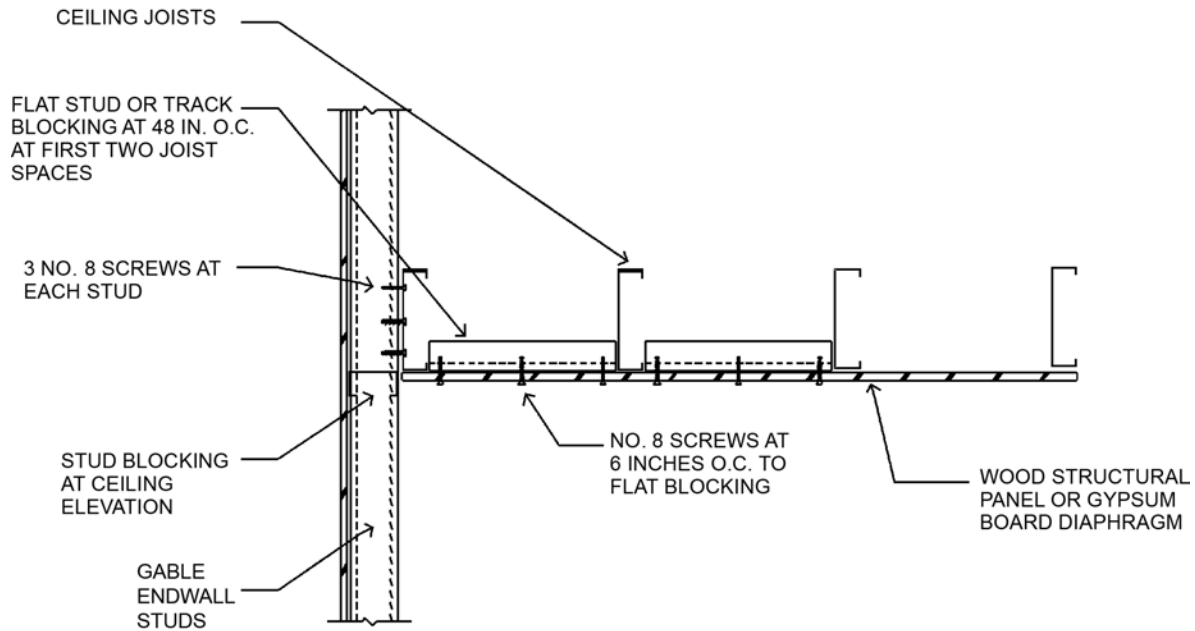
**TABLE R804.3.7.1
REQUIRED LENGTHS FOR CEILING DIAPHRAGMS AT GABLE
ENDWALLS GYPSUM BOARD SHEATHED, CEILING HEIGHT = 8 FEET^{a, b, c, d, e, f, g}**

EXPOSURE CATEGORY		ULTIMATE DESIGN WIND SPEED (mph)					
B		115	120	130	< 140	—	—
C		—	—	115	120	130	< 140
Roof pitch	Building endwall width (feet)	Minimum diaphragm length (feet)					
3:12 to 6:12	24–28	16	18	24	26	30	34
	> 28–32	20	20	26	32	34	40
	> 32–36	24	26	30	36	42	46
	> 36–40	26	28	36	40	48	52
6:12 to 9:12	> 24–28	20	20	26	30	34	38
	> 28–32	24	26	30	36	42	46
	> 32–36	26	30	38	42	48	54
	> 36–40	30	34	40	50	56	62
9:12 to 12:12	> 24–28	22	24	30	34	38	44
	> 28–32	26	28	36	40	46	52
	> 32–36	30	32	40	48	54	62
	> 36–40	36	38	48	56	64	72

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s, 1 foot = 304.8 mm, 1 mil = 0.0254 mm.

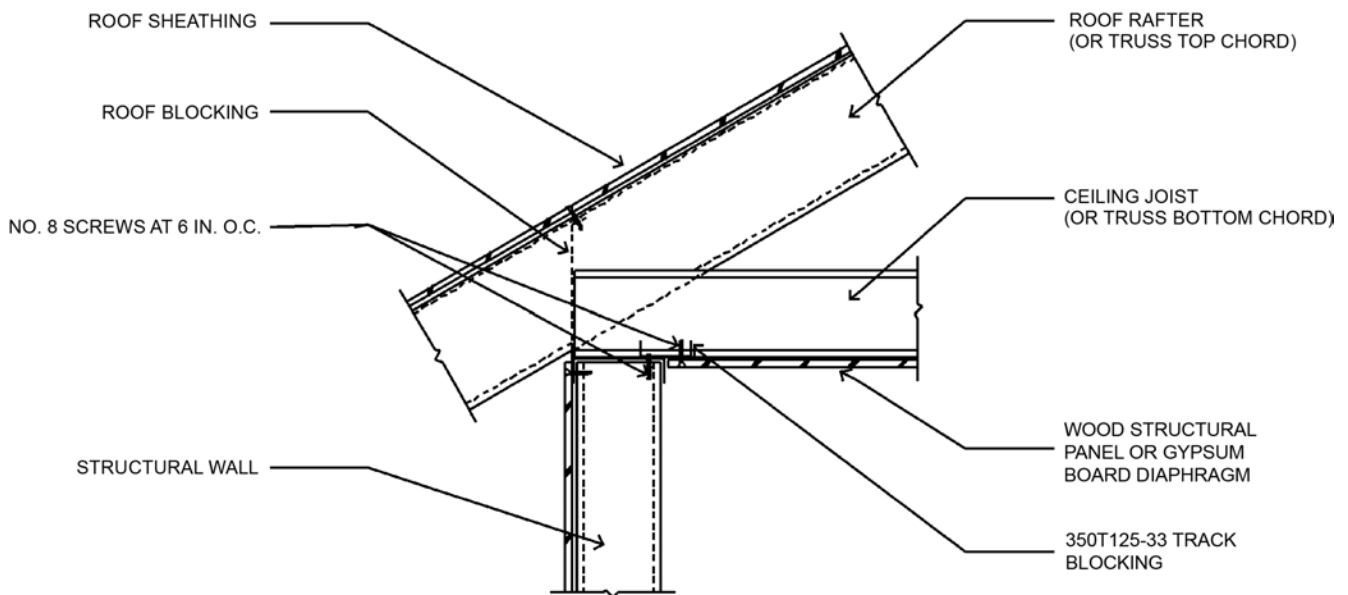
- a. Ceiling diaphragm is composed of 1/2-inch gypsum board (min. thickness) secured with screws spaced at 6 inches o.c. at panel edges and 12 inches o.c. infield. Use No. 8 screws (min.) where framing members have a designation thickness of 54 mils or less and No. 10 screws (min.) where framing members have a designation thickness greater than 54 mils.
- b. Maximum aspect ratio (length/width) of diaphragms is 2:1.
- c. Building width is in the direction of horizontal framing members supported by the wall studs.
- d. Required diaphragm lengths are to be provided at each end of the structure.
- e. Multiplying required diaphragm lengths by 0.35 is permitted if all panel edges are blocked.
- f. Multiplying required diaphragm lengths by 0.9 is permitted if all panel edges are secured with screws spaced at 4 inches o.c.
- g. To determine the minimum diaphragm length for buildings with ceiling heights of 9 feet or 10 feet values in this table shall be multiplied by 1.15.

ROOF-CEILING CONSTRUCTION



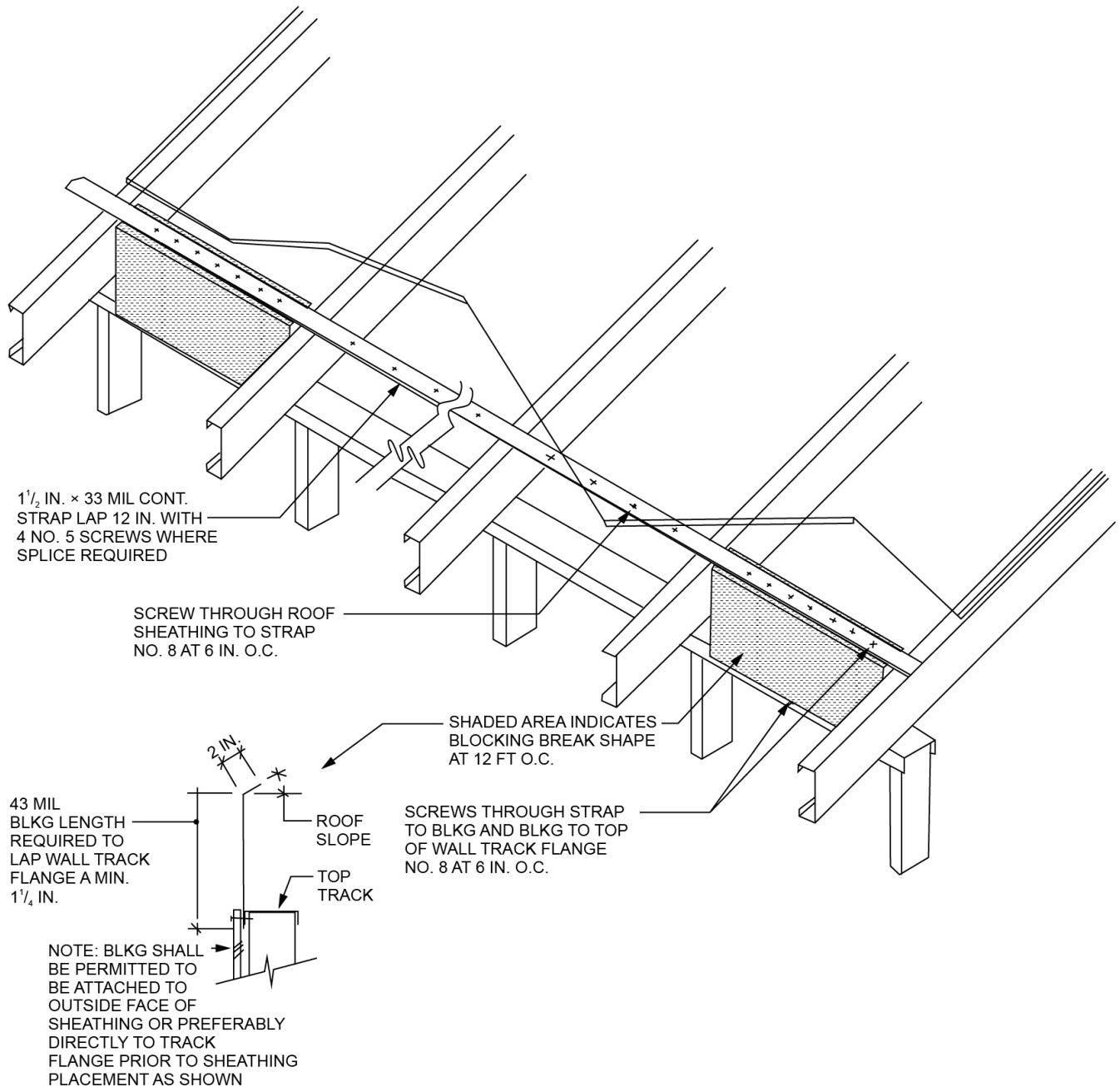
For SI: 1 inch = 25.4 mm.

**FIGURE R804.3.7.1(1)
CEILING DIAPHRAGM TO GABLE ENDWALL DETAIL**



For SI: 1 inch = 25.4 mm.

**FIGURE R804.3.7.1(2)
CEILING DIAPHRAGM TO SIDEWALL DETAIL**



For SI: 1 mil = 0.0254 mm, 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**FIGURE R804.3.7.2
ROOF BLOCKING DETAIL**

**SECTION R805
CEILING FINISHES**

R805.1 Ceiling installation. Ceilings shall be installed in accordance with the requirements for interior wall finishes as provided in Sections R702.1 through R702.6.

**SECTION R806
ROOF VENTILATION**

Note: The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Table R702.7(5).

R806.1 Ventilation required. Enclosed attics and enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters shall have cross ventilation for each separate space by ventilating openings protected against the entrance of rain or snow. Ventilation openings shall have a least dimension of $\frac{1}{16}$ inch (1.6 mm) minimum and $\frac{1}{4}$ inch (6.4 mm) maximum. Ventilation openings having a least dimension larger than $\frac{1}{4}$ inch (6.4 mm) shall be provided with corrosion-resistant wire cloth screening, hardware cloth, perforated vinyl or similar material with openings having a least dimension of $\frac{1}{16}$ inch (1.6 mm) minimum and $\frac{1}{4}$ inch (6.4 mm) maximum. Openings in roof framing members shall conform to the requirements of Section R802.7. Required ventilation openings shall open directly to the outside air and shall be protected to prevent the entry of birds, rodents, snakes and other similar creatures.

R806.1.1 Vents in the Wildland Urban Interface (WUI).

Where provided, ventilation openings for enclosed attics, gable ends, ridge ends, under eaves and cornices, enclosed eave soffit spaces, enclosed rafter spaces formed where ceilings are applied directly to the underside of roof rafters, underfloor ventilation, foundations and crawl spaces, or any other opening intended to permit ventilation, either in a horizontal or vertical plane, shall be in accordance with Sections R337.6.1 through R337.6.2 to resist building ignition from the intrusion of burning embers and flame through the ventilation openings.

R806.2 Minimum vent area. The minimum net free ventilation area shall be $\frac{1}{150}$ of the area of the vented space.

Exception: The minimum net free ventilation area shall be $\frac{1}{300}$ of the vented space provided both of the following conditions are met:

1. In Climate Zones 6, 7 and 8, a Class I or II vapor retarder is installed on the warm-in-winter side of the ceiling.
2. Not less than 40 percent and not more than 50 percent of the required ventilating area is provided by ventilators located in the upper portion of the attic or rafter space. Upper ventilators shall be located not more than 3 feet (914 mm) below the ridge or highest point of the space, measured vertically. The balance of the required ventilation provided shall be located in the bottom one-third of the attic space. Where the loca-

tion of wall or roof framing members conflicts with the installation of upper ventilators, installation more than 3 feet (914 mm) below the ridge or highest point of the space shall be permitted.

R806.3 Vent and insulation clearance. Where eave or cornice vents are installed, blocking, bridging and insulation shall not block the free flow of air. Not less than a 1-inch (25 mm) space shall be provided between the insulation and the roof sheathing and at the location of the vent.

R806.4 Installation and weather protection. Ventilators shall be installed in accordance with manufacturer's instructions. Installation of ventilators in roof systems shall be in accordance with the requirements of Section R903. Installation of ventilators in wall systems shall be in accordance with the requirements of Section R703.1.

R806.5 Unvented attic and unvented enclosed rafter assemblies. Unvented attics and unvented enclosed roof framing assemblies created by ceilings that are applied directly to the underside of the roof framing members and structural roof sheathing applied directly to the top of the roof framing members/rafters, shall be permitted where all the following conditions are met:

1. The unvented attic space is completely within the building thermal envelope.
2. Interior Class I vapor retarders are not installed on the ceiling side (attic floor) of the unvented attic assembly or on the ceiling side of the unvented enclosed roof framing assembly.
3. Where wood shingles or shakes are used, a minimum $\frac{1}{4}$ -inch (6.4 mm) vented airspace separates the shingles or shakes and the roofing underlayment above the structural sheathing.
4. In Climate Zones 5, 6, 7 and 8, any air-impermeable insulation shall be a Class II vapor retarder, or shall have a Class II vapor retarder coating or covering in direct contact with the underside of the insulation.
5. Insulation shall comply with Item 5.3 and either Item 5.1 or 5.2:
 - 5.1. Item 5.1.1, 5.1.2, 5.1.3 or 5.1.4 shall be met, depending on the air permeability of the insulation directly under the structural roof sheathing.
 - 5.1.1. Where only air-impermeable insulation is provided, it shall be applied in direct contact with the underside of the structural roof sheathing.
 - 5.1.2. Where air-permeable insulation is installed directly below the structural sheathing, rigid board or sheet insulation shall be installed directly above the structural roof sheathing in accordance with the R-values in Table R806.5 for condensation control.
 - 5.1.3. Where both air-impermeable and air-permeable insulation are provided, the air-impermeable insulation shall be applied in direct contact with the underside of the

structural roof sheathing in accordance with Item 5.1.1 and shall be in accordance with the R-values in Table R806.5 for condensation control. The air-permeable insulation shall be installed directly under the air-impermeable insulation.

- 5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

> 5.2. In Climate Zones 1, 2 and 3, air-permeable insulation installed in unvented attics shall meet the following requirements:

- 5.2.1. An approved vapor diffusion port shall be installed not more than 12 inches (305 mm) from the highest point of the roof, measured vertically from the highest point of the roof to the lower edge of the port.
- 5.2.2. The port area shall be greater than or equal to 1:600 of the ceiling area. Where there are multiple ports in the attic, the sum of the port areas shall be greater than or equal to the area requirement.
- 5.2.3. The vapor-permeable membrane in the vapor diffusion port shall have a vapor permeance rating of greater than or equal to 20 perms when tested in accordance with Procedure A of ASTM E96.
- 5.2.4. The vapor diffusion port shall serve as an air barrier between the attic and the exterior of the building.
- 5.2.5. The vapor diffusion port shall protect the attic against the entrance of rain and snow.
- 5.2.6. Framing members and blocking shall not block the free flow of water vapor to the port. Not less than a 2-inch (51 mm) space shall be provided between any blocking and the roof sheathing. Air-permeable insulation shall be permitted within that space.
- 5.2.7. The roof slope shall be greater than or equal to 3:12 (vertical/horizontal).

5.2.8. Where only air-permeable insulation is used, it shall be installed directly below the structural roof sheathing, on top of the attic floor, or on top of the ceiling.

5.2.9. Air-impermeable insulation, where used in conjunction with air-permeable insulation, shall be directly above or below the structural roof sheathing and is not required to meet the R-value in Table R806.5. Where directly below the structural roof sheathing, there shall be no space between the air-impermeable insulation and air-permeable insulation.

5.2.10. Where air-permeable insulation is used and is installed directly below the roof structural sheathing, air shall be supplied at a flow rate greater than or equal to 50 CFM (23.6 L/s) per 1,000 square feet (93 m²) of ceiling. The air shall be supplied from ductwork providing supply air to the occupiable space when the conditioning system is operating. Alternatively, the air shall be supplied by a supply fan when the conditioning system is operating.

Exceptions:

- 1. Where both air-impermeable and air-permeable insulation are used, and the R-value in Table 806.5 is met, air supply to the attic is not required.
- 2. Where only air-permeable insulation is used and is installed on top of the attic floor, or on top of the ceiling, air supply to the attic is not required.

5.3. Where preformed insulation board is used as the air-impermeable insulation layer, it shall be sealed at the perimeter of each individual sheet interior surface to form a continuous layer.

**SECTION R807
ATTIC ACCESS**

R807.1 Attic access. Buildings with combustible ceiling or roof construction shall have an attic access opening to attic areas that have a vertical height of 30 inches (762 mm) or greater over an area of not less than 30 square feet (2.8 m²). The vertical height shall be measured from the top of the ceiling framing members to the underside of the roof framing members.

The rough-framed opening shall be not less than 22 inches by 30 inches (559 mm by 762 mm) and shall be located in a hallway or other location with ready access. Where located in

ROOF-CEILING CONSTRUCTION

a wall, the opening shall be not less than 22 inches wide by 30 inches high (559 mm wide by 762 mm high). Where the access is located in a ceiling, minimum unobstructed head-room in the attic space shall be 30 inches (762 mm) at some point above the access measured vertically from the bottom of ceiling framing members. See *the California Mechanical Code* for access requirements where mechanical equipment is located in attics.

**TABLE R806.5
INSULATION FOR CONDENSATION CONTROL**

CLIMATE ZONE	MINIMUM RIGID BOARD ON AIR-IMPERMEABLE INSULATION R-VALUE ^{a, b}
2B and 3B tile roof only	0 (none required)
1, 2A, 2B, 3A, 3B, 3C	R-5
4C	R-10
4A, 4B	R-15
5	R-20
6	R-25
7	R-30
8	R-35

- a. Contributes to but does not supersede requirements.
- b. Alternatively, sufficient continuous insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 9 – ROOF ASSEMBLIES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R901.1			X																			
R902.1 - R902.4			X																			
R903.4.1				X																		
R904.1 - R904.4			X																			
R905.16				X																		
R905.17				X																		
R907.1				X																		
<i>R907.2 – R907.5</i>			X																			

The state agency does not adopt sections identified with the following symbol: †

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CHAPTER 9

ROOF ASSEMBLIES

User note:

About this chapter: Chapter 9 addresses the design and construction of roof assemblies. A roof assembly includes the roof deck, substrate or thermal barrier, insulation, vapor retarder and roof covering. This chapter provides the requirement for wind resistance of roof coverings. The types of roof covering materials and installation addressed by Chapter 9 are: asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shakes and shingles, built-up roofs, metal roof panels, modified bitumen roofing, thermoset and thermoplastic single-ply roofing, sprayed polyurethane foam roofing, liquid applied coatings and photovoltaic shingles. Chapter 9 also provides requirements for roof drainage, flashing, above-deck thermal insulation, rooftop-mounted photovoltaic systems and recovering or replacing an existing roof covering.

SECTION R901 GENERAL

R901.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies.

SECTION R902 FIRE CLASSIFICATION

R902.1 Roof covering materials. Roofs shall be covered with materials as set forth in Sections R904 and R905. A minimum Class A, B or C roofing shall be installed in areas designated by this section or where the edge of the roof is less than 3 feet (914 mm) from a lot line. Class A, B and C roofing required by this section to be listed shall be tested in accordance with ASTM E108 or UL 790.

Exceptions:

1. Class A roof assemblies include those with coverings of brick, masonry and exposed concrete roof deck.
2. Class A roof assemblies include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile, or slate installed on noncombustible decks.
3. Class A roof assemblies include minimum 16 ounces per square foot (4.882 kg/m²) copper sheets installed over combustible decks.
4. Class A roof assemblies include slate installed over underlayment over combustible decks.

> **R902.1.1 Roof coverings within fire hazard severity zones.** The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class A.

Exception: The requirements shall not apply in any jurisdiction that adopts the model ordinance approved by the State Fire Marshal pursuant to Section 51189 of the Government Code or an ordinance that substantially conforms to the model ordinance and transmits a copy to the State Fire Marshal.

R902.1.2 Roof coverings in all other areas. The entire roof covering of every existing structure where more than 50 percent of the total roof area is replaced within any one-year period, the entire roof covering of every new structure, and any roof covering applied in the alteration, repair or replacement of the roof of every existing structure, shall be a fire-retardant roof covering that is at least Class C.

R902.1.3 Roofing requirements a wildland-urban interface fire area. Roofing requirements for structures located in a wildland-urban interface fire area shall also comply with Section R337.5.

R902.2 Fire-retardant-treated shingles and shakes. Fire-retardant-treated wood shakes and shingles are wood shakes and shingles complying with UBC Standard 15-3 or 15-4 which are impregnated by the full-cell vacuum-pressure process with fire-retardant chemicals, and which have been qualified by UBC Standard 15-2 for use on Class A, B or C roofs. Fire-retardant-treated wood shakes and shingles shall comply with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7 (j). Each bundle shall bear labels from an ICBO accredited quality control agency identifying their roof-covering classification and indicating their compliance with ICC-ES EG107 and with the weathering requirements contained in Health and Safety Code Section 13132.7 (j).

Health and Safety Code Section 13132.7 (j) No wood roof covering materials shall be sold or applied in this state unless both of the following conditions are met:

- (1) The materials have been approved and listed by the State Fire Marshal as complying with the requirements of this section.
- (2) The materials have passed at least five years of the 10-year natural weathering test. The 10-year natural weathering test required by this subdivision shall be conducted in accordance with Standard 15-2 of the 1994 edition of the Uniform Building Code at a testing facility recognized by the State Fire Marshal.

R902.3 Building-integrated photovoltaic product. Building-integrated photovoltaic (BIPV) products installed as the roof covering shall be tested, listed and labeled for fire classification in accordance with UL 7103 [SFM] Section R902.1 through R902.1.3. Class A, B or C BIPV products shall be

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installed where the edge of the roof is less than 3 feet (914 mm) from a lot line.

R902.4 Rooftop-mounted photovoltaic (PV) panel systems. Rooftop-mounted photovoltaic (PV) panel systems installed on or above the roof covering shall be tested, listed and identified with a fire classification in accordance with UL 2703. *Listed systems shall be installed in accordance with the manufacturer's installation instructions and their listing.* Class A, B or C photovoltaic panel systems and modules shall be installed in jurisdictions designated by law as requiring their use or where the edge of the roof is less than 3 feet (914 mm) from a lot line.

SECTION R903 WEATHER PROTECTION

R903.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof assemblies shall be designed and installed in accordance with this code and the approved manufacturer's instructions such that the roof assembly shall serve to protect the building or structure.

R903.2 Flashing. Flashings shall be installed in a manner that prevents moisture from entering the wall and roof through joints in copings, through moisture permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

R903.2.1 Locations. Flashings shall be installed at wall and roof intersections, wherever there is a change in roof slope or direction and around roof openings. A flashing shall be installed to divert the water away from where the eave of a sloped roof intersects a vertical sidewall. Where flashing is of metal, the metal shall be corrosion resistant with a thickness of not less than 0.019 inch (0.5 mm) (No. 26 galvanized sheet).

R903.2.2 Crickets and saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration more than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Unit skylights installed in accordance with Section R308.6 and flashed in accordance with the manufacturer's instructions shall be permitted to be installed without a cricket or saddle.

R903.3 Coping. Parapet walls shall be properly coped with noncombustible, weatherproof materials of a width not less than the thickness of the parapet wall.

R903.4 Roof drainage. Unless roofs are sloped to drain over roof edges, roof drains shall be installed at each low point of the roof.

R903.4.1 Secondary (emergency overflow) drains or scuppers. Where roof drains are required, secondary emergency overflow roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be

entrapped if the primary drains allow buildup for any reason. Overflow drains having the same size as the roof drains shall be installed with the inlet flow line located 2 inches (51 mm) above the low point of the roof, or overflow scuppers having three times the size of the roof drains and having a minimum opening height of 4 inches (102 mm) shall be installed in the adjacent parapet walls with the inlet flow located 2 inches (51 mm) above the low point of the roof served. The installation and sizing of overflow drains, leaders and conductors shall comply with Sections 1106 and 1108 of the *California Plumbing Code*, as applicable.

SECTION R904 MATERIALS

R904.1 Scope. The requirements set forth in this section shall apply to the application of roof covering materials specified herein. Roof assemblies shall be applied in accordance with this chapter and the manufacturer's installation instructions. Installation of roof assemblies shall comply with the applicable provisions of Section R905.

R904.2 Compatibility of materials. Roof assemblies shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

R904.3 Material specifications and physical characteristics. Roof covering materials shall conform to the applicable standards listed in this chapter.

R904.4 Product identification. Roof covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required. Bulk shipments of materials shall be accompanied by the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

SECTION R905 REQUIREMENTS FOR ROOF COVERINGS

R905.1 Roof covering application. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions. Unless otherwise specified in this section, roof coverings shall be installed to resist the component and cladding loads specified in Table R301.2.1(1), adjusted for height and exposure in accordance with Table R301.2.1(2).

R905.1.1 Underlayment. Underlayment for asphalt shingles, clay and concrete tile, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles, wood shakes, metal roof panels and photovoltaic shingles shall conform to the applicable standards listed in this chapter. Underlayment materials required to comply with ASTM D226, D1970, D4869 and D6757 shall bear a label indicating compliance to the standard designation and, if applicable, type classification indicated in Table R905.1.1(1). Underlayment shall be applied in accordance with Table R905.1.1(2). Under-

layment shall be attached in accordance with Table R905.1.1(3).

Exceptions:

1. As an alternative, self-adhering polymer-modified bitumen underlayment bearing a label indicating compliance with ASTM D1970 and installed in accordance with both the underlayment manufacturer's and roof covering manufacturer's instructions for the deck material, roof ventilation configuration and climate exposure for the roof covering to be installed, shall be permitted.
2. As an alternative, a minimum 4-inch-wide (102 mm) strip of self-adhering polymer-modified bitumen membrane bearing a label indicating compliance with ASTM D1970, installed in accordance with the manufacturer's installation instructions for the deck material, shall be applied over all joints in the roof decking. An approved underlayment complying with Table R905.1.1(1) for the applicable roof covering for areas where wind design is not required in accordance with Figure R301.2.1.1 shall be applied over the entire roof over the 4-inch-wide (102 mm) membrane strips. Underlayment shall be

applied in accordance with Table R905.1.1(2) using the application requirements for areas where wind design is not required in accordance with Figure R301.2.1.1. Underlayment shall be attached in accordance with Table R905.1.1(3).

R905.1.2 Ice barriers. In areas where there has been a history of ice forming along the eaves causing a backup of water as designated in Table R301.2, an ice barrier shall be installed for asphalt shingles, metal roof shingles, mineral-surfaced roll roofing, slate and slate-type shingles, wood shingles and wood shakes. The ice barrier shall consist of not fewer than two layers of underlayment cemented together, or a self-adhering polymer-modified bitumen sheet shall be used in place of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the exterior wall line of the building. On roofs with slope equal to or greater than 8 units vertical in 12 units horizontal (67-percent slope), the ice barrier shall also be applied not less than 36 inches (914 mm) measured along the roof slope from the eave edge of the building.

Exception: Detached accessory structures not containing conditioned floor area.

**TABLE R905.1.1(1)
UNDERLAYMENT TYPES**

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D226 Type II ASTM D4869 Type III or Type IV
Clay and concrete tile	R905.3	ASTM D226 Type II ASTM D2626 Type I ASTM D6380 Class M mineral-surfaced roll roofing	ASTM D226 Type II
Metal roof shingles	R905.4	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Mineral-surfaced roll roofing	R905.5	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Slate and slate-type shingles	R905.6	ASTM D226 Type I ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Wood shingles	R905.7	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Wood shakes	R905.8	ASTM D226 Type I or II ASTM D4869 Type I, II, III or IV	ASTM D226 Type II ASTM D4869 Type III or Type IV
Metal panels	R905.10	Manufacturer's instructions	ASTM D226 Type II ASTM D4869 Type III or Type IV
Photovoltaic shingles	R905.16	ASTM D4869 Type I, II, III or IV ASTM D6757	ASTM D4869 Type III or Type IV

For SI: 1 mile per hour = 0.447 m/s.

**TABLE R905.1.1(2)
UNDERLAYMENT APPLICATION**

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.
Clay and concrete tile	R905.3	For roof slopes from 2 ¹ / ₂ units vertical in 12 units horizontal (2 ¹ / ₂ :12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be not fewer than two layers applied as follows: starting at the eave, apply a 19-inch strip of underlayment parallel with the eave. Starting at the eave, apply 36-inch-wide strips of underlayment felt, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be not fewer than one layer of underlayment felt applied shingle fashion, parallel to and starting from the eaves and lapped 2 inches. End laps shall be 4 inches and shall be offset by 6 feet.	Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.
Metal roof shingles	R905.4	Apply in accordance with the manufacturer's installation instructions.	Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. End laps shall be 4 inches and shall be offset by 6 feet.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		
Photovoltaic shingles	R905.16	For roof slopes from 2 units vertical in 12 units horizontal (2:12), up to 4 units vertical in 12 units horizontal (4:12), underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet. For roof slopes of 4 units vertical in 12 units horizontal (4:12) or greater, underlayment shall be one layer applied in the following manner: underlayment shall be applied shingle fashion, parallel to and starting from the eave and lapped 2 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.	Underlayment shall be two layers applied in the following manner: apply a 19-inch strip of underlayment felt parallel to and starting at the eaves. Starting at the eave, apply 36-inch-wide sheets of underlayment, overlapping successive sheets 19 inches. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. End laps shall be 4 inches and shall be offset by 6 feet.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

**TABLE R905.1.1(3)
UNDERLAYMENT APPLICATION**

ROOF COVERING	SECTION	AREAS WHERE WIND DESIGN IS NOT REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1	AREAS WHERE WIND DESIGN IS REQUIRED IN ACCORDANCE WITH FIGURE R301.2.1.1
Asphalt shingles	R905.2	Fastened sufficiently to hold in place	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing.
Clay and concrete tile	R905.3		
Photovoltaic	R905.16		
Metal roof shingles	R905.4	Manufacturer's installation instructions.	The underlayment shall be attached with corrosion-resistant fasteners in a grid pattern of 12 inches between side laps with a 6-inch spacing at side and end laps. Underlayment shall be attached using annular ring or deformed shank nails with 1-inch-diameter metal or plastic caps. Metal caps shall have a thickness of not less than 32-gage sheet metal. Power-driven metal caps shall have a minimum thickness of 0.010 inch. Minimum thickness of the outside edge of plastic caps shall be 0.035 inch. The cap nail shank shall be not less than 0.083 inch. The cap nail shank shall have a length sufficient to penetrate through the roof sheathing or not less than 3/4 inch into the roof sheathing.
Mineral-surfaced roll roofing	R905.5		
Slate and slate-type shingles	R905.6		
Wood shingles	R905.7		
Wood shakes	R905.8		
Metal panels	R905.10		

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

**TABLE R905.2.4.1
CLASSIFICATION OF ASPHALT ROOF SHINGLES**

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM Figure R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3 (mph)	ASTM D7158 ^a SHINGLE CLASSIFICATION	ASTM D3161 SHINGLE CLASSIFICATION
110	85	D, G or H	A, D or F
116	90	D, G or H	A, D or F
129	100	G or H	A, D or F
142	110	G or H	F
155	120	G or H	F
168	130	H	F
181	140	H	F
194	150	H	F

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

a. The standard calculations contained in ASTM D7158 assume Exposure Category B or C and a building height of 60 feet or less. Additional calculations are required for conditions outside of these assumptions.

R905.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

R905.2.1 Sheathing requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

R905.2.2 Slope. Asphalt shingles shall be used only on roof slopes of 2 units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from 2 units vertical in 12 units horizontal (17-percent slope) up to 4 units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section R905.1.1.

R905.2.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.2.4 Asphalt shingles. Asphalt shingles shall comply with ASTM D3462.

R905.2.4.1 Wind resistance of asphalt shingles. Asphalt shingles shall be tested in accordance with ASTM D7158. Asphalt shingles shall meet the classification requirements of Table R905.2.4.1 for the appropriate ultimate design wind speed. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D7158 and the required classification in Table R905.2.4.1.

Exception: Asphalt shingles not included in the scope of ASTM D7158 shall be tested and labeled in accordance with ASTM D3161. Asphalt shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table R905.2.4.1.

R905.2.5 Fasteners. Fasteners for asphalt shingles shall be galvanized steel, stainless steel, aluminum or copper roofing nails, minimum 12-gage [0.105 inch (3 mm)] shank with a minimum ³/₈-inch-diameter (9.5 mm) head, complying with ASTM F1667, of a length to penetrate through the roofing materials and not less than ³/₄ inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than ³/₄ inch (19.1 mm) thick, the fasteners shall penetrate through the sheathing.

R905.2.6 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer’s approved installation instructions, but not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12, 175-percent slope), shingles shall be installed in accordance with the manufacturer’s approved installation instructions.

R905.2.7 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.2.8 Flashing. Flashing for asphalt shingles shall comply with this section and the asphalt shingle manufacturer’s approved installation instructions.

R905.2.8.1 Base and cap flashing. Base and cap flashing shall be installed in accordance with manufacturer’s instructions. Base flashing shall be of either corrosion-resistant metal of minimum nominal 0.019-inch (0.5 mm) thickness or mineral-surfaced roll roofing weighing not less than 77 pounds per 100 square feet (4 kg/m²). Cap flashing shall be corrosion-resistant metal of minimum nominal 0.019-inch (0.5 mm) thickness.

R905.2.8.2 Valleys. Valley linings shall be installed in accordance with the manufacturer’s instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys (valley lining exposed) lined with metal, the valley lining shall be not less than 24 inches (610 mm) wide and of any of the corrosion-resistant metals in Table R905.2.8.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing, complying with ASTM D3909 or ASTM D6380 Class M, shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer not less than 36 inches (914 mm) wide.
3. For closed valleys (valley covered with shingles), valley lining of one ply of smooth roll roofing complying with ASTM D6380 and not less than 36 inches wide (914 mm) or valley lining as

**TABLE R905.2.8.2
VALLEY LINING MATERIAL**

MATERIAL	MINIMUM THICKNESS (inches)	GAGE	WEIGHT (pounds)
Aluminum	0.024	—	—
Cold-rolled copper	0.0216 nominal	—	ASTM B370, 16 oz. per square foot
Galvanized steel	0.0179	26 (zinc coated G90)	—
High-yield copper	0.0162 nominal	—	ASTM B370, 12 oz. per square foot
Lead	—	—	2 ¹ / ₂
Lead-coated copper	0.0216 nominal	—	ASTM B101, 16 oz. per square foot
Lead-coated high-yield copper	0.0162 nominal	—	ASTM B101, 12 oz. per square foot
Painted terne	—	—	20
Stainless steel	—	28	—
Zinc alloy	0.027	—	—

For SI: 1 inch = 25.4 mm, 1 pound = 0.454 kg, 1 square foot = 0.93 m².

described in Item 1 or 2 shall be permitted. Self-adhering polymer-modified bitumen underlayment complying with ASTM D1970 shall be permitted in lieu of the lining material.

R905.2.8.3 Sidewall flashing. Base flashing against a vertical sidewall shall be continuous or step flashing and shall be not less than 4 inches (102 mm) in height and 4 inches (102 mm) in width and shall direct water away from the vertical sidewall onto the roof or into the gutter. Where siding is provided on the vertical sidewall, the vertical leg of the flashing shall be continuous under the siding. Where anchored masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and counterflashing shall be provided in accordance with Section R703.8.2.2. Where exterior plaster or adhered masonry veneer is provided on the vertical sidewall, the base flashing shall be provided in accordance with this section and Section R703.6.3.

R905.2.8.4 Other flashing. Flashing against a vertical front wall, as well as soil stack, vent pipe and chimney flashing, shall be applied in accordance with the asphalt shingle manufacturer’s printed instructions.

R905.2.8.5 Drip edge. A drip edge shall be provided at eaves and rake edges of shingle roofs. Adjacent segments of drip edge shall be overlapped not less than 2 inches (51 mm). Drip edges shall extend not less than 1/4 inch (6.4 mm) below the roof sheathing and extend up back onto the roof deck not less than 2 inches (51 mm). Drip edges shall be mechanically fastened to the roof deck at not more than 12 inches (305 mm) o.c. with fasteners as specified in Section R905.2.5. Underlayment shall be installed over the drip edge along eaves and under the drip edge along rake edges.

R905.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

R905.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing.

Exception: Spaced lumber sheathing in accordance with Section R803.1 shall be permitted in Seismic Design Categories A, B and C.

R905.3.2 Deck slope. Clay and concrete roof tile shall be installed on roof slopes of 2 1/2 units vertical in 12 units horizontal (25-percent slope) or greater. For roof slopes from 2 1/2 units vertical in 12 units horizontal (25-percent slope) to 4 units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section R905.3.3.

R905.3.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.3.4 Clay tile. Clay roof tile shall comply with ASTM C1167.

R905.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C1492.

R905.3.6 Fasteners. Nails shall be corrosion resistant and not less than 11-gage [0.120 inch (3 mm)], 5/16-inch (11

mm) head, and of sufficient length to penetrate the deck not less than 3/4 inch (19 mm) or through the thickness of the deck, whichever is less. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2 mm). Perimeter fastening areas include three tile courses but not less than 36 inches (914 mm) from either side of hips or ridges and edges of eaves and gable rakes.

R905.3.7 Application. Tile shall be applied in accordance with this chapter and the manufacturer’s installation instructions, based on the following:

1. Climatic conditions.
2. Roof slope.
3. Underlayment system.
4. Type of tile being installed.

Clay and concrete roof tiles shall be fastened in accordance with this section and the manufacturer’s installation instructions. Perimeter tiles shall be fastened with not less than one fastener per tile. Tiles with installed weight less than 9 pounds per square foot (0.4 kg/m²) require not less than one fastener per tile regardless of roof slope. Clay and concrete roof tile attachment shall be in accordance with the manufacturer’s installation instructions where applied in areas where the ultimate design wind speed exceeds 130 miles per hour (58 m/s) and on buildings where the roof is located more than 40 feet (12 192 mm) above grade. In areas subject to snow, not less than two fasteners per tile are required. In other areas, clay and concrete roof tiles shall be attached in accordance with Table R905.3.7.

**TABLE R905.3.7
CLAY AND CONCRETE TILE ATTACHMENT**

SHEATHING	ROOF SLOPE	NUMBER OF FASTENERS
Solid without battens	All	One per tile
Spaced or solid with battens and slope < 5:12	Fasteners not required	—
Spaced sheathing without battens	5:12 ≤ slope < 12:12	One per tile/ every other row
	12:12 ≤ slope < 24:12	One per tile

R905.3.8 Flashing. At the juncture of roof vertical surfaces, flashing and counterflashing shall be provided in accordance with this chapter and the manufacturer’s installation instructions and, where of metal, shall be not less than 0.019 inch (0.5 mm) (No. 26 galvanized sheet gage) corrosion-resistant metal. The valley flashing shall extend not less than 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) in height at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of 3 units vertical in 12 units horizontal (25-percent slope) and greater, valley flashing shall have a 36-inch-wide (914 mm) underlayment of one layer of Type I underlayment running the full length of the valley, in addition to

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other required underlayment. In areas where the average daily temperature in January is 25°F (-4°C) or less, metal valley flashing underlayment shall be solid-cemented to the roofing underlayment for slopes less than 7 units vertical in 12 units horizontal (58-percent slope) or be of self-adhering polymer-modified bitumen sheet.

R905.4 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

R905.4.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

R905.4.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below 3 units vertical in 12 units horizontal (25-percent slope).

R905.4.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.4.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.4.4 Material standards. Metal roof shingle roof coverings shall comply with Table R905.10.3(1). The materials used for metal roof shingle roof coverings shall be naturally corrosion resistant or be made corrosion resistant in accordance with the standards and minimum thicknesses listed in Table R905.10.3(2).

R905.4.4.1 Wind resistance of metal roof shingles. Metal roof shingles applied to a solid or closely fitted deck shall be tested in accordance with ASTM D3161, FM 4474, UL 580 or UL 1897. Metal roof shingles tested in accordance with ASTM D3161 shall meet the classification requirements of Table R905.4.4.1 for the appropriate maximum basic wind speed and the metal shingle packaging shall bear a label to indicate compliance with ASTM D3161 and the required classification in Table R905.2.4.1.

R905.4.5 Application. Metal roof shingles shall be secured to the roof in accordance with this chapter and the approved manufacturer's installation instructions.

R905.4.6 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table R905.10.3(1). The valley flashing shall extend not less than 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than $\frac{3}{4}$ inch (19 mm) in height at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). The metal valley flashing shall have a 36-inch-wide (914 mm) underlayment directly under it consisting of one layer of underlayment running the full length of the valley, in addition to underlayment required for metal roof shingles. In areas where the average daily temperature in January is 25°F (-4°C) or less, the metal valley flashing underlayment shall be solid-cemented to the roofing underlayment for roof slopes under 7 units vertical in 12 units horizontal (58-percent slope) or self-adhering polymer-modified bitumen sheet.

R905.5 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

R905.5.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

R905.5.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below 1 unit vertical in 12 units horizontal (8-percent slope).

R905.5.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.5.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.5.4 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D3909 or ASTM D6380, Class M.

R905.5.5 Application. Mineral-surfaced roll roofing shall be installed in accordance with this chapter and the manufacturer's instructions.

R905.6 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

TABLE R905.4.4.1
CLASSIFICATION OF STEEP SLOPE METAL ROOF SHINGLES TESTED IN ACCORDANCE WITH ASTM D3161

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM FIGURE R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3 (mph)	ASTM D3161 SHINGLE CLASSIFICATION
110	85	A, D or F
116	90	A, D or F
129	100	A, D or F
142	110	F
155	120	F
168	130	F
181	140	F
194	150	F

For SI: 1 mile per hour = 1.609 kph.

R905.6.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

R905.6.2 Deck slope. Slate shingles shall be used only on slopes of 4 units vertical in 12 units horizontal (33-percent slope) or greater.

R905.6.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.6.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.6.4 Material standards. Slate shingles shall comply with ASTM C406.

R905.6.5 Application. Minimum headlap for slate shingles shall be in accordance with Table R905.6.5. Slate shingles shall be secured to the roof with two fasteners per slate. Slate shingles shall be installed in accordance with this chapter and the manufacturer’s instructions.

**TABLE R905.6.5
SLATE SHINGLE HEADLAP**

SLOPE	HEADLAP (inches)
4:12 ≤ slope < 8:12	4
8:12 ≤ slope < 20:12	3
Slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm.

R905.6.6 Flashing. Flashing and counterflashing shall be made with sheet metal. Valley flashing shall be not less than 15 inches (381 mm) wide. Valley and flashing metal shall be a minimum uncoated thickness of 0.0179-inch (0.5 mm) zinc coated G90. Chimneys, stucco or brick walls shall have not less than two plies of felt for a cap flashing consisting of a 4-inch-wide (102 mm) strip of felt set in plastic cement and extending 1 inch (25 mm) above the first felt and a top coating of plastic cement. The felt shall extend 2 inches (51 mm) over the base flashing.

R905.7 Wood shingles. The installation of wood shingles shall comply with the provisions of this section.

R905.7.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

R905.7.1.1 Solid sheathing required. In areas where the average daily temperature in January is 25°F (-4°C) or less, solid sheathing is required on that portion of the roof requiring the application of an ice barrier.

R905.7.2 Deck slope. Wood shingles shall be installed on slopes of 3 units vertical in 12 units horizontal (25-percent slope) or greater.

R905.7.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.7.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.7.4 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table R905.7.4.

**TABLE R905.7.4
WOOD SHINGLE MATERIAL REQUIREMENTS**

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

R905.7.5 Application. Wood shingles shall be installed in accordance with this chapter and the manufacturer’s instructions. Wood shingles shall be laid with a side lap not less than 1½ inches (38 mm) between joints in courses, and two joints shall not be in direct alignment in any three adjacent courses. Spacing between shingles shall be not less than ¼ inch to ⅜ inch (6.4 mm to 9.5 mm). Weather exposure for wood shingles shall not exceed those set in Table R905.7.5(1). Fasteners for untreated (naturally durable) wood shingles shall be box nails in accordance with Table R905.7.5(2). Nails shall be stainless steel Type 304 or 316 or hot-dipped galvanized with a coating weight of ASTM A153 Class D (1.0 oz/ft²). Alternatively, two 16-gage stainless steel Type 304 or 316 staples with crown widths 7/16 inch (11.1 mm) minimum, ¾ inch (19.1 mm) maximum, shall be used. Fasteners installed within 15 miles (24 km) of saltwater coastal areas shall be stainless steel Type 316. Fasteners for fire-retardant-treated shingles in accordance with Section R902 or pressure-impregnated-preservative-treated shingles of naturally durable wood in accordance with AWPA U1 shall be stainless steel Type 316. Fasteners shall have a minimum penetration into the sheathing of ¾ inch (19.1 mm). For sheathing less than ¾ inch in (19.1 mm) thickness, each fastener shall penetrate through the sheathing. Wood shingles shall be attached to the roof with two fasteners per shingle, positioned in accordance with the manufacturer’s installation instructions. Fastener packaging shall bear a label indicating the appropriate grade material or coating weight.

R905.7.6 Valley flashing. Roof flashing shall be not less than No. 26 gage [0.019 inches (0.5 mm)] corrosion-resistant sheet metal and shall extend 10 inches (254 mm) from the centerline each way for roofs having slopes less than 12 units vertical in 12 units horizontal (100-percent slope), and 7 inches (178 mm) from the centerline each way for slopes of 12 units vertical in 12 units horizontal (100-percent slope) and greater. Sections of flashing shall have an end lap of not less than 4 inches (102 mm).

R905.7.7 Label required. Each bundle of shingles shall be identified by a label of an approved grading or inspection bureau or agency.

TABLE R905.7.5(1)
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1	3 ³ / ₄	5
		No. 2	3 ¹ / ₂	4
		No. 3	3	3 ¹ / ₂
	18	No. 1	4 ¹ / ₄	5 ¹ / ₂
		No. 2	4	4 ¹ / ₂
		No. 3	3 ¹ / ₂	4
	24	No. 1	5 ³ / ₄	7 ¹ / ₂
		No. 2	5 ¹ / ₂	6 ¹ / ₂
		No. 3	5	5 ¹ / ₂

For SI: 1 inch = 25.4 mm.

TABLE R905.7.5(2)
NAIL REQUIREMENTS FOR WOOD SHAKES AND WOOD SHINGLES

PRODUCT TYPE	NAIL TYPE, MINIMUM LENGTH AND SHANK DIAMETER (inches)
Shakes	
18" straight-split	5d box 1 ³ / ₄ " × 0.080
18" and 24" handsplit and resawn	6d box 2" × 0.099
24" taper-split	5d box 1 ³ / ₄ " × 0.080
18" and 24" tapersawn	6d box 2" × 0.099
Shingles	
16" and 18"	3d box 1 ¹ / ₄ " × 0.076
24"	4d box 1 ¹ / ₂ " × 0.076

For SI: 1 inch = 25.4 mm.

R905.8 Wood shakes. The installation of wood shakes shall comply with the provisions of this section.

R905.8.1 Deck requirements. Wood shakes shall be used only on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall be not less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to

coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) on center, additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

R905.8.1.1 Solid sheathing required. In areas where the average daily temperature in January is 25°F (-4°C) or less, solid sheathing is required on that portion of the roof requiring an ice barrier.

R905.8.2 Deck slope. Wood shakes shall only be used on slopes of 3 units vertical in 12 units horizontal (25-percent slope) or greater.

R905.8.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.8.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.8.4 Interlayment. Interlayment shall comply with ASTM D226, Type I.

R905.8.5 Material standards. Wood shakes shall comply with the requirements of Table R905.8.5.

R905.8.6 Application. Wood shakes shall be installed in accordance with this chapter and the manufacturer's installation instructions. Wood shakes shall be laid with a side lap not less than 1¹/₂ inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be ³/₈ inch to ⁵/₈ inch (9.5 mm to 15.9 mm) including tapersawn shakes. Weather exposures for wood shakes shall not exceed those set in Table R905.8.6. Fasteners for untreated (naturally durable) wood shakes shall be box nails in accordance with Table R905.7.5(2). Nails shall be stainless steel Type 304, or Type 316 or hot-dipped with a coating weight of ASTM A153 Class D (1.0 oz/ft²). Alternatively, two 16-gage Type 304 or Type 316 stainless steel staples, with crown widths ⁷/₁₆ inch (11.1 mm) minimum, ³/₄ inch (19.1 mm) maximum, shall be used. Fasteners installed within 15 miles (24 km) of salt-water coastal areas shall be stainless steel Type 316. Wood shakes shall be attached to the roof with two fasteners per shake positioned in accordance with the manufacturer's installation instructions. Fasteners for fire-retardant-treated (as defined in Section R902) shakes or pressure-impregnated-preservative-treated shakes of naturally durable wood in accordance with AWPA U1 shall be stainless

TABLE R905.8.5
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	Cedar Shake and Shingle Bureau
Tapersawn shakes of naturally durable wood	1 or 2	Cedar Shake and Shingle Bureau
Preservative-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Fire-retardant-treated shakes and shingles of naturally durable wood	1	Cedar Shake and Shingle Bureau
Preservative-treated tapersawn shakes of Southern pine treated in accordance with AWPA Standard U1 (Commodity Specification A, Special Requirement 4.6)	1 or 2	Forest Products Laboratory of the Texas Forest Services

**TABLE R905.8.6
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE**

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)
			4:12 pitch or steeper
Shakes of naturally durable wood	18	No. 1	7½
	24	No. 1	10 ^a
Preservative-treated tapered shakes of Southern Yellow Pine	18	No. 1	7½
	24	No. 1	10
	18	No. 2	5½
	24	No. 2	7½
Taper-sawn shakes of naturally durable wood	18	No. 1	7½
	24	No. 1	10
	18	No. 2	5½
	24	No. 2	7½

For SI: 1 inch = 25.4 mm.

a. For 24-inch by ¾-inch handsplit shakes, the maximum exposure is 7½ inches.

steel Type 316. Fasteners shall have a minimum penetration into the sheathing of ¾ inch (19.1 mm). Where the sheathing is less than ¾ inch (19.1 mm) thick, each fastener shall penetrate through the sheathing. Fastener packaging shall bear a label indicating the appropriate grade material or coating weight.

R905.8.7 Shake placement. The starter course at the eaves shall be doubled and the bottom layer shall be either 15-inch (381 mm), 18-inch (457 mm) or 24-inch (610 mm) wood shakes or wood shingles. Fifteen-inch (381 mm) or 18-inch (457 mm) wood shakes shall be permitted to be used for the final course at the ridge. Shakes shall be interlaid with 18-inch-wide (457 mm) strips of not less than No. 30 felt shingled between each course in such a manner that felt is not exposed to the weather by positioning the lower edge of each felt strip above the butt end of the shake it covers a distance equal to twice the weather exposure.

R905.8.8 Valley flashing. Roof valley flashing shall be not less than No. 26 gage [0.019 inch (0.5 mm)] corrosion-resistant sheet metal and shall extend not less than 11 inches (279 mm) from the centerline each way. Sections of flashing shall have an end lap of not less than 4 inches (102 mm).

R905.8.9 Label required. Each bundle of shakes shall be identified by a label of an approved grading or inspection bureau or agency.

R905.9 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section and the manufacturer’s approved installation instructions.

R905.9.1 Slope. Built-up roofs shall have a design slope of not less than ¼ unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs, which shall have a design slope of a minimum ⅛ unit vertical in 12 units horizontal (1-percent slope).

R905.9.2 Material standards. Built-up roof covering materials shall comply with the standards in Table R905.9.2 or UL 55A.

R905.9.3 Application. Built-up roofs shall be installed in accordance with this chapter and the manufacturer’s instructions.

R905.10 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

R905.10.1 Deck requirements. Metal roof panel roof coverings shall be applied to solid or spaced sheathing, except where the roof covering is specifically designed to be applied to spaced supports.

R905.10.2 Slope. Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered-seam metal roofs without applied lap sealant shall be 3 units vertical in 12 units horizontal (25-percent slope).
2. The minimum slope for lapped, nonsoldered-seam metal roofs with applied lap sealant shall be ½ unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the approved manufacturer’s installation instructions.
3. The minimum slope for standing-seam roof systems shall be ¼ unit vertical in 12 units horizontal (2-percent slope).

R905.10.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with the *California Building Code*. Metal-sheet roof coverings installed over structural decking shall comply with Table R905.10.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table R905.10.3(2).

ROOF ASSEMBLIES

**TABLE R905.9.2
BUILT-UP ROOFING MATERIAL STANDARDS**

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D6083
Aggregate surfacing	ASTM D1863
Asphalt adhesive used in roofing	ASTM D3747
Asphalt cements used in roofing	ASTM D2822; D3019; D4586
Asphalt-coated glass fiber base sheet	ASTM D4601
Asphalt coatings used in roofing	ASTM D1227; D2823; D2824; D4479
Asphalt glass felt	ASTM D2178
Asphalt primer used in roofing	ASTM D41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D2626
Asphalt-saturated organic felt (perforated)	ASTM D2626
Asphalt used in roofing	ASTM D312
Coal-tar cements used in roofing	ASTM D4022; D5643
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D43
Coal-tar saturated organic felt	ASTM D227
Coal-tar used in roofing	ASTM D450, Type I or II
Glass mat, coal tar	ASTM D4990
Glass mat, venting type	ASTM D4897
Mineral-surfaced inorganic cap sheet	ASTM D3909
Thermoplastic fabrics used in roofing	ASTM D5665; D5726

**TABLE R905.10.3(1)
METAL ROOF COVERING STANDARDS**

ROOF COVERING TYPE	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B209, 0.024 minimum thickness for roll-formed panels and 0.019-inch minimum thickness for press-formed shingles.
Cold-rolled copper	ASTM B370 minimum 16 oz/sq ft and 12 oz/sq ft high-yield copper for metal-sheet roof-covering systems; 12 oz/sq ft for preformed metal shingle systems.
Galvanized steel	ASTM A653 G90 Zinc coated
Hard lead	2 lb/sq ft
Lead-coated copper	ASTM B101
Soft lead	3 lb/sq ft
Stainless steel	ASTM A240, 300 Series alloys
Steel	ASTM A924
Terne (tin) and terne-coated stainless	Terne coating of 40 lb per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc	0.027 inch minimum thickness: 99.995% electrolytic high-grade zinc with alloy additives of copper (0.08–0.20%), titanium (0.07%–0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.305 kg/m², 1 pound per square foot = 4.214 kg/m², 1 inch = 25.4 mm, 1 pound = 0.454 kg.

**TABLE R905.10.3(2)
MINIMUM CORROSION RESISTANCE**

55% aluminum-zinc-alloy-coated steel	ASTM A792 AZ 50
5% aluminum alloy-coated steel	ASTM A875 GF60
Aluminum-coated steel	ASTM A463 T2 65
Galvanized steel	ASTM A653 G-90
Prepainted steel	ASTM A755 ^a

a. Paint systems in accordance with ASTM A755 shall be applied over steel products with corrosion-resistant coatings complying with ASTM A792, ASTM A875, ASTM A463 or ASTM A653.

R905.10.4 Attachment. Metal roof panels shall be secured to the supports in accordance with this chapter and the manufacturer’s installation instructions. In the absence of manufacturer’s installation instructions, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. Copper, brass, bronze, copper alloy and 300-series stainless steel fasteners shall be used for copper roofs.
3. Stainless steel fasteners are acceptable for metal roofs.

R905.10.5 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section and the manufacturer’s approved installation instructions.

R905.11.1 Slope. Modified bitumen roofing shall have a design slope of not less than one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

R905.11.2 Material standards. Modified bitumen roofing shall comply with the standards in Table R905.11.2.

R905.11.2.1 Base sheet. A base sheet that complies with the requirements of Section 1507.11.2 of the *California Building Code*, ASTM D1970 or ASTM D4601 shall be permitted to be used with a modified bitumen cap sheet.

**TABLE R905.11.2
MODIFIED BITUMEN ROOFING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Asphalt adhesive	ASTM D3747
Asphalt cement	ASTM D3019
Asphalt coating	ASTM D1227; D2824
Asphalt primer	ASTM D41
Modified bitumen roof membrane	ASTM D6162; D6163; D6164; D6222; D6223; D6298

R905.11.3 Application. Modified bitumen roofs shall be installed in accordance with this chapter and the manufacturer’s instructions.

R905.12 Thermoset single-ply roofing. The installation of thermoset single-ply roofing shall comply with the provisions of this section.

R905.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

R905.12.2 Material standards. Thermoset single-ply roof coverings shall comply with ASTM D4637 or ASTM D5019.

R905.12.3 Application. Thermoset single-ply roofs shall be installed in accordance with this chapter and the manufacturer’s instructions.

R905.13 Thermoplastic single-ply roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

R905.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope).

R905.13.2 Material standards. Thermoplastic single-ply roof coverings shall comply with ASTM D4434, D6754 or D6878.

R905.13.3 Application. Thermoplastic single-ply roofs shall be installed in accordance with this chapter and the manufacturer’s instructions.

R905.14 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

R905.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope) for drainage.

R905.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ASTM C1029, Type III or IV or ASTM D7425.

R905.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with this chapter and the manufacturer’s instructions. A liquid-applied protective coating that complies with Table R905.14.3 shall be applied not less than 2 hours nor more than 72 hours following the application of the foam.

**TABLE R905.14.3
PROTECTIVE COATING MATERIAL STANDARDS**

MATERIAL	STANDARD
Acrylic coating	ASTM D6083
Moisture-cured polyurethane coating	ASTM D6947
Silicone coating	ASTM D6694

R905.14.4 Foam plastics. Foam plastic materials and installation shall comply with Section R316.

R905.15 Liquid-applied roofing. The installation of liquid-applied roofing shall comply with the provisions of this section.

R905.15.1 Slope. Liquid-applied roofing shall have a design slope of not less than 1/4 unit vertical in 12 units horizontal (2-percent slope).

R905.15.2 Material standards. Liquid-applied roofing shall comply with ASTM C836, C957, D1227, D3468, D6083, D6694 or D6947.

R905.15.3 Application. Liquid-applied roofing shall be installed in accordance with this chapter and the manufacturer’s installation instructions.

ROOF ASSEMBLIES

R905.16 Photovoltaic shingles. The installation of photovoltaic shingles shall comply with the provisions of this section, Section R324 and *the California Electrical Code*.

R905.16.1 Deck requirements. Photovoltaic shingles shall be applied to a solid or closely-fitted deck, except where the roof covering is specifically designed to be applied over spaced sheathing.

R905.16.2 Deck slope. Photovoltaic shingles shall be used only on roof slopes of 2 units vertical in 12 units horizontal (2:12) or greater.

R905.16.3 Underlayment. Underlayment shall comply with Section R905.1.1.

R905.16.3.1 Ice barrier. Where required, ice barriers shall comply with Section R905.1.2.

R905.16.4 Material standards. Photovoltaic shingles shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

R905.16.5 Attachment. Photovoltaic shingles shall be attached in accordance with the manufacturer’s installation instructions.

R905.16.6 Wind resistance. Photovoltaic shingles shall comply with the classification requirements of Table R905.16.6 for the appropriate maximum basic wind speed.

R905.17 Building-integrated photovoltaic (BIPV) roof panels applied directly to the roof deck. The installation of BIPV roof panels shall comply with the provisions of this section, Section R324 and *the California Electrical Code*.

R905.17.1 Deck requirements. BIPV roof panels shall be applied to a solid or closely-fitted deck, except where the roof covering is specifically designed to be applied over spaced sheathing.

R905.17.2 Deck slope. BIPV roof panels shall be used only on roof slopes of 2 units vertical in 12 units horizontal (17-percent slope) or greater.

R905.17.3 Underlayment. Underlayment shall comply with Section 905.1.1.

R905.17.3.1 Ice barrier. Where required, an ice barrier shall comply with Section R905.1.2.

R905.17.4 Ice barrier. In areas where there has been a history of ice forming along the eaves causing a backup of water, as designated in Table R301.2, an ice barrier that consists of not less than two layers of underlayment cemented together or of a self-adhering polymer-modified bitumen sheet shall be used in lieu of normal underlayment and extend from the lowest edges of all roof surfaces to a point not less than 24 inches (610 mm) inside the exterior wall line of the building.

Exception: Detached accessory structures that do not contain conditioned floor area.

R905.17.5 Material standards. BIPV roof panels shall be listed and labeled in accordance with UL 7103 or with both UL 61730-1 and UL 61730-2.

R905.17.6 Attachment. BIPV roof panels shall be attached in accordance with the manufacturer’s installation instructions.

**SECTION R906
ROOF INSULATION**

R906.1 General. Where above-deck thermal insulation is installed, such insulation shall be covered with an approved roof covering and shall comply with NFPA 276 or UL 1256.

R906.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table R906.2.

**TABLE R905.16.6
CLASSIFICATION OF PHOTOVOLTAIC SHINGLES**

MAXIMUM ULTIMATE DESIGN WIND SPEED, V_{ult} FROM FIGURE R301.2(2) (mph)	MAXIMUM BASIC WIND SPEED, V_{ASD} FROM TABLE R301.2.1.3 (mph)	UL 7103 SHINGLE CLASSIFICATION
110	85	A, D or F
116	90	A, D or F
129	100	A, D or F
142	110	F
155	120	F
168	130	F
181	140	F
194	150	F

For SI: 1 mile per hour = 1.609 kph.

**TABLE R906.2
MATERIAL STANDARDS FOR ROOF INSULATION**

Cellular glass board	ASTM C552
Composite boards	ASTM C1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C578
Extruded polystyrene board	ASTM C578
Fiber-reinforced gypsum board	ASTM C1278
Glass-faced gypsum board	ASTM C1177
Mineral wool board	ASTM C726
Perlite board	ASTM C728
Polyisocyanurate board	ASTM C1289, Type I or II
Wood fiberboard	ASTM C208

**SECTION R907
ROOFTOP-MOUNTED
PHOTOVOLTAIC PANEL SYSTEMS**

R907.1 Rooftop-mounted photovoltaic (PV) panel systems. Rooftop-mounted photovoltaic panel systems shall be designed and installed in accordance with Section R324 and *the California Electrical Code*.

R907.2 Fire classification. Rooftop-mounted photovoltaic panel systems shall have the fire classification as required by Section R902.4.

R907.3 Installation. Rooftop-mounted photovoltaic panel systems shall be installed in accordance with the manufacturer's installation instructions.

R907.4 Photovoltaic panels and modules. Photovoltaic panel systems mounted on top of a roof shall be listed and labeled in accordance with UL 2703 and shall be installed in accordance with the manufacturer's installation instructions.

R907.5 Fire safety provisions for photovoltaic panel system. Solar photovoltaic panel systems installed upon a roof or as an integral part of a roof assembly shall comply with the requirements of this code and *the California Fire Code*.

**SECTION R908
REROOFING**

R908.1 General. Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 9.

Exceptions:

1. Reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section R905 for roofs that provide positive roof drainage.
2. For roofs that provide positive drainage, recovering or replacing an existing roof covering shall not require the secondary (emergency overflow) drains

or scuppers of Section R903.4.1 to be added to an existing roof.

R908.2 Structural and construction loads. The structural roof components shall be capable of supporting the roof covering system and the material and equipment loads that will be encountered during installation of the roof covering system.

R908.3 Roof replacement. Roof replacement shall include the removal of existing layers of roof coverings down to the roof deck.

Exception: Where the existing roof assembly includes an ice barrier membrane that is adhered to the roof deck, the existing ice barrier membrane shall be permitted to remain in place and covered with an additional layer of ice barrier membrane in accordance with Section R905.

R908.3.1 Roof recover. The installation of a new roof covering over an existing roof covering shall be permitted where any of the following conditions occur:

1. Where the new roof covering is installed in accordance with the roof covering manufacturer's approved instructions
2. Complete and separate roofing systems, such as standing-seam metal roof systems, that are designed to transmit the roof loads directly to the building's structural system and do not rely on existing roofs and roof coverings for support, shall not require the removal of existing roof coverings.
3. Metal panel, metal shingle and concrete and clay tile roof coverings shall be permitted to be installed over existing wood shake roofs where applied in accordance with Section R908.4.
4. The application of a new protective roof coating over an existing protective roof coating, metal roof panel, metal roof shingle, mineral surfaced roll roofing, built-up roof, modified bitumen roofing, thermoset and thermoplastic single-ply roofing and spray polyurethane foam roofing system shall be permitted without tear-off of existing roof coverings.

R908.3.1.1 Roof recover not allowed. A roof recover shall not be permitted where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

R908.4 Roof recovering. Where the application of a new roof covering over wood shingle or shake roofs creates a combustible concealed space, the entire existing surface shall be covered with gypsum board, mineral fiber, glass fiber or other approved materials securely fastened in place.

ROOF ASSEMBLIES

R908.5 Reinstallation of materials. Existing slate, clay or cement tile shall be permitted for reinstallation, except that damaged, cracked or broken slate or tile shall not be reinstalled. Any existing flashings, edgings, outlets, vents or similar devices that are a part of the assembly shall be replaced where rusted, damaged or deteriorated. Aggregate surfacing materials shall not be reinstalled.

R908.6 Flashings. Flashings shall be reconstructed in accordance with approved manufacturer's installation instructions. Metal flashing to which bituminous materials are to be adhered shall be primed prior to installation.

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CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 10 – CHIMNEYS AND FIREPLACES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below			X																			
Chapter / Section																						
R1001.3				X																		
R1001.4				X																		
Table R1001.1, Footnote (b)				X																		
R1003.3				X																		
R1003.4				X																		
R1003.9.1			X																			
R1003.11.3				X																		
R1003.14				X																		
<i>R1004.1.1</i>				X																		
R1004.4				†																		

The state agency does not adopt sections identified with the following symbol: †

CHAPTER 10

CHIMNEYS AND FIREPLACES

User note:

About this chapter: Chapter 10 contains requirements for the construction, seismic reinforcing and anchorage of masonry chimneys and fireplaces; and establishes standards for the use and installation of factory-built chimneys, fireplaces and masonry heaters. Chimneys and fireplaces constructed of masonry rely on prescriptive requirements for the details of their construction; factory-built versions rely on the listing and labeling method of approval.

SECTION R1001 MASONRY FIREPLACES

R1001.1 General. Masonry fireplaces shall be constructed in accordance with this section and the applicable provisions of Chapters 3 and 4.

R1001.2 Footings and foundations. Footings for masonry fireplaces and their chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the fireplace or foundation wall on all sides. Footings shall be founded on natural, undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

R1001.2.1 Ash dump cleanout. Cleanout openings located within foundation walls below fireboxes, where provided, shall be equipped with ferrous metal or masonry doors and frames constructed to remain tightly closed except when in use. Cleanouts shall be located to allow access so that ash removal will not create a hazard to combustible materials.

R1001.3 Seismic reinforcing. Masonry or concrete chimneys in *all structures regulated by this code assigned to Seismic Design Category C, D₀, D₁ or D₂* shall be reinforced. Reinforcing shall conform to the requirements set forth in Table R1001.1 and Section R606.

R1001.3.1 Vertical reinforcing. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars shall be placed between wythes of solid masonry or within the cells of hollow unit masonry and grouted in accordance with Section R606. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys more than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be provided for each additional flue incorporated into the chimney or for each additional 40 inches (1016 mm) in width or fraction thereof.

R1001.3.2 Horizontal reinforcing. Vertical reinforcement shall be placed within $\frac{1}{4}$ -inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area,

placed in the bed joints in accordance with Section R606 at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be installed at each bend in the vertical bars.

R1001.4 Seismic anchorage. Masonry or concrete chimneys in *all structures regulated by this code assigned to Seismic Design Category C, D₀, D₁ or D₂* shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the requirements of Section R1001.4.1.

R1001.4.1 Anchorage. Two $\frac{3}{16}$ -inch by 1-inch (5 mm by 25 mm) straps shall be embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor ceiling or floor joists or rafters with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

R1001.4.1.1 Cold-formed steel framing. Where cold-formed steel framing is used, the location where the $\frac{1}{2}$ -inch (12.7 mm) bolts are used to attach the straps to the framing shall be reinforced with not less than a 3-inch \times 3-inch \times 0.229-inch (76 mm \times 76 mm \times 5.8 mm) steel plate on top of the strap that is screwed to the framing with not fewer than seven No. 6 screws for each bolt.

R1001.5 Firebox walls. Masonry fireboxes shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. Where a lining of firebrick not less than 2 inches (51 mm) thick or other approved lining is provided, the minimum thickness of back and side-walls shall each be 8 inches (203 mm) of solid masonry, including the lining. The width of joints between firebricks shall not be greater than $\frac{1}{4}$ inch (6.4 mm). Where a lining is not provided, the total minimum thickness of back and side walls shall be 10 inches (254 mm) of solid masonry. Firebrick shall conform to ASTM C27 or C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199.

CHIMNEYS AND FIREPLACES

TABLE R1001.1
SUMMARY OF REQUIREMENTS FOR MASONRY FIREPLACES AND CHIMNEYS

ITEM	LETTER ^a	REQUIREMENTS
Hearth slab thickness	A	4 inches
Hearth extension (each side of opening)	B	8-inch fireplace opening < 6 square feet. 12-inch fireplace opening ≥ 6 square feet.
Hearth extension (front of opening)	C	16-inch fireplace opening < 6 square feet. 20-inch fireplace opening ≥ 6 square feet.
Hearth slab reinforcing	D	Reinforced to carry its own weight and all imposed loads.
Thickness of wall of firebox	E	10-inch solid brick or 8 inches where a firebrick lining is used. Joints in firebrick 1/4-inch maximum.
Distance from top of opening to throat	F	8 inches
Smoke chamber wall thickness Unlined walls	G	6 inches 8 inches
Chimney Vertical reinforcing ^b	H	Four No. 4 full-length bars for chimney up to 40 inches wide. Add two No. 4 bars for each additional 40 inches or fraction of width or each additional flue.
Horizontal reinforcing	J	1/4-inch ties at 18 inches and two ties at each bend in vertical steel.
Bond beams	K	No specified requirements.
Fireplace lintel	L	Noncombustible material.
Chimney walls with flue lining	M	Solid masonry units or hollow masonry units grouted solid with not less than 4-inch nominal thickness.
Distances between adjacent flues	—	See Section R1003.13.
Effective flue area (based on area of fireplace opening)	P	See Section R1003.15.
Clearances Combustible material Mantel and trim Above roof	R	See Sections R1001.11 and R1003.18. See Section R1001.11, Exception 4. 3 feet at roofline and 2 feet at 10 feet.
Anchorage ^b Strap Number Embedment into chimney Fasten to Bolts	S	3/16-inch × 1-inch Two 12 inches hooked around outer bar with 6-inch extension. 4 joists Two 1/2-inch diameter.
Footing Thickness Width	T	12 inches min. 6 inches each side of fireplace wall.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

Note: This table provides a summary of major requirements for the construction of masonry chimneys and fireplaces. Letter references are to Figure R1001.1, which shows examples of typical construction. This table does not cover all requirements, nor does it cover all aspects of the indicated requirements. For the actual mandatory requirements of the code, see the indicated section of text.

a. The letters refer to Figure R1001.1.

b. Not required in Seismic Design Category A or B.

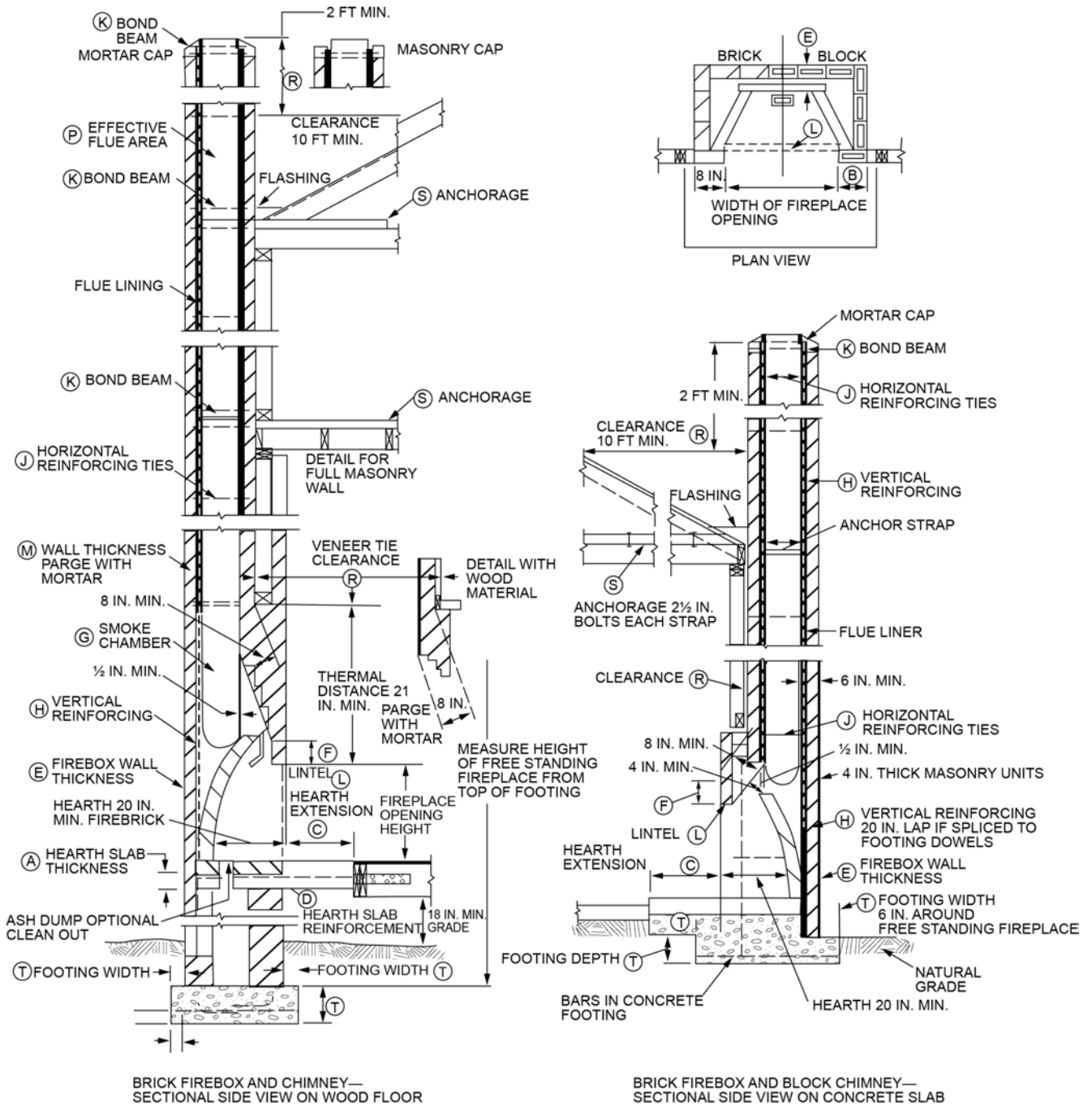


FIGURE R1001.1
FIREPLACE AND CHIMNEY DETAILS

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

R1001.5.1 Steel fireplace units. Installation of steel fireplace units with solid masonry to form a masonry fireplace is permitted where installed either in accordance with the requirements of their listing or the requirements of this section. Steel fireplace units incorporating a steel firebox lining shall be constructed with steel not less than $\frac{1}{4}$ inch (6.4 mm) thick, and an air-circulating chamber that is ducted to the interior of the building. The firebox lining shall be encased with solid masonry to provide a total thickness at the back and sides of not less than 8 inches (203 mm), of which not less than 4 inches (102 mm) shall be of solid masonry or concrete. Circulating air ducts used with steel fireplace units shall be constructed of metal or masonry.

R1001.6 Firebox dimensions. The firebox of a concrete or masonry fireplace shall have a depth of not less than 20 inches (508 mm). The throat shall be not less than 8 inches (203 mm) above the fireplace opening. The throat opening shall be not less than 4 inches (102 mm) deep. The cross-sectional area of the passageway above the firebox, including the throat, damper and smoke chamber, shall be not less than the cross-sectional area of the flue.

Exception: Rumford fireplaces shall be permitted provided that the depth of the fireplace is not less than 12 inches (305 mm) and not less than one-third of the width of the fireplace opening, that the throat is not less than 12 inches (305 mm) above the lintel and is not less than one-twentieth the cross-sectional area of the fireplace opening.

R1001.7 Lintel and throat. Masonry over a fireplace opening shall be supported by a lintel of noncombustible material. The minimum required bearing length on each end of the fireplace opening shall be 4 inches (102 mm). The fireplace throat or damper shall be located not less than 8 inches (203 mm) above the lintel.

R1001.7.1 Damper. Masonry fireplaces shall be equipped with a ferrous metal damper located not less than 8 inches (203 mm) above the top of the fireplace opening. Dampers shall be installed in the fireplace or the chimney venting the fireplace, and shall be operable from the room containing the fireplace.

R1001.8 Smoke chamber. Smoke chamber walls shall be constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete. The total minimum thickness of front, back and side walls shall be 8 inches (203 mm) of solid masonry. The inside surface shall be parged smooth with refractory mortar conforming to ASTM C199. Where a lining of firebrick not less than 2 inches (51 mm) thick, or a lining of vitrified clay not less than $\frac{5}{8}$ inch (16 mm) thick, is provided, the total minimum thickness of front, back and side walls shall be 6 inches (152 mm) of solid masonry, including the lining. Firebrick shall conform to ASTM C1261 and shall be laid with medium-duty refractory mortar conforming to ASTM C199. Vitrified clay linings shall conform to ASTM C315.

R1001.8.1 Smoke chamber dimensions. The inside height of the smoke chamber from the fireplace throat to the beginning of the flue shall not be greater than the inside width of the fireplace opening. The inside surface of

the smoke chamber shall not be inclined more than 45 degrees (0.79 rad) from vertical where prefabricated smoke chamber linings are used or where the smoke chamber walls are rolled or sloped rather than corbeled. Where the inside surface of the smoke chamber is formed by corbeled masonry, the walls shall not be corbeled more than 30 degrees (0.52 rad) from vertical.

R1001.9 Hearth and hearth extension. Masonry fireplace hearths and hearth extensions shall be constructed of concrete or masonry, supported by noncombustible materials, and reinforced to carry their own weight and all imposed loads. Combustible material shall not remain against the underside of hearths and hearth extensions after construction.

R1001.9.1 Hearth thickness. The minimum thickness of fireplace hearths shall be 4 inches (102 mm).

R1001.9.2 Hearth extension thickness. The minimum thickness of hearth extensions shall be 2 inches (51 mm).

Exception: Where the bottom of the firebox opening is raised not less than 8 inches (203 mm) above the top of the hearth extension, a hearth extension of not less than $\frac{3}{8}$ -inch-thick (10 mm) brick, concrete, stone, tile or other approved noncombustible material is permitted.

R1001.10 Hearth extension dimensions. Hearth extensions shall extend not less than 16 inches (406 mm) in front of and not less than 8 inches (203 mm) beyond each side of the fireplace opening. Where the fireplace opening is 6 square feet (0.6 m²) or larger, the hearth extension shall extend not less than 20 inches (508 mm) in front of and not less than 12 inches (305 mm) beyond each side of the fireplace opening.

R1001.11 Fireplace clearance. Wood beams, joists, studs and other combustible material shall have a clearance of not less than 2 inches (51 mm) from the front faces and sides of masonry fireplaces and not less than 4 inches (102 mm) from the back faces of masonry fireplaces. The airspace shall not be filled, except to provide fireblocking in accordance with Section R1001.12.

Exceptions:

1. Masonry fireplaces listed and labeled for use in contact with combustibles in accordance with UL 127 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry fireplaces are part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete walls less than 12 inches (306 mm) from the inside surface of the nearest firebox lining.
3. Exposed combustible trim and the edges of sheathing materials such as wood siding, flooring and gypsum board shall be permitted to abut the masonry fireplace sidewalls and hearth extension in accordance with Figure R1001.11, provided such combustible trim or sheathing is not less than 12 inches (305 mm) from the inside surface of the nearest firebox lining.

- Exposed combustible mantels or trim is permitted to be placed directly on the masonry fireplace front surrounding the fireplace opening providing such combustible materials are not placed within 6 inches (152 mm) of a fireplace opening. Combustible material within 12 inches (306 mm) of the fireplace opening shall not project more than 1/8 inch (3 mm) for each 1-inch (25 mm) distance from such an opening.

R1001.12 Fireplace fireblocking. Fireplace fireblocking shall comply with the provisions of Section R602.8.

R1001.13 Fireplace accessories. Listed and labeled fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer’s instructions. Fireplace accessories shall comply with UL 907.

**SECTION R1002
MASONRY HEATERS**

R1002.1 Definition. A masonry heater is a heating appliance constructed of concrete or solid masonry, hereinafter referred to as masonry, that is designed to absorb and store heat from a solid-fuel fire built in the firebox by routing the exhaust gases through internal heat exchange channels in which the flow path downstream of the firebox includes flow in a horizontal or downward direction before entering the chimney and that delivers heat by radiation from the masonry surface of the heater.

R1002.2 Installation. Masonry heaters shall be installed in accordance with this section and comply with one of the following:

- Masonry heaters shall comply with the requirements of ASTM E1602.
- Masonry heaters shall be listed and labeled in accordance with UL 1482 or CEN 15250 and installed in accordance with the manufacturer’s instructions.

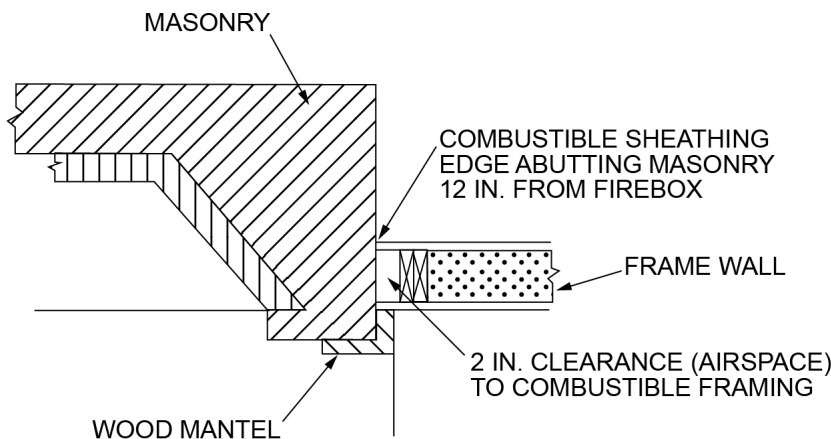
R1002.3 Footings and foundation. The firebox floor of a masonry heater shall be a minimum thickness of 4 inches (102 mm) of noncombustible material and be supported on a noncombustible footing and foundation in accordance with Section R1003.2.

R1002.4 Seismic reinforcing. In Seismic Design Categories D₀, D₁ and D₂, masonry heaters shall be anchored to the masonry foundation in accordance with Section R1003.3. Seismic reinforcing shall not be required within the body of a masonry heater whose height is equal to or less than 3.5 times its body width and where the masonry chimney serving the heater is not supported by the body of the heater. Where the masonry chimney shares a common wall with the facing of the masonry heater, the chimney portion of the structure shall be reinforced in accordance with Section R1003.

R1002.5 Masonry heater clearance. Combustible materials shall not be placed within 36 inches (914 mm) of the outside surface of a masonry heater in accordance with NFPA 211 Section 8-7 (clearances for solid-fuel-burning appliances), and the required space between the heater and combustible material shall be fully vented to permit the free flow of air around all heater surfaces.

Exceptions:

- Where the masonry heater wall is not less than 8 inches (203 mm) thick of solid masonry and the wall of the heat exchange channels is not less than 5 inches (127 mm) thick of solid masonry, combustible materials shall not be placed within 4 inches (102 mm) of the outside surface of a masonry heater. A clearance of not less than 8 inches (203 mm) shall be provided between the gas-tight capping slab of the heater and a combustible ceiling.
- Masonry heaters listed and labeled in accordance with UL 1482 or CEN 15250 shall be installed in accordance with the listing specifications and the manufacturer’s written instructions.



For SI: 1 inch = 25.4 mm.

**FIGURE R1001.11
CLEARANCE FROM COMBUSTIBLES**

SECTION R1003 MASONRY CHIMNEYS

R1003.1 Definition. A masonry chimney is a chimney constructed of solid masonry units, hollow masonry units grouted solid, stone or concrete, hereinafter referred to as masonry. Masonry chimneys shall be constructed, anchored, supported and reinforced as required in this chapter.

R1003.2 Footings and foundations. Footings for masonry chimneys shall be constructed of concrete or solid masonry not less than 12 inches (305 mm) thick and shall extend not less than 6 inches (152 mm) beyond the face of the foundation or support wall on all sides. Footings shall be founded on natural undisturbed earth or engineered fill below frost depth. In areas not subjected to freezing, footings shall be not less than 12 inches (305 mm) below finished grade.

R1003.3 Seismic reinforcing. Masonry or concrete chimneys shall be constructed, anchored, supported and reinforced as required in this chapter. In *all structures regulated by this code assigned to Seismic Design Category C, D₀, D₁ or D₂* masonry and concrete chimneys shall be reinforced and anchored as detailed in Sections R1003.3.1, R1003.3.2 and R1003.4. In *Seismic Design Category A or B*, reinforcement and seismic anchorage are not required.

R1003.3.1 Vertical reinforcing. For chimneys up to 40 inches (1016 mm) wide, four No. 4 continuous vertical bars, anchored in the foundation, shall be placed in the concrete, or between wythes of solid masonry, or within the cells of hollow unit masonry, and grouted in accordance with Section R608.1.1. Grout shall be prevented from bonding with the flue liner so that the flue liner is free to move with thermal expansion. For chimneys more than 40 inches (1016 mm) wide, two additional No. 4 vertical bars shall be installed for each additional 40 inches (1016 mm) in width or fraction thereof.

R1003.3.2 Horizontal reinforcing. Vertical reinforcement shall be placed enclosed within $\frac{1}{4}$ -inch (6.4 mm) ties, or other reinforcing of equivalent net cross-sectional area, spaced not to exceed 18 inches (457 mm) on center in concrete, or placed in the bed joints of unit masonry, at not less than every 18 inches (457 mm) of vertical height. Two such ties shall be installed at each bend in the vertical bars.

R1003.4 Seismic anchorage. Masonry and concrete chimneys and foundations in *all structures regulated by this code assigned to Seismic Design Category C, D₀, D₁ or D₂* shall be anchored at each floor, ceiling or roof line more than 6 feet (1829 mm) above grade, except where constructed completely within the exterior walls. Anchorage shall conform to the requirements in Section R1003.4.1.

R1003.4.1 Anchorage. Two $\frac{3}{16}$ -inch by 1-inch (5 mm by 25 mm) straps shall be embedded not less than 12 inches (305 mm) into the chimney. Straps shall be hooked around the outer bars and extend 6 inches (152 mm) beyond the bend. Each strap shall be fastened to not less than four floor joists with two $\frac{1}{2}$ -inch (12.7 mm) bolts.

R1003.4.1.1 Cold-formed steel framing. Where cold-formed steel framing is used, the location where the $\frac{1}{2}$ -

inch (12.7 mm) bolts are used to attach the straps to the framing shall be reinforced with not less than a 3-inch \times 3-inch \times 0.229-inch (76 mm \times 76 mm \times 5.8 mm) steel plate on top of a strap that is screwed to the framing with not fewer than seven No. 6 screws for each bolt.

R1003.5 Corbeling. Masonry chimneys shall not be corbeled more than one-half of the chimney's wall thickness from a wall or foundation, nor shall a chimney be corbeled from a wall or foundation that is less than 12 inches (305 mm) thick unless it projects equally on each side of the wall, except that on the second story of a two-story dwelling, corbeling of chimneys on the exterior of the enclosing walls shall be permitted to be equal to the wall thickness. The projection of a single course shall not exceed one-half the unit height or one-third of the unit bed depth, whichever is less.

R1003.6 Changes in dimension. The chimney wall or chimney flue lining shall not change in size or shape within 6 inches (152 mm) above or below where the chimney passes through floor components, ceiling components or roof components.

R1003.7 Offsets. Where a masonry chimney is constructed with a fireclay flue liner surrounded by one wythe of masonry, the maximum offset shall be such that the centerline of the flue above the offset does not extend beyond the center of the chimney wall below the offset. Where the chimney offset is supported by masonry below the offset in an approved manner, the maximum offset limitations shall not apply. Each individual corbeled masonry course of the offset shall not exceed the projection limitations specified in Section R1003.5.

R1003.8 Additional load. Chimneys shall not support loads other than their own weight unless they are designed and constructed to support the additional load. Construction of masonry chimneys as part of the masonry walls or reinforced concrete walls of the building shall be permitted.

R1003.9 Termination. Chimneys shall extend not less than 2 feet (610 mm) higher than any portion of a building within 10 feet (3048 mm), but shall be not less than 3 feet (914 mm) above the highest point where the chimney passes through the roof.

R1003.9.1 Chimney caps. Masonry chimneys shall have a concrete, metal or stone cap, a drip edge and a caulked bond break around any flue liners in accordance with ASTM C1283. The concrete, metal or stone cap shall be sloped to shed water.

R1003.9.2 Spark arrestors. *All chimneys attached to any appliance or fireplace that burns solid fuel shall be equipped with an approved spark arrester.* Where a spark arrester is installed on a masonry chimney, the spark arrester shall meet all of the following requirements:

1. The net free area of the arrester shall be not less than four times the net free area of the outlet of the chimney flue it serves.
2. The arrester screen shall have heat and corrosion resistance equivalent to *12 gage wire*, 19-gage galvanized steel or 24-gage stainless steel.

3. Openings shall not permit the passage of spheres having a diameter greater than $\frac{1}{2}$ inch (12.7 mm) nor block the passage of spheres having a diameter less than $\frac{3}{8}$ inch (9.5 mm).
4. The spark arrestor shall be located with access for cleaning and the screen or chimney cap shall be removable to allow for cleaning of the chimney flue.

R1003.9.3 Rain caps. Where a masonry or metal rain cap is installed on a masonry chimney, the net free area under the cap shall be not less than four times the net free area of the outlet of the chimney flue it serves.

R1003.10 Wall thickness. Masonry chimney walls shall be constructed of solid masonry units or hollow masonry units grouted solid with not less than a 4-inch (102 mm) nominal thickness.

R1003.10.1 Masonry veneer chimneys. Where masonry is used to veneer a frame chimney, through-flashing and weep holes shall be installed as required by Section R703.

R1003.11 Flue lining (material). Masonry chimneys shall be lined. The lining material shall be appropriate for the type of appliance connected, in accordance with the terms of the appliance listing and manufacturer's instructions.

R1003.11.1 Residential-type appliances (general). Flue lining systems shall comply with one of the following:

1. Clay flue lining complying with the requirements of ASTM C315.
2. Listed and labeled chimney lining systems complying with UL 1777.
3. Factory-built chimneys or chimney units listed for installation within masonry chimneys.
4. Other approved materials that will resist corrosion, erosion, softening or cracking from flue gases and condensate at temperatures up to 1,800°F (982°C).

R1003.11.2 Flue linings for specific appliances. Flue linings other than these covered in Section R1003.11.1, intended for use with specific types of appliances, shall comply with Sections R1003.11.3 through R1003.11.6.

R1003.11.3 Gas appliances. Flue lining systems for gas appliances shall be in accordance with *the California Mechanical Code*.

R1003.11.4 Pellet fuel-burning appliances. Flue lining and vent systems for use in masonry chimneys with pellet fuel-burning appliances shall be limited to the following:

1. Flue lining systems complying with Section R1003.11.1.
2. Pellet vents listed for installation within masonry chimneys (see Section R1003.11.6 for marking).

R1003.11.5 Oil-fired appliances approved for use with Type L vent. Flue lining and vent systems for use in masonry chimneys with oil-fired appliances approved for use with Type L vent shall be limited to the following:

1. Flue lining systems complying with Section R1003.11.1.

2. Listed chimney liners complying with UL 641 (see Section R1003.11.6 for marking).

R1003.11.6 Notice of usage. Where a flue is relined with a material not complying with Section R1003.11.1, the chimney shall be plainly and permanently identified by a label attached to a wall, ceiling or other conspicuous location adjacent to where the connector enters the chimney. The label shall include the following message or equivalent language:

THIS CHIMNEY FLUE IS FOR USE ONLY WITH
[TYPE OR CATEGORY OF APPLIANCE] APPLI-
ANCES THAT BURN [TYPE OF FUEL]. DO NOT
CONNECT OTHER TYPES OF APPLIANCES.

R1003.12 Clay flue lining (installation). Clay flue liners shall be installed in accordance with ASTM C1283 and extend from a point not less than 8 inches (203 mm) below the lowest inlet or, in the case of fireplaces, from the top of the smoke chamber to a point above the enclosing walls. The lining shall be carried up vertically, with a slope not greater than 30 degrees (0.52 rad) from the vertical.

Clay flue liners shall be laid in medium-duty water insoluble refractory mortar conforming to ASTM C199 with tight mortar joints left smooth on the inside and installed to maintain an airspace or insulation not to exceed the thickness of the flue liner separating the flue liners from the interior face of the chimney masonry walls. Flue liners shall be supported on all sides. Only enough mortar shall be placed to make the joint and hold the liners in position.

R1003.12.1 Listed materials. Listed materials used as flue linings shall be installed in accordance with the terms of their listings and manufacturer's instructions.

R1003.12.2 Space around lining. The space surrounding a chimney lining system or vent installed within a masonry chimney shall not be used to vent any other appliance.

Exception: This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's instructions.

R1003.13 Multiple flues. Where two or more flues are located in the same chimney, masonry wythes shall be built between adjacent flue linings. The masonry wythes shall be not less than 4 inches (102 mm) thick and bonded into the walls of the chimney.

Exception: Where venting only one appliance, two flues shall be permitted to adjoin each other in the same chimney with only the flue lining separation between them. The joints of the adjacent flue linings shall be staggered not less than 4 inches (102 mm).

R1003.14 Flue area (appliance). Chimney flues shall not be smaller in area than that of the area of the connector from the appliance [see Tables R1003.14(1) and R1003.14(2)]. The sizing of a chimney flue to which multiple appliance venting systems are connected shall be in accordance with *the California Mechanical Code*.

CHIMNEYS AND FIREPLACES

**TABLE R1003.14(1)
NET CROSS-SECTIONAL AREA OF ROUND FLUE SIZES^a**

FLUE SIZE, INSIDE DIAMETER (inches)	CROSS-SECTIONAL AREA (square inches)
6	28
7	38
8	50
10	78
10 ³ / ₄	90
12	113
15	176
18	254

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

a. Flue sizes are based on ASTM C315.

**TABLE R1003.14(2)
NET CROSS-SECTIONAL AREA OF
SQUARE AND RECTANGULAR FLUE SIZES**

FLUE SIZE, OUTSIDE NOMINAL DIMENSIONS (inches)	CROSS-SECTIONAL AREA (square inches)
4.5 × 8.5	23
4.5 × 13	34
8 × 8	42
8.5 × 8.5	49
8 × 12	67
8.5 × 13	76
12 × 12	102
8.5 × 18	101
13 × 13	127
12 × 16	131
13 × 18	173
16 × 16	181
16 × 20	222
18 × 18	233
20 × 20	298
20 × 24	335
24 × 24	431

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

R1003.15 Flue area (masonry fireplace). Flue sizing for chimneys serving fireplaces shall be in accordance with Section R1003.15.1 or R1003.15.2.

R1003.15.1 Option 1. Round chimney flues shall have a minimum net cross-sectional area of not less than one-twelfth of the fireplace opening. Square chimney flues shall have a minimum net cross-sectional area of one-tenth of the fireplace opening. Rectangular chimney flues with an aspect ratio less than 2 to 1 shall have a minimum net cross-sectional area of one-tenth of the fireplace opening. Rectangular chimney flues with an aspect ratio of 2 to 1 or more shall have a minimum net cross-sectional area of one-eighth of the fireplace opening. Cross-sectional areas

of clay flue linings are shown in Tables R1003.14(1) and R1003.14(2) or as provided by the manufacturer or as measured in the field.

R1003.15.2 Option 2. The minimum net cross-sectional area of the chimney flue shall be determined in accordance with Figure R1003.15.2. A flue size providing not less than the equivalent net cross-sectional area shall be used. Cross-sectional areas of clay flue linings are shown in Tables R1003.14(1) and R1003.14(2) or as provided by the manufacturer or as measured in the field. The height of the chimney shall be measured from the firebox floor to the top of the chimney flue.

R1003.16 Inlet. Inlets to masonry chimneys shall enter from the side. Inlets shall have a thimble of fireclay, rigid refractory material or metal that will prevent the connector from pulling out of the inlet or from extending beyond the wall of the liner.

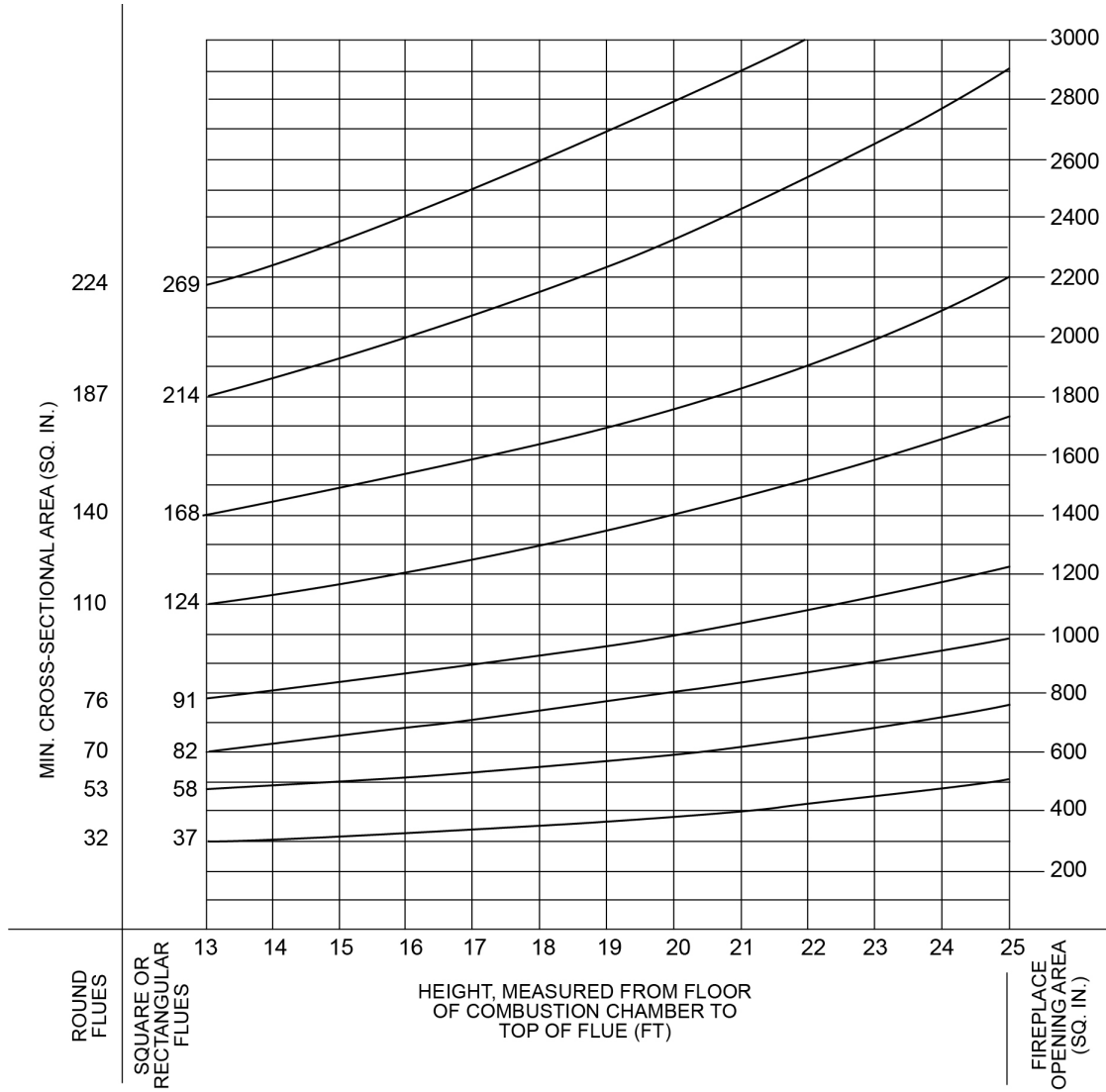
R1003.17 Masonry chimney cleanout openings. Cleanout openings shall be provided within 6 inches (152 mm) of the base of each flue within every masonry chimney. The upper edge of the cleanout shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The height of the opening shall be not less than 6 inches (152 mm). The cleanout shall be provided with a noncombustible cover.

Exception: Chimney flues serving masonry fireplaces where cleaning is possible through the fireplace opening.

R1003.18 Chimney clearances. Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The airspace shall not be filled, except to provide fire blocking in accordance with Section R1003.19.

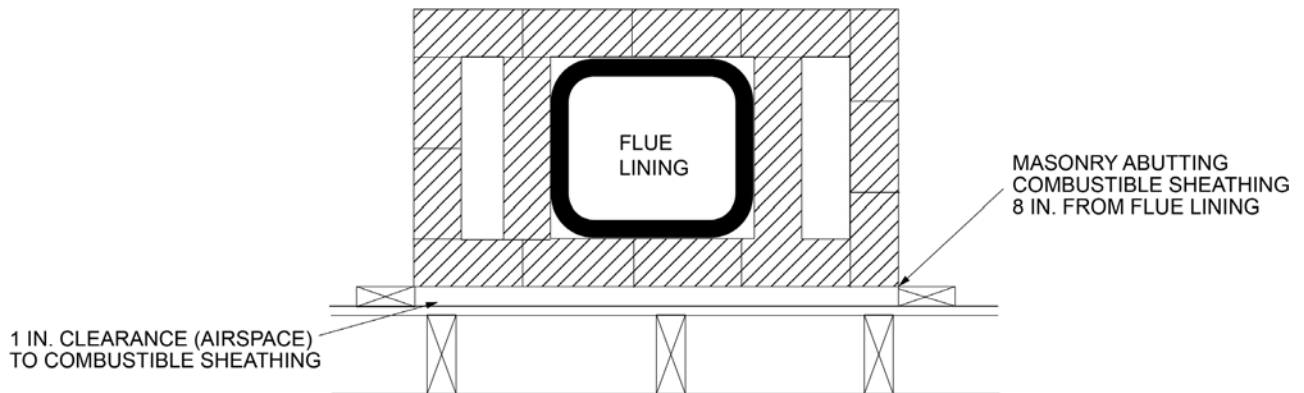
Exceptions:

1. Masonry chimneys equipped with a chimney lining system listed and labeled for use in chimneys in contact with combustibles in accordance with UL 1777 and installed in accordance with the manufacturer's instructions are permitted to have combustible material in contact with their exterior surfaces.
2. Where masonry chimneys are constructed as part of masonry or concrete walls, combustible materials shall not be in contact with the masonry or concrete wall less than 12 inches (305 mm) from the inside surface of the nearest flue lining.
3. Exposed combustible trim and the edges of sheathing materials, such as wood siding and flooring, shall be permitted to abut the masonry chimney side walls, in accordance with Figure R1003.18, provided such combustible trim or sheathing is not less than 8 inches (203 mm) from the inside surface of the nearest flue lining.



For SI: 1 foot = 304.8 mm, 1 square inch = 645.16 mm².

**FIGURE R1003.15.2
FLUE SIZES FOR MASONRY CHIMNEYS**



For SI: 1 inch = 25.4 mm.

**FIGURE R1003.18
CLEARANCE FROM COMBUSTIBLES**

CHIMNEYS AND FIREPLACES

R1003.19 Chimney fireblocking. Spaces between chimneys and floors and ceilings through which chimneys pass shall be fireblocked with noncombustible material securely fastened in place. The fireblocking of spaces between chimneys and wood joists, beams or headers shall be self-supporting or be placed on strips of metal or metal lath laid across the spaces between combustible material and the chimney.

R1003.20 Chimney crickets. Chimneys shall be provided with crickets where the dimension parallel to the ridgeline is greater than 30 inches (762 mm) and does not intersect the ridgeline. The intersection of the cricket and the chimney shall be flashed and counterflashed in the same manner as normal roof-chimney intersections. Crickets shall be constructed in compliance with Figure R1003.20 and Table R1003.20.

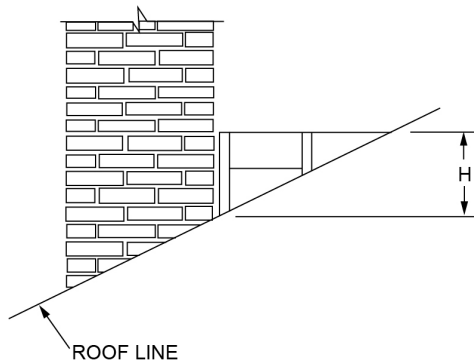
**TABLE R1003.20
CRICKET DIMENSIONS**

ROOF SLOPE	H
12:12	$\frac{1}{2}$ of W
8:12	$\frac{1}{3}$ of W
6:12	$\frac{1}{4}$ of W
4:12	$\frac{1}{6}$ of W
3:12	$\frac{1}{8}$ of W

SECTION R1004 FACTORY-BUILT FIREPLACES

R1004.1 General. Factory-built fireplaces shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

R1004.1.1 Factory-built wood burning fireplaces. *Factory-built wood burning fireplaces shall be qualified at the U.S. EPA's Voluntary Fireplace Program Phase 2 emissions level and be in accordance with the California Green Building Standards Code, Chapter 4, Division 4.5.*



For SI: 1 inch = 25.4 mm.

**FIGURE R1003.20
CHIMNEY CRICKET**

R1004.2 Hearth extensions. Hearth extensions of approved factory-built fireplaces shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area. Listed and labeled hearth extensions shall comply with UL 1618.

R1004.3 Decorative shrouds. Decorative shrouds shall not be installed at the termination of chimneys for factory-built fireplaces except where the shrouds are listed and labeled for use with the specific factory-built fireplace system and installed in accordance with the manufacturer's instructions.

R1004.5 Gasketed fireplace doors. A gasketed fireplace door shall not be installed on a factory-built fireplace except where the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

SECTION R1005 FACTORY-BUILT CHIMNEYS

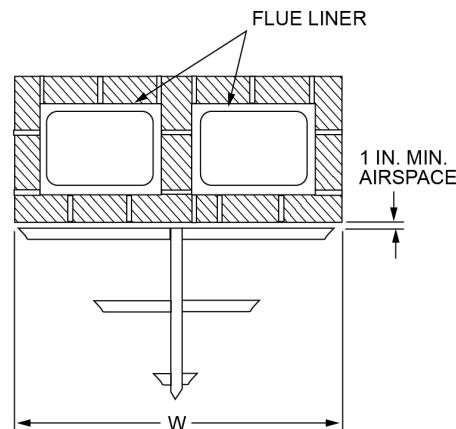
R1005.1 Listing. Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

R1005.2 Decorative shrouds. Decorative shrouds shall not be installed at the termination of factory-built chimneys except where the shrouds are listed and labeled for use with the specific factory-built chimney system and installed in accordance with the manufacturer's installation instructions.

R1005.3 Solid-fuel appliances. Factory-built chimneys installed in dwelling units with solid-fuel-burning appliances shall comply with the Type HT requirements of UL 103 and shall be marked "Type HT" and "Residential Type and Building Heating Appliance Chimney."

Exception: Chimneys for use with open combustion chamber fireplaces shall comply with the requirements of UL 103 and shall be marked "Residential Type and Building Heating Appliance Chimney."

Chimneys for use with open combustion chamber appliances installed in buildings other than dwelling units shall comply with the requirements of UL 103 and shall be



marked “Building Heating Appliance Chimney” or “Residential Type and Building Heating Appliance Chimney.”

R1005.4 Factory-built fireplaces. Chimneys for use with factory-built fireplaces shall comply with the requirements of UL 127.

R1005.5 Support. Where factory-built chimneys are supported by structural members, such as joists and rafters, those members shall be designed to support the additional load.

R1005.6 Medium-heat appliances. Factory-built chimneys for medium-heat appliances producing flue gases having a temperature above 1,000°F (538°C), measured at the entrance to the chimney, shall comply with UL 959.

R1005.7 Factory-built chimney offsets. Where a factory-built chimney assembly incorporates offsets, no part of the chimney shall be at an angle of more than 30 degrees (0.52 rad) from vertical at any point in the assembly and the chimney assembly shall not include more than four elbows.

R1005.8 Insulation shield. Where factory-built chimneys pass through insulated assemblies, an insulation shield constructed of steel having a thickness of not less than 0.0187 inch (0.4712 mm) (No. 26 gage) shall be installed to provide clearance between the chimney and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the chimney manufacturer’s installation instructions. Where chimneys pass through attic space, the shield shall terminate not less than 2 inches (51 mm) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed chimney system shall be installed in accordance with the manufacturer’s installation instructions.

SECTION R1006 EXTERIOR AIR SUPPLY

R1006.1 Exterior air. Factory-built or masonry fireplaces covered in this chapter shall be equipped with an exterior air supply to ensure proper fuel combustion unless the room is mechanically ventilated and controlled so that the indoor pressure is neutral or positive.

R1006.1.1 Factory-built fireplaces. Exterior combustion air ducts for factory-built fireplaces shall be a listed component of the fireplace and shall be installed in accordance with the fireplace manufacturer’s instructions.

R1006.1.2 Masonry fireplaces. Listed combustion air ducts for masonry fireplaces shall be installed in accordance with the terms of their listing and the manufacturer’s instructions.

R1006.2 Exterior air intake. The exterior air intake shall be capable of supplying all combustion air from the exterior of the dwelling or from spaces within the dwelling ventilated with outdoor air such as nonmechanically ventilated crawl or attic spaces. The exterior air intake shall not be located within the garage or basement of the dwelling. The exterior air intake, for other than listed factory-built fireplaces, shall not be located at an elevation higher than the firebox. The exte-

rior air intake shall be covered with a corrosion-resistant screen of 1/4-inch (6.4 mm) mesh.

R1006.3 Clearance. Unlisted combustion air ducts shall be installed with a minimum 1-inch (25 mm) clearance to combustibles for all parts of the duct within 5 feet (1524 mm) of the duct outlet.

R1006.4 Passageway. The combustion air passageway shall be not less than 6 square inches (3870 mm²) and not more than 55 square inches (0.035 m²), except that combustion air systems for listed fireplaces shall be constructed in accordance with the fireplace manufacturer’s instructions.

R1006.5 Outlet. The exterior air outlet shall be located in the back or side of the firebox chamber or shall be located outside of the firebox, at the level of the hearth and not greater than 24 inches (610 mm) from the firebox opening. The outlet shall be closable and designed to prevent burning material from dropping into concealed combustible spaces.

Part IV—Energy Conservation

(Note: Part IV is not adopted. See California Energy Code, Title 24, Part 6.)

Part V—Mechanical

(Note: Part V is not adopted. See California Mechanical Code, Title 24, Part 4.)

Part VI—Fuel Gas

(Note: Part VI is not adopted. See California Mechanical Code and California Plumbing Code, Title 24, Parts 4 and 5.)

Part VII—Plumbing

(Note: Part VII is not adopted. See California Plumbing Code, Title 24, Part 5.)

Part VIII—Electrical

(Note: Part VIII is not adopted. See California Electrical Code, Title 24, Part 3.)

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE CHAPTER 44 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)			X	X																		
Adopt only those sections that are listed below																						
Chapter / Section																						
AAMA				X																		
ACCA				X																		
ANSI			X	X																		
ASME				X																		
ASTM			X	X																		
CSA				X																		
DASMA				X																		
ICC			X	X																		
IFC-18				X																		
ISO				X																		
NFPA			X	X																		
NFPA 68-13			X																			
SFM			X																			
UBC			X																			
UL				X																		
UL 1974-17			X																			
UL 9540-20			X																			
UL 9540 Edition 4 2019			X																			
WDMA				X																		

The state agency does not adopt sections identified with the following symbol: †

Part IX—Referenced Standards

CHAPTER 44

REFERENCED STANDARDS

Notwithstanding California laws and regulations, these referenced standards shall be applicable only to those California Residential Code sections that are adopted.

User notes:

About this chapter: *The one- and two-family dwelling code contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials, products and methods of construction. Chapter 44 contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.*

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section R102.4.

AAMA

American Architectural Manufacturers Association
1900 E. Golf Road, Suite 1250
Schaumburg, IL 60173

450—20: Voluntary Performance Rating Method for Muller Fenestration Assemblies

R609.8

506—16: Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products

R609.6.1

711—20: Voluntary Specification for Self-adhering Flashing Used for Installation of Exterior Wall Fenestration Products

R703.4

712—14: Voluntary Specification for Mechanically Attached Flexible Flashing

R703.4

714—19: Voluntary Specification for Liquid Applied Flashing Used to Create a Water-resistive Seal around Exterior Wall Openings in Buildings

R703.4

AAMA/NSA 2100—19: Specifications for Sunrooms

R301.2.1.1.1

AAMA/WDMA/CSA 101/LS.2/A440—17: North American Fenestration Standards/Specifications for Windows, Doors and Skylights

R308.6.9, R609.3

ACCA

Air Conditioning Contractors of America
1330 Braddock Place, Suite 350
Alexandria, VA 22314

ANSI/ACCA 1 Manual D—2016: Residential Duct Systems

Table R301.2

ACI

American Concrete Institute
38800 Country Club Drive
Farmington Hills, MI 48331

318—19: Building Code Requirements for Structural Concrete

R402.2, Table R404.1.2(2), Table R404.1.2(5), Table R404.1.2(6), Table R404.1.2(7),
Table R404.1.2(8), R404.1.3, R404.1.3.1, R404.1.3.3, R404.1.3.4, R404.1.4.2, R404.5.1, R608.1,
R608.1.1, R608.1.2, R608.2, R608.5.1, R608.6.1, R608.8.2, R608.9.2, R608.9.3

332—20: Residential Code Requirements for Structural Concrete

R402.2, R403.1, R404.1.3, R404.1.3.4, R404.1.4.2, R506.1

REFERENCED STANDARDS

AISI

American Iron and Steel Institute
25 Massachusetts Avenue, NW Suite 800
Washington, DC 20001

AISI S100—16 (2020) w/S2—20: North American Specification for the Design of Cold-Formed Steel Structural Members, 2016 Edition (Reaffirmed 2020), with Supplement 2, 2020 Edition

R608.9.2, R608.9.3

AISI S220—20: North American Standard for Cold-Formed Steel Nonstructural Framing, 2020

R702.3.3

AISI S230—19: Standard for Cold-Formed Steel Framing—Prescriptive Method for One- and Two-Family Dwellings, 2019

R301.1.1, R301.2.1.1, R301.2.2.7, R301.2.2.8, R603.6, R603.9.4.1, R603.9.4.2, Figure 608.9(11),
R608.9.2, R608.9.3, R608.10

AISI S240—20: North American Standard for Cold-Formed Steel Structural Framing, 2020

R505.1.3, R603.6, R702.3.3, R804.3.6

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004

ANSI/AMCA 210-ANSI/ASHRAE 51—16: Laboratory Methods of Testing Fans for Aerodynamic Performance Rating

Table M1504.2, M1505.3

ANCE

Association of Standardization and Certification
Av. Lázaro Cárdenas No. 869
Fraccion 3
Col. Nva. Industrial Vallejo
Deleg. Gustavo A. Madero
Mexico, D.F.

NMX-J-521/2-40-ANCE—2014/CAN/CSA-22.2 No. 60335-2-40—12/UL 60335-2-40: Safety of Household and Similar Electric Appliances, Part 2-40: Particular Requirements for Heat Pumps, Air-Conditioners and Dehumidifiers

M1403.1, M1412.1, M1413.1

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

A108.1A—17: Installation of Ceramic Tile in the Wet-set Method, with Portland Cement Mortar

R702.4.1

A108.1B—2017: Installation of Ceramic Tile, Quarry Tile on a Cured Portland Cement Mortar Setting Bed with Dry-set or Latex Portland Mortar

R702.4.1

A108.4—09: Installation of Ceramic Tile with Organic Adhesives or Water-Cleanable Tile-setting Epoxy Adhesive

R702.4.1

A108.5—19: Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex Portland Cement Mortar

R702.4.1

A108.6—99 (reaffirmed 2019): Installation of Ceramic Tile with Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy

R702.4.1

A108.11—10: Interior Installation of Cementitious Backer Units

R702.4.1

A118.1—18: American National Standard Specifications for Dry-set Portland Cement Mortar

R702.4.1

A118.3—13: American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy, and Water-cleanable Tile-setting Epoxy Adhesive

R702.4.1

ANSI—continued

- A118.4—18: American National Standard Specifications for Modified Dry-Set Cement Mortar**
R606.2.1.1
- A136.1—20: American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile**
R702.4.1
- A137.1—19: American National Standard Specifications for Ceramic Tile**
R702.4.1
- ANSI 117—2020: Standard Specifications for Structural Glued Laminated Timber of Softwood Species**
R502.1.3, R602.1.3, R802.1.3
- S3.41: American National Standard Audible Evacuation Signal**
R335.5.2.1
- Z97.1—2014: Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test**
R308.1.1, R308.3.1

APA

APA—The Engineered Wood Association
7011 South 19th Street
Tacoma, WA 98466

- ANSI/A190.1—2017: Structural Glued-laminated Timber**
R502.1.3, R602.1.3, R802.1.2
- ANSI/APA PRG 320—2019: Standard for Performance-rated Cross Laminated Timber**
R502.1.6, R602.1.6, R802.1.6
- ANSI/APA PRP 210—2019: Standard for Performance-rated Engineered Wood Siding**
R604.1, Table R703.3(1), R703.3.4
- ANSI/APA PRR 410—2016: Standard for Performance-rated Engineered Wood Rim Boards**
R502.1.7, R602.1.7, R802.1.7
- ANSI/APA PRS 610.1—2018: Standard for Performance-Rated Structural Insulated Panels in Wall Applications**
R602.1.11, R610.3, R610.4
- APA E30—19: Engineered Wood Construction Guide**
Table R503.2.1.1(1), R503.2.2, R803.2.2, R803.2.3

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
Reston, VA 20191-4400

- 7—16 with Supplement 1: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
Table R608.7(1A), Table R608.7(1B), Table R608.7(1C), R301.2.1.1, R301.2.1.2, R301.2.1.2.1, R301.2.1.5, R301.2.1.5.1, Table R608.6(1), Table R608.6(2), Table R608.6(3), Table R608.6(4), R608.9.2, R608.9.3, R609.2, R609.6.2
- 24—14: Flood-resistant Design and Construction**
R301.2.4, R301.2.4.1, R322.1, R322.1.1, R322.1.6, R322.1.9, R322.2.2, R322.3.3
- 32—01: Design and Construction of Frost-protected Shallow Foundations**
R403.1.4.1

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

- A18.1—2020: Safety Standard for Platforms and Stairway Chair Lifts**
R321.2
- ASME A17.1—2019/CSA B44—2019: Safety Code for Elevators and Escalators**
R321.1

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428

A36/A36M—14: Specification for Carbon Structural Steel
R608.5.2.2

➔ **A53/A53M—2018: 2018 Specification for Pipe, Steel, Black and Hot-dipped, Zinc-coated Welded and Seamless**
R407.3

➔ **A123/A123M—2017: Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products**
Table 507.2.3

➔ **A153/A153M—2016A: Specification for Zinc Coating (Hot Dip) on Iron and Steel Hardware**
R317.3, Table 507.2.3, Table R606.3.4.1, R703.6.3, R905.7.5, R905.8.6

A167—99(2009): Specification for Stainless and Heat-resisting Chromium-nickel Steel Plate, Sheet and Strip
Table R606.3.4.1

A240/A240M—17: Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications
Table R905.10.3(1)

➔ **A307—2014E1: Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength**
Table R507.2.3, R608.5.2.2

➔ **A463/A463M—15: Standard Specification for Steel Sheet, Aluminum-coated by the Hot-dip Process**
Table R905.10.3(2)

➔ **A563—15: Standard Specification for Carbon and Alloy Steel Nuts**
Table R507.2.3

A615/A615M—2015aE1: Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement
R402.3.1, R403.1.3.5.1, R404.1.3.3.7.1, R608.5.2.1

A641/A641M—09a(2014): Specification for Zinc-coated (Galvanized) Carbon Steel Wire
Table R606.3.4.1

➔ **A653—2017: Specification for Steel Sheet, Zinc-coated (Galvanized) or Zinc-iron Alloy-coated (Galvannealed) by the Hot-dip Process**
R317.3.1, R505.2.2, Table R507.2.3, R603.2.2, Table R606.3.4.1, R608.5.2.3, R804.2.2, R804.2.3,
Table R905.10.3(1), Table R905.10.3(2)

A706M—2016: Specification for Low-alloy Steel Deformed and Plain Bars for Concrete Reinforcement
R402.3.1, R403.1.3.5.1, R404.1.3.3.7.1, R608.5.2.1

➔ **A755M—2016E1: Specification for Steel Sheet, Metallic Coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products**
Table R905.10.3(2)

A792/A792M—10(2015): Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process
R505.2.2, R603.2.2, R608.5.2.3, R804.2.2, Table 905.10.3(2)

A875/A875M—13: Specification for Steel Sheet, Zinc-5%, Aluminum Alloy-coated by the Hot-dip Process
R608.5.2.3, Table R905.10.3(2)

➔ **A924M—2017A: Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process**
Table R905.10.3(1)

A996M—2016: Specifications for Rail-steel and Axle-steel Deformed Bars for Concrete Reinforcement
R403.1.3.5.1, Table R404.1.2(9), R404.1.3.3.7.1, R608.5.2.1, Table R608.5.4(2)

➔ **A1003/A1003M—15: Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-coated for Cold-formed Framing Members**
R505.2.1, R505.2.2, R603.2.1, R603.2.2, R804.2.1, R804.2.2

➔ **B101—12: Specification for Lead-coated Copper Sheet and Strip for Building Construction**
Table R905.2.8.2, Table R905.10.3(1)

➔ **B209—14: Specification for Aluminum and Aluminum-alloy Sheet and Plate**
Table 905.10.3(1)

➔ **B370—12: Specification for Copper Sheet and Strip for Building Construction**
Table R905.2.8.2, Table R905.10.3(1)

➔ **B695—2004(2016): Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel**
R317.3.1, R317.3.3, Table R507.2.3

ASTM—continued

- C22/C22M—2015: Specification for Gypsum**
R702.2.1, R702.3.1
- C27—1998(2018): Specification for Standard Classification of Fireclay and High-alumina Refractory Brick**
R1001.5
- C28/C28M—10(2015): Specification for Gypsum Plasters**
R702.2.1
- C33/C33M—2018: Specification for Concrete Aggregates**
R403.4.1
- C34—2017: Specification for Structural Clay Load-bearing Wall Tile**
Table R301.2, R606.2.2
- C35/C35M—01(2014): Specification for Inorganic Aggregates for Use in Gypsum Plaster**
R702.2.1
- C55—2017: Specification for Concrete Building Brick**
R202, Table R301.2, R606.2.1
- C56—2013(2017): Standard Specification for Structural Clay Nonloadbearing Tile**
R606.2.2
- C59/C59M—00(2015): Specification for Gypsum Casting Plaster and Molding Plaster**
R702.2.1
- C61/C61M—00(2015): Specification for Gypsum Keene’s Cement**
R702.2.1
- C62—2017: Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)**
R202, Table R301.2, R606.2.2
- C73—2017: Specification for Calcium Silicate Face Brick (Sand Lime Brick)**
R202, Table R301.2, R606.2.1
- C90—2016A: Specification for Load-bearing Concrete Masonry Units**
Table R301.2, 606.2.1
- C91M—2018: Specification for Masonry Cement**
R702.2.2, R703.7.2
- C94/C94M—2017A: Standard Specification for Ready-mixed Concrete**
R404.1.3.3.2, R608.5.1.2
- C126—2017: Standard Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units**
R606.2.2
- C129—2017: Specification for Nonload-bearing Concrete Masonry Units**
Table R301.2
- C143/C143M—15A: Test Method for Slump of Hydraulic Cement Concrete**
R404.1.3.3.4, R608.5.1.4
- C145—85: Specification for Solid Load-bearing Concrete Masonry Units**
R202, Table R301.2
- C150/C150M—2018: Specification for Portland Cement**
R608.5.1.1, R702.7.2
- C199—1984(2016): Test Method for Pier Test for Refractory Mortar**
R1001.5, R1001.8, R1003.12
- C207—2018: Specification for Hydrated Lime for Masonry Purposes**
Table R606.2.8
- C208—2012(2017)E1: Specification for Cellulosic Fiber Insulating Board**
R602.1.1.10, Table R602.3(1), Table R906.2
- C212—2017: Standard Specification for Structural Clay Facing Tile**
R606.2.2
- C216—2017A: Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)**
R202, Table R301.2, R606.2.2
- C270—14A: Specification for Mortar for Unit Masonry**
R606.2.8, Table R606.2.8, R606.2.11

REFERENCED STANDARDS

ASTM—continued

- ➡ **C315—2007(2016): Specification for Clay Flue Liners and Chimney Pots**
R1001.8, R1003.11.1, Table R1003.14(1)
- C406/C406M—2015: Specifications for Roofing Slate**
R905.6.4
- ➡ **C475M—2017: Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard**
R702.3.1
- C476—2018: Specification for Grout for Masonry**
R606.2.12
- C503M—2015: Standard Specification for Marble Dimension Stone**
R606.2.4
- C514—04(2014): Specification for Nails for the Application of Gypsum Wallboard**
R702.3.1
- C552—2017E1: Standard Specification for Cellular Glass Thermal Insulation**
Table R906.2
- C557—2003(2017): Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing**
R702.3.1.1
- ➡ **C568M—2015: Standard Specification for Limestone Dimension Stone**
R606.2.4
- C578—2018: Specification for Rigid, Cellular Polystyrene Thermal Insulation**
R316.8, R403.3, Table 703.8.4(2), Table R703.15.1, Table R703.15.2, Table R703.16.1,
Table R703.16.2, Table R906.2
- C587—2004(2018): Specification for Gypsum Veneer Plaster**
R702.2.1
- C595/C595M—2018: Specification for Blended Hydraulic Cements**
R608.5.1.1, R702.2.2, R703.7.2
- C615/C615M—2018E1: Standard Specification for Granite Dimension Stone**
R606.2.4
- C616/C616M—2015: Standard Specification for Quartz-based Dimension Stone**
R606.2.4
- C629/C629M—2015: Standard Specification for Slate Dimension Stone**
R606.2.4
- C631—09(2014): Specification for Bonding Compounds for Interior Gypsum Plastering**
R702.2.1
- C645—2018: Specification for Nonstructural Steel Framing Members**
R702.3.3
- C652—2017A: Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)**
R202, Table R301.2, R606.2.2
- C685/C685M—2017: Specification for Concrete Made by Volumetric Batching and Continuous Mixing**
R404.1.3.3.2, R608.5.1.2
- ➡ **C726—2017: Standard Specification for Mineral Wool Roof Insulation Board**
Table R906.2
- C728—2017A: Standard Specification for Perlite Thermal Insulation Board**
Table R906.2
- C744—2016: Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units**
R606.2.1
- C836/C836M—2018: Specification for High Solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course**
R905.15.2
- C841—2003(2018): Standard Specification for Installation of Interior Lathing and Furring**
R702.2.1
- C842—05(2015): Standard Specification for Application of Interior Gypsum Plaster**
R702.2.1

ASTM—continued

- C843—2017: Specification for Application of Gypsum Veneer Plaster**
R702.2.1
- C844—2015: Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster**
R702.2.1
- C847—2018: Specification for Metal Lath**
R702.2.1, R702.2.2
- C887—13: Specification for Packaged, Dry, Combined Materials for Surface Bonding Mortar**
R406.1, R606.2.9
- C897—15: Specification for Aggregate for Job-mixed Portland Cement-based Plasters**
R702.2.2
- C920—2018: Standard Specification for Elastomeric Joint Sealants**
R406.4.1
- C926—2018B: Specification for Application of Portland Cement-based Plaster**
R702.2.2, R702.2.2.1, R703.7, R703.7.2, R703.7.2.1, R703.7.4
- C933—2018: Specification for Welded Wire Lath**
R702.2.1, R702.2.2
- C946—2018: Standard Practice for Construction of Dry-Stacked, Surface-Bonded Walls**
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- C954—2018: Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in (0.84 mm) or to 0.112 in. (2.84 mm) in Thickness**
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- C1032—2018: Specification for Woven Wire Plaster Base**
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- C1047—14a: Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base**
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- C1063—2018B: Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-based Plaster**
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- C1088—2018: Standard Specification for Thin Veneer Brick Units Made from Clay or Shale**
R606.2.2
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R702.3.1, Table 906.2
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R606.2.6

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R606.2.3

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- D1227—13: Specification for Emulsified Asphalt Used as a Protective Coating for Roofing**
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R905.1.1, R905.2.8.2, R905.11.2.1
- D2178/D2178M—15A: Specification for Asphalt Glass Felt Used in Roofing and Waterproofing** ←
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- D2626/D2626M—04 (2012)e1: Specification for Asphalt-saturated and Coated Organic Felt Base Sheet Used in Roofing** ←
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- D2822/D2822M—2005(2011): Specification for Asphalt Roof Cement, Asbestos Containing** ←
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- D2823/D2823M—05(2011)e1: Specification for Asphalt Roof Coatings, Asbestos Containing**
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- D3201/D3201M—2013: Test Method for Hygroscopic Properties of Fire-retardant Wood and Wood-base Products**
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R703.11
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- D4637/D4637M—2015: Specification for EPDM Sheet Used in Single-ply Roof Membrane**
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- D6164/D6164M—2016: Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements**
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- D6222/D6222M—2016: Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements**
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- E2886/E2886M—2014: Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingent
R337.6.2, R337.6.3

*ASTM E2886, Amended Sections as follows:

Revise Sections 10.1.8.3, 10.1.8.4 and 10.1.8.5 as follows:

10.1.8.3 Report the temperatures of the unexposed temperatures on the unexposed side of the vent during the entire optional Insulation Test of the Flame Intrusion.

10.1.8.4 The maximum temperature reached during the test by any one of the unexposed surface thermocouples during the entire optional Insulation Test of the Flame Intrusion Test.

10.1.8.5 The maximum average temperature reached during the test by all of the unexposed surface thermocouples during the entire optional Insulation Test of the Flame Intrusion Test.

ASTM—continued

E2957—2015: Standard Test Method for Resistance to Wildfire Penetration of Eaves, Soffits and Other Projections
R337.7.5, R337.7.6, R337.7.8, R337.7.10

**ASTM E2957, Amended Sections as follows:*

Add new Section 12.5 as follows:

12.5 Conditions of Acceptance: *Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.*

- 1. Absence of flame penetration of the eaves or horizontal projection assembly at any time.*
- 2. Absence of structural failure of the eaves or horizontal projection subassembly at any time.*
- 3. Absence of sustained combustion of any kind at the conclusion of the 40-minute test.*

E2925—17: Standard Specification for Manufactured Polymeric Drainage and Ventilation Materials Used to Provide a Rainscreen Function

R703.7.3.2

F844—07a(2013): Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use

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F1667—2018: Specification for Driven Fasteners, Nails, Spikes and Staples

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F2374: Standard Practice for Design, Manufacture, Operation, and Maintenance of Inflatable Amusement Devices

AWC

American Wood Council
222 Catoctin Circle SE, Suite 201
Leesburg, VA 20175

ANSI/AWC NDS—2018: National Design Specification (NDS) for Wood Construction—with 2018 Supplement

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AWC STJR—2021: Span Tables for Joists and Rafters

R502.3, R802.4.1, R802.5.1

AWPA

American Wood Protection Association
P.O. Box 361784
Birmingham, AL 35236-1784

C1—03: All Timber Products—Preservative Treatment by Pressure Processes

R902.2

M4—15: Standard for the Care of Preservative-treated Wood Products

R317.1.1, R318.1.2

U1—20: USE CATEGORY SYSTEM: User Specification for Treated Wood Except Commodity Specification H

R317.1, R402.1.2, R504.3, R703.6.3, R905.7.5, Table R905.8.5, R905.8.6

CEN

European Committee for Standardization (EN)
Rue de la Science 23
Brussels, Belgium B - 1040

EN 15250—2007: Slow Heat Release Appliances Fired by Solid Fuel Requirements and Test Methods

R1002.2

CPA

Composite Panel Association
19465 Deerfield Avenue, Suite 306
Leesburg, VA 20176

- A208.1—2016: Particleboard**
R503.3.1, R602.1.9, R605.1
- ANSI A135.4—2012: Basic Hardboard**
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- ANSI A135.5—2012: Prefinished Hardboard Paneling**
R702.5
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R703.5
- ANSI A135.7—2012: Engineered Wood Trim**
R703.5

CPSC

Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814

- 16 CFR, Part 1201—(2002): Safety Standard for Architectural Glazing**
R308.1.1, R308.3.1, Table R308.3.1(1)
- 16 CFR, Part 1209—(2002): Interim Safety Standard for Cellulose Insulation**
R302.10.3
- 16 CFR, Part 1404—(2002): Cellulose Insulation**
R302.10.3

CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland, OH 44131-5516

- ➔ **AAMA/WDMA/CSA 101/LS.2/A440—17: North American Fenestration Standard/Specification for Windows, Doors and Unit Skylights**
R308.6.9, R609.3
- ➔ **ASME A17.1/CSA B44—2019: Safety Code for Elevators and Escalators**
R321.1
- ➔ **B44—2019: Safety Code for Elevators and Escalators**
R321.1
- ➔ **CSA O325—16: Construction Sheathing**
R503.2.1, R602.1.8, R604.1, R803.2.1
- O437-Series—93(R2011): Standards on OSB and Waferboard**
R503.2.1, R602.1.8, R604.1, R803.2.1

CSSB

Cedar Shake & Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

- CSSB—97: Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau**
R702.6, R703.6

DASMA

Door & Access Systems Manufacturers Association International
1300 Sumner Avenue
Cleveland, OH 44115-2851

- ➔ **108—2017: Standard Method for Testing Garage Doors, Rolling Doors and Flexible Doors; Determination of Structural Performance Under Uniform Static Air Pressure Difference**
R609.4
- 115—2017: Standard Method for Testing Sectional Garage Doors, Rolling Doors and Flexible Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure**
R301.2.1.2

DHA

Decorative Hardwoods Association (formerly HPVA)
42777 Trade West Drive
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ANSI/HPVA HP-1—2016: American National Standard for Hardwood and Decorative Plywood
R702.5

DOC

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1401 Constitution Avenue, NW
Washington, DC 20230

PS 1—19: Structural Plywood
R404.2.1, Table R404.2.3, R503.2.1, R602.1.8, R604.1, R803.2.1

PS 2—18: Performance Standard for Wood Structural Panels
R404.2.1, Table R404.2.3, R503.2.1, R602.1.8, R604.1, R803.2.1

PS 20—05: American Softwood Lumber Standard
R404.2.1, R502.1.1, R602.1.1, R802.1.1

FEMA

Federal Emergency Management Agency
500 C Street SW
Washington, DC 20472

FEMA TB-2—08: Flood Damage-resistant Materials Requirements
R322.1.8

FEMA TB-11—01: Crawlspace Construction for Buildings Located in Special Flood Hazard Area
R408.7

FM

FM Approvals
Headquarters Office
Norwood, MA 02062

4450—(1989): Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992
R906.1

4474—2011: American National Standard for Evaluating the Simulated Wind Uplift Resistance of Roof Assemblies Using Static Positive and/or Negative Differential Pressures
R905.4.4.1

ANSI/FM 4880—(2017): American National Standard for Evaluating the Fire Performance of Insulated Building Panel Assemblies and Interior Finish Materials
R316.6

GA

Gypsum Association
6525 Belcrest Road, Suite 480
Hyattsville, MD 20782

GA-253—2018: Application of Gypsum Sheathing
Table R602.3(1)

ICC

International Code Council, Inc.
500 New Jersey Avenue NW
6th Floor
Washington, DC 20001

CBC—22: California Building Code
R320.1.1, R101.2, R202, R301.1.1, R301.1.3, R301.2.1.1, R301.2.2.1.1, R301.2.2.1.2, R301.3,
Table R302.1(1), Table R302.1(2), R302.2.1, R302.2.2, R302.3, R308.5, R320.1, R321.3, R403.1.8,
Table R602.10.3(3), Table R606.12.2.1, R609.2, R802.1.5.4, R905.10.3

CEBC—22: California Existing Building Code
R110.2

CFC—22: California Fire Code
R102.7, R324.2

REFERENCED STANDARDS

ICC—continued

ICC 400—17: Standard on the Design and Construction of Log Structures

R301.1.1, R502.1.4, R602.1.4, R703.1, R802.1.3

➔ ICC 500—2020: ICC/NSSA Standard for the Design and Construction of Storm Shelters

R323.1

ICC 600—2020: Standard for Residential Construction in High-wind Regions

R301.2.1.1

➔ ICC/ANSI A117.1—17: Accessible and Usable Buildings and Facilities

R321.3

ISO

International Organization for Standardization
Chemin de Blandonnet 8
Geneva, Switzerland CP 401 - 1214

➔ 8336—2009: Fibre-cement Flat Sheets-product Specification and Test Methods

Table R503.2.1.1(1), Table R503.2.1.1(2), Table R602.3(2), Table R702.4.2, R703.10.1, R703.10.2

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

|| 13D—22: Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes as amended*

R313.1.1, R313.2.1, R324.6.2.1

|| *See California Fire Code for amendments

**NFPA 13D, Amended Sections as follows:*

Revise Section 6.2.2 to read as follows:

6.2.2 Where a well, pump, tank or combination thereof is the source of supply for a fire sprinkler system, the configuration for the system shall be one of the following:

- (1) The water supply shall serve both domestic and fire sprinkler systems,
 - (a) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
 - (b) Any disconnecting means for the pump shall be approved.
 - (c) A method for refilling the tank shall be piped to the tank.
 - (d) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (e) The pump shall not be permitted to sit directly on the floor.
- (2) A stand-alone tank is permitted if the following conditions are met:
 - (a) The pump shall be connected to a 220-volt circuit breaker shared with a common household appliance (e.g., range, oven, dryer),
 - (b) The pump shall be a stainless steel 240-volt pump,
 - (c) A valve shall be provided to exercise the pump. The discharge of the exercise valve shall drain to the tank, and
 - (d) A sign shall be provided stating “Valve must be opened monthly for 5 minutes.”
 - (e) A means for automatically refilling the tank level, so that the tank capacity will meet the required water supply duration in minutes, shall be provided.
 - (f) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection may return water to the tank.
 - (g) Any disconnecting means for the pump shall be approved.
 - (h) A method for refilling the tank shall be piped to the tank.
 - (i) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (j) The pump shall not be permitted to sit directly on the floor.

Add new Section 6.2.2.1 to read as follows:

6.2.2.1 Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.

Add new Section 6.2.4 to read as follows:

6.2.4 Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.

NFPA—continued

Revise Section 8.3.4 to read as follows:

8.3.4* Sprinklers shall not be required in detached garages, open attached porches, carports with no habitable space above and similar structures.

Add new Section 8.3.10 and 8.3.10.1 as follows:

8.3.11 Solar photovoltaic panel structures

8.3.11.1 Sprinklers shall be permitted to be omitted from the following structures:

(1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.

(2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

13R—22: Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies

R325.5

68—13: Standard on Explosion Protection by Deflagration Venting

R202, R327, R327.1, R327.2, R327.3, R327.3.1, 327.4, R327.5, R327.6, R327.7, R327.8, R327.9, R327.10

70—20: National Electrical Code

*See California Electrical Code for amendments

72—22: National Fire Alarm and Signaling Code as amended*

R314.1, R314.7.1, R315.6, R315.7.2

*NFPA 72, Amended Sections as follows:

Revise Section 10.3.1 to read as follows:

10.3.1 Equipment constructed and installed in conformity with this code shall be listed for the purpose for which it is used. Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.

Revise Section 10.3.3 to read as follows:

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be California State Fire Marshal listed for use with the control unit.

Revise Section 12.3.8.1 to read as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure or raceway only under the following conditions:

(1) For a distance not to exceed 10 ft (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance or control unit enclosures

(2) Single drops installed in the raceway to individual devices or appliances

(3)*In a single room not exceeding 1000 ft² (93 m²) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices

(4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

Revise Section 14.4.6.1 to read as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in accordance with the manufacturer’s published instructions according to the methods of Table 14.4.3.2.

Revise Section 17.16 to read as follows:

17.16 Fire Extinguisher Electronic Monitoring Device. A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2 (c) and California Fire Code to a fire alarm control unit.

Revise Section 23.8.1.2 to read as follows:

23.8.1.2 Positive alarm sequence.

23.8.1.2.1 Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.

Revise Section 23.8.5.1.2 to read as follows:

23.8.5.1.2* Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, and supervisory service and fire sprinkler monitoring as permitted in Section 17.15 of NFPA 72.

NFPA—continued

Revise Section 23.8.5.4.1 to read as follows:

23.8.5.4.1 *Systems equipped with alarm verification features shall be permitted under the following conditions:*

- (1) *The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.*
- (2) *A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 by more than 30 seconds.*
- (3) *Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 without additional delay.*
- (4) *The current status of the alarm verification feature is shown on the record of completion (see Figure 7.8.2(a), item 4.3).*
- (5) *Operation of a patient room smoke detector in I-2 and R-2.1 Occupancies shall not include an alarm verification feature.*

Revise Section 29.3.1 to read as follows:

29.3.1 *All devices, combinations of devices and equipment to be installed in conformity with this chapter shall be approved and listed by the California State Fire Marshal for the purposes for which they are intended.*

Revise Section 29.8.2.1.1 to read as follows:

29.8.2.1.1* *Smoke and Heat Alarms. Where connected to a supervising station unless exempted by applicable laws, codes or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms, or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.*

Note: Exception to 29.8.2.1.1 not adopted by the SFM

Add Section 29.10.2.1 to read as follows:

29.10.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Add Section 29.10.6.8.1 to read as follows:

29.10.6.8.1 *The alarm verification feature shall not be used for household fire warning equipment.*

259—18: Standard for Test Method for Potential Heat of Building Materials

R316.5.7, R316.5.8

275—17: Standard Method of Fire Tests for the Evaluation of Thermal Barriers

R316.4

276—15: Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components

R906.1

286—19: Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth

R302.9.4, R316.6

501—17: Standard on Manufactured Housing

R202

720—15: Standard for the Installation of Carbon Monoxide (CO) Detectors and Warning Equipment

R315.7.1, R315.7.2

PCA

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

100—17: Prescriptive Design of Exterior Concrete Walls for One- and Two-family Dwellings (Pub. No. PCA 100.3)

R301.2.2.5, R404.1.3, R404.1.3.2.1, R404.1.3.2.2, R404.1.3.4, R404.1.4.2, R608.1, R608.2, R608.5.1, R608.9.2, R608.9.3

SBCA

Structural Building Components Association
6300 Enterprise Lane
Madison, WI 53719

ANSI/FS100—12(R2018): Standard Requirements for Wind Pressure Resistance of Foam Plastic Insulating Sheathing Used in Exterior Wall Covering Assemblies

R316.8

BCSI—2018: Building Component Safety Information Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses

R502.11.2, R802.10.3

CFS-BCSI—(updated June 2016): Cold-formed Steel Building Component Safety Information (CFSBCSI) Guide to Good Practice for Handling, Installing & Bracing of Cold-formed Steel Trusses

R505.1.3, R804.3.6

SFM

State of California
 Department of Forestry and Fire Protection
 Office of the State Fire Marshal
 P.O. Box 944246
 Sacramento, CA 944246-2460

SFM 12-3: Releasing Systems for Security Bars in Dwellings
 R310

SFM 12-7A-1: Exterior Wall Siding and Sheathing
 R327.5.3, R327.6.3.1, R327.6.3.2.3

SFM 12-7A-2: Exterior Window
 R327.5.3, R327.6.3.2.2

SFM 12-7A-3: Horizontal Protection Underside
 R327.5.3, R327.6.2.3

SFM 12-7A-4: Decking
 R327.5.3, R327.6.4.1.1

SFM 12-7A-4A: Decking Alternate Method A
 R327.3.7, R327.9.3.4

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)

TMS

The Masonry Society
 105 South Sunset Street, Suite Q
 Longmont, CO 80501

402—2016: Building Code Requirements for Masonry Structures
 R404.1.2, R606.1, R606.1.1, R606.12.1, R606.12.2.3.1, R606.12.3.1, R703.12

403—2017: Direct Design Handbook for Masonry Structures
 R606.1, R606.1.1, R606.12.1, R606.12.3.1

404—2016: Standard for the Design of Architectural Cast Stone
 R606.1

602—2016: Specification for Masonry Structures
 R606.2.10, R606.2.13, R703.12

TPI

Truss Plate Institute
 2670 Crain Highway, Suite 203
 Waldorf, MD 20601

TPI 1—2014: National Design Standard for Metal Plate Connected Wood Truss Construction
 R502.11.1, R802.10.2

UBC

International Code Council, Inc.
 500 New Jersey Avenue, NW 6th Floor
 Washington, DC 20001

UBC Standard 15-2: Test Standard for Determining the Fire Retardancy of Roof-covering Materials
 R902

UBC Standard 15-3: Wood Shakes
 R902

UBC Standard 15-4: Wood Shingles
 R902

UL

UL LLC
 333 Pfingsten Road
 Northbrook, IL 60062

55A—2004: Materials for Built-up Roof Coverings
 R905.9.2

103—2010: Factory-built Chimneys for Residential Type and Building Heating Appliances—with revisions through March 2017
 R202, R1005.3

REFERENCED STANDARDS

UL—continued

- ➡ 127—2011: **Factory-built Fireplaces—with revisions through July 2016**
R1001.11, R1004.1, R1004.4, R1004.5, R1005.4
- ➡ 217—2015: **Smoke Alarms—with revisions through November 2016**
R314.1.1, R315.1.1
- 263—2011: **Fire Test of Building Construction and Materials—with revisions through March 2018**
Table R302.1(2), R302.2, R302.2.1, R302.2.2, R302.4.1, R302.11.1, R606.2.2
- 268—2016: **Smoke Detectors for Fire Alarm Systems—with revisions through July 2016**
R314.7.1, R314.7.4, R315.7.4
- 325—2017: **Door, Drapery, Gate, Louver and Window Operations and Systems**
R309.4
- ➡ 580—2006: **Test for Uplift Resistance of Roof Assemblies—with Revisions through October 2013**
R905.4.4.1
- 641—2010: **Type L, Low-temperature Venting Systems—with revisions through April 2018**
R202, R1003.11.5
- ➡ 723—2018: **Standard for Test for Surface Burning Characteristics of Building Materials**
R202, R302.9.3, R302.9.4, R302.10.1, R302.10.2, R316.3, R316.5.9, R316.5.11, R507.2.2.2,
R703.14.3, R802.1.5
- ➡ 790—04: **Standard Test Methods for Fire Tests of Roof Coverings—with revisions through October 2018**
R302.2.4, R902.1
- ➡ 907—94: **Fireplace Accessories—with revisions through November 2014**
R1001.13
- ➡ 959—2010: **Medium Heat Appliance Factory-built Chimneys—with revisions through June 2014**
R1005.6
- ➡ 1040—1996: **Fire Test of Insulated Wall Construction—with revisions through April 2017**
R316.6
- ➡ 1256—02: **Fire Test of Roof Deck Construction—with revisions through August 2018**
R906.1
- ➡ 1479—2015: **Fire Tests of Through-Penetration Firestops**
R302.4.1.2
- 1482—2011: **Solid-Fuel-type Room Heaters—with revisions through August 2015**
R1002.2, R1002.5
- ➡ 1618—2015: **Wall Protectors, Floor Protectors, and Hearth Extensions—with revisions through January 2018**
R1004.2
- ➡ 1703—2002: **Flat-plate Photovoltaic Modules and Panels—with revisions through September 2018**
R324.3.1, R902.4, R905.16.4
- 1715—97: **Fire Test of Interior Finish Material—with revisions through April 2017**
R316.6
- ➡ 1741—2010: **Inverters, Converters, Controllers and Interconnection System Equipment with Distributed Energy Resources—with revisions through February 2018**
R324.3.1, R328.6
- ➡ 1777—07: **Chimney Liners—with revisions through April 2014**
R1003.11.1, R1003.18
- 1897—15: **Uplift Tests for Roof Covering Systems**
R905.4.4.1
- 1974—17: *Evaluation for Re-purposing Batteries*
R202, R327, R327.1, R327.2, R327.3, R327.3.1, R327.4, R327.5, R327.6, R327.7, R327.8, R327.9, R327.10
- ➡ 2034—2017: **Standard for Single- and Multiple-station Carbon Monoxide Alarms—with revisions through September 2018**
R314.1.1, R315.1.1
- 2075—2013: **Gas and Vapor Detectors and Sensors—with revisions through December 2017**
R314.7.4, R315.7.1, R315.7.4
- ➡ 2200—2012: **Stationary Engine Generator Assemblies—with revisions through October 2015**
R329.1

UL—continued

- 2703—2014: Mounting Systems, Mounting Devices, Clamping/Retention Devices and Ground Lugs for Use with Flat-Plate Photovoltaic Modules and Panels—with revisions through December 2019** ←
- R902.4
- 7103—19: Outline of Investigation for Building-Integrated Photovoltaic Roof Covering**
- R902.3, R905.16.4, Table 905.16.6, R905.17.5
- 9540 Edition 2—2020: Standard for Energy Storage Systems and Equipment** ||
- R328.2, R328.6
- 9540A Edition 4—2019: Standard for Safety Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems** ||
- R202, R327, R327.1, R327.2, R327.3, R327.3.1, R327.4, R327.5, R327.6, R327.7, R327.8, R327.9, R327.10
- 61730-1—2017: Photovoltaic (PV) Module Safety Qualification—Part 1: Requirements for Construction**
- R324.3.1, R905.16.4, 905.17.5
- 61730-2—2017: Photovoltaic (PV) Module Safety Qualification—Part 2: Requirements for Testing**
- R324.3.1, R905.16.4, R905.17.5

ULC

ULC
13775 Commerce Parkway
Richmond, BC V6V 2V4

- CAN/ULC S 102.2—2018: Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies** ←
- R302.10.1, R302.10.2

WDMA

Window and Door Manufacturers Association
2025 M Street NW, Suite 800
Washington, DC 20036-3309

- AAMA/WDMA/CSA 101/I.S.2/A440—17: North American Fenestration Standard/Specifications for Windows, Doors and Skylights** ←
- R308.6.9, R609.3
- I.S. 11—16: Industry Standard Analytical Method for Design Pressure (DP) Ratings of Fenestration Products**
- R308.6.9.1, R609.3.1

WMA

World Millwork Alliance (formerly Association of Millwork Distributors Standards AMD)
10047 Robert Trent Parkway
New Port Richey, FL 34655-4649

- ANSI WMA 100—2018: Standard Method of Determining Structural Performance Ratings of Side-Hinged Exterior Door Systems and Procedures for Component Substitution**
- R609.3

APPENDIX AA
RESERVED

APPENDIX AB
RESERVED

APPENDIX AC
RESERVED

APPENDIX AD
RESERVED

APPENDIX AE
RESERVED

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AF – RADON CONTROL METHODS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

APPENDIX AF

RADON CONTROL METHODS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix AF contains provisions that are intended to mitigate the transfer of radon gases from the soil into dwelling units. Radon is a radioactive gas that has been identified as a cancer-causing agent. Radon comes from the natural breakdown of uranium in soil, rock and water.

SECTION AF101 SCOPE

AF101.1 General. This appendix contains requirements for new construction in jurisdictions where radon-resistant construction is required.

Inclusion of this appendix by jurisdictions shall be determined through the use of locally available data or determination of Zone 1 designation in Figure AF101.1 and Table AF101.1.

SECTION AF102 DEFINITIONS

AF102.1 General. For the purpose of these requirements, the terms used shall be defined as follows:

DRAIN TILE LOOP. A continuous length of drain tile or perforated pipe extending around all or part of the internal or external perimeter of a basement or crawl space footing.

RADON GAS. A naturally occurring, chemically inert, radioactive gas that is not detectable by human senses. As a gas, it can move readily through particles of soil and rock, and can

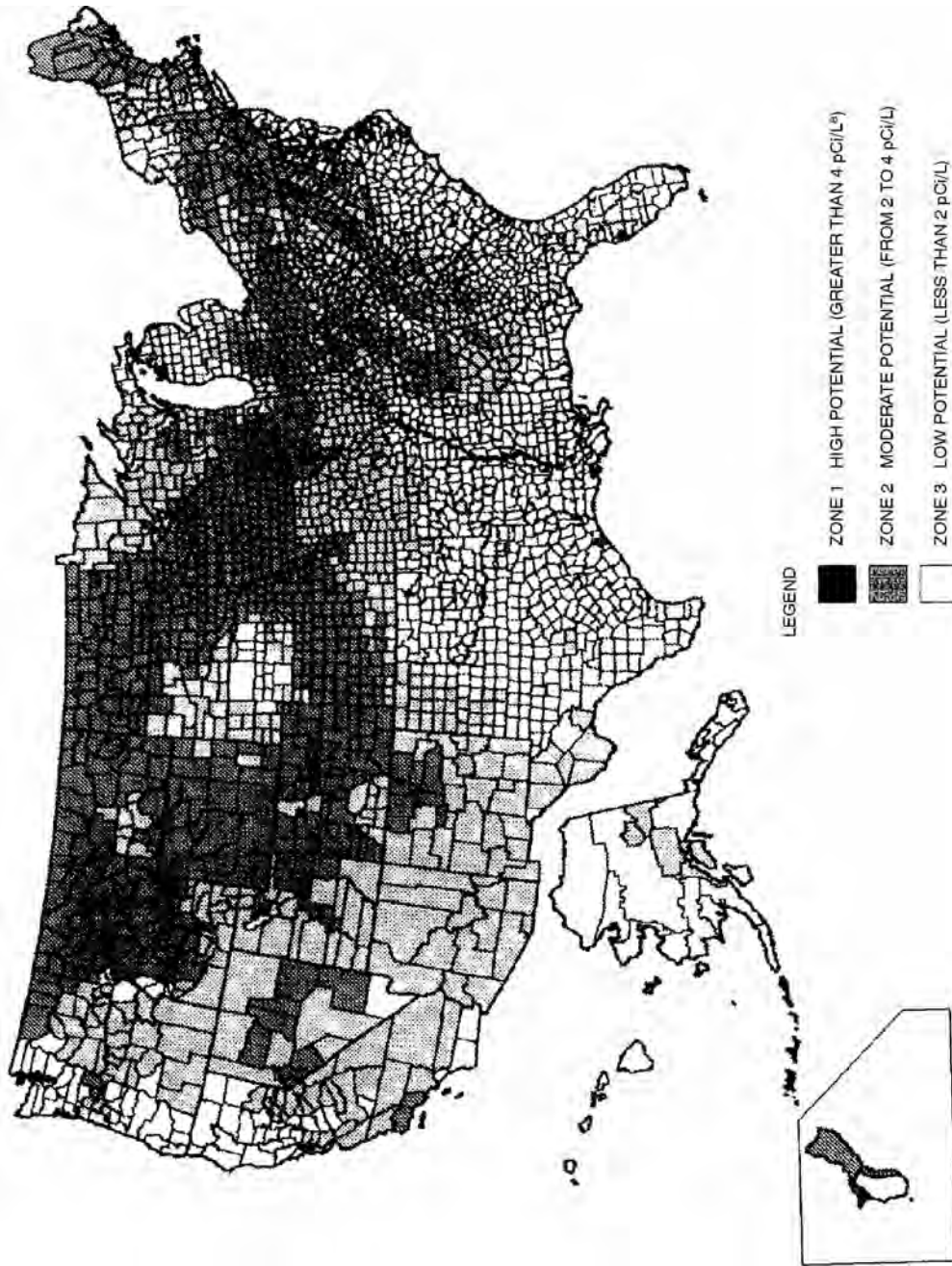
accumulate under the slabs and foundations of homes where it can easily enter into the living space through construction cracks and openings.

SOIL-GAS-RETARDER. A continuous membrane of 6-mil (0.15 mm) polyethylene or other equivalent material used to retard the flow of soil gases into a building.

SUBMEMBRANE DEPRESSURIZATION SYSTEM. A system designed to achieve lower submembrane air pressure relative to crawl space air pressure by use of a vent drawing air from beneath the soil-gas-retarder membrane.

SUBSLAB DEPRESSURIZATION SYSTEM (Active). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a fan-powered vent drawing air from beneath the slab.

SUBSLAB DEPRESSURIZATION SYSTEM (Passive). A system designed to achieve lower subslab air pressure relative to indoor air pressure by use of a vent pipe routed through the *conditioned space* of a building and connecting the subslab area with outdoor air, thereby relying on the convective flow of air upward in the vent to draw air from beneath the slab.



a.pCi/L stands for picocuries per liter of radon gas. The US Environmental Protection Agency (EPA) recommends that homes that measure 4 pCi/L and greater be mitigated. The EPA and the US Geological Survey have evaluated the radon potential in the United States and have developed a map of radon zones designed to assist building officials in deciding whether radon-resistant features are applicable in new construction. The map assigns each of the 3,141 counties in the United States to one of three zones based on radon potential. Each zone designation reflects the average short-term radon measurement that can be expected to be measured in a building without the implementation of radon-control methods. The radon zone designation of highest priority is Zone 1. Table AF101.1 lists the Zone 1 counties illustrated on the map. More detailed information can be obtained from state-specific booklets (EPA-401-R-93-021 through 070) available through the State Radon Offices or from the EPA Regional Offices.

**FIGURE AF101.1
EPA MAP OF RADON ZONES**

TABLE AF101.1

ALABAMA	Kit Carson	Clark	Macon	Fulton
Calhoun	Lake	Clearwater	Marshall	Grant
Clay	Larimer	Custer	Mason	Hamilton
Cleburne	Las Animas	Elmore	McDonough	Hancock
Colbert	Lincoln	Fremont	McLean	Harrison
Coosa	Logan	Gooding	Menard	Hendricks
Franklin	Mesa	Idaho	Mercer	Henry
Jackson	Moffat	Kootenai	Morgan	Howard
Lauderdale	Montezuma	Latah	Moultrie	Huntington
Lawrence	Montrose	Lemhi	Ogle	Jay
Limestone	Morgan	Shoshone	Peoria	Jennings
Madison	Otero	Valley	Piatt	Johnson
Morgan	Ouray	ILLINOIS	Pike	Kosciusko
Talladega	Park	Adams	Putnam	LaGrange
CALIFORNIA	Phillips	Boone	Rock Island	Lawrence
Santa Barbara	Pitkin	Brown	Sangamon	Madison
Ventura	Prowers	Bureau	Schuyler	Marion
COLORADO	Pueblo	Calhoun	Scott	Marshall
Adams	Rio Blanco	Carroll	Stark	Miami
Arapahoe	San Miguel	Cass	Stephenson	Monroe
Baca	Summit	Champaign	Tazewell	Montgomery
Bent	Teller	Coles	Vermilion	Noble
Boulder	Washington	De Kalb	Warren	Orange
Chaffee	Weld	De Witt	Whiteside	Putnam
Cheyenne	Yuma	Douglas	Winnebago	Randolph
Clear Creek	CONNECTICUT	Edgar	Woodford	Rush
Crowley	Fairfield	Ford	INDIANA	Scott
Custer	Middlesex	Fulton	Adams	Shelby
Delta	New Haven	Greene	Allen	St. Joseph
Denver	New London	Grundy	Bartholomew	Steuben
Dolores	GEORGIA	Hancock	Benton	Tippecanoe
Douglas	Cobb	Henderson	Blackford	Tipton
El Paso	De Kalb	Henry	Boone	Union
Elbert	Fulton	Iroquois	Carroll	Vermillion
Fremont	Gwinnett	Jersey	Cass	Wabash
Garfield	IDAHO	Jo Daviess	Clark	Warren
Gilpin	Benewah	Kane	Clinton	Washington
Grand	Blaine	Kendall	De Kalb	Wayne
Gunnison	Boise	Knox	Decatur	Wells
Huerfano	Bonner	La Salle	Delaware	White
Jackson	Boundary	Lee	Elkhart	Whitley
Jefferson	Butte	Livingston	Fayette	IOWA
Kiowa	Camas	Logan	Fountain	All Counties

(continued)

TABLE AF101.1—continued

KANSAS	Pawnee	Monroe	Lenawee	Pennington
Atchison	Phillips	Nelson	St. Joseph	Pipestone
Barton	Pottawatomie	Pendleton	Washtenaw	Polk
Brown	Pratt	Pulaski	MINNESOTA	Pope
Cheyenne	Rawlins	Robertson	Becker	Ramsey
Clay	Republic	Russell	Big Stone	Red Lake
Cloud	Rice	Scott	Blue Earth	Redwood
Decatur	Riley	Taylor	Brown	Renville
Dickinson	Rooks	Warren	Carver	Rice
Douglas	Rush	Woodford	Chippewa	Rock
Ellis	Saline	MAINE	Clay	Roseau
Ellsworth	Scott	Androscoggin	Cottonwood	Scott
Finney	Sheridan	Aroostook	Dakota	Sherburne
Ford	Sherman	Cumberland	Dodge	Sibley
Geary	Smith	Franklin	Douglas	Stearns
Gove	Stanton	Hancock	Faribault	Steele
Graham	Thomas	Kennebec	Fillmore	Stevens
Grant	Trego	Lincoln	Freeborn	Swift
Gray	Wallace	Oxford	Goodhue	Todd
Greeley	Washington	Penobscot	Grant	Traverse
Hamilton	Wichita	Piscataquis	Hennepin	Wabasha
Haskell	Wyandotte	Somerset	Houston	Wadena
Hodgeman	KENTUCKY	York	Hubbard	Waseca
Jackson	Adair	MARYLAND	Jackson	Washington
Jewell	Allen	Baltimore	Kanabec	Watonwan
Johnson	Barren	Calvert	Kandiyohi	Wilkin
Kearny	Bourbon	Carroll	Kittson	Winona
Kingman	Boyle	Frederick	Lac Qui Parle	Wright
Kiowa	Bullitt	Harford	Le Sueur	Yellow Medicine
Lane	Casey	Howard	Lincoln	MISSOURI
Leavenworth	Clark	Montgomery	Lyon	Andrew
Lincoln	Cumberland	Washington	Mahnomen	Atchison
Logan	Fayette	MASS.	Marshall	Buchanan
Marion	Franklin	Essex	Martin	Cass
Marshall	Green	Middlesex	McLeod	Clay
McPherson	Harrison	Worcester	Meeker	Clinton
Meade	Hart	MICHIGAN	Mower	Holt
Mitchell	Jefferson	Branch	Murray	Iron
Nemaha	Jessamine	Calhoun	Nicollet	Jackson
Ness	Lincoln	Cass	Nobles	Nodaway
Norton	Marion	Hillsdale	Norman	Platte
Osborne	Mercer	Jackson	Olmsted	
Ottawa	Metcalfe	Kalamazoo	Otter Tail	

(continued)

TABLE AF101.1—continued

MONTANA	Teton	Phelps	Taos	Transylvania
Beaverhead	Toole	Pierce	NEW YORK	Watauga
Big Horn	Valley	Platte	Albany	N. DAKOTA
Blaine	Wibaux	Polk	Allegany	All Counties
Broadwater	Yellowstone	Red Willow	Broome	OHIO
Carbon	NEBRASKA	Richardson	Cattaraugus	Adams
Carter	Adams	Saline	Cayuga	Allen
Cascade	Boone	Sarpy	Chautauqua	Ashland
Chouteau	Boyd	Saunders	Chemung	Auglaize
Custer	Burt	Seward	Chenango	Belmont
Daniels	Butler	Stanton	Columbia	Butler
Dawson	Cass	Thayer	Cortland	Carroll
Deer Lodge	Cedar	Washington	Delaware	Champaign
Fallon	Clay	Wayne	Dutchess	Clark
Fergus	Colfax	Webster	Erie	Clinton
Flathead	Cuming	York	Genesee	Columbiana
Gallatin	Dakota	NEVADA	Greene	Coshocton
Garfield	Dixon	Carson City	Livingston	Crawford
Glacier	Dodge	Douglas	Madison	Darke
Granite	Douglas	Eureka	Onondaga	Delaware
Hill	Fillmore	Lander	Ontario	Fairfield
Jefferson	Franklin	Lincoln	Orange	Fayette
Judith Basin	Frontier	Lyon	Otsego	Franklin
Lake	Furnas	Mineral	Putnam	Greene
Lewis and Clark	Gage	Pershing	Rensselaer	Guernsey
Madison	Gosper	White Pine	Schoharie	Hamilton
McCone	Greeley	NEW HAMPSHIRE	Schuylar	Hancock
Meagher	Hamilton	Carroll	Seneca	Hardin
Missoula	Harlan	NEW JERSEY	Steuben	Harrison
Park	Hayes	Hunterdon	Sullivan	Holmes
Phillips	Hitchcock	Mercer	Tioga	Huron
Pondera	Hurston	Monmouth	Tompkins	Jefferson
Powder River	Jefferson	Morris	Ulster	Knox
Powell	Johnson	Somerset	Washington	Licking
Prairie	Kearney	Sussex	Wyoming	Logan
Ravalli	Knox	Warren	Yates	Madison
Richland	Lancaster	NEW MEXICO	N. CAROLINA	Marion
Roosevelt	Madison	Bernalillo	Alleghany	Mercer
Rosebud	Nance	Colfax	Buncombe	Miami
Sanders	Nemaha	Mora	Cherokee	Montgomery
Sheridan	Nuckolls	Rio Arriba	Henderson	Morrow
Silver Bow	Otoe	San Miguel	Mitchell	Muskingum
Stillwater	Pawnee	Santa Fe	Rockingham	Perry

(continued)

TABLE AF101.1—continued

OHIO —continued	Lancaster	Douglas	Hawkins	Brunswick
Pickaway	Lebanon	Edmunds	Hickman	Buckingham
Pike	Lehigh	Faulk	Humphreys	Buena Vista
Preble	Luzerne	Grant	Jackson	Campbell
Richland	Lycoming	Hamlin	Jefferson	Chesterfield
Ross	Mifflin	Hand	Knox	Clarke
Seneca	Monroe	Hanson	Lawrence	Clifton Forge
Shelby	Montgomery	Hughes	Lewis	Covington
Stark	Montour	Hutchinson	Lincoln	Craig
Summit	Northampton	Hyde	Loudon	Cumberland
Tuscarawas	Northumberland	Jerauld	Marshall	Danville
Union	Perry	Kingsbury	Maury	Dinwiddie
Van Wert	Schuylkill	Lake	McMinn	Fairfax
Warren	Snyder	Lincoln	Meigs	Falls Church
Wayne	Sullivan	Lyman	Monroe	Fluvanna
Wyandot	Susquehanna	Marshall	Moore	Frederick
PENNSYLVANIA	Tioga	McCook	Perry	Fredericksburg
Adams	Union	McPherson	Roane	Giles
Allegheny	Venango	Miner	Rutherford	Goochland
Armstrong	Westmoreland	Minnehaha	Smith	Harrisonburg
Beaver	Wyoming	Moody	Sullivan	Henry
Bedford	York	Perkins	Trousdale	Highland
Berks	RHODE ISLAND	Potter	Union	Lee
Blair	Kent	Roberts	Washington	Lexington
Bradford	Washington	Sanborn	Wayne	Louisa
Bucks	S. CAROLINA	Spink	Williamson	Martinsville
Butler	Greenville	Stanley	Wilson	Montgomery
Cameron	S. DAKOTA	Sully	UTAH	Nottoway
Carbon	Aurora	Turner	Carbon	Orange
Centre	Beadle	Union	Duchesne	Page
Chester	Bon Homme	Walworth	Grand	Patrick
Clarion	Brookings	Yankton	Piute	Pittsylvania
Clearfield	Brown	TENNESSEE	Sanpete	Powhatan
Clinton	Brule	Anderson	Sevier	Pulaski
Columbia	Buffalo	Bedford	Uintah	Radford
Cumberland	Campbell	Blount	VIRGINIA	Roanoke
Dauphin	Charles Mix	Bradley	Alleghany	Rockbridge
Delaware	Clark	Claiborne	Amelia	Rockingham
Franklin	Clay	Davidson	Appomattox	Russell
Fulton	Codington	Giles	Augusta	Salem
Huntingdon	Corson	Grainger	Bath	Scott
Indiana	Davison	Greene	Bland	Shenandoah
Juniata	Day	Hamblen	Botetourt	Smyth
Lackawanna	Deuel	Hancock	Bristol	Spotsylvania

(continued)

TABLE AF101.1—continued

VIRGINIA—continued	Brooke	WISCONSIN	Richland	Hot Springs
Stafford	Grant	Buffalo	Rock	Johnson
Staunton	Greenbrier	Crawford	Shawano	Laramie
Tazewell	Hampshire	Dane	St. Croix	Lincoln
Warren	Hancock	Dodge	Vernon	Natrona
Washington	Hardy	Door	Walworth	Niobrara
Waynesboro	Jefferson	Fond du Lac	Washington	Park
Winchester	Marshall	Grant	Waukesha	Sheridan
Wythe	Mercer	Green	Waupaca	Sublette
WASHINGTON	Mineral	Green Lake	Wood	Sweetwater
Clark	Monongalia	Iowa	WYOMING	Teton
Ferry	Monroe	Jefferson	Albany	Uinta
Okanogan	Morgan	Lafayette	Big Horn	Washakie
Pend Oreille	Ohio	Langlade	Campbell	
Skamania	Pendleton	Marathon	Carbon	
Spokane	Pocahontas	Menominee	Converse	
Stevens	Preston	Pepin	Crook	
W. VIRGINIA	Summers	Pierce	Fremont	
Berkeley	Wetzel	Portage	Goshen	

- a. The EPA recommends that this county listing be supplemented with other available state and local data to further understand the radon potential of a Zone 1 area.

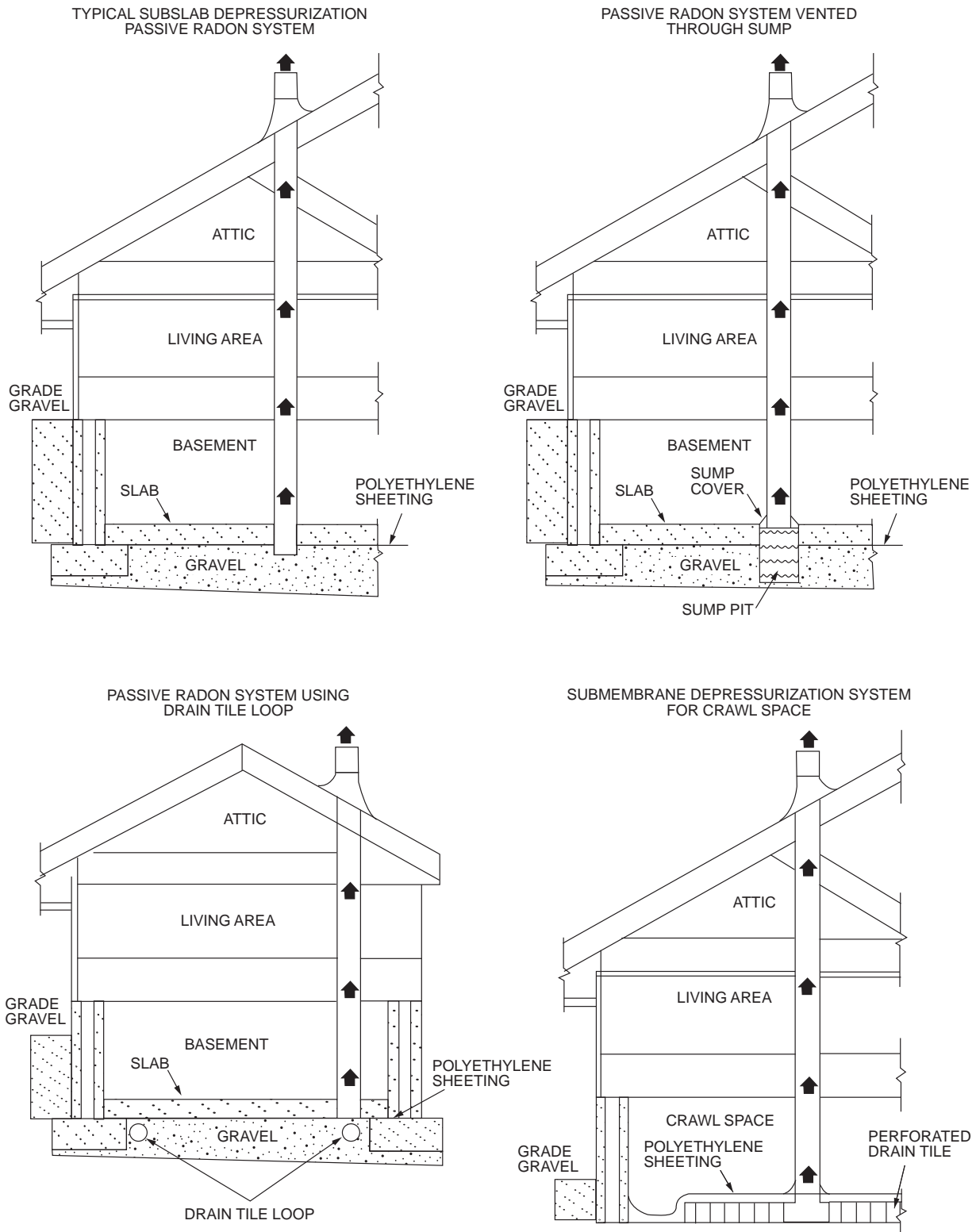


FIGURE AF103.1
RADON-RESISTANT CONSTRUCTION DETAILS FOR FOUR FOUNDATION TYPES

SECTION AF103 REQUIREMENTS

AF103.1 General. The following construction techniques are intended to resist radon entry and prepare the building for post-construction radon mitigation, if necessary (see Figure AF103.1). These techniques are required in areas where designated by the jurisdiction.

AF103.2 Subfloor preparation. A layer of gas-permeable material shall be placed under all concrete slabs and other floor systems that directly contact the ground and are within the walls of the living spaces of the building, to facilitate future installation of a subslab depressurization system, if needed. The gas-permeable layer shall consist of one of the following:

1. A uniform layer of clean aggregate, not less than 4 inches (102 mm) thick. The aggregate shall consist of material that will pass through a 2-inch (51 mm) sieve and be retained by a 1/4-inch (6.4 mm) sieve.
2. A uniform layer of sand (native or fill), not less than 4 inches (102 mm) thick, overlain by a layer or strips of geotextile drainage matting designed to allow the lateral flow of soil gases.
3. Other materials, systems or floor designs with demonstrated capability to permit depressurization across the entire subfloor area.

AF103.3 Soil-gas-retarder. A minimum 6-mil (0.15 mm) [or 3-mil (0.075 mm) cross-laminated] polyethylene or equivalent flexible sheeting material shall be placed on top of the gas-permeable layer prior to casting the slab or placing the floor assembly to serve as a soil-gas-retarder by bridging any cracks that develop in the slab or floor assembly, and to prevent concrete from entering the void spaces in the aggregate base material. The sheeting shall cover the entire floor area with separate sections of sheeting lapped not less than 12 inches (305 mm). The sheeting shall fit closely around any pipe, wire or other penetrations of the material. Punctures or tears in the material shall be sealed or covered with additional sheeting.

AF103.4 Entry routes. Potential radon entry routes shall be closed in accordance with Sections AF103.4.1 through AF103.4.10.

AF103.4.1 Floor openings. Openings around bathtubs, showers, water closets, pipes, wires or other objects that penetrate concrete slabs, or other floor assemblies, shall be filled with a polyurethane caulk or equivalent sealant applied in accordance with the manufacturer's recommendations.

AF103.4.2 Concrete joints. Control joints, isolation joints, construction joints, and any other joints in concrete slabs or between slabs and foundation walls shall be sealed with a caulk or sealant. Gaps and joints shall be cleared of loose material and filled with polyurethane caulk or other elastomeric sealant applied in accordance with the manufacturer's recommendations.

AF103.4.3 Condensate drains. Condensate drains shall be trapped or routed through nonperforated pipe to daylight.

AF103.4.4 Sumps. Sump pits open to soil or serving as the termination point for subslab or exterior drain tile loops shall be covered with a gasketed or otherwise sealed lid. Sumps used as the suction point in a subslab depressurization system shall have a lid designed to accommodate the vent pipe. Sumps used as a floor drain shall have a lid equipped with a trapped inlet.

AF103.4.5 Foundation walls. Hollow block masonry foundation walls shall be constructed with either a continuous course of solid masonry, one course of masonry grouted solid, or a solid concrete beam at or above finished ground surface to prevent the passage of air from the interior of the wall into the living space. Where a brick veneer or other masonry ledge is installed, the course immediately below that ledge shall be sealed. Joints, cracks or other openings around all penetrations of both exterior and interior surfaces of masonry block or wood foundation walls below the ground surface shall be filled with polyurethane caulk or equivalent sealant. Penetrations of concrete walls shall be filled.

AF103.4.6 Dampproofing. The exterior surfaces of portions of concrete and masonry block walls below the ground surface shall be dampproofed in accordance with Section R406.

AF103.4.7 Air-handling units. Air-handling units in crawl spaces shall be sealed to prevent air from being drawn into the unit.

Exception: Units with gasketed seams or units that are otherwise sealed by the manufacturer to prevent leakage.

AF103.4.8 Ducts. Ductwork passing through or beneath a slab shall be of seamless material unless the air-handling system is designed to maintain continuous positive pressure within such ducting. Joints in such ductwork shall be sealed to prevent air leakage.

Ductwork located in crawl spaces shall have seams and joints sealed by closure systems in accordance with Section M1601.4.1.

AF103.4.9 Crawl space floors. Openings around all penetrations through floors above crawl spaces shall be caulked or otherwise filled to prevent air leakage.

AF103.4.10 Crawl space access. Access doors and other openings or penetrations between basements and adjoining crawl spaces shall be closed, gasketed or otherwise filled to prevent air leakage.

AF103.5 Passive submembrane depressurization system. In buildings with crawl space foundations, the following components of a passive submembrane depressurization system shall be installed during construction.

Exception: Buildings in which an approved mechanical crawl space ventilation system or other equivalent system is installed.

AF103.5.1 Ventilation. Crawl spaces shall be provided with vents to the exterior of the building. The minimum net area of ventilation openings shall comply with Section R408.1.

AF103.5.2 Soil-gas-retarder. The soil in crawl spaces shall be covered with a continuous layer of minimum 6-mil (0.15 mm) polyethylene soil-gas-retarder. The ground cover shall be lapped not less than 12 inches (305 mm) at joints and shall extend to all foundation walls enclosing the crawl space area.

AF103.5.3 Vent pipe. A plumbing tee or other approved connection shall be inserted horizontally beneath the sheeting and connected to a 3- or 4-inch-diameter (76 or 102 mm) fitting with a vertical vent pipe installed through the sheeting. The vent pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6 Passive subslab depressurization system. In basement or slab-on-grade buildings, the following components of a passive subslab depressurization system shall be installed during construction.

AF103.6.1 Vent pipe. A minimum 3-inch-diameter (76 mm) ABS, PVC or equivalent gasket pipe shall be embedded vertically into the subslab aggregate or other permeable material before the slab is cast. A “T” fitting or equivalent method shall be used to ensure that the pipe opening remains within the subslab permeable material. Alternatively, the 3-inch (76 mm) pipe shall be inserted directly into an interior perimeter drain tile loop or through a sealed sump cover where the sump is exposed to the subslab aggregate or connected to it through a drainage system.

The pipe shall be extended up through the building floors, and terminate not less than 12 inches (305 mm) above the surface of the roof in a location not less than 10 feet (3048 mm) away from any window or other opening into the conditioned spaces of the building that is less than 2 feet (610 mm) below the exhaust point, and 10 feet (3048 mm) from any window or other opening in adjoining or adjacent buildings.

AF103.6.2 Multiple vent pipes. In buildings where interior footings or other barriers separate the subslab aggregate or other gas-permeable material, each area shall be fitted with an individual vent pipe. Vent pipes shall connect to a single vent that terminates above the roof or each individual vent pipe shall terminate separately above the roof.

AF103.7 Vent pipe drainage. Components of the radon vent pipe system shall be installed to provide positive drainage to the ground beneath the slab or soil-gas-retarder.

AF103.8 Vent pipe accessibility. Radon vent pipes shall be accessible for future fan installation through an attic or other area outside the habitable space.

Exception: The radon vent pipe need not be accessible in an attic space where an approved roof-top electrical supply is provided for future use.

AF103.9 Vent pipe identification. Exposed and visible interior radon vent pipes shall be identified with not less than one label on each floor and in accessible attics. The label shall read: “Radon Reduction System.”

AF103.10 Combination foundations. Combination basement/crawl space or slab-on-grade/crawl space foundations shall have separate radon vent pipes installed in each type of foundation area. Each radon vent pipe shall terminate above the roof or shall be connected to a single vent that terminates above the roof.

AF103.11 Building depressurization. Joints in air ducts and plenums in unconditioned spaces shall meet the requirements of Section M1601. Thermal envelope air infiltration requirements shall comply with the energy conservation provisions in Chapter 11. Fireblocking shall meet the requirements contained in Section R302.11.

AF103.12 Power source. To provide for future installation of an active submembrane or subslab depressurization system, an electrical circuit terminated in an approved box shall be installed during construction in the attic or other anticipated location of vent pipe fans. An electrical supply shall be accessible in anticipated locations of system failure alarms.

SECTION AF104 TESTING

AF104.1 Testing. Where radon-resistant construction is required, radon testing shall be as specified in Items 1 through 11:

1. Testing shall be performed after the dwelling passes its air tightness test.
2. Testing shall be performed after the radon control system and HVAC installations are complete. The HVAC system shall be operating during the test. Where the radon system has an installed fan, the dwelling shall be tested with the radon fan operating.
3. Testing shall be performed at the lowest occupied floor level, whether or not that space is finished. Spaces that are physically separated and served by different HVAC systems shall be tested separately.
4. Testing shall not be performed in a closet, hallway, stairway, laundry room, furnace room, bathroom or kitchen.
5. Testing shall be performed with a commercially available radon test kit or testing shall be performed by an approved third party with a continuous radon monitor. Testing with test kits shall include two tests, and the test results shall be averaged. Testing shall be in accordance with this section and the testing laboratory kit manufacturer’s instructions.
6. Testing shall be performed with the windows closed. Testing shall be performed with the exterior doors closed, except when being used for entrance or exit. Windows and doors shall be closed for not fewer than 12 hours prior to the testing.

7. Testing shall be performed by the builder, a registered design professional or an approved third party.
8. Testing shall be conducted over a period of not less than 48 hours or not less than the period specified by the testing device manufacturer, whichever is longer.
9. Written radon test results shall be provided by the test lab or testing party. The final written test report with results less than 4 picocuries per liter (pCi/L) shall be provided to the code official.
10. Where the radon test result is 4 pCi/L or greater, the fan for the radon vent pipe shall be installed as specified in Sections AF103.9 and AF103.12.
11. Where the radon test result is 4 pCi/L or greater, the system shall be modified and retested until the test result is less than 4 pCi/L.

Exception: Testing is not required where the occupied space is located above an unenclosed open space.

APPENDIX AG
RESERVED

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AH – PATIO COVERS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/C C	1	1R	2	3	4								
Adopt entire chapter				X																		
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AH

PATIO COVERS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

***About this appendix:** Appendix AH relaxes certain provisions contained in the body of the code as related to patio covers, including those regarding: permitted uses; exterior wall insect screens; glazing and translucent or transparent plastic; light, ventilation and emergency egress; height; structural design loads; and footings. This appendix also includes provisions that are specifically applicable to hurricane-prone regions.*

SECTION AH101 GENERAL

AH101.1 Scope. Patio covers shall conform to the requirements of Sections AH101 through AH106.

AH101.2 Permitted uses. Patio covers detached from or attached to dwelling units shall be used only for recreational, outdoor living purposes, and not as carports, garages, storage rooms or habitable rooms.

SECTION AH102 DEFINITION

AH102.1 General. The following word and term shall, for the purposes of this appendix, have the meaning shown herein.

PATIO COVER. A structure with open or glazed walls that is used for recreational, outdoor living purposes associated with a dwelling unit.

SECTION AH103 EXTERIOR WALLS AND OPENINGS

AH103.1 Enclosure walls. Enclosure walls shall be permitted to be of any configuration, provided that the open or glazed area of the longer wall and one additional wall is not less than 65 percent of the area below 6 feet 8 inches (2032 mm) of each wall, measured from the floor. Openings shall be enclosed with any of the following:

1. Insect screening.
2. Approved translucent or transparent plastic not more than 0.125 inch (3.2 mm) in thickness.
3. Glass conforming to the provisions of Section R308.
4. Any combination of the foregoing.

AH103.2 Light, ventilation and emergency egress. Exterior openings required for light and ventilation into a patio structure conforming to Section AH101 shall be unenclosed where such openings serve as emergency egress or rescue openings from sleeping rooms. Where such exterior openings serve as an exit from the dwelling unit, the patio structure, unless unenclosed, shall be provided with exits conforming to the provisions of Section R311.

**SECTION AH104
HEIGHT**

AH104.1 Height. Patio covers are limited to one-story structures not exceeding 12 feet (3657 mm) in height.

**SECTION AH105
STRUCTURAL PROVISIONS**

AH105.1 Design loads. Patio covers shall be designed and constructed to sustain, within the stress limits of this code, all dead loads plus a vertical live load of not less than 10 pounds per square foot (0.48 kN/m²), except that snow loads shall be used where such snow loads exceed this minimum. Such covers shall be designed to resist the minimum wind loads set forth in Section R301.2.1.

AH105.2 Footings. In areas with a frostline depth of zero as specified in Table R301.2, for patio covers supported on a slab-on-grade without footings, the slab shall conform to the provisions of Section R506, shall be not less than 3.5 inches (89 mm) thick and the columns shall not support live and dead loads in excess of 750 pounds (3.34 kN) per column.

**SECTION AH106
SPECIAL PROVISIONS FOR ALUMINUM SCREEN ENCLOSURES IN HURRICANE-PRONE REGIONS**

AH106.1 General. Screen enclosures in hurricane-prone regions shall be in accordance with the provisions of this section.

AH106.1.1 Habitable spaces. Screen enclosures shall not be considered habitable spaces.

AH106.1.2 Minimum ceiling height. Screen enclosures shall have a ceiling height of not less than 7 feet (2134 mm).

AH106.2 Definition. The following word and term shall, for the purposes of this appendix, have the meaning shown herein.

SCREEN ENCLOSURE. A building or part thereof, in whole or in part self-supporting, and having walls of insect screening, and a roof of insect screening, plastic, aluminum or similar lightweight material.

AH106.3 Screen enclosures. Screen enclosures shall comply with Sections AH106.3.1 and AH106.3.2.

AH106.3.1 Thickness. Actual wall thickness of extruded aluminum members shall be not less than 0.040 inch (1.02 mm).

AH106.3.2 Density. Screen density shall be not more than 20 threads per inch by 20 threads per inch mesh.

AH106.4 Design. The structural design of screen enclosures shall comply with Sections AH106.4.1 through AH106.4.3.

AH106.4.1 Wind load. Structural members supporting screen enclosures shall be designed to support the minimum wind loads given in Tables AH106.4.1(1) and AH106.4.1(2) for the ultimate design wind speed, V_{ult} , determined from Figure AH106.4.1. Where any value is

**TABLE AH106.4.1(1)
DESIGN WIND PRESSURES FOR SCREEN ENCLOSURE FRAMING^{a, b, e, f, g, h}**

LOAD CASE	WALL	ULTIMATE DESIGN WIND SPEED, V_{ult} (mph)											
		90	95	100	105	110	120	130	140	150	160	170	180
		Exposure Category B Design Pressure (psf)											
A ^c	Windward and leeward walls (flow thru) and windward wall (nonflow thru) $L/W = 0-1$	5	6	6	7	8	9	11	13	14	16	18	21
A ^c	Windward and leeward walls (flow thru) and windward wall (nonflow thru) $L/W = 2$	6	7	7	8	9	11	12	14	16	19	21	24
B ^d	Windward: Nongable roof	7	8	9	10	11	13	15	18	21	23	26	30
B ^d	Windward: Gable roof	10	10	11	13	14	16	19	22	26	29	33	37
	ROOF												
All ^e	Roof-screen	2	2	2	3	3	3	4	4	5	6	7	7
All ^e	Roof-solid	6	6	7	8	8	10	12	13	15	18	20	22

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.44 m/s, 1 pound per square foot = 0.0479 kPa, 1 foot = 304.8 mm.

- a. Design pressure shall be not less than 10 psf in accordance with Section AH106.4.1.
- b. Loads are applicable to screen enclosures with a mean roof height of 30 feet or less in Exposure B. For screen enclosures of different heights or exposure, the pressures given shall be adjusted by multiplying the table pressure by the adjustment factor given in Table AH106.4.1(2).
- c. For Load Case A flow-thru condition, the pressure given shall be applied simultaneously to both the upwind and downwind screen walls acting in the same direction as the wind. The structure shall be analyzed for wind coming from the opposite direction. For the nonflow-thru condition, the screen enclosure wall shall be analyzed for the load applied acting toward the interior of the enclosure.
- d. For Load Case B, the table pressure multiplied by the projected frontal area of the screen enclosure is the total drag force, including drag on screen surfaces parallel to the wind, that must be transmitted to the ground. Use Load Case A for members directly supporting the screen surface perpendicular to the wind. Load Case B loads shall be applied only to structural members that carry wind loads from more than one surface.
- e. The roof structure shall be analyzed for the pressure given occurring both upward and downward.
- f. Table pressures are MWFRS loads. The design of solid roof panels and their attachments shall be based on component and cladding loads for enclosed or partially enclosed structures as appropriate.
- g. Table pressures apply to 20-inch by 20-inch by 0.013-inch mesh screen. For 18-inch by 14-inch by 0.013-inch mesh screen, pressures on screen surfaces shall be permitted to be multiplied by 0.88. For screen densities greater than 20 inches by 20 inches by 0.013 inch, pressures for enclosed buildings shall be used.
- h. Linear interpolation shall be permitted.

less than 10 pounds per square foot (psf) (0.479 kN/m²)
use 10 pounds per square foot (0.479 kN/m²).

TABLE AH106.4.1(2)
ADJUSTMENT FACTOR FOR
BUILDING HEIGHT AND EXPOSURE

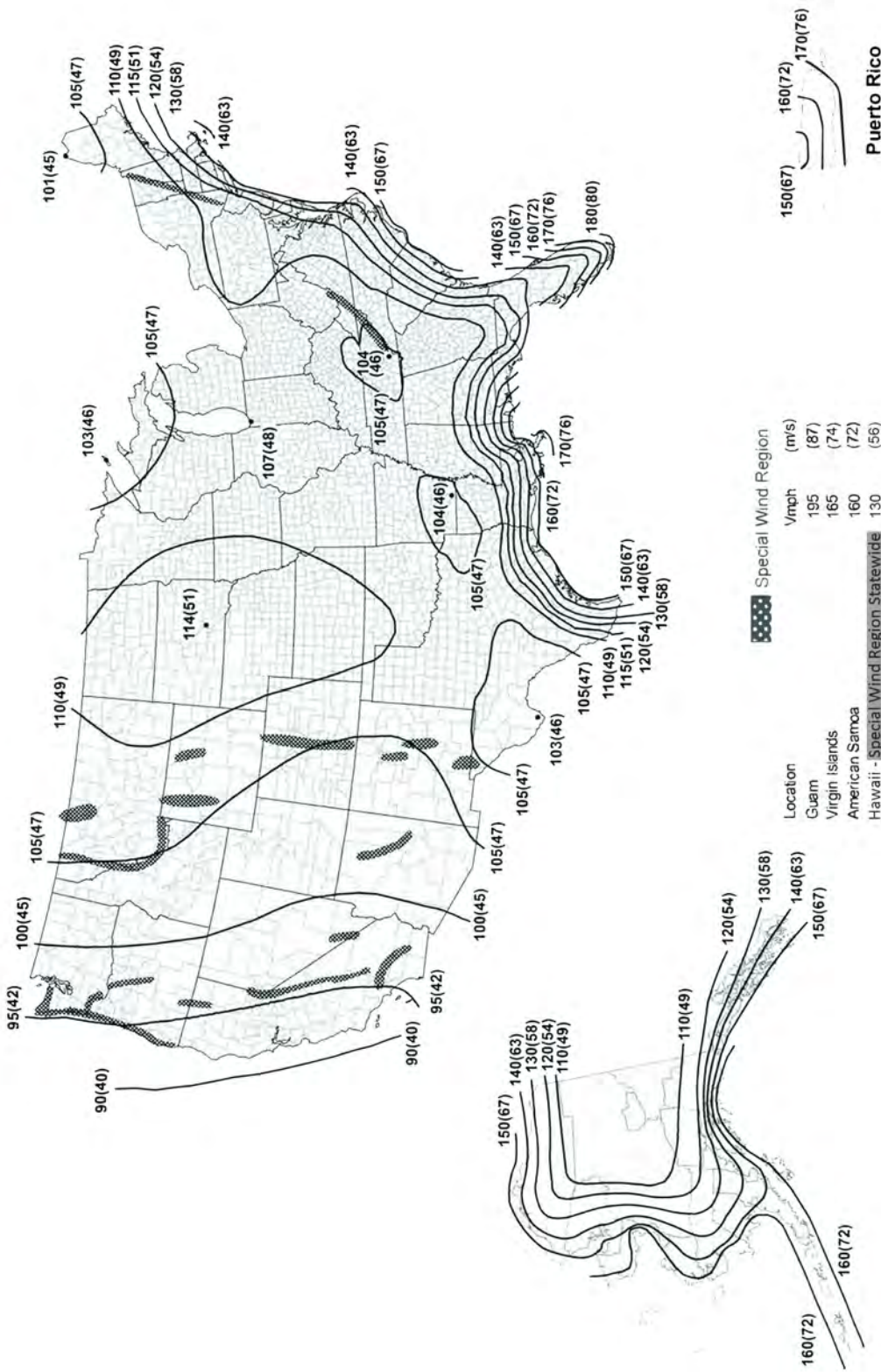
MEAN ROOF HEIGHT (feet)	EXPOSURE		
	B	C	D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

For SI: 1 foot = 304.8 mm.

AH106.4.2 Deflection limit. For members supporting screen surfaces only, the total load deflection shall not exceed $l/60$. Screen surfaces shall be permitted to include not more than 25-percent solid flexible finishes.

AH106.4.3 Roof live load. The roof live load shall be not less than 10 psf (0.479 kN/m²).

AH106.5 Footings. In areas with a frost line depth of zero, screen enclosures supported on a concrete slab-on-grade without footings shall conform to the provisions of Section R506, be not less than 3½ inches (89 mm) thick and the columns shall not support loads in excess of 750 pounds (3.36 kN) per column.



For SI: 1 foot = 304.8 mm, 1 mph = 0.447 m/s.

Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 feet above ground for Exposure C category.
2. Linear interpolation between contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7-percent probability of exceedence in 50 years (Annual Exceedence Probability = 0.00143, MRI = 700 years).

FIGURE AH106.4.1
ULTIMATE DESIGN WIND SPEEDS FOR PATIO COVERS AND SCREEN ENCLOSURES

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE APPENDIX AI – PRIVATE SEWAGE DISPOSAL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AI

PRIVATE SEWAGE DISPOSAL

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix AI has one simple requirement that private sewage disposal systems must be in accordance with the International Private Sewage Disposal Code®.

SECTION AI101 GENERAL

AI101.1 Scope. Private sewage disposal systems shall conform to the *International Private Sewage Disposal Code*.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AJ – EXISTING BUILDINGS AND STRUCTURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AJ

EXISTING BUILDINGS AND STRUCTURES

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix AJ regulates the repair, renovation alteration and reconstruction of existing buildings that are within the scope of this code. It is intended to encourage the continued safe use of existing buildings and ensure that new work conforms to the intent of the code and that exiting conditions remain at their current level of compliance or are improved.

SECTION AJ101 PURPOSE AND INTENT

AJ101.1 General. The purpose of these provisions is to encourage the continued use or reuse of legally existing buildings and structures. These provisions are intended to permit work in existing buildings that is consistent with the purpose of this code. Compliance with these provisions shall be deemed to meet the requirements of this code.

AJ101.2 Classification of work. For purposes of this appendix, work in existing buildings shall be classified into the categories of repair, renovation, alteration and reconstruction. Specific requirements are established for each category of work in these provisions.

AJ101.3 Multiple categories of work. Work of more than one category shall be part of a single work project. Related work permitted within a 12-month period shall be considered to be a single work project. Where a project includes one category of work in one building area and another category of work in a separate and unrelated area of the building, each project area shall comply with the requirements of the respective category of work. Where a project with more than one category of work is performed in the same area or in related

areas of the building, the project shall comply with the requirements of the more stringent category of work.

SECTION AJ102 COMPLIANCE

AJ102.1 General. Regardless of the category of work being performed, the work shall not cause the structure to become unsafe or adversely affect the performance of the building; shall not cause an existing mechanical or plumbing system to become unsafe, hazardous, insanitary or overloaded; and unless expressly permitted by these provisions, shall not make the building any less compliant with this code or to any previously approved alternative arrangements than it was before the work was undertaken.

AJ102.2 Requirements by category of work. Repairs shall conform to the requirements of Section AJ107. Renovations shall conform to the requirements of Section AJ108. Alterations shall conform to the requirements of Section AJ109 and the requirements for renovations. Reconstructions shall conform to the requirements of Section AJ110 and the requirements for alterations and renovations.

AJ102.3 Smoke detectors. Regardless of the category of work, smoke detectors shall be provided where required by Section R314.2.2.

AJ102.4 Replacement windows. Regardless of the category of work, where an existing window, including the sash and glazed portion, or safety glazing is replaced, the replacement window or safety glazing shall comply with the requirements of Sections AJ102.4.1 through AJ102.4.4, as applicable.

AJ102.4.1 Energy efficiency. Replacement windows shall comply with the requirements of Chapter 11.

AJ102.4.2 Safety glazing. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of Section R308.

AJ102.4.3 Replacement windows for emergency escape and rescue openings. Where windows are required to provide emergency escape and rescue openings, replacement windows shall be exempt from Sections R310.2 and R310.4.4 provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement window is not part of a change of occupancy.

Window opening control devices and fall prevention devices complying with ASTM F2090 shall be permitted for use on windows serving as required emergency escape and rescue openings.

AJ102.4.3.1 Control devices. Emergency escape and rescue openings with window opening control devices or fall prevention devices complying with ASTM F2090, after operation to release the control device allowing the window to fully open, shall not reduce the net clear opening area of the window unit. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

AJ102.4.4 Window control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
 - 2.1. The window replacement includes replacement of the sash and the frame.
 - 2.2. The window replacement includes the sash only when the existing frame remains.

3. The bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere where the window is in its largest opened position.
5. The vertical distance from the top of the sill of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

AJ102.5 Flood hazard areas. Work performed in existing buildings located in a flood hazard area as established by Table R301.2 shall be subject to the provisions of Section R105.3.1.1.

AJ102.6 Equivalent alternatives. Work performed in accordance with the *California Existing Building Code* shall be deemed to comply with the provisions of this appendix. These provisions are not intended to prevent the use of any alternative material, alternative design or alternative method of construction not specifically prescribed herein, provided that any alternative has been deemed to be equivalent and its use authorized by the building official.

AJ102.7 Other alternatives. Where compliance with these provisions or with this code as required by these provisions is technically infeasible or would impose disproportionate costs because of construction or dimensional difficulties, the building official shall have the authority to accept alternatives. These alternatives include materials, design features and operational features.

AJ102.8 More restrictive requirements. Buildings or systems in compliance with the requirements of this code for new construction shall not be required to comply with any more restrictive requirement of these provisions.

AJ102.9 Features exceeding code requirements. Elements, components and systems of existing buildings with features that exceed the requirements of this code for new construction, and are not otherwise required as part of approved alternative arrangements or deemed by the building official to be required to balance other building elements not complying with this code for new construction, shall not be prevented by these provisions from being modified as long as they remain in compliance with the applicable requirements for new construction.

SECTION AJ103 PRELIMINARY MEETING

AJ103.1 General. If a building permit is required at the request of the prospective permit applicant, the building official or his or her designee shall meet with the prospective applicant to discuss plans for any proposed work under these provisions prior to the application for the permit. The purpose of this preliminary meeting is for the building official to gain an understanding of the prospective applicant's intentions for the proposed work, and to determine, together with the prospective applicant, the specific applicability of these provisions.

SECTION AJ104 EVALUATION OF AN EXISTING BUILDING

AJ104.1 General. The building official shall have the authority to require an existing building to be investigated and evaluated by a registered design professional in the case of proposed reconstruction of any portion of a building. The evaluation shall determine the existence of any potential nonconformities to these provisions, and shall provide a basis for determining the impact of the proposed changes on the performance of the building. The evaluation shall use the following sources of information, as applicable:

1. Available documentation of the existing building.
 - 1.1. Field surveys.
 - 1.2. Tests (nondestructive and destructive).
 - 1.3. Laboratory analysis.

Exception: Detached one- or two-family dwellings that are not irregular buildings under Section R301.2.2.6 and are not undergoing an extensive reconstruction shall not be required to be evaluated.

SECTION AJ105 PERMIT

AJ105.1 Identification of work area. The work area shall be clearly identified on the permits issued under these provisions.

SECTION AJ106 DEFINITIONS

AJ106.1 General. For purposes of this appendix, the terms used are defined as follows:

ALTERATION. The reconfiguration of any space; the addition or elimination of any door or window; the reconfiguration or extension of any system; or the installation of any additional equipment.

CATEGORIES OF WORK. The nature and extent of construction work undertaken in an existing building. The categories of work covered in this appendix, listed in increasing order of stringency of requirements, are repair, renovation, alteration and reconstruction.

DANGEROUS. Where the stresses in any member; the condition of the building, or any of its components or elements or attachments; or other condition that results in an overload exceeding 150 percent of the stress allowed for the member or material in this code.

EQUIPMENT OR FIXTURE. Any plumbing, heating, electrical, ventilating, air-conditioning, refrigerating and fire protection equipment; and elevators, dumb waiters, boilers, pressure vessels, and other mechanical facilities or installations that are related to building services.

MATERIALS AND METHODS REQUIREMENTS. Those requirements in this code that specify material standards; details of installation and connection; joints; penetrations; and continuity of any element, component or system in the building. The required quantity, fire resistance,

flame spread, acoustic or thermal performance, or other performance attribute is specifically excluded from materials and methods requirements.

RECONSTRUCTION. The reconfiguration of a space that affects an exit, a renovation or alteration where the work area is not permitted to be occupied because existing means-of-egress and fire protection systems, or their equivalent, are not in place or continuously maintained; or there are extensive alterations as defined in Section AJ109.3.

REHABILITATION. Any repair, renovation, alteration or reconstruction work undertaken in an existing building.

RENOVATION. The change, strengthening or addition of load-bearing elements; or the refinishing, replacement, bracing, strengthening, upgrading or extensive repair of existing materials, elements, components, equipment or fixtures. Renovation does not involve reconfiguration of spaces. Interior and exterior painting are not considered refinishing for purposes of this definition, and are not renovation.

REPAIR. The patching, restoration or minor replacement of materials, elements, components, equipment or fixtures for the purposes of maintaining those materials, elements, components, equipment or fixtures in good or sound condition.

WORK AREA. That portion of a building affected by any renovation, alteration or reconstruction work as initially intended by the owner and indicated as such in the permit. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed, and portions of the building where work not initially intended by the owner is specifically required by these provisions for a renovation, alteration or reconstruction.

SECTION AJ107 REPAIRS

AJ107.1 Materials. Except as otherwise required herein, work shall be done using like materials or materials permitted by this code for new construction.

AJ107.1.1 Hazardous materials. Hazardous materials no longer permitted, such as asbestos and lead-based paint, shall not be used.

AJ107.1.2 Plumbing materials and supplies. The following plumbing materials and supplies shall not be used:

1. All-purpose solvent cement, unless listed for the specific application.
2. Flexible traps and tailpieces, unless listed for the specific application.
3. Solder having more than 0.2-percent lead in the repair of potable water systems.

AJ107.2 Water closets. Where any water closet is replaced with a newly manufactured water closet, the replacement water closet shall comply with the requirements of Section P2903.2.

AJ107.3 Electrical. Repair or replacement of existing electrical wiring and equipment undergoing repair with like material shall be permitted.

Exceptions:

1. Replacement of electrical receptacles shall comply with the requirements of Chapters 34 through 43.
2. Plug fuses of the Edison-base type shall be used for replacements only where there is not evidence of overfusing or tampering in accordance with the applicable requirements of Chapters 34 through 43.
3. For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system, or to any accessible point on the grounding electrode conductor, as allowed and described in Chapters 34 through 43.

**SECTION AJ108
RENOVATIONS**

AJ108.1 Materials and methods. The work shall comply with the materials and methods requirements of this code.

AJ108.2 Door and window dimensions. Minor reductions in the clear opening dimensions of replacement doors and windows that result from the use of different materials shall be allowed, whether or not they are permitted by this code.

AJ108.3 Interior finish. Wood paneling and textile wall coverings used as an interior finish shall comply with the flame spread requirements of Section R302.9.

AJ108.4 Structural. Unreinforced masonry buildings located in Seismic Design Category D₂ or E shall have parapet bracing and wall anchors installed at the roofline whenever a reroofing permit is issued. Such parapet bracing and wall anchors shall be of an approved design.

**SECTION AJ109
ALTERATIONS**

AJ109.1 Newly constructed elements. Newly constructed elements, components and systems shall comply with the requirements of this code.

Exceptions:

1. Added openable windows are not required to comply with the light and ventilation requirements of Section R303.
2. Newly installed electrical equipment shall comply with the requirements of Section AJ109.5.

AJ109.2 Nonconformities. The work shall not increase the extent of noncompliance with the requirements of Section AJ110, or create nonconformity to those requirements that did not previously exist.

AJ109.3 Extensive alterations. Where the total area of all of the work areas included in an alteration exceeds 50 percent of the area of the dwelling unit, the work shall be considered to be a reconstruction and shall comply with the requirements of these provisions for reconstruction work.

Exception: Work areas in which the alteration work is exclusively plumbing, mechanical or electrical shall not be included in the computation of the total area of all work areas.

AJ109.4 Structural. The minimum design loads for the structure shall be the loads applicable at the time the building was constructed, provided that a dangerous condition is not created. Structural elements that are uncovered during the course of the alteration and that are found to be unsound or dangerous shall be made to comply with the applicable requirements of this code.

AJ109.5 Electrical equipment and wiring.

AJ109.5.1 Materials and methods. Newly installed electrical equipment and wiring relating to work done in any work area shall comply with the materials and methods requirements of Chapters 34 through 43.

Exception: Electrical equipment and wiring in newly installed partitions and ceilings shall comply with the applicable requirements of Chapters 34 through 43.

AJ109.5.2 Electrical service. Service to the dwelling unit shall be not less than 100 ampere, three-wire capacity and service equipment shall be dead front having no live parts exposed that could allow accidental contact. Type “S” fuses shall be installed where fused equipment is used.

Exception: Existing service of 60 ampere, three-wire capacity, and feeders of 30 ampere or larger two- or three-wire capacity shall be accepted if adequate for the electrical load being served.

AJ109.5.3 Additional electrical requirements. Where the work area includes any of the following areas within a dwelling unit, the requirements of Sections AJ109.5.3.1 through AJ109.5.3.5 shall apply.

AJ109.5.3.1 Enclosed areas. Enclosed areas other than closets, kitchens, basements, garages, hallways, laundry areas and bathrooms shall have not less than two duplex receptacle outlets, or one duplex receptacle outlet and one ceiling- or wall-type lighting outlet.

AJ109.5.3.2 Kitchen and laundry areas. Kitchen areas shall have not less than two duplex receptacle outlets. Laundry areas shall have not less than one duplex receptacle outlet located near the laundry equipment and installed on an independent circuit.

AJ109.5.3.3 Ground-fault circuit interruption. Ground-fault circuit interruption shall be provided on newly installed receptacle outlets if required by Chapters 34 through 43.

AJ109.5.3.4 Lighting outlets. Not less than one lighting outlet shall be provided in every bathroom, hallway, stairway, attached garage and detached garage with electric power to illuminate outdoor entrances and exits, and in utility rooms and basements where these

spaces are used for storage or contain equipment requiring service.

AJ109.5.3.5 Clearance. Clearance for electrical service equipment shall be provided in accordance with Chapters 34 through 43.

AJ109.6 Ventilation. Reconfigured spaces intended for occupancy and spaces converted to habitable or occupiable space in any work area shall be provided with ventilation in accordance with Section R303.

AJ109.7 Ceiling height. Habitable spaces created in existing basements shall have ceiling heights of not less than 6 feet, 8 inches (2032 mm), except that the ceiling height at obstructions shall be not less than 6 feet 4 inches (1930 mm) from the basement floor. Existing finished ceiling heights in nonhabitable spaces in basements shall not be reduced.

AJ109.8 Stairs.

AJ109.8.1 Stair width. Existing basement stairs and handrails not otherwise being altered or modified shall be permitted to maintain their current clear width at, above and below existing handrails.

AJ109.8.2 Stair headroom. Headroom height on existing basement stairs being altered or modified shall not be reduced below the existing stairway finished headroom. Existing basement stairs not otherwise being altered shall be permitted to maintain the current finished headroom.

AJ109.8.3 Stair landing. Landings serving existing basement stairs being altered or modified shall not be reduced below the existing stairway landing depth and width. Existing basement stairs not otherwise being altered shall be permitted to maintain the current landing depth and width.

**SECTION AJ110
RECONSTRUCTION**

AJ110.1 Stairways, handrails and guards.

AJ110.1.1 Stairways. Stairways within the work area shall be provided with illumination in accordance with Section R303.7.

AJ110.1.2 Handrails. Every required exit stairway that has four or more risers, is part of the means of egress for any work area, and is not provided with not fewer than one handrail, or in which the existing handrails are judged to be in danger of collapsing, shall be provided with handrails designed and installed in accordance with Section R311 for the full length of the run of steps on not less than one side.

AJ110.1.3 Guards. Every open portion of a stair, landing or balcony that is more than 30 inches (762 mm) above the floor or grade below, is part of the egress path for any work area, and does not have guards, or in which the existing guards are judged to be in danger of collapsing, shall be provided with guards designed and installed in accordance with Section R312.

AJ110.2 Wall and ceiling finish. The interior finish of walls and ceilings in any work area shall comply with the requirements of Section R302.9. Existing interior finish materials that do not comply with those requirements shall be removed or shall be treated with an approved fire-retardant coating in accordance with the manufacturer’s instructions to secure compliance with the requirements of this section.

AJ110.3 Separation walls. Where the work area is in an attached dwelling unit, walls separating dwelling units that are not continuous from the foundation to the underside of the roof sheathing shall be constructed to provide a continuous fire separation using construction materials consistent with the existing wall or complying with the requirements for new structures. Performance of work shall be required only on the side of the wall of the dwelling unit that is part of the work area.

AJ110.4 Ceiling height. Habitable spaces created in existing basements shall have ceiling heights of not less than 6 feet, 8 inches (2032 mm), except that the ceiling height at obstructions shall be not less than 6 feet 4 inches (1930 mm) from the basement floor. Existing finished ceiling heights in nonhabitable spaces in basements shall not be reduced.

**SECTION AJ111
REFERENCED STANDARDS**

AJ111.1 General. See Table AJ111.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.

**TABLE AJ111.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTION HEREIN REFERENCED
ASTM F2090—17	<i>Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms</i>	AJ102.4.3, AJ102.4.4
CEBC—22	<i>California Existing Building Code</i>	AJ102.6

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AK – SOUND TRANSMISSION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

APPENDIX AK

SOUND TRANSMISSION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

See Section 1206 “Sound Transmission” of the California Building Code, Title 24, Part 2, for requirements applicable to structures in this code.

User note:

About this appendix: Sound transmission relates directly to the psychological and long-term physical well-being of building occupants. Many human activities cannot be accommodated efficiently or comfortably in various types of building spaces without proper attention to the mitigation of sound transmission from other spaces within the building, or from outside of the building. In Appendix AK, attention is specifically paid to the mitigation of sound transmission between dwelling units and other dwelling units and occupancies.

SECTION AK101 GENERAL

AK101.1 General. Wall and floor-ceiling assemblies separating dwelling units, including those separating adjacent townhouse units, shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

SECTION AK102 AIRBORNE SOUND

AK102.1 General. Airborne sound insulation for wall and floor-ceiling assemblies shall meet a sound transmission class (STC) rating of 45 where tested in accordance with ASTM E90 or a Normalized Noise Isolation Class (NNIC) rating of 42 where tested in accordance with ASTM E336. Penetrations or openings in construction assemblies for piping; electrical devices; recessed cabinets; bathtubs; soffits; or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings. Dwelling unit entrance doors, which share a common space, shall be tight fitting to the frame and sill.

AK102.1.1 Masonry. The sound transmission class of concrete masonry and clay masonry assemblies shall be calculated in accordance with TMS 0302 or determined through testing in accordance with ASTM E90.

SECTION AK103 STRUCTURAL-BORNE SOUND

AK103.1 General. Floor/ceiling assemblies between dwelling units, or between a dwelling unit and a public or service area within a structure, shall have an impact insulation class (IIC) rating of not less than 45 when tested in accordance with ASTM E492 or a Normalized Impact Sound Rating (NISR) of 42 where tested in accordance with ASTM E1007.

SECTION AK104 REFERENCED STANDARDS

AK104.1 General. See Table AK104.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title, and the section or sections of this appendix that references the standard.

APPENDIX AK—SOUND TRANSMISSION

**TABLE AK104.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM E90—09	<i>Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements</i>	AK102.1, AK102.1.1
ASTM E336—17a	<i>Standard Test Method for Measurement of Airborne Sound Attenuation between Rooms in Buildings</i>	AK102.1
ASTM E492—09	<i>Specification for Laboratory Measurement of Impact Sound Transmission through Floor-ceiling Assemblies Using the Tapping Machine</i>	AK103.1
ASTM E1007—16	<i>Standard Test Method for Field Measurement of Tapping Machine Impact Sound Transmission Through Floor-Ceiling Assemblies and Associated Support Structures</i>	AK103.1
TMS 0302—12	<i>Standard for Determining the Sound Transmission Class Rating for Masonry Walls</i>	AK102.1.1

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE APPENDIX AL – PERMIT FEES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AL PERMIT FEES

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

***About this appendix:** Appendix AL is intended to provide guidance to building departments in their efforts to set fees for building permits. This appendix provides examples that may be used as a reference when setting fee schedules and are not intended to be literally applied.*

SECTION AL101 GENERAL

AL101.1 Permit fee schedule. Permit fees shall be in accordance with Table AL101.1.

**TABLE AL101.1
PERMIT FEE SCHEDULE**

TOTAL VALUATION	FEE
\$1 to \$500	\$24
\$501 to \$2,000	\$24 for the first \$500; plus \$3 for each additional \$100 or fraction thereof, up to and including \$2,000
\$2,001 to \$40,000	\$69 for the first \$2,000; plus \$11 for each additional \$1,000 or fraction thereof, up to and including \$40,000
\$40,001 to \$100,000	\$487 for the first \$40,000; plus \$9 for each additional \$1,000 or fraction thereof, up to and including \$100,000
\$100,000 to \$500,000	\$1,027 for the first \$100,000; plus \$7 for each additional \$1,000 or fraction thereof, up to and including \$500,000
\$500,001 to \$1,000,000	\$3,827 for the first \$500,000; plus \$5 for each additional \$1,000 or fraction thereof, up to and including \$1,000,000
\$1,000,001 to \$5,000,000	\$6,327 for the first \$1,000,000; plus \$3 for each additional \$1,000 or fraction thereof, up to and including \$5,000,000
\$5,000,001 and over	\$18,327 for the first \$5,000,000; plus \$1 for each additional \$1,000 or fraction thereof

APPENDIX AM
RESERVED

APPENDIX AN
RESERVED

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AO – AUTOMATIC VEHICULAR GATES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AO

AUTOMATIC VEHICULAR GATES

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix AO provides requirements for automatic vehicular gates, including a definition of and references to standards that regulate such gates.

SECTION AO101 GENERAL

AO101.1 General. The provisions of this appendix shall control the design and construction of automatic vehicular gates installed on the lot of a one- or two-family dwelling.

SECTION AO102 DEFINITION

AO102.1 General. The following term shall, for the purposes of this appendix, have the meaning shown herein.

VEHICULAR GATE. A gate that is intended for use at a vehicular entrance or exit to the lot of a one- or two-family dwelling, and that is not intended for use by pedestrian traffic.

SECTION AO103 AUTOMATIC VEHICULAR GATES

AO103.1 Vehicular gates intended for automation. Vehicular gates intended for automation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

AO103.2 Vehicular gate openers. Vehicular gate openers, where provided, shall be listed in accordance with UL 325.

SECTION AO104 REFERENCED STANDARDS

AO104.1 General. See Table AO104.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title, and the section or sections of this appendix that reference the standard.

**TABLE AO104.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM F2200—14	<i>Standard Specification for Automated Vehicular Gate Construction</i>	AO103.1
UL 325—02	<i>Door, Drapery, Gate, Louver and Window Operations and Systems— with revisions through May 2015</i>	AO103.2

APPENDIX AP
RESERVED

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AQ – TINY HOUSES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter				X	X																	
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AQ

TINY HOUSES

This provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Appendix AQ relaxes various requirements in the body of the code as they apply to houses that are 400 square feet in area or less. Attention is specifically paid to features such as compact stairs, including stair handrails and headroom, ladders, reduced ceiling heights in lofts and guard and emergency escape and rescue opening requirements at lofts.

SECTION AQ101 GENERAL

AQ101.1 Scope. This appendix shall be applicable to tiny houses used as single dwelling units. Tiny houses shall comply with this code except as otherwise stated in this appendix.

SECTION AQ102 DEFINITIONS

AQ102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

EGRESS ROOF ACCESS WINDOW. A skylight or roof window designed and installed to satisfy the emergency escape and rescue opening requirements of Section R310.2.

LANDING PLATFORM. A landing provided as the top step of a stairway accessing a loft.

LOFT. A floor level located more than 30 inches (762 mm) above the main floor, open to the main floor on one or more sides with a ceiling height of less than 6 feet 8 inches (2032 mm) and used as a living or sleeping space.

TINY HOUSE. A dwelling that is 400 square feet (37 m²) or less in floor area excluding lofts.

SECTION AQ103 CEILING HEIGHT

AQ103.1 Minimum ceiling height. Habitable space and hallways in tiny houses shall have a ceiling height of not less than 6 feet 8 inches (2032 mm). Bathrooms, toilet rooms and kitchens shall have a ceiling height of not less than 6 feet 4 inches (1930 mm). Obstructions including, but not limited to, beams, girders, ducts and lighting, shall not extend below these minimum ceiling heights.

Exception: Ceiling heights in lofts are permitted to be less than 6 feet 8 inches (2032 mm).

SECTION AQ104 LOFTS

AQ104.1 Minimum loft area and dimensions. Lofts used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections AQ104.1.1 through AQ104.1.3.

AQ104.1.1 Minimum area. Lofts shall have a floor area of not less than 35 square feet (3.25 m²).

AQ104.1.2 Minimum horizontal dimensions. Lofts shall be not less than 5 feet (1524 mm) in any horizontal dimension.

AQ104.1.3 Height effect on loft area. Portions of a loft with a sloped ceiling measuring less than 3 feet (914 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft. See Figure AQ104.1.3.

Exception: Under gable roofs with a minimum slope of 6 units vertical in 12 units horizontal (50-percent slope), portions of a loft with a sloped ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.

AQ104.2 Loft access and egress. The access to and primary egress from lofts shall be of any type described in Sections AQ104.2.1 through AQ104.2.5. The loft access and egress element along its required minimum width shall meet the loft where its ceiling height is not less than 3 feet (914 mm).

AQ104.2.1 Stairways. Stairways accessing lofts shall comply with this code or with Sections AQ104.2.1.1 through AQ104.2.1.7.

AQ104.2.1.1 Width. Stairways accessing a loft shall not be less than 17 inches (432 mm) in clear width at or above the handrail. The width below the handrail shall be not less than 20 inches (508 mm).

AQ104.2.1.2 Headroom. The headroom above stairways accessing a loft shall be not less than 6 feet 2 inches (1880 mm), as measured vertically, from a sloped line connecting the tread, landing or landing platform nosings in the center of their width and vertically from the landing platform along the center of its width.

AQ104.2.1.3 Treads and risers. Risers for stairs accessing a loft shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:

1. The tread depth shall be 20 inches (508 mm) minus four-thirds of the riser height.
2. The riser height shall be 15 inches (381 mm) minus three-fourths of the tread depth.

AQ104.2.1.4 Landings. Intermediate landings and landings at the bottom of stairways shall comply with Section R311.7.6, except that the depth in the direction of travel shall be not less than 24 inches (610 mm).

AQ104.2.1.5 Landing platforms. The top tread and riser of stairways accessing lofts shall be constructed as a landing platform where the loft ceiling height is less than 6 feet 2 inches (1880 mm) where the stairway meets the loft. The landing platform shall be not less than 20 inches (508 mm) in width and in depth measured horizontally from and perpendicular to the nosing of the landing platform. The landing platform riser height to the loft floor shall be not less than 16 inches (406 mm) and not greater than 18 inches (457 mm).

AQ104.2.1.6 Handrails. Handrails shall comply with Section R311.7.8.

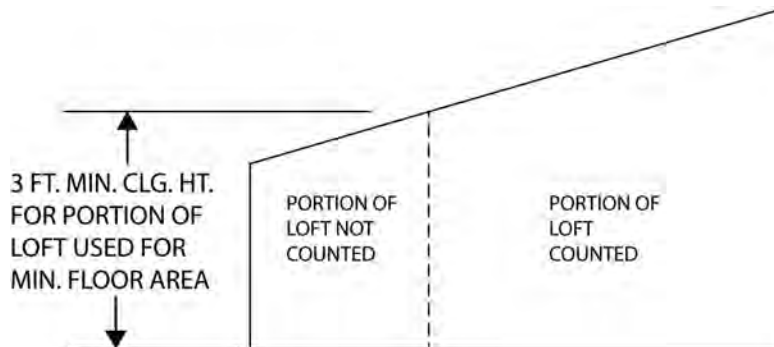
AQ104.2.1.7 Stairway guards. Guards at open sides of stairways, landings and landing platforms shall comply with Section R312.1.

AQ104.2.2 Ladders. Ladders accessing lofts shall comply with Sections AQ104.2.1 and AQ104.2.2.2.

AQ104.2.2.1 Size and capacity. Ladders accessing lofts shall have a rung width of not less than 12 inches (305 mm), and 10-inch (254 mm) to 14-inch (356 mm) spacing between rungs. Ladders shall be capable of supporting a 300-pound (136 kg) load on any rung. Rung spacing shall be uniform within ³/₈ inch (9.5 mm).

AQ104.2.2.2 Incline. Ladders shall be installed at 70 to 80 degrees from horizontal.

AQ104.2.3 Alternating tread devices. Alternating tread devices accessing lofts shall comply with Sections R311.7.11.1 and R311.7.11.2. The clear width at and below the handrails shall be not less than 20 inches (508 mm).



For SI: 1 foot = 304.8 mm.

FIGURE AQ104.1.3
HEIGHT EFFECT ON LOFT AREA

AQ104.2.4 Ship’s ladders. Ship’s ladders accessing lofts shall comply with Sections R311.7.12.1 and R311.7.12.2. The clear width at and below handrails shall be not less than 20 inches (508 mm).

AQ104.2.5 Loft guards. Loft guards shall be located along the open sides of lofts. Loft guards shall be not less than 36 inches (914 mm) in height or one-half of the clear height to the ceiling, whichever is less. Loft guards shall comply with Section R312.1.3 and Table R301.5 for their components.

4. Solar, wind or other renewable energy source supplies not less than 90 percent of the energy for service water heating.
5. Permanently installed lighting is in accordance with Section N1104.
6. Mechanical ventilation is provided in accordance with Section M1505 and operable fenestration is not used to meet ventilation requirements.

SECTION AQ105

EMERGENCY ESCAPE AND RESCUE OPENINGS

AQ105.1 General. Tiny houses shall meet the requirements of Section R310 for emergency escape and rescue openings.

Exception: Egress roof access windows in lofts used as sleeping rooms shall be deemed to meet the requirements of Section R310 where installed such that the bottom of the opening is not more than 44 inches (1118 mm) above the loft floor, provided the egress roof access window complies with the minimum opening area requirements of Section R310.2.1.

SECTION AQ106

ENERGY CONSERVATION

AQ106.1 Air leakage testing. The air leakage rate for tiny houses shall not exceed 0.30 cubic feet per minute at 50 Pascals of pressure per square foot of the dwelling unit enclosure area. The air leakage testing shall be in accordance with the testing methods required in Section N1102.4.1.2. The dwelling unit enclosure area shall be the sum of the areas of ceilings, floors and walls that separate the conditioned space of a dwelling unit from the exterior, its adjacent unconditioned spaces and adjacent dwelling units.

AQ106.1.1 Whole-house mechanical ventilation. Where the air leakage rate is in accordance with Section AQ106.1, the tiny house shall be provided with whole-house mechanical ventilation in accordance with Section M1505.4.

AQ106.2 Alternative compliance. Tiny houses shall be deemed to be in compliance with Chapter 11 of this code and Chapter R4 of the *California Energy Code*, provided that the following conditions are met:

1. The insulation and fenestration meet the requirements of Table N1102.1.2.
2. The thermal envelope meets the requirements of Section N1102.4.1.1 and Table N1102.4.1.1.
3. Solar, wind or other renewable energy source supplies not less than 90 percent of the energy use for the structure.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AR – LIGHT STRAW-CLAY CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AR

LIGHT STRAW-CLAY CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: While heavier forms of straw-clay construction have been used in various parts of the world for thousands of years, light forms of straw-clay construction began to appear in Europe in 1950 and in the United States in 1990. These lighter forms of straw-clay construction are intended as infill materials in nonload-bearing walls. The advantages of light straw-clay construction, such as regulated by Appendix AR, include thermal performance and low environmental impact.

SECTION AR101 GENERAL

AR101.1 Scope. This appendix shall govern the use of light straw-clay as a nonbearing building material and wall infill system in Seismic Design Categories A and B. Use of light straw-clay in Seismic Design Categories C, D₀, D₁ and D₂ shall require an approved engineered design by a registered design professional in accordance with Section R301.1.3.

SECTION AR102 DEFINITIONS

AR102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

CLAY. Inorganic soil with particle sizes of less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity.

CLAY SLIP. A suspension of clay or clay subsoil particles in water.

CLAY SUBSOIL. Subsoil sourced directly from the earth or refined, containing clay and not more than trace amounts organic matter.

INFILL. Light straw-clay that is placed between the structural and nonstructural members of a building.

LIGHT STRAW-CLAY. A mixture of straw and clay slip compacted and dried to form insulation and plaster substrate between or around structural and nonstructural members in a wall.

NONBEARING. Not bearing the weight of the building other than the weight of the light straw-clay itself and its finish.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

VOID. Any space in a light straw-clay wall wider than 1/4 inch (6 mm), greater than 2 inches (51 mm) in horizontal length and greater than 2 inches (51 mm) in depth.

SECTION AR103 NONBEARING LIGHT STRAW-CLAY CONSTRUCTION

AR103.1 General. Light straw-clay shall be limited to infill between or around structural and nonstructural wall framing members.

AR103.2 Structure. The structure of buildings using light straw-clay shall be in accordance with the *California Resi-*

APPENDIX AR—LIGHT STRAW-CLAY CONSTRUCTION

dential Code or shall be in accordance with an approved design by a registered design professional.

AR103.2.1 Number of stories. Use of light straw-clay infill shall be limited to buildings that are not more than one story above grade plane.

Exception: Buildings using light straw-clay infill that are greater than one story above grade plane shall be in accordance with an approved design by a registered design professional.

AR103.2.2 Bracing. Bracing for buildings with light straw-clay infill shall be in accordance with Section R602.10. Walls with light straw-clay infill shall use Method LIB and shall not be sheathed with solid sheathing. Walls without light straw-clay infill shall comply with any bracing method prescribed by this code.

AR103.2.3 Requirements and properties of light straw-clay mixtures. The requirements and properties of light straw-clay mixtures shall be in accordance with Table AR103.2.3.

AR103.2.4 Stabilization of light straw-clay. Light straw-clay shall be stabilized as follows, or shall be in accordance with an approved design by a registered design professional:

1. Vertical stabilization shall be of structural or non-structural wood framing in accordance with Figure AR103.2.4(1), AR103.2.4(2) or AR103.2.4(3). Framing members that are both load-bearing and stabilization members shall meet the requirements of Section R602 and this section. Nonstructural stabilization members shall be not more than 32 inches (813 mm) on center.
2. Horizontal stabilization shall be installed at not more than 24 inches (610 mm) on center and in accordance with Figure AR103.2.4(1), AR103.2.4(2) or AR103.2.4(3). Horizontal stabilization shall be of any of the following with the stated minimum dimensions:

³/₄-inch (19.1 mm) bamboo, ¹/₂-inch (12.7 mm) fiber-glass rod, 1-inch (25 mm) wood dowel or nominal 1-inch by 2-inch (25 mm by 51 mm) wood.

AR103.3 Materials. The materials used in light straw-clay construction shall be in accordance with Sections AR103.3.1 through AR103.3.3.

AR103.3.1 Straw requirements. Straw shall be stems of wheat, rye, oats, rice or barley, and shall be free of visible decay, insects and green plant material.

AR103.3.2 Clay subsoil requirements. Suitability of clay subsoil shall be determined in accordance with Table AR103.2.3.

AR103.3.3 Light straw-clay mixture. A light straw-clay mixture shall consist of loose straw mixed and coated with clay slip such that there is not more than 5 percent uncoated straw, and shall be in accordance with Table AR103.2.3.

AR103.4 Wall construction. Light straw-clay wall construction shall be in accordance with the requirements of Sections AR103.4.1 through AR103.4.7.

AR103.4.1 Light straw-clay maximum thickness. The maximum thickness of light straw-clay shall be in accordance with Table AR103.2.3.

AR103.4.2 Distance above grade. Light straw-clay and its exterior finish shall be not less than 8 inches (203 mm) above exterior finished grade.

AR103.4.3 Moisture barrier. An approved moisture barrier shall separate the bottom of light straw-clay walls from any masonry or concrete foundation or slab that directly supports the walls. Penetrations and joints in the barrier shall be sealed with an approved sealant.

AR103.4.4 Contact with wood members. Light straw-clay shall be permitted to be in contact with untreated wood members.

**TABLE AR103.2.3
REQUIREMENTS AND PROPERTIES OF LIGHT STRAW-CLAY MIXTURES^a**

Density (pcf)	Straw (pcf)	Subsoil (pcf)	Water (gal/cf) ^b	Min. % clay in subsoil	Minimum clay: silt ratio	Subsoil testing method ^{c, d}	Max. wall thickness, inches	R-value (hr/F°/cf/BTU/inch)
10	6.7	3.3	1.55	70	3.5:1	A	15	1.80
12	6.7	5.3	1.63	46	1.7:1	A	15	1.72
13	6.7	6.3	1.67	40	1.33:1	A	15	1.69
15	6.7	8.3	1.74	35	0.95:1	A	15	1.63
20	6.7	13.3	1.93	30	0.60:1	A	12	1.48
30	6.7	23.3	2.31	NA	NA	B	12	1.22
40	6.7	33.3	2.70	NA	NA	B	12	1.01
50	6.7	43.3	3.08	NA	NA	B	12	0.84

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a. Interpolation permitted. Extrapolation not permitted.

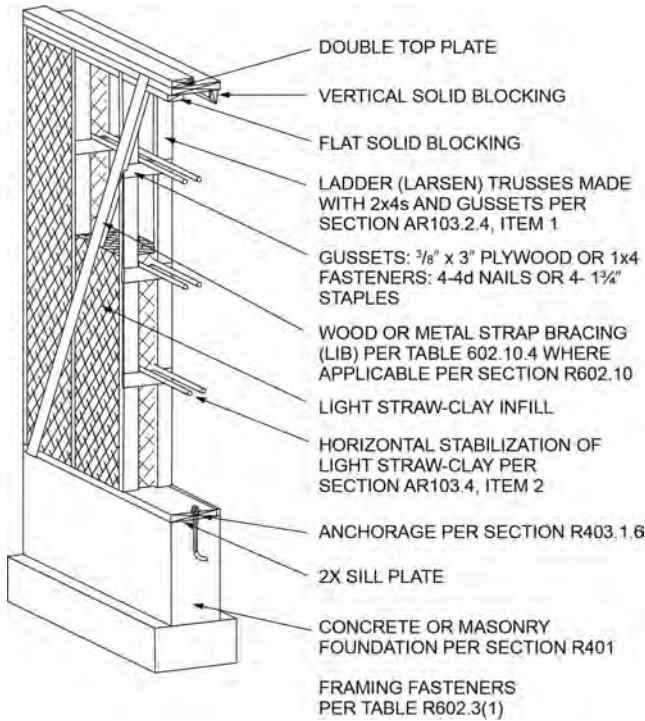
b. Water mixed with subsoil equals clay slip.

c. Subsoil Testing Methods:

1. Lab test for percent of clay, silt and sand via hydrometer method.

2. The Figure 2 Ribbon Test and the Figure 3 Ball Test in the Appendix of ASTM E2392/E2392M.

d. Trace amounts of organic materials are acceptable.



For SI: 1 inch = 25.4 mm.

FIGURE AR103.2.4(1)
LIGHT STRAW-CLAY WALL WITH LARSEN TRUSSES

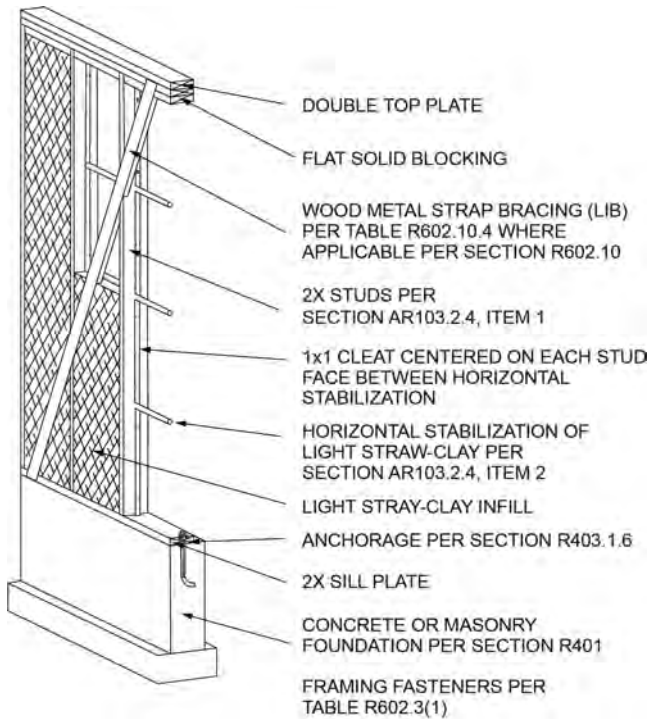


FIGURE AR103.2.4(2)
LIGHT STRAW-CLAY WALL SINGLE STUD WIDTH

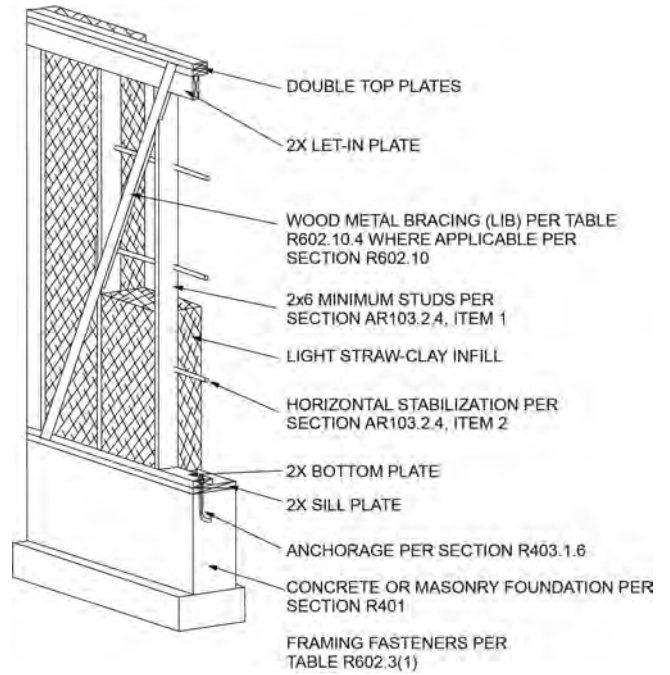


FIGURE AR103.2.4(3)
LIGHT STRAW-CLAY WALL WITH BLIND STUDS

AR103.4.5 Contact with nonwood structural members. Nonwood structural members in contact with light straw-clay shall be resistant to corrosion or shall be coated to prevent corrosion with an approved coating.

AR103.4.6 Installation. Light straw-clay shall be installed in accordance with the following:

1. Formwork shall be sufficiently strong to resist bowing where the light straw-clay is compacted into the forms.
2. Light straw-clay shall be uniformly placed into forms and evenly tamped to achieve stable walls free of voids. Light straw-clay shall be placed in lifts of not more than 6 inches (152 mm) and shall be thoroughly tamped before additional material is added.
3. Temporary formwork shall be removed from walls within 24 hours after tamping, and walls shall remain exposed until moisture content is in accordance with Section AR103.5.1. Visible voids shall be filled with light straw-clay or other insulative material prior to plastering.

AR103.4.7 Openings in walls. Openings in walls shall be in accordance with the following:

1. Rough framing for doors and windows shall be fastened to structural members in accordance with the *California Residential Code*. Windows and doors shall be flashed in accordance with the *California Residential Code*.
2. An approved moisture barrier shall be installed at window sills in light straw-clay walls prior to installation of windows.

AR103.5 Wall finishes. The interior and exterior surfaces of light straw-clay walls shall be protected with a finish in accordance with Sections AR103.5.1 through AR103.5.5.

AR103.5.1 Dimensional stability of light straw-clay prior to application of plaster finish. Light straw-clay infill having a density of 30 pounds per cubic foot (480.6 kg/m³) or greater shall be dry to a moisture content of not more than 20 percent at a depth of 4 inches (102 mm), as measured from each side of the wall. Light straw-clay infill having a density of less than 30 pounds per cubic foot (480.6 kg/m³) shall be sufficiently dry such that the overall shrinkage of the light straw-clay is dimensionally stable.

AR103.5.2 Plaster finish. Exterior plaster shall be clay plasters or lime plasters. Interior plasters shall be clay plasters, lime plasters or gypsum plasters. Plasters shall be permitted to be applied directly to the surface of the light straw-clay walls without reinforcement, except that the juncture of dissimilar substrates shall be in accordance with Section AR103.5.4. Plasters shall have a thickness of not less than 1/2 inch (12.7 mm) and not more than 1 inch (25 mm) and shall be installed in not less than two coats. Rain-exposed clay plasters shall be finished with a lime-based or silicate-mineral coating.

AR103.5.3 Separation of wood and plaster. Where wood framing occurs in light straw-clay walls, such wood surfaces shall be separated from exterior plaster with No.15 asphalt felt, Grade D paper or other approved material except where the wood is preservative treated or naturally durable.

Exception: Exterior clay plasters shall not be required to be separated from wood.

AR103.5.4 Bridging across dissimilar substrates. Bridging shall be installed across dissimilar substrates prior to the application of plaster. Acceptable bridging materials include expanded metal lath, woven wire mesh, welded wire mesh, fiberglass mesh, reed matting or burlap. Bridging shall extend not less than 4 inches (102 mm), on both sides of the juncture.

AR103.5.5 Exterior cladding. Exterior cladding shall be spaced not less than 1/2 inch (12.7 mm) from the light straw-clay such that a ventilation space is created to allow for moisture diffusion. Furring strips that create this ventilation space shall be securely fastened to the stabilization members or framing. The cladding shall be fastened to the wood furring strips in accordance with the manufacturer’s instructions. Insect screening shall be provided at the top and bottom of the ventilation space.

**SECTION AR104
THERMAL PERFORMANCE**

AR104.1 Thermal characteristics. Walls with light straw-clay infill of densities of greater than or equal to 20 pounds per cubic foot (480.6 kg/m³) shall be classified as mass walls in accordance with Section N1102.2.5 (R402.2.5) and shall

meet the *R*-value requirements for mass walls in Table N1102.1.3 (R402.1.2). Walls with light straw-clay infill of densities less than 20 pounds per cubic foot (480.6 kg/m³) shall meet the *R*-value requirements for wood frame walls in Table N1102.1.3 (R402.1.2).

AR104.2 Thermal resistance. Light straw-clay shall be deemed to have a thermal resistance as specified in Table AR103.2.3.

**SECTION AR105
REFERENCED STANDARDS**

AR105.1 General. See Table AR105.1 for standards that are referenced in various section of this appendix. Standards are listed by the standard identification with the effective date, the standard title, and the section or sections of this appendix that reference this standard.

**TABLE AR105.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM E2392/E2392M—10	<i>Standard Guide for Design of Earthen Wall Building Systems</i>	Table AR103.2.3

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AS – STRAWBALE CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)				X																		
Adopt only those sections that are listed below																			X			
Chapter / Section																						
AS Note																			X			

APPENDIX AS

STRAWBALE CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

Note: The IECC climate zones used by this section differ from those used by the California Energy Code to determine applicability of energy efficiency measures. Comparison of IECC and California Energy Code climate zones is shown in Table R702.7(5).

User note:

About this appendix: The use of strawbale construction has steadily increased since the 1980s such that there are now buildings of strawbale construction in every state in the United States and in more than 50 countries around the globe. Estimates are that there are over 1,000 buildings of strawbale construction in California alone, including both residential and commercial buildings. Appendix AS provides prescriptive requirements for the construction of exterior and interior walls, both structural and nonstructural, in buildings that are under the scope of this code.

SECTION AS101 GENERAL

AS101.1 Scope. This appendix provides prescriptive and performance-based requirements for the use of baled straw as a building material. Other methods of strawbale construction shall be subject to approval in accordance with Section R104.11 of this code. Buildings using strawbale walls shall comply with this code except as otherwise stated in this appendix.

AS101.2 Strawbale wall systems. Strawbale wall systems include those shown in Figure AS101.2 and approved variations.

SECTION AS102 DEFINITIONS

AS102.1 Definitions. The following words and terms shall, for the purposes of this appendix, have the meanings shown

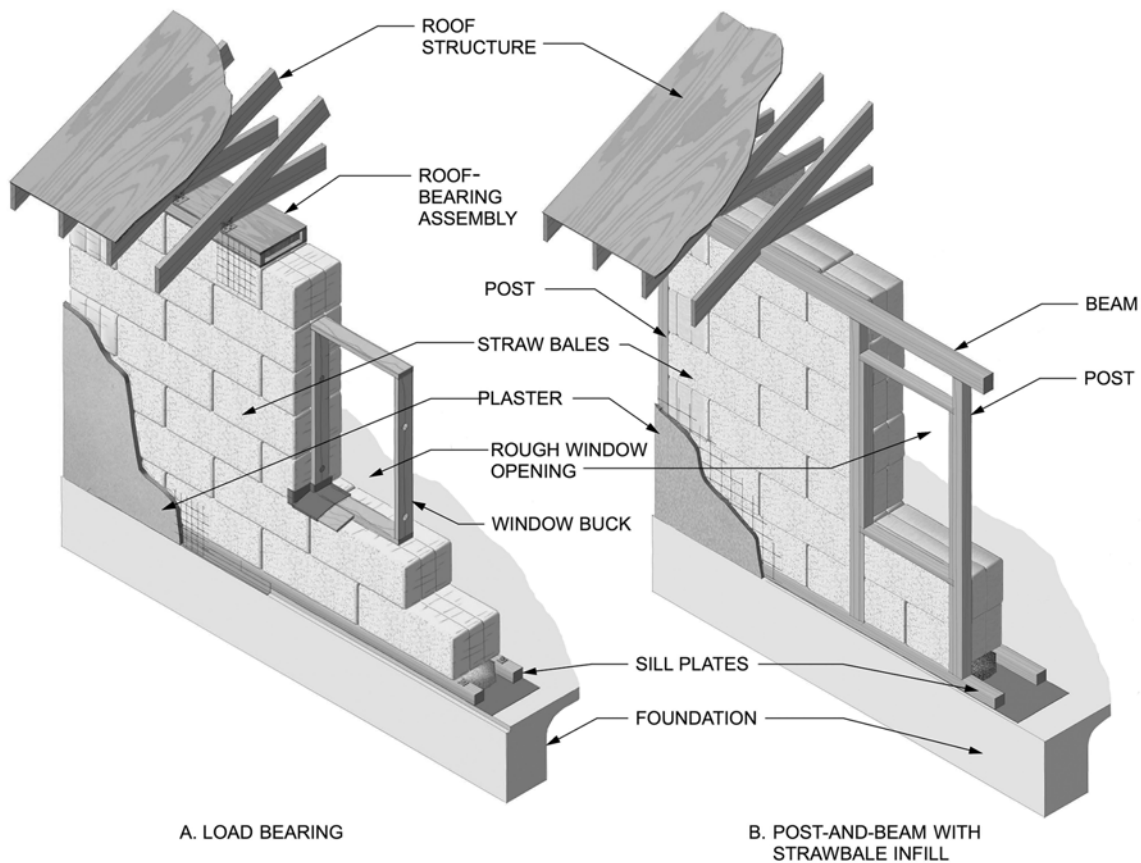
herein. Refer to Chapter 2 of the *California Residential Code* for general definitions.

BALE. Equivalent to straw bale.

BRACED WALL PANEL, STRAWBALE. A strawbale wall designed and constructed to resist in-plane shear loads through the interaction of the stacked straw bales, the reinforced plaster and its connections to the top plate, sill plates and foundation. The panel's length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AS106.13 and R602.10.1.

CLAY. Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in clay plaster and straw-clay.

CLAY SLIP. A suspension of clay or clay subsoil particles in water.



Note: See Figures AS105.1(1) through AS105.1(4) for detailed views and section references. Other strawbale wall systems or variations are permitted as approved.

**FIGURE AS101.2
TYPICAL STRAWBALE WALL SYSTEMS**

CLAY SUBSOIL. Subsoil sourced directly from the earth, containing clay, sand, silt and not more than trace amounts of organic matter.

FINISH. Completed combination of materials on the interior or exterior faces of stacked bales.

FLAKE. An intact section of compressed straw removed from an untied bale.

LAID FLAT. The orientation of a bale with its largest faces horizontal, its longest dimension parallel with the wall plane, its ties concealed in the unfinished wall and its straw lengths oriented predominantly across the thickness of the wall. See Figure AS102.1.

LOAD-BEARING WALL. A strawbale wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition its own weight.

MESH. An openwork fabric of linked strands of metal, plastic, or natural or synthetic fiber.

NONSTRUCTURAL WALL. Walls other than load-bearing walls or shear walls.

ON-EDGE. The orientation of a bale with its largest faces vertical, its longest dimension parallel with the wall plane, its ties on the face of the wall and its straw lengths oriented predominantly vertically. See Figure AS102.1.

ON-END. The orientation of a bale with its longest dimension vertical. For use in nonstructural strawbale walls only. See Figure AS102.1.

PIN. A vertical metal rod, wood dowel or bamboo, driven into the center of stacked bales, or placed on opposite surfaces of stacked bales and through-tied.

PLASTER. Clay, soil-cement, gypsum, lime, clay-lime, lime-cement or cement plaster, as described in Section AS104.

PRECOMPRESSION. Permanent vertical compression of stacked bales before the application of finish.

REINFORCED PLASTER. A plaster containing mesh reinforcement.

ROOF-BEARING ASSEMBLY. In load-bearing strawbale walls, a structural assembly at the top of the wall that bears and distributes roof loads to the wall.

RUNNING BOND. The placement of straw bales such that the head joints in successive courses are offset not less than one-quarter the bale length.

SHEAR WALL. A strawbale wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AS106.13. This term is synonymous with “Braced wall panel.”

SKIN. The compilation of plaster and reinforcing, if any, applied to the surface of stacked bales.

STACK BOND. The placement of straw bales such that head joints in successive courses are vertically aligned.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

STRAW BALE. A rectangular compressed block of straw, bound by ties.

STRAWBALE. The adjective form of straw bale.

STRAW-CLAY. Loose straw mixed and coated with clay slip.

STRUCTURAL WALL. A wall that meets the definition for a load-bearing wall or shear wall.

TIE. A synthetic fiber, natural fiber or metal wire used to confine a straw bale.

TRUTH WINDOW. An area of a strawbale wall left without its finish, to allow view of the straw otherwise concealed by its finish.

AS103.2 Size. Bales shall have a height and thickness of not less than 12 inches (305 mm), except as otherwise permitted or required in this appendix. Bales used within a continuous wall shall be of consistent height and thickness to ensure even distribution of loads within the wall system. See Figure AS103.2 for approximate dimensions of common straw bales.

AS103.3 Ties. Bales shall be confined by synthetic fiber, natural fiber or metal ties sufficient to maintain required bale density. Ties shall be not less than 3 inches (76 mm) and not more than 6 inches (152 mm) from the two untied faces and shall be spaced not more than 12 inches (305 mm) apart. Bales with broken ties shall be retied with sufficient tension to maintain required bale density.

AS103.4 Moisture content. The moisture content of bales at the time of application of the first coat of plaster or the installation of another finish shall not exceed 20 percent of the weight of the bale. The moisture content of bales shall be determined with a moisture meter designed for use with baled straw or hay, equipped with a probe of sufficient length to reach the center of the bale. Not less than 5 percent and not fewer than 10 bales shall be randomly selected and tested.

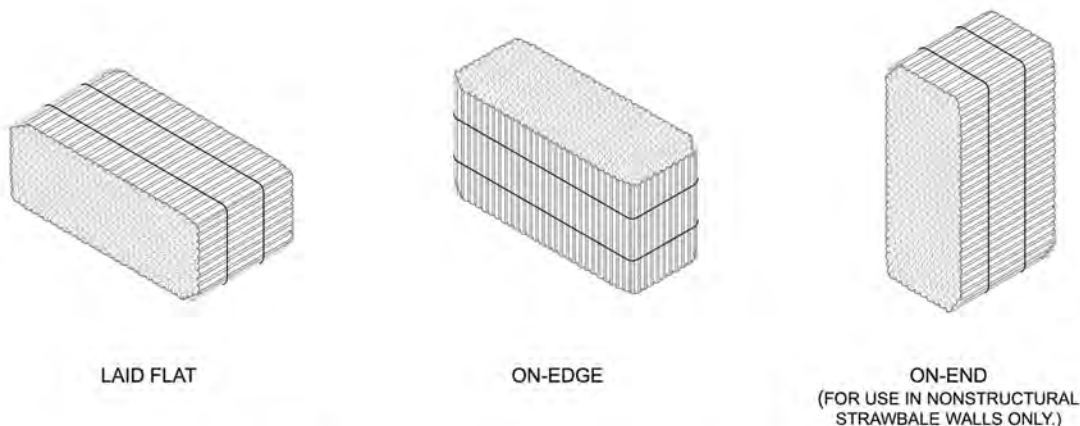
AS103.5 Density. Bales shall have a dry density of not less than 6.5 pounds per cubic foot (104 kg/cubic meter). The dry density shall be calculated by subtracting the weight of the moisture in pounds (kg) from the actual bale weight and dividing by the volume of the bale in cubic feet (cubic meters). Not less than 2 percent and not fewer than five bales shall be randomly selected and tested on-site.

AS103.6 Partial bales. Partial bales made after original fabrication shall be retied with ties complying with Section AS103.3.

AS103.7 Types of straw. Bales shall be composed of straw from wheat, rice, rye, barley or oat. The dry stems of other cereal grains or similar crops shall be acceptable where

**SECTION AS103
BALES**

AS103.1 Shape. Bales shall be rectangular in shape, except for partial bales made to fill nonrectangular spaces in accordance with Section AS103.6.



NOTE: ILLUSTRATIONS ALSO SHOW THE PREDOMINANT DIRECTION OF THE LENGTHS OF STRAW IN A TYPICAL STRAW BALE. HOWEVER, SOME RANDOMNESS OF DIRECTION IS NORMAL.

Note: Illustrations also show the predominant direction of the lengths of straw in a typical straw bale. However, some randomness of direction is normal.

**FIGURE AS102.1
BALE ORIENTATIONS**

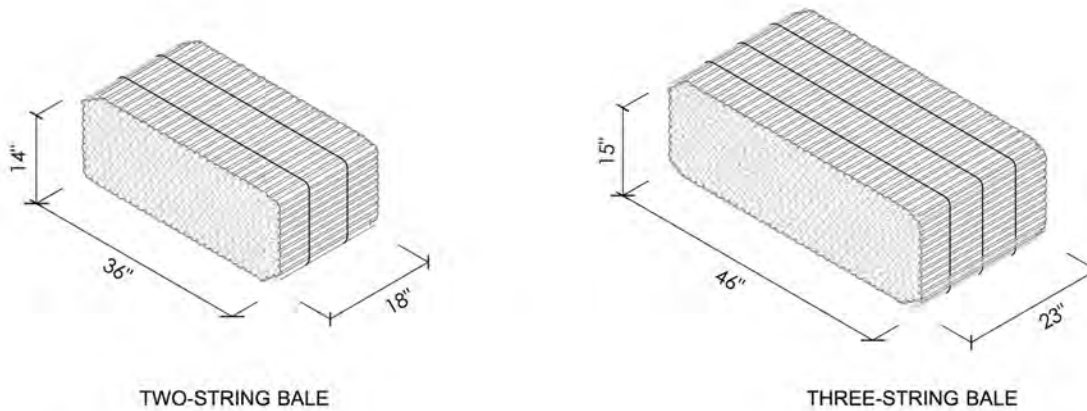


FIGURE AS103.2
APPROXIMATE DIMENSIONS OF COMMON STRAW BALES

For SI: 1 inch = 25.4 mm.

approved by the building official. Bales shall not be composed of hay.

AS103.8 Orientation of bales. Straw bales shall be placed laid flat, on-edge or on end in accordance with this appendix.

**SECTION AS104
FINISHES**

AS104.1 General. Finishes applied to strawbale walls shall comply with this section and with Chapters 3 and 7 unless stated otherwise in this section.

AS104.1.1 Exterior wall finishes. Exterior wall finishes shall be plasters in accordance with Section AS104.4, or nonplaster exterior wall coverings in accordance with Section R703 and other finish systems complying with all of the following:

1. With approved specifications and details showing the finish system’s means of attachment to the wall or its independent support, and a means of draining or evaporating water that penetrates the exterior finish to the exterior.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor through the wall.
3. Finish systems with weights greater than 10 or less than or equal to 20 pounds per square foot (> 48.9 and ≤ 97.8 kg/m) of wall area require a factor of 1.2 for minimum total length of braced wall panels in Table AS106.13(3).
4. Finish systems with weights greater than 20 pounds per square foot (97.8 kg/m) of wall area require an engineered design.

AS104.2 Purpose, and where required. Strawbale walls shall be finished so as to provide mechanical protection, fire resistance and protection from weather and to restrict the passage of air through the bales, in accordance with this appendix and this code. Vertical strawbale wall surfaces shall receive a coat of plaster not less than 3/8 inch (10 mm) thick,

or greater where required elsewhere in this appendix, or shall fit tightly against a solid wall panel or dense-packed cellulose insulation with a density of not less than 3.5 pounds per cubic foot (56 kg/m³) blown into an adjacent framed wall. The tops of strawbale walls shall receive a coat of plaster not less than 3/8 inch (10 mm) thick or be tightly covered by gypsum board or a roof-bearing assembly.

Exception: Truth windows shall be permitted where a fire-resistance rating is not required. Weather-exposed truth windows shall be fitted with a weather-tight cover. Interior truth windows in Climate Zones 5, 6, 7, 8 and Marine 4 shall be fitted with an airtight cover.

AS104.3 Vapor retarders. Class I and II vapor retarders shall not be used on a strawbale wall, nor shall any other material be used that has a vapor permeance rating of less than 5 perms, except as permitted or required elsewhere in this appendix.

AS104.4 Plaster. Plaster applied to bales shall be any type described in this section, and as required or limited in this appendix. Plaster thickness shall not exceed 2 inches (51 mm).

AS104.4.1 Plaster and membranes. Plaster shall be applied directly to strawbale walls to facilitate transpiration of moisture from the bales, and to secure a mechanical bond between the skin and the bales, except where a membrane is allowed or required elsewhere in this appendix.

AS104.4.2 Lath and mesh for plaster. The surface of the straw bales functions as lath, and other lath or mesh shall not be required, except as required for out-of-plane resistance by Table AS105.4 or for structural walls by Tables AS106.12 and AS106.13(1).

AS104.4.3 Clay plaster. Clay plaster shall comply with Sections AS104.4.3.1 through AS104.4.3.6.

AS104.4.3.1 General. Clay plaster shall be any plaster having a clay or clay subsoil binder. Such plaster shall contain sufficient clay to fully bind the sand or other aggregate, and shall be permitted to contain reinforcing fibers. Acceptable reinforcing fibers include chopped straw, sisal and animal hair.

AS104.4.3.2 Clay subsoil requirements. The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

AS104.4.3.3 Thickness and coats. Clay plaster shall be not less than 1 inch (25 mm) thick, except where required to be thicker for structural walls as described elsewhere in this appendix, and shall be applied in not less than two coats.

AS104.4.3.4 Rain-exposed. Clay plaster, where exposed to rain, shall be finished with lime wash, lime plaster, linseed oil or other approved erosion-resistant finish.

AS104.4.3.5 Prohibited finish coat. Plaster containing Portland cement shall not be permitted as a finish coat over clay plasters.

AS104.4.3.6 Plaster additives. Additives shall be permitted to increase plaster workability, durability, strength or water resistance.

AS104.4.4 Soil-cement plaster. Soil-cement plaster shall comply with Sections AS104.4.4.1 through AS104.4.4.3.

AS104.4.4.1 General. Soil-cement plaster shall be composed of clay subsoil, sand and not less than 10 percent and not more than 20 percent Portland cement by volume, and shall be permitted to contain reinforcing fibers.

AS104.4.4.2 Lath and mesh. Soil-cement plaster shall use any corrosion-resistant lath or mesh permitted by this code, or as required in Section AS106 where used on structural walls.

AS104.4.4.3 Thickness. Soil-cement plaster shall be not less than 1 inch (25 mm) thick.

AS104.4.5 Gypsum plaster. Gypsum plaster shall comply with Section R702.2.1. Gypsum plaster shall be limited to use on interior surfaces of nonstructural walls, and as an interior finish coat over a structural plaster that complies with this appendix.

AS104.4.6 Lime plaster. Lime plaster shall comply with Sections AS104.4.6.1 through AS104.4.6.3.

AS104.4.6.1 General. Lime plaster is any plaster with a binder that is composed of calcium hydroxide (CaOH) including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and CEN EN 459. Quicklime shall comply with ASTM C5.

AS104.4.6.2 Thickness and coats. Lime plaster shall be not less than $\frac{7}{8}$ inch (22 mm) thick, and shall be applied in not less than three coats.

AS104.4.6.3 On structural walls. Lime plaster on strawbale structural walls in accordance with Table AS106.12 or AS106.13.1) shall use hydraulic or natural hydraulic lime.

AS104.4.7 Clay-lime plaster. Clay-lime plaster shall be composed of refined clay or clay subsoil, sand, and lime, and shall be permitted to contain reinforcing fibers.

AS104.4.8 Cement-lime plaster. Cement-lime plaster shall be plaster mixes CL, F or FL, as described in ASTM C926.

AS104.4.9 Cement plaster. Cement plaster shall conform to ASTM C926 and shall comply with Sections R703.7.4 and R703.7.5, except that the amount of lime in plaster coats shall be not less than 1 part lime to 4 parts cement to allow a minimum acceptable vapor permeability. The combined thickness of plaster coats shall be not more than $1\frac{1}{2}$ inches (38 mm).

SECTION AS105 STRAWBALE WALLS—GENERAL

AS105.1 General. Strawbale walls shall be designed and constructed in accordance with this section and with Figures AS105.1(1) through AS105.1(4) or an approved alternative design. Strawbale structural walls shall be in accordance with the additional requirements of Section AS106.

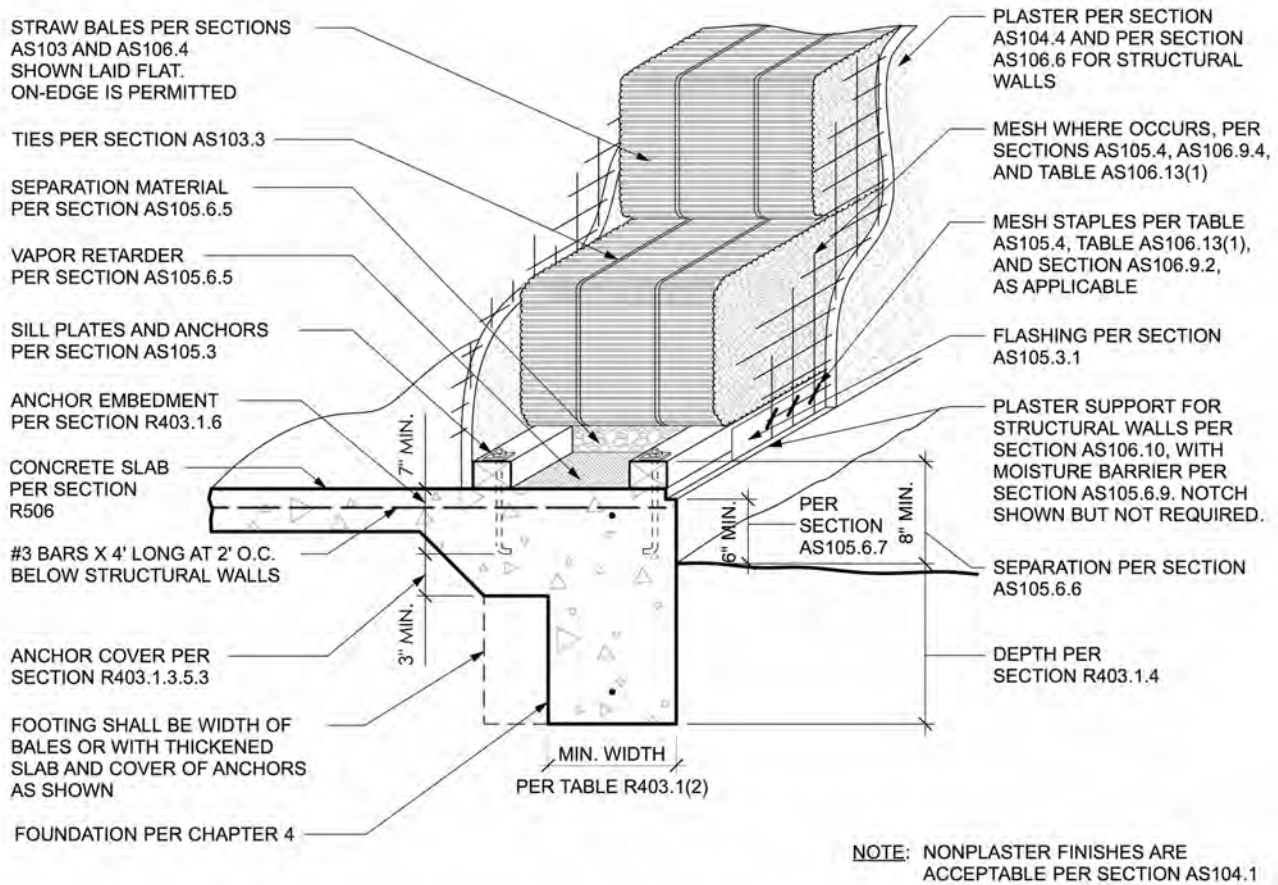
AS105.2 Building limitations and requirements for use of strawbale nonstructural walls. Buildings using strawbale nonstructural walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one, except that two stories shall be allowed with an approved engineered design.
2. Building height: not more than 25 feet (7620 mm), except that greater heights shall be allowed with an approved engineered design.
3. Wall height: in accordance with Table AS105.4.
4. Braced wall panel lengths: in accordance with Section R602.10.3, with the additional requirements that Table R602.10.3(3) shall apply to all buildings in Seismic Design Category C, and the minimum total length of braced wall panels in Table R602.10.3(3) shall be increased by 60 percent for buildings in Seismic Design Categories C, D₀, D₁ and D₂.

AS105.3 Sill plates. Sill plates shall be installed in accordance with Figure AS105.1(1) or AS105.1(2). Sill plates shall support and be flush with each face of the straw bales above and shall be of naturally durable or preservative-treated wood where required by this code. Sill plates shall be not less than nominal 2 inches by 4 inches (51 mm by 102 mm) with anchoring complying with Section R403.1.6 and the additional requirements of Table AS105.4, where applicable, and Sections AS106.13.2 and AS106.13.3 for strawbale braced wall panels.

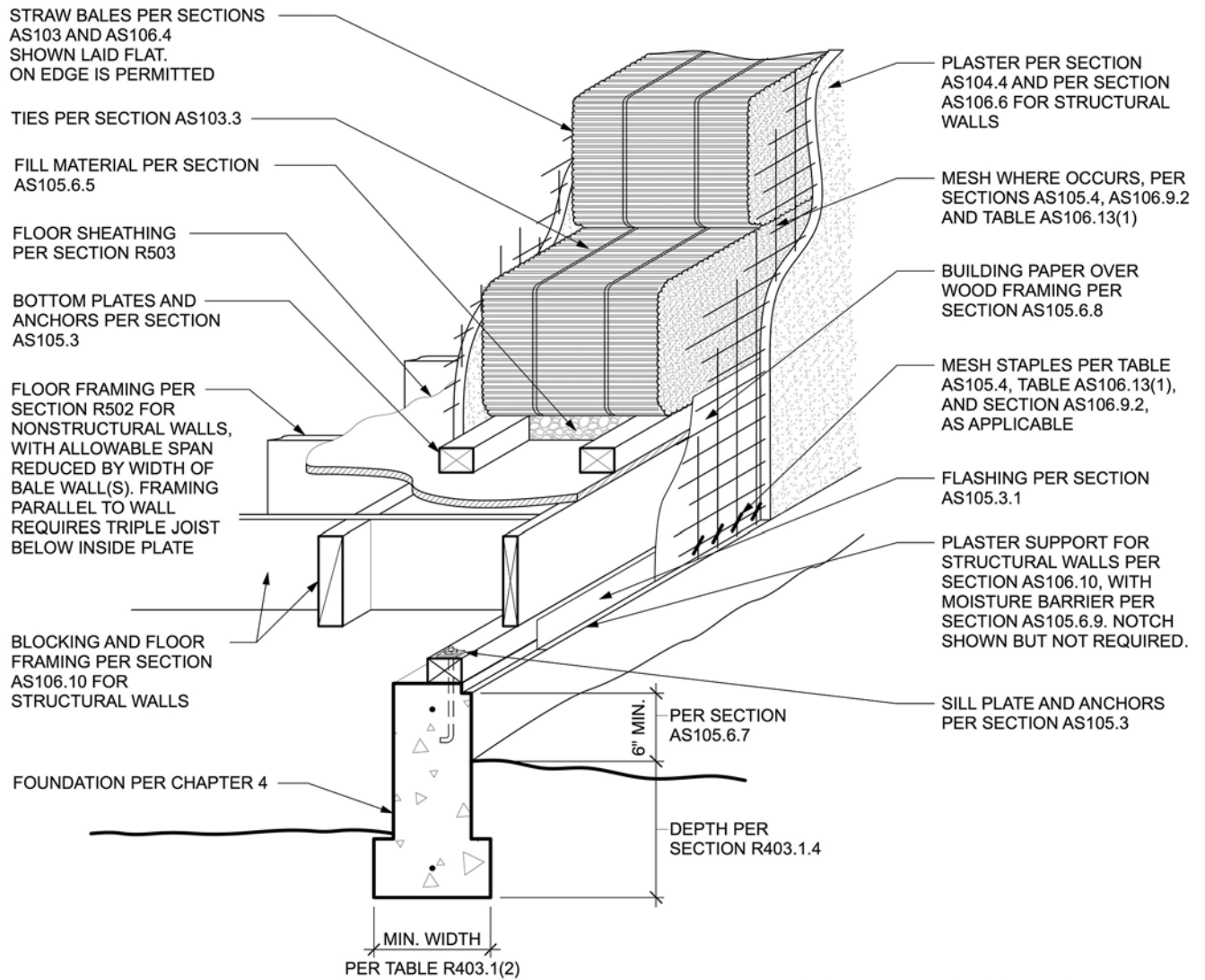
AS105.3.1 Exterior sill plate flashing. Exterior sill plates shall receive flashing across the plate to slab or foundation joints.

APPENDIX AS—STRAWBALE CONSTRUCTION



For SI: 1 inch = 25.4 mm.

FIGURE AS105.1(1)
TYPICAL BASE OF PLASTERED STRAWBALE WALL ON CONCRETE SLAB AND FOOTING

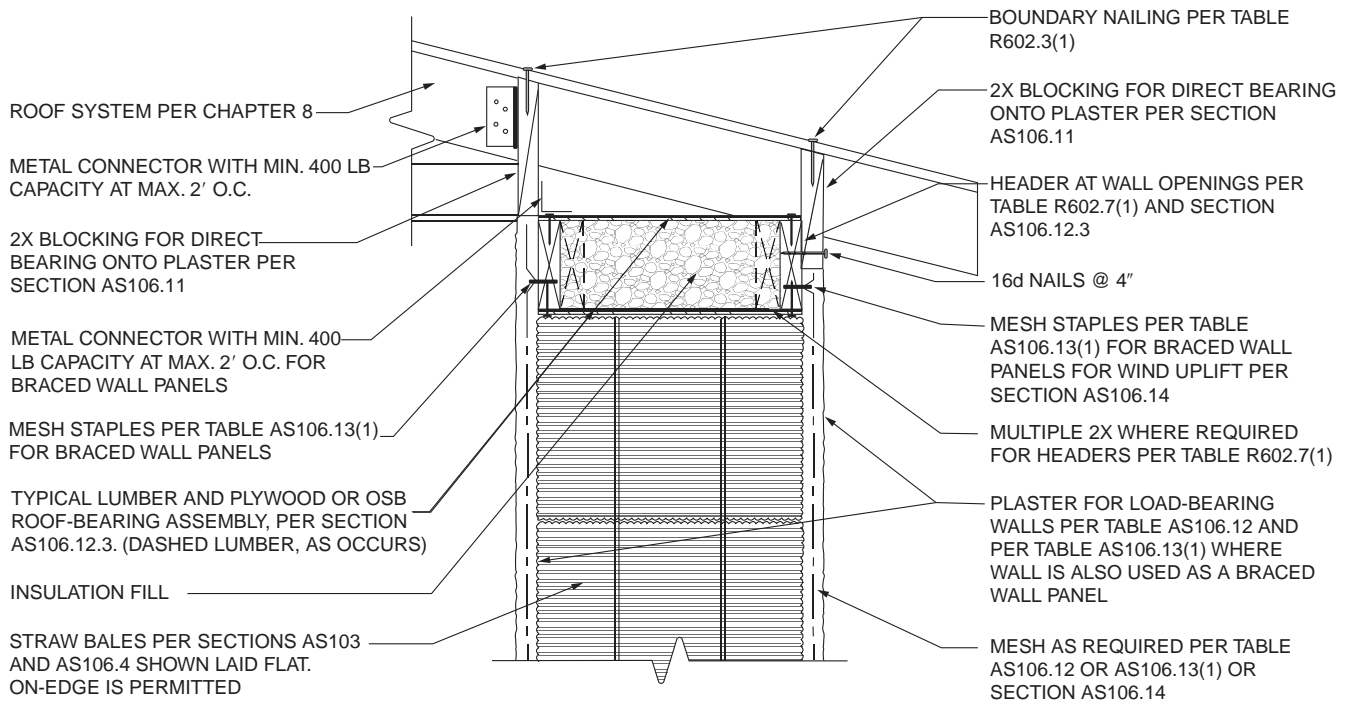


NOTE: NONPLASTER FINISHES ARE ACCEPTABLE PER SECTION AS104.1

For SI: 1 inch = 25.4 mm.

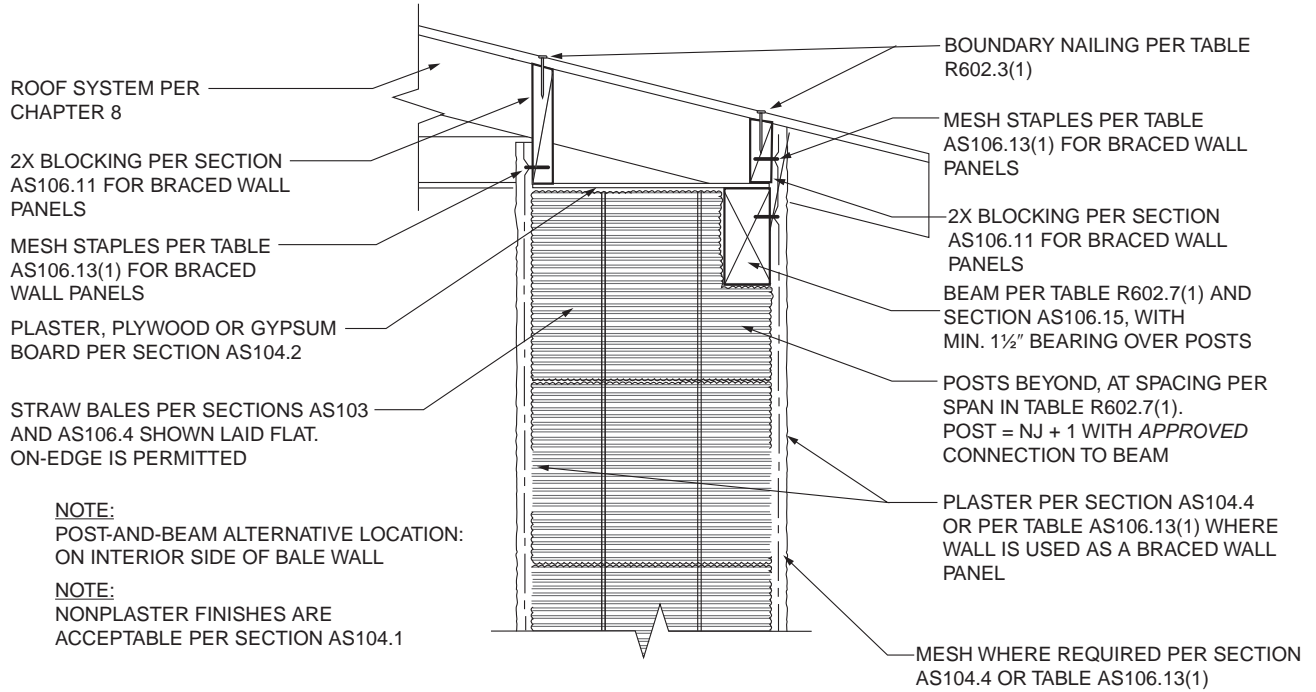
FIGURE AS105.1(2)
TYPICAL BASE OF PLASTERED STRAWBALE WALL OVER RAISED FLOOR

APPENDIX AS—STRAWBALE CONSTRUCTION



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound = 2.2 kg.

**FIGURE AS105.1(3)
TYPICAL TOP OF LOAD-BEARING STRAWBALE WALL**



For SI: 1 inch = 25.4 mm.

FIGURE AS105.1(4)
TYPICAL TOP OF POST-AND-BEAM WALL WITH PLASTERED STRAWBALE INFILL

AS105.4 Out-of-plane resistance methods and unrestrained wall dimension limits. Strawbale walls shall employ a method of out-of-plane load resistance in accordance with Table AS105.4, and comply with its associated limits and requirements.

AS105.4.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AS105.4 shall be in terms of the ultimate design wind speed and seismic design category as determined in accordance with Sections R301.2.1 and R301.2.2. An engineered design in accordance with Section R301.2.1 shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2(2) and Section R301.2.1.1, respectively.

AS105.4.2 Pins. Pins used for out-of-plane resistance shall comply with the following or shall be in accordance

with an approved engineered design. Pins shall be external, internal or a combination of the two.

1. Pins shall be 1/2-inch-diameter (12.7 mm) steel, 3/4-inch-diameter (19.1 mm) wood or 1/2-inch-diameter (12.7 mm) bamboo.
2. External pins shall be installed vertically on both sides of the wall at a spacing of not more than 24 inches (610 mm) on center. External pins shall have full lateral bearing on the sill plate and the top plate or roof-bearing element, and shall be tightly tied through the wall to an opposing pin with ties spaced not more than 32 inches (813 mm) apart and not more than 8 inches (203 mm) from each end of the pins.
3. Internal pins shall be installed vertically within the center third of the bales, at spacing of not more than 24 inches (610 mm) and shall extend from top

**TABLE AS105.4
OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL DIMENSION LIMITS**

METHOD OF OUT-OF-PLANE LOAD RESISTANCE ^a	FOR ULTIMATE DESIGN WIND SPEEDS (mph)	FOR SEISMIC DESIGN CATEGORIES	UNRESTRAINED WALL DIMENSIONS, H ^b		MESH STAPLE SPACING AT BOUNDARY RESTRAINTS
			Absolute limit in feet	Limit based on bale thickness T ^c in feet (mm)	
Nonplaster finish or unreinforced plaster	≤ 130	A, B, C, D ₀	H ≤ 8	H ≤ 5T	None required
Pins per Section AS105.4.2	≤ 130	A, B, C, D ₀	H ≤ 12	H ≤ 8T	None required
Pins per Section AS105.4.2	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ≤ 10	H ≤ 7T	None required
Reinforced ^d clay plaster	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ≤ 10	H ≤ 8T ^{0.5} (H ≤ 140T ^{0.5})	≤ 6 inches
Reinforced ^d clay plaster	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	10 < H ≤ 12	H ≤ 8T ^{0.5} (H ≤ 140T ^{0.5})	≤ 4 inches ^e
Reinforced ^d cement, cement-lime, lime or soil-cement plaster	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ≤ 10	H ≤ 9T ^{0.5} (H ≤ 157T ^{0.5})	≤ 6 inches
Reinforced ^d cement, cement-lime, lime or soil-cement plaster	≤ 155	A, B, C, D ₀ , D ₁ , D ₂	H ≤ 12	H ≤ 9T ^{0.5} (H ≤ 157T ^{0.5})	≤ 4 inches ^e
2×6 load-bearing wood studs ^f at max. 6' o.c.	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ^g ≤ 9	NA	None required
2×6 load-bearing wood studs ^f at max. 4' o.c.	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ^g ≤ 10	NA	None required
2×6 load-bearing wood studs ^f at max. 2' o.c.	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ^g ≤ 12	NA	None required
2×4 load-bearing wood studs ^f at max. 2' o.c.	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ^g ≤ 10	NA	None required
2×6 nonload-bearing wood studs ^f at max. 6' o.c.	≤ 140	A, B, C, D ₀ , D ₁ , D ₂	H ^g ≤ 12	NA	None required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

NA = Not Applicable.

- a. Finishes applied to both sides of stacked bales. Where different finishes are used on opposite sides of a wall, the more restrictive requirements shall apply.
- b. H = Stacked bale height in feet (mm) between sill plate and top plate or other approved horizontal restraint, or the horizontal distance in feet (mm) between approved vertical restraints. For load-bearing walls, H refers to vertical height only.
- c. T = Bale thickness in feet (mm).
- d. Plaster reinforcement shall be any mesh allowed in Table AS106.13(1) for the matching plaster type, and with staple spacing in accordance with this table. Mesh shall be installed in accordance with Section AS106.9.
- e. Sill plate attachment shall be with 5/8-inch anchor bolts or approved equivalent at not more than 48 inches on center where staple spacing is required to be ≤ 4 inches.
- f. Bales shall be attached to the studs by an approved method. Horizontal framing and attachment at top and bottom of studs shall be in accordance with Section R602 or an approved alternative. Table R602.7(1) shall be used to determine the top framing member where load-bearing stud spacing exceeds 24 inches o.c.
- g. H is vertical height only.

course to bottom course. The bottom course shall be connected to its support and the top course shall be connected to the roof- or floor-bearing member above with pins or other approved means. Internal pins shall be continuous or shall overlap through not less than one bale course.

AS105.5 Connection of light-frame walls to strawbale walls. Light-frame walls perpendicular to, or at an angle to a strawbale wall assembly, shall be fastened to the bottom and top wood members of the strawbale wall in accordance with requirements for wood or cold-formed steel light-frame walls in this code, or the abutting stud shall be connected to alternating strawbale courses with a $\frac{1}{2}$ -inch diameter (12.7 mm) steel, $\frac{3}{4}$ -inch-diameter (19.1 mm) wood or $\frac{5}{8}$ -inch-diameter (15.9 mm) bamboo dowel, with not less than 8-inch (203 mm) penetration.

AS105.6 Moisture control. Strawbale walls shall be protected from moisture intrusion and damage in accordance with Sections AS105.6.1 through AS105.6.9.

AS105.6.1 Water-resistant barriers and vapor permeance ratings. Plastered bale walls shall be constructed without any membrane barrier between straw and plaster to facilitate transpiration of moisture from the bales, and to secure a structural bond between straw and plaster, except as permitted or required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior finish, it shall have a vapor permeance rating of not less than 5 perms, except as permitted or required elsewhere in this appendix.

AS105.6.2 Vapor retarders. Wall finishes shall have an equivalent vapor permeance rating of a Class III vapor retarder on the interior side of exterior strawbale walls in Climate Zones 5, 6, 7, 8 and Marine 4, as defined in Chapter 11. Bales in walls enclosing showers or steam rooms shall be protected on the interior side by a Class I or Class II vapor retarder.

AS105.6.3 Penetrations in exterior strawbale walls. Penetrations in exterior strawbale walls shall be sealed with an approved sealant or gasket on the exterior side of the wall in all climate zones, and on the interior side of the wall in Climate Zones 5, 6, 7, 8 and Marine 4, as defined in Chapter 11.

AS105.6.4 Horizontal surfaces. Bale walls and other bale elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent water from entering the wall system. Horizontal surfaces shall include exterior window sills, sills at exterior niches and buttresses. Horizontal surfaces shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain away from bale walls and elements. Where the water-resistant barrier is below the finish material, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8-percent slope) and shall drain to the outside surface of the bale wall's vertical finish.

AS105.6.5 Separation of bales and concrete. A sheet or liquid-applied Class II vapor retarder shall be installed

between bales and supporting concrete or masonry. The bales shall be separated from the vapor retarder by not less than $\frac{3}{4}$ inch (19.1 mm), and that space shall be filled with an insulating material such as wood or rigid insulation, or a material that allows vapor dispersion such as gravel, or other approved insulating or vapor dispersion material. Sill plates shall be installed at this interface in accordance with Section AS105.3. Where bales abut a concrete or masonry wall that retains earth, a Class II vapor retarder shall be provided between such wall and the bales.

AS105.6.6 Separation of bales and earth. Bales shall be separated from earth by not less than 8 inches (203 mm).

AS105.6.7 Separation of exterior plaster and earth. Exterior plaster applied to straw bales shall be located not less than 6 inches (102 mm) above earth or 3 inches (51 mm) above paved areas.

AS105.6.8 Separation of wood and plaster. Where wood framing or wood sheathing occurs at the exterior face of strawbale walls, such wood surfaces shall be separated from exterior plaster with two layers of Grade D paper, No. 15 asphalt felt or other approved material in accordance with Section R703.7.3, extending not less than 1 inch (25 mm) past the edges of the framing member.

Exceptions:

1. Where the wood is preservative treated or naturally durable and is not greater than $1\frac{1}{2}$ inches (38 mm) in width.
2. Clay plaster shall not be required to be separated from untreated wood that is not greater than $1\frac{1}{2}$ inches (38 mm) in width.

AS105.6.9 Separation of exterior plaster and foundation. Exterior plaster shall be separated from the building foundation with a moisture barrier.

AS105.7 Inspections. The building official shall inspect the following aspects of strawbale construction in accordance with Section R109.1:

1. Sill plate anchors, as part of and in accordance with Section R109.1.1.
2. Mesh placement and attachment, where mesh is required by this appendix.
3. Pins, where required by and in accordance with Section AS105.4.

AS105.8 Voids and stuffing. Voids between bales and between bales and framing members shall not exceed 4 inches (102 mm) in width, and such voids shall be tightly stuffed with flakes, loose straw or straw-clay before application of finish.

SECTION AS106 STRAWBALE WALLS—STRUCTURAL

AS106.1 General. Plastered strawbale walls shall be permitted to be used as structural walls in accordance with the prescriptive provisions of this section.

AS106.2 Building limitations and requirements for use of strawbale structural walls. Buildings using strawbale structural walls shall be subject to the following limitations and requirements:

1. Number of stories: Not more than one, except that two stories shall be allowed with an approved engineered design.
2. Building height: Not more than 25 feet (7620 mm), except that greater heights shall be allowed with an approved engineered design.
3. Wall height: In accordance with Table AS105.4, AS106.13(2) or AS106.13(3) as applicable, whichever is most restrictive.
4. Braced wall panel lengths: The greater of the values determined in accordance with Tables AS106.13(2) and AS106.13(3) for buildings using strawbale braced wall panels, or in accordance with Item 4 of Section AS105.2 for buildings with load-bearing strawbale walls that do not use strawbale braced wall panels.

AS106.3 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301. Strawbale wall dead loads shall not exceed 60 psf (2872 N/m²) per face area of wall.

AS106.4 Foundations. Foundations for plastered strawbale walls shall be in accordance with Chapter 4, Figure AS105.1(1), Figure AS105.1(2) or an approved engineered design.

AS106.5 Orientation and configuration of bales. Bales in strawbale structural walls shall be laid flat or on-edge and in a running bond or stack bond, except that bales in structural walls with unreinforced plasters shall be laid in a running bond only.

AS106.6 Plaster on structural walls. Plaster on load-bearing walls shall be in accordance with Table AS106.12. Plaster on shear walls shall be in accordance with Table AS106.13(1).

AS106.6.1 Compressive strength. For plaster on strawbale structural walls, the building official is authorized to require a 2-inch (51mm) cube test conforming to ASTM C109 to demonstrate a minimum compressive strength in accordance with Table AS106.6.1.

**TABLE AS106.6.1
MINIMUM COMPRESSIVE STRENGTH
FOR PLASTERS ON STRUCTURAL WALLS**

PLASTER TYPE	MINIMUM COMPRESSIVE STRENGTH (psi)
Clay	100
Soil-cement	1,000
Lime	600
Cement-lime	1,000
Cement	1,400

For SI: 1 pound per square inch = 6894.76 N/m².

AS106.7 Straightness of plaster. Plaster on strawbale structural walls shall be straight, as a function of the bale wall surfaces they are applied to, in accordance with all of the following:

1. As measured across the face of a bale, straw bulges shall not protrude more than ³/₄ inch (19.1 mm) across 2 feet (610 mm) of its height or length.
2. As measured across the face of a bale wall, straw bulges shall not protrude from the vertical plane of a bale wall more than 2 inches (51 mm) over 8 feet (2438 mm).
3. The vertical faces of adjacent bales shall not be offset more than ³/₈ inch (9.5 mm).

AS106.8 Plaster and membranes on structural walls. Strawbale structural walls shall not have a membrane between straw and plaster, or shall have attachment through the bale wall from one plaster skin to the other in accordance with an approved engineered design.

AS106.9 Mesh. Mesh in plasters on strawbale structural walls, and where required by Table AS105.4, and where used to resist wind uplift in accordance with Section AS106.14, shall be installed in accordance with Sections AS106.9.1 through AS106.9.4.

AS106.9.1 Mesh laps. Mesh required by Table AS105.4 or AS106.12 shall be installed with not less than 4-inch (102 mm) laps. Mesh required by Table AS106.13(1) or in walls designed to resist wind uplift of more than 100 plf (1459 N/m) in accordance with Section AS106.14, shall run continuous vertically from sill plate to the top plate or roof-bearing element, or shall lap not less than 8 inches (203 mm). Horizontal laps in such mesh shall be not less than 4 inches (102 mm).

AS106.9.2 Mesh attachment. Mesh shall be attached with staples to top plates or roof-bearing elements and to sill plates in accordance with all of the following:

1. **Staples.** Staples shall be pneumatically driven, stainless steel or electro-galvanized, 16 gage with 1¹/₂-inch (38 mm) legs, ⁷/₁₆-inch (11.1 mm) crown; or manually driven, galvanized, 15 gage with 1-inch (25 mm) legs. Other staples shall be as designed by a registered design professional. Staples into preservative-treated wood shall be stainless steel.
2. **Staple orientation.** Staples shall be firmly driven diagonally across mesh intersections at the required spacing.
3. **Staple spacing.** Staples shall be spaced not more than 4 inches (102 mm) on center, except where a lesser spacing is required by Table AS106.13(1) or Section AS106.14, as applicable.

AS106.9.3 Steel mesh. Steel mesh shall be galvanized, and shall be separated from preservative-treated wood by Grade D paper, No. 15 roofing felt or other approved barrier.

AS106.9.4 Mesh in plaster. Required mesh shall be embedded in the plaster except where staples fasten the mesh to horizontal boundary elements.

AS106.10 Support of plaster skins. Plaster skins on strawbale structural walls shall be continuously supported along their bottom edge. Acceptable supports include: a concrete or masonry stem wall, a concrete slab-on-grade, a wood-framed floor in accordance with Figure AS105.1(2) and an approved engineered design or a steel angle anchored with an approved engineered design. A weep screed as described in Section R703.7.2.1 is not an acceptable support.

AS106.11 Transfer of loads to and from plaster skins. Where plastered strawbale walls are used to support superimposed vertical loads, such loads shall be transferred to the plaster skins by continuous direct bearing in accordance with Figure AS105.1(3) or by an approved engineered design. Where plastered strawbale walls are used to resist in-plane lateral loads, such loads shall be transferred to the reinforcing mesh from the structural member or assembly above in accordance with Figure AS105.1(3) or AS105.1(4) and to the sill plate in accordance with Figure AS105.1(1) or AS105.1(2) and with Table AS106.13(1).

AS106.12 Load-bearing walls. Bearing capacities for plastered strawbale walls used as load-bearing walls in one-story buildings to support vertical loads imposed in accordance with Section R301 shall be in accordance with Table AS106.12.

AS106.12.1 Precompression of load-bearing strawbale walls. Prior to application of plaster, walls designed to be load-bearing shall be precompressed by a uniform load of not less than 100 plf (1459 N/m).

AS106.12.2 Concentrated loads. Concentrated loads shall be distributed by structural elements capable of distributing the loads to the bearing wall within the allowable bearing capacity listed in Table AS106.12 for the plaster type used.

AS106.12.3 Roof-bearing assembly. Roof-bearing assemblies shall be of nominal 2-inch by 6-inch (51 mm by 152 mm) lumber with ¹⁵/₃₂-inch (12 mm) plywood or OSB panels fastened with 8d nails at 6 inches (152 mm) on center in accordance with Figure AS105.1(3) and Items 1 through 6, or be of an approved engineered design.

1. Assembly shall be a box assembly on the top course of bales, with the panels horizontal.

2. Assembly shall be the width of the strawbale wall and shall comply with Section AS106.11.
3. Discontinuous lumber shall be spliced with a metal strap with not less than a 500-pound (2224 N) allowable wind or seismic load tension capacity. Where the wall line includes a braced wall panel the strap shall have not less than a 2,000-pound (8896 N) capacity.
4. Panel joints shall be blocked.
5. Roof and ceiling framing shall be attached to the roof-bearing assembly in accordance with Table R602.3(1), Items 2 and 6.
6. Where the roof-bearing assembly spans wall openings, it shall comply with Section AS106.12.3.1

AS106.12.3.1 Roof-bearing assembly spanning openings. Roof-bearing assemblies that span openings in strawbale walls shall comply with the following at each opening:

1. Lumber on each side of the assembly shall be of the dimensions and quantity required to span each opening in accordance with Table R602.7(1).
2. The required lumber in the assembly shall be supported at each side of the opening by the number of jack studs required by Table R602.7(1), or shall extend beyond the opening on both sides a distance, D, using the following equation:

$$D = S \times R/2 / (1-R) \tag{Equation AS-1}$$

where:

D = Minimum distance (in feet) for required spanning lumber to extend beyond the opening

S = Span in feet

R = B_L/B_C

B_L = Design load on the wall (in pounds per lineal foot) in accordance with Sections R301.4 and R301.6

B_C = Allowable bearing capacity of the wall in accordance with Table AS106.12

TABLE AS106.12
ALLOWABLE SUPERIMPOSED VERTICAL LOADS (LBS/FOOT) FOR PLASTERED LOAD-BEARING STRAWBALE WALLS

WALL DESIGNATION	PLASTER ^a (both sides) Minimum thickness in inches each side	MESH ^b	STAPLES ^c	ALLOWABLE BEARING CAPACITY ^d (plf)
A	Clay 1½	None required	None required	400
B	Soil-cement 1	Required	Required	800
C	Lime ^e 7/8	Required	Required	500
D	Cement-lime 7/8	Required	Required	800
E	Cement 7/8	Required	Required	800

For SI: 1 inch = 25.4 mm, 1 pound per foot = 14.5939 N/m.

a. Plasters shall conform to Sections AS104.4.3 through AS104.4.9, AS106.7 and AS106.10.

b. Any metal mesh allowed by this appendix and installed in accordance with Section AS106.9.

c. In accordance with Section AS106.9.2, except as required to transfer roof loads to the plaster skins in accordance with Section AS106.11.

d. For walls with a different plaster on each side, the lower value shall be used. For walls with plaster on only one side, half of the tabular value shall be used.

e. Shall use hydraulic or natural hydraulic lime.

AS106.13 Braced wall panels. Plastered strawbale walls used as braced wall panels for one-story buildings shall be in accordance with Section R602.10 and Tables AS106.13(1), AS106.13(2) and AS106.13(3). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An approved engineered design in accordance with Section R301.2.1 shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2(2) and Section R301.2.1.1, respectively.

AS106.13.1 Bale wall thickness. The thickness of strawbale braced wall panels without their plaster shall be not less than 15 inches (381 mm).

AS106.13.2 Sill plates. Sill plates shall be in accordance with Table AS106.13(1).

AS106.13.3 Sill plate fasteners. Sill plates shall be fastened with not less than $\frac{5}{8}$ -inch-diameter (15.9 mm) steel anchor bolts with 3-inch by 3-inch by $\frac{3}{16}$ -inch (76.2 mm by 76.2 mm by 4.8 mm) steel washers, with not less than 7-inch (177.8 mm) embedment in a concrete or masonry foundation, or shall be an approved equivalent, with the spacing shown in Table AS106.13(1). Anchor

bolts or other fasteners into framed floors shall be of an approved engineered design.

AS106.14 Resistance to wind uplift forces. Plaster mesh in skins of strawbale walls that resist uplift forces from the roof assembly, as determined in accordance with Section R802.11, shall be in accordance with all of the following:

1. Plaster shall be any type and thickness allowed in Section AS104.
2. Mesh shall be any type allowed in Table AS106.13(1), and shall be attached to top plates or roof-bearing elements and to sill plates in accordance with Section AS106.9.2.
3. Sill plates shall be not less than nominal 2-inch by 4-inch (51 mm by 102 mm) with anchoring complying with Section R403.1.6.
4. Mesh attached with staples at 4 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 100 plf (1459 N/m) for each plaster skin.
5. Mesh attached with staples at 2 inches (51 mm) on center shall be considered to be capable of resisting uplift forces of 200 plf (2918 N/m) for each plaster skin.

TABLE AS106.13(1)
PLASTERED STRAWBALE BRACED WALL PANEL TYPES

WALL DESIGNATION	PLASTER ^a (both sides)		SILL PLATES ^b (nominal size in inches)	ANCHOR BOLT ^c SPACING (inches on center)	MESH ^d (inches)	STAPLE SPACING ^e (inches on center)
	Type	Thickness (minimum in inches each side)				
A1	Clay	1.5	2 × 4	32	None	None
A2	Clay	1.5	2 × 4	32	2 × 2 high-density polypropylene	2
A3	Clay	1.5	2 × 4	32	2 × 2 × 14 gage	4
B	Soil-cement	1	4 × 4	24	2 × 2 × 14 gage	2
C1	Lime ^f	$\frac{7}{8}$	2 × 4	32	17-gage woven wire	3
C2	Lime ^f	$\frac{7}{8}$	4 × 4	24	2 × 2 × 14 gage	2
D1	Cement-lime	$\frac{7}{8}$	4 × 4	32	17-gage woven wire	2
D2	Cement-lime	$\frac{7}{8}$	4 × 4	24	2 × 2 × 14 gage	2
E1	Cement	$\frac{7}{8}$	4 × 4	32	2 × 2 × 14 gage	2
E2	Cement	1.5	4 × 4	24	2 × 2 × 14 gage	2

For SI: 1 inch = 25.4 mm.

- a. Plasters shall comply with Sections AS104.4.3 through AS104.4.9, AS106.7, AS106.8 and AS106.12.
- b. Sill plates shall be Douglas fir-larch or southern pine and shall be preservative treated where required by the *California Residential Code*.
- c. Anchor bolts shall be in accordance with Section AS106.13.3 at the spacing shown in this table.
- d. Installed in accordance with Section AS106.9.
- e. Staples shall be in accordance with Section AS106.9.2 at the spacing shown in this table.
- f. Shall use hydraulic or natural hydraulic lime.

**TABLE AS106.13(2)
BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS BASED ON WIND SPEED**

<ul style="list-style-type: none"> • EXPOSURE CATEGORY B^d • 25-FOOT MEAN ROOF HEIGHT • 10-FOOT EAVE-TO-RIDGE HEIGHT^d • 10-FOOT WALL HEIGHT^d • 2 BRACED WALL LINES^d 		MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d}			
Ultimate design windspeed (mph)	Story location	Braced wall line spacing (feet)	Strawbale braced wall panel ^e A2, A3	Strawbale braced wall panel ^e C1, C2, D1	Strawbale braced wall panel ^e B, D2, E1, E2
≤ 110	One-story building	10	6.4	3.8	3.0
		20	8.5	5.1	4.0
		30	10.2	6.1	4.8
		40	13.3	6.9	5.5
		50	16.3	7.7	6.1
		60	19.4	8.3	6.6
≤ 115	One-story building	10	6.4	3.8	3.0
		20	8.5	5.1	4.0
		30	11.2	6.4	5.1
		40	14.3	7.2	5.7
		50	18.4	8.1	6.5
		60	21.4	8.8	7.0
≤ 120	One-story building	10	7.1	4.3	3.4
		20	9.0	5.4	4.3
		30	12.2	6.6	5.3
		40	16.3	7.7	6.1
		50	19.4	8.3	6.6
		60	23.5	9.2	7.3
≤ 130	One-story building	10	7.1	4.3	3.4
		20	10.2	6.1	4.8
		30	14.3	7.2	5.7
		40	18.4	8.1	6.5
		50	22.4	9.0	7.1
		60	26.5	9.8	7.8
≤ 140	One-story building	10	7.8	4.7	3.7
		20	11.2	6.4	5.1
		30	16.3	7.7	6.1
		40	21.4	8.8	7.0
		50	26.5	9.8	7.8
		60	30.6	11.0	8.3

For SI: 1 foot = 305 mm, 1 mile per hour = 0.447 m/s.

- a. Linear interpolation shall be permitted.
- b. All braced wall panels shall be without openings and shall have an aspect ratio (H:L) ≤ 2:1.
- c. Tabulated minimum total lengths are for braced wall lines using single-braced wall panels with an aspect ratio (H:L) ≤ 2:1, or using multiple braced wall panels with aspect ratios (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an aspect ratio (H:L) > 1:1, the minimum total length shall be multiplied by the largest aspect ratio (H:L) of braced wall panels in that line.
- d. Subject to applicable wind adjustment factors associated with “All methods” in Table AS106.13(2)
- e. Strawbale braced panel types indicated shall comply with Sections AS106.13.1 through AS106.13.3 and with Table AS106.13(1).

TABLE AS106.13(3)
BRACING REQUIREMENTS FOR STRAWBALE BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY

• SOIL CLASS D ^f • WALL HEIGHT = 10 FEET ^d • 15 PSF ROOF-CEILING DEAD LOAD ^d • BRACED WALL LINE SPACING ≤ 25 FEET ^d			MINIMUM TOTAL LENGTH (FEET) OF STRAWBALE BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d}	
Seismic Design Category	Story location	Braced wall line length (feet)	Strawbale braced wall panel ^e A2, A3 ^g , C1, C2, D1	Strawbale braced wall panel ^e B, D2, E1, E2
C	One-story building	10	5.7	4.6
		20	8.0	6.5
		30	9.8	7.9
		40	12.9	9.1
		50	16.1	10.4
D ₀	One-story building	10	6.0	4.8
		20	8.5	6.8
		30	10.9	8.4
		40	14.5	9.7
		50	18.1	11.7
D ₁	One-story building	10	6.3	5.1
		20	9.0	7.2
		30	12.1	8.8
		40	16.1	10.4
		50	20.1	13.0
D ₂	One-story building	10	7.1	5.7
		20	10.1	8.1
		30	15.1	9.9
		40	20.1	13.0
		50	25.1	16.3

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square foot = 0.0479 kPa.

- Linear interpolation shall be permitted.
- Braced wall panels shall be without openings and shall have an aspect ratio (H:L) ≤ 2:1.
- Tabulated minimum total lengths are for braced wall lines using single braced wall panels with an aspect ratio (H:L) ≤ 2:1, or using multiple braced wall panels with aspect ratios (H:L) ≤ 1:1. For braced wall lines using two or more braced wall panels with an aspect ratio (H:L) > 1:1, the minimum total length shall be multiplied by the largest aspect ratio (H:L) of braced wall panels in that line.
- Subject to applicable seismic adjustment factors associated with “All methods” in Table R602.10.3(4), except “Wall dead load.”
- Strawbale braced wall panel types indicated shall comply with Sections AS106.13.1 through AS106.13.3 and Table AS106.13(1).
- Wall bracing lengths are based on a soil site class “D.” Interpolation of bracing lengths between S_{ds} values associated with the seismic design categories is allowable where a site-specific S_{ds} value is determined in accordance with Section 1613.3 of the *California Building Code*.
- Where using wall Type A3, the minimum total length of braced wall panels in this column shall be multiplied by 1.25.

AS106.15 Post-and-beam with strawbale infill. Post-and-beam with strawbale infill systems shall be in accordance with Figure AS105.1(4) and Items 1 through 7, or be of an approved engineered design.

- Beams shall be of the dimensions and number of members in accordance with Table R602.7(1), where the space between posts equals the span in the table.
- Beam ends shall bear over posts not less than 1½ inches (38 mm) or be supported by a framing anchor in accordance with Table R602.7(1).
- Discontinuous beam ends shall be spliced with a metal strap with not less than 1,000-pound (454 kg) wind or seismic load tension capacity. Where the wall line

includes a braced wall panel, the strap shall have not less than a 4,000-pound (1814 kg) capacity.

- Each post shall equal $NJ + 1$ in accordance with Table R602.7(1), where the space between posts equals the span in the table.
- Posts shall be connected to the beam by an approved means.
- Roof and ceiling framing shall be attached to the beam in accordance with Table R602.3(1), Items 2 and 6.
- Posts shall be supported by the sill plate of the bale wall in accordance with Section AS105.3 or AS106.13.2, with fastening in accordance with Table R602.3(1), Item 16, or shall be supported and fastened at their base by an approved means.

**SECTION AS107
FIRE RESISTANCE**

AS107.1 Fire-resistance rating. Strawbale walls shall not be considered to exhibit a fire-resistance rating, except for walls constructed in accordance with Section AS107.1.1 or AS107.1.2. Alternately, fire-resistance ratings of strawbale walls shall be determined in accordance with Section R302.

AS107.1.1 One-hour-rated clay-plastered wall. One-hour fire-resistance-rated nonload-bearing clay plastered strawbale walls shall comply with all of the following:

1. Bales shall be laid flat or on-edge in a running bond.
2. Bales shall maintain thickness of not less than 18 inches (457 mm).
3. Bales shall have a minimum dry density of 7.25 pounds per cubic foot (116 kg/m³).
4. Gaps shall be stuffed with straw-clay.
5. Clay plaster on each side of the wall shall be not less than 1 inch (25 mm) thick and shall be composed of a mixture of 3 parts clay, 2 parts chopped straw and 6 parts sand, or an alternative approved clay plaster.
6. Plaster application shall be in accordance with Section AS104.4.3.3 for the number and thickness of coats.

AS107.1.2 Two-hour-rated cement-plastered wall. Two-hour fire-resistance-rated nonload-bearing cement-plastered strawbale walls shall comply with all of the following:

1. Bales shall be laid flat or on-edge in a running bond.
2. Bales shall maintain a thickness of not less than 14 inches (356 mm).
3. Bales shall have a minimum dry density of 7.25 pounds per cubic foot (116 kg/m³).
4. Gaps shall be stuffed with *straw-clay*.
5. A single section of 1/2-inch (38 mm) by 17-gage galvanized woven wire mesh shall be attached to wood members with 1 1/2-inch (38 mm) staples at 6 inches (152 mm) on center. 9 gage U-pins with not less than 8-inch (203 mm) legs shall be installed at 18 inches (457 mm) on center to fasten the mesh to the bales.
6. Cement plaster on each side of the wall shall be not less than 1 inch (25 mm) thick.
7. Plaster application shall be in accordance with Section AS104.4.9 for the number and thickness of coats.

AS107.2 Openings in rated walls. Openings and penetrations in bale walls required to have a fire-resistance rating shall satisfy the same requirements for openings and penetrations as prescribed in this code.

AS107.3 Clearance to fireplaces and chimneys. Strawbale surfaces adjacent to fireplaces or chimneys shall be finished with not less than 3/8-inch-thick (10 mm) plaster of any type permitted by this appendix. Clearance from the face of such plaster to fireplaces and chimneys shall be maintained as required from fireplaces and chimneys to combustibles in

Chapter 10, or as required by manufacturer’s instructions, whichever is more restrictive.

**SECTION AS108
THERMAL INSULATION**

AS108.1 R-value. The unit *R*-value of a strawbale wall with bales laid flat is R-1.55 for each inch of bale thickness. The unit *R*-value of a strawbale wall with bales on-edge is R-1.85 for each inch of bale thickness.

AS108.2 Compliance with Section R302.10.1. Straw bales meet the requirements for insulation materials in Section R302.10.1 for flame spread index and smoke-developed index as tested in accordance with ASTM E84.

**SECTION AS109
REFERENCED STANDARDS**

AS109.1 General. See Table AS109.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.

**TABLE AS109.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM C5—10	Standard Specification for Quicklime for Structural Purposes	AS104.4.6.1
ASTM C109/C109M—2015e1	<i>Standard Test Method for Compressive Strength of Hydraulic Cement Mortars</i>	AS106.6.1
ASTM C141/C141M—14	<i>Standard Specification for Hydrated Hydraulic Lime for Structural Purposes</i>	AS104.4.6.1
ASTM C206—14	<i>Standard Specification for Finishing Hydrated Lime</i>	AS104.4.6.1
ASTM C926—15B	<i>Standard Specification for Application of Portland Cement Based Plaster</i>	AS104.4.8, AS104.4.9
ASTM C1707—11	<i>Standard Specification for Pozzolanitic Hydraulic Lime for Structural Purposes</i>	AS104.4.6.1
ASTM E2392/ASTM E2392M—10	<i>Standard Guide for Design of Earthen Wall Building Systems</i>	AS104.4.3.2
CEN EN 459—2015	<i>Part 1: Building Lime. Definitions, Specifications and Conformity Criteria; Part 2: Test Methods</i>	AS104.4.6.1

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
APPENDIX AT – SOLAR-READY PROVISIONS—DETACHED ONE- AND
TWO-FAMILY DWELLINGS AND TOWNHOUSES**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AT [RE]

**SOLAR-READY PROVISIONS—DETACHED ONE- AND
TWO-FAMILY DWELLINGS AND TOWNHOUSES**

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

***About this appendix:** Harnessing the heat or radiation from the sun’s rays is a method to reduce the energy consumption of a building. Although Appendix AT does not require solar systems to be installed for a building, it does require the space(s) for installing such systems, providing pathways for connections and requiring adequate structural capacity of roof systems to support solar systems.*

Section numbers in parenthesis are those in Appendix RB of the residential provisions of the International Energy Conservation Code®.

**SECTION AT101 (RB101)
SCOPE**

AT101.1 (RB101.1) General. These provisions shall be applicable for new construction where solar-ready provisions are required.

**SECTION AT102 (RB102)
GENERAL DEFINITION**

AT102.1 (RB102.1) General. The following term shall, for the purpose of this appendix, have the meaning shown herein.

SOLAR-READY ZONE. A section or sections of the roof or building overhang designated and reserved for the future installation of a solar photovoltaic or solar thermal system.

**SECTION AT103 (RB103)
SOLAR-READY ZONE**

AT103.1 (RB103.2) General. New detached one- and two-family dwellings, and townhouses with not less than 600

square feet (55.74 m²) of roof area oriented between 110 degrees and 270 degrees of true north, shall comply with Sections AT103.2 through AT103.10.

Exceptions:

1. New residential buildings with a permanently installed on-site renewable energy system.
2. A building where all areas of the roof that would otherwise meet the requirements of Section AT103 are in full or partial shade for more than 70 percent of daylight hours annually.

AT103.2 (RB103.2) Construction document requirements for solar-ready zone. Construction documents shall indicate the solar-ready zone.

AT103.3 (RB103.3) Solar-ready zone area. The total solar-ready zone area shall be not less than 300 square feet (27.87 m²) exclusive of mandatory access or setback areas as required by the *California Fire Code*. New townhouses three stories or less in height above grade plane and with a total floor area less than or equal to 2,000 square feet (185.8 m²) per dwelling shall have a solar-ready zone area of not less

than 150 square feet (13.94 m²). The solar-ready zone shall be composed of areas not less than 5 feet (1524 mm) in width and not less than 80 square feet (7.44 m²) exclusive of access or set-back areas as required by the *California Fire Code*.

AT103.4 (RB103.4) Obstructions. Solar-ready zones shall be free from obstructions, including but not limited to vents, chimneys, and roof-mounted equipment.

AT103.5 (RB103.5) Shading. The solar-ready zone shall be set back from any existing or new, permanently affixed object on the building or site that is located south, east or west of the solar zone a distance not less than two times the object's height above the nearest point on the roof surface. Such objects include, but are not limited to, taller portions of the building itself, parapets, chimneys, antennas, signage, rooftop equipment, trees and roof plantings.

AT103.6 (RB103.6) Capped roof penetration sleeve. A capped roof penetration sleeve shall be provided adjacent to a solar-ready zone located on a roof slope of not greater than 1 unit vertical in 12 units horizontal (8-percent slope). The capped roof penetration sleeve shall be sized to accommodate the future photovoltaic system conduit, but shall have an inside diameter of not less than 1¹/₄ inches (32 mm).

AT103.7 (RB103.7) Roof load documentation. The structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

AT103.8 (RB103.8) Interconnection pathway. Construction documents shall indicate pathways for routing of conduit or plumbing from the solar-ready zone to the electrical service panel or service hot water system.

AT103.9 (RB103.9) Electrical service reserved space. The main electrical service panel shall have a reserved space to allow installation of a dual pole circuit breaker for future solar electric installation and shall be labeled "For Future Solar Electric." The reserved space shall be positioned at the opposite (load) end from the input feeder location or main circuit location.

AT103.10 (RB103.10) Construction documentation certificate. A permanent certificate, indicating the solar-ready zone and other requirements of this section, shall be posted near the electrical distribution panel, water heater or other conspicuous location by the builder or registered design professional.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AU – COB CONSTRUCTION (MONOLITHIC ADOBE)

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AU

COB CONSTRUCTION (MONOLITHIC ADOBE)

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User note:

About this appendix: Cob construction has been used for thousands of years around the world, notably in England and Northern Europe, the Middle East, West Africa, China and the Southwestern United States. An estimated 20,000 cob homes are still inhabited in the English county of Devon alone, some dating from the 15th century. The term “cob” derives from an Old English word for “lump,” since historical structures were often constructed one handful at a time.

SECTION AU101 GENERAL

AU101.1 Scope. This appendix provides prescriptive and performance-based requirements for the use of natural cob as a building material. Buildings using cob walls shall comply with this code except as otherwise stated in this appendix.

AU101.2 Intent. In addition to the intent described in Section R101.3, the purpose of this appendix is to establish minimum requirements for cob structures that provide flexibility in the application of certain provisions of the code, to permit the use of site-sourced and local materials, and to permit combinations of historical and modern techniques.

AU101.3 Tests and empirical evidence. Tests for an alternative material, design or method of construction shall be in accordance with Section R104.11.1, and the building official shall have the authority to consider evidence of a history of successful use in lieu of testing.

AU101.4 Cob wall systems. Cob wall systems include those shown in Figure AU101.4 and approved variations.

AU101.5 Definitions. The words and terms in Section AU102 shall, for the purposes of this appendix, have the

meanings shown herein. Refer to Chapter 2 for general definitions.

SECTION AU102 DEFINITIONS

BRACED WALL PANEL. A cob wall designed and constructed to resist in-plane shear loads through the interaction of the cob material, its reinforcing and its connections to its bond beam and foundation. The panel’s length meets the requirements for the particular wall type and contributes toward the total amount of bracing required along its braced wall line in accordance with Sections AU106.11 and R602.10.1.

BUTTRESS. A mass set at an angle to or bonded to a wall that it strengthens or supports.

CLAY. Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) and having the characteristics of high to very high dry strength and medium to high plasticity, used as the binder of other component materials in a mix of cob or of clay plaster.

APPENDIX AU—COB CONSTRUCTION (MONOLITHIC ADOBE)

CLAY SUBSOIL. Subsoil sourced directly from the earth, containing clay, sand and silt, and containing not more than trace amounts of organic matter.

COB. A composite building material consisting of refined clay or clay subsoil wet-mixed with loose straw and sometimes sand. Also known as “Monolithic adobe.”

COB CONSTRUCTION. A wall system of layers or lifts of moist cob placed to create monolithic walls, typically without formwork.

DRY JOINT. The boundary between a layer of moist cob and a previously laid and significantly drier, nonmalleable layer of cob that requires wetting to achieve bonding between the layers.

FINISH. Completed combination of materials on the face of a cob wall.

LIFT. A layer of installed cob.

LOAD-BEARING WALL. A cob wall that supports more than 100 pounds per linear foot (1459 N/m) of vertical load in addition to its own weight.

MONOLITHIC ADOBE. See “Cob.”

NATURAL COB. Cob not containing admixtures such as Portland cement, lime, asphalt emulsion or oil. Synonymous with “Unstabilized cob.”

NONSTRUCTURAL WALL. Walls other than load-bearing walls or shear walls.

PLASTER. Clay, soil-cement, gypsum, lime, clay-lime, cement-lime or cement plaster as described in Section AU104.

SHEAR WALL. A cob wall designed and constructed to resist in-plane lateral seismic and wind forces in accordance with Section AU106.11. Synonymous with “Braced wall panel.”

STABILIZED. Cob or other earthen material containing admixtures, such as Portland cement, lime, asphalt emulsion or oil, that are intended to help limit water absorption, stabilize volume, increase strength and increase durability.

STRAW. The dry stems of cereal grains after the seed heads have been removed.

STRUCTURAL WALL. A wall that meets the definition for a “Load-bearing wall” or “Shear wall.”

UNSTABILIZED. A cob or other earthen material that does not contain admixtures such as Portland cement, lime, asphalt emulsion or oil.

UNSTABILIZED COB. See “Natural cob.”

SECTION AU103 MATERIALS, MIXING AND INSTALLATION

AU103.1 Clay subsoil. Clay subsoil for a cob mix shall be acceptable if the mix it produces meets the requirements of Section AU103.4.

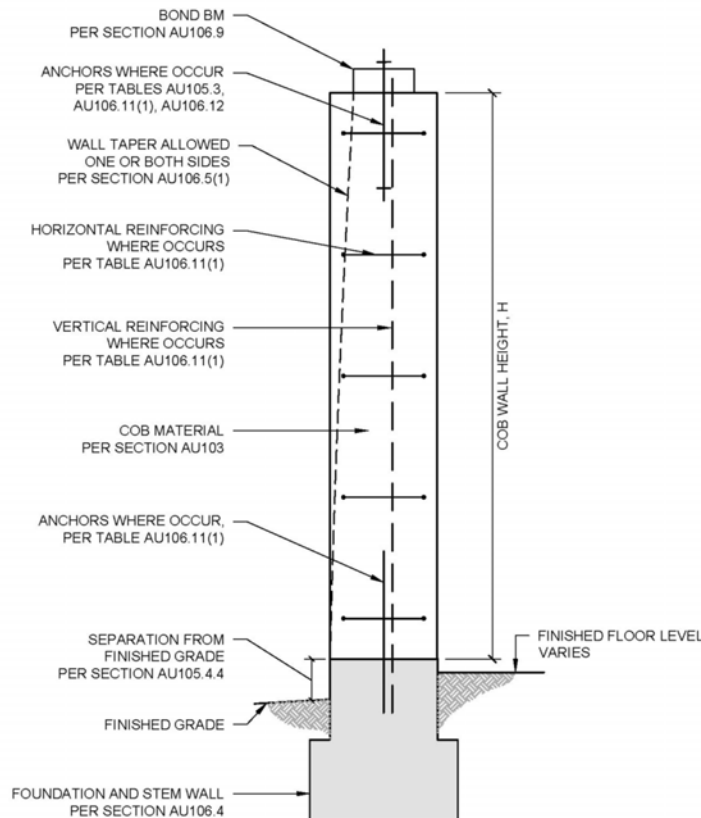


FIGURE AU101.4
TYPICAL COB WALL

AU103.2 Sand. Sand or other aggregates such as, but not limited to, gravel, pumice and lava rock, when added to cob mixes, shall yield a mix that meets the requirements of Section AU103.4.

AU103.3 Straw. Straw for cob mixes shall be from wheat, rice, rye, barley or oat, or similar reinforcing fibers with similar performance. Before mixing, the straw or other reinforcing fibers shall be dry to the touch and free of visible decay.

AU103.4 Mix proportions. Cob mixes shall be of any proportions of refined clay or clay subsoil, added sand (if any) and straw that produce a dried mix that passes the shrinkage test in accordance with Section AU103.4.1, complies with the compressive strength requirements of Section AU106.6 and complies with the modulus of rupture requirements of Section AU106.7.

AU103.4.1 Shrinkage test for cob mixes. Each proposed *cob* mix of different mix proportions shall be placed moist to completely fill a 24-inch by 3 $\frac{1}{2}$ -inch by 3 $\frac{1}{2}$ -inch (610 mm by 89 mm by 89 mm) wooden form on a plastic or paper slip sheet and dried to ambient moisture conditions, or oven dried. The total shrinkage of the length shall not exceed 1 inch (25 mm), as measured from the dried edges of the material to the insides of the form. Cracks in the sample greater than $\frac{1}{16}$ inch (1.5 mm) shall first be closed manually. The shrinkage test shall be shown to the building official for approval before placement of the *cob* mix onto walls

AU103.5 Mixing. The clay subsoil, sand and straw for cob shall be thoroughly mixed by manual or mechanical means with water sufficient to produce a mix of a plastic consistency capable of bonding of successively placed layers or lifts.

AU103.6 Installation. Cob shall be installed on the wall in lifts of a height that supports itself with minimal slumping.

AU103.7 Dry joints. Each layer of cob shall be prevented from drying until the next layer is installed, to ensure bonding of successive layers. The top of each layer shall be kept moist and malleable with one or more of the following methods:

1. Covering with a material that prevents loss of or holds moisture.
2. Covering with a material that shades it from direct sun.
3. Wetting.

Where dry joints are unavoidable, the previous layer shall be wetted prior to application of the next layer.

AU103.8 Drying holes. Where holes to facilitate drying are used, such holes shall be of any depth and not exceeding $\frac{3}{4}$ inch (19 mm) in diameter on the face of cob walls. Drying holes shall not be spaced closer than 10 hole-diameters. Drying holes shall not be placed in braced wall panels. The design load on load-bearing walls with drying holes shall not exceed 90 percent of the allowable bearing capacity as determined in accordance with Section AU106.8. Drying holes shall be filled with cob before final inspection.

AU103.9 Adding roof loads to walls. Roof and ceiling loads shall not be added until walls are sufficiently dry to support them without compressing.

SECTION AU104 FINISHES

AU104.1 General. Cob walls shall not require a finish, except as required by Section AU104.2. Finishes applied to cob walls shall comply with this section and Chapters 3 and 7 unless stated otherwise in this section.

AU104.1.1 Interior wall finishes. Where installed, interior wall finishes and interior fire protection shall comply with the applicable provisions of Section R302, and shall be plasters in accordance with Section AU104.4 or nonplaster wall coverings in accordance with Section R702.

AU104.1.2 Exterior wall finishes. Where installed, exterior wall finishes shall be plasters in accordance with Section AU104.4, nonplaster exterior wall coverings in accordance with Section R703, or other finish systems in accordance with the following:

1. Specifications and details of the finish system's means of attachment to the wall or its independent support and means of draining or evaporating water that penetrates the exterior finish shall be provided.
2. The vapor permeance of the combination of finish materials shall be 5 perms or greater to allow the transpiration of water vapor from the wall.
3. Finish systems with weights greater than 10 pounds per square foot (48.9 kg/m) and less than or equal to 20 pounds per square foot (97.8 kg/m) of wall area shall require that the minimum total length of braced wall panels in Table AU106.11(3) be multiplied by a factor of 1.2.
4. Finish systems with weights greater than 20 pounds per square foot (97.8 kg/m) of wall area shall require an engineered design.

AU104.2 Where required. Cob walls exposed to rain due to local climate, building design and wall orientation shall be finished or clad to provide protection from excessive erosion.

AU104.3 Vapor retarders. Class I and II vapor retarders shall not be used on cob walls, except at cob walls surrounding showers or as required or addressed elsewhere in this appendix.

AU104.4 Plaster. Plaster applied to cob walls shall be any type described in this section. Plaster thickness shall not exceed 3 inches (76 mm) on each face except where an approved engineered design is provided.

AU104.4.1 Plaster and membranes. Plaster shall be applied directly to cob walls to facilitate transpiration of moisture from the walls and to secure a mechanical bond between the plaster and the cob. A membrane shall not be located between the cob wall and the plaster.

AU104.4.2 Plaster lath. The surface of cob walls shall be permitted to function as lath for plaster, with no other lath required. Metal, plastic, and natural fiber lath shall be permitted to be used to limit plaster cracking, increase the plaster bond to the wall, or to bridge dissimilar materials.

AU104.4.3 Clay plaster. Clay plaster shall comply with Sections AU104.4.3.1 and AU104.4.3.2.

AU104.4.3.1 General. Clay plaster shall be any plaster having a clay or clay subsoil binder. Such plaster shall contain sufficient clay to fully bind the sand or other aggregate and any reinforcing fibers. Reinforcing fibers shall be chopped straw, sisal, hemp, animal hair or other similar approved fibers.

AU104.4.3.2 Clay subsoil requirements. The suitability of clay subsoil shall be determined in accordance with the Figure 2 Ribbon Test and the Figure 3 Ball Test in the appendix of ASTM E2392/E2392M.

AU104.4.4 Soil-cement plaster. Soil-cement plaster shall be composed of clay subsoil, sand, not more than 7 percent Portland cement by volume and, where provided, reinforcing fibers.

AU104.4.5 Gypsum plaster. Gypsum plaster shall comply with Section R702.2.1 and shall be limited to interior use.

AU104.4.6 Lime plaster. Lime plaster is any plaster with a binder composed of calcium hydroxide including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and EN 459. Quicklime shall comply with ASTM C5.

AU104.4.7 Clay-lime plaster. Clay-lime plaster shall be composed of refined clay or clay subsoil, sand, lime and, where provided, reinforcing fibers.

AU104.4.8 Cement-lime plaster. Cement-lime plaster shall be plaster mix types CL, F or FL, as described in ASTM C926.

AU104.4.9 Cement plaster. Cement plaster shall have not less than 1 part lime to 4 parts cement and be not thicker than $1\frac{1}{2}$ inches (38 mm), to ensure minimum acceptable vapor permeability

SECTION AU105 COB WALLS—GENERAL

AU105.1 General. Cob walls shall be designed and constructed in accordance with this section and Figure AU101.4 or an approved alternative design. In addition to the general requirements for cob walls in this section, cob structural walls shall comply with Section AU106.

AU105.2 Building limitations and requirements for cob wall construction. Cob walls shall be subject to the following limitations and requirements:

1. Number of stories: not more than one.
2. Building height: not more than 20 feet (6096 mm).
3. Seismic design categories: limited to use in Seismic Design Categories A, B and C, except where an approved engineered design is provided.

4. Wall height: in accordance with Table AU105.3, and with Table AU106.11(1) for braced wall panels.
5. Wall thickness, excluding finish, shall be not less than 10 inches (254 mm), not greater than 24 inches (610 mm) at the top two-thirds, not limited at the bottom third and, for structural walls, shall comply with Section AU106.2, Item 2. Wall taper is permitted in accordance with Section AU106.5, Item 1.
6. Interior cob walls shall require an approved engineered design that accounts for the seismic load of the interior cob walls, except in Seismic Design Category A for walls with a height to thickness ratio less than or equal to 6.

AU105.3 Out-of-plane resistance methods and unrestrained wall height limits. Cob walls shall employ a method of out-of-plane load resistance in accordance with Table AU105.3, and comply with its associated height limits and requirements.

AU105.3.1 Determination of out-of-plane loading. Out-of-plane loading for the use of Table AU105.3 shall be in accordance with the ultimate design wind speed and seismic design category requirements of Sections R301.2.1 and R301.2.2, respectively. An approved engineered design shall be required where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.

AU105.3.2 Bond beams for nonstructural walls. Nonstructural cob walls shall be provided with a bond beam at the top of the wall that complies with Section AU106.9, except for requirements relating to roof and/or ceiling loads or braced wall panels.

AU105.3.3 Lintels in nonstructural walls. Door, window and other openings in nonstructural cob walls shall require a lintel in accordance with Section AU106.10, except for requirements relating to roof and/or ceiling loads or braced wall panels.

AU105.3.4 Reinforcing at wall openings. Reinforcing shall be installed at window, door, and similar wall openings and penetrations greater than 2 feet (610 mm) in width in accordance with Sections AU105.3.4.1 through AU105.3.4.3. Surface voids deeper than 25 percent of the wall thickness shall be considered an opening.

AU105.3.4.1 Opening size limit. Openings shall not exceed 6 feet (1829 mm) in width, and the height of the cob wall below openings shall not exceed 6 feet (1829 mm) above the top of the foundation.

AU105.3.4.2 Horizontal reinforcing. Two-inch by 2-inch (51 mm by 51 mm) 14-gage galvanized steel mesh shall be embedded 4 inches (102 mm) in the cob above the rough opening and below the rough opening for windows, and shall extend 12 inches (305 mm) beyond the sides of the opening. Walls below rough window openings greater than 4 feet 6 inches (1372 mm) in height shall be provided with additional horizontal reinforcing at midheight.

AU105.3.4.3 Vertical reinforcing. Full-height $\frac{5}{8}$ -inch (16 mm) threaded rod shall be installed 4 inches (102

mm) from each side of the opening, centered in the thickness of the cob wall. The threaded rods shall be embedded 7 inches (178 mm) in the foundation, and 4 inches (102 mm) in concrete bond beams or shall penetrate through wood bond beams and be secured with a nut and washer. The threaded rods shall be embedded in concrete lintels or pass through a drilled hole in wood lintels.

AU105.3.5 Minimum length of cob walls. Sections of cob walls between openings shall be not less than 2 feet, 6 inches (762 mm) in length. Wall sections less than 4 feet (1219 mm) and not less than 2 feet, 6 inches (762 mm) in length shall contain vertical reinforcing in accordance with Section AU105.3.4.3.

AU105.4 Moisture control. Cob walls shall be protected from moisture intrusion and damage in accordance with Sections AU105.4.1 through AU105.4.5.

AU105.4.1 Water-resistant barriers and vapor permeance. Cob walls shall be constructed without a membrane barrier between the cob wall and plaster to facilitate transpiration of water vapor from the wall, and to secure a mechanical bond between the cob and plaster, except as otherwise required elsewhere in this appendix. Where a water-resistant barrier is placed behind an exterior finish, it shall be considered part of the finish system and shall comply with Item 2 of Section AU104.1.2 for the combined vapor permeance rating.

AU105.4.2 Horizontal surfaces. Cob walls and other cob elements shall be provided with a water-resistant barrier at weather-exposed horizontal surfaces. The water-resistant barrier shall be of a material and installation that will prevent erosion and prevent water from entering the wall system. Horizontal surfaces, including exterior window sills, sills at exterior niches and exterior buttresses, shall be sloped not less than 1 unit vertical in 12 units horizontal to drain away from cob walls or other cob elements.

**TABLE AU105.3
OUT-OF-PLANE RESISTANCE METHODS AND UNRESTRAINED WALL HEIGHT LIMITS**

WALL TYPE ^{a, g, h} AND METHOD OF OUT-OF-PLANE LOAD RESISTANCE	FOR ULTIMATE DESIGN WIND SPEEDS (mph)	FOR SEISMIC DESIGN CATEGORIES	UNRESTRAINED COB WALL HEIGHT $H^{p, e, h}$		TOP ANCHOR ^o SPACING (inches)	TENSION TIE ^f SPACING (inches)
			Absolute Limit (feet)	Limit Based on Wall Thickness T^d (feet)		
Wall 1 ⁱ : no anchors, no steel wall reinforcing	≤ 110	A	$H \leq 8$	$H \leq 6T$	None	48
Wall 2: top anchors ^j , continuous vertical 6" × 6" × 6" gage steel mesh in center of wall embedded in foundation 12 inches	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall A ⁱ : top anchors, no vertical steel reinforcing	≤ 120	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall B ⁱ : top and bottom anchors, no vertical steel reinforcing	≤ 130	A, B	$H \leq 8$	$H \leq 6T$	12	48
Wall C: top and bottom anchors, continuous vertical threaded rod at 4 feet on center embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24
Wall D: continuous vertical threaded rod at 1 foot on center embedded in foundation and connected to bond beam	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	N/A	24
Wall E: top anchors, continuous vertical 6" × 6" × 6" gage steel mesh 2 inches from each face of wall embedded in foundation	≤ 140	A, B, C	$H \leq 8$	$H \leq 8T$	12	24

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

N/A = Not Applicable

- a. See Table AU106.11(1) for reinforcing and anchorage specifications for wall Types A, B, C, D and E.
- b. H = height of the cob portion of the wall only. See Figure AU101.4. The maximum H is the absolute limit or the limit based on wall thickness, whichever is more restrictive.
- c. Bond beams or other horizontal restraints are capable of separating a wall into more than one unrestrained wall height with an approved engineered design.
- d. T = Cob wall thickness (in feet) at its minimum, without plaster.
- e. ⁵/₈-inch threaded rod anchors at prescribed spacing with 12-inch embedment in cob, full embedment in concrete bond beams or full penetration in wood bond beam with a nut and washer.
- f. Attach rafters to bond beam with 4-inch by 3-inch by 3-inch by 18 gage tension tie angles at prescribed spacing. See Figure AU106.9.5. Where rafters are attached to tension ties, roof sheathing shall be edge nailed.
- g. All walls shall be tested for compressive strength in accordance with Section AU106.6.
- h. For curved walls with an arc length to radius ratio of 1.5:1 or greater, the H/T factor shall be increased by 1, and the absolute height limit by 1 foot.
- i. Wall type requires a modulus of rupture test in accordance with Section AU106.7.
- j. See wall Type A in Table AU106.11(1) for top anchor requirements.

AU105.4.3 Separation of cob and foundation. A liquid-applied or bituminous Class II vapor retarder shall be installed between cob and supporting concrete or masonry.

Exception: Where local climate, site conditions and foundation design limit ground moisture migration into the base of the cob wall, including but not limited to the use of a moisture barrier or capillary break between the supporting concrete or masonry and the earth.

AU105.4.4 Separation of cob and finished grade. Cob shall be not less than 8 inches (203 mm) above finished grade.

Exception: The minimum separation shall be 4 inches (102 mm) in dry climate zones as defined in Section N1101.7.2, and shall be 2 inches (51mm) on walls that are not weather exposed.

AU105.4.5 Installation of windows and doors. Windows and doors shall be installed in accordance with the manufacturer’s instructions to a wooden frame of not less than nominal 2-inch by 4-inch (51 mm by 102 mm) wood members anchored into the cob wall with 16d galvanized nails half-driven at a maximum 6-inch (152 mm) spacing, with the protruding half embedded in the cob. The wood frame shall be embedded not less than 1½ inches (38 mm) in the cob and shall be set in from each face of the wall not less than 3 inches (76 mm). Alternative window and door installation methods shall be capable of resisting the wind loads in Table R301.2.1(1). Windows and doors in cob walls shall be installed so as to mitigate the passage of air or moisture into or through the wall system. Window sills shall comply with Section AU105.4.2.

AU105.5 Inspections. In addition to ensuring compliance with Section R109.1, the building official shall inspect the following aspects of cob construction:

1. Anchors and vertical and horizontal reinforcing in cob walls, where required in accordance with Tables AU105.3 and AU106.11(1) and Sections AU105.3.4 through AU105.3.5.
2. Reinforcing in any concrete bond beams or lintels, in accordance with Section AU106.9.2 and Table AU106.10.

SECTION AU106 COB WALLS—STRUCTURAL

AU106.1 General. Cob structural walls shall be in accordance with the prescriptive provisions of this section. Designs or portions of designs not complying with this section shall require an approved engineered design.

AU106.2 Requirements for cob structural walls. In addition to the requirements of Section AU105.2, cob structural walls shall be subject to the following:

1. Wall height: shall be in accordance with Table AU105.3 for load-bearing cob walls or Table AU106.11(1) for cob braced wall panels, as applicable and most restrictive.

2. Wall thickness: shall be in accordance with Sections AU105.2, Item 5 and Section AU106.8.1 for load-bearing cob walls or Table AU106.11(1) for cob braced wall panels, as applicable and most restrictive.
3. Braced wall panel lengths: for buildings using cob braced wall panels, the greater of the values determined in accordance with Table AU106.11(2) for wind loads and Table AU106.11(3), AU106.11(4) or AU106.11(5) for seismic loads shall be used.

AU106.3 Loads and other limitations. Live and dead loads and other limitations shall be in accordance with Section R301, except that the dead load for cob walls shall be determined by Equation AU-1.

$$CW_{DL} = (H \times T_{avg} \times D) \quad \text{(Equation AU-1)}$$

CW_{DL} = Cob wall dead load (in pounds per lineal foot of wall).

H = Height of cob portion of wall (in feet).

T_{avg} = Average thickness of wall (in feet).

D = Density of cob = 110 (in pounds per cubic foot), unless a lesser value at equilibrium moisture content is demonstrated to the building official.

AU106.4 Foundations. Foundations for cob walls shall be in accordance with Chapter 4. The width of foundations for cob walls shall be not less than the width of the cob at its base, excluding finish.

AU106.5 Wall taper, straightness and surface voids for cob walls. Cob walls shall be in accordance with the following:

1. Cob structural and nonstructural walls shall be vertical or shall taper from bottom to top with the wall thickness in accordance with Section AU105.2, Item 5 and the wall height in accordance with Section AU105.2, Item 4.
2. Cob structural and nonstructural walls shall be straight or curved. Curved braced wall panels shall be in accordance with Sections AU106.11.2 and AU106.11.3.
3. Niches and other surface voids in load-bearing walls are limited to 12 inches (305 mm) in width and height and 25 percent of the wall thickness, and shall be located in the top two-thirds of the wall. Surface voids that exceed these limits shall be considered wall openings, and shall receive a lintel in accordance with Section AU106.10 and be reinforced in accordance with Section AU105.3.4. Surface voids are prohibited in braced wall panels.

AU106.6 Compressive strength of cob structural and nonstructural walls. All cob walls shall have a minimum compressive strength of 60 psi (414 kPa). Cob in walls used as braced wall panels shall have a minimum compressive strength of 85 psi (586 kPa).

AU106.6.1 Demonstration of compressive strength. The compressive strength of the cob mix to be used in structural walls and nonstructural walls as required in Section

AU106.6 shall be demonstrated to the building official before the placement of cob onto walls, with compressive strength tests and an associated report by an approved laboratory or with an approved on-site test as follows:

1. Five samples of the proposed cob mix shall be placed moist to completely fill a 4-inch by 4-inch by 4-inch (102 mm by 102 mm by 102 mm) form and dried to ambient moisture conditions.
2. Samples shall not be oven dried.
3. Any opposite faces shall be faced with plaster of paris if needed to achieve smooth, parallel faces, after which the sample shall reach ambient moisture conditions before testing.
4. The horizontal cross section of the dried sample as tested, and the maximum applied load at failure shall be used to calculate the sample's compressive strength.
5. The fourth-lowest value shall be used to determine the mix's compressive strength.

AU106.7 Modulus of rupture of cob structural walls. Cob in walls used as braced wall panels shall have a minimum modulus of rupture of 50 pounds per square inch (345 kPa).

AU106.7.1 Demonstration of modulus of rupture. The modulus of rupture of cob used in structural walls shall be demonstrated to the building official before the placement of cob onto walls, with modulus of rupture tests and an associated report by an approved laboratory or with an approved on-site test as follows:

1. Five samples of the proposed cob mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm by 152 mm by 305 mm) form and dried to indoor ambient moisture conditions.
2. Samples shall not be oven dried.
3. Each sample shall be tested with the 12-inch (305 mm) dimension horizontal.
4. The fourth-lowest value shall be used to determine if the mix meets the minimum required modulus of rupture.

AU106.8 Bearing capacity. The allowable bearing capacity for cob load-bearing walls supporting vertical roof and/or ceiling loads imposed in accordance with Section R301 shall be determined by Equation AU-2.

$$BC = 144 (C \times T_{min})/3 - (H \times T_{avg} \times D) \quad \text{(Equation AU-2)}$$

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall).

C = Compressive strength (in psi) as determined in accordance with Section AU106.6.

T_{min} = Thickness of wall (in feet) at its minimum.

H = Height of cob portion of wall (in feet).

T_{avg} = Average thickness of wall (in feet).

D = Density of cob = 110 (in pounds per cubic foot), unless a lesser value at equilibrium moisture content is demonstrated.

AU106.8.1 Support of uniform loads. Uniform roof and/or ceiling loads shall be supported by cob load-bearing walls not exceeding their allowable bearing capacity, as demonstrated in accordance with Equation AU-3.

$$BL \leq BC \quad \text{(Equation AU-3)}$$

BL = Design load on the wall (in pounds per lineal foot) determined in accordance with Sections R301.4 and R301.6.

BC = Allowable bearing capacity of wall (in pounds per lineal foot of wall) determined in accordance with Section AU106.8.

AU106.8.2 Support of concentrated loads. Concentrated roof and ceiling loads shall be distributed by structural elements capable of distributing the loads to the cob load-bearing wall and within its allowable bearing capacity as determined in accordance with Section AU106.8. Concentrated loads over lintels or over bond beams spanning openings shall require an approved engineered design.

AU106.9 Bond beams. Cob structural walls shall require a bond beam at the top of the wall in accordance with Section AU106.9.1, AU106.9.2 or AU106.9.3, and shall be anchored to the cob below in accordance with Tables AU105.3, AU106.11(1) and AU106.12 as applicable and most restrictive. Bond beams spanning openings shall be in accordance with Section AU106.9.4.

AU106.9.1 Wood bond beams. Wood bond beams shall be not less than nominal 4 inches high by 8 inches wide and shall comply with Sections AU106.9.1.1 through AU106.9.1.3.

AU106.9.1.1 Wood species and grade. Wood bond beams shall be of a species with an extreme fiber in bending (*F_b*) of not less than 850 psi (5.9 MPa), a modulus of elasticity (*E*) of not less than 1,300,000 psi (8964 MPa), and No. 2 grade or better. Composite lumber bond beams shall have an *F_b* of not less than 850 psi (5.9 MPa), and an *E* of not less than 1,300,000 psi (8964 MPa).

AU106.9.1.2 Discontinuity. Discontinuous wood bond beams shall be spliced on top with a metal strap with not less than the allowable wind or seismic load tension capacity in accordance with the following, whichever is more restrictive:

1. For seismic design categories: A, 2,500 pounds (11 kN); B, 4,500 pounds (20 kN); C, 6,000 pounds (26.7 kN).
2. For braced wall line lengths, when wind governs: 10 feet, 2,500 pounds (11 kN); 20 feet, 3,400 pounds (15.1 kN); 30 feet, 5,000 pounds (22.2 kN).

AU106.9.1.3 Corners and curved walls. Wood bond beams at corners and discontinuities atop curved walls shall be connected across their exterior faces with a metal strap with a capacity of not less than that determined in accordance with Section AU106.9.1.2.

AU106.9.2 Concrete bond beams. Concrete bond beams shall be not less than 6 inches (152 mm) high by 8 inches

(305 mm) wide. Concrete bond beams shall be reinforced with two No. 4 bars, 2 inches (51 mm) clear from the bottom and 2 inches (51 mm) clear from the sides. Lap splices shall comply with Table R608.5.4(1). Reinforcing at corners shall be in accordance with the horizontal reinforcing requirements in Section R608.6.4. The concrete shall have a compressive strength of not less than 2,500 pounds per square inch (17.2 MPa) at 28 days.

AU106.9.3 Other bond beams. Bond beams of other materials, including earthen materials, require an approved engineered design.

AU106.9.4 Bond beams spanning openings. Bond beams that support uniform roof and/or ceiling loads and span openings in cob walls shall be in accordance with Table AU106.10. Bond beams shall be continuous across the opening and not less than 1 foot (305 mm) beyond each side of the opening.

AU106.9.5 Connection of roof framing to bond beams. Roof and ceiling framing shall be attached to bond beams in accordance with Table R602.3(1), Items 2 and 6, and Figure AU106.9.5. Roof sheathing shall be attached to roof framing in accordance with Figure AU106.9.5. A minimum nominal 2-inch by 6-inch (51 mm by 152 mm) wood plate shall be installed on concrete bond beams with ⁵/₈-inch (16 mm) diameter anchor bolts with 5-inch (127 mm) embedment at 2 feet (610 mm) on center to allow the required fastening of roof and ceiling framing, including tension ties and straps.

AU106.9.6 Bond beams and connections at gable and shed roof end walls. Bond beams and connections at end

walls of buildings with gable or shed roofs shall comply with Figure AU106.9.6 and the following:

1. End walls shall not exceed 20 feet (6096 mm) in length.
2. Bond beams shall be continuous and straight for the entire wall line.
3. Wood bond beams shall comply with the following:
 - 3.1. Not less than nominal 4 inches by 8 inches (102 mm by 203 mm) where wind design governs in accordance with Table AU106.11(2) and where seismic design governs in accordance with Table AU106.11(3), AU106.11(4) or AU106.11(5) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category A or wall lengths less than or equal to 10 feet (3048 mm) in Seismic Design Categories B and C.
 - 3.2. Not less than nominal 4 inches by 10 inches (102 mm by 254 mm) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category B.
 - 3.3. Not less than nominal 6 inches by 12 inches (152 mm by 305 mm) or 4 inches by 16 inches (102 mm by 406 mm) for wall lengths less than or equal to 20 feet (6096 mm) in Seismic Design Category C.
 - 3.4. Corners shall be connected in accordance with Section AU106.9.3.

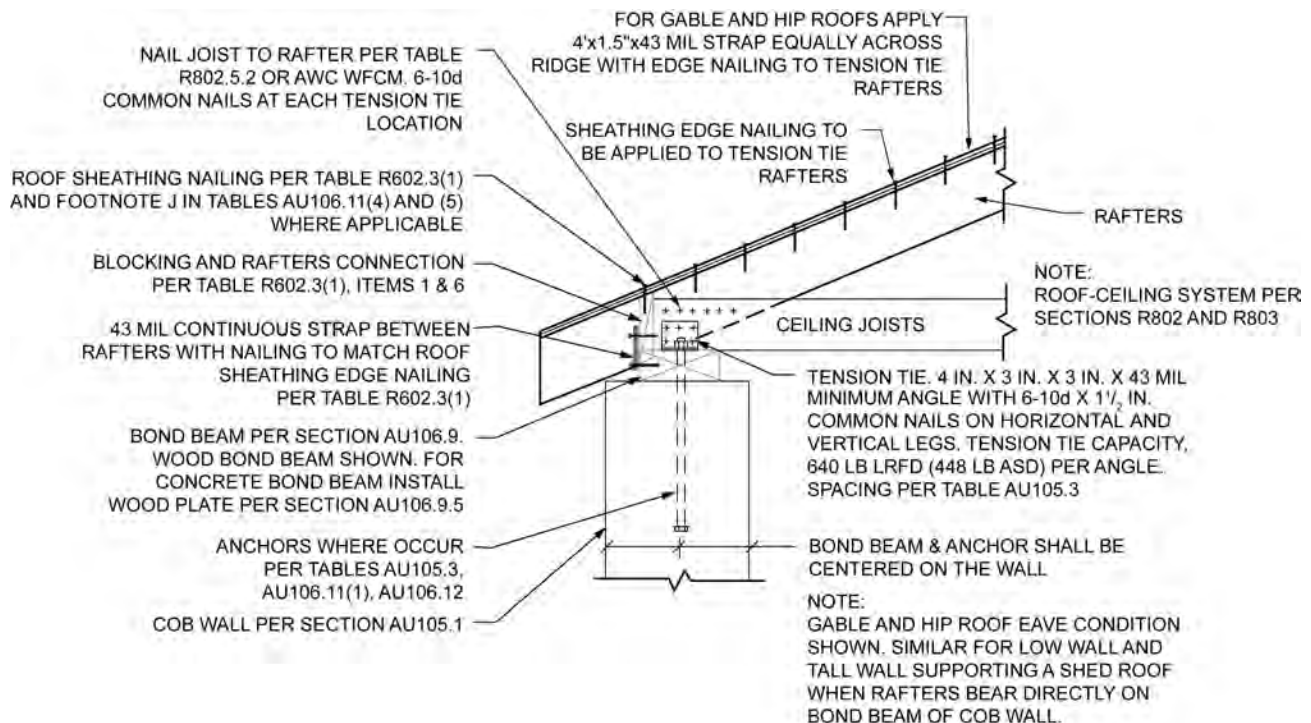


FIGURE AU106.9.5
CONNECTION OF ROOF FRAMING TO BOND BEAMS

4. Concrete bond beams when used shall be in accordance with Section AU106.9.2 in Seismic Design Categories A, B and C and for ultimate design wind speeds less than or equal to 140 mph (63.6 m/s).
5. Walls between the bond beam and roof shall be of wood-framed construction in accordance with Section R602. The ratio of its greatest height to its length shall not exceed 1:2. The wall shall not contain openings.

AU106.10 Lintels. Door, window and other openings in load-bearing *cob* walls shall be provided with a lintel of wood or concrete in accordance with Table AU106.10.

AU106.11 Cob braced wall panels. Cob braced wall panels shall be in accordance with Section R602.10 and Tables AU106.11(1), AU106.11(2), AU106.11(3), AU106.11(4) and AU106.11(5). Wind design criteria shall be in accordance with Section R301.2.1. Seismic design criteria shall be in accordance with Section R301.2.2. An approved engineered design shall be required in accordance with Section R301.2.1 where the building is located in a special wind region or where wind design is required in accordance with Figure R301.2.1.1.

AU106.11.1 Nonorthogonal braced wall panels. Braced wall panels at an angle to the orthogonal braced wall lines shall be considered to contribute to the minimum total

braced wall lengths in Tables AU106.11(2), AU106.11(3), AU106.11(4) and AU106.11(5), as follows:

1. A braced wall panel not more than 45 degrees and greater than 30 degrees to an adjacent orthogonal braced wall line shall contribute 50 percent of its length to that line.
2. A braced wall panel not more than 30 degrees to an orthogonal braced wall line shall contribute 65 percent of its length to that line.
3. A braced wall panel greater than 45 degrees and not more than 60 degrees to an orthogonal braced wall line shall contribute 35 percent of its length to that line.
4. The angle of a curved braced wall panel to a braced wall line shall be determined with the chord of that section of wall, connecting the end points of the arc at the center of the wall.

AU106.11.2 Braced wall lines for buildings with curved walls. Buildings with curved cob walls shall contain two braced wall lines in two orthogonal directions. The spacing of the braced wall lines for wind design in Table AU106.11(2) and the spacing and length of the braced wall lines for seismic design in Tables AU106.11(3), AU106.11(4) and AU106.11(5) shall be the maximum widths of the building in the two orthogonal directions.

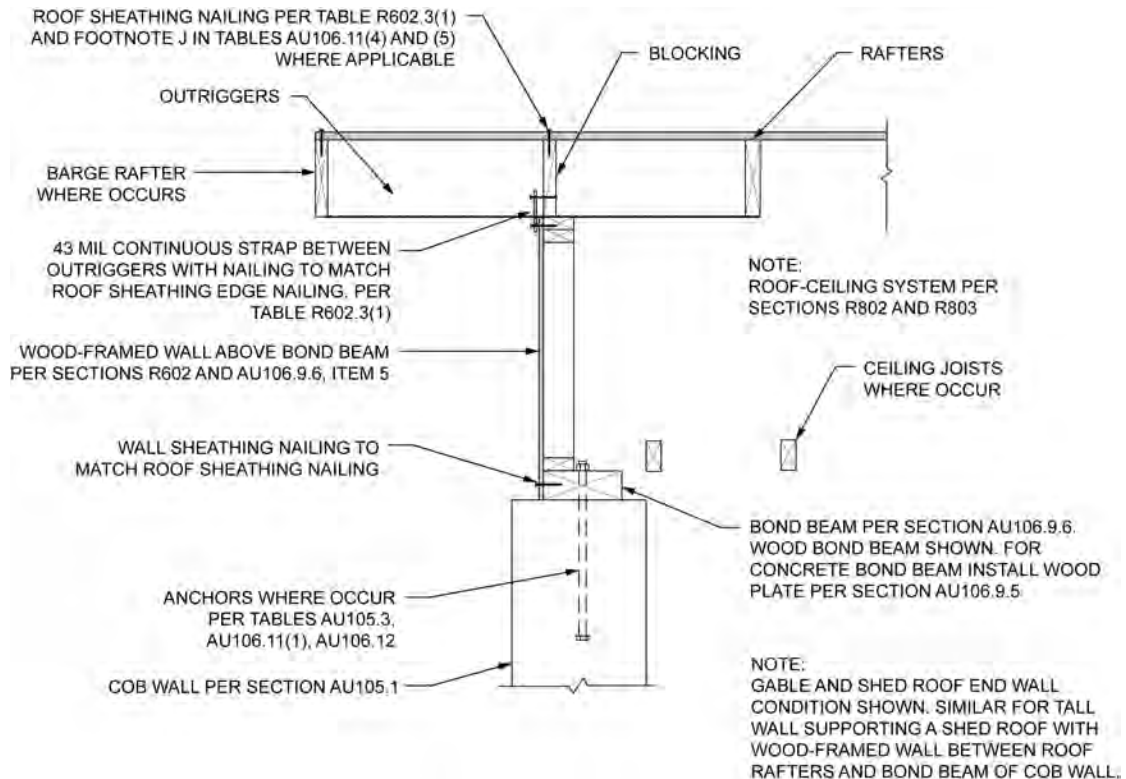


FIGURE AU106.9.6 CONNECTIONS AT GABLE AND SHED ROOF END WALLS

**TABLE AU106.10
LINTELS AND BOND BEAMS SPANNING OPENINGS**

GROUND SNOW LOAD ≤ 30 PSF			WOOD:		CONCRETE:	
			<ul style="list-style-type: none"> • $F_b \geq 850$ psi • $E \geq 1,300,000$ psi • No. 2 Grade or better • Oriented flat • 1 piece or 2 equal-width pieces • Extend 1 foot beyond opening sides 		<ul style="list-style-type: none"> • 2500 psi compressive strength • Height = 6 inches • Extend 1 foot beyond opening sides • Reinforcement two No. 4 bars^a • 2 inches clear from bottom • 2 inches clear from sides^a 	
Building Width (feet)	Cob above Lintel (feet)	Total Cob Wall and Plaster Thickness (inches)	Size of Wood Lintel or Bond Beam— $H \times W$ (nominal inches)		Width of Concrete Lintel or Bond Beam (inches)	
			For Span ≤ 4 ft	For Span ≤ 6 ft	For Span ≤ 6 ft	For Span ≤ 8 ft
10	0	≤ 27	4 × 8	4 × 8	8	8
10	1	15	4 × 12	4 × 12	12	12
10	1	19	4 × 16	4 × 16	16	16
10	1	27	4 × 24	4 × 24	24	24
10	2	15	4 × 12	6 × 12	12	12
10	2	19	4 × 16	6 × 16	16	16
10	2	27	4 × 24	4 × 24	24	24
20	0	≤ 27	4 × 8	6 × 8	8	8
20	1	15	4 × 12	6 × 12	12	12
20	1	19	4 × 16	6 × 16	16	16
20	1	27	4 × 24	4 × 24	24	24
20	2	15	4 × 12	6 × 12	12	NP
20	2	19	4 × 16	6 × 16	16	NP
20	2	27	4 × 24	6 × 24	24	NP
30	0	≤ 27	4 × 8	6 × 8	8	NP
30	1	15	4 × 12	6 × 12	12	NP
30	1	19	4 × 13	6 × 16	16	NP
30	1	27	4 × 24	6 × 24	24	NP
30	2	15	4 × 12	6 × 12	12	NP
30	2	19	4 × 16	6 × 16	16	NP
30	2	27	4 × 24	6 × 24	24	NP

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square inch = 6.895 kPa.

NP = Not Permitted.

a. Concrete bond beams spanning openings, and lintels greater than 16 inches in width, shall have an additional No. 4 bar in the center of their width.

TABLE AU106.11(1)
COB BRACED WALL PANEL TYPES

WALL TYPE ^a DESIGNATION	ANCHORS TO FOUNDATION ^b	ANCHORS TO BOND BEAM ^c	VERTICAL STEEL REINFORCING ^{b,c}	HORIZONTAL STEEL REINFORCING	MAXIMUM HEIGHT <i>H</i> ^d (in feet)	MAXIMUM ASPECT RATIO (<i>H</i> : <i>L</i>)
A	none	$\frac{5}{8}$ " threaded rod @ 12"; 4" from wall ends; 12" embedment in cob	none	none	7 ^e	1:1
B	#5 bar @ 12"; 16" embedment in cob	$\frac{5}{8}$ " threaded rod @ 12"; 4" from wall ends; 16" embedment in cob; 2" × 2" × $\frac{1}{4}$ " washer and nut at cob end	none	2" × 2" × 14 gage welded wire mesh ^f @ 18"; 6" from foundation and bond beam	7 ^e	1:1
C	#5 bar @ 12"; 16" embedment in cob	$\frac{5}{8}$ " threaded rod @ 12"; 16" embedment in cob	$\frac{5}{8}$ " threaded rod; 4" from each end of braced wall panel; continuous from founda- tion to bond beam	2" × 2" × 14 gage welded wire mesh ^f @ 18"; 6" from foundation and bond beam	7 ^e	2:1
D	(see vertical steel reinforcing)	(see vertical steel rein- forcing)	$\frac{5}{8}$ " threaded rod; 4" from each end of braced wall panel and @ 12"; continuous from founda- tion to bond beam	2" × 2" × 14 gage welded wire mesh ^f @ 18"; 6" from foundation and bond beam	7 ^e	2:1
E	6" × 6" × 6 gage welded wire mesh; 12" embedment in foundation	$\frac{5}{8}$ " threaded rod @ 12"; 4" from wall ends; 12" embedment in cob	6" × 6" × 6 gage welded wire mesh; 2" from each wall face	none	7.5	1:1

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Braced wall panel Types A, B, C and D shall be not less than 16 inches thick. Braced wall panel Type E shall be not less than 12 inches thick. All braced wall panels shall be not greater than 24 inches thick.
- b. Not less than 8-inch embedment into foundation, unless otherwise stated.
- c. Not less than 4-inch embedment into concrete bond beams. Full penetration through wood bond beam, secured with nut and washer.
- d. *H* = height of the cob portion of the wall only. See Figure AU101.4.
- e. Maximum height shall be 8 feet when wall thickness is increased to 18 inches.
- f. Galvanized mesh.

**TABLE AU106.11(2)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON WIND SPEED**

<ul style="list-style-type: none"> • EXPOSURE CATEGORY B^d • 25-FOOT MEAN ROOF HEIGHT • 10-FOOT EAVE-TO-RIDGE HEIGHT^d • 10-FOOT WALL HEIGHT^d • 2 BRACED WALL LINES^d 			MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d}			
Ultimate Design Wind Speed (mph)	Story Location	Braced Wall Line Spacing (feet)	Cob Braced Wall Panel ^o A; (aspect ratio $H:L \leq 1:1$)	Cob Braced Wall Panel ^o B; (aspect ratio $H:L \leq 1:1$)	Cob Braced Wall Panel ^o C, D; (aspect ratio $H:L \leq 2:1$)	Cob Braced Wall Panel ^o E; (aspect ratio $H:L \leq 1:1$)
≤ 110	One-story building	10	6.0	6.0	3.7	6.0
≤ 110	One-story building	20	7.9	7.4	7.4	6.0
≤ 110	One-story building	30	11.8	11.0	11.0	6.9
≤ 115	One-story building	10	6.0	6.0	4.1	6.0
≤ 115	One-story building	20	8.7	8.1	8.1	6.0
≤ 115	One-story building	30	13.0	12.1	12.1	7.6
≤ 120	One-story building	10	6.0	6.0	4.4	6.0
≤ 120	One-story building	20	9.4	8.8	8.8	6.0
≤ 120	One-story building	30	14.1	13.1	13.1	8.3
≤ 130	One-story building	10	6.0	6.0	5.1	6.0
≤ 130	One-story building	20	11.0	10.3	10.3	6.5
≤ 130	One-story building	30	16.5	15.4	15.4	9.7
≤ 140	One-story building	10	6.0	6.0	5.9	6.0
≤ 140	One-story building	20	12.7	11.9	11.9	7.5
≤ 140	One-story building	30	19.1	17.8	17.8	11.2

For SI: 1 foot = 304.8 mm, 1 mile per hour = 0.447 m/s.

- a. Linear interpolation shall be permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel Types A, B and E shall have an aspect ratio ($H:L$) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio ($H:L$) ≤ 2:1.
- d. Subject to applicable wind adjustment factors associated with Items 1 and 2 of Table R602.10.3(2).
- e. Cob braced wall panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).

**TABLE AU106.11(3)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY A**

<ul style="list-style-type: none"> • SOIL CLASS D^f • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AU106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY A • 1.5" PLASTER THICKNESS EACH SIDE^g 				MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d, e}		
Braced Wall Line Spacing (feet)	Braced Wall Line Length (feet)	Min. Braced Wall Line % Openings	Min. Perpendicular Braced Wall Line % Openings	Cob Braced Wall Panel ^o A, B	Cob Braced Wall Panel ^o C, D	Cob Braced Wall Panel ^o E
10	30	0	0	—	3.4	6.0
20	20	0	0	—	3.5	6.0
20	30	0	0	—	4.5	6.0
30	30	0	0	—	5.6	6.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel Types A, B and E shall have an aspect ratio ($H:L$) ≤ 1:1. Braced wall panel Types C and D shall have an aspect ratio ($H:L$) ≤ 2:1.
- d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).
- e. Cob braced wall panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.
- g. For total plaster thickness between 3 inches and 6 inches, the minimum total length of braced wall panels shall be multiplied by 1.2.

**TABLE AU106.11(4)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY B**

<ul style="list-style-type: none"> • SOIL CLASS D^f • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AU106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY B • 1.5" PLASTER THICKNESS EACH SIDE^g 				MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d, e}		
Braced Wall Line Spacing (feet)	Braced Wall Line Length (feet)	Min. Braced Wall Line % Openings	Min. Perpendicular Braced Wall Lines % Openings	Cob Braced Wall Panel ^e A, B	Cob Braced Wall Panel ^e C, D	Cob Braced Wall Panel ^e E
10	10	0	0	6.0	3.2	6.0
10	20	0	0	6.0	4.9	6.0
10	20	50	0	6.0	3.5	6.0
10	30	0	0	7.1	6.6	6.0
10	30	50	0	6.0	4.5	6.0
20	10	0	0	6.0 ^h	4.9 ^h	6.0
20	10	0	50	6.0	3.5	6.0
20	10	50	0	NP	4.2	NP
20	10	50	50	NP	3.0	NP
20	20	0	0	7.4	6.9	6.0
20	20	0	50	6.0	5.5	6.0
20	20	50	0	6.0	5.5	6.0
20	20	50	50	6.0	4.1	6.0
20	30	0	0	9.4	8.8	6.0
20	30	0	50	7.9	7.4	6.0
20	30	50	0	7.2	6.7	6.0
20	30	50	50	6.0	5.3	6.0
30	10	0	0	7.1	6.6	6.0
30	20	0	0	9.4	8.8	6.0
30	20	0	50	7.2	6.7	6.0
30	20	50	0	7.9	7.4	6.0
30	30	0	0	11.8	11.0	6.0
30	30	0	50	9.5	8.9	6.0
30	30	50	0	9.5	8.9	6.0
30	30	50	50	7.3	6.8	6.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel Types A, B and E shall have an aspect ratio ($H:L$) \leq 1:1. Braced wall panel Types C and D shall have an aspect ratio ($H:L$) \leq 2:1.
- d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).
- e. Cob braced panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.
- g. For total plaster thicknesses 3 inches to 6 inches, the minimum total length of braced wall panels shall be multiplied by 1.2.
- h. Total plaster thicknesses shall be not greater than 3 inches. Substitute $15/32$ " roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

**TABLE AU106.11(5)
BRACING REQUIREMENTS FOR COB BRACED WALL PANELS BASED ON SEISMIC DESIGN CATEGORY C**

<ul style="list-style-type: none"> • SOIL CLASS D^f • TOTAL WALL HEIGHT = 10 FEET (INCLUDING STEM WALL AND BOND BEAM) • COB WALL HEIGHT PER TABLE AU106.11(1) • 15 PSF ROOF-CEILING DEAD LOAD^d • STORY LOCATION: ONE-STORY BUILDING • SEISMIC DESIGN CATEGORY C • 1.5" PLASTER THICKNESS EACH SIDE^g 				MINIMUM TOTAL LENGTH (FEET) OF COB BRACED WALL PANELS REQUIRED ALONG EACH BRACED WALL LINE ^{a, b, c, d, e}		
Braced Wall Line Spacing (feet)	Braced Wall Line Length (feet)	Min. Braced Wall Line % Openings	Min. Perpendicular Braced Wall Lines % Openings	Cob Braced Wall Panel ^e A, B	Cob Braced Wall Panel ^e C, D	Cob Braced Wall Panel ^e E
10	10	0	0	8.3 ^h	7.8 ^h	6.0
10	10	0	50	6.5	6.1	6.0
10	10	25	0	7.4 ^h	6.9 ^h	6.0
10	10	50	50	NP	4.4	6.0
10	15	0	0	10.6	9.9	6.0
10	15	0	50	8.7	8.2	6.0
10	15	50	0	NP	7.3	6.0
10	15	50	50	6.0	5.6	6.0
10	20	0	0	12.8	11.9	6.0
10	20	0	50	11.0	10.2	6.0
10	20	50	0	9.1	8.5	6.0
10	20	50	50	7.3	6.8	6.0
15	10	25	0	NP	NP	6.0 ^h
15	10	0	50	7.8	7.3	6.0
15	10	50	0	NP	NP	NP
15	10	50	50	NP	NP	NP
15	15	0	0	12.9	12.1	6.0
15	15	0	50	10.2	9.5	6.0
15	15	50	0	NP	NP	6.0
15	15	50	50	7.5	7.0	6.0
15	20	0	0	15.3	14.3	6.0
15	20	0	50	12.6	11.7	6.0
15	20	50	0	NP	NP	6.0
15	20	50	50	8.9	8.3	6.0
20	10	25	0	NP	NP	NP
20	10	0	50	9.1	8.5	6.0
20	10	50	0	NP	NP	NP
20	10	50	50	NP	NP	NP
20	15	0	0	NP	14.3 ^h	6.0 ^h
20	15	0	50	11.7 ^h	10.9 ^h	6.0
20	15	50	0	NP	NP	6.0 ^h
20	15	50	50	NP	NP	6.0
20	20	0	0	17.8	16.7	6.9
20	20	0	50	14.2	13.3	6.0
20	20	50	0	NP	NP	6.0
20	20	50	50	NP	9.9	6.0

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 0.0479 kPa.

NP = Not Permitted.

- a. Interpolation is not permitted.
- b. Braced wall panels shall be without openings.
- c. Braced wall panel Types A, B and E shall have an aspect ratio ($H:L$) \leq 1:1. Braced wall panel Types C and D shall have an aspect ratio ($H:L$) \leq 2:1.
- d. Subject to applicable seismic adjustment factors associated with Item 5 in Table R602.10.3(4).
- e. Cob braced panel types indicated shall comply with Section AU106.11 and Table AU106.11(1).
- f. Wall bracing lengths are based on a soil site class D. Interpolation of bracing lengths between S_{DS} values associated with the seismic design categories is allowable where a site-specific S_{DS} value is determined in accordance with Section 1613 of the *International Building Code*.
- g. For total plaster thicknesses 3" to 6", multiply the minimum total length of braced wall panels by 1.2.
- h. Total plaster thickness shall not be greater than 3 inches. Substitute $1\frac{5}{32}$ " roof sheathing and 10d at 6" edge nailing for requirements in Table R602.3(1).

AU106.11.3 Radius, thickness and length of curved braced wall panels. Cob curved braced wall panels shall have an inside radius of not less than 5 feet (1524 mm), shall be of the thickness required in Table AU106.11(1) and of the length determined in accordance with Section AU106.11. The length of the curved wall shall be considered to be the length of the arc at the center of the wall, in accordance with Figure AU106.11.3 and determined by Equation

$$ARC_C = 0.0175 R_C \times A \quad \text{(Equation AU-4)}$$

- ARC_C = Length of arc at center of wall (in feet).
- R_C = Radius at center of wall = $R_i + 0.5T$ (in feet).
- R_i = Inside radius of wall (in feet).
- T = Thickness of wall without finish (in feet).
- A = Angle of extent of braced wall panel from the center of the arc (in degrees).

AU106.12 Resistance to wind uplift forces. Cob walls that resist uplift forces from the roof assembly, as determined in accordance with Section R802.11, shall be in accordance with Table AU106.12.

AU106.13 Post-and-beam with cob infill. Post-and-beam with cob infill wall systems shall be in accordance with an approved engineered design.

AU106.14 Buttresses. Cob buttresses that are intended to provide out-of-plane wall bracing or additional capacity for braced wall panels shall be in accordance with an approved engineered design.

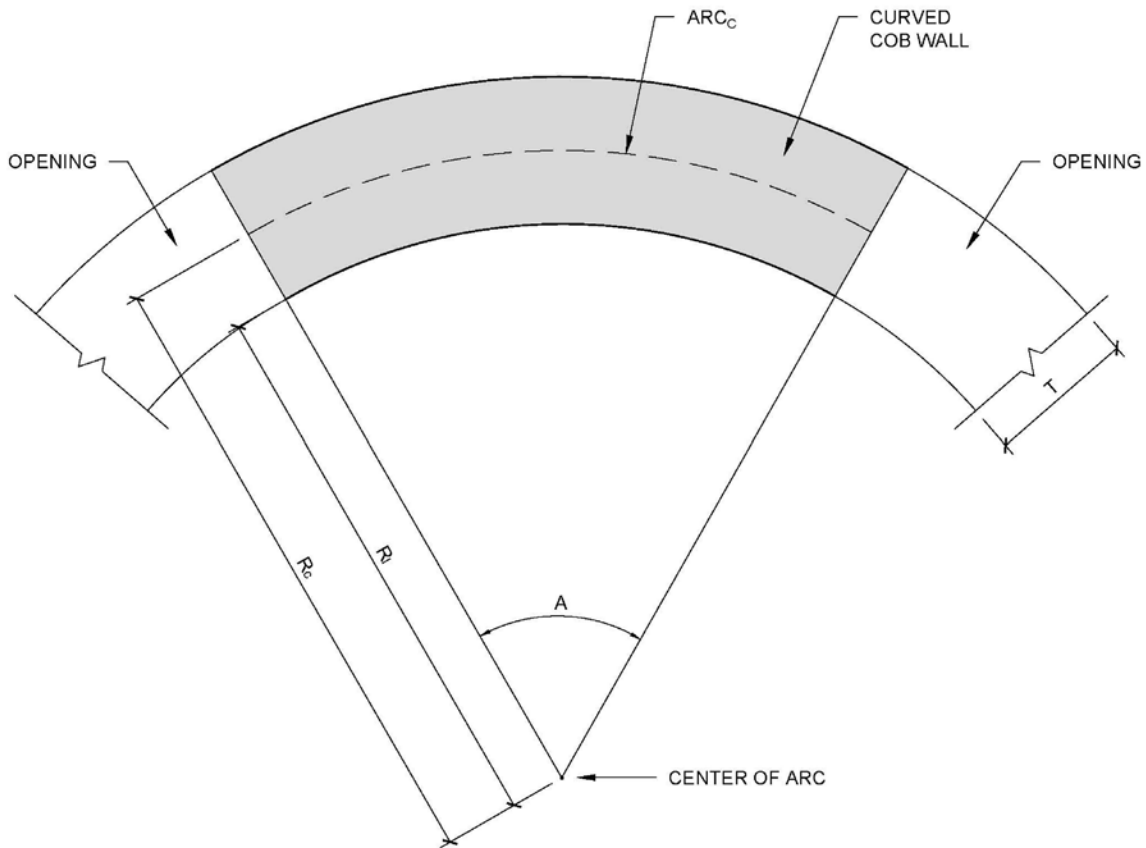
**SECTION AU107
COB FLOORS**

AU107.1 Cob floors. Cob floors supported by grade shall be in accordance with an approved specification. Straw shall not be required in the material mix.

**SECTION AU108
FIRE RESISTANCE**

AU108.1 Fire-resistance rating. Cob walls are not fire-resistance rated.

AU108.2 Clearance to fireplaces and chimneys. Cob walls or other cob surfaces shall not require clearance to fireplaces and chimneys, except where clearance to noncombustibles is required by the manufacturer’s instructions.



**FIGURE AU106.11.3
CURVED BRACED WALL PANEL**

**TABLE AU106.12
ANCHORAGE OF BOND BEAMS FOR WIND UPLIFT**

ANCHORS:			
<ul style="list-style-type: none"> • 5/8" ALL THREAD AT 12" O.C.^{a, b} • 2" x 2" x 1/4" WASHERS AND NUT AT END IN COB • 4" EMBEDMENT IN CONCRETE BOND BEAMS • FULL PENETRATION THROUGH WOOD BOND BEAMS WITH 2" x 2" x 1/4" WASHER AND NUT 			
WIND UPLIFT FORCE FROM TABLE R802.11 (PLF)	ANCHORAGE DEPTH IN INCHES, PER WALL WIDTH AND WIND UPLIFT FORCE		
	≤ 12" Wall Width ^c	≤ 16" Wall Width ^c	≤ 24" wall width ^c
< 75	16	12	12
< 100	24	16	12
< 150	48 o.c. continuous from foundation to bond beam ^d	24	16
< 200	48 o.c. continuous from foundation to bond beam ^d	48 o.c. continuous from foundation to bond beam ^d	24

For SI: 1 inch = 25.4 mm.

- a. For wood bond beams a maximum of 6 inches from bond beam ends.
- b. For minimum 6-inch by 8-inch concrete bond beams, at 18" o.c. for wind uplift forces less than 75 pounds per linear foot, and at 16" o.c. for wind uplift forces less than 100 pounds per linear foot.
- c. Excluding finishes.
- d. With 7-inch embedment in foundation, 4-inch embedment in concrete bond beam or full penetration through wood bond beam with 2-inch by 2-inch by 1/4-inch washer and nut.

**SECTION AU109
THERMAL PERFORMANCE**

AU109.1 Thermal characteristics. Cob walls shall be classified as mass walls in accordance with Section N1102.2.5 and shall meet the *R*-value requirements for mass walls in Table N1102.1.3.

AU109.2 Thermal resistance. The unit *R*-value for cob walls with a density of 110 pounds per cubic foot (1762 kg/m³) shall be *R*-0.22 per inch of cob thickness. Walls that vary in thickness along their height or length shall use the average thickness of the wall to determine its *R*-value. The thermal resistance values of air films and finish materials or additional insulation shall be added to the cob wall's thermal resistance value to determine the *R*-value of the wall assembly.

AU109.3 Additional insulation. Where insulating materials are added to the face of a cob wall, the combination of additional insulation and any associated connecting, weather-resisting or protective materials shall comply with Section AU104.1.2, Items 1–4.

**SECTION AU110
REFERENCED STANDARDS**

AU110.1 General. See Table AU110.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date,

the standard title and the section or sections of this appendix that reference the standard.

**TABLE AU110.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM C5—10	<i>Standard Specification for Quicklime for Structural Purposes</i>	AU104.4.6
ASTM C141/C141M—14	<i>Standard Specification for Hydrated Hydraulic Lime for Structural Purposes</i>	AU104.4.6
ASTM C206—14	<i>Standard Specification for Finishing Hydrated Lime</i>	AU104.4.6
ASTM C926	<i>Specification for Appliance of Portland Cement-based Plaster</i>	AU104.4.8
ASTM C1707—11	<i>Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes</i>	AU104.4.6
ASTM E2392/E2392M—10	<i>Standard Guide for Design of Earthen Wall Building Systems</i>	AU104.4.3.2
ASTM BS1, ASTM BS EN 459—2015	<i>Part 1: Building Lime. Definitions, Specifications and Conformity Criteria; Part 2: Test Methods</i>	AU104.4.6

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AV – BOARD OF APPEALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

APPENDIX AV

BOARD OF APPEALS

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User Note:

About this appendix: Appendix AV provides criteria for Board of Appeals members. Also provided are procedures by which the Board of Appeals should conduct its business.

SECTION AV101 GENERAL

AV101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section R112. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the building official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

AV101.2 Application for appeal. Any person shall have the right to appeal a decision of the building official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the building official within 20 days after the notice was served.

AV101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

AV101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

AV101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member’s terms shall be staggered at intervals, so as to provide continuity. The building official shall be an ex officio member of said board but shall not vote on any matter before the board.

AV101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

AV101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

AV101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

AV101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

AV101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

AV101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

AV101.3.7 Compensation of members. Compensation of members shall be determined by law.

AV101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their term only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

AV101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

AV101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

AV101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the building official and any person whose interests are affected shall be given an opportunity to be heard.

AV101.5.2 Quorum. Three members of the board shall constitute a quorum.

AV101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

AV101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

AV101.7 Board decision. The board shall only modify or reverse the decision of the building official by a concurring vote of three or more members.

AV101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the building official within 3 days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the building official.

AV101.7.2 Administration. The building official shall take immediate action in accordance with the decision of the board.

AV101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AW – 3D-PRINTED BUILDING CONSTRUCTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt entire chapter																							
Adopt entire chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

APPENDIX AW

3D-PRINTED BUILDING CONSTRUCTION

The provisions contained in this appendix are not mandatory unless specifically adopted by a state agency or referenced in the adopting ordinance.

User Note:

About this appendix: Appendix AW provides for the design, construction and inspection of 3D building construction. UL 3401 was developed to evaluate critical aspects of this construction process to result in consistent 3D-printed building techniques that comply with a level of safety and performance equivalent to legacy construction techniques currently in the code.

SECTION AW101 GENERAL

AW101.1 Scope. Buildings, structures and building elements fabricated in whole or in part using 3D-printed construction techniques shall be designed, constructed and inspected in accordance with the provisions contained in this appendix and other applicable requirements in this code.

AW101.2 Definitions. The words and terms in Section AW102 shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

SECTION AW102 DEFINITIONS

3D-PRINTED BUILDING CONSTRUCTION. A process for fabricating buildings, structures and building elements from 3D model data using automated equipment that deposits construction material in a layer-upon-layer fashion.

ADDITIVE MANUFACTURING MATERIALS. Materials used by the 3D printer to produce the building structure or system components of the building.

FABRICATION PROCESS. Preparation of the job site and construction material, the deposition, curing, finishing, insertion of components and other methods used to construct building elements such as walls, partitions, roof assemblies and structural components, and the means used to connect assemblies together.

PRODUCTION EQUIPMENT. The equipment, including the 3D printer, its settings, nozzles and other accessories used in the fabrication process.

SYSTEM COMPONENTS. Devices, equipment and *appliances* that are installed in the building elements as part of the wiring, plumbing, HVAC and other systems. These include, but are not limited to, electrical outlet boxes, conduit, wiring, piping, tubing and HVAC ducts, each of which is covered by a product standard or installation code requirement.

SECTION AW103 BUILDING DESIGN

AW103.1 Design organization. 3D-printed buildings, structures and building elements shall be designed by an organization certified in accordance with UL 3401 by an approved agency and approved by the building official in accordance with this section.

AW103.2 Design approval. The structural design, construction documents and UL 3401 report of findings shall be submitted for review and approval in accordance with Section 104.11.

**SECTION AW104
BUILDING CONSTRUCTION**

AW104.1 Construction. 3D-printed buildings, structures and building elements shall be constructed in accordance with this section.

AW104.2 Construction method. The building construction method, consisting of the manufacturer’s production equipment and fabrication process, shall be in accordance with the UL 3401 report of findings. The unique identifier of the construction method used shall match the identifier in the UL 3401 report of findings.

AW104.3 Additive manufacturing materials. Only the listed additive manufacturing materials identified in the UL 3401 report of findings shall be used to fabricate the building structure or system components. Containers of the additive manufacturing materials shall be labeled.

AW104.4 Depositing of manufacturing materials. Manufacturing materials shall only be deposited where ambient temperature and environmental conditions at the job site are within limits specified in the UL 3401 report of findings. The maximum number of layers permitted, specified curing time and any surface preparation or finishing shall be performed as specified in the UL 3401 report of findings.

**SECTION AW105
SPECIAL INSPECTIONS**

AW105.1 Initial inspection. An initial inspection of the production equipment, including 3D printer, and the fabrication process shall be performed after the production equipment is located on site and before building fabrication has begun. The inspection shall be conducted by representatives of the approved agency that evaluated the fabrication process for compliance with UL 3401. The inspection shall verify that the fabrication process, including production equipment, 3D-printing parameters and additive manufacturing materials, are in accordance with the UL 3401 report of findings and the proprietary information in the UL 3401 detailed report of findings.

Exception: Where approved by the building official, inspections of the production equipment, including 3D printer, and the fabrication process used in a single housing tract shall be conducted on the first building to be constructed, and on a selected number of subsequent buildings, where the same equipment, equipment operators and fabrication process are used on all buildings. The number of inspections to be performed shall be determined by the building official.

**SECTION AW106
REFERENCED STANDARDS**

AW106.1 General. See Table AW106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference the standard.

**TABLE AW106.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
UL 3401—19	<i>Outline of Investigation for 3D Printed Building Construction</i>	AW103.2, AW104.2, AW104.3, AW104.4, AW105.1

CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AX – SWIMMING POOL SAFETY ACT

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter	X																					
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AX

SWIMMING POOL SAFETY ACT

(Note: See Chapter 31, Section 3109 of the California Building Code, Title 24, Part 2.)

The provisions contained in this appendix are mandatory to reflect the Swimming Pool Safety Act found in Health and Safety Code Sections 115920 through 115929.

AX100 California swimming pool safety act (statewide).

The following text in this section contains the statutory language in the Swimming Pool Safety Act (HS Code, Sections 115920 through 115929) that is required to be duplicated and published in California Code of Regulations, Title 24. As such, the section numbers reflect those within the Health and Safety Code.

NOTE: These regulations are subject to local government modification. You should verify the applicable local government requirements at the time of application for a building permit.

Authority: Health and Safety Code Section 18942(b)

Reference: Health and Safety Code Section 18942(b); Chapter 925, Statutes of 1996

115920. *This act shall be known and may be cited as the Swimming Pool Safety Act.*

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115921. *As used in this article the following terms have the following meanings:*

- (a) “Swimming pool” or “pool” means any structure intended for swimming or recreational bathing that contains water over 18 inches deep. “Swimming pool” includes in-ground and aboveground structures and includes, but is not limited to, hot tubs, spas, portable spas and nonportable wading pools.*
- (b) “Public swimming pool” means a swimming pool operated for the use of the general public with or without charge, or for the use of the members and guests of a private club. Public swimming pool does*

not include a swimming pool located on the grounds of a private single-family home.

- (c) “Enclosure” means a fence, wall or other barrier that isolates a swimming pool from access to the home.*
- (d) “Approved safety pool cover” means a manually or power-operated safety pool cover that meets all of the performance standards of the American Society for Testing and Materials (ASTM), in compliance with standard F1346-91.*
- (e) “Exit alarms” means devices that make audible, continuous alarm sounds when any door or window, that permits access from the residence to the pool area that is without any intervening enclosure, is opened or is left ajar. Exit alarms may be battery operated or may be connected to the electrical wiring of the building.*
- (f) “ANSI/APSP performance standard” means a standard that is accredited by the American National Standards Institute (ANSI) and published by the Association of Pool and Spa Professionals (APSP).*
- (g) “Suction outlet” means a fitting or fixture typically located at the bottom or on the sides of a swimming pool that conducts water to a recirculating pump.*

[Amended by Stats. 2012, Ch. 679, Sec. 1. (AB 2114) Effective January 1, 2013.]

115922.

- (a) Except as provided in Section 115925, when a building permit is issued for the construction of a new swimming pool or spa or the remodeling of an existing swimming pool or spa at a private single-family*

home, the respective swimming pool or spa shall be equipped with at least two of the following seven drowning prevention safety features:

- (1) An enclosure that meets the requirements of Section 115923 and isolates the swimming pool or spa from the private single-family home.
- (2) Removable mesh fencing that meets American Society for Testing and Materials (ASTM) Specifications F2286 standards in conjunction with a gate that is self-closing and self-latching and can accommodate a key lockable device.
- (3) An approved safety pool cover, as defined in subdivision (d) of Section 115921.
- (4) Exit alarms on the private single-family home's doors that provide direct access to the swimming pool or spa. The exit alarm may cause either an alarm noise or a verbal warning, such as a repeating notification that "the door to the pool is open."
- (5) A self-closing, self-latching device with a release mechanism placed no lower than 54 inches above the floor on the private single-family home's doors providing direct access to the swimming pool or spa.
- (6) An alarm that, when placed in a swimming pool or spa, will sound upon detection of accidental or unauthorized entrance into the water. The alarm shall meet and be independently certified to the ASTM Standard F2208 "Standard Safety Specification for Residential Pool Alarms," which includes surface motion, pressure, sonar, laser and infrared type alarms. A swimming protection alarm feature designed for individual use, including an alarm attached to a child that sounds when the child exceeds a certain distance or becomes submerged in water, is not a qualifying drowning prevention safety feature.
- (7) Other means of protection, if the degree of protection afforded is equal to or greater than that afforded by any of the features set forth above and has been independently verified by an approved testing laboratory as meeting standards for those features established by the ASTM or the American Society of Mechanical Engineers (ASME).

- (b) Before the issuance of a final approval for the completion of permitted construction or remodeling work, the local building code official shall inspect the drowning safety prevention features required by this section and, if no violations are found, shall give final approval. [Amended by Stats. 2017, Ch. 670, Sec. 4. (SB 442) Effective January 1, 2018.]

115923. An enclosure shall have all of the following characteristics:

- (a) Any access gates through the enclosure open away from the swimming pool and are self-closing with a

self-latching device placed no lower than 60 inches above the ground.

- (b) A minimum height of 60 inches.
- (c) A maximum vertical clearance from the ground to the bottom of the enclosure of two inches.
- (d) Gaps or voids, if any, do not allow passage of a sphere equal to or greater than four inches in diameter.
- (e) An outside surface free of protrusions, cavities or other physical characteristics that would serve as handholds or footholds that could enable a child below the age of five years to climb over.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115924.

- (a) Any person entering into an agreement to build a swimming pool or spa, or to engage in permitted work on a pool or spa covered by this article, shall give the consumer notice of the requirements of this article.
- (b) Pursuant to existing law, the Department of Health Services shall have available on the department's Web site, commencing January 1, 2007, approved pool safety information available for consumers to download. Pool contractors are encouraged to share this information with consumers regarding the potential dangers a pool or spa poses to toddlers. Additionally, pool contractors may provide the consumer with swimming pool safety materials produced from organizations such as the United States Consumer Product Safety Commission, Drowning Prevention Foundation, California Coalition for Children's Safety & Health, Safe Kids Worldwide, Association of Pool and Spa Professionals, or the American Academy of Pediatrics.

(Amended by Stats. 2006, Ch. 478, Sec. 3. Effective January 1, 2007.)

115925. The requirements of this article do not apply to any of the following:

- (a) Public swimming pools.
- (b) Hot tubs or spas with locking safety covers that comply with the American Society for Testing and Materials (ASTM F1346).
- (c) An apartment complex or any residential setting other than a single-family home.

[Amended by Stats. 2017, Ch. 670, Sec. 5. (SB 442) Effective January 1, 2018.]

115926. This article does not apply to any facility regulated by the State Department of Social Services even if the facility is also used as the private residence of the operator. Pool safety in those facilities shall be regulated pursuant to regulations adopted therefor by the State Department of Social Services.

(Added by Stats. 1996, Ch. 925, Sec. 3.5. Effective January 1, 1997.)

115927. Notwithstanding any other provision of law, this article shall not be subject to further modification or interpretation by any regulatory agency of the state, this authority being reserved exclusively to local jurisdictions, as provided for in paragraph (7) of subdivision (a) of Section 115922 and subdivision (c) of Section 115925.

(Amended by Stats. 2018, Ch. 957, Sec. 13. (SB 1078) Effective January 1, 2019.)

115928. Whenever a building permit is issued for the construction of a new swimming pool or spa, the pool or spa shall meet all of the following requirements:

- (a) (1) The suction outlets of the pool or spa for which the permit is issued shall be equipped to provide circulation throughout the pool or spa as prescribed in paragraphs (2) and (3).
 - (2) The swimming pool or spa shall either have at least two circulation suction outlets per pump that shall be hydraulically balanced and symmetrically plumbed through one or more “T” fittings, and that are separated by a distance of at least three feet in any dimension between the suction outlets, or be designed to use alternatives to suction outlets, including, but not limited to, skimmers or perimeter overflow systems to conduct water to the recirculation pump.
 - (3) The circulation system shall have the capacity to provide a complete turnover of pool water, as specified in Section 3124B of Chapter 31B of the California Building Standards Code (Title 24 of the California Code of Regulations).
- (b) Suction outlets shall be covered with antientrapment grates, as specified in the ANSI/APSP-16 performance standard or successor standard designated by the federal Consumer Product Safety Commission, that cannot be removed except with the use of tools. Slots or openings in the grates or similar protective devices shall be of a shape, area and arrangement that would prevent physical entrapment and would not pose any suction hazard to bathers.
- (c) Any backup safety system that an owner of a new swimming pool or spa may choose to install in addition to the requirements set forth in subdivisions (a) and (b) shall meet the standards as published in the document, “Guidelines for Entrapment Hazards: Making Pools and Spas Safer,” Publication Number 363, March 2005, United States Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 2. (AB 2114) Effective January 1, 2013.]

115928.5. Whenever a building permit is issued for the remodel or modification of an existing swimming pool, toddler pool or spa, the permit shall require that the suction outlet or suction outlets of the existing swimming pool, toddler pool or spa be upgraded so as to be equipped with

antientrapment grates, as specified in the ANSI/APSP-16 performance standard or a successor standard designated by the federal Consumer Product Safety Commission.

[Amended by Stats. 2012, Ch. 679, Sec. 3. (AB 2114) Effective January 1, 2013.]

115929.

- (a) The Legislature encourages a private entity, in consultation with the Epidemiology and Prevention for Injury Control Branch of the department, to produce an informative brochure or booklet, for consumer use, explaining the child drowning hazards of, possible safety measures for and appropriate drowning hazard prevention measures for home swimming pools and spas, and to donate the document to the department.
- (b) The Legislature encourages the private entity to use existing documents from the United States Consumer Product Safety Commission on pool safety.
- (c) If a private entity produces the document described in subdivisions (a) and (b) and donates it to the department, the department shall review and approve the brochure or booklet.
- (d) Upon approval of the document by the department, the document shall become the property of the state and a part of the public domain. The department shall place the document on its Web site in a format that is readily available for downloading and for publication. The department shall review the document in a timely and prudent fashion and shall complete the review within 18 months of receipt of the document from a private entity.

(Added by Stats. 2003, Ch. 422, Sec. 3. Effective January 1, 2004.)

**CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE
APPENDIX AY – AREAS PROTECTED BY THE FACILITIES
OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC -CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/ CC	1	1R	2	3	4								
Adopt entire chapter				X																		
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AY

**AREAS PROTECTED BY THE FACILITIES OF THE
CENTRAL VALLEY FLOOD PROTECTION PLAN**

Note: The effective date of these standards shall be March 1, 2012 or ninety (90) days after the corresponding maps are completed and readily available to the general public, whichever is the later date.

Table W301.2(1) Revise as follows:

Replace the Flood Hazards cell in table as follows:

FLOOD HAZARDS	
NFIP ^a	CVFPP ^b

j. Jurisdictions with Areas Protected by the Facilities of the Central Valley where Flood Levels are Anticipated to Exceed Three Feet for the 200-Year Flood Event, as defined in Section AY102, shall fill in this part of the table with “Yes” or “No”.

AY101 General. *The provisions of this section shall apply to new construction, changes of use or repair and to substantial improvement and restoration of substantial damage of buildings in areas protected by the facilities of the Central Valley Flood Protection Plan, as established in Table R301.2, where flood levels are anticipated to exceed three feet for the 200-year flood event. Except as specifically required by this section, buildings and structures shall meet applicable provisions of this code.*

AY101.1 Construction documents. *Construction documents shall include the WSEL200 and the elevation(s) of the floor(s) and, as applicable, the elevation(s) and slopes of roofs, of the building or structure.*

AY102 Definitions.

The following words and terms shall, for the purposes of this section, have the meanings shown.

AREAS PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN WHERE FLOOD LEVELS ARE ANTICIPATED TO

EXCEED THREE FEET FOR THE 200-YEAR FLOOD EVENT. *Geographical areas identified by the state as “Areas Protected by the Facilities of the Central Valley Flood Protection Plan where Flood Levels are Anticipated to Exceed Three Feet for the 200-Year Flood Event” in accordance with the Health and Safety Code Section 50465. Published data from the California Department of Water Resources can be obtained online at the following website: www.water.ca.gov/BuildingCodes.*

Note: *The facilities of the Central Valley Flood Protection Plan are identified in the following counties: Butte, Colusa, Fresno, Glenn, Lake, Madera, Merced, Plumas, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, Tehama, Yolo and Yuba. Determination of additional facilities is ongoing.*

CENTRAL VALLEY. *Any lands in the bed or along or near the banks of the Sacramento River and the San Joaquin River, and any of their tributaries or connected therewith, or upon any land adjacent thereto, or within any of the overflow basins thereof, or upon any land susceptible to overflow therefrom. The following counties and the incorporated municipalities within these counties, in whole or in part, are in the Central Valley: Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Fresno, Glenn, Lake, Lassen, Madera, Mariposa, Merced, Modoc, Napa, Nevada, Placer, Plumas, Sacramento, San Benito, San Joaquin, Shasta, Sierra, Siskiyou, Solano, Stanislaus, Sutter, Tehama, Tuolumne, Yolo and Yuba. A map that delineates the Central Valley can be*

obtained online at the following website: www.water.ca.gov/BuildingCodes.

EVACUATION LOCATION. A location no less than one (1) foot (0.30 meter) above the WSEL200 where occupants are expected to congregate pending evacuation and from which occupants may be evacuated during conditions of flooding, such as a space within the building that has an exit door or operable window; a deck, balcony, porch, rooftop platform or rooftop area; or combinations thereof.

FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN. The facilities referenced herein include the facilities of State Plan of Flood Control and other flood management facilities in the Central Valley evaluated under the Central Valley Flood Protection Plan, which will be completed in 2012 and updated every 5 years thereafter. The facilities of State Plan of Flood Control include the state and federal flood control works (levees, weirs, channels and other features) of the Sacramento River Flood Control Project described in Water Code Section 8350, and flood control projects in the Sacramento River and San Joaquin River watersheds authorized pursuant to Article 2 (commencing with Water Code section 12648) of Chapter 2 of Part 6 of Division 6 for which the Central Valley Flood Protection Board or the Department of Water Resources has provided the assurances of nonfederal cooperation to the United States, and those facilities identified in Water Code Section 8361.

ROUTE TO THE EVACUATION LOCATION. The path through and along which occupants move from the habitable areas of a building or structure that are below the WSEL200 to the evacuation location.

SUBSTANTIAL DAMAGE. Damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

SUBSTANTIAL IMPROVEMENT. Any repair, reconstruction, rehabilitation, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the improvement or repair is started. If the structure has sustained damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the building official and that area the minimum necessary to assure safe living conditions.
2. Any alteration of a historic structure provided that the alteration will not preclude the structure's continued designation as a historic structure.

WSEL200. The water surface elevation (WSEL) of the 200-year flood event that is identified by the state when it identifies areas that receive protection from the facilities of the Central Valley Flood Protection Plan.

AY103 Structural stability. Portions of buildings and structures that support evacuation locations shall be designed, constructed, connected and anchored to resist flotation, collapse or permanent lateral movement resulting from the hydrostatic loads anticipated during conditions of flooding anticipated for the 200-year flood event.

Exception: When one flood vent (minimum) is provided on two opposite sides of the building or structure that comply with Figure AY103.

AY103.1 Determination of loads. Hydrostatic loads, based on the depth of water determined by the WSEL200 shall be determined in accordance with Chapter 5 of ASCE 7. Reduction of hydrostatic loads may be accomplished by allowing for the automatic entry and exit of floodwaters to minimize unbalanced loads. Such means shall be designed by a registered design professional and include, but are not limited to, openings, valves and panels designed to yield under load.

AY104 Evacuation Locations. An evacuation location and a route to the evacuation location shall be provided.

AY104.1 Route to evacuation location. A route shall be allowed through any number of intervening rooms or spaces. Doors along the route shall be openable without the use of a key, lock, special knowledge or effort.

AY104.2 minimum size requirements. Evacuation locations shall provide a minimum gross floor area of 7 square feet (0.65 m²) per occupant, based on the occupant load of the portions of the building that are below WSEL200. The area provided shall be adequate to accommodate the occupant load of the upper levels as well as the anticipated occupant load from the area below the WSEL200.

AY105 Space within the building. If the evacuation location is a space within a building, the evacuation location shall be provided with a means for occupants to be evacuated out of the building specified in Section AY105.1, AY105.2 or AY105.3. The means for occupants to be evacuated out of the building shall address the mobility of the occupants.

AY105.1 Windows, minimum size and dimensions. A minimum of one window shall be provided that meet the minimum size, minimum dimensions and operational constraints of Section R310. The number of such windows shall be appropriate for the occupancy or occupancies of the portions of the building that are below WSEL200.

Note: It is the intent of this section that windows be of sufficient number, sizes and dimensions to reasonably accommodate the needs and limitations of the occupants of the building. Reasonable judgment in the application of this requirement must be exercised by the building official.

AY105.2 Exterior doors to decks, balconies and porches. Exterior doors to decks, balconies and porches shall be sized in accordance with Section R311.

AY105.3 Means of escape to rooftops from spaces within a building. The means of escape to rooftops shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

AY106 Decks and balconies that are evacuation locations. Decks and balconies that have finish floors no less than one (1) foot (0.30 meter) above the WSEL200 shall be permitted to be evacuation locations. When a deck or balcony used as an evacuation location is not at the same level as a floor within the building, it shall be permitted to be accessed by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

AY106.1 Live load. Decks and balconies that are evacuation locations shall be designed for the live load required in Table R301.5.

AY106.2 Evacuation route. Evacuation routes to decks and balconies that are evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

AY107 Rooftop evacuation locations. Rooftop evacuation locations shall be permitted to include rooftop platforms and rooftop areas provided that they are no less than one (1) foot (0.30 meter) above the WSEL200. A minimum horizontal distance of 3 feet (0.91 meter) shall be provided between the lower edge of the rooftop evacuation location access point and the evacuation location lower perimeter.

AY107.1 Rooftop platforms required. A rooftop platform shall be provided if the roof covering materials are:

1. Clay tile, concrete tile, slate shingles, wood shingles or wood shakes and the roof slope is three units vertical in 12 units horizontal (25 percent slope) or greater.
2. Metal roof panels or metal roof shingles and the roof slope is one unit vertical in 12 units horizontal (8.33 percent slope) or greater.

AY107.2 Roof live loads. Roof areas that are rooftop evacuation locations and roofs that support rooftop platforms that are evacuation locations shall be designed for the roof live load required for the occupancy as required in CBC Table 1607.2.

AY107.3 Evacuation routes to rooftop evacuation locations. Evacuation routes to rooftop evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

AY107.4 Perimeter protection. The perimeter of rooftop evacuation locations shall be protected by:

1. Guards per Section R312 if a rooftop platform is provided; or
2. A railing that is 12 inches (305 mm) in height if a sloped roof is provided.

AY107.5 Utility/equipment buffer zone. A separation of 48 inches shall be provided between an evacuation location and any mechanical equipment, photovoltaic system, utility service drop or other utility line. Electrical service lines shall not pass over evacuation locations.

AY108 Attics that are evacuation locations. Attics that have finish floors no less than one (1) foot above the WSEL200 shall be permitted to be evacuation locations.

AY108.1 Headroom. When an attic is used as an evacuation location, the minimum headroom of the required area shall be 30 inches (762 mm) with 50 percent of the required area having a headroom of 60 inches (1524 mm).

AY108.2 Attic flooring. The required area of the evacuation location shall be solidly sheathed.

AY108.3 Attic live loads. Attic areas that are used as evacuation locations shall be designed for the attic with limited live load requirement in Table R301.5.

AY108.4 Evacuation routes to attic evacuation locations. In Group R-3.1 occupancies that are subject to the requirements of Chapter 11A or 11B, such requirements shall apply to the evacuation routes to attics. In Group R-3 occupancies, evacuation routes to attic evacuation locations shall be permitted to be provided by a stairway, ramp, alternating tread device, fixed ladder or other means approved by the building official.

AY108.5 Means of escape from attics. The means of escape from attics shall comply with Section AY105.

AY109 Alternate means of protection.

AY109.1 Request for approval of alternate means of protection. Requests for approval to use an alternative means of protection shall be made in writing to the building official by the owner or the owner's authorized representative. The request shall be accompanied by a full statement of the conditions and sufficient evidence that the proposed alternate means of protection provides reasonable protection to occupants. The building official shall require the owner to obtain a written statement from the applicable emergency management authority regarding plans and processes related to notification of anticipated conditions of flooding, warnings, evacuations and other pertinent conditions relative to the proximity of nearby levees. The building official shall also require the owner to obtain a written statement and findings from the entity that has jurisdiction over the management, maintenance, monitoring and control of flood protection works in the vicinity of the location of the owner's property, such statement shall comment on the viability of the proposed alternate means of protection. The building official may request written statements from the Central Valley Flood Protection Board, the California Department of Water Resources and the California Emergency Management Agency.

Approval of a request for use of an alternative means of protection made pursuant to these provisions shall be limited to the particular case covered by the request and shall not be construed as establishing any precedent for any future request except in substantially equivalent situations.

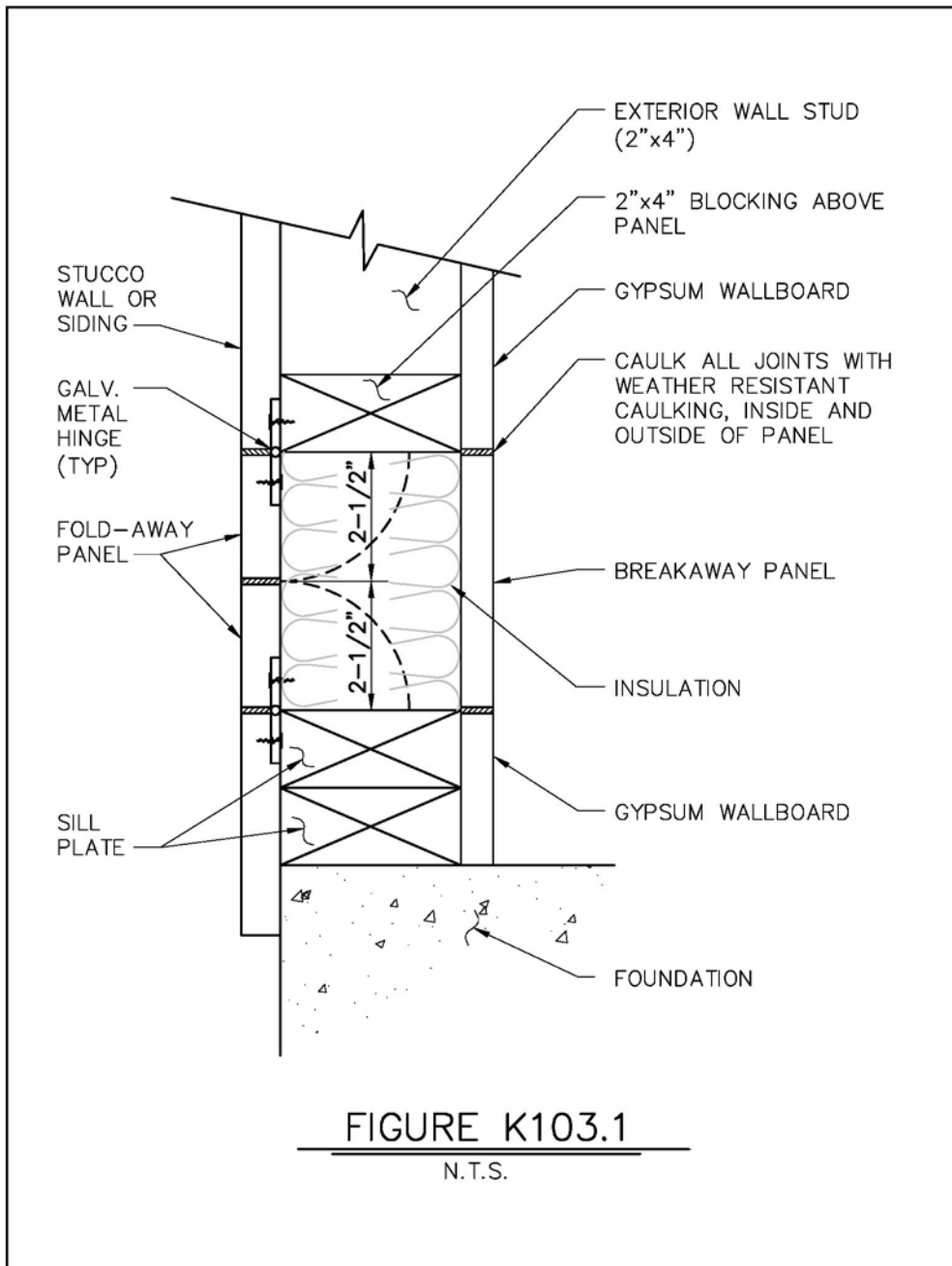
Note: Contact information for the California Department of Water Resources and the Department's Directory of Flood Officials, which includes levee and reclamation district boundary maps, is available online at the following website: www.water.ca.gov/BuildingCodes. The Department of Water Resources Building Code Project Engineer can be contacted at 916-574-1451. The Central Valley Flood Control

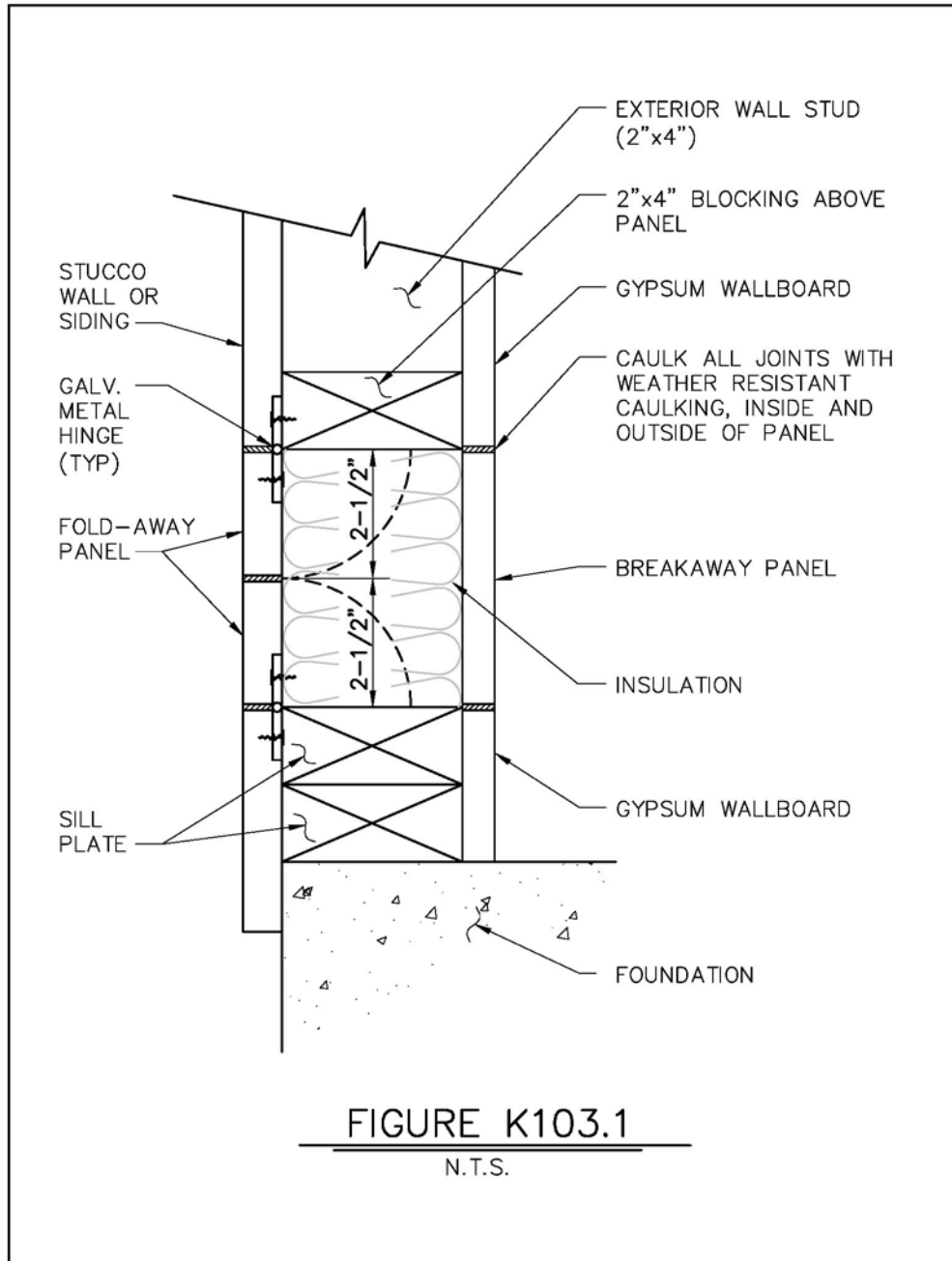
APPENDIX AY—AREAS PROTECTED BY THE FACILITIES OF THE CENTRAL VALLEY FLOOD PROTECTION PLAN

Board Chief Engineer can be contacted at 916-574-0609. The California Emergency Management Agency Inland Region Program Manager can be contacted at 916-845-8488.

may provide additional information to, and request additional written statements from the Central Valley Flood Protection Board, the California Department of Water Resources and the California Emergency Management Agency. If such additional written statements are provided, the board of appeals shall consider those statements.

AY109.2 Appeals. When a request for an alternate means of protection has been denied by the building official, the applicant may file a written appeal with the board of appeals. In considering such appeal, the board of appeals





CALIFORNIA RESIDENTIAL CODE – MATRIX ADOPTION TABLE

APPENDIX AZ – EMERGENCY HOUSING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt entire chapter				X																		
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

APPENDIX AZ

EMERGENCY HOUSING

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION AZ101 GENERAL

AZ101.1 Scope. This appendix shall be applicable to emergency housing and emergency housing facilities, as defined in Section AZ102.

SECTION AZ102 DEFINITIONS

AZ102.1 General. The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 of this code for general definitions.

DECLARATION OF SHELTER CRISIS. The duly proclaimed existence of a situation in which a significant number of persons are without the ability to obtain shelter, resulting in a threat to their health and safety. (See Government Code Section 8698.)

DEPENDENT UNIT. Emergency housing not equipped with a kitchen area, toilet and sewage disposal system. Recreational vehicles that are not self-contained and without utility service connections shall be considered dependent units.

EMERGENCY HOUSING. Housing in a permanent or temporary structure(s), occupied during a declaration of state of emergency, local emergency or shelter crisis. Emergency housing may include, but is not limited to, buildings and structures constructed in accordance with the California Building Standards Code; and emergency sleeping cabins, emergency transportable housing units and tents constructed in accordance with this appendix.

EMERGENCY HOUSING FACILITIES. On-site common use facilities supporting emergency housing. Emergency housing facilities include, but are not limited to, kitchen areas, toilets, showers and bathrooms with running water. The use of

emergency housing facilities is limited exclusively to the occupants of the emergency housing, personnel involved in operating the housing and other emergency personnel.

EMERGENCY HOUSING SITE. A site containing emergency housing and emergency housing facilities supporting the emergency housing.

EMERGENCY SLEEPING CABIN. Relocatable hard-sided structure constructed in accordance with this appendix, which may be occupied only for emergency housing if allowed by the enforcing agency.

EMERGENCY TRANSPORTABLE HOUSING UNIT. A single- or multiple-section prefabricated structure that is transportable by a vehicle and that can be installed on a permanent or temporary site in response to a need for emergency housing. Emergency transportable housing units include, but are not limited to, manufactured homes, mobile-homes, multifamily manufactured homes, recreational vehicles and park trailers. For the purposes of this appendix, emergency transportable housing units may also include commercial modulars as defined in the Health and Safety Code Section 18001.8, if approved by the enforcing agency.

Emergency transportable housing units do not include factory-built housing as defined in the Health and Safety Code Section 19971.

LANDING PLATFORM. A landing provided as the top step of a stairway accessing a loft.

LOCAL EMERGENCY. Local Emergency as defined in the Government Code, Section 8558.

LOFT. A floor level located more than 30 inches (762 mm) above the main floor and open to it on at least one side with a ceiling height of less than 6 feet 8 inches (2032 mm), used as a living or sleeping space.

MANUFACTURED HOME. A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18007.

MEMBRANE STRUCTURE. An air-inflated, air-supported, cable or frame-covered structure, not otherwise defined as a tent. (See Chapter 31 of the California Building Code.)

MOBILEHOME. A structure designed to be used as a single-family dwelling, as defined in the Health and Safety Code, Section 18008.

MULTIFAMILY MANUFACTURED HOME. A structure designed to contain not less than two dwelling units, as defined in the Health and Safety Code, Section 18008.7.

PARK TRAILER. A trailer designed for human habitation that meets all requirements in the Health and Safety Code, Section 18009.3.

RECREATIONAL VEHICLE. A motor home, travel trailer, truck camper or camping trailer, with or without motive power, designed for human habitation, that meets all requirements in the Health and Safety Code, Section 18010.

STATE OF EMERGENCY. State of Emergency as defined in the Government Code, Section 8558.

TENT. A structure, enclosure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported by any manner except by air or the contents that it protects.

SECTION AZ103 EMERGENCY HOUSING

AZ103.1 General. Emergency sleeping cabins, emergency transportable housing units, membrane structures and tents constructed and/or assembled in accordance with this appendix, shall be occupied only during declaration of state of emergency, local emergency or shelter crisis.

Buildings and structures constructed in accordance with the California Building Standards Code, used as emergency housing, shall be permitted to be permanently occupied.

AZ103.2 Existing buildings. Existing residential and nonresidential buildings or structures shall be permitted to be used as emergency housing and emergency housing facilities provided such buildings or structures comply with the building code provisions and/or other regulations in effect at the time of original construction and/or alteration. Existing buildings or structures used as emergency housing shall not become or continue to be substandard buildings, as determined by the enforcing agency.

AZ103.2.1 New additions, alterations and change of occupancy. New additions, alterations and change of occupancy to existing buildings shall comply with the requirements of the California Building Standards Code effective at the time of addition, alteration or change of occupancy. The requirements shall apply only to and/or within the specific area of the addition, alteration or change of occupancy.

Exception: Existing buildings and structures used for emergency housing and emergency housing facilities may not be required to comply with the California Energy Code, as determined by the enforcing agency.

AZ103.3 Occupant load. Except as otherwise stated in this appendix, the maximum occupant load allowed in buildings and structures used as emergency housing shall be determined by the enforcing agency, but the interior floor area shall not be less than 70 square feet (6.5 m²) for one occupant. Where more than one person occupies the building/structure, the required floor area shall be increased at the rate of 50 square feet (4.65 m²) for each occupant in excess of one.

Exceptions:

1. Tents.
2. Recreational vehicles and park trailers designed for human habitation that meet the requirements in the Health and Safety Code, Sections 18009.3 and 18010, as applicable.
3. For emergency housing, including emergency sleeping cabins, the minimum interior floor area may be reduced to 53 square feet (4.9 m²) if the enforcing agency determines that 53 square feet (4.9 m²) is adequate space for a single-occupancy sleeping unit.

AZ103.4 Fire and life safety requirements not addressed in this appendix. If not otherwise addressed in this appendix, fire and life safety measures, including, but not limited to, means of egress, fire separation, fire sprinklers, smoke alarms and carbon monoxide alarms, shall be determined and enforced by the enforcing agency.

AZ103.5 Privacy. Emergency housing shall be provided with a privacy lock on each entrance door and all windows for use by the occupants.

AZ103.6 Heating. All sleeping areas shall be provided with adequate heating as determined by the enforcing agency.

SECTION AZ104 EMERGENCY SLEEPING CABINS

AZ104.1 General. Emergency sleeping cabins shall have an interior floor area of not less than 70 square feet (6.5 m²) for one occupant. Where more than one person occupies the cabin, the required floor area shall be increased at the rate of 50 square feet (4.65 m²) for each occupant in excess of one. The interior floor area shall not exceed 400 square feet (37 m²), excluding lofts.

AZ104.2 Live loads. Emergency sleeping cabins shall be designed to resist intrusion of wind, rain, and to support the following live loads:

1. Floor live loads not less than 40 pounds per square foot (1.92 kPa) of floor area.
2. Horizontal live loads not less than 15 pounds per square foot (718 Pa) of vertical wall and roof area.
3. Roof live loads not less than 20 pounds per square foot (958 Pa) of horizontal roof area.
4. In areas where snow loads are greater than 20 pounds per square foot (958 Pa), the roof shall be designed and constructed to resist these additional loads.

AZ104.3 Minimum ceiling height. Habitable space and hallways in emergency sleeping cabins shall have a ceiling height of not less than 80 inches (2032 mm). Bathrooms, toilet rooms, and kitchens, if provided, shall have a ceiling height of not less than 76 inches (1930 mm). Obstructions

shall not extend below these minimum ceiling heights including beams, girders, ducts, lighting and other obstructions.

Exception: Ceiling heights in lofts constructed in accordance with Section AZ108 are permitted to be less than 80 inches (2032 mm).

AZ104.4 Means of egress. Emergency sleeping cabins shall be provided with at least two forms of egress placed remotely from each other. One form of egress may be an egress window complying with Section AZ104.4.1. When a loft is provided, one form of egress shall be an egress window complying with Section AZ104.4.1, provided in the loft space.

AZ104.4.1 Egress window. The bottom of the clear opening of the egress window shall not be more than 44 inches (1118 mm) above the floor. The egress window shall have a minimum net clear opening height of 24 inches (610 mm), and a minimum net clear opening width of 20 inches (508 mm). The egress window shall have a minimum net clear opening area of 5 square feet (0.465 m²).

AZ104.5 Plumbing and gas service. If an emergency sleeping cabin contains plumbing or gas service, it shall comply with all applicable requirements of the California Plumbing Code and the California Mechanical Code.

AZ104.6 Electrical. Emergency sleeping cabins shall be provided with all of the following installed in compliance with the California Electrical Code:

1. Continuous source of electricity.

Exception: The source of electricity may be an emergency generator or renewable source of power such as solar or wind power.

2. At least one interior lighting fixture.
3. Electrical heating equipment listed for residential use and a dedicated receptacle outlet for the electrical heating equipment.

Exception: Electrical heating equipment and a dedicated receptacle outlet for the electrical heating equipment are not required if non-electrical source of heating is provided.

4. At least one GFCI-protected receptacle outlet for use by the occupant(s).

AZ104.7 Ventilation. Emergency sleeping cabins shall be provided with means of ventilation (natural and/or mechanical) allowing for adequate air replacement, as determined by the enforcing agency.

AZ104.8 Smoke alarms. Emergency sleeping cabins shall be provided with at least one smoke alarm installed in accordance with Section R314.

AZ104.9 Carbon monoxide alarms. If an emergency sleeping cabin contains a fuel-burning appliance(s) or a fire-place(s), a carbon monoxide alarm shall be installed in accordance with Section R315.

SECTION AZ105

EMERGENCY TRANSPORTABLE HOUSING UNITS

AZ105.1 General. In addition to the requirements in this appendix, manufactured homes, mobilehomes, multifamily

manufactured homes, commercial modulars, recreational vehicles and park trailers used as emergency transportable housing shall comply with all applicable requirements in the Health and Safety Code, Division 13, Part 2; and Title 25, Division 1, Chapter 3, Subchapter 2.

SECTION AZ106

TENTS AND MEMBRANE STRUCTURES

AZ106.1 General. Tents shall not be used to house occupants for more than 7 days unless such tents are maintained with tight wooden floors raised at least 4 inches (101.6 mm) above the ground level and are equipped with baseboards on all sides to a height of at least 6 inches (152.4 mm). Tents may be maintained with concrete slabs with the finished surface at least 4 inches (101.6 mm) above grade and equipped with curbs on all sides at least 6 inches (152.4 mm) high.

A tent shall not be considered a suitable sleeping place when it is found necessary to provide heating facilities in order to maintain a minimum temperature of 50 degrees Fahrenheit (10 degrees Celsius) within such tent during the period of occupancy.

Membrane structures installed and/or assembled in accordance with Chapter 31 of the California Building Code, may be permitted to be used as emergency housing and emergency housing facilities, as determined by the enforcing agency.

SECTION AZ107

ACCESSIBILITY

AZ107.1 General. Emergency housing shall comply with the applicable requirements in the California Building Code, Chapter 11B, and/or the US Access Board Final Guidelines for Emergency Transportable Housing.

Note: The Architectural and Transportation Barriers Compliance Board (US Access Board) issued the Final Guidelines for Emergency Transportable Housing on May 7, 2014. The final guidelines amended the 2004 ADA Accessibility Guidelines (2004 ADAAG) and the 2004 Architectural Barriers Act (ABA) Accessibility Guidelines (2004 ABAAG) to specifically address emergency transportable housing units provided to disaster survivors by entities subject to the ADA or ABA. The final rule ensures that the emergency transportable housing units are readily accessible to and usable by disaster survivors with disabilities.

SECTION AZ108

LOFTS IN EMERGENCY HOUSING

AZ108.1 Minimum loft area and dimensions. Lofts used as a sleeping or living space shall meet the minimum area and dimension requirements of Sections AZ108.1.1 through AZ108.1.3.

AZ108.1.1 Minimum area. Lofts shall have a floor area of not less than 35 square feet (3.25 m²).

AZ108.1.2 Minimum dimensions. Lofts shall be not less than 5 feet (1524 mm) in any horizontal dimension.

AZ108.1.3 Height effect on loft area. Portions of a loft with a sloping ceiling measuring less than 3 feet (914 mm)

from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.

Exception: Under gable roofs with a minimum slope of 6:12, portions of a loft with a sloping ceiling measuring less than 16 inches (406 mm) from the finished floor to the finished ceiling shall not be considered as contributing to the minimum required area for the loft.

AZ108.2 Loft access. The access to and primary egress from lofts shall be any type described in Sections AZ108.2.1 through AZ108.2.4.

AZ108.2.1 Stairways. Stairways accessing lofts shall comply with this code or with Sections AZ108.2.1.1 through AZ108.2.1.6.

AZ108.2.1.1 Width. Stairways accessing a loft shall not be less than 17 inches (432 mm) in clear width at or above the handrail. The minimum width below the handrail shall be not less than 20 inches (508 mm).

AZ108.2.1.2 Headroom. The headroom in stairways accessing a loft shall be not less than 74 inches (1880 mm), as measured vertically, from a sloped line connecting the tread or landing platform nosings in the middle of their width.

AZ108.2.1.3 Treads and risers. Risers for stairs accessing a loft shall be not less than 7 inches (178 mm) and not more than 12 inches (305 mm) in height. Tread depth and riser height shall be calculated in accordance with one of the following formulas:

1. The tread depth shall be 20 inches (508 mm) minus $4/3$ of the riser height, or
2. The riser height shall be 15 inches (381 mm) minus $3/4$ of the tread depth.

AZ108.2.1.4 Landing platforms. The top step of stairways accessing lofts shall be constructed as a landing platform where the loft ceiling height is less than 74 inches (1880 mm). The landing platform shall be 18 inches (457 mm) to 22 inches (559 mm) in depth measured from the nosing of the landing platform to the edge of the loft, and 16 inches (406 mm) to 18 inches (457 mm) in height measured from the landing platform to the loft floor.

AZ108.2.1.5 Handrails. Handrails shall comply with Section R311.7.8.

AZ108.2.1.6 Stairway guards. Guards at open sides of stairways shall comply with Section R312.1.

AZ108.2.2 Ladders. Ladders accessing lofts shall comply with Sections AZ108.2.1 and AZ108.2.2.

AZ108.2.2.1 Size and capacity. Ladders accessing lofts shall have a rung width of not less than 12 inches (305 mm), and 10-inch (254 mm) to 14-inch (356 mm) spacing between rungs. Ladders shall be capable of supporting a 200 pound (90.7 kg) load on any rung. Rung spacing shall be uniform within $3/8$ inch (9.5 mm).

AZ108.2.2.2 Incline. Ladders shall be installed at 70 to 80 degrees from horizontal.

AZ108.2.3 Alternating tread devices. Alternating tread devices are acceptable as allowed by the enforcing agency.

AZ108.2.4 Loft guards. Loft guards shall be located along the open side of lofts. Loft guards shall not be less than 36 inches (914 mm) in height or one-half of the clear height to the ceiling, whichever is less. Loft guards shall not have openings from the walking surface to the required guard height that allow passage of a sphere 4 inches (102 mm) in diameter.

SECTION AZ109

LOCATION, MAINTENANCE AND IDENTIFICATION

AZ109.1 Maintenance. Emergency housing and emergency housing facilities shall be maintained in a safe and sanitary condition, and free from vermin, vectors and other matter of an infectious or contagious nature. The grounds within emergency housing sites shall be kept clean and free from accumulation of debris, filth, garbage and deleterious matter. Emergency housing and emergency housing facilities shall not be occupied if a substandard condition exists, as determined by the enforcing agency.

AZ109.1.1 Fire hazards. Dangerous materials or materials that create a fire hazard, as determined by the enforcing agency, shall not be allowed on the grounds within emergency housing sites.

AZ109.2 Identification. Emergency housing shall be designated by address numbers, letters or other suitable means of identification. The identification shall be in a conspicuous location facing the street or driveway fronting the building or structure. Each identification character shall be not less than 4 inches (102 mm) in height and not less than 0.5 inch (12.7 mm) in width, installed/painted on a contrasting background.

SECTION AZ110

EMERGENCY HOUSING FACILITIES

AZ110.1 Drinking water. Potable drinking water shall be provided for all occupants of emergency housing.

AZ110.2 Kitchens. Where occupants of dependent units are permitted or required to cook for themselves, a separate area shall be equipped and maintained as a common use kitchen. Refrigerated storage shall be provided for safe storage of food.

AZ110.3 Toilet and bathing facilities. When dependent units are used as emergency housing, the emergency housing site shall be provided with one toilet and one bathing facility for every 15 occupants of each gender. The enforcing agency may permit different types and ratios of toilet and bathing facilities. The approval shall be based upon a finding that the type and ratio of toilet and bathing facilities are sufficient to process the anticipated volume of sewage and waste water, while maintaining sanitary conditions for the occupants of the emergency housing.

Bathing facilities shall be provided with heating equipment which shall be capable of maintaining a temperature of 70 degrees F (21.0 degrees Celsius) within such facilities.

Lavatories with running water shall be installed and maintained in the toilet facilities or adjacent to the toilet facilities.

AZ110.4 Garbage, waste and rubbish disposal. *All garbage, kitchen waste and rubbish shall be deposited in approved covered receptacles, which shall be emptied when filled and the contents shall be disposed of in a sanitary manner acceptable to the enforcing agency.*

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HISTORY NOTE APPENDIX

2022 California Residential Code California Code of Regulations, Title 24, Part 2.5

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HISTORY:

For prior code history, see the History Note Appendix to the *California Residential Code, 2019 Triennial Edition*, effective January 1, 2020.

1. (BSC 06/21, CEC 03/21, HCD 06/21, SFM 05/21)—Adoption by reference of the 2021 *International Residential Code* with necessary amendments to become the 2022 *California Residential Code*, and repeal of the 2018 edition of the *International Residential Code*; effective on January 1, 2023.

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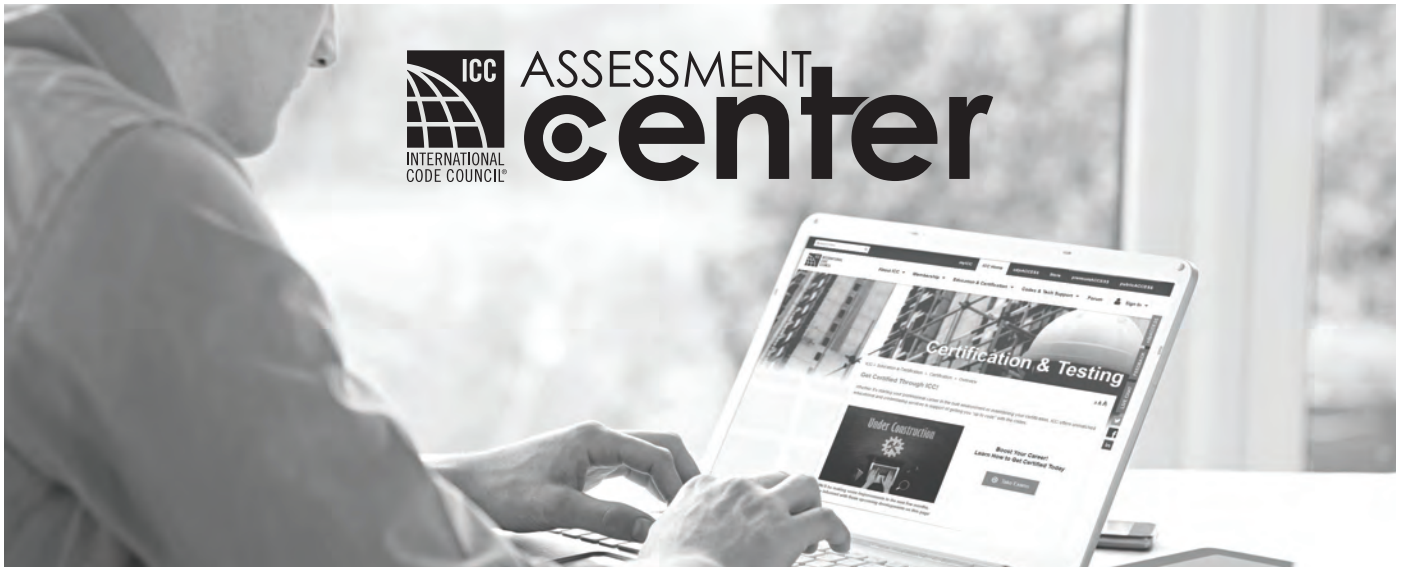
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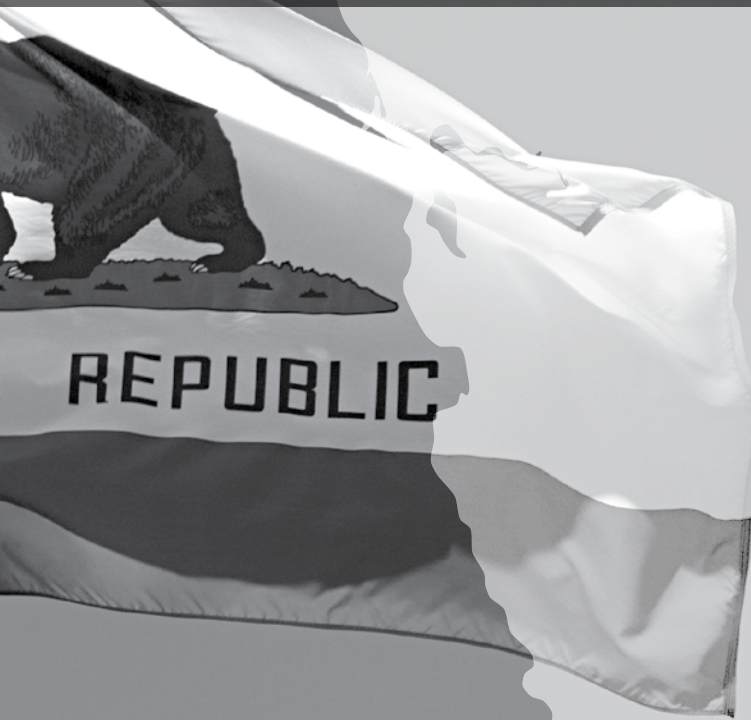
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2022 CALIFORNIA ENERGY CODE

CALIFORNIA CODE OF REGULATIONS | TITLE 24, PART 6

California Building Standards Commission



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2022 CALIFORNIA ENERGY CODE

CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 6

California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is the Part 6 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Energy Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833–2936

Phone: (916) 263–0916
Email: cbsc@dgs.ca.gov

Web page: www.dgs.ca.gov/bsc

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The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections, and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Edmund G. Brown Jr.

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For questions on California state agency amendments, please refer to the contact list on page v.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

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Detention Facility Standards

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State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

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Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312
Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200
Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 574-7900
Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210
Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041
Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188
Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220
Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov
Meat & Poultry Packing Plant Standards
Rendering & Collection Center Standards (916) 900-5004
Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (916) 445-9471
Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks
(916) 445-3338
Factory-Built Housing, Manufactured Housing &
Commercial Modular
Mobilehome—Permits & Inspections
Northern Region—(916) 255-2501
Southern Region—(951) 782-4420
(916) 445-9471
Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661
Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

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Fire and Life Safety

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Community College Standards

State Historical Building Safety Board

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Restoration or Relocation Standards

Office of Statewide Health Planning and Development

www.oshpd.ca.gov (916) 440-8356
Hospital Standards
Skilled Nursing Facility Standards &
Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800
Code Development and Analysis
Fire Safety Standards

HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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SUBCHAPTER 1

ALL OCCUPANCIES—GENERAL PROVISIONS

SECTION 100.0 SCOPE

(a) **Buildings covered.** The provisions of Part 6 apply to all buildings:

1. That are of Occupancy Group A, B, E, F, H, I, M, R, S or U; and
2. For which an application for a building permit or renewal of an existing permit is filed (or is required by law to be filed) on or after the effective date of the provisions, or which are constructed by a governmental agency; and
3. That are:
 - A. Unconditioned; or
 - B. Indirectly or directly conditioned, or process spaces.

Exception 1 to Section 100.0(a): Qualified historic buildings as regulated by the *California Historic Building Code* (Title 24, Part 8). Lighting in qualified historic buildings shall comply with the applicable requirements in Section 140.6(a)3Q.

Exception 2 to Section 100.0(a): Building departments, at their discretion, may exempt temporary buildings, temporary outdoor lighting or temporary lighting in an unconditioned building, or structures erected in response to a natural disaster. Temporary buildings or structures shall be completely removed upon the expiration of the time limit stated in the permit.

Exception 3 to Section 100.0(a): Buildings in Occupancy Group I-3 and I-4.

(b) **Parts of buildings regulated.** The provisions of Part 6 apply to the building envelope, space-conditioning systems, water-heating systems, pool and spas, solar ready buildings, indoor lighting systems of buildings, outdoor lighting systems, electrical power distribution systems, and signs located either indoors or outdoors, in buildings that are:

1. Covered by Section 100.0(a); and
2. Set forth in Table 100.0-A.

(c) **Habitable stories.**

1. All conditioned space in a story shall comply with Part 6, whether or not the story is a habitable space.
2. All unconditioned space in a story shall comply with the lighting requirements of Part 6, whether or not the story is a habitable space.

(d) **Outdoor lighting and indoor and outdoor signs.** The provisions of Part 6 apply to outdoor lighting systems and to signs located either indoors or outdoors as set forth in Table 100.0-A.

(e) **Sections applicable to particular buildings.** Table 100.0-A and this subsection list the provisions of Part 6 that are applicable to different types of buildings covered by Section 100.0(a).

1. **All buildings.** Sections 100.0 through 110.12 apply to all buildings.

Exception to Section 100.0(e)1: Spaces or requirements not listed in Table 100.0-A.

2. **Newly constructed buildings.**

A. **All newly constructed buildings.** Sections 110.0 through 110.12 apply to all newly constructed buildings within the scope of Section 100.0(a). In addition, newly constructed buildings shall meet the requirements of Subsections B, C, D or E, as applicable.

B. **Nonresidential and hotel/motel buildings that are mechanically heated or mechanically cooled.**

i. **Sections applicable.** Sections 120.0 through 140.8 apply to newly constructed nonresidential buildings and hotels/motels that are mechanically heated or mechanically cooled.

ii. **Compliance approaches.** In order to comply with Part 6, newly constructed nonresidential buildings and hotels/motels that are mechanically heated or mechanically cooled must meet the requirements of:

a. **Mandatory measures:** The applicable provisions of Sections 120.0 through 130.5; and

b. **Either:**

(i) Performance approach: Section 140.1; or

(ii) Prescriptive approach: Sections 140.2 through 140.8.

C. **Unconditioned nonresidential buildings and process space.** Sections 110.9, 110.10, 130.0 through 130.5, 140.3(c), 140.6, 140.7 and 140.9 apply to all newly constructed unconditioned buildings and 140.1, and 140.3(c), for process spaces within the scope of Section 100.0(a).

D. **Single-family buildings.**

i. **Sections applicable.** Sections 150.0 through 150.1 apply to newly constructed single-family buildings.

ii. **Compliance approaches.** In order to comply with Part 6, newly constructed single-family buildings must meet the requirements of:

a. **Mandatory measures:** The applicable provisions of Sections 110.0 through 110.10 and 150.0; and

b. **Either:**

(i) Performance approach: Section 150.1(a) and (b); or

(ii) Prescriptive approach: Sections 150.1(a) and (c).

Exception to Section 100.0(e)2Diib: Seasonally occupied agricultural housing limited by state or federal agency contract to occupancy not more than 180 days in any calendar year.

ALL OCCUPANCIES—GENERAL PROVISIONS

TABLE 100.0-A—APPLICATION OF STANDARDS

OCCUPANCIES	APPLICATION	MANDATORY	PRESCRIPTIVE	PERFORMANCE	ADDITIONS/ ALTERATIONS
All Buildings	General	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0	100.0, 100.1, 100.2, 110.0
Nonresidential and Hotels/ Motels	General	120.0	140.0, 140.2	140.0, 140.1	141.0
	Envelope (conditioned)	110.6, 110.7, 110.8, 120.7	140.3		
	Envelope (unconditioned, process spaces)	N.A.	140.3(c)		
	HVAC (conditioned)	110.2, 110.5, 120.1, 120.2, 120.3, 120.4, 120.5, 120.8	140.4		
	Water Heating	110.3, 120.3, 120.8, 120.9	140.5		
	Indoor Lighting (conditioned, process spaces)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6	N.A.	
	Indoor Lighting (unconditioned and parking garages)	110.9, 120.8, 130.0, 130.1, 130.4	140.3(c), 140.6		
	Outdoor Lighting	110.9, 130.0, 130.2, 130.4	140.7		
	Electrical Power Distribution	110.11, 130.5	N.A.		
	Pool and Spa Systems	110.4, 110.5, 150.0(p)			
	Solar Ready Buildings	110.10			
	Solar PV and Battery Storage Systems	N.A.	141.10	140.0, 140.1	N.A.
Covered Processes ¹	Envelope, Ventilation, Process Loads	110.2, 120.6	140.9	140.1	120.6, 140.9, 141.1
Signs	Indoor and Outdoor	110.9, 130.0, 130.3	140.8	N.A.	141.0, 141.0(b)2H
Single-family	General	150.0	150.1(a), (c)	150.1(a), (b)	150.2(a), (b)
	Envelope (conditioned)	110.6, 110.7, 110.8, 150(a), 150.0(b), 150.0(c), 150.0(d), 150.0(e), 150.0(g), 150.0(q)			
	HVAC (conditioned)	110.2, 110.5, 150.0(h), 150.0(i), 150.0(j), 150.0(m), 150.0(o)			
	Water Heating	110.3, 150.0(j, n)			
	Indoor Lighting (conditioned, unconditioned and parking garages)	110.9, 130.0, 150.0(k)			
	Outdoor Lighting	110.9, 130.0, 150.0(k)			
	Pool and Spa Systems	110.4, 150.0(p)	N.A.	N.A.	
	Solar Ready Buildings	110.10	N.A.	N.A.	N.A.
	Electric Ready	150.0(s), 150.0(t), 150.0(u), 150.0(v)	N.A.	N.A.	N.A.
	Solar PV Systems	N.A.	150.0(c)14	150.1(a), (b)	N.A.
Multifamily	General	160.0	170.2	170.1	180.0
	HVAC (conditioned)	110.6, 110.7, 110.8, 160.1	170.1(a)		
	Ventilation and Indoor Air Quality	160.2	N.A.		
	HVAC (conditioned)	110.2, 110.5, 160.3	170.2(c)		
	Water Heating	110.3, 160.4	170.2(d)		
	Indoor Lighting	110.9, 160.5	170.2(e)		
	Outdoor Lighting	110.9, 160.5	170.2(e)	N.A.	
	Electrical Power Distribution	110.11, 160.6	N.A.		
	Pool and Spa Systems	110.4, 110.5, 160.7			
	Solar Ready Buildings	110.10, 160.8			
	Electric Ready	160.9			
Solar PV and Battery Storage Systems	N.A.	170.2(f), (g), (h)		170.1	N.A.

1. Nonresidential and hotel/motel buildings that contain covered processes may conform to the applicable requirements of both occupancy types listed in this table.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

E. Multifamily Buildings.

- i. Sections applicable. Sections 160.0 through 170.2 apply to newly constructed multifamily buildings.
- ii. Compliance approaches. In order to comply with Part 6, newly constructed multifamily buildings must meet the requirements of:
 - a. Mandatory measures: The applicable provisions of Sections 110.0 through 110.10, and 160.0; and
 - b. Either:
 - (i) Performance approach: Section 170.1; or
 - (ii) Prescriptive approach: Section 170.2(a) through (f).

F. Covered processes.

- i. Sections applicable. Sections 110.2, 120.6 and 140.9 apply to covered processes.
- ii. Compliance approaches. In order to comply with Part 6, covered processes must meet the requirements of:
 - a. The applicable mandatory measures in Section 120.6; and
 - b. Either:
 - (i) The performance approach requirements of Section 140.1; or
 - (ii) The prescriptive approach requirements of Section 140.9.

Note: If covered processes do not have prescriptive requirements, then only the applicable mandatory measures in Section 120.6 must be met.

3. New construction in existing buildings (additions, alterations and repairs).

A. Nonresidential and hotel/motel buildings. Section 141.0 applies to new construction in existing nonresidential, high-rise residential and hotel/motel buildings. New construction in existing buildings includes additions, alterations and repairs. Section 141.0 specifies requirements that uniquely apply to additions, alterations or repairs to existing buildings, and specify which requirements in other sections also apply. For alterations that change the occupancy classification of the building, the requirements specified in Section 141.0 apply to the occupancy after the alterations.

B. Single-family buildings. Section 150.2 applies to new construction in existing single-family buildings. New construction in existing buildings includes additions, alterations and repairs. Section 150.2 specifies requirements that uniquely apply to additions, alterations or repairs to existing buildings, and specifies which requirements in other sections also apply. For alterations that change the occupancy classification of the building, the requirements spec-

ified in Section 150.2 apply to the occupancy after the alterations.

C. Multifamily buildings. Section 180.0 applies to new construction in existing multifamily buildings. New construction in existing buildings includes additions, alterations and repairs. Section 180.0 specifies requirements that uniquely apply to additions, alterations or repairs to existing buildings, and specifies which requirements in other sections also apply. For alterations that change the occupancy classification of the building, the requirements specified in Section 180.0 apply to the occupancy after the alterations.

4. Installation of insulation in existing buildings. Section 110.8(d) applies to buildings in which insulation is being installed in existing attics, or on existing water heaters or existing space conditioning ducts.

5. Outdoor lighting. Sections 110.9, 130.0, 130.2, 130.4, 140.7, and 150.0 apply to newly constructed outdoor lighting systems, and Section 141.0 applies to outdoor lighting that is either added or altered.

6. Signs. Sections 130.0, 130.3 and 140.8 apply to newly constructed signs located either indoors or outdoors, and Section 141.0 applies to sign alterations located either indoors or outdoors.

(f) Mixed occupancy. When a building is designed and constructed for more than one type of occupancy (residential and nonresidential), the space for each occupancy shall meet the provisions of Part 6, applicable to that occupancy.

Exception 1 to Section 100.0(f): If one occupancy constitutes at least 80 percent of the conditioned floor area of the building, the entire building envelope, HVAC and water heating may be designed to comply with the provisions of Part 6 applicable to that occupancy, provided that the applicable lighting requirements in Sections 140.6 through 140.8, 150.0(k), or 160.5 and 170.2(e) are met for each occupancy and space, and mandatory measures in Sections 110.0 through 130.5, 150.0, and 160.0 through 160.9 are met for each occupancy and space.

Exception 2 to Section 100.0(f): If one occupancy constitutes at least 90 percent of the combined conditioned plus unconditioned floor area of the building, the entire building indoor lighting may be designed to comply with only the lighting provisions of Part 6 applicable to that occupancy.

(g) Administrative requirements. Administrative requirements relating to permit requirements, enforcement by the Commission, locally adopted energy standards, interpretations, claims of exemption, approved calculation methods, rights of appeal, and certification and labeling requirements of fenestration products and roofing products are specified in California Code of Regulations, Title 24, Part 1, Sections 10-101 to 10-114.

(h) Certification requirements for manufactured equipment, products and devices. Part 6 limits the installation of manufactured equipment, products and devices to those that have been certified as specified by Sections 110.0 and 110.1.

Requirements for manufactured equipment, products, and devices, when not specified in Title 24 Part 6, are specified in California Code of Regulations, Title 20, Sections 1601–1609.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 100.1
DEFINITIONS AND RULES OF CONSTRUCTION**

(a) Rules of Construction.

1. Where the context requires, the singular includes the plural and the plural includes the singular.
2. The use of “and” in a conjunctive provision means that all elements in the provision must be complied with or must exist to make the provision applicable. Where compliance with one or more elements suffices, or where existence of one or more elements makes the provision applicable, “or” (rather than “and/or”) is used.
3. “Shall” is mandatory and “may” is permissive.

(b) Definitions. Terms, phrases, words and their derivatives in Part 6, shall be defined as specified in Section 100.1. Terms, phrases, words and their derivatives not found in Section 100.1 shall be defined as specified in the “Definitions” chapters of Title 24, Parts 1 through 5 of the California Code of Regulations. Where terms, phrases, words and their derivatives are not defined in any of the references above, they shall be defined as specified in *Webster’s Third New International Dictionary of the English Language, Unabridged* (1961 edition, through the 2002 addenda), unless the context requires otherwise.

AAMA/WDMA/CSA 101/LS.2/A440-17 are the American Architectural Manufacturers Association/Window and Door Manufacturers Association/Canadian Standards Association document titled “North American Fenestration Standard/Specification for windows, doors, and skylights” (2017).

ACCA is the Air-Conditioning Contractors of America.

ACCA MANUAL J is the Air-Conditioning Contractors of America document titled “Manual J-Residential Load Calculation, (ANSI/ACCA 2 Manual J – 2016).

ACCEPTANCE REQUIREMENTS FOR CODE COMPLIANCE is a description of test procedures in the Reference Nonresidential Appendices that includes equipment and systems to be tested, functions to be tested, conditions under which the test shall be performed, the scope of the tests, results to be obtained and measurable criteria for acceptable performance.

ACCESSIBLE is having access thereto, but which first may require removal or opening of access panels, doors or similar obstructions.

ADDITION is any change to a building that increases conditioned floor area and conditioned volume. See also, “newly conditioned space.” Addition is also any change that

increases the floor area and volume of an unconditioned building of an occupancy group or type regulated by Part 6. Addition is also any change that increases the illuminated area of an outdoor lighting application regulated by Part 6.

ADIABATIC PAD is a material located before the heat transfer surface of an adiabatic condenser, which precools the ambient air by becoming fully wetted during precool mode operation.

AGRICULTURAL BUILDING is a structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. It is not a structure that is a place of human habitation, a place of employment where agricultural products are processed, treated or packaged, or a place used by the public.

AHAM is the Association of Home Appliance Manufacturers.

AHAM HRH-2 is the Association of Home Appliance Manufacturers document titled “Residential Kitchen Range Hood Performance Test Procedures,” 2020 (AHAM HRH-2).

AHAM RKRH-CPPG is the Association of Home Appliance Manufacturers document titled “Residential Kitchen Range Hood Certification Program Procedural Guide,” 2020 (version 3).

AHRI is the Air-Conditioning, Heating and Refrigeration Institute.

AHRI 210/240 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment,” 2017 (AHRI Standard 210/240-2017 with Addenda 1).

AHRI 310/380 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Packaged Terminal Air-Conditioners and Heat Pumps (CSA-C744-17),” 2004 (AHRI 310/380-2017).

AHRI 340/360 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment,” 2019 (AHRI Standard 340/360 (I-P)-2019).

AHRI 365 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units,” 2009 (ANSI/AHRI Standard 365 (I-P)-2009).

AHRI 390 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Single Package Vertical Air-Conditioners and Heat Pumps,” 2003 (ANSI/AHRI Standard 390 (I-P)-2003).

AHRI 400 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Liquid to Liquid Heat Exchangers,” 2015 (ANSI/AHRI Standard 400 (I-P)-2015).

AHRI 430 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Central Station Air-handling Unit Supply Fans,” 2020 (AHRI Standard 430 (I-P)-2020).

AHRI 440 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Fan-coil Units,” 2019 (AHRI Standard 440 (I-P)-2019).

> **AHRI 460** is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers,” 2005 (ANSI/AHRI Standard 460-2005).

AHRI 550/590 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Water Chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle,” 2020 (AHRI Standard 550/590 (I-P)-2020).

> **AHRI 560** is the Air-Conditioning, Heating and Refrigeration Institute document titled “Absorption Water Chilling and Water Heating Packages,” 2000 (AHRI Standard 560-2000).

> **AHRI 680** is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Residential Air Filter Equipment,” 2017 (AHRI Standard 680-2017).

AHRI 920 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Direct Expansion-Dedicated Outdoor Air System Units,” 2020 (AHRI Standard 920 (I-P)-2020).

AHRI 1060 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment,” 2018 (AHRI Standard 1060 (I-P)-2018).

AHRI 1230 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment,” 2014 (AHRI Standard 1230-2014) with Addendum 1.

AHRI 1360 is the Air-Conditioning, Heating and Refrigeration Institute document titled “Performance Rating of Computer and Data Processing Room Air Conditioners,” 2017 (AHRI Standard 1360 (I-P)-2017).

AIR, AVAILABLE TRANSFER is that portion of total outdoor ventilation air that is not required to satisfy other exhaust needs or to maintain pressurization of other spaces and that is transferable according to Section 120.1(g).

AIR, INFILTRATION is outdoor air that enters a building or space through openings in the building or space envelope due to negative pressure in the space or building relative to the exterior of the building envelope.

AIR, MAKEUP, or COMPENSATING OUTDOOR AIR is outdoor air that is intentionally conveyed by openings or ducts into the building from the outside; is supplied to the vicinity of an exhaust hood; and replaces air, vapor and contaminants being exhausted by the exhaust hood. Makeup air is generally filtered and fan-forced, and it may be heated or cooled. Makeup air may be delivered through openings or ducts integral to the exhaust hood.

AIR, REPLACEMENT is air that is used to replace air removed from a building through an exhaust system. Replacement air may be derived from one or more of the fol-

lowing: makeup air, portions of supply air, transfer air, or infiltration air.

AIR, SUPPLY is air entering a space from an air-conditioning, heating, or ventilating system for the purpose of comfort conditioning. Supply air is generally filtered, fan-forced, and heated, cooled, humidified or dehumidified as necessary to maintain specified temperature and humidity conditions.

AIR, TRANSFER is air transferred, whether actively by fans or passively by pressure differentials, from one room to another within a building through openings in the room envelope.

AIR BARRIER is a combination of interconnected materials and assemblies joined and sealed together to provide a continuous barrier to air leakage through the building envelope that separates conditioned from unconditioned space, or that separates adjoining conditioned spaces of different occupancies or uses.

AIR CONDITIONER is an appliance that supplies cooled and dehumidified air to a space for the purpose of cooling objects within the space.

AIR CURTAIN UNIT means equipment providing a directionally controlled stream of air moving across the entire height and width of an opening that reduces the infiltration or transfer of air from one side of the opening.

AIR FILTER, AIR FILTER EQUIPMENT, or AIR FILTER DEVICE is air-cleaning equipment used for removing particulate matter from the air.

AIR FILTER MEDIA is the part of the air filter equipment which is the actual particulate removing agent.

AIR-COOLED AIR CONDITIONER is an air conditioner using an air-cooled condenser.

AIR-HANDLING UNIT or AIR HANDLER is a blower or fan that distributes supply air to a room, space or area.

AIR-SOURCE HEAT PUMP is an appliance that consists of one or more factory-made assemblies that includes an indoor conditioning coil, a compressor and a refrigerant-to-air heat exchanger, and that provides heating and cooling functions.

AIR-TO-AIR HEAT EXCHANGER is a device which will reduce the heat losses or gains that occur when a building is mechanically ventilated, by transferring heat between the conditioned air being exhausted and outside air being supplied.

ALTERATION is any change to a building’s water-heating system, space-conditioning system, lighting system, electrical power distribution system, or envelope that is not an addition. Alteration is also any change that is regulated by Part 6 to an outdoor lighting system that is not an addition. Alteration is also any change that is regulated by Part 6 to signs located either indoors or outdoors. Alteration is also any change that is regulated by Part 6 to a covered process that is not an addition. (See also “fenestration alteration”.)

ALTERED COMPONENT is a component that has undergone an alteration.

ALTERNATING CURRENT-OUTPUT UNINTERRUPTIBLE POWER SUPPLY (AC-OUTPUT UPS) is a combination of converters, switches and energy storage devices, such as batteries, constituting a power system for maintaining continuity of load power in case of input power failure. Input power failure occurs when voltage and frequency are outside rated steady-state and transient tolerance bands or when distortion or interruptions are outside the limits specified for the uninterruptible power supply. An AC-output UPS is an uninterruptible power supply that supplies power with a continuous flow of electric charge that periodically reverses direction.

ALTERNATIVE CALCULATION METHODS (ACM) are compliance software, or alternative component packages, or exceptional methods approved by the Commission under Section 10-109. ACMs are also referred to as Compliance Software.

ALTERNATIVE CALCULATION METHODS (ACM) APPROVAL MANUAL are the documents establishing the requirements for Energy Commission approval of Compliance Software used to demonstrate compliance with the Building Energy Efficiency Standards for Residential and Nonresidential Buildings currently adopted by the Energy Commission.

AMCA is the Air Movement and Control Association.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE) is a measure of the percentage of heat from the combustion of gas or oil which is transferred to the space being heated during a year, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

ANNUNCIATED is a type of visual signaling device that indicates the on, off, or other status of a load.

ANSI is the American National Standards Institute.

ANSI/AMCA 208 is the Air Movement and Control Association document titled “Calculation of the Fan Energy Index,” 2018 (ANSI/AMCA 208-18).

ANSI/AMCA 210 is the Air Movement and Control Association document titled “Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating,” 2016 (ANSI/AMCA 210-16).

ANSI/AMCA STANDARD 500-D is the American National Standards Institute / Air Movement and Control Association document titled “Laboratory Methods of Testing Dampers for Rating” 2018 (ANSI/AMCA 500-D-2018).

ANSI/ASABE S640 is the American National Standards Institute/American Society of Agricultural and Biological Engineers document titled “Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms),” 2017 (ANSI/ASABE S640 JUL2017).

ANSI/ASSP Z9.5 is the American National Standards Institute document titled “Laboratory Ventilation,” 2012 (ANSI/AIHA/ASSPE Z9.5-2012).

ANSI C82.6 is the American National Standards Institute document titled “AMERICAN NATIONAL STANDARD

FOR LAMP BALLASTS—Ballasts for High-Intensity Discharge Lamps—Methods of Measurement,” 2020 (ANSI C82.6-2015 (R2020)).

ANSI/CTA-2045-B is the American National Standards Institute document titled “Modular Communications Interface for Energy Management,” 2021 (ANSI/CTA-2045-B-2021).

ANSI/NEMA WD 6 is the National Electrical Manufacturers Association Document titled “American National Standard for Wiring Devices—Dimensional Specification,” 2016 (ANSI/NEMA WD 6-2016).

ANSI Z21.40.4a is the American National Standards Institute document titled “Performance Testing and Rating of Gas-Fired, Air Conditioning and Heat Pump Appliances,” 2017 (ANSI Z21.40.4a-1996 (R2017)/CGA 2.94a-M96 (R2017)).

ANSI Z21.47 is the American National Standards Institute document titled “Gas-Fired Central Furnaces,” 2021 (ANSI Z21.47-2021/CSA 2.3-2021).

ANSI Z83.8 is the American National Standards Institute document titled “Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces,” 2016 (ANSI Z83.8-2016/CSA 2.6-2016 (R2021)).

APPLIANCE EFFICIENCY REGULATIONS are the regulations in Title 20, Sections 1601 et seq. of the California Code of Regulations.

APPROVED CALCULATION METHOD (See “alternative calculation methods.”)

ASCE 7-16 is the American Society of Civil Engineers Standard 7-16.

ASHRAE is the American Society of Heating Refrigerating and Air-Conditioning Engineers.

ASHRAE CLIMATIC DATA FOR REGION X is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “ASHRAE Climatic Data for Region X, Arizona, California, Hawaii and Nevada,” Publication SPCDX, 1982 and “Supplement,” 1994.

ASHRAE HANDBOOK, APPLICATIONS VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Applications” (I-P) (2019).

ASHRAE HANDBOOK, FUNDAMENTALS VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “ASHRAE Handbook: Fundamentals” (I-P) (2017).

ASHRAE HANDBOOK, SYSTEMS AND EQUIPMENT VOLUME is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “ASHRAE Handbook: Heating, Ventilating, and Air-Conditioning Systems and Equipment” (I-P) (2020).

ASHRAE STANDARD 52.2 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Method of Testing General Ventilation Air-

Cleaning Devices for Removal Efficiency by Particle Size,” 2017 (ANSI/ASHRAE Standard 52.2-2017).

ASHRAE STANDARD 55 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Thermal Environmental Conditions for Human Occupancy,” 2020 (ANSI/ASHRAE Standard 55-2020).

ASHRAE STANDARD 62.1 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Ventilation for Acceptable Indoor Air Quality,” 2019 (ANSI/ASHRAE Standard 62.1-2019, including Addenda y, ao, P, B).

ASHRAE STANDARD 62.2 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Ventilation and Acceptable Indoor Air Quality in Residential Buildings,” 2019 (ANSI/ASHRAE Standard 62.2-2019 including ANSI/ASHRAE Addenda v and d published in the 2020 Supplement).

ASHRAE STANDARD 84 is the American National Standards Institute/American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Method of Testing Air-to-Air Heat/Energy Exchangers,” 2020 (ANSI/ASHRAE 84-2020).

ASHRAE STANDARD 90.1 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Energy Standards for Buildings Except Low-Rise Residential Buildings,” 2019 (ANSI/ASHRAE/IES Standards 90.1-2019).

ASHRAE STANDARD 154 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Ventilation for Commercial Cooking Operations,” 2016 (ANSI/ASHRAE Standard 154-2016).

ASHRAE STANDARD 193 is the American Society of Heating, Refrigerating and Air-Conditioning Engineers document titled “Method of Test for Determining the Airtightness of HVAC Equipment,” RA2014 (ANSI/ASHRAE Standard 193-RA2014).

ASME is the American Society of Mechanical Engineers.

ASME A17.1/CSA B44 is the American Society of Mechanical Engineers document titled “Safety Code for Elevators and Escalators,” 2019 (ASME A17.1-2019/CSA B44-2019).

ASME A112.18.1/CSA B125.1 is the American Society of Mechanical Engineers document titled “Plumbing Supply Fittings,” 2018 (ASME A112.18.1-2018/CSA B125.1-18).

ASTM is the American Society for Testing and Materials International.

ASTM C55 is the American Society for Testing and Materials document titled “Standard Specifications for Concrete Building Brick,” 2017 (ASTM C55-17).

ASTM C177 is the American Society for Testing and Materials document titled “Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus,” 2019 (ASTM C177-19).

ASTM C272 is the American Society for Testing and Materials document titled “Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions,” 2018 (ASTM C272/C272M-18).

ASTM C335/C335M is the American Society for Testing and Materials document titled “Standard Test Method for Steady-State Heat Transfer Properties of Pipe Insulation,” 2017 (ASTM C335/C335M-17).

ASTM C518 is the American Society for Testing and Materials document titled “Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus,” 2017 (ASTM C518-17).

ASTM C731 is the American Society for Testing and Materials document titled “Standard Test Method for Extrudability, After Package Aging of Latex Sealants,” 2015 (ASTM C731-15).

ASTM C732 is the American Society for Testing and Materials document titled “Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants,” 2017 (ASTM C732-17).

ASTM C836 is the American Society for Testing and Materials document titled “Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course,” 2018 (ASTM C836/C836M-18).

ASTM C1167 is the American Society for Testing and Materials document titled “Standard Specification for Clay Roof Tiles,” 2017 (ASTM C1167-11(2017)).

ASTM C1371 is the American Society for Testing and Materials document titled “Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers,” 2015 (ASTM C1371-15).

ASTM C1492 is the American Society for Testing and Materials document entitled “Standard Specification for Concrete Roof Tile,” 2016 [ASTM C1492-03 (2016)].

ASTM C1549 is the American Society for Testing and Materials document entitled “Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer,” 2016 (ASTM C1549-16).

ASTM C1583 is the American Society for Testing and Materials document titled “Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method),” 2020 (ASTM C1583/C1583M-20).

ASTM D448 is the American Society for Testing and Materials document titled “Standard Classification for Sizes of Aggregate for Road and Bridge Construction,” 2017 [ASTM D448-12(2017)].

ASTM D522 is the American Society for Testing and Materials document titled “Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings,” 2017 (ASTM D522/D522M-17).

ASTM D822 is the American Society for Testing and Materials document titled “Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings,” 2018 (ASTM D822/D822M-13(2018)).

ASTM D1003 is the American Society for Testing and Materials document titled “Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics,” 2021 (ANSI/ASTM D1003-21).

ASTM D1653 is the American Society for Testing and Materials document titled “Standard Test Methods for Water Vapor Transmission of Organic Coating Films,” 2021 (ASTM D1653-21).

ASTM D1863 is the American Society for Testing and Materials document titled “Standard Specification for Mineral Aggregate Used on Built-Up Roofs,” 2018 [ASTM D1863/D1863M-05 (2018)].

ASTM D2202 is the American Society for Testing and Materials document titled “Standard Test Method for Slump of Sealants,” 2019 (ASTM D2202-00(2019)).

ASTM D2370 is the American Society for Testing and Materials document titled “Standard Test Method for Tensile Properties of Organic Coatings,” 2016 (ASTM D2370-98-16).

ASTM D2824 is the American Society for Testing and Materials document titled “Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered, and Fibered without Asbestos,” 2018 (ASTM D2824/D2824M-18).

ASTM D3468 is the American Society for Testing and Materials document titled “Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing,” 2020 [ASTM D3468/D3468M-99 (2020)].

ASTM D3805 is the American Society for Testing and Materials document titled “Standard Guide for Application of Aluminum-Pigmented Asphalt Roof Coatings,” 2016 (ASTM D3805/D3805M-16).

ASTM D4798 is the American Society for Testing and Materials document titled “Standard Practice for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method),” 2021 [ASTM D4798/D4798M-11(2021)].

ASTM D5870 is the American Society for Testing and Materials document titled “Standard Practice for Calculating Property Retention Index of Plastics,” 2016 (ASTM D5870-16).

ASTM D6083 is the American Society for Testing and Materials document titled “Standard Specification for Liquid Applied Acrylic Coatings Used in Roofing,” 2021 (ASTM D6083/D6083M-21).

ASTM D6694 is the American Society for Testing and Materials document titled “Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing Systems,” 2015 (ASTM D6694/D6694M-15).

ASTM E96 is the American Society for Testing and Materials document titled “Standard Test Methods for Water Vapor Transmission of Materials,” 2016 (ASTM E96/E96M-16).

ASTM E283 is the American Society for Testing and Materials document titled “Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylight, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen,” 2019 (ASTM E283/E238-19).

ASTM E408 is the American Society for Testing and Materials document titled “Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques,” 2019 [ASTM E408-13 (2019)].

ASTM E779 is the American Society for Testing and Materials document titled “Standard Test Method for Determining Air Leakage Rate by Fan Pressurization,” 2019 (ASTM E779-19).

ASTM E903 is the American Society for Testing and Materials document titled “Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres,” 2020 (ASTM E903-20).

ASTM E972 is the American Society for Testing and Materials document titled “Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight,” 2021 [ASTM E972-96 (2021)].

ASTM E1175 is the American Society for Testing and Materials document titled “Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere,” 2015 [ASTM E1175-87(2015)].

ASTM E1677 is the American Society for Testing and Materials document titled “Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls,” 2019 (ASTM E1677-19).

ASTM E1680 is the American Society for Testing and Materials document titled “Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems,” 2016 (ASTM E1680-16).

ASTM E1918 is the American Society for Testing and Materials document entitled “Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field,” 2016 (ASTM E1918-16).

ASTM E1980 is the American Society for Testing and Materials document titled “Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surface,” 2019 [ASTM E1980-11 (2019)].

ASTM E2178 is the American Society for Testing and Materials document titled “Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials,” 2021 (ASTM E21778-21).

ASTM E2357 is the American Society for Testing and Materials document titled “Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies,” 2018 (ASTM E2357-18).

ASTM E3087 is the American Society for Testing and Materials document titled “Standard Test Method for Measuring Capture Efficiency of Domestic Range Hoods,” 2018 (ASTM E3087-18).

ATTIC is an enclosed space directly below the roof deck and above the ceiling beams.

AUTOMATED TELLER MACHINE (ATM) is any electronic information processing device which accepts or dispenses currency in connection with a credit, deposit or convenience account without involvement by a clerk.

AUTOMATIC is capable of operating without human intervention.

AZIMUTH is the degrees of clockwise rotation from true north.

BACK-UP COMPRESSORS are those compressors not used to meet peak compressed air loads. Back-up compressors are physically connected to the compressed air piping system and can be automatically controlled to turn on if one of the online compressors fails. Back-up compressors do not normally operate.

BATTERY SYSTEM, STATIONARY STORAGE. A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls, and associated electrical equipment designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, and uninterruptible power supply, load shedding, load sharing or similar capabilities.

BELOW-GRADE WALL is the portion of a wall, enclosing conditioned space, that is below the grade line.

BOILER SYSTEM is one or more boilers and their piping and controls that work together to supply steam or hot water to heat output devices remote from the boiler.

BUBBLE POINT is the liquid saturation temperature of a refrigerant at a specified pressure.

BUILDING is any structure or space covered by Section 100.0 of the Building Energy Efficiency Standards.

BUILDING COMMISSIONING is a systematic quality assurance process that spans the entire design and construction process, including verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to meet the owner’s project requirements.

BUILDING ENVELOPE is the ensemble of exterior and demising partitions of a building that enclose conditioned space.

CALL CENTER is a phone center that handles large number of phone calls including but not limited to help desk, customer and sales support, technical support, emergency response, telephone answering service, and inbound and outbound telemarketing.

CARBON DIOXIDE ENRICHMENT is injection of additional carbon dioxide into controlled environment horticulture spaces for the purpose of stimulating plant growth.

CASCADE REFRIGERATION SYSTEM is a type of refrigeration system that uses a low-stage refrigeration system where the heat rejected from condensing the low-stage refrigerant is absorbed using a heat-exchanger by a separate high-stage refrigeration system, and the ultimate heat rejection to ambient air is accomplished by the high-stage refrigeration system.

CEILING FAN means a nonportable device that is suspended from a ceiling or overhead structure for circulating air via the rotation of fan blades as defined in 10 CFR 430.2.

CENTRAL FAN VENTILATION COOLING SYSTEM (CFVCS) is a ducting arrangement including outside air ducts, motorized dampers and an automatic control system that allows a residential space-conditioning system central fan and ducts to distribute outside air throughout a residential dwelling unit, intending to reduce or eliminate the need for mechanical cooling.

CERTIFIED TO THE ENERGY COMMISSION means, when used in association with appliances, certified under Section 1606 of Title 20 of the California Code of Regulations; and otherwise means certified by the manufacturer in a declaration, executed under penalty of perjury under the laws of the State of California, that all the information provided pursuant to the certification is true, complete, accurate and in compliance with all applicable provisions of Part 6; and if applicable that the equipment, product or device was tested under the applicable test method specified in Part 6.

CERTIFYING ORGANIZATION is an independent organization recognized by the Commission to certify manufactured devices for performance values in accordance with procedures adopted by the Commission.

CIE 13.3 is the International Commission on Illumination (Commission Internationale de l’Eclairage) document titled “Method of Measuring and Specifying Colour Rendering Properties of Light Sources,” 1995 (CIE 13.3-1995).

CIE 15 is the International Commission on Illumination (Commission Internationale de l’Eclairage) document titled “Technical Report: Colorimetry,” 2018 (CIE 15:2018).

CIRCULATING FAN means a fan that is not a ceiling fan, but that is used to move air within a space that has no provision for connection to ducting or separation of the fan inlet from its outlet, and designed to be used for the general circulation of air.

CLIMATE ZONES are the 16 geographic areas of California for which the commission has established typical weather data, prescriptive packages and energy budgets. Climate zones are defined by ZIP code and listed in Reference Joint Appendix JA2. FIGURE 100.1-A is an approximate map of the 16 climate zones.

CLOSED-CIRCUIT COOLING TOWER is a cooling tower that utilizes indirect contact between a heated fluid, typically water or glycol, and the cooling atmosphere to transfer the source heat load through sensible heat, latent heat and mass transfer indirectly to the air, essentially combining a

heat exchanger and cooling tower into an integrated and relatively compact device.

CODES, CALIFORNIA HISTORICAL BUILDING CODE is the *California Historical Building Code*, California Code of Regulations, Title 24, Part 8 and Part 2 (Chapter 34).

CODES, CBC is the 2022 *California Building Code*.

CODES, CEC is the 2022 *California Electrical Code*.

CODES, CFC is the 2022 *California Fire Code*.

CODES, CMC is the 2022 *California Mechanical Code*.

CODES, CPC is the 2022 *California Plumbing Code*.

COEFFICIENT OF PERFORMANCE (COP), COOLING is the ratio of the rate of net heat removal to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

COEFFICIENT OF PERFORMANCE (COP), HEATING is the ratio of the rate of net heat output to the rate of total energy input, calculated under designated operating conditions and expressed in consistent units, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

COEFFICIENT OF PERFORMANCE (COP), HEAT PUMP is the ratio of the rate of useful heat output delivered by the complete heat pump unit (exclusive of supplementary heating) to the corresponding rate of energy input, in consistent units and as determined using the applicable test method in Appliance Efficiency Regulations or Section 110.2.

COMBINED ENERGY EFFICIENCY RATIO (CEER) is the ratio of net cooling capacity (in Btu/hr) to total rate of electrical energy input (in watts) of a cooling system under designated operating conditions, including standby mode, as determined using the applicable test method in the Appliance Efficiency Regulations.

COMBUSTION AIR POSITIVE SHUT-OFF is a means of restricting air flow through a boiler combustion chamber during standby periods, used to reduce standby heat loss. A flue damper and a vent damper are two examples of combustion air positive shut-off devices.

COMBUSTION EFFICIENCY is a measure of the percentage of heat from the combustion of gas or oil that is transferred to the medium being heated or lost as jacket loss.

COMMERCIAL BOILER is a type of boiler with a capacity (rated maximum input) of 300,000 Btus per hour (Btu/h) or more and serving a space heating or water heating load in a commercial building.

COMMISSION is the California State Energy Resources Conservation and Development Commission, which is also referred to as the California Energy Commission.

COMPLEX MECHANICAL SYSTEMS are systems that include 1) fan systems each serving multiple thermostatically controlled zones; or 2) built-up air handler systems (nonunitary or nonpackaged HVAC equipment); or 3) hydronic or

steam heating systems; or 4) hydronic cooling systems. Complex mechanical systems are NOT the following: (1) unitary or packaged equipment listed in Table 110.2-A, 110.2-B, 110.2-C or 110.2-E that each serves one zone, or (2) two-pipe, heating only systems serving one or more zones.

COMPLIANCE SOFTWARE is software that has been approved pursuant to Section 10-109 of Part 1 of Title 24 of the California Code of Regulations, to demonstrate compliance with the performance approach of Part 6.

COMPRESSED AIR SYSTEM is a system of at least one compressor providing compressed air at 40 psig or higher.

COMPUTER ROOM is a room within a building whose primary function is to house electronic equipment and that has a design information technology equipment (ITE) equipment power density exceeding 20 watts/ft² (215 watts/m²) of conditioned floor area.

CONDENSER is a refrigeration component that condenses refrigerant vapor by rejecting heat to air mechanically circulated over its heat transfer surface.

CONDENSER, ADIABATIC is a condenser that has the ability to use two heat transfer processes in series as accomplished by a single factory-made unit. The first heat transfer process is the precooling of the entering air by lowering the entering air drybulb temperature. The second heat transfer process is forced-air circulation cooling over the heat transfer surface of the condenser.

DRY MODE is an operating condition of an adiabatic condenser wherein the only means of heat transfer is accomplished through forced-air circulation over the heat transfer surface of the condenser without any precooling of the entering air.

PRECOOL MODE is an operating condition of an adiabatic condenser wherein the entering air is precooled.

CONDENSER SPECIFIC EFFICIENCY is the full load condenser Total Heat of Rejection (THR) capacity at standardized conditions divided by the fan input electric power (including but not limited to spray pump electric input power for evaporative condensers) at 100 percent rated fan speed.

CONDITIONED FLOOR AREA (CFA) is the floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

CONDITIONED GREENHOUSE is a greenhouse that is provided with wood heating, mechanical heating that has a capacity exceeding 10 Btu/hr-ft², or mechanical cooling that has a capacity exceeding 5 Btu/hr-ft².

CONDITIONED SPACE is an enclosed space within a building that is directly conditioned or indirectly conditioned.

CONDITIONED SPACE, DIRECTLY is an enclosed space that is provided with wood heating, mechanical heating that has a capacity exceeding 10 Btu/hr-ft² or mechanical cooling that has a capacity exceeding 5 Btu/hr-ft². Directly conditioned space does not include process space. (See “process space.”)

CONDITIONED SPACE, INDIRECTLY is enclosed space that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.

CONDITIONED VOLUME is the total volume (in cubic feet) of the conditioned space within a building.

CONTINUOUS INSULATION (c.i.) is insulation that is continuous across all assemblies that separate conditioned from unconditioned space. It is installed on the exterior or interior or is integral to any opaque surface of the building envelope and has no thermal bridges other than fasteners and necessary service openings.

CONTROLLED ATMOSPHERE is an airtight space maintained at reduced oxygen levels for the purpose of reducing respiration of perishable product in long-term storage.

CONTROLLED ENVIRONMENT HORTICULTURE (CEH) SPACE is a building space dedicated to plant production by manipulating indoor environmental conditions, such as through electric lighting, irrigation, mechanical heating, mechanical cooling or dehumidification. CEH space does not include building space where plants are grown solely to decorate that same space.

COOLER is a space to be capable of operation at a temperature greater than or equal to 28°F but less than 55°F.

COOL ROOF is a roofing material with high thermal emittance and high solar reflectance, or low thermal emittance and exceptionally high solar reflectance as specified in Part 6 that reduces heat gain through the roof.

COOLING EQUIPMENT is equipment used to provide mechanical cooling for a room or rooms in a building.

CRAWL SPACE is a space immediately under the first floor of a building adjacent to grade.

CRRC-1 is the Cool Roof Rating Council document entitled “Product Rating Program Manual” (2021).

CTI is the Cooling Technology Institute.

CTI ATC-105 is the Cooling Technology Institute document titled “Acceptance Test Code for Cooling Towers,” 2019 (CTI ATC-105-19).

CTI ATC-105DS is the Cooling Technology Institute document titled “Acceptance Test Code for Dry Fluid Coolers,” 2018 [CTI ATC-105DS (18)].

CTI ATC-105S(11) is the Cooling Technology Institute document titled “Acceptance Test Code for Closed-Circuit Cooling Towers,” 2011 (CTI ATC-105-11).

CTI ATC-106 is the Cooling Technology Institute document titled “Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers,” 2011 [CTI ATC-106 (11)].

CTI STD-201 is the Cooling Technology Institute document titled “Standard for the Certification of Water Cooling Thermal Performance,” 2017 [CTI STD-201-RS(17)].

CURRENT AIR DEMAND is the actual cubic feet per minute (acfm) of total air flow necessary for end uses in a compressed air system.

C-VALUE (also known as C-factor) is the time rate of heat flow through unit area of a body induced by a unit temperature difference between the body surfaces, in Btu (hr × ft² × °F). It is not the same as K-value or K-factor.

CYCLES OF CONCENTRATION is the number of times the concentration of total dissolved solids (TDS) in cooling tower water is multiplied relative to the TDS in the makeup water. Because evaporation of pure water leaves dissolved solids behind in the system water, TDS increases over time as the tower operates. The number of times the dissolved minerals are concentrated is relative to the TDS in the makeup water. For example, five cycles of concentration represents five times the concentration of solids in the cooling tower system water relative to the TDS in the makeup water entering the tower.

DATA CENTER is a building whose primary function is to house computer room(s).

DAYLIT ZONE is the floor area under skylights or next to windows. Types of daylit zones includes primary sidelit daylit zone, secondary sidelit daylit zone, and skylit daylit zone.

DEADBAND is the temperature range within which the HVAC system is neither calling for heating or cooling.

DECORATIVE GAS APPLIANCE is a gas appliance that is designed or installed for visual effect only, cannot burn solid wood, and simulates a fire in a fireplace.

DEDICATED OUTDOOR AIR SYSTEM (DOAS) is a ventilation system that delivers 100 percent outdoor air and delivers ventilation supply air to each space, either directly or in conjunction with local or central space-conditioning systems serving those same spaces such as a DX-DOAS, HRV, ERV or custom ventilation-only unit.

DEGREE DAY, HEATING is a unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal annual heating load of a building. For any one day, when the mean temperature is less than 65°F, there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and 65°F. The number of degree days for specific geographical locations are those listed in the Reference Joint Appendix JA2. For those localities not listed in the Reference Joint Appendix JA2, the number of degree days is as determined by the applicable enforcing agency.

DEHUMIDIFIER is a product other than a portable air conditioner, room air conditioner or packaged terminal air conditioner that is a self-contained, electrically operated and mechanically encased assembly consisting of 1) a refrigerated surface (evaporator) that condenses moisture from the

atmosphere, 2) a refrigerating system, including an electric motor, 3) an air-circulating fan and 4) a means for collecting or disposing of the condensate.

DEMAND FLEXIBILITY MEASURE is a measure that reduces TDV energy consumption using communication and control technology to shift electricity use across hours of the day to decrease energy use onpeak or increase energy use off-peak, including but not limited to battery storage, or HVAC or water heating load shifting.

DEMAND RESPONSE is short-term changes in electricity usage by end-use customers from their normal consumption patterns. Demand response may be in response to:

- a. changes in the price of electricity; or
- b. participation in programs or services designed to modify electricity use:
 - i. in response to wholesale market prices; or
 - ii. when system reliability is jeopardized.

DEMAND RESPONSE PERIOD is a period of time during which electricity loads are modified in response to a demand response signal.

DEMAND RESPONSE SIGNAL is a signal that indicates a price or a request to modify electricity consumption, for a limited time period.

DEMAND RESPONSIVE CONTROL is an automatic control that is capable of receiving and automatically responding to a demand response signal.

DEMISING PARTITION is a wall, fenestration, floor or ceiling that separates conditioned space from enclosed unconditioned space or a controlled environment horticulture space.

DESICCANT DEHUMIDIFICATION SYSTEM is a mechanical dehumidification technology that uses a solid or liquid desiccant to remove moisture from the air.

DESIGN CONDITIONS are the parameters and conditions used to determine the performance requirements of space-conditioning systems. Design conditions for determining design heating and cooling loads are specified in Section 140.4(b) for nonresidential and hotel/motel buildings, in Section 150.0(h) for single-family residential buildings, and in Sections 160.3(b) and 170.2(c) for multifamily buildings.

DESIGN HEAT GAIN RATE is the total calculated heat gain through the building envelope under design conditions.

DESIGN HEAT LOSS RATE is the total calculated heat loss through the building envelope under design conditions.

DESIGN REVIEW is an additional review of the construction documents (drawings and specifications) that seeks to improve compliance with existing Title 24 regulations, to encourage adoption of best practices in design, and to encourage designs that are constructable and maintainable. It is an opportunity for an experienced design engineer or architect to look at a project with a fresh perspective in an effort to catch missing or unclear design information and to suggest design enhancements.

DEW POINT TEMPERATURE is the vapor saturation temperature at a specified pressure for a substance undergoing phase change from vapor to liquid.

DIRECT DIGITAL CONTROL (DDC) is a type of control where controlled and monitored analog or binary data, such as temperature and contact closures, are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control mechanical devices.

DIRECT-VENT APPLIANCE or “sealed combustion” appliance is an appliance that is constructed and installed so that air from combustion is derived directly from the outdoors and flue gases are discharged to the outdoors.

DISPLAY PERIMETER is the length of an exterior wall in a Group B; Group F, Division 1; or Group M Occupancy that immediately abuts a public sidewalk, measured at the sidewalk level for each story that abuts a public sidewalk.

DOMESTIC WATER HEATING SYSTEMS (see “service water heating”).

DOOR is an operable opening in the building envelope including swinging and roll-up doors, fire doors, pet doors and access hatches with less than 25 percent glazed area. When that operable opening has 25 percent or more glazed area it is a glazed door. See Fenestration: Glazed Door.

DOOR AREA is the total rough opening area which includes the door, and when present, the fenestration, and the fenestration frame components in the door frame assembly.

DRAIN WATER HEAT RECOVERY (DWHR) is a system that recovers heat from effluent in waste piping and uses it to preheat water in a domestic or service water-heating system in order to reduce water-heating energy usage.

DRY COOLER is a fan-powered heat rejection device that includes a water or glycol circuit connected by a closed circulation loop refrigerant condenser and is air-cooled.

DUAL-FUEL HEAT PUMP is an electric heat pump with gas furnace supplemental heat that alternates between the two fuel sources.

DUCT SEALING is a procedure for installing a space-conditioning distribution system that minimizes leakage of air from or to the distribution system. Minimum specifications for installation procedures, materials, diagnostic testing and field verification are contained in the Reference Residential Appendix RA3 and Reference Nonresidential Appendix NA1.

DUCT SYSTEM is all the ducts, duct fittings, plenums and fans when assembled to form a continuous passageway for the distribution of air.

DUCT WALL PENETRATIONS are openings to the duct wall made by pipes, holes, conduit, tie rods or wires.

DUCTED SYSTEM is an air conditioner or heat pump, either a split system or single-packaged unit, that is designed to be permanently installed equipment and delivers conditioned air to an indoor space through a duct.

DWELLING is a building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

DWELLING UNIT is a single unit providing complete, independent living facilities for one or more persons including access, permanent provisions for living, sleeping, eating, cooking and sanitation.

DWELLING UNIT, ATTACHED is a dwelling unit that shares a common wall or common floor/ceiling with another dwelling unit.

DWELLING UNIT, JUNIOR ACCESSORY, or JADU is a dwelling unit that is no more than 500 square feet in size and contained entirely within an existing single-family building. A JADU includes a kitchen, a separate entrance from the main entrance to the building, and an interior entry to the main living area. A JADU may include separate sanitation facilities, or may share sanitation facilities with the existing single-family building.

DX-DEDICATED OUTDOOR AIR SYSTEM UNIT (DX-DOAS) is a type of air-cooled, water-cooled or water-source DOAS unit that dehumidifies 100-percent outdoor air and includes reheat that is capable of controlling the supply dry-bulb temperature of the dehumidified air to the designed supply air temperature. This conditioned outdoor air is then delivered directly or indirectly to the conditioned spaces. It may precondition outdoor air by containing an enthalpy wheel, sensible wheel, desiccant wheel, plate heat exchanger, heat pipes, or other heat or mass transfer apparatus.

EAST-FACING (See “orientation.”)

ECONOMIZER, AIR, is a ducting arrangement, including dampers, linkages and an automatic control system that allows a cooling supply fan system to supply outside air to reduce or eliminate the need for mechanical cooling.

ECONOMIZER, PUMPED REFRIGERANT, is a system by which the supply air of a cooling system is cooled directly by refrigerant pumped between indoor and outdoor units during cooler ambient temperatures in order to reduce or eliminate the need for mechanical cooling.

ECONOMIZER, WATER, is a system by which the supply air of a cooling system is cooled directly or indirectly by evaporation of water in order to reduce or eliminate the need for mechanical cooling.

ELECTRICAL POWER DISTRIBUTION SYSTEMS. The following definitions are intended to apply to Section 130.5 only:

ELECTRICAL METERING is a device or system for measuring the electrical power and energy supplied to a customer or premise(s).

EQUIPMENT. A general term, including devices, luminaires, apparatus, machinery, and the like used as a part of, or in connection with, an electrical installation.

LOW VOLTAGE DRY-TYPE DISTRIBUTION TRANSFORMER is a distribution transformer that has an input voltage of 600 volts or less, that is air-cooled, and that does not use oil as a coolant.

PLUG LOAD is the energy consumed by any appliances or electronic device that is plugged into a receptacle or receptacle outlet. Plug loads are not related to general lighting, heating, ventilation, cooling, and water heating, domestic and service water system, renewable power, information technology equipment, computer room electronic equipment, and electric vehicle charging.

SERVICE is the conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premise served.

SERVICE EQUIPMENT is the necessary equipment, usually consisting of a circuit breaker(s) or switch(es) and fuse(s) and their accessories, connected to the load end of service conductors to a building or other structure, or an otherwise designated area, and intended to constitute the main control and cutoff of the supply.

ELECTRONICALLY-COMMUTATED MOTOR is a brushless DC motor with a permanent magnet rotor that is surrounded by stationary motor windings, and an electronic controller that varies rotor speed and direction by sequentially supplying DC current to the windings.

EMITTANCE, THERMAL is the ratio of the radiant heat flux emitted by a sample to that emitted by a blackbody radiator at the same temperature.

ENCLOSED SPACE is space that is substantially surrounded by solid surfaces, including walls, ceilings or roofs, doors, fenestration areas, and floors or ground.

ENERGY BUDGET is the maximum energy consumption, based on Time Dependent Valuation (TDV) energy that a proposed building, or portion of a building, can be designed to consume, calculated using Commission-approved compliance software as specified by the Alternative Calculation Method Approval Manual. The Energy Budget for newly constructed, low-rise residential buildings is expressed in terms of the Energy Design Rating.

ENERGY COMMISSION (CEC) is the California State Energy Resources Conservation and Development Commission.

ENERGY DESIGN RATING (EDR) is a way to express the energy consumption of a building as a rating score index where a score of 100 represents the energy consumption of the building built to the specifications of the Residential Energy Services (RESNET) reference home characterization of the 2006 *International Energy Conservation Code (IECC)* with Title 24, Part 6 modeling assumptions, and a score of 0 (zero) represents a building that has zero net energy consumption. The EDR is calculated using Commission-approved compliance software as specified by the Alternative Calculation Method Approval Manual.

ENERGY DESIGN RATING, ENERGY EFFICIENCY is an Energy Design Rating based on the TDV energy consumption of a building that results from the building’s energy efficiency characteristics, calculated using Commission-approved compliance software as specified by the Alternative Calculation Methods Approval Manual.

ENERGY DESIGN RATING, SOLAR ELECTRIC GENERATION AND DEMAND FLEXIBILITY is the reduction in TDV energy consumption of a building expressed in terms of an Energy Design Rating reduction that results from the combination of the building’s solar electric generation system and demand flexibility measures.

ENERGY DESIGN RATING, TOTAL is the total Energy Design Rating for the building that is determined by subtracting the Solar Electric Generation System and Demand Flexibility Energy Design Rating from the Energy Efficiency Energy Design Rating.

ENERGY EFFICIENCY RATIO (EER) is the ratio of net cooling capacity (in Btu/hr) to total rate of electrical energy input (in watts), of a cooling system under designated operating conditions, as determined using the applicable test method in the Appliance Efficiency Regulations or Section 110.2.

ENERGY EFFICIENCY RATIO 2 (EER2) is the EER metric for residential central air conditioners effective January 1, 2023, as created by the U.S. Department of Energy “ISSUANCE 2016-11-30 Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps, Final Rule.”

ENERGY MANAGEMENT CONTROL SYSTEM (EMCS) is an automated control system that regulates the energy consumption of a building by controlling the operation of energy-consuming systems and is capable of monitoring loads and adjusting operations in order to optimize energy usage and respond to demand response signals.

ENERGY OBTAINED FROM DEPLETABLE SOURCES is electricity purchased from a public utility, or any energy obtained from coal, oil, natural gas or liquefied petroleum gases.

ENERGY OBTAINED FROM NONDEPLETABLE SOURCES is energy that is not energy obtained from depletable sources.

ENERGY STORAGE SYSTEM (ESS) is one or more devices, assembled together, that are capable of storing energy used for safely supplying electrical energy to selected loads at a future time.

ENFORCEMENT AGENCY is the city, county or state agency responsible for issuing a building permit.

ENTHALPY RECOVERY RATIO (ERR) is a ratio of the change in enthalpy of the outdoor air supply to the difference in enthalpy between the entering supply airflow and the entering exhaust airflow, with no adjustment to account for that portion of the psychometric change in the leaving supply airflow that is the result of leakage of entering exhaust airflow rather than exchange of heat or moisture between the airstreams.

ENTIRE BUILDING is the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all existing conditioned and unconditioned space within the structure.

ENVELOPE (See “Building envelope.”)

ESS-READY INTERCONNECTION EQUIPMENT is equipment, including but not limited to an ESS-ready panelboard, that can accommodate the connection of a distributed energy resource or an ESS capable of either automatic or manual isolation from the utility power source.

ESS-READY PANELBOARD is a panelboard that can accommodate either automatic or manual switching between a utility power source to a distributed energy resource or an energy storage system, such as a split-bus panelboard.

EXFILTRATION is uncontrolled outward air leakage from inside a building, including leakage through cracks and interstices, around windows and doors, and through any other exterior partition or duct penetration.

EXTERIOR FLOOR/SOFFIT is a horizontal exterior partition, or a horizontal demising partition, under conditioned space. For low-rise residential occupancies, exterior floors also include those on grade.

EXTERIOR PARTITION is an opaque, translucent or transparent solid barrier that separates conditioned space from ambient air or space. For low-rise residential occupancies, exterior partitions also include barriers that separate conditioned space from unconditioned space, or the ground.

EXTERIOR ROOF/CEILING is an exterior partition, or a demising partition, that has a slope less than 60 degrees from horizontal, that has conditioned space below, and that is not an exterior door or skylight.

EXTERIOR ROOF/CEILING AREA is the area of the exterior surface of exterior roof/ceilings.

EXTERIOR WALL is any wall or element of a wall, or any member or group of members, which defines the exterior boundaries or courts of a building and which has a slope of 60 degrees or greater with the horizontal plane. An exterior wall or partition is not an exterior floor/soffit, exterior door, exterior roof/ceiling, window, skylight or demising wall.

EXTERIOR WALL AREA is the area of the opaque exterior surface of exterior walls.

FAÇADE is the contiguous exterior of a building surface, but not limited to fenestration products.

FACTORY is a build, structure or space designated as Factory Group F that is used for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations.

FACTORY-ASSEMBLED COOLING TOWERS are cooling towers constructed from factory-assembled modules either shipped to the site in one piece or put together in the field.

FAN, EMBEDDED is a fan that is part of a manufactured assembly where the assembly includes functions other than air movement.

FAN ARRAYS are multiple fans in parallel and in a single enclosure between two plenum sections in an air distribution system, where plenum means a compartment or chamber that forms a part of the air distribution system, and that is not used for occupancy or storage.

FAN ELECTRICAL INPUT POWER (FAN kW_{design}) is the electrical input power in kilowatts required to operate an individual fan or fan array at design conditions. It includes the power consumption of motor controllers, if present.

FAN ENERGY INDEX (FEI) is the ratio of the electric input power of a reference fan to the electric input power of the actual fan as calculated per ANSI/AMCA 208-18 at fan system design conditions.

FAN NAMEPLATE ELECTRICAL INPUT POWER (kW) is the nominal electrical input power rating stamped on a fan assembly nameplate.

FAN SYSTEM includes all the fans that contribute to the movement of air through a point of a common duct, plenum or cabinet.

FAN SYSTEM, COMPLEX means a fan system that combines a single-cabinet fan system with other supply fans, exhaust fans or both.

FAN SYSTEM, EXHAUST/RELIEF is a fan system dedicated to the removal of air from interior spaces to the outdoors.

FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) is a fan system that serves three or more space-conditioning zones where airflow to each zone is individually controlled based on heating, cooling and/or ventilation requirements, indoor fan airflow varies as a function of load, and the sum of the minimum zone airflows for each zone is 40 percent or less of the fan system design conditions.

FAN SYSTEM, RETURN is a fan system dedicated to removing air from interior spaces where some or all of the air is to be recirculated except during economizer operation.

FAN SYSTEM, SINGLE-CABINET is a fan system where a single fan, a single-fan array, a single set of fans operating in parallel, or fans or fan arrays in series and embedded in the same cabinet both supply air to a space and recirculate the air.

FAN SYSTEM, SUPPLY-ONLY is a fan system that provides supply air to interior spaces and does not recirculate the air.

FAN SYSTEM, TRANSFER is a fan system that exclusively moves air from one occupied space to another.

FAN SYSTEM AIRFLOW (cfm) is the sum of the airflow of all fans with fan electrical input power greater than 1 kW at fan system design conditions, excluding the airflow that passes through downstream fans with fan input power less than 1 kW.

FAN SYSTEM DESIGN CONDITIONS are operating conditions that can be expected to occur during normal system operation that result in the highest supply airflow rate to or from the conditioned spaces served by the fan system.

FAN SYSTEM ELECTRICAL INPUT POWER (Fan kW_{design,system}) is the sum of the fan electrical input power (Fan kW_{design}) in kilowatts of all fans that are required to operate at fan system design conditions to supply air from the heating or cooling source to the conditioned spaces, return it to the source, exhaust it to the outdoors or transfer it to another space.

FENESTRATION: Includes the following:

ACE is an NFRC-Approved Calculation Entity that conducts calculations of fenestration product ratings for certification authorization using the NFRC component modeling approach and issues label certificates to Specifying Authorities for product certification authorization in accordance with NFRC requirements.

ALTERED COMPONENT is a new fenestration component that has undergone an alteration other than a repair and is subject to all applicable standards requirements.

BAY WINDOW is a combination assembly which is composed of three or more individual windows either joined side by side or installed within opaque assemblies and which projects away from the wall on which it is installed. Center windows, if used, are parallel to the wall on which the bay is installed, the end panels or two side windows, are angled with respect to the center window. Common angles are 30° and 45°, although other angles may be employed.

CHROMOGENIC GLAZING is a class of switchable glazing that includes active materials (e.g., electrochromic) and passive materials (e.g., photochromic and thermochromic) permanently integrated into the glazing assembly. Their primary function is to switch reversibly from a high transmission state to a low transmission state with associated changes in VT and SHGC.

CLERESTORY FENESTRATION is fenestration installed above a roofline greater than or equal to 60 degrees from the horizontal, or any portion of exterior vertical glazing greater than 8 feet per floor above the finished floor of a space.

CMA (component modeling approach) is a fenestration product certification program from the National Fenestration Rating Council (NFRC) that enables energy-related performance ratings for nonresidential fenestration products, including the thermal performance *U*-factor, solar heat gain coefficient, and visible transmittance.

CMAS (component modeling approach software tool) is an NFRC approved software that allows a user to create a fenestration product “virtually” and generate its energy-related performance ratings, including the thermal performance *U*-factor, solar heat gain coefficient, and visible transmittance.

CURTAIN WALL/STOREFRONT is an external non-bearing wall intended to separate the exterior nonconditioned and interior conditioned spaces. It also consists of any combination of framing materials, fixed glazing, opaque glazing, operable windows or other in-fill materials.

Note: Window wall is also included as part of the curtain wall/storefront fenestration category.

DUAL-GLAZED GREENHOUSE WINDOWS is a double glass pane separated by an air or other gas space that adds conditioned volume but not conditioned floor area to a building.

DYNAMIC GLAZING SYSTEMS are glazing systems that have the ability to reversibly change their perfor-

mance properties, including *U*-factor, Solar Heat Gain Coefficient (SHGC) and/or Visible Transmittance (VT) between well-defined end points. These may include, but are not limited to, chromogenic glazing systems and integrated shading systems (defined below). Dynamic Glazing systems do not include internally mounted or externally mounted shading devices that attach to the window framing/glazing that may or may not be removable.

FENESTRATION ALTERATION is any change to an existing building’s exterior fenestration product that is not a repair (see “fenestration repair”) that:

- i. Replaces existing fenestration in an existing wall or roof with no net area added; or
- ii. Replaces existing fenestration and adds new net area in the existing wall or roof; or
- iii. Adds a new window that increases the net fenestration area to an existing wall or roof.

FENESTRATION AREA is the rough opening area of any fenestration product.

FENESTRATION PRODUCT is any transparent or translucent material plus any sash, frame, mullions and dividers, in the facade of a building, including, but not limited to, windows, glazed doors, skylights, curtain walls, dynamic glazing, garden windows, glass block and glazing used in greenhouses.

FENESTRATION REPAIR is the reconstruction or renewal for the purpose of maintenance of any fenestration product, component or system and shall not increase the preexisting energy consumption of the repaired fenestration product, component, system or equipment. Replacement of any component, system or equipment for which there are requirements in the Standards are considered an alteration (see Fenestration, alteration) and not a repair and is subject to the requirements of Part 6 of the Standards.

FIELD-FABRICATED is a fenestration product whose frame is made at the construction site of standard dimensional lumber or other materials that were not previously cut, or otherwise formed with the specific intention of being used to fabricate a fenestration product. Field fabricated does not include site-built fenestration.

FIN is an opaque surface, oriented vertically and projecting outward horizontally from an exterior vertical surface.

FIN OFFSET is the horizontal distance from the edge of exposed exterior glazing at the jamb of a window to the fin.

FIN PROJECTION is the horizontal distance, measured outward horizontally, from the surface of exposed exterior glazing at the jamb of a window to the outward edge of a fin.

FIXED is fenestration that is not designed to be opened or closed.

GLAZED DOOR is an exterior door having a glazed area of 25 percent or greater of the area of the door. Glazed

doors shall meet fenestration product requirements. See “door.”

GREENHOUSE or **GARDEN WINDOW** is a window unit that consists of a three-dimensional, five-sided structure generally protruding from the wall in which it is installed. Operating sash may or may not be included.

HORIZONTAL SLATS, when referring to a daylighting device, is a set of adjacent surfaces located directly adjacent to vertical fenestration, oriented horizontally and projecting horizontally from its interior or exterior vertical surface.

INTEGRATED SHADING SYSTEM is a class of fenestration products including an active layer: e.g., shades, louvers, blinds or other materials permanently integrated between two or more glazing layers. The *U*-factor and/or SHGC and VT of the insulating glass assembly can be altered by reversibly changing the enclosed active layer.

LIGHT SHELF is an adjacent, opaque surfaced daylighting device located at the sill of clerestory glazing, oriented horizontally and projecting horizontally from an interior or exterior vertical surface.

MANUFACTURED or KNOCKED DOWN PRODUCT is a fenestration product constructed of materials that are factory cut or otherwise factory formed with the specific intention of being used to fabricate a fenestration product. Knocked down or partially assembled products may be sold as a fenestration product when provided with temporary and permanent labels as described in Section 10-111, or as a site-built fenestration product when not provided with temporary and permanent labels as described in Section 10-111.

NFRC 100 is the National Fenestration Rating Council document titled “Procedure for Determining Fenestration Product *U*-factors,” (2020) (ANSI/NFRC 100-2020). <

NFRC 200 is the National Fenestration Rating Council document titled “Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence,” (2020) (ANSI/NFRC 200-2020). <

NFRC 202 is the National Fenestration Rating Council document titled “Procedures for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence,” (2020) (ANSI/NFRC 202-2020). <

NFRC 203 is the National Fenestration Rating Council document titled “Procedure for Determining Visible Transmittance of Tubular Daylighting Devices,” (2020) (ANSI/NFRC 203-2020). <

NFRC 400 is the National Fenestration Rating Council document titled “Procedure for Determining Fenestration Product Air Leakage,” (2020) (ANSI/NFRC 400-2020). >

OPERABLE SHADING DEVICE is a device at the interior or exterior of a building or integral with a fenestration product, which is capable of being operated, either manually or automatically, to adjust the amount of solar radiation admitted to the interior of the building.

RELATIVE SOLAR HEAT GAIN COEFFICIENT (RSHGC) is the ratio of solar heat gain through a fenestration product (corrected for external shading) to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted or convected into the space.

SITE-BUILT is fenestration designed to be field-glazed or field assembled units using specific factory cut or otherwise factory formed framing and glazing units that are manufactured with the intention of being assembled at the construction site. These include storefront systems, curtain walls and atrium roof systems.

SKYLIGHT ROOF RATIO (SRR) is the ratio of the skylight area to the gross exterior roof area.

SOLAR HEAT GAIN COEFFICIENT (SHGC) is the ratio of the solar heat gain entering the space through the fenestration area to the incident solar radiation. Solar heat gain includes directly transmitted solar heat and absorbed solar radiation, which is then reradiated, conducted or convected into the space.

SPANDRAL is opaque glazing material most often used to conceal building elements between floors of a building so they cannot be seen from the exterior, also known as “opaque in-fill systems.”

TINTED GLASS is colored glass by incorporation of a mineral admixture resulting in a degree of tinting. Any tinting reduces both visible and radiant transmittance.

VERTICAL FENESTRATION is all fenestration other than skylights and doors.

VISIBLE REFLECTANCE is the reflectance of light at wavelengths from 410 to 722 nanometers.

VISIBLE TRANSMITTANCE (VT) is the ratio (expressed as a decimal) of visible light that is transmitted through a glazing fenestration. The higher the VT rating, the more light is allowed through a window.

WINDOW is fenestration that is not a skylight and that is an assembled unit consisting of a frame and sash component holding one or more pieces of glazing.

WINDOW AREA is the area of the surface of a window, plus the area of the frame, sash and mullions.

WINDOW HEAD HEIGHT is the height from the floor to the top of the vertical fenestration.

WINDOW WALL RATIO (WWR) is the ratio of the window area to the gross exterior wall area.

FIELD ERECTED COOLING TOWERS are cooling towers which are custom designed for a specific application and which cannot be delivered to a project site in the form of factory assembled modules due to their size, configuration, or materials of construction.

FIREPLACE is a hearth and fire chamber, or similar prepared place, in which a fire may be made and which is built in conjunction with a flue or chimney, including but not limited to factory-built fireplaces, masonry fireplaces, and masonry heaters as further clarified in the CBC.

FLOOR/SOFFIT TYPE is a type of floor/soffit assembly having a specific heat capacity, framing type and *U*-factor.

FLUID COOLER is a fan-powered heat rejection device that includes a water or glycol circuit connected by a closed circulation loop to a liquid-cooled refrigerant condenser, and may be either evaporative-cooled, or air-cooled, or a combination of the two.

FLUX is the rate of energy flow per unit area.

FOOD PREPARATION EQUIPMENT is cooking equipment intended for commercial use, including coffee machines, espresso coffee makers, conductive cookers, food warmers including heated food servers, fryers, griddles, nut warmers, ovens, popcorn makers, steam kettles, ranges and cooking appliances for use in commercial kitchens, restaurants or other business establishments where food is dispensed.

FREEZER is a space designed to be capable of operation at less than 28°F.

GAS COOLER is a refrigeration component that reduces the temperature of a refrigerant vapor by rejecting heat to air mechanically circulated over its heat transfer surface. Used by a CO₂ refrigeration system in transcritical mode, and normally also capable of operating in subcritical mode.

GAS COOLING EQUIPMENT is cooling equipment that produces chilled water or cold air using natural gas or liquefied petroleum gas as the primary energy source.

GAS HEATING SYSTEM is a system that uses natural gas or liquefied petroleum gas as a fuel to heat a conditioned space.

GAS LOG is a self-contained, free-standing, open-flame, gas-burning appliance consisting of a metal frame or base supporting simulated logs, and designed for installation only in a vented fireplace.

GLAZED DOOR is an exterior door having a glazed area of 50 percent or greater of the area of the door.

GLAZING (See “fenestration product.”)

GLOBAL WARMING POTENTIAL (GWP) is the radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time.

GLOBAL WARMING POTENTIAL VALUE (GWP Value) is the 100-year GWP value published by the Intergovernmental Panel on Climate Change (IPCC) in either its Second Assessment Report (SAR) (IPCC, 1995), or its Fourth Assessment A-3 Report (AR4) (IPCC, 2007). Both the 1995 IPCC SAR values and the 2007 IPCC AR4 values are published in Table 2.14 of the 2007 IPCC AR4. The SAR GWP values are found in column “SAR (100-yr)” of Table 2.14.; the AR4 GWP values are found in column “100 yr” of Table 2.14.

GOVERNMENTAL AGENCY is any public agency or subdivision thereof, including, but not limited to, any agency of the state, a county, a city, a district, an association of governments or a joint power agency.

GROSS EXTERIOR ROOF AREA is the sum of the skylight area and the exterior roof/ceiling area.

GROSS EXTERIOR WALL AREA is the sum of the window area, door area and exterior wall area.

HABITABLE SPACE is space in a building for living, sleeping, eating or cooking, excluding bathrooms, toilets, hallways, storage areas, closets, utility rooms and similar areas are not considered habitable spaces. (See also “occupiable space”.)

HABITABLE STORY is a story that contains habitable space and that has at least 50 percent of its volume above grade.

HEALTHCARE FACILITY is any building or portion thereof licensed pursuant to California Health and Safety Code Division 2, Chapter 1, §1204 or Chapter 2, §1250.

HEAT CAPACITY (HC) is the measurable physical quantity that characterizes the amount of heat required to change a substance’s temperature by a given amount.

HEAT PUMP is an appliance that consists of one or more assemblies; that uses an indoor conditioning coil, a compressor, and a refrigerant-to-outdoor air heat exchanger to provide air heating; and that may also provide air cooling, dehumidifying, humidifying, circulating, or air cleaning.

HEAT PUMP WATER HEATER (HPWH) is a water heater that transfers thermal energy from one temperature level to a higher temperature level for the purpose of heating water, including all ancillary equipment such as fans, storage tanks, pumps or controls necessary for the device to perform its function.

MULTI-PASS HEAT PUMP WATER HEATER is an HPWH in which the cold water passes through the heat pump(s) multiple times, each time gaining a temperature increase, until the tank reaches the intended storage temperature.

SINGLE-PASS HEAT PUMP WATER HEATER is an HPWH in which the cold water passes through the heat pump(s) once and is heated to the intended storage temperature.

HEATED SLAB FLOOR is a concrete floor either on-grade, raised, or a lightweight concrete slab topping. Heating is provided by a system placed within or under the slab and is sometimes referred to as a radiant slab floor.

HEATING EQUIPMENT is equipment used to provide mechanical heating for a room or rooms in a building.

HEATING SEASONAL PERFORMANCE FACTOR (HSPF) is the total heating output of a central air-conditioning heat pump (in Btu) during its normal use period for heating divided by the total electrical energy input (in watt-hours) during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

HEATING SEASONAL PERFORMANCE FACTOR 2 (HSPF2) is the HSPF metric for residential central heat pumps effective January 1, 2023, as created by the U.S. Department of Energy “ISSUANCE 2016-11-30 Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps, Final Rule.”

HIGH-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel, of occupancy Group R-2 or R-4 with four or more habitable stories.

HORTICULTURAL LIGHTING consists of luminaires used for plant growth and maintenance. Horticultural luminaires may have either plug-in or hard-wired connections for electric power.

HOTEL/MOTEL is a building or buildings that has six or more guest rooms or a lobby serving six or more guest rooms, where the guest rooms are intended or designed to be used, or which are used, rented or hired out to be occupied, or which are occupied for sleeping purposes by guests, and all conditioned spaces within the same building envelope. Hotel/motel includes all conditioned spaces which are (1) on the same property as the hotel/motel, (2) served by the same central heating, ventilation and air-conditioning system as the hotel/motel, and (3) integrally related to the functioning of the hotel/motel as such, including, but not limited to, exhibition facilities, meeting and conference facilities, food service facilities, lobbies and laundries. Hotel/motel also includes the following:

- A building of Occupancy Group R-1,
- Vacation timeshare properties and hotel or motel buildings of Occupancy Group R-2, and

The following types of Occupancy Group R-3:

- Congregate residences for transient use,
- Boarding houses of more than 6 guests, and
- Alcohol or drug abuse recovery homes of more than 6 guests.

HVAC SYSTEM is a space-conditioning system or a ventilation system.

HVI 915 is the Home Ventilating Institute document titled “HVI Loudness Testing and Rating Procedure,” 2020 (HVI Publication 915-2020).

HVI 916 is the Home Ventilating Institute document titled “HVI Airflow Test Procedure,” 2020 (HVI Publication 916-2020).

HVI 920 is the Home Ventilating Institute document titled “HVI Product Performance Certification Procedure Including Verification and Challenge,” 2020 (HVI Publication 920-2020).

IES HB (See “IES Lighting Library.”)

IES LIGHTING LIBRARY, formerly called the “IES Lighting Handbook (IES HB),” is the Illuminating Engineering Society document titled “The IES Lighting Library™.”

INTEGRATED SEASONAL COEFFICIENT OF PERFORMANCE (ISCOP) is a seasonal efficiency number that is a combined value based on the formula listed in AHRI Standard 920 of the two COP values for the heating season of a DX-DOAS unit water or air source heat pump, expressed in W/W.

INTEGRATED SEASONAL MOISTURE REMOVAL EFFICIENCY (ISMRE) is a seasonal efficiency number that is a combined value based on the formula listed in AHRI Standard 920 of the four dehumidification moisture removal

efficiency (MRE) ratings required for DX-DOAS units, expressed in lb of moisture/kWh.

IES LM-79-19 is an American National Standard authored by the Illuminating Engineering Society and titled “Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products,” (2019) (ANSI/IES LM-79-19).

IES LS-1-20 is an American National Standard authored by the Illuminating Engineering Society and titled “Lighting Science: Nomenclature and Definitions for Illuminating Engineering,” 2020 (ANSI/IES LS-1-20).

IES TM-15-20 is an American National Standard authored by the Illuminating Engineering Society and titled “Technical Memorandum: Luminaire Classification System for Outdoor Luminaires,” (2020) (ANSI/IES TM-15-20).

INDOOR GROWING is a type of CEH space in a building with a Skylight Roof Ratio less than 50 percent. Growing plants in a warehouse with or without skylights is an example of indoor growing.

INFILTRATION is uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors, and through any other exterior or demising partition or pipe or duct penetration. See AIR BARRIER.

INFORMATION TECHNOLOGY EQUIPMENT (ITE) includes computers, data storage, servers and network/communication equipment located in a computer room.

INTEGRATED ENERGY EFFICIENCY RATIO (IEER) is a single-number cooling part-load efficiency figure of merit calculated as specified by the method described in ANSI/AHRI Standard 340/360/1230. This metric replaces the IPLV for ducted and non-ducted units.

INTEGRATED HVAC SYSTEM is an HVAC system designed to handle both sensible and latent heat removal. Integrated HVAC systems may include, but are not limited to: HVAC systems with a sensible heat ratio of 0.65 or less and the capability of providing cooling, dedicated outdoor air systems, single package air conditioners with at least one refrigerant circuit providing hot gas reheat, and dehumidifiers modified to allow external heat rejection.

INTEGRATED PART-LOAD VALUE (IPLV) is a single-number cooling part-load efficiency figure of merit calculated as specified by the method described in ANSI/AHRI Standard 550/590 for use with chillers.

ISO 5801 is the International Organization for Standardization document titled “Fans—Performance testing using standardized airways,” 2017 (ISO 5801:2017).

ISO 13256-1 is the International Organization for Standardization document titled “Water-source heat pumps—Testing and rating for performance—Part 1: Water-to-air and brine-to-air heat pumps,” 2012 [ANSI/AHRI/ASHRAE ISO 13256-1:1998 (RA 2012)].

ISO 13256-2 is the International Organization for Standardization document titled “Water-source heat pumps—Testing and rating for performance—Part 1: Water-to-water and brine-to-water heat pumps,” 2012 [ANSI/AHRI/ASHRAE ISO 13256-2-01 (R2012)].

ISO 17025 is the International Organization for Standardization document titled “General Criteria for the Competence of Testing and Calibration Laboratories,” 2017 (ISO/IEC 17025:2017).

ITE DESIGN LOAD is the combined power of all the ITE loads for which the ITE cooling system is designed.

LANGELIER SATURATION INDEX (LSI) is expressed as the difference between the actual system pH and the saturation pH. LSI indicates whether water will precipitate, dissolve or be in equilibrium with calcium carbonate, and is a function of hardness, alkalinity, conductivity, pH and temperature.

LARGEST NET CAPACITY INCREMENT is the largest increase in capacity when switching between combinations of base compressors that is expected to occur under the compressed air system control scheme.

LIGHTING definitions:

Accent lighting is directional lighting to emphasize a particular object or surface feature, or to draw attention to a part of the field of view. It can be recessed, surface mounted or mounted to a pendant, stem or track, and can be display lighting. It shall not provide general lighting.

Astronomical time-switch control is a lighting control that controls lighting based on the time of day and astronomical events such as sunset and sunrise, accounting for geographic location and calendar date.

Automatic daylight control adjusts the luminous flux of the electric lighting system either in a series of steps or by continuous dimming in response to available daylight. This kind of control uses one or more photosensors to detect changes in daylight illumination and then automatically adjusts the electric lighting levels in response.

Automatic scheduling control is a time-based lighting control that is capable of being programmed to reduce or turn off lighting power for a portion of the night and to turn off lighting power for the day.

Automatic time switch control controls lighting based on the time of day.

Captive-key override is a type of lighting control in which the key that activates the override cannot be released when the lights are in the on position.

Chandelier is a ceiling-mounted, close-to-ceiling or suspended decorative luminaire that uses glass, crystal, ornamental metals or other decorative material.

Correlated Color Temperature (CCT) is the absolute temperature of a blackbody whose chromaticity most nearly resembles that of the light source.

Color Rendering Index (CRI) is a measure of the degree of color shift that objects undergo when illuminated by the lighting source as compared with the color of the same objects when illuminated by a reference source of comparable color temperature. CRI is calculated according to CIE 13.3.

Colored light source is a light source designed and marketed as a colored light source and not designed or marketed for general lighting applications with either of the following characteristics maintained throughout all modes of operation including color changing operation:

- (1) A Color Rendering Index (CRI) less than 40, as determined according to the method set forth in CIE Publication 13.3; or
- (2) A Correlated Color Temperature as measured with ANSI/IES LM-66-20 or ANSI/IES LM-79-19 (as appropriate) and calculated with CIE 15, which does not have a corresponding nominal CCT designation in ANSI C78.377-2017.

Compact fluorescent lamp is a fluorescent lamp with a small-diameter glass tube (T5 or smaller) that is folded, bent or bridged to create a long discharge path in a small volume. The lamp designs generally include an amalgam and a cold chamber, or a cold spot, to control the mercury vapor pressure and light output.

Countdown timer switch turns lighting or other loads ON when activated using one or more selectable countdown time periods and then automatically turns lighting or other loads OFF when the selected time period has elapsed.

Daylight continuous dimming controls are continuous dimming controls that vary the luminous flux in response to available daylight.

Decorative (lighting/luminaires) is lighting or luminaires installed only for aesthetic purposes and that does not serve as display lighting or general lighting. Decorative luminaires are chandeliers, sconces, lanterns, neon or cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels not providing general lighting or task lighting.

Dimmer is a device used to control the intensity of light emitted by a luminaire by controlling the voltage or current available to it.

Dimmer, continuous means a dimmer that varies the luminous flux of the electric lighting system over a continuous range from the device's maximum light output to the device's minimum light output without visually apparent abrupt changes in light level between the various steps.

Dimmer, forward phase cut varies the luminous flux of the electric lighting system in which a portion of the alternating current voltage waveform supplying to the light source is removed.

Dimmer, stepped varies the luminous flux of the electric lighting system in one or more predetermined discrete steps between maximum light output and OFF with changes in light level between adjacent steps being visually apparent.

Display lighting, case is lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance of small art objects, artifacts or valuable collections that involve customer

inspection of very fine detail from outside of a glass enclosed display case.

Display lighting, floor is supplementary lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance required to highlight features, such as merchandise on a clothing rack or sculpture or free standing of artwork, not displayed against a wall.

Display lighting, wall is supplementary lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance required to highlight features, such as merchandise on a shelf or wall-mounted artwork, displayed on perimeter walls.

Display lighting, window is lighting that provides a higher level of illuminance to a specific area than the level of surrounding ambient illuminance of objects such as merchandise, goods and artifacts, in a show window, to be viewed from the outside of a space through a window.

Enclosed luminaires are luminaires which contain enclosed lamp compartments where ventilation openings are less than 3 square inches per lamp in the lamp compartment as defined by UL 1598.

General lighting is installed electric lighting that provides a uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect, exclusive of daylighting, and also known as ambient lighting.

GU-24 is the designation of a lamp holder and socket configuration, based on a coding system by the International Energy Consortium, where "G" indicates the broad type of two or more projecting contacts, such as pins or posts, "U" distinguishes between lamp and holder designs of similar type but that are not interchangeable due to electrical or mechanical requirements, and "24" indicates 24 millimeters center to center spacing of the electrical contact posts.

Illuminance is the area density of the luminous flux incident at a point on a surface.

Illumination is commonly used in a qualitative sense to designate the act of illuminating or the state of being illuminated.

Inseparable Solid State Lighting (SSL) Luminaire is a luminaire featuring solid state lighting components such as LEDs, light engines and/or driver components which cannot be easily removed or replaced by the end user, thus requiring replacement of the entire luminaire. Removal of solid state lighting components may require the cutting of wires, use of a soldering iron, or damage to or destruction of the luminaire. If solid state lighting components are not removable without destruction to the luminaire, the luminaire is deemed inseparable.

Institutional tuning is the process of adjusting the maximum light output of lighting systems to support visual needs or save energy. Institutional tuning differs from personal tuning in that the control strategy is implemented at the institutional rather than the individual user level, and maximum light level adjustments are available only to authorized personnel.

Lamp is an electrical appliance that produces optical radiation for the purpose of visual illumination, designed with a base to provide an electrical connection between the lamp and a luminaire, and designed to be installed into a luminaire. A lamp is not a luminaire and is not an LED retrofit kit

Landscape lighting is a type of outdoor lighting that is recessed into or mounted on the ground, paving or raised deck, which is mounted less than 42 inches above grade or mounted onto trees or trellises, and that is intended to be aimed only at landscape features.

Lantern is an outdoor luminaire that uses an electric lamp to replicate the appearance of a pre-electric lantern, which used a flame to generate light.

Light is a form of radiant energy that is capable of exciting the retina and producing a visual sensation. The visible portion of the electromagnetic spectrum extends from about 380 to about 770 nanometers.

Lighting, or illumination, is commonly used in a qualitative or general sense to designate the act of illuminating or the state of being illuminated.

Lighting control, self-contained is a unitary lighting control module that requires no additional components to be a fully functional lighting control.

Lighting control system requires two or more components to be installed in the building to provide all the functionality required to make up a fully functional and compliant lighting control.

Light emitting diode (LED) is a p-n junction semiconductor device that emits incoherent optical radiation when forward-biased. The optical emission may be in the ultraviolet, visible or infrared wavelength regions.

LED driver is a device composed of a power source and light emitting diode (LED) control circuitry designed to operate an LED package (component), an LED array (module) or an LED lamp. An LED driver is a power source that adjusts the voltage or current to LEDs, ranging in complexity from a resistor to a constant voltage or constant current power supply. An LED driver is also known and referred to as lamp control gear.

LED light engine is an integrated assembly composed of light emitting diode (LED) packages (components) or LED arrays (modules), as well as an LED driver and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a custom connector compatible with the LED luminaire for which it was designed. It does not use an ANSI standard base.

LED retrofit kit is a solid state lighting product intended to replace existing light sources and systems, including incandescent and fluorescent light sources, in previously installed luminaires that already comply with safety standards. These kits replace the existing light source and related electrical components, and are classified or certified to UL 1598C. They may employ an ANSI standard lamp base, either integral or connected to the retrofit by

wire leads. LED retrofit kit does not include self-ballasted lamps.

Integrated LED lamp is an integrated assembly composed of light emitting diode (LED) packages (components) or LED arrays (modules), as well as an LED driver, an ANSI standard base, and other optical, thermal, mechanical and electrical components. The device is intended to connect directly to the branch circuit through a corresponding ANSI standard lamp-holder (socket). (ANSI/IES LS-1-20).

Non-integrated LED lamp is an assembly composed of a light emitting diode (LED) array (module) or LED packages (components), and an ANSI standard base. The device is intended to connect to the LED driver of an LED luminaire through an ANSI standard lamp-holder (socket). The device cannot be connected directly to the branch circuit. (ANSI/IES LS-1-20).

Low voltage is less than 90 volts.

Luminaire is a complete lighting unit consisting of a light source such as a lamp or lamps, together with the parts that distribute the light, to position and protect the light source, and to connect the light source to the power supply.

Luminaire alteration is adding luminaires, removing and reinstalling luminaires, or combined replacement of lamps and ballasts or drivers. Luminaire alterations do not include repairs, such as replacing lamps only, ballasts or drivers only, diffusers, shades or luminaire covers.

Luminance is the luminous intensity of the source or surface divided by the area of the source or surface seen by the observer.

Luminous efficacy is a measure of the luminous efficiency of a light source. It is the quotient of the total luminous flux emitted by the total light source power input, expressed in lm/W.

Luminous flux is the time rate of flow of radiant energy, evaluated in terms of a standardized visual response.

Luminous maintenance (often referred to as “lumen flux maintenance” or “lumen maintenance”) is the remaining luminous flux output, typically expressed as a percentage of initial luminous flux output, at any selected elapsed operating time. Luminous maintenance is the converse of luminous flux depreciation (or “lumen depreciation”).

Marquee lighting is a permanent lighting system consisting of one or more rows of many small lamps, including light emitting diodes (LEDs) lamps, tungsten lamps, low pressure discharge lamps or fiber optic lighting, attached to a canopy.

Multilevel Astronomical Time Switch is an astronomical time-switch control that reduces lighting power in multiple steps.

Multilevel lighting control reduces power going to a lighting system in multiple steps.

Multiscene programmable control allows for two or more predefined lighting settings, in addition to all-OFF, for two or more groups of luminaires to suit multiple activities in the space.

Narrow band spectrum is a limited range of wavelengths (nm) concentric to a dominant peak wavelength in the visible spectrum. The limited range of wavelength shall be within 20 nm on either side of the peak wavelength at 50 percent of the peak wavelength's relative spectral power, and within 75 nm on either side of the peak wavelength at 10 percent of the peak wavelength's relative spectral power.

NEMA LSD 57 is the National Electrical Manufacturers Association document titled "Polyurethane Foam Application: Lighting Equipment," 2018 (NEMA LSD 57-2018).

NEMA SSL 7A is the National Electrical Manufacturers Association document titled "Phase Cut Dimming for Solid State Lighting: Basic Compatibility," 2015 (NEMA SSL 7A-2015).

Occupant sensing controls automatically control levels of illumination, allow for manual operation and consist of the following types:

Motion sensing control is used outdoors, automatically reduces lighting power or turns lights OFF after an area is vacated of occupants, and automatically turns the lights ON when the area is occupied.

Occupant sensing control is used indoors, automatically reduces lighting power or turns lights OFF after an area is vacated of occupants, and is capable of automatically turning the lighting load ON when an area is occupied.

Partial-ON occupant or motion sensing control automatically turns lights OFF after an area is vacated of occupants and is capable of automatically or manually turning ON part of the lighting load when an area is occupied.

Partial-OFF occupant or motion sensing control automatically dims the lighting or turns OFF part of the lighting load after an area is vacated of occupants, and is capable of automatically turning ON the lighting load or restoring it to full when an area is occupied.

Vacancy sensing control automatically turns lights OFF after an area is vacated of occupants but requires lights to be turned ON manually.

One-to-one alteration is either replacement of whole luminaires one for one, in which the only electrical modification involves disconnecting the existing luminaire and reconnecting the replacement luminaire, or when components of a luminaire are modified without replacing the entire luminaire.

Ornamental lighting/Luminaires are lighting or luminaires installed outdoors that are rated for 50 watts or less that are post-top luminaires, lanterns, pendant luminaires, chandeliers and marquee lighting, not providing general lighting or task lighting.

Pendant luminaire (Suspended luminaire) A luminaire that is hung from a ceiling by supports.

Permanently installed lighting consists of luminaires that are affixed to land, within the meaning of Civil Code

Sections 658 and 660, except as provided below. Permanently installed luminaires may be mounted inside or outside of a building or site. Permanently installed luminaires may have either plug-in or hardwired connections for electric power. Examples include track and flexible lighting systems; lighting attached to walls, ceilings, columns, inside or outside of permanently installed cabinets, internally illuminated cabinets, mounted on poles, in trees, or in the ground; attached to ceiling fans and integral to exhaust fans. Permanently installed lighting does not include portable lighting or lighting that is installed by the manufacturer in exhaust hoods for cooking equipment, refrigerated cases, food preparation equipment, and scientific and industrial equipment.

Photo control automatically turns lights ON and OFF, or automatically adjusts lighting levels, in response to the amount of daylight that is available. A photo control may also be one component of a field-assembled lighting system, the component having the capability to provide a signal proportional to the amount of daylight to a lighting control system to dim or brighten the electric lights in response.

Portable lighting is lighting equipment designed for manual portability, with plug-in connections for electric power, that is: table and freestanding floor lamps; attached to modular furniture; workstation task luminaires; luminaires attached to workstation panels; attached to movable displays; or attached to other personal property.

Post top luminaire is an outdoor luminaire that is mounted directly on top of a lamp-post.

Precision lighting is task lighting for commercial or industrial work that illuminates low contrast, finely detailed, or fast moving objects.

Radiant energy is energy travelling in the form of electromagnetic waves. It is measured in units of energy such as joules or kilowatt hours.

Radiant power is the time rate of flow of radiant energy. It is expressed preferably in watts.

Recessed luminaire is a luminaire that is mounted in the ceiling or behind a wall or other surface with the opening of the luminaire flush with the surface.

Sconce is a wall mounted decorative accent luminaire.

Security cameras are any operational camera used to enhance the safety and security within a general hardscape area.

Shut-off controls are any lighting control capable of automatically shutting OFF the lighting in a space when the space is typically unoccupied.

Solid State Lighting (SSL) is a family of light sources that includes: semiconductor light emitting diodes (LEDs); and organic light emitting diodes (OLEDs).

Driver, when used in relation to solid state lighting, is a device that uses semiconductors to control and supply DC power for LED starting and operation.

Source (light) is the general term used to reference a source of light. It can refer variously to an electric lamp, a light emitting diode (LED), an entire luminaire with lamp and optical control, or fenestration for daylighting.

Special effects lighting is lighting installed to give off luminance instead of providing illuminance, which does not serve as general, task or display lighting.

Task lighting is lighting directed to a specific surface or area, providing illumination for visual tasks. Task lighting is not general lighting.

Temporary lighting is a lighting installation, with plug-in connections, that does not persist beyond 60 consecutive days or more than 120 days per year.

Track lighting is a lighting equipment system consisting of an electrified power channel (track) and removable luminaires (lamp holders; track heads) that can be mechanically attached anywhere along the power channel. The luminaires can be repositioned and re-aimed as desired. Track lighting includes the following types:

Line-voltage track lighting is equipped with luminaires that use line-voltage lamps or that are equipped with integral transformers at each luminaire.

Low-voltage track lighting is equipped with remote transformers for use with low-voltage equipment along the entire length of track.

Track lighting integral current limiter consists of a current limiter integral to the end-feed housing of a manufactured line-voltage track lighting system.

Track lighting supplementary overcurrent protection panel is a panelboard containing Supplementary Overcurrent Protection Devices as defined in Article 100 of the *California Electrical Code*, and used only with line voltage track lighting.

Track-mounted luminaires are luminaires designed to be attached at any point along a track lighting system. Track-mounted luminaires may be line-voltage or low-voltage.

Tunable lighting are light sources with the ability to alter their luminous flux and/or spectral power distribution. Tunable lighting includes the following types:

Color tunable light source is capable of emitting highly saturated light of varying hues, as well as white light, for example by varying the relative intensity of individual emitters within the light source.

Dim-to-warm (also known as warm dim) light source is capable of simultaneously decreasing its correlated color temperature as its light output decreases, typically resembling the change in color temperature of an incandescent lamp as it dims.

Tunable white light source is capable of adjusting its correlated color temperature while maintaining its relative light output and capable of adjusting its light output while maintaining its correlated color temperature.

LISTED is in accordance with Article 100 of the *California Electrical Code*.

LOW-GWP REFRIGERANT is a compound used as a heat transfer fluid or gas that is: (A) any compound or blend of compounds, with a GWP Value less than 150; and (B) U.S. EPA Significant New Alternatives Policy (SNAP)-approved; and (C) not an ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2017).

LOW-RISE RESIDENTIAL BUILDING is a building, other than a hotel/motel that is Occupancy Group:

R-2, multifamily, with three habitable stories or less; or

R-3, single family; or

U-building, located on a residential site.

LPG is liquefied petroleum gas.

MANUAL is capable of being operated by personal intervention.

MANUFACTURED DEVICE is any heating, cooling, ventilation, lighting, water heating, refrigeration, cooking, plumbing fitting, insulation, door, fenestration product, or any other appliance, device, equipment, or system subject to Sections 110.0 through 110.9 of Part 6.

MECHANICAL COOLING is lowering the temperature within a space using refrigerant compressors or absorbers, desiccant dehumidifiers or other systems that require energy to directly condition the space. Systems that are solely energy recovery ventilation (ERV) or heat recovery ventilation (HRV) are not considered mechanical cooling. In nonresidential, multifamily buildings and hotel/motel buildings, cooling of a space by direct or indirect evaporation of water alone is not considered mechanical cooling.

MECHANICAL HEATING is raising the temperature within a space using electric resistance heaters, fossil fuel burners, heat pumps or other systems that require energy to directly condition the space. Systems that only use solar energy or heat recovery as the heat source are not mechanical heating systems.

MERV is the minimum efficiency reporting value as determined by ASHRAE Standard 52.2 Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.

METAL BUILDING is a complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin. This does not include structural glass or metal panels such as in a curtainwall system.

MICROCHANNEL CONDENSER is an air-cooled condenser for refrigeration systems which utilizes multiple small parallel gas flow passages in a flat configuration with fin surfaces bonded between the parallel gas passages.

MINISPLIT AIR CONDITIONERS AND HEAT PUMPS are air conditioner or heat pump systems that have a single outdoor section and one or more indoor sections. The indoor sections cycle on and off in unison in response to a single indoor thermostat.

MODELING ASSUMPTIONS are the conditions (such as weather conditions, thermostat settings and schedules, internal gain schedules, etc.) that are used for calculating a building’s annual energy consumption as specified in the Alternative Calculation Methods (ACM) Approval Manuals.

MULTIFAMILY BUILDING is any of the following:

A building of Occupancy Group R-2, other than a hotel/motel building or timeshare property,

A building of Occupancy Group R-3 that is a nontransient congregate residence, other than boarding houses of more than 6 guests and alcohol or drug abuse recovery homes of more than 6 guests, or

A building of Occupancy Group R-4.

MULTIPLE-SPLIT AIR CONDITIONERS AND HEAT PUMPS are air conditioner or heat pump systems that have two or more indoor sections. The indoor sections operate independently and can be used to condition multiple zones in response to multiple indoor thermostats.

MULTIPLE ZONE SYSTEM is an air distribution system that supplies air to more than one space conditioning zone, each of which has one or more devices (such as dampers, cooling coils and heating coils) that regulate airflow, cooling or heating capacity to the zone.

NATURAL GAS AVAILABILITY. For newly constructed buildings, natural gas is available if a gas service line can be connected to the site without a gas main extension. For addition and alteration, natural gas is available if a gas service line is connected to the existing building.

NEEA is the Northwest Energy Efficiency Alliance.

NEEA ADVANCED WATER HEATER SPECIFICATION is the Northwest Energy Efficiency Alliance (NEEA) specification version 7.0 for heat pump water heaters.

NET EXHAUST FLOW RATE is the exhaust flow rate for a hood, minus any internal discharge makeup air flow rate.

NET SENSIBLE COEFFICIENT OF PERFORMANCE (COP) is defined by AHRI 1360 and includes all indoor unit power and air-cooled condenser/condensing unit power for air-cooled units and includes all indoor unit power and the power allowance for pump and heat rejection as described in the Heat Rejection/Cooling Fluid Standard Rating Conditions table of AHRI 1360 for water, glycol and chilled water units.

NEWLY CONDITIONED SPACE is any space being converted from unconditioned to directly conditioned or indirectly conditioned space. Newly conditioned space must comply with the requirements for an addition. See Section 141.0 for nonresidential occupancies and Section 150.2 for residential occupancies.

NEWLY CONSTRUCTED BUILDING is a building that has never been used or occupied for any purpose.

NONDUCTED SYSTEM is an air conditioner or heat pump that is permanently installed; directly heats or cools air within the conditioned space; and uses one or more indoor coils that are mounted on walls or ceilings within the conditioned space. The system may be of a modular design that allows for

combining multiple outdoor coils and compressors to create one unified system.

NONRESIDENTIAL BUILDING is any building which is identified in the *California Building Code* Table; Description of Occupancy as Group A, B, E, F, H, I, M, or S, and is a U; as defined by Part 2 of Title 24 of the California Code or Regulation.

Note: Requirements for high-rise residential buildings and hotels/motels are included in the nonresidential sections of Part 6.

NONRESIDENTIAL BUILDING OCCUPANCY TYPES are building types in which a minimum of 90 percent of the building floor area functions as one of the following, which do not qualify as any other Building Occupancy Types more specifically defined in Section 100.1, and which do not have a combined total of more than 10 percent of the area functioning of any Nonresidential Function Areas specifically defined in Section 100.1:

Assembly building is a building with meeting halls in which people gather for civic, social, or recreational activities. These include civic centers, convention centers and auditoriums.

Commercial and industrial storage building is a building with building floor areas used for storing items.

Financial institution building is a building with floor areas used by an institution which collects funds from the public and places them in financial assets such as deposits, loans, and bonds.

Grocery store building is a building with building floor areas used for the display and sale of food.

Gymnasium building is a building with building floor areas used for physical exercises and recreational sport events and activities.

Industrial/manufacturing facility building is a building with building floor areas used for performing a craft, assembly or manufacturing operation.

Library building is a building with building floor areas used for repository of literary materials and for reading reference, such as books, periodicals, newspapers, pamphlets and prints.

Motion picture theater building is a building with building floor areas used for showing motion pictures to audiences.

Museum building is a building with building floor areas in which objects of historical, scientific, artistic or cultural interests are curated, treated, preserved, exhibited and stored.

Office building is a building of CBC Group B Occupancy with building floor areas in which business, clerical or professional activities are conducted.

Parking garage building is a building with building floor areas used for parking vehicles, and consists of at least a roof over the parking area enclosed with walls on all sides. The building includes areas for vehicle maneuvering to reach designated parking spaces. If the roof of a parking

structure is also used for parking, the section without an overhead roof is considered an outdoor parking lot instead of a parking garage.

Performance arts theater building is a building with building floor areas used for showing performing arts that include plays, music or dance to audiences.

Religious facility building is a building with building floor areas used for assembly of people to worship.

Restaurant building is a building with building floor areas in which food and drink are prepared and served to customers in return for money.

Retail store building is a building with building floor areas used for the display and sale of merchandise except food.

School building is a building used by an educational institution. The building floor area can include classrooms or educational laboratories and may include an auditorium, gymnasium, kitchen, library, multipurpose room, cafeteria, student union or workroom. A maintenance or storage building is not a school building.

Sports arena building is a building with building floor areas used for public viewing of sporting events and activities. Sports arenas are classified according to the number of spectators they are able to accommodate, as follows:

Class I Facility is used for competition play for 5,000 or more spectators.

Class II Facility is used for competition play for up to 5,000 spectators.

Class III Facility is used for competition play for up to 2,000 spectators.

Class IV Facility is normally used for recreational play and there is limited or no provision for spectators.

NONRESIDENTIAL COMPLIANCE MANUAL is the manual developed by the Commission, under Section 25402.1(e) of the Public Resources Code, to aid designers, builders and contractors in meeting the energy efficiency requirements for nonresidential, high-rise residential and hotel/motel buildings.

NONRESIDENTIAL FUNCTION AREAS are those areas, rooms, and spaces within Nonresidential Buildings that fall within the following particular definitions and are defined according to the most specific definition.

Aisle way is the passage or walkway between storage racks permanently anchored to the floor in a Commercial or Industrial Storage Building, where the racks are used to store materials such as goods and merchandise.

Atrium is a large-volume indoor space created by openings between two or more stories but is not used for an enclosed stairway, elevator hoistway, escalator opening or utility shaft for plumbing, electrical, air-conditioning or other equipment.

Audience seating area is a room or area with fixed seats for public meetings or gatherings.

Auditorium area is a room or area with a stage and fixed seats used for public meetings or gatherings.

Auto repair/maintenance area is an area used to repair or maintain automotive equipment and/or vehicles.

Barber, beauty salon, spa area is a room or area in which the primary activity is manicures, pedicures, facials, or the cutting or styling of hair.

Civic meeting place area is a space in a government building designed or used for public debate, discussion or public meetings of governmental bodies.

Classroom, lecture, training, vocational area is a room or area where an audience or class receives instruction.

Commercial and industrial storage area (refrigerated) is a room or area used for storing items where mechanical refrigeration is used to maintain the space temperature at 55°F or less.

Convention, conference, multipurpose and meeting area are rooms or areas that are designed or used for meetings, conventions or events, and that have neither fixed seating nor fixed staging.

Copy room is a room or area used for copying, scanning, or binding documents.

Corridor area is a passageway or route into which compartments or rooms open.

Dining areas include the following:

Bar/lounge is a room or area where wait staff serve patrons with liquor, cocktails, wine and beer in a relaxed atmosphere, usually with tables and chairs.

Cafeteria/fast food is a room or area where customers pick up their food at a counter and there is little or no wait staff or table service.

Family dining is a room or area where wait staff serve patrons with meals in a casual atmosphere.

Fine dining is a room or area where wait staff serve patrons with meals in an elegant and formal atmosphere.

Electrical/mechanical/telephone room is a room in which the building's electrical switchbox or control panels, telephone switchbox, and/or HVAC controls or equipment is located.

Exercise/fitness center and gymnasium area is a room or area equipped for gymnastics, exercise equipment or indoor athletic activities.

Financial transaction area is a room or area used by an institution that collects funds from the public and places them in financial assets such as deposits, loans and bonds, and includes tellers, work stations and customers' waiting areas; to complete financial transactions. Financial transaction areas do not include private offices, hallways, restrooms or other support areas.

Hotel function area is a hotel room or area such as a hotel ballroom, meeting room, exhibit hall or conference room, together with prefunction areas and other spaces ancillary to its function.

Kitchen/food preparation area is a room or area with cooking facilities or where food is prepared.

Laboratory, scientific area is a room or area where research, experiments, and measurement in medical and physical sciences are performed requiring examination of fine details. The area may include workbenches, countertops, scientific instruments, and associated floor spaces. Scientific laboratory does not refer to film, computer, and other laboratories where scientific experiments are not performed.

Laundry area is a room or area primarily designed or used for laundering activities.

Library area is a room or area primarily designed or used as a repository for literary materials such as books, periodicals, newspapers, pamphlets and prints, kept for reading or reference.

Reading area is a room or area in a library containing tables, chairs or desks for patrons to use for the purpose of reading books and other reference documents. Library reading areas include reading, circulation and checkout areas. Reading areas do not include private offices, meeting, photocopy or other rooms not used specifically for reading by library patrons.

Stack area is a room or area in a library with grouping of shelving sections. Stack aisles include pedestrian paths located in stack areas.

Lobby, main entry is the contiguous area in buildings including hotel/motel that is directly located by the main entrance of the building through which persons must pass, including any ancillary reception, waiting and seating areas.

Locker room is a room or area for changing clothing, sometimes equipped with lockers.

Lounge/breakroom or waiting area is a room or area in which people sit, wait and relax.

Mall is a roofed or covered common pedestrian area within a mall building that serves as access for two or more tenants.

Manufacturing, commercial and industrial work area is a room or area in which an art, craft, assembly or manufacturing operation is performed. Lighting installed in these areas is classified as follows:

High bay: Where the luminaires are 25 feet or more above the floor.

Low bay: Where the luminaires are less than 25 feet above the floor.

Precision: Where visual tasks of small size or fine detail such as electronic assembly, fine woodworking, metal lathe operation, fine hand painting and finishing, egg processing operations or tasks of similar visual difficulty are performed.

Healthcare facilities may have a room or area as follows:

Exam/treatment room is a room or area that does not provide overnight patient care and that is used to provide physical and mental care through medical, dental, or psychological examination and treatment, including laboratories and treatment spaces.

Imaging room is a diagnostic room and area for application and review of results from imaging technologies including x-ray, ultrasound, computerized tomography (CT), and magnetic resonance imaging (MRI).

Medical supply room is a room or area used for storing medical supplies.

Nursery is a room or area for providing medical care for newly born infants.

Nurse's station is a room or area where health care staff work when not directly interacting with patients.

Operating room is a room or area where surgical operations are carried out in a sterile environment. This category also applies to veterinary operating rooms.

Patient room is a room or area that is occupied by one or more patients during a stay in a healthcare facility or hospital.

Physical therapy room is a room or area for providing physical therapy treatment.

Recovery room is a room or area that is equipped with apparatus for meeting postoperative emergencies and in which surgical patients are kept during the immediate postoperative period for care and recovery from anesthesia.

Multipurpose room is a room that can be used for multipurpose activities such as meetings, instructional activities and social gatherings. Multipurpose rooms are typically found in offices, schools, convention centers, and assisted living facilities.

Museum areas include the following:

Exhibit/display is a room or area in a museum that has for its primary purpose exhibitions, having neither fixed seating nor fixed staging. An exhibit does not include a gallery or other place where art is for sale. An exhibit does not include a lobby, conference room, or other occupancies where the primary function is not exhibitions.

Restoration room is a room or area in which the primary function is the care of works of artistic, historical or scientific value. A restoration does not include a gallery or other place where art is for sale. A restoration does not include a lobby, conference room or other occupancies where the primary function is not the care or exhibit of works of artistic, historical or scientific value.

Office area is a room or area in a building of CBC Group B Occupancy in which business, clerical or professional activities are conducted.

Parking garage areas include the following:

Daylight adaptation zone in a parking garage is the interior path of travel for vehicles adjacent to the entrance or exit of a parking garage as needed for visual adaptation to transition from exterior daylight levels to interior light levels. Daylight adaptation zones only

include the path of vehicular travel and do not include adjacent parking areas.

Parking zones and ramps in a parking garage are used for the purpose of parking and maneuvering of vehicles. Parking areas include sloping floors of a parking garage, ramps and driveways specifically for the purpose of moving vehicles between floors of a parking garage. Parking areas and ramps do not include daylight adaptation zones or the roof of a parking garage, which may be present in a parking garage.

Pharmacy area is a room or area where medicinal drugs are dispensed and sold, usually in a retail store.

Playing area for sports arena is an area where sports are played in front an audience.

Religious worship area is a room or area in which the primary function is for an assembly of people to worship. Religious worship does not include classrooms, offices or other areas in which the primary function is not for an assembly of people to worship.

Restroom is a room providing personal facilities such as toilets and washbasins.

Retail sales areas include the following:

Fitting room is a room or area where the retail customers try out clothing before purchasing.

Grocery sales is a room or area that has as its primary purpose the sale of foodstuffs requiring additional preparation prior to consumption.

Retail merchandise sales is a room or area in which the primary activity is the sale of merchandise.

Server room is a room smaller than 500 square feet, within a larger building, in which networking equipment and Information Technology (IT) server equipment is housed, and a minimum of five IT servers are installed in frame racks.

Server aisle is an aisle of racks of Information Technology (IT) server equipment in a Server Room. While networking equipment may also be housed on these racks, it is largely a room to manage server equipment.

Stairs is a series of steps providing passage for persons from one level of a building to another, including escalators.

Stairwell is a vertical shaft in which stairs are located.

Storage, commercial and industrial area includes the following:

Shipping & Handling is a room or areas used for packing, wrapping, labeling and shipping out goods, merchandise and materials.

Warehouse is a room or areas used for storing of items such as goods, merchandise and materials.

Support area is a room or area used as a passageway, utility room, storage space or other type of space associated with or secondary to the function of an occupancy that is listed in these regulations.

Tenant lease area is a room or area in a building intended for lease for which a specific tenant is not identified at the time of building permit application.

Theater areas include the following:

Motion picture theater is an assembly room or area with rows of seats for the showing of motion pictures.

Performance theater is an assembly room or area with rows of seats for the viewing of dramatic performances, lectures, musical events and similar live performances.

Transportation function areas include the following:

Baggage area is a room or area in a transportation facility such as an airport where the travelers reclaim their baggage.

Ticketing area is a room or area in a transportation facility such as an airport or a train station where travelers purchase tickets, check in baggage, or inquire about travel information.

Videoconferencing studio is a room or area with permanently installed videoconferencing cameras, audio equipment and playback equipment for both audio-based and video-based two-way communication between local and remote sites.

NONSTANDARD PART LOAD VALUE (NPLV) is a single-number part-load efficiency figure of merit for chillers referenced to conditions other than IPLV conditions. (See “integrated part load value.”)

NORTH-FACING (See “orientation.”)

OCCUPANCY is the purpose for which a building or part thereof is used or intended to be used.

OCCUPANCY, HUMAN is any occupancy that is intended primarily for human activities.

OCCUPANCY GROUP is a classification of occupancy defined in Chapter 3 of the CBC (Title 24, Part 2).

OCCUPANCY TYPE is a description of occupancy that is more specific than occupancy group and that relates to determining the amount of lighting, ventilation, or other services needed for that portion of the building.

OCCUPIABLE SPACE is any enclosed space that is intended for human occupancy, including all habitable spaces as well as bathrooms, toilets, closets, halls, storage and utility areas, laundry areas, and similar areas. (See also “habitable space.”)

OCCUPIED STANDBY MODE is when a zone is scheduled to be occupied and an occupant sensor indicates zero population within the zone.

ONLINE CAPACITY is the total combined capacity in actual cubic feet per minute of compressed air at a given pressure from all online compressors.

ONLINE COMPRESSORS are all the compressors that are physically connected to compressed air piping and are available to serve peak load. Online compressors do not include back up compressors whose only purpose is to be available when an online compressor fails.

OPEN COOLING TOWER, or OPEN-CIRCUIT COOLING TOWER is an open, or direct contact, cooling tower which exposes water directly to the cooling atmosphere, thereby transferring the source heat load from the water directly to the air by a combination of heat and mass transfer.

OPENADR 2.0a is the OpenADR Alliance document titled “OpenADR 2.0 Profile Specification A Profile,” 2011.

OPENADR 2.0b is the OpenADR Alliance document titled “OpenADR 2.0 Profile Specification B Profile,” 2015.

OPERABLE FENESTRATION is designed to be opened or closed.

OPTIMUM START CONTROLS are controls that are designed to automatically adjust the start time of a space-conditioning system each day with the intent of bringing the space to desired occupied temperature levels at the beginning of scheduled occupancy.

OPTIMUM STOP CONTROLS are controls that are designed to setup or setback thermostat setpoints before scheduled unoccupied periods based upon the thermal lag and acceptable drift in space temperature that is within comfort limits.

OSHPD is the California Office of Statewide Health Planning and Development.

ORIENTATION, CARDINAL is one of the four principal directional indicators, north, east, south and west, which are marked on a compass. Also called cardinal directions.

ORIENTATION, EAST-FACING is oriented to within 45 degrees of true east, including 45°00'00" south of east (SE), but excluding 45°00'00" north of east (NE).

ORIENTATION, NORTH-FACING is oriented to within 45 degrees of true north, including 45°00'00" east of north (NE), but excluding 45°00'00" west of north (NW).

ORIENTATION, SOUTH-FACING is oriented to within 45 degrees of true south including 45°00'00" west of south (SW), but excluding 45°00'00" east of south (SE).

ORIENTATION, WEST-FACING is oriented to within 45 degrees of true west, including 45°00'00" north of due west (NW), but excluding 45°00'00" south of west (SW).

OUTDOOR AIR (Outside air) is air taken from outdoors and not previously circulated in the building.

OUTDOOR AREAS are areas external to a building. These include but are not limited to the following areas:

Building entrance way is the external area of any operable doorway in or out of a building, including overhead doors. These areas serve any doorway, set of doors (including elevator doors such as in parking garages), turnstile, vestibule or other form of portal that is ordinarily used to gain access to the building by its users and occupants. Where buildings have separate one-way doors to enter and to leave, this also includes any area serving any doors ordinarily used to leave the building.

Building façade is the exterior surfaces of a building, not including horizontal roofing, signs and surfaces not visible from any public accessible viewing location.

Canopy is a permanent structure, other than a parking garage area, consisting of a roof and supporting building elements, with the area beneath at least partially open to the elements. A canopy may be freestanding or attached to surrounding structures. A canopy roof may serve as the floor of a structure above.

Carport is a covered, open-sided structure designed or used primarily for the purpose of parking vehicles, having a roof over the parking area. Typically, carports are free-standing or projected from the side of the building and are only two or fewer car lengths deep. A “Carport” is not a “Garage.”

Hardscape is the area of an improvement to a site that is paved or has other structural features such as curbs, plazas, entries, parking lots, site roadways, driveways, walkways, sidewalks, bikeways, water features and pools, storage or service yards, loading docks, amphitheaters, outdoor sales lots, and private monuments and statuary.

Outdoor sales canopy is a canopy specifically to cover and protect an outdoor sales area.

Outdoor sales frontage is the portion of the perimeter of an outdoor sales area immediately adjacent to a public street, road or sidewalk.

Outdoor sales lot is an uncovered paved area used exclusively for the display of vehicles, equipment or other merchandise for sale. All internal and adjacent access drives, walkway areas, employee and customer parking areas, vehicle service or storage areas are not outdoor sales lot areas, but are considered hardscape.

Parking lot is an uncovered area for the purpose of parking vehicles. Parking lot is a type of hardscape.

Paved area is an area that is paved with concrete, asphalt, stone, brick, gravel or other improved wearing surface, including the curb.

Principal viewing location is anywhere along the adjacent highway, street, road or sidewalk running parallel to an outdoor sales frontage.

Public monuments are statuary, buildings, structures and/or hardscape on public land.

Stairways and ramps. Stairways are one or more flights of stairs with the necessary landings and platforms connecting them to form a continuous and uninterrupted passage from one level to another. An exterior stairway is open on at least one side, except for required structural columns, beams, handrails and guards. The adjoining open areas shall be either yards, courts or public ways. The other sides of the exterior stairway need not be open. Ramps are walking surfaces with a slope steeper than 5 percent.

Vehicle service station is a gasoline, natural gas, diesel or other fuel dispensing station.

OUTDOOR LIGHTING is electrical lighting used to illuminate outdoor areas.

OUTDOOR LIGHTING ZONE is a geographic area designated by the California Energy Commission in accordance with Part 1, Section 10-114, that determines

requirements for outdoor lighting, including lighting power densities and specific control, equipment or performance requirements. Lighting zones are numbered LZ0, LZ1, LZ2, LZ3 and LZ4.

OVERHANG is a contiguous opaque surface, oriented horizontally and projecting outward horizontally from an exterior vertical surface.

PART 1 means Part 1 of Title 24 of the California Code of Regulations.

PART 6 means Part 6 of Title 24 of the California Code of Regulations.

PART-LOAD OPERATION occurs when a system or device is operating below its maximum rated capacity.

PARTICLE SIZE EFFICIENCY is the fraction (percentage) of particles that are captured on air filter equipment as determined during rating tests conducted in accordance with ASHRAE Standard 52.2 or AHRI Standard 680. Particle Size Efficiency is measured in three particle size ranges: 0.3-1.0, 1.0-3.0, 3.0-10 microns.

PHOTOSYNTHETIC PHOTON EFFICACY (PPE) is photosynthetic photon flux divided by input electric power in units of micromoles per second per watt, or micromoles per joule as defined by ANSI/ASABE S640.

PHOTOSYNTHETIC PHOTON FLUX (PPF) is the rate of flow of photons between 400 to 700 nanometers in wavelength from a radiation source as defined by ANSI/ASABE S640.

POOLS, ANSI/APSP/ICC-5 is the American National Standards Institute and National Spa and Pool Institute document entitled “American National Standard for Residential Inground Swimming Pools,” 2011 (ANSI/APSP/ICC-5 2011) with Addenda A.

POOLS, AUXILIARY POOL LOADS are features or devices that circulate pool water in addition to that required for pool filtration, including, but not limited to, solar pool heating systems, filter backwashing, pool cleaners, waterfalls, fountains and spas.

POOLS, BACKWASH VALVE is a diverter valve designed to backwash filters located between the circulation pump and the filter, including, but not limited to, slide, push-pull, multiport and full-flow valves.

POOLS, MULTISPEED PUMP is a pump capable of operating at two (2) or more speeds and includes two-speed and variable-speed pumps.

POOLS, NSF/ANSI/CAN 50 is the NSF International (formerly National Sanitation Foundation) Standard and American National Standards Institute document entitled “Equipment and Chemicals for Swimming Pools, Spas, Hot Tubs, and Other Recreational Water Facilities,” 2020 (NSF/ANSI/CAN 50—2020).

POOLS, RESIDENTIAL are permanently installed residential in-ground swimming pools intended for use by a single-family home for noncommercial purposes and with dimensions as defined in ANSI/NSPI-5.

PRESSURE BOUNDARY is the primary air enclosure boundary separating indoor and outdoor air. For example, a volume that has more leakage to the outside than to the conditioned space would be considered outside the pressure boundary. Exposed earth in a crawlspace or basement shall not be considered part of the pressure boundary.

PRIMARY AIRFLOW is the airflow (cfm or L/s) supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means.

PRIMARY STORAGE is compressed air storage located upstream of the distribution system and any pressure flow regulators.

PROCESS is an activity or treatment that is not related to the space conditioning, lighting, service water heating or ventilating of a building as it relates to human occupancy.

PROCESS BOILER is a type of boiler with a capacity (rated maximum input) of 300,000 Btus per hour (Btu/h) or more that serves a process.

PROCESS, COVERED is a process that is regulated under Part 6, Sections 120.6 and 140.9, which includes computer rooms, data centers, elevators, escalators and moving walkways, laboratories, enclosed parking garages, commercial kitchens, refrigerated warehouses, commercial refrigeration, compressed air systems, process boilers and controlled environment horticultural spaces.

PROCESS, EXEMPT is a process that is not a covered process regulated under Part 6.

PROCESS LOAD is an energy load resulting from a process.

PROCESS SPACE is a nonresidential space that is designed to be thermostatically controlled to maintain a process environment temperature less than 55°F or to maintain a process environment temperature greater than 90°F for the whole space that the system serves, or that is a space with a space-conditioning system designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperatures below 90°F at design conditions.

PROPOSED DESIGN BUILDING is a building that is simulated by Commission-approved compliance software to determine the energy consumption resulting from all of the characteristics and energy consuming features that are actually proposed for a building, as specified by the Alternative Calculation Method (ACM) Approval Manual.

PUBLIC AREAS are spaces generally open to the public at large, customers or congregation members, or similar spaces where occupants need to be prevented from controlling lights for safety, security or business reasons.

R-VALUE is the measure of the thermal resistance of insulation or any material or building component expressed in ft²-hr-°F/Btu.

RADIANT BARRIER is a highly reflective, low emitting material installed at the underside surface of the roof deck and the inside surface of gable ends or other exterior vertical surfaces in attics to reduce solar heat gain.

RAISED FLOOR is a floor (partition) over a crawl space, or an unconditioned space, or ambient air.

READILY ACCESSIBLE is capable of being reached quickly for operation, repair or inspection, without requiring climbing or removing obstacles, or resorting to access equipment.

RECOOL is the cooling of air that has been previously heated by space-conditioning equipment or systems serving the same building.

RECOVERED ENERGY is energy used in a building that (1) is recovered from space conditioning, service water heating, lighting, or process equipment after the energy has performed its original function; (2) provides space conditioning, service water heating, or lighting; and (3) would otherwise be wasted.

REFERENCE APPENDICES is the support document for the Building Energy Efficiency Standards and the ACM Approval Manuals. The document consists of three sections: the Reference Joint Appendices (JA), the Reference Residential Appendices (RA) and the Reference Nonresidential Appendices (NA).

REFLECTANCE, SOLAR is the ratio of the reflected solar flux to the incident solar flux.

REFRIGERATED CASE is a manufactured commercial refrigerator or freezer, including but not limited to display cases, reach-in cabinets, meat cases, and frozen food and soda fountain units.

REFRIGERATED SPACE is a space constructed for storage or handling of products, where mechanical refrigeration is used to maintain the space temperature at 55°F or less.

REFRIGERATED WAREHOUSE is a building or a space greater than or equal to 3,000 square feet constructed for storage or handling of products, where mechanical refrigeration is used to maintain the space temperature at 55°F or less.

REHEAT is the heating of air that has been previously cooled by cooling equipment or supplied by an economizer.

RELOCATABLE PUBLIC SCHOOL BUILDING is a relocatable building as defined by Title 24, Part 1, Section 4-314, which is subject to Title 24, Part 1, Chapter 4, Group 1.

REPAIR is the reconstruction or renewal for the purpose of maintenance of any component, system or equipment of an existing building. Repairs shall not increase the preexisting energy consumption of the repaired component, system or equipment. Replacement of any component, system or equipment for which there are requirements in the Standards is considered an alteration and not a repair.

RESIDENTIAL BUILDING (See “High-rise residential building” and “Low-rise residential building.”)

RESIDENTIAL COMPLIANCE MANUAL is the manual developed by the Commission, under Section 25402.1 of the Public Resources Code, to aid designers, builders and contractors in meeting energy efficiency standards for low-rise residential buildings.

RESIDENTIAL SPACE TYPE is one of the following:

Bathroom is a room or area containing a sink used for personal hygiene, toilet, shower or a tub.

Closet is a nonhabitable room used for the storage of linens, household supplies, clothing, nonperishable food or similar uses, and which is not a hallway or passageway.

Garage is a nonhabitable building or portion of building, attached to or detached from a residential dwelling unit, in which motor vehicles are parked.

Kitchen is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens and floor area.

Laundry is a nonhabitable room or space which contains plumbing and electrical connections for a washing machine or clothes dryer.

Storage building is a nonhabitable detached building used for the storage of tools, garden equipment or miscellaneous items.

Utility room is a nonhabitable room or building which contains only HVAC, plumbing, or electrical controls or equipment; and which is not a bathroom, closet, garage or laundry room.

RESNET 380 is the Residential Energy Services Network document titled “Standard for Testing Airtightness of Building Enclosures, Dwelling Unit, and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems,” 2019 (ANSI/RESNET/ICC 380-2019).

ROOF is the outside cover of a building or structure including the structural supports, decking and top layer that is exposed to the outside with a slope less than 60 degrees from the horizontal.

ROOF, LOW-SLOPED is a roof that has a ratio of rise to run of less than 2:12 (9.5 degrees from the horizontal).

ROOF, STEEP-SLOPED is a roof that has a ratio of rise to run of greater than or equal to 2:12 (9.5 degrees from the horizontal).

ROOF RECOVER is the process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF RECOVER BOARD is a rigid type board installed directly below a low-sloped roof membrane, with or without above deck thermal insulation, to: (a) improve a roof system’s compressive strength, (b) physically separate the roof membrane from the thermal insulation, or (c) physically separate a new roof covering from an underlying roof membrane as part of a roof overlay project.

ROOF REPLACEMENT is the process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

ROOFING PRODUCT is the top layer of the roof that is exposed to the outside, which has properties including but not limited to solar reflectance, thermal emittance and mass.

RUNOUT is piping that is no more than 12 feet long and that connects to a fixture or an individual terminal unit.

SAE J1772 is the SAE International document titled “SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler” (SAE J1772_201710).

SATURATED CONDENSING TEMPERATURE (also known as CONDENSING TEMPERATURE) is: (a) for single component and azeotropic refrigerants, the saturation temperature corresponding to the refrigerant pressure at the condenser entrance, or (b) for zeotropic refrigerants, the arithmetic average of the Dew Point and Bubble Point temperatures corresponding to the refrigerant pressure at the condenser entrance.

SCIENTIFIC EQUIPMENT is measurement, testing or metering equipment used for scientific research or investigation, including but not limited to manufactured cabinets, carts and racks.

SEAL CLASS A is a ductwork sealing category that requires sealing all transverse joints, longitudinal seams and duct wall penetrations. Duct wall penetrations are openings made by pipes, conduit, tie rods or wires. Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two duct sections oriented perpendicular to airflow. Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels and duct connections to equipment. Sealing that would void product listings is not required. All duct pressure class ratings shall be designated in the design documents.

SEASONAL ENERGY EFFICIENCY RATIO (SEER) is the total cooling output of an air conditioner in Btu during its normal usage period for cooling divided by the total electrical energy input in watt-hours during the same period, as determined using the applicable test method in the Appliance Efficiency Regulations.

SEASONAL ENERGY EFFICIENCY RATIO 2 (SEER2) is the SEER metric for residential central air conditioners and heat pumps effective January 1, 2023, as created by the U.S. Department of Energy “ISSUANCE 2016-11-30 Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps, Final Rule.”

SENSIBLE ENERGY RECOVERY RATIO is a ratio of the change in the dry-bulb temperature of the outdoor air supply to the difference in dry-bulb temperature between the outdoor air and entering exhaust airflow, with no adjustment to account for that portion of the dry-bulb temperature change in the leaving supply airflow that is the result of leakage of entering exhaust airflow rather than heat exchange between the airstreams.

SERVICE WATER HEATING is heating of water for sanitary purposes for human occupancy, other than for comfort heating.

SHADING is the protection from heat gains because of direct solar radiation by permanently attached exterior devices or building elements, interior shading devices, glazing material or adherent materials.

SHADING COEFFICIENT(SC) is the ratio of the solar heat gain through a fenestration product to the solar heat gain through an unshaded $\frac{1}{8}$ -inch-thick clear double strength glass under the same set of conditions. For nonresidential, high-rise residential and hotel/motel buildings, this shall exclude the effects of mullions, frames, sashes, and interior and exterior shading devices.

SIDELIT DAYLIT ZONE, PRIMARY is the area in plan view directly adjacent to each vertical glazing, one window head height deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window, minus any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

SIDELIT DAYLIT ZONE, SECONDARY is the area in plan view directly adjacent to each vertical glazing, two window head heights deep into the area, and window width plus 0.5 times window head height wide on each side of the rough opening of the window, minus any area on a plan beyond a permanent obstruction that is 6 feet or taller as measured from the floor.

SIGN definitions include the following:

Electronic message center (EMC) is a pixelated image producing electronically controlled sign formed by any light source. Bare lamps used to create linear lighting animation sequences through the use of chaser circuits, also known as “chaser lights” are not considered an EMC.

Illuminated face is a side of a sign that has the message on it. For an exit sign it is the side that has the word “EXIT” on it.

Sign, cabinet is an internally illuminated sign consisting of frame and face, with a continuous translucent message panel, also referred to as a panel sign.

Sign, channel letter is an internally illuminated sign with multiple components, each built in the shape of an individual three-dimensional letter or symbol that are each independently illuminated, with a separate translucent panel over the light source for each element.

Sign, double-faced is a sign with two parallel opposing faces.

Sign, externally illuminated is any sign or a billboard that is lit by a light source that is external to the sign directed towards and shining on the face of the sign.

Sign, internally illuminated is a sign that is illuminated by a light source that is contained inside the sign where the message area is luminous, including cabinet signs and channel letter signs.

Sign, traffic is a sign for traffic direction, warning and roadway identification.

Sign, unfiltered is a sign where the viewer perceives the light source directly as the message, without any colored filter between the viewer and the light source, including neon, cold cathode and LED signs.

SINGLE FAMILY BUILDING is any of the following:

A residential building of Occupancy Group R-3 with two or fewer dwelling units,

A building of Occupancy Group R-3, other than a multi-family building or hotel/motel building,

A townhouse,

A building of Occupancy Group R-3.1 or

A building of Occupancy Group U when located on a residential site.

SINGLE PACKAGE VERTICAL AIR CONDITIONER (SPVAC) is a type of air-cooled small or large commercial package air-conditioning and heating equipment; factory assembled as a single package having its major components arranged vertically, which is an encased combination of cooling and optional heating components; is intended for exterior mounting on, adjacent interior to, or through an outside wall; and is powered by single or three-phase current. It may contain separate indoor grille, outdoor louvers, various ventilation options, indoor free air discharge, ductwork, wall plenum or sleeve. Heating components may include electrical resistance, steam, hot water, gas, or no heat but may not include reverse cycle refrigeration as a heating means.

SINGLE PACKAGE VERTICAL HEAT PUMP (SPVHP) is an SPVAC that utilizes reverse cycle refrigeration as its primary heat source, with secondary supplemental heating by means of electrical resistance, steam, hot water or gas.

SINGLE ZONE SYSTEM is an air distribution system that supplies air to one thermal zone controlled by a single thermostat.

SITE SOLAR ENERGY is thermal, chemical or electrical energy derived from direct conversion of incident solar radiation at the building site.

SKYLIGHT is fenestration installed on a roof less than 60 degrees from the horizontal.

SKYLIGHT AREA is the area of the rough opening for the skylight.

SKYLIGHT TYPE is one of the following three types of skylights: glass mounted on a curb, glass not mounted on a curb, or plastic (assumed to be mounted on a curb).

SKYLIT DAYLIT ZONE is the rough area in plan view under each skylight, plus 0.7 times the average ceiling height in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than one-half of the distance from the floor to the bottom of the skylight. The bottom of the skylight is measured from the bottom of the skylight well for skylights having wells, or the bottom of the skylight if no skylight well exists. For the purpose of determining the skylit daylit zone,

the geometric shape of the skylit daylit zone shall be identical to the plan view geometric shape of the rough opening of the skylight; for example, for a rectangular skylight the skylit daylit zone plan area shall be rectangular, and for a circular skylight the skylit daylit zone plan area shall be circular. For skylight located in an atrium, the skylit daylit zone shall include the floor area directly under the atrium, and the area of the top floor that is directly under the skylight, plus 0.7 times the average ceiling height of the top floor, in each direction from the edge of the rough opening of the skylight, minus any area on a plan beyond a permanent obstruction that is taller than one-half of the distance from the top floor to the bottom of the skylight.

SMACNA is the Sheet Metal and Air-conditioning Contractors National Association.

SMACNA HVAC DUCT CONSTRUCTION STANDARDS is the Sheet Metal Contractors' National Association document "HVAC Duct Construction Standards Metal and Flexible - 3rd Edition," 2006 (2006 ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition).

SMACNA RESIDENTIAL COMFORT SYSTEM INSTALLATION STANDARDS is the Sheet Metal Contractors' National Association document entitled "Residential Comfort System Installation Standards, Eighth Edition," (2016).

SOCIAL SERVICES BUILDING is a space where public assistance and social services are provided to individuals or families.

SOLAR ELECTRIC GENERATION SYSTEM or PHOTOVOLTAIC SYSTEM is the complete set of all components for converting sunlight into electricity through the photovoltaic process, including the array of panels, inverter(s) and the balance of system components required to enable the system to effectively deliver power to reduce a building's consumption of electricity from the utility grid.

SOLAR REFLECTANCE INDEX (SRI) is a measure of the roof's ability to reject solar heat, which includes both reflectance and emittance.

SOLAR SAVINGS FRACTION (SSF) is the fraction of domestic hot water demand provided by a solar water-heating system.

SOLAR ZONE is a section of the roof designated and reserved for the future installation of a solar electric or solar thermal system.

SOUTH-FACING (See "orientation.")

SPA is a vessel that contains heated water in which humans can immerse themselves, is not a pool, and is not a bathtub.

SPACE-CONDITIONING SYSTEM is a system that provides mechanical heating or mechanical cooling within or associated with conditioned spaces in a building, and may incorporate use of components such as chillers/compressors, fluid distribution systems (e.g., air ducts, water piping, refrigerant piping), pumps, air handlers, cooling and heating coils, air or water cooled condensers, economizers, terminal units, and associated controls.

STANDARD DESIGN BUILDING is a building that is automatically simulated by Commission-approved compliance software to establish the energy budget that is the maximum energy consumption allowed by a proposed design building to comply with the Title 24 Building Energy Efficiency Standards. The standard design building is simulated using the same location and having the same characteristics of the proposed design building, but assuming minimal compliance with the mandatory and prescriptive requirements that are applicable to the proposed building, as specified by the Alternative Calculation Methods Approval Manual.

STORAGE, COLD is a storage area within a refrigerated warehouse where space temperatures are maintained at or above 32°F.

STORAGE, FROZEN is a storage area within a refrigerated warehouse where the space temperatures are maintained below 32°F.

TENANT SPACE is a portion of a building occupied by a tenant.

THERMAL MASS is solid or liquid material with a high overall heat capacity to store energy for heating or cooling requirements.

THERMAL RESISTANCE (R) is a measurement of the resistance over time of a material or building component to the passage of heat in $(\text{hr} \times \text{ft}^2 \times ^\circ\text{F})/\text{Btu}$.

THERMOSTAT is an automatic control device or system used to maintain temperature at a fixed or adjustable setpoint.

THERMOSTATIC EXPANSION VALVE (TXV) is a refrigerant metering valve, installed in an air conditioner or heat pump, which controls the flow of liquid refrigerant entering the evaporator in response to the superheat of the gas leaving it.

TIME DEPENDENT VALUATION (TDV) ENERGY is the time varying energy caused to be used by the building to provide space conditioning and water heating and for specified buildings lighting. TDV energy accounts for the energy used at the building site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.

TOTAL HEAT OF REJECTION (THR) is the heat rejected by refrigeration system compressors at design conditions, consisting of the design cooling capacity plus the heat of compression added by the compressors.

TOWNHOUSE is a single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.

TRANSCRITICAL CO₂ REFRIGERATION SYSTEM is a type of refrigeration system that uses CO₂ as the refrigerant where the ultimate heat rejection to ambient air can take place above the critical point.

SUBCRITICAL MODE is a system operating condition for a refrigeration system wherein the refrigerant pressure and temperature leaving the compressor is such that the

refrigerant is below the critical point. Typically used in reference to CO₂ refrigeration systems.

TRANSCRITICAL MODE is a system operating condition for a refrigeration system wherein the refrigerant pressure and temperature leaving the compressor is such that the refrigerant is at or above the critical point. Typically used in reference to CO₂ refrigeration systems.

TRANSIENT is the occupancy for not more than 30 days of a dwelling unit or sleeping unit.

TRIM COMPRESSOR is a compressor that is designated for part-load operation, handling the short-term variable trim load of end uses, in addition to the fully loaded base compressors.

U-FACTOR is the overall coefficient of thermal transmittance of a fenestration, wall, floor, roof or ceiling component in $\text{Btu}/(\text{hr} \times \text{ft}^2 \times ^\circ\text{F})$, including air film resistance at both surfaces.

UL is the Underwriters Laboratories.

UL 181 is the Underwriters Laboratories document titled “Standard for Safety for Factory-Made Air Ducts and Air Connectors,” 2017 (UL 181).

UL 181A is the Underwriters Laboratories document titled “Standard for Safety for Closure Systems for Use with Rigid Air Ducts,” 2017 (UL 181A).

UL 181B is the Underwriters Laboratories document titled “Standard for Safety for Closure Systems for Use with Flexible Air Ducts and Air Connectors,” 2017 (UL 181B).

UL 723 is the Underwriters Laboratories document titled “Standard for Safety for Test for Surface Burning Characteristics,” 2018 (UL 723).

UL 727 is the Underwriters Laboratories document entitled “Standard for Safety for Oil-Fired Central Furnaces,” 2018 (UL 727).

UL 731 is the Underwriters Laboratories document entitled “Standard for Safety for Oil-Fired Unit Heaters,” 2018 (UL 731).

UL 1077 is the Underwriters Laboratories document titled “Standard for Safety for Supplementary Protectors for Use in Electrical Equipment,” 2016 (UL 1077).

UL 1574 is the Underwriters Laboratories document entitled “Standard for Safety for Track Lighting Systems,” 2020 (UL 1574).

UL 1598 is the Underwriters Laboratories document entitled “Standard for Safety for Luminaires,” 2021 (UL 1598).

UL 1741 is the Underwriters Laboratories document titled “Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources,” 2021 (UL 1741).

UL 1973 is the Underwriters Laboratories document titled “Standard for Safety for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications,” 2018 (ANSI/CAN/UL-1973:2018).

UL 2108 is the Underwriters Laboratories document titled “Standard for Safety for Low Voltage Lighting Systems,” 2019 (UL 2108).

UL 8750 is the Underwriters Laboratories document titled “Standards for Safety for Light Emitting Diode (LED) Equipment for Use in Lighting Products,” 2021 (UL 8750).

UL 9540 is the Underwriters Laboratories document titled “Standard for Safety for Energy Storage Systems and Equipment,” 2020 (ANSI/CAN/UL 9540:2021).

UNCONDITIONED SPACE is enclosed space within a building that is not directly conditioned or indirectly conditioned.

UNIFORM ENERGY FACTOR (UEF) of a water heater is a measure of overall water heater efficiency, as determined using the applicable test method in the Appliance Efficiency Regulations.

USDOE 10 CFR 430 is the regulation issued by Department of Energy and available in the Code of Federal Regulation - Title 10, Chapter II, Subchapter D, Part 430 – Energy Conservation Program for Consumer Products. Relevant testing methodologies are specified in applicable appendices.

USDOE 10 CFR 431 is the regulation issued by Department of Energy and available in the Code of Federal Regulation - Title 10, Chapter II, Subchapter D, Part 431 - Energy Conservation Program for Certain Commercial and Industrial equipment. Relevant testing methodologies are specified in “Subpart E to Part 431 – Uniform test method for the measurement of energy efficiency of commercial packaged boilers.”

VAPOR RETARDER CLASS is a measure of the ability of a material or assembly to limit the amount of moisture that passes through the material or assembly meeting Section 202 of the *California Building Code*.

VARIABLE AIR VOLUME (VAV) SYSTEM is a space-conditioning system that maintains comfort levels by varying the volume of supply air to the zones served.

VENDING MACHINE is a machine for vending and dispensing refrigerated or nonrefrigerated food and beverages or general merchandise.

VENTILATION SYSTEM, BALANCED is a mechanical device intended to remove air from buildings, and simultaneously replace it with outdoor air.

VENTILATION SYSTEM, CENTRAL FAN INTEGRATED, or CFI is a ventilation system configuration in which the ventilation ductwork is connected to the duct system of a dwelling unit space-conditioning system to enable distribution of ventilation air to the dwelling unit while the space-conditioning system air handling unit is operating.

VENTILATION SYSTEM, ENERGY RECOVERY, or ERV is a mechanical device intended to remove air from buildings, simultaneously replace it with outdoor air, and in the process transfer heat from the warmer to the colder of the simultaneous airflows and transfer moisture from the most humid to least humid of the simultaneous airflows.

VENTILATION SYSTEM, EXHAUST is a mechanical device intended to remove air from buildings, causing outdoor air to enter by ventilation inlets or normal leakage paths through the building envelope.

VENTILATION SYSTEM, HEAT RECOVERY, or HRV is a mechanical device intended to remove air from buildings, simultaneously replace it with outdoor air, and in the process transfer heat from the warmer to the colder of the simultaneous airflows.

VENTILATION SYSTEM, SUPPLY is a mechanical device intended to bring outdoor air into buildings, causing indoor air to flow out of the building through ventilation relief outlets or normal leakage paths through the building envelope.

VERY VALUABLE MERCHANDISE are rare or precious objects, including, but not limited to, jewelry, coins, small art objects, crystal, ceramics or silver, the selling of which involves customer inspection of very fine detail from outside of a locked case.

VIRTUAL END NODE (VEN) is an interface with a demand responsive control system that accepts signals transmitted through OpenADR, consistent with the specifications in OpenADR 2.0a or 2.0b.

WALL TYPE is a type of wall assembly having a specific heat capacity, framing type and *U*-factor.

WATER BALANCE IN EVAPORATIVE COOLING TOWERS. The water balance of a cooling tower is:

$M = E + B$, where:

M = makeup water (from the mains water supply)

E = losses due to evaporation

B = losses due to blowdown

WEST-FACING (See “orientation.”)

WINDOW FILM is a fenestration attachment product that consists of a flexible adhesive-backed polymer film, which may be applied to the interior or exterior surface of an existing glazing system.

WOOD HEATER is an enclosed wood-burning appliance used for space heating and/or domestic water heating.

WOOD STOVE (See “wood heater.”)

ZONAL describes characterized by or relating to a zone or zones.

ZONE, CRITICAL is a zone serving a process where reset of the zone temperature setpoint during a demand shed event might disrupt the process, including but not limited to computer rooms, data centers, telecom and private branch exchange (PBX) rooms, and laboratories.

ZONE, NONCRITICAL is a zone that is not a critical zone.

ZONE, SPACE-CONDITIONING, is a space or group of spaces within a building with sufficiently similar comfort conditioning requirements so that comfort conditions, as specified in Section 140.4(b)3 or 150.0(h), as applicable, can be maintained throughout the zone by a single controlling device.

**SECTION 100.2
CALCULATION OF TIME DEPENDENT
VALUATION (TDV) ENERGY**

Time Dependent Valuation (TDV) energy shall be used to compare proposed designs to their energy budget when using the performance compliance approach. TDV energy is calculated by multiplying the site energy use (electricity kWh, natural gas therms, or fuel oil or LPG gallons) for each energy type times the applicable TDV multiplier. TDV multipliers vary for each hour of the year and by energy type (electricity, natural gas or propane), by climate zone and by building type (low-rise residential or nonresidential, high-rise residential or hotel/motel). TDV multipliers are summarized in Reference Joint Appendix JA3. TDV multipliers for propane shall be used for all energy obtained from depletable sources other than electricity and natural gas.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

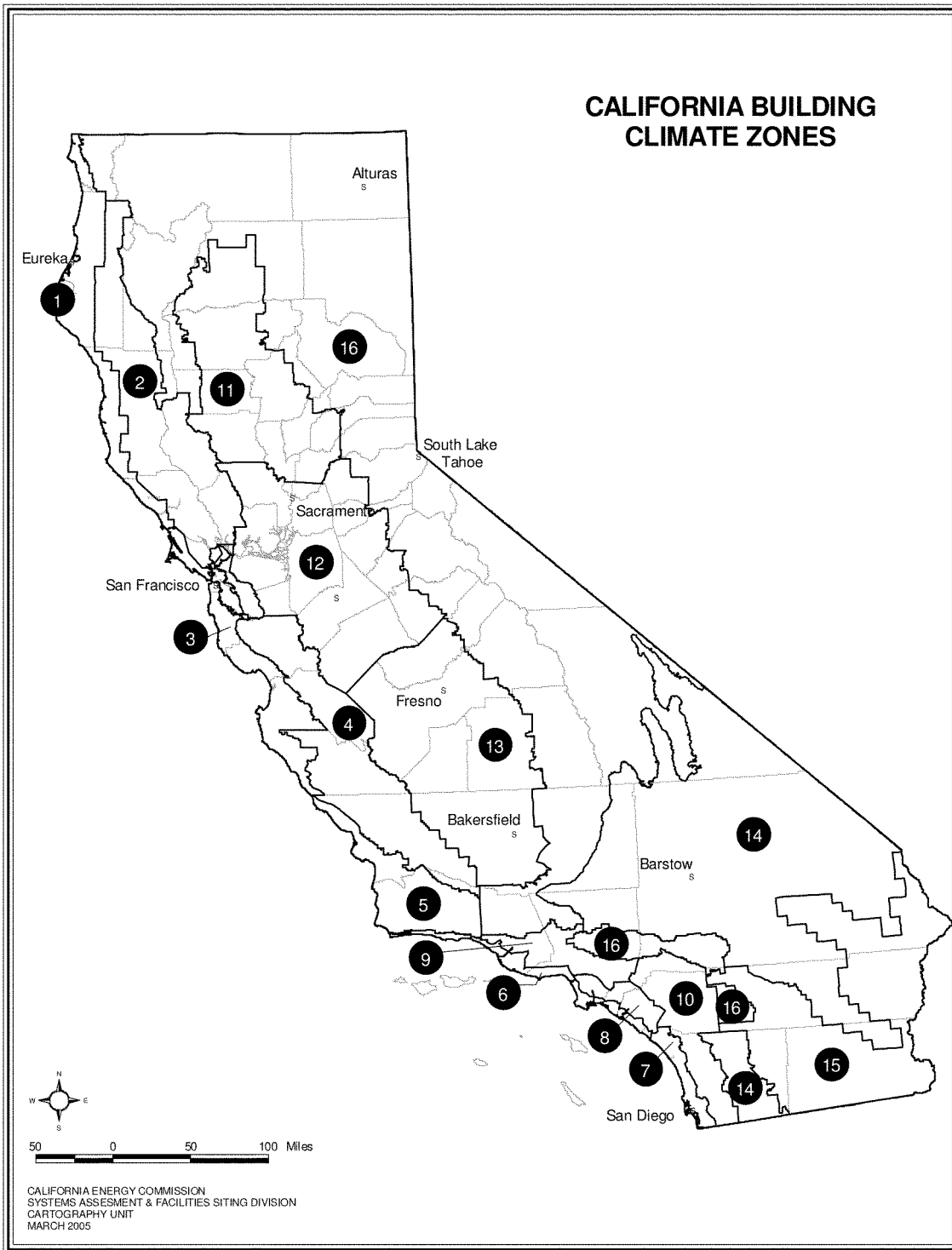


FIGURE 100.1-A CALIFORNIA CLIMATE ZONES
 Climate Zones for Residential and Nonresidential Occupancies

SUBCHAPTER 2

ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

SECTION 110.0 SYSTEMS AND EQUIPMENT—GENERAL

Sections 110.1 through 110.12 specify requirements for manufacturing, construction and installation of certain systems, equipment, appliances and building components that are installed in buildings within the scope of Section 100.0(a).

NOTE: The requirements of Sections 110.0 through 110.12 apply to newly constructed buildings. Sections 141.0 and 150.2 specify which requirements of Sections 110.1 through 110.12 also apply to additions and alterations to existing buildings.

(a) **General Requirements.** Systems, equipment, appliances and building components shall only be installed in a building within the scope of Section 100.0(a) regulated by Part 6 only if:

1. The manufacturer has certified that the system, equipment, appliances or building component complies with the applicable manufacturing provisions of Sections 110.1 through 110.12; and
2. The system, equipment, appliance or building component complies with all applicable installation provisions of Sections 110.1 through 110.12.

(b) **Certification Requirements for Manufactured Systems, Equipment, Appliances and Building Components.**

1. Appliances that are within the scope of Section 1601 of the Appliance Efficiency Regulations shall only be installed if they have been certified to the Energy Commission by the manufacturer, pursuant to the provisions of Title 20 California Code of Regulations, Section 1606; or
2. Systems, equipment, appliances and building components that are required by Part 6 or the Reference Appendices to be certified to the Energy Commission, which are not appliances that are within the scope of Section 1601 of the Appliance Efficiency Regulations, shall only be installed if they are certified by the manufacturer in a declaration, executed under penalty of perjury under the laws of the State of California, that:
 - A. all the information provided pursuant to the certification is true, complete, accurate and in compliance with all applicable requirements of Part 6; and
 - B. the equipment, product, or device was tested using the test procedure specified in Part 6 if applicable
3. The certification status of any system, equipment, appliance or building component shall be confirmed only by reference to:

- A. A directory published or approved by the Commission; or
- B. A copy of the application for certification from the manufacturer and the letter of acceptance from the Commission staff; or
- C. Written confirmation from the publisher of a Commission-approved directory that a device has been certified; or
- D. A Commission-approved label on the device.

NOTE: Part 6 does not require a builder, designer, owner, operator, or enforcing agency to test any certified device to determine its compliance with minimum specifications or efficiencies adopted by the Commission.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 110.1 MANDATORY REQUIREMENTS FOR APPLIANCES

(a) Any appliance regulated by the Appliance Efficiency Regulations, Title 20 California Code of Regulations, Section 1601 et seq., may be installed only if the appliance fully complies with Section 1608(a) of those regulations.

(b) Except for those circumstances described in Section 110.1(c), conformance with efficiency levels required to comply with Part 6 mandatory, prescriptive and performance standards shall be verified utilizing data from either:

1. The Energy Commission's database of certified appliances maintained pursuant to Title 20 California Code of Regulations Section 1606, and which is available at: www.energy.ca.gov/appliances/database/; or
2. An equivalent directory published by a federal agency; or
3. An approved trade association directory as defined in Title 20 California Code of Regulations Section 1606(h).

(c) Conformance with efficiency levels required to comply with Part 6 mandatory, prescriptive and performance standards shall be demonstrated either by default to the mandatory efficiency levels specified in Part 6 or by following procedures approved by the Commission pursuant to Section 10-109 of Title 24, Part 1, when:

1. Data to verify conformance with efficiency levels required to comply with Part 6 mandatory, prescriptive and performance standards is not available pursuant to subdivision (b); or

ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

2. Field verification and diagnostic testing is required for compliance with Part 6 and the Energy Commission has not approved a field verification and diagnostic test protocol that is applicable to the appliance; or
3. The appliance meets the requirements of Section 110.1(a) but has been site-modified in a way that affects its performance; or
4. The U.S. Department of Energy has approved a waiver from federal test procedures, pursuant to 10 CFR Section 430.27 or Section 431.401 and that waiver fails to specify how the efficiency of the system shall be determined.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 110.2
MANDATORY REQUIREMENTS FOR
SPACE-CONDITIONING EQUIPMENT**

Certification by manufacturers. Any space-conditioning equipment listed in this section may be installed only if the manufacturer has certified to the Commission that the equipment complies with all the applicable requirements of this section.

(a) **Efficiency.** Equipment shall meet the applicable efficiency requirements in Tables 110.2-A through 110.2-N, subject to the following:

1. If more than one efficiency standard is listed for any equipment in Tables 110.2-A through 110.2-N, the equipment shall meet all the applicable standards that are listed; and
2. If more than one test method is listed in Tables 110.2-A through 110.2-N, the equipment shall comply with the applicable efficiency standard when tested with each listed test method; and
3. Where equipment serves more than one function, it shall comply with the efficiency standards applicable to each function; and
4. Where a requirement is for equipment rated at its “maximum rated capacity” or “minimum rated capacity,” the capacity shall be as provided for and allowed by the controls, during steady-state operation.

Exception 1 to Section 110.2(a): Water-cooled centrifugal water-chilling packages that are not designed for operation at ANSI/AHRI Standard 550/590 test conditions of 44°F leaving chilled water temperature and 85°F entering condenser water temperature with 3 gallons per minute per ton condenser water flow shall have a maximum full load kW/ton and NPLV ratings adjusted using the following equation:

Adjusted maximum full-load kW/ton rating = (full-load kW/ton from Table 110.2-D)/ K_{adj}

Adjusted maximum NPLV rating = (IPLV from Table 110.2-D)/ K_{adj}

Where:

$$K_{adj} = (A) \times (B)$$

$$A = 0.00000014592 \times (\text{LIFT})^4 - 0.0000346496 \times (\text{LIFT})^3 + 0.00314196 \times (\text{LIFT})^2 - 0.147199 \times (\text{LIFT}) + 3.9302$$

$$\text{LIFT} = L_{vg} \text{Cond} - L_{vg} \text{Evap} (\text{°F})$$

$L_{vg} \text{Cond}$ = Full-load leaving condenser fluid temperature (°F)

$L_{vg} \text{Evap}$ = Full-load leaving evaporator fluid temperature (°F)

$$B = (0.0015 \times L_{vg} \text{Evap}) + 0.934$$

The adjusted full-load and NPLV values are only applicable for centrifugal chillers meeting all of the following full-load design ranges:

- Minimum Leaving Evaporator Fluid Temperature: 36°F
- Maximum Leaving Condenser Fluid Temperature: 115°F
- LIFT \geq 20°F and \leq 80°F

Centrifugal chillers designed to operate outside of these ranges are not covered by this exception.

Exception 2 to Section 110.2(a): Positive displacement (air-cooled and water-cooled) chillers with a leaving evaporator fluid temperature higher than 32°F shall show compliance with Table 110.2-D when tested or certified with water at standard rating conditions, per the referenced test procedure.

Exception 3 to Section 110.2(a): Equipment primarily serving refrigerated warehouses or commercial refrigeration.

(b) **Controls for heat pumps with supplementary electric resistance heaters.** Heat pumps with supplementary electric resistance heaters shall have controls:

1. That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and
2. In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating, and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

Exception 1 to Section 110.2(b): The controls may allow supplementary heater operation during:

- A. Defrost; and
- B. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

Exception 2 to Section 110.2(b): Room air-conditioner heat pumps.

(c) **Thermostats.** All heating or cooling systems not controlled by a central energy management control system (EMCS) shall have a setback thermostat.

1. **Setback capabilities.** All thermostats shall have a clock mechanism that allows the building occupant to program the temperature setpoints for at least four periods within 24 hours. Thermostats for heat pumps shall meet the requirements of Section 110.2(b).

Exception to Section 110.2(c): Gravity gas wall heaters, gravity floor heaters, gravity room heaters, noncentral electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners and room air-conditioner heat pumps.

(d) **Gas-fired and oil-fired furnace standby loss controls.** Gas-fired and oil-fired forced-air furnaces with input ratings $\geq 225,000$ Btu/hr shall also have an intermittent ignition or interrupted device (IID), and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings $\geq 225,000$ Btu/hr, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.

(e) **Open and closed-circuit cooling towers.** All open and closed cooling tower installations shall comply with the following:

1. Be equipped with conductivity or flow-based controls that maximize cycles of concentration based on local water quality conditions. Controls shall automate system bleed and chemical feed based on conductivity, or in proportion to metered makeup volume, metered bleed volume, recirculating pump run time, or bleed time. Conductivity controllers shall be installed in accordance with manufacturer's specifications in order to maximize accuracy.

2. Documentation of maximum achievable cycles of concentration. Building owners shall document the maximum cycles of concentration based on local water supply as reported annually by the local water supplier, and using the calculator approved by the Energy Commission. The calculator is intended to determine maximum cycles based on a Langelier Saturation Index (LSI) of 2.5 or less. Building owner shall document maximum cycles of concentration on the mechanical compliance form which shall be reviewed and signed by the Professional Engineer (P.E.) of Record.
3. Be equipped with a flow meter with an analog output for flow either hardwired or available through a gateway on the makeup water line.
4. Be equipped with an overflow alarm to prevent overflow of the sump in case of makeup water valve failure. Overflow alarm shall send an audible signal or provide an alert via the energy management control system to the tower operator in case of sump overflow.
5. Be equipped with efficient drift eliminators that achieve drift reduction to 0.002 percent of the circulated water volume for counter-flow towers and 0.005 percent for cross-flow towers.

Exception to Section 110.2(e): Open and closed-circuit cooling towers with rated capacity < 150 tons.

(f) **Low leakage air-handling units.** To qualify as a low leakage air-handling unit for use for meeting the requirements for applicable low leakage air-handling unit compliance credit(s) available in the performance standards set forth in Sections 150.1(b) and 140.1, the manufacturer shall certify to the Energy Commission that the air-handling unit meets the specifications in Reference Joint Appendix JA9.

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**TABLE 110.2-A
AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	EFFICIENCY^a	TEST PROCEDURE^b
Air conditioners, air cooled both split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h	11.2 EER ^a 14.8 IEER ^a	ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	11.0 EER ^a 14.2 IEER ^a	ANSI/AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	10.0 EER ^a 13.2 IEER ^a	
	≥ 760,000 Btu/h	9.7 EER ^a 12.5 IEER ^a	
Air conditioners, water cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	12.1 EER ^a 13.9 IEER ^a	ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	12.5 EER ^a 13.9 IEER ^a	ANSI/AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	12.4 EER ^a 13.6 IEER ^a	ANSI/AHRI 340/360
	≥ 760,000 Btu/h	12.2 EER ^a 13.5 IEER ^a	ANSI/AHRI 340/360
Air conditioners, evaporatively cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	12.1 EER ^a 12.3 IEER ^a	ANSI/AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	12.0 EER ^a 12.2 IEER ^a	ANSI/AHRI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	11.9 EER ^a 12.1 IEER ^a	ANSI/AHRI 340/360
	≥ 760,000 Btu/h	11.7 EER ^a 11.9 IEER ^a	ANSI/AHRI 340/360
Condensing units, air cooled	≥ 135,000 Btu/h	10.5 EER 11.8 IEER	ANSI/AHRI 365
Condensing units, water cooled	≥ 135,000 Btu/h	13.5 EER 14.0 IEER	
Condensing units, evaporatively cooled	≥ 135,000 Btu/h	13.5 EER 14.0 IEER	

a. Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.

b. Applicable test procedure and reference year are provided under the definitions.

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**TABLE 110.2-B
HEAT PUMPS, MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	EFFICIENCY ^a	TEST PROCEDURE ^b
Air cooled (cooling mode), both split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h		11.0 EER 14.1 IEER	AHRI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h		10.6 EER 13.5 IEER	
	≥ 240,000 Btu/h		9.5 EER 12.5 IEER	
Water source (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	86°F entering water	13.0 EER	ISO-13256-1
Groundwater source (cooling mode)	< 135,000 Btu/h	59°F entering water	18.0 EER	ISO-13256-1
Ground source (cooling mode)	< 135,000 Btu/h	77°F entering water	14.1 EER	ISO-13256-1
Water source water-to-water (cooling mode)	< 135,000 Btu/h	86°F entering water	10.6 EER	ISO-13256-2
Groundwater source water-to-water (cooling mode)	< 135,000 Btu/h	59°F entering water	16.3 EER	ISO-13256-2
Ground source brine-to-water (cooling mode)	< 135,000 Btu/h	77°F entering water	12.1 EER	ISO-13256-2
Air cooled (heating mode) Split system and single package	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	47°F db/43°F wb outdoor air	3.4 COP	AHRI 340/360
		17°F db/15°F wb outdoor air	2.25 COP	
	≥ 135,000 Btu/h (cooling capacity)	47°F db/43°F wb outdoor air	3.3 COP	
		17°F db/15°F wb outdoor air	2.05 COP	
Water source (heating mode)	< 135,000 Btu/h (cooling capacity)	68°F entering water	4.3 COP	ISO-13256-1
	≥ 135,000 Btu/h and < 240,000 Btu/h	68°F entering water	2.90 COP	ISO-13256-1
Groundwater source (heating mode)	< 135,000 Btu/h (cooling capacity)	50°F entering water	3.7 COP	ISO-13256-1
Ground source (heating mode)	< 135,000 Btu/h (cooling capacity)	32°F entering water	3.2 COP	ISO-13256-1
Water source water-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	68°F entering water	3.7 COP	ISO-13256-2
Groundwater source water-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	50°F entering water	3.1 COP	ISO-13256-2
Ground source brine-to-water (heating mode)	< 135,000 Btu/h (cooling capacity)	32°F entering water	2.5 COP	ISO-13256-2

- a. Deduct 0.2 from the required EERs and IEERs for units with a heating section other than electric resistance heat.
b. Applicable test procedure and reference year are provided under the definitions.

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**TABLE 110.2-C
AIR-COOLED GAS-ENGINE HEAT PUMPS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	EFFICIENCY	TEST PROCEDURE ^a
Air-cooled gas-engine heat pump (cooling mode)	All capacities	95°F db outdoor air	0.60 COP	ANSI Z21.40.4A
Air-cooled gas-engine heat pump (heating mode)	All capacities	47°F db/43°F wb outdoor air	0.72 COP	ANSI Z21.40.4A

a. Applicable test procedure and reference year are provided under the definitions.

**TABLE 110.2-D
WATER CHILLING PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS^{a, b}**

EQUIPMENT TYPE	SIZE CATEGORY	PATH A EFFICIENCY ^{a, b}	PATH B EFFICIENCY ^{a, b}	TEST PROCEDURE ^c
Air cooled, with condenser electrically operated	< 150 tons	≥ 10.100 EER ≥ 13.700 IPLV	≥ 9.700 EER ≥ 15.800 IPLV	AHRI 550/590
	≥ 150 tons	≥ 10.100 EER ≥ 14.000 IPLV	≥ 9.700 EER ≥ 16.100 IPLV	
Air cooled, without condenser electrically operated	All capacities	Air-cooled chillers without condensers must be rated with matching condensers and comply with the air-cooled chiller efficiency requirements.		AHRI 550/590
Water cooled, electrically operated reciprocating	All capacities	Reciprocating units must comply with the water-cooled positive displacement efficiency requirements.		AHRI 550/590
Water cooled, electrically operated, positive displacement	< 75 tons	≤ 0.750 kW/ton ≤ 0.600 IPLV	≤ 0.780 kW/ton ≤ 0.500 IPLV	AHRI 550/590
	≥ 75 tons and < 150 tons	≤ 0.720 kW/ton ≤ 0.560 IPLV	≤ 0.750 kW/ton ≤ 0.490 IPLV	
	≥ 150 tons and < 300 tons	≤ 0.660 kW/ton ≤ 0.540 IPLV	≤ 0.680 kW/ton ≤ 0.440 IPLV	
	≥ 300 tons and < 300 tons	≤ 0.610 kW/ton ≤ 0.520 IPLV	≤ 0.625 kW/ton ≤ 0.410 IPLV	
	≥ 600 tons	≤ 0.560 kW/ton ≤ 0.500 IPLV	≤ 0.585 kW/ton ≤ 0.380 IPLV	
Water cooled, electrically operated, centrifugal	> 150 ton	≤ 0.610 kW/ton ≤ 0.550 IPLV	≤ 0.695 kW/ton ≤ 0.440 IPLV	AHRI 550/590
	≥ 150 tons and < 300 tons	≤ 0.610 kW/ton ≤ 0.550 IPLV	≤ 0.635 kW/ton ≤ 0.400 IPLV	
	≥ 300 tons and < 400 tons	≤ 0.560 kW/ton ≤ 0.520 IPLV	≤ 0.595 kW/ton ≤ 0.390 IPLV	
	≥ 400 tons and < 600 tons	≤ 0.560 kW/ton ≤ 0.500 IPLV	≤ 0.585 kW/ton ≤ 0.380 IPLV	
	≥ 600 tons	≤ 0.560 kW/ton ≤ 0.500 IPLV	≤ 0.585 kW/ton ≤ 0.380 IPLV	
Air cooled absorption single effect	All capacities	≥ 0.600 COP	N.A. ^d	AHRI 560
Water cooled absorption single effect	All capacities	≥ 0.700 COP	N.A. ^d	
Absorption double effect, indirect-fired	All capacities	≥ 1.000 COP ≥ 1.050 IPLV	N.A. ^d	
Absorption double effect, direct-fired	All capacities	≥ 1.000 COP ≥ 1.000 IPLV	N.A. ^d	
Water cooled gas engine driven chiller	All capacities	≥ 1.2 COP ≥ 2.0 IPLV	N.A. ^d	ANSI Z21.40.4

a. No requirements for:

- Centrifugal chillers with design leaving evaporator temperature < 36°F; or
- Positive displacement chillers with design leaving fluid temperature ≤ 32°F; or
- Absorption chillers with design leaving fluid temperature < 40°F.

b. Must meet the minimum requirements of Path A or Path B. However, both the full load (COP) and IPLV must be met to fulfill the requirements of the applicable path.

c. See Section 100.1 for definitions.

d. N.A. means not applicable.

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**TABLE 110.2-E
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS— MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY (Input)	SUBCATEGORY OR RATING CONDITION	EFFICIENCY	TEST PROCEDURE ^c
PTAC (cooling mode) Newly constructed or newly conditioned buildings or additions	All capacities	95°F db outdoor air	14.0 - (0.300 × Cap/1000) ^a EER	ANSI/AHRI/CSA 310/380
PTAC (cooling mode) Replacements ^b	All capacities	95°F db outdoor air	10.9 - (0.213 × Cap/1000) ^a EER	
PTHP (cooling mode) Newly constructed or newly conditioned buildings or additions	All capacities	95°F db outdoor air	14.0 - (0.300 × Cap/1000) ^a EER	
PTHP (cooling mode) Replacements ^b	All capacities	95°F db outdoor air	10.8 - (0.213 × Cap/1000) ^a EER	
PTHP (heating mode) Newly constructed or newly conditioned buildings or additions	All capacities	—	3.7 - (0.052 × Cap/1000) ^a COP	
PTHP (heating mode) Replacements ^b	All capacities	—	2.9 - (0.026 × Cap/1000) ^a COP	
SPVAC (cooling mode)	< 65,000 Btu/h	95°F db/75°F wb outdoor air	11.0 EER	ANSI/AHRI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/75°F wb outdoor air	10.0 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/75°F wb outdoor air	10.0 EER	
SPVHP (cooling mode)	< 65,000 Btu/h	95°F db/75°F wb outdoor air	11.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h	95°F db/75°F wb outdoor air	10.0 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h	95°F db/75°F wb outdoor air	10.0 EER	
SPVHP (heating mode)	< 65,000 Btu/h	47°F db/43°F wb outdoor air	3.3 COP	
	≥ 65,000 Btu/h and < 135,000 Btu/h	47°F db/43°F wb outdoor air	3.0 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h	47°F db/43°F wb outdoor air	3.0 COP	

- a. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.
- b. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEWLY CONSTRUCTED BUILDINGS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high or less than 42 inch wide and having a cross-sectional area less than 670 square inches.
- c. Applicable test procedure and reference year are provided under the definitions.

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**TABLE 110.2-F
PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT**

EQUIPMENT TYPE	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED ^{a, b, c, d}	TEST PROCEDURE ^e
Propeller or axial fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering air wb	≥ 42.1 gpm/hp	CTI ATC-105 and CTI STD-201 RS
Centrifugal fan open-circuit cooling towers	All	95°F entering water 85°F leaving water 75°F entering air wb	≥ 20.0 gpm/hp	
Propeller or axial fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering air wb	≥ 16.1 gpm/hp	CTI ATC-105S and CTI STD-201 RS
Centrifugal fan closed-circuit cooling towers	All	102°F entering water 90°F leaving water 75°F entering air wb	≥ 7.0 gpm/hp	
Propeller or axial fan evaporative condensers	All	R-448A test fluid 165°F entering gas temp 105°F condensing temp 75°F entering air wb	≥ 157,000 Btu/h • hp	CTI ATC-106
	All	Ammonia test fluid 140°F entering gas temp 96.3°F condensing temp 75°F entering air wb	≥ 134,000 Btu/h • hp	
Centrifugal fan evaporative condensers	All	R-448A test fluid 165°F entering gas temp 105°F condensing temp 75°F entering air wb	≥ 135,000 Btu/h • hp	
	All	Ammonia test fluid 140°F entering gas temp 96.3°F condensing temp 75°F entering air wb	≥ 110,000 Btu/h • hp	
Air cooled condensers	All	125°F condensing temperature 190°F entering gas temperature 15°F subcooling 95°F entering dry-bulb	≥ 176,000 Btu/h • hp	AHRI 460
Propeller or axial fan dry coolers (air-cooled fluid coolers)	All	115°F entering water 105°F leaving water 95°F entering air db	≥ 4.5 gpm/hp	CTI ATC-105DS

- For purposes of this table, open-circuit cooling tower performance is defined as the water flow rating of the tower at the given rated conditions divided by the fan motor nameplate power.
- For purposes of this table, closed-circuit cooling tower performance is defined as the process water flow rating of the tower at the given rated conditions divided by the sum of the fan motor nameplate rated power and the integral spray pump motor nameplate power.
- For purposes of this table, dry cooler performance is defined as the process water flow rating of the unit at the given thermal rating condition divided by the total fan motor nameplate power of the unit and air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan motor nameplate power of the unit.
- Open cooling towers shall be tested using the test procedures in CTI ATC-105. Performance of factory-assembled open cooling towers shall be either certified as base models as specified in CTI STD-201 or verified by testing in the field by a CTI approved testing agency. Open factory assembled cooling towers with custom options added to a CTI certified base model for the purpose of safe maintenance or to reduce environmental or noise impact shall be rated at 90 percent of the CTI certified performance of the associated base model or at the manufacturer’s stated performance, whichever is less. Base models of open factory-assembled cooling towers are open cooling towers configured in exact accordance with the Data of Record submitted to CTI as specified by CTI STD-201. There are no certification requirements for field-erected cooling towers.
- Applicable test procedure and reference year are provided under the definitions. For refrigerated warehouses or commercial refrigeration applications, condensers shall comply with requirements specified by Section 120.6(a) or Section 120.6(b).

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**TABLE 110.2-G
ELECTRICALLY OPERATED VARIABLE REFRIGERANT FLOW (VRF) AIR CONDITIONERS MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE^a
VRF Air conditioners, Air cooled	< 65,000 Btu/h	All	VRF multisplit system	13.0 SEER	AHRI 1230
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	VRF multisplit system	11.2 EER 15.5 IEER ^b	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	11.0 EER 14.9 IEER ^b	
	≥ 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system	10.0 EER 13.9 IEER ^b	

a. Applicable test procedure and reference year are provided under the definitions.

b. IEERs are only applicable to equipment with capacity control as specified in ANSI/AHRI 1230 test procedures.

**TABLE 110.2-H
ELECTRICALLY OPERATED VARIABLE REFRIGERANT FLOW
AIR-TO-AIR AND APPLIED HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	HEATING SECTION TYPE	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE ^{a, b}
VRF Air cooled (cooling mode)	< 65,000 Btu/h	All	VRF multisplit system	13.0 SEER	AHRI 1230
	≥ 65,000 Btu/h and < 135,000 Btu/h	Electric resistance (or none)	VRF multisplit system ^a	11.0 EER 14.6 IEER ^c	
	≥ 135,000 Btu/h and < 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system ^a	10.6 EER 13.9 IEER ^c	
	≥ 240,000 Btu/h	Electric resistance (or none)	VRF multisplit system ^a	9.5 EER 12.7 IEER ^c	
VRF Water source (cooling mode)	< 65,000 Btu/h	All	VRF multisplit system ^a 86°F entering water	12.0 EER 16.0 IEER ^c	AHRI 1230
	≥ 65,000 Btu/h and < 135,000 Btu/h	All	VRF multisplit system ^a 86°F entering water	12.0 EER 16.0 IEER ^c	
	≥ 135,000 Btu/h and < 240,000 Btu/h	All	VRF multisplit system ^a 86°F entering water	10.0 EER 14.0 IEER ^c	
	≥ 240,000 Btu/h	All	VRF multisplit system ^a 86°F entering water	10.0 EER 12.0 IEER	
VRF Groundwater source (cooling mode)	< 135,000 Btu/h	All	VRF multisplit system ^a 59°F entering water	16.2 EER	AHRI 1230
	≥ 135,000 Btu/h	All	VRF multisplit system ^a 59°F entering water	13.8 EER	
VRF Ground source (cooling mode)	< 135,000 Btu/h	All	VRF multisplit system ^a 77°F entering water	13.4 EER	AHRI 1230
	≥ 135,000 Btu/h	All	VRF multisplit system ^a 77°F entering water	11.0 EER	
VRF Air cooled (heating mode)	< 65,000 Btu/h (cooling capacity)	—	VRF multisplit system	7.7 HSPF	AHRI 1230
	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.3 COP	
		—	VRF multisplit system 17°F db/15°F wb outdoor air	2.25 COP	
	≥ 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 47°F db/43°F wb outdoor air	3.2 COP	
—		VRF multisplit system 17°F db/15°F wb outdoor air	2.05 COP		
VRF Water source (heating mode)	< 65,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	4.3 COP	AHRI 1230
	≥ 65,000 Btu/h and < 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	4.3 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	4.0 COP	
	≥ 240,000 Btu/h (cooling capacity)	—	VRF multisplit system 68°F entering water	3.9 COP	
VRF Groundwater source (heating mode)	< 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 50°F entering water	3.6 COP	AHRI 1230
	≥ 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 50°F entering water	3.3 COP	
VRF Ground source (heating mode)	< 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 32°F entering water	3.1 COP	AHRI 1230
	≥ 135,000 Btu/h (cooling capacity)	—	VRF multisplit system 32°F entering water	2.8 COP	

a. Deduct 0.2 from the required EERs and IEERs for variable refrigerant flow (VRF) multisplit system units with a heating recovery section.

b. Applicable test procedure and reference year are provided under the definitions.

c. IEERs are only applicable to equipment with capacity control as specified in ANSI/AHRI 1230 test procedures.

TABLE 110.2-I
WARM-AIR FURNACES AND COMBINATION
WARM-AIR FURNACES/AIR-CONDITIONING UNITS, WARM-AIR DUCT FURNACES AND UNIT HEATERS^{c, f}

EQUIPMENT TYPE	SIZE CATEGORY (Input)	SUBCATEGORY OR RATING CONDITION ^b	MINIMUM EFFICIENCY ^{d, e}	TEST PROCEDURE ^a
Warm-Air furnace, gas-fired	≥ 225,000 Btu/h	Maximum capacity	81% E_t	Section 2.39, Thermal Efficiency, ANSI Z21.47
Warm-Air furnace, oil-fired	≥ 225,000 Btu/h	Maximum capacity	82% E_t	Section 42, Combustion, UL 727
Warm-Air duct furnaces, gas-fired	All capacities	Maximum capacity	80% E_c	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air unit heaters, gas-fired	All capacities	Maximum capacity	80% E_c	Section 2.10, Efficiency, ANSI Z83.8
Warm-Air unit heaters, oil-fired	All capacities	Maximum capacity	80% E_c	Section 40, Combustion, UL 731

- a. Applicable test procedure and reference year are provided under the definitions.
- b. Compliance of multiple firing rate units shall be at maximum firing rate.
- c. Combustion units not covered by the U.S. Department of Energy Code of Federal Regulations 10 CFR 430 (3-phase power or cooling capacity greater than or equal to 19 kW) may comply with either rating.
- d. E_t = thermal efficiency. Units must also include an interrupted or intermittent ignition device (IID), have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
- e. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.
- f. As of August 8, 2008, according to the Energy Policy Act of 2005, units must also include an interrupted or intermittent ignition device (IID) and have either power venting or an automatic flue damper.

ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

TABLE 110.2-J
GAS- AND OIL-FIRED BOILERS, MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SUBCATEGORY	SIZE CATEGORY (Input)	MINIMUM EFFICIENCY ^{b, c}		TEST PROCEDURE ^a
			Before 1/10/2023	On or After 1/10/2023 ^f	
Boiler, hot water	Gas-Fired	< 300,000 Btu/h	82% AFUE	82% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	80% E_t	80% E_t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h ^e	82% E_c	85% E_c	
		> 10,000,000 Btu/h	82% E_c	82% E_c	
	Oil-Fired ^e	< 300,000 Btu/h	84% AFUE	84% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	82% E_t	87% E_t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h ^e	84% E_c	88% E_c	
		> 10,000,000 Btu/h	84% E_c	84% E_c	
Boiler, steam	Gas-Fired	< 300,000 Btu/h	80% AFUE	80% AFUE	DOE 10 CFR Part 430
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h		81% E_t	DOE 10 CFR Part 431
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h		82% E_t	
		> 10,000,000 Btu/h		79% E_t	
	Gas-Fired all, except natural draft ^f	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	79% E_t	81% E_t	
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h ^e	79% E_t	82% E_t	
		> 10,000,000 Btu/h	79% E_t	79% E_t	
	Gas-Fired, natural draft ^f	≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	77% E_t	81% E_t	
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h ^e	77% E_t	82% E_t	
		> 10,000,000 Btu/h	77% E_t	79% E_t	
	Oil-Fired ^e	< 300,000 Btu/h	82% AFUE	82% AFUE	
		≥ 300,000 Btu/h and ≤ 2,500,000 Btu/h ^d	81% E_t	84% E_t	
		> 2,500,000 Btu/h and ≤ 10,000,000 Btu/h ^e	81% E_t	85% E_t	
		> 10,000,000 Btu/h	81% E_t	81% E_t	

- a. Applicable test procedure and reference year are provided under the definitions.
- b. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed information.
- c. E_t = thermal efficiency. See test procedure for detailed information.
- d. Maximum capacity—maximum rating per the certified unit capacity.
- e. Included oil-fired (residual).
- f. Federal efficiency standards do not distinguish between natural draft gas-fired steam boilers and other gas-fired steam boilers on or after January 10, 2023.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**TABLE 110.2-K
DX-DOAS UNITS, SINGLE-PACKAGE AND REMOTE CONDENSER—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	ENERGY RECOVERY	SUBCATEGORY OR RATING CONDITION	MINIMUM EFFICIENCY	TEST PROCEDURE^a
Air cooled (dehumidification mode)	Without energy recovery		4.0 ISMRE	AHRI 920
Air source heat pumps (dehumidification mode)	Without energy recovery		4.0 ISMRE	AHRI 920
Water cooled (dehumidification mode)	Without energy recovery	Cooling tower condenser water	4.9 ISMRE	AHRI 920
	Without energy recovery	Chilled water	6.0 ISMRE	AHRI 920
Water source heat pump (dehumidification mode)	Without energy recovery	Ground source, closed loop	4.8 ISMRE	AHRI 920
	Without energy recovery	Ground-water source	5.0 ISMRE	AHRI 920
	Without energy recovery	Water source	4.0 ISMRE	AHRI 920
Air source heat pumps (heating mode)	Without energy recovery		2.7 ISCOP	AHRI 920
Water source heat pump (heating mode)	Without energy recovery	Ground source, closed loop	2.0 ISCOP	AHRI 920
	Without energy recovery	Ground-water source	3.2 ISCOP	AHRI 920
	Without energy recovery	Water source	3.5 ISCOP	AHRI 920
Air cooled (dehumidification mode)	With energy recovery		5.2 ISMRE	AHRI 920
Air source heat pumps (dehumidification mode)	With energy recovery		5.2 ISMRE	AHRI 920
Water cooled (dehumidification mode)	With energy recovery	Cooling tower condenser water	5.3 ISMRE	AHRI 920
Water cooled (dehumidification mode)	With energy recovery	Chilled water	6.6 ISMRE	AHRI 920
Water source heat pump (dehumidification mode)	With energy recovery	Ground source, closed loop	5.2 ISMRE	AHRI 920
	With energy recovery	Ground-water source	5.8 ISMRE	AHRI 920
	With energy recovery	Water source	4.8 ISMRE	AHRI 920
Air source heat pumps (heating mode)	With energy recovery		3.3 ISCOP	AHRI 920
Water source heat pump (heating mode)	With energy recovery	Ground source, closed loop	3.8 ISCOP	AHRI 920
	With energy recovery	Ground-water source	4.0 ISCOP	AHRI 920
	With energy recovery	Water source	4.8 ISCOP	AHRI 920

a. Applicable test procedure and reference year are provided under the definitions.

**TABLE 110.2-L
FLOOR-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS SERVING
COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (dry bulb/dew point)	TEST PROCEDURE ^a
Air cooled	Downflow	< 80,000 Btu/h	2.70	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.58		
		≥ 295,000 Btu/h	2.36		
	Upflow—ducted	< 80,000 Btu/h	2.67		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.55		
		≥ 295,000 Btu/h	2.33		
	Upflow—nonducted	< 65,000 Btu/h	2.16	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.04		
		≥ 240,000 Btu/h	1.89		
	Horizontal	< 65,000 Btu/h	2.65	95°F/52°F (Class 3)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.55		
		≥ 240,000 Btu/h	2.47		
Air cooled with fluid economizer	Downflow	< 80,000 Btu/h	2.70	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.58		
		≥ 295,000 Btu/h	2.36		
	Upflow—ducted	< 80,000 Btu/h	2.67		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.55		
		≥ 295,000 Btu/h	2.33		
	Upflow—nonducted	< 65,000 Btu/h	2.09	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	1.99		
		≥ 240,000 Btu/h	1.81		
	Horizontal	< 65,000 Btu/h	2.65	95°F/52°F (Class 3)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.55		
		≥ 240,000 Btu/h	2.47		
Water cooled	Downflow	< 80,000 Btu/h	2.82	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.73		
		≥ 295,000 Btu/h	2.67		
	Upflow—ducted	< 80,000 Btu/h	2.79		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.70		
		≥ 295,000 Btu/h	2.64		
	Upflow—nonducted	< 65,000 Btu/h	2.43	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.32		
		≥ 240,000 Btu/h	2.20		
	Horizontal	< 65,000 Btu/h	2.79	95°F/52°F (Class 3)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.68		
		≥ 240,000 Btu/h	2.60		

(continued)

**TABLE 110.2-L—continued
FLOOR-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS SERVING
COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (dry bulb/dew point)	TEST PROCEDURE ^a
Water cooled with fluid economizer	Downflow	< 80,000 Btu/h	2.77	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.68		
		≥ 295,000 Btu/h	2.61		
	Upflow—ducted	< 80,000 Btu/h	2.74		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.65		
		≥ 295,000 Btu/h	2.58		
	Upflow—nonducted	< 65,000 Btu/h	2.35	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.24		
		≥ 240,000 Btu/h	2.12		
	Horizontal	< 65,000 Btu/h	2.71	95°F/52°F (Class 3)	
≥ 65,000 Btu/h and < 240,000 Btu/h		2.60			
≥ 240,000 Btu/h		2.54			
Glycol cooled	Downflow	< 80,000 Btu/h	2.56	85°F/52°F (Class 2)	AHRI 1360
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.24		
		≥ 295,000 Btu/h	2.21		
	Upflow—ducted	< 80,000 Btu/h	2.53		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.21		
		≥ 295,000 Btu/h	2.18		
	Upflow—nonducted	< 65,000 Btu/h	2.08	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	1.90		
≥ 240,000 Btu/h		1.81			
Glycol cooled with fluid economizer	Horizontal	< 65,000 Btu/h	2.48	95°F/52°F (Class 3)	AHRI 1360
		≥ 65,000 Btu/h and < 240,000 Btu/h	2.18		
		≥ 240,000 Btu/h	2.18		
	Downflow	< 80,000 Btu/h	2.51	85°F/52°F (Class 2)	
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.19		
		≥ 295,000 Btu/h	2.15		
	Upflow—ducted	< 80,000 Btu/h	2.48		
		≥ 80,000 Btu/h and < 295,000 Btu/h	2.16		
		≥ 295,000 Btu/h	2.12		
	Upflow—nonducted	< 65,000 Btu/h	2.00	75°F/52°F (Class 1)	
		≥ 65,000 Btu/h and < 240,000 Btu/h	1.82		
		≥ 240,000 Btu/h	1.73		
Horizontal	< 65,000 Btu/h	2.44	95°F/52°F (Class 3)		
	≥ 65,000 Btu/h and < 240,000 Btu/h	2.10			
	≥ 240,000 Btu/h	2.10			

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8, COP = (Btu/h × hp)/(2,550.7).

a. Applicable test procedure and reference year are provided under the definitions.

ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

TABLE 110.2-M
CEILING-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS
SERVING COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (dry bulb/dew point)	TEST PROCEDURE ^a
Air cooled with free air discharge condenser	Ducted	< 29,000 Btu/h	2.05	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.02		
		≥ 65,000 Btu/h	1.92		
	Nonducted	< 29,000 Btu/h	2.08		
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.05		
		≥ 65,000 Btu/h	1.94		
Air cooled with free air discharge condenser with fluid economizer	Ducted	< 29,000 Btu/h	2.01	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.97		
		≥ 65,000 Btu/h	1.87		
	Nonducted	< 29,000 Btu/h	2.04		
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.00		
		≥ 65,000 Btu/h	1.89		
Air cooled with ducted condenser	Ducted	< 29,000 Btu/h	1.86	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.83		
		≥ 65,000 Btu/h	1.73		
	Nonducted	< 29,000 Btu/h	1.89		
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.86		
		≥ 65,000 Btu/h	1.75		
Air cooled with fluid economizer and ducted condenser	Ducted	< 29,000 Btu/h	1.82	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.78		
		≥ 65,000 Btu/h	1.68		
	Nonducted	< 29,000 Btu/h	1.85		
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.81		
		≥ 65,000 Btu/h	1.70		
Water cooled	Ducted	< 29,000 Btu/h	2.38	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.38		
		≥ 65,000 Btu/h	2.18		
	Nonducted	< 29,000 Btu/h	2.41		
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.31		
		≥ 65,000 Btu/h	2.20		

(continued)

TABLE 110.2-M—continued
 CEILING-MOUNTED AIR CONDITIONERS AND CONDENSING UNITS
 SERVING COMPUTER ROOMS—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	STANDARD MODEL	NET SENSIBLE COOLING CAPACITY	MINIMUM NET SENSIBLE COP	RATING CONDITIONS RETURN AIR (dry bulb/dew point)	TEST PROCEDURE ^a
Water cooled with fluid economizer	Ducted	< 29,000 Btu/h	2.33	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.23		
		≥ 65,000 Btu/h	2.13		
	Nonducted	< 29,000 Btu/h	2.36		
		≥ 29,000 Btu/h and < 65,000 Btu/h	2.26		
		≥ 65,000 Btu/h	2.16		
Glycol cooled	Ducted	< 29,000 Btu/h	1.97	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.93		
		≥ 65,000 Btu/h	1.78		
	Nonducted	< 29,000 Btu/h	2.00		
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.98		
		≥ 65,000 Btu/h	1.81		
Glycol cooled with fluid economizer	Ducted	< 29,000 Btu/h	1.92	75°F/52°F (Class 1)	AHRI 1360
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.88		
		≥ 65,000 Btu/h	1.73		
	Nonducted	< 29,000 Btu/h	1.95		
		≥ 29,000 Btu/h and < 65,000 Btu/h	1.93		
		≥ 65,000 Btu/h	1.76		

For SI: 1 British thermal unit per hour = 0.2931 W, °C = [(°F) - 32]/1.8, COP = (Btu/h × hp)/(2,550.7).

a. Applicable test procedure and reference year are provided under the definitions.

TABLE 110.2-N HEAT-PUMP AND HEAT RECOVERY CHILLER PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS

EQUIPMENT TYPE	SIZE CATEGORY, tons	COOLING-ONLY OPERATION		HEATING SOURCE CONDITIONS ^{d,e}	HEATING OPERATION						Test Procedure				
		COOLING EFFICIENCY ^a FULL-LOAD EFFICIENCY (EER OR kW/ton) IPLV (EER OR kW/ton)			HEAT-PUMP HEATING FULL-LOAD EFFICIENCY (COP _h) ^b			HEAT RECOVERY CHILLER FULL-LOAD EFFICIENCY (COP _{h,r}) ^{b,c} SIMULTANEOUS COOLING AND HEATING FULL-LOAD EFFICIENCY (COP _{sh,c}) ^b							
		Path A	Path B		Low	Medium	High	Boost	Low	Medium		High	Boost		
Air source	All sizes	≥ 9.595 EER	≥ 9.215 EER	47 db	105°F	120°F	140°F	140°F	105°F	120°F	140°F	140°F	AHRI 550/590		
		≥ 13.02 IPLV	≥ 15.01 IPLV	43 wb ^e	≥ 3.290	≥ 2.770	≥ 2.310	NA	NA	NA	NA	NA		NA	
Water-source electrically operated positive displacement	< 75	≥ 9.595 EER	≥ 9.215 EER	17 db	105°F	120°F	140°F	140°F	105°F	120°F	140°F	140°F	AHRI 550/590		
		≥ 13.30 IPLV	≥ 15.30 IPLV	15 wb ^e	≥ 2.230	≥ 1.950	≥ 1.630	NA	NA	NA	NA	NA		NA	
	≤ 0.7885 kW/ton	≤ 0.7875 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420	NA		NA	
	≤ 0.6316 IPLV	≤ 0.5145 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA			≥ 6.150
	≥ 75 and < 150	≤ 0.7579 kW/ton	≤ 0.7140 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420		NA	NA
	≤ 0.5895 IPLV	≤ 0.4620 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	
	≥ 150 and < 300	≤ 0.6947 kW/ton	≤ 0.7140 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420		NA	NA
	≤ 0.5684 IPLV	≤ 0.4620 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	
	≥ 300 and < 600	≤ 0.6421 kW/ton	≤ 0.6563 kW/ton	54/44 ^f	≥ 4.930	≥ 3.960	≥ 2.970	NA	NA	≥ 8.900	≥ 6.980	≥ 5.000		NA	NA
	≤ 0.5474 IPLV	≤ 0.4305 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA		NA	
≥ 600	≤ 0.5895 kW/ton	≤ 0.6143 kW/ton	54/44 ^f	≥ 4.930	≥ 3.960	≥ 2.970	NA	NA	≥ 8.900	≥ 6.980	≥ 5.000	NA	NA		
≤ 0.5263 IPLV	≤ 0.3990 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.850	
< 75	≤ 0.6421 kW/ton	≤ 0.7316 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420	NA	NA		
≤ 0.5789 IPLV	≤ 0.4632 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.150	
≥ 75 and < 150	≤ 0.5895 kW/ton	≤ 0.6684 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420	NA	NA		
≤ 0.5474 IPLV	≤ 0.4211 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.150	
≥ 150 and < 300	≤ 0.5895 kW/ton	≤ 0.6263 kW/ton	54/44 ^f	≥ 4.640	≥ 3.680	≥ 2.680	NA	NA	≥ 8.330	≥ 6.410	≥ 4.420	NA	NA		
≤ 0.5263 IPLV	≤ 0.4105 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.150	
≥ 300 and < 600	≤ 0.5895 kW/ton	≤ 0.6158 kW/ton	54/44 ^f	≥ 4.930	≥ 3.960	≥ 2.970	NA	NA	≥ 8.900	≥ 6.980	≥ 5.000	NA	NA		
≤ 0.5263 IPLV	≤ 0.4000 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.850	
≥ 600	≤ 0.5895 kW/ton	≤ 0.6158 kW/ton	54/44 ^f	≥ 4.930	≥ 3.960	≥ 2.970	NA	NA	≥ 8.900	≥ 6.980	≥ 5.000	NA	NA		
≤ 0.5263 IPLV	≤ 0.4000 IPLV	75/65 ^f	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		≥ 6.850	

a. Cooling-only rating conditions are standard rating conditions defined in AHRI 550/590, Table 1.
 b. Heating full-load rating conditions are at rating conditions defined in AHRI 550/590, Table 1.
 c. For water-cooled heat recovery chillers that have capabilities for heat rejection to a heat recovery condenser and a tower condenser, the COP applies to operation at full load with 100 percent heat recovery (no tower rejection). Units that only have capabilities for partial heat recovery shall meet the requirements of Table 110.2-D.
 d. Outdoor air entering dry-bulb (db) temperature and wet-bulb (wb) temperature.
 e. Source-water entering and leaving water temperature.

SECTION 110.3
MANDATORY REQUIREMENTS FOR SERVICE
WATER-HEATING SYSTEMS AND EQUIPMENT

(a) **Certification by manufacturers.** Any service water-heating system or equipment may be installed only if the manufacturer has certified that the system or equipment complies with all of the requirements of this subsection for that system or equipment.

1. **Temperature controls for service water-heating systems.** Service water-heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use as listed in Table 3, Chapter 50 of the ASHRAE Handbook, HVAC Applications Volume or Table 613.1 of the *California Plumbing Code* for healthcare facilities.

Exception to Section 110.3(a)1: Residential occupancies.

(b) **Efficiency.** Equipment shall meet the applicable requirements of the Appliance Efficiency Regulations as required by Section 110.1, subject to the following:

1. If more than one standard is listed in the Appliance Efficiency Regulations, the equipment shall meet all the standards listed; and
2. If more than one test method is listed in the Appliance Efficiency Regulations, the equipment shall comply with the applicable standard when tested with each test method; and
3. Where equipment can serve more than one function, such as both heating and cooling, or both space heating and water heating, it shall comply with all the requirements applicable to each function; and
4. Where a requirement is for equipment rated at its “maximum rated capacity” or “minimum rated capacity,” the capacity shall be as provided for and allowed by the controls, during steady-state operation.

(c) **Installation.** Any service water-heating system or equipment may be installed only if the system or equipment complies with all of the applicable requirements of this subsection for the system or equipment.

1. **Outlet temperature controls.** On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the ASHRAE Handbook, Applications Volume, shall have separate remote heaters, heat exchangers or boosters to supply the outlet with the higher temperature.

Exception to Section 110.3(c)1: Systems covered by *California Plumbing Code* Section 613.0 shall instead follow the requirements of that section.

2. **Controls for hot water distribution systems.** Service hot water systems with circulating pumps or with electrical heat trace systems shall be capable of automatically turning off the system.

Exception to Section 110.3(c)2: Systems serving healthcare facilities.

3. **Insulation.** Unfired service water heater storage tanks and backup tanks for solar water-heating systems shall have:

- A. External insulation with an installed *R*-value of at least R-3.5; or
- B. Internal and external insulation with a combined *R*-value of at least R-16; or
- C. The heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.

4. **Water heating recirculation loops serving multiple dwelling units, high-rise residential, hotel/motel, and nonresidential occupancies.** A water heating recirculation loop is a type of hot water distribution system that reduces the time needed to deliver hot water to fixtures that are distant from the water heater, boiler or other water heating equipment. The recirculation loop is comprised of a supply portion, connected to branches that serve multiple dwelling units, guest rooms, or fixtures and a return portion that completes the loop back to the water heating equipment. A water heating recirculation loop shall meet the following requirements:

A. Air release valve or vertical pump installation.

An automatic air release valve shall be installed on the recirculation loop piping on the inlet side of the recirculation pump and no more than 4 feet from the pump. This valve shall be mounted on top of a vertical riser at least 12 inches in length and shall be accessible for replacement and repair. Alternatively, the pump shall be installed on a vertical section of the return line.

- B. Recirculation loop backflow prevention.** A check valve or similar device shall be located between the recirculation pump and the water heating equipment to prevent water from flowing backwards through the recirculation loop.

- C. Equipment for pump priming.** A hose bibb shall be installed between the pump and the water heating equipment. An isolation valve shall be installed between the hose bibb and the water heating equipment. This hose bibb is used for bleeding air out of the pump after pump replacement.

- D. Pump isolation valves.** Isolation valves shall be installed on both sides of the pump. These valves may be part of the flange that attaches the pump to the pipe. One of the isolation valves may be the same isolation valve as in Item C.

- E. Cold water supply and recirculation loop connection to hot water storage tank.** Storage water heaters and boilers shall be plumbed in accordance with the manufacturer’s specifications. The cold water piping and the recirculation loop piping shall not be connected to the hot water storage tank drain port.

- F. Cold water supply backflow prevention.** A check valve shall be installed on the cold water supply line

between the hot water system and the next closest tee on the cold water supply line. The system shall comply with the expansion tank requirements as described in the *California Plumbing Code* Section 608.3.

5. **Service water heaters in state buildings.** Any newly constructed building constructed by the State shall derive its service water heating from a system that provides at least 60 percent of the energy needed for service water heating from site solar energy or recovered energy, per the statutory requirement of California *Public Resources Code* Section 25498.

Exception to Section 110.3(c)5: Buildings for which the state architect determines that service water heating from site solar energy or recovered energy is economically or physically infeasible.

6. **Isolation valves.** Instantaneous water heaters with an input rating greater than 6.8 kBTU/hr (2 kW) shall have isolation valves on both the cold water supply and the hot water pipe leaving the water heater, and hose bibbs or other fittings on each valve for flushing the water heater when the valves are closed.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 110.4 MANDATORY REQUIREMENTS FOR POOL AND SPA SYSTEMS AND EQUIPMENT

(a) **Certification by manufacturers.** Any pool or spa heating system or equipment may be installed only if the manufacturer has certified that the system or equipment has all of the following:

1. **Efficiency.** For equipment subject to State or federal appliance efficiency standards, listings in the Commission's directory of certified equipment showing compliance with applicable standards; and
2. **On-off switch.** A readily accessible on-off switch, mounted on the outside of the heater that allows shutting off the heater without adjusting the thermostat setting; and
3. **Instructions.** A permanent, easily readable and weatherproof plate or card that gives instruction for the energy efficient operation of the pool or spa heater and for the proper care of pool or spa water when a cover is used; and
4. **Electric resistance heating.** No electric resistance heating.

Exception 1 to Section 110.4(a)4: Listed package units with fully insulated enclosures, and with tight-fitting covers that are insulated to at least R-6.

Exception 2 to Section 110.4(a)4: Pools or spas deriving at least 60 percent of the annual heating energy from site solar energy or recovered energy.

(b) **Installation.** Any pool or spa system or equipment shall be installed with all of the following:

1. **Piping.** At least 36 inches of pipe shall be installed between the filter and the heater or dedicated suction and return lines, or built-in or built-up connections shall be installed to allow for the future addition of solar heating equipment;
2. **Covers.** A cover for outdoor pools or outdoor spas that have a heat pump or gas heater; and
3. **Directional inlets and time switches for pools.** If the system or equipment is for a pool:
 - i. The pool shall have directional inlets that adequately mix the pool water; and
 - ii. A time switch or similar control mechanism shall be installed as part of a pool water circulation control system that will allow all pumps to be set or programmed to run only during off-peak electric demand period, and for the minimum time necessary to maintain the water in the condition required by applicable public health standards.

SECTION 110.5 NATURAL GAS CENTRAL FURNACES, COOKING EQUIPMENT, POOL AND SPA HEATERS, AND FIREPLACES: PILOT LIGHTS PROHIBITED

Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:

- (a) Fan-type central furnaces.
- (b) Household cooking appliances.
- (c) Pool heaters.
- (d) Spa heaters.
- (e) Indoor and outdoor fireplaces.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 110.6 MANDATORY REQUIREMENTS FOR FENESTRATION PRODUCTS AND EXTERIOR DOORS

(a) **Certification of fenestration products and exterior doors other than field-fabricated.** Any fenestration product and exterior door, other than field-fabricated fenestration products and field-fabricated exterior doors, may be installed only if the manufacturer has certified to the Commission, or if an independent certifying organization approved by the Commission has certified, that the product complies with all of the applicable requirements of this subsection.

- Air leakage.** Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft² of window area, 0.3 cfm/ft² of door area for residential doors, 0.3 cfm/ft² of door area for nonresidential single doors (swinging and sliding), and 1.0 cfm/ft² for nonresidential double doors (swinging), when tested according to NFRC-400 or ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft²), incorporated herein by reference.

NOTES TO SECTION 110.6(a)1:

Pet doors must meet 0.3 cfm/ft² when tested according to ASTM E283 at 75 pascals (or 1.57 pounds per square foot).

AAMA/WDMA/CSA 101/I.S.2/A440-2011 specification is equivalent to ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds per square foot) and satisfies the air leakage certification requirements of this section.

Exception to Section 110.6(a)1: Field-fabricated fenestration and field-fabricated exterior doors.

- U-factor.** The fenestration product and exterior door’s U-factor shall be rated in accordance with NFRC 100, or use the applicable default U-factor set forth in Table 110.6-A.

Exception 1 to Section 110.6(a)2: If the fenestration product is a skylight in a building covered by the nonresidential standards with less than 200 square feet of skylight area, the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

Exception 2 to Section 110.6(a)2: If the fenestration product is an alteration consisting of any area replacement of glass in a skylight product in a building covered by the nonresidential standards, the default U-factor may be calculated as set forth in Reference Nonresidential Appendix NA6.

- Solar heat gain coefficient SHGC.** The fenestration product’s SHGC shall be rated in accordance with NFRC 200, or use the applicable default SHGC set forth in Table 110.6-B.

Exception 1 to Section 110.6(a)3: If the fenestration product is a skylight in a building covered by the nonresidential standards with less than 200 square feet of skylight area, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

Exception 2 to Section 110.6(a)3: If the fenestration product is an alteration consisting of any area replacement of glass in a skylight product in a building covered by the nonresidential standards, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6.

**TABLE 110.6-A
DEFAULT FENESTRATION PRODUCT U-FACTORS**

FRAME ^{1,2}	PRODUCT TYPE	SINGLE PANE ^{3,4} U-FACTOR	DOUBLE PANE ^{1,3,4} U-FACTOR	GLASS BLOCK ^{2,3} U-FACTOR
Metal	Operable	1.28	0.79	0.87
	Fixed	1.19	0.71	0.72
	Greenhouse/garden window	2.26	1.40	NA
	Glazed doors	1.25	0.77	NA
	Skylight	1.98	1.3	NA
Metal, thermal break	Operable	NA	0.66	NA
	Fixed	NA	0.55	NA
	Greenhouse/garden window	NA	1.12	NA
	Glazed doors	NA	0.59	NA
	Skylight	NA	1.11	NA
Nonmetal	Operable	0.99	0.58	0.60
	Fixed	1.04	0.55	0.57
	Greenhouse/garden window	0.99	0.53	NA
	Glazed doors	1.94	1.06	NA
	Skylight	1.47	0.84	NA

- For all dual-glazed fenestration products, adjust the listed U-factors as follows:
 - Add 0.05 for products with dividers between panes if spacer is less than 7/16 inch wide.
 - Add 0.05 to any product with true divided lite (dividers through the panes).
- Translucent or transparent panels shall use glass block values when not rated by NFRC 100.
- Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.
- Windows with window film applied that is not rated by NFRC 100 shall use the default values from this table.

TABLE 110.6-B
DEFAULT SOLAR HEAT GAIN COEFFICIENT (SHGC)

FRAME TYPE	PRODUCT	GLAZING	FENESTRATION PRODUCT SHGC		
			Single Pane ^{2,3} SHGC	Double Pane ^{2,3} SHGC	Glass Block ^{1,2} SHGC
Metal	Operable	Clear	0.80	0.70	0.70
	Fixed	Clear	0.83	0.73	0.73
	Operable	Tinted	0.67	0.59	NA
	Fixed	Tinted	0.68	0.60	NA
Metal, thermal break	Operable	Clear	NA	0.63	NA
	Fixed	Clear	NA	0.69	NA
	Operable	Tinted	NA	0.53	NA
	Fixed	Tinted	NA	0.57	NA
Nonmetal	Operable	Clear	0.74	0.65	0.70
	Fixed	Clear	0.76	0.67	0.67
	Operable	Tinted	0.60	0.53	NA
	Fixed	Tinted	0.63	0.55	NA

1. Translucent or transparent panels shall use glass block values when not rated by NFRC 200.
2. Visible Transmittance (VT) shall be calculated by using Reference Nonresidential Appendix NA6.
3. Windows with window film applied that is not rated by NFRC 200 shall use the default values from this table.

4. **Visible transmittance (VT).** The fenestration product's VT shall be rated in accordance with NFRC 200 or ASTM E972. For tubular daylighting devices VT shall be rated using NFRC 203.

Exception 1 to Section 110.6(a)4: If the fenestration product is a skylight in a building covered by the nonresidential standards with less than 200 square feet of skylight area, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

Exception 2 to Section 110.6(a)4: If the fenestration product is an alteration consisting of any area; replacement of glass in a skylight product in a building covered by the nonresidential standards, the default VT may be calculated as set forth in Reference Nonresidential Appendix NA6.

5. **Labeling.** Fenestration products and exterior doors shall:
- A. Have a temporary label for manufactured fenestration products and exterior doors or a label certificate when the component modeling approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)1. The temporary label shall not be removed before inspection by the enforcement agency; and
 - B. Have a permanent label or label certificate when the component modeling approach (CMA) is used and for site-built fenestration meeting the requirements of Section 10-111(a)2 if the product is rated using NFRC procedures.
6. **Fenestration acceptance requirements.** Before an occupancy permit is granted site-built fenestration products in other than single-family buildings shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified in the Reference Non-

residential Appendix NA7 to ensure that site-built fenestration meets Standards requirements, including a matching label certificate for product(s) installed and be readily accessible at the project location. A certificate of acceptance certifying that the fenestration product meets the acceptance requirements shall be completed, signed and submitted to the enforcement agency.

Exception to Section 110.6(a): Fenestration products removed and reinstalled as part of a building alteration or addition.

(b) **Installation of field-fabricated fenestration and exterior doors.** Field-fabricated fenestration and field-fabricated exterior doors may be installed only if the compliance documentation has demonstrated compliance for the installation using *U*-factors from Table 110.6-A and SHGC values from Table 110.6-B. Field-fabricated fenestration and field-fabricated exterior doors shall be caulked between the fenestration products or exterior door and the building, and shall be weatherstripped.

Exception to Section 110.6(b): Unframed glass doors and fire doors need not be weatherstripped or caulked.

SECTION 110.7 MANDATORY REQUIREMENTS TO LIMIT AIR LEAKAGE

All joints, penetrations and other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weather-stripped or otherwise sealed to limit infiltration and exfiltration.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 110.8
MANDATORY REQUIREMENTS FOR INSULATION,
ROOFING PRODUCTS AND RADIANT BARRIERS**

(a) **Insulation certification by manufacturers.** All insulation shall be certified by Department of Consumer Affairs, Bureau of Household Goods and Services that the insulation conductive thermal performance is approved pursuant to the California Code of Regulations, Title 24, Part 12, Chapters 12 – 13, Article 3, “Standards for Insulating Material.”

(b) **Installation of urea formaldehyde foam insulation.** Urea formaldehyde foam insulation may be applied or installed only if:

1. It is installed in exterior side walls; and
2. A 4-mil-thick plastic polyethylene vapor retarder or equivalent plastic sheathing vapor retarder is installed between the urea formaldehyde foam insulation and the interior space in all applications.

(c) **Flamespread rating of insulation.** All insulating material shall be installed in compliance with the flamespread rating and smoke density requirements of the CBC.

(d) **Installation of insulation in existing buildings.** Insulation installed in an existing attic, or on an existing duct or water heater, shall comply with the applicable requirements of Subsections 1, 2 and 3 below. If a contractor installs the insulation, the contractor shall certify to the customer, in writing, that the insulation meets the applicable requirements of Subsections 1, 2 and 3 below.

1. **Attics.** If insulation is installed in the existing attic of a low-rise residential building, the *R*-value of the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall meet the requirements of Section 150.0(a) for single-family buildings and Section 180.2(a)1 for multifamily buildings three habitable stories or fewer.

Exception to Section 110.8(d)1: Where the accessible space in the attic is not large enough to accommodate the required *R*-value, the entire accessible space shall be filled with insulation, provided such installation does not violate Section 1202.2 of Title 24, Part 2 or Section 806 of Title 24, Part 2.5.

2. **Water heaters.** If external insulation is installed on an existing unfired water storage tank or on an existing back-up tank for a solar water-heating system, it shall have an *R*-value of at least *R*-3.5, or the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.

3. **Ducts.** If insulation is installed on an existing space-conditioning duct, it shall comply with Section 605.0 of the CMC.

(e) **Reserved.**

(f) **Reserved.**

(g) **Insulation requirements for heated slab floors.** Heated slab floors shall be insulated according to the requirements in Table 110.8-A.

1. Insulation materials in ground contact must:

- A. Comply with the certification requirements of Section 110.8(a); and
- B. Have a water absorption rate for the insulation material alone without facings that is no greater than 0.3 percent when tested in accordance with Test Method A – 24 Hour-Immersion of ASTM C272.
- C. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM E96.

2. Insulation installation must:

- A. Be covered with a solid guard that protects against damage from ultraviolet radiation, moisture, landscaping operation, equipment maintenance and wind; and
- B. Include a rigid plate, which penetrates the slab and blocks the insulation from acting as a conduit for insects from the ground to the structure above the foundation.

(h) **Wet insulation systems.** When insulation is installed on roofs above the roofing membrane or layer used to seal the roof from water penetration, the effective *R*-value of the insulation shall be as specified in Reference Joint Appendix JA4.

**TABLE 110.8-A
SLAB INSULATION REQUIREMENTS FOR HEATED SLAB-ON-GRADE**

INSULATION LOCATION	INSULATION ORIENTATION	INSTALLATION REQUIREMENTS	CLIMATE ZONE	INSULATION R-VALUE
Outside edge of heated slab, either inside or outside the foundation wall	Vertical	From the level of the top of the slab, down 16 inches or to the frost line, whichever is greater. Insulation may stop at the top of the footing where this is less than the required depth. For below grade slabs, vertical insulation shall be extended from the top of the foundation wall to the bottom of the foundation (or the top of the footing) or to the frost line, whichever is greater.	1–15	5
			16	10
Between heated slab and outside foundation wall	Vertical and horizontal	Vertical insulation from top of slab at inside edge of outside wall down to the top of the horizontal insulation. Horizontal insulation from the outside edge of the vertical insulation extending 4 feet toward the center of the slab in a direction normal to the outside of the building in plan view.	1–15	5
			16	10 vertical and 7 horizontal

(i) **Roofing products solar reflectance and thermal emittance.**

- In order to meet the requirements of Sections 140.1, 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)1I or 150.2(b)2, a roofing product’s thermal emittance and an aged solar reflectance shall be certified and labeled according to the requirements of Section 10-113.

Exception 1 to Section 110.8(i)1: Roofing products that are not certified according to Section 10-113 shall assume the following default aged solar reflectance/thermal emittance values:

- For asphalt shingles: 0.08/0.75
- For all other roofing products: 0.10/0.75

- If CRRC testing for an aged solar-reflectance is not available for any roofing products, the aged value shall be derived from the CRRC initial value using the equation $\rho_{aged} = [0.2 + \beta[\rho_{initial} - 0.2]]$, where $\rho_{initial}$ = the initial solar reflectance and soiling resistance β is listed by product type in Table 110.8-B.

**TABLE 110.8-B
VALUES OF SOILING RESISTANCE β BY PRODUCT TYPE**

PRODUCT TYPE	CRRC PRODUCT CATEGORY	β
Field-Applied coating	Field-Applied coating	0.65
Other	Not a field-applied coating	0.70

- Solar Reflectance Index (SRI), calculated as specified by ASTM E1980-01, may be used as an alternative to thermal emittance and an aged solar reflectance when complying with the requirements of Sections 140.2, 140.3(a)1, 141.0(b)2B, 150.1(c)11, 150.2(b)1I or 150.2(b)2. SRI calculations shall be based on moderate wind velocity of 2–6 meters per second. The SRI shall be calculated based on the aged solar reflectance value of the roofing products.
- Liquid applied roof coatings applied to low-sloped roofs in the field as the top surface of a roof covering shall:

- Be applied across the entire roof surface to meet the dry mil thickness or coverage recommended by the coating manufacturer, taking into consideration the substrate on which the coating is applied; and
- Meet the minimum performance requirements listed in Table 110.8-B or the minimum performance requirements of ASTM C836, D3468, D6083 or D6694, whichever are appropriate to the coating material.

Exception 1 to Section 110.8(i)4B: Aluminum-pigmented asphalt roof coatings shall meet the requirements of ASTM D2824 and be installed as specified by ASTM D3805.

Exception 2 to Section 110.8(i)4B: Cement-based roof coatings shall contain a minimum of 20 percent cement and shall meet the requirements of ASTM C1583, ASTM D822 and ASTM D5870.

- Radiant barrier.** A radiant barrier shall have an emittance of 0.05 or less, tested in accordance with ASTM C1371 or ASTM E408, and shall be certified to the Department of Consumer Affairs as required by Title 24, Part 12, Chapter 12-13, Standards for Insulating Material.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 110.9
MANDATORY REQUIREMENTS
FOR LIGHTING CONTROLS**

- All lighting control devices and systems and all light sources** subject to the requirements of Section 110.9 shall meet the following requirements:

- Shall be installed only if the lighting control or light source complies with all of the applicable requirements of Section 110.9.

**TABLE 110.8-C
MINIMUM PERFORMANCE REQUIREMENTS FOR LIQUID APPLIED ROOF COATINGS**

PHYSICAL PROPERTY	ASTM TEST PROCEDURE	REQUIREMENT
Initial percent elongation (break)	D2370	Minimum 200% @ 73°F (23°C)
Initial percent elongation (break) or initial flexibility	D2370 D522, Test B	Minimum 60% @ 0°F (-18°C) Minimum pass 1" mandrel @ 0°F (-18°C)
Initial tensile strength (maximum stress)	D2370	Minimum 100 psi (1.38 MPa) @ 73°F (23°C)
Initial tensile strength (maximum stress) or initial flexibility	D2370 D522, Test B	Minimum 200 psi (2.76 MPa) @ 0°F (-18°C) Minimum pass 1" mandrel @ 0°F (-18°C)
Final percent elongation (break) after accelerated weathering 1000 h	D2370	Minimum 100% @ 73°F (23°C)
Final percent elongation (break) after accelerated weathering 100 h or Flexibility after accelerated weathering 100 h	D2370 D522, Test B	Minimum 40% @ 0°F (-18°C) Minimum pass 1" mandrel @ 0°F (-18°C)
Permeance	D1653	Maximum 50 perms
Accelerated weathering 1000 h	D4798	No cracking or checking ¹

1. Any cracking or checking visible to the eye fails the test procedure.

2. Lighting controls may be individual devices or systems consisting of two or more components.

(b) **All lighting controls.** Lighting controls listed in Section 110.9(b) shall comply with the requirements listed below; and all components of the system considered together as installed shall meet all applicable requirements for the application for which they are installed as required in Sections 130.0 through 130.5, Sections 140.6 through 140.8, Section 141.0, and Section 150.0(k).

1. **Time-switch lighting controls.** All controls that provide time-switch functionality, including all automatic and astronomical time-switch controls, shall have program backup capabilities that prevent the loss of the device's schedule for at least 7 days, and the device's date and time for at least 72 hours if power is interrupted. In addition:

A. **Time-switch controls** installed in nonresidential buildings shall:

- i. For each connected load, be capable of providing manual override to each connected load and of resuming normally scheduled operation after a manual override is initiated within 2 hours; and
- ii. Provide an automatic holiday shutoff feature that turns off all connected loads for at least 24 hours and then resumes normally scheduled operation.

B. **Astronomical time-switch controls** shall:

- i. Have sunrise and sunset prediction accuracy within plus-or-minus 15 minutes and time-keeping accuracy within 5 minutes per year;
- ii. Be capable of displaying date, current time, sunrise time, sunset time, and switching times for each step during programming;
- iii. Be capable of automatically adjusting for daylight savings time; and
- iv. Have the ability to independently offset the on and off for each channel by at least 90 minutes before and after sunrise or sunset.

C. **Multilevel time-switch controls** shall include at least two separately programmable steps per zone.

D. **Time-switch controls installed outdoors** shall have setback functions that allow the lighting on each controlled channel to be switched or dimmed to lower levels. The set back functions shall be capable of being programmed by the user for at least one specific time of day.

2. **Daylighting controls.** Controls that provide automatic daylighting functionality shall:

- A. Automatically return to its most recent time delay settings within 60 minutes of the last received input when left in calibration mode;
- B. Have a set point control that easily distinguishes settings to within 10 percent of full-scale adjustment;

C. Provide a linear response within 5 percent accuracy over the range of illuminance measured by the light sensor; and

D. Be capable of being calibrated in a manner that the person initiating the calibration is remote from the sensor during calibration to avoid influencing calibration accuracy, for example by having a light sensor that is physically separated from where the calibration adjustments are made.

3. **Dimmers.** Controls that provide dimming functionality shall:

A. Be capable of reducing lighting power consumption by a minimum of 65 percent when at its lowest setting;

B. Provide reduced flicker operation, meaning that directly controlled light sources shall be provided electrical power such that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz without causing premature lamp failure;

C. Provide an off setting that produces a zero lumen output; and

D. For wall box dimmers and associated switches designed for use in three way circuits, be capable of turning lights off, and on to the level set by the dimmer if the lights are off.

4. **Occupant sensing controls.** Occupant sensing controls include occupant sensors, motion sensors, and vacancy sensors, including those with a partial-ON or partial-OFF function. Occupant sensing controls shall:

A. Be capable of automatically turning the controlled lights in the area either off or down no more than 20 minutes after the area has been vacated;

B. For manual-on controls, have a grace period of no less than 15 seconds and no more than 30 seconds to turn on lighting automatically after the sensor has timed out; and

C. Provide a visible status signal that indicates that the device is operating properly, or that it has failed or malfunctioned. The visible status signal may have an override that turns off the signal.

Exception to Section 110.9(b)4: Occupant sensing control systems may consist of a combination of single or multilevel occupant, motion or vacancy sensor controls, provided that components installed to comply with manual-on requirements shall not be capable of conversion by occupants from manual-on to automatic-on functionality.

5. **Reserved.**

6. **Sensors used to detect occupants.** Sensors that are used by occupant sensing controls to detect occupants shall meet all of the following requirements:

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ALL OCCUPANCIES—MANDATORY REQUIREMENTS FOR THE MANUFACTURE, CONSTRUCTION AND INSTALLATION OF SYSTEMS, EQUIPMENT AND BUILDING COMPONENTS

A. Sensors shall not incorporate switches or mechanical devices that allow the sensor to be disabled without changing the settings of the control.

B. Sensors that utilize ultrasonic radiation for detection of occupants shall:

- i. comply with 21 C.F.R. part 1002.12;
- ii. not emit audible sound; and
- iii. not emit ultrasound in excess of the decibel levels shown in Table 110.9-A measured no more than 5 feet from the source, on axis.

C. Sensors that utilize microwave radiation for detection of occupants shall:

- i. comply with 47 C.F.R. parts 2 and 15; and
- ii. not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device.

7. **Indicator lights.** Indicator lights integral to lighting controls shall consume no more than 1 watt of power per indicator light.

(c) **Track lighting integral current limiter.** An integral current limiter for line-voltage track lighting shall be recognized for compliance with Part 6 only if it meets all of the following requirements:

1. Shall have the identical volt-ampere (VA) rating of the current limiter as installed and rated for compliance with Part 6 clearly marked as follows:
 - A. So that it is visible for the enforcement agency’s field inspection without opening coverplates, fixtures or panels; and
 - B. Permanently marked on the circuit breaker; and
 - C. On a factory-printed label that is permanently affixed to a nonremovable base-plate inside the wiring compartment.
2. Shall have a conspicuous factory installed label permanently affixed to the inside of the wiring compartment warning against removing, tampering with, rewiring or bypassing the device; and
3. Each electrical panel from which track lighting integral current limiters are energized shall have a factory printed label permanently affixed and prominently located, stating the following: “NOTICE: Current limiting devices installed in track lighting integral current limiters connected to this panel shall only be replaced with the same or lower amperage. Adding track or replacement of existing current limiters with higher continuous ampere rating will void the track lighting integral current limiter certification, and will require resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards.”

(d) **Track lighting supplementary overcurrent protection panel.** A Track Lighting Supplementary Overcurrent Protection Panel shall be used only for line-voltage track lighting and shall be recognized for compliance with Part 6 only if it meets all of the following requirements:

1. Shall be listed as defined in Section 100.1; and
2. Shall have a permanently installed label that is prominently located stating the following: “NOTICE: This Panel for Track Lighting Energy Code Compliance Only.” The overcurrent protection devices in this panel shall only be replaced with the same or lower amperage. No other overcurrent protective device shall be added to this panel. Adding to, or replacement of, existing overcurrent protective device(s) with higher continuous ampere rating will void the panel listing and require resubmittal of compliance documentation to the enforcement agency responsible for compliance with the California Title 24, Part 6 Building Energy Efficiency Standards.

**TABLE 110.9-A
ULTRASOUND MAXIMUM DECIBEL VALUES**

MID-FREQUENCY OF SOUND PRESSURE THIRD-OCTAVE BAND (IN kHz)	MAXIMUM DB LEVEL WITHIN THIRD-OCTAVE BAND (IN dB REFERENCE 20 MICROPASCALS)
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 52943, *Public Resources Code*.

**SECTION 110.10
MANDATORY REQUIREMENTS
FOR SOLAR READINESS**

(a) **Covered occupancies.**

1. **Single-family residences.** Single-family residences located in subdivisions with ten or more single-family residences and where the application for a tentative subdivision map for the residences has been deemed complete or approved by the enforcement agency, which do not have a photovoltaic system installed, shall comply with the requirements of Sections 110.10(b) through 110.10(e)
2. **Low-rise multifamily buildings.** Low-rise multifamily buildings that do not have a photovoltaic system installed shall comply with the requirements of Sections 110.10(b) through 110.10(d).
3. **Hotel/motel occupancies and high-rise multifamily buildings.** Hotel/motel occupancies and high-rise multifamily buildings with ten habitable stories or fewer, that do not have a photovoltaic system installed, shall comply with the requirements of Sections 110.10(b) through 110.10(d).

4. **Nonresidential buildings.** Nonresidential buildings with three habitable stories or fewer, other than I-2 and I-2.1 buildings, that do not have a photovoltaic system installed, shall comply with the requirements of Sections 110.10(b) through 110.10(d).

(b) **Solar zone.**

1. **Minimum solar zone area.** The solar zone shall have a minimum total area as described below. The solar zone shall comply with access, pathway, smoke ventilation and spacing requirements as specified in Title 24, Part 9 or other Parts of Title 24 or in any requirements adopted by a local jurisdiction. The solar zone total area shall be comprised of areas that have no dimension less than five feet and are no less than 80 square feet each for buildings with roof areas less than or equal to 10,000 square feet or no less than 160 square feet each for buildings with roof areas greater than 10,000 square feet.

A. **Single-family residences.** The solar zone shall be located on the roof or overhang of the building and have a total area no less than 250 square feet.

Exception 1 to Section 110.10(b)1A: Single-family residences with a permanently installed domestic solar water-heating system meeting the installation criteria specified in the Reference Residential Appendix RA4 and with a minimum solar savings fraction of 0.50.

Exception 2 to Section 110.10(b)1A: Single-family residences with three habitable stories or more and with a total floor area less than or equal to 2000 square feet and having a solar zone total area no less than 150 square feet.

Exception 3 to Section 110.10(b)1A: Single-family residences located in the Wildland-Urban Interface Fire Area as defined in Title 24, Part 2 and having a whole house fan and having a solar zone total area no less than 150 square feet.

Exception 4 to Section 110.10(b)1A: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

Exception 5 to Section 110.10(b)1A: Single-family residences having a solar zone total area no less than 150 square feet and where all thermostats are demand responsive controls and comply with Section 110.12(a), and are capable of receiving and responding to Demand Response

Signals prior to granting of an occupancy permit by the enforcing agency.

Exception 6 to Section 110.10(b)1A: Single-family residences meeting the following conditions:

A. All thermostats are demand responsive controls that comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency.

B. Comply with one of the following measures:

i. Install a dishwasher that meets or exceeds the ENERGY STAR® Program requirements with a refrigerator that meets or exceeds the ENERGY STAR Program requirements, a whole house fan driven by an electronically commutated motor, or an SAE J1772 Level 2 Electric Vehicle Supply Equipment (EVSE or EV charger) with a minimum of 40 amperes; or

ii. Install a home automation system capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or

iii. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the *California Plumbing Code* and any applicable local ordinances; or

iv. Install a rainwater catchment system designed to comply with the *California Plumbing Code* and any applicable local ordinances, and that uses rainwater flowing from at least 65 percent of the available roof area.

B. **Multifamily buildings, hotel/motel occupancies and nonresidential buildings.** The solar zone shall be located on the roof or overhang of the building or on the roof or overhang of another structure located within 250 feet of the building or on covered parking installed with the building project, and shall have a total area no less than 15 percent of the total roof area of the building excluding any skylight area. The solar zone requirement is applicable to the entire building, including mixed occupancy.

Exception 1 to Section 110.10(b)1B: High-rise multifamily buildings, hotel/motel occupancies, and nonresidential buildings with a permanently installed solar electric system having a nameplate DC power rating, measured under Standard Test

Conditions, of no less than one watt per square foot of roof area.

Exception 2 to Section 110.10(b)1B: High-rise multifamily buildings, hotel/motel occupancies with a permanently installed domestic solar water-heating system complying with Section 150.1(c)8Biii.

Exception 3 to Section 110.10(b)1B: Buildings with a designated solar zone area that is no less than 50 percent of the potential solar zone area. The potential solar zone area is the total area of any low-sloped roofs where the annual solar access is 70 percent or greater and any steep-sloped roofs oriented between 90 degrees and 300 degrees of true north where the annual solar access is 70 percent or greater. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

Exception 4 to Section 110.10(b)1B: Low-rise and high-rise multifamily buildings with all thermostats in each dwelling unit are demand response controls that comply with Section 110.12(a), and are capable of receiving and responding to Demand Response Signals prior to granting of an occupancy permit by the enforcing agency. In addition, either A or B below:

- A. In each dwelling unit, comply with one of the following measures:
 - i. Install a dishwasher that meets or exceeds the ENERGY STAR Program requirements with either a refrigerator that meets or exceeds the ENERGY STAR Program requirements or a whole house fan driven by an electronically commutated motor; or
 - ii. Install a home automation system that complies with Section 110.12(a) and is capable of, at a minimum, controlling the appliances and lighting of the dwelling and responding to demand response signals; or
 - iii. Install alternative plumbing piping to permit the discharge from the clothes washer and all showers and bathtubs to be used for an irrigation system in compliance with the *California Plumbing Code* and any applicable local ordinances; or
 - iv. Install a rainwater catchment system designed to comply with the *California Plumbing Code* and any applicable local ordinances, and that uses rainwater flowing from at least 65 percent of the available roof area.

B. Meet the Title 24, Part 11, Section A4.106.8.2 requirements for electric vehicle charging spaces.

Exception 5 to Section 110.10(b)1B: Buildings where the roof is designed and approved to be used for vehicular traffic or parking or for a heliport.

2. **Azimuth range.** All sections of the solar zone located on steep-sloped roofs shall have an azimuth range between 90 degrees and 300 degrees of true north.

3. **Shading.**

A. No obstructions, including but not limited to, vents, chimneys, architectural features and roof mounted equipment, shall be located in the solar zone.

B. Any obstruction, located on the roof or any other part of the building that projects above a solar zone shall be located at least twice the distance, measured in the horizontal plane, of the height difference between the highest point of the obstruction and the horizontal projection of the nearest point of the solar zone, measured in the vertical plane.

Exception to Section 110.10(b)3: Any roof obstruction, located on the roof or any other part of the building, that is oriented north of all points on the solar zone.

4. **Structural design loads on construction documents.** For areas of the roof designated as solar zone, the structural design loads for roof dead load and roof live load shall be clearly indicated on the construction documents.

Note: Section 110.10(b)4 does not require the inclusion of any collateral loads for future solar energy systems.

(c) **Interconnection pathways.**

1. The construction documents shall indicate a location reserved for inverters and metering equipment and a pathway reserved for routing of conduit from the solar zone to the point of interconnection with the electrical service.
2. For single-family residences and central water-heating systems, the construction documents shall indicate a pathway for routing of plumbing from the solar zone to the water-heating system.

(d) **Documentation.** A copy of the construction documents or a comparable document indicating the information from Sections 110.10(b) through 110.10(c) shall be provided to the occupant.

(e) **Main electrical service panel.**

1. The main electrical service panel shall have a minimum busbar rating of 200 amps.
2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future solar electric installation. The

reserved space shall be permanently marked as “For Future Solar Electric”.

Note: Authority: Sections 25213, 25218, 25218.5, 25402, 25402.1, and 25605, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, 25605, and 25943, *Public Resources Code*.

SECTION 110.11 MANDATORY REQUIREMENTS FOR ELECTRICAL POWER DISTRIBUTION SYSTEM

Certification by Manufacturers. Any electrical power distribution system equipment listed in this section may be installed only if the manufacture has certified to the Commission that the equipment complies with all the applicable requirements of this section.

(a) **Low-voltage dry-type distribution transformer** shall be certified by the Manufacturer as required by the Title 20 Appliance Efficiency Regulations.

EXCEPTION to Section 110.11(a):

1. autotransformer;
2. drive (isolation) transformer;
3. grounding transformer;
4. machine-tool (control) transformer;
5. nonventilated transformer;
6. rectifier transformer;
7. regulating transformer;
8. sealed transformer;
9. special-impedance transformer;
10. testing transformer;
11. transformer with tap range of 20 percent or more;
12. uninterruptible power supply transformer; or
13. welding transformer.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 110.12 MANDATORY REQUIREMENTS FOR DEMAND MANAGEMENT

Buildings, other than healthcare facilities, that install or are required to install demand responsive controls shall comply with the applicable demand responsive control requirements of Sections 110.12(a) through 110.12(e).

(a) Demand responsive controls.

1. All demand responsive controls shall be either:
 - A. A certified OpenADR 2.0a or OpenADR 2.0b Virtual End Node (VEN), as specified under Clause 11, Conformance, in the applicable OpenADR 2.0 Specification; or

- B. Certified by the manufacturer as being capable of responding to a demand response signal from a certified OpenADR 2.0b Virtual End Node by automatically implementing the control functions requested by the Virtual End Node for the equipment it controls.
2. All demand responsive controls shall be capable of communicating with the VEN using a wired or wireless bidirectional communication pathway.
3. When communications are disabled or unavailable, all demand responsive controls shall continue to perform all other control functions provided by the control.
4. Demand responsive control thermostats shall comply with Reference Joint Appendix 5 (JA5), Technical Specifications for Occupant Controlled Smart Thermostats.

(b) **Demand Responsive Zonal HVAC Controls.** Non-residential HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for noncritical zones as follows:

1. The controls shall have a capability to remotely increase the operating cooling temperature set points by 4 degrees or more in all noncritical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).
2. The controls shall have a capability to remotely decrease the operating heating temperature set points by 4 degrees or more in all noncritical zones on signal from a centralized contact or software point within an EMCS.
3. The controls shall have capabilities to remotely reset the temperatures in all noncritical zones to original operating levels on signal from a centralized contact or software point within an EMCS.
4. The controls shall be programmed to provide an adjustable rate of change for the temperature increase, decrease, and reset.
5. The controls shall have the following features:

A. Disabled. Disabled by authorized facility operators; and

B. Manual control. Manual control by authorized facility operators to allow adjustment of heating and cooling set points globally from a single point in the EMCS; and

C. Automatic Demand Shed Control. Upon receipt of a demand response signal, the space-conditioning systems shall conduct a centralized demand shed, as specified in Sections 110.12(b)1 and 110.12(b)2, for noncritical zones during the demand response period.

(c) **Demand Responsive Lighting Controls.** Buildings with nonresidential lighting systems having a total installed lighting power of 4,000 watts or greater that are subject to the requirements of Section 130.1(b)

shall install controls that are capable of automatically reducing lighting power in response to a Demand Response Signal.

1. For compliance testing, the lighting controls shall demonstrate a 15-percent or greater reduction in lighting power as described in NA7.6.3. The controls may provide additional demand responsive functions or abilities.
2. For buildings where demand response controls are required, demand responsive controls shall control the general lighting that is subject to the requirements of Section 130.1(b) and may control additional lighting.
3. General lighting shall be reduced in a manner consistent with the uniform level of illumination requirements in Table 130.1-A.

Exception to Section 110.12(c): Spaces where a health or life safety statute, ordinance, or regulation does not permit the general lighting to be reduced are not required to install demand responsive controls and do not count toward the 4,000-watt threshold.

- (d) **Demand Responsive Electronic Message Center Control.** Controls for electronic message centers greater than 15 kW shall be capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal.

Exception to Section 110.12(d): Electronic message centers that are not permitted by a health or life safety statute, ordinance, or regulation to be reduced.

- (e) **Demand Responsive Controlled Receptacles.** Controlled receptacles in buildings shall be capable of automatically turning off all loads connected to the receptacle in response to a demand response signal.

Exception 1 to Section 110.12(e): Buildings not required to have demand responsive lighting controls.

Exception 2 to Section 110.12(e): Spaces where a health or life safety statute, ordinance or regulation does not permit the receptacles to be automatically controlled.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SUBCHAPTER 3

NONRESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES—MANDATORY REQUIREMENTS

SECTION 120.0 GENERAL

Sections 120.1 through 120.10 establish requirements for the design and installation of building envelopes, ventilation, space-conditioning and service water-heating systems and equipment in nonresidential and hotel/motel buildings as well as covered processes that are within the scope of Section 100.0(a).

NOTE: The requirements of Sections 120.1 through 120.10 apply to newly constructed buildings. Section 141.0 specifies which requirements of Sections 120.1 through 120.10 also apply to additions or alterations to existing buildings.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 120.1 REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

(a) General requirements.

1. All occupiable spaces in hotel/motel buildings, and nonresidential buildings other than healthcare facilities shall comply with the applicable requirements of Section 120.1(a) through 120.1(g). Healthcare facilities shall be ventilated in accordance with Chapter 4 of the *California Mechanical Code*.
2. The required outdoor air-ventilation rate and the air-distribution system design shall be clearly identified on the plans in accordance with Section 10-103 of Title 24, Part 1.

(b) Reserved.

(c) **Nonresidential and hotel/motel buildings.** All occupiable spaces shall meet the requirements of Section 120.1(c)1, and shall also comply with either Section 120.1(c)2 or Section 120.1(c)3.

1. Air filtration.

A. Mechanical system types specified in Subsections i, ii and iii below shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through any system thermal conditioning components. Air filters shall conform to the requirements of Sections 120.1(c)1B, 120.1(c)1C and 120.1(c)1D.

- i. Mechanical space-conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.
- ii. Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.

iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems and energy recovery ventilation systems that provide outside air to an occupiable space.

Exception to Section 120.1(c)1A: For heat recovery ventilators and energy recovery ventilators, the location of the filters required by Section 120.1(c)1A may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

B. Air filter efficiency. The filters shall have a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30–1.0 μm range, and equal to or greater than 85 percent in the 1.0–3.0 μm range when tested in accordance with AHRI Standard 680; and

C. Systems shall be equipped with air filters that meet either Subsection i or ii below.

- i. Nominal 2-inch minimum depth filter(s); or
- ii. Nominal 1-inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 120.1-A, based on a maximum face velocity of 150 feet per minute.

$$A_{\text{face}} = Q_{\text{filter}} / V_{\text{face}} \quad \text{(Equation 120.1-A)}$$

Where:

A_{face} = air filter face area, the product of air filter nominal length \times nominal width, ft^2

Q_{filter} = design airflow rate for the air filter, ft^3/min

V_{face} = air filter face velocity ≤ 150 , ft/min

D. Filter racks or grilles shall use gaskets, sealing or other means to close gaps around inserted filters and prevent air from bypassing the filter.

2. **Natural ventilation.** Naturally ventilated spaces shall be designed in accordance with 120.1(c)2A through 120.1(c)2C and include a mechanical ventilation system designed in accordance with 120.1(c)3:

A. Floor area to be ventilated. Spaces or portions of spaces to be naturally ventilated shall be located within a distance based on the ceiling height, as specified in i, ii and iii. The ceiling height (H) to be used in i, ii or iii shall be the minimum ceiling height in the space, or for ceilings that are increasing in height as distance from the operable openings

is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet from the operable opening. [ASHRAE 62.1:6.4.1]

- i. Single side opening. For spaces with operable opening on one side of the space, the maximum distance from the operable opening shall be not more than $2H$. [ASHRAE 62.1:6.4.1.1]
- ii. Double side opening. For spaces with operable openings on two opposite sides of the space, the maximum distance from the operable opening shall be not more than $5H$. [ASHRAE 62.1:6.4.1.2]
- iii. Corner opening. For spaces with operable openings on two adjacent sides of a space, the maximum distance from the operable openings shall be not more than $5H$ along a line drawn between the two openings that are the farthest apart. Floor area outside that line shall comply with i or ii. [ASHRAE 62.1:6.4.1.3]
- iv. Ceiling height. The ceiling height (H) to be used in Section 120.1(c)2Ai through 120.1(c)2Aiii shall be the minimum ceiling height in the space.

Exception to Section 120.1(c)2Aiv: For ceilings that are increasing in height as distance from the opening is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet from the operable openings. [ASHRAE 62.1:6.4.1.4]

- B. Location and size of openings. Spaces or portions of spaces to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors. The openable area shall be not less than 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, the openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8 percent of the area of the interior room or less than 25 square feet. [ASHRAE 62.1:6.4.2]
- C. Control and accessibility. The means to open the required operable opening shall be readily accessible to building occupants whenever the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

Exception 1 to Section 120.1(c)2: The mechanical ventilation system shall not be required where natural ventilation openings complying with 120.1(c)2 are either permanently open or have controls that prevent the openings from being closed during periods of expected occupancy.

Exception 2 to Section 120.1(c)2: The mechanical ventilation system shall not be required where the zone is not served by a space-conditioning system.

- 3. **Mechanical ventilation.** Occupiable spaces shall be ventilated with a mechanical ventilation system capable of providing an outdoor airflow rate to the zone (V_z) no less than Equation 120.1-F as described below:

$$V_z = R_t \times A_z \quad \text{(Equation 120.1-F)}$$

Where:

R_t = Total outdoor airflow rate required per unit area as determined from Table 120.1-A.

A_z = Zone floor area, meaning the net occupiable floor area of the ventilation zone in square feet.

Exception 1 to Section 120.1(c)3: Designed occupancy. For spaces designed for an expected number of occupants per the Exception to Section 1004.5 of the CBC, or spaces with fixed seating per Section 1004.6 of the CBC, the outdoor airflow rate to the zone (V_z) shall be determined in accordance with Equation 120.1-G;

$$V_z = \text{The larger of } R_p \times P_z \text{ or } R_a \times A_z \quad \text{(Equation 120.1-G)}$$

Where:

R_p = 15 cubic feet per minute of outdoor airflow per person

P_z = The expected number of occupants. The expected number of occupants shall be the expected number specified by the building designer. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with the *California Building Code*.

R_a = The minimum ventilation airflow rate allowed for DCV in Table 120.1-A. If R_a is not defined for an occupancy category, $R_a = 0$.

A_z = Zone floor area, meaning the net occupiable floor area of the ventilation zone in square feet.

Exception 2 to Section 120.1(c)3: Transfer air. The rate of outdoor air required by Section 120.1(c)3 may be provided with air transferred from other ventilated space if:

- A. Use of transfer air is in accordance with Section 120.1(g); and
- B. The outdoor air that is supplied to all spaces combined, is sufficient to meet the requirements of Section 120.1(c)3 for each space individually.

- 4. **Exhaust ventilation.** The design exhaust airflow shall be determined in accordance with the requirements in Table 120.1-B. Exhaust makeup air shall be permitted to be any combination of outdoor air, recirculated air, or transfer air. [ASHRAE 62.1:6.5.1]

(d) **Operation and control requirements for minimum quantities of outdoor air.**

1. **Times of occupancy.** The minimum rate of outdoor air required by Section 120.1(c) shall be supplied to each space at all times when the space is usually occupied.

Exception 1 to Section 120.1(d)1: Demand control ventilation. In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gasses and are not provided with local exhaust ventilation (such as indoor operation of internal combustion engines or areas designated for unvented food service preparation), the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 120.1(d)4 or by an occupant sensor ventilation control device complying with Section 120.1(d)5.

Exception 2 to Section 120.1(d)1: Temporary reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 120.1(c)2 for up to 30 minutes at a time if the average rate for each hour is equal to or greater than the required ventilation rate.

2. **Pre-occupancy.** The lesser of the minimum rate of outdoor air required by Section 120.1(c)2 or three complete air changes shall be supplied to the entire building during the one-hour period immediately before the building is normally occupied.
3. **Required demand control ventilation.** Demand ventilation controls complying with 120.1(d)4 are required for a space with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1,000 square feet (40 square feet or less per person) if the ventilation system serving the space has one or more of the following:

- A. an air economizer; or
- B. modulating outside air control; or
- C. design outdoor airflow rate > 3,000 cfm

Exception 1 to Section 120.1(d)3: Where space exhaust is greater than the design ventilation rate specified in Section 120.1(c)3 minus 0.2 cfm per square foot of conditioned area.

Exception 2 to Section 120.1(d)3: Spaces that have processes or operations that generate dusts, fumes, mists, vapors or gases and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, daycare sick-rooms, science labs, barber shops or beauty and nail salons shall not install demand control ventilation.

Exception 3 to Section 120.1(d)3: Spaces with an area of less than 150 square feet, or a design occupancy of less than 10 people as specified by Section 120.1(c)3.

4. **Demand control ventilation devices.**

- A. For each system with demand control ventilation (DCV), CO₂ sensors shall be installed in each room that meets the criteria of Section 120.1(d)3 with no

less than one sensor per 10,000 square feet of floor space. When a zone or a space is served by more than one sensor, a signal from any sensor indicating that CO₂ is near or at the setpoint within the zone or space, shall trigger an increase in ventilation.

- B. CO₂ sensors shall be located in the room between 3 feet and 6 feet above the floor or at the anticipated height of the occupants' heads.
- C. Demand ventilation controls shall maintain CO₂ concentrations less than or equal to 600 ppm plus the outdoor air CO₂ concentration in all rooms with CO₂ sensors.

Exception to Section 120.1(d)4C: The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section 120.1(c)3 regardless of CO₂ concentration.

- D. Outdoor air CO₂ concentration shall be determined by one of the following:
 - i. CO₂ concentration shall be assumed to be 400 ppm without any direct measurement; or
 - ii. CO₂ concentration shall be dynamically measured using a CO₂ sensor located within 4 feet of the outdoor air intake.

- E. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in Table 120.1-A for DCV, times the conditioned floor area for spaces with CO₂ sensors, plus the rate required by Section 120.1(c)3 for other spaces served by the system, or the exhaust air rate, whichever is greater.

- F. CO₂ sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal which resets to supply the minimum quantity of outside air to levels required by Section 120.1(c)3 to the zone serviced by the sensor at all times that the zone is occupied.

- G. The CO₂ sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with DDC to the zone level.

5. **Occupant sensor ventilation control devices.** Occupant sensing or ventilation controls are required for space-conditioning zones that are both permitted to have their ventilation air reduced to zero while in occupied-standby mode per Table 120.1-A and required to install occupant sensors to comply with Section 130.1(c)5, 6 and 7. Occupant sensor ventilation control devices used to reduce the rate of outdoor air flow when occupants are not present shall comply with the following:

- A. Occupant sensors shall have suitable coverage and placement to detect occupants in the entire space ventilated. In 20 minutes or less after no occupancy is detected by any sensors covering the room, occupant sensing controls shall indicate a room is vacant.

- B. When occupant sensors controlling lighting are also used for ventilation, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.
- C. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupant sensor in each room and the zone shall not be considered vacant until all rooms in the zone are vacant.
- D. One hour prior to normal scheduled occupancy, the occupant sensor ventilation control shall allow pre-occupancy purge as described in Section 120.1(d)2.
- E. When the zone is scheduled to be occupied and occupant sensing controls in all rooms and areas served by the zone indicate the spaces are unoccupied, the zone shall be placed in occupied-standby mode.
- F. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall be shut off until the space becomes occupied or until ventilation is needed to provide space heating or conditioning. When mechanical ventilation is shut off to the zone, the ventilation system serving the zone shall reduce the system outside air rate by the amount of outside air required for the zone.
- G. Where the system providing space conditioning also provides ventilation to the zone, in 5 minutes or less after entering occupied-standby mode, space-conditioning zone setpoints shall be reset in accordance with Section 120.2(e)3.

(e) **Ducting for zonal heating and cooling units.** Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit, which then supplies the air to a space in order to meet the requirements of Section 120.1(c)3, the outdoor air shall be ducted to discharge either:

- 1. Within 5 feet of the unit; or
- 2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

(f) **Design and control requirements for quantities of outdoor air.**

- 1. All mechanical ventilation and space-conditioning systems shall be designed with and have installed ductwork, dampers and controls that allow design minimum outside air rates to be operated at no less than the larger of (1) the minimum levels specified in Section 120.1(c)3; or (2) the rate required for make-up of exhaust systems that are required for an exempt or covered process, for control of odors, or for the removal of contaminants within the space.
- 2. All variable air volume mechanical ventilation and space-conditioning systems shall include dynamic controls that are capable of maintaining measured outside air ventilation rates within 10 percent of the design minimum outside air ventilation rate at both full and reduced supply airflow conditions. Fixed minimum damper position is not considered to be dynamic and is not an allowed control strategy.
- 3. All mechanical ventilation and space-conditioning systems shall be tested to confirm their ability to operate within 10 percent of the design minimum outside air rate.

(g) **Air classification and recirculation limitations.** Air classification and recirculation limitations of air shall be based on the air classification as listed in Table 120.1-A or Table 120.1-C, and in accordance with the requirements of Sections 120.1(g)1 through 4.

Note: Air class definitions are taken directly from ASHRAE 62.1 and are duplicated here for convenience.

- 1. **Class 1 Air** is air with low contaminant concentration, low sensory-irritation intensity or inoffensive odor. Recirculation or transfer of Class 1 air to any space shall be permitted; [ASHRAE 62.1:5.16.3.1]
- 2. **Class 2 Air** is air with moderate contaminant concentration, mild sensory-irritation intensity or mildly offensive odors (Class 2 air also includes air that is not necessarily harmful or objectionable but that is inappropriate for transfer or recirculation to spaces used for different purposes). Recirculation or transfer of Class 2 air shall be permitted in accordance with Sections 120.1(g)2A through 120.1(g)2E:
 - A. Recirculation of Class 2 air within the space of origin shall be permitted [ASHRAE 62.1:5.16.3.2.1];
 - B. Recirculation or transfer of Class 2 to other Class 2 or Class 3 spaces shall be permitted, provided that the other spaces are used for the same or similar purpose or task and involve the same or similar pollutant sources as the Class 2 space [ASHRAE 62.1:5.16.3.2.2]; or
 - C. Transfer of Class 2 air to toilet rooms [ASHRAE 62.1:5.16.3.2.3]; or
 - D. Recirculation or transfer of Class 2 air to Class 4 spaces [ASHRAE 62.1:5.16.3.2.4]; or
 - E. Class 2 air shall not be recirculated or transferred to Class 1 spaces. [ASHRAE 62.1:5.16.3.2.5]

Exception to Section 120.1(g)2E: When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 2 air shall not exceed 10 percent of the outdoor air intake flow.

- 3. **Class 3 Air** is air with significant contaminant concentration, significant sensory-irritation intensity or offensive odor. Recirculation or transfer of Class 3 air shall be permitted in accordance with Section 120.1(g)3A and B:
 - A. Recirculation of Class 3 air within the space of origin shall be permitted. [ASHRAE 62.1:5.16.3.3.1]
 - B. Class 3 air shall not be recirculated or transferred to any other space. [ASHRAE 62.1:5.16.3.3.2].

Exception to Section 120.1(g)3B: When using any energy recovery device, recirculation from leakage, carryover, or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 3 air shall not exceed 5 percent of the outdoor air intake flow.

- 4. **Class 4 Air** is air with highly objectionable fumes or gases or with potentially dangerous particles, bioaerosols, or gases at concentrations high enough to be considered as harmful. Class 4 air shall not be recirculated

NONRESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES—MANDATORY REQUIREMENTS

or transferred to any space or recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]

5. Ancillary spaces. Redesignation of Class 1 air to Class 2 air shall be permitted for Class 1 spaces that are ancillary to Class 2 spaces. [ASHRAE 62.1:5.16.2.3]
6. Transfer. A mixture of air that has been transferred through or returned from spaces or locations with different air classes shall be redesignated with the highest classification among the air classes mixed. [ASHRAE 62.1:5.16.2.2]

7. Classification. Air leaving each space or location shall be designated at an expected air-quality classification not less than that shown in Tables 120.1-A, 120.1-B or 120.1-C. Air leaving spaces or locations that are not listed in Tables 120.1-A, 120.1-B or 120.1-C shall be designated with the same classification as air from the most similar space or location listed in terms of occupant activities and building construction.

(h) **Ventilation only mechanical systems.** HVAC systems without mechanical cooling or mechanical heating shall meet the requirements of Section 120.2(f).

**TABLE 120.1-A
MINIMUM VENTILATION RATES**

OCCUPANCY CATEGORY	TOTAL OUTDOOR AIR RATE ¹ R_t (cfm/ft ²)	MIN VENTILATION AIR RATE FOR DCV ² R_o (cfm/ft ²)	AIR CLASS	NOTES
Educational Facilities				
Daycare (through age 4)	0.21	0.15	2	
Daycare sickroom	0.15		3	
Classrooms (ages 5–8)	0.38	0.15	1	
Classrooms (age 9–18)	0.38	0.15	1	
Lecture/postsecondary classroom	0.38	0.15	1	F
Lecture hall (fixed seats)	—	0.15	1	F
Art classroom	0.15		2	
Science laboratories	0.15		2	
University/college laboratories	0.15		2	
Wood/metal shop	0.15		2	
Computer lab	0.15		1	
Media center	0.15		1	A
Music/theater/dance	1.07	0.15	1	F
Multiuse assembly	0.50	0.15	1	F
Food and Beverage Service				
Restaurant dining rooms	0.50	0.15	2	
Cafeteria/fast-food dining	0.50	0.15	2	
Bars, cocktail lounges	0.50	0.20	2	
Kitchen (cooking)	0.15		2	
General				
Break rooms	0.50	0.15	1	F
Coffee Stations	0.50	0.15	1	F
Conference/meeting	0.50	0.15	1	F
Corridors	0.15		1	F
Occupiable storage rooms for liquids or gels	0.15		2	B
Hotels, Motels, Resorts, Dormitories				
Bedroom/living room	0.15		1	F
Barracks sleeping areas	0.15		1	F
Laundry rooms, central	0.15		2	
Laundry rooms within dwelling units	0.15		1	
Lobbies/pre-function	0.50	0.15	1	F
Multipurpose assembly	0.50		1	F

(continued)

NONRESIDENTIAL, HOTEL/MOTEL OCCUPANCIES, AND COVERED PROCESSES—MANDATORY REQUIREMENTS

TABLE 120.1-A—continued
MINIMUM VENTILATION RATES

OCCUPANCY CATEGORY	TOTAL OUTDOOR AIR RATE ¹ R_t (cfm/ft ²)	MIN VENTILATION AIR RATE FOR DCV ² R_a (cfm/ft ²)	AIR CLASS	NOTES
Office Buildings				
Breakrooms	0.50	0.15	1	
Main entry lobbies	0.50	0.15	1	F
Occupiable storage rooms for dry materials	0.15		1	
Office space	0.15		1	F
Reception areas	0.15		1	F
Telephone/data entry	0.15		1	F
Miscellaneous Spaces				
Bank vaults/safe deposit	0.15		2	F
Banks or bank lobbies	0.15		1	F
Computer (not printing)	0.15		1	F
Freezer and refrigerated spaces (< 50°F)	—		2	E
General manufacturing (excludes heavy industrial and process using chemicals)	0.15		3	
Pharmacy (prep. Area)	0.15		2	
Photo studios	0.15		1	
Shipping/receiving	0.15		2	B
Sorting, packing, light assembly	0.15		2	
Telephone closets	0.15		1	
Transportation waiting	0.50	0.15	1	F
Warehouses	0.15		2	B
All others	0.15		2	
Public Assembly Spaces				
Auditorium seating area	1.07	0.15	1	F
Places of religious worship	1.07	0.15	1	F
Courtrooms	0.19	0.15	1	F
Legislative chambers	0.19	0.15	1	F
Libraries (reading rooms and stack areas)	0.15		1	
Lobbies	0.50	0.15	1	F
Museums (children's)	0.25	0.15	1	
Museums/galleries	0.25	0.15	1	F

(continued)

TABLE 120.1-A—continued
MINIMUM VENTILATION RATES

OCCUPANCY CATEGORY	TOTAL OUTDOOR AIR RATE ¹ R_t (cfm/ft ²)	MIN VENTILATION AIR RATE FOR DCV ² R_a (cfm/ft ²)	AIR CLASS	NOTES
Residential				
Common corridors				
Retail				
Sales (except as below)	0.25	0.20	2	
Mall common areas	0.25	0.15	1	F
Barbershop	0.40		2	
Beauty and nail salons	0.40		2	
Pet shops (animal areas)	0.25	0.15	2	
Supermarket	0.25	0.20	1	F
Coin-operated laundries	0.30		2	
Sports and Entertainment				
Gym, sports arena (play area)	0.50	0.15	2	E
Spectator areas	0.50	0.15	1	F
Swimming (pool)	0.15		2	C
Swimming (deck)	0.50	0.15	2	C
Disco/dance floors	1.50	0.15	2	F
Health club/aerobics room	0.15		2	
Health club/weight rooms	0.15		2	
Bowling alley (seating)	1.07	0.15	1	
Gambling casinos	0.68	0.15	1	
Game arcades	0.68	0.15	1	
Stages, studios	0.50	0.15	1	D, F

General footnotes for Table 120.1-A:

1. R_t is determined as being the larger of the area method and the default per person method. The occupant density used in the default per person method is one-half of the maximum occupant load assumed for egress purposes in the CBC.

Specific Notes:

A – For high-school and college libraries, the values shown for “Public Assembly Spaces – Libraries” shall be used.

B – Rate may not be sufficient where stored materials include those having potentially harmful emissions.

C – Rate does not allow for humidity control. “Deck area” refers to the area surrounding the pool that is capable of being wetted during pool use or when the pool is occupied. Deck area that is not expected to be wetted shall be designated as an occupancy category.

D – Rate does not include special exhaust for stage effects such as dry ice vapors and smoke.

E – Where combustion equipment is intended to be used on the playing surface or in the space, additional dilution ventilation, source control, or both shall be provided.

F – Ventilation air for this occupancy category shall be permitted to be reduced to zero when the space is in occupied-standby mode.

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**TABLE 120.1-B – MINIMUM EXHAUST RATES
[ASHRAE 62.1: TABLE 6.5]**

OCCUPANCY CATEGORY	EXHAUST RATE cfm/unit	EXHAUST RATE cfm/ft ²	AIR CLASS	NOTES
Arenas	—	0.50	1	B
Art classrooms	—	0.70	2	
Auto repair rooms	—	1.5	2	A
Barber shops	—	0.50	2	
Beauty and nail salons	—	0.60	2	
Cells with toilet	—	1.00	2	
Copy, printing rooms	—	0.50	2	
Darkrooms	—	1.00	2	
Educational science laboratories	—	1.00	2	
Janitor closets, trash rooms, recycling	—	1.00	3	
Kitchenettes	—	0.30	2	
Kitchens – commercial	—	0.70	2	
Locker rooms for athletic or industrial facilities	—	0.50	2	
All other locker rooms	—	0.25	2	
Shower rooms	20/50	—	2	G,H
Paint spray booths	—	—	4	F
Parking garages	—	0.75	2	C
Pet shops (animal areas)	—	0.90	2	
Refrigerating machinery rooms	—	-	3	F
Soiled laundry storage rooms	—	1.00	3	F
Storage rooms, chemical	—	1.50	4	F
Toilets – private	25/50	—	2	E
Toilets – public	50/70	—	2	D
Woodwork shop/classrooms	—	0.50	2	

Notes:

A – Stands where engines are run shall have exhaust systems that directly connect to the engine exhaust and prevent escape of fumes.

B – Where combustion equipment is intended to be used on the playing surface, additional dilution ventilation, source control, or both shall be provided.

C – Exhaust shall not be required where two or more sides comprise walls that are at least 50% open to the outside.

D – Rate is per water closet, urinal, or both. Provide the higher rate where periods of heavy use are expected to occur. The lower rate shall be permitted to be used otherwise.

E – Rate is for a toilet room intended to be occupied by one person at a time. For continuous systems operation during hours of use, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.

F – See other applicable standards for exhaust rate.

G – For continuous system operation, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.

H – Rate is per showerhead.

**TABLE 120.1-C – AIRSTREAMS OR SOURCES
[ASHRAE 62.1:TABLE 5.16.1]**

DESCRIPTION	AIR CLASS
Diazo printing equipment discharge	4
Commercial kitchen grease hoods	4
Commercial kitchen hoods other than grease	3
Laboratory hoods	4 ^a
Hydraulic elevator machine room	2

a. Air Class 4 unless determined otherwise by the Environmental Health and Safety professional responsible to the owner or to the owner’s designee.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 120.2
REQUIRED CONTROLS FOR SPACE-
CONDITIONING SYSTEMS**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.2(a) through 120.2(k).

(a) **Thermostatic controls for each zone.** The supply of heating and cooling energy to each space-conditioning zone or dwelling unit shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of Section 120.2(b). An energy management control system (EMCS) may be installed to comply with the requirements of one or more thermostatic controls if it complies with all applicable requirements for each thermostatic control.

Exception to Section 120.2(a): An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

1. All zones are also served by an interior cooling system; and
2. The perimeter system is designed solely to offset envelope heat losses or gains; and
3. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
4. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

(b) **Criteria for zonal thermostatic controls.** The individual thermostatic controls required by Section 120.2(a) shall meet the following requirements as applicable:

1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.

3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items 1 and 2 and shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception 1 to Section 120.2(b)3: Systems with thermostats that require manual changeover between heating and cooling modes.

Exception 2 to Section 120.2(b)3: Systems serving healthcare facilities.

4. Thermostatic controls for all single zone, air conditioners and heat pumps shall comply with the requirements of Sections 110.2(c) and 110.12(a) and, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section 110.12(b).

Exception 1 to Section 120.2(b)4: Systems serving exempt process loads that must have constant temperatures to prevent degradation of materials, a process, plants or animals.

Exception 2 to Section 120.2(b)4: Package terminal air conditioners, package terminal heat pumps, room air conditioners and room air conditioner heat pumps.

Exception 3 to Section 120.2(b)4: Systems serving healthcare facilities.

(c) **Hotel/motel guest room thermostats.** <

1. Hotel/motel guest room thermostats shall:
 - A. Have numeric temperature setpoints in °F and °C; and
 - B. Have setpoint stops, which are accessible only to authorized personnel, such that guest room occupants cannot adjust the setpoint more than ±5°F (±3°C); and
 - C. Meet the requirements of Section 110.2(c).

Exception to Section 120.2(c)1: Thermostats that are integrated into the room heating and cooling equipment. <

(d) **Heat pump controls.** All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section 110.2(b).

(e) **Shut-off and reset controls for space-conditioning systems.** Each space-conditioning system shall be installed with controls that comply with the following:

1. The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:
 - A. An automatic time switch control device complying with Section 110.9(c), with an accessible manual override that allows operation of the system for up to 4 hours; or
 - B. An occupancy sensor; or
 - C. A 4-hour timer that can be manually operated.

Exception to Section 120.2(e)1: Mechanical systems serving retail stores and associated malls,

restaurants, grocery stores, churches and theaters equipped with 7-day programmable timers.

2. The control shall automatically restart and temporarily operate the system as required to maintain:

- A. A setback heating thermostat setpoint if the system provides mechanical heating; and

Exception to Section 120.2(e)2A: Thermostat setback controls are not required in nonresidential buildings in areas where the Winter Median of Extremes outdoor air temperature determined in accordance with Section 140.4(b)3 is greater than 32°F.

- B. A setup cooling thermostat setpoint if the system provides mechanical cooling.

Exception to Section 120.2(e)2B: Thermostat setup controls are not required in nonresidential buildings in areas where the Summer Design Dry Bulb 0.5 percent temperature determined in accordance with Section 140.4(b)3 is less than 100°F.

3. **Occupant sensing zone controls.** Where the system providing space conditioning also provides the ventilation required by Section 120.1 and includes occupant sensor ventilation control as specified in Section 120.1(d)5, the occupant sensing zone controls shall additionally comply with the following:

- A. In 5 minutes or less after entering occupied-standby mode as described in Section 120.1(d).

- i. Automatically set up the operating cooling temperature set point by 2°F or more and set back the operating heating temperature set point by 2°F or more; or
- ii. For multiple zone systems with Direct Digital Controls (DDC) to the zone level, setup the operating cooling temperature setpoint by 0.5°F or more and setback the operating heating temperature setpoint by 0.5°F or more.

- B. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall remain off whenever the space temperature is between the active heating and cooling setpoints.

Exception 1 to Sections 120.2(e)1, 2, 3: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

Exception 2 to Sections 120.2(e)1, 2, 3: Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

Exception 3 to Sections 120.2(e) 1 and 2: Systems serving hotel/motel guest rooms, if they have a readily accessible manual shut-off switch.

4. Hotel and motel guest rooms shall have captive card key controls, occupancy sensing controls or automatic controls such that, no longer than 30 minutes after the guest room has been vacated, setpoints are set up at

least +5°F (+3°C) in cooling mode and set down at least -5°F (-3°C) in heating mode.

Exception to Section 120.2(e): Systems serving healthcare facilities.

- (f) **Dampers for air supply and exhaust equipment.** Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.

Exception 1 to Section 120.2(f): Equipment that serves an area that must operate continuously.

Exception 2 to Section 120.2(f): Gravity and other non-electrical equipment that has readily accessible manual damper controls.

Exception 3 to Section 120.2(f): At combustion air intakes and shaft vents.

Exception 4 to Section 120.2(f): Where prohibited by other provisions of law.

- (g) **Isolation area devices.** Each space-conditioning system serving multiple zones with a combined conditioned floor area of more than 25,000 square feet shall be designed, installed and controlled to serve isolation areas.

1. Each zone, or any combination of zones not exceeding 25,000 square feet, shall be a separate isolation area.
2. Each isolation area shall be provided with isolation devices, such as valves or dampers, that allow the supply of heating or cooling to be reduced or shut off independently of other isolation areas.
3. Each isolation area shall be controlled by a device meeting the requirements of Section 120.2(e)1.

Exception to Section 120.2(g): Zones designed to be conditioned continuously.

- (h) **Automatic demand shed controls.** See Section 110.12 for requirements for automatic demand shed controls.

- (i) **Economizer fault detection and diagnostics (FDD).** All newly installed air handlers with a mechanical cooling capacity over 33,000 Btu/hr and an installed air economizer shall include a stand-alone or integrated Fault Detection and Diagnostics (FDD) system in accordance with Subsections 120.2(i)1 through 120.2(i)8.

1. The following temperature sensors shall be permanently installed to monitor system operation: outside air, supply air, and when required for differential economizer operation a return air sensor, and
2. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F; and
3. The controller shall have the capability of displaying the value of each sensor; and
4. The controller shall provide system status by indicating the following conditions:
 - A. Free cooling available;
 - B. Economizer enabled;
 - C. Compressor enabled;
 - D. Heating enabled, if the system is capable of heating; and
 - E. Mixed-air low limit cycle active.

5. The unit controller shall allow manual initiation of each operating mode so that the operation of cooling systems, economizers, fans and heating system can be independently tested and verified; and
6. Faults shall be reported in one of the following ways:
 - A. Reported to an Energy Management Control System regularly monitored by facility personnel.
 - B. Annunciated locally on one or more zone thermostats, or a device within five (5) feet of zone thermostat(s), clearly visible, at eye level, and meeting the following requirements:
 - i. On the thermostat, device, or an adjacent written sign, display instructions to contact appropriate building personnel or an HVAC technician; and
 - ii. In buildings with multiple tenants, the annunciation shall either be within property management offices or in a common space accessible by the property or building manager.
 - C. Reported to a fault management application which automatically provides notification of the fault to a remote HVAC service provider.
7. The FDD system shall detect the following faults:
 - A. Air temperature sensor failure/fault;
 - B. Not economizing when it should;
 - C. Economizing when it should not;
 - D. Damper not modulating; and
 - E. Excess outdoor air.
8. The FDD System shall be certified by the Energy Commission as meeting requirements of Subsections 120.2(i)1 through 120.2(i)7 in accordance with Section 110.0 and JA6.3.

Exception to Section 120.2(i)8: FDD algorithms based in direct digital control systems are not required to be certified to the Energy Commission.

(j) **Direct Digital Controls (DDC).** Direct Digital Controls to the zone shall be provided as specified by Table 120.2-A.

The provided DDC system shall meet the control logic requirements of Sections 110.12(a), 110.12(b) and 120.1(d) and be capable of the following:

1. Monitoring zone and system demand for fan pressure, pump pressure, heating and cooling;
2. Transferring zone and system demand information from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers;
3. Automatically detecting the zones and systems that may be excessively driving the reset logic and generate an alarm or other indication to the system operator;
4. Readily allow operator removal of zone(s) from the reset algorithm;
5. For new buildings, trending and graphically displaying input and output points; and
6. Resetting heating and cooling setpoints in all noncritical zones upon receipt of a signal from a centralized contact or software point as described in Section 110.12(b).

(k) **Optimum start/stop controls.** Space conditioning systems with DDC to the zone level shall have optimum start/stop controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy. Mass radiant

**TABLE 120.2-A
DDC APPLICATIONS AND QUALIFICATIONS**

BUILDING STATUS	APPLICATIONS	QUALIFICATIONS
Newly Constructed Buildings	Air handling system and all zones served by the system	Individual systems supplying more than three zones and with design heating or cooling capacity of 300 kBtu/h and larger
	Chilled water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300 kBtu/h (87.9 kW) and larger
	Hot water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	Zone terminal unit such as VAV box	Where existing zones served by the same air handling, chilled water, or hot water systems that have DDC
	Air handling system or fan coil	Where existing air handling system(s) and fan coil(s) served by the same chilled or hot water plant have DDC
	New air handling system and all new zones served by the system	Individual systems with design heating or cooling capacity of 300 kBtu/h and larger and supplying more than three zones and more than 75 percent of zones are new
	New or upgraded chilled water plant	Where all chillers are new and plant design cooling capacity is 300 kBtu/h (87.9 kW) and larger
	New or upgraded hot water plant	Where all boilers are new and plant design heating capacity is 300 kBtu/h (87.9 kW) and larger

floor slab systems shall incorporate floor temperature onto the optimum start algorithm.

Exception to Section 120.2(k): Systems that must operate continuously.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 120.3
REQUIREMENTS FOR PIPE INSULATION**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.3(a) through 120.3(c).

(a) **General requirements.** The piping conditions listed below for space-conditioning and service water-heating systems with fluid normal operating temperatures listed in Table 120.3-A, shall have at least the amount of insulation specified in Subsection (c):

1. **Space cooling systems.** All refrigerant suction, chilled water, and brine fluid distribution systems.
2. **Space heating systems.** All refrigerant, steam, steam condensate and hot water fluid distribution systems.
3. **Service water-heating systems.**
 - A. Recirculating system piping, including the supply and return piping to the water heater.
 - B. The first 8 feet of hot and cold outlet piping, including piping between a storage tank and a heat trap, for a nonrecirculating storage system.
 - C. Pipes that are externally heated.

Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in Table 120.3-A, and shall be rounded to the nearest $\frac{1}{100}$ Btu-inch per hour per square foot per °F. Fluid distribution systems include all elements that are in series with the fluid flow, such as pipes, pumps, valves, strainers, coil u-bends, and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders, and drains.

(b) **Insulation protection.** Pipe insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. Protection shall, at minimum, include the following:

1. Pipe insulation exposed to weather shall be protected by a cover suitable for outdoor service. The cover shall be water retardant and provides shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be used to provide this protection.
2. Pipe insulation covering chilled water piping and refrigerant suction piping located outside the condi-

tioned space shall include, or be protected by, a Class I or Class II vapor retarder. All penetrations and joints shall be sealed.

3. Pipe insulation buried below grade must be installed in a water proof and noncrushable casing or sleeve.

(c) **Insulation thickness**

1. For insulation with a conductivity in the range shown in Table 120.3-A for the applicable fluid temperature range, the insulation shall have the applicable minimum thickness or R-value shown in Table 120.3-A.
2. For insulation with a conductivity outside the range shown in Table 120.3-A for the applicable fluid temperature range, the insulation shall have a minimum R-value shown in Table 120.3-A or thickness as calculated:

MINIMUM INSULATION THICKNESS EQUATION

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

where:

T = minimum insulation thickness for material with conductivity K, inches.

PR = pipe actual outside radius, inches.

t = insulation thickness from Table 120.3-A, inches.

K = conductivity of alternate material at the mean rating temperature indicated in Table 120.3-A for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.

k = The lower value of the conductivity range listed in Table 120.3-A for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

Exception 1 to Section 120.3: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 2 to Section 120.3: Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

Exception 3 to Section 120.3: Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

Exception 4 to Section 120.3: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**TABLE 120.3-A
PIPE INSULATION THICKNESS**

FLUID OPERATING TEMPERATURE RANGE (°F)	INSULATION CONDUCTIVITY			NOMINAL PIPE DIAMETER (in inches)						
	CONDUCTIVITY (in Btu·in/h·ft ² · °F)	MEAN RATING TEMPERATURE (°F)		< 1	1 to < 1.5	1.5 to < 4	4 to < 8	8 and larger		
Space heating and Service Water Heating Systems (Steam, Steam Condensate, Refrigerant, Space Heating, Service Hot Water)				Minimum Pipe Insulation Required (Thickness in inches or R-value)						
Above 350	0.32–0.34	250	Inches	4.5	5.0	5.0	5.0	5.0		
			R-value	R-37	R-41	R-37	R-27	R-23		
251–350	0.29–0.32	200	Inches	3.0	4.0	4.5	4.5	4.5		
			R-value	R-24	R-34	R-35	R-26	R-22		
201–250	0.27–0.30	150	Inches	2.5	2.5	2.5	3.0	3.0		
			R-value	R-21	R-20	R-17.5	R-17	R-14.5		
141–200	0.25–0.29	125	Inches	1.5	1.5	2.0	2.0	2.0		
			R-value	R-11.5	R-11	R-14	R-11	R-10		
105–140	0.22–0.28	100	Inches	1.0	1.5	1.5	1.5	1.5		
			R-value	R-7.7	R-12.5	R-11	R-9	R-8		
FLUID OPERATING TEMPERATURE RANGE (°F)	INSULATION CONDUCTIVITY			Nominal Pipe Diameter (in inches)						
	CONDUCTIVITY (in Btu·in/h·ft ² · °F)	MEAN RATING TEMPERATURE (°F)		< 1	1 to < 1.5	1.5 to < 4	4 to < 8	8 and larger		
Space cooling systems (chilled water, refrigerant and brine)				Minimum Pipe Insulation Required (Thickness in inches or R-value) ¹						
40–60	0.21–0.27	75	Inches	Nonres 0.5	Res 0.75	Nonres 0.5	Res 0.75	1.0	1.0	1.0
			R-value	Nonres R-3	Res R-6	Nonres R-3	Res R-5	R-7	R-6	R-5
Below 40	0.20–0.26	50	Inches	1.0	1.5	1.5	1.5	1.5	1.5	
			R-value	R-8.5	R-14	R-12	R-10	R-9		

1. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

**SECTION 120.4
REQUIREMENTS FOR AIR DISTRIBUTION
SYSTEM DUCTS AND PLENUMS**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.4(a) through 120.4(g).

Exception to Section 120.4: Systems serving healthcare facilities shall comply with the applicable requirements of the *California Mechanical Code*.

(a) **CMC compliance.** All air distribution system ducts and plenums, including but not limited to building cavities, mechanical closets, air-handler boxes and support platforms used as ducts or plenums, shall meet the requirements of the CMC Sections 601.0, 602.0, 603.0, 604.0, and 605.0, and ANSI/SMACNA-006-2006 *HVAC Duct Construction Standards Metal and Flexible*, 3rd Edition incorporated herein by reference. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened. Openings shall be sealed with mastic, tape, aerosol sealant or other duct-closure system that meets the applicable requirements of UL 181, UL 181A, or UL 181B. If mastic or tape is used to seal

openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum installed level of R-8:

1. Outdoors; or
2. In a space between the roof and an insulated ceiling; or
3. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or
4. In an unconditioned crawlspace; or
5. In other unconditioned spaces.

Portions of supply-air ducts that are not in one of these spaces, including ducts buried in concrete slab, shall be insulated to a minimum installed level of R-4.2 or be enclosed in directly conditioned space.

(b) Duct and plenum materials.

1. Factory-fabricated duct systems.

A. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, includ-

ing collars, connections and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.

- B. All pressure-sensitive tapes, heat-activated tapes, and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
- C. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
- D. All ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Joints and seams of duct systems and their components shall not be sealed with cloth-back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

Exception to Section 120.4(b)1D: Ductwork located in occupied space and exposed to view is not required to meet Seal Class A.

2. Field-fabricated duct systems.

- A. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A and UL 181B.

B. Mastic sealants and mesh.

- i. Sealants shall comply with the applicable requirements of UL 181, UL 181A and UL 181B, and be nontoxic and water resistant.
- ii. Sealants for interior applications shall pass ASTM C731 (extrudability after aging) and D2202 (slump test on vertical surfaces), incorporated herein by reference.
- iii. Sealants for exterior applications shall pass ASTM tests C731, C732 (artificial weathering test), and D2202, incorporated herein by reference.
- iv. Sealants and meshes shall be rated for exterior use.

- C. **Pressure-sensitive tape.** Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A and UL 181B.

- D. All ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Joints and seams of duct systems and their components shall not be sealed with cloth-back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

Exception to Section 120.4(b)2D: Ductwork located in occupied space and exposed to view is not required to meet Seal Class A.

E. Drawbands used with flexible duct.

- i. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
- ii. Drawbands shall have a minimum tensile strength rating of 150 pounds.
- iii. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.

F. Aerosol-sealant closures.

- i. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
- ii. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.

(c) All duct insulation product *R*-values shall be based on insulation only (excluding air films, vapor retarders or other duct components) and tested *C*-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.

(d) The installed thickness of duct insulation used to determine its *R*-value shall be determined as follows:

- 1. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
- 2. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
- 3. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

(e) Insulated flexible duct products installed to meet this requirement must include labels, in maximum intervals of 3 feet, showing the thermal performance *R*-value for the duct insulation itself (excluding air films, vapor retarder or other duct components), based on the tests in Section 120.4(c) and the installed thickness determined by Section 120.4(d)3.

(f) **Protection of insulation.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, but not limited to the following:

Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

(g) **Duct sealing.** Duct systems shall comply with Subsection 1 or 2 below:

- 1. New duct systems that meet the criteria in Subsections A, B, C and D below shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler airflow rate as confirmed through HERS field verification

and diagnostic testing, in accordance with Reference Nonresidential Appendix NA7.5.3;

- A. The duct system does not serve a healthcare facility; and
- B. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and
- C. The space-conditioning system serves less than 5,000 square feet of conditioned floor area; and
- D. The combined surface area of the ducts located outdoors or in unconditioned space is more than 25 percent of the total surface area of the entire duct system.

- 2. New duct systems that are not subject to testing under Section 120.4(g)1 shall instead meet the duct leakage testing requirements of CMC Section 603.9.2.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 120.5
REQUIRED NONRESIDENTIAL
MECHANICAL SYSTEM ACCEPTANCE**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.5(a) through 120.5(b).

Exception to Section 120.5: Systems serving healthcare facilities.

(a) Before an occupancy permit is granted, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:

- 1. Outdoor air ventilation systems shall be tested in accordance with NA7.5.1.
- 2. Constant volume, single zone unitary air conditioning and heat pump unit controls shall be tested in accordance with NA7.5.2.
- 3. Duct systems that are subject to testing under Section 120.4(g)1, Section 141.0(b)2Di or Section 141.0(b)2Dii shall be tested in accordance with NA7.5.3.
- 4. Air economizers shall be tested in accordance with NA7.5.4.

Exception to Section 120.5(a)4: Air economizers installed by the HVAC system manufacturer and certified to the Commission as being factory calibrated and tested are exempt from the Functional Testing section

of the air economizer controls acceptance test as described in NA7.5.4.2.

- 5. Demand control ventilation systems required by Section 120.1(c)3 shall be tested in accordance with NA7.5.5.
- 6. Supply fan variable flow controls shall be tested in accordance with NA7.5.6.
- 7. Hydronic system variable flow controls shall be tested in accordance with NA7.5.7 and NA7.5.9.
- 8. Boiler or chillers that require isolation controls as specified by Section 140.4(k)2 or 140.4(k)3 shall be tested in accordance with NA7.5.7.
- 9. Hydronic systems with supply water temperature reset controls shall be tested in accordance with NA7.5.8.
- 10. Automatic demand shed controls shall be tested in accordance with NA7.5.10.
- 11. Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion Units shall be tested in accordance with NA7.5.11.
- 12. Automatic fault detection and diagnostics (FDD) for air handling units and zone terminal units shall be tested in accordance with NA7.5.12.
- 13. Distributed Energy Storage DX AC Systems shall be tested in accordance with NA7.5.13.
- 14. Thermal Energy Storage (TES) Systems shall be tested in accordance with NA7.5.14.
- 15. Supply air temperature reset controls shall be tested in accordance with NA7.5.15.
- 16. Water-cooled chillers served by cooling towers with condenser water reset controls shall be tested in accordance with NA7.5.16.
- 17. When an energy management control system is installed, it shall functionally meet all of the applicable requirements of Part 6.
- 18. Occupant sensing zone controls shall be tested in accordance with NA7.5.17.

(b) When certification is required by Title 24, Part 1, Section 10-103.2, the acceptance testing specified by Section 120.5(a) shall be performed by a certified mechanical acceptance test technician (CMATT). If the CMATT is operating as an employee, the CMATT shall be employed by a certified mechanical acceptance test employer. The CMATT shall disclose on the certificate of acceptance a valid CMATT certification identification number issued by an approved acceptance test technician certification provider. The CMATT shall complete all certificate of acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

Note: Authority cited: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 120.6
MANDATORY REQUIREMENTS
FOR COVERED PROCESSES**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 120.6(a) through 120.6(g).

(a) Mandatory requirements for refrigerated warehouses.

Refrigerated warehouses that are greater than or equal to 3,000 square feet and refrigerated spaces with a sum total of 3,000 square feet or more that are served by the same refrigeration system shall meet the requirements of Section 120.6(a).

Refrigerated spaces that are less than 3,000 square feet shall meet the requirements of the Appliance Efficiency Regulations for walk-in coolers or freezers contained in the Appliance Efficiency Regulations (California Code of Regulations, Title 20, Sections 1601 through 1608).

- 1. **Insulation requirements.** Exterior surfaces of refrigerated warehouses shall be insulated at least to the R-values in Table 120.6-A.

TABLE 120.6-A REFRIGERATED WAREHOUSE INSULATION

SPACE	SURFACE	MINIMUM R-VALUE (°F·hr·sf/Btu)
Freezers	Roof/ceiling	R-40
	Wall	R-36
	Floor	R-35
	Floor with all heating from productive refrigeration capacity ¹	R-20
Coolers	Roof/ceiling	R-28
	Wall	R-28

1. All underslab heating is provided by a heat exchanger that provides refrigerant subcooling or other means that result in productive refrigeration capacity on the associated refrigerated system.

- 2. **Underslab heating.** Electric resistance heat shall not be used for the purposes of underslab heating.

Exception to Section 120.6(a)2: Underslab heating systems controlled such that the electric resistance heat is thermostatically controlled and disabled during the summer on-peak period defined by the local electric utility.

- 3. **Evaporators.** New fan-powered evaporators used in coolers and freezers shall conform to the following:

- A. Single phase fan motors less than 1 hp and less than 460 Volts in newly installed evaporators shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions.

- B. Evaporator fans served either by a suction group with multiple compressors or by a single compressor with variable capacity capability shall be variable speed and the speed shall be controlled in response to space temperature or humidity.

Exception 1 to Section 120.6(a)3B: Addition, alteration or replacement of less than all of the evaporators in an existing refrigerated space that does not have speed-controlled evaporators.

Exception 2 to Section 120.6(a)3B: Coolers within refrigerated warehouses that maintain a controlled atmosphere for which a licensed engineer has certified that the types of products stored will require constant operation at 100 percent of the design airflow.

Exception 3 to Section 120.6(a)3B: Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products, including but not limited to spaces with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 square feet).

- C. Evaporator fans served by a single compressor that does not have variable capacity shall utilize controls to reduce airflow by at least 40 percent for at least 75 percent of the time when the compressor is not running.

Exception to Section 120.6(a)3C: Areas within refrigerated warehouses that are designed solely for the purpose of quick chilling/freezing of products [space with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 square feet)].

- 4. **Condensers.** New fan-powered condensers on new refrigeration systems shall conform to the following:

- A. Design saturated condensing temperatures for evaporative-cooled condensers and water-cooled condensers served by fluid coolers or cooling towers shall be less than or equal to:

- i. The design wetbulb temperature plus 20°F in locations where the design wetbulb temperature is less than or equal to 76°F;
- ii. The design wetbulb temperature plus 19°F in locations where the design wetbulb temperature is between 76°F and 78°F; or
- iii. The design wetbulb temperature plus 18°F in locations where the design wetbulb temperature is greater than or equal to 78°F.

Exception 1 to Section 120.6(a)4A: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling/freezing of products (space with design cooling capacities of greater than 240 Btu/hr-ft²), or process refrigeration cooling for other than a refrigerated space.

- B. Design saturated condensing temperatures for air-cooled condensers shall be less than or equal to:

- i. The design drybulb temperature plus 10°F for systems serving freezers;
- ii. The design drybulb temperature plus 15°F for systems serving coolers.

Exception 1 to Section 120.6(a)4B: Condensing units with a total compressor horsepower less than 100 HP.

Exception 2 to Section 120.6(a)4B: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling/freezing of products (space with design cooling capacities of greater than 240 Btu/hr-ft²), or process refrigeration cooling for other than a refrigerated space.

C. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:

- i. The design drybulb temperature plus 20°F for systems serving freezers;
- ii. The design drybulb temperature plus 30°F for systems serving coolers.

Exception 1 to Section 120.6(a)4C: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling/freezing of products [space with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 ft²)], or process refrigeration cooling for other than a refrigerated space.

D. All condenser fans for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water fluid coolers or cooling towers shall be continuously variable speed, with system shall control the speed of all fans serving a common condenser high side controlled in unison.

E. The minimum condensing temperature setpoint shall be less than or equal to 70°F for systems utilizing air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air or water-cooled fluid coolers or cooling towers for heat rejection.

F. Condensing temperature reset. The condensing temperature set point of systems served by air-cooled condensers shall be reset in response to ambient drybulb temperature. The condensing temperature set point of systems served by evaporative-cooled condensers or water-cooled condensers (via cooling towers or fluid coolers) shall be reset in response to ambient wetbulb temperatures. The condensing temperature set point for systems served by adiabatic condensers shall be reset in response to ambient drybulb temperature while operating in dry mode.

Exception 1 to Section 120.6(a)4F: Condensing temperature control strategies approved by the Executive Director that have been demonstrated to provide at least equal energy savings.

Exception 2 to Section 120.6(a)4F: Systems served by adiabatic condensers in Climate Zones 1, 3, 5, 12, 14 and 16.

G. Fan-powered condensers shall meet the condenser efficiency requirements listed in Table 120.6-B. Condenser efficiency is defined as the total heat of rejection (THR) capacity divided by all electrical input power including fan power at 100 percent fan speed, and power of spray pumps for evaporative condensers.

Exception to Section 120.6(a)4G: Adiabatic condensers with ammonia as refrigerant.

H. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

Exception to Section 120.6(a)4H: Micro-channel condensers.

Exception to Section 120.6(a): Transcritical CO₂ refrigeration systems.

5. **Compressors.** Compressor systems utilized in refrigerated warehouses shall conform to the following:

- A. Compressors serving refrigeration systems that are not transcritical CO₂ shall be designed to operate at a minimum condensing temperature of 70°F or less.

**TABLE 120.6-B
FAN-POWERED CONDENSERS – MINIMUM EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor evaporative cooled with THR Capacity > 8,000 MBH	All	350 Btuh/Watt	100°F saturated condensing temperature (SCT), 70°F outdoor wetbulb temperature
Outdoor evaporative cooled with THR Capacity < 8,000 MBH and indoor evaporative cooled	All	160 Btuh/Watt	
Outdoor air cooled	Ammonia	75 Btuh/Watt	105°F saturated condensing temperature (SCT), 95°F outdoor drybulb temperature
	Halocarbon	65 Btuh/Watt	
Adiabatic dry mode	Halocarbon	45 Btuh/Watt	105°F saturated condensing temperature (SCT), 95°F outdoor drybulb temperature
Indoor air cooled	All		Exempt

B. Compressors for transcritical CO₂ refrigeration systems shall be designed to operate at a minimum condensing temperature of 60°F or less.

Exception to Section 120.6(a)5B: Compressors with a design saturated suction temperature greater than or equal to 30°F shall be designed to operate at a minimum condensing temperature of 70°F or less.

C. New open-drive screw compressors in new refrigeration systems with a design saturated suction temperature (SST) of 28°F or lower that discharges to the system condenser pressure shall control compressor speed in response to the refrigeration load.

Exception 1 to Section 120.6(a)5C: Refrigeration plants with more than one dedicated compressor per suction group.

Exception 2 to Section 120.6(a)5C: Compressors and condensers on a refrigeration system for which more than 20 percent of the total design refrigeration cooling load is for quick chilling/freezing of products [space with design cooling capacities of greater than 240 Btu/hr-ft² (2 tons per 100 ft²)], or process refrigeration cooling for other than a refrigerated space.

D. New screw compressors with nominal electric motor power greater than 150 HP shall include the ability to automatically vary the compressor volume ratio (Vi) in response to operating pressures.

6. **Infiltration barriers.** Passageways between freezers and higher-temperature spaces, and passageways between coolers and nonrefrigerated spaces, shall have an infiltration barrier consisting of strip curtains, an automatically-closing door or an air curtain designed by the manufacturer for use in the passageway and temperature for which it is applied.

Exception 1 to Section 120.6(a)6: Openings with less than 16 square feet of opening area.

Exception 2 to Section 120.6(a)6: Dock doorways for trailers.

7. **Refrigerated warehouse acceptance.** Before an occupancy permit is granted for a new refrigerated warehouse, or before a new refrigeration system serving a refrigerated warehouse is operated for normal use, the following equipment and systems shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. A certificate of acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:

A. Electric resistance underslab heating systems shall be tested in accordance with NA7.10.1.

B. Evaporators fan motor controls shall be tested in accordance with NA7.10.2.

C. Evaporative condensers shall be tested in accordance with NA7.10.3.1.

D. Air-Cooled condensers shall be tested in accordance with NA7.10.3.2.

E. Adiabatic condensers shall be tested in accordance with NA7.10.3.3.

F. Variable speed compressors shall be tested in accordance with NA7.10.4.

G. Transcritical CO₂ refrigeration systems shall be tested in accordance with NA7.20.1.

8. **Transcritical CO₂ gas coolers.** New fan-powered gas coolers on all new transcritical CO₂ refrigeration systems shall conform to the following:

A. Air-cooled gas coolers are prohibited in Climate Zones 9 through 15.

B. Design leaving gas temperature for air-cooled gas coolers shall be less than or equal to the design dry-bulb temperature plus 6°F.

Exception to Section 120.6(a)8B: Design leaving gas temperature for air-cooled gas coolers in Climate Zones 2, 4 and 8 shall be less than or equal to the design dry-bulb temperature plus 8°F.

C. Design leaving gas temperature for adiabatic gas coolers necessary to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to the design dry-bulb temperature plus 15°F.

D. All gas cooler fans shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

E. While operating below the critical point, the gas cooler pressure shall be controlled in accordance with Section 120.6(a)4F.

F. While operating above the critical point, the gas cooler pressure setpoint shall be reset based on ambient conditions such that the system efficiency is maximized.

G. The minimum condensing temperature setpoint shall be less than or equal to 60°F for systems utilizing air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water-cooled fluid coolers or cooling towers for heat rejection.

Exception to Section 120.6(a)8G: Transcritical CO₂ refrigeration systems with a design intermediate saturated suction temperature greater than or equal to 30°F shall have a minimum condensing temperature setpoint of 70°F or less.

H. Fan-powered gas coolers shall meet the gas cooler efficiency requirements listed in Table 120.6-C. Gas cooler efficiency is defined as the Total Heat of Rejection (THR) capacity divided by all electrical input power (fan power at 100 percent fan speed).

9. **Automatic door closers.** Doors designed for the passage of people that are between freezers and higher-temperature spaces, or between coolers and nonrefrigerated spaces, shall have automatic door closers.

**TABLE 120.6-C
TRANSCRITICAL CO₂ FAN-POWERED GAS COOLERS—
MINIMUM EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor air cooled	Transcritical CO ₂	160 Btuh/watt	1400 psig, 100°F outlet gas temperature, 90°F outdoor dry-bulb temperature
Adiabatic dry mode	Transcritical CO ₂	90 Btuh/watt	1100 psig, 100°F outlet gas temperature, 90°F outdoor dry-bulb temperature

(b) Mandatory requirements for commercial refrigeration.

Retail food or beverage stores with 8,000 square feet or more of conditioned floor area, and that utilize either refrigerated display cases, or walk-in coolers or freezers shall meet all applicable state and federal appliance and equipment standards consistent with Section 110.0 and 110.1 or, for equipment not subject to such standards, the requirements of Subsections 1 through 4.

1. Condensers serving refrigeration systems. Fan-powered condensers shall conform to the following requirements:

- A. All condenser fans for air-cooled condensers, evaporative-cooled condensers, adiabatic condensers, gas coolers, air- or water-cooled fluid coolers or cooling towers shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.
- B. The refrigeration system condenser controls for systems with air-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature.
- C. The refrigeration system condenser controls for systems with evaporative-cooled condensers shall use variable-setpoint control logic to reset the condensing temperature setpoint in response to ambient wetbulb temperature.
- D. The refrigeration system condenser controls for systems with adiabatic condensers shall use variable setpoint control logic to reset the condensing temperature setpoint in response to ambient drybulb temperature while operating in dry mode.

Exception 1 to Section 120.6(b)1B, C and D: Condensing temperature control strategies approved by the executive director that have been demonstrated to provide equal energy savings.

Exception 2 to Section 120.6(b)1D: Systems served by adiabatic condensers in Climate Zone 16.

E. The saturated condensing temperature necessary for adiabatic condensers to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to:

- i. The design drybulb temperature plus 20°F for systems serving freezers;

- ii. The design drybulb temperature plus 30°F for systems serving coolers.

F. The minimum condensing temperature setpoint shall be less than or equal to 70°F.

G. Fan-powered condensers shall meet the specific efficiency requirements listed in Table 120.6-D.

**TABLE 120.6-D
FAN-POWERED CONDENSERS—
SPECIFIC EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	MINIMUM SPECIFIC EFFICIENCY ^a	RATING CONDITION
Evaporative cooled	160 Btuh/Watt	100°F saturated condensing temperature (SCT), 70°F outdoor wetbulb temperature
Air cooled	160 Btuh/Watt	105°F saturated condensing temperature (SCT), 95°F outdoor drybulb temperature
Adiabatic dry mode	45 Btu/W (halocarbon)	105°F saturated condensing temperature (SCT), 95°F outdoor drybulb temperature

a. See Section 100.1 for definition of condenser specific efficiency.

Exception 1 to Section 120.6(b)1G: Condensers with a total heat rejection capacity of less than 150,000 Btuh at the specific efficiency rating condition.

Exception 2 to Section 120.6(b)1G: Stores located in Climate Zone 1.

Exception 3 to Section 120.6(b)1G: Existing condensers that are reused for an addition or alteration.

H. Air-cooled condensers shall have a fin density no greater than 10 fins per inch.

Exception 1 to Section 120.6(b)1H: Microchannel condensers.

Exception 2 to Section 120.6(b)1H: Existing condensers that are reused for an addition or alteration.

Exception to Section 120.6(b)1B, 1C, 1D, 1E, 1F, 1G: Transcritical CO₂ refrigeration systems.

Exception to Section 120.6(b)1: New condensers replacing existing condensers when the attached compressor system total heat of rejection does not increase and less than 25 percent of both the attached compressors and the attached display cases are new.

2. **Compressor systems.** Refrigeration compressor systems and condensing units shall conform to the following requirements:

A. Compressors and multiple-compressor suction groups shall include control systems that use floating suction pressure logic to reset the target saturated suction temperature based on the temperature requirements of the attached refrigeration display cases or walk-ins.

Exception 1 to Section 120.6(b)2A: Single compressor systems that do not have continuously variable capacity capability.

Exception 2 to Section 120.6(b)2A: Suction groups that have a design saturated suction temperature of 30°F or higher, or suction groups that comprise the high stage of a two-stage or cascade system or that primarily serve chillers for secondary cooling fluids.

B. Liquid subcooling shall be provided for all low temperature compressor systems with a design cooling capacity equal or greater than 100,000 Btu/hr with a design saturated suction temperature of -10°F or lower, with the subcooled liquid temperature maintained continuously at 50°F or less at the exit of the subcooler, using compressor economizer port(s) or a separate medium or high temperature suction group operating at a saturated suction temperature of 18°F or higher.

Exception 1 to Section 120.6(b)2B: Low temperature cascade systems that condense into another refrigeration system rather than condensing to ambient temperature.

Exception 2 to Section 120.6(b)2B: Transcritical CO₂ refrigeration systems.

C. Compressors for transcritical CO₂ refrigeration systems shall be designed to operate at a minimum condensing temperature of 60°F or less.

Exception to Section 120.6(b)2C: Compressors with a design saturated suction temperature greater than or equal to 30°F shall be designed to operate at a minimum condensing temperature of 70°F or less.

Exception to Section 120.6(b)2: Existing compressor systems that are reused for an addition or alteration.

3. **Refrigerated display cases.** Lighting in refrigerated display cases, and lights on glass doors installed on walk-in coolers and freezers shall be controlled by one of the following:

A. Automatic time switch controls to turn off lights during nonbusiness hours. Timed overrides for any line-up or walk-in case may only be used to turn the lights on for up to one hour. Manual overrides shall time-out automatically to turn the lights off after one hour.

B. Motion sensor controls on each case that reduce display case lighting power by at least 50 percent within 30 minutes after the area near the case is vacated.

4. **Refrigeration heat recovery.**

A. HVAC systems shall utilize heat recovery from refrigeration system(s) for space heating, using no less than 25 percent of the sum of the design total heat of rejection of all refrigeration systems that have individual total heat of rejection values of 150,000 Btu/h or greater at design conditions.

Exception 1 to Section 120.6(b)4A: Stores located in Climate Zone 15.

Exception 2 to Section 120.6(b)4A: HVAC systems or refrigeration systems that are reused for an addition or alteration.

Exception 3 to Section 120.6(b)4A: Stores where the design total heat of rejection of all refrigeration systems is less than or equal to 500,000 Btu/h.

B. The increase in hydrofluorocarbon refrigerant charge associated with refrigeration heat recovery equipment and piping shall be no greater than 0.35 lbs per 1,000 Btu/h of heat recovery heating capacity.

5. **Transcritical CO₂ gas coolers.** New fan-powered gas coolers on all new transcritical CO₂ refrigeration systems shall conform to the following:

A. Air-cooled gas coolers are prohibited in Climate Zones 10 through 15.

B. Design leaving gas temperature for air-cooled gas coolers shall be less than or equal to the design dry-bulb temperature plus 6°F.

C. Design leaving gas temperature for adiabatic gas coolers necessary to reject the design total heat of rejection of a refrigeration system assuming dry mode performance shall be less than or equal to the design dry-bulb temperature plus 15°F.

D. All gas cooler fans shall be continuously variable speed, with the speed of all fans serving a common condenser high side controlled in unison.

E. While operating below the critical point, the gas cooler pressure shall be controlled in accordance with Section 120.6(b)1A.

F. While operating above the critical point, the gas cooler pressure setpoint shall be reset based on ambient conditions such that the system efficiency is maximized.

G. The minimum condensing temperature setpoint shall be less than or equal to 60°F for air-cooled gas coolers, evaporative-cooled gas coolers, adiabatic gas coolers, air or water-cooled fluid coolers or cooling towers.

Exception to Section 120.6(b)5G: Transcritical CO₂ refrigeration systems with a design intermediate saturated suction temperature greater than or equal to 30°F shall have a minimum condensing temperature setpoint of 70°F or less.

H. Fan-powered gas coolers shall meet the condenser efficiency requirements listed in Table 120.6-E. Gas cooler efficiency is defined as the total heat of rejection (THR) capacity divided by all electrical input power (fan power at 100-percent fan speed).

**TABLE 120.6-E
TRANSCRITICAL CO₂ FAN-POWERED GAS COOLERS—
MINIMUM EFFICIENCY REQUIREMENTS**

CONDENSER TYPE	REFRIGERANT TYPE	MINIMUM EFFICIENCY	RATING CONDITION
Outdoor air cooled	Transcritical CO ₂	160 Btuh/watt	1400 psig, 100°F outlet gas temperature, 90°F outdoor dry-bulb temperature
Adiabatic dry mode	Transcritical CO ₂	90 Btuh/watt	1100 psig, 100°F outlet gas temperature, 90°F outdoor dry-bulb temperature

6. **Commercial refrigeration acceptance.** Before an occupancy permit is granted for a new retail food or beverage store, or before a new refrigeration system serving a retail food or beverage store is operated for normal use, the following equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements. Transcritical CO₂ refrigeration systems shall be tested in accordance with NA7.20.1.

(c) **Mandatory requirements for enclosed parking garages.**

Mechanical ventilation systems for enclosed parking garages where the total design exhaust rate for the garage is greater than or equal to 10,000 cfm shall conform to all of the following:

1. Automatically detect contaminant levels and stage fans or modulate fan airflow rates to 50 percent or less of design capacity, provided acceptable contaminant levels are maintained.
2. Have controls and/or devices that will result in fan motor demand of no more than 30 percent of design wattage at 50 percent of design airflow.
3. CO shall be monitored with at least one sensor per 5,000 square feet, with the sensor located in the highest expected concentration locations, with at least two sensors per proximity zone. A proximity zone is defined as an area that is isolated from other areas either by floor or other impenetrable obstruction.
4. CO concentration at all sensors is maintained at ≤ 25 ppm or less at all times.
5. The ventilation rate shall be at least 0.15 cfm/ft² when the garage is scheduled to be occupied.
6. The system shall maintain the garage at negative or neutral pressure relative to other occupiable spaces when the garage is scheduled to be occupied.
7. CO sensors shall be:
 - A. Certified by the manufacturer to be accurate within plus or minus 5 percent of measurement.
 - B. Factory calibrated.
 - C. Certified by the manufacturer to drift no more than 5 percent per year.

D. Certified by the manufacturer to require calibration no more frequently than once a year.

E. Monitored by a control system. The system shall have logic that automatically checks for sensor failure by the following means. Upon detection of a failure, the system shall reset to design ventilation rates and transmit an alarm to the facility operators.

- i. If any sensor has not been calibrated according to the manufacturer’s recommendations within the specified calibration period, the sensor has failed.
- ii. During unoccupied periods the system compares the readings of all sensors, e.g., if any sensor is more than 15 ppm above or below the average of all sensors for longer than four hours, the sensor has failed.
- iii. During occupied periods the system compares the readings of sensors in the same proximity zone, e.g., if the 30 minute rolling average for any sensor in a proximity zone is more than 15 ppm above or below the 30 minute rolling average for other sensor(s) in that proximity zone, the sensor has failed.

8. **Parking garage ventilation system acceptance.** Before an occupancy permit is granted for a parking garage system subject to Section 120.6(c), the following equipment and systems shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. A certificate of acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.12.

Exception 1 to Section 120.6(c): Any garage, or portion of a garage, where more than 20 percent of the vehicles expected to be stored have nongasoline combustion engines.

Exception 2 to Section 120.6(c): Additions and alterations to existing garages where less than 10,000 cfm of new exhaust capacity is being added.

(d) **Mandatory requirements for process boilers.**

1. Combustion air positive shut-off shall be provided on all newly installed process boilers as follows:
 - A. All process boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a nonpositive vent static pressure.

- B. All process boilers where one stack serves two or more boilers with a total combined input capacity per stack of 2.5 MMBtu/h (2,500,000 Btu/h).
- 2. Process boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:
 - A. The fan motor shall be driven by a variable speed drive; or.
 - B. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.
- 3. Newly installed process boilers with an input capacity greater than 5 MMBtu/h (5,000,000 Btu/h) shall maintain stack-gas oxygen concentrations at less than or equal to 3.0 percent by volume on a dry basis over firing rates of 20 to 100 percent. Combustion air volume shall be controlled with respect to measured flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

Exception to Section 120.6(d)3: Boilers with steady state full-load combustion efficiency 90 percent or higher.

(e) Mandatory requirements for compressed air systems.

All new compressed air systems, and all additions or alterations of compressed air systems where the total combined horsepower (hp) of the compressor(s) is 25 hp or more shall meet the requirements of Subsections 1 through 5. These requirements apply to the compressors, related piping systems and related controls that provide compressed air and do not apply to any equipment or controls that use or process the compressed air.

Exception 1 to Section 120.6(e): Medical gas compressed air systems serving healthcare facilities.

- 1. **Trim compressor and storage.** The compressed air system shall be equipped with an appropriately sized trim compressor and primary storage to provide acceptable performance across the range of the system and to avoid control gaps. The compressed air system shall comply with Subsection A or B below.
 - A. The compressed air system shall include one or more variable speed drive (VSD) compressors. For systems with more than one compressor, the total combined capacity of the VSD compressor(s) acting as trim compressors must be at least 1.25 times the largest net capacity increment between combinations of compressors. The compressed air system shall include primary storage of at least one gallon per actual cubic feet per minute (acfm) of the largest trim compressor; or
 - B. The compressed air system shall include a compressor or set of compressors with total effective trim capacity at least the size of the largest net capacity increment between combinations of compressors, or the size of the smallest compressor, whichever is larger. The total effective trim capacity of single

compressor systems shall cover at least the range from 70 to 100 percent of rated capacity. The effective trim capacity of a compressor is the size of the continuous operational range where the specific power of the compressor (kW/100 acfm) is within 15 percent of the specific power at its most efficient operating point. The total effective trim capacity of the system is the sum of the effective trim capacity of the trim compressors. The system shall include primary storage of at least 2 gallons per acfm of the largest trim compressor.

Exception 1 to Section 120.6(e)1: Alterations where the total combined added or replaced compressor horsepower is less than the average per-compressor horsepower of all compressors in the system.

Exception 2 to Section 120.6(e)1: Alterations where all added or replaced compressors are variable speed drive (VSD) compressors and compressed air system includes primary storage of at least one gallon per actual cubic foot per minute (acfm) of the largest trim compressor.

Exception 3 to Section 120.6(e)1: Compressed air systems that have been approved by the Energy Commission Executive Director as having demonstrated that the system serves loads for which typical air demand fluctuates less than 10 percent.

Exception 4 to Section 120.6(e)1: Alterations of existing compressed air systems that include one or more centrifugal compressors.

- 2. **Controls.** Compressed air systems with three or more compressors and a combined horsepower rating of more than 100 hp shall operate with controls that are able to choose the most energy efficient combination and loading of compressors within the system based on the current compressed air demand.
- 3. **Monitoring.** Compressed air systems having a combined horsepower rating equal to or greater than 100 hp shall have an energy and air demand monitoring system with the following minimum requirements:
 - A. Measurement of system pressure.
 - B. Measurement of amps or power of each compressor.
 - C. Measurement or determination of total airflow from compressors in cfm.
 - D. Data logging of pressure, power in kW, airflow in cfm and compressed air system specific efficiency in kW/100 cfm at intervals of 5 minutes or less.
 - E. Maintained data storage of at least the most recent 24 months.
 - F. Visual trending display of each recorded point, load and specific energy.
- 4. **Leak testing of compressed air piping.** Compressed air system piping greater than 50 adjoining feet in length shall be pressure tested after being isolated from the compressed air supply and end uses. The piping shall be pressurized to the design pressure and test pressures shall be held for a length of time at the discretion of the authority having jurisdiction, but in no

case for less than 30 minutes, with no perceptible drop in pressure.

If dial gauges are used for conducting this test, these gauges must conform with *California Plumbing Code* Sections 318.3, 318.4 and 318.5.

Piping less than or equal to 50 adjoining feet in length shall be pressurized and inspected. Connections shall be tested with a noncorrosive leak-detecting fluid or other leak-detecting methods at the discretion of the authority having jurisdiction.

5. **Pipe sizing.** Compressed air piping greater than 50 adjoining feet in length shall be designed and installed to minimize frictional losses in the distribution network. These piping installations shall meet the requirements of Section 120.6(e)5A and either Section 120.6(e)5B or 120.6(e)5C:

- A. Service line piping shall have inner diameters greater than or equal to $\frac{3}{4}$ inch. Service line piping are pipes that deliver compressed air from distribution piping to end uses.

- B. Piping section average velocity. Compressor room interconnection and main header piping shall be sized so that at coincident peak flow conditions, the average velocity in the segment of pipe is no greater than 20 ft/sec. Compressor room interconnection and main header piping are the pipes that deliver compressed air from the compressor outlets to the inlet to the distribution piping. Each segment of distribution and service piping shall be sized so that at coincident peak flow conditions, the average velocity in the segment of pipe is no greater than 30 ft/sec. Distribution piping are pipes that deliver compressed air from the compressor room interconnection piping or main header piping to the service line piping.

- C. Piping total pressure drop. Piping shall be designed such that piping frictional pressure loss at coincident peak loads is less than 5 percent of operating pressure between the compressor and end use or end use regulator.

6. **Compressed air system acceptance.** Before an occupancy permit is granted for a compressed air system subject to Section 120.6(e), the equipment and systems shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. A certificate of acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA 7.13.

(f) **Mandatory requirements for elevators.** Elevators shall meet the following requirements:

1. The light power density for the luminaires inside the elevator cab shall be no greater than 0.6 watts per square foot.

Exception to Section 120.6(f)1: Interior signal lighting and interior display lighting are not included in the calculation of lighting power density.

2. Elevator cab ventilation fans for cabs without space conditioning shall not exceed 0.33 watts per cfm as measured at maximum speed.
3. When the elevator cab is stopped and unoccupied with doors closed for over 15 minutes, the cab interior lighting and ventilation fans shall be switched off until elevator cab operation resumes.
4. Lighting and ventilation shall remain operational in the event that the elevator cabin gets stuck when passengers are in the cabin.
5. Elevator Lighting and Ventilation Control Acceptance. Before an occupancy permit is granted for elevators subject to 120.6(f), the following equipment and systems shall be certified as meeting the Acceptance Requirement for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.14.

Exception to Section 120.6(f): Elevators located in healthcare facilities.

(g) **Mandatory requirements for escalators and moving walkways.**

1. Escalators and moving walkways located in airports, hotels, and transportation function areas shall automatically slow to the minimum permitted speed in accordance with ASME A17.1/CSA B44 when not conveying passengers.
2. Escalators and Moving Walkways Acceptance. Before an occupancy permit is granted for escalators and moving walkways subject to 120.6(g), the following equipment and systems shall be certified as meeting the Acceptance Requirement for Code Compliance, as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.15.

(h) **Mandatory requirements for controlled environment horticulture (CEH) spaces.**

1. **Indoor growing, dehumidification.** Dehumidification equipment shall be one of the following:
 - A. Dehumidifiers subject to regulation under federal appliance standards tested in accordance with 10 CFR 430.23(z) and Appendix X or X1 to Subpart B of 10 CFR Part 430 as applicable, and complying with 10 CFR 430.32(v)2.ng with 10 CFR 430.32(v)2.
 - B. Integrated HVAC system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat;
 - C. Chilled water system with on-site heat recovery designed to fulfill at least 75 percent of the annual energy for dehumidification reheat; or

- D. Solid or liquid desiccant dehumidification system for system designs that require dew point of 50°F or less.
2. **Indoor growing, horticultural lighting.** In a building with CEH spaces and with more than 40 kW of aggregate horticultural lighting load, the electric lighting systems used for plant growth and plant maintenance shall meet the all of the following requirements:
- A. The horticultural lighting systems shall have a photosynthetic photon efficacy (PPE) rated in accordance with ANSI/ASABE S640 for wavelengths from 400 to 700 nanometers and meet one of the following requirements:
- i. Integrated, nonserviceable luminaires shall have a rated PPE of at least 1.9 micromoles per joule; or
 - ii. Luminaires with removable or serviceable lamps shall have lamps with a rated PPE of at least 1.9 micromoles per joule.
- B. Time-switch lighting controls shall be installed and comply with Section 110.9(b)1, Section 130.4(a)4 and applicable sections of NA7.6.2.
- C. Multilevel lighting controls shall be installed and comply with Section 130.1(b).
3. **Indoor growing, electrical power distribution systems.** Electrical power distribution systems serving CEH spaces shall be designed so that a measurement device is capable of monitoring the electrical energy usage of aggregate horticultural lighting load.
4. **Conditioned greenhouses, building envelope.** Conditioned greenhouses shall meet the following requirements:
- A. Opaque wall and opaque roof assembly shall meet the requirements of Section 120.7; and
- B. Nonopaque envelopes shall have two or more glazings separated by either air or gas fill.
5. **Conditioned greenhouses, space-conditioning systems.** Space-conditioning systems used for plant production shall comply with all applicable requirements.
6. **Greenhouses, horticultural lighting.** In a greenhouse with more than 40 kW of aggregate horticultural lighting load, the electric lighting system used for plant growth and plant maintenance shall meet the following requirements:
- A. The horticultural lighting systems shall have a photosynthetic photon efficacy (PPE) rated in accordance with ANSI/ASABE S640 for wavelengths from 400 to 700 nanometers and meet one of the following requirements:
- i. Integrated, nonserviceable luminaires shall have a rated PPE of at least 1.7 micromoles per joule; or
 - ii. Luminaires with removable or serviceable lamps shall have lamps with a rated PPE of at least 1.7 micromoles per joule.
- B. Time-switch lighting controls shall be installed and comply with Section 110.9(b)1, Section 130.4(a)4 and applicable sections of Reference Nonresidential Appendix NA7.6.2.
- C. Multilevel lighting controls shall be installed and comply with Section 130.1(b).
- (i) **Mandatory requirements for steam traps.** Steam traps in new industrial facilities and new steam traps added to support new, nonreplacement, process equipment in existing industrial facilities where the installed steam trap operating pressure, which is the steam pressure entering the steam trap during normal design operating conditions, is greater than 15 psig and the total combined connected boiler input rating is greater than 5 million Btu/hr shall meet the following requirements:
1. **Central steam trap fault detection and diagnostics monitoring.** Steam trap systems shall be equipped with a central steam trap monitoring system that:
 - A. Provides a status update of all steam trap fault detection sensors at no greater than 8-hour intervals.
 - B. Automatically displays an alarm that identifies which steam trap has a fault once the system has detected a fault.
 2. **Steam trap fault detection.** Steam traps shall be equipped with automatic fault detection sensors that shall communicate their operational state to the central steam trap monitoring system as described in Section 120.6(i)1.
 3. **Steam trap strainer installation.** Steam traps shall either:
 - A. Be equipped with an integral strainer and blow-off valve; or
 - B. Be installed downstream within 3 feet of a strainer and blow-off valve.
 4. **Steam trap system acceptance.** Before an occupancy permit is granted for steam trap systems subject to Section 120.6(i), the equipment and systems shall be certified as meeting the Acceptance Requirement for Code Compliance, as specified by the Reference Nonresidential Appendix NA7.19. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.19.
- Exception 1 to Section 120.6(i):** Steam traps where steam is diverted to a steam system of lower pressure for use when the steam trap fails open.
- (j) **Mandatory requirements for computer rooms.** Space-conditioning systems serving a computer room shall meet the following requirements:
1. **Reheat.** Each computer room zone shall have controls that prevent reheating, recooling and simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been

previously cooled, either by cooling equipment or by economizer systems.

2. **Humidification.** Humidification shall be adiabatic. Nonadiabatic humidification, including but not limited to steam and infrared, is prohibited.
3. **Fan control.** Each unitary air conditioner with mechanical cooling capacity exceeding 60,000 Btu/hr and each chilled water fan system shall be designed to vary the airflow rate as a function of actual load. Fan motor demand shall not exceed 50 percent of design wattage at 66 percent of design fan speed.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 120.7 MANDATORY INSULATION REQUIREMENTS

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements in Sections 120.7(a) through 120.7(c).

(a) **Roof/Ceiling insulation.** The opaque portions of the roof/ceiling that separates conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Metal building.** The weighted average *U*-factor of the roof assembly shall not exceed 0.098.
2. **Wood framed and others.** The weighted average *U*-factor of the roof assembly shall not exceed 0.075.
3. **Insulation placement.** Insulation installed to limit heat loss and gain from conditioned spaces to unconditioned spaces shall comply with all of the following:

> A. Insulation shall be installed in direct contact with a roof or ceiling that is sealed to limit infiltration and exfiltration as specified in Section 110.7. This may include, but is not limited to, placing insulation either above or below the roof deck or on top of the finished ceiling.

B. When insulation is installed at the roof in nonresidential buildings, fixed vents or openings to the outdoors or to unconditioned spaces shall not be installed. When the space between the ceiling and the roof is either directly or indirectly conditioned space, it shall not be considered an attic for the purposes of complying with CBC attic ventilation requirements.

C. Insulation placed on top of a suspended ceiling with removable ceiling panels shall not be used to meet the Roof/Ceiling requirement of Sections 140.3 and 141.0.

Exception to Section 120.7(a)3: When there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building, and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet,

insulation placed in direct contact with a suspended ceiling with removable ceiling panels shall be an acceptable method of reducing heat loss from a conditioned space and shall be accounted for in heat loss calculations.

NOTE: Vents that do not penetrate the roof deck and are instead designed for wind resistance for roof membranes are not within the scope of Section 120.7(a)3B.

(b) **Wall insulation.** The opaque portions of walls that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 7 below:

1. **Metal building.** The weighted average *U*-factor of the wall assembly shall not exceed 0.113.
2. **Metal framed.** The weighted average *U*-factor of the wall assembly shall not exceed 0.151.
3. **Light mass walls.** A 6-inch or greater hollow core concrete masonry unit shall have a *U*-factor not to exceed 0.440.
4. **Heavy mass walls.** An 8-inch or greater hollow core concrete masonry unit shall have a *U*-factor not to exceed 0.690.
5. **Wood framed and others.** The weighted average *U*-factor of the wall assembly shall not exceed 0.110.
6. **Spandrel panels and curtain wall.** The weighted average *U*-factor of the spandrel panels and curtain wall assembly shall not exceed 0.280.
7. **Demising walls.** The opaque portions of framed demising walls shall meet the requirements of Item A or B below:
 - A. Wood framed walls shall be insulated to meet a *U*-factor not greater than 0.099.
 - B. Metal framed walls shall be insulated to meet a *U*-factor not greater than 0.151.

(c) **Floor and soffit insulation.** The opaque portions of floors and soffits that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 and 2 below:

1. **Raised mass floors.** Shall have a minimum of 3 inches of lightweight concrete over a metal deck, or the weighted average *U*-factor of the floor assembly shall not exceed 0.269.
2. **Other floors.** The weighted average *U*-factor of the floor assembly shall not exceed 0.071.
3. **Heated slab on grade floor.** A heated slab on grade floor shall be insulated to meet the requirements of Section 110.8(g).

Exception to Section 120.7: A dedicated building used solely as a data center that has a total covered process load exceeding 750 kW.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 120.8
NONRESIDENTIAL BUILDING COMMISSIONING**

Nonresidential buildings other than healthcare facilities, with conditioned space of 10,000 square feet or more, shall comply with the applicable requirements of Sections 120.8(a) through 120.8(i) in the building design and construction processes. All building systems and components covered by Sections 110.0, 120.0, 130.0, and 140.0 shall be included in the scope of the commissioning requirements in this Section, excluding those related solely to covered processes.

Nonresidential buildings other than healthcare facilities, with conditioned space of less than 10,000 square feet shall comply with the design review requirements specified in Sections 120.8(d), and shall include any measures or requirements necessary for completing this review in the construction documents in a manner consistent with Section 120.8(e).

Healthcare facilities shall instead comply with the applicable requirements of Chapter 7 of the *California Administrative Code* (Title 24, Part 1).

NOTE: Nonresidential buildings include nonresidential spaces such as nonresidential function areas within hotel/motel and high-rise residential buildings. The requirements of Section 120.8 apply based on the square footage of the nonresidential spaces.

The commissioning described in this Section is in addition to any commissioning required by Title 24, Part 11, Section 5.410.2, 5.410.4 and subsections.

(a) **Summary of commissioning requirements.** Commissioning shall include completion of the following items:

1. Owner’s or owner representative’s project requirements;
2. Basis of design;
3. Design phase design review;
4. Commissioning measures shown in the construction documents;
5. Commissioning plan;
6. Functional performance testing;
7. Documentation and training; and
8. Commissioning report.

(b) **Owner’s or Owner Representative’s Project Requirements (OPR).** The energy-related expectations and requirements of the building shall be documented before the design phase of the project begins. This documentation shall include the following:

1. Energy efficiency goals;
2. Ventilation requirements;
3. Project documentation requirements, including facility functions, hours of operation, and need for after-hours operation;
4. Equipment and systems expectations; and
5. Building envelope performance expectations.

(c) **Basis of design (BOD).** A written explanation of how the design of the building systems and components meets the OPR shall be completed at the design phase of the building project, and updated as necessary during the design and construction phases. The basis of design document shall cover the following systems and components:

1. Heating, ventilation, air conditioning (HVAC) systems and controls;
2. Indoor lighting system and controls;
3. Water heating systems and controls;
4. Any other building equipment or system listed in the OPR; and
5. Any building envelope component considered in the OPR.

(d) **Design phase design review.**

1. **Design reviewer requirements.** The design reviewer shall be the signer of the Design Review Kickoff Certificate(s) of Compliance and Construction Document Design Review Checklist Certificate(s) of Compliance as specified in Part 1 Section 10-103(a)1.
2. **Design review kickoff.** During the schematic design phase of the building project, the owner or owner’s representative, design team and design reviewer must meet to discuss the project scope, schedule and how the design reviewer will coordinate with the project team. The building owner or owner’s representative shall include the Design Review Kickoff Certificate of Compliance form in the certificate of compliance documentation (as specified in Part 1 Section 10-103).
3. **Construction documents design review.** The construction documents design review Checklist Certificate of Compliance shall list the items checked by the design reviewer during the construction document review. The completed form shall be returned to the owner and design team for review and sign-off. The building owner or owner’s representative shall include this form in the certificate of compliance documentation (as specified in Part 1 Section 10-103).

(e) **Commissioning measures shown in the construction documents.** Complete descriptions of all measures or requirements necessary for commissioning shall be included in the construction documents (plans and specifications). Commissioning measures or requirements shall be clear, detailed and complete to clarify the commissioning process.

(f) **Commissioning plan.** Prior to permit issuance a commissioning plan shall be completed to document how the project will be commissioned and shall be started during the design phase of the building project. The commissioning plan shall include the following:

1. General project information;
2. Commissioning goals;
3. Systems to be commissioned; and
4. Plans to test systems and components, which shall include:
 - A. An explanation of the original design intent;

- > B. Equipment and systems to be tested, including the extent of tests;
- > C. Functions to be tested;
- > D. Conditions under which the test shall be performed;
- > E. Measurable criteria for acceptable performance;
- F. Commissioning team information; and
- G. Commissioning process activities, schedules and responsibilities. Plans for the completion of commissioning requirements listed in Sections 120.8(g) through 120.8(i) shall be included.

(g) **Functional performance testing.** Functional performance tests shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the acceptance test requirements in Sections 120.5, 130.4, 140.9, 160.3(d) and 160.5(e). Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized, and include any readings and adjustments made.

Exception to Section 120.8(g): Healthcare facilities.

(h) **Documentation and training.** A systems manual and systems operations training shall be completed.

1. **Systems manual.** Documentation of the operational aspects of the building shall be completed within the systems manual and delivered to the building owner or representative and facilities operator. The systems manual shall include the following:
 - > A. Site information, including facility description, history and current requirements;
 - > B. Site contact information;
 - > C. Instructions for basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, and a site events log;
 - > D. Description of major systems;
 - E. Site equipment inventory and maintenance notes; and
 - F. A copy of all special inspection verifications required by the enforcing agency or the standards.
2. **Systems operations training.** The training of the appropriate maintenance staff for each equipment type or system shall be documented in the commissioning report. Training materials shall include the following:
 - || A. System and equipment overview (i.e., what the equipment is, what it does and with what other systems or equipment it interfaces);
 - || B. Review and demonstration of operation, servicing and preventive maintenance procedures;
 - || C. Review of the information in the systems manual; and
 - || D. Review of the record drawings on the systems and equipment.

(i) **Commissioning report.** A complete report of commissioning process activities undertaken through the design, construction and reporting recommendations for post-construction phases of the building project shall be completed and provided to the owner or owner’s representative.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 120.9 MANDATORY REQUIREMENTS FOR COMMERCIAL BOILERS

(a) Combustion air positive shut-off shall be provided on all newly installed boilers as follows:

1. All boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is designed to operate with a nonpositive vent static pressure.
2. All boilers where one stack serves two or more boilers with a total combined input capacity per stack of 2.5 MMBtu/h (2,500,000 Btu/h).

(b) Boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:

1. The fan motor shall be driven by a variable speed drive, or
2. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.

(c) Newly installed boilers with an input capacity 5 MMBtu/h (5,000,000 Btu/h) and greater shall maintain stack-gas oxygen concentrations at less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 to 100 percent. Combustion air volume shall be controlled with respect to firing rate or flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

Exception to Section 120.9(c): Boilers with steady state full-load combustion efficiency 90 percent or higher. ||

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 120.10 MANDATORY REQUIREMENTS FOR FANS

(a) Each fan or fan array with a combined motor nameplate horsepower greater than 1.00 hp or with a combined fan nameplate electrical input power greater than 0.89 kW shall have a fan energy index (FEI) of 1.00 or higher at fan system design conditions. Each fan and fan array used for a variable-air-volume system that meets the requirements of Section

140.4(c)2 shall have an FEI of 0.95 or higher at fan system design conditions.

1. The FEI for fan arrays shall be calculated in accordance with ANSI/AMCA 208-18 Annex C.
2. All FEI values shall be provided by a manufacturer, where fan selection software and/or fan catalogs display third-party-verified FEI values in accordance with ANSI/AMCA 208-18.

Exception to Section 120.10(a)2: FEI values for embedded fans do not need to be third-party verified.

Exception 1 to Section 120.10(a): Embedded fans that are part of the equipment listed under Section 110.1 or Section 110.2, computer room air conditioners (CRACs) as defined in 10 CFR 431, and DX-DOAS units.

Exception 2 to Section 120.10(a): Embedded fans and embedded fan arrays with a combined motor nameplate horsepower of 5 hp or less or with a fan system electrical input power of 4.1 kW or less.

Exception 3 to Section 120.10(a): Circulation fans, ceiling fans and air curtains.

Exception 4 to Section 120.10(a): Fans that are intended to operate only during emergency conditions.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8 and 25943, *Public Resources Code*.

SUBCHAPTER 4

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES— MANDATORY REQUIREMENTS FOR LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS

SECTION 130.0 LIGHTING SYSTEMS AND EQUIPMENT, AND ELECTRICAL POWER DISTRIBUTION SYSTEMS—GENERAL

(a) The design and installation of all lighting systems and equipment in nonresidential and hotel/motel buildings, outdoor lighting, and electrical power distribution systems within the scope of Section 100.0(a), shall comply with the applicable provisions of Sections 130.0 through 130.5.

NOTE: The requirements of Sections 130.0 through 130.5 apply to newly constructed buildings. Section 141.0 specifies which requirements of Sections 130.0 through 130.5 also apply to additions and alterations to existing buildings.

(b) **Functional areas where compliance with the residential lighting standards is required.** The design and installation of all lighting systems, lighting controls and equipment in the following functional areas shall comply with the applicable residential lighting requirements of Section 150.0(k). In buildings containing these functional areas, all other functional areas, such as common areas, shall comply with the applicable nonresidential lighting and controlled receptacle requirements.

1. **Reserved.**
2. Outdoor lighting attached to a hotel/motel building and separately controlled from the inside of a guest room.
3. Fire station dwelling accommodations.
4. Hotel and motel guest rooms. Additionally, hotel and motel guest rooms shall meet the requirements of Section 130.1(c)8 and Section 130.5(d)4.
5. **Reserved.**

NOTE: The requirements of Section 130.0(b) also apply to additions and alterations to functional areas of existing buildings as specified in Section 130.0(b).

(c) **Luminaire classification and power.** Luminaires classified and their wattage shall be determined as follows:

1. Luminaire wattage shall be labeled as follows:
 - A. The maximum rated wattage or relamping rated wattage of a luminaire shall be listed on a permanent, preprinted, factory installed label, as specified by UL 1574, 1598, 2108 or 8750, as applicable; and
 - B. The factory-installed maximum rated wattage or relamping rated wattage label shall not consist of peel-off or peel-down layers or other methods that allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.

Exception to Section 130.0(c)1B: Peel-down labels may be used only for the following luminaires, when they can accommodate a range of lamp wattages without changing the luminaire housing, ballast, transformer or wiring. Qualifying luminaires shall have a single lamp, and shall have integrated ballasts or transformers. Peel-down labels must be layered such that the rated wattage reduces as successive layers are removed.

- i. High-intensity discharge luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 150 watts.
 - ii. Low-voltage luminaires (except low voltage track systems), ≤ 24 volts, with a maximum relamping rated wattage of 50 watts.
 - iii. Compact fluorescent luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 42 watts.
2. For luminaires with line voltage lamp holders not served by drivers, ballasts, or transformers; the wattage of such luminaires shall be determined as the maximum relamping rated wattage as labeled in accordance with Section 130.0(c)1.
 3. For luminaires with permanently installed or remotely installed ballasts, the wattage of such luminaires shall be the operating input wattage of the rated lamp/ballast combination published in the ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.
 4. For inseparable SSL luminaires and SSL luminaires with remotely mounted drivers, the maximum rated wattage shall be the maximum rated input wattage of the SSL luminaire as specified in Section 130.0(c)1 when tested in accordance with UL 1598, 2108 or 8750, or IES LM-79.
 5. For LED tape lighting and LED linear lighting with LED tape lighting components, the maximum rated wattage shall be the sum of the installed length of the tape lighting times its rated linear power density in watts per linear feet, or the maximum rated input wattage of the driver or power supply providing power to the lighting system, with tape lighting tested in accordance with UL 2108 or 8750, or IES LM-79.
 6. For modular lighting systems that allow the addition or relocation of luminaires without altering the wiring of the system, wattage shall be determined as follows:
 - A. The wattage shall be the greater of:
 - i. 30 watts per linear foot of track or plug-in busway; or

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ii. the rated wattage of all of the luminaires included in the system, where the luminaire wattage is determined as specified in Section 130.0(c)1.

B. For line-voltage lighting track and plug-in busway served by a track lighting integral current limiter or a dedicated track lighting supplementary overcurrent protection panel, the wattage shall be determined as follows:

i. The volt-ampere rating of the current limiter as specified by UL 1077; or

ii. The sum of the ampere (A) rating of all of the current protection devices times the branch circuit voltages for track lighting supplementary overcurrent protection panel.

C. For other modular lighting systems with power supplied by a driver, power supply or transformer, including but not limited to low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformer published in the manufacturer's catalogs, as specified by UL 2108 or 8750.

Exception to Section 130.0(c)6: For power-over-Ethernet lighting systems, power provided to installed nonlighting devices may be subtracted from the total power rating of the power-over-Ethernet system.

7. For all other lighting equipment not addressed by Sections 130.0(c)2 through 6, the wattage of the lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, labeled in accordance with Section 130.0(c)1, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574, 1598, 2108 or 8750, or IES LM-79.

(d) **Lighting controls.** All lighting controls and equipment shall comply with the applicable requirements in Sections 110.9, 130.1 and 130.2, and shall be installed in accordance with any applicable manufacturer instructions.

(e) **Energy Management Control System (EMCS).** An EMCS may be installed to comply with the requirements of one or more lighting controls if it meets the following minimum requirements:

1. Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Sections 110.9, 130.1 and 130.2; and
2. Complies with all applicable lighting control installation requirements in accordance with Section 130.4 for each specific lighting control or system for which it is installed; and
3. Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007,

25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 130.1
MANDATORY INDOOR LIGHTING CONTROLS**

Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.1(a) through 130.1(f), in addition to the applicable requirements of Sections 110.9 and 130.0.

(a) **Manual area controls.** Each area enclosed by ceiling-height partitions shall provide lighting controls that allow the lighting in that area to be manually turned on and off. The manual control shall:

1. Be readily accessible; and

Exception to Section 130.1(a)1: Restrooms having two or more stalls, parking areas, stairwells, corridors and areas of the building intended for access or use by the public may use a manual control not accessible to unauthorized personnel.

2. Be located in the same enclosed area with the lighting it controls; and

Exception 1 to Section 130.1(a)2: For malls and atria, main entry lobbies, auditorium areas, dining areas, retail merchandise sales areas, wholesale showroom areas, commercial and industrial storage areas, general commercial and industrial work areas, convention centers, arenas, psychiatric and secure areas in healthcare facilities, and other areas where placement of a manual area control poses a health and safety hazard, the manual area control may instead be located so that a person using the control can see the lights or area controlled by that control, or include a visual signal or display showing the current state of the controlled lighting.

Exception 2 to Section 130.1(a)2: In healthcare facilities, for restrooms and bathing rooms intended for a single occupant, the lighting control may be located outside the enclosed area but directly adjacent to the door.

3. Provide separate control of general, floor display, wall display, window display, case display, ornamental, and special effects lighting, such that each type of lighting can be turned on or off without turning on or off other types of lighting. Scene controllers may comply with this requirement provided that at least one scene turns on general lighting only, and the control provides a means to manually turn off all lighting.

Exception to Section 130.1(a): Up to 0.1 watts per square foot of indoor lighting may be continuously illuminated to allow for means of egress illumination consistent with *California Building Code* Section 1008. Egress lighting complying with this wattage limitation is not required to comply with manual area control requirements if:

1. The area is designated for means of egress on the plans and specifications submitted to the enforce-

ment agency under Section 10-103(a)2 of Part 1; and

2. The controls for the egress lighting are not accessible to unauthorized personnel.

(b) **Multilevel lighting controls.** The general lighting of any enclosed area 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per square foot shall provide multilevel lighting controls that allow the level of lighting to be adjusted up and down. The multi-level controls shall:

1. Provide the number of control steps specified in Table 130.1-A; and

Exception to Section 130.1(b)1: Classrooms with a connected general lighting load of 0.6 watts per square foot or less shall have a minimum of one control step between 30 and 70 percent of full rated power, regardless of luminaire type.

2. Meet the uniformity requirements specified in Table 130.1-A.

Exception 1 to Section 130.1(b): An area enclosed by ceiling-height partitions that has only one luminaire with no more than two lamps or has only one inseparable SSL luminaire.

Exception 2 to Section 130.1(b): Restrooms.

Exception 3 to Section 130.1(b): Healthcare facilities.

(c) **Shut-OFF Controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.

Exception 1 to Section 130.1(c): Healthcare facilities.

1. In addition to lighting controls installed to comply with Sections 130.1(a) and (b), all installed indoor lighting shall be equipped with controls that meet the following requirements:

A. Shall be controlled with an occupant sensing control, automatic time-switch control, or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and

B. Separate controls for the lighting on each floor, other than lighting in stairwells; and

C. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet.

Exception to Section 130.1(c)1C: The area controlled may not exceed 20,000 square feet in the following function areas: malls, auditoriums, single tenant retail, industrial, convention centers and arenas.

Exception 1 to Section 130.1(c)1: Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.

Exception 2 to Section 130.1(c)1: Lighting complying with Section 130.1(c)5 or 7.

Exception 3 to Section 130.1(c)1: Up to 0.1 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1. Lighting providing means of egress illumination, as the term is used in the *California Building Code*, shall be configured to provide no less than the amount of light required by *California Building Code* Section 1008 while in the partial-off mode.

Exception 4 to Section 130.1(c)1: Electrical equipment rooms subject to Article 110.26(D) of the *California Electrical Code*.

Exception 5 to Section 130.1(c)1: Illumination provided by lighting equipment that is designated for emergency lighting, connected to an emergency power source or battery supply, and is intended to function in emergency mode only when normal power is absent.

2. Countdown timer switches may be used to comply with the automatic shut-OFF control requirements in Section 130.1(c)1 only in closets less than 70 square feet, and server aisles in server rooms. The maximum timer setting shall be 10 minutes for closets, and 30 minutes for server aisles.

3. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 130.1(c)1, it shall incorporate a manual override lighting control that:

A. Complies with Section 130.1(a); and

B. Allows the lighting to remain ON for no more than 2 hours when an override is initiated.

Exception to Section 130.1(c)3B: In the following function areas, the override time may exceed 2 hours: Malls, auditoriums, single tenant retail, industrial, laboratories and arenas where captive-key override is utilized.

4. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 130.1(c)1, it shall incorporate an automatic holiday “shut-OFF” feature that turns OFF all loads for at least 24 hours, and then resumes the normally scheduled operation.

Exception to Section 130.1(c)4: In retail stores and associated malls, restaurants, grocery stores, churches, and theaters, the automatic time-switch control is not required to incorporate an automatic holiday shut-OFF feature.

5. **Occupant sensing controls are required for specified offices, multipurpose rooms, classrooms, conference rooms and restrooms.** In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, classrooms of any size, conference rooms of any size, and restrooms of any size, lighting shall be con-

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trolled with occupant sensing controls to automatically shut OFF all of the lighting in 20 minutes or less after the control zone is unoccupied.

In areas required by Section 130.1(b) to have multi-level lighting controls, the occupant sensing controls shall function either as a:

- A. Partial-ON occupant sensing controls capable of automatically activating between 50 and 70 percent of controlled lighting power, or
- B. Vacancy sensing controls, where all lighting responds to a manual ON input only.

In areas not required by Section 130.1(b) to have multilevel lighting controls, the occupant sensing controls shall function either as:

- A. Occupant sensing controls; or
- B. Partial-ON occupant sensing controls, or
- C. Vacancy sensing controls, where all lighting responds to a manual ON input only.

In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 130.1(a) regardless of the sensor status.

6. Full or partial-OFF occupant sensing controls are required for aisle ways and open area in warehouses, library book stack aisles, corridors and stairwells, and offices greater than 250 square feet.

Lighting installed in the following areas shall meet the requirements below in addition to complying with Section 130.1(c)1.

A. In aisle ways and open areas in warehouses, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

Exception 1 to Section 130.1(c)6A: In aisle ways and open areas in warehouses in which the installed lighting power is 80 percent or less of the value allowed under the area category method, occupant sensing controls shall reduce lighting power by at least 40 percent.

Exception 2 to Section 130.1(c)6A: When metal halide lighting or high pressure sodium lighting is installed in warehouses, occupant sensing controls shall reduce lighting power by at least 40 percent.

B. In library book stack aisles 10 feet or longer that are accessible from only one end, and library book stack aisles 20 feet or longer that are accessible from both ends, lighting shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall independently control lighting in each aisle way, and shall not control lighting beyond the aisle way being controlled by the sensor.

C. In corridors and stairwells, lighting shall be controlled by occupant sensing controls that separately reduce the lighting power in each space by at least 50 percent when the space is unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

D. In office spaces greater than 250 square feet, general lighting shall be controlled with occupant sensing controls that meet all of the following:

- i. The occupant sensing controls shall be configured so that lighting shall be controlled separately in control zones not greater than 600 square feet. For luminaires with an embedded occupant sensor that are capable of reducing power independently from other luminaires, each luminaire can be considered its own control zone; and
- ii. In 20 minutes or less after the control zone is unoccupied, the occupant sensing controls shall uniformly reduce lighting power in the control zone by at least 80 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement; and
- iii. In 20 minutes or less after the entire office space is unoccupied, the occupant sensing controls shall automatically turn off lighting in all control zones in the space; and
- iv. In each control zone, lighting shall be allowed to automatically turn on to any level up to full power upon occupancy within the control zone. When occupancy is detected in any control zone in the space, the lighting in other control zones that are unoccupied shall operate at no more than 20 percent of full power.

Exception to Section 130.1(c)6D: Under-shelf or furniture-mounted task lighting controlled by a local switch and either a time switch or an occupancy sensor.

7. Partial-OFF occupant sensing controls are required. Partial-OFF occupant sensing controls are required for specified stairwells and common area corridors, parking garages, parking areas and loading and unloading areas. Lighting installed in the following areas shall meet the requirements below instead of complying with Section 130.1(c)1.

A. Lighting in stairwells and common area corridors that provide access to guestrooms of hotel/motels shall be controlled with occupant sensing controls that automatically reduce lighting power by at least 50 percent when the areas are unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

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Exception to Section 130.1(c)7A: In corridors and stairwells in which the installed lighting power is 80 percent or less of the value allowed under the area category method, occupant sensing controls shall reduce power by at least 40 percent.

- B. In parking garages, parking areas and loading and unloading areas, general lighting shall be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power. No more than 500 watts of rated lighting power shall be controlled together as a single zone. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in Table 130.1-A. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 130.1(c)7B. Parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in Section 130.2.

Exception to Section 130.1(c)7B: Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt, used for general lighting in parking garages, parking areas and loading and unloading areas, shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power.

8. Hotel/motel guest rooms shall be controlled with one of the following such that, no longer than 20 minutes after the guest room has been vacated, lighting power is switched off:
- i. Captive card key controls; or
 - ii. Occupant sensing controls; or
 - iii. Other automatic controls.

Exception to Section 130.1(c)8: One high-efficacy luminaire as defined in Table 150.0-A that is switched separately and where the switch is located within 6 feet of the entry door.

(d) **Automatic daylighting controls.** The general lighting in skylit daylight zones, primary sidelit daylight zones and secondary sidelit daylight zones, as well as the general lighting in the combined primary and secondary sidelit daylight zones in parking garages, shall be provided with controls that automatically adjust the power of the installed lighting up and down to keep the total light level stable as the amount of incoming daylight changes. For skylight located in an atrium, the skylit daylight zone definition shall apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium.

1. All skylit daylight zones, primary sidelit daylight zones, secondary sidelit daylight zones, and the combined primary

and secondary sidelit daylight zones in parking garages shall be shown on the plans.

NOTE: Parking areas on the roof of a parking structure are outdoor hardscape, not skylit daylight areas.

2. The automatic daylighting controls shall provide separate control for general lighting in each type of daylight zone. General lighting in overlapping skylit daylight zone and sidelit daylight zone shall be controlled as part of the skylit daylight zone. General lighting in overlapping primary and secondary sidelit daylight zones shall be controlled as part of the primary sidelit daylight zone. Linear LED and other solid state lighting (SSL) light sources in linear form may be treated as linear lamps in increments of 4-foot segments or smaller, and each segment is separately controlled based on the type of the daylight zone in which the segment is primarily located.
3. The automatic daylighting controls shall:
 - A. For spaces required to install multilevel controls under Section 130.1(b), adjust lighting via continuous dimming or the number of control steps provided by the multilevel controls;
 - B. For each space, ensure the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available;
 - C. For areas other than parking garages, ensure that, when the daylight illuminance is greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in that daylight zone shall be reduced by a minimum of 90 percent; and
 - D. For parking garages, ensure that when daylight illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in the combined primary and secondary sidelit daylight zones shall be reduced by 100 percent.
4. Photosensors shall be located so that they are not readily accessible to unauthorized personnel.
5. The location where calibration adjustments are made to the automatic daylighting controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover which requires a tool for access.

Exception 1 to Section 130.1(d): Areas under skylights where it is documented that existing adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.

Exception 2 to Section 130.1(d): Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the ratio of the overhang projection to the overhang rise is greater

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than 1.5 for South, East and West orientations or greater than 1 for North orientations.

Exception 3 to Section 130.1(d): Rooms where the combined total installed wattage of the general lighting in the skylit and primary sidelit zones is less than 120 watts are not required to have daylighting controls for those zones. Rooms where the total installed wattage of the general lighting in the secondary sidelit zones is less than 120 watts are not required to have daylighting controls for that zone.

Exception 4 to Section 130.1(d): Parking garage areas where the total installed wattage of the general lighting in the primary and the secondary sidelit daylit zones is less than 60 watts do not require automatic daylighting controls in the daylit zones.

Exception 5 to Section 130.1(d): Rooms that have a total glazing area of less than 24 square feet, or parking garage areas with a combined total of less than 36 square feet of glazing or opening.

Exception 6 to Section 130.1(d): For parking garages, luminaires located in the daylight adaptation zone.

Exception 7 to Section 130.1(d): Luminaires in sidelit daylit zones in retail merchandise sales and wholesale showroom areas.

(e) **Demand responsive controls.** See Section 110.12 for requirements for demand responsive lighting controls.

(f) **Control interactions.** Each lighting control installed to comply with Section 130.1(a) through (e) shall permit or incorporate the functions of the other lighting controls.

1. For general lighting, the manual area control shall permit the level or amount of light provided while the lighting is on to be set or adjusted by the controls specified in Section 130.1(b), (c), (d), and (e).
2. The manual area control shall permit the shutoff control to turn the lighting down or off.
3. The multilevel lighting control shall permit the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.
4. The multilevel lighting control shall permit the demand responsive control to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.
5. The shutoff control shall permit the manual area control to turn the lighting on. If the on request occurs while an automatic time switch control would turn the lighting off, then the on request shall be treated as an override request consistent with Section 130.1(c)3.
6. The automatic daylighting control shall permit the multilevel lighting control to adjust the level of lighting.
7. For lighting controlled by multilevel lighting controls and by occupant sensing controls that provide an auto-

**TABLE 130.1-A
MULTILEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS**

LUMINAIRE TYPE	MINIMUM REQUIRED CONTROL STEPS (percent of full rated power ¹)	UNIFORM LEVEL OF ILLUMINANCE SHALL BE ACHIEVED BY:
LED luminaires and LED source systems	Continuous dimming 10–100 percent	
Line-voltage sockets except GU-24		
Low-voltage incandescent systems		
Fluorescent luminaires	Continuous dimming 20–100 percent	
GU-24 sockets rated for fluorescent ≤ 20 watts	Minimum one step between 30 and 70 percent	Continuous dimming; or Stepped dimming; or Switching alternate lamps in a luminaire; or Separately switching circuits in multi-circuit track with a minimum of two circuits
Pin-based compact fluorescent ≤ 20 watts		
Linear fluorescent and U-bent fluorescent ≤ 13 watts		
Track lighting		
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range: 20–40% 50–70% 75–85% 100%	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of four lamps per luminaire, illuminating the same area and in the same manner
Other light sources, including HID and induction	Minimum one step between 50 and 70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of two lamps per luminaire, illuminating the same area and in the same manner

1. Full rated input power of ballast and lamp, corresponding to maximum ballast factor.

matic-on function, the controls shall provide a partial-on function that is capable of automatically activating between 50–70 percent of controlled lighting power.

8. Reserved.

9. For space-conditioning system zones serving only spaces that are required to have occupant sensing controls as specified in Section 130.1(c)5, 6 and 7, and where Table 120.1-A allows the ventilation air to be reduced to zero when the space is in occupied-standby mode, the space-conditioning system shall be controlled by occupancy sensing controls as specified in Section 120.2(e)3.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 130.2
OUTDOOR LIGHTING CONTROLS AND EQUIPMENT**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.2(a) through 130.2(c).

(a) **Reserved.**

|| (b) **Luminaire shielding requirements.** All outdoor luminaires of 6,200 initial luminaire lumens or greater shall comply with backlight, uplight and glare (BUG) in accordance with ANSI/IES TM-15-20, Annex A requirements in accordance with Title 24, Part 11, Section 5.106.8.

Exception 1 to Section 130.2(b): Signs.

|| **Exception 2 to Section 130.2(b):** Lighting for building facades, public monuments, public art, statues and vertical surfaces of bridges.

Exception 3 to Section 130.2(b): Lighting not permitted by a health or life safety statute, ordinance or regulation to be a cutoff luminaire.

Exception 4 to Section 130.2(b): Temporary outdoor lighting.

Exception 5 to Section 130.2(b): Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:

- A. Where the existing luminaire does not meet the luminaire BUG requirements in Section 130.2(b); and
- B. Spacing between existing poles is greater than six times the mounting height of the existing luminaires; and
- C. Where no additional poles are being added to the site; and
- D. Where new wiring to the luminaires is not being installed; and
- E. Provided that the connected lighting power wattage is not increased.

Exception 6 to Section 130.2(b): Luminaires that illuminate the public right of way including publicly-maintained or utility-maintained roadways, sidewalks and bikeways.

Exception 7 to Section 130.2(b): Outdoor lighting attached to a hotel/motel building and separately controlled from the inside of a guest room.

(c) **Controls for outdoor lighting.** Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

Exception 1 to Section 130.2(c): Outdoor lighting not permitted by a health or life safety statute, ordinance or regulation to be turned OFF or reduced.

Exception 2 to Section 130.2(c): Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

1. **Daylight availability.** All installed outdoor lighting shall be controlled by a photo control, astronomical time-switch control, or other control capable of automatically shutting OFF the outdoor lighting when daylight is available.

2. **Automatic scheduling controls.**

A. Automatic scheduling controls shall be installed for all outdoor lighting. Automatic scheduling controls may be installed in combination with motion sensing controls or other outdoor lighting controls.

B. Automatic scheduling controls shall be capable of reducing the outdoor lighting power by at least 50 percent and no more than 90 percent, and separately capable of turning the lighting OFF, during scheduled unoccupied periods.

C. Automatic scheduling controls shall allow scheduling of a minimum of two nighttime periods with independent lighting levels, and may include an override function that turns lighting ON during its scheduled dim or OFF state for no more than two hours when an override is initiated.

3. **Motion sensing controls.**

A. Motion sensing controls shall be installed for the following luminaires. Motion sensing controls may be installed for other outdoor lighting and in combination with other outdoor lighting controls.

- i. Outdoor luminaires other than those providing building façade, ornamental hardscape, outdoor dining or outdoor sales frontage lighting, where the bottom of luminaire is mounted 24 feet above grade or lower; and
- ii. Bilaterally symmetric outdoor wall-mounted luminaires (typically referred to as “wall packs”) providing building façade, ornamental hardscape or outdoor dining lighting that are mounted 24 feet above grade or lower.

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B. Motion sensing controls shall be capable of reducing the outdoor lighting power of each controlled luminaire by at least 50 percent and no more than 90 percent, and separately capable of turning the luminaire OFF, during unoccupied periods.

C. Motion sensing controls shall be capable of reducing the lighting to its dim or OFF state no longer than 15 minutes after the area has been vacated, and of returning the lighting to its ON state when the area becomes occupied.

D. No more than 1,500 watts of lighting power shall be controlled by a single sensor or as a single zone.

Exception 1 to Section 130.2(c)3: Luminaires with a maximum rated wattage of 40 watts each are not required to have motion sensing controls.

Exception 2 to Section 130.2(c)3: Applications listed as Exceptions to Section 140.7(a) are not required to have motion sensing controls.

Exception 3 to Section 130.2(c)3: Lighting subject to a health or life safety statute, ordinance, or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent when necessary to comply with the applicable law.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 130.3
SIGN LIGHTING CONTROLS**

Nonresidential buildings other than healthcare facilities, and hotel/motel buildings shall comply with the applicable requirements of Sections 130.3(a)1 through 130.3(a)3.

(a) **Controls for sign lighting.** All sign lighting shall meet the requirements below as applicable:

1. **Indoor signs.** All indoor sign lighting other than exit sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.
2. **Outdoor signs.** Outdoor sign lighting shall meet the following requirements as applicable:
 - A. All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.

Exception to Section 130.3(a)2A: Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.

B. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during

nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

Exception to Section 130.3(a)2B: Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.

3. **Demand responsive Electronic Message Center (EMC) control.** See Section 110.12 for requirements for demand responsive EMC controls.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 130.4
LIGHTING CONTROL ACCEPTANCE AND
INSTALLATION CERTIFICATE REQUIREMENTS**

Nonresidential buildings other than healthcare facilities and hotel/motel buildings shall comply with the applicable requirements of Sections 130.4(a) through 130.4(c). Healthcare facilities shall comply with the applicable acceptance and installation documentation requirements of OSHPD.

(a) **Lighting and receptacle control acceptance requirements.** Before an occupancy permit is granted, indoor and outdoor lighting and receptacle controls serving the building, area or site and installed to comply with Section 110.12, 130.1, 130.2, 130.5 or 140.6 shall be certified as meeting the Acceptance Requirements for Code Compliance as specified by the Reference Nonresidential Appendix NA7.6 and NA7.8. A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1, that the equipment and systems meet the acceptance requirements:

1. **Reserved.**
2. **Reserved.**
3. Automatic daylight controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.1;
4. Lighting shut-OFF controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.2;
5. Demand responsive lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.3; and
6. Outdoor lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.8; and
7. Lighting systems receiving the Institutional Tuning Power Adjustment Factor shall be tested in accordance with Reference Nonresidential Appendix NA7.6.4.
8. Demand responsive controls required to control controlled receptacles shall be tested in accordance with Reference Nonresidential Appendix NA7.6.5.

(b) **Lighting control installation certificate requirements.** To be recognized for compliance with Part 6 an installation certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, energy

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> management control system, interlocked lighting system, lighting power adjustment factor, or additional wattage available for a videoconference studio, in accordance with the following requirements, as applicable:

1. Certification that when a lighting control system is installed to comply with lighting control requirements in Part 6 it complies with the applicable requirements of Section 110.9; and complies with Reference Nonresidential Appendix NA7.7.1.
2. Certification that when an energy management control system is installed to function as a lighting control required by Part 6 it functionally meets all applicable requirements for each application for which it is installed, in accordance with Sections 110.9, 130.0 through 130.5, 140.6 through 150.0, and 150.2; and complies with Reference Nonresidential Appendix NA7.7.2.
3. **Reserved.**
4. **Reserved.**
5. Certification that interlocked lighting systems used to serve an approved area comply with Section 140.6(a)1; and comply with Reference Nonresidential Appendix NA7.7.4.
6. Certification that lighting controls installed to earn a lighting power adjustment factor (PAF) comply with Section 140.6(a)2; and comply with Reference Nonresidential Appendix NA7.7.5.
7. Certification that additional lighting wattage installed for a videoconference studio complies with Section 140.6(c)2Gvii; and complies with Reference Nonresidential Appendix NA7.7.6.

(c) When certification is required by Title 24, Part 1, Section 10-103.1, the acceptance testing specified by Section 130.4 shall be performed by a certified lighting controls acceptance test technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a certified lighting controls acceptance test employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved acceptance test technician certification provider. The CLCATT shall complete all certificate of acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

Note: Authority cited: Sections 25402, 25402.1 and 25213, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 130.5
ELECTRICAL POWER DISTRIBUTION SYSTEMS**

> Nonresidential and hotel/motel buildings shall comply with the applicable requirements of Sections 130.5(a) through 130.5(e).

(a) **Service electrical metering.** Each electrical service or feeder shall have a permanently installed metering system

which measures electrical energy use in accordance with Table 130.5-A.

Exception 1 to Section 130.5(a): Service or feeder for which the utility company provides a metering system that indicates instantaneous kW demand and kWh for a utility-defined period.

Exception 2 to Section 130.5(a): Electrical power distribution systems subject to *California Electrical Code* Article 517.

(b) **Separation of electrical circuits for electrical energy monitoring.** Electrical power distribution systems shall be designed so that measurement devices can monitor the electrical energy usage of load types according to Table 130.5-B.

Exception 1 to Section 130.5(b): For each separate load type, up to 10 percent of the connected load may be of any type.

Exception 2 to Section 130.5(b): Electrical power distribution systems subject to *California Electrical Code* Article 517.

(c) **Voltage drop.** The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet shall not exceed 5 percent.

Exception to Section 130.5(c): Voltage drop permitted by *California Electrical Code* Sections 647.4, 695.6 and 695.7.

(d) **Circuit controls for 120-volt receptacles and controlled receptacles.** In all buildings, both controlled and uncontrolled 120 volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces and copy rooms. Additionally, hotel/motel guest rooms shall comply with Section 130.5(d)4. Controlled receptacles shall meet the following requirements, as applicable:

1. Install a control capable of automatically shutting OFF the controlled receptacles when the space is typically unoccupied, either at the receptacle or circuit level. When an automatic time switch control is installed it shall incorporate an override control that allows the controlled receptacle to remain ON for no more than 2 hours when an override is initiated and an automatic holiday “shut-OFF” feature that turns OFF all loads for at least 24 hours and then resumes the normally scheduled operation. Countdown timer switches shall not be used to comply with the automatic time switch control requirements; and
2. Install at least one controlled receptacle within 6 feet from each uncontrolled receptacle or install a splitwired receptacle with at least one controlled and one uncontrolled receptacle. Where receptacles are installed in modular furniture in open office areas, at least one controlled receptacle shall be installed at each workstation; and
3. Provide a permanent and durable marking for controlled receptacles or to differentiate them from uncontrolled receptacles or circuits; and

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4. For hotel and motel guest rooms, install controlled receptacles for at least one-half of the 120-volt receptacles in each guestroom. Electric circuits serving controlled receptacles in guestrooms shall have captive card key controls, occupant sensing controls, or automatic controls so the power is switched OFF no longer than 30 minutes after the guestroom has been vacated.

NOTE: A hardwired power strip controlled by an occupant sensing control may be used to comply with Section 130.5(d). Plug-in strips and other plug-in devices shall not be used to comply with the requirements of Section 130.5(d).

Exception 1 to Section 130.5(d): Receptacles that are only for the following purposes:

- i. Receptacles specifically for refrigerators and water dispensers in kitchen area.
- ii. Receptacles located a minimum of six feet above the floor that are specifically for clocks.
- iii. Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.
- iv. Receptacles on circuits rated more than 20 amperes.

**TABLE 130.5-A
MINIMUM REQUIREMENTS FOR METERING OF ELECTRICAL LOAD**

METERING FUNCTIONALITY	ELECTRICAL SERVICES RATED 50 kVA OR LESS	ELECTRICAL SERVICES RATED MORE THAN 50 kVA AND LESS THAN OR EQUAL TO 250 kVA	ELECTRICAL SERVICES RATED MORE THAN 250 kVA AND LESS THAN OR EQUAL TO 1000 kVA	ELECTRICAL SERVICES RATED MORE THAN 1000 kVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

**TABLE 130.5-B
MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD**

ELECTRICAL LOAD TYPE	ELECTRICAL SERVICES RATED 50 kVA OR LESS	ELECTRICAL SERVICES RATED MORE THAN 50 kVA AND LESS THAN OR EQUAL TO 250 kVA	ELECTRICAL SERVICES RATED MORE THAN 250 kVA AND LESS THAN OR EQUAL TO 1000 kVA	ELECTRICAL SERVICES RATED MORE THAN 1000 kVA
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50 kVA	All HVAC in aggregate and each HVAC load rated at least 50 kVA
Domestic and service water system pumps and related systems and components	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Plug load including appliances rated less than 25 kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area All groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf
Elevators, escalators, moving walks and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Other individual non-HVAC loads or appliances rated 25 kVA or greater	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Industrial and commercial load centers 25 kVA or greater, including theatrical lighting installations and commercial kitchens	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Renewable power source (net or total)	Each group	Each group	Each group	Each group
Loads associated with renewable power source	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Charging stations for electric vehicles	All loads in aggregate	All loads in aggregate	All loads in aggregate	All loads in aggregate

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- v. Receptacles connected to an uninterruptible power supply (UPS) that are intended to be in continuous use, 24 hours per day/365 days per year, and are marked to differentiate them from other uncontrolled receptacles or circuits.

Exception 2 to Section 130.5(d): Receptacles in healthcare facilities.

(e) **Demand responsive controls and equipment.** See Section 110.12 for requirements for demand responsive controls and equipment, including demand responsive controls for controlled receptacles.

NOTE: Definitions of terms and phrases in Section 130.5 are determined as specified in Section 100.1(b). Terms and phrases not found in Section 100.1(b) shall be defined as specified in Title 24, Part 3, Article 100 of the *California Electrical Code*.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SUBCHAPTER 5

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES— PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

SECTION 140.0 PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

- > Nonresidential and hotel/motel buildings shall comply with all of the following:
- (a) The requirements of Sections 100.0 through 110.12 applicable to the building project (mandatory measures for all buildings).
 - > (b) The requirements of Sections 120.0 through 130.5 (mandatory measures for nonresidential and hotel/motel buildings).
 - (c) Either the performance compliance approach (energy budgets) specified in Section 140.1 or the prescriptive compliance approach specified in Section 140.2 for the climate zone in which the building will be located. Climate zones are shown in Figure 100.1-A.

Note to Section 140.0(c): The Commission periodically updates, publishes and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, which is available by zip code boundaries depicted in the Reference Joint Appendices along with a list of the communities in each zone.

Note to Section 140.0: The requirements of Sections 140.1 through 140.9 apply to newly constructed buildings. Section 141.0 specifies which requirements of Sections 140.1 through 140.9 also apply to additions or alterations to existing buildings.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 140.1 PERFORMANCE APPROACH: ENERGY BUDGETS

A building complies with the performance approach if the energy budget calculated for the proposed design building under Subsection (b) is no greater than the energy budget calculated for the standard design building under Subsection (a).

(a) **Energy budget for the standard design building.** The energy budget for the Standard Design Building is determined by applying the mandatory and prescriptive requirements to the proposed design building. The energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage systems, service water heating and covered process loads.

(b) **Energy budget for the proposed design building.** The energy budget for a proposed design building is determined by calculating the TDV energy for the proposed design building. The energy budget is the sum of the TDV energy for

space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage systems, and service water heating and covered process loads.

Exception to Section 140.1(b). A community shared solar electric generation system, or other renewable electric generation system, and/or community shared battery storage system, that provides dedicated power, utility energy reduction credits or payments for energy bill reductions to the permitted building and is approved by the Energy Commission as specified in Title 24, Part 1, Section 10-115, may offset part or all of the solar electric generation system or battery storage system TDV energy required to comply with the standards, as calculated according to methods established by the Commission in the Nonresidential ACM Reference Manual.

(c) **Calculation of energy budget.** The TDV energy for both the standard design building and the proposed design building shall be computed by compliance software certified for this use by the Commission. The processes for compliance software approval by the Commission are documented in the ACM Approval Manual.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 140.2 PRESCRIPTIVE APPROACH

To comply using the prescriptive approach a building shall be designed with and shall have constructed and installed systems and components meeting the applicable requirements of Sections 140.3 through 140.9.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SECTION 140.3 PRESCRIPTIVE REQUIREMENTS FOR BUILDING ENVELOPES

A building complies with this section by being designed with and constructed to meet all prescriptive requirements in Subsection (a) and the requirements of Subsection (c) and (d) where they apply.

(a) **Envelope component requirements.**

1. **Exterior roofs and ceilings.** Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

A. **Roofing products.** Shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i through ii:

- i. Nonresidential buildings:
 - a. Low-sloped roofs in climate zones 1 through 16 shall have:
 1. A minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75; or
 2. A minimum solar reflectance index (SRI) of 75.

Exception 1 to Section 140.3(a)1Aia: Wood-framed roofs in climate zones 3 and 5 are exempt from the requirements of Section 140.3(a)1Aia if the roof assembly has a *U*-factor of 0.034 or lower.

Exception 2 to Section 140.3(a)1Aia: Roof constructions with a weight of at least 25 lb/ft² over the roof membrane are exempt from the requirements of Section 140.3(a)1Aia.

Exception 3 to Section 140.3(a)1Aia: An aged solar reflectance less than 0.63 is allowed provided the maximum roof/ceiling *U*-factor in Table 140.3 is not exceeded.

- b. Steep-sloped roofs:
 1. in Climate Zones 1 and 3 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.
 2. in Climate Zones 2 and 4 through 16 shall have a minimum aged solar reflectance of 0.25 and a minimum thermal emittance of 0.80, or a minimum SRI of 23.

- ii. Guest rooms of hotel and motel buildings:
 - a. Low-sloped roofs in Climate Zones 9, 10, 11, 13, 14 and 15 shall have a minimum aged solar reflectance of 0.55 and a minimum thermal emittance of 0.75, or a minimum SRI of 64.

Exception to Section 140.3(a)1Aii: Roof constructions with a weight of at least 25 lb/ft² over the roof membrane.

- b. Steep-sloped roofs in Climate Zones 2 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

Exception to Section 140.3(a)1A: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

B. **Roof insulation.** Roofs shall have an overall assembly *U*-factor no greater than the applicable value in Table 140.3-B, C or D, and where required by Sec-

tion 110.8 and 120.7(a)3, insulation shall be placed in direct contact with a roof or drywall ceiling.

**TABLE 140.3
ROOF/CEILING INSULATION TRADEOFF FOR
AGED SOLAR REFLECTANCE—NONRESIDENTIAL BUILDINGS**

Aged Solar Reflectance	Metal Building Climate Zone 1-16 <i>U</i> -factor	Wood Framed and Other Climate Zones 6-8 <i>U</i> -factor	Wood Framed and Other All Other Climate Zones <i>U</i> -factor
0.62-0.56	0.038	0.045	0.032
0.55-0.46	0.035	0.042	0.030
0.45-0.36	0.033	0.039	0.029
0.35-0.25	0.031	0.037	0.028

- 2. **Exterior walls.** Exterior walls shall have an overall assembly *U*-factor no greater than the applicable value in Table 140.3-B, C or D.
- 3. **Demising walls.** Demising walls shall meet the requirements of Section 120.7(b)7. Vertical windows in demising walls between conditioned and unconditioned spaces shall have an area-weighted average *U*-factor no greater than the applicable value in Table 140.3-B, C or D.
- 4. **Exterior floors and soffits.** Exterior floors and soffits shall have an overall assembly *U*-factor no greater than the applicable value in Table 140.3-B, C or D.
- 5. **Exterior Windows.** Vertical windows in exterior walls shall:
 - A. Percent window area shall be limited in accordance with the applicable requirements of i and ii below:
 - i. a west-facing area no greater than 40 percent of the gross west-facing exterior wall area, or 6 feet times the west-facing display perimeter, whichever is greater;
 - ii. a total area no greater than 40 percent of the gross exterior wall area, or 6 feet times the display perimeter, whichever is greater; and

NOTE: Demising walls are not exterior walls, and therefore demising wall area is not part of the gross exterior wall area or display perimeter and windows in demising walls are not part of the window area.

Exception to Section 140.3(a)5A: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- B. Have an area-weighted average *U*-factor no greater than the applicable value in Table 140.3-B, C or D.

Exception 1 to Section 140.3(a)5B: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

Exception 2 to Section 140.3(a)5B: For vertical windows containing chromogenic type glazing:

- i. The lower-rated labeled *U*-factor shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

- ii. Chromogenic glazing shall be considered separately from other glazing; and
 - iii. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.
- C. Have an area-weighted average relative solar heat gain coefficient, RSHGC, excluding the effects of interior shading, no greater than the applicable value in Table 140.3-B, C or D.

For purposes of this paragraph, the relative solar heat gain coefficient, RSHGC, of a vertical window is:

- i. The solar heat gain coefficient of the windows; or
- ii. Relative solar heat gain coefficient is calculated using Equation 140.3-A, if the window has an overhang or exterior horizontal slats that extend beyond each side of the window jamb by a distance equal to the overhang's horizontal projection.

Exception 1 to Section 143(a)5C: An area-weighted average relative solar heat gain coefficient of 0.56 or less shall be used for windows:

- a. That are in the first story of exterior walls that form a display perimeter; and
- b. For which codes restrict the use of overhangs to shade the windows.

Exception 2 to Section 140.3(a)5C: For vertical glazing containing chromogenic type glazing:

- i. the lower-rate labeled RSHGC shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity to demonstrate compliance with this section; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 3 to Section 140.3(a)5C: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

NOTE: Demising walls are not exterior walls, and therefore windows in demising walls are not subject to SHGC requirements.

- D. Have an area-weighted average visible transmittance (VT) no less than the applicable value in Tables 140.33-B and C, or Equation 140.3-B, as applicable.

Exception 1 to Section 140.3(a)5D: When the window's primary and secondary sidelit daylight zones are completely overlapped by one or more skylit daylight zones, then the window need not comply with Section 140.3(a)5D.

Exception 2 to Section 140.3(a)5D: If the window's VT is not within the scope of NFRC 200, or ASTM E972, then the VT shall be calculated according to Reference Nonresidential Appendix NA6.

Exception 3 to Section 140.3(a)5D: For vertical windows containing chromogenic type glazing:

- i. The higher-rate labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity; and
- ii. Chromogenic glazing shall be considered separately from other glazing; and
- iii. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 4 to Section 140.3(a)5D: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

NOTE: Demising walls are not exterior walls, and therefore windows in demising walls are not subject to VT requirements.

**EQUATION 140.3-A
RELATIVE SOLAR HEAT GAIN, COEFFICIENT, RSHGC**

$$RSHGC = SHGC \times \{1 + a \times (2.72^{-PF} - 1) \times [\sin(b \times Az) - c]\}$$

where:

	a	b	c
Overhang	0.150	0.130	5.67
Exterior Horizontal Slat	0.144	0.133	5.13

RSHGC = Relative solar heat gain coefficient.

SHGC = Solar heat gain coefficient of the vertical fenestration.

Az = Azimuth of the vertical fenestration in degrees.

PF = Projection factor as calculated by Equation 140.3-C.

**EQUATION 140.3-B
VERTICAL FENESTRATION MINIMUM VT**

$$VT \geq 0.11/WWR$$

where:

WWR = Window wall ratio, the ratio of (i) the total window area of the entire building to (ii) the total gross exterior wall area of the entire building. If the WWR is greater than 0.40, then 0.40 shall be used as the value for WWR in Equation 140.3-B.

VT = Visible transmittance of framed window.

6. Skylights. Skylights shall:

- A. Have an area no greater than 5 percent of the gross exterior roof area Skylight Roof Ratio (SRR); and

Exception 1 to Section 140.3(a)6A: Buildings with atria over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

Exception 2 to Section 140.3(a)6A: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- B. Have an area-weighted performance rating *U*-factor no greater than the applicable value in Table 140.3-B, C or D.

Exception 1 to Section 140.3(a)6B: For skylights containing chromogenic type glazing:

- i. the lower-rate labeled *U*-factor shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 2 to Section 140.3(a)6B: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- C. Have an area-weighted performance rating solar heat gain coefficient no greater than the applicable value in Table 140.3-B, C or D.

Exception 1 to Section 140.3(a)6C: For skylights containing chromogenic type glazing:

- i. the lower-rated labeled SHGC shall be used to demonstrate compliance with this section; and
- ii. chromogenic glazing shall be considered separately from other glazing; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 2 to Section 140.3(a)6C: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- D. Have an area-weighted performance rating VT no less than the applicable value in Table 140.3-B or C; and

Exception 1 to Section 140.3(a)6D: For skylights containing chromogenic type glazing:

- i. the higher-rated labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity and;
- ii. chromogenic glazing shall be considered separately from other skylights; and
- iii. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 2 to Section 140.3(a)6D: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

- E. Have a glazing material or diffuser that has a measured haze value greater than 90 percent, determined

according to ASTM D1003 or other test method approved by the Energy Commission.

Exception 1 to Section 140.3(a)6E: Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or automated baffles or the geometry of the skylight and light well.

Exception 2 to Section 140.3(a)6E: Conditioned greenhouses. The requirements of Section 120.6(h)4 apply.

7. **Exterior doors.** All exterior doors that separate conditioned space from unconditioned space or from ambient air shall have a *U*-factor not greater than the applicable value in Table 140.3-B, C or D. Doors that are more than one-quarter glass in area are considered glazed doors.

8. **Relocatable public school buildings.** In complying with Sections 140.3(a)1 to 7 shall meet the following:

A. Relocatable public school buildings shall comply with Table 140.3-B for a specific climate zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use only in a specific climate zone; or

B. Relocatable public school buildings shall comply with Table 140.3-D for any climate zone when the manufacturer or builder of the relocatable public school building certifies that the building is intended for use in any climate zone; and

C. The manufacturer or builder of a relocatable public school building shall certify that components of the building comply with requirements of this section by:

- i. The placement of two (2) metal identification labels on the building, one mechanically fastened and visible from the exterior and the other mechanically fastened to the interior frame above the ceiling at the end of the module, both labels stating (in addition to any other information by the Division of the State Architect or other law) “Complies with Title 24, Part 6 for all climate zones”; and
- ii. Identification of the location of the two labels on the plans submitted to the enforcing agency.

9. **Air barrier.** To meet the requirement of Table 140.3-B, all buildings shall have a continuous air barrier that is designed and constructed to control air leakage into, and out of, the building’s conditioned space. The air barrier shall be sealed at all joints for its entire length and shall be composed of:

Exception to Section 140.3(a)9: Relocatable public school buildings.

A. Design. Construction documents shall include air barrier boundaries, interconnections and penetrations, and associated square foot calculations for all sides of the air barrier.

B. Acceptable materials and assemblies. The air barrier shall be sealed at all joints for its entire length and shall be composed of:

- i. Materials that have an air permeance not exceeding 0.004 cfm/ft², under a pressure differential of 0.3 in. of water (1.57 psf) (0.02 L/sec-m²) at 75 Pa), when tested in accordance with ASTM E2178; or
- ii. Assemblies of materials and components that have an average air leakage not exceeding 0.04 cfm/ft², under a pressure differential of 0.3 in. of water (1.57 psf) (0.2 L/m² at 75 Pa), when tested in accordance with ASTM E2357, ASTM E1677, ASTM E1680 or ASTM E283.

Exception to Section 140.3(a)9 Bi: Materials in Table 140.3-A shall be deemed to comply with Section 140.3(a)9B provided that all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions.

Exception to Section 140.3(a)9Bii: The following materials shall be deemed to comply with Section 140.3(a)9B if all joints are sealed and all of the materials are installed as air barriers in accordance with the manufacturer's instructions:

- a. Concrete masonry walls that have at least two coatings of paint or at least two coatings of sealer coating.
- b. Concrete masonry walls with integral rigid board insulation.
- c. Structurally insulated panels.
- d. Portland cement or Portland sand parge, or stucco, or a gypsum plaster, each with a minimum 1/2 inch thickness.

C. Verification. Verification of the installed air barrier may be performed.

- i. If verification is performed the entire building shall meet one of the following requirements:

a. An air leakage rate not exceeding 0.40 cfm/ft² at a pressure differential of 0.3 in. of water (1.57 psf) (2.0 L/m² at 75 Pa). when the entire building is tested, after completion of construction, in accordance with NA 5, or another test method approved by the Commission; or

b. For buildings that have more than 50,000 ft² of conditioned floor area, a sectional test method of co-pressurizing representative test floors and taking data from the specific floors to achieve the requirement in Section 140.3(a)9Ci when following the procedures in Sections NA5.2 to NA5.7. Representative test floors must meet the following conditions:

- I. The entire floor area of all stories that have any spaces directly under a roof.
- II. The entire floor area of all stories that have a building entrance or loading dock.
- III. Representative above-grade wall sections of the building totaling at least 25 percent of the wall area enclosing the remaining conditioned space. Floor areas in Parts a and b above shall not be included in the 25 percent.

ii. If the air leakage requirements of either Section 140.3(a)9Cia or 140.3(a)9Cib are not met, a visual inspection and diagnostic evaluation shall be completed in accordance with NA5.7, all observed leaks shall be sealed where such sealing can be made without destruction of existing building components, and buildings where the tested leakage rate exceeded 0.6 cfm/ft² of building shell area at 75 Pa have been retested to confirm leakage is below 0.6 cfm/ft² of building shell at 75 Pa.

(b) **Reserved.**

**TABLE 140.3-A
MATERIALS DEEMED TO COMPLY WITH SECTION 140.3(a)9B**

	MATERIALS	MINIMUM THICKNESS
1	Plywood	Minimum 3/8 inch thickness
2	Oriented strand board	Minimum 3/8 inch thickness
3	Extruded polystyrene insulation board	Minimum 1/2 inch thickness
4	Foil-backed polyisocyanurate insulation board	Minimum 1/2 inch thickness
5	Closed cell spray foam with a minimum density of 2.0 pcf	Minimum 2 inch thickness
6	Open cell spray foam with a density no less than 0.4 pcf and no greater than 1.5 pcf	Minimum 5/2 inch thickness
7	Exterior and interior gypsum board	Minimum 1/2 inch thickness
8	Cement board	Minimum 1/2 inch thickness
9	Built-up roofing membrane	No minimum thickness
10	Modified bituminous roof membrane	No minimum thickness
11	Fully adhered single-ply roof membrane	No minimum thickness
12	A Portland cement or Portland sand parge, or a gypsum plaster	Each with minimum 5/8 inch thickness
13	Cast-in-place concrete, or precast concrete	No minimum thickness
14	Fully grouted concrete block masonry	No minimum thickness
15	Sheet steel or sheet aluminum	No minimum thickness

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

**TABLE 140.3-B
PRESCRIPTIVE ENVELOPE CRITERIA FOR NONRESIDENTIAL BUILDINGS (INCLUDING RELOCATABLE PUBLIC SCHOOL BUILDINGS WHERE MANUFACTURER CERTIFIES USE ONLY IN SPECIFIC CLIMATE ZONE;
NOT INCLUDING HIGH-RISE RESIDENTIAL BUILDINGS AND GUESTROOMS OF HOTEL/MOTEL BUILDINGS)**

			CLIMATE ZONE																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
ENVELOPE	Maximum U-factor	Roofs/ Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041		
			Wood-framed and other	0.034	0.034	0.034	0.034	0.034	0.049	0.049	0.049	0.034	0.034	0.034	0.034	0.034	0.034	0.034	0.034	
		Walls	Metal building	0.113	0.061	0.113	0.061	0.061	0.113	0.113	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.061
			Metal-framed	0.060	0.055	0.071	0.055	0.055	0.060	0.060	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055	0.055
			Mass light ¹	0.196	0.170	0.278	0.227	0.440	0.440	0.440	0.440	0.440	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass heavy ¹	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.690	0.650	0.184	0.253	0.211	0.184	0.184	0.160	0.160
		Floors/ Soffits	Raised mass	0.092	0.092	0.269	0.269	0.269	0.269	0.269	0.269	0.269	0.092	0.092	0.092	0.092	0.092	0.092	0.092	0.058
			Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039	0.071	0.071	0.039	0.039	0.039	0.039	0.039
	Roofing Products	Low-sloped	Aged solar reflectance	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	
			Thermal emittance	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	
		Steep-sloped	Aged solar reflectance	0.20	0.25	0.20	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
			Thermal emittance	0.75	0.80	0.75	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
	Air Barrier			REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	Exterior Doors, Maximum U-factor	Nonswinging		0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50	
Swinging		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70			

			CLIMATE ZONE																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16				
ENVELOPE	Fenestration	Vertical	Area-weighted Performance Rating	FIXED WINDOW																		
				Max U-factor	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.34	0.36	0.34	0.34	0.34	0.34	0.34	0.36	
				Max RSHGC	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.22	0.25	0.22	0.22	0.22	0.22	0.22	0.25	
				Min VT	0.42																	
				CURTAINWALL OR STOREFRONT																		
				Max U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41
				Max RSHGC	0.25	0.26	0.26	0.26	0.26	0.26	0.25	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26
				Min VT	0.46																	
				OPERABLE WINDOW																		
				Max U-factor	0.46																	
				Max RSHGC	0.22																	
				Min VT	0.32																	
				GLAZED DOORS																		
				Max U-factor	0.45																	
Max RSHGC	0.23																					
Min VT	0.17																					
Max WWR%	40%																					
			ALL CLIMATE ZONES																			
Skylights	Area-weighted Performance Rating	Glass, Curb Mounted			Glass, Deck Mounted			Plastic, Curb Mounted			Tubular Daylighting Devices (TDDs)											
		Max U-factor	0.58			0.46			0.88			0.88										
		Max SHGC	0.25			0.25			NR			NR										
		Min VT (Min VT _{annual} for TDDs)	0.49			0.49			0.64			0.38										
Max SRR%	5%																					

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

**TABLE 140.3-C
PRESCRIPTIVE ENVELOPE CRITERIA FOR GUESTROOMS OF HOTEL/MOTEL BUILDINGS**

			CLIMATE ZONE																	
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
ENVELOPE	Maximum U-factor	Roofs/ Ceilings	Metal building	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
			Wood-framed and other	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028
		Walls	Metal building	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.057	0.057	0.057	0.057	0.057	0.057	0.057
			Metal-framed	0.069	0.069	0.069	0.069	0.069	0.069	0.105	0.069	0.069	0.069	0.069	0.069	0.069	0.069	0.048	0.069	0.069
			Mass light ¹	0.170	0.170	0.170	0.170	0.170	0.227	0.227	0.227	0.196	0.170	0.170	0.170	0.170	0.170	0.170	0.170	0.170
			Mass heavy ¹	0.160	0.160	0.160	0.184	0.211	0.690	0.690	0.690	0.690	0.690	0.184	0.253	0.211	0.184	0.184	0.184	0.160
		Floors/ Soffits	Raised mass	0.045	0.045	0.058	0.058	0.058	0.069	0.092	0.092	0.092	0.669	0.058	0.058	0.058	0.045	0.058	0.037	0.037
			Other	0.034	0.034	0.039	0.039	0.039	0.039	0.071	0.039	0.039	0.039	0.039	0.039	0.039	0.034	0.039	0.034	0.034
	Roofing Products	Low-sloped	Aged solar reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.55	0.55	0.55	NR	0.55	0.55	0.55	NR
			Thermal emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	NR	0.75	0.75	0.75	NR
		Steep-sloped	Aged solar reflectance	NR	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal emittance	NR	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	NR
	Air barrier			REQ	REQ	REQ	REQ	REQ	REQ	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	
	Exterior Doors, Maximum U-factor	Nonswinging		0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50	
		Swinging		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70

ENVELOPE	FENESTRATION	ALL CLIMATE ZONES				
			Fixed Window	Operable Window	Curtainwall or Storefront	Glazed ² Doors
Vertical	Area-Weighted performance rating	Max U-factor	0.36	0.46	0.41	0.45
		Max RSHGC	0.25	0.22	0.26	0.23
	Area-Weighted performance rating	Min VT	0.42	0.32	0.46	0.17
	Maximum WWR%		40%			
Skylights	Area-Weighted performance rating		Glass, Curb Mounted	Glass, Deck Mounted	Plastic, Curb Mounted	
		Max U-factor	0.58	0.46	0.88	
	Area-Weighted performance rating	Max SHGC	0.25	0.25	NR	
	Area-Weighted performance rating	Min VT	0.49	0.49	0.64	
Maximum SRR%		5%				

- As defined in Section 100.1, light mass walls are walls with a heat capacity of at least 7.0 Btu/ft² • °F and less than 15.0 Btu/ft² • °F. Heavy mass walls are walls with a heat capacity of at least 15.0 Btu/ft² • °F.
- Glazed doors applies to both site-built and to factory-assembled glazed doors.

**TABLE 140.3-D
PRESCRIPTIVE ENVELOPE CRITERIA FOR RELOCATABLE
PUBLIC SCHOOL BUILDINGS FOR USE IN ALL CLIMATE ZONES**

Roofs/ Ceilings	Metal Buildings	Maximum <i>U</i> -factor	0.041	
	Non-Metal Buildings		0.034	
Walls	Wood frame buildings		0.042	
	Metal frame buildings		0.057	
	Metal Buildings		0.057	
	Mass/7.0 ≤ HC		0.170	
	All Other Walls		0.059	
Floors and Soffits	Floors and Soffits		0.048	
Roofing Products	Low-Sloped		Aged Solar Reflectance	0.63
			Thermal Emittance	0.75
	Steep-Sloped	Aged Solar Reflectance	0.25	
		Thermal Emittance	0.80	
Fenestration	Windows	Maximum <i>U</i> -factor	0.47	
		Maximum SHGC	0.26	
	Glazed Doors (Site-Built and Factory Assembled)	Maximum <i>U</i> -factor	0.45	
		Maximum SHGC	0.23	
	Skylights	Glass with Curb	Maximum <i>U</i> -factor	0.99
				0.57
		Glass without Curb	Maximum <i>U</i> -factor	0.87
				0.46
		Plastic with Curb	Maximum SHGC	0.36
				0.69
Glass Type	0-2% SRR	Maximum SHGC	0.57	
	2.1-5% SRR		0.57	
Exterior Doors	Non-Swinging doors	Maximum <i>U</i> -factor	0.50	
			Swinging doors	0.70

(c) **Minimum daylighting requirement for large enclosed spaces.** In climate zones 2 through 15, conditioned enclosed spaces, and unconditioned enclosed spaces that are greater than 5,000 square feet and that are directly under a roof with ceiling heights greater than 15 feet, shall meet the following requirements:

1. A combined total of at least 75 percent of the floor area, as determined in building floor plan (drawings) view, shall be within one or more of the following:
 - A. Primary sidelit daylit zone in accordance with Section 130.1(d), or
 - B. The total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.
2. All skylit daylit zones and primary sidelit daylit zones shall be shown on building plans.
3. General lighting in daylit zones shall be controlled in accordance with Section 130.1(d).

4. The total skylight area is at least 3 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights; or the product of the total skylight area and the average skylight visible transmittance is no less than 1.5 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.
5. All skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 (notwithstanding its scope) or other test method approved by the Commission.
6. Skylights for conditioned and unconditioned spaces shall have an area-weighted average visible transmittance (VT) no less than the applicable value required by Section 140.3(a)6D.

Exception 1 to Section 140.3(c): Auditoriums, churches, movie theaters, museums and refrigerated warehouses.

Exception 2 to Section 140.3(c): In buildings with unfinished interiors, future enclosed spaces for which there are plans to have:

- A. A floor area of less than or equal to 5,000 square feet, or
- B. Ceiling heights of less than or equal to 15 feet.

This exception shall not be used for S-1 or S-2 (storage), or for F-1 or F-2 (factory) occupancies.

Exception 3 to Section 140.3(c): Enclosed spaces having a designed general lighting system with a lighting power density less than 0.5 watts per square foot.

Exception 4 to Section 140.3(c): Enclosed spaces where it is documented that permanent architectural features of the building, existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed space for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.

(d) **Daylighting Design Power Adjustment Factors (PAFs).** To qualify for a Power Adjustment Factor (PAF) as specified in Section 140.6(a)2L, daylighting devices shall meet the following requirements:

1. **Clerestory fenestration.** To qualify for a PAF, clerestory fenestration shall meet the following requirements:
 - A. Shall be installed on east-, west-, or south-facing facades.
 - B. Shall have a head height that is at least 10 feet above the finished floor.
 - C. Shall have a glazing height that is greater than or equal to 10 percent of the head height.
 - D. If operable shading is installed on the clerestory fenestration, then the clerestory fenestration shading shall be controlled separately from shading serving other vertical fenestration.

2. **Interior and exterior horizontal slats.** To qualify for a PAF, horizontal slats shall meet the following requirements:

- A. Shall be installed adjacent to vertical fenestration on east- or west-facing facades with Window Wall Ratios between 20 and 30 percent.
- B. Exterior horizontal slats shall be level or sloped downwards from fenestration. Interior horizontal slats shall be level or sloped upwards from fenestration.
- C. Shall have a projection factor as specified in Table 140.3-E. The projection factor is calculated using Equation 140.3-C.
- D. Shall have a minimum distance factor of 0.3. The distance factor is calculated using Equation 140.3-C.

Exception to Section 140.3(d)2D: Where it is documented that existing adjacent structures or natural objects within view of the vertical fenestration block direct sunlight onto the vertical fenestration between 8 a.m. and 5 p.m. for less than 500 daytime hours per year.

- E. Shall have a minimum Visible Reflectance of 0.50 when tested as specified in ASTM E903.
- F. Shall be opaque.

Exception to Section 140.3(d)2F: Horizontal slats with a Visible Transmittance of 0.03 or less when tested as specified in ASTM E1175.

- G. Shall be permanently mounted and not adjustable.
- H. Shall extend the entire height of the vertical fenestration and beyond each side of the window jamb by a distance equal to or greater than their horizontal projection.

Exception to Section 140.3(d)2H: Where the slats are located entirely within the vertical fenestration’s rough opening or a fin is located at the window jambs and extends vertically the entire height of the window jamb and extends horizontally the entire depth of the projection.

- I. Shall be shown on the plans with the dimensions for the slat projection and slat spacing as specified in Equation 140.3-C.
- J. Shall have a conspicuous factory installed label permanently affixed and prominently located on an attachment point of the device to the building envelope, stating the following: “NOTICE: Removal of this device will require re-submittal of compliance documentation to the enforcement agency responsible for compliance with California Title 24, Part 6”.

3. **Interior and Exterior Light Shelves.** To qualify for a PAF, light shelves shall meet the following requirements:

- A. Where there is vertical fenestration area below the light shelf, both interior and exterior light shelves shall be installed.
- B. Shall be installed adjacent to clerestory fenestration on south-facing facades with Window Wall Ratios greater than 30 percent. The head height of the light shelves shall be no more than one foot below the finished ceiling. The clerestory fenestration shall meet the requirements of Section 140.3(d)1.
- C. Exterior light shelves shall be level or sloped downwards from fenestration. Interior light shelves shall be level or sloped upwards from fenestration.
- D. Shall have a projection factor of the applicable value as specified in Table 140.3-E. The light shelf projection factor is calculated using Equation 140.3-C.
- E. Shall have a minimum Distance Factor of 0.3. The distance factor is calculated using Equation 140.3-C.

Exception to Section 140.3(d)3E: Where it is documented that existing adjacent structures or natural objects within view of the vertical fenestration block direct sunlight onto the vertical fenestration between 8 a.m. and 5 p.m. for less than 750 daytime hours per year.

- F. Shall have a top surface with a minimum Visible Reflectance of 0.50 when tested as specified in ASTM E903.

Exception to Section 140.3(d)3F: Where an exterior light shelf is installed greater than two feet below the clerestory sill.

- G. Shall extend beyond each side of the window jamb by a distance equal to or greater than their horizontal projection.
- H. Shall be shown on the plans with the dimensions for the light shelf projection and light shelf spacing as specified in Equation 140.3-C.

**TABLE 140.3-E
DAYLIGHTING DEVICES**

DAYLIGHTING DEVICE	ORIENTATION OF THE VERTICAL FENESTRATION	PROJECTION FACTOR
Horizontal Slats	East or West	2.0 to 3.0
Interior Light Shelf	South	1.0 to 2.0
Exterior Light Shelf	South	0.25 to 1.25

**EQUATION 140.3-C
PROJECTION AND DISTANCE FACTOR CALCULATION**

Projection Factor = Projection/Spacing

Distance Factor = $D/(H_{AS} \times \text{Projection Factor})$

where:

Projection = The horizontal distance between the base edge and the projected edge of the overhang, slat or light shelf.

Spacing = For overhangs, the vertical distance between the projected edge of the overhang and sill of the vertical fenestration below it.

For horizontal slats, the vertical distance between the projected edge of a slat to the base edge of the slat below it.

For interior light shelves, the vertical distance between the projected edge of the light shelf and head of the clerestory fenestration above it.

For exterior light shelves, the vertical distance between the projected edge of the light shelf and sill of the vertical fenestration below it.

D = Distance between the existing structure or nature object and the fenestration.

H_{AS} = Height difference between the top of the existing structure or nature object and the bottom of the fenestration.

NOTE: The base edge is the edge of an overhang, slat or light shelf that is adjacent to the vertical fenestration. The projected edge is the opposite edge from the base edge.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 140.4
PRESCRIPTIVE REQUIREMENTS
FOR SPACE-CONDITIONING SYSTEMS**

A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the applicable prescriptive requirements of Subsections (a) through (q).

(a) Sizing, equipment selection and type.

1. **Sizing and equipment selection.** Mechanical heating and mechanical cooling equipment serving healthcare facilities shall be sized to meet the design heating and cooling loads as calculated according to the Subsection (b). Mechanical heating and mechanical cooling equipment serving hotel/motel buildings and nonresidential buildings other than healthcare facilities shall be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating

and cooling loads of the building, as calculated according to Subsection (b).

Exception 1 to Section 140.4(a)1: Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.

Exception 2 to Section 140.4(a)1: Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

Exception 3 to Section 140.4(a)1: Multiple units of the same equipment type, such as multiple chillers and boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

2. **Single zone space-conditioning system type.** Single zone space-conditioning systems with direct expansion cooling with rated cooling capacity 240,000 Btu/hr or less serving the following spaces shall meet the applicable requirements in Items A–H, or shall meet the performance compliance requirements of Section 140.1. All other system types, including systems with rated cooling capacity greater than 240,000 Btu/hr, multi-zone systems and systems using central boilers or chillers, shall comply with the applicable requirements of Section 140.

- A. Retail and grocery building spaces in Climate Zones 2 through 15. The space-conditioning system shall be a heat pump.
- B. Retail and grocery building spaces in Climate Zones 1 and 16 with cooling capacity less than 65,000 Btu/hr. The space-conditioning system shall be an air conditioner with furnace.
- C. Retail and grocery building spaces in Climate Zones 1 and 16 with cooling capacity 65,000 Btu/hr or greater. The space-conditioning system shall be a dual-fuel heat pump.
- D. School building spaces. For Climate Zones 2 through 15, the space-conditioning system shall be a heat pump. For Climate Zones 1 and 16, the space-conditioning system shall be a dual-fuel heat pump.
- E. Office, financial institution and library building spaces in Climate Zones 1 through 15. The space-conditioning system shall be a heat pump.
- F. Office, financial institution and library building spaces in Climate Zone 16 with cooling capacity less than 65,000 Btu/hr. The space-conditioning system shall be an air conditioner with furnace.
- G. Office, financial institution and library building spaces in Climate Zone 16 with cooling capacity 65,000 Btu/hr or greater. The space-conditioning system shall be a dual-fuel heat pump.
- H. Office spaces in warehouses. The space-conditioning system shall be a heat pump in all climate zones.

Exception to Section 140.4(a)2: Systems utilizing recovered heat for space heating.

(b) **Calculations.** In making equipment sizing calculations under Subsection (a), all of the following rules shall apply:

1. **Heating and cooling loads.** Heating and cooling system design loads shall be determined in accordance with the procedures described in Subsection A or B below:
 - > A. For systems serving hotel/motel buildings, and non-residential buildings other than healthcare facilities, the method in the 2017 ASHRAE Handbook, Fundamentals shall be used or as specified in a method approved by the Commission.
 - B. For system serving healthcare facilities the method in the *California Mechanical Code* shall be used.
2. **Indoor design conditions.** Indoor design temperature and humidity conditions for comfort applications shall be determined in accordance with Subsection A or B below:
 - > A. For systems serving hotel/motel buildings, and non-residential buildings other than healthcare facilities, ASHRAE Standard 55 or the 2017 ASHRAE Handbook, Fundamentals Volume, except that winter humidification and summer dehumidification shall not be required.
 - B. For systems serving healthcare facilities the method in the *California Mechanical Code* shall be used.
3. **Outdoor design conditions.** Outdoor design conditions shall be selected in accordance with Subsection A or B below:
 - > A. For systems serving hotel/motel buildings, and non-residential buildings other than healthcare facilities the design conditions from Reference Joint Appendix JA2 shall be used, which is based on data from the ASHRAE Climatic Data for Region X. Heating design temperatures shall be no lower than the Heating Winter Median of Extremes values. Cooling design temperatures shall be no greater than the 0.5 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.
 - B. For system serving healthcare facilities the method in Section 320.0 of the *California Mechanical Code* shall be used.

Exception to Section 140.4(b)3: Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent cooling design wet bulb values.
4. **Ventilation.** Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 120.1(c)3.
5. **Envelope.** Envelope heating and cooling loads shall be calculated using envelope characteristics, including square footage, thermal conductance, Solar Heat Gain Coefficient or shading coefficient, and air leakage, consistent with the proposed design.
6. **Lighting.** Lighting heating and cooling loads shall be based on actual design lighting levels or power densities as specified in Section 140.6.

7. **People.** Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 120.1(c)3A, if used. Sensible and latent heat gains shall be as listed in the 2005 ASHRAE Handbook, Fundamentals, Chapter 30, Table 1.
8. **Process loads.** Loads caused by a process shall be based upon actual information on the intended use of the building.
9. **Miscellaneous equipment.** Equipment loads other than process loads shall be calculated using design data compiled from one or more of the following sources:
 - A. Actual information based on the intended use of the building; or
 - B. Published data from manufacturer’s technical publications or from technical societies, such as the ASHRAE Handbook, Applications Volume; or
 - C. Other data based on the designer’s experience of expected loads and occupancy patterns.
10. **Internal heat gains.** Internal heat gains may be ignored for heating load calculations.
11. **Safety factor.** Calculated design loads based on 140.4(b)1 through 10 may be increased by up to 10 percent to account for unexpected loads or changes in space usage.
12. **Other loads.** Loads such as warm-up or cool-down shall be calculated from principles based on the thermal capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be no more than 30 percent for heating and 10 percent for cooling of the steady-state design loads. In addition, the steady-state load may include a safety factor in accordance with Section 140.4(b)11.

(c) **Fan systems.** Each fan system moving air into, out of or between conditioned spaces or circulating air for the purpose of conditioning air within a space shall meet the requirements of Items 1, 2 and 3 below.

1. **Fan power budget.** For each fan system that includes at least one fan or fan array with fan electrical input power ≥ 1 kW, fan system electrical input power (Fan kW_{design,system}) determined per Section 140.4(c)1(B) at the fan system design airflow shall not exceed Fan kW_{budget} as calculated per Section 140.4(c)1(A).
 - A. **Calculation of fan power budget (Fan kW_{budget}).** For each fan system:
 - i. Determine the fan system airflow and choose the appropriate table(s) for fan power allowance.
 - a. For single-cabinet fan systems, use the fan system airflow and the power allowances in both Table 140.4-A and Table 140.4-B.
 - b. For supply-only fan systems, use the fan system airflow and power allowances in Table 140.4-A.

- c. For relief fan systems, use the design relief airflow and the power allowances in Table 140.4-B.
 - d. For exhaust, return and transfer fan systems, use the fan system airflow and the power allowances in Table 140.4-B.
 - e. For complex fan systems, separately calculate the fan power allowance for the supply and return/exhaust systems and sum them. For the supply airflow, use supply airflow at the fan system design conditions, and the power allowances in Table 140.4-A. For the return exhaust airflow, use return/exhaust airflow at the fan system design conditions, and the power allowances in Table 140.4-B.
- ii. For each fan system determine the components included in the fan system and sum the fan power allowances of those components. All fan systems shall include the system base allowance. If, for a given component, only a portion of the fan system airflow passes through the component, calculate the fan power allowance for that component per Equation 140.4-A:

EQUATION 140.4-A FAN POWER ALLOWANCE

$$FPA_{adj} = \frac{Q_{comp}}{Q_{sys}} \times FPA_{comp}$$

Where

FPA_{adj} = The corrected fan power allowance for the component in W/cfm.

Q_{comp} = The airflow through component in cfm.

Q_{sys} = The fan system airflow in cfm.

FPA_{comp} = The fan power allowance of the component from Table 140.4A or Table 140.4B.

- iii. Multiply the fan system airflow by the sum of the fan power allowances for the fan system.
- iv. Divide by 1000 to convert to Fan kW_{budget}.
- v. For building sites at elevations greater than 3,000 feet, multiply Fan kW_{budget} by the correction factor in Table 140.4-C.

B. Determining fan system electrical input power (Fan kW_{design,system}). Fan kW_{design,system} is the sum of Fan kW_{design} for each fan or fan array included in the fan system with Fan kW_{design} ≥ 1 kW. If variable speed drives are used, their efficiency losses shall be included. Fan input power shall be calculated with two times the clean filter pressure drop. The Fan kW_{design} for each fan or fan array shall be determined using one of the following methods. There is no requirement to use the same method for all fans in a fan system:

- i. Use the default Fan kW_{design} in Table 140.4-D for one or more of the fans. This method cannot be used for complex fan systems.

- ii. Use the Fan kW_{design} at fan system design conditions provided by the manufacturer of the fan, fan array, or equipment that includes the fan or fan array calculated per a test procedure included in USDOE 10 CFR Part 430, USDOE 10 CFR Part 431, ANSI/AMCA Standard 208-2018, ANSI/AMCA Standard 210-2016, AHRI Standard 430-2020, AHRI Standard 440-2019 or ISO 5801-2017.
- iii. Use the Fan kW_{design} provided by the manufacturer, calculated at fan system design conditions per one of the methods listed in Section 5.3 of ANSI/AMCA 208-2018.
- iv. Determine the Fan kW_{design} by using the maximum electrical input power provided on the motor nameplate.

2. Variable air volume (VAV) systems.

A. Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section 140.4(c)2B. If this results in the sensor being located downstream of any major duct split, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint; and

B. Setpoint reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure setpoints shall be reset based on the zone requiring the most pressure; i.e., the setpoint is reset lower until one zone damper is nearly wide open.

3. **Fractional HVAC motors for fans.** HVAC motors for fans that are less than 1 hp and 1/12 hp or greater shall be electronically-commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of a varying motor speed.

Exception 1 to Section 140.4(c)3: Motors in fan-coils and terminal units that operate only when providing heating to the space served.

Exception 2 to Section 140.4(c)3: Motors in space conditioning equipment certified under Section 110.1 or 110.2.

Exception to Section 140.4(c): Fan system power caused solely by process loads.

**TABLE 140.4-A
SUPPLY FAN POWER ALLOWANCES (watts/cfm)**

AIRFLOW	MULTI-ZONE VAV SYSTEMS ≤5,000 cfm ¹	MULTI-ZONE VAV SYSTEMS >5,000 and ≤10,000 cfm ¹	MULTI-ZONE VAV SYSTEMS >10,000 cfm ¹	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 and ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm ¹
Supply system base allowance for AHU serving spaces ≤ 6 floors away)	0.395	0.453	0.413	0.232	0.256	0.236
Supply system base allowance for AHU serving spaces > 6 floors away	0.508	0.548	0.501	0.349	0.356	0.325
MERV 13 to MERV 16 filter upstream of thermal conditioning equipment (two times the clean filter pressure drop) ²	0.136	0.114	0.105	0.139	0.120	0.107
MERV 13 to MERV 16 final filter downstream of thermal conditioning equipment (two times the clean filter pressure drop) ²	0.225	0.188	0.176	0.231	0.197	0.177
Filtration allowance for > MERV 16 or HEPA filter (two times the clean filter pressure drop) ²	0.335	0.280	0.265	0.342	0.292	0.264
Central hydronic heating coil allowance	0.046	0.048	0.052	0.046	0.050	0.054
Electric heat allowance	0.046	0.038	0.035	0.046	0.040	0.036
Gas heat allowance	0.069	0.057	0.070	0.058	0.060	0.072
Hydronic/DX cooling coil or heat pump coil (wet) allowance ³	0.135	0.114	0.105	0.139	0.120	0.107
Solid or liquid desiccant system allowance	0.157	0.132	0.123	0.163	0.139	0.124
Reheat coil for dehumidification allowance	0.045	0.038	0.035	0.046	0.040	0.036
Allowance for evaporative humidifier/cooler in series with a cooling coil. Value shown is allowed watts/cfm per 1.0 inch of water gauge (in. w.g.) Determine pressure loss (in. w.g.) at 400 fpm or maximum velocity allowed by the manufacturer, whichever is less. [Calculation required, see Note 4]	0.224	0.188	0.176	0.231	0.197	0.177
Allowance for 100% outdoor air system ⁵	0.000	0.000	0.000	0.070	0.100	0.107
Energy recovery allowance for 0.50 ≤ ERR <0.55 ⁶	0.135	0.114	0.105	0.139	0.120	0.107
Energy recovery allowance for 0.55 ≤ ERR <0.60 ⁶	0.160	0.134	0.124	0.165	0.141	0.126
Energy recovery allowance for 0.60 ≤ ERR <0.65 ⁶	0.184	0.155	0.144	0.190	0.163	0.146
Energy recovery allowance for 0.65 ≤ ERR <0.70 ⁶	0.208	0.175	0.163	0.215	0.184	0.165
Energy recovery allowance for 0.70 ≤ ERR <0.75 ⁶	0.232	0.196	0.183	0.240	0.205	0.184
Energy recovery allowance for 0.75 ≤ ERR <0.80 ⁶	0.257	0.216	0.202	0.264	0.226	0.203
Energy recovery allowance for ERR ≥ 0.80 ⁶	0.281	0.236	0.222	0.289	0.247	0.222
Coil runaround loop	0.135	0.114	0.105	0.139	0.120	0.107
Allowance for gas phase filtration. Value shown is allowed w/cfm per 1.0 in. w.g. air pressure drop. [Calculation required, see Note 4]	0.224	0.188	0.176	0.231	0.197	0.177
Economizer return damper	0.045	0.038	0.035	0.046	0.040	0.036
Air blender allowance	0.045	0.038	0.035	0.046	0.040	0.036
Sound attenuation section [fans serving spaces with design background noise goals below NC35]	0.034	0.029	0.026	0.035	0.030	0.027
Deduction for systems that feed a terminal unit with a fan with electrical input power < 1 kW	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100
Low-turndown single-zone VAV fan systems meeting the requirements in Note 7.	0.000	0.000	0.000	0.070	0.100	0.089

1. See Section 100.1 for the definition of FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV).
2. Filter fan power allowance can only be counted once per fan system, except fan systems in healthcare facilities, which can claim one of the MERV 13 to 16 filter allowances and the HEPA filter allowance if both are included in the fan system.
3. Healthcare facilities can claim this fan power allowance twice per fan system where coil design leaving air temperature is less than 44°F.
4. Power allowance requires further calculation by multiplying the actual inches of water gauge (in. w.g.) of the device/component by the watts/cfm in Table 140.4-A.
5. The 100% outdoor air system must serve three or more HVAC zones and airflow during noneconomizer operating periods must not exceed 135% of minimum requirements in Section 120.1(c)(3).
6. Enthalpy recovery ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
7. A low-turndown single-zone VAV fan system must be capable of and configured to reduce airflow to 50 percent of design airflow and use no more than 30 percent of the design wattage at that airflow. No more than 10 percent of the design load served by the equipment shall have fixed loads.

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

**TABLE 140.4-B
EXHAUST, RETURN, RELIEF, TRANSFER FAN POWER ALLOWANCES (WATTS/CFM)**

AIRFLOW	MULTI-ZONE VAV SYSTEMS ¹ ≤5,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >5,000 and ≤10,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >10,000 cfm	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 and ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm
Exhaust system base allowance	0.221	0.246	0.236	0.186	0.184	0.190
Filter (any MERV value) ²	0.046	0.041	0.036	0.046	0.041	0.035
Energy recovery allowance for $0.50 \leq \text{ERR} < 0.55^3$	0.139	0.120	0.107	0.139	0.123	0.109
Energy recovery allowance for $0.55 \leq \text{ERR} < 0.60^3$	0.165	0.142	0.126	0.165	0.144	0.128
Energy recovery allowance for $0.60 \leq \text{ERR} < 0.65^3$	0.190	0.163	0.146	0.191	0.166	0.148
Energy recovery allowance for $0.65 \leq \text{ERR} < 0.70^3$	0.215	0.184	0.165	0.216	0.188	0.167
Energy recovery allowance for $0.70 \leq \text{ERR} < 0.75^3$	0.240	0.206	0.184	0.241	0.209	0.186
Energy recovery allowance for $0.75 \leq \text{ERR} < 0.80^3$	0.265	0.227	0.203	0.266	0.231	0.205
Energy recovery allowance for $\text{ERR} \geq 0.80^3$	0.289	0.248	0.222	0.291	0.252	0.225
Coil runaround loop	0.139	0.120	0.107	0.139	0.123	0.109
Return or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.116	0.100	0.089	0.116	0.102	0.091
Return and/or exhaust airflow control devices required for space pressurization control	0.116	0.100	0.089	0.116	0.102	0.091
Laboratory and vivarium exhaust systems in high-rise buildings for vertical duct exceeding 75 ft. Value shown is allowed W/cfm per 0.25 in. w.g. for each 100 ft exceeding 75 ft. [Calculation required, see Note 4]	0.058	0.051	0.045	0.058	0.052	0.046
Biosafety cabinet. Value shown is allowed W/cfm per 1.0 in. w.g. air pressure drop. [Calculation required, see Note 4]	0.231	0.198	0.177	0.232	0.202	0.179
Exhaust filters, scrubbers or other exhaust treatment required by code or standard. Value shown is allowed W/cfm per 1.0 in. w.g. air pressure drop. [Calculation required, see Note 4]	0.231	0.198	0.177	0.232	0.202	0.179
Healthcare facility allowance ⁵	0.231	0.198	0.177	0.232	0.202	0.179
Sound attenuation section [fans serving spaces with design background noise goals below NC35]	0.035	0.030	0.027	0.035	0.031	0.028

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) in definitions for “Multi-zone” to be classified as a multi-zone VAV system.
2. Filter pressure loss can only be counted once per fan system.
3. Enthalpy recovery ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
4. Power allowance requires further calculation, multiplying the actual pressure drop (in. w.g.) of the device/component by the watts/cfm in Table 140.4-B.
5. This allowance can only be taken for healthcare facilities.

**TABLE 140.4-C:
AIR DENSITY CORRECTION FACTORS**

ALTITUDE (ft)	CORRECTION FACTOR
<3,000	1.000
≥3,000 and <4,000	0.896
≥4,000 and <5,000	0.864
≥5,000 and <6,000	0.832
≥6,000	0.801

**TABLE 140.4-D:
DEFAULT VALUES FOR FAN KW_{DESIGN}
BASED ON MOTOR NAMEPLATE HP**

MOTOR NAMEPLATE HP	DEFAULT FAN KW _{design} WITH VARIABLE SPEED DRIVE (Fan kW _{design})	DEFAULT FAN KW _{design} WITHOUT VARIABLE SPEED DRIVE (Fan kW _{design})
<1	0.96	0.89
≥1 and <1.5	1.38	1.29
≥1.5 and <2	1.84	1.72
≥2 and <3	2.73	2.57
≥3 and <5	4.38	4.17
≥5 and <7.5	6.43	6.15
≥7.5 and <10	8.46	8.13
≥10 and <15	12.47	12.03
≥15 and <20	16.55	16.04
≥20 and <25	20.58	19.92
≥25 and <30	24.59	23.77
≥30 and <40	32.74	31.70
≥40 and <50	40.71	39.46
≥50 and <60	48.50	47.10
≥60 and <75	60.45	58.87
≥75 and ≤100	80.40	78.17

- This table cannot be used for motor nameplate horsepower values greater than 100.
- This table is to be used only with motors with a service factor ≤1.15. If the service factor is not provided, this table may not be used.

(d) **Space-conditioning zone controls.** Each space-conditioning zone shall have controls designed in accordance with 1 or 2:

- Each space-conditioning zone shall have controls that prevent:
 - Reheating; and
 - Recooling; and
 - Simultaneous provisions of heating and cooling to the same zone, such as mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by cooling equipment or by economizer systems; or
- Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, re-cooled, or mixed air are allowed only if the controls meet all of the following requirements:

- For each zone with direct digital controls (DDC):
 - The volume of primary air that is reheated, re-cooled or mixed air supply shall not exceed the larger of:
 - 50 percent of the peak primary airflow; or
 - The design zone outdoor airflow rate as specified by Section 120.1(c)3.
 - The volume of primary air in the deadband shall not exceed the design zone outdoor airflow rate as specified by Section 120.1(c)3.
 - The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95°F while the airflow is maintained at the dead band flow rate.
 - The second stage of heating consists of modulating the airflow rate from the dead band flow rate up to the heating maximum flow rate.
- For each zone without DDC, the volume of primary air that is reheated, re-cooled, or mixed air supply shall not exceed the larger of the following:
 - 30 percent of the peak primary airflow; or
 - The design zone outdoor airflow rate as specified by Section 120.1(c)3.

Exception 1 to Section 140.4(d): Zones with special pressurization relationships or cross-contamination control needs.

Exception 2 to Section 140.4(d): Zones served by space-conditioning systems in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.

Exception 3 to Section 140.4(d): Zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or other spaces where the only process load is from IT equipment may not use this exception.

Exception 4 to Section 140.4(d): Zones with a peak supply-air quantity of 300 cfm or less.

Exception 5 to Section 140.4(d): Systems serving healthcare facilities.

(e) **Economizers.**

- Each cooling air handler that has a design total mechanical cooling capacity over 33,000 Btu/hr or chilled-water cooling systems without a fan or that use induced airflow that has a cooling capacity greater than the systems listed in Table 140.4-C, shall include either:
 - An air economizer capable of modulating outside-air and return-air dampers to supply 100 percent of the design supply air quantity as outside air; or
 - A water economizer capable of providing 100 percent of the expected system cooling load at outside

air temperatures of 50°F dry-bulb and 45°F wet-bulb and below.

Exception 1 to Section 140.4(e)1: Where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

Exception 2 to Section 140.4(e)1: Where the use of outdoor air for cooling will affect other systems, such as humidification, dehumidification or super-market refrigeration systems, so as to increase overall building TDV energy use.

Exception 3 to Section 140.4(e)1: Systems serving hotel/motel guestrooms.

Exception 4 to Section 140.4(e)1: Where comfort cooling systems have the cooling efficiency that meets or exceeds the cooling efficiency improvement requirements in Table 140.4-F.

Exception 5 to Section 140.4(e)1: Fan systems primarily serving computer rooms. See Section 140.9(a) for computer room economizer requirements.

Exception 6 to Section 140.4(e)1: In all climate zones, each air handler that has a design total mechanical cooling capacity less than 54,000 Btu/hr where ventilation is provided by a dedicated outdoor air system (DOAS) with exhaust air heat recovery in accordance with Section 140.4(p) and the following:

- A. The DOAS unit shall meet the exhaust air heat recovery ratio as specified in Section 140.4(q)1 and include bypass or control to disable energy recovery as specified in Section 140.4(q)2.
- B. The DOAS unit shall provide at least the minimum ventilation air flow rate as specified in Section 120.1(c)3 and provide no less than 0.3 cfm/ft² during economizer conditions.

Exception 7 to Section 140.4(e)1: Where the use of an air economizer in controlled environment horticulture spaces will affect carbon dioxide enrichment systems.

**TABLE 140.4-E
CHILLED WATER SYSTEM COOLING CAPACITY**

CLIMATE ZONES	TOTAL BUILDING CHILLED WATER SYSTEM CAPACITY, MINUS CAPACITY OF THE COOLING UNITS WITH AIR ECONOMIZERS	
	Building Water-Cooled Chilled Water System	Air-Cooled Chilled Water Systems or District Chilled Water Systems
15	≥ 960,000 Btu/h (280 kW)	≥ 1,250,000 Btu/h (365 kW)
1-14	≥ 720,000 Btu/h (210 kW)	≥ 940,000 Btu/h (275 kW)
16	≥ 1,320,000 Btu/h (385 kW)	≥ 1,720,000 Btu/h (505 kW)

**TABLE 140.4-F
ECONOMIZER TRADE-OFF TABLE FOR COOLING SYSTEMS**

CLIMATE ZONE	EFFICIENCY IMPROVEMENT ^a
1	70%
2	65%
3	65%
4	65%
5	70%
6	30%
7	30%
8	30%
9	30%
10	30%
11	30%
12	30%
13	30%
14	30%
15	30%
16	70%

a. If a unit is rated with an annualized or part-load metric, then to eliminate the required economizer, only the applicable minimum cooling efficiency of the unit must be increased by the percentage shown. If the unit is only rated with a full load metric, like EER or COP cooling, then that metric must be increased by the percentage shown. To determine the efficiency required to eliminate the economizer, when the unit equipment efficiency is rated with an energy-input divided by work-output metric, the metric shall first be converted to COP prior to multiplying by the efficiency improvement percentage and then converted back to the rated metric.

- 2. If an economizer is required by Section 140.4(e)1, and an air economizer is used to meet the requirement, then it shall be:
 - A. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and

Exception to Section 140.4(e)2A: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.
 - B. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.
 - C. Designed and equipped with a device type and high limit shut off complying with Table 140.4-G.
- D. The air economizer and all air dampers shall have the following features:
 - i. **Warranty.** 5-year manufacturer warranty of economizer assembly.
 - ii. **Damper reliability testing.** Suppliers of economizers shall certify that the economizer assembly, including but not limited to outdoor air damper,

TABLE 140.4-G
AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS

DEVICE TYPE ^a	CLIMATE ZONES	REQUIRED HIGH LIMIT (ECONOMIZER OFF WHEN):	
		Equation ^b	Description
Fixed dry bulb	1, 3, 5, 11–16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
	2, 4, 10	$T_{OA} > 73^{\circ}\text{F}$	Outdoor air temperature exceeds 73°F
	6, 8, 9	$T_{OA} > 71^{\circ}\text{F}$	Outdoor air temperature exceeds 71°F
	7	$T_{OA} > 69^{\circ}\text{F}$	Outdoor air temperature exceeds 69°F
Differential dry bulb	1, 3, 5, 11–16	$T_{OA} > T_{RA}^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature
	2, 4, 10	$T_{OA} > T_{RA}-2^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 2°F
	6, 8, 9	$T_{OA} > T_{RA}-4^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 4°F
	7	$T_{OA} > T_{RA}-6^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy ^c + Fixed dry bulb	All	$h_{OA} > 28 \text{ Btu/lb}^c$ or $T_{OA} > 75^{\circ}\text{F}$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^c or Outdoor air temperature exceeds 75°F

- a. Only the high limit control devices listed are allowed to be used and at the setpoints listed. Others such as Dew Point, Fixed Enthalpy, Electronic Enthalpy, and Differential Enthalpy Controls may not be used in any climate zone for compliance with Section 140.4(e)1 unless approval for use is provided by the Energy Commission Executive Director.
- b. Devices with selectable (rather than adjustable) setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.
- c. At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6,000 foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

return air damper, drive linkage and actuator, have been tested and are able to open and close against the rated airflow and pressure of the system for 60,000 damper opening and closing cycles.

- iii. **Damper leakage.** Economizer outdoor air and return air dampers shall have a maximum leakage rate of 10 cfm/sf at 250 Pascals (1.0 in. of water) when tested in accordance with AMCA Standard 500-D. The economizer outside air and return air damper leakage rates shall be certified to the Energy Commission in accordance with Section 110.0.
- iv. **Adjustable setpoint.** If the high-limit control is fixed dry bulb or fixed enthalpy + fixed dry bulb, then the control shall have an adjustable setpoint.
- v. **Sensor accuracy.** Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies.
 1. Drybulb and wetbulb temperatures accurate to $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F;
 2. Enthalpy accurate to $\pm 3 \text{ Btu/lb}$ over the range of 20 Btu/lb to 36 Btu/lb;
 3. Relative humidity (RH) accurate to ± 5 percent over the range of 20 percent to 80 percent RH;
- vi. **Sensor calibration data.** Data used for control of the economizer shall be plotted on a sensor performance curve.
- vii. **Sensor high limit control.** Sensors used for the high limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight.

viii. **Relief air system.** Relief air systems shall be capable of providing 100 percent outside air without over-pressurizing the building.

E. The space-conditioning system shall include the following:

- i. Unit controls shall have mechanical capacity controls interlocked with economizer controls such that the economizer is at 100 percent open position when mechanical cooling is on and does not begin to close until the leaving air temperature is less than 45°F.
- ii. Direct Expansion (DX) units greater than 65,000 Btu/hr that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of two stages of mechanical cooling capacity.
- iii. DX units not within the scope of Section 140.4(e)2E.B shall (i) comply with the requirements in Table 140.4-H, and (ii) shall have controls that do not false load the mechanical cooling system by limiting or disabling the economizer or by any other means except at the lowest stage of mechanical cooling capacity.

TABLE 140.4-H
DIRECT EXPANSION (DX) UNIT REQUIREMENTS FOR COOLING STAGES AND COMPRESSOR DISPLACEMENT

COOLING CAPACITY	MINIMUM NUMBER OF MECHANICAL COOLING STAGES	MINIMUM COMPRESSOR DISPLACEMENT
$\geq 65,000 \text{ Btu/h}$ and $< 240,000 \text{ Btu/h}$	3 stages	$\leq 35\%$ full load
$\geq 240,000 \text{ Btu/h}$	4 stages	$\leq 25\%$ full load

3. Systems that include a water economizer to meet Section 140.4(e)1 shall include the following:

A. Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer shall either have a waterside pressure drop of less than 15 feet of water, or a secondary loop shall be installed so that the coil or heat exchanger pressure drop is not contributing to pressure drop when the system is in the normal cooling (non-economizer) mode.

B. Economizer systems shall be integrated with the mechanical cooling system so that they are capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not false load the mechanical cooling system by limiting or disabling the economizer or by any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

(f) **Supply air temperature reset controls.** Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply air temperatures. Air distribution systems serving zones that are likely to have constant loads shall be designed for the air flows resulting from the fully reset supply air temperature. Supply air temperature reset controls shall be:

1. In response to representative building loads or to outdoor air temperature; and
2. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Exception 1 to Section 140.4(f): Systems that meet the requirements of Section 140.4(d)1, without using Exception 1 to that section.

Exception 2 to Section 140.4(f): Where supply-air temperature reset would increase overall building energy use.

Exception 3 to Section 140.4(f): Systems supplying zones in which specific humidity levels are required to satisfy process loads. Computer rooms or other spaces with only IT equipment may not use this exception.

Exception 4 to Section 140.4(f): Systems serving health-care facilities.

(g) **Electric resistance heating.** Electric resistance heating systems shall not be used for space heating.

Exception 1 to Section 140.4(g): Where an electric resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.

Exception 2 to Section 140.4(g): Where an electric resistance heating system supplements a heat pump heating system, and the heating capacity of the heat pump is more than 75 percent of the design heating load calculated in accordance with Section 140.4(a) at the design outdoor temperature specified in Section 140.4(b)4.

Exception 3 to Section 140.4(g): Where the total capacity of all electric resistance heating systems serving the entire

building is less than 10 percent of the total design output capacity of all heating equipment serving the entire building.

Exception 4 to Section 140.4(g): Where the total capacity of all electric resistance heating systems serving the building, excluding those allowed under Exception 2, is no more than 3 kW.

Exception 5 to Section 140.4(g): Where an electric resistance heating system serves an entire building that is not a hotel/motel building; and has a conditioned floor area no greater than 5,000 square feet; and has no mechanical cooling; and is in an area where natural gas is not currently available.

Exception 6 to Section 140.4(g): Heating systems serving as emergency backup to gas heating equipment.

(h) **Heat rejection systems.** Heat rejection equipment used in comfort cooling systems, such as air-cooled condensers, open cooling towers, closed-circuit cooling towers and evaporative condensers shall include the following:

1. **Fan speed control.** Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at two thirds of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature or pressure of the heat rejection device.

Exception 1 to Section 140.4(h)1: Heat rejection devices included as an integral part of the equipment listed in Tables 110.2-A through 110.2-N.

Exception 2 to Section 140.4(h)1: Condenser fans serving multiple refrigerant circuits.

Exception 3 to Section 140.4(h)1: Condenser fans serving flooded condensers.

Exception 4 to Section 140.4(h)1: Up to one third of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement.

2. **Tower flow turndown.** Open cooling towers configured with multiple condenser water pumps shall be designed so that all cells can be run in parallel with the larger of:

A. The flow that is produced by the smallest pump, or

B. 50 percent of the design flow for the cell.

3. **Limitation on centrifugal fan cooling towers.** Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet-bulb temperature shall use propeller fans and shall not use centrifugal fans.

Exception 1 to Section 140.4(h)3: Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability.

Exception 2 to Section 140.4(h)3: Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section 110.2, Table 110.2-F.

4. **Multiple cell heat rejection equipment.** Multiple cell heat rejection equipment with variable speed fan drives shall:

- A. Operate the maximum number of fans allowed that comply with the manufacturer’s requirements for all system components, and
- B. Control all operating fans to the same speed. Minimum fan speed shall comply with the minimum allowable speed of the fan drive as specified by the manufacturer’s recommendation. Staging of fans is allowed once the fans are at their minimum operating speed.

5. **Cooling tower efficiency.** Axial fan, open-circuit cooling towers serving condenser water loops for chilled water plants with a total of 900 gpm or greater, shall have a rated efficiency of no less than 60 gpm/hp when rated in accordance with the conditions as listed in Table 110.2-F.

Exception 1 to Section 140.4(h)5: Replacement of existing cooling towers that are inside an existing building or on an existing roof.

Exception 2 to Section 140.4(h)5: Cooling towers serving buildings in Climate Zone 1 or 16.

(i) **Minimum chiller efficiency.** Chillers shall meet or exceed Path B from Table 110.2-D.

Exception 1 to Section 140.4(i): Chillers with electrical service > 600V.

Exception 2 to Section 140.4(i): Chillers attached to a heat recovery system with a design heat recovery capacity > 40 percent of the design chiller cooling capacity.

Exception 3 to Section 140.4(i): Chillers used to charge thermal energy storage systems where the charging temperature is < 40°F.

Exception 4 to Section 140.4(i): In buildings with more than three chillers, only three chillers are required to meet the Path B efficiencies.

(j) **Limitation of air-cooled chillers.** Chilled water plants shall not have more than 300 tons provided by air-cooled chillers.

Exception 1 to Section 140.4(j): Where the water quality at the building site fails to meet manufacturer’s specifications for the use of water-cooled chillers.

Exception 2 to Section 140.4(j): Chillers that are used to charge a thermal energy storage system with a design temperature of less than 40°F (4°C).

Exception 3 to Section 140.4(j): Systems serving healthcare facilities.

(k) **Hydronic system measures.**

1. **Hydronic variable flow systems.** HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of: a) 50 percent or less of the design flow rate; or b) the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

Exception 1 to Section 140.4(k)1: Systems that include no more than three control valves.

Exception 2 to Section 140.4(k)1: Systems having a total pump system power less than or equal to 1.5 hp.

2. **Chiller isolation.** When a chilled water system includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped in series for the purpose of increased temperature differential shall be considered as one chiller.

3. **Boiler isolation.** When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).

4. **Chilled and hot water temperature reset controls.** Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

Exception 1 to Section 140.4(k)4: Hydronic systems that use variable flow to reduce pumping energy in accordance with 140.4(k)1.

Exception 2 to Section 140.4(k)4: Systems serving healthcare facilities.

5. **Water-cooled air conditioner and hydronic heat pump systems.** Water circulation systems serving water-cooled air conditioners, hydronic heat pumps, or both that have total pump system power exceeding 5 hp shall have flow controls that meet the requirements of Section 140.4(k)6. Each such air conditioner or heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.

6. **Variable flow controls.**

A. Variable speed drives. Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp shall have controls or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The pumps shall be controlled as a function of required differential pressure.

B. Pressure sensor location and setpoint.

i. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

ii. For systems with direct digital control of individual coils with a central control panel, the static pressure setpoint shall be reset based on the valve requiring the most pressure, and the setpoint shall be no less than 80 percent open. Pressure sensors may be mounted anywhere.

Exception 1 to Section 140.4(k)6: Heating hot water systems.

Exception 2 to Section 140.4(k)6: Condenser water systems serving only water-cooled chillers.

7. **Hydronic heat pump (WLHP) controls.** Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature dead band of at least 20°F between initiation of heat rejection and heat addition by the central devices.

Exception to Section 140.4(k)7: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, dead bands of less than 20°F shall be allowed.

8. **High capacity space heating gas boiler systems.** In Climate Zones 1 through 6, 9 through 14, and 16, gas hot water boiler systems for space heating with a total system input of at least 1 MMBtu/h but no more than 10 MMBtu/h shall meet all of the following requirements.

A. **Boiler system efficiency.** Gas hot water boilers shall have a minimum thermal efficiency of 90 percent. Systems with multiple boilers can meet this requirement if the space-heating input provided by equipment with thermal efficiencies above and below 90 percent has an input capacity-weighted average thermal efficiency of at least 90 percent. For boilers federally regulated by combustion efficiency, the calculation for the input capacity-weighted average thermal efficiency shall use the combustion efficiency value.

B. **Hot water distribution design.** The hot water distribution system shall be designed to comply with Items i and ii.

- i. Coils and other heat exchangers shall be selected so that at design conditions the hot water return temperature entering the boilers is 120°F or less.
- ii. Under all operating conditions, the water temperature entering the boiler is 120°F or less or the flow rate of supply hot water that recirculates directly into the return system, such as by three-way valves or minimum flow bypass controls, shall be no greater than 20 percent of the design flow of the operating boilers.

Exception 1 to Section 140.4(k)8: Where 25 percent of the annual space heating requirement is provided by on-site renewable energy, site-recovered energy or heat recovery chillers.

Exception 2 to Section 140.4(k)8: Space heating boilers installed in individual dwelling units.

Exception 3 to Section 140.4(k)8: Where 50 percent or more of the design heating load is

served using perimeter convective heating, radiant ceiling panels or both.

Exception 4 to Section 140.4(k)8: Individual gas boilers with input capacity less than 300,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

(l) **Reserved.**

(m) **Fan control.** Each cooling system listed in Table 140.4-I shall be designed to vary the indoor fan airflow as a function of load and shall comply with the following requirements:

1. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall (i) have a minimum of two stages of fan control with no more than 66 percent speed when operating on stage 1; and (ii) draw no more than 40 percent of the fan power at full fan speed, when operating at 66 percent speed.
2. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent air flow the power draw is no more than 30 percent of the fan power at full fan speed.
3. Systems that include an air side economizer to meet Section 140.4(e)1 shall have a minimum of two speeds of fan control during economizer operation.

Exception 1 to Section 140.4(m): Modulating fan control is not required for chilled water systems with all fan motors < 1 HP, or for evaporative systems with all fan motors < 1 HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

Exception 2 to Section 140.0(m): Systems serving healthcare facilities.

TABLE 140.4-I
FAN CONTROL SYSTEMS

COOLING SYSTEM TYPE	FAN MOTOR SIZE	COOLING CAPACITY
DX cooling	Any	≥ 65,000 Btu/hr
Chilled water and evaporative	≥ ¼ HP	Any

(n) **Mechanical system shut-off.** Any directly conditioned space with operable wall or roof openings to the outdoors shall be provided with interlock controls that disable or reset the temperature setpoint to 55°F for mechanical heating and disable or reset the temperature setpoint to 90°F for mechanical cooling to that space when any such opening is open for more than 5 minutes.

Exception 1 to Section 140.4(n): Interlocks are not required on doors with automatic closing devices.

Exception 2 to Section 140.4(n): Any space without a thermostatic control (thermostat or a space temperature sensor used to control heating or cooling to the space).

Exception 3 to Section 140.4(n): Healthcare facilities.

(o) **Exhaust system transfer air.** Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of:

1. The supply flow required to meet the space heating or cooling load; or
2. The ventilation rate required by the authority having jurisdiction, the facility Environmental Health and Safety Department, or by Section 120.1(c)3; or
3. The mechanical exhaust flow minus the available transfer air. Available transfer air shall be from another conditioned space or return air plenums on the same floor and same smoke or fire compartment, and that at their closest point are within 15 feet of each other.

Exception 1 to Section 140.4(o): Biosafety level classified laboratories 3 or higher.

Exception 2 to Section 140.4(o): Vivarium spaces.

Exception 3 to Section 140.4(o): Spaces that are required by applicable codes and standards to be maintained at a positive pressure differential relative to adjacent spaces.

Exception 4 to Section 140.4(o): Spaces where the highest amount of transfer air that could be used for exhaust makeup may exceed the available transfer airflow rate and where the spaces have a required negative pressure relationship.

Exception 5 to Section 140.4(o): Healthcare facilities.

(p) **Dedicated outdoor air systems (DOAS).** HVAC systems that utilize a dedicated outdoor air system (DOAS) such as a DX-DOAS, HRV or ERV unit to condition, temper or filter 100 percent outdoor air separate from local or central space-conditioning systems serving the same space shall meet the following criteria:

1. DOAS unit fan systems with input power less than 1 kW shall not exceed a total combined fan power of 1.0 W/cfm. DOAS with fan power greater than or equal to 1 kW shall meet the requirements of Section 140.4 (c).
2. The DOAS supply air shall be delivered directly to the occupied space or at the outlet of any terminal heating or cooling coils and shall cycle off any zone heating and cooling equipment fans, circulation pumps and terminal unit fans when there is no call for heating or cooling in the zone.

Exception 1 to Section 140.4(p)2: Active chilled beam systems.

Exception 2 to Section 140.4(p)2: Sensible-only cooling terminal units with pressure-independent variable-airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.

Exception 3 to Section 140.4(p)2: Any configuration where a DOAS unit provides ventilation air to a downstream fan (a terminal box, air handling unit or other space-conditioning equipment) where the total system airflow can be reduced to ventilation minimum or the downstream fan power is no greater than 0.12 watts per

cfm when space temperatures are within the thermostat deadband (at low speed per manufacturer's literature).

3. DOAS supply and exhaust fans shall have a minimum of three speeds to facilitate system balancing.
4. DOAS with mechanical cooling providing ventilation to multiple zones and operating in conjunction with zone heating and cooling systems shall not use heating or heat recovery to warm supply air above 60°F when representative building loads or outdoor air temperature indicates that the majority of zones require cooling.

(q) **Exhaust air heat recovery.** Fan systems designed to operate to the criteria listed in either Table 140.4-J or Table 140.4-K shall include an exhaust air heat recovery system that meets the following:

1. A sensible energy recovery ratio of at least 60 percent or an enthalpy recovery ratio of at least 50 percent for both heating and cooling design conditions and a rating in accordance with AHRI 1060.
2. Energy recovery bypass or control to disable energy recovery and to directly economize with ventilation air based on outdoor air temperature limits specified in Table 140.4-G. For energy recovery systems where the transfer of energy cannot be stopped, bypass shall prevent the total airflow rate of either outdoor air or exhaust air through the energy recovery exchanger from exceeding 10 percent of the full design airflow rate.

Exception to Section 140.4(q)2: For DOAS units with the capability to shut off when a separate space-conditioning system serving the same space meets the economizer requirements in Section 140.4(e)1A.

Exception 1 to Section 140.4(q): Systems meeting Section 140.9(c), Prescriptive requirements for laboratory and factory exhaust systems.

Exception 2 to Section 140.4(q): Systems serving spaces that are not cooled and that are heated to less than 60°F.

Exception 3 to Section 140.4(q): Where more than 60 percent of the outdoor air heating energy is provided from site-recovered energy in Climate Zone 16.

Exception 4 to Section 140.4(q): Sensible recovery ratio requirements at heating design conditions are exempted for Climate Zone 15.

Exception 5 to Section 140.4(q): Sensible recovery ratio requirements at cooling design conditions are exempted for Climate Zone 1.

Exception 6 to Section 140.4(q): Where the sum of the airflow rates exhausted and relieved within 20 feet of each other is less than 75 percent of the design outdoor airflow rate, excluding exhaust air that is either:

1. used for another energy recovery system,
2. not allowed by the *California Mechanical Code* (Title 24, Part 4) (CMC) for use in energy recovery systems with leakage potential, or

3. of Class 4 as specified in Section 120.1(g).

Exception 7 to Section 140.4(q): Systems expected to operate less than 20 hours per week.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

**SECTION 140.5
PRESCRIPTIVE REQUIREMENTS
FOR SERVICE WATER-HEATING SYSTEMS**

(a) **Nonresidential occupancies.** Service water-heating systems in nonresidential buildings shall meet the requirements of 1 or 2 below, or meet the performance compliance requirements of Section 140.1:

1. **School buildings less than 25,000 square feet and less than 4 stories in Climate Zones 2 through 15.** A

heat pump water-heating system that meets the applicable requirements of Sections 110.1, 110.3 and 120.3.

2. **All other occupancies.** A service water-heating system that meets the applicable requirements of Sections 110.1, 110.3, 120.3 and 140.5(c).

Exception to Section 140.5(a)1: A water-heating system serving an individual bathroom space may be an instantaneous electric water heater.

(b) **Hotel/motel occupancies.** A service water-heating system installed in hotel/motel buildings shall meet the requirements of Section 170.2(d).

(c) **High-capacity service water-heating systems.** Gas service water-heating systems with a total installed gas water-heating input capacity of 1 MMBtu/h or greater shall have gas service water-heating equipment with a minimum thermal efficiency of 90 percent. Multiple units can meet this requirement if the water-heating input provided by equipment with thermal efficiencies above and below 90 percent aver-

**TABLE 140.4-J:
ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT
OUTDOOR AIR AT FULL DESIGN AIRFLOW (<8,000 HOURS/YEAR)**

% OUTDOOR AIR AT FULL DESIGN AIRFLOW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥10% and <20%	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
≥20% and <30%	≥15,000	≥20,000	NR	NR	NR	NR	NR	NR	NR	NR	≥18,500	≥18,500	≥18,500	≥18,500	≥18,500	≥18,500
≥30% and <40%	≥13,000	≥15,000	NR	NR	NR	NR	NR	NR	NR	NR	≥15,000	≥15,000	≥15,000	≥15,000	≥15,000	≥15,000
≥40% and <50%	≥10,000	≥12,000	NR	NR	NR	NR	NR	NR	NR	≥22,000	≥10,000	≥10,000	≥10,000	≥10,000	≥10,000	≥10,000
≥50% and <60%	≥9,000	≥10,000	NR	≥18,500	NR	NR	NR	NR	NR	≥17,000	≥8,000	≥8,000	≥8,000	≥8,000	≥8,000	≥8,000
≥60% and <70%	≥7,000	≥7,500	NR	≥16,500	NR	NR	NR	NR	≥20,000	≥15,000	≥7,000	≥7,000	≥7,000	≥7,000	≥7,000	≥7,000
≥70% and <80%	≥6,500	≥7,000	NR	≥15,000	NR	NR	NR	NR	≥17,000	≥14,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥80%	≥4,500	≥6,500	NR	≥14,000	NR	NR	NR	NR	≥15,000	≥13,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

- Flow rates in Table 140.4-J represent the design supply fan airflow rate in cfm.
- For a DOAS unit providing outdoor air to another space-conditioning system, the full design supply fan airflow rate shall be the total airflow of only the DOAS unit.

**TABLE 140.4-K:
ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT
OUTDOOR AIR AT FULL DESIGN AIRFLOW (≥8,000 HOURS/YEAR)**

% OUTDOOR AIR AT FULL DESIGN AIRFLOW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥10% and <20%	≥10,000	≥10,000	NR	NR	NR	NR	NR	NR	NR	≥40,000	≥40,000	≥20,000	≥10,000	≥10,000	≥10,000	≥10,000
≥20% and <30%	≥2,000	≥5,000	≥13,000	≥9,000	≥9,000	NR	NR	NR	NR	≥15,000	≥15,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥30% and <40%	≥2,000	≥3,000	≥10,000	≥6,500	≥6,500	NR	NR	NR	≥15,000	≥7,500	≥7,500	≥3,000	≥3,000	≥3,000	≥3,000	≥3,000
≥40% and <50%	≥2,000	≥2,000	≥8,000	≥6,000	≥6,000	NR	NR	NR	≥12,000	≥6,000	≥6,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥50% and <60%	≥2,000	≥2,000	≥7,000	≥6,000	≥6,000	NR	NR	≥20,000	≥10,000	≥5,000	≥5,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥60% and <70%	≥2,000	≥2,000	≥6,000	≥6,000	≥6,000	NR	NR	≥18,000	≥9,000	≥4,000	≥4,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥70% and <80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥15,000	≥8,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	≥12,000	≥7,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

- Flow rates in Table 140.4-K represent the design supply fan airflow rate in cfm.
- For a DOAS unit providing outdoor air to another space-conditioning system, the full design supply fan airflow rate shall be the total airflow of only the DOAS unit.

ages out to an input capacity-weighted average of at least 90 percent.

Exception 1 to Section 140.5(c): If 25 percent of the annual service water-heating requirement is provided by site-solar energy or site-recovered energy.

Exception 2 to Section 140.5(c): Water heaters installed in individual dwelling units.

Exception 3 to Section 140.5(c): Individual gas water heaters with input capacity at or below 100,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SECTION 140.6 PRESCRIPTIVE REQUIREMENTS FOR INDOOR LIGHTING

A building complies with this section if:

- i. The calculation of adjusted indoor lighting power of all proposed building areas combined, calculated under Subsection (a) is no greater than the calculation of allowed indoor lighting power, specific methodologies calculated under Subsection (c); and
- ii. The calculation of allowed indoor lighting power, general rules comply with Subsection (b).

The prescriptive limits on indoor lighting power are the smaller of the adjusted and allowed indoor lighting power values determined in accordance with Item i.

(a) **Calculation of adjusted indoor lighting power.** The adjusted indoor lighting power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions 1 through 4 of this subsection and the requirements of Subdivision 4 of this subsection.

Exception to Section 140.6(a): Up to 0.3 watts per square foot of portable lighting for office areas shall not be required to be included in the calculation of actual indoor lighting power.

1. **Two interlocked lighting systems.** No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the adjusted indoor lighting power density if:

- A. An installation certificate detailing compliance with Section 140.6(a)1 is submitted in accordance with Sections 10-103 and 130.4; and
- B. The area or areas served by the interlocking systems is an auditorium, a convention center, a conference room, a multipurpose room or a theater; and

- C. The two lighting systems are interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems.

For compliance with Part 6 a nonprogrammable double-throw switch is an electrical switch commonly called a “single pole double throw” or “three-way” switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously.

2. **Reduction of wattage through controls.** In calculating adjusted indoor lighting power, the installed watts of a luminaire providing general lighting in an area listed in Table 140.6-A may be reduced by the product of (i) the number of watts controlled as described in Table 140.6-A, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

- A. An installation certificate is submitted in accordance with Section 130.4(b), and
- B. Luminaires and controls meet the applicable requirements of Section 110.9, and Sections 130.0 through 130.5; and
- C. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls.

When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:

- i. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and
- ii. The furniture mounted luminaires shall be permanently hardwired; and
- iii. The furniture mounted lighting system shall be designed to provide indirect general lighting; and
- iv. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.2 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires; and
- v. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in Section 140.6(a)2.

- D. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 140.6-A. Luminaires on lighting

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tracks shall be within the applicable area in order to qualify for a PAF.

E. Only one PAF from Table 140.6-A may be used for each qualifying luminaire. PAFs shall not be added together unless allowed in Table 140.6-A.

F. Only lighting wattage directly controlled in accordance with Section 140.6(a)2 shall be used to reduce the installed watts as allowed by Section 140.6(a)2 for calculating the Adjusted Indoor Lighting Power. If only a portion of the wattage in a luminaire is controlled in accordance with Section 140.6(a)2, then only that portion of controlled wattage may be reduced in calculating adjusted indoor lighting power.

G. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel, and automatic lighting controls required in Section 130.1, and in addition to any other lighting controls required by any provision of Part 6. PAFs shall not be available for lighting controls required by Part 6.

H. To qualify for the PAF for continuous daylight dimming plus OFF control, the daylight control and controlled luminaires shall comply with Section 130.1(d), 130.4(a)3 and 130.4(a)7, and the daylight control shall be continuous dimming and shall additionally turn lights completely OFF when the daylight available in the daylit zone is greater than 150 percent of the illuminance received from the general lighting system at full power. The PAF shall apply to the luminaires in the primary sidelit daylit zone, secondary sidelit daylit zone and skylit daylit zone.

I. To qualify for the PAF for an occupant sensing control controlling the general lighting in large office areas above workstations, in accordance with Table 140.6-A, the following requirements shall be met:

- i. The office area shall be greater than 250 square feet; and
- ii. This PAF shall be available only in office areas which contain workstations; and
- iii. Controlled luminaires shall only be those that provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 140.6(a)2 and provide general lighting directly above the controlled area; and
- iv. Qualifying luminaires shall be controlled by occupant sensing controls that meet all of the following requirements, as applicable:
 - a. Infrared sensors shall be equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.

b. Ultrasonic sensors shall be tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.

c. All other sensors shall be installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.

J. To qualify for the PAF for an Institutional Tuning in Table 140.6-A, the tuned lighting system shall comply with all of the following requirements:

- i. The lighting controls shall limit the maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw; and
- ii. The means of setting the limit is accessible only to authorized personnel; and
- iii. The setting of the limit is verified by the acceptance test required by Section 130.4(a)7; and
- iv. The construction documents specify which lighting systems shall have their maximum light output or maximum power draw set to no greater than 85 percent of full light output or full power draw.

K. To qualify for the PAF for a demand responsive control in Table 140.6-A, the general lighting wattage receiving the PAF shall not be within the scope of Section 110.12(c) and a demand responsive control shall meet all of the following requirements:

- i. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and
- ii. General lighting shall be reduced in a manner consistent with uniform level of illumination requirements in Table 130.1-A.

L. To qualify for the PAFs for clerestory fenestration, horizontal slats, or light shelves in Table 140.6-A, the daylighting design shall meet the requirements in Section 140.3(d). The PAFs shall only apply to lighting in a primary or secondary sidelit daylit zone where continuous dimming daylighting controls meeting the requirements of Section 130.1(d) are installed.

3. **Lighting wattage excluded.** The watts of the following indoor lighting applications may be excluded from adjusted indoor lighting power. (Indoor lighting not listed below shall comply with all applicable nonresidential indoor lighting requirements in Part 6):

- A. In theme parks: lighting for themes and special effects;
- B. Studio lighting for film or photography, provided that these lighting systems are in addition to and

separately switched from a general lighting system;

- C. Lighting for dance floors, lighting for theatrical and other live performances, and theatrical lighting used for religious worship, provided that these lighting systems are additions to a general lighting system and are separately controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators;

Lighting intended for makeup, hair, and costume preparation in performing arts facility dressing rooms, provided that the lighting is separately switched from the general lighting system, switched independently at each dressing station, and is controlled with a vacancy sensor.

- D. In civic facilities, transportation facilities, convention centers and hotel function areas: lighting for temporary exhibits, if the lighting is in addition to a general lighting system, and is separately controlled from a panel accessible only to authorized operators;

- E. Lighting installed by the manufacturer in walk-in coolers or freezers, vending machines, food preparation equipment, and scientific and industrial equipment;

- > F. Examination and surgical lights, low ambient night lights and lighting integral to medical equipment, provided that these lighting systems are additions to and separately switched from a general lighting system;

- || G. Lighting for plant growth or maintenance in non-CEH spaces, if it is controlled by a multilevel astronomical time-switch control that complies with the applicable provisions of Section 110.9;

- H. Lighting equipment that is for sale;

- I. Lighting demonstration equipment in lighting education facilities;

- J. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations;

- K. Exitway or egress illumination that is normally off and that is subject to the CBC;

- L. In hotel/motel buildings, lighting in guest rooms (lighting in hotel/motel guestrooms shall comply with Section 130.0(b). (Indoor lighting not in guestrooms shall comply with all applicable non-residential lighting requirements in Part 6.)

- > || M. Reserved.

- > N. Temporary lighting systems.

- O. Lighting in occupancy group U buildings less than 1,000 square feet;

- P. Lighting in unconditioned agricultural buildings less than 2,500 square feet;

- Q. Lighting systems in qualified historic buildings, as defined in the *California Historical Building Code* (Title 24, Part 8), are exempt from the lighting power density allowances, if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the lighting power density allowances;

- R. Lighting in nonresidential parking garages for seven or less vehicles: Lighting in nonresidential parking garages for seven or less vehicles shall comply with the applicable residential parking garage provisions of Section 150.0(k).

- S. Lighting for signs: Lighting for signs shall comply with Section 140.8.

- T. Lighting in refrigerated cases less than 3,000 square feet. (Lighting in refrigerated cases less than 3,000 square feet shall comply with the Title 20 Appliance Efficiency Regulations).

- U. Lighting in elevators where the lighting meets the requirements in Section 120.6(f).

- V. Lighting connected to a Life Safety Branch or Critical Branch, as specified in Section 517 of the *California Electrical Code*.

- W. Horticultural lighting in CEH spaces (indoor growing and greenhouses) complying with Section 120.6(h).

4. **Luminaire classification and power adjustment.**

- A. Luminaire classification and power shall be determined in accordance with Section 130.0(c).

- B. Small aperture tunable-white and dim-to-warm luminaires lighting power adjustment. For qualifying small aperture tunable-white and dim-to-warm LED luminaires, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage by 0.80. Qualifying luminaires shall meet all of the following:

- i. Small aperture. Qualifying luminaires with a luminaire aperture length longer than 18 inches shall have a luminaire aperture no wider than four inches. Qualifying luminaires with a luminaire aperture length of 18 inches or less shall have a luminaire aperture no wider than eight inches.

- ii. Color changing. qualifying tunable-white luminaires shall be capable of a color change greater than or equal to 2,000 Kel-

vin correlated color temperature (CCT). Qualifying dim-to-warm luminaires shall be capable of color change greater than or equal to 500 Kelvin CCT.

- iii. Controls. Qualifying luminaires shall be connected to controls that allows color changing of the luminaires.

C. Tailored method display lighting mounting height lighting power adjustment. For wall display luminaires or floor display luminaires meeting Tailored Method Section 140.6(c)3G and H and where the bottom of luminaires are 10 feet 7 inches and greater above the finished floor, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage and the appropriated mounting height adjustment factor from Table 140.6-E. Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire. General lighting shall not qualify for a mounting height multiplier.

(b) Calculation of allowed indoor lighting power: general rules.

1. The allowed indoor lighting power allotment for conditioned areas shall be calculated separately from the allowed lighting power allotment for unconditioned areas. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between conditioned and unconditioned area allotments.
2. Allowed indoor lighting power allotment shall be calculated separately from the allowed outdoor lighting power allotment. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between the separate indoor and outdoor allotments.
3. The allowed indoor lighting power density allotment for general lighting shall be calculated as follows:
 - A. The complete building method, as described in Section 140.6(c)1, shall be used only for an entire building, except as permitted by Section 140.6(c)1. As described more fully in Section 140.6(c)1, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting for the entire building shall be calculated as follows:
 - i. For a conditioned building, the product of the square feet of conditioned space of the building times the applicable allotment of watts per square foot described in Table 140.6-B.
 - ii. For an unconditioned building, the product of the square foot of unconditioned space of the building times the applicable allotment of watts per square feet described in Table 140.6-B.
 - B. The area category method, as described in Section 140.6(c)2, shall be used either by itself for all areas in the building, or when some areas in the building

use the tailored method described in Section 140.6(c)3. Under the area category method (either by itself or in conjunction with the tailored method), as described more fully in Section 140.6(c)2, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

- i. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-C (or Table 140.6-D if the tailored method is used for that area).
- ii. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-C (or Table 140.6-D if the tailored method is used for that area).

The allowed indoor lighting power allotment for general lighting for one area for which the area category method was used may be increased up to the amount that the allowed indoor lighting power allotment for general lighting for another area using the area category method or tailored method is decreased, except that such increases and decreases shall not be made between conditioned and unconditioned space.

C. The tailored method, as described in Section 140.6(c)3, shall be used either by itself for all areas in the building, or when some areas in the building use the area category method described in Section 140.6(c)2. Under the tailored method (either by itself or in conjunction with the area category method) as described more fully in Section 140.6(c)3, and subject to the adjustments listed there, allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

- i. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-D (or Table 140.6-C if the area category method is used for that area);
- ii. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 140.6-D (or Table 140.6-C if the area category method is used for that area);

The allowed indoor lighting power allotment for general lighting for one area for which the tailored method was used may be increased up to the amount that the allowed indoor power lighting for general lighting for another area is decreased, but only if the tailored method or area category method was used for the other area, except that such increases and decreases shall not be made between conditioned and unconditioned space.

D. If the area category method is used for an area, the tailored method may not be used for that area. If the tailored method is used for an area, the area category method may not be used for that area.

4. Allowed indoor lighting power allotments for all lighting power allotments other than general lighting shall be restricted as follows:

A. When using the area category method, allowed indoor lighting power allotments for specialized task work; precision commercial and industrial work; white board or chalk board; accent, display and feature; decorative; or videoconferencing studio; may not be increased as a result of, or otherwise traded off against, decreasing any other allotment; and

B. When using the tailored method, allowed indoor lighting power allotments for wall display; floor display and task; decorative/special effect; or very valuable display case; may not be increased, or otherwise traded between any of the separate allotments.

(c) **Calculation of allowed indoor lighting power: specific methodologies.** The allowed indoor lighting power for each building type, or each primary function area shall be calculated using only one of the methods in Subsection 1, 2 or 3 below as applicable.

1. **Complete building method.** Requirements for using the complete building method include all of the following:

A. The complete building method shall be used only for building types, as defined in Section 100.1, that are specifically listed in Table 140.6-B. (For example, retail and wholesale stores, hotel/motel, and high-rise residential buildings shall not use this method.)

B. The complete building method shall be used only on projects involving:

i. Entire buildings with one type of use occupancy; or

ii. Mixed occupancy buildings where one type of use makes up at least 90 percent of the entire building (in which case, when applying the complete building method, it shall be assumed that the primary use is 100 percent of the building); or

iii. A tenant space where one type of use makes up at least 90 percent of the entire tenant space (in which case, when applying the complete building method, it shall be assumed that the primary use is 100 percent of the tenant space).

C. The complete building method shall be used only when the applicant is applying for a lighting permit and submits plans and specifications for the entire building or the entire tenant space.

D. Under the complete building method, the allowed indoor lighting power allotment is the lighting power density value times the floor area of the entire building.

E. For buildings including a parking garage plus another type of use listed in Table 140.6-B, the parking garage portion of the building and other type of

use portion of the building shall each separately use the Complete Building Method.

2. **Area category method.** Requirements for using the area category method include all of the following:

A. The area category method shall be used only for primary function areas, as defined in Section 100.1, that are listed in Table 140.6-C. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted.

B. Primary function areas in Table 140.6-C shall not apply to a complete building. Each primary function area shall be determined as a separate area.

C. For purposes of compliance with Section 140.6(c)2, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 146.0-C.

D. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in primary function area.

E. If at the time of permitting for a newly constructed building, a tenant is not identified for a multitenant area, a maximum of 0.4 watts per square foot shall be allowed for the lighting in each area in which a tenant has not been identified. The area shall be classified as unleased tenant area.

F. Under the area category method, the allowed indoor lighting power for each primary function area is the lighting power density value in Table 140.6-C times the square feet of the primary function area. The total allowed indoor lighting power density for the building is the sum of all allowed indoor lighting powers densities for all areas in the building.

G. In addition to the allowed indoor lighting power calculated according to Sections 140.6(c)2 A through F, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in Table 140.6-C under the following conditions:

i. Only primary function areas having a lighting systems as specified in the Qualifying Lighting Systems column in Table 140.6-C and in accordance with the corresponding footnote of the table shall qualify for the additional lighting power allowances; and

ii. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and

iii. Tasks that are performed less than two hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and

iv. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and

- v. The additional lighting power allowances shall not be used when using the complete building method, or when the tailored method used for any area in the building; and
- vi. The additional lighting power allowed is the smaller of:
 - a. the lighting power density listed in the “Allowed Additional Lighting LPD” column in Table 140.6-C, times the square feet of the primary function, or
 - b. the adjusted indoor lighting power of the applicable lighting; and
- vii. In addition to meeting Sections 140.6(c)2Gi through vi, additional lighting power for videoconferencing as specified in Table 140.6-C shall be allowed in a videoconferencing studio, as defined in Section 100.1, provided the following conditions are met:
 - a. A completed and signed installation certificate is prepared and submitted in accordance with Section 130.4(b), specifically detailing compliance with the applicable requirements of Section 140.6(c)2Gvii; and
 - b. The videoconferencing studio is a room with permanently installed videoconferencing cameras, audio equipment, and playback equipment for both audio-based and video-based two-way communication between local and remote sites; and
 - c. General lighting is switched in accordance with Table 130.1-A; and
 - d. Wall wash lighting is separately switched from the general lighting system; and
 - e. All of the lighting in the studio, including general lighting and additional lighting power allowed by Section 140.6(c)2Gvii is controlled by a multiscene programmable control system (also known as a scene preset control system).

3. **Tailored method.** Requirements for using the tailored method include all of the following:

- A. The tailored method shall be used only for primary function areas listed in Table 140.6-D, as defined in Section 100.1.
- B. Allowed indoor lighting power allotments for general lighting shall be determined according to Section 140.6(c)3F, as applicable.
- C. For compliance with Section 140.6(c)3, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 140.6-D.
- D. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior

partitions may be included in a primary function area.

- E. In addition to the allowed indoor lighting power allotments for general lighting calculated according to Sections 140.6(c)3F, as applicable, the building may add additional lighting power allowances for wall display lighting, floor display lighting and task lighting, decorative/special effects lighting, and very valuable display cases lighting according to Sections 140.6(c)3G through J.
- F. Determine allowed indoor lighting power allotments for general lighting for primary function areas listed in Table 140.6-D as follows:
 - i. Use the General Illumination Level (Lux) listed in Column 2 of Table 140.6-D to determine the allowed general lighting power density allotments for the area.
 - ii. Determine the room cavity ratio (RCR) for the area. The RCR shall be calculated according to the applicable equation in Table 140.6-F.
 - iii. Find the allowed general lighting power density allotments in Table 140.6-G that is applicable to the general illuminance level (Lux) from Column 2 of Table 140.6-D (as described in Item i) and the RCR determined in accordance with Table 140.6-F (as described in Item ii).
 - iv. Determine the square feet of the area in accordance with Section 140.6(c)3C and D.
 - v. Multiply the allowed lighting power density allotment, as determined in accordance with Item iii by the square feet of each primary function area, as determined in accordance with Item iv. The product is the allowed indoor lighting power allotment for general lighting for the area.
- G. Determine additional allowed power for wall display lighting according to column 3 of Table 140.6-D for each primary function area as follows:
 - i. Floor displays shall not qualify for wall display allowances.
 - ii. Qualifying wall lighting shall:
 - a. Be mounted within 10 feet of the wall having the wall display. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more than 10 feet from the wall shall not be used for the wall display allowance.
 - b. Be a lighting system type appropriate for wall lighting. Lighting systems appropriate for wall lighting are lighting track adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light. (Accent luminaires are

adjustable or fixed luminaires with PAR, R, MR, AR or luminaires providing directional display light.)

- iii. Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays. The length of display walls shall include the length of the perimeter walls, including but not limited to closable openings and permanent full height interior partitions. Permanent full height interior partitions are those that (I) extend from the floor to within 2 feet of the ceiling or are taller than 10 feet and (II) are permanently anchored to the floor.
- iv. For wall display lighting where the bottom of the luminaire is greater than 10 feet 6 inches above the finished floor, the mounting height adjustment factor from Table 140.6-E can be used to adjust the installed luminaire wattage as specified in Section 140.6(a)4C.
- v. The allowed power for wall display lighting shall be the smaller of:
 - a. the “wall display lighting power density” determined in accordance with Table 140.6-D, multiplied by the wall display lengths determined in accordance with Item iii; and
 - b. The adjusted indoor lighting power used for the wall display lighting systems.
- vi. Lighting internal to display cases that are attached to a wall or directly adjacent to a wall are counted as wall display lighting as specified in Section 140.6(c)3G. All other lighting internal to display cases are counted as floor display lighting as specified in Section 140.6(c)3H, or as very valuable display case lighting as specified in Section 140.6(c)3J.

H. Determine additional allowed power for floor display lighting and task lighting as follows:

- i. Displays that are installed against a wall shall not qualify for the floor display lighting power allowances.
- ii. Lighting internal to display cases that are not attached to a wall and not directly adjacent to a wall shall be counted as floor display lighting in accordance with Section 140.6(c)3H; or very valuable display case lighting in accordance with Section 140.6(c)3J.
- iii. Additional allowed power for floor display lighting, and additional allowed power for task lighting, may be used by qualifying floor display lighting systems, qualifying task lighting systems, or a combination of both. For floor areas qualifying for both floor display and task lighting power allowances, the additional allowed power shall be used only once for the same floor area, so that the allowance shall not be additive.

- iv. Qualifying floor display lighting shall:
 - a. Be mounted no closer than 2 feet to a wall.
 - b. Consist of only (I) directional lamp types, such as PAR, R, MR, AR; or (II) luminaires providing directional display light.
 - c. If track lighting is used, shall be only track heads that are classified as direction lighting types.
- v. Qualifying task lighting shall:
 - a. Be located immediately adjacent to and capable of illuminating the task for which it is installed.
 - b. Be of a type different from the general lighting system.
 - c. Be separately switched from the general lighting system.
- vi. If there are illuminated floor displays, floor display lighting power shall be used only if allowed by Column 4 of Table 140.6-D.
- vii. The square footage of floor display or the square footage of task areas shall be determined in accordance with Section 140.6(c)3C and D, except that any floor area designed to not have floor displays or tasks, such as floor areas designated as a path of egress, shall not be included for the floor display allowance.
- viii. For floor display lighting where the bottom of the luminaire is greater than 10.6 feet above the finished floor, multiply the floor display installed watts by the appropriate mounting height adjustment factor from Table 140.6-E to calculate the Adjusted Indoor Lighting Power as specified in Section 140.6(a)4C.
- ix. The allowed power for floor display lighting for each applicable area shall be the smaller of:
 - a. the allowed floor display and task lighting power determined in accordance with Section 140.6(c)3Hvi multiplied by the floor square footage determined in accordance with Section 140.6(c)3Hvii; and
 - b. The Adjusted Indoor Lighting Power used for the floor display lighting systems.

I. Determine additional allowed power for decorative/special effects lighting as follows:

- i. Qualifying decorative lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels, when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.
- ii. Additional lighting power for decorative/special effects lighting shall be used only if allowed by Column 5 of Table 140.6-D.

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- iii. Additional lighting power for decorative/special effects lighting shall be used only in areas having decorative/special effects lighting. The square footage of the floor area shall be determined in accordance with Section 140.6(c)3C and D, and it shall not include floor areas not having decorative/special effects lighting.
 - iv. The additional allowed power for decorative/special effects lighting for each applicable area shall be the smaller of:
 - a. The product of the allowed decorative/special effects lighting power determined in accordance with Section 140.6(c)3Iii, multiplied by the floor square footage determined in accordance with Section 140.6(c)3Iiii; and
 - b. The adjusted indoor lighting power of allowed decorative/special effects lighting.
- J. Determine additional allowed power for very valuable display case lighting as follows:
- i. Additional allowed power for very valuable display case lighting shall be available only for display cases in appropriate function areas in retail merchandise sales, museum and religious worship.
 - ii. To qualify for additional allowed power for very valuable display case lighting, a case shall contain jewelry, coins, fine china, fine

crystal, precious stones, silver, small art objects and artifacts, and/or valuable collections the display of which involves customer inspection of very fine detail from outside of a locked case.

- iii. Qualifying lighting includes internal display case lighting or external lighting employing highly directional luminaires specifically designed to illuminate the case or inspection area without spill light, and shall not be fluorescent lighting unless installed inside of a display case.
- iv. If there is qualifying very valuable display case lighting in accordance with Section 140.6(c)3Jii, the smallest of the following separate lighting power for display cases presenting very valuable display items is permitted:
 - a. The product of the area of the primary function and 0.50 watt per square foot; or
 - b. The product of the area of the display case and 7 watts per square foot; or
 - c. The adjusted indoor lighting power of lighting for very valuable displays.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**TABLE 140.6-A
LIGHTING POWER ADJUSTMENT FACTORS (PAF)**

TYPE OF CONTROL	TYPE OF AREA	FACTOR
a. To qualify for any of the power adjustment factors in this table, the installation shall comply with the applicable requirements in Section 140.6(a)2.		
b. Only one PAF may be used for each qualifying luminaire unless combined below.		
c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.		
1. Daylight Continuous Dimming plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone or secondary sidelit daylit zone	0.10
2. Occupant sensing controls in offices larger than 250 square feet	One sensor controlling an area that is:	No larger than 125 square feet
		From 126 to 250 square feet
3. Institutional Tuning	Luminaires in non-daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10
	Luminaires in daylit areas: Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
4. Demand responsive control	General lighting luminaires not in the scope of Section 110.12(c). Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF.	0.05
5. Clerestory Fenestration	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
6. Horizontal Slats	Luminaires in daylit areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
7. Light Shelves	Luminaires in daylit areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF	0.10

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**TABLE 140.6-B
COMPLETE BUILDING METHOD LIGHTING POWER DENSITY VALUES**

TYPE OF BUILDING	ALLOWED LIGHTING POWER DENSITY (WATTS PER SQUARE FOOT)
Assembly building	0.65
Bank or financial institution building	0.65
Grocery store building	0.90
Gymnasium building	0.60
Healthcare facility	0.90
Industrial/manufacturing facility building	0.60
Library building	0.70
Motion picture theater building	0.60
Museum building	0.65
Office building	0.60
Parking garage building	0.13
Performing arts theater building	0.75
Religious facility building	0.70
Restaurant building	0.65
Retail store building	0.90
School building	0.60
Sports arena building	0.75
All other buildings	0.40

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**TABLE 140.6-C
AREA CATEGORY METHOD—LIGHTING POWER DENSITY VALUES (WATTS/FT²)**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER DENSITY FOR GENERAL LIGHTING (W/ft ²)	ADDITIONAL LIGHTING POWER ¹	
			Qualified Lighting Systems	Additional Allowance (W/ft ² , unless noted otherwise)
Aging Eye/Low-Vision ¹¹	Corridor Area	0.70	Decorative/display	0.30
	Dining	0.80	Decorative/display	0.30
			Tunable white or dim-to-warm ¹⁰	0.10
	Lobby, Main Entry	0.85	Decorative/display	0.30
			Transition lighting OFF at night ¹²	0.95
	Lounge/Waiting Area	0.80	Tunable white or dim-to-warm ¹⁰	0.10
			Decorative/display	0.30
	Multipurpose Room	0.85	Tunable white or dim-to-warm ¹⁰	0.10
			Decorative/display	0.30
Religious Worship Area	1.00	Tunable white or dim-to-warm ¹⁰	0.10	
		Decorative/display	0.30	
Restroom	1.00	Decorative/display	0.20	
Stairwell	0.80	Decorative/display	0.30	
Audience Seating Area		0.50	Decorative/display	0.25
Auditorium Area		0.70	Decorative/display	0.45
Auto Repair / Maintenance Area		0.55	Detailed task work ⁷	0.20
Barber, Beauty Salon, Spa Area		0.70	Detailed task work ⁷	0.30
			Decorative/display	0.25
Civic Meeting Place Area		0.90	Decorative/display	0.25
Classroom, Lecture, Training, Vocational Area		0.60	White or chalk board ¹	7 W/ft
Concourse and Atrium Area		0.60	Decorative/display	0.25
Convention, Conference, Multipurpose and Meeting Area		0.75	Decorative/display	0.25
Copy Room		0.50	—	—
Corridor Area		0.40	Decorative/display	0.25
Dining Area	Bar/Lounge and Fine Dining	0.45	Decorative/display	0.35
	Cafeteria/Fast Food	0.45		0.25
	Family and Leisure	0.40		0.25
Electrical, Mechanical, Telephone Rooms		0.40	Detailed task work ⁷	0.20
Exercise/Fitness Center and Gymnasium Area		0.50	—	—
Financial Transaction Area		0.70	Decorative/display	0.25
Healthcare Facility and Hospital	Exam/Treatment Room	1.15	—	—
	Imaging Room	0.60	Decorative/display	0.20
			Tunable white or dim-to-warm ¹⁰	0.10
	Medical Supply Room	0.55	—	—
	Nursery	0.80	Tunable white or dim-to-warm ¹⁰	0.10
	Nurse's Station	0.85	Tunable white or dim-to-warm ¹⁰	0.10
			Detailed task work ⁷	0.20
	Operating Room	1.90	—	—
	Patient Room	0.70	Decorative/display	0.15
Tunable white or dim-to-warm ¹⁰			0.10	
Physical Therapy Room	0.75	Tunable white or dim-to-warm ¹⁰	0.10	
Recovery Room	0.90	Tunable white or dim-to-warm ¹⁰	0.10	
Hotel Function Area		0.85	Decorative/display	0.25
Kitchen/Food Preparation Area		0.95	—	—
Laboratory, Scientific		0.90	Specialized task work ⁸	0.35
Laundry Area		0.45	—	—

(continued)

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**TABLE 140.6-C
AREA CATEGORY METHOD - LIGHTING POWER DENSITY VALUES (WATTS/FT²)—continued**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER DENSITY FOR GENERAL LIGHTING (W/ft ²)	ADDITIONAL LIGHTING POWER ¹	
			Qualified Lighting Systems	Additional Allowance (W/ft ² , unless noted otherwise)
Library	Reading Area	0.80	Decorative/display	0.25
	Stacks Area	1.00	—	—
Lobby, Main Entry		0.70	Decorative/display	0.25
Locker Room		0.45	—	—
Lounge, Breakroom, or Waiting Area		0.55	Decorative/display	0.25
Manufacturing, Commercial & Industrial Work Area	Low Bay	0.60	Detailed task work ⁷	0.20
	High Bay	0.65	Detailed task work ⁷	0.20
	Precision	0.85	Precision specialized work ⁹	0.70
Museum Area	Exhibition/Display	0.60	Decorative/display	0.45
	Restoration Room	0.70	Detailed task work ⁷	0.35
Office Area	> 250 square feet	0.60	Decorative/display and portable lighting for office areas ⁶	0.20
	≤ 250 square feet	0.65		
Parking Garage Area	Parking Zone and Ramps	0.10	First ATM or ticket machine	100 W
	Daylight Adaptation Zones ²	1.00	Additional ATM or ticket machine	50 W each
Pharmacy Area		1.00	Specialized task work ⁸	0.35
Retail Sales Area	Grocery Sales	1.00	Decorative/display	0.35
	Retail Merchandise Sales	0.95	Decorative/display	0.35
	Fitting Room	0.60	External illuminated mirror ⁵	40 W each
Internal illuminated mirror ⁵			120 W each	
Religious Worship Area		0.95	Decorative/display	0.25
Restrooms		0.65	Decorative/display	0.35
Stairwell		0.60	Decorative/display	0.35
Storage, Commercial/Industrial	Warehouse	0.40	—	—
	Shipping & Handling	0.60		
Sports Arena—Playing Area	Class I Facility ¹³	2.25	—	—
	Class II Facility ¹³	1.45		
	Class III Facility ¹³	1.10		
	Class IV Facility ¹³	0.75		
Theater Area	Motion Picture	0.50	Decorative/display	0.25
	Performance	0.80		
Transportation Function	Baggage Area	0.40	—	—
	Ticketing Area	0.45	Decorative/display	0.20
Videoconferencing Studio		0.90	Videoconferencing ¹⁴	1.00
All other		0.40	—	—

- White board or chalk board: directional lighting dedicated to a white board or chalk board.
- Daylight adaptation zones shall be no longer than 66 feet from the entrance to the parking garage.
- Reserved.
- Reserved.
- Illuminated mirrors: lighting shall be dedicated to the mirror.
- Portable lighting in office areas includes under-shelf or furniture-mounted supplemental task lighting when controlled by a time clock or an occupancy sensor.
- Detailed task work: lighting provides the high level of visual acuity needed for activities that require close attention to small elements and/or extreme close-up work.
- Specialized task work: lighting provides for small-scale, cognitive or fast-performance visual tasks; lighting required for operating specialized equipment associated with pharmaceutical/laboratorial activities.
- Precision specialized work: lighting for work performed within a commercial or industrial environment that entails working with low-contrast, finely detailed or fast-moving objects.
- Tunable white luminaires capable of color change greater than or equal to 2000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allow color changing of the luminaires.
- Aging eye/low-vision areas can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and are or will be licensed by local or state authorities for senior long-term care, adult day care, senior support and/or people with special visual needs.
- Transition lighting OFF at night. Lighting power controlled by astronomical time clock or other control to shut off lighting at night. Additional LPD only applies to area within 30 feet of an exit. Not applicable to lighting in daylight zones.
- Class I facility is used for competition play for 5000 or more spectators. Class II facility is used for competition play for up to 5000 spectators. Class III facility is used for competition play for up to 2000 spectators. Class IV facility is normally used for recreational play and there is limited or no provision for spectators.
- The additional videoconferencing lighting power shall be allowed provided the videoconferencing studio meets all the requirements of Section 140.6(c)2Gvii.

**TABLE 140.6-D
TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Display Lighting Power Density (W/ft)	Allowed Combined Floor Display Power and Task Lighting Power Density (W/ft ²)	Allowed Decorative/Special Effect Lighting Power Density (W/ft ²)
Auditorium area	300	3.00	0.20	0.35
Convention, conference, multipurpose, and meeting center areas	300	2.00	0.30	0.35
Dining areas	200	1.25	0.45	0.35
Exhibit, museum areas	150	11.20	0.70	0.35
Hotel area:				
Ballroom/events	400	1.80	0.12	0.35
Lobby	200	3.40	0.20	0.35
Lobby, Main entry	200	3.40	0.20	0.35
Religious worship area	300	1.30	0.40	0.35
Retail sales				
Grocery	600	6.60	0.60	0.35
Merchandise sales, and showroom areas	500	11.50	0.70	0.35
Theater area:				
Motion picture	200	2.00	0.20	0.35
Performance	200	7.30	0.20	0.35

**TABLE 140.6-E
TAILORED WALL AND FLOOR DISPLAY MOUNTING HEIGHT ADJUSTMENT FACTORS**

HEIGHT IN FEET ABOVE FINISHED FLOOR AND BOTTOM OF LUMINAIRE(S)	FLOOR DISPLAY OR WALL DISPLAY—MOUNTING HEIGHT ADJUSTMENT FACTOR
≤ 10'-6"	1.00
> 10'-6" to 14'-0"	0.85
> 14'-0" to 18'-0"	0.75
> 18'-0"	0.70

**TABLE 140.6-F
ROOM CAVITY RATIO (RCR) EQUATIONS**

Determine the room cavity ratio for Table 140.6-G using one of the following equations.
Room cavity ratio for rectangular rooms
$RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms
$RCR = \frac{2.5 \times H \times P}{A}$
Where: <i>L</i> = Length of room; <i>W</i> = Width of room; <i>H</i> = Vertical distance from the work plane to the centerline of the lighting fixture; <i>P</i> = Perimeter of room; and <i>A</i> = Area of room

TABLE 140.6-G
TAILORED METHOD GENERAL LIGHTING POWER ALLOWED—BY ILLUMINANCE AND ROOM CAVITY RATIO

GENERAL ILLUMINANCE LEVEL (LUX) ^a	GENERAL LIGHTING POWER DENSITY (W/FT ²) FOR THE FOLLOWING RCR VALUES ^b			
	RCR ≤ 2.0	RCR > 2.0 AND ≤ 3.5	RCR > 3.5 AND ≤ 7.0	RCR > 7.0
150	0.35	0.40	0.50	0.65
200	0.40	0.50	0.65	0.85
300	0.55	0.70	0.85	1.20
400	0.65	0.80	1.05	1.25
500	0.80	0.90	1.25	1.55
600	0.90	1.05	1.40	2.00

a. Illuminance values from Column 2 of Table 140.6-D.

b. RCR values are calculated using applicable equations in Table 140.6-F.

SECTION 140.7 PRESCRIPTIVE REQUIREMENTS FOR OUTDOOR LIGHTING

(a) An outdoor lighting installation complies with this section if it meets the requirements in Subsections (b) and (c), and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection (d). The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

Exceptions to Section 140.7(a): When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 140.7:

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration, and the Coast Guard.
3. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields, and children’s playgrounds.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants, and aviation facilities.
6. Lighting of public monuments.
7. Lighting of signs complying with the requirements of Sections 130.3 and 140.8.
8. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
9. Landscape lighting.
10. In theme parks: outdoor lighting only for themes and special effects.
11. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems

are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.

12. Outdoor lighting systems for qualified historic buildings, as defined in the *California Historic Building Code* (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 140.7.

(b) **Outdoor lighting power trade-offs.** Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section 140.7(d)1 for general hardscape lighting allowance may be traded to specific applications in Section 140.7(d)2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 140.7(d)1A.
2. Allowed lighting power determined according to Section 140.7(d)2 for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 140.7(d)1.
3. Trading of lighting power allowances between outdoor and indoor areas shall not be permitted.

(c) **Calculation of actual lighting power.** The wattage of outdoor luminaires shall be determined in accordance with Section 130.0(c).

(d) **Calculation of allowed lighting power.** The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section 140.7(d)1, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 140.7(d)2.

1. **General hardscape lighting allowance.** Determine the general hardscape lighting power allowances as follows:

- A. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s), and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the area wattage allowance (AWA) from Table 140.7-A for the appropriate lighting zone.
- B. Determine the perimeter length of the general hardscape area. The total perimeter shall not include portions of hardscape that are not illuminated according to Section 140.7(d)1A. Multiply the hardscape perimeter by the linear wattage allowance (LWA) for hardscape from Table 140.7-A for the appropriate lighting zone. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:
- i. Landscaped areas completely enclosed within the hardscape area, and which have a width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
 - ii. Landscaped areas completely enclosed within the hardscape area, and which width or length is a minimum of 10 feet wide, the perimeter of the landscaped areas or permanent planter shall be added to the hardscape perimeter length.
 - iii. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.
- C. Determine the initial wattage allowance (IWA) for general hardscape lighting from Table 140.7-A for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.

- D. The general hardscape lighting allowance shall be the sum of the allowed watts determined from (A), (B) and (C) above.
2. **Additional lighting power allowance for specific applications.** Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table 140.7-B for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

**SECTION 140.8
PRESCRIPTIVE REQUIREMENTS FOR SIGNS**

This section applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs) and unfiltered neon, both indoor and outdoor. Each sign shall comply with either Subsection (a) or (b), as applicable.

(a) Maximum allowed lighting power.

1. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
2. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.
3. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 140.8(b).

(b) Alternate lighting sources. The sign shall be equipped with one or more of the following light sources:

1. High pressure sodium lamps; or
2. Metal halide lamps that are:
 - A. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater, or
 - B. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent.

Ballast efficiency is the reference lamp power divided by the ballast input power when tested according to ANSI C82.6-2015.

**TABLE 140.7-A
GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE**

TYPE OF POWER ALLOWANCE	LIGHTING ZONE 0 ³	LIGHTING ZONE 1 ³	LIGHTING ZONE 2 ³	LIGHTING ZONE 3 ³	LIGHTING ZONE 4 ³
Area wattage allowance (AWA)	No allowance ¹	0.016 W/ft ²	0.019 W/ft ²	0.021 W/ft ²	0.024 W/ft ²
Linear wattage allowance (LWA)	No allowance ¹	0.13 W/lf	0.15 W/lf	0.20 W/lf	0.29 W/lf
Initial wattage allowance (IWA)	No allowance ¹	150 W	200 W	250 W	320 W

1. Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse or toilet facility; as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in Section 130.2(b).
2. Reserved.
3. Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm—as mandated by local, state or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna—shall be allowed a 2.0 lighting power allowance multiplier.

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR ACHIEVING ENERGY EFFICIENCY

**TABLE 140.7-B
ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS
All area and distance measurements in plan view unless otherwise noted.**

LIGHTING APPLICATION	LIGHTING ZONE 0	LIGHTING ZONE 1	LIGHTING ZONE 2	LIGHTING ZONE 3	LIGHTING ZONE 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building entrances or exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not applicable	9 watts	15 watts	19 watts	21 watts
Primary entrances to senior care facilities, police stations, healthcare facilities, fire stations and emergency vehicle facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not applicable	20 watts	40 watts	57 watts	60 watts
Drive up windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within two mounting heights of the sill of the window.	Not applicable	16 watts	30 watts	50 watts	75 watts
Vehicle service station uncovered fuel dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within two mounting heights of the dispenser.	Not applicable	55 watts	77 watts	81 watts	135 watts
ATM machine lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM machine, 35 watts for each additional ATM machine.			
WATTAGE ALLOWANCE PER UNIT LENGTH (W/linear ft). May be used for one or two frontage side(s) per site.					
Outdoor sales frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides, provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	Not applicable	No Allowance	11 W/linear ft	19 W/linear ft	25 W/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape ornamental lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 50 watts or less as determined in accordance with Section 130.0(c), and shall be post-top luminaires, lanterns, pendant luminaires or chandeliers.	Not applicable	No Allowance	0.007 W/ft ²	0.013 W/ft ²	0.019 W/ft ²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate, provided that none of the following specific applications shall be used for the same area.					
Building facades. Only areas of building facade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the facade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	Not applicable	No Allowance	0.100 W/ft ²	0.170 W/ft ²	0.225 W/ft ²
Outdoor sales lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other nonsales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within five mounting heights of the sales lot area.	Not applicable	0.060 W/ft ²	0.210 W/ft ²	0.280 W/ft ²	0.485 W/ft ²
Vehicle service station hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property, or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines or obstructed by a sign or other structure.	Not applicable	0.006 W/ft ²	0.068 W/ft ²	0.138 W/ft ²	0.200 W/ft ²
Vehicle service station canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	0.220 W/ft ²	0.430 W/ft ²	0.580 W/ft ²	1.010 W/ft ²
Sales canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	Not applicable	No Allowance	0.470 W/ft ²	0.622 W/ft ²	0.740 W/ft ²
Nonsales canopies and tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not applicable	0.057 W/ft ²	0.137 W/ft ²	0.270 W/ft ²	0.370 W/ft ²
Guard stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates and vehicle contents. Qualifying luminaires shall be within two mounting heights of a vehicle lane or the guardhouse.	Not applicable	0.081 W/ft ²	0.176 W/ft ²	0.325 W/ft ²	0.425 W/ft ²
Student pick-up/drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked-up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within two mounting heights of the student pick-up/drop-off zone.	Not applicable	No Allowance	0.056 W/ft ²	0.200 W/ft ²	No Allowance
Outdoor dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within two mounting heights of the hardscape area of outdoor dining.	Not applicable	0.004 W/ft ²	0.030 W/ft ²	0.050 W/ft ²	0.075 W/ft ²
Special security lighting for retail parking and pedestrian hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not applicable	0.004 W/ft ²	0.005 W/ft ²	0.010 W/ft ²	No Allowance
Security cameras. This additional allowance is for illuminated general hardscape area. This allowance shall apply when a security camera is installed within 2 mounting heights of the general hardscape area and mounted more than 10 feet away from a building.	Not applicable	No allowance	0.018 W/ft ²	0.018 W/ft ²	0.018 W/ft ²

3. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:

- A. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
- B. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

The ratio of the output wattage to the input wattage is at 100 percent tubing load.

4. Fluorescent lighting systems meeting one of the following requirements:

- A. Use only lamps with a minimum color rendering index (CRI) of 80; or
- B. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz.

5. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

Exception to Section 140.8(b)5: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the appliance efficiency regulations (Title 20).

6. Compact fluorescent lamps that do not contain a medium screw base socket (E24/E26).

Exception 1 to Section 140.8: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section 140.8: Exit signs. Exit signs shall meet the requirements of the appliance efficiency regulations.

Exception 3 to Section 140.8: Traffic Signs. Traffic signs shall meet the requirements of the appliance efficiency regulations.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

**SECTION 140.9
PRESCRIPTIVE REQUIREMENTS
FOR COVERED PROCESSES**

(a) **Prescriptive requirements for computer rooms.**

> | Computer rooms with a power density greater than 20 W/ft²
> shall comply with this section.

1. **Economizers.** Each individual cooling system primarily serving computer room shall include either:

- A. An integrated air economizer capable of providing partial cooling even when additional mechanical

cooling is required and capable of providing 100 percent of the expected system cooling load at 65°F to 80.6°F supply air temperature at outside air temperatures of 65°F dry-bulb and below or 50°F wet-bulb and below, and be equipped with a fault detection and diagnostic system as specified by Section 120.2(i); or

B. An integrated water economizer capable of providing partial cooling even when additional mechanical cooling is required and capable of providing 100 percent of the expected system cooling load at 65°F to 80.6°F supply air temperature at outside air temperatures of 50°F dry-bulb and below or 45°F wet-bulb and below.

Exception 1 to Section 140.9(a)1: Individual computer rooms with an ITE design load under 5 tons (18 kW) in a building that does not have any economizers.

Exception 2 to Section 140.9(a)1: A computer room with an ITE design load less than 20 tons (70 kW) may be served by a second fan system without an economizer if it is also served by a fan system with an economizer that also serves other spaces within the building, provided that all of the following are met:

- i. The economizer system is sized to meet the design cooling load of the computer room when the other spaces within the building are at 50 percent of their design load at outside air temperatures of 65°F dry-bulb and below or 50°F wet-bulb and below; and
- ii. The economizer system has the ability to serve only the computer rooms connected to it, e.g., shut off flow to other spaces within the building when unoccupied.

2. **Power consumption of fans.** The total fan power at design conditions of each fan system shall not exceed 27 W/kBtu·h of net sensible cooling capacity.

3. **Air containment.** Computer rooms with air-cooled computers in racks and with an ITE design load exceeding 10 kW (2.8 tons) per room shall include air barriers such that there is no significant air path for computer discharge air to recirculate back to computer inlets without passing through a cooling system.

Exception 1 to Section 140.9(a)3: Expansions of existing computer rooms.

Exception 2 to Section 140.9(a)3: Computer racks with a design load less than 1 kW (0.28 tons) per rack.

Exception 3 to Section 140.9(a)3: Equivalent energy performance based on computational fluid dynamics or other analysis.

4. **Alternating current-output uninterruptible power supplies (UPS).** Alternating current-output UPS systems serving a computer room shall meet or exceed minimum average efficiencies in Table 140.9-B. Mini-

imum average efficiency for alternating current-output UPS shall meet or exceed calculation and testing requirements identified in ENERGY STAR Program Requirements for Uninterruptible Power Supplies (UPSs) – Eligibility Criteria Version 2.0.

where:

P is the rated output power in watts (W).

E_{MOD} is an allowance of 0.004 for modular UPSs applicable in the commercial 1,500–10,000 W range.

\ln is the natural logarithm.

The requirement shall be rounded to the third decimal place for certification and reporting.

Exception to Section 140.9(a)4: Alternating current-output UPS that utilizes standardized NEMA 1-15P or NEMA 5-15P input plug, as specified in ANSI/NEMA WD-6-2016.

(b) **Prescriptive requirements for commercial kitchens.**

1. **Kitchen exhaust systems.**

A. Replacement air introduced directly into the hood cavity of kitchen exhaust hoods shall not exceed 10 percent of the hood exhaust airflow rate.

B. For kitchen/dining facilities having total Type I and Type II kitchen hood exhaust airflow rates greater than 5,000 cfm, each Type I hood shall have an exhaust rate that complies with Table 140.9-C. If a single hood or hood section is installed over appliances with different duty ratings, then the maximum allowable flow rate for the hood or hood section shall not exceed the Table 140.9-A values for the highest appliance duty rating under the hood or hood section. Refer to ASHRAE Standard 154-2011 for definitions of hood type, appliance duty and next exhaust flow rate.

Exception 1 to Section 140.9(b)1.B: 75 percent of the total Type I and Type II exhaust replacement air is transfer air that would otherwise be exhausted.

Exception 2 to Section 140.9(b)1.B: Existing hoods not being replaced as part of an addition or alteration.

2. **Kitchen ventilation.**

A. Mechanically cooled or heated makeup air delivered to any space with a kitchen hood shall not exceed the greater of:

- i. The supply flow required to meet the space heating and cooling load; or
- ii. The hood exhaust flow minus the available transfer air from adjacent spaces. Available transfer air is that portion of outdoor ventilation air serving adjacent spaces not required to satisfy other exhaust needs, such as restrooms, not required to maintain pressurization of adjacent spaces, and that would otherwise be relieved from the building.

Exception to Section 140.9(b)2.A: Existing kitchen makeup air units not being replaced as part of an addition or alteration.

B. A kitchen/dining facility having a total Type I and Type II kitchen hood exhaust airflow rate greater than 5,000 cfm shall have one of the following:

- i. At least 50 percent of all replacement air is transfer air that would otherwise be exhausted; or
- ii. Demand ventilation system(s) on at least 75 percent of the exhaust air. Such systems shall:
 - a. Include controls necessary to modulate airflow in response to appliance operation and to maintain full capture and containment of

**TABLE 140.9-B
ALTERNATING CURRENT-OUTPUT UNINTERRUPTIBLE POWER SUPPLY MINIMUM AVERAGE EFFICIENCY**

	VOLTAGE AND FREQUENCY DEPENDENT	VOLTAGE INDEPENDENT	VOLTAGE AND FREQUENCY INDEPENDENT
$P < 350 \text{ W}$	$5.71 \times 10^{-5} \times P + 0.962$	$5.71 \times 10^{-5} \times P + 0.964$	$0.011 \times \ln(P) + 0.824$
$350 \text{ W} < P < 1,500 \text{ W}$	0.982	0.984	$0.011 \times \ln(P) + 0.824$
$1,500 \text{ W} < P < 10,000 \text{ W}$	$0.981 - E_{MOD}$	$0.980 - E_{MOD}$	$0.0145 \times \ln(P) + 0.800 - E_{MOD}$
$P > 10,000 \text{ W}$	0.970	0.940	$0.0058 \times \ln(P) + 0.886$

**TABLE 140.9-C
MAXIMUM NET EXHAUST FLOW RATE, CFM PER LINEAR FOOT OF HOOD LENGTH**

TYPE OF HOOD	LIGHT DUTY EQUIPMENT	MEDIUM DUTY EQUIPMENT	HEAVY DUTY EQUIPMENT	EXTRA HEAVY DUTY EQUIPMENT
Wall-mounted canopy	140	210	280	385
Single island	280	350	420	490
Double island	175	210	280	385
Eyebrow	175	175	Not allowed	Not allowed
Backshelf/passover	210	210	280	Not allowed

- smoke, effluent and combustion products during cooking and idle; and
- b. Include failsafe controls that result in full flow upon cooking sensor failure; and
- c. Include an adjustable timed override to allow occupants the ability to temporarily override the system to full flow; and
- d. Be capable of reducing exhaust and replacement air system airflow rates to the larger of:
 - (i) 50 percent of the total design exhaust and replacement air system airflow rates; or
 - (ii) The ventilation rate required as specified by Section 120.1(c)3.
- iii. Listed energy recovery devices with a sensible heat recovery effectiveness of not less than 40 percent on at least 50 percent of the total exhaust airflow; or
- iv. A minimum of 75 percent of makeup air volume that is:
 - a. Unheated or heated to no more than 60°F; and
 - b. Uncooled or cooled without the use of mechanical cooling.

Exception to Section 140.9(b)2B: Existing hoods not being replaced as part of an addition or alteration.

3. **Kitchen exhaust system acceptance.** Before an occupancy permit is granted for a commercial kitchen subject to Section 140.9(b), the following equipment and systems shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. A certificate of acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.11.

Exception to Section 140.9(b): healthcare facilities.

(c) Prescriptive requirements for laboratory and factory exhaust systems.

1. **Airflow reduction requirements.** For buildings with laboratory exhaust systems where the minimum circulation rate to comply with code or accreditation standards is 10 ACH or less, the design exhaust airflow shall be capable of reducing zone exhaust and makeup airflow rates to the regulated minimum circulation rate, or the minimum required to maintain pressurization requirements, whichever is larger. Variable exhaust and makeup airflow shall be coordinated to achieve the required space pressurization at varied levels of demand and fan system capacity.

Exception 1 to Section 140.9(c)1: Laboratory exhaust systems serving zones where constant volume is required by the authority having jurisdiction, facility environmental health & safety department or other applicable code.

Exception 2 to Section 140.9(c)1: New zones on an existing constant volume exhaust system.

2. **Exhaust System Transfer Air.** Conditioned supply air delivered to any space with mechanical exhaust shall comply with the requirements of Section 140.4(o).
3. **Fan System Power Consumption.** All newly installed fan exhaust systems serving a laboratory or factory greater than 10,000 cfm shall meet Subsection A and either B, C, or D:

A. System shall meet all discharge requirements in ANSI Z9.5-2012.

B. The exhaust fan system power shall not exceed 0.85 watts per cfm of exhaust air for systems with air filtration, scrubbers, or other air treatment devices. For all other exhaust fan systems the system power shall not exceed 0.65 watts per cfm of exhaust air. Exhaust fan system power equals the sum of the power of all fans in the exhaust system that are required to operate at normal occupied design conditions in order to exhaust air from the conditioned space to the outdoors. Exhaust air does not include entrained air, but does include all exhaust air from fume hoods, hazardous exhaust flows, or other manifolded exhaust streams.

Exception to Section 140.9(c)3B: Laboratory exhaust systems where applicable local, state, or federal exhaust treatment requirements specify installation of air treatment devices that cause more than 1 in. of water pressure drop.

C. The volume flow rate at the stack shall vary based on the measured 5-minute averaged wind speed and wind direction obtained from a calibrated local anemometer.

i. At least one sonic anemometer or at least two anemometers of other types shall be installed in a location that experiences similar wind conditions to the free stream environment above the exhaust stacks and be at a height that is outside the wake region of nearby structures.

ii. Look-up tables shall be used to define the required exhaust volume flow rate, as a function of at least eight wind speeds and eight wind directions, to maintain downwind concentrations below health and odor limits, as defined by the 2018 American Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices, for all contaminants, or as defined by applicable local, state, or federal jurisdictions, if more stringent.

iii. Wind speed/direction sensors shall be certified by the manufacturer to be accurate within plus or minus 40 fpm (0.2 m/s) and 5.0 degrees when measured at sea level and 25°C, factory calibrated, and certified by

the manufacturer to require calibration no more frequently than once every 5 years.

- iv. Upon detection of anemometer and/or signal failure, the system shall reset the exhaust volume flow rate to the value needed to maintain downwind concentrations below health and odor limits for all contaminants at worst-case wind conditions and shall report the fault to an Energy Management Control System or fault management application which automatically provides notification of the fault to a remote system provider. The EMCS or fault management system shall log the error and the time when it occurred. The system shall have logic that automatically checks for anemometer failure by the following means.

- a. If any anemometer has not been calibrated within the manufacturer's recommended calibration period, the anemometer has failed.
- b. During unoccupied periods the system compares the readings of all anemometers. If any anemometer is more than 30% above or below the average reading for a period of 4 hours, the anemometer has failed.
- c. Wind speed and wind direction readings shall be sampled at least 10 times per minute. If the difference between the maximum and minimum readings from the average of either the wind direction or the wind speed over a 1-minute period is less than 10% of the average value, the measurements shall be considered a signal failure.
- d. Other error signals sent by the anemometer.

- v. Before an occupancy permit is granted for a laboratory or process facility subject to Section 140.9(c)3C, the applicable equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7.16. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.16.

D. The volume flow rate at the stack shall vary based on the measured contaminant concentration in the exhaust plenum from a calibrated contaminant sensor installed within each exhaust plenum.

- i. A contaminant-event threshold shall be established based on maintaining downwind concentrations below health and odor limits for all chemicals at worst-case wind conditions, as defined by the 2018 Ameri-

can Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices, or as defined by applicable local, state, or federal jurisdictions, if more stringent.

- ii. At least two contaminant concentration sensors shall be Photo Ionization Detectors (PID) certified by the manufacturer to be accurate within plus or minus 5% when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 6 months.

- iii. Upon detection of sensor and/or signal failure, the system shall reset the exhaust volume flow rate to the value needed to maintain downwind concentrations below health and odor limits for all contaminants at worst-case wind conditions and shall report the fault to an Energy Management Control System or fault management application which automatically provides notification of the fault to a remote system provider. The system shall have logic that automatically checks for sensor failure by the following means.

- a. If any sensor has not been calibrated within the manufacturer's recommended calibration period, the sensor has failed.
- b. During unoccupied periods the system compares the readings of all sensors. If any sensor is more than 30% above or below the average reading for a period of 4 hours, the sensor has failed.

- iv. Before an occupancy permit is granted for a laboratory or process facility subject to Section 140.9(c)3D, the applicable equipment and systems shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7.16. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.16.

4. **Fume Hood Automatic Sash Closure.** Variable air volume laboratory fume hoods with vertical only sashes located in fume hood intensive laboratories, as described in Table 140.9-D, shall have an automatic sash closure system that complies with the following:

A. The automatic sash closure system shall be capable of the following:

- i. The automatic sash closure system shall have a dedicated zone presence sensor that detects people in the area near the fume

**TABLE 140.9-D
FUME HOOD INTENSIVE LABORATORIES**

Occupied Minimum Ventilation ACH	≤ 4	> 4 and ≤ 6	> 6 and ≤ 8	> 8 and ≤ 10	> 10 and ≤ 12	> 12 and ≤ 14
Hood Density (linear feet per 10,000 ft ³ of laboratory space)	≥ 6	≥ 8	≥ 10	≥ 12	≥ 14	≥ 16

hood sash and automatically closes the sash within 5 minutes of no detection.

- ii. The automatic sash closure system shall have controls to prevent the sash from automatic closing when a force of no more than 10 lbs is detected.
- iii. The automatic sash closure system shall be equipped with an obstruction sensor that prevents the sash from automatic closing with obstructions in the sash opening. Obstruction sensor shall be capable of sensing transparent materials such as laboratory glassware.
- iv. The automatic sash closure system shall be capable of being configured in a manual open mode where once the sash is closed, detection of people in the area near the fume hood by the zone presence sensor does not open the fume hood sash.

B. Fume Hood Automatic Sash Closure Acceptance. Before an occupancy permit is granted for the fume hoods subject to 140.9(c)4, the equipment and systems shall be certified as meeting the Acceptance Requirement for Code Compliance as specified by the Reference Nonresidential Appendix NA7. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements specified in NA7.17.

Exception to Section 140.9(c): healthcare facilities.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8 and 25943, *Public Resources Code*.

**SECTION 140.10
PRESCRIPTIVE REQUIREMENTS
FOR PHOTOVOLTAIC AND BATTERY
STORAGE SYSTEMS**

(a) **Photovoltaic requirements.** All newly constructed building types specified in Table 140.10-A, or mixed occupancy buildings where one or more of these building types constitute at least 80 percent of the floor area of the building, shall have a newly installed photovoltaic (PV) system meeting the minimum qualification requirements of Reference Joint Appendix JA11. The PV size in kW_{dc} shall be not less than the smaller of the PV system size determined by

Equation 140.10-A, or the total of all available solar access roof area (SARA) multiplied by 14 W/ft².

1. SARA includes the area of the building’s roof space capable of structurally supporting a PV system, and the area of all roof space on covered parking areas, carports and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2, Section 1511.2.
2. SARA does NOT include:
 - A. Any area that has less than 70 percent annual solar access. Annual solar access is determined by dividing the total annual solar insolation (accounting for shading obstructions) by the total annual solar insolation if the same areas were unshaded by those obstructions. For all roofs, all obstructions, including those that are external to the building, and obstructions that are part of the building design and elevation features may be considered for the annual solar access calculations.
 - B. Occupied roofs as specified by CBC Section 503.1.4.
 - C. Roof space that is otherwise not available due to compliance with other building code requirements if confirmed by the Executive Director.

**EQUATION 140.10-A
PHOTOVOLTAIC DIRECT CURRENT SIZE**

$$kW_{PVdc} = (CFA \times A) / 1000$$

where:

kW_{PVdc} = Size of the PV system in kW.

CFA = Conditioned floor area in square feet.

A = PV capacity factor specified in Table 140.10-A for the building type.

Where the building includes more than one of the space types listed in Table 140.10-A, the total PV system capacity for the building shall be determined by applying Equation 140.10-A to each of the listed space types and summing the capacities determined for each.

Exception 1 to Section 140.10(a): No PV system is required where the total of all available SARA is less than 3 percent of the conditioned floor area.

Exception 2 to Section 140.10(a): No PV system is required where the required PV system size is less than 4 kW_{dc}.

Exception 3 to Section 140.10(a): No PV system is required if the SARA contains less than 80 contiguous square feet.

Exception 4 to Section 140.10(a): Buildings with enforcement-authority-approved roof designs, where the enforcement authority determines it is not possible for the PV system, including panels, modules, components, supports and attachments to the roof structure, to meet ASCE 7-16, Chapter 7, Snow Loads.

Exception 5 to Section 140.10(a): Multitenant buildings in areas where a load-serving entity does not provide either a virtual net metering (VNEM) or community solar program.

(b) **Battery storage system requirements.** All buildings that are required by Section 140.10(a) to have a PV system shall also have a battery storage system meeting the minimum qualification requirements of Reference Joint Appendix JA12. The rated energy capacity and the rated power capacity shall be not less than the values determined by Equation 140.10-B and Equation 140.10-C. Where the building includes more than one of the space types listed in Table 140.10-B, the total battery system capacity for the building shall be determined by applying Equations 140.10-B and 140.10-C to each of the listed space types and summing the capacities determined for each space type and equation.

**EQUATION 140.10-B
BATTERY STORAGE RATED ENERGY CAPACITY**

$$kWh_{batt} = kW_{PVdc} \times B / D^{0.5}$$

where:

kWh_{batt} = Rated useable energy capacity of the battery storage system in kWh.

kW_{PVdc} = PV system capacity required by Section 140.10(a) in kWdc.

B = Battery energy capacity factor specified in Table 140.10-B for the building type.

D = Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system.

**EQUATION 140.10-C
BATTERY STORAGE RATED POWER CAPACITY**

$$kW_{batt} = kW_{PVdc} \times C$$

where:

kW_{batt} = Power capacity of the battery storage system in kWdc.

kW_{PVdc} = PV system capacity required by Section 140.10(a) in kWdc.

C = Battery power capacity factor specified in Table 140.10-B for the building type.

Exception 1 to Section 140.10(b): No battery storage system is required if the installed PV system size is less than 15 percent of the size determined by Equation 140.10-A.

Exception 2 to Section 140.10(b): No battery storage system is required in buildings with battery storage system requirements with less than 10 kWh rated capacity.

Exception 3 to Section 140.10(b): For multitenant buildings, the energy capacity and power capacity of the battery storage system shall be based on the tenant spaces with more than 5,000 square feet of conditioned floor area. For single-tenant buildings with less than 5,000 square feet of conditioned floor area, no battery storage system is required.

Exception 4 to Section 140.10(b): In Climate Zone 1, no battery storage system is required for offices, schools and warehouses.

**TABLE 140.10-A
PV CAPACITY FACTORS**

CLIMATE ZONE	FACTOR A—MINIMUM PV CAPACITY (W/ft ² of conditioned floor area)		
	1, 3, 5, 16	2, 4, 6–14	15
Grocery	2.62	2.91	3.53
High-Rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58

**TABLE 140.10-B
BATTERY STORAGE CAPACITY FACTORS**

Storage-to-PV Ratio	FACTOR B—ENERGY CAPACITY	FACTOR C—POWER CAPACITY
	Wh/W	W/W
Grocery	1.03	0.26
High-Rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8 and 25943, *Public Resources Code*.

SUBCHAPTER 6

NONRESIDENTIAL AND HOTEL/MOTEL OCCUPANCIES— ADDITIONS, ALTERATIONS AND REPAIRS

SECTION 141.0 ADDITIONS, ALTERATIONS AND REPAIRS TO EXISTING NONRESIDENTIAL AND HOTEL/ MOTEL BUILDINGS, TO EXISTING OUTDOOR LIGHTING, AND TO INTERNALLY AND EXTERNALLY ILLUMINATED SIGNS

- > Additions, alterations, and repairs to existing nonresidential and hotel/motel buildings, existing outdoor lighting for these occupancies, and internally and externally illuminated signs, shall meet the requirements specified in Sections 100.0 through 110.10, and 120.0 through 130.5 that are applicable to the building project, and either the performance compliance approach (energy budgets) in Section 141.0(a)2 (for additions) or 141.0(b) 3 (for alterations), or the prescriptive compliance approach in Section 141.0(a)1 (for additions) or 141.0(b)2 (for alterations), for the Climate Zone in which the building is located. Climate zones are shown in Figure 100.1-A.

- > Covered process requirements for additions, alterations and repairs to existing nonresidential and hotel/motel buildings are specified in Section 141.1.

Exception to Section 141.0: Alterations to healthcare facilities are not required to comply with this Section.

|| NOTES:

1. For alterations that change the occupancy classification of the building, the requirements specified in Section 141.0(b) apply to the occupancy after the alterations.
2. Relocation or moving of a relocatable public school building is not, by itself, considered an alteration for the purposes of Title 24, Part 6.
 - (a) **Additions.** Additions shall meet either Item 1 or 2 below.
 1. **Prescriptive approach.** The envelope and lighting of the addition, any newly installed space-conditioning system, electrical power distribution system, or water-heating system; any addition to an outdoor lighting system; and any new sign installed in conjunction with an indoor or outdoor addition shall meet the applicable requirements of Sections 110.0 through 120.7, 120.9 through 130.5 and 140.2 through 140.9.
 2. **Performance approach.**
 - A. The envelope and indoor lighting in the conditioned space of the addition, and any newly installed space-conditioning system, electrical power distribution system, or water-heating system, shall meet the applicable requirements of Sections 110.0 through 120.7, 120.9 through 130.5; and
 - B. Either:

- i. The addition alone shall comply with Section 140.1; or
- ii. Existing plus addition plus alteration. The standard design for existing plus addition, plus alteration energy use is the combination of the existing building's unaltered components to remain, existing building altered components that are the more efficient, in TDV energy, of either the existing conditions, or the requirements of Section 141.0(b)2, plus the proposed addition's energy use meeting the requirements of Section 140.1. The proposed design energy use is the combination of the existing building's unaltered components to remain and the altered component's energy features, plus the proposed energy features of the addition.

Exception 1 to Section 141.0(a): When heating, cooling or service water heating to an addition are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110.0 through 120.9 or Sections 140.4 through 140.5.

Exception 2 to Section 141.0(a): Where an existing system with electric reheat is expanded by adding variable air volume (VAV) boxes to serve an addition, total electric reheat capacity may be expanded so that the total capacity does not exceed 150 percent of the existing installed electric heating capacity in any one permit, and the system need not comply with Section 140.4(g). Additional electric reheat capacity in excess of 150 percent of the existing installed electric heating capacity may be added subject to the requirements of Section 140.4(g).

Exception 3 to Section 141.0(a): Duct sealing. When ducts are extended from an existing duct system to serve the addition, the existing duct system and the extended ducts shall meet the applicable requirements specified in Section 141.0(b)2D.

Exception 4 to Section 141.0(a): Additions that increase the area of the roof by 2,000 square feet or less are exempt from the requirements of Section 110.10.

Exception 5 to Section 141.0(a): A gas hot water boiler system with a total system input of at least 1 MMBtu/h but no more than 10 MMBtu/h added to an existing building is exempt from the requirements of Section 140.4(k)8.

Exception 6 to Section 141.0(a): A gas service water-heating system with a total system input of at least 1 MMBtu/h added to an existing building is exempt from the requirements of Section 140.5(c).

Exception 7 to Section 141.0(a): Section 140.4(a)2 shall not apply to new space-conditioning systems or components.

(b) **Alterations.** Alterations to components of existing nonresidential, hotel/motel, or relocatable public school buildings, including alterations made in conjunction with a change in building occupancy to a nonresidential, high-rise residential or hotel/motel occupancy.

1. **Mandatory requirements.** Altered components in a nonresidential or hotel/motel building shall meet the minimum requirements in this section.

A. **Roof/ceiling insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Section 141.0(b)2Bii.

B. **Wall insulation.** For the altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 4 below:

1. **Metal building.** A minimum of R-13 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.113.
2. **Metal framed.** A minimum of R-13 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.217.
3. **Wood framed and others.** A minimum of R-11 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.110.
4. **Spandrel panels and glass curtain walls.** A minimum of R-4, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.280.

Exception to Section 141.0(b)1B: Light and heavy mass walls.

C. **Floor insulation.** For the altered portion of raised floors that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. **Raised framed floors.** A minimum of R-11 insulation between framing members, or the area-weighted average *U*-factor of the floor assembly shall not exceed the *U*-factor of U-0.071.

2. **Raised mass floors in hotel/motel guest rooms.** A minimum of R-6 insulation, or the area-weighted average *U*-factor of the floor assembly shall not exceed the *U*-factor of U-0.111.

3. **Raised mass floors in other occupancies.** No minimum *U*-factor requirement.

D. **Fan energy index:** New fan systems serving an existing building shall meet the requirements of Section 120.10.

2. **Prescriptive approach.** The altered components of the envelope, or space conditioning, lighting, electrical power distribution and water heating systems, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.9 through 130.5.

Exception to Section 141.0(b)2: The requirements of Section 120.1(i) shall not apply to alterations of space-conditioning systems or components.

A. Fenestration alterations other than repair and those subject to Section 141.0(b)2 shall meet the requirements below:

- i. Vertical fenestration alterations shall meet the requirements in Table 141.0-A.
- ii. Added vertical fenestration shall meet the requirements of Table 140.3-B, C or D.
- iii. All altered or newly installed skylights shall meet the requirements of Table 140.3-B, C or D.

Exception 1 to Section 141.0(b)2Ai: In an alteration, where 150 square feet or less of the entire building's vertical fenestration is replaced, RSHGC and VT requirements of Table 141.0-A shall not apply.

Exception 2 to Section 141.0(b)2Aii: In an alteration, where 50 square feet or less of vertical fenestration is added, RSHGC and VT requirements of Table 140.3-B, C or D shall not apply.

Exception 3 to Section 141.0(b)2Aiii: In an alteration, where 50 square feet or less of skylight is added, SHGC and VT requirements of Table 140.3-B, C or D shall not apply.

NOTE: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs. In these cases, Section 141.0(c) requires that the replacement be at least equivalent to the original in performance.

**TABLE 141.0-A
ALTERED VERTICAL FENESTRATION MAXIMUM U-FACTOR AND MAXIMUM RSHGC**

CLIMATE ZONE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
U-factor	0.47	0.47	0.58	0.47	0.58	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
RSHGC	0.41	0.31	0.41	0.31	0.41	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.41
VT	See Table 140.3-B, C and D for all climate zones															

B. Existing roofs of a nonresidential or hotel/motel building being replaced, recovered or recoated, as defined in Section 100.1(b) and Title 24, Part 2, Chapter 2, shall meet the requirements of Section 110.8(i). When roofs with more than 50 percent of the roof area or more than 2,000 square feet of roof, whichever is less, are being altered the requirements of i and ii apply:

i. Roofing products shall comply with requirements in Section 140.3(a)1A.

Exception 1 to Section 141.0(b)2Bi: An aged solar reflectance less than 0.63 is allowed for low-sloped roofs provided the maximum roof/ceiling *U*-factor in Table 141.0-B is not exceeded.

Exception 2 to Section 141.0(b)2Bi: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

Exception 3 to Section 141.0(b)2Bi: Roof constructions with a weight of at least 25 lb/ft² are not required to meet the minimum requirements for solar reflectance, thermal emittance, or SRI.

ii. **Roof/ceiling insulation.** For low-sloped roofs, the area of the roof recover or roof replacement shall be insulated to the level specified in Table 141.0-C.

Exception 1 to Section 141.0(b)2Bii: Roof recovers with new R-10 insulation added above deck do not need to be insulated to the level specified in Table 141.0-C.

Exception 2 to Section 141.0(b)2Bii: When existing mechanical equipment located on the roof will not be disconnected and lifted, insulation added is the greater of R-10 or the maximum installed thickness that will allow the distance from the height of the roof membrane surface to the top of the base flashing to remain in accordance with the manufacturer’s instructions.

Exception 3 to Section 141.0(b)2Bii: At the drains and other low points, tapered insulation with a thermal resistance less than that prescribed in Table 141.0-C may be used, provided that insulation thickness is increased at the high points of the roof so that the average thermal resistance equals or exceeds the value specified in Table 141.0-C.

Exception 4 to Section 141.0(b)2Bii: The area of the roof recoat is not required to be insulated.

C. **New or replacement space-conditioning systems or components** other than new or replacement space-conditioning system ducts shall meet the requirements of Section 140.4 applicable to the systems or components being altered. Additional fan power allowances are available when determining the fan power budget (Fan kW_{budget}) as specified in Table 141.0-D. These values can be added to the fan power allowance values in Table 140.4-A and Table 140.4-B.

Exception 1 to Section 141.0(b)2C: Section 140.4(a)2 shall not apply to new or replacement space-conditioning systems or components.

**TABLE 141.0-B
ROOF/CEILING INSULATION TRADEOFF FOR LOW-SLOPED AGED SOLAR REFLECTANCE**

NONRESIDENTIAL		
Aged Solar Reflectance	Climate Zones 6, 7 and 8 <i>U</i> -factor	All Other Climate Zones <i>U</i> -factor
0.62–0.60	0.043	0.035
0.59–0.55	0.041	0.034
0.54–0.50	0.038	0.031
0.49–0.45	0.034	0.029
0.44–0.40	0.032	0.028
0.39–0.35	0.029	0.026
0.34–0.30	0.028	0.025
0.29–0.25	0.026	0.024

**TABLE 141.0-C
INSULATION REQUIREMENTS FOR ROOF ALTERATIONS**

Climate Zone	Continuous Insulation <i>R</i> -value	<i>U</i> -factor
1–5, 9–16	R-23	0.037, with at least R-10 above deck
6–8	R-17	0.047, with at least R-10 above deck

**TABLE 141.0-D
ADDITIONAL FAN POWER ALLOWANCES**

AIRFLOW	MULTI-ZONE VAV SYSTEMS ¹ ≤5,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >5,000 and ≤10,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >10,000 cfm	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 and ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm
Supply Fan System Additional Allowance	0.135	0.114	0.105	0.139	0.12	0.107
Supply Fan System Additional Allowance in Unit with Adapter Curb	0.033	0.033	0.043	0.000	0.000	0.000
Exhaust/Relief/Return/Transfer Fan System Additional Allowance	0.07	0.061	0.054	0.07	0.062	0.055
Exhaust/Relief/Return/Transfer Fan System Additional Allowance in Unit with Adapter Curb	0.016	0.017	0.022	0.000	0.000	0.000

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) for the definition of a multi-zone VAV system.

Exception 2 to Section 141.0(b)2C: Subsection (b)2C does not apply to replacement of electric reheat of equivalent or lower capacity electric resistance space heaters, when natural gas is not available.

Exception 3 to Section 141.0(b)2C. Section 140.4(n) is not applicable to new or replacement space-conditioning systems.

Exception 4 to Section 141.0(b)2C: Section 140.4(e) is applicable to systems, other than single package air-cooled commercial unitary air conditioners and heat pumps, with cooling capacity less than 54,000 Btu/h.

Exception 5 to Section 141.0(b)2C: A new or replacement gas hot water boiler system with a total system input of at least 1 MMBtu/h but no more than 10 MMBtu/h need not comply with the requirements of Section 140.4(k)8.

D. Altered duct systems. New or replacement space-conditioning system ducts installed to serve an existing building shall meet the requirements of Section 120.4 (a) through (f) and meet i, ii or iii below:

- i. Entirely new or complete replacement duct systems installed as part of an alteration shall be leakage tested in accordance with Section 120.4(g). This applies to replacement duct systems installed as part of an alteration that are constructed of at least 75 percent new duct material. Up to 25 percent of that alteration may consist of reused parts from the building’s existing duct system (including registers, grilles, boots, air handlers, coils, plenums and ducts) if the reused parts are accessible and can be sealed to prevent leakage.
- ii. If the new ducts are an extension of an existing duct system and the combined new and existing duct system meets the criteria in Subsections 1, 2, 3 and 4 below, the duct system shall be sealed to a leakage rate not to exceed 15 percent of the nominal air handler airflow rate as confirmed through HERS field verification and diagnostic

testing, in accordance with the applicable procedures in Reference Nonresidential Appendix NA7.5.3:

- 1. The duct system does not serve a healthcare facility;
- 2. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system;
- 3. The space-conditioning system serves less than 5,000 square feet of conditioned floor area; and
- 4. The combined surface area of the ducts located outdoors or in unconditioned space is more than 25 percent of the total surface area of the entire duct system.

Exception 1 to Section 141.0(b)2Dii: When it is not possible to achieve the duct leakage criteria in Section 141.0(b)2Dii, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test performed by a certified HERS Rater utilizing the methods specified in Reference Nonresidential Appendix NA2.1.4.2.2.

Exception 2 to Section 141.0(b)2Dii: Duct sealing. Existing duct systems that are extended, which are constructed insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2Dii.

- iii. If new ducts installed as part of an alteration are exempt from leakage testing according to Section 141.0(b)2Di or 141.0(b)2Dii, then the new ducts shall meet the duct leakage testing requirements of CMC Section 603.9.2.

E. Altered space-conditioning systems. When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:

- i. For all altered units where the existing thermostat does not comply with the requirements for

demand responsive controls specified in Section 110.12, the existing thermostat shall be replaced with a demand responsive thermostat that complies with Section 110.12. All newly installed space-conditioning systems requiring a thermostat shall be equipped with a demand responsive thermostat that complies with Section 110.12; and

- ii. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed in accordance with Section 141.0(b)2Dii.

Exception 1 to Section 141.0(b)2Eii: Duct sealing. Buildings altered so that the duct system no longer meets the criteria of Section 141.0(b)2Dii.

Exception 2 to Section 141.0(b)2Eii: Duct sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in Reference Nonresidential Appendix NA2.

Exception 3 to Section 141.0(b)2Eii: Duct sealing. Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 141.0(b)2Eii.

- F. Spaces with lighting systems installed for the first time shall meet the requirements of Sections 110.9, 130.0, 130.1, 130.2, 130.4, 140.3(c), 140.6 and 140.7.
- G. When the requirements of Section 130.1(d) are triggered by the addition of skylights to an existing building and the lighting system is not recircuited, the daylighting control need not meet the multilevel requirements in Section 130.1(d).
- H. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 130.3 and 140.8.
- I. **Altered indoor lighting systems.** Alterations to indoor lighting systems that include 10% or more of the luminaires serving an enclosed space shall meet the requirements of i, ii, or iii below:

- i. The alteration shall comply with the indoor lighting power requirements specified in Section 140.6 and the lighting control requirements specified in Table 141.0-F;
- ii. The alteration shall not exceed 80% of the indoor lighting power requirements specified in Section 140.6, and shall comply with the lighting control requirements specified in Table 141.0-F; or
- iii. The alteration shall be a one-for-one luminaire alteration within a building or tenant space of 5,000 square feet or less, the total wattage of the altered luminaires shall be at least 40% lower compared to their total pre-alteration wattage, and the alteration shall comply with

the lighting control requirements specified in Table 141.0-F.

Alterations to indoor lighting systems shall not prevent the operation of existing, unaltered controls, and shall not alter controls to remove functions specified in Section 130.1.

Alterations to lighting wiring are considered alterations to the lighting system. Alterations to indoor lighting systems are not required to separate existing general, floor, wall, display, or decorative lighting on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of Section 130.1(a)3 and 130.1(c)1D.

Exception 1 to Section 141.0(b)2I. Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in Section 140.6(a)3.

Exception 2 to Section 141.0(b)2I. Any enclosed space with only one luminaire.

Exception 3 to Section 141.0(b)2I. Any alteration that would directly cause the disturbance of asbestos, unless the alteration is made in conjunction with asbestos abatement.

Exception 4 to Section 141.0(b)2I. Acceptance testing requirements of Section 130.4 are not required for alterations where lighting controls are added to control 20 or fewer luminaires.

Exception 5 to Section 141.0(b)2I. Any alteration limited to adding lighting controls or replacing lamps, ballasts, or drivers.

Exception 6 to Section 141.0(b)2I. One-for-one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

J. **Reserved.**

K. **Reserved.**

- L. Alterations to existing outdoor lighting systems in a lighting application listed in Table 140.7-A or 140.7-B shall meet the applicable requirements of Sections 130.0, 130.2(b) and 130.4, and:

- i. In alterations that increase the connected lighting load, the added or altered luminaires shall meet the applicable requirements of Section 130.2(c) and the requirements of Section 140.7 for general hardscape lighting or for the specific lighting applications containing the alterations; and
- ii. In alterations that do not increase the connected lighting load, where 10 percent or more of the existing luminaires are replaced in a general hardscape or a specific lighting application, the alterations shall meet the following requirements:
 - a. In parking lots and outdoor sales lots where the bottom of the luminaire is mounted 24

feet or less above the ground, the replacement luminaires shall comply with Section 130.2(c)1 AND Section 130.2(c)3;

- b. For parking lots and outdoor sales lots where the bottom of the luminaire is mounted greater than 24 feet above the ground and for all other lighting applications, the replacement luminaires shall comply with Section 130.2(c)1 and either comply with Section 130.2(c)2 or be controlled by lighting control systems, including motion sensors, that automatically reduce lighting power by at least 40 percent in response to the area being vacated of occupants; and

Exception to Section 141.0(b)2Lii. Alterations where fewer than five existing luminaires are replaced.

- iii. In alterations that do not increase the connected lighting load, where 50 percent or more of the existing luminaires are replaced in general hardscape or a specific application, the replacement luminaires shall meet the requirements of Subsection ii above and the requirements of Section 140.7 for general hardscape lighting or specific lighting applications containing the alterations.

Exception 1 to Section 141.0(b)2Liii. Alterations where the replacement luminaires have at least 40 percent lower power consumption compared to the original luminaires are not required to comply with the lighting power allowances of Section 140.7.

Exception 2 to Section 141.0(b)2Liii. Alterations where fewer than five existing luminaires are replaced.

Exception to Section 141.0(b)2L. Acceptance testing requirements of Section 130.4 are not required for alterations where controls are added to 20 or fewer luminaires.

- M. Alterations to existing internally and externally illuminated signs that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the sign to a different location on the same site or on a different site shall meet the requirements of Section 140.8.

Exception to Section 141.0(b)2M. Replacement of parts of an existing sign, including replacing lamps, the sign face or ballasts, that do not require rewiring or that are done at a time other than when the sign is relocated, is not an alteration subject to the requirements of Section 141.0(b)2M.

- N. Service water-heating systems shall meet the requirements of Sections 140.5(a)2 and b, except for the solar water heating requirements.

- O. A building shell for which interior walls or ceilings are installed for the first time shall meet the requirements of Section 140.3(c).

- P. **Electrical power distribution systems.** Alterations to electrical power distribution systems shall meet the applicable requirements of Section 130.5 as follows:

- i. Service electrical metering. New or replacement electrical service equipment shall meet the requirements of Section 130.5(a) applicable to the electrical power distribution system altered.

- ii. Separation of electrical circuits for electrical energy monitoring. For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Section 130.5(b).

- iii. Voltage drop. Alterations of feeders and branch circuits where the alteration includes addition, modification, or replacement of both feeders and branch circuits, the altered circuits shall meet the requirements of Section 130.5(c).

Exception to Section 141.0(b)2Piii: Voltage drop permitted by *California Electrical Code* Sections 647.4, 695.6 and 695.7.

- iv. Circuit controls for 120-volt receptacles and controlled receptacles. For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Sections 130.5(d) and 130.5(e).

- Q. Existing building envelope wall where 25 percent or more of the wall area is being altered must comply with Section 140.3(a)9. Where the building is tested in accordance with the procedures for whole building air leakage in NA2.4 and the tested leakage rate exceeds 0.4 cfm/ft² of building shell at 75 pascals, a visual inspection and diagnostic evaluation shall be done in accordance with NA2.4.7 and all observed leaks shall be sealed where such sealing can be made without destruction of existing building components.

Exception to Section 141.0(b)2Q: Healthcare facilities.

- R. **Exterior doors.** Alterations that add exterior door area shall meet the *U*-factor requirements of Section 140.3(a)7.

3. Performance approach.

- A. The altered envelope, space-conditioning system, lighting and water heating components, and any newly installed equipment serving the alteration, shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 120.0 through 120.6, and Sections 120.8 through 130.5.

Exception 1 to Section 141.0(b)(3)A Window films. Applied window films installed as part of an alteration complies with the *U*-factor, RSHGC and VT requirements of Table 141.0-E.

Exception 2 to Section 141.0(b)2: The requirements of Section 120.2(i) shall not apply to alterations of space-conditioning systems or components.

- B. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements of Section 141.0(b)2. For components not being altered, the standard design shall be based on the unaltered existing conditions such that the standard and proposed designs for these components are identical.
- C. When the third party verification option is specified, all components proposed for alteration, for which the additional credit is taken, must be verified. The Executive Director shall determine the qualifications required by the third party inspector.
- D. The proposed design shall be based on the actual values of the altered components.

Notes to Section 141.0(b)3:

- 1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the energy budget and must therefore meet the requirements of Section 141.0(b)3.
- 2. The standard design assumes the same geometry and orientation as the proposed design.

- 3. The “existing efficiency level” modeling rules, including situations where nameplate data is not available, are described in the *Nonresidential ACM Reference Manual*.

Exception 1 to Section 141.0(b): When heating, cooling or service water heating for an alteration are provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110.0 through 120.9 and Section 140.4 or 140.5.

Exception 2 to Section 141.0(b): When existing heating, cooling or service water heating systems or components are moved within a building, the existing systems or components need not comply with Sections 110.0 through 120.9 and Section 140.4 or 140.5.

Exception 3 to Section 141.0(b): Where an existing system with electric reheat is expanded when adding variable air volume (VAV) boxes to serve an alteration, total electric reheat capacity may be expanded not to exceed 20 percent of the existing installed electric capacity in any one permit and the system need not comply with Section 140.4(g). Additional electric reheat capacity in excess of 20 percent may be added subject to the requirements of Section 140.4(g).

Exception 4 to Section 141.0(b): The requirements of Section 120.2(i) shall not apply to alterations of space-conditioning systems or components.

**TABLE 141.0-E
THE STANDARD DESIGN FOR AN ALTERED COMPONENT**

ALTERED COMPONENT	STANDARD DESIGN WITHOUT THIRD-PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON	STANDARD DESIGN WITH THIRD-PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON
Roof/ceiling insulation, wall insulation, and floor/soffit insulation	The requirements of Section 141.0(b)1 and 141.0(b)2Bii.	
Fenestration The allowed glass area shall be the smaller of a. or b. below: a. The proposed glass area: or b. The larger of: 1. The existing glass area that remains; or 2. The area allowed in Section 140.3(a)5A.	The <i>U</i> -factor and RSHGC requirements of Table 141.0-A.	The existing <i>U</i> -factor and RSHGC levels.
Space-conditioning system equipment and ducts	The requirements of Section 141.0(b)2C, 141.0(b)2Di or 141.0(b)2Dii, and Section 141.0(b)2E.	
Window film	The <i>U</i> -factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Tables 110.6-A and 110.6-B.
Service water heating systems	The requirements of Section 140.5 without solar water heating requirements.	
Roofing products	The requirements of Section 141.0(b)2B.	
Lighting system	The requirements of Sections 141.0(b)2F through 141.0(b)2K.	
All other measures	The proposed efficiency levels.	

TABLE 141.0-F
CONTROL REQUIREMENTS FOR INDOOR LIGHTING SYSTEM ALTERATIONS

CONTROL SPECIFICATIONS		PROJECTS COMPLYING WITH SECTION 141.0(B)2li	PROJECTS COMPLYING WITH SECTION 141.0(B)2lii OR 141.0(B)2liii
Manual Area Controls	130.1(a)1	Required	Required
	130.1(a)2	Required	Required
	130.1(a)3	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multi-Level Controls	130.1(b)	Required	Not Required
Automatic Shut Off Controls	130.1(c)1	Required; 130.1(c)1D only required for new or completely replaced circuits	Required; 130.1(c)1D only required for new or completely replaced circuits
	130.1(c)2	Required	Required
	130.1(c)3	Required	Required
	130.1(c)4	Required	Required
	130.1(c)5	Required	Required
	130.1(c)6	Required	Required; except for 130.1(c)6D
	130.1(c)7	Required	Required
	130.1(c)8	Required	Required
Daylighting Controls	130.1(d)	Required	Not Required
Demand Responsive Controls	110.12(a) and 110.12(c)	Required	Not Required

(c) **Repairs.** Repairs shall not increase the preexisting energy consumption of the repaired component, system or equipment.

(d) **Alternate method of compliance.** Any addition, alteration or repair may comply with the requirements of Title 24, Part 6 by meeting the applicable requirements for the entire building.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, 25910, and 25943, *Public Resources Code*.

**SECTION 141.1
REQUIREMENTS FOR COVERED
PROCESSES IN ADDITIONS, ALTERATIONS
TO EXISTING NONRESIDENTIAL AND
HOTEL/MOTEL BUILDINGS**

Covered processes in additions or alterations to existing buildings that will be nonresidential and hotel/motel occupancies shall comply with the applicable Subsections of Section 120.6 and 140.9.

(a) **Lab and Process Facility Exhaust Systems.** All newly installed fan systems for a laboratory or process facility exhaust system greater than 10,000 cfm shall meet the requirements of Section 140.9(c).

(b) **Computer Rooms.** All newly installed computer room cooling systems and uninterruptible power supply systems in additions/alterations shall meet the requirements of Sections

120.6(j), 140.9(a)2 and 140.9(a)4 and comply with Item 1 below.

1. **Economizers.** Each individual cooling system primarily serving computer rooms in an existing building shall include either:

- A. An integrated air economizer capable of partial cooling when additional mechanical cooling is required and capable of providing 100 percent of the expected system cooling load up to 80°F room supply air temperature at outside air temperatures of 55°F dry-bulb and below or 50°F wet-bulb and below, and be equipped with a fault detection and diagnostic system as specified by Section 120.2(i); or
- B. An integrated water economizer capable of partial cooling when additional mechanical cooling is required and capable of providing 100 percent of the expected system cooling load up to 80°F room supply air temperature at outside air temperatures of 40°F dry-bulb and below or 35°F wet-bulb and below; or

Exception 1 to Section 141.1(b)1: Individual computer rooms with an ITE design load under 5 tons (18 kW) in a building that does not have any economizers.

Exception 2 to Section 141.1(b)1: New cooling systems serving an existing computer room in an existing building with an ITE design load up to a total of 50 tons (176 kW).

Exception 3 to Section 141.1(b)1: New cooling systems serving a new computer room in an existing building with an ITE design load up to a total of 20 tons (70 kW).

(c) Controlled Environment Horticulture Spaces.

1. Indoor growing, space-conditioning systems and dehumidification. All newly installed heating, ventilation, air conditioning systems or dehumidification systems in buildings with indoor growing shall meet the applicable requirements of Section 120.6(h)1.
2. Greenhouses, building envelope and space-conditioning systems. A greenhouse being converted to a conditioned greenhouse or additions to a conditioned greenhouse shall meet the requirements of Sections 120.6(h)4 and 120.6(h)5.
3. Indoor growing and greenhouses, horticultural lighting. When alterations to horticultural lighting systems increase lighting wattage or include adding, replacing or altering 10 percent or more of the horticultural luminaires serving an enclosed space, the newly installed, replaced or altered lighting shall meet the requirements of Section 120.6(h)2 for indoor growing or Section 120.6(h)6 for greenhouses.

Exception to Section 141.1(c)3: Any alteration limited to adding lighting controls or replacing lamps, ballasts or drivers.

NOTE: For alterations that change the occupancy classification of the building, the requirements of Section 141.1 apply to the occupancy that will exist after the alterations.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8, and 25943, *Public Resources Code*.

SUBCHAPTER 7

SINGLE-FAMILY RESIDENTIAL BUILDINGS— MANDATORY FEATURES AND DEVICES

SECTION 150.0 MANDATORY FEATURES AND DEVICES

Single-family residential buildings shall comply with the applicable requirements of Sections 150(a) through 150.0(v).

NOTE: The requirements of Sections 150.0(a) through 150.0(r) apply to newly constructed buildings. Sections 150.2(a) and 150.2(b) specify which requirements of Sections 150.0(a) through 150.0(r) also apply to additions or alterations.

(a) **Roof deck, ceiling and rafter roof insulation.** The opaque portions of roof decks separating attic spaces from ambient air, and ceilings or rafter roofs separating conditioned spaces from unconditioned spaces or ambient air, shall meet the requirements of Items 1 through 4 below:

1. In Climate Zones 4 and 8 through 16, roof decks in newly constructed attic systems shall be insulated to achieve an area-weighted average *U*-factor not exceeding U-0.184.

Exception to Section 150.0(a)1:

- i. The space-conditioning system air handler and ducts are located entirely in conditioned space below the ceiling separating the occupiable space from the attic; or
 - ii. The space-conditioning system air handler is located in unconditioned space and has 12 linear feet or less of supply duct, including the length of the air handler and the plenum, located in unconditioned space, with all other portions of the supply ducts located in conditioned space below the ceiling separating the occupiable space from the attic.
2. Ceilings and rafter roofs shall be insulated to achieve an area-weighted average *U*-factor not exceeding U-0.043 or shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-22 or greater for the insulation alone. For vented attics, the mandatory insulation shall be installed at the ceiling level; for unvented attics, the mandatory insulation shall be placed at either ceiling or roof level; and

Exception to Section 150.0(a)2: Ceilings and rafter roofs in an alteration shall be insulated to achieve an area-weighted average *U*-factor not exceeding 0.054 or shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-19 or greater.

3. Attic access doors shall have permanently attached insulation using adhesive or mechanical fasteners. The attic access shall be gasketed to prevent air leakage; and
4. Insulation shall be installed in direct contact with a roof or ceiling which is sealed to limit infiltration and

exfiltration as specified in Section 110.7, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling.

(b) **Loose-fill insulation.** When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled *R*-value.

(c) **Wall insulation.** Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the following requirements:

1. 2 × 4 inch framing shall have an overall assembly *U*-factor not exceeding U-0.102.

Exception to Section 150.0(c)1: Existing walls already insulated to a *U*-factor not exceeding U-0.110 or already insulated between framing members with insulation having an installed thermal resistance of R-11 or greater.

2. 2 × 6 inch or greater framing shall have an overall assembly *U*-factor not exceeding U-0.071.
3. Opaque nonframed assemblies shall have an overall assembly *U*-factor not exceeding U-0.102.
4. Bay or bow window roofs and floors shall be insulated to meet the wall insulation requirements of Table 150.1-A.
5. Masonry walls shall be insulated to meet the wall insulation requirements of Table 150.1-A.
6. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing wall insulation with an *R*-value of 13 in 2x4 assemblies, and 20 in 2x6 assemblies.

(d) **Raised-floor insulation.** Raised floors separating conditioned space from unconditioned space or ambient air shall have an overall assembly *U*-factor not exceeding U-0.037. In a wood framed assembly, compliance with the *U*-factor may be demonstrated by installing insulation with an *R*-value of 19 or greater.

Exception to Section 150.0(d): A building with a controlled ventilation or unvented crawlspace may omit raised floor insulation if all of the following are met:

- i. The foundation walls are insulated to meet the wall insulation minimums as shown in Table 150.1-A; and
- ii. A Class I or Class II vapor retarder is placed over the entire floor of the crawl space; and
- iii. Vents between the crawlspace and outside air are fitted with automatically operated louvers that are temperature actuated; and
- iv. The requirements in Reference Residential Appendix RA4.5.1.

(e) **Installation of fireplaces, decorative gas appliances and gas logs.** If a masonry or factory-built fireplace is installed, it shall comply with Section 110.5, Section 4.503 of Part 11, and shall have the following:

1. Closable metal or glass doors covering the entire opening of the firebox; and
2. A combustion air intake to draw air from the outside of the building, which is at least 6 square inches in area and is equipped with a readily accessible, operable and tight-fitting damper or combustion-air control device; and

Exception to Section 150.0(e)2: An outside combustion-air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.

3. A flue damper with a readily accessible control.

Exception to Section 150.0(e)3: When a gas log, log lighter or decorative gas appliance is installed in a fireplace, the flue damper shall be blocked open if required by the CMC or the manufacturer’s installation instructions.

(f) **Slab edge insulation.** Material used for slab edge insulation shall meet the following minimum specifications:

1. Water absorption rate for the insulation material alone without facings no greater than 0.3 percent when tested in accordance with Test Method A – 24-Hour-Immersion of ASTM C272.
2. Water vapor permeance no greater than 2.0 perm/inch when tested in accordance with ASTM E96.
3. Concrete slab perimeter insulation shall be protected from physical damage and ultraviolet light deterioration.
4. Insulation for a heated slab floor shall meet the requirements of Section 110.8(g).

(g) **Vapor retarder.**

1. In Climate Zones 1–16, the earth floor of unvented crawl space shall be covered with a Class I or Class II vapor retarder. This requirement shall also apply to controlled ventilation crawl space for buildings complying with the Exception to Section 150.0(d).
2. In Climate Zones 14 and 16, a Class I or Class II vapor retarder shall be installed on the conditioned space side of all insulation in all exterior walls, vented attics and unvented attics with air-permeable insulation.

(h) **Space-conditioning equipment.**

1. Building cooling and heating loads. Building heating and cooling loads shall be determined using a method based on any one of the following:
 - A. The ASHRAE Handbook, Equipment Volume, Applications Volume and Fundamentals Volume; or
 - B. The SMACNA Residential Comfort System Installation Standards Manual; or
 - C. The ACCA Manual J.

The cooling and heating loads are two of the criteria that shall be used for equipment sizing and selection.

Note: Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the CBC. The furnace output capacity and other specifications are published in the Commission’s directory of certified equipment or other directories approved by the Commission.

2. **Design conditions.** For the purpose of sizing the space-conditioning (HVAC) system, the indoor design temperatures shall be 68°F for heating and 75°F for cooling. Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. The outdoor design temperatures for heating shall be no lower than the Heating Winter Median of Extremes values. The outdoor design temperatures for cooling shall be no greater than the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

3. **Outdoor condensing units.**

A. **Clearances.** Installed air conditioner and heat pump outdoor condensing units shall have a clearance of at least five (5) feet (1.5 meters) from the outlet of any dryer vent.

B. **Liquid line drier.** Installed air conditioner and heat pump systems shall be equipped with liquid line filter driers if required, as specified by manufacturer’s instructions.

4. **Central forced-air heating furnaces.**

A. **Temperature rise.** Central forced-air heating furnace installations shall be configured to operate in conformance with the furnace manufacturer’s maximum inlet-to-outlet temperature rise specifications.

(i) **Thermostats.** All heating or cooling systems, including heat pumps, not controlled by a central energy management control system (EMCS) shall have a setback thermostat, as specified in Section 110.2(c).

(j) **Insulation for piping and tanks.**

1. **Water piping, solar water-heating system piping, and space-conditioning system line insulation thickness and conductivity.** Piping shall be insulated as follows:

A. All domestic hot water piping shall be insulated as specified in Section 609.11 of the *California Plumbing Code*.

B. Piping for space-conditioning systems, solar water-heating system collector loop, and distribution piping for steam and hydronic heating system shall meet the requirements of Section 120.3(c).

Exception 1 to Section 150.0(j)1: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 2 to Section 150.0(j)1: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the

metal framing. Insulation shall butt securely against all framing members.

Exception 3 to Section 150.0(j)1: Piping installed in interior or exterior walls shall not be required to have pipe insulation if all of the requirements are met for compliance with quality insulation installation (QII) as specified in the Reference Residential Appendix RA3.5.

Exception 4 to Section 150.0(j)1: Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawlspace insulation, or 4 inches of attic insulation shall not be required to have pipe insulation.

2. **Insulation protection.** Pipe insulation shall meet the insulation protection requirements of Section 120.3(b).

(k) **Residential lighting.**

1. **Luminaire requirements.**

A. **Luminaire efficacy.** All installed luminaires shall meet the requirements in Table 150.0-A.

Exception 1 to Section 150.0(k)1A: Integrated device lighting. Lighting integral to exhaust fans, kitchen range hoods, bath vanity mirrors and garage door openers.

Exception 2 to Section 150.0(k)1A: Navigation lighting such as night lights, step lights, and path lights less than 5 watts.

Exception 3 to Section 150.0(k)1A: Cabinet lighting. Lighting internal to drawers, cabinetry and linen closets with an efficacy of 45 lumens per watt or greater.

B. **Screw-based luminaires.** Screw-based luminaires shall contain lamps that comply with Reference Joint Appendix JA8.

C. **Recessed downlight luminaires in ceilings.** Luminaires recessed into ceilings shall meet all of the following requirements:

- i. Shall not contain screw base lamp sockets; and
- ii. Have a label that certifies the luminaire is airtight with air leakage less than 2.0 cfm at 75 Pascals when tested in accordance with ASTM E283. An exhaust fan housing with integral light shall not be required to be certified airtight; and
- iii. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk, or be installed per manufacturer’s instructions to maintain airtightness between the luminaire housing and ceiling; and
- iv. Meet the clearance and installation requirements of *California Electrical Code* Section 410.116 for recessed luminaires.

Exception to Sections 150.0(k)1Cii and iii: Recessed luminaires marked for use in fire-rated installations extruded into ceiling space and

recessed luminaires installed in noninsulated ceilings.

D. **Light sources in enclosed or recessed luminaires.** Lamps and other separable light sources that are not compliant with the JA8 elevated temperature requirements, including marking requirements, shall not be installed in enclosed or recessed luminaires.

E. **Blank electrical boxes.** The number of electrical boxes that are more than 5 feet above the finished floor and do not contain a luminaire or other device shall be no greater than the number of bedrooms. These electrical boxes must be served by a dimmer, vacancy sensor control, low voltage wiring or fan speed control.

2. **Indoor lighting controls.**

A. Lighting shall have readily accessible wall-mounted controls that allow the lighting to be manually turned ON and OFF.

Exception to Section 150.0(k)2A: Ceiling fans may provide control of integrated lighting via a remote control.

B. No controls shall bypass a dimmer, occupant sensor or vacancy sensor function where that dimmer or sensor has been installed to comply with Section 150.0(k).

C. Lighting controls shall comply with the applicable requirements of Section 110.9.

D. An energy management control system (EMCS) or a multiscene programmable control may be used to comply with dimming, occupancy and lighting control requirements in Section 150.0(k)2 if it provides the functionality of the specified controls in accordance with Section 110.9, and the physical controls specified in Section 150.0(k)2A.

E. **Automatic-off controls.**

- i. In bathrooms, garages, laundry rooms, utility rooms and walk-in closets, at least one installed luminaire shall be controlled by an occupancy or vacancy sensor providing automatic-off functionality.
- ii. For lighting internal to drawers and cabinetry with opaque fronts or doors, controls that turn the light off when the drawer or door is closed shall be provided.

F. **Dimming controls.** Lighting in habitable spaces, including but not limited to living rooms, dining rooms, kitchens and bedrooms, shall have readily accessible wall-mounted dimming controls that allow the lighting to be manually adjusted up and down. Forward phase cut dimmers controlling LED light sources in these spaces shall comply with NEMA SSL 7A.

Exception 1 to Section 150.0(k)2F: Ceiling fans may provide control of integrated lighting via a remote control.

Exception 2 to Section 150.0(k)2F: Luminaires connected to a circuit with controlled lighting power less

than 20 watts or controlled by an occupancy or vacancy sensor providing automatic-off functionality.

Exception 3 to Section 150.0(k)2F: Navigation lighting such as night lights, step lights, and path lights less than 5 watts, and lighting internal to drawers and cabinetry with opaque fronts or doors or with automatic-off controls.

G. Independent controls. Integrated lighting of exhaust fans shall be controlled independently from the fans. The following shall be controlled separately from ceiling-installed lighting such that one can be turned on without turning on the other:

- i. Undercabinet lighting.
- ii. Undershelf lighting.
- iii. Interior lighting of display cabinets.
- iv. Switched outlets.

3. **Residential outdoor lighting.** In addition to meeting the requirements of Section 150.0(k)1A, luminaires providing residential outdoor lighting shall meet the following requirements, as applicable:

A. For single-family residential buildings, outdoor lighting permanently mounted to a residential building or to other buildings on the same lot shall meet the requirement in Item i and the requirements in either Item ii or Item iii:

- i. Controlled by a manual ON and OFF control switch that permits the automatic actions of items ii or iii below; and
- ii. Controlled by a photocell and either a motion sensor or an automatic time switch control; or
- iii. Controlled by an astronomical time clock control.

Controls that override to ON shall not be allowed unless the override automatically returns the automatic control to its normal operation within 6 hours. An energy management control system that provides the specified lighting control functionality and complies with all requirements applicable to the specified controls may be used to meet these requirements.

4. **Internally illuminated address signs.** Internally illuminated address signs shall either:

- A. Comply with Section 140.8; or
- B. Consume no more than 5 watts of power.

5. **Residential garages for eight or more vehicles.** Lighting for residential parking garages for eight or more vehicles shall comply with the applicable requirements for nonresidential garages in Sections 110.9, 130.0, 130.1, 130.4, 140.6 and 141.0.

(l) **Reserved.**

(m) **Air-distribution and ventilation system ducts, plenums and fans.**

1. **CMC compliance.**

A. All air-distribution system ducts and plenums, including but not limited to, mechanical closets and air-handler boxes, shall meet the requirements of the CMC Sections 601.0, 602.0, 603.0, 604.0, 605.0 and

ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible, 3rd Edition, incorporated herein by reference.

B. Portions of supply-air and return-air ducts and plenums of a space heating or cooling system shall be insulated in accordance with either Subsection i or ii below:

- i. Ducts shall have a minimum installed level of R-6.0, or

Exception to Section 150.0(m)1Bi: Portions of the duct system located in conditioned space below the ceiling separating the occupiable space from the attic are not required to be insulated if all of the following conditions are met:

- a. The noninsulated portion of the duct system is located entirely inside the building's thermal envelope as confirmed by visual inspection.
- b. At all locations where noninsulated portions of the duct system penetrate into unconditioned space, the penetration shall be draft stopped compliant with CFC Sections 703.1 and 704.1 and air-sealed to the construction materials that are penetrated, using materials compliant with CMC Section E502.4.2 to prevent air infiltration into the cavity. All connections in unconditioned space are insulated to a minimum of R-6.0 as confirmed by visual inspection.

- ii. Ducts do not require insulation when the duct system is located entirely in conditioned space as confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.

C. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened.

D. Openings shall be sealed with mastic, tape or other duct-closure system that meets the applicable requirements of UL 181, UL181A or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

E. Building cavities, support platforms for air handlers and plenums designed or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

Exception to Section 150.0(m)1: Ducts and fans integral to a wood heater or fireplace.

2. Factory-fabricated duct systems.

- A. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.
- B. All pressure-sensitive tapes, heat-activated tapes and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
- C. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth-back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

3. Field-fabricated duct systems.

- A. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A and UL 181B.
- B. Mastic sealants and mesh.
 - i. Sealants shall comply with the applicable requirements of UL 181, UL 181A and UL 181B, and be nontoxic and water resistant.
 - ii. Sealants for interior applications shall be tested in accordance with ASTM C731 and D2202 incorporated herein by reference.
 - iii. Sealants for exterior applications shall be tested in accordance with ASTM C731, C732 and D2202, incorporated herein by reference.
 - iv. Sealants and meshes shall be rated for exterior use.
- C. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A and UL 181B.
- D. Joints and seams of duct systems and their components shall not be sealed with cloth-back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
- E. Drawbands used with flexible duct.
 - i. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
 - ii. Drawbands shall have a minimum tensile strength rating of 150 pounds.
 - iii. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.

F. Aerosol-sealant closures.

- i. Aerosol sealants shall meet the requirements of UL 723, and be applied according to manufacturer specifications.
- ii. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.

- 4. **Duct insulation R-value ratings.** All duct insulation product R-values shall be based on insulation only (excluding air films, vapor retarder or other duct components) and tested C-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.
- 5. **Duct insulation thickness.** The installed thickness of duct insulation used to determine its R-value shall be determined as follows:
 - A. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
 - B. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
 - C. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
- 6. **Duct labeling.** Insulated flexible duct products installed to meet this requirement shall include labels, in maximum intervals of 3 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor retarders or other duct components), based on the tests in Section 150.0(m)4 and the installed thickness determined by Section 150.0(m)5C.
- 7. **Backdraft dampers.** All fan systems, regardless of volumetric capacity, that exchange air between the building conditioned space and the outside of the building shall be provided with backdraft or automatic dampers to prevent unintended air leakage through the fan system when the fan system is not operating.
- 8. **Gravity ventilation dampers.** All gravity ventilating systems that serve conditioned space shall be provided with either automatic or readily accessible, manually operated dampers in all openings to the outside except combustion inlet and outlet air openings and elevator shaft vents.
- 9. **Protection of insulation.** Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

10. **Porous inner core flex duct.** Flexible ducts having porous inner cores shall have a non-porous layer or air barrier between the inner core and the outer vapor barrier.

11. **Duct system sealing and leakage testing.** When space-conditioning systems utilize forced air duct systems to supply conditioned air to an occupiable space, the ducts shall be sealed as confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.1, and conforming to one of the following Subsections A, B or C as applicable. Air handler airflow for calculation of duct leakage rate compliance targets shall be determined according to methods specified in Reference Residential Appendix RA3.1.4.2.

A. For single-family dwellings and townhouses with the air-handling unit installed and the ducts connected directly to the air handler, the total leakage of the duct system shall not exceed 5 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1.

B. For single-family dwellings and townhouses at the rough-in stage of construction prior to installation of the dwelling’s interior finishing:

i. **Air-handling unit installed.** If the air-handling unit is installed and the ducts are connected directly to the air handler, the total leakage of the duct system shall not exceed 5 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Sections RA3.1.4.3.2, RA3.1.4.3.2.1 and RA3.1.4.3.3.

ii. **Air-handling unit not yet installed.** If the air-handling unit is not yet installed, the total leakage of the duct system shall not exceed 4 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Sections RA3.1.4.3.2, RA3.1.4.3.2.2 and RA3.1.4.3.3.

12. **Air filtration.**

A. System types specified in Subsections i, ii, and iii shall be provided with air filters in accordance with Sections 150.0(m)12B, 150.0(m)12C, and 150.0(m)12D. System types specified in Subsection i shall also comply with Section 150.0(m)12E.

i. Mechanical space-conditioning systems that supply air to an occupiable space through ductwork exceeding 10 feet (3 m) in length.

ii. Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.

iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems, and energy recovery

ventilation systems that provide outside air to an occupiable space.

Exception 1 to Section 150.0(m)12A: Evaporative coolers are exempt from the air filtration requirements in Section 150.0(m)12.

B. System design and installation.

i. The system shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space is filtered before passing through any system’s thermal conditioning components.

Exception 1 to Section 150.0(m)12Bi: For heat recovery ventilators and energy recovery ventilators the location of the filters required by Section 150.0(m)12 may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system’s thermal conditioning component.

ii. All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter(s). The design airflow rate and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter shall be determined and reported on labels according to Subsection iv below.

Systems specified in Section 150.0(m)12Ai shall be equipped with air filters that meet either Subsection a or b below.

a. Nominal two-inch minimum depth filter(s) shall be sized by the system designer, or

b. Nominal one-inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 150.0-A, based on a maximum face velocity of 150 ft per minute, and according to the maximum allowable clean-filter pressure drop specified in Section 150.0(m)12Dii.

$$A_{face} = Q_{filter} / V_{face} \quad \text{(Equation 150.0-A)}$$

where

A_{face} = air filter face area, the product of air filter nominal length x nominal width, ft².

Q_{filter} = design airflow rate for the air filter, ft³/min.

V_{face} = air filter face velocity ≤150, ft/min.

iii. All system air filters shall be located and installed in such a manner as to be accessible for regular service by the system owner.

iv. All system air filter installation locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter installation location, readily legible, and visible to a person replacing the air filter.

- v. Filter racks or grilles shall use gaskets, sealing or other means to close gaps around inserted filters to and prevent air from bypassing the filter.
- C. **Air filter efficiency.** The system shall be provided with air filter(s) having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30-1.0 μm range, and equal to or greater than 85 percent in the 1.0-3.0 μm range when tested in accordance with AHRI Standard 680.
- D. **Air filter pressure drop.** All system shall be provided with air-filter(s) that conforms to the applicable maximum allowable clean-filter pressure drop specified in Subsections i, ii, iii, or iv below, when tested using ASHRAE Standard 52.2, or as rated using AHRI Standard 680, for the applicable design airflow rate(s) for the system air filter(s).
- i. The maximum allowable clean-filter pressure drop shall be determined by the system design for the nominal two-inch minimum depth air filter required by Section 150.0(m)12Biia, or
 - ii. A maximum of 25 PA (0.1 inches water) clean-filter pressure drop shall be allowed for a nominal one-inch depth air filter sized according to Section 150.0(m)12Biib, or
 - iii. For systems specified in 150.0(m)12Aii, and 150.0(m)12Aiii, the maximum allowable clean filter pressure drop shall be determined by the system design.
 - iv. If Exception 1 to Section 150.0(m)13B or D is utilized for compliance with cooling system airflow rate and fan efficacy requirements, the clean-filter pressure drop for the system air filter shall conform to the requirements given in Table 150.0-B or 150.0-C.
- E. **Air filter product labeling.** Systems described in 150.0(m)12Ai shall be equipped with air filters that have been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that demonstrate conformance with Sections 150.0(m)12C and 150.0(m)12D.
13. **Space conditioning system airflow rate and fan efficacy.** Space conditioning systems that utilize forced air ducts to supply cooling to an occupiable space shall:
- A. **Static pressure probe.** Have a hole for the placement of a static pressure probe (HSPP), or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location, and labeling of the HSPP or PSPP shall conform to the requirements specified in Reference Residential Appendix RA3.3.1.1 as confirmed by field verification and diagnostic testing; and
- Exception to 150.0(m)13A:** Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.3-1 shall not be required to provide holes as described in Figure RA3.3-1.
- B. **Single zone central forced air systems.** Demonstrate, in every control mode, airflow greater than or equal to 350 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to the maximum W/CFM specified in Subsections i or ii below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.
- i. 0.45 W/CFM for gas furnace air-handling units.
 - ii. 0.58 W/CFM for air-handling units that are not gas furnaces.
- C. **Zonally controlled central forced air systems.** Zonally controlled central forced air cooling systems shall be capable of simultaneously delivering, in every zonal control mode, an airflow from the dwelling, through the air handler fan and delivered to the dwelling, of greater than or equal to the maximum W/CFM specified in Subsections i or ii below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.3.
- i. 0.45 W/CFM for gas furnace air-handling units.
 - ii. 0.58 W/CFM for air-handling units that are not gas furnaces.
- D. **Small duct high velocity forced air systems.** Demonstrate, in every control mode, airflow greater than or equal to 250 CFM per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.62 W/CFM as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.
- Exception 1 to Section 150.0(m)13B and D:** Standard ducted systems (without zoning dampers) may comply by meeting the applicable requirements in Table 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements specified by Section 150.0(m)12Div for the system air filter(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.
- Exception 2 to Section 150.0(m)13B and D:** Multi-speed compressor systems or variable speed compressor systems shall verify air flow (cfm/ton) and fan efficacy (Watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.
- Exception 3 to Section 150.0(m)13B:** Gas furnace air-handling units manufactured prior to July 3,

2019 shall comply with a fan efficacy value less than or equal to 0.58 w/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

Exception 1 to Section 150.0(m)13C: Multispeed or variable speed compressor systems, or single speed compressor systems that utilize the performance compliance approach, shall demonstrate compliance with the airflow (cfm/ton) and fan efficacy (Watt/cfm) requirements of Section 150.0(m)13C by operating the system at maximum compressor capacity and system fan speed with all zones calling for conditioning, rather than in every zonal control mode.

Exception 2 to Section 150.0(m)13C: Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 w/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

(n) Water heating system.

1. Systems using gas or propane water heaters to serve individual dwelling units shall designate a space at least 2.5 feet by 2.5 feet wide and 7 feet tall suitable for the future installation of a heat pump water heater (HPWH) by meeting either A or B below. All electrical components shall be installed in accordance with the *California Electrical Code*:

- A. If the designated space is within 3 feet from the water heater, then this space shall include the following:
 - i. A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible to the water heater with no obstructions; and
 - ii. Both ends of the unused conductor shall be labeled with the word “spare” and be electrically isolated; and
 - iii. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words “Future 240V Use”; and
 - iv. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance.

- B. If the designated space is more than 3 feet from the water heater, then this space shall include the following:
 - i. A dedicated 240 volt branch circuit shall be installed within 3 feet from the designated space. The branch circuit shall be rated at 30 amps mini-

mum. The blank cover shall be identified as “240V ready”; and

- ii. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future HPWH installation. The reserved space shall be permanently marked as “For Future 240V use”; and
- iii. Either a dedicated cold water supply, or the cold water supply shall pass through the designated HPWH location just before reaching the gas or propane water heater; and
- iv. The hot water supply pipe coming out of the gas or propane water heater shall be routed first through the designated HPWH location before serving any fixtures; and
- v. The hot and cold water piping at the designated HPWH location shall be exposed and readily accessible for future installation of an HPWH; and
- vi. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance.

- 2. Water heating recirculation loops serving multiple dwelling units shall meet the requirements of Section 110.3(c)4.
- 3. Solar water-heating systems and collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or by a listing agency that is approved by the executive director.
- 4. Instantaneous water heaters with an input rating greater than 6.8 kBtu/hr (2kW) shall meet the requirements of Section 110.3(c)6.

(o) Requirements for ventilation and indoor air quality. All dwelling units shall meet the requirements of ASHRAE Standard 62.2. Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified in Section 150.0(o)1 below. All dwelling units shall comply with Section 150.0(o)2 below.

Exception to Section 150.0(o): The following sections of ASHRAE 62.2 shall not be required for compliance: Section 4.1.1, Section 4.1.2, Section 4.1.4, Section 4.3, Section 4.6, Section 5, Section 6.1.1, Section 6.5.2 and Normative Appendix A.

- 1. Amendments to ASHRAE 62.2 requirements.
 - A. **Window operation.** Window operation is not a permissible method of providing the dwelling unit ventilation airflow specified in Section 150.0(o)1C below.
 - B. **Central fan integrated (CFI) ventilation systems.** CFI ventilation systems shall meet the following requirements.
 - i. **Continuous operation prohibition.** Continuous operation of a dwelling unit’s central forced air

system air handlers used in CFI ventilation systems is not a permissible method of providing the whole-dwelling unit ventilation airflow required in Section 150.0(o)1C.

- ii. **Outdoor air damper(s).** A motorized damper(s) shall be installed on the connected ventilation duct(s) of CFI systems that prevents all airflow into or out of the space-conditioning duct system when the damper(s) is closed.
- iii. **Damper control.** The required motorized damper(s) shall be controlled to be in an opened position when outdoor air ventilation is required for compliance, and shall be in the closed position when ventilation air is not required. The damper(s) shall be closed whenever the space-conditioning system air handling unit is not operating. If the outdoor airflow for the CFI ventilation system is fan-powered, then the outdoor air fan shall not operate when the required motorized damper(s) on the outdoor air ventilation duct(s) is closed.
- iv. **Variable ventilation.** CFI ventilation systems shall incorporate controls that track outdoor air ventilation run time, and either open or close the required motorized damper(s) depending on whether or not outdoor air ventilation is required for compliance with Section 150.0(o)1C. During periods when comfort conditioning is not called for by the space-conditioning thermostat, the CFI ventilation system controls shall operate the space-conditioning system central fan and outdoor air damper(s) when necessary to ensure compliance with the minimum outdoor air ventilation required by Section 150.0(o) in accordance with applicable variable mechanical ventilation methods specified in ASHRAE 62.2 Section 4.5.

C. Whole-dwelling unit mechanical ventilation for single-family detached and townhouses. Single-family detached dwelling units, and attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces shall have mechanical ventilation airflow as specified in Subsections i, ii, and iii below.

- i. Total Required Ventilation Rate [ASHRAE 62.2:4.1.1].

The total required ventilation rate shall be calculated using Equation 150.0-B.

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1)$$

(Equation 150.0-B)

where

Q_{tot} = total required ventilation rate, cfm

A_{floor} = dwelling-unit floor area, ft²

N_{br} = number of bedrooms (not to be less than 1)

- ii. Effective Annual Average Infiltration Rate. The effective annual average infiltration rate shall be determined in accordance with Subsections a and b:

- a. An enclosure leakage rate in cubic feet per minute at 50 Pa (0.2 inch water) (Q_{50}) shall be determined by either Subsection 1, or Subsection 2 below.

- 1. Q_{50} shall be calculated based on the conditioned volume of the dwelling unit and a default value for dwelling unit envelope leakage of 2 air changes per hour at 50 Pa (0.2 inch water) ($2 ACH_{50}$) as specified by equation 150.0-C below.

$$Q_{50} = V_{du} \times 2 ACH_{50} / 60 \text{ min}$$

(Equation 150.0-C)

where

Q_{50} = leakage rate at 50 Pa.

V_{du} = dwelling unit conditioned volume, ft³.

ACH_{50} = air changes per hour at 50 Pa (0.2 inch water).

- 2. If dwelling unit envelope leakage less than $2 ACH_{50}$ is confirmed by field verification and diagnostic testing, Q_{50} shall be calculated according to Equation 150.0-D below, using the value for dwelling unit envelope leakage less than $2 ACH_{50}$ verified by the procedures specified in Reference Residential Appendix RA3.8.

$$Q_{50} = V_{du} \times \text{Verified } ACH_{50} / 60 \text{ min}$$

(Equation 150.0-D)

where

Q_{50} = leakage rate at 50 Pa.

V_{du} = dwelling unit conditioned volume, ft³.

ACH_{50} = air changes per hour at 50 Pa (0.2 inch water).

- b. The Effective Annual Average Infiltration Rate (Q_{inf}) shall be calculated using Equation 150.0-E [ASHRAE 62.2:4.1.2.1].

$$Q_{inf} = 0.052 \times Q_{50} \times wsf \times [H/H_r]^2$$

(Equation 150.0-E)

where

Q_{inf} = effective annual infiltration rate, cfm (L/s).

Q_{50} = leakage rate at 50 Pa from equation 150.0-C, or equation 150.0-D.

w_{sf} = weather and shielding factor from Table 150.0-D.

H = vertical distance between the lowest and highest above-grade points within the pressure boundary, ft (m).

H_r = reference height, 8.2 ft (2.5 m).

z = 0.4 for the purpose of calculating the Effective Annual Average Infiltration Rate.

iii. **Required Mechanical Ventilation Rate** [ASHRAE 62.2:4.1.2]

The Required Mechanical Ventilation Rate (Q_{fan}) shall be calculated using Equation 150.0-F.

$$Q_{fan} = Q_{tot} - \Phi(Q_{inf} \times A_{ext})$$

(Equation 150.0-F)

where

Q_{fan} = required mechanical ventilation rate, cfm (L/s).

Q_{tot} = total required ventilation rate, cfm (L/s) from Equation 150.0-B.

Q_{inf} = effective annual average infiltration rate, cfm (L/s) from Equation 150.0-E.

A_{ext} = 1 for single-family detached homes, or the ratio of exterior envelope surface area that is not attached to garages or other dwelling units to total envelope surface area for attached dwelling units not sharing ceilings or floors with other dwelling units, occupiable spaces, public garages, or commercial spaces.

Φ = 1 for balanced ventilation systems and Q_{inf}/Q_{tot} otherwise.

D. **Air filtration.** Air filtration shall conform to the specifications in Section 150.0(m)12. Compliance with ASHRAE 62.2 Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) shall not be required.

E. **Reserved.**

F. **Reserved.**

G. **Local mechanical exhaust.** A local mechanical exhaust system shall be installed in each kitchen and bathroom. Systems shall be rated for airflow in accordance with ASHRAE 62.2 Section 7.1.

i. **Nonenclosed kitchens** shall have a demand-controlled mechanical exhaust system meeting the requirements of Section 150.0(o)1Giii.

ii. **Enclosed kitchens and all bathrooms** shall have either one of the following alternatives a or b:

a. A demand-controlled mechanical exhaust system meeting the requirements of Section 150.0(o)1Giii.

b. A continuous mechanical exhaust system meeting the requirements of Section 150.0(o)1Giv.

iii. **Demand-controlled mechanical exhaust.** A local mechanical exhaust system shall be designed to be operated as needed.

a. **Control and operation.** Demand-controlled mechanical exhaust systems shall be provided with at least one of the following controls:

1. A readily accessible occupant-controlled ON-OFF control.

2. An automatic control that does not impede occupant ON control.

b. **Ventilation rate and capture efficiency.** The system shall meet or exceed either the minimum airflow in accordance with Table 150.0-E or the minimum capture efficiency in accordance with Table 150.0-E, and Table 150.0-G. Capture efficiency ratings shall be determined in accordance with ASTM E3087 and listed in a product directory approved by the Energy Commission.

iv. **Continuous mechanical exhaust.** A mechanical exhaust system shall be installed to operate continuously. The system may be part of a balanced mechanical ventilation system.

a. **Control and operation.** A manual ON-OFF control shall be provided for each continuous mechanical exhaust system. The system shall be designed to operate during all occupiable hours. The ON-OFF control shall be accessible to the dwelling unit occupant.

b. **Ventilation rate.** The minimum delivered ventilation shall be at least the amount indicated in Table 150.0-F during each hour of operation.

v. **Airflow measurement of local mechanical exhaust by the system installer.** The airflow required by Section 150.0(o)1G is the quantity of indoor air exhausted by the ventilation system as installed in the dwelling unit. When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 150.0(o)1Giii, the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be met by the installed system. The as-installed airflow shall be verified by the system installer to ensure compliance by use of either Subsection a or b below:

a. The system installer shall measure the airflow by using a flow hood, flow grid or other airflow measuring device at the mechanical ven-

tilation fan's inlet terminals/grilles or outlet terminals/grilles in accordance with the procedures in Reference Residential Appendix RA3.7.

- b. As an alternative to performing an airflow measurement of the system as installed in the dwelling unit, compliance may be demonstrated by installing an exhaust fan and duct system that conforms to the specifications of Table 150.0-H. Visual inspection shall verify the installed system conforms to the requirements of Table 150.0-H.

When using Table 150.0-H for demonstrating compliance, the airflow rating shall be greater than or equal to the value required by Section 150.0(o)1G at a static pressure greater than or equal to 0.25 in. of water (62.5 Pa). When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 150.0(o)1Giiib, a static pressure greater than or equal to 0.25 in. of water at the rating point shall not be required, and the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be applied to Table 150.0-H for determining compliance.

Use of Table 150.0-H is limited to ventilation systems that conform to all of the following three specifications:

1. Total duct length is less than or equal to 25 ft (8 m),
2. Duct system has no more than three elbows, and
3. Duct system has exterior termination fitting with a hydraulic diameter greater than or equal to the minimum duct diameter and not less than the hydraulic diameter of the fan outlet.

vi. **Sound ratings for local mechanical exhaust.**

Local mechanical exhaust systems shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2 at no less than the minimum airflow rate required by Section 150.0(o)1G.

Exception to Section 150.0(o)1Gvi: Kitchen range hoods may be rated for sound at no less than 100 cfm at a static pressure determined at working speed as specified in HVI 916 section 7.2.

H. **Airflow measurement of whole-dwelling unit ventilation.**

The airflow required by Section 150.0(o)1C is the quantity of outdoor ventilation air supplied or indoor air exhausted by the mechanical ventilation system as installed and shall be measured by using a flow hood, flow grid or other airflow measuring device at the mechanical ventilation fan's inlet terminals/grilles or outlet terminals/grilles in accordance with the procedures in Reference Residential Appendix RA3.7. Balanced mechanical ven-

tilation system airflow shall be the average of the supply fan and exhaust fan flows.

- I. **Sound ratings for whole-dwelling unit ventilation systems.** Whole-dwelling unit ventilation systems shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2 at no less than the minimum airflow rate required by Section 150.0(o)1C.

- J. **Label for whole-dwelling unit ventilation system on-off control.** Compliance with ASHRAE 62.2 Section 4.4 (Control and Operation) shall require manual ON-OFF control switches associated with whole-dwelling unit ventilation systems to have a label clearly displaying the following text, or equivalent text: "This switch controls the indoor air quality ventilation for the home. Leave switch in the 'on' position at all times unless the outdoor air quality is very poor."

K. **Combustion air and compensating outdoor air or makeup air.**

- i. All dwelling units shall conform to the applicable requirements specified in *California Mechanical Code* Chapter 7, Combustion Air.
- ii. All dwelling units shall conform to the requirements in ASHRAE 62.2 Section 6.4, Combustion and Solid-Fuel-Burning Appliances.

2. **Field verification and diagnostic testing.**

A. **Whole-dwelling unit ventilation airflow performance.**

The whole-dwelling unit ventilation airflow required by Section 150.0(o)1C shall be confirmed through field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.7. Balanced mechanical ventilation system airflow shall be the average of the supply fan and exhaust fan flows. Ventilation airflow of systems with multiple operating modes shall be tested in all modes designed to comply with the required ventilation airflows.

B. **Kitchen local mechanical exhaust—vented range hoods.**

Vented range hoods installed to comply with local mechanical exhaust requirements specified in Section 150.0(o)1G shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.7.4.3 to confirm the model is rated by HVI or AHAM to comply with the following requirements:

- i. The minimum ventilation airflow rate as specified by Section 150.0(o)1G, or alternatively the minimum capture efficiency as specified by Section 150.0(o)1G.
- ii The maximum sound rating as specified in Section 150.0(o)1Gvi.

C. **Heat recovery ventilation (HRV) and energy recovery ventilation (ERV) system fan efficacy.**

Systems with heat or energy recovery serving a single dwelling unit shall have a fan efficacy of ≤ 1.0 W/cfm as confirmed by HERS field verification in accordance with Reference Appendix RA3.7.4.4.

(p) **Pool systems and equipment installation.** Any residential pool system or equipment installed shall comply with the applicable requirements of Section 114, as well as the requirements listed in this section.

1. Pump sizing and flow rate.

A. All installed pumps and pump motors subject to State or federal appliance standards shall be listed in the Commission's directory of certified equipment and shall comply with the Appliance Efficiency Regulations.

B. All pump flow rates shall be calculated using the following system equation:

$$H = C \times F^2$$

where:

H is the total system head in feet of water.

F is the flow rate in gallons per minute (gpm).

C is a coefficient based on the volume of the pool:

0.0167 for pools less than or equal to 17,000 gallons.

0.0082 for pools greater than 17,000 gallons.

C. Filtration pumps shall be sized, or if programmable shall be programmed, so that the filtration flow rate is not greater than the rate needed to turn over the pool water volume in 6 hours or 36 gpm, whichever is greater; and

D. Pump motors used for filtration shall meet the applicable federal standard in 10 CFR 431.465; and

E. Each auxiliary pool load shall be served by either separate pumps, or the system shall be served by a multispeed pump; and

Exception to Section 150.0(p)1E: Pumps if less than 1 hp may be single speed.

F. Multispeed pumps shall have controls which default to the filtration flow rate when no auxiliary pool loads are operating; and

G. For multispeed pumps, the controls shall default to the filtration flow rate setting within 24 hours and shall have an override capability for servicing.

2. System piping.

A. A length of straight pipe that is greater than or equal to at least 4 pipe diameters shall be installed before the pump; and

B. Pool piping shall be sized so that the velocity of the water at maximum flow for auxiliary pool loads does not exceed 8 feet per second in the return line and 6 feet per second in the suction line; and

C. All elbows shall be sweep elbows or of an elbow-type that has a pressure drop of less than the pressure drop of straight pipe with a length of 30 pipe diameters.

3. **Filters.** Filters shall be at least the size specified in NSF/ANSI 50 for public pool intended applications.

4. **Valves.** Minimum diameter of backwash valves shall be 2 inches or the diameter of the return pipe, whichever is greater.

(q) **Fenestration products.** Fenestration separating conditioned space from unconditioned space or outdoors shall meet the requirements of either Item 1 or 2 below:

1. Fenestration, including skylight products, must have a maximum U -factor of 0.45.

Exception 1 to Section 150.0(q)1: Up to 10 square feet of fenestration area or 0.5 percent of the conditioned floor area, whichever is greater, is exempt from the maximum U -factor requirement.

Exception 2 to Section 150.0(q)1: For dual-glazed greenhouse or garden windows, up to 30 square feet of fenestration area is exempt from the maximum U -factor requirement.

2. The area-weighted average U -factor of all fenestration, including skylight products shall not exceed 0.45.

(r) **Solar ready buildings.** shall meet the requirements of Section 110.10 applicable to the building project.

(s) **Energy storage systems (ESS) ready.** All single-family residences that include one or two dwelling units shall meet the following. All electrical components shall be installed in accordance with the *California Electrical Code*:

1. At least one of the following shall be provided:

A. ESS ready interconnection equipment with a minimum backed-up capacity of 60 amps and a minimum of four ESS-supplied branch circuits, or

B. A dedicated raceway from the main service to a panelboard (subpanel) that supplies the branch circuits in Section 150.0(s)(2). All branch circuits are permitted to be supplied by the main service panel prior to the installation of an ESS. The trade size of the raceway shall be not less than 1 inch. The panelboard that supplies the branch circuits (subpanel) must be labeled "Subpanel shall include all backed-up load circuits."

2. A minimum of four branch circuits shall be identified and have their source of supply collocated at a single panelboard suitable to be supplied by the ESS. At least one circuit shall supply the refrigerator, one lighting circuit shall be located near the primary egress and at least one circuit shall supply a sleeping room receptacle outlet.

3. The main panelboard shall have a minimum busbar rating of 225 amps.

4. Sufficient space shall be reserved to allow future installation of a system isolation equipment/transfer switch within 3 feet of the main panelboard. Raceways shall be installed between the panelboard and the system isolation equipment/transfer switch location to allow the connection of backup power source.

(t) **Heat pump space heater ready.** Systems using gas or propane furnace to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the furnace and accessible to the furnace with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready.” All electrical components shall be installed in accordance with the *California Electrical Code*.
2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future heat pump space heater installation. The reserved space shall be permanently marked as “For Future 240V use.”

(u) **Electric cooktop ready.** Systems using gas or propane cooktop to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the cooktop and accessible to the cooktop with no obstructions. The branch circuit conductors shall be rated at 50 amps minimum. The blank cover shall be identified as “240V ready.” All

electrical components shall be installed in accordance with the *California Electrical Code*.

2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric cooktop installation. The reserved space shall be permanently marked as “For Future 240V use.”

(v) **Electric clothes dryer ready.** Clothes dryer locations with gas or propane plumbing to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the clothes dryer location and accessible to the clothes dryer location with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready.” All electrical components shall be installed in accordance with the *California Electrical Code*.
2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric clothes dryer installation. The reserved space shall be permanently marked as “For Future 240V use.”

**TABLE 150.0-A
CLASSIFICATION OF HIGH LUMINOUS EFFICACY LIGHT SOURCES**

HIGH-EFFICACY LIGHT SOURCES	
Light sources shall comply with one of the columns below:	
Light sources in this column, other than those installed in ceiling recessed downlight luminaires, are classified as high efficacy and are not required to comply with Reference Joint Appendix JA8.	Light sources in this column are only considered to be high efficacy if they are certified to the Commission as High Efficacy Light Sources in accordance with Reference Joint Appendix JA8 and marked as required by JA8.
<ol style="list-style-type: none"> 1. LED light sources installed outdoors. 2. Inseparable solid state lighting (SSL) luminaires containing colored light sources that are installed to provide decorative lighting. 3. Pin-based linear fluorescent or compact fluorescent light sources using electronic ballasts. 4. High intensity discharge (HID) light sources including pulse start metal halide and high pressure sodium light sources. 5. Luminaires with hardwired high frequency generator and induction lamp. 6. Ceiling fan light kits subject to federal appliance regulations. 	<ol style="list-style-type: none"> 7. All light sources installed in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw bases regardless of lamp type as described in Section 150.0(k)1C. 8. Any light source not otherwise listed in this table.

**TABLE 150.0-B
RETURN DUCT SIZING FOR SINGLE RETURN DUCT SYSTEMS**

Return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.		
Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille’s design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.		
SYSTEM NOMINAL COOLING CAPACITY (Ton)*	RETURN DUCT MINIMUM NOMINAL DIAMETER (inch)	MINIMUM TOTAL RETURN FILTER GRILLE NOMINAL AREA (inch ²)
1.5	16	500
2.0	18	600
2.5	20	800

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton.

**TABLE 150.0-C
RETURN DUCT SIZING FOR MULTIPLE RETURN DUCT SYSTEMS**

Each return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 150.0(m)12Biv to disclose the grille’s design airflow rate and a maximum allowable clean-filter pressure drop of 12.5 Pa (0.05 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

SYSTEM NOMINAL COOLING CAPACITY (Ton)*	RETURN DUCT 1 MINIMUM NOMINAL DIAMETER (inch)	RETURN DUCT 2 MINIMUM NOMINAL DIAMETER (inch)	MINIMUM TOTAL RETURN FILTER GRILLE NOMINAL AREA (inch ²)
1.5	12	10	500
2.0	14	12	600
2.5	14	14	800
3.0	16	14	900
3.5	16	16	1000
4.0	18	18	1200
5.0	20	20	1500

*Not applicable to systems with nominal cooling capacity greater than 5.0 tons or less than 1.5 tons.

**TABLE 150.0-D
INFILTRATION EFFECTIVENESS WEATHER AND SHIELDING FACTORS [ASHRAE 62.2:TABLE B1]**

TMY3	WSF	WEATHER STATION	LATITUDE	LONGITUDE	STATE
690150	0.50	Twentynine Palms	34.30	-116.17	California
722860	0.43	March AFB	33.90	-117.25	California
722868	0.45	Palm Springs Intl	33.83	-116.50	California
722869	0.42	Riverside Muni	33.95	-117.45	California
722880	0.39	Burbank–Glendale–Pasadena AP	34.20	-118.35	California
722885	0.39	Santa Monica Muni	34.02	-118.45	California
722886	0.39	Van Nuys Airport	34.22	-118.48	California
722895	0.55	Lompoc (AWOS)	34.67	-120.47	California
722897	0.51	San Luis Co Rgnl	35.23	-120.63	California
722899	0.45	Chino Airport	33.97	-117.63	California
722900	0.38	San Diego Lindbergh Field	32.73	-117.17	California
722903	0.39	San Diego/Montgomery	32.82	-117.13	California
722904	0.40	Chula Vista Brown Field NAAS	32.58	-116.98	California
722906	0.39	San Diego North Island NAS	32.70	-117.20	California
722926	0.40	Camp Pendleton MCAS	33.30	-117.35	California
722927	0.38	Carlsbad/Palomar	33.13	-117.28	California
722930	0.39	San Diego Miramar NAS	32.87	-117.13	California
722950	0.42	Los Angeles Intl Arpt	33.93	-118.40	California
722956	0.38	Jack Northrop Fld H	33.92	-118.33	California
722970	0.38	Long Beach Daugherty Fld	33.83	-118.17	California
722976	0.34	Fullerton Municipal	33.87	-117.98	California
722977	0.36	Santa Ana John Wayne AP	33.68	-117.87	California
723805	0.51	Needles Airport	34.77	-114.62	California
723810	0.59	Edwards AFB	34.90	-117.87	California
723815	0.58	Daggett Barstow–Daggett AP	34.85	-116.80	California
723816	0.62	Lancaster Gen Wm Fox Field	34.73	-118.22	California
723820	0.57	Palmdale Airport	34.63	-118.08	California
723830	0.68	Sandberg	34.75	-118.72	California
723840	0.43	Bakersfield Meadows Field	35.43	-119.05	California
723890	0.45	Fresno Yosemite Intl AP	36.78	-119.72	California
723895	0.42	Porterville (AWOS)	36.03	-119.07	California
723896	0.43	Visalia Muni (AWOS)	36.32	-119.40	California
723910	0.45	Point Mugu Nf	34.12	-119.12	California
723925	0.44	Santa Barbara Municipal AP	34.43	-119.85	California
723926	0.43	Camarillo (AWOS)	34.22	-119.08	California
723927	0.45	Oxnard Airport	34.20	-119.20	California
723940	0.52	Santa Maria Public Arpt	34.92	-120.47	California

(continued)

SINGLE-FAMILY RESIDENTIAL BUILDINGS—MANDATORY FEATURES AND DEVICES

**TABLE 150.0-D—continued
INFILTRATION EFFECTIVENESS WEATHER AND SHIELDING FACTORS [ASHRAE 62.2:TABLE B1]**

TMY3	WSF	WEATHER STATION	LATITUDE	LONGITUDE	STATE
723965	0.53	Paso Robles Municipal Arpt	35.67	-120.63	California
724800	0.55	Bishop Airport	37.37	-118.35	California
724815	0.46	Merced/Macready Fld	37.28	-120.52	California
724830	0.51	Sacramento Executive Arpt	38.50	-121.50	California
724837	0.45	Beale AFB	39.13	-121.43	California
724838	0.50	Yuba Co	39.10	-121.57	California
724839	0.51	Sacramento Metropolitan AP	38.70	-121.58	California
724915	0.49	Monterey Naf	36.60	-121.87	California
724917	0.54	Salinas Municipal AP	36.67	-121.60	California
724920	0.50	Stockton Metropolitan Arpt	37.90	-121.23	California
724926	0.47	Modesto City-County AP	37.63	-120.95	California
724927	0.53	Livermore Municipal	37.70	-121.82	California
724930	0.54	Oakland Metropolitan Arpt	37.72	-122.22	California
724935	0.47	Hayward Air Term	37.67	-122.12	California
724936	0.53	Concord-Buchanan Field	38.00	-122.05	California
724940	0.60	San Francisco Intl AP	37.62	-122.40	California
724945	0.48	San Jose Intl AP	37.37	-121.93	California
724955	0.55	Napa Co. Airport	38.22	-122.28	California
724957	0.49	Santa Rosa (AWOS)	38.52	-122.82	California
725845	0.44	Blue Canyon AP	39.30	-120.72	California
725846	0.66	Truckee-Tahoe	39.32	-120.13	California
725847	0.64	South Lake Tahoe	38.90	-120.00	California
725905	0.47	Ukiah Municipal AP	39.13	-123.20	California
725910	0.50	Red Bluff Municipal Arpt	40.15	-122.25	California
725920	0.47	Redding Municipal Arpt	40.52	-122.32	California
725945	0.56	Arcata Airport	40.98	-124.10	California
725946	0.60	Crescent City Faa Ai	41.78	-124.23	California
725955	0.55	Montague Siskiyou County AP	41.78	-122.47	California
725958	0.59	Alturas	41.50	-120.53	California
745090	0.45	Mountain View Moffett Fld NAS	37.40	-122.05	California
745160	0.67	Travis Field AFB	38.27	-121.93	California
746120	0.52	China Lake Naf	35.68	-117.68	California
747020	0.50	Lemoore Reeves NAS	36.33	-119.95	California
747185	0.46	Imperial	32.83	-115.58	California
747187	0.46	Palm Springs Thermal AP	33.63	-116.17	California
747188	0.48	Blythe Riverside Co Arpt	33.62	-114.72	California

**TABLE 150.0-E
DEMAND-CONTROLLED LOCAL VENTILATION EXHAUST
AIRFLOW RATES AND CAPTURE EFFICIENCY**

APPLICATION	COMPLIANCE CRITERIA
Enclosed kitchen or non-enclosed kitchen	Vented range hood, including appliance-range hood combinations, shall meet either the capture efficiency (CE) or the airflow rate specified in Table 150.0-G as applicable.
Enclosed kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s) or a capacity of 5 ACH
Nonenclosed kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s)
Bathroom	50 cfm (25 L/s)

**TABLE 150.0-G
KITCHEN RANGE HOOD AIRFLOW RATES (CFM) AND ASTM
E3087 CAPTURE EFFICIENCY (CE) RATINGS ACCORDING TO
DWELLING UNIT FLOOR AREA AND KITCHEN RANGE FUEL TYPE**

DWELLING UNIT FLOOR AREA (ft ²)	HOOD OVER ELECTRIC RANGE	HOOD OVER NATURAL GAS RANGE
>1500	50% CE or 110 cfm	70% CE or 180 cfm
>1000–1500	50% CE or 110 cfm	80% CE or 250 cfm
750–1000	55% CE or 130 cfm	85% CE or 280 cfm
<750	65% CE or 160 cfm	85% CE or 280 cfm

**TABLE 150.0-F
CONTINUOUS LOCAL VENTILATION EXHAUST AIRFLOW RATES**

APPLICATION	AIRFLOW
Enclosed kitchen	5 ACH, based on kitchen volume
Bathroom	20 cfm (10 L/s)

**TABLE 150.0-H
PRESCRIPTIVE VENTILATION SYSTEM DUCT SIZING [ASHRAE 62.2:Table 5-3]**

Fan airflow rating, cfm at minimum static pressure ^f 0.25 in. water (L/s at minimum 62.5 Pa)	≤50 (25)	≤80 (40)	≤100 (50)	≤125 (60)	≤150 (70)	≤175 (85)	≤200 (95)	≤250 (120)	≤350 (165)	≤400 (190)	≤450 (210)	≤700 (330)	≤800 (380)
Minimum duct diameter, in. (mm) ^{a,b} for rigid duct	4 ^e (100)	5 (125)	5 (125)	6 (150)	6 (150)	7 (180)	7 (180)	8 (205)	9 (230)	10 (255)	10 (255)	12 (305)	12 ^d (305)
Minimum duct diameter, in. (mm) ^{a,b} for flex duct ^c	4 (100)	5 (125)	6 (150)	6 (150)	7 (150)	7 (180)	8 (205)	8 (205)	9 (230)	10 (255)	NP	NP	NP

- a. For noncircular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.
- b. NP = application of the prescriptive table is not permitted for this scenario.
- c. Use of this table for verification of flex duct systems requires flex duct to be fully extended and any flex duct elbows to have a minimum bend radius-to-duct diameter ratio of 1.0.
- d. For this scenario, use of elbows is not permitted.
- e. For this scenario, 4 in. (100 mm) oval duct shall be permitted, provided the minor axis of the oval is greater than or equal to 3 in. (75 mm).
- f. When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 150.0(o)1Giiib, a static pressure greater than or equal to 0.25 in. of water at the rating point shall not be required, and the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be applied to Table 150.0-H for determining compliance.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, and 25943, *Public Resources Code*.

SUBCHAPTER 8

SINGLE-FAMILY RESIDENTIAL BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 150.1 PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES FOR SINGLE-FAMILY RESIDENTIAL BUILDINGS

(a) **Basic requirements.** Single-family residential buildings shall meet all of the following:

1. The applicable requirements of Sections 110.0 through 110.10.
2. The applicable requirements of Section 150.0 (mandatory features).
3. Either the performance standards or the prescriptive standards set forth in this section for the climate zone in which the building is located. Climate zones are shown in Reference Joint Appendix JA2–Weather/Climate Data.

Exception to Section 150.1(a)3: If a single contiguous subdivision or tract falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

Note: The Commission periodically updates, publishes, and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, as specified in Reference Joint Appendix JA2–Weather/Climate Data.

Note: The requirements of Sections 150.0(a) through 150.0(r) apply to newly constructed buildings and Sections 150.2(a) and 150.2(b) specifies changes to the requirements of Sections 150.1(a) through 150.1(c) that apply to additions or alterations.

(b) **Performance standards.** A building complies with the performance standards if the energy consumption calculated for the proposed design building is no greater than the energy budget calculated for the standard design building using Commission-certified compliance software as specified by the Alternative Calculation Methods Approval Manual.

1. **Newly constructed buildings.** The Energy Budget for newly constructed buildings is expressed in terms of the Energy Design Ratings, which are based on source energy and time-dependent valuation (TDV) energy. The Energy Design Rating 1 (EDR1) is based on source energy. The Energy Design Rating 2 (EDR2) is based on TDV energy and has two components, the Energy Efficiency Design Rating, and the Solar Electric Generation and Demand Flexibility Design Rating. The total Energy Design Rating shall account for both the Energy Efficiency Design Rating and the Solar Electric Generation and Demand Flexibility Design Rating. The proposed building shall separately comply with the

Source Energy Design Rating, Energy Efficiency Design Rating and Total Energy Design Rating.

Exception to Section 150.1(b)1. A community shared solar electric generation system, or other renewable electric generation system, or community shared battery storage system, which provides dedicated power, utility energy reduction credits, or payments for energy bill reductions to the permitted building and is approved by the Energy Commission as specified in Title 24, Part 1, Section 10-115, may offset part or all of the solar electric generation system and demand flexibility Energy Design Rating required to comply with the Standards, as calculated according to methods established by the Commission in the Residential ACM Reference Manual.

2. **Additions and alterations to existing buildings.** The energy budget for additions and alterations is expressed in terms of TDV energy.
3. **Compliance demonstration requirements for performance standards.**

A. Certificate of compliance and application for a building permit. The application for a building permit shall include documentation pursuant to Sections 10-103(a)1 and 10-103(a)2 which demonstrates, using an approved calculation method, that the building has been designed so that its Energy Efficiency Design Rating and the total EDR meets or exceeds the standard design EDR for the applicable climate zone.

Exception to Section 150.1(b)3A Multiple orientation: A permit applicant may demonstrate compliance with the energy budget requirements of Section 150.1(a) and (b) for any orientation of the same building model if the documentation demonstrates that the building model with its proposed designs and features would comply in each of the four cardinal orientations.

B. Field verification. When performance of installed features, materials, components, manufactured devices or systems above the minimum specified in Section 150.1(c) is necessary for the building to comply with Section 150.1(b), or is necessary to achieve a more stringent local ordinance, field verification shall be performed in accordance with the applicable requirements in the following subsections, and the results of the verification(s) shall be documented on applicable certificates of installation pursuant to Section 10-103(a)3 and applicable certificates of verification pursuant to Section 10-103(a)5.

- i. **EER/EER2/SEER/SEER2/CEER/HSPF/HSPF2 Rating.** When performance compliance requires

installation of a space-conditioning system with a rating that is greater than the minimum rating required by Table 150.1-A or specified for the standard design, the installed system shall be field verified in accordance with the procedures specified in the applicable sections of Reference Residential Appendix RA3.4.

- ii. **Variable capacity heat pump (VCHP) compliance option.** When performance compliance requires installation of a heat pump system that meets all the requirements of the VCHP compliance option specified in the ACM Reference Manual, the system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.4.4.3.
- iii. **Low leakage air handler.** When performance compliance requires installation of a low leakage air-handling unit, the installed air-handling unit shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.1.4.3.9.
- iv. **Reserved.**
- v. **Heat pump—rated heating capacity.** When performance compliance requires installation of a heat pump system, the heating capacity values at 47°F and 17°F shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.
- vi. **Whole-house fan.** When performance compliance requires installation of a whole-house fan, the whole-house fan ventilation airflow rate and fan efficacy shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.9.
- vii. **Central fan ventilation cooling system.** When performance compliance requires installation of a central fan ventilation cooling system, the installed system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.3.4.
- viii. **Building enclosure air leakage.** When performance compliance requires a building enclosure leakage rate that is lower than the standard design, the building enclosure shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.8.
- ix. **Quality Insulation Installation (QII).** When performance compliance requires field verification of QII, the building insulation system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.5.

(c) **Prescriptive standards/component packages.** Buildings that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements for the appropriate climate zone shown in Table 150.1-A. In Table 150.1-A, an NA (not allowed) means that feature is not permitted in a particular climate zone and an NR (no

requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:

1. **Insulation.**

- A. Roof and ceiling insulation shall be installed in a ventilated attic with an *R*-value equal to or greater than that shown in Table 150.1-A meeting Option ii or iii below.
 - i. Option A: **Reserved.**
 - ii. Option B: A minimum *R*-value of insulation installed between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9A; or
 - iii. Option C: A minimum *R*-value of ceiling insulation located between the attic and the conditioned space when meeting Section 150.1(c)9B.

Note: Low-rise residential single-family buildings with the ducts and air handler located in the conditioned space, as specified by Section 150.1(c)9B, need only comply with insulation requirements of Option C.

B. **Walls.**

- i. Framed exterior walls shall be insulated such that the exterior wall has an assembly *U*-factor equal to or less than that shown in Table 150.1-A. The *U*-factors shown are maximum *U*-factors for the exterior wall assembly.
 - ii. Mass walls above grade and below grade shall be insulated such that the wall has an assembly *U*-factor equal to or less than that shown in Table 150.1-A, or walls shall be insulated with continuous insulation that has an *R*-value equal to or greater than that shown in Table 150.1-A. “Interior” denotes continuous insulation installed on the inside surface of the wall, and “exterior” denotes continuous insulation installed on the outside surface of the wall.
 - iii. Other unframed exterior walls, excluding mass walls, shall meet the requirements for framed walls shown in Table 150.1-A.
- C. Raised floors shall be insulated such that the floor assembly has an assembly *U*-factor equal to or less than shown in Table 150.1-A, or shall be insulated between wood framing with insulation having an *R*-value equal to or greater than that shown in Table 150.1-A.

Exception to Section 150.1(c)1C: Raised-floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Table 150.1-A, and a vapor retarder is placed over the entire floor of the crawl space, and the vents are fitted with automatically operated louvers, and the requirements of Reference Residential Appendix RA 4.5.1 are met.

D. Slab floor perimeter insulation shall be installed with a *U*-factor equal to or less than, or *R*-value equal to or greater than, shown in Table 150.1-A. The minimum depth of concrete-slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

Exception to Section 150.1(c)1: The insulation requirements of Table 150.1-A may also be met by ceiling, roof deck, wall, or floor assemblies that meet the required maximum *U*-factors using a *U*-factor calculation method that considers the thermal effects of all elements of the assembly and is approved by the executive director.

E. All buildings shall comply with the quality insulation installation (QII) requirements shown in Table 150.1-A. When QII is required, insulation installation shall meet the criteria specified in Reference Appendix RA3.5.

2. **Radiant barrier.** A radiant barrier required in Table 150.1-A shall meet the requirements specified in Section 110.8(j), and shall meet the installation criteria specified in the Reference Residential Appendix RA4.

3. **Fenestration.**

A. Installed fenestration products, including glazed doors, shall have an area-weighted average *U*-factor and Solar Heat Gain Coefficient (SHGC) meeting the applicable fenestration value in Table 150.1-A and shall be determined in accordance with Sections 110.6(a)2 and 110.6(a)3.

Exception 1 to Section 150.1(c)3A: For each dwelling unit, up to 3 square feet of new glazing area installed in doors and up to 3 square feet of new tubular skylights area with dual-pane diffusers shall not be required to meet the *U*-factor and SHGC requirements of Table 150.1-A.

Exception 2 to Section 150.1(c)3A: For each dwelling unit up to 16 square feet of new skylight area with a maximum *U*-factor of 0.55 and a maximum SHGC of 0.30.

Exception 3 to Section 150.1(c)3A: For fenestration containing chromogenic type glazing:

- i. The lower-rated labeled *U*-factor and SHGC shall be used with automatic controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;
- ii. Chromogenic glazing shall be considered separately from other fenestration; and
- iii. Area-weighted averaging with other fenestration that is not chromatic shall not be permitted and shall be determined in accordance with Section 110.6(a).

Exception 4 to Section 150.1(c)3A: For dwelling units containing unrated site-built fenestration that meets the maximum area restriction, the *U*-factor and SHGC can be determined in accordance with

the Nonresidential Reference Appendix NA6 or use default values in Table 116-A and Table 116-B.

B. The maximum total fenestration area shall not exceed the percentage of conditioned floor area CFA as indicated in Table 150.1-A. Total fenestration includes skylights and west-facing glazing.

C. The maximum west-facing fenestration area shall not exceed the percentage of conditioned floor area as indicated in Table 150.1-A. West-facing fenestration area includes skylights tilted in any direction when the pitch is less than 1:12.

4. **Shading.** Where Table 150.1-A requires a maximum SHGC, the requirements shall be met by one of the following:

- A. Complying with the required SHGC pursuant to Section 150.1(c)3A, or
- B. An exterior operable shading louver or other exterior shading device that meets the required SHGC; or
- C. A combination of Items A and B to achieve the same performance as achieved in Section 150.1(c)3A.

D. For south-facing glazing only, optimal overhangs shall be installed so that the south-facing glazing is fully shaded at solar noon on August 21 and substantially exposed to direct sunlight at solar noon on December 21.

E. Exterior shading devices must be permanently secured with attachments or fasteners that are not intended for removal.

Exception to Section 150.1(c)4E: Where the *California Building Code* (CBC) requires emergency egress or where compliance would conflict with health and safety regulations.

5. **Doors.** Installed swinging door products separating conditioned space from outside or adjacent unconditioned space, but not including glazed door products, shall have an area-weighted average *U*-factor no greater than the applicable door value in Table 150.1-A and shall be determined in accordance with Section 110.6(a)2. Glazed door products are treated as fenestration products in Sections 150.1(c)3 and 150.1(c)4.

Exception to Section 150.1(c)5: Swinging doors between the garage and conditioned space that are required to have fire protection are not required to meet the applicable door value in Table 150.1-A.

6. **Heating system type.** Heating system types shall be installed as required in Table 150.1-A. For Climate Zones 3, 4, 13 and 14, the space-conditioning system shall be a heat pump, or shall meet the performance compliance requirements of Section 150.1(b)1.

Exception to Section 150.1(c)6: A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.

7. **Space heating and space cooling.** All space heating and space cooling equipment shall comply with minimum appliance efficiency regulations as specified in Sections 110.0 through 110.2 and meet all applicable requirements of Sections 150.0 and 150.1(c)7A.

A. **Refrigerant charge.** When refrigerant charge verification or fault indicator display is shown as required by Table 150.1-A, the system shall comply with either Section 150.1(c)7Ai or 150.1(c)7Aii:

i. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high velocity systems, and mini-split systems, shall comply with Subsections a, b and c, unless the system is of a type that cannot be verified using the specified procedures:

a. Have measurement access holes (MAH), installed according to the specifications in Reference Residential Appendix Section RA3.2.2.3; and

Exception to Section 150.1(c)7Aia: Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1, shall not be required to provide holes as described in Figure RA3.2-1.

b. System airflow rate in accordance with Subsection I or II shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified by Section RA1; and

I. For small duct high velocity systems the system airflow rate shall be greater than or equal to 250 cfm per ton; or

II. For all other air-cooled air conditioner or air-source heat pump systems the system airflow rate shall be greater than or equal to 350 cfm per ton.

Exception to Section 150.1(c)7Aib: Standard ducted systems without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in Table 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Section RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12D for the system air filter device(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.

c. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable:

I. The installer and rater shall perform the standard charge procedure as specified by Reference Residential Appendix Section

RA3.2.2, or an approved alternative procedure as specified by Section RA1; or

II. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or

III. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1 provided the system is of a type that can be verified using the Section RA3.2.2 standard charge verification procedure and Section RA3.3 airflow rate verification procedure or approved alternatives in Section RA1. The HERS Rater shall verify the charge using Sections RA3.2.2 and RA3.3 or approved alternatives in Section RA1.

Exception 1 to Section 150.1(c)7Aic: When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to verify the refrigerant charge, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Section 110.12. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.1(c)7Aib.

ii. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high-velocity systems and mini-split systems, which are of a type that cannot comply with the requirements of Section 150.1(c)7Ai shall comply with Subsections a and b, as applicable.

I. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.2.3.2.; and

II. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.1(c)7Aib provided the system is of a type that can be verified using the procedures in Section RA3.3 or an approved alternative procedure in Section RA1.

Exception to Section 150.1(c)7A: Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirements in Section 150.1(c)7Aib, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

8. **Domestic water-heating systems.** Water-heating systems shall meet the requirements of A, B or C, or shall meet the performance compliance requirements of Section 150.1(b)1. For recirculation distribution systems, only demand recirculation systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used:

A. A single 240 volt heat pump water heater (HPWH). The storage tank shall be located in the garage or conditioned space. In addition, meet the following:

- i. A compact hot water distribution system that is field verified as specified in the Reference Appendix RA4.4.16 in Climate Zones 1 and 16; and
- ii. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 in Climate Zone 16.

B. A single 240 volt HPWH that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. In addition, for Climate Zone 16, a drain water heat recovery system that is field verified as specified in Reference Appendix RA3.6.9 and the storage tank shall be located in the garage or conditioned space.

C. A solar water-heating system with electric backup meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum annual solar savings fraction of 0.7.

Exception 1 to Section 150.1(c)8: For Climate Zones 3, 4, 13 and 14, a gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank may be installed.

NOTE: The space-conditioning system shall be a heat pump as specified in Section 150.1(c)6.

Exception 2 to Section 150.1(c)8: An instantaneous electric water heater with point of use distribution as specified in RA4.4.5 may be installed for new dwelling units with a conditioned floor area of 500 square feet or less.

Exception 3 to Section 150.1(c)8A and B: A 120V HPWH may be installed in place of a 240V HPWH for new dwelling unit with one bedroom or fewer.

9. **Space conditioning distribution systems.** All space-conditioning systems shall meet all applicable requirements of A or B below:

A. High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation level meet Option B in Table 150.1-A. Duct insulation levels shall meet the requirements in Table 150.1-A.

B. Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix Section RA3.1.4.3.8. Duct insulation levels shall meet the requirements in Table 150.1-A.

Note: Gas heating appliances installed in conditioned spaces must meet the combustion air requirements of the *California Mechanical Code* Chapter 7, as applicable.

10. **Central fan integrated ventilation systems.** Central forced air system fans used to provide outside air shall have an air-handling unit fan efficacy less than or equal to the maximum W/cfm specified in A, B or C. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3. Central fan integrated ventilation systems shall be certified to the Energy Commission as intermittent ventilation systems as specified in Reference Residential Appendix RA3.7.4.2.

- A. 0.45 W/cfm for gas furnace air-handling units.
- B. 0.58 W/cfm for air-handling units that are not gas furnaces.
- C. 0.62 W/cfm for small-duct high-velocity air-handling units.

Exception to Section 150.1(c)10A: Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 w/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

11. **Roofing products.** All roofing products shall meet the requirements of Section 110.8 and the applicable requirements of Subsection A or B:

- A. Single-family residential buildings with steep-sloped roofs in climate zones 10 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.
- B. Single-family residential buildings with low-sloped roofs, in climate zones 13 and 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75 or a minimum SRI of 0.75.

Exception 1 to Section 150.1(c)11: Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for aged solar reflectance and thermal emittance or SRI.

Exception 2 to Section 150.1(c)11: Roof constructions with a weight of at least 25 lb/ft² are exempt from the minimum requirements for aged solar reflectance and thermal emittance or SRI.

12. **Ventilation cooling.** Single-family homes shall comply with the whole-house fan (WHF) requirements shown in Table 150.1-A. When a WHF is required, comply with Subsections A, B and C below.

A. Have installed one or more WHFs whose total airflow cfm is equal to or greater than 1.5 cfm/ft² of conditioned floor area. Airflow cfm for WHFs shall be determined based on the airflow listed in the Home Ventilating Institute Certified Products Directory.

B. Have at least 1 square foot of attic vent free area for each 750 cfm of rated whole-house fan airflow cfm, or if the manufacturer has specified a greater free vent area, the manufacturer’s free vent area specifications.

Exception to Section 150.1(c)12B: WHFs that are directly vented to the outside.

C. Provide homeowners who have WHFs with a one page “How to operate your whole-house fan” informational sheet.

Exception to Section 150.1(c)12: New dwelling units with a conditioned floor area of 500 square feet or less shall not be required to comply with the WHF requirements.

13. **HVAC system bypass ducts.** Bypass ducts that deliver conditioned supply air directly to the space-conditioning system return duct airflow shall not be used.

14. **Photovoltaic requirements.** All single-family residential buildings shall have a newly installed photovoltaic (PV) system or newly installed PV modules meeting the minimum qualification requirements specified in Joint Appendix JA11. The annual electrical output of the PV system shall be no less than the smaller of a PV system size determined using Equation 150.1-C, or the maximum PV system size that can be installed on the building’s solar access roof area (SARA).

A. SARA includes the area of the building’s roof space capable of structurally supporting a PV system, and the area of all roof space on covered parking areas, carports and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2, Section 1511.2.

B. SARA does NOT include:

- i. Any roof area that has less than 70 percent annual solar access. Annual solar access is determined by dividing the total annual solar insolation, accounting for shading obstructions, by the total annual solar insolation if the same areas were unshaded by obstructions. For steep slope roofs, only shading from existing permanent natural or manmade obstructions that are external to the dwelling, including but not limited to trees, hills, and adjacent structures, shall be considered for annual solar access calculations. For low slope

roofs, all obstructions, including those that are external to the dwelling unit, and obstructions that are part of the building design and elevation features shall be considered for the annual solar access calculations.

ii. Occupied roof areas as specified by CBC Section 503.1.4.

iii. Roof area that is otherwise not available due to compliance with other building code requirements if confirmed by the Executive Director.

**EQUATION 150.1-C
ANNUAL PHOTOVOLTAIC ELECTRICAL OUTPUT**

$$kW_{PV} = (CFA \times A)/1000 + (N_{DU} \times B)$$

where:

kW_{PV} = kW_{dc} size of the PV system.

CFA = Conditioned floor area.

N_{DU} = Number of dwelling units.

A = CFA adjustment factor from Table 150.1-C.

B = Dwelling unit adjustment factor from Table 150.1-C.

Exception 1 to Section 150.1(c)14: For steep slope roofs, SARA shall not consider roof areas with a northerly azimuth that lies between 300 degrees and 90 degrees from true north. No PV system is required if the SARA is less than 80 contiguous square feet.

Exception 2 to Section 150.1(c)14: No PV system is required when the minimum PV system size specified by Section 150.0(c)14 is less than 1.8 kW_{dc} .

Exception 3 to Section 150.1(c)14: Buildings with enforcement-authority-approved roof designs, where the enforcement authority determines it is not possible for the PV system, including panels, modules and components and supports and attachments to the roof structure, to meet the requirements of the American Society of Civil Engineers (ASCE), Standard 7-16, Chapter 7, Snow Loads.

Exception 4 to Section 150.1(c)14: For buildings that are approved by the local planning department prior to January 1, 2020 with mandatory conditions for approval:

- a. Shading from roof designs and configurations for steep-sloped roofs, which are required by the mandatory conditions for approval, shall be considered for the annual solar access calculations; and
- b. Roof areas that are not allowed by the mandatory conditions for approval to have PVs shall not be considered in determining the SARA.

Exception 5 to Section 150.1(c)14: PV system sizes determined using Equation 150.1-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum usable capacity of 7.5 kWh.

TABLE 150.1-A
COMPONENT PACKAGE—SINGLE-FAMILY STANDARD BUILDING DESIGN

SINGLE FAMILY		CLIMATE ZONE																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			
Building Envelope Insulation																				
Building Envelope	Roofs/Ceilings	Option B (meets §150.1(c)9A)	Below Roof Deck Insulation ^{1,2} (With Air Space)	NR	NR	NR	R-19	NR	NR	NR	R-19	R-19	R-19	R-19	R-19	R-19	R-19	R-19		
			Ceiling Insulation	R-38	R-38	R-30	R-38	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	
			Radiant Barrier	NR	REQ	REQ	NR	REQ	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	
		Option C (meets §150.1(c)9B)	Ceiling Insulation	R-38	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-38	R-38	R-38	R-38	R-38	R-38	
			Radiant Barrier	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	
	Walls	Above Grade	Framed ³	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.065	U 0.065	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	U 0.048	
			Mass Wall Interior ^{4,5}	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-17	
			Mass Wall Exterior ^{4,5}	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.125 R-8.0	U 0.077 R-13
		Below Grade	Below Grade Interior ⁶	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.077 R-13	U 0.067 R-15
			Below Grade Exterior ⁶	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.200 R-5.0	U 0.100 R-10	U 0.100 R-10	U 0.053 R-19
	Floors	Slab Perimeter	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R-7.0	
		Raised	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	U 0.037 R-19	
		Concrete Raised	U 0.092 R-8.0	U 0.092 R-8.0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.269 R-0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0	U 0.092 R-8.0	U 0.138 R-4.0	U 0.092 R-8.0	
	Quality Insulation Installation (QII)		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Roofing Products	Low-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.63	NR	0.63	NR	
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	NR	0.75	NR	
		Steep-sloped	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.20	0.20	0.20	0.20	0.20	0.20	NR
			Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.75	0.75	0.75	0.75	0.75	0.75	NR
Fenestration	Maximum U-factor		0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30		
	Maximum SHGC		NR	0.23	NR	0.23	NR	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	NR		
	Maximum Total Area		20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%		
	Maximum West Facing Area		NR	5%	NR	5%	NR	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	NR		
Door	Maximum U-factor		0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20		

(continued)

TABLE 150.1-A—continued
COMPONENT PACKAGE—SINGLE-FAMILY STANDARD BUILDING DESIGN

		CLIMATE ZONE																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
HVAC SYSTEM	Space Heating ⁶	Electric-Resistance allowed	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	
		If gas, AFUE	MIN	MIN	NA	NA	MIN	MIN	MIN	MIN	MIN	MIN	NA	MIN	MIN	NA	NA	MIN	MIN
		If Heat Pump, HSPF ⁷ /HSPF2	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Space Cooling	SEER/SEER2	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
		Refrigerant Charge Verification or Fault Indicator Display	NR	REQ	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR
		Whole House Fan ⁸	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	NR	NR
	Central System Air Handlers	Central Fan Integrated Ventilation System Fan Efficacy	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
	Ducts ¹⁰	Roof/Ceiling Option B	Duct Insulation	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
			§150.1(c)9A	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Roof/Ceiling Option C	Duct Insulation	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6	R-6
§150.1(c)9B			REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
WATER HEATING	All Buildings	System Shall meet Section 150.1(c)8																	

1. Install the specified *R*-value with an air space present between the roofing and the roof deck, such as standard installation of concrete or clay tile.
2. *R*-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. Alternatives including insulation above rafters or above roof deck shall comply with the performance standards.
3. Assembly *U*-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly *U*-factor equal to or less than the *U*-factor shown. Use Reference Joint Appendices JA4 Table 4.3.1, 4.3.1(a), or Table 4.3.4 to determine alternative insulation products to be less than or equal to the required maximum *U*-factor.
4. Mass wall has a heat capacity greater than or equal to 7.0 Btu/h-ft².
5. “Interior” denotes insulation installed on the inside surface of the wall. “Exterior” denotes insulation installed on the exterior surface of the wall.
6. Below grade “interior” denotes insulation installed on the inside surface of the wall; and Below grade “exterior” denotes insulation installed on the outside surface of the wall.
7. HSPF means “heating seasonal performance factor.”
8. When whole-house fans are required (REQ), only those whole-house fans that are listed in the Home Ventilating Institute Certified Products Directory may be installed. Compliance requires installation of one or more WHFs whose total airflow cfm is capable of meeting or exceeding a minimum 1.5 cfm/square foot of conditioned floor area as specified by Section 150.1(c)12.
9. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.
10. For duct and air handler location: REQ denotes location in conditioned space. When the table indicates ducts and air handlers are in conditioned space, a HERS verification is required as specified by Reference Residential Appendix RA3.1.4.3.8.

**TABLE 150.1-B
RESERVED**

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**TABLE 150.1-C
CFA AND DWELLING UNIT ADJUSTMENT FACTORS**

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CLIMATE ZONE	A—CFA	B—DWELLING UNITS
1	0.793	1.27
2	0.621	1.22
3	0.628	1.12
4	0.586	1.21
5	0.585	1.06
6	0.594	1.23
7	0.572	1.15
8	0.586	1.37
9	0.613	1.36
10	0.627	1.41
11	0.836	1.44
12	0.613	1.40
13	0.894	1.51
14	0.741	1.26
15	1.56	1.47
16	0.59	1.22

Note: Authority: Sections 25213, 25218, 25218.5, 25402, 25402.1, and 25605, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, 25605, and 25943, *Public Resources Code*.

SUBCHAPTER 9

SINGLE-FAMILY RESIDENTIAL BUILDINGS—ADDITIONS AND ALTERATIONS TO EXISTING RESIDENTIAL BUILDINGS

SECTION 150.2 ENERGY EFFICIENCY STANDARDS FOR ADDITIONS AND ALTERATIONS TO EXISTING SINGLE-FAMILY RESIDENTIAL BUILDINGS

(a) **Additions.** Additions to existing single-family residential buildings shall meet the requirements of Sections 110.0 through 110.9; Sections 150.0(a) through (n), (p) and (q); and either Section 150.2(a)1 or 2.

Exception 1 to Section 150.2(a): Additions of 300 square feet or less are exempt from the roofing requirements of Section 150.1(c)11.

Exception 2 to Section 150.2(a): Existing inaccessible piping shall not require insulation as defined under Section 150.0(j)1.

Exception 3 to Section 150.2(a): Space-conditioning system. When heating or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 1204.1.

Exception 4 to Section 150.2(a): Space-conditioning system ducts. When any length of duct is extended from an existing duct system to serve the addition, the existing duct system and the extended duct shall meet the applicable requirements specified in Section 150.2(b)1Di and 150.2(b)1Dii.

Exception 5 to Section 150.2(a): Additions 1,000 square feet or less are exempt from the ventilation cooling requirements of Section 150.1(c)12.

Exception 6 to Section 150.2(a): Photovoltaic systems, as specified in Section 150.1(c)14, are not required for additions.

Exception 7 to Section 150.2(a): Space heating system. A new or replacement space heating system serving an addition may be a heat pump or gas heating system.

1. **Prescriptive approach.** Additions to existing buildings shall meet the following additional requirements:

A. Additions that are greater than 700 square feet shall meet the requirements of Section 150.1(c), with the following modifications:

i. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2 × 4 framing and R-19 in a 2 × 6 framing.

ii. The maximum allowed fenestration area shall be the greater of 175 square feet or 20 percent of the addition floor area, and the maximum allowed west-facing fenestration area shall be the greater of 70 square feet or the requirements of Section 150.1(c).

iii. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2 × 4 framing and R-21 in a 2 × 6 framing shall be installed and continuous insulation is not required.

iv. Additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to perform the following as part of QII:

a. Existing window and door headers shall not be required to be insulated.

b. Air sealing shall not be required when the existing air barrier is not being removed or replaced.

B. Additions that are 700 square feet or less shall meet the requirements of Section 150.1(c), with the following modifications:

i. Roof and ceiling insulation in a ventilated attic shall meet one of the following requirements:

a. In Climate Zones 1, 2, 4, and 8 through 16, achieve an overall assembly *U*-factor not exceeding 0.025. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing insulation with an *R*-value of R-38 or greater.

b. In Climate Zones 3, and 5 through 7, achieve an overall assembly *U*-factor not exceeding 0.031. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing insulation with an *R*-value of R-30 or greater.

ii. Radiant barriers shall be installed in Climate Zones 2-15.

iii. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2 × 4 framing and R-21 in a 2 × 6 framing.

iv. In Climate Zones 2, 4 and 6-15; the maximum allowed west-facing fenestration area shall not be greater than 60 square feet; and shall also comply with either a or b below:

a. For additions that are 700 square feet or less but greater than 400 square feet, the maximum allowed fenestration area limit is the greater of 120 square feet or 25 percent of the conditioned floor area of the addition.

b. For additions that are 400 square feet or less, the maximum allowed fenestration area is

the greater of 75 square feet or 30 percent of the conditioned floor area of the addition.

- v. Quality Insulation Installation (QII) requirements of Section 150.1(c)1E do not apply.
- vi. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2 × 4 framing and R-21 in a 2 × 6 framing shall be installed and continuous insulation is not required.

Exception to Section 150.2(a)1B: Insulation in an enclosed rafter ceiling shall meet the requirements of Section 150.0.

C. Mechanical ventilation for indoor air quality.

Additions to existing buildings shall comply with Section 150.0(o) subject to the requirements specified in Subsections i and ii below.

i. Whole-dwelling unit mechanical ventilation.

- a. Dwelling units that meet the conditions in Subsection 1 or 2 below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F.
 - 1. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to 1000 square feet.
 - 2. Junior accessory dwelling units (JADU) that are additions to an existing building.
- b. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.
- c. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

ii. Local mechanical exhaust. Additions to existing buildings shall comply with all applicable requirements specified in Sections 150.0(o)1G and 150.0(o)2.

D. Water heater. When a second water heater is installed as part of the addition, one of the following types of water heaters shall be installed:

- i. A single heat pump water heater. The storage tank shall not be located outdoors and shall be

placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2045-B communication port; or

- ii. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or
- iii. A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank; or
- iv. For additions that are 500 square feet or less, an instantaneous electric water heater with point of use distribution as specified in RA4.4.5; or
- v. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item i, ii, iii or iv.

2. Performance approach. Performance calculations shall meet the requirements of Section 150.1(a) through (c), pursuant to the applicable requirements in Items A, B and C below.

A. For additions alone. The addition complies if the addition alone meets the energy budgets as specified in Section 150.1(b).

B. Existing plus alteration plus addition. The standard design for existing plus alteration plus addition energy use is the combination of the existing building's unaltered components to remain; existing building altered components that are the more efficient, in TDV energy, of either the existing conditions or the requirements of Section 150.2(b)2; plus the proposed addition's energy use meeting the requirements of Section 150.2(a)1. The proposed design energy use is the combination of the existing building's unaltered components to remain and the altered components' energy features, plus the proposed energy features of the addition.

Exception to Section 150.2(a)2B: Existing structures with a minimum R-11 insulation in framed walls showing compliance with Section 150.2(a)2 are exempt from showing compliance with Section 150.0(c).

C. Mechanical ventilation for indoor air quality. Additions to existing buildings shall comply with Section 150.0(o) subject to the requirements specified in Subsections i and ii below.

i. Whole-dwelling unit mechanical ventilation.

- a. Dwelling units that meet the conditions in Subsection 1 or 2 below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F.
 - 1. Additions to an existing dwelling unit that increase the conditioned floor area of the

existing dwelling unit by less than or equal to 1000 square feet.

2. Junior accessory dwelling units (JADU) that are additions to an existing building.

b. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprised of the existing dwelling unit conditioned floor area plus the addition conditioned floor area.

c. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

ii. **Local mechanical exhaust.** Additions to existing buildings shall comply with all applicable requirements specified in Sections 150.0(o)1G and 150.0(o)2.

(b) **Alterations.** Alterations to existing single-family residential buildings or alterations in conjunction with a change in building occupancy to a single-family residential occupancy shall meet either Item 1 or 2 below.

1. **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall meet the applicable requirements of Sections 110.0 through 110.9, all applicable requirements of Sections 150.0(a) through (l), 150.0(m)1 through 150.0(m)10, and 150.0(p) through (q); and

A. **Added fenestration.** Alterations that add vertical fenestration and skylight area shall meet the total fenestration area and west facing fenestration area, *U*-factor, and solar heat gain coefficient requirements of Section 150.1(c) and Table 150.1-A.

Exception 1 to Section 150.2(b)1A: Alterations that add fenestration area of up to 75 square feet shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Section 150.1(c)3B and C.

Exception 2 to Section 150.2(b)1A: Alterations that add up to 16 square feet of new skylight area with a maximum *U*-factor of 0.55 and a maximum SHGC of 0.30 area shall not be required to meet the total fenestration area and west-facing fenestration area requirements of Sections 150.1(c)3B and C.

B. **Replacement fenestration.** New manufactured fenestration products installed to replace existing fenestration products of the same total area shall meet the *U*-factor and Solar Heat Gain Coefficient requirements of Sections 150.1(c)3A, and 150.1(c)4.

Exception 1 to Section 150.2(b)1B: Replacement of vertical fenestration no greater than 75 square feet with a *U*-factor no greater than 0.40 in Climate Zones 1–16, and a SHGC value no greater than 0.35 in Climate Zones 2, 4 and 6–15.

Exception 2 to Section 150.2(b)1B: Replaced skylights must meet a *U*-factor no greater than 0.55, and a SHGC value no greater than 0.30.

Note: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are considered repairs, provided that the replacement is at least equivalent to the original in performance.

C. **Entirely new or complete replacement space-conditioning systems** installed as part of an alteration, shall include all the system heating or cooling equipment, including but not limited to: condensing unit, cooling or heating coil, and air handler for split systems; or complete replacement of a packaged unit; plus entirely new or replacement duct system [Section 150.2(b)1Diia]. Entirely new or complete replacement space-conditioning systems shall meet the requirements of Sections 150.0(h), 150.0(i), 150.0(j)1, 150.0(j)2, 150.0(m)1 through 150.0(m)10, 150.0(m)12, 150.0(m)13, 150.1(c)7, 150.2(b)1G and Table 150.2-A.

D. **Altered duct systems—duct sealing.** In all climate zones, when more than 25 feet of new or replacement space-conditioning system ducts are installed, the ducts shall comply with the applicable requirements of Subsections i and ii below. Additionally, when altered ducts, air-handling units, cooling or heating coils, or plenums are located in garage spaces, the system shall comply with Subsection 150.2(b)1Diic regardless of the length of any new or replacement space-conditioning ducts installed in the garage space.

i. New ducts located in unconditioned space shall meet the applicable requirements of Sections 150.0(m)1 through 150.0(m)10, and the duct insulation requirements of Table 150.2-A; and

TABLE 150.2-A
DUCT INSULATION R-VALUE

Climate Zone	3, 5 through 7	1, 2, 4, 8 through 16
Duct R-Value	R-6	R-8

ii. The altered duct system, regardless of location, shall be sealed as confirmed through field verification and diagnostic testing in accordance with all applicable procedures for duct sealing of altered existing duct systems as specified in Reference Residential Appendix Section RA3.1, utilizing the leakage compliance criteria specified in Subsection a or b below:

a. **Entirely new or complete replacement duct system.** If the new ducts form an entirely new or complete replacement duct system directly

connected to the air handler, the duct system shall meet one of the following requirements:

- I. For single-family dwellings, the measured duct leakage shall be equal to or less than 5 percent of the system air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1.
- II. For multifamily dwellings, regardless of duct system location,
 - A. The total leakage of the duct system shall not exceed 12 percent of the nominal system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1, or
 - B. The duct system leakage to outside shall not exceed 6 percent of the nominal system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4.

Entirely new or complete replacement duct systems installed as part of an alteration are constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system, including but not limited to, registers, grilles, boots, air handler, coil, plenums, duct material, if the reused parts are accessible and can be sealed to prevent leakage.

Entirely new or complete replacement duct systems shall also conform to the requirements of Sections 150(m)12 and 150(m)13. If the air handler and ducts are located within a vented attic, the requirements of Section 150.2(b)1J shall also be met.

- b. **Extension of an existing duct system.** If the new ducts are an extension of an existing duct system serving single-family or multifamily dwellings, the combined new and existing duct system shall meet one of the following requirements:
 - I. The measured duct leakage shall be equal to or less than 10 percent of system air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
 - II. The measured duct leakage to outside shall be equal to or less than 7 percent of system air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4; or

- III. If it is not possible to meet the duct sealing requirements of either Section 150.2(b)1DiibI or 150.2(b)1DiibII, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater utilizing the methods specified in Reference Residential Appendix Section RA3.1.4.3.5.

Exception to Section 150.2(b)1Diib: Duct sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.

- c. **Altered ducts and duct system components in garage spaces.** When new or replacement space-conditioning ducts, air-handling units, cooling or heating coils, or plenums are located in a garage space, compliance with either I or II below is required.
 - I. The measured system duct leakage shall be less than or equal to 6 percent of system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
 - II. All accessible leaks located in the garage space shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater utilizing the methods specified in Reference Residential Appendix RA3.1.4.3.5.

- E. **Altered space-conditioning system—duct sealing.** In all climate zones, when a space-conditioning system serving a single-family or multifamily dwelling is altered by the installation or replacement of space-conditioning system equipment, including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil, the duct system that is connected to the altered space-conditioning system equipment shall be sealed, as confirmed through field verification and diagnostic testing in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Residential Appendix Section RA3.1, and the leakage compliance criteria specified in Subsection i, ii, or iii below. Additionally, when altered ducts, air-handling units, cooling or heating coils, or plenums are located in garage spaces, the system shall comply with Section 150.2(b)1Diic regardless of the length of any new or replacement space-conditioning ducts installed in the garage space.

- i. The measured duct leakage shall be equal to or less than 10 percent of system air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
- ii. The measured duct leakage to outside shall be equal to or less than 7 percent of system air handler airflow as determined utilizing the proce-

dures in Reference Residential Appendix Section RA3.1.4.3.4; or

- iii. If it is not possible to meet the duct sealing requirements of either Section 150.2(b)1Ei or 150.2(b)1Eii, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater utilizing the methods specified in Reference Residential Appendix Section RA3.1.4.3.5.

Exception 1 to Section 150.2(b)1E: Duct sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Reference Residential Appendix Section RA3.1.

Exception 2 to Section 150.2(b)1E: Duct sealing. Duct systems with less than 40 linear feet as determined by visual inspection.

Exception 3 to Section 150.2(b)1E: Duct sealing. Existing duct systems constructed, insulated or sealed with asbestos.

- F. **Altered space-conditioning system—mechanical cooling.** When a space-conditioning system is an air conditioner or heat pump that is altered by the installation or replacement of refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping, the altered system shall comply with the following requirements:

- i. All thermostats associated with the system shall be replaced with setback thermostats meeting the requirements of Section 110.2(c).
- ii. In Climate Zones 2, 8, 9, 10, 11, 12, 13, 14 and 15, air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted package systems, small duct high-velocity air systems, and minisplit systems shall comply with Subsections a and b, unless the system is of a type that cannot be verified using the specified procedures. Systems that cannot comply with the requirements of Section 150.2(b)1Fii shall comply with Section 150.2(b)1Fiii.

Exception to Section 150.2(b)1Fii: Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall

comply with minimum system airflow rate requirement in Section 150.2(b)1Fiia, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

- a. Minimum system airflow rate shall comply with the applicable Subsection I or II below as confirmed through field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified in Section RA1.
 - 1. Small duct high-velocity systems shall demonstrate a minimum system airflow rate greater than or equal to 250 cfm per ton of nominal cooling capacity; or
 - 2. All other air-cooled air conditioner or air-source heat pump systems shall demonstrate a minimum system airflow rate greater than or equal to 300 cfm per ton of nominal cooling capacity; and

Exception 1 to Section 150.2(b)1Fiia: Systems unable to comply with the minimum airflow rate requirement shall demonstrate compliance using the procedures in Section RA3.3.3.1.5; and the system's thermostat shall conform to the specifications in Section 110.12.

Exception 2 to Section 150.2(b)1Fiia: Entirely new or complete replacement space-conditioning systems, as specified by Section 150.2(b)1C, without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in Table 150.0-B or 150.0-C as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 150.0(m)12C for the system air filter device(s) shall conform to the requirements given in Tables 150.0-B and 150.0-C.

- b. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable.
 - 1. The installer and rater shall perform the standard charge verification procedure as specified in Reference Residential Appendix Section RA3.2.2, or an approved alternative procedure as specified in Section RA1; or
 - 2. The system shall be equipped with a fault indicator display (FID) device that meets

the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or

3. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1, provided the system is of a type that can be verified using the Section RA3.2.2 standard charge verification procedure and Section RA3.3 airflow rate verification procedure or approved alternatives in Section RA1. The HERS Rater shall verify the charge using Sections RA3.2.2 and RA3.3 or approved alternatives in Section RA1.

Exception to Section 150.2(b)1Fiib: When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to demonstrate compliance, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Section 110.12. Ducted systems shall comply with the minimum system airflow rate requirements in Section 150.2(b)1Fiia.

- iii. In Climate Zones 2, 8, 9, 10, 11, 12, 13, 14 and 15, air-cooled air conditioners or air-source heat pumps, including but not limited to ducted split systems, ducted package systems, small duct high-velocity, and minisplit systems, which are of a type that cannot comply with the requirements of 150.2(b)1Fiib shall comply with Subsections a and b, as applicable.
 - a. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.2.3.2; and
 - b. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 150.2(b)1Fiia provided the system is of a type that can be verified using the procedures in Section RA3.3 or an approved alternative procedure in Section RA1.

Exception to Section 150.2(b)1Fiii: Entirely new or complete replacement packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify on the Certificate of Installation that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 150.2(b)1Fiib, provided that the system is of a type that can be verified using the procedure specified in Section RA3.3 or an approved alternative in Section RA1.

- G. **Altered space-heating system.** Altered or replacement space-heating systems shall not use electric resistance as the primary heat source.

Exception 1 to Section 150.2(b)1G: Nonducted electric resistance space heating systems, if the existing space heating system is electric resistance.

Exception 2 to Section 150.2(b)1G: Ducted electric resistance space heating systems, if the existing space heating system is electric resistance and a ducted space cooling system is not being replaced or installed.

Exception 3 to Section 150.2(b)1G: Electric resistance space heating systems, if the existing space heating system is electric resistance and the building is located in Climate Zone 7 or 15.

- H. **Water-heating system.** Altered or replacement service water-heating systems or components shall meet the applicable requirements below:

- i. **Pipe insulation.** For newly installed and existing accessible piping, the insulation requirements of Section 150.0(j)1 shall be met.

- ii. **Distribution system.** For recirculation distribution systems: serving individual dwelling units, only demand recirculation systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be installed.

- iii. **Water heating system.** The water heating system shall meet one of the following:

- a. A natural gas or propane water-heating system; or

- b. A single heat pump water heater. The storage tank shall not be located outdoors and be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2045-B communication port; or

- c. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or
- d. If the existing water heater is an electric resistance water heater, a consumer electric water heater; or
- e. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item a above; or if no natural gas is connected to the existing water heater location, a water-heating system determined by the executive director to use no more energy than the one specified in Item d above.

I. Roofs. Replacements of the exterior surface of existing roofs, including adding a new surface layer on top of the existing exterior surface, shall meet the requirements of Section 110.8 and the applicable requirements of Subsections i and ii where more than 50 percent of the roof is being replaced.

i. Steep-sloped roofs. Steep-sloped roofs shall meet the following:

New roofing products in Climate Zones 4 and 8 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

Exception 1 to Section 150.2(b)1Ii: The following shall be considered equivalent to Subsection i:

- a. Buildings with ceiling assemblies with a *U*-factor lower than or equal to 0.025 or that are insulated with at least R-38 ceiling insulation; or
- b. Buildings with a radiant barrier in the attic, where the radiant barrier is not installed directly above spaced sheathing, meeting the requirements of Section 150.1(c)2; or
- c. In Climate Zones 2, 4, 9, 10, 12 and 14, buildings that have no ducts in the attic; or
- d. Buildings with R-2 or greater continuous insulation above or below the roof deck.

Exception 2 to Section 150.2(b)1Ii: Roof area covered by building integrated photovoltaic panels or building integrated solar thermal panels is not required to meet minimum requirements for aged solar reflectance, thermal emittance or SRI.

Exception 3 to Section 150.2(b)1Ii: Roof constructions with a weight of at least 25 lb/ft² are exempt from minimum requirements for aged solar reflectance and thermal emittance, or SRI.

ii. Low-sloped roofs. Low-sloped roofs shall meet the following:

- a. New roofing products in Climate Zones 4 and 6 through 15 shall have an aged solar reflectance equal to or greater than 0.63 and a thermal

emittance equal or greater than 0.75, or a minimum SRI of 75.

Exception 1 to Section 150.2(b)1Iiia: The aged solar reflectance can be met by using insulation at the roof deck specified in Table 150.2-B.

**TABLE 150.2-B
AGED SOLAR REFLECTANCE INSULATION TRADE-OFF TABLE**

MINIMUM AGED SOLAR REFLECTANCE	ROOF DECK CONTINUOUS INSULATION R-VALUE (Climate Zones 6–7)	ROOF DECK CONTINUOUS INSULATION R-VALUE (Climate Zones 2, 4 and 8–15)
0.60	2	16
0.55	4	18
0.50	6	20
0.45	8	22
No requirement	10	24

Exception 2 to Section 150.2(b)1Iiia: Roof area covered by building integrated photovoltaic panels or building integrated solar thermal panels is not required to meet the minimum requirements for aged solar reflectance, thermal emittance or SRI.

Exception 3 to Section 150.2(b)1Iiia: Roof constructions with a weight of at least 25 lb/ft² are exempt from the minimum requirements for aged solar reflectance and thermal emittance, or SRI.

b. Roofs shall be insulated to the levels specified in Table 150.2-C.

**TABLE 150.2-C
INSULATION REQUIREMENTS FOR ROOF ALTERATIONS**

CLIMATE ZONE	CONTINUOUS INSULATION R-VALUE	ROOF ASSEMBLY U-FACTOR
3, 5–7	N.A.	N.A.
1, 2, 4, 8–16	R-14	0.039

Exception 1 to Section 150.2(b)1Iiib: Existing roofs with R-10 or greater continuous insulation above or below the roof deck; or

Exception 2 to Section 150.2(b)1Iiib: Existing roofs with an assembly *U*-factor of 0.056 or less or that are insulated with at least R-19 insulation between the roof rafters and in contact with the roof deck in Climate Zones 1, 2, 4, and 8 through 10; or

Exception 3 to Section 150.2(b)1Iiib: The continuous insulation requirements of Table 150.2-C may be reduced to R-4 where the following conditions are met:

- i. Mechanical equipment is located on the roof and will not be temporarily disconnected and lifted as part of the roof replacement and the addition of insulation required by Table 150.2-C would reduce the height from the roof surface to the top of the base flashing to less than that set forth in

the manufacturer's installation instructions as per *California Residential Code* Section R900; or

- ii. Replaced roofing abuts sidewall or parapet walls and the addition of insulation required by Table 150.2-C would reduce the height from the roof surface to the top of the base flashing to less than that set forth in the manufacturer's installation instructions as per *California Residential Code* Section R900, provided that the following conditions apply:
 1. The sidewall or parapet walls are finished with an exterior cladding material other than the roof covering membrane material; and
 2. The sidewall or parapet walls have exterior cladding material that must be removed to install the new roof covering membrane to maintain the minimum base flashing height; and
 3. The ratio of the replaced roof area to the linear dimension of affected sidewall or parapet walls is less than 25 square feet per linear foot; or

Exception 4 to Section 150.2(b)1Iiib: The continuous insulation requirements per Table 150.2-C may be reduced where increasing the thickness of above deck insulation would reduce the flashing around an existing exterior wall opening below what is permitted by the fenestration or door manufacturer's installation instructions, or registered design professional's approved flashing design, as per *California Residential Code* Section R703.4, or by *California Residential Code* Section R905.2.8.3.

Exception 5 to Section 150.2(b)1Biib: Tapered insulation with thermal resistance less than prescribed at the drains and other low points may be used provided that the thickness of insulation is increased at the high points of the roof so that the average thermal resistance equals or exceeds the required value.

J. Ceiling. Vented attics shall meet the following:

- i. In Climate Zones 1 through 4, 6, and 8 through 16 insulation shall be installed to achieve a weighted U-factor of 0.020 or insulation installed at the ceiling level shall result in an insulated thermal resistance of R-49 or greater for the insulation alone; and

Exception to Section 150.2(b)1Ji: In Climate Zones 1, 3 and 6, dwelling units with at least R-19 existing insulation installed at the ceiling level.

- ii. In Climate Zones 2, 4, and 8 through 16, air seal all accessible areas of the ceiling plane between the attic and the conditioned space in accordance with Section 110.7; and

Exception 1 to Section 150.2(b)1Jii: Dwelling units with at least R-19 existing insulation installed at the ceiling level.

Exception 2 to Section 150.2(b)1Jii: Dwelling units with atmospherically vented space-heating or water-heating combustion appliances located inside the pressure boundary of the dwelling unit.

- iii. In Climate Zones 1 through 4 and 8 through 16, recessed downlight luminaires in the ceiling shall be covered with insulation to the same depth as the rest of the ceiling. Luminaires not rated for insulation contact must be replaced or retrofitted with a fireproof cover that allows for insulation to be installed directly over the cover; and

Exception 1 to Section 150.2(b)1Jiii: In Climate Zones 1 through 4 and 8 through 10, dwelling units with at least R-19 existing insulation installed at the ceiling level with third-party verification of existing conditions.

- iv. Attic ventilation shall comply with the *California Building Code* requirements.

Exception 1 to Section 150.2(b)1J: Dwelling units with at least R-38 existing insulation installed at the ceiling level.

Exception 2 to Section 150.2(b)1J: Dwelling units where the alteration would directly cause the disturbance of asbestos.

Exception 3 to Section 150.2(b)1J: Dwelling units with knob and tube wiring located in the vented attic.

Exception 4 to Section 150.2(b)1J: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 806.3 of Title 24, Part 2.5.

Exception 5 to Section 150.2(b)1J: Where the attic space above the altered dwelling unit is shared with other dwelling units and the requirements of Section 150.2(b)1J are not triggered for the other dwelling units.

- K. **Lighting.** The altered lighting system shall meet the lighting requirements of Section 150.0(k). The altered luminaires shall meet the luminaire efficacy requirements of Section 150.0(k) and Table 150.0-A. Where existing screw-base sockets are present in ceiling-recessed luminaires, removal of these sockets is not required provided that new JA8-compliant trim kits or lamps designed for use with recessed downlights or luminaires are installed.

- L. **Mechanical ventilation for indoor air quality—entirely new or complete replacement ventilation systems.** Entirely new or complete replacement ventilation systems shall comply with all applicable requirements in Section 150.0(o). An entirely new or complete replacement ventilation system includes

a new ventilation fan component and an entirely new duct system. An entirely new or complete replacement duct system is constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system, including but not limited to registers, grilles, boots, air filtration devices and duct material, if the reused parts are accessible and can be sealed to prevent leakage.

M. Mechanical ventilation for indoor air quality—altered ventilation systems. Altered ventilation system components or newly installed ventilation equipment serving the alteration shall comply with Section 150.0(o) as applicable subject to the requirements specified in Subsections i and ii below.

i. Whole-dwelling unit mechanical ventilation.

a. **Whole-dwelling unit airflow.** If the whole-dwelling ventilation fan is altered or replaced, then one of the following Subsections 1 or 2 shall be used for compliance as applicable.

1. Dwellings that were required by a previous building permit to comply with the whole-dwelling unit airflow requirements in Section 150.0(o) shall meet or exceed the whole-dwelling unit mechanical ventilation airflow specified in Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F as confirmed through field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.7.
2. Dwellings that were not required by a previous building permit to have a whole-dwelling unit ventilation system shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 150.0(o)1C, 150.0(o)1E or 150.0(o)1F.

b. **Replacement ventilation fans.** Whole-dwelling unit replacement ventilation fans shall be rated for airflow and sound in accordance with the requirements of ASHRAE 62.2 Sections 7.1 and 7.2. Additionally, when conformance to a specified whole-dwelling unit airflow rate is required for compliance, the replacement fans shall be rated at no less than the airflow rate required for compliance.

c. **Air filters.** If the air filtration device for a whole-dwelling unit ventilation system is altered or replaced, then one of the following Subsections 1 or 2 shall be used for compliance as applicable.

1. Dwellings that were required by a previous building permit to comply with the ventilation system air filtration requirements in Section 150.0(m)12 shall comply with the air filtration requirements in Section 150.0(m)12.

2. Dwellings that were not required by a previous building permit to comply with the ventilation system air filtration requirements in Section 150.0(m)12 shall not be required to comply with the air filtration requirements specified in Section 150.0(m)12.

ii. Local mechanical exhaust.

a. **Bathroom local mechanical exhaust.** Altered bathroom local mechanical exhaust systems shall comply with the applicable requirements specified in Section 150.0(o)1G.

b. **Kitchen local mechanical exhaust.** If the kitchen local ventilation fan is altered or replaced, then one of the following Subsections 1, 2 or 3 shall be used for compliance as applicable.

1. Dwellings that were required by a previous building permit to comply with the kitchen local exhaust requirements in Section 150.0(o)1G shall meet or exceed the applicable airflow or capture efficiency requirements in Section 150.0(o)1G.
2. Dwellings that were required by a previous building permit to install a vented kitchen range hood or other kitchen exhaust fan shall install a replacement fan that meets or exceeds the airflow required by the previous building permit, or 100 cfm, whichever is greater.
3. Dwellings that were not required to have a kitchen local ventilation exhaust system according to the conditions in either Subsection 1 or 2 above shall not be required to comply with the requirements of Section 150.0(o)1G.

c. **Replacement ventilation fans.** New or replacement local mechanical exhaust fans shall be rated for airflow and sound in accordance with the requirements of ASHRAE 62.2 Section 7.1 and Title 24, Part 6 Section 150.0(o)1Gvi. Additionally, when compliance with a specified exhaust airflow rate is required, the replacement fan shall be rated at no less than the airflow rate required for compliance.

N. Exterior doors. Alterations that add exterior door area shall meet the *U*-factor requirement of Section 150.1(c)5.

2. Performance approach. The altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections A, B, and C below.

A. The altered components shall meet the applicable requirements of Sections 110.0 through 110.9, Sections 150.0(a) through (l), Sections 150.0(m)1 through 150.0(m)10, and Sections 150.0(p) through (q). Entirely new or complete replacement mechanical ventilation systems, as these terms are used in

Section 150.2(b)1L, shall comply with the requirements in Section 150.2(b)1L. Altered mechanical ventilation systems shall comply with the requirements of Section 150.2(b)1M. Entirely new or complete replacement space-conditioning systems, and entirely new or complete replacement duct systems, as these terms are used in Sections 150.2(b)1C and 150.2(b)1Diia, shall comply with the requirements of Sections 150.0(m)12 and 150.0(m)13.

B. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements stated in Table 150.2-D. For components not being altered, the standard design shall be based on the existing conditions. When the third party verification option is specified as a requirement, all components proposed for alteration for which the additional credit is taken must be verified.

C. The proposed design shall be based on the actual values of the altered components.

Notes to Section 150.2(b)2:

1. If an existing component must be replaced with a new component, that component is considered an altered component for the purpose of determining the standard design altered

component energy budget and must meet the requirements of Section 152(b)2B.

2. The standard design shall assume the same geometry and orientation as the proposed design.
3. The “existing efficiency level” modeling rules, including situations where nameplate data are not available, are described in the Residential ACM Approval Manual.

Exception 1 to Section 150.2(b): Any dual-glazed greenhouse or/garden window installed as part of an alteration complies with the *U*-factor requirements in Section 150.1(c)3.

Exception 2 to Section 150.2(b): Where the space in the attic or rafter area is not large enough to accommodate the required *R*-value, the entire space shall be filled with insulation, provided such installation does not violate Section 1203.2 of Title 24, Part 2.

(c) **Whole building.** Any addition or alteration may comply with the requirements of Title 24, Part 6 by meeting the requirements for the entire building.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8, 25910, and 25943, *Public Resources Code*.

**TABLE 150.2-D
STANDARD DESIGN FOR AN ALTERED COMPONENT**

ALTERED COMPONENT	STANDARD DESIGN WITHOUT THIRD PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON	STANDARD DESIGN WITH THIRD-PARTY VERIFICATION OF EXISTING CONDITIONS SHALL BE BASED ON
Ceiling insulation, wall insulation, and raised-floor insulation	The requirements of Sections 150.0(a), (c), and (d)	The existing insulation <i>R</i> -value
Fenestration	The <i>U</i> -factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.	If the proposed <i>U</i> -factor is ≤ 0.40 and SHGC value is ≤ 0.35 , the standard design shall be based on the existing <i>U</i> -factor and SHGC values as verified. Otherwise, the standard design shall be based on the <i>U</i> -factor of 0.40 and SHGC value of 0.35. The glass area shall be the glass area of the existing building.
Window film	The <i>U</i> -factor of 0.40 and SHGC value of 0.35.	The existing fenestration in the alteration shall be based on Tables 110.6-A and 110.6-B.
Doors	The <i>U</i> -factor of 0.20. The door area shall be the door area of the existing building.	If the proposed <i>U</i> -factor is < 0.20 , the standard design shall be based on the existing <i>U</i> -factor value as verified. Otherwise, the standard design shall be based on the <i>U</i> -factor of 0.20. The door area shall be the door area of the existing building.
Space-heating and space-cooling equipment	Table 150.1-A for equipment efficiency requirements; Section 150.2(b)1C for entirely new or complete replacement systems; Section 150.2(b)1F for refrigerant charge verification requirements.	The existing efficiency levels.
Air distribution system – duct sealing	The requirements of Sections 150.2(b)1D and 150.2(b)1E	
Air distribution system – duct insulation	The proposed efficiency levels.	The existing efficiency levels.
Water heating systems	The requirements of Section 150.2(b)1Hii.	The existing efficiency levels.
Roofing products	The requirements of Section 150.2(b)1I.	
All other measures	The proposed efficiency levels.	The existing efficiency levels.

CALIFORNIA MECHANICAL CODE, CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 4, CHAPTER 6, DUCT SYSTEMS

TABLE P4-A ADOPTION TABLE

CODE SECTION		AGENCY
Adopt entire Chapter as amended (amended sections listed below) ¹		CEC
601.0		X
602.0		X
603.0		X
604.0		X
605.0		X

1. Adopted by reference for Occupancies A, B, E, F, H, M, R, S, and U; see Sections 110.8(d)3, 120.4 and 150.0(m).

SUBCHAPTER 10

MULTIFAMILY BUILDINGS—MANDATORY REQUIREMENTS

SECTION 160.0 GENERAL

Multifamily buildings shall comply with the applicable requirements of Sections 160.1 through 160.9. Sections 160.1 through 160.8 apply to dwelling units and common use areas in multifamily buildings. Nonresidential occupancies in a mixed occupancy building shall comply with nonresidential requirements in Sections 120.0 through 141.1.

NOTE: The requirements of Sections 160.1 through 160.9 apply to newly constructed buildings. Sections 180.1 through 180.4 specify which requirements of Sections 160.1 through 160.9 apply to additions or alterations.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 160.1 MANDATORY REQUIREMENTS FOR BUILDING ENVELOPES

(a) **Ceiling and roof insulation.** The opaque portions of ceilings and roofs separating conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Item 1 or 2, and 3 below:

1. Attic roof. Roofs with an attic space shall meet the requirements of A through C below:
 - A. Shall be insulated to achieve an area-weighted average U -factor not exceeding $U-0.043$ or shall be insulated between wood-framing members with insulation resulting in an installed thermal resistance of R-22 or greater for the insulation alone. For vented attics, the mandatory insulation shall be installed at the ceiling level; for unvented attics, the mandatory insulation shall be placed at either ceiling or roof level;
 - B. Attic access doors shall have permanently attached insulation using adhesive or mechanical fasteners. The attic access shall be gasketed to prevent air leakage; and
 - C. When loose-fill insulation is installed, the minimum installed weight per square foot shall conform with the insulation manufacturer's installed design weight per square foot at the manufacturer's labeled R -value.
2. Nonattic roof. Roofs without attic spaces shall meet the applicable requirements of A through C below:
 - A. Metal building—The area-weighted average U -factor of the roof assembly shall not exceed 0.098.
 - B. Wood framed and others—The area-weighted average U -factor of the roof assembly shall not exceed 0.075.

C. Insulation placement—When insulation is installed at the roof, fixed vents or openings to the outdoors or to unconditioned spaces shall not be installed. When the space between the ceiling and the roof is either directly or indirectly conditioned space, it shall not be considered an attic for the purposes of complying with CBC attic ventilation requirements.

Exception to Section 160.1(a)2C: Vents that do not penetrate the roof deck and are instead designed for wind resistance for roof membranes are not within the scope of Section 160.1(a)2C.

3. Insulation shall be installed in direct contact with a roof or ceiling that is sealed to limit infiltration and exfiltration as specified in Section 110.7, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling.

(b) **Wall insulation.** Opaque portions of above grade walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the following applicable requirements:

1. Metal building—The area-weighted average U -factor of the wall assembly shall not exceed 0.113.
2. Metal framed—The area-weighted average U -factor of the wall assembly shall not exceed 0.151.
3. Wood framed and others—
 - A. Nominal 2x4 inch framing shall have an area-weighted average U -factor of the wall assembly not exceeding 0.102.
 - B. Nominal 2x6 inch framing shall have an area-weighted average U -factor of the wall assembly not exceeding 0.071.
 - C. Other wall assemblies shall have an area-weighted average U -factor of the wall assembly not exceeding 0.102.
4. Light mass walls—A 6 inch or greater hollow core concrete masonry unit shall have a U -factor not to exceed 0.440.
5. Heavy mass walls—An 8 inch or greater hollow core concrete masonry unit shall have a U -factor not to exceed 0.690.
6. Spandrel panels and curtain wall—The area-weighted average U -factor of the spandrel panels and curtain wall assembly shall not exceed 0.280.
7. Demising walls—The opaque portions of framed demising walls shall meet the requirements of Item A or B below:
 - A. Wood framed walls shall be insulated to meet a U -factor not greater than 0.099.
 - B. Metal framed walls shall be insulated to meet a U -factor not greater than 0.151.

8. Bay or bow window roofs and floors shall be insulated to meet the wall insulation requirements of Table 170.2-A.

(c) **Floor and soffit insulation.** The opaque portions of floors and soffits that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items 1 through 3 below:

1. Raised mass floors shall have a minimum of 3 inches of lightweight concrete over a metal deck or the area-weighted average *U*-factor of the floor assembly shall not exceed 0.269.
2. Raised wood floor shall have an overall assembly *U*-factor not exceeding U-0.037. In a wood framed assembly, compliance with the *U*-factor may be demonstrated by installing insulation with an *R*-value of 19 or greater.
3. Other floors—The area-weighted average *U*-factor of the floor assembly shall not exceed 0.071.
4. Heated slab on grade floor—A heated slab on grade floor shall be insulated to meet the requirements of Section 110.8(g).

Exception to Section 160.1(c): A building with a controlled ventilation or unvented crawl space may omit raised floor insulation if all of the following are met:

- A. The foundation walls are insulated to meet the wall insulation minimums as shown in Table 170.2-A; and
- B. A Class I or Class II vapor retarder is placed over the entire floor of the crawl space; and
- C. Vents between the crawl space and outside air are fitted with automatically operated louvers that are temperature actuated; and
- D. The requirements in Reference Residential Appendix RA4.5.1.

(d) **Vapor retarder.**

1. In Climate Zones 1–16, the earth floor of unvented crawl space shall be covered with a Class I or Class II vapor retarder. This requirement shall also apply to controlled ventilation crawl space for buildings complying with the Exception to Section 160.1(c).
2. In Climate Zones 14 and 16, a Class I or Class II vapor retarder shall be installed on the conditioned space side of all insulation in all exterior walls, vented attics and unvented attics with air-permeable insulation.

(e) **Fenestration products.** Fenestration separating conditioned space from unconditioned space or outdoors shall meet the requirements of either Item 1 or 2 below:

1. Fenestration, including skylight products, must have a maximum *U*-factor of 0.58.

Exception 1 to Section 160.1(e)1: Up to 0.5 percent of the conditioned floor area is exempt from the maximum *U*-factor requirement.

Exception 2 to Section 160.1(e)1: For dual-glazed greenhouse or garden windows, up to 30 square feet of

fenestration area per dwelling unit is exempt from the maximum *U*-factor requirement.

2. The area-weighted average *U*-factor of all fenestration, including skylight products, shall not exceed 0.58.

(f) **Installation of fireplaces, decorative gas appliances and gas logs.** If a masonry or factory-built fireplace is installed, it shall comply with Section 110.5, Section 4.503 of Part 11, and shall have the following:

1. Closable metal or glass doors covering the entire opening of the firebox; and
2. A combustion air intake to draw air from the outside of the building, which is at least 6 square inches in area and is equipped with a readily accessible, operable and tight-fitting damper or combustion-air control device; and

Exception to Section 160.1(f)2: An outside combustion-air intake is not required if the fireplace will be installed over concrete slab flooring and the fireplace will not be located on an exterior wall.

3. A flue damper with a readily accessible control.

Exception to Section 160.1(f)3: When a gas log, log lighter or decorative gas appliance is installed in a fireplace, the flue damper shall be blocked open if required by the CMC or the manufacturer's installation instructions.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 160.2 MANDATORY REQUIREMENTS FOR VENTILATION AND INDOOR AIR QUALITY

(a) **General requirements.**

1. Attached dwelling units in multifamily buildings shall comply with the applicable requirements of Subsection 160.2(b) below. Occupiable spaces in multifamily buildings other than attached dwelling units shall comply with the applicable requirements of Section 160.2(c). When HERS field verification and diagnostic testing of attached dwelling units is required by Section 160.2, buildings with three habitable stories or fewer shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

NOTE: Section 160.2 is not applicable to townhouses or dwellings that contain two dwelling units.

2. The required outdoor air-ventilation rate and the air-distribution system design shall be clearly identified on the building design plans submitted to the enforcement agency in accordance with Section 10-103 of Title 24, Part 1.

(b) **Attached dwelling units.** Attached dwelling units shall comply with the requirements of Subsections 1 and 2 below.

1. Air filtration.

A. System types specified in Subsections i, ii and iii shall be provided with air filters in accordance with Sections 160.2(b)1B, 160.2(b)1C and 160.2(b)1D. System types specified in Subsection i shall also comply with Section 160.2(b)1E.

- i. Mechanical space-conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.
- ii. Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.
- iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems, and energy recovery ventilation systems that provide outside air to an occupiable space.

B. System design and installation.

- i. The system shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space are filtered before passing through any system's thermal conditioning components.

Exception to Section 160.2(b)1Bi: For heat recovery ventilators and energy recovery ventilators, the location of the filters required by Section 160.2(b)1 may be downstream of a system thermal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

- ii. All systems shall be designed to accommodate the clean-filter pressure drop imposed by the system air filter(s). The design airflow rate, and maximum allowable clean-filter pressure drop at the design airflow rate applicable to each air filter, shall be determined and reported on labels according to Subsection iv below.

Systems specified in Section 160.2(b)1Ai shall be equipped with air filters that meet either Subsection a or b below:

- a. Nominal 2-inch minimum depth filter(s) shall be sized by the system designer, or
- b. Nominal 1-inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 160.2-A, based on a maximum face velocity of 150 ft per minute and according to the maximum allowable clean-filter pressure drop specified in Section 160.2(b)1Dii.

$$A_{\text{face}} = Q_{\text{filter}} / V_{\text{face}} \quad \text{(Equation 160.2-A)}$$

where:

A_{face} = air filter face area, the product of air filter nominal length \times nominal width, ft².

Q_{filter} = design airflow rate for the air filter, ft³/min

V_{face} = air filter face velocity \leq 150 ft/min

- iii. All system air filters shall be located and installed in such a manner as to be accessible for regular service by the system owner.

- iv. All system air filter installation locations shall be labeled to disclose the applicable design airflow rate and the maximum allowable clean-filter pressure drop. The labels shall be permanently affixed to the air filter installation location, readily legible and visible to a person replacing the air filter.

- v. Filter racks or grilles shall use gaskets, sealing or other means to close gaps around inserted filters and prevent air from bypassing the filter.

C. **Air filter efficiency.** The system shall be provided with air filters having a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30–1.0 μm range, and equal to or greater than 85 percent in the 1.0–3.0 μm range when tested in accordance with AHRI Standard 680.

D. **Air filter pressure drop.** All systems shall be provided with air filters that conform to the applicable maximum allowable clean-filter pressure drop specified in Subsection i, ii, iii or iv below, when tested using ASHRAE Standard 52.2, or as rated using AHRI Standard 680, for the applicable design airflow rates for the system air filters.

- i. The maximum allowable clean-filter pressure drop shall be determined by the system design for the nominal 2-inch minimum depth air filter required by Section 160.2(b)1Biia, or
- ii. A maximum of 25 Pa (0.1 inches water) clean-filter pressure drop shall be allowed for a nominal 1-inch depth air filter sized according to Section 160.2(b)1Biib, or
- iii. For systems specified in Sections 160.2(b)1Aii and 160.2(b)1Aiii, the maximum allowable clean filter pressure drop shall be determined by the system design.

- iv. If Exception 1 to Section 160.3(b)5Lii or iv is utilized for compliance with cooling system airflow rate and fan efficacy requirements, the clean-filter pressure drop for the system air filter shall conform to the requirements given in Table 160.3-A or 160.3-B.

E. **Air filter product labeling.** Systems described in Section 160.2(b)1Ai shall be equipped with air filters that have been labeled by the manufacturer to disclose the efficiency and pressure drop ratings that demonstrate conformance with Sections 160.2(b)1C and 160.2(b)1D.

Exception to Section 160.2(b)1: Evaporative coolers are exempt from the air filtration requirements in Section 160.2(b)1.

2. **Ventilation and indoor air quality for attached dwelling units.** All attached dwelling units shall meet the requirements of ASHRAE Standard 62.2, Ventilation and Acceptable Indoor Air Quality in Residential Buildings subject to the amendments specified in Section 160.2(b)2A below. All dwelling units shall comply with Section 160.2(b)2B below.

Exception to Section 160.2(b)2 The following sections of ASHRAE 62.2 shall not be required for compliance: Section 4.1.1, Section 4.1.2, Section 4.1.4, Section 4.3, Section 4.6, Section 5, Section 6.1.1, Section 6.5.2 and Normative Appendix A.

A. Amendments to ASHRAE 62.2 requirements.

- i. **Window operation.** Window operation is not a permissible method of providing the dwelling unit ventilation airflow specified in Subsection iv or v below.
- ii. **Central fan integrated (CFI) ventilation systems.**
 - a. Continuous operation prohibition. Continuous operation of a dwelling unit's central forced air system air handlers used in CFI ventilation systems is not a permissible method of providing the whole-dwelling unit ventilation airflow required by Section 160.2(b)2Aiv.

Exception to Section 160.2(b)2Aii: The Energy Commission may approve continuous operation of central fan integrated ventilation systems pursuant to Section 10-109(h).

- b. Outdoor air damper(s). A motorized damper(s) shall be installed on the connected ventilation duct(s) of CFI systems that prevents all airflow into or out of the space-conditioning duct system when the damper(s) is closed.
- c. Damper control. The required motorized damper(s) shall be controlled to be in an opened position when outdoor air ventilation is required for compliance, and shall be in the closed position when ventilation air is not required. The damper(s) shall be closed whenever the space-conditioning system air handling unit is not operating. If the outdoor airflow for the CFI ventilation system is fan-powered, then the outdoor air fan shall not operate when the required motorized damper(s) on the outdoor air ventilation duct(s) is closed.
- d. Variable ventilation. CFI ventilation systems shall incorporate controls that track outdoor air ventilation run time, and either open or close the required motorized damper(s) depending on whether or not outdoor air ventilation is required for compliance with Section 160.2(b)2Aiv. During periods when comfort conditioning is not called for by the space-conditioning thermostat, the CFI ventilation

system controls shall operate the space-conditioning system central fan and outdoor air damper(s) when necessary to ensure compliance with the minimum outdoor air ventilation required by Section 160.2(b)2Aiv in accordance with applicable variable mechanical ventilation methods specified in ASHRAE 62.2 Section 4.5.

iii. **Air filtration.** Air filtration shall conform to the specifications in Section 160.2(b)1. Compliance with ASHRAE 62.2 Sections 6.7 (Minimum Filtration) and 6.7.1 (Filter Pressure Drop) shall not be required.

iv. **Whole-dwelling unit mechanical ventilation.** Multifamily attached dwelling units shall comply with Subsections a and b below.

- a. Mechanical ventilation airflow shall be provided at rates greater than or equal to the value determined in accordance with Equation 160.2-B.

Total Required Ventilation Rate [ASHRAE 62.2:4.1.1]:

$$Q_{tot} = 0.03A_{floor} + 7.5(N_{br} + 1) \quad \text{(Equation 160.2-B)}$$

where:

Q_{tot} = total required ventilation rate, cfm.

A_{floor} = dwelling-unit floor area, ft².

N_{br} = number of bedrooms (not to be less than 1).

- b. All dwelling units in a multifamily building shall use the same whole-dwelling unit ventilation system type. The system type installed throughout the building shall be only one of the following three types: supply, exhaust or balanced. The dwelling unit shall comply with one of the following Subsections 1 or 2 below.

1. **Balanced ventilation.** A balanced ventilation system shall provide the required whole-dwelling-unit ventilation airflow. Systems with heat recovery or energy recovery that serve a single dwelling unit shall have a fan efficacy of ≤ 1.0 W/cfm; or

2. **Supply or exhaust ventilation with compartmentalization testing.** Continuously operating supply ventilation systems or continuously operating exhaust ventilation systems shall be allowed to be used to provide the required whole-dwelling unit ventilation airflow only if the dwelling unit envelope leakage is less than or equal to 0.3 cubic feet per minute at 50 Pa (0.2 inch water) per ft² of dwelling unit envelope surface area as confirmed by HERS field verification and diagnostic testing in accordance with the procedures specified in Reference Appendix RA3.8 or NA2.3 as applicable.

- v. **Multifamily building central ventilation system airflow rate tolerance.** Multifamily building central ventilation systems that serve multiple dwelling units shall have airflow rates in each dwelling unit served that meet or exceed a design ventilation airflow rate specification.
- a. Designers shall specify a design ventilation airflow rate for each dwelling unit that is equal to or greater than the rate specified by Equation 160.2-B.
 - b. The design ventilation airflow rate for each dwelling unit shall be stated on the building design plans approved by the enforcement agency.
 - c. Airflow in each dwelling unit shall be no more than 20 percent greater than the specified design ventilation airflow rate. Ventilation systems shall utilize mechanical or software airflow control means to ensure each of the dwelling-unit airflows can be maintained at the design ventilation airflow within this tolerance at all times. System airflow control means may include but are not limited to constant air regulation devices, orifice plates and variable speed central fans.
- vi. **Local mechanical exhaust.** A local mechanical exhaust system shall be installed in each kitchen and bathroom. Systems shall be rated for airflow in accordance with ASHRAE 62.2 Section 7.1.
- a. **Nonenclosed kitchens** shall have a demand-controlled mechanical exhaust system meeting the requirements of Section 160.2(b)2Avic.
 - b. **Enclosed kitchens and all bathrooms** shall have either one of the following options 1 or 2:
 1. A demand-controlled mechanical exhaust system meeting the requirements of Section 160.2(b)2Avic; or
 2. A continuous mechanical exhaust system meeting the requirements of Section 160.2(b)2Avid.
 - c. **Demand-controlled mechanical exhaust.** A local mechanical exhaust system shall be designed to be operated as needed.
 1. **Control and operation.** Demand-controlled mechanical exhaust systems shall be provided with at least one of the following controls:
 - A. A readily accessible occupant-controlled ON-OFF control.
 - B. An automatic control that does not impede occupant ON control.
 2. **Ventilation rate and capture efficiency.** The system shall meet or exceed either the minimum airflow in accordance with Table 160.2-E or the minimum capture efficiency in accordance with Table 160.2-E, and Table 160.2-G. Capture efficiency ratings shall be determined in accordance with ASTM E3087, and listed in a product directory approved by the Energy Commission.
- d. **Continuous mechanical exhaust.** A mechanical exhaust system shall be installed to operate continuously. The system may be part of a balanced mechanical ventilation system.
1. **Control and operation.** A manual ON-OFF control shall be provided for each continuous mechanical exhaust system. The system shall be designed to operate during all occupiable hours. For multifamily dwelling units, the manual ON-OFF control may be accessible to the dwelling unit occupant; however, the manual ON-OFF control shall not be required to be accessible to the dwelling unit occupant.
 2. **Ventilation rate.** The minimum delivered ventilation shall be at least the amount indicated in Table 160.2-F during each hour of operation.
- e. **Airflow measurement of local mechanical exhaust by the system installer.** The airflow required by Section 160.2(b)2Avi is the quantity of indoor air exhausted by the ventilation system as installed in the dwelling unit. When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 160.2(b)2Avic2, the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be met by the installed system. The as-installed airflow shall be verified by the system installer to ensure compliance by use of either Subsection 1 or 2 below:
1. The system installer shall measure the airflow by using a flow hood, flow grid or other airflow measuring device at the mechanical ventilation fan's inlet terminals/grilles or outlet terminals/grilles in accordance with the procedures in Reference Appendix RA3.7 or NA2.2 as applicable.
 2. As an alternative to performing an airflow measurement of the system as installed in the dwelling unit, compliance may be demonstrated by installing an exhaust fan and duct system that conforms to the specifications of Table 160.2-H. Visual inspection shall verify the installed system conforms to the requirements of Table 160.2-H.
- When using Table 160.2-H for demonstrating compliance, the airflow rating shall be

greater than or equal to the value required by Section 160.2(b)2Avi at a static pressure greater than or equal to 0.25 in. of water (62.5 Pa). When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 160.2(b)2Avic2, a static pressure greater than or equal to 0.25 in. of water at the rating point shall not be required, and the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be applied to Table 160.2-H for determining compliance.

Use of Table 160.2-H is limited to ventilation systems that conform to all of the following three specifications:

- A. Total duct length is less than or equal to 25 feet (8 m),
- B. Duct system has no more than three elbows, and
- C. Duct system has exterior termination fitting with a hydraulic diameter greater than or equal to the minimum duct diameter and not less than the hydraulic diameter of the fan outlet.

- f. **Sound ratings for local mechanical exhaust.** Local mechanical exhaust systems shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2 at no less than the minimum airflow rate required by Section 160.2(b)2Avi.

Exception to Section 160.2(b)2Avif: Kitchen range hoods may be rated for sound at a static pressure determined at working speed as specified in HVI 916 Section 7.2.

- vii. **Airflow measurement of whole-dwelling unit ventilation.** The airflow required by Section 160.2(b)2Aiv or 160.2(b)2Av is the quantity of outdoor ventilation air supplied or indoor air exhausted by the mechanical ventilation system as installed and shall be measured by using a flow hood, flow grid or other airflow measuring device at the mechanical ventilation fan's inlet terminals/grilles or outlet terminals/grilles in accordance with the procedures in Reference Appendix Section RA3.7.4.1.1 or NA2.2.4.1.1 as applicable for supply and exhaust systems or RA3.7.4.1.2 or NA2.2.4.1.2 as applicable for balanced systems. Balanced mechanical ventilation system airflow shall be the average of the supply fan and exhaust fan flows.
- viii. **Sound ratings for whole-dwelling unit ventilation systems.** Whole-dwelling unit ventilation systems shall be rated for sound in accordance with Section 7.2 of ASHRAE 62.2 at no less than the minimum airflow rate required by Section 160.2(b)2Aiv or 160.2(b)2Av as applicable.

- ix. **Label for whole-dwelling unit ventilation system on-off control.** Compliance with ASHRAE 62.2 Section 4.4 (Control and Operation) shall require manual ON-OFF control switches associated with whole-dwelling unit ventilation systems to have a label clearly displaying the following text, or equivalent text: "This switch controls the indoor air quality ventilation for the home. Leave switch in the 'on' position at all times unless the outdoor air quality is very poor."

- x. **Combustion air and compensating outdoor air or makeup air.**

- a. All dwelling units shall conform to the applicable requirements specified in *California Mechanical Code* Chapter 7, Combustion Air.
- b. All dwelling units shall conform to the requirements in ASHRAE 62.2 Section 6.4, Combustion and Solid-Fuel-Burning Appliances.

B. Dwelling unit HERS field verification and diagnostic testing.

- i. **Whole-dwelling unit ventilation airflow performance.** The whole-dwelling unit ventilation airflow required by Section 160.2(b)2Aiv or 160.2(b)2Av shall be confirmed through HERS field verification and diagnostic testing in accordance with Reference Appendix RA3.7.4.1.1 or NA2.2.4.1.1 as applicable for supply and exhaust systems or RA3.7.4.1.2 or NA2.2.4.1.2 as applicable for balanced systems. Balanced mechanical ventilation system airflow shall be the average of the supply fan and exhaust fan flows. Ventilation airflow of systems with multiple operating modes shall be tested in all modes designed to comply with the required ventilation airflows.
- ii. **Kitchen local mechanical exhaust—vented range hoods.** Vented range hoods installed to comply with local mechanical exhaust requirements specified in Section 160.2(b)2Avi shall be HERS field verified in accordance with Reference Appendix RA3.7.4.3 or NA2.2.4.1.4 as applicable to confirm the model is rated by HVI or AHAM to comply with the following requirements:
 - a. The minimum ventilation airflow rate as specified by Section 160.2(b)2Avi, or alternatively the minimum capture efficiency as specified by Section 160.2(b)2Avi; and
 - b. The maximum sound rating as specified in Section 160.2(b)2Avif.
- iii. **Heat recovery ventilation (HRV) and energy recovery ventilation (ERV) system fan efficacy.** At a minimum, systems with heat or energy recovery serving a single dwelling unit shall have a fan efficacy of ≤ 1.0 W/cfm as confirmed by HERS field verification in accordance with Reference Appendix RA3.7.4.4 or NA2.2.4.1.5 as

applicable. If Section 170.2(c)3Biva requirements are applicable to the dwelling unit, then HERS field verification shall instead confirm compliance with the maximum fan efficacy and minimum sensible recovery efficiency specified in Section 170.2(c)3Biva in accordance with the procedures specified in Reference Appendix RA3.7.4.4 or NA2.2.4.1.5 as applicable.

C. Multifamily building central ventilation system field verification.

- i. **Central ventilation system duct sealing.** Ventilation ducts that conform to Subsections a and b below shall meet the duct sealing requirements in *California Mechanical Code* Section 603.10 and have leakage that is no greater than 6 percent of the rooftop fan or central fan design airflow rate as confirmed by field verification in accordance with the procedures in Reference Appendix NA7.18.3. The leakage test shall be conducted using a test pressure of 25 Pa (0.1 inches) for ducts serving six or fewer dwelling units and 50 Pa (0.2 inches) for ducts serving more than six dwelling units, and shall measure the leakage of all ductwork between the central fan and the connection point to the in-unit grille or fan.
 - a. The ventilation ducts serve multiple dwelling units.
 - b. The ventilation ducts provide continuous airflows or airflows to provide balanced ventilation to meet the requirements specified in Section 160.2(b)2Aiv or 160.2(b)2Av as applicable.

(c) **Common use areas.** All occupiable spaces shall comply with the requirements of Subsection 1 and shall also comply with either Subsection 2 or Subsection 3:

1. Air filtration.

- A. Mechanical system types specified in Subsections i, ii and iii below shall be designed to ensure that all recirculated air and all outdoor air supplied to the occupiable space are filtered before passing through any system's thermal conditioning components. Air filters shall conform to the requirements of Sections 160.2(c)1B, 160.2(c)1C and 160.2(c)1D.
 - i. Mechanical space-conditioning systems that supply air to an occupiable space through ductwork exceeding 10 ft (3 m) in length.
 - ii. Mechanical supply-only ventilation systems and makeup air systems that provide outside air to an occupiable space.
 - iii. The supply side of mechanical balanced ventilation systems, including heat recovery ventilation systems and energy recovery ventilation systems that provide outside air to an occupiable space.

Exception to Section 160.2(c)1A: For heat recovery ventilators and energy recovery ventilators, the location of the filters required by Section 160.2(c)1A may be downstream of a system's ther-

mal conditioning component, provided the system is equipped with ancillary filtration upstream of the system's thermal conditioning component.

- B. **Air filter efficiency.** The filters shall have a designated efficiency equal to or greater than MERV 13 when tested in accordance with ASHRAE Standard 52.2, or a particle size efficiency rating equal to or greater than 50 percent in the 0.30–1.0 μm range, and equal to or greater than 85 percent in the 1.0–3.0 μm range when tested in accordance with AHRI Standard 680; and

C. Systems shall be equipped with air filters that meet either Subsection i or ii below.

- i. Nominal 2 inch minimum depth filter(s); or
- ii. Nominal 1 inch minimum depth filter(s) shall be allowed if the filter(s) are sized according to Equation 160.2-A, based on a maximum face velocity of 150 ft per minute.

D. Filter racks or grilles shall be gasketed or sealed to eliminate any gaps around the filter to prevent air from bypassing the filter.

2. **Natural ventilation.** Naturally ventilated spaces shall be designed in accordance with Sections 160.2(c)2A through 160.2(c)2C and include a mechanical ventilation system designed in accordance with Section 160.2(c)3:

Exception 1 to Section 160.2(c)2: The mechanical ventilation system shall not be required where natural ventilation openings complying with Section 160.2(c)2 are either permanently open or have controls that prevent the openings from being closed during periods of expected occupancy.

Exception 2 to Section 160.2(c)2: The mechanical ventilation system shall not be required where the zone is not served by a space-conditioning system.

A. **Floor area to be ventilated.** Spaces or portions of spaces to be naturally ventilated shall be located within a distance based on the ceiling height, as specified in i, ii and iii. The ceiling height (H) to be used in i, ii or iii shall be the minimum ceiling height in the space, or for ceilings that are increasing in height as distance from the operable openings is increased, the ceiling height shall be determined as the average height of the ceiling within 20 ft from the operable opening. [ASHRAE 62.1:6.4.1]

- i. Single side opening. For spaces with operable opening on one side of the space, the maximum distance from the operable opening shall be not more than 2H. [ASHRAE 62.1:6.4.1.1]
- ii. Double side opening. For spaces with operable openings on two opposite sides of the space, the maximum distance from the operable opening shall be not more than 5H. [ASHRAE 62.1:6.4.1.2]
- iii. Corner opening. For spaces with operable openings on two adjacent sides of a space, the maxi-

imum distance from the operable openings shall be not more than 5H along a line drawn between the two openings that are the farthest apart. Floor area outside that line shall comply with i or ii. [ASHRAE 62.1:6.4.1.3]

- iv. Ceiling height. The ceiling height (H) to be used in Sections 160.2(c)2Ai through 160.2(c)2Aiii shall be the minimum ceiling height in the space.

Exception to Section 160.2(c)2Aiv: For ceilings that are increasing in height as distance from the opening is increased, the ceiling height shall be determined as the average height of the ceiling within 20 feet from the operable openings. [ASHRAE 62.1:6.4.1.4]

- B. Location and size of openings.** Spaces or portions of spaces to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors. The openable area shall be not less than 4 percent of the net occupiable floor area. Where openings are covered with louvers or otherwise obstructed, the openable area shall be based on the net free unobstructed area through the opening. Where interior rooms, or portions of rooms, without direct openings to the outdoors are ventilated through adjoining rooms, the opening between rooms shall be permanently unobstructed and have a free area of not less than 8 percent of the area of the interior room or less than 25 square feet. [ASHRAE 62.1:6.4.2]

- C. Control and accessibility.** The means to open the required operable opening shall be readily accessible to building occupants whenever the space is occupied. Controls shall be designed to coordinate operation of the natural and mechanical ventilation systems. [ASHRAE 62.1:6.4.3]

- 3. **Mechanical ventilation.** Occupiable spaces shall be ventilated with a mechanical ventilation system capable of providing an outdoor airflow rate (V_z) to the zone no less than the larger of A or B as described below:

- A. The outdoor airflow rate to the zone (V_z) shall be determined in accordance with Equation 160.2-G; or

$$V_z = R_a \times A_z \quad \text{(Equation 160.2-G)}$$

where:

R_a = Outdoor airflow rate required per unit area as determined from Table 160.2-B.

A_z = Zone floor area is the net occupiable floor area of the ventilation zone in square feet.

- B. For spaces designed for an expected number of occupants, the outdoor airflow rate to the zone (V_z) shall be determined in accordance with Equation 160.2-H;

$$V_z = R_p \times P_z \quad \text{(Equation 160.2-H)}$$

where:

R_p = 15 cubic feet per minute of outdoor airflow per person.

P_z = The expected number of occupants. The expected number of occupants shall be the expected number specified by the building designer. For spaces with fixed seating, the expected number of occupants shall be determined in accordance with the *California Building Code*.

Exception to Section 160.2(c)3: Transfer air. The rate of outdoor air required by Section 160.2(c)3 may be provided with air transferred from other ventilated space if:

- i. Use of transfer air is in accordance with Section 160.2(c)8; and
- ii. The outdoor air that is supplied to all spaces combined is sufficient to meet the requirements of Section 160.2(c)3 for each space individually.

- 4. **Exhaust ventilation.** The design exhaust airflow shall be determined in accordance with the requirements in Table 160.2-C. Exhaust makeup air shall be permitted to be any combination of outdoor air, recirculated air or transfer air. [ASHRAE 62.1:6.5.1]

- 5. **Operation and control requirements for minimum quantities of outdoor air.**

- A. **Times of occupancy.** The minimum rate of outdoor air required by Section 160.2(c) shall be supplied to each space at all times when the space is usually occupied.

Exception 1 to Section 160.2(c)5A: Demand control ventilation. In intermittently occupied spaces that do not have processes or operations that generate dusts, fumes, mists, vapors or gases and are not provided with local exhaust ventilation (such as indoor operation of internal combustion engines or areas designated for unvented food service preparation), the rate of outdoor air may be reduced if the ventilation system serving the space is controlled by a demand control ventilation device complying with Section 160.2(c)5D or by an occupant sensor ventilation control device complying with Section 160.2(c)5E.

Exception 2 to Section 160.2(c)5A: Temporary reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 160.2(c) for up to 30 minutes at a time if the average rate for each hour is equal to or greater than the required ventilation rate.

- B. **Preoccupancy.** The lesser of the minimum rate of outdoor air required by Section 160.2(c) or three complete air changes shall be supplied to the entire building during the 1-hour period immediately before the building is normally occupied.

- C. **Required demand control ventilation.** Demand ventilation controls complying with Section 160.2(c)5D are required for a space with a design occupant density, or a maximum occupant load factor for egress purposes in the CBC, greater than or equal to 25 people per 1000 square feet (40 square

feet or less per person) if the system serving the space has one or more of the following:

- i. an air economizer; or
- ii. modulating outside air control; or
- iii. design outdoor airflow rate > 3,000 cfm.

Exception 1 to Section 160.2(c)5C: Where space exhaust is greater than the design ventilation rate specified in Section 160.2(c)3 minus 0.2 cfm per ft² of conditioned area.

Exception 2 to Section 160.2(c)5C: Spaces that have processes or operations that generate dusts, fumes, mists, vapors or gases and are not provided with local exhaust ventilation, such as indoor operation of internal combustion engines or areas designated for unvented food service preparation, daycare sickrooms, science labs, barber shops or beauty and nail salons, shall not install demand control ventilation.

Exception 3 to Section 160.2(c)5C: Spaces with an area of less than 150 square feet or a design occupancy of less than 10 people as specified by Section 160.2(c)3.

D. Demand control ventilation devices.

- i. For each system with demand control ventilation (DCV), CO₂ sensors shall be installed in each room that meets the criteria of Section 160.2(c)5C with no fewer than one sensor per 10,000 ft² of floor space. When a zone or a space is served by more than one sensor, a signal from any sensor indicating that CO₂ is near or at the setpoint within the zone or space shall trigger an increase in ventilation.
- ii. CO₂ sensors shall be located in the room between 3 ft and 6 ft above the floor or at the anticipated height of the occupants' heads.
- iii. Demand ventilation controls shall maintain CO₂ concentrations less than or equal to 600 ppm plus the outdoor air CO₂ concentration in all rooms with CO₂ sensors.

Exception to Section 160.2(c)5Diii: The outdoor air ventilation rate is not required to be larger than the design outdoor air ventilation rate required by Section 160.2(c)3 regardless of CO₂ concentration.

- iv. Outdoor air CO₂ concentration shall be determined by one of the following:
 - a. CO₂ concentration shall be assumed to be 400 ppm without any direct measurement; or
 - b. CO₂ concentration shall be dynamically measured using a CO₂ sensor located within 4 ft of the outdoor air intake.
- v. When the system is operating during hours of expected occupancy, the controls shall maintain system outdoor air ventilation rates no less than the rate listed in Table 160.2-B for DCV, times

the conditioned floor area for spaces with CO₂ sensors, plus the rate required by Section 160.2(c)3 for other spaces served by the system, or the exhaust air rate, whichever is greater.

- vi. CO₂ sensors shall be certified by the manufacturer to be accurate within plus or minus 75 ppm at a 600 and 1000 ppm concentration when measured at sea level and 25°C, factory calibrated, and certified by the manufacturer to require calibration no more frequently than once every 5 years. Upon detection of sensor failure, the system shall provide a signal that resets to supply the minimum quantity of outside air to levels required by Section 160.2(c)3 to the zone serviced by the sensor at all times that the zone is occupied.
- vii. The CO₂ sensor(s) reading for each zone shall be displayed continuously, and shall be recorded on systems with digital direct controls (DDC) to the zone level.

E. Occupant sensing ventilation control devices.

Occupant sensing ventilation controls are required for space-conditioning zones that are both permitted to have their ventilation air reduced to zero while in occupied-standby mode per Table 160.2-B and required to install occupant sensors to comply with Sections 160.5(b)4Cv, vi and vii. Occupant sensing ventilation control devices used to reduce the rate of outdoor air flow when occupants are not present shall comply with the following:

- i. Occupant sensors shall meet the requirements in Section 110.9(b)4 and shall have suitable coverage and placement to detect occupants in the entire space ventilated.
- ii. When occupant sensors controlling lighting are also used for ventilation, the ventilation signal shall be independent of daylighting, manual lighting overrides or manual control of lighting.
- iii. When a single zone damper or a single zone system serves multiple rooms, there shall be an occupant sensor in each room and the zone shall not be considered vacant until all rooms in the zone are vacant.
- iv. One hour prior to normal scheduled occupancy, the occupant sensor ventilation control shall allow preoccupancy purge as described in Section 160.2(c)5B.
- v. When the zone is scheduled to be occupied and occupant sensing controls in all rooms and areas served by the zone indicate the spaces are unoccupied, the zone shall be placed in occupied-standby mode.
- vi. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall be shut off until the space becomes occupied or until ventilation is needed to provide space heating or conditioning. When mechanical

ventilation is shut off to the zone, the ventilation system serving the zone shall reduce the system outside air rate by the amount of outside air required for the zone.

- vii. Where the system providing space conditioning also provides ventilation to the zone, in 5 minutes or less after entering occupied-standby mode, space-conditioning zone setpoints shall be reset in accordance with Section 120.2(e)3.

6. Ducting for zonal heating and cooling units. Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit that then supplies the air to a space in order to meet the requirements of Section 160.2(c)3, the outdoor air shall be ducted to discharge either:

- A. Within 5 feet of the unit; or
- B. Within 15 feet of the unit, substantially toward the unit and at a velocity not less than 500 feet per minute.

7. Design and control requirements for quantities of outdoor air.

- A. All mechanical ventilation and space-conditioning systems shall be designed with and have installed ductwork, dampers and controls to allow outside air rates to be operated at the minimum levels specified in Section 160.2(c)3 or the rate required for make-up of exhaust systems that are required for an exempt or covered process, for control of odors or for the removal of contaminants within the space.
- B. All variable air volume mechanical ventilation and space-conditioning systems shall include dynamic controls that maintain measured outside air ventilation rates within 10 percent of the required outside air ventilation rate at both full and reduced supply airflow conditions. Fixed minimum damper position is not considered to be dynamic and is not an allowed control strategy.
- C. Measured outdoor air rates of constant volume mechanical ventilation and space-conditioning systems shall be within 10 percent of the required outside air rate.

8. Air classification and recirculation limitations. Air classification and recirculation limitations of air shall be based on the air classification as listed in Table 160.2-B or Table 160.2-D, in accordance with the following:

- A. Class 1 air is air with significant contaminant concentration, significant sensory-irritation intensity or offensive odor. Recirculation or transfer of Class 1 air to any space shall be permitted; [ASHRAE 62.1:5.16.3.1]
- B. Class 2 air is air with moderate contaminant concentration, mild sensory-irritation intensity or mildly offensive odor (Class 2 air also includes air that is

not necessarily harmful or objectionable but that is inappropriate for transfer or recirculation to spaces used for different purposes). Recirculation or transfer of Class 2 air shall be permitted in accordance with Sections 160.2(c)8Bi through 160.2(c)8Bv:

- i. Recirculation of Class 2 air within the space of origin shall be permitted [ASHRAE 62.1:5.16.3.2.1].
- ii. Recirculation or transfer of Class 2 air to other Class 2 or Class 3 spaces shall be permitted, provided that the other spaces are used for the same or similar purpose or task and involve the same or similar pollutant sources as the Class 2 space [ASHRAE 62.1:5.16.3.2.2]; or
- iii. Transfer of Class 2 air to toilet rooms [ASHRAE 62.1:5.16.3.2.3]; or
- iv. Recirculation or transfer of Class 2 air to Class 4 spaces [ASHRAE 62.1:5.16.3.2.4].
- v. Class 2 air shall not be recirculated or transferred to Class 1 spaces. [ASHRAE 62.1:5.16.3.2.5].

Exception to Section 160.2(c)8Bv: When using any energy recovery device, recirculation from leakage, carryover or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 2 air shall not exceed 10 percent of the outdoor air intake flow.

C. Class 3 air is air with significant contaminant concentration, significant sensory-irritation intensity or offensive odor. Recirculation or transfer of Class 3 air shall be permitted in accordance with Sections 160.2(c)8Ci and 160.2(c)8Cii:

- i. Recirculation of Class 3 air within the space of origin shall be permitted. [ASHRAE 62.1:5.16.3.3.1]
- ii. Class 3 air shall not be recirculated or transferred to any other space. [ASHRAE 62.1:5.16.3.3.2].

Exception to Section 160.2(c)8Cii: When using any energy recovery device, recirculation from leakage, carryover or transfer from the exhaust side of the energy recovery device is permitted. Recirculated Class 3 air shall not exceed 5 percent of the outdoor air intake flow.

D. Class 4 air is air with highly objectionable fumes or gases or with potentially dangerous particles, bio-aerosols or gases at concentrations high enough to be considered as harmful. Class 4 air shall not be recirculated or transferred to any space or recirculated within the space of origin. [ASHRAE 62.1:5.16.3.4]

E. Ancillary spaces. Redesignation of Class 1 air to Class 2 air shall be permitted for Class 1 spaces that are ancillary to Class 2 spaces. [ASHRAE 62.1:5.16.2.3]

F. Transfer. A mixture of air that has been transferred through or returned from spaces or locations with different air classes shall be redesignated with the highest classification among the air classes mixed. [ASHRAE 62.1:5.16.2.2]

G. Classification. Air leaving each space or location shall be designated at an expected air-quality classification not less than that shown in Table 160.2-B, 160.2-C or 160.2-D. Air leaving spaces or locations that are not listed in Table 160.2-B, 160.2-C or 160.2-D shall be designated with the same classification as air from the most similar space or location listed in terms of occupant activities and building construction.

(d) **Parking garages.** Mechanical ventilation systems for enclosed parking garages in multifamily buildings shall comply with Section 120.6(c).

SECTION 160.3 MANDATORY REQUIREMENTS FOR SPACE- CONDITIONING SYSTEMS IN MULTIFAMILY BUILDINGS

Space-conditioning systems serving multifamily dwelling units and common use areas shall comply with the applicable requirements of Sections 160.3(a) through 160.3(c).

(a) **Controls.** Space-conditioning systems serving dwelling units and common use areas in multifamily buildings shall comply with applicable requirements of Section 160.3(a)1 or 160.3(a)2.

1. **Dwelling unit thermostats.** All heating or cooling systems, including heat pumps, not controlled by a central energy management control system (EMCS) shall have a setback thermostat, as specified in Section 110.2(c).
2. **Common use area controls.** Heating or cooling systems serving common use areas of multifamily buildings shall comply with application requirements of Sections 160.3(a)2A through 160.3(a)2J.

Exception to Section 160.3(a)2: Heating or cooling systems exclusively serving dwelling units and common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions may instead comply with Section 160.3(a)1.

A. **Thermostatic controls for each zone.** The supply of heating and cooling energy to each space-conditioning zone shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of Section 160.3(a)2B. An energy management control system (EMCS) may be installed to comply with the requirements of one or

more thermostatic controls if it complies with all applicable requirements for each thermostatic control.

Exception to Section 160.3(a)2A: An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

- i. All zones are also served by an interior cooling system; and
- ii. The perimeter system is designed solely to offset envelope heat losses or gains; and
- iii. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
- iv. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

B. **Criteria for zonal thermostatic controls.** The individual thermostatic controls required by Section 160.3(a)2A shall meet the following requirements as applicable:

- i. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
- ii. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.
- iii. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items i and ii and shall be capable of providing a temperature range or deadband of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception to Section 160.3(a)2Biii: Systems with thermostats that require manual changeover between heating and cooling modes.

- iv. Thermostatic controls for all single zone air conditioners and heat pumps shall comply with the requirements of Sections 110.2(c) and 110.12(a) and, if equipped with DDC to the zone level, with the automatic demand shed controls of Section 110.12(b).

Exception to Section 160.3(a)2Biv: Package terminal air conditioners, package terminal heat pumps, room air conditioners and room air-conditioner heat pumps.

C. **Heat pump controls.** All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section 110.2(b).

MULTIFAMILY BUILDINGS—MANDATORY REQUIREMENTS

**TABLE 160.2-A
INFILTRATION EFFECTIVENESS WEATHER AND SHIELDING FACTORS [ASHRAE 62.2:Table B1]**

TMY3	wsf	WEATHER STATION	LATITUDE	LONGITUDE	STATE
690150	0.50	Twentynine Palms	34.30	-116.17	California
722860	0.43	March AFB	33.90	-117.25	California
722868	0.45	Palm Springs Intl	33.83	-116.50	California
722869	0.42	Riverside Muni	33.95	-117.45	California
722880	0.39	Burbank–Glendale–Pasadena AP	34.20	-118.35	California
722885	0.39	Santa Monica Muni	34.02	-118.45	California
722886	0.39	Van Nuys Airport	34.22	-118.48	California
722895	0.55	Lompoc (AWOS)	34.67	-120.47	California
722897	0.51	San Luis Co Rgnl	35.23	-120.63	California
722899	0.45	Chino Airport	33.97	-117.63	California
722900	0.38	San Diego Lindbergh Field	32.73	-117.17	California
722903	0.39	San Diego/Montgomery	32.82	-117.13	California
722904	0.40	Chula Vista Brown Field NAAS	32.58	-116.98	California
722906	0.39	San Diego North Island NAS	32.70	-117.20	California
722926	0.40	Camp Pendleton MCAS	33.30	-117.35	California
722927	0.38	Carlsbad/Palomar	33.13	-117.28	California
722930	0.39	San Diego Miramar NAS	32.87	-117.13	California
722950	0.42	Los Angeles Intl Arpt	33.93	-118.40	California
722956	0.38	Jack Northrop Fld H	33.92	-118.33	California
722970	0.38	Long Beach Daugherty Fld	33.83	-118.17	California
722976	0.34	Fullerton Municipal	33.87	-117.98	California
722977	0.36	Santa Ana John Wayne AP	33.68	-117.87	California
723805	0.51	Needles Airport	34.77	-114.62	California
723810	0.59	Edwards AFB	34.90	-117.87	California
723815	0.58	Daggett Barstow–Daggett AP	34.85	-116.80	California
723816	0.62	Lancaster Gen Wm Fox Field	34.73	-118.22	California
723820	0.57	Palmdale Airport	34.63	-118.08	California
723830	0.68	Sandberg	34.75	-118.72	California
723840	0.43	Bakersfield Meadows Field	35.43	-119.05	California
723890	0.45	Fresno Yosemite Intl AP	36.78	-119.72	California
723895	0.42	Porterville (AWOS)	36.03	-119.07	California
723896	0.43	Visalia Muni (AWOS)	36.32	-119.40	California
723910	0.45	Point Mugu Nf	34.12	-119.12	California
723925	0.44	Santa Barbara Municipal AP	34.43	-119.85	California
723926	0.43	Camarillo (AWOS)	34.22	-119.08	California
723927	0.45	Oxnard Airport	34.20	-119.20	California
723940	0.52	Santa Maria Public Arpt	34.92	-120.47	California

continued

TABLE 160.2-A
INFILTRATION EFFECTIVENESS WEATHER AND SHIELDING FACTORS [ASHRAE 62.2:Table B1] (continued)

TMY3	wsf	WEATHER STATION	LATITUDE	LONGITUDE	STATE
723965	0.53	Paso Robles Municipal Arpt	35.67	-120.63	California
724800	0.55	Bishop Airport	37.37	-118.35	California
724815	0.46	Merced/Macready Fld	37.28	-120.52	California
724830	0.51	Sacramento Executive Arpt	38.50	-121.50	California
724837	0.45	Beale AFB	39.13	-121.43	California
724838	0.50	Yuba Co	39.10	-121.57	California
724839	0.51	Sacramento Metropolitan AP	38.70	-121.58	California
724915	0.49	Monterey Naf	36.60	-121.87	California
724917	0.54	Salinas Municipal AP	36.67	-121.60	California
724920	0.50	Stockton Metropolitan Arpt	37.90	-121.23	California
724926	0.47	Modesto City-County AP	37.63	-120.95	California
724927	0.53	Livermore Municipal	37.70	-121.82	California
724930	0.54	Oakland Metropolitan Arpt	37.72	-122.22	California
724935	0.47	Hayward Air Term	37.67	-122.12	California
724936	0.53	Concord-Buchanan Field	38.00	-122.05	California
724940	0.60	San Francisco Intl AP	37.62	-122.40	California
724945	0.48	San Jose Intl AP	37.37	-121.93	California
724955	0.55	Napa Co. Airport	38.22	-122.28	California
724957	0.49	Santa Rosa (AWOS)	38.52	-122.82	California
725845	0.44	Blue Canyon AP	39.30	-120.72	California
725846	0.66	Truckee-Tahoe	39.32	-120.13	California
725847	0.64	South Lake Tahoe	38.90	-120.00	California
725905	0.47	Ukiah Municipal AP	39.13	-123.20	California
725910	0.50	Red Bluff Municipal Arpt	40.15	-122.25	California
725920	0.47	Redding Municipal Arpt	40.52	-122.32	California
725945	0.56	Arcata Airport	40.98	-124.10	California
725946	0.60	Crescent City Faa Ai	41.78	-124.23	California
725955	0.55	Montague Siskiyou County AP	41.78	-122.47	California
725958	0.59	Alturas	41.50	-120.53	California
745090	0.45	Mountain View Moffett Fld NAS	37.40	-122.05	California
745160	0.67	Travis Field AFB	38.27	-121.93	California
746120	0.52	China Lake Naf	35.68	-117.68	California
747020	0.50	Lemoore Reeves NAS	36.33	-119.95	California
747185	0.46	Imperial	32.83	-115.58	California
747187	0.46	Palm Springs Thermal AP	33.63	-116.17	California
747188	0.48	Blythe Riverside Co Arpt	33.62	-114.72	California

**TABLE 160.2-B
MINIMUM VENTILATION RATES FOR MULTIFAMILY COMMON USE AREAS**

OCCUPANCY CATEGORY ³	AREA OUTDOOR AIR RATE ¹ R _a cfm/ft ²	MIN AIR RATE FOR DC cfm/ft ² V ²	AIR CLASS	NOTES
Daycare (through age 4)	0.21	0.15	2	—
Multiuse assembly	0.50	0.15	1	F
Dining rooms	0.50	0.15	2	—
Bars, cocktail lounges	0.50	0.20	2	—
Kitchen (cooking)	0.15	—	2	—
Break rooms	0.50	0.15	1	F
Coffee stations	0.50	0.15	1	F
Conference/meeting	0.50	0.15	1	F
Corridors	0.15	—	1	F
Occupiable storage rooms for liquids or gels	0.15	—	2	B
Laundry rooms, central	0.15	—	2	—
Lobbies/pre-function	0.50	0.15	1	F
Breakrooms	0.50	0.15	—	—
Occupiable storage rooms for dry materials	0.15	—	—	—
Office space	0.15	—	1	—
Reception areas	0.15	—	1	F
Telephone/data entry	0.15	—	1	F
Computer (not printing)	0.15	—	—	—
Freezer and refrigerated spaces (<50°F)	—	—	1	F
Shipping/receiving	0.15	—	—	—
Gym, sports arena (play area)	0.50	0.15	2	E
Swimming (pool)	0.15	—	2	C
Swimming (deck)	0.50	0.15	2	C
Disco/dance floors	1.50	0.15	2	F
Health club/aerobics room/weight rooms	0.15	—	2	—
Game arcades	0.68	0.15	1	—
All others	0.15	—	—	—

A – RESERVED.

B – Rate may not be sufficient where stored materials include those having potentially harmful emissions.

C – Rate does not allow for humidity control. “Deck area” refers to the area surrounding the pool that is capable of being wetted during pool use or when the pool is occupied. Deck area that is not expected to be wetted shall be designated as an occupancy category.

D – RESERVED.

E – Where combustion equipment is intended to be used on the playing surface or in the space, additional dilution ventilation, source control or both shall be provided.

F – Ventilation air for this occupancy category shall be permitted to be reduced to zero when the space is in occupied-standby mode.

Notes:

1. R_a was determined as being the larger of the area method and the default per person method. The occupant density used in the per person method was assumed to be one-half of the maximum occupant load assumed for egress purposes in the CBC.
2. If this column specifies a minimum cfm/ft² then it shall be used to comply with Section 160.2(c)5E.
3. For spaces not included in this table, the spaces in Table 120.1-A shall apply.

**TABLE 160.2-C
MINIMUM EXHAUST RATES
[ASHRAE 62.1: TABLE 6.5]**

OCCUPANCY CATEGORY ¹	EXHAUST RATE, cfm/unit	EXHAUST RATE, cfm/ft ²	AIR CLASS	NOTES
Copy, printing rooms	—	0.50	2	—
Janitor closets, trash rooms, recycling	—	1.00	3	—
Kitchenettes	—	0.30	2	—
Kitchens – commercial	—	0.70	2	—
Locker rooms for athletic or industrial facilities	—	0.50	2	—
All other locker rooms	—	0.25	2	—
Shower rooms	20/50	—	2	G, H
Parking garages	—	0.75	2	C
Pet shops (animal areas)	—	0.90	2	—
Soiled laundry storage rooms	—	1.00	3	F
Storage rooms, chemical	—	1.50	4	F
Toilets – private	25/50	—	2	E
Toilets – public	50/70	—	2	D

A – RESERVED.

B – RESERVED.

C – Exhaust shall not be required where two or more sides comprise walls that are at least 50 percent open to the outside.

D – Rate is per water closet, urinal or both. Provide the higher rate where periods of heavy use are expected to occur. The lower rate shall be permitted to be used otherwise.

E – Rate is for a toilet room intended to be occupied by one person at a time. For continuous systems operation during hours of use, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.

F – See other applicable standards for exhaust rate.

G – For continuous system operation, the lower rate shall be permitted to be used. Otherwise the higher rate shall be used.

H – Rate is per showerhead.

Notes:

1. For spaces not included in this table, the spaces in Table 120.1-B shall apply.

**TABLE 160.2-D
AIRSTREAMS OR SOURCES
[ASHRAE 62.1: TABLE 5.16.1]**

DESCRIPTION	AIR CLASS
Commercial kitchen grease hoods	4
Commercial kitchen hoods other than grease	3
Hydraulic elevator machine room	2

**TABLE 160.2-E
DEMAND-CONTROLLED LOCAL VENTILATION EXHAUST AIRFLOW RATES AND CAPTURE EFFICIENCY**

APPLICATION	COMPLIANCE CRITERIA
Enclosed kitchen or nonenclosed kitchen	Vented range hood, including appliance-range hood combinations, shall meet either the capture efficiency (CE) or the airflow rate specified in Table 160.2-G as applicable.
Enclosed kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s) or a capacity of 5 ACH
Nonenclosed kitchen	Other kitchen exhaust fans, including downdraft: 300 cfm (150 L/s)
Bathroom	50 cfm (25 L/s)

**TABLE 160.2-F
CONTINUOUS LOCAL VENTILATION EXHAUST AIRFLOW RATES**

APPLICATION	AIRFLOW
Enclosed kitchen	5 ach, based on kitchen volume
Bathroom	20 cfm (10 L/s)

**TABLE 160.2-G
KITCHEN RANGE HOOD AIRFLOW RATES (cfm) AND ASTM E3087 CAPTURE EFFICIENCY (CE) RATINGS
According to Dwelling Unit Floor Area and Kitchen Range Fuel Type**

DWELLING UNIT FLOOR AREA (FT ²)	HOOD OVER ELECTRIC RANGE	HOOD OVER NATURAL GAS RANGE
>1500	50% CE or 110 cfm	70% CE or 180 cfm
>1000–1500	50% CE or 110 cfm	80% CE or 250 cfm
750–1000	55% CE or 130 cfm	85% CE or 280 cfm
<750	65% CE or 160 cfm	85% CE or 280 cfm

**TABLE 160.2-H
PRESCRIPTIVE VENTILATION SYSTEM DUCT SIZING [ASHRAE 62.2:TABLE 5-3]**

Fan airflow rating, cfm at minimum static pressure ^f 0.25 in. water (L/s at minimum 62.5 Pa)	≤50 (25)	≤80 (40)	≤100 (50)	≤125 (60)	≤150 (70)	≤175 (85)	≤200 (95)	≤250 (120)	≤350 (165)	≤400 (190)	≤450 (210)	≤700 (330)	≤800 (380)
Minimum duct diameter, in. (mm) ^{a,b} for rigid duct	4 ^e (100)	5 (125)	5 (125)	6 (150)	6 (150)	7 (180)	7 (180)	8 (205)	9 (230)	10 (255)	10 (255)	12 (305)	12 ^d (305)
Minimum duct diameter, in. (mm) ^{a,b} for flex duct ^c	4 (100)	5 (125)	6 (150)	6 (150)	7 (150)	7 (180)	8 (205)	8 (205)	9 (230)	10 (255)	NP	NP	NP

- a. For noncircular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.
- b. NP = application of the prescriptive table is not permitted for this scenario.
- c. Use of this table for verification of flex duct systems requires flex duct to be fully extended and any flex duct elbows to have a minimum bend radius to duct diameter ratio of 1.0.
- d. For this scenario, use of elbows is not permitted.
- e. For this scenario, 4 in. (100 mm) oval duct shall be permitted, provided the minor axis of the oval is greater than or equal to 3 in. (75 mm).
- f. When a vented range hood utilizes a capture efficiency rating to demonstrate compliance with Section 160.2(b)2A^{vic2}, a static pressure greater than or equal to 0.25 in. of water at the rating point shall not be required, and the airflow listed in the approved directory corresponding to the compliant capture efficiency rating point shall be applied to Table 160.2-H for determining compliance.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

D. Shut-off and reset controls for space-conditioning systems. Each space-conditioning system shall be installed with controls that comply with the following:

- i. The control shall be capable of automatically shutting off the system during periods of nonuse and shall have:
 - a. An automatic time switch control device complying with Section 110.9, with an accessible manual override that allows operation of the system for up to 4 hours; or
 - b. An occupancy sensor; or
 - c. A 4-hour timer that can be manually operated.
- ii. The control shall automatically restart and temporarily operate the system as required to maintain:
 - a. A setback heating thermostat setpoint if the system provides mechanical heating; and

Exception to Section 160.3(a)2Diia: Thermostat setback controls are not required in multifamily buildings in areas where the Winter Median of Extremes outdoor air temperature determined in accordance with Section 170.2(c)1C is greater than 32°F.

- b. A setup cooling thermostat setpoint if the system provides mechanical cooling.

Exception to Section 160.3(a)2Diib: Thermostat setup controls are not required in multifamily buildings in areas where the summer design dry-bulb 0.5-percent temperature determined in accordance with Section 170.2(c)1C is less than 100°F.

iii. Occupant sensing zone controls. Where the system providing space conditioning also provides the ventilation required by Section 160.2(c)3 and includes occupant sensor ventilation control as specified in Section 160.2(c)5E, the occupant sensing zone controls shall additionally comply with the following:

- a. Occupant sensing zone controls shall comply with the occupant sensor ventilation control device requirements of Section 160.3(c)5E and allow preoccupancy ventilation requirements of Section 160.3(c)5B; and
- b. In 5 minutes or less after entering occupied-standby mode as described in Section 160.2(c)5:
 - I. Automatically set up the operating cooling temperature setpoint by 2°F or more and set back the operating heating temperature setpoint by 2°F or more; or
 - II. For multiple zone systems with direct digital controls (DDC) to the zone level, set up the operating cooling temperature setpoint by 0.5°F or more and set back the operating heating temperature setpoint by 0.5°F or more.

- c. In 5 minutes or less after entering occupied-standby mode, mechanical ventilation to the zone shall remain off whenever the space temperature is between the active heating and cooling setpoints.

Exception to Section 160.3(a)2Diii: Zones that are only ventilated by a natural ventilation system in accordance with Section 120.1(c)2.

Exception 1 to Sections 160.3(a)2Di, ii and iii: Where it can be demonstrated to the satisfaction of the enforcing agency that the system serves an area that must operate continuously.

Exception 2 to Sections 160.3(a)2Di, ii and iii: Systems with full load demands of 2 kW or less, if they have a readily accessible manual shut-off switch.

E. Dampers for air supply and exhaust equipment. Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.

Exception 1 to Section 160.3(a)2E: Equipment that serves an area that must operate continuously.

Exception 2 to Section 160.3(a)2E: Gravity and other nonelectrical equipment that has readily accessible manual damper controls.

Exception 3 to Section 160.3(a)2E: At combustion air intakes and shaft vents.

Exception 4 to Section 160.3(a)2E: Where prohibited by other provisions of law.

F. Isolation area devices. Each space-conditioning system serving multiple zones with a combined conditioned floor area of more than 25,000 square feet shall be designed, installed and controlled to serve isolation areas.

- i. Each zone, or any combination of zones not exceeding 25,000 square feet, shall be a separate isolation area.
- ii. Each isolation area shall be provided with isolation devices, such as valves or dampers that allow the supply of heating or cooling to be reduced or shut off independently of other isolation areas.
- iii. Each isolation area shall be controlled by a device meeting the requirements of Section 160.3(a)2Di.

Exception to Section 160.3(a)2F: Zones designed to be conditioned continuously.

G. Automatic demand shed controls. See Section 110.12 for requirements for automatic demand shed controls.

H. Economizer fault detection and diagnostics (FDD). All newly installed air handlers with a mechanical cooling capacity over 33,000 Btu/hr and an installed air economizer shall include a stand-alone or integrated fault detection and diagnostics

(FDD) system in accordance with Subsections 160.3(a)2Hi through 160.3(a)2Hviii.

- i. The following temperature sensors shall be permanently installed to monitor system operation: outside air, supply air and, when required for differential economizer operation, a return air sensor; and
- ii. Temperature sensors shall have an accuracy of $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F ; and
- iii. The controller shall have the capability of displaying the value of each sensor; and
- iv. The controller shall provide system status by indicating the following conditions:
 - a. Free cooling available;
 - b. Economizer enabled;
 - c. Compressor enabled;
 - d. Heating enabled, if the system is capable of heating; and
 - e. Mixed air low limit cycle active.
- v. The unit controller shall allow manual initiation of each operating mode so that the operation of cooling systems, economizers, fans and heating systems can be independently tested and verified; and
- vi. Faults shall be reported in one of the following ways:
 - a. Reported to an energy management control system regularly monitored by facility personnel.
 - b. Annunciated locally on one or more zone thermostats, or a device within 5 feet of zone thermostat(s), clearly visible, at eye level and meeting the following requirements:
 - I. On the thermostat, the device or an adjacent written sign, display instructions to contact appropriate building personnel or an HVAC technician; and
 - II. In buildings with multiple tenants, the annunciation shall either be within property management offices or in a common space accessible by the property or building manager.
 - c. Reported to a fault management application that automatically provides notification of the fault to remote HVAC service provider.
- vii. The FDD system shall detect the following faults:
 - a. Air temperature sensor failure/fault;
 - b. Not economizing when it should;
 - c. Economizing when it should not;
 - d. Damper not modulating; and
 - e. Excess outdoor air.

- viii. The FDD system shall be certified by the Energy Commission as meeting the requirements of Sections 160.3(a)2Hi through 160.3(a)2Hvii in accordance with Section 110.0 and JA6.3.

Exception to Section 160.3(a)2Hviii: FDD algorithms based in direct digital control systems are not required to be certified to the Energy Commission.

- I. **Direct digital controls (DDC).** Direct digital controls to the zone shall be provided as specified by Table 160.3-C.
 - i. The provided DDC system shall meet the control logic requirements of Sections 160.3(a)2E and 160.3(a)2G, and be capable of the following:
 - ii. Monitoring zone and system demand for fan pressure, pump pressure, heating and cooling;
 - iii. Transferring zone and system demand information from zones to air distribution system controllers and from air distribution systems to heating and cooling plant controllers;
 - iv. Automatically detecting the zones and systems that may be excessively driving the reset logic and generate an alarm or other indication to the system operator;
 - v. Readily allow operator removal of zone(s) from the reset algorithm;
 - vi. For new buildings, trending and graphically displaying input and output points; and
 - vii. Resetting heating and cooling setpoints in all noncritical zones upon receipt of a signal from a centralized contact or software point as described in Section 160.3(a)2G.
- J. **Optimum start/stop controls.** Space-conditioning systems with DDC to the zone level shall have optimum start/stop controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint, the outdoor air temperature, and the amount of time prior to scheduled occupancy. Mass radiant floor slab systems shall incorporate floor temperature onto the optimum start algorithm.

Exception to Section 160.3(a)2J: Systems that must operate continuously.

 - (b) **Dwelling unit space-conditioning and air distribution systems.**
 1. **Building cooling and heating loads.** Building heating and cooling loads shall be determined using a method based on any one of the following, using cooling and heating loads as two of the criteria for equipment sizing and selection:
 - A. The ASHRAE Handbook, Equipment Volume, Applications Volume and Fundamentals Volume; or
 - B. The SMACNA Residential Comfort System Installation Standards Manual; or

C. The ACCA Manual J.

NOTE: Heating systems are required to have a minimum heating capacity adequate to meet the minimum requirements of the CBC.

2. **Design conditions.** Design conditions shall be determined in accordance with the following:

A. For the purpose of sizing the space-conditioning (HVAC) system, the indoor design temperatures shall be 68°F for heating and 75°F for cooling.

B. Outdoor design conditions shall be selected from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X.

C. The outdoor design temperatures for heating shall be no lower than the Heating Winter Median of Extremes values.

D. The outdoor design temperatures for cooling shall be no greater than the 1.0 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

3. **Outdoor condensing units.**

A. **Clearances.** Installed air conditioner and heat pump outdoor condensing units shall have a clearance of at least 5 feet (1.5 meters) from the outlet of any dryer vent.

B. **Liquid line drier.** Installed air conditioner and heat pump systems shall be equipped with liquid line filter driers if required, as specified by manufacturer's instructions.

4. **Central forced-air heating furnaces.**

A. **Temperature rise.** Central forced-air heating furnace installations shall be configured to operate in conformance with the furnace manufacturer's maximum inlet-to-outlet temperature rise specifications.

5. **Air-distribution and ventilation system ducts, plenums and fans.**

A. **CMC compliance.**

i. All air-distribution system ducts and plenums, including, but not limited to, mechanical closets and air-handler boxes, shall meet the requirements of the CMC Sections 601.0, 602.0, 603.0, 604.0 and 605.0 and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition, incorporated herein by reference.

ii. Portions of supply-air and return-air ducts and plenums of a space heating or cooling system shall be insulated in accordance with either Subsection a or b below:

a. Ducts shall have a minimum installed level of R-6.0, or

Exception to Section 160.3(b)5Aii: Portions of the duct system located in conditioned space below the ceiling separating the occupiable space from the attic are not required to be

insulated if all of the following conditions are met:

i. The noninsulated portion of the duct system is located entirely inside the building's thermal envelope as confirmed by visual inspection.

ii. At all locations where noninsulated portions of the duct system penetrate into unconditioned space, the penetration shall be draft stopped compliant with CFC Sections 703.1 and 704.1 and air-sealed to the construction materials that are penetrated, using materials compliant with CMC Section E502.4.2 to prevent air infiltration into the cavity. All connections in unconditioned space are insulated to a minimum of R-6.0 as confirmed by visual inspection.

b. Ducts do not require insulation when the duct system is located entirely in conditioned space. For buildings with three or fewer habitable stories, duct systems located entirely in conditioned space shall be confirmed through field verification and diagnostic testing in accordance with the requirements of Reference Residential Appendix RA3.1.4.3.8.

iii. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened.

iv. Openings shall be sealed with mastic, tape or other duct-closure system that meets the applicable requirements of UL 181, UL 181A or UL 181B or aerosol sealant that meets the requirements of UL 723. If mastic or tape is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

v. Building cavities, support platforms for air handlers, and plenums designed or constructed with materials other than sealed sheet metal, duct board or flexible duct shall not be used for conveying conditioned air. Building cavities and support platforms may contain ducts. Ducts installed in cavities and support platforms shall not be compressed to cause reductions in the cross-sectional area of the ducts.

Exception to Section 160.3(b)5A: Ducts and fans integral to a wood heater or fireplace.

B. **Factory-fabricated duct systems.**

i. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.

ii. All pressure-sensitive tapes, heat-activated tapes and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.

- iii. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
- iv. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

C. Field-fabricated duct systems.

- i. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A and UL 181B.
- ii. Mastic sealants and mesh.
 - a. Sealants shall comply with the applicable requirements of UL 181, UL 181A and UL 181B, and be nontoxic and water resistant.
 - b. Sealants for interior applications shall be tested in accordance with ASTM C731 and D2202, incorporated herein by reference.
 - c. Sealants for exterior applications shall be tested in accordance with ASTM C731, C732 and D2202, incorporated herein by reference.
 - d. Sealants and meshes shall be rated for exterior use.
- iii. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A and UL 181B.
- iv. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
- v. Drawbands used with flexible duct.
 - a. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
 - b. Drawbands shall have a minimum tensile strength rating of 150 pounds.
 - c. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.
- vi. Aerosol-sealant closures.
 - a. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
 - b. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.

D. Duct insulation R-value ratings. All duct insulation product R-values shall be based on insulation only (excluding air films, vapor retarder or other duct components) and tested C-values at 75°F mean

temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.

E. Duct insulation thickness. The installed thickness of duct insulation used to determine its R-value shall be determined as follows:

- i. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
- ii. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
- iii. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

F. Duct labeling. Insulated flexible duct products installed to meet this requirement shall include labels, in maximum intervals of 3 feet, showing the thermal performance R-value for the duct insulation itself (excluding air films, vapor retarder or other duct components), based on the tests in Section 160.3(b)5D and the installed thickness determined by Section 160.3(b)5Eiii.

G. Backdraft dampers. All fan systems, regardless of volumetric capacity, that exchange air between the building conditioned space and the outside of the building shall be provided with backdraft or automatic dampers to prevent unintended air leakage through the fan system when the fan system is not operating.

H. Gravity ventilation dampers. All gravity ventilating systems that serve conditioned space shall be provided with either automatic or readily accessible, manually operated dampers in all openings to the outside except combustion inlet and outlet air openings and elevator shaft vents.

I. Protection of insulation. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service (e.g., protected by aluminum, sheet metal, painted canvas or plastic cover).

Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

J. Porous inner core flex duct. Flexible ducts having porous inner cores shall have a nonporous layer or air barrier between the inner core and the outer vapor barrier.

K. Duct system sealing and leakage testing. When space-conditioning systems utilize forced air duct systems to supply conditioned air to an individual

dwelling unit, the ducts shall be sealed, as confirmed through field verification and diagnostic testing, in accordance with all applicable procedures specified in Reference Residential Appendix RA3.1. Air handler airflow for calculation of duct leakage rate compliance targets shall be determined according to methods specified in Reference Residential Appendix RA3.1.4.2.

For multifamily dwellings with the air-handling unit installed and the ducts connected directly to the air handler, regardless of duct system location:

- i. The total leakage of the duct system shall not exceed 12 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
- ii. The duct system leakage to outside shall not exceed 6 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4.

Exception 1 to Section 160.3(b)5K: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four habitable stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

Exception 2 to Section 160.3(b)5K: Multifamily dwelling units in buildings four habitable stories and greater in Climate Zones 1, 3, 5 and 7.

L. System airflow rate and fan efficacy. Space-conditioning systems that utilize forced air ducts to supply cooling to an individual dwelling unit shall:

- i. **Static pressure probe.** Have a hole for the placement of a static pressure probe (HSPP), or a permanently installed static pressure probe (PSPP) in the supply plenum downstream of the air conditioning evaporator coil. The size, location and labeling of the HSPP or PSPP shall conform to the requirements specified in Reference Residential Appendix RA3.3.1.1 as confirmed by field verification and diagnostic testing; and

Exception to Section 160.3(b)5Li: Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.3-1 shall not be required to provide holes as described in Figure RA3.3-1.

- ii. **Single zone central forced air systems.** Demonstrate, in every control mode, airflow greater than or equal to 350 cfm per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to the maximum W/cfm specified in Subsection a or b below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance

with the procedures given in Reference Residential Appendix RA3.3.

- a. 0.45 W/cfm for gas furnace air-handling units.
- b. 0.58 W/cfm for air-handling units that are not gas furnaces.

Exception 1 to Section 160.3(b)5Lii: Standard ducted systems without zoning dampers may comply by meeting the applicable requirements in Table 160.3-A or 160.3-B as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements specified by Section 160.2(b)1Div for the system air filter(s) shall conform to the requirements given in Table 160.3-A or 160.3-B.

Exception 2 to Section 160.3(b)5Lii: Multi-speed compressor systems or variable speed compressor systems shall verify airflow (cfm/ton) and fan efficacy (watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.

Exception 3 to Section 160.3(b)5Lii: Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 w/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

iii. **Zonally controlled central forced air systems.**

Zonally controlled central forced air cooling systems shall be capable of simultaneously delivering, in every zonal control mode, an airflow from the dwelling, through the air handler fan and delivered to the dwelling, of greater than or equal to 350 cfm per ton of nominal cooling capacity, and operating at an air-handling unit fan efficacy of less than or equal to the maximum W/cfm specified in Subsection a or b below. The airflow rate and fan efficacy requirements in this section shall be confirmed by field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Residential Appendix RA3.3.

- a. 0.45 W/cfm for gas furnace air-handling units.
- b. 0.58 W/cfm for air-handling units that are not gas furnaces.

Exception 1 to Section 160.3(b)5Liii: Multi-speed or variable speed compressor systems, or single speed compressor systems that utilize the performance compliance approach, shall demonstrate compliance with the airflow (cfm/ton) and fan efficacy (watt/cfm) requirements of Section 160.3(b)5Liii by operating the system at maximum compressor capacity

and system fan speed with all zones calling for conditioning, rather than in every zonal control mode.

Exception 2 to Section 160.3(b)5Liii: Gas furnace air-handling units manufactured prior to July 3, 2019 shall comply with a fan efficacy value less than or equal to 0.58 w/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

- iv. **Small duct high velocity forced air systems.** Demonstrate, in every control mode, airflow greater than or equal to 250 cfm per ton of nominal cooling capacity through the return grilles, and an air-handling unit fan efficacy less than or equal to 0.62 W/cfm as confirmed by field verification and diagnostic testing in accordance with the procedures given in Reference Residential Appendix RA3.3.

Exception 1 to Section 160.3(b)5Liv: Standard ducted systems without zoning dampers may comply by meeting the applicable requirements in Table 160.3-A or 160.3-B as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements specified by Section 160.2(b)1Div for the system air filter(s) shall conform to the requirements given in Table 160.3-A or 160.3-B.

Exception 2 to Section 160.3(b)5Liv: Multi-speed compressor systems or variable speed compressor systems shall verify airflow (cfm/ton) and fan efficacy (watt/cfm) for system operation at the maximum compressor speed and the maximum air handler fan speed.

Exception 1 to Section 160.3(b)5L: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four habitable stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

Exception 2 to Section 160.3(b)5L: Multifamily dwelling units in buildings four habitable stories and greater in Climate Zone 1.

6. Piping for space-conditioning systems, solar water-heating system collector loop, and distribution piping for steam and hydronic heating system shall meet the requirements of Section 160.3(c)1.

(c) **Fluid distribution systems; common area space-conditioning systems.** Multifamily buildings shall comply

with the applicable requirements of Section 160.3(a)1. Multifamily common areas shall comply with the applicable requirements of Sections 160.3(a)2A through 160.3(a)2J.

1. **Pipe insulation.** Multifamily buildings shall comply with the applicable requirements of Sections 160.3(c)1A through 160.3(c)1D.

A. **General requirements.** The piping conditions listed below for space-conditioning systems with fluid normal operating temperatures listed in Table 160.3-D shall have at least the amount of insulation specified in Section 160.3(c)1C:

- i. **Space cooling systems.** All refrigerant suction, chilled water and brine fluid distribution systems.
- ii. **Space heating systems.** All refrigerant, steam, steam condensate and hot water fluid distribution systems.

B. Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in Table 160.3-D, and shall be rounded to the nearest $\frac{1}{100}$ Btu-inch per hour per square foot per °F. Fluid distribution systems include all elements that are in series with the fluid flow, such as pipes, pumps, valves, strainers, coil u-bends and air separators, but not including elements that are not in series with the fluid flow, such as expansion tanks, fill lines, chemical feeders and drains.

C. **Insulation protection.** Pipe insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. Protection shall, at minimum, include the following:

- i. Pipe insulation exposed to weather shall be protected by a cover suitable for outdoor service. The cover shall be water retardant and provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be used to provide this protection.
- ii. Pipe insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include, or be protected by, a Class I or Class II vapor retarder. All penetrations and joints shall be sealed.
- iii. Pipe insulation buried below grade must be installed in a waterproof and noncrushable casing or sleeve.

D. **Insulation thickness.**

- i. For insulation with a conductivity in the range shown in Table 160.3-D for the applicable fluid temperature range, the insulation shall have the applicable minimum thickness or *R*-value shown in Table 160.3-D.
- ii. For insulation with a conductivity outside the range shown in Table 160.3-D for the applicable fluid temperature range, the insulation shall have

a minimum *R*-value shown in Table 160.3-D or thickness as calculated with Equation 160.3-A:

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right] \quad \text{(Equation 160.3-A)}$$

where:

T = Minimum insulation thickness for material with conductivity *K*, inches.

PR = Pipe actual outside radius, inches.

t = Insulation thickness from 160.3-D, inches.

K = Conductivity of alternate material at the mean rating temperature indicated in Table 160.3-D for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.

k = The lower value of the conductivity range listed in Table 160.3-D for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

Exception 1 to Section 160.3(c)1: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 2 to Section 160.3(c)1: Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.

Exception 3 to Section 160.3(c)1: Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.

Exception 4 to Section 160.3(c)1: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to ensure that no contact is made with the metal framing.

2. Requirements for air distribution system, ducts and plenum. Multifamily common areas shall comply with the applicable requirements of Sections 160.3(c)2A through 160.3(c)2F.

A. CMC compliance. All air distribution system ducts and plenums, including, but not limited to, building cavities, mechanical closets, air-handler boxes and support platforms used as ducts or plenums shall meet the requirements of CMC Sections 601.0, 602.0, 603.0, 604.0 and 605.0, and ANSI/SMACNA-006-2006 HVAC Duct Construction Standards Metal and Flexible 3rd Edition, incorporated herein by reference. Connections of metal ducts and the inner core of flexible ducts shall be mechanically fastened. Openings shall be sealed with mastic, tape, aerosol sealant or other duct-closure system that meets the applicable requirements of UL 181, UL 181A or UL 181B. If mastic or tape

is used to seal openings greater than 1/4 inch, the combination of mastic and either mesh or tape shall be used.

B. Portions of supply-air and return-air ducts conveying heated or cooled air located in one or more of the following spaces shall be insulated to a minimum installed level of R-8:

- i. Outdoors; or
- ii. In a space between the roof and an insulated ceiling; or
- iii. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or
- iv. In an unconditioned crawl space; or
- v. In other unconditioned spaces.

Portions of supply-air ducts that are not in one of these spaces, including ducts buried in concrete slab, shall be insulated to a minimum installed level of R-4.2 or be enclosed in directly conditioned space.

C. Duct and plenum materials.

- i. Factory-fabricated duct systems.
 - a. All factory-fabricated duct systems shall comply with UL 181 for ducts and closure systems, including collars, connections and splices, and be labeled as complying with UL 181. UL 181 testing may be performed by UL laboratories or a laboratory approved by the Executive Director.
 - b. All pressure-sensitive tapes, heat-activated tapes and mastics used in the manufacture of rigid fiberglass ducts shall comply with UL 181 and UL 181A.
 - c. All pressure-sensitive tapes and mastics used with flexible ducts shall comply with UL 181 and UL 181B.
 - d. Ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.

Exception to Section 160.3(c)2Cid: Ductwork located in occupied space and exposed to view.

- ii. Field-fabricated duct systems.
 - a. Factory-made rigid fiberglass and flexible ducts for field-fabricated duct systems shall comply with UL 181. All pressure-sensitive tapes, mastics, aerosol sealants or other closure systems used for installing field-fabricated duct systems shall meet the applicable requirements of UL 181, UL 181A and UL 181B.

- b. Mastic sealants and mesh.
 - I. Sealants shall comply with the applicable requirements of UL 181, UL 181A and UL 181B, and be nontoxic and water resistant.
 - II. Sealants for interior applications shall pass ASTM C731 (extrudability after aging) and D2202 (slump test on vertical surfaces), incorporated herein by reference.
 - III. Sealants for exterior applications shall pass ASTM C731, C732 (artificial weathering test) and D2202, incorporated herein by reference.
 - IV. Sealants and meshes shall be rated for exterior use.
- c. Pressure-sensitive tape. Pressure-sensitive tapes shall comply with the applicable requirements of UL 181, UL 181A and UL 181B.
- d. Ductwork and plenums with pressure class ratings shall be constructed to Seal Class A. Joints and seams of duct systems and their components shall not be sealed with cloth back rubber adhesive duct tapes unless such tape is used in combination with mastic and drawbands.
- e. Drawbands used with flexible duct.
 - I. Drawbands shall be either stainless-steel worm-drive hose clamps or UV-resistant nylon duct ties.
 - II. Drawbands shall have a minimum tensile strength rating of 150 pounds.
 - III. Drawbands shall be tightened as recommended by the manufacturer with an adjustable tensioning tool.
- f. Aerosol-sealant closures.
 - I. Aerosol sealants shall meet the requirements of UL 723 and be applied according to manufacturer specifications.
 - II. Tapes or mastics used in combination with aerosol sealing shall meet the requirements of this section.
- D. All duct insulation product *R*-values shall be based on insulation only (excluding air films, vapor retarders or other duct components) and tested *C*-values at 75°F mean temperature at the installed thickness, in accordance with ASTM C518 or ASTM C177, incorporated herein by reference, and certified pursuant to Section 110.8.
- E. The installed thickness of duct insulation used to determine its *R*-value shall be determined as follows:
 - i. For duct board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.
 - ii. For duct wrap, installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
 - iii. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.
- F. Insulated flexible duct products installed to meet this requirement must include labels, in maximum intervals of 3 feet, showing the thermal performance *R*-value for the duct insulation itself (excluding air films, vapor retarder or other duct components), based on the tests in Section 160.3(c)2D and the installed thickness determined by Section 160.3(c)2Eiii.
- G. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind but not limited to the following: Insulation exposed to weather shall be suitable for outdoor service; e.g., protected by aluminum, sheet metal, painted canvas or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
- H. Duct systems shall be tested in accordance with i or ii below:
 - i. New duct systems that meet the criteria in Subsections a, b and c below or ductwork that is part of a system that meets the criteria of Section 180.2(b)2B shall be sealed to a leakage rate not to exceed 6 percent of the nominal air handler airflow rate as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures in Reference Nonresidential Appendices NA1 and NA2.
 - a. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and
 - b. The space-conditioning system serves less than 5,000 square feet of conditioned floor area; and
 - c. The combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:
 - I. Outdoors; or
 - II. In a space directly under a roof that has a *U*-factor greater than the *U*-factor of the ceiling, or if the roof does not meet the requirements of Section 170.2(a)1; or
 - III. In a space directly under a roof that has fixed vents or openings to the outside or unconditioned spaces; or
 - IV. In an unconditioned crawl space; or
 - V. In other unconditioned spaces.

- ii. All duct systems that do not meet the criteria in Section 160.3(c)2H shall meet the duct leakage testing requirements of CMC Section 603.9.2.

(d) Mechanical acceptance testing.

1. Common areas. Before an occupancy permit is granted, the following systems and equipment serving multifamily common areas shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by Reference Nonresidential Appendix NA7. These systems and equipment shall also comply with the applicable requirements of Section 160.3(d)3. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:
 - A. Outdoor air ventilation systems shall be tested in accordance with NA7.5.1.
 - B. Constant volume, single zone air conditioning and heat pump unit controls shall be tested in accordance with NA7.5.2.
 - C. Duct systems shall be tested in accordance with NA7.5.3 where either:
 - a. They are new duct systems; or
 - b. They are part of an altered system.
 - D. Air economizers shall be tested in accordance with NA7.5.4.

Exception to Section 160.3(d)1D: Air economizers installed by the HVAC system manufacturer and certified to the Commission as being factory calibrated and tested are exempt from the Functional Testing section of the Air Economizer Controls acceptance test as described in NA7.5.4.2.
 - E. Demand control ventilation systems required by Section 160.2(c)3 shall be tested in accordance with NA7.5.5.
 - F. Supply fan variable flow controls shall be tested in accordance with NA7.5.6.
 - G. Hydronic system variable flow controls shall be tested in accordance with NA7.5.7 and NA7.5.9.
 - H. Boilers or chillers that require isolation controls as specified by Section 170.2(c)4Iii or 170.2(c)4Iiii shall be tested in accordance with NA7.5.7.
 - I. Hydronic systems with supply water temperature reset controls shall be tested in accordance with NA7.5.8.
 - J. Automatic demand shed controls shall be tested in accordance with NA7.5.10.
 - K. Fault detection and diagnostics (FDD) for packaged direct expansion units shall be tested in accordance with NA7.5.11.
 - L. Automatic fault detection and diagnostics (FDD) for air handling units and zone terminal units shall be tested in accordance with NA7.5.12.
 - M. Distributed energy storage DX AC systems shall be tested in accordance with NA7.5.13.

- N. Thermal energy storage (TES) systems shall be tested in accordance with NA7.5.14.
 - O. Supply air temperature reset controls shall be tested in accordance with NA7.5.15.
 - P. Water-cooled chillers served by cooling towers with condenser water reset controls shall be tested in accordance with NA7.5.16.
 - Q. When an energy management control system is installed, it shall functionally meet all of the applicable requirements of Part 6.
 - R. Occupant sensing zone controls shall be tested in accordance with NA7.5.17.
2. Multifamily dwelling units. Before an occupancy permit is granted, the following systems and equipment serving multifamily dwelling units shall be certified as meeting the acceptance requirements for code compliance, as specified by the Reference Nonresidential Appendix NA7. These systems and equipment shall also comply with the applicable requirements of Section 160.3(d)3. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the equipment and systems meet the acceptance requirements:
 - A. In multifamily buildings with four or more habitable stories, dwelling unit ventilation systems shall be tested in accordance with NA7.18.1.
 - B. In multifamily buildings with four or more habitable stories, dwelling unit enclosure leakage shall be tested in accordance with NA7.18.2 when exhaust or supply ventilation systems are used for compliance with whole-dwelling unit ventilation requirements as specified in Section 160.2(b)2Aivb2.
 - C. Multifamily building central ventilation ducts in multifamily buildings with four or more habitable stories shall be leak tested in accordance with NA7.18.3.
 - D. Multifamily building central ventilation system heat recovery or energy recovery systems in multifamily buildings with four or more habitable stories shall be tested in accordance with NA7.18.4.
 3. When certification is required by Title 24, Part 1, Section 10-103.2, the acceptance testing specified by Section 160.3(d)1 and 2 shall be performed by a Certified Mechanical Acceptance Test Technician (CMATT). If the CMATT is operating as an employee, the CMATT shall be employed by a Certified Mechanical Acceptance Test Employer. The CMATT shall disclose on the Certificate of Acceptance a valid CMATT certification identification number issued by an approved Acceptance Test Technician Certification Provider. The CMATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

**TABLE 160.3-A
RETURN DUCT SIZING FOR SINGLE RETURN DUCT SYSTEMS**

Return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 160.2(b)1Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

SYSTEM NOMINAL COOLING CAPACITY (TON)*	RETURN DUCT MINIMUM NOMINAL DIAMETER (INCH)	MINIMUM TOTAL RETURN FILTER GRILLE NOMINAL AREA (INCH ²)
1.5	16	500
2.0	18	600
2.5	20	800

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton.

**TABLE 160.3-B
RETURN DUCT SIZING FOR MULTIPLE RETURN DUCT SYSTEMS**

Each return duct length shall not exceed 30 feet and shall contain no more than 180 degrees of bend. If the total bending exceeds 90 degrees, one bend shall be a metal elbow.

Return grille devices shall be labeled in accordance with the requirements in Section 160.2(b)1Biv to disclose the grille's design airflow rate and a maximum allowable clean-filter pressure drop of 25 Pa (0.1 inches water) for the air filter when tested using ASHRAE Standard 52.2, or as rated in accordance with AHRI Standard 680 for the design airflow rate for the return grille.

SYSTEM NOMINAL COOLING CAPACITY (TON)*	RETURN DUCT 1 MINIMUM NOMINAL DIAMETER (INCH)	RETURN DUCT 2 MINIMUM NOMINAL DIAMETER (INCH)	MINIMUM TOTAL RETURN FILTER GRILLE NOMINAL AREA (INCH ²)
1.5	12	10	500
2.0	14	12	600
2.5	14	14	800
3.0	16	14	900
3.5	16	16	1000
4.0	18	18	1200
5.0	20	20	1500

*Not applicable to systems with nominal cooling capacity greater than 2.5 tons or less than 1.5 ton.

**TABLE 160.3-C
DDC APPLICATIONS AND QUALIFICATIONS**

BUILDING STATUS	APPLICATIONS	QUALIFICATIONS
Newly Constructed Buildings	Air handling system and all zones served by the system	Individual systems supplying more than three zones and with design heating or cooling capacity of 300 kBtu/h and larger
Newly Constructed Buildings	Chilled water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design cooling capacity of 300 kBtu/h (87.9 kW) and larger
Newly Constructed Buildings	Hot water plant and all coils and terminal units served by the system	Individual plants supplying more than three zones and with design heating capacity of 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	Zone terminal unit such as VAV box	Where existing zones served by the same air handling, chilled water or hot water systems that have DDC
Additions or Alterations	Air handling system or fan coil	Where existing air handling system(s) and fan coil(s) served by the same chilled or hot water plant have DDC
Additions or Alterations	New air handling system and all new zones served by the system	Individual systems with design heating or cooling capacity of 300 kBtu/h and larger and supplying more than three zones and more than 75 percent of zones are new
Additions or Alterations	New or upgraded chilled water plant	Where all chillers are new and plant design cooling capacity is 300 kBtu/h (87.9 kW) and larger
Additions or Alterations	New or upgraded hot water plant	Where all boilers are new and plant design heating capacity is 300 kBtu/h (87.9 kW) and larger

**TABLE 160.3-D
PIPE INSULATION THICKNESS**

FLUID OPERATING TEMPERATURE RANGE (°F)	INSULATION CONDUCTIVITY			NOMINAL PIPE DIAMETER (in inches)				
	Conductivity (in Btu-in/h-ft ² -°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space heating (Steam, Steam Condensate, Refrigerant, Space Heating)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
Above 350	0.32–0.34	250	Inches	4.5	5.0	5.0	5.0	5.0
			R-value	R37	R41	R37	R27	R23
251–350	0.29–0.32	200	Inches	3.0	4.0	4.5	4.5	4.5
			R-value	R24	R34	R35	R26	R22
201–250	0.27–0.30	150	Inches	2.5	2.5	2.5	3.0	3.0
			R-value	R21	R20	R17.5	R17	R14.5
141–200	0.25–0.29	125	Inches	1.5	1.5	2.0	2.0	2.0
			R-value	R11.5	R11	R14	R11	R10
105–140	0.22–0.28	100	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R7.7	R12.5	R11	R9	R8
FLUID OPERATING TEMPERATURE RANGE (°F)	INSULATION CONDUCTIVITY			NOMINAL PIPE DIAMETER (in inches)				
	Conductivity (in Btu-in/h-ft ² -°F)	Mean Rating Temperature (°F)		< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger
Space cooling systems (chilled water, refrigerant and brine)				Minimum Pipe Insulation Required (Thickness in inches or R-value)				
40–60	0.21–0.27	75	Inches	0.75	0.75	1.0	1.0	1.0
			R-value	R6	R5	R7	R6	R5
Below 40	0.20–0.26	50	Inches	1.0	1.5	1.5	1.5	1.5
			R-value	R8.5	R14	R12	R10	R9

1. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 160.4
MANDATORY REQUIREMENTS
FOR WATER-HEATING SYSTEMS**

(a) Systems using gas or propane water heaters to serve individual dwelling units shall include the following components:

1. A dedicated 125 volt, 20 amp electrical receptacle that is connected to the electric panel with a 120/240 volt 3 conductor, 10 AWG copper branch circuit, within 3 feet from the water heater and accessible to the water heater with no obstructions. In addition, all of the following:
 - A. Both ends of the unused conductor shall be labeled with the word “spare” and be electrically isolated; and
 - B. A reserved single pole circuit breaker space in the electrical panel adjacent to the circuit breaker for the branch circuit in A above and labeled with the words “Future 240V Use”; and
2. A Category III or IV vent, or a Type B vent with straight pipe between the outside termination and the space where the water heater is installed; and
3. A condensate drain that is no more than 2 inches higher than the base of the installed water heater, and allows natural draining without pump assistance; and
4. A gas supply line with a capacity of at least 200,000 Btu/hr.

(b) Water-heating recirculation loops serving multiple dwelling units shall meet the requirements of Section 110.3(c)4.

(c) Solar water-heating systems and collectors shall be certified and rated by the Solar Rating and Certification Corporation (SRCC), the International Association of Plumbing and Mechanical Officials, Research and Testing (IAPMO R&T), or a listing agency that is approved by the Executive Director.

(d) Instantaneous water heaters with an input rating greater than 6.8 kBTU/hr (2kW) shall meet the requirements of Section 110.3(c)6.

(e) Commercial boilers

1. Combustion air positive shut-off shall be provided on all newly installed boilers as follows:
 - A. All boilers with an input capacity of 2.5 MMBtu/h (2,500,000 Btu/h) and above, in which the boiler is

designed to operate with a nonpositive vent static pressure.

- B. All boilers where one stack serves two or more boilers with a total combined input capacity per stack of 2.5 MMBtu/h (2,500,000 Btu/h).
2. Boiler combustion air fans with motors 10 horsepower or larger shall meet one of the following for newly installed boilers:
 - A. The fan motor shall be driven by a variable speed drive, or
 - B. The fan motor shall include controls that limit the fan motor demand to no more than 30 percent of the total design wattage at 50 percent of design air volume.
3. Newly installed boilers with an input capacity 5 MMBtu/h (5,000,000 Btu/h) and greater shall maintain excess (stack-gas) oxygen concentrations at less than or equal to 5.0 percent by volume on a dry basis over firing rates of 20 percent to 100 percent. Combustion air volume shall be controlled with respect to firing rate or flue gas oxygen concentration. Use of a common gas and combustion air control linkage or jack shaft is prohibited.

Exception to Section 160.4(e)3: Boilers with steady state full-load thermal combustion efficiency 90 percent or higher.

(f) Insulation for piping and tanks

1. Piping for multifamily domestic hot water systems shall be insulated to meet the requirements of Table 160.4-A.

Exception 1 to Section 160.4(f)1: Factory-installed piping within space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 2 to Section 160.4(f)1: Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to ensure that no contact is made with the metal framing. Insulation shall abut securely against all framing members.

Exception 3 to Section 160.4(f)1: Piping installed in interior or exterior walls shall not be required to have pipe insulation if all of the requirements are met for

**TABLE 160.4-A
PIPE INSULATION THICKNESS—MULTIFAMILY DOMESTIC HOT WATER**

FLUID OPERATING TEMPERATURE RANGE (°F)	INSULATION CONDUCTIVITY		NOMINAL PIPE DIAMETER (in inches)					
	Conductivity (in Btu-in/h-ft ² -°F)	Mean Rating Temperature (°F)	< 1	1 to <1.5	1.5 to < 4	4 to < 8	8 and larger	
Multifamily Domestic Hot Water Systems			Minimum Pipe Insulation Required (Thickness in inches or R-value)					
105–140 ¹	0.22–0.28	100	Inches	1.0	1.5	2.0	2.0	2.0
			R-value	R7.7	R12.5	R16	R12.5	R11

1. Multifamily and hotel/motel domestic hot water systems with water temperature above 140°F shall use the row in Table 120.3-A for the applicable water temperature.

compliance with quality insulation installation (QII) as specified in Reference Residential Appendix RA3.5.

Exception 4 to Section 160.4(f)1: Piping surrounded with a minimum of 1 inch of wall insulation, 2 inches of crawl space insulation or 4 inches of attic insulation shall not be required to have pipe insulation.

2. **Insulation protection.** Pipe insulation shall be protected from damage due to sunlight, moisture, equipment maintenance and wind. Protection shall, at minimum, include the following:

A. Pipe insulation exposed to weather shall be protected by a cover suitable for outdoor service. The cover shall be water retardant and provide shielding from solar radiation that can cause degradation of the material. Adhesive tape shall not be used to provide this protection.

B. Pipe insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include, or be protected by, a Class I or Class II vapor retarder. All penetrations and joints shall be sealed.

C. Pipe insulation buried below grade must be installed in a waterproof and noncrushable casing or sleeve.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 160.5
MANDATORY LIGHTING REQUIREMENTS
FOR INDOOR AND OUTDOOR SPACES**

The design and installation of all lighting systems and equipment in multifamily buildings within the scope of Section 100.0(a) shall comply with the applicable provisions of Section 160.5. All functional areas except dwelling units and common living areas shall comply with the applicable requirements of Sections 160.5(b) through 160.5(e).

(a) **Dwelling unit lighting.** The design and installation of all lighting systems and equipment in multifamily dwelling units shall comply with Section 160.5(a). Multifamily dwelling units include dormitory and senior housing dwelling accommodations. Outdoor lighting attached to multifamily buildings and controlled from the inside of a dwelling unit shall comply with the lighting requirements of Section 160.5(a).

1. Luminaire requirements.

A. Luminaire efficacy. All installed luminaires shall meet the requirements in Table 160.5-A.

Exception 1 to Section 160.5(a)1A: Integrated device lighting: Lighting integral to exhaust fans, kitchen range hoods, bath vanity mirrors and garage door openers, and nonremovable lighting attached to ceiling fans.

Exception 2 to Section 160.5(a)1A: Navigation lighting: Night lights, step lights, path lights less than 5 watts.

Exception 3 to Section 160.5(a)1A: Cabinet lighting: Lighting internal to drawers, cabinetry and linen closets with an efficacy of 45 lumens per watt or greater.

B. Screw based luminaires. Screw based luminaires shall contain lamps that comply with Reference Joint Appendix JA8.

C. Recessed downlight luminaires. In addition to complying with Section 160.5(a)1A, luminaires recessed into ceilings shall meet all of the following requirements:

- i. Shall not contain screw base lamp sockets; and
- ii. Have a label that certifies the luminaire is airtight with air leakage less than 2.0 cfm at 75 Pascals when tested in accordance with ASTM E283. An exhaust fan housing with integral light shall not be required to be certified airtight; and

iii. Be sealed with a gasket or caulk between the luminaire housing and ceiling, and have all air leak paths between conditioned and unconditioned spaces sealed with a gasket or caulk, or be installed per manufacturer’s instructions to maintain airtightness between the luminaire housing and ceiling; and

iv. Meet the clearance and installation requirements of *California Electrical Code* Section 410.116 for recessed luminaires.

Exception to Section 160.5(a)1Cii and Iii: Recessed luminaires marked for use in fire-rated installations, and recessed luminaires installed in noninsulated ceilings.

D. Light sources in enclosed or recessed luminaires. Lamps and other separable light sources that are not compliant with the JA8 elevated temperature requirements, including marking requirements, shall not be installed in enclosed or recessed luminaires.

E. Blank electrical boxes. The number of electrical boxes that are more than 5 feet above the finished floor and do not contain a luminaire or other device shall be no greater than the number of bedrooms. These electrical boxes must be served by a dimmer, vacancy sensor control, low voltage wiring or fan speed control.

2. Indoor lighting controls.

A. Lighting shall have readily accessible wall-mounted controls that allow the lighting to be manually turned ON and OFF.

Exception to Section 160.5(a)2A: Ceiling fans may provide control of integrated lighting via a remote control.

B. No controls shall bypass a dimmer, occupant sensor or vacancy sensor function where that dimmer or sensor has been installed to comply with Section 160.5(a)2.

C. Lighting controls shall comply with the applicable requirements of Section 110.9.

D. An energy management control system (EMCS) or a multiscene programmable controller may be used to comply with dimming, occupancy and lighting control requirements in Section 160.5(a)2 if it provides the functionality of the specified controls in accordance with Section 110.9 and the physical controls specified in Section 160.5(a)2A.

E. Automatic off controls.

- i. In bathrooms, garages, laundry rooms, utility rooms and walk-in closets, at least one installed luminaire shall be controlled by an occupancy or vacancy sensor providing automatic-off functionality.
- ii. For lighting internal to drawers and cabinetry with opaque fronts or doors, controls that turn the lighting off when the drawer or door is closed shall be provided.

F. Dimming controls. Lighting in habitable spaces, including but not limited to living rooms, dining rooms, kitchens and bedrooms, shall have readily accessible wall-mounted dimming controls that allow the lighting to be manually adjusted up and down. Forward phase cut dimmers controlling LED light sources shall comply with NEMA SSL 7A.

Exception 1 to Section 160.5(a)2F: Ceiling fans may provide control of integrated lighting via a remote control.

Exception 2 to Section 160.5(a)2F: Luminaires controlled by an occupancy or vacancy sensor providing automatic-off functionality.

Exception 3 to Section 160.5(a)2F: Navigation lighting such as night lights, step lights and path lights less than 5 watts; and lighting internal to

drawers and cabinetry with opaque fronts or doors, or with automatic off controls.

G. Independent controls. Integrated lighting of exhaust fans shall be controlled independently from the fans. The following shall be controlled separately from ceiling-installed lighting such that one can be turned on without turning on the other:

- i. Undercabinet lighting
- ii. Undershelf lighting
- iii. Interior lighting of display cabinets
- iv. Switched outlets

3. **Outdoor lighting controls.** In addition to meeting the requirements of Section 160.5(a)1, luminaires providing residential outdoor lighting shall meet the following requirements, as applicable:

A. Outdoor lighting attached to a building and separately controlled from the inside of a dwelling unit shall meet the requirement in Item i and the requirements in either Item ii or Item iii:

- i. Controlled by a manual ON and OFF control switch that permits the automatic actions of Item ii or iii below; and
- ii. Controlled by a photocell and either a motion sensor or an automatic time switch control; or
- iii. Controlled by an astronomical time clock control.

Controls that override to ON shall not be allowed unless the override automatically returns the automatic control to its normal operation within 6 hours. An energy management control system that provides the specified lighting control functionality and complies with all requirements applicable to the specified controls may be used to meet these requirements.

**TABLE 160.5-A
CLASSIFICATION OF DWELLING UNIT HIGH LUMINOUS EFFICACY LIGHT SOURCES**

Light sources in this column other than those installed in ceiling recessed downlight luminaires are classified as high luminous efficacy and are not required to comply with Reference Joint Appendix JA8.	Light sources in this column are required to comply with Reference Joint Appendix JA8 and shall be certified and marked as required by JA8.
<ul style="list-style-type: none"> 1. LED light sources installed outdoors. 2. Inseparable solid state lighting (SSL) luminaires containing colored light sources that are installed to provide decorative lighting. 3. Pin-based linear fluorescent or compact fluorescent light sources using electronic ballasts. 4. High intensity discharge (HID) light sources including pulse start metal halide and high pressure sodium light sources. 5. Luminaires with hardwired high frequency generator and induction lamp. 6. Ceiling fan light kits subject to federal appliance regulations. 	<ul style="list-style-type: none"> 7. All light sources installed in ceiling recessed downlight luminaires. Note that ceiling recessed downlight luminaires shall not have screw base sockets regardless of lamp type as specified in Section 150.0(k)1C. 8. Any light source not otherwise listed in this table.

(b) **Common use area lighting.** Lighting systems and equipment in multifamily common use areas shall comply with the applicable provisions of Sections 160.5(b)1 through 160.5(b)4.

Exception to Section 160.5(b): Lighting systems in common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions may instead comply with Section 160.5(a).

NOTE: The requirements of Section 160.5(b) apply to newly constructed buildings. Sections 180.1 and 180.2 specify which requirements of Sections 160.5(b)1 through 160.5(e) also apply to additions and alterations to existing buildings.

1. **Luminaire classification and power.** Luminaires shall be classified and their wattage determined as follows:

A. Luminaire wattage shall be labeled as follows:

- i. The maximum rated wattage or relamping rated wattage of a luminaire shall be listed on a permanent, preprinted, factory-installed label, as specified by UL 1574, 1598, 2108 or 8750, as applicable; and
- ii. The factory-installed maximum rated wattage or relamping rated wattage label shall not consist of peel-off or peel-down layers or other methods that allow the rated wattage to be changed after the luminaire has been shipped from the manufacturer.

Exception to Section 160.3(b)1Aii: Luminaires with a single lamp and an integrated ballast or transformer may use a peel-down label provided that they are layered such that the rated wattage reduces as successive layers are removed.

- a. Low-voltage luminaires (except low voltage track systems), ≤ 24 volts, with a maximum relamping rated wattage of 50 watts.
- b. Compact fluorescent luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 42 watts.
- c. High intensity discharge luminaires, having an integral electronic ballast, with a maximum relamping rated wattage of 150 watts.

B. For luminaires with line voltage lamps not served by drivers, ballasts or transformers, the wattage of such luminaires shall be determined as the maximum rated wattage as labeled in accordance with Section 160.5(b)1A.

C. For luminaires with permanently installed or remotely installed ballasts, the wattage of such luminaires shall be the operating input wattage of the rated lamp/ballast combination published in the ballast manufacturer's catalogs based on independent testing lab reports as specified by UL 1598.

D. For inseparable SSL luminaires and SSL luminaires with remotely mounted drivers, the maximum rated wattage shall be the maximum rated input wattage

of the SSL luminaire as specified in Section 160.5(b)1A when tested in accordance with UL 1598, 2108 or 8750, or IES LM-79.

E. For LED tape lighting and LED linear lighting with LED tape lighting components, the maximum rated wattage shall be the sum of the installed length of the tape lighting times its rated linear power density in watts per linear foot, or the maximum rated input wattage of the driver or power supply providing power to the lighting system, with tape lighting tested in accordance with UL 2108 or 8750, or IES LM-79.

F. For modular lighting systems that allow the addition or relocation of luminaires without altering the wiring of the system, wattage shall be determined as follows:

i. The wattage shall be the greater of:

- a. 30 watts per linear foot of track or plug-in busway; or
- b. the rated wattage of all of the luminaires included in the system, where the luminaire wattage is determined as specified in Section 160.5(b)1A; or

ii. For line-voltage lighting track and plug-in busway served by a track lighting integral current limiter or a dedicated track lighting supplementary overcurrent protection panel, the wattage shall be determined as follows:

- a. The volt-ampere rating of current limiter as specified by UL 1077; or
- b. The sum of the ampere (A) rating of all of the current protection devices times the branch circuit voltages for track lighting supplementary overcurrent protection panel.

iii. For other modular lighting systems with power supplied by a driver, power supply or transformer, including but not limited to low-voltage lighting systems, the wattage of the system shall be the maximum rated input wattage of the driver, power supply or transformer published in the manufacturer's catalogs, as specified by UL 2108 or 8750.

Exception to Section 160.5(b)1F: For power-over-Ethernet lighting systems, power provided to installed nonlighting devices may be subtracted from the total power rating of the power-over-Ethernet system.

G. For all other lighting equipment not addressed by Sections 160.5(b)1B through F, the wattage of the lighting equipment shall be the maximum rated wattage of the lighting equipment, or operating input wattage of the system, labeled in accordance with Section 160.5(b)1A, or published in manufacturer's catalogs, based on independent testing lab reports as specified by UL 1574, 1598, 2108 or 8750, or IES LM-79.

2. **Lighting controls.** All lighting controls and equipment shall comply with the applicable requirements in Sections 110.9, 160.5(b) and 160.5(c), and shall be installed in accordance with any applicable manufacturer instructions.
3. **Energy management control system (EMCS).** An EMCS may be installed to comply with the requirements of one or more lighting controls if it meets the following minimum requirements:
 - A. Provides all applicable functionality for each specific lighting control or system for which it is installed in accordance with Sections 110.9, 160.5(b) and 160.5(c); and
 - B. Complies with all applicable lighting control installation requirements in accordance with Section 160.5(e) for each specific lighting control or system for which it is installed; and
 - C. Complies with all applicable application requirements for each specific lighting control or system for which it is installed, in accordance with Part 6.
4. **Mandatory indoor lighting controls.** Multifamily common use areas shall comply with the applicable requirements of Sections 160.5(b)4A through 160.5(b)4F, in addition to the applicable requirements of Section 110.9.
 - A. **Manual area controls.** Each area enclosed by ceiling-height partitions shall provide lighting controls that allow the lighting in that area to be manually turned on and off. The manual control shall:
 - i. Be readily accessible; and

Exception to Section 160.5(b)4Ai: Restrooms having two or more stalls, parking areas, stairwells, corridors and areas of the building intended for access or use by the public may use a manual control not accessible to unauthorized personnel.
 - ii. Be located in the same enclosed area with the lighting it controls; and

Exception to Section 160.5(b)4Aii: For areas where placement of a manual area control poses a health and safety hazard, the manual area control may instead be located so that a person using the control can see the lights or area controlled by that control, or a visual signal or display showing the current state of the controlled lighting.
 - iii. Provide separate control of general, floor display, wall display, window display, case display, ornamental and special effects lighting, such that each type of lighting can be turned on or off without turning on or off other types of lighting. Scene controllers may comply with this requirement provided that at least one scene turns on general lighting only, and the control provides a means to manually turn off all lighting.

Exception to Section 160.5(b)4A: Up to 0.1 watts per square foot of indoor lighting may be

continuously illuminated to allow for means of egress illumination consistent with *California Building Code* Section 1008. Egress lighting complying with this wattage limitation is not required to comply with manual area control requirements if:

- i. The area is designated for means of egress on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1; and
 - ii. The controls for the egress lighting are not accessible to unauthorized personnel.
- B. Multi-level lighting controls.** The general lighting of any enclosed area 100 square feet or larger with a connected lighting load that exceeds 0.5 watts per square foot shall provide multi-level lighting controls that allow the level of lighting to be adjusted up and down. The multi-level controls shall:
- i. Provide the number of control steps specified in Table 160.5-B; and
 - ii. Meet the uniformity requirements specified in Table 160.5-B.
- Exception 1 to Section 160.5(b)4B:** An area enclosed by ceiling height partitions that has only one luminaire with no more than two lamps or has only one inseparable SSL luminaire.
- Exception 2 to Section 160.5(b)4B:** Restrooms.
- C. Automatic shut-OFF controls.** All installed indoor lighting shall be equipped with controls able to automatically reduce lighting power when the space is typically unoccupied.
- i. In addition to lighting controls installed to comply with Sections 160.5(b)4A and B, all installed indoor lighting shall be equipped with controls that meet the following requirements:
 - a. Shall be controlled with an occupant sensing control, automatic time-switch control or other control capable of automatically shutting OFF all of the lighting when the space is typically unoccupied; and
 - b. Separate controls for the lighting on each floor, other than lighting in stairwells; and
 - c. Separate controls for a space enclosed by ceiling height partitions not exceeding 5,000 square feet.

Exception 1 to Section 160.5(b)4Ci: Where the lighting is serving an area that is in continuous use, 24 hours per day/365 days per year.

Exception 2 to Section 160.5(b)4Ci: Lighting complying with Section 160.5(b)4Cv or vii.

Exception 3 to Section 160.5(b)4Ci: Up to 0.1 watts per square foot of lighting in any area within a building may be continuously illuminated, provided that the area is designated for means of egress on the plans and

specifications submitted to the enforcement agency under Section 10-103(a)2 of Part 1. Lighting providing means of egress illumination, as the term is used in the *California Building Code*, shall be configured to provide no less than the amount of light required by *California Building Code* Section 1008 while in the partial-off mode.

Exception 4 to Section 160.5(b)4Ci: Electrical equipment rooms subject to Article 110.26(D) of the *California Electrical Code*.

Exception 5 to Section 160.5(b)4Ci: Illumination provided by lighting equipment that is designated for emergency lighting, connected to an emergency power source or battery supply, and intended to function in emergency mode only when normal power is absent.

- ii. Countdown timer switches may be used to comply with the automatic shut-OFF control requirements in Section 160.5(b)4Ci only in closets less than 70 square feet. The maximum timer setting shall be 10 minutes for closets.
- iii. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 160.5(b)4Ci, it shall incorporate a manual override lighting control that:
 - a. Complies with Section 160.5(b)4A; and
 - b. Allows the lighting to remain ON for no more than 2 hours when an override is initiated.
- iv. If an automatic time-switch control, other than an occupant sensing control, is installed to comply with Section 160.5(b)4Ci, it shall incorporate an automatic holiday “shut-OFF” feature that turns OFF all loads for at least 24 hours, and then resumes the normally scheduled operation.
- v. Occupant sensing controls are required for specified offices, multipurpose rooms, conference rooms and restrooms. In offices 250 square feet or smaller, multipurpose rooms of less than 1,000 square feet, conference rooms of any size and restrooms of any size, lighting shall be controlled with occupant sensing controls to automatically shut OFF all of the lighting in 20 minutes or less after the control zone is unoccupied.

In areas required by Section 160.5(b)4B to have multi-level lighting controls, the occupant sensing controls shall function either as:

- a. a partial-ON occupant sensing control capable of automatically activating between 50 and 70 percent of controlled lighting power, or
- b. a vacancy sensing control, where all lighting responds to a manual ON input only.

In areas not required by Section 160.5(b)4B to have multi-level lighting controls, the occupant sensing controls shall function either as:

- a. an occupant sensing control; or
- b. a partial-ON occupant sensing control, or
- c. a vacancy sensing control, where all lighting responds to a manual ON input only.

In addition, controls shall be provided that allow the lights to be manually shut OFF in accordance with Section 160.5(b)4A regardless of the sensor status.

- vi. Full or partial OFF occupant sensing controls are required for corridors and stairwells, and offices greater than 250 square feet. Lighting installed in the following areas shall meet the requirements below in addition to complying with Section 160.5(b)4Ci.
 - a. In corridors and stairwells, lighting shall be controlled by occupant sensing controls that separately reduce the lighting power in each space by at least 50 percent when the space is unoccupied. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.
 - b. In office spaces greater than 250 square feet, general lighting shall be controlled by occupancy sensing controls that meet all of the following:
 - I. The occupancy sensing controls shall be configured so that lighting shall be controlled separately in control zones not greater than 600 square feet. For luminaires with an embedded occupancy sensor that are capable of reducing power independently from other luminaires, each luminaire can be considered its own control zone; and
 - II. In 20 minutes or less after the control zone is unoccupied, the occupancy sensing controls shall uniformly reduce lighting power in the control zone by at least 80 percent of full power. Control functions that switch control zone lights completely off when the zone is vacant meet this requirement; and
 - III. In 20 minutes or less after the entire office space is unoccupied, the occupancy sensing controls shall automatically turn off lighting in all control zones in the space; and
 - IV. In each control zone, lighting shall be allowed to automatically turn on to any

level up to full power upon occupancy within the control zone. When occupancy is detected in any control zone in the space, the lighting in other control zones that are unoccupied shall operate at no more than 20 percent of full power.

Exception to Section 160.5(b)4Cvi: Under-shelf or furniture-mounted task lighting controlled by a local switch and either a time switch or an occupancy sensor.

- vii. **Partial OFF occupant sensing controls required for parking garages, parking areas, and loading and unloading areas.** Lighting installed in the following areas shall meet the requirements below instead of complying with Section 160.5(b)4Ci.

- a. (reserved)
- b. In parking garages, parking areas, and loading and unloading areas, general lighting shall be controlled by occupant sensing controls having at least one control step between 20 percent and 50 percent of design lighting power. No more than 500 watts of rated lighting power shall be controlled together as a single zone. A reasonably uniform level of illuminance shall be achieved in accordance with the applicable requirements in Table 160.5-B. The occupant sensing controls shall be capable of automatically turning the lighting fully ON only in the separately controlled space, and shall be automatically activated from all designed paths of egress.

Interior areas of parking garages are classified as indoor lighting for compliance with Section 160.5(b)4Cviiib. Parking areas on the roof of a parking structure are classified as outdoor hardscape and shall comply with the applicable provisions in Section 160.5(c).

Exception to Section 160.5(b)4Cviiib: Metal halide luminaires with a lamp plus ballast mean system efficacy of greater than 75 lumens per watt, used for general lighting in parking garages, parking areas, and loading and unloading areas, shall be controlled by occupant sensing controls having at least one control step between 20 percent and 60 percent of design lighting power.

- D. **Automatic daylighting controls.** The general lighting in skylit daylight zones, primary sidelit daylight zones and secondary sidelit daylight zones, as well as the general lighting in the combined primary and secondary sidelit daylight zones in parking garages, shall be provided with controls that automatically adjust the power of the installed general lighting up and down to keep the total light level stable as the amount of incoming daylight changes. For skylights located in an atrium, the skylit daylight zones shall

apply to the floor area directly under the atrium and the top floor area directly adjacent to the atrium.

- i. All skylit daylight zones, primary sidelit daylight zones, secondary sidelit daylight zones and the combined primary and secondary sidelit daylight zones in parking garages shall be shown on the plans.

NOTE: Parking areas on the roof of a parking structure are outdoor hardscape, not skylit daylight areas.

- ii. The automatic daylighting controls shall provide separate control for general lighting in each type of daylight zone. General lighting in overlapping skylit daylight zone and sidelit daylight zone shall be controlled as part of the skylit daylight zone. General lighting in overlapping primary and secondary sidelit daylight zone shall be controlled as part of the primary sidelit daylight zone. Linear LED luminaires and other solid state lighting (SSL) light sources in linear form may be treated as linear lamps in increments of 4 feet segment or smaller, and each segment is separately controlled based on the type of the daylight zone where the segment is primarily located.

- iii. The automatic daylighting controls shall:

- a. For spaces required to install multilevel controls under Section 160.5(b)4B, adjust lighting via continuous dimming or the number of control steps provided by the multilevel controls;
- b. For each space, ensure the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available;
- c. For areas other than parking garages, ensure that when the daylight illuminance is greater than 150 percent of the illuminance provided by the controlled lighting system when no daylight is available, the controlled lighting power in that daylight zone shall be reduced by a minimum of 90 percent; and
- d. For parking garages, ensure that when daylight illuminance levels measured at the farthest edge of the secondary sidelit zone away from the glazing or opening are greater than 150 percent of the illuminance provided by the controlled lighting when no daylight is available, the controlled lighting power in the combined primary and secondary sidelit daylight zones shall be reduced by 100 percent.

- iv. Photosensors shall be located so that they are not readily accessible to unauthorized personnel.
- v. The location where calibration adjustments are made to the automatic daylighting controls shall be readily accessible to authorized personnel but may be inside a locked case or under a cover that requires a tool for access.

Exception 1 to Section 160.5(b)4D: Areas under skylights where it is documented that existing

adjacent structures or natural objects block direct sunlight for more than 1,500 daytime hours per year between 8 a.m. and 4 p.m.

Exception 2 to Section 160.5(b)4D: Areas adjacent to vertical glazing below an overhang, where the overhang covers the entire width of the vertical glazing, no vertical glazing is above the overhang, and the ratio of the overhang projection to the overhang rise is greater than 1.5 for south, east and west orientations or greater than 1 for north orientations.

Exception 3 to Section 160.5(b)4D: Rooms where the combined total installed wattage of the general lighting in the skylit and primary sidelit zones is less than 120 watts are not required to have daylighting controls for those zones. Rooms where the total installed wattage of the general lighting in the secondary sidelit zones is less than 120 watts are not required to have daylighting controls for that zone.

Exception 4 to Section 160.5(b)4D: Parking garage areas where the total installed wattage of the general lighting in the primary and the secondary sidelit daylight zones is less than 60 watts do

not require automatic daylighting controls in the daylight zones.

Exception 5 to Section 160.5(b)4D: Rooms that have a total glazing area of less than 24 square feet, or parking garage areas with a combined total of less than 36 square feet of glazing or opening.

Exception 6 to Section 160.5(b)4D: For parking garages, luminaires located in the daylight adaptation zone and luminaires for only dedicated ramps. Daylight adaptation zone and dedicated ramps are defined in Section 100.1.

Exception 7 to Section 160.5(b)4D: Luminaires in sidelit daylight zones in retail merchandise sales and wholesale showroom areas.

- E. **Demand responsive controls.** See Section 110.12 for requirements for demand responsive lighting controls.
- F. **Control interactions.** Each lighting control installed to comply with Section 160.5(b)4 shall permit or incorporate the functions of the other lighting controls required by this section.
 - i. For general lighting, the manual area control shall permit the level or amount of light provided

**TABLE 160.5-B
MULTI-LEVEL LIGHTING CONTROLS AND UNIFORMITY REQUIREMENTS**

LUMINAIRE TYPE	MINIMUM REQUIRED CONTROL STEPS (PERCENT OF FULL RATED POWER ¹)	UNIFORM LEVEL OF ILLUMINANCE SHALL BE ACHIEVED BY:
LED luminaires and LED light source systems	Continuous dimming 10–100 percent	Continuous dimming 10–100 percent
Line-voltage sockets except GU-24	Continuous dimming 10–100 percent	Continuous dimming 10–100 percent
Low-voltage incandescent systems	Continuous dimming 10–100 percent	Continuous dimming 10–100 percent
Fluorescent luminaires	Continuous dimming 20–100 percent	Continuous dimming 20–100 percent
GU-24 sockets rated for fluorescent ≤ 20 watts; Pin-based compact fluorescent ≤ 20 watts ² Linear fluorescent and U-bent fluorescent ≤ 13 watts	Minimum one step between 30 and 70 percent	Continuous dimming; or Stepped dimming; or Switching alternate lamps in a luminaire, or Separately switching circuits in multi-circuit track with a minimum of two circuits.
Track lighting	Minimum one step between 30 and 70 percent	Continuous dimming; or Stepped dimming; or Switching alternate lamps in a luminaire, or Separately switching circuits in multi-circuit track with a minimum of two circuits.
Linear fluorescent and U-bent fluorescent > 13 watts	Minimum one step in each range: 20–40 percent 50–70 percent 75–85 percent 100 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 4 lamps per luminaire illuminating the same area and in the same manner
Other light sources, including HID and induction	Minimum one step between 50 and 70 percent	Stepped dimming; or Continuous dimming; or Switching alternate lamps in each luminaire, having a minimum of 2 lamps per luminaire, illuminating the same area and in the same manner.

1. Full rated input power of driver, ballast and lamp, corresponding to maximum ballast factor.
2. Includes only pin-based lamps: twin tube, multiple twin tube and spiral lamps.

while the lighting is on to be set or adjusted by the controls specified in Sections 160.5(b)4B, C, D and E.

- ii. The manual area control shall permit the shutoff control to turn the lighting down or off.
- iii. The multi-level lighting control shall permit the automatic daylighting control to adjust the electric lighting level in response to changes in the amount of daylight in the daylit zone.
- iv. The multi-level lighting control shall permit the demand responsive control to adjust the lighting during a demand response event and to return it to the level set by the multilevel control after the event.
- v. The shutoff control shall permit the manual area control to turn the lighting on. If the on request occurs while an automatic time switch control would turn the lighting off, then the on request shall be treated as an override request consistent with Section 160.5(c)4Ciii.
- vi. The automatic daylighting control shall permit the multi-level lighting control to adjust the level of lighting.
- vii. For lighting controlled by multi-level lighting controls and by occupant sensing controls that provide an automatic-on function, the controls shall provide a partial-on function that is capable of automatically activating between 50 and 70 percent of controlled lighting power.
- viii. Reserved.
- ix. For space-conditioning system zones serving only spaces that are required to have occupancy sensing controls as specified in Sections 160.5(b)4Cv, vi and vii, and where Table 120.1-A allows the ventilation air to be reduced to zero when the space is in occupied-standby mode, the space-conditioning system shall be controlled by occupancy sensing controls as specified in Section 120.2(e)3.

(c) **Outdoor lighting and control equipment.** Multifamily buildings shall comply with the applicable requirements of Sections 160.5(c)1 through 160.5(c)2.

1. **Luminaire shielding requirements.** All outdoor luminaires of 6,200 initial luminaire lumens or greater shall comply with backlight, uplight, and glare (BUG) (in accordance with ANSI/IES TM-15-20, Annex A) requirements in accordance with Title 24, Part 11, Section 5.106.8.

Exception 1 to Section 160.5(c)1: Signs.

Exception 2 to Section 160.5(c)1: Lighting for building facades, public monuments, public art, statues and vertical surfaces of bridges.

Exception 3 to Section 160.5(c)1: Lighting not permitted by a health or life safety statute, ordinance or regulation to be a cutoff luminaire.

Exception 4 to Section 160.5(c)1: Temporary outdoor lighting.

Exception 5 to Section 160.5(c)1: Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:

- A. Where the existing luminaire does not meet the luminaire BUG requirements in Section 160.5(c)1; and
- B. Spacing between existing poles is greater than six times the mounting height of the existing luminaires; and
- C. Where no additional poles are being added to the site; and
- D. Where new wiring to the luminaires is not being installed; and
- E. Provided that the connected lighting power wattage is not increased.

Exception 6 to Section 160.5(c)1: Luminaires that illuminate the public right of way, including publicly maintained or utility-maintained roadways, sidewalks and bikeways.

Exception 7 to Section 160.5(c)1: Outdoor lighting attached to a multifamily building and separately controlled from the inside of a dwelling unit.

2. **Controls for outdoor lighting.** Outdoor lighting shall be independently controlled from other electrical loads, and the controls for outdoor lighting shall meet the following functional requirements:

Exception 1 to Section 160.5(c)2: Outdoor lighting not permitted by a health or life safety statute, ordinance or regulation to be turned OFF or reduced.

Exception 2 to Section 160.5(c)2: Lighting in tunnels required to be illuminated 24 hours per day and 365 days per year.

A. Daylight availability. All installed outdoor lighting shall be controlled by a photo control, astronomical time-switch control or other control capable of automatically shutting OFF the outdoor lighting when daylight is available.

B. Automatic scheduling controls.

- i. Automatic scheduling controls shall be installed for all outdoor lighting. Automatic scheduling controls may be installed in combination with motion sensing controls or other outdoor lighting controls.
- ii. Automatic scheduling controls shall be capable of reducing the outdoor lighting power by at least 50 percent and no more than 90 percent, and separately capable of turning the lighting OFF, during scheduled unoccupied periods.
- iii. Automatic scheduling controls shall allow scheduling of a minimum of two nighttime periods with independent lighting levels, and may include an override function that turns lighting ON during its

scheduled dim or OFF state for no more than 2 hours when an override is initiated.

C. Motion sensing controls.

- i. Motion sensing controls shall be installed for the following luminaires. Motion sensing controls may be installed for other outdoor lighting and in combination with other outdoor lighting controls:
 - a. Outdoor luminaires other than those providing building façade, ornamental hardscape or outdoor dining lighting, where the bottom of the luminaire is mounted 24 feet above grade or lower; and
 - b. Outdoor wall-mounted luminaires installed for general hardscape parking lot lighting, located within one mounting height of a parking space, mounted 24 feet above grade or lower.
- ii. Motion sensing controls shall be capable of reducing the outdoor lighting power of each controlled luminaire by at least 50 percent and no more than 90 percent, and separately capable of turning the luminaire OFF, during unoccupied periods.
- iii. Motion sensing controls shall be capable of reducing the lighting to its dim or OFF state no longer than 15 minutes after the area has been vacated, and of returning the lighting to its ON state when the area becomes occupied.
- iv. No more than 1,500 watts of lighting power shall be controlled by a single sensor or as a single zone.

Exception 1 to Section 160.5(c)2C: Luminaires with a maximum rated wattage of 40 watts each are not required to have motion sensing controls.

Exception 2 to Section 160.5(c)2C: Applications listed as exceptions to Section 170.2(e)2A are not required to have motion sensing controls.

Exception 3 to Section 160.5(c)2C: Lighting subject to a health or life safety statute, ordinance or regulation may have a minimum time-out period longer than 15 minutes or a minimum dimming level above 50 percent when necessary to comply with the applicable law.

(d) **Sign lighting controls.** All sign lighting shall meet the requirements below as applicable:

1. **Indoor signs.** All indoor sign lighting other than exit sign lighting shall be controlled with an automatic time-switch control or astronomical time-switch control.
2. **Outdoor signs.** Outdoor sign lighting shall meet the following requirements as applicable:
 - A. All outdoor sign lighting shall be controlled with a photocontrol in addition to an automatic time-switch control, or an astronomical time-switch control.

Exception to Section 160.5(d)2A: Outdoor signs in tunnels, and signs in large permanently covered outdoor areas that are intended to be continuously lit, 24 hours per day and 365 days per year.

- B. All outdoor sign lighting that is ON both day and night shall be controlled with a dimmer that provides the ability to automatically reduce sign lighting power by a minimum of 65 percent during nighttime hours. Signs that are illuminated at night and for more than 1 hour during daylight hours shall be considered ON both day and night.

Exception to Section 160.5(d)2B: Outdoor signs in tunnels and large covered areas that are intended to be illuminated both day and night.

3. **Demand responsive electronic message center (EMC) control.** See Section 110.12 for requirements for demand responsive EMC controls.

(e) **Lighting control acceptance and installation certificate requirement.** Multifamily common use areas shall comply with the applicable requirements of Sections 160.5(e)1 through 160.5(e)3.

1. **Lighting control acceptance requirements.** Before an occupancy permit is granted, indoor and outdoor lighting controls serving the building, area or site and installed to comply with Section 160.5(b)4D, 160.5(b)4C, 160.5(b)4E, 160.5(c)2 or 170.2(e)1Aii shall be certified as meeting the Acceptance Requirements for Code Compliance as specified by Reference Nonresidential Appendix NA7.6 and NA7.8. A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Part 1 that the equipment and systems meet the acceptance requirements:

A. Reserved;

B. Reserved;

C. Automatic daylight controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.1;

D. Lighting shut-OFF controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.2;

E. Demand responsive lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.6.3; and

F. Outdoor lighting controls shall be tested in accordance with Reference Nonresidential Appendix NA7.8; and

G. Lighting systems receiving the Institutional Tuning Power Adjustment Factor shall be tested in accordance with Reference Nonresidential Appendix NA7.6.4.

H. Demand responsive controls required to control controlled receptacles shall be tested in accordance with Reference Nonresidential Appendix NA7.6.5.

2. **Lighting control installation certificate requirements.** To be recognized for compliance with Part 6, an Installation Certificate shall be submitted in accordance with Section 10-103(a) for any lighting control system, energy management control system, interlocked lighting system, lighting power adjustment factor, or addi-

tional wattage available for a videoconference studio, in accordance with the following requirements, as applicable:

- A. Certification that when a lighting control system is installed to comply with lighting control requirements in Part 6, it complies with the applicable requirements of Section 110.9 and complies with Reference Nonresidential Appendix NA7.7.1.
 - B. Certification that when an energy management control system is installed to function as a lighting control required by Part 6, it functionally meets all applicable requirements for each application for which it is installed, in accordance with Sections 110.9, 160, 170 and 180, and complies with Reference Nonresidential Appendix NA7.7.2.
 - C. Certification that interlocked lighting systems used to serve an approved area comply with Section 170.2(e)2A and comply with Reference Nonresidential Appendix NA7.7.4.
 - D. Certification that lighting controls installed to earn a lighting power adjustment factor (PAF) comply with Section 170.2(e)2B and comply with Reference Nonresidential Appendix NA7.7.5.
 - E. Reserved.
3. When certification is required by Title 24, Part 1, Section 10-103.1, the acceptance testing specified by Section 160.5(e) shall be performed by a Certified Lighting Controls Acceptance Test Technician (CLCATT). If the CLCATT is operating as an employee, the CLCATT shall be employed by a Certified Lighting Controls Acceptance Test Employer. The CLCATT shall disclose on the Certificate of Acceptance a valid CLCATT certification identification number issued by an approved Acceptance Test Technician Certification Provider. The CLCATT shall complete all Certificate of Acceptance documentation in accordance with the applicable requirements in Section 10-103(a)4.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 160.6
MANDATORY REQUIREMENTS FOR
ELECTRIC POWER DISTRIBUTION SYSTEMS**

Multifamily buildings shall comply with the applicable requirements of Sections 160.6(a) through 160.6(e).

(a) **Service electrical metering.** Each electrical service or feeder that provides power to the common use areas (interior and exterior) shall have a permanently installed metering system that measures electrical energy use in accordance with Table 160.6-A.

Exception to Section 160.6(a): Service or feeder for which the utility company provides a metering system for the multifamily building that indicates instantaneous kW demand and kWh for a utility-defined period.

(b) **Separation of electrical circuits for electrical energy monitoring.** Electrical power distribution systems shall be designed so that measurement devices can monitor the electrical energy usage of load types according to Table 160.6-B.

Exception 1 to Section 160.6(b): For each separate load type, up to 10 percent of the connected load may be of any type.

Exception 2 to Section 160.6(b): Submetered electrical power distribution systems that provide power to dwelling units.

(c) **Voltage drop.** The maximum combined voltage drop on both installed feeder conductors and branch circuit conductors to the farthest connected load or outlet shall not exceed 5 percent.

Exception to Section 160.6(c): Voltage drop permitted by *California Electrical Code* Sections 647.4, 695.6 and 695.7.

(d) **Circuit controls for 120-volt receptacles and controlled receptacles.** In all common areas, both controlled and uncontrolled 120 volt receptacles shall be provided in office areas, lobbies, conference rooms, kitchen areas in office spaces, and copy rooms. Controlled receptacles shall meet the following requirements, as applicable:

- 1. Install a control capable of automatically shutting OFF the controlled receptacles when the space is typically unoccupied, either at the receptacle or circuit level. When an automatic time switch control is installed it

**TABLE 160.6-A
MINIMUM REQUIREMENTS FOR METERING OR SUBMETERING OF ELECTRICAL LOAD**

METERING FUNCTIONALITY	ELECTRICAL SERVICES ¹ RATED 50 KVA OR LESS	ELECTRICAL SERVICES ¹ RATED MORE THAN 50 KVA AND LESS THAN OR EQUAL TO 250 KVA	ELECTRICAL SERVICES ¹ RATED MORE THAN 250 KVA AND LESS THAN OR EQUAL TO 1000 KVA	ELECTRICAL SERVICES ¹ RATED MORE THAN 1000 KVA
Instantaneous (at the time) kW demand	Required	Required	Required	Required
Historical peak demand (kW)	Not required	Not required	Required	Required
Tracking kWh for a user-definable period	Required	Required	Required	Required
kWh per rate period	Not required	Not required	Not required	Required

1. "Electrical services" applies to the building service-entrance rating or to the submetering service. For a building with submetering, this applies to the submetering service size to the common use areas.

**TABLE 160.6-B
MINIMUM REQUIREMENTS FOR SEPARATION OF ELECTRICAL LOAD**

ELECTRICAL LOAD TYPE	ELECTRICAL SERVICES ¹ RATED 50 KVA OR LESS	ELECTRICAL SERVICES ¹ RATED MORE THAN 50 KVA AND LESS THAN OR EQUAL TO 250 KVA	ELECTRICAL SERVICES ¹ RATED MORE THAN 250 KVA AND LESS THAN OR EQUAL TO 1000 KVA	ELECTRICAL SERVICES ¹ RATED MORE THAN 1000 KVA
Lighting including exit and egress lighting and exterior lighting	Not required	All lighting in aggregate	All lighting disaggregated by floor, type or area	All lighting disaggregated by floor, type or area
HVAC systems and components including chillers, fans, heaters, furnaces, package units, cooling towers and circulation pumps associated with HVAC	Not required	All HVAC in aggregate	All HVAC in aggregate and each HVAC load rated at least 50 kVA	All HVAC in aggregate and each HVAC load rated at least 50 kVA
Domestic and service water system pumps and related systems and components	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Plug load including appliances rated less than 25 kVA	Not required	All plug load in aggregate Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area Groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf	All plug load separated by floor, type or area All groups of plug loads exceeding 25 kVA connected load in an area less than 5000 sf
Elevators, escalators, moving walks and transit systems	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Renewable power source (net or total)	Each group	Each group	Each group	Each group
Loads associated with renewable power source	Not required	All loads in aggregate	All loads in aggregate	All loads in aggregate
Charging stations for electric vehicles	All loads in aggregate	All loads in aggregate	All loads in aggregate	All loads in aggregate

1. “Electrical services” applies to the building service-entrance rating or to the submetering service. For a building with submetering, this applies to the submetering service size to the common use areas.

shall incorporate an override control that allows the controlled receptacle to remain ON for no more than 2 hours when an override is initiated and an automatic holiday “shut-OFF” feature that turns OFF all loads for at least 24 hours and then resumes the normally scheduled operation. Countdown timer switches shall not be used to comply with the automatic time switch control requirements; and

2. Install at least one controlled receptacle within 6 feet from each uncontrolled receptacle, or install a split-wired receptacle with at least one controlled and one uncontrolled receptacle. Where receptacles are installed in modular furniture in open office areas, at least one controlled receptacle shall be installed at each workstation; and
3. Provide a permanent and durable marking for controlled receptacles or circuits to differentiate them from uncontrolled receptacles or circuits; and

NOTE: A hardwired power strip controlled by an occupant sensing control may be used to comply with Section 160.6(d). Plug-in strips and other plug-in devices shall not be used to comply with the requirements of this section.

Exception 1 to Section 160.6(d): Receptacles that are only for the following purposes:

- A. Receptacles specifically for refrigerators and water dispensers in kitchen areas.
- B. Receptacles located a minimum of 6 feet above the floor that are specifically for clocks.
- C. Receptacles for network copiers, fax machines, A/V and data equipment other than personal computers in copy rooms.
- D. Receptacles on circuits rated more than 20 amperes.
- E. Receptacles connected to an uninterruptible power supply (UPS) that are intended to be in continuous use, 24 hours per day/365 days per year, and are marked to differentiate them from other uncontrolled receptacles or circuits.

Exception 2 to Section 160.6(d): Receptacles in common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions.

(e) **Demand responsive controls and equipment.** See Section 110.12 for requirements for demand responsive controls and equipment.

NOTE: Definitions of terms and phrases in Section 160.6 are determined as specified in Section 100.1(b). Terms and phrases not found in Section 100.1(b) shall be defined as

specified in Title 24, Part 3, Article 100 of the *California Electrical Code*.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 160.7 MANDATORY REQUIREMENTS FOR COVERED PROCESSES

(a) **Elevators.** Elevators shall meet the requirements of Section 120.6(f).

(b) **Pool and spa systems.** Pool and spa systems available to multiple tenants or to the public shall comply with the applicable requirements of Section 110.4. Pool and spa systems installed for exclusive use by a single tenant shall comply with the applicable requirements of Section 150.0(p).

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 160.8 MANDATORY REQUIREMENTS FOR SOLAR READY BUILDINGS

(a) **Solar ready buildings.** Newly constructed multifamily buildings shall meet the requirements of Section 110.10 applicable to the building project.

SECTION 160.9 MANDATORY REQUIREMENTS FOR ELECTRIC READY BUILDINGS

(a) **Heat pump space heater ready.** Systems using gas or propane furnaces to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the furnace and accessible to the furnace with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready.” All electrical components shall be installed in accordance with the *California Electrical Code*.
2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future heat pump space heater installation. The reserved space shall be permanently marked as “For Future 240V use.”

(b) **Electric cooktop ready.** Systems using gas or propane cooktops to serve individual dwelling units shall include the following:

1. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the cooktop and accessible to the cooktop with no obstructions. The branch circuit conductors shall be rated at 50 amps minimum. The

blank cover shall be identified as “240V ready.” All electrical components shall be installed in accordance with the *California Electrical Code*.

2. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric cooktop installation. The reserved space shall be permanently marked as “For Future 240V use.”

(c) **Electric clothes dryer ready.** Clothes dryer locations with gas or propane plumbing shall include the following:

1. Systems serving individual dwelling units shall include:
 - A. A dedicated 240 volt branch circuit wiring shall be installed within 3 feet from the clothes dryer location and accessible to the clothes dryer location with no obstructions. The branch circuit conductors shall be rated at 30 amps minimum. The blank cover shall be identified as “240V ready.” All electrical components shall be installed in accordance with the *California Electrical Code*.
 - B. The main electrical service panel shall have a reserved space to allow for the installation of a double pole circuit breaker for a future electric clothes dryer installation. The reserved space shall be permanently marked as “For Future 240V use.”
2. Systems in common use areas shall include:
 - A. Conductors or raceway shall be installed with termination points at the main electrical panel, via subpanels panels if applicable, to a location no more than 3 feet from each gas outlet or a designated location of future electric replacement equipment. Both ends of the conductors or raceway shall be labelled “Future 240V Use.” The conductors or raceway and any intervening subpanels, panelboards, switchboards and busbars shall be sized to meet the future electric power requirements, at the service voltage to the point at which the conductors serving the building connect to the utility distribution system, as specified below. The capacity requirements may be adjusted for demand factors in accordance with the *California Electric Code*. Gas flow rates shall be determined in accordance with the *California Plumbing Code*. Capacity shall be one of the following:
 - i. 24 amps at 208/240 volts per clothes dryer;
 - ii. 2.6 kVA for each 10,000 Btu per hour of rated gas input or gas pipe capacity; or
 - iii. The electrical power required to provide equivalent functionality of the gas-powered equipment as calculated and documented by the responsible person associated with the project.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SUBCHAPTER 11

MULTIFAMILY BUILDINGS—PERFORMANCE AND PRESCRIPTIVE COMPLIANCE APPROACHES

SECTION 170.0 GENERAL

Multifamily buildings shall comply with the applicable requirements of Sections 170.0 through 170.2. Sections 170.0 through 170.2 apply to dwelling units and common use areas in multifamily buildings. Nonresidential occupancies in mixed occupancy buildings shall comply with nonresidential requirements in Sections 120, 130, 140 and 141.

- (a) Multifamily buildings shall meet all of the following:
1. The applicable requirements of Sections 110.0 through 110.10.
 2. The applicable requirements of Section 160.0 (mandatory features).
 3. Either the performance standards (170.1) or the prescriptive standards (170.2) set forth in this subchapter for the climate zone in which the building is located. Climate zones are shown in Reference Joint Appendix JA2—Weather/Climate Data.

Exception to Section 170.0 (a)3: If a single development falls in more than one climate zone, all buildings in the subdivision or tract may be designed to meet the performance or prescriptive standards for the climate zone that contains 50 percent or more of the dwelling units.

NOTE: The Commission periodically updates, publishes and makes available to interested persons and local enforcement agencies precise descriptions of the climate zones, as specified in Reference Joint Appendix JA2—Weather/Climate Data.

NOTE: The requirements of Sections 170.1(a) through 170.2(e) apply to newly constructed buildings and Sections 180.1 and 180.2 specify changes to the requirements of Sections 170.1(a) through 170.2(e) that apply to additions or alterations.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 170.1 PERFORMANCE APPROACH

A building complies with the performance approach if the energy budget calculated for the proposed design building under Subsection (b) is no greater than the energy budget calculated for the standard design building under Subsection (a).

(a) **Energy budget for the standard design building.** The energy budget for the standard design building is expressed in terms of source energy and time-dependent val-

uation (TDV) energy, and they are determined by applying the mandatory and prescriptive requirements to the proposed design building. The source energy budget and the TDV energy budget is the sum of the TDV energy for space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage system, service water heating and covered process loads.

(b) **Energy budget for the proposed design building.** The energy budget for a proposed design building is expressed in terms of source energy and time-dependent valuation (TDV) energy, and they are determined by calculating the source energy and TDV energy for the proposed design building. The source energy budget and the TDV energy budget is the sum of the energy for space-conditioning, indoor lighting, mechanical ventilation, photovoltaic (PV) and battery storage system, and service water heating and covered process loads. The proposed building shall separately comply with the source energy budget and the TDV energy budget.

Exception to Section 170.1(b): A community shared solar electric generation system, or other renewable electric generation system, and/or community shared battery storage system, that provides dedicated power, utility energy reduction credits or payments for energy bill reductions to the permitted building and is approved by the Energy Commission as specified in Title 24, Part 1, Section 10-115, may offset part or all of the solar electric generation system or battery storage system TDV energy required to comply with the standards, as calculated according to methods established by the Commission in the Nonresidential ACM Reference Manual.

(c) **Calculation of energy budget.** The TDV energy for both the standard design building and the proposed design building shall be computed by compliance software certified for this use by the Commission. The processes for compliance software approval by the Commission are documented in the ACM Approval Manual.

(d) **Compliance demonstration requirements for performance standards.**

1. Certificate of Compliance and Application for a Building Permit. The application for a building permit shall include documentation pursuant to Sections 10-103(a)1 and 10-103(a)2 that demonstrates, using an approved calculation method, that the building has been designed so that its source energy budget and TDV energy budget do not exceed the standard design for the applicable climate zone.
2. Field verification of individual dwelling unit systems. When performance of installed features, materials, components, manufactured devices or systems above the minimum specified in Section 170.2 is necessary for the building to comply with Section 170.1, or is necessary to achieve a more stringent local ordinance,

field verification shall be performed in accordance with the applicable requirements in the following subsections, and the results of the verification(s) shall be documented on applicable Certificates of Installation pursuant to Section 10-103(a)3 and applicable Certificates of Verification pursuant to Section 10-103(a)5.

A. EER/EER2/SEER/SEER2/CEER/HSPF/HSPF2

Rating. When performance compliance requires installation of a space-conditioning system with a rating that is greater than the minimum rating required by Table 170.2-K or specified for the standard design, the installed system shall be field verified in accordance with the procedures specified in the applicable sections of Reference Residential Appendix RA3.

B. Variable capacity heat pump (VCHP) compliance option. When performance compliance requires installation of a heat pump system that meets all the requirements of the VCHP compliance option specified in the ACM Reference Manual, the system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.4.4.3.

C. Low leakage air handler. When performance compliance requires installation of a low leakage air-handling unit, the installed air handling unit shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.1.4.3.9.

D. Reserved.

E. Heat pump—rated heating capacity. When performance compliance requires installation of a heat pump system, the heating capacity values at 47°F and 17°F shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.4.4.2.

F. Whole-house fan. When performance compliance requires installation of a whole-house fan, the whole-house fan ventilation airflow rate and fan efficacy shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.9.

G. Central fan ventilation cooling system. When performance compliance requires installation of a central fan ventilation cooling system, the installed system shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.3.4.

H. Dwelling unit enclosure air leakage. When performance compliance requires a building enclosure leakage rate that is lower than the standard design, the building enclosure shall be field verified in accordance with the procedures specified in Reference Residential Appendix RA3.8.

I. Quality insulation installation (QII). When performance compliance requires field verification of QII, the building insulation system shall be field verified

in accordance with the procedures in Reference Residential Appendix RA3.5.

J. Precooling. When performance compliance requires field verification of the installation and programming of a precooling thermostat, it shall be field verified in accordance with the procedures in Reference Residential Appendix RA3.4.5.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 170.2 PRESCRIPTIVE APPROACH

Multifamily buildings, including both dwelling units and common use areas, that comply with the prescriptive standards shall be designed, constructed and equipped to meet all of the requirements for the appropriate climate zone shown in Table 170.2-A. In Table 170.2-A, NA (not allowed) means that feature is not permitted in a particular climate zone and NR (no requirement) means that there is no prescriptive requirement for that feature in a particular climate zone. Installed components shall meet the following requirements:

(a) **Envelope component requirements.**

1. **Exterior roofs and ceilings.** Exterior roofs and ceilings shall comply with each of the applicable requirements in this subsection:

A. Roofing products. All roofing products shall meet the requirements of Section 110.8 and the applicable minimum aged solar reflectance and thermal emittance requirements of Table 170.2-A.

Exception 1 to Section 170.2(a)1A: Building integrated photovoltaic panels and building integrated solar thermal panels are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

Exception 2 to Section 170.2(a)1A: Roof constructions with a weight of at least 25 lb/ft² are exempt from the minimum requirements for solar reflectance and thermal emittance or SRI.

B. Roof insulation. roofs shall have an overall assembly *U*-factor no greater than the applicable value in Table 170.2-A, meeting i, ii, iii or iv below. Where required by Sections 110.8 and 160.1(a), insulation shall be placed in direct contact with a continuous roof or drywall ceiling.

i. Option A: Reserved.

ii. Option B: A minimum *R*-value of insulation installed between the roof rafters in contact with the roof deck and an additional layer of ceiling insulation located between the attic and the conditioned space when meeting Section 170.2(c)3Biia; or

iii. Option C: A minimum *R*-value of ceiling insulation located between the attic and the conditioned space when meeting Section 170.2(c)3Biib.

iv. Option D: A minimum *U*-factor for roof assemblies above conditioned space without attic space.

C. Radiant barrier. A radiant barrier required in Table 170.2-A shall meet the requirements specified in Section 110.8(j), and shall meet the installation criteria specified in Reference Residential Appendix RA4.

2. Wall insulation.

A. Exterior walls shall have an overall assembly *U*-factor no greater than the applicable value in Table 170.2-A.

B. Demising walls shall meet the requirements of Section 160.1(b)7. Vertical windows in demising walls between conditioned and unconditioned spaces shall have an area-weighted average *U*-factor no greater than the applicable value in Table 170.2-A.

3. Fenestration.

A. Vertical fenestration and glazed doors in exterior walls shall comply with Subsections i, ii and iii:

i. Percent fenestration area shall be limited in accordance with the applicable requirements of a and b below:

a. A total fenestration area no greater than 20 percent of the conditioned floor area; and

b. A total fenestration area no greater than 40 percent of the gross exterior wall area.

NOTE: Demising walls are not exterior walls, and therefore demising wall area is not part of the gross exterior wall area, and fenestration in demising walls is not part of the fenestration area limitation.

ii. Fenestration properties. Installed fenestration products, including glazed doors, shall have an area-weighted average *U*-factor, relative solar heat gain coefficient (RSHGC) and visual transmittance (VT) meeting the applicable fenestration values in Table 170.2-A and shall be determined in accordance with Sections 110.6(a)2 and 110.6(a)3.

Vertical fenestration in demising walls between conditioned and unconditioned spaces is only required to comply with the area-weighted average *U*-factor requirement in Table 170.2-A.

Exception 1 to Section 170.2(a)3Aii: For each dwelling unit, up to 3 square feet of new glazing area installed in doors shall not be required to meet the *U*-factor and RSHGC requirements of Table 170.2-A.

Exception 2 to Section 170.2(a)3Aii: For fenestration containing chromogenic type glazing:

a. The lower-rated labeled *U*-factor and SHGC shall be used with automatic controls to modulate the amount of solar gain and light transmitted into the space in multiple steps in response to daylight levels or solar intensity;

b. Chromogenic glazing shall be considered separately from other fenestration; and

c. Area-weighted averaging with other fenestration that is not chromogenic shall not be permitted and shall be determined in accordance with Section 110.6(a).

Exception 3 to Section 170.2(a)3Aii: For dwelling units containing unrated site-built fenestration that meets the maximum area restriction, the *U*-factor and SHGC can be determined in accordance with Nonresidential Reference Appendix NA6 or using default values in Table 110.6-A and Table 110.6-B.

Exception 4 to Section 170.2(a)3ii: Fenestration in dwelling units of buildings that are three habitable stories or fewer in Climate Zones 1, 3, 5 and 16 is not required to comply with the RSHGC requirements.

Exception 5 to Section 170.2(a)3ii: Fenestration in dwelling units of buildings that are three habitable stories or fewer is not required to comply with the VT requirements.

iii. Shading. Where Table 170.2-A requires a maximum RSHGC, the requirements shall be met with an area-weighted average RSHGC excluding the effects of interior shading, no greater than the applicable value in Table 170.2-A.

For the purposes of this paragraph, the RSHGC of a vertical window is:

a. The solar heat gain coefficient of the window; or

b. Relative solar heat gain coefficient is calculated using Equation 170.2-A, if the window has an overhang that extends beyond each side of the window jamb by a distance equal to the overhang's horizontal projection.

Exception 1 to Section 170.2(a)3Aiiib: An area-weighted average relative solar heat gain coefficient of 0.56 or less shall be used for windows:

I. That are in the first story of exterior walls that form a display perimeter; and

II. For which codes restrict the use of overhangs to shade the windows.

Exception 2 to Section 170.2(a)3Aiiib: For vertical glazing containing chromogenic type glazing:

I. the lower-rate labeled RSHGC shall be used with automatic controls to modulate

the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and

- II. chromogenic glazing shall be considered separately from other glazing; and
- III. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

NOTE: Demising walls are not exterior walls, and therefore fenestration in demising walls is not subject to SHGC requirements.

$$RSHGC = SHGC \times [1 + a \times (2.72^{-PF} - 1) \times (\sin(b \times Az) - c)]$$

(Equation 170.2-A)

where:

	a	b	c
Overhang	0.150	0.130	5.67
Exterior Horizontal Slat	0.144	0.133	5.13

RSHGC = Relative solar heat gain coefficient.

SHGC = Solar heat gain coefficient of the vertical fenestration.

Az = Azimuth of the vertical fenestration in degrees.

PF = Projection factor as calculated by Equation 140.3-D.

- iv. Vertical fenestration shall have an area-weighted average visible transmittance (VT) no less than the applicable value in Table 170.2-A, or Equation 170.2-B, as applicable.

Exception 1 to Section 170.2(a)3Aiv: When the window’s primary and secondary sidelit daylight zones are completely overlapped by one or more skylit daylight zones, then the window need not comply with Section 170.2(a)3Aivw.

Exception 2 to Section 170.2(a)3Aiv: If the window’s VT is not within the scope of NFRC 200 or ASTM E972, then the VT shall be calculated according to Reference Nonresidential Appendix NA6.

Exception 3 to Section 170.2(a)3Aiv: For vertical windows containing chromogenic type glazing:

- a. The higher rated labeled VT shall be used with automatic controls to modulate the amount of light transmitted into the space in multiple steps in response to daylight levels or solar intensity;
- b. Chromogenic glazing shall be considered separately from other glazing; and
- c. Area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

Exception 4 to Section 170.2(a)3Aiv: Fenestration in dwelling units of buildings that are three habitable stories or fewer is not required to comply with the VT requirements.

NOTE: Demising walls are not exterior walls, and therefore windows in demising walls are not subject to VT requirements.

$$VT \geq 0.11/WWR \quad \text{(Equation 170.2-B)}$$

where:

WWR=Window Wall Ratio, the ratio of (i) the total window area of the entire building to (ii) the total gross exterior wall area of the entire building. If the WWR is greater than 0.40, then 0.40 shall be used as the value for WWR in Equation 170.2-B.

VT = Visible transmittance of framed window.

B. Skylights shall:

- i. Have an area no greater than 5 percent of the gross exterior roof area Skylight Roof Ratio (SRR); and

Exception 1 to Section 170.2(a)3Bi: Buildings with an atrium over 55 feet high shall have a skylight area no greater than 10 percent of the gross exterior roof area.

- ii. Have an area-weighted performance rating U-factor no greater than the applicable value in Table 170.2-A.

Exception 2 to Section 170.2(a)3Bii: For each dwelling unit up to 16 square feet of new skylight area with a maximum U-factor of 0.55 and a maximum SHGC of 0.30.

- iii. Solar heat gain coefficient. Have an area-weighted performance rating solar heat gain coefficient no greater than the applicable value in Table 170.2-A.

Exception to Sections 170.2(a)3Bii and 170.2(a)3Biii: For skylights containing chromogenic type glazing:

- a. the lower-rated labeled SHGC shall be used with automatic controls to modulate the amount of heat flow into the space in multiple steps in response to daylight levels or solar intensity; and
- b. chromogenic glazing shall be considered separately from other glazing; and
- c. area-weighted averaging with other glazing that is not chromogenic shall not be permitted.

- iv. Haze value. Have a glazing material or diffuser that has a measured haze value greater than 90 percent, determined according to ASTM D1003 or other test method approved by the Energy Commission.

Exception to Section 170.2(a)3Biv: Skylights designed and installed to exclude direct sunlight entering the occupied space by the use of fixed or

automated baffles or the geometry of the skylight and light well.

4. All exterior doors, excluding glazed doors, that separate conditioned space from unconditioned space or from ambient air shall have a *U*-factor not greater than the applicable value in Table 170.2-A. Glazed doors must comply with the requirements of Section 170.2(a)3A.

Exception to Section 170.2(a)4: Swinging doors that are required to have fire protection are not required to meet the applicable door value in Table 170.2-A.

5. Floors shall meet the following requirements:

- A. Raised floors shall be insulated such that the floor assembly has an assembly *U*-factor equal to or less than shown in Table 170.2-A, or shall be insulated between wood framing with insulation having an *R*-value equal to or greater than shown in Table 170.2-A.

- B. All buildings with three habitable stories or fewer shall have slab floor perimeter insulation installed with a *U*-factor equal to or less than or *R*-value equal to or greater than shown in Table 170.2-A. The minimum depth of concrete slab floor perimeter insulation shall be 16 inches or the depth of the footing of the building, whichever is less.

Exception to Section 170.2(a)5: Raised-floor insulation may be omitted if the foundation walls are insulated to meet the wall insulation minimums shown in Table 170.2-A.

6. All buildings up to three habitable stories shall comply with the quality insulation installation (QII) requirements shown in Table 170.2-A. When QII is required, insulation installation shall meet the criteria specified in Reference Appendix RA3.5.

Exception to Section 170.2(a): The insulation requirements of Table 170.2-A and Table 170.2-B may be met by ceiling, roof deck, wall or floor assemblies that meet the required maximum *U*-factors using a *U*-factor calculation method that considers the thermal effects of all elements of the assembly and is approved by the Executive Director.

(b) **Minimum daylighting requirement for large enclosed spaces.** In Climate Zones 2 through 15, conditioned enclosed spaces and unconditioned enclosed spaces that are greater than 5,000 ft² and that are directly under a roof with ceiling heights greater than 15 feet shall meet the following requirements:

1. A combined total of at least 75 percent of the floor area, as determined in building floor plan (drawings) view, shall be within one or more of the following:
 - A. Primary sidelight daylight zone in accordance with Section 160.5(b)4Dib, or
 - B. The total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.

2. All skylit daylit zones and primary sidelit daylit zones shall be shown on building plans.

3. General lighting in daylit zones shall be controlled in accordance with Section 160.5(b)4D.

4. The total skylight area is at least 3 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights; or the product of the total skylight area and the average skylight visible transmittance is no less than 1.5 percent of the total floor area in the space within a horizontal distance of 0.7 times the average ceiling height from the edge of rough opening of skylights.

5. All skylights shall have a glazing material or diffuser that has a measured haze value greater than 90 percent, tested according to ASTM D1003 (notwithstanding its scope) or another test method approved by the Commission.

Exception 1 to Section 170.2(b): In buildings with unfinished interiors, future enclosed spaces for which there are plans to have:

- A. A floor area of less than or equal to 5,000 square feet; or
- B. Ceiling heights of less than or equal to 15 feet. This exception shall not be used for S-1 or S-2 (storage), or for F-1 or F-2 (factory) occupancies.

Exception 2 to Section 170.2(b): Enclosed spaces having a designed general lighting system with a lighting power density less than 0.5 watts per square foot.

Exception 3 to Section 170.2(b): Enclosed spaces where it is documented that permanent architectural features of the building, existing structures or natural objects block direct beam sunlight on at least half of the roof over the enclosed space for more than 1500 daytime hours per year between 8 a.m. and 4 p.m.

(c) **Space-conditioning systems.** All space heating, space cooling and ventilation equipment shall comply with minimum Appliance Efficiency Regulations as specified in Sections 110.0 through 110.2 and the applicable requirements of Subsections 1 through 4.

1. Sizing and equipment selection—common use areas. Mechanical heating and mechanical cooling equipment serving common use areas of multifamily buildings shall be the smallest size, within the available options of the desired equipment line, necessary to meet the design heating and cooling loads of the building, as calculated according to Subsection 2 below.

Exception 1 to Section 170.2(c)1: Where it can be demonstrated to the satisfaction of the enforcing agency that oversizing will not increase building TDV energy use.

Exception 2 to Section 170.2(c)1: Standby equipment with controls that allow the standby equipment to operate only when the primary equipment is not operating.

Exception 3 to Section 170.2(c)1: Multiple units of the same equipment type, such as multiple chillers and

TABLE 170.2-A
ENVELOPE COMPONENT PACKAGE—Multifamily Standard Building Design

MULTIFAMILY		CLIMATE ZONE																	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		
Roof/Ceiling	Option B [meets §170.2(a)1B]ii]	Below Roof Deck Insulation ^{1,2} (With Air Space)	NR	NR	NR	R19	NR	NR	R19	R13	R19	R19	R19	R19	R19	R19	R19	R13	
		Ceiling Insulation	R.38	R.38	R.30	R.38	R.30	REQ	R.30	R.38	R.38	R.38	R.38	R.38	R.38	R.38	R.38	R.38	R.38
		Radiant Barrier	NR	REQ	NR	NR	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Solar Reflectance Index (SRI)	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
	Option C [meets §170.2(a)1B]iii]	Low-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Steep-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Ceiling Insulation	R.38	R.30	R.30	R.30	R.30	R.30	R.30	R.30	R.30	R.30	R.38	R.38	R.38	R.38	R.38	R.38	R.38
		Radiant Barrier	NR	REQ	NR	NR	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
		Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
Option D [Nonattic Roof]	Low-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
	Steep-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
	Metal Building U-factor	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	0.041	
	Wood Framed and Other U-factor	0.028	0.028	0.034	0.028	0.034	0.034	0.039	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	0.028	
	Aged Solar Reflectance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
	Thermal Emittance	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
Walls	Option E [meets §170.2(a)1B]iv]	Low-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
		Steep-sloped	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	
		Metal-Building, any fire rating	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061	0.061
		Framed (wood, metal, and others) > 1 hr fire rating	0.059	0.059	0.059	0.059	0.059	0.065	0.065	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059	0.059
		Framed (wood, metal and others), ≤ 1 hr fire rating ³	0.051	0.051	0.051	0.051	0.051	0.065	0.065	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051	0.051
		Mass Light ^{4,5}	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.077 R 13	U 0.059 R 17
	Option F [meets §170.2(a)1B]v]	Mass Heavy	0.253	0.650	0.650	0.650	0.650	0.690	0.690	0.690	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.650	0.160
		Slab Perimeter, Three Habitable Stories or Fewer	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	U 0.58 R 7.0
		Wood Framed	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19	U 0.037 R 19
		Raised Mass	U 0.092 R 8.0	U 0.092 R 8.0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.269 R 0	U 0.092 R 8.0
		Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039
		Other	0.048	0.039	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.071	0.039

(continued)

TABLE 170.2-A—continued
ENVELOPE COMPONENT PACKAGE – Multifamily Standard Building Design

Exterior Door ^s	Quality insulation installation (QII) for buildings up to three habitable stories	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes				
		0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38		
Fenestration	Curtain Wall/Storefront	Maximum U-factor	NR	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	NR	0.25		
		Maximum RSHGC, three or fewer habitable stories	NR	0.26	NR	0.26	NR	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	NR
		Maximum RSHGC, four or more habitable stories	0.35	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25
	NAFS 2017 Performance Class AW ^s	Minimum VT, four or more habitable stories	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
		Maximum U-factor	0.38	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.38
All Other Fenestration	Maximum RSHGC, three or fewer habitable stories	Maximum RSHGC, three or fewer habitable stories	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	NR	0.24	
		Maximum RSHGC, four or more habitable stories	0.35	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
	Maximum Window to Floor Ratio	Minimum VT, four or more habitable stories	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
		Maximum U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
		Maximum RSHGC, three or fewer habitable stories	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR	0.23	NR
Maximum Window to Wall Ratio	Maximum RSHGC, four or more habitable stories	0.35	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	
	Maximum Window to Floor Ratio	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	
	Maximum Skylight Roof Ratio	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	40%	
Maximum U-factor	Dwelling Unit Entry	Maximum Skylight Roof Ratio	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	5%	
		Common Use Area Entry Nonswinging	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	
		Common Use Area Entry Swinging	0.50	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	0.50
Exterior Door ^s	Maximum U-factor	Common Use Area Entry Swinging	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	

1. Install the specified R-value with an air space present between the roofing and the roof deck, such as standard installation of concrete or clay tile.
2. R-values shown for below roof deck insulation are for wood-frame construction with insulation installed between the framing members. Alternatives including insulation above rafters or above roof deck shall comply with the performance standards.
3. Assembly U-factors for exterior framed walls can be met with cavity insulation alone or with continuous insulation alone, or with both cavity and continuous insulation that results in an assembly U-factor equal to or less than the U-factor shown. Use Reference Joint Appendix JA4 Table 4.3.1, 4.3.1(a) or Table 4.3.4 to determine alternative insulation products to be less than or equal to the required maximum U-factor.
4. Mass wall has a heat capacity greater than or equal to 7.0 Btu/h-ft².
5. Product must be certified to meet the North American Fenestration Standard/Specification for an Architectural Window (AW).
6. Glazed doors must meet the fenestration requirements.

boilers, having combined capacities exceeding the design load, if they have controls that sequence or otherwise optimally control the operation of each unit based on load.

2. Calculations—common use areas. In making equipment sizing calculations under Subsection (c)1, all of the following rules shall apply:

A. Heating and cooling loads. Heating and cooling system design loads shall be determined in accordance with the method in the 2017 ASHRAE Handbook, Fundamentals Volume, or as specified in a method approved by the Commission.

B. Indoor design conditions. Indoor design temperature and humidity conditions for comfort applications shall be determined using ASHRAE Standard 55 or the 2017 ASHRAE Handbook, Fundamentals Volume, except that winter humidification and summer dehumidification shall not be required.

C. Outdoor design conditions. Outdoor design conditions shall be in accordance with the design conditions from Reference Joint Appendix JA2, which is based on data from the ASHRAE Climatic Data for Region X. Heating design temperatures shall be no lower than the Heating Winter Median of Extremes values. Cooling design temperatures shall be no greater than the 0.5 percent Cooling Dry Bulb and Mean Coincident Wet Bulb values.

Exception to Section 170.2(c)2C: Cooling design temperatures for cooling towers shall be no greater than the 0.5 percent Cooling Design Wet Bulb values.

D. Ventilation. Outdoor air ventilation loads shall be calculated using the ventilation rates required in Section 160.2(c)3.

E. Envelope. Envelope heating and cooling loads shall be calculated using envelope characteristics, including square footage, thermal conductance, solar heat gain coefficient or shading coefficient, and air leakage, consistent with the proposed design.

F. Lighting. Lighting heating and cooling loads shall be based on actual design lighting levels or power densities as specified in Section 170.2(e)1.

G. People. Occupant density shall be based on the expected occupancy of the building and shall be the same as determined under Section 160.2(c)3A, if used. Sensible and latent heat gains shall be as listed in the 2017 ASHRAE Handbook—Fundamentals, Chapter 18.

H. Process loads. Loads caused by a process shall be based upon actual information on the intended use of the building.

I. Miscellaneous equipment. Equipment loads other than process loads shall be calculated using design data compiled from one or more of the following sources:

i. Actual information based on the intended use of the building; or

ii. Published data from manufacturers' technical publications or from technical societies, such as the ASHRAE Handbook, Applications Volume; or

iii. Other data based on the designer's experience of expected loads and occupancy patterns.

J. Internal heat gains. Internal heat gains may be ignored for heating load calculations.

K. Safety factor. Calculated design loads based on Sections 170.2(c)2A through K may be increased by up to 10 percent to account for unexpected loads or changes in space usage.

L. Other loads. Loads such as warm-up or cool-down shall be calculated from principles based on the thermal capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be no more than 30 percent for heating and 10 percent for cooling of the steady-state design loads. In addition, the steady-state load may include a safety factor in accordance with Section 170.2(c)2K.

3. Dwelling unit space-conditioning systems.

A. Heating system type. Space-conditioning systems serving dwelling units shall meet i or ii. Systems that cannot meet the requirements of i or ii, including multi-zone systems and systems using central boilers or chillers, shall comply with the performance requirements of Section 170.1.

i. Multifamily buildings three habitable stories or fewer. For Climate Zones 1 through 15, the space-conditioning system shall be a heat pump. For Climate Zone 16, the space-conditioning system shall be an air conditioner with furnace. Additionally, balanced ventilation systems serving these dwelling units shall meet the applicable requirements of Section 170.2(c)3Bivc.

ii. Multifamily buildings four habitable stories or greater. For Climate Zones 2 through 15, the space-conditioning system shall be a heat pump. For Climate Zones 1 and 16, the space-conditioning system shall be a dual-fuel heat pump.

Exception to Section 170.2(c)3A: A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kW or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.

B. Space-conditioning and ventilation systems. All space heating and space cooling equipment serving dwelling units shall comply with minimum Appliance Efficiency Regulations as specified in Sections

110.0 through 110.2 and meet all applicable requirements of Sections 160.3(b) and 170.2(c)2.

i. Refrigerant charge—systems serving individual dwelling units. When refrigerant charge verification or fault indicator display is shown as required by Table 170.2-K, the system shall comply with either Section 170.2(c), 170.2(c)3Bia or 170.2(c)3Bib:

a. Air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high velocity systems and mini-split systems, shall comply with Subsections I, II and III, unless the system is of a type that cannot be verified using the specified procedures:

I. Have measurement access holes (MAH) installed according to the specifications in Reference Residential Appendix Section RA3.2.2.3; and

II. System airflow rate in accordance with Subsection A or B below shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified by RA1; and

A. For small duct high velocity systems, the system airflow rate shall be greater than or equal to 250 cfm per ton; or

B. For all other air-cooled air conditioner or air-source heat pump systems, the system airflow rate shall be greater than or equal to 350 cfm per ton.

III. The installer shall charge the system according to manufacturer's specifications. Refrigerant charge shall be verified according to one of the following options, as applicable:

A. The installer and rater shall perform the standard charge procedure as specified by Reference Residential Appendix Section RA3.2.2 or an approved alternative procedure as specified by RA1; or

B. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify the FID device in accordance with the procedures in Section RA3.4.2; or

C. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1, provided the system is of a type that can be verified using the RA3.2.2 standard charge verification procedure and RA3.3 airflow rate verification procedure or approved alternatives in RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in RA1.

Exception to Section 170.2(c)3BiaI: Systems that cannot conform to the specifications for hole location in Reference Residential Appendix Figure RA3.2-1 shall not be required to provide holes as described in Figure RA3.2-1.

Exception to Section 170.2(c)3BiaII: Standard ducted systems without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in Table 160.3-A and Table 160.3-B as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 160.2(b)1D for the system air filter device(s) shall conform to the requirements given in Table 160.3-A and Table 160.3-B.

Exception to Section 170.2(c)3BiaIII: When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to verify the refrigerant charge, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Section 110.12. Ducted systems shall comply with the minimum system airflow rate requirement in Section 170.2(c)3BiaII.

b. For air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted packaged systems, small duct high velocity systems and mini-split systems, which are of a type that cannot comply with the requirements of Section 170.2(c)3Bi:

I. The installer shall confirm the refrigerant charge using the weigh-in charging procedure specified in Reference Residential Appendix Section RA3.2.3.1, as verified by a HERS Rater according to the procedures specified in Reference Residential Appendix Section RA3.2.3.2; and

II. Systems that utilize forced air ducts shall comply with the minimum system airflow rate requirement in Section 170.2(c)3BiaII, provided the system is of a type that can be

verified using the procedures in RA3.3 or an approved alternative procedure in RA1.

Exception 1 to Section 170.2(c)3Bi: Packaged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify that the packaged system was precharged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with minimum system airflow rate requirement in Section 170.2(c)3Bib, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.

Exception 2 to Section 170.2(c)3Bi: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four habitable stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

- ii. Space-conditioning distribution systems. All space-conditioning systems shall meet all applicable requirements of a or b below:
 - a. High performance attics. Air handlers or ducts are allowed to be in ventilated attic spaces when the roof and ceiling insulation level meet Option B in Table 170.2-A.
 - b. Duct and air handlers located in conditioned space. Duct systems and air handlers of HVAC systems shall be located in conditioned space, and confirmed by field verification and diagnostic testing to meet the criterion of Reference Residential Appendix RA3.1.4.3.8.

NOTE: Gas heating appliances installed in conditioned spaces must meet the combustion air requirements of *California Mechanical Code* Chapter 7, as applicable.

- iii. Central fan integrated ventilation systems—systems serving individual dwelling units. Central forced air system fans used to provide outside air shall have an air-handling unit fan efficacy less than or equal to the maximum W/cfm specified in a or b below. The airflow rate and fan efficacy requirements in this section shall be confirmed through field verification and diagnostic testing in accordance with all applicable procedures specified in Reference Residential Appendix RA3.3. Central Fan Integrated Ventilation Systems shall be certified to the Energy Commission as Intermittent Ventilation Systems as specified in Reference Residential Appendix RA3.7.4.2.
 - a. 0.45 W/cfm for gas furnace air-handling units; or

- b. 0.58 W/cfm for air-handling units that are not gas furnaces.

iv. Balanced ventilation systems. When balanced ventilation systems are used to meet Section 160.2(b)2Aivb, they shall meet the applicable requirements of a, b or c below:

- a. In Climate Zones 1, 2 and 11–16, balanced ventilation systems serving individual dwelling units shall:
 - 1. Be an energy recovery ventilator (ERV) or heat recovery ventilator (HRV),
 - 2. Have a minimum sensible recovery efficiency of 67 percent, rated at 32 degrees Fahrenheit (0 degrees Celsius), and
 - 3. Have a fan efficacy less than or equal to 0.6 W per cfm.

These measures shall be confirmed through HERS field verification in accordance with the procedures in RA3.7.4.4 for buildings with three habitable stories or fewer, or the procedures in NA2.2.4.1.5 for buildings with four or more habitable stories.

- b. In Climate Zones 1, 2 and 11–16, balanced ventilation systems serving multiple dwelling units in buildings with four or more habitable stories shall:
 - 1. Be an ERV or HRV,
 - 2. Have a minimum sensible recovery efficiency or effectiveness of 67 percent, rated at 32 degrees Fahrenheit (0 degrees Celsius),
 - 3. Meet the fan power requirements of Section 170.2(c)4A, and
 - 4. Have recovery bypass or control to directly economize with ventilation air based on outdoor air temperature limits specified in Table 170.2-G.

These measures shall be filed verified in accordance with NA7.18.4.

- c. In buildings with three habitable stories or fewer in Climate Zones 4–10, when a heat pump space-conditioning system is installed to meet the requirements of Section 170.2(c)3Ai, balanced ventilation systems without an ERV or HRV shall have a fan efficacy less than or equal to 0.4 W/cfm.

Exception to Section 170.2(c)3B: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four habitable stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

C. HVAC system bypass ducts. Bypass ducts that deliver conditioned supply air directly to the space-conditioning system return duct airflow shall not be used.

4. Common use area space-conditioning systems. A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the applicable requirements of Subsections A through O.

A. Fan systems. Each fan system moving air into, out of, or between spaces or circulating air for the purpose of conditioning air within a space shall meet the requirements of Items i, ii and iii below.

i. Fan power budget. For each fan system that includes at least one fan or fan array with fan electrical input power ≥ 1 kW, fan system electrical input power (Fan kW_{design,system}) determined per Section 170.2(c)4Aib at the fan system design airflow shall not exceed Fan kW_{budget} as calculated per Section 170.2(c)4Aia.

a. Calculation of fan power budget (Fan kW_{budget}). For each fan system:

I. Determine the fan system airflow and choose the appropriate table(s) for fan power allowance.

A. For single-cabinet fan systems, use the fan system airflow and the power allowances in both Tables 170.2-B and Table 170.2-C.

B. For supply-only fan systems, use the fan system airflow and power allowances in Table 170.2-B.

C. For relief fan systems, use the design relief airflow and the power allowances in Table 170.2-C.

D. For exhaust, return and transfer fan systems, use the fan system airflow and the power allowances in Table 170.2-C.

E. For complex fan systems, separately calculate the fan power allowance for the supply and return/exhaust systems and sum them. For the supply airflow, use supply airflow at the fan system design conditions, and the power allowances in Table 170.2-B. For the return/exhaust airflow, use return/exhaust airflow at the fan system design conditions, and the power allowances in Table 170.2-C.

II. For each fan system, determine the components included in the fan system and sum the fan power allowances of those components. All fan systems shall include

the system base allowance. If, for a given component, only a portion of the fan system airflow passes through the component, calculate the fan power allowance for that component per this equation:

$$FPA_{adj} = \frac{Q_{comp}}{Q_{sys}} \times FPA_{comp}$$

where:

FPA_{adj} = The correct/ed fan power allowance for the component in W/cfm.

Q_{comp} = The airflow through component in cfm.

Q_{sys} = The fan system airflow in cfm.

FPA_{comp} = The fan power allowance of the component from Table 170.2-B or Table 170.2-C.

III. Multiply the fan system airflow by the sum of the fan power allowances for the fan system.

IV. Divide by 1000 to convert to Fan kW_{budget}.

V. For building sites at elevations greater than 3,000 feet, multiply Fan kW_{budget} by the correction factor in Table 170.2-D.

b. Determining fan system electrical input power (Fan kW_{design,system}). Fan kW_{design,system} is the sum of Fan kW_{design} for each fan or fan array included in the fan system with Fan kW_{design} ≥ 1 kW. If variable speed drives are used, their efficiency losses shall be included. Fan input power shall be calculated with two times the clean filter pressure drop, which is the mean of the clean filter pressure drop and design final filter pressure drop. The Fan kW_{design} for each fan or fan array shall be determined using one of the following methods. There is no requirement to use the same method for all fans in a fan system:

I. Use the default Fan kW_{design} in Table 170.2-E for one or more of the fans. This method cannot be used for complex fan systems.

II. Use the Fan kW_{design} at fan system design conditions provided by the manufacturer of the fan, fan array, or equipment that includes the fan or fan array calculated per a test procedure included in USDOE 10 CFR Part 430, USDOE 10 CFR Part 431, ANSI/AMCA Standard 208-2018, ANSI/AMCA Standard 210-2016, AHRI Standard 430-2020, AHRI Standard 440-2019 or ISO 5801-2017.

III. Use the Fan kW_{design} provided by the manufacturer, calculated at fan system design

conditions per one of the methods listed in Section 5.3 of ANSI/AMCA 208-2018.

IV. Determine the Fan kW_{design} by using the maximum electrical input power provided on the motor nameplate.

ii. VAV systems.

- a. Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller setpoint is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section 170.2(c)4Aii. If this results in the sensor being located downstream of any major duct split, multiple sensors shall be installed in each major branch with fan capacity controlled to satisfy the sensor furthest below its setpoint; and
- b. Setpoint reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure setpoints shall be reset based on the zone requiring the most pressure; i.e., the setpoint is reset lower until one zone damper is nearly wide open.

iii. Fractional HVAC motors for fans. HVAC motors for fans that are less than 1 hp and 1/12 hp or greater shall be electronically commutated motors or shall have a minimum motor efficiency of 70 percent when rated in accordance with NEMA Standard MG 1-2006 at full load rating conditions. These motors shall also have the means to adjust motor speed for either balancing or remote control. Belt-driven fans may use sheave adjustments for airflow balancing in lieu of a varying motor speed.

Exception 1 to Section 170.2(c)4Aiii: Motors in fan-coils and terminal units that operate only when providing heating to the space served.

Exception 2 to Section 170.2(c)4Aiii: Motors in space-conditioning equipment certified under Section 110.1 or 110.2.

Exception 1 to 170.2(c)4A: Fan system power caused solely by process loads.

B. **Space-conditioning zone controls.** Each space-conditioning zone shall have controls designed in accordance with i or ii:

- i. Each space-conditioning zone shall have controls that prevent:
 - a. Reheating; and
 - b. Recooling; and
 - c. Simultaneous provisions of heating and cooling to the same zone, such as mixing or simul-

taneous supply of air that has been previously mechanically heated and air that has been previously cooled either by cooling equipment or by economizer systems; or

ii. Zones served by variable air-volume systems that are designed and controlled to reduce, to a minimum, the volume of reheated, recooled or mixed air are allowed only if the controls meet all of the following requirements:

- a. For each zone with direct digital controls (DDC), the volume of primary air that is reheated, recooled or mixed air supply shall not exceed the larger of:
 - I. 50 percent of the peak primary airflow; or
 - II. The design zone outdoor airflow rate as specified by Section 160.2(c)3.
- b. The volume of primary air in the deadband shall not exceed the design zone outdoor airflow rate as specified by Section 160.2(c)3.
- c. The first stage of heating consists of modulating the zone supply air temperature setpoint up to a maximum setpoint no higher than 95°F while the airflow is maintained at the deadband flow rate.
- d. The second stage of heating consists of modulating the airflow rate from the deadband flow rate up to the heating maximum flow rate.
- e. For each zone without DDC, the volume of primary air that is reheated, recooled or mixed air supply shall not exceed the larger of the following:
 - I. 30 percent of the peak primary airflow; or
 - II. The design zone outdoor airflow rate as specified by Section 160.2(c)3.

Exception 1 to Section 170.2(c)4B: Zones with special pressurization relationships or cross-contamination control needs.

Exception 2 to Section 170.2(c)4B: Zones served by space-conditioning systems in which at least 75 percent of the energy for reheating, or providing warm air in mixing systems, is provided from a site-recovered or site-solar energy source.

Exception 3 to Section 170.2(c)4B: Zones in which specific humidity levels are required to satisfy exempt process loads. Computer rooms or other spaces where the only process load is from IT equipment may not use this exception.

Exception 4 to Section 170.2(c)4B: Zones with a peak supply-air quantity of 300 cfm or less.

**TABLE 170.2-B
SUPPLY FAN POWER ALLOWANCES (watts/cfm)**

	MULTI-ZONE VAV SYSTEMS ≤5,000 cfm	MULTI-ZONE VAV SYSTEMS >5,000 and ≤10,000 cfm	MULTI-ZONE VAV SYSTEMS >10,000 cfm	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 and ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm
Supply System Base Allowance for AHU Serving Spaces ≤ 6 Floors Away	0.395	0.453	0.413	0.232	0.256	0.236
Supply System Base Allowance for AHU Serving Spaces > 6 Floors Away	0.508	0.548	0.501	0.349	0.356	0.325
MERV 13 to MERV 16 Filter Upstream of Thermal Conditioning Equipment (two times the clean filter pressure drop) ²	0.136	0.114	0.105	0.139	0.120	0.107
MERV 13 to MERV 16 Final Filter Downstream of Thermal Conditioning Equipment (two times the clean filter pressure drop) ²	0.225	0.188	0.176	0.231	0.197	0.177
Filtration Allowance for > MERV 16 or HEPA Filter (two times the clean filter pressure drop) ²	0.335	0.280	0.265	0.342	0.292	0.264
Central Hydronic Heating Coil Allowance	0.046	0.048	0.052	0.046	0.050	0.054
Electric Heat Allowance	0.046	0.038	0.035	0.046	0.040	0.036
Gas Heat Allowance	0.069	0.057	0.070	0.058	0.060	0.072
Hydronic/DX Cooling Coil, or Heat Pump Coil (wet) Allowance	0.135	0.114	0.105	0.139	0.120	0.107
Solid or Liquid Desiccant System Allowance	0.157	0.132	0.123	0.163	0.139	0.124
Reheat Coil for Dehumidification Allowance	0.045	0.038	0.035	0.046	0.040	0.036
Allowance for evaporative humidifier/cooler in series with a cooling coil. Value shown is allowed watts/cfm per 1.0 in. wg. Determine pressure loss (in. wg) at 400 fpm or maximum velocity allowed by the manufacturer, whichever is less. [Calculation required, see note 4]	0.224	0.188	0.176	0.231	0.197	0.177
Allowance for 100% outdoor air system meeting the requirements of Note 5.	0.000	0.000	0.000	0.070	0.100	0.107
Energy Recovery Allowance for $0.50 \leq \text{ERR} < 0.55^6$	0.135	0.114	0.105	0.139	0.120	0.107
Energy Recovery Allowance for $0.55 \leq \text{ERR} < 0.60^6$	0.160	0.134	0.124	0.165	0.141	0.126
Energy Recovery Allowance for $0.60 \leq \text{ERR} < 0.65^6$	0.184	0.155	0.144	0.190	0.163	0.146
Energy Recovery Allowance for $0.65 \leq \text{ERR} < 0.70^6$	0.208	0.175	0.163	0.215	0.184	0.165
Energy Recovery Allowance for $0.70 \leq \text{ERR} < 0.75^6$	0.232	0.196	0.183	0.240	0.205	0.184
Energy Recovery Allowance for $0.75 \leq \text{ERR} < 0.80^6$	0.257	0.216	0.202	0.264	0.226	0.203
Energy Recovery Allowance for $\text{ERR} \geq 0.80^6$	0.281	0.236	0.222	0.289	0.247	0.222
Coil Runaround Loop	0.135	0.114	0.105	0.139	0.120	0.107
Allowance for gas phase filtration required by code or accredited standard. Value shown is allowed W/cfm per 1.0 in. wg air pressure drop. [Calculation required, see note 4]	0.224	0.188	0.176	0.231	0.197	0.177
Economizer Return Damper	0.045	0.038	0.035	0.046	0.040	0.036
Air Blender Allowance	0.045	0.038	0.035	0.046	0.040	0.036
Allowance for sound attenuation section [fans serving spaces with design background noise goals below NC35]	0.034	0.029	0.026	0.035	0.030	0.027
Deduction for systems that feed a terminal unit with a fan with electrical input power < 1kW	-0.100	-0.100	-0.100	-0.100	-0.100	-0.100
Low-turndown single-zone VAV fan systems meeting the requirements in Note 7	0.000	0.000	0.000	0.070	0.100	0.089

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) in definition a multi-zone VAV system.
2. Filter fan power allowance can only be counted once per fan system.
3. Reserved.
4. Power allowance requires further calculation by multiplying the actual in. wg of the device/component by the watts/cfm in Table 170.2-B.
5. The 100 percent outdoor air system must serve three or more HVAC zones and airflow during noneconomizer operating periods must not exceed 135 percent of minimum requirements in Section 120.1(c)(3).
6. Energy recovery ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
7. A low-turndown single-zone VAV fan system must be capable of and configured to reduce airflow to 50 percent of design airflow and use no more than 30 percent of the design wattage at that airflow. No more than 10 percent of the design load served by the equipment shall have fixed loads.

**TABLE 170.2-C
EXHAUST, RETURN, RELIEF, TRANSFER FAN POWER ALLOWANCES (WATT/CFM)**

	MULTI-ZONE VAV SYSTEMS ≤5,000 cfm	MULTI-ZONE VAV SYSTEMS >5,000 and ≤10,000 cfm ¹	MULTI-ZONE VAV SYSTEMS >10,000 cfm ¹	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 and ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm
Exhaust System Base Allowance	0.221	0.246	0.236	0.186	0.184	0.190
Filter (any MERV value) ²	0.046	0.041	0.036	0.046	0.041	0.035
Energy Recovery Allowance for 0.50 ≤ ERR <0.55 ³	0.139	0.120	0.107	0.139	0.123	0.109
Energy Recovery Allowance for 0.55 ≤ ERR <0.60 ³	0.165	0.142	0.126	0.165	0.144	0.128
Energy Recovery Allowance for 0.60 ≤ ERR <0.65 ³	0.190	0.163	0.146	0.191	0.166	0.148
Energy Recovery Allowance for 0.65 ≤ ERR <0.70 ³	0.215	0.184	0.165	0.216	0.188	0.167
Energy Recovery Allowance for 0.70 ≤ ERR <0.75 ³	0.240	0.206	0.184	0.241	0.209	0.186
Energy Recovery Allowance for 0.75 ≤ ERR <0.80 ³	0.265	0.227	0.203	0.266	0.231	0.205
Energy Recovery Allowance for ERR ≥ 0.80 ³	0.289	0.248	0.222	0.291	0.252	0.225
Coil Runaround Loop	0.139	0.120	0.107	0.139	0.123	0.109
Return or exhaust systems required by code or accreditation standards to be fully ducted, or systems required to maintain air pressure differentials between adjacent rooms	0.116	0.100	0.089	0.116	0.102	0.091
Return and/or exhaust airflow control devices required for space pressurization control	0.116	0.100	0.089	0.116	0.102	0.091
Laboratory and vivarium exhaust systems in high-rise buildings for vertical duct exceeding 75 ft. Value shown is allowed W/cfm per 0.25 in. wg for each 100 feet exceeding 75 feet. [Calculation required, see Note 4]	0.058	0.051	0.045	0.058	0.052	0.046
Biosafety cabinet. Value shown is allowed W/cfm per 1.0 in. wg air pressure drop. [Calculation required, see Note 4]	0.231	0.198	0.177	0.232	0.202	0.179
Exhaust filters, scrubbers or other exhaust treatment required by code or standard. Value shown is allowed W/cfm per 1.0 in. wg air pressure drop. [Calculation required, see Note 4]	0.231	0.198	0.177	0.232	0.202	0.179
Sound attenuation section [Fans serving spaces with design background noise goals below NC35]	0.035	0.030	0.027	0.035	0.031	0.028

1. For requirements to be classified as a multi-zone VAV system, see definition for “Multi-zone variable air volume fan system.”
2. Filter pressure loss can only be counted once per fan system.
3. Energy recovery ratio (ERR) calculated per ANSI/ASHRAE 84-2020.
4. Power allowance requires further calculation, multiplying the actual pressure drop (in. wg) of the device/component by the watts/cfm in Table 170.2-C.

**TABLE 170.2-D
AIR DENSITY CORRECTION FACTORS**

ALTITUDE (ft)	CORRECTION FACTOR
<3,000	1.000
≥3,000 and <4,000	0.896
≥4,000 and <5,000	0.864
≥5,000 and <6,000	0.832
≥6,000	0.801

**TABLE 170.2-E
DEFAULT VALUES FOR FAN KW_{DESIGN} BASED ON MOTOR NAMEPLATE HP**

MOTOR NAMEPLATE HP	DEFAULT FAN KW _{DESIGN} WITH VARIABLE SPEED DRIVE (FAN KW _{DESIGN})	DEFAULT FAN KW _{DESIGN} WITHOUT VARIABLE SPEED DRIVE (FAN KW _{DESIGN})
<1	0.96	0.89
≥1 and <1.5	1.38	1.29
≥1.5 and <2	1.84	1.72
≥2 and <3	2.73	2.57
≥3 and <5	4.38	4.17
≥5 and <7.5	6.43	6.15
≥7.5 and <10	8.46	8.13
≥10 and <15	12.47	12.03
≥15 and <20	16.55	16.04
≥20 and <25	20.58	19.92
≥25 and <30	24.59	23.77
≥30 and <40	32.74	31.70
≥40 and <50	40.71	39.46
≥50 and <60	48.50	47.10
≥60 and <75	60.45	58.87
≥75 and ≤100	80.40	78.17

1. This table cannot be used for motor nameplate horsepower values greater than 100.
2. This table is to be used only with motors with a service factor ≤1.15. If the service factor is not provided, this table may not be used.

C. Economizers.

- i. Each cooling air handler that has a design total mechanical cooling capacity over 33,000 Btu/hr, or chilled-water cooling systems without a fan or that use induced airflow that has a cooling capacity greater than the systems listed in Table 170.2-E, shall include either:
 - a. An air economizer capable of modulating outside-air and return-air dampers to supply 100 percent of the design supply air quantity as outside air; or
 - b. A water economizer capable of providing 100 percent of the expected system cooling load, at outside air temperatures of 50°F dry-bulb and 45°F wet-bulb and below.

Exception 1 to Section 170.2(c)4Ci: Where special outside air filtration and treatment, for the reduction and treatment of unusual outdoor contaminants, makes compliance infeasible.

Exception 2 to Section 170.2(c)4Ci: Where the use of outdoor air for cooling will affect other systems, such as humidification or dehumidification, so as to increase overall building TDV energy use.

Exception 3 to Section 170.2(c)4Ci: Systems serving dwelling units.

Exception 4 to Section 170.2(c)4Ci: Where comfort cooling systems have the cooling efficiency that meets or exceeds the cooling efficiency improvement requirements in Table 170.2-F.

Exception 5 to Section 170.2(c)4Ci: Fan systems primarily serving computer rooms. See Section 140.9(a) for computer room economizer requirements.

**TABLE 170.2-E
CHILLED WATER SYSTEM COOLING CAPACITY**

CLIMATE ZONES	TOTAL BUILDING CHILLED WATER SYSTEM CAPACITY, MINUS CAPACITY OF THE COOLING UNITS WITH AIR ECONOMIZERS	
	Building Water-Cooled Chilled Water System	Air-Cooled Chilled Water Systems or District Chilled Water Systems
15	≥960,000 Btu/h (280 kW)	≥1,250,000 Btu/h (365 kW)
1–14	≥720,000 Btu/h (210 kW)	≥940,000 Btu/h (275 kW)
16	≥1,320,000 Btu/h (385 kW)	≥1,720,000 Bu/h (505 kW)

**TABLE 170.2-F
ECONOMIZER TRADE-OFF TABLE FOR COOLING SYSTEMS**

CLIMATE ZONE	EFFICIENCY IMPROVEMENT ^a
1	70%
2	65%
3	65%
4	65%
5	70%
6	30%
7	30%
8	30%
9	30%
10	30%
11	30%
12	30%
13	30%
14	30%
15	30%
16	70%

a. If a unit is rated with an annualized or part-load metric, then to eliminate the required economizer, only the annualized or part-load minimum cooling efficiency of the unit must be increased by the percentage shown. If the unit is only rated with a full load metric, like EER or COP cooling, then that metric must be increased by the percentage shown. To determine the efficiency required to eliminate economizer, when the unit equipment efficiency is rated with an energy-input divided by work-output metric, the metric shall first be converted to COP prior to multiplying by the efficiency improvement percentage and then converted back to the rated metric.

ii. If an economizer is required by Section 170.2(c)4Ci, and an air economizer is used to meet the requirement, then it shall be:

a. Designed and equipped with controls so that economizer operation does not increase the building heating energy use during normal operation; and

Exception to Section 170.2(c)4Cia: Systems that provide 75 percent of the annual energy used for mechanical heating from site-recovered energy or a site-solar energy source.

b. Capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load.

c. Designed and equipped with a device type and high limit shut off complying with Table 170.2-G.

iii. The air economizer and all air dampers shall have the following features:

a. **Warranty.** 5-year manufacturer warranty of economizer assembly.

b. **Damper reliability testing.** Suppliers of economizers shall certify that the economizer assembly, including but not limited to outdoor air damper, return air damper, drive linkage and actuator, has been tested and is able to open and close against the rated airflow and pressure of the system for 60,000 damper opening and closing cycles.

**TABLE 170.2-G
AIR ECONOMIZER HIGH LIMIT SHUT OFF CONTROL REQUIREMENTS**

DEVICE TYPE ^a	CLIMATE ZONES	REQUIRED HIGH LIMIT (Economizer Off When):	REQUIRED HIGH LIMIT (Economizer Off When):
		Equation ^b	Description
Fixed Dry Bulb	1, 3, 5, 11–16	$T_{OA} > 75^{\circ}\text{F}$	Outdoor air temperature exceeds 75°F
Fixed Dry Bulb	2, 4, 10	$T_{OA} > 73^{\circ}\text{F}$	Outdoor air temperature exceeds 73°F
Fixed Dry Bulb	6, 8, 9	$T_{OA} > 71^{\circ}\text{F}$	Outdoor air temperature exceeds 71°F
Fixed Dry Bulb	7	$T_{OA} > 69^{\circ}\text{F}$	Outdoor air temperature exceeds 69°F
Differential Dry Bulb	1, 3, 5, 11–16	$T_{OA} > T_{RA}^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature
Differential Dry Bulb	2, 4, 10	$T_{OA} > T_{RA} - 2^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 2°F
Differential Dry Bulb	6, 8, 9	$T_{OA} > T_{RA} - 4^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 4°F
Differential Dry Bulb	7	$T_{OA} > T_{RA} - 6^{\circ}\text{F}$	Outdoor air temperature exceeds return air temperature minus 6°F
Fixed Enthalpy ^c + Fixed Dry Bulb	All	$h_{OA} > 28 \text{ Btu/lb}^c$ or $T_{OA} > 75^{\circ}\text{F}$	Outdoor air enthalpy exceeds 28 Btu/lb of dry air ^c or Outdoor air temperature exceeds 75°F

a. Only the high limit control devices listed are allowed to be used and at the setpoints listed. Others, such as Dew Point, Fixed Enthalpy, Electronic Enthalpy and Differential Enthalpy Controls, may not be used in any climate zone for compliance with Section 170.2(c)4Ci unless approval for use is provided by the Energy Commission Executive Director.

b. Devices with selectable (rather than adjustable) setpoints shall be capable of being set to within 2°F and 2 Btu/lb of the setpoint listed.

c. At altitudes substantially different than sea level, the Fixed Enthalpy limit value shall be set to the enthalpy value at 75°F and 50% relative humidity. As an example, at approximately 6,000 foot elevation, the fixed enthalpy limit is approximately 30.7 Btu/lb.

- c. **Damper leakage.** Economizer outdoor air and return air dampers shall have a maximum leakage rate of 10 cfm/sf at 250 Pascals (1.0 in. of water) when tested in accordance with AMCA Standard 500-D. The economizer outside air and return air damper leakage rates shall be certified to the Energy Commission in accordance with Section 110.0.
 - d. **Adjustable setpoint.** If the high-limit control is fixed dry-bulb or fixed enthalpy + fixed dry-bulb then the control shall have an adjustable setpoint.
 - e. **Sensor accuracy.** Outdoor air, return air, mixed air and supply air sensors shall be calibrated within the following accuracies.
 - I. Drybulb and wetbulb temperatures accurate to $\pm 2^{\circ}\text{F}$ over the range of 40°F to 80°F ;
 - II. Enthalpy accurate to ± 3 Btu/lb over the range of 20 Btu/lb to 36 Btu/lb;
 - III. Relative humidity (RH) accurate to ± 5 percent over the range of 20 percent to 80 percent RH.
 - f. **Sensor calibration data.** Data used for control of the economizer shall be plotted on a sensor performance curve.
 - g. **Sensor high limit control.** Sensors used for the high limit control shall be located to prevent false readings, including but not limited to being properly shielded from direct sunlight.
 - h. **Relief air system.** Relief air systems shall be capable of providing 100 percent outside air without overpressurizing the building.
- iv. The space-conditioning system shall include the following:
- a. Unit controls shall have mechanical capacity controls interlocked with economizer controls such that the economizer is at 100 percent open position when mechanical cooling is on and does not begin to close until the leaving air temperature is less than 45°F .
 - b. Direct Expansion (DX) units greater than 65,000 Btu/hr that control the capacity of the mechanical cooling directly based on occupied space temperature shall have a minimum of two stages of mechanical cooling capacity.
 - c. DX units not within the scope of Section 170.2(c)4Ciib shall (i) comply with the requirements in Table 170.2-H, and (ii) have controls that do not false load the mechanical cooling system by limiting or disabling the economizer or by any other means except at the lowest stage of mechanical cooling capacity.

**TABLE 170.2-H
DIRECT EXPANSION (DX) UNIT REQUIREMENTS FOR
COOLING STAGES AND COMPRESSOR DISPLACEMENT**

COOLING CAPACITY	MINIMUM NUMBER OF MECHANICAL COOLING STAGES	MINIMUM COMPRESSOR DISPLACEMENT
$\geq 65,000$ Btu/h and $< 240,000$ Btu/h	3 stages	$\leq 35\%$ full load
$\geq 240,000$ Btu/h	4 stages	$\leq 25\%$ full load

- v. Systems that include a water economizer to meet Section 170.2(c)4Ci shall include the following:
 - a. Maximum pressure drop. Precooling coils and water-to-water heat exchangers used as part of a water economizer shall either have a water-side pressure drop of less than 15 feet of water, or a secondary loop shall be installed so that the coil or heat exchanger pressure drop is not contributing to pressure drop when the system is in the normal cooling (noneconomizer) mode.
 - b. Economizer systems shall be integrated with the mechanical cooling system so that they are capable of providing partial cooling even when additional mechanical cooling is required to meet the remainder of the cooling load. Controls shall not false load the mechanical cooling system by limiting or disabling the economizer or by any other means, such as hot gas bypass, except at the lowest stage of mechanical cooling.

D. Supply air temperature reset controls. Space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply-air temperatures. Air distribution systems serving zones that are likely to have constant loads shall be designed for the air flows resulting from the fully reset supply air temperature. Supply air temperature reset controls shall be:

- i. In response to representative building loads or to outdoor air temperature; and
- ii. At least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Exception 1 to Section 170.2(c)4D: Systems that meet the requirements of Section 170.2(c)3Bi, without using Exception 1 to that section.

Exception 2 to Section 170.2(c)4D: Where supply-air temperature reset would increase overall building energy use.

Exception 3 to Section 170.2(c)4D: Systems supplying zones in which specific humidity levels are required to satisfy process loads. Computer rooms or other spaces with only IT equipment may not use this exception.

E. **Electric-resistance heating.** Electric-resistance heating systems shall not be used for space heating.

Exception 1 to Section 170.2(c)4E: Where an electric-resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.

Exception 2 to Section 170.2(c)4E: Where an electric-resistance heating system supplements a heat pump heating system, and the heating capacity of the heat pump is more than 75 percent of the design heating load calculated in accordance with Section 170.2(c)1 at the design outdoor temperature specified in Section 170.2(c)2.

Exception 3 to Section 170.2(c)4E: Where the total capacity of all electric-resistance heating systems serving the entire building is less than 10 percent of the total design output capacity of all heating equipment serving the entire building.

Exception 4 to Section 170.2(c)4E: Where the total capacity of all electric-resistance heating systems serving the entire building, excluding those allowed under Exception 2, is no more than 3 kW.

Exception 5 to Section 170.2(c)4E: Heating systems serving as emergency backup to gas heating equipment.

F. **Heat rejection systems.** Heat rejection equipment used in comfort cooling systems such as air-cooled condensers, open cooling towers, closed-circuit cooling towers and evaporative condensers shall include the following:

i. **Fan speed control.** Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at $\frac{2}{3}$ of full speed or less, and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature or pressure of the heat rejection device.

Exception 1 to Section 170.2(c)4Fi: Heat rejection devices included as an integral part of the equipment listed in Table 110.2-A through Table 110.2-N.

Exception 2 to Section 170.2(c)4Fi: Condenser fans serving multiple refrigerant circuits.

Exception 3 to Section 170.2(c)4Fi: Condenser fans serving flooded condensers.

Exception 4 to Section 170.2(c)4Fi: Up to one-third of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement.

ii. **Tower flow turndown.** Open cooling towers configured with multiple condenser water pumps shall be designed so that all cells can be run in parallel with the larger of:

a. The flow that is produced by the smallest pump; or

b. 50 percent of the design flow for the cell.

iii. **Limitation on centrifugal fan cooling towers.**

Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet-bulb temperature shall use propeller fans and shall not use centrifugal fans.

Exception 1 to Section 170.2(c)4Fiii: Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability.

Exception 2 to Section 170.2(c)4Fiii: Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section 110.2, Table 110.2-F.

iv. **Multiple cell heat rejection equipment.** Multiple cell heat rejection equipment with variable speed fan drives shall:

a. Operate the maximum number of fans allowed that comply with the manufacturer's requirements for all system components, and

b. Control all operating fans to the same speed. Minimum fan speed shall comply with the minimum allowable speed of the fan drive as specified by the manufacturer's recommendation. Staging of fans is allowed once the fans are at their minimum operating speed.

v. **Cooling tower efficiency.** Axial fan, open-circuit cooling towers serving condenser water loops for chilled water plants with a total of 900 gpm or greater shall have a rated efficiency of no less than 60 gpm/hp when rated in accordance with the conditions as listed in Table 110.2-F.

Exception 1 to Section 170.2(c)4Fv: Replacement of existing cooling towers that are inside an existing building or on an existing roof.

Exception 2 to Section 170.2(c)4Fv: Cooling towers serving buildings in Climate Zone 1 or 16.

G. **Minimum chiller efficiency.** Chillers shall meet or exceed Path B from Table 110.2-D.

Exception 1 to Section 170.2(c)4G: Chillers with electrical service > 600 V.

Exception 2 to Section 170.2(c)4G: Chillers attached to a heat recovery system with a design heat recovery capacity > 40 percent of the design chiller cooling capacity.

Exception 3 to Section 170.2(c)4G: Chillers used to charge thermal energy storage systems where the charging temperature is < 40°F.

Exception 4 to Section 170.2(c)4G: In buildings with more than three chillers, only three chillers are required to meet the Path B efficiencies.

H. Limitation of air-cooled chillers. Chilled water plants shall not have more than 300 tons provided by air-cooled chillers.

Exception 1 to Section 170.2(c)4H: Where the water quality at the building site fails to meet manufacturer’s specifications for the use of water-cooled chillers.

Exception 2 to Section 170.2(c)4H: Chillers that are used to charge a thermal energy storage system with a design temperature of less than 40°F (4°C).

I. Hydronic system measures.

i. **Hydronic variable flow systems.** HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of: a) 50 percent or less of the design flow rate; or b) the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

Exception 1 to Section 170.2(c)4I: Systems that include no more than three control valves.

Exception 2 to Section 170.2(c)4I: Systems having a total pump system power less than or equal to 1.5 hp.

ii. **Chiller isolation.** When a chilled water system includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped in series for the purpose of increased temperature differential shall be considered as one chiller.

iii. **Boiler isolation.** When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).

iv. **Chilled and hot water temperature reset controls.** Systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

Exception to Section 170.2(c)4Iv: Hydronic systems that use variable flow to reduce pumping energy in accordance with Section 170.2(c)4Ii.

v. **Water-cooled air conditioner and hydronic heat pump systems.** Water circulation systems serving water-cooled air conditioners, hydronic heat pumps or both, that have total pump system power exceeding 5 hp, shall have flow controls that meet the requirements of Section 170.2(c)4Ivi. Each such air conditioner or heat pump shall have a two-position automatic valve

interlocked to shut off water flow when the compressor is off.

vi. **Variable flow controls.**

a. Variable speed drives. Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp shall have controls or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The pumps shall be controlled as a function of required differential pressure.

b. Pressure sensor location and setpoint.

I. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

II. For systems with direct digital control of individual coils with a central control panel, the static pressure setpoint shall be reset based on the valve requiring the most pressure, and the setpoint shall be no less than 80 percent open. Pressure sensors may be mounted anywhere.

Exception 1 to Section 170.2(c)4Ivi: Heating hot water systems.

Exception 2 to Section 170.2(c)4Ivi: Condenser water systems serving only water-cooled chillers.

vii. **Hydronic heat pump (WLHP) controls.**

Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of providing a heat pump water supply temperature deadband of at least 20°F between initiation of heat rejection and heat addition by the central devices.

Exception to Section 170.2(c)4Ivii: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, deadbands of less than 20°F shall be allowed.

J. Reserved.

K. Fan control. Each cooling system listed in Table 170.2-H shall be designed to vary the indoor fan air-flow as a function of load and shall comply with the following requirements:

i. DX and chilled water cooling systems that control the capacity of the mechanical cooling directly based on occupied space temperature shall (i) have a minimum of two stages of fan control with no more than 66 percent speed when operating on stage 1; and (ii) draw no more than

40 percent of the fan power at full fan speed, when operating at 66 percent speed.

- ii. All other systems, including but not limited to DX cooling systems and chilled water systems that control the space temperature by modulating the airflow to the space, shall have proportional fan control such that at 50 percent air flow the power draw is no more than 30 percent of the fan power at full fan speed.
- iii. Systems that include an air side economizer to meet Section 170.2(c)4Ci shall have a minimum of two speeds of fan control during economizer operation.

Exception to Section 170.2(c)4K: Modulating fan control is not required for chilled water systems with all fan motors <1 HP, or for evaporative systems with all fan motors < 1 HP, if the systems are not used to provide ventilation air and all indoor fans cycle with the load.

- L. **Mechanical system shut-off.** Any directly conditioned common use area space with operable wall or roof openings to the outdoors shall be provided with interlock controls that disable or reset the temperature setpoint to 55°F for mechanical heating and disable or reset the temperature setpoint to 90°F for mechanical cooling to that space when any such opening is open for more than 5 minutes.

Exception 1 to Section 170.2(c)4L: Interlocks are not required on doors with automatic closing devices.

Exception 2 to Section 170.2(c)4L: Any space without a thermostatic control (thermostat or a space temperature sensor used to control heating or cooling to the space).

- M. **Exhaust system transfer air.** Conditioned supply air delivered to any space with mechanical exhaust shall not exceed the greater of:
 - i. The supply flow required to meet the space heating or cooling load; or
 - ii. The ventilation rate required by the authority having jurisdiction, the facility Environmental Health and Safety Department or Section 160.2(c)3; or
 - iii. The mechanical exhaust flow minus the available transfer air. Available transfer air shall be from another conditioned space or return air plenums on the same floor and same smoke or fire compartment, and that at their closest point are within 15 feet of each other.

Exception 1 to Section 170.2(c)4M: Spaces that are required by applicable codes and standards to be maintained at a positive pressure differential relative to adjacent spaces.

Exception 2 to Section 170.2(c)4M: Spaces where the highest amount of transfer air that could be used for exhaust makeup may exceed

the available transfer airflow rate and where the spaces have a required negative pressure relationship.

- N. **Dedicated outdoor air systems (DOAS).** HVAC systems utilizing a dedicated outdoor air system (DOAS) to condition, temper or filter 100 percent outdoor air separate from local or central space-conditioning systems serving the same space shall meet the following criteria:

- i. Provide each space with one of the following configurations:
 - a. A DOAS unit and a separate independent space-conditioning system in which the independent space-conditioning system complies with the economizer requirements specified by Section 170.2(c)4Ci and the DOAS unit complies with the exhaust air heat recovery requirements specified in Section 170.2(c)4N.
 - b. A DOAS unit that meets or exceeds the following criteria and a separate space cooling system:
 - I. Provides at least the minimum ventilation air flow rate as specified in Section 120.1(c)3 and provides no less than 0.3 cfm/ft² during economizer operation.
 - II. Ventilation sensible energy recovery ratio of at least 60 percent or enthalpy recovery ratio of at least 50 percent at full flow cooling design conditions and heating design condition.
 - III. Energy recovery bypass or control to directly economize with ventilation air based on outdoor air temperature limits specified in Table 170.2-G.
 - c. DOAS units with airflow rate > 1,000 cfm must meet demand ventilation control requirements in accordance with Sections 160.2(c)5C, D and E.

Exception to Section 170.2(c)4Ni: Systems installed for the sole purpose of providing makeup air for exhausting toxic fumes, flammable materials, paint, corrosive fumes, dust, dryer exhaust, or commercial kitchen hoods used for collecting and removing grease vapors and smoke.

- ii. Ventilation fan systems shall be capable of modulating fan speed control.
- iii. Heating and cooling equipment fans, heating and cooling circulation pumps, and terminal unit fans shall cycle off, and terminal unit primary cooling air shall be shut off when there is no call for heating or cooling in the zone.

Exception to Section 170.2(c)4Niii: Fans used for heating and cooling using less than 0.12 watts per cfm may operate when space temperatures

are within the thermostat deadband to provide destratification and air mixing in the space.

- iv. The DOAS supply air shall be delivered directly to the occupied space or downstream of the terminal heating or cooling coils.

Exception 1 to Section 170.2(c)4Niv: Active chilled beam systems.

Exception 2 to Section 170.2(c)4Niv: Sensible only cooling terminal units with pressure-independent variable-airflow regulating devices limiting the DOAS supply air to the greater of latent load or minimum ventilation requirements.

Exception 3 to Section 170.2(c)4Niv: Terminal heating or cooling units that comply with the low fan power allowance requirements in Exception 6 to Section 170.2(c)4O.

- v. DOAS with mechanical cooling providing ventilation to multiple zones and operating in conjunction with zone heating and cooling systems shall not use heating or heat recovery to warm supply air above 60°F when representative building loads or outdoor air temperature indicate that the majority of zones require cooling.

- vi. DOAS with a total fan system power less than 1 kW shall not exceed a total combined fan power of 1.0 W/cfm. DOAS with fan power greater than or equal to 1 kW shall meet the requirements of Section 170.2(c)4A.

O. Exhaust air heat recovery. Fan systems designed to operate to the criteria listed in either Table 170.2-I or Table 170.2-J shall include an exhaust air heat recovery system that meets the following:

- i. A sensible energy recovery ratio of at least 60 percent or an enthalpy recovery ratio of at least 50 percent for both heating and cooling design conditions.
- ii. Energy recovery bypass or control to disable energy recovery and to directly economize with ventilation air based on outdoor air temperature limits specified in Table 170.2-G. For energy recovery systems where the transfer of energy cannot be stopped, bypass shall prevent the total airflow rate of either outdoor air or exhaust air through the energy recovery exchanger from exceeding 10 percent of the full design airflow rate.
- iii. For a DOAS unit and a separate independent space-conditioning system meeting the requirements of Section 170.2(c)4Nia, the design supply fan airflow rate shall be the total airflow of only the DOAS unit.

Exception to Section 170.2(c)4Oiii: DOAS units with the capability to shut off when a separate independent space-conditioning system meets the

economizer requirements specified by Section 170.2(c)4Ci is economizing.

Exception 1 to Section 170.2(c)4O: Systems meeting Section 140.9(c) prescriptive requirements for laboratory and factory exhaust systems.

Exception 2 to Section 170.2(c)4O: Systems serving spaces that are not cooled and that are heated to less than 60°F.

Exception 3 to Section 170.2(c)4O: Where more than 60 percent of the outdoor air heating energy is provided from site-recovered energy in Climate Zone 16.

Exception 4 to Section 170.2(c)4O: Sensible recovery ratio requirements at heating design conditions are exempted for Climate Zone 15.

Exception 5 to Section 170.2(c)4O: Sensible recovery ratio requirements at cooling design conditions are exempted for Climate Zone 1.

Exception 6 to Section 170.2(c)4O: Where the sum of the airflow rates exhausted and relieved within 20 feet of each other is less than 75 percent of the design outdoor airflow rate, excluding exhaust air that is either:

- i. used for another energy recovery system;
- ii. not allowed by the *California Mechanical Code* (Title 24, Part 4) for use in energy recovery systems with leakage potential; or
- iii. of Class 4 as specified in Section 160.2(c)8.

Exception 7 to Section 170.2(c)4O: Systems expected to operate less than 20 hours per week.

(d) Water-heating systems. Water-heating systems shall meet the requirements of either 1, 2, 3 or 4.

For recirculation distribution systems serving individual dwelling units, only demand recirculation systems with manual on/off control as specified in the Reference Appendix RA4.4.9 shall be used. Recirculation system serving multiple dwelling units shall meet the requirements of Sections 110.3(c)2 and 110.3(c)5, and shall be capable of automatically controlling the recirculation pump operation based on measurement of hot water demand and hot water return temperature:

- 1. For systems serving individual dwelling units, the water-heating system shall meet the requirement of either A, B or C, or shall meet the performance compliance requirements of Section 170.1:
 - A. A single 240 volt heat pump water heater. In addition, meet the following:
 - i. A compact hot water distribution system as specified in Reference Appendix RA4.4.6 in Climate Zones 1 and 16; and
 - ii. A drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9 in Climate Zone 16.

- B. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher. In addition, for Climate Zone 16, a drain water heat recovery system that is field verified as specified in Reference Appendix RA3.6.9.
 - C. A gas or propane instantaneous water heater with an input of 200,000 Btu per hour or less and no storage tank.
2. For heat pump water-heating systems serving multiple dwelling units, the water-heating system shall be installed according to the manufacturer’s design and installation guidelines and meet the following requirements:
- A. The hot water return from the recirculation loop shall connect to a recirculation loop tank and shall not directly connect to the primary heat pump water heater inlet or the primary thermal storage tanks.
 - B. The fuel source for the recirculation loop tank shall be electricity if auxiliary heating is needed. The recirculation loop heater shall be capable of multi-pass water-heating operation.
 - C. For systems with single pass primary heat pump water heater, the primary thermal storage tanks shall be piped in series if multiple tanks are used. For systems with multi-pass primary heat pump water heater, the primary thermal storage tanks shall be piped in parallel if multiple tanks are used.
 - D. The primary storage tank temperature setpoint shall be at least 135°F.
 - E. The recirculation loop tank temperature setpoint shall be at least 10°F lower than the primary thermal storage tank temperature setpoint such that hot water from the recirculation loop tank is used for the temperature maintenance load before engaging the recirculation loop tank heater.
 - F. The minimum heat pump water heater compressor cut-off temperature shall be equal to or lower than 40°F ambient air temperature.
 - G. A recirculation system.
 - Exception to Section 170.2(d)2G:** Buildings with eight or fewer dwelling units.
 - H. Design documentation shall be provided in accordance with JA14.4.
3. For gas or propane systems serving multiple dwelling units, a central water-heating system that includes the following components shall be installed:
- A. For Climate Zones 1 through 9, gas service water-heating systems with a total installed gas water-heating input capacity of 1 MMBtu/h or greater shall have gas service water-heating equipment with a minimum thermal efficiency of 90 percent. Multiple units are allowed to meet this requirement with an

input capacity-weighted average of at least 90 percent.

Exception 1 to Section 170.2(d)3A: Individual gas water heaters with input capacity at or below 100,000 Btu/h shall not be included in the calculations of the total system input or total system efficiency.

Exception 2 to Section 170.2(d)3A: If 25 percent of the annual water-heating requirement is provided by site-solar energy or site-recovered energy.

B. A recirculation system.

Exception to Section 170.2(d)3B: Buildings with eight or fewer dwelling units.

C. A solar water-heating system meeting the installation criteria specified in Reference Residential Appendix RA4 and with a minimum solar savings fraction of either i or ii below:

- i. A minimum solar savings fraction of 0.20 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.35 in Climate Zones 10 through 16; or

- ii. A minimum solar savings fraction of 0.15 in Climate Zones 1 through 9 or a minimum solar savings fraction of 0.30 in Climate Zones 10 through 16. In addition, a drain water heat recovery system that is field verified as specified in the Reference Appendix RA3.6.9.

4. A water-heating system serving multiple dwelling units determined by the Executive Director to use no more energy than the one specified in Subsection 1, 2 or 3 above.

(e) **Lighting.** Dwelling unit lighting shall meet the applicable mandatory requirements of Section 160.5(a). Common use area lighting shall meet the following requirements:

Exception to Section 170.2(e): Common use areas providing shared provisions for living, eating, cooking or sanitation to dwelling units that would otherwise lack these provisions may instead comply with Section 160.5(a).

1. **Interior common use area lighting.** A building complies with Section 170.2(e)1 if:

- A. The calculation of adjusted indoor lighting power of all proposed building areas combined, calculated under Subsection 170.2(e)2, is no greater than the calculation of allowed indoor lighting power, specific methodologies calculated under Subsection 170.2(e)4; and

- B. The calculation of allowed indoor lighting power, general rules comply with Subsection 170.2(e)3.

The prescriptive limits on indoor lighting power are the smaller of the actual and allowed indoor lighting power values determined in accordance with Item i.

**TABLE 170.2-I
ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW (<8,000 HOURS / YEAR)**

% OUTDOOR AIR AT FULL DESIGN AIRFLOW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥10% and <20%	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
≥20% and <30%	≥15,000	≥20,000	NR	NR	NR	NR	NR	NR	NR	NR	≥18,500	≥18,500	≥18,500	≥18,500	≥18,500	≥18,500
≥30% and <40%	≥13,000	≥15,000	NR	NR	NR	NR	NR	NR	NR	NR	≥15,000	≥15,000	≥15,000	≥15,000	≥15,000	≥15,000
≥40% and <50%	≥10,000	≥12,000	NR	NR	NR	NR	NR	NR	NR	≥22,000	≥10,000	≥10,000	≥10,000	≥10,000	≥10,000	≥10,000
≥50% and <60%	≥9,000	≥10,000	NR	≥18,500	NR	NR	NR	NR	NR	≥17,000	≥8,000	≥8,000	≥8,000	≥8,000	≥8,000	≥8,000
≥60% and <70%	≥7,000	≥7,500	NR	≥16,500	NR	NR	NR	NR	≥20,000	≥15,000	≥7,000	≥7,000	≥7,000	≥7,000	≥7,000	≥7,000
≥70% and <80%	≥6,500	≥7,000	NR	≥15,000	NR	NR	NR	NR	≥17,000	≥14,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥80%	≥4,500	≥6,500	NR	≥14,000	NR	NR	NR	NR	≥15,000	≥13,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

**TABLE 170.2-J
ENERGY RECOVERY REQUIREMENTS BY CLIMATE ZONE AND PERCENT OUTDOOR AIR AT FULL DESIGN AIRFLOW (≥8,000 HOURS / YEAR)**

% OUTDOOR AIR AT FULL DESIGN AIRFLOW	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
≥10% and <20%	≥10,000	≥10,000	NR	NR	NR	NR	NR	NR	NR	≥40,000	≥40,000	≥20,000	≥10,000	≥10,000	≥10,000	≥10,000
≥20% and <30%	≥2,000	≥5,000	≥13,000	≥9,000	≥9,000	NR	NR	NR	NR	≥15,000	≥15,000	≥5,000	≥5,000	≥5,000	≥5,000	≥5,000
≥30% and <40%	≥2,000	≥3,000	≥10,000	≥6,500	≥6,500	NR	NR	NR	≥15,000	≥7,500	≥7,500	≥3,000	≥3,000	≥3,000	≥3,000	≥3,000
≥40% and <50%	≥2,000	≥2,000	≥8,000	≥6,000	≥6,000	NR	NR	NR	≥12,000	≥6,000	≥6,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥50% and <60%	≥2,000	≥2,000	≥7,000	≥6,000	≥6,000	NR	NR	NR	≥20,000	≥5,000	≥5,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥60% and <70%	≥2,000	≥2,000	≥6,000	≥6,000	≥6,000	NR	NR	NR	≥18,000	≥4,000	≥4,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥70% and <80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	NR	≥15,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000
≥80%	≥2,000	≥2,000	≥6,000	≥5,000	≥5,000	NR	NR	NR	≥12,000	≥3,000	≥3,000	≥2,000	≥2,000	≥2,000	≥2,000	≥2,000

TABLE 170.2-K
MECHANICAL COMPONENT PACKAGE—MULTIFAMILY STANDARD BUILDING DESIGN

MULTIFAMILY		CLIMATE ZONE																
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Unitary (serving one dwelling unit)	HRV or ERV Sensible Recovery Efficiency	0.67	0.67	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.67	0.67	0.67	0.67	0.67	0.67
	HRV or ERV Fan Efficacy (W/cfm)	0.6	0.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.6	0.6	0.6	0.6	0.6	0.6
	Non-HRV or Non-ERV Fan Efficacy (W/cfm)	NR	NR	NR	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	NR	NR	NR	NR	NR	NR
	If Heat Pump, HSPF/HSPF2	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
Central (serving multiple dwelling units)	If Dual-Fuel Heat Pump, AFUE	MIN	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Refrigerant Charge Verification or Fault Indicator Display	NR	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	NR
Central System Air Handlers	SEER/SEER2	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN	MIN
	Sensible Recovery Efficiency or Effectiveness	0.67	0.67	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.67	0.67	0.67	0.67	0.67	0.67
Duct Insulation	Bypass Function	REQ	REQ	NR	NR	NR	NR	NR	NR	NR	NR	NR	REQ	REQ	REQ	REQ	REQ	REQ
	Central Fan Integrated Ventilation System Fan Efficacy	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ	REQ
Water Heating	Ducts in Unconditioned Space	R-8	R-8	R-6	R-8	R-6	R-6	R-6	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8	R-8
	All Buildings	System shall meet Section 170.2(d)																

1. Requirements only apply when using balanced ventilation to meet Section 160.2(b)2Aivb.

2. HSPF means "heating seasonal performance factor."

3. A supplemental heating unit may be installed in a space served directly or indirectly by a primary heating system, provided that the unit thermal capacity does not exceed 2 kilowatts or 7,000 Btu/hr and is controlled by a time-limiting device not exceeding 30 minutes.

2. **Calculation of Adjusted Indoor Lighting Power.** The Adjusted Indoor Lighting Power of all proposed building areas is the total watts of all planned permanent and portable lighting systems in all areas of the proposed building; subject to the applicable adjustments under Subdivisions A through D of this subsection.

A. Two interlocked lighting systems: No more than two lighting systems may be used for an area, and if there are two they must be interlocked. Where there are two interlocked lighting systems, the watts of the lower wattage system may be excluded from the Adjusted Indoor Lighting Power if:

- i. An installation certificate detailing compliance with Section 170.2(e)1A is submitted in accordance with Section 10-103 and Section 160.5(e); and
- ii. The area (or areas) served by the interlocking systems is an auditorium, a conference room, a multipurpose room or a theater; and
- iii. The two lighting systems are interlocked with a nonprogrammable double-throw switch to prevent simultaneous operation of both systems.

For compliance with Part 6, a nonprogrammable double-throw switch is an electrical switch commonly called a “single pole double throw” or “three-way” switch that is wired as a selector switch allowing one of two loads to be enabled. It can be a line voltage switch or a low voltage switch selecting between two relays. It cannot be overridden or changed in any manner that would permit both loads to operate simultaneously.

B. Reduction of wattage through controls. In calculating Adjusted Indoor Lighting Power, the installed watts of a luminaire providing general lighting in an area listed in Table 170.2-L may be reduced by the product of (i) the number of watts controlled as described in Table 170.2-L, times (ii) the applicable power adjustment factor (PAF), if all of the following conditions are met:

- i. An installation certificate is submitted in accordance with Section 160.5(e)2; and
- ii. Luminaires and controls meet the applicable requirements of Section 110.9 and Sections 160.5(b) through 160.6; and
- iii. The controlled lighting is permanently installed general lighting systems and the controls are permanently installed nonresidential-rated lighting controls.

When used for determining PAFs for general lighting in offices, furniture mounted luminaires that comply with all of the following conditions shall qualify as permanently installed general lighting systems:

- a. The furniture mounted luminaires shall be permanently installed no later than the time of building permit inspection; and

- b. The furniture mounted luminaires shall be permanently hardwired; and
 - c. The furniture mounted lighting system shall be designed to provide indirect general lighting; and
 - d. Before multiplying the installed watts of the furniture mounted luminaire by the applicable PAF, 0.3 watts per square foot of the area illuminated by the furniture mounted luminaires shall be subtracted from installed watts of the furniture mounted luminaires; and
 - e. The lighting control for the furniture mounted luminaire complies with all other applicable requirements in Section 170.2(e)1Aii.
- iv. At least 50 percent of the light output of the controlled luminaire is within the applicable area listed in Table 170.2-L. Luminaires on lighting tracks shall be within the applicable area in order to qualify for a PAF.
 - v. Only one PAF from Table 170.2-L may be used for each qualifying luminaire. PAFs shall not be added together unless allowed in Table 170.2-L.
 - vi. Only lighting wattage directly controlled in accordance with Section 170.2(e)1Aii shall be used to reduce the installed watts as allowed by Section 170.2(e)1Aii for calculating the Adjusted Indoor Lighting Power. If only a portion of the wattage in a luminaire is controlled in accordance with Section 170.2(e)1Aii, then only that portion of controlled wattage may be reduced in calculating Adjusted Indoor Lighting Power.
 - vii. Lighting controls used to qualify for a PAF shall be designed and installed in addition to manual, multilevel and automatic lighting controls required in Section 160.5(b)4, and in addition to any other lighting controls required by any provision of Part 6. PAFs shall not be available for lighting controls required by Part 6.
 - viii. To qualify for the PAF for daylight continuous dimming plus OFF control, the daylight control and controlled luminaires shall comply with Sections 160.5(b)4D, 160.5(e)1C and 160.5(e)1G, and the controls shall be continuously dimming and shall additionally turn lights completely OFF when the daylight available in the daylight zone is greater than 150 percent of the illuminance received from the general lighting system at full power. The PAF shall apply to the luminaires in the primary sidelit daylight zone, secondary sidelit daylight zone and skylit daylight zone.
 - ix. To qualify for the PAF for an occupant sensing control controlling the general lighting in open plan office areas above workstations, in accordance with Table 170.2-L, the following requirements shall be met:
 - a. The open plan office area shall be greater than 250 square feet; and

- b. This PAF shall be available only in office areas that contain workstations; and
- c. Controlled luminaires shall only be those that provide general lighting directly above the controlled area, or furniture mounted luminaires that comply with Section 170.2(e)1Aii and provide general lighting directly above the controlled area; and
- d. Qualifying luminaires shall be controlled by occupant sensing controls that meet all of the following requirements, as applicable:
 - I. Infrared sensors shall be equipped by the manufacturer, or fitted in the field by the installer, with lenses or shrouds to prevent them from being triggered by movement outside of the controlled area.
 - II. Ultrasonic sensors shall be tuned to reduce their sensitivity to prevent them from being triggered by movements outside of the controlled area.
 - III. All other sensors shall be installed and adjusted as necessary to prevent them from being triggered by movements outside of the controlled area.
- x. To qualify for the PAF for an Institutional Tuning in Table 170.2-L, the tuned lighting system shall comply with all of the following requirements:
 - a. The lighting controls shall limit the maximum output or maximum power draw of the controlled lighting to 85 percent or less of full light output or full power draw; and
 - b. The means of setting the limit is accessible only to authorized personnel; and
 - c. The setting of the limit is verified by the acceptance test required by Section 160.5(e)1G; and
 - d. The construction documents specify which lighting systems shall have their maximum light output or maximum power draw set to no greater than 85 percent of full light output or full power draw.
- xi. To qualify for the PAF for a demand responsive control in Table 170.2-L, the general lighting wattage receiving the PAF shall not be within the scope of Section 110.12(c) and a demand responsive control shall meet all of the following requirements:
 - a. The controlled lighting shall be capable of being automatically reduced in response to a demand response signal; and
 - b. General lighting shall be reduced in a manner consistent with uniform level of illumination requirements in Table 160.5-B.
- xii. To qualify for the PAFs for clerestory fenestration, horizontal slats or light shelves in Table

170.2-L, the daylighting design shall meet the requirements in Section 140.3(d). The PAFs shall only apply to lighting in a primary or secondary sidelit daylit zone where continuous dimming daylighting controls meeting the requirements of Section 160.5(b)4D are installed.

C. Lighting wattage excluded. The watts of the following indoor lighting applications may be excluded from Adjusted Indoor Lighting Power:

- i. Lighting installed by the manufacturer in walk-in coolers or freezers, vending machines and food preparation equipment.
- ii. Lighting that is required for exit signs subject to the CBC. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.
- iii. Exit way or egress illumination that is normally off and that is subject to the CBC.
- iv. Temporary lighting systems.
- v. Lighting systems in qualified historic buildings, as defined in the *California Historical Building Code* (Title 24, Part 8), are exempt from the lighting power density allowances if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems in qualified buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other lighting systems in qualified historic buildings shall comply with the lighting power density allowances.
- vi. Lighting for signs shall comply with Section 170.2(e)7.
- vii. Lighting in elevators where the lighting meets the requirements in Section 120.6(f).
- viii. Lighting connected to a Life Safety Branch or Critical Branch, as specified in Section 517 of the *California Electrical Code*.

D. Luminaire classification and power adjustment.

- i. Luminaire classification and power shall be determined in accordance with Section 160.5(b)1.
- ii. Small Aperture Tunable-White and Dim-to-Warm Luminaires Lighting Power Adjustment. For qualifying small aperture tunable-white and dim-to-warm LED luminaires, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage by 0.75. Qualifying luminaires shall meet all of the following:
 - a. Small aperture. Qualifying luminaires with a luminaire aperture length longer than 18 inches shall have a luminaire aperture no wider than 4 inches. Qualifying luminaires with a luminaire aperture length of 18 inches

or less shall have a luminaire aperture no wider than 8 inches.

- b. Color changing. Qualifying tunable-white luminaires shall be capable of a color change greater than or equal to 2000 Kelvin correlated color temperature (CCT). Qualifying dim-to-warm luminaires shall be capable of color change greater than or equal to 500 Kelvin CCT.

- c. Controls. Qualifying luminaires shall be connected to controls that allow color changing of the luminaires.

- iii. Tailored Method Display Lighting Mounting Height Lighting Power Adjustment. For wall display luminaires or floor display luminaires meeting the Tailored Method described in Sections 170.2(e)1Ciig and h and where the bottom of luminaires are 10 feet 7 inches and greater above the finished floor, the adjusted indoor lighting power of these luminaires shall be calculated by multiplying their maximum rated wattage and the appropriate mounting height adjustment factor from Table 170.2-O. Luminaire mounting height is the distance from the finished floor to the bottom of the luminaire. General lighting shall not qualify for a mounting height multiplier.

3. Calculation of allowed indoor lighting power: general rules.

- A. The allowed indoor lighting power allotment for conditioned areas shall be calculated separately from the allowed lighting power allotment for unconditioned areas. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between conditioned and unconditioned area allotments.

- B. The allowed indoor lighting power allotment shall be calculated separately from the allowed outdoor lighting power allotment. Each allotment is applicable solely to the area to which it applies, and there shall be no trade-offs between the separate indoor and outdoor allotments.

- C. The allowed indoor lighting power allotment for general lighting shall be calculated as follows:

- i. The Area Category Method, as described in Section 170.2(e)1Ci, shall be used either by itself for all common use areas in the building, or when some areas in the building use the Tailored Method described in Section 170.2(e)1Cii. Under the Area Category Method (either by itself or in conjunction with the Tailored Method), as described more fully in Section 170.2(e)1Ci, and subject to the adjustments listed there, the allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

- a. For conditioned areas, by multiplying the conditioned square feet of the area times the

applicable allotment of watts per square foot for the area shown in Table 170.2-M (or Table 170.2-N if the Tailored Method is used for that area).

- b. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 170.2-M (or Table 170.2-N if the Tailored Method is used for that area).

The allowed indoor lighting power allotment for general lighting for one area for which the Area Category Method was used may be increased up to the amount that the allowed indoor lighting power allotment for general lighting for another area using the Area Category Method or Tailored Method is decreased, except that such increases and decreases shall not be made between conditioned and unconditioned space.

- D. The tailored method, as described in Section 170.2(e)1Cii, shall be used either by itself for all areas in the building, or when some areas in the building use the Area Category Method described in Section 170.2(e)1Ci. Under the Tailored Method (either by itself or in conjunction with the Area Category Method) as described more fully in Section 170.2(e)1Cii, and subject to the adjustments listed there, allowed indoor lighting power allotment for general lighting shall be calculated for each area in the building as follows:

- i. For conditioned areas, by multiplying the conditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 170.2-N (or Table 170.2-M if the Area Category Method is used for that area);

- ii. For unconditioned areas, by multiplying the unconditioned square feet of the area times the applicable allotment of watts per square foot for the area shown in Table 170.2-L (or Table 170.2-M if the Area Category Method is used for that area).

- E. The allowed indoor lighting power allotment for general lighting for one area for which the Tailored Method was used may be increased up to the amount that the allowed indoor lighting power for general lighting for another area is decreased, but only if the Tailored Method or Area Category Method was used for the other area, except that such increases and decreases shall not be made between conditioned and unconditioned space.

- F. If the Area Category Method is used for an area, the Tailored Method may not be used for that area. If the Tailored Method is used for an area, the Area Category Method may not be used for that area.

4. Calculation of allowed indoor lighting power: specific methodologies. The allowed indoor lighting power for each common use primary function area shall

be calculated using only one of the methods in Subsection i, ii or iii below as applicable.

A. Area Category Method. Requirements for using the Area Category Method include all of the following:

- i. The Area Category Method shall be used only for primary function areas, as defined in Section 100.1, that are listed in Table 170.2-M. For primary function areas not listed, selection of a reasonably equivalent type shall be permitted.
- ii. For purposes of compliance with Section 170.2(e)1Ci, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 170.2-M.
- iii. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a primary function area.
- iv. The allowed indoor lighting power for each primary function area is the Lighting Power Density value in Table 170.2-M times the square feet of the primary function area. The total allowed indoor lighting power for the building is the sum of all allowed indoor lighting power for all areas in the building.
- v. In addition to the allowed indoor lighting power calculated according to Sections 170.2(e)1Cia through f, the building may add additional lighting power allowances for qualifying lighting systems as specified in the Qualifying Lighting Systems column in Table 170.2-M under the following conditions:
 - a. Only primary function areas having a lighting system as specified in the Qualifying Lighting Systems column in Table 170.2-M and in accordance with the corresponding footnote of the table shall qualify for the additional lighting power allowances; and
 - b. The additional lighting power allowances shall be used only if the plans clearly identify all applicable task areas and the lighting equipment designed to illuminate these tasks; and
 - c. Tasks that are performed less than 2 hours per day or poor quality tasks that can be improved are not eligible for the additional lighting power allowances; and
 - d. The additional lighting power allowances shall not utilize any type of luminaires that are used for general lighting in the building; and
 - e. The additional lighting power allowances shall not be used when using the Complete Building Method, or when the Tailored Method is used for any area in the building; and

f. The additional lighting power allowed is the smaller of:

- I. the lighting power density listed in the “Allowed Additional Lighting LPD” column in Table 170.2-M, times the square feet of the primary function, or
- II. the adjusted indoor lighting power of the applicable lighting; and

g. Reserved.

B. Tailored Method. Requirements for using the Tailored Method include all of the following:

- i. The Tailored Method shall be used only for primary function areas listed in Table 170.2-N as defined in Section 100.1.
- ii. Allowed indoor lighting power allotments for general lighting shall be determined according to Section 170.2(e)1Ciif, as applicable.
- iii. For compliance with Section 170.2(e)1Cii, an “area” shall be defined as all contiguous areas that accommodate or are associated with a single primary function area listed in Table 170.2-N.
- iv. Where areas are bounded or separated by interior partitions, the floor area occupied by those interior partitions may be included in a primary function area.
- v. In addition to the allowed indoor lighting power allotments for general lighting calculated according to Section 170.2(e)1Ciif, as applicable, the building may add additional lighting power allowances for wall display lighting, task lighting and decorative/special effects lighting, according to Sections 170.20(e)1Ciig through j.
- vi. Determine allowed indoor lighting power allotments for general lighting for primary function areas listed in Table 170.2-N as follows:
 - a. Use the general illumination level (lux) listed in column 2 of Table 170.2-N to determine the allowed general lighting power density allotments for the area.
 - b. Determine the room cavity ratio (RCR) for the area. The RCR shall be calculated according to the applicable equation in Table 170.2-P.
 - c. Find the allowed general lighting power density allotment in Table 170.2-Q that is applicable to the general illuminance level (lux) from column 2 of Table 170.2-N (as described in Item i) and the RCR determined in accordance with Table 170.2-P (as described in Item ii).
 - d. Determine the square feet of the area in accordance with Sections 170.2(e)1Ciiic and d.
 - e. Multiply the allowed lighting power density allotment, as determined in accordance with Item iii by the square feet of each primary function area, as determined in accordance with Item iv. The product is the allowed

- indoor lighting power allotment for general lighting for the area.
- vii. Determine additional allowed power for wall display lighting according to column 3 of Table 170.2-N for each primary function area as follows:
 - a. Qualifying wall lighting shall:
 - I. Be mounted within 10 feet of the wall having the wall display. When track lighting is used for wall display, and where portions of that lighting track are more than 10 feet from the wall and other portions are within 10 feet of the wall, portions of track more than 10 feet from the wall shall not be used for the wall display allowance.
 - II. Be a lighting system type appropriate for wall lighting. Lighting systems appropriate for wall lighting are lighting track adjacent to the wall, wall-washer luminaires, luminaires behind a wall valance or wall cove, or accent light. (Accent luminaires are adjustable or fixed luminaires with PAR, R, MR or AR, or luminaires providing directional display light.)
 - b. Additional allowed power for wall display lighting is available only for lighting that illuminates walls having wall displays. The length of display walls shall include the length of the perimeter walls, including but not limited to closable openings and permanent full height interior partitions. Permanent full height interior partitions are those that (I) extend from the floor to within 2 feet of the ceiling or are taller than 10 feet and (II) are permanently anchored to the floor.
 - c. For wall display lighting where the bottom of the luminaire is greater than 10 feet 6 inches above the finished floor, the mounting height adjustment factor from Table 170.2-O can be used to adjust the installed luminaire wattage as specified in Section 170.2(e)1Aivc.
 - d. The allowed power for wall display lighting shall be the smaller of:
 - I. the “wall display lighting power density” determined in accordance with Table 170.2-N, multiplied by the wall display lengths determined in accordance with Item iii; and
 - II. The Adjusted Indoor Lighting Power used for the wall display lighting systems.
 - e. Lighting internal to display cases that are attached to a wall or directly adjacent to a wall are counted as wall display lighting as specified in Section 170.2(e)1Ciig. All other lighting internal to display cases is counted as floor display lighting.
 - viii. Determine additional allowed power allotment for task lighting according to column 4 of Table 170.2-N for each primary function area as follows:
 - a. Additional allowed power for task lighting may be used by qualifying task lighting systems. For floor areas qualifying for task lighting power allowances, the additional allowed power shall be used only once for the same floor area, so that the allowance shall not be additive.
 - b. Qualifying task lighting shall:
 - I. Be located immediately adjacent to and capable of illuminating the task for which it is installed.
 - II. Be of a type different from the general lighting system.
 - III. Be separately switched from the general lighting system.
 - c. The square footage of task areas shall be determined in accordance with Sections 170.2(e)1ciic and d, except that any floor area designed to not have tasks, such as floor areas designated as a path of egress, shall not be included for the task lighting allowance.
 - d. The allowed power for task lighting for each applicable area shall be the smaller of:
 - I. The allowed task lighting power determined in accordance with Section 170.2(e)1ciih multiplied by the floor square footage determined in accordance with Section 170.2(e)1cihIII; and
 - II. The adjusted indoor lighting power used for the task lighting systems.
 - ix. Determine additional allowed power for decorative/special effects lighting for each primary function area as follows:
 - a. Qualifying decorative/special effects lighting includes luminaires such as chandeliers, sconces, lanterns, neon and cold cathode, light emitting diodes, theatrical projectors, moving lights and light color panels when any of those lights are used in a decorative manner that does not serve as display lighting or general lighting.
 - b. Additional lighting power for decorative/special effects lighting shall be used only if allowed by column 5 of Table 170.2-N.
 - c. Additional lighting power for decorative/special effects lighting shall be used only in areas having decorative/special effects lighting. The square footage of the floor area shall be determined in accordance with Sections 170.2(e)1Ciic and d, and it shall not include floor areas not having decorative/special effects lighting.

- d. The additional allowed power for decorative/special effects lighting for each applicable area shall be the smaller of:
 - I. The product of the “allowed decorative/special effects lighting power” determined in accordance with Section 170.2(e)1CiikII, multiplied by the floor square footage determined in accordance with Section 170.2(e)1CiikIII; and
 - II. The adjusted indoor lighting power of allowed ornamental/special effects lighting.

5. **Reserved.**

6. **Outdoor lighting.**

A. A multifamily or mixed occupancy outdoor lighting installation complies with this section if it meets the requirements in Subsections 170.2(e)6B and C, and the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Subsection 170.2(e)6D. The allowed outdoor lighting shall be calculated according to outdoor lighting zone in Title 24, Part 1, Section 10-114.

Exceptions to Section 170.2(e)6A: When more than 50 percent of the light from a luminaire falls within one or more of the following applications, the lighting power for that luminaire shall be exempt from Section 170.2(e)6:

- i. Temporary outdoor lighting.
- ii. Lighting required and regulated by the Federal Aviation Administration and the Coast Guard.
- iii. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-

- of-way owned or maintained by a local municipality or utility.
- iv. Lighting for sports and athletic fields, and children’s playgrounds.
- v. Reserved.
- vi. Lighting of public monuments.
- vii. Lighting of signs complying with the requirements of Sections 160.5(d) and 170.2(e)7.
- viii. Lighting of stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance, and ramps that are other than parking garage ramps.
- ix. Landscape lighting.
- x. Reserved.
- xi. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
- xii. Outdoor lighting systems for qualified historic buildings, as defined in the *California Historic Building Code* (Title 24, Part 8), if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section 170.2(e)6.

**TABLE 170.2-L
LIGHTING POWER ADJUSTMENT FACTORS (PAF)**

TYPE OF CONTROL	TYPE OF AREA	FACTOR
1. Daylight Continuous Dimming Plus OFF Control	Luminaires in skylit daylit zone or primary sidelit daylit zone	0.10
2. Occupant Sensing Controls in Office Spaces Larger Than 250 Square Feet	In open plan offices > 250 square feet: One sensor controlling an area that is: No larger than 125 square feet	0.30
	In open plan offices > 250 square feet: One sensor controlling an area that is: From 126 to 250 square feet	0.20
3. Institutional Tuning	Luminaires in nondaylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.10
	Luminaires in daylit areas. Luminaires that qualify for other PAFs in this table may also qualify for this tuning PAF.	0.05
4. Demand Responsive Control	General lighting luminaires not in the scope of Section 110.12(c). Luminaires that qualify for other PAFs in this table may also qualify for this demand responsive control PAF.	0.05
5. Clerestory Fenestration	Luminaires in daylit areas adjacent to the clerestory. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
6. Horizontal Slats	Luminaires in daylit areas adjacent to vertical fenestration with interior or exterior horizontal slats. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.05
7. Light Shelves	Luminaires in daylit areas adjacent to clerestory fenestration with interior or exterior light shelves. This PAF may be combined with the PAF for clerestory fenestration. Luminaires that qualify for daylight dimming plus OFF control may also qualify for this PAF.	0.10

- a. To qualify for any of the power adjustment factors in this table, the installation shall comply with the applicable requirements in Section 170.2(e)1Aii.
- b. Only one PAF may be used for each qualifying luminaire unless combined.
- c. Lighting controls that are required for compliance with Part 6 shall not be eligible for a PAF.

**TABLE 170.2-M
AREA CATEGORY METHOD—LIGHTING POWER DENSITY VALUES (WATTS/FT²)**

PRIMARY FUNCTION AREA		ALLOWED LIGHTING POWER DENSITY FOR GENERAL LIGHTING (W/ft ²)	ADDITIONAL LIGHTING POWER QUALIFIED LIGHTING SYSTEMS	ADDITIONAL LIGHTING POWER ADDITIONAL ALLOWANCE (W/ft ² , unless noted otherwise)
Storage		0.45	—	—
Conference, Multipurpose and Meeting Area		0.75	Display/decorative	0.30
Copy Room		0.50	—	—
Corridor Area		0.40	Decorative/display	0.25
Dining Area		0.45	Display/decorative	0.35
Bar/Lounge and Fine Dining				
Dining Area		0.45	Display/decorative	0.25
Cafeteria/Fast Food				
Dining Area		0.40	Display/decorative	0.25
Family and Leisure				
Health Care / Assisted Living		0.75	Tunable white or dim-to-warm ⁸	0.10
Nurse’s Station				
Health Care/Assisted Living		0.85	Tunable white or dim-to-warm ⁸	0.10
Physical Therapy Room				
Kitchen/Food Preparation Area		0.95	—	—
Electrical, Mechanical, Telephone Rooms		0.40	Detailed task work ¹	0.20
Exercise/Fitness Center and Gymnasium Area		0.50	—	—
Lobby, Main Entry		0.70	Display/decorative	0.25
Locker Room		0.45	—	—
Lounge, Breakroom or Waiting Area		0.55	Display/decorative	0.25
Concourse and Atrium Area		0.60	Display/decorative	0.25
Office Area	> 250 square feet	0.60	Decorative/display and portable lighting for office areas ⁵	0.20
Office Area	≤ 250 square feet	0.65	Decorative/display and portable lighting for office areas ⁵	0.20
Parking Garage Area	Parking Zone and Ramps	0.10	First ATM or ticket machine	100 W
Parking Garage Area	Parking Zone and Ramps	0.10	Additional ATM or ticket machine	50 W each
Parking Garage Area	Daylight Adaptation Zones ³	1.00	—	—
Laundry Area		0.45	—	—
Restrooms		0.65	Display/decorative	0.35
Stairwell		0.60	Display/decorative	0.35
All other		0.40	—	—
Aging Eye/Low-vision ⁶	Lobby, Main Entry	0.85	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Lobby, Main Entry	0.85	Transition lighting OFF at night ⁷	0.95
Aging Eye/Low-vision ⁶	Stairwell	0.80	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Corridor Area	0.70	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Lounge/Waiting Area	0.80	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Multipurpose Room	0.85	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Dining	0.80	Display/decorative	0.30
Aging Eye/Low-vision ⁶	Restroom	1.00	Display/decorative	0.20

1. Detailed task work—Lighting provides the high level of visual acuity required for activities with close attention to small elements and/or extreme close-up work.
2. Reserved.
3. Daylight adaptation zones shall be no longer than 66 feet from the entrance to the parking garage.
4. Reserved.
5. Portable lighting in office areas includes under-shelf or furniture-mounted supplemental task lighting qualifies when controlled by a time clock or an occupancy sensor.
6. Aging Eye/Low-vision areas can be documented as being designed to comply with the light levels in ANSI/IES RP-28 and are or will be licensed by local or state authorities for either senior long-term care, adult day care, senior support and/or people with special visual needs.
7. Transition lighting OFF at night. Lighting power controlled by astronomical time clock or other control to shut off lighting at night. Additional LPD only applies to area within 30 feet of an exit. Not applicable to lighting in daylight zones.
8. Tunable white luminaires capable of color change greater than or equal to 2000K CCT, or dim-to-warm luminaires capable of color change greater than or equal to 500K CCT, connected to controls that allow color changing of the luminaires.

**TABLE 170.2-N
TAILORED METHOD LIGHTING POWER ALLOWANCES**

1	2	3	4	5
Primary Function Area	General Illumination Level (Lux)	Wall Lighting Power Density (W/ft ²)	Task Lighting Power Density (W/ft ²)	Allowed Decorative/Special Effect Lighting Power Density (W/ft ²)
Conference, Multipurpose and Meeting Center Areas	300	2.00	0.25	0.35
Dining Areas	200	1.25	0.25	0.35
Lobby, Main Entry	200	3.50	0.25	0.35

**TABLE 170.2-O
TAILORED WALL AND FLOOR DISPLAY MOUNTING HEIGHT ADJUSTMENT FACTORS**

HEIGHT IN FEET ABOVE FINISHED FLOOR AND BOTTOM OF LUMINAIRE(S)	WALL DISPLAY MOUNTING HEIGHT ADJUSTMENT FACTOR
< 10'-7"	1.00
10'-7" to 14'-0"	0.85
>14'-0" to 18'-0"	0.75
> 18'-0"	0.70

**TABLE 170.2-P
ROOM CAVITY RATIO (RCR) EQUATIONS**

Determine the room cavity ratio for Table 170.2-Q using one of the following equations.
Room cavity ratio for rectangular rooms
$RCR = \frac{5 \times H \times (L + W)}{L \times W}$
Room cavity ratio for irregular-shaped rooms
$RCR = \frac{2.5 \times H \times P}{A}$
Where: L = Length of room; W = Width of room; H = Vertical distance from the work plane to the centerline of the lighting fixture; P = Perimeter of room and A = Area of room

**TABLE 170.2-Q
TAILORED METHOD GENERAL LIGHTING POWER ALLOWED—BY ILLUMINANCE AND ROOM CAVITY RATIO
General Lighting Power Density (W/ft²) for the following RCR values^b**

GENERAL ILLUMINANCE LEVEL (lux) ^a	RCR ≤ 2.0	RCR > 2.0 and ≤ 3.5	RCR > 3.5 and ≤ 7.0	RCR > 7.0
150	0.35	0.40	0.50	0.65
200	0.40	0.50	0.65	0.85
300	0.55	0.70	0.85	1.20
400	0.65	0.80	1.05	1.25
500	0.80	0.90	1.25	1.55
600	0.90	1.05	1.40	2.00

- a. Illuminance values from Column 2 of Table 170.2-N.
- b. RCR values are calculated using applicable equations in Table 170.2-P.

B. Outdoor lighting power trade-offs. Outdoor lighting power trade-offs shall be determined as follows:

- i. Allowed lighting power determined according to Section 170.2(e)6Di for general hardscape lighting allowance may be traded to specific applications in Section 170.2(e)6Dii, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section 170.2(e)6Dia.
- ii. Allowed lighting power determined according to Section 170.2(e)2Dii for additional lighting power allowances for specific applications shall not be traded between specific applications, or to hardscape lighting in Section 170.2(e)6Di.
- iii. Trading off lighting power allowances between outdoor and indoor areas shall not be permitted.

C. Calculation of actual lighting power. The wattage of outdoor luminaires shall be determined in accordance with Section 160.5(b)1.

D. Calculation of allowed lighting power. The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section 170.2(e)2Di, and the sum of the additional lighting power allowance for specific applications determined in accordance with Section 170.2(e)6Dii.

- i. **General hardscape lighting allowance.** Determine the general hardscape lighting power allowances as follows:
 - a. The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s), bridge(s), tunnel(s) and other improved area(s) that are illuminated. Public roadway(s) that are illuminated by a lighting system owned or maintained by the local municipality or utility shall not be included in the area calculations. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include por-

tions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the Area Wattage Allowance (AWA) from Table 170.2-R for the appropriate lighting zone.

- b. Determine the Initial Wattage Allowance (IWA) for general hardscape lighting from Table 170.2-R for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.
- c. The general hardscape lighting allowance shall be the sum of the allowed watts determined from a and b above.

ii. **Additional lighting power allowance for specific applications.** Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table 170.2-S for the appropriate lighting zone, or the actual installed lighting power meeting the requirements for the allowance.

7. Requirements for signs. Section 170.2(e)7 applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs), and unfiltered neon, both indoor and outdoor. Each sign shall comply with either Subsection A or B, as applicable.

A. Maximum allowed lighting power.

- i. For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.
- ii. For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.
- iii. Lighting for unfiltered light emitting diodes (LEDs) and unfiltered neon shall comply with Section 170.2(e)7B.

**TABLE 170.2-R
GENERAL HARDSCAPE MULTIFAMILY LIGHTING POWER ALLOWANCE**

TYPE OF POWER ALLOWANCE	LIGHTING ZONE 0 ²	LIGHTING ZONE 1 ²	LIGHTING ZONE 2 ²	LIGHTING ZONE 3 ²	LIGHTING ZONE 4 ²
Area Wattage Allowance (AWA)	No allowance ¹	0.026 W/ft ²	0.030 W/ft ²	0.038 W/ft ²	0.055 W/ft ²
Initial Wattage Allowance (IWA)	No allowance ¹	300 W	350 W	400 W	450 W

1. Continuous lighting is explicitly prohibited in Lighting Zone 0. A single luminaire of 15 watts or less may be installed at an entrance to a parking area, trail head, fee payment kiosk, outhouse or toilet facility, as required to provide safe navigation of the site infrastructure. Luminaires installed shall meet the maximum zonal lumen limits as specified in Section 160.5(c)1.
2. Narrow band spectrum light sources with a dominant peak wavelength greater than 580 nm—as mandated by local, state or federal agencies to minimize the impact on local, active professional astronomy or nocturnal habitat of specific local fauna—shall be allowed a 2.0 lighting power allowance multiplier.

**TABLE 170.2-S
ADDITIONAL MULTIFAMILY LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS
All area and distance measurements in plan view unless otherwise noted.**

LIGHTING APPLICATION	LIGHTING ZONE 0	LIGHTING ZONE 1	LIGHTING ZONE 2	LIGHTING ZONE 3	LIGHTING ZONE 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
Building Entrances or Exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	Not applicable	9 watts	15 watts	19 watts	21 watts
Primary Entrances to Senior Care Facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	Not applicable	20 watts	40 watts	57 watts	60 watts
ATM Machine Lighting. Allowance per ATM machine. Luminaires qualifying for this allowance shall be within 50 feet of the dispenser.	Not applicable	100 watts for first ATM machine, 35 watts for each additional ATM machine			
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
Hardscape Ornamental Lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 50 watts or less as determined in accordance with Section 160.5(b)1 and shall be post-top luminaires, lanterns, pendant luminaires or chandeliers.	Not applicable	No Allowance	0.007 W/ft²	0.013 W/ft²	0.019 W/ft²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.					
Building Façades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects. This allowance calculation shall not include portions of the building facades within 20 feet of residence bedroom windows.	Not applicable	No Allowance	0.100 W/ft²	0.170 W/ft²	0.225 W/ft²
Canopies and Tunnels. Allowance for the total area within the drip line of the canopy or inside the tunnel. Luminaires qualifying for this allowance shall be located under the canopy or tunnel.	Not applicable	0.057 W/ft²	0.137 W/ft²	0.270 W/ft²	0.370 W/ft²
Student Pick-up/Drop-off Zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within two mounting heights of the student pick-up/drop-off zone.	Not applicable	No Allowance	0.056 W/ft²	0.200 W/ft²	No Allowance
Outdoor Dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within two mounting heights of the hardscape area of outdoor dining.	Not applicable	0.004 W/ft²	0.030 W/ft²	0.050 W/ft²	0.075 W/ft²
Special Security Lighting for Retail Parking and Pedestrian Hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	Not applicable	0.004 W/ft²	0.005 W/ft²	0.010 W/ft²	No Allowance
Security Camera. This additional allowance is for the illuminated general hardscape area. This allowance shall apply when a security camera is installed within two mounting heights of the general hardscape area and mounted more than 10 feet away from a building.	Not applicable	No Allowance	0.018 W/ft²	0.018 W/ft²	0.018 W/ft²

B. Alternate lighting sources. The sign shall be equipped with one or more of the following light sources:

- i. High pressure sodium lamps; or
- ii. Metal halide lamps that are:
 - a. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater; or
 - b. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps, and are served by a ballast that has a minimum efficiency of 80 percent.

Ballast efficiency is the reference lamp power divided by the ballast input power when tested according to ANSI C82.6-2015.

- iii. Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:
 - a. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
 - b. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

The ratio of the output wattage to the input wattage is at 100 percent tubing load.

- iv. Fluorescent lighting systems meeting one of the following requirements:
 - a. Use only lamps with a minimum color rendering index (CRI) of 80; or
 - b. Use only electronic ballasts with a fundamental output frequency not less than 20 kHz.
- v. Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

Exception to Section 170.2(e)7Bv: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output, and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the Appliance Efficiency Regulations (Title 20).

- vi. Compact fluorescent lamps that do not contain a medium screw base socket (E24/E26).

Exception 1 to Section 170.2(e)7: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section 170.2(e)7: Exit signs. Exit signs shall meet the requirements of the Appliance Efficiency Regulations.

(f) Photovoltaic requirements—three habitable stories or fewer. All multifamily buildings up to three habitable stories shall have a newly installed photovoltaic (PV) system or

newly installed PV modules meeting the minimum qualification requirements specified in Joint Appendix JA11. The annual electrical output of the PV system shall be no less than the smaller of a PV system size determined using Equation 170.2-C, or the maximum PV system size that can be installed on the building’s solar access roof area (SARA).

A. SARA includes the area of the building’s roof space capable of structurally supporting a PV system, and the area of all roof space on covered parking areas, carports, and all other newly constructed structures on the site that are compatible with supporting a PV system per Title 24, Part 2, Section 1511.2.

B. SARA does NOT include:

- i. Any roof area that has less than 70 percent annual solar access. Annual solar access is determined by dividing the total annual solar insolation, accounting for shading obstructions, by the total annual solar insolation if the same areas were unshaded by obstructions. For steep-sloped roofs, only shading from existing permanent natural or manmade obstructions that are external to the dwelling, including but not limited to trees, hills and adjacent structures, shall be considered for annual solar access calculations. For low slope roofs, all obstructions including those that are external to the dwelling unit, and obstructions that are part of the building design and elevation features, shall be considered for the annual solar access calculations.
- ii. Occupied roof areas as specified by CBC Section 503.1.4.
- iii. Roof area that is otherwise not available due to compliance with other building code requirements if confirmed by the Executive Director.

**EQUATION 170.2-C
ANNUAL PHOTOVOLTAIC ELECTRICAL OUTPUT**

$$kW_{PV} = (CFA \times A) / 1000 + N_{DU} \times B$$

where:

kW_{PV} = kW_{dc} size of the PV system.

CFA = Conditioned floor area.

N_{DU} = Number of dwelling units.

A = CFA adjustment factor from Table 170.2-T.

B = Dwelling unit adjustment factor from Table 170.2-T.

Exception 1 to Section 170.2(f): For steep slope roofs, SARA shall not consider roof areas with a northerly azimuth that lies between 300 degrees and 90 degrees from true north. No PV system is required if the SARA is less than 80 contiguous square feet.

Exception 2 to Section 170.2(f): No PV system is required when the minimum PV system size specified by Section 170.2(f) is less than 1.8 kW_{dc} .

Exception 3 to Section 170.2(f): Buildings with enforcement-authority-approved roof designs, where the enforcement authority determines it is not possible for the PV system, including panels, modules and components and

supports and attachments to the roof structure, to meet the requirements of American Society of Civil Engineers (ASCE) Standard 7-16, Chapter 7, Snow Loads.

Exception 4 to Section 170.2(f): For buildings that are approved by the local planning department prior to January 1, 2020 with mandatory conditions of approval:

- a. Shading from roof designs and configurations for steep slope roofs shall be considered for the annual solar access calculations; and
- b. Roof areas that are not allowed to have PVs by the mandatory conditions of approval shall not be considered in determining the SARA.

Exception 5 to Section 170.2(f): PV system sizes determined using Equation 170.2-C may be reduced by 25 percent if installed in conjunction with a battery storage system. The battery storage system shall meet the qualification requirements specified in Joint Appendix JA12 and have a minimum usable capacity of 7.5 kWh.

**TABLE 170.2-T
CFA AND DWELLING UNIT ADJUSTMENT FACTORS**

CLIMATE ZONE	A—CFA	B—DWELLING UNITS
1	0.793	1.27
2	0.621	1.22
3	0.628	1.12
4	0.586	1.21
5	0.585	1.06
6	0.594	1.23
7	0.572	1.15
8	0.586	1.37
9	0.613	1.36
10	0.627	1.41
11	0.836	1.44
12	0.613	1.40
13	0.894	1.51
14	0.741	1.26
15	1.56	1.47
16	0.59	1.22

(g) Photovoltaic requirements—more than three habitable stories. All newly constructed building types specified in Table 170.2-U, or mixed occupancy buildings where one or more of these building types constitute at least 80 percent of the floor area of the building, shall have a newly installed photovoltaic (PV) system meeting the minimum qualification requirements of Reference Joint Appendix JA11. The PV size in kW_{dc} shall be not less than the smaller of the PV system size determined by Equation 170.2-D, or the total of all available solar access roof areas (SARA) multiplied by 14 W/ft².

1. SARA include the area of the building’s roof space capable of structurally supporting a PV system, and the area of all roof space on covered parking areas, carports and all other newly constructed structures on the site

that are compatible with supporting a PV system per Title 24, Part 2, Section 1511.2.

2. SARA does not include:
 - A. Any area that has less than 70 percent annual solar access. Annual solar access is determined by dividing the total annual solar insolation (accounting for shading obstructions) by the total annual solar insolation if the same areas were unshaded by those obstructions. For all roofs, all obstructions including those that are external to the building, and obstructions that are part of the building design and elevation features, may be considered for the annual solar access calculations.
 - B. Occupied roofs as specified by CBC Section 503.1.4.
 - C. Roof space that is otherwise not available due to compliance with other building code requirements if confirmed by the Executive Director.

**EQUATION 170.2-D
PHOTOVOLTAIC DIRECT CURRENT SIZE**

$$kW_{PVdc} = (CFA \times A)/1000$$

where:

kW_{PVdc} = Size of the PV system in kW.

CFA = Conditioned floor area in square feet.

A = PV capacity factor specified in Table 170.2-U for the building type.

Where the building includes more than one of the space types listed in Table 170.2-U, the total PV system capacity for the building shall be determined by applying Equation 170.2-D to each of the listed space types and summing the capacities determined for each.

Exception 1 to Section 170.2(g): No PV system is required where the total of all available SARA is less than 3 percent of the conditioned floor area.

Exception 2 to Section 170.2(g): No PV system is required where the required PV system size is less than 4 kW_{dc}.

Exception 3 to Section 170.2(g): No PV system is required if the SARA contains less than 80 contiguous square feet.

Exception 4 to Section 170.2(g): Buildings with enforcement-authority-approved roof designs, where the enforcement authority determines it is not possible for the PV system, including panels, modules, components, supports and attachments to the roof structure, to meet ASCE 7-16, Chapter 7, Snow Loads.

Exception 5 to Section 170.2(g): Multi-tenant buildings in areas where a load serving entity does not provide either a virtual net metering (VNEM) or community solar program.

- (h) **Battery storage system requirements—more than three habitable stories.** All buildings that are required by Section 170.2(g) to have a PV system shall also have a battery storage system meeting the minimum qualification requirements of Reference Joint Appendix JA12. The rated

**TABLE 170.2-U
PV CAPACITY FACTORS**

BUILDING TYPE	FACTOR A—MINIMUM PV CAPACITY (W/FT ² OF CONDITIONED FLOOR AREA) CLIMATE ZONES 1, 3, 5, 16	FACTOR A—MINIMUM PV CAPACITY (W/FT ² OF CONDITIONED FLOOR AREA) CLIMATE ZONES 2, 4, 6–14	FACTOR A—MINIMUM PV CAPACITY (W/FT ² OF CONDITIONED FLOOR AREA) CLIMATE ZONE 15
Grocery	2.62	2.91	3.53
High-Rise Multifamily	1.82	2.21	2.77
Office, Financial Institutions, Unleased Tenant Space	2.59	3.13	3.80
Retail	2.62	2.91	3.53
School	1.27	1.63	2.46
Warehouse	0.39	0.44	0.58
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.39	0.44	0.58

energy capacity and the rated power capacity shall be not less than the values determined by Equation 170.2-E and Equation 170.2-F. Where the building includes more than one of the space types listed in Table 170.2-V, the total battery system capacity for the building shall be determined by applying Equations 170.2-E and 170.2-F to each of the listed space types and summing the capacities determined for each space type and equation.

**EQUATION 170.2-E
BATTERY STORAGE RATED ENERGY CAPACITY**

$$kWh_{batt} = kW_{PVdc} \times B / D^{0.5}$$

where:

kWh_{batt} = Rated usable energy capacity of the battery storage system in kWh.

kW_{PVdc} = PV system capacity required by Section 170.2(g) in kW_{dc} .

B = Battery energy capacity factor specified in Table 170.2-V for the building type.

D = Rated single charge-discharge cycle AC to AC (round-trip) efficiency of the battery storage system.

**EQUATION 170.2-F
BATTERY STORAGE RATED POWER CAPACITY**

$$kW_{batt} = kW_{PVdc} \times C$$

where:

kW_{batt} = Power capacity of the battery storage system in kW_{dc} .

kW_{PVdc} = PV system capacity required by Section 170.2(g) in kW_{dc} .

C = Battery power capacity factor specified in Table 170.2-V for the building type.

Exception 1 to Section 170.2(h): No battery storage system is required if the installed PV system size is less than 15 percent of the size determined by Equation 170.2-D.

Exception 2 to Section 170.2(h): No battery storage system is required in buildings with battery storage system requirements with less than 10 kWh rated capacity.

**TABLE 170.2-V
BATTERY STORAGE CAPACITY FACTORS**

	FACTOR B—ENERGY CAPACITY	FACTOR C—POWER CAPACITY
Storage-to-PV Ratio	Wh/W	W/W
Grocery	1.03	0.26
High-Rise Multifamily	1.03	0.26
Office, Financial Institutions, Unleased Tenant Space	1.68	0.42
Retail	1.03	0.26
School	1.87	0.46
Warehouse	0.93	0.23
Auditorium, Convention Center, Hotel/Motel, Library, Medical Office Building/Clinic, Restaurant, Theater	0.93	0.23

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.8 and 25943, *Public Resources Code*.

SUBCHAPTER 12

MULTIFAMILY BUILDINGS—ADDITIONS, ALTERATIONS AND REPAIRS TO EXISTING MULTIFAMILY BUILDINGS

SECTION 180.0 GENERAL

Additions, alterations and repairs to existing attached dwelling units and common use areas in multifamily buildings, existing outdoor lighting for these occupancies, and internally and externally illuminated signs shall meet the requirements specified in Sections 100.0 through 110.10, 160.1, and 160.3 through 170.2 that are applicable to the building project, and either the performance compliance approach (energy budgets) in Section 180.1(b) (for additions) or 180.2(c) (for alterations), or the prescriptive compliance approach in Section 180.1(a) (for additions) or 180.2(b) (for alterations), for the climate zone in which the building is located. Climate zones are shown in Figure 100.1-A.

Covered process requirements for additions, alterations and repairs to existing multifamily buildings are specified in Section 141.1.

Nonresidential occupancies in mixed occupancy buildings shall comply with nonresidential requirements in Sections 120.0 through 141.1.

NOTE: For alterations that change the occupancy classification of the building, the requirements specified in Section 180.2 apply to the occupancy after the alterations.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

SECTION 180.1 ADDITIONS

Additions to existing multifamily buildings shall meet the applicable requirements of Sections 110.0 through 110.9; Sections 160.0, 160.1, and 160.2(c) and (d); Sections 160.3 through 160.7; and either Section 180.1(a) or 180.1(b).

Exception 2 to Section 180.1: Additions of 300 square feet or less are exempt from the roofing product requirements of Section 170.2(a)1A.

Exception 3 to Section 180.1: Existing inaccessible piping shall not require insulation as defined under Section 160.4(f)2Aiii.

Exception 4 to Section 180.1: Space-conditioning system. When heating or cooling will be extended to an addition from the existing system(s), the existing heating and cooling equipment need not comply with Part 6. The heating system capacity must be adequate to meet the minimum requirements of CBC Section 1204.1.

Exception 5 to Section 180.1: Space-conditioning system ducts. When any length of ducts are extended from an existing duct system to serve the addition, the existing duct system and the extended ducts shall meet the applica-

ble requirements specified in Sections 180.1(b)2ai and 180.1(b)2aii.

Exception 6 to Section 180.1: Photovoltaic and battery storage systems, as specified in Sections 170.2(f) through 170.2(h), are not required for additions.

Exception 7 to Section 180.1: Dwelling unit space heating system. New or replacement space heating systems serving an addition may be a heat pump or gas heating system.

(a) **Prescriptive approach.** The envelope and lighting of the addition; any newly installed space-conditioning or ventilation system, electrical power distribution system, or water-heating system; any addition to an outdoor lighting system; and any new sign installed in conjunction with an indoor or outdoor addition shall meet the applicable requirements of Sections 110.0 through 110.12; 160.0, 160.1, and 160.2(c) and (d); and 160.3 through 170.2.

1. Envelope.

A. Additions that are greater than 700 square feet shall meet the requirements of Section 170.2(a), with the following modifications:

i. Framed walls extension. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing.

ii. The maximum allowed fenestration area shall be the greater of 175 square feet or 20 percent of the addition floor area.

iii. When existing siding of a wood-framed wall is not being removed or replaced, cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing shall be installed and continuous insulation is not required.

iv. Additions that consist of the conversion of existing spaces from unconditioned to conditioned space shall not be required to perform the air sealing part of QII when the existing air barrier is not being removed or replaced.

B. Additions that are 700 square feet or less shall meet the requirements of Section 170.2(a), with the following modifications.

i. Roof and ceiling insulation in a ventilated attic shall meet one of the following requirements:

a. In Climate Zones 1, 2, 4, and 8 through 16, achieve an overall assembly *U*-factor not exceeding 0.025. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing insulation with an *R*-value of R-38 or greater.

- b. In Climate Zones 3 and 5 through 7, achieve an overall assembly *U*-factor not exceeding 0.031. In wood framed assemblies, compliance with *U*-factors may be demonstrated by installing insulation with an *R*-value of R-30 or greater.
- ii. Radiant barrier. For buildings three habitable stories or less, radiant barriers shall be installed in attics with exposed attic deck undersides in Climate Zones 2–15.
- iii. Extensions of existing wood-framed walls may retain the dimensions of the existing walls and shall install cavity insulation of R-15 in a 2x4 framing and R-21 in a 2x6 framing; and
- iv. Fenestration products must meet the *U*-factor, RSGHC and VT requirements of Table 180.2-B.
- v. Quality insulation installation (QII) requirements of Section 170.2(a)6 do not apply.

Exception to Section 180.1(a)1B: Insulation in an enclosed rafter ceiling shall meet the requirements of Section 160.1(a).

Exception to Section 180.1(a)1: Additions that increase the area of the roof by 2,000 square feet or less are exempt from the solar ready requirements of Section 160.8.

2. **Mechanical ventilation for indoor air quality.** Additions to existing buildings shall comply with Section 160.2 subject to the requirements specified in Subsections A and B below. When HERS field verification and diagnostic testing are required by Section 180.1(a)2, buildings with three habitable stories or fewer shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

A. Whole-dwelling unit mechanical ventilation.

- i. Dwelling units that meet the conditions in Subsection a or b below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 160.2(b)2Aiv or 160.2(b)2Av.
 - a. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to 1,000 square feet.
 - b. Junior accessory dwelling units (JADU) that are additions to an existing building.
- ii. Additions to an existing dwelling unit that increase conditioned floor area by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av, as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprising the existing dwelling unit

conditioned floor area plus the addition conditioned floor area.

- iii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

B. Local mechanical exhaust. Additions to existing buildings shall comply with all applicable requirements specified in Sections 160.2(b)2Aiv and 160.2(b)2B.

3. **Water heater.** When additional water-heating equipment is installed to serve a dwelling unit as part of the addition, one of the following types of water heaters shall be installed:

- A. A water-heating system that meets the requirements of Section 170.2(d); or
- B. A water-heating system determined by the Executive Director to use no more energy than the one specified in Item A above.

(b) **Performance approach.** Performance calculations shall meet the requirements of Sections 170.0 through 170.2(a), pursuant to the applicable requirements in Items 1, 2 and 3 below.

- 1. **For additions alone.** The addition complies if the addition alone meets the energy budgets as specified in Section 170.1.
- 2. **Existing plus alteration plus addition.** The standard design for existing plus alteration plus addition energy use is the combination of the existing building’s unaltered components to remain; existing building altered components that are the more efficient, in TDV energy, of either the existing conditions or the requirements of Section 180.2(c); plus the proposed addition’s energy use meeting the requirements of Section 180.1(a). The proposed design energy use is the combination of the existing building’s unaltered components to remain and the altered components’ energy features, plus the proposed energy features of the addition.

Exception to Section 180.1(b)2: Existing structures with a minimum R-11 insulation in framed walls showing compliance with Section 180.1(b) are exempt from showing compliance with Section 160.1(b).

- 3. **Mechanical ventilation for indoor air quality.** Additions to existing buildings shall comply with Section 160.2 subject to the requirements specified in Subsections A and B below. When HERS field verification and diagnostic testing are required by Section 180.1(b)3, buildings with three habitable stories or fewer shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

A. Whole-dwelling unit mechanical ventilation.

- i. Dwelling units that meet the conditions in Sub-section a or b below shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 160.2(b)2Aiv or 160.2(b)2Av.
 - a. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by less than or equal to 1000 square feet.
 - b. Junior accessory dwelling units (JADU) that are additions to an existing building.
- ii. Additions to an existing dwelling unit that increase the conditioned floor area of the existing dwelling unit by more than 1,000 square feet shall have mechanical ventilation airflow in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the entire dwelling unit comprising the existing dwelling unit conditioned floor area plus the addition conditioned floor area.
- iii. New dwelling units that are additions to an existing building shall have mechanical ventilation airflow provided in accordance with Section 160.2(b)2Aiv or 160.2(b)2Av as applicable. The mechanical ventilation airflow rate shall be based on the conditioned floor area of the new dwelling unit.

B. Local mechanical exhaust. Additions to existing buildings shall comply with all applicable requirements specified in Sections 160.2(b)2Avi and 160.2(b)2B.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 180.2
ALTERATIONS**

Alterations to components of existing multifamily buildings, including alterations made in conjunction with a change in building occupancy to a multifamily occupancy, shall meet Item (a), and either Item (b) or (c) below:

Exception 1 to Section 180.2: When heating, cooling or service water heating for an alteration is provided by expanding existing systems, the existing systems and equipment need not comply with Sections 110.0 through 110.10; Sections 160.0 through 160.7; and Section 170.2(c) or 170.2(d).

Exception 2 to Section 180.2: When existing heating, cooling or service water-heating systems or components are moved within a building, the existing systems or components need not comply with Sections 110.0 through

110.10; Sections 160.0 through 160.7; and Section 170.2(c) or 170.2(d).

Exception 3 to Section 180.2: Where an existing system with electric reheat is expanded when adding variable air volume (VAV) boxes to serve an alteration, total electric reheat capacity may be expanded not to exceed 20 percent of the existing installed electric capacity in any one permit and the system need not comply with Section 170.2(b)4E. Additional electric reheat capacity in excess of 20 percent may be added subject to the requirements of Section 170.2(b)4E.

Exception 4 to Section 180.2: The requirements of Section 160.3(a)2H shall not apply to alterations of space-conditioning systems or components.

(a) **Mandatory requirements.** Altered components in a multifamily building shall meet the minimum requirements in this section.

1. **Roof/ceiling insulation.** The opaque portions of the roof/ceiling that separate conditioned spaces from unconditioned spaces or ambient air shall meet the requirements of Section 180.2(b)1B.

2. **Wall insulation.** For the altered opaque portion of walls separating conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items A through D below:

A. **Metal building.** A minimum of R-13 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.113.

B. **Metal framed.** A minimum of R-13 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.217.

C. **Wood framed and others.** A minimum of R-11 insulation between framing members, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.110.

D. **Spandrel panels and curtain walls.** A minimum of R-4, or the area-weighted average *U*-factor of the wall assembly shall not exceed U-0.280.

Exception to Section 180.2(a)2: Light and heavy mass walls.

3. **Floor insulation.** For the altered portion of raised floors that separate conditioned spaces from unconditioned spaces or ambient air shall meet the applicable requirements of Items A and B below:

A. **Raised framed floors.** A minimum of R-11 insulation between framing members, or the area-weighted average *U*-factor of the floor assembly shall not exceed U-0.071.

B. **Raised mass floors.** A minimum of R-6 insulation, or the area-weighted average *U*-factor of the floor assembly shall not exceed U-0.111.

(b) **Prescriptive approach.** The altered component and any newly installed equipment serving the alteration shall

meet the applicable requirements of Sections 110.0 through 110.9 and all applicable requirements of Sections 160.0, 160.1, 160.2(c) and (d), 160.3(a) through 160.3(b)5J, 160.3(b)6, 160.3(c) and 160.5; and

1. **Envelope.**

A. **Roof alterations.** Existing roofs being replaced, recovered or recoated of a multifamily building shall meet the requirements of Section 110.8(i). For roofs with more than 50 percent of the roof area or more than 2,000 square feet of roof, whichever is less, being altered, the requirements of i and iii below apply:

- i. Low-sloped roofs in Climate Zones 2, 4, and 6 through 15 shall have a minimum aged solar reflectance of 0.63 and a minimum thermal emittance of 0.75, or a minimum SRI of 75.

Exception to Section 180.2(b)1Ai: The aged solar reflectance requirement can be met by using insulation at the roof deck specified in Table 180.2-A.

**TABLE 180.2-A
ROOF/CEILING INSULATION TRADEOFF FOR
LOW-SLOPED AGED SOLAR REFLECTANCE**

MINIMUM AGED SOLAR REFLECTANCE	ROOF DECK CONTINUOUS INSULATION R-VALUE (Climate Zones 6–7)	ROOF DECK CONTINUOUS INSULATION R-VALUE (Climate Zones 2, 4, 8–15)
0.60	2	16
0.55	4	18
0.50	6	20
0.45	8	22
No requirement	10	24

- ii. Steep-sloped roofs in Climate Zones 4 and 8 through 15 shall have a minimum aged solar reflectance of 0.20 and a minimum thermal emittance of 0.75, or a minimum SRI of 16.

Exception to Section 180.2(b)1Aii: The following shall be considered equivalent to Subsection ii:

- a. Buildings with ceiling assemblies with a *U*-factor lower than or equal to 0.025 or that are insulated with at least R-38 ceiling insulation in an attic; or
- b. Buildings with a radiant barrier in the attic, where the radiant barrier is not installed directly above spaced sheathing, meeting the requirements of Section 170.2(a)1C; or
- c. Buildings that have no ducts in the attic in Climate Zones 2, 4, 9, 10, 12 and 14; or
- d. Buildings with R-2 or greater continuous insulation above or below the roof deck.

Exception 1 to Sections 180.2(b)1Ai and ii: Roof area covered by building integrated photovoltaic panels and building integrated solar thermal panels is not required to meet the minimum requirements for solar reflectance, thermal emittance or SR.

imum requirements for solar reflectance, thermal emittance or SR.

Exception 2 to Sections 180.2(b)1Ai and ii: Roof constructions with a weight of at least 25 lb/ft² are not required to meet the minimum requirements for solar reflectance, thermal emittance or SRI.

- iii. For low-sloped roofs, the area of the roof recover or roof replacement shall be insulated to R-14 continuous insulation or a *U*-factor of .039 in Climate Zones 1, 2, 4, and 8 through 16.

Exception 1 to Section 180.2(b)1Aiii: Roof recovers with new R-10 insulation added above deck do not need to be insulated to meet R-14.

Exception 2 to Section 180.2(b)1Aiii: When existing mechanical equipment located on the roof will not be disconnected and lifted, insulation added may be limited to the greater of R-10 or the maximum installed thickness that will allow the distance between the height of the roof membrane surface to the top of the base flashing to remain in accordance with the manufacturer’s instructions.

Exception 3 to Section 180.2(b)1Aiii: At the drains and other low points, tapered insulation with a thermal resistance less than R-14 may be used, provided that insulation thickness is increased at the high points of the roof so that the average thermal resistance equals or exceeds R-14.

Exception 4 to Section 180.2(b)1Aiii: The area of the roof recoat is not required to be insulated.

B. **Roof/ceiling insulation.**

- i. **Attic roof.** Vented attics shall meet the following:

- a. In Climate Zones 1 through 4 and 8 through 16, insulation shall be installed to achieve a weighted *U*-factor of 0.020 or insulation installed at the ceiling level shall result in an installed thermal resistance of R-49 or greater for the insulation alone; and

Exception to Section 180.2(b)1Bia: In Climate Zones 1, 3, 4 and 9, dwelling units with at least R-19 existing insulation installed at the ceiling level.

- b. In Climate Zones 2 and 11 through 16, air seal all accessible areas of the ceiling plane between the attic and the conditioned space in accordance with Section 110.7; and

Exception 1 to Section 180.2(b)1Bib: Dwelling units with at least R-19 existing insulation installed at the ceiling level.

Exception 2 to Section 180.2(b)1Bib: Dwelling units with atmospherically vented space heating or water-heating combustion appliances located inside the pressure boundary of the dwelling unit.

**TABLE 180.2-B
ALTERED FENESTRATION MAXIMUM U-FACTOR AND MAXIMUM SHGC**

CLIMATE ZONE		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Curtainwall/Storefront/Window Wall and Glazed Doors ¹	U-factor	0.38	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.41	0.38
Curtainwall/Storefront/Window Wall and Glazed Doors ¹	RSHGC	0.35	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.25
Curtainwall/Storefront/Window Wall and Glazed Doors ¹	VT ²	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
NAFS 2017 Performance Class AW Window – Fixed ¹	U-factor	0.38	0.38	0.38	0.38	0.38	0.47	0.47	0.41	0.41	0.38	0.38	0.38	0.38	0.38	0.38	0.38
NAFS 2017 Performance Class AW Window – Fixed ¹	RSHGC	0.35	0.25	0.25	0.25	0.25	0.31	0.31	0.26	0.26	0.25	0.25	0.25	0.25	0.25	0.25	0.25
NAFS 2017 Performance Class AW Window – Fixed ¹	VT ²	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
NAFS 2017 Performance Class AW Window – Operable ¹	U-factor	0.43	0.43	0.43	0.43	0.43	0.47	0.47	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43	0.43
NAFS 2017 Performance Class AW Window – Operable ¹	RSHGC	0.35	0.24	0.24	0.24	0.24	0.31	0.31	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
NAFS 2017 Performance Class AW Window – Operable ¹	VT ²	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
All Other Windows and Glazed Doors ¹	U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.34	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
All Other Windows and Glazed Doors ¹	RSHGC	0.35	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23	0.23
Skylights, 3 Habitable Stories and Fewer	U-factor	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Skylights, 3 Habitable Stories and Fewer	RSHGC	NA	0.23	NA	0.23	NA	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	0.30	NA
Skylights, 4 Habitable Stories and Greater	U-factor	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46
Skylights, 4 Habitable Stories and Greater	RSHGC	0.35	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Skylights, 4 Habitable Stories and Greater	VT ²	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49

1. For fenestration installed in buildings with three or fewer habitable stories, there is no SHGC requirement in Climate Zones 1, 3, 5 and 16.
 2. Minimum VT requirements to not apply to multifamily buildings 3 habitable stories or fewer.

c. In Climate Zones 1 through 4 and 8 through 16, recessed downlight luminaires in the ceiling shall be covered with insulation to the same depth as the rest of the ceiling. Luminaires not rated for insulation contact must be replaced or fitted with a fireproof cover that allows for insulation to be installed directly over the cover; and

Exception to Section 180.2(b)1Bi: In Climate Zones 1 through 4 and 8 through 10, dwelling units with at least R-19 existing insulation installed at the ceiling level.

d. Attic ventilation shall comply with the *California Building Code* requirements.

Exception 1 to Section 180.2(b)1Bi: Dwelling units with at least R-38 existing insulation installed at the ceiling level.

Exception 2 to Section 180.2(b)1Bi: Dwelling units where the alteration would directly cause the disturbance of asbestos, unless the

alteration is made in conjunction with asbestos abatement.

Exception 3 to Section 180.2(b)1Bi: Dwelling units with knob and tube wiring located in the vented attic.

Exception 4 to Section 180.2(b)1Bi: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation, provided such installation does not violate Section 806.3 of Title 24, Part 2.5.

Exception 5 to Section 180.2(b)1Bi: Where the attic space above the altered dwelling unit is shared with other dwelling units and the requirements of Section 180.2(b)1Bi are not triggered for the other dwelling units.

Fenestration alterations other than repair shall meet the requirements below:

NOTE: Glass replaced in an existing sash and frame or sashes replaced in an existing frame are

considered repairs. In these cases, Section 180.2(b) requires that the replacement be at least equivalent to the original in performance.

- i. Fenestration products installed to replace existing fenestration products of the same total area shall meet either a or b:
 - a. The maximum *U*-factor, RSHGC and VT requirements of Table 180.2-B, or
 - b. The area-weighted *U*-factor and RSHGC of Table 170.2-A.

Exception 1 to Section 180.2(b)1Ci: In an alteration, where 150 square feet or less of the entire building's vertical fenestration is replaced, RSHGC and VT requirements of Table 180.2-B shall not apply.

- ii. Alterations that add fenestration and skylight area shall meet the total fenestration area requirements of Section 170.2(a) and the *U*-factor, RSHGC and VT requirements of Table 180.2-B.

Exception 1 to Section 180.2(b)1Cii: Alterations that add fenestration area of up to 50 square feet shall not be required to meet the total fenestration area requirements of Sections 170.2(a), nor the *U*-factor, RSHGC and VT requirements of Table 180.2-B.

Exception 2 to Section 180.2(b)1Cii: Alterations that add up to 16 square feet of new skylight area per dwelling unit with a maximum *U*-factor of 0.55 and a maximum RSHGC of 0.30 shall not be required to meet the total fenestration area requirements of Section 170.2(a)3.

D. Exterior doors. Alterations that add exterior door area shall meet the *U*-factor requirement of Section 170.2(a)4.

2. Space-conditioning systems.

A. Space-conditioning systems serving dwelling units.

- i. **Entirely new or complete replacement space-conditioning systems** installed as part of an alteration shall include all the system heating or cooling equipment, including but not limited to: condensing unit, cooling or heating coil, and air handler for split systems; or complete replacement of a packaged unit; plus entirely new or replacement duct system [Section 180.2(b)2Aii]. Entirely new or complete replacement space-conditioning systems shall meet the requirements of Sections 160.2(a)1, 160.3(a)1, 160.3(b)1 through 3, 160.3(b)5, 160.3(b)6, 160.3(c)1, 170.2(c)3BA and 180.2(b)2Av, and Table 180.2-C.

- ii. **Altered duct systems—duct sealing:** In all climate zones, when more than 25 feet of new or

replacement space-conditioning system ducts are installed, the ducts shall comply with the applicable requirements of Subsections a and b below. New ducts located in unconditioned space shall meet the applicable requirements of Sections 160.3(b)5A through J and the duct insulation requirements of Table 180.2-C, and

- a. The altered duct system, regardless of location, shall be sealed as confirmed through field verification and diagnostic testing in accordance with all applicable procedures for duct sealing of altered existing duct systems as specified in Reference Residential Appendix RA3.1, utilizing the leakage compliance criteria specified in Subsection I or II below.

**TABLE 180.2-C
DUCT INSULATION R-VALUE**

Climate Zone	3, 5 through 7	1, 2, 4, 8 through 16
Duct R-Value	R-6	R-8

- I. Entirely new or complete replacement duct system. If the new ducts form an entirely new or complete replacement duct system directly connected to the air handler, the duct system shall meet one of the following requirements:

A. The total leakage of the duct system shall not exceed 12 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1, or

B. The duct system leakage to outside shall not exceed 6 percent of the air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4.

Entirely new or complete replacement duct systems installed as part of an alteration are constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system, including but not limited to registers, grilles, boots, air handler, coil, plenums and duct material, if the reused parts are accessible and can be sealed to prevent leakage.

Entirely new or complete replacement duct systems shall also conform to the requirements of Sections 160.2(a)1 and 160.3(b)5L. If the air handler and ducts are located within a vented attic, the requirements of Section 180.2(b)1Bi shall also be met.

- II. Extension of an existing duct system. If the new ducts are an extension of an existing duct system serving multifamily dwell-

ings, the combined new and existing duct system shall meet one of the following requirements:

- A. The measured duct leakage shall be equal to or less than 15 percent of air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or
- B. The measured duct leakage to outside shall be equal to or less than 10 percent of air handler airflow as confirmed by field verification and diagnostic testing utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4; or
- C. If it is not possible to meet the duct sealing requirements of either Section 180.2(b)2AiiI or II then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater utilizing the methods specified in Reference Residential Appendix RA3.1.4.3.5.

Exception to Section 180.2(b)2AiiBII: duct sealing. Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos.

Exception 1 to 180.2(b)2Aii: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

iii. Altered space-conditioning system—duct sealing.

In all climate zones, when a space-conditioning system serving a multifamily dwelling is altered by the installation or replacement of space-conditioning system equipment, including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil, the duct system that is connected to the altered space-conditioning system equipment shall be sealed, as confirmed through field verification and diagnostic testing in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Residential Appendix RA3.1 and the leakage compliance criteria specified in Subsection a, b or c below.

- a. The measured duct leakage shall be equal to or less than 15 percent of air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.1; or

- b. The measured duct leakage to outside shall be equal to or less than 10 percent of air handler airflow as determined utilizing the procedures in Reference Residential Appendix Section RA3.1.4.3.4; or
- c. If it is not possible to meet the duct sealing requirements of either Section 180.2(b)2Aiiia or b, then all accessible leaks shall be sealed and verified through a visual inspection and a smoke test by a certified HERS Rater utilizing the methods specified in Reference Residential Appendix RA3.1.4.3.5.

Exception 1 to Section 180.2(b)2Aiii: duct sealing. Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in Reference Residential Appendix RA3.1.

Exception 2 to Section 180.2(b)2Aiii: duct sealing. Duct systems with less than 40 linear feet as determined by visual inspection.

Exception 3 to Section 180.2(b)2Aiii: duct sealing. Existing duct systems constructed, insulated or sealed with asbestos.

Exception 4 to Section 180.2(b)2Aiii: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

iv. Altered space-conditioning system mechanical cooling.

When a space-conditioning system is an air conditioner or heat pump that is altered by the installation or replacement of refrigerant-containing system components such as the compressor, condensing coil, evaporator coil, refrigerant metering device or refrigerant piping, the altered system shall comply with the following requirements:

- a. All thermostats associated with the system shall be replaced with setback thermostats meeting the requirements of Section 110.2(c).
- b. In Climate Zones 2, 8, 9, 10, 11, 12, 13, 14 and 15, air-cooled air conditioners and air-source heat pumps, including but not limited to ducted split systems, ducted package systems, small duct high velocity air systems, and minisplit systems, shall comply with Subsections I and II, unless the system is of a type that cannot be verified using the specified procedures. Systems that cannot comply with the requirements of Section 180.2(b)2Aivb shall comply with Section 180.2(b)2Aivc.

Exception to Section 180.2(b)2Aivb: Entirely new or complete replacement pack-

aged systems for which the manufacturer has verified correct system refrigerant charge prior to shipment from the factory are not required to have refrigerant charge confirmed through field verification and diagnostic testing. The installer of these packaged systems shall certify that the packaged system was pre-charged at the factory and has not been altered in a way that would affect the charge. Ducted systems shall comply with the minimum system airflow rate requirement in Section 180.2(b)2AivbI, provided that the system is of a type that can be verified using the procedure specified in RA3.3 or an approved alternative in RA1.

I. The minimum system airflow rate shall comply with the applicable Subsection A or B below as confirmed through field verification and diagnostic testing in accordance with the procedures specified in Reference Residential Appendix Section RA3.3 or an approved alternative procedure as specified in Section RA1.

A. Small duct high velocity systems shall demonstrate a minimum system airflow rate greater than or equal to 250 cfm per ton of nominal cooling capacity; or

B. All other air-cooled air conditioner or air-source heat pump systems shall demonstrate a minimum system airflow rate greater than or equal to 300 cfm per ton of nominal cooling capacity.

Exception 1 to Section 180.2(b)2AivbI: Systems unable to comply with the minimum airflow rate requirement shall demonstrate compliance using the procedures in Section RA3.3.3.1.5, and the system's thermostat shall conform to the specifications in Section 110.12.

Exception 2 to Section 180.2(b)2AivbI: Entirely new or complete replacement space-conditioning systems, as specified by Section 180.2(b)2Ai, without zoning dampers may comply with the minimum airflow rate by meeting the applicable requirements in Table 160.3-A or 160.3-B as confirmed by field verification and diagnostic testing in accordance with the procedures in Reference Residential Appendix Sections RA3.1.4.4 and RA3.1.4.5. The design clean-filter pressure drop requirements of Section 160.2(a)1C for the system air filter device(s) shall conform to the requirements given in Tables 160.3-A and 160.3-B.

II. The installer shall charge the system according to manufacturer's specifica-

tions. Refrigerant charge shall be verified according to one of the following options, as applicable.

A. The installer and rater shall perform the standard charge verification procedure as specified in Reference Residential Appendix Section RA3.2.2, or an approved alternative procedure as specified in Section RA1; or

B. The system shall be equipped with a fault indicator display (FID) device that meets the specifications of Reference Joint Appendix JA6. The installer shall verify the refrigerant charge and FID device in accordance with the procedures in Reference Residential Appendix Section RA3.4.2. The HERS Rater shall verify FID device in accordance with the procedures in Section RA3.4.2; or

C. The installer shall perform the weigh-in charging procedure as specified by Reference Residential Appendix Section RA3.2.3.1, provided the system is of a type that can be verified using the RA3.2.2 standard charge verification procedure and RA3.3 airflow rate verification procedure or approved alternatives in RA1. The HERS Rater shall verify the charge using RA3.2.2 and RA3.3 or approved alternatives in RA1.

Exception 1 to Section 180.2(b)2AivbII: When the outdoor temperature is less than 55°F and the installer utilizes the weigh-in charging procedure in Reference Residential Appendix Section RA3.2.3.1 to demonstrate compliance, the installer may elect to utilize the HERS Rater verification procedure in Reference Residential Appendix Section RA3.2.3.2. If the HERS Rater verification procedure in Section RA3.2.3.2 is used for compliance, the system's thermostat shall conform to the specifications in Section 110.12. Ducted systems shall comply with the minimum system airflow rate requirements in Section 180.2(b)2AivbI.

Exception 2 to Section 180.2(b)2Aivb: The HERS Rater field verification and HERS Provider data registry requirements of Reference Residential Appendix RA2 and RA3 are not required for multifamily dwelling units in buildings four stories and greater. The installer shall certify that diagnostic testing was performed in accordance with the applicable procedures.

v. **Altered space-heating system.** Altered or replacement space-heating systems shall not use electric resistance as the primary heat source.

Exception 1 to Section 180.2(b)2Av: Nonducted electric resistance space heating systems, if the existing space heating system is electric resistance.

Exception 2 to Section 180.2(b)2Av: Ducted electric resistance space heating systems, if the existing space heating system is electric resistance and a ducted space cooling system is not being replaced or installed.

Exception 3 to Section 180.2(b)2Av: Electric resistance space heating systems, if the existing space heating system is electric resistance in Climate Zone 6, 7, 8 or 15.

b. **Common use area space-conditioning systems.**

i. New or replacement space-conditioning systems or components other than new or replacement space-conditioning system ducts shall meet the requirements of Sections 170.2(c)1, 2 and 4, applicable to the systems or components being altered. For compliance with Section 170.2(c)4A, additional fan power adjustment credits are available as specified in Table 180.2-D.

Exception 1 to Section 180.2(b)2Bi: Section 180.2(b)2Av does not apply to replacement of electric reheat of equivalent or lower capacity electric resistance space heaters, when natural gas is not available.

Exception 2 to Section 180.2(b)2Bi: Section 170.2(c)4L is not applicable to new or replacement space-conditioning systems.

Exception 3 to Section 180.2(b)2Bi: Section 140.4(e) is applicable to systems, other than single package air-cooled commercial unitary air conditioners and heat pumps, with cooling capacity less than 54,000 Btu/h.

ii. **Altered duct systems.** When new or replacement space-conditioning system ducts are installed to

serve an existing building, the new ducts shall meet the requirements of Section 160.3(c)2 and meet a or b below:

- a. Reserved.
- b. Entirely new or replacement duct systems installed as part of an alteration shall be leakage-tested in accordance with Section 160.2(c)2H. Entirely new or replacement duct systems installed as part of an alteration shall be constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the building's existing duct system, including registers, grilles, boots, air handlers, coils, plenums and ducts, if the reused parts are accessible and can be sealed to prevent leakage.
- c. If the new ducts are an extension of an existing duct system, the combined new and existing duct system meets the criteria in Subsections I, II and III below. The duct system shall be sealed to a leakage rate not to exceed 15 percent of the nominal air handler airflow rate as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures in Reference Nonresidential Appendices NA1 and NA2:
 - I. The duct system provides conditioned air to an occupiable space for a constant volume, single zone, space-conditioning system; and
 - II. The space-conditioning system serves less than 5,000 square feet of conditioned floor area; and
 - III. The combined surface area of the ducts located in the following spaces is more than 25 percent of the total surface area of the entire duct system:
 - A. Outdoors;
 - B. In a space directly under a roof that
 - i. Has a *U*-factor greater than the *U*-factor of the ceiling, or if the roof

**TABLE 180.2-D
FAN POWER LIMITATION PRESSURE DROP ADJUSTMENT**

AIRFLOW	MULTI-ZONE VAV SYSTEMS ¹ ≤5,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >5,000 AND ≤10,000 cfm	MULTI-ZONE VAV SYSTEMS ¹ >10,000 cfm	ALL OTHER FAN SYSTEMS ≤5,000 cfm	ALL OTHER FAN SYSTEMS >5,000 AND ≤10,000 cfm	ALL OTHER FAN SYSTEMS >10,000 cfm
Supply Fan System Additional Allowance	0.135	0.114	0.105	0.139	0.12	0.107
Supply Fan System Additional Allowance in Unit with Adapter Curb	0.033	0.033	0.043	0.000	0.000	0.000
Exhaust/Relief/Return/Transfer Fan System Additional Allowance	0.07	0.061	0.054	0.07	0.062	0.055
Exhaust/Relief/Return/Transfer Fan System Additional Allowance in Unit with Adapter Curb	0.016	0.017	0.022	0.000	0.000	0.000

1. See FAN SYSTEM, MULTI-ZONE VARIABLE AIR VOLUME (VAV) for the definition of a multi-zone VAV system.

does not meet the requirements of Section 170.2(a)1B, or

- ii. Has fixed vents or openings to the outside or unconditioned spaces; or

C. In an unconditioned crawl space; or

D. In other unconditioned spaces.

Exception 1 to Section 180.2(b)2Biib:

When it is not possible to achieve the duct leakage criteria in Section 180.2(b)2Biib, all accessible leaks shall be sealed and verified through a visual inspection and a smoke test performed by a certified HERS Rater utilizing the methods specified in Reference Nonresidential Appendix NA2.1.4.2.2a.

Exception 2 to Section 180.2(b)2Biib: duct sealing.

Existing duct systems that are extended, which are constructed, insulated or sealed with asbestos, are exempt from the requirements of Subsection 180.2(b)2Biib.

- iii. **Altered space-conditioning systems.** When a space-conditioning system is altered by the installation or replacement of space-conditioning system equipment (including replacement of the air handler, outdoor condensing unit of a split system air conditioner or heat pump, or cooling or heating coil:

- a. For all altered units where the existing thermostat does not comply with the requirements for demand responsive controls specified in Section 110.12, the existing thermostat shall be replaced with a demand responsive thermostat that complies with Section 110.12. All newly installed space-conditioning systems requiring a thermostat shall be equipped with a demand responsive thermostat that complies with Section 110.12; and
- b. The duct system that is connected to the new or replaced space-conditioning system equipment shall be sealed, if the duct system meets the criteria of Section 170.2(c)4Ji, as confirmed through field verification and diagnostic testing, in accordance with the applicable procedures for duct sealing of altered existing duct systems as specified in Reference Nonresidential Appendix NA2, and conforming to the applicable leakage compliance criteria in Section 180.2(b)2Bii.

Exception 1 to Section 180.2(b)2Biib: duct sealing.

Buildings altered so that the duct system no longer meets the criteria of Section 170.2(c)4Ji are exempt from the requirements of Subsection 180.2(b)2Biib.

Exception 2 to Section 180.2(b)2Biib: duct sealing.

Duct systems that are documented to have been previously sealed as confirmed through field verification and diagnostic testing in accordance with procedures in the Ref-

erence Nonresidential Appendix NA2 are exempt from the requirements of Subsection 180.2(b)2Biib.

Exception 3 to Section 180.2(b)2Biib: duct sealing.

Existing duct systems constructed, insulated or sealed with asbestos are exempt from the requirements of Subsection 180.2(b)2Biib.

- 3. **Hot water systems.** Altered or replacement water-heating systems or components serving individual dwelling units shall meet the applicable requirements below:

- A. **Pipe insulation.** For newly installed piping and existing accessible piping, the insulation requirements of Section 160.4(f) shall be met.

- B. **Distribution system.** For recirculation distribution system serving individual dwelling units, only demand recirculation systems with manual on/off control as specified in Reference Appendix RA4.4.9 shall be installed.

- C. **Water-heating system.** The water-heating system shall meet one of the following:

- i. A natural gas or propane water-heating system; or

- ii. A single heat pump water heater. The storage tank shall not be located outdoors and shall be placed on an incompressible, rigid insulated surface with a minimum thermal resistance of R-10. The water heater shall be installed with a communication interface that either meets the requirements of Section 110.12(a) or has an ANSI/CTA-2045-B communication port; or

- iii. A single heat pump water heater that meets the requirements of NEEA Advanced Water Heater Specification Tier 3 or higher; or

- iv. If the existing water heater is an electric resistance water heater, a consumer electric water heater.

- v. A water-heating system determined by the Executive Director to use no more energy than the one specified in Sections 180.2(b)3Ci through iii above; or if no natural gas is connected to the existing water heater location, a water-heating system determined by the Executive Director to use no more energy than the one specified in Section 180.2(b)3Civ above.

- 4. **Lighting.**

- A. **Dwelling unit lighting.** The altered lighting system shall meet the lighting requirements of Section 160.5(a). The altered luminaires shall meet the luminaire efficacy requirements of Section 160.5(a) and Table 160.5-A. Where existing screw base sockets are present in ceiling-recessed luminaires, removal of these sockets is not required, provided that new JA8 compliant trim kits or lamps designed for use with recessed downlights or luminaires are installed.

B. Common use area—lighting, sign lighting, and electrical power distribution systems.

- i. Spaces with lighting systems installed for the first time shall meet the applicable requirements of Sections 110.9, 160.5(b)1, 160.5(b)2, 160.5(b)3, 160.5(b)4, 160.5(c), 160.5(e), 170.2(b), and 170.2(e)1 through 170.2(e)6.
- ii. When the requirements of Section 160.5(b)4D are triggered by the addition of skylights to an existing building and the lighting system is not recircuited, the daylighting control need not meet the multi-level requirements in Section 160.5(b)4D.
- iii. New internally and externally illuminated signs shall meet the requirements of Sections 110.9, 160.5(d) and 170.2(e)7.
- iv. Altered indoor lighting systems. Alterations to indoor lighting systems that include 10 percent or more of the luminaires serving an enclosed space shall meet the requirements of a, b or c below:
 - a. The alteration shall comply with the indoor lighting power requirements specified in Sections 170.2(e)1 through 4 and the lighting control requirements specified in Table 180.2-E; or
 - b. The alteration shall not exceed 80 percent of the indoor lighting power requirements specified in Section 170.2(e)1 through 4, and shall comply with the lighting control requirements specified in Table 180.2-E; or
 - c. The alteration shall be a one-for-one luminaire alteration within a building or tenant space of 5,000 square feet or less, the total wattage of the altered luminaires shall be at least 40 percent lower compared to their total prealteration wattage and the alteration shall comply with the lighting control requirements specified in Table 180.2-E.

Alterations to indoor lighting systems shall not prevent the operation of existing, unaltered controls, and shall not alter controls to remove functions specified in Section 160.5(b)4.

Alterations to lighting wiring are considered alterations to the lighting system. Alterations to indoor lighting systems are not required to separate existing general, floor, wall, display or decorative lighting on shared circuits or controls. New or completely replaced lighting circuits shall comply with the control separation requirements of Sections 160.5(b)4Aiv and 160.5(b)4Cid.

Exception 1 to Section 180.2(b)4Biv: Alteration of portable luminaires, luminaires affixed to moveable partitions, or lighting excluded as specified in Section 170.2(e)2C.

Exception 2 to Section 180.2(b)4Biv: Any enclosed space with only one luminaire.

Exception 3 to Section 180.2(b)4Biv: Any alteration that would directly cause the disturbance of asbestos, unless the alteration is made in conjunction with asbestos abatement.

Exception 4 to Section 180.2(b)4Biv: Acceptance testing requirements of Section 160.5(e) are not required for alterations where lighting controls are added to control 20 or fewer luminaires.

Exception 5 to Section 180.2(b)4Biv: Any alteration limited to adding lighting controls or replacing lamps, ballasts or drivers.

Exception 6 to Section 180.2(b)4Biv: One-for-one luminaire alteration of up to 50 luminaires either per complete floor of the building or per complete tenant space, per annum.

- v. Alterations to existing outdoor lighting systems in a lighting application listed in Table 170.2-R or 170.2-S shall meet the applicable requirements of Sections 160.5(b)1, 160.5(b)2, 160.5(b)3, 160.5(c)1 and 160.5(e), and:
 - a. In alterations that increase the connected lighting load, the added or altered luminaires shall meet the applicable requirements of Section 160.5(c)2 and the requirements of Section 170.2(e)6 for general hardscape lighting or for the specific lighting applications containing the alterations; and
 - b. In alterations that do not increase the connected lighting load, where 10 percent or more of the existing luminaires are replaced in a general hardscape or a specific lighting application, the alterations shall meet the following requirements:
 - I. In parking lots and outdoor sales lots where the bottom of the luminaire is mounted 24 feet or less above the ground, the replacement luminaires shall comply with Section 160.5(c)2A and Section 160.5(c)2C;
 - II. For parking lots and outdoor sales lots where the bottom of the luminaire is mounted greater than 24 feet above the ground and for all other lighting applications, the replacement luminaires shall comply with Section 160.5(c)2A and either comply with Section 160.5(c)2B or be controlled by lighting control systems, including motion sensors, that automatically reduce lighting power by at least 40 percent in response to the area being vacated of occupants; and
- Exception to Section 180.2(b)4Bvb:** Alterations where fewer than five existing luminaires are replaced.
- c. In alterations that do not increase the connected lighting load, where 50 percent or more of the existing luminaires are replaced in general hardscape or a specific application, the

replacement luminaires shall meet the requirements of Subsection b above and the requirements of Section 170.2(e)6 for general hardscape lighting or specific lighting applications containing the alterations.

Exception 1 to Section 180.2(b)4Bvc: Alterations where the replacement luminaires have at least 40 percent lower power consumption compared to the original luminaires are not required to comply with the lighting power allowances of Section 170.2(e)6.

Exception 2 to Section 180.2(b)4Bvc: Alterations where fewer than five existing luminaires are replaced.

Exception 3 to Section 180.2(b)4Bv: Acceptance testing requirements of Section 160.5(e) are not required for alterations where controls are added to 20 or fewer luminaires.

- vi. Alterations to existing internally and externally illuminated signs that increase the connected lighting load, replace and rewire more than 50 percent of the ballasts, or relocate the sign to a different location on the same site or on a different site shall meet the requirements of Section 170.2(e)7.

Exception to Section 180.2(b)4Bvi: Replacement of parts of an existing sign, including replacing lamps, the sign face or ballasts, that do not require rewiring or that are done at a time other than when the sign is relocated, is not an alteration subject to the requirements of Section 180.2(b)4Bvi.

- vii. Alterations to existing electrical power distribution systems shall meet the applicable requirements of the following sections:

- a. Service electrical metering. New or replacement electrical service equipment shall meet the requirements of Section 160.6(a) applicable to the electrical power distribution system altered; and
- b. Separation of electrical circuits for electrical energy monitoring. For entirely new or complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Section 160.6(b); and
- c. Voltage drop. For alterations of feeders and branch circuits where the alteration includes addition, modification or replacement of both feeders and branch circuits, the altered circuits shall meet the requirements of Section 160.6(c); and

Exception to Section 180.2(b)4Bviic: Voltage drop permitted by *California Electrical Code* Sections 647.4, 695.6 and 695.7.

- d. Circuit controls for 120-volt receptacles and controlled receptacles. For entirely new or

complete replacement of electrical power distribution systems, the entire system shall meet the applicable requirements of Section 160.6(d).

- 5. **Mechanical ventilation and indoor air quality for dwelling units.** Alterations to existing buildings shall comply with Subsections A and B below as applicable. When HERS field verification and diagnostic testing are required by Section 180.2(b)5, buildings with three habitable stories or fewer shall use the applicable procedures in the Residential Appendices, and buildings with four or more habitable stories shall use the applicable procedures in Nonresidential Appendices NA1 and NA2.

A. Entirely new or complete replacement ventilation systems. Entirely new or complete replacement ventilation systems shall comply with all applicable requirements in Section 160.2(b)2. An entirely new or complete replacement ventilation system includes a new ventilation fan component and an entirely new duct system. An entirely new or complete replacement duct system is constructed of at least 75 percent new duct material, and up to 25 percent may consist of reused parts from the dwelling unit's existing duct system, including but not limited to registers, grilles, boots, air filtration devices and duct material, if the reused parts are accessible and can be sealed to prevent leakage.

B. Altered ventilation systems. Altered ventilation system components or newly installed ventilation equipment serving the alteration shall comply with Section 160.2(b)2 as applicable subject to the requirements specified in Subsections i and ii below.

i. Whole-dwelling unit mechanical ventilation.

- a. **Whole-dwelling unit airflow.** If the whole-dwelling ventilation fan is altered or replaced, then one of the following Subsections 1 or 2 shall be used for compliance as applicable.

1. Dwellings that were required by a previous building permit to comply with the whole-dwelling unit airflow requirements in Section 160.2(b)2, 120.1(b) or 150.0(o) shall meet or exceed the whole-dwelling unit mechanical ventilation airflow specified in Section 160.2(b)2Aiv or 160.2(b)2Av as confirmed through HERS field verification and diagnostic testing in accordance with the applicable procedures specified in Reference Appendix RA3.7 or NA2.2.

2. Dwellings that were not required by a previous building permit to have a whole-dwelling unit ventilation system to comply with Section 160.2(b)2, 120.1(b) or 150.0(o) shall not be required to comply with the whole-dwelling unit ventilation airflow specified in Section 160.2(b)2Aiv or 160.2(b)2Av.

**TABLE 180.2-E
CONTROL REQUIREMENTS FOR INDOOR LIGHTING SYSTEM ALTERATIONS FOR COMMON USE AREAS**

CONTROL SPECIFICATIONS	PROJECTS COMPLYING WITH SECTION 180.2(B)4Biva	PROJECTS COMPLYING WITH SECTION 180.2(B)4Bivb OR 180.2(B)4Bivc
Manual Area Controls 160.5(b)4Ai	Required	Required
Manual Area Controls 160.5(b)4Aii	Required	Required
Manual Area Controls 160.5(b)4Aiii	Only required for new or completely replaced circuits	Only required for new or completely replaced circuits
Multi-Level Area Controls 160.5(b)4B	Required	Not Required
Automatic Shut Off Controls 160.5(b)4Ci	Required	Required
Automatic Shut Off Controls 160.5(b)4Cii	Required	Required
Automatic Shut Off Controls 160.5(b)4Ciii	Required	Required
Automatic Shut Off Controls 160.5(b)4Civ	Required	Required
Automatic Shut Off Controls 160.5(b)4Cv	Required	Required
Automatic Shut Off Controls 160.5(b)4Cvi	Required	Required
Automatic Shut Off Controls 160.5(b)4Cvii	Required	Required
Daylighting Controls 160.5(b)4D	Required	Not Required
Demand Responsive Controls 160.5(b)4E	Required	Not Required

- b. **Replacement ventilation fans.** Whole-dwelling unit replacement ventilation fans shall be rated for airflow and sound in accordance with the requirements of ASHRAE 62.2 Sections 7.1 and 7.2. Additionally, when conformance to a specified whole-dwelling unit airflow rate is required for compliance, the replacement fans shall be rated at no less than the airflow rate required for compliance.
- c. **Air filters.** If the air filtration device for a whole-dwelling unit ventilation system is altered or replaced, then one of the following Subsections 1 or 2 shall be used for compliance.
 1. Dwellings that were required by a previous building permit to comply with the ventilation system air filtration requirements in Section 160.2(b)1, 120.1(b)1 or 150.0(m)12 shall comply with the air filtration requirements in Section 160.2(b)1.
 2. Dwellings that were not required by a previous building permit to comply with the ventilation system air filtration require-

ments in Section 160.2(b)1, 120.1(b)1 or 150.0(m)12 shall not be required to comply with the air filtration requirements specified in Section 160.2(b)1.

- ii. **Local mechanical exhaust.**
 - a. **Bathroom local mechanical exhaust.** Altered bathroom local mechanical exhaust systems shall comply with the applicable requirements specified in Section 160.0(b)2Avi.
 - b. **Kitchen local mechanical exhaust.** If the kitchen local ventilation fan is altered or replaced, then one of the following Subsections 1, 2 or 3 shall be used for compliance.
 1. Dwellings that were required by a previous building permit to comply with the kitchen local exhaust requirements in Section 160.0(b)2Avi, 120.1(b)2vi or 150.0(o)1G shall meet or exceed the applicable airflow or capture efficiency requirements in Section 160.0(b)2Avi.
 2. Dwellings that were required by a previous building permit to install a vented kitchen

range hood or other kitchen exhaust fan shall install a replacement fan that meets or exceeds the airflow required by the previous building permit, or 100 cfm, whichever is greater.

3. Dwellings that were not required to have a kitchen local ventilation exhaust system according to the conditions in either Subsection 1 or 2 above shall not be required to comply with the requirements of Section 160.0(b)2Avi.

- c. **Replacement ventilation fans.** New or replacement local mechanical exhaust fans shall be rated for airflow and sound in accordance with the requirements of ASHRAE 62.2 Section 7.1 and Title 24, Part 6, Section 160.0(b)2Avif. Additionally, when compliance with a specified exhaust airflow rate is required, the replacement fan shall be rated at no less than the airflow rate required for compliance.

(c) **Performance approach.** The altered component(s) and any newly installed equipment serving the alteration shall meet the applicable requirements of Subsections 1, 2 and 3 below.

1. The altered components shall meet the applicable requirements of Sections 110.0 through 110.9, 160.0, 160.1, 160.2(c) and (d), 160.3(a) through 160.3(b)5J, 160.3(b)6, 160.3(c), and 160.5. Entirely new or complete replacement mechanical ventilation systems as these terms are used in Section 180.2(b)5A shall comply with the requirements in Section 180.2(b)5A. Altered mechanical ventilation systems shall comply with the requirements of Sections 180.2(b)5B. Entirely new or complete replacement space-conditioning systems, and entirely new or complete replacement duct systems, as these terms are used in Sections 180.2(b)2Ai and 180.2(b)2Aii, shall comply with the requirements of Sections 160.2(a)1 and 160.3(b)5L.
2. The standard design for an altered component shall be the higher efficiency of existing conditions or the requirements of Section 180.2(b). For components not being altered, the standard design shall be based on the unaltered existing conditions such that the standard and proposed designs for these components are identical. When the third-party verification option is specified, all components proposed for alteration for which the additional credit is taken shall be verified by a qualified third party.
3. The proposed design shall be based on the actual values of the altered components.

NOTES TO SECTION 180.2(c):

1. If an existing component must be replaced with a new component, that component is considered an altered

component for the purpose of determining the standard design altered component energy budget and must meet the requirements of Section 180.2(c)2.

2. The standard design shall assume the same geometry and orientation as the proposed design.
3. The “existing efficiency level” modeling rules, including situations where nameplate data is not available, are described in the applicable Residential or Nonresidential ACM Approval Manual.

EXCEPTION 1 to Section 180.2(c): Any dual-glazed greenhouse or garden window installed as part of an alteration complies with the *U*-factor requirements in Section 170.2.

EXCEPTION 2 to Section 180.2(c): Where the space in the attic or rafter area is not large enough to accommodate the required *R*-value, the entire space shall be filled with insulation, provided such installation does not violate Section 1203.2 of Title 24, Part 2.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 180.3
REPAIRS**

Repairs shall not increase the preexisting energy consumption of the repaired component, system or equipment.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

**SECTION 180.4
WHOLE BUILDING**

Any addition or alteration may comply with the requirements of Title 24, Part 6 by meeting the requirements for the entire building.

NOTE: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, *Public Resources Code*. Reference: Sections 25007, 25008, 25218.5, 25310, 25402, 25402.1, 25402.4, 25402.5, 25402.8 and 25943, *Public Resources Code*.

CALIFORNIA MECHANICAL CODE, CALIFORNIA CODE OF REGULATIONS, TITLE 24, PART 4, CHAPTER 6, DUCT SYSTEMS

TABLE P4-A ADOPTION TABLE

CODE SECTION	AGENCY
Adopt entire Chapter as amended (amended sections listed below) ¹	CEC
601.0	X
602.0	X
603.0	X
604.0	X
605.0	X

1. Adopted by reference for Occupancies A, B, E, F, H, M, R, S and U; see Sections 110.8(d)3, 120.4 and 150.0(m).

APPENDIX 1-A

STANDARDS AND DOCUMENTS REFERENCED IN THE ENERGY CODE

The following documents are incorporated by reference to the extent they are referenced in the Energy Code.

AIR-CONDITIONING, HEATING AND REFRIGERATION INSTITUTE		AHRI 1060 (I-P)-2018 Performance Rating of Air-to-Air Exchangers for Energy Recovery Ventilation Equipment (2018)	
>	AHRI 210/240-2017 Performance Rating of Unitary Air Conditioning and Air-Source Heat Pump Equipment (2017 with Addendum 1)	AHRI 1230-2014 Performance Rating of Variable Refrigerant Flow (VRF) Multi-Split Air-Conditioning and Heat Pump Equipment (w/Addendum 1)	
>	AHRI 310/380-2017 Packaged Terminal Air-Conditioners and Heat Pumps (2017)	AHRI 1360 (I-P)-2017 Performance Rating of Computer and Data Processing Room Air Conditioners (2017)	
>	AHRI 340/360 (I-P)-2019 Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment (2019)	Available from: Air-Conditioning, Heating and Refrigeration Institute 2311 Wilson Blvd., Suite 400 Arlington, VA 22203 (703) 524-8800	
	ANSI/AHRI 365 (I-P)-2009 Performance Rating of Commercial and Industrial Unitary Air-Conditioning Condensing Units (2009)	AIR-CONDITIONING CONTRACTORS OF AMERICA	
	ANSI/AHRI 390-2003 Performance Rating of Single Package Vertical Air Conditioners and Heat Pumps (2003)	ANSI/ACCA 2 Manual J-2016 Manual J—Residential Load Calculation, Eighth Edition (2016)	
	ANSI/AHRI 400 (I-P)-2015 Performance Rating of Liquid to Liquid Heat Exchangers (2015)	Available from: Air-Conditioning Contractors of America, Inc. 2800 Shirlington Road, Suite 300 Arlington, VA 22206 www.acca.org (703) 575-4477	
	AHRI 430 (I-P)-2020 Performance Rating of Central Station Air-handling Unit Supply Fans (2020)	AMERICAN ARCHITECTURAL MANUFACTURERS ASSOCIATION	
	AHRI 440 (I-P)-2019 Performance Rating of Fan-coil Units (2019)	CANADIAN STANDARDS ASSOCIATION	
	ANSI/AHRI 460-2005 Performance Rating of Remote Mechanical-Draft Air-Cooled Refrigerant Condensers (2005)	WINDOW AND DOOR MANUFACTURERS ASSOCIATION	
	AHRI 550/590 (I-P)-2020 Performance Rating of Water-Chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle (2020)	AAMA/WDMA/ CSA 101/I.S.2/ A440-17 North American Fenestration Standard/Specification for Windows, Doors, and Skylights (2017)	<
>	AHRI 560-2000 Absorption Water Chilling and Water Heating Packages (2000)	Available from: AAMA 1827 Walden Office Square, Suite 550 Schaumburg, IL 60173-4268 (847) 303-5664 www.aamanet.org	
	AHRI 680 (I-P)-2017 Performance Rating of Residential Air Filter Equipment (2017)	CSA 5060 Spectrum Way, Suite 100 Mississauga, ON, Canada L4W 5N6 (800) 463-6727 www.csagroup.org	
	AHRI 920 (I-P)-2020 Performance Rating of Direct Expansion-Dedicated Outdoor Air System Units (2020)		

STANDARDS AND DOCUMENTS REFERENCED IN THE ENERGY CODE

WDMA
2025 M Street, NW, Suite 800
Washington, DC 20036-3309
(202) 367-1157
www.wdma.com

Available from: American National Standards Institute
25 West 43rd Street, 4th floor
New York, NY 10036
(212) 642-4900

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

2021 TLVs and BEIs

Threshold Limit Values (TLVS) and Biological Exposure Indices (BEIS)

Available from: ACGIH
1330 Kemper Meadow Drive
Cincinnati, Ohio 45240
(513) 742-2020
www.acgih.org

ANSI/APSP/ICC-5-2011

American National Standard For Residential Inground Swimming Pools (2011 w/Addendum A)

Available from: Association of Pool & Spa Professionals
2111 Eisenhower Ave.
Alexandria, VA 22314
(703) 838-0083

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (NATIONAL PUBLICATIONS)

AMERICAN NATIONAL STANDARDS INSTITUTE

ANSI/AMCA 208-18

Calculation of the Fan Energy Index (2018)

ANSI/AMCA 210-16

Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating (2016)

ANSI/AMCA 500-D-18

Laboratory Methods Of Testing Dampers For Rating (2018)

ANSI/ASABE S640 JUL2017

Quantities and Units of Electromagnetic Radiation for Plants (Photosynthetic Organisms)

ANSI/ASSP Z9.5-2012

Laboratory Ventilation (2012)

ANSI/CTA-2045-B2021

Modular Communications Interface for Energy Management (2018)

ANSI C82.6-2015 (R2020)

American National Standard for Lamp Ballasts—Ballasts for High-Intensity Discharge Lamps—Methods of Measurement (2020)

ANSI/NEMA WD 6-2016

American National Standard for Wiring Devices—Dimensional Specifications (2016)

ANSI Z21.40.4a-1998 (R2017)/CGA 2.94a-M98 (R2017)

Performance Testing and Rating of Gas-Fired, Air-Conditioning and Heat Pump Appliances (2017)

ANSI Z21.47-2021/CSA 2.3:21

Gas-Fired Central Furnaces (2021)

ANSI Z83.8-2016/CSA 2.6-2016 (R2021)

Gas Unit Heaters, Gas Packaged Heaters, Gas Utility Heaters and Gas-Fired Duct Furnaces (2016)

ANSI/ASHRAE Standard 52.2-2017

Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size (2017)

ANSI/ASHRAE Standard 55-2020

Thermal Environment Conditions for Human Occupancy (2020)

ANSI/ASHRAE Standard 62.1-2019

Ventilation for Acceptable Indoor Air Quality (2019)

ANSI/ASHRAE Standard 62.2-2019

Ventilation and Acceptable Indoor Air Quality in Residential Buildings (2019)

ANSI/ASHRAE Standard 84-2020

Method of Testing Air-to-Air Heat/Energy Exchangers (2020)

ANSI/ASHRAE/IES Standards 90.1-2019

Energy Standards for Buildings Except Low-Rise Residential Buildings (2019)

ANSI/ASHRAE Standard 154-2016

Ventilation for Commercial Cooking Operations (2016)

ANSI/ASHRAE 193-2010 (RA2014)

Method of Test for Determining the Airtightness of HVAC Equipment (RA2014)

ASHRAE Handbooks

HVAC Applications (I-P) (2019)

HVAC Systems and Equipment (I-P) (2020)

Fundamentals (I-P) (2017)

Available from: American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
1791 Tullie Circle N.E.
Atlanta, GA 30329
www.ashrae.org

AMERICAN SOCIETY OF HEATING, REFRIGERATING AND AIR-CONDITIONING ENGINEERS (REGIONAL PUBLICATION)

ASHRAE Climatic Data for Region X Arizona, California, Hawaii, Nevada, Publication SPCDX, 1982, ISBN #20002196 and Supplement, 1994, ISBN #20002596

Available from: Order Desk
 Building News
 10801 National Boulevard
 Los Angeles, CA 90064
 (800) 873-6397 or (310) 474-7771
 www.bnibooks.com/

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

ASME A17.1-2019/CSA B44:19
 Safety Code for Elevators and Escalators (2019)

ASME A112.18.1-2018/CSA B125.1-18
 Plumbing Supply Fittings

Available from: ASME
 Two Park Avenue
 New York, NY 10016-5990
 (800) 843-2763
 http://www.asme.org/

ASSOCIATION OF HOME APPLIANCE MANUFACTURERS

AHAM HRH-2-2020 Residential Kitchen Range Hood Performance Test Procedures (2020)

AHAM RKRH-CPPG-2020 Residential Kitchen Range Hood Certification Program Procedural Guide (2020) Version 3.0

Available from: Association of Home Appliance Manufacturers
 1111 19th Street, NW, Suite 402
 Washington, DC 20036
 (202) 872-5955
 www.aham.org

ASTM INTERNATIONAL (FORMERLY AMERICAN SOCIETY FOR TESTING AND MATERIALS)

ASTM C55-17 Standard Specification for Concrete Building Brick (2017)

ASTM C177-19 Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded Hot Plate Apparatus (2019)

ASTM C272/C272M-18 Standard Test Method for Water Absorption of Core Materials for Sandwich Constructions (2018)

ASTM C335/C335M-17 Standard Test Method for Steady-State Heat Transfer Properties of Horizontal Pipe Insulation (2017)

ASTM C518-17 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus (2017)

ASTM C731-15 Standard Test Method for Extrudability, After Package Aging, of Latex Sealants (2015)

ASTM C732-17 Standard Test Method for Aging Effects of Artificial Weathering on Latex Sealants (2017)

ASTM C836/C836M-18 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course (2018)

ASTM C1167-11 (2017) Standard Specification for Clay Roof Tiles (2017)

ASTM C1371-15 Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers (2015)

ASTM C1492-03 (2016) Standard Specification for Concrete Roof Tile (2016)

ASTM C1549-16 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer (2016)

ASTM C1583/C1583M-20 Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method) (2020)

ASTM D448-12 (2017) Standard Classification for Sizes of Aggregate for Road and Bridge Construction (2017)

ASTM D522/D522M-17 Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings (2017)

ASTM D822-13 (2018) Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings (2018)

STANDARDS AND DOCUMENTS REFERENCED IN THE ENERGY CODE

<p> ASTM D1003-21 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics (2021)</p> <p> ASTM D1653-21 Standard Test Methods for Water Vapor Transmission of Organic Coating Films (2021)</p> <p> ASTM D1863/D1863M-05(2018) Standard Specification for Mineral Aggregate Used on Built-Up Roofs (2018)</p> <p> ASTM D2202-00(2019) Standard Test Method for Slump of Sealants (2019)</p> <p> ASTM D2370-16 Standard Test Method for Tensile Properties of Organic Coatings (2016)</p> <p> ASTM D2824/D2824M-18 Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered and Fibered without Asbestos (2018)</p> <p>> ASTM D3468/D3468M (2020) Standard Specification for Liquid-Applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing (2020)</p> <p> ASTM D3805/D3805M-16 Standard Guide for Application of Aluminum-Pigmented Asphalt Roof Coatings (2016)</p> <p> ASTM D4798/D4798M-11(2021) Standard Practice for Accelerated Weathering Test Conditions and Procedures for Bituminous Materials (Xenon-Arc Method) (2021)</p> <p> ASTM D5870-16 Standard Practice for Calculating Property Retention Index of Plastics (2016)</p> <p> ASTM D6083/D6083M-21 Standard Specification for Liquid-Applied Acrylic Coating Used in Roofing (2021)</p> <p> ASTM D6694/D6694M-15 Standard Specification for Liquid-Applied Silicone Coating Used in Spray Polyurethane Foam Roofing Systems (2015)</p> <p> ASTM E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials (2016)</p> <p> ASTM E283/E283M-19 Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen (2019)</p>	<p>ASTM E779-19 Standard Test Method for Determining Air Leakage Rate by Fan Pressurization (2019)</p> <p>ASTM E903-20 Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres (2020)</p> <p>ASTM E972-96(2021) Standard Test Method for Solar Photometric Transmittance of Sheet Materials Using Sunlight (2021)</p> <p>ASTM E1175-87(2015) Standard Test Method for Determining Solar or Photopic Reflectance, Transmittance, and Absorptance of Materials Using a Large Diameter Integrating Sphere (2015)</p> <p>ASTM E1677-19 Standard Specification for Air Barrier (AB) Material or Assemblies for Low-Rise Framed Building Walls (2019)</p> <p>ASTM E1680-16 Standard Test Method for Rate of Air Leakage through Exterior Metal Roof Panel Systems (2016)</p> <p>ASTM E1918-16 Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field (2016)</p> <p>ASTM E1980-11 (2019) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces (2019)</p> <p>ASTM E2178-21 Standard Test Method for Determining Air Leakage Rate and Calculation of Air Permeance of Building Materials (2021)</p> <p>ASTM E2357-18 Standard Test Method for Determining Air Leakage Rate of Air Barrier Assemblies (2018)</p> <p>ASTM E3087-18 Standard Test Method for Measuring Capture Efficiency of Domestic Range Hoods (2018)</p> <p>Available from: ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428-2959 (800) 262-1373 or (610) 832-9500</p>
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CALIFORNIA HISTORICAL BUILDING CODE

- 2022 California Building Code
- 2022 California Electrical Code
- 2022 California Fire Code
- 2022 California Mechanical Code
- 2022 California Plumbing Code

Available from: California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
(916) 263-0916
www.bsc.ca.gov

CALIFORNIA ENERGY COMMISSION

Appliance Efficiency Regulations
Alternative Calculation Method (ACM) Manual

Available from: California Energy Commission
1516 Ninth Street
Sacramento, CA 95814
(916) 654-5106 or
(800) 772-3300 (in California)
www.energy.ca.gov/title24

CALIFORNIA DEPARTMENT OF CONSUMER AFFAIRS

Standards for Insulating Material
Available from: California Department of Consumer Affairs
Bureau of Household Goods and Services
4244 South Market Court, Suite D
Sacramento, California 95834-1243
(916) 999-2041

CERTIFYING ORGANIZATION

CIE 13.3-1995 Method of Measuring and Specifying Colour Rendering Properties of Light Sources (1995)
CIE 015-2018 Technical Report: Colorimetry (2018)

COOLING TECHNOLOGY INSTITUTE

CTI ATC-105 (19) Acceptance Test Code for Cooling Towers (2019)
CTI ATC-105DS (18) Acceptance Test Code for Dry Fluid Coolers (2018)
CTI ATC-105S (11) Acceptance Test Code for Closed-Circuit Cooling Towers (2011)
CTI ATC-106 (11) Acceptance Test Code for Mechanical Draft Evaporative Vapor Condensers (2011)
CTI STD-201 RS (17)

Standard for the Certification of Water-Cooling Tower Thermal Performance (2017)
Available from: Cooling Technology Institute
2611 FM 1960 West, Suite A101
Houston, Texas 77068-3730
PO Box 73383
Houston, TX 77273-3383
(281) 583-4087

COOL ROOF RATING COUNCIL

CRRC-1 Product Rating Program Manual (2021)
Available from: Cool Roof Rating Council
2435 N. Lombard Street
Portland, OR 97217
(866) 465-2523
www.coolroofs.org

HOME VENTILATING INSTITUTE

HVI Publication 915-2020
HVI Loudness Testing and Rating Procedure (2020)
HVI Publication 916-2020
HVI Airflow Test Procedure (2020)
HVI Publication 920-2020
HVI Product Performance Certification Procedure Including Verification and Challenge (2020)
Available from: Home Ventilating Institute
1740 Dell Range Blvd.,
Suite H, PMB 450
Cheyenne, WY 82009
(855) 484-8368
www.hvi.org

ILLUMINATING ENGINEERING SOCIETY

The IES Lighting Library™
ANSI/IES LM-79-19 Approved Method: Optical and Electrical Measurements of Solid-State Lighting Products (2019)
ANSI/IES LS-1-20 Lighting Science: Nomenclature and Definitions for Illuminating Engineering (2020)
ANSI/IES TM-15-20 Technical Memorandum: Luminaire Classification System for Outdoor Luminaires (2020)
Available from: Illuminating Engineering Society
120 Wall Street, 17th Floor
New York, NY 10005-4026
(212) 248-5000
www.ies.org

INTERNATIONAL ASSOCIATION OF PLUMBING AND MECHANICAL OFFICIALS

California Mechanical Code
Available from: International Association of Plumbing and Mechanical Officials
4755 E. Philadelphia St.
Ontario, CA 91761
(800) 85-IAPMO (854-2766)
www.iapmo.org

INTERNATIONAL CODE COUNCIL

California Building Code

Available from: International Code Council
Western Regional Office
3060 Saturn St.
Brea, CA 92821
(888) 422-7233
www.iccsafe.org

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO 5801:2017 Fans—Performance testing using standardized airways (2017)

ISO 13256-1:1998 (RA 2012) Water-Source Heat Pumps—Testing and Rating for Performance—Part 1: Water-to-Air and Brine-to-Air Heat Pumps (2012)

ISO 13256-2:1998 (RA 2012) Water-Source Heat pumps—Testing and rating for Performance—Part 2: Water-to-Water and Brine-to-Water Heat Pumps (2012)

ISO/IEC 17025:2017 General Criteria for the Competence of Testing and Calibration Laboratories (2017)

Available from: ISO
Chemin de Blandonnet 8
CP 401
1214 Vernier
Geneva, Switzerland

INTERNATIONAL WINDOW FILM ASSOCIATION

Architectural Visual Inspection Standard Window Film (reendorsed 2018)

Available from: International Window Film Association
P.O. Box 3871
Martinsville, VA 24115-3871
276-666-4932

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION

NEMA LSD 57-2018 Polyurethane Foam Application: Lighting Equipment (2018)

NEMA SSL 7A-2015 Phase Cut Dimming for Solid State Lighting: Basic Compatibility (2015)

Available from: 1300 North 17th Street, Suite 1752
Rosslyn, VA 22209
708-841-3200
www.nema.org

NATIONAL FENESTRATION RATING COUNCIL

ANSI/NFRC 100-2020 Procedure for Determining Fenestration Product *U*-factors (2020)

ANSI/NFRC 200-2020 Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmittance at Normal Incidence (2020)

ANSI/NFRC 202-2020 Procedure for Determining Translucent Fenestration Product Visible Transmittance at Normal Incidence (2020)

ANSI/NFRC 203-2020 Procedure for Determining Visible Transmittance of Tubular Daylighting Devices (2020)

ANSI/NFRC 400-2020 Procedure for Determining Fenestration Product Air Leakage (2020)

Available from: National Fenestration Rating Council
6035 Ivy Lane, Suite 140
Greenbelt, MD 20770
(301) 589-1776
www.NFRC.org
Email: info@nfr.org

NSF INTERNATIONAL (FORMERLY NATIONAL SANITATION FOUNDATION)

NSF/ANSI/CAN 50-2020 Equipment and Chemicals for Swimming Pools, Spas, Hot Tubs, and Other Recreational Water Facilities (2020)

Available from: NSF International
PO Box 130140
Ann Arbor, MI 48113
(735) 769-8010

RESIDENTIAL ENERGY SERVICES NETWORK

ANSI/RESNET/ICC 380-2019 Standard for Testing Airtightness of Building Enclosures, Dwelling Unit, and Sleeping Unit Enclosures, Airtightness of Heating and Cooling Air Distribution Systems, and Airflow of Mechanical Ventilation Systems (2019)

Available from: Residential Energy Services Network, Inc. (RESNET)
P.O. Box 4561
Oceanside, CA 92052-4561
http://resnet.us/

<p>SAE INTERNATIONAL</p> <p>SAE J1772_201710 SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler (2017)</p>	<p>UL 1973</p>	<p>Standard for Safety for Batteries for Use in Stationary, Vehicle Auxiliary Power and Light Electric Rail (LER) Applications (2018)</p>	<p> </p>
<p>SHEET METAL AND AIR-CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION</p> <p>Residential Comfort System Installation Standards Manual, Eighth Edition (2016)</p> <p>ANSI/SMACNA 006-2006 HVAC Duct Construction Standards—Metal and Flexible (2006)</p> <p>Available from: Sheet Metal and Air-Conditioning Contractors' National Association (SMACNA) 4201 Lafayette Center Drive Chantilly, VA 20151-1209 (703) 803-2980 www.smacna.org</p>	<p>UL 2108</p> <p>UL 8750</p> <p>UL 9540</p> <p>Available from:</p>	<p>Standard for Safety for Low Voltage Lighting Systems (2019)</p> <p>Standard for Safety for Light Emitting Diode (LED) Equipment for Use in Lighting Products (2021)</p> <p>Standard for Safety for Energy Storage Systems and Equipment (2021)</p> <p>UL LLC 333 Pfingsten Road Northbrook, IL 60062-2096 (847) 272-8800</p>	<p> </p> <p> </p> <p> </p> <p> </p>
<p>UNDERWRITERS LABORATORIES / UL</p> <p>UL 181 Standard for Safety for Factory-made Air Ducts and Connectors (2017)</p> <p>UL 181A Standard for Safety for Closure Systems for Use with Rigid Air Ducts (2017)</p> <p>UL 181B Standard for Safety for Closure Systems for Use with Flexible Air Ducts and Air Connectors (2017)</p> <p>UL 723 Standard for Safety for Test for Surface Burning Characteristics of Building Materials (2018)</p> <p>UL 727 Standard for Safety for Oil-Fired Central Furnaces (2018)</p> <p>UL 731 Standard for Safety for Oil-Fired Unit Heaters (2018)</p> <p>UL 1077 Standard for Safety for Supplementary Protectors for Use in Electrical Equipment (2016)</p> <p>UL 1574 Standard for Safety for Track Lighting Systems (2020)</p> <p>UL 1598 Standard for Safety for Luminaires (2021)</p> <p>UL 1741 Standard for Safety for Inverters, Converters, Controllers and Interconnection System Equipment for Safety for Use With Distributed Energy Resources (2021)</p>			

APPENDIX 1-B

ENERGY COMMISSION DOCUMENTS INCORPORATED BY REFERENCE IN THEIR ENTIRETY

The following documents published by the California Energy Commission are incorporated by reference in their entirety into the Energy Code.

Referenced appendices for the Building Energy Efficiency Standards for Residential and Nonresidential Buildings, including the Joint Appendices (JA), the Residential Appendices (RA), and Nonresidential Appendices (NA)

Alternative Calculation Method (ACM) Approval Manual

Available from: California Energy Commission/
Publications
1516 Ninth Street
Sacramento, CA 95814
(916) 654-5200
www.energy.ca.gov/title24

HISTORY NOTE APPENDIX

2022 California Energy Code California Code of Regulations, Title 24, Part 6

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Energy Code*, 2019 Triennial Edition, effective January 1, 2020.

1. (CEC 04/21)—Repeal the 2019 adoption of the *California Energy Code*, CCR Title 24, Part 6 and adopt the 2022 *California Energy Code*, effective on January 1, 2023.



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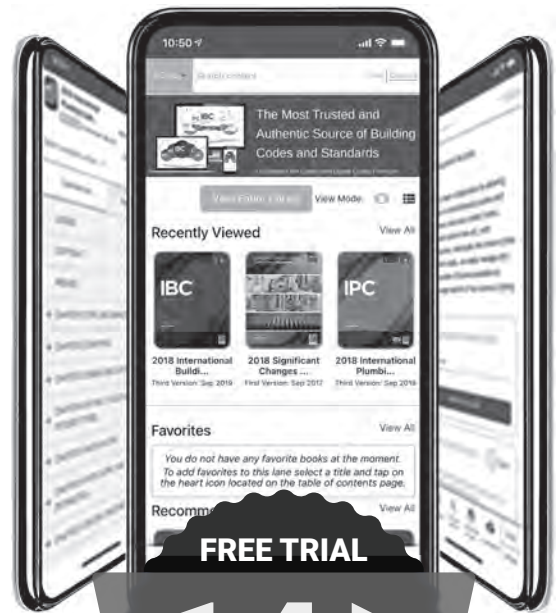
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2022 CALIFORNIA FIRE CODE

CALIFORNIA CODE OF REGULATIONS TITLE 24, PART 9

Based on the 2021 International Fire Code®

California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

2022 California Fire Code
California Code of Regulations, Title 24, Part 9

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ISBN: 978-1-957212-95-1 (PDF download)

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PREFACE

This document is Part 9 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Fire Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

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This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom
Members of the California Building Standards Commission
Secretary Yolanda Richardson – Chair
Rajesh Patel – Vice-Chair
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Aaron Stockwell *Juvilyn Alegre*
Peter Santillan *Kent Sasaki*
Laura Rambin
Mia Marvelli – Executive Director
Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page iv.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov..... (916) 445-5073

Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc..... (916) 263-0916

State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov..... **Energy Hotline** (800) 772-3300

Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov..... (562) 499-6312

Marine Oil Terminal Standards

California State Library

www.library.ca.gov..... (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov..... (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov..... (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov..... (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov..... (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov..... (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov..... (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards..... (916) 900-5004

Dairy Standards..... (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov..... (800) 952-8356

Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov..... (916) 449-5661

Organized Camps Standards

Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa..... (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development AKA: California Department of Health Care Access and Information (HCAI)

www.hcai.ca.gov..... (916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

Office of the State Fire Marshal

oxfm.fire.ca.gov..... (916) 568-3800

Code Development and Analysis

Fire Safety Standards

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption, and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

Legend of Acronyms of Adopting State Agencies

BSC	California Building Standards Commission (see Section 1.2)
BSC-CG	California Building Standards Commission-CALGreen (see Section 1.2.2)
BSCC	Board of State and Community Corrections (see Section 1.3)
SFM	Office of the State Fire Marshal (see Section 1.11)
HCD 1	Department of Housing and Community Development (see Section 1.8.2.1.1)
HCD 2	Department of Housing and Community Development (see Section 1.8.2.1.3)
HCD 1/AC	Department of Housing and Community Development (see Section 1.8.2.1.2)
DSA-AC	Division of the State Architect-Access Compliance (see Section 1.9.1)
DSA-SS	Division of the State Architect-Structural Safety (see Section 1.9.2)
DSA-SS/CC	Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)
OSHPD 1	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 1R	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 2	Office of Statewide Health Planning and Development (see Section 1.10.2)
OSHPD 3	Office of Statewide Health Planning and Development (see Section 1.10.3)
OSHPD 4	Office of Statewide Health Planning and Development (see Section 1.10.4)
OSHPD 5	Office of Statewide Health Planning and Development (see Section 1.10.5)
DPH	Department of Public Health (see Section 1.7)
AGR	Department of Food and Agriculture (see Section 1.6)
CEC	California Energy Commission (see Section 100 in Part 6, the California Energy Code)
CA	Department of Consumer Affairs (see Section 1.4): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Household Goods & Services Structural Pest Control Board (SPCB)
SL	State Library (see Section 1.12)
SLC	State Lands Commission (see Section 1.14)
DWR	Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages viii and ix. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are non-regulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency's statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies' adoption as follows:

Adopt the entire IFC chapter without state amendments.

If there is an "X" under a particular state agency's acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA FIRE CODE-MATRIX ADOPTION TABLE

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.
See Chapter 1 for state agency authority and building applications.)

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter			X																		
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								S	A	M	P	L	E								
Chapter/Section																					

Adopt the entire IFC chapter as amended, state-amended sections are listed below:

If there is an "X" under a particular state agency's acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an "X" in the column, by that particular section, under the agency's acronym, as well as an "X" by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter																					
Adopt entire chapter as amended (amended sections listed below)			X																		
Adopt only those sections that are listed below								S	A	M	P	L	E								
Chapter 1																					
202			X																		

Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS AND ABBREVIATIONS

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter																					
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below				X	X			S	A	M	P	L	E								
Chapter 1																					
202				X	X			S	A	M	P	L	E								
202				X	X				C	O	N	T.									
203				X	X																
203				X	X																

California Matrix Adoption Tables with California Code of Regulations, Title 19, Division 1

State Fire Marshal T-24 Column:

If there is an “X” in the T-24 column under SFM, refer to the California Matrix Adoption Tables explaining how to use the matrix adoption tables.

State Fire Marshal T-19 Column:

If there is an “X” in the T-19 column under SFM, this means that the corresponding section was reprinted from the California Code of Regulations (CCR), Title 19, Division 1 into the *California Fire Code* for the code user’s convenience. The corresponding Title-19 sections were listed in the matrix adoption tables in the order that they appear in the *California Fire Code*. The scope, applicability and appeals procedures of CCR, Title 19, Division 1 has not changed. For information regarding the specific purpose and scope of CCR, Title 19, unless otherwise specified, refer to CCR, Title 19, Division 1, Chapter 1, Subchapter 1, Article 1, Sections 1.00 through 1.14.

Example:

CHAPTER 3 – GENERAL PRECAUTIONS AGAINST FIRE

Adopting agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1-AC	AC	SS	1	1R	2	3	4								
Adopt entire chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below			X																			
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section							S	A	M	P		L	E									
301		X																				
[T-19 §3.14]				X																		
[T-19 §3.19 (a-g)]				X																		
304		X																				
[T-19 §3.07(a)]				X																		
[T-19 §3.07(b)]				X																		

*The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division 1 remains the same.

Marginal Markings

Symbols in the margin indicate the status of code changes as follows:

- || This symbol indicates that a change has been made to a California amendment.
- > This symbol indicates deletion of California amendment language.
- | This symbol indicates that a change has been made to International Code Council model language.
- ➔ This symbol indicates deletion of International Code Council model language.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2021 edition of the *International Fire Code*.

2021 LOCATION	2018 LOCATION
106.1–106.4	105.4–105.4.6
107	106
108	107
109	108
110	113
111	109
112	110
113	112
114	111
603	604
604	606
605	603
606	607
607	608
608	605
3303	3308
6303.1.5	6303.1.1.2

Coordination of the International Codes

The coordination of technical provisions is one of the strengths of the ICC family of model codes. The codes can be used as a complete set of complementary documents, which will provide users with full integration and coordination of technical provisions. Individual codes can also be used in subsets or as stand-alone documents. To make sure that each individual code is as complete as possible, some technical provisions that are relevant to more than one subject area are duplicated in some of the model codes. This allows users maximum flexibility in their application of the I-Codes.

Development

This 2021 edition presents the code as originally issued, with changes reflected in the 2003 through 2018 editions and further changes approved by the ICC Code Development Process through 2019. A new edition such as this is promulgated every 3 years.

Maintenance

The IFC is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate.

The ICC Code Development Process reflects principles of openness, transparency, balance, due process and consensus, the principles embodied in OMB Circular A-119, which governs the federal

government's use of private-sector standards. The ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the ICC's cloud-based app, cdp-Access®. A broad cross section of interests are represented in the ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC's important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- American Institute of Architects (AIA)
- International Association of Fire Chiefs (IAFC)
- National Association of Home Builders (NAHB)
- National Association of State Fire Marshals (NASFM)

The code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the ICC.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. The ICC does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

In each code development cycle, proposed changes to this code are considered at the Committee Action Hearings by the International Fire Code Development Committee, whose action constitutes a recommendation to the voting membership for final action on the proposed change. Code change proposals to sections of the code that are preceded by a bracketed letter designation are considered by a different code development committee. For example, proposed changes to code sections that have [BE] in front of them (e.g., [BE] 604.4) are considered by the appropriate International Building Code Development Committee (IBC—Egress) at the code development hearings.

The bracketed letter designations for committees responsible for portions of this code are as follows:

- [A] = Administrative Code Development Committee
- [BE] = IBC—Egress Code Development Committee
- [BF] = IBC—Fire Safety Code Development Committee
- [BG] = IBC—General Code Development Committee
- [BS] = IBC—Structural Code Development Committee
- [EB] = International Existing Building Code Development Committee
- [FG] = International Fuel Gas Code Development Committee
- [M] = International Mechanical Code Development Committee
- [P] = International Plumbing Code Development Committee

For the development of the 2024 edition of the I-Codes, there will be two groups of code development committees and they will meet in separate years, as shown in the following Code Development Hearings table.

The majority of the sections of Chapter 1 of this code are designated as the responsibility of the Administrative Code Development Committee, and that committee is part of the Group B portion of the hearings. This committee will conduct its code development hearings in 2022 to consider most code change proposals for Chapter 1 of this code and proposals for Chapter 1 of all I-Codes except the IECC, IRC and IgCC. Therefore, any proposals received for Chapter 1 of this code preceded by the designation [A] will be assigned to the Administrative Code Development Committee for consideration in 2022.

It is very important that anyone submitting code change proposals understands which code development committee is responsible for the section of the code that is the subject of the code change proposal. For further information on the Code Development Committee responsibilities, please visit the ICC website at www.iccsafe.org/current-code-development-cycle.

CODE DEVELOPMENT HEARINGS

Group A Codes (Heard in 2021, Code Change Proposals Deadline: January 11, 2021)	Group B Codes (Heard in 2022, Code Change Proposals Deadline: January 10, 2022)
International Building Code – Egress (Chapters 10, 11, Appendix E) – Fire Safety (Chapters 7, 8, 9, 14, 26) – General (Chapters 2–6, 12, 27–33, Appendices A, B, C, D, K, N)	Administrative Provisions (Chapter 1 of all codes except IECC, IRC and IgCC; IBC Appendix O; the appendices titled “Board of Appeals” for all codes except IECC, IRC, IgCC, ICCPC and IZC; administrative updates to currently referenced standards; and designated definitions)
International Fire Code	International Building Code – Structural (Chapters 15–25, Appendices F, G, H, I, J, L, M)
International Fuel Gas Code	International Existing Building Code
International Mechanical Code	International Energy Conservation Code—Commercial
International Plumbing Code	International Energy Conservation Code—Residential – IECC—Residential – IRC—Energy (Chapter 11)
International Property Maintenance Code	International Green Construction Code (Chapter 1)
International Private Sewage Disposal Code	International Residential Code – IRC—Building (Chapters 1–10, Appendices AE, AF, AH, AJ, AK, AL, AM, AO, AQ, AR, AS, AT, AU, AV, AW)
International Residential Code – IRC—Mechanical (Chapters 12–23) – IRC—Plumbing (Chapters 25–33, Appendices AG, AI, AN, AP)	
International Swimming Pool and Spa Code	
International Wildland-Urban Interface Code	
International Zoning Code	

Note: Proposed changes to the ICCPC will be heard by the code development committee noted in brackets [] in the text of the ICCPC.

Effective Use of the International Fire Code

The IFC is a model code that regulates minimum fire safety requirements for new and existing buildings, facilities, storage and processes. The IFC addresses fire prevention, fire protection, life safety and safe storage and use of hazardous materials in new and existing buildings, facilities and processes. The IFC provides a total approach of controlling hazards in all buildings and sites, regardless of the hazard being indoors or outdoors.

The IFC is a design document. For example, before one constructs a building, the site must be provided with an adequate water supply for fire-fighting operations and a means of building access for emergency responders in the event of a medical emergency, fire or natural or technological disaster. Depending on the building's occupancy and uses, the IFC regulates the various hazards that may be housed within the building, including refrigeration systems, application of flammable finishes, fueling of motor vehicles, high-piled combustible storage, and the storage and use of hazardous materials. The IFC sets forth minimum requirements for these and other hazards and contains requirements for maintaining the life safety of building occupants; protecting emergency responders; and limiting the damage to a building and its contents as the result of a fire, explosion or unauthorized hazardous material discharge.

As described, the IFC has many types of requirements for buildings and facilities. The applicability of these requirements varies. An understanding of the applicability of requirements, as addressed in Sections 102.1 and 102.2, is necessary. Section 102.1 addresses when the construction and design provisions are applicable, whereas Section 102.2 addresses when the administrative, operational and maintenance provisions are applicable. Generally, the construction and design provisions apply to only new buildings or existing buildings and occupancies as addressed by Chapter 11. The administrative, maintenance and operational requirements are applicable to all buildings and facilities, whether new or existing.

ARRANGEMENT AND FORMAT OF THE 2021 IFC

Before applying the requirements of the IFC, it is beneficial to understand its arrangement and format. The IFC, like other codes published by the ICC, is arranged and organized to follow sequential steps that generally occur during a plan review or inspection.

The IFC is organized into seven parts. Each part represents a broad subject matter and includes the chapters that logically fit under the subject matter of each part. It is also foreseeable that additional chapters will need to be added in the future as regulations for new processes or operations are developed. Accordingly, the structure was designed to accommodate such future chapters by providing reserved (unused) chapters in several of the parts. This will allow the subject matter parts to be conveniently and logically expanded without requiring a major renumbering of the IFC chapters.

CHAPTER TOPICS

Parts and Chapters	Subjects
Part I—Chapters 1 and 2	Administrative and definitions
Part II—Chapters 3 and 4	General safety provisions
Part III—Chapters 5 through 12	Building and equipment design features
Part III—Chapters 13 through 19	Reserved for future use
Part IV—Chapters 20 through 40	Special occupancies and operations
Part IV—Chapters 41 through 49; 52	Reserved for future use
Part V—Chapters 50, 51 and 53 through 67	Hazardous materials
Part V—Chapters 68 through 79	Reserved for future use
Part VI—Chapter 80	Referenced standards
Part VII—Appendices A through N	Adoptable and informational appendices

IBC Correlated Topics

The IFC requirements for fire-resistance-rated construction, interior finish, fire protection systems, means of egress and construction safeguards are directly correlated to the chapters containing parallel requirements in the IBC, as follows:

IFC/IBC CORRELATED TOPICS

IFC Chapter/Section	IBC Chapter/Section	Subject
Chapter 7	Chapter 7	Fire and smoke protection features (Fire-resistance-rated construction in the IBC)
Chapter 8	Chapter 8	Interior finish, decorative materials and furnishings
Chapter 9	Chapter 9	Fire protection and life safety systems
Chapter 10	Chapter 10	Means of egress
Section 1203	Chapter 27	Emergency and standby power
Chapter 31	Section 3103	Temporary structures
Chapter 33	Chapter 33	Construction fire safety
Chapters 50–67	Sections 307, 414, 415	Hazardous materials and Group H requirements

PART I—ADMINISTRATIVE

Chapter 1 Scope and Administration

Chapter 1 contains provisions for the application, enforcement and administration of subsequent requirements of the code. In addition to establishing the scope of the code, Chapter 1 identifies which buildings and structures come under its purview. Chapter 1 is largely concerned with maintaining “due process of law” in enforcing the regulations contained in the body of the code. Only through careful observation of the administrative provisions can the code official reasonably expect to demonstrate that “equal protection under the law” has been provided.

Chapter 2 Definitions

All terms that are defined in the code are listed alphabetically in Chapter 2. While a defined term may be used in one chapter or another, the meaning provided in Chapter 2 is applicable throughout the code.

Where understanding of a term’s definition is especially key to or necessary for understanding of a particular code provision, the term is shown in italics wherever it appears in the code. This is true only for those terms that have a meaning that is unique to the code. In other words, the generally understood meaning of a term or phrase might not be sufficient or consistent with the meaning prescribed by the code; therefore, it is essential that the code-defined meaning be known.

Guidance regarding tense, gender and plurality of defined terms as well as guidance regarding terms not defined in this code are also provided.

PART II—GENERAL SAFETY PROVISIONS

Chapter 3 General Requirements

The open burning, ignition source, vacant building, miscellaneous storage, roof gardens and landscaped roofs, artificial combustible vegetation on buildings, outdoor pallet storage, additive manufacturing, and hazards to fire fighters requirements and precautions, among other general regulations contained in this chapter, are intended to improve premises safety for everyone, including construction workers, tenants, operations and maintenance personnel, and emergency response personnel.

Chapter 4 Emergency Planning and Preparedness

Chapter 4 addresses the human contribution to life safety in buildings when a fire or other emergency occurs. The requirements for continuous training and scheduled fire, evacuation and lock-down drills can be as important as the required periodic inspections and maintenance of built-in fire protection features. The level of preparation by the occupants also improves the emergency responders’ abilities during an emergency. The *IBC* focuses on built-in fire protection features, such as automatic sprinkler systems, fire-resistance-rated construction and properly designed egress systems, whereas this chapter fully addresses the human element.

PART III—BUILDING AND EQUIPMENT DESIGN FEATURES

Chapter 5 Fire Service Features

The requirements of Chapter 5 apply to all buildings and occupancies and pertain to access roads, access to building openings and roofs, premises identification, key boxes, fire protection water supplies, fire command centers, fire department access to equipment, and in-building emergency responder communication system coverage.

Chapter 6 Building Services and Systems

Chapter 6 focuses on building systems and services as they relate to potential safety hazards and when and how they should be installed. This chapter brings together building system- and service-related issues for convenience and provides a more systematic view of buildings. The following building services and systems are addressed: electrical equipment, wiring and hazards (Section 603); elevator recall and maintenance (Section 604); fuel-fired appliances (Section 605); commercial kitchen hoods (Section 606); commercial kitchen cooking oil storage (Section 607); mechanical refrigeration (Section 608); hyperbaric facilities (Section 609); and clothes dryer exhaust systems (Section 610). Note that building systems focused on energy systems and components are addressed by Chapter 12.

Chapter 7 Fire and Smoke Protection Features

The maintenance of assemblies required to be fire-resistance rated is a key component in a passive fire protection philosophy. Chapter 7 sets forth requirements to maintain required fire-resistance ratings of building elements and limit fire spread. Section 701 addresses the basics of what construction elements such as fire barriers and smoke barriers need to be maintained as well as defining the owner's responsibility. The rest of the chapter, Sections 703 through 708, deals with various fire and smoke protection features that must also be maintained. These features include penetrations, joint protection, door and window openings, duct and air transfer opening protection, concealed spaces, and spray-applied fire-resistant and intumescent fire-resistant materials.

Chapter 8 Interior Finish, Decorative Materials and Furnishings

The overall purpose of Chapter 8 is to regulate interior finishes, decorative materials and furnishings in new and existing buildings so that they do not significantly add to or create fire hazards within buildings. The provisions tend to focus on occupancies with specific risk characteristics, such as vulnerability of occupants, density of occupants, lack of familiarity with the building and societal expectations of importance. This chapter is consistent with Chapter 8 of the IBC, which regulates the interior finishes of new buildings.

Chapter 9 Fire Protection and Life Safety Systems

Chapter 9 prescribes the minimum requirements for active systems of fire protection equipment to perform the functions of detecting a fire, alerting the occupants or fire department of a fire emergency, controlling smoke and controlling or extinguishing the fire. There are provisions relating to more general life safety systems such as gas detection and associated alarms. Mass notification systems are also addressed. Generally, the requirements are based on the occupancy, the height and the area of the building, because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the IBC; however, this chapter also contains periodic testing criteria that are not contained in the IBC. In addition, the special fire protection system requirements based on use and occupancy found in Chapter 4 of the IBC are duplicated in Chapter 9 of the IFC as a user convenience.

Chapter 10 Means of Egress

The general criteria set forth in Chapter 10 regulating the design of the means of egress are established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. It addresses all portions of the egress system (i.e., exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics also are specified for the components that will permit their safe use without special knowledge or effort. The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Sections 1002 through 1031 duplicate text from Chapter 10 of the IBC; however, the IFC contains an additional Section 1032 on maintenance of the means of egress system in existing buildings. Retroactive minimum means of egress requirements for existing buildings are found in Chapter 11.

Chapter 11 Construction Requirements for Existing Buildings

Chapter 11 applies to existing buildings constructed prior to the adoption of the code and intends to provide a minimum degree of fire and life safety to persons occupying existing buildings by providing for alterations to such buildings that do not comply with the minimum requirements of the IBC. Prior to the 2009 edition, its content existed in the IFC but in a random manner that was neither efficient nor user-friendly. In the 2007/2008 code development cycle, a code change (F294-07/ 08) was approved that consolidated the retroactive elements of IFC into a single chapter for easier and more efficient reference and application to existing buildings. The provisions address general fire safety features such as requirements for fire alarm systems, CO detection and automatic sprinkler systems in some existing buildings, general means of egress, and finally, the chapter contains a section dedicated to existing Group I-2 occupancies.

Chapter 12 Energy Systems

Chapter 12 was added to address the current energy systems found in the IFC. The chapter covers a wide range of systems that generate and store energy in, on and adjacent to buildings and facilities. The expansion of such energy systems is related to meeting today's energy, environmental and economic challenges. Ensuring appropriate criteria to address the safety of such systems in building and fire codes is an important part of protecting the public at large, building occupants and emergency responders. Previously, requirements for energy systems, such as standby power systems, PV systems and stationary battery systems, were scattered about in various locations in Chapter 6, which addresses building services and systems. However, with the addition of fuel cells, energy storage systems and portable generators to the IFC, a chapter dedicated to such related issues was necessary. This chapter provides an appropriate location for the addition of future energy-related issues.

Chapters 13 through 19

Reserved for future use.

PART IV—SPECIAL OCCUPANCIES AND OPERATIONS

Chapter 20 Aviation Facilities

Chapter 20 specifies minimum requirements for the fire-safe operation of airports, heliports and helistops. The principal nonflight operational hazards associated with aviation involve fuel, facilities and operations. Therefore, safe use of flammable and combustible liquids during fueling and maintenance operations is emphasized. Availability of portable Class B:C-rated fire extinguishers for prompt control or suppression of incipient fires is required.

Chapter 21 Dry Cleaning

The provisions of Chapter 21 are intended to reduce hazards associated with the use of flammable and combustible dry cleaning solvents. These materials, like all volatile organic chemicals, generate significant quantities of static electricity and are thus readily ignitable. Many flammable and non-flammable dry cleaning solvents also create health hazards when involved in a fire.

Chapter 22 Combustible Dust-producing Operations

The requirements of Chapter 22 seek to reduce the likelihood of dust explosions by managing the hazards of ignitable suspensions of combustible dusts associated with a variety of operations, including woodworking, mining, food processing, agricultural commodity storage and handling, and pharmaceutical manufacturing, among others. Ignition source control and good housekeeping practices in occupancies containing dust-producing operations are emphasized.

Chapter 23 Motor Fuel-dispensing Facilities and Repair Garages

Chapter 23 provides provisions that regulate the storage and dispensing of both liquid and gaseous motor fuels at public and private automotive, marine and aircraft motor fuel-dispensing facilities, and fleet vehicle motor fuel-dispensing facilities. In addition, this chapter addresses the various hazards created by the use of both liquid and gaseous fuels within repair garages.

Chapter 24 Flammable Finishes

Chapter 24 requirements govern operations where flammable or combustible finishes are applied by spraying, dipping, powder coating or flow-coating processes. As with all operations involving flammable or combustible liquids and combustible dusts or vapors, controlling ignition sources and methods of reducing or controlling flammable vapors or combustible dusts at or near these operations are emphasized.

Chapter 25 Fruit and Crop Ripening

Chapter 25 provides guidance that is intended to reduce the likelihood of explosions resulting from improper use or handling of ethylene gas used for crop ripening and coloring processes. This is accomplished by regulating ethylene gas generation, storage, and distribution systems and controlling ignition sources. Design and construction of facilities for this use are regulated by the *IBC* to reduce the impact of potential accidents on people and buildings.

Chapter 26 Fumigation and Insecticidal Fogging

Chapter 26 regulates fumigation and insecticidal fogging operations that use toxic pesticide chemicals to kill insects, rodents and other vermin. Fumigants and insecticidal fogging agents pose little hazard if properly applied; however, the inherent toxicity of all these agents and the potential flammability of some makes special precautions necessary when they are used. Requirements of this chapter are intended to protect both the public and fire fighters from hazards associated with these products.

Chapter 27 Semiconductor Fabrication Facilities

The requirements of Chapter 27 are intended to control hazards associated with the manufacture of electrical circuit boards or microchips, commonly called semiconductors. Though the finished product possesses no unusual hazards, materials commonly associated with semiconductor manufacturing are often quite hazardous and include flammable liquids, pyrophoric and flammable gases, toxic substances, and corrosives. The requirements of this chapter are concerned with both life safety and property protection. However, the fire code official should recognize that the risk of extraordinary property damages is far more common than the risk of personal injuries from fire.

Chapter 28 Lumber Yards and Agro-industrial, Solid Biomass and Woodworking Facilities

Provisions of Chapter 28 are intended to prevent fires and explosions, facilitate fire control and reduce exposures to and from facilities storing, selling or processing wood and forest products, including sawdust, wood chips, shavings, bark mulch, shorts, finished planks, sheets, posts, poles, timber and raw logs and the hazard they represent once ignited. Also included are solid biomass feedstock and raw products associated with agro-industrial facilities, the outdoor storage of pallets, and manufacturing and recycling facilities. This chapter requires active and passive fire protection features to reduce on- and off-site exposures, limit fire size and development, and facilitate fire fighting by employees and the fire service.

Chapter 29 Manufacture of Organic Coatings

Chapter 29 regulates materials and processes associated with the manufacture of paints as well as bituminous, asphaltic and other diverse compounds formulated to protect buildings, machines and objects from the effects of weather, corrosion and hostile environmental exposures. Paint for decorative, architectural and industrial uses comprises the bulk of organic coating production. Painting and processes related to the manufacture of nonflammable and noncombustible or water-based products are exempt from the provisions of this chapter. The application of organic coatings is covered by Chapter 24. Elimination of ignition sources, maintenance of fire protection equipment and isolation or segregation of hazardous operations are emphasized.

Chapter 30 Industrial Ovens

Chapter 30 addresses the fuel supply, ventilation, emergency shutdown equipment, fire protection and the operation and maintenance of industrial ovens, which are sometimes referred to as industrial heat enclosures or industrial furnaces. Compliance with this chapter is intended to reduce the likelihood of fires involving industrial ovens, which are usually the result of the fuel in use or volatile vapors given off by the materials being heated, or to manage the impact if a fire should occur.

Chapter 31 Tents, Temporary Structures and Other Membrane Structures

The requirements in Chapter 31 are intended to protect temporary as well as permanent tents and air-supported and other membrane structures and temporary special event structures from fire and similar hazards. These hazards are regulated through provisions related to structure location and access, anchorage, egress, heat-producing equipment, hazardous materials and operations, combustible vegetation, ignition sources, waste accumulation and requiring regular inspections and certifying continued compliance with fire safety regulations. This chapter also addresses outdoor assembly events, which are not limited to those events where tents or other membrane structures are used but are regulated due to the number of people, density of those people and hazards associated with large outdoor events related to egress, fire hazards from cooking and other related concerns.

Chapter 32 High-piled Combustible Storage

Chapter 32 provides guidance for reasonable protection of life from hazards associated with the storage of combustible materials in closely packed piles or on pallets, in racks, or on shelves where the top of storage is greater than 12 feet in height. It provides requirements for identifying various classes of commodities; general fire and life safety features, including storage arrangements, smoke and heat venting, and fire department access; and housekeeping and maintenance requirements. The chapter attempts to define the potential fire severity and, in turn, determine fire and life safety protection measures needed to control, and in some cases suppress, a potential fire. This chapter does not cover miscellaneous combustible materials storage regulated in Section 315.

Chapter 33 Fire Safety during Construction and Demolition

Chapter 33 outlines general fire safety precautions for all structures and all occupancies during construction and demolition operations. Most importantly, this chapter addresses owner responsibility and provides requirements for a site safety plan and requires a site safety director. Generally, these requirements seek to maintain required levels of fire protection, limit fire spread, establish the appropriate operation of equipment and promote prompt response to fire emergencies. Features regulated include fire protection systems, fire fighter access to the site and building, means of egress, hazardous materials storage and use, and temporary heating equipment and other ignition sources. This chapter is consistent with both Chapter 33 of the IBC and Chapter 15 of the IEBC.

Chapter 34 Tire Rebuilding and Tire Storage

The requirements of Chapter 34 are intended to prevent or control fires and explosions associated with the remanufacture and storage of tires and tire byproducts. Additionally, the requirements are

intended to minimize the impact of indoor and outdoor tire storage fires by regulating pile volume and location, segregating the various operations, providing for fire department access and a water supply, and controlling ignition sources.

Chapter 35 Welding and Other Hot Work

Chapter 35 covers requirements for safety in welding and other types of hot work by reducing the potential for fire ignitions that often result in large losses. Several different types of hot work would fall under the requirements found in Chapter 35, including both gas and electric arc methods and any open-torch operations. Many of the activities of this chapter focus on the actions of the occupants.

Chapter 36 Marinas

Chapter 36 addresses the fire protection and prevention requirements for marinas. It was developed in response to the complications encountered by a number of fire departments responsible for the protection of marinas as well as fire loss history in marinas that lacked fire protection. Compliance with this chapter intends to establish safe practices in marina areas, provide an identification method for mooring spaces in the marina, and provide fire fighters with safe operational areas and fire protection methods to extend hose lines in a safe manner.

Chapter 37 Combustible Fibers

Chapter 37 establishes the requirements for storage and handling of combustible fibers, including animal, vegetable and synthetic fibers, whether woven into textiles, baled, packaged or loose. Operations involving combustible fibers are typically associated with salvage, paper milling, recycling, cloth manufacturing, carpet and textile mills and agricultural operations, among others. The primary hazard associated with these operations is the abundance of materials and their ready ignitability.

Chapter 38 Higher Education Laboratories

Chapter 38 is a chapter addressing the unique needs of laboratories in higher education academic institutions. The advancement of technologies, science, medicine and our knowledge of the world often relies on having vibrant and successful academic institutions. These academic institutions often have chemistry, biology, medical, engineering and other laboratories where hazardous materials are used. This chapter addresses both new and existing buildings and new and existing laboratories. Applying the general hazardous material provisions has proven to be difficult due to the way in which these laboratories operate. This chapter offers unique solutions for laboratories that allow the necessary quantities of hazardous materials while not requiring a Group H occupancy classification. This is achieved through a series of requirements to protect and separate the hazards, thus reducing risks. This chapter also provides more flexibility for laboratories in existing buildings by allowing the use of certain materials typically prohibited through method, such as the use of storage cabinets or fume hoods.

Chapter 39 Processing and Extraction Facilities

Chapter 39 focuses on the processing and extraction of oils and fats from various plants. This process includes the extraction by use of solvent, desolventizing of the raw material and production of the miscella, and distillation of the solvent from the miscella and solvent recovery. The processes used are not necessarily typical hazardous material processes and often the systems and equipment associated with such processes are not listed. This chapter provides the tools to appropriately enforce the IFC to meet the unique needs of industry while providing the appropriate level of safety. This chapter has provisions for a technical report prepared by a registered design professional. This chapter also requires site inspections to make sure equipment and systems are installed as designed and approved.

Chapter 40 Storage of Distilled Spirits and Wines

Chapter 40 is a new chapter that provides specific requirements for the storage of distilled spirits and wines. This chapter provides a package of safety requirements to address the unique hazards associated with the storage of distilled spirits and wines, including basic fire prevention requirements, fire protection features, storage configuration and signage. Additionally, in accordance with Section 307.1.1 of the IBC, these occupancies are not classified as a Group H occupancy. Instead, as listed in Sections 311.2 and 311.3 of the IBC, the storage of beverages that contain up to and including 16-percent alcohol are classified as a Group S-2 occupancy, and those that contain over 16-percent alcohol content are classified as a Group S-1 occupancy.

Chapters 41 through 47

Reserved for future use.

Chapter 48 Motion Picture and Television Production Studio Stages, Approved Production Facilities and Production Locations

On July 23, 1982, a Bell UH-1 Iroquois helicopter crashed at Indian Dunes in Valencia, Santa Clarita, California, during the making of Twilight Zone: The Movie. The crash killed three people on the ground and injured the six helicopter passengers. Those killed were actor Vic Morrow and child actors Myca Dinh Le and Renee Shin-Yi Chen. The incident led to years of civil and criminal action and was responsible for the introduction of new procedures and safety standards in the filmmaking industry.

Chapter 49 Requirements for Wildland-Urban Interface Fire Areas

This chapter regulates development and construction in areas designated by the Director of the Department of Forestry and Fire Protection as Very High Fire Hazard Severity Zones in any Local Responsibility Area (LRA) and areas designated by the Board of Forestry and Fire Protection as a State Responsibility Area (SRA). In addition to the building construction requirements in the California Building Code and California Residential Code, this chapter contains requirements for development and construction in the LRA designated as Very High Fire Hazard Severity Zones and areas designated as SRA. While many of these provisions are found in Title 14 of the California Code of Regulations, they are replicated here for the code user. The local jurisdiction has the authority to apply the same regulations to LRA when the regulations are adopted by local ordinance. The requirements in this chapter address the adoption of Very High Fire Hazard Severity Zones in the LRA; criteria for evaluating existing subdivisions that are at significant fire risk and are without an adequate secondary egress; and criteria for fire safety provisions required in the Safety Element of a city or county General Plan.

PART V—HAZARDOUS MATERIALS

Chapter 50 Hazardous Materials—General Provisions

Chapter 50 contains the general requirements for all hazardous chemicals in all occupancies. Hazardous chemicals are defined as those that pose an unreasonable risk to the health and safety of operating or emergency personnel, the public and the environment if not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal or transportation. The general provisions of this chapter are intended to be companion provisions with the specific requirements of Chapters 51 through 67 regarding a given hazardous material.

Chapter 51 Aerosols

Chapter 51 addresses the prevention, control and extinguishment of fires and explosions in facilities where retail aerosol products are displayed or stored. It is concerned with both life safety and prop-

erty protection from a fire; however, historically, aerosol product fires have caused property loss more frequently than loss of life. Requirements for storing aerosol products are dependent on the level of aerosol product, level of sprinkler protection, type of storage condition and quantity of aerosol products.

Chapter 52

Reserved for future use.

Chapter 53 Compressed Gases

Chapter 53 regulates the storage, use and handling of all flammable and nonflammable compressed gases, such as those that are used in medical facilities, air separation plants, industrial plants, agricultural equipment facilities and similar occupancies. In addition, systems such as carbon dioxide beverage dispensing systems and carbon dioxide enrichment systems are addressed. Standards for the design, construction and marking of compressed gas cylinders and pressure vessels are referenced. Compressed gases used in welding and cutting, cryogenic liquids and liquefied petroleum gases are also regulated under Chapters 35, 55 and 61, respectively. Compressed gases that are classified as hazardous materials are also regulated in Chapter 50, which includes general requirements.

Chapter 54 Corrosive Materials

Chapter 54 addresses the hazards of corrosive materials that have a destructive effect on living tissues. Although corrosive gases exist, most corrosive materials are solid or liquid and classified as either acids or bases (alkalis). These materials may pose a wide range of hazards other than corrosivity, such as combustibility, reactivity or oxidizing hazards, and must conform to the requirements of this code with respect to all known hazards. The focus of this chapter is on materials whose primary hazard is corrosivity; that is, the ability to destroy or irreparably damage living tissue on contact.

Chapter 55 Cryogenic Fluids

Chapter 55 regulates the hazards associated with the storage, use and handling of cryogenic fluids through regulation of such things as pressure relief mechanisms and proper container storage. These hazards are in addition to the code requirements that address the other hazards of cryogenic fluids such as flammability and toxicity. These other characteristics are dealt with in Chapter 50 and other chapters, such as Chapter 58 dealing with flammable gases. Cryogenics are hazardous because they are held at extremely low temperatures and high pressures. Many cryogenic fluids, however, are actually inert gases and would not be regulated elsewhere in this code. Cryogenics are used for many applications but specifically have had widespread use in the biomedical field and in space programs.

Chapter 56 Explosives and Fireworks

Chapter 56 prescribes minimum requirements for the safe manufacture, storage, handling and use of explosives, ammunition and blasting agents for commercial and industrial occupancies. These provisions are intended to protect the general public, emergency responders and individuals who handle explosives. Chapter 56 also regulates the manufacturing, retail sale, display and wholesale distribution of fireworks, establishing the requirements for obtaining approval to manufacture, store, sell, discharge or conduct a public display, and references national standards for regulations governing manufacture, storage and public displays.

Chapter 57 Flammable and Combustible Liquids

The requirements of Chapter 57 are intended to reduce the likelihood of fires involving the storage, handling, use or transportation of flammable and combustible liquids. Adherence to these practices

may also limit damage in the event of an accidental fire involving these materials. These liquids are used for fuel, lubricants, cleaners, solvents, medicine and even drinking. The danger associated with flammable and combustible liquids is that the vapors from these liquids, when combined with air in their flammable range, will burn or explode at temperatures near normal living and working environment. The protection provided by this code is to prevent the flammable and combustible liquids from being ignited.

Chapter 58 Flammable Gases and Flammable Cryogenic Fluids

Chapter 58 sets requirements for the storage and use of flammable gases. For safety purposes, there is a limit on the quantities of flammable gas allowed per control area. Exceeding these limitations increases the possibility of damage to both property and individuals. The principal hazard posed by flammable gas is its ready ignitability, or even explosivity, when mixed with air in the proper proportions. Consequently, occupancies storing or handling large quantities of flammable gas are classified as Group H- 2 (high hazard) by the *IBC*.

Chapter 59 Flammable Solids

Chapter 59 addresses general requirements for storage and handling of flammable solids, especially magnesium; however, it is important to note that several other solid materials, primarily metals including, but not limited to, titanium, zirconium, hafnium, calcium, zinc, sodium, lithium, potassium, sodium/potassium alloys, uranium, thorium and plutonium, can be explosion hazards under the right conditions. Some of these metals are almost exclusively laboratory materials but because of where they are used, fire service personnel must be trained to handle emergency situations. Because uranium, thorium and plutonium are also radioactive materials, they present still more specialized problems for fire service personnel.

Chapter 60 Highly Toxic and Toxic Materials

The main purpose of Chapter 60 is to protect occupants, emergency responders and those in the immediate area of the building and facility from short-term, acute hazards associated with a release or general exposure to toxic and highly toxic materials. This chapter deals with all three states of toxic and highly toxic materials: solids, liquids and gases. This code does not address long-term exposure effects of these materials, which are addressed by agencies such as the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA).

Chapter 61 Liquefied Petroleum Gases

Chapter 61 establishes requirements for the safe handling, storing and use of LP-gas to reduce the possibility of damage to containers, accidental releases of LP-gas and exposure of flammable concentrations of LP-gas to ignition sources. LP-gas (notably propane) is well known as a camping fuel for cooking, lighting, heating and refrigerating and also remains a popular standby fuel supply for auxiliary generators as well as being widely used as an alternative motor vehicle fuel. Its characteristic as a clean-burning fuel has resulted in the addition of propane dispensers to service stations throughout the country.

Chapter 62 Organic Peroxides

Chapter 62 addresses the hazards associated with the storage, handling and use of organic peroxides and intends to manage the fire and oxidation hazards of organic peroxides by preventing their uncontrolled release. These chemicals possess the characteristics of flammable or combustible liquids and are also strong oxidizers. This unusual combination of properties requires special storage and handling precautions to prevent uncontrolled release, contamination, hazardous chemical reactions, fires or explosions. The requirements of this chapter pertain to industrial applications in which significant quantities of organic peroxides are stored or used; however, smaller quantities of organic peroxides still pose a significant hazard and, therefore, must be stored and used in accordance with the applicable provisions of this chapter and Chapter 50.

Chapter 63 Oxidizers, Oxidizing Gases and Oxidizing Cryogenic Fluids

Chapter 63 addresses the hazards associated with solid, liquid, gaseous and cryogenic fluid oxidizing materials, including oxygen in home use, and establishes criteria for their safe storage and protection in indoor and outdoor storage facilities, minimizing the potential for uncontrolled releases and contact with fuel sources. Although oxidizers themselves do not burn, they pose unique fire hazards because of their ability to support combustion by breaking down and giving off oxygen.

Chapter 64 Pyrophoric Materials

Chapter 64 regulates the hazards associated with pyrophoric materials, which are capable of spontaneously igniting in the air at or below a temperature of 130°F (54°C). Many pyrophoric materials also pose severe flammability or reactivity hazards. This chapter addresses only the hazards associated with pyrophoric materials. Materials that pose multiple hazards must conform to the requirements of the code with respect to all hazards.

Chapter 65 Pyroxylin (Cellulose Nitrate) Plastics

Chapter 65 addresses the significant hazards associated with pyroxylin (cellulose nitrate) plastics, which are the most dangerous and unstable of all plastic compounds. The chemically bound oxygen in their structure permits them to burn vigorously in the absence of atmospheric oxygen at a rate 15 times greater than comparable common combustibles. Strict compliance with the provisions of this chapter, along with proper housekeeping and storage arrangements, helps to reduce the hazards associated with pyroxylin (cellulose nitrate) plastics in a fire or other emergencies.

Chapter 66 Unstable (Reactive) Materials

Chapter 66 addresses the hazards of unstable (reactive) liquid and solid materials as well as unstable (reactive) compressed gases. In addition to their unstable reactivity, these materials may pose other hazards, such as toxicity, corrosivity, explosivity, flammability or oxidizing potential. This chapter, however, intends to address those materials whose primary hazard is unstable reactivity. Materials that pose multiple hazards must conform to the requirements of the code with respect to all hazards. Strict compliance with the provisions of this chapter, along with proper housekeeping and storage arrangements, help reduce the exposure hazards associated with unstable (reactive) materials in a fire or other emergency.

Chapter 67 Water-reactive Solids and Liquids

Chapter 67 addresses the hazards associated with water-reactive materials that are solid or liquid at normal temperatures and pressures. In addition to their water reactivity, these materials may pose a wide range of other hazards, such as toxicity, flammability, corrosiveness or oxidizing potential. This chapter addresses only those materials whose primary hazard is water reactivity. Materials that pose multiple hazards must conform to the requirements of the code with respect to all hazards. Strict compliance with the requirements of this chapter, along with proper housekeeping and storage arrangements, helps to reduce the exposure hazards associated with water-reactive materials in a fire or other emergency.

Chapters 68 through 79

Reserved for future use.

PART VI—REFERENCED STANDARDS

Chapter 80 Referenced Standards

This code contains several references to standards that are used to regulate materials and methods of construction. Chapter 80 contains a comprehensive list of all standards that are referenced in this code. The standards are part of the code to the extent of the reference to the standard (see Section 102.7). Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with this code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the code official, contractor, designer and owner.

Chapter 80 is organized in a manner that makes it easy to locate specific standards. It lists all of the referenced standards alphabetically by acronym of the promulgating agency of the standard. Each agency's standards are then listed in either alphabetical or numeric order based on the standard identification. The list also contains the title of the standard, the edition (date) of the standard referenced, any addenda included as part of the ICC adoption, and the section or sections of this code that reference the standard.

PART VII—APPENDICES

Appendix Chapter 4 Special Detailed Requirements Based on Use and Occupancy

Appendix Chapter 4 provides detailed criteria for special uses and occupancies. The unique characteristics of a live/work unit as opposed to a 30-story high-rise building call for specific standards for each. Twenty-seven sections address covered and open mall buildings, atriums, hospitals, stages, buildings where hazardous materials are used and stored, jails and prisons, ambulatory care facilities and storm shelters, among other special occupancy issues.

Appendix A Board of Appeals

Appendix A contains optional criteria that, when adopted, provide jurisdictions with detailed appeals, board member qualifications and administrative procedures to supplement the basic requirements found in Section 111 of this code. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix B Fire-flow Requirements for Buildings

Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the *IBC*. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix BB Fire-flow Requirements for Buildings

The procedures determining fire-flow requirements for any school buildings or portions of buildings hereafter constructed for which review and approval is required under Subdivision(a) of Section 17280 of the Government Code shall be in accordance with this appendix as amended by the state fire marshal.

Appendix C Fire Hydrant Locations and Distribution

Appendix C focuses on the location and spacing of fire hydrants, which is important to the success of fire-fighting operations. The difficulty with determining the spacing of fire hydrants is that every situation is unique and has unique challenges. Finding one methodology for determining hydrant spacing is difficult. This particular appendix gives one methodology based on the required fire flow that fire departments can work with to set a policy for hydrant distribution around new buildings and facilities in conjunction with Section 507.5. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix CC Fire Hydrant Locations and Distribution

Fire hydrants shall be provided in accordance with this appendix for the protection of any school buildings, or portions thereof, hereafter constructed for which review and approval are required under Subdivision(a) of Section 17280 of the Government Code.

Appendix D Fire Apparatus Access Roads

Appendix D contains more detailed elements for use with the basic access requirements found in Section 503, which gives some minimum criteria, such as a maximum length of 150 feet and a minimum width of 20 feet, but in many cases does not state specific criteria. This appendix, like Appendices B and C, is a tool for jurisdictions looking for guidance in establishing access requirements and includes criteria for multiple-family residential developments, large one- and two-family subdivisions, specific examples for various types of turnarounds for fire department apparatus and parking regulatory signage. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix E Hazard Categories

Appendix E contains guidance for designers, engineers, architects, code officials, plans reviewers and inspectors in the classifying of hazardous materials so that proposed designs can be evaluated intelligently and accurately. The descriptive materials and explanations of hazardous materials and how to report and evaluate them on a Safety Data Sheet (SDS) are intended to be instructional as well as informative. Note that this appendix is for information purposes and is not intended for adoption.

Appendix F Hazard Ranking

The information in Appendix F is intended to be a companion to the specific requirements of Chapters 51 through 67, which regulate the storage, handling and use of all hazardous materials classified as either physical or health hazards. These materials pose diverse hazards, including instability, reactivity, flammability, oxidizing potential or toxicity; therefore, identifying them by hazard ranking is essential. This appendix lists the various hazardous materials categories that are defined in this code, along with the NFPA 704 hazard ranking for each. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix G Cryogenic Fluids—Weight and Volume Equivalents

Appendix G gives the fire code official and design professional a ready reference tool for the conversion of the liquid weight and volume of cryogenic fluid to their corresponding volume of gas and vice versa and is a companion to the provisions of Chapter 55 of this code. Note that this appendix is for information purposes and is not intended for adoption.

Appendix H Hazardous Materials Management Plan (HMMP) and Hazardous Materials Inventory Statement (HMIS) Instructions

Appendix H is intended to assist businesses in establishing a Hazardous Materials Management Plan (HMMP) and Hazardous Materials Inventory Statement (HMIS) based on the classification and quantities of materials that would be found on-site, in storage or in use. The sample forms and available Safety Data Sheets (SDS) provide the basis for the evaluations. It is also a companion to IFC Sections 407.5 and 407.6, which provide the requirement that the HMIS and HMMP be submitted when required by the fire code official. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix I Fire Protection Systems—Noncompliant Conditions

The purpose of Appendix I, which was developed by the ICC Hazard Abatement in Existing Buildings Committee, is to provide the fire code official with a list of conditions that are readily identifiable by the inspector during the course of an inspection utilizing the IFC. The specific conditions identified in this appendix are primarily derived from applicable NFPA standards and pose a hazard to the proper operation of the respective systems. While these do not represent all of the conditions that pose a hazard or otherwise may impair the proper operation of fire protection systems, their identification in this adoptable appendix will provide a more direct path for enforcement by the fire code official. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix J Building Information Sign

Appendix J provides design, installation and maintenance requirements for a Building Information Sign (BIS), a fire service tool to be utilized in the crucial, initial response of fire fighters to a structure fire. The BIS placard is designed to be utilized within the initial response time frame of an incident to assist fire fighters in their tactical size-up of a situation as soon as possible after arrival on the scene of a fire emergency. The BIS design is in the shape of a fire service Maltese Cross and includes five spaces (the four wings plus the centerpiece of the cross symbol) in which information is placed about the tactical considerations of construction type and hourly rating, fire protection systems, occupancy type, content hazards and special features that could affect tactical decisions and operations. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix K Construction Requirements for Existing Ambulatory Care Facilities

Appendix K was created by the ICC Ad Hoc Committee on Healthcare (AHC) and its intent is to provide jurisdictions with an option for assessing minimum fire and life safety requirements for buildings containing ambulatory care facilities. While this appendix is written with the intent to apply retroactive minimum standards, the AHC recognized that the ambulatory care requirements are relatively recent additions to the *IBC*. For that reason, these requirements are presented as an appendix so that the adopting authority can exercise judgment in the adoption and application of this section. This appendix would also be useful for those local and state jurisdictions that are specifically focused on ensuring the safety for existing ambulatory care facilities by providing minimum criteria that could be used to bring older facilities into compliance with the current standards at the discretion of the adopting jurisdiction. The technical requirements are based on the current *IBC* language, which is consistent with the overall concept of the current federal requirements. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix L Requirements for Fire Fighter Air Replenishment Systems

Appendix L provides for the design, installation and maintenance of permanently installed fire fighter breathing air systems in buildings designated by the jurisdiction. Breathing air is critical for fire-fighting operations. Historically, fire departments have supplied air bottles by means of a “bottle brigade,” whereby fire fighters manually transport air bottles up stairways, which is an extraordinarily fire fighter-intensive process and takes fire fighters away from their primary mission of rescue

and fire fighting. Technology now exists to address the issue using in-building air supply systems. Fire fighter breathing air systems were introduced in the late 1980s and are now required in a number of communities throughout the United States. The system has been called a “standpipe for air” and consists of stainless steel, high-pressure piping that is supplied by on-site air storage or fire department air supply units. Air-filling stations are then strategically located throughout the building, allowing fire fighters to refill breathing air cylinders inside the fire building, negating the required “bottle brigade,” and making more fire fighters available for search, rescue and fire suppression operations. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix M High-rise Buildings—Retroactive Automatic Sprinkler Requirement

Appendix M was created with the intent to provide an option for adoption by jurisdictions that choose to require existing high-rise buildings to be retrofitted with automatic sprinklers. Modern fire and building codes require complete automatic fire sprinkler protection and a variety of other safety features in new high-rise construction. Many older high-rise buildings lack automatic sprinkler protection and other basic fire protection features necessary to protect the occupants, emergency responders and the structure itself. Without complete automatic sprinkler protection, fire departments cannot provide the level of protection that high-rise buildings demand. Existing high-rise buildings that are not protected with automatic sprinklers represent a significant hazard to occupants and fire fighters, and can significantly impact a community’s infrastructure and economic viability in the event of a fire loss. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix N Indoor Trade Shows and Exhibitions

Appendix N was created to address the hazards that are associated with larger, more complex trade shows and exhibitions. Although many of these requirements are already included in various locations in this code, some of the more important items, such as requirements for covered booths and multiple-story booths, are not. The intent is to have the requirements covering these events in a single location. The provisions are essentially a series of pointers to other locations within this code. This assists those organizing exhibitions and individual exhibitors unfamiliar with the fire code. The appendix can be adopted by jurisdictions looking for specific regulations on this subject or used as a guide where it is not. Note that the provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

Appendix O Temporary Haunted Houses, Ghost Walks and Similar Amusement Uses

These regulations shall apply to temporary haunted houses, ghost walks or similar amusement uses, where decorative materials and confusing sounds and/or visual effects are present and shall be in accordance with this appendix.

Appendix P Community Wildland-Urban Interface (WUI) Fire Hazard Evaluation Framework

Appendix P is meant to be a tool to enable communities to collect, assemble and represent the associated risks within the Wildland-Urban Interface (WUI) fire area. Community-level fire hazard data is not always readily available in a centralized location and not in a standard format. This framework enables communities’ leaders to collect their WUI fire hazard data in an immediately accessible format. This framework also allows the community WUI fire hazard area data to be an inclusive picture. Part of the data assembled in the framework layout will help first responders during an incident. This data may enhance situational awareness, facilitate ingress and egress routes, and increase structure survivability through targeted fire responder actions. The framework allows decision makers the ability to access WUI fire hazard risks across multiple communities when implemented in this standardized method. For example, a comparison can be made between a community of 5,000 residents to a community with 20,000 residents. They will be able to compare their overall fire hazard as well as the relative fire hazard. The information from the standardized framework may be used to assist with making the design and prioritizing resources at the community, county and state level. These resources may include funding for fuel treatment around communities in designated very high fire

hazard severity zones. The proposed framework has the benefit of enabling communities, county and state to use a methodized approach to assess hazards, offer property solutions and inform first responders before and during incidents.

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CHAPTER 1 – SCOPE AND ADMINISTRATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X																			
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
Division I																						
1.1 – 1.1.12			X																			
1.1.3.2	X																					
1.11 – 1.11.2.1.1			X																			
1.11.4.5			X																			
1.11.6			X																			
1.11.11			X																			
[T-19 §1.11]				X																		
[T-19 §3.12]				X																		
1.11.2.1.2 – 1.11.2.2			X																			
[T-19 §1.08]				X																		
[T-19 §1.13]				X																		
1.11.2.3 – 1.11.10			X																			
[T-19 §1.03]				X																		
[T-19 §1.09.1]				X																		
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102.1 – 102.5			X																			
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105.3.1.1	X																					
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105.6.10 – 105.6.11			X																			
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105.6.20			X																			
Table 105.6.20 – 105.6.26			X																			
105.6.36			X																			
105.6.38			X																			
105.6.40			X																			
105.6.47			X																			
105.6.49			X																			
105.6.51			X																			
105.7 – 105.7.25			X																			
107.2 – 107.4			X																			
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111.1 – 111.4			X																			
112 – 112.4			X																			

* The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

The state agency does not adopt sections identified by the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

Part I—Administrative

CHAPTER 1

SCOPE AND ADMINISTRATION

DIVISION I CALIFORNIA ADMINISTRATION

SECTION 1.1 GENERAL

1.1.1 Title. These regulations shall be known as the California Fire Code, may be cited as such and will be referred to herein as “this code.” The California Fire Code is Part 9 of thirteen parts of the official compilation and publication of the adoptions, amendment and repeal of building regulations to the California Code of Regulations, Title 24, also referred to as the California Building Standards Code. This part incorporates by adoption the 2021 International Fire Code of the International Code Council (ICC) with necessary California amendments.

1.1.2 Purpose. The purpose of this code is to establish the minimum requirements consistent with nationally recognized good practices to safeguard the public health, safety and general welfare from the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises, and to provide safety and assistance to fire fighters and emergency responders during emergency operations.

1.1.3 Scope. The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such building structures throughout the State of California.

This code establishes regulations affecting or relating to buildings, structures, processes, premises and a reasonable degree of life and property safeguards regarding:

1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices.
2. Conditions hazardous to life, property or public welfare in the use or occupancy of buildings, structures or premises.
3. Fire hazards in the buildings, structures or on premises from use of, occupancy of, or operation.
4. Matters related to the construction, extension, repair, alteration or removal of fire suppression or alarm systems.
5. Conditions affecting the safety of fire fighters and emergency responders during emergency operations.

1.1.3.1 Nonstate-regulated buildings, structures and applications. Except as modified by local ordinance pursuant to Section 1.1.8, the following standards in the California Code of Regulations, Title 24, Parts 2, 3, 4, 5, 6, 9,

10 and 11 shall apply to all occupancies and applications not regulated by a state agency.

1.1.3.2 State-regulated buildings, structures and applications. The model code, state amendments to the model code, and/or state amendments where there are no relevant model code provisions, shall apply to the following buildings, structures and applications regulated by state agencies as specified in Sections 1.2 through 1.14, except where modified by local ordinance pursuant to Section 1.1.8. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.

Note: See “How to Distinguish Between Model Code Language and California Amendments” following the Preface.

1. State-owned buildings, including buildings constructed by the Trustees of the California State University, and to the extent permitted by California laws, buildings designed and constructed by the Regents of the University of California, and regulated by the Building Standards Commission. See Section 1.2 for additional scope provisions.
2. Local detention facilities regulated by the Board of State and Community Corrections. See Section 1.3 for additional scope provisions.
3. Barbering, cosmetology or electrolysis establishments, acupuncture offices, pharmacies, veterinary facilities and structural pest control locations regulated by the Department of Consumer Affairs. See Section 1.4 for additional scope provisions.
4. Section 1.5 reserved for the California Energy Commission.
5. Dairies and places of meat inspection regulated by the Department of Food and Agriculture. See Section 1.6 for additional scope provisions.
6. Organized camps, laboratory animal quarters, public swimming pools, radiation protection, commissaries serving mobile food preparation vehicles and wild animal quarantine facilities regulated by the Department of Public Health. See Section 1.7 for additional scope provisions.
7. Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for

homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities. See Section 1.8.2.1.1 for additional scope provisions.

8. Accommodations for persons with disabilities in buildings containing newly constructed covered multifamily dwellings, new common use spaces serving existing covered multifamily dwellings, additions to existing buildings where the addition alone meets the definition of a “COVERED MULTIFAMILY DWELLING,” and new common-use areas serving new covered multifamily dwellings which are regulated by the Department of Housing and Community Development. See Section 1.8.2.1.2 for additional scope provisions.
9. Permanent buildings and permanent accessory buildings or structures constructed within mobile home parks and special occupancy parks regulated by the Department of Housing and Community Development. See Section 1.8.2.1.3 for additional scope provisions.
10. Accommodations for persons with disabilities regulated by the Division of the State Architect. See Section 1.9.1 for additional scope provisions.
11. Public elementary and secondary schools, community college buildings and state-owned or state-leased essential service buildings regulated by the Division of the State Architect. See Section 1.9.2 for additional scope provisions.
12. Qualified historical buildings and structures and their associated sites regulated by the State Historical Building Safety Board with the Division of the State Architect. See Section 1.9.3 for additional scope provisions.
13. General acute care hospitals, acute psychiatric hospitals, skilled nursing and/or intermediate care facilities, clinics licensed by the Department of Public Health and correctional treatment centers regulated by the Office of Statewide Health Planning and Development. See Section 1.10 for additional scope provisions.
14. Applications regulated by the Office of the State Fire Marshal include, but are not limited to, the following in accordance with Section 1.11:
 - 14.1. Buildings or structures used or intended for use as an:
 1. Asylum, jail, prison.
 2. Mental hospital, hospital, home for the elderly, children’s nursery, children’s home or institution, school or any similar occupancy of any capacity.
 3. Theater, dancehall, skating rink, auditorium, assembly hall, meeting

hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation or education.

4. Small family daycare homes, large family daycare homes, residential facilities and residential facilities for the elderly, residential care facilities.
5. State institutions or other state-owned or state-occupied buildings.
6. High-rise structures.
7. Motion picture production studios.
8. Organized camps.
9. Residential structures.
- 14.2. Tents, awnings or other fabric enclosures used in connection with any occupancy.
- 14.3. Fire alarm devices, equipment and systems in connection with any occupancy.
- 14.4. Hazardous materials, flammable and combustible liquids.
- 14.5. Public school automatic fire detection, alarm and sprinkler systems.
- 14.6. Wildland-urban interface fire areas.
15. Public libraries constructed and renovated using funds from the California Library Construction and Renovation Bond Act of 1988 and regulated by the State Librarian. See Section 1.12 of the California Building Code for additional scope provisions.
16. Section 1.13 reserved for the Department of Water Resources.
17. For applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, outdoor environments and uses shall be classified according to accessibility uses described in Chapters 11A, 11B and 11C.
18. Marine Oil Terminals regulated by the California State Lands Commission. See Section 1.14 of the California Building Code for additional scope provisions.

1.1.4 Appendices. Provisions contained in the appendices of this code shall not apply unless specifically adopted by a state agency or adopted by a local enforcing agency in compliance with Health and Safety Code, Section 18901 et. seq. for Building Standards Law, Health and Safety Code, Section 17950 for State Housing Law and Health and Safety Code, Section 13869.7 for Fire Protection Districts. See Section 1.1.8 of this code.

1.1.5 Referenced codes. The codes, standards and publications adopted and set forth in this code, including other codes, standards and publications referred to therein are, by title and date of publication, hereby adopted as standard reference documents of this code. When this code does not specifically cover any subject related to building design and construction, recognized architectural or engineering practices shall be employed. The National Fire Codes, standards and the Fire Protection Handbook of the National Fire Protection Association are permitted to be used as authoritative guides in determining recognized fire prevention engineering practices.

1.1.6 Nonbuilding standards, orders and regulations. Requirements contained in the California Fire Code, or in any other referenced standard, code or document, which are not building standards as defined in Health and Safety Code, Section 18909 shall not be construed as part of the provisions of this code. For nonbuilding standards, orders and regulations, see other titles of the California Code of Regulations.

1.1.7 Order of precedence and use.

1.1.7.1 Differences. In the event of any differences between these building standards and the standard reference documents, the text of these building standards shall govern.

1.1.7.2 Specific provisions. Where a specific provision varies from a general provision, the specific provision shall apply.

1.1.7.3 Conflicts. When the requirements of this code conflict with the requirements of any other part of the California Building Standards Code, Title 24, the most restrictive requirements shall prevail.

1.1.7.3.1. Detached one- and two-family dwellings, efficiency dwelling units, lodging houses, live/work units, townhouses not more than three stories above grade plane with a separate means of egress, and their accessory structures, may be designed and constructed in accordance with the California Building Code or the California Residential Code, but not both, unless the proposed structure(s) or element(s) exceed the design limitations established in the California Residential Code, and the code user is specially directed by the California Residential Code to use the California Building Code.

1.1.8 City, county or city and county amendments, additions or deletions. The provisions of this code do not limit the authority of city, county or city and county governments to establish more restrictive and reasonably necessary differences to the provisions contained in this code pursuant to complying with Section 1.1.8.1. The effective date of amendments, additions or deletions to this code of a city, county or a city and county filed pursuant to Section 1.1.8.1 shall be the date filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with Health and Safety Code, Section 18941.5 for Building Standards Law, Health

and Safety Code, Section 17958 for State Housing Law or Health and Safety Code, Section 13869.7 for Fire Protection Districts.

1.1.8.1 Findings and filings.

1. The city, county or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geological conditions.

Exception: Hazardous building ordinances and programs mitigating unreinforced masonry buildings.

2. The city, county or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties and fire departments shall file the amendments, additions or deletions, and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.

3. Findings prepared by fire protection districts shall be ratified by the local city, county or city and county and filed with the California Department of Housing and Community Development, Division of Codes and Standards, P.O. Box 1407, Sacramento, CA 95812-1407 or 2020 West El Camino Avenue, Suite 250, Sacramento, CA 95833-1829.

1.1.8.2 Locally adopted energy standards—California Energy Code, Part 6

In addition to the provisions of Section 1.1.8.1 of this Part, the provisions of this section apply to cities, counties and city and county amending adopted energy standards affecting buildings and structures subject to the California Energy Code, Part 6.

Applicable provisions of Public Resources Code Section 25402.1 and applicable provisions of Chapter 10 of the California Administrative Code, Part 1 apply to local amendment of energy standards adopted by the California Energy Commission.

1.1.9 Effective date of this code. Only those standards approved by the California Building Standards Commission that are effective at the time an application for building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the History Note page of this code.

1.1.10 Availability of codes. At least one complete copy each of Titles 8, 19, 20, 24 and 25 with all revisions shall be maintained in the office of the building official responsible for the administration and enforcement of this code. Each state department concerned and each city, county or city and county shall have an up-to-date copy of the code available for public inspection. See Health and Safety Code, Section 18942(e)(1) and (2).

1.1.11 Format. This part fundamentally adopts the California Fire Code by reference on a chapter-by-chapter basis. When a specific chapter of the California Fire Code is not printed in the

code and is marked “Reserved,” such chapter of the California Fire Code is not adopted as a portion of this code. When a specific chapter of the California Fire Code is marked “Not adopted by the State of California,” but appears in the code, it may be available for adoption by local ordinance.

Note: Matrix Adoption Tables at the front of each chapter may aid the code user in determining which chapter or sections within a chapter are applicable to buildings under the authority of a specific state agency, but they are not to be considered regulatory.

1.1.12 Validity. If any chapter, section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, contrary to statute, exceeding the authority of the state as stipulated by statutes or otherwise inoperative, such decision shall not affect the validity of the remaining portion of this code.

**SECTION 1.11
OFFICE OF THE STATE FIRE MARSHAL**

1.11.1 SFM—Office of the State Fire Marshal. Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application:

Institutional, educational or any similar occupancy. Any building or structure used or intended for use as an asylum, jail, prison, mental hospital, hospital, sanitarium, home for the elderly, children’s nursery, children’s home or institution, school or any similar occupancy of any capacity.

Authority cited—Health and Safety Code, Section 13143.

Reference—Health and Safety Code, Section 13143.

Assembly or similar place of assemblage. Any theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation or education.

Authority cited—Health and Safety Code, Section 13143.

Reference—Health and Safety Code, Section 13143.

Small family daycare homes.

Authority cited—Health and Safety Code, Sections 1597.45, 1597.54, 13143 and 17921.

Reference—Health and Safety Code, Section 13143.

Large family daycare homes.

Authority cited—Health and Safety Code, Sections 1597.46, 1597.54 and 17921.

Reference—Health and Safety Code, Section 13143.

Residential facilities and residential facilities for the elderly.

Authority cited—Health and Safety Code, Section 13133.

Reference—Health and Safety Code, Section 13143.

Any state institution or other state-owned or specified state-occupied building.

Specified state-occupied buildings. Any building, structure or area that meets any of the following criteria:

1. A building where the state has contracted into a build-to-suit lease.
2. A courthouse holding facility or trial court with a detention area.
3. A building used by the Department of Corrections and Rehabilitation (CDCR) as a community correctional reentry center.
4. 100 percent state occupied.
5. State-occupied areas in a state-leased building that is a high-rise and is 75 percent of the net area floor space or more occupied by state entities.
6. State-occupied areas in a building that contains 5,000 square feet or more space of state-leased Group H or Group L occupancy.
7. A state-leased building with facilities with the primary purpose of housing state records and/or state artifacts of historical significance.
8. Properties leased by California State University (CSU) or University of California (UC).
9. State institutions and their real property.
10. CAL FIRE occupied areas in leased buildings.
11. State-leased facilities where the governing body’s fire protection services rely on an all-volunteer fire department.

Except as provided in Items 1 through 11, buildings shall become the responsibility of the local jurisdiction.

Authority cited—Health and Safety Code, Sections 13108, 13145, 13146, 16022.5 and 17921.

Reference—Health and Safety Code, Sections 13108, 13143, 13145, 13146, 16022.5 and 17921.

High-rise structures.

Authority cited—Health and Safety Code, Section 13211.

Reference—Health and Safety Code, Section 13143.

Motion picture production studios.

Authority cited—Health and Safety Code, Section 13143.1.

Reference—Health and Safety Code, Section 13143.

Organized camps.

Authority cited—Health and Safety Code, Section 18897.3.

Reference—Health and Safety Code, Section 13143.

Residential. All hotels, motels, lodging houses, apartment houses and dwellings, including congregate residences and buildings and structures accessory thereto. Multiple-story structures existing on January 1, 1975, let for human habitation, including and limited to, hotels, motels and apartment houses, less than 75 feet (22 860 mm) above the lowest floor

level having building access, wherein rooms used for sleeping are let above the ground floor.

Authority cited—Health and Safety Code, Sections 13143.2 and 17921.

Reference—Health and Safety Code, Section 13143.

Residential care facilities. Certified family care homes, out-of-home placement facilities, halfway houses, drug and/or alcohol rehabilitation facilities and any building or structure used or intended for use as a home or institution for the housing of any person of any age when such person is referred to or placed within such home or institution for protective social care and supervision services by any governmental agency.

Authority cited—Health and Safety Code, Section 13143.6.

Reference—Health and Safety Code, Section 13143.

Tents, awnings or other fabric enclosures used in connection with any occupancy.

Authority cited—Health and Safety Code, Section 13116.

Reference—Health and Safety Code, Section 13143.

Fire alarm devices, equipment and systems in connection with any occupancy.

Authority cited—Health and Safety Code, Section 13114.

Reference—Health and Safety Code, Section 13143.

Hazardous materials.

Authority cited—Health and Safety Code, Section 13143.9.

Reference—Health and Safety Code, Section 13143.

Flammable and combustible liquids.

Authority cited—Health and Safety Code, Section 13143.6.

Reference—Health and Safety Code, Section 13143.

Public school automatic fire detection, alarm and sprinkler systems.

Authority cited—Health and Safety Code, Section 13143 and California Education Code, Article 7.5, Sections 17074.50, 17074.52 and 17074.54.

Reference—Government Code, Section 11152.5, Health and Safety Code, Section 13143 and California Education Code Chapter 12.5, Leroy F. Greene School Facilities Act of 1998, Article 1.

Wildland-urban interface Fire Area.

Authority cited—Health and Safety Code, Sections 13143, 13108.5(a) and 18949.2(b) and (c) and Government Code, Section 51189.

Reference—Health and Safety Code, Sections 13143, Government Code, Sections 51176, 51177, 51178 and 51179 and Public Resources Code, Sections 4201 through 4204.

1.11.1.1 Adopting agency identification. The provisions of this code applicable to buildings identified in this Subsection 1.11.1 will be identified in the Matrix Adoption Tables under the acronym SFM.

1.11.2 Duties and powers of the enforcing agency.

1.11.2.1 Enforcement.

1.11.2.1.1 The responsibility for enforcement of building standards adopted by the State Fire Marshal and

published in the California Building Standards Code relating to fire and panic safety and other regulations of the State Fire Marshal shall be, except as provided in Section 1.11.2.1.2, as follows:

1. The city, county or city and county with jurisdiction in the area affected by the standard or regulation shall delegate the enforcement of the building standards relating to fire and panic safety and other regulations of the State Fire Marshal as they relate to Group R-3 occupancies, as described in Section 310.1 of Part 2 of the California Building Standards Code, to either of the following:
 - 1.1. The chief of the fire authority of the city, county or city and county or an authorized representative.
 - 1.2. The chief building official of the city, county or city and county or an authorized representative.
2. The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.
3. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.
4. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.
5. Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.

[California Code of Regulations, Title 19, Division 1, §1.11] Enforcement of Regulations.

In most instances, the application of California Code of Regulations, Title 19, Division 1 to existing occupancies will necessitate the granting of sufficient time to affect the necessary changes. The inspection authority must, therefore, exercise good judgment in authorizing sufficient time to complete the required changes, taking into consideration the degree of danger to life in event of fire while rectification is being carried out. The inspection authority may require immediate compliance with any or all of the regulations, or he may grant a reasonable length of time in which to conform.

[California Code of Regulations, Title 19, Division 1, §3.12] Enforcement Agency.

- (a) *The provisions of California Code of Regulations, Title 19, Division 1 regulations shall be enforced by the State Fire Marshal, the chief of any city or county fire department or fire protection district, and their authorized representatives, in their respective areas of jurisdiction.*
- (b) *The division of authority for the enforcement of these regulations shall be in accordance with the following:*
 - (1) *The chief of any city or county fire department or fire protection district, and their authorized representatives shall enforce the rules and regulations in their respective areas.*
 - (2) *The State Fire Marshal shall have authority to enforce the rules and regulations in areas outside of corporate cities and county fire protection districts.*
 - (3) *The State Fire Marshal shall have authority to enforce the rules and regulations in corporate cities and county fire protection districts upon request of the chief fire official or the governing body.*
- (c) *Regardless of the provisions of subsections (a) and (b) above, these regulations shall be enforced in state institutions, state-owned and state-occupied buildings in accordance with the provisions of Section 13108, Health and Safety Code.*
- (d) *Regardless of the above provisions of this section, these regulations shall be enforced only by the State Fire Marshal in every jail or place of detention for persons charged with or convicted of a crime, unless the chief of a city or county fire department or fire protection district, or such chief's authorized representative, indicates in writing to the State Fire Marshal that inspections of such jails or places of detention will be conducted by the chief or such person's authorized representative, in their respective area of jurisdiction. The inspections shall be made at least once every two years for the purpose of enforcing the regulations adopted by the State Fire Marshal, pursuant to Section 13143. Reports of inspection conducted pursuant to this subsection shall be on forms provided by the State Fire Marshal and shall be submitted to the official in charge of the facility, the local governing body, the State Fire Marshal and the Corrections Standards Authority within 30 days of the inspections.*

1.11.2.1.2 Pursuant to Health and Safety Code, Section 13108, and except as otherwise provided in this section, building standards adopted by the State Fire Marshal published in the California Building Standards Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings and state institutions throughout the state. Upon the written request of the chief fire official of any city, county or fire protection district, the State Fire Marshal may authorize such chief fire offi-

cial and his or her authorized representatives, in their geographical area of responsibility, to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.

Pursuant to Health and Safety Code, Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

1.11.2.1.3 Pursuant to Health and Safety Code, Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than \$100.00 or more than \$500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

1.11.2.2 Right of entry. The fire chief of any city, county or fire protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of preparing a fire suppression preplanning program or for the purpose of investigating any fire in a state-occupied building.

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department or fire protection district and his or her authorized repre-

sentatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

[California Code of Regulations, Title 19, Division 1, §1.08] Report of Arrest.

Any inspection authority who, in the exercise of his authority as a Deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

[California Code of Regulations, Title 19, Division 1, §1.13] Penalty.

Section 13112 of the Health and Safety Code provides that:

- (a) "Every person who violates any provision of this chapter, or any order, rule or regulation made pursuant to this chapter is guilty of a misdemeanor punishable by a fine of not less than one hundred dollars (\$100) or more than five hundred dollars (\$500), or by imprisonment for not more than six months, or by both."
- (b) "A person is guilty of a separate offense each day during which he commits, continues or permits a violation of any provision of, or any order, rule or regulation made pursuant to, this chapter."

1.11.2.3 More restrictive fire and panic safety building standards.

1.11.2.3.1 Any fire protection district organized pursuant to Health and Safety Code Part 2.7 (commencing with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to Section 1.1.8.1.

1.11.2.3.2 Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 1.11.2.3.1, to the city, county or city and county where the ordinance will apply. The city, county or city and county may provide the district with written comments, which shall become part of the fire protection district's public hearing record.

1.11.2.3.3 The fire protection district shall transmit the adopted ordinance to the city, county or city and county

where the ordinance will apply. The legislative body of the city, county or city and county may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county or city and county shall file a copy of the findings of the district, and any findings of the city, county or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 1.1.8.1(3).

1.11.2.4 Request for alternate means of protection.

Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance. The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in California Code of Regulations, Title 19, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

1.11.2.5 Appeals. When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.

1.11.3 Construction documents.

1.11.3.1 Public schools. Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.

1.11.3.2 Movable walls and partitions. Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.

1.11.3.3 New construction high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.
2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to perform such services. Administration of the work of construction shall be under the charge of the responsible architect or engineer except that where plans and specifications involve alterations or repairs, such work of construction may be administered by an engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 65700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications and estimates and work of construction are applicable.

This section shall not be construed as preventing the design of fire-extinguishing systems by persons holding a C-16 license issued pursuant to Division 3, Chapter 9, Business and Professions Code. In such instances, however, the responsibility charge of this section shall prevail.

1.11.3.4 Existing high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required by Chapter 11 and California Existing Building Code for existing high-rise buildings. Such plans or specifications shall be submitted to the enforcing agency having jurisdiction.
2. When new construction is required to conform with the provisions of these regulations, complete plans or specifications, or both, shall be prepared in accordance with the provisions of this subsection. As used in this section, “new construction” is not intended to include repairs, replacements or minor alterations which do not disrupt or appreciably add to or affect the structural aspects of the building.

1.11.3.5 Retention of plans. Refer to Building Standards Law, Health and Safety Code, Sections 19850 and 19851 for permanent retention of plans.

1.11.4 Fees.

1.11.4.1 Other fees. Pursuant to Health and Safety Code, Section 13146.2, a city, county or district which inspects a hotel, motel, lodging house or apartment house may charge and collect a fee for the inspection from the owner of the structure in an amount, as determined by the city, county or district, sufficient to pay its costs of that inspection.

1.11.4.2 Large family daycare. Pursuant to Health and Safety Code, Section 1597.46, Large Family Day-Care Homes, the local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process.

1.11.4.3 High-rise. Pursuant to Health and Safety Code, Section 13217, High-rise Structure Inspection: Fees and Costs, a local agency which inspects a high-rise structure pursuant to Health and Safety Code Section 13217 may charge and collect a fee for the inspection from the owner of the high-rise structure in an amount, as determined by the local agency, sufficient to pay its costs of that inspection.

1.11.4.4 Fire clearance pre-inspection. Pursuant to Health and Safety Code, Section 13235, Fire Clearance Pre-inspection, fee, upon receipt of a request from a prospective licensee of a community care facility, as defined in Section 1502, of a residential care facility for the elderly, as defined in Section 1569.2, or of a child daycare facility, as defined in Section 1596.750, the local fire enforcing agency, as defined in Section 13244, or State Fire Marshal, whichever has primary jurisdiction, shall conduct a pre-inspection of the facility prior to the final fire clearance approval. At the time of the preinspection, the primary fire enforcing agency shall price consultation and interpretation of the fire safety regulations and shall notify the prospective licensee of the facility in writing of the specific fire safety regulations which shall be enforced in order to obtain fire clearance approval. A fee equal to, but not exceeding, the actual cost of the pre-inspection may be charged for the pre-inspection of a facility. <

1.11.4.5 Care facilities. The primary fire enforcing agency shall complete the final fire clearance inspection for a community care facility, residential care facility for the elderly or child day-care facility within 30 days of receipt of the request for the final inspection, or as of the date the prospective facility requests the final precicensure inspection by the State Department of Social Services, whichever is later.

Pursuant to Health and Safety Code, Section 13235, a pre-inspection fee equal to, but not exceeding, the actual cost of the pre-inspection services may be charged for the pre-inspection of a facility. ||<

Pursuant to Health and Safety Code, Section 13131.5, a reasonable final inspection fee, not to exceed the actual cost of inspection services necessary to complete a final inspection may be charged for occupancies classified as residential care facilities for the elderly (RCFE).

Pursuant to Health and Safety Code, Section 1569.84, neither the State Fire Marshal nor any local public entity shall charge any fee for enforcing fire inspection regulations pursuant to state law or regulation or local ordinance, with respect to residential care facilities for the elderly (RCFE) which service six or fewer persons.

1.11.4.6 Requests of the Office of the State Fire Marshal. Whenever a local authority having jurisdiction requests that the State Fire Marshal perform plan review and/or inspection services related to a building permit, the applicable fees for such shall be payable to the Office of the State Fire Marshal.

1.11.5 Inspections. Work performed subject to the provisions of this Code shall comply with the inspection requirements contained in Section 107, as adopted by the Office of the State Fire Marshal.

1.11.5.1 Existing Group R occupancies. Licensed 24-hour care in a Group R occupancy in existence and originally classified under previously adopted state codes shall be reinspected under the appropriate previous code, provided there is no change in the use or character which would place the facility in a different occupancy group.

1.11.6 Certificate of Occupancy. A Certificate of Occupancy shall be issued as specified in Title 24, Part 2, California Building Code, Section 111.

Exception: Certificates of occupancy are not required for work exempt from permits in accordance with Section 105.2 of the California Building Code.

1.11.7 Temporary Structures and Uses. See Title 24, Part 2, California Building Code, Section 108.

1.11.8 Service Utilities. See Title 24, Part 2, California Building Code, Section 112.

1.11.9 Stop Work Order. See Title 24, Part 2, California Building Code, Section 115.

1.11.10 Unsafe Buildings, Structures and Equipment. See Title 24, Part 2, California Building Code, Section 116.

[California Code of Regulations, Title 19, Division 1, §1.03] Scope.

(a) California Code of Regulations, Title 19, Division 1 regulations shall govern the use and maintenance of any building or structure used or intended for use as an asylum, jail, mental hospital, hospital, sanitarium, home for aged, children’s home or institution, school or any similar occupancy of any capacity; and any theater, dance hall, skating rink, auditorium, assembly hall, meeting hall, night club, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation or education, and in any building

or structure which is open to the public and is used or intended to be used for the showing of motion pictures when an admission fee is charged and when such building or structure has a capacity of 10 or more persons, and shall apply to both new and existing occupancies.

Exceptions:

- (1) Buildings controlled by the Federal Government, provided they are not subject to the provisions of Section 15452, Education Code.
- (2) Homes and institutions and day-care facilities which provide nonmedical board, room and care for six or fewer ambulatory children.

California Code of Regulations, Title 19, Division 1 regulations shall also apply to any building housing any occupancy when such building is used as an auxiliary or accessory structure to any of the occupancies specified herein. They do not apply to structural requirements not relating to fire and panic safety nor to matters dealing exclusively with health and sanitation.

- (b) In accordance with Section 13108 of the Health and Safety Code, California Code of Regulations, Title 19, Division 1 regulations shall govern the design and construction relating to fire protection in any state institution and in any state-owned or state-occupied building. For purposes of California Code of Regulations, Title 19, Division 1 regulations, “state-occupied buildings” are defined as those portions of a building which are leased or rented by the state and shall include all required exits leading therefrom to a public way. Portions of state-occupied buildings which are not leased or rented by the state shall not fall within the scope of this subsection unless such portions present an exposure hazard to the state-occupied area.
- (c) California Code of Regulations, Title 19, Division 1 regulations shall also govern the use and maintenance of “organized camps” as defined in Section 18897, Health and Safety Code.
- (d) California Code of Regulations, Title 19, Division 1 regulations shall also govern the use and maintenance of any building or structure used or intended for the housing of any person of any age when such person is referred to or placed within such home or facility for protective social care and supervision services by any governmental agency.
- (e) California Code of Regulations, Title 19, Division 1 regulations shall also govern the construction, use and maintenance of every building of any type of construction or occupancy having floors used for human occupancy located more than 75 feet above the lowest floor level having building access. For the purpose of this subsection, “building access” shall mean an exterior door opening conforming to all of the following:
 - (1) Suitable and available for fire department use.
 - (2) Located not more than 2 feet above the adjacent ground level.

- (3) *Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.*
- (4) *Designed to permit penetration through the use of fire department forcible entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.*
- (f) *California Code of Regulations, Title 19, Division 1 regulations shall also apply to vehicles, ships and boats or other mobile structures when fixed in a specific location and used for any occupancy within the scope of this section.*

Note: Unless otherwise specified, Title 19 applies to all building occupancies, and related features and equipment throughout the state.

[California Code of Regulations, Title 19, Division 1, §1.09.1] Order of Precedence.

In the event of any differences between California Code of Regulations, Title 19, Division 1 regulations and the standard reference documents or standard fire prevention practices, the text of California Code of Regulations, Title 19, Division 1 regulations shall govern. Where a specific provision varies from a general provision, the specific provision shall apply.

1.11.11 Adopting agency identification. *The provisions of this code applicable to buildings identified in Section 1.11 will be identified in the Matrix Adoption Tables under the acronym SFM.*

DIVISION II

SCOPE AND ADMINISTRATION

User note:

About this chapter: Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts: Part 1—General Provisions (Sections 101–102) and Part 2—Administrative Provisions (Sections 103–114). Section 102 identifies which buildings and structures come under its purview and references other I-Codes as applicable.

This code is intended to be adopted as a legally enforceable document, and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the authority having jurisdiction and also establish the rights and privileges of the design professional, contractor and property owner.

Code development reminder: Code change proposals to this chapter will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

Portions of this chapter were extensively reorganized for the 2021 edition. For clarity, the relocation marginal markings have not been included. For complete information, see the relocations table in the preface information of this code.

PART 1—GENERAL PROVISIONS

SECTION 101 SCOPE AND GENERAL REQUIREMENTS

Note: Sections adopted or amended by state agencies are specifically indicated by an agency banner or indicated in the Matrix Adoption Table.

[A] **101.1 Title.** These regulations shall be known as the *Fire Code* of [NAME OF JURISDICTION], hereinafter referred to as “this code.”

[A] **101.2 Scope.** This code establishes regulations affecting or relating to structures, processes, premises and safeguards regarding all of the following:

1. The hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices.
2. Conditions hazardous to life, property or public welfare in the occupancy of structures or premises.
3. Fire hazards in the structure or on the premises from occupancy or operation.
4. Matters related to the construction, extension, repair, alteration or removal of fire protection systems.
5. Conditions affecting the safety of fire fighters and emergency responders during emergency operations.

[A] **101.2.1 Appendices.** Provisions in the appendices shall not apply unless specifically adopted.

[A] **101.3 Purpose.** The purpose of this code is to establish the minimum requirements consistent with nationally recognized good practice for providing a reasonable level of life safety and property protection from the hazards of fire, explosion or dangerous conditions in new and existing buildings, structures and premises, and to provide a reasonable level of safety to fire fighters and emergency responders during emergency operations.

[A] **101.4 Severability.** If a section, subsection, sentence, clause or phrase of this code is, for any reason, held to be

unconstitutional, such decision shall not affect the validity of the remaining portions of this code.

[A] **101.5 Validity.** In the event any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions hereof, which are determined to be legal; and it shall be presumed that this code would have been adopted without such illegal or invalid parts or provisions.

SECTION 102 APPLICABILITY

[A] **102.1 Construction and design provisions.** The construction and design provisions of this code shall apply to:

1. Structures, facilities and conditions arising after the adoption of this code.
2. Existing structures, facilities and conditions not legally in existence at the time of adoption of this code.
3. Existing structures, facilities and conditions where required in Chapter 11.
4. Existing structures, facilities and conditions that, in the opinion of the fire code official, constitute a distinct hazard to life or property.

[A] **102.2 Administrative, operational and maintenance provisions.** The administrative, operational and maintenance provisions of this code shall apply to:

1. Conditions and operations arising after the adoption of this code.
2. Existing conditions and operations.

[A] **102.3 Change of use or occupancy.** A change of occupancy shall not be made unless the use or occupancy is made to comply with the requirements of this code and the *California Existing Building Code*.

Exception: Where approved by the fire code official, a change of occupancy shall be permitted without complying with the requirements of this code and the *California Existing Building Code*, provided that the new or proposed

DIVISION II SCOPE AND ADMINISTRATION

use or occupancy is less hazardous, based on life and fire risk, than the existing use or occupancy.

[A] 102.4 Application of building code. The design and construction of new structures shall comply with the *California Building Code*, and any alterations, additions, changes in use or changes in structures required by this code, which are within the scope of the *California Building Code*, shall be made in accordance therewith.

[A] 102.5 Application of residential code. Where structures are designed and constructed in accordance with the *California Residential Code*, the provisions of this code shall apply as follows:

1. Construction and design provisions of this code pertaining to the exterior of the structure shall apply including, but not limited to, premises identification, fire apparatus access and water supplies. Where interior or exterior systems or devices are installed, construction permits required by Section 105.6 shall apply.
2. Administrative, operational and maintenance provisions of this code shall apply.

[A] 102.6 Historic buildings. The provisions of this code relating to the construction, alteration, repair, enlargement, restoration, relocation or moving of buildings or structures shall not be mandatory for existing buildings or structures identified and classified by the state or local jurisdiction as historic buildings where such buildings or structures do not constitute a distinct hazard to life or property. Fire protection in designated historic buildings shall be provided with an approved fire protection plan as required in Section 1103.1.1.

[A] 102.7 Referenced codes and standards. The codes and standards referenced in this code shall be those that are listed in Chapter 80, and such codes and standards shall be considered to be part of the requirements of this code to the prescribed extent of each such reference and as further regulated by Sections 102.7.1 and 102.7.2.

[A] 102.7.1 Conflicts. Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

[A] 102.7.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

[A] 102.8 Subjects not regulated by this code. Where applicable standards or requirements are not set forth in this code, or are contained within other laws, codes, regulations, ordinances or bylaws adopted by the jurisdiction, compliance with applicable standards of the National Fire Protection Association or other nationally recognized fire safety standards, as approved, shall be deemed as prima facie evidence of compliance with the intent of this code. Nothing herein shall derogate from the authority of the fire code official to determine compliance with codes or standards for those activities or installations within the fire code official's jurisdiction or responsibility.

[A] 102.9 Matters not provided for. Requirements that are essential for the public safety of an existing or proposed activity, building or structure, or for the safety of the occupants thereof, that are not specifically provided for by this code, shall be determined by the fire code official.

[A] 102.10 Conflicting provisions. Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[A] 102.11 Other laws. The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

[A] 102.12 Application of references. References to chapter or section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION 103 CODE COMPLIANCE AGENCY

[A] 103.1 Creation of agency. The [INSERT NAME OF DEPARTMENT] is hereby created and the official in charge thereof shall be known as the fire code official. The function of the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] 103.2 Appointment. The fire code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] 103.3 Deputies. In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the fire code official shall have the authority to appoint a deputy fire code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the fire code official.

SECTION 104 DUTIES AND POWERS OF THE FIRE CODE OFFICIAL

[A] 104.1 General. The fire code official is hereby authorized to enforce the provisions of this code. The fire code official shall have the authority to render interpretations of this code and to adopt policies, procedures, rules and regulations in order to clarify the application of its provisions. Such interpretations, policies, procedures, rules and regulations shall be in compliance with the intent and purpose of this code. Such policies, procedures, rules and regulations shall not have the effect of waiving requirements specifically provided for in this code.

[A] 104.2 Applications and permits. The fire code official is authorized to receive applications, review construction documents and issue permits for construction regulated by this

code, issue permits for operations regulated by this code, inspect the premises for which such permits have been issued and enforce compliance with the provisions of this code.

[A] 104.3 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the fire code official has reasonable cause to believe that there exists in a building or on any premises any conditions or violations of this code that make the building or premises unsafe, dangerous or hazardous, the fire code official shall have the authority to enter the building or premises at all reasonable times to inspect or to perform the duties imposed on the fire code official by this code. If such building or premises is occupied, the fire code official shall present credentials to the occupant and request entry. If such building or premises is unoccupied, the fire code official shall first make a reasonable effort to locate the owner, the owner's authorized agent or other person having charge or control of the building or premises and request entry. If entry is refused, the fire code official has recourse to every remedy provided by law to secure entry.

[A] 104.3.1 Warrant. Where the fire code official has first obtained a proper inspection warrant or other remedy provided by law to secure entry, an owner, the owner's authorized agent or occupant or person having charge, care or control of the building or premises shall not fail or neglect, after proper request is made as herein provided, to permit entry therein by the fire code official for the purpose of inspection and examination pursuant to this code.

[A] 104.4 Identification. The fire code official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

[A] 104.5 Notices and orders. The fire code official is authorized to issue such notices or orders as are required to affect compliance with this code in accordance with Sections 112.1 and 112.2.

[A] 104.6 Official records. The fire code official shall keep official records as required by Sections 104.6.1 through 104.6.4. Such official records shall be retained for not less than 5 years or for as long as the structure or activity to which such records relate remains in existence, unless otherwise provided by other regulations.

[A] 104.6.1 Approvals. A record of approvals shall be maintained by the fire code official and shall be available for public inspection during business hours in accordance with applicable laws.

[A] 104.6.2 Inspections. The fire code official shall keep a record of each inspection made, including notices and orders issued, showing the findings and disposition of each.

104.6.3 Fire records. The fire department shall keep a record of fires occurring within its jurisdiction and of facts concerning the same, including statistics as to the extent of such fires and the damage caused thereby, together with other information as required by the fire code official.

[A] 104.6.4 Administrative. Application for modification, alternative methods or materials and the final

decision of the fire code official shall be in writing and shall be officially recorded in the permanent records of the fire code official.

[A] 104.7 Liability. The fire code official, member of the board of appeals, officer or employee charged with the enforcement of this code, while acting for the jurisdiction, in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally, and is hereby relieved from all personal liability for any damage accruing to persons or property as a result of an act or by reason of an act or omission in the discharge of official duties.

[A] 104.7.1 Legal defense. Any suit or criminal complaint instituted against any officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by the legal representatives of the jurisdiction until the final termination of the proceedings. The fire code official or any subordinate shall not be liable for costs in an action, suit or proceeding that is instituted in pursuance of the provisions of this code; and any officer of the department of fire prevention, acting in good faith and without malice, shall be free from liability for acts performed under any of its provisions or by reason of any act or omission in the performance of official duties in connection therewith.

[A] 104.8 Approved materials and equipment. Materials, equipment and devices approved by the fire code official shall be constructed and installed in accordance with such approval.

[A] 104.8.1 Material and equipment reuse. Materials, equipment and devices shall not be reused or reinstalled unless such elements have been reconditioned, tested and placed in good and proper working condition and approved.

[A] 104.8.2 Technical assistance. To determine the acceptability of technologies, processes, products, facilities, materials and uses attending the design, operation or use of a building or premises subject to inspection by the fire code official, the fire code official is authorized to require the owner or owner's authorized agent to provide, without charge to the jurisdiction, a technical opinion and report. The opinion and report shall be prepared by a qualified engineer, specialist, laboratory or fire safety specialty organization acceptable to the fire code official and shall analyze the fire safety properties of the design, operation or use of the building or premises and the facilities and appurtenances situated thereon, to recommend necessary changes. The fire code official is authorized to require design submittals to be prepared by, and bear the stamp of, a registered design professional.

[A] 104.9 Modifications. Where there are practical difficulties involved in carrying out the provisions of this code, the fire code official shall have the authority to grant modifications for individual cases, provided that the fire code official shall first find that special individual reason makes the strict letter of this code impractical and the modification is in

compliance with the intent and purpose of this code and that such modification does not lessen health, life and fire safety requirements. The details of action granting modifications shall be recorded and entered in the files of the department of fire prevention.

[A] 104.10 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the fire code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the fire code official shall respond in writing, stating the reasons why the alternative was not approved.

[A] 104.10.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

[A] 104.10.2 Tests. Where there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the fire code official shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the fire code official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the fire code official for the period required for retention of public records.

104.11 Fire investigations. The fire code official, the fire department or other responsible authority shall have the authority to investigate the cause, origin and circumstances of any fire, explosion or other hazardous condition. Information that could be related to trade secrets or processes shall not be made part of the public record, except as directed by a court of law.

104.11.1 Assistance from other agencies. Police and other enforcement agencies shall have authority to render necessary assistance in the investigation of fires when requested to do so.

104.12 Authority at fires and other emergencies. The fire chief or officer of the fire department in charge at the scene of a fire or other emergency involving the protection of life or property, or any part thereof, shall have the authority to direct such operation as necessary to extinguish or control any fire, perform any rescue operation, investigate the existence of suspected or reported fires, gas leaks or other hazardous conditions or situations, or take any other action necessary in

the reasonable performance of duty. In the exercise of such power, the fire chief is authorized to prohibit any person, vehicle, vessel or thing from approaching the scene, and is authorized to remove, or cause to be removed or kept away from the scene, any vehicle, vessel or thing that could impede or interfere with the operations of the fire department and, in the judgment of the fire chief, any person not actually and usefully employed in the extinguishing of such fire or in the preservation of property in the vicinity thereof.

104.12.1 Barricades. The fire chief or officer of the fire department in charge at the scene of an emergency is authorized to place ropes, guards, barricades or other obstructions across any street, alley, place or private property in the vicinity of such operation so as to prevent accidents or interference with the lawful efforts of the fire department to manage and control the situation and to handle fire apparatus.

104.12.2 Obstructing operations. Persons shall not obstruct the operations of the fire department in connection with extinguishment or control of any fire, or actions relative to other emergencies, or disobey any lawful command of the fire chief or officer of the fire department in charge of the emergency, or any part thereof, or any lawful order of a police officer assisting the fire department.

104.12.3 Systems and devices. Persons shall not render a system or device inoperative during an emergency unless by direction of the fire chief or fire department official in charge of the incident.

SECTION 105 PERMITS

[A] 105.1 General. Permits shall be in accordance with Sections 105.1.1 through 105.6.24.

[A] 105.1.1 Permits required. A property owner or owner's authorized agent who intends to conduct an operation or business, or install or modify systems and equipment that are regulated by this code, or to cause any such work to be performed, shall first make application to the fire code official and obtain the required permit.

105.1.2 Types of permits. There shall be two types of permits as follows:

1. Operational permit. An operational permit allows the applicant to conduct an operation or a business for which a permit is required by Section 105.5 for either:
 - 1.1. A prescribed period.
 - 1.2. Until renewed or revoked.
2. Construction permit. A construction permit allows the applicant to install or modify systems and equipment for which a permit is required by Section 105.6.

105.1.3 Multiple permits for the same location. Where more than one permit is required for the same location, the fire code official is authorized to consolidate such permits

into a single permit provided that each provision is listed in the permit.

[A] 105.1.4 Emergency repairs. Where equipment replacement and repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the fire code official.

[A] 105.1.5 Repairs. Application or notice to the fire code official is not required for ordinary repairs to structures, equipment or systems. Such repairs shall not include the cutting away of any wall, partition or portion thereof, the removal or change of any required means of egress, or rearrangement of parts of a structure affecting the egress requirements; nor shall any repairs include addition to, alteration of, replacement or relocation of any standpipe, fire protection water supply, automatic sprinkler system, fire alarm system or other work affecting fire protection or life safety.

[A] 105.1.6 Annual permit. Instead of an individual construction permit for each alteration to an already approved system or equipment installation, the fire code official is authorized to issue an annual permit on application therefor to any person, firm or corporation regularly employing one or more qualified tradespersons in the building, structure or on the premises owned or operated by the applicant for the permit.

[A] 105.1.6.1 Annual permit records. The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The fire code official shall have access to such records at all times or such records shall be filed with the fire code official as designated.

[A] 105.2 Application. Application for a permit required by this code shall be made to the fire code official in such form and detail as prescribed by the fire code official. Applications for permits shall be accompanied by such plans as prescribed by the fire code official.

[A] 105.2.1 Refusal to issue permit. If the application for a permit describes a use that does not conform to the requirements of this code and other pertinent laws and ordinances, the fire code official shall not issue a permit, but shall return the application to the applicant with the refusal to issue such permit. Such refusal shall, where requested, be in writing and shall contain the reasons for refusal.

[A] 105.2.2 Inspection authorized. Before a new operational permit is approved, the fire code official is authorized to inspect the receptacles, vehicles, buildings, devices, premises, storage spaces or areas to be used to determine compliance with this code or any operational constraints required.

[A] 105.2.3 Time limitation of application. An application for a permit for any proposed work or operation shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been diligently prosecuted or a permit shall have been issued; except that the fire code official is authorized to grant one or more exten-

sions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated.

[A] 105.2.4 Action on application. The fire code official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the fire code official shall reject such application in writing, stating the reasons therefor. If the fire code official is satisfied that the proposed work or operation conforms to the requirements of this code and laws and ordinances applicable thereto, the fire code official shall issue a permit therefor as soon as practicable.

[A] 105.3 Conditions of a permit. A permit shall constitute permission to maintain, store or handle materials; or to conduct processes that produce conditions hazardous to life or property; or to install equipment utilized in connection with such activities; or to install or modify any fire protection system or equipment or any other construction, equipment installation or modification in accordance with the provisions of this code where a permit is required by Section 105.5 or 105.6. Such permission shall not be construed as authority to violate, cancel or set aside any of the provisions of this code or other applicable regulations or laws of the jurisdiction.

[A] 105.3.1 Expiration. An operational permit shall remain in effect until reissued, renewed or revoked, or for such a period of time as specified in the permit. Construction permits shall automatically become invalid unless the work authorized by such permit is commenced within 180 days after its issuance, or if the work authorized by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. Before such work recommences, a new permit shall be first obtained and the fee to recommence work, if any, shall be one-half the amount required for a new permit for such work, provided that changes have not been made and will not be made in the original construction documents for such work, and provided further that such suspension or abandonment has not exceeded one year. Permits are not transferable and any change in occupancy, operation, tenancy or ownership shall require that a new permit be issued.

105.3.1.1 Expiration. [BSC] *On or after January 1, 2019, every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 12 months after its issuance or if the work authorized on the site by such permit is suspended or abandoned for a period of 12 months after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. (See Health and Safety Code Section 18938.5 and 18938.6.*

[A] 105.3.2 Extensions. A permittee holding an unexpired permit shall have the right to apply for an extension of the time within which the permittee will commence work under that permit where work is unable to be commenced

within the time required by this section for good and satisfactory reasons. The fire code official is authorized to grant, in writing, one or more extensions of the time period of a permit for periods of not more than 180 days each. Such extensions shall be requested by the permit holder in writing and justifiable cause demonstrated.

[A] 105.3.3 Occupancy prohibited before approval. The building or structure shall not be occupied prior to the fire code official issuing a permit and conducting associated inspections indicating the applicable provisions of this code have been met.

[A] 105.3.4 Conditional permits. Where permits are required and on the request of a permit applicant, the fire code official is authorized to issue a conditional permit to occupy the premises or portion thereof before the entire work or operations on the premises is completed, provided that such portion or portions will be occupied safely prior to full completion or installation of equipment and operations without endangering life or public welfare. The fire code official shall notify the permit applicant in writing of any limitations or restrictions necessary to keep the permit area safe. The holder of a conditional permit shall proceed only to the point for which approval has been given, at the permit holder's own risk and without assurance that approval for the occupancy or the utilization of the entire premises, equipment or operations will be granted.

[A] 105.3.5 Posting the permit. Issued permits shall be kept on the premises designated therein at all times and shall be readily available for inspection by the fire code official.

[A] 105.3.6 Compliance with code. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the fire code official from requiring the correction of errors in the construction documents and other data. Any addition to or alteration of approved construction documents shall be approved in advance by the fire code official, as evidenced by the issuance of a new or amended permit.

[A] 105.3.7 Information on the permit. The fire code official shall issue all permits required by this code on an approved form furnished for that purpose. The permit shall contain a general description of the operation or occupancy and its location and any other information required by the fire code official. Issued permits shall bear the signature of the fire code official or other approved legal authorization.

[A] 105.3.8 Validity of permit. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinances of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction

shall not be valid. The issuance of a permit based on construction documents, operational documents and other data shall not prevent the fire code official from requiring correction of errors in the documents or other data.

[A] 105.4 Revocation. The fire code official is authorized to revoke a permit issued under the provisions of this code where it is found by inspection or otherwise that there has been a false statement or misrepresentation as to the material facts in the application or construction documents on which the permit or approval was based including, but not limited to, any one of the following:

1. The permit is used for a location or establishment other than that for which it was issued.
2. The permit is used for a condition or activity other than that listed in the permit.
3. Conditions and limitations set forth in the permit have been violated.
4. There have been any false statements or misrepresentations as to the material fact in the application for permit or plans submitted or a condition of the permit.
5. The permit is used by a different person or firm than the name for which it was issued.
6. The permittee failed, refused or neglected to comply with orders or notices duly served in accordance with the provisions of this code within the time provided therein.
7. The permit was issued in error or in violation of an ordinance, regulation or this code.

105.5 Required operational permits. The fire code official is authorized to issue operational permits for the operations set forth in Sections 105.5.2 through 105.5.52.

105.5.1 Additive manufacturing. An operational permit is required to conduct additive manufacturing operations regulated by Section 320.3.

105.5.2 Aerosol products, aerosol cooking spray products and plastic aerosol 3 products. An operational permit is required to manufacture, store or handle an aggregate quantity of Level 2 or Level 3 aerosol products, aerosol cooking spray products or plastic aerosol 3 products in excess of 500 pounds (227 kg) net weight.

105.5.3 Amusement buildings. An operational permit is required to operate a special amusement building.

105.5.4 Aviation facilities. An operational permit is required to use a Group H or Group S occupancy for aircraft servicing or repair and aircraft fuel-servicing vehicles. Additional permits required by other sections of this code include, but are not limited to, hot work, hazardous materials and flammable or combustible finishes.

105.5.5 Carnivals and fairs. An operational permit is required to conduct a carnival or fair.

105.5.6 Cellulose nitrate film. An operational permit is required to store, handle or use cellulose nitrate film in a Group A occupancy.

105.5.7 Combustible dust-producing operations. An operational permit is required to operate a grain elevator, flour starch mill, feed mill, or a plant pulverizing aluminum, coal, cocoa, magnesium, spices or sugar, or other operations producing combustible dusts as defined in Chapter 2.

105.5.8 Combustible fibers. An operational permit is required for the storage and handling of combustible fibers in quantities greater than 100 cubic feet (2.8 m³).

Exception: A permit is not required for agricultural storage.

105.5.9 Compressed gases. An operational permit is required for the storage, use or handling at normal temperature and pressure (NTP) of compressed gases in excess of the amounts listed in Table 105.5.9.

Exception: Vehicles equipped for and using compressed gas as a fuel for propelling the vehicle.

**TABLE 105.5.9
PERMIT AMOUNTS FOR COMPRESSED GASES**

TYPE OF GAS	AMOUNT (cubic feet at NTP)
Carbon dioxide used in carbon dioxide enrichment systems	875 (100 lb)
Carbon dioxide used in insulated liquid carbon dioxide beverage dispensing applications	875 (100 lb)
Corrosive	200
Flammable (except cryogenic fluids and liquefied petroleum gases)	200
Highly toxic	Any Amount
Inert and simple asphyxiant	6,000
Oxidizing (including oxygen)	504
Pyrophoric	Any Amount
Toxic	Any Amount

For SI: 1 cubic foot = 0.02832 m³.

105.5.10 Covered and open mall buildings. An operational permit is required for:

1. The placement of retail fixtures and displays, concession equipment, displays of highly combustible goods and similar items in the mall.
2. The display of liquid- or gas-fired equipment in the mall.
3. The use of open-flame or flame-producing equipment in the mall.

105.5.11 Cryogenic fluids. An operational permit is required to produce, store, transport on site, use, handle or dispense cryogenic fluids in excess of the amounts listed in Table 105.5.11.

Exception: Permits are not required for vehicles equipped for and using cryogenic fluids as a fuel for propelling the vehicle or for refrigerating the lading.

**TABLE 105.5.11
PERMIT AMOUNTS FOR CRYOGENIC FLUIDS**

TYPE OF CRYOGENIC FLUID	INSIDE BUILDING (gallons)	OUTSIDE BUILDING (gallons)
Flammable	More than 1	60
Inert	60	500
Oxidizing (includes oxygen)	10	50
Physical or health hazard not indicated above	Any Amount	Any Amount

For SI: 1 gallon = 3.785 L.

105.5.12 Cutting and welding. An operational permit is required to conduct cutting or welding operations within the jurisdiction.

105.5.13 Dry cleaning. An operational permit is required to engage in the business of dry cleaning or to change to a more hazardous cleaning solvent used in existing dry cleaning equipment.

105.5.14 Energy storage systems. An operational permit is required for stationary and mobile energy storage systems regulated by Section 1207.

105.5.15 Exhibits and trade shows. An operational permit is required to operate exhibits and trade shows.

105.5.16 Explosives. An operational permit is required for the manufacture, storage, handling, sale or use of any quantity of explosives, explosive materials, fireworks or pyrotechnic special effects within the scope of Chapter 56. See *Health and Safety Code Division 11, Part 1, Sections 12000, et seq.* for additional requirements.

Exception: Storage in Group R-3 occupancies of smokeless propellant, black powder and small arms primers for personal use, not for resale and in accordance with Section 5606.

105.5.17 Fire hydrants and valves. An operational permit is required to use or operate fire hydrants or valves intended for fire suppression purposes that are installed on water systems and provided with ready access from a fire apparatus access road that is open to or generally used by the public.

Exception: A permit is not required for authorized employees of the water company that supplies the system or the fire department to use or operate fire hydrants or valves.

105.5.18 Flammable and combustible liquids. An operational permit is required:

1. To use or operate a pipeline for the transportation within facilities of flammable or combustible liquids. This requirement shall not apply to the off-site transportation in pipelines regulated by the Department of Transportation (DOTn) nor does it apply to piping systems.
2. To store, handle or use Class I liquids in excess of 5 gallons (19 L) in a building or in excess of 10 gallons (37.9 L) outside of a building, except that a permit is not required for the following:

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- 2.1. The storage or use of Class I liquids in the fuel tank of a motor vehicle, aircraft, motorboat, mobile power plant or mobile heating plant, unless such storage, in the opinion of the fire code official, would cause an unsafe condition.
- 2.2. The storage or use of paints, oils, varnishes or similar flammable mixtures where such liquids are stored for maintenance, painting or similar purposes for a period of not more than 30 days.
3. To store, handle or use Class II or Class IIIA liquids in excess of 25 gallons (95 L) in a building or in excess of 60 gallons (227 L) outside a building, except for fuel oil used in connection with oil-burning equipment.
4. To store, handle or use Class IIIB liquids in tanks or portable tanks for fueling motor vehicles at motor fuel-dispensing facilities or where connected to fuel-burning equipment.

Exception: Fuel oil and used motor oil used for space heating or water heating.

5. To remove Class I or II liquids from an underground storage tank used for fueling motor vehicles by any means other than the approved, stationary on-site pumps normally used for dispensing purposes.
6. To operate tank vehicles, equipment, tanks, plants, terminals, wells, fuel-dispensing stations, refineries, distilleries and similar facilities where flammable and combustible liquids are produced, processed, transported, stored, dispensed or used.
7. To place temporarily out of service (for more than 90 days) an underground, protected above-ground or above-ground flammable or combustible liquid tank.
8. To change the type of contents stored in a flammable or combustible liquid tank to a material that poses a greater hazard than that for which the tank was designed and constructed.
9. To manufacture, process, blend or refine flammable or combustible liquids.
10. To engage in the dispensing of liquid fuels into the fuel tanks of motor vehicles at commercial, industrial, governmental or manufacturing establishments in accordance with Section 5706.5.4 or to engage in on-demand mobile fueling operations in accordance with Section 5707.
11. To utilize a site for the dispensing of liquid fuels from tank vehicles into the fuel tanks of motor vehicles, marine craft and other special equipment at commercial, industrial, governmental or manufacturing establishments in accordance with Section 5706.5.4 or, where required by the fire code official, to utilize a site for on-demand mobile fueling operations in accordance with Section 5707.

105.5.19 Floor finishing. An operational permit is required for floor finishing or surfacing operations exceeding 350 square feet (33 m²) using Class I or Class II liquids.

105.5.20 Fruit and crop ripening. An operational permit is required to operate a fruit- or crop-ripening facility or conduct a fruit-ripening process using ethylene gas.

105.5.21 Fumigation and insecticidal fogging. An operational permit is required to operate a business of fumigation or insecticidal fogging, and to maintain a room, vault or chamber in which a toxic or flammable fumigant is used.

105.5.22 Hazardous materials. An operational permit is required to store, transport on site, dispense, use or handle hazardous materials in excess of the amounts listed in Table 105.5.22.

105.5.23 HPM facilities. An operational permit is required to store, handle or use hazardous production materials.

105.5.24 High-piled storage. An operational permit is required to use a building or portion thereof with more than 500 square feet (46 m²), including aisles, of high-piled combustible storage.

105.5.25 Hot work operations. An operational permit is required for hot work including, but not limited to:

1. Public exhibitions and demonstrations where hot work is conducted.
2. Use of portable hot work equipment inside a structure.

Exception: Work that is conducted under a construction permit.

3. Fixed-site hot work equipment, such as welding booths.
4. Hot work conducted within a wildfire risk area.
5. Application of roof coverings with the use of an open-flame device.
6. Where approved, the fire code official shall issue a permit to carry out a hot work program. This program allows approved personnel to regulate their facility's hot work operations. The approved personnel shall be trained in the fire safety aspects denoted in this chapter and shall be responsible for issuing permits requiring compliance with the requirements found in Chapter 35. These permits shall be issued only to their employees or hot work operations under their supervision.

105.5.26 Industrial ovens. An operational permit is required for operation of industrial ovens regulated by Chapter 30.

105.5.27 Lumber yards and woodworking plants. An operational permit is required for the storage or processing of lumber exceeding 100,000 board feet (8,333 ft³) (236 m³).

**TABLE 105.5.22
PERMIT AMOUNTS FOR HAZARDOUS MATERIALS**

TYPE OF MATERIAL	AMOUNT
Combustible liquids	See Section 105.5.16
Corrosive materials	
Gases	See Section 105.5.8
Liquids	55 gallons
Solids	500 pounds
Explosive materials	See Section 105.5.14
Flammable materials	
Gases	See Section 105.5.8
Liquids	See Section 105.5.16
Solids	100 pounds
Highly toxic materials	
Gases	See Section 105.5.8
Liquids	Any Amount
Solids	Any Amount
Organic peroxides	
Liquids	
Class I	Any Amount
Class II	Any Amount
Class III	1 gallon
Class IV	2 gallons
Class V	No Permit Required
Solids	
Class I	Any Amount
Class II	Any Amount
Class III	10 pounds
Class IV	20 pounds
Class V	No Permit Required
Oxidizing materials	
Gases	See Section 105.5.8
Liquids	
Class 4	Any Amount
Class 3	1 gallon ^a
Class 2	10 gallons
Class 1	55 gallons
Solids	
Class 4	Any Amount
Class 3	10 pounds ^b
Class 2	100 pounds
Class 1	500 pounds
Pyrophoric materials	
Gases	Any Amount
Liquids	Any Amount
Solids	Any Amount
Toxic materials	
Gases	See Section 105.5.8
Liquids	10 gallons
Solids	100 pounds

(continued)

**TABLE 105.5.22—continued
PERMIT AMOUNTS FOR HAZARDOUS MATERIALS**

TYPE OF MATERIAL	AMOUNT
Unstable (reactive) materials	
Liquids	
Class 4	Any Amount
Class 3	Any Amount
Class 2	5 gallons
Class 1	10 gallons
Solids	
Class 4	Any Amount
Class 3	Any Amount
Class 2	50 pounds
Class 1	100 pounds
Water-reactive materials	
Liquids	
Class 3	Any Amount
Class 2	5 gallons
Class 1	55 gallons
Solids	
Class 3	Any Amount
Class 2	50 pounds
Class 1	500 pounds

For SI: 1 gallon = 3.785 L, 1 pound = 0.454 kg.

- a. 22 gallons where Table 5003.1.1(1) Note k applies and hazard identification signs in accordance with Section 5003.5 are provided for quantities of 22 gallons or less.
- b. 220 pounds where Table 5003.1.1(1) Note k applies and hazard identification signs in accordance with Section 5003.5 are provided for quantities of 220 pounds or less.

105.5.28 Liquid- or gas-fueled vehicles or equipment in assembly buildings. An operational permit is required to display, operate or demonstrate liquid- or gas-fueled vehicles or equipment in assembly buildings.

105.5.29 LP-gas. An operational permit is required for:

1. Storage and use of LP-gas.

Exception: A permit is not required for individual containers with a 500-gallon (1893 L) water capacity or less or multiple container systems having an aggregate quantity not exceeding 500 gallons (1893 L), serving occupancies in Group R-3.

2. Operation of cargo tankers that transport LP-gas.

105.5.30 Magnesium. An operational permit is required to melt, cast, heat treat or grind more than 10 pounds (4.54 kg) of magnesium.

105.5.31 Miscellaneous combustible storage. An operational permit is required to store in any building or on any premises in excess of 2,500 cubic feet (71 m³) gross volume of combustible empty packing cases, boxes, barrels or similar containers, combustible pallets, rubber tires, rubber, cork or similar combustible material.

105.5.32 Mobile fueling of hydrogen-fueled vehicles.

An operational permit is required:

1. To engage in the mobile dispensing of gaseous hydrogen as a fuel into the fuel tanks of motor vehicles.

2. Where required by the fire code official, to utilize a site for the dispensing of gaseous hydrogen as a fuel from tank vehicles into the fuel tanks of motor vehicles.

Exception: In cases of an emergency, a site permit is not required.

105.5.33 Motor fuel-dispensing facilities. An operational permit is required for the operation of automotive, marine and fleet motor fuel-dispensing facilities.

105.5.34 Open burning. An operational permit is required for the kindling or maintaining of an open fire or a fire on any public street, alley, road, or other public or private ground. Instructions and stipulations of the permit shall be complied with.

Exception: Recreational fires.

105.5.35 Open flames and torches. An operational permit is required to remove paint with a torch, or to use a torch or open-flame device in a wildfire risk area.

105.5.36 Open flames and candles. An operational permit is required to use open flames or candles in connection with assembly areas, dining areas of restaurants or drinking establishments.

105.5.37 Organic coatings. An operational permit is required for any organic-coating manufacturing operation producing more than 1 gallon (4 L) of an organic coating in one day.

105.5.38 Outdoor assembly event. An operational permit is required to conduct an outdoor assembly event where planned attendance exceeds 1,000 persons.

105.5.39 Places of assembly. An operational permit is required to operate a place of assembly.

105.5.40 Plant extraction systems. An operational permit is required to use plant extraction systems.

105.5.41 Private fire hydrants. An operational permit is required for the removal from service, use or operation of private fire hydrants.

Exception: A permit is not required for private industry with trained maintenance personnel, private fire brigade or fire departments to maintain, test and use private hydrants.

105.5.42 Pyrotechnic special effects material. An operational permit is required for use and handling of pyrotechnic special effects material. *See Health and Safety Code Division 11, Part 2, Sections 12500, et seq. for additional requirements.*

105.5.43 Pyroxylin plastics. An operational permit is required for storage or handling of more than 25 pounds (11 kg) of cellulose nitrate (pyroxylin) plastics, and for the assembly or manufacture of articles involving pyroxylin plastics.

105.5.44 Refrigeration equipment. An operational permit is required to operate a mechanical refrigeration unit or system regulated by Chapter 6.

105.5.45 Repair garages and motor fuel-dispensing facilities. An operational permit is required for operation of repair garages.

105.5.46 Rooftop heliports. An operational permit is required for the operation of a rooftop heliport.

105.5.47 Spraying or dipping. An operational permit is required to conduct a spraying or dipping operation utilizing flammable or combustible liquids, or the application of combustible powders regulated by Chapter 24.

105.5.48 Storage of scrap tires and tire byproducts. An operational permit is required to establish, conduct or maintain storage of scrap tires and tire byproducts that exceeds 2,500 cubic feet (71 m³) of total volume of scrap tires, and for indoor storage of tires and tire byproducts.

105.5.49 Temporary membrane structures and tents. An operational permit is required to operate an air-supported temporary membrane structure, a temporary special event structure or a tent having an area in excess of 400 square feet (37 m²).

Exceptions:

1. Tents used exclusively for recreational camping purposes.
2. Tents open on all sides, which comply with all of the following:
 - 2.1. Individual tents having a maximum size of 700 square feet (65 m²).
 - 2.2. The aggregate area of multiple tents placed side by side without a fire break clearance of not less than 12 feet (3658 mm) shall not exceed 700 square feet (65 m²) total.
 - 2.3. A minimum clearance of 12 feet (3658 mm) to structures and other tents shall be provided.

105.5.50 Tire-rebuilding plants. An operational permit is required for the operation and maintenance of a tire-rebuilding plant.

105.5.51 Waste handling. An operational permit is required for the operation of wrecking yards, junk yards and waste material-handling facilities.

105.5.52 Wood products. An operational permit is required to store chips, hogged material, lumber or plywood in excess of 200 cubic feet (6 m³).

105.5.53 Lithium batteries. An operational permit is required for an accumulation of more than 15 cubic feet (0.42 m³) of lithium-ion and lithium metal batteries, where required by Section 322.1.

105.5.54 Additional permits. In addition to the permits required by Section 105.6, the following permits shall be obtained from the Bureau of Fire Prevention prior to engaging in the following activities, operations, practices or functions:

1. Production facilities. To change use or occupancy, or allow the attendance of a live audience, or for wrap parties.
2. Pyrotechnics and special effects. To use pyrotechnic special effects, open flame, use of flammable or

combustible liquids and gases, welding and the parking of motor vehicles in any building or location used for the purpose of motion picture, television and commercial production.

3. *Live audiences. To install seating arrangements for live audiences in approved production facilities, production studios and sound stages. See Chapter 48.*

[A] 105.6 Required construction permits. The fire code official is authorized to issue construction permits for work as set forth in Sections 105.6.1 through 105.6.24.

[A] 105.6.1 Automatic fire-extinguishing systems. A construction permit is required for installation of or modification to an automatic fire-extinguishing system. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.2 Compressed gases. Where the compressed gases in use or storage exceed the amounts listed in Table 105.5.9, a construction permit is required to install, repair damage to, abandon, remove, place temporarily out of service, or close or substantially modify a compressed gas system.

Exceptions:

1. Routine maintenance.
2. For emergency repair work performed on an emergency basis, application for permit shall be made within two working days of commencement of work.

[A] 105.6.3 Cryogenic fluids. A construction permit is required for installation of or alteration to outdoor stationary cryogenic fluid storage systems where the system capacity exceeds the amounts listed in Table 105.5.11. Maintenance performed in accordance with this code is not considered to be an alteration and does not require a construction permit.

[A] 105.6.4 Emergency responder communication coverage system. A construction permit is required for installation of or modification to in-building, two-way emergency responder communication coverage systems and related equipment. Maintenance performed in accordance with this code is not considered to be a modification and does not require a construction permit.

105.6.5 Energy storage systems. A construction permit is required to install energy storage systems regulated by Section 1207.

[A] 105.6.6 Fire alarm and detection systems and related equipment. A construction permit is required for installation of or modification to fire alarm and detection systems and related equipment. Maintenance performed in accordance with this code is not considered to be a modification and does not require a construction permit.

[A] 105.6.7 Fire pumps and related equipment. A construction permit is required for installation of or modification to fire pumps and related fuel tanks, jockey pumps, controllers and generators. Maintenance performed in

accordance with this code is not considered to be a modification and does not require a construction permit.

[A] 105.6.8 Flammable and combustible liquids. A construction permit is required:

1. To install, repair or modify a pipeline for the transportation of flammable or combustible liquids.
2. To install, construct or alter tank vehicles, equipment, tanks, plants, terminals, wells, fuel-dispensing stations, refineries, distilleries and similar facilities where flammable and combustible liquids are produced, processed, transported, stored, dispensed or used.
3. To install, alter, remove, abandon or otherwise dispose of a flammable or combustible liquid tank.

[A] 105.6.9 Fuel cell power systems. A construction permit is required to install stationary fuel cell power systems.

[A] 105.6.10 Gas detection systems. A construction permit is required for the installation of or modification to gas detection systems. Maintenance performed in accordance with this code is not considered a modification and shall not require a permit.

[A] 105.6.11 Gates and barricades across fire apparatus access roads. A construction permit is required for the installation of or modification to a gate or barricade across a fire apparatus access road.

[A] 105.6.12 Hazardous materials. A construction permit is required to install, repair damage to, abandon, remove, place temporarily out of service, or close or substantially modify a storage facility or other area regulated by Chapter 50 where the hazardous materials in use or storage exceed the amounts listed in Table 105.5.22.

Exceptions:

1. Routine maintenance.
2. For repair work performed on an emergency basis, application for permit shall be made within two working days of commencement of work.

[A] 105.6.13 High-piled combustible storage. A construction permit is required for the installation of or modification to a structure with more than 500 square feet (46 m²), including aisles, of high-piled combustible storage. Maintenance performed in accordance with this code is not considered to be a modification and does not require a construction permit.

[A] 105.6.14 Industrial ovens. A construction permit is required for installation of industrial ovens regulated by Chapter 30.

Exceptions:

1. Routine maintenance.
2. For repair work performed on an emergency basis, application for permit shall be made within two working days of commencement of work.

[A] 105.6.15 LP-gas. A construction permit is required for installation of or modification to an LP-gas system. Maintenance performed in accordance with this code is not

considered to be a modification and does not require a permit.

[A] 105.6.16 Motor vehicle repair rooms and booths. A construction permit is required to install or modify a motor vehicle repair room or booth. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.17 Plant extraction systems. A construction permit is required for installation of or modification to plant extraction systems. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.18 Private fire hydrants. A construction permit is required for the installation or modification of private fire hydrants. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.19 Smoke control or smoke exhaust systems. Construction permits are required for installation of or alteration to smoke control or smoke exhaust systems. Maintenance performed in accordance with this code is not considered to be an alteration and does not require a permit.

[A] 105.6.20 Solar photovoltaic power systems. A construction permit is required to install or modify solar photovoltaic power systems. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.21 Special event structure. A single construction permit is required to erect and take down a temporary special event structure.

[A] 105.6.22 Spraying or dipping. A construction permit is required to install or modify a spray room, dip tank or booth. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.23 Standpipe systems. A construction permit is required for the installation, modification or removal from service of a standpipe system. Maintenance performed in accordance with this code is not considered to be a modification and does not require a permit.

[A] 105.6.24 Temporary membrane structures and tents. A construction permit is required to erect an air-supported temporary membrane structure, a temporary stage canopy or a tent having an area in excess of 400 square feet (37 m²).

Exceptions:

1. Tents used exclusively for recreational camping purposes.
2. Funeral tents and curtains, or extensions attached thereto, when used for funeral services.
3. Tents and awnings open on all sides, which comply with all of the following:
 - 3.1. Individual tents shall have a maximum size of 700 square feet (65 m²).

3.2. The aggregate area of multiple tents placed side by side without a fire break clearance of not less than 12 feet (3658 mm) shall not exceed 700 square feet (65 m²) total.

3.3. A minimum clearance of 12 feet (3658 mm) to structures and other tents shall be maintained.

**SECTION 106
CONSTRUCTION DOCUMENTS**

[A] 106.1 Submittals. Construction documents and supporting data shall be submitted in two or more sets with each application for a permit and in such form and detail as required by the fire code official. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.

Exception: The fire code official is authorized to waive the submission of construction documents and supporting data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that review of construction documents is not necessary to obtain compliance with this code.

[A] 106.2 Examination of documents. The fire code official shall examine or cause to be examined the accompanying construction documents and shall ascertain by such examinations whether the work indicated and described is in accordance with the requirements of this code.

[A] 106.2.1 Information on construction documents. Construction documents shall be drawn to scale on suitable material. Documents in a digital format are allowed to be submitted where approved by the fire code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations as determined by the fire code official.

[A] 106.2.2 Fire protection system shop drawings. Shop drawings for the fire protection system(s) shall be submitted to indicate compliance with this code and the construction documents, and shall be approved prior to the start of installation. Shop drawings shall contain all information as required by the referenced installation standards in Chapter 9.

[A] 106.2.3 Applicant responsibility. It shall be the responsibility of the applicant to ensure that the construction documents include all of the fire protection requirements and the shop drawings are complete and in compliance with the applicable codes and standards.

[A] 106.2.4 Approved documents. Construction documents approved by the fire code official are approved with the intent that such construction documents comply in all respects with this code. Review and approval by the fire code official shall not relieve the applicant of the responsibility of compliance with this code.

[A] **106.2.4.1 Phased approval.** The fire code official is authorized to issue a permit for the construction of part of a structure, system or operation before the construction documents for the whole structure, system or operation have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such permit for parts of a structure, system or operation shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure, system or operation will be granted.

[A] **106.3 Amended construction documents.** Work shall be installed in accordance with the approved construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

[A] **106.4 Retention of construction documents.** One set of construction documents shall be retained by the fire code official for a period of not less than 180 days from date of completion of the permitted work, or as required by state or local laws. One set of approved construction documents shall be returned to the applicant, and said set shall be kept on the site of the building or work at all times during which the work authorized thereby is in progress.

SECTION 107 FEES

[A] **107.1 Fees.** A permit shall not be issued until the fees have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

[A] **107.2 Schedule of permit fees.** Where a permit is required, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] **107.3 Permit valuations.** The applicant for a permit shall provide an estimated permit value at the time of application. Permit valuations shall include the total value of work, including materials and labor, for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the fire code official, the valuation is underestimated on the application, the permit shall be denied unless the applicant can show detailed estimates to meet the approval of the fire code official. Final permit valuation shall be set by the fire code official.

[A] **107.4 Work commencing before permit issuance.** A person who commences any work, activity or operation regulated by this code before obtaining the necessary permits shall be subject to a fee established by the applicable governing authority, which shall be in addition to the required permit fees.

[A] **107.5 Related fees.** The payment of the fee for the construction, alteration, removal or demolition of work done in connection to or concurrently with the work or activity authorized by a permit shall not relieve the applicant or

holder of the permit from the payment of other fees that are prescribed by law.

[A] **107.6 Refunds.** The applicable governing authority is authorized to establish a refund policy.

SECTION 108 INSPECTIONS

[A] **108.1 Inspection authority.** The fire code official is authorized to enter and examine any building, structure, marine vessel, vehicle or premises in accordance with Section 104.3 for the purpose of enforcing this code.

[A] **108.2 Inspections.** The fire code official is authorized to conduct such inspections as are deemed necessary to determine the extent of compliance with the provisions of this code and to approve reports of inspection by approved agencies or individuals. Reports of such inspections shall be prepared and submitted in writing for review and approval. Inspection reports shall be certified by a responsible officer of such approved agency or by the responsible individual. The fire code official is authorized to engage such expert opinion as deemed necessary to report on unusual, detailed or complex technical issues subject to the approval of the governing body.

[A] **108.2.1 Inspection requests.** It shall be the duty of the holder of the permit or their duly authorized agent to notify the fire code official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for inspections of such work that are required by this code.

[A] **108.2.2 Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the fire code official. The fire code official, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with this code. Any portions that do not comply shall be corrected, and such portion shall not be covered or concealed until authorized by the fire code official.

[A] **108.3 Concealed work.** It shall be the duty of the permit applicant to cause the work to remain visible and able to be accessed for inspection purposes. Where any installation subject to inspection prior to use is covered or concealed without having first been inspected, the fire code official shall have the authority to require that such work be made visible and able to be accessed for inspection. Neither the fire code official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

[A] **108.4 Approvals.** Approval as the result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel provisions of this code or of other ordinances of the jurisdiction shall not be valid.

**SECTION 109
MAINTENANCE**

[A] **109.1 Maintenance of safeguards.** Where any device, equipment, system, condition, arrangement, level of protection, or any other feature is required for compliance with the provisions of this code, or otherwise installed, such device, equipment, system, condition, arrangement, level of protection, or other feature shall thereafter be continuously maintained in accordance with this code and applicable referenced standards.

[A] **109.2 Testing and operation.** Equipment requiring periodic testing or operation to ensure maintenance shall be tested or operated as specified in this code.

[A] **109.2.1 Reinspection and testing.** Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the fire code official for inspection and testing.

[A] **109.3 Recordkeeping.** A record of periodic inspections, tests, servicing and other operations and maintenance shall be maintained on the premises or other approved location for not less than 3 years, or a different period of time where specified in this code or referenced standards. Records shall be made available for inspection by the fire code official, and a copy of the records shall be provided to the fire code official on request.

The fire code official is authorized to prescribe the form and format of such recordkeeping. The fire code official is authorized to require that certain required records be filed with the fire code official.

[A] **109.4 Supervision.** Maintenance and testing shall be under the supervision of a responsible person who shall ensure that such maintenance and testing are conducted at specified intervals in accordance with this code.

109.5 Rendering equipment inoperable. Portable or fixed fire-extinguishing systems or devices, and fire-warning systems, shall be provided with ready access and shall not be rendered inoperative, except as necessary during emergencies, maintenance, repairs, alterations, drills or prescribed testing.

[A] **109.6 Overcrowding.** Overcrowding or admittance of any person beyond the approved capacity of a building or a portion thereof shall not be allowed. The fire code official, on finding any overcrowding conditions or obstructions in aisles, passageways or other means of egress, or on finding any condition that constitutes a life safety hazard, shall be authorized to cause the event to be stopped until such condition or obstruction is corrected.

**SECTION 110
SERVICE UTILITIES**

[A] **110.1 Authority to disconnect service utilities.** The fire code official shall have the authority to authorize disconnection of utility service to the building, structure or system in order to safely execute emergency operations or to eliminate

an immediate hazard. The fire code official shall notify the serving utility and, where possible, the owner or the owner’s authorized agent and the occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnection, then the owner, the owner’s authorized agent or occupant of the building, structure or service system shall be notified in writing as soon as practical thereafter.

**SECTION 111
MEANS OF APPEALS**

[A] **111.1 Board of appeals established.** In order to hear and decide appeals of orders, decisions or determinations made by the fire code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the fire code official.

[A] **111.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] **111.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to hazards of fire, explosions, hazardous conditions or fire protection systems, and are not employees of the jurisdiction.

[A] **111.4 Administration.** The fire code official shall take immediate action in accordance with the decision of the board.

**SECTION 112
VIOLATIONS**

[A] **112.1 Unlawful acts.** It shall be unlawful for a person, firm or corporation to erect, construct, alter, repair, remove, demolish or utilize a building, occupancy, premises or system regulated by this code, or cause same to be done, in conflict with or in violation of any of the provisions of this code.

[A] **112.2 Owner/occupant responsibility.** Correction and abatement of violations of this code shall be the responsibility of the owner or the owner’s authorized agent. Where an occupant creates, or allows to be created, hazardous conditions in violation of this code, the occupant shall be held responsible for the abatement of such hazardous conditions.

[A] **112.3 Notice of violation.** Where the fire code official finds a building, premises, vehicle, storage facility or outdoor area that is in violation of this code, the fire code official is authorized to prepare a written notice of violation describing

the conditions deemed unsafe and, where compliance is not immediate, specifying a time for reinspection.

[A] **112.3.1 Service.** A notice of violation issued pursuant to this code shall be served on the owner, the owner's authorized agent, operator, occupant or other person responsible for the condition or violation, either by personal service, mail or by delivering the same to, and leaving it with, some person of responsibility on the premises. For unattended or abandoned locations, a copy of such notice of violation shall be posted on the premises in a conspicuous place at or near the entrance to such premises and the notice of violation shall be mailed by certified mail with return receipt requested or a certificate of mailing, to the last known address of the owner, the owner's authorized agent, or occupant.

[A] **112.3.2 Compliance with orders and notices.** A notice of violation issued or served as provided by this code shall be complied with by the owner, the owner's authorized agent, operator, occupant or other person responsible for the condition or violation to which the notice of violation pertains.

[A] **112.3.3 Prosecution of violations.** If the notice of violation is not complied with promptly, the fire code official is authorized to request the legal counsel of the jurisdiction to institute the appropriate legal proceedings at law or in equity to restrain, correct or abate such violation or to require removal or termination of the unlawful occupancy of the structure in violation of the provisions of this code or of the order or direction made pursuant hereto.

[A] **112.3.4 Unauthorized tampering.** Signs, tags or seals posted or affixed by the fire code official shall not be mutilated, destroyed or tampered with, or removed, without authorization from the fire code official.

[A] **112.4 Violation penalties.** Persons who shall violate a provision of this code or shall fail to comply with any of the requirements thereof or who shall erect, install, alter, repair or do work in violation of the approved construction documents or directive of the fire code official, or of a permit or certificate used under provisions of this code, shall be guilty of a [SPECIFY OFFENSE], punishable by a fine of not more than [AMOUNT] dollars or by imprisonment not exceeding [NUMBER OF DAYS], or both such fine and imprisonment. Each day that a violation continues after due notice has been served shall be deemed a separate offense.

[A] **112.4.1 Abatement of violation.** In addition to the imposition of the penalties herein described, the fire code official is authorized to institute appropriate action to prevent unlawful construction or to restrain, correct or abate a violation; or to prevent illegal occupancy of a structure or premises; or to stop an illegal act, conduct of business or occupancy of a structure on or about any premises.

**SECTION 113
STOP WORK ORDER**

[A] **113.1 Authority.** Where the fire code official finds any work regulated by this code being performed in a manner

contrary to the provisions of this code, or in a dangerous or unsafe manner, the fire code official is authorized to issue a stop work order.

[A] **113.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume.

[A] **113.3 Emergencies.** Where an emergency exists, the fire code official shall not be required to give a written notice prior to stopping the work.

[A] **113.4 Failure to comply.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the authority having jurisdiction.

**SECTION 114
UNSAFE STRUCTURES OR EQUIPMENT**

[A] **114.1 General.** If during the inspection of a premises, a structure, or any building system, in whole or in part, constitutes a clear and inimical threat to human life, safety or health, the fire code official shall issue such notice or orders to remove or remedy the conditions as shall be deemed necessary in accordance with this section, and shall refer the building to the building official for any repairs, alterations, remodeling, removing or demolition required.

[A] **114.1.1 Unsafe conditions.** Structures or existing equipment that are or hereafter become unsafe, insanitary or deficient because of inadequate means of egress, inadequate light and ventilation, or that constitute a fire hazard, are otherwise dangerous to human life or the public welfare, or involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe, as the fire code official deems necessary and as provided for in this section. A vacant structure that is not secured against unauthorized entry shall be deemed unsafe.

[A] **114.1.2 Structural hazards.** Where an apparent structural hazard is caused by the faulty installation, operation or malfunction of any of the items or devices governed by this code, the fire code official shall immediately notify the building code official in accordance with Section 114.1.

[A] **114.2 Evacuation.** The fire code official or the fire department official in charge of an incident shall be authorized to order the immediate evacuation of any occupied structure deemed unsafe where such structure has hazardous conditions that pose an imminent danger to structure occupants. Persons so notified shall immediately leave the structure or premises and shall not enter or re-enter until authorized to do so by the fire code official or the fire department official in charge of the incident.

[A] **114.3 Record.** The fire code official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.

[A] **114.4 Notice.** If an unsafe condition is found, the fire code official shall serve on the owner of the structure or the owner's authorized agent a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or requires the unsafe structure to be demolished within a stipulated time. Such notice shall require the person thus notified to declare immediately to the fire code official acceptance or rejection of the terms of the order.

[A] **114.5 Method of service.** Such notice shall be deemed properly served where a copy thereof is served in accordance with one of the following methods:

1. A copy is delivered to the owner personally.
2. A copy is sent by certified or registered mail addressed to the owner at the last known address with return receipt requested.
3. A copy is delivered in any other manner as prescribed by local law.

If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner on the owner's authorized agent shall constitute service of notice on the owner.

[A] **114.6 Restoration or abatement.** The structure or equipment determined to be unsafe by the fire code official is permitted to be restored to a safe condition. The owner, the owner's authorized agent, operator or occupant of a structure, premises or equipment deemed unsafe by the fire code official shall abate or cause to be abated or corrected such unsafe conditions either by repair, rehabilitation, demolition or other approved corrective action. To the extent that repairs, alterations or additions are made or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions or change of occupancy shall comply with the requirements of Section 105.1.5 and the *California Existing Building Code*.

[A] **114.7 Summary abatement.** Where conditions exist that are deemed hazardous to life and property, the fire code official or fire department official in charge of the incident is authorized to abate summarily such hazardous conditions that are in violation of this code.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below															X							
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
Additive Manufacturing			X																			
Aged Home or Institution			X																			
Assembly			X																			
<i>Atrium</i>			X																			
Battery Types: Lead-Acid Battery			X																			
Battery Types: Lithium Metal Polymer Battery			X																			
Battery Types: Nickel-Cadmium Battery			X																			
Bedridden Person			X																			
Blasting Agent			X																			
Building			X																			
Bullet Resistant			X																			
Carbon Dioxide Enrichment System			X																			
Capacitor Energy Storage System			X																			
Care and Supervision			X																			
Care Suite			X																			
Catastrophically Injured			X																			
Cell			X																			
Cell Complex			X																			
Cell Tiers			X																			
Charter School			X																			
<i>Child Care</i>			X																			
Child-Care Center			X																			
Child or Children			X																			
Chronically Ill			X																			
Clinic Outpatient			X																			
Community Care Facility			X																			
Community Correctional Reentry Centers			X																			
Congregate Living Health Facility (CLHF)			X																			
Congregate Residence			X																			
Courthouse Holding Facility			X																			
Courtroom Dock			X																			
Day-Care			X																			
Day-Care Home, Family			X																			
Day-Care Home, Large Family			X																			

(continued)

CHAPTER 2 – DEFINITIONS—continued

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below															X							
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
Day-Care Home, Small Family			X																			
Day Room			X																			
Detention Elevator			X																			
Detention Treatment Room			X																			
Detoxification Facilities			X																			
Direct Access			X																			
Energy Storage Management Systems			X																			
Energy Storage System (ESS)			X																			
Energy Storage System Cabinet			X																			
Energy Storage System Commissioning			X																			
Energy Storage System Decommissioning			X																			
Energy Storage System, Electrochemical			X																			
Energy Storage System, Mobile			X																			
Energy Storage System, Stationary			X																			
Energy Storage System, Walk-in Unit			X																			
Enforcing Agency			X																			
Fire Appliance			X																			
Fireworks			X																			
Fixed Guideway and Passenger Rail Transit Systems			X																			
Full-Time Care			X																			
Group Home			X																			
High-Rise Building			X																			
Highway			X																			
Holding Facility			X																			
Hospitals and Psychiatric Hospitals			X																			
Housing Unit			X																			
Hydrogen Fueled Vehicles			X																			
Infant			X																			
Inflatable Amusement Device			X																			
Laboratory			X																			
Laboratory Suite			X																			
Listed			X																			
Lodging House			X																			
Mass Timber			X																			

(continued)

CHAPTER 2 – DEFINITIONS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																X						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
Mechanical-Access Enclosed Parking			X																			
Mobile Fueling			X																			
Mortar			X																			
Non-Accessible Area			X																			
Nonambulatory Persons			X																			
Noncombustible			X																			
Nonpatient Care Suite			X																			
Nursing Homes			X																			
Occupancy Classification			X																			
Permanent Portable Building			X																			
Persons With Intellectual Disabilities, Profoundly or Severely			X																			
<i>Photovoltaic (PV) Panel System, Ground Mounted</i>			X																			
<i>Photovoltaic (PV) Support Structure, Elevated</i>			X																			
Protective Social Care Facility			X																			
Puzzle Room			X																			
Railway			X																			
Relocatable Building (Public School)			X																			
Residential Care Facility for the Chronically Ill (RCF/CI)			X																			
Residential Care Facility For The Elderly (RCFE)			X																			
Residential Facility (RF)			X																			
Restraint			X																			
Roadside Hydrogen Service Vehicles			X																			
Secure Interview Rooms			X																			
Small Arms Ammunition [T-19 §1559.19(a)]				X																		
Small Management Yard			X																			
Special Amusement Area			X																			
Spray Room			X																			
State-Owned/Leased Building			X																			
Tank in an Underground Area			X																			
Temporary Holding Cell, Room or Area			X													X						

(continued)

CHAPTER 2 – DEFINITIONS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below															X							
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
Temporary Holding Facility			X																			
Tenable Environment			X																			
Tent [T-19 §3.10(a) – (c)]				X																		
Terminally Ill			X																			
Toddler			X																			
Waiting Room			X																			
Wildland Urban Interface Area			X																			
Winery Caves			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division 1 remain the same.

CHAPTER 2

DEFINITIONS

User note:

About this chapter: Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.

SECTION 201 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the *California Building Code*, *California Mechanical Code* or *California Plumbing Code*, such terms shall have the meanings ascribed to them as in those codes.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies. *Merriam Webster's Collegiate Dictionary, 11th Edition*, shall be considered as providing ordinarily accepted meanings.

SECTION 202 GENERAL DEFINITIONS

[BG] 24-HOUR BASIS. The actual time that a person is an occupant within a facility for the purpose of receiving care. It shall not include a facility that is open for 24 hours and is capable of providing care to someone visiting the facility during any segment of the 24 hours.

3D PRINTER. A machine used in the additive manufacturing process for fabricating objects through the deposition of a material using a print head, nozzle or other printer technology.

[M] ACCESS (TO). That which enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel or similar obstruction [see also "*Ready access (to)*"].

[BE] ACCESSIBLE MEANS OF EGRESS. A continuous and unobstructed way of egress travel from any accessible point in a building or facility to a public way.

[BE] ACCESSIBLE ROUTE. A continuous, unobstructed path that complies with Chapter 11 of the *California Building Code*.

ACTIVE RF EMITTING DEVICE. Any type of circuit component that requires an AC or DC power source with the ability to electrically control electron flow and/or amplification of RF signal, including but not limited to signal boosters, repeaters, bidirectional amplifiers and fiber-distributed antenna systems.

ADDITIVE MANUFACTURING. A process of joining materials to make objects from 3D model data, usually layer upon layer, sometimes referred to as 3D printing. This code recognizes two types of additive manufacturing:

Industrial additive manufacturing. 3D printing operations that typically utilize combustible powders or metals, an inert gas supply, a combustible dust collection system, or that create a hazardous (classified) location area or zone outside the equipment.

Nonindustrial additive manufacturing. 3D printing operations that do *not* create a hazardous (classified) location area outside the equipment and do not utilize an inert gas supply or a combustible dust collection system.

AEROSOL CONTAINER. A metal can or plastic container up to a maximum size of 33.8 fluid ounces (1000 ml) or a glass bottle up to a maximum size of 4 fluid ounces (118 ml) designed and intended to dispense an aerosol.

AEROSOL COOKING SPRAY PRODUCTS. Aerosol cooking spray products are those aerosol products designed to deliver a vegetable oil or a solid or nonflammable liquid to reduce sticking on cooking and baking surfaces, or to be applied to food, or both. These products have a chemical heat of combustion that is greater than 8600 Btu/lb. (20 kJ/g) and contain no more than 18 percent by weight of flammable propellant.

AEROSOL PRODUCT. A combination of a container, a propellant and a material that is dispensed. Aerosol products shall be classified by means of the calculation of their chemical heats of combustion and shall be designated Level 1, Level 2 or Level 3.

Level 1 aerosol products. Those with a total chemical heat of combustion that is less than or equal to 8,600 British thermal units per pound (Btu/lb) (20 kJ/g).

Level 2 aerosol products. Those with a total chemical heat of combustion that is greater than 8,600 Btu/lb (20 kJ/g), but less than or equal to 13,000 Btu/lb (30 kJ/g).

Level 3 aerosol products. Those with a total chemical heat of combustion that is greater than 13,000 Btu/lb (30 kJ/g).

DEFINITIONS

AEROSOL PRODUCT WAREHOUSE. A building used for warehousing aerosol products.

AGED HOME OR INSTITUTION. A facility used for the housing of persons 65 years of age or older in need of care and supervision. (See definition of “care and supervision”.)

AGENCY. Any emergency responder department within the jurisdiction that utilizes radio frequencies for communication. This could include, but not be limited to, various public safety agencies such as fire departments, emergency medical services and law enforcement.

AGENT. A person who shall have charge, care or control of any structure as owner, or agent of the owner, or as executor, executrix, administrator, administratrix, trustee or guardian of the estate of the owner. Any such person representing the actual owner shall be bound to comply with the provisions of this code to the same extent as if that person was the owner.

[BG] AGRICULTURAL BUILDING. A structure designed and constructed to house farm implements, hay, grain, poultry, livestock or other horticultural products. This structure shall not be a place of human habitation or a place of employment where agricultural products are processed, treated or packaged, nor shall it be a place used by the public.

AGRO-INDUSTRIAL. A facility, or portion thereof, housing operations involving the transforming of raw agricultural products into intermediate or consumable products.

AIRCRAFT MOTOR-VEHICLE FUEL-DISPENSING FACILITY. That portion of property where flammable or combustible liquids or gases used as motor fuels are stored and dispensed from fixed automotive-type equipment into the fuel tanks of aircraft.

AIRCRAFT OPERATION AREA (AOA). Any area used or intended for use for the parking, taxiing, takeoff, landing or other ground-based aircraft activity.

[BG] AIR-INFLATED STRUCTURE. A structure that uses air-pressurized membrane beams, arches or other elements to enclose space. Occupants of such a structure do not occupy the pressurized areas used to support the structure.

AIRPORT. An area of land or structural surface that is used, or intended for use, for the landing and taking off of aircraft with an overall length greater than 39 feet (11 887 mm) and an overall exterior fuselage width greater than 6.6 feet (2012 mm), and any appurtenant areas that are used or intended for use for airport buildings and other airport facilities.

[BG] AIR-SUPPORTED STRUCTURE. A structure wherein the shape of the structure is attained by air pressure, and occupants of the structure are within the elevated pressure area. Air supported structures are of two basic types:

Double skin. Similar to a single skin, but with an attached liner that is separated from the outer skin and provides an airspace which serves for insulation, acoustic, aesthetic or similar purposes.

Single skin. Where there is only the single outer skin and the air pressure is directly against that skin.

[BE] AISLE. An unenclosed exit access component that defines and provides a path of egress travel.

[BE] AISLE ACCESSWAY. That portion of an exit access that leads to an aisle.

ALARM, NUISANCE. See “Nuisance alarm.”

ALARM DEVICE, MULTIPLE STATION. See “Multiple-station alarm device.”

ALARM NOTIFICATION APPLIANCE. A fire alarm system component such as a bell, horn, speaker, light or text display that provides audible, tactile or visible outputs, or any combination thereof. See also “Audible alarm notification appliance” or “Visible alarm notification appliance.”

ALARM SIGNAL. A signal indicating an emergency requiring immediate action, such as a signal indicative of fire.

ALARM VERIFICATION FEATURE. A feature of automatic fire detection and alarm systems to reduce unwanted alarms wherein smoke detectors report alarm conditions for a minimum period of time, or confirm alarm conditions within a given time period, after being automatically reset, in order to be accepted as a valid alarm-initiation signal.

ALCOHOL-BASED HAND RUB. An alcohol-containing preparation designed for application to the hands for reducing the number of viable microorganisms on the hands and containing ethanol or isopropanol in an amount not exceeding 95-percent by volume.

ALCOHOL-BLENDED FUELS. Flammable liquids consisting of greater than 10 percent, by volume, ethanol or other alcohols blended with gasoline.

[A] ALTERATION. Any construction or renovation to an existing structure other than a repair or addition.

[BE] ALTERNATING TREAD DEVICE. A device that has a series of steps between 50 and 70 degrees (0.87 and 1.22 rad) from horizontal, usually attached to a center support rail in an alternating manner so that the user does not have both feet on the same level at the same time.

[BG] AMBULATORY CARE FACILITY. Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less-than-24-hour basis to persons who are rendered incapable of self-preservation by the services provided or staff has accepted responsibility for care recipients already incapable.

AMMONIUM NITRATE. A chemical compound represented by the formula NH_4NO_3 .

ANNUNCIATOR. A unit containing one or more indicator lamps, alphanumeric displays or other equivalent means in which each indication provides status information about a circuit, condition or location.

[A] APPROVED. Acceptable to the fire code official.

[BG] AREA, BUILDING. The area included within surrounding exterior walls (or exterior walls and fire walls) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above.

[BE] AREA OF REFUGE. An area where persons unable to use stairways can remain temporarily to await instructions or assistance during emergency evacuation.

ARRAY. The configuration of storage. Characteristics considered in defining an array include the type of packaging, flue spaces, height of storage and compactness of storage.

ARRAY, CLOSED. A storage configuration having a 6-inch (152 mm) or smaller width vertical flue space that restricts air movement through the stored commodity.

ASSEMBLY. *The gathering together of 50 or more persons for such purposes as deliberation, education, instruction, worship, entertainment, amusement, drinking, dining or awaiting transportation.*

|| ATRIUM. *A vertical space that is closed at the top, connecting two or more stories in Group I-2 and I-3 occupancies or three or more stories in all other occupancies.*

[BG] ATTIC. The space between the ceiling framing of the top story and the underside of the roof.

AUDIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of hearing.

AUTOMATED RACK STORAGE. Automated rack storage is a stocking method whereby the movement of pallets, products, apparatus or systems are automatically controlled by mechanical or electronic devices.

AUTOMATIC. As applied to fire protection devices, a device or system providing an emergency function without the necessity for human intervention and activated as a result of a predetermined temperature rise, rate of temperature rise or combustion products.

AUTOMATIC FIRE-EXTINGUISHING SYSTEM. An approved system of devices and equipment which automatically detects a fire and discharges an approved fire-extinguishing agent onto or in the area of a fire.

AUTOMATIC SMOKE DETECTION SYSTEM. A fire alarm system that has initiation devices that utilize smoke detectors for protection of an area such as a room or space with detectors to provide early warning of fire.

AUTOMATIC SPRINKLER SYSTEM. An automatic sprinkler system, for fire protection purposes, is an integrated system of underground and overhead piping designed in accordance with fire protection engineering standards. The system includes a suitable water supply. The portion of the system above the ground is a network of specially sized or hydraulically designed piping installed in a structure or area, generally overhead, and to which automatic sprinklers are connected in a systematic pattern. The system is usually activated by heat from a fire and discharges water over the fire area.

AUTOMATIC WATER MIST SYSTEM. A system consisting of a water supply, a pressure source and a distribution piping system with attached nozzles which, at or above a minimum operating pressure, defined by its listing, discharges water in fine droplets meeting the requirements of NFPA 750 for the purpose of the control, suppression or

extinguishment of a fire. Such systems include wet-pipe, dry-pipe and pre-action types. The systems are designed as engineered, preengineered, local-application or total flooding systems.

AUTOMOTIVE MOTOR FUEL-DISPENSING FACILITY. That portion of property where flammable or combustible liquids or gases used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles.

AVERAGE AMBIENT SOUND LEVEL. The root mean square, A-weighted sound pressure level measured over a 24-hour period, or the time any person is present, whichever time period is less.

[BG] AWNING. An architectural projection that provides weather protection, identity or decoration and is partially or wholly supported by the building to which it is attached. An awning is comprised of a lightweight frame structure over which a covering is attached.

[BE] BALANCED DOOR. A door equipped with double-pivoted hardware so designed as to cause a semicounter balanced swing action when opening.

BALED COTTON. See "Cotton."

BALED COTTON, DENSELY PACKED. See "Cotton."

BARRICADE. A structure that consists of a combination of walls, floor and roof, which is designed to withstand the rapid release of energy in an explosion and which is fully confined, partially vented or fully vented; or other effective method of shielding from explosive materials by a natural or artificial barrier.

Artificial barricade. An artificial mound or revetment with a minimum thickness of 3 feet (914 mm).

Natural barricade. Natural features of the ground, such as hills, or timber of sufficient density that the surrounding exposures that require protection cannot be seen from the magazine or building containing explosives when the trees are bare of leaves.

BARRICADED. The effective screening of a building containing explosive materials from the magazine or other building, railway or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosive materials to the eave line of any magazine or other building or to a point 12 feet (3658 mm) above the center of a railway or highway shall pass through such barrier.

[BG] BASEMENT. A story that is not a story above grade plane.

BATTERY SYSTEM, STATIONARY STORAGE. A rechargeable energy storage system consisting of electrochemical storage batteries, battery chargers, controls and associated electrical equipment designed to provide electrical power to a building. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.

BATTERY TYPES. For the purposes of this code, certain types are defined as follows:

DEFINITIONS

Flow battery. A type of storage battery that includes chemical components dissolved in two different liquids. Ion exchange, which provides the flow of electrical current, occurs through the membrane while both liquids circulate in their respective spaces.

Lead-acid battery. A storage battery that is comprised of lead electrodes immersed in a solution of water and sulphuric acid electrolyte.

Lithium metal polymer battery. A storage battery that is similar to the lithium ion battery except that it has a lithium metal anode in the place of the traditional carbon or graphite anode.

Lithium-ion battery. A storage battery with lithium ions serving as the charge carriers of the battery. The electrolyte is a polymer mixture of carbonates with an inorganic salt and can be in a liquid or a gelled polymer form. Lithiated metal oxide is typically a cathode and forms of carbon or graphite typically form the anode.

Nickel-cadmium (Ni-Cd) battery. An alkaline storage battery in which the positive active material is nickel oxide, the negative electrode contains cadmium and the electrolyte is a solution of water and potassium hydroxide.

Nickel-metal hydride (Ni-MH). An alkaline storage battery in which the positive active material is nickel oxide, the negative electrode is an intermetallic compound and the electrolyte is usually potassium hydroxide.

Stationary storage battery. A group of electrochemical cells interconnected to supply a nominal voltage of DC power to a suitably connected electrical load, designed for service in a permanent location.

BEDRIDDEN PERSON. *A person, requiring assistance in turning and repositioning in bed, or being unable to independently transfer to and from bed, except in facilities with appropriate and sufficient care staff, mechanical devices if necessary, and safety precautions as determined in Title 22 regulations, by the Director of Social Services or his or her designated representative. Persons who are unable to independently transfer to and from bed, but who do not need assistance to turn or reposition in bed, shall be considered nonambulatory.*

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of persons with developmental disabilities, in consultation with the Director of Developmental Services or his or her designated representative.

The Director of Social Services or his or her designated representative shall make the determination of the bedridden status of all other persons with disabilities who are not developmentally disabled.

BIN BOX. A five-sided container with the open side facing an aisle. Bin boxes are self-supporting or supported by a structure designed so that little or no horizontal or vertical space exists around the boxes.

BIOMASS. Plant- or animal-based material of biological origin excluding material embedded in geologic formations or transformed into fossils.

BLAST AREA. The area including the blast site and the immediate adjacent area within the influence of flying rock, missiles and concussion.

BLAST SITE. The area in which explosive materials are being or have been loaded and which includes all holes loaded or to be loaded for the same blast and a distance of 50 feet (15 240 mm) in all directions.

BLASTER. A person qualified in accordance with Section 5601.4 to be in charge of and responsible for the loading and firing of a blast.

BLASTING AGENT. *Any material or mixture, consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive and in which none of the ingredients are classified as an explosive, provided that the finished product, as mixed and packaged for use or shipment, cannot be detonated by means of a No. 8 test blasting cap when unconfined.*

- 1. A No. 8 test blasting cap is one containing 2 grams of a mixture of 80% mercury fulminate and 20% potassium chlorate, or a cap of equivalent strength.*
- 2. Nitro-Carbo-Nitrates shall mean any blasting agent which has been classified as nitro-carbo-nitrate by the US DOTn, and which is packaged and shipped in compliance with the regulations of the US DOTn.*

[BE] BLEACHERS. Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Grandstand”).

[BG] BOARDING HOUSE. A building arranged or used for lodging for compensation, with or without meals, and not occupied as a single-family unit.

BOILING POINT. The temperature at which the vapor pressure of a liquid equals the atmospheric pressure of 14.7 pounds per square inch absolute (psia) (101 kPa) or 760 mm of mercury. Where an accurate boiling point is unavailable for the material in question, or for mixtures which do not have a constant boiling point, for the purposes of this classification, the 20-percent evaporated point of a distillation performed in accordance with ASTM D86 shall be used as the boiling point of the liquid.

BONFIRE. An outdoor fire utilized for ceremonial purposes.

[BE] BREAKOUT. For revolving doors, a process whereby wings or door panels can be pushed open manually for means of egress travel.

BRITISH THERMAL UNIT (BTU). The heat necessary to raise the temperature of 1 pound (0.454 kg) of water by 1°F (0.5565°C).

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any occupancy.

Note: Building shall have the same meaning as defined in Health and Safety Code Sections 17920 and 18908 for the applications specified in Section 1.11.

BUILDING AREA. See “Area, building.”

BUILDING HEIGHT. See “Height, building.”

[A] BUILDING OFFICIAL. The officer or other designated authority charged with the administration and enforcement of the *California Building Code*, or a duly authorized representative.

BULK OXYGEN SYSTEM. An assembly of equipment, such as oxygen storage containers, pressure regulators, safety devices, vaporizers, manifolds and interconnecting piping, that has a storage capacity of more than 20,000 cubic feet (566 m³) of oxygen at normal temperature and pressure (NTP) including unconnected reserves on hand at the site. The bulk oxygen system terminates at the point where oxygen at service pressure first enters the supply line. The oxygen containers can be stationary or movable, and the oxygen can be stored as a gas or liquid.

BULK PLANT OR TERMINAL. That portion of a property where flammable or combustible liquids are received by tank vessel, pipelines, tank car or tank vehicle and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, portable tank or container.

BULK TRANSFER. The loading or unloading of flammable or combustible liquids from or between tank vehicles, tank cars or storage tanks.

BULLET RESISTANT. Constructed so as to resist penetration of a bullet of 150-grain M2 ball ammunition having a nominal muzzle velocity of 2,700 feet per second (fps) (824 mps) when fired from a 30-caliber rifle at a distance of 100 feet (30 480 mm), measured perpendicular to the target.

CANOPY. A structure or architectural projection of rigid construction over which a covering is attached that provides weather protection, identity or decoration, and may be structurally independent or supported by attachment to a building on one end and by not less than one stanchion on the outer end.

➔ **CAPACITOR ENERGY STORAGE SYSTEM.** A stationary, rechargeable energy storage system consisting of capacitors, chargers, controls and associated electrical equipment designed to provide electrical power to a building or facility. The system is typically used to provide standby or emergency power, an uninterruptable power supply, load shedding, load sharing or similar capabilities.

➔ **CARBON DIOXIDE ENRICHMENT SYSTEM.** A system where carbon dioxide gas is intentionally introduced into an indoor environment, typically for the purpose of stimulating plant growth.

CARBON DIOXIDE EXTINGUISHING SYSTEM. A system supplying carbon dioxide (CO₂) from a pressurized vessel through fixed pipes and nozzles. The system includes a manual- or automatic-actuating mechanism.

CARBON MONOXIDE ALARM. A single- or multiple-station alarm intended to detect carbon monoxide gas and alert occupants by a distinct audible signal. It incorporates a sensor, control components and an alarm notification appliance in a single unit.

CARBON MONOXIDE DETECTOR. A device with an integral sensor to detect carbon monoxide gas and transmit an alarm signal to a connected alarm control unit.

CARE AND SUPERVISION. Any one or more of the following activities provided by a person or facility to meet the needs of the clients:

1. Assistance in dressing, grooming, bathing and other personal hygiene.
2. Assistance with taking medication.
3. Central storing and/or distribution of medications.
4. Arrangement of and assistance with medical and dental care.
5. Maintenance of house rules for the protection of clients.
6. Supervision of client schedules and activities.
7. Maintenance and/or supervision of client cash resources or property.
8. Monitoring food intake or special diets.
9. Providing basic services required by applicable law and regulation to be provided by the licensee in order to obtain and maintain a community-care facility license.

[BG] CARE SUITE. In Group I-2 or I-2.1 occupancies, a group of treatment rooms, care recipient sleeping rooms and the support rooms or spaces and circulation space within the suite where staff are in attendance for supervision of all care recipients within the suite, and the suite is in compliance with the requirements of Section 407.4.4 of the *California Building Code*.

CARTON. A cardboard or fiberboard box enclosing a product.

CATASTROPHICALLY INJURED. As termed, means a person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined by the Department of Health Services Certification and Licensing that active rehabilitation would be beneficial.

CEILING LIMIT. The maximum concentration of an airborne contaminant to which one may be exposed. The ceiling limits utilized are those published in DOL 29 CFR Part 1910.1000. The ceiling Recommended Exposure Limit (REL-C) concentrations published by the US National Institute for Occupational Safety and Health (NIOSH), Threshold Limit Value-Ceiling (TLV-C) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), Ceiling Workplace Environmental Exposure Level (WEEL-Ceiling) Guides published by the American Industrial Hygiene Association (AIHA), and other approved, consistent measures are allowed as surrogates for hazardous substances not listed in DOL 29 CFR Part 1910.1000.

CELL. (Detention or correctional facility). A sleeping or housing unit in a detention or correctional facility for the confinement of not more than two inmates or prisoners.

CELL COMPLEX. A cluster or group of cells or dormitories in a jail, prison or other detention facility, together with rooms used for accessory purposes, all of which open into the cell complex, and are used for functions such as dining, counseling, exercise, classrooms, sick call, visiting, storage, staff

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offices, control rooms or similar functions, and interconnecting corridors all within the cell complex.

CELL TIERS. Cells, dormitories and accessory spaces. Cell tiers are located one level above the other, and do not exceed two levels per floor. A cell tier shall not be considered a story or mezzanine.

[A] CHANGE OF OCCUPANCY. Either of the following shall be considered as a change of occupancy where this code requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.

CHARTER SCHOOL. A Charter School is a public school providing instruction from kindergarten through 12th grade, established pursuant to Education Code, Title 2, Division 4, Part 26.8, Section 47600, et seq.

CHEMICAL. An element, chemical compound or mixture of elements or compounds or both.

CHEMICAL FUME HOOD. A ventilated enclosure designed to contain and exhaust fumes, gases, vapors, mists and particulate matter generated within the hood.

CHEMICAL NAME. The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry, the Chemical Abstracts Service rules of nomenclature, or a name which will clearly identify a chemical for the purpose of conducting an evaluation.

CHILD-CARE CENTER. Any facility of any capacity other than a large or small family day-care home as defined in these regulations in which less than 24-hour-per-day non-medical supervision is provided for children in a group setting.

CHILD CARE. For the purposes of these regulations, means the care of children during any period of a 24-hour day where permanent sleeping accommodations are not provided. The time-period shall not be more than 24 hours. Note: "Child care" shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

CHILD OR CHILDREN. A person or persons under the age of 18 years.

[M] CHIMNEY. A primarily vertical structure containing one or more flues for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outdoor atmosphere.

Factory-built chimney. A listed and labeled chimney composed of factory-made components, assembled in the field in accordance with manufacturer's instructions and the conditions of the listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones, or concrete.

Metal chimney. A field-constructed chimney of metal.

CHRONICALLY ILL. See "Terminally ill."

CLEAN AGENT. Electrically nonconducting, volatile or gaseous fire extinguishant that does not leave a residue upon evaporation.

[BG] CLINIC, OUTPATIENT. Buildings or portions thereof used to provide medical care on a less-than-24-hour basis to persons who are not classified as non-ambulatory or bedridden or rendered incapable of self-preservation by the services provided.

CLOSED CONTAINER. A container sealed by means of a lid or other device such that liquid, vapor or dusts will not escape from it under ordinary conditions of use or handling.

CLOSED SYSTEM. The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations; and all uses of compressed gases. Examples of closed systems for solids and liquids include product conveyed through a piping system into a closed vessel, system or piece of equipment.

COLD DECK. A pile of unfinished cut logs.

COMBUSTIBLE DUST. Finely divided solid material which is 420 microns or less in diameter and which, when dispersed in air in the proper proportions, could be ignited by a flame, spark or other source of ignition. Combustible dust will pass through a US No. 40 standard sieve.

COMBUSTIBLE FIBERS. Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials. This definition does not include densely packed baled cotton.

COMBUSTIBLE GAS DETECTOR. An instrument that samples the local atmosphere and indicates the presence of ignitable vapors or gases within the flammable or explosive range expressed as a volume percent in air.

COMBUSTIBLE LIQUID. A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

The category of combustible liquids does not include compressed gases or cryogenic fluids or liquids that do not have a fire point when tested in accordance with ASTM D92.

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having closed cup flash points at or above 200°F (93°C).

[M] COMMERCIAL COOKING APPLIANCES. Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers, upright broilers, griddles, broilers, steam-jacketed kettles, hot-top ranges, under-fired broilers (charbroilers), ovens, barbecues, rotisseries, and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

COMMERCIAL MOTOR VEHICLE. A motor vehicle used to transport passengers or property where the motor vehicle:

1. Has a gross vehicle weight rating of 10,000 pounds (454 kg) or more; or
2. Is designed to transport 16 or more passengers, including the driver.

COMMODITY. A combination of products, packing materials and containers.

[BE] COMMON PATH OF EGRESS TRAVEL. That portion of exit access travel distance measured from the most remote point of each room, area or space to that point where the occupants have separate and distinct access to two exits or exit access doorways.

[BE] COMMON USE. Interior or exterior circulation paths, rooms, spaces or elements that are not for public use and are made available for the shared use of two or more people.

COMMUNITY CARE FACILITY. *Community care facility means any facility, place or building that is maintained and operated to provide nonmedical residential care, day treatment, adult day care or agency services for children, adults or children and adults, including, but not limited to, the physically handicapped, mentally impaired, incompetent persons, and abused or neglected children, and includes but is not limited to the following as defined in Health and Safety Code Section 1502:*

1. Residential facility.
2. Adult day program.
3. Therapeutic day services facility.
4. Social rehabilitation facility.
5. Community treatment facility.
6. Full-service adoption agency.
7. Transitional shelter care facility.
8. Transitional housing placement facility.

COMMUNITY CORRECTIONAL REENTRY CENTERS—California Department of Corrections and Rehabilitation (CDCR)—community-located facilities that provide housing and transitional rehabilitative or community-based programming services for ambulatory inmates. CDCR Program services assist with substance use disorder treatment, employment, education, family reunification and social support. Program participants remain under the jurisdiction of CDCR, are monitored by CDCR staff and supervised by CDCR,

approved/contracted program providers 24/7. The facilities include residential living, food services, administrative and program functional spaces in a nonlicensed 24-hour facility.

COMPRESSED GAS. A material, or mixture of materials that:

1. Is a gas at 68°F (20°C) or less at 14.7 psia (101 kPa) of pressure; and
2. Has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa) which is either liquefied, nonliquefied or in solution, except those gases which have no other health- or physical-hazard properties are not considered to be compressed until the pressure in the packaging exceeds 41 psia (282 kPa) at 68°F (20°C).

The states of a compressed gas are categorized as follows:

1. Nonliquefied compressed gases are gases, other than those in solution, which are in a packaging under the charged pressure and are entirely gaseous at a temperature of 68°F (20°C).
2. Liquefied compressed gases are gases that, in a packaging under the charged pressure, are partially liquid at a temperature of 68°F (20°C).
3. Compressed gases in solution are nonliquefied gases that are dissolved in a solvent.
4. Compressed gas mixtures consist of a mixture of two or more compressed gases contained in a packaging, the hazard properties of which are represented by the properties of the mixture as a whole.

COMPRESSED GAS CONTAINER. A pressure vessel designed to hold compressed gases at pressures greater than one atmosphere at 68°F (20°C) and includes cylinders, containers and tanks.

COMPRESSED GAS SYSTEM. An assembly of equipment designed to contain, distribute or transport compressed gases. It can consist of a compressed gas container or containers, reactors and appurtenances, including pumps, compressors and connecting piping and tubing.

CONGREGATE LIVING HEALTH FACILITY (CLHF). *As defined in Health and Safety Code Section 1250.*

(1) A residential home with a capacity, except as provided in paragraph (4), of no more than 18 beds, that provides inpatient care, including the following basic services: medical supervision, 24-hour skilled nursing and supportive care, pharmacy, dietary, social, recreational and at least one type of service specified in paragraph (2). The primary need of congregate living health facility residents shall be for availability of skilled nursing care on a recurring, intermittent, extended or continuous basis. This care is generally less intense than that provided in general acute care hospitals but more intense than that provided in skilled nursing facilities.

(2) Congregate living health facilities shall provide one of the following services:

- (A) Services for persons who are mentally alert, persons with physical disabilities, who may be ventilator dependent.*

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(B) *Services for persons who have a diagnosis of terminal illness, a diagnosis of a life-threatening illness or both. Terminal illness means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon. A “life-threatening illness” means the individual has an illness that can lead to a possibility of a termination of life within five years or less as stated in writing by his or her attending physician and surgeon.*

(C) *Services for persons who are catastrophically and severely disabled. A person who is catastrophically and severely disabled means a person whose origin of disability was acquired through trauma or nondegenerative neurologic illness, for whom it has been determined that active rehabilitation would be beneficial and to whom these services are being provided. Services offered by a congregate living health facility to a person who is catastrophically disabled shall include, but not be limited to, speech, physical and occupational therapy.*

(3) *A congregate living health facility license shall specify which of the types of persons described in paragraph (2) to whom a facility is licensed to provide services.*

(4)(A) *A facility operated by a city and county for the purposes of delivering services under this section may have a capacity of 59 beds.*

(B) *A congregate living health facility not operated by a city and county servicing persons who are terminally ill, persons who have been diagnosed with a life-threatening illness or both, that is located in a county with a population of 500,000 or more persons, or located in a county of the 16th class pursuant to Section 28020 of the Government Code, may have not more than 25 beds for the purpose of serving persons who are terminally ill.*

(C) *A congregate living health facility not operated by a city and county serving persons who are catastrophically and severely disabled, as defined in subparagraph (C) of paragraph (1) that is located in a county of 500,000 or more persons may have not more than 12 beds for the purpose of serving persons who are catastrophically and severely disabled.*

(5) *A congregate living health facility shall have a noninstitutional, homelike environment.*

CONGREGATE RESIDENCE. *Any building or portion thereof that contains facilities for living, sleeping and sanitation, as required by this code, and may include facilities for eating and cooking, for occupancy by other than a family. A congregate residence may be a shelter, convent, monastery, dormitory, fraternity or sorority house, but does not include jails, hospitals, nursing homes, hotels or lodging houses.*

CONSTANTLY ATTENDED LOCATION. *A designated location at a facility staffed by trained personnel on a continuous basis where alarm or supervisory signals are monitored and facilities are provided for notification of the fire department or other emergency services.*

[A] CONSTRUCTION DOCUMENTS. *The written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a permit.*

CONTAINER. *A vessel of 60 gallons (227 L) or less in capacity used for transporting or storing hazardous materials. Pipes, piping systems, engines and engine fuel tanks are not considered to be containers.*

CONTAINMENT SYSTEM. *A gastight recovery system comprised of equipment or devices which can be placed over a leak in a compressed gas container, thereby stopping or controlling the escape of gas from the leaking container.*

CONTAINMENT VESSEL. *A gastight recovery vessel designed so that a leaking compressed gas container can be placed within its confines thereby encapsulating the leaking container.*

CONTROL AREA. *Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See also the definition of “Outdoor control area.”*

[BE] CORRIDOR. *An enclosed exit access component that defines and provides a path of egress travel.*

CORRIDOR, OPEN-ENDED. *See “Open-ended corridor.”*

CORROSIVE. *A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. A chemical shall be considered corrosive if, when tested on the intact skin of albino rabbits by the method described in DOTn 49 CFR 173.137, such chemical destroys or changes irreversibly the structure of the tissue at the point of contact following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.*

COTTON.

Baled cotton. *A natural seed fiber wrapped in and secured with industry-accepted materials, usually consisting of burlap, woven polypropylene, polyethylene or cotton or sheet polyethylene, and secured with steel, synthetic or wire bands or wire; also includes linters (lint removed from the cottonseed) and motes (residual materials from the ginning process).*

Baled cotton, densely packed. *Cotton, made into banded bales, with a packing density of not less than 22 pounds per cubic foot (360 kg/m³), and dimensions complying with the following: a length of 55 inches (1397 mm), a width of 21 inches (533.4 mm) and a height of 27.6 to 35.4 inches (701 to 899 mm).*

Seed cotton. *Perishable raw agricultural commodity consisting of cotton fiber (lint) attached to the seed of the cotton plant, which requires ginning to become a commercial product.*

[BG] COURT. *An open, uncovered space, unobstructed to the sky, bounded on three or more sides by exterior building walls or other enclosing devices.*

COURTHOUSE HOLDING FACILITY. [SFM] *Courthouse Holding Facility shall mean a room, cell, cell complex or building for the confinement of persons for the purpose of a court appearance for a period not to exceed 12 hours.*

COURTROOM DOCK. *Courtroom Dock shall mean an area within a courtroom where persons may be restrained and are awaiting court proceedings.*

[BG] COVERED MALL BUILDING. A single building enclosing a number of tenants and occupants such as retail stores, drinking and dining establishments, entertainment and amusement facilities, passenger transportation terminals, offices, and other similar uses wherein two or more tenants have a main entrance into one or more malls. Anchor buildings shall not be considered as a part of the covered mall building. The term “covered mall building” shall include open mall buildings as defined below.

Mall. A roofed or covered common pedestrian area within a covered mall building that serves as access for two or more tenants and not to exceed three levels that are open to each other. The term “mall” shall include open malls as defined below.

Open mall. An unroofed common pedestrian way serving a number of tenants not exceeding three levels. Circulation at levels above grade shall be permitted to include open exterior balconies leading to exits discharging at grade.

Open mall building. Several structures housing a number of tenants such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses wherein two or more tenants have a main entrance into one or more open malls. Anchor buildings are not considered as a part of the open mall building.

CRITICAL AREAS. Areas that are designated for the highest level of emergency responder radio coverage including but not limited to areas such as exit stairs, exit passageways, elevator lobbies, fire protection equipment room and control valve locations, and fire command centers.

CRITICAL CIRCUIT. A circuit that requires continuous operation to ensure safety of the structure and occupants.

CRYOGENIC CONTAINER. A cryogenic vessel of any size used for the transportation, handling or storage of cryogenic fluids.

CRYOGENIC FLUID. A fluid having a boiling point lower than -130°F (-89.9°C) at 14.7 pounds per square inch atmosphere (psia) (an absolute pressure of 101.3 kPa).

CRYOGENIC VESSEL. A pressure vessel, low-pressure tank or atmospheric tank designed to contain a cryogenic fluid on which venting, insulation, refrigeration or a combination of these is used in order to maintain the operating pressure within the design pressure and the contents in a liquid phase.

CURRENT TAP. An electrical device that, where connected to a permanently installed receptacle outlet, provides multiple receptacle outlet configurations.

[BG] CUSTODIAL CARE. Assistance with day-to-day living tasks; such as assistance with cooking, taking medication, bathing, using toilet facilities and other tasks of daily

living. Custodial care includes persons receiving care who have the ability to respond to emergency situations and evacuate at a slower rate and/or who have mental and psychiatric complications.

CYLINDER. A pressure vessel designed for pressures higher than 40 psia (275.6 kPa) and having a circular cross section. It does not include a portable tank, multiunit tank car tank, cargo tank or tank car.

DAMPER. See “Fire damper” and “Smoke damper.”

DAY BOX. A portable magazine designed to hold explosive materials and constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56.

DAY-CARE. *For the purposes of these regulations, shall mean the care of persons during any period of a 24-hour day where permanent sleeping accommodations are not provided.*

Note: “Day-care” shall not be construed to preclude the use of cots or mats for napping purposes, provided all employees, attendants and staff personnel are awake and on duty in the area where napping occurs.

DAY-CARE HOME, FAMILY. *A home that regularly provides care, protection and supervision for 14 or fewer children, in the provider’s own home, for periods of less than 24 hours per day, while the parents or guardians are away, and is either a large family day-care home or a small family day-care home.*

DAY-CARE HOME, LARGE FAMILY. *A provider’s own home licensed to provide day care for periods less than 24-hours per day for nine to 14 persons, including children under the age of 10 years who reside at the home.*

DAY-CARE HOME, SMALL FAMILY. *A home which provides family day-care to eight or fewer children, including children under the age of 10 years who reside at the home, in the provider’s own home, for periods of less than 24 hours per day. Small family day-care homes are exempted from state fire and life safety regulations other than those state and local standards applicable to Group R-3 occupancies. (See Health and Safety Code, Section 13143 (b).)*

DAY ROOM. *A room which is adjacent to a cell, or cell tier or dormitory and which is used as a dining, exercise or other activity room for inmates.*

DECORATIVE MATERIALS. All materials applied over the building interior finish for decorative, acoustical or other effect including, but not limited to, curtains, draperies, fabrics, streamers and all other materials utilized for decorative effect including, but not limited to, bulletin boards, artwork, posters, photographs, paintings, batting, cloth, cotton, hay, stalks, straw, vines, leaves, trees, moss and similar items, foam plastics and materials containing foam plastics. Decorative materials do not include wall coverings, ceiling coverings, floor coverings, ordinary window shades, interior finish and materials 0.025 inch (0.64 mm) or less in thickness applied directly to and adhering tightly to a substrate.

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DEFLAGRATION. An exothermic reaction, such as the extremely rapid oxidation of a flammable dust or vapor in air, in which the reaction progresses through the unburned material at a rate less than the velocity of sound. A deflagration can have an explosive effect.

DELIVERED AUDIO QUALITY (DAQ). A measure of audio quality over a transmission medium. This metric is often used to quantify the quality of audio heard over a radio system. DAQ levels are defined by the following scale:

DAQ 1 = unusable. Speech is present but not understandable.

DAQ 2 = speech is understandable with considerable effort. Requires frequent repetition due to noise or distortion.

DAQ 3 = speech understandable with slight effort. Requires occasional repetition due to noise or distortion.

DAQ 3.4 = speech understandable without repetition. Some noise or distortion present.

DAQ 4 = speech easily understandable. Little noise or distortion.

DAQ 5 = perfect. No distortion or noise discernible.

DELUGE SYSTEM. A sprinkler system employing open sprinklers attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same area as the sprinklers. When this valve opens, water flows into the piping system and discharges from all sprinklers attached thereto.

DESIGN PRESSURE. The maximum gauge pressure that a pressure vessel, device, component or system is designed to withstand safely under the temperature and conditions of use expected.

DESOLVENTIZING. The act of removing a solvent from a material.

DETACHED BUILDING. A separate single-story building, without a basement or crawl space, used for the storage or use of hazardous materials and located an approved distance from all structures.

DETEARING. A process for rapidly removing excess wet coating material from a dipped or coated object or material by passing it through an electrostatic field.

DETECTOR, HEAT. A fire detector that senses heat, either abnormally high temperature or rate of rise, or both.

DETENTION ELEVATOR. [SFM] *Detention Elevator shall mean an elevator which moves in-custody individuals within a secure and restrained environment.*

DETENTION TREATMENT ROOM. [SFM] *Detention Treatment Room shall mean a lockable room or rooms within Group I-3 occupancies used for recreational therapy, group rooms, interdisciplinary treatment team rooms and interview rooms not classified solely as a Group I-2 occupancy.*

DETONATING CORD. A flexible cord containing a center core of high explosive used to initiate other explosives.

DETONATION. An exothermic reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction. The reaction zone progresses through the material at a rate greater than the velocity of sound. The principal heating mechanism is one of shock compression. Detonations have an explosive effect.

DETONATOR. A device containing any initiating or primary explosive that is used for initiating detonation. A detonator shall not contain more than 154.32 grains (10 grams) of total explosives by weight, excluding ignition or delay charges. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and noninstantaneous and delay blasting caps which use detonating cord, shock tube or any other replacement for electric leg wires. All types of detonators in strengths through No. 8 cap should be rated at 1½ pounds (0.68 kg) of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the manufacturer.

[BG] DETOXIFICATION FACILITIES. Facilities that provide treatment for substance abuse serving care recipients who are incapable of self-preservation *or classified as non-ambulatory or bedridden* or who are harmful to themselves or others.

DIP TANK. A tank, vat or container of flammable or combustible liquid in which articles or materials are immersed for the purpose of coating, finishing, treating and similar processes.

DISPENSING. The pouring or transferring of any material from a container, tank or similar vessel, whereby vapors, dusts, fumes, mists or gases are liberated to the atmosphere.

DISPENSING DEVICE, OVERHEAD TYPE. A dispensing device that consists of one or more individual units intended for installation in conjunction with each other, mounted above a dispensing area typically within the motor fuel-dispensing facility canopy structure, and characterized by the use of an overhead hose reel.

DOOR, BALANCED. See “Balanced door.”

DOOR, DUTCH. See “Dutch door.”

DOOR, LOW ENERGY POWER-OPERATED. See “Low energy power-operated door.”

DOOR, POWER-ASSISTED. See “Power-assisted door.”

DOOR, POWER-OPERATED. See “Power-operated door.”

DOORWAY, EXIT ACCESS. See “Exit access doorway.”

[BG] DORMITORY. A space in a building where group sleeping accommodations are provided in one room, or in a series of closely associated rooms, for persons not members of the same family group, under joint occupancy and single management, as in college dormitories or fraternity houses.

DRAFT CURTAIN. A structure arranged to limit the spread of smoke and heat along the underside of the ceiling or roof.

[BF] DRAFTSTOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl

spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

DRY CLEANING. The process of removing dirt, grease, paints and other stains from such items as wearing apparel, textiles, fabrics and rugs by use of nonaqueous liquids (solvents).

DRY CLEANING PLANT. A facility in which dry cleaning and associated operations are conducted, including the office, receiving area and storage rooms.

DRY CLEANING ROOM. An occupiable space within a building used for performing dry cleaning operations, the installation of solvent-handling equipment or the storage of dry cleaning solvents.

DRY CLEANING SYSTEM. Machinery or equipment in which textiles are immersed or agitated in solvent or in which dry cleaning solvent is extracted from textiles.

DRY-CHEMICAL EXTINGUISHING AGENT. A powder composed of small particles, usually of sodium bicarbonate, potassium bicarbonate, urea-potassium-based bicarbonate, potassium chloride or monoammonium phosphate, with added particulate material supplemented by special treatment to provide resistance to packing, resistance to moisture absorption (caking) and the proper flow capabilities.

DUST COLLECTION SYSTEM. A combination of equipment designed to contain, capture and collect airborne combustible dusts.

DUTCH DOOR. A door divided horizontally so that the top can be operated independently from the bottom.

[A] DWELLING. A building that contains one or two dwelling units used, intended or designed to be used, rented, leased, let or hired out to be occupied for living purposes.

[A] DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

EARLY SUPPRESSION FAST-RESPONSE (ESFR) SPRINKLER. A sprinkler listed for early suppression fast-response performance.

[BE] EGRESS COURT. A court or yard which provides access to a public way for one or more exits.

ELECTROSTATIC FLUIDIZED BED. A container holding powder coating material that is aerated from below so as to form an air-supported expanded cloud of such material that is electrically charged with a charge opposite to that of the object to be coated. Such object is transported through the container immediately above the charged and aerated materials in order to be coated.

ELEVATOR GROUP. A grouping of elevators in a building located adjacent or directly across from one another that respond to a common hall call button(s).

EMERGENCY ALARM SYSTEM. A system to provide indication and warning of emergency situations involving hazardous materials.

EMERGENCY CONTROL STATION. An approved location on the premises where signals from emergency equipment are received and which is staffed by trained personnel.

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

EMERGENCY EVACUATION DRILL. An exercise performed to train staff and occupants and to evaluate their efficiency and effectiveness in carrying out emergency evacuation procedures.

EMERGENCY POWER SYSTEM. A source of automatic electric power of a required capacity and duration to operate required life safety, fire alarm, detection and ventilation systems in the event of a failure of the primary power. Emergency power systems are required for electrical loads where interruption of the primary power could result in loss of human life or serious injuries.

EMERGENCY SHUTOFF VALVE. A valve designed to shut off the flow of gases or liquids.

EMERGENCY SHUTOFF VALVE, AUTOMATIC. A fail-safe automatic-closing valve designed to shut off the flow of gases or liquids initiated by a control system that is activated by automatic means.

EMERGENCY SHUTOFF VALVE, MANUAL. A manually operated valve designed to shut off the flow of gases or liquids.

EMERGENCY VOICE/ALARM COMMUNICATIONS. Dedicated manual or automatic facilities for originating and distributing voice instructions, as well as alert and evacuation signals pertaining to a fire emergency, to the occupants of a building.

[BE] EMPLOYEE WORK AREA. All or any portion of a space used only by employees and only for work. Corridors, toilet rooms, kitchenettes and break rooms are not employee work areas.

ENERGY STORAGE MANAGEMENT SYSTEM. An electronic system that protects energy storage systems from operating outside their safe operating parameters and disconnects electrical power to the ESS or places it in a safe condition if potentially hazardous temperatures or other conditions are detected.

ENERGY STORAGE SYSTEM (ESS). One or more devices, assembled together, capable of storing energy in order to supply electrical energy at a future time.

ENERGY STORAGE SYSTEM, ELECTROCHEMICAL. An energy storage system that stores energy and produces electricity using chemical reactions. It includes, among others, battery ESS and capacitor ESS.

ENERGY STORAGE SYSTEM, MOBILE. An energy storage system capable of being moved and utilized for temporary energy storage applications, and not installed as fixed or stationary electrical equipment. The system can

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include integral wheels for transportation or be loaded on a trailer and unloaded for charging, storage and deployment.

ENERGY STORAGE SYSTEM, STATIONARY. An energy storage system installed as fixed or stationary electrical equipment in a permanent location.

ENERGY STORAGE SYSTEM, WALK-IN UNIT. A prefabricated building that contains energy storage systems. It includes doors that provide walk-in access for personnel to maintain, test and service the equipment, and is typically used in outdoor and mobile ESS applications.

ENERGY STORAGE SYSTEM CABINET. A cabinet containing components of the energy storage system that is included in the UL 9540 listing for the system. Personnel are not able to enter the enclosure other than reaching in to access components for maintenance purposes.

ENERGY STORAGE SYSTEM COMMISSIONING. A systematic process that provides documented confirmation that an energy storage system functions according to the intended design criteria and complies with applicable code requirements.

ENERGY STORAGE SYSTEM DECOMMISSIONING. A systematic process that provides documentation and procedures that allow an energy storage system to be safely de-energized, disassembled, readied for shipment or storage, and removed from the premises in accordance with applicable code requirements.

[BG] EQUIPMENT PLATFORM. An unoccupied, elevated platform used exclusively for mechanical systems or industrial process equipment, including the associated elevated walkways, stairways, alternating tread devices and ladders necessary to access the platform (see Section 505.3 of the *California Building Code*).

EXCESS FLOW CONTROL. A fail-safe system or other approved means designed to shut off flow caused by a rupture in pressurized piping systems.

EXCESS FLOW VALVE. A valve inserted into a compressed gas cylinder, portable tank or stationary tank that is designed to positively shut off the flow of gas in the event that its predetermined flow is exceeded.

EXHAUSTED ENCLOSURE. An appliance or piece of equipment which consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to retain and exhaust locally the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.

EXISTING. Buildings, facilities or conditions that are already in existence, constructed or officially authorized prior to the adoption of this code.

[BE] EXIT. That portion of a means of egress system between the exit access and the exit discharge or public way. Exit components include exterior exit doors at the level of

exit discharge, interior exit stairways and ramps, exit passageways, exterior exit stairways and ramps and horizontal exits.

[BE] EXIT ACCESS. That portion of a means of egress system that leads from any occupied portion of a building or structure to an exit.

[BE] EXIT ACCESS DOORWAY. A door or access point along the path of egress travel from an occupied room, area or space where the path of egress enters an intervening room, corridor, exit access stairway or ramp.

[BE] EXIT ACCESS RAMP. A ramp within the exit access portion of the means of egress system.

[BE] EXIT ACCESS STAIRWAY. A stairway within the exit access portion of the means of egress system.

[BE] EXIT DISCHARGE. That portion of a means of egress system between the termination of an exit and a public way.

[BE] EXIT DISCHARGE, LEVEL OF. The story at the point at which an exit terminates and an exit discharge begins.

[BE] EXIT PASSAGEWAY. An exit component that is separated from other interior spaces of a building or structure by fire-resistance-rated construction and opening protectives, and provides for a protected path of egress travel in a horizontal direction to the exit discharge.

EXPANDED PLASTIC. A foam or cellular plastic material having a reduced density based on the presence of numerous small cavities or cells dispersed throughout the material.

EXPLOSION. An effect produced by the sudden violent expansion of gases, which may be accompanied by a shock wave or disruption, or both, of enclosing materials or structures. An explosion could result from any of the following:

1. Chemical changes such as rapid oxidation, deflagration or detonation, decomposition of molecules and runaway polymerization (usually detonations).
2. Physical changes such as pressure tank ruptures.
3. Atomic changes (nuclear fission or fusion).

EXPLOSIVE. A chemical compound, mixture or device, the primary or common purpose of which is to function by explosion. The term includes, but is not limited to, dynamite, black powder, pellet powder, initiating explosives, detonators, safety fuses, squibs, detonating cord, igniter cord and igniters.

The term “explosive” includes any material determined to be within the scope of USC Title 18: Chapter 40 and also includes any material classified as an explosive by the hazardous materials regulations of DOTn 49 CFR Parts 100–185.

High explosive. Explosive material, such as dynamite, which can be caused to detonate by means of a No. 8 test blasting cap where unconfined.

Low explosive. Explosive material that will burn or deflagrate when ignited. It is characterized by a rate of reaction that is less than the speed of sound. Examples of low explo-

sives include, but are not limited to, black powder, safety fuse, igniters, igniter cord, fuse lighters, fireworks and propellants, 1.3C.

Mass-detonating explosives. Division 1.1, 1.2 and 1.5 explosives alone or in combination, or loaded into various types of ammunition or containers, most of which can be expected to explode virtually instantaneously when a small portion is subjected to fire, severe concussion, impact, the impulse of an initiating agent or the effect of a considerable discharge of energy from without. Materials that react in this manner represent a mass explosion hazard. Such an explosive will normally cause severe structural damage to adjacent objects. Explosive propagation could occur immediately to other items of ammunition and explosives stored sufficiently close to and not adequately protected from the initially exploding pile with a time interval short enough so that two or more quantities must be considered as one for quantity-distance purposes.

UN/DOTh Class 1 explosives. The former classification system used by DOTn included the terms “high” and “low” explosives as defined herein. The following terms further define explosives under the current system applied by DOTn for all explosive materials defined as hazard Class 1 materials. Compatibility group letters are used in concert with the division to specify further limitations on each division noted (for example, the letter G identifies the material as a pyrotechnic substance or article containing a pyrotechnic substance and similar materials).

Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.

Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.

Division 1.5. Very insensitive explosives. This division is comprised of substances that have a mass explosion hazard but which are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

EXPLOSIVE MATERIAL. The term “explosive” material means explosives, blasting agents and detonators.

[BE] EXTERIOR EXIT RAMP. An exit component that serves to meet one or more means of egress design require-

ments, such as required number of exits or exit access travel distance, and is open to yards, courts or public ways.

[BE] EXTERIOR EXIT STAIRWAY. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and is open to yards, courts or public ways.

[BF] EXTERIOR WALL. A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

EXTRA-HIGH-RACK COMBUSTIBLE STORAGE. Storage on racks of Class I, II, III or IV commodities that exceed 40 feet (12 192 mm) in height and storage on racks of high-hazard commodities that exceed 30 feet (9144 mm) in height.

FABRICATION AREA. An area within a semiconductor fabrication facility and related research and development areas in which there are processes using hazardous production materials. Such areas are allowed to include ancillary rooms or areas such as dressing rooms and offices that are directly related to the fabrication area processes.

[A] FACILITY. A building or use in a fixed location including exterior storage areas for flammable and combustible substances and hazardous materials, piers, wharves, tank farms and similar uses. This term includes recreational vehicles, mobile home and manufactured housing parks, sales and storage lots.

FAIL-SAFE. A design condition incorporating a feature for automatically counteracting the effect of an anticipated possible source of failure; also, a design condition eliminating or mitigating a hazardous condition by compensating automatically for a failure or malfunction.

FALSE ALARM. The willful and knowing initiation or transmission of a signal, message or other notification of an event of fire when no such danger exists.

FINES. Small pieces or splinters of wood byproducts that will pass through a 0.25-inch (6.4 mm) screen.

FIRE ALARM. The giving, signaling or transmission to any public fire station, or company or to any officer or employee thereof, whether by telephone, spoken word or otherwise, of information to the effect that there is a fire at or near the place indicated by the person giving, signaling or transmitting such information.

FIRE ALARM BOX, MANUAL. See “*Manual fire alarm box.*”

FIRE ALARM CONTROL UNIT. A system component that receives inputs from automatic and manual fire alarm devices and may be capable of supplying power to detection devices and transponder(s) or off-premises transmitter(s). The control unit may be capable of providing a transfer of power to the notification appliances and transfer of condition to relays or devices.

FIRE ALARM SIGNAL. A signal initiated by a fire alarm-initiating device such as a manual fire alarm box, automatic fire detector, waterflow switch or other device whose activation is indicative of the presence of a fire or fire signature.

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FIRE ALARM SYSTEM. A system or portion of a combination system consisting of components and circuits arranged to monitor and annunciate the status of fire alarm or supervisory signal-initiating devices and to initiate the appropriate response to those signals.

FIRE APPARATUS ACCESS ROAD. A road that provides fire apparatus access from a fire station to a facility, building or portion thereof. This is a general term inclusive of all other terms such as fire lane, public street, private street, parking lot lane and access roadway.

FIRE APPLIANCE. See Section 902.1.

[BF] FIRE AREA. The aggregate floor area enclosed and bounded by fire walls, fire barriers, exterior walls or horizontal assemblies of a building. Areas of the building not provided with surrounding walls shall be included in the fire area if such areas are included within the horizontal projection of the roof or floor next above.

[BF] FIRE BARRIER. A fire-resistance-rated wall assembly of materials designed to restrict the spread of fire in which continuity is maintained.

FIRE CHIEF. The chief officer of the fire department serving the jurisdiction, or a duly authorized representative.

FIRE CODE OFFICIAL. The fire chief or other designated authority charged with the administration and enforcement of the code, or a duly authorized representative.

FIRE COMMAND CENTER. The principal attended or unattended location where the status of detection, alarm communications and control systems is displayed, and from which the system(s) can be manually controlled.

[BF] FIRE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon detection of heat and resist the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

FIRE DEPARTMENT MASTER KEY. A limited issue key of special or controlled design to be carried by fire department officials in command which will open key boxes on specified properties.

FIRE DETECTOR, AUTOMATIC. A device designed to detect the presence of a fire signature and to initiate action.

[BF] FIRE DOOR. The door component of a fire door assembly.

[BF] FIRE DOOR ASSEMBLY. Any combination of a fire door, frame, hardware and other accessories that together provide a specific degree of fire protection to the opening.

[BF] FIRE EXIT HARDWARE. Panic hardware that is listed for use on fire door assemblies.

FIRE LANE. A road or other passageway developed to allow the passage of fire apparatus. A fire lane is not necessarily intended for vehicular traffic other than fire apparatus.

[BF] FIRE PARTITION. A vertical assembly of materials designed to restrict the spread of fire in which openings are protected.

FIRE POINT. The lowest temperature at which a liquid will ignite and achieve sustained burning when exposed to a test flame in accordance with ASTM D92.

[BF] FIRE PROTECTION RATING. The period of time that an opening protective assembly will maintain the ability to confine a fire as determined by tests prescribed in Section 716 of the *California Building Code*. Ratings are stated in hours or minutes.

FIRE PROTECTION SYSTEM. Approved devices, equipment and systems or combinations of systems used to detect a fire, activate an alarm, extinguish or control a fire, control or manage smoke and products of a fire or any combination thereof.

[BF] FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

FIRE SAFETY FUNCTIONS. Building and fire control functions that are intended to increase the level of life safety for occupants or to control the spread of the harmful effects of fire.

[BF] FIRE SEPARATION DISTANCE. The distance measured from the building face to one of the following:

1. The closest interior lot line.
2. To the centerline of a street, an alley or public way.
3. To an imaginary line between two buildings on the lot.

The distance shall be measured at right angles from the face of the wall.

[BF] FIRE WALL. A fire-resistance-rated wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIRE WATCH. A temporary measure intended to ensure continuous and systematic surveillance of a building or portion thereof by one or more qualified individuals for the purposes of identifying and controlling fire hazards, detecting early signs of unwanted fire, raising an alarm of fire and notifying the fire department.

[BF] FIREBLOCKING. Building materials, or materials approved for use as fireblocking, installed to resist the free passage of flame to other areas of the building through concealed spaces.

[BF] FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to confine a fire, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703 of the *California Building Code*.

[BF] FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated in accordance with either ASTM E1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

FIREWORKS. Any composition or device for the purpose of producing a visible or an audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.3G fireworks or 1.4G fireworks.

Fireworks, 1.3G. Large fireworks devices, which are explosive materials, intended for use in fireworks displays and designed to produce audible or visible effects by combustion, deflagration or detonation. Such 1.3G fireworks include, but are not limited to, firecrackers containing more than 130 milligrams (2 grains) of explosive composition, aerial shells containing more than 40 grams of pyrotechnic composition and other display pieces which exceed the limits for classification as 1.4G fireworks. Such 1.3G fireworks are also described as Fireworks, UN 0335 by the DOTn.

Fireworks, 1.4G. Small fireworks devices containing restricted amounts of pyrotechnic composition designed primarily to produce visible or audible effects by combustion or deflagration that complies with the construction, chemical composition and labeling regulations of the DOTn for Fireworks, UN 0336, and the US Consumer Product Safety Commission as set forth in CPSC 16 CFR Parts 1500 and 1507.

Note: Fireworks shall have the same meaning as defined in Health and Safety Code Sections 12511 and 12512 which have been reprinted as follows:

12511. "Fireworks" means any device containing chemical elements and chemical compounds capable of burning independently of the oxygen of the atmosphere and producing audible, visual, mechanical or thermal effects which are useful as pyrotechnic devices or for entertainment.

The term "fireworks" includes, but is not limited to, devices designated by the manufacturer as fireworks, torpedoes, skyrockets, roman candles, rockets, Daygo bombs, sparklers, party poppers, paper caps, chasers, fountains, smoke sparks, aerial bombs and fireworks kits.

12512. "Fireworks kit" means any assembly of materials or explosive substances, which is designed and intended by the seller to be assembled by the person receiving such material or explosive substance and when so assembled would come within the definition of fireworks in Section 12511.

FIREWORKS DISPLAY. A presentation of fireworks for a public or private gathering.

[BG] FIXED BASE OPERATOR (FBO). A commercial business granted the right by the airport sponsor to operate on an airport and provide aeronautical services such as fueling, hangaring, tie-down and parking, aircraft rental, aircraft maintenance and flight instruction.

FIXED GUIDEWAY AND PASSENGER RAIL TRANSIT SYSTEMS. (See California Building Code, Section 443.)

[BE] FIXED SEATING. Furniture or fixtures designed and installed for the use of sitting and secured in place including bench-type seats and seats with or without back or arm rests.

[BF] FLAME SPREAD. The propagation of flame over a surface.

[BF] FLAME SPREAD INDEX. A comparative measure, expressed as a dimensionless number, derived from visual measurements of the spread of flame versus time for a material tested in accordance with ASTM E84 or UL 723.

FLAMMABLE CRYOGENIC FLUID. A cryogenic fluid that is flammable in its vapor state.

FLAMMABLE FINISHES. Coatings to articles or materials in which the material being applied is a flammable liquid, combustible liquid, combustible powder, fiberglass resin or flammable or combustible gel coating.

FLAMMABLE GAS. A material which is a gas at 68°F (20°C) or less at 14.7 pounds per square inch atmosphere (psia) (101 kPa) of pressure [a material that has a boiling point of 68°F (20°C) or less at 14.7 psia (101 kPa)] which:

1. Is ignitable at 14.7 psia (101 kPa) when in a mixture of 13 percent or less by volume with air; or
2. Has a flammable range at 14.7 psia (101 kPa) with air of not less than 12 percent, regardless of the lower limit.

The limits specified shall be determined at 14.7 psi (101 kPa) of pressure and a temperature of 68°F (20°C) in accordance with ASTM E681.

FLAMMABLE LIQUEFIED GAS. A liquefied compressed gas which, under a charged pressure, is partially liquid at a temperature of 68°F (20°C) and which is flammable.

FLAMMABLE LIQUID. A liquid having a closed cup flash point below 100°F (38°C). Flammable liquids are further categorized into a group known as Class I liquids. The Class I category is subdivided as follows:

Class IA. Liquids having a flash point below 73°F (23°C) and having a boiling point below 100°F (38°C).

Class IB. Liquids having a flash point below 73°F (23°C) and having a boiling point at or above 100°F (38°C).

Class IC. Liquids having a flash point at or above 73°F (23°C) and below 100°F (38°C).

The category of flammable liquids does not include compressed gases or cryogenic fluids or liquids that do not have a fire point when tested in accordance with ASTM D92.

FLAMMABLE MATERIAL. A material capable of being readily ignited from common sources of heat or at a temperature of 600°F (316°C) or less.

FLAMMABLE SOLID. A solid, other than a blasting agent or explosive, that is capable of causing fire through friction, absorption of moisture, spontaneous chemical change or retained heat from manufacturing or processing, or which has an ignition temperature below 212°F (100°C) or which

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burns so vigorously and persistently when ignited as to create a serious hazard. A chemical shall be considered a flammable solid as determined in accordance with the test method of CPSC 16 CFR Part 1500.44, if it ignites and burns with a self-sustained flame at a rate greater than 0.0866 inch (2.2 mm) per second along its major axis.

FLAMMABLE VAPOR AREA. An area in which the concentration of flammable constituents (vapor, gas, fume, mist or dust) in air exceeds 25 percent of their lower flammable limit (LFL) because of the flammable finish processes operation. It shall include:

1. The interior of spray booths.
2. The interior of ducts exhausting from spraying processes.
3. Any area in the direct path of spray or any area containing dangerous quantities of air-suspended powder, combustible residue, dust, deposits, vapor or mists as a result of spraying operations.
4. The area in the vicinity of dip tanks, drain boards or associated drying, conveying or other equipment during operation or shutdown periods.

The fire code official is authorized to determine the extent of the flammable vapor area, taking into consideration the material characteristics of the flammable materials, the degree of sustained ventilation and the nature of the operations.

FLAMMABLE VAPORS OR FUMES. The concentration of flammable constituents in air that exceeds 25 percent of their lower flammable limit (LFL).

FLASH POINT. The minimum temperature in degrees Fahrenheit at which a liquid will give off sufficient vapors to form an ignitable mixture with air near the surface or in the container, but will not sustain combustion. The flash point of a liquid shall be determined by appropriate test procedure and apparatus as specified in ASTM D56, ASTM D93 or ASTM D3278.

FLEET VEHICLE MOTOR FUEL-DISPENSING FACILITY. That portion of a commercial, industrial, governmental or manufacturing property where liquids used as fuels are stored and dispensed into the fuel tanks of motor vehicles that are used in connection with such businesses, by persons within the employ of such businesses.

[BE] FLIGHT. A continuous run of rectangular treads, winders or combination thereof from one landing to another.

FLOAT. A floating structure normally used as a point of transfer for passengers and goods, or both, for mooring purposes.

[BE] FLOOR AREA, GROSS. The floor area within the inside perimeter of the exterior walls of the building under consideration, exclusive of vent shafts and courts, without deduction for corridors, stairways, ramps, closets, the thickness of interior walls, columns or other features. The floor area of a building, or portion thereof, not provided with surrounding exterior walls shall be the usable area under the horizontal projection of the roof or floor above. The gross floor area shall not include shafts with no openings or interior courts.

[BE] FLOOR AREA, NET. The actual occupied area not including unoccupied accessory areas such as corridors, stairways, ramps, toilet rooms, mechanical rooms and closets.

FLUE SPACES.

Longitudinal flue space. The flue space between rows of storage perpendicular to the direction of loading.

Transverse flue space. The space between rows of storage parallel to the direction of loading.

FLUIDIZED BED. A container holding powder coating material that is aerated from below so as to form an air-supported expanded cloud of such material through which the preheated object to be coated is immersed and transported.

FOAM-EXTINGUISHING SYSTEM. A special system discharging a foam made from concentrates, either mechanically or chemically, over the area to be protected.

[BE] FOLDING AND TELESCOPIC SEATING. Tiered seating having an overall shape and size that is capable of being reduced for purposes of moving or storing and is not a building element.

FUEL CELL POWER SYSTEM, STATIONARY. A stationary energy generation system that converts the chemical energy of a fuel and oxidant to electric energy (DC or AC electricity) by an electrochemical process.

Field-fabricated fuel cell power system. A stationary fuel cell power system that is assembled at the job site and is not a preengineered or prepackaged factory-assembled fuel cell power system.

Preengineered fuel cell power system. A stationary fuel cell power system consisting of components and modules that are produced in a factory, and shipped to the job site for assembly.

Prepackaged fuel cell power system. A stationary fuel cell power system that is factory assembled as a single, complete unit and shipped as a complete unit for installation at the job site.

FUEL LIMIT SWITCH. A mechanism, located on a tank vehicle, that limits the quantity of product dispensed at one time.

FULL-TIME CARE shall mean the establishment and routine care of persons on an hourly, daily, weekly, monthly, yearly or permanent basis, whether for 24-hours per day or less, and where sleeping accommodations are provided.

FUMIGANT. A substance which by itself or in combination with any other substance emits or liberates a gas, fume or vapor utilized for the destruction or control of insects, fungi, vermin, germs, rats or other pests, and shall be distinguished from insecticides and disinfectants which are essentially effective in the solid or liquid phases. Examples are methyl bromide, ethylene dibromide, hydrogen cyanide, carbon disulfide and sulfur fluoride.

FUMIGATION. The utilization within an enclosed space of a fumigant in concentrations that are hazardous or acutely toxic to humans.

FURNACE CLASS A. An oven or furnace that has heat utilization equipment operating at approximately atmospheric pressure wherein there is a potential explosion or fire hazard that could be occasioned by the presence of flammable volatiles or combustible materials processed or heated in the furnace.

Note: Such flammable volatiles or combustible materials can, for instance, originate from the following:

1. Paints, powders, inks, and adhesives from finishing processes, such as dipped, coated, sprayed and impregnated materials.
2. The substrate material.
3. Wood, paper and plastic pallets, spacers or packaging materials.
4. Polymerization or other molecular rearrangements.

Potentially flammable materials, such as quench oil, waterborne finishes, cooling oil or cooking oils, that present a hazard are ventilated according to Class A standards.

FURNACE CLASS B. An oven or furnace that has heat utilization equipment operating at approximately atmospheric pressure wherein there are no flammable volatiles or combustible materials being heated.

FURNACE CLASS C. An oven or furnace that has a potential hazard due to a flammable or other special atmosphere being used for treatment of material in process. This type of furnace can use any type of heating system and includes a special atmosphere supply system. Also included in the Class C classification are integral quench furnaces and molten salt bath furnaces.

FURNACE CLASS D. An oven or furnace that operates at temperatures from above ambient to over 5,000°F (2760°C) and at pressures normally below atmospheric using any type of heating system. These furnaces can include the use of special processing atmospheres.

GAS CABINET. A fully enclosed, ventilated, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.

GAS DETECTION SYSTEM. A system or portion of a combination system that utilizes one or more stationary sensors to detect the presence of a specified gas at a specified concentration and initiate one or more responses required by this code, such as notifying a responsible person, activating an alarm signal, or activating or deactivating equipment. A self-contained gas detection and alarm device is not classified as a gas detection system.

GAS ROOM. A separately ventilated, fully enclosed room in which only compressed gases and associated equipment and supplies are stored or used.

GAS ROOM, HYDROGEN FUEL. See “Hydrogen fuel gas room.”

GASEOUS HYDROGEN SYSTEM. An assembly of piping, devices and apparatus designed to generate, store, contain, distribute or transport a nontoxic, gaseous hydrogen-containing mixture having not less than 95-percent hydrogen

gas by volume and not more than 1-percent oxygen by volume. Gaseous hydrogen systems consist of items such as compressed gas containers, reactors and appurtenances, including pressure regulators, pressure relief devices, manifolds, pumps, compressors and interconnecting piping and tubing and controls.

GLOVE BOX. A sealed enclosure in which items inside the box are handled exclusively using long gloves sealed to ports in the enclosure.

[BE] GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENING. An emergency escape and rescue opening located such that the bottom of the clear opening is not more than 44 inches (1118 mm) above or below the finished ground level adjacent to the opening.

[BG] GRADE PLANE. A reference plane representing the average of finished ground level adjoining the building at exterior walls. Where the finished ground level slopes away from the exterior walls, the reference plane shall be established by the lowest points within the area between the building and the lot line or, where the lot line is more than 6 feet (1829 mm) from the building, between the building and a point 6 feet (1829 mm) from the building.

[BE] GRANDSTAND. Tiered seating supported on a dedicated structural system and two or more rows high and is not a building element (see “Bleachers”).

GROUP HOME. *Group Home means a facility which provides 24-hour care and supervision to children, provides services specified in this chapter to a specific client group, and maintains a structured environment, with such services provided at least in part by staff employed by the licensee. The care and supervision provided by a group home shall be nonmedical except as permitted by Welfare and Institutions Code Section 17736(b). Since small family and foster family homes, by definition, care for six or fewer children only, any facility providing 24-hour care for seven or more children must be licensed as a group home.*

[BE] GUARD. A building component or a system of building components located at or near the open sides of elevated walking surfaces that minimizes the possibility of a fall from the walking surface to a lower level.

[BG] GUESTROOM. A room used or intended to be used by one or more guests for living or sleeping purposes.

[BS] GYPSUM BOARD. Gypsum wallboard, gypsum sheathing, gypsum base for gypsum veneer plaster, exterior gypsum soffit board, predecorated gypsum board or water-resistant gypsum backing board complying with the standards listed in Tables 2506.2 and 2507.2 and Chapter 35 of the *California Building Code*.

[BG] HABITABLE SPACE. A space in a building for living, sleeping, eating or cooking. Bathrooms, toilet rooms, closets, halls, storage or utility spaces and similar areas are not considered habitable spaces.

HALOGENATED EXTINGUISHING SYSTEM. A fire-extinguishing system using one or more atoms of an element from the halogen chemical series: fluorine, chlorine, bromine and iodine.

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HANDLING. The deliberate transport by any means to a point of storage or use.

[BE] HANDRAIL. A horizontal or sloping rail intended for grasping by the hand for guidance or support.

HAZARDOUS MATERIALS. Those chemicals or substances which are physical hazards or health hazards as defined and classified in this chapter, whether the materials are in usable or waste condition.

HAZARDOUS PRODUCTION MATERIAL (HPM). A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes which have, as their end product, materials that are not hazardous.

HEALTH HAZARD. A classification of a chemical for which there is statistically significant evidence that acute or chronic health effects are capable of occurring in exposed persons. The term “health hazard” includes chemicals that are toxic, highly toxic and corrosive.

HEAT DETECTOR. See “Detector, heat.”

[BG] HEIGHT, BUILDING. The vertical distance from grade plane to the average height of the highest roof surface.

HELIPORT. An area of land or water or a structural surface that is used, or intended for use, for the landing and taking off of helicopters, and any appurtenant areas which are used, or intended for use, for heliport buildings and other heliport facilities.

HELISTOP. The same as “Heliport,” except that fueling, defueling, maintenance, repairs or storage of helicopters is not permitted.

HI-BOY. A cart used to transport hot roofing materials on a roof.

HIGHLY TOXIC. A material which produces a lethal dose or lethal concentration which falls within any of the following categories:

1. A chemical that has a median lethal dose (LD₅₀) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD₅₀) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC₅₀) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume or dust, when administered by continuous inhalation for one hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

Mixtures of these materials with ordinary materials, such as water, might not warrant classification as highly toxic. While this system is basically simple in application, any hazard evaluation that is required for the precise categoriza-

tion of this type of material shall be performed by experienced, technically competent persons.

HIGHLY VOLATILE LIQUID. A liquefied compressed gas with a boiling point of less than 68°F (20°C).

HIGH-PILED COMBUSTIBLE STORAGE. Storage of combustible materials in closely packed piles or combustible materials on pallets, in racks or on shelves where the top of storage is greater than 12 feet (3658 mm) in height. Where required by the fire code official, high-piled combustible storage also includes certain high-hazard commodities, such as rubber tires, Group A plastics, flammable liquids, idle pallets and similar commodities, where the top of storage is greater than 6 feet (1829 mm) in height.

HIGH-PILED STORAGE AREA. An area within a building which is designated, intended, proposed or actually used for high-piled combustible storage, including operating aisles.

[BG] HIGH-RISE BUILDING. *In other than Group I-2 occupancies, “high-rise buildings” as used in this code:*

Existing high-rise structure. A high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.

High-rise structure. Every building of any type of construction or occupancy having floors used for human occupancy located more than 75 feet above the lowest floor level having building access (see Section 403), except buildings used as hospitals as defined in Health and Safety Code Section 1250.

New high-rise building. A high-rise structure, the construction of which is commenced on or after July 1, 1974. For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Unless all provisions of this section have been met, the construction of such buildings shall commence on or before January 1, 1976.

New high-rise structure. A high-rise structure, the construction of which is commenced on or after July 1, 1974.

HIGH-VOLTAGE TRANSMISSION LINE. An electrical power transmission line operating at or above 66 kilovolts.

HIGHWAY. Any public street, public alley or public road including a privately financed, constructed or maintained road that is regularly and openly traveled by the general public (27 CFR).

[A] HISTORIC BUILDINGS. Any building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing by the state historic preservation officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a national register, state designated or locally designated historic district.

HOGGED MATERIALS. Wood waste materials produced from the lumber production process.

HOLDING FACILITY. *A detention or correctional facility or area where inmates, staff and public are not housed but are restrained.*

[M] HOOD. An air-intake device used to capture by entrapment, impingement, adhesion or similar means, grease and similar contaminants before they enter a duct system.

Type I. A kitchen hood for collecting and removing grease vapors and smoke.

Type II. A general kitchen hood for collecting and removing steam vapor, heat, odors and products of combustion.

[BF] HORIZONTAL ASSEMBLY. A fire-resistance-rated floor or roof assembly of materials designed to restrict the spread of fire in which continuity is maintained.

[BE] HORIZONTAL EXIT. An exit component consisting of fire-resistance-rated construction and opening protectives intended to compartmentalize portions of a building thereby creating refuge areas that afford safety from fire and smoke from the area of fire origin.

[BG] HOSPITALS AND PSYCHIATRIC HOSPITALS. Facilities that provide care or treatment for the medical, psychiatric, obstetrical or surgical treatment of inpatient care recipients that are incapable of self-preservation *or classified as non-ambulatory or bedridden.*

HOT WORK. Operations including cutting, welding, Thermit welding, brazing, soldering, grinding, thermal spraying, thawing pipe, installation of torch-applied roof systems or any other similar activity.

HOT WORK AREA. The area exposed to sparks, hot slag, radiant heat, or convective heat as a result of the hot work.

HOT WORK EQUIPMENT. Electric or gas welding or cutting equipment used for hot work.

HOT WORK PERMITS. Permits issued by the responsible person at the facility under the hot work permit program permitting welding or other hot work to be done in locations referred to in Section 3503.3 and prepermitted by the fire code official.

HOT WORK PROGRAM. A permitted program, carried out by approved facilities-designated personnel, allowing them to oversee and issue permits for hot work conducted by their personnel or at their facility. The intent is to have trained, on-site, responsible personnel ensure that required hot work safety measures are taken to prevent fires and fire spread.

HOUSING UNIT *is an area intended to lodge inmates on a 24-hour basis where accommodations are provided for sleeping.*

HPM. See “Hazardous Production Material.”

HPM FACILITY. See “Semiconductor fabrication facility.”

HPM ROOM. A room used in conjunction with or serving a Group H-5 occupancy, where HPM is stored or used and which is classified as a Group H-2, H-3 or H-4 occupancy.

HYDROGEN FUEL GAS ROOM. A room or space that is intended exclusively to house a gaseous hydrogen system.

HYDROGEN-FUELED VEHICLES. *Hydrogen-fueled vehicles are motor vehicles having compressed hydrogen fuel storage tanks on board and using hydrogen fuel directly or indirectly for the motor vehicle propulsion. Hydrogen-fueled vehicles include fuel cell electric vehicles, battery electric vehicles with fuel cell range extender and internal combustion engine vehicles.*

IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH). The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It generally is expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m³). Where adequate data do not exist for precise establishment of IDLH concentrations, an independent certified industrial hygienist, industrial toxicologist, appropriate regulatory agency or other source approved by the fire code official shall make such determination.

IMPAIRMENT COORDINATOR. The person responsible for the maintenance of a particular fire protection system.

[BG] INCAPABLE OF SELF-PRESERVATION. Persons who, because of age, physical limitations, mental limitations, chemical dependency or medical treatment, cannot respond as an individual to an emergency situation.

INCOMPATIBLE MATERIALS. Materials that, when mixed, have the potential to react in a manner which generates heat, fumes, gases or byproducts which are hazardous to life or property.

INERT GAS. A gas that is capable of reacting with other materials only under abnormal conditions such as high temperatures, pressures and similar extrinsic physical forces. Within the context of the code, inert gases do not exhibit either physical or health hazard properties as defined (other than acting as a simple asphyxiant) or hazard properties other than those of a compressed gas. Some of the more common inert gases include argon, helium, krypton, neon, nitrogen and xenon.

INFANT. *For the purpose of these regulations, shall mean any child who because of age only, is unable to walk and requires the aid of another person to evacuate the building. In no case shall the term “infant” mean a child 2 years of age or older.*

INFLATABLE AMUSEMENT DEVICE. *A device made of flexible fabric or other combustible materials that is inflated by one or more air-blowers providing internal air pressure to maintain its shape. Such a device is designed for recreational activities that allow occupants to bounce, climb, slide, negotiate an obstacle course or participate in interactive play.*

INHABITED BUILDING. A building regularly occupied in whole or in part as a habitation for people, or any place of religious worship, schoolhouse, railroad station, store or other structure where people are accustomed to assemble,

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except any building or structure occupied in connection with the manufacture, transportation, storage or use of explosive materials.

INITIATING DEVICE. A system component that originates transmission of a change-of-state condition, such as in a smoke detector, manual fire alarm box, or supervisory switch.

INSECTICIDAL FOGGING. The utilization of insecticidal liquids passed through fog-generating units where, by means of pressure and turbulence, with or without the application of heat, such liquids are transformed and discharged in the form of fog or mist blown into an area to be treated.

INTEGRATED TESTING (FIRE PROTECTION AND LIFE SAFETY SYSTEM). A testing procedure to establish the operational status, interaction and coordination of two or more fire protection and safety systems.

[BE] INTERIOR EXIT RAMP. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

[BE] INTERIOR EXIT STAIRWAY. An exit component that serves to meet one or more means of egress design requirements, such as required number of exits or exit access travel distance, and provides for a protected path of egress travel to the exit discharge or public way.

[BG] INTERIOR FINISH. Interior finish includes interior wall and ceiling finish and interior floor finish.

[BG] INTERIOR FLOOR-WALL BASE. Interior floor finish trim used to provide a functional or decorative border at the intersection of walls and floors.

[BG] INTERIOR WALL AND CEILING FINISH. The exposed interior surfaces of buildings, including but not limited to: fixed or movable walls and partitions; toilet room privacy partitions; columns; ceilings; and interior wainscoting, paneling or other finish applied structurally or for decoration, acoustical correction, surface insulation, structural fire resistance or similar purposes, but not including trim.

IRRITANT. A chemical which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of CPSC 16 CFR Part 1500.41 for an exposure of four or more hours or by other appropriate techniques, it results in an empirical score of 5 or more. A chemical is classified as an eye irritant if so determined under the procedure listed in CPSC 16 CFR Part 1500.42 or other approved techniques.

[A] JURISDICTION. The governmental unit that has adopted this code.

KEY BOX. A secure device with a lock operable only by a fire department master key, and containing building entry keys and other keys that may be required for access in an emergency.

[A] LABELED. Equipment, materials or products to which have been affixed a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, approved agency or other organization concerned with product evaluation that maintains periodic inspection of the production of such labeled items and whose labeling indicates either that the equipment, material or product meets identified standards or has been tested and found suitable for a specified purpose.

LABORATORY. [SFM] A room, building or area where the use and storage of hazardous materials are utilized for testing, analysis, instruction, research or developmental activities.

LABORATORY SUITE. [SFM] A laboratory suite is a Group L occupancy space within a building or structure, which may include multiple laboratories, offices, storage, equipment rooms or similar support functions, where the aggregate quantities of hazardous materials stored and used do not exceed the quantities set forth in the California Building Code Table 453.7.3.1 (see the California Building Code Section 453).

LEVEL OF EXIT DISCHARGE. See “Exit discharge, level of.”

LIFE SAFETY SYSTEMS. Systems, devices and equipment that enhance or facilitate evacuation, smoke control, compartmentation and/or isolation.

LIMITED SPRAYING SPACE. An area in which operations for touch-up or spot painting of a surface area of 9 square feet (0.84 m²) or less are conducted.

LIQUEFIED NATURAL GAS (LNG). A fluid in the liquid state composed predominantly of methane and which may contain minor quantities of ethane, propane, nitrogen or other components normally found in natural gas.

LIQUEFIED PETROLEUM GAS (LP-gas). A material which is composed predominantly of the following hydrocarbons or mixtures of them: propane, propylene, butane (normal butane or isobutane) and butylenes.

LIQUID. A material having a melting point that is equal to or less than 68°F (20°C) and a boiling point which is greater than 68°F (20°C) at 14.7 pounds per square inch absolute (psia) (101 kPa). Where not otherwise identified, the term “liquid” includes both flammable and combustible liquids.

LIQUID OXYGEN AMBULATORY CONTAINER. A container used for liquid oxygen not exceeding 0.396 gallons (1.5 liters) specifically designed for use as a medical device as defined by 21 USC Chapter 9 that is intended for portable therapeutic use and to be filled from its companion base unit, a liquid oxygen home care container.

LIQUID OXYGEN HOME CARE CONTAINER. A container used for liquid oxygen not exceeding 15.8 gallons (60 liters) specifically designed for use as a medical device as defined by 21 USC Chapter 9 that is intended to deliver gaseous oxygen for therapeutic use in a home environment.

LIQUID STORAGE ROOM. A room classified as a Group H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

LIQUID STORAGE WAREHOUSE. A building classified as a Group H-2 or H-3 occupancy used for the storage of flammable or combustible liquids in a closed condition.

[A] LISTED. Equipment, materials, products or services included in a list published by an organization acceptable to the fire code official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material, product or service meets identified standards or has been tested and found suitable for a specified purpose.

For applications listed in Section 1.11 regulated by the Office of the State Fire Marshal, “listed” shall also mean equipment or materials accepted by the State Fire Marshal as conforming to the provisions of the State Fire Marshal’s regulations and which are included in a list published by the State Fire Marshal.

LOCKDOWN. An emergency situation, in other than a Group I-3 occupancy, requiring that the occupants be sheltered and secured in place within a building when normal evacuation would put occupants at risk.

LODGING HOUSE is any building or portion thereof containing not more than five guest rooms where rent is paid in money, goods, labor or otherwise.

LONGITUDINAL FLUE SPACE. See “Flue spaces—longitudinal.”

[A] LOT. A portion or parcel of land considered as a unit.

[A] LOT LINE. A line dividing one lot from another, or from a street or any public place.

[BE] LOW ENERGY POWER-OPERATED DOOR. Swinging, sliding or folding door which opens automatically upon an action by a pedestrian such as pressing a push plate or waving a hand in front of a sensor. The door closes automatically, and operates with decreased forces and decreased speeds. See also “Power-assisted door” and “Power-operated door.”

LOWER EXPLOSIVE LIMIT (LEL). See “Lower flammable limit.”

LOWER FLAMMABLE LIMIT (LFL). The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source. The LFL is sometimes referred to as LEL or lower explosive limit.

LOW-PRESSURE TANK. A storage tank designed to withstand an internal pressure greater than 0.5 pound per square inch gauge (psig) (3.4 kPa) but not greater than 15 psig (103.4 kPa).

LP-GAS CONTAINER. Any vessel, including cylinders, tanks, portable tanks and cargo tanks, used for transporting or storing LP-gases.

MAGAZINE. A building, structure or container, other than an operating building, approved for storage of explosive materials.

Indoor. A portable structure, such as a box, bin or other container, constructed as required for Type 2, 4 or 5 maga-

zines in accordance with NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555 so as to be fire resistant and theft resistant.

Type 1. A permanent structure, such as a building or igloo, that is bullet resistant, fire resistant, theft resistant, weather resistant and ventilated in accordance with the requirements of NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555.

Type 2. A portable or mobile structure, such as a box, skid-magazine, trailer or semitrailer, constructed in accordance with the requirements of NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555 that is fire resistant, theft resistant, weather resistant and ventilated. If used outdoors, a Type 2 magazine is also bullet resistant.

Type 3. A fire resistant, theft resistant and weather resistant “day box” or portable structure constructed in accordance with NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555 used for the temporary storage of explosive materials.

Type 4. A permanent, portable or mobile structure such as a building, igloo, box, semitrailer or other mobile container that is fire resistant, theft resistant and weather resistant and constructed in accordance with NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555.

Type 5. A permanent, portable or mobile structure such as a building, igloo, box, bin, tank, semitrailer, bulk trailer, tank trailer, bulk truck, tank truck or other mobile container that is theft resistant, which is constructed in accordance with NFPA 495, NFPA 1124 or DOTy 27 CFR Part 555.

MAGNESIUM. The pure metal and alloys, of which the major part is magnesium.

MALL. See “Covered mall building.”

MANUAL FIRE ALARM BOX. A manually operated device used to initiate an alarm signal.

MANUAL STOCKING METHODS. Stocking methods utilizing ladders or other nonmechanical equipment to move stock.

MARINA. Any portion of the ocean or inland water, either naturally or artificially protected, for the mooring, servicing or safety of vessels and shall include artificially protected works, the public or private lands ashore, and structures or facilities provided within the enclosed body of water and ashore for the mooring or servicing of vessels or the servicing of their crews or passengers.

MARINE MOTOR FUEL-DISPENSING FACILITY. That portion of property where flammable or combustible liquids or gases used as fuel for watercraft are stored and dispensed from fixed equipment on shore, piers, wharves, floats or barges into the fuel tanks of watercraft and shall include all other facilities used in connection therewith.

MASS TIMBER. *Structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross section dimensions of Type IV construction.*

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA. The maximum amount of a hazardous material allowed to be stored or used within a control area inside

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a building or an outdoor control area. The maximum allowable quantity per control area is based on the material state (solid, liquid or gas) and the material storage or use conditions.

[BE] MEANS OF EGRESS. A continuous and unobstructed path of vertical and horizontal egress travel from any occupied portion of a building or structure to a public way. A means of egress consists of three separate and distinct parts: the exit access, the exit and the exit discharge.

MECHANICAL STOCKING METHODS. Stocking methods utilizing motorized vehicles or hydraulic jacks to move stock.

MECHANICAL-ACCESS ENCLOSED PARKING GARAGE. *An enclosed parking garage which employs parking machines, lifts, elevators or other mechanical devices for vehicle moving from and to street level and in which public occupancy in the garage is prohibited in all areas except the vehicle access bay.*

[BG] MEDICAL CARE. Care involving medical or surgical procedures, nursing or for psychiatric purposes.

MEMBRANE STRUCTURE. An air-inflated, air-supported, cable or frame-covered structure as defined by the *California Building Code* and not otherwise defined as a tent. See Chapter 31 of the *California Building Code*.

[BF] MEMBRANE-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor-ceiling, roof-ceiling or wall assembly, one or more penetrating items installed into or passing through the breach in one side of the assembly and the materials or devices, or both, installed to resist the spread of fire into the assembly for a prescribed period of time.

[BE] MERCHANDISE PAD. A merchandise pad is an area for display of merchandise surrounded by aisles, permanent fixtures or walls. Merchandise pads contain elements such as nonfixed and moveable fixtures, cases, racks, counters and partitions as indicated in Section 105.2 of the *California Building Code* from which customers browse or shop.

METAL HYDRIDE. A generic name for compounds composed of metallic element(s) and hydrogen.

METAL HYDRIDE STORAGE SYSTEM. A closed system consisting of a group of components assembled as a package to contain metal-hydrogen compounds for which there exists an equilibrium condition where the hydrogen-absorbing metal alloy(s), hydrogen gas and the metal-hydrogen compound(s) coexist and where only hydrogen gas is released from the system in normal use.

[BG] MEZZANINE. An intermediate level or levels between the floor and ceiling of any story and in accordance with Section 505 of the *California Building Code*.

MISCELLA. A mixture, in any proportion, of the extracted oil or fat and the extracting solvent.

MOBILE FUELING. The operation of dispensing liquid and gaseous fuels from tank vehicles into the fuel tanks of motor vehicles. Mobile fueling may also be known by the terms "Mobile fleet fueling," and for conventional liquid fuels as "Wet fueling" and "Wet hosing."

MORTAR. See Section 5608.

MULTIPLE-STATION ALARM DEVICE. Two or more single-station alarm devices that can be interconnected such that actuation of one causes all integral or separate audible alarms to operate. A multiple-station alarm device can consist of one single-station alarm device having connections to other detectors or to a manual fire alarm box.

MULTIPLE-STATION SMOKE ALARM. Two or more single-station alarm devices that are capable of interconnection such that actuation of one causes the appropriate alarm signal to operate in all interconnected alarms.

NESTING. A method of securing flat-bottomed compressed gas cylinders upright in a tight mass using a contiguous three-point contact system whereby all cylinders within a group have not less than three points of contact with other cylinders, walls or bracing.

NET EXPLOSIVE WEIGHT (net weight). The weight of explosive material expressed in pounds. The net explosive weight is the aggregate amount of explosive material contained within buildings, magazines, structures or portions thereof, used to establish quantity-distance relationships.

NON-ACCESSIBLE AREA. *An enclosed area that creates a cavity by the application of any construction feature and/or building materials. This area shall be recognized by the enforcing agency as a separation between the non-accessible space and any adjacent, occupied space of the building.*

NONAMBULATORY PERSONS. *Persons unable to leave a building unassisted under emergency conditions. It includes, but is not limited to, persons who depend on mechanical aids such as crutches, walkers and wheelchairs and any person who is unable to physically and mentally respond to a sensory signal approved by the State Fire Marshal or an oral instruction relating to fire danger.*

The determination of ambulatory or nonambulatory status of persons with developmental disabilities shall be made by the Director of Social Services or his or her designated representative, in consultation with the Director of Developmental Services or his or her designated representative. The determination of ambulatory or nonambulatory status of all other disabled persons placed after January 1, 1984, who are not developmentally disabled shall be made by the Director of Social Services or his or her designated representative.

NONCOMBUSTIBLE. [SFM] *Noncombustible as applied to building construction material means a material which, in the form in which it is used, is either one of the following:*

- 1. Material of which no part will ignite and burn when subjected to fire. Any material passing ASTM E136 shall be considered noncombustible.*
- 2. Material having a structural base of noncombustible material as defined in Item 1 above, with a surfacing material not over $\frac{1}{8}$ inch (3.2 mm) thick which has a flame-spread index of 50 or less.*

"Noncombustible" does not apply to surface finish materials. Material required to be noncombustible for reduced clearances to flues, heating appliances or other sources of high temperature shall refer to material conforming to Item 1. No material shall be classed as noncombustible which is subject to increase in combustibility or flame-spread index,

beyond the limits herein established, through the effects of age, moisture or other atmospheric condition.

NON-PATIENT CARE SUITE. In Group I-2 or I-2.1 occupancies, a group of rooms or spaces within a suite for use as administrative, business and professional offices.

NORMAL TEMPERATURE AND PRESSURE (NTP). A temperature of 70°F (21°C) and a pressure of 1 atmosphere [14.7 psia (101 kPa)].

[BE] NOSING. The leading edge of treads of stairs and of landings at the top of stairway flights.

NOTIFICATION ZONE. See “Zone, notification.”

NUISANCE ALARM. An alarm caused by mechanical failure, malfunction, improper installation or lack of proper maintenance, or an alarm activated by a cause that cannot be determined.

[BG] NURSING HOMES. Facilities that provide care, including both intermediate care facilities and skilled nursing facilities, where any of the persons are incapable of self-preservation or classified as nonambulatory or bedridden..

OCCUPANCY CLASSIFICATION. For the purposes of this code, certain occupancies are defined as follows:

[BG] Group A, Assembly. Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions; recreation, food or drink consumption; or awaiting transportation or *Motion Picture and Television Production Studio Sound Stages, Approved Production Facilities and production locations. Any building or structure or portion thereof used or intended to be used for the showing of motion pictures when an admission fee is charged and when such building or structure is open to the public and has a capacity of 10 or more persons.*

[BG] Accessory with places of religious worship. Accessory religious educational rooms and religious auditoriums with occupant loads of less than 100 per room or space are not considered separate occupancies.

[BG] Assembly Group A-1. Group A occupancy includes assembly uses, usually with fixed seating, intended for the production and viewing of performing arts or motion pictures including, but not limited to:

*Motion picture and television production studio
Sound Stages, Approved Production Facilities
and production locations. (With live audiences).*

Motion picture theaters

Symphony and concert halls

Television and radio studios admitting an audience

Theaters

[BG] Assembly Group A-2. Group A-2 occupancy includes assembly uses intended for food and/or drink consumption including, but not limited to:

Banquet halls

Casinos (gaming areas)

Night clubs

Restaurants, cafeterias and similar dining facilities (including associated commercial kitchens)

Taverns and bars

[BG] Assembly Group A-3. Group A-3 occupancy includes assembly uses intended for worship, recreation or amusement and other assembly uses not classified elsewhere in Group A, including, but not limited to:

Amusement arcades

Art galleries

Bowling alleys

Community halls

Courtrooms

Dance halls (not including food or drink consumption)

Exhibition halls

Funeral parlors

Greenhouses with public access for the conservation and exhibition of plants

Gymnasiums (without spectator seating)

Indoor swimming pools (without spectator seating)

Indoor tennis courts (without spectator seating)

Lecture halls

Libraries

Museums

Places of religious worship

Pool and billiard parlors

Waiting areas in transportation terminals

[BG] Assembly Group A-4. Group A-4 occupancy includes assembly uses intended for viewing of indoor sporting events and activities with spectator seating including, but not limited to:

Arenas

Skating rinks

Swimming pools

Tennis courts

[BG] Assembly Group A-5. Group A-5 occupancy includes assembly uses intended for participation in or viewing outdoor activities including, but not limited to:

Amusement park structures

Bleachers

Fixed guideway transit systems. [SFM] Fixed guideway transit system buildings shall conform to the requirements of this code for their occupancy classification in addition to the provisions set forth in Section 443 of the California Building Code.

Grandstands

Stadiums

Subterranean spaces for winery facilities in natural or manmade caves. [SFM] For fire and life safety requirements, see Section 446 of the California Building Code.

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[BG] Associated with Group E occupancies. A room or space used for assembly purposes that is associated with a Group E occupancy is not considered a separate occupancy.

[BG] Small assembly spaces. The following rooms and spaces shall not be classified as assembly occupancies:

1. A room or space used for assembly purposes with an occupant load of less than 50 persons and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.
2. A room or space used for assembly purposes that is less than 750 square feet (70 m²) in area and accessory to another occupancy shall be classified as a Group B occupancy or as part of that occupancy.

[BG] Small buildings and tenant spaces. A building or tenant space used for assembly purposes with an occupant load of less than 50 persons shall be classified as a Group B occupancy.

[BG] Special amusement areas. Special amusement areas shall comply with Section 411 of the *California Building Code*.

[BG] Group B, Business. Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts. Business occupancies shall include, but not be limited to, the following:

Airport traffic control towers

Ambulatory care facilities *servicing five or fewer patients*
(see Section 308.3.3, *Institutional Group I-2.1* for facilities *servicing more than five patients*)

Animal hospitals, kennels and pounds

Banks

Barber and beauty shops

Car wash

Civic administration

Clinic-outpatient [*SFM*] (not classified as Group I-2.1)

Dry cleaning and laundries: pick-up and delivery stations and self-service

Educational occupancies for students above the 12th grade

Electronic data processing

Food processing establishments and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities not more than 2,500 square feet (232 m²) in area.

Laboratories: testing and research and [*SFM*] instruction.

Motor vehicle showrooms

Post offices

Print shops

Professional services (architects, attorneys, dentists, physicians, engineers, etc.)

Radio and television stations

Telephone exchanges

Training and skill development not in a school or academic program (This shall include, but not be limited to, tutoring centers, martial arts studios, gymnastics and similar uses regardless of the ages served, and where not classified as a Group A occupancy).

[BG] Airport traffic control towers. Airport traffic control towers shall comply with Section 412.2 of the *California Building Code*.

[BG] Ambulatory care facilities. Ambulatory care facilities shall comply with Section 422 of the *California Building Code*.

Group C (CAMPS, ORGANIZED). *An organized camp is a site with programs and facilities established for the primary purpose of providing an outdoor group living experience with social, spiritual, educational or recreational objectives, for five days or more during one or more seasons of the year. See California Building Code Section 450, Group C occupancy.*

[BG] Group E, Educational. Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, *more than six* persons at any one time for educational purposes through the 12th grade.

Exception: *A residence used as a home school for the children who normally reside at the residence. Such residences shall remain classified as Group R-2, or Group R-3 occupancies.*

[BG] Accessory to places of religious worship. Religious educational rooms and religious auditoriums, which are accessory to places of religious worship in accordance with Section 303.1.4 of the *California Building Code* and have occupant loads of less than 100 per room or space shall be classified as Group A-3 occupancies.

[BG] Group E, child-care facilities. This group includes buildings and structures or portions thereof occupied by more than *six* children *36 months* of age and older who receive educational, supervision or personal care services for *fewer* than 24 hours per day.

Exception: [*SFM*] *A child-care facility not otherwise classified as a Group R-3 occupancy, where occupants are not capable of responding to an emergency situation without physical assistance from the staff shall be classified as Group I-4. A maximum of five infants and toddlers are allowed in a Group E child care.*

[BG] Within places of worship. Rooms and spaces within places of worship providing such care during religious functions shall be classified as part of the primary occupancy *where not licensed for child-care purposes by the Department of Social Services.*

[BG] Storm shelters in Group E occupancies. Storm shelters shall be provided for Group E occupancies where required by Section 423.4 of the *California Building Code*.

[BG] Group F, Factory Industrial. Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H high-hazard or Group S storage occupancy.

[BG] Factory Industrial F-1 Moderate-hazard occupancy. Factory industrial uses that are not classified as Factory Industrial F-2 Low Hazard shall be classified as F-1 Moderate Hazard and shall include, but not be limited to, the following:

- Aircraft (manufacturing, not to include repair)
- Appliances
- Athletic equipment
- Automobiles and other motor vehicles
- Bakeries
- Beverages; over 16-percent alcohol content
- Bicycles
- Boats
- Brooms or brushes
- Business machines
- Cameras and photo equipment
- Canvas or similar fabric
- Carpets and rugs (includes cleaning)
- Clothing
- Construction and agricultural machinery
- Disinfectants
- Dry cleaning and dyeing
- Electric generation plants
- Electronics
- Energy storage systems (ESS) in dedicated-use buildings
- Engines (including rebuilding)
- Food processing and commercial kitchens not associated with restaurants, cafeterias and similar dining facilities more than 2,500 square feet (232 m²) in area.
- Furniture
- Hemp products
- Jute products
- Laundries
- Leather products
- Machinery
- Metals
- Millwork (sash and door)
- Motion picture and television production studio*
- Sound Stages, Approved Production Facilities*
- and production locations (without live audiences)*

Motion pictures and television filming (without spectators)

Musical instruments

Optical goods

Paper mills or products

Photographic film

Plastic products

Printing or publishing

Refuse incineration

Shoes

Soaps and detergents

Textiles

Tobacco

Trailers

Upholstering

Water/sewer treatment facilities

Wood; distillation

Woodworking (cabinet)

[BG] Aircraft manufacturing facilities. Aircraft manufacturing facilities shall comply with Section 412.6 of the *California Building Code*.

[BG] Factory Industrial F-2 Low-hazard Occupancy. Factory industrial uses involving the fabrication or manufacturing of noncombustible materials that, during finishing, packaging or processing do not involve a significant fire hazard, shall be classified as Group F-2 occupancies and shall include, but not be limited to, the following:

Beverages; up to and including 16-percent alcohol content

Brick and masonry

Ceramic products

Foundries

Glass products

Gypsum

Ice

Metal products (fabrication and assembly)

Group H, High-hazard. High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas complying with Section 5003.8.3, based on the maximum allowable quantity limits for control areas set forth in Tables 5003.1.1(1) and 5003.1.1(2). Hazardous occupancies are classified in Groups H-1, H-2, H-3, H-4 and H-5 and shall be in accordance with this code and the requirements of Section 415 of the *California Building Code*. Hazardous materials stored or used on top of roofs or canopies shall be classified as outdoor storage or use and shall comply with this code.

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High-hazard Group H-1. Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:

Detonable pyrophoric materials

Explosives:

Division 1.1

Division 1.2

Division 1.3

Division 1.4

Division 1.5

Division 1.6

Organic peroxides, unclassified detonable

Oxidizers, Class 4

Unstable (reactive) materials, Class 3 detonable, and Class 4

High-hazard Group H-2. Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103.4 kPa)

Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3 of the *California Building Code*

Cryogenic fluids, flammable

Flammable gases

Organic peroxides, Class I

Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge (103.4 kPa)

Pyrophoric liquids, solids and gases, nondetonable

Unstable (reactive) materials, Class 3, nondetonable

Water-reactive materials, Class 3

High-hazard Group H-3. Buildings and structures containing materials that readily support combustion or that pose a physical hazard shall be classified as Group H-3. Such materials shall include, but not be limited to, the following:

Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less

Combustible fibers, other than densely packed baled cotton, where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3 of the *California Building Code*

Consumer fireworks, 1.4G (Class C, Common)

Cryogenic fluids, oxidizing

Flammable solids

Organic peroxides, Class II and III

Oxidizers, Class 2

Oxidizers, Class 3, that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103 kPa) or less

Oxidizing gases

Unstable (reactive) materials, Class 2

Water-reactive materials, Class 2

High-hazard Group H-4. Buildings and structures containing materials that are health hazards shall be classified as Group H-4. Such materials shall include, but not be limited to, the following:

Corrosives

Highly toxic materials

Toxic materials

High-hazard Group H-5. Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 5003.1.1(1) and 5003.1.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.11 of the *California Building Code*.

Multiple hazards. Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.

Occupancies containing explosives not classified as H-1. The following occupancies containing explosive materials shall be classified as follows:

1. Division 1.3 explosive materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire hazard to mass explosion hazard shall be allowed in Group H-2 occupancies.
2. Articles, including articles packaged for shipment, that are not regulated as a Division 1.4 explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.

Uses other than Group H. The storage, use or handling of hazardous materials as described in one or more of the following items shall not cause the occupancy to be classified as Group H, but it shall be classified as the occupancy that it most nearly resembles:

1. Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Chapter 24 of this code and Section 416 of the *California Building Code*.
2. Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to Chapter 57.
3. Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.
4. Cleaning establishments that utilize combustible liquid solvents having a flash point of 140°F (60°C) or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers in accordance with Section 707 of the *California Building Code* or 1-hour horizontal assemblies in accordance with Section 711 of the *California Building Code*, or both.
5. Cleaning establishments that utilize a liquid solvent having a flash point at or above 200°F (93°C).
6. Liquor stores and distributors without bulk storage.
7. Refrigeration systems.
8. The storage or utilization of materials for agricultural purposes on the premises.
9. Stationary storage battery systems installed in accordance with Section 1207.
10. Corrosive personal or household products in their original packaging used in retail display.
11. Commonly used corrosive building materials.
12. Buildings and structures occupied for aerosol product storage, aerosol cooking spray products or plastic aerosol 3 products shall be classified as Group S-1, provided that such buildings conform to the requirements of Chapter 51.
13. Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 5003.8.3.5.1.
14. The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided that such storage conforms to the quantity limits and requirements of this code.
15. Stationary fuel cell power systems installed in accordance with this code.
16. Capacitor energy storage systems in accordance with this code.
17. *[SFM] Group L occupancies as defined in Section 453 of the California Building Code.*
18. Distilling or brewing of beverages conforming to the requirements of this code.
19. The storage of beer, distilled spirits and wines in barrels and casks conforming to the requirements of this code.

[BG] Group I, Institutional. Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self-preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-2, *I-2.1*, I-3 or I-4. *Restraint shall not be permitted in any building except in Group I-2 occupancies constructed for such use in accordance with Section 407.1.1 of the California Building Code and Group I-3 occupancies constructed for such use, in accordance with Section 408.1.2 of the California Building Code.*

Where occupancies house both ambulatory and nonambulatory persons, the more restrictive requirements shall apply.

[BG] Institutional Group I-1. *Not used. (See Group R-2.1 or Section 310.1 of the California Building Code)*

[BG] Institutional Group I-2. Institutional Group I-2 occupancy shall include buildings and structures used for medical care on a 24-hour basis for more than five persons who are not capable of self-preservation or classified as nonambulatory or bedridden. This group shall include, but not be limited to, the following:

- Detoxification facilities
- Hospitals
- Nursing homes
- Psychiatric hospitals

Institutional Group I-2.1. *A healthcare facility that receives persons for outpatient medical care that may render the patient incapable of unassisted self-preservation and where each tenant space accommodates more than five such patients.*

[BG] Five or fewer persons receiving medical care.

A facility with five or fewer persons receiving medical care shall be classified as Group R-3.1 or shall comply with the *California Residential Code* provided that an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or with Section *R313* of the *California Residential Code*.

[BG] Institutional Group I-3. Institutional Group I-3 occupancy shall include buildings or portions of buildings and structures which are inhabited by one or more

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persons who are under restraint or security. A Group I-3 facility is occupied by persons who are generally incapable of self-preservation due to security measures not under the occupants' control *which includes persons restrained*. This group shall include, but not be limited to, the following:

- Correctional centers
- Courthouse holding facilities*
- Detention centers
- Detention treatment rooms*
- Jails
- Juvenile halls*
- Prerelease centers
- Prisons
- Reformatories
- Secure interview rooms*
- Temporary holding facilities*

Buildings of Group I-3 shall be classified as one of the following occupancy conditions and shall comply with Section 408 of the *California Building Code*:

[BG] Condition 1. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and other spaces where access or occupancy is permitted to the exterior via means of egress without restraint. A Condition 1 facility is permitted to be constructed as Group R.

[BG] Condition 2. This occupancy condition shall include buildings in which free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments. Egress to the exterior is impeded by locked exits.

[BG] Condition 3. This occupancy condition shall include buildings in which free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping units and group activity spaces, where egress is impeded by remote-controlled release of means of egress from such smoke compartment to another smoke compartment.

[BG] Condition 4. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Remote-controlled release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

[BG] Condition 5. This occupancy condition shall include buildings in which free movement is restricted from an occupied space. Staff-controlled manual release is provided to permit movement from sleeping units, activity spaces and other occupied areas within the smoke compartment to other smoke compartments.

Condition 6. This occupancy condition shall include buildings containing only one temporary holding facility with five or less persons under restraint or security where the building is protected throughout with a monitored automatic sprinkler system installed in accordance with Section 903.3.1.1 and where the temporary holding facility is protected throughout with an automatic fire alarm system with notification appliances. A Condition 6 building shall be permitted to be classified as a Group B occupancy.

Condition 7. This occupancy condition shall include buildings containing only one temporary holding facility with nine or less persons under restraint or security where limited to the first or second story, provided the building complies with Section 408.1.2.6 of the *California Building Code*. A Condition 7 building shall be permitted to be classified as a Group B occupancy.

Condition 8. This occupancy condition shall include buildings containing not more than four secure interview rooms located within the same fire area where not more than six occupants under restraint are located in the same fire area. A Condition 8 building shall be permitted to be classified as a Group B occupancy, provided the requirements in Section 408.1.2.7 of the *California Building Code* are met.

[BG] Institutional Group I-4, day care facilities. Institutional Group I-4 shall include buildings and structures occupied by more than six clients of any age who receive custodial care for fewer than 24 hours by persons other than parents or guardians; relatives by blood, marriage, or adoption; and in a place other than the home of the clients cared for. This group shall include, but not be limited to, the following:

Adult day care

Child care (*not classified as a Group E*)

Group L Laboratories. [SFM] Group L occupancy includes the use of a building or structure, or a portion thereof containing one or more laboratory suites as defined in Section 453 of the *California Building Code*.

[BG] Group M, Mercantile. Mercantile Group M occupancy includes, among others, the use of a building or structure or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public. Mercantile occupancies shall include, but not be limited to, the following:

Department stores

Drug stores

Greenhouses with public access that maintain plants for display and sale

Markets

Motor fuel-dispensing facilities

Retail or wholesale stores

Sales rooms

[BG] Motor fuel-dispensing facilities. Motor fuel-dispensing facilities shall comply with Section 406.7 of the *California Building Code*.

[BG] Quantity of hazardous materials. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored or displayed in a single control area of a Group M occupancy shall not exceed the quantities in Table 5704.3.4.1.

[BG] Group R, Residential. Residential Group R includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *California Residential Code* in accordance with Section 101.2 of the *California Building Code*. Group R occupancies not constructed in accordance with the *California Residential Code* as permitted by Sections 310.4.1 and 310.4.2 of the *California Building Code* shall comply with Section 420 of the *California Building Code*.

[BG] Residential Group R-1. Residential Group R-1 occupancies containing sleeping units where the occupants are primarily transient in nature, including:

Boarding houses (transient) with more than 10 occupants

Congregate residences (transient) with more than 10 occupants

Hotels (transient)

Motels (transient)

[BG] Residential Group R-2. Residential Group R-2 occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature, including:

Apartment houses

Large family child care

Small family child care

Congregate residences (nontransient) with more than 16 occupants

Boarding houses (nontransient)

Convents

Dormitories

Fraternities and sororities

Monasteries

Hotels (nontransient)

Live/work units

Motels (nontransient)

Vacation timeshare properties

Residential Group R-2.1. *Residential Group R-2.1 occupancies shall include buildings, structures or parts thereof housing clients, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services.*

This occupancy may contain more than six nonambulatory and/or bedridden clients. (See Appendix Chapter 4, Section 435 Special Provisions for Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 occupancy). This group shall include, but not be limited to, the following:

Assisted living facilities such as:

Residential Care Facilities

Residential Care Facilities for the Elderly (RCFEs)

Adult Residential Facilities

Congregate Living Health facilities

Group homes

Residential Care Facilities for the Chronically Ill

Congregate Living Health Facilities for the Terminally Ill

Social rehabilitation facilities such as:

Halfway houses

Community Correctional Centers

Community Treatment Programs

Work Furlough Programs

Alcoholism or drug abuse recovery or treatment facilities

Residential Group R-2.2 (CDCR Only). *Residential occupancies operated by CDCR in a community located facility that provides housing and community based program services for non-transient ambulatory participants in a non-licensed facility with 24/7 supervision Community Correctional Reentry Centers.*

[BG] Residential Group R-3. Residential Group R-3 occupancies where the occupants are primarily permanent in nature and not classified as Group R-1, R-2, R-2.1, R-2.2, R-3.1, R-4 or I, including:

Buildings that do not contain more than two dwelling units

Congregate residences (nontransient) with 16 or fewer occupants

Boarding houses (nontransient)

Convents

Dormitories

Fraternities and sororities

Monasteries

Congregate residences (transient) with 10 or fewer occupants

Boarding houses (transient)

Lodging houses (transient) with five or fewer guest-rooms and 10 or fewer occupants

Adult care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours.

Licensing categories that may use this classification include, but are not limited to:

Adult Day Programs

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Child-care facilities that provide accommodations for six or fewer clients of any age for less than 24 hours.

Licensing categories that may use this classification include, but are not limited to:

*Day-Care Center for Mildly Ill Children
Adult Day Programs
Infant Care Center
School Age Child Day-Care Center.*

Congregate residences (nontransient) with 16 or fewer occupants

Congregate residences (transient) with 10 or fewer occupants

Alcoholism or drug abuse recovery homes (ambulatory only)

Family Day-Care Homes that provide accommodations for 14 or fewer children, in the provider's own home for less than 24-hours.

Adult care and child-care facilities that are within a single-family home are permitted to comply with the California Residential Code.

[BG] Care facilities within a dwelling. Care facilities for five or fewer persons receiving care that are within a single-family dwelling are permitted to comply with the *California Residential Code* provided an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the *California Residential Code*.

[BG] Lodging houses. Owner-occupied lodging houses with five or fewer guestrooms and 10 or fewer total occupants shall be permitted to be constructed in accordance with the *California Residential Code* provided that an automatic sprinkler system is installed in accordance with Section 903.3.1.3 or Section P2904 of the *California Residential Code*.

Residential Group R-3.1. Residential Group R-3.1 occupancies may include facilities licensed by a governmental agency for a residentially based 24-hour care facility providing accommodations for six or fewer clients of any age. Clients may be classified as ambulatory, nonambulatory or bedridden. A Group R-3.1 occupancy shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in Appendix Chapter 4, Section 425, Special Provisions For Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 occupancy. This group may include:

*Adult Residential Facilities
Congregate Living Health Facilities
Intermediate Care Facilities for the Developmentally Disabled Habilitative
Intermediate Care Facilities for the Developmentally Disabled Nursing*

Nurseries for the full-time care of children under the age of six, but not including "infants" as defined in Chapter 2

*Residential Care Facilities for the Elderly (RCFEs)
Small Family Homes and Residential Care Facilities for the Chronically Ill*

Exception: Group Homes licensed by the Department of Social Services which provide nonmedical board, room and care for six or fewer ambulatory children or children two years of age or younger, and which do not have any nonambulatory clients shall not be subject to regulations found in Appendix Chapter 4, Section 435.

Pursuant to Health and Safety Code Section 13143 with respect to these exempted facilities, no city, county or public district shall adopt or enforce any requirement for the prevention of fire or for the protection of life and property against fire and panic unless the requirement would be applicable to a structure regardless of the special occupancy. Nothing shall restrict the application of state or local housing standards to such facilities if the standards are applicable to residential occupancies and are not based on the use of the structure as a facility for ambulatory children. For the purpose of this exception, ambulatory children do not include relatives of the licensee or the licensee's spouse.

[BG] Residential Group R-4. Residential Group R-4 shall include buildings, structures or portions thereof for more than six ambulatory clients, but not more than 16 persons, excluding staff, who reside on a 24-hour basis in a supervised residential environment and receive custodial care. The persons receiving care are capable of self-preservation. Group R-4 occupancies shall meet the requirements for construction as defined for Group R-3, except as otherwise provided for in the *California Building Code*. This occupancy classification may include a maximum six non-ambulatory or bedridden clients (see Appendix Chapter 4, Section 435, Special Provisions For Licensed 24-Hour Care Facilities in a Group R-2.1, R-3.1 or R-4 occupancy). This group shall include, but not be limited to, the following:

*Assisted living facilities such as:
Residential care facilities
Residential Care Facilities for the Elderly (RCFEs)
Adult Residential Facilities
Congregate Living Health facilities
Group homes*

*Social rehabilitation facilities such as:
Halfway houses
Community Treatment Programs
Work Furlough Programs
Alcoholism or drug abuse recovery or treatment facilities*

[BG] Group S, Storage. Storage Group S occupancy includes, among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.

[BG] Group S-1 moderate-hazard storage. Storage Group S-1 occupancies are buildings occupied for storage uses that are not classified as Group S-2, including, but not limited to, storage of the following:

- Aerosols, Levels 2 and 3
- Aircraft hangar (storage and repair)
- Bags: cloth, burlap and paper
- Bamboos and rattan
- Baskets
- Belting: canvas and leather
- Beverages over 16-percent alcohol content
- Books and paper in rolls or packs
- Boots and shoes
- Buttons, including cloth covered, pearl or bone
- Cardboard and cardboard boxes
- Clothing, woolen wearing apparel
- Cordage
- Dry boat storage (indoor)
- Furniture
- Furs
- Glues, mucilage, pastes and size
- Grains
- Horns and combs, other than celluloid
- Leather
- Linoleum
- Lumber
- Motor vehicle repair garages complying with the maximum allowable quantities of hazardous materials listed in Table 5003.1.1(1) (see Section 406.8 of the *California Building Code*)
- Photo engravings
- Resilient flooring
- Self-service storage facility (mini-storage)
- Silks
- Soaps
- Sugar
- Tires, bulk storage of Tobacco, cigars, cigarettes and snuff
- Upholstery and mattresses
- Wax candles

[BG] Aircraft hangars. Aircraft hangars used for storage or repair shall comply with Section 412.3 of the *California Building Code*.

[BG] Motor vehicle repair garages. Motor vehicle repair garages shall comply with Section 406.8 of the *California Building Code*.

[BG] Group S-2 low-hazard storage. Storage Group S-2 occupancies include, among others, buildings used for the storage of noncombustible materials such as products on wood pallets or in paper cartons with or without single thickness divisions; or in paper wrappings. Such products are permitted to have a negligible amount of plastic trim, such as knobs, handles or film wrapping. Storage uses shall include, but not be limited to, storage of the following:

- Asbestos
- Beverages up to and including 16-percent alcohol
- Cement in bags
- Chalk and crayons
- Dairy products in nonwaxed coated paper containers
- Dry cell batteries
- Electrical coils
- Electrical motors
- Empty cans
- Food products
- Foods in noncombustible containers
- Fresh fruits and vegetables in nonplastic trays or containers
- Frozen foods
- Glass
- Glass bottles, empty or filled with noncombustible liquids
- Gypsum board
- Inert pigments
- Ivory
- Meats
- Metal cabinets
- Metal desks with plastic tops and trim
- Metal parts
- Metals
- Mirrors
- Oil-filled and other types of distribution transformers
- Porcelain and pottery
- Public parking garages, open or enclosed
- Stoves
- Talc and soapstones
- Washers and dryers

[BG] Public parking garages. Public parking garages shall comply with Section 406.4 of the *California Building Code* and the additional requirements of Section 406.5 of the *California Building Code* for open parking garages or Section 406.6 of the *California Building Code* for enclosed parking garages.

[BG] Combustible storage. High-piled stock or rack storage, or attic, under-floor and concealed spaces used for storage of combustible materials, shall be in

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accordance with Section 413 of the *California Building Code*.

[BG] Accessory storage spaces. A room or space used for storage purposes that is accessory to another occupancy shall be classified as part of that occupancy.

[BG] Group U, Miscellaneous. Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy. Group U shall include, but not be limited to, the following:

Agricultural buildings

Aircraft hangar, accessory to a one- or two-family residence (see Section 412.4 of the *California Building Code*)

Barns

Carports

Communication equipment structures with a gross floor area of less than 1,500 square feet (139 m²)

Fences more than 7 feet (2134 mm) in height

Grain silos, accessory to a residential occupancy

Livestock shelters

Private garages

Retaining walls

Sheds

Stables

Tanks

Towers

[BG] Private garages and carports. Private garages and carports shall comply with Section 406.3 of the *California Building Code*.

[BG] Residential aircraft hangars. Aircraft hangars accessory to a one- or two-family residence shall comply with Section 412.4 of the *California Building Code*.

[BG] Greenhouses. Greenhouses not classified as another occupancy shall be classified as Use Group U.

[BG] OCCUPANT LOAD. The number of persons for which the means of egress of a building or portion thereof is designed.

OPEN BURNING. The burning of materials wherein products of combustion are emitted directly into the ambient air without passing through a stack or chimney from an enclosed chamber. Open burning does not include road flares, smudgepots and similar devices associated with safety or occupational uses typically considered open flames, recreational fires or use of portable outdoor fireplaces. For the purpose of this definition, a chamber shall be regarded as enclosed when, during the time combustion occurs, only apertures, ducts, stacks, flues or chimneys necessary to provide combustion air and permit the escape of exhaust gas are open.

OPEN MALL. See “Covered mall building.”

OPEN MALL BUILDING. See “Covered mall building.”

[BG] OPEN PARKING GARAGE. A structure or portion of a structure with the openings as described in Section 406.5.2 of the *California Building Code* on two or more sides that is used for the parking or storage of private motor vehicles as described in Section 406.5 of the *California Building Code*.

OPEN SYSTEM. The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations. Examples of open systems for solids and liquids include dispensing from or into open beakers or containers, dip tank and plating tank operations.

OPEN-AIR ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure and is open to the atmosphere.

[BE] OPEN-ENDED CORRIDOR. An interior corridor that is open on each end and connects to an exterior stairway or ramp at each end with no intervening doors or separation from the corridor.

[BF] OPENING PROTECTIVE. A fire door assembly, fire shutter assembly, fire window assembly or glass-block assembly in a fire-resistance-rated wall or partition.

OPERATING BUILDING. A building occupied in conjunction with the manufacture, transportation or use of explosive materials. Operating buildings are separated from one another with the use of intraplant or intraline distances.

OPERATING LINE. A group of buildings, facilities or workstations so arranged as to permit performance of the steps in the manufacture of an explosive or in the loading, assembly, modification and maintenance of ammunition or devices containing explosive materials.

OPERATING PRESSURE. The pressure at which a system operates.

ORGANIC COATING. A liquid mixture of binders such as alkyd, nitrocellulose, acrylic or oil, and flammable and combustible solvents such as hydrocarbon, ester, ketone or alcohol, which, when spread in a thin film, convert to a durable protective and decorative finish.

ORGANIC PEROXIDE. An organic compound that contains the bivalent -O-O- structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms have been replaced by an organic radical. Organic peroxides can present an explosion hazard (detonation or deflagration) or they can be shock sensitive. They can also decompose into various unstable compounds over an extended period of time.

Class I. Describes those formulations that are capable of deflagration but not detonation.

Class II. Describes those formulations that burn very rapidly and that pose a moderate reactivity hazard.

Class III. Describes those formulations that burn rapidly and that pose a moderate reactivity hazard.

Class IV. Describes those formulations that burn in the same manner as ordinary combustibles and that pose a minimal reactivity hazard.

Class V. Describes those formulations that burn with less intensity than ordinary combustibles or do not sustain combustion and that pose no reactivity hazard.

Unclassified detonable. Organic peroxides that are capable of detonation. These peroxides pose an extremely high-explosion hazard through rapid explosive decomposition.

OUTDOOR ASSEMBLY EVENT. An outdoor gathering of persons for any purpose.

OUTDOOR CONTROL AREA. An outdoor area that contains hazardous materials in amounts not exceeding the maximum allowable quantities of Table 5003.1.1(3) or Table 5003.1.1(4).

OUTPATIENT CLINIC. See “Clinic, outpatient.”

OVERCROWDING. A condition that exists when either there are more people in a building, structure or portion thereof than have been authorized or posted by the fire code official, or when the fire code official determines that a threat exists to the safety of the occupants due to persons sitting and/or standing in locations that may obstruct or impede the use of aisles, passages, corridors, stairways, exits or other components of the means of egress.

[A] OWNER. Any person, agent, operator, entity, firm or corporation having any legal or equitable interest in the property; or recorded in the official records of the state, county or municipality as holding an interest or title to the property; or otherwise having possession or control of the property, including the guardian of the estate of any such person, and the executor or administrator of the estate of such person if ordered to take possession of real property by a court.

OXIDIZER. A material that readily yields oxygen or other oxidizing gas, or that readily reacts to promote or initiate combustion of combustible materials and, if heated or contaminated, can result in vigorous self-sustained decomposition.

Class 4. An oxidizer that can undergo an explosive reaction due to contamination or exposure to thermal or physical shock and that causes a severe increase in the burning rate of combustible materials with which it comes into contact. Additionally, the oxidizer causes a severe increase in the burning rate and can cause spontaneous ignition of combustibles.

Class 3. An oxidizer that causes a severe increase in the burning rate of combustible materials with which it comes in contact.

Class 2. An oxidizer that will cause a moderate increase in the burning rate of combustible materials with which it comes in contact.

Class 1. An oxidizer that does not moderately increase the burning rate of combustible materials.

OXIDIZING CRYOGENIC FLUID. An oxidizing gas in the cryogenic state.

OXIDIZING GAS. A gas that can support and accelerate combustion of other materials more than air does.

OZONE-GAS GENERATOR. Equipment which causes the production of ozone.

[BE] PANIC HARDWARE. A door-latching assembly incorporating a device that releases the latch upon the application of a force in the direction of egress travel. See also “Fire exit hardware.”

PASSIVE RF EMITTING DEVICE. A device that does not require an external AC or DC source of power for its operation, and does not provide amplification of the RF signal, including but not limited to coax, couplers, splitters and passive antennas.

PASS-THROUGH. An enclosure installed in a wall with a door on each side that allows chemicals, HPM, equipment, and parts to be transferred from one side of the wall to the other.

[BG] PENTHOUSE. An enclosed, unoccupied rooftop structure used for sheltering mechanical and electrical equipment, tanks, elevators and related machinery, and vertical shaft openings.

PERMANENT PORTABLE BUILDING. A portable building that is used to serve or house students and is certified as a permanent building on a new public school campus by the public school administration shall comply with the requirements of new campus buildings.

PERMISSIBLE EXPOSURE LIMIT (PEL). The maximum permitted 8-hour time-weighted-average concentration of an airborne contaminant. The exposure limits to be utilized are those published in DOL 29 CFR Part 1910.1000. The Recommended Exposure Limit (REL) concentrations published by the US National Institute for Occupational Safety and Health (NIOSH), Threshold Limit Value-Time Weighted Average (TLV-TWA) concentrations published by the American Conference of Governmental Industrial Hygienists (ACGIH), Workplace Environmental Exposure Level (WEEL) Guides published by the American Industrial Hygiene Association (AIHA), and other approved, consistent measures are allowed as surrogates for hazardous substances not listed in DOL 29 CFR Part 1910.1000.

[A] PERMIT. An official document or certificate issued by the fire code official that authorizes performance of a specified activity.

[A] PERSON. An individual, heirs, executors, administrators or assigns, and also includes a firm, partnership or corporation, its or their successors or assigns, or the agent of any of the aforesaid.

PERSONS WITH INTELLECTUAL DISABILITIES, PROFOUNDLY OR SEVERELY. Shall mean any persons with intellectual disabilities who is unable to evacuate a building unassisted during emergency conditions.

Note: The determination as to such incapacity shall be made by the Director of the State Department of Public Health or his or her designated representative pursuant to Health and Safety Code Section 13131.3.

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PESTICIDE. A substance or mixture of substances, including fungicides, intended for preventing, destroying, repelling or mitigating pests and substances or a mixture of substances intended for use as a plant regulator, defoliant or desiccant. Products defined as drugs in the Federal Food, Drug and Cosmetic Act are not pesticides.

[BE] PHOTOLUMINESCENT. Having the property of emitting light that continues for a length of time after excitation by visible or invisible light has been removed.

PHOTOVOLTAIC (PV) PANEL SYSTEM, GROUND-MOUNTED. *An independent photovoltaic (PV) panel system without useable space underneath, installed directly on the ground.*

PHOTOVOLTAIC (PV) SUPPORT STRUCTURE, ELEVATED. *An independent photovoltaic (PV) panel support structure designed with useable space underneath with minimum clear height of 7 feet 6 inches (2286 mm), intended for secondary use such as providing shade or parking of motor vehicles.*

PHYSICAL HAZARD. A chemical for which there is evidence that it is a combustible liquid, cryogenic fluid, explosive, flammable (solid, liquid or gas), organic peroxide (solid or liquid), oxidizer (solid or liquid), oxidizing gas, pyrophoric (solid, liquid or gas), unstable (reactive) material (solid, liquid or gas) or water-reactive material (solid or liquid).

PHYSIOLOGICAL WARNING THRESHOLD. A concentration of airborne contaminants, normally expressed in parts per million (ppm) or milligrams per cubic meter (mg/m³), that represents the concentration at which persons can sense the presence of the contaminant due to odor, irritation or other quick-acting physiological responses. When used in conjunction with the permissible exposure limit (PEL), the physiological warning threshold levels are those consistent with the classification system used to establish the PEL. See the definition of “Permissible exposure limit (PEL).”

PIER. A structure built over the water, supported by pillars or piles, and used as a landing place, pleasure pavilion or similar purpose.

PLACE OF RELIGIOUS WORSHIP. See “Religious worship, place of.”

[M] PLENUM. An enclosed portion of the building structure, other than an occupiable space being conditioned, that is designed to allow air movement and thereby serve as part of an air distribution system.

PLOSOPHORIC MATERIAL. Two or more unmixed, commercially manufactured, prepackaged chemical substances including oxidizers, flammable liquids or solids, or similar substances that are not independently classified as explosives but which, when mixed or combined, form an explosive that is intended for blasting.

PLYWOOD AND VENEER MILLS. Facilities where raw wood products are processed into finished wood products, including waferboard, oriented strandboard, fiberboard, composite wood panels and plywood.

PORTABLE GENERATOR. A mobile internal combustion engine-driven device that provides temporary electrical power. This includes hand portable, wheeled, trailer mounted, and motor vehicle-mounted generator sets. It does not include generators in permanent, fixed installations.

PORTABLE OUTDOOR FIREPLACE. A portable, outdoor, solid-fuel-burning fireplace that may be constructed of steel, concrete, clay or other noncombustible material. A portable outdoor fireplace may be open in design, or may be equipped with a small hearth opening and a short chimney or chimney opening in the top.

[BE] POWER-ASSISTED DOOR. Swinging door that opens by reduced pushing or pulling force on the door-operating hardware. The door closes automatically after the pushing or pulling force is released, and functions with decreased forces. See also “Low energy power-operated door” and “Power-operated door.”

POWERED INDUSTRIAL TRUCK. A forklift, tractor, platform lift truck or motorized hand truck powered by an electrical motor or internal combustion engine. Powered industrial trucks do not include farm vehicles or automotive vehicles for highway use.

[BE] POWER-OPERATED DOOR. Swinging, sliding, or folding door that opens automatically when approached by a pedestrian or opens automatically upon an action by a pedestrian. The door closes automatically and includes provisions such as presence sensors to prevent entrapment. See also “Low energy power-operated door” and “Power-assisted door.”

PRESSURE VESSEL. A closed vessel designed to operate at pressures above 15 psig (103 kPa).

PRIMARY CONTAINMENT. The first level of containment, consisting of the inside portion of that container which comes into immediate contact on its inner surface with the material being contained.

[BG] PRIVATE GARAGE. A building or portion of a building in which motor vehicles used by the owner or tenants of the building or buildings on the premises are stored or kept, without provisions for repairing or servicing such vehicles for profit.

PROCESS TRANSFER. The transfer of flammable or combustible liquids between tank vehicles or tank cars and process operations. Process operations may include containers, tanks, piping and equipment.

PROPELLANT. The liquefied or compressed gas in an aerosol container that expels the contents from an aerosol container when the valve is actuated. A propellant is considered flammable if it forms a flammable mixture with air, or if a flame is self-propagating in a mixture with air.

PROTECTIVE SOCIAL CARE FACILITY. *A facility housing persons, who are referred, placed or caused to be placed in the facility, by any governmental agency and for whom the services, or a portion thereof, are paid for by any governmental agency. These occupancies shall include, but are not limited to, those commonly referred to as “assisted living facilities,” “social rehabilitation facilities,” “certi-*

fied family care homes,” “out-of-home placement facilities,” and “halfway houses.”

PROXIMATE AUDIENCE. An audience closer to pyrotechnic devices than allowed by NFPA 1123.

[B] PSYCHIATRIC HOSPITALS. See “Hospitals and psychiatric hospitals.”

PUBLIC TRAFFIC ROUTE (PTR). Any public street, road, highway, navigable stream or passenger railroad that is used for through traffic by the general public.

[A] PUBLIC WAY. A street, alley or other parcel of land open to the outside air leading to a street, that has been deeded, dedicated or otherwise permanently appropriated to the public for public use and which has a clear width and height of not less than 10 feet (3048 mm).

[BE] PUBLIC-USE AREAS. Interior or exterior rooms or spaces that are made available to the general public.

PUZZLE ROOM. *A type of special amusement area in which occupants are encouraged to solve a challenge to escape from a room or series of rooms.*

PYROPHORIC. A chemical with an autoignition temperature in air, at or below a temperature of 130°F (54°C).

PYROTECHNIC ARTICLE. A pyrotechnic device for use in the entertainment industry, which is not classified as fireworks.

PYROTECHNIC COMPOSITION. A chemical mixture that produces visible light displays or sounds through a self-propagating, heat-releasing chemical reaction which is initiated by ignition.

PYROTECHNIC SPECIAL EFFECT. A visible or audible effect for entertainment created through the use of pyrotechnic materials and devices.

PYROTECHNIC SPECIAL-EFFECT MATERIAL. A chemical mixture used in the entertainment industry to produce visible or audible effects by combustion, deflagration or detonation. Such a chemical mixture predominantly consists of solids capable of producing a controlled, self-sustaining and self-contained exothermic chemical reaction that results in heat, gas sound, light or a combination of these effects. The chemical reaction functions without external oxygen.

PYROTECHNICS. Controlled exothermic chemical reactions timed to create the effects of heat, hot gas, sound, dispersion of aerosols, emission of visible light or a combination of such effects to achieve the maximum effect from the least volume of pyrotechnic composition.

QUANTITY-DISTANCE (Q-D). The quantity of explosive material and separation distance relationships providing protection. These relationships are based on levels of risk considered acceptable for the stipulated exposures and are tabulated in the appropriate Q-D tables. The separation distances specified afford less than absolute safety:

Inhabited building distance (IBD). The minimum separation distance between an operating building or magazine containing explosive materials and an inhabited building or site boundary.

Intermagazine distance (IMD). The minimum separation distance between magazines.

Intraline distance (ILD) or Intraplant distance (IPD). The distance to be maintained between any two operating buildings on an explosives manufacturing site when at least one contains or is designed to contain explosives, or the distance between a magazine and an operating building.

RADIO FREQUENCY (RF). A measurement representing the oscillation rate of the electromagnetic radiation spectrum, or electromagnetic radio waves, from public safety frequency bands as specified by the fire code official.

RAILWAY. A steam, electric or other railroad or railway that carries passengers for hire. *Also see Chapter 56 for “railway” as it relates to explosives.*

[BE] RAMP. A walking surface that has a running slope steeper than 1 unit vertical in 20 units horizontal (5-percent slope).

RAMP, EXIT ACCESS. See “Exit access ramp.”

RAMP, EXTERIOR EXIT. See “Exterior exit ramp.”

RAMP, INTERIOR EXIT. See “Interior exit ramp.”

RAW PRODUCT. A mixture of natural materials such as tree, brush trimmings, or waste logs and stumps.

[M] READY ACCESS (TO). That which enables a device, appliance or equipment to be directly reached, without requiring the removal or movement of any panel or similar obstruction [see “Access (to)”].

READY BOX. A weather-resistant container with a self-closing or automatic-closing cover that protects fireworks shells from burning debris. Tarpaulins shall not be considered as ready boxes.

[A] RECORD DRAWINGS. Drawings (“as built”) that document the location of all devices, appliances, wiring, sequences, wiring methods and connections of the components of a fire alarm system as installed.

RECREATIONAL FIRE. An outdoor fire burning materials other than rubbish where the fuel being burned is not contained in an incinerator, outdoor fireplace, portable outdoor fireplace, barbecue grill or barbecue pit and has a total fuel area of 3 feet (914 mm) or less in diameter and 2 feet (610 mm) or less in height for pleasure, religious, ceremonial, cooking, warmth or similar purposes.

REDUCED FLOW VALVE. A valve equipped with a restricted flow orifice and inserted into a compressed gas cylinder, portable tank or stationary tank that is designed to reduce the maximum flow from the valve under full-flow conditions. The maximum flow rate from the valve is determined with the valve allowed to flow to atmosphere with no other piping or fittings attached.

REFINERY. A plant in which flammable or combustible liquids are produced on a commercial scale from crude petroleum, natural gasoline or other hydrocarbon sources.

REFRIGERANT. The fluid used for heat transfer in a refrigeration system; the refrigerant absorbs heat and transfers it at a higher temperature and a higher pressure, usually with a change of state.

DEFINITIONS

[M] REFRIGERATING (REFRIGERATION) SYSTEM. A combination of interconnected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat.

[A] REGISTERED DESIGN PROFESSIONAL. An architect or engineer, registered or licensed to practice professional architecture or engineering, as defined by the statutory requirements of the professional registration laws of the state in which the project is to be constructed.

[BG] RELIGIOUS WORSHIP, PLACE OF. A building or portion thereof intended for the performance of religious services.

RELOCATABLE BUILDING (PUBLIC SCHOOL). Any building with an integral floor structure which is capable of being readily moved. (See Education Code Section 17350.) Relocatable buildings that are to be placed on substandard foundations not complying with the requirements of Part 2, Title 24, C.C.R., require a statement from the school district stating that the durability requirements for those foundations may be waived and acknowledging the temporary nature of the foundations.

RELOCATABLE POWER TAP. A relocatable electrical enclosure that provides one or more receptacle outlets and that is provided with an attached power supply cord and attachment plug for connection to a permanently installed receptacle outlet (also called a “multiplug adaptor”).

REMOTE EMERGENCY SHUTOFF DEVICE. The combination of an operator-carried signaling device and a mechanism on the tank vehicle. Activation of the remote emergency shutoff device sends a signal to the tanker-mounted mechanism and causes fuel flow to cease.

REMOTE SOLVENT RESERVOIR. A liquid solvent container enclosed against evaporative losses to the atmosphere during periods when the container is not being utilized, except for a solvent return opening not larger than 16 square inches (10 322 mm²). Such return allows pump-cycled used solvent to drain back into the reservoir from a separate solvent sink or work area.

REMOTELY LOCATED, MANUALLY ACTIVATED SHUTDOWN CONTROL. A control system that is designed to initiate shutdown of the flow of gases or liquids that is manually activated from a point located some distance from the delivery system.

REPAIR GARAGE. A building, structure or portion thereof used for servicing or repairing motor vehicles.

RESIDENTIAL CARE FACILITY FOR THE CHRONICALLY ILL (RCF/CI). As termed, means a housing arrangement with a maximum capacity of 25 residents that provides a range of services to residents who have chronic, life-threatening illnesses.

RESIDENTIAL CARE FACILITY FOR THE ELDERLY (RCFE). As defined in Health and Safety Code Section §1569.2, shall mean a facility with a housing arrangement chosen voluntarily by persons 60 years of age or over, or their authorized representative, where varying levels and intensities of care and supervision, protective supervision or personal care are provided, based on their varying needs, as

determined in order to be admitted and to remain in the facility. Persons under 60 years of age with compatible needs, as determined by the Department of Social Services in regulations, may be allowed to be admitted or retained in a residential-care facility for the elderly.

Pursuant to Health and Safety Code Section §13133, regulations of the State Fire Marshal pertaining to Group R-2.1 occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section §13143.5, or a fire protection district may pursuant to Health and Safety Code Section §13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential-care Facilities for the Elderly.

RESIDENTIAL FACILITY (RF). As defined in Section §1502 of the Health and Safety Code, shall mean any family home, group care facility or similar facility determined by the director of Social Services, for 24-hour nonmedical care of persons in need of personal services, supervision or assistance essential for sustaining the activities of daily living or for the protection of the individual. Such facilities include small family homes and social rehabilitation facilities.

Pursuant to Health and Safety Code Section §13133, regulations of the state fire marshal pertaining to Group R, Division 2 Occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may pursuant to Health and Safety Code Section §13143.5, or a fire protection district may pursuant to Health and Safety Code Section §13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential-care Facilities for the Elderly.

RESIN APPLICATION AREA. An area where reinforced plastics are used to manufacture products by hand lay-up or spray-fabrication methods.

RESPONSIBLE PERSON. A person trained in the safety and fire safety considerations concerned with hot work. Responsible for reviewing the sites prior to issuing permits as part of the hot work permit program and following up as the job progresses.

RETAIL DISPLAY AREA. The area of a Group M occupancy open for the purpose of viewing or purchasing merchandise offered for sale. Individuals in such establishments are free to circulate among the items offered for sale which are typically displayed on shelves, racks or the floor.

RESTRAINT. [SFM]. *The physical retention of a person within a room, cell or cell block, holding cells, temporary holding cell, rooms or area, holding facility, secure interview rooms, courthouse holding facilities, courtroom docks or similar buildings or portions thereof by any means, or within the exterior walls of a building by means of locked doors inoperable by the person restrained. Restraint shall also mean the physical binding, strapping or similar restriction of any person in a chair, walker, bed or other contrivance for the purpose of deliberately restricting the free movement of ambulatory persons.*

Restraint shall not be construed to include nonambulatory persons nor shall it include the use of bandage material, strip sheeting or other fabrics or materials (soft ties) used to restrain persons in hospital-type beds or wheelchairs to prevent injury, provided an approved method of quick release is maintained.

Facilities employing the use of soft ties, however, shall be classified as a building used to house nonambulatory persons. Restraint shall not be practiced in licensed facilities classified as Group R-2.1, R-3.1 and R-4 occupancies unless constructed as a Group I-3 occupancy. For Group I-3 Occupancies see California Building Code Section 408.1.1.

ROADSIDE HYDROGEN SERVICE VEHICLES. *Approved vehicles used for dispensing of compressed gaseous hydrogen at partial pressure into the fuel tanks of hydrogen-fueled vehicles from on-board hydrogen supply tanks.*

ROLL COATING. The process of coating, spreading and impregnating fabrics, paper or other materials as they are passed directly through a tank or trough containing flammable or combustible liquids, or over the surface of a roller revolving partially submerged in a flammable or combustible liquid.

RUBBISH (TRASH). Combustible and noncombustible waste materials, including residue from the burning of coal, wood, coke or other combustible material, paper, rags, cartons, tin cans, metals, mineral matter, glass crockery, dust and discarded refrigerators, and heating, cooking or incinerator-type appliances.

SAFETY CAN. An approved container of not more than 5-gallon (19 L) capacity having a spring-closing lid and spout cover so designed that it will relieve internal pressure when subjected to fire exposure.

SAFETY DATA SHEET (SDS). Information concerning a hazardous material which is prepared in accordance with the provisions of DOL 29 CFR Part 1910.1200 or in accordance with the provisions of a federally approved state OSHA plan. A document titled as a Material Safety Data Sheet (MSDS) is equivalent to an SDS for the purposes of this code.

[BE] SCISSOR STAIRWAY. Two interlocking stairways providing two separate paths of egress located within one exit enclosure.

SECONDARY CONTAINMENT. That level of containment that is external to and separate from primary containment.

SECURE INTERVIEW ROOM. *A lockable room used to hold and interview detainees for further processing.*

SEED COTTON. See “Cotton.”

SEGREGATED. Storage in the same room or inside area, but physically separated by distance from incompatible materials.

[BF] SELF-CLOSING. As applied to a fire door or other opening, means equipped with an approved device that will ensure closing after having been opened.

[BE] SELF-LUMINOUS. Illuminated by a self-contained power source, other than batteries, and operated independently of external power sources.

SELF-PRESERVATION, INCAPABLE OF. See “Incapable of self-preservation.”

SELF-SERVICE MOTOR FUEL-DISPENSING FACILITY. That portion of motor fuel-dispensing facility where liquid motor fuels are dispensed from fixed approved dispensing equipment into the fuel tanks of motor vehicles by persons other than a motor fuel-dispensing facility attendant.

SEMICONDUCTOR FABRICATION FACILITY. A building or a portion of a building in which electrical circuits or devices are created on solid crystalline substances having electrical conductivity greater than insulators but less than conductors. These circuits or devices are commonly known as semiconductors.

SERVICE CORRIDOR. A fully enclosed passage used for transporting HPM and purposes other than required means of egress.

SHELF STORAGE. Storage on shelves less than 30 inches (762 mm) deep with the distance between shelves not exceeding 3 feet (914 mm) vertically. For other shelving arrangements, see the requirements for rack storage.

SINGLE-STATION SMOKE ALARM. An assembly incorporating the detector, the control equipment and the alarm-sounding device in one unit, operated from a power supply either in the unit or obtained at the point of installation.

[BG] SITE. A parcel of land bounded by a lot line or a designated portion of a public right-of-way.

SITE SAFETY PLAN. A plan developed to establish a fire prevention program at a construction site.

[BG] SITE-FABRICATED STRETCH SYSTEM. A system, fabricated on site and intended for acoustical, tackable or aesthetic purposes, that is composed of three elements:

1. A frame constructed of plastic, wood, metal or other material used to hold fabric in place.

DEFINITIONS

2. A core material (infill, with the correct properties for the application).
3. An outside layer, comprised of a textile, fabric or vinyl, that is stretched taut and held in place by tension or mechanical fasteners via the frame.

SKY LANTERN. An unmanned device with a fuel source that incorporates an open flame in order to make the device airborne.

[BG] SLEEPING UNIT. A single unit providing rooms or spaces for one or more persons that includes permanent provisions for sleeping and can include provisions for living, eating and either sanitation or kitchen facilities but not both. Such rooms and spaces that are also part of a dwelling unit are not sleeping units.

SMALL ARMS AMMUNITION. *California Code of Regulations, Title 19, Division 1, §1559.19 (a) Small arms ammunition]*

§1559.19 (a) Small arms ammunition shall mean ammunition of 75 caliber or less when designated as a Division 1.4 explosive by the US DOTn which includes a shotgun, rifle or pistol cartridge and any cartridge for propellant-actuated devices.

SMALL ARMS PRIMERS. Small percussion-sensitive explosive charges, encased in a cap, used to ignite propellant powder.

SMALL MANAGEMENT YARD. *An exterior exercise yard within a Group I-3 prison used for inmate exercise for a maximum of 2 hours per day, constructed in accordance with California Building Code Section 408.15.*

SMOKE ALARM. A single- or multiple-station alarm responsive to smoke. See also “Single-station smoke alarm” and “Multiple-station smoke alarm.”

[BF] SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke.

[BG] SMOKE COMPARTMENT. A space within a building separated from other interior areas of the building by smoke barriers, including *interior walls and horizontal assemblies.*

[BF] SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

SMOKE DETECTOR. A listed device that senses visible or invisible particles of combustion.

SMOKE PARTITION. A wall assembly that extends from the top of the foundation or floor below to the underside of the floor or roof sheathing, deck or slab above or to the underside of the ceiling above where the ceiling membrane is constructed to limit the transfer of smoke.

[BG] SMOKE-DEVELOPED INDEX. A comparative measure, expressed as a dimensionless number, derived from

measurements of smoke obscuration versus time for a material tested in accordance with ASTM E84.

SMOKELESS PROPELLANTS. Solid propellants, commonly referred to as smokeless powders, used in small arms ammunition, cannons, rockets, propellant-actuated devices and similar articles.

[BF] SMOKEPROOF ENCLOSURE. An interior exit stairway designed and constructed so that the movement of the products of combustion produced by a fire occurring in any part of the building into the enclosure is limited.

[BE] SMOKE-PROTECTED ASSEMBLY SEATING. Seating served by means of egress that is not subject to smoke accumulation within or under a structure for a specified design time by means of passive design or by mechanical ventilation.

SOLID. A material that has a melting point and decomposes or sublimates at a temperature greater than 68°F (20°C).

SOLID BIOFUEL. Densified biomass made in the form of cubiform, polyhedral, polyhydric or cylindrical units, produced by compressing milled biomass.

SOLID BIOMASS FEEDSTOCK. The basic materials of which solid biofuel is composed, manufactured or made.

SOLID SHELVING. Shelving that is solid, slatted or of other construction located in racks and which obstructs sprinkler discharge down into the racks.

SOLVENT DISTILLATION UNIT. An appliance that receives contaminated flammable or combustible liquids and which distills the contents to remove contaminants and recover the solvents.

SOLVENT OR LIQUID CLASSIFICATIONS. A method for classifying solvents or liquids according to the following classes:

Class I solvents. Liquids having a flash point below 100°F (38°C).

Class II solvents. Liquids having a flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA solvents. Liquids having a flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB solvents. Liquids having a flash point at or above 200°F (93°C).

Class IV solvents. Liquids classified as nonflammable.

SPECIAL AMUSEMENT AREA. A special amusement area is any temporary or permanent building or portion thereof that is occupied for amusement, entertainment or educational purposes and is arranged in a manner that:

1. Makes the means of egress path not readily apparent due to visual and audio distractions, or
2. Intentionally confounds identification of the means of egress path, or
3. Otherwise makes the means of egress path not readily available because of the nature of the attraction or mode of conveyance through the special amusement area, building, structure or portion thereof.

[A] SPECIAL EXPERT. An individual who has demonstrated qualifications in a specific area, outside the practice of architecture or engineering, through education, training and experience.

SPECIAL INDUSTRIAL EXPLOSIVE DEVICE. An explosive power pack containing an explosive charge in the form of a cartridge or construction device. The term includes but is not limited to explosive rivets, explosive bolts, explosive charges for driving pins or studs, cartridges for explosive-actuated power tools and charges of explosives used in automotive air bag inflators, jet tapping of open hearth furnaces and jet perforation of oil well casings.

SPRAY BOOTH. A mechanically ventilated appliance of varying dimensions and construction provided to enclose or accommodate a spraying operation and to confine and limit the escape of spray vapor and residue and to exhaust it safely.

SPRAY ROOM. A room designed to accommodate spraying operations, constructed in accordance with the *California Building Code*.

SPRAYING SPACE. An area in which dangerous quantities of flammable vapors or combustible residues, dusts or deposits are present due to the operation of spraying processes. The fire code official is authorized to define the limits of the spraying space in any specific case.

[BE] STAIR. A change in elevation, consisting of one or more risers.

[BE] STAIRWAY. One or more flights of stairs, either exterior or interior, with the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another.

STAIRWAY, EXIT ACCESS. See “Exit access stairway.”

STAIRWAY, EXTERIOR EXIT. See “Exterior exit stairway.”

STAIRWAY, INTERIOR EXIT. See “Interior exit stairway.”

STAIRWAY, SCISSOR. See “Scissor stairway.”

[BE] STAIRWAY, SPIRAL. A stairway having a closed circular form in its plan view with uniform section-shaped treads attached to and radiating from a minimum-diameter supporting column.

STANDBY POWER SYSTEM. A source of automatic electric power of a required capacity and duration to operate required building, hazardous materials or ventilation systems in the event of a failure of the primary power. Standby power systems are required for electrical loads where interruption of the primary power could create hazards or hamper rescue or fire-fighting operations.

STANDPIPE, TYPES OF. Standpipe types are as follows:

Automatic dry. A dry standpipe system, normally filled with pressurized air, that is arranged through the use of a device, such as a dry pipe valve, to admit water into the system piping automatically upon the opening of a hose valve. The water supply for an automatic dry standpipe system shall be capable of supplying the system demand.

Automatic wet. A wet standpipe system that has a water supply that is capable of supplying the system demand automatically.

Manual dry. A dry standpipe system that does not have a permanent water supply attached to the system. Manual dry standpipe systems require water from a fire department pumper to be pumped into the system through the fire department connection in order to supply the system demand.

Manual wet. A wet standpipe system connected to a water supply for the purpose of maintaining water within the system but which does not have a water supply capable of delivering the system demand attached to the system. Manual wet standpipe systems require water from a fire department pumper (or the like) to be pumped into the system in order to supply the system demand.

Semiautomatic dry. A dry standpipe system that is arranged through the use of a device, such as a deluge valve, to admit water into the system piping upon activation of a remote control device located at a hose connection. A remote control activation device shall be provided at each hose connection. The water supply for a semiautomatic dry standpipe system shall be capable of supplying the system demand.

STANDPIPE SYSTEM, CLASSES OF. Standpipe system classes are as follows:

Class I system. A system providing 2½-inch (64 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.

Class II system. A system providing 1½-inch (38 mm) hose stations to supply water for use primarily by the building occupants or by the fire department during initial response.

Class III system. A system providing 1½-inch (38 mm) hose stations to supply water for use by building occupants and 2½-inch (64 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams.

STATE-OWNED/LEASED BUILDING. *A building or portion of a building that is owned, leased or rented by the state. State-leased buildings shall include all required exits to a public way serving such leased area or space. Portions of state-leased buildings that are not leased or rented by the state shall not be included within the scope of this section unless such portions present an exposure hazard to the state-leased area or space.*

STATIC PILES. Piles in which processed wood product or solid biomass feedstock is mounded and is not being turned or moved.

STEEL. Hot- or cold-rolled as defined by the *California Building Code*.

STORAGE, HAZARDOUS MATERIALS. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders, or similar vessels; or vessels supplying operations through closed connections to the vessel.

DEFINITIONS

[BG] STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor or roof next above (see “Basement,” “Building height,” “Grade plane” and “Mezzanine”). A story is measured as the vertical distance from top to top of two successive tiers of beams or finished floor surfaces and, for the topmost story, from the top of the floor finish to the top of the ceiling joists or, where there is not a ceiling, to the top of the roof rafters.

[BG] STORY ABOVE GRADE PLANE. Any story having its finished floor surface entirely above grade plane, or in which the finished surface of the floor next above is:

1. More than 6 feet (1829 mm) above grade plane; or
2. More than 12 feet (3658 mm) above the finished ground level at any point.

SUBORDINATE (FIRE PROTECTION AND LIFE SAFETY SYSTEM). A system that is activated by another fire protection or life safety system. For example, where a fire alarm system activates a smoke removal or elevator recall system, the smoke removal or elevator recall system is considered to be “subordinate” to the fire alarm system.

SUPERVISING STATION. A facility that receives signals and at which personnel are in attendance at all times to respond to these signals.

SUPERVISORY SERVICE. The service required to monitor performance of guard tours and the operative condition of fire protection systems or other systems for the protection of life and property.

SUPERVISORY SIGNAL. A signal indicating the need of action in connection with the supervision of guard tours, the fire protection systems or equipment, or the maintenance features of related systems.

SUPERVISORY SIGNAL-INITIATING DEVICE. An initiating device such as a valve supervisory switch, water level indicator, or low-air pressure switch on a dry-pipe sprinkler system whose change of state signals an off-normal condition and its restoration to normal of a fire protection or life safety system; or a need for action in connection with guard tours, fire protection systems or equipment, or maintenance features of related systems.

SYSTEM. An assembly of equipment consisting of a tank, container or containers, appurtenances, pumps, compressors and connecting piping.

TANK. A vessel containing more than 60 gallons (227 L).

TANK, ATMOSPHERIC. A storage tank designed to operate at pressures from atmospheric through 1.0 pound per square inch gauge (760 mm Hg through 812 mm Hg) measured at the top of the tank.

TANK, MOTOR VEHICLE FUEL. A tank permanently mounted on a motor vehicle to store a gas or liquid fuel that is used for propulsion.

TANK, PORTABLE. A packaging of more than 60-gallon (227 L) capacity and designed primarily to be loaded into or on or temporarily attached to a transport vehicle or ship and equipped with skids, mountings or accessories to facilitate

handling of the tank by mechanical means. It does not include any cylinder having less than a 1,000-pound (454 kg) water capacity, cargo tank, tank car tank or trailers carrying cylinders of more than 1,000-pound (454 kg) water capacity.

TANK, PRIMARY. A listed atmospheric tank used to store liquid. See “Primary containment.”

TANK, PROTECTED ABOVE GROUND. A tank listed in accordance with UL 2085 consisting of a primary tank provided with protection from physical damage and fire-resistive protection from a high-intensity liquid pool fire exposure. The tank may provide protection elements as a unit or may be an assembly of components, or a combination thereof.

TANK, STATIONARY. Packaging designed primarily for stationary installations not intended for loading, unloading or attachment to a transport vehicle as part of its normal operation in the process of use. It does not include cylinders having less than a 1,000-pound (454 kg) water capacity.

TANK IN AN UNDERGROUND AREA. A tank located in a structure that is at least 10 percent below the ground surface, including, but not limited to, a basement, cellar, shaft, pit or vault.

Note: A tank in an underground area shall have the same meaning as defined in Health and Safety Code Section 25270.2(o)(1) for the applications specified in Sections 2306.6.2.7, 5703.4.1 and 5703.6.2.2 of this code.

Exceptions:

1. A pressure vessel or boiler that is subject to Labor Code, Division 5, Part 6 (commencing with Section 7620).
2. A tank containing hazardous waste or extremely hazardous waste, as respectively defined in Health and Safety Code Sections 25117 and 25115, if the Department of Toxic Substances Control has issued the person owning or operating the tank a hazardous waste facilities permit for the tank.
3. An aboveground oil production tank that is subject to Public Resources Code Section 3106.
4. Oil-filled electrical equipment, including but not limited to transformers, circuit breakers or capacitors, if the oil-filled electrical equipment meets either of the following conditions:
 - 4.1. The equipment contains less than 10,000 gallons of dielectric fluid.
 - 4.2. The equipment contains 10,000 gallons or more of dielectric fluid with polychlorinated biphenyl levels less than 50 parts per million, appropriate containment or diversionary structures or equipment are employed to prevent discharged oil from reaching a navigable water course, and the electrical equipment is visually inspected in accordance with the usual routine maintenance procedures of the owner or operator.

5. A tank regulated as an underground storage tank under Health and Safety Code Division 20, Chapter 6.7 (commencing with Section 25280) and the California Code of Regulations, Title 23, Division 3, Chapter 16 (commencing with Section 2610) and that does not meet the definition of a tank in an underground area.
6. A transportation-related tank facility, subject to the authority and control of the United States Department of Transportation, as defined in the Memorandum of Understanding between the Secretary of Transportation and the Administrator of the United States Environmental Protection Agency, as set forth in the Code of Federal Regulations, Title 40, Chapter I, Subchapter D, Part 112 (commencing with Section 112.1).
7. A tank or tank facility located on and operated by a farm that is exempt from the federal spill, prevention, control and countermeasure rule requirements pursuant to the Code of Federal Regulations, Title 40, Chapter I, Subchapter D, Part 112 (commencing with Section 112.1).

TANK VEHICLE. A vehicle other than a railroad tank car or boat, with a cargo tank mounted thereon or built as an integral part thereof, used for the transportation of flammable or combustible liquids, LP-gas or hazardous chemicals. Tank vehicles include self-propelled vehicles and full trailers and semitrailers, with or without motive power, and carrying part or all of the load.

TEMPORARY HOLDING CELL, ROOM or AREA [BSCC and SFM]. Temporary holding cell, room or area shall mean a room for temporary holding of inmates, detainees or in-custody individuals for less than 24 hours.

TEMPORARY HOLDING FACILITY [SFM]. A building or portion of a building, operated by law enforcement personnel, with one or more temporary holding cells or rooms.

TEMPORARY SPECIAL EVENT STRUCTURE. Any temporary ground-supported structure, platform, stage, stage scaffolding or rigging, canopy, tower supporting audio or visual effects equipment or similar structures not regulated within the scope of the *California Building Code*.

TENABLE ENVIRONMENT [SFM]. Tenable environment shall mean an environment in which the products of combustion, toxic gases, smoke and heat are limited or otherwise restricted to maintain the impact on occupants to a level that is not life threatening.

TENT. A structure, enclosure, umbrella structure or shelter, with or without sidewalls or drops, constructed of fabric or pliable material supported in any manner except by air or the contents it protects (see “Umbrella structure”).

[California Code of Regulations, Title 19, Division 1, §310.(a) through (c)] Definitions.

- (a) Tent. A shelter, structure or enclosure made of fabric or similar pliable material.
- (b) Large tent. A tent designed for use by 10 or more people.
- (c) Small tent. A tent designed for use by less than 10 people.

TERMINALLY ILL. As termed for an individual, means the individual has a life expectancy of six months or less as stated in writing by his or her attending physician and surgeon.

THEFT RESISTANT. Construction designed to deter illegal entry into facilities for the storage of explosive materials.

[BF] THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage consisting of a fire-resistance-rated floor, floor-ceiling or wall assembly, one or more penetrating items passing through the breaches in both sides of the assembly and the materials or devices, or both, installed to resist the spread of fire through the assembly for a prescribed period of time.

TIMBER AND LUMBER PRODUCTION FACILITIES. Facilities where raw wood products are processed into finished wood products.

TIRES, BULK STORAGE OF. Storage of tires where the area available for storage exceeds 20,000 cubic feet (566 m³).

TODDLER. Any child between 18 months and 36 months of age.

TOOL. A device, storage container, workstation or process machine used in a fabrication area.

TORCH-APPLIED ROOF SYSTEM. Bituminous roofing systems using membranes that are adhered by heating with a torch and melting asphalt back coating instead of mopping hot asphalt for adhesion.

[A] TOWNHOUSE. A single-family dwelling unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on not less than two sides.

TOXIC. A chemical falling within any of the following categories:

1. A chemical that has a median lethal dose (LD₅₀) of more than 50 milligrams per kilogram, but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.
2. A chemical that has a median lethal dose (LD₅₀) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 kilograms each.
3. A chemical that has a median lethal concentration (LC₅₀) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than 2 milligrams per liter but not more than 20 milligrams per liter of mist, fume or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 grams each.

TRAFFIC CALMING DEVICES. Traffic calming devices are design elements of fire apparatus access roads such as street alignment, installation of barriers, and other physical

DEFINITIONS

measures intended to reduce traffic and cut-through volumes, and slow vehicle speeds.

[BG] TRANSIENT. Occupancy of a dwelling unit or sleeping unit for not more than 30 days.

[BG] TRANSIENT AIRCRAFT. Aircraft based at another location and that is at the transient location for not more than 90 days.

TRANSVERSE FLUE SPACE. See “Flue spaces—Transverse.”

TRASH. See “Rubbish (trash).”

TROUBLE SIGNAL. A signal initiated by the fire alarm system or device indicative of a fault in a monitored circuit or component.

TUBE TRAILER. A semitrailer on which a number of tubular gas cylinders have been mounted. A manifold is typically provided that connects the cylinder valves enabling gas to be discharged from one or more tubes or cylinders through a piping and control system.

TWENTY-FOUR-HOUR BASIS. See “24-hour basis” before the “A” entries.

UMBRELLA STRUCTURE. A structure, enclosure or shelter with or without sidewalls or drops, constructed of fabric or pliable material supported by a central pole or poles (see “Tent”).

UNAUTHORIZED DISCHARGE. A release or emission of materials in a manner which does not conform to the provisions of this code or applicable public health and safety regulations.

UNSTABLE (REACTIVE) MATERIAL. A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials. Unstable (reactive) materials are subdivided as follows:

Class 4. Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperature and pressure. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperature and pressure.

Class 3. Materials that in themselves are capable of detonation or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but do not detonate. This class includes materials that can undergo chemical change with rapid release of energy at normal temperature and pressure, and that can undergo violent chemical change at elevated temperature and pressure.

Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperature and pressure.

UNWANTED FIRE. A fire not used for cooking, heating or recreational purposes or one not incidental to the normal operations of the property.

USE (MATERIAL). Placing a material into action, including solids, liquids and gases.

VAPOR PRESSURE. The pressure exerted by a volatile fluid as determined in accordance with ASTM D323.

[M] VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VESSEL. A motorized watercraft, other than a seaplane on the water, used or capable of being used as a means of transportation. Nontransportation vessels, such as houseboats and boathouses, are included in this definition.

VISIBLE ALARM NOTIFICATION APPLIANCE. A notification appliance that alerts by the sense of sight.

WAITING ROOM. *[SFM] Waiting room is a room or area normally provided with seating and used for persons waiting.*

WATER MIST SYSTEM, AUTOMATIC. See “Automatic water mist system.”

WATER-REACTIVE MATERIAL. A material that explodes; violently reacts; produces flammable, toxic or other hazardous gases; or evolves enough heat to cause auto-ignition or ignition of combustibles upon exposure to water or moisture. Water-reactive materials are subdivided as follows:

Class 3. Materials that react explosively with water without requiring heat or confinement.

Class 2. Materials that react violently with water or have the ability to boil water. Materials that produce flammable, toxic or other hazardous gases, or evolve enough heat to cause autoignition or ignition of combustibles upon exposure to water or moisture.

Class 1. Materials that react with water with some release of energy, but not violently.

WET FUELING. See “Mobile fueling.”

WET HOSING. See “Mobile fueling.”

WET-CHEMICAL EXTINGUISHING AGENT. A solution of water and potassium-carbonate-based chemical, potassium-acetate-based chemical or a combination thereof, forming an extinguishing agent.

WHARF. A structure or bulkhead constructed of wood, stone, concrete or similar material built at the shore of a harbor, lake or river for vessels to lie alongside of, and to anchor piers or floats.

WILDFIRE RISK AREA. Land that is covered with grass, grain, brush or forest, whether privately or publicly owned, which is so situated or is of such inaccessible location that a fire originating upon it would present an abnormally difficult job of suppression or would result in great or unusual

damage through fire or such areas designated by the fire code official.

WILDLAND-URBAN INTERFACE AREA (WUI). [SFM] (See California Building Code Chapter 7A, Section 702A for defined term.)

[BE] WINDER. A tread with nonparallel edges.

WINERY CAVES. A subterranean space for winery facilities in natural or manmade caves shall be in accordance with Section 446 of the California Building Code.

WIRELESS PROTECTION SYSTEM. A system or a part of a system that can transmit and receive signals without the aid of wire.

WORKSTATION. A defined space or an independent principal piece of equipment using HPM within a fabrication area where a specific function, laboratory procedure or research activity occurs. Approved or listed hazardous materials storage cabinets, flammable liquid storage cabinets or gas cabinets serving a workstation are included as part of the workstation. A workstation is allowed to contain ventilation equipment, fire protection devices, detection devices, electrical devices and other processing and scientific equipment.

[BG] YARD. An open space, other than a court, unobstructed from the ground to the sky, except where specifically provided by the California Building Code, on the lot on which a building is situated.

ZONE. A defined area within the protected premises. A zone can define an area from which a signal can be received, an area to which a signal can be sent or an area in which a form of control can be executed.

ZONE, NOTIFICATION. An area within a building or facility covered by notification appliances which are activated simultaneously.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 3 – GENERAL REQUIREMENTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below			X																			
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
301			X																			
[T-19 §3.14]				X																		
[T-19 §3.19 (a-g)]				X																		
304			X																			
[T-19 §3.07(a)]				X																		
[T-19 §3.07(b)]				X																		
[T-19 §3.19 (b)(c)]				X																		
308.1.1			X																			
308.5			X																			
[T-19 §3.25 (a)(b)]				X																		
310.2			X																			
[T-19 §3.32 (a)(b)]				X																		
[T-19 §3.32 (d)]				X																		
[T-19 §3.32 (c)]				X																		
312			X																			
313			X																			
314			X																			
315			X																			
316			X																			
[T-19 §3.05 (b)]				X																		
317			X																			
320			X																			
322			X																			

* The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

Part II—General Safety Provisions

CHAPTER 3 GENERAL REQUIREMENTS

User note:

About this chapter: Chapter 3 provides general requirements for asphalt kettles, combustible waste material, ignition sources, motion picture projection rooms and film, open burning, recreational fires, portable outdoor fireplaces, open flames, powered industrial trucks and equipment, smoking, vacant premises, vehicle impact protection, fueled equipment, indoor displays, general storage, outdoor pallet storage, hazards to fire fighters, landscaped roofs, laundry carts, additive manufacturing (3D printing) and artificial combustible vegetation. These are intended to improve premises safety for everyone, including construction workers, tenants, operations and maintenance personnel, and emergency response personnel.

SECTION 301 GENERAL

301.1 Scope. The provisions of this chapter shall govern the occupancy and maintenance of all structures and premises for precautions against fire and the spread of fire and general requirements of fire safety.

[California Code of Regulations, Title 19, Division 1, §3.14] Fire Hazard.

No person, including but not limited to the State and its political subdivisions, operating any occupancy subject to California Code of Regulations, Title 19, Division 1 regulations shall permit any fire hazard, as defined in this article, to exist on premises under their control, or fail to take immediate action to abate a fire hazard when requested to do so by the enforcing agency.

Note: “Fire Hazard” as used in California Code of Regulations, Title 19, Division 1 regulations means any condition, arrangement, or act which will increase, or may cause an increase of, the hazard or menace of fire to a greater degree than customarily recognized as normal by persons in the public service of preventing, suppressing or extinguishing fire; or which may obstruct, delay or hinder, or may become the cause of obstruction, delay or hindrance to the prevention, suppression, or extinguishment of fire.

[California Code of Regulations, Title 19, Division 1, §3.19(a) through (g)] Housekeeping.

Every building or portion of a building governed by California Code of Regulations, Title 19, Division 1 regulations shall be maintained in a neat orderly manner, free from any condition that would create a fire or life hazard or a condition which would add to or contribute to the rapid spread of fire. Provisions shall be made for the proper storage and disposal of waste materials and rubbish consistent with the following:

(b) All combustible waste material and rubbish shall be stored in approved containers or shall be stored in a manner approved by the enforcing agency as being consistent with standard fire prevention practices until such waste material and rubbish is removed from the premises or otherwise disposed of in a proper manner.

(1) Containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m³) shall comply with the provisions of California Code of Regulations, Title 24, Part 9, Section 304.3.

(2) Wastebaskets and linen containers in Group I-2 and I-3 occupancies shall comply with the provisions of California Code of Regulations Title 24, Part 9, Section 808.

(c) Approved self-closing metal containers or listed disposal containers by an approved testing or listing agency shall be provided and maintained in all rooms or locations where oily rags, oily waste, paint rags or similar materials subject to spontaneous ignition are used or are stored temporarily. Such containers shall be emptied daily.

(d) Ashes shall not be placed in, on or near combustible material, but shall be placed in approved metal containers, until removed from the premises or otherwise properly disposed of.

(e) No dry vegetation shall be permitted to exist within 20 feet of any building or occupancies subject to California Code of Regulations, Title 19, Division 1 regulations.

(f) Except when permitted by the enforcing agency, boiler rooms, mechanical rooms, transformer and switchgear vaults and electrical panel rooms, shall not be used for storage.

(g) Electric motors, filters on heating equipment and grease hoods shall be checked periodically and kept clean and maintained in a safe operating condition.

301.2 Permits. Permits shall be required as set forth in Section 105.5 for the activities or uses regulated by Sections 306, 307, 308, 315, 320 and 322.

SECTION 302 DEFINITIONS

302.1 Definitions. The following terms are defined in Chapter 2:

3D PRINTER.

ADDITIVE MANUFACTURING.

GENERAL REQUIREMENTS

BONFIRE.
HI-BOY.
HIGH-VOLTAGE TRANSMISSION LINE.
OPEN BURNING.
PORTABLE OUTDOOR FIREPLACE.
POWERED INDUSTRIAL TRUCK.
RECREATIONAL FIRE.
SKY LANTERN.

SECTION 303 ASPHALT KETTLES

303.1 Transporting. Asphalt (tar) kettles shall not be transported over any highway, road or street when the heat source for the kettle is operating.

Exception: Asphalt (tar) kettles in the process of patching road surfaces.

303.2 Location. Asphalt (tar) kettles shall not be located within 20 feet (6096 mm) of any combustible material, combustible building surface or any building opening and within a controlled area identified by the use of traffic cones, barriers or other approved means. Asphalt (tar) kettles and pots shall not be utilized inside or on the roof of a building or structure. Roofing kettles and operating asphalt (tar) kettles shall not block means of egress, gates, roadways or entrances.

303.3 Location of fuel containers. Fuel containers shall be located not less than 10 feet (3048 mm) from the burner.

Exception: Containers properly insulated from heat or flame are allowed to be within 2 feet (610 mm) of the burner.

303.4 Attendant. An operating kettle shall be attended by not less than one employee knowledgeable of the operations and hazards. The employee shall be within 100 feet (30 480 mm) of the kettle and have the kettle within sight. Ladders or similar obstacles shall not form a part of the route between the attendant and the kettle.

303.5 Fire extinguishers. There shall be a portable fire extinguisher complying with Section 906 and with a minimum 40-B:C rating within 25 feet (7620 mm) of each asphalt (tar) kettle during the period such kettle is being utilized. Additionally, there shall be one portable fire extinguisher with a minimum 3-A:40-B:C rating on the roof being covered.

303.6 Lids. Asphalt (tar) kettles shall be equipped with tight-fitting lids.

303.7 Hi-boys. Hi-boys shall be constructed of noncombustible materials. Hi-boys shall be limited to a capacity of 55 gallons (208 L). Fuel sources or heating elements shall not be allowed as part of a hi-boy.

303.8 Roofing kettles. Roofing kettles shall be constructed of noncombustible materials.

303.9 Fuel containers under air pressure. Fuel containers that operate under air pressure shall not exceed 20 gallons (76 L) in capacity and shall be approved.

SECTION 304 COMBUSTIBLE WASTE MATERIAL

304.1 Waste accumulation prohibited. Combustible waste material creating a fire hazard shall not be allowed to accumulate in buildings or structures or upon premises.

[California Code of Regulations, Title 19, Division 1, §3.07(a)] Clearances.

(a) General. No combustible material shall be placed or stored within 10 feet of any building or structure.

304.1.1 Waste material. Accumulations of wastepaper, wood, hay, straw, weeds, litter or combustible or flammable waste or rubbish of any type shall not be permitted to remain on a roof or in any court, yard, vacant lot, alley, parking lot, open space, or beneath a grandstand, bleacher, pier, wharf, manufactured home, recreational vehicle or other similar structure.

304.1.2 Vegetation. Weeds, grass, vines or other growth that is capable of being ignited and endangering property, shall be cut down and removed by the owner or occupant of the premises. Vegetation clearance requirements in wildland-urban interface areas shall be in accordance with Chapter 49.

[California Code of Regulations, Title 19, Division 1, §3.07(b)] Clearances.

(b) Ground Clearance. The space surrounding every building or structure shall be maintained in accordance with the following:

Any person that owns, leases, controls, operates or maintains any building or structure in, upon or adjoining any mountainous area or forest-covered lands, brush covered lands or grass-covered lands, or any land which is covered with flammable material, shall at all times do all of the following:

(1) Maintain around and adjacent to such building or structure a firebreak made by removing and clearing away, for a distance of not less than 30 feet on each side thereof or to the property line, whichever is nearer, all flammable vegetation or other combustible growth. This section does not apply to single specimens of trees, ornamental shrubbery or similar plants which are used as ground cover, if they do not form a means of rapidly transmitting fire from the native growth to any building or structure.

(2) Maintain around and adjacent to any such building or structure additional fire protection or firebreak made by removing all bush, flammable vegetation or combustible growth which is located from 30 feet to 100 feet from such building or structure or to the property line, whichever is nearer, as may be required by the enforcing agency if he finds that, because of extra hazardous conditions, a firebreak of only 30 feet around such building or structure is not sufficient to provide reasonable fire safety. Grass and other vegetation located more than 30 feet from such building or structure and less than 18 inches in height above the ground may be main-

tained where necessary to stabilize the soil and prevent erosion.

(3) Remove that portion of any tree which extends within 10 feet of the outlet of any chimney or stovepipe.

(4) Cut and remove all dead or dying portions of trees located adjacent to or overhanging any building.

(5) Maintain the roof of any structure free of leaves, needles or other dead vegetative growth.

(6) Provide and maintain at all times a screen over the outlet of every chimney or stovepipe that is attached to any fireplace, stove or other device that burns any solid or liquid fuel. The screen shall be constructed of nonflammable material with openings of not more than $\frac{1}{2}$ inch in size.

(7) Vegetation around all applicable buildings and structures shall be maintained in accordance with the following laws and regulations:

(A) Public Resources Code Section 4291.

(B) California Code of Regulations Title 14 - Natural Resources, Division 1.5 - Department of Forestry and Fire Protection, "General Guideline to Create Defensible Space."

(C) California Government Code Section 51182.

(D) California Code of Regulations, Title 24, Part 9.

304.1.3 Space underneath seats. Spaces underneath grandstand and bleacher seats shall be kept free from combustible and flammable materials. Except where enclosed in not less than 1-hour fire-resistance-rated construction in accordance with the *California Building Code*.

304.1.3.1 Spaces underneath grandstands and bleachers. Spaces underneath grandstands and bleachers shall not be occupied or utilized for purposes other than means of egress except where equipped with an automatic sprinkler system in accordance with Section 903.2.1.5.1, or separated with fire barriers and horizontal assemblies in accordance with Section 1030.1.1.1.

304.2 Storage. Storage of combustible rubbish shall not produce conditions that will create a nuisance or a hazard to the public health, safety or welfare.

304.3 Containers. Combustible rubbish and waste material kept within or near a structure shall be stored in accordance with Sections 304.3.1 through 304.3.4.

[California Code of Regulations, Title 19, Division 1, §3.19(b) and (c)] Housekeeping.

Every building or portion of a building governed by California Code of Regulations, Title 19, Division 1 regulations shall be maintained in a neat orderly manner, free from any condition that would create a fire or life hazard or a condition which would add to or contribute to the rapid spread of fire. Provisions shall be made for the proper storage and disposal of waste materials and rubbish consistent with the following:

(b) All combustible waste material and rubbish shall be stored in approved containers or shall be stored in a manner approved by the enforcing agency as being consistent with standard fire prevention practices until such waste material and rubbish is removed from the premises or otherwise disposed of in a proper manner.

(1) Containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m^3) shall comply with the provisions of California Code of Regulations, Title 24, Part 9, Section 304.3.

(2) Wastebaskets and linen containers in Group I-2 and I-3 occupancies shall comply with the provisions of California Code of Regulations Title 24, Part 9, Section 808.

(c) Approved self-closing metal containers or listed disposal containers by an approved testing or listing agency shall be provided and maintained in all rooms or locations where oily rags, oily waste, paint rags or similar materials subject to spontaneous ignition are used or are stored temporarily. Such containers shall be emptied daily.

304.3.1 Spontaneous ignition. Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container. Contents of such containers shall be removed and disposed of daily.

304.3.2 Capacity exceeding 5.33 cubic feet. Containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m^3) shall be provided with lids. Containers and lids shall be constructed of noncombustible materials or of combustible materials with a peak rate of heat release not exceeding 300 kW/m^2 where tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m^2 in the horizontal orientation.

Exception: Wastebaskets complying with Section 808.

304.3.3 Capacity exceeding 1.5 cubic yards. Dumpsters and containers with an individual capacity of 1.5 cubic yards [40.5 cubic feet (1.15 m^3)] or more shall not be stored in buildings or placed within 5 feet (1524 mm) of combustible walls, openings or combustible roof eave lines.

Exceptions:

1. Dumpsters or containers that are placed inside buildings in areas protected by an approved automatic sprinkler system installed throughout in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.
2. Storage in a structure shall not be prohibited where the structure is of Type I or IIA construction, located not less than 10 feet (3048 mm) from other buildings and used exclusively for dumpster or container storage.
3. Dumpsters or containers that are located adjacent to buildings where the exterior area is protected by an approved automatic sprinkler system.

304.3.4 Capacity of 1 cubic yard or more. Dumpsters with an individual capacity of 1.0 cubic yard [200 gallons

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(0.76 m³) or more shall not be stored in buildings or placed within 5 feet (1524 mm) of combustible walls, openings or combustible roof eave lines unless the dumpsters are constructed of noncombustible materials or of combustible materials with a peak rate of heat release not exceeding 300 kW/m² where tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation.

Exceptions:

1. Dumpsters in areas protected by an approved automatic sprinkler system installed throughout in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.
2. Storage in a structure shall not be prohibited where the structure is of Type I or IIA construction, located not less than 10 feet (3048 mm) from other buildings and used exclusively for dumpster or container storage.

SECTION 305 IGNITION SOURCES

305.1 Clearance from ignition sources. Clearance between ignition sources, such as luminaires, heaters, flame-producing devices and combustible materials, shall be maintained in an approved manner.

305.2 Hot ashes and spontaneous ignition sources. Hot ashes, cinders, smoldering coals or greasy or oily materials subject to spontaneous ignition shall not be deposited in a combustible receptacle, within 10 feet (3048 mm) of other combustible material including combustible walls and partitions or within 2 feet (610 mm) of openings to buildings.

Exception: The minimum required separation distance to other combustible materials shall be 2 feet (610 mm) where the material is deposited in a covered, noncombustible receptacle placed on a noncombustible floor, ground surface or stand.

305.3 Open-flame warning devices. Open-flame warning devices shall not be used along an excavation, road, or any place where the dislodgment of such device might permit the device to roll, fall or slide on to any area or land containing combustible material.

305.4 Deliberate or negligent burning. It shall be unlawful to deliberately or through negligence set fire to or cause the burning of combustible material in such a manner as to endanger the safety of persons or property.

305.5 Unwanted fire ignitions. Acts or processes that have caused repeated ignition of unwanted fires shall be modified to prevent future ignition.

SECTION 306 MOTION PICTURE PROJECTION ROOMS AND FILM

306.1 Motion picture projection rooms. Electric arc, xenon or other light source projection equipment that develops hazardous gases, dust or radiation and the projection of

ribbon-type cellulose nitrate film, regardless of the light source used in projection, shall be operated within a motion picture projection room complying with Section 409 of the *California Building Code*.

306.2 Cellulose nitrate film storage. Storage of cellulose nitrate film shall be in accordance with NFPA 40.

SECTION 307 OPEN BURNING, RECREATIONAL FIRES AND PORTABLE OUTDOOR FIREPLACES

307.1 General. A person shall not kindle or maintain or authorize to be kindled or maintained any open burning unless conducted and approved in accordance with Sections 307.1.1 through 307.5.

307.1.1 Prohibited open burning. Open burning shall be prohibited when atmospheric conditions or local circumstances make such fires hazardous.

Exception: Prescribed burning for the purpose of reducing the impact of wildland fire when authorized by the fire code official.

307.2 Permit required. A permit shall be obtained from the fire code official in accordance with Section 105.5 prior to kindling a fire for recognized silvicultural or range or wildlife management practices, prevention or control of disease or pests, or a bonfire. Application for such approval shall only be presented by and permits issued to the owner of the land on which the fire is to be kindled.

307.2.1 Authorization. Where required by state or local law or regulations, open burning shall only be permitted with prior approval from the state or local air and water quality management authority, provided that all conditions specified in the authorization are followed.

307.3 Extinguishment authority. Where open burning creates or adds to a hazardous situation, or a required permit for open burning has not been obtained, the fire code official is authorized to order the extinguishment of the open burning operation.

307.4 Location. The location for open burning shall be not less than 50 feet (15 240 mm) from any structure, and provisions shall be made to prevent the fire from spreading to within 50 feet (15 240 mm) of any structure.

Exceptions:

1. Fires in approved containers that are not less than 15 feet (4572 mm) from a structure.
2. The minimum required distance from a structure shall be 25 feet (7620 mm) where the pile size is 3 feet (914 mm) or less in diameter and 2 feet (610 mm) or less in height.

307.4.1 Bonfires. A bonfire shall not be conducted within 50 feet (15 240 mm) of a structure or combustible material unless the fire is contained in a barbecue pit. Conditions that could cause a fire to spread within 50 feet (15 240 mm) of a structure shall be eliminated prior to ignition.

307.4.2 Recreational fires. Recreational fires shall not be conducted within 25 feet (7620 mm) of a structure or

combustible material. Conditions that could cause a fire to spread within 25 feet (7620 mm) of a structure shall be eliminated prior to ignition.

307.4.3 Portable outdoor fireplaces. Portable outdoor fireplaces shall be used in accordance with the manufacturer's instructions and shall not be operated within 15 feet (3048 mm) of a structure or combustible material.

Exception: Portable outdoor fireplaces used at one- and two-family dwellings.

307.5 Attendance. Open burning, bonfires, recreational fires and use of portable outdoor fireplaces shall be constantly attended until the fire is extinguished. Not fewer than one portable fire extinguisher complying with Section 906 with a minimum 4-A rating or other approved on-site fire-extinguishing equipment, such as dirt, sand, water barrel, garden hose or water truck, shall be available for immediate utilization.

SECTION 308 OPEN FLAMES

308.1 General. Open flame, fire and burning on all premises shall be in accordance with Sections 308.1.1 through 308.4.1 and with other applicable sections of this code.

308.1.1 Where prohibited. A person shall not take or utilize an open flame or light in a structure, vessel, boat or other place where highly flammable, combustible or explosive material is utilized or stored. Lighting appliances shall be well-secured in a glass globe and wire mesh cage or a similar approved device.

[California Code of Regulations, Title 19, Division 1, §3.25(a) and (b)] Open Flame Devices.

(a) Open flame devices shall be prohibited in every Group A, E, I, R-2.1, R-3.1 and R-4 Occupancy.

Exceptions:

(1) Fuel burning elements of approved appliances shall not be considered as open flame devices.

(2) Upon approval of the enforcing agency, open flame devices may be used under the following conditions.

(A) When necessary for ceremonial or theatrical purposes under such restrictions as may be deemed necessary to avoid danger of ignition of combustible materials or injury to occupants.

(B) In approved and stable candle holders on individual tables of dining establishments.

(b) Under no circumstances shall hand held open flame devices such as exposed candles be permitted for any purpose in any occupancy within the scope of California Code of Regulations, Title 19, Division 1 regulations.

308.1.2 Throwing or placing sources of ignition. A person shall not throw or place, or cause to be thrown or placed, a lighted match, cigar, cigarette, matches, or other flaming or glowing substance or object on any surface or article where it can cause an unwanted fire.

308.1.3 Torches for removing paint. A person utilizing a torch or other flame-producing device for removing paint from a structure shall provide not less than one portable fire extinguisher complying with Section 906 and with a minimum 4-A rating, two portable fire extinguishers, each with a minimum 2-A rating, or a water hose connected to the water supply on the premises where such burning is done. The person doing the burning shall remain on the premises 1 hour after the torch or flame-producing device is utilized.

308.1.4 Open-flame cooking devices. Charcoal burners and other open-flame cooking devices shall not be operated on combustible balconies or within 10 feet (3048 mm) of combustible construction.

Exceptions:

1. One- and two-family dwellings.
2. Where buildings, balconies and decks are protected by an automatic sprinkler system.
3. LP-gas cooking devices having LP-gas container with a water capacity not greater than 2¹/₂ pounds [nominal 1 pound (0.454 kg) LP-gas capacity].

308.1.5 Location near combustibles. Open flames such as from candles, lanterns, kerosene heaters and gas-fired heaters shall not be located on or near decorative material or similar combustible materials.

308.1.6 Open-flame devices. Torches and other devices, machines or processes liable to start or cause fire shall not be operated or used in or on wildfire risk areas, except by a permit in accordance with Section 105.5 secured from the fire code official.

Exception: Use within inhabited premises or designated campsites that are not less than 30 feet (9144 mm) from grass-, grain-, brush- or forest-covered areas.

308.1.6.1 Signals and markers. Flame-employing devices, such as lanterns or kerosene road flares, shall not be operated or used as a signal or marker in or on wildfire risk areas.

Exception: The proper use of fusees at the scenes of emergencies or as required by standard railroad operating procedures.

308.1.6.2 Portable fueled open-flame devices. Portable open-flame devices fueled by flammable or combustible gases or liquids shall be enclosed or installed in such a manner as to prevent the flame from contacting combustible material.

Exceptions:

1. LP-gas-fueled devices used for sweating pipe joints or removing paint in accordance with Chapter 61.
2. Cutting and welding operations in accordance with Chapter 35.
3. Torches or flame-producing devices in accordance with Section 308.4.
4. Candles and open-flame decorative devices in accordance with Section 308.3.

GENERAL REQUIREMENTS

308.1.6.3 Sky lanterns. A person shall not release or cause to be released an untethered sky lantern.

308.1.7 Religious ceremonies. Where, in the opinion of the fire code official, adequate safeguards have been taken, participants in religious ceremonies are allowed to carry hand-held candles. Hand-held candles shall not be passed from one person to another while lighted.

308.1.7.1 Aisles and exits. Candles shall be prohibited in areas where occupants stand, or in an aisle or exit.

308.1.8 Flaming food and beverage preparation. The preparation of flaming foods or beverages in places of assembly and drinking or dining establishments shall be in accordance with Sections 308.1.8.1 through 308.1.8.5.

308.1.8.1 Dispensing. Flammable or combustible liquids used in the preparation of flaming foods or beverages shall be dispensed from one of the following:

1. A 1-ounce (29.6 ml) container.
2. A container not exceeding 1-quart (946.5 ml) capacity with a controlled pouring device that will limit the flow to a 1-ounce (29.6 ml) serving.

308.1.8.2 Containers not in use. Containers shall be secured to prevent spillage when not in use.

308.1.8.3 Serving of flaming food. The serving of flaming foods or beverages shall be done in a safe manner and shall not create high flames. The pouring, ladling or spooning of liquids is restricted to a maximum height of 8 inches (203 mm) above the receiving receptacle.

308.1.8.4 Location. Flaming foods or beverages shall be prepared only in the immediate vicinity of the table being serviced. They shall not be transported or carried while burning.

308.1.8.5 Fire protection. The person preparing the flaming foods or beverages shall have a wet cloth towel immediately available for use in smothering the flames in the event of an emergency.

308.2 Permits required. Permits shall be obtained from the fire code official in accordance with Section 105.5 prior to engaging in the following activities involving open flame, fire and burning:

1. Use of a torch or flame-producing device to remove paint from a structure.
2. Use of open flame, fire or burning in connection with Group A or E occupancies.
3. Use or operation of torches and other devices, machines or processes liable to start or cause fire in or on wildfire risk areas.

308.3 Group A occupancies. Open-flame devices shall not be used in a Group A occupancy.

Exceptions:

1. Open-flame devices are allowed to be used in the following situations, provided that approved precautions are taken to prevent ignition of a combustible material or injury to occupants:

- 1.1. Where necessary for ceremonial or religious purposes in accordance with Section 308.1.7.

- 1.2. On stages and platforms as a necessary part of a performance in accordance with Section 308.3.2.

- 1.3. Where candles on tables are securely supported on substantial noncombustible bases and the candle flames are protected.

2. Heat-producing equipment complying with Chapter 6 and the *California Mechanical Code*.

3. Gas lights are allowed to be used provided that adequate precautions satisfactory to the fire code official are taken to prevent ignition of combustible materials.

308.3.1 Open-flame decorative devices. Open-flame decorative devices shall comply with all of the following restrictions:

1. Class I and Class II liquids and LP-gas shall not be used.
2. Liquid- or solid-fueled lighting devices containing more than 8 ounces (237 ml) of fuel must self-extinguish and not leak fuel at a rate of more than 0.25 teaspoon per minute (1.26 ml per minute) if tipped over.

3. The device or holder shall be constructed to prevent the spillage of liquid fuel or wax at the rate of more than 0.25 teaspoon per minute (1.26 ml per minute) when the device or holder is not in an upright position.

4. The device or holder shall be designed so that it will return to the upright position after being tilted to an angle of 45 degrees (0.79 rad) from vertical.

Exception: Devices that self-extinguish if tipped over and do not spill fuel or wax at the rate of more than 0.25 teaspoon per minute (1.26 ml per minute) if tipped over.

5. The flame shall be enclosed except where openings on the side are not more than 0.375-inch (9.5 mm) diameter or where openings are on the top and the distance to the top is such that a piece of tissue paper placed on the top will not ignite in 10 seconds.

6. Chimneys shall be made of noncombustible materials and securely attached to the open-flame device.

Exception: A chimney is not required to be attached to any open-flame device that will self-extinguish if the device is tipped over.

7. Fuel canisters shall be safely sealed for storage.

8. Storage and handling of combustible liquids shall be in accordance with Chapter 57.

9. Shades, where used, shall be made of noncombustible materials and securely attached to the open-flame device holder or chimney.

10. Candelabras with flame-lighted candles shall be securely fastened in place to prevent overturning,

and shall be located away from occupants using the area and away from possible contact with drapes, curtains or other combustibles.

308.3.2 Theatrical performances. Where approved, open-flame devices used in conjunction with theatrical performances are allowed to be used where adequate safety precautions have been taken in accordance with NFPA 160.

308.4 Group R occupancies. Open flame, fire and burning in Group R occupancies shall comply with the requirements of Sections 308.1 through 308.1.6.3 and Section 308.4.1.

308.4.1 Group R-2 dormitories. Candles, incense and similar open-flame-producing items shall not be allowed in sleeping units in Group R-2 dormitory occupancies.

308.5 Group I, R-2.1, R-3.1, R-4 occupancies or any Licensed Care Facility. A person shall not utilize or allow to be utilized, an open flame in Group I, R-2.1, R-3.1, R-4 occupancies or any Licensed Care Facilities.

SECTION 309 POWERED INDUSTRIAL TRUCKS AND EQUIPMENT

309.1 General. Powered industrial trucks and similar equipment including, but not limited to, floor scrubbers and floor buffers, shall be operated and maintained in accordance with Sections 309.2 through 309.7.

309.2 Use in hazardous (classified) locations. Powered industrial trucks used in areas designated as hazardous (classified) locations in accordance with *the California Electrical Code* shall be listed and labeled for use in the environment intended in accordance with NFPA 505.

309.3 Battery chargers. Battery chargers shall be of an approved type. Combustible storage shall be kept not less than 3 feet (915 mm) from battery chargers. Battery charging shall not be conducted in areas open to the public.

309.4 Ventilation. Ventilation shall be provided in an approved manner in battery-charging areas to prevent a dangerous accumulation of flammable gases.

309.5 Fire extinguishers. Battery-charging areas shall be provided with a fire extinguisher complying with Section 906 having a minimum 4-A:20-B:C rating within 20 feet (6096 mm) of the battery charger.

309.6 Refueling. Powered industrial trucks using liquid fuel, LP-gas or hydrogen shall be refueled outside of buildings or in areas specifically approved for that purpose. Fixed fuel-dispensing equipment and associated fueling operations shall be in accordance with Chapter 23. Other fuel-dispensing equipment and operations, including cylinder exchange for LP-gas-fueled vehicles, shall be in accordance with Chapter 57 for flammable and combustible liquids or Chapter 61 for LP-gas.

309.7 Repairs. Repairs to fuel systems, electrical systems and repairs utilizing open flame or welding shall be done in approved locations outside of buildings or in areas specifically approved for that purpose.

SECTION 310 SMOKING

310.1 General. The smoking or carrying of a lighted pipe, cigar, cigarette or any other type of smoking paraphernalia or material is prohibited in the areas indicated in Sections 310.2 through 310.8.

310.2 Prohibited areas. Smoking shall be prohibited where conditions are such as to make smoking a hazard, and in spaces where flammable or combustible materials are stored or handled.

[California Code of Regulations, Title 19, Division 1, §3.32(a) and (b)] Smoking.

(a) Smoking shall not be permitted in any Group E Occupancy as defined in California Code of Regulations, Title 24, Part 2, except as provided in California Code of Regulations, Title 19, Division 1, subsection (b), below.

(b) The governing board of any school district maintaining a community college or high school may adopt rules and regulations permitting the smoking and possession of tobacco on the campus of a community college or high school or while under the authority of school personnel by pupils of the community college or high school; provided that such rules and regulations shall not permit students to smoke in any classroom or other enclosed facility which any student is required to occupy or which is customarily occupied by nonsmoking students. Areas designated for smoking shall be approved by the enforcing agency.

NOTE: See Section 48901 of the Education Code relating to the smoking or possession of tobacco by pupils.

[California Code of Regulations, Title 19, Division 1, §3.32(d)] Smoking.

(d) Smoking shall be prohibited in any patient room of a Group I, R-2.1, R-3.1 or R-4 occupancy utilizing air-induced mattresses. "No Smoking – Open Flame" signs shall be installed as specified in NFPA 99B, *Hypobaric Facilities*, 2005 edition.

310.3 "No Smoking" signs. The fire code official is authorized to order the posting of "No Smoking" signs or the international symbol for no smoking in a conspicuous location in each structure or location in which smoking is prohibited. The content, lettering, size, color and location of required "No Smoking" signs shall be approved.

Exception: "No Smoking" signs are not required in interior locations of the facility where signs are displayed at all major entrances into the facility.

[California Code of Regulations, Title 19, Division 1, §3.32(c)] Smoking.

(c) Approved no smoking signs shall be posted on all stages and platforms of Group A occupancies. Smoking shall not be permitted on stages or platforms except in approved designated areas and as necessary for theatrical, opera or similar productions.

310.4 Removal of signs prohibited. A posted "No Smoking" sign shall not be obscured, removed, defaced, mutilated or destroyed.

GENERAL REQUIREMENTS

310.5 Compliance with “No Smoking” signs. Smoking shall not be permitted nor shall a person smoke, throw or deposit any lighted or smoldering substance in any place where “No Smoking” signs are posted.

310.6 Ash trays. Where smoking is permitted, suitable noncombustible ash trays or match receivers shall be provided on each table and at other appropriate locations. In Group I-2 occupancies, noncombustible metal containers with self-closing covers shall be provided in areas where smoking is permitted.

310.7 Burning objects. Lighted matches, cigarettes, cigars or other burning object shall not be discarded in such a manner that could cause ignition of other combustible material.

310.8 Hazardous environmental conditions. Where the fire code official determines that hazardous environmental conditions necessitate controlled use of smoking materials, the ignition or use of such materials in mountainous, brush-covered or forest-covered areas or other designated areas is prohibited except in approved designated smoking areas.

SECTION 311 VACANT PREMISES

311.1 General. Temporarily unoccupied buildings, structures, premises or portions thereof, including tenant spaces, shall be safeguarded and maintained in accordance with Sections 311.1.1 through 311.6.

311.1.1 Abandoned premises. Buildings, structures and premises for which an owner cannot be identified or located by dispatch of a certificate of mailing to the last known or registered address, which persistently or repeatedly become unprotected or unsecured, which have been occupied by unauthorized persons or for illegal purposes, or which present a danger of structural collapse or fire spread to adjacent properties shall be considered to be abandoned, declared unsafe and abated by demolition or rehabilitation in accordance with the *International Property Maintenance Code* and the *California Building Code*.

311.1.2 Tenant spaces. Storage and lease plans required by this code shall be revised and updated to reflect temporary or partial vacancies.

311.2 Safeguarding vacant premises. Temporarily unoccupied buildings, structures, premises or portions thereof shall be secured and protected in accordance with Sections 311.2.1 through 311.2.3.

311.2.1 Security. Exterior and interior openings open to other tenants or unauthorized persons shall be boarded, locked, blocked or otherwise protected to prevent entry by unauthorized individuals. The fire code official is authorized to placard, post signs, erect barrier tape or take similar measures as necessary to secure public safety.

311.2.2 Fire protection. Fire protection systems shall be maintained in an operable condition at all times.

Exceptions:

1. Where the premises have been cleared of all combustible materials and debris and, in the opinion

of the fire code official, the type of construction, fire separation distance and security of the premises do not create a fire hazard.

2. Where approved by the fire code official, buildings that will not be heated and where fire protection systems will be exposed to freezing temperatures, fire alarm and automatic sprinkler systems are permitted to be placed out of service and standpipes are permitted to be maintained as dry systems (without an automatic water supply), provided that the building does not have contents or storage, and windows, doors and other openings are secured to prohibit entry by unauthorized persons.
3. Where approved by the fire code official, fire alarm and automatic sprinkler systems are permitted to be placed out of service in seasonally occupied buildings: that will not be heated; where fire protection systems will be exposed to freezing temperatures; where fire areas do not exceed 12,000 square feet (1115 m²); and that do not store motor vehicles or hazardous materials.

311.2.3 Fire separation. Fire-resistance-rated partitions, fire barriers and fire walls separating vacant tenant spaces from the remainder of the building shall be maintained. Openings, joints and penetrations in fire-resistance-rated assemblies shall be protected in accordance with Chapter 7.

311.3 Removal of combustibles. Persons owning, or in charge or control of, a vacant building or portion thereof, shall remove therefrom all accumulations of combustible materials, flammable or combustible waste or rubbish and shall securely lock or otherwise secure doors, windows and other openings to prevent entry by unauthorized persons. The premises shall be maintained clear of waste or hazardous materials.

Exceptions:

1. Buildings or portions of buildings undergoing additions, alterations, repairs or change of occupancy in accordance with the *California Building Code*, where waste is controlled and removed as required by Section 304.
2. Seasonally occupied buildings.

311.4 Removal of hazardous materials. Persons owning or having charge or control of a vacant building containing hazardous materials regulated by Chapter 50 shall comply with the facility closure requirements of Section 5001.6.

311.5 Placards. Any vacant or abandoned buildings or structures determined to be unsafe pursuant to Section 111 of this code relating to structural or interior hazards shall be marked as required by Sections 311.5.1 through 311.5.5.

311.5.1 Placard location. Placards shall be applied on the front of the structure and be visible from the street. Additional placards shall be applied to the side of each entrance to the structure and on penthouses.

311.5.2 Placard size and color. Placards shall be 24 inches by 24 inches (610 mm by 610 mm) minimum in size with a red background, white reflective stripes and a

white reflective border. The stripes and border shall have a 2-inch (51 mm) minimum stroke.

311.5.3 Placard date. Placards shall bear the date of their application to the building and the date of the most recent inspection.

311.5.4 Placard symbols. The design of the placards shall use the following symbols:

1. This symbol shall mean that the structure had normal structural conditions at the time of marking.
2. This symbol shall mean that structural or interior hazards exist and interior fire-fighting or rescue operations should be conducted with extreme caution.
3. This symbol shall mean that structural or interior hazards exist to a degree that consideration should be given to limit fire fighting to exterior operations only, with entry only occurring for known life hazards.
4. Vacant marker hazard identification symbols: The following symbols shall be used to designate known hazards on the vacant building marker. They shall be placed directly above the symbol.
 - 4.1. R/O—Roof open.
 - 4.2. S/M—Stairs, steps and landing missing.
 - 4.3. F/E—Avoid fire escapes.
 - 4.4. H/F—Holes in floor.

311.5.5 Informational use. The use of these symbols shall be informational only and shall not in any way limit the discretion of the on-scene incident commander.

311.6 Unoccupied tenant spaces in mall buildings. Unoccupied tenant spaces in covered and open mall buildings shall be:

1. Kept free from the storage of any materials.
2. Separated from the remainder of the building by partitions of not less than 0.5-inch-thick (12.7 mm) gypsum board or an approved equivalent to the underside of the ceiling of the adjoining tenant spaces.
3. Without doors or other access openings other than one door that shall be kept key locked in the closed position except during that time when opened for inspection.
4. Kept free from combustible waste and be broomswept clean.

SECTION 312 VEHICLE IMPACT PROTECTION

312.1 General. Vehicle impact protection required by this code shall be provided by posts that comply with Section 312.2 or by other approved physical barriers that comply with Section 312.3.

312.2 Posts. Guard posts shall comply with all of the following requirements:

1. Constructed of steel not less than 4 inches (102 mm) in diameter and concrete filled.

2. Spaced not more than 4 feet (1219 mm) between posts on center.
3. Set not less than 3 feet (914 mm) deep in a concrete footing of not less than a 15-inch (381 mm) diameter.
4. Set with the top of the posts not less than 3 feet (914 mm) above ground.
5. Located not less than 3 feet (914 mm) from the protected object.

312.3 Other barriers. Barriers, other than posts specified in Section 312.2, that are designed to resist, deflect or visually deter vehicular impact commensurate with an anticipated impact scenario shall be permitted where approved.

SECTION 313 FUELED EQUIPMENT

313.1 General. Fueled equipment including, but not limited to, motorcycles, mopeds, lawn-care equipment, portable generators and portable cooking equipment, shall not be stored, operated or repaired within a building.

Exceptions:

1. Buildings or rooms constructed for such use in accordance with the *California Building Code*.
2. Where allowed by Section 314.
3. Storage of equipment utilized for maintenance purposes is allowed in approved locations where the aggregate fuel capacity of the stored equipment does not exceed 10 gallons (38 L) and the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

313.1.1 Removal. The fire code official is authorized to require removal of fueled equipment from locations where the presence of such equipment is determined by the fire code official to be hazardous.

313.2 Group R occupancies. Vehicles powered by flammable liquids, Class II combustible liquids or compressed flammable gases shall not be stored within the living space of Group R buildings.

SECTION 314 INDOOR DISPLAYS

314.1 General. Indoor displays constructed within any occupancy shall comply with Sections 314.2 through 314.4.

314.2 Fixtures and displays. Fixtures and displays of goods for sale to the public shall be arranged so as to maintain free, immediate and unobstructed access to exits as required by Chapter 10.

314.3 Highly combustible goods. The display of highly combustible goods, including but not limited to fireworks, flammable or combustible liquids, liquefied flammable gases, oxidizing materials, pyroxylin plastics and agricultural goods, in main exit access aisles, corridors, covered and open malls, or within 5 feet (1524 mm) of entrances to exits and exterior exit doors is prohibited where a fire involving such goods would rapidly prevent or obstruct egress.

GENERAL REQUIREMENTS

314.4 Vehicles. Liquid-fueled or gaseous-fueled vehicles, aircraft, boats or other motorcraft shall not be located indoors except as follows:

1. The engine starting system is made inoperable or batteries are disconnected except where the fire code official requires that the batteries remain connected to maintain safety features.
2. Fuel in fuel tanks does not exceed one-quarter tank or 5 gallons (19 L) (whichever is least).
3. Fuel tanks and fill openings are closed and sealed to prevent tampering.
4. Vehicles, aircraft, boats or other motorcraft equipment are not fueled or defueled within the building.

SECTION 315 GENERAL STORAGE

315.1 General. Storage shall be in accordance with Sections 315.2 through 315.6. Outdoor pallet storage shall be in accordance with Sections 315.2 and 315.7.

Exception: Wood and wood composite pallets stored outdoors at pallet manufacturing and recycling facilities and complying with Section 2810.

315.2 Permit required. A permit for miscellaneous combustible storage shall be required as set forth in Section 105.5.

315.3 Storage in buildings. Storage of materials in buildings shall be orderly and stacks shall be stable. Storage of combustible materials shall be separated from heaters or heating devices by distance or shielding so that ignition cannot occur.

315.3.1 Ceiling clearance. Storage shall be maintained 2 feet (610 mm) or more below the ceiling in nonsprinklered areas of buildings or not less than 18 inches (457 mm) below sprinkler head deflectors in sprinklered areas of buildings.

Exceptions:

1. The 2-foot (610 mm) ceiling clearance is not required for storage along walls in nonsprinklered areas of buildings.
2. The 18-inch (457 mm) ceiling clearance is not required for storage along walls in areas of buildings equipped with an automatic sprinkler system in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.

315.3.2 Means of egress. Combustible materials shall not be stored in exits or enclosures for stairways and ramps. Combustible materials in the means of egress during construction, demolition, remodeling or alterations shall comply with Section 3312.3.

315.3.3 Equipment rooms. Combustible material shall not be stored in boiler rooms, mechanical rooms, electrical equipment rooms or in fire command centers as specified in Section 508.1.5.

315.3.4 Attic, under-floor and concealed spaces. Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage

side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are self-closing and are of noncombustible construction or solid wood core not less than 1³/₄ inches (44.5 mm) in thickness. Storage shall not be placed on exposed joists.

Exceptions:

1. Areas protected by approved automatic sprinkler systems.
2. Group R-3 and Group U occupancies.

315.4 Outside storage. Outside storage of combustible materials shall not be located within 10 feet (3048 mm) of a lot line.

Exceptions:

1. The separation distance is allowed to be reduced to 3 feet (914 mm) for storage not exceeding 6 feet (1829 mm) in height.
2. The separation distance is allowed to be reduced where the fire code official determines that hazard to the adjoining property does not exist.

315.4.1 Storage beneath overhead projections from buildings. Where buildings are protected by an automatic sprinkler system, the outdoor storage, display and handling of combustible materials under eaves, canopies or other projections or overhangs are prohibited except where automatic sprinklers are installed under such eaves, canopies or other projections or overhangs.

315.4.2 Height. Storage in the open shall not exceed 20 feet (6096 mm) in height.

315.5 Storage underneath high-voltage transmission lines. Storage located underneath high-voltage transmission lines shall be in accordance with Section 316.6.2.

315.6 Storage in plenums. Storage is prohibited in plenums. Abandoned material in plenums shall be deemed to be storage and shall be removed. Where located in plenums, the portion of abandoned cables that are able to be accessed without causing damage, or requiring demolition to the building shall be identified for future use with a tag or shall be deemed storage and shall be removed.

315.7 Outdoor pallet storage. Pallets stored outdoors shall comply with Sections 315.7 through 315.7.7. Pallets stored within a building shall be protected in accordance with Chapter 32.

315.7.1 Storage beneath overhead projections from buildings. Where buildings are equipped throughout with an automatic sprinkler system, the outdoor storage of pallets under eaves, canopies or other projections or overhangs are prohibited except where automatic sprinklers are installed under such eaves, canopies or other projections or overhangs.

315.7.2 Distance to lot line. Pallet storage shall not be located within 10 feet (3048 mm) of a lot line.

315.7.3 Storage height. Pallet storage shall not exceed 20 feet (6096 mm) in height.

315.7.4 Pallet pile stability and size. Pallet stacks shall be arranged to form stable piles. Individual pallet piles

shall cover an area not greater than 400 square feet (37 m²).

315.7.5 Pallet types. Pallets shall be all wood, with slatted or solid top or bottom, with metal fasteners, or shall be plastic or composite pallets, listed and labeled in accordance with UL 2335 or FM 4996. Plastic pallets shall be both solid and gridded deck, independent of the pallet manufacturing process, type of resin used in fabrication or geometry of the pallet.

315.7.6 Pile separation distances. In addition to the other requirements of this section, pallet stacks and piles shall be separated in accordance with Sections 315.7.6.1 and 315.7.6.2.

315.7.6.1 Building separation. Pallet stacks and piles shall be separated from buildings in accordance with Table 315.7.6(1) for wood pallets and Table 315.7.6(2) for plastic pallets.

315.7.6.2 Separation from other pallets and on-site storage. Pallets shall be separated from other pallet piles and other storage in accordance with Table 315.7.6(3) for wood pallets and Table 315.7.6(4) for plastic pallets.

315.7.7 Prohibited locations. Pallets shall not be stored underneath high-voltage transmission lines, elevated roadways or elevated railways.

**SECTION 316
HAZARDS TO FIRE FIGHTERS**

316.1 Trapdoors to be closed. Trapdoors and scuttle covers, other than those that are within a dwelling unit or automatically operated, shall be kept closed at all times except when in use.

316.2 Shaftway markings. Vertical shafts shall be identified as required by this section.

316.2.1 Exterior access to shaftways. Outside openings that can be reached by the fire department and that open directly on a hoistway or shaftway communicating

between two or more floors in a building shall be plainly marked with the word “SHAFTWAY” in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible from the outside of the building.

316.2.2 Interior access to shaftways. Door or window openings to a hoistway or shaftway from the interior of the building shall be plainly marked with the word “SHAFTWAY” in red letters not less than 6 inches (152 mm) high on a white background. Such warning signs shall be placed so as to be readily discernible.

Exception: Marking shall not be required on shaftway openings that are readily discernible as openings onto a shaftway by the construction or arrangement.

316.3 Pitfalls. The intentional design or alteration of buildings to disable, injure, maim or kill intruders is prohibited. A person shall not install and use firearms, sharp or pointed objects, razor wire, explosives, flammable or combustible liquid containers, or dispensers containing highly toxic, toxic, irritant or other hazardous materials in a manner that could passively or actively disable, injure, maim or kill a fire fighter who forcibly enters a building for the purpose of controlling or extinguishing a fire, rescuing trapped occupants or rendering other emergency assistance.

316.4 Obstructions on roofs. Wires, cables, ropes, antennas, or other suspended obstructions installed on the roof of a building having a roof slope of less than 30 degrees (0.52 rad) shall not create an obstruction that is less than 7 feet (2133 mm) high above the surface of the roof.

Exceptions:

1. Such obstruction shall be permitted where the wire, cable, rope, antenna or suspended obstruction is encased in a white, 2-inch (51 mm) minimum diameter plastic pipe or an approved equivalent.
2. Such obstruction shall be permitted where there is a solid obstruction below such that accidentally walking into the wire, cable, rope, antenna or suspended obstruction is not possible.

**TABLE 315.7.6(1)
SEPARATION DISTANCE BETWEEN WOOD PALLET STACKS AND BUILDINGS**

WALL CONSTRUCTION	OPENING TYPE	WOOD PALLET SEPARATION DISTANCE (feet)		
		≤ 50 Pallets	51 to 200 Pallets	> 200 Pallets
Masonry	None	2	2	2
Masonry	Fire-rated glazing with open sprinklers	2	5	20
Masonry	Fire-rated glazing	5	10	20
Masonry	Plain glass with open sprinklers	5	10	20
Noncombustible	None	5	10	20
Wood with open sprinklers	—	5	10	20
Wood	None	15	30	90
Any	Plain glass	15	30	90

For SI: 1 foot = 304.8 mm.

GENERAL REQUIREMENTS

**TABLE 315.7.6(2)
SEPARATION DISTANCE BETWEEN PLASTIC PALLET STACKS AND BUILDINGS**

WALL CONSTRUCTION	OPENING TYPE	PLASTIC PALLET SEPARATION DISTANCE (feet)		
		≤ 50 Pallets	51 to 200 Pallets	> 200 Pallets
Masonry	None	2	2	2
Masonry	Fire-rated glazing with open sprinklers	10	20	50
Masonry	Fire-rated glazing	15	40	100
Masonry	Plain glass with open sprinklers	15	40	100
Noncombustible	None	15	40	100
Wood with open sprinklers	—	15	40	100
Wood	None	30	80	150
Any	Plain glass	30	80	150

For SI: 1 foot = 304.8 mm.

**TABLE 315.7.6(3)
SEPARATION FROM OTHER PALLET PILES AND ON-SITE STORAGE (WOOD PALLETS)**

	WOOD PALLET SEPARATION DISTANCE (feet)		
	≤ 50 Pallets	51 to 200 Pallets	> 200 Pallets
Between pallet piles	7.5	15	45
Other on-site storage	7.5	15	45

For SI: 1 foot = 304.8 mm.

**TABLE 315.7.6(4)
SEPARATION FROM OTHER PALLET PILES AND ON-SITE STORAGE (PLASTIC PALLETS)**

	PLASTIC PALLET SEPARATION DISTANCE (feet)		
	≤ 50 Pallets	51 to 200 Pallets	> 200 Pallets
Between pallet piles	15	40	75
Other on-site storage	15	40	75

For SI: 1 foot = 304.8 mm.

[California Code of Regulations, Title 19, Division 1, §3.05(b)] Fire Department Access and Egress. (Roofs).

(b) Roofs. No person shall install or maintain any security barrier such as barbed wire fencing, razor wire fencing, chain link fencing or any other fencing material, cable, aerial, antenna or other obstruction on the roof of any commercial establishment in such a manner as to obstruct or render egress or access hazardous in the event of fire or other emergency.

Exception: Guy wire, rods and aerial antenna masts may be attached to a roof structure having a slope of less than 30 degrees provided there is full clearance of seven feet or more between the roof and said obstruction. Guy wire or rods required to support aerial or antenna masts may be attached to a roof structure a lateral distance from the mast not in excess of one-sixth the height of the mast.

316.5 Security device. Any security device or system that emits any medium that could obscure a means of egress in any building, structure or premise shall be prohibited.

316.6 Structures and outdoor storage underneath high-voltage transmission lines. Structures and outdoor storage underneath high-voltage transmission lines shall comply with Sections 316.6.1 and 316.6.2, respectively.

316.6.1 Structures. Structures shall not be constructed within the utility easement beneath high-voltage transmission lines.

Exception: Restrooms and unoccupied telecommunication structures of noncombustible construction less than 15 feet (4572 mm) in height.

316.6.2 Outdoor storage. Outdoor storage within the utility easement underneath high-voltage transmission lines shall be limited to noncombustible material. Storage of hazardous materials including, but not limited to, flammable and combustible liquids is prohibited.

Exception: Combustible storage, including vehicles and fuel storage for backup power equipment serving public utility equipment, is allowed, provided that a plan indicating the storage configuration is submitted and approved.

SECTION 317 LANDSCAPED ROOFS

317.1 General. Landscaped roofs shall be installed and maintained in accordance with Sections 317.2 through 317.5 and Sections 1505 and 1507.15 of the *California Building Code*.

317.2 Landscaped roof size. Landscaped roof areas shall not exceed 15,625 square feet (1450 m²) in size for any single area with a maximum dimension of 125 feet (39 m) in length or width. A minimum 6-foot-wide (1.8 m) clearance consisting of a listed Class A roof assembly tested in accordance with ASTM E108 or UL 790 shall be provided between adjacent landscaped roof areas.

317.3 Rooftop structure and equipment clearance. For all vegetative roofs abutting combustible vertical surfaces, a Class A-rated roof system complying with ASTM E108 or UL 790 shall be achieved for a minimum 6-foot-wide (1829 mm) continuous border placed around rooftop structures and all rooftop equipment including, but not limited to, mechanical and machine rooms, penthouses, skylights, roof vents, solar panels, antenna supports and building service equipment.

317.4 Vegetation. Vegetation shall be maintained in accordance with Sections 317.4.1 and 317.4.2.

317.4.1 Irrigation. Supplemental irrigation shall be provided to maintain levels of hydration necessary to keep green roof plants alive and to keep dry foliage to a minimum.

317.4.2 Dead foliage. Excess biomass, such as overgrown vegetation, leaves and other dead and decaying material, shall be removed at regular intervals not less than two times per year.

317.4.3 Maintenance plan. The fire code official is authorized to require a maintenance plan for vegetation placed on roofs due to the size of a landscaped roof, materials used or where a fire hazard exists to the building or exposures due to the lack of maintenance.

317.5 Maintenance equipment. Fueled equipment stored on roofs and used for the care and maintenance of vegetation on roofs shall be stored in accordance with Section 313.

SECTION 318 LAUNDRY CARTS

318.1 Laundry carts with a capacity of 1 cubic yard or more. Laundry carts with an individual capacity of 1 cubic yard [200 gallons (0.76 m³)] or more, used in laundries within Group B, E, F-1, I, M and R-1 occupancies, shall be constructed of noncombustible materials or materials having a peak rate of heat release not exceeding 300 kW/m² at a flux of 50 kW/m² where tested in a horizontal orientation in accordance with ASTM E1354.

Exceptions:

1. Laundry carts in areas protected by an approved automatic sprinkler system installed throughout in accordance with Section 903.3.1.1.
2. Laundry carts in coin-operated laundries.

SECTION 319 RESERVED

SECTION 320 ADDITIVE MANUFACTURING (3D PRINTING)

320.1 General. Additive manufacturing equipment and operations shall comply with Section 320.

320.1.1 Scope. Additive manufacturing shall comply with one of the following:

1. Nonindustrial additive manufacturing shall comply with Section 320.2.
2. Industrial additive manufacturing shall comply with Section 320.3.

320.1.2 Installation, operation and maintenance. 3D printers and associated additive manufacturing equipment shall be installed, operated and maintained in accordance with this code, the listing and the manufacturer's instructions.

320.1.3 Production materials. Only the production materials listed for use with the equipment and included in the manufacturer's instructions shall be used.

320.2 Nonindustrial additive manufacturing. Nonindustrial additive manufacturing equipment and operations shall comply with Sections 320.2.1 and 320.2.2. Additive manufacturing equipment and operations that do not comply with Section 320.2 shall comply with Section 320.3.

320.2.1 Listing. 3D printers used in nonindustrial additive manufacturing shall be listed and labeled in accordance with UL 2011, UL 60950-1 or UL 62368-1. The listing shall also verify:

1. The 3D printers are self-contained and utilize maximum 30-liter prepackaged production materials.
2. The operation of the 3D printers shall not create a hazardous (classified) electrical area or zone outside the unit.
3. If any hazardous (classified) electrical area or zone exists inside the unit's outer enclosure, the area shall be protected by intrinsically safe electrical construction or other acceptable protection methods.
4. The 3D printers shall not utilize inert gas or an external combustible dust collection system.

320.2.2 Occupancies. Nonindustrial additive manufacturing shall be permitted in all occupancy groups.

320.3 Industrial additive manufacturing. Industrial additive manufacturing equipment and operations shall comply with Sections 320.3.1 through 320.3.12.

320.3.1 Permits required. Permits shall be obtained from the fire code official in accordance with Section 105.5 prior to engaging in industrial additive manufacturing operations.

320.3.2 Listing. 3D printers used in industrial additive manufacturing shall be listed and labeled in accordance with UL 2011 or approved for the application based on a field evaluation conducted by an approved agency.

GENERAL REQUIREMENTS

320.3.3 Combustible dusts and metals. Industrial additive manufacturing operations that store, use or produce combustible dust, combustible particulate solids or combustible metals shall comply with Chapter 22 and this section.

320.3.4 Powder evaluation. Printing powders used in industrial additive manufacturing operations shall be tested for combustibility in accordance with NFPA 484 or NFPA 652 as applicable. A copy of test reports shall be provided to the fire code official upon request.

320.3.5 Combustible (nonmetallic) dusts. Industrial additive manufacturing operations that store, use or produce combustible (nonmetallic) dusts shall comply with NFPA 654.

320.3.6 Combustible metals. Industrial additive manufacturing operations that store or use combustible metals shall comply with NFPA 484.

320.3.7 Ancillary equipment. Ancillary equipment provided for recycling, sieving, vacuuming or handling combustible powders shall be designed and approved for such use.

320.3.8 Hazardous materials. Industrial additive manufacturing operations that store or use hazardous materials exceeding the maximum allowable quantity limits shall comply with Chapter 50.

320.3.9 Inert gas. Additive manufacturing processes that utilize inert gases shall comply with Chapter 53. Ventilation or gas detection shall be provided in accordance with Section 5307.

320.3.10 Technical assistance. Where required by the fire code official, a report evaluating the acceptability of technologies, processes, products, facilities, materials and uses associated with the operation shall be provided in accordance with Section 104.8.2 and approved.

320.3.11 Performance-based design alternative. Where approved by the fire code official, buildings and facilities where industrial additive manufacturing is performed shall be permitted to comply with the performance-based design options in Section 5001.3 as an alternative to compliance with the other requirements set forth in this section.

320.3.12 Occupancies. Industrial additive manufacturing shall be conducted only in the occupancy groups associated with manufacturing operation and permitted by the Chapter 50 maximum allowable quantity tables. Where approved, the requirements in Section 320.3.6 shall be permitted to provide the technical basis for determining compliance with Table 5003.1.1(1), Note q.

SECTION 321 ARTIFICIAL COMBUSTIBLE VEGETATION

321.1 Artificial combustible vegetation on roofs and near buildings. Artificial combustible vegetation exceeding 6 feet (1829 mm) in height and permanently installed outdoors within 5 feet (1524 mm) of a building or on the roof of a building shall comply with Section 807.4.1. The placement of

artificial combustible vegetation shall also comply with Sections 806.3 and 807.4.2.

Exception: Artificial decorative vegetation located more than 30 feet (9144 mm) from the exterior wall of a building.

SECTION 322 STORAGE OF LITHIUM-ION AND LITHIUM METAL BATTERIES

322.1 General. The storage of lithium-ion and lithium metal batteries shall comply with Section 322.

Exceptions:

1. New or refurbished batteries installed in the equipment, devices or vehicles they are designed to power.
2. New or refurbished batteries packed for use with the equipment, devices or vehicles they are designed to power.
3. Batteries in original retail packaging that are rated at 300 watt-hours or less for lithium-ion batteries or contain 25 grams or less of lithium metal for lithium metal batteries.
4. Temporary storage of batteries or battery components during the battery manufacturing process prior to completion of final quality control checks.
5. Temporary storage of batteries during the vehicle manufacturing or repair process.

322.2 Permits. Permits shall be required for an accumulation of more than 15 cubic feet (0.42 m³) of lithium-ion and lithium metal batteries, other than batteries listed in the exceptions to Section 322.1, as set forth in Section 105.5.53.

322.3 Fire safety plan. A fire safety plan shall be provided in accordance with Section 403.10.6. In addition, the fire safety plan shall include emergency response actions to be taken upon detection of a fire or possible fire involving lithium-ion or lithium metal battery storage.

322.4 Storage requirements. Lithium-ion and lithium metal batteries shall be stored in accordance with Sections 322.4.1, 322.4.2 or 322.4.3, as applicable.

322.4.1 Limited indoor storage in containers. Not more than 15 cubic feet (0.42 m³) of lithium-ion or lithium metal batteries shall be permitted to be stored in containers in accordance with all of the following:

1. Containers shall be open-top and constructed of noncombustible materials or shall be approved for battery collection.
2. Individual containers and groups of containers shall not exceed a capacity of 7.5 cubic feet (0.21 m³).
3. A second container or group of containers shall be separated by not less than 3 feet (914 mm) of open space, or 10 feet (3048 mm) of space that contains combustible materials.
4. Containers shall be located not less than 5 feet (1524 mm) from exits or exit access doors.

322.4.2 Indoor storage areas. Indoor storage areas for lithium-ion and lithium metal batteries, other than those complying with Section 322.4.1, shall comply with Sections 322.4.2.1 through 322.4.2.6.

322.4.2.1 Technical opinion and report. A technical opinion and report complying with Section 104.8.2 shall be prepared to evaluate the fire and explosion risks associated with the indoor storage area and to make recommendations for fire and explosion protection. The report shall be submitted to the fire code official and shall require the fire code official's approval prior to issuance of a permit. In addition to the requirements of Section 104.8.2, the technical opinion and report shall specifically evaluate the following:

1. The potential for deflagration of flammable gases released during a thermal runaway event.
2. The basis of design for an automatic sprinkler system or other approved fire suppression system. Such design basis shall reference relevant full-scale fire testing or another approved method of demonstrating sufficiency of the recommended design.

322.4.2.2 Construction requirements. Where indoor storage areas for lithium-ion and lithium metal batteries are located in a building with other uses, battery storage areas shall be separated from the remainder of the building by 2-hour-rated fire barriers or horizontal assemblies. Fire barriers shall be constructed in accordance with Section 707 of the California Building Code, and horizontal assemblies shall be constructed in accordance with Section 711 of the California Building Code.

Exceptions:

1. Where battery storage is contained in one or more approved prefabricated portable structures providing a complete 2-hour fire-resistance-rated enclosure, fire barriers and horizontal assemblies are not required.
2. Where battery storage is limited to new batteries in packaging that has been demonstrated to and approved by the fire code official as sufficient to isolate a fire in packaging to the package interior, fire barriers and horizontal assemblies are not required.

322.4.2.3 Fire protection systems. Indoor storage areas for lithium-ion and lithium metal batteries shall be protected by an automatic sprinkler system complying with Section 903.3.1.1 or an approved alternative fire suppression system. The system design shall be based on recommendations in the approved technical opinion and report required by Section 322.4.2.1.

322.4.2.4 Fire alarm systems. Indoor storage areas for lithium-ion and lithium metal batteries shall be provided with an approved automatic fire detection and alarm system complying with Section 907. The fire detection system shall use air-aspirating smoke detection, radiant energy-sensing fire detection, or both.

322.4.2.5 Explosion control. Where the approved technical opinion and report required by Section 322.4.2.1 recommends explosion control, explosion control complying with Section 911 shall be provided.

322.4.2.6 Reduced requirements for storage of partially charged batteries. Indoor storage areas for lithium-ion and lithium metal batteries with a demonstrated state of charge not exceeding 30 percent shall not be required to comply with Sections 322.4.2.1, 322.4.2.2 or 322.4.2.5, provided that procedures for limiting and verifying that the state of charge will not exceed 30 percent have been approved.

322.4.3 Outdoor storage. Outdoor storage of lithium-ion or lithium metal batteries shall comply with Sections 322.4.3.1 through 322.4.3.3.

322.4.3.1 Distance from storage to exposures. Outdoor storage of lithium-ion or lithium metal batteries, including storage beneath weather protection in accordance with Section 414.6.1 of the California Building Code, shall comply with one of the following:

1. Battery storage shall be located not less than 20 feet (6096 mm) from any building, lot line, public street, public alley, public way or means of egress.
2. Battery storage shall be located not less than 3 feet (914 mm) from any building, lot line, public street, public alley, public way or means of egress where the battery storage is separated by a 2-hour fire-resistance-rated assembly without openings or penetrations and extending 5 feet (1524 mm) above and to the sides of the battery storage area.
3. Battery storage shall be located not less than 3 feet (914 mm) from any building, lot line, public street, public alley, public way or means of egress where batteries are contained in approved prefabricated portable structures providing a complete 2-hour fire-resistance-rated enclosure.

322.4.3.2 Storage area size limits and separation. Outdoor storage areas for lithium-ion or lithium metal batteries, including storage beneath weather-protection in accordance with Section 414.6.1 of the California Building Code, shall not exceed 900 square feet (83.6 m²). The height of battery storage in such areas shall not exceed 10 feet (3048 mm). Multiple battery storage areas shall be separated from each other by not less than 10 feet (3048 mm) of open space.

322.4.3.3 Fire detection. Outdoor storage areas for lithium-ion or lithium metal batteries, regardless of whether such areas are open, under weather protection or in a prefabricated portable structure, shall be provided with an approved automatic fire detection and alarm system complying with Section 907. The fire detection system shall use radiant energy-sensing fire detection.

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**SECTION 323
ROAD TUNNELS, BRIDGES AND
OTHER LIMITED ACCESS HIGHWAYS [SFM]**

323.1 General. Road tunnels, bridges and other limited access highways that are state owned shall comply with NFPA 502.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 4 – EMERGENCY PLANNING AND PREPAREDNESS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below			X																			
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
401 – 401.9			X																			
402			X																			
403.1			X																			
403.2			X																			
403.4 – 403.4.4			X																			
[T-19 §3.13 (a)(1)]				X																		
403.10.2.1.1			X																			
403.10.6			X																			
403.12 – 403.12.3			X																			
[T-19 §3.13 (c)(1)]				X																		
[T-19 §3.10]				X																		
[T-19 §3.13 (a)(2)]				X																		
[T-19 §3.13 (b)]				X																		
404.5-404.6.6			X																			
[T-19 §3.13 (a)(1)]				X																		
[T-19 §3.13 (c)(2 & 3)]				X																		
407			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 4

EMERGENCY PLANNING AND PREPAREDNESS

User note:

***About this chapter:** Chapter 4 addresses the human contribution to life safety in buildings when a fire or other emergency occurs. The requirements for continuous training and scheduled fire, evacuation and lockdown drills can be as important as the required periodic inspections and maintenance of built-in fire protection features. The level of preparation by the occupants also improves the emergency responders' abilities during an emergency. The California Building Code focuses on built-in fire protection features, such as automatic sprinkler systems, fire-resistance-rated construction and properly designed egress systems, whereas this chapter fully addresses the human element.*

SECTION 401 GENERAL

401.1 Scope. Reporting of emergencies, coordination with emergency response forces, emergency plans and procedures for managing or responding to emergencies shall comply with the provisions of this section.

Exception: Firms that have approved on-premises fire-fighting organizations and that are in compliance with approved procedures for fire reporting.

401.2 Approval. Where required by this code, fire safety plans, emergency procedures and employee training programs shall be approved by the fire code official.

401.3 Emergency responder notification. Notification of emergency responders shall be in accordance with Sections 401.3.1 through 401.3.3.

401.3.1 Fire events. In the event an unwanted fire occurs on a property, the owner or occupant shall immediately report such condition to the fire department.

401.3.2 Alarm activations. Upon activation of a fire alarm signal, employees or staff shall immediately notify the fire department.

401.3.3 Delayed notification. A person shall not, by verbal or written directive, require any delay in the reporting of a fire to the fire department.

401.3.4 Group E fire alarm initiation. *Every person and public officer managing, controlling or in charge of any public, private or parochial school shall cause the fire alarm signal to be sounded upon the discovery of fire.*

401.4 Required plan implementation. In the event an unwanted fire is detected in a building or a fire alarm activates, the emergency plan shall be implemented.

401.5 Making false report. A person shall not give, signal or transmit a false alarm.

401.6 Emergency evacuation drills. The sounding of a fire alarm signal and the carrying out of an emergency evacuation drill in accordance with the provisions of Section 405 shall be allowed.

401.7 Unplanned evacuation. Evacuations made necessary by the unplanned activation of a fire alarm system or by any

other emergency shall not be substituted for a required evacuation drill.

401.8 Interference with fire department operations. It shall be unlawful to interfere with, attempt to interfere with, conspire to interfere with, obstruct or restrict the mobility of or block the path of travel of a fire department emergency vehicle in any way, or to interfere with, attempt to interfere with, conspire to interfere with, obstruct or hamper any fire department operation.

401.9 Evacuation of buildings. *Upon notification of fire, conduct of any fire drill, upon activation of the fire alarm, or upon orders of the fire authority having jurisdiction, buildings or structures within the scope of these regulations shall be immediately evacuated or occupants shall be relocated in accordance with established plans.*

SECTION 402 DEFINITIONS

402.1 Definitions. The following terms are defined in Chapter 2:

**EMERGENCY EVACUATION DRILL.
LOCKDOWN.**

SECTION 403 EMERGENCY PREPAREDNESS REQUIREMENTS

403.1 General. In addition to the requirements of Section 401, occupancies, uses and outdoor locations shall comply with the emergency preparedness requirements set forth in Sections 403.2 through 403.11.3.3. Where a fire safety and evacuation plan is required by Sections 403.2 through 403.10.6, evacuation drills shall be in accordance with Section 405 and employee training shall be in accordance with Section 406.

403.2 Group A occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group A occupancies, other than those occupancies used exclusively for purposes of religious worship with an occupant load less than 2,000, and for buildings containing both a Group A occupancy and an atrium.

Group A occupancies shall comply with Sections 403.2.1 through 403.2.4.

403.2.1 Seating plan. In addition to the requirements of Section 404.2, the fire safety and evacuation plans for assembly occupancies shall include a detailed seating plan, occupant load and occupant load limit. Deviations from the approved plans shall be allowed provided that the occupant load limit for the occupancy is not exceeded and the aisles and exit accessways remain unobstructed.

403.2.2 Announcements. In theaters, motion picture theaters, auditoriums and similar assembly occupancies in Group A used for noncontinuous programs, an audible announcement shall be made not more than 10 minutes prior to the start of each program to notify the occupants of the location of the exits to be used in the event of a fire or other emergency.

Exception: In motion picture theaters, the announcement is allowed to be projected on the screen in a manner approved by the fire code official.

403.2.3 Fire watch personnel. Fire watch personnel shall be provided where required by Section 403.11.1.

403.2.4 Crowd managers. Crowd managers shall be provided where required by Section 403.11.3.

403.3 Group B occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for buildings containing a Group B occupancy where the Group B occupancy has an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge and for buildings having an ambulatory care facility.

403.3.1 Ambulatory care facilities. Ambulatory care facilities shall comply with the requirements of Sections 401, 403.3.1.1 through 403.3.1.2 and 404 through 406.

403.3.1.1 Fire safety and evacuation plan. The fire safety and evacuation plan required by Section 404 shall include a description of special staff actions. This shall include procedures for stabilizing care recipients in a defend-in-place response, staged evacuation, or full evacuation in conjunction with the entire building if part of a multitenant facility.

403.3.1.1.1 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include all of the following in addition to the requirements of Section 404:

1. Locations of care recipients who are rendered incapable of self-preservation.
2. Maximum number of care recipients rendered incapable of self-preservation.
3. Area and extent of each ambulatory care facility.
4. Location of any special locking arrangements.

403.3.1.2 Staff training. Staff shall be periodically instructed and kept informed of their duties and responsibilities under the plan. Records of instruction shall be maintained. Such instruction shall be reviewed by the

staff at intervals not exceeding three months. Training of new staff shall be provided promptly on entrance to duty.

Staff shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment.

403.4 Group E occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group E occupancies and for buildings containing both a Group E occupancy and an atrium. Group E occupancies shall comply with Sections 403.4.1 through 403.4.4.

[California Code of Regulations, Title 19, Division 1, §3.13(a)(1)] Fire Drills. (Group E Occupancies)

(a) Group E Occupancies.

(1) General. Every person and public officer managing, controlling or in charge of any public, private or parochial school shall cause the fire alarm signal to be sounded upon the discovery of fire. Every person and public officer managing, controlling or in charge of any public, private or parochial school, other than a two-year community college, shall cause the fire alarm signal to be sounded not less than once every calendar month at the elementary and intermediate levels, and not less than twice yearly at the secondary level, in the manner prescribed in California Code of Regulations, Title 24, Part 2, Section 907.

A fire drill shall be held at the secondary level not less than twice every school year.

403.4.1 Group E Occupancies. *Every person and public officer managing, controlling or in charge of any public, private or parochial school, other than a two-year community college, shall cause the fire alarm signal to be sounded not less than once every calendar month at the elementary and intermediate levels, and not less than twice yearly at the secondary level in the manner prescribed in Section 907. A fire drill shall be held at the secondary level not less than twice every school year.*

403.4.1.1 Emergency Pre-Fire Planning. *Each school principal, district superintendent or day nursery manager shall, in cooperation with the enforcing agency, prepare procedures to be followed in case of fire or other emergency. They should include the following:*

1. *Posting of the telephone number of the fire department in the office and/or at the main switchboard.*
2. *Assignment of a responsible person to call the fire department upon notification of any fire or activation of the alarm system for any reason other than fire drills.*
3. *Posting in a conspicuous place in each classroom or assembly area a plan showing paths of travel to evacuate the room in case of emergency and including an alternate route.*
4. *Posting in each classroom instructions to be followed by the teacher. These should include:*

- 4.1. *Maintaining of order during evacuation.*
- 4.2. *Removal of roll call book and calling of roll when designated evacuation area is reached.*

- || **403.4.2 First emergency evacuation drill.** The first emergency evacuation drill of each school year shall be conducted within 10 days of the beginning of classes.
- || **403.4.3 Time of day.** Emergency evacuation drills shall be conducted at different hours of the day or evening, during the changing of classes, when the school is at assembly, during the recess or gymnastic periods, or during other times to avoid distinction between drills and actual fires.
- || **403.4.4 Assembly points.** Outdoor assembly areas shall be designated and shall be located a safe distance from the building being evacuated so as to avoid interference with fire department operations. The assembly areas shall be arranged to keep each class separate to provide accountability of all individuals.

403.5 Group F occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for buildings containing a Group F occupancy where any of the following conditions apply:

1. The Group F occupancy has an occupant load of 500 or more persons.
2. The Group F occupancy has an occupant load of more than 100 persons above or below the lowest level of exit discharge.
3. Group F pallet manufacturing and recycling facilities as required by Section 2810.

403.6 Group H occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group H occupancies.

403.6.1 Group H-5 occupancies. Group H-5 occupancies shall comply with Sections 403.6.1.1 through 403.6.1.4.

403.6.1.1 Plans and diagrams. In addition to the requirements of Section 404 and Section 407.6, plans and diagrams shall be maintained in approved locations indicating the approximate plan for each area; the amount and type of HPM stored, handled and used; locations of shutoff valves for HPM supply piping; emergency telephone locations and locations of exits.

403.6.1.2 Plan updating. The plans and diagrams required by Sections 404, 403.6.1.1 and 407.6 shall be maintained up-to-date and the fire code official and fire department shall be informed of major changes.

403.6.1.3 Emergency response team. Responsible persons shall be designated as an on-site emergency response team and trained to be liaison personnel for the fire department. These persons shall aid the fire department in preplanning emergency responses, identifying locations where HPM is stored, handled and used, and be familiar with the chemical nature of such material. An adequate number of personnel for each work shift shall be designated.

403.6.1.4 Emergency drills. Emergency drills of the on-site emergency response team shall be conducted on a regular basis but not less than once every three months. Records of drills conducted shall be maintained.

403.7 Group I occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group I occupancies. Group I occupancies shall comply with Sections 403.7.1 through 403.7.3.6.

403.7.1 Group R-2.1 occupancies. Group R-2.1 occupancies shall comply with Sections 403.7.1.1 through 403.7.1.7.

403.7.1.1 Fire safety and evacuation plan. The fire safety and evacuation plan required by Section 404 shall include a description of special staff actions. Plans shall include all of the following in addition to the requirements of Section 404:

1. Procedures for full evacuation of care recipients.
2. In Group R-2.1 procedures for staged evacuation of care recipients through a refuge area in an adjacent smoke compartment and then to an exterior assembly point.
3. Shall be amended or revised upon admission of any resident care recipient with unusual needs.

403.7.1.1.1 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include the following in addition to the requirements of Section 404.2.2:

1. Location and number of care recipient sleeping rooms.
2. Location of special locking arrangements.

403.7.1.2 Staff training. Staff shall be periodically instructed and kept informed of their duties and responsibilities under the plan. Records of instruction shall be maintained. Such instruction shall be reviewed by staff at intervals not exceeding three months. Training of new staff shall be provided promptly upon entrance to duty.

Staff shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment.

403.7.1.3 Resident training. Residents capable of assisting in their own evacuation shall be trained in the proper actions to take in the event of a fire. In Group R-2.1 occupancies, training shall include evacuation through an adjacent smoke compartment and then to an exterior assembly point. The training shall include actions to take if the primary escape route is blocked. Residents shall be trained to assist each other in case of fire to the extent their physical and mental abilities permit them to do so without additional personal risk.

403.7.1.4 Drill frequency. In addition to the evacuation drills required in Section 405.3, staff shall participate in drills an additional two times a year on

each shift. Twelve drills with all occupants shall be conducted in the first year of operation.

403.7.2 Group I-2 occupancies. Group I-2 occupancies shall comply with Sections 403.7.2.1 through 403.7.2.4.

403.7.2.1 Fire safety and evacuation plan. The fire safety and evacuation plans required by Section 404 shall include a description of special staff actions. Plans shall include all of the following in addition to the requirements of Section 404:

1. Procedures for evacuation for care recipients with needs for containment or restraint and post-evacuation containment, where present.
2. A written plan for maintenance of the means of egress.
3. Procedure for a defend-in-place strategy.
4. Procedures for a full-floor or building evacuation, where necessary.
5. In Group I-2, Condition 2, amendments or revisions upon admission of any care recipients with unusual needs.

403.7.2.2 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include all of the following in addition to the requirements of Section 404.2.2:

1. Location and number of care recipient sleeping rooms and operating rooms.
2. Location of special locking arrangements.

403.7.2.3 Staff training. Staff shall be periodically instructed and kept informed of their duties and responsibilities under the plan. Records of instruction shall be maintained. Such instruction shall be reviewed by staff at intervals not exceeding three months. Training of new staff shall be provided promptly upon entrance to duty.

Staff shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment.

403.7.2.4 Emergency evacuation drills. Emergency evacuation drills shall comply with Section 405.

403.7.2.5 Fire loss prevention in operating rooms. Fire protection features and procedures for fire loss prevention in surgical operating rooms shall comply with NFPA 99, Section 16.13.

403.7.3 Group I-3 occupancies. Group I-3 occupancies shall comply with Sections 403.7.3.1 through 403.7.3.6.

403.7.3.1 Fire safety and evacuation plans. The fire safety and evacuation plans required by Section 404 shall include a description of special staff actions. Plans shall include all of the following in addition to the requirements of Section 404:

1. Procedures for evacuation of detainees with needs for containment or restraint and post-evacuation containment, where present.
2. Procedures for a defend-in-place strategy.

3. Procedures for a full-floor or building evacuation, where necessary.

403.7.3.2 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include both of the following in addition to the requirements of Section 404.2.2:

1. Location and number of cells.
2. Location of special locking arrangements.

403.7.3.3 Staff training. Staff shall be periodically instructed and kept informed of their duties and responsibilities under the plan. Records of instruction shall be maintained. Such instruction shall be reviewed by staff at intervals not exceeding three months. Training of new staff shall be provided promptly upon entrance to duty.

Staff shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment.

403.7.3.4 Staffing. Group I-3 occupancies shall be provided with 24-hour staffing. A staff person shall be within three floors or 300 feet (91 440 mm) horizontal distance of the access door of each resident housing area. In Group I-3 Conditions 3, 4 and 5, as defined in Chapter 2, the arrangement shall be such that the staff involved can start release of locks necessary for emergency evacuation or rescue and initiate other necessary emergency actions within 2 minutes of an alarm.

Exception: A staff person shall not be required to be within three floors or 300 feet (91 440 mm) horizontal distance of the access door of each resident housing area in areas in which all locks are unlocked remotely and automatically in accordance with Section 408.4 of the *California Building Code*.

403.7.3.5 Notification. Provisions shall be made for residents in Group I-3 Conditions 3, 4 and 5, as defined in Chapter 2, to readily notify staff of an emergency.

403.7.3.6 Keys. Keys necessary for unlocking doors installed in a means of egress shall be individually identifiable by both touch and sight.

403.8 Group M occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for buildings containing a Group M occupancy where the Group M occupancy has an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge and for buildings containing both a Group M occupancy and an atrium.

403.9 Group R occupancies. Group R occupancies shall comply with Sections 403.9.1 through 403.9.3.4.

403.9.1 Group R-1 occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group R-1 occupancies. Group R-1 occupancies shall comply with Sections 403.9.1.1 through 403.9.1.3.

403.9.1.1 Evacuation diagrams. A diagram depicting two evacuation routes shall be posted on or immedi-

ately adjacent to every required egress door from each hotel or motel sleeping unit.

403.9.1.2 Emergency duties. Upon discovery of a fire or suspected fire, hotel and motel employees shall perform the following duties:

1. Activate the fire alarm system, where provided.
2. Notify the public fire department.
3. Take other action as previously instructed.

403.9.1.3 Fire safety and evacuation instructions. Information shall be provided in the fire safety and evacuation plan required by Section 404 to allow guests to decide whether to evacuate to the outside, evacuate to an area of refuge, remain in place, or any combination of the three.

403.9.2 Group R-2 occupancies. Group R-2 occupancies shall comply with Sections 403.9.2.1 through 403.9.2.3.

403.9.2.1 College and university buildings. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group R-2 college and university buildings. Group R-2 college and university buildings shall comply with Sections 403.9.2.1.1 through 403.9.2.1.3.

403.9.2.1.1 College and University Pre-Fire Planning. *The Chancellor, President, or his designated representative, shall, in cooperation with the enforcing agency, propose procedures to be followed in case of fire or other emergency. They should include the following:*

1. *Posting the telephone number of the fire department in the office and/or at the main switchboard.*
2. *Assignment of a responsible person to call the fire department upon notification of any fire or activation of the alarm system for any reason other than fire drills.*
3. *Posting in a conspicuous place in each classroom or assembly area a plan showing paths of travel to evacuate the room in case of emergency and including an alternate route.*
4. *Posting in each classroom instructions to be followed by the teacher. These should include:*
 - 4.1. *Maintaining order during evacuation.*
 - 4.2. *Removal of roll call book and calling of roll when designated evacuation area is reached.*

403.9.2.1.1 First emergency evacuation drill. The first emergency evacuation drill of each school year shall be conducted within 10 days of the beginning of classes.

403.9.2.1.2 Time of day. Emergency evacuation drills shall be conducted at different hours of the day or evening, during the changing of classes, when school is at assembly, during recess or gymnastic periods or during other times to avoid distinction

between drills and actual fires. One required drill shall be held during hours after sunset or before sunrise.

403.9.2.2 Emergency guide. Fire emergency guides shall be provided for Group R-2 occupancies. Guide contents, maintenance and distribution shall comply with Sections 403.9.2.2.1 through 403.9.2.2.3.

403.9.2.2.1 Guide contents. A fire emergency guide shall describe the location, function and use of fire protection equipment and appliances available for use by residents, including fire alarm systems, smoke alarms and portable fire extinguishers. Guides shall include an emergency evacuation plan for each dwelling unit.

403.9.2.2.2 Emergency guide maintenance. Emergency guides shall be reviewed and approved by the fire code official.

403.9.2.2.3 Emergency guide distribution. A copy of the emergency guide shall be given to each tenant prior to initial occupancy.

403.9.2.3 Evacuation diagrams for dormitories. A diagram depicting two evacuation routes shall be posted on or immediately adjacent to every required egress door from each dormitory sleeping unit or dwelling unit. Evacuation diagrams shall be reviewed and updated as needed to maintain accuracy.

403.9.3 Group R-4 occupancies. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for Group R-4 occupancies. Group R-4 occupancies shall comply with Sections 403.9.3.1 through 403.9.3.4.

403.9.3.1 Fire safety and evacuation plan. The fire safety and evacuation plan required by Section 404 shall include a description of special staff actions. Plans shall include procedures necessary for full evacuation of care recipients, and shall be amended or revised upon admission of care recipients with unusual needs.

403.9.3.1.1 Fire safety plan. A copy of the fire safety plan shall be maintained at the facility at all times. The plan shall include the following in addition to the requirements of Section 404.2.2:

1. Location and number of care recipient sleeping rooms.
2. Location of special locking arrangements.

403.9.3.2 Staff training. Staff shall be periodically instructed and kept informed of their duties and responsibilities under the plan. Records of instruction shall be maintained. Such instruction shall be reviewed by staff at intervals not exceeding three months. Training of new staff shall be provided promptly upon entrance to duty.

Staff shall be instructed in the proper use of portable fire extinguishers and other manual fire suppression equipment.

403.9.3.3 Resident training. Residents capable of assisting in their own evacuation shall be trained in the proper actions to take in the event of a fire. The training shall include actions to take if the primary escape route is blocked. Residents shall be trained to assist each other in case of fire to the extent their physical and mental abilities permit them to do so without additional personal risk.

403.9.3.4 Drill frequency. In addition to the evacuation drills required in Section 405.3, staff shall participate in drills an additional two times a year on each shift. Twelve drills with all occupants shall be conducted in the first year of operation.

403.10 Special uses. Special uses shall be in accordance with Sections 403.10.1 through 403.10.6.

403.10.1 Covered and open mall buildings. Covered and open mall buildings shall comply with the requirements of Sections 403.10.1.1 through 403.10.1.6.

403.10.1.1 Malls and mall buildings exceeding 50,000 square feet. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for covered malls exceeding 50,000 square feet (4645 m²) in aggregate floor area and for open mall buildings exceeding 50,000 square feet (4645 m²) in aggregate area within the perimeter line.

403.10.1.2 Lease plan. In addition to the requirements of Section 404.2.2, a lease plan that includes the following information shall be prepared for each covered and open mall building:

1. Each occupancy, including identification of tenant.
2. Exits from each tenant space.
3. Fire protection features, including the following:
 - 3.1. Fire department connections.
 - 3.2. Fire command center.
 - 3.3. Smoke management system controls.
 - 3.4. Elevators, elevator machine rooms and controls.
 - 3.5. Hose valve outlets.
 - 3.6. Sprinkler and standpipe control valves.
 - 3.7. Areas protected with automatic sprinkler systems and automatic fire-extinguishing systems.
 - 3.8. Automatic fire detector zones.
 - 3.9. Fire barriers.

403.10.1.3 Lease plan approval. The lease plan shall be submitted to the fire code official for approval, and shall be maintained on-site for immediate reference by responding fire service personnel.

403.10.1.4 Lease plan revisions. The lease plans shall be revised annually or as often as necessary to keep them current. Modifications or changes in tenants or

occupancies shall not be made without prior approval of the fire code official and building official.

403.10.1.5 Tenant identification. Tenant identification shall be provided for secondary exits from occupied tenant spaces that lead to an exit corridor or directly to the exterior of the building. Tenant identification shall be posted on the exterior side of the exit or exit access door and shall identify the business name and address using plainly legible letters and numbers that contrast with their background.

Exception: Tenant identification is not required for anchor stores.

403.10.1.6 Unoccupied tenant spaces. The fire safety and evacuation plan shall provide for compliance with the requirements for unoccupied tenant spaces in Section 311.

403.10.2 High-rise buildings. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for high-rise buildings.

403.10.3 Underground buildings. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for underground buildings.

403.10.4 Buildings using occupant evacuation elevators. In buildings using occupant evacuation elevators in accordance with Section 3008 of the *California Building Code*, the fire safety and evacuation plan and the training required by Sections 404 and 406, respectively, shall incorporate specific procedures for the occupants using such elevators.

403.10.5 Buildings with high-piled storage. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared for buildings with high-piled combustible storage in any of the following situations:

1. The high-piled storage area exceeds 500,000 square feet (46 450 m²) for Class I-IV commodities.
2. The high-piled storage area exceeds 300,000 square feet (27 870 m²) for high-hazard commodities.
3. The high-piled storage is located in a Group H occupancy.
4. The high-piled storage is located in a Group F occupancy with an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge.
5. The high-piled storage is located in a Group M occupancy with an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge.
6. Where required by the fire code official for other high-piled storage areas.

403.10.6 Lithium-ion and lithium metal batteries. An approved fire safety and evacuation plan in accordance with Section 404 shall be prepared and maintained for occupancies that involve activities for the research and

development, testing, manufacturing, handling, storage of lithium-ion batteries or lithium metal batteries or the repair or servicing of vehicles powered by lithium-ion batteries or lithium metal batteries.

Exceptions: A fire safety and evacuation plan is not required for the storage or merchandizing of any of the following:

1. New or refurbished batteries installed for use in the equipment or vehicles they are designed to power.
2. New or refurbished batteries packed for use with the equipment or vehicles they are designed to power for merchandizing purposes.
3. New or refurbished lithium-ion batteries rated at no more than 300 watt-hours and lithium metal batteries containing no more than 25 grams of lithium metal in their original retail packaging.
4. The storage, repair and charging activities in detached one- and two-family dwellings and townhouses, provided that such devices are for personal use.

403.10.6.1 Mitigation planning. The approved fire safety and evacuation plan shall include thermal runaway event mitigation measures addressing activities undertaken to prevent thermal runaway, early detection of a thermal runaway event and mitigations measures to be undertaken to limit the size and impact of the event on occupants and the facility.

403.11 Special requirements for public safety. Special requirements for public safety shall be in accordance with Sections 403.11.1 through 403.11.3.3.

403.11.1 Fire watch personnel. Where, in the opinion of the fire code official, it is essential for public safety in a place of assembly or any other place where people congregate, because of the number of persons, or the nature of the performance, exhibition, display, contest or activity, the owner, agent or lessee shall provide one or more fire watch personnel, as required and approved. Fire watch personnel shall comply with Sections 403.11.1.1 and 403.11.1.2.

403.11.1.1 Duty times. Fire watch personnel shall remain on duty while places requiring a fire watch are open to the public, or when an activity requiring a fire watch is being conducted.

403.11.1.2 Duties. On-duty fire watch personnel shall have the following responsibilities:

1. Keep diligent watch for fires, obstructions to means of egress and other hazards.
2. Take prompt measures for remediation of hazards and extinguishment of fires that occur.
3. Take prompt measures to assist in the evacuation of the public from the structures.

403.11.2 Public safety plan for gatherings. Where the fire code official determines that an indoor or outdoor gathering of persons has an adverse impact on public safety through diminished access to buildings, structures,

fire hydrants and fire apparatus access roads or where such gatherings adversely affect public safety services of any kind, the fire code official shall have the authority to order the development of or prescribe a public safety plan that provides an approved level of public safety and addresses the following items:

1. Emergency vehicle ingress and egress.
2. Fire protection.
3. Emergency egress or escape routes.
4. Emergency medical services.
5. Public assembly areas.
6. The directing of both attendees and vehicles, including the parking of vehicles.
7. Vendor and food concession distribution.
8. The need for the presence of law enforcement.
9. The need for fire and emergency medical services personnel.
10. The need for a weather monitoring person.

403.11.3 Crowd managers. Where facilities or events involve a gathering of more than 500 people, crowd managers shall be provided in accordance with Sections 403.11.3.1 through 403.11.3.3.

403.11.3.1 Number of crowd managers. Not fewer than two trained crowd managers, and not fewer than one trained crowd manager for each 250 persons or portion thereof, shall be provided for the gathering.

Exceptions:

1. Outdoor events with fewer than 1,000 persons in attendance shall not require crowd managers.
2. Assembly occupancies used exclusively for religious worship with an occupant load not exceeding 1,000 shall not require crowd managers.
3. The number of crowd managers shall be reduced where, in the opinion of the fire code official, the fire protection provided by the facility and the nature of the event warrant a reduction.

403.11.3.2 Training. Training for crowd managers shall be approved.

403.11.3.3 Duties. The duties of crowd managers shall include, but not be limited to:

1. Conduct an inspection of the area of responsibility and identify and address any egress barriers.
2. Conduct an inspection of the area of responsibility to identify and mitigate any fire hazards.
3. Verify compliance with all permit conditions, including those governing pyrotechnics and other special effects.
4. Direct and assist the event attendees in evacuation during an emergency.
5. Assist emergency response personnel where requested.

6. Other duties required by the fire code official.
7. Other duties as specified in the fire safety plan.

403.12 Organized camps. *Group C occupancies shall comply with the requirements of Sections 403.12.1 through 403.12.3.*

403.12.1 Staff training and evacuation plan. *Every organized camp shall institute fire training programs for all employees in the use of all fire extinguishing equipment and methods of evacuation, and shall establish procedures which shall, as far as possible, be followed in the event of fire or any other emergency. If located in a forest area a plan shall be prepared for the evacuation of the camp in case of an approaching forest fire or other emergency.*

403.12.2 Resident training. *Within 24 hours after arrival, every group of persons attending an organized camp shall be made familiar with the method by which the fire alarm may be activated and with the procedures to be followed upon notification of fire.*

403.12.3 Fire drills. *At least 1 fire drill shall be held within 24 hours of the commencement of each camping session. Additional drills shall be conducted at least once each week thereafter. When sessions exceed a 7-day period, at least 1 drill shall be held during night-time sleeping hours.*

[California Code of Regulations, Title 19, Division 1, §3.13(c)(1)] Fire Drills. (Organized Camps)

(c) Organized Camps.

- (1) Every organized camp shall institute fire training programs for all employees in the use of all fire extinguishing equipment and methods of evacuation, and shall establish procedures which shall, as far as possible, be followed in the event of fire or any other emergency. If located in a forest area a plan shall be prepared for the evacuation of the camp in case of an approaching forest fire or other emergency.*

SECTION 404 FIRE SAFETY, EVACUATION AND LOCKDOWN PLANS

404.1 General. Where required by Section 403, fire safety, evacuation and lockdown plans shall comply with Sections 404.2 through 404.4.1.

[California Code of Regulations, Title 19, Division 1, §3.10] Evacuation of Buildings.

Upon notification of fire, conduct of any fire drill, upon activation of the fire alarm, or upon orders of the fire authority having jurisdiction, buildings or structures within the scope of California Code of Regulations, Title 19, Division 1 regulations shall be immediately evacuated or occupants shall be relocated in accordance with established plans.

404.2 Contents. Fire safety, evacuation and lockdown plan contents shall be in accordance with Sections 404.2.1 through 404.2.3.2.

404.2.1 Fire evacuation plans. Fire evacuation plans shall include the following:

1. Emergency egress or escape routes and whether evacuation of the building is to be complete by selected floors or areas only or with a defend-in-place response.
2. Procedures for employees who must remain to operate critical equipment before evacuating.
3. Procedures for the use of elevators to evacuate the building where occupant evacuation elevators complying with Section 3008 of the *California Building Code* are provided.
4. Procedures for assisted rescue for persons unable to use the general means of egress unassisted.
5. Procedures for accounting for employees and occupants after evacuation has been completed.
6. Identification and assignment of personnel responsible for rescue or emergency medical aid.
7. The preferred and any alternative means of notifying occupants of a fire or emergency.
8. The preferred and any alternative means of reporting fires and other emergencies to the fire department or designated emergency response organization.
9. Identification and assignment of personnel who can be contacted for further information or explanation of duties under the plan.
10. A description of the emergency voice/alarm communication system alert tone and preprogrammed voice messages, where provided.

404.2.2 Fire safety plans. Fire safety plans shall include the following:

1. The procedure for reporting a fire or other emergency.
2. The life safety strategy including the following:
 - 2.1. Procedures for notifying occupants, including areas with a private mode alarm system.
 - 2.2. Procedures for occupants under a defend-in-place response.
 - 2.3. Procedures for evacuating occupants, including those who need evacuation assistance.
3. Site plans indicating the following:
 - 3.1. The occupancy assembly point.
 - 3.2. The locations of fire hydrants.
 - 3.3. The normal routes of fire department vehicle access.
4. Floor plans identifying the locations of the following:
 - 4.1. Exits.
 - 4.2. Primary evacuation routes.
 - 4.3. Secondary evacuation routes.
 - 4.4. Accessible egress routes.

- 4.4.1. Areas of refuge.
- 4.4.2. Exterior areas for assisted rescue.
- 4.5. Refuge areas associated with smoke barriers and horizontal exits.
- 4.6. Manual fire alarm boxes.
- 4.7. Portable fire extinguishers.
- 4.8. Occupant-use hose stations.
- 4.9. Fire alarm annunciators and controls.
- 5. A list of major fire hazards associated with the normal use and occupancy of the premises, including maintenance and housekeeping procedures.
- 6. Identification and assignment of personnel responsible for maintenance of systems and equipment installed to prevent or control fires.
- 7. Identification and assignment of personnel responsible for maintenance, housekeeping and controlling fuel hazard sources.

[California Code of Regulations, Title 19, Division 1, §3.13(a)(2)] Fire Drills. (Group E Occupancies)

(a) Group E Occupancies.

(2) Emergency Pre-Fire Planning. Each school principal, district superintendent or day nursery manager shall, in cooperation with the enforcing agency, prepare procedures to be followed in case of fire or other emergency. They should include the following:

(A) Posting of the telephone number of the fire department in the office and/or at the main switchboard.

(B) Assignment of a responsible person to call the fire department upon notification of any fire or activation of the alarm system for any reason other than fire drills.

(C) Posting in a conspicuous place in each classroom or assembly area a plan showing paths of travel to evacuate the room in case of emergency and including an alternate route.

(D) Posting in each classroom instructions to be followed by the teacher. These should include:

- 1. Maintaining of order during evacuation.*
- 2. Removal of roll call book and calling of roll when designated evacuation area is reached.*

[California Code of Regulations, Title 19, Division 1, §3.13(b)] Fire Drills. (College and University)

(b) College and University Pre-Fire Planning. The Chancellor, President, or his designated representative, shall, in cooperation with the enforcing agency, propose procedures to be followed in case of fire or other emergency in accordance with the provisions of California Code of Regulations, Title 19, Division 1, Section 3.13 (a)(2).

404.2.3 Lockdown plans. Lockdown plans shall only be permitted where such plans are approved by the fire code official and are in compliance with Sections 404.2.3.1 and 404.2.3.2.

404.2.3.1 Lockdown plan contents. Lockdown plans shall include the following:

1. Identification of individuals authorized to issue a lockdown order.
2. Security measures used during normal operations, when the building is occupied, that could adversely affect egress or fire department operations.
3. A description of identified emergency and security threats addressed by the plan, including specific lockdown procedures to be implemented for each threat condition.
4. Means and methods of initiating a lockdown plan for each threat, including:
 - 4.1. The means of notifying occupants of a lockdown event, which shall be distinct from the fire alarm signal.
 - 4.2. Identification of each door or other access point that will be secured.
 - 4.3. A description of the means or methods used to secure doors and other access points.
 - 4.4. A description of how locking means and methods are in compliance with the requirements of this code for egress and accessibility.
5. Procedures for reporting to the fire department any lockdown condition affecting egress or fire department operations.
6. Procedures for determining and reporting the presence or absence of occupants to emergency response agencies during a lockdown.
7. Means for providing two-way communication between a central location and each area subject to being secured during a lockdown.
8. Identification of the prearranged signal for terminating the lockdown.
9. Identification of individuals authorized to issue a lockdown termination order.
10. Procedures for unlocking doors and verifying that the means of egress has been returned to normal operations upon termination of the lockdown.
11. Training procedures and frequency of lockdown plan drills.

404.2.3.2 Drills. Lockdown plan drills shall be conducted in accordance with the approved plan. Such drills shall not be substituted for fire and evacuation drills required by Section 405.3.

404.3 Maintenance. Fire safety, evacuation and lockdown plans shall be reviewed or updated annually or as necessitated by changes in staff assignments, occupancy or the physical arrangement of the building.

404.4 Availability. Fire safety, evacuation and lockdown plans shall be available in the workplace for reference and review by employees, and copies shall be furnished to the fire code official for review on request.

404.4.1 Distribution. The fire safety, evacuation and lockdown plans shall be distributed to the tenants and building service employees by the owner or owner's agent. Tenants shall distribute to their employees applicable parts of the fire safety plan and lockdown plan affecting the employees' actions in the event of a fire or other emergency.

404.5 College and university pre-fire planning. The Chancellor, President, or his designated representative, shall, in cooperation with the enforcing agency, propose procedures to be followed in case of fire or other emergency in accordance with the provisions of Section 403.10.2.1.1.

404.6 Office buildings. All office buildings two or more stories in height, except high-rise buildings as defined by Health and Safety Code Section 13210, shall comply with this section.

404.6.1 Owner(s) or operator(s) shall employ either one of the following methods of providing emergency procedures and information to the building occupants:

1. Emergency procedures information published in the form of a leaflet, brochure or pamphlet shall be available to all persons entering the building. Emergency procedures information shall be located immediately inside all entrances to the building, as determined by the authority having jurisdiction. Locations shall be clearly marked.
2. A floor plan providing emergency procedures information shall be posted at every stairway landing, at every elevator landing and immediately inside all public entrances to the building. The information shall be posted so that it describes the represented floor level and can be easily seen immediately upon entering the floor level of the building. Emergency procedures information shall be printed with a minimum of $\frac{3}{16}$ -inch high nondecorative lettering providing a sharp contrast to the background.

404.6.1.2 Emergency procedures information shall provide all ambulatory, nonambulatory and the physically disabled instructions to be followed in the event of an emergency. Emergency procedures information shall include, but not be limited to, the following:

1. Location of exits.
2. Location of fire alarm initiating stations, if required.
3. What the fire alarm, if required, sounds and looks like (audible and visual warning devices).

4. Fire department emergency telephone number 911.

5. The prohibition of elevator use during emergencies, if any.

404.6.2 Hotels, motels and lodging houses. Every guestroom available for rental in a hotel, motel or lodging house shall have clearly visible emergency procedures information printed on a floor plan representative of the floor level and posted on the interior of each entrance door or immediately adjacent to such door. The owner/operator of a hotel, motel or lodging house may, in lieu of posting emergency procedures information in each guestroom, provide such information through the use of leaflets, brochures, pamphlets, videotapes or any other method as approved by the authority having jurisdiction. Oral communication in itself does not fulfill the intent of this section. However, oral communication can be incorporated as a part of the transfer of emergency procedures information. When emergency procedures information signage is posted on the interior of the guestroom entrance door, the bottom of the information shall not be located more than 4-feet above the floor level. Visually impaired persons shall receive instructions of a type they will understand, for example: taping of instructions, instructions in Braille or other appropriate methods.

404.6.2.1 Each method of providing information shall include, but not be limited to that described in Section 404.6.1.2.

404.6.2.2 Hotels, motels and lodging houses shall maintain at the registration desk a list noting the guestrooms assigned to guests with disabilities when such guests have indicated that they have special emergency evacuation requirements. The innkeeper shall, at the innkeeper's option, do one of the following:

1. Provide a place on the registration form for physically disabled guests who have such requirements to so identify themselves.
2. Provide a notice on the room key jacket advising guests with disabilities who have special emergency evacuation requirements to so notify the front desk.
3. Utilize such other means for allowing such guests with disabilities to so identify themselves as may be approved by the authority having jurisdiction.

404.6.3 Stairways. Hotels, motels, lodging houses, high-rise office buildings and Group I, Division 1 and 2 occupancies as defined in the California Building Code (except honor farms and conservation camps) shall comply with this section.

404.6.3.1 Emergency procedures information printed on a floor plan shall be posted at every stairway landing, at every elevator landing and immediately inside all public entrances to the building. The information shall be representative of the floor level and be posted so that the bottom edge of such information is not

located more than 4-feet above the floor, where it can be easily identified. Emergency procedures information shall be printed with a minimum of $\frac{3}{16}$ -inch nondecorative lettering providing a sharp contrast to the background.

404.6.3.1.1 Emergency procedures information shall include, but not be limited to, that described in Section 404.6.1.2.

404.6.4 Emergency Director. Owner(s) and operator(s) of hotels, motels, lodging houses, high-rise office buildings and Group I, Division 1 and 2 occupancies as defined in the California Building Code (except honor farms and conservation camps) shall appoint a Fire Safety Director, who shall:

1. Report to owner(s) or operator(s).
2. Coordinate fire safety activities of the facility with the authority having jurisdiction.
3. Conduct, or cause to be conducted, all training as described in Sections 404.6.5 through 404.6.5.3 for all building employees and maintain records of dates, subjects and attendance of each training session.
4. Develop and maintain a written facility emergency plan acceptable to the authority having jurisdiction. Upon request, the facility emergency plan shall be made physically available at the respective facility to the authority having jurisdiction. Facility emergency plans shall include, but not be limited to the following:
 - 4.1. Fire department emergency telephone number 911.
 - 4.2. Other emergency response telephone numbers.
 - 4.3. Evacuation or relocation plan for the building occupants.
 - 4.4. Duties of the Fire Safety Director and other designated emergency personnel.
 - 4.5. Building employee responsibilities in case of emergency, including individual assignment and reporting responsibilities.
 - 4.6. Procedures to identify and assist the non-ambulatory and physically disabled.
5. Assure that the requirements of Section 404.6.4, item 4, subsection 4.6, procedures to identify and assist the nonambulatory and physically disabled are accomplished as follows:
 - 5.1. Hotels, motels and lodging houses shall comply with subsection (b)(3);
 - 5.2. Owner(s) or operator(s) of high-rise office buildings shall maintain a list of all permanent building tenants who have disabilities. Building owner(s) or operator(s) shall be notified in writing by those who have disabilities. Information provided in the list shall include any special emergency evacuation needs and permanent work location of such physically

disabled persons. The list shall be located in the building manager's office;

- 5.3 Group I, Division 1 and 2 occupancies as defined in the California Building Code (except honor farms and conservation camps) shall comply with normal hospital policies of assisting patients and guests during an emergency evacuation.

404.6.5 Training. Hotels, motels, lodging houses and high-rise office buildings shall conduct annually, emergency procedures training for all building employees. Group I, Division 1 and 2 occupancies as defined in the California Building Code (except honor farms and conservation camps) shall conduct quarterly fire emergency training for all building employees.

404.6.5.1 Fire Safety Directors and their designated emergency personnel shall receive training in the identification and use of facility fire safety equipment, communication procedures, people movement procedures, fire prevention practices and their duties outlined in their respective emergency plan. The training curriculum shall be approved by, and made available to the authority having jurisdiction.

404.6.5.2 All building employees shall receive training covering the identification and use of facility fire safety equipment, fire prevention practices and appropriate procedures to follow in the event of a fire.

404.6.5.3 Actual evacuation or relocation of building occupants pursuant to procedures contained in the emergency plan shall be conducted at least annually for all building employees. Appropriate records, including dates, floors or building involved, and persons conducting evacuation or relocation procedures shall be maintained and made immediately available to the authority having jurisdiction upon their request. The authority having jurisdiction shall be notified not less than 48 hours in advance of such planned evacuation or relocation.

Exception: In hotels, motels, lodging houses and Group I, Division 1 and 2 occupancies as defined in the California Building Code, guests and patients are not required to participate in evacuation or relocation of the building. In hotels, motels, lodging houses, Group I, Division 1 and 2 occupancies as defined in the California Building Code, and high-rise office buildings, on-duty personnel who have security or maintenance related responsibilities, and designated management personnel approved by the fire authority having jurisdiction shall not be required to participate in any drill but, they shall provide an alternate method approved by the authority having jurisdiction to measure their knowledge of their respective duties pursuant to the emergency plan.

404.6.6 Emergency procedures signage posted prior to the effective date of these regulations may be continued in use until one year after such effective date of these regulations.

**SECTION 405
EMERGENCY EVACUATION DRILLS**

405.1 General. Emergency fire and evacuation drills complying with Sections 405.3 through 405.10 shall be conducted not less than annually where fire safety and evacuation plans are required by Section 403 or where required by the fire code official. Lockdown plan drills shall be conducted in accordance with the approved plan. Such drills shall not be substituted for fire and evacuation drills required by Section 405.3. Drills shall be designed in cooperation with the local authorities.

405.2 Occupant participation. Emergency fire and evacuation drills shall involve the actual evacuation of occupants to a selected assembly point and shall provide occupants with experience in exiting through required exits.

Exceptions:

1. In ambulatory care facilities and Group I-2, the movement of care recipients to a safe area or to the exterior of the building is not required.
2. In Group I-1, Condition 2, the assembly point for residents is permitted to be within an adjacent smoke compartment.
3. In Group R-4, actual exiting from emergency escape and rescue openings shall not be required. Opening the emergency escape and rescue openings and signaling for help shall be an acceptable alternative.
4. In Group I-3, Conditions 2 through 5 where a defend-in-place response is permitted, the assembly point for detainees is permitted to be within an adjacent smoke compartment.
5. In Group I-3, Conditions 2 through 5, movement of detainees is not required to an assembly point where there are security concerns.

405.3 Frequency. Required emergency evacuation drills shall be held at the intervals specified in Table 405.3 or more frequently where necessary to familiarize all occupants with the drill procedure.

[California Code of Regulations, Title 19, Division 1, §3.13(a)(1)] Fire Drills. (Group E Occupancies)

(a) Group E Occupancies.

(1) General. Every person and public officer managing, controlling or in charge of any public, private or parochial school shall cause the fire alarm signal to be sounded upon the discovery of fire. Every person and public officer managing, controlling or in charge of any public, private or parochial school, other than a two-year community college, shall cause the fire alarm signal to be sounded not less than once every calendar month at the elementary and intermediate levels, and not less than twice yearly at the secondary level, in the manner prescribed in California Code of Regulations, Title 24, Part 2, Section 907.

A fire drill shall be held at the secondary level not less than twice every school year.

**TABLE 405.3
FIRE AND EVACUATION DRILL
FREQUENCY AND PARTICIPATION**

GROUP OR OCCUPANCY	FREQUENCY	PARTICIPATION
Group A	Quarterly	Staff
Group B ^a	Annually	All occupants
Group B (Ambulatory care facilities)	Quarterly on each shift	Staff
Group B ^a (Clinic, outpatient)	Annually	Staff
Group E	<i>See Section 403.4</i>	All occupants
Group F	Annually	Employees
Group I-2	Quarterly on each shift	Staff
Group I-3	Quarterly on each shift ^a	Staff
Group I-4	Monthly on each shift	All occupants
Group R-1	Quarterly on each shift	Employees
Group R-2 ^b	<i>See Section 403.9.2</i>	All occupants
Group R-4	Semiannually on each shift	All occupants

- a. Emergency evacuation drills are required in Group B buildings having an occupant load of 500 or more persons or more than 100 persons above or below the lowest level of exit discharge.
- b. Emergency evacuation drills in Group R-2 college and university buildings shall be in accordance with Section 403.9.2.1. Other Group R-2 occupancies shall be in accordance with Section 403.9.2.2.

405.4 Leadership. Responsibility for the planning and conduct of drills shall be assigned to competent persons designated to exercise leadership.

405.5 Time. Drills shall be held at unexpected times and under varying conditions to simulate the unusual conditions that occur in case of fire.

Exceptions:

1. In severe climates, the fire code official shall have the authority to modify the emergency evacuation drill termination points and frequency.
2. In Groups I-1, I-2, I-3 and R-4, where staff-only emergency evacuation drills are conducted after visiting hours or where care recipients are expected to be asleep, a coded announcement shall be an acceptable alternative to audible alarms.

405.6 Recordkeeping. Records shall be maintained of required emergency evacuation drills and include the following information:

1. Identity of the person conducting the drill.
2. Date and time of the drill.
3. Notification method used.
4. Employees on duty and participating.
5. Number of occupants evacuated.
6. Special conditions simulated.

7. Problems encountered.
8. Weather conditions when occupants were evacuated.
9. Time required to accomplish complete evacuation.

405.7 Notification. Where required by the fire code official, prior notification of emergency evacuation drills shall be given to the fire code official.

405.8 Initiation. Where a fire alarm system is provided, emergency evacuation drills shall be initiated by activating the fire alarm system.

405.9 Accountability. As building occupants arrive at the assembly point, efforts shall be made to determine if all occupants have been successfully evacuated or have been accounted for.

Exception: In Group I-2 and ambulatory care facilities, the movement of care recipients to safe areas or to the exterior of the building is not required.

405.10 Recall and reentry. An electrically or mechanically operated signal used to recall occupants after an evacuation shall be separate and distinct from the signal used to initiate the evacuation. The recall signal initiation means shall be manually operated and under the control of the person in charge of the premises or the official in charge of the incident. Persons shall not reenter the premises until authorized to do so by the official in charge.

[California Code of Regulations, Title 19, Division 1, §3.13(c)(2) and (3)] Fire Drills. (Organized Camps)

(c) Organized Camps.

(2) Within 24 hours after arrival, every group of persons attending an organized camp shall be made familiar with the method by which the fire alarm may be activated and with the procedures to be followed upon notification of fire.

(3) At least 1 fire drill shall be held within 24 hours of the commencement of each camping session. Additional drills shall be conducted at least once each week thereafter. When sessions exceed a 7 day period, at least 1 drill shall be held during night-time sleeping hours.

SECTION 406 EMPLOYEE TRAINING AND RESPONSE PROCEDURES

406.1 General. Where fire safety and evacuation plans are required by Section 403, employees shall be trained in fire emergency procedures based on plans prepared in accordance with Section 404.

406.2 Frequency. Employees shall receive training in the contents of fire safety and evacuation plans and their duties as part of new employee orientation and not less than annually thereafter. Records of training shall be maintained.

406.3 Employee training program. Employees shall be trained in fire prevention, evacuation and fire safety in accordance with Sections 406.3.1 through 406.3.4.

406.3.1 Fire prevention training. Employees shall be apprised of the fire hazards of the materials and processes to which they are exposed. Each employee shall be instructed in the proper procedures for preventing fires in the conduct of their assigned duties.

406.3.2 Evacuation training. Employees shall be familiarized with the fire alarm and evacuation signals, their assigned duties in the event of an alarm or emergency, evacuation routes, areas of refuge, exterior assembly areas and procedures for evacuation.

406.3.3 Fire safety training. Employees assigned fire-fighting duties shall be trained to know the locations and proper use of portable fire extinguishers or other manual fire-fighting equipment and the protective clothing or equipment required for its safe and proper use.

406.3.4 Emergency lockdown training. Where a facility has a lockdown plan, employees shall be trained on their assigned duties and procedures in the event of an emergency lockdown.

SECTION 407 HAZARD COMMUNICATION

407.1 General. The provisions of Sections 407.2 through 407.7 shall be applicable where hazardous materials subject to permits under Section 5001.5 are located on the premises or where required by the fire code official.

407.2 Safety Data Sheets. Safety Data Sheets (SDS) for all hazardous materials shall be either readily available on the premises as a paper copy, or where approved, shall be permitted to be readily retrievable by electronic access.

407.3 Identification. Individual containers of hazardous materials, cartons or packages shall be marked or labeled in accordance with applicable federal regulations. Buildings, rooms and spaces containing hazardous materials shall be identified by hazard warning signs in accordance with Section 5003.5.

407.4 Training. Persons responsible for the operation of areas in which hazardous materials are stored, dispensed, handled or used shall be familiar with the chemical nature of the materials and the appropriate mitigating actions necessary in the event of a fire, leak or spill. Responsible persons shall be designated and trained to be liaison personnel for the fire department. These persons shall aid the fire department in preplanning emergency responses and identification of where hazardous materials are located, and shall have access to Safety Data Sheets and be knowledgeable in the site emergency response procedures.

407.5 Hazardous Materials Inventory Statement. Where required by the fire code official, each application for a permit shall include a Hazardous Materials Inventory Statement (HMIS) in accordance with Section 5001.5.2.

407.6 Hazardous Materials Management Plan. Where required by the fire code official, each application for a permit shall include a Hazardous Materials Management Plan

EMERGENCY PLANNING AND PREPAREDNESS

(HMMP) in accordance with Section 5001.5.1. The fire code official is authorized to accept a similar plan required by other regulations.

407.7 Facility closure plans. The permit holder or applicant shall submit to the fire code official a facility closure plan in accordance with Section 5001.6.3 to terminate storage, dispensing, handling or use of hazardous materials.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 5 – FIRE SERVICE FEATURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
503			†																			
[T-19 §3.05 (a)]				X																		
503.5.2			X																			
[T-19 §3.05 (b)]				X																		
504.4			X																			
507.2.1			X																			
507.3			X																			
507.5			X																			
507.5.1			X																			
507.5.3			X																			
508.1			X																			
508.1.2			X																			
508.1.5			X																			
508.1.6			X																			
508.18			X																			
510.3			†																			

This state agency does not adopt sections identified with the following symbol: †

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

Part III—Building and Equipment Design Features

CHAPTER 5

FIRE SERVICE FEATURES

User note:

About this chapter: Chapter 5 provides requirements that apply to all buildings and occupancies and pertain to access roads, access to building openings and roofs, premises identification, key boxes, fire protection water supplies, fire command centers, fire department access to equipment and emergency responder radio coverage in buildings. Although many safety features are part of the building design, features such as proper fire department access roads and radio coverage are necessary in case of emergency and are important tools for emergency responders for public safety and their own safety.

SECTION 501 GENERAL

501.1 Scope. Fire service features for buildings, structures and premises shall comply with this chapter.

501.2 Permits. A permit shall be required as set forth in Sections 105.5 and 105.6.

501.3 Construction documents. Construction documents for proposed fire apparatus access, location of fire lanes, security gates across fire apparatus access roads and construction documents and hydraulic calculations for fire hydrant systems shall be submitted to the fire department for review and approval prior to construction.

501.3.1 Site safety plan. The owner or owner's authorized agent shall be responsible for the development, implementation and maintenance of an approved written site safety plan in accordance with Section 3303.

501.4 Timing of installation. Where fire apparatus access roads or a water supply for fire protection are required to be installed, such protection shall be installed and made serviceable prior to and during the time of construction except where approved alternative methods of protection are provided. Temporary street signs shall be installed at each street intersection where construction of new roadways allows passage by vehicles in accordance with Section 505.2.

SECTION 502 DEFINITIONS

502.1 Definitions. The following terms are defined in Chapter 2:

AGENCY.

FIRE APPARATUS ACCESS ROAD.

FIRE COMMAND CENTER.

FIRE DEPARTMENT MASTER KEY.

FIRE LANE.

KEY BOX.

TRAFFIC CALMING DEVICES.

SECTION 503 FIRE APPARATUS ACCESS ROADS

503.1 Where required. Fire apparatus access roads shall be provided and maintained in accordance with Sections 503.1.1 through 503.1.3.

503.1.1 Buildings and facilities. Approved fire apparatus access roads shall be provided for every facility, building or portion of a building hereafter constructed or moved into or within the jurisdiction. The fire apparatus access road shall comply with the requirements of this section and shall extend to within 150 feet (45 720 mm) of all portions of the facility and all portions of the exterior walls of the first story of the building as measured by an approved route around the exterior of the building or facility.

Exceptions:

1. The fire code official is authorized to increase the dimension of 150 feet (45 720 mm) where any of the following conditions occur:
 - 1.1. The building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3.
 - 1.2. Fire apparatus access roads cannot be installed because of location on property, topography, waterways, nonnegotiable grades or other similar conditions, and an approved alternative means of fire protection is provided.
 - 1.3. There are not more than two Group R-3 or Group U occupancies.
2. Where approved by the fire code official, fire apparatus access roads shall be permitted to be exempted or modified for solar photovoltaic power generation facilities.

503.1.2 Additional access. The fire code official is authorized to require more than one fire apparatus access road based on the potential for impairment of a single road by

vehicle congestion, condition of terrain, climatic conditions or other factors that could limit access.

503.1.3 High-piled storage. Fire department vehicle access to buildings used for high-piled combustible storage shall comply with the applicable provisions of Chapter 32.

503.2 Specifications. Fire apparatus access roads shall be installed and arranged in accordance with Sections 503.2.1 through 503.2.8.

[California Code of Regulations, Title 19, Division 1, §3.05(a)] Fire Department Access and Egress. (Roads)

(a) Roads. Required access roads from every building to a public street shall be all-weather hard-surfaced (suitable for use by fire apparatus) right-of-way not less than 20 feet in width. Such right-of-way shall be unobstructed and maintained only as access to the public street.

***Exception:** The enforcing agency may waive or modify this requirement if in his opinion such all-weather hard-surfaced condition is not necessary in the interest of public safety and welfare.*

503.2.1 Dimensions. Fire apparatus access roads shall have an unobstructed width of not less than 20 feet (6096 mm), exclusive of shoulders, except for approved security gates in accordance with Section 503.6, and an unobstructed vertical clearance of not less than 13 feet 6 inches (4115 mm).

503.2.2 Authority. The fire code official shall have the authority to require or permit modifications to the required access widths where they are inadequate for fire or rescue operations or where necessary to meet the public safety objectives of the jurisdiction.

503.2.3 Surface. Fire apparatus access roads shall be designed and maintained to support the imposed loads of fire apparatus and shall be surfaced so as to provide all-weather driving capabilities.

503.2.4 Turning radius. The required turning radius of a fire apparatus access road shall be determined by the fire code official.

503.2.5 Dead ends. Dead-end fire apparatus access roads in excess of 150 feet (45 720 mm) in length shall be provided with an approved area for turning around fire apparatus.

503.2.6 Bridges and elevated surfaces. Where a bridge or an elevated surface is part of a fire apparatus access road, the bridge shall be constructed and maintained in accordance with AASHTO HB-17. Bridges and elevated surfaces shall be designed for a live load sufficient to carry the imposed loads of fire apparatus. Vehicle load limits shall be posted at both entrances to bridges where required by the fire code official. Where elevated surfaces designed for emergency vehicle use are adjacent to surfaces that are not designed for such use, approved barriers, approved signs or both shall be installed and maintained where required by the fire code official.

503.2.7 Grade. The grade of the fire apparatus access road shall be within the limits established by the fire code official based on the fire department’s apparatus.

503.2.8 Angles of approach and departure. The angles of approach and departure for fire apparatus access roads shall be within the limits established by the fire code official based on the fire department’s apparatus.

503.3 Marking. Where required by the fire code official, approved signs or other approved notices or markings that include the words “NO PARKING—FIRE LANE” shall be provided for fire apparatus access roads to identify such roads or prohibit the obstruction thereof. The means by which fire lanes are designated shall be maintained in a clean and legible condition at all times and be replaced or repaired when necessary to provide adequate visibility.

503.4 Obstruction of fire apparatus access roads. Fire apparatus access roads shall not be obstructed in any manner, including the parking of vehicles. The minimum widths and clearances established in Sections 503.2.1 and 503.2.2 shall be maintained at all times.

503.4.1 Traffic calming devices. Traffic calming devices shall be prohibited unless approved by the fire code official.

503.5 Required gates or barricades. The fire code official is authorized to require the installation and maintenance of gates or other approved barricades across fire apparatus access roads, trails or other accessways, not including public streets, alleys or highways. Electric gate operators, where provided, shall be listed in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

503.5.1 Secured gates and barricades. Where required, gates and barricades shall be secured in an approved manner. Roads, trails and other accessways that have been closed and obstructed in the manner prescribed by Section 503.5 shall not be trespassed on or used unless authorized by the owner and the fire code official.

Exception: The restriction on use shall not apply to public officers acting within the scope of duty.

503.5.2 Fences and Gates. *School grounds may be fenced and gates therein may be equipped with locks, provided that safe dispersal areas based on 3 square feet (0.28 m²) per occupant are located between the school and the fence. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from school buildings.*

Every public and private school shall conform with Section 32020 of the Education Code which states:

The governing board of every public school district, and the governing authority of every private school, which maintains any building used for the instruction or housing of school pupils on land entirely enclosed (except for building walls) by fences of walls, shall, through cooperation with the local law enforcement and fire-protection agencies having jurisdiction of the area, make provision for the erection of gates in such fences or walls. The gates shall be of sufficient size to permit the entrance of the ambulances, police equipment and fire-fighting

apparatus used by the law enforcement and fire-protection agencies. There shall be no less than one such access gate and there shall be as many such gates as needed to assure access to all major buildings and ground areas. If such gates are to be equipped with locks, the locking devices shall be designed to permit ready entrance by the use of the chain or bolt-cutting devices with which the local law enforcement and fire-protection agencies may be equipped.

503.6 Security gates. The installation of security gates across a fire apparatus access road shall be approved by the fire code official. Where security gates are installed, they shall have an approved means of emergency operation. The security gates and the emergency operation shall be maintained operational at all times. Electric gate operators, where provided, shall be listed in accordance with UL 325. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

SECTION 504 ACCESS TO BUILDING OPENINGS AND ROOFS

504.1 Required access. Exterior doors and openings required by this code or the *California Building Code* shall be maintained readily accessible for emergency access by the fire department. An approved access walkway leading from fire apparatus access roads to exterior openings shall be provided where required by the fire code official.

[California Code of Regulations, Title 19, Division 1, §3.05(b)] Fire Department Access and Egress. (Roofs)

(b) Roofs. No person shall install or maintain any security barrier such as barbed wire fencing, razor wire fencing, chain link fencing or any other fencing material, cable, aerial, antenna or other obstruction on the roof of any commercial establishment in such a manner as to obstruct or render egress or access hazardous in the event of fire or other emergency.

Exception: Guy wire, rods and aerial antenna masts may be attached to a roof structure having a slope of less than 30 degrees provided there is full clearance of seven feet or more between the roof and said obstruction. Guy wire or rods required to support aerial or antenna masts may be attached to a roof structure a lateral distance from the mast not in excess of one-sixth the height of the mast.

504.2 Maintenance of exterior doors and openings. Exterior doors and their function shall not be eliminated without prior approval. Exterior doors that have been rendered nonfunctional and that retain a functional door exterior appearance shall have a sign affixed to the exterior side of the door with the words "THIS DOOR BLOCKED." The sign shall consist of letters having a principal stroke of not less than $\frac{3}{4}$ inch (19.1 mm) wide and not less than 6 inches (152 mm) high on a contrasting background. Required fire department access doors shall not be obstructed or eliminated. Exit and exit access doors shall comply with Chapter 10. Access doors for high-piled combustible storage shall comply with Section 3206.7.

504.3 Stairway access to roof. New buildings four or more stories above grade plane, except those with a roof slope greater than four units vertical in 12 units horizontal (33.3-percent slope), shall be provided with a stairway to the roof. Stairway access to the roof shall be in accordance with Section 1011.12. Such stairway shall be marked at street and floor levels with a sign indicating that the stairway continues to the roof. Where roofs are used for landscaped roofs or for other purposes, stairways shall be provided as required for such occupancy classification.

504.4 Roof access. *No person shall install or maintain any security barrier such as barbed wire fencing, razor wire fencing, chain link fencing or any other fencing material, cable, aerial, antenna or other obstruction on the roof of any commercial establishment in such a manner as to obstruct or render egress or access hazardous in the event of fire or other emergency.*

Exception: Guy wire, rods and aerial antenna masts may be attached to a roof structure having a slope of less than 30 degrees provided there is full clearance of 7 feet or more between the roof and said obstruction. Guy wire or rods required to support aerial or antenna masts may be attached to a roof structure a lateral distance from the mast not in excess of one-sixth the height of the mast.

SECTION 505 PREMISES IDENTIFICATION

505.1 Address identification. New and existing buildings shall be provided with approved address identification. The address identification shall be legible and placed in a position that is visible from the street or road fronting the property. Address identification characters shall contrast with their background. Address numbers shall be Arabic numbers or alphabetical letters. Numbers shall not be spelled out. Each character shall be not less than 4 inches (102 mm) high with a minimum stroke width of $\frac{1}{2}$ inch (12.7 mm). Where required by the fire code official, address identification shall be provided in additional approved locations to facilitate emergency response. Where access is by means of a private road and the building cannot be viewed from the public way, a monument, pole or other sign or means shall be used to identify the structure. Address identification shall be maintained.

505.2 Street or road signs. Streets and roads shall be identified with approved signs. Temporary signs shall be installed at each street intersection when construction of new roadways allows passage by vehicles. Signs shall be of an approved size, weather resistant and be maintained until replaced by permanent signs.

SECTION 506 KEY BOXES

506.1 Where required. Where access to or within a structure or an area is restricted because of secured openings or where immediate access is necessary for life-saving or fire-fighting purposes, the fire code official is authorized to require a key box to be installed in an approved location. The key box shall be of an approved type listed in accordance with UL 1037,

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and shall contain keys to gain necessary access as required by the fire code official.

506.1.1 Locks. An approved lock shall be installed on gates or similar barriers where required by the fire code official.

506.1.2 Key boxes for nonstandardized fire service elevator keys. Key boxes provided for nonstandardized fire service elevator keys shall comply with Section 506.1 and all of the following:

1. The key box shall be compatible with an existing rapid entry key box system in use in the jurisdiction and approved by the fire code official.
2. The front cover shall be permanently labeled with the words "FIRE DEPARTMENT USE ONLY—ELEVATOR KEYS."
3. The key box shall be mounted at each elevator bank at the lobby nearest to the lowest level of fire department access.
4. The key box shall be mounted 5 feet 6 inches (1676 mm) above the finished floor to the right side of the elevator bank.
5. Contents of the key box are limited to fire service elevator keys. Additional elevator access tools, keys and information pertinent to emergency planning or elevator access shall be permitted where authorized by the fire code official.
6. In buildings with two or more elevator banks, a single key box shall be permitted to be used where such elevator banks are separated by not more than 30 feet (9144 mm). Additional key boxes shall be provided for each individual elevator or elevator bank separated by more than 30 feet (9144 mm).

Exception: A single key box shall be permitted to be located adjacent to a fire command center or the nonstandard fire service elevator key shall be permitted to be secured in a key box used for other purposes and located in accordance with Section 506.1.

506.2 Key box maintenance. The operator of the building shall immediately notify the fire code official and provide the new key where a lock is changed or rekeyed. The key to such lock shall be secured in the key box.

SECTION 507 FIRE PROTECTION WATER SUPPLIES

507.1 Required water supply. An approved water supply capable of supplying the required fire flow for fire protection shall be provided to premises on which facilities, buildings or portions of buildings are hereafter constructed or moved into or within the jurisdiction.

507.2 Type of water supply. A water supply shall consist of reservoirs, pressure tanks, elevated tanks, water mains or other fixed systems capable of providing the required fire flow.

507.2.1 Private fire service mains. Private fire service mains and appurtenances shall be installed in accordance with NFPA 24 *as amended in Chapter 80*.

507.2.2 Water tanks. Water tanks for private fire protection shall be installed in accordance with NFPA 22.

507.3 Fire flow. Fire-flow requirements for buildings or portions of buildings and facilities shall be determined by an approved method *or Appendix B*.

507.4 Water supply test. The fire code official shall be notified prior to the water supply test. Water supply tests shall be witnessed by the fire code official or approved documentation of the test shall be provided to the fire code official prior to final approval of the water supply system.

507.5 Fire hydrant systems. Fire hydrant systems shall comply with Sections 507.5.1 through 507.5.6 *and Appendix C or by an approved method*.

507.5.1 Where required. Where a portion of the facility or building hereafter constructed or moved into or within the jurisdiction is more than 400 feet (122 m) from a hydrant on a fire apparatus access road, as measured by an approved route around the exterior of the facility or building, on-site fire hydrants and mains shall be provided where required by the fire code official.

Exception: For Group R-3 and Group U occupancies, *equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3*, the distance requirement shall *be not more than 600 feet (183 m)*.

507.5.1.1 Hydrant for standpipe systems. Buildings equipped with a standpipe system installed in accordance with Section 905 shall have a fire hydrant within 100 feet (30 480 mm) of the fire department connections.

Exception: The distance shall be permitted to exceed 100 feet (30 480 mm) where approved by the fire code official.

507.5.2 Inspection, testing and maintenance. Fire hydrant systems shall be subject to periodic tests as required by the fire code official. Fire hydrant systems shall be maintained in an operative condition at all times and shall be repaired where defective. Additions, repairs, alterations and servicing shall comply with approved standards. Records of tests and required maintenance shall be maintained.

507.5.3 Private fire service mains and water tanks. Private fire service mains and water tanks shall be periodically inspected, tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

1. Private fire hydrants of all types: Inspection annually and after each operation; flow test and maintenance annually.
2. Fire service main piping: Inspection of exposed, annually; flow test every 5 years.
3. Fire service main piping strainers: Inspection and maintenance after each use.

Records of inspections, testing and maintenance shall be maintained.

507.5.4 Obstruction. Unobstructed access to fire hydrants shall be maintained at all times. The fire department shall not be deterred or hindered from gaining immediate access to fire protection equipment or fire hydrants.

507.5.5 Clear space around hydrants. A 3-foot (914 mm) clear space shall be maintained around the circumference of fire hydrants, except as otherwise required or approved.

507.5.6 Physical protection. Where fire hydrants are subject to impact by a motor vehicle, guard posts or other approved means shall comply with Section 312.

SECTION 508 FIRE COMMAND CENTER

508.1 General. Where required by other sections of this code and in all buildings classified as high-rise buildings by the *California Building Code and Group I-2 occupancies having occupied floors located more than 75 feet (23 m) above the lowest level of fire department vehicle access and in all F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 451 m²)*, a fire command center for fire department operations shall be provided and shall comply with Sections 508.1.1 through 508.1.7.

508.1.1 Location and access. The location and access to the fire command center shall be approved by the fire code official.

508.1.2 Separation. The fire command center shall be separated from the remainder of the building by not less than a 2-hour fire barrier constructed in accordance with Section 707 of the *California Building Code* or horizontal assembly constructed in accordance with Section 711 of the *California Building Code*, or both.

508.1.3 Size. The fire command center shall be not less than 0.015 percent of the total building area of the facility served or 200 square feet (19 m²) in area, whichever is greater, with a minimum dimension of 0.7 times the square root of the room area or 10 feet (3048 mm), whichever is greater.

Where a fire command center is required for Group F-1 and S-1 occupancies with a building footprint greater than 500,000 square feet (46 452 m²), the fire command center shall have a minimum size of 96 square feet (9 m²) with a minimum dimension of 8 feet (2438 mm) where approved by the fire code official.

508.1.4 Layout approval. A layout of the fire command center and all features required by this section to be contained therein shall be submitted for approval prior to installation.

508.1.5 Storage. Storage unrelated to operation of the fire command center shall be prohibited. *Fire command centers shall not be used for the housing of any boiler, heating unit, generator, combustible storage or similar hazardous equipment or storage.*

508.1.6 Required features. The fire command center shall comply with NFPA 72 and shall contain the following features:

1. The emergency voice/alarm communication system control unit.
2. The fire department communications system.
3. *Fire alarm system zoning annunciator panel required by Section 907.6.4.3.*
4. Annunciator unit visually indicating the location of the elevators and whether they are operational.
5. Status indicators and controls for air distribution systems.
6. The fire fighter's control panel required by Section 909.16 for smoke control systems installed in the building.
7. Controls for unlocking interior exit stairway doors simultaneously.
8. Sprinkler valve and water-flow detector display panels.
9. Emergency and standby power status indicators.
10. A telephone for fire department use with controlled access to the public telephone system.
11. Fire pump status indicators.
12. Schematic building plans indicating the typical floor plan and detailing the building core, means of egress, fire protection systems, fire-fighter air-replenishment systems, fire-fighting equipment and fire department access, and the location of fire walls, fire barriers, fire partitions, smoke barriers and smoke partitions.
13. An approved Building Information Card that includes, but is not limited to, all of the following information:
 - 13.1. General building information that includes: property name, address, the number of floors in the building above and below grade, use and occupancy classification (for mixed uses, identify the different types of occupancies on each floor) and the estimated building population during the day, night and weekend.
 - 13.2. Building emergency contact information that includes: a list of the building's emergency contacts including but not limited to building manager, building engineer and their respective work phone number, cell phone number and email address.
 - 13.3. Building construction information that includes: the type of building construction including but not limited to floors, walls, columns and roof assembly.
 - 13.4. Exit access stairway and exit stairway information that includes: number of exit

access stairways and exit stairways in building; each exit access stairway and exit stairway designation and floors served; location where each exit access stairway and exit stairway discharges, interior exit stairways that are pressurized; exit stairways provided with emergency lighting; each exit stairway that allows reentry; exit stairways providing roof access; elevator information that includes: number of elevator banks, elevator bank designation, elevator car numbers and respective floors that they serve; location of elevator machine rooms, control rooms and control spaces; location of sky lobby; and location of freight elevator banks.

- 13.5. Building services and system information that includes: location of mechanical rooms, location of building management system, location and capacity of all fuel oil tanks, location of emergency generator and location of natural gas service.
- 13.6. Fire protection system information that includes: location of standpipes, location of fire pump room, location of fire department connections, floors protected by automatic sprinklers and location of different types of automatic sprinkler systems installed including but not limited to dry, wet and pre-action.
- 13.7. Hazardous material information that includes: location and quantity of hazardous material.

- 14. Work table.
- 15. Generator supervision devices, manual start and transfer features.
- 16. Public address system, where specifically required by other sections of this code.
- 17. Elevator fire recall switch in accordance with ASME A17.1/CSA B44.
- 18. Elevator emergency or standby power selector switch(es), where emergency or standby power is provided.
- 19. *A master switch for unlocking elevator lobby doors permitted by Section 1010.2.12.1.*

508.1.7 Fire command center identification. The fire command center shall be identified by a permanent, easily visible sign stating “FIRE COMMAND CENTER” located on the door to the fire command center.

508.1.8 Ventilation. *The fire command center shall be provided with an independent ventilation or air-conditioning system.*

SECTION 509 FIRE PROTECTION AND UTILITY EQUIPMENT IDENTIFICATION AND ACCESS

509.1 Identification. Fire protection equipment shall be identified in an approved manner. Rooms containing controls for air-conditioning systems or fire protection systems shall be identified for the use of the fire department. Approved signs required to identify fire protection system equipment and equipment location shall be constructed of durable materials, permanently installed and readily visible.

509.1.1 Utility identification. Where required by the fire code official, gas shutoff valves, electric meters, service switches and other utility equipment shall be clearly and legibly marked to identify the unit or space that it serves. Identification shall be made in an approved manner, readily visible and shall be maintained.

509.2 Equipment access. Approved access shall be provided and maintained for all fire protection system equipment to permit immediate safe operation and maintenance of such equipment. Storage, trash and other materials or objects shall not be placed or kept in such a manner that would prevent such equipment from being readily accessible.

SECTION 510 EMERGENCY RESPONDER COMMUNICATION COVERAGE

510.1 Emergency responder communication coverage in new buildings. Approved in-building, two-way emergency responder communication coverage for emergency responders shall be provided in all new buildings. In-building, two-way emergency responder communication coverage within the building shall be based on the existing coverage levels of the public safety communication systems utilized by the jurisdiction, measured at the exterior of the building. This section shall not require improvement of the existing public safety communication systems.

Exceptions:

1. Where approved by the building official and the fire code official, a wired communication system in accordance with Section 907.2.13.2 shall be permitted to be installed or maintained instead of an approved radio coverage system.
2. Where it is determined by the fire code official that the radio coverage system is not needed.
3. In facilities where emergency responder radio coverage is required and such systems, components or equipment required could have a negative impact on the normal operations of that facility, the fire code official shall have the authority to accept an automatically activated emergency responder radio coverage system.

510.2 Emergency responder communication coverage in existing buildings. Existing buildings shall be provided with approved in-building, two-way emergency responder communication coverage for emergency responders as required in Chapter 11.

510.3 Permit required. A construction permit for the installation of or modification to in-building, two-way emergency responder communication coverage systems and related equipment is required as specified in Section 105.6.4. Maintenance performed in accordance with this code is not considered a modification and does not require a permit.

510.4 Technical requirements. Equipment required to provide in-building, two-way emergency responder communication coverage shall be listed in accordance with UL 2524. Systems, components and equipment required to provide the in-building, two-way emergency responder communication coverage system shall comply with Sections 510.4.1 through 510.4.2.8.

510.4.1 Emergency responder communication coverage system signal strength. The building shall be considered to have acceptable in-building, two-way emergency responder communication system coverage where signal strength measurements in 95 percent of all areas and 99 percent of areas designated as critical areas by the fire code official on each floor of the building meet the signal strength requirements in Sections 510.4.1.1 through 510.4.1.3.

510.4.1.1 Minimum signal strength into the building. The minimum inbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The inbound signal level shall be a minimum of -95dBm throughout the coverage area and sufficient to provide not less than a Delivered Audio Quality (DAQ) of 3.0 or an equivalent Signal-to-Interference-Plus-Noise Ratio (SINR) applicable to the technology for either analog or digital signals.

510.4.1.2 Minimum signal strength out of the building. The minimum outbound signal strength shall be sufficient to provide usable voice communications throughout the coverage area as specified by the fire code official. The outbound signal level shall be sufficient to provide not less than a DAQ of 3.0 or an equivalent SINR applicable to the technology for either analog or digital signals.

510.4.1.3 System performance. Signal strength shall be sufficient to meet the requirements of the applications being utilized by public safety for emergency operations through the coverage area as specified by the fire code official in Section 510.4.2.2.

510.4.2 System design. The in-building, two-way emergency responder communication coverage system shall be designed in accordance with Sections 510.4.2.1 through 510.4.2.8 and NFPA 1221.

510.4.2.1 Amplification systems and components. Buildings and structures that cannot support the required level of in-building, two-way emergency responder communication coverage shall be equipped with systems and components to enhance the radio signals and achieve the required level of in-building, two-way emergency responder communication cover-

age specified in Sections 510.4.1 through 510.4.1.3. In-building, two-way emergency responder communication systems utilizing radio-frequency-emitting devices and cabling shall be approved by the fire code official. Prior to installation, all RF-emitting devices shall have the certification of the radio licensing authority and be suitable for public safety use.

510.4.2.2 Technical criteria. The fire code official shall maintain a document providing the specific technical information and requirements for the in-building, two-way emergency responder communication coverage system. This document shall contain, but not be limited to, the various frequencies required, the location of radio sites, the effective radiated power of radio sites, the maximum propagation delay in microseconds, the applications being used and other supporting technical information necessary for system design.

510.4.2.3 Standby power. In-building, two-way emergency responder communication radio coverage systems shall be provided with dedicated standby batteries or provided with 2-hour standby batteries and connected to the facility generator power system in accordance with Section 1203. The standby power supply shall be capable of operating the in-building, two-way emergency responder communication coverage system at 100-percent system capacity for a duration of not less than 12 hours.

510.4.2.4 Signal booster requirements. If used, signal boosters shall meet the following requirements:

1. All signal booster components shall be contained in a National Electrical Manufacturer's Association (NEMA) 4-type waterproof cabinet.
2. Battery systems used for the emergency power source shall be contained in a NEMA 3R or higher-rated cabinet.
3. Equipment shall have FCC or other radio licensing authority certification and be suitable for public safety use prior to installation.
4. Where a donor antenna exists, isolation shall be maintained between the donor antenna and all inside antennas to not less than 20dB greater than the system gain under all operating conditions.
5. Active RF-emitting devices used for in-building, two-way emergency responder communication coverage systems shall have built-in oscillation detection and control circuitry.
6. The installation of amplification systems or systems that operate on or provide the means to cause interference on any in-building, two-way emergency responder communication coverage network shall be coordinated and approved by the fire code official.

510.4.2.5 System monitoring. The in-building, two-way emergency responder communication coverage system shall be monitored by a listed fire alarm control

unit, or where approved by the fire code official, shall sound an audible signal at a constantly attended on-site location. Automatic supervisory signals shall include the following:

1. Loss of normal AC power supply.
2. System battery charger(s) failure.
3. Malfunction of the donor antenna(s).
4. Failure of active RF-emitting device(s).
5. Low-battery capacity at 70-percent reduction of operating capacity.
6. Failure of critical system components.
7. The communications link between the fire alarm system and the in-building, two-way emergency responder communication coverage system.
8. Oscillation of active RF-emitting device(s).

510.4.2.6 Additional frequencies and change of frequencies. The in-building, two-way emergency responder communication coverage system shall be capable of modification or expansion in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority.

510.4.2.7 Design documents. The fire code official shall have the authority to require “as-built” design documents and specifications for in-building, two-way emergency responder communication coverage systems. The documents shall be in a format acceptable to the fire code official.

510.4.2.8 Radio communication antenna density. Systems shall be engineered to minimize the near-far effect. In-building, two-way emergency responder communication coverage system designs shall include sufficient antenna density to address reduced gain conditions.

Exception: Systems where all portable devices within the same band use active power control features.

510.5 Installation requirements. The installation of the in-building, two-way emergency responder communication coverage system shall be in accordance with NFPA 1221 and Sections 510.5.2 through 510.5.5.

510.5.1 Mounting of the donor antenna(s). To maintain proper alignment with the system designed donor site, donor antennas shall be permanently affixed on the building or where approved, mounted on a movable sled with a clearly visible sign stating “MOVEMENT OR REPOSITIONING OF THIS ANTENNA IS PROHIBITED WITHOUT APPROVAL FROM THE FIRE CODE OFFICIAL.” The antenna installation shall be in accordance with the applicable requirements in the *California Building Code* for weather protection of the building envelope.

510.5.2 Approval prior to installation. Amplification systems capable of operating on frequencies licensed to any public safety agency by the FCC or other radio licensing authority shall not be installed without prior coordination and approval of the fire code official.

510.5.3 Minimum qualifications of personnel. The minimum qualifications of the system designer and lead installation personnel shall include both of the following:

1. A valid FCC-issued general radio operators license.
2. Certification of in-building system training issued by an approved organization or approved school, or a certificate issued by the manufacturer of the equipment being installed.

These qualifications shall not be required where demonstration of adequate skills and experience satisfactory to the fire code official is provided.

510.5.4 Acceptance test procedure. Where an in-building, two-way emergency responder communication coverage system is required, and upon completion of installation, the building owner shall have the radio system tested to verify that two-way coverage on each floor of the building is not less than 95 percent. The test procedure shall be conducted as follows:

1. Each floor of the building shall be divided into a grid of 20 approximately equal test areas.
2. The test shall be conducted using a calibrated portable radio of the latest brand and model used by the agency talking through the agency’s radio communications system or equipment approved by the fire code official.
3. Failure of more than one test area shall result in failure of the test.
4. In the event that two of the test areas fail the test, in order to be more statistically accurate, the floor shall be permitted to be divided into 40 equal test areas. Failure of not more than two nonadjacent test areas shall not result in failure of the test. If the system fails the 40-area test, the system shall be altered to meet the 95-percent coverage requirement.
5. A test location approximately in the center of each test area shall be selected for the test, with the radio enabled to verify two-way communications to and from the outside of the building through the public agency’s radio communications system. Once the test location has been selected, that location shall represent the entire test area. Failure in the selected test location shall be considered to be a failure of that test area. Additional test locations shall not be permitted.
6. The gain values of all amplifiers shall be measured and the test measurement results shall be kept on file with the building owner so that the measurements can be verified during annual tests. In the event that the measurement results become lost, the building

owner shall be required to rerun the acceptance test to reestablish the gain values.

7. As part of the installation, a spectrum analyzer or other suitable test equipment shall be utilized to ensure spurious oscillations are not being generated by the subject signal booster. This test shall be conducted at the time of installation and at subsequent annual inspections.
8. Systems shall be tested using two portable radios simultaneously conducting subjective voice quality checks. One portable radio shall be positioned not greater than 10 feet (3048 mm) from the indoor antenna. The second portable radio shall be positioned at a distance that represents the farthest distance from any indoor antenna. With both portable radios simultaneously keyed up on different frequencies within the same band, subjective audio testing shall be conducted and comply with DAQ levels as specified in Sections 510.4.1.1 and 510.4.1.2.

510.5.5 FCC compliance. The in-building, two-way emergency responder communication coverage system installation and components shall comply with all applicable federal regulations including, but not limited to, FCC 47 CFR Part 90.219.

510.6 Maintenance. The in-building, two-way emergency responder communication coverage system shall be maintained operational at all times in accordance with Sections 510.6.1 through 510.6.4.

510.6.1 Testing and proof of compliance. The owner of the building or owner’s authorized agent shall have the in-building, two-way emergency responder communication coverage system inspected and tested annually or where structural changes occur, including additions or remodels that could materially change the original field performance tests. Testing shall consist of the following:

1. In-building coverage test as described in Section 510.5.4.
2. Signal boosters shall be tested to verify that the gain is the same as it was upon initial installation and acceptance or set to optimize the performance of the system.
3. Backup batteries and power supplies shall be tested under load of a period of 1 hour to verify that they will properly operate during an actual power outage. If within the 1-hour test period the battery exhibits symptoms of failure, the test shall be extended for additional 1-hour periods until the integrity of the battery can be determined.
4. All active components shall be checked to verify operation within the manufacturer’s specifications.

At the conclusion of the testing, a report, which shall verify compliance with Section 510.5.4, shall be submitted to the fire code official.

510.6.2 Additional frequencies. The building owner shall modify or expand the in-building, two-way emergency responder communication coverage system at his or her expense in the event frequency changes are required by the FCC or other radio licensing authority, or additional frequencies are made available by the FCC or other radio licensing authority. Prior approval of an in-building, two-way emergency responder communication coverage system on previous frequencies does not exempt this section.

510.6.3 Nonpublic safety system. Where other nonpublic safety amplification systems installed in buildings reduce the performance or cause interference with the in-building, two-way emergency responder communication coverage system, the nonpublic safety amplification system shall be corrected or removed.

510.6.4 Field testing. Agency personnel shall have the right to enter onto the property at any reasonable time to conduct field testing to verify the required level of radio coverage.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 6 – BUILDING SERVICES AND SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					CSA	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
603.1.2			X																			
603.4			X																			
[T-19 §3.17 (a)(b)]				X																		
603.5.1.1			X																			
603.8			X																			
604.2.4 - 604.2.5			X																			
604.5.3			X																			
604.6.3			X																			
604.4 - 604.4.4			X																			
606.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 6

BUILDING SERVICES AND SYSTEMS

User note:

About this chapter: Chapter 6 focuses on building systems and services as they relate to potential safety hazards and when and how they should be installed. This chapter brings together all building system- and service-related issues for convenience and provides a more systematic view of buildings. The following building services and systems are addressed: electrical equipment wiring and hazards, elevator operation, maintenance and fire service keys, fuel-fired appliances, commercial cooking equipment and systems, commercial cooking oil storage, mechanical refrigeration, hyperbaric facilities and clothes dryer exhaust systems. Note that building systems focused on energy systems and components are addressed by Chapter 12. Portions of this chapter were extensively reorganized for the 2021 edition. For clarity, the relocation marginal markings have not been included. For complete information, see the relocations table in the preface information of this code.

SECTION 601 GENERAL

601.1 Scope. The provisions of this chapter shall apply to the installation, operation and maintenance of the following building services and systems:

1. Electrical systems, equipment and wiring.
2. Information technology server rooms.
3. Elevator systems, emergency operation and recall.
4. Fuel-fired appliances, heating systems, chimneys and fuel oil storage.
5. Commercial cooking equipment and systems.
6. Commercial cooking oil storage.
7. Mechanical refrigeration systems.
8. Hyperbaric facilities.
9. Clothes dryer exhaust systems.

601.2 Hazard abatement. Operations or conditions deemed unsafe or hazardous by the fire code official shall be abated. Equipment, appliances, materials and systems that are modified or damaged and constitute an electrical shock or fire hazard shall not be used.

601.2.1 Correction of unsafe conditions. The fire code official shall be authorized to require the owner, the owner's authorized agent, operator or occupant of a building or premises to abate or cause to be abated or corrected such unsafe operations or conditions either by repair, rehabilitation, demolition or other approved corrective action in compliance with this code.

SECTION 602 DEFINITIONS

602.1 Definitions. The following terms are defined in Chapter 2:

COMMERCIAL COOKING APPLIANCES.

HOOD.

Type I.

REFRIGERANT.

REFRIGERATING (REFRIGERATION) SYSTEM.

SECTION 603 ELECTRICAL EQUIPMENT, WIRING AND HAZARDS

603.1 General. Electrical equipment, wiring and systems required by this code or the *California Building Code* shall be installed, used and maintained in accordance with *the California Electrical Code* and Sections 603.2 through 603.10.

603.1.1 Equipment and wiring. All electrical equipment, wiring, devices and appliances shall be tested; listed and labeled; and installed, used and maintained in accordance with *the California Electrical Code* and all instructions included as part of such listing.

603.1.2 Healthcare facilities. In Group I-2 facilities, ambulatory care facilities and outpatient clinics, the electrical systems and equipment shall be maintained and tested in accordance with NFPA 99 and Article 517 of the *California Electrical Code*.

603.2 Abatement of unsafe conditions and electrical hazards. Conditions that constitute an electrical shock or fire hazard shall be abated.

603.2.1 Modified or damaged. Electrical wiring, devices, equipment and appliances that are modified or damaged, and constitute an electrical shock or fire hazard, shall not be used until repaired or replaced in accordance with this code and *the California Electrical Code*.

603.2.2 Open electrical terminations. Open junction boxes and open-wiring splices shall be prohibited. Approved covers shall be provided for all switch and electrical outlet boxes.

603.3 Illumination. Illumination shall be provided for service equipment areas, motor control centers and electrical panelboards.

603.4 Working space and clearances. Working space around electrical equipment shall be provided in accordance with Section 110.26 of *the California Electrical Code* for electrical equipment rated 1,000 volts or less, and Section 110.32 of *the California Electrical Code* for electrical equipment rated over 1,000 volts. The minimum required working space shall be not less than 30 inches (762 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height in front of electrical service equipment. Where the electrical

service equipment is wider than 30 inches (762 mm), the minimum working space shall be not less than the width of the equipment. Storage of materials shall not be located within the designated working space.

603.4.1 Labeling. Doors into electrical control panel rooms shall be marked with a plainly visible and legible sign stating “ELECTRICAL ROOM” or similar approved wording. The disconnecting means for each service, feeder or branch circuit originating on a switchboard or panel-board shall be legibly and durably marked to indicate its purpose unless such purpose is clearly evident. Where buildings or structures are supplied by more than one power source, markings shall be provided at each service equipment location and at all interconnected electric power production sources identifying all electric power sources at the premises in accordance with *the California Electrical Code*.

603.5 Relocatable power taps and current taps. The construction and use of current taps and relocatable taps shall be in accordance with *the California Electrical Code* and this code.

603.5.1 Listing. Relocatable power taps shall be listed in accordance with UL 1363. Current taps shall be listed and labeled in accordance with UL 498A.

603.5.1.1 Listing in Group I-2 occupancies and ambulatory care facilities. In Group I-2 occupancies and ambulatory care facilities, relocatable power taps shall be listed in accordance with UL 1363 except under the following conditions:

1. In Group I-2 occupancies, relocatable power taps providing power to patient care-related electrical equipment in the patient care vicinity, as defined by NFPA 99, shall be listed in accordance with UL 1363A or UL 60601-1.
2. In Group I-2 facilities, in care recipient rooms using line-operated patient care-related electrical equipment, relocatable power taps in the patient care vicinity, as defined by NFPA 99, shall be listed in accordance with UL 1363A or UL 60601-1.
3. In ambulatory care facilities, relocatable power taps providing power to patient care-related electrical equipment in the patient care vicinity, as defined by NFPA 99, shall be listed in accordance with UL 1363A or UL 60601-1.

603.5.2 Application and use. Relocatable power taps and current taps shall be directly connected to a permanently installed receptacle.

Exceptions:

1. Where approved for use in a Group A occupancy or in a meeting room in a Group B occupancy, not more than five relocatable power taps shall be permitted to be connected together or connected to an extension cord for temporary use to supply power to electronic equipment.

2. Current taps and relocatable power taps shall not be required to connect directly to a permanently installed receptacle outlet where used for 90 days or less for the purpose of testing the performance of such devices.

603.5.3 Installation. Relocatable power tap cords shall not extend through walls, ceilings, floors, under doors or floor coverings, or be subject to environmental or physical damage.

603.6 Extension cords. Extension cords shall not be a substitute for permanent wiring and shall be listed and labeled in accordance with UL 817. Extension cords shall not be affixed to structures, extended through walls, ceilings or floors, or under doors or floor coverings, nor shall such cords be subject to environmental damage or physical impact. Extension cords shall be used only with portable appliances. Extension cords marked for indoor use shall not be used outdoors.

603.6.1 Application and use. Extension cords shall be plugged directly into an approved receptacle, relocatable power tap or current tap and, except for approved multi-plug extension cords, shall serve only one portable appliance.

603.6.2 Ampacity. The ampacity of the extension cords shall be not less than the rated capacity of the portable appliance supplied by the cord.

603.6.3 Maintenance. Extension cords shall be maintained in good condition without splices, deterioration or damage.

603.6.4 Grounding. Extension cords shall be grounded where serving grounded portable appliances.

603.7 Electrical motors. Electrical motors shall be maintained free from excessive accumulations of oil, dirt, waste and debris.

603.8 Temporary wiring. The use of temporary wiring for electrical power and lighting installations shall not exceed a period of 90 days. Temporary wiring methods shall meet the applicable provisions of *the California Electrical Code*.

Exception: Temporary wiring for electrical power and lighting installations complying with the applicable provisions of *the California Electrical Code* is permitted during periods of construction, remodeling, repair or demolition of buildings, structures, equipment or similar activities.

603.8.1 Attachment to structures. Temporary wiring attached to a structure shall be protected from physical damage and supported on insulators spaced not more than 10 feet (3048 mm) apart.

603.9 Portable, electric space heaters. Where not prohibited by other sections of this code, portable, electric space heaters shall be permitted to be used in all occupancies in accordance with Sections 603.9.1 through 603.9.5.

603.9.1 Listed and labeled. Only listed and labeled portable, electric space heaters shall be used.

603.9.2 Power supply. Portable, electric space heaters shall be plugged directly into an approved receptacle.

603.9.3 Extension cords. Portable, electric space heaters shall not be plugged into extension cords.

603.9.4 Prohibited areas. Portable, electric space heaters shall not be operated within 3 feet (914 mm) of any combustible materials. Portable, electric space heaters shall be operated only in locations for which they are listed.

603.9.5 Group I-2 occupancies and ambulatory care facilities. Where used in Group I-2 and ambulatory care facilities, portable, electric space heaters shall be limited to those having a heating element that cannot exceed a temperature of 212°F (100°C), and such heaters shall only be used in nonsleeping staff and employee areas.

603.10 Abandoned wiring in plenums. Abandoned cables in plenums that are able to be accessed without causing damage, or requiring demolition to the building, shall be tagged for future use or shall be removed.

SECTION 604 ELEVATOR OPERATION, MAINTENANCE AND FIRE SERVICE KEYS

604.1 General. Where elevators and conveying systems are installed, they shall comply with Chapter 30 of the *California Building Code* and Sections 604.2 through 604.7 of this code.

604.2 Emergency operation. Existing elevators with a travel distance of 25 feet (7620 mm) or more shall comply with the requirements in Chapter 11. New elevators shall be provided with Phase I emergency recall operation and Phase II emergency in-car operation in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

604.3 Standby power. In buildings and structures where standby power is required or furnished to operate an elevator, standby power shall be provided in accordance with Section 1203 of this code and Chapter 30 of the *California Building Code*. Operation of the system shall be in accordance with Sections 604.3.1 through 604.3.5.

604.3.1 Manual transfer. Standby power shall be manually transferable to all elevators in each bank.

604.3.2 One elevator. Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

604.3.3 Two or more elevators. Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, not less than one elevator shall remain operable from the standby power source.

604.3.4 Temperature and humidity control. Where standby power is connected to elevators, the machine room, *machine space, control room and control space ventilation or air conditioning system* shall be connected to the standby power source.

604.3.5 Emergency hoistway venting. Where standby power is connected to elevators, the emergency hoistway ventilation system, if required, shall be connected to the standby power source.

[BE] 604.4 Emergency signs. An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: "IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS."

Exceptions:

1. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1009.4.
2. The emergency sign shall not be required for elevators that are used for occupant self-evacuation in accordance with Section 3008 of the *California Building Code*.

604.5 Maintenance of elevators. Elevator features and lobbies required by Section 3006 of the *California Building Code* shall be maintained in accordance with Sections 604.5.1 through 604.5.4.

604.5.1 Fire service access elevators and lobbies. Where fire service access elevators are required by Section 3007 of the *California Building Code*, fire service access elevator fire protection and safety features and lobbies required by Section 3007 of the *California Building Code* shall be maintained free of storage and furniture.

604.5.2 Occupant evacuation elevators and lobbies. Where occupant evacuation elevators are provided in accordance with Section 3008 of the *California Building Code*, occupant evacuation elevator fire protection and safety features and lobbies required by Section 3008 of the *California Building Code* shall be maintained free of storage and furniture.

604.5.3 Storage within elevator lobbies. Where hoistway opening protection is required by Section 3006.2 of the *California Building Code*, elevator lobbies shall be maintained free of storage.

604.5.4 Water protection of hoistway enclosures. Methods to prevent water from infiltrating into a hoistway enclosure required by Sections 3007.3 and 3008.3 of the *California Building Code* shall be maintained.

604.6 Elevator keys. All elevators shall be provided with elevator car door and fire-fighter service keys in accordance with Sections 604.6.1 through 604.6.2.4.

604.6.1 Elevator key location. Keys for the elevator car doors and fire-fighter service keys shall be kept in an approved location for immediate use by the fire department.

604.6.2 Standardized fire service elevator keys. Buildings with elevators equipped with Phase I emergency recall, Phase II emergency in-car operation, or a fire service access elevator shall be equipped to operate with a standardized fire service elevator key approved by the fire code official or a standardized key in accordance with ASME A17.1/CSA B44.

Exception: The owner shall be permitted to place the building’s nonstandardized fire service elevator keys in a key box installed in accordance with Section 506.1.2.

604.6.2.1 Requirements for standardized fire service elevator keys. Standardized fire service elevator keys shall comply with all of the following:

1. All fire service elevator keys within the jurisdiction shall be uniform and approved in accordance with Section 604.6.2. Keys shall be cut to a uniform key code.
2. Fire service elevator keys shall be of a patent-protected design to prevent unauthorized duplication.
3. Fire service elevator keys shall be factory restricted by the manufacturer to prevent the unauthorized distribution of key blanks. Uncut key blanks shall not be permitted to leave the factory.
4. Fire service elevator keys subject to these rules shall be engraved with the words “DO NOT DUPLICATE.”

604.6.2.2 Access to standardized fire service keys. Access to standardized fire service elevator keys shall be restricted to the following:

1. Elevator owners or their authorized agents.
2. Elevator contractors.
3. Elevator inspectors of the jurisdiction.
4. Fire code officials of the jurisdiction.
5. The fire department and other emergency response agencies designated by the fire code official.

604.6.2.3 Duplication or distribution of keys. A person shall not duplicate a standardized fire service elevator key or issue, give, or sell a duplicated key unless in accordance with this code.

604.6.2.4 Responsibility to provide keys. The building owner shall provide up to three standardized fire service elevator keys where required by the fire code official, upon installation of a standardized fire service key switch or switches in the building.

604.6.3 Shunt trip. Where elevator hoistways or elevator machine rooms containing elevator control equipment are protected with automatic sprinklers, a means installed in accordance with NFPA 72, Section 21.4, Elevator Shutdown, shall be provided to automatically disconnect the main line power supply to the affected elevator prior to the application of water. This means shall not be self-resetting. The activation of sprinklers outside the hoistway or

machine room shall not disconnect the main line power supply.

604.6.4 Emergency hoistway venting. Elevator hoistways containing the driving machine shall be provided with a means for venting smoke and hot gases to the outer air in case of fire.

604.6.4.1 Location of vents. Vents shall be located at the top of the hoistway and shall open either directly to the outer air or through noncombustible ducts to the outer air.

604.6.4.2 Area of vents. Except as provided for in Section 3003.1.4.4 of the California Building Code, the area of the vents shall be not less than 3½ percent of the area of the hoistway nor less than 3 square feet (0.28 m²) for each elevator car.

604.6.4.3 Operation of vents. Vent openings shall automatically open upon detection of smoke in the elevator hoistway and upon activation of a manual override control. The manual override control shall be capable of opening and closing the vents and shall be located in an approved location. Smoke detectors provided in elevator hoistways to activate the hoistway ventilation system, shall also be required to activate the elevator Phase I emergency recall operation function in accordance with California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders.

604.6.4.4 Reduced vent area. Where mechanical ventilation conforming to the California Mechanical Code is provided, a reduction in the required vent area is allowed provided that all of the following conditions are met:

1. The vents required by Section 3003.1.4.1 of the California Building Code do not have outside exposure.
2. The hoistway does not extend to the top of the building.
3. The hoistway exhaust fan is automatically reactivated by thermostatic means.
4. Equivalent venting of the hoistway is accomplished.

604.7 Storage. Storage is prohibited in elevator cars or elevator machine rooms.

Exceptions:

1. Blankets used for protection of elevator cab walls during construction or renovation.
2. Materials necessary for the operation and maintenance of the elevator equipment.

SECTION 605 FUEL-FIRED APPLIANCES

605.1 General. The design, construction, installation, operation, alteration, repair and maintenance of nonportable gas-fired appliances and systems shall comply with the California

Plumbing Code. The design, construction, installation, operation, alteration, repair and maintenance of nonportable solid fuel-fired and oil-fired appliances and systems shall comply with the provisions of this section and the *California Mechanical Code*. The construction and use of portable fuel-fired appliances not connected to a fixed fuel piping system, such as blow torches, melting pots and weed burners, shall comply with this section.

605.1.1 Installation of nonportable fuel-fired appliances. The installation of nonportable fuel-fired appliances shall be made in accordance with the manufacturer's installation instructions and applicable federal, state and local rules and regulations.

605.1.2 Electrical wiring and equipment. Electrical wiring and equipment used in connection with fuel-fired appliances and equipment shall be installed and maintained in accordance with Section 603 and *the California Electrical Code*.

605.1.3 Fuel oil. The grade of fuel oil used in an oil burner shall be that for which the oil burner is approved and as stipulated by the oil burner manufacturer's instructions. Oil containing gasoline shall not be used. Waste crankcase oil shall be an acceptable fuel in Group F, M and S occupancies where utilized in equipment listed and labeled for use with waste oil and where such equipment is installed in accordance with the manufacturer's instructions and the terms of its listing.

605.1.4 Access. The installation of fuel-fired equipment shall be provided with access to equipment for cleaning hot surfaces; removing burners; replacing motors, controls, air filters, chimney and vent connectors, draft regulators and other working parts; and for adjusting, cleaning and lubricating parts.

605.1.5 Testing, diagrams and instructions. After installation of the fuel-fired equipment, operation and combustion performance tests shall be conducted to determine that the equipment is in proper operating condition and that all accessory equipment, controls, and safety devices function properly.

605.1.5.1 Diagrams. Contractors installing industrial oil-burning systems shall furnish not less than two copies of diagrams showing the main oil lines and controlling valves, one copy of which shall be posted at the oil-burning equipment and another at an approved location that will be available in case of emergency.

605.1.5.2 Operating instructions. After completing the installation, the installer shall instruct the owner or operator in the proper operation of the equipment. The installer shall furnish the owner or operator with the manufacturer's operating instructions.

605.1.6 Clearances. Working clearances between fuel-fired appliances and electrical panelboards and equipment shall be in accordance with *the California Electrical Code*. Clearances between oil-fired equipment and oil supply tanks shall be in accordance with *the California Electrical Code*.

605.2 Abatement of unsafe conditions. The fire code official is authorized to order that measures be taken to prevent the operation of any existing stove, oven, furnace, incinerator, boiler or any other heat-producing device or appliance found to be defective or in violation of code requirements for existing appliances after giving notice to this effect to any person, owner, firm or agent or operator in charge of the same. The fire code official is authorized to take measures to prevent the operation of any device or appliance without notice when inspection shows the existence of an immediate fire hazard or when imperiling human life. The defective device shall remain withdrawn from service until all necessary repairs or alterations have been made or replaced in accordance with Section 605.1.

605.2.1 Chimneys and appliances. Chimneys, vents, incinerators, smokestacks or similar devices for conveying smoke or hot gases to the outer air and the appliances such as stoves, furnaces, fireboxes or boilers to which such devices are connected, shall be maintained so as not to create a fire hazard.

605.2.1.1 Masonry chimneys. Masonry chimneys that, upon inspection, are found to be without a flue liner and that have open mortar joints which will permit smoke or gases to be discharged into the building, or which are cracked as to be dangerous, shall be repaired or relined with a listed chimney liner system installed in accordance with the manufacturer's instructions and *the California Mechanical Code* or a flue lining system installed in accordance with the requirements of the *California Building Code* and appropriate for the intended class of chimney service.

605.2.1.2 Metal chimneys. Metal chimneys that are corroded or improperly supported shall be repaired or replaced in accordance with the *California Mechanical Code*.

605.2.1.3 Decorative shrouds. Decorative shrouds installed at the termination of factory-built chimneys or vents shall be removed except where such shrouds are listed and labeled for use with the specific factory-built chimney system and are installed in accordance with the chimney or vent manufacturer's instructions and the *California Mechanical Code* or *International Fuel Gas Code*.

605.2.1.4 Factory-built chimney and vent systems. Existing factory-built chimneys and vent systems that are damaged, corroded or improperly supported shall be repaired or replaced in accordance with the *California Mechanical Code*.

605.2.1.5 Connectors. Existing chimney and vent connectors that are damaged, corroded or improperly supported shall be repaired or replaced in accordance with the *California Mechanical Code*.

605.3 Chimneys and vents. Masonry chimneys shall be constructed in accordance with the *California Building Code*. Factory-built chimneys and vent systems serving solid-fuel-fired appliances or oil-fired appliances shall be installed in

accordance with the *California Mechanical Code*. Metal chimneys shall be constructed and installed in accordance with the *California Mechanical Code*. Factory-built chimneys and vent systems serving gas-fired appliances shall be installed in accordance with the *International Fuel Gas Code*.

605.4 Fuel oil storage systems. Fuel oil storage systems for building heating systems shall be installed and maintained in accordance with this code. Tanks and fuel-oil piping systems shall be installed in accordance with Chapter 13 of the *California Mechanical Code*.

605.4.1 Fuel oil storage in outside, above-ground tanks.

Where connected to a fuel-oil piping system, the maximum amount of fuel oil storage allowed outside above ground without additional protection shall be 660 gallons (2498 L). The storage of fuel oil above ground in quantities exceeding 660 gallons (2498 L) shall comply with NFPA 31.

605.4.1.1 Approval. Outdoor fuel oil storage tanks shall be in accordance with UL 142 or UL 2085.

605.4.2 Fuel oil storage inside buildings. Fuel oil storage inside buildings shall comply with Sections 605.4.2.2 through 605.4.2.8 or Chapter 57.

605.4.2.1 Approval. Indoor fuel oil storage tanks shall be in accordance with UL 80, UL 142 or UL 2085.

605.4.2.2 Quantity limits. One or more fuel oil storage tanks containing Class II or III combustible liquid shall be permitted in a building. The aggregate capacity of all tanks shall not exceed the following:

1. 660 gallons (2498 L) in unsprinklered buildings, where stored in a tank complying with UL 80, UL 142 or UL 2085.
2. 1,320 gallons (4996 L) in buildings equipped with an automatic sprinkler system in accordance with Section 903.3.1.1, where stored in a tank complying with UL 142. The tank shall be listed as a secondary containment tank, and the secondary containment shall be monitored visually or automatically.
3. 3,000 gallons (11 356 L) in buildings equipped with an automatic sprinkler system in accordance with Section 903.3.1.1, where stored in protected above-ground tanks complying with UL 2085 and Section 5704.2.9.7. The tank shall be listed as a secondary containment tank, as required by UL 2085, and the secondary containment shall be monitored visually or automatically.

605.4.2.3 Restricted use and connection. Tanks installed in accordance with Section 605.4.2 shall be used only to supply fuel oil to fuel-burning equipment, generators or fire pumps installed in accordance with Section 605.4.2.5. Connections between tanks and equipment supplied by such tanks shall be made using closed piping systems in accordance with the *California Mechanical Code*.

605.4.2.4 Applicability of maximum allowable quantity and control area requirements. The quantity of combustible liquid stored in tanks complying with Section 605.4.2 shall not be counted towards the maximum allowable quantity set forth in Table 5003.1.1(1), and such tanks shall not be required to be located in a control area.

605.4.2.5 Installation. Tanks and piping systems shall be installed in accordance with Section 915 and Chapter 13, both of the *California Mechanical Code*, as applicable.

605.4.2.6 Separation. Rooms containing fuel oil tanks for internal combustion engines shall be separated from the remainder of the building by fire barriers, horizontal assemblies, or both, with a minimum 1-hour fire-resistance rating with 1-hour fire-protection-rated opening protectives constructed in accordance with the *California Building Code*.

Exception: Rooms containing protected above-ground tanks complying with Section 5704.2.9.7 shall not be required to be separated from surrounding areas.

605.4.2.7 Spill containment. Tanks exceeding 60-gallon (227 L) capacity or an aggregate capacity of 1,000 gallons (3785 L) that are not provided with integral secondary containment shall be provided with spill containment sized to contain a release from the largest tank.

605.4.2.8 Tanks in basements. Tanks in basements shall be located not more than two stories below grade plane.

605.4.3 Underground storage of fuel oil. The storage of fuel oil in underground storage tanks shall comply with UL 58 or UL 1316 and be installed in accordance with NFPA 31.

605.5 Portable unvented heaters. Portable unvented fuel-fired heating equipment shall be prohibited in occupancies in Groups A, E, I, R-1, R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4 and ambulatory care facilities.

Exceptions:

1. Portable unvented fuel-fired heaters listed in accordance with UL 647 are permitted to be used in one- and two-family dwellings, where operated and maintained in accordance with the manufacturer's instructions.
2. Portable outdoor gas-fired heating appliances in accordance with Section 605.5.2.

605.5.1 Prohibited locations. Unvented fuel-fired heating equipment shall not be located in, or obtain combustion air from, any of the following rooms or spaces: sleeping rooms, bathrooms, toilet rooms or storage closets.

605.5.2 Portable outdoor gas-fired heating appliances. Portable gas-fired heating appliances located outdoors shall be in accordance with Sections 605.5.2.1 through 605.5.2.3.4.

605.5.2.1 Location. Portable outdoor gas-fired heating appliances shall be used and located in accordance with Sections 605.5.2.1.1 through 605.5.2.1.4.

605.5.2.1.1 Prohibited locations. The storage or use of portable outdoor gas-fired heating appliances is prohibited in any of the following locations:

1. Inside of any occupancy where connected to the fuel gas container.
2. Inside of tents, canopies and membrane structures.
3. On exterior balconies.

Exception: As permitted in Chapter 61.

605.5.2.1.2 Clearance to buildings. Portable outdoor gas-fired heating appliances shall be located not less than 5 feet (1524 mm) from buildings.

605.5.2.1.3 Clearance to combustible materials. Portable outdoor gas-fired heating appliances shall not be located beneath, or closer than 5 feet (1524 mm) to combustible decorations and combustible overhangs, awnings, sunshades or similar combustible attachments to buildings.

605.5.2.1.4 Proximity to exits. Portable outdoor gas-fired heating appliances shall not be located within 5 feet (1524 mm) of exits or exit discharges.

605.5.2.2 Use and operation. Portable outdoor gas-fired heating appliances shall be used and operated in accordance with Sections 605.5.2.2.1 through 605.5.2.2.4.

605.5.2.2.1 Listing and approval. Only listed and approved portable outdoor gas-fired heating appliances utilizing a fuel gas container that is integral to the appliance shall be used. Portable outdoor gas-fired heating appliances shall be listed and labeled in accordance with ANSI Z83.26/CSA 2.37.

605.5.2.2.2 Use and maintenance. Portable outdoor gas-fired heating appliances shall be used and maintained in accordance with the manufacturer's instructions.

605.5.2.2.3 Tip-over switch. Portable outdoor gas-fired heating appliances shall be equipped with a tilt or tip-over switch that automatically shuts off the flow of gas if the appliance is tilted more than 15 degrees (0.26 rad) from the vertical.

605.5.2.2.4 Guard against contact. The heating element or combustion chamber of portable outdoor gas-fired heating appliances shall be permanently guarded so as to prevent accidental contact by persons or material.

605.5.2.3 Gas containers. Fuel gas containers for portable outdoor gas-fired heating appliances shall comply with Sections 605.5.2.3.1 through 605.5.2.3.4.

605.5.2.3.1 Approved containers. Only approved DOTn or ASME gas containers shall be used.

605.5.2.3.2 Container replacement. Replacement of fuel gas containers in portable outdoor gas-fired heating appliances shall not be conducted while the public is present.

605.5.2.3.3 Container capacity. The maximum individual capacity of gas containers used in connection with portable outdoor gas-fired heating appliances shall not exceed 20 pounds (9 kg).

605.5.2.3.4 Indoor storage prohibited. Gas containers shall not be stored inside of buildings except in accordance with Section 6109.9.

605.6 Heating appliances. Heating appliances shall be listed and shall comply with Sections 605.6.1 and 605.6.2.

[California Code of Regulations, Title 19, Division 1, §3.17(a) and (b)] Guards for Heating Appliances.

Every heating appliance in any occupancy governed by California Code of Regulations, Title 19, Division 1 regulations which does not have protective features incorporated in its design, shall be provided with guards that will provide protection against ignition of clothing and other combustible material.

(a) Appliances employing open flame radiated heat shall have fixed and substantially constructed metallic guards located not less than 10 inches from the radiating flame and the guard members shall be spaced not more than 2 inches apart.

(b) Cabinet type appliances that are not provided with an inner combustion chamber and an air circulating space between the combustion chamber and the outer shell, shall have fixed and substantially constructed metallic guards located not less than 3 inches from the shell and spaced not more than 2 inches apart.

605.6.1 Guard against contact. The heating element or combustion chamber shall be permanently guarded so as to prevent accidental contact by persons or material.

605.6.2 Heating appliance installation and maintenance. Heating appliances shall be installed and maintained in accordance with the manufacturer's instructions, the *California Building Code*, the *International Fuel Gas Code*, the *California Mechanical Code* and the *California Electrical Code*.

605.7 Unauthorized operation. It shall be a violation of this code for any person, user, firm or agent to continue the utilization of any device or appliance (the operation of which has been discontinued or ordered discontinued in accordance with Section 605.2) unless written authority to resume operation is given by the fire code official. Removing or breaking the means by which operation of the device is prevented shall be a violation of this code.

605.8 Incinerators. Commercial, industrial and residential-type incinerators and chimneys shall be constructed in accordance with the *California Building Code* and the *California Mechanical Code*. *Unless other approved means are provided for the prompt disposal of rubbish, an approved incinerator shall be provided and maintained for the disposal of combustible waste. Incinerators shall be constructed, located and maintained in such manner that waste material*

can be safely burned at any hour of the day, where local ordinances permit. Fuel-fired and garbage burning incinerators shall be constructed and maintained in conformance with NFPA 82-2019 Incinerators, Waste and Linen Handling Systems and Equipment or UL 791-2006 Standard for Residential Incinerators, whichever is applicable.

605.8.1 Residential incinerators. Residential incinerators shall be listed and labeled in accordance with UL 791.

605.8.2 Spark arrestor. Incinerators shall be equipped with an effective means for arresting sparks.

605.8.3 Restrictions. Where the fire code official determines that burning in incinerators located within 500 feet (152 m) of mountainous, brush or grass-covered areas will create an undue fire hazard because of atmospheric conditions, such burning shall be prohibited.

605.8.4 Time of burning. Burning shall take place only during approved hours.

605.8.5 Discontinuance. The fire code official is authorized to require incinerator use to be discontinued immediately if the fire code official determines that smoke emissions are offensive to occupants of surrounding property or if the use of incinerators is determined by the fire code official to constitute a hazardous condition.

605.8.6 Flue-fed incinerators in Group I-2. In Group I-2 occupancies, the continued use of existing flue-fed incinerators is prohibited.

605.8.7 Incinerator inspections in Group I-2. Incinerators in Group I-2 occupancies shall be inspected not less than annually in accordance with the manufacturer’s instructions. Inspection records shall be maintained on the premises and made available to the fire code official upon request.

605.9 Gas meters. Above-ground gas meters, regulators and piping subject to damage shall be protected by a barrier complying with Section 312 or otherwise protected in an approved manner.

**SECTION 606
COMMERCIAL COOKING EQUIPMENT
AND SYSTEMS**

[M] **606.1 General.** Commercial kitchen exhaust hoods shall comply with the requirements of the *California Mechanical Code*.

[M] **606.2 Where required.** A Type I hood shall be installed at or above all commercial cooking appliances and domestic cooking appliances used for commercial purposes that produce grease vapors.

Exceptions:

1. Factory-built commercial exhaust hoods that are listed and labeled in accordance with UL 710, and installed in accordance with Section 304.1 of the *California Mechanical Code*, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5 of the *California Mechanical Code*.

2. Factory-built commercial cooking recirculating systems that are listed and labeled in accordance with UL 710B, and installed in accordance with Section 304.1 of the *California Mechanical Code*, shall not be required to comply with Sections 507.1.5, 507.2.3, 507.2.5, 507.2.8, 507.3.1, 507.3.3, 507.4 and 507.5 of the *California Mechanical Code*. Spaces in which such systems are located shall be considered to be kitchens and shall be ventilated in accordance with Table 403.3.1.1 of the *California Mechanical Code*. For the purpose of determining the floor area required to be ventilated, each individual appliance shall be considered as occupying not less than 100 square feet (9.3 m²).
3. Where cooking appliances are equipped with integral down-draft exhaust systems and such appliances and exhaust systems are listed and labeled for the application in accordance with NFPA 96, a hood shall not be required at or above them.
4. A Type I hood shall not be required for an electric cooking appliance where an approved testing agency provides documentation that the appliance effluent contains 5 mg/m³ or less of grease when tested at an exhaust flow rate of 500 cfm (0.236 m³/s) in accordance with UL 710B.

606.3 Operations and maintenance. Commercial cooking systems shall be operated and maintained in accordance with Sections 606.3.1 through 606.3.4.

606.3.1 Ventilation system. The ventilation system in connection with hoods shall be operated at the required rate of air movement, and grease filters listed and labeled in accordance with UL 1046 shall be in place where equipment under a kitchen grease hood is used.

606.3.2 Grease extractors. Where grease extractors are installed, they shall be operated when the commercial-type cooking equipment is used.

606.3.3 Cleaning. Hoods, grease-removal devices, fans, ducts and other appurtenances shall be cleaned at intervals as required by Sections 606.3.3.1 through 606.3.3.3.

606.3.3.1 Inspection. Hoods, grease-removal devices, fans, ducts and other appurtenances shall be inspected at intervals specified in Table 606.3.3.1 or as approved by the fire code official. Inspections shall be completed by qualified individuals.

**TABLE 606.3.3.1
COMMERCIAL COOKING SYSTEM INSPECTION FREQUENCY**

TYPE OF COOKING OPERATIONS	FREQUENCY OF INSPECTION
High-volume cooking operations such as 24-hour cooking, charbroiling or wok cooking	3 months
Low-volume cooking operations such as places of religious worship, seasonal businesses and senior centers	12 months
Cooking operations utilizing solid fuel-burning cooking appliances	1 month
All other cooking operations	6 months

606.3.3.2 Grease accumulation. If during the inspection it is found that hoods, grease-removal devices, fans, ducts or other appurtenances have an accumulation of grease, such components shall be cleaned in accordance with ANSI/IKECA C10.

606.3.3.3 Records. Records for inspections shall state the individual and company performing the inspection, a description of the inspection and when the inspection took place. Records for cleanings shall state the individual and company performing the cleaning and when the cleaning took place. Such records shall be completed after each inspection or cleaning and maintained.

606.3.3.3.1 Tags. When a commercial kitchen hood or duct system is inspected, a tag containing the service provider name, address, telephone number and date of service shall be provided in a conspicuous location. Prior tags shall be covered or removed.

606.3.4 Extinguishing system service. Automatic fire-extinguishing systems protecting commercial cooking systems shall be serviced as required in Section 904.13.5.

606.4 Appliance connection to building piping. Gas-fired commercial cooking appliances installed on casters and appliances that are moved for cleaning and sanitation purposes shall be connected to the piping system with an appliance connector listed as complying with ANSI Z21.69/CSA 6.16. The commercial cooking appliance connector installation shall be configured in accordance with the manufacturer's installation instructions. Movement of appliances with casters shall be limited by a restraining device installed in accordance with the connector and appliance manufacturer's instructions.

SECTION 607 COMMERCIAL COOKING OIL STORAGE

607.1 General. Storage of cooking oil (grease) in commercial cooking operations utilizing above-ground tanks with a capacity greater than 60 gal (227 L) installed within a building shall comply with Sections 607.2 through 607.7 and NFPA 30. For purposes of this section, cooking oil shall be classified as a Class IIIB liquid unless otherwise determined by testing.

607.2 Metallic storage tanks. Metallic cooking oil storage tanks shall be listed in accordance with UL 80 or UL 142, and shall be installed in accordance with the tank manufacturer's instructions.

607.3 Nonmetallic storage tanks. Nonmetallic cooking oil storage tanks shall be listed in accordance with UL 2152 and shall be installed in accordance with the tank manufacturer's instructions. Tank capacity shall not exceed 200 gallons (757 L) per tank.

607.4 Cooking oil storage system components. Cooking oil storage system components shall include but are not limited to piping, connections, fittings, valves, tubing, hose, pumps, vents and other related components used for the transfer of

cooking oil, and are permitted to be of either metallic or nonmetallic construction.

607.4.1 Design standards. The design, fabrication and assembly of system components shall be suitable for the working pressures, temperatures and structural stresses to be encountered by the components.

607.4.2 Components in contact with heated oil. System components that come in contact with heated cooking oil shall be rated for the maximum operating temperatures expected in the system.

607.5 Tank venting. Normal and emergency venting shall be provided for cooking oil storage tanks.

607.5.1 Normal vents. Normal vents shall be located above the maximum normal liquid line, and shall have a minimum effective area not smaller than the largest filling or withdrawal connection. Normal vents shall be permitted to vent inside the building.

607.5.2 Emergency vents. Emergency relief vents shall be located above the maximum normal liquid line, and shall be in the form of a device or devices that will relieve excessive internal pressure caused by an exposure fire. For nonmetallic tanks, the emergency relief vent shall be allowed to be in the form of construction. Emergency vents shall be permitted to vent inside the building.

607.6 Heating of cooking oil. Electrical equipment used for heating cooking oil in cooking oil storage systems shall be listed to UL 499 and shall comply with *the California Electrical Code*. Use of electrical immersion heaters shall be prohibited in nonmetallic tanks.

607.7 Electrical equipment. Electrical equipment used for the operation of cooking oil storage systems shall comply with *the California Electrical Code*.

SECTION 608 MECHANICAL REFRIGERATION

[M] **608.1 Scope.** Refrigeration systems shall be installed in accordance with the *California Mechanical Code*.

608.1.1 Refrigerants other than ammonia. Where a refrigerant other than ammonia is used, refrigeration systems and the buildings in which such systems are installed shall be in accordance with ASHRAE 15.

608.1.2 Ammonia refrigeration. Refrigeration systems using ammonia refrigerant and the buildings in which such systems are installed shall comply with IIAR 2 for system design; IIAR 6 for inspection, testing and maintenance; and IIAR 7 for operating procedures. Decommissioning of ammonia refrigeration systems shall comply with IIAR 8, and engineering practices for existing ammonia refrigeration systems shall be in accordance with IIAR 9.

608.2 Permits. Permits shall be obtained for refrigeration systems in accordance with Sections 105.5 and 105.6.

[M] **608.3 Refrigerants.** The use and purity of new, recovered and reclaimed refrigerants shall be in accordance with the *California Mechanical Code*.

[M] 608.4 Refrigerant classification. Refrigerants shall be classified in accordance with the *California Mechanical Code*.

[M] 608.5 Change in refrigerant type. A change in the type of refrigerant in a refrigeration system shall be in accordance with the *California Mechanical Code*.

608.6 Access. Access to refrigeration systems having a refrigerant circuit containing more than 220 pounds (100 kg) of Group A1 or 30 pounds (14 kg) of any other group refrigerant shall be provided for the fire department at all times as required by the fire code official.

608.7 Testing of equipment. Refrigeration equipment and systems having a refrigerant circuit containing more than 220 pounds (100 kg) of Group A1 or 30 pounds (14 kg) of any other group refrigerant shall be subject to periodic testing in accordance with Section 608.7.1. Records of tests shall be maintained. Tests of emergency devices or systems required by this chapter shall be conducted by persons trained and qualified in refrigeration systems.

608.7.1 Periodic testing. The following emergency devices or systems shall be periodically tested in accordance with the manufacturer's instructions and as required by the fire code official.

1. Treatment and flaring systems.
2. Valves and appurtenances necessary to the operation of emergency refrigeration control boxes.
3. Fans and associated equipment intended to operate emergency ventilation systems.
4. Detection and alarm systems.

608.8 Emergency signs. Refrigeration units or systems having a refrigerant circuit containing more than 220 pounds (100 kg) of Group A1 or 30 pounds (14 kg) of any other group refrigerant shall be provided with approved emergency signs, charts and labels in accordance with NFPA 704. Hazard signs shall be in accordance with the *California Mechanical Code* for the classification of refrigerants listed therein.

608.9 Refrigerant detection. Machinery rooms shall be provided with a refrigerant detector with an audible and visible alarm. Where ammonia is used as the refrigerant, detection shall comply with IIAR 2. For refrigerants other than ammonia, refrigerant detection shall comply with Section 608.9.1.

608.9.1 Refrigerants other than ammonia. A detector, or a sampling tube that draws air to a detector, shall be provided at an approved location where refrigerant from a leak is expected to accumulate. The system shall be designed to initiate audible and visible alarms inside of and outside each entrance to the refrigerating machinery room and transmit a signal to an approved location where the concentration of refrigerant detected exceeds the lesser of the following:

1. The corresponding TLV-TWA values shown in the *California Mechanical Code* for the refrigerant classification.

2. Twenty-five percent of the lower flammable limit (LFL).

Detection of a refrigerant concentration exceeding the upper detection limit or 25 percent of the lower flammable limit (LFL), whichever is lower, shall stop refrigerant equipment in the machinery room in accordance with Section 608.10.1.

608.10 Remote controls. Where flammable refrigerants are used and compliance with Section 1106 of the *California Mechanical Code* is required, remote control of the mechanical equipment and appliances located in the machinery room as required by Sections 608.10.1 and 608.10.2 shall be provided at an approved location immediately outside the machinery room and adjacent to its principal entrance.

608.10.1 Refrigeration system emergency shutoff. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide off-only control of refrigerant compressors, refrigerant pumps and normally closed automatic refrigerant valves located in the machinery room. Additionally, this equipment shall be automatically shut off when the refrigerant vapor concentration in the machinery room exceeds the vapor detector's upper detection limit or 25 percent of the LEL, whichever is lower.

608.10.2 Ventilation system. A clearly identified switch of the break-glass type or with an approved tamper-resistant cover shall provide on-only control of the machinery room ventilation fans.

608.11 Emergency pressure control system. Permanently installed refrigeration systems in machinery rooms containing more than 6.6 pounds (3 kg) of flammable, toxic or highly toxic refrigerant or ammonia shall be provided with an emergency pressure control system in accordance with Sections 608.11.1 and 608.11.2.

608.11.1 Automatic crossover valves. Each high- and intermediate-pressure zone in a refrigeration system shall be provided with a single automatic valve providing a crossover connection to a lower pressure zone. Automatic crossover valves shall comply with Sections 608.11.1.1 through 608.11.1.3.

608.11.1.1 Overpressure limit set point. Automatic crossover valves shall be arranged to automatically relieve excess system pressure to a lower pressure zone if the pressure in a high- or intermediate-pressure zone rises to within 90 percent of the set point for emergency pressure relief devices.

608.11.1.2 Manual operation. Where required by the fire code official, automatic crossover valves shall be capable of manual operation.

608.11.1.3 System design pressure. Refrigeration system zones that are connected to a higher pressure zone by an automatic crossover valve shall be designed to safely contain the maximum pressure that can be achieved by interconnection of the two zones.

608.11.2 Automatic emergency stop. An automatic emergency stop feature shall be provided in accordance with Sections 608.11.2.1 and 608.11.2.2.

608.11.2.1 Operation of an automatic crossover valve. Operation of an automatic crossover valve shall cause all compressors on the affected system to immediately stop. Dedicated pressure-sensing devices located immediately adjacent to crossover valves shall be permitted as a means for determining operation of a valve. To ensure that the automatic crossover valve system provides a redundant means of stopping compressors in an overpressure condition, high-pressure cutout sensors associated with compressors shall not be used as a basis for determining operation of a crossover valve.

608.11.2.2 Overpressure in low-pressure zone. The lowest pressure zone in a refrigeration system shall be provided with a dedicated means of determining a rise in system pressure to within 90 percent of the set point for emergency pressure relief devices. Activation of the overpressure sensing device shall cause all compressors on the affected system to immediately stop.

608.12 Storage, use and handling. Flammable and combustible materials shall not be stored in machinery rooms for refrigeration systems having a refrigerant circuit containing more than 220 pounds (100 kg) of Group A1 or 30 pounds (14 kg) of any other group refrigerant. Storage, use or handling of extra refrigerant or refrigerant oils shall be as required by Chapters 50, 53, 55 and 57.

Exception: This provision shall not apply to spare parts, tools and incidental materials necessary for the safe and proper operation and maintenance of the system.

608.13 Discharge and termination of pressure relief and purge systems. Pressure relief devices, fusible plugs and purge systems discharging to the atmosphere from refrigeration systems containing flammable, toxic or highly toxic refrigerants or ammonia shall comply with Sections 608.13.2 through 608.13.4.

608.13.1 Fusible plugs and rupture members. Discharge piping and devices connected to the discharge side of a fusible plug or rupture member shall have provisions to prevent plugging the pipe in the event the fusible plug or rupture member functions.

608.13.2 Flammable refrigerants. Systems containing more than 6.6 pounds (3 kg) of flammable refrigerants having a density equal to or greater than the density of air shall discharge vapor to the atmosphere only through an approved treatment system in accordance with Section 608.13.5 or a flaring system in accordance with Section 608.13.6. Systems containing more than 6.6 pounds (3 kg) of flammable refrigerants having a density less than the density of air shall be permitted to discharge vapor to the atmosphere provided that the point of discharge is located outside of the structure at not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, ventilation opening or exit.

608.13.3 Toxic and highly toxic refrigerants. Systems containing more than 6.6 pounds (3 kg) of toxic or highly toxic refrigerants shall discharge vapor to the atmosphere only through an approved treatment system in accordance

with Section 608.13.5 or a flaring system in accordance with Section 608.13.6.

608.13.4 Ammonia refrigerant. Systems containing more than 6.6 pounds (3 kg) of ammonia refrigerant shall discharge vapor to the atmosphere in accordance with one of the following methods:

1. Directly to atmosphere where the fire code official determines, on review of an analysis prepared in accordance with Section 104.8.2, that a health hazard would not result from atmospheric discharge of ammonia.
2. Through an approved treatment system in accordance with Section 608.13.5.
3. Through a flaring system in accordance with Section 608.13.6.
4. Through an approved ammonia diffusion system in accordance with Section 608.13.7.
5. By other approved means.

Exception: Ammonia/water absorption systems containing less than 22 pounds (10 kg) of ammonia and for which the ammonia circuit is located entirely outdoors.

608.13.5 Treatment systems. Treatment systems shall be designed to reduce the allowable discharge concentration of the refrigerant gas to not more than 50 percent of the IDLH at the point of exhaust. Treatment systems shall be in accordance with Chapter 60.

608.13.6 Flaring systems. Flaring systems for incineration of flammable refrigerants shall be designed to incinerate the entire discharge. The products of refrigerant incineration shall not pose health or environmental hazards. Incineration shall be automatic upon initiation of discharge, shall be designed to prevent blowback and shall not expose structures or materials to threat of fire. Standby fuel, such as LP-gas, and standby power shall have the capacity to operate for one and one-half the required time for complete incineration of refrigerant in the system. Standby electrical power, where required to complete the incineration process, shall be in accordance with Section 1203.

608.13.7 Ammonia diffusion systems. Ammonia diffusion systems shall include a tank containing 1 gallon of water for each pound of ammonia (8.3 L of water for each 1 kg of ammonia) that will be released in 1 hour from the largest relief device connected to the discharge pipe. The water shall be prevented from freezing. The discharge pipe from the pressure relief device shall distribute ammonia in the bottom of the tank, but not lower than 33 feet (10 058 mm) below the maximum liquid level. The tank shall contain the volume of water and ammonia without overflowing.

608.14 Mechanical ventilation exhaust. Exhaust from mechanical ventilation systems serving refrigeration machinery rooms containing flammable, toxic or highly toxic refrigerants, other than ammonia, capable of exceeding 25 percent of the LFL or 50 percent of the IDLH shall be

equipped with approved treatment systems to reduce the discharge concentrations to those values or lower.

Exception: Refrigeration systems containing Group A2L complying with Section 608.18.

608.15 Notification of refrigerant discharges. The fire code official shall be notified immediately when a discharge becomes reportable under state, federal or local regulations in accordance with Section 5003.3.1.

608.16 Records. A record of refrigerant quantities brought into and removed from the premises shall be maintained.

[M] 608.17 Electrical equipment. Where refrigerant of Groups A2, A3, B2 and B3, as defined in the *California Mechanical Code*, are used, refrigeration machinery rooms shall conform to the Class I, Division 2, hazardous location classification requirements of *the California Electrical Code*.

Exceptions:

1. Ammonia machinery rooms that are provided with ventilation in accordance with Section 1101.1.2, Exception 1 of the *California Mechanical Code*.
2. Machinery rooms for systems containing Group A2L refrigerants that are provided with ventilation in accordance with Section 608.18.

[M] 608.18 Special requirements for Group A2L refrigerant machinery rooms. Machinery rooms with systems containing Group A2L refrigerants that do not comply with the Class I, Division 2, hazardous location electrical requirements of *the California Electrical Code*, as permitted by Section 608.17, Exception 2, shall comply with Sections 608.18.1 through 608.18.2.

608.18.1 Ventilation system activation. Ventilation shall be activated by the refrigerant detection system in the machinery room. Refrigerant detection shall be in accordance with Section 608.9 and all of the following:

1. The detectors shall activate at or below a refrigerant concentration of 25 percent of the LFL.
2. Upon activation, the detection system shall activate the emergency ventilation system in Section 608.18.2.
3. The detection, signaling and control circuits shall be supervised.

[M] 608.18.2 Emergency ventilation system. An emergency ventilation system shall be provided at the minimum exhaust rate specified in ASHRAE 15 or Table 608.18.2. Shut down of the emergency ventilation system shall be by manual means.

[M] 608.18.3 Emergency ventilation system discharge. The point of discharge to the atmosphere shall be located outside of the structure at not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, ventilation opening or exit.

**[M] TABLE 608.18.2
MINIMUM EXHAUST RATE**

REFRIGERANT	Q (m ³ /sec)	Q (cfm)
R32	15.4	32,600
R143a	13.6	28,700
R444A	6.46	13,700
R444B	10.6	22,400
R445A	7.83	16,600
R446A	23.9	50,700
R447A	23.8	50,400
R451A	7.04	15,000
R451B	7.05	15,000
R1234yf	7.80	16,600
R1234ze(E)	5.92	12,600

**SECTION 609
HYPERBARIC FACILITIES**

609.1 General. Hyperbaric facilities shall be inspected, tested and maintained in accordance with NFPA 99.

609.2 Records. Records shall be maintained of all testing and repair conducted on the hyperbaric chamber and associated devices and equipment. Records shall be available to the fire code official.

**SECTION 610
CLOTHES DRYER EXHAUST SYSTEMS**

610.1 Clothes dryer exhaust duct systems. Clothes dryer exhaust duct systems shall be in accordance with Sections 610.1.1 and 610.1.2.

610.1.1 Installation. Clothes dryer exhaust duct systems shall be installed in accordance with the *California Mechanical Code* or the *International Fuel Gas Code*, and the manufacturer’s installation instructions.

610.1.2 Maintenance. The lint trap, mechanical and heating components, and the exhaust duct system of a clothes dryer shall be maintained in accordance with the manufacturer’s operating instructions to prevent the accumulation of lint or debris that prevents the exhaust of air and products of combustion.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 7 – FIRE AND SMOKE PROTECTION FEATURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
701.6			X																			
709			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 7

FIRE AND SMOKE PROTECTION FEATURES

User note:

About this chapter: Chapter 7 provides requirements to maintain the fire-resistance ratings of building elements and to limit fire spread. Section 701 addresses the maintenance of and owner's responsibility for construction elements such as fire barriers and smoke barriers. The rest of the chapter deals with various aspects that also must be maintained to achieve overall fire resistance of the main fire- and smoke-resistive features. These include penetrations, joint protection, door and window openings, and duct and air transfer opening protection.

SECTION 701 GENERAL

701.1 Scope. The provisions of this chapter shall govern the inspection and maintenance of the materials, systems and assemblies used for structural fire resistance, fire-resistance-rated construction separation of adjacent spaces and construction installed to resist the passage of smoke to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings. New buildings shall comply with the *California Building Code*.

701.2 Fire-resistance-rated construction. The fire-resistance rating of the following fire-resistance-rated construction shall be maintained:

1. Structural members.
2. Exterior walls.
3. Fire walls, fire barriers, fire partitions.
4. Horizontal assemblies.
5. Shaft enclosures.

701.2.1 Hanging displays. The hanging and displaying of salable goods and other decorative materials from acoustical ceiling systems that are part of a fire-resistance-rated horizontal assembly shall be prohibited.

701.3 Smoke barriers. The fire-resistance rating and smoke-resistant characteristics of smoke barriers shall be maintained.

701.4 Smoke partitions. The smoke-resistant characteristics of smoke partitions shall be maintained.

701.5 Maintaining protection. Materials, systems and devices used to repair or protect breaches and openings in fire-resistance-rated construction and construction installed to resist the passage of smoke shall be maintained in accordance with Sections 703 through 707.

701.6 Owner's responsibility. The owner shall maintain an inventory of all required fire-resistance-rated construction, construction installed to resist the passage of smoke and the construction included in Sections 703 through 707 and Sections 602.4.1 and 602.4.2 of the *California Building Code*. Such construction shall be visually inspected by the owner annually and properly repaired, restored or replaced where damaged, altered, breached or penetrated. Records of inspections and repairs shall be maintained. Where

concealed, such elements shall not be required to be visually inspected by the owner unless the concealed space is accessible by the removal or movement of a panel, access door, ceiling tile or similar movable entry to the space.

701.7 Unsafe conditions. Where any components in this chapter are not maintained and do not function as intended or do not have the fire resistance or the resistance to the passage of smoke required by the code under which the building was constructed, remodeled or altered, such component(s) or portion thereof shall be deemed an unsafe condition, in accordance with Section 114.1.1. Components or portions thereof determined to be unsafe shall be repaired or replaced to conform to that code under which the building was constructed, remodeled or altered or this chapter, as deemed appropriate by the fire code official.

Where the condition of components is such that any building, structure or portion thereof presents an imminent danger to the occupants of the building, structure or portion thereof, the fire code official shall act in accordance with Section 114.2.

SECTION 702 DEFINITIONS

702.1 Definitions. The following terms are defined in Chapter 2:

DRAFTSTOP.

FIREBLOCKING.

MEMBRANE-PENETRATION FIRESTOP SYSTEM.

OPENING PROTECTIVE.

SMOKE BARRIER.

SMOKE PARTITION.

THROUGH-PENETRATION FIRESTOP SYSTEM.

SECTION 703 PENETRATIONS

703.1 Maintaining protection. Materials and firestop systems used to protect membrane and through penetrations in fire-resistance-rated construction and construction installed to resist the passage of smoke shall be maintained. The materials and firestop systems shall be securely attached

FIRE AND SMOKE PROTECTION FEATURES

to or bonded to the construction being penetrated with no openings visible through or into the cavity of the construction. Where the system design number is known, the system shall be inspected to the listing criteria and manufacturer's installation instructions.

703.2 Repair of penetrations. Where damaged, materials used to protect membrane- and through-penetrations shall be replaced or restored with materials or systems that meet or exceed the code requirements applicable at the time when the assembly was constructed, remodeled or altered.

SECTION 704 JOINTS AND VOIDS

704.1 Maintaining protection. Where required when the building was originally constructed, materials and systems used to protect joints and voids in the following locations shall be maintained. The materials and systems shall be securely attached to or bonded to the adjacent construction, without openings visible through the construction.

1. Joints in or between fire-resistance-rated walls, floors or floor/ceiling assemblies and roof or roof/ceiling assemblies.
2. Joints in smoke barriers.
3. Voids at the intersection of a horizontal floor assembly and an exterior curtain wall.
4. Voids at the intersection of a horizontal smoke barrier and an exterior curtain wall.
5. Voids at the intersection of a nonfire-resistance-rated floor assembly and an exterior curtain wall.
6. Voids at the intersection of a vertical fire barrier and an exterior curtain wall.
7. Voids at the intersection of a vertical fire barrier and a nonfire-resistance-rated roof assembly.

Unprotected joints and voids do not need to be protected where such joints and voids were not required to be protected when the building was originally constructed. Where the system design number is known, the system shall be inspected to the listing criteria and manufacturer's installation instructions.

704.2 Repair of joints and voids. Where damaged, materials used to protect joints and voids shall be replaced or restored with materials or systems that meet or exceed the code requirements applicable at the time when the assembly was constructed, remodeled or altered.

704.3 Opening protectives. Where openings are required to be protected, opening protectives shall be maintained self-closing or automatic-closing by smoke detection. Existing fusible-link-type automatic door-closing devices are permitted if the fusible link rating does not exceed 135°F (57°C).

SECTION 705 DOOR AND WINDOW OPENINGS

705.1 General. Where required when the building was originally constructed, opening protectives installed in fire-

resistance-rated assemblies, smoke barriers and smoke partitions shall be inspected and maintained in accordance with this section.

705.2 Inspection and maintenance. Opening protectives in fire-resistance-rated assemblies shall be inspected and maintained in accordance with NFPA 80. Opening protectives in smoke barriers shall be inspected and maintained in accordance with NFPA 80 and NFPA 105. Openings in smoke partitions shall be inspected and maintained in accordance with NFPA 105. Fire doors and smoke and draft control doors shall not be blocked, obstructed, or otherwise made inoperable. Fusible links shall be replaced promptly whenever fused or damaged. Opening protectives and smoke and draft control doors shall not be modified.

705.2.1 Labeling requirements. Where approved by the fire code official, the application of field-applied labels associated with the maintenance of opening protectives shall follow the requirements of the approved third-party certification organization accredited for listing the opening protective.

705.2.2 Signs. Where required by the fire code official, a sign shall be permanently displayed on or near each fire door in letters not less than 1 inch (25 mm) high to read as follows:

1. For doors designed to be kept normally open: "FIRE DOOR—DO NOT BLOCK."
2. For doors designed to be kept normally closed: "FIRE DOOR—KEEP CLOSED."

705.2.3 Hold-open devices and closers. Hold-open devices and automatic door closers, where provided, shall be maintained. During the period that such device is out of service for repairs, the door it operates shall remain in the closed position.

705.2.4 Door operation. Swinging fire doors shall close from the full-open position and latch automatically.

705.2.5 Smoke- and heat-activated doors. Smoke-activated doors shall be maintained to self-close or automatically close upon detection of smoke. Existing fusible-link-type automatic door-closing devices are permitted if the fusible link rating does not exceed 135°F (57°C).

705.2.6 Testing. Horizontal and vertical sliding and rolling fire doors shall be inspected and tested annually to confirm proper operation and full closure. Records of inspections and testing shall be maintained.

SECTION 706 DUCT AND AIR TRANSFER OPENINGS

706.1 Maintaining protection. Dampers protecting ducts and air transfer openings shall be inspected and maintained in accordance with NFPA 80 and NFPA 105. Other products or materials used to protect the openings for ducts and air transfer openings shall be securely attached to or bonded to the construction containing the duct or air transfer opening, without visible openings through or into the cavity of the construction. Any damaged products or materials protecting

duct and air transfer openings shall be repaired, restored or replaced.

706.2 Unprotected openings. Unprotected duct and air transfer openings in fire-resistance-rated construction and construction installed to resist the passage of smoke shall be protected so as to comply with requirements that were in effect when the building was constructed.

SECTION 707 CONCEALED SPACES

707.1 Fireblocking and draftstopping. Required fireblocking and draftstopping in combustible concealed spaces shall be maintained to provide continuity and integrity of the construction.

SECTION 708 SPRAY FIRE-RESISTANT MATERIALS AND INTUMESCENT FIRE-RESISTANT MATERIALS

708.1 Maintaining protection. Where required when the building was originally permitted and constructed, spray fire-resistant materials and intumescent fire-resistant materials shall be visually inspected to verify that the materials do not exhibit exposure to the substrate.

SECTION 709 EXTERIOR WALLS

709.1 Exterior graphics on exterior walls of high-rise buildings. Where installed on the exterior walls of high-rise buildings, exterior graphics, both permanent and temporary, greater than 100 square feet in area or greater than 10 feet in either dimension shall comply with the following conditions subject to the review and approval of the fire code official and building official:

1. The materials used for graphics installed at a height greater than 40 feet above the grade plane shall be noncombustible materials or shall have a flame spread index not greater than 25 when tested in accordance with ASTM E84 or UL 723.
2. The method of attachment and mounting of the graphics to the exterior wall shall be such that the graphics are securely attached.
3. The graphics shall not interfere with the active or passive ventilation required for the building and the required smoke control systems in the building.
4. The graphics shall not impair the functions of any fire or life safety systems in the building.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE

CHAPTER 8 – INTERIOR FINISH, DECORATIVE MATERIALS AND FURNISHINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
[T-19 §1172]				X																		
[T-19 §1173]				X																		
[T-19 §1174]				X																		
[T-19 §1191]				X																		
[T-19 §1196]				X																		
[T-19 §1201]				X																		
[T-19 §1202]			X	X																		
[T-19 §3.21(a)(b)]				X																		
Table 803.3			X																			
803.5.1.2			X																			
803.5.1.3			X																			
804.1			X																			
804.3.3.1			X																			
804.3.3.2			X																			
804.3.3.3			X																			
805			†																			
805.1 Reserved			X																			
806			†	X																		
[T-19 §3.08]				X																		
807			†	X																		
[T-19 §3.08]				X																		
[T-19 §1273.1]				X																		
[T-19 §1273.2]				X																		
807.3			X																			
[T-19 §1321.1]				X																		
[T-19 §1324]				X																		
[T-19 §1325]				X																		
[T-19 §1326]				X																		
[T-19 §1327]				X																		
807.5.1.2			X																			
807.5.3			X																			
807.5.3.1			X																			
807.5.3.2			X																			
807.5.3.3			X																			
807.5.3.4			X																			
807.5.7			X																			
807.5.7.1			X																			
808			†																			
[T-19 §3.19 (b)(c)]				X																		

This state agency does not adopt sections identified with the following symbol: †

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CHAPTER 8

INTERIOR FINISH, DECORATIVE MATERIALS AND FURNISHINGS

User note:

About this chapter: Chapter 8 provides requirements for interior finishes, decorative materials and furnishings in new and existing buildings so that they do not significantly add to or create fire hazards in buildings. The provisions tend to focus on occupancies with specific risk characteristics, such as vulnerability of occupants, density of occupants, lack of familiarity with the building and societal expectations of importance. This chapter is consistent with Chapter 8 of the California Building Code, which regulates the interior finishes and decorative materials of new buildings.

SECTION 801 GENERAL

801.1 Scope. The provisions of this chapter shall govern interior finish, interior trim, furniture, furnishings, decorative materials and decorative vegetation in buildings. Existing buildings shall comply with Sections 803 through 808. New buildings shall comply with Sections 804 through 808, and Section 803 of the *California Building Code*.

[California Code of Regulations, Title 19, Division 1, §1172] Purpose.

California Code of Regulations, Title 19, Division 1, Chapter 8 have been prepared and adopted for the purpose of establishing minimum standards for the prevention of fire and for the protection of life and property against fire and panic through the use of flame-retardant chemicals, fabrics and materials.

[California Code of Regulations, Title 19, Division 1, §1173] Scope.

California Code of Regulations, Title 19, Division 1, Chapter 8 shall govern the manufacture, sale and application of flame-retardant chemicals used in connection with fabrics or materials required to be treated and maintained in a flame-retardant condition as provided in Sections 13115 or 13119 of the Health and Safety Code. These rules and regulations shall also apply to fabrics or materials inherently nonflammable and, they shall also establish minimum fire-resistive standards for such fabrics or materials.

California Code of Regulations, Title 19, Division 1, Chapter 8 shall also establish minimum standards and specific procedures for the approval of flame-retardant chemicals, flame retardant materials and flame retardant applicator concerns.

[California Code of Regulations, Title 19, Division 1, §1174] Basis.

California Code of Regulations, Title 19, Division 1, Chapter 8 are based upon the presumption of fact that fabrics and similar materials commonly known to be flammable increase, or may cause the increase of, the hazard or menace of fire; that proper and adequate flame-retardant treatment through the use of certain chemicals is possible whereby the danger to life and property from fire and panic can be materially reduced; and, that there do exist certain fabrics and materials which by nature are nonflammable.

SECTION 802 DEFINITIONS

802.1 Definitions. The following terms are defined in Chapter 2:

FLAME SPREAD.

FLAME SPREAD INDEX.

INTERIOR FLOOR-WALL BASE.

SITE-FABRICATED STRETCH SYSTEM.

SMOKE-DEVELOPED INDEX.

[California Code of Regulations, Title 19, Division 1, §1191] Approved.

“Approved” means approved by the State Fire Marshal.

[California Code of Regulations, Title 19, Division 1, §1196] Flame-retardant Chemical.

“Flame-Retardant Chemical,” as used herein, means any chemical, chemical compound or chemical mixture which when properly applied to a fabric or material will render such fabric or material incapable of supporting combustion to the extent that it will successfully withstand the tests and meet the specifications promulgated by the State Fire Marshal.

[California Code of Regulations, Title 19, Division 1, §1201] Nonflammable Material.

“Nonflammable Material,” as used herein, means a fabric or material which is inherently flame-resistant to the extent that it will meet the requirements of the fire resistance test herein prescribed, but shall not include materials which must be chemically treated or processed after manufacture to make them flame-resistant.

[California Code of Regulations, Title 19, Division 1, §1202] Place of Public Assemblage.

“Place of Public Assemblage,” as used herein, means any occupancy mentioned in Sections 13115 or 13119 of the Health and Safety Code.

SECTION 803 INTERIOR WALL AND CEILING FINISH IN EXISTING BUILDINGS

803.1 General. The provisions of this section shall limit the allowable fire performance and smoke development of interior wall and ceiling finishes in existing buildings based on

location and occupancy classification. Interior wall and ceiling finishes shall be classified in accordance with Section 803 of the *California Building Code*. Such materials shall be classified in accordance with NFPA 286, as indicated in Section 803.1.1, or in accordance with ASTM E84 or UL 723, as indicated in Section 803.1.2.

Materials tested in accordance with Section 803.1.1 shall not be required to be tested in accordance with Section 803.1.2.

803.1.1 Interior wall and ceiling finish materials tested in accordance with NFPA 286. Interior wall and ceiling finish materials shall be classified in accordance with NFPA 286 and tested in accordance with Section 803.1.1.1. Materials complying with Section 803.1.1.1 shall be considered to comply with the requirements of Class A specified in Section 803.1.2.

803.1.1.1 Acceptance criteria for NFPA 286. The interior finish shall comply with the following:

1. During the 40 kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremity of the sample on any wall or ceiling.
3. Flashover, as defined in NFPA 286, shall not occur.
4. The peak heat release rate throughout the test shall not exceed 800 kW.
5. The total smoke released throughout the test shall not exceed 1,000 m².

803.1.2 Interior wall and ceiling finish materials tested in accordance with ASTM E84 or UL 723. Interior wall and ceiling finishes shall be classified in accordance with ASTM E84 or UL 723. Such interior finish materials shall be grouped in the following classes in accordance with their flame spread and smoke-developed indices:

Class A: Flame spread index 0–25; smoke-developed index 0–450.

Class B: Flame spread index 26–75; smoke-developed index 0–450.

Class C: Flame spread index 76–200; smoke-developed index 0–450.

Exception: Materials tested in accordance with Section 803.1.1 and as indicated in Sections 803.1.3 through 803.15.

803.1.3 Interior wall and ceiling finish materials with specific requirements. The materials indicated in Sections 803.4 through 803.15 shall be tested as indicated in the corresponding sections.

803.2 Stability. Interior finish materials regulated by this chapter shall be applied or otherwise fastened in such a manner that such materials will not readily become detached where subjected to room temperatures of 200°F (93°C) for not less than 30 minutes.

803.3 Interior finish requirements based on occupancy. Interior wall and ceiling finish shall have a flame spread index not greater than that specified in Table 803.3 for the group and location designated. Interior wall and ceiling finish

materials tested in accordance with NFPA 286, and meeting the acceptance criteria of Section 803.1.1.1, shall be used where a Class A classification in accordance with ASTM E84 or UL 723 is required.

803.4 Fire-retardant coatings. The required flame spread or smoke-developed index of surfaces in existing buildings shall be allowed to be achieved by application of approved fire-retardant coatings, paints or solutions to surfaces having a flame spread index exceeding that allowed. Such applications shall comply with NFPA 703 and the required fire-retardant properties shall be maintained or renewed in accordance with the manufacturer’s instructions. The fire-retardant paint, coating or solution shall have been assessed by testing over the same substrate to be used in the application.

803.5 Textile wall coverings. Where used as interior wall finish materials, textile wall coverings, including materials having a woven, nonwoven, napped, tufted, looped or similar surface, shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1, 803.5.1 or 803.5.2.

[California Code of Regulations, Title 19, Division 1, §3.21(a) and (b)] Interior Finish of Decorative Material.

(a) Unframed Rigid Combustible Decorative Material. Rigid combustible decorative material and assemblies of materials not more than 1/4 inch in thickness used for folding doors, room dividers, decorative screens and similar applications, which do not create concealed spaces and which are installed with exposed edges, shall be flame resistant in accordance with the following:

(1) Test specimen shall be 12 inches wide and 24 inches long. Four specimens shall be tested, two in each direction of the material.

(2) The specimen shall be suspended vertically with its lower edge 2 inches above the top of a 3/8 inch diameter Bunsen Burner. The test shall be performed in a draft-free area.

(3) The flames from the burner shall be 4 inches long and shall be adjusted with sufficient air supply to eliminate any yellow flame tips but without any distinct inner blue cone.

(4) The specimen shall be exposed to the flame at each corner and at not less than one other point along the lower edge. Each exposure shall be of sufficient duration to determine if the material will ignite and continue to burn, but shall be not less than 20 seconds.

(5) The criteria for acceptance shall be as follows:

(A) There shall be not more than intermittent flaming appreciably beyond the area exposed to the test flame.

(B) No flame shall reach the top of the specimen.

(C) On removing the test flame there shall be not more than one second of after flaming except there may be nonprogressive flaming of short duration in areas of accumulated char which were directly exposed to the test flame.

**TABLE 803.3
INTERIOR WALL AND CEILING FINISH REQUIREMENTS BY OCCUPANCY^k**

GROUP	SPRINKLERED ^l			NONSPRINKLERED		
	Interior exit stairways and ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c	Interior exit stairways and ramps and exit passageways ^{a, b}	Corridors and enclosure for exit access stairways and ramps	Rooms and enclosed spaces ^c
A-1 and A-2	B	B	C	A	A ^d	B ^e
A-3 ^f , A-4, A-5	B	B	C	A	A ^d	C
B, E, M, R-1, R-4	B	C ^m	C	A	B ^m	C
F	C	C	C	B	C	C
H, L	B	B	C ^g	A	A	B
I-2, I-2.1	B	B	B ^{h, i}	A	A	B
I-3	A	A ^j	C	A	A	B
I-4	B	B	B ^{h, i}	A	A	B
R-2	C	C	C	B	B	C
R-2.1	B	C	C	A	B	B
R-3, R-3.1	C	C	C	C	C	C
S	C	C	C	B	B	C
U	No Restrictions			No Restrictions		

For SI: 1 inch = 25.4 mm, 1 square foot = 0.0929 m².

NP=Not Permitted [SFM]

- a. Class C interior finish materials shall be allowed for wainscoting or paneling of not more than 1,000 square feet of applied surface area in the grade lobby where applied directly to a noncombustible base or over furring strips applied to a noncombustible base and fireblocked as required by Section 803.11 of the California Building Code.
- b. In other than Group I-2 and I-2.1 occupancies in buildings less than three stories above grade plane of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C interior finish for sprinklered buildings shall be permitted in interior exit stairways and ramps.
- b. In exit enclosures of buildings less than three stories in height of other than Group I-3, Class B interior finish for nonsprinklered buildings and Class C for sprinklered buildings shall be permitted.
- c. Requirements for rooms and enclosed spaces shall be based on spaces enclosed by partitions. Where a fire-resistance rating is required for structural elements, the enclosing partitions shall extend from the floor to the ceiling. Partitions that do not comply with this shall be considered as enclosing spaces and the rooms or spaces on both sides shall be considered as one. In determining the applicable requirements for rooms and enclosed spaces, the specific occupancy thereof shall be the governing factor, regardless of the group classification of the building or structure.
- d. Lobby areas in Group A-1, A-2 and A-3 occupancies shall be not less than Class B materials.
- e. Class C interior finish materials shall be allowed in Group A occupancies with an occupant load of 300 persons or less.
- f. In places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall be allowed.
- g. Class B material is required where the building exceeds two stories.
- h. Class C interior finish materials shall be allowed in administrative spaces.
- i. Class C interior finish materials shall be allowed in rooms with a capacity of four persons or less.
- j. Class B materials shall be allowed as wainscoting extending not more than 48 inches above the finished floor in corridors.
- k. Finish materials as provided for in other sections of this code.
- l. Applies where the vertical exits, exit passageways, corridors or rooms and spaces are protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
- m. Corridors in ambulatory care facilities shall have a Class B or better interior finish material.

(b) Framed Rigid Combustible Decorative Material. Rigid combustible decorative material and assemblies of materials not more than 1/4 inch in thickness used for folding doors, room dividers, decorative screens and similar applications, and which are installed with all edges protected, shall conform to the following:

- (1) All exposed edges shall be protected with frames of metal or other noncombustible material, or solid wood of minimum 1/4 inch dimension.*
- (2) The total square foot area of the material shall not exceed ten percent of that of the floor area of the room in which the material is installed.*
- (3) When tested as follows, no flames shall reach the top edge of the specimen.*

The test shall be conducted in a draft free area, on a specimen of the material 12 inches by 12 inches suspended at a 45 degree angle from the horizontal with the upper and lower edges in a horizontal plane. The test flame shall be 3 inches long from a Bunsen Burner of approximately 1/2 inch inside diameter with the air supply completely shut off. The burner shall be so positioned so that its top is 1 inch vertically below a point on the lower surface of the test specimen, 1 inch up from its lower horizontal edge, and mid-way between the inclined edges. The exposure to the test flame and the duration of test shall be for a period of 2 minutes.

803.5.1 Room corner test for textile wall coverings and expanded vinyl wall coverings. Textile wall coverings and expanded vinyl wall coverings shall meet the criteria of Section 803.5.1.1 when tested in the manner intended

for use in accordance with the Method B protocol of NFPA 265 using the product mounting system, including adhesive. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

803.5.1.1 Acceptance criteria for NFPA 265 Method B test protocol. Where testing to NFPA 265, the interior finish shall comply with the following:

1. During the 40-kW exposure, flames shall not spread to the ceiling.
2. The flame shall not spread to the outer extremities of the samples on the 8-foot by 12-foot (203 by 305 mm) walls.
3. Flashover, as defined in NFPA 265, shall not occur.
4. For newly introduced wall coverings, the total smoke released throughout the test shall not exceed 1,000 m².

803.5.1.2 Unframed rigid combustible decorative material. *Rigid combustible decorative material and assemblies of materials not more than 1/4 inch in thickness used for folding doors, room dividers, decorative screens and similar applications, which do not create concealed spaces and which are installed with exposed edges, shall be flame resistant in accordance with SFM Standard 12-7-5 contained in Title 24, Part 12, California Referenced Standards Code.*

803.5.1.3 Framed rigid combustible decorative material. *Rigid combustible decorative material and assemblies of materials not more than 1/4 inch in thickness used for folding doors, room dividers, decorative screens and similar applications, and which are installed with all edges protected, shall conform to SFM Standard 12-7-5 contained in Title 24, Part 12, California Referenced Standards Code.*

803.5.2 Acceptance criteria for wall and ceiling coverings. Textile wall and ceiling coverings shall have a Class A flame spread index in accordance with ASTM E84 or UL 723, and be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

803.6 Textile ceiling coverings. Where used as interior ceiling finish materials, textile ceiling coverings, including materials having a woven, nonwoven, napped, tufted, looped or similar surface and carpet or similar textile materials, shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1 or 803.5.2.

803.7 Expanded vinyl wall coverings. Where used as interior wall finish materials, expanded vinyl wall coverings shall be tested in the manner intended for use, using the product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1, 803.5.1 or 803.5.2.

803.8 Expanded vinyl ceiling coverings. Where used as interior ceiling finish materials, expanded vinyl ceiling coverings shall be tested in the manner intended for use, using the

product mounting system, including adhesive, and shall comply with the requirements of Section 803.1.1 or 803.5.2.

[BF] 803.9 High-density polyethylene (HDPE) and polypropylene (PP). Where high-density polyethylene or polypropylene is used as an interior finish, it shall comply with Section 803.1.1.

[BF] 803.10 Site-fabricated stretch systems. Where used as newly installed interior wall or interior ceiling finish materials, site-fabricated stretch systems containing all three components described in the definition in Chapter 2 shall be tested in the manner intended for use, and shall comply with the requirements of Section 803.1.1 or 803.1.2. If the materials are tested in accordance with ASTM E84 or UL 723, specimen preparation and mounting shall be in accordance with ASTM E2573.

803.11 Foam plastic materials. Foam plastic materials shall not be used as interior wall and ceiling finish unless specifically allowed by Section 803.11.1 or 803.11.2. Foam plastic materials shall not be used as interior trim unless specifically allowed by Section 804.2.

803.11.1 Foam plastic combustibility characteristics. Foam plastic materials shall be allowed on the basis of fire tests that substantiate their combustibility characteristics for the use intended under actual fire conditions, as indicated in Section 2603.9 of the *California Building Code*. This section shall apply both to exposed foam plastics and to foam plastics used in conjunction with a textile or vinyl facing or cover.

803.11.2 Thermal barrier for foam plastics. Foam plastic material shall be allowed if it is separated from the interior of the building by a thermal barrier in accordance with Section 2603.4 of the *California Building Code*.

803.12 Facings or wood veneers intended to be applied on site over a wood substrate. Facings or veneers intended to be applied on site over a wood substrate shall comply with one of the following:

1. The facing or veneer shall meet the criteria of Section 803.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, described in Section 5.8.9 of NFPA 286.
2. The facing or veneer shall have a Class A, B or C flame spread index and smoke-developed index based on the requirements of Table 803.3, in accordance with ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2404.

803.13 Laminated products factory produced with an attached wood substrate. Laminated products factory produced with an attached wood substrate shall comply with one of the following:

1. The laminated product shall meet the criteria of Section 803.1.1 when tested in accordance with NFPA 286 using the product mounting system, including adhesive, of actual use.
2. The laminated product shall have a Class A, B or C flame spread index and smoke-developed index based on the requirements of Table 803.3, in accordance with

ASTM E84 or UL 723. Test specimen preparation and mounting shall be in accordance with ASTM E2579.

803.14 Thickness exemption. Materials having a thickness less than 0.036 inch (0.9 mm) applied directly to the surface of walls or ceilings shall not be required to be tested.

803.15 Heavy timber exemption. Exposed portions of building elements complying with the requirements of Type IV construction in accordance with the *California Building Code* shall not be subject to interior finish requirements.

**SECTION 804
INTERIOR WALL AND CEILING TRIM AND
INTERIOR FLOOR FINISH IN NEW
AND EXISTING BUILDINGS**

804.1 Interior trim. Combustible trim in new and existing buildings, excluding handrails and guards, shall not exceed 10 percent of the specific wall or ceiling areas to which it is attached. Other than foam plastic, material used as interior trim shall *have minimum Class B flame spread and 450 smoke-developed index in Group I-3 and for all other occupancies shall comply with Section 804.1.1 or 804.1.2.* Foam plastic used as interior trim shall comply with Section 804.2.

804.1.1 Testing in accordance with NFPA 286. Interior trim material shall be tested in accordance with NFPA 286 and comply with the acceptance criteria in Section 803.1.1.1. Where the interior trim material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.1.1, it shall not be required to be tested for flame spread index and smoke-developed index in accordance with ASTM E84 or UL 723.

804.1.2 Testing in accordance with ASTM E84 or UL 723. Material, other than foam plastic, used as interior trim shall have minimum Class C flame spread and smoke-developed indices, when tested in accordance with ASTM E84 or UL 723, as described in Section 803.1.2.

804.2 Foam plastic interior trim. Foam plastic used as interior trim shall comply with Sections 804.2.1 through 804.2.4.

804.2.1 Density. The minimum density of the interior trim shall be 20 pounds per cubic foot (320 kg/m³).

804.2.2 Thickness. The maximum thickness of the interior trim shall be 1/2 inch (12.7 mm) and the maximum width shall be 8 inches (203 mm).

804.2.3 Area limitation. The interior trim shall not constitute more than 10 percent of the specific wall or ceiling area to which it is attached.

804.2.4 Flame spread. The flame spread index shall not exceed 75 where tested in accordance with ASTM E84 or UL 723. The smoke-developed index shall not be limited.

Exception: Where the interior trim material has been tested as an interior finish in accordance with NFPA 286 and complies with the acceptance criteria in Section 803.1.1.1, it is not required to be tested for flame spread index in accordance with ASTM E84 or UL 723.

804.3 New interior floor finish. New interior floor finish and floor covering materials in new and existing buildings shall comply with Sections 804.3.1 through 804.3.3.2.

Exception: Floor finishes and coverings of a traditional type, such as wood, vinyl, linoleum or terrazzo, and resilient floor covering materials that are not composed of fibers.

804.3.1 Classification. Interior floor finish and floor covering materials required by Section 804.3.3.2 to be of Class I or II materials shall be classified in accordance with ASTM E648 or NFPA 253. The classification referred to herein corresponds to the classifications determined by ASTM E648 or NFPA 253 as follows: Class I, 0.45 watts/cm² or greater; Class II, 0.22 watts/cm² or greater.

804.3.2 Testing and identification. Interior floor finish and floor covering materials shall be tested by an *approved* agency in accordance with ASTM E648 or NFPA 253 and identified by a hang tag or other suitable method so as to identify the manufacturer or supplier and style, and shall indicate the interior floor finish or floor covering classification in accordance with Section 804.3.1. Carpet-type floor coverings shall be tested as proposed for use, including underlayment. Test reports confirming the information provided in the manufacturer's product identification shall be furnished to the fire code official upon request.

804.3.3 Interior floor finish requirements. New interior floor covering materials shall comply with Sections 804.3.3.1 and 804.3.3.2, and interior floor finish materials shall comply with Section 804.3.1.

804.3.3.1 Test requirement. *In all occupancies, interior floor finish and interior floor covering materials shall comply with the requirements of ASTM Standard E648, and having a specific optical density smoke rating not to exceed 450 per ASTM E662. For Group I-3 occupancies and Group I-2 areas where patients are restrained, see Section 804.3.3.3.*

804.3.3.2 Minimum critical radiant flux. In all occupancies, new interior floor finish and floor covering materials in enclosures for stairways and ramps, exit passageways, corridors and rooms or spaces not separated from corridors by full-height partitions extending from the floor to the underside of the ceiling shall withstand a minimum critical radiant flux. The minimum critical radiant flux shall be not less than Class I in Groups I-2 and I-3 areas where restraint is not used and R-2.1 and not less than Class II in Groups A, B, E, H, I-2.1, I-4, M, R-1, R-2, R-2.2 and S.

Exception: Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, Class II materials shall be permitted in any area where Class I materials are required and materials complying with *ASTM Standard E648, and having a specific optical density smoke rating not to exceed 450 per ASTM E662 are permitted in any area where Class II materials are required.*

For Group I-3 areas occupied by inmates or Group I-2 areas where patients are restrained, see Section 804.3.3.3.

804.3.3.3 Group I-2 and Group I-3 floor surfaces. Interior floor finish and floor coverings occupied by inmates or patients whose personal liberties are restrained shall be noncombustible. Carpet or other floor covering materials may be used in areas protected by an automatic sprinkler system installed throughout in accordance with Section 903.3.1.1. Carpet or other floor coverings shall comply with the requirements of ASTM Standard E648; the minimum critical radiant flux shall be not less than Class I and the specific optical density smoke rating shall not exceed 450 per ASTM E662. Carpeting and carpet padding shall be tested as a unit in accordance with floor covering radiant panel test meeting Class I and has a critical radiant flux limit of not less than 0.45 watt per centimeter square. The carpeting and padding shall be identified by a hang-tag or other suitable method as to manufacturer and style and shall indicate the classification of the material based on the limits set forth above.

804.4 Interior floor-wall base. Interior floor-wall base that is 6 inches (152 mm) or less in height shall be tested in accordance with ASTM E648 or NFPA 253 and shall be not less than Class II. Where a Class I floor finish is required, the floor-wall base shall be Class I. The classification referred to herein corresponds to the classifications determined by ASTM E648 or NFPA 253 as follows: Class I, 0.45 watt/cm² or greater; Class II, 0.22 watts/cm² or greater.

Exception: Interior trim materials that comply with Section 804.1.

SECTION 805 UPHOLSTERED FURNITURE AND MATTRESSES IN NEW AND EXISTING BUILDINGS

805.1 *Reserved.*

805.2 Group I-2 and Group B ambulatory care facilities. The requirements in Sections 805.2.1 through 805.2.2 shall apply to Group I-2 occupancies and Group B ambulatory care facilities.

805.2.1 Upholstered furniture. Newly introduced upholstered furniture shall meet the requirements of Sections 805.2.1.1 through 805.2.1.3.

805.2.1.1 Ignition by cigarettes. Newly introduced upholstered furniture shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with one of the following: (a) mocked-up composites of the upholstered furniture shall have a char length not exceeding 1.5 inches (38 mm) when tested in accordance with NFPA 261 or (b) the components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260.

Exception: Upholstered furniture belonging to the patients in sleeping rooms of Group I-2, Condition 1

occupancies, provided that a smoke detector is installed in such rooms. Battery-powered, single-station smoke alarms shall be allowed.

805.2.1.2 Heat release rate. Newly introduced upholstered furniture shall have limited rates of heat release when tested in accordance with ASTM E1537 or California Technical Bulletin 133, as follows:

1. The peak rate of heat release for the single upholstered furniture item shall not exceed 80 kW.

Exception: Upholstered furniture in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

2. The total heat released by the single upholstered furniture item during the first 10 minutes of the test shall not exceed 25 MJ.

Exception: Upholstered furniture in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

805.2.1.3 Identification. Upholstered furniture shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.2.1.1 and 805.2.1.2.

805.2.2 Mattresses. Newly introduced mattresses shall meet the requirements of Sections 805.2.2.1 through 805.2.2.3.

805.2.2.1 Ignition by cigarettes. Newly introduced mattresses shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with DOC 16 CFR Part 1632 and shall have a char length not exceeding 2 inches (51 mm).

805.2.2.2 Heat release rate. Newly introduced mattresses shall have limited rates of heat release when tested in accordance with ASTM E1590 or California Technical Bulletin 129, as follows:

1. The peak rate of heat release for the single mattress shall not exceed 100 kW.

Exception: Mattresses in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

2. The total heat released by the single mattress during the first 10 minutes of the test shall not exceed 25 MJ.

Exception: Mattresses in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

805.2.2.3 Identification. Mattresses shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.2.2.1 and 805.2.2.2.

805.3 Group I-3, detention and correction facilities. The requirements in Sections 805.3.1 through 805.3.2 shall apply to detention and correction facilities classified in Group I-3.

805.3.1 Upholstered furniture. Newly introduced upholstered furniture shall meet the requirements of Sections 805.3.1.1 through 805.3.1.3

805.3.1.1 Ignition by cigarettes. Newly introduced upholstered furniture shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with one of the following:

1. Mocked-up composites of the upholstered furniture shall have a char length not exceeding 1.5 inches (38 mm) when tested in accordance with NFPA 261.
2. The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260.

805.3.1.2 Heat release rate. Newly introduced upholstered furniture shall have limited rates of heat release when tested in accordance with ASTM E1537, as follows:

1. The peak rate of heat release for the single upholstered furniture item shall not exceed 80 kW.
2. The total heat released by the single upholstered furniture item during the first 10 minutes of the test shall not exceed 25 MJ.

805.3.1.3 Identification. Upholstered furniture shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.3.1.1 and 805.3.1.2.

805.3.2 Mattresses. Newly introduced mattresses shall meet the requirements of Sections 805.3.2.1 through 805.3.2.3.

805.3.2.1 Ignition by cigarettes. Newly introduced mattresses shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with DOC 16 CFR Part 1632 and shall have a char length not exceeding 2 inches (51 mm).

805.3.2.2 Fire performance tests. Newly introduced mattresses shall be tested in accordance with Section 805.3.2.2.1 or 805.3.2.2.2.

805.3.2.2.1 Heat release rate. Newly introduced mattresses shall have limited rates of heat release when tested in accordance with ASTM E1590 or California Technical Bulletin 129, as follows:

1. The peak rate of heat release for the single mattress shall not exceed 100 kW.
2. The total heat released by the single mattress during the first 10 minutes of the test shall not exceed 25 MJ.

805.3.2.2.2 Mass loss test. Newly introduced mattresses shall have a mass loss not exceeding 15 percent of the initial mass of the mattress where tested in accordance with the test in Annex A3 of ASTM F1085.

805.3.2.3 Identification. Mattresses shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.3.2.1 and 805.3.2.2.

805.4 Group R-2 college and university dormitories. The requirements of Sections 805.4.1 through 805.4.2.3 shall apply to college and university dormitories classified in Group R-2, including decks, porches and balconies.

805.4.1 Upholstered furniture. Newly introduced upholstered furniture shall meet the requirements of Sections 805.4.1.1 through 805.4.1.3.

805.4.1.1 Ignition by cigarettes. Newly introduced upholstered furniture shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with one of the following:

1. Mocked-up composites of the upholstered furniture shall have a char length not exceeding 1½ inches (38 mm) when tested in accordance with NFPA 261.
2. The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260.

805.4.1.2 Heat release rate. Newly introduced upholstered furniture shall have limited rates of heat release when tested in accordance with ASTM E1537 or California Technical Bulletin 133, as follows:

1. The peak rate of heat release for the single upholstered furniture item shall not exceed 80 kW.

Exception: Upholstered furniture in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

2. The total heat released by the single upholstered furniture item during the first 10 minutes of the test shall not exceed 25 MJ.

Exception: Upholstered furniture in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

805.4.1.3 Identification. Upholstered furniture shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.4.1.1 and 805.4.1.2.

805.4.2 Mattresses. Newly introduced mattresses shall meet the requirements of Sections 805.4.2.1 through 805.4.2.3.

805.4.2.1 Ignition by cigarettes. Newly introduced mattresses shall be shown to resist ignition by cigarettes as determined by tests conducted in accordance with DOC 16 CFR Part 1632 and shall have a char length not exceeding 2 inches (51 mm).

805.4.2.2 Heat release rate. Newly introduced mattresses shall have limited rates of heat release when tested in accordance with ASTM E1590 or California Technical Bulletin 129, as follows:

1. The peak rate of heat release for the single mattress shall not exceed 100 kW.

Exception: Mattresses in rooms or spaces protected by an approved automatic sprinkler

system installed in accordance with Section 903.3.1.1.

- The total heat released by the single mattress during the first 10 minutes of the test shall not exceed 25 MJ.

Exception: Mattresses in rooms or spaces protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.

805.4.2.3 Identification. Mattresses shall bear the label of an approved agency, confirming compliance with the requirements of Sections 805.4.2.1 and 805.4.2.2.

SECTION 806 NATURAL DECORATIVE VEGETATION IN NEW AND EXISTING BUILDINGS

806.1 Natural cut trees. Natural cut trees, where allowed by this section, shall have the trunk bottoms cut off not less than 0.5 inch (12.7 mm) above the original cut and shall be placed in a support device complying with Section 806.1.2.

806.1.1 Restricted occupancies. Natural cut trees shall be prohibited within ambulatory care facilities and Group A, E, I-2, I-3, I-4, M, R-1, R-2 and R-4 occupancies.

Exceptions:

- Trees located in areas protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 shall not be prohibited in Groups A, E, M, R-1 and R-2.
- Trees shall be allowed within dwelling units in Group R-2 occupancies.

806.1.2 Support devices. The support device that holds the tree in an upright position shall be of a type that is stable and that meets all of the following criteria:

- The device shall hold the tree securely and be of adequate size to avoid tipping over of the tree.
- The device shall be capable of containing a minimum two-day supply of water.
- The water level, when full, shall cover the tree stem not less than 2 inches (51 mm). The water level shall be maintained above the fresh cut and checked not less than once daily.

806.1.3 Dryness. The tree shall be removed from the building whenever the needles or leaves fall off readily when a tree branch is shaken or if the needles are brittle and break when bent between the thumb and index finger. The tree shall be checked daily for dryness.

806.1.4 Fire-retardant treatments for natural cut trees. Where fire-retardant treatments are applied to natural cut trees, the fire-retardant treatment shall be tested by an approved agency and shall be treated and maintained in a flame-retardant condition by means of a flame-retardant solution or process approved by the State Fire Marshal, as

set forth in California Code of Regulations, Title 19, Division 1, Chapter 8.

[California Code of Regulations, Title 19, Division 1, §3.08]. Decorative Materials.

In every Group A, E, I, R-1, R-2, R-2.1, R-3.1 and R-4 occupancy, all drapes, hangings, curtains, drops and all other decorative material, including Christmas trees, that would tend to increase the fire and panic hazard shall be made from a nonflammable material, or shall be treated and maintained in a flame-retardant condition by means of a flame-retardant solution or process approved by the State Fire Marshal, as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8. Exits, exit lights, fire alarm sending stations, wet standpipe hose cabinets and fire extinguisher locations shall not be concealed, in whole or in part, by any decorative material.

Exceptions:

- Cubical curtains and individual patient room window curtains and drapes in Group I, R-2.1, R-3.1 and R-4 occupancies.
- Window curtains and drapes within dwelling units of Group R-1 and R-2 occupancies.
- Christmas trees within dwelling units of Group R-1 and R-2 occupancies.

806.2 Obstruction of means of egress. The required width of any portion of a means of egress shall not be obstructed by decorative vegetation. Natural cut trees shall not be located within an exit, corridor, or a lobby or vestibule.

806.3 Open flame. Candles and open flames shall not be used on or near decorative vegetation. Natural cut trees shall be kept a distance from heat vents and any open flame or heat-producing devices not less than the height of the tree.

806.4 Electrical fixtures and wiring. The use of unlisted electrical wiring and lighting on natural vegetation, including natural cut trees, shall be prohibited.

SECTION 807 DECORATIVE MATERIALS AND ARTIFICIAL DECORATIVE VEGETATION IN NEW AND EXISTING BUILDINGS

807.1 General. The following requirements shall apply to all occupancies:

- Furnishings or decorative materials of an explosive or highly flammable character shall not be used.
- Fire-retardant coatings in existing buildings shall be maintained so as to retain the effectiveness of the treatment under service conditions encountered in actual use.
- Furnishings or other objects shall not be placed to obstruct exits, access thereto, egress therefrom or visibility thereof.
- The permissible amount of noncombustible decorative materials shall not be limited.

807.2 Combustible decorative materials. In Groups A, B, E, I, M and R-1 and in dormitories in Group R-2, curtains, draperies, fabric hangings and other similar combustible decorative materials suspended from walls or ceilings shall comply with Section 807.3 and shall not exceed 10 percent of the specific wall or ceiling area to which such materials are attached.

Fixed or movable walls and partitions, paneling, wall pads and crash pads applied structurally or for decoration, acoustical correction, surface insulation or other purposes shall be considered to be interior finish, shall comply with Section 803 and shall not be considered decorative materials or furnishings.

Exceptions:

1. In auditoriums in Group A, the permissible amount of curtains, draperies, fabric hangings and similar combustible decorative material suspended from walls or ceilings shall not exceed 75 percent of the aggregate wall area where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, and where the material is installed in accordance with Section 803.15 of the *California Building Code*.
2. In Group R-2 dormitories, within sleeping units and dwelling units, the permissible amount of curtains, draperies, fabric hangings and similar decorative materials suspended from walls or ceilings shall not exceed 50 percent of the aggregate wall areas where the building is equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.
3. In Group B and M occupancies, the amount of combustible fabric partitions suspended from the ceiling and not supported by the floor shall comply with Section 807.3 and shall not be limited.
4. The 10-percent limit shall not apply to curtains, draperies, fabric hangings and similar combustible decorative materials used as window coverings.

[California Code of Regulations, Title 19, Division 1, §3.08]. Decorative Materials.

In every Group A, E, I, R-1, R-2, R-2.1, R-3.1 and R-4 occupancy, all drapes, hangings, curtains, drops and all other decorative material, including Christmas trees, that would tend to increase the fire and panic hazard shall be made from a nonflammable material, or shall be treated and maintained in a flame-retardant condition by means of a flame-retardant solution or process approved by the State Fire Marshal, as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8. Exits, exit lights, fire alarm sending stations, wet standpipe hose cabinets and fire extinguisher locations shall not be concealed, in whole or in part, by any decorative material.

Exceptions:

- (a) Cubical curtains and individual patient room window curtains and drapes in Group I, R-2.1, R-3.1 and R-4 occupancies.

(b) Window curtains and drapes within dwelling units of Group R-1 and R-2 occupancies.

(c) Christmas trees within dwelling units of Group R-1 and R-2 occupancies.

[California Code of Regulations, Title 19, Division 1, §1273.1] Fabrics for Interior Use.

Fabrics as described in California Code of Regulations, Title 19, Division 1, 1272(c) intended for interior use shall be tested in their original condition only and shall meet the requirements for fire resistance outlined in California Code of Regulations, Title 19, Division 1, Section 1273.3.

[California Code of Regulations, Title 19, Division 1, §1273.2] Fabrics for Exterior Use.

Fabrics as described in California Code of Regulations, Title 19, Division 1, 1272(c) intended for exterior use shall meet the requirements for fire resistance outlined in California Code of Regulations, Title 19, Division 1, 1273.3, and, in addition, they shall meet the requirements for fire resistance outlined in California Code of Regulations, Title 19, Division 1, 1237, both in their original state and after accelerated weathering.

807.3 Acceptance criteria and reports. Where required to exhibit improved fire performance, curtains, draperies, fabric hangings and other similar combustible decorative materials suspended from walls or ceilings (*shall be flame resistant in accordance with the provisions set forth in CCR, Title 19, Division 1, Chapter 8.*) shall be tested by an approved agency and meet the flame propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 or exhibit a maximum rate of heat release of 100 kW when tested in accordance with NFPA 289, using the 20 kW ignition source. Reports of test results shall be prepared in accordance with the test method used and furnished to the fire code official upon request.

[California Code of Regulations, Title 19, Division 1, §1321.1] Fabric and Material Certification.

All concerns in whose name an approved flame-resistant fabric or material is registered shall issue approved certificates of flame resistance covering all such products sold for use in occupancies governed by the statutes. Copies shall be furnished to the buyer as well as the State Fire Marshal and the local fire authority of the customer's city. These certificates shall be delivered within 10 days after the product is shipped and shall be completely filled out and signed by an authorized representative of the concern.

In addition to the required description on the reverse side of the certificate as to yardage or quantity, color and kind, notation should be made of the manufacturer's production or lot control number, the purchase order or invoice number, and, where possible, the ultimate location and use.

[California Code of Regulations, Title 19, Division 1, §1324] Job Labeling.

To every article that is treated and to every roll or package of registered approved fabric or material, a small label or tag shall be securely affixed, bearing the following information:

- (a) The Seal of Registration of the State Fire Marshal of California.

(b) Name and registration number of the concern responsible for the job or production.

(c) Name of the registered chemical used or the registered fabric or material.

(d) Date the chemical was applied, or the fabric or material was produced.

(e) The statement, "This article must be re-treated after washing or dry cleaning by systems with soap and water added" (if treated with a "Type II" chemical).

This information may be stamped, printed or stenciled on the article if so desired.

Concerns which treat or manufacture yardage goods may print or stencil their name, or the name of their fabric if registered, on the salvage (at least once every three yards) instead of affixing the label or tag as above.

[California Code of Regulations, Title 19, Division 1, §1325] Labeling Required.

No drape, hanging, curtain, drop or similar decorative material or exterior fabric which has been treated by a registered flame-retardant application concern, either as yardage or after fabrication, or which is made from a registered approved fabric shall be installed after the effective date of these rules and regulations [California Code of Regulations, Title 19, Division 1, Chapter 8] in any place or under any condition governed by Sections 13115 and 13119 of the Health and Safety Code unless such drape, hanging, curtain, drop, or similar decorative material or exterior fabric shall be labeled as required by California Code of Regulations, Title 19, Division 1, Section 1324.

[California Code of Regulations, Title 19, Division 1, §1326] Retreatment.

In cases where instructions are issued by the State Fire Marshal requiring retreatment or replacement of fabrics or materials previously treated with a flame-retardant chemical or registered as an approved fabric or material, the retreatment or replacement shall be made within ten (10) days after date of the order so requiring. A new certificate of flame resistance covering each such retreatment shall be delivered as for an original job as is provided for by California Code of Regulations, Title 19, Division 1, Section 1321. A new sample of the retreated fabric or material shall be attached to the certificate of flame resistance submitted to the State Fire Marshal.

[California Code of Regulations, Title 19, Division 1, §1327] Installation.

The standard fire-resistance tests presume installation of approved registered fabrics in a normal vertical position. Some decorative materials installed otherwise, such as in narrow strips or suspended overhead in a horizontal position, may exhibit different burning characteristics. Since it is not feasible to devise tests for all such installations differing from normal, they must be judged on an individual basis. Where indicated, the State Fire Marshal may perform such additional tests as he deems necessary to ensure adequate fire resistance of materials as installed.

807.4 Artificial decorative vegetation. Artificial decorative vegetation shall comply with this section and the requirements of Sections 807.2 and 807.3. Natural decorative vegetation shall comply with Section 806.

Exception: Testing of artificial vegetation is not required in Group I-2; Group R-2; Group R-3; or Group R-4 occupancies equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1, where such artificial vegetation complies with the following:

1. Wreaths and other decorative items on doors shall not obstruct the door operation and shall not exceed 50 percent of the surface area of the door.
2. Decorative artificial vegetation shall be limited to not more than 30 percent of the wall area to which it is attached.
3. Decorative artificial vegetation not on doors or walls shall not exceed 3 feet (914 mm) in any dimension.

807.4.1 Flammability. Artificial decorative vegetation shall meet the flame propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701. Meeting such criteria shall be documented and certified by the manufacturer in an approved manner. Alternatively, the artificial decorative vegetation shall be tested in accordance with NFPA 289, using the 20 kW ignition source, and shall have a maximum heat release rate of 100 kW.

807.4.2 Electrical fixtures and wiring on artificial vegetation. The use of unlisted electrical wiring and lighting on artificial decorative vegetation shall be prohibited. The use of electrical wiring and lighting on artificial trees constructed entirely of metal shall be prohibited.

807.5 Occupancy-based requirements. Occupancies shall comply with Sections 807.5.1 through 807.5.6.

807.5.1 Group A. In Group A occupancies, the requirements in Sections 807.5.1.1 through 807.5.1.4 shall apply.

807.5.1.1 Foam plastics. Exposed foam plastic materials and unprotected materials containing foam plastic used for decorative purposes or stage scenery or exhibit booths shall have a maximum heat release rate of 100 kW when tested in accordance with UL 1975, or when tested in accordance with NFPA 289 using the 20 kW ignition source.

Exceptions:

1. Individual foam plastic items or items containing foam plastic where the foam plastic does not exceed 1 pound (0.45 kg) in weight.
2. Cellular or foam plastic shall be allowed for trim in accordance with Section 804.2.

807.5.1.2 Motion picture screens. The screens on which motion pictures are projected in new and existing buildings of Group A shall either meet the flame propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 or shall comply with the requirements for a Class B interior

finish in accordance with Section 803 of the *California Building Code*.

807.5.1.2.1 Motion picture and television production studio sound stages. *Approved production facilities and production locations with live audiences.*

807.5.1.2.2 Foam plastics, decorations, textile and film materials. *Foam plastics, textile and film materials and other decorative materials and materials containing foam plastics shall be in accordance with the following:*

1. *Exhibit booth construction shall have a maximum heat-release rate of 100 kilowatts when tested in accordance with UL 1975.*
2. *Decorative objects, including but not limited to mannequins, murals and signs, shall have a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975.*

Exception: *When the aggregate area of murals, signs or similar decorative objects occupies less than 10 percent of the floor or wall area, this requirement may be waived by the fire chief.*

3. *Theater, motion picture and television stage settings with or without horizontal projections and simulated caves or caverns shall have a maximum heat-release rate of 100 kilowatts when tested in accordance with UL 1975.*

807.5.1.3 Wood use in places of religious worship. In places of religious worship, wood used for ornamental purposes, trusses, paneling or chancel furnishing shall not be limited.

807.5.1.4 Pyroxylin plastic. Imitation leather or other material consisting of or coated with a pyroxylin or similarly hazardous base shall not be used.

807.5.2 Group E. Group E occupancies shall comply with Sections 807.5.2.1 through 807.5.2.3.

807.5.2.1 Storage in corridors and lobbies. Clothing and personal effects shall not be stored in corridors and lobbies.

Exceptions:

1. Corridors protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. Corridors protected by an approved fire alarm system installed in accordance with Section 907.
3. Storage in metal lockers, provided the minimum required egress width is maintained.

807.5.2.2 Artwork in corridors. Artwork and teaching materials shall be limited on the walls of corridors to not more than 20 percent of the wall area.

807.5.2.3 Artwork in classrooms. Artwork and teaching materials shall be limited on walls of classrooms to

not more than 50 percent of the specific wall area to which they are attached.

807.5.3 Groups I-2, I-2.1 and R-2.1. In Group I-2, I-2.1 and R-2.1 occupancies, combustible decorative materials shall comply with Sections 807.5.3.1 through 807.5.3.4.

807.5.3.1 Group R-2.1 within units. In Group R-2.1 occupancies, equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, within sleeping units and dwelling units, combustible decorative materials placed on walls shall be limited to not more than 50 percent of the wall area to which they are attached.

807.5.3.2 In Group R-2.1 for areas other than within units. In Group R-2.1 occupancies, equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, combustible decorative materials placed on walls in areas other than within dwelling and sleeping units shall be limited to not more than 30 percent of the wall area to which they are attached.

807.5.3.3 In Groups I-2, I-2.1 and R-2.1. In Groups I-2, I-2.1 and R-2.1 occupancies equipped throughout with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1, combustible decorative materials placed on walls shall be limited to not more than 30 percent of the wall area to which they are attached.

807.5.3.4 Other areas in Groups I-2, I-2.1 and R-2.1. In Groups I-2, I-2.1 and R-2.1 occupancies, in areas not equipped throughout with an approved automatic sprinkler system, combustible decorative materials shall be of such limited quantities that a hazard of fire development or spread is not present.

807.5.4 Group I-3. In Group I-3, combustible decorative materials are prohibited.

807.5.5 Group I-4. Group I-4 occupancies shall comply with the requirements in Sections 807.5.5.1 through 807.5.5.3.

807.5.5.1 Storage in corridors and lobbies. Clothing and personal effects shall not be stored in corridors and lobbies.

Exceptions:

1. Corridors protected by an approved automatic sprinkler system installed in accordance with Section 903.3.1.1.
2. Corridors protected by an approved fire alarm system installed in accordance with Section 907.
3. Storage in metal lockers, provided that the minimum required egress width is maintained.

807.5.5.2 Artwork in corridors. Artwork and teaching materials shall be limited on walls of corridors to not more than 20 percent of the wall area.

807.5.5.3 Artwork in classrooms. Artwork and teaching materials shall be limited on walls of classrooms to

not more than 50 percent of the specific wall area to which they are attached.

807.5.6 Dormitories in Group R-2. In Group R-2 dormitories, within sleeping units and dwelling units, the combustible decorative materials shall be of limited quantities such that a hazard of fire development or spread is not present.

807.5.7 Group F-1 motion picture and television production studio sound stages, approved production facilities and production locations without live audiences.

807.5.7.1 Foam plastics, decorations, textile and film materials. Foam plastics, textile and film materials and other decorative materials and materials containing foam plastics shall be in accordance with the following:

1. Exhibit booth construction shall have a maximum heat-release rate of 100 kilowatts when tested in accordance with UL 1975.
2. Decorative objects, including but not limited to mannequins, murals and signs, shall have a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975.

Exception: When the aggregate area of murals, signs or similar decorative objects occupies less than 10 percent of the floor or wall area, this requirement may be waived by the fire chief.

3. Theater, motion picture and television stage settings with or without horizontal projections and simulated caves or caverns shall have a maximum heat-release rate of 100 kilowatts when tested in accordance with UL 1975.

SECTION 808

FURNISHINGS OTHER THAN UPHOLSTERED FURNITURE AND MATTRESSES OR DECORATIVE MATERIALS IN NEW AND EXISTING BUILDINGS

➔ **808.1 Wastebaskets and linen containers in Group I-2 and I-3 occupancies and Group B ambulatory care facilities.** Wastebaskets, linen containers and other waste containers, including their lids, located in Group I-1, I-2 and I-3 occupancies and Group B ambulatory care facilities shall be constructed of noncombustible materials or of materials that meet a peak rate of heat release not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation. Metal wastebaskets and other metal waste containers with a capacity of 20 gallons (75.7 L) or more shall be listed in accordance with UL 1315 and shall be provided with a noncombustible lid. Portable containers exceeding 32 gallons (121 L) shall be stored in an area classified as a waste and linen collection room and constructed in accordance with Table 509.1 of the *California Building Code*.

Exception: Recycling containers complying with Section 808.1.2 are not required to be stored in waste and linen collection rooms.

[California Code of Regulations, Title 19, Division 1, §3.19(b) and (c) Housekeeping.

Every building or portion of a building governed by California Code of Regulations, Title 19, Division 1 regulations shall be maintained in a neat orderly manner, free from any condition that would create a fire or life hazard or a condition which would add to or contribute to the rapid spread of fire. Provisions shall be made for the proper storage and disposal of waste materials and rubbish consistent with the following:

(b) All combustible waste material and rubbish shall be stored in approved containers or shall be stored in a manner approved by the enforcing agency as being consistent with standard fire prevention practices until such waste material and rubbish is removed from the premises or otherwise disposed of in a proper manner.

(1) Containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m³) shall comply with the provisions of California Code of Regulations, Title 24, Part 9, Section 304.3.

(2) Wastebaskets and linen containers in Group I-2 and I-3 occupancies shall comply with the provisions of California Code of Regulations, Title 24, Part 9, Section 808.

(c) Approved self-closing metal containers or listed disposal containers by an approved testing or listing agency shall be provided and maintained in all rooms or locations where oily rags, oily waste, paint rags or similar materials subject to spontaneous ignition are used, or are stored temporarily. Such containers shall be emptied daily.

808.1.1 Capacity density. The average capacity density of containers located in an individual room or space, other than waste and linen collection rooms, shall not be greater than 0.5 gal/ft² (20.4 L/m²).

808.1.2 Recycling clean waste containers. Recycling clean waste containers, including their lids, shall not exceed an individual capacity of 96 gallons (363 L).

808.2 Waste containers with a capacity of 20 gallons or more in Group R-2 college and university dormitories. Waste containers, including their lids, located in Group R-2 college and university dormitories, and with a capacity of 20 gallons (75.7 L) or more, shall be constructed of noncombustible materials or of materials that meet a peak rate of heat release not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation. Metal wastebaskets and other metal waste containers with a capacity of 20 gallons (75.7 L) or more shall be listed in accordance with UL 1315 and shall be provided with a noncombustible lid. Portable containers exceeding 32 gallons (121 L) shall be stored in an area classified as a waste and linen collection room constructed in accordance with Table 509.1 of the *California Building Code*.

808.3 Signs. Foam plastic signs that are not affixed to interior building surfaces shall have a maximum heat release rate of 150 kW when tested in accordance with UL 1975, or when

tested in accordance with NFPA 289 using the 20-kW ignition source.

Exception: Where the aggregate area of foam plastic signs is less than 10 percent of the floor area or wall area of the room or space in which the signs are located, whichever is less, subject to the approval of the fire code official.

808.4 Combustible lockers. Where lockers constructed of combustible materials are used, the lockers shall be considered to be interior finish and shall comply with Section 803.

Exception: Lockers constructed entirely of wood and noncombustible materials shall be permitted to be used wherever interior finish materials are required to meet a Class C classification in accordance with Section 803.1.2.

808.5 Play structures added to existing buildings. Where play structures that exceed 10 feet (3048 mm) in height or 150 square feet (14 m²) in area are added inside an existing building, they shall comply with Section 424 of the *California Building Code*.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
901.5			X																			
901.6			X																			
[T-19 §1.14]				X																		
[T-19 §3.24]				X																		
[T-19 §904 (a)]				X																		
[T-19 §904 (a)(1)]				X																		
[T-19 §904 (b)]				X																		
[T-19 §904.2 (a)]				X																		
[T-19 §904.2 (b)]				X																		
[T-19 §904.2 (h)]				X																		
[T-19 §904.2 (i)]				X																		
901.6.1			X																			
[T-19 §904.1 (a)]				X																		
[T-19 §904.2 (g)]				X																		
Table 901.6.1			X																			
[T-19 §904.1 (b)]				X																		
[T-19 §904.2 (c)]				X																		
[T-19 §904.2 (j)]				X																		
[T-19 §904.1 (c)]				X																		
[T-19 §904.2 (d)]				X																		
[T-19 §904.2 (e)]				X																		
[T-19 §904.2 (f)]				X																		
901.7			X																			
902.1			X																			
[T-19 §902.4 (b)]				X																		
Fire Appliance			X																			
[T-19 §902.9 (a)]				X																		
[T-19 §902.12 (a)]				X																		
[T-19 §902.15 (a)]				X																		
[T-19 §902.18 (a)]				X																		
[T-19 §902.19 (a)]				X																		
903.1.1			X																			
903.2			X																			
903.2.1.2			X																			
903.2.1.3			X																			
903.2.3			X																			
903.2.4.1			X																			
903.2.5.4			X																			
903.2.6			X																			
903.2.6.1			X																			

(continued)

CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
903.2.6.2			X																			
903.2.7			X																			
903.2.8			X																			
903.2.8.3			X																			
903.2.8.4			X																			
903.2.10.2			X																			
Table 903.2.11.6			X																			
903.2.13 – 903.2.21			X																			
903.3.1.1			X																			
903.3.1.1.1			X																			
903.3.1.2			X																			
903.3.1.2.3			X																			
903.3.1.1.3			X																			
903.3.1.3			X																			
903.3.5			X																			
903.3.9			X																			
903.4.2			X																			
903.4.3			X																			
[T-19 §904 (a)(2)]				X																		
[T-19 §904 (c)]				X																		
[T-19 §904.7 (a-c)]				X																		
904.1.1			†																			
904.5			X																			
904.6			X																			
904.7			X																			
904.7.1			X																			
904.8			X																			
904.8.1			X																			
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904.9.1			X																			
904.10			X																			
904.10.1			X																			
904.11.3			X																			
904.12			X																			
904.12.5			X																			
904.13			X																			
905.2			X																			
905.3			X																			
905.3.1			X																			
905.3.9			X																			
905.3.10			X																			
905.3.11			X																			
905.3.11.1				X																		
905.3.11.2				X																		

(continued)

CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]				X																			
Chapter / Section																							
905.4				X																			
905.5				X																			
905.7.2				X																			
906.1			X																				
[T-19 §3.29 (a-d)]				X																			
[T-19 §565 (a)]				X																			
906.2			X																				
[T-19 §565.1 (a-c)]				X																			
[T-19 §565.2 (a-e)]				X																			
[T-19 §566 (a-f)]				X																			
[T-19 §567.8]				X																			
[T-19 §574.1]				X																			
[T-19 §574.2]				X																			
[T-19 §567.1]				X																			
[T-19 §574.3]				X																			
[T-19 §574.4]				X																			
[T-19 §575.10]				X																			
[T-19 §591.5]				X																			
[T-19 §596.7 (a)(b)]				X																			
[T-19 §574.5 (a-c)]				X																			
906.2.1			X																				
[T-19 §567 (a-k)]				X																			
[T-19 §568 (a-e)]				X																			
[T-19 §569 (a-c)]				X																			
[T-19 §570 (a-e)]				X																			
[T-19 §571 (a)]				X																			
Table 906.3(1)			X																				
906.3.2			X																				
Table 906.3(2)			X																				
906.3.4			X																				
[T-19 §573 (a-c)]				X																			
[T-19 §567.5]				X																			
[T-19 §567.3]				X																			
[T-19 §567.4]				X																			
[T-19 §567.6]				X																			
[T-19 §567.2]				X																			
[T-19 §567.7]				X																			
[T-19 §573 (a-c)]				X																			
907.1.2			X																				
907.1.3			X																				
907.1.4			X																				
907.1.5			X																				

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CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
907.2			X																			
907.2.1			X																			
907.2.1.1			X																			
907.2.1.3			X																			
907.2.2			X																			
907.2.2.2			X																			
907.2.3			X																			
907.2.3.1			X																			
907.2.3.2			X																			
907.2.3.3			X																			
907.2.3.4			X																			
907.2.3.5			X																			
907.2.3.6			X																			
907.2.3.6.1			X																			
907.2.3.6.2			X																			
907.2.3.7			X																			
907.2.3.8			X																			
907.2.3.9			X																			
907.2.3.9.1			X																			
907.2.3.9.2			X																			
907.2.3.10			X																			
907.2.5.1			X																			
907.2.6			X																			
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907.2.6.3			X																			
907.2.6.3.3			X																			
907.2.6.3.4			X																			
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907.2.10.3			X																			
907.2.10.4			X																			
907.2.10.6			X																			
907.2.11			X																			
907.2.11.2.1			X																			
907.2.11.2.2			X																			
907.2.11.2.3			X																			

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CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
907.2.11.2.4			X																			
907.2.11.2.5			X																			
907.2.11.3			X																			
907.2.11.4			X																			
907.2.11.8			X																			
907.2.12 – 907.2.12.3			X																			
907.2.23			X																			
907.2.24 – 907.2.25.2			X																			
[T-19 §3.12]				X																		
907.2.26 – 907.2.29.1			X																			
907.3.2			X																			
907.3.2.1			X																			
907.3.2.2			X																			
907.3.2.3			X																			
907.3.2.4			X																			
907.3.2.5			X																			
907.3.3			X																			
907.4.2.1			X																			
907.4.2.2			X						X													
907.4.2.7			X																			
907.5			X																			
907.5.1			X																			
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907.5.2.1.3			X																			
907.5.2.2			X																			
907.5.2.2.4			X																			
907.5.2.3			X																			
907.5.2.3.1			X																			
907.5.2.3.2			X																			
Table 907.5.2.3.2			X																			
907.5.2.3.3			X																			
907.5.2.3.4			X																			
907.5.2.4			X																			
907.5.2.5			X																			
907.6			X																			
907.6.1.1			X																			
907.6.4			X																			
907.6.4.1			X																			
907.6.4.1.1			X																			
907.6.4.2			X																			
907.6.4.3			X																			
907.6.4.4			X																			
907.6.6			X																			

(continued)

CHAPTER 9 – FIRE PROTECTION AND LIFE SAFETY SYSTEMS—continued

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
907.6.6.4			X																			
907.10			X																			
908.4			X																			
909.5.3			X																			
909.5.3.1			X																			
909.12.1			X																			
909.16			X																			
909.18.9			X																			
910.2.1			X																			
910.3.1			X																			
911.1			X																			
Table 911.1			X																			
911.4			X																			
912.4			X																			
912.6			X																			
912.7			X																			
913.5			X																			
913.6			X																			
914.3			X																			
914.3.1			X																			
914.3.1.1			X																			
914.3.1.2			X																			
914.3.1.2.1			X																			
914.3.2			X																			
914.3.8			X																			
914.3.8.1			X																			
914.3.8.2			X																			
914.7 – 914.7.3			X																			
915.1			X																			
915.2			X																			
915.2.1			X																			
915.2.3			X																			
915.4.1			X																			
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915.4.3			X																			
915.4.4			X																			
915.4.5			X																			
915.5.3			X																			
915.7			X																			
916			X																			

This state agency does not adopt sections identified with the following symbol: †

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 9

FIRE PROTECTION AND LIFE SAFETY SYSTEMS

User note:

About this chapter: Chapter 9 prescribes the minimum requirements for active fire protection equipment systems to perform the functions of detecting a fire, alerting the occupants or fire department of a fire emergency, mass notification, gas detection, controlling smoke and controlling or extinguishing the fire. Generally, the requirements are based on the occupancy, the height and the area of the building because these are the factors that most affect fire-fighting capabilities and the relative hazard of a specific building or portion thereof. This chapter parallels and is substantially duplicated in Chapter 9 of the California Building Code; however, this chapter also contains periodic testing criteria that are not contained in the California Building Code. In addition, the special fire protection system requirements based on use and occupancy found in Chapter 4 of the California Building Code are duplicated in this chapter as a user convenience.

SECTION 901 GENERAL

901.1 Scope. The provisions of this chapter shall specify where fire protection and life safety systems are required and shall apply to the design, installation, inspection, operation, testing and maintenance of all fire protection and life safety systems.

901.2 Construction documents. The fire code official shall have the authority to require construction documents and calculations for all fire protection and life safety systems and to require permits be issued for the installation, rehabilitation or modification of any fire protection and life safety systems. Construction documents for fire protection and life safety systems shall be submitted for review and approval prior to system installation.

901.2.1 Statement of compliance. Before requesting final approval of the installation, where required by the fire code official, the installing contractor shall furnish a written statement to the fire code official that the subject fire protection or life safety system has been installed in accordance with approved plans and has been tested in accordance with the manufacturer's specifications and the appropriate installation standard. Any deviations from the design standards shall be noted and copies of the approvals for such deviations shall be attached to the written statement.

901.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

901.4 Fire protection and life safety systems. Fire protection and life safety systems shall be installed, repaired, operated and maintained in accordance with this code and the *California Building Code*.

901.4.1 Required fire protection and life safety systems. Fire protection and life safety systems required by this code or the *California Building Code* shall be installed, repaired, operated, tested and maintained in accordance with this code. A fire protection or life safety system for which a design option, exception or reduction to the provisions of this code or the *California Building Code* has been granted shall be considered to be a required system.

901.4.2 Nonrequired fire protection and life safety systems. Fire protection and life safety systems or portion thereof not required by this code or the *California Building Code* shall be allowed to be furnished for partial or complete protection provided that such installed systems meet the applicable requirements of this code and the *California Building Code*.

901.4.3 Alterations in buildings and structures. For any alteration within a building or structure, the fire protection and life safety systems shall be extended, altered or augmented to maintain and continue protection within the building or structure. Persons shall not remove or modify any fire protection or life safety system installed or maintained under the provisions of this code or the *California Building Code* without approval from the fire code official.

901.4.4 Fire areas. Where buildings, or portions thereof, are divided into fire areas so as not to exceed the limits established for requiring a fire protection system in accordance with this chapter, such fire areas shall be separated by fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, having a fire-resistance rating of not less than that determined in accordance with Section 707.3.10 of the *California Building Code*.

901.4.5 Additional fire protection systems. In occupancies of a hazardous nature, where special hazards exist in addition to the normal hazards of the occupancy, or where the fire code official determines that access for fire apparatus is unduly difficult, the fire code official shall have the authority to require additional safeguards and fire protection systems. Fire protection and life safety systems required under this section shall be installed in accordance with this code and the applicable referenced standards.

901.4.6 Appearance of equipment. Any device that has the physical appearance of life safety or fire protection equipment but that does not perform that life safety or fire protection function shall be prohibited.

901.4.7 Pump and riser room size. Where provided, fire pump rooms and automatic sprinkler system riser rooms shall be designed with adequate space for all equipment necessary for the installation, as defined by the manufacturer, with sufficient working space around the stationary equipment. Clearances around equipment to elements of permanent construction, including other installed equipment and appliances, shall be sufficient to allow inspection, service, repair or replacement without removing such elements of permanent construction or disabling the function of a required fire-resistance-rated assembly. Fire pump and automatic sprinkler system riser rooms shall be provided with doors and unobstructed passageways large enough to allow removal of the largest piece of equipment.

901.4.7.1 Access. Automatic sprinkler system risers, fire pumps and controllers shall be provided with ready access. Where located in a fire pump room or automatic sprinkler system riser room, the door shall be permitted to be locked provided that the key is available at all times.

901.4.7.2 Marking on access doors. Access doors for automatic sprinkler system riser rooms and fire pump rooms shall be labeled with an approved sign. The lettering shall be in contrasting color to the background. Letters shall have a minimum height of 2 inches (51 mm) with a minimum stroke of $\frac{3}{8}$ inch (10 mm).

901.4.7.3 Environment. Automatic sprinkler system riser rooms and fire pump rooms shall be maintained at a temperature of not less than 40°F (4°C). Heating units shall be permanently installed.

901.4.7.4 Lighting. Permanently installed artificial illumination shall be provided in the automatic sprinkler system riser rooms and fire pump rooms.

901.5 Administration of installation acceptance testing.

Fire protection and life safety systems and appurtenances thereto shall be subject to acceptance tests as contained in the installation standards and as approved by the fire code official. The fire code official shall be notified before any required acceptance testing.

901.5.1 Occupancy. It shall be unlawful to occupy any portion of a building or structure until the required fire protection and life safety systems have been tested and approved.

901.6 Inspection, testing and maintenance. Fire protection and life safety systems shall be maintained in an operative condition at all times, and shall be replaced or repaired where defective. Nonrequired fire protection and life safety systems and equipment shall be inspected, tested and maintained or removed in accordance with Section 901.8.

All fire alarm systems, fire detection systems, automatic sprinkler or extinguishing systems, communication systems, and all other equipment, material or systems required by these regulations shall be maintained in an operable condition at all times in accordance with this code and California Code of Regulations, Title 19, Division 1. Upon disruption or

diminishment of the fire protective qualities of such equipment, material or systems, immediate action shall be instituted to affect a reestablishment of such equipment, material or systems to their original normal and operational condition.

[California Code of Regulations, Title 19, Division 1, §1.14] Maintenance.

Every fire alarm system or device, sprinkler system, fire extinguisher, fire hose, fire-resistive assembly or any other fire safety assembly, device, material or equipment installed and retained in service in any building or structure subject to California Code of Regulations, Title 19, Division 1 regulations shall be maintained in an operable condition at all times in accordance with California Code of Regulations, Title 19, Division 1 regulations and with their intended use.

[California Code of Regulations, Title 19, Division 1, §3.24] Maintenance of Equipment.

All fire alarm systems, fire detection systems, automatic sprinkler or extinguishing systems, communication systems, and all other equipment, material or systems required by California Code of Regulations, Title 19, Division 1 shall be maintained in an operable condition at all times. Upon disruption or diminishment of the fire protective qualities of such equipment, material or systems, immediate action shall be instituted to affect a reestablishment of such equipment material or systems to their original normal and operational condition.

[California Code of Regulations, Title 19, Division 1, §904(a)] Required Inspection, Testing and Maintenance Frequencies.

(a) All automatic fire extinguishing systems, including systems installed as an alternate to other building requirements, shall be inspected, tested and maintained in accordance with the following frequencies. Local authorities may require more frequent inspection, testing and maintenance and additional procedures.

[California Code of Regulations, Title 19, Division 1, §904(a)(1)] Required Inspection, Testing and Maintenance Frequencies.

(1) Water-based fire protection systems shall be inspected, tested and maintained in accordance with the frequencies required by NFPA 25 (2011 edition) including Annexes A, B, C, D, E, F and G as amended by the State of California. (Published as NFPA 25, 2013 California Edition.)

[California Code of Regulations, Title 19, Division 1, §904(b)] Required Inspection, Testing and Maintenance Frequencies.

(b) When proof of the installation date of standpipe systems or automatic fire sprinkler systems cannot be furnished, such systems shall receive initial testing and maintenance by July 1, 1985.

[California Code of Regulations, Title 19, Division 1, §904.2(a)] Testing and Maintenance Requirements.

(a) All testing and maintenance on automatic fire extinguishing systems in accordance with Health & Safety Code Section 13195 shall be performed by those licensed

in accordance with Health and Safety Code Section 13196.5.

Exceptions:

(1) The State Fire Marshal may waive, in writing, licensing of fire departments which conduct fire sprinkler and standpipe system testing and maintenance.

(2) Service on fire alarm systems and industrial systems as specified in Health and Safety Code Sections 13196.5(b) and (c) may be conducted without a license.

(3) Testing and maintenance on automatic fire extinguishing systems exempted in writing by the State Fire Marshal, when the building owner or occupant has the staff and equipment to conduct testing and maintenance.

[California Code of Regulations, Title 19, Division 1, §904.2(b)] Testing and Maintenance Requirements.

(b) Any testing and maintenance of automatic fire extinguishing systems shall be performed in accordance with these requirements.

Exceptions:

(1) The State Fire Marshal may waive, in writing, the requirement that testing and maintenance be performed in accordance with these requirements when a licensee can demonstrate that a system cannot functionally be tested and maintained in accordance with the California Code of Regulations, Title 19, Division 1, Chapter 5.

(2) If at any time a licensee encounters a specialized or modified system which cannot be tested and maintained in accordance with California Code of Regulations, Title 19, Division 1, Chapter 5, the licensee shall contact the State Fire Marshal and test and maintain the system as directed.

(A) The intent of this section is to cover automatic fire extinguishing systems as originally designed, installed and approved by the Authority Having Jurisdiction. It is not, however, intended to require that such systems be upgraded to current adopted standards.

[California Code of Regulations, Title 19, Division 1, §904.2(h)] Testing and Maintenance Requirements.

(h) At the time of testing and maintenance, building management shall be consulted to avoid unnecessary disturbance of normal building operation.

[California Code of Regulations, Title 19, Division 1, §904.2(i)] Testing and Maintenance Requirements.

(i) The licensee shall contact the local fire authority having jurisdiction prior to testing and maintenance of a system when required by the local fire authority having jurisdiction to do so.

901.6.1 Standards. Fire protection systems shall be inspected, tested and maintained in accordance with the referenced standards listed in Table 901.6.1 and Califor-

nia Code of Regulations, Title 19, Division 1, Chapters 3 and 5.

[California Code of Regulations, Title 19, Division 1, §904.1(a)] Inspection Requirements.

(a) A license shall not be required to perform inspections. Inspections may be conducted by any person designated by the building owner or occupant who has developed competence through training and experience.

[California Code of Regulations, Title 19, Division 1, §904.2(g)] Testing and Maintenance Requirements.

(g) Prior to activating any fire alarm component of an automatic fire extinguishing system, the licensee shall ensure that the licensee is capable of restoring the fire alarm system.

**TABLE 901.6.1
FIRE PROTECTION SYSTEM INSPECTION,
TESTING AND MAINTENANCE STANDARDS**

SYSTEM	STANDARD
Portable fire extinguishers	California Code of Regulations, Title 19, Division 1, Chapter 3
Carbon dioxide fire-extinguishing systems	NFPA 12
Halon 1301 fire-extinguishing systems	NFPA 12A
Dry-chemical extinguishing systems	NFPA 17
Wet-chemical extinguishing systems	NFPA 17A
Water-based fire protection systems	California Code of Regulations, Title 19, Division 1, Chapter 5
Fire alarm systems	NFPA 72
Smoke and heat vents	NFPA 204
Water-mist systems	NFPA 750
Clean-agent extinguishing systems	NFPA 2001
Aerosol fire-extinguishing systems	NFPA 2010

901.6.2 Integrated testing. Where two or more fire protection or life safety systems are interconnected, the intended response of subordinate fire protection and life safety systems shall be verified when required testing of the initiating system is conducted. In addition, integrated testing shall be performed in accordance with Sections 901.6.2.1 and 901.6.2.2.

901.6.2.1 High-rise buildings. For high-rise buildings, integrated testing shall comply with NFPA 4, with an integrated test performed prior to issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

901.6.2.2 Smoke control systems. Where a fire alarm system is integrated with a smoke control system as outlined in Section 909, integrated testing shall comply with NFPA 4, with an integrated test performed prior to

issuance of the certificate of occupancy and at intervals not exceeding 10 years, unless otherwise specified by an integrated system test plan prepared in accordance with NFPA 4. If an equipment failure is detected during integrated testing, a repeat of the integrated test shall not be required, except as necessary to verify operation of fire protection or life safety functions that are initiated by equipment that was repaired or replaced.

901.6.3 Records. Records of all system inspections, tests and maintenance required by the referenced standards shall be maintained.

[California Code of Regulations, Title 19, Division 1, §904.1(b)] Inspection Requirements.

(b) Records of all inspections shall be retained on the premises by the building or system owner for a period of five years after the next required inspection.

[California Code of Regulations, Title 19, Division 1, §904.2(c)] Testing and Maintenance Requirements.

(c) Records of all testing and maintenance shall be retained on the premises by the building or system owner for a period of five years after the next required test or maintenance.

[California Code of Regulations, Title 19, Division 1, §904.2(j)] Testing and Maintenance Requirements.

(j) It is the responsibility of the contractor, company or licensee to provide a written report of the test and maintenance results to the building owner and the local fire authority having jurisdiction at the completion of the testing and maintenance.

901.6.3.1 Records information. Initial records shall include the name of the installation contractor, type of components installed, manufacturer of the components, location and number of components installed per floor. Records shall include the manufacturers' operation and maintenance instruction manuals. Such records shall be maintained for the life of the installation.

901.7 Systems out of service. Where a required fire protection system is out of service, the fire department and the fire code official shall be notified immediately and, where required by the fire code official, the building shall be either evacuated or an approved fire watch shall be provided for all occupants left unprotected by the shutdown until the fire protection system has been returned to service.

Where utilized, fire watches shall be provided with not less than one approved means for notification of the fire department and their only duty shall be to perform constant patrols of the protected premises and keep watch for fires.

Exception: Facilities with an approved notification and impairment management program. The notification and impairment program for water-based fire protection systems shall comply with California NFPA 25.

[California Code of Regulations, Title 19, Division 1, §904.1(c)] Inspection Requirements.

(c) The owner or occupant shall promptly correct or repair deficiencies, damaged parts or impairments found while

performing the inspection, test and maintenance requirements of this standard. Recalled products shall be replaced or remedied. Such replacement or remedial product shall be installed in accordance with the listing requirements, the manufacturer's instructions and the appropriate NFPA installation standards. A recalled product is a product subject to a statute or administrative regulation specifically requiring the manufacturer, importer, distributor, wholesaler or retailer of a product, or any combination of such entities, to recall the product, or a product voluntarily recalled by a combination of such entities.

[California Code of Regulations, Title 19, Division 1, §904.2(d)] Testing and Maintenance Requirements.

(d) The building or system owner shall ensure immediate correction of any deficiencies noted during the service. A tag or label shall be affixed to a system only after all deficiencies have been corrected. The owner or occupant shall promptly correct or repair deficiencies, damaged parts or impairments found while performing the inspection, test and maintenance requirements of this standard. Recalled products shall be replaced or remedied. Such replacement or remedial product shall be installed in accordance with the listing requirements, the manufacturer's instructions and the appropriate NFPA installation standards. A recalled product is a product subject to a statute or administrative regulation specifically requiring the manufacturer, importer, distributor, wholesaler or retailer of a product, or any combination of such entities, to recall the product, or a product voluntarily recalled by a combination of such entities.

[California Code of Regulations, Title 19, Division 1, §904.2(e)] Testing and Maintenance Requirements.

(e) At the time of testing and maintenance, or at any time parts are replaced, an itemized invoice showing work performed and parts replaced shall be provided by the licensee to the system owner. If testing and maintenance is performed more than thirty (30) days prior to the next required testing and maintenance date, the invoice shall bear a statement indicating the system was tested and maintained early.

[California Code of Regulations, Title 19, Division 1, §904.2(f)] Testing and Maintenance Requirements.

(f) The licensee shall offer to return all replaced parts to the system owner or owner's representative, except those parts that are required to be returned to the manufacturer under conditions of warranty.

901.7.1 Impairment coordinator. The building owner shall assign an impairment coordinator to comply with the requirements of this section. In the absence of a specific designee, the owner shall be considered to be the impairment coordinator.

901.7.2 Tag required. A tag shall be used to indicate that a system, or portion thereof, has been removed from service.

901.7.3 Placement of tag. The tag shall be posted at each fire department connection, system control valve, fire alarm control unit, fire alarm annunciator and fire

command center, indicating which system, or part thereof, has been removed from service. The fire code official shall specify where the tag is to be placed.

901.7.4 Preplanned impairment programs. Preplanned impairments shall be authorized by the impairment coordinator. Before authorization is given, a designated individual shall be responsible for verifying that all of the following procedures have been implemented:

1. The extent and expected duration of the impairment have been determined.
2. The areas or buildings involved have been inspected and the increased risks determined.
3. Recommendations have been submitted to management or the building owner/manager.
4. The fire department has been notified.
5. The insurance carrier, the alarm company, the building owner/manager and other authorities having jurisdiction have been notified.
6. The supervisors in the areas to be affected have been notified.
7. A tag impairment system has been implemented.
8. Necessary tools and materials have been assembled on the impairment site.

901.7.5 Emergency impairments. Where unplanned impairments occur, appropriate emergency action shall be taken to minimize potential injury and damage. The impairment coordinator shall implement the steps outlined in Section 901.7.4.

901.7.6 Restoring systems to service. Where impaired equipment is restored to normal working order, the impairment coordinator shall verify that all of the following procedures have been implemented:

1. Necessary inspections and tests have been conducted to verify that affected systems are operational.
2. Supervisors have been advised that protection is restored.
3. The fire department has been advised that protection is restored.
4. The building owner/manager, insurance carrier, alarm company and other involved parties have been advised that protection is restored.
5. The impairment tag has been removed.

901.8 Removal of or tampering with equipment. It shall be unlawful for any person to remove, tamper with or otherwise disturb any fire protection or life safety system required by this code except for the purposes of extinguishing fire, training, recharging or making necessary repairs or where approved by the fire code official.

901.8.1 Removal of or tampering with appurtenances. Locks, gates, doors, barricades, chains, enclosures, signs, tags or seals that have been installed by or at the direction of the fire code official shall not be removed, unlocked,

destroyed, tampered with or otherwise vandalized in any manner.

901.8.2 Removal of existing occupant-use hose lines. The fire code official is authorized to permit the removal of existing occupant-use hose lines where both of the following conditions exist:

1. The hose line would not be utilized by trained personnel or the fire department.
2. The remaining outlets are compatible with local fire department fittings.

901.9 Termination of monitoring service. For fire alarm systems required to be monitored by this code, notice shall be made to the fire code official whenever alarm monitoring services are terminated. Notice shall be made in writing by the provider of the monitoring service being terminated.

901.10 Recall of fire protection components. Any fire protection system component regulated by this code that is the subject of a voluntary or mandatory recall under federal law shall be replaced with approved, listed components in compliance with the referenced standards of this code. The fire code official shall be notified in writing by the building owner when the recalled component parts have been replaced.

SECTION 902 DEFINITIONS

902.1 Definitions. The following terms are defined in Chapter 2:

ALARM NOTIFICATION APPLIANCE.

ALARM SIGNAL.

ALARM VERIFICATION FEATURE.

ANNUNCIATOR.

AUDIBLE ALARM NOTIFICATION APPLIANCE.

AUTOMATIC.

AUTOMATIC FIRE-EXTINGUISHING SYSTEM.

AUTOMATIC SMOKE DETECTION SYSTEM.

AUTOMATIC SPRINKLER SYSTEM.

AUTOMATIC WATER MIST SYSTEM.

AVERAGE AMBIENT SOUND LEVEL.

CARBON DIOXIDE EXTINGUISHING SYSTEM.

CLEAN AGENT.

COMMERCIAL MOTOR VEHICLE.

CONSTANTLY ATTENDED LOCATION.

DELUGE SYSTEM.

DETECTOR, HEAT.

DRY-CHEMICAL EXTINGUISHING AGENT.

ELEVATOR GROUP.

EMERGENCY ALARM SYSTEM.

EMERGENCY VOICE/ALARM COMMUNICATIONS.

[California Code of Regulations, Title 19, Division 1, §902.4(b)] “E” Definitions

(b) *Engineered Fixed Extinguishing System.* A system which is custom designed for a particular hazard, using components which are approved or listed only for their broad performance characteristics. Components may be arranged into a variety of configurations. These systems shall include but not be limited to:

- (1) Dry chemical systems
- (2) Carbon dioxide systems
- (3) Halogenated agent systems
- (4) Steam systems
- (5) High expansion foam systems
- (6) Foam extinguishing systems
- (7) Liquid agent systems
- (8) Clean agent systems

FIRE ALARM BOX, MANUAL.

FIRE ALARM CONTROL UNIT.

FIRE ALARM SIGNAL.

FIRE ALARM SYSTEM.

FIRE APPLIANCE [SFM] is apparatus or equipment provided or installed for use in the event of an emergency.

FIRE AREA.

FIRE DETECTOR, AUTOMATIC.

FIRE PROTECTION SYSTEM.

FIRE SAFETY FUNCTIONS.

FIXED BASE OPERATOR (FBO).

FOAM-EXTINGUISHING SYSTEM.

GAS DETECTION SYSTEM.

HALOGENATED EXTINGUISHING SYSTEM.

IMPAIRMENT COORDINATOR.

INITIATING DEVICE.

[California Code of Regulations, Title 19, Division 1, §902.9(a)] “I” Definitions.

(a) *Inspection.* A visual examination of a system or portion thereof to verify that it appears to be in operating condition and is free of physical damage.

LIFE SAFETY SYSTEMS.

MANUAL FIRE ALARM BOX.

MULTIPLE-STATION ALARM DEVICE.

MULTIPLE-STATION SMOKE ALARM.

[California Code of Regulations, Title 19, Division 1, §902.12(a)] “M” Definitions.

(a) *Maintenance.* Work performed to keep equipment operable or to make repairs.

NOTIFICATION ZONE.

NUISANCE ALARM.

[California Code of Regulations, Title 19, Division 1, §902.15(a)] “P” Definitions.

(a) *Pre-engineered Fixed Extinguishing System.* A system where the number of components and their configurations are included in the description of the systems approval and listing. These systems shall include but not be limited to:

- (1) Dry chemical systems
- (2) Carbon dioxide systems
- (3) Halogenated agent systems
- (4) Liquid agent systems
- (5) Clean agent systems

PRIVATE GARAGE.

RECORD DRAWINGS.

SINGLE-STATION SMOKE ALARM.

SLEEPING UNIT.

SMOKE ALARM.

SMOKE DETECTOR.

STANDPIPE, TYPES OF.

Automatic dry.

Automatic wet.

Manual dry.

Manual wet.

Semiautomatic dry.

STANDPIPE SYSTEM, CLASSES OF.

Class I system.

Class II system.

Class III system.

SUPERVISING STATION.

SUPERVISORY SERVICE.

SUPERVISORY SIGNAL.

SUPERVISORY SIGNAL-INITIATING DEVICE.

[California Code of Regulations, Title 19, Division 1, §902.18(a)] “S” Definitions.

(a) *Service.* The performance of testing and maintenance on an automatic fire extinguishing system.

TIRES, BULK STORAGE OF.

TRANSIENT AIRCRAFT.

TROUBLE SIGNAL.

VISIBLE ALARM NOTIFICATION APPLIANCE.

WET-CHEMICAL EXTINGUISHING AGENT.

WIRELESS PROTECTION SYSTEM.

ZONE.

ZONE, NOTIFICATION.

**SECTION 903
AUTOMATIC SPRINKLER SYSTEMS**

903.1 General. Automatic sprinkler systems shall comply with this section.

903.1.1 Alternative protection. Alternative automatic fire-extinguishing systems complying with Section 904 shall be permitted instead of automatic sprinkler system protection where recognized by the applicable standard and approved by the fire code official.

903.2 Where required. Approved automatic sprinkler systems in new buildings and structures shall be provided in the locations described in Sections 903.2.1 through 903.2.12 and Sections 903.2.14 through 903.2.21.

903.2.1 Group A. An automatic sprinkler system shall be provided throughout buildings and portions thereof used as Group A occupancies as provided in this section.

903.2.1.1 Group A-1. An automatic sprinkler system shall be provided throughout stories containing Group A-1 occupancies and throughout all stories from the Group A-1 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. The fire area contains a multiple-theater complex.

903.2.1.2 Group A-2. An automatic sprinkler system shall be provided throughout stories containing Group A-2 occupancies and throughout all stories from the Group A-2 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 5,000 square feet (464 m²).
2. The fire area has an occupant load of 100 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. *The structure exceeds 5,000 square feet (465 m²), contains more than one fire area containing a Group A-2 occupancy, and is separated into two or more buildings by fire walls of less than 4-hour fire-resistance rating without openings.*

903.2.1.3 Group A-3. An automatic sprinkler system shall be provided throughout stories containing Group A-3 occupancies and throughout all stories from the Group A-3 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).

2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.
4. *The structure exceeds 12,000 square feet (1155 m²), contains more than one fire area containing exhibition and display rooms, and is separated into two or more buildings by fire walls of less than 4-hour fire-resistance rating without openings.*

903.2.1.4 Group A-4. An automatic sprinkler system shall be provided throughout stories containing Group A-4 occupancies and throughout all stories from the Group A-4 occupancy to and including the levels of exit discharge serving that occupancy where one of the following conditions exists:

1. The fire area exceeds 12,000 square feet (1115 m²).
2. The fire area has an occupant load of 300 or more.
3. The fire area is located on a floor other than a level of exit discharge serving such occupancies.

903.2.1.5 Group A-5. An automatic sprinkler system shall be provided for all enclosed Group A-5 accessory use areas in excess of 1,000 square feet (93 m²).

903.2.1.5.1 Spaces under grandstands or bleachers. Enclosed spaces under grandstands or bleachers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where either of the following exist:

1. The enclosed area is 1,000 square feet (93 m²) or less and is not constructed in accordance with Section 1030.1.1.1.
2. The enclosed area exceeds 1,000 square feet (93 m²).

903.2.1.6 Assembly occupancies on roofs. Where an occupied roof has an assembly occupancy with an occupant load exceeding 100 for Group A-2 and 300 for other Group A occupancies, all floors between the occupied roof and the level of exit discharge shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

Exception: Open parking garages of Type I or Type II construction.

903.2.1.7 Multiple fire areas. An automatic sprinkler system shall be provided where multiple fire areas of Group A-1, A-2, A-3 or A-4 occupancies share exit or exit access components and the combined occupant load of these fire areas is 300 or more.

903.2.2 Ambulatory care facilities. An automatic sprinkler system shall be installed throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:

1. Four or more care recipients are incapable of self-preservation.

2. One or more care recipients that are incapable of self-preservation are located at other than the level of exit discharge serving such a facility.

In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor as well as all floors below where such care is provided, and all floors between the level of ambulatory care and the nearest level of exit discharge, the level of exit discharge, and all floors below the level of exit discharge.

Exception: Floors classified as an open parking garage are not required to be sprinklered.

903.2.3 Group E. An automatic sprinkler system shall be provided for Group E occupancies as follows:

1. Throughout all Group E fire areas greater than 12,000 square feet (1115 m²) in area.
2. The Group E fire area is located on a floor other than a level of exit discharge serving such occupancies.

Exception: In buildings where every classroom has not fewer than one exterior exit door at ground level, an automatic sprinkler system is not required in any area below the lowest level of exit discharge serving that area.

3. The Group E fire area has an occupant load of 300 or more.
4. *In rooms or areas with special hazards such as laboratories, vocational shops and other such areas where hazardous materials in quantities not exceeding the maximum allowable quantity are used or stored.*
5. *Throughout any Group E structure greater than 12,000 square feet (1115 m²) in area, which contains more than one fire area, and which is separated into two or more buildings by fire walls of less than 4-hour fire-resistance rating without openings.*
6. *For public school state-funded construction projects see Section 903.2.19.*
7. *For public school campuses, Kindergarten through 12th grade, see Section 903.2.20.*

903.2.4 Group F-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group F-1 occupancy where one of the following conditions exists:

1. A Group F-1 fire area exceeds 12,000 square feet (1115 m²).
2. A Group F-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group F-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).

903.2.4.1 Woodworking operations. An automatic sprinkler system shall be provided throughout all Group F-1 occupancy fire areas that contain woodworking operations in excess of 2,500 square feet (232

m²) in area that generate finely divided combustible waste or use finely divided combustible materials. *[SFM] A fire wall of less than 4-hour fire-resistance rating without openings, or any fire wall with openings, shall not be used to establish separate fire areas.*

903.2.4.2 Group F-1 distilled spirits. An automatic sprinkler system shall be provided throughout a Group F-1 fire area used for the manufacture of distilled spirits.

903.2.4.3 Group F-1 upholstered furniture or mattresses. An automatic sprinkler system shall be provided throughout a Group F-1 fire area that exceeds 2,500 square feet (232 m²) used for the manufacture of upholstered furniture or mattresses.

903.2.5 Group H. Automatic sprinkler systems shall be provided in high-hazard occupancies as required in Sections 903.2.5.1 through 903.2.5.3.

903.2.5.1 General. An automatic sprinkler system shall be installed in Group H occupancies.

903.2.5.2 Group H-5 occupancies. An automatic sprinkler system shall be installed throughout buildings containing Group H-5 occupancies. The design of the sprinkler system shall be not less than that required under the *California Building Code* for the occupancy hazard classifications in accordance with Table 903.2.5.2.

Where the design area of the sprinkler system consists of a corridor protected by one row of sprinklers, the maximum number of sprinklers required to be calculated is 13.

**TABLE 903.2.5.2
GROUP H-5 SPRINKLER DESIGN CRITERIA**

LOCATION	OCCUPANCY HAZARD CLASSIFICATION
Fabrication areas	Ordinary Hazard Group 2
Service corridors	Ordinary Hazard Group 2
Storage rooms without dispensing	Ordinary Hazard Group 2
Storage rooms with dispensing	Extra Hazard Group 2
Corridors	Ordinary Hazard Group 2

903.2.5.3 Pyroxylin plastics. An automatic sprinkler system shall be provided in buildings, or portions thereof, where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg).

903.2.5.4 Group H occupancies located on the 11th story and above. *The fire sprinkler system shall be designed and zoned to provide separate indication upon water-flow for each side of the 2-hour fire-smoke barrier on the 11th story and above.*

903.2.6 Group I. An automatic sprinkler system shall be provided throughout buildings with a Group I fire area.

Exceptions:

1. *Those areas exempted by Section 407.6 of the California Building Code.*

2. Pursuant to Health and Safety Code Section 13113 (d), Group I-2 occupancies, or any alterations thereto, located in Type IA construction in existence on March 4, 1972.

903.2.6.1 Group I-2. An existing, unsprinklered Group I-2, nurses' station open to fire-resistive exit access corridors shall be protected by an automatic sprinkler system located directly above the nurses' station. It shall be permitted to connect the automatic sprinkler system to the domestic water service.

903.2.6.2 Group I-3. Every building, or portion thereof, where inmates or persons are in custody or restrained shall be protected by an automatic sprinkler system conforming to NFPA 13. The main sprinkler control valve or valves and all other control valves in the system shall be locked in the open position and electrically supervised so that at least an audible and visual alarm will sound at a constantly attended location when valves are closed. The sprinkler branch piping serving cells may be embedded in the concrete construction.

903.2.7 Group M. An automatic sprinkler system shall be provided throughout buildings containing a Group M occupancy where one of the following conditions exists:

1. A Group M fire area exceeds 12,000 square feet (1115 m²).
2. A Group M fire area is located more than three stories above grade plane.
3. The combined area of all Group M fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
5. [SFM] The structure exceeds 24,000 square feet (465 m²), contains more than one fire area containing a Group M occupancy, and is separated into two or more buildings by fire walls of less than 4-hour fire-resistance rating without openings.

903.2.7.1 High-piled storage. An automatic sprinkler system shall be provided as required in Chapter 32 in all buildings of Group M where storage of merchandise is in high-piled or rack storage arrays.

903.2.7.2 Group M upholstered furniture or mattresses. An automatic sprinkler system shall be provided throughout a Group M fire area where the area used for the display and sale of upholstered furniture or mattresses exceeds 5,000 square feet (464 m²).

903.2.8 Group R. An automatic sprinkler system installed in accordance with Section 903.3 shall be provided throughout all buildings with a Group R fire area.

Exceptions:

1. Existing Group R-3 occupancies converted to Group R-3.1 occupancies not housing bedridden clients, not housing nonambulatory clients above the first floor, and not housing clients above the second floor.

2. Existing Group R-3 occupancies converted to Group R-3.1 occupancies housing only one bedridden client and complying with Section 435.8.3.3 of the California Building Code.

3. Pursuant to Health and Safety Code, Section 13113, occupancies housing ambulatory children only, none of whom are mentally ill children or children with intellectual disabilities, and the buildings or portions thereof in which such children are housed are not more than two stories in height, and buildings or portions thereof housing such children have an automatic fire alarm system activated by approved smoke detectors.

4. Pursuant to Health and Safety Code, Section 13143.6, occupancies licensed for protective social care which house ambulatory clients only, none of whom is a child (under the age of 18 years), or who is elderly (65 years of age or over).

When not used in accordance with area or height increases for automatic fire sprinklers allowed in the California Building Code, an automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be allowed in Group R-2.1 occupancies.

An automatic sprinkler system designed in accordance with Section 903.3.1.3 shall not be utilized in Group R-2.1 or R-4 occupancies.

903.2.8.1 Group R-3. An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3 occupancies.

903.2.8.2 Reserved.

903.2.8.3 Group R-4, Condition 2. An automatic sprinkler system installed in accordance with Section 903.3.1.2 shall be permitted in Group R-4, Condition 2 occupancies.

903.2.8.4 Group R-3.1. An automatic sprinkler system installed in accordance with Section 903.3.1.3 shall be permitted in Group R-3.1 occupancies with six or fewer individuals in a single-family dwelling.

903.2.9 Group S-1. An automatic sprinkler system shall be provided throughout all buildings containing a Group S-1 occupancy where one of the following conditions exists:

1. A Group S-1 fire area exceeds 12,000 square feet (1115 m²).
2. A Group S-1 fire area is located more than three stories above grade plane.
3. The combined area of all Group S-1 fire areas on all floors, including any mezzanines, exceeds 24,000 square feet (2230 m²).
4. A Group S-1 fire area used for the storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

903.2.9.1 Repair garages. An automatic sprinkler system shall be provided throughout all buildings used as repair garages in accordance with Section 406.8 of the *California Building Code*, as shown:

1. Buildings having two or more stories above grade plane, including basements, with a fire area containing a repair garage exceeding 10,000 square feet (929 m²).
2. Buildings not more than one story above grade plane, with a fire area containing a repair garage exceeding 12,000 square feet (1115 m²).
3. Buildings with repair garages servicing vehicles parked in basements.
4. A Group S-1 fire area used for the repair of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

903.2.9.2 Bulk storage of tires. Buildings and structures where the area for the storage of tires exceeds 20,000 cubic feet (566 m³) shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

903.2.9.3 Group S-1 distilled spirits or wine. An automatic sprinkler system shall be provided throughout a Group S-1 fire area used for the bulk storage of distilled spirits or wine.

903.2.9.4 Group S-1 upholstered furniture and mattresses. An automatic sprinkler system shall be provided throughout a Group S-1 fire area where the area used for the storage of upholstered furniture or mattresses exceeds 2,500 square feet (232 m²).

Exception: Self-service storage facilities not greater than one story above grade plane where all storage spaces can be accessed directly from the exterior.

903.2.10 Group S-2 parking garages. An automatic sprinkler system shall be provided throughout buildings classified as parking garages where any of the following conditions exist:

1. Where the fire area of the enclosed parking garage, in accordance with Section 406.6 of the *California Building Code*, exceeds 12,000 square feet (1115 m²).
2. Where the enclosed parking garage, in accordance with Section 406.6 of the *California Building Code*, is located beneath other groups.

Exception: Enclosed parking garages located beneath Group R-3 occupancies.

3. Where the fire area of the open parking garage, in accordance with Section 406.5 of the *California Building Code*, exceeds 48,000 square feet (4460 m²).

903.2.10.1 Commercial parking garages. An automatic sprinkler system shall be provided throughout buildings used for storage of commercial motor vehicles where the fire area exceeds 5,000 square feet (464 m²).

903.2.10.2 Mechanical-access enclosed parking garages. An approved automatic sprinkler system shall

be provided throughout buildings used for the storage of motor vehicles in a mechanical-access enclosed parking garage. The portion of the building that contains the mechanical-access enclosed parking garage shall be protected with a specially engineered automatic sprinkler system.

903.2.11 Specific buildings areas and hazards. In all occupancies other than Group U, an automatic sprinkler system shall be installed for building design or hazards in the locations set forth in Sections 903.2.11.1 through 903.2.11.6.

903.2.11.1 Stories without openings. An automatic sprinkler system shall be installed throughout all stories, including basements, of all buildings where the floor area exceeds 1,500 square feet (139 m²) and where the story does not comply with the following criteria for exterior wall openings:

1. Openings below grade that lead directly to ground level by an exterior stairway complying with Section 1011 or an outside ramp complying with Section 1012. Openings shall be located in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm).
2. Openings entirely above the adjoining ground level totaling not less than 20 square feet (1.86 m²) in each 50 linear feet (15 240 mm), or fraction thereof, of exterior wall in the story on not fewer than one side. The required openings shall be distributed such that the lineal distance between adjacent openings does not exceed 50 feet (15 240 mm). The height of the bottom of the clear opening shall not exceed 44 inches (1118 mm) measured from the floor.

903.2.11.1.1 Opening dimensions and access. Openings shall have a minimum dimension of not less than 30 inches (762 mm). Access to such openings shall be provided for the fire department from the exterior and shall not be obstructed in a manner such that fire fighting or rescue cannot be accomplished from the exterior.

903.2.11.1.2 Openings on one side only. Where openings in a story are provided on only one side and the opposite wall of such story is more than 75 feet (22 860 mm) from such openings, the story shall be equipped throughout with an approved automatic sprinkler system, or openings shall be provided on not fewer than two sides of the story.

903.2.11.1.3 Basements. Where any portion of a basement is located more than 75 feet (22 860 mm) from openings required by Section 903.2.11.1, or where walls, partitions or other obstructions are installed that restrict the application of water from hose streams, the basement shall be equipped throughout with an approved automatic sprinkler system.

903.2.11.2 Rubbish and linen chutes. An automatic sprinkler system shall be installed at the top of rubbish and linen chutes and in their terminal rooms. Chutes shall have additional sprinkler heads installed at alternate floors and at the lowest intake. Where a rubbish chute extends through a building more than one floor below the lowest intake, the extension shall have sprinklers installed that are recessed from the drop area of the chute and protected from freezing in accordance with Section 903.3.1.1. Such sprinklers shall be installed at alternate floors, beginning with the second level below the last intake and ending with the floor above the discharge. Access to sprinklers in chutes shall be provided for servicing.

903.2.11.3 Buildings 55 feet or more in height. An automatic sprinkler system shall be installed throughout buildings that have one or more stories with an occupant load of 30 or more located 55 feet (16 764 mm) or more above the lowest level of fire department vehicle access, measured to the finished floor.

Exception: Occupancies in Group F-2.

903.2.11.4 Ducts conveying hazardous exhausts. Where required by the *California Mechanical Code*, automatic sprinklers shall be provided in ducts conveying hazardous exhaust or flammable or combustible materials.

Exception: Ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

903.2.11.5 Commercial cooking operations. An automatic sprinkler system shall be installed in commercial kitchen exhaust hood and duct systems where an automatic sprinkler system is used to comply with Section 904.

903.2.11.6 Other required fire protection systems. In addition to the requirements of Section 903.2, the provisions indicated in Table 903.2.11.6 require the installation of a fire protection system for certain buildings and areas.

903.2.12 During construction. Automatic sprinkler systems required during construction, alteration and demolition operations shall be provided in accordance with Section 3314.

903.2.13 Reserved.

903.2.14 Motion picture and television production studio sound stages, approved production facilities and production locations.

903.2.14.1 Existing Sound Stages and Approved Production Facilities. All existing sound stages and approved production facilities equipped with an automatic fire sprinkler system shall be maintained in accordance with the provisions in this chapter.

903.2.14.2 New sound stages. All new sound stages shall be equipped with an approved automatic fire sprinkler system. The system shall be installed in accordance with the provisions of the *California Fire Code*, Chapter 9, and shall meet the minimum design requirements of an Extra Hazard, Group 2 system.

**TABLE 903.2.11.6
ADDITIONAL REQUIRED FIRE PROTECTION SYSTEMS**

SECTION	SUBJECT
322.2	<i>Lithium-ion and lithium metal battery storage</i>
903.2.10.2	Mechanical-access enclosed parking garages
914.2.1	Covered and open mall buildings
914.3.1	High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access
914.4.1	Atriums
914.5.1	Underground structures
914.6.1	Stages
914.7.1	Special amusement areas
914.8.2	Airport traffic control towers
914.8.3, 914.8.6	Aircraft hangars
914.9	Flammable finishes
914.10	Drying rooms
914.11.1	Ambulatory care facilities
1030.6.2.3	Smoke-protected assembly seating
1103.5.1	Existing Group A occupancies
1103.5.2	Pyroxylin plastic storage in existing buildings
1103.5.3	Existing Group I-2 occupancies
1103.5.5	Existing Group I-2, Condition 2 occupancies
1103.5.5	Pyroxylin plastics
Table 1207.7, Table 1207.8, Table 1206.9, Table 1206.10	Stationary and mobile energy storage systems
2108.2	Dry cleaning plants
2108.3	Dry cleaning machines
2309.3.1.5.2	Hydrogen motor fuel-dispensing area canopies
2404.2	Spray finishing in Group A, E, I or R
2404.4	Spray booths and spray rooms
2405.2	Dip-tank rooms in Group A, I or R
2405.4.1	Dip tanks
2405.9.4	Hardening and tempering tanks
2703.10	HPM facilities
2703.10.1.1	HPM work station exhaust
2703.10.2	HPM gas cabinets and exhausted enclosures
2703.10.3	HPM exit access corridor
2703.10.4	HPM exhaust ducts
2703.10.4.1	HPM noncombustible ducts
2703.10.4.2	HPM combustible ducts
2807.3	Lumber production conveyor enclosures
2808.7	Recycling facility conveyor enclosures
3006.1	Class A and B ovens
3006.2	Class C and D ovens
Table 3206.2	Storage fire protection
3206.4	Storage

(continued)

TABLE 903.2.11.6—continued
ADDITIONAL REQUIRED FIRE PROTECTION SYSTEMS

SECTION	SUBJECT
3210.1.1	Record storage over 12 feet
3704.5	Storage of more than 1,000 cubic feet of loose combustible fibers
5003.8.4.1	Gas rooms
5003.8.5.3	Exhausted enclosures
5004.5	Indoor storage of hazardous materials
5005.1.8	Indoor dispensing of hazardous materials
5104.4.1	Aerosol product warehouses
5106.3.2	Aerosol display and merchandising areas
5306.2.1	Exterior medical gas storage room
5306.2.2	Interior medical gas storage room
5306.2.3	Medical gas storage cabinet
5606.5.2.1	Storage of smokeless propellant
5606.5.2.3	Storage of small arms primers
5704.3.7.5.1	Flammable and combustible liquid storage rooms
5704.3.8.4	Flammable and combustible liquid storage warehouses
5705.3.7.3	Flammable and combustible liquid Group H-2 or H-3 areas
6004.1.2	Gas cabinets for highly toxic and toxic gas
6004.1.3	Exhausted enclosures for highly toxic and toxic gas
6004.2.2.6	Gas rooms for highly toxic and toxic gas
6004.3.3	Outdoor storage for highly toxic and toxic gas
6504.1.1	Pyroxylin plastic storage cabinets
6504.1.3	Pyroxylin plastic storage vaults
6504.2	Pyroxylin plastic storage and manufacturing
California Building Code Section 440	Horse racing stables
California Building Code Section 441	Pet kennels
California Building Code Section 449	Public libraries

For SI: 1 cubic foot = 0.023 m³.

903.2.15 Automatic sprinkler system – existing high-rise buildings. Regardless of any other provisions of these regulations, every existing high-rise building of Type II-B, Type III-B or Type V-B construction shall be provided with an approved automatic sprinkler system conforming to NFPA 13.

903.2.15.1 Existing R-1 and R-2 high-rise buildings fire-extinguishing systems. Automatic fire-extinguishing systems installed in any existing high-rise structure in which a Group R-1 or a Group R-2 occupancy is

located shall have an approved flow indicator electrically interconnected to the required fire alarm system.

903.2.16 Group L occupancies. An automatic sprinkler system shall be installed throughout buildings housing Group L occupancies. Sprinkler systems for Group L occupancy shall be designed for the square footage area of the Group L occupancy based on an area of sprinkler operation of 2,500 square feet (232 m²) and design density of 0.20 gpm/sf.

In mixed occupancies, portions of floors with Group L occupancies, but not classified as Group L, shall be provided with a sprinkler protection system per NFPA 13.

903.2.16.1 Group L occupancies located on the 11th story and above. The automatic sprinkler system shall be designed and zoned to provide separate indication upon water-flow for each side of the 2-hour fire-smoke barrier on the 11th story and above.

903.2.17 Fixed guideway and passenger rail transit systems.

903.2.17.1 Automatic sprinkler system. An automatic sprinkler system shall be installed in all stations of fixed guideway transit systems.

Exceptions:

1. Guideways when the closest sprinkler heads to the guideway are within 3 feet (914 mm) of the edge, over the platform and spaced 6 feet (1829 mm) on center, parallel to the guideway.
2. Station agent booths not exceeding 150 square feet (13.9 m²) in area, when provided with an approved smoke detector connected to the building fire alarm system.
3. Power substations.
4. Machinery rooms, electrical rooms and train control rooms protected by an approved automatic fixed fire-extinguishing system.
5. Open stations.
6. Station platform areas open to three or more sides.

903.2.17.2 Station guideway deluge system. Underground stations and stations in open cuts with walls 5 feet (1524 mm) above the top of the running rail and with a raised platform shall be provided with an under-vehicle guideway manually activated deluge sprinkler system. In open cut stations, such system shall be provided in guideways which are situated between a raised platform edge and a retaining wall.

903.2.17.2.1 Systems shall be provided along the entire length of track at each station platform.

903.2.17.2.2 Deluge nozzles with caps shall be located in the approximate center of track with spacing designed to completely wet the undersides of the vehicle at the applied density.

903.2.17.2.3 System density shall be a minimum of 0.19 gallon per minute (gpm) per square foot (0.72

L/m per m²) for the design area. When more than one zone is provided, two adjacent zones are required to be considered operating for calculating purposes.

903.2.17.2.4 *Deluge systems shall be directly connected to a water supply capable of supplying the required flow rate for a minimum 30-minute duration.*

903.2.17.2.5 *Controls or manually operable valves shall be in a location acceptable to the Fire Code Official. All deluge systems shall be monitored by the station fire alarm system.*

903.2.17.2.6 *Each valve shall be monitored by a separate circuit. The alarm panel shall be located in an area normally occupied by station personnel or signals shall be transmitted to the operations control center (OCC).*

903.2.18 *Group U private garages and carports accessory to Group R-3 occupancies. Carports with habitable space above and attached garages, accessory to Group R-3 occupancies, shall be protected by residential fire sprinklers in accordance with this section. Residential fire sprinklers shall be connected to, and installed in accordance with, an automatic residential fire sprinkler system that complies with Section R313 of the California Residential Code or with NFPA 13D. Fire sprinklers shall be residential sprinklers or quick-response sprinklers, designed to provide a minimum density of 0.05 gpm/ft² (2.04 mm/min) over the area of the garage and/or carport, but not to exceed two sprinklers for hydraulic calculation purposes. Garage doors shall not be considered obstructions with respect to sprinkler placement.*

Exception: *An automatic residential fire sprinkler system shall not be required when additions or alterations are made to existing carports and/or garages that do not have an automatic residential fire sprinkler system installed in accordance with this section.*

903.2.19 *Public school state-funded construction projects for kindergarten through 12th grade — automatic sprinkler system requirements.*

903.2.19.1 *New public school campus. An automatic sprinkler system shall be provided in all occupancies. The provisions of this section shall apply to any public school project consisting of one or more buildings on a new school campus and receiving state funds pursuant to Leroy F. Greene School Facilities Act of 1998, California Education Code, Sections 17070.10 through 17079. For purposes of this section, new campus refers to a school site, where an application for construction of original buildings was made to DSA on or after July 1, 2002.*

An automatic fire sprinkler system is not required in locations identified in Section 903.2.20.

903.2.19.1.1 *Sprinklers shall be installed in spaces where the ceiling creates a “ceiling-plenum” or the space above the ceiling is utilized for environmental air.*

903.2.19.1.2 *Fire-resistive substitution for new campus. A new public school campus shall be entitled to include in the design and construction documents all of the applicable fire-resistive construction substitutions as permitted by this code.*

903.2.20 *Public school campuses. An automatic fire sprinkler system is not required to be provided in the following locations on Kindergarten through 12th grade.*

1. *A relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.*
2. *Detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:*

- Concession Stand*
- Press Box*
- Restroom Facilities*
- Shade Structure*
- Snack Bar*
- Storage Building*
- Ticket Booth*

903.2.21 *Required exterior entrance covers. An automatic sprinkler system shall be provided throughout covered exterior entrances required by California Building Code Section 11B-206.4.10 or Section 1224.33.2.1.*

903.3 *Installation requirements. Automatic sprinkler systems shall be designed and installed in accordance with Sections 903.3.1 through 903.3.8.*

903.3.1 *Standards. Sprinkler systems shall be designed and installed in accordance with Section 903.3.1.1, unless otherwise permitted by Sections 903.3.1.2 and 903.3.1.3 and other chapters of this code, as applicable.*

903.3.1.1 *NFPA 13 sprinkler systems. Where the provisions of this code require that a building or portion thereof be equipped throughout with an automatic sprinkler system in accordance with this section, sprinklers shall be installed throughout in accordance with NFPA 13 as amended in Chapter 80 except as provided in Sections 903.3.1.1.1 through 903.3.1.1.3.*

903.3.1.1.1 *Exempt locations. Automatic sprinklers shall not be required in the following rooms or areas where such rooms or areas are protected with an approved automatic fire detection system in accordance with Section 907.2 that will respond to visible or invisible particles of combustion. Sprinklers shall not be omitted from a room merely because it is damp, of fire-resistance-rated construction or contains electrical equipment.*

1. *A room where the application of water, or flame and water, constitutes a serious life or fire hazard as determined by the authority having jurisdiction.*

2. A room or space where sprinklers are considered undesirable because of the nature of the contents, where approved by the fire code official *as determined by the authority having jurisdiction*.
3. *Machine rooms, machinery spaces, control rooms, control spaces and hoistways associated with fire service access elevators in accordance with Section 3007.*
4. Machine rooms, machinery spaces, control rooms and control spaces *and hoistways* associated with occupant evacuation elevators designed in accordance with Section 3008 of the *California Building Code*.
5. *Spaces or areas in telecommunications buildings used exclusively for telecommunications equipment, and associated electrical power distribution equipment, provided those spaces or areas are equipped throughout with an automatic smoke detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 of the California Building Code or not less than 2-hour horizontal assemblies constructed in accordance with Section 712 of the California Building Code, or both.*
6. *Elevator hoistways, machine rooms, machinery spaces, control spaces and control rooms in accordance with Section 3005.4.1 of the California Building Code.*

903.3.1.1.2 Bathrooms. In Group R occupancies, sprinklers shall not be required in bathrooms that do not exceed 55 square feet (5 m²) in area and are located within individual dwelling units or sleeping units, provided that walls and ceilings, including the walls and ceilings behind a shower enclosure or tub, are of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating.

903.3.1.1.3 Solar photovoltaic power systems. *Automatic sprinklers shall not be required in the following areas:*

1. *Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath, including storage.*
2. *Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.*

903.3.1.2 NFPA 13R sprinkler systems. Automatic sprinkler systems in Group R occupancies shall be permitted to be installed throughout in accordance with NFPA 13R *as amended in Chapter 80.*

1. Four stories or less above grade plane.
2. The floor level of the highest story is 30 feet (9144 mm) or less above the lowest level of fire department vehicle access.
3. The floor level of the lowest story is 30 feet (9144 mm) or less below the lowest level of fire department vehicle access.

The number of stories of Group R occupancies constructed in accordance with Sections 510.2 and 510.4 of the *California Building Code* shall be measured from grade plane.

903.3.1.2.1 Balconies and decks. Sprinkler protection shall be provided for exterior balconies, decks and ground floor patios of dwelling units and sleeping units where either of the following conditions exists:

1. The building is of Type V construction, provided that there is a roof or deck above.
2. Exterior balconies, decks and ground floor patios of dwelling units and sleeping units are constructed in accordance with Section 705.2.3.1, Exception 3 of the *California Building Code*.

Sidewall sprinklers that are used to protect such areas shall be permitted to be located such that their deflectors are within 1 inch (25 mm) to 6 inches (152 mm) below the structural members and a maximum distance of 14 inches (356 mm) below the deck of the exterior balconies and decks that are constructed of open wood joist construction.

903.3.1.2.2 Corridors and balconies in the means of egress. Sprinkler protection shall be provided in corridors and for balconies in the means of egress where any of the following conditions apply:

1. Corridors with combustible floor or walls.
2. Corridors with an interior change of direction exceeding 45 degrees (0.79 rad).
3. Corridors that are less than 50 percent open to the outside atmosphere at the ends.
4. Open-ended corridors and associated exterior stairways and ramps as specified in Section 1027.6, Exception 3.
5. Egress balconies not complying with Sections 1021.2 and 1021.3.

903.3.1.2.3 Attics. Attic protection shall be provided as follows:

1. Attics that are used or intended for living purposes or storage shall be protected by an automatic sprinkler system.
2. Where fuel-fired equipment is installed in an un-sprinklered attic, not fewer than one quick-response intermediate temperature sprinkler shall be installed above the equipment.

3. Where located in a building of Type III, Type IV or Type V construction designed in accordance with Section 510.2 or 510.4 of the *California Building Code*, attics not required by Item 1 to have sprinklers shall comply with one of the following if the roof assembly is located more than 55 feet (16 764 mm) above the lowest level of fire department vehicle access needed to meet the provisions in Section 503:

- 3.1. Provide automatic sprinkler system protection.
- 3.2. Construct the attic using noncombustible materials.
- 3.3. Construct the attic using fire-retardant-treated wood complying with Section 2303.2 of the *California Building Code*.
- 3.4. Fill the attic with noncombustible insulation.

The height of the roof assembly shall be determined by measuring the distance from the lowest required fire vehicle access road surface adjacent to the building to the eave of the highest pitched roof, the intersection of the highest roof to the exterior wall, or the top of the highest parapet, whichever yields the greatest distance. For the purpose of this measurement, required fire vehicle access roads shall include only those roads that are necessary for compliance with Section 503.

903.3.1.3 NFPA 13D sprinkler systems. Automatic sprinkler systems installed in one- and two-family dwellings; Group R-3; Group R-4, Condition 1; and townhouses shall be permitted to be installed throughout in accordance with NFPA 13D *as amended in Chapter 80*.

903.3.2 Quick-response and residential sprinklers. Where automatic sprinkler systems are required by this code, quick-response or residential automatic sprinklers shall be installed in all of the following areas in accordance with Section 903.3.1 and their listings:

1. Throughout all spaces within a smoke compartment containing care recipient sleeping units in Group I-2 in accordance with the *California Building Code*.
2. Throughout all spaces within a smoke compartment containing gas fireplace appliances and decorative gas appliances in Group I-2 in accordance with the *California Building Code*.
3. Throughout all spaces within a smoke compartment containing treatment rooms in ambulatory care facilities.
4. Dwelling units and sleeping units in Group R occupancies.
5. Light-hazard occupancies as defined in NFPA 13.

903.3.3 Obstructed locations. Automatic sprinklers shall be installed with regard to obstructions that will delay activation or obstruct the water distribution pattern and shall be in accordance with the applicable automatic sprinkler system standard that is being used. Automatic sprinklers shall be installed in or under covered kiosks, displays, booths, concession stands or equipment that exceeds 4 feet (1219 mm) in width. Not less than a 3-foot (914 mm) clearance shall be maintained between automatic sprinklers and the top of piles of combustible fibers.

Exception: Kitchen equipment under exhaust hoods protected with a fire-extinguishing system in accordance with Section 904.

903.3.4 Actuation. Automatic sprinkler systems shall be automatically actuated unless specifically provided for in this code.

903.3.5 Water supplies. Water supplies for automatic sprinkler systems shall comply with this section and the standards referenced in Section 903.3.1. The potable water supply shall be protected against backflow in accordance with *Health and Safety Code 13114.7*. For connections to public waterworks systems, the water supply test used for design of fire protection systems shall be adjusted to account for seasonal and daily pressure fluctuations based on information from the water supply authority and as approved by the fire code official.

903.3.5.1 Domestic services. Where the domestic service provides the water supply for the automatic sprinkler system, the supply shall be in accordance with this section.

903.3.5.2 Residential combination services. A single combination water supply shall be allowed provided that the domestic demand is added to the sprinkler demand as required by NFPA 13R.

903.3.6 Hose threads. Fire hose threads and fittings used in connection with automatic sprinkler systems shall be as prescribed by the fire code official.

903.3.7 Fire department connections. Fire department connections for automatic sprinkler systems shall be installed in accordance with Section 912.

903.3.8 Limited area sprinkler systems. Limited area sprinkler systems shall be in accordance with the standards listed in Section 903.3.1 except as provided in Sections 903.3.8.1 through 903.3.8.5.

903.3.8.1 Number of sprinklers. Limited area sprinkler systems shall not exceed six sprinklers in any single fire area.

903.3.8.2 Occupancy hazard classification. Only areas classified by NFPA 13 as Light Hazard or Ordinary Hazard Group 1 shall be permitted to be protected by limited area sprinkler systems.

903.3.8.3 Piping arrangement. Where a limited area sprinkler system is installed in a building with an automatic wet standpipe system, sprinklers shall be supplied by the standpipe system. Where a limited area sprinkler system is installed in a building without an

automatic wet standpipe system, water shall be permitted to be supplied by the plumbing system provided that the plumbing system is capable of simultaneously supplying domestic and sprinkler demands.

903.3.8.4 Supervision. Control valves shall not be installed between the water supply and sprinklers unless the valves are of an approved indicating type that are supervised or secured in the open position.

903.3.8.5 Calculations. Hydraulic calculations in accordance with NFPA 13 shall be provided to demonstrate that the available water flow and pressure are adequate to supply all sprinklers installed in any single fire area with discharge densities corresponding to the hazard classification.

903.3.9 Floor control valves. *Floor control valves and waterflow detection assemblies shall be installed at each floor where any of the following occur:*

1. *Buildings where the floor level of the highest story is located more than 30 feet above the lowest level of fire department vehicle access.*
2. *Buildings that are four or more stories in height.*
3. *Buildings that are two or more stories below the highest level of fire department vehicle access.*

Exception: *Group R-3 and R-3.1 occupancies floor control valves and waterflow detection assemblies shall not be required.*

903.4 Sprinkler system supervision and alarms. Valves controlling the water supply for automatic sprinkler systems, pumps, tanks, water levels and temperatures, critical air pressures and waterflow switches on all sprinkler systems shall be electrically supervised by a listed fire alarm control unit.

Exceptions:

1. Automatic sprinkler systems protecting one- and two-family dwellings.
2. Limited area sprinkler systems in accordance with Section 903.3.8.
3. Automatic sprinkler systems installed in accordance with NFPA 13R where a common supply main is used to supply both domestic water and the automatic sprinkler system, and a separate shutoff valve for the automatic sprinkler system is not provided.
4. Jockey pump control valves that are sealed or locked in the open position.
5. Control valves to commercial kitchen hoods, paint spray booths or dip tanks that are sealed or locked in the open position.
6. Valves controlling the fuel supply to fire pump engines that are sealed or locked in the open position.
7. Trim valves to pressure switches in dry, preaction and deluge sprinkler systems that are sealed or locked in the open position.
8. Underground key or hub gate valves in roadway boxes.

903.4.1 Monitoring. Alarm, supervisory and trouble signals shall be distinctly different and shall be automatically transmitted to an approved supervising station or, where approved by the fire code official, shall sound an audible signal at a constantly attended location.

Exception: Backflow prevention device test valves located in limited area sprinkler system supply piping shall be locked in the open position. In occupancies required to be equipped with a fire alarm system, the backflow preventer valves shall be electrically supervised by a tamper switch installed in accordance with NFPA 72 and separately annunciated.

903.4.2 Alarms. *One exterior* approved audible device, located on the exterior of the building in an approved location, shall be connected to each automatic sprinkler system. Such sprinkler waterflow alarm devices shall be activated by water flow equivalent to the flow of a single sprinkler of the smallest orifice size installed in the system. Where a fire alarm system is installed, actuation of the automatic sprinkler system shall actuate the building fire alarm system. *Visible alarm notification appliances shall not be required except when required by Section 907.*

903.4.3 Floor control valves. Approved supervised indicating control valves shall be provided at the point of connection to the riser on each floor in high-rise buildings and *Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access..*

903.5 Testing and maintenance. *Automatic* sprinkler systems shall be tested and maintained in accordance with Section 901.

903.6 Where required in existing buildings and structures. An automatic sprinkler system shall be provided in existing buildings and structures where required in Chapter 11.

**SECTION 904
ALTERNATIVE AUTOMATIC
FIRE-EXTINGUISHING SYSTEMS**

904.1 General. Automatic fire-extinguishing systems, other than automatic sprinkler systems, shall be designed, installed, inspected, tested and maintained in accordance with the provisions of this section and the applicable referenced standards.

[California Code of Regulations, Title 19, Division 1, §904(a)(2)] Required Inspection, Testing and Maintenance Frequencies.

(2) Engineered and pre-engineered fixed extinguishing systems shall be inspected, tested and maintained at least semi-annually, and immediately after a system activation.

[California Code of Regulations, Title 19, Division 1, §904(c)] Required Inspection, Testing and Maintenance Frequencies.

(c) Engineered and pre-engineered fixed extinguishing systems, regardless of installation date, shall be inspected, tested and maintained within the time periods specified in

California Code of Regulations, Title 19, Division 1, Section 904(a)(2) above.

[California Code of Regulations, Title 19, Division 1, §904.7(a) through (c)] Inspection, Testing and Maintenance Requirements for Engineered and Pre-engineered Fixed Extinguishing Systems.

Inspection, Testing and Maintenance shall be performed in accordance with:

(a) *California Code of Regulations, Title 19, Division 1, Section 904(a)(2),*

(b) *the manufacturer's written instructions, which are approved and on file with the Office of the State Fire Marshal; and*

(c) *the applicable standards adopted in California Code of Regulations, Title 24, Part 9, (California Fire Code).*

904.1.1 Certification of service personnel for fire-extinguishing equipment. Service personnel providing or conducting maintenance on automatic fire-extinguishing systems, other than automatic sprinkler systems, shall possess a valid certificate issued by an approved governmental agency, or other approved organization for the type of system and work performed.

904.2 Where permitted. Automatic fire-extinguishing systems installed as an alternative to the required automatic sprinkler systems of Section 903 shall be approved by the fire code official.

904.2.1 Restriction on using automatic sprinkler system exceptions or reductions. Automatic fire-extinguishing systems shall not be considered alternatives for the purposes of exceptions or reductions allowed for automatic sprinkler systems or by other requirements of this code.

904.2.2 Commercial hood and duct systems. Each required commercial kitchen exhaust hood and duct system required by Section 606 to have a Type I hood shall be protected with an approved automatic fire-extinguishing system installed in accordance with this code.

904.3 Installation. Automatic fire-extinguishing systems shall be installed in accordance with this section.

904.3.1 Electrical wiring. Electrical wiring shall be in accordance with *the California Electrical Code.*

904.3.2 Actuation. Automatic fire-extinguishing systems shall be automatically actuated and provided with a manual means of actuation in accordance with Section 904.13.1. Where more than one hazard could be simultaneously involved in fire due to their proximity, all hazards shall be protected by a single system designed to protect all hazards that could become involved.

Exception: Multiple systems shall be permitted to be installed if they are designed to operate simultaneously.

904.3.3 System interlocking. Automatic equipment interlocks with fuel shutoffs, ventilation controls, door closers, window shutters, conveyor openings, smoke and heat vents and other features necessary for proper operation of the fire-extinguishing system shall be provided as required

by the design and installation standard utilized for the hazard.

904.3.4 Alarms and warning signs. Where alarms are required to indicate the operation of automatic fire-extinguishing systems, distinctive audible, visible alarms and warning signs shall be provided to warn of pending agent discharge. Where exposure to automatic-extinguishing agents poses a hazard to persons and a delay is required to ensure the evacuation of occupants before agent discharge, a separate warning signal shall be provided to alert occupants once agent discharge has begun. Audible signals shall be in accordance with Section 907.5.2.

904.3.5 Monitoring. Where a building fire alarm system is installed, automatic fire-extinguishing systems shall be monitored by the building fire alarm system in accordance with NFPA 72.

904.4 Inspection and testing. Automatic fire-extinguishing systems shall be inspected and tested in accordance with the provisions of this section prior to acceptance.

904.4.1 Inspection. Prior to conducting final acceptance tests, all of the following items shall be inspected:

1. Hazard specification for consistency with design hazard.
2. Type, location and spacing of automatic- and manual-initiating devices.
3. Size, placement and position of nozzles or discharge orifices.
4. Location and identification of audible and visible alarm devices.
5. Identification of devices with proper designations.
6. Operating instructions.

904.4.2 Alarm testing. Notification appliances, connections to fire alarm systems and connections to approved supervising stations shall be tested in accordance with this section and Section 907 to verify proper operation.

904.4.2.1 Audible and visible signals. The audibility and visibility of notification appliances signaling agent discharge or system operation, where required, shall be verified.

904.4.3 Monitor testing. Connections to protected premises and supervising station fire alarm systems shall be tested to verify proper identification and retransmission of alarms from automatic fire-extinguishing systems.

904.5 Wet-chemical systems. Wet-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17A and their listing. Records of inspections and testing shall be maintained.

904.5.1 System test. Systems shall be inspected and tested for proper operation at six-month intervals. Tests shall include a check of the detection system, alarms and releasing devices, including manual stations and other associated equipment. Extinguishing system units shall be weighed and the required amount of agent verified. Stored

pressure-type units shall be checked for the required pressure. The cartridge of cartridge-operated units shall be weighed and replaced at intervals indicated by the manufacturer.

904.5.2 Fusible link maintenance. Fixed temperature-sensing elements shall be maintained to ensure proper operation of the system.

904.6 Dry-chemical systems. Dry-chemical extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 17 and their listing. Records of inspections and testing shall be maintained.

904.6.1 System test. Systems shall be inspected and tested for proper operation at six-month intervals. Tests shall include a check of the detection system, alarms and releasing devices, including manual stations and other associated equipment. Extinguishing system units shall be weighed, and the required amount of agent verified. Stored pressure-type units shall be checked for the required pressure. The cartridge of cartridge-operated units shall be weighed and replaced at intervals indicated by the manufacturer.

904.6.2 Fusible link maintenance. Fixed temperature-sensing elements shall be maintained to ensure proper operation of the system.

904.7 Foam systems. Foam-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 11 and NFPA 16 and their listing. Records of inspections and testing shall be maintained.

904.7.1 System test. Foam-extinguishing systems shall be inspected and tested at intervals in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

904.8 Carbon dioxide systems. Carbon dioxide extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 12 and their listing. Records of inspections and testing shall be maintained.

904.8.1 System test. Systems shall be inspected and tested for proper operation in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

904.8.2 High-pressure cylinders. High-pressure cylinders shall be weighed and the date of the last hydrostatic test shall be verified at six-month intervals. Where a container shows a loss in original content of more than 10 percent, the cylinder shall be refilled or replaced.

904.8.3 Low-pressure containers. The liquid-level gauges of low-pressure containers shall be observed at one-week intervals. Where a container shows a content loss of more than 10 percent, the container shall be refilled to maintain the minimum gas requirements.

904.8.4 System hoses. System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be

replaced or tested. At five-year intervals, all hoses shall be tested.

904.8.4.1 Test procedure. Hoses shall be tested at not less than 2,500 pounds per square inch (psi) (17 238 kPa) for high-pressure systems and at not less than 900 psi (6206 kPa) for low-pressure systems.

904.8.5 Auxiliary equipment. Auxiliary and supplementary components, such as switches, door and window releases, interconnected valves, damper releases and supplementary alarms, shall be manually operated at 12-month intervals to ensure that such components are in proper operating condition.

904.9 Halon systems. Halogenated extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 12A and their listing. Records of inspections and testing shall be maintained.

904.9.1 System test. Systems shall be inspected and tested for proper operation in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

904.9.2 Containers. The extinguishing agent quantity and pressure of containers shall be checked at six-month intervals. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure (adjusted for temperature) of more than 10 percent, the container shall be refilled or replaced. The weight and pressure of the container shall be recorded on a tag attached to the container.

904.9.3 System hoses. System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be replaced or tested. At five-year intervals, all hoses shall be tested.

904.9.3.1 Test procedure. For Halon 1301 systems, hoses shall be tested at not less than 1,500 psi (10 343 kPa) for 600 psi (4137 kPa) charging pressure systems and not less than 900 psi (6206 kPa) for 360 psi (2482 kPa) charging pressure systems. For Halon 1211 hand-hose line systems, hoses shall be tested at 2,500 psi (17 238 kPa) for high-pressure systems and 900 psi (6206 kPa) for low-pressure systems.

904.9.4 Auxiliary equipment. Auxiliary and supplementary components, such as switches, door and window releases, interconnected valves, damper releases and supplementary alarms, shall be manually operated at 12-month intervals to ensure such components are in proper operating condition.

904.10 Clean-agent systems. Clean-agent fire-extinguishing systems shall be installed, maintained, periodically inspected and tested in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 2001 and their listing. Records of inspections and testing shall be maintained.

904.10.1 System test. Systems shall be inspected and tested for proper operation in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

904.10.2 Containers. The extinguishing agent quantity and pressure of the containers shall be checked at six-month intervals. Where a container shows a loss in original weight of more than 5 percent or a loss in original pressure, adjusted for temperature, of more than 10 percent, the container shall be refilled or replaced. The weight and pressure of the container shall be recorded on a tag attached to the container.

904.10.3 System hoses. System hoses shall be examined at 12-month intervals for damage. Damaged hoses shall be replaced or tested. All hoses shall be tested at five-year intervals.

904.11 Automatic water mist systems. Automatic water mist systems shall be permitted in applications that are consistent with the applicable listing or approvals and shall comply with Sections 904.11.1 through 904.11.3.

904.11.1 Design and installation requirements. Automatic water mist systems shall be designed and installed in accordance with Sections 904.11.1.1 through 904.11.1.4.

904.11.1.1 General. Automatic water mist systems shall be designed and installed in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5* and NFPA 750 and the manufacturer's instructions.

904.11.1.2 Actuation. Automatic water mist systems shall be automatically actuated.

904.11.1.3 Water supply protection. Connections to a potable water supply shall be protected against backflow in accordance with the *California Plumbing Code*.

904.11.1.4 Secondary water supply. Where a secondary water supply is required for an automatic sprinkler system, an automatic water mist system shall be provided with an approved secondary water supply.

904.11.2 Water mist system supervision and alarms. Supervision and alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.

904.11.2.1 Monitoring. Monitoring shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.1.

904.11.2.2 Alarms. Alarms shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.2.

904.11.2.3 Floor control valves. Floor control valves shall be provided as required for automatic sprinkler systems in accordance with Section 903.4.3.

904.11.3 Testing and maintenance. Automatic water mist systems shall be tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

904.12 Aerosol fire-extinguishing systems. Aerosol fire-extinguishing systems shall be installed, maintained, periodically

inspected and tested in accordance with NFPA 2010 and their listing.

Such devices and appurtenances shall be listed and installed in compliance with manufacturer's instructions.

904.12.1 Maintenance. Not less than semiannually, an inspection shall be conducted by a trained person to assess whether the system is in working order. Not less than annually, a certified fire suppression contractor having knowledge of and training in the installation, operation and maintenance of the specific fire-extinguishing system shall inspect, test, service and maintain such system in accordance with this section and the manufacturer's specifications and servicing manuals. Records of inspections and testing shall be maintained.

904.13 Commercial cooking systems. *Commercial cooking equipment that produce grease laden vapors shall be provided with a Type I Hood, in accordance with the California Mechanical Code, and an automatic fire extinguishing system that is listed and labeled for its intended use as follows:*

1. *Wet chemical extinguishing system, complying with UL 300.*
2. *Carbon dioxide extinguishing systems.*
3. *Automatic fire sprinkler systems.*

All existing dry chemical and wet chemical extinguishing systems shall comply with UL 300.

Exception: *Public school kitchens, without deep-fat fryers, shall be upgraded to a UL 300 compliant system during state-funded modernization projects that are under the jurisdiction of the Division of the State Architect.*

All systems shall be installed in accordance with the California Mechanical Code, appropriate adopted standards, their listing and the manufacturers' installation instructions.

Exception: *Factory-built commercial cooking recirculating systems that are tested in accordance with UL 710B and listed, labeled and installed in accordance with Section 304.1 of the California Mechanical Code.*

904.13.1 Manual system operation. A manual actuation device shall be located at or near a means of egress from the cooking area not less than 10 feet (3048 mm) and not more than 20 feet (6096 mm) from the kitchen exhaust system. The manual actuation device shall be installed not more than 48 inches (1200 mm) nor less than 42 inches (1067 mm) above the floor and shall clearly identify the hazard protected. The manual actuation shall require a maximum force of 40 pounds (178 N) and a maximum movement of 14 inches (356 mm) to actuate the fire suppression system.

Exception: *Automatic sprinkler systems shall not be required to be equipped with manual actuation means.*

904.13.2 System interconnection. The actuation of the fire extinguishing system shall automatically shut down

the fuel or electrical power supply to the cooking equipment. The fuel and electrical supply reset shall be manual.

904.13.3 Carbon dioxide systems. Where carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. Where the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Automatic carbon dioxide fire-extinguishing systems shall be sufficiently sized to protect all hazards venting through a common duct simultaneously.

904.13.3.1 Ventilation system. Commercial-type cooking equipment protected by an automatic carbon dioxide extinguishing system shall be arranged to shut off the ventilation system upon activation.

904.13.4 Special provisions for automatic sprinkler systems. Automatic sprinkler systems protecting commercial-type cooking equipment shall be supplied from a separate, indicating-type control valve that is identified. Access to the control valve shall be provided.

904.13.4.1 Listed sprinklers. Sprinklers used for the protection of fryers shall be tested in accordance with UL 199E, listed for that application and installed in accordance with their listing.

904.13.5 Operations and maintenance. Automatic fire-extinguishing systems protecting commercial cooking systems shall be maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5 and Sections 904.13.5.1 through 904.13.5.3.*

904.13.5.1 Existing automatic fire-extinguishing systems. Where changes in the cooking media, positioning of cooking equipment or replacement of cooking equipment occur in existing commercial cooking systems, the automatic fire-extinguishing system shall be required to comply with the applicable provisions of Sections 904.13 through 904.13.4.

904.13.5.2 Extinguishing system service. Automatic fire-extinguishing systems shall be serviced not less frequently than every six months and after activation of the system. Inspection shall be by qualified individuals, and a certificate of inspection shall be forwarded to the fire code official upon completion.

904.13.5.3 Fusible link and sprinkler head replacement. Fusible links and automatic sprinkler heads shall be replaced annually, and other protection devices shall be serviced or replaced in accordance with the manufacturer's instructions.

Exception: Frangible bulbs are not required to be replaced annually.

904.14 Domestic cooking facilities. Cooktops and ranges installed in the following occupancies shall be protected in accordance with Section 904.14.1:

1. In Group *R-2.1* occupancies where domestic cooking facilities are installed in accordance with Section 420.9 of the *California Building Code*.
2. In Group I-2 occupancies where domestic cooking facilities are installed in accordance with Section 407.2.7 of the *California Building Code*.
3. In Group R-2 college dormitories where domestic cooking facilities are installed in accordance with Section 420.11 of the *California Building Code*.

904.14.1 Protection from fire. Cooktops and ranges shall be protected in accordance with Section 904.14.1.1 or 904.14.1.2.

904.14.1.1 Automatic fire-extinguishing system. The domestic recirculating or exterior vented cooking hood provided over the cooktop or range shall be equipped with an approved automatic fire-extinguishing system complying with the following:

1. The automatic fire-extinguishing system shall be of a type recognized for protection of domestic cooking equipment. Preengineered automatic fire-extinguishing systems shall be listed and labeled in accordance with UL 300A and installed in accordance with the manufacturer's instructions.
2. Manual actuation of the fire-extinguishing system shall be provided in accordance with Section 904.13.1.
3. Interconnection of the fuel and electric power supply shall be in accordance with Section 904.13.2.

904.14.1.2 Ignition prevention. Cooktops and ranges shall include burners that have been tested and listed to prevent ignition of cooking oil with burners turned on to their maximum heat settings and allowed to operate for 30 minutes.

SECTION 905 STANDPIPE SYSTEMS

905.1 General. Standpipe systems shall be provided in new buildings and structures in accordance with Sections 905.2 through 905.11. In buildings used for high-piled combustible storage, fire protection shall be in accordance with Chapter 32.

905.2 Installation standard. Standpipe systems shall be installed in accordance with this section and NFPA 14 *as amended in Chapter 80*. Fire department connections for standpipe systems shall be in accordance with Section 912.

905.3 Required installations. Standpipe systems shall be installed where required by Sections 905.3.1 through

905.3.11.1. Standpipe systems are allowed to be combined with automatic sprinkler systems.

Exception: Standpipe systems are not required in Group R-3 occupancies.

905.3.1 Height. *In other than Group R-3 and R-3.1 occupancies, Class III standpipe systems shall be installed throughout at each floor where any of the following occur:*

1. Buildings where the floor level of the highest story is located more than 30 feet (9144 mm) above the lowest level of fire department vehicle access.
2. Buildings that are four or more stories in height.
3. Buildings where the floor level of the lowest story is located more than 30 feet (9144 mm) below the highest level of fire department vehicle access.
4. Buildings that are two or more stories below the highest level of fire department vehicle access.

Exceptions:

1. Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
2. Class I standpipes are allowed in Group B and E occupancies.
3. Class I standpipes are allowed in parking garages.
4. Class I standpipes are allowed in basements equipped throughout with an automatic sprinkler system.
5. Class I standpipes are allowed in buildings where occupant-use hose lines will not be utilized by trained personnel or the fire department.
6. In determining the lowest level of fire department vehicle access, it shall not be required to consider either of the following:
 - 6.1. Recessed loading docks for four vehicles or less.
 - 6.2. Conditions where topography makes access from the fire department vehicle to the building impractical or impossible.

905.3.2 Group A. Class I automatic wet standpipes shall be provided in nonsprinklered Group A buildings having an occupant load exceeding 1,000 persons.

Exceptions:

1. Open-air-seating spaces without enclosed spaces.
2. Class I automatic dry and semiautomatic dry standpipes or manual wet standpipes are allowed in buildings that are not high-rise buildings.

905.3.3 Covered and open mall buildings. Covered mall and open mall buildings shall be equipped throughout with a standpipe system where required by Section 905.3.1.

Mall buildings not required to be equipped with a standpipe system by Section 905.3.1 shall be equipped with Class I hose connections connected to the automatic sprinkler system sized to deliver water at 250 gallons per minute (946.4 L/min) at the hydraulically most remote hose connection while concurrently supplying the automatic sprinkler system demand. The standpipe system shall be designed not to exceed a 50 pounds per square inch (psi) (345 kPa) residual pressure loss with a flow of 250 gallons per minute (946.4 L/min) from the fire department connection to the hydraulically most remote hose connection. Hose connections shall be provided at each of the following locations:

1. Within the mall at the entrance to each exit passageway or corridor.
2. At each floor-level landing within interior exit stairways opening directly on the mall.
3. At exterior public entrances to the mall of a covered mall building.
4. At public entrances at the perimeter line of an open mall building.
5. At other locations as necessary so that the distance to reach all portions of a tenant space does not exceed 200 feet (60 960 mm) from a hose connection.

905.3.4 Stages. Stages greater than 1,000 square feet (93 m²) in area shall be equipped with a Class III wet standpipe system with 1½-inch and 2½-inch (38 mm and 64 mm) hose connections on each side of the stage.

Exception: Where the building or area is equipped throughout with an automatic sprinkler system, a 1½-inch (38 mm) hose connection shall be installed in accordance with NFPA 13 or in accordance with NFPA 14 for Class II or III standpipes.

905.3.4.1 Hose and cabinet. The 1½-inch (38 mm) hose connections shall be equipped with sufficient lengths of 1½-inch (38 mm) hose to provide fire protection for the stage area. Hose connections shall be equipped with an approved adjustable fog nozzle and be mounted in a cabinet or on a rack.

905.3.5 Underground buildings. Underground buildings shall be equipped throughout with a Class I automatic wet or manual wet standpipe system.

905.3.6 Helistops and heliports. Buildings with a rooftop helistop or heliport shall be equipped with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located in accordance with Section 2007.5.

905.3.7 Marinas and boatyards. Standpipes in marinas and boatyards shall comply with Chapter 36.

905.3.8 Landscaped roofs. Buildings or structures that have landscaped roofs and that are equipped with a standpipe system shall have the standpipe system extended to the roof level on which the landscaped roof is located.

905.3.9 Smokeproof enclosures. For smokeproof enclosures, see California Building Code, Section 909.20.

905.3.10 Group I-3. A housing pod within housing units where 50 or more inmates are restrained shall be provided with Class I wet standpipes. In addition, Class I wet standpipes shall be located so that it will not be necessary to extend hose lines through interlocking security doors and any doors in smoke-barrier walls, horizontal fire walls or fire barrier walls. Standpipes located in housing units may be placed in secured pipe chases.

905.3.11 Fixed guideway and passenger rail transit systems. Fixed-guideway and passenger rail transit systems shall be provided with a Class I standpipe system in accordance with this section.

905.3.11.1 Underground stations. Underground stations shall be provided with an automatic Class I standpipe system.

905.3.11.2 All other stations. All other stations shall be provided with a Class I standpipe system.

Exception: Open at-grade stations with unrestricted fire department access need not be provided with a standpipe system.

905.4 Location of Class I standpipe hose connections.

Class I standpipe hose connections shall be provided in all of the following locations:

1. In every required interior exit stairway, a hose connection shall be provided for each story above and below grade plane. Hose connections shall be located at the main floor landing unless otherwise approved by the fire code official. See Section 909.20.2.3 of the California Building Code for additional provisions in smokeproof enclosures.

Exception: A single hose connection shall be permitted to be installed in the open corridor or open breezeway between open stairs that are not greater than 75 feet (22 860 mm) apart.

2. On each side of the wall adjacent to the exit opening of a horizontal exit.

Exception: Where floor areas adjacent to a horizontal exit are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose as measured along the path of travel, a hose connection shall not be required at the horizontal exit.

3. In every exit passageway, at the entrance from the exit passageway to other areas of a building.

Exception: Where floor areas adjacent to an exit passageway are reachable from an interior exit stairway hose connection by a 30-foot (9144 mm) hose stream from a nozzle attached to 100 feet (30 480 mm) of hose, a hose connection shall not be required at the entrance from the exit passageway to other areas of the building.

4. In covered mall buildings, adjacent to each exterior public entrance to the mall and adjacent to each entrance from an exit passageway or exit corridor to the mall. In open mall buildings, adjacent to each public entrance to the mall at the perimeter line and adjacent to each entrance from an exit passageway or exit corridor to the mall.

5. Where the roof has a slope less than 4 units vertical in 12 units horizontal (33.3-percent slope), a hose connection shall be located to serve the roof or at the highest landing of an interior exit stairway with access to the roof provided in accordance with Section 1011.12.

6. Where the most remote portion of a nonsprinklered floor or story is more than 150 feet (45 720 mm) from a hose connection or the most remote portion of a sprinklered floor or story is more than 200 feet (60 960 mm) from a hose connection, the fire code official is authorized to require that additional hose connections be provided in approved locations. The distances from a hose connection shall be measured along the path of travel.

905.4.1 Protection. Risers and laterals of Class I standpipe systems not located within an interior exit stairway shall be protected by a degree of fire resistance equal to that required for vertical enclosures in the building in which they are located.

Exception: In buildings equipped throughout with an approved automatic sprinkler system, laterals that are not located within an interior exit stairway are not required to be enclosed within fire-resistance-rated construction.

905.4.2 Interconnection. In buildings where more than one standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

905.5 Location of Class II standpipe hose connections.

Class II standpipe hose connections shall be located so that all portions of the building are within 30 feet (9144 mm) of a listed variable stream fog nozzle attached to 100 feet (30 480 mm) of hose. Class II standpipe hose connections shall be located where they will have ready access.

905.5.1 Groups A-1 and A-2. In Group A-1 and A-2 occupancies with occupant loads of more than 1,000, hose connections shall be located on each side of any stage, on each side of the rear of the auditorium, on each side of the balcony and on each tier of dressing rooms.

905.5.2 Protection. Fire-resistance-rated protection of risers and laterals of Class II standpipe systems is not required.

905.5.3 Class II system 1-inch hose. A minimum 1-inch (25 mm) hose shall be allowed to be used for hose stations in light-hazard occupancies where investigated and listed for this service and where approved by the fire code official.

905.6 Location of Class III standpipe hose connections.

Class III standpipe systems shall have hose connections located as required for Class I standpipes in Section 905.4 and shall have Class II hose connections as required in Section 905.5.

905.6.1 Protection. Risers and laterals of Class III standpipe systems shall be protected as required for Class I systems in accordance with Section 905.4.1.

905.6.2 Interconnection. In buildings where more than one Class III standpipe is provided, the standpipes shall be interconnected in accordance with NFPA 14.

905.7 Cabinets. Cabinets containing fire-fighting equipment, such as standpipes, fire hose, fire extinguishers or fire department valves, shall not be blocked from use or obscured from view.

905.7.1 Cabinet equipment identification. Cabinets shall be identified in an approved manner by a permanently attached sign with letters not less than 2 inches (51 mm) high in a color that contrasts with the background color, indicating the equipment contained therein.

Exceptions:

1. Doors not large enough to accommodate a written sign shall be marked with a permanently attached pictogram of the equipment contained therein.
2. Doors that have either an approved visual identification clear glass panel or a complete glass door panel are not required to be marked.

905.7.2 Locking cabinet doors. Cabinets shall be unlocked.

Exceptions:

1. Visual identification panels of glass or other approved transparent frangible material that is easily broken and allows access.
2. Approved locking arrangements.
3. Group I-3 occupancies *and in mental health areas of Group I-2 occupancies.*

905.8 Dry standpipes. Dry standpipes shall not be installed.

Exception: Where subject to freezing and in accordance with NFPA 14.

905.9 Valve supervision. Valves controlling water supplies shall be supervised in the open position so that a change in the normal position of the valve will generate a supervisory signal at the supervising station required by Section 903.4. Where a fire alarm system is provided, a signal shall be transmitted to the control unit.

Exceptions:

1. Valves to underground key or hub valves in road-way boxes do not require supervision.
2. Valves locked in the normal position and inspected as provided in this code in buildings not equipped with a fire alarm system.

905.10 During construction. Standpipe systems required during construction and demolition operations shall be provided in accordance with Section 3313.

905.11 Locking standpipe outlet caps. The fire code official is authorized to require locking caps on the outlets on standpipes where the responding fire department carries key

wrenches for the removal that are compatible with locking FDC connection caps.

905.12 Existing buildings. Where required in Chapter 11, existing structures shall be equipped with standpipes installed in accordance with Section 905.

**SECTION 906
PORTABLE FIRE EXTINGUISHERS**

906.1 Where required. Portable fire extinguishers shall be installed in all of the following locations:

1. In new and existing Group A, B, E, F, H, I, L, M, R-1, R-2, *R-2.1, R-2.2, R-3.1,* R-4 and S occupancies.

Exception: In Group R-2 occupancies, portable fire extinguishers shall be required only in locations specified in Items 2 through 6 where each dwelling unit is provided with a portable fire extinguisher having a minimum rating of 1-A:10-B:C.

2. Within 30 feet (9144 mm) distance of travel from commercial cooking equipment and from domestic cooking equipment in Group R-2 college dormitory occupancies.
3. In areas where flammable or combustible liquids are stored, used or dispensed.
4. On each floor of structures under construction, except Group R-3 occupancies, in accordance with Section 3316.1.
5. Where required by the sections indicated in Table 906.1.
6. Special-hazard areas, including but not limited to laboratories, computer rooms and generator rooms, where required by the fire code official.
7. *Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2-A:10-B:C rating.*
8. *Where required by California Code of Regulations, Title 19, Division 1.*
9. *Within 30 feet (9144 mm) of domestic cooking equipment located in a Group I-2.*

[California Code of Regulations, Title 19, Division 1, §3.29(a) through (d)] Portable Fire Extinguishing Equipment.

(a) *General. Portable fire extinguishers conforming to the requirements of California Code of Regulations, Title 19, Division 1, Chapter 3, shall be installed and maintained in accordance with guides established therein.*

(b) *Special Coverage. Additional Class A, B and C units of adequate extinguishing potential shall be provided for any other hazard, as determined by the enforcing agency.*

(c) *Group A Occupancies.*

(1) *One additional Class 2-A unit shall be provided in Group A Occupancies as follows:*

(A) *On each side of the stage or platform.*

Exception: *Platforms 1000 square feet or less in area need have only one such extinguishing unit.*

- (B) On each side of every fly gallery.
- (C) In basements beneath the stage or platform.
- (D) In every hallway or passageway leading to a dressing room.
- (E) In every property room, carpenter shop or similar workroom.

(2) Not less than one 10-B:C unit (not less than 4-B:C for existing extinguishers in existing occupancies) shall be provided:

- (A) For each motor and fan room.
- (B) Adjacent to each switchboard on the stage or platform.
- (C) For each motion picture machine in projection rooms.

Exception: One 20-B:C unit (not less than 8-B:C for existing extinguishers in existing occupancies) in each projection room may be accepted as providing substantially equal protection.

(3) The enforcing agency may allow modifications or deviations relative to the number and location of portable fire extinguishers as required by this section provided such authority finds that the basic intent of this section and the ease of accessibility to extinguishers is otherwise achieved.

(d) Group R-2.1, R-3.1 and R-4 Occupancies. In Group R-2.1, R-3.1 and R-4 occupancies, a continuously attached garden hose, equipped with a water flow control nozzle, may be provided in lieu of one or more required fire extinguishers when acceptable to the enforcing agency. The location and length of such hose shall be as designated or approved by the enforcing agency.

NOTE: It is recommended that, wherever possible, portable fire extinguishers be located adjacent to manual fire alarm sending stations.

[California Code of Regulations, Title 19, Division 1, §565(a)] Selection of Fire Extinguishers.

(a) The selection of extinguishers for a given situation shall be determined by the authority having jurisdiction in accordance with adopted codes or ordinances. The character of the fires anticipated, the construction and occupancy of the individual property, the vehicle or hazard to be protected, ambient-temperature conditions and other factors shall be considered. The number, size, placement and limitations of use of extinguishers required shall be determined by using California Code of Regulations, Title 19, Division 1, Sections 567 through 573.

Exception: Portable fire extinguishers are not required at normally unmanned Group U occupancy buildings or structures where a portable fire extinguisher suitable to the hazard of the location is provided on the vehicle of visiting personnel.

**TABLE 906.1
ADDITIONAL REQUIRED PORTABLE FIRE EXTINGUISHERS**

SECTION	SUBJECT
303.5	Asphalt kettles
307.5	Open burning
308.1.3	Open flames—torches
309.4	Powered industrial trucks
1204.10	Portable generators
2005.2	Aircraft towing vehicles
2005.3	Aircraft welding apparatus
2005.4	Aircraft fuel-servicing tank vehicles
2005.5	Aircraft hydrant fuel-servicing vehicles
2005.6	Aircraft fuel-dispensing stations
2007.7	Heliports and helistops
2108.4	Dry cleaning plants
2305.5	Motor fuel-dispensing facilities
2310.6.4	Marine motor fuel-dispensing facilities
2311.6	Repair garages
2404.4.1	Spray-finishing operations
2405.4.2	Dip-tank operations
2406.4.2	Powder-coating areas
2804.3	Lumberyards/woodworking facilities
2808.8	Recycling facilities
2809.5	Exterior lumber storage
2903.5	Organic-coating areas
3006.3	Industrial ovens
3107.9	Tents and membrane structures
3206.10	High-piled storage
3316.1	Buildings under construction or demolition
3318.3	Roofing operations
3408.2	Tire rebuilding/storage
3504.2.6	Welding and other hot work
3604.4	Marinas
3703.6	Combustible fibers
5703.2.1	Flammable and combustible liquids, general
5704.3.3.1	Indoor storage of flammable and combustible liquids
5704.3.7.5.2	Liquid storage rooms for flammable and combustible liquids
5705.4.9	Solvent distillation units
5706.2.7	Farms and construction sites—flammable and combustible liquids storage
5706.4.10.1	Bulk plants and terminals for flammable and combustible liquids
5706.5.4.5	Commercial, industrial, governmental or manufacturing establishments—fuel dispensing
5706.6.4	Tank vehicles for flammable and combustible liquids
5906.5.7	Flammable solids
6108.2	LP-gas

906.2 General requirements. Portable fire extinguishers shall be selected, installed and maintained in accordance with this section and *California Code of Regulations, Title 19, Division 1, Chapter 3.*

Exceptions:

- 1. The distance of travel to reach an extinguisher shall not apply to the spectator seating portions of Group A-5 occupancies.
- ➔ 2. Thirty-day inspections shall not be required for portable fire extinguishers that are supervised by a listed and approved electronic monitoring device, provided that all of the following conditions are met:
 - 2.1. Electronic monitoring shall confirm that extinguishers are properly positioned, properly charged and unobstructed.
 - 2.2. Loss of power or circuit continuity to the electronic monitoring device shall initiate a trouble signal.
 - 2.3. The extinguishers shall be installed inside of a building or cabinet in a noncorrosive environment.
 - ➔ 2.4. Electronic monitoring devices and supervisory circuits shall be tested when extinguisher maintenance is performed.
 - 2.5. A written log of required hydrostatic test dates for extinguishers shall be maintained by the owner to verify that hydrostatic tests are conducted at the frequency required by *California Code of Regulations, Title 19, Division 1, Chapter 3.*
- 3. In Group I-3, and in mental health areas of Group I-2, portable fire extinguishers shall be permitted to be located at staff locations.

[California Code of Regulations, Title 19, Division 1, §565.1(a) through (c)] Classification of Hazards.

(a) Light (Low) Hazard. Locations where the total amounts of Class A combustible materials, including furnishings, decorations and contents, is of minor quantity. These shall include buildings or rooms occupied as offices, classrooms, churches, assembly halls, etc. This classification anticipates that the majority of the contents are either noncombustible or so arranged that a fire is not likely to spread rapidly. Small amounts of Class B flammables used for duplicating machines, art departments, etc., are included provided that they are kept in closed containers and safely stored.

(b) Ordinary (Moderate) Hazard. Locations where the total amounts of Class A combustibles and Class B flammables are present in greater amounts than expected under Light (Low) Hazard occupancies. These occupancies could consist of offices, classrooms, mercantile shops and allied storage, light manufacturing, research operations, auto showrooms, parking garages, workshop or support service areas of Light (Low) Hazard occupancies, and warehouses containing Class I or Class II commodities.

(c) Extra (High) Hazard. Locations where the total amount of Class A combustibles and Class B flammables are present, in storage, production use, and/or finished product over and above those expected and classed as Ordinary (Moderate) Hazards. These occupancies could consist of woodworking, vehicle repair, aircraft and boat servicing, individual product display showrooms, product convention center displays, storage and manufacturing processes such as painting, dipping, coating, including flammable liquid handling. Also, included in warehousing of, or in-process storage of other Class I and Class II commodities.

[California Code of Regulations, Title 19, Division 1, §565.2(a) through (e)] Selection by Hazard.

(a) Extinguishers shall be selected for the specific class or classes of hazards to be protected in accordance with the following subdivisions (b), (c), (d) and (e).

(b) Extinguishers for protecting Class A hazards shall be selected from the following: Water-type, halogenated agent types, multipurpose dry chemical and wet chemical type.

(c) Extinguishers for protection of Class B hazards shall be selected from the following: carbon dioxide, dry chemical types, halogenated agent types and water-type and water chemical extinguishers rated for Class B hazards.

(d) Extinguishers for protection of Class C hazards shall be selected from the following: carbon dioxide, dry chemical types, halogenated agent types and water mist types rated for Class C. Carbon dioxide extinguishers equipped with metal horns are not considered safe for use on fires in energized electrical equipment and, therefore, are not classified for use on Class C hazards.

(e) Extinguishers and extinguishing agents for the protection of Class D hazards shall be of types approved for use on the specific combustible metal hazard.

[California Code of Regulations, Title 19, Division 1, §566(a) through (f)] Application for Specific Hazards.

(a) Class B Fire Extinguishers for Pressurized Flammable Liquids and Pressurized Gas Fires. Fires of this nature are considered to be a special hazard. Class B fire extinguishers containing agents other than dry chemical are relatively ineffective on this type of hazard due to stream and agent characteristics. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not applicable to these types of hazards. It has been determined that special nozzle design and rates of agent application are required to cope with such hazards. Caution: It is undesirable to attempt to extinguish this type of fire unless there is reasonable assurance that the source of fuel can be promptly shut off.

(b) Fire extinguishers provided for the protection of cooking appliances that use combustible cooking media (vegetable or animal oils and fats) shall be listed and labeled Class K fires.

(c) *Three-dimensional Class B Fires.* A three-dimensional Class B fire involves Class B materials in motion such as pouring, running or dripping flammable liquids and generally includes vertical as well as one or more horizontal surfaces. Fires of this nature are considered to be a special hazard. Selection of extinguishers for this type of hazard shall be made on the basis of recommendations by manufacturers of this specialized equipment. The system used to rate extinguishers on Class B fires (flammable liquids in depth) is not directly applicable to this type of hazard.

(d) *Water Soluble Flammable Liquid Fires (Polar Solvents).* Extinguishers used for the protection of water soluble flammable liquids, such as alcohols, acetones, esters, ketones, etc., shall be selected in accordance with Section 565.2. AFFF-type and FFFP-type fire extinguishers shall not be used for the protection of water soluble flammable liquids, such as alcohols, acetone, esters, ketones, etc., unless specifically referenced on the extinguisher nameplate.

(e) *Electronic Equipment Fires.* Extinguishers for the protection of delicate electronic equipment shall be selected from the following: carbon dioxide type or a halogenated agent type, or a distilled water mist type with a minimum Class A:C Rating.

(f) *In patient care areas and sleeping rooms of health care facilities, fire extinguishers, including the agents and expelling means, should be selected and utilized that would not be detrimental to patients and are appropriate for the type of fire expected, such as distilled water mist type fire extinguishers with a minimum 2-A:C rating.*

[California Code of Regulations, Title 19, Division 1, §567.8] Installation Temperatures.

Water-type (water, AFFF, FFFP) extinguishers shall not be installed in areas where temperatures are outside the range of 40°F to 120°F (4°C to 49°C). Other types shall not be installed in areas where temperatures are outside the range of -40°F to 120°F (-40°C to 49°C). Fire extinguishers shall not be exposed to temperatures outside of the range shown on the fire extinguisher label.

Exceptions:

1. Where fire extinguishers are installed in locations subject to temperatures outside these ranges, they shall be of a type approved and listed for the temperature to which they are exposed, or they shall be placed in an enclosure capable of maintaining the stipulated temperature range.
2. Fire extinguishers containing plain water only can be protected to temperatures as low as -40°F (-40°C) by the addition of an antifreeze stipulated on the extinguisher nameplate. Calcium chloride solutions shall not be used in stainless steel fire extinguishers.
3. Some fire extinguishers are approved or listed for use at temperatures as low as -65°F (-54°C).

[California Code of Regulations, Title 19, Division 1, §574.1] Frequency of Inspection.

Fire extinguishers shall be manually inspected when initially placed in service. Thereafter, extinguishers shall be manually inspected at least monthly by the building owner, occupant or his/her authorized agent, or electronically monitored. Fire extinguishers shall be inspected at more frequent intervals when circumstances require, as determined by the Authority Having Jurisdiction.

[California Code of Regulations, Title 19, Division 1, §574.2] Inspection Procedures.

(a) In addition to California Code of Regulations, Title 19, Division 1, Section 574.1, fire extinguishers shall be manually inspected in accordance with this section if they are located where any of the following conditions exist:

- (1) High frequency of fires in the past.
- (2) Extra (high) hazard areas.
- (3) Location that makes fire extinguishers susceptible to mechanical or physical damage.
- (4) Exposure to abnormal temperatures or corrosive atmospheres.

(b) Manual inspection of extinguishers shall include a check of at least the following items:

- (1) Located in designated place.
- (2) No obstruction to access or visibility.
- (3) Operating instructions on nameplate legible and facing outward.
- (4) Safety seals and tamper indicators not broken or missing.
- (5) Examine for obvious physical damage, corrosion, leakage or clogged nozzle.
- (6) Pressure gauge reading or indicator in the operable range or position.
- (7) Fullness determined by weighing or hefting.
- (8) For wheeled units, the condition of tires, wheels, carriage, hose and nozzle shall also be checked.
- (9) For nonrechargeable extinguishers using push-to-test pressure indicators, test the indicator.

(c) Electronic monitoring shall include monitoring of the following items:

- (1) Located in the designated place.
- (2) No obstruction to access or visibility.
- (3) Pressure gauge reading or indicator in the operable range or position.

[California Code of Regulations, Title 19, Division 1, §567.1] Operating Conditions.

Portable extinguishers shall be maintained in a fully charged and operable condition, and kept in their designated places at all times when they are not being used.

[California Code of Regulations, Title 19, Division 1, §574.3] Corrective Action.

When an inspection of any extinguisher reveals a deficiency in any of the conditions listed in Title 19, Division 1, Sections 574.2(b)(c), immediate corrective action shall be taken.

[California Code of Regulations, Title 19, Division 1, §574.4] Nonrechargeable Extinguishers.

When an inspection of any nonrechargeable fire extinguisher reveals a deficiency in any of the conditions listed in (3), (4), (5), (6), (7) or (9) of Title 19, Division 1, Section 574.2(b), it shall be discharged and removed from service.

Exception: Nonrechargeable extinguishers containing a halon agent shall be removed from service, not discharged, and returned to the manufacturer or local fire extinguisher distributor having the capability of recovering the halon agent.

[California Code of Regulations, Title 19, Division 1, §575.10] Out of Service.

Fire extinguishers removed from service for maintenance or recharge shall be replaced by fire extinguishers suitable for the type of hazard protected and shall be of at least equal rating.

[California Code of Regulations, Title 19, Division 1, §591.5] Replacement Extinguishers.

Portable fire extinguishers shall not be removed from the premises for hydrostatic testing or any other purpose, without first replacing the extinguisher with a unit rated for the hazard being protected. The customer's original unit shall be returned within 60 calendar days.

[California Code of Regulations, Title 19, Division 1, §596.7(a) and (b)] Removal of Tag.

(a) No person shall remove any tag, collar or label required by Title 19, Division 1, Chapter 3, Article 9 from a portable fire extinguisher except when service is performed.

(b) No person shall deface, modify or alter any tag collar or label required by California Code of Regulations, Title 19, Division 1, Chapter 3, Article 9 to be attached to any portable fire extinguisher.

[California Code of Regulations, Title 19, Division 1, §574.5(a) through (c)] Inspection Record Keeping.

(a) The fire extinguisher owner shall maintain records of all fire extinguishers inspected, including those extinguishers that were found to require corrective actions. Records shall be maintained until next required maintenance.

(b) At least monthly, the date the manual inspection was performed and the initials of the person performing the inspection shall be recorded on a tag or label attached to the fire extinguisher, or an inspection checklist maintained on file, or an electronic system (e.g., bar coding) that provides a permanent record.

(c) Fire extinguishers being inspected via electronic monitoring, whereby the extinguisher causes a signal at a control unit when a deficiency in any of the conditions

listed in California Code of Regulations, Title 19, Division 1, Section 574.2(c) occurs, shall provide record keeping in the form of an electronic event log at the control panel.

906.2.1 Certification of service personnel for portable fire extinguishers. Service personnel providing or conducting maintenance on portable fire extinguishers shall possess a valid certificate in accordance with California Code of Regulations, Title 19, Division 1, Chapter 3.

906.3 Size and distribution. The size and distribution of portable fire extinguishers shall be in accordance with Sections 906.3.1 through 906.3.4.

[California Code of Regulations, Title 19, Division 1, §567(a) through (k)] Distribution of Fire Extinguishers.

(a) The minimum number of fire extinguishers needed to protect a property shall be determined as outlined in this section. Additional extinguishers may be installed to provide more suitable protection.

(b) Fire extinguishers shall be provided for the protection of both the building structure and the occupancy hazards contained therein.

(c) Required building protection shall be provided by fire extinguishers suitable for Class A fires.

(d) Occupancy hazard protection shall be provided by fire extinguishers suitable for such Class A, B, C, D or K fire potentials as may be present.

(e) Extinguishers provided for building protection may be considered also for the protection of occupancies having a Class A fire potential.

(f) Buildings having an occupancy hazard subject to Class B and/or Class C fires shall have a standard complement of Class A fire extinguishers for building protection, plus additional Class B and/or Class C extinguishers. Where fire extinguishers have more than one letter classification (such as 2-A:20-B:C), they may be considered to satisfy the requirements of each letter class. When using multi-purpose extinguishers for the protection of Class B hazards, the maximum travel distances described in California Code of Regulations, Title 19, Division 1, Section 568, Table 2 must be observed.

(g) Rooms or areas shall be classified generally as light (low) hazard, ordinary (moderate) hazard or extra (high) hazard. Limited areas of greater or lesser hazard shall be protected as required.

(h) On each floor level, the area protected and the travel distances shall be based on fire extinguishers installed in accordance with California Code of Regulations, Title 19, Division 1, Section 568, Tables 2 and 3.

(i) Fire extinguishers shall not be obstructed or obscured from view.

Exception: In large rooms, and in certain locations where visual obstruction cannot be completely avoided, means shall be provided to indicate the fire extinguisher's location.

(j) Fire extinguishers shall be conspicuously located along normal paths of travel where they will be readily accessible and immediately available in the event of a fire.

(k) Where wheeled extinguishers are installed, aisles and doorways through which such extinguishers are to be moved shall have a clear and unobstructed width not less than one foot wider than the overall width of the extinguisher.

[California Code of Regulations, Title 19, Division 1, §568(a) through (e)] Fire Extinguisher Size and Placement for Class A Hazards.

(a) Minimum sizes of fire extinguishers for the listed grades of hazards shall be provided on the basis of California Code of Regulations, Title 19, Division 1, Section 568, Table 2, except as modified by California Code of Regulations, Title 19, Division 1, Section 568(d). Extinguishers shall be located so that the maximum travel distances shall not exceed those specified in California Code of Regulations, Title 19, Division 1, Section 568, Table 2, except as modified by California Code of Regulations, Title 19, Division 1, Section 568(d).

(b) Certain smaller fire extinguishers which are charged with a multipurpose dry chemical or halogenated agent are rated on Class B and Class C fires, but having insufficient effectiveness to earn the minimum 1-A rating even though they have value in extinguishing smaller Class A fires. They shall not be used to meet the requirements of California Code of Regulations, Title 19, Division 1, Section 568, Table 2.

TITLE 19, DIVISION 1, SECTION 568, TABLE 2

	Light (Low) Hazard Occupancy	Ordinary (Moderate) Hazard Occupancy	Extra (High) Hazard Occupancy
Minimum rated single extinguisher	2-A	2-A	4-A*
Maximum floor area per unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum floor area for extinguisher	11,250 square feet	11,250 square feet	11,250 square feet
Maximum travel distance to extinguisher	75 feet	75 feet	75 feet

* Two 2½-gallon (9.46 L) water-type extinguishers can be used to fulfill the requirement of one 4-A rated extinguisher.

Note: 1 foot = 0.305 m, 1 square foot = 0.0929 m².

(c) Extinguishers as specified in California Code of Regulations, Title 19, Division 1, Section 568, Table 2 may be replaced by uniformly spaced 1½ inch (3.810 cm) hose stations for use by the occupants of the building. When hose stations are so provided, they shall conform to Part 9, Title 24, California Code of Regulations, Chapter 9. The location of hose stations and the placement of fire extinguishers shall be in such a manner that the hose stations do not replace more than every other extinguisher.

(d) Where the floor area of a building is less than that specified in California Code of Regulations, Title 19, Division 1, Section 568, Table 2, at least one extinguisher of the minimum size recommended shall be provided.

(e) The protection requirements may be fulfilled with extinguishers of a higher rating provided the travel distance from anywhere in the building to such larger extinguishers shall not exceed 75 feet (22.7 m), as shown in California Code of Regulations, Title 19, Division 1, Section 568, Table 2 above.

[California Code of Regulations, Title 19, Division 1, §569(a) through (c)] Fire Extinguisher Size and Placement for Class B Fires Other than for Fires in Flammable Liquids of Appreciable Depth.

(a) Minimum sizes of fire extinguishers for the listed grades of hazard shall be provided on the basis of California Code of Regulations, Title 19, Division 1, Section 569, Table 3. Extinguishers shall be located so that the maximum travel distances from anywhere in the building shall not exceed those specified in the table used.

Exception: Extinguishers of lesser rating, desired for small specific hazards within the general hazard area, may be used, but shall not be considered as fulfilling any part of the requirements of California Code of Regulations, Title 19, Division 1, Section 569, Table 3.

TITLE 19, DIVISION 1, SECTION 569, TABLE 3

Type of Hazard	Basic Minimum Extinguisher Rating	Maximum Travel Distance to Extinguishers (in feet)	(in meters)
Light (low)	5B	30	9.15
	10B	50	15.25
Ordinary (moderate)	10B	30	9.15
	20B	50	15.25
Extra (high)	40B	30	9.15
	80B	50	15.25

Note 1. The specified rating does not imply that fires of the magnitudes indicated by these ratings will occur, but rather to give the operators more time and agent to handle difficult spill fires that may occur.

Note 2. For fires involving water-soluble flammable liquids, see California Code of Regulations, Title 19, Division 1, Section 566(d).

Note 3. For specific hazard applications, see California Code of Regulations, Title 19, Division 1, Section 566.

(b) Two or more extinguishers of lower rating shall not be used to fulfill the protection requirements of California Code of Regulations, Title 19, Division 1, Section 569, Table 3.

(c) The protection requirements may be fulfilled with extinguishers of high ratings, provided the travel distance to such larger extinguishers shall not exceed 50 feet (15.25 m), as shown in California Code of Regulations, Title 19, Division 1, Section 569, Table 3.

[California Code of Regulations, Title 19, Division 1, §570(a) through (e)] Fire Extinguisher Size and Placement for Class B Fires in Flammable Liquids of Appreciable Depth.

(a) Portable fire extinguishers shall not be installed as the sole protection for flammable liquid hazards of appreciable depth [greater than 1/4 inch (0.64 cm)] where the surface area exceeds 10 square feet (0.93 m²).

Exception: Where personnel who are trained in extinguishing fires in the protected hazards are available on the premises, the maximum surface area shall not exceed 20 square feet. (1.86 m²).

(b) For flammable liquid hazards of appreciable depth, a Class B fire extinguisher shall be provided on the basis of at least two numerical units of Class B extinguishing potential per square foot (0.0929 m²) of flammable liquid surface of the largest hazard area. For fires involving cooking grease or water-soluble flammable liquids, see California Code of Regulations, Title 19, Division 1, Section 566(b) and 566(d).

Exception: AFFF- or FFFP-type extinguishers may be provided on the basis of a 1B rating of protection per square foot of hazard.

(c) Two or more extinguishers of lower ratings shall not be used in lieu of the extinguisher required for the largest hazard area.

Exception: Up to three AFFF or FFFP extinguishers may be used to fulfill the requirements provided the sum of the Class B ratings meets or exceeds the value required for the largest hazard area.

(d) Travel distances for portable extinguishers shall not exceed 50 feet (15.25 m) as shown in California Code of Regulations, Title 19, Division 1, Section 569, Table 3.

(e) Scattered or widely separated hazards shall be individually protected. An extinguisher in the proximity of a hazard shall be carefully located to be accessible in the presence of a fire without undue danger to the operator.

[California Code of Regulations, Title 19, Division 1, §571(a)] Fire Extinguisher Size and Placement for Class C Hazards.

(a) Fire extinguishers with Class C ratings shall be required where energized electrical equipment can be encountered which would require a nonconducting extinguishing medium. This requirement includes situations where fire either directly involves or surrounds electrical equipment. Since the fire itself is a Class A or Class B hazard, the fire extinguishers shall be sized and located on the basis of the anticipated Class A or Class B hazard.

Note: Electrical equipment should be de-energized as soon as possible to prevent reigniting.

906.3.1 Class A fire hazards. The minimum sizes and distribution of portable fire extinguishers for occupancies that involve primarily Class A fire hazards shall comply with Table 906.3(1).

906.3.2 Class B fire hazards. Portable fire extinguishers for occupancies involving flammable or combustible

liquids with depths less than or equal to 0.25 inch (6.4 mm) shall be selected and placed in accordance with Table 906.3(2).

Portable fire extinguishers for occupancies involving flammable or combustible liquids with a depth of greater than 0.25 inch (6.4 mm) shall be selected and placed in accordance with California Code of Regulations, Title 19, Division 1, Chapter 3.

906.3.3 Class C fire hazards. Portable fire extinguishers for Class C fire hazards shall be selected and placed on the basis of the anticipated Class A or B hazard.

906.3.4 Class D fire hazards. Portable fire extinguishers for occupancies involving combustible metals shall be selected and placed in accordance with California Code of Regulations, Title 19, Division 1, Chapter 3.

**TABLE 906.3(1)
FIRE EXTINGUISHERS FOR CLASS A FIRE HAZARDS**

	LIGHT (Low) HAZARD OCCUPANCY	ORDINARY (Moderate) HAZARD OCCUPANCY	EXTRA (High) HAZARD OCCUPANCY
Minimum-rated single extinguisher	2-A ^c	2-A	4-A ^a
Maximum floor area per unit of A	3,000 square feet	1,500 square feet	1,000 square feet
Maximum floor area for extinguisher ^b	11,250 square feet	11,250 square feet	11,250 square feet
Maximum distance of travel to extinguisher	75 feet	75 feet	75 feet

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon = 3.785 L.

- a. Two 2 1/2-gallon water-type extinguishers shall be deemed the equivalent of one 4-A rated extinguisher.
- b. California Code of Regulations, Title 19, Division 1, Chapter 3 concerning application of the maximum floor area criteria.
- c. Two water-type extinguishers, each with a 1-A rating, shall be deemed the equivalent of one 2-A rated extinguisher for Light (Low) Hazard Occupancies.

**TABLE 906.3(2)
FIRE EXTINGUISHERS FOR FLAMMABLE OR COMBUSTIBLE LIQUIDS WITH DEPTHS OF LESS THAN OR EQUAL TO 0.25 INCH^a**

TYPE OF HAZARD	BASIC MINIMUM EXTINGUISHER RATING	MAXIMUM DISTANCE OF TRAVEL TO EXTINGUISHERS (feet)
Light (Low)	5-B	30
	10-B	50
Ordinary (Moderate)	10-B	30
	20-B	50
Extra (High)	40-B	30
	80-B	50

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. For requirements on water-soluble flammable liquids and alternative sizing criteria, see California Code of Regulations, Title 19, Division 1, Chapter 3.

906.4 Cooking equipment fires. Fire extinguishers provided for the protection of cooking equipment shall be of an approved type compatible with the automatic fire-extinguishing system agent. Cooking equipment involving solid fuels or vegetable or animal oils and fats shall be protected by a Class K-rated portable extinguisher in accordance with Sections 906.1, Item 2, 906.4.1 and 906.4.2 as applicable.

[California Code of Regulations, Title 19, Division 1, §573(a) through (c)] Fire Extinguisher Size and Placement for Commercial Cooking Operations.

(a) Fire extinguishers with a Class K rating shall be provided for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats).

(b) Maximum travel distance shall not exceed 30 feet (9.15 m) from the hazard to the extinguishers.

(c) Additional fire extinguishers, required for the control of other classes of fires, shall be provided for commercial cooking areas as required by California Code of Regulations, Title 19, Division 1, Section 567.

906.4.1 Portable fire extinguishers for solid fuel cooking appliances. Solid fuel cooking appliances, whether or not under a hood, with fireboxes 5 cubic feet (0.14 m³) or less in volume shall have a minimum 2.5-gallon (9 L) or two 1.5-gallon (6 L) Class K wet-chemical portable fire extinguishers located in accordance with Section 906.1.

906.4.2 Class K portable fire extinguishers for deep fat fryers. Where hazard areas include deep fat fryers, listed Class K portable fire extinguishers shall be provided as follows:

1. For up to four fryers having a maximum cooking medium capacity of 80 pounds (36.3 kg) each: one Class K portable fire extinguisher of a minimum 1.5-gallon (6 L) capacity.
2. For every additional group of four fryers having a maximum cooking medium capacity of 80 pounds (36.3 kg) each: one additional Class K portable fire extinguisher of a minimum 1.5-gallon (6 L) capacity shall be provided.
3. For individual fryers exceeding 6 square feet (0.55 m²) in surface area: Class K portable fire extinguishers shall be installed in accordance with the extinguisher manufacturer's recommendations.

906.5 Conspicuous location. Portable fire extinguishers shall be located in conspicuous locations where they will have ready access and be immediately available for use. These locations shall be along normal paths of travel, unless the fire code official determines that the hazard posed indicates the need for placement away from normal paths of travel.

[California Code of Regulations, Title 19, Division 1, §567.5] Physical Damage Protection.

Extinguishers installed under conditions where they are subject to physical damage, (e.g., from impact, vibration, the environment) shall be adequately protected.

906.6 Unobstructed and unobscured. Portable fire extinguishers shall not be obstructed or obscured from view. In rooms or areas in which visual obstruction cannot be completely avoided, means shall be provided to indicate the locations of extinguishers.

906.7 Hangers and brackets. Hand-held portable fire extinguishers, not housed in cabinets, shall be installed on the hangers or brackets supplied. Hangers or brackets shall be securely anchored to the mounting surface in accordance with the manufacturer's installation instructions.

[California Code of Regulations, Title 19, Division 1, §567.3] Installation.

Portable fire extinguishers other than wheeled types shall be securely installed on the hanger or in the bracket supplied or placed in cabinets or wall recesses. The hanger or bracket shall be securely and properly anchored to the mounting surface in accordance with the manufacturer's instructions. Wheeled-type fire extinguishers shall be located in a designated location.

[California Code of Regulations, Title 19, Division 1, §567.4] Brackets.

Extinguishers installed under conditions where they are subject to dislodgement shall be installed in brackets specifically designed to cope with this problem.

[California Code of Regulations, Title 19, Division 1, §567.6] Mounting.

Fire extinguishers having a gross weight not exceeding 40 pounds (18.14 kg) shall be installed so that the top of the fire extinguisher is not more than 5 feet (1.53 m) above the floor. Fire extinguishers having a gross weight greater than 40 pounds (18.14 kg) (except wheeled types) shall be so installed that the top of the fire extinguisher is not more than 3 1/2 feet (1.07 m) above the floor. In no case shall the clearance between the bottom of the extinguisher and the floor be less than 4 inches (10.2 cm).

906.8 Cabinets. Cabinets used to house portable fire extinguishers shall not be locked.

Exceptions:

1. Where portable fire extinguishers subject to malicious use or damage are provided with a means of ready access.
2. In Group I-3 occupancies and in mental health areas in Group I-2 occupancies, access to portable fire extinguishers shall be permitted to be locked or to be located in staff locations provided that the staff has keys.

[California Code of Regulations, Title 19, Division 1, §567.2] Cabinets.

Cabinets housing extinguishers shall not be locked.

Exception: Where extinguishers are subject to malicious use, locked cabinets may be used provided they include a means of emergency access and are approved by the authority having jurisdiction.

[California Code of Regulations, Title 19, Division 1, §567.7] Sealed Cabinets.

Where extinguishers are installed in closed cabinets that are exposed to elevated temperatures, the cabinets shall be provided with screened openings and drains.

906.9 Extinguisher installation. The installation of portable fire extinguishers shall be in accordance with Sections 906.9.1 through 906.9.3.

906.9.1 Extinguishers weighing 40 pounds or less. Portable fire extinguishers having a gross weight not exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 5 feet (1524 mm) above the floor.

906.9.2 Extinguishers weighing more than 40 pounds. Hand-held portable fire extinguishers having a gross weight exceeding 40 pounds (18 kg) shall be installed so that their tops are not more than 3.5 feet (1067 mm) above the floor.

906.9.3 Floor clearance. The clearance between the floor and the bottom of installed hand-held portable fire extinguishers shall be not less than 4 inches (102 mm).

906.10 Wheeled units. Wheeled fire extinguishers shall be conspicuously located in a designated location.

SECTION 907 FIRE ALARM AND DETECTION SYSTEMS

907.1 General. This section covers the application, installation, performance and maintenance of fire alarm systems and their components in new and existing buildings and structures. The requirements of Section 907.2 are applicable to new buildings and structures. The requirements of Section 907.9 are applicable to existing buildings and structures.

907.1.1 Construction documents. Construction documents for fire alarm systems shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code; the *California Building Code*; and relevant laws, ordinances, rules and regulations, as determined by the fire code official.

907.1.2 Fire alarm shop drawings. Shop drawings for fire alarm systems shall be prepared in accordance with NFPA 72 and submitted for review and approval prior to system installation. *All plans and shop drawings shall use the symbols identified in NFPA 170, Standard for Fire Safety and Emergency Symbols.*

Exception: Other symbols are allowed where approved by the enforcing agency.

907.1.3 Equipment. Systems and components shall be *California State Fire Marshal* listed and approved in accordance with *California Code of Regulations, Title 19, Division 1* for the purpose for which they are installed.

907.1.4 Fire-walls and fire barrier walls. For the purpose of Section 907, fire walls and fire barrier walls shall not define separate buildings.

907.1.5 Fire alarm use. A fire alarm system shall not be used for any purpose other than fire warning or mass notification and where permitted by NFPA 72.

907.2 Where required—new buildings and structures. An approved fire alarm system installed in accordance with the provisions of this code and NFPA 72 shall be provided in new buildings and structures in accordance with Sections 907.2.1 through 907.2.29 and provide occupant notification in accordance with Section 907.5, unless other requirements are provided by another section of this code.

Not fewer than one manual fire alarm box shall be provided in an approved location to initiate a fire alarm signal for fire alarm systems employing automatic fire detectors or waterflow detection devices. Where other sections of this code allow elimination of fire alarm boxes due to sprinklers or automatic fire alarm systems, a single fire alarm box shall be installed at a location approved by the enforcing agency.

Exceptions:

1. The manual fire alarm box is not required for fire alarm control units systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring.
2. The manual fire alarm box is not required for Group R-2 occupancies unless required by the fire code official to provide a means for fire watch personnel to initiate an alarm during a sprinkler system impairment event. Where provided, the manual fire alarm box shall not be located in an area that is open to the public.
3. The manual fire alarm box is not required to be installed when approved by the fire code official.

907.2.1 Group A. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group A occupancies where the occupant load due to the assembly occupancy is 300 or more, or where the Group A occupant load is more than 100 persons above or below the lowest level of exit discharge. Group A occupancies not separated from one another in accordance with Section 707.3.10 of the *California Building Code* shall be considered as a single occupancy for the purposes of applying this section. Portions of Group E occupancies occupied for assembly purposes with an occupant load of less than 1000 shall be provided with a fire alarm system as required for the Group E occupancy.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

Every Group A building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not necessarily be limited to, every community college and university.

Exception: Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.

907.2.1.1 System initiation in Group A occupancies with an occupant load of 1,000 or more. Activation of the fire alarm in Group A occupancies with an occupant load of 1,000 or more shall initiate a signal using an emergency voice/alarm communications system in accordance with Section 907.5.2.2. *For Group A occupancies with an occupant load of 10,000 or more, see Section 907.2.1.3.*

Exception: Where approved, the prerecorded announcement is allowed to be manually deactivated for a period of time, not to exceed 3 minutes, for the sole purpose of allowing a live voice announcement from an approved, constantly attended location.

907.2.1.2 Emergency voice/alarm communication system captions. Stadiums, arenas and grandstands required to caption audible public announcements shall be in accordance with Section 907.5.2.2.4.

907.2.1.3 Public address system. Pursuant to Health and Safety Code Section 13108.9, for all buildings or structures constructed on or after July 1, 1991, which are intended for public assemblies of 10,000 or more persons, a public address system with an emergency backup power system shall be required.

907.2.2 Group B. A manual fire alarm system, which activates the occupant notification system in accordance with Section 907.5, shall be installed in Group B occupancies where one of the following conditions exists:

1. The combined Group B occupant load of all floors is 500 or more.
2. The Group B occupant load is more than 100 persons above or below the lowest level of exit discharge.
3. The fire area contains an ambulatory care facility.
4. For Group B occupancies containing educational facilities, see Section 907.2.2.2.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

907.2.2.1 Ambulatory care facilities. Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public corridors and elevator lobbies.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 provided that the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

907.2.2.2 Group B Educational facilities. Every Group B building used for educational purposes shall be provided with a manual or automatic fire alarm system. This provision shall apply to, but shall not

necessarily be limited to, every community college and university.

Exception: Privately owned trade or vocational schools or any firm or company which provides educational facilities and instructions for its employees.

907.2.3 Group E. A manual and automatic fire alarm system that initiates the occupant notification signal utilizing an emergency voice/alarm communication system meeting the requirements of Section 907.5.2.2 and installed in accordance with Section 907.6 shall be installed in Group E occupancies. *with an occupant load of 50 or more persons or containing more than one classroom or one or more rooms used for Group E or I-4 child-care purposes in accordance with this section.* Where automatic sprinkler systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system. *One additional manual fire alarm box shall be located at the administration office or location approved by the AHJ.*

Exceptions:

1. For public school state funded construction projects see Section 907.2.29.
2. For public schools see Section 907.2.3.7.
3. For private schools see Section 907.2.3.8.

907.2.3.1 System connection. Where more than one fire alarm control unit is used at the school campus, they shall be interconnected and shall operate all notification appliances.

Exception: Interconnection of fire alarm control units is not required when all of the following are provided:

1. Buildings that are separated a minimum of 20 feet (6096 mm) and in accordance with the California Building Code; and
2. There is a method of two-way communication between each classroom and the school administrative office approved by the fire enforcing agency; and
3. A method of manual activation of each fire alarm system is provided.

907.2.3.2 Assemblies located within a Group E occupancy. Assembly occupancies with an occupant load of less than 1,000 and located within a Group E occupancy campus or building shall be provided with a fire alarm system as required for the Group E occupancy.

907.2.3.3 Notification. The fire alarm system notification shall comply with the requirements of Section 907.5.

907.2.3.4 Annunciation. Annunciation of the fire alarm system shall comply with the requirements of Section 907.6.4.1.

907.2.3.5 Monitoring. School fire alarm systems shall be monitored in accordance with Section 907.6.6.3.

907.2.3.6 Automatic fire alarm system. Automatic detection shall be provided in accordance with this section.

907.2.3.6.1 Smoke detectors. Smoke detectors shall be installed at the ceiling of every room and in “ceiling-plenums” utilized for environmental air. Where the ceiling is attached directly to the underside of the roof structure, smoke detectors shall be installed on the ceiling only.

Exception: Where the environment or ambient conditions exceed smoke detector installation guidelines, heat detectors or fire sprinklers shall be used.

907.2.3.6.2 Heat detectors. Heat detectors shall be installed in combustible spaces where sprinklers or smoke detectors are not installed.

907.2.3.7 Public school campuses. An automatic fire alarm system in compliance with Section 907.2.3 shall be provided in new buildings for all occupancies on Kindergarten through 12th grade public school campuses.

Exceptions:

1. A manual fire alarm system may be provided for a relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. Also see CCR, Title 24, Part 1, California Administrative Code, Section 4-314 for definition of relocatable building.
2. A fire alarm system is not required for detached buildings designed and used for non-instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

- Concession Stand
- Press Box
- Restroom Facilities
- Shade Structure
- Snack Bar
- Storage Building
- Ticket Booth

907.2.3.8 Private schools. An automatic fire alarm system shall be provided in new buildings of private schools.

Exception: Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

907.2.3.9 Day care, Group E.

907.2.3.9.1 An automatic fire alarm system shall be provided in all buildings used as or containing a Group E day care.

Exception: Automatic detection devices are not required where an approved automatic sprinkler system is installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate on sprinkler water flow and manual activation is provided from a normally occupied location.

907.2.3.9.2 Smoke detectors shall be installed in every room used for sleeping or napping.

907.2.3.10 Day care, Group E or Group I-4 located on a public school campus. An automatic fire alarm system shall be provided in all buildings used as or containing a Group E or Group I-4 day care.

907.2.4 Group F. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group F occupancies where both of the following conditions exist:

1. The Group F occupancy is two or more stories in height.
2. The Group F occupancy has a combined occupant load of 500 or more above or below the lowest level of exit discharge.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

907.2.5 Group H. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group H-5 occupancies and in occupancies used for the manufacture of organic coatings. An automatic smoke detection system shall be installed for highly toxic gases, organic peroxides and oxidizers in accordance with Chapters 60, 62 and 63, respectively.

907.2.5.1 Group H occupancies located on the 11th story and above. Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit on the 11th story and above.

907.2.6 Group I. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group I occupancies. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in accordance with Sections 907.2.6.1, 907.2.6.2 and 907.2.6.3.3.

Exceptions:

1. Large family day care.
2. Occupant notification systems are not required to be activated where private mode signaling installed in accordance with NFPA 72 is approved by the fire code official and staff evacuation responsibilities are included in the fire safety and evacuation plan required by Section 404.

➔ **907.2.6.1 Reserved.**

907.2.6.2 Group I-2 and Group I-2.1. A manual and automatic fire alarm system shall be installed in Group I-2 and I-2.1 occupancies. Where automatic fire suppression systems or smoke detectors are installed, such systems or detectors shall be connected to the building fire alarm system.

Exception: Where an entire facility is used for the housing of persons, none of whom are physically or mentally handicapped or nonambulatory, and are between the ages of 18 and 64, the buildings or structures comprising such facility shall be exempt from the provisions of this subsection relating to the installation of an automatic fire alarm system.

907.2.6.2.1 Notification. The fire alarm notification system shall be in accordance with Section 907.5.2.5.

907.2.6.2.2 Automatic fire detection. Smoke detectors shall be provided in accordance with this section.

1. In patient and client sleeping rooms. Actuation of such detectors shall cause a visual display on the corridor side of the room in which the detector is located and shall cause an audible and visual alarm at the respective nurses' station. A nurse call system listed for this function is an acceptable means of providing the audible and visual alarm at the respective nurses' station and corridor room display. Operation of the smoke detector shall not include any alarm verification feature.

Exception: In patient and client rooms equipped with existing automatic door closers having integral smoke detector, the integral detector is allowed to substitute for the room smoke detector, provided it meets all the required alerting functions.

2. Group I-2 nurses' stations. A minimum of one (1) smoke detector shall be installed at the nurses' station and centrally located.
3. In waiting areas and corridors onto which they open, in the same smoke compartment, in accordance with Section 407.2.1 of the California Building Code.
4. In areas where patients are restrained, smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke compartments and in adjacent smoke compartments where occupants of those compartments utilize the same means of egress.

907.2.6.3 Group I-3 occupancies. Group I-3 occupancies shall be equipped with a manual fire alarm system and automatic smoke detection system installed for alerting staff.

Exception: An automatic smoke detection system is not required within temporary holding cells.

907.2.6.3.1 System initiation. Actuation of an automatic fire-extinguishing system, automatic sprinkler

system, a manual fire alarm box or a fire detector shall initiate an approved fire alarm signal that automatically notifies staff.

907.2.6.3.2 Manual fire alarm boxes. Manual fire alarm boxes are not required to be located in accordance with Section 907.4.2 where the fire alarm boxes are provided at staff-attended locations having direct supervision over areas where manual fire alarm boxes have been omitted.

907.2.6.3.2.1 Manual fire alarms boxes in detainee areas. Manual fire alarm boxes are allowed to be locked in areas occupied by detainees, provided that staff members are present within the subject area and have keys readily available to operate the manual fire alarm boxes.

907.2.6.3.3 Automatic smoke detection system. An automatic smoke detection system shall be installed throughout resident housing areas, including sleeping units and contiguous day rooms, group activity spaces and other common spaces normally open to inmates.

Exceptions:

1. Other approved smoke detection arrangements may be used to prevent damage or tampering or for other purposes provided the function of detecting any fire is fulfilled and the location of the detectors is such that the speed of detection will be equivalent to that provided by the spacing and location required in accordance with NFPA 72 as referenced in Chapter 80. This may include the location of detectors in return air ducts from cells, behind grilles or in other locations. Spot type, combination duct and open area smoke detectors may be used when located not more than 14 inches (356 mm) from the return air grill. For initiation and annunciation purposes, these detectors may be combined in groups of four. The fire code official having jurisdiction, however, must approve the proposed equivalent performance of the design.
2. For detention housing and/or mental health housing area(s), including correctional medical and mental health uses, automatic smoke detection system in sleeping units shall not be required when all of the following conditions are met:
 - 2.1. All rooms, including the inmate cells, are provided with an automatic sprinkler system in accordance with Section 903.3.1.1.
 - 2.2. Building is continuously staffed by a correctional officer at all times.
3. Smoke detectors are not required to be installed in inmate cells with two or fewer occupants in detention facilities which do

not have a correctional medical and mental health use.

4. *Smoke detectors are not required to be installed in inmate day rooms of detention facilities where 24-hour direct visual supervision is provided by a correctional officer(s) and a manual fire alarm box is located in the control room.*

907.2.6.3.4 System annunciation. *A staff alerting fire alarm shall sound at all staff control stations on the floor of activation and an audible and visual signal shall be indicated on an annunciator at the facility control center upon activation of any automatic extinguishing system, automatic detection system or any smoke detector or manual actuating or initiating device. In addition, where there are staff-control stations on the floor, an audible, visual and manual alarm shall be located in each staff control station.*

Fire and trouble signals of fire alarm systems and sprinkler water-flow and supervisory signals of extinguishing systems shall be annunciated in an area designated as the facility control center which shall be constantly attended by staff personnel. All such signals shall produce both an audible signal and visual display at the facility control center indicating the building, floor zone or other designated area from which the signal originated, in accordance with Section 907.6.4.

All local detention facilities within the scope of Section 6031.4 of the Penal Code shall have an automatic smoke detection system. A manual fire alarm-initiating device shall be installed in all guard control stations and shall be capable of alerting personnel in a central control point to the presence of fire or smoke within the facility.

907.2.6.4 Group I-4 occupancies. *An automatic smoke detection system shall be installed throughout the Group I-4 occupancies, including contiguous day rooms, group activity spaces and other common spaces normally occupied by the clients. Group I-4 facilities located above the first story shall comply with the provisions of Section 436.1.*

907.2.6.5 Large family day care. *Every large family day-care home shall be provided with at least one manual fire alarm box at a location approved by the enforcing agency. Such device shall actuate a fire alarm signal, which shall be audible throughout the facility at a minimum level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel or be electrically supervised or provided with emergency power. Such device or devices shall be attached to the structure and must be a device that is listed and approved by the Office of the State Fire Marshal.*

907.2.7 Group M. A manual fire alarm system that activates the occupant notification system in accordance with

Section 907.5 shall be installed in Group M occupancies where one of the following conditions exists:

1. The combined Group M occupant load of all floors is 500 or more persons.
2. The Group M occupant load is more than 100 persons above or below the lowest level of exit discharge.

Exceptions:

1. A manual fire alarm system is not required in covered or open mall buildings complying with Section 402 of the *California Building Code*.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will automatically activate throughout the notification zones upon sprinkler water flow.

907.2.7.1 Occupant notification. During times that the building is occupied, the initiation of a signal from a manual fire alarm box or from a waterflow switch shall not be required to activate the alarm notification appliances when an alarm signal is activated at a constantly attended location from which evacuation instructions shall be initiated over an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

907.2.8 Group R-1. Fire alarm systems and smoke alarms shall be installed in Group R-1 occupancies as required in Sections 907.2.8.1 through 907.2.8.3.

907.2.8.1 Manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-1 occupancies.

Exceptions:

1. A manual fire alarm system is not required in buildings not more than two stories in height where all individual sleeping units and contiguous attic and crawl spaces to those units are separated from each other and public or common areas by not less than 1-hour fire partitions and each individual sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required throughout the building where all of the following conditions are met:
 - 2.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
 - 2.2. The notification appliances will activate upon sprinkler water flow.
 - 2.3. Not fewer than one manual fire alarm box is installed at an approved location.

907.2.8.2 Automatic smoke detection system. An automatic smoke detection system that activates the

occupant notification system in accordance with Section 907.5 shall be installed throughout all interior corridors serving sleeping units.

Exception: An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

907.2.8.3 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

907.2.9 Group R-2, R-2.1 and R-2.2. Fire alarm systems and smoke alarms shall be installed in Group R-2 and R-2.1 occupancies as required in Sections 907.2.9.1 and 907.2.9.3 through 907.2.10.2.1.1. *Group R-2.2 shall be equipped throughout with an automatic fire alarm system and shall have a manual fire alarm pull station at the 24-hour staff watch office..*

907.2.9.1 Manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies where any of the following conditions apply:

1. Any dwelling unit or sleeping unit is located three or more stories above the lowest level of exit discharge.
2. Any dwelling unit or sleeping unit is located more than one story below the highest level of exit discharge of exits serving the dwelling unit or sleeping unit.
3. The building contains more than 16 dwelling units or sleeping units.
4. *Congregate residences with more than 16 occupants.*

Exceptions:

1. A fire alarm system is not required in buildings not more than two stories in height where all dwelling units or sleeping units and contiguous attic and crawl spaces are separated from each other and public or common areas by not less than 1-hour fire partitions and each dwelling unit or sleeping unit has an exit directly to a public way, egress court or yard.
2. Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and the occupant notification appliances will automatically activate throughout the notification zones upon a sprinkler water flow.
3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved automatic sprinkler system installed

in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1027.6, Exception 3.

907.2.9.2 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

907.2.9.3 Group R-2 college and university buildings. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-2 occupancies operated by a college or university for student or staff housing in all of the following locations:

1. Common spaces outside of dwelling units and sleeping units.
2. Laundry rooms, mechanical equipment rooms and storage rooms.
3. All interior corridors serving sleeping units or dwelling units.

Exception: An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units or dwelling units and where each sleeping unit or dwelling unit either has a means of egress door opening directly to an exterior exit access that leads directly to an exit or a means of egress door opening directly to an exit.

Required smoke alarms in dwelling units and sleeping units in Group R-2 occupancies operated by a college or university for student or staff housing shall be interconnected with the fire alarm system in accordance with NFPA 72.

907.2.10 Group S. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group S public- and self-storage occupancies three stories or greater in height for interior corridors and interior common areas. Visible notification appliances are not required within storage units.

Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

907.2.11 Single- and multiple-station smoke alarms. Listed single- and multiple-station smoke alarms complying with UL 217 shall be installed in accordance with Sections 907.2.11.1 through 907.2.11.7 and NFPA 72.

Exception: *For Group R occupancies. A fire alarm system with smoke detectors located in accordance with this section may be installed in lieu of smoke alarms. Upon actuation of the detector, only those noti-*

fication appliances in the dwelling unit or guest room where the detector is actuated shall activate.

907.2.11.1 Group R-1. Single- or multiple-station smoke alarms shall be installed in all of the following locations in Group R-1:

1. In sleeping areas.
2. In every room in the path of the means of egress from the sleeping area to the door leading from the sleeping unit.
3. In each story within the sleeping unit, including basements. For sleeping units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.

See Section 907.2.10.8 for specific location requirements.

907.2.11.2 Groups R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4. Single- or multiple-station smoke alarms shall be installed and maintained in Groups R-2, R-2.1, R-2.2, R-3, R-3.1 and R-4 regardless of occupant load at all of the following locations:

1. On the ceiling or wall outside of each separate sleeping area in the immediate vicinity of bedrooms.
2. In each room used for sleeping purposes.
3. In each story within a dwelling unit, including basements but not including crawl spaces and uninhabitable attics. In dwellings or dwelling units with split levels and without an intervening door between the adjacent levels, a smoke alarm installed on the upper level shall suffice for the adjacent lower level provided that the lower level is less than one full story below the upper level.
4. In a Group R-3.1 occupancies, in addition to the above, smoke alarms shall be provided throughout the habitable areas of the dwelling unit except kitchens.

See Section 907.2.10.8 for specific location requirements.

907.2.11.2.1 Licensed Group R-2.1 occupancies. Licensed Group R-2.1 occupancies housing more than six nonambulatory, elderly clients shall be provided with an approved manual and automatic fire alarm system.

Exceptions: Buildings housing nonambulatory clients on the first story only and which are protected throughout by the following:

1. An approved and supervised automatic sprinkler system, as specified in Sections 903.3.1.1 or 903.3.1.2, which upon activation will initiate the fire alarm system to notify all occupants.

2. A manual fire alarm system.

3. Smoke alarms required by Section 907.2.11.

907.2.11.2.1.1 Smoke alarms. Single- and multiple-station smoke alarms shall be installed in accordance with Section 907.2.11.

907.2.11.2.2 Group I-4 occupancies. Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms.

907.2.11.2.3 Group R-3.1. In all facilities housing a bedridden client, smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms shall be electrically interconnected so as to cause all smoke alarms to sound a distinctive alarm signal upon actuation of any single smoke alarm. Such alarm signal shall be audible throughout the facility at a minimal level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel, or be electronically supervised or provided with emergency power.

907.2.11.2.4 Smoke alarms. Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms that no longer function shall be replaced.

907.2.11.2.5 Existing Group R occupancies. See the California Residential Code for existing Group R-3 occupancies or Chapter 11 of the California Fire Code for all other existing Group R occupancies.

907.2.11.2.6 Group R-4. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in Group R-4 occupancies housing non-ambulatory clients.

907.2.11.3 Installation near cooking appliances. See Section 907.2.11.8.

907.2.11.4 Installation near bathrooms. See Section 907.2.11.8.

907.2.11.5 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling unit or sleeping unit in Group R occupancies, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

907.2.11.6 Power source. In new construction, and in newly classified Group R-3.1 occupancies, required smoke alarms shall receive their primary power from

the building wiring where such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery back-up shall be connected to an emergency electrical system in accordance with Section 1203. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exception: Smoke alarms are not required to be equipped with battery backup where they are connected to an emergency electrical system that complies with Section 603.

907.2.11.7 Smoke detection system. Smoke detectors listed in accordance with UL 268 and provided as part of the building fire alarm system shall be an acceptable alternative to single- and multiple-station smoke alarms and shall comply with the following:

1. The fire alarm system shall comply with all applicable requirements in Section 907.
2. Activation of a smoke detector in a dwelling unit or sleeping unit shall initiate alarm notification in the dwelling unit or sleeping unit in accordance with Section 907.5.2.
3. Activation of a smoke detector in a dwelling unit or sleeping unit shall not activate alarm notification appliances outside of the dwelling unit or sleeping unit, provided that a supervisory signal is generated and monitored in accordance with Section 907.6.6.

907.2.11.8 Specific location requirements.

Extract from NFPA 72 Section 29.11.3.4 Specific Location Requirements.*

This extract has been provided by NFPA for the Office of the State Fire Marshal adoption by reference as follows:

29.11.3.4 Specific location requirements. *The installation of smoke alarms and smoke detectors shall comply with the following requirements:*

- (1) Smoke alarms and smoke detectors shall not be located where ambient conditions, including humidity and temperature, are outside the limits specified by the manufacturer's published instructions.*
- (2) Smoke alarms and smoke detectors shall not be located within unfinished attics or garages or in other spaces where temperatures can fall below 40°F (4°C) or exceed 100°F (38°C).*
- (3) Where the mounting surface could become considerably warmer or cooler than the room, such as a poorly insulated ceiling below an unfinished attic or an exterior wall, smoke alarms and smoke detectors shall be mounted on an inside wall.*

(4) Smoke alarms and smoke detectors shall not be installed within an area of exclusion determined by a 10-foot (3.0 m) radial distance along a horizontal flow path from a stationary or fixed cooking appliance, unless listed for installation in close proximity to cooking appliances. Smoke alarms and smoke detectors installed between 10 feet (3.0 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed appliance shall be equipped with an alarm-silencing means or use photoelectric detection.

(5) Smoke alarms or smoke detectors that use photoelectric detection shall be permitted for installation at a radial distance greater than 6 feet (1.8 m) from any stationary or fixed cooking appliance when both of the following conditions are met:

- (a) The kitchen or cooking area and adjacent spaces have no clear partitions or headers.*
- (b) The 10-foot (3.0 m) area of exclusion would prohibit the placement of a smoke alarm or smoke detector required by other sections of this code.*

(6) Effective January 1, 2022, smoke alarms and smoke detectors installed between 6 feet (1.8 m) and 20 feet (6.1 m) along a horizontal flow path from a stationary or fixed cooking appliance shall be listed for resistance to common nuisance sources from cooking.

(7) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from a door to a bathroom containing a shower or tub unless listed for installation in close proximity to such locations.

(8) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the supply registers of a forced air heating or cooling system and shall be installed outside of the direct airflow from those registers.

(9) Smoke alarms and smoke detectors shall not be installed within a 36-inch (910 mm) horizontal path from the tip of the blade of a ceiling-suspended (paddle) fan unless the room configuration restricts meeting this requirement.

(10) Where stairs lead to other occupied levels, a smoke alarm or smoke detector shall be located so that smoke rising in the stairway cannot be prevented from reaching the smoke alarm or smoke detector by an intervening door or obstruction.

(11) For stairways leading up from a basement, smoke alarms or smoke detectors shall be located on the basement ceiling near the entry to the stairs.

(12) For tray-shaped ceilings (coffered ceilings), smoke alarms and smoke detectors shall be installed on the highest portion of the ceiling or on the sloped portion of the ceiling within 12 inches (300 mm) vertically down from the highest point.

(13) Smoke alarms and detectors installed in rooms with joists or beams shall comply with the requirements of Section 17.7.3.2.4 of NFPA 72.

(14) Heat alarms and detectors installed in rooms with joists or beams shall comply with the requirements of Section 17.6.3 of NFPA 72.

*For additional requirements or clarification, see NFPA 72.

907.2.12 Special amusement areas. An automatic smoke detection system shall be provided in special amusement areas and throughout the exit access to the point of exit discharge in accordance with Sections 907.2.12.1 through 907.2.12.3.

907.2.12.1 Alarm. Activation of any single smoke detector, the automatic sprinkler system or any other automatic fire detection device shall immediately activate an audible and visible alarm at the building at a constantly attended location from which emergency action can be initiated, including the capability of manual initiation of requirements in Section 907.2.12.2.

907.2.12.2 System response. The activation of two or more smoke detectors, a single smoke detector equipped with an alarm verification feature, the automatic sprinkler system or other approved fire detection device shall automatically do all of the following:

1. Cause illumination of the means of egress with light of not less than 1 footcandle (11 lux) at the walking surface level.
2. Stop any conflicting or confusing sounds and visual distractions.
3. Activate an approved directional exit marking that will become apparent in an emergency.
4. Activate a prerecorded message, audible throughout the special amusement area and throughout the exit access to the point of exit discharge, building, instructing patrons to proceed to the nearest exit. Alarm signals used in conjunction with the prerecorded message shall produce a sound that is distinctive from other sounds used during normal operation.

907.2.12.3 Emergency voice/alarm communication system. An emergency voice/alarm communication system, which is allowed to serve as a public address system, shall be installed in accordance with Section 907.5.2.2 and be audible throughout the entire special amusement area and throughout the exit access to the point of exit discharge.

907.2.13 High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access. High-

rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be provided with an automatic smoke detection system in accordance with Section 907.2.13.1, a fire department communication system in accordance with Section 907.2.13.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.

Exceptions:

1. Airport traffic control towers in accordance with Section 907.2.22 of this code and Section 412 of the *California Building Code*.
2. Open parking garages in accordance with Section 406.5 of the *California Building Code*.
3. Buildings with an occupancy in Group A-5 in accordance with Section 303.1 of the *California Building Code*.
4. Low-hazard special occupancies in accordance with Section 503.1.1 of the *California Building Code*.
5. Buildings with an occupancy in Group H-1, H-2 or H-3 in accordance with Section 415 of the *California Building Code*.
6. In Group I-2, I-2.1 and R-2.1 occupancies, the alarm shall sound at a constantly attended location and occupant notification shall be broadcast by the emergency voice/alarm communication system.

907.2.13.1 Automatic smoke detection. Automatic smoke detection in high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be in accordance with Sections 907.2.13.1.1 and 907.2.13.1.2.

907.2.13.1.1 Area smoke detection. Area smoke detectors shall be provided in accordance with this section. Smoke detectors shall be connected to an automatic fire alarm system. The activation of any detector required by this section shall activate the emergency voice/alarm communication system in accordance with Section 907.5.2.2. In addition to smoke detectors required by Sections 907.2.1 through 907.2.9, smoke detectors shall be located as follows:

1. In each mechanical equipment, electrical, transformer, telephone equipment or similar room that is not provided with sprinkler protection.
2. In each elevator machine room, machinery space, control room and control space and in elevator lobbies.

907.2.13.1.2 Duct smoke detection. Smoke detectors listed for use in air duct systems shall be provided in accordance with this section and the *California Mechanical Code*. The activation of any detector required by this section shall initiate a visi-

ble and audible supervisory signal at a constantly attended location. Duct smoke detectors complying with Section 907.3.1 shall be located as follows:

1. In the main return air and exhaust air plenum of each air-conditioning system having a capacity greater than 2,000 cubic feet per minute (cfm) (0.94 m³/s). Such detectors shall be located in a serviceable area downstream of the last duct inlet.
2. At each connection to a vertical duct or riser serving two or more stories from a return air duct or plenum of an air-conditioning system. In Group R-1 and R-2 occupancies, a smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m³/s) and serving not more than 10 air-inlet openings.

907.2.13.2 Fire department communication system.

Where a wired communication system is approved in lieu of an in-building, two-way emergency responder communication coverage system in accordance with Section 510, the wired fire department communication system shall be designed and installed in accordance with NFPA 72 and shall operate between a fire command center complying with Section 508, elevators, elevator lobbies, emergency and standby power rooms, fire pump rooms, areas of refuge and inside interior exit stairways. The fire department communication device shall be provided at each floor level within the interior exit stairway.

907.2.13.3 Multiple-channel voice evacuation. In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, voice evacuation systems for high-rise buildings shall be multiple-channel systems.

907.2.14 Atriums connecting more than two stories. A fire alarm system shall be installed in occupancies with an atrium that connects more than two stories, with smoke detection in locations required by a rational analysis in Section 909.4 and in accordance with the system operation requirements in Section 909.17. The system shall be activated in accordance with Section 907.5. Such occupancies in Group A, E or M shall be provided with an emergency voice/alarm communication system complying with the requirements of Section 907.5.2.2.

907.2.15 High-piled combustible storage areas. An automatic smoke detection system shall be installed throughout high-piled combustible storage areas where required by Section 3206.5.

907.2.16 Aerosol storage uses. Aerosol product rooms and general-purpose warehouses containing aerosol products shall be provided with an approved manual fire alarm system where required by this code.

907.2.17 Lumber, wood structural panel and veneer mills. Lumber, wood structural panel and veneer mills shall be provided with a manual fire alarm system.

907.2.18 Underground buildings with smoke control systems. Where a smoke control system is installed in an underground building in accordance with the *California Building Code*, automatic smoke detectors shall be provided in accordance with Section 907.2.18.1.

907.2.18.1 Smoke detectors. Not fewer than one smoke detector listed for the intended purpose shall be installed in all of the following areas:

1. Mechanical equipment, electrical, transformer, telephone equipment, elevator machine or similar rooms.
2. Elevator lobbies.
3. The main return and exhaust air plenum of each air-conditioning system serving more than one story and located in a serviceable area downstream of the last duct inlet.
4. Each connection to a vertical duct or riser serving two or more floors from return air ducts or plenums of heating, ventilating and air-conditioning systems, except that in Group R occupancies, a listed smoke detector is allowed to be used in each return air riser carrying not more than 5,000 cfm (2.4 m³/s) and serving not more than 10 air inlet openings.

907.2.18.2 Alarm required. Activation of the smoke control system shall activate an audible alarm at a constantly attended location.

907.2.19 Deep underground buildings. Where the lowest level of a structure is more than 60 feet (18 288 mm) below the finished floor of the lowest level of exit discharge, the structure shall be equipped throughout with a manual fire alarm system, including an emergency voice/alarm communication system installed in accordance with Section 907.5.2.2.

907.2.20 Covered and open mall buildings. Where the total floor area exceeds 50,000 square feet (4645 m²) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided. Access to emergency voice/alarm communication systems serving a mall, required or otherwise, shall be provided for the fire department. The system shall be provided in accordance with Section 907.5.2.2.

907.2.21 Residential aircraft hangars. Not fewer than one single-station smoke alarm shall be installed within a residential aircraft hangar as defined in Chapter 2 of the *California Building Code* and shall be interconnected into the residential smoke alarm or other sounding device to provide an alarm that will be audible in all sleeping areas of the dwelling.

907.2.22 Airport traffic control towers. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be provided in airport control towers in accordance with Sections 907.2.22.1 and 907.2.22.2.

Exception: Audible appliances shall not be installed within the control tower cab.

907.2.22.1 Airport traffic control towers with multiple exits and automatic sprinklers. Airport traffic control towers with multiple exits and equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Outside each opening into interior exit stairways.
5. Along the single means of egress permitted from observation levels.
6. Outside each opening into the single means of egress permitted from observation levels.

907.2.22.2 Other airport traffic control towers. Airport traffic control towers with a single exit or where sprinklers are not installed throughout shall be provided with smoke detectors in all of the following locations:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.
6. Means of egress.
7. Utility shafts where access to smoke detectors can be provided.

907.2.23 Energy storage systems. An automatic smoke detection system or radiant-energy detection system shall be installed in rooms, areas and walk-in units containing energy storage systems as required in Section 1207.5.4.

907.2.24 Motion Picture and Television Production Studio Sound Stages and Approved Production Facilities

907.2.24.1 Sound Stages—Solid-ceiling Sets and Platforms. Where required by Chapter 48, all interior solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms (when provided) over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height shall be protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer’s installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.5 or a local alarm which will give an audible signal at a constantly attended location.

907.2.24.2 Production locations—solid-ceiling sets and platforms. Where required by Chapter 48 of the California Fire Code, buildings with existing fire protection systems and where production intends to construct solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height shall be

protected by an approved heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer’s installation instructions. The fire alarm system shall be connected to an approved supervising station in accordance with Section 907.6.6 or a local alarm which will give an audible signal at a constantly attended location.

907.2.24.3 Fire alarm control units. Fire alarm control units shall be California State Fire Marshal listed and shall be utilized in accordance with their listing. Control units are permitted to be temporarily supported by sets, platforms or pedestals.

907.2.24.4 Heat detectors.

907.2.24.4.1 Heat detection required by this section shall be defined as a portable system as it is intended to be reinstalled when platforms or sets are changed.

907.2.24.4.2 Heat detectors shall be secured to standard outlet boxes and are allowed to be temporarily supported by sets, platforms or pedestals.

907.2.24.4.3 Heat detectors shall be provided for solid-ceiling sets and platforms where required by Section 4805.3 and 4811.14.

907.2.25 Group C occupancies (Organized Camps).

907.2.25.1 General. Every building and structure used or intended for sleeping purposes shall be provided with an automatic smoke-detection system.

Exception:

1. Buildings and structures in existence and in operation prior to January 1, 1985.
2. Tents, tent structures and buildings and structures that do not exceed 25 feet (7620 mm) in any lateral dimensions and where such building or structure is not more than one story.

907.2.25.2 Camp fire alarm. Every organized camp shall provide and maintain audible appliances or devices suitable for sounding a fire alarm. Such audible appliances or devices may be of any type acceptable to the enforcing agency, provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises. When an automatic fire alarm system is provided, as required by Section 450.6.6 of the California Building Code, all audible appliances required by this section shall be of the same type as that used in the automatic system.

[California Code of Regulations, Title 19, Division 1, §3.12] Fire Alarm.

Every organized camp shall provide and maintain an audible appliance or audible appliances suitable for sounding a fire alarm. Such audible appliance or audible appliances may be of any type acceptable to the enforcing agency provided they are distinctive in tone from all other signaling devices or systems and shall be audible throughout the camp premises.

When an automatic fire alarm system is provided, all audible appliances and fire alarm signals as required by this section shall be of the same type as that used in the automatic system.

907.2.26 Fixed guideway and passenger rail transits systems fire alarm and communication systems.

907.2.26.1 General. Every fixed guideway transit station shall be provided with an approved emergency voice/alarm communication system in accordance with NFPA 72. The emergency voice/alarm communication system shall be designed and installed so that damage to any one speaker will not render any paging zone of the system inoperative.

Exception: Open stations.

907.2.26.2 System components. Each station fire alarm system shall consist of:

1. Fire alarm control unit at a location as permitted by the enforcing agency.
2. An alarm annunciator(s). The annunciator(s) shall be located at a point acceptable to the enforcing agency. The annunciator(s) shall indicate the type of device and general location of alarm. All alarm, supervisory and trouble signals shall be transmitted to the local annunciator(s) and the operations control center.
3. Manual fire alarm boxes shall be provided throughout passenger platforms and stations.

Exception: Two-way emergency communication reporting devices (emergency telephones) are allowed to be used in lieu of manual fire alarm boxes, as permitted by the enforcing agency. Such devices shall provide two-way communication between the operations control center and each device. Such devices shall be located as required for manual fire alarm boxes, and shall be distinctly identified by signs, coloring or other means acceptable to the enforcing agency.

4. Automatic smoke detectors in all ancillary spaces.

Exceptions:

1. Ancillary spaces protected by an approved fixed automatic extinguishing system; or
2. Ancillary spaces protected by quick-response sprinklers.
5. Automatic control of exiting components.

907.2.26.3 Emergency voice/alarm communication system. Each station shall be provided with a an emergency voice/alarm communication system capable of transmitting voice, recorded or electronically generated textual messages to all areas of the station. The system(s) shall be configured such that the messages can be initiated from either the Emergency Management Panel (EMP) or the operations control center.

907.2.26.4 Emergency telephones. A dedicated two-way emergency communication phone system designed and installed in accordance with NFPA 72 shall be provided in all underground stations to facilitate direct communications for emergency response between remote locations and the EMP.

907.2.26.4.1. Remote emergency phones shall be located at ends of station platforms, each hose outlet connection and station valve rooms.

907.2.26.4.2. Provisions shall be made in the design of this two-way emergency communication phone system for extensions of the system to the next passenger station or guideway portal.

907.2.27 Winery caves. An approved manual fire alarm system conforming to the provisions of Section 907.2.1 shall be provided in all Type 3 winery caves.

907.2.28 Group L. A manual fire alarm system shall be installed throughout buildings having Group L occupancy.

When Group L occupancies are located in mixed use buildings, at least one manual fire alarm box shall be located within the Group L occupancy.

907.2.28.1 Group L occupancies located on the 11th story and above. Manual fire alarm boxes shall be required on each side of the 2-hour fire-smoke barrier and at each exit on the 11th story and above.

907.2.29 Public school state-funded construction projects for kindergarten through 12th grade — automatic fire alarm system requirements.

907.2.29.1 Alterations to existing buildings on an existing public school campus. An automatic fire alarm system shall be provided for all portions within the scope of an alteration project. The provisions of this section shall apply to any public school project on an existing campus and receiving state funds pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code, Sections 17070.10 through 17079. For purposes of this section, an existing campus refers to a school site, where an application for construction of original buildings was made to DSA prior to July 1, 2002.

Exceptions:

1. A manual fire alarm system may be provided for a construction project that has an estimated total cost of less than \$200,000.
2. A manual fire alarm system may be provided for a relocatable building that is sited with the intent that it be at the site for less than three years and is sited upon a temporary foundation in a manner that is designed to permit easy removal. See California Administrative Code, Section 4-314 for definition of relocatable building.
3. A fire alarm system is not required for detached buildings designed and used for non-

instructional purposes that meet the applicable requirements for that occupancy. Buildings would include, but not be limited to:

- Concession stand.*
- Press box.*
- Restroom facilities.*
- Shade structure.*
- Snack bar.*
- Storage building.*
- Ticket booth.*

907.3 Fire safety functions. Automatic fire detectors utilized for the purpose of performing fire safety functions shall be connected to the building’s fire alarm control unit where a fire alarm system is required by Section 907.2. Detectors shall, upon actuation, perform the intended function and activate the alarm notification appliances or activate a visible and audible supervisory signal at a constantly attended location. In buildings not equipped with a fire alarm system, the automatic fire detector shall be powered by normal electrical service and, upon actuation, perform the intended function. The detectors shall be located in accordance with NFPA 72.

907.3.1 Duct smoke detectors. Smoke detectors installed in ducts shall be listed for the air velocity, temperature and humidity present in the duct. Duct smoke detectors shall be connected to the building’s fire alarm control unit where a fire alarm system is required by Section 907.2. Activation of a duct smoke detector shall initiate a visible and audible supervisory signal at a constantly attended location and shall perform the intended fire safety function in accordance with this code and the *California Mechanical Code*. In facilities that are required to be monitored by a supervising station, duct smoke detectors shall report only as a supervisory signal and not as a fire alarm. They shall not be used as a substitute for required open area detection.

Exceptions:

1. The supervisory signal at a constantly attended location is not required where duct smoke detectors activate the building’s alarm notification appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

907.3.2 Special locking systems. Where special locking systems are installed on means of egress doors in accordance with Section 1010.2.14 or 1010.2.13, an automatic smoke detection system shall be installed as required by those sections and Sections 907.3.2.1 through 907.3.2.5.

907.3.2.1 Delayed egress. *In other than Group I, Group R-2.1 and Group R-4, occupancies for single-story building smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces. For multiple-story buildings, smoke detectors*

shall be installed throughout all occupied areas and mechanical/electrical spaces for the story where delayed egress devices are installed. Additional detectors are required on adjacent stories where occupants of those stories utilize the same means of egress.

Exception: Refer to Section 907.3.2.4 for Group A courthouse occupancies.

907.3.2.2 Delayed egress for Group I and R-2.1 occupancies. *Smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke-compartments where delayed egress devices are installed. Additional detectors are required in adjacent smoke-compartments where occupants of those compartments utilize the same means of egress.*

907.3.2.3 Delayed egress for Group R-4 occupancies. *In occupancies licensed as residential care facilities for the elderly and housing clients with Alzheimer’s disease or dementia, smoke detectors shall be installed at ceilings throughout all occupiable rooms and areas and mechanical/electrical rooms and spaces.*

907.3.2.4 Delayed egress for Group A Courthouse occupancies. *Approved automatic smoke detection systems shall be installed at ceilings in all occupied corridors and mechanical/electrical spaces of occupancies where delayed egress devices are installed.*

907.3.2.5 Controlled egress doors for Group I-2 occupancies. *Smoke detectors shall be installed at ceilings throughout all occupied areas and mechanical/electrical spaces of smoke-compartments where controlled egress doors are installed.*

907.3.3 Elevator emergency operation. Automatic fire detectors installed for elevator emergency operation shall be installed in accordance with the provisions of *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders* and NFPA 72.

907.3.4 Wiring. The wiring to the auxiliary devices and equipment used to accomplish the fire safety functions shall be monitored for integrity in accordance with NFPA 72.

907.4 Initiating devices. Where a fire alarm system is required by another section of this code, occupant notification in accordance with Section 907.5 shall be initiated by one or more of the following. Initiating devices shall be installed in accordance with Sections 907.4.1 through 907.4.3.1.

1. Manual fire alarm boxes.
2. Automatic fire detectors.
3. Automatic sprinkler system waterflow devices.
4. Automatic fire-extinguishing systems.

907.4.1 Protection of fire alarm control unit. In areas that are not continuously occupied, a single smoke detector shall be provided at the location of each fire alarm control unit, notification appliance circuit power extenders and supervising station transmitting equipment.

Exception: Where ambient conditions prohibit installation of a smoke detector, a heat detector shall be permitted.

907.4.2 Manual fire alarm boxes. Where a manual fire alarm system is required by another section of this code, it shall be activated by fire alarm boxes installed in accordance with Sections 907.4.2.1 through 907.4.2.6.

907.4.2.1 Location. Manual fire alarm boxes shall be located not more than 5 feet (1524 mm) from the entrance to each exit. In buildings not protected by an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, additional manual fire alarm boxes shall be located so that the distance of travel to the nearest box does not exceed 200 feet (60 960 mm).

Exception: When individual dwelling units are served by a single exit stairway, additional boxes at other than the ground floor may be omitted.

907.4.2.2 Height. The height of the manual fire alarm boxes shall be not less than 42 inches (1067 mm) and not more than 48 inches (1372 mm) measured vertically, from the floor level to the *highest point of the activating handle or lever of the box.* Manual fire alarm boxes shall also comply with Section 11B309.4 of the California Building Code.

Exception: [DSA-AC] In existing buildings there is no requirement to retroactively relocate existing manual fire alarm boxes to a minimum of 42 inches (1067 mm) and a maximum of 48 inches (1219 mm) from the floor level to the activating handle or lever of the box.

907.4.2.3 Color. Manual fire alarm boxes shall be red in color.

907.4.2.4 Signs. Where fire alarm systems are not monitored by an approved supervising station in accordance with Section 907.6.6, an approved permanent sign shall be installed adjacent to each manual fire alarm box that reads: “WHEN ALARM SOUNDS—CALL FIRE DEPARTMENT.”

Exception: Where the manufacturer has permanently provided this information on the manual fire alarm box.

907.4.2.5 Protective covers. The fire code official is authorized to require the installation of listed manual fire alarm box protective covers to prevent malicious false alarms or to provide the manual fire alarm box with protection from physical damage. The protective cover shall be transparent or red in color with a transparent face to permit visibility of the manual fire alarm box. Each cover shall include proper operating instructions. A protective cover that emits a local alarm signal shall not be installed unless approved. Protective covers shall not project more than that permitted by Section 1003.3.3.

907.4.2.6 Unobstructed and unobscured. Manual fire alarm boxes shall be provided with ready access, unobstructed, unobscured and visible at all times.

907.4.2.7 Operation. Manual fire alarm boxes shall be operable with one hand including boxes with protective covers.

907.4.3 Automatic smoke detection. Where an automatic smoke detection system is required, it shall utilize smoke detectors unless ambient conditions prohibit such an installation. In spaces where smoke detectors cannot be utilized due to ambient conditions, approved automatic heat detectors shall be permitted.

907.4.3.1 Automatic sprinkler system. For conditions other than specific fire safety functions noted in Section 907.3, in areas where ambient conditions prohibit the installation of smoke detectors, an automatic sprinkler system installed in such areas in accordance with Section 903.3.1.1 or 903.3.1.2 and that is connected to the fire alarm system shall be approved as automatic heat detection.

907.5 Occupant notification. Occupant notification by fire alarms shall be in accordance with Sections 907.5.1 through 907.5.2.5. Occupant notification by smoke alarms in Group R-1 and R-2 occupancies shall comply with Section 907.5.2.1.3.2.

907.5.1 Alarm activation and annunciation. Upon activation, fire alarm systems shall initiate occupant notification and shall annunciate at the fire alarm control unit, or where allowed elsewhere by Section 907, at a constantly attended location.

907.5.1.1 Presignal feature. A presignal feature shall only be provided where approved. The presignal shall be annunciated at an approved, constantly attended location, having the capability to activate the occupant notification system in the event of fire or other emergency.

Exception: A presignal feature shall not be permitted to be installed in a Group I-2, I-2.1 or R-2.1 occupancy.

907.5.2 Alarm notification appliances. Alarm notification appliances shall be provided and shall be listed for their purpose.

907.5.2.1 Audible alarms. Audible alarm notification appliances shall be provided and emit a distinctive sound that is not to be used for any purpose other than that of a fire alarm. *In Group I-2 occupancies, audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff. See Section 907.5.2.5.*

Exceptions:

1. Audible alarm notification appliances are not required in *patient* areas of Group I-2 occupancies that are in compliance with Section 907.5.2.5.
2. A visible alarm notification appliance installed in a nurses’ control station or other continuously attended staff location in a Group I-2 *care* suite shall be an acceptable alternative to the installation of audible alarm notification appliances throughout a *care* suite in Group I-2 occupancies that are in compliance with Section 907.5.2.5.

3. Where provided, audible notification appliances located in each enclosed occupant evacuation elevator lobby in accordance with Section 3008.9.1 of the *California Building Code* shall be connected to a separate notification zone for manual paging only.

907.5.2.1.1 Average sound pressure. The audible alarm notification appliances shall provide a sound pressure level of 15 decibels (dBA) above the average ambient sound level or 5 dBA above the maximum sound level having a duration of not less than 60 seconds, whichever is greater, in every occupiable space within the building.

907.5.2.1.2 Maximum sound pressure. The total sound pressure level produced by combining the ambient sound pressure level with all audible notification appliances operating shall not exceed 110 dBA at the minimum hearing distance from the audible appliance. Where the average ambient noise is greater than 105 dBA, visible alarm notification appliances shall be provided in accordance with NFPA 72 and audible alarm notification appliances shall not be required.

907.5.2.1.3 Audible signal frequency in Group R-1 and R-2 sleeping rooms. Audible signal frequency in Group R-1 and R-2 occupancies shall be in accordance with Sections 907.5.2.1.3.1 and 907.5.2.1.3.2.

907.5.2.1.3.1 Fire alarm system signal. In sleeping rooms of Group R-1 and R-2 occupancies, the audible alarm activated by a fire alarm system shall be a 520-Hz low-frequency signal complying with NFPA 72.

907.5.2.1.3.2 Smoke alarm signal in sleeping rooms. In sleeping rooms of Group R-1 and R-2 occupancies that are required by Section 907.2.8 or 907.2.9 to have a fire alarm system, the audible alarm signal activated by single- or multiple-station smoke alarms in the dwelling unit or sleeping unit shall be a 520-Hz signal complying NFPA 72.

Where a sleeping room smoke alarm is unable to produce a 520-Hz signal, the 520-Hz alarm signal shall be provided by a listed notification appliance or a smoke detector with an integral 520-Hz sounder.

907.5.2.1.4 Audible alarm signal. *The audible signal shall be the standard fire alarm evacuation signal, ANSI S3.41 Audible Emergency Evacuation Signal, “three pulse temporal pattern,” as described in NFPA 72.*

Exception: *The use of the existing evacuation signaling scheme shall be permitted where approved by the enforcing agency.*

907.5.2.2 Emergency voice/alarm communication systems. Emergency voice/alarm communication systems required by this code shall be designed and installed in accordance with NFPA 72. The operation of any automatic fire detector, sprinkler waterflow device

or manual fire alarm box shall automatically sound an alert tone followed by voice instructions giving approved information and directions for a general or staged evacuation in accordance with the building’s fire safety and evacuation plans required by Section 404. In high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access, the system shall operate on at least the alarming floor, the floor above and the floor below. Speakers shall be provided throughout the building by paging zones. At a minimum, paging zones shall be provided as follows:

1. Elevator groups.
2. Interior exit stairways.
3. Each floor.
4. Areas of refuge as defined in Chapter 2.

Exception: *In Group I-2 and I-2.1 occupancies, where in accordance with Section 907.5.2.5, audible fire alarm notification devices are not provided, upon receipt of an alarm at a constantly attended location, a general occupant notification shall be broadcast over the public-address system.*

907.5.2.2.1 Manual override. A manual override for emergency voice communication shall be provided on a selective and all-call basis for all paging zones.

907.5.2.2.2 Live voice messages. The emergency voice/alarm communication system shall have the capability to broadcast live voice messages by paging zones on a selective and all-call basis.

907.5.2.2.3 Alternative uses. The emergency voice/alarm communication system shall be allowed to be used for other announcements, provided that the manual fire alarm use takes precedence over any other use.

907.5.2.2.4 Emergency voice/alarm communication captions. Where stadiums, arenas and grandstands have 15,000 fixed seats or more and provide audible public announcements, the emergency/voice alarm communication system shall provide prerecorded or real-time captions. Prerecorded or live emergency captions shall be from an approved location constantly attended by personnel trained to respond to an emergency.

907.5.2.2.5 Standby power. Emergency voice/alarm communications systems shall be provided with standby power in accordance with Section 1203.

907.5.2.3 Visible alarms. Visible alarm notification appliances shall be provided in accordance with Sections 907.5.2.3.1 through 907.5.2.3.4.

Exceptions:

1. *In other than Group I-2 and I-2.1, visible alarm notification appliances are not required in alterations, except where an existing fire alarm system is upgraded or replaced, or a new fire alarm system is installed.*

2. Visible alarm notification appliances shall not be required in *enclosed exit stairways, enclosed exit ramps, exterior exit stairs and exterior exit ramps.*
3. Visible alarm notification appliances shall not be required in elevator cars.
4. Visual alarm notification appliances are not required in critical care areas of Group I-2 occupancies that are in compliance with Section 907.5.2.5.
5. A visible alarm notification appliance installed in a nurses' control station or other continuously attended staff location in a Group I-2 *care* suite shall be an acceptable alternative to the installation of visible alarm notification appliances throughout the *care* suite in Group I-2 occupancies that are in compliance with Section 907.5.2.5.

907.5.2.3.1 Public use areas and common use areas. Visible alarm notification appliances shall be provided in public use areas and common use areas including but not limited to:

1. *Band rooms.*
2. *Classrooms.*
3. *Corridors.*
4. *Gymnasiums.*
5. *Lobbies.*
6. *Meeting rooms.*
7. *Multipurpose rooms.*
8. *Music practice rooms.*
9. *Occupational shops.*
10. *Occupied rooms where ambient noise impairs hearing of the fire alarm.*
11. *Sanitary facilities including restrooms, bathrooms and shower rooms.*

Exception: Where employee work areas have audible alarm coverage, the notification appliance circuits serving the employee work areas shall be initially designed with not less than 20-percent spare capacity to account for the potential of adding visible notification appliances in the future to accommodate hearing-impaired employee(s).

907.5.2.3.2 Groups R-1 and R-2.1. Habitable spaces in dwelling units and sleeping units in Group R-1 and R-2.1 occupancies in accordance with Table 907.5.2.3.2 shall be provided with visible alarm notification. Visible alarms shall be activated by the in-room smoke alarm and the building fire alarm system.

907.5.2.3.3 Group R-2. In Group R-2 occupancies required by Section 907 to have a fire alarm system, each story that contains dwelling units and sleeping units shall be provided with the capability to support

future visible alarm notification appliances in accordance with *NFPA 72*. Such capability shall accommodate wired or wireless equipment.

**TABLE 907.5.2.3.2
VISIBLE ALARMS**

NUMBER OF SLEEPING UNITS	SLEEPING ACCOMMODATIONS WITH VISIBLE ALARMS
6 to 25	2
26 to 50	4
51 to 75	7
76 to 100	9
101 to 150	12
151 to 200	14
201 to 300	17
301 to 400	20
401 to 500	22
501 to 1,000	5% of total
1,001 and over	50 plus 3 for each 100 over 1,000

[SFM] Also see Chapter 11B of the California Building Code.

907.5.2.3.3.1 Wired equipment. Where wired equipment is used to comply with the future capability required by Section 907.5.2.3.3, the system shall include one of the following capabilities:

1. The replacement of audible appliances with combination audible/visible appliances or additional visible notification appliances.
2. The future extension of the existing wiring from the unit smoke alarm locations to required locations for visible appliances.
3. For wired equipment, the fire alarm power supply and circuits shall have not less than 5-percent excess capacity to accommodate the future addition of visible alarm notification appliances, and a single access point to such circuits shall be available on every story. Such circuits shall not be required to be extended beyond a single access point on a story. The fire alarm system shop drawings required by Section 907.1.2 shall include the power supply and circuit documentation to accommodate the future addition of visible notification appliances.

907.5.2.3.4 Group R-2.1, R-3.1 and R-4. *Protective social care facilities which house persons who are hearing impaired, shall be provided with notification appliances for the hearing impaired installed in accordance with NFPA 72 and which shall activate upon initiation of the fire alarm system or the smoke alarms.*

907.5.2.4 Group E schools. *One audible alarm notification appliance shall be mounted on the exterior of a building to alert occupants at each playground area.*

907.5.2.5 Groups I-2 and I-2.1. *Audible appliances shall be used in nonpatient areas. Visible appliances are*

allowed to be used in lieu of audible appliances in patient occupied areas. Audible appliances located in patient areas shall be only chimes or similar sounding appliances for alerting staff. Where audible fire alarm notification devices are not provided, upon receipt of an alarm at a constantly attended location, a general occupant notification shall be broadcast over the public-address system.

In occupancies housing nonambulatory persons where restraint is practiced, staff and attendants shall be provided and housed or located in such a manner that such supervisory personnel will also be alerted upon activation of the fire alarm system or any detector required by this section.

907.6 Installation and monitoring. A fire alarm system shall be installed and monitored in accordance with Sections 907.6.1 through 907.6.6.3 and NFPA 72.

907.6.1 Wiring. Wiring shall comply with the requirements of the California Electrical Code and NFPA 72. Wireless protection systems utilizing radio-frequency transmitting devices shall comply with the special requirements for supervision of low-power wireless systems in NFPA 72.

907.6.1.1 High-rise buildings. Wiring for fire alarm network communication circuits between multiple control units shall be in accordance with the following:

1. Class A or Class X installed in accordance with NFPA 72.
2. Installed in enclosed continuous metallic raceways in accordance with the California Electrical Code.

907.6.2 Power supply. The primary and secondary power supply for the fire alarm system shall be provided in accordance with NFPA 72.

Exception: Backup power for single-station and multiple-station smoke alarms as required in Section 907.2.11.6.

907.6.3 Initiating device identification. The fire alarm system shall identify the specific initiating device address, location, device type, floor level where applicable and status including indication of normal, alarm, trouble and supervisory status, as appropriate.

Exceptions:

1. Fire alarm systems in single-story buildings less than 22,500 square feet (2090 m²) in area.
2. Fire alarm systems that only include manual fire alarm boxes, waterflow initiating devices and not more than 10 additional alarm-initiating devices.
3. Special initiating devices that do not support individual device identification.
4. Fire alarm systems or devices that are replacing existing equipment.

907.6.3.1 Annunciation. The initiating device status shall be annunciated at an approved on-site location.

907.6.4 Zones. Fire alarm systems shall be divided into zones where required by this section. For the purposes of annunciation and notification, zoning shall be in accordance with the following:

1. Where the fire-protective signaling system serves more than one building, each building shall be considered as a separate zone.
2. Each floor of a building shall be considered as a separate zone.
3. Each section of floor of a building that is separated by fire walls or by horizontal exits shall be considered as a separate zone.
4. Each zone shall not exceed 22,500 square feet (2090 m²). The length of any zone shall not exceed 300 feet (91 440 mm) in any direction.

Exception: Automatic sprinkler system zones shall not exceed the area permitted by NFPA 13.

5. For Group I-3 occupancies each cell complex shall be considered a separate zone.
6. For Group H and L occupancies on the 11th story and above, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.
7. Annunciation shall be further divided into zones where deemed necessary by the enforcing agency.

907.6.4.1 Annunciation. Alarm, supervisory and trouble signals shall be annunciated in the main control unit by means of an audible signal and a visual display in accordance with NFPA 72. Identification of the type of alarm and supervisory initiating devices, such as manual, automatic, sprinkler waterflow, sprinkler valve supervisory, fire-pump supervisory, etc., shall be separately indicated.

Exception: Group R-3 occupancies.

907.6.4.1.1 Annunciator panel. An annunciator panel complying with 907.6.4.1 and the associated controls shall be provided in an approved remote location where deemed necessary by the Enforcing Agency. The visual zone indication shall lock in until the system is reset and shall not be canceled by the operation of an audible alarm-silencing switch.

907.6.4.2 High-rise buildings. In high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access, a separate zone by floor shall be provided for each of the following types of alarm-initiating devices where provided:

1. Smoke detectors.
2. Sprinkler waterflow devices.
3. Manual fire alarm boxes.
4. Other approved types of automatic fire protection systems.

907.6.4.3 High-rise buildings zoning annunciator panel. In high-rise buildings, a zoning annunciator panel shall be provided in the Fire Command Center.

This panel shall not be combined with the Firefighter Smoke Control Panel unless approved. Panel shall be in matrix format or an approved equivalent configuration. All indicators shall be based upon positive confirmation. The panel shall include the following features at a minimum:

1. Fire alarm initiating devices with individual annunciation per floor for manual fire alarm boxes, area smoke detectors, elevator lobby smoke detectors, duct smoke detectors, heat detectors, auxiliary alarms and sprinkler water-flow. (Red LED)
2. Sprinkler and standpipe system control valves per floor—supervisory. (Yellow LED)
3. Common fire alarm system trouble. (Yellow LED)
4. Annunciation Panel Power On. (Green LED)
5. Lamp test. (Push Button)

907.6.4.4 Notification zoning. Upon activation of initiating devices where occupant notification is required for evacuation, all notification zones shall operate simultaneously throughout the building.

Exceptions:

1. High-rise buildings as permitted in Section 907.2.
2. Hospitals and convalescent facilities with staff alerting notification appliances or emergency voice/alarm communication, zoning shall be in accordance with the approved fire plan.
3. Detention facilities.
4. Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the notification zones are separated by a minimum of a 2-hour fire barrier and 2-hour fire-resistive floor assembly. The system shall have the capability to activate all other notification zones by automatic and manual means.
5. Upon approval by the fire code official in buildings which are sprinklered throughout, specific notification zoning shall be permitted where the activated initiating device or fire extinguishing system is separated from any nonactive notification zones by a minimum of 300-foot horizontal distance. The system shall have the capability to activate all other notification zones by automatic and manual means.
6. Where a Group H or L occupancy is located above the 10th story, each side of the 2-hour fire-smoke barrier shall be considered a separate zone.

907.6.5 Access. Access shall be provided to each fire alarm device and notification appliance for periodic inspection, maintenance and testing.

907.6.6 Monitoring. Fire alarm systems required by this chapter or by the *California Building Code* shall be moni-

tored by an approved supervising station in accordance with NFPA 72 and this section.

Exception: Monitoring by a supervising station is not required for:

1. Single- and multiple-station smoke alarms required by Section 907.2.11.
2. Smoke detectors in Group I-3 occupancies shall be monitored in accordance with Section 907.2.6.3.
3. Automatic sprinkler systems in one- and two-family dwellings.

907.6.6.1 Transmission of alarm signals. Transmission of alarm signals to a supervising station shall be in accordance with NFPA 72.

907.6.6.2 MIY monitoring. Direct transmission of alarms associated with monitor it yourself (MIY) transmitters to a public safety answering point (PSAP) shall not be permitted unless approved by the fire code official.

907.6.6.3 Termination of monitoring service. Termination of fire alarm monitoring services shall be in accordance with Section 901.9.

907.6.6.4 Group E schools. Automatic fire alarm systems shall be monitored and shall transmit the alarm, supervisory and trouble signals to an approved supervising station in accordance with NFPA 72. The supervising station shall be listed as either UUFEX (Central Station) or UUJS (remote & proprietary) by the Underwriters Laboratory Inc. (UL) or other approved listing and testing laboratory or shall comply with the requirements of FM 3011. Termination of monitoring services shall be in accordance with Section 907.6.6.2.

907.7 Acceptance tests and completion. Upon completion of the installation, the fire alarm system and all fire alarm components shall be tested in accordance with NFPA 72.

907.7.1 Single- and multiple-station alarm devices. When the installation of the alarm devices is complete, each device and interconnecting wiring for multiple-station alarm devices shall be tested in accordance with the smoke alarm provisions of NFPA 72.

907.7.2 Record of completion. A record of completion in accordance with NFPA 72 verifying that the system has been installed and tested in accordance with the approved plans and specifications shall be provided.

907.7.3 Instructions. Operating, testing and maintenance instructions and record drawings (“as built”) and equipment specifications shall be provided at an approved location.

907.8 Inspection, testing and maintenance. The maintenance and testing schedules and procedures for fire alarm and fire detection systems shall be in accordance with Sections 907.8.1 through 907.8.4 and NFPA 72. Records of inspection, testing and maintenance shall be maintained.

907.8.1 Maintenance required. Where required for compliance with the provisions of this code, devices, equipment, systems, conditions, arrangements, levels of protection or other features shall thereafter be continuously maintained in accordance with applicable NFPA requirements or as directed by the fire code official.

907.8.2 Testing. Testing shall be performed in accordance with the schedules in NFPA 72 or more frequently where required by the fire code official. Records of testing shall be maintained.

Exception: Devices or equipment that are inaccessible because of safety considerations shall be tested during scheduled shutdowns where approved by the fire code official, but not less than every 18 months.

907.8.3 Smoke detector sensitivity. Smoke detector sensitivity shall be checked within one year after installation and every alternate year thereafter. After the second calibration test, where sensitivity tests indicate that the detector has remained within its listed and marked sensitivity range (or 4-percent obscuration light gray smoke, if not marked), the length of time between calibration tests shall be permitted to be extended to not more than 5 years. Where the frequency is extended, records of detector-caused nuisance alarms and subsequent trends of these alarms shall be maintained. In zones or areas where nuisance alarms show any increase over the previous year, calibration tests shall be performed.

907.8.4 Inspection, testing and maintenance. The building owner shall be responsible to maintain the fire and life safety systems in an operable condition at all times. Service personnel shall meet the qualification requirements of NFPA 72 for inspection, testing and maintenance of such systems. Records of inspection, testing and maintenance shall be maintained.

907.9 Where required in existing buildings and structures. An approved fire alarm system shall be provided in existing buildings and structures where required in Chapter 11.

907.10 Smoke alarm maintenance. Smoke alarms shall be tested and maintained in accordance with the manufacturer's instructions. Smoke alarms shall be replaced when they fail to respond to operability tests, or when they exceed 10 years from the date of manufacture, unless an earlier replacement is specified in the manufacturer's published instructions.

SECTION 908 EMERGENCY ALARM SYSTEMS

908.1 Group H occupancies. Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as required in Chapter 50.

908.2 Group H-5 occupancy. Emergency alarms for notification of an emergency condition in an HPM facility shall be provided as required in Section 2703.12.

908.3 Fire alarm system interface. Where an emergency alarm system is interfaced with a building's fire alarm system, the signal produced at the fire alarm control unit shall be a supervisory signal.

908.4 Carbon dioxide enrichment systems. A gas detection system shall be provided in rooms and indoor areas in which carbon dioxide enrichment processes are located in accordance with Section 5307.3.2.

SECTION 909 SMOKE CONTROL SYSTEMS

909.1 Scope and purpose. This section applies to mechanical or passive smoke control systems where they are required for new buildings or portions thereof by provisions of the *California Building Code* or this code. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat-removal provisions found in Section 910. Mechanical smoke control systems shall not be considered exhaust systems under Chapter 5 of the *California Mechanical Code*.

909.2 General design requirements. Buildings, structures, or parts thereof required by the *California Building Code* or this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to describe adequately the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied with sufficient information and analysis to demonstrate compliance with these provisions.

909.3 Special inspection and test requirements. In addition to the ordinary inspection and test requirements that buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms as in Section 1704 of the *California Building Code*.

909.4 Analysis. A rational analysis supporting the types of smoke control systems to be employed, the methods of their operations, the systems supporting them and the methods of construction to be utilized shall accompany the construction

documents submission and include, but not be limited to, the items indicated in Sections 909.4.1 through 909.4.7.

909.4.1 Stack effect. The system shall be designed such that the maximum probable normal or reverse stack effect will not adversely interfere with the system’s capabilities. In determining the maximum probable stack effect, altitude, elevation, weather history and interior temperatures shall be used.

909.4.2 Temperature effect of fire. Buoyancy and expansion caused by the design fire in accordance with Section 909.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with the system’s capabilities.

909.4.3 Wind effect. The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of the *California Building Code*.

909.4.4 Systems. The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems status. The design shall consider the effects of the fire on the heating, ventilating and air-conditioning systems.

909.4.5 Climate. The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

909.4.6 Duration of operation. All portions of active or engineered smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than either 20 minutes or 1.5 times the calculated egress time, whichever is greater.

909.4.7 Smoke control system interaction. The design shall consider the interaction effects of the operation of multiple smoke control systems for all design scenarios.

909.5 Smoke barrier construction. Smoke barriers required for passive smoke control and a smoke control system using the pressurization method shall comply with Section 709 of the *California Building Code*. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1. Walls: $A/A_w = 0.00100$
2. Interior exit stairways and ramps and exit passageways: $A/A_w = 0.00035$
3. Enclosed exit access stairways and ramps and all other shafts: $A/A_w = 0.00150$
4. Floors and roofs: $A/A_F = 0.00050$

where:

- A = Total leakage area, square feet (m²).
- A_F = Unit floor or roof area of barrier, square feet (m²).
- A_w = Unit wall area of barrier, square feet (m²).

The leakage area ratios shown do not include openings due to gaps around doors and operable windows. The total leakage area of the smoke barrier shall be determined in accordance with Section 909.5.1 and tested in accordance with Section 909.5.2.

909.5.1 Total leakage area. Total leakage area of the barrier is the product of the smoke barrier gross area multiplied by the allowable leakage area ratio, plus the area of other openings such as gaps around doors and operable windows.

909.5.2 Testing of leakage area. Compliance with the maximum total leakage area shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems utilizing the pressurization method. Compliance with the maximum total leakage area of passive smoke control systems shall be verified through methods such as door fan testing or other methods, as approved by the fire code official.

909.5.3 Opening protection. Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by fire door assemblies complying with Section 716 of the *California Building Code*.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with Section 907.3. *When used in a Group I-2 or a I-2.1, such detectors shall activate the fire alarm system and shall close all the smoke barrier doors within the effected zone.*
2. Fixed openings between smoke zones that are protected utilizing the airflow method *in other than Group I-2 or I-2.1.*
3. In Group I-2, *I-2.1, R-2.1* and ambulatory care facilities, where a pair of opposite-swinging doors are installed across a corridor in accordance with Section 909.5.3.1, the doors shall be protected in accordance with Section 716 of the *California Building Code*. The doors shall not have a center mullion. *Positive-latching devices are required. Doors installed across corridors shall comply with Section 1010.1.1.*
4. In Group I-2, *I-2.1, R-2.1* and ambulatory care facilities, where such doors are special-purpose horizontal sliding, accordion or folding door assemblies installed in accordance with Section 1010.3.3 and are automatic closing by smoke detection in accordance with Section 716.2.6.6 of the *California Building Code* they shall be protected in accordance with Section 716 of the *California Building Code*. *Doors installed across corridors shall comply with Section 1010.1.1.*
5. Group I-3.
6. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank-down capacity of greater than 20 minutes as determined by the design fire size.

7. In Group I-2 or I-2.1, smoke damper activation may be accomplished by a fire alarm control unit provided that an open area smoke detection system is provided within all areas served by an HVAC system.

909.5.3.1 Group I-2, I-2.1, R-2.1 and ambulatory care facilities. In Group I-2, I-2.1, R-2.1 and ambulatory care facilities, where doors are installed across a corridor, the doors shall be automatic closing by smoke detection in accordance with Section 716.2.6.6 of the *California Building Code* and shall have a vision panel with fire-protection-rated glazing materials in fire-protection-rated frames, the area of which shall not exceed that tested. In Group I-2, where swinging doors are installed across a corridor, such doors shall be opposite swinging pairs.

909.5.3.2 Ducts and air transfer openings. Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke damper complying with Section 717 of the *California Building Code*.

909.6 Pressurization method. The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke-control zone of fire origin.

909.6.1 Minimum pressure difference. The pressure difference across a smoke barrier used to separate smoke zones shall be not less than 0.05-inch water gage (0.0124 kPa) in fully sprinklered buildings.

In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences not less than two times the maximum calculated pressure difference produced by the design fire.

909.6.2 Maximum pressure difference. The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with Section 1010.1.3. Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$$F = F_{dc} + K(WA\Delta P)/2(W - d) \quad \text{(Equation 9-1)}$$

where:

A = Door area, square feet (m²).

d = Distance from door handle to latch edge of door, feet (m).

F = Total door opening force, pounds (N).

F_{dc} = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches of water (Pa).

909.6.3 Pressurized stairways and elevator hoistways. Where stairways or elevator hoistways are pressurized, such pressurization systems shall comply with Section 909 as smoke control systems, in addition to the requirements of Sections 909.20 and 909.21.

909.7 Airflow design method. Where approved by the fire code official, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflow shall be in accordance with this section. Airflow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects. Smoke control systems using the airflow method shall be designed in accordance with NFPA 92.

909.7.1 Prohibited conditions. This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. Airflow toward the fire shall not exceed 200 feet per minute (1.02 m/s). Where the calculated airflow exceeds this limit, the airflow method shall not be used.

909.8 Exhaust method. Where approved by the fire code official, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92.

909.8.1 Smoke layer. The height of the lowest horizontal surface of the smoke layer interface shall be maintained not less than 6 feet (1829 mm) above a walking surface that forms a portion of a required egress system within the smoke zone.

909.9 Design fire. The design fire shall be based on a rational analysis performed by the registered design professional and approved by the fire code official. The design fire shall be based on the analysis in accordance with Section 909.4 and this section.

909.9.1 Factors considered. The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire and whether the fire is likely to be steady or unsteady.

909.9.2 Design fire fuel. Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

909.9.3 Heat-release assumptions. The analysis shall make use of best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

909.9.4 Sprinkler effectiveness assumptions. A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

909.10 Equipment. Equipment including, but not limited to, fans, ducts, automatic dampers and balance dampers shall be suitable for their intended use, suitable for the probable expo-

sure temperatures that the rational analysis indicates, and as approved by the fire code official.

909.10.1 Exhaust fans. Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c/mc) + (T_a) \quad \text{(Equation 9-2)}$$

where:

c = Specific heat of smoke at smoke layer temperature, Btu/lb°F (kJ/kg × K).

m = Exhaust rate, pounds per second (kg/s).

Q_c = Convective heat output of fire, Btu/s (kW).

T_a = Ambient temperature, °F (K).

T_s = Smoke temperature, °F (K).

Exception: Reduced T_s as calculated based on the assurance of adequate dilution air.

909.10.2 Ducts. Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 909.10.1. Ducts shall be constructed and supported in accordance with the *California Mechanical Code*. Ducts shall be leak tested to 1.5 times the maximum design pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception: Flexible connections, for the purpose of vibration isolation, complying with the *California Mechanical Code* and that are constructed of approved fire-resistance-rated materials.

909.10.3 Equipment, inlets and outlets. Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outside air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

909.10.4 Automatic dampers. Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved recognized standards.

909.10.5 Fans. In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the structural design requirements of Chapter 16 of the *California Building Code*.

Motors driving fans shall not be operated beyond their nameplate horsepower (kilowatts) as determined from measurement of actual current draw and shall have a minimum service factor of 1.15.

909.11 Standby power. Smoke control systems shall be provided with standby power in accordance with Section 1203.

909.11.1 Equipment room. The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gears and ventilated directly to and from the exterior. The room shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

909.11.2 Power sources and power surges. Elements of the smoke control system relying on volatile memories or the like shall be supplied with uninterruptable power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke control system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

909.12 Detection and control systems. Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Section 907. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment.

909.12.1 Verification. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override and the presence of power downstream of all disconnects. A preprogrammed weekly test sequence shall report abnormal conditions audibly, visually and by printed report. The preprogrammed weekly test shall operate all devices, equipment and components used for smoke control.

Exception: Where verification of individual components tested through the preprogrammed weekly testing sequence will interfere with, and produce unwanted effects to, normal building operation, such individual components are permitted to be bypassed from the preprogrammed weekly testing, where approved by the fire code official and in accordance with both of the following:

1. Where the operation of components is bypassed from the preprogrammed weekly test, presence of power downstream of all disconnects shall be verified weekly by a listed control unit.
2. Testing of all components bypassed from the preprogrammed weekly test shall be in accordance with Section 909.20.6.

The status of dampers shall be determined using limit or proximity switches installed at the damper or incorporated into the damper actuator. Where multiple dampers are grouped together in an assembly requiring one or more actuators, each damper shall be independently con-

rolled by a separate actuator and provided with an individual limit or proximity switch, or the dampers shall be linked together by a reliable and durable mechanical means or otherwise by permanent means into one or more groups, with each group provided with a common limit or proximity switch.

The status of fans shall be determined by sensing the airflow downstream of the fans using pressure differential switches or transmitters, or by other means of positive proof of airflow where approved by the enforcing authority.

909.12.2 Wiring. In addition to meeting requirements of the *California Electrical Code*, all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

909.12.3 Activation. Smoke control systems shall be activated in accordance with this section.

909.12.3.1 Pressurization, airflow or exhaust method. Mechanical smoke control systems using the pressurization, airflow or exhaust method shall have completely automatic control.

909.12.3.2 Passive method. Passive smoke control systems actuated by approved spot-type detectors listed for releasing service shall be permitted.

909.12.4 Automatic control. Where completely automatic control is required or used, the automatic-control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Section 903.3.1.1, manual controls provided with ready access for the fire department and any smoke detectors required by the engineering analysis.

909.13 Control air tubing. Control air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections and shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

909.13.1 Materials. Control air tubing shall be hard drawn copper, Type L, ACR in accordance with ASTM B42, ASTM B43, ASTM B68/B68M, ASTM B88, ASTM B251 and ASTM B280. Fittings shall be wrought copper or brass, solder type, in accordance with ASME B16.18 or ASME B16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solidus above 1,100°F (593°C) and liquidus below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices, provided that all of the following conditions are met:

1. Tubing shall comply with the requirements of Section 602.2.1.3 of the *California Mechanical Code*.

2. Tubing and the connected device shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or Teflon or by suitable brass compression to male-barbed adapter.
3. Tubing shall be identified by appropriately documented coding.
4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing connected to devices on doors shall be fastened along hinges.

909.13.2 Isolation from other functions. Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

909.13.3 Testing. Control air tubing shall be tested at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

909.14 Marking and identification. The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

909.15 Control diagrams. Identical control diagrams showing all devices in the system and identifying their location and function shall be maintained current and kept on file with the fire code official, the fire department and in the fire command center in a format and manner approved by the fire code official.

909.16 Fire fighter's smoke control panel. A fire fighter's smoke control panel for fire department emergency response purposes only shall be provided and shall include manual control or override of automatic control for mechanical smoke control systems. The panel shall be located in a fire command center complying with Section 508 in high-rise buildings *Group 1-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access* or buildings with smoke-protected assembly seating. In all other buildings, the fire fighter's smoke control panel shall be installed in an approved location adjacent to the fire alarm control panel. The fire fighter's smoke control panel shall comply with Sections 909.16.1 through 909.16.3.

909.16.1 Smoke control systems. Fans within the building shall be shown on the fire fighter's control panel. A clear indication of the direction of airflow and the relationship of components shall be displayed. Status indicators shall be provided for all smoke control equipment, annunciated by fan and zone and by pilot-lamp-type indicators as follows:

1. Fans, dampers and other operating equipment in their normal status—WHITE.

2. Fans, dampers and other operating equipment in their off or closed status—RED.
3. Fans, dampers and other operating equipment in their on or open status—GREEN.
4. Fans, dampers and other operating equipment in a fault status—YELLOW/AMBER.

909.16.2 Smoke control panel. The fire fighter’s control panel shall provide control capability over the complete smoke control system equipment within the building as follows:

1. ON-AUTO-OFF control over each individual piece of operating smoke control equipment that can be controlled from other sources within the building. This includes stairway pressurization fans; smoke exhaust fans; supply, return and exhaust fans; elevator shaft fans; and other operating equipment used or intended for smoke control purposes.
2. OPEN-AUTO-CLOSE control over individual dampers relating to smoke control and that are controlled from other sources within the building.
3. ON-OFF or OPEN-CLOSE control over smoke control and other critical equipment associated with a fire or smoke emergency and that can only be controlled from the fire fighter’s control panel.

Exceptions:

1. Complex systems, where approved, where the controls and indicators are combined to control and indicate all elements of a single smoke zone as a unit.
2. Complex systems, where approved, where the control is accomplished by computer interface using approved, plain English commands.

909.16.3 Control action and priorities. The fire fighter’s control panel actions shall be as follows:

1. ON-OFF and OPEN-CLOSE control actions shall have the highest priority of any control point within the building. Once issued from the fire fighter’s control panel, automatic or manual control from any other control point within the building shall not contradict the control action. Where automatic means are provided to interrupt normal, nonemergency equipment operation or produce a specific result to safeguard the building or equipment including, but not limited to, duct freezestats, duct smoke detectors, high-temperature cutouts, temperature-actuated linkage and similar devices, such means shall be capable of being overridden by the fire fighter’s control panel. The last control action as indicated by each fire fighter’s control panel switch position shall prevail. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

Exception: Power disconnects required by *the California Electrical Code*.

2. Only the AUTO position of each three-position fire-fighter’s control panel switch shall allow automatic or manual control action from other control points within the building. The AUTO position shall be the NORMAL, nonemergency, building control position. Where a fire fighter’s control panel is in the AUTO position, the actual status of the device (on, off, open, closed) shall continue to be indicated by the status indicator described in Section 909.16.1. Where directed by an automatic signal to assume an emergency condition, the NORMAL position shall become the emergency condition for that device or group of devices within the zone. Control actions shall not require the smoke control system to assume more than one configuration at any one time.

909.17 System response time. Smoke-control system activation shall be initiated immediately after receipt of an appropriate automatic or manual activation command. Smoke control systems shall activate individual components (such as dampers and fans) in the sequence necessary to prevent physical damage to the fans, dampers, ducts and other equipment. For purposes of smoke control, the fire fighter’s control panel response time shall be the same for automatic or manual smoke control action initiated from any other building control point. The total response time, including that necessary for detection, shutdown of operating equipment and smoke control system startup, shall allow for full operational mode to be achieved before the conditions in the space exceed the design smoke condition. Upon receipt of an alarm condition at the fire alarm control panel, fans, dampers and automatic doors shall have achieved their proper operating state and the final status shall be indicated at the smoke control panel within 90 seconds. The system response time for each component and their sequential relationships shall be detailed in the required rational analysis and verification of their installed condition reported in the required final report.

909.18 Acceptance testing. Devices, equipment, components and sequences shall be individually tested. These tests, in addition to those required by other provisions of this code, shall consist of determination of function, sequence and, where applicable, capacity of their installed condition.

909.18.1 Detection devices. Smoke or fire detectors that are a part of a smoke control system shall be tested in accordance with Chapter 9 in their installed condition. Where applicable, this testing shall include verification of airflow in both minimum and maximum conditions.

909.18.2 Ducts. Ducts that are part of a smoke control system shall be traversed using generally accepted practices to determine actual air quantities.

909.18.3 Dampers. Dampers shall be tested for function in their installed condition.

909.18.4 Inlets and outlets. Inlets and outlets shall be read using generally accepted practices to determine air quantities.

909.18.5 Fans. Fans shall be examined for correct rotation. Measurements of voltage, amperage, revolutions per minute and belt tension shall be made.

909.18.6 Smoke barriers. Measurements using inclined manometers or other approved calibrated measuring devices shall be made of the pressure differences across smoke barriers. Such measurements shall be conducted for each possible smoke control condition.

909.18.7 Controls. Each smoke zone equipped with an automatic-initiation device shall be put into operation by the actuation of one such device. Each additional device within the zone shall be verified to cause the same sequence without requiring the operation of fan motors in order to prevent damage. Control sequences shall be verified throughout the system, including verification of override from the fire fighter's control panel and simulation of standby power conditions.

909.18.8 Testing for smoke control. Smoke control systems shall be tested by a special inspector in accordance with Section 1705.19 of the *California Building Code*.

909.18.8.1 Scope of testing. Testing shall be conducted in accordance with the following:

1. During erection of ductwork and prior to concealment for the purposes of leakage testing and recording of device location.
2. Prior to occupancy and after sufficient completion for the purposes of pressure-difference testing, flow measurements, and detection and control verification.

909.18.8.2 Qualifications. Approved agencies for smoke control testing shall have expertise in fire protection engineering, mechanical engineering and certification as air balancers.

909.18.8.3 Reports. A complete report of testing shall be prepared by the approved agency. The report shall include identification of all devices by manufacturer, nameplate data, design values, measured values and identification tag or mark. The report shall be reviewed by the responsible registered design professional and, when satisfied that the design intent has been achieved, the responsible registered design professional shall sign, seal and date the report.

909.18.8.3.1 Report filing. A copy of the final report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.

909.18.9 Identification and documentation. Charts, drawings and other documents identifying and locating each component of the smoke control system, and describing their proper function and maintenance requirements, shall be maintained on file at the building as an attachment to the report required by Section 909.18.8.3. Devices shall have an approved identifying tag or mark on them consistent with the other required documentation and shall be dated indicating the last time they were successfully tested and by whom.

An approved operations manual describing the complete operations of the smoke control system and functioning of the fire-fighter's smoke control panel shall be maintained at the fire command center.

909.19 System acceptance. Buildings, or portions thereof, required by this code to comply with this section shall not be issued a certificate of occupancy until such time that the fire code official determines that the provisions of this section have been fully complied with and that the fire department has received satisfactory instruction on the operation, both automatic and manual, of the system and a written maintenance program complying with the requirements of Section 909.22.1 has been submitted and approved by the fire code official.

Exception: In buildings of phased construction, a temporary certificate of occupancy, as approved by the fire code official, shall be allowed, provided that those portions of the building to be occupied meet the requirements of this section and that the remainder does not pose a significant hazard to the safety of the proposed occupants or adjacent buildings.

[BF] 909.20 Smokeproof enclosures. Where required by Section 1023.12, a smokeproof enclosure shall be constructed in accordance with this section. A smokeproof enclosure shall consist of an interior exit stairway or ramp that is enclosed in accordance with the applicable provisions of Section 1023 and an open exterior balcony or ventilated vestibule meeting the requirements of this section. Where access to the roof is required, such access shall be from the smokeproof enclosure where a smokeproof enclosure is required.

[BF] 909.20.1 Access. Access to the stairway or ramp shall be by way of a vestibule or an open exterior balcony. The minimum dimension of the vestibule shall be not less than the required width of the corridor leading to the vestibule but shall not have a width of less than 44 inches (1118 mm) and shall not have a length of less than 72 inches (1829 mm) in the direction of egress travel.

[BF] 909.20.2 Construction. The smokeproof enclosure shall be separated from the remainder of the building by not less than 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both. Openings are not permitted other than the required means of egress doors. The vestibule shall be separated from the stairway or ramp by not less than 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both. The open exterior balcony shall be constructed in accordance with the fire-resistance-rating requirements for floor assemblies.

[BF] 909.20.2.1 Door closers. Doors in a smokeproof enclosure shall be self-closing or automatic closing by actuation of a smoke detector in accordance with Section 716.2.6.6 of the *California Building Code* and shall be installed at the floor-side entrance to the smokeproof enclosure. The actuation of the smoke detector on any door shall activate the closing devices on all doors in the smokeproof enclosure at all levels. Smoke detectors shall be installed in accordance with Section 907.3.

[BF] 909.20.3 Natural ventilation alternative. The provisions of Sections 909.20.3.1 through 909.20.3.3 shall apply to ventilation of smokeproof enclosures by natural means.

[BF] 909.20.3.1 Balcony doors. Where access to the stairway or ramp is by way of an open exterior balcony, the door assembly into the enclosure shall be a fire door assembly in accordance with Section 716 of the *California Building Code*.

[BF] 909.20.3.2 Vestibule doors. Where access to the stairway or ramp is by way of a vestibule, the door assembly into the vestibule shall be a fire door assembly complying with Section 716 of the *California Building Code*. The door assembly from the vestibule to the stairway shall have not less than a 20-minute fire protection rating complying with Section 716 of the *California Building Code*.

[BF] 909.20.3.3 Vestibule ventilation. Each vestibule shall have a minimum net area of 16 square feet (1.5 m²) of opening in a wall facing an outer court, yard or public way that is not less than 20 feet (6096 mm) in width.

[BF] 909.20.4 Mechanical ventilation alternative. The provisions of Sections 909.20.4.1 through 909.20.4.4 shall apply to ventilation of smokeproof enclosures by mechanical means.

[BF] 909.20.4.1 Vestibule doors. The door assembly from the building into the vestibule shall be a fire door assembly complying with Section 716.2.2.1 of the *California Building Code*. The door assembly from the vestibule to the stairway or ramp shall have not less than a 20-minute fire protection rating and shall meet the requirements for a smoke door assembly in accordance with Section 716.2.2.1 of the *California Building Code*. The door shall be installed in accordance with NFPA 105.

[BF] 909.20.4.2 Vestibule ventilation. The vestibule shall be supplied with not less than one air change per minute and the exhaust shall be not less than 150 percent of supply. Supply air shall enter and exhaust air shall discharge from the vestibule through separate, tightly constructed ducts used only for that purpose. Supply air shall enter the vestibule within 6 inches (152 mm) of the floor level. The top of the exhaust register shall be located at the top of the smoke trap but not more than 6 inches (152 mm) down from the top of the trap, and shall be entirely within the smoke trap area. Doors in the open position shall not obstruct duct openings. Duct openings with controlling dampers are permitted where necessary to meet the design requirements, but dampers are not otherwise required.

[BF] 909.20.4.2.1 Engineered ventilation system. Where a specially engineered system is used, the system shall exhaust a quantity of air equal to not less than 90 air changes per hour from any vestibule when in emergency operation mode and shall be sized to handle three vestibules simultaneously. Smoke detectors shall be located at the floor-side entrance to

each vestibule and shall activate the system for the affected vestibule. Smoke detectors shall be installed in accordance with Section 907.3.

[BF] 909.20.4.3 Smoke trap. The vestibule ceiling shall be not less than 20 inches (508 mm) higher than the door opening into the vestibule to serve as a smoke and heat trap and to provide an upward-moving air column. The height shall not be decreased unless approved and justified by design and test.

[BF] 909.20.4.4 Stairway or ramp shaft air movement system. The stairway or ramp shaft shall be provided with a dampered relief opening and supplied with sufficient air to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) in the shaft relative to the vestibule with all doors closed.

[BF] 909.20.5 Stairway and ramp pressurization alternative. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the vestibule is not required, provided that each interior exit stairway or ramp is pressurized to not less than 0.10 inch of water (25 Pa) and not more than 0.35 inch of water (87 Pa) in the shaft relative to the building measured with all interior exit stairway and ramp doors closed under maximum anticipated conditions of stack effect and wind effect.

[BF] 909.20.6 Ventilating equipment. The activation of ventilating equipment required by the alternatives in Sections 909.20.4 and 909.20.5 shall be by smoke detectors installed at each floor level at an approved location at the entrance to the smokeproof enclosure. When the closing device for the stairway and ramp shaft and vestibule doors is activated by smoke detection or power failure, the mechanical equipment shall activate and operate at the required performance levels. Smoke detectors shall be installed in accordance with Section 907.3.

[BF] 909.20.6.1 Ventilation systems. Smokeproof enclosure ventilation systems shall be independent of other building ventilation systems. The equipment, control wiring, power wiring and ductwork shall comply with one of the following:

1. Equipment, control wiring, power wiring and ductwork shall be located exterior to the building and directly connected to the smokeproof enclosure or connected to the smokeproof enclosure by ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.
2. Equipment, control wiring, power wiring and ductwork shall be located within the smokeproof enclosure with intake or exhaust directly from and to the outside or through ductwork enclosed by not less than 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

3. Equipment, control wiring, power wiring and ductwork shall be located within the building if separated from the remainder of the building, including other mechanical equipment, by not less than 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

Exception: Control wiring and power wiring located outside of a 2-hour fire barrier construction shall be protected using any one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 2 hours.
2. Where encased with not less than 2 inches (51 mm) of concrete.
3. Electrical circuit protective systems shall have a fire-resistance rating of not less than 2 hours. Electrical circuit protective systems shall be installed in accordance with their listing requirements.

[BF] 909.20.6.2 Standby power. Mechanical vestibule and stairway and ramp shaft ventilation systems and automatic fire detection systems shall be provided with standby power in accordance with Section 603.

[BF] 909.20.6.3 Acceptance and testing. Before the mechanical equipment is approved, the system shall be tested in the presence of the building official to confirm that the system is operating in compliance with these requirements.

[BF] 909.21 Elevator hoistway pressurization alternative. Where elevator hoistway pressurization is provided in lieu of required enclosed elevator lobbies, the pressurization system shall comply with Sections 909.21.1 through 909.21.11.

[BF] 909.21.1 Pressurization requirements. Elevator hoistways shall be pressurized to maintain a minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to adjacent occupied space on all floors. This pressure shall be measured at the midpoint of each hoistway door, with all elevator cars at the floor of recall and all hoistway doors on the floor of recall open and all other hoistway doors closed. The pressure differentials shall be measured between the hoistway and the adjacent elevator landing. The opening and closing of hoistway doors at each level must be demonstrated during this test. The supply air intake shall be from an outside, uncontaminated source located a minimum distance of 20 feet (6096 mm) from any air exhaust system or outlet.

Exceptions:

1. On floors containing only Group R occupancies, the pressure differential is permitted to be measured between the hoistway and a dwelling unit or sleeping unit.

2. Where an elevator opens into a lobby enclosed in accordance with Section 3007.6 or 3008.6 of the *California Building Code*, the pressure differential is permitted to be measured between the hoistway and the space immediately outside the door(s) from the floor to the enclosed lobby.
3. The pressure differential is permitted to be measured relative to the outdoor atmosphere on floors other than the following:
 - 3.1. The fire floor.
 - 3.2. The two floors immediately below the fire floor.
 - 3.3. The floor immediately above the fire floor.
4. The minimum positive pressure of 0.10 inch of water (25 Pa) and a maximum positive pressure of 0.25 inch of water (67 Pa) with respect to occupied floors is not required at the floor of recall with the doors open.

[BF] 909.21.1.1 Use of ventilation systems. Ventilation systems, other than hoistway supply air systems, are permitted to be used to exhaust air from adjacent spaces on the fire floor, two floors immediately below and one floor immediately above the fire floor to the building's exterior where necessary to maintain positive pressure relationships as required in Section 909.21.1 during operation of the elevator shaft pressurization system.

[BF] 909.21.2 Rational analysis. A rational analysis complying with Section 909.4 shall be submitted with the construction documents.

[BF] 909.21.3 Ducts for system. Any duct system that is part of the pressurization system shall be protected with the same fire-resistance rating as required for the elevator shaft enclosure.

[BF] 909.21.4 Fan system. The fan system provided for the pressurization system shall be as required by Sections 909.21.4.1 through 909.21.4.4.

[BF] 909.21.4.1 Fire resistance. Where located within the building, the fan system that provides the pressurization shall be protected with the same fire-resistance rating required for the elevator shaft enclosure.

[BF] 909.21.4.2 Smoke detection. The fan system shall be equipped with a smoke detector that will automatically shut down the fan system when smoke is detected within the system.

[BF] 909.21.4.3 Separate systems. A separate fan system shall be used for each elevator hoistway.

[BF] 909.21.4.4 Fan capacity. The supply fan shall be either adjustable with a capacity of not less than 1,000 cfm (0.4719 m³/s) per door, or that specified by a registered design professional to meet the requirements of a designed pressurization system.

[BF] 909.21.5 Standby power. The pressurization system shall be provided with standby power in accordance with Section 1203.

[BF] 909.21.6 Activation of pressurization system. The elevator pressurization system shall be activated upon activation of either the building fire alarm system or the elevator lobby smoke detectors. Where both a building fire alarm system and elevator lobby smoke detectors are present, each shall be independently capable of activating the pressurization system.

[BF] 909.21.7 Testing. Testing for performance shall be required in accordance with Section 909.18.8. System acceptance shall be in accordance with Section 909.19.

[BF] 909.21.8 Marking and identification. Detection and control systems shall be marked in accordance with Section 909.14.

[BF] 909.21.9 Control diagrams. Control diagrams shall be provided in accordance with Section 909.15.

[BF] 909.21.10 Control panel. A control panel complying with Section 909.16 shall be provided.

[BF] 909.21.11 System response time. Hoistway pressurization systems shall comply with the requirements for smoke control system response time in Section 909.17.

909.22 Maintenance. Smoke control systems shall be maintained to ensure to a reasonable degree that the system is capable of controlling smoke for the duration required. The system shall be maintained in accordance with the manufacturer's instructions and Sections 909.22.1 through 909.22.6.

909.22.1 Schedule. A routine maintenance and operational testing program shall be initiated immediately after the smoke control system has passed the acceptance tests. A written schedule for routine maintenance and operational testing shall be established.

909.22.2 Records. Records of smoke control system testing and maintenance shall be maintained. The record shall include the date of the maintenance, identification of the servicing personnel and notification of any unsatisfactory condition and the corrective action taken, including parts replaced.

909.22.3 Testing. Operational testing of the smoke control system shall include all equipment such as initiating devices, fans, dampers, controls, doors and windows.

909.22.4 Dedicated smoke control systems. Dedicated smoke control systems shall be operated for each control sequence semiannually. The system shall be tested under standby power conditions.

909.22.5 Nondedicated smoke control systems. Nondedicated smoke control systems shall be operated for each control sequence annually. The system shall be tested under standby power conditions.

909.22.6 Components bypassing weekly test. Where components of the smoke control system are bypassed by the preprogrammed weekly test required by Section 909.12.1, such components shall be tested semiannually. The system shall be tested under standby power conditions.

SECTION 910 SMOKE AND HEAT REMOVAL

910.1 General. Where required by this code, smoke and heat vents or mechanical smoke removal systems shall conform to the requirements of this section.

910.2 Where required. Smoke and heat vents or a mechanical smoke removal system shall be installed as required by Sections 910.2.1 and 910.2.2.

Exceptions:

1. Frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.
2. Smoke and heat removal shall not be required in areas of buildings equipped with early suppression fast-response (ESFR) sprinklers.
3. Smoke and heat removal shall not be required in areas of buildings equipped with control mode special application sprinklers with a response time index of $50(m \times s)^{1/2}$ or less that are listed to control a fire in stored commodities with 12 or fewer sprinklers.

910.2.1 Group F-1 or S-1. Smoke and heat vents installed in accordance with Section 910.3 or a mechanical smoke removal system installed in accordance with Section 910.4 shall be installed in buildings and portions thereof used as a Group F-1 or S-1 occupancy having more than 50,000 square feet (4645 m²) of undivided area. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

Exception: *Group F-1 aircraft manufacturing buildings and Group S-1 aircraft repair hangars.*

910.2.2 High-piled combustible storage. Smoke and heat removal required by Table 3206.2 for buildings and portions thereof containing high-piled combustible storage shall be installed in accordance with Section 910.3 in unsprinklered buildings. In buildings and portions thereof containing high-piled combustible storage equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, a smoke and heat removal system shall be installed in accordance with Section 910.3 or 910.4. In occupied portions of a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 where the upper surface of the story is not a roof assembly, a mechanical smoke removal system in accordance with Section 910.4 shall be installed.

910.3 Smoke and heat vents. The design and installation of smoke and heat vents shall be in accordance with Sections 910.3.1 through 910.3.3.

910.3.1 Listing and labeling. Smoke and heat vents shall be listed and labeled to indicate compliance with UL 793 or FM 4430 or ICC ES AC 331.

910.3.2 Smoke and heat vent locations. Smoke and heat vents shall be located 20 feet (6096 mm) or more from adjacent lot lines and fire walls and 10 feet (3048 mm) or more from fire barriers. Vents shall be uniformly located within the roof in the areas of the building where the vents are required to be installed by Section 910.2, with consideration given to roof pitch, sprinkler location and structural members.

910.3.3 Smoke and heat vents area. The required aggregate area of smoke and heat vents shall be calculated as follows:

For buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1:

$$A_{VR} = V/9000 \quad \text{(Equation 9-3)}$$

where:

A_{VR} = The required aggregate vent area (ft²).

V = Volume (ft³) of the area that requires smoke removal.

For unsprinklered buildings:

$$A_{VR} = A_{FA}/50 \quad \text{(Equation 9-4)}$$

where:

A_{VR} = The required aggregate vent area (ft²).

A_{FA} = The area of the floor in the area that requires smoke removal.

910.3.4 Vent operation. Smoke and heat vents shall be capable of being operated by approved automatic and manual means.

910.3.5 Fusible link temperature rating. Where vents are installed in areas provided with automatic fire sprinklers and the vents operate by fusible link, the fusible link shall have a temperature rating of 360°F (182°C).

910.4 Mechanical smoke removal systems. Mechanical smoke removal systems shall be designed and installed in accordance with Sections 910.4.1 through 910.4.7.

910.4.1 Automatic sprinklers required. The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

910.4.2 Exhaust fan construction. Exhaust fans that are part of a mechanical smoke removal system shall be rated for operation at 221°F (105°C). Exhaust fan motors shall be located outside of the exhaust fan airstream.

910.4.3 System design criteria. The mechanical smoke removal system shall be sized to exhaust the building at a minimum rate of two air changes per hour based on the volume of the building or portion thereof without contents. The capacity of each exhaust fan shall not exceed 30,000 cubic feet per minute (14.2 m³/s).

910.4.3.1 Makeup air. Makeup air openings shall be provided within 6 feet (1829 mm) of the floor level. Operation of makeup air openings shall be manual or automatic. The minimum gross area of makeup air inlets shall be 8 square feet per 1,000 cubic feet per minute (0.74 m² per 0.4719 m³/s) of smoke exhaust.

910.4.4 Activation. The mechanical smoke removal system shall be activated by manual controls only.

910.4.5 Manual control location. Manual controls shall be located where they are able to be accessed by the fire service from an exterior door of the building and separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

910.4.6 Control wiring. Wiring for operation and control of mechanical smoke removal systems shall be connected ahead of the main disconnect in accordance with Section 701.12E of the *California Electrical Code* and be protected against interior fire exposure to temperatures in excess of 1,000°F (538°C) for a period of not less than 15 minutes.

910.4.7 Controls. Where building air-handling and mechanical smoke removal systems are combined or where independent building air-handling systems are provided, fans shall automatically shut down in accordance with the *California Mechanical Code*. The manual controls provided for the smoke removal system shall have the capability to override the automatic shutdown of fans that are part of the smoke removal system.

910.5 Maintenance and testing. Maintenance and testing of smoke and heat vents and mechanical smoke removal systems shall be in accordance with Sections 910.5.1 and 910.5.2. A written record of inspection, testing and maintenance that includes the date, identification of personnel involved, any unsatisfactory result, corrective action taken and replaced parts shall be maintained on the premises.

910.5.1 Smoke and heat vents. Smoke and heat vents shall be maintained in an operative condition. Inspection, testing and maintenance shall be in accordance with NFPA 204 except as follows:

1. Mechanically operated smoke and heat vents shall be inspected annually and operationally tested not less than every 5 years.
2. Gravity dropout smoke and heat vents shall be inspected annually.
3. Fused, damaged or painted fusible links shall be replaced.

910.5.2 Mechanical smoke removal systems. Mechanical smoke removal systems shall be maintained in accordance with NFPA 204 and the equipment manufacturer's instructions except as follows:

1. Systems shall be inspected and operationally tested annually.
2. Testing shall include the operation of all system components, controls and ancillary equipment, such as makeup air openings.
3. A written schedule for routine maintenance and operational testing shall be established and testing shall be conducted in accordance with the schedule.

**SECTION 911
EXPLOSION CONTROL**

911.1 General. Explosion control shall be provided in the following locations:

1. Where a structure, room or space is occupied for purposes involving explosion hazards as identified in Table 911.1.
2. Where quantities of hazardous materials specified in Table 911.1 exceed the maximum allowable quantities in Table 5003.1.1(1).

Such areas shall be provided with explosion (deflagration) venting, explosion (deflagration) prevention systems or barricades in accordance with this section and NFPA 68, NFPA 69 or NFPA 495 as applicable. Deflagration venting shall not be utilized as a means to protect buildings from detonation hazards.

911.2 Required deflagration venting. Areas that are required to be provided with deflagration venting shall comply with the following:

1. Walls, ceilings and roofs exposing surrounding areas shall be designed to resist a minimum internal pressure of 100 pounds per square foot (psf) (4788 Pa). The minimum internal design pressure shall be not less than five times the maximum internal relief pressure specified in Item 5 of this section.
2. Deflagration venting shall be provided only in exterior walls and roofs.

Exception: Where sufficient exterior wall and roof venting cannot be provided because of inadequate exterior wall or roof area, deflagration venting shall be allowed by specially designed shafts vented to the exterior of the building.

3. Deflagration venting shall be designed to prevent unacceptable structural damage. Where relieving a deflagration, vent closures shall not produce projectiles of sufficient velocity and mass to cause life threatening injuries to the occupants or other persons on the property or adjacent public ways.
4. The aggregate clear area of vents and venting devices shall be governed by the pressure resistance of the construction assemblies specified in Item 1 of this section and the maximum internal pressure allowed by Item 5 of this section.
5. Vents shall be designed to withstand loads in accordance with the *California Building Code*. Vents shall consist of any one or any combination of the following to relieve at a maximum internal pressure of 20 pounds per square foot (958 Pa), but not less than the loads required by the *California Building Code*:
 - 5.1. Exterior walls designed to release outward.
 - 5.2. Hatch covers.
 - 5.3. Outward swinging doors.
 - 5.4. Roofs designed to uplift.
 - 5.5. Venting devices listed for the purpose.

6. Vents designed to release from the exterior walls or roofs of the building when venting a deflagration shall discharge directly to the exterior of the building where an unoccupied space not less than 50 feet (15 240 mm) in width is provided between the exterior walls of the building and the lot line.

Exception: Vents complying with Item 7 of this section.

7. Vents designed to remain attached to the building when venting a deflagration shall be so located that the discharge opening shall be not less than 10 feet (3048 mm) vertically from window openings and exits in the building and 20 feet (6096 mm) horizontally from exits in the building, from window openings and exits in adjacent buildings on the same lot and from the lot line.
8. Discharge from vents shall not be into the interior of the building.

911.3 Explosion prevention systems. Explosion prevention systems shall be of an approved type and installed in accordance with the provisions of this code and NFPA 69.

911.4 Deflagration venting. Deflagration venting shall be of an approved type and installed in accordance with the provisions of this code and NFPA 68.

911.5 Barricades. Barricades shall be designed and installed in accordance with NFPA 495.

**SECTION 912
FIRE DEPARTMENT CONNECTIONS**

912.1 Installation. Fire department connections shall be installed in accordance with the NFPA standard applicable to the system design and shall comply with Sections 912.2 through 912.7.

912.2 Location. With respect to hydrants, driveways, buildings and landscaping, fire department connections shall be so located that fire apparatus and hose connected to supply the system will not obstruct access to the buildings for other fire apparatus. The location of fire department connections shall be approved by the fire code official.

912.2.1 Visible location. Fire department connections shall be located on the street side of buildings or facing approved fire apparatus access roads, fully visible and recognizable from the street, fire apparatus access road or nearest point of fire department vehicle access or as otherwise approved by the fire code official.

912.2.2 Existing buildings. On existing buildings, whenever the fire department connection is not visible to approaching fire apparatus, the fire department connection shall be indicated by an approved sign mounted on the street front or on the side of the building. Such sign shall have the letters "FDC" not less than 6 inches (152 mm) high and words in letters not less than 2 inches (51 mm) high or an arrow to indicate the location. Such signs shall be subject to the approval of the fire code official.

912.3 Fire hose threads. Fire hose threads used in connection with standpipe systems shall be approved and shall be compatible with fire department hose threads.

912.4 Access. Immediate access to fire department connections shall be maintained at all times and without obstruction by fences, bushes, trees, walls or any other fixed or moveable object. Access to fire department connections shall be approved by the fire code official.

Exceptions:

1. Fences, where provided with an access gate equipped with a sign complying with the legend requirements of Section 912.5 and a means of emergency operation. The gate and the means of emergency operation shall be approved by the fire code official and maintained operational at all times.

**TABLE 911.1
EXPLOSION CONTROL REQUIREMENTS^f**

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems
Hazard Category			
Combustible dusts ^a	—	Not required	Required
Cryogenic fluids	Flammable	Not required	Required
Explosives	Division 1.1	Required	Not required
	Division 1.2	Required	Not required
	Division 1.3	Not required	Required
	Division 1.4	Not required	Required
	Division 1.5	Required	Not required
	Division 1.6	Required	Not required
Flammable gas	Gaseous	Not required	Required
	Liquefied	Not required	Required
Flammable liquids	IA ^b	Not required	Required
	IB ^c	Not required	Required
Organic peroxides	Unclassified detonable	Required	Not permitted
	I	Required	Not permitted
Oxidizer liquids and solids	4	Required	Not permitted
Pyrophoric	Gases	Not required	Required
Unstable (reactive)	4	Required	Not permitted
	3 detonable	Required	Not permitted
	3 nondetonable	Not required	Required
Water-reactive liquids and solids	3	Not required	Required
	2 ^c	Not required	Required
Special Uses			
Acetylene generator rooms	—	Not required	Required
Electrochemical energy storage systems ^g	—	Not required	Required
Energy storage systems ^g	—	Not required	Required
Grain processing	—	Not required	Required
Liquefied petroleum gas distribution facilities	—	Not required	Required
Where explosion hazards exist ^d	Detonation	Required	Not permitted
	Deflagration	Not required	Required

- a. Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.8.2. See definition of “Combustible dust” in Chapter 2.
- b. Storage or use.
- c. In open use or dispensing.
- d. Rooms containing dispensing and use of hazardous materials where an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.
- e. A method of explosion control shall be provided where Class 2 water-reactive materials can form potentially explosive mixtures.
- f. Explosion venting is not required for Group H-5 Fabrication Areas complying with Chapter 27 and the *California Building Code*.
- g. Where explosion control is required in Section 1207.6.3.

2. When acceptable to the fire enforcing agency, fire department connections for Group I-3 detention facilities may be located inside all security walls or fences on the property.

912.4.1 Locking fire department connection caps. The fire code official is authorized to require locking caps on fire department connections for water-based fire protection systems where the responding fire department carries appropriate key wrenches for removal.

912.4.2 Clear space around connections. A working space of not less than 36 inches (914 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of wall-mounted fire department connections and around the circumference of free-standing fire department connections, except as otherwise required or approved by the fire code official.

912.4.3 Physical protection. Where fire department connections are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312.

912.5 Signs. A metal sign with raised letters not less than 1 inch (25 mm) in size shall be mounted on all fire department connections serving automatic sprinklers, standpipes or fire pump connections. Such signs shall read: “AUTOMATIC SPRINKLERS” or “STANDPIPES” or “TEST CONNECTION” or a combination thereof as applicable. Where the fire department connection does not serve the entire building, a sign shall be provided indicating the portions of the building served.

912.6 Backflow protection. The potable water supply to automatic sprinkler and standpipe systems shall be protected against backflow as required by the *Health and Safety Code Section 13114.7*.

912.7 Inspection, testing and maintenance. Fire department connections shall be periodically inspected, tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*. Records of inspection, testing and maintenance shall be maintained.

SECTION 913 FIRE PUMPS

913.1 General. Where provided, fire pumps for fire protection systems shall be installed in accordance with this section and NFPA 20.

Exception: Pumps for automatic sprinkler systems installed in accordance with Section 903.3.1.3 or Section R313 of the *California Residential Code*.

913.2 Protection against interruption of service. The fire pump, driver and controller shall be protected in accordance with NFPA 20 against possible interruption of service through damage caused by explosion, fire, flood, earthquake, rodents, insects, windstorm, freezing, vandalism and other adverse conditions.

913.2.1 Protection of fire pump rooms. Rooms where fire pumps are located shall be separated from all other

areas of the building in accordance with Section 913.2.1 of the *California Building Code*.

913.2.2 Circuits supplying fire pumps. Cables used for survivability of circuits supplying fire pumps shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.
4. The cable or raceway is encased in a minimum of 2 inches (51 mm) of concrete.

Exception: This section shall not apply to cables, or portions of cables, located within a fire pump room or generator room that is separated from the remainder of the occupancy with fire-resistance-rated construction.

913.3 Temperature of pump room. Suitable means shall be provided for maintaining the temperature of a pump room or pump house, where required, above 40°F (5°C).

913.3.1 Engine manufacturer’s recommendation. Temperature of the pump room, pump house or area where engines are installed shall never be less than the minimum recommended by the engine manufacturer. The engine manufacturer’s recommendations for oil heaters shall be followed.

913.4 Valve supervision. Where provided, the fire pump suction, discharge and bypass valves, and isolation valves on the backflow prevention device or assembly shall be supervised open by one of the following methods:

1. Central-station, proprietary or remote-station signaling service.
2. Local signaling service that will cause the sounding of an audible signal at a constantly attended location.
3. Locking valves open.
4. Sealing of valves and approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.

913.4.1 Test outlet valve supervision. Fire pump test outlet valves shall be supervised in the closed position.

913.5 Testing and maintenance. Fire pumps shall be inspected, tested and maintained in accordance with the requirements of this section and *California Code of Regulations, Title 19, Division 1, Chapter 5*. Records of inspection, testing and maintenance shall be maintained.

913.5.1 Acceptance test. Acceptance testing shall be done in accordance with the requirements of NFPA 20.

913.5.2 Generator sets. Engine generator sets supplying emergency or standby power to fire pump assemblies shall

be periodically tested in accordance with NFPA 110. Records of testing shall be maintained.

913.5.3 Transfer switches. Automatic transfer switches shall be periodically tested in accordance with NFPA 110. Records of testing shall be maintained.

913.5.4 Pump room environmental conditions. Tests of pump room environmental conditions, including heating, ventilation and illumination, shall be made to ensure proper manual or automatic operation of the associated equipment.

913.6 Fire pumps in high-rise buildings. *Engine-driven fire pumps and electric drive fire pumps supplied by generators shall both be provided with an on-premises fuel supply, sufficient for not less than 8-hour full-demand operation at 100 percent of the rated pump capacity in addition to all other required supply demands in accordance with NFPA 20 and this section.*

SECTION 914

FIRE PROTECTION BASED ON SPECIAL DETAILED REQUIREMENTS OF USE AND OCCUPANCY

914.1 General. This section shall specify where fire protection systems are required based on the detailed requirements of use and occupancy of the *California Building Code*.

914.2 Covered and open mall buildings. Covered and open mall buildings shall comply with Sections 914.2.1 through 914.2.4.

914.2.1 Automatic sprinkler system. Covered and open mall buildings and buildings connected shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, which shall comply with the all of the following:

1. The automatic sprinkler system shall be complete and operative throughout occupied space in the mall building prior to occupancy of any of the tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with approved alternative protection.
2. Sprinkler protection for the mall of a covered mall building shall be independent from that provided for tenant spaces or anchor buildings.
3. Sprinkler protection for the tenant spaces of an open mall building shall be independent from that provided for anchor buildings.
4. Sprinkler protection shall be provided beneath exterior circulation balconies located adjacent to an open mall.
5. Where tenant spaces are supplied by the same system, they shall be independently controlled.

Exception: An automatic sprinkler system shall not be required in spaces or areas of open parking garages separated from the covered or open mall in accordance with Section 402.4.2.3 of the *California Building Code* and constructed in accordance with Section 406.5 of the *California Building Code*.

914.2.2 Standpipe system. The covered and open mall building shall be equipped throughout with a standpipe system as required by Section 905.3.3.

914.2.3 Emergency voice/alarm communication system. Where the total floor area exceeds 50,000 square feet (4645 m²) within either a covered mall building or within the perimeter line of an open mall building, an emergency voice/alarm communication system shall be provided. Access to emergency voice/alarm communication systems serving a mall, required or otherwise, shall be provided for the fire department. The system shall be provided in accordance with Section 907.5.2.2.

914.2.4 Fire department access to equipment. Rooms or areas containing controls for air-conditioning systems or fire protection systems shall be identified for use by the fire department.

914.3 High-rise buildings. High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall comply with Sections 914.3.1 through 914.3.7.

914.3.1 Automatic sprinkler system. Buildings and structures shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 914.3.2. *A sprinkler water-flow alarm-initiating device and a control valve with a supervisory signal-initiating device shall be provided at the lateral connection to the riser on each floor.*

Exception: An automatic sprinkler system shall not be required in spaces or areas of telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an automatic fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or not less than 2-hour horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

914.3.1.1 Number of sprinkler system risers and system design. Each sprinkler system serving a floor in buildings that are more than 420 feet (128 m) in height shall be connected to a minimum of two sprinkler risers or combination standpipe system risers located in separate shafts. *Each sprinkler system shall be hydraulically designed so that when one connection is shut-down, the other connection shall be capable of supplying the sprinkler system design demand.* Each riser shall supply sprinklers on alternate floors. If more than two risers are provided for a zone, sprinklers on adjacent floors shall not be supplied from the same riser.

914.3.1.1.1 Riser location. Sprinkler risers shall be placed in interior exit stairways and ramps that are remotely located in accordance with Section 1007.

914.3.1.2 Water supply to required fire pumps. In all buildings *having an occupied floor that is more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access*, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

Exception: Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

914.3.1.2.1 Fire pumps. *Redundant fire pump systems shall be required for high-rise buildings having an occupied floor more than 200 feet above the lowest level of fire department vehicle access. Each fire pump system shall be capable of automatically supplying the required demand for the automatic sprinkler and standpipe systems.*

914.3.2 Secondary water supply. An automatic secondary on-site water supply having a *usable capacity not less than the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 ft above the lowest level of fire department vehicle access assigned to Seismic Design Category C, D, E or F as determined by the California Building Code.* An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump supplying the automatic sprinkler system. The secondary water supply shall have a *useable capacity of not less than the hydraulically calculated sprinkler demand plus 100 GPM for the inside hose stream, allowance for a duration of not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13, whichever is greater. The Class I standpipe system demand shall not be required to be included in the secondary on-site water supply calculations. In no case shall the secondary on-site water supply be less than 15,000 gallons.*

914.3.3 Fire alarm system. A fire alarm system shall be provided in accordance with Section 907.2.13.

914.3.4 Automatic smoke detection. Smoke detection shall be provided in accordance with Section 907.2.13.1.

914.3.5 Emergency voice/alarm communication system. An emergency voice/alarm communication system shall be provided in accordance with Section 907.5.2.2.

914.3.6 Emergency responder communication coverage. In-building, two-way emergency responder communication coverage shall be provided in accordance with Section 510.

914.3.7 Fire command. A fire command center complying with Section 508 shall be provided in a location approved by the fire department.

914.3.8 Smoke control.

914.3.8.1 Smoke control system. *All portions of high-rise buildings shall be provided with a smoke control system in accordance with California Building Code, Section 909.*

914.3.8.2 Smokeproof exit enclosures. *Every exit enclosure in high-rise buildings shall comply with California Building Code, Sections 909.20 and 1023.11. Every required stairway in Group I-2 occupancies serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall comply with Sections 909.20 and 1023.11 of the California Building Code.*

Exception: *In high-rise buildings, exit enclosures serving three or less adjacent floors where one of the adjacent floors is the level of exit discharge.*

914.4 Atriums. Atriums shall comply with Sections 914.4.1 and 914.4.2.

914.4.1 Automatic sprinkler system. An approved automatic sprinkler system shall be installed throughout the entire building.

Exceptions:

1. That area of a building adjacent to or above the atrium need not be sprinklered, provided that portion of the building is separated from the atrium portion by not less than a 2-hour fire barrier constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.
2. Where the ceiling of the atrium is more than 55 feet (16 764 mm) above the floor, sprinkler protection at the ceiling of the atrium is not required.

914.4.2 Fire alarm system. A fire alarm system shall be provided where required by Section 907.2.14.

914.5 Underground buildings. Underground buildings shall comply with Sections 914.5.1 through 914.5.5.

914.5.1 Automatic sprinkler system. The highest level of exit discharge serving the underground portions of the building and all levels below shall be equipped with an automatic sprinkler system installed in accordance with Section 903.3.1.1. Waterflow switches and control valves shall be supervised in accordance with Section 903.4.

914.5.2 Smoke control system. A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and provisions of this section. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain means of egress in a usable condition.

914.5.3 Compartment smoke control system. Where compartmentation is required by Section 405.4 of the *California Building Code*, each compartment shall have an

independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with Section 907.2.18.

914.5.4 Fire alarm system. A fire alarm system shall be provided where required by Sections 907.2.18 and 907.2.19.

914.5.5 Standpipe system. The underground building shall be provided throughout with a standpipe system in accordance with Section 905.

914.6 Stages. Stages shall comply with Sections 914.6.1 and 914.6.2.

914.6.1 Automatic sprinkler system. Stages shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the stage. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such stages.

Exceptions:

1. Sprinklers are not required under stage areas less than 4 feet (1219 mm) in clear height utilized exclusively for storage of tables and chairs, provided that the concealed space is separated from the adjacent spaces by Type X gypsum board not less than $\frac{5}{8}$ inch (15.9 mm) in thickness.
2. Sprinklers are not required for stages 1,000 square feet (93 m²) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.
3. Sprinklers are not required within portable orchestra enclosures on stages.

914.6.2 Standpipe system. Standpipe systems shall be provided in accordance with Section 905.

914.7 Special amusement areas. Special amusement areas shall comply with Sections 914.7.1 through 914.7.3 and Section 411 of the California Building Code.

914.7.1 Automatic sprinkler system. Buildings containing special amusement areas shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where the special amusement area is temporary; *less than 180 days*; the sprinkler water supply shall be of an approved temporary; *less than 180 days*; means *determined by the authority having jurisdiction*.

Exception: Automatic sprinklers are not required where the total floor area of a temporary; *less than 180 days*; special amusement area is less than 1,000 square feet (93 m²) and the exit access travel distance from any point in the special amusement area to an exit is less than 50 feet (15 240 mm).

914.7.2 Fire alarm system. Special amusement areas shall be equipped with an automatic smoke detection system in accordance with Section 907.2.12.

914.7.3 Emergency voice/alarm communications system. An emergency voice/alarm communications system shall be provided in accordance with Sections 907.2.11 and 907.5.2.2, is permitted to serve as a public-address system and shall be audible throughout the entire special amusement area.

914.8 Aircraft-related occupancies. Aircraft-related occupancies shall comply with Sections 914.8.1 through 914.8.6.

914.8.1 Automatic smoke detection systems. Airport traffic control towers shall be provided with an automatic smoke detection system installed in accordance with Section 907.2.22.

914.8.2 Automatic sprinkler system for new airport traffic control towers. Where an occupied floor is located more than 35 feet (10 668 mm) above the lowest level of fire department vehicle access, new airport traffic control towers shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

914.8.3 Fire suppression for aircraft hangars. Aircraft hangars shall be provided with a fire suppression system designed in accordance with NFPA 409, based on the classification for the hangar given in Table 914.8.3.

Exception: Where a fixed base operator has separate repair facilities on-site, Group II hangars operated by a fixed base operator used for storage of transient aircraft only shall have a fire suppression system, but the system shall be exempt from foam requirements.

914.8.3.1 Hazardous operations. Any Group III aircraft hangar in accordance with Table 914.8.3 that contains hazardous operations including, but not limited to, the following shall be provided with a Group I or II fire suppression system in accordance with NFPA 409 as applicable:

1. Doping.
2. Hot work including, but not limited to, welding, torch cutting and torch soldering.
3. Fuel transfer.
4. Fuel tank repair or maintenance not including defueled tanks in accordance with NFPA 409, inerted tanks or tanks that have never been fueled.
5. Spray finishing operations.
6. Total fuel capacity of all aircraft within the unsprinklered single fire area in excess of 1,600 gallons (6057 L).
7. Total fuel capacity of all aircraft within the maximum single fire area in excess of 7,500 gallons (28 390 L) for a hangar equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

914.8.3.2 Separation of maximum single fire areas. Maximum single fire areas established in accordance with hangar classification and construction type in Table 914.8.3 shall be separated by 2-hour fire walls constructed in accordance with Section 706 of the California Building Code. In determining the maximum

**TABLE 914.8.3
HANGAR FIRE SUPPRESSION REQUIREMENTS^{a, b, c}**

MAXIMUM SINGLE FIRE AREA (square feet)	CALIFORNIA BUILDING CODE TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
≥ 40,001	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I
40,000	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
30,000	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
20,000	Group III	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II
15,000	Group III	Group III	Group III	Group II	Group III	Group II	Group III	Group II	Group II
12,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II	Group II
8,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II
5,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III

For SI: 1 square foot = 0.0929 m², 1 foot = 304.8 mm.

- a. Aircraft hangars with a door height greater than 28 feet shall be provided with fire suppression for a Group I hangar regardless of maximum fire area.
- b. Groups shall be as classified in accordance with NFPA 409.
- c. Membrane structures complying with Section 3102 of the *California Building Code* shall be classified as a Group IV hangar.

single fire area as set forth in Table 914.8.3, ancillary uses that are separated from aircraft servicing areas by not less than a 1-hour fire barrier constructed in accordance with Section 707 of the *California Building Code* shall not be included in the area.

914.8.4 Finishing. The process of “doping,” involving the use of a volatile flammable solvent, or of painting shall be carried on in a separate detached building equipped with automatic fire-extinguishing equipment in accordance with Section 903.

914.8.5 Residential aircraft hangar smoke alarms. Smoke alarms shall be provided within residential aircraft hangars in accordance with Section 907.2.21.

914.8.6 Aircraft paint hangar fire suppression. Aircraft paint hangars shall be provided with fire suppression as required by NFPA 409.

914.9 Application of flammable finishes. An automatic sprinkler system or fire-extinguishing system shall be provided in all spray rooms and spray booths, and shall be installed in accordance with Chapter 9.

914.10 Drying rooms. Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4 of the *California Building Code*, shall be protected by an approved automatic fire-extinguishing system complying with the provisions of Chapter 9.

914.11 Ambulatory care facilities. Occupancies classified as ambulatory care facilities shall comply with Sections 914.11.1 through 914.11.3.

914.11.1 Automatic sprinkler systems. An automatic sprinkler system shall be provided for ambulatory care facilities in accordance with Section 903.2.2.

914.11.2 Manual fire alarm systems. A manual fire alarm system shall be provided for ambulatory care facilities in accordance with Section 907.2.2.

914.11.3 Fire alarm systems. An automatic smoke detection system shall be provided for ambulatory care facilities in accordance with Section 907.2.2.1.

**SECTION 915
CARBON MONOXIDE DETECTION**

915.1 General. Carbon monoxide detection shall be installed in new buildings in accordance with Sections 915.1.1 through 915.7. Carbon monoxide detection shall be installed in existing buildings in accordance with *this section and* Chapter 11 of the *California Fire Code*.

Pursuant to Health and Safety Code Section 17926, carbon monoxide detection shall be installed in all existing Group R buildings as required in this section.

915.1.1 Where required. Carbon monoxide detection shall be provided in Group I-2, I-4 and R occupancies and in classrooms in Group E occupancies in the locations specified in Section 915.2 where any of the conditions in Sections 915.1.2 through 915.1.6 exist.

915.1.2 Fuel-burning appliances and fuel-burning fire-places. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms that contain a fuel-burning appliance or a fuel-burning fireplace.

915.1.3 Fuel-burning forced-air furnaces. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms served by a fuel-burning, forced-air furnace.

Exception: Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where a carbon monoxide detector is provided in the first room or area served by each main duct leaving the furnace, and the carbon monoxide alarm signals are automatically transmitted to an approved location.

915.1.4 Fuel-burning appliances outside of dwelling units, sleeping units and classrooms. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms located in buildings that contain fuel-burning appliances or fuel-burning fireplaces.

Exceptions:

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms

without communicating openings between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.

2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms where a carbon monoxide detector is provided in one of the following locations:
 - 2.1. In an approved location between the fuel-burning appliance or fuel-burning fireplace and the dwelling unit, sleeping unit or classroom.
 - 2.2. On the ceiling of the room containing the fuel-burning appliance or fuel-burning fireplace.

915.1.5 Private garages. Carbon monoxide detection shall be provided in dwelling units, sleeping units and classrooms in buildings with attached private garages.

Exceptions:

1. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms without communicating openings between the private garage and the dwelling unit, sleeping unit or classroom.
2. Carbon monoxide detection shall not be required in dwelling units, sleeping units and classrooms located more than one story above or below a private garage.
3. Carbon monoxide detection shall not be required where the private garage connects to the building through an open-ended corridor.
4. Where a carbon monoxide detector is provided in an approved location between openings to a private garage and dwelling units, sleeping units or classrooms.

915.1.6 Exempt garages. For determining compliance with Section 915.1.5, an open parking garage complying with Section 406.5 of the *California Building Code* or an enclosed parking garage complying with Section 406.6 of the *California Building Code* shall not be considered a private garage.

915.2 Locations. Where required by Section 915.1.1, carbon monoxide detection shall be installed *in accordance with the manufacturer's published instructions* in the locations specified in Sections 915.2.1 through 915.2.3.

915.2.1 Dwelling units. Carbon monoxide detection shall be installed in dwelling units *in the following locations:*

1. Outside of each separate sleeping area in the immediate vicinity of the bedrooms.
2. *On every occupiable level of a dwelling unit, including basements.*
3. Where a fuel-burning appliance is located within a bedroom or its attached bathroom, carbon monoxide detection shall be installed within the bedroom.

915.2.2 Sleeping units. Carbon monoxide detection shall be installed in sleeping units.

Exception: Carbon monoxide detection shall be allowed to be installed outside of each separate sleeping area in the immediate vicinity of the sleeping unit where the sleeping unit or its attached bathroom does not contain a fuel-burning appliance and is not served by a forced-air furnace.

915.2.3 Group E occupancies. Carbon monoxide detectors shall be installed in classrooms in Group E occupancies *where classrooms include any of the conditions identified in Sections 915.1.2 through 915.1.6.* Carbon monoxide alarm signals shall be automatically transmitted to an on-site location that is staffed by school personnel.

Exception: Carbon monoxide alarm signals shall not be required to be automatically transmitted to an on-site location that is staffed by school personnel in Group E occupancies with an occupant load of 30 or less.

915.3 Carbon monoxide detection. Carbon monoxide detection required by Sections 915.1 through 915.2.3 shall be provided by carbon monoxide alarms complying with Section 915.4 or carbon monoxide detection systems complying with Section 915.5.

915.4 Carbon monoxide alarms. Carbon monoxide alarms shall comply with Sections 915.4.1 through 915.4.4.

915.4.1 Power source. Carbon monoxide alarms shall receive their primary power from the building wiring where such wiring is served from a commercial source, and when primary power is interrupted, shall receive power from a battery. Wiring shall be permanent and without a disconnecting switch other than that required for overcurrent protection.

Exceptions:

1. Where installed in buildings without commercial power, battery-powered carbon monoxide alarms shall be an acceptable alternative.
2. *Carbon monoxide alarms in Group R occupancies shall be permitted to receive their primary power from other power sources recognized for use by NFPA 720.*
3. *Carbon monoxide alarms in Group R occupancies shall be permitted to be battery-powered or plug-in with a battery backup in existing buildings built prior to January 1, 2011, under any of the following conditions:*
 - 3.1. *No construction is taking place.*
 - 3.2. *Repairs or alterations do not result in the removal of interior wall and ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*
 - 3.3. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the*

addition or replacement of windows or doors, or the addition of a porch or deck.

- 3.4. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*

915.4.2 Listings. Residential carbon monoxide alarms shall be listed in accordance with UL 2034.

No person shall install, market, distribute, offer for sale or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the Office of the State Fire Marshal.

915.4.3 Locations. Carbon monoxide alarms shall only be installed in dwelling units and in sleeping units. They shall not be installed in locations where the code requires carbon monoxide detectors to be used.

915.4.4 Interconnection. *Where more than one carbon monoxide alarm is required to be installed within a dwelling unit or within a sleeping unit in Group R occupancies, the alarms shall be interconnected in a manner that activation of one alarm shall activate all of the alarms in the individual unit.*

Exception: *Interconnection is not required in existing buildings, built prior to January 1, 2011, under any of the following conditions:*

1. *Physical interconnection is not required where listed wireless alarms are installed and all alarms sound upon activation of one alarm.*
2. *No construction is taking place.*
3. *Repairs or alterations do not result in the removal of interior wall and ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*
4. *Repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding or the addition or replacement of windows or doors, or the addition of a porch or deck.*
5. *Work is limited to the installation, alteration or repair of plumbing, mechanical or electrical systems, which do not result in the removal of interior wall or ceiling finishes exposing the structure in areas/spaces where carbon monoxide alarms are required.*

915.4.5 Combination alarms. Combination carbon monoxide/smoke alarms shall be an acceptable alternative to carbon monoxide alarms. Combination carbon monoxide/smoke alarms shall be listed in accordance with UL 217 and UL 2034.

Combination carbon monoxide/smoke alarms shall comply with Section 915, and all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

915.5 Carbon monoxide detection systems. Carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide alarms and shall comply with Sections 915.5.1 through 915.5.3.

915.5.1 General. Carbon monoxide detection systems shall comply with NFPA 720. Carbon monoxide detectors shall be listed in accordance with UL 2075.

915.5.2 Locations. Carbon monoxide detectors shall be installed in the locations specified in Section 915.2. These locations supersede the locations specified in NFPA 720.

915.5.3 Combination detectors. Combination carbon monoxide/smoke detectors installed in carbon monoxide detection systems shall be an acceptable alternative to carbon monoxide detectors, provided that they are listed in accordance with UL 268 and UL 2075.

Combination carbon monoxide/smoke alarms shall comply with Section 915, and all requirements for listing and approval by the Office of the State Fire Marshal for smoke alarms.

915.6 Maintenance. Carbon monoxide alarms and carbon monoxide detection systems shall be maintained in accordance with NFPA 720. Carbon monoxide alarms and carbon monoxide detectors that become inoperable or begin producing end-of-life signals shall be replaced.

915.6.1 Enclosed parking garages. Carbon monoxide and nitrogen dioxide detectors installed in enclosed parking garages in accordance with Section 404.1 of the *California Mechanical Code* shall be maintained in accordance with the manufacturer's instructions and their listing. Detectors that become inoperable or begin producing end-of-life signals shall be replaced.

915.7 Visible alarms. *In buildings containing covered multi-family dwellings as defined in Chapter 2, all required carbon monoxide alarms shall be equipped with the capability to support visible alarm notification in accordance with NFPA 720.*

SECTION 916 GAS DETECTION SYSTEMS

916.1 Gas detection systems. Gas detection systems required by this code shall comply with Sections 916.2 through 916.11.

916.2 Permits. Permits shall be required as set forth in Section 105.6.10.

916.2.1 Construction documents. Documentation of the gas detection system design and equipment to be used that demonstrates compliance with the requirements of this code shall be provided with the application for permit.

916.3 Equipment. Gas detection system equipment shall be designed for use with the gases being detected and shall be installed in accordance with manufacturer's instructions.

916.4 Power connections. Gas detection systems shall be permanently connected to the building electrical power supply or shall be permitted to be cord connected to an

unswitched receptacle using an approved restraining means that secures the plug to the receptacle.

916.5 Emergency and standby power. Standby or emergency power shall be provided or the gas detection system shall initiate a trouble signal at an approved location if the power supply is interrupted.

916.6 Sensor locations. Sensors shall be installed in approved locations where leaking gases are expected to accumulate.

916.7 Gas sampling. Gas sampling shall be performed continuously. Sample analysis shall be processed immediately after sampling, except as follows:

1. For HPM gases, sample analysis shall be performed at intervals not exceeding 30 minutes.
2. For toxic gases that are not HPM, sample analysis shall be performed at intervals not exceeding 5 minutes, in accordance with Section 6004.2.2.7.
3. Where a less frequent or delayed sampling interval is approved.

916.8 System activation. A gas detection alarm shall be initiated where any sensor detects a concentration of gas exceeding the following thresholds:

1. For flammable gases, a gas concentration exceeding 25 percent of the lower flammability limit (LFL).
2. For nonflammable gases, a gas concentration exceeding one-half of the IDLH, unless a different threshold is specified by the section of this code requiring a gas detection system.

Upon activation of a gas detection alarm, alarm signals or other required responses shall be as specified by the section of this code requiring a gas detection system. Audible and visible alarm signals associated with a gas detection alarm shall be distinct from fire alarm and carbon monoxide alarm signals.

916.9 Signage. Signs shall be provided adjacent to gas detection system alarm signaling devices that advise occupants of the nature of the signals and actions to take in response to the signal.

916.10 Fire alarm system connections. Gas sensors and gas detection systems shall not be connected to fire alarm systems unless approved and connected in accordance with the fire alarm equipment manufacturer's instructions.

916.11 Inspection, testing and sensor calibration. Inspection and testing of gas detection systems shall be conducted not less than annually. Sensor calibration shall be confirmed at the time of sensor installation and calibration shall be performed at the frequency specified by the sensor manufacturer.

SECTION 917 MASS NOTIFICATION SYSTEMS

917.1 College and university campuses. Prior to construction of a new building requiring a fire alarm system on a multiple-building college or university campus having a cumulative building occupant load of 1,000 or more, a mass notification risk analysis shall be conducted in accordance with NFPA 72. Where the risk analysis determines a need for mass notification, an approved mass notification system shall be provided in accordance with the findings of the risk analysis.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 10 – MEANS OF EGRESS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
1001.1			X																			
[T-19 §4.1 (a)]				X																		
[T-19 §4.1 (b)]				X																		
1003.1			X																			
1003.2			X																			
1003.3			X																			
1003.3.1			X																			
1003.3.3.1			X																			
1003.3.4			X																			
1003.5			X																			
[T-19 §3.27]				X																		
1004.1			X																			
Table 1004.5			X																			
1004.6				X																		
[T-19 §3.30]				X																		
1005.3.1			X																			
1005.3.2			X																			
1005.7.1			X																			
1005.7.2			X																			
1006.2.1			X																			
Table 1006.2.1			X																			
1006.2.2.2			X																			
1006.2.2.3			X																			
1006.2.2.4			X																			
1006.2.2.6			X																			
1006.2.2.8			X																			
1006.3.3			X																			
Table 1006.3.3(1)			X																			
Table 1006.3.3(2)			X																			
1008.2			X																			
1008.3.2			X																			
1009.1			X																			
1009.2			X																			
1009.4			X																			
1009.5			X																			
1009.6.3			X																			
1009.8.1			X																			
1009.8.2			X																			

(continued)

CHAPTER 10 – MEANS OF EGRESS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]				X																			
Chapter / Section																							
1009.10			X																				
1009.12			X																				
1010.1.1			X																				
1010.1.1.1																							
1010.1.2			X																				
1010.1.2.1			X																				
1010.1.4			X																				
1010.1.7			X																				
1010.1.8			X																				
1010.1.9.1			X																				
1010.1.9.9			X																				
1010.1.9.10			X																				
1010.1.9.11			X																				
1010.2.5			X																				
1010.2.8.1			X																				
1010.2.8.2			X																				
1010.2.9			X																				
1010.2.12.1			X																				
1010.2.13			X																				
1010.2.13.1			X																				
1010.2.14			X																				
1011.2			X																				
1011.5.2			X																				
1011.6			X																				
1011.11			X																				
1011.15			X																				
1012.6.3			X																				
1013.1			X																				
1013.2			X																				
1013.4			X																				
1013.6.3			X																				
1013.7			X																				
1013.8			X																				
1014.8			X																				
1015.3			X																				
1015.4			X																				
1016.2			X																				
Table 1017.2			X																				
1018			X																				

(continued)

CHAPTER 10 – MEANS OF EGRESS—continued

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
[T-19 §3.06 (a)]				X																		
[T-19 §3.06 (b)]				X																		
1018.3			X																			
1019.3			X																			
1019.4			X																			
1020.1			X																			
Table 1020.1			X																			
Table 1020.2			X																			
Table 1020.3			X																			
1020.4			X																			
1020.5			X																			
1020.6			X																			
1022.3			X																			
1023.2			X																			
1023.9			X																			
1023.9.1			X																			
1023.11.2			X																			
1024.2			X																			
1024.6			X																			
1026.4.1			X																			
1026.4.2			X																			
1028.5			X																			
1029.1			X																			
1029.2			X																			
1029.3			X																			
1029.3.1			X																			
1029.9.1			X																			
[T-19 §3.06 (a)]				X																		
1030.1			X																			
1030.1.1			X																			
[T-19 §4.2]				X																		
[T-19 §4.3 (a-c)]				X																		
[T-19 §4.4]				X																		
[T-19 §4.5 (a)]				X																		
[T-19 §4.6 (a)(b)]				X																		
1030.6.3.2			X																			
[T-19 §3.11 (a-d)]				X																		
1032.2.1.2			X																			
1032.2.1.3			X																			

* The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 10

MEANS OF EGRESS

User note:

About this chapter: Chapter 10 provides the general criteria for designing the means of egress established as the primary method for protection of people in buildings by allowing timely relocation or evacuation of building occupants. Both prescriptive and performance language is utilized in this chapter to provide for a basic approach in the determination of a safe exiting system for all occupancies. This chapter addresses all portions of the egress system (exit access, exits and exit discharge) and includes design requirements as well as provisions regulating individual components. The requirements detail the size, arrangement, number and protection of means of egress components. Functional and operational characteristics that will permit the safe use of components without special knowledge or effort are specified.

The means of egress protection requirements work in coordination with other sections of the code, such as protection of vertical openings (see Chapter 7), interior finish (see Chapter 8), fire suppression and detection systems (see Chapter 9) and numerous others, all having an impact on life safety. Sections 1003 through 1031 are duplicated text from Chapter 10 of the California Building Code; however, the California Fire Code contains an additional Section 1032 on maintenance of the means of egress system in existing buildings. Retroactive minimum means of egress requirements for existing buildings are found in Chapter 11. Section 1010 was extensively reorganized for the 2021 edition. For complete information, see the relocations table in the preface information for the California Building Code.

SECTION 1001 ADMINISTRATION

1001.1 General. Buildings or portions thereof shall be provided with a means of egress system as required by this chapter. The provisions of this chapter shall control the design, construction and arrangement of means of egress components required to provide an approved means of egress from structures and portions thereof. Sections 1003 through 1031 shall apply to new construction. Section 1032 shall apply to existing buildings.

➔ **Exception:** Detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress and their accessory structures shall comply with the *California Residential Code*.

[BE] 1001.2 Minimum requirements. It shall be unlawful to alter a building or structure in a manner that will reduce the number of exits or the capacity of the means of egress to less than required by this code.

SECTION 1002 DEFINITIONS

[BE] 1002.1 Definitions. The following terms are defined in Chapter 2:

ACCESSIBLE MEANS OF EGRESS.

AISLE.

AISLE ACCESSWAY.

ALTERNATING TREAD DEVICE.

AREA OF REFUGE.

BLEACHERS.

BREAKOUT.

COMMON PATH OF EGRESS TRAVEL.

CORRIDOR.

DOOR, BALANCED.

EGRESS COURT.

EMERGENCY ESCAPE AND RESCUE OPENING.

EXIT.

EXIT ACCESS.

EXIT ACCESS DOORWAY.

EXIT ACCESS RAMP.

EXIT ACCESS STAIRWAY.

EXIT DISCHARGE.

EXIT DISCHARGE, LEVEL OF.

EXIT PASSAGEWAY.

EXTERIOR EXIT RAMP.

EXTERIOR EXIT STAIRWAY.

FIRE EXIT HARDWARE.

FIXED SEATING.

FLIGHT.

FLOOR AREA, GROSS.

FLOOR AREA, NET.

FOLDING AND TELESCOPIC SEATING.

GRADE FLOOR EMERGENCY ESCAPE AND RESCUE OPENINGS.

GRANDSTAND.

GUARD.

HANDRAIL.

HORIZONTAL EXIT.

INTERIOR EXIT RAMP.

INTERIOR EXIT STAIRWAY.

LOW ENERGY POWER-OPERATED DOOR.

MEANS OF EGRESS.

MERCHANDISE PAD.

- NOSING.
- OCCUPANT LOAD.
- OPEN-AIR ASSEMBLY SEATING.
- OPEN-ENDED CORRIDOR.
- PANIC HARDWARE.
- PHOTOLUMINESCENT.
- POWER-ASSISTED DOOR.
- POWER-OPERATED DOOR.
- PUBLIC WAY.
- RAMP.
- SCISSOR STAIRWAY.
- SELF-LUMINOUS.
- SMOKE-PROTECTED ASSEMBLY SEATING.
- STAIR.
- STAIRWAY.
- STAIRWAY, INTERIOR EXIT.
- STAIRWAY, SPIRAL.
- WINDER.

[California Code of Regulations, Title 19, Division 1, §4.1(a)] Definitions.

(a) Burglar bars – Security bars located on the inside or outside of a door or window of a residential dwelling.

[California Code of Regulations, Title 19, Division 1, §4.1 (b)] Definitions.

(b) Residential Dwelling – A house, apartment, motel, hotel or other type of residential dwelling subject to the State Housing Law Part. 1.5 (commencing with Section 17910), Division 13 of Health and Safety Code and a manufactured home, mobilehome and multi-unit manufactured housing as defined in Part 2 (commencing with Section 18000) of Division 13 of the Health and Safety Code.

SECTION 1003 GENERAL MEANS OF EGRESS

[BE] 1003.1 Applicability. The general requirements specified in Sections 1003 through 1015 shall apply to all three elements of the means of egress system, in addition to those specific requirements for the exit access, the exit and the exit discharge detailed elsewhere in this chapter.

Exception: Exiting requirements for Fixed Guideway Transit Systems shall be in accordance with Section 443 of the California Building Code.

[BE] 1003.2 Ceiling height. The means of egress shall have a ceiling height of not less than 7 feet 6 inches (2286 mm) above the finished floor.

Exceptions:

1. Sloped ceilings in accordance with Section 1207.2 of the California Building Code.
2. Ceilings of dwelling units and sleeping units within residential occupancies in accordance with Section 1207.2 of the California Building Code.

3. Allowable projections in accordance with Section 1003.3.
4. Stair headroom in accordance with Section 1011.3.
5. Door height in accordance with Section 1010.1.1.
6. Ramp headroom in accordance with Section 1012.5.2.
7. The clear height of floor levels in vehicular and pedestrian traffic areas of public and private parking garages in accordance with Section 406.2.2 of the California Building Code.
8. Areas above and below mezzanine floors in accordance with Section 505.2 of the California Building Code.
9. In Group I-2, I-2.1 and I-3 occupancies, the means of egress shall have a ceiling height of not less than 8 feet (2439 mm).

[BE] 1003.3 Protruding objects. Protruding objects on circulation paths shall comply with the requirements of Sections 1003.3.1 through 1003.3.4.

Exception: In Group I-2 and Group I-2.1 occupancies, protruding objects shall not extend more than 12 inches (305 mm) below the minimum ceiling height required by Section 1003.2.

[BE] 1003.3.1 Headroom. Protruding objects are permitted to extend below the minimum ceiling height required by Section 1003.2 where a minimum headroom of 80 inches (2032 mm) is provided over any circulation paths, including walks, corridors, aisles and passageways. In other than Group I-2 and Group I-2.1 occupancies, 50 percent of the ceiling area of a means of egress shall be permitted to be reduced in height by protruding objects.

Exception: Door closers and stops shall not reduce headroom to less than 78 inches (1981 mm).

A barrier shall be provided where the vertical clearance above a circulation path is less than 80 inches (2032 mm) high above the finished floor. The leading edge of such a barrier shall be located 27 inches (686 mm) maximum above the finished floor.

[BE] 1003.3.2 Post-mounted objects. A free-standing object mounted on a post or pylon shall not overhang that post or pylon more than 4 inches (102 mm) where the lowest point of the leading edge is more than 27 inches (686 mm) and less than 80 inches (2032 mm) above the finished floor. Where a sign or other obstruction is mounted between posts or pylons and the clear distance between the posts or pylons is greater than 12 inches (305 mm), the lowest edge of such sign or obstruction shall be 27 inches (686 mm) maximum or 80 inches (2032 mm) minimum above the finished floor or ground.

Exception: These requirements shall not apply to sloping portions of handrails between the top and bottom riser of stairs and above the ramp run.

[BE] 1003.3.3 Horizontal projections. Objects with leading edges more than 27 inches (685 mm) and not more than 80 inches (2030 mm) above the finished floor shall

not project horizontally more than 4 inches (102 mm) into the circulation path.

Exception: Handrails are permitted to protrude 4¹/₂ inches (114 mm) from the wall or guard.

1003.3.3.1 Horizontal projections for Group I-2 and I-2.1 occupancies. Structural elements, fixtures or furnishings shall not project horizontally from either side more than 1¹/₂ inches (38 mm) into the required width of an exit access corridor serving any area caring for one or more nonambulatory or bedridden persons.

Exceptions:

1. Handrails are permitted to protrude 3¹/₂ inches (89 mm) from the wall.
2. Alcohol-based hand-rub dispensers are permitted to protrude 4 inches.
3. Manual fire alarm boxes with a protective cover installed are permitted to protrude 4 inches.

[BE] 1003.3.4 Clear width. Protruding objects shall not reduce the minimum clear width of accessible routes as required by Chapter 11A or 11B of the California Building Code.

[BE] 1003.4 Slip-resistant surface. Circulation paths of the means of egress shall have a slip-resistant surface and be securely attached.

[BE] 1003.5 Elevation change. Where changes in elevation of less than 12 inches (305 mm) exist in the means of egress, sloped surfaces shall be used. Where the slope is greater than 1 unit vertical in 20 units horizontal (5-percent slope), ramps complying with Section 1012 shall be used. Where the difference in elevation is 6 inches (152 mm) or less, the ramp shall be equipped with either handrails or floor finish materials that contrast with adjacent floor finish materials.

Exceptions:

1. Steps at exterior doors complying with Section 1010.1.4.
2. A stair with a single riser or with two risers and a tread is permitted at locations not required to be accessible by Chapter 11A or 11B of the California Building Code, where the risers and treads comply with Section 1011.5, the minimum depth of the tread is 13 inches (330 mm) and not less than one handrail complying with Section 1014 is provided within 30 inches (762 mm) of the centerline of the normal path of egress travel on the stair.
3. A step is permitted in aisles serving seating that has a difference in elevation less than 12 inches (305 mm) at locations not required to be accessible by Chapter 11A or 11B of the California Building Code, provided that the risers and treads comply with Section 1030.14 and the aisle is provided with a handrail complying with Section 1030.16.

Throughout a story in a Group I-2 and I-2.1 occupancy, any change in elevation in portions of the means of egress

that serve nonambulatory persons shall be by means of a ramp or sloped walkway.

[BE] 1003.6 Means of egress continuity. The path of egress travel along a means of egress shall not be interrupted by a building element other than a means of egress component as specified in this chapter. Obstructions shall not be placed in the minimum width or required capacity of a means of egress component except projections permitted by this chapter. The minimum width or required capacity of a means of egress system shall not be diminished along the path of egress travel.

[BE] 1003.7 Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress from any other part of the building.

Exception: Elevators used as an accessible means of egress in accordance with Section 1009.4.

SECTION 1004 OCCUPANT LOAD

[BE] 1004.1 Design occupant load. In determining means of egress requirements, the number of occupants for whom means of egress facilities are provided shall be determined in accordance with this section.

[California Code of Regulations, Title 19, Division 1, §3.27] Overcrowding.

The number of occupants of any building, structure or portion thereof, shall not exceed the permitted or posted capacity.

[BE] 1004.2 Cumulative occupant loads. Where the path of egress travel includes intervening rooms, areas or spaces, cumulative occupant loads shall be determined in accordance with this section.

[BE] 1004.2.1 Intervening spaces or accessory areas. Where occupants egress from one or more rooms, areas or spaces through others, the design occupant load shall be the combined occupant load of interconnected accessory or intervening spaces. Design of egress path capacity shall be based on the cumulative portion of occupant loads of all rooms, areas or spaces to that point along the path of egress travel.

[BE] 1004.2.2 Adjacent levels for mezzanines. That portion of the occupant load of a mezzanine with required egress through a room, area or space on an adjacent level shall be added to the occupant load of that room, area or space.

[BE] 1004.2.3 Adjacent stories. Other than for the egress components designed for convergence in accordance with Section 1005.6, the occupant load from separate stories shall not be added.

[BE] 1004.3 Multiple-function occupant load. Where an area under consideration contains multiple functions having different occupant load factors, the design occupant load for such area shall be based on the floor area of each function calculated independently.

[BE] 1004.4 Multiple occupancies. Where a building contains two or more occupancies, the means of egress require-

MEANS OF EGRESS

ments shall apply to each portion of the building based on the occupancy of that space. Where two or more occupancies utilize portions of the same means of egress system, those egress components shall meet the more stringent requirements of all occupancies that are served.

[BE] 1004.5 Areas without fixed seating. The number of occupants shall be computed at the rate of one occupant per unit of area as prescribed in Table 1004.5. For areas without fixed seating, the occupant load shall be not less than that number determined by dividing the floor area under consideration by the occupant load factor assigned to the function of the space as set forth in Table 1004.5. Where an intended function is not listed in Table 1004.5, the fire code official shall establish a function based on a listed function that most nearly resembles the intended function.

Exception: Where approved by the fire code official, the actual number of occupants for whom each occupied space, floor or building is designed, although less than those determined by calculation, shall be permitted to be used in the determination of the design occupant load.

**[BE] TABLE 1004.5
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR ^a
Accessory storage areas, mechanical equipment room	300 gross
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal	
Baggage claim	20 gross
Baggage handling	300 gross
Concourse	100 gross
Waiting areas	15 gross
Assembly	
Gaming floors (keno, slots, etc.)	11 gross
Exhibit gallery and museum	30 net
Assembly with fixed seats	See Section 1004.6
Assembly without fixed seats	
Concentrated (chairs only—not fixed)	7 net
Standing space	5 net
Unconcentrated (tables and chairs)	15 net
Bowling centers, allow 5 persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	150 gross
Concentrated business use areas	See Section 1004.8
Courtrooms—other than fixed seating areas	40 net
Day care	35 net

(continued)

**[BE] TABLE 1004.5—continued
MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT**

FUNCTION OF SPACE	OCCUPANT LOAD FACTOR ^a
Dormitories	50 gross
Educational	
Classroom area	20 net
Shops and other vocational room areas	50 net
Exercise rooms	50 gross
Group H-5 fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas ^c	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Laboratory	
Educational (K–12)	50 net
Laboratories, noneducational	100 net
Laboratory suite ^b	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Locker rooms	50 gross
Mall buildings—covered and open	See Section 402.8.2 of the <i>California Building Code</i>
Mercantile	60 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Warehouses	500 gross

For SI: 1 square foot = 0.0929 m², 1 foot = 304.8 mm.

a. Floor area in square feet per occupant.

b. See *California Building Code Section 453.2*.

c. See *California Building Code Section 408.3.13 for I-3 facilities*.

[BE] 1004.5.1 Increased occupant load. The occupant load permitted in any building, or portion thereof, is permitted to be increased from that number established for the occupancies in Table 1004.5, provided that all other requirements of the code are met based on such modified number and the occupant load does not exceed one occupant per 7 square feet (0.65 m²) of occupiable floor space. Where required by the fire code official, an approved aisle, seating or fixed equipment diagram substantiating any increase in occupant load shall be submit-

ted. Where required by the fire code official, such diagram shall be posted.

[California Code of Regulations, Title 19, Division 1, §3.30] Posting of Room Capacity.

Any room having an occupant load of 50 or more persons where fixed seats are not installed, and which is used for assembly, classroom, dining, drinking or similar purposes, shall have the capacity of the room posted in a conspicuous place near the main exit from the room. Posting shall be by means of a durable sign having a contrasting color from the background to which it is attached. Signs shall be of an approved type and shall be maintained in a legible manner by the owner or his authorized agent and shall indicate the number of occupants permitted for each room use. No person shall deface or remove such signs except as authorized by the enforcing agency.

[BE] 1004.6 Fixed seating. For areas having fixed seats and aisles, the occupant load shall be determined by the number of fixed seats installed therein. The occupant load for areas in which fixed seating is not installed, such as waiting spaces, shall be determined in accordance with Section 1004.5 and added to the number of fixed seats.

The occupant load of wheelchair spaces and the associated companion seat shall be based on one occupant for each wheelchair space and one occupant for the associated companion seat provided in accordance with *Chapter 11B* of the *California Building Code*.

For areas having fixed seating without dividing arms, the occupant load shall be not less than the number of seats based on one person for each 18 inches (457 mm) of seating length.

The occupant load of seating booths shall be based on one person for each 24 inches (610 mm) of booth seat length measured at the backrest of the seating booth.

[BE] 1004.7 Outdoor areas. Yards, patios, occupied roofs courts and similar outdoor areas accessible to and usable by the building occupants shall be provided with means of egress as required by this chapter. The occupant load of such outdoor areas shall be assigned by the fire code official in accordance with the anticipated use. Where outdoor areas are to be used by persons in addition to the occupants of the building, and the path of egress travel from the outdoor areas passes through the building, means of egress requirements for the building shall be based on the sum of the occupant loads of the building plus the outdoor areas.

Exceptions:

1. Outdoor areas used exclusively for service of the building need only have one means of egress.
2. Both outdoor areas associated with Group R-3 and individual dwelling units of Group R-2.

[BE] 1004.8 Concentrated business use areas. The occupant load factor for concentrated business use shall be applied to telephone call centers, trading floors, electronic data processing centers and similar business use areas with a higher density of occupants than would normally be expected in a typical business occupancy environment. Where approved by the code official, the occupant load for concentrated business use areas shall be the actual occupant load, but not less than

one occupant per 50 square feet (4.65 m²) of gross occupiable floor space.

[BE] 1004.9 Posting of occupant load. Every room or space which is used for assembly, classroom, dining, drinking or similar purposes having an occupant load of 50 or more that is an assembly occupancy shall have the occupant load of the room or space posted in a conspicuous place, near the main exit or exit access doorway from the room or space, for the intended configurations. Posted signs shall be of an approved legible permanent design and shall be maintained by the owner or the owner's authorized agent.

**SECTION 1005
MEANS OF EGRESS SIZING**

[BE] 1005.1 General. All portions of the means of egress system shall be sized in accordance with this section.

Exception: Aisles and aisle accessways in rooms or spaces used for assembly purposes complying with Section 1030.

[BE] 1005.2 Minimum width based on component. The minimum width, in inches (mm), of any means of egress components shall be not less than that specified for such component, elsewhere in this code.

[BE] 1005.3 Required capacity based on occupant load. The required capacity, in inches (mm), of the means of egress for any room, area, space or story shall be not less than that determined in accordance with Sections 1005.3.1 and 1005.3.2.

[BE] 1005.3.1 Stairways. The capacity, in inches, of means of egress stairways shall be calculated by multiplying the occupant load served by such stairways by a means of egress capacity factor of 0.3 inch (7.6 mm) per occupant. Where stairways serve more than one story, only the occupant load of each story considered individually shall be used in calculating the required capacity of the stairways serving that story.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of means of egress stairways shall be calculated by multiplying the occupant load served by such stairways by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.
2. Facilities with smoke-protected assembly seating shall be permitted to use the capacity factors in Table 1030.6.2 indicated for stepped aisles for exit access or exit stairways where the entire path for means of egress from the seating to the exit discharge is provided with a smoke control system complying with Section 909.
3. Facilities with open-air assembly seating shall be permitted to the capacity factors in Section

1030.6.3 indicated for stepped aisles for exit access or exit stairways where the entire path for means of egress from the seating to the exit discharge is open to the outdoors.

4. For Group H-1, H-2, H-3 and H-4 occupancies, the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.7 inches (7.62 mm) per occupant.

[BE] 1005.3.2 Other egress components. The capacity, in inches, of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.2 inch (5.1 mm) per occupant.

Exceptions:

1. For other than Group H and I-2 occupancies, the capacity, in inches, of means of egress components other than stairways shall be calculated by multiplying the occupant load served by such component by a means of egress capacity factor of 0.15 inch (3.8 mm) per occupant in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and an emergency voice/alarm communication system in accordance with Section 907.5.2.2.
2. Facilities with smoke-protected assembly seating shall be permitted to use the capacity factors in Table 1030.6.2 indicated for level or ramped aisles for means of egress components other than stairways where the entire path for means of egress from the seating to the exit discharge is provided with a smoke control system complying with Section 909.
3. Facilities with open-air assembly seating shall be permitted to the capacity factors in Section 1030.6.3 indicated for level or ramped aisles for means of egress components other than stairways where the entire path for means of egress from the seating to the exit discharge is open to the outdoors.
4. For Group H-1, H-2, H-3 and H-4 occupancies, the total width of means of egress in inches (mm) shall not be less than the total occupant load served by the means of egress multiplied by 0.4 inches (5.08 mm) per occupant.

[BE] 1005.4 Continuity. The minimum width or required capacity of the means of egress required from any story of a building shall not be reduced along the path of egress travel until arrival at the public way.

[BE] 1005.5 Distribution of minimum width and required capacity. Where more than one exit, or access to more than one exit, is required, the means of egress shall be configured such that the loss of any one exit, or access to one exit, shall not reduce the available capacity or width to less than 50 percent of the required capacity or width.

[BE] 1005.6 Egress convergence. Where the means of egress from stories above and below converge at an intermediate level, the capacity of the means of egress from the point of convergence shall be not less than the largest minimum width or the sum of the required capacities for the stairways or ramps serving the two adjacent stories, whichever is larger.

[BE] 1005.7 Encroachment. Encroachments into the required means of egress width shall be in accordance with the provisions of this section.

[BE] 1005.7.1 Doors. Doors, when fully opened, shall not reduce the required width by more than 7 inches (178 mm). Doors in any position shall not reduce the required width by more than one-half.

Exceptions:

1. In other than Group I-2 occupancies, surface-mounted latch release hardware shall be exempt from inclusion in the 7-inch maximum (178 mm) encroachment where both of the following conditions exist:
 - 1.1. The hardware is mounted to the side of the door facing away from the adjacent wall where the door is in the open position.
 - 1.2. The hardware is mounted not less than 34 inches (865 mm) nor more than 48 inches (1219 mm) above the finished floor.
2. The restrictions on door swing shall not apply to doors within individual dwelling units and sleeping units of Group R-2 occupancies and dwelling units of Group R-3 occupancies.

[BE] 1005.7.2 Other projections. Handrail projections shall be in accordance with the provisions of Section 1014.8. Other nonstructural projections such as trim and similar decorative features shall be permitted to project into the required width not more than 1½ inches (38 mm) on each side.

[BE] 1005.7.3 Protruding objects. Protruding objects shall comply with the applicable requirements of Section 1003.3.

**SECTION 1006
NUMBERS OF EXITS AND
EXIT ACCESS DOORWAYS**

[BE] 1006.1 General. The number of exits or exit access doorways required within the means of egress system shall comply with the provisions of Section 1006.2 for spaces, including mezzanines, and Section 1006.3 for stories or occupied roofs.

[BE] 1006.2 Egress from spaces. Rooms, areas or spaces, including mezzanines, within a story or basement shall be provided with the number of exits or access to exits in accordance with this section.

[BE] 1006.2.1 Egress based on occupant load and common path of egress travel distance. Two exits or exit access doorways from any space shall be provided where

the design occupant load or the common path of egress travel distance exceeds the values listed in Table 1006.2.1. The cumulative occupant load from adjacent rooms, areas or spaces shall be determined in accordance with Section 1004.2.

Exceptions:

1. The number of exits from foyers, lobbies, vestibules or similar spaces need not be based on cumulative occupant loads for areas discharging through such spaces, but the capacity of the exits from such spaces shall be based on applicable cumulative occupant loads.
2. Rooms and care suites in Group I-2 and I-2.1 occupancies complying with Section 407.4 of the California Building Code.
3. Unoccupied mechanical rooms and penthouses are not required to comply with the common path of egress travel distance measurement.

4. In detention and correctional facilities and holding cells, such as are found in courthouse buildings, when the occupant load is more than 20 see Section 408.3.11 of the California Building Code.

[BE] 1006.2.1.1 Three or more exits or exit access doorways. Three exits or exit access doorways shall be provided from any space with an occupant load of 501 to 1,000. Four exits or exit access doorways shall be provided from any space with an occupant load greater than 1,000.

[BE] 1006.2.2 Egress based on use. The numbers, configuration and types of components of exits or access to exits shall be provided in the uses described in Sections 1006.2.2.1 through 1006.2.2.7.

[BE] 1006.2.2.1 Boiler, incinerator and furnace rooms. Two exit access doorways are required in boiler, incinerator and furnace rooms where the area is over 500 square feet (46 m²) and any fuel-fired equip-

**[BE] TABLE 1006.2.1
SPACES WITH ONE EXIT OR EXIT ACCESS DOORWAY**

OCCUPANCY	MAXIMUM OCCUPANT LOAD OF SPACE	MAXIMUM COMMON PATH OF EGRESS TRAVEL DISTANCE (feet)		
		Without Sprinkler System (feet)		With Sprinkler System (feet)
		Occupant Load		
		OL ≤ 30	OL > 30	
A ^c , E, M	49	75	75	75 ^a
B	49	100	75	100 ^a
F	49	75	75	100 ^a
H-1, H-2, H-3	3	NP	NP	25 ^b
H-4, H-5	10	NP	NP	75 ^b
I-2 ^d , I-2.1, I-4	10	NP ⁱ	NP ⁱ	75 ^a
I-3	10	NP	NP	100 ^a
R-1	10	NP	NP	75 ^a
R-2	20	NP	NP	125 ^a
R-2.1	10	NP	NP	75 ^a
R-2.2	20	NP	NP	125 ^a
R-3 ^c , R-3.1 ^e	20	NP	NP	125 ^{a, g}
R-4 ^c	20	NP	NP	125 ^{a, g}
S ^f	29	100	75	100 ^a
U	49	100	75	75 ^a
L	See Section 453.6.1 of the California Building Code	NP	NP	NP

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

- a. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2
- b. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.
- c. For a room or space used for assembly purposes having fixed seating, see Section 1030.8.
- d. For the travel distance limitations and number of exit and exit access requirements for rooms and spaces in Group I-2 or I-2.1, see Section 407.4 of the California Building Code.
- e. The common path of egress travel distance shall apply only in a Group R-3 occupancy located in a mixed occupancy building.
- f. The length of common path of egress travel distance in a Group S-2 open parking garage shall be not more than 100 feet.
- g. For the travel distance limitations in Groups R-3 and R-4 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3, see Section 1006.2.2.6.
- h. For holding cells, see Section 408.3.11 of the California Building Code.
- i. In accordance with Health and Safety Code Section 13113(d), there is no requirement for automatic sprinkler protection in an existing Group I-2 located in Type IA construction.

ment exceeds 400,000 British thermal units (Btu) (422 000 KJ) input capacity. Where two exit access doorways are required, one is permitted to be a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the length of the maximum overall diagonal dimension of the room.

[BE] 1006.2.2.2 Refrigeration machinery rooms. Machinery rooms larger than 1,000 square feet (93 m²) shall have not less than two exits or exit access doorways. Where two exit access doorways are required, one such doorway is permitted to be served by a fixed ladder or an alternating tread device. Exit access doorways shall be separated by a horizontal distance equal to one-half the maximum horizontal dimension of the room.

All portions of machinery rooms shall be within 150 feet (45 720 mm) of an exit or exit access doorway.

Exit and exit access doorways shall swing in the direction of egress travel and shall be equipped with panic hardware, regardless of the occupant load served. Exit and exit access doorways shall be tight fitting and self-closing.

[BE] 1006.2.2.3 Refrigerated rooms or spaces. Rooms or spaces having a floor area larger than 1,000 square feet (93 m²), containing a refrigerant evaporator and maintained at a temperature below 68°F (20°C), shall have access to not less than two exits or exit access doorways.

Exit access travel distance shall be determined as specified in Section 1017.1. All portions of a refrigerated room or space shall be within 150 feet (45 720 mm) of an exit or exit access doorway leading to a non-refrigerated area where such rooms are not protected by an approved automatic sprinkler system.

Exception: Where using refrigerants in quantities limited to the amounts based on the volume set forth in the *California Mechanical Code*. Egress is allowed through adjoining refrigerated rooms or spaces.

[BE] 1006.2.2.4 Electrical rooms. The location and number of exit or exit access doorways shall be provided for electrical rooms in accordance with Section 110.26 of the *California Electrical Code* for electrical equipment rated 1,000 volts or less, and Section 110.33 of the *California Electrical Code* for electrical equipment rated over 1,000 volts. Panic hardware shall be provided where required in accordance with Section 1010.2.9.2.

[BE] 1006.2.2.5 Vehicular ramps. Vehicular ramps shall not be considered as an exit access ramp unless pedestrian facilities are provided.

[BE] 1006.2.2.6 Groups R-3 and R-4. Where Group R-3 occupancies are permitted by Section 903.2.8 to be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.3, the exit access travel distance for Group R-3 shall be not more than 125 feet (38 100 mm). Where Group R-4 occupancies are permitted by Section 903.2.8 to be protected by an

automatic sprinkler system installed in accordance with Section 903.3.1.3, the exit access travel distance for Group R-4 shall be not more than 75 feet (22 860 mm).

1006.2.2.7 Large family day-care home. Every story or basement of a large family day-care home shall be provided with two exits which are remotely located from each other. Every required exit shall be of a size to permit the installation of a door not less than 32 inches (813 mm) in clear width and not less than 6 feet 8 inches (2,032 mm) in height. A manually operated horizontal sliding door may be used as one of the two required exits.

Where basements are used for day-care purposes, one of the two required exits shall provide access directly to the exterior without entering the first story. The second exit from the basement may either pass through the story above or exit directly to the exterior.

Rooms used for day-care purposes shall not be located above the first story.

Exception: Buildings equipped with an automatic sprinkler system throughout and which have at least one of the required exits providing access directly to the exterior. NFPA 13R may be used in large family day-care homes. The sprinkler omissions of NFPA 13R shall not apply unless approved by the enforcing agency.

Exit doors, including manually operated horizontal sliding doors, shall be openable from the inside without use of a key or any special knowledge or effort.

Tables 1006.3.3(1) and 1006.3.3(2) are not applicable to this occupancy classification.

1006.2.2.8 Group I-4 means of egress. Group I-4 facilities, rooms or spaces where care is provided for more than 10 children that are 36 months of age or less shall have access to not less than two exits or exit access doorways.

[BE] 1006.3 Egress from stories or occupied roofs. The means of egress system serving any story or occupied roof shall be provided with the number of separate and distinct exits or access to exits based on the aggregate occupant load served in accordance with this section.

[BE] 1006.3.1 Occupant load. Where stairways serve more than one story, or more than one story and an occupied roof, only the occupant load of each story or occupied roof, considered individually, shall be used when calculating the required number of exits or access to exits serving that story.

[BE] 1006.3.2 Path of egress travel. The path of egress travel to an exit shall not pass through more than one adjacent story.

Exception: The path of egress travel to an exit shall be permitted to pass through more than one adjacent story in any of the following:

1. In Group R-1, R-2 or R-3 occupancies, exit access stairways and ramps connecting four stories or fewer serving and contained within an

- individual dwelling unit or sleeping unit or live/work unit.
- 2. Exit access stairways serving and contained within a Group R-3 congregate residence or a Group R-4 facility.
- 3. Exit access stairways and ramps within an atrium complying with Section 404.
- 4. Exit access stairways and ramps in open parking garages that serve only the parking garage.
- 5. Exit access stairways and ramps serving open-air assembly seating complying with the exit access travel distance requirements of Section 1030.7.
- 6. Exit access stairways and ramps between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.
- 7. Exterior exit access stairways and ramps between occupied roofs.

[BE] 1006.3.3 Egress based on occupant load. Each story and occupied roof shall have the minimum number of separate and distinct exits, or access to exits, as specified in Table 1006.3.3. A single exit or access to a single exit shall be permitted in accordance with Section 1006.3.4. The required number of exits, or exit access stairways or ramps providing access to exits, from any story or occupied roof shall be maintained until arrival at the exit discharge or public way.

**[BE] TABLE 1006.3.3
MINIMUM NUMBER OF EXITS OR
ACCESS TO EXITS PER STORY**

OCCUPANT LOAD PER STORY	MINIMUM NUMBER OF EXITS OR ACCESS TO EXITS FROM STORY
1-500	2
501-1,000	3
More than 1,000	4

[BE] 1006.3.4 Single exits. A single exit or access to a single exit shall be permitted from any story or occupied roof, where one of the following conditions exists:

- 1. The occupant load, number of dwelling units and exit access travel distance do not exceed the values in Table 1006.3.4(1) or 1006.3.4(2).

- 2. Rooms, areas and spaces *at the level of exit discharge*, complying with Section 1006.2.1 with exits that discharge directly to the exterior at the level of exit discharge, are permitted to have one exit or access to a single exit.
- 3. Parking garages where vehicles are mechanically parked shall be permitted to have one exit or access to a single exit.
- 4. Group R-3 and R-4 occupancies shall be permitted to have one exit or access to a single exit.
- 5. Individual single-story or multistory dwelling units shall be permitted to have a single exit or access to a single exit from the dwelling unit provided that both of the following criteria are met:
 - 5.1. The dwelling unit complies with Section 1006.2.1 as a space with one means of egress.
 - 5.2. Either the exit from the dwelling unit discharges directly to the exterior at the level of exit discharge, or the exit access outside the dwelling unit's entrance door provides access to not less than two approved independent exits.

[BE] 1006.3.4.1 Mixed occupancies. Where one exit, or exit access stairway or ramp providing access to exits at other stories, is permitted to serve individual stories, mixed occupancies shall be permitted to be served by single exits provided that each individual occupancy complies with the applicable requirements of Table 1006.3.4(1) or 1006.3.4(2) for that occupancy. Where applicable, cumulative occupant loads from adjacent occupancies shall be considered to be in accordance with the provisions of Section 1004.1. In each story of a mixed occupancy building, the maximum number of occupants served by a single exit shall be such that the sum of the ratios of the calculated number of occupants of the space divided by the allowable number of occupants indicated in Table 1006.3.4(2) for each occupancy does not exceed one. Where dwelling units are located on a story with other occupancies, the actual number of dwelling units divided by four plus the ratio from the other occupancy does not exceed one.

**[BE] TABLE 1006.3.4(1)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR R-2 AND R-3 OCCUPANCIES**

STORY	OCCUPANCY	MAXIMUM NUMBER OF DWELLING UNITS	MAXIMUM EXIT ACCESS TRAVEL DISTANCE
Basement, first, second or third story above grade plane	R-2 ^{a, b} R-3 ^a	4 dwelling units NA	125 feet NA
Fourth story above grade plane and higher	R-3 ^a	NA	125 feet

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

- a. Buildings classified as Group R-2 or R-3 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
- b. This table is used for R-2 occupancies consisting of dwelling units. For R-2 occupancies consisting of sleeping units, use Table 1006.3.4(2).

[BE] TABLE 1006.3.4(2)
STORIES WITH ONE EXIT OR ACCESS TO ONE EXIT FOR OTHER OCCUPANCIES*

STORY	OCCUPANCY	MAXIMUM OCCUPANT LOAD PER STORY	MAXIMUM EXIT ACCESS TRAVEL DISTANCE (feet)
First story above or below grade plane	A, B ^b , E, F ^b , M, U	49	75
	H-2, H-3	3	25
	H-4, H-5, I, R-1, R-2 ^{a,c} , R-2.2	10	75
	S ^{b,d}	29	75
	I-2, I-2.1	7 occupants	50 feet
Second story above grade plane	B, F, M, S ^d	29	75
Third story above grade plane and higher	NP	NA	NA

For SI: 1 foot = 304.8 mm.

NP = Not Permitted.

NA = Not Applicable.

- a. Buildings classified as Group R-2 equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 and provided with emergency escape and rescue openings in accordance with Section 1031.
- b. Group B, F and S occupancies in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 shall have a maximum exit access travel distance of 100 feet.
- c. This table is used for R-2 occupancies consisting of sleeping units. For R-2 occupancies consisting of dwelling units, use Table 1006.3.4(1).
- d. The length of exit access travel distance in a Group S-2 open parking garage shall be not more than 100 feet.
- e. For Group L occupancies see Section 453.6.1 of the California Building Code.

**SECTION 1007
EXIT AND EXIT ACCESS
DOORWAY CONFIGURATION**

[BE] 1007.1 **General.** Exits, exit access doorways, and exit access stairways and ramps serving spaces, including individual building stories, shall be separated in accordance with the provisions of this section.

[BE] 1007.1.1 **Two exits or exit access doorways.** Where two exits, exit access doorways, exit access stairways or ramps, or any combination thereof, are required from any portion of the exit access, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between them. Interlocking or scissor stairways shall be counted as one exit stairway.

Exceptions:

1. Where interior exit stairways or ramps are interconnected by a 1-hour fire-resistance-rated corridor conforming to the requirements of Section 1020, the required exit separation shall be measured along the shortest direct line of travel within the corridor.
2. Where a building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2, the separation distance shall be not less than one-third of the length of the maximum overall diagonal dimension of the area served.

[BE] 1007.1.1.1 **Measurement point.** The separation distance required in Section 1007.1.1 shall be measured in accordance with the following:

1. The separation distance to exit or exit access doorways shall be measured to any point along the width of the doorway.

2. The separation distance to exit access stairways shall be measured to the closest riser.
3. The separation distance to exit access ramps shall be measured to the start of the ramp run.

[BE] 1007.1.2 **Three or more exits or exit access doorways.** Where access to three or more exits is required, not less than two exit or exit access doorways shall be arranged in accordance with the provisions of Section 1007.1.1. Additional required exit or exit access doorways shall be arranged a reasonable distance apart so that if one becomes blocked, the others will be available.

[BE] 1007.1.3 **Remoteness of exit access stairways or ramps.** Where two exit access stairways or ramps provide the required means of egress to exits at another story, the required separation distance shall be maintained for all portions of such exit access stairways or ramps.

[BE] 1007.1.3.1 **Three or more exit access stairways or ramps.** Where more than two exit access stairways or ramps provide the required means of egress, not less than two shall be arranged in accordance with Section 1007.1.3.

**SECTION 1008
MEANS OF EGRESS ILLUMINATION**

[BE] 1008.1 **Means of egress illumination.** Illumination shall be provided in the means of egress in accordance with Section 1008.2. Under emergency power, means of egress illumination shall comply with Section 1008.3.

[BE] 1008.2 **Illumination required.** The means of egress serving a room or space shall be illuminated at all times that the room or space is occupied.

Exceptions:

1. Occupancies in Group U.

2. Aisle accessways in Group A.
3. Dwelling units and sleeping units in Groups R-1, R-2 and R-3.
4. Sleeping units of Group I, *R-2.1 and R-4* occupancies.

[BE] 1008.2.1 Illumination level under normal power.

The means of egress illumination level shall be not less than 1 footcandle (11 lux) at the walking surface. Along exit access stairways, exit stairways and at their required landings, the illumination level shall be not less than 10 footcandles (108 lux) at the walking surface when the stairway is in use.

Exception: For auditoriums, theaters, concert or opera halls and similar assembly occupancies, the illumination at the walking surface is permitted to be reduced during performances by one of the following methods provided that the required illumination is automatically restored upon activation of a premises' fire alarm system:

1. Externally illuminated walking surfaces shall be permitted to be illuminated to not less than 0.2 footcandle (2.15 lux).
2. Steps, landings and the sides of ramps shall be permitted to be marked with self-luminous materials in accordance with Sections 1025.2.1, 1025.2.2 and 1025.2.4 by systems listed in accordance with UL 1994.

[BE] 1008.2.2 Group I-2. In Group I-2 occupancies where two or more exits are required, on the exterior landings required by Section 1010.1.5, means of egress illumination levels for the exit discharge shall be provided such that failure of a single lamp in a luminaire shall not reduce the illumination level on that landing to less than 1 footcandle (11 lux).

[BE] 1008.2.3 Exit discharge. Illumination shall be provided along the path of travel for the exit discharge from each exit to the public way.

Exception: Illumination shall not be required where the path of the exit discharge meets both of the following requirements:

1. The path of exit discharge is illuminated from the exit to a safe dispersal area complying with Section 1028.5.
2. A dispersal area shall be illuminated to a level not less than 1 footcandle (11 lux) at the walking surface.

[BE] 1008.3 Emergency power for illumination. The power supply for means of egress illumination shall normally be provided by the premises' electrical supply.

[BE] 1008.3.1 General. In the event of power supply failure in rooms and spaces that require two or more exits or access to exits, an emergency electrical system shall automatically illuminate all of the following areas:

1. Aisles.
2. Corridors.
3. Exit access stairways and ramps.

[BE] 1008.3.2 Buildings. In the event of power supply failure, in buildings that require two or more exits or access to exits, an emergency electrical system shall automatically illuminate all of the following areas:

1. Interior exit access stairways and ramps.
2. Interior and exterior exit stairways and ramps.
3. Exit passageways.
4. Vestibules and areas on the level of discharge used for exit discharge in accordance with Section 1028.2.
5. Exterior landings as required by Section 1010.1.5 for exit doorways that lead directly to the exit discharge.
6. *Group I-2 and I-2.1 exit discharge stairways, ramps, aisles, walkways and escalators leading to a public way or to a safe dispersal area in accordance with Section 1028.5.*

[BE] 1008.3.3 Rooms and spaces. In the event of power supply failure, an emergency electrical system shall automatically illuminate all of the following areas:

1. Electrical equipment rooms.
2. Fire command centers.
3. Fire pump rooms.
4. Generator rooms.
5. Public restrooms with an area greater than 300 square feet (27.87 m²).

[BE] 1008.3.4 Duration. The emergency power system shall provide power for a duration of not less than 90 minutes and shall consist of storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 2702 of the *California Building Code*.

[BE] 1008.3.5 Illumination level under emergency power. Emergency lighting facilities shall be arranged to provide initial illumination that is not less than an average of 1 footcandle (11 lux) and a minimum at any point of 0.1 footcandle (1 lux) measured along the path of egress at floor level. Illumination levels shall be permitted to decline to 0.6 footcandle (6 lux) average and a minimum at any point of 0.06 footcandle (0.6 lux) at the end of the emergency lighting time duration. A maximum-to-minimum illumination uniformity ratio of 40 to 1 shall not be exceeded. In Group I-2 occupancies, failure of a single lamp in a luminaire shall not reduce the illumination level to less than 0.2 footcandle (2.2 lux).

SECTION 1009 ACCESSIBLE MEANS OF EGRESS

[BE] 1009.1 Accessible means of egress required. Accessible means of egress shall comply with this section. Accessible spaces shall be provided with not less than one accessible means of egress. Where more than one means of egress is required by Section 1006.2 or 1006.3 from any accessible space, each accessible portion of the space shall be served by

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not less than two accessible means of egress *in at least the same number as required by Section 1006.2 or 1006.3. In addition to the requirements of this chapter, means of egress, which provide access to, or egress from, buildings for persons with disabilities, shall also comply with the requirements of Chapter 11A or 11B of the California Building Code, as applicable.*

Exceptions:

1. One accessible means of egress is required from an accessible mezzanine level in accordance with Section 1009.3, 1009.4 or 1009.5 *and Chapter 11A or 11B of the California Building Code.*
2. In assembly areas with ramped aisles or stepped aisles, one accessible means of egress is permitted where the common path of travel is accessible and meets the requirements in Section 1030.8, *and Chapter 11A or 11B of the California Building Code.*

[BE] 1009.2 Continuity and components. Each required accessible means of egress shall be continuous to a public way and shall consist of one or more of the following components:

1. Accessible routes complying with *Chapter 11A or 11B of the California Building Code.*
2. Interior exit stairways complying with Sections 1009.3 and 1023 *of this code and Chapter 11A or 11B of the California Building Code.*
3. Exit access stairways complying with Sections 1009.3 and 1019.3 or 1019.4 *of this code and Chapter 11A or 11B of the California Building Code.*
4. Exterior exit stairways complying with Sections 1009.3 and 1027 and serving levels other than the level of exit discharge *of this code and Chapter 11A or 11B of the California Building Code.*
5. Elevators complying with Section 1009.4 *of this code and Chapter 11A or 11B of the California Building Code.*
6. Platform lifts complying with Section 1009.5 *of this code and Chapter 11A or 11B of the California Building Code.*
7. Horizontal exits complying with Section 1026.
8. Ramps complying with Section 1012 *of this code and Chapter 11A or 11B of the California Building Code.*
9. Areas of refuge complying with Section 1009.6.
10. Exterior areas for assisted rescue complying with Section 1009.7 serving exits at the level of exit discharge.

[BE] 1009.2.1 Elevators required. In buildings where a required accessible floor or occupied roof is four or more stories above or below a level of exit discharge, not less than one required accessible means of egress shall be an elevator complying with Section 1009.4.

Exceptions:

1. In buildings equipped throughout with an automatic sprinkler system installed in accordance

with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a horizontal exit and located at or above the levels of exit discharge.

2. In buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, the elevator shall not be required on floors provided with a ramp conforming to the provisions of Section 1012.

[BE] 1009.3 Stairways. In order to be considered part of an accessible means of egress, a stairway between stories shall comply with Sections 1009.3.1 through 1009.3.3.

[BE] 1009.3.1 Exit access stairways. Exit access stairways that connect levels in the same story are not permitted as part of an accessible means of egress.

Exception: Exit access stairways providing means of egress from mezzanines are permitted as part of an accessible means of egress.

[BE] 1009.3.2 Stairway width. Stairways shall have a clear width of 48 inches (1219 mm) minimum between handrails.

Exceptions:

1. The clear width of 48 inches (1219 mm) between handrails is not required in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
2. The clear width of 48 inches (1219 mm) between handrails is not required for stairways accessed from a refuge area in conjunction with a horizontal exit.

[BE] 1009.3.3 Area of refuge. Stairways shall either incorporate an area of refuge within an enlarged floor-level landing or shall be accessed from an area of refuge complying with Section 1009.6.

Exceptions:

1. Areas of refuge are not required at exit access stairways where two-way communication is provided at the elevator landing in accordance with Section 1009.8.
2. Areas of refuge are not required at stairways in buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Areas of refuge are not required at stairways serving open parking garages.
4. Areas of refuge are not required for smoke-protected or open-air assembly seating areas complying with Sections 1030.6.2 and 1030.6.3.
5. Areas of refuge are not required at stairways in Group R-2 occupancies.
6. Areas of refuge are not required for stairways accessed from a refuge area in conjunction with a horizontal exit.

[BE] 1009.4 Elevators. In order to be considered part of an accessible means of egress, an elevator shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

[BE] 1009.4.1 Standby power. The elevator shall meet the emergency operation and signaling device requirements of Section 2.27 of ASME A17.1/CSA B44. Standby power shall be provided in accordance with Chapter 27 and Section 3003 of the *California Building Code*.

[BE] 1009.4.2 Area of refuge. The elevator shall be accessed from an area of refuge complying with Section 1009.6.

Exceptions:

1. Areas of refuge are not required at the elevator in open parking garages.
2. Areas of refuge are not required in buildings and facilities equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Areas of refuge are not required at elevators not required to be located in a shaft in accordance with Section 712 of the *California Building Code*.
4. Areas of refuge are not required at elevators serving smoke protected or open-air assembly seating areas complying with Sections 1030.6.2 and 1030.6.3.
5. Areas of refuge are not required for elevators accessed from a refuge area in conjunction with a horizontal exit.

[BE] 1009.5 Platform lifts. Platform lifts shall be permitted to serve as part of an accessible means of egress where allowed as part of a required accessible route in *Chapter 11B* of the *California Building Code* except for Item 10. Standby power for the platform lift shall be provided in accordance with Chapter 27 of the *California Building Code*.

[BE] 1009.6 Areas of refuge. Every required area of refuge shall be accessible from the space it serves by an accessible means of egress.

[BE] 1009.6.1 Travel distance. The maximum travel distance from any accessible space to an area of refuge shall not exceed the exit access travel distance permitted for the occupancy in accordance with Section 1017.1.

[BE] 1009.6.2 Stairway or elevator access. Every required area of refuge shall have direct access to a stairway complying with Sections 1009.3 and 1023 or an elevator complying with Section 1009.4.

Exception: An interior area of refuge at the level of exit discharge that provides direct access to an exterior exit door.

[BE] 1009.6.3 Size. Each area of refuge shall be sized to accommodate *two* wheelchair spaces *that are not less than* 30 inches by 48 inches (762 mm by 1219 mm). *The total number of such 30-inch by 52-inch (762 mm by 1320 mm) spaces per story shall be not less than one for every 200*

persons of calculated occupant load served by the area of refuge. Such wheelchair spaces shall not reduce the means of egress minimum width or required capacity. Access to any of the required wheelchair spaces in an area of refuge shall not be obstructed by more than one adjoining wheelchair space.

Exception: *The enforcing agency may reduce the size of each required area of refuge to accommodate one wheelchair space that is not less than 30 inches by 52 inches (762 mm by 1320 mm) on floors where the occupant load is less than 200.*

[BE] 1009.6.4 Separation. Each area of refuge shall be separated from the remainder of the story by a smoke barrier complying with Section 709 of the *California Building Code* or a horizontal exit complying with Section 1026. Each area of refuge shall be designed to minimize the intrusion of smoke.

Exceptions:

1. Areas of refuge located within an enclosure for interior exit stairways complying with Section 1023.
2. Areas of refuge in outdoor facilities where exit access is essentially open to the outside.

[BE] 1009.6.5 Two-way communication. Areas of refuge shall be provided with a two-way communication system complying with Sections 1009.8.1 and 1009.8.2.

[BE] 1009.7 Exterior areas for assisted rescue. Exterior areas for assisted rescue shall be accessed by an accessible route from the area served.

Where the exit discharge does not include an accessible route from an exit located on the level of exit discharge to a public way, an exterior area of assisted rescue shall be provided on the exterior landing in accordance with Sections 1009.7.1 through 1009.7.4.

[BE] 1009.7.1 Size. Each exterior area for assisted rescue shall be sized to accommodate wheelchair spaces in accordance with Section 1009.6.3.

[BE] 1009.7.2 Separation. Exterior walls separating the exterior area of assisted rescue from the interior of the building shall have a minimum fire-resistance rating of 1 hour, rated for exposure to fire from the inside. The fire-resistance-rated exterior wall construction shall extend horizontally not less than 10 feet (3048 mm) beyond the landing on either side of the landing or equivalent fire-resistance-rated construction is permitted to extend out perpendicular to the exterior wall not less than 4 feet (1219 mm) on the side of the landing. The fire-resistance-rated construction shall extend vertically from the ground to a point not less than 10 feet (3048 mm) above the floor level of the area for assisted rescue or to the roof line, whichever is lower. Openings within such fire-resistance-rated exterior walls shall be protected in accordance with Section 716 of the *California Building Code*.

Exception: The fire-resistance rating and opening protectives are not required in the exterior wall where the building is equipped throughout with an automatic

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sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

[BE] 1009.7.3 Openness. The exterior area for assisted rescue shall be open to the outside air. The sides other than the separation walls shall be not less than 50 percent open, and the open area shall be distributed so as to minimize the accumulation of smoke or toxic gases.

[BE] 1009.7.4 Stairways. Stairways that are part of the means of egress for the exterior area for assisted rescue shall provide a minimum clear width of 48 inches (1219 mm) between handrails.

Exception: The minimum clear width of 48 inches (1219 mm) between handrails is not required at stairways serving buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.

[BE] 1009.8 Two-way communication. A two-way communication system complying with Sections 1009.8.1 and 1009.8.2 shall be provided at the landing serving each elevator or bank of elevators on each accessible floor that is one or more stories above or below the level of exit discharge.

Exceptions:

1. Two-way communication systems are not required at the landing serving each elevator or bank of elevators where the two-way communication system is provided within areas of refuge in accordance with Section 1009.6.5.
2. Two-way communication systems are not required on floors provided with ramps conforming to the provisions of Section 1012.
3. Two-way communication systems are not required at the landings serving only service elevators that are not designated as part of the accessible means of egress or serve as part of the required accessible route into a facility.
4. Two-way communication systems are not required at the landings serving only freight elevators.
5. Two-way communication systems are not required at the landing serving a private residence elevator.
6. Two-way communication systems are not required in Group I-2 or I-3 facilities.

[BE] 1009.8.1 System requirements. Two-way communication systems shall provide communication between each required location and a central control point location approved by the fire department. Where the central control point is not a constantly attended location, the two-way communication system shall have a timed automatic telephone dial-out capability that provides two-way communication with an approved supervising station or 9-1-1. The two-way communication system shall include both audible and visible signals.

[BE] 1009.8.2 Directions. Directions for the use of the two-way communication system, instructions for summoning assistance via the two-way communication system and written identification of the location shall be

posted adjacent to the two-way communication system. Signage shall comply with *Chapter 11A, Section 1143A of the California Building Code* requirements for visual characters.

[BE] 1009.9 Signage. Signage indicating special accessibility provisions shall be provided as shown:

1. Each door providing access to an area of refuge from an adjacent floor area shall be identified by a sign stating: "AREA OF REFUGE."
2. Each door providing access to an exterior area for assisted rescue shall be identified by a sign stating: "EXTERIOR AREA FOR ASSISTED RESCUE."

Signage shall comply with the ICC A117.1 requirements for visual characters and include the International Symbol of Accessibility. Where exit sign illumination is required by Section 1013.3, the signs shall be illuminated. Additionally, visual characters, raised character and braille signage complying with ICC A117.1 shall be located at each door to an area of refuge and exterior area for assisted rescue in accordance with Section 1013.4.

[BE] 1009.10 Directional signage. Directional signage complying with *Chapter 11B, Section 11B-703.5*, indicating the location of all other means of egress and which of those are accessible means of egress shall be provided at the following:

1. At exits serving a required accessible space but not providing an approved accessible means of egress.
2. At elevator landings.
3. Within areas of refuge.

[BE] 1009.11 Instructions. In areas of refuge and exterior areas for assisted rescue, instructions on the use of the area under emergency conditions shall be posted. Signage shall comply with the ICC A117.1 requirements for visual characters. The instructions shall include all of the following:

1. Persons able to use the exit stairway do so as soon as possible, unless they are assisting others.
2. Information on planned availability of assistance in the use of stairs or supervised operation of elevators and how to summon such assistance.
3. Directions for use of the two-way communication system where provided.

1009.12 Alarms and emergency warning systems and two-way communication systems. Required emergency warning systems shall activate a means of warning the hearing impaired. Emergency warning systems provided as part of the fire-alarm system and two-way communication systems required by Chapter 10 shall be designed and installed in accordance with NFPA 72 as amended in Chapter 80.

SECTION 1010 DOORS, GATES AND TURNSTILES

[BE] 1010.1 Doors. Doors in the means of egress shall comply with the requirements of Sections 1010.1.1 through 1010.3.4. Exterior exit doors shall also comply with the

requirements of Section 1022.2. Gates in the means of egress shall comply with the requirements of Sections 1010.4 and 1010.4.1. Turnstiles in the means of egress shall comply with the requirements of Sections 1010.5 through 1010.5.4.

Doors, gates and turnstiles provided for egress purposes in numbers greater than required by this code shall comply with the requirements of this section.

Doors in the means of egress shall be readily distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Mirrors or similar reflecting materials shall not be used on means of egress doors. Means of egress doors shall not be concealed by curtains, drapes, decorations or similar materials.

[BE] 1010.1.1 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 32 inches (813 mm). The clear opening width of doorways with swinging doors shall be measured between the face of the door and the stop, with the door open 90 degrees (1.57 rad). Where this section requires a minimum clear opening width of 32 inches (813 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 32 inches (813 mm). In Group I-2 or I-2.1, doors serving as means of egress doors; where used for the movement of beds and stretcher patients shall provide a minimum clear opening width of 44 inches (1118 mm). Where this section requires a minimum clear opening width of 44 inches (1118 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 44 inches (1118 mm). The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal. The minimum clear opening height of doors shall be not less than 80 inches (2032 mm).

Exceptions:

1. In Group R-2 and R-3 dwelling and sleeping units that are not required to be an Accessible unit, Type A unit or Type B unit, the minimum width shall not apply to door openings that are not part of the required means of egress.
2. Group I-3 door openings to resident sleeping units that are not required to be an Accessible unit shall have a minimum clear opening width of 28 inches (711 mm).
3. Door openings to storage closets less than 10 square feet (0.93 m²) in area shall not be limited by the minimum clear opening width.
4. The maximum width of door leaves in revolving doors that comply with Section 1010.3.1 shall not be limited.
5. The maximum width of door leaves in power-operated doors that comply with Section 1010.3.2 shall not be limited.
6. Door openings within a dwelling unit or sleeping unit shall have a minimum clear opening height of 78 inches (1981 mm).

7. In dwelling and sleeping units that are not required to be Accessible, Type A or Type B units, exterior door openings, other than the required exit door, shall have a minimum clear opening height of 76 inches (1930 mm).
8. In Groups R-2, R-3 and R-4, in dwelling and sleeping units that are not required to be Accessible, Type A or Type B units, the minimum clear opening widths shall not apply to interior egress doors.
9. Door openings required to be accessible within Type B units intended for user passage shall have a minimum clear opening width of 31.75 inches (806 mm).
10. Doors to walk-in freezers and coolers less than 1,000 square feet (93 m²) in area shall have a maximum width of 60 inches (1524 mm) nominal.
11. Doors serving nonaccessible single-user shower or sauna compartments; toilet stalls; or dressing, fitting or changing rooms shall have a minimum clear opening width of 20 inches (508 mm).

[BE] 1010.1.1.1 Projections into clear opening. There shall not be projections into the required clear opening width lower than 34 inches (864 mm) above the floor or ground. Projections into the clear opening width between 34 inches (864 mm) and 80 inches (2032 mm) above the floor or ground shall not exceed 4 inches (102 mm).

Exceptions:

1. Door closers, overhead door stops, power door operators, and electromagnetic door locks shall be permitted to be 78 inches (1980 mm) minimum above the floor.
2. In a Group I-2 or I-2.1 occupancy, there shall be no projections into the clear width of doors used for the movement of beds and stretcher patients in the means of egress.

[BE] 1010.1.2 Egress door types. Egress doors shall be of the side-hinged swinging door, pivoted door or balanced door types.

Exceptions:

1. Private garages, office areas, factory and storage areas with an occupant load of 10 or less.
2. Group I-3 occupancies used as a place of detention.
3. Critical or intensive care patient rooms within suites of health care facilities.
4. Doors within or serving a single dwelling unit in Groups R-2 and R-3.
5. In other than Group H occupancies, revolving doors complying with Section 1010.3.1.
6. In other than Group H occupancies, special-purpose horizontal sliding, accordion or folding door assemblies complying with Section 1010.3.3.
7. Power-operated doors in accordance with Section 1010.3.2.
8. Doors serving a bathroom within an individual sleeping unit in Group R-1.

9. In other than Group H occupancies, manually operated horizontal sliding doors are permitted in a means of egress from spaces with an occupant load of 10 or less.

10. In Group I-2 and I-2.1 occupancies, exit doors serving an occupant load of 50 or more shall not be of the pivoted or balanced type.

[BE] 1010.1.2.1 Direction of swing. Side-hinged swinging doors, pivoted doors and balanced doors shall swing in the direction of egress travel where serving a room or area containing an occupant load of 50 or more persons or a Group H occupancy. For Group L occupancies, see Section 453.6.2 of the California Building Code.

In a Group I-2 occupancy, all required exterior egress doors shall open in the direction of egress regardless of the occupant load served.

[BE] 1010.1.3 Forces to unlatch and open doors. The forces to unlatch doors shall comply with the following:

1. Where door hardware operates by push or pull, the operational force to unlatch the door shall not exceed 15 pounds (66.7 N).
2. Where door hardware operates by rotation, the operational force to unlatch the door shall not exceed 28 inch-pounds (315 N-cm).

The force to open doors shall comply with the following:

1. For interior swinging egress doors that are manually operated, other than doors required to be fire rated, the force for pushing or pulling open the door shall not exceed 5 pounds (22 N).
2. For other swinging doors, sliding doors or folding doors, and doors required to be fire rated, the door shall require not more than a 30-pound (133 N) force to be set in motion and shall move to a full-open position when subjected to not more than a 15-pound (67 N) force.

[BE] 1010.1.3.1 Location of applied forces. Forces shall be applied to the latch side of the door.

[BE] 1010.1.3.2 Manual horizontal sliding doors. Where a manual horizontal sliding door is required to latch, the latch or other mechanism shall prevent the door from rebounding into a partially open position when the door is closed.

[BE] 1010.1.4 Floor elevation. There shall be a floor or landing on each side of a door. Such floor or landing shall be at the same elevation on each side of the door. Landings shall be level except for exterior landings, which are permitted to have a slope not to exceed 0.25 unit vertical in 12 units horizontal (2-percent slope).

Exceptions:

1. At doors serving individual dwelling units or sleeping units in Groups R-2 and R-3, a door is permitted to open at the top step of an interior flight of stairs, provided that the door does not swing over the top step.

2. At exterior doors serving Groups F, H, R-2 and S and where such doors are not part of an accessible route *or are not required to be accessible by Chapter 11A or 11B of the California Building Code*, the landing at an exterior door shall be not more than 7 inches (178 mm) below the landing on the egress side of the door, provided that the door, other than an exterior storm or screen door, does not swing over the landing.

3. At exterior doors serving Group U and individual dwelling units and sleeping units in Groups R-2 and R-3, and where such units are not required to be Accessible units, Type A units or Type B units, the landing at an exterior doorway shall be not more than 7³/₄ inches (197 mm) below the landing on the egress side of the door. Such doors, including storm or screen doors, shall be permitted to swing over either landing.

4. Variations in elevation due to differences in finish materials, but not more than 1/2 inch (12.7 mm).

5. Exterior decks, patios or balconies that are part of Type B dwelling units or sleeping units, that have impervious surfaces and that are not more than 4 inches (102 mm) below the finished floor level of the adjacent interior space of the dwelling unit or sleeping unit.

6. Doors serving equipment spaces not required to be accessible in accordance with Section 1103.2.9 of the California Building Code and serving an occupant load of five or less shall be permitted to have a landing on one side to be not more than 7 inches (178 mm) above or below the landing on the egress side of the door.

[BE] 1010.1.5 Landings at doors. Landings shall have a width not less than the width of the stairway or the door, whichever is greater. Doors in the fully open position shall not reduce a required dimension by more than 7 inches (178 mm). Where a landing serves an occupant load of 50 or more, doors in any position shall not reduce the landing to less than one-half its required width. Landings shall have a length measured in the direction of travel of not less than 44 inches (1118 mm).

Exception: Landing length in the direction of travel in Groups R-3 and U and within individual units of Group R-2 need not exceed 36 inches (914 mm).

[BE] 1010.1.6 Thresholds. Thresholds at doorways shall not exceed 3/4 inch (19.1 mm) in height above the finished floor or landing for sliding doors serving dwelling units or 1/2 inch (12.7 mm) above the finished floor or landing for other doors. Raised thresholds and floor level changes greater than 1/4 inch (6.4 mm) at doorways shall be beveled with a slope not greater than 1 unit vertical in 2 units horizontal (50-percent slope).

Exceptions:

1. In occupancy Group R-2 or R-3, threshold heights for sliding and side-hinged exterior doors

shall be permitted to be up to 7³/₄ inches (197 mm) in height if all of the following apply:

- 1.1. The door is not part of the required means of egress.
 - 1.2. The door is not part of an accessible route as required by Chapter 11A or 11B of the *California Building Code*.
 - 1.3. The door is not part of an *adaptable or accessible dwelling unit*.
2. In *adaptable or accessible dwelling units*, where Exception 5 to Section 1010.1.4 permits a 4-inch (102 mm) elevation change at the door, the threshold height on the exterior side of the door shall not exceed 4³/₄ inches (120 mm) in height above the exterior deck, patio or balcony for sliding doors or 4¹/₂ inches (114 mm) above the exterior deck, patio or balcony for other doors.

[BE] 1010.1.7 Door arrangement. Space between two doors in a series shall be 48 inches (1219 mm) minimum plus the width of a door swinging into the space. Doors in a series shall swing either in the same direction or away from the space between the doors.

Exceptions:

1. The minimum distance between horizontal sliding power-operated doors in a series shall be 48 inches (1219 mm).
2. Storm and screen doors serving individual dwelling units in Groups R-2 and R-3 need not be spaced 48 inches (1219 mm) from the other door.
3. Doors within individual dwelling units in Groups R-2 and R-3 other than *adaptable or accessible dwelling units*.

[BE] 1010.2 Door operations. Except as specifically permitted by this section, egress doors shall be readily openable from the egress side without the use of a key or special knowledge or effort.

[BE] 1010.2.1 Unlatching. The unlatching of any door or leaf for egress shall require not more than one motion in a single linear or rotational direction to release all latching and all locking devices.

Exceptions:

1. Places of detention or restraint.
2. Where manually operated bolt locks are permitted by Section 1010.2.5.
3. Doors with automatic flush bolts as permitted by Section 1010.2.4, Item 4.
4. Doors from individual dwelling units and sleeping units of Group R occupancies as permitted by Section 1010.2.4, Item 5.

[BE] 1010.2.2 Hardware. Door handles, pulls, latches, locks and other operating devices on doors required to be accessible by Chapter 11A or 11B of the *California Build-*

ing Code shall not require tight grasping, tight pinching or twisting of the wrist to operate.

These design requirements for door handles, pulls, latches, locks and other operating devices, intended for use on required means of egress doors in other than Group R and M occupancies with an occupant load of 10 or less, shall comply with SFM Standard 12-10-2, Section 12-10-202, contained in the CCR, Title 24, Part 12, California Referenced Standards Code.

[BE] 1010.2.3 Hardware height. Door handles, pulls, latches, locks and other operating devices shall be installed 34 inches (864 mm) minimum and 48 inches (1219 mm) maximum above the finished floor. Locks used only for security purposes and not used for normal operation are permitted at any height.

Exception: Access doors or gates in barrier walls and fences protecting pools, spas and hot tubs shall be permitted to have operable parts of the latch release on self-latching devices at 54 inches (1370 mm) maximum above the finished floor or ground, provided that the self-latching devices are not also self-locking devices operated by means of a key, electronic opener or integral combination lock.

[BE] 1010.2.4 Locks and latches. Locks and latches shall be permitted to prevent operation of doors where any of the following exist:

1. Places of detention or restraint.
2. In Group R-2.1 and Group I-2 occupancies where the clinical needs of persons receiving care require containment or where persons receiving care pose a security threat, provided that all clinical staff can readily unlock doors at all times, and all such locks are keyed to keys carried by all clinical staff at all times or all clinical staff have the codes or other means necessary to operate the locks at all times.
3. In buildings in occupancy Group A having an occupant load of 300 or less, Groups B, F, M and S, and in places of religious worship, the main door or doors are permitted to be equipped with key-operated locking devices from the egress side provided:
 - 3.1. The locking device is readily distinguishable as locked.
 - 3.2. A readily visible durable sign is posted on the egress side on or adjacent to the door stating: "THIS DOOR TO REMAIN UNLOCKED WHEN THIS SPACE IS OCCUPIED." The sign shall be in letters 1 inch (25 mm) high on a contrasting background.
 - 3.3. The use of the key-operated locking device is revocable by the fire code official for due cause.
4. Where egress doors are used in pairs, approved automatic flush bolts shall be permitted to be used, provided that the door leaf having the automatic flush

bolts does not have a doorknob or surface-mounted hardware.

5. Doors from individual dwelling or sleeping units of Group R occupancies having an occupant load of 10 or less are permitted to be equipped with a night latch, dead bolt or security chain, provided such devices are openable from the inside without the use of a key or tool.
6. Fire doors after the minimum elevated temperature has disabled the unlatching mechanism in accordance with listed fire door test procedures.
7. Doors serving roofs not intended to be occupied shall be permitted to be locked, preventing entry to the building from the roof.
8. Other than egress courts, where occupants must egress from an exterior space through the building for means of egress, exit access doors shall be permitted to be equipped with an approved locking device where installed and operated in accordance with all of the following:
 - 8.1. The maximum occupant load shall be posted where required by Section 1004.9. Such sign shall be permanently affixed inside the building and shall be posted in a conspicuous space near all the exit access doorways.
 - 8.2. A weatherproof telephone or two-way communication system installed in accordance with Sections 1009.8.1 and 1009.8.2 shall be located adjacent to not less than one required exit access door on the exterior side.
 - 8.3. The egress door locking device is readily distinguishable as locked and shall be a key-operated locking device.
 - 8.4. A clear window or glazed door opening, not less than 5 square feet (0.46 m²) in area, shall be provided at each exit access door to determine if there are occupants using the outdoor area.
 - 8.5. A readily visible durable sign shall be posted on the interior side on or adjacent to each locked required exit access door serving the exterior area stating: "THIS DOOR TO REMAIN UNLOCKED WHEN THE OUTDOOR AREA IS OCCUPIED." The letters on the sign shall be not less than 1 inch (25.4 mm) high on a contrasting background.
 - 8.6. The occupant load of the occupied exterior area shall not exceed 300 occupants in accordance with Section 1004.
9. Locking devices are permitted on doors to balconies, decks or other exterior spaces serving individual dwelling or sleeping units.
10. Locking devices are permitted on doors to balconies, decks or other exterior spaces of 250 square feet (23.23 m²) or less, serving a private office space.

[BE] 1010.2.5 Bolt locks. Manually operated flush bolts or surface bolts are not permitted.

Exceptions:

1. On doors not required for egress in individual dwelling units or sleeping units.
2. Where a pair of doors serves a storage or equipment room, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf.
3. Where a pair of doors serves an occupant load of less than 50 persons in a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf. The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.
4. Where a pair of doors serves a Group B, F or S occupancy, manually operated edge- or surface-mounted bolts are permitted on the inactive leaf provided that such inactive leaf is not needed to meet egress capacity requirements and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.
5. *Manually operated edge and surface-mounted bolts shall be permitted on the inactive leaf of pairs of doors that serve patient care rooms in Group I-2 occupancies, provided that the bolts are self-latching and the inactive leaf is not needed to meet the minimum clear opening width required by Section 1010.1.1 of the California Building Code. The inactive leaf shall not contain doorknobs, panic bars or similar operating hardware.*

[BE] 1010.2.6 Closet doors. Closet doors that latch in the closed position shall be openable from inside the closet.

[BE] 1010.2.7 Stairway doors. Interior stairway means of egress doors shall be openable from both sides without the use of a key or special knowledge or effort.

Exceptions:

1. Stairway discharge doors shall be openable from the egress side and shall only be locked from the opposite side.
2. This section shall not apply to doors arranged in accordance with Section 403.5.3 of the *California Building Code*.
3. Stairway exit doors are permitted to be locked from the side opposite the egress side, provided that they are openable from the egress side and capable of being unlocked simultaneously without unlatching upon a signal from the fire command center, if present, or a signal by emergency personnel from a single location inside the main entrance to the building.
4. Stairway exit doors shall be openable from the egress side and shall only be locked from the

opposite side in Group B, F, M and S occupancies where the only interior access to the tenant space is from a single exit stairway where permitted in Section 1006.3.4.

5. Stairway exit doors shall be openable from the egress side and shall only be locked from the opposite side in Group R-2 occupancies where the only interior access to the dwelling unit is from a single exit stairway where permitted in Section 1006.3.4.

[BE] 1010.2.8 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors from classrooms, offices and other occupied rooms with locking arrangements designed to keep intruders from entering the room shall comply with all of the following conditions:

1. The door shall be capable of being unlocked from outside the room with a key or other approved means.
2. The door shall be openable from within the room in accordance with Section 1010.2.
3. Modifications shall not be made to listed panic hardware, fire door hardware or door closers.
4. Modifications to fire door assemblies shall be in accordance with NFPA 80.

Remote locking or unlocking of doors from an approved location shall be permitted in addition to the unlocking operation in Item 1.

1010.2.8.1 Special provisions school classrooms. School classrooms constructed after January 1, 1990, not equipped with automatic sprinkler systems, which have metal grilles or bars on all their windows and do not have at least two exit doors within 3 feet (914 mm) of each end of the classroom opening to the exterior of the building or to a common hallway used for evacuation purposes, shall have an inside release for the grilles or bars on at least one window farthest from the exit doors. The window or windows with the inside release shall be clearly marked as emergency exits.

1010.2.8.2 Group E lockable doors from the inside. New buildings that are included in public schools (kindergarten through 12th grade) state-funded projects and are receiving state funding pursuant to Leroy F. Green, School Facilities Act of 1998, California Education Code Sections 17070.10 through 17079, and that are submitted to the Division of the State Architect for plan review after July 1, 2011, in accordance with Education Code 17075.50 shall include locks that allow doors to classrooms and any room with an occupancy of five or more persons to be locked from the inside. The locks shall conform to the specification and requirements found in Section 1010.2.

Exceptions:

1. Doors that are locked from the outside at all times such as, but not limited to, janitor's closet,

electrical room, storage room, boiler room, elevator equipment room and pupil restroom.

2. Reconstruction projects that utilize original plans in accordance with California Administrative Code, Section 4-314.
3. Existing relocatable buildings that are relocated within the same site, in accordance with California Administrative Code, Section 4-314.

[BE] 1010.2.9 Panic and fire exit hardware. Swinging doors serving a Group H occupancy and swinging doors serving rooms or spaces with an occupant load of 50 or more in a Group A or E occupancy, assembly area not classified as an assembly occupancy, E, I-2 or I-2.1 occupancies shall not be provided with a latch or lock other than panic hardware or fire exit hardware. For Group L occupancies see Section 453.6.3 of the California Building Code.

Exceptions:

1. A main exit of a Group A occupancy shall be permitted to have locking devices in accordance with Section 1010.2.4, Item 3.
2. Doors provided with panic hardware or fire exit hardware and serving a Group A or E occupancy shall be permitted to be electrically locked in accordance with Section 1010.2.12 or 1010.2.11.
3. Exit access doors serving occupied exterior areas shall be permitted to be locked in accordance with Section 1010.2.4, Item 8.
4. Courtrooms shall be permitted to be locked in accordance with Section 1010.2.13, Item 3.

[BE] 1010.2.9.1 Refrigeration machinery room. Refrigeration machinery rooms larger than 1,000 square feet (93 m²) shall have not less than two exit or exit access doorways that swing in the direction of egress travel and shall be equipped with panic hardware or fire exit hardware.

[BE] 1010.2.9.2 Rooms with electrical equipment. Exit or exit access doors serving transformer vaults, rooms designated for batteries or energy storage systems, or modular data centers shall be equipped with panic hardware or fire exit hardware. Rooms containing electrical equipment rated 800 amperes or more that contain overcurrent devices, switching devices or control devices and where the exit or exit access door is less than 25 feet (7620 mm) from the equipment working space as required by the California Electrical Code, such doors shall not be provided with a latch or lock other than panic hardware or fire exit hardware. The doors shall swing in the direction of egress travel.

[BE] 1010.2.9.3 Installation. Where panic or fire exit hardware is installed, it shall comply with the following:

1. Panic hardware shall be listed in accordance with UL 305.
2. Fire exit hardware shall be listed in accordance with UL 10C and UL 305.

3. The actuating portion of the releasing device shall extend not less than one-half of the door leaf width.
4. The maximum unlatching force shall not exceed 15 pounds (67 N).

[BE] 1010.2.9.4 Balanced doors. If balanced doors are used and panic hardware is required, the panic hardware shall be the push-pad type and the pad shall not extend more than one-half the width of the door measured from the latch side.

[BE] 1010.2.10 Monitored or recorded egress. Where electrical systems that monitor or record egress activity are incorporated, the locking system shall comply with Section 1010.2.11, 1010.2.12, 1010.2.13, 1010.2.14 or 1010.2.15, or shall be readily openable from the egress side without the use of a key or special knowledge or effort.

[BE] 1010.2.11 Door hardware release of electrically locked egress doors. Door hardware release of electric locking systems shall be permitted on doors in the means of egress in any occupancy except Group H where installed and operated in accordance with all of the following:

1. The door hardware that is affixed to the door leaf has an obvious method of operation that is readily operated under all lighting conditions.
2. The door hardware is capable of being operated with one hand and shall comply with Section 1010.2.1.
3. Operation of the door hardware directly interrupts the power to the electric lock and unlocks the door immediately.
4. Loss of power to the electric locking system automatically unlocks the door.
5. Where panic or fire exit hardware is required by Section 1010.2.9, operation of the panic or fire exit hardware also releases the electric lock.
6. The locking system units shall be listed in accordance with UL 294.

[BE] 1010.2.12 Sensor release of electrically locked egress doors. Sensor release of electric locking systems shall be permitted on doors located in the means of egress in any occupancy except Group E, H or L where installed and operated in accordance with all of the following criteria:

1. The sensor shall be installed on the egress side, arranged to detect an occupant approaching the doors and shall cause the electric locking system to unlock.
2. The electric locks shall be arranged to unlock by a signal from or loss of power to the sensor.
3. Loss of power to the lock or locking system shall automatically unlock the electric locks.
4. The doors shall be arranged to unlock from a manual unlocking device located 40 inches to 48 inches (1016 mm to 1219 mm) vertically above the floor

and within 5 feet (1524 mm) of the secured doors. Ready access shall be provided to the manual unlocking device and the device shall be clearly identified by a sign that reads "PUSH TO EXIT." When operated, the manual unlocking device shall result in direct interruption of power to the electric lock— independent of other electronics—and the electric lock shall remain unlocked for not less than 30 seconds.

5. Activation of the building fire alarm system, where provided, shall automatically unlock the electric lock, and the electric lock shall remain unlocked until the fire alarm system has been reset.
6. Activation of the building automatic sprinkler system or fire detection system, where provided, shall automatically unlock the electric lock. The electric lock shall remain unlocked until the fire alarm system has been reset.
7. Emergency lighting shall be provided on the egress side of the door.
8. The door locking system units shall be listed in accordance with UL 294.

1010.2.12.1 Access-controlled elevator lobby doors in high-rise office buildings. *For elevator lobbies in high-rise office buildings where the occupants of the floor are not required to travel through the elevator lobby to reach an exit, when approved by the fire chief, the doors separating the elevator lobby from the adjacent occupied tenant space that also serve as the entrance doors to the tenant space shall be permitted to be equipped with an approved entrance and egress access control provided all of the following requirements are met:*

1. *The building is provided throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.*
2. *A smoke detector is installed on the ceiling on the tenant side of the elevator lobby doors along the center line of the door opening, not less than 1 foot and not more than 5 feet from the door opening, and is connected to the fire alarm system.*
3. *A remote master switch capable of unlocking the elevator lobby doors shall be provided in the fire command center for use by the fire department.*
4. *Locks for the elevator lobby shall be UL and California State Fire Marshal listed fail-safe type locking mechanisms. The locking device shall automatically release on activation of any fire alarm device on the floor of alarm (water-flow, smoke detector, manual pull stations, etc.). All locking devices shall unlock, but not unlatch, upon activation.*
5. *A two-way voice communication system, utilizing dedicated lines, shall be provided from each locked elevator lobby to the 24-hour staffed location on site, annunciated as to loca-*

tion. Operating instructions shall be posted above each two-way communication device.

Exception: When approved by the fire chief, a two-way voice communication system to an off-site facility may be permitted where means to remotely unlock the access controlled doors from the off-site facility are provided.

6. An approved momentary mushroom-shaped palm button connected to the doors and installed adjacent to each locked elevator lobby door shall be provided to release the door locks when operated by an individual in the elevator lobby. The locks shall be reset manually at the door. Mount palm button so that the center line is 48 inches above the finished floor.

Provide a sign stating:

“IN CASE OF EMERGENCY,
PUSH PALM BUTTON,
DOOR WILL UNLOCK AND
SECURITY ALARM WILL SOUND.”

The sign lettering shall be 3/4-inch high letters by 1/8-inch width stroke on a contrasting background.

7. Loss of power to that part of the access control system which locks the doors shall automatically unlock the doors.

[BE] 1010.2.13 Delayed egress. Delayed egress locking systems shall be permitted to be installed on doors serving the following occupancies in buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke or heat detection system installed in accordance with Section 907:

1. Group B, F, I, M, R, S and U occupancies.
2. Group E classrooms with an occupant load of less than 50.
3. In courtrooms in Group A-3 and B occupancies, delayed egress locking systems shall be permitted to be installed on exit or exit access doors, other than the main exit or exit access door, in buildings that are equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke detection system installed in accordance with Section 907.

[BE] 1010.2.13.1 Delayed egress locking system. The delayed egress locking system shall be installed and operated in accordance with all of the following:

1. The delay electronics of the delayed egress locking system shall deactivate upon actuation of the automatic sprinkler system or automatic fire detection system, allowing immediate, free egress.
2. The delay electronics of the delayed egress locking system shall deactivate upon loss of power

controlling the lock or lock mechanism, allowing immediate free egress, to any one of the following:

- 2.1. The egress-control device itself.
 - 2.2. The smoke detection system.
 - 2.3. Means of egress illumination as required by Section 1008.
3. The delayed egress locking system shall have the capability of being deactivated at the fire command center and other approved locations.
 4. An attempt to egress shall initiate an irreversible process that shall allow such egress in not more than 15 seconds when a physical effort to exit is applied to the egress side door hardware for not more than 3 seconds. Initiation of the irreversible process shall activate an audible signal in the vicinity of the door. Once the delay electronics have been deactivated, rearming the delay electronics shall be by manual means only. The time delay established for each egress-control device shall not be field adjustable. For applications listed in Section 1.9.1 regulated by the Division of the State Architect—Access Compliance, see Chapter 11B.
- Exception:** In facilities housing Alzheimer’s or dementia clients, a delay of not more than 30 seconds is permitted on a delayed egress door.
5. The egress path from any point shall not pass through more than one delayed egress locking system.

Exceptions:

1. In Group R-2.1, Group I-2 or I-3 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided that the combined delay does not exceed 30 seconds.
2. In Group I-4 occupancies, the egress path from any point in the building shall pass through not more than two delayed egress locking systems provided that the combined delay does not exceed 30 seconds and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

6. A sign shall be provided on the door and shall be located above and within 12 inches (305 mm) of the door exit hardware:

Exception: Where approved, in Group I occupancies, the installation of a sign is not required where care recipients who, because of clinical needs, require restraint

or containment as part of the function of the treatment area.

- 6.1. For doors that swing in the direction of egress, the sign shall read: "PUSH UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS."
- 6.2. For doors that swing in the opposite direction of egress, the sign shall read: "PULL UNTIL ALARM SOUNDS. DOOR CAN BE OPENED IN 15 [30] SECONDS."
- 6.3. *Sign lettering shall be at least 1 inch (25 mm) in height and shall have a stroke of not less than 1/8 inch (3.2 mm).*
- 6.4. *A tactile sign shall also be provided in Braille and raised characters, which complies with Chapter 11B.*
7. Emergency lighting shall be provided on the egress side of the door.
8. The delayed egress locking system units shall be listed in accordance with UL 294.
9. *Actuation of the panic bar or other door-latching hardware shall activate an audible signal at the door.*
10. *The unlatching shall not require more than one operation.*
11. *Regardless of the means of deactivation, relocking of the egress-control device shall be by manual means only at the door.*

[BE] 1010.2.14 Controlled egress doors in Group I-2. *Electric locking systems, including electromechanical locking systems and electromagnetic locking systems, shall be permitted to be locked in the means of egress in Group I-2 occupancies where the clinical needs of persons receiving psychiatric or mental health treatment require their restraint or containment. Controlled egress doors shall be permitted in such occupancies where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and an approved automatic smoke detection system installed in accordance with Section 907, provided that the doors are installed and operate in accordance with all of the following:*

1. *The door locks shall unlock on actuation of the automatic sprinkler system or automatic smoke detection system.*
2. *The door locks shall unlock on loss of power controlling the lock or lock mechanism.*
3. *The door locking system shall be installed to have the capability of being unlocked by a switch located at the fire command center, a nursing station or other approved location. The switch shall directly break power to the lock.*

4. *A building occupant shall not be required to pass through more than one door equipped with a controlled egress locking system before entering an exit.*
5. *All clinical staff shall have the keys, codes or other means necessary to operate the locking systems.*
6. *Emergency lighting shall be provided at the door.*
7. *The door locking system units shall be listed in accordance with UL 294.*

Exception: *Items 1 through 4 shall not apply to doors to areas occupied by persons who, because of clinical needs, require restraint or containment as part of the function of a psychiatric or mental health treatment area.*

[BE] 1010.2.15 Reserved.

[BE] 1010.3 Special doors. Special doors and security grilles shall comply with the requirements of Sections 1010.3.1 through 1010.3.4.

[BE] 1010.3.1 Revolving doors. Revolving doors shall comply with the following:

1. Revolving doors shall comply with BHMA A156.27 and shall be installed in accordance with the manufacturer's instructions.
2. Each revolving door shall be capable of breakout in accordance with BHMA A156.27 and shall provide an aggregate width of not less than 36 inches (914 mm).
3. A revolving door shall not be located within 10 feet (3048 mm) of the foot or top of stairways or escalators. A dispersal area shall be provided between the stairways or escalators and the revolving doors.
4. The revolutions per minute (rpm) for a revolving door shall not exceed the maximum rpm as specified in BHMA A156.27. Manual revolving doors shall comply with Table 1010.3.1(1). Automatic or power-operated revolving doors shall comply with Table 1010.3.1(2).
5. An emergency stop switch shall be provided near each entry point of power or automatic operated revolving doors within 48 inches (1219 mm) of the door and between 34 inches (864 mm) and 48 inches (1219 mm) above the floor. The activation area of the emergency stop switch button shall be not less than 1 inch (25 mm) in diameter and shall be red.
6. Each revolving door shall have a side-hinged swinging door that complies with Section 1010.1 in the same wall and within 10 feet (3048 mm) of the revolving door.
7. Revolving doors shall not be part of an accessible route required by Section 1009 of this code and Chapter 11 of the *California Building Code*.

**[BE] TABLE 1010.3.1(1)
MAXIMUM DOOR SPEED MANUAL REVOLVING DOORS**

REVOLVING DOOR MAXIMUM NOMINAL DIAMETER (FT-IN)	MAXIMUM ALLOWABLE REVOLVING DOOR SPEED (RPM)
6-0	12
7-0	11
8-0	10
9-0	9
10-0	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BE] TABLE 1010.3.1(2)
MAXIMUM DOOR SPEED AUTOMATIC OR POWER-OPERATED REVOLVING DOORS**

REVOLVING DOOR MAXIMUM NOMINAL DIAMETER (FT-IN)	MAXIMUM ALLOWABLE REVOLVING DOOR SPEED (RPM)
8-0	7.2
9-0	6.4
10-0	5.7
11-0	5.2
12-0	4.8
12-6	4.6
14-0	4.1
16-0	3.6
17-0	3.4
18-0	3.2
20-0	2.9
24-0	2.4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BE] 1010.3.1.1 Egress component. A revolving door used as a component of a means of egress shall comply with Section 1010.3.1 and the following three conditions:

1. Revolving doors shall not be given credit for more than 50 percent of the minimum width or required capacity.
2. Each revolving door shall be credited with a capacity based on not more than a 50-person occupant load.
3. Each revolving door shall provide for egress in accordance with BHMA A156.27 with a breakout force of not more than 130 pounds (578 N).

[BE] 1010.3.1.2 Other than egress component. A revolving door used as other than a component of a means of egress shall comply with Section 1010.3.1. The breakout force of a revolving door not used as a component of a means of egress shall not be more than 180 pounds (801 N).

Exception: A breakout force in excess of 180 pounds (801 N) is permitted if the breakout force is reduced to not more than 130 pounds (578 N) when

not less than one of the following conditions is satisfied:

1. There is a power failure or power is removed to the device holding the door wings in position.
2. There is an actuation of the automatic sprinkler system where such system is provided.
3. There is an actuation of a smoke detection system that is installed in accordance with Section 907 to provide coverage in areas within the building that are within 75 feet (22 860 mm) of the revolving doors.
4. There is an actuation of a manual control switch, in an approved location and clearly identified, that reduces the breakout force to not more than 130 pounds (578 N).

[BE] 1010.3.2 Power-operated doors. Where means of egress doors are operated or assisted by power, the design shall be such that in the event of power failure, the door is capable of being opened manually to permit means of egress travel or closed where necessary to safeguard means of egress. The forces required to open these doors manually shall not exceed those specified in Section 1010.1.3, except that the force to set the door in motion shall not exceed 50 pounds (220 N). The door shall be capable of opening from any position to the full width of the opening in which such door is installed when a force is applied to the door on the side from which egress is made. Power-operated swinging doors, power-operated sliding doors and power-operated folding doors shall comply with BHMA A156.10. Power-assisted swinging doors and low energy power-operated swinging doors shall comply with BHMA A156.19. Low-energy power-operated sliding doors and low-energy power-operated folding doors shall comply with BHMA A156.38.

Exceptions:

1. Occupancies in Group I-3.
2. Special-purpose horizontal sliding, accordion or folding doors complying with Section 1010.3.3.
3. For a biparting door in the emergency breakout mode, a door leaf located within a multiple-leaf opening shall be exempt from the minimum 32-inch (813 mm) single-leaf requirement of Section 1010.1.1, provided that a minimum 32-inch (813 mm) clear opening is provided when the two biparting leaves meeting in the center are broken out.

[BE] 1010.3.3 Special-purpose horizontal sliding, accordion or folding doors. In other than Group H occupancies, special-purpose horizontal sliding, accordion, or folding door assemblies permitted to be a component of a means of egress in accordance with Exception 6 to Section 1010.1.2 shall comply with all of the following criteria:

1. The doors shall be power operated and shall be capable of being operated manually in the event of power failure.

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2. The doors shall be openable by a simple method without special knowledge or effort from the egress side or sides.
3. The force required to operate the door shall not exceed 30 pounds (133 N) to set the door in motion and 15 pounds (67 N) to close the door or open it to the minimum required width.
4. The door shall be openable with a force not to exceed 15 pounds (67 N) when a force of 250 pounds (1100 N) is applied perpendicular to the door adjacent to the operating device.
5. The door assembly shall comply with the applicable fire protection rating and, where rated, shall be self-closing or automatic closing by smoke detection in accordance with Section 716.2.6.6 of the *California Building Code*, shall be installed in accordance with NFPA 80 and shall comply with Section 716 of the *California Building Code*.
6. The door assembly shall have an integrated standby power supply.
7. The door assembly power supply shall be electrically supervised.
8. The door shall open to the minimum required width within 10 seconds after activation of the operating device.

[BE] 1010.3.4 Security grilles. In Groups B, F, M and S, horizontal sliding or vertical security grilles are permitted at the main exit and shall be openable from the inside without the use of a key or special knowledge or effort during periods that the space is occupied. The grilles shall remain secured in the full-open position during the period of occupancy by the general public. Where two or more exits or access to exits are required, not more than one-half of the exits or exit access doorways shall be equipped with horizontal sliding or vertical security grilles.

[BE] 1010.4 Gates. Gates serving the means of egress system shall comply with the requirements of this section. Gates used as a component in a means of egress shall conform to the applicable requirements for doors.

Exception: Horizontal sliding or swinging gates exceeding the 4-foot (1219 mm) maximum leaf width limitation are permitted in fences and walls surrounding a stadium.

[BE] 1010.4.1 Stadiums. Panic hardware is not required on gates surrounding stadiums where such gates are under constant immediate supervision while the public is present, and where safe dispersal areas based on 3 square feet (0.28 m²) per occupant are located between the fence and enclosed space. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from the enclosed space. See Section 1028.5 for means of egress from safe dispersal areas.

[BE] 1010.5 Turnstiles and similar devices. Turnstiles or similar devices that restrict travel to one direction shall not be placed so as to obstruct any required means of egress, except where permitted in accordance with Sections 1010.5.1, 1010.5.2 and 1010.5.3.

[BE] 1010.5.1 Capacity. Each turnstile or similar device shall be credited with a capacity based on not more than a 50-person occupant load where all of the following provisions are met:

1. Each device shall turn free in the direction of egress travel when primary power is lost and on the manual release by an employee in the area.
2. Such devices are not given credit for more than 50 percent of the required egress capacity or width.
3. Each device is not more than 39 inches (991 mm) high.
4. Each device has not less than 16½ inches (419 mm) clear width at and below a height of 39 inches (991 mm) and not less than 22 inches (559 mm) clear width at heights above 39 inches (991 mm).

[BE] 1010.5.1.1 Clear width. Where located as part of an accessible route, turnstiles shall have not less than 36 inches (914 mm) clear width at and below a height of 34 inches (864 mm), not less than 32 inches (813 mm) clear width between 34 inches (864 mm) and 80 inches (2032 mm) and shall consist of a mechanism other than a revolving device.

[BE] 1010.5.2 Security access turnstiles. Security access turnstiles that inhibit travel in the direction of egress utilizing a physical barrier shall be permitted to be considered as a component of the means of egress, provided that all of the following criteria are met:

1. The building is protected throughout by an approved, supervised automatic sprinkler system in accordance with Section 903.3.1.1.
2. Each security access turnstile lane configuration has a minimum clear passage width of 22 inches (559 mm).
3. Any security access turnstile lane configuration providing a clear passage width of less than 32 inches (810 mm) shall be credited with a maximum egress capacity of 50 persons.
4. Any security access turnstile lane configuration providing a clear passage width of 32 inches (810 mm) or more shall be credited with a maximum egress capacity as calculated in accordance with Section 1005.
5. Each secured physical barrier shall automatically retract or swing to an unobstructed open position in the direction of egress, under each of the following conditions:
 - 5.1. Upon loss of power to the turnstile or any part of the access control system that secures the physical barrier.
 - 5.2. Upon actuation of a clearly identified manual release device with ready access that results in direct interruption of power to each secured physical barrier, after which such barriers remain in the open position for not less than 30 seconds. The manual

release device shall be positioned at one of the following locations:

- 5.2.1. On the egress side of each security access turnstile lane.
- 5.2.2. At an approved location where it can be actuated by an employee assigned to the area at all times that the building is occupied.
- 5.3. Upon actuation of the building fire alarm system, if provided, after which the physical barrier remains in the open position until the fire alarm system is manually reset.

Exception: Actuation of a manual fire alarm box.

- 5.4. Upon actuation of the building automatic sprinkler system or fire detection system, after which the physical barrier remains in the open position until the fire alarm system is manually reset.

[BE] 1010.5.3 High turnstile. Turnstiles more than 39 inches (991 mm) high shall meet the requirements for revolving doors or the requirements of Section 1010.5.2 for security access turnstiles.

[BE] 1010.5.4 Additional door. Where serving an occupant load greater than 300, each turnstile that is not portable shall have a side-hinged swinging door that conforms to Section 1010.1 within 50 feet (15 240 mm).

Exception: A side-hinged swinging door is not required at security access turnstiles that comply with Section 1010.5.2.

SECTION 1011 STAIRWAYS

[BE] 1011.1 General. Stairways serving occupied portions of a building shall comply with the requirements of Sections 1011.2 through 1011.13. Alternating tread devices shall comply with Section 1011.14. Ship's ladders shall comply with Section 1011.15. Ladders shall comply with Section 1011.16.

Exception: Within rooms or spaces used for assembly purposes, stepped aisles shall comply with Section 1030.

[BE] 1011.2 Width and capacity. The required capacity of stairways shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm). See Section 1009.3 for accessible means of egress stairways.

Exceptions:

1. Stairways serving an occupant load of less than 50 shall have a width of not less than 36 inches (914 mm).
2. Spiral stairways as provided for in Section 1011.10.
3. Where an incline platform lift or stairway chairlift is installed on stairways serving occupancies in Group R-3, or within dwelling units in occupancies in Group R-2, a clear passage width not less than 20

inches (508 mm) shall be provided. Where the seat and platform can be folded when not in use, the distance shall be measured from the folded position.

Means of egress stairs in a Group I-2 or I-2.1 occupancy used for the movement of beds and stretcher patients shall provide a clear width not less than 44 inches (1118 mm).

[BE] 1011.3 Headroom. Stairways shall have a headroom clearance of not less than 80 inches (2032 mm) measured vertically from a line connecting the edge of the nosings. Such headroom shall be continuous above the stairway to the point where the line intersects the landing below, one tread depth beyond the bottom riser. The minimum clearance shall be maintained the full width of the stairway and landing.

Exceptions:

1. Spiral stairways complying with Section 1011.10 are permitted a 78-inch (1981 mm) headroom clearance.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; where the nosings of treads at the side of a flight extend under the edge of a floor opening through which the stair passes, the floor opening shall be allowed to project horizontally into the required headroom not more than 4³/₄ inches (121 mm).

[BE] 1011.4 Walkline. The walkline across winder treads shall be concentric to the direction of travel through the turn and located 12 inches (305 mm) from the side where the winders are narrower. The 12-inch (305 mm) dimension shall be measured from the widest point of the clear stair width at the walking surface of the winder. Where winders are adjacent within the flight, the point of the widest clear stair width of the adjacent winders shall be used.

[BE] 1011.5 Stair treads and risers. Stair treads and risers shall comply with Sections 1011.5.1 through 1011.5.5.3.

[BE] 1011.5.1 Dimension reference surfaces. For the purpose of this section, all dimensions are exclusive of carpets, rugs or runners.

[BE] 1011.5.2 Riser height and tread depth. Stair riser heights shall be 7 inches (178 mm) maximum and 4 inches (102 mm) minimum. The riser height shall be measured vertically between the nosings of adjacent treads or between the stairway landing and the adjacent tread. Rectangular tread depths shall be 11 inches (279 mm) minimum measured horizontally between the vertical planes of the foremost projection of adjacent treads and at a right angle to the tread's nosing. Winder treads shall have a minimum tread depth of 11 inches (279 mm) between the vertical planes of the foremost projection of adjacent treads at the intersections with the walkline and a minimum tread depth of 10 inches (254 mm) within the clear width of the stair.

Exceptions:

1. Spiral stairways in accordance with Section 1011.10.

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2. Stairways connecting stepped aisles to cross aisles or concourses shall be permitted to use the riser/tread dimension in Section 1030.14.2.
3. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; the maximum riser height shall be $7\frac{3}{4}$ inches (197 mm); the minimum tread depth shall be 10 inches (254 mm); the minimum winder tread depth at the walkline shall be 10 inches (254 mm); and the minimum winder tread depth shall be 6 inches (152 mm). A nosing projection not less than $\frac{3}{4}$ inch (19.1 mm) but not more than $1\frac{1}{4}$ inches (32 mm) shall be provided on stairways with solid risers where the tread depth is less than 11 inches (279 mm).
4. See *Chapter 11 and California Existing Building Code* for the replacement of existing stairways. **[DSA-AC]** For applications listed in Section 1.9.1 of the California Building Code regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, Section 11B-202.
5. In Group I-3 facilities, stairways providing access to guard towers, observation stations and control rooms, not more than 250 square feet (23 m²) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).
6. **[SFM]** Stairways providing access to lifeguard towers not open to the public, not more than 250 square feet (23 m²) in area, shall be permitted to have a maximum riser height of 8 inches (203 mm) and a minimum tread depth of 9 inches (229 mm).

[BE] 1011.5.3 Winder treads. Winder treads are not permitted in means of egress stairways except within a dwelling unit.

Exceptions:

1. Curved stairways in accordance with Section 1011.9.
2. Spiral stairways in accordance with Section 1011.10.

[BE] 1011.5.4 Dimensional uniformity. Stair treads and risers shall be of uniform size and shape. The tolerance between the largest and smallest riser height or between the largest and smallest tread depth shall not exceed $\frac{3}{8}$ inch (9.5 mm) in any flight of stairs. The greatest winder tread depth at the walkline within any flight of stairs shall not exceed the smallest by more than $\frac{3}{8}$ inch (9.5 mm).

Exceptions:

1. Stairways connecting stepped aisles to cross aisles or concourses shall be permitted to comply with the dimensional nonuniformity in Section 1030.14.2.

2. Consistently shaped winders, complying with Section 1011.5, differing from rectangular treads in the same flight of stairs.
3. Nonuniform riser dimension complying with Section 1011.5.4.1.

[BE] 1011.5.4.1 Nonuniform height risers. Where the bottom or top riser adjoins a sloping public way, walkway or driveway having an established grade and serving as a landing, the bottom or top riser is permitted to be reduced along the slope to less than 4 inches (102 mm) in height, with the variation in height of the bottom or top riser not to exceed 1 unit vertical in 12 units horizontal (8-percent slope) of stair width. The nosings or leading edges of treads at such nonuniform height risers shall have a distinctive marking stripe, different from any other nosing marking provided on the stair flight. The distinctive marking stripe shall be visible in descent of the stair and shall have a slip-resistant surface. Marking stripes shall have a width of not less than 1 inch (25 mm) but not more than 2 inches (51 mm).

[BE] 1011.5.5 Nosing and riser profile. Nosings shall have a curvature or bevel of not less than $\frac{1}{16}$ inch (1.6 mm) but not more than $\frac{9}{16}$ inch (14.3 mm) from the foremost projection of the tread. Risers shall be solid and vertical or sloped under the tread above from the underside of the nosing above at an angle not more than 30 degrees (0.52 rad) from the vertical.

[BE] 1011.5.5.1 Nosing projection size. The leading edge (nosings) of treads shall project not more than $1\frac{1}{4}$ inches (32 mm) beyond the tread below.

[BE] 1011.5.5.2 Nosing projection uniformity. Nosing projections of the leading edges shall be of uniform size, including the projections of the nosing's leading edge of the floor at the top of a flight.

[BE] 1011.5.5.3 Solid risers. Risers shall be solid.

Exceptions:

1. Solid risers are not required for stairways that are not required to comply with Section 1009.3, provided that the opening between treads does not permit the passage of a sphere with a diameter of 4 inches (102 mm).
2. Solid risers are not required for occupancies in Group I-3 or in Group F, H and S occupancies other than areas accessible to the public. The size of the opening in the riser is not restricted.
3. Solid risers are not required for spiral stairways constructed in accordance with Section 1011.10.

[BE] 1011.6 Stairway landings. There shall be a floor or landing at the top and bottom of each stairway. The width of landings, measured perpendicularly to the direction of travel, shall be not less than the width of stairways served. Every landing shall have a minimum depth, measured parallel to the direction of travel, equal to the width of the stairway or 48 inches (1219 mm), whichever is less. Doors opening onto a landing shall not reduce the landing to less than one-half the required width. When fully open, the door

shall not project more than 7 inches (178 mm) into the required width of a landing. Where wheelchair spaces are required on the stairway landing in accordance with Section 1009.6.3, the wheelchair space shall not be located in the required width of the landing and doors shall not swing over the wheelchair spaces.

Exceptions:

1. Where stairways connect stepped aisles to cross aisles or concourses, stairway landings are not required at the transition between stairways and stepped aisles constructed in accordance with Section 1030.
2. Where curved stairways of constant radius have intermediate landings, the landing depth shall be measured horizontally between the intersection of the walkline of the lower flight at the landing nosing and the intersection of the walkline of the upper flight at the nosing of the lowest tread of the upper flight.
3. Where a landing turns 90 degrees (1.57 rad) or more, the minimum landing depth in accordance with this section shall not be required where the landing provided is not less than that described by an arc with a radius equal to the width of the flight served.
4. *In Group R-3 occupancies, a floor or landing is not required at the top of an interior flight of stairs, including stairs in an enclosed garage, provided a door does not swing over the stairs.*

[BE] 1011.7 Stairway construction. Stairways shall be built of materials consistent with the types permitted for the type of construction of the building.

Exceptions:

1. Wood handrails shall be permitted in all types of construction.
2. Interior exit stairway in accordance with Section 510.2 of the *California Building Code*.

[BE] 1011.7.1 Stairway walking surface. The walking surface of treads and landings of a stairway shall not be sloped steeper than 1 unit vertical in 48 units horizontal (2-percent slope) in any direction. Stairway treads and landings shall have a solid surface. Finish floor surfaces shall be securely attached.

Exceptions:

1. Openings in stair walking surfaces shall be a size that does not permit the passage of $\frac{1}{2}$ -inch-diameter (12.7 mm) sphere. Elongated openings shall be placed so that the long dimension is perpendicular to the direction of travel.
2. In Group F, H and S occupancies, other than areas of parking structures accessible to the public, openings in treads and landings shall not be prohibited provided that a sphere with a diameter of $1\frac{1}{8}$ inches (29 mm) cannot pass through the opening.

[BE] 1011.7.2 Outdoor conditions. Outdoor stairways and outdoor approaches to stairways shall be designed so that water will not accumulate on walking surfaces.

[BE] 1011.7.3 Enclosures under interior stairways. The walls and soffits within enclosed usable spaces under enclosed and unenclosed stairways shall be protected by 1-hour fire-resistance-rated construction or the fire-resistance rating of the stairway enclosure, whichever is greater. Access to the enclosed space shall not be directly from within the stairway enclosure.

Exception: Spaces under stairways serving and contained within a single residential dwelling unit in Group R-2 or R-3 shall be permitted to be protected on the enclosed side with $\frac{1}{2}$ -inch (12.7 mm) gypsum board.

[BE] 1011.7.4 Enclosures under exterior stairways. There shall not be enclosed usable space under exterior exit stairways unless the space is completely enclosed in 1-hour fire-resistance-rated construction. The open space under exterior stairways shall not be used for any purpose.

[BE] 1011.8 Vertical rise. A flight of stairs shall not have a vertical rise greater than 12 feet (3658 mm) between floor levels or landings.

Exception: Spiral stairways used as a means of egress from technical production areas.

[BE] 1011.9 Curved stairways. Curved stairways with winder treads shall have treads and risers in accordance with Section 1011.5 and the smallest radius shall be not less than twice the minimum width or required capacity of the stairway.

Exception: The radius restriction shall not apply to curved stairways in Group R-3 and within individual dwelling units in Group R-2.

[BE] 1011.10 Spiral stairways. Spiral stairways are permitted to be used as a component in the means of egress only within dwelling units or from a space not more than 250 square feet (23 m²) in area and serving not more than five occupants, or from technical production areas in accordance with Section 410.5 of the *California Building Code*.

A spiral stairway shall have a $\frac{3}{4}$ -inch (171 mm) minimum clear tread depth at a point 12 inches (305 mm) from the narrow edge. The risers shall be sufficient to provide a headroom of 78 inches (1981 mm) minimum, but riser height shall not be more than $9\frac{1}{2}$ inches (241 mm). The minimum stairway clear width at and below the handrail shall be 26 inches (660 mm).

[BE] 1011.11 Handrails. Flights of stairways shall have handrails on each side and shall comply with Section 1014. Where glass is used to provide the handrail, the handrail shall comply with Section 2407 of the *California Building Code*.

[DSA-AC] *For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, see Chapter 11B, of the California Building Code.*

Exceptions:

1. Flights of stairways within dwelling units, and flights of spiral stairways are permitted to have a handrail on one side only.

2. Decks, patios and walkways that have a single change in elevation where the landing depth on each side of the change of elevation is greater than what is required for a landing do not require handrails.
3. *[SFM]* In Group R-3 occupancies, a continuous run of treads or flight of stairs with less than four risers does not require handrails.
4. Changes in room elevations of three or fewer risers within dwelling units and sleeping units in Group R-2 and R-3 do not require handrails.
5. Where a platform lift is in a stationary position and the floor of the platform lift serves as the upper landing of a stairway, handrails shall not be required on the stairway, provided that all of the following criteria are met:
 - 5.1. The stairway contains not more than two risers.
 - 5.2. A handhold, positioned horizontally or vertically, is located on one side of the stairway adjacent to the top landing.
 - 5.3. The handhold is located not less than 34 inches (864 mm) and not more than 42 inches (1067 mm) above the bottom landing of the stairway.
 - 5.4. The handhold gripping surface complies with Section 1014.3 and is not less than 4.5 inches (114 mm) in length.

[BE] 1011.12 Stairway to roof. In buildings four or more stories above grade plane, one stairway shall extend to the roof surface, unless the roof has a slope steeper than 4 units vertical in 12 units horizontal (33-percent slope).

Exception: Other than where required by Section 1011.12.1, in buildings without an occupied roof, access to the roof from the top story shall be permitted to be by an alternating tread device, a ship's ladder or a permanent ladder.

[BE] 1011.12.1 Stairway to elevator equipment. Roofs and penthouses containing elevator equipment that must be accessed for maintenance are required to be accessed by a stairway.

[BE] 1011.12.2 Roof access. Where a stairway is provided to a roof, access to the roof shall be provided through a penthouse complying with Section 1511.2 of the *California Building Code*.

Exception: In buildings without an occupied roof, access to the roof shall be permitted to be a roof hatch or trap door not less than 16 square feet (1.5 m²) in area and having a minimum dimension of 2 feet (610 mm).

[BE] 1011.13 Guards. Guards shall be provided along stairways and landings where required by Section 1015 and shall be constructed in accordance with Section 1015. Where the roof hatch opening providing the required access is located within 10 feet (3049 mm) of the roof edge, such roof access or roof edge shall be protected by guards installed in accordance with Section 1015.

[BE] 1011.14 Alternating tread devices. Alternating tread devices are limited to an element of a means of egress in buildings of Groups F, H and S from a mezzanine not more than 250 square feet (23 m²) in area and that serves not more than five occupants; in buildings of Group I-3 from a guard tower, observation station or control room not more than 250 square feet (23 m²) in area and for access to unoccupied roofs. Alternating tread devices used as a means of egress shall not have a rise greater than 20 feet (6096 mm) between floor levels or landings.

[BE] 1011.14.1 Handrails of alternating tread devices. Handrails shall be provided on both sides of alternating tread devices and shall comply with Section 1014.

[BE] 1011.14.2 Treads of alternating tread devices. Alternating tread devices shall have a minimum tread depth of 5 inches (127 mm), a minimum projected tread depth of 8½ inches (216 mm), a minimum tread width of 7 inches (178 mm) and a maximum riser height of 9½ inches (241 mm). The tread depth shall be measured horizontally between the vertical planes of the foremost projections of adjacent treads. The riser height shall be measured vertically between the leading edges of adjacent treads. The riser height and tread depth provided shall result in an angle of ascent from the horizontal of between 50 and 70 degrees (0.87 and 1.22 rad). The initial tread of the device shall begin at the same elevation as the platform, landing or floor surface.

Exception: Alternating tread devices used as an element of a means of egress in buildings from a mezzanine area not more than 250 square feet (23 m²) in area that serves not more than five occupants shall have a minimum tread depth of 3 inches (76 mm) with a minimum projected tread depth of 10½ inches (267 mm). The rise to the next alternating tread surface shall not exceed 8 inches (203 mm).

[BE] 1011.15 Ship's ladders. Ship's ladders are permitted to be used in *lifeguard towers not open to the public* and Group I-3 as a component of a means of egress to and from control rooms or elevated facility observation stations not more than 250 square feet (23 m²) with not more than three occupants and for access to unoccupied roofs. The minimum clear width at and below the handrails shall be 20 inches (508 mm). Ship's ladders shall be designed for the live loads indicated in Section 1607.17 of the *California Building Code*.

[BE] 1011.15.1 Handrails of ship's ladders. Handrails shall be provided on both sides of ship's ladders.

[BE] 1011.15.2 Treads of ship's ladders. Ship's ladders shall have a minimum tread depth of 5 inches (127 mm). The tread shall be projected such that the total of the tread depth plus the nosing projection is not less than 8½ inches (216 mm). The maximum riser height shall be 9½ inches (241 mm).

[BE] 1011.16 Ladders. Permanent ladders shall not serve as a part of the means of egress from occupied spaces within a building. Permanent ladders shall be constructed in accordance with Section 304.3 of the *California Mechanical Code* and designed for the live loads indicated in Section 1607.17

of the *California Building Code*. Permanent ladders shall be permitted to provide access to the following areas:

1. Spaces frequented only by personnel for maintenance, repair or monitoring of equipment.
2. Nonoccupiable spaces accessed only by catwalks, crawl spaces, freight elevators or very narrow passageways.
3. Raised areas used primarily for purposes of security, life safety or fire safety including, but not limited to, observation galleries, prison guard towers, fire towers or lifeguard stands.
4. Elevated levels in Group U not open to the general public.
5. Nonoccupied roofs that are not required to have stairway access in accordance with Section 1011.12.1.
6. Where permitted to access equipment and appliances in accordance with Section 306.5 of the *California Mechanical Code*.

SECTION 1012 RAMPS

[BE] 1012.1 Scope. The provisions of this section shall apply to ramps used as a component of a means of egress.

Exceptions:

1. Ramped aisles within assembly rooms or spaces shall comply with the provisions in Section 1030.
2. Curb ramps shall comply with ICC A117.1.
3. Vehicle ramps in parking garages for pedestrian exit access shall not be required to comply with Sections 1012.3 through 1012.10 where they are not an accessible route serving accessible parking spaces, other required accessible elements or part of an accessible means of egress.

[BE] 1012.2 Slope. Ramps used as part of a means of egress shall have a running slope not steeper than 1 unit vertical in 12 units horizontal (8-percent slope). The slope of other pedestrian ramps shall not be steeper than 1 unit vertical in 8 units horizontal (12.5-percent slope).

[BE] 1012.3 Cross slope. The slope measured perpendicular to the direction of travel of a ramp shall not be steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

[BE] 1012.4 Vertical rise. The rise for any ramp run shall be 30 inches (762 mm) maximum.

[BE] 1012.5 Minimum dimensions. The minimum dimensions of means of egress ramps shall comply with Sections 1012.5.1 through 1012.5.3.

[BE] 1012.5.1 Width and capacity. The minimum width and required capacity of a means of egress ramp shall be not less than that required for corridors by Section 1020.3. The clear width of a ramp between handrails, if provided, or other permissible projections shall be 36 inches (914 mm) minimum.

[BE] 1012.5.2 Headroom. The minimum headroom in all parts of the means of egress ramp shall be not less than 80

inches (2032 mm) above the finished floor of the ramp run and any intermediate landings. The minimum clearance shall be maintained for the full width of the ramp and landing.

[BE] 1012.5.3 Restrictions. Means of egress ramps shall not reduce in width in the direction of egress travel. Projections into the required ramp and landing width are prohibited. Doors opening onto a landing shall not reduce the clear width to less than 42 inches (1067 mm).

[BE] 1012.6 Landings. Ramps shall have landings at the bottom and top of each ramp, points of turning, entrance, exits and at doors. Landings shall comply with Sections 1012.6.1 through 1012.6.5.

[BE] 1012.6.1 Slope. Landings shall have a slope not steeper than 1 unit vertical in 48 units horizontal (2-percent slope) in any direction. Changes in level are not permitted.

[BE] 1012.6.2 Width. The landing width shall be not less than the width of the widest ramp run adjoining the landing.

[BE] 1012.6.3 Length. The landing length shall be 60 inches (1525 mm) minimum.

Exceptions:

1. In Group R-2 and R-3 individual dwelling and sleeping units that are not required to be Accessible units, Type A units or Type B units *in accordance with Chapter 11A or 11B of the California Building Code*, landings are permitted to be 36 inches (914 mm) minimum.
2. Where the ramp is not a part of an accessible route, the length of the landing shall not be required to be more than 48 inches (1219 mm) in the direction of travel.

[BE] 1012.6.4 Change in direction. Where changes in direction of travel occur at landings provided between ramp runs, the landing shall be 60 inches by 60 inches (1524 mm by 1524 mm) minimum.

Exception: In Group R-2 and R-3 individual dwelling or sleeping units that are not required to be Accessible units, Type A units or Type B units in accordance with Section 1108 of the *California Building Code*, landings are permitted to be 36 inches by 36 inches (914 mm by 914 mm) minimum.

[BE] 1012.6.5 Doorways. Where doorways are located adjacent to a *ramp* landing, maneuvering clearances required by ICC A117.1 are permitted to overlap the required landing area.

[BE] 1012.7 Ramp construction. Ramps shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction.

[BE] 1012.7.1 Ramp surface. The surface of ramps shall be of slip-resistant materials that are securely attached.

[BE] 1012.7.2 Outdoor conditions. Outdoor ramps and outdoor approaches to ramps shall be designed so that water will not accumulate on walking surfaces.

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[BE] **1012.8 Handrails.** Ramps with a rise greater than 6 inches (152 mm) shall have handrails on both sides. Handrails shall comply with Section 1014.

[BE] **1012.9 Guards.** Guards shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015.

[BE] **1012.10 Edge protection.** Edge protection complying with Section 1012.10.1 or 1012.10.2 shall be provided on each side of ramp runs and at each side of ramp landings.

Exceptions:

1. Edge protection is not required on ramps that are not required to have handrails, provided that they have flared sides that comply with the ICC A117.1 curb ramp provisions.
2. Edge protection is not required on the sides of ramp landings serving an adjoining ramp run or stairway.
3. Edge protection is not required on the sides of ramp landings having a vertical dropoff of not more than $\frac{1}{2}$ inch (12.7 mm) within 10 inches (254 mm) horizontally of the required landing area.

[BE] **1012.10.1 Curb, rail, wall or barrier.** A curb, rail, wall or barrier shall be provided to serve as edge protection. A curb shall be not less than 4 inches (102 mm) in height. Barriers shall be constructed so that the barrier prevents the passage of a 4-inch-diameter (102 mm) sphere, where any portion of the sphere is within 4 inches (102 mm) of the floor or ground surface.

[BE] **1012.10.2 Extended floor or ground surface.** The floor or ground surface of the ramp run or landing shall extend 12 inches (305 mm) minimum beyond the inside face of a handrail complying with Section 1014.

SECTION 1013 EXIT SIGNS

[BE] **1013.1 Where required.** Exits and exit access doors shall be marked by an approved exit sign readily visible from any direction of egress travel. The path of egress travel to exits and within exits shall be marked by readily visible exit signs to clearly indicate the direction of egress travel in cases where the exit or the path of egress travel is not immediately visible to the occupants. Intervening means of egress doors within exits shall be marked by exit signs. Exit sign placement shall be such that any point in an exit access corridor or exit passageway is within 100 feet (30 480 mm) or the listed viewing distance of the sign, whichever is less, from the nearest visible exit sign.

Exceptions:

1. Exit signs are not required in rooms or areas that require only one exit or exit access.
2. Main exterior exit doors or gates that are obviously and clearly identifiable as exits need not have exit signs where approved by the fire code official.
3. Exit signs are not required in occupancies in Group U and individual sleeping units or dwelling units in Group R-1, R-2 or R-3 or R-3.1.

4. Exit signs are not required *where inmates are housed or held* in dayrooms, sleeping rooms or dormitories in occupancies in Group I-3.

5. In occupancies in Groups A-4 and A-5, exit signs are not required on the seating side of vomitories or openings into seating areas where exit signs are provided in the concourse that are readily apparent from the vomitories. Egress lighting is provided to identify each vomitory or opening within the seating area in an emergency.

[BE] **1013.2 Low-level exit signs in Group R-1.** See Section 1013.7.

The bottom of the sign shall be not less than 10 inches (254 mm) nor more than 18 inches (455 mm) above the floor level. The sign shall be flush mounted to the door or wall. Where mounted on the wall, the edge of the sign shall be within 4 inches (102 mm) of the door frame on the latch side.

[BE] **1013.3 Illumination.** Exit signs shall be internally or externally illuminated.

Exception: Tactile signs required by Section 1013.4 need not be provided with illumination.

[BE] **1013.4 Raised character and braille exit signs.** *Tactile exit signs shall be required at the following locations:*

1. *Each grade-level exterior exit door that is required to comply with Section 1013.1 shall be identified by a tactile exit sign with the word, "EXIT."*
2. *Each exit door that is required to comply with Section 1013.1, and that leads directly to a grade-level exterior exit by means of a stairway or ramp, shall be identified by a tactile exit sign with the following words, as appropriate:*
 - 2.1. "EXIT STAIR DOWN"
 - 2.2. "EXIT RAMP DOWN"
 - 2.3. "EXIT STAIR UP"
 - 2.4. "EXIT RAMP UP"
3. *Each exit door that is required to comply with Section 1013.1, and that leads directly to a grade-level exterior exit by means of an exit enclosure or an exit passageway shall be identified by a tactile exit sign with the words, "EXIT ROUTE."*
4. *Each exit access door from an interior room or area to a corridor or hallway that is required to comply with Section 1013.1 shall be identified by a tactile exit sign with the words "EXIT ROUTE."*
5. *Each exit door through a horizontal exit that is required to comply with Section 1013.1 shall be identified by a sign with the words, "TO EXIT."*

Raised character and Braille exit signs shall comply with Chapter 11B of the California Building Code.

[BE] **1013.5 Internally illuminated exit signs.** Electrically powered, self-luminous and photoluminescent exit signs shall be listed and labeled in accordance with UL 924 and shall be installed in accordance with the manufacturer's instructions and Section 1203. Exit signs shall be illuminated at all times.

[BE] 1013.6 Externally illuminated exit signs. Externally illuminated exit signs shall comply with Sections 1013.6.1 through 1013.6.3.

[BE] 1013.6.1 Graphics. Every exit sign and directional exit sign shall have plainly legible letters not less than 6 inches (152 mm) high with the principal strokes of the letters not less than $\frac{3}{4}$ inch (19.1 mm) wide. The word “EXIT” shall have letters having a width not less than 2 inches (51 mm) wide, except the letter “I,” and the minimum spacing between letters shall be not less than $\frac{3}{8}$ inch (9.5 mm). Signs larger than the minimum established in this section shall have letter widths, strokes and spacing in proportion to their height.

The word “EXIT” shall be in high contrast with the background and shall be clearly discernible when the means of exit sign illumination is or is not energized. If a chevron directional indicator is provided as part of the exit sign, the construction shall be such that the direction of the chevron directional indicator cannot be readily changed.

[BE] 1013.6.2 Exit sign illumination. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux).

[BE] 1013.6.3 Power source. Exit signs shall be illuminated at all times. To ensure continued illumination for a duration of not less than 90 minutes in case of primary power loss, the sign illumination means shall be connected to an emergency power system provided from storage batteries, unit equipment or an on-site generator. The installation of the emergency power system shall be in accordance with Section 603. Group I-2 exit sign illumination shall not be provided by unit equipment batteries only.

Exception: Approved exit sign illumination types that provide continuous illumination independent of external power sources for a duration of not less than 90 minutes, in case of primary power loss, are not required to be connected to an emergency electrical system.

1013.7 Floor-level exit signs. *Where exit signs are required by Chapter 10, additional approved low-level exit signs which are internally or externally illuminated photoluminescent or self-luminous shall be provided in all interior corridors of Group A, E, I and R-2.1 occupancies and in all areas serving guest rooms of hotels in Group R, Division 1 occupancies.*

Exceptions:

1. *Group A occupancies that are protected throughout by an approved supervised fire sprinkler system.*
2. *Group E occupancies where direct exits have been provided from each classroom.*
3. *Group I and R-2.1 occupancies which are provided with smoke barriers constructed in accordance with Section 407.5 of the California Building Code.*
4. *Group I-3 occupancies.*

The bottom of the sign shall not be less than 6 inches (152 mm) or more than 8 inches (203 mm) above the floor level and shall indicate the path of exit travel. For

exit and exit-access doors, the sign shall be on the door or adjacent to the door with the closest edge of the sign or marker within 4 inches (102 mm) of the door frame.

Note: Pursuant to Health and Safety Code Section 13143, this California amendment applies to all newly constructed buildings or structures, subject to this section, for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

1013.8 Path marking. *When exit signs are required by Chapter 10, in addition to approved floor-level exit signs, approved path marking shall be installed at floor level or no higher than 8 inches (203 mm) above the floor level in all interior-rated exit corridors of unsprinklered Group A, R-1 and R-2 occupancies.*

Such marking shall be continuous, except as interrupted by door-ways, corridors or other such architectural features, in order to provide a visible delineation along the path of travel.

Note: Pursuant to Health and Safety Code Section 13143, the California amendments of this section shall apply to all newly constructed buildings or structures, subject to this section, for which a building permit is issued (or construction commenced, where no building permit is issued) on or after January 1, 1989.

SECTION 1014 HANDRAILS

[BE] 1014.1 Where required. Handrails serving flights of stairways, ramps, stepped aisles and ramped aisles shall be adequate in strength and attachment in accordance with Section 1607.8 of the *California Building Code*. Handrails required for flights of stairways by Section 1011.11 shall comply with Sections 1014.2 through 1014.9. Handrails required for ramps by Section 1012.8 shall comply with Sections 1014.2 through 1014.8. Handrails for stepped aisles and ramped aisles required by Section 1030.16 shall comply with Sections 1014.2 through 1014.8.

[BE] 1014.2 Height. Handrail height, measured above stair tread nosings, or finish surface of ramp slope, shall be uniform, not less than 34 inches (864 mm) and not more than 38 inches (965 mm). Handrail height of alternating tread devices and ship’s ladders, measured above tread nosings, shall be uniform, not less than 30 inches (762 mm) and not more than 34 inches (864 mm).

Exceptions:

1. Where handrail fittings or bendings are used to provide continuous transition between flights, the fittings or bendings shall be permitted to exceed the maximum height.
2. In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are associated with a Group R-3 occupancy or associated with individual dwelling units in Group R-2 occupancies; where handrail fittings or bendings are used to provide continuous transition

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between flights, transition at winder treads, transition from handrail to guard, or where used at the start of a flight, the handrail height at the fittings or bendings shall be permitted to exceed the maximum height.

3. Handrails on top of a guard where permitted along stepped aisles and ramped aisles in accordance with Section 1030.16.

[BE] 1014.3 Handrail graspability. Required handrails shall comply with Section 1014.3.1 or shall provide equivalent graspability.

Exception: In Group R-3 occupancies; within dwelling units in Group R-2 occupancies; and in Group U occupancies that are accessory to a Group R-3 occupancy or accessory to individual dwelling units in Group R-2 occupancies; handrails shall be Type I in accordance with Section 1014.3.1, Type II in accordance with Section 1014.3.2 or shall provide equivalent graspability.

[BE] 1014.3.1 Type I. Handrails with a circular cross section shall have an outside diameter of not less than $1\frac{1}{4}$ inches (32 mm) and not greater than 2 inches (51 mm). Where the handrail is not circular, it shall have a perimeter dimension of not less than 4 inches (102 mm) and not greater than $6\frac{1}{4}$ inches (160 mm) with a maximum cross-sectional dimension of $2\frac{1}{4}$ inches (57 mm) and minimum cross-sectional dimension of 1 inch (25 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

[BE] 1014.3.2 Type II. Handrails with a perimeter greater than $6\frac{1}{4}$ inches (160 mm) shall provide a graspable finger recess area on both sides of the profile. The finger recess shall begin within a distance of $\frac{3}{4}$ inch (19 mm) measured vertically from the tallest portion of the profile and achieve a depth of not less than $\frac{5}{16}$ inch (8 mm) within $\frac{7}{8}$ inch (22 mm) below the widest portion of the profile. This required depth shall continue for not less than $\frac{3}{8}$ inch (10 mm) to a level that is not less than $1\frac{3}{4}$ inches (45 mm) below the tallest portion of the profile. The width of the handrail above the recess shall be not less than $1\frac{1}{4}$ inches (32 mm) to not greater than $2\frac{3}{4}$ inches (70 mm). Edges shall have a minimum radius of 0.01 inch (0.25 mm).

[BE] 1014.4 Continuity. Handrail gripping surfaces shall be continuous, without interruption by newel posts or other obstructions.

Exceptions:

1. Handrails within dwelling units are permitted to be interrupted by a newel post at a turn or landing.
2. Within a dwelling unit, the use of a volute, turnout, starting easing or starting newel is allowed over the lowest tread.
3. Handrail brackets or balusters attached to the bottom surface of the handrail that do not project horizontally beyond the sides of the handrail within $1\frac{1}{2}$ inches (38 mm) of the bottom of the handrail shall not be considered obstructions. For each $\frac{1}{2}$ inch (12.7 mm) of additional handrail perimeter dimension above 4 inches (102 mm), the vertical clearance

dimension of $1\frac{1}{2}$ inches (38 mm) shall be permitted to be reduced by $\frac{1}{8}$ inch (3.2 mm).

4. Where handrails are provided along walking surfaces with slopes not steeper than 1:20, the bottoms of the handrail gripping surfaces shall be permitted to be obstructed along their entire length where they are integral to crash rails or bumper guards.
5. Handrails serving stepped aisles or ramped aisles are permitted to be discontinuous in accordance with Section 1030.16.1.

[BE] 1014.5 Fittings. Handrails shall not rotate within their fittings.

[BE] 1014.6 Handrail extensions. Handrails shall return to a wall, guard or the walking surface or shall be continuous to the handrail of an adjacent flight of stairs or ramp run. Where handrails are not continuous between flights the handrails shall extend horizontally not less than 12 inches (305 mm) beyond the top riser and continue to slope for the depth of one tread beyond the bottom riser. At ramps where handrails are not continuous between runs, the handrails shall extend horizontally above the landing 12 inches (305 mm) minimum beyond the top and bottom of ramp runs. The extensions of handrails shall be in the same direction of the flights of stairs at stairways and the ramp runs at ramps.

Exceptions:

1. Handrails within a dwelling unit that is not required to be accessible need extend only from the top riser to the bottom riser.
2. Handrails serving aisles in rooms or spaces used for assembly purposes are permitted to comply with the handrail extensions in accordance with Section 1030.16.
3. Handrails for alternating tread devices and ship's ladders are permitted to terminate at a location vertically above the top and bottom risers. Handrails for alternating tread devices are not required to be continuous between flights or to extend beyond the top or bottom risers.

[BE] 1014.7 Clearance. Clear space between a handrail and a wall or other surface shall be not less than $1\frac{1}{2}$ inches (38 mm). A handrail and a wall or other surface adjacent to the handrail shall be free of any sharp or abrasive elements.

[BE] 1014.8 Projections. On ramps and on ramped aisles that are part of an accessible route, the clear width between handrails shall be 36 inches (914 mm) minimum. Projections into the required width of aisles, stairways and ramps at each side shall not exceed $4\frac{1}{2}$ inches (114 mm) at or below the handrail height. Projections into the required width shall not be limited above the minimum headroom height required in Section 1011.3. Projections due to intermediate handrails shall not constitute a reduction in the egress width. Where a pair of intermediate handrails are provided within the stairway width without a walking surface between the pair of intermediate handrails and the distance between the pair of intermediate handrails is greater than 6 inches (152 mm), the available egress width shall be reduced by the distance

between the closest edges of each such intermediate pair of handrails that is greater than 6 inches (152 mm).

In Group I-2 occupancies, ramps required for exit access shall not be less than 8 feet in width and handrails are permitted to protrude 3 1/2 inches from the wall on both sides. For ramps used as exits and stairways used for the movement of bed and litter patients, the clear width between handrails shall be 44 inches (1118 mm) minimum.

[BE] 1014.9 Intermediate handrails. Stairways shall have intermediate handrails located in such a manner that all portions of the stairway minimum width or required capacity are within 30 inches (762 mm) of a handrail. On monumental stairs, handrails shall be located along the most direct path of egress travel.

SECTION 1015 GUARDS

[BE] 1015.1 General. Guards shall comply with the provisions of Sections 1015.2 through 1015.7. Operable windows with sills located more than 72 inches (1829 mm) above finished grade or other surface below shall comply with Section 1015.8.

[BE] 1015.2 Where required. Guards shall be located along open-sided walking surfaces, including mezzanines, equipment platforms, aisles, stairs, ramps and landings that are located more than 30 inches (762 mm) measured vertically to the floor or grade below at any point within 36 inches (914 mm) horizontally to the edge of the open side. Guards shall be adequate in strength and attachment in accordance with Section 1607.8 of the *California Building Code*.

Exception: Guards are not required for the following locations:

1. On the loading side of loading docks or piers.
2. On the audience side of stages and raised platforms, including stairs leading up to the stage and raised platforms.
3. On raised stage and platform floor areas, such as runways, ramps and side stages used for entertainment or presentations.
4. At vertical openings in the performance area of stages and platforms.
5. At elevated walking surfaces appurtenant to stages and platforms for access to and utilization of special lighting or equipment.
6. Along vehicle service pits not accessible to the public.
7. In assembly seating areas at cross aisles in accordance with Section 1030.17.2.
8. On the loading side of station platforms on fixed guideway transit or passenger rail systems.

[BE] 1015.2.1 Glazing. Where glass is used to provide a guard or as a portion of the guard system, the guard shall comply with Section 2407 of the *California Building Code*. Where the glazing provided does not meet the strength and attachment requirements of Section 1607.8 of

the *California Building Code*, complying guards shall be located along glazed sides of open-sided walking surfaces.

[BE] 1015.3 Height. Required guards shall be not less than 42 inches (1067 mm) high, measured vertically as follows:

1. From the adjacent walking surfaces.
2. On stairways and stepped aisles, from the line connecting the leading edges of the tread nosings.
3. On ramps and ramped aisles, from the ramp surface at the guard.

Exceptions:

1. For occupancies in Group R-3 not more than three stories above grade in height and within individual dwelling units in occupancies in Group R-2 not more than three stories above grade in height with separate means of egress, required guards shall be not less than 36 inches (914 mm) in height measured vertically above the adjacent walking surfaces.
2. For occupancies in Group R-3, and within individual dwelling units in occupancies in Group R-2, where the top of the guard serves as a handrail on the open sides of stairs, the top of the guard shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.
3. The guard height in assembly seating areas shall comply with Section 1030.17 as applicable.
4. Along alternating tread devices and ship's ladders, guards where the top rail serves as a handrail shall have height not less than 30 inches (762 mm) and not more than 34 inches (864 mm), measured vertically from the leading edge of the device tread nosing.
5. In Group F occupancies where exit access stairways serve fewer than three stories and such stairways are not open to the public, and where the top of the guard also serves as a handrail, the top of the guard shall be not less than 34 inches (864 mm) and not more than 38 inches (965 mm) measured vertically from a line connecting the leading edges of the treads.

[BE] 1015.4 Opening limitations. Required guards shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter from the walking surface to the required guard height.

Exceptions:

1. From a height of 36 inches (914 mm) to 42 inches (1067 mm), guards shall not have openings that allow passage of a sphere 4³/₈ inches (111 mm) in diameter.
2. The triangular openings at the open sides of a stair, formed by the riser, tread and bottom rail shall not allow passage of a sphere 6 inches (152 mm) in diameter.
3. At elevated walking surfaces for access to and use of electrical, mechanical or plumbing systems or

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equipment, guards shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.

4. In areas that are not open to the public within occupancies in Group I-3, F, H or S, and for alternating tread devices and ship's ladders, guards shall not have openings that allow passage of a sphere 21 inches (533 mm) in diameter.
5. In assembly seating areas, guards required at the end of aisles in accordance with Section 1030.17.4 shall not have openings that allow passage of a sphere 4 inches (102 mm) in diameter up to a height of 26 inches (660 mm). From a height of 26 inches (660 mm) to 42 inches (1067 mm) above the adjacent walking surfaces, guards shall not have openings that allow passage of a sphere 8 inches (203 mm) in diameter.
6. Within individual dwelling units and sleeping units in Group R-2 and R-3 occupancies, guards on the open sides of stairs shall not have openings that allow passage of a sphere $4\frac{3}{8}$ (111 mm) inches in diameter.
7. *[SFM] In lifeguard towers not open to the public, guards shall not have openings which allow passage of a sphere 21 inches (533 mm) in diameter.*

[BE] 1015.5 Screen porches. Porches and decks that are enclosed with insect screening shall be provided with guards where the walking surface is located more than 30 inches (762 mm) above the floor or grade below.

[BE] 1015.6 Mechanical equipment, systems and devices. Guards shall be provided where various components that require service are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of such components. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: Guards are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z359.1 are installed.

[BE] 1015.7 Roof access. Guards shall be provided where the roof hatch opening is located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of the hatch parallel to the roof edge. The guard shall be constructed so as to prevent the passage of a sphere 21 inches (533 mm) in diameter.

Exception: Guards are not required where personal fall arrest anchorage connector devices that comply with ANSI/ASSE Z359.1 are installed.

[BE] 1015.8 Window openings. Windows in Group R-2 and R-3 buildings including dwelling units, where the bottom of the clear opening of an operable window is located less than 36 inches (914 mm) above the finished floor and more than

72 inches (1829 mm) above the finished grade or other surface below on the exterior of the building, shall comply with one of the following:

1. Operable windows where the top of the sill of the opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below and that are provided with window fall prevention devices that comply with ASTM F2006.
2. Operable windows where the openings will not allow a 4-inch-diameter (102 mm) sphere to pass through the opening when the window is in its largest opened position.
3. Operable windows where the openings are provided with window fall prevention devices that comply with ASTM F2090.
4. Operable windows that are provided with window opening control devices that comply with Section 1015.8.1.

[BE] 1015.8.1 Window opening control devices. Window opening control devices shall comply with ASTM F2090. The window opening control device, after operation to release the control device allowing the window to fully open, shall not reduce the minimum net clear opening area of the window unit to less than the area required by Section 1031.3.1.

SECTION 1016 EXIT ACCESS

[BE] 1016.1 General. The exit access shall comply with the applicable provisions of Sections 1003 through 1015. Exit access arrangement shall comply with Sections 1016 through 1021.

[BE] 1016.2 Egress through intervening spaces. Egress through intervening spaces shall comply with this section.

1. Exit access through an enclosed elevator lobby is permitted *in other than a Group I-2 and I-2.1*. Where access to two or more exits or exit access doorways is required in Section 1006.2.1, access to not less than one of the required exits shall be provided without travel through the enclosed elevator lobbies required by Section 3006 of the *California Building Code*. Where the path of exit access travel passes through an enclosed elevator lobby the level of protection required for the enclosed elevator lobby is not required to be extended to the *exit* unless direct access to an *exit* is required by other sections of this code.
2. Egress from a room or space shall not pass through adjoining or intervening rooms or areas, except where such adjoining rooms or areas and the area served are accessory to one or the other, are not a Group H occupancy and provide a discernible path of egress travel to an exit.

Exception: Means of egress are not prohibited through adjoining or intervening rooms or spaces in a Group H, S or F occupancy where the adjoining or intervening rooms or spaces are the same or a lesser hazard occupancy group.

3. An exit access shall not pass through a room that can be locked to prevent egress.
4. Means of egress from dwelling units or sleeping areas shall not lead through other sleeping areas, toilet rooms or bathrooms.
5. Egress shall not pass through kitchens, storage rooms, closets or spaces used for similar purposes.

Exceptions:

1. Means of egress are not prohibited through a kitchen area serving adjoining rooms constituting part of the same dwelling unit or sleeping unit.
2. Means of egress are not prohibited through stockrooms in Group M occupancies where all of the following are met:
 - 2.1. The stock is of the same hazard classification as that found in the main retail area.
 - 2.2. Not more than 50 percent of the exit access is through the stockroom.
 - 2.3. The stockroom is not subject to locking from the egress side.
 - 2.4. There is a demarcated, minimum 44-inch-wide (1118 mm) aisle defined by full- or partial-height fixed walls or similar construction that will maintain the required width and lead directly from the retail area to the exit without obstructions.
6. Exits shall not pass through any room subject to locking except in Group I-3 occupancies classified as detention facilities.

[BE] 1016.2.1 Multiple tenants. Where more than one tenant occupies any one floor of a building or structure, each tenant space, dwelling unit and sleeping unit shall be provided with access to the required exits without passing through adjacent tenant spaces, dwelling units and sleeping units.

Exception: The means of egress from a smaller tenant space shall not be prohibited from passing through a larger adjoining tenant space where such rooms or spaces of the smaller tenant occupy less than 10 percent of the area of the larger tenant space through which they pass; are the same or similar occupancy group; a discernable path of egress travel to an exit is provided; and the means of egress into the adjoining space is not subject to locking from the egress side. A required means of egress serving the larger tenant space shall not pass through the smaller tenant space or spaces.

**SECTION 1017
EXIT ACCESS TRAVEL DISTANCE**

[BE] 1017.1 General. Travel distance within the exit access portion of the means of egress system shall be in accordance with this section.

[BE] 1017.2 Limitations. Exit access travel distance shall not exceed the values given in Table 1017.2.

**[BE] TABLE 1017.2
EXIT ACCESS TRAVEL DISTANCE^a**

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, M, R, S-1	200	250 ^{b,c}
R-2.1	Not Permitted	250 ^c
B	200	300 ^c
F-2, S-2, U	300	400 ^c
H-1	Not Permitted	75 ^d
H-2	Not Permitted	100 ^d
H-3	Not Permitted	150 ^d
H-4	Not Permitted	175 ^d
H-5	Not Permitted	200 ^c
I-2, I-2.1, I-3 ^f , I-4	Not Permitted	200 ^c
L	Not Permitted	200 ^c

For SI: 1 foot = 304.8 mm.

- a. See the following sections for modifications to exit access travel distance requirements:
 - Section 402.8 of the *California Building Code*: For the distance limitation in malls.
 - Section 407.4 of the *California Building Code*: For the distance limitation in Group I-2.
 - Section 408.3.10 of the *California Building Code*: For increased limitation in Group I-3.
 - Sections 408.6.1 and 408.8.1 of the *California Building Code*: For the distance limitations in Group I-3.
 - Section 411.2 of the *California Building Code*: For the distance limitation in special amusement areas.
 - Section 412.6 of the *California Building Code*: For the distance limitations in aircraft manufacturing facilities.
 - Section 1006.2.2.2: For the distance limitation in refrigeration machinery rooms.
 - Section 1006.2.2.3: For the distance limitation in refrigerated rooms and spaces.
 - Section 1006.3.4: For buildings with one exit.
 - Section 1017.2.2: For increased distance limitation in Groups F-1 and S-1.
 - Section 1030.7: For increased limitation in assembly seating.
 - Section 3103.4 of the *California Building Code*: For temporary structures.
 - Section 3104.9 of the *California Building Code*: For pedestrian walkways.
- b. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2. See Section 903 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.2.
- c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- d. Group H occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.1.
- e. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.
- f. Not permitted in nonsprinklered Group I-3 occupancies.

[BE] 1017.2.1 Exterior egress balcony increase. Exit access travel distances specified in Table 1017.2 shall be increased up to an additional 100 feet (30 480 mm) provided that the last portion of the exit access leading to the exit occurs on an exterior egress balcony constructed in

accordance with Section 1021. The length of such balcony shall be not less than the amount of the increase taken.

[BE] 1017.2.2 Groups F-1 and S-1 increase. The maximum exit access travel distance shall be 400 feet (122 m) in Group F-1 or S-1 occupancies where all of the following conditions are met:

1. The portion of the building classified as Group F-1 or S-1 is limited to one story in height.
2. The minimum height from the finished floor to the bottom of the ceiling or roof slab or deck is 24 feet (7315 mm).
3. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

[BE] 1017.3 Measurement. Exit access travel distance shall be measured from the most remote point of each room, area or space along the natural and unobstructed path of horizontal and vertical egress travel to the entrance to an exit. Where more than one exit is required, exit access travel distance shall be measured to the nearest exit.

Exceptions:

1. In open parking garages, exit access travel distance is permitted to be measured to the closest riser of an exit access stairway or the closest slope of an exit access ramp.
2. In smoke-protected seating and open-air assembly seating, exit access travel distance shall be measured in accordance with Section 1030.7.

[BE] 1017.3.1 Exit access stairways and ramps. Travel distance on exit access stairways or ramps shall be included in the exit access travel distance measurement. The measurement along stairways shall be made on a plane parallel and tangent to the stair tread nosings in the center of the stair and landings. The measurement along ramps shall be made on the walking surface in the center of the ramp and landings.

1017.3.2 Atriums. Exit access travel distance for areas open to an atrium shall comply with the requirements of Sections 1017.3.2.1 through 1017.3.2.3.

1017.3.2.1 Egress not through the atrium. Where required access to the exits is not through the atrium, exit access travel distance shall comply with Section 1017.2.

1017.3.2.2 Exit access travel distance at the level of exit discharge. Where the path of egress travel is through an atrium space, exit access travel distance at the level of exit discharge shall be determined in accordance with Section 1017.2.

1017.3.2.3 Exit access travel distance at other than the level of exit discharge. Where the path of egress travel is not at the level of exit discharge from the atrium, that portion of the total permitted exit access travel distance that occurs within the atrium shall be not greater than 200 feet (60 960 mm).

SECTION 1018 AISLES

[DSA-AC] In addition to the requirements of this section, means of egress, which provide access to, or egress from, buildings or facilities where accessibility is required for applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, shall also comply with Chapter 11A or Chapter 11B, Section 403, as applicable.

[BE] 1018.1 General. Aisles and aisle accessways serving as a portion of the exit access in the means of egress system shall comply with the requirements of this section. Aisles or aisle accessways shall be provided from all occupied portions of the exit access that contain seats, tables, furnishings, displays and similar fixtures or equipment. The minimum width or required capacity of aisles shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

[California Code of Regulations, Title 19, Division 1, §3.06(a)] Bonding of Chairs and Spacing of Tables.

(a) Bonding of chairs. In every Group A and Group E occupancy, all loose seats, folding chairs or similar seating facilities that are not fixed to the floor shall be bonded together in groups of not less than three.

Exceptions:

(1) When not more than 200 such seats, chairs or facilities are provided, bonding thereof may be deleted.

(2) The bonding of chairs shall not be required when tables are provided, as when the occupancy is used for dining or similar purposes.

(3) Upon approval of the enforcing agency, the bonding of chairs shall not be required when the placement and location of such chairs does not obstruct any required exit or any line of egress toward required exits and does not constitute a fire hazard as defined in California Code of Regulations, Title 19, Division 1, Section 3.14.

[California Code of Regulations, Title 19, Division 1, §3.06(b)] Bonding of Chairs and Spacing of Tables.

(b) Spacing of Tables. In occupancies having rectangular conference or banquet-type tables, such tables shall be placed not less than 54 inches apart and not less than 36 inches from walls.

[BE] 1018.2 Aisles in assembly spaces. Aisles and aisle accessways serving a room or space used for assembly purposes shall comply with Section 1030.

[BE] 1018.3 Aisles in Groups B and M. In Group B and M occupancies, the minimum clear aisle width shall be determined by Section 1005.1 for the occupant load served, but shall be not less than that required for corridors by Section 1020.3.

Exception: Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11A or 11B of the California Building Code need not exceed 28 inches (711 mm) in width.

[BE] 1018.4 Aisle accessways in Group M. An aisle accessway shall be provided on not less than one side of each element within the merchandise pad. The minimum clear width

for an aisle accessway not required to be accessible shall be 30 inches (762 mm). The required clear width of the aisle accessway shall be measured perpendicular to the elements and merchandise within the merchandise pad. The 30-inch (762 mm) minimum clear width shall be maintained to provide a path to an adjacent aisle or aisle accessway. The common path of egress travel shall not exceed 30 feet (9144 mm) from any point in the merchandise pad.

Exception: For areas serving not more than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).

[BE] 1018.5 Aisles in other than assembly spaces and Groups B and M. In other than rooms or spaces used for assembly purposes and Group B and M occupancies, the minimum clear aisle capacity shall be determined by Section 1005.1 for the occupant load served, but the width shall be not less than that required for corridors by Section 1020.3.

Exception: Nonpublic aisles serving less than 50 people and not required to be accessible by Chapter 11 of the *California Building Code* need not exceed 28 inches (711 mm) in width.

SECTION 1019 EXIT ACCESS STAIRWAYS AND RAMPS

[BE] 1019.1 General. Exit access stairways and ramps serving as an exit access component in a means of egress system shall comply with the requirements of this section. The number of stories connected by exit access stairways and ramps shall include basements, but not mezzanines.

[BE] 1019.2 All occupancies. Exit access stairways and ramps that serve floor levels within a single story are not required to be enclosed.

[BE] 1019.3 Occupancies other than Groups I-2, I-2.1, I-3 and R-2.1. In other than Group I-2, I-2.1, I-3 and R-2.1 occupancies, floor openings containing exit access stairways or ramps shall be enclosed with a shaft enclosure constructed in accordance with Section 713 of the *California Building Code*.

Exceptions:

1. Exit access stairways and ramps that serve or atmospherically communicate between only two adjacent stories. Such interconnected stories shall not be open to other stories.
2. In Group R-1, R-2, R-2.1, R-2.2, R-3 or R-3.1 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit or sleeping unit or live/work unit.
3. Exit access stairways serving and contained within a Group R-3 congregate residence or a Group R-4 facility are not required to be enclosed.
4. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected area of the stairway or ramp and the opening is protected by a

draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.

5. Exit access stairways and ramps within an atrium complying with the provisions of Section 404 of the *California Building Code*.
6. Exit access stairways and ramps in open parking garages that serve only the parking garage.
7. Exit access stairways and ramps serving smoke-protected or open-air assembly seating complying with the exit access travel distance requirements of Section 1030.7.
8. Exit access stairways and ramps between the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.
9. Exterior exit access stairways or ramps between occupied roofs.
10. Fixed guideway transit stations, constructed in accordance with Section 443 of the *California Building Code*.

[BE] 1019.4 Group I-2, I-2.1, I-3 and R-2.1 occupancies. In Group I-2, I-2.1, I-3 and R-2.1 occupancies, floor openings between stories containing exit access stairways or ramps are required to be enclosed with a shaft enclosure constructed in accordance with Section 713 of the *California Building Code*.

Exception: In Group I-3 occupancies, exit access stairways or ramps constructed in accordance with Section 408 of the *California Building Code* are not required to be enclosed.

SECTION 1020 CORRIDORS

[BE] 1020.1 General. Corridors serving as an exit access component in a means of egress system shall comply with the requirements of Sections 1020.2 and 1020.7.

[BE] 1020.2 Construction. Corridors shall be fire-resistance rated in accordance with Table 1020.2. The corridor walls required to be fire-resistance rated shall comply with Section 708 of the *California Building Code* for fire partitions.

Exceptions:

1. A fire-resistance rating is not required for corridors in an occupancy in Group E where each room that is used for instruction has not less than one door opening directly to the exterior and rooms for assembly purposes have not less than one-half of the required means of egress doors opening directly to the exterior. Exterior doors specified in this exception are required to be at ground level.
2. A fire-resistance rating is not required for corridors contained within a dwelling unit or sleeping unit in an occupancy in Group R.
3. A fire-resistance rating is not required for corridors in open parking garages.

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4. A fire-resistance rating is not required for corridors in an occupancy in Group B that is a space requiring only a single means of egress complying with Section 1006.2.
5. Corridors adjacent to the exterior walls of buildings shall be permitted to have unprotected openings on unrated exterior walls where unrated walls are permitted by Table 705.5 of the *California Building Code* and unprotected openings are permitted by Table 705.8 of the *California Building Code*.
6. A fire-resistance rating is not required for corridors within suites in a Group I-2 or I-2.1 constructed in accordance with Section 407.4.4 or 407.4.5 of the *California Building Code*.

[BE] 1020.2.1 Hoistway opening protection. Elevator hoistway openings shall be protected in accordance with Section 3006.2.1 of the *California Building Code*.

[BE] 1020.3 Width and capacity. The required capacity of corridors shall be determined as specified in Section 1005.1, but the minimum width shall be not less than that specified in Table 1020.3.

Exception: In Group I-2 occupancies, corridors are not required to have a clear width of 96 inches (2438 mm) in areas where there will not be stretcher or bed movement for access to care or as part of the defend-in-place strategy.

[BE] 1020.4 Obstruction. The minimum width or required capacity of corridors shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

[BE] 1020.5 Dead ends. Where more than one exit or exit access doorway is required, the exit access shall be arranged such that dead-end corridors do not exceed 20 feet (6096 mm) in length.

Exceptions:

1. In Group I-3, Condition 2, 3 or 4 occupancies, the dead end in a corridor shall not exceed 50 feet (15 240 mm).

2. In occupancies in Groups B, E, F, M, R-1, R-2, R-2.1, R-2.2, S and U, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of the dead-end corridors shall not exceed 50 feet (15 240 mm).
3. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.
4. In Group I-2 and I-2.1 occupancies, where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the length of dead-end corridors that do not serve patient rooms or patient treatment spaces shall not exceed 30 feet (9144 mm).

[BE] 1020.6 Air movement in corridors. Corridors shall not serve as supply, return, exhaust, relief or ventilation air ducts.

Exceptions:

1. Use of a corridor as a source of makeup air for exhaust systems in *small rooms of 30 square feet or less* that open directly onto such corridors, including toilet rooms, bathrooms, dressing rooms, smoking lounges and janitor closets, shall be permitted, provided that each such corridor is directly supplied with outdoor air at a rate greater than the rate of makeup air taken from the corridor.
2. Where located within a dwelling unit, the use of corridors for conveying return air shall not be prohibited.
3. Where located within tenant spaces of 1,000 square feet (93 m²) or less in area, utilization of corridors for conveying return air is permitted.
4. Transfer air movement required to maintain the pressurization difference within health care facilities

**[BE] TABLE 1020.2
CORRIDOR FIRE-RESISTANCE RATING**

OCCUPANCY	OCCUPANT LOAD SERVED BY CORRIDOR	REQUIRED FIRE-RESISTANCE RATING (hours)	
		Without sprinkler system	With sprinkler system
H-1, H-2, H-3	All	Not Permitted	1 ^c
H-4, H-5, I	Greater than 30	Not Permitted	1 ^c
A ^c , B, F, M, S, U	Greater than 30	1	0
R-1, R-2, R-3, R-3.1, R-4	Greater than 10	Not Permitted	1
I-2 ^a , I-2.1	Greater than 6	1	1
I-3, R-2.1	Greater than 6	Not Permitted	1 ^{b, c}
E	Greater than 10	1	0
I-4	All	1	0

- a. For requirements for occupancies in Group I-2, see Sections 407.2 and 407.3 of the *California Building Code*.
- b. For a reduction in the fire-resistance rating for occupancies in Group I-3, see Section 408.8 of the *California Building Code*.
- c. Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 where allowed.
- d. Group R-3 and R-4 buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.3. See Section 903.2.8 for occupancies where automatic sprinkler systems are permitted in accordance with Section 903.3.1.3.
- e. **[SFM]** See Section 1030.

[BE] TABLE 1020.3
MINIMUM CORRIDOR WIDTH

OCCUPANCY	MINIMUM WIDTH (inches)
Any facility not listed below	44
Access to and utilization of mechanical, plumbing or electrical systems or equipment	24
With an occupant load of less than 50	36
Within a dwelling unit	36
In Group E with a corridor having a occupant load of 100 or more	72
In corridors and areas serving stretcher traffic in ambulatory care facilities	72
Group I-2 and I-3 in areas where required for bed movement	96
Corridors in Group I-2 and I-3 occupancies serving any area caring for one or more nonambulatory persons ^a	72

For SI: 1 inch = 25.4 mm.

a. See California Building Code Section 1224.4.7.1 for Group I-2.

and Group L occupancies, in accordance with ASHRAE 170.

5. For health care facilities under the jurisdiction of the Office of Statewide Health Planning and Development (OSHDP), see the California Mechanical Code.

[BE] 1020.6.1 **Corridor ceiling.** Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction.
2. The corridor is separated from the plenum by fire-resistance-rated construction.
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by the California Mechanical Code.
4. The air-handling system serving the corridor is shut down upon detection of sprinkler water flow where the building is equipped throughout with an automatic sprinkler system.
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.

[BE] 1020.7 **Corridor continuity.** Fire-resistance-rated corridors shall be continuous from the point of entry to an exit, and shall not be interrupted by intervening rooms. Where the path of egress travel within a fire-resistance-rated corridor to the exit includes travel along unenclosed exit access stairways or ramps, the fire-resistance-rating shall be continuous for the length of the stairway or ramp and for the length of the connecting corridor on the adjacent floor leading to the exit.

Exceptions:

1. Foyers, lobbies or reception rooms constructed as required for corridors shall not be construed as intervening rooms.

2. Enclosed elevator lobbies as permitted by Item 1 of Section 1016.2 shall not be construed as intervening rooms.
3. [SFM] In fully sprinklered office buildings, corridors may lead through enclosed elevator lobbies if all areas of the building have access to at least one required exit without passing through the elevator lobby.

**SECTION 1021
EGRESS BALCONIES**

[BE] 1021.1 **General.** Balconies used for egress purposes shall conform to the same requirements as corridors for minimum width, required capacity, headroom, dead ends and projections.

[BE] 1021.2 **Wall separation.** Exterior egress balconies shall be separated from the interior of the building by walls and opening protectives as required for corridors.

Exception: Separation is not required where the exterior egress balcony is served by not less than two stairways and a dead-end travel condition does not require travel past an unprotected opening to reach a stairway.

[BE] 1021.3 **Openness.** The long side of an egress balcony shall be not less than 50 percent open, and the open area above the guards shall be so distributed as to minimize the accumulation of smoke or toxic gases.

[BE] 1021.4 **Location.** Exterior egress balconies shall have a minimum fire separation distance of 10 feet (3048 mm) measured at right angles from the exterior edge of the egress balcony to the following:

1. Adjacent lot lines.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 of the California Building Code based on fire separation distance.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

SECTION 1022 EXITS

[BE] 1022.1 General. Exits shall comply with Sections 1022 through 1027 and the applicable requirements of Sections 1003 through 1015. An exit shall not be used for any purpose that interferes with its function as a means of egress. Once a given level of exit protection is achieved, such level of protection shall not be reduced until arrival at the exit discharge. Exits shall be continuous from the point of entry into the exit to the exit discharge.

[BE] 1022.2 Exterior exit doors. Buildings or structures used for human occupancy shall have not less than one exterior door that meets the requirements of Section 1010.1.1.

[BE] 1022.2.1 Detailed requirements. Exterior exit doors shall comply with the applicable requirements of Section 1010.1.

[BE] 1022.2.2 Arrangement. Exterior exit doors shall lead directly to the exit discharge or the public way.

|| **1022.3 Basement exits in Group I-2 occupancies.** For additional requirements for occupancies in Group I-2 or I-2.1, see Section 407.4.1.2 of the *California Building Code*.

SECTION 1023 INTERIOR EXIT STAIRWAYS AND RAMPS

[BE] 1023.1 General. Interior exit stairways and ramps serving as an exit component in a means of egress system shall comply with the requirements of this section. Interior exit stairways and ramps shall be enclosed and lead directly to the exterior of the building or shall be extended to the exterior of the building with an exit passageway conforming to the requirements of Section 1024, except as permitted in Section 1028.2. An interior exit stairway or ramp shall not be used for any purpose other than as a means of egress and a circulation path.

[BE] 1023.2 Construction. Enclosures for interior exit stairways and ramps shall be constructed as fire barriers in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both. Interior exit stairway and ramp enclosures shall have a fire-resistance rating of not less than 2 hours where connecting four stories or more and not less than 1 hour where connecting less than four stories. The number of stories connected by the interior exit stairways or ramps shall include any basements, but not any mezzanines. Enclosure for interior exit stairways and ramp enclosures shall have a fire-resistance rating not less than the floor assembly penetrated, but need not exceed 2 hours.

Exceptions:

1. Interior exit stairways and ramps in Group I-3 occupancies in accordance with the provisions of Section 408.3.8 of the *California Building Code*.
2. Interior exit stairways within an atrium enclosed in accordance with Section 404.6 of the *California Building Code*.
3. Interior exit stairways in accordance with Section 510.2 of the *California Building Code*.

4. Fixed guideway transit stations, constructed in accordance with Section 443 of the *California Building Code*.

[BE] 1023.3 Termination. Interior exit stairways and ramps shall terminate at an exit discharge or a public way.

Exception: A combination of interior exit stairways, interior exit ramps and exit passageways, constructed in accordance with Sections 1023.2, 1023.3.1 and 1024, respectively, and forming a continuous protected enclosure, shall be permitted to extend an interior exit stairway or ramp to the exit discharge or a public way.

[BE] 1023.3.1 Extension. Where interior exit stairways and ramps are extended to an exit discharge or a public way by an exit passageway, the interior exit stairway and ramp shall be separated from the exit passageway by a fire barrier constructed in accordance with Section 707 of the *California Building Code* or a horizontal assembly constructed in accordance with Section 711 of the *California Building Code*, or both. The fire-resistance rating shall be not less than that required for the interior exit stairway and ramp. A fire door assembly complying with Section 716 of the *California Building Code* shall be installed in the fire barrier to provide a means of egress from the interior exit stairway and ramp to the exit passageway. Openings in the fire barrier other than the fire door assembly are prohibited. Penetrations of the fire barrier are prohibited.

Exceptions:

1. Penetrations of the fire barrier in accordance with Section 1023.5 shall be permitted.
2. Separation between an interior exit stairway or ramp and the exit passageway extension shall not be required where there are no openings into the exit passageway extension.
3. Separation between an interior exit stairway or ramp and the exit passageway extension shall not be required where the interior exit stairway and the exit passageway extension are pressurized in accordance with Section 909.20.5 of the *California Building Code*.

[BE] 1023.4 Openings. Interior exit stairway and ramp opening protectives shall be in accordance with the requirements of Section 716 of the *California Building Code*.

Openings in interior exit stairways and ramps other than unprotected exterior openings shall be limited to those required for exit access to the enclosure from normally occupied spaces and for egress from the enclosure.

Elevators shall not open into interior exit stairways and ramps.

[BE] 1023.5 Penetrations. Penetrations into or through interior exit stairways and ramps are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. Fire protection systems.

3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication systems.
6. Electrical raceway serving the interior exit stairway and ramp and terminating at a steel box not exceeding 16 square inches (0.010 m²).
7. Structural elements supporting the interior exit stairway or ramp or enclosure, such as beams or joists.

Such penetrations shall be protected in accordance with Section 714 of the *California Building Code*. There shall not be penetrations or communication openings, whether protected or not, between adjacent interior exit stairways and ramps.

Exception: Membrane penetrations shall be permitted on the outside of the interior exit stairway and ramp. Such penetrations shall be protected in accordance with Section 714.4.2 of the *California Building Code*.

[BE] 1023.6 Ventilation. Equipment and ductwork for interior exit stairway and ramp ventilation as permitted by Section 1023.5 shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the interior exit stairway and ramp by ductwork enclosed in construction as required for shafts.
2. Where such equipment and ductwork is located within the interior exit stairway and ramp, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 of the *California Building Code* for shaft enclosures.

The interior exit stairway and ramp ventilation systems shall be independent of other building ventilation systems.

[BE] 1023.7 Interior exit stairway and ramp exterior walls. Exterior walls of the interior exit stairway or ramp shall comply with the requirements of Section 705 of the *California Building Code* for exterior walls. Where nonrated walls or unprotected openings enclose the exterior of the stairway or ramps and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the topmost

landing of the stairway or ramp, or to the roof line, whichever is lower.

[BE] 1023.8 Barriers at level of exit discharge. An interior exit stairway and ramp shall not continue below its level of exit discharge unless an approved barrier is provided at the level of exit discharge to prevent persons from unintentionally continuing into levels below. Directional exit signs shall be provided as specified in Section 1013.

[BE] 1023.9 Stairway identification signs. A sign shall be provided at each floor landing in an interior exit stairway and ramp connecting more than three stories designating the floor level, the terminus of the top and bottom of the interior exit stairway and ramp and the identification of the stairway or ramp. The signage shall state the story of, and the direction to, the exit discharge and the availability of roof access from the interior exit stairway and ramp for the fire department. The bottom of the sign shall be located not less than 5 feet (1524 mm) above the floor landing in a position that is readily visible when the doors are in the open and closed positions.

In addition to the stairway identification sign, raised characters and braille floor identification signs that comply with Chapter 11B of the California Building Code shall be located at the landing of each floor level, placed adjacent to the door on the latch side, in all enclosed stairways in buildings two or more stories in height to identify the floor level. At the exit discharge level, the sign shall include a raised five pointed star located to the left of the identifying floor level. The outside diameter of the star shall be the same as the height of the raised characters.

[BE] 1023.9.1 Signage requirements. Stairway identification signs shall comply with all of the following requirements:

1. The signs shall be a minimum size of 18 inches (457 mm) by 12 inches (305 mm).
2. The letters designating the identification of the *stair enclosure*, such as STAIR NO. 1 or WEST STAIR, shall be placed at the top of the sign and shall be not less than $1\frac{1}{2}$ inches (38 mm) in height *block lettering with $\frac{1}{4}$ -inch (6 mm) strokes*.
3. The number designating the floor level shall be not less than 5 inches (127 mm) in height *with $\frac{3}{4}$ -inch (19 mm) strokes* and located in the center of the sign. *The mezzanine levels shall have the letter "M" preceding the floor level. basement levels shall have the letter "B" preceding the floor number.*
4. Other lettering and numbers shall be not less than 1 inch (25 mm) in height.
5. *The stairway's upper terminus, such as ROOF ACCESS or NO ROOF ACCESS, shall be placed under the stairway identification in 1-inch-high (25 mm) block lettering with $\frac{1}{4}$ -inch (6 mm) strokes.*
6. *The lower and upper terminus of the stairway shall be placed at the bottom of the sign in 1-inch-high (25 mm) block lettering with $\frac{1}{4}$ -inch (6 mm) strokes.*
7. Characters and their background shall have a non-glare finish. Characters shall contrast with their back-

ground, with either light characters on a dark background or dark characters on a light background.

8. Where signs required by Section 1023.9 are installed in the interior exit stairways and ramps of buildings subject to Section 1025, the signs shall be made of the same materials as required by Section 1025.4.

[BE] 1023.10 Elevator lobby identification signs. At landings in interior exit stairways where two or more doors lead to the floor level, any door with direct access to an enclosed elevator lobby shall be identified by signage located on the door or directly adjacent to the door stating “Elevator Lobby.” Signage shall be in accordance with Section 1023.9.1, Items 4, 5 and 6.

[BE] 1023.11 Tactile floor-level signs. Where floor-level signs are provided in interior exit stairways and ramps, a floor-level sign identifying in the floor level in visual characters, raised characters and braille complying with ICC A117.1 shall be located at each floor-level landing adjacent to the door leading from the interior exit stairway and ramp into the corridor.

[BE] 1023.12 Smokeproof enclosures. Where required by Section 403.5.4, 405.7.2 or 412.2.2.1 of the *California Building Code*, interior exit stairways and ramps shall be smokeproof enclosures in accordance with Section 909.20.

[BE] 1023.12.1 Termination and extension. A smokeproof enclosure shall terminate at an exit discharge or a public way. The smokeproof enclosure shall be permitted to be extended by an exit passageway in accordance with Section 1023.3. The exit passageway shall be without openings other than the fire door assembly required by Section 1023.3.1 and those necessary for egress from the exit passageway. The exit passageway shall be separated from the remainder of the building by 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

Exceptions:

1. Openings in the exit passageway serving a smokeproof enclosure are permitted where the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure, and openings are protected as required for access from other floors.
2. The fire barrier separating the smokeproof enclosure from the exit passageway is not required, provided that the exit passageway is protected and pressurized in the same manner as the smokeproof enclosure.
3. A smokeproof enclosure shall be permitted to egress through areas on the level of exit discharge or vestibules as permitted by Section 1028.

[BE] 1023.12.2 Enclosure access. Access to the stairway or ramp within a smokeproof enclosure shall be by way of a vestibule or an open exterior balcony.

[BE] 1023.13 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1024 EXIT PASSAGEWAYS

[BE] 1024.1 General. Exit passageways serving as an exit component in a means of egress system shall comply with the requirements of this section. An exit passageway shall not be used for any purpose other than as a means of egress and a circulation path.

[BE] 1024.2 Width and capacity. The required capacity of exit passageways shall be determined as specified in Section 1005.1 but the minimum width shall be not less than 44 inches (1118 mm), except that exit passageways serving an occupant load of less than 50 shall be not less than 36 inches (914 mm) in width. The minimum width or required capacity of exit passageways shall be unobstructed.

Exception: Encroachments complying with Section 1005.7.

The clear width of exit passageways in a Group I-2 occupancy used for the movement of beds and litters shall be 44 inches (1118 mm) minimum.

[BE] 1024.3 Construction. Exit passageway enclosures shall have walls, floors and ceilings of not less than a 1-hour fire-resistance rating, and not less than that required for any connecting interior exit stairway or ramp. Exit passageways shall be constructed as fire barriers in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

[BE] 1024.4 Termination. Exit passageways on the level of exit discharge shall terminate at an exit discharge. Exit passageways on other levels shall terminate at an exit.

[BE] 1024.5 Openings. Exit passageway opening protectives shall be in accordance with the requirements of Section 716 of the *California Building Code*.

Except as permitted in Section 402.8.7 of the *California Building Code*, openings in exit passageways other than unprotected exterior openings shall be limited to those necessary for exit access to the exit passageway from normally occupied spaces and for egress from the exit passageway.

Where an interior exit stairway or ramp is extended to an exit discharge or a public way by an exit passageway, the exit passageway shall comply with Section 1023.3.1.

Elevators shall not open into an exit passageway.

[BE] 1024.6 Penetrations. Penetrations into or through an exit passageway are prohibited except for the following:

1. Equipment and ductwork necessary for independent ventilation or pressurization.
2. Fire protection systems.
3. Security systems.
4. Two-way communication systems.
5. Electrical raceway for fire department communication.

6. Electrical raceway serving the exit passageway and terminating at a steel box not exceeding 16 square inches (0.010 m²).

Such penetrations shall be protected in accordance with Section 714 of the *California Building Code*. There shall not be penetrations or communicating openings, whether protected or not, between adjacent exit passageways.

Exception: Membrane penetrations shall be permitted on the outside of the exit passageway. Such penetrations shall be protected in accordance with Section 714.4.2 of the *California Building Code*.

[BE] 1024.7 Ventilation. Equipment and ductwork for exit passageway ventilation as permitted by Section 1024.6 shall comply with one of the following:

1. The equipment and ductwork shall be located exterior to the building and shall be directly connected to the exit passageway by ductwork enclosed in construction as required for shafts.
2. Where the equipment and ductwork is located within the exit passageway, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or the air shall be conveyed through ducts enclosed in construction as required for shafts.
3. Where located within the building, the equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required for shafts.

In each case, openings into the fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by opening protectives in accordance with Section 716 of the *California Building Code* for shaft enclosures.

Exit passageway ventilation systems shall be independent of other building ventilation systems.

[BE] 1024.8 Exit passageway exterior walls. Exterior walls of the exit passageway shall comply with Section 705. Where nonrated walls or unprotected openings enclose the exterior of the exit passageway and the walls or openings are exposed by other parts of the building at an angle of less than 180 degrees (3.14 rad), the building exterior walls within 10 feet (3048 mm) horizontally of a nonrated wall or unprotected opening shall have a fire-resistance rating of not less than 1 hour. Openings within such exterior walls shall be protected by opening protectives having a fire protection rating of not less than $\frac{3}{4}$ hour. This construction shall extend vertically from the ground to a point 10 feet (3048 mm) above the floor of the exit passageway or to the roof line, whichever is lower.

[BE] 1024.9 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1025 LUMINOUS EGRESS PATH MARKINGS

[BE] 1025.1 General. Approved luminous egress path markings delineating the exit path shall be provided in high-rise

buildings of Group A, B, E, M or R-1 occupancies in accordance with this section.

Exception: Luminous egress path markings shall not be required on the level of exit discharge in lobbies that serve as part of the exit path in accordance with Section 1028.2, Exception 1.

[BE] 1025.2 Markings within exit components. Egress path markings shall be provided in interior exit stairways, interior exit ramps and exit passageways, in accordance with Sections 1025.2.1 through 1025.2.6.3.

[BE] 1025.2.1 Steps. A solid and continuous stripe shall be applied to the horizontal leading edge of each step and shall extend for the full length of the step. Outlining stripes shall have a minimum horizontal width of 1 inch (25 mm) and a maximum width of 2 inches (51 mm). The leading edge of the stripe shall be placed not more than $\frac{1}{2}$ inch (12.7 mm) from the leading edge of the step and the stripe shall not overlap the leading edge of the step by not more than $\frac{1}{2}$ inch (12.7 mm) down the vertical face of the step.

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

[BE] 1025.2.2 Landings. The leading edge of landings shall be marked with a stripe consistent with the dimensional requirements for steps.

[BE] 1025.2.3 Handrails. Handrails and handrail extensions shall be marked with a solid and continuous stripe having a minimum width of 1 inch (25 mm). The stripe shall be placed on the top surface of the handrail for the entire length of the handrail, including extensions and newel post caps. Where handrails or handrail extensions bend or turn corners, the stripe shall not have a gap of more than 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

[BE] 1025.2.4 Perimeter demarcation lines. Stair landings and other floor areas within interior exit stairways, interior exit ramps and exit passageways, with the exception of the sides of steps, shall be provided with solid and continuous demarcation lines on the floor or on the walls or a combination of both. The stripes shall be 1 to 2 inches (25 mm to 51 mm) wide with interruptions not exceeding 4 inches (102 mm).

Exception: The minimum width of 1 inch (25 mm) shall not apply to outlining stripes listed in accordance with UL 1994.

[BE] 1025.2.4.1 Floor-mounted demarcation lines. Perimeter demarcation lines shall be placed within 4 inches (102 mm) of the wall and shall extend to within 2 inches (51 mm) of the markings on the leading edge of landings. The demarcation lines shall continue across the floor in front of all doors.

Exception: Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit

and through which occupants must travel to complete the exit path.

[BE] 1025.2.4.2 Wall-mounted demarcation lines. Perimeter demarcation lines shall be placed on the wall with the bottom edge of the stripe not more than 4 inches (102 mm) above the finished floor. At the top or bottom of the stairs, demarcation lines shall drop vertically to the floor within 2 inches (51 mm) of the step or landing edge. Demarcation lines on walls shall transition vertically to the floor and then extend across the floor where a line on the floor is the only practical method of outlining the path. Where the wall line is broken by a door, demarcation lines on walls shall continue across the face of the door or transition to the floor and extend across the floor in front of such door.

Exception: Demarcation lines shall not extend in front of exit discharge doors that lead out of an exit and through which occupants must travel to complete the exit path.

[BE] 1025.2.4.3 Transition. Where a wall-mounted demarcation line transitions to a floor-mounted demarcation line, or vice-versa, the wall-mounted demarcation line shall drop vertically to the floor to meet a complimentary extension of the floor-mounted demarcation line, thus forming a continuous marking.

[BE] 1025.2.5 Obstacles. Obstacles at or below 6 feet 6 inches (1981 mm) in height and projecting more than 4 inches (102 mm) into the egress path shall be outlined with markings not less than 1 inch (25 mm) in width comprised of a pattern of alternating equal bands, of luminous material and black, with the alternating bands not more than 2 inches (51 mm) thick and angled at 45 degrees (0.79 rad). Obstacles shall include, but are not limited to, standpipes, hose cabinets, wall projections, and restricted height areas. However, such markings shall not conceal any required information or indicators including but not limited to instructions to occupants for the use of standpipes.

Exception: The minimum width of 1 inch (25 mm) shall not apply to markings listed in accordance with UL 1994.

[BE] 1025.2.6 Doors within the exit path. Doors through which occupants must pass in order to complete the exit path shall be provided with markings complying with Sections 1025.2.6.1 through 1025.2.6.3.

[BE] 1025.2.6.1 Emergency exit symbol. The doors shall be identified by a low-location luminous emergency exit symbol complying with NFPA 170. The exit symbol shall be not less than 4 inches (102 mm) in height and shall be mounted on the door, centered horizontally, with the top of the symbol not higher than 18 inches (457 mm) above the finished floor.

[BE] 1025.2.6.2 Door hardware markings. Door hardware shall be marked with not less than 16 square inches (10323 mm²) of luminous material. This marking shall be located behind, immediately adjacent to, or on the door handle or escutcheon. Where a panic bar is

installed, such material shall be not less than 1 inch (25 mm) wide for the entire length of the actuating bar or touchpad.

[BE] 1025.2.6.3 Door frame markings. The top and sides of the door frame shall be marked with a solid and continuous 1-inch- to 2-inch-wide (25 mm to 51 mm) stripe. Where the door molding does not provide sufficient flat surface on which to locate the stripe, the stripe shall be permitted to be located on the wall surrounding the frame.

[BE] 1025.3 Uniformity. Placement and dimensions of markings shall be consistent and uniform throughout the same enclosure.

[BE] 1025.4 Self-luminous and photoluminescent. Luminous egress path markings shall be permitted to be made of any material, including paint, provided that an electrical charge is not required to maintain the required luminance. Such materials shall include, but not be limited to, self-luminous materials and photoluminescent materials. Materials shall comply with either of the following standards:

1. UL 1994.
2. ASTM E2072, except that the charging source shall be 1 footcandle (11 lux) of fluorescent illumination for 60 minutes, and the minimum luminance shall be 30 milicandelas per square meter at 10 minutes and 5 milicandelas per square meter after 90 minutes.

[BE] 1025.5 Illumination. Where photoluminescent exit path markings are installed, they shall be provided with not less than 1 footcandle (11 lux) of illumination for not less than 60 minutes prior to periods when the building is occupied and continuously during the building occupancy.

SECTION 1026 HORIZONTAL EXITS

[BE] 1026.1 General. Horizontal exits serving as an exit in a means of egress system shall comply with the requirements of this section. A horizontal exit shall not serve as the only exit from a portion of a building, and where two or more exits are required, not more than one-half of the total number of exits or total exit minimum width or required capacity shall be horizontal exits.

Exceptions:

1. Horizontal exits are permitted to comprise two-thirds of the required exits from any building or floor area for occupancies in Group I-2.
2. Horizontal exits are permitted to comprise 100 percent of the exits required for occupancies in Group I-3. Not less than 6 square feet (0.6 m²) of accessible space per occupant shall be provided on each side of the horizontal exit for the total number of people in adjoining compartments.

[BE] 1026.2 Separation. The separation between buildings or refuge areas connected by a horizontal exit shall be provided by a fire wall complying with Section 706 of the *California Building Code*; or by a fire barrier complying with

Section 707 of the *California Building Code* or a horizontal assembly complying with Section 711 of the *California Building Code*, or both. The minimum fire-resistance rating of the separation shall be 2 hours. Opening protectives in horizontal exits shall also comply with Section 716 of the *California Building Code*. Duct and air transfer openings in a fire wall or fire barrier that serves as a horizontal exit shall also comply with Section 717 of the *California Building Code*. The horizontal exit separation shall extend vertically through all levels of the building unless floor assemblies have a fire-resistance rating of not less than 2 hours and do not have unprotected openings.

Exception: A fire-resistance rating is not required at horizontal exits between a building area and an above-grade pedestrian walkway constructed in accordance with Section 3104 of the *California Building Code*, provided that the distance between connected buildings is more than 20 feet (6096 mm).

Horizontal exits constructed as fire barriers shall be continuous from exterior wall to exterior wall so as to divide completely the floor served by the horizontal exit.

[BE] 1026.3 Opening protectives. Fire doors in horizontal exits shall be self-closing or automatic-closing when activated by a smoke detector in accordance with Section 716.2.6.6 of the *California Building Code*. Doors, where located in a cross-corridor condition, shall be automatic-closing by activation of a smoke detector installed in accordance with Section 716.2.6.6 of the *California Building Code*.

[BE] 1026.4 Refuge area. The refuge area of a horizontal exit shall be a space occupied by the same tenant or a public area and each such refuge area shall be adequate to accommodate the original occupant load of the refuge area plus the occupant load anticipated from the adjoining compartment. The anticipated occupant load from the adjoining compartment shall be based on the capacity of the horizontal exit doors entering the refuge area, or the total occupant load of the adjoining compartment, whichever is less.

[BE] 1026.4.1 Capacity. The capacity of the refuge area shall be computed based on a net floor area allowance of 3 square feet (0.2787 m²) for each occupant to be accommodated therein. Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-2, I-2.1, I-3 and R-2.1 occupancies shall comply with Sections 407.5.3, 408.6.2 and 420.6.2 of the *California Building Code* as applicable.

[BE] 1026.4.2 Number of exits. The refuge area into which a horizontal exit leads shall be provided with exits adequate to meet the occupant requirements of this chapter, but not including the added occupant load imposed by persons entering the refuge area through horizontal exits from other areas. *In other than I-3 occupancies, not less than one refuge area exit shall lead directly to the exterior or to an interior exit stairway or ramp.*

Exception: The adjoining compartment shall not be required to have a stairway or door leading directly outside, provided that the refuge area into which a horizontal exit leads has stairways or doors leading directly

outside and are so arranged that egress shall not require the occupants to return through the compartment from which egress originates.

[BE] 1026.5 Standpipes. Standpipes and standpipe hose connections shall be provided where required by Sections 905.3 and 905.4.

SECTION 1027 EXTERIOR EXIT STAIRWAYS AND RAMPS

[BE] 1027.1 General. Exterior exit stairways and ramps serving as an exit component in a means of egress system shall comply with the requirements of this section.

[BE] 1027.2 Use in a means of egress. Exterior exit stairways shall not be used as an element of a required means of egress for Group I-2 occupancies. For occupancies in other than Group I-2, exterior exit stairways and ramps shall be permitted as an element of a required means of egress for buildings not exceeding six stories above grade plane or that are not high-rise buildings.

[BE] 1027.3 Open side. Exterior exit stairways and ramps serving as an element of a required means of egress shall be open on not less than one side, except for required structural columns, beams, handrails and guards. An open side shall have not less than 35 square feet (3.3 m²) of aggregate open area adjacent to each floor level and the level of each intermediate landing. The required open area shall be located not less than 42 inches (1067 mm) above the adjacent floor or landing level.

[BE] 1027.4 Side yards. The open areas adjoining exterior exit stairways or ramps shall be either yards, courts or public ways; the remaining sides are permitted to be enclosed by the exterior walls of the building.

[BE] 1027.5 Location. Exterior exit stairways and ramps shall have a minimum fire separation distance of 10 feet (3048 mm) measured at right angles from the exterior edge of the stairway or ramps, including landings, to:

1. Adjacent lot lines.
2. Other portions of the building.
3. Other buildings on the same lot unless the adjacent building exterior walls and openings are protected in accordance with Section 705 of the *California Building Code* based on fire separation distance.

For the purposes of this section, other portions of the building shall be treated as separate buildings.

Exception: Exterior exit stairways and ramps serving individual dwelling units of Group R-3 shall have a fire separation distance of not less than 5 feet (1524 mm).

[BE] 1027.6 Exterior exit stairway and ramp protection. Exterior exit stairways and ramps shall be separated from the interior of the building as required in Section 1023.2. Openings shall be limited to those necessary for egress from normally occupied spaces. Where a vertical plane projecting from the edge of an exterior exit stairway or ramp and landings is exposed by other parts of the building at an angle of

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less than 180 degrees (3.14 rad), the exterior wall shall be rated in accordance with Section 1023.7.

Exceptions:

1. Separation from the interior of the building is not required for occupancies, other than those in Group R-1 or R-2, in buildings that are not more than two stories above grade plane where a level of exit discharge serving such occupancies is the first story above grade plane.
2. Separation from the interior of the building is not required where the exterior exit stairway or ramp is served by an exterior exit ramp or balcony that connects two remote exterior exit stairways or other approved exits, with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be not less than 50 percent of the height of the enclosing wall, with the top of the openings not less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the open-ended corridor of the building is not required for exterior exit stairways or ramps, provided that Items 3.1 through 3.5 are met:
 - 3.1. The building, including open-ended corridors, and stairways and ramps, shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.
 - 3.2. The open-ended corridors comply with Section 1020.
 - 3.3. The open-ended corridors are connected on each end to an exterior exit stairway or ramp complying with Section 1027.
 - 3.4. The exterior walls and openings adjacent to the exterior exit stairway or ramp comply with Section 1023.7.
 - 3.5. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3.3 m²) or an exterior stairway or ramp shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.
4. In Group R-3 occupancies not more than four stories in height, exterior exit stairways and ramps serving individual dwelling units are not required to be separated from the interior of the building where the exterior exit stairway or ramp discharges directly to grade.

SECTION 1028 EXIT DISCHARGE

[BE] 1028.1 General. The exit discharge shall comply with Sections 1028 and 1029 and the applicable requirements of Sections 1003 through 1015.

[BE] 1028.2 Exit discharge. Exits shall discharge directly to the exterior of the building. The exit discharge shall be at

grade or shall provide a direct path of egress travel to grade. The exit discharge shall not reenter a building. The combined use of Exceptions 1 and 2 shall not exceed 50 percent of the number and minimum width or required capacity of the required exits.

Exceptions:

1. Not more than 50 percent of the number and minimum width or required capacity of interior exit stairways and ramps is permitted to egress through areas, including atriums, on the level of discharge provided that all of the following conditions are met:
 - 1.1. Discharge of interior exit stairways and ramps shall be provided with a free and unobstructed path of travel to an exterior exit door and such exit is readily visible and identifiable from the point of termination of the enclosure.
 - 1.2. The entire area of the level of exit discharge is separated from areas below by construction conforming to the fire-resistance rating for the enclosure.
 - 1.3. The egress path from the interior exit stairway and ramp on the level of exit discharge is protected throughout by an approved automatic sprinkler system. Portions of the level of exit discharge with access to the egress path shall either be equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, or separated from the egress path in accordance with the requirements for the enclosure of interior exit stairways or ramps.
 - 1.4. Where a required interior exit stairway or ramp and an exit access stairway or ramp serve the same floor level and terminate at the same level of exit discharge, the termination of the exit access stairway or ramp and the exit discharge door of the interior exit stairway or ramp shall be separated by a distance of not less than 30 feet (9144 mm) or not less than one-fourth the length of the maximum overall diagonal dimension of the building, whichever is less. The distance shall be measured in a straight line between the exit discharge door from the interior exit stairway or ramp and the last tread of the exit access stairway or termination of slope of the exit access ramp.
2. Not more than 50 percent of the number and minimum width or required capacity of the interior exit stairways and ramps is permitted to egress through a vestibule provided that all of the following conditions are met:
 - 2.1. The entire area of the vestibule is separated from areas below by construction conform-

ing to the fire-resistance rating of the interior exit stairway or ramp enclosure.

- 2.2. The depth from the exterior of the building is not greater than 10 feet (3048 mm) and the length is not greater than 30 feet (9144 mm).
- 2.3. The area is separated from the remainder of the level of exit discharge by a fire partition constructed in accordance with Section 708 of the *California Building Code*.

Exception: The maximum transmitted temperature rise is not required.
- 2.4. The area is used only for means of egress and exits directly to the outside.
3. Horizontal exits complying with Section 1026 shall not be required to discharge directly to the exterior of the building.

[BE] 1028.3 Exit discharge width or capacity. The minimum width or required capacity of the exit discharge shall be not less than the minimum width or required capacity of the exits being served.

[BE] 1028.4 Exit discharge components. Exit discharge components shall be sufficiently open to the exterior so as to minimize the accumulation of smoke and toxic gases.

[BE] 1028.5 Access to a public way. The exit discharge shall provide a direct and unobstructed access to a public way.

Exception: Where access to a public way cannot be provided, a safe dispersal area shall be provided where all of the following are met:

1. The area shall be of a size to accommodate not less than 5 square feet (0.46 m²) for each person.
2. *For other than Group E buildings* the area shall be located on the same lot not less than 50 feet (15 240 mm) away from the building requiring egress. *For Group E buildings, the area shall be located on the same lot at least 50 feet (15 240 mm) away from any building.*
3. The area shall be permanently maintained and identified as a safe dispersal area.
4. The area shall be provided with a safe and unobstructed path of travel from the building.

SECTION 1029 EGRESS COURTS

[BE] 1029.1 General. Egress courts serving as an exit discharge component in the means of egress system shall comply with the requirements in this section.

[BE] 1029.2 Width or capacity. The required capacity of egress courts shall be determined as specified in Section 1005.1, but the minimum width shall be not less than 44 inches (1118 mm), except as specified herein. Egress courts serving Group R-3 and U occupancies shall be not less than 36 inches (914 mm) in width. The required capacity and

width of egress courts shall be unobstructed to a height of 7 feet (2134 mm).

The width of the egress court shall be not less than the required capacity.

Exception: Encroachments complying with Section 1005.7.

[BE] 1029.3 Construction and openings. Where an egress court serving a building or portion thereof is less than 10 feet (3048 mm) in width, the egress court walls shall have not less than 1-hour fire-resistance-rated construction for a distance of 10 feet (3048 mm) above the floor of the egress court. Openings within such walls shall be protected by opening protectives having a fire protection rating of not less than ³/₄ hour.

Exceptions:

1. Egress courts serving an occupant load of less than 10.
2. Egress courts serving Group R-3.

SECTION 1030 ASSEMBLY

[BE] 1030.1 General. A room or space used for assembly purposes that contains seats, tables, displays, equipment or other material shall comply with this section.

Exception: *Group A occupancies within Group I-3 facilities are exempt from egress requirements of Section 1029.*

[BE] 1030.1.1 Bleachers. Bleachers, grandstands and folding and telescopic seating, that are not building elements, shall comply with ICC 300.

[BE] 1030.1.1.1 Spaces under grandstands and bleachers. Spaces under grandstands or bleachers shall be separated by fire barriers complying with Section 707 of the *California Building Code* and horizontal assemblies complying with Section 711 of the *California Building Code* with not less than 1-hour fire-resistance-rated construction.

Exceptions:

1. Ticket booths less than 100 square feet (9 m²) in area.
2. Toilet rooms.
3. Other accessory use areas 1,000 square feet (93 m²) or less in area and equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

[BE] 1030.2 Assembly main exit. A building, room or space used for assembly purposes that has an occupant load of greater than 300 and is provided with a main exit, that main exit shall be of sufficient capacity to accommodate not less than one-half of the occupant load, but such capacity shall be not less than the total required capacity of all means of egress leading to the exit. Where the building is classified as a Group A occupancy, the main exit shall front on not less than one street or an unoccupied space of not less than 20 feet (6096 mm) in width that adjoins a street or public way. In a building, room or space used for assembly purposes where

there is not a well-defined main exit or where multiple main exits are provided, exits shall be permitted to be distributed around the perimeter of the building provided that the total capacity of egress is not less than 100 percent of the required capacity *and not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or publicway. Smoke-protected seating shall comply with Section 1030.6.2.*

[BE] 1030.3 Assembly other exits. In addition to having access to a main exit, each level in a building used for assembly purposes having an occupant load greater than 300 and provided with a main exit, shall be provided with additional means of egress that shall provide an egress capacity for not less than one-half of the total occupant load served by that level and shall comply with Section 1007.1. *Not less than one-half of the additional means of egress required by this section shall be directly to an exit, or through a lobby, that is not used to access the main exit, to an exit, or to a 1-hour rated corridor to an exit.* In a building used for assembly purposes where there is not a well-defined main exit or where multiple main exits are provided, exits for each level shall be permitted to be distributed around the perimeter of the building, provided that the total width of egress is not less than 100 percent of the required width *and not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or publicway. Smoke-protected seating shall comply with Section 1030.6.2.*

1030.3.1 Occupant loads 300 or less. *Group A occupancies or assembly occupancies accessory to Group E occupancies that have an occupant load of 100 or more and 300 or less, shall have not less than one of the required means of egress directly to an exit, or through a lobby, that is not used to access the other required exit, to an exit, or to a 1-hour rated corridor to an exit or continuous through a 1-hour rated lobby to an exit. Not less than one exit shall discharge on a street or an unoccupied space of not less than 20 feet (6096 mm) in capacity that adjoins a street or public way.*

[BE] 1030.4 Foyers and lobbies. In Group A-1 occupancies, where persons are admitted to the building at times when seats are not available, such persons shall be allowed to wait in a lobby or similar space, provided that such lobby or similar space shall not encroach on the minimum width or required capacity of the means of egress. Such foyer, if not directly connected to a public street by all the main entrances or exits, shall have a straight and unobstructed corridor or path of travel to every such main entrance or exit.

[BE] 1030.5 Interior balcony and gallery means of egress. For balconies, galleries or press boxes having a seating capacity of 50 or more located in a building, room or space used for assembly purposes, not less than two means of egress shall be provided, with one from each side of every balcony, gallery or press box.

[BE] 1030.6 Capacity of aisle for assembly. The required capacity of aisles shall be not less than that determined in accordance with Section 1030.6.1 where smoke-protected assembly seating is not provided, with Section 1030.6.2

where smoke-protected assembly seating is provided, and with Section 1030.6.3 where open-air assembly seating is provided.

[BE] 1030.6.1 Without smoke protection. The required capacity in inches (mm) of the aisles for assembly seating without smoke protection shall be not less than the occupant load served by the egress element in accordance with all of the following, as applicable:

1. Not less than 0.3 inch (7.6 mm) of aisle capacity for each occupant served shall be provided on stepped aisles having riser heights 7 inches (178 mm) or less and tread depths 11 inches (279 mm) or greater, measured horizontally between tread nosings.
2. Not less than 0.005 inch (0.127 mm) of additional aisle capacity for each occupant shall be provided for each 0.10 inch (2.5mm) of riser height above 7 inches (178 mm).
3. Where egress requires stepped aisle descent, not less than 0.075 inch (1.9 mm) of additional aisle capacity for each occupant shall be provided on those portions of aisle capacity that do not have a handrail within a horizontal distance of 30 inches (762 mm).
4. Ramped aisles, where slopes are steeper than 1 unit vertical in 12 units horizontal (8-percent slope), shall have not less than 0.22 inch (5.6 mm) of clear aisle capacity for each occupant served. Level or ramped aisles, where slopes are not steeper than 1 unit vertical in 12 units horizontal (8-percent slope), shall have not less than 0.20 inch (5.1 mm) of clear aisle capacity for each occupant served.

[BE] 1030.6.2 Smoke-protected assembly seating. The required capacity in inches (mm) of the aisle for smoke-protected assembly seating shall be not less than the occupant load served by the egress element multiplied by the appropriate factor in Table 1030.6.2. The total number of seats specified shall be those within the space exposed to the same smoke-protected environment. Interpolation is permitted between the specific values shown. A life safety evaluation, complying with NFPA 101, shall be done for a facility utilizing the reduced width requirements of Table 1030.6.2 for smoke-protected assembly seating.

[BE] 1030.6.2.1 Smoke control. Aisles and aisle accessways serving a smoke-protected assembly seating area shall be provided with a smoke control system complying with Section 909 or natural ventilation designed to maintain the smoke level not less than 6 feet (1829 mm) above the floor of the means of egress.

[BE] 1030.6.2.2 Roof height. A smoke-protected assembly seating area with a roof shall have the lowest portion of the roof deck not less than 15 feet (4572 mm) above the highest aisle or aisle accessway.

Exception: A roof canopy in an outdoor stadium shall be permitted to be less than 15 feet (4572 mm) above the highest aisle or aisle accessway provided that there are no objects less than 80 inches (2032 mm) above the highest aisle or aisle accessway.

[BE] 1030.6.2.3 Automatic sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing smoke-protected assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exceptions:

1. The floor area used for contests, performances or entertainment provided that the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low fire hazard uses.
2. Press boxes and storage facilities less than 1,000 square feet (93 m²) in area.

[BE] 1030.6.3 Open-air assembly seating. In open-air assembly seating, the required capacity in inches (mm) of aisles shall be not less than the total occupant load served by the egress element multiplied by 0.08 (2.0 mm) where egress is by stepped aisle and multiplied by 0.06 (1.52 mm) where egress is by level aisles and ramped aisles.

Exception: The required capacity in inches (mm) of aisles shall be permitted to comply with Section 1030.6.2 for the number of seats in the open-air assembly seating where Section 1030.6.2 permits less capacity.

[BE] 1030.6.3.1 Automatic sprinklers. Enclosed areas with walls and ceilings in buildings or structures containing open-air assembly seating shall be protected with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exceptions:

1. The floor area used for contests, performances or entertainment, provided that the roof construction is more than 50 feet (15 240 mm) above the floor level and the use is restricted to low-fire hazard uses.
2. Press boxes and storage facilities less than 1,000 square feet (93 m²) in area.
3. Open-air assembly seating facilities where seating and the means of egress in the seating area are essentially open to the outside.

1030.6.3.2 Public address system. See Section 907.2.1.1.

[BE] 1030.7 Travel distance. The exit access travel distance shall comply with Section 1017. Where aisles are provided for seating, the distance shall be measured along the aisles and aisle accessways without travel over or on the seats.

Exceptions:

1. In facilities with smoke-protected assembly seating the total exit access travel distance shall be not greater than 400 feet (122 m). That portion of the total permitted exit access travel distance from each seat to the nearest entrance to a vomitory or concourse shall not exceed 200 feet (60 960 mm). The portion of the total permitted exit access travel distance from the entrance to the vomitory or concourse to one of the following shall not exceed 200 feet (60 960 mm).
 - 1.1. The closest riser of an exit access stairway.
 - 1.2. The closest slope of an exit access ramp.
 - 1.3. An exit.
2. In facilities with open-air assembly seating of Type III, IV or V construction, the total exit access travel distance to one of the following shall not exceed 400 feet (122 m).
 - 2.1. The closest riser of an exit access stairway.
 - 2.2. The closest slope of an exit access ramp.
 - 2.3. An exit.
3. In facilities with open-air assembly seating of Type I or II construction, the exit access travel distance shall not be limited.

[BE] 1030.8 Common path of egress travel. The common path of egress travel shall not exceed 30 feet (9144 mm) from any seat to a point where an occupant has a choice of two paths of egress travel to two exits.

Exceptions:

1. For areas serving less than 50 occupants, the common path of egress travel shall not exceed 75 feet (22 860 mm).
2. For smoke-protected or open-air assembly seating, the common path of egress travel shall not exceed 50 feet (15 240 mm).

[BE] 1030.8.1 Path through adjacent row. Where one of the two paths of travel is across the aisle through a row of

**[BE] TABLE 1030.6.2
CAPACITY FOR AISLES FOR SMOKE-PROTECTED ASSEMBLY**

TOTAL NUMBER OF SEATS IN THE SMOKE-PROTECTED ASSEMBLY SEATING	INCHES OF CAPACITY PER SEAT SERVED			
	Stepped aisles with handrails within 30 inches	Stepped aisles without handrails within 30 inches	Level aisles or ramped aisles not steeper than 1 in 10 in slope	Ramped aisles steeper than 1 in 10 in slope
Equal to or less than 5,000	0.200	0.250	0.150	0.165
10,000	0.130	0.163	0.100	0.110
15,000	0.096	0.120	0.070	0.077
20,000	0.076	0.095	0.056	0.062
Equal to or greater than 25,000	0.060	0.075	0.044	0.048

For SI: 1 inch = 25.4 mm.

seats to another aisle, there shall be not more than 24 seats between the two aisles, and the minimum clear width between rows for the row between the two aisles shall be 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row between aisles.

Exception: For smoke-protected or open-air assembly seating there shall be not more than 40 seats between the two aisles and the minimum clear width shall be 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat.

[BE] 1030.9 Assembly aisles are required. Every occupied portion of any building, room or space used for assembly purposes that contains seats, tables, displays, similar fixtures or equipment shall be provided with aisles leading to exits or exit access doorways in accordance with this section.

[BE] 1030.9.1 Minimum aisle width. The minimum clear width for aisles shall comply with one of the following:

1. Forty-eight inches (1219 mm) for stepped aisles having seating on both sides.

Exception: Thirty-six inches (914 mm) where the stepped aisles serve less than 50 seats.

2. Thirty-six inches (914 mm) for stepped aisles having seating on only one side.

Exception: Twenty-three inches (584 mm) between a stepped aisle handrail and seating where a stepped aisle does not serve more than five rows on one side.

3. Twenty-three inches (584 mm) between a stepped aisle handrail or guard and seating where the stepped aisle is subdivided by a mid-aisle handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

Exceptions:

1. Thirty-six inches (914 mm) where the aisle serves less than 50 seats.
2. Thirty inches (762 mm) where the aisle serves fewer than 15 seats and does not serve as part of an accessible route.
5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.

Exception: Thirty inches (762 mm) where the aisle serves fewer than 15 seats and does not serve as part of an accessible route.

6. *Libraries with open book stacks shall have main aisles not less than 44 inches (1118 mm) in width, and side, range and end aisles not less than 36 inches (914 mm) in width.*

[BE] 1030.9.2 Aisle catchment area. The aisle shall provide sufficient capacity for the number of persons accommodated by the catchment area served by the aisle. The catchment area served by an aisle is that portion of the total space served by that section of the aisle. In establishing catchment areas, the assumption shall be made that

there is a balanced use of all means of egress, with the number of persons in proportion to egress capacity.

[BE] 1030.9.3 Converging aisles. Where aisles converge to form a single path of egress travel, the required capacity of that path shall be not less than the combined required capacity of the converging aisles.

[BE] 1030.9.4 Uniform width and capacity. Those portions of aisles, where egress is possible in either of two directions, shall be uniform in minimum width or required capacity.

[BE] 1030.9.5 Dead-end aisles. Each end of an aisle shall be continuous to a cross aisle, foyer, doorway, vomitory, concourse or stairway in accordance with Section 1030.9.7 having access to an exit.

Exceptions:

1. Dead-end aisles shall be not greater than 20 feet (6096 mm) in length.
2. Dead-end aisles longer than 16 rows are permitted where seats beyond the 16th row dead-end aisle are not more than 24 seats from another aisle, measured along a row of seats having a minimum clear width of 12 inches (305 mm) plus 0.6 inch (15.2 mm) for each additional seat above seven in the row where seats have backrests or beyond 10 where seats are without backrests in the row.
3. For smoke-protected or open-air assembly seating, the dead-end aisle length of vertical aisles shall not exceed a distance of 21 rows.
4. For smoke-protected or open-air assembly seating, a longer dead-end aisle is permitted where seats beyond the 21-row dead-end aisle are not more than 40 seats from another aisle, measured along a row of seats having an aisle accessway with a minimum clear width of 12 inches (305 mm) plus 0.3 inch (7.6 mm) for each additional seat above seven in the row where seats have backrests or beyond 10 where seats are without backrests in the row.

[BE] 1030.9.6 Aisle measurement. The clear width for aisles shall be measured to walls, edges of seating and tread edges except for permitted projections.

Exception: The clear width of aisles adjacent to seating at tables shall be permitted to be measured in accordance with Section 1030.13.1.

[BE] 1030.9.6.1 Assembly aisle obstructions. There shall not be obstructions in the minimum width or required capacity of aisles.

Exception: Handrails are permitted to project into the required width of stepped aisles and ramped aisles in accordance with Section 1014.8.

[BE] 1030.9.7 Stairways connecting to stepped aisles. A stairway that connects a stepped aisle to a cross aisle or concourse shall be permitted to comply with the assembly aisle walking surface requirements of Section 1030.14.

Transitions between stairways and stepped aisles shall comply with Section 1030.10.

[BE] 1030.9.8 Stairways connecting to vomitories. A stairway that connects a vomitory to a cross aisle or concourse shall be permitted to comply with the assembly aisle walking surface requirements of Section 1030.14. Transitions between stairways and stepped aisles shall comply with Section 1030.10.

[BE] 1030.10 Transitions. Transitions between stairways and stepped aisles shall comply with either Section 1030.10.1 or 1030.10.2.

[BE] 1030.10.1 Transitions to stairways that maintain stepped aisle riser and tread dimensions. Stepped aisles, transitions and stairways that maintain the stepped aisle riser and tread dimensions shall comply with Section 1030.14 as one exit access component.

[BE] 1030.10.2 Transitions to stairways that do not maintain stepped aisle riser and tread dimensions. Transitions between stairways and stepped aisles having different riser and tread dimensions shall comply with Sections 1030.10.2.1 through 1030.10.3.

[BE] 1030.10.2.1 Stairways and stepped aisles in a straight run. Where stairways and stepped aisles are in a straight run, transitions shall have one of the following:

1. A depth of not less than 22 inches (559 mm) where the treads on the descending side of the transition have greater depth.
2. A depth of not less than 30 inches (762 mm) where the treads on the descending side of the transition have lesser depth.

[BE] 1030.10.2.2 Stairways that change direction from stepped aisles. Transitions where the stairway changes direction from the stepped aisle shall have a minimum depth of 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater, between the stepped aisle and stairway.

[BE] 1030.10.3 Transition marking. A distinctive marking stripe shall be provided at each nosing or leading edge adjacent to the transition. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide. The edge marking stripe shall be distinctively different from the stepped aisle contrasting marking stripe.

[BE] 1030.11 Stepped aisles at vomitories. Stepped aisles that change direction at vomitories shall comply with Section 1030.11.1. Transitions between a stepped aisle above a vomitory and a stepped aisle to the side of a vomitory shall comply with Section 1030.11.2.

[BE] 1030.11.1 Stepped aisles that change direction at vomitories. Stepped aisle treads where the stepped aisle changes direction at a vomitory shall have a depth of not less than 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater. The height of a stepped aisle tread above a transition at a vomitory shall comply with Section 1030.14.2.2.

[BE] 1030.11.2 Stepped aisle transitions at the top of vomitories. Transitions between the stepped aisle above a vomitory and stepped aisles to the side of a vomitory shall have a depth of not less than 11 inches (280 mm) or the stepped aisle tread depth, whichever is greater.

[BE] 1030.12 Construction. Aisles, stepped aisles and ramped aisles shall be built of materials consistent with the types permitted for the type of construction of the building.

Exception: Wood handrails shall be permitted for all types of construction.

[BE] 1030.12.1 Walking surface. The surface of aisles, stepped aisles and ramped aisles shall be of slip-resistant materials that are securely attached. The surface for stepped aisles shall comply with Section 1011.7.1.

[BE] 1030.12.2 Outdoor conditions. Outdoor aisles, stepped aisles and ramped aisles and outdoor approaches to aisles, stepped aisles and ramped aisles shall be designed so that water will not accumulate on the walking surface.

[BE] 1030.13 Aisle accessways. Aisle accessways for seating at tables shall comply with Section 1030.13.1. Aisle accessways for seating in rows shall comply with Section 1030.13.2.

[BE] 1030.13.1 Seating at tables. Where seating is located at a table or counter and is adjacent to an aisle or aisle accessway, the measurement of required clear width of the aisle or aisle accessway shall be made to a line 19 inches (483 mm) away from and parallel to the edge of the table or counter. The 19-inch (483 mm) distance shall be measured perpendicular to the side of the table or counter. In the case of other side boundaries for aisles or aisle accessways, the clear width shall be measured to walls, edges of seating and tread edges.

Exception: Where tables or counters are served by fixed seats, the width of the aisle or aisle accessway shall be measured from the back of the seat.

[BE] 1030.13.1.1 Aisle accessway capacity and width for seating at tables. Aisle accessways serving arrangements of seating at tables or counters shall comply with the capacity requirements of Section 1005.1 but shall not have less than 12 inches (305 mm) of width plus $\frac{1}{2}$ inch (12.7 mm) of width for each additional 1 foot (305 mm), or fraction thereof, beyond 12 feet (3658 mm) of aisle accessway length measured from the center of the seat farthest from an aisle.

Exception: Portions of an aisle accessway having a length not exceeding 6 feet (1829 mm) and used by a total of not more than four persons.

[BE] 1030.13.1.2 Seating at table aisle accessway length. The length of travel along the aisle accessway shall not exceed 30 feet (9144 mm) from any seat to the point where a person has a choice of two or more paths of egress travel to separate exits.

[BE] 1030.13.2 Clear width of aisle accessways serving seating in rows. Where seating rows have 14 or fewer seats, the minimum clear aisle accessway width shall be not

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less than 12 inches (305 mm) measured as the clear horizontal distance from the back of the row ahead and the nearest projection of the row behind. Where chairs have automatic or self-rising seats, the measurement shall be made with seats in the raised position. Where any chair in the row does not have an automatic or self-rising seat, the measurements shall be made with the seat in the down position. For seats with folding tablet arms, row spacing shall be determined with the tablet arm in the used position.

Exception: For seats with folding tablet arms, row spacing is permitted to be determined with the tablet arm in the stored position where the tablet arm when raised manually to vertical position in one motion automatically returns to the stored position by force of gravity.

[BE] 1030.13.2.1 Dual access. For rows of seating served by aisles or doorways at both ends, there shall be not more than 100 seats per row. The minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.3 inch (7.6 mm) for every additional seat beyond 14 seats where seats have backrests or beyond 21 where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

Exception: For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1030.13.2.1.

[BE] 1030.13.2.2 Single access. For rows of seating served by an aisle or doorway at only one end of the row, the minimum clear width of 12 inches (305 mm) between rows shall be increased by 0.6 inch (15.2 mm) for every additional seat beyond seven seats where seats have backrests or beyond 10 where seats are without backrests. The minimum clear width is not required to exceed 22 inches (559 mm).

Exception: For smoke-protected or open-air assembly seating, the row length limits for a 12-inch-wide (305 mm) aisle accessway, beyond which the aisle accessway minimum clear width shall be increased, are in Table 1030.13.2.1.

[BE] 1030.14 Assembly aisle walking surfaces. Ramped aisles shall comply with Sections 1030.14.1 through 1030.14.1.3. Stepped aisles shall comply with Sections 1030.14.2 through 1030.14.2.4.

[BE] 1030.14.1 Ramped aisles. Aisles that are sloped more than 1 unit vertical in 20 units horizontal (5-percent slope) shall be considered to be a ramped aisle. Ramped aisles that serve as part of an accessible route in accordance with Section 1009 of this code and Section 1108.2 of the *California Building Code* shall have a maximum slope of 1 unit vertical in 12 units horizontal (8-percent slope). The slope of other ramped aisles shall not exceed 1 unit vertical in 8 units horizontal (12.5-percent slope).

[BE] 1030.14.1.1 Cross slope. The slope measured perpendicular to the direction of travel of a ramped aisle shall not be steeper than 1 unit vertical in 48 units horizontal (2-percent slope).

[BE] 1030.14.1.2 Landings. Ramped aisles shall have landings in accordance with Sections 1012.6 through 1012.6.5. Landings for ramped aisles shall be permitted to overlap required aisles or cross aisles.

[BE] 1030.14.1.3 Edge protection. Ramped aisles shall have edge protection in accordance with Sections 1012.10 and 1012.10.1.

Exception: In assembly spaces with fixed seating, edge protection is not required on the sides of ramped aisles where the ramped aisles provide access to the adjacent seating and aisle accessways.

[BE] 1030.14.2 Stepped aisles. Aisles with a slope exceeding 1 unit vertical in 8 units horizontal (12.5-percent slope) shall consist of a series of risers and treads that extends across the full width of aisles and complies with Sections 1030.14.2.1 through 1030.14.2.4.

[BE] 1030.14.2.1 Treads. Tread depths shall be not less than 11 inches (279 mm) and shall have dimensional uniformity.

Exception: The tolerance between adjacent treads shall not exceed $\frac{3}{16}$ inch (4.8 mm).

**[BE] TABLE 1030.13.2.1
SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY AISLE ACCESSWAYS**

NUMBER OF SEATS IN THE SMOKE-PROTECTED OR OPEN-AIR ASSEMBLY SEATING	MAXIMUM NUMBER OF SEATS PER ROW PERMITTED TO HAVE A MINIMUM 12-INCH CLEAR WIDTH AISLE ACCESSWAY			
	Aisle or doorway at both ends of row		Aisle or doorway at one end of row only	
	Seats with backrests	Seats without backrests	Seats with backrests	Seats without backrests
Less than 4,000	14	21	7	10
4,000 to 6,999	15	22	7	10
7,000 to 9,999	16	23	8	11
10,000 to 12,999	17	24	8	11
13,000 to 15,999	18	25	9	12
16,000 to 18,999	19	26	9	12
19,000 to 21,999	20	27	10	13
22,000 and greater	21	28	11	14

For SI: 1 inch = 25.4 mm.

[BE] 1030.14.2.2 Risers. Where the gradient of stepped aisles is to be the same as the gradient of adjoining seating areas, the riser height shall be not less than 4 inches (102 mm) nor more than 8 inches (203 mm) and shall be uniform within each flight.

Exceptions:

1. Riser height nonuniformity shall be limited to the extent necessitated by changes in the gradient of the adjoining seating area to maintain adequate sightlines. Where nonuniformities exceed $\frac{3}{16}$ inch (4.8 mm) between adjacent risers, the exact location of such nonuniformities shall be indicated with a distinctive marking stripe on each tread at the nosing or leading edge adjacent to the nonuniform risers. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide. The edge marking stripe shall be distinctively different from the contrasting marking stripe.
2. Riser heights not exceeding 9 inches (229 mm) shall be permitted where they are necessitated by the slope of the adjacent seating areas to maintain sightlines.

[BE] 1030.14.2.2.1 Construction tolerances. The tolerance between adjacent risers on a stepped aisle that were designed to be equal height shall not exceed $\frac{3}{16}$ inch (4.8 mm). Where the stepped aisle is designed in accordance with Exception 1 of Section 1030.14.2.2, the stepped aisle shall be constructed so that each riser of unequal height, determined in the direction of descent, is not more than $\frac{3}{8}$ inch (9.5 mm) in height different from adjacent risers where stepped aisle treads are less than 22 inches (560 mm) in depth and $\frac{3}{4}$ inch (19.1 mm) in height different from adjacent risers where stepped aisle treads are 22 inches (560 mm) or greater in depth.

[BE] 1030.14.2.3 Tread contrasting marking stripe. A contrasting marking stripe shall be provided on each tread at the nosing or leading edge such that the location of each tread is readily apparent when viewed in descent. Such stripe shall be not less than 1 inch (25 mm), and not more than 2 inches (51 mm), wide.

Exception: The contrasting marking stripe is permitted to be omitted where tread surfaces are such that the location of each tread is readily apparent when viewed in descent.

[BE] 1030.14.2.4 Nosing and profile. Nosing and riser profile shall comply with Sections 1011.5.5 through 1011.5.5.3.

[BE] 1030.15 Seat stability. In a building, room or space used for assembly purposes, the seats shall be securely fastened to the floor.

Exceptions:

1. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered

floors for seating and with 200 or fewer seats, the seats shall not be required to be fastened to the floor.

2. In a building, room or space used for assembly purposes or portions thereof with seating at tables and without ramped or tiered floors for seating, the seats shall not be required to be fastened to the floor.
3. In a building, room or space used for assembly purposes or portions thereof without ramped or tiered floors for seating and with greater than 200 seats, the seats shall be fastened together in groups of not less than three or the seats shall be securely fastened to the floor.
4. In a building, room or space used for assembly purposes where flexibility of the seating arrangement is an integral part of the design and function of the space and seating is on tiered levels, not more than 200 seats shall not be required to be fastened to the floor. Plans showing seating, tiers and aisles shall be submitted for approval.
5. Groups of seats within a building, room or space used for assembly purposes separated from other seating by railings, guards, partial height walls or similar barriers with level floors and having not more than 14 seats per group shall not be required to be fastened to the floor.
6. Seats intended for musicians or other performers and separated by railings, guards, partial height walls or similar barriers shall not be required to be fastened to the floor.

[California Code of Regulations, Title 19, Division 1, §3.06(a)] Bonding of Chairs and Spacing of Tables.

(a) Bonding of chairs. In every Group A and Group E occupancy, all loose seats, folding chairs or similar seating facilities that are not fixed to the floor shall be bonded together in groups of not less than three.

Exceptions:

- (1) When not more than 200 such seats, chairs or facilities are provided, bonding thereof may be deleted.
- (2) The bonding of chairs shall not be required when tables are provided as when the occupancy is used for dining or similar purposes.
- (3) Upon approval of the enforcing agency, the bonding of chairs shall not be required when the placement and location of such chairs do not obstruct any required exit or any line of egress toward required exits and do not constitute a fire hazard as defined in California Code of Regulations, Title 19, Division 1, Section 3.14.

[BE] 1030.16 Handrails. Ramped aisles having a slope exceeding 1 unit vertical in 15 units horizontal (6.7-percent slope) and stepped aisles shall be provided with handrails in compliance with Section 1014 located either at one or both sides of the aisle or within the aisle width. Where stepped aisles have seating on one side and the aisle width is 74

inches (1880 mm) or greater, two handrails are required. Where two handrails are required, one of the handrails shall be within 30 inches (762 mm) horizontally of the stepped aisle.

Exceptions:

1. Handrails are not required for ramped aisles with seating on both sides.
2. Handrails are not required where, at the side of the aisle, there is a guard with a top surface that complies with the graspability requirements of handrails in accordance with Section 1014.3.
3. Handrail extensions are not required at the top and bottom of stepped aisles and ramped aisles to permit crossovers within the aisles.

[BE] 1030.16.1 Discontinuous handrails. Where there is seating on both sides of the aisle, the mid-aisle handrails shall be discontinuous. Where a stepped aisle is required to have two handrails, the mid-aisle handrails shall be discontinuous. Gaps or breaks shall be provided at intervals not exceeding five rows to facilitate access to seating and to permit crossing from one side of the aisle to the other. These gaps or breaks shall have a clear width of not less than 22 inches (559 mm) and not greater than 36 inches (914 mm), measured horizontally, and the mid-aisle handrail shall have rounded terminations or bends.

[BE] 1030.16.2 Handrail termination. Handrails located on the side of stepped aisles shall return to a wall, guard or the walking surfaces or shall be continuous to the handrail of an adjacent stepped aisle flight.

[BE] 1030.16.3 Mid-aisle termination. Mid-aisle handrails shall not extend beyond the lowest riser and shall terminate within 18 inches (381 mm), measured horizontally, from the lowest riser. Handrail extensions are not required.

Exception: Mid-aisle handrails shall be permitted to extend beyond the lowest riser where the handrail extensions do not obstruct the width of the cross aisle.

[BE] 1030.16.4 Rails. Where mid-aisle handrails are provided in stepped aisles, there shall be an additional rail located approximately 12 inches (305 mm) below the handrail. The rail shall be adequate in strength and attachment in accordance with Section 1607.9.1.2 of the *California Building Code*.

[BE] 1030.17 Assembly guards. Guards adjacent to seating in a building, room or space used for assembly purposes shall be provided where required by Section 1015 and shall be constructed in accordance with Section 1015 except where provided in accordance with Sections 1030.17.1 through 1030.17.4. At bleachers, grandstands and folding and telescopic seating, guards must be provided where required by ICC 300 and Section 1030.17.1.

[BE] 1030.17.1 Perimeter guards. Perimeter guards shall be provided where the footboards or walking surface of seating facilities are more than 30 inches (762 mm) above the floor or grade below. Where the seatboards are adjacent to the perimeter, guard height shall be 42 inches (1067 mm) high minimum, measured from the seatboard.

Where the seats are self-rising, guard height shall be 42 inches (1067 mm) high minimum, measured from the floor surface. Where there is an aisle between the seating and the perimeter, the guard height shall be measured in accordance with Section 1015.3.

Exceptions:

1. Guards that impact sightlines shall be permitted to comply with Section 1030.17.3.
2. Bleachers, grandstands and folding and telescopic seating shall not be required to have perimeter guards where the seating is located adjacent to a wall and the space between the wall and the seating is less than 4 inches (102 mm).

[BE] 1030.17.2 Cross aisles. Cross aisles located more than 30 inches (762 mm) above the floor or grade below shall have guards in accordance with Section 1015.

Where an elevation change of 30 inches (762 mm) or less occurs between a cross aisle and the adjacent floor or grade below, guards not less than 26 inches (660 mm) above the aisle floor shall be provided.

Exception: Where the backs of seats on the front of the cross aisle project 24 inches (610 mm) or more above the adjacent floor of the aisle, a guard need not be provided.

[BE] 1030.17.3 Sightline-constrained guard heights. Unless subject to the requirements of Section 1030.17.4, a fascia or railing system in accordance with the guard requirements of Section 1015 and having a minimum height of 26 inches (660 mm) shall be provided where the floor or footboard elevation is more than 30 inches (762 mm) above the floor or grade below and the fascia or railing would otherwise interfere with the sightlines of immediately adjacent seating.

[BE] 1030.17.4 Guards at the end of aisles. A fascia or railing system complying with the guard requirements of Section 1015 shall be provided for the full width of the aisle where the foot of the aisle is more than 30 inches (762 mm) above the floor or grade below. The fascia or railing shall be not less than 36 inches (914 mm) high and shall provide not less than 42 inches (1067 mm) measured diagonally between the top of the rail and the nosing of the nearest tread.

SECTION 1031 EMERGENCY ESCAPE AND RESCUE

[BE] 1031.1 General. Emergency escape and rescue openings shall comply with the requirements of this section.

[BE] 1031.2 Where required. In addition to the means of egress required by this chapter, emergency escape and rescue openings shall be provided in *Group R* occupancies:

Basements and sleeping rooms below the fourth story above grade plane shall have not fewer than one emergency escape and rescue opening in accordance with this section. Where basements contain one or more sleeping rooms, an emergency escape and rescue opening shall be required in

each sleeping room, but shall not be required in adjoining areas of the basement. Such openings shall open directly into a public way or to a yard or court that opens to a public way.

Exceptions:

1. In Groups R-1 and R-2 occupancies constructed of Type I, Type IIA, Type IIIA or Type IV construction equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
2. Group R-2.1 occupancies meeting the requirements for delayed egress in accordance with Section 1010.2.13 may have operable windows that are breakable in sleeping rooms permanently restricted to a maximum of 4-inch open position.
3. Basements with a ceiling height of less than 80 inches (2032 mm) shall not be required to have emergency escape and rescue openings.
4. Emergency escape and rescue openings are not required from basements or sleeping rooms that have an exit door or exit access door that opens directly into a public way or to a yard, court or exterior egress balcony that opens to a public way.
5. Basements without habitable spaces and having not more than 200 square feet (18.6 m²) in floor area shall not be required to have emergency escape and rescue openings.
6. Storm shelters are not required to comply with this section where the shelter is constructed in accordance with ICC 500.
7. Within individual dwelling and sleeping units in Groups R-2 and R-3, where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3, sleeping rooms in basements shall not be required to have emergency escape and rescue openings provided that the basement has one of the following:
 - 7.1. One means of egress and one emergency escape and rescue opening.
 - 7.2. Two means of egress.
8. In Group R-2.2 occupancies a certified fire escape is acceptable as a secondary means of egress of existing buildings for this section of the code.

[BE] 1031.2.1 Operational constraints and opening control devices. Emergency escape and rescue openings and any exit doors shall be maintained free of any obstructions other than those allowed by this section and shall be operational from inside the room without the use of keys or tools. Window-opening control devices complying with ASTM F2090 shall be permitted for use on windows serving as a required emergency escape and rescue opening. The release mechanism shall be maintained operable at all times.

Such bars, grilles, grates or any similar devices shall be equipped with an approved exterior release device for use by

the fire department only when required by the authority having jurisdiction.

Where security bars (burglar bars) are installed on emergency egress and rescue windows or doors, on or after July 1, 2000, such devices shall comply with California Building Standards Code, Part 12, Chapter 12-3 and other applicable provisions of Part 2.

Exception: Group R-1 occupancies provided with a monitored fire sprinkler system in accordance with Section 903.2.8 and designed in accordance with NFPA 13 may have openable windows permanently restricted to a maximum 4-inch (102 mm) open position.

[California Code of Regulations, Title 19, Division 1, §4.2] Labeling.

Burglar bars shall not be sold in California at wholesale or retail unless warning information as specified in California Code of Regulations, Title 19, Division 1, Section 4.3 is provided either on the packaging or provided inside the packaging along with the burglar bars.

[California Code of Regulations, Title 19, Division 1, §4.3(a) through (c)] Warning Information.

(a) Warning information located on or in burglar bar packaging shall contain the following information:

- (1) Warning that the burglar bars are intended to deter or delay intruders, they are not intended to prevent entry.
- (2) A reprint of the following requirements from California Building Code, Part 2, Chapter 10:

“Bars, grilles, grates or similar devices may be installed on emergency escape or rescue windows, doors or window wells or any required exit door, provided:

1. The devices are equipped with approved release mechanisms which are openable from the inside without the use of a key or special knowledge or effort; and
2. The building is equipped with smoke alarms installed in accordance with California Building Code, Part 2, Section 907.

Such bars, grilles, grates or similar devices shall be equipped with an approved release device for use by the fire department only on the exterior side for the purpose of fire department emergency access, when required by the authority having jurisdiction.”

- (3) A statement regarding the necessity of installing early warning smoke alarms (as required by the California Building Code, Part 2, Section 907) and planning occupant’s escape routes and meeting places.
- (4) Contact the local building and fire official to determine if a local ordinance requires a building permit prior to installation and if the burglar bars are required to have a release mechanism on the out-

side for use by the fire department in the event of a fire emergency.

- (5) *Written directions and illustrations on the operation of the emergency escape release mechanisms. These directions shall include a warning that the mechanisms be tested on a monthly basis.*

(b) *The textual information required by this section shall be printed in a minimum 12-point nondecorative lettering providing a sharp contrast to the background.*

(c) *Graphical information required by this section shall be of sufficient size to clearly illustrate the intended actions.*

[California Code of Regulations, Title 19, Division 1, §4.4] Warning Information Location.

When placed on burglar bar packaging, the information required by California Code of Regulations, Title 19, Division 1, Section 4.3 shall be conspicuously located and shall not be covered or made illegible by product advertising not required by Section 4.3.

[California Code of Regulations, Title 19, Division 1, §4.5(a)] Contractor or Installer Disclosures.

Any contractor or installer of burglar bars shall provide the owner of the residential dwelling the warning information required pursuant to California Code of Regulations, Title 19, Division 1, Section 4.3 prior to installing burglar bars.

[California Code of Regulations, Title 19, Division 1, §4.6(a) and (b)] Prohibited Installations.

No person shall install for profit unopenable burglar bars on a residential dwelling:

- (a) *Where the California Building Code requires openable burglar bars for emergency escape or rescue, or*
- (b) *On mobile homes, manufactured homes or multi-unit manufactured housing unless at least one window or door to the exterior in each bedroom is openable for emergency escape or rescue.*

[BE] 1031.3 Emergency escape and rescue openings. Emergency escape and rescue openings shall comply with Sections 1031.3.1 through 1031.3.3.

[BE] 1031.3.1 Minimum size. Emergency escape and rescue openings shall have a minimum net clear opening of 5.7 square feet (0.53 m²).

Exception: The minimum net clear opening for grade-floor emergency escape and rescue openings shall be 5 square feet (0.46 m²).

[BE] 1031.3.2 Minimum dimensions. The minimum net clear opening height dimension shall be 24 inches (610 mm). The minimum net clear opening width dimension shall be 20 inches (508 mm). The net clear opening dimensions shall be the result of normal operation of the opening.

[BE] 1031.3.3 Maximum height from floor. Emergency escape and rescue openings shall have the bottom of the clear opening not greater than 44 inches (1118 mm) measured from the floor.

[BE] 1031.4 Emergency escape and rescue doors. Where a door is provided as the required emergency escape and rescue opening, it shall be a swinging door or a sliding door.

[BE] 1031.5 Area wells. An emergency escape and rescue opening with the bottom of the clear opening below the adjacent grade shall be provided with an area well in accordance with Sections 1031.5.1 through 1031.5.3.

[BE] 1031.5.1 Minimum size. The minimum horizontal area of the area well shall be 9 square feet (0.84 m²), with a horizontal projection and width of not less than 36 inches (914 mm). The area well shall allow the emergency escape and rescue opening to be fully opened.

Exception: The ladder or steps required by Section 1031.5.2 shall be permitted to encroach not more than 6 inches (152 mm) into the required dimensions of the area well.

[BE] 1031.5.2 Ladders or steps. Area wells with a vertical depth of more than 44 inches (1118 mm) shall be equipped with an approved permanently affixed ladder or steps. The ladder or steps shall not be obstructed by the emergency escape and rescue opening when the window or door is in the open position. Ladders or steps required by this section shall not be required to comply with Section 1011.

[BE] 1031.5.2.1 Ladders. Ladders or rungs shall have an inside width of at least 12 inches (305 mm), shall project at least 3 inches (76 mm) from the wall and shall be spaced not more than 18 inches (457 mm) on center (o.c.) vertically for the full height of the area well.

[BE] 1031.5.2.2 Steps. Steps shall have an inside width of not less than 12 inches (305 mm), shall have treads greater than 5 inches (127 mm) in depth and a riser height not greater than 18 inches (457 mm) for the full height of the area well.

[BE] 1031.5.3 Drainage. Area wells shall be designed for proper drainage by connecting to the building's foundation drainage system required by Section 1805 of the *California Building Code*.

Exception: A drainage system for area wells is not required where the foundation is on well-drained soil or sand-gravel mixture soils in accordance with the United Soil Classification System, Group I Soils, in accordance with Section 1803.5.1 of the *California Building Code*.

[BE] 1031.6 Bars, grilles, covers and screens. Where bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, or area wells that serve such openings, the minimum net clear opening size shall comply with Sections 1031.3 and 1031.5. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.

SECTION 1032 MAINTENANCE OF THE MEANS OF EGRESS

1032.1 General. The means of egress for buildings or portions thereof shall be maintained in accordance with this section.

[California Code of Regulations, Title 19, Division 1, §3.11(a) through (d)] Exits, Aisles, Ramps, Corridors and Passageways.

(a) No person shall install, place or permit the installation or placement of any bed, chair, equipment, concession, turnstile, ticket office or anything whatsoever, in any manner which would block or obstruct the required width of any exit.

(b) No person shall install, place or permit the installation or placement of any combustible material or equipment in or exposed to any exit.

Exceptions:

(1) Furniture or equipment constructed of wood or other material of similar combustibility may be permitted in an exit or exposed to an exit when approved by the enforcing agency.

(2) When approved by the enforcing agency, combustible materials may be permitted in exit foyers and lobbies.

(c) No person shall install, place or permit the installation or placement of any storage material of any kind in any exit regardless of the required width of such exit.

Exception: Personal material located in metal lockers in Group B and E occupancies as defined in California Code of Regulations, Title 24, Part 2.

(d) Aisles shall not be occupied by any person for whom seating is not available.

1032.2 Reliability. Required exit accesses, exits and exit discharges shall be continuously maintained free from obstructions or impediments to full instant use in the case of fire or other emergency where the building area served by the means of egress is occupied. An exit or exit passageway shall not be used for any purpose that interferes with a means of egress.

1032.2.1 Security devices and egress locks. Security devices affecting means of egress shall be subject to approval of the fire code official. Security devices and locking arrangements in the means of egress that restrict, control, or delay egress shall be installed and maintained as required by this chapter.

1032.2.1.1 Fire escapes. Security enclosures, fences or screening for fire escape stairways shall be approved by the fire code official and shall be constructed such that they do not impede egress to the public way. Means shall be provided for emergency personnel to access the fire escape stair from the exterior of the enclosure.

1032.2.1.2 Maintenance. Fire escape stairways and balconies shall be kept clear and unobstructed at all times and shall be maintained in good working order.

1032.2.1.3 Examination. Fire escape stairways and balconies shall be examined for structural adequacy

and safety by a registered design professional or other person acceptable to the fire code official every 5 years. The examination shall determine whether the fire escape stairways and balconies can support the dead load plus a live load of not less than 100 pounds per square foot (4.78 kN/m²). An inspection report shall be submitted to the fire code official after such examination.

[BE] 1032.2.2 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors from classrooms, offices and other occupied rooms shall be permitted to be provided with locking arrangements designed to keep intruders from entering the room where all of the following conditions are met:

1. The door shall be capable of being unlocked from outside the room with a key or other approved means.
2. The door shall be openable from within the room in accordance with Section 1010.2.
3. Modifications shall not be made to existing listed panic hardware, fire door hardware or door closers.
4. Modifications to fire door assemblies shall be in accordance with NFPA 80.

1032.3 Obstructions. A means of egress shall be free from obstructions that would prevent its use, including the accumulation of snow and ice.

1032.3.1 Group I-2. In Group I-2, the required clear width for aisles, corridors and ramps that are part of the required means of egress shall comply with Section 407.4.3 of the California Building Code and Section 1020.3. The facility shall have a plan to maintain the required clear width during emergency situations.

Exception: In areas required for bed movement, equipment shall be permitted in the required width where all of the following provisions are met:

1. The equipment is low hazard and wheeled.
2. The equipment does not reduce the effective clear width for the means of egress to less than 5 feet (1525 mm).
3. The equipment is limited to:
 - 3.1. Equipment and carts in use.
 - 3.2. Medical emergency equipment.
 - 3.3. Infection control carts.
 - 3.4. Patient lift and transportation equipment.
4. Medical emergency equipment and patient lift and transportation equipment, when not in use, are required to be located on one side of the corridor.
5. The equipment is limited in number to not more than one per patient sleeping room or patient care room within each smoke compartment.

[BE] 1032.4 Exit signs. Exit signs shall be installed and maintained in accordance with the building code that was in

MEANS OF EGRESS

effect at the time of construction and the applicable provisions in Section 1104. Decorations, furnishings, equipment or adjacent signage that impairs the visibility of exit signs, creates confusion or prevents identification of the exit shall not be allowed.

1032.5 Nonexit identification. Where a door is adjacent to, constructed similar to and can be confused with a means of egress door, that door shall be identified with an approved sign that identifies the room name or use of the room.

1032.6 Finishes, furnishings and decorations. Means of egress doors shall be maintained in such a manner as to be distinguishable from the adjacent construction and finishes such that the doors are easily recognizable as doors. Furnishings, decorations or other objects shall not be placed so as to obstruct exits, access thereto, egress therefrom, or visibility thereof. Hangings and draperies shall not be placed over exit doors or otherwise be located to conceal or obstruct an exit. Mirrors shall not be placed on exit doors. Mirrors shall not be placed in or adjacent to any exit in such a manner as to confuse the direction of egress.

1032.7 Emergency escape and rescue openings. Required emergency escape and rescue openings shall be maintained in accordance with the code in effect at the time of construction, and both of the following:

1. Required emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.
2. Bars, grilles, grates or similar devices are permitted to be placed over emergency escape and rescue openings provided that the minimum net clear opening size complies with the code that was in effect at the time of construction and the unit is equipped with smoke alarms installed in accordance with Section 907.2.11. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the emergency escape and rescue opening.

1032.8 Inspection, testing and maintenance. Two-way communication systems shall be inspected and tested on a yearly basis to verify that all components are operational. Where required, the tests shall be conducted in the presence of the fire code official. Records of inspection, testing and maintenance shall be maintained.

1032.9 Floor identification signs. The floor identification signs required by Sections 1023.9 and 1104.24 shall be maintained in an approved manner.

1032.10 Emergency lighting equipment inspection and testing. Emergency lighting shall be maintained in accordance with Section 1008 and shall be inspected and tested in accordance with Sections 1032.10.1 and 1032.10.2.

1032.10.1 Activation test. Emergency lighting equipment shall be tested monthly for a duration of not less than 30 seconds. The test shall be performed manually or by an automated self-testing and self-diagnostic routine. Where

testing is performed by self-testing and self-diagnostics, a visual inspection of the emergency lighting equipment shall be conducted monthly to identify any equipment displaying a trouble indicator or that has become damaged or otherwise impaired.

1032.10.2 Power test. Battery-powered emergency lighting equipment shall be tested annually by operating the equipment on battery power for not less than 90 minutes.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 11 – CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
<i>Adopt Entire Chapter</i>																						
<i>Adopt Entire Chapter as amended (amended sections listed below)</i>																						
<i>Adopt only those sections that are listed below</i>			X																			
<i>[California Code of Regulations, Title 19, Division 1]</i>																						
<i>Chapter / Section</i>																						
1103.3.3			X																			
1103.7			X																			
1103.7.3			X																			
1103.7.3.1			X																			
1103.7.8 – 1103.7.8.2			X																			
1103.7.9 – 1103.7.9.10			X																			
1103.8 – 1103.8.5.3			X																			
1103.9.1			X																			
1107			X																			
1113			X																			
1114			X																			
1115			X																			
1116			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 11

CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

User note:

About this chapter: Chapter 11 applies to existing buildings constructed prior to the adoption of the code and is intended to ensure a minimum degree of fire and life safety to persons occupying existing buildings by providing for alterations to such buildings that do not comply with the minimum requirements of the California Building Code®. The provisions address general fire safety features such as requirements for fire alarm systems in some existing buildings and general means of egress, and include a section dedicated to existing Group I-2 occupancies.

SECTION 1101 GENERAL

1101.1 Scope. The provisions of this chapter shall apply to existing buildings constructed prior to the adoption of this code.

1101.2 Intent. The intent of this chapter is to provide a minimum degree of fire and life safety to persons occupying existing buildings by providing minimum construction requirements where such existing buildings do not comply with the minimum requirements of the *California Building Code*.

1101.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6 and the *California Building Code*.

1101.4 Owner notification. When a building is found to be in noncompliance with this chapter, the fire code official shall duly notify the owner of the building. Upon receipt of such notice, the owner shall, subject to the following time limits, take necessary actions to comply with the provisions of this chapter.

1101.4.1 Construction documents. Construction documents necessary to comply with this chapter shall be completed and submitted within a time schedule approved by the fire code official.

1101.4.2 Completion of work. Work necessary to comply with this chapter shall be completed within a time schedule approved by the fire code official.

1101.4.3 Extension of time. The fire code official is authorized to grant necessary extensions of time where it can be shown that the specified time periods are not physically practical or pose an undue hardship. The granting of an extension of time for compliance shall be based on the showing of good cause and subject to the filing of an acceptable systematic plan of correction with the fire code official.

SECTION 1102 DEFINITIONS

1102.1 Definitions. The following terms are defined in Chapter 2:

DUTCH DOOR.

EXISTING.

SECTION 1103 FIRE SAFETY REQUIREMENTS FOR EXISTING BUILDINGS

1103.1 Required construction. Existing buildings shall comply with not less than the minimum provisions specified

in Table 1103.1 and as further enumerated in Sections 1103.2 through 1103.10.

The provisions of this chapter shall not be construed to allow the elimination of fire protection systems or a reduction in the level of fire safety provided in buildings constructed in accordance with previously adopted codes.

Exceptions:

1. Where a change in fire-resistance rating has been approved in accordance with Section 501.2 or 802.6 of the *California Existing Building Code*.
2. Group U occupancies.

1103.1.1 Historic buildings. Facilities designated as historic buildings shall develop a fire protection plan in accordance with NFPA 914. The fire protection plans shall comply with the maintenance and availability provisions in Sections 404.3 and 404.4.

1103.2 Emergency responder communication coverage in existing buildings. Existing buildings other than Group R-3, that do not have approved in-building, two-way emergency response communication coverage for emergency responders in the building based on existing coverage levels of the public safety communication systems, shall be equipped with such coverage according to one of the following:

1. Where an existing wired communication system cannot be repaired or is being replaced, or where not approved in accordance with Section 510.1, Exception 1.
2. Within a time frame established by the adopting authority.

Exception: Where it is determined by the fire code official that the in-building, two-way emergency responder communication coverage system is not needed.

1103.3 Existing elevators. In other than Group R-3, existing elevators, escalators and moving walks shall comply with the requirements of Sections 1103.3.1 and 1103.3.3.

1103.3.1 Elevators, escalators and moving walks. Existing elevators, escalators and moving walks in Group I-2, Condition 2 occupancies and serving ambulatory care facilities shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

1103.3.2 Elevator emergency operation. Existing elevators with a travel distance of 25 feet (7620 mm) or more above or below the main floor or other level of a building

CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

TABLE 1103.1
OCCUPANCY AND USE REQUIREMENTS^a

SECTION	USE				OCCUPANCY CLASSIFICATION																	
	High-rise	Atrium or covered mall	Under-ground building	Tire storage	A	B	E	F	H-1	H-2	H-3	H-4	H-5	I-2	I-3	I-4	M	R-1	R-2	R-3	R-4	S
1103.2	R	R	R	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	—	—	R
1103.3	R	—	R	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	—	—	R
1103.4.1	R	—	R	—	—	—	—	—	—	—	—	—	—	R	R	—	—	—	—	—	—	—
1103.4.2	R	—	R	—	R	R	R	R	R	R	R	R	R	—	—	R	R	R	R	—	—	R
1103.4.3	R	—	R	—	R	R	R	R	R	R	R	R	R	—	—	R	R	R	R	—	—	R
1103.4.4	—	R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1103.4.5	—	—	—	—	—	R	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—
1103.4.6	—	—	—	—	R	—	R	R	R	R	R	R	R	R	R	R	—	R	R	R	R	R
1103.4.7	—	—	—	—	R	—	R	R	R	R	R	R	R	R	R	R	—	R	R	R	R	R
1103.4.8	R	—	R	—	R	R	R	R	R	R	R	R	R	—	—	R	R	R	R	R	R	R
1103.4.9	R	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—
1103.4.10	—	—	—	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1103.5.1	—	—	—	—	R ^c	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1103.5.2	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—
1103.5.3	—	—	—	—	—	—	—	—	—	—	—	—	—	R ^b	—	—	—	—	—	—	—	—
1103.5.5	—	—	—	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1103.6.1	R	—	R	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	—	—	R
1103.6.2	R	—	R	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	—	—	R
1103.7.1	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1103.7.2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1103.7.3	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—
1103.7.4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—
1103.7.5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—
1103.7.6	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—
1103.8	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	R	R	R	R	—
1103.9	R	—	—	—	—	—	—	—	—	—	—	—	—	R	—	R	—	R	R	R	R	—
1103.10	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—
1104	R	R	R	—	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
1105	—	—	—	—	—	—	—	—	—	—	—	—	—	R	—	—	—	—	—	—	—	—
1106	—	—	—	R	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

R = The building is required to comply.

- a. Existing buildings shall comply with the sections identified as “Required” (R) based on occupancy classification or use, or both, whichever is applicable.
- b. Only applies to Group I-2, Condition 2 occupancies as established by the adopting ordinance or legislation of the jurisdiction.
- c. Only applies to Group A-2 occupancies where alcoholic beverages are consumed.

and intended to serve the needs of emergency personnel for fire-fighting or rescue purposes shall be provided with emergency operation in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

Exceptions:

1. Buildings without occupied floors located more than 55 feet (16 764 mm) above or 25 feet (7620 mm) below the lowest level of fire department vehicle access where protected at the elevator

shaft openings with additional fire doors in accordance with Section 716 of the *California Building Code* and where all of the following conditions are met:

- 1.1. The doors shall be provided with vision panels of approved fire-protection-rated glazing so located as to furnish clear vision of the approach to the elevator. Such glazing shall not exceed 100 square inches (0.065 m²) in area.

- 1.2. The doors shall be held open but be automatic-closing by activation of a fire alarm initiating device installed in accordance with the requirements of NFPA 72 as for Phase I Emergency Recall Operation, and shall be located at each floor served by the elevator; in the associated elevator machine room, control space, or control room; and in the elevator hoistway, where sprinklers are located in those hoistways.
 - 1.3. The doors, when closed, shall have signs visible from the approach area stating: “WHEN THESE DOORS ARE CLOSED OR IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRWAYS.”
2. Buildings without occupied floors located more than 55 feet (16 764 mm) above or 25 feet (7620 mm) below the lowest level of fire department vehicle access where provided with automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2.
 3. Freight elevators in buildings provided with both automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2 and not less than one ASME 17.3-compliant elevator serving the same floors.

Elimination of previously installed Phase I emergency recall or Phase II emergency in-car systems shall not be permitted.

1103.3.3 Medical emergency elevator. *For existing hoistways with elevator alterations, or replacements, where the elevator car dimensions do not comply with Section 3002.4.1a of the California Building Code. The elevator car dimensions and/or the clear entrance opening dimensions may be altered where it can be demonstrated to the local jurisdictional authority’s satisfaction that the proposed configuration will accommodate the designated gurney or stretcher with equivalent ease to the existing car and/or clear entrance conditions. Written documentation from the local authority shall be provided to the California Occupational Safety and Health Elevator Unit.*

1103.4 Vertical openings. Interior vertical openings, including but not limited to stairways, elevator hoistways, service and utility shafts, that connect two or more stories of a building shall be enclosed or protected as specified in Sections 1103.4.1 through 1103.4.10.

1103.4.1 Group I-2 and I-3 occupancies. In Group I-2 and I-3 occupancies, interior vertical openings connecting two or more stories shall be protected with 1-hour fire-resistance-rated construction.

Exceptions:

1. In Group I-2, unenclosed vertical openings not exceeding two connected stories and not concealed within the building construction shall be permitted as follows:

- 1.1. The unenclosed vertical openings shall be separated from other unenclosed vertical openings serving other floors by a smoke barrier.
 - 1.2. The unenclosed vertical openings shall be separated from corridors by smoke partitions.
 - 1.3. The unenclosed vertical openings shall be separated from other fire or smoke compartments on the same floors by a smoke barrier.
 - 1.4. On other than the lowest level, the unenclosed vertical openings shall not serve as a required means of egress.
2. In Group I-2, atriums connecting three or more stories shall not require 1-hour fire-resistance-rated construction where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3, and all of the following conditions are met:
 - 2.1. For other than existing approved atriums with a smoke control system, where the atrium was constructed and is maintained in accordance with the code in effect at the time the atrium was created, the atrium shall have a smoke control system that is in compliance with Section 909.
 - 2.2. Glass walls forming a smoke partition or a glass-block wall assembly shall be permitted where in compliance with Condition 2.2.1 or 2.2.2.
 - 2.2.1. Glass walls forming a smoke partition shall be permitted where all of the following conditions are met:
 - 2.2.1.1. Automatic sprinklers are provided along both sides of the separation wall and doors, or on the room side only if there is not a walkway or occupied space on the atrium side.
 - 2.2.1.2. The sprinklers shall be not more than 12 inches (305 mm) away from the face of the glass and at intervals along the glass of not greater than 72 inches (1829 mm).
 - 2.2.1.3. Windows in the glass wall shall be nonoperating type.

2.2.1.4. The glass wall and windows shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates.

2.2.1.5. The sprinkler system shall be designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction.

2.2.2. A fire barrier is not required where a glass-block wall assembly complying with Section 2110 of the *California Building Code* and having a $\frac{3}{4}$ -hour fire protection rating is provided.

2.3. Where doors are provided in the glass wall, they shall be either self-closing or automatic-closing and shall be constructed to resist the passage of smoke.

3. In Group I-3 occupancies, exit stairways or ramps and exit access stairways or ramps constructed in accordance with Section 408 of the *California Building Code*.

1103.4.2 Three to five stories. In other than Group I-2 and I-3 occupancies, interior vertical openings connecting three to five stories shall be protected by either 1-hour fire-resistance-rated construction or an automatic sprinkler system shall be installed throughout the building in accordance with Section 903.3.1.1 or 903.3.1.2.

Exceptions:

1. Vertical opening protection is not required for Group R-3 occupancies.
2. Vertical opening protection is not required for open parking garages.
3. Vertical opening protection for escalators shall be in accordance with Section 1103.4.5, 1103.4.6 or 1103.4.7.
4. Exit access stairways and ramps shall be in accordance with Section 1103.4.8.

1103.4.3 More than five stories. In other than Group I-2 and I-3 occupancies, interior vertical openings connecting more than five stories shall be protected by 1-hour fire-resistance-rated construction.

Exceptions:

1. Vertical opening protection is not required for Group R-3 occupancies.
2. Vertical opening protection is not required for open parking garages.

3. Vertical opening protection for escalators shall be in accordance with Section 1103.4.5, 1103.4.6 or 1103.4.7.

4. Exit access stairways and ramps shall be in accordance with Section 1103.4.8.

1103.4.4 Atriums and covered malls. In other than Group I-2 and I-3 occupancies, interior vertical openings in a covered mall building or a building with an atrium shall be protected by either 1-hour fire-resistance-rated construction or an automatic sprinkler system shall be installed throughout the building in accordance with Section 903.3.1.1 or 903.3.1.2.

Exceptions:

1. Vertical opening protection is not required for Group R-3 occupancies.
2. Vertical opening protection is not required for open parking garages.
3. Exit access stairways and ramps shall be in accordance with Section 1103.4.8.

1103.4.5 Escalators in Group B and M occupancies. In Group B and M occupancies, escalators creating vertical openings connecting any number of stories shall be protected by either 1-hour fire-resistance-rated construction or an automatic sprinkler system in accordance with Section 903.3.1.1 installed throughout the building, with a draft curtain and closely spaced sprinklers around the escalator opening.

1103.4.6 Escalators connecting four or fewer stories. In other than Group B and M occupancies, escalators creating vertical openings connecting four or fewer stories shall be protected by either 1-hour fire-resistance-rated construction or an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 shall be installed throughout the building, and a draft curtain with closely spaced sprinklers shall be installed around the escalator opening.

1103.4.7 Escalators connecting more than four stories. In other than Group B and M occupancies, escalators creating vertical openings connecting five or more stories shall be protected by 1-hour fire-resistance-rated construction.

1103.4.8 Occupancies other than Groups I-2 and I-3. In other than Group I-2 and I-3 occupancies, floor openings containing exit access stairways or ramps that do not comply with one of the conditions listed in this section shall be protected by 1-hour fire-resistance-rated construction.

1. Exit access stairways and ramps that serve, or atmospherically communicate between, only two stories. Such interconnected stories shall not be open to other stories.
2. In Group R-1, R-2 or R-3 occupancies, exit access stairways and ramps connecting four stories or less serving and contained within an individual dwelling unit or sleeping unit or live/work unit.
3. Exit access stairways and ramps in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, where the area of the vertical opening between stories does not exceed twice the horizontal projected

area of the stairway or ramp, and the opening is protected by a draft curtain and closely spaced sprinklers in accordance with NFPA 13. In other than Group B and M occupancies, this provision is limited to openings that do not connect more than four stories.

4. Exit access stairways and ramps within an atrium complying with the provisions of Section 404 of the *California Building Code*.
5. Exit access stairways and ramps in open parking garages that serve only the parking garage.
6. Exit access stairways and ramps serving open-air seating complying with the exit access travel distance requirements of Section 1030.7 of the *California Building Code*.
7. Exit access stairways and ramps serving the balcony, gallery or press box and the main assembly floor in occupancies such as theaters, places of religious worship, auditoriums and sports facilities.

1103.4.9 Waste and linen chutes. In Group I-2 occupancies, existing waste and linen chutes shall comply with Sections 1103.4.9.1 through 1103.4.9.5.

1103.4.9.1 Enclosure. Chutes shall be enclosed with 1-hour fire-resistance-rated construction. Opening protectives shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

1103.4.9.2 Chute intakes. Chute intakes shall comply with Section 1103.4.9.2.1 or 1103.4.9.2.2.

1103.4.9.2.1 Chute intake direct from corridor. Where intake to chutes is direct from a corridor, the intake opening shall be equipped with a chute-intake door in accordance with Section 716 of the *California Building Code* and having a fire protection rating of not less than 1 hour.

1103.4.9.2.2 Chute intake via a chute-intake room. Where the intake to chutes is accessed through a chute-intake room, the room shall be enclosed with 1-hour fire-resistance-rated construction. Opening protectives for the intake room shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than $\frac{3}{4}$ hour. Opening protectives for the chute enclosure shall be in accordance with Section 1103.4.9.1.

1103.4.9.3 Automatic sprinkler system. Chutes shall be equipped with an approved automatic sprinkler system in accordance with Section 903.2.11.2.

1103.4.9.4 Chute discharge rooms. Chutes shall terminate in a dedicated chute discharge room. Such rooms shall be separated from the remainder of the building by not less than 1-hour fire-resistance-rated construction. Opening protectives shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

1103.4.9.5 Chute discharge protection. Chute discharges shall be equipped with a self-closing or

automatic-closing opening protective in accordance with Section 716 of the *California Building Code* and having a fire protection rating of not less than 1 hour.

1103.4.10 Flue-fed incinerators. Existing flue-fed incinerator rooms and associated flue shafts shall be protected with 1-hour fire-resistance-rated construction and shall not have other vertical openings connected with the space other than the associated flue. Opening protectives shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

1103.5 Sprinkler systems. An automatic sprinkler system shall be provided in existing buildings in accordance with Sections 1103.5.1 through 1103.5.5.

1103.5.1 Group A-2. Where alcoholic beverages are consumed in a Group A-2 occupancy having an occupant load of 300 or more, the fire area containing the Group A-2 occupancy shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1.

1103.5.2 Group I-2. In Group I-2, an automatic sprinkler system shall be provided in accordance with Section 1105.9.

1103.5.3 Group I-2, Condition 2. In addition to the requirements of Section 1103.5.2, existing buildings of Group I-2, Condition 2 occupancy shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. The automatic sprinkler system shall be installed as established by the adopting ordinance. **[DATE BY WHICH SPRINKLER SYSTEM MUST BE INSTALLED].**

1103.5.4 High-rise buildings. Where Appendix M has not been adopted, existing high-rise buildings that do not have a previously approved fire sprinkler system shall be equipped with an automatic sprinkler system in accordance with Section 903.3.1.1 where any of the following conditions apply:

1. The high-rise building has an occupied floor located more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access.
2. The high-rise building has occupied floors located more than 75 feet (22 860 mm) and not more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, and the building does not have at least two interior exit stairways complying with Section 1104.10 that are separated from the building interior by fire assemblies having a fire-resistance rating of not less than 2 hours with opening protection in accordance with Table 716.1(2) of the *California Building Code*.
3. The high-rise building has occupied floors located more than 75 feet (22 860 mm) and not more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, and the building does not have a fire alarm system that includes smoke detection in mechanical equipment, electrical, transformer, telephone equipment and similar rooms; corridors; elevator lobbies; and at doors penetrating interior exit stairway enclosures.

Building owners shall file a compliance schedule with the fire code official not later than 365 days after receipt of a written notice. The compliance schedule shall not exceed 12 years for completion of the automatic sprinkler system retrofit.

1103.5.5 Pyroxylin plastics. An automatic sprinkler system shall be provided throughout existing buildings where cellulose nitrate film or pyroxylin plastics are manufactured, stored or handled in quantities exceeding 100 pounds (45 kg). Vaults located within buildings for the storage of raw pyroxylin shall be protected with an approved automatic sprinkler system capable of discharging 1.66 gallons per minute per square foot (68 L/min/m²) over the area of the vault.

1103.6 Standpipes. Existing structures shall be equipped with standpipes installed in accordance with Section 905 where required in Sections 1103.6.1 and 1103.6.2. The fire code official is authorized to approve the installation of manual standpipe systems to achieve compliance with this section where the responding fire department is capable of providing the required hose flow at the highest standpipe outlet.

1103.6.1 Existing multiple-story buildings. Existing buildings with occupied floors located more than 50 feet (15 240 mm) above the lowest level of fire department access or more than 50 feet (15 240 mm) below the highest level of fire department access shall be equipped with standpipes.

1103.6.2 Existing helistops and heliports. Existing buildings with a rooftop helistop or heliport located more than 30 feet (9144 mm) above the lowest level of fire department access to the roof level on which the helistop or heliport is located shall be equipped with standpipes in accordance with Section 2007.5.

1103.7 Fire alarm systems. An approved fire alarm system shall be installed in existing buildings and structures in accordance with Sections 1103.7.1 through 1103.7.6 and provide occupant notification in accordance with Section 907.5 unless other requirements are provided by other sections of this code. *Existing high-rise buildings shall comply with Section 1103.7.9.*

Exception: Occupancies with an existing, previously approved fire alarm system.

1103.7.1 Group E. A fire alarm system shall be installed in existing Group E occupancies in accordance with Section 907.2.3.

Exceptions:

1. A manual fire alarm system is not required in a building with a maximum area of 1,000 square feet (93 m²) that contains a single classroom and is located not closer than 50 feet (15 240 mm) from another building.
2. A manual fire alarm system is not required in Group E occupancies with an occupant load less than 50.

1103.7.2 Reserved.

1103.7.3 Group I-2 and Group I-2.1. In Group I-2 and Group I-2.1, an automatic fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in accordance with Section 1105.10.

1103.7.3.1 Additional provisions for existing Group I occupancies. In projects requiring the Office of State-wide Health Planning and Development approval in existing Group I-2 and I-2.1 occupancies located in buildings defined as hospitals in Section 1250 of the Health and Safety Code, facilities not equipped with an automatic sprinkler system throughout shall be equipped with an automatic fire alarm system which responds to the products of combustion other than heat.

Exception: Heat detectors may be used in closets, unusable spaces under floor areas, storage rooms, bathrooms and rooms of similar use.

1103.7.4 Group I-3. An automatic and manual fire alarm system shall be installed in existing Group I-3 occupancies in accordance with Section 907.2.6.3.

1103.7.5 Group R-1. A fire alarm system and smoke alarms shall be installed in existing Group R-1 occupancies in accordance with Sections 1103.7.5.1 through 1103.7.5.2.1.

1103.7.5.1 Group R-1 hotel and motel manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-1 hotels and motels more than one story in height or with more than 20 sleeping units.

Exceptions:

1. A manual fire alarm system is not required in buildings less than two stories in height where all sleeping units, attics and crawl spaces are separated by 1-hour fire-resistance-rated construction and each sleeping unit has direct access to a public way, egress court or yard.
2. A manual fire alarm system is not required in buildings not more than three stories in height with not more than 20 sleeping units and equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
3. Manual fire alarm boxes are not required throughout the building where the following conditions are met:
 - 3.1. The building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2.
 - 3.2. The notification appliances will activate upon sprinkler water flow.
 - 3.3. Not less than one manual fire alarm box is installed at an approved location.

1103.7.5.1.1 Group R-1 hotel and motel automatic smoke detection system. An automatic smoke detection system that activates the occupant notification system shall be installed in existing Group R-1 hotels and motels more than one story in height or with more than 20 sleeping units.

tion system in accordance with Section 907.5 shall be installed in existing Group R-1 hotels and motels throughout all interior corridors serving sleeping rooms not equipped with an approved, supervised automatic sprinkler system installed in accordance with Section 903.

Exception: An automatic smoke detection system is not required in buildings that do not have interior corridors serving sleeping units and where each sleeping unit has a means of egress door opening directly to an exit or to an exterior exit access that leads directly to an exit.

1103.7.5.2 Group R-1 boarding and rooming houses manual fire alarm system. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-1 boarding and rooming houses.

Exception: Buildings less than two stories in height where all sleeping units, attics and crawl spaces are separated by 1-hour fire-resistance-rated construction and each sleeping unit has direct access to a public way, egress court or yard.

1103.7.5.2.1 Group R-1 boarding and rooming houses automatic smoke detection system. An automatic smoke detection system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-1 boarding and rooming houses throughout all interior corridors serving sleeping units not equipped with an approved, supervised sprinkler system installed in accordance with Section 903.

Exception: Buildings equipped with single-station smoke alarms meeting or exceeding the requirements of Section 907.2.11.1 and where the fire alarm system includes not less than one manual fire alarm box per floor arranged to initiate the alarm.

1103.7.6 Group R-2. A manual fire alarm system that activates the occupant notification system in accordance with Section 907.5 shall be installed in existing Group R-2 occupancies more than three stories in height or with more than 16 dwelling or sleeping units.

Exceptions:

1. Where each living unit is separated from other contiguous living units by fire barriers having a fire-resistance rating of not less than $\frac{3}{4}$ hour, and where each living unit has either its own independent exit or its own independent stairway or ramp discharging at grade.
2. A separate fire alarm system is not required in buildings that are equipped throughout with an approved supervised automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 and having a local alarm to notify all occupants.
3. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units and are protected by an approved auto-

matic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2, provided that dwelling units either have a means of egress door opening directly to an exterior exit access that leads directly to the exits or are served by open-ended corridors designed in accordance with Section 1027.6, Exception 3.

4. A fire alarm system is not required in buildings that do not have interior corridors serving dwelling units, do not exceed three stories in height and comply with both of the following:
 - 4.1. Each dwelling unit is separated from other contiguous dwelling units by fire barriers having a fire-resistance rating of not less than $\frac{3}{4}$ hour.
 - 4.2. Each dwelling unit is provided with smoke alarms complying with the requirements of Section 907.2.11.

1103.7.8 Existing Group R-1 and Group R-2 High-rise buildings. See Section 1113.3.

1103.7.8.1 General. Every apartment house and every hotel shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously.

1103.7.8.2 Installation. The installation of all fire alarm equipment shall be in accordance with this code.

1103.7.9 Existing High-rise Buildings.

1103.7.9.1 Fire alarm system. Every existing high-rise building shall be provided with an approved fire alarm system. In department stores, retail sales stores and similar occupancies where the general public is admitted, such systems shall be of a type capable of alerting staff and employees. In office buildings and all other high-rise buildings, such systems shall be of a type capable of alerting all occupants simultaneously.

Exceptions:

1. In areas of public assemblage, the type and location of audible appliances shall be as determined by the enforcing agency.
2. When acceptable to the enforcing agency, the occupant voice notification system required by Section 1114.20 and California Existing Building Code may be used in lieu of the fire alarm system.

1103.7.9.2 Existing systems. Existing fire alarm systems, when acceptable to the enforcing agency, shall be deemed as conforming to the provisions of these regulations.

1103.7.9.3 Annunciation. When a new fire alarm system is installed, it shall be connected to an annunciator panel installed in a location approved by the enforcing agency.

For purposes of annunciation, zoning shall be in accordance with Section 907.6.4.4.

CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

1103.7.9.4 Monitoring. *Monitoring shall be in accordance with Section 907.6.6.*

1103.7.9.5 Systems interconnection. *When an automatic fire detection system or automatic extinguishing system is installed, activation of such system shall cause the sounding of the fire alarm notification appliances at locations designated by the enforcing agency.*

1103.7.9.6 Manual fire alarm boxes. *A manual fire alarm box shall be provided in the locations designated by the enforcing agency. Such locations shall be where boxes are readily accessible and visible and in normal paths of daily travel by occupants of the building.*

1103.7.9.7 Emergency voice/alarm communication system. *Such system shall provide communication from a location available to and designated by the enforcing agency to not less than all public areas.*

The emergency voice/alarm communication system may be combined with a fire alarm system provide the combined system has been approved and listed by the State Fire Marshal. The sounding of a fire alarm signal in any given area or floor shall not prohibit voice communication to other areas of floors. Combination systems shall be designed to permit voice transmission to override the fire alarm signal, but the fire alarm signal shall not terminate in less than three minutes.

1103.7.9.8 Fire department system. *When it is determined by test that portable fire department communication equipment is ineffective, a communication system acceptable to the enforcing agency shall be installed within the building to permit emergency communication between fire-suppression personnel.*

1103.7.9.9 Smoke control systems. *Existing air-circulation systems shall be provided with an override switch in a location approved by the enforcing agency which will allow for the manual control of shutdown of the systems.*

Exception: *Systems which serve only a single floor, or portion thereof, without any penetration by ducts or other means into adjacent floors.*

1103.7.9.10 Elevator recall smoke detection. *Smoke detection for emergency operation of elevators shall be provided in accordance with Section 907.3.3.*

1103.8 Single- and multiple-station smoke alarms. Single- and multiple-station smoke alarms shall be installed in existing Group R occupancies in accordance with Sections 1103.8.1 through 1103.8.3.

➔ **1103.8.1 Where required.** Existing Group R occupancies shall be provided with single-station smoke alarms in accordance with Section 907.2.11. Interconnection and power sources shall be in accordance with Sections 1103.8.2 and 1103.8.3, respectively.

Exceptions:

1. Where the code that was in effect at the time of construction required smoke alarms and smoke alarms complying with those requirements are already provided.

2. Where smoke alarms have been installed in occupancies and dwellings that were not required to have them at the time of construction, additional smoke alarms shall not be required provided that the existing smoke alarms comply with requirements that were in effect at the time of installation.
3. Where smoke detectors connected to a fire alarm system have been installed as a substitute for smoke alarms.

1103.8.2 Interconnection. Where more than one smoke alarm is required to be installed within an individual dwelling or sleeping unit, the smoke alarms shall be interconnected in such a manner that the activation of one alarm will activate all of the alarms in the individual unit. Physical interconnection of smoke alarms shall not be required where listed wireless alarms are installed and all alarms sound upon activation of one alarm. The alarm shall be clearly audible in all bedrooms over background noise levels with all intervening doors closed.

Exceptions:

1. Interconnection is not required in buildings that are not undergoing alterations, repairs or construction of any kind.
2. Smoke alarms in existing areas are not required to be interconnected where alterations or repairs do not result in the removal of interior wall or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for interconnection without the removal of interior finishes.
3. *Smoke alarms are not required to be interconnected where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
4. *Smoke alarms are not required to be interconnected when work is limited to the installation, alteration or repairs of plumbing or mechanical systems or the installation, alteration or repair of electrical systems which do not result in the removal of interior wall or ceiling finishes exposing the structure.*

1103.8.3 Power source. Single-station smoke alarms shall receive their primary power from the building wiring provided that such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms with integral strobes that are not equipped with battery backup shall be connected to an emergency electrical system. Smoke alarms shall emit a signal when the batteries are low. Wiring shall be permanent and without a disconnecting switch other than as required for overcurrent protection.

Exceptions:

1. Smoke alarms are permitted to be solely battery operated in existing buildings where construction is not taking place.

2. Smoke alarms are permitted to be solely battery operated in buildings that are not served from a commercial power source.
3. Smoke alarms are permitted to be solely battery operated in existing areas of buildings undergoing alterations or repairs that do not result in the removal of interior walls or ceiling finishes exposing the structure, unless there is an attic, crawl space or basement available that could provide access for building wiring without the removal of interior finishes.
4. *Smoke alarms are permitted to be solely battery operated where repairs or alterations are limited to the exterior surfaces of dwellings, such as the replacement of roofing or siding, or the addition or replacement of windows or doors, or the addition of a porch or deck.*
5. *Smoke alarms are permitted to be solely battery operated when work is limited to the installation, alteration or repairs of plumbing or mechanical systems or the installation, alteration or repair of electrical systems which do not result in the removal of interior wall or ceiling finishes exposing the structure.*

1103.8.4 Group R-3.1. *In all facilities housing a bedridden client, smoke alarms shall receive their primary power from the building wiring when such wiring is served from a commercial source and shall be equipped with a battery backup. Smoke alarms shall be electrically interconnected so as to cause all smoke alarms to sound a distinctive alarm signal upon actuation of any single smoke alarm. Such alarm signal shall be audible throughout the facility at a minimal level of 15 db above ambient noise level. These devices need not be interconnected to any other fire alarm device, have a control panel, or be electrically supervised or provided with emergency power.*

1103.8.5 Additional provisions for existing Group R occupancies.

1103.8.5.1 *Existing Buildings housing Group R occupancies established prior to the effective date of these regulations may have their use continued if they conform or are made to conform to provisions of these regulations to the extent that reasonable and adequate life safety against the hazards of fire, panic and explosion is substantially provided. Additional means of egress, the installation of automatic sprinkler systems, automatic fire alarm system or other life safety measures, may be required to provide reasonable and adequate safety.*

Note: *It is the intent of this section that every existing occupancy need not mandatorily conform with the requirements for new construction. Reasonable judgment in the application of requirements must be exercised by the enforcing agency.*

1103.8.5.2 *For purposes of clarification, Health and Safety Code, Section 13113.7 is repeated.*

(a) Except as otherwise provided in this section, smoke alarms, approved and listed by the State Fire Marshal pursuant to Section 13114 at the time of installation, shall be installed in accordance with the manufacturer's instructions in each dwelling intended for human occupancy:

(1) For all dwelling units intended for human occupancy, upon the owner's application on or after January 1, 1985, for a permit for alterations, repairs or additions, exceeding one thousand dollars (\$1,000).

(2) For all other dwelling units intended for human occupancy for which a building permit is issued on or after January 1, 2014, for alterations, repairs or additions exceeding one thousand dollars (\$1,000), the permit issuer shall not sign off on the completion of work until the permittee demonstrates that all smoke alarms required for the dwelling unit are devices approved and listed by the State Fire Marshal pursuant to Section 13114.

(3) However, if any local rule, regulation or ordinance, adopted prior to January 1, 1987, requires installation in a dwelling unit intended for human occupancy of smoke alarms which receive their power from the electrical system of the building and requires compliance with the local rule, regulation or ordinance at a date subsequent to the dates specified in this section, the compliance date specified in the rule, regulation or ordinance shall, but only with respect to the dwelling units specified in this section, take precedence over the date specified in this section.

(4) Unless prohibited by local rules, regulations or ordinances, a battery-operated smoke alarm, which otherwise met the standards adopted pursuant to Section 13114 for smoke alarms at the time of installation, satisfies the requirements of this section.

(5) A fire alarm system with smoke detectors installed in accordance with the State Fire Marshal's regulations may be installed in lieu of smoke alarms required pursuant to paragraph (1) or (2) of this subdivision, or paragraph (3) of subdivision (d).

(b) "Dwelling units intended for human occupancy," as used in this section, includes a duplex, lodging house, apartment complex, hotel, motel, condominium, stock cooperative, time-share project or dwelling unit of a multiple-unit dwelling complex. For the purpose of this part, "dwelling units intended for human occupancy" does not include manufactured homes as defined in Section 18007, mobilehomes as defined in Section 18008, and commercial coaches as defined in Section 18001.8.

(c) A high-rise structure, as defined in subdivision (b) of Section 13210 and regulated by Chapter 3 (commencing with Section 13210), and which is

used for purposes other than as dwelling units intended for human occupancy, is exempt from the requirements of this section.

(d) (1) The owner shall be responsible for testing and maintaining alarms in hotels, motels, lodging houses, apartment complexes and other multiple-dwelling complexes in which units are neither rented nor leased.

(2) The owner of a hotel, motel, lodging house, apartment complex or other multiple-dwelling complex in which units are rented or leased, and commencing January 1, 2014, the owner of a single-family dwelling that is rented or leased, shall be responsible for testing and maintaining alarms required by this section as follows:

(A) An owner or the owner's agent may enter any dwelling unit, efficiency dwelling unit, guest room and suite owned by the owner for the purpose of installing, repairing, testing and maintaining single station smoke alarms required by this section. Except in cases of emergency, the owner or owner's agent shall give the tenants of each such unit, room or suite reasonable notice in writing of the intention to enter and shall enter only during normal business hours. Twenty-four hours shall be presumed to be reasonable notice in absence of evidence to the contrary.

(B) At the time that a new tenancy is created, the owner shall ensure that smoke alarms are operable. The tenant shall be responsible for notifying the manager or owner if the tenant becomes aware of an inoperable smoke alarm within his or her unit. The owner or authorized agent shall correct any reported deficiencies in the smoke alarm and shall not be in violation of this section for a deficient smoke alarm when he or she has not received notice of the deficiency.

(3) On or before January 1, 2016, the owner of a dwelling unit intended for human occupancy in which one or more units is rented or leased shall install additional smoke alarms, as needed, to ensure that smoke alarms are located in compliance with current building standards. Existing alarms need not be replaced unless the alarm is inoperable. New smoke alarms installed in compliance with current building standards may be battery operated provided the alarms have been approved by the State Fire Marshal for sale in the state. This paragraph shall not apply to fire alarm systems with smoke detectors, fire alarm devices that connect to a panel, or other devices that use a low-power radio frequency wireless communication signal.

(e) A violation of this section is an infraction punishable by a maximum fine of two hundred dollars (\$200) for each offense.

(f) This section shall not affect any rights which the parties may have under any other provision of law

because of the presence or absence of a smoke alarm.

(Amended by Stats. 2012, Ch. 420, Sec. 1. Effective January 1, 2013.)

1103.8.5.3 For purposes of clarification, Health and Safety Code Section 13113.8 is repeated.

(a) On and after January 1, 1986, every single-family dwelling and factory-built housing, as defined in Section 19971, which is sold shall have an operable smoke detector. The detector shall be approved and listed by the State Fire Marshal and installed in accordance with the State Fire Marshal's regulations. Unless prohibited by local rules, regulations or ordinances, a battery-operated smoke detector shall be deemed to satisfy the requirements of this section.

(b) On and after January 1, 1986, the transferor of any real property containing a single-family dwelling, as described in subdivision (a), whether the transfer is made by sale, exchange or real property sales contract, as defined in Section 2985 of the Civil Code, shall deliver to the transferee a written statement indicating that the transferor is in compliance with this section. The disclosure statement shall be either included in the receipt for deposit in a real estate transaction, an addendum attached thereto, or a separate document.

(c) The transferor shall deliver the statement referred to in subdivision (b) as soon as practicable before the transfer of title in the case of a sale or exchange, or prior to execution of the contract where the transfer is by a real property sales contract, as defined in Section 2985. or purposes of this subdivision, "delivery" means delivery in person or by mail to the transferee or transferor, or to any person authorized to act for him or her in the transaction, or to additional transferees who have requested delivery from the transferor in writing. Delivery to the spouse of a transferee or transferor shall be deemed delivery to a transferee or transferor, unless the contract states otherwise.

(d) This section does not apply to any of the following:

(1) Transfers which are required to be preceded by the furnishing to a prospective transferee of a copy of a public report pursuant to Section 11018.1 of the Business and Professions Code.

(2) Transfers pursuant to court order, including, but not limited to, transfers ordered by a probate court in the administration of an estate, transfers pursuant to a writ of execution, transfers by a trustee in bankruptcy, transfers by eminent domain or transfers resulting from a decree for specific performance.

(3) Transfers to a mortgagee by a mortgagor in default, transfers to a beneficiary of a deed of trust by a trustor in default, transfers by any foreclosure sale after default, transfers by any foreclosure sale after default in an obligation secured

by a mortgage, or transfers by a sale under a power of sale after a default in an obligation secured by a deed of trust or secured by any other instrument containing a power of sale.

(4) Transfers by a fiduciary in the course of the administration of a decedent's estate, guardianship, conservatorship or trust.

(5) Transfers from one co-owner to one or more co-owners.

(6) Transfers made to a spouse, or to a person or persons in the lineal line of consanguinity of one or more of the transferors.

(7) Transfers between spouses resulting from a decree of dissolution of a marriage, from a decree of legal separation, or from a property settlement agreement incidental to either of those decrees.

(8) Transfers by the Controller in the course of administering the Unclaimed Property Law provided for in Chapter 7 (commencing with Section 1500) of Title 10 of Part 3 of the Code of Civil Procedure.

(9) Transfers under the provisions of Chapter 7 (commencing with Section 3691) or Chapter 8 (commencing with Section 3771) of Part 6 of Division 1 of the Revenue and Taxation Code.

(e) No liability shall arise, nor any action be brought or maintained against any agent of any party to a transfer of title, including any person or entity acting in the capacity of an escrow, for any error, inaccuracy or omission relating to the disclosure required to be made by a transferor pursuant to this section.

However, this subdivision does not apply to a licensee, as defined in Section 10011 of the Business and Professions Code, where the licensee participates in the making of the disclosure required to be made pursuant to this section with actual knowledge of the falsity of the disclosure.

(f) Except as otherwise provided in this section, this section shall not be deemed to create or imply a duty upon a licensee, as defined in Section 10011 of the Business and Professions Code, or upon any agent of any party to a transfer of title, including any person or entity acting in the capacity of an escrow, to monitor or ensure compliance with this section.

(g) No transfer of title shall be invalidated on the basis of a failure to comply with this section, and the exclusive remedy for the failure to comply with this section is an award of actual damages not to exceed one hundred dollars (\$100), exclusive of any court costs and attorney's fees.

(h) Local ordinances requiring smoke detectors in single-family dwellings may be enacted or amended. However, the ordinances shall satisfy the minimum requirements of this section.

(i) For the purposes of this section, "single-family dwelling" does not include a manufactured home as defined in Section 18007, a mobilehome as defined in Section 18008, or a commercial coach as defined in Section 18001.8.

(j) This section shall not apply to the installation of smoke detectors in dwellings intended for human occupancy, as defined in and regulated by Section 13113.7 of the Health and Safety Code, as added by Senate Bill No. 1448 in the 1983-84 Regular Session.

1103.9 Carbon monoxide detection. Carbon monoxide detection shall be installed in existing Group I-1, I-2, I-4 and R occupancies and in classrooms in Group E occupancies where those units include any of the conditions identified in Sections 915.1.2 through 915.1.6. The carbon monoxide alarms shall be installed in the locations specified in Section 915.2 and the installation shall be in accordance with Section 915.4.

Exceptions:

1. Carbon monoxide alarms are permitted to be solely battery operated where the code that was in effect at the time of construction did not require carbon monoxide detectors to be provided.
2. Carbon monoxide alarms are permitted to be solely battery operated in dwelling units that are not served from a commercial power source.
3. A carbon monoxide detection system in accordance with Section 915.5 shall be an acceptable alternative to carbon monoxide alarms.

1103.9.1 Carbon monoxide detection in existing Group E buildings. For the purposes of carbon monoxide detection, an existing Group E is a building constructed before January 1, 2017. When an existing Group E occupancy has a fossil-fuel-burning furnace located inside the building, the school is encouraged to install carbon monoxide detection in accordance with the California Existing Building Code.

No person shall install, market, distribute, offer for sale or sell any carbon monoxide device in the state of California unless the device and instructions have been approved and listed by the Office of the State Fire Marshal.

1103.10 Medical gases. Medical gases stored and transferred in health-care-related facilities shall be in accordance with Chapter 53.

**SECTION 1104
MEANS OF EGRESS FOR EXISTING BUILDINGS**

1104.1 General. Means of egress in existing buildings shall comply with the minimum egress requirements where specified in Table 1103.1 as further enumerated in Sections 1104.2 through 1104.25, and the building code that applied at the time of construction. Where the provisions of this chapter conflict with the building code that applied at the time of construction, the most restrictive provision shall apply. Existing buildings that were not required to comply with a building code at the time of construction shall comply with the minimum egress

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requirements where specified in Table 1103.1 as further enumerated in Sections 1104.2 through 1104.25.

1104.2 Elevators, escalators and moving walks. Elevators, escalators and moving walks shall not be used as a component of a required means of egress.

Exceptions:

1. Elevators used as an accessible means of egress where allowed by Section 1009.4.
2. Previously approved elevators, escalators and moving walks in existing buildings.

1104.3 Exit sign illumination. Exit signs shall be internally or externally illuminated. The face of an exit sign illuminated from an external source shall have an intensity of not less than 5 footcandles (54 lux). Internally illuminated signs shall provide equivalent luminance and be listed for the purpose.

Exception: Approved self-luminous signs that provide evenly illuminated letters shall have a minimum luminance of 0.06 foot-lamberts (0.21 cd/m²).

1104.4 Power source. Where emergency illumination is required in Section 1104.5, exit signs shall be visible under emergency illumination conditions.

Exception: Approved signs that provide continuous illumination independent of external power sources are not required to be connected to an emergency electrical system.

1104.5 Illumination emergency power. Where means of egress illumination is provided, the power supply for means of egress illumination shall normally be provided by the premises' electrical supply. In the event of power supply failure, illumination shall be automatically provided from an emergency system for the following occupancies where such occupancies require two or more means of egress:

1. Group A having 50 or more occupants.

Exception: Assembly occupancies used exclusively as a place of worship and having an occupant load of less than 300.

2. Group B buildings three or more stories in height, buildings with 100 or more occupants above or below a level of exit discharge serving the occupants or buildings with 1,000 or more total occupants.
3. Group E in interior exit access and exit stairways and ramps, corridors, windowless areas with student occupancy, shops and laboratories.
4. Group F having more than 100 occupants.

Exception: Buildings used only during daylight hours and that are provided with windows for natural light in accordance with the *California Building Code*.

5. Group I.
6. Group M.

Exception: Buildings less than 3,000 square feet (279 m²) in gross sales area on one story only, excluding mezzanines.

7. Group R-1.

Exception: Where each sleeping unit has direct access to the outside of the building at grade.

8. Group R-2.

Exception: Where each dwelling unit or sleeping unit has direct access to the outside of the building at grade.

1104.5.1 Emergency power duration and installation. Emergency power for means of egress illumination shall be provided in accordance with Section 1203. In other than Group I-2, emergency power shall be provided for not less than 60 minutes for systems requiring emergency power.

1104.6 Guards. Guards complying with this section shall be provided at the open sides of means of egress that are more than 30 inches (762 mm) above the floor or grade below.

1104.6.1 Height of guards. Guards shall form a protective barrier not less than 42 inches (1067 mm) high.

Exceptions:

1. Existing guards on the open side of stairways shall be not less than 30 inches (760 mm) high.
2. Existing guards within dwelling units shall be not less than 36 inches (910 mm) high.
3. Existing guards in assembly seating areas.

1104.6.2 Opening limitations. Open guards shall have balusters or ornamental patterns such that a 6-inch-diameter (152 mm) sphere cannot pass through any opening up to a height of 34 inches (864 mm).

Exceptions:

1. At elevated walking surfaces for access to, and use of, electrical, mechanical or plumbing systems or equipment, guards shall have balusters or be of solid materials such that a sphere with a diameter of 21 inches (533 mm) cannot pass through any opening.
2. In occupancies in Group I-3, F, H or S, the clear distance between intermediate rails measured at right angles to the rails shall not exceed 21 inches (533 mm).
3. Approved existing open guards.

1104.7 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 28 inches (711 mm). Where this section requires a minimum clear opening width of 28 inches (711 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a clear opening width of 28 inches (711 mm). The minimum clear opening height of doorways shall be 80 inches (2032 mm).

Exceptions:

1. The minimum and maximum width shall not apply to door openings that are not part of the required means of egress in occupancies in Group R-2 and R-

- 3 units that are not required to be an Accessible Type A unit or Type B unit.
- 2. Door openings to storage closets less than 10 square feet (0.93 m²) in area shall not be limited by the minimum clear opening width.
- 3. The width of door leaves in revolving doors that comply with Section 1010.3.1 shall not be limited.
- 4. The maximum width of door leaves in power-operated doors that comply with Section 1010.3.2 shall not be limited.
- 5. Door openings within a dwelling unit shall have a minimum clear opening height of 78 inches (1981 mm).
- 6. In dwelling and sleeping units that are not required to be Accessible units, Type A units or Type B units, exterior door openings, other than the required exit door, shall have a minimum clear opening height of 76 inches (1930 mm).
- 7. Exit access doors serving a room not larger than 70 square feet (6.5 m²) shall have a minimum door leaf width of 24 inches (610 mm).
- 8. The minimum clear opening width shall not apply to doors for nonaccessible showers or sauna compartments.
- 9. The minimum clear opening width shall not apply to the doors for nonaccessible toilet stalls.
- 10. Door closers and door stops shall be permitted to be 78 inches (1980 mm) minimum above the floor.

1104.7.1 Group I-2. In Group I-2 occupancies, means of egress doors where used for the movement of beds shall provide a minimum clear opening width of 41½ inches (1054 mm).

Doors serving as means of egress doors and not used for movement of beds shall provide a minimum clear opening width of 32 inches (813 mm).

1104.7.2 Ambulatory care. In ambulatory care facilities, doors serving as means of egress from patient treatment rooms shall provide a minimum clear opening width of 32 inches (813 mm).

1104.8 Opening force for doors. The opening force for interior side-swinging doors without closers shall not exceed a 5-pound (22 N) force. The opening forces do not apply to the force required to retract latch bolts or disengage other devices that hold the door in a closed position. For other side-swinging, sliding and folding doors, the door latch shall release when subjected to a force of not more than 15 pounds (66 N). The door shall be set in motion when subjected to a force not exceeding 30 pounds (133 N). The door shall swing to a full-open position when subjected to a force of not more than 50 pounds (222 N). Forces shall be applied to the latch side.

1104.9 Revolving doors. Revolving doors shall comply with the following:

- 1. A revolving door shall not be located within 10 feet (3048 mm) of the foot or top of stairways or escalators. A dispersal area shall be provided between the stairways or escalators and the revolving doors.

- 2. The revolutions per minute for a revolving door shall not exceed those shown in Table 1104.9.
- 3. Each revolving door shall have a conforming side-hinged swinging door in the same wall as the revolving door and within 10 feet (3048 mm).

Exceptions:

- 1. A revolving door is permitted to be used without an adjacent swinging door for street-floor elevator lobbies provided that a stairway, escalator or door from other parts of the building does not discharge through the lobby and the lobby does not have any occupancy or use other than as a means of travel between elevators and a street.
- 2. Existing revolving doors where the number of revolving doors does not exceed the number of swinging doors within 20 feet (6096 mm).

**TABLE 1104.9
REVOLVING DOOR SPEEDS**

INSIDE DIAMETER (feet-inches)	POWER-DRIVEN-TYPE SPEED CONTROL (rpm)	MANUAL-TYPE SPEED CONTROL (rpm)
6-6	11	12
7-0	10	11
7-6	9	11
8-0	9	10
8-6	8	9
9-0	8	9
9-6	7	8
10-0	7	8

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

1104.9.1 Egress component. A revolving door used as a component of a means of egress shall comply with Section 1104.9 and all of the following conditions:

- 1. Revolving doors shall not be given credit for more than 50 percent of the required egress capacity.
- 2. Each revolving door shall be credited with not more than a 50-person capacity.
- 3. Revolving doors shall be capable of being collapsed when a force of not more than 130 pounds (578 N) is applied within 3 inches (76 mm) of the outer edge of a wing.

1104.10 Stair dimensions for existing stairways. Existing stairways in buildings shall be permitted to remain if the rise does not exceed 8¼ inches (210 mm) and the run is not less than 9 inches (229 mm). Existing stairways can be rebuilt.

Exception: Other stairways approved by the fire code official.

1104.10.1 Dimensions for replacement stairways. The replacement of an existing stairway in a structure shall not be required to comply with the new stairway requirements of Section 1011 where the existing space and construction will not allow a reduction in pitch or slope.

1104.11 Winders. Existing winders shall be allowed to remain in use if they have a minimum tread depth of 6 inches

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(152 mm) and a minimum tread depth of 9 inches (229 mm) at a point 12 inches (305 mm) from the narrowest edge.

1104.12 Curved stairways. Existing curved stairways shall be allowed to continue in use, provided that the minimum depth of tread is 10 inches (254 mm) and the smallest radius shall be not less than twice the width of the stairway.

1104.13 Stairway handrails. Stairways shall have handrails on at least one side. Handrails shall be located so that all portions of the stairway width required for egress capacity are within 44 inches (1118 mm) of a handrail.

Exception: Aisle stairs provided with a center handrail are not required to have additional handrails.

1104.13.1 Height. Handrail height, measured above stair tread nosings, shall be uniform, not less than 30 inches (762 mm) and not more than 42 inches (1067 mm).

1104.14 Slope of ramps. Ramp runs utilized as part of a means of egress shall have a running slope not steeper than 1 unit vertical in 10 units horizontal (10-percent slope). The slope of other ramps shall not be steeper than 1 unit vertical in 8 units horizontal (12.5-percent slope).

1104.15 Width of ramps. Existing ramps are permitted to have a minimum width of 30 inches (762 mm) but not less than the width required for the number of occupants served as determined by Section 1005.1. In Group I-2, ramps serving as a means of egress and used for the movement of patients in beds shall comply with Section 1105.6.4.

[BE] 1104.16 Fire escape stairways. Fire escape stairways shall comply with Sections 1104.16.1 through 1104.16.7.

[BE] 1104.16.1 Existing means of egress. Fire escape stairways shall be permitted in existing buildings but shall not constitute more than 50 percent of the required exit capacity.

[BE] 1104.16.2 Opening protectives. Doors and windows within 10 feet (3048 mm) of fire escape stairways shall be protected with $\frac{3}{4}$ -hour opening protectives.

Exception: Opening protectives shall not be required in buildings equipped throughout with an approved automatic sprinkler system.

[BE] 1104.16.3 Dimensions. Fire escape stairways shall meet the minimum width, capacity, riser height and tread depth as specified in Section 1104.10.

[BE] 1104.16.4 Access. Access to a fire escape stairway from a corridor shall not be through an intervening room. Access to a fire escape stairway shall be from a door or window meeting the criteria of Section 1005.1. Access to a fire escape stairway shall be directly to a balcony, landing or platform. These shall not be higher than the floor or window sill level and not lower than 8 inches (203 mm) below the floor level or 18 inches (457 mm) below the window sill.

[BE] 1104.16.5 Materials and strength. Components of fire escape stairways shall be constructed of noncombustible materials. Fire escape stairways and balconies shall support the dead load plus a live load of not less than 100 pounds per square foot (4.78 kN/m²). Fire escape stair-

ways and balconies shall be provided with a top and intermediate handrail on each side.

[BE] 1104.16.5.1 Examination. Fire escape stairways and balconies shall be examined for structural adequacy and safety in accordance with Section 1104.16.5 by a registered design professional or others acceptable to the fire code official every 5 years, or as required by the fire code official. An inspection report shall be submitted to the fire code official after such examination.

[BE] 1104.16.6 Termination. The lowest balcony shall not be more than 18 feet (5486 mm) from the ground. Fire escape stairways shall extend to the ground or be provided with counterbalanced stairs reaching the ground.

Exception: For fire escape stairways serving 10 or fewer occupants, an approved fire escape ladder is allowed to serve as the termination.

[BE] 1104.16.7 Maintenance. Fire escape stairways shall be kept clear and unobstructed at all times and shall be maintained in good working order.

1104.17 Corridor construction. Corridors serving an occupant load greater than 30 and the openings therein shall provide an effective barrier to resist the movement of smoke. Transoms, louvers, doors and other openings shall be kept closed or be self-closing. In Group I-2, corridors in areas housing patient sleeping or care rooms shall comply with Section 1105.5.

Exceptions:

1. Corridors in occupancies other than in Group H, that are equipped throughout with an approved automatic sprinkler system.
2. Corridors in occupancies in Group E where each room utilized for instruction or assembly has not less than one-half of the required means of egress doors opening directly to the exterior of the building at ground level.
3. Corridors that are in accordance with the *California Building Code*.

1104.17.1 Corridor openings. Openings in corridor walls shall comply with the requirements of the *California Building Code*.

Exceptions:

1. Where 20-minute fire door assemblies are required, solid wood doors not less than 1.75 inches (44 mm) thick or insulated steel doors are allowed.
2. Openings protected with fixed wire glass set in steel frames.
3. Openings covered with 0.5-inch (12.7 mm) gypsum wallboard or 0.75-inch (19.1 mm) plywood on the room side.
4. Opening protection is not required where the building is equipped throughout with an approved automatic sprinkler system.

1104.18 Dead ends. Where more than one exit or exit access doorway is required, the exit access shall be arranged such that dead ends do not exceed the limits specified in Table 1104.18.

Exceptions:

1. A dead-end corridor shall not be limited in length where the length of the dead-end corridor is less than 2.5 times the least width of the dead-end corridor.
2. In existing buildings, existing dead-end corridors shall be permitted to comply with lengths established in Section 804.7 of the *California Existing Building Code*. Any newly constructed dead-end corridors

within an existing building shall be limited to the lengths allowed by the *California Building Code*.

1104.19 Exit access travel distance. Exits shall be located so that the maximum length of exit access travel, measured from the most remote point to an approved exit along the natural and unobstructed path of egress travel, does not exceed the distances given in Table 1104.18.

1104.20 Common path of egress travel. The common path of egress travel shall not exceed the distances given in Table 1104.18.

1104.21 Stairway discharge identification. An interior exit stairway or ramp that continues below its level of exit

**TABLE 1104.18
COMMON PATH, DEAD-END AND TRAVEL DISTANCE LIMITS (by occupancy)**

OCCUPANCY	COMMON PATH OF EGRESS TRAVEL LIMIT		DEAD-END LIMIT		EGRESS ACCESS TRAVEL DISTANCE LIMIT	
	Unsprinklered (feet)	Sprinklered (feet)	Unsprinklered (feet)	Sprinklered (feet) ^j	Unsprinklered (feet)	Sprinklered (feet)
Group A	75	20/75 ⁱ	20 ^a	20 ^a	200	250 ^j
Group B ^h	75 ^e	100 ^j	50	50	200	300 ^j
Group E	75	75 ⁱ	20	50	200	250 ^j
Group F-1, S-1	75 ^e	100 ^j	50	50	200 ^c	250 ^{c,h,j}
Group F-2, S-2	75 ^e	100 ^j	50	50	300	400 ^j
Group H-1	25	25 ⁱ	0	0	75	75 ^{i,1}
Group H-2	50	100 ⁱ	0	0	75	100 ^{i,1}
Group H-3	50	100 ⁱ	20	20	100	150 ^{i,1}
Group H-4	75	75 ⁱ	20	20	150	175 ^{i,1}
Group H-5	75	75 ⁱ	20	50	150	200 ^j
Group I-2	Notes d, e, f	Notes d, e, f, j	Note e	Note e	150	200 ^{b,j}
Group I-3	100	100 ^j	NR	NR	150 ^b	200 ^{b,j}
Group I-4	NR	NR	20	20	200	250 ^j
Group M	75	100 ^j	50	50	200	250 ^j
Group R-1	75	75 ^{j,k}	50	50	200	250 ^k
Group R-2	75	125 ^{j,k}	50	50	200	250 ^k
Group R-3	NR	NR	NR	NR	NR	NR
Group R-4	NR	NR	NR	NR	NR	NR
Group U	75 ^e	100 ^j	20	50	300	400 ^j

NR = No Requirements.

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

- a. See Section 1030.9.5 for dead-end aisles in Group A occupancies.
- b. This dimension is for the total travel distance, assuming incremental portions have fully utilized their allowable maximums. For travel distance within the room, and from the room exit access door to the exit, see the appropriate occupancy chapter.
- c. See Section 412 of the *California Building Code* for special requirements on spacing of doors in aircraft hangars.
- d. Separation of exit access doors within a care recipient sleeping room, or any suite that includes care recipient sleeping rooms, shall comply with Section 1105.5.6.
- e. In smoke compartments containing care recipient sleeping rooms and treatment rooms, dead-end corridors shall comply with Section 1105.6.5.
- f. In Group I-2, Condition 2, care recipient sleeping rooms or any suite that includes care recipient sleeping rooms shall comply with Section 1105.7.
- g. Where a tenant space in Group B, S and U occupancies has an occupant load of not more than 30, the length of a common path of egress travel shall be not more than 100 feet.
- h. Where the building, or portion of the building, is limited to one story and the height from the finished floor to the bottom of the ceiling or roof slab or deck is 24 feet or more, the exit access travel distance is increased to 400 feet.
- i. For covered and open malls, the exit access travel distance is increased to 400 feet.
- j. Buildings equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
- k. Buildings equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.2.
- l. Group H occupancies equipped with an approved automatic sprinkler system in accordance with Section 903.2.5.

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discharge shall be arranged and marked to make the direction of egress to a public way readily identifiable.

Exception: Stairways that continue one-half story beyond their levels of exit discharge need not be provided with barriers where the exit discharge is obvious.

1104.22 Exterior stairway protection. Exterior exit stairways shall be separated from the interior of the building as required in Section 1027.6. Openings shall be limited to those necessary for egress from normally occupied spaces.

Exceptions:

1. Separation from the interior of the building is not required for buildings that are two stories or less above grade where the level of exit discharge serving such occupancies is the first story above grade.
2. Separation from the interior of the building is not required where the exterior stairway is served by an exterior balcony that connects two remote exterior stairways or other approved exits, with a perimeter that is not less than 50 percent open. To be considered open, the opening shall be not less than 50 percent of the height of the enclosing wall, with the top of the opening not less than 7 feet (2134 mm) above the top of the balcony.
3. Separation from the interior of the building is not required for an exterior stairway located in a building or structure that is permitted to have unenclosed interior stairways in accordance with Section 1023.
4. Separation from the open-ended corridors of the building is not required for exterior stairways provided that:
 - 4.1. The open-ended corridors comply with Section 1020.
 - 4.2. The open-ended corridors are connected on each end to an exterior exit stairway complying with Section 1027.
 - 4.3. At any location in an open-ended corridor where a change of direction exceeding 45 degrees (0.79 rad) occurs, a clear opening of not less than 35 square feet (3 m²) or an exterior stairway shall be provided. Where clear openings are provided, they shall be located so as to minimize the accumulation of smoke or toxic gases.

1104.23 Minimum aisle width. The minimum clear width of aisles shall comply with the following:

1. Forty-two inches (1067 mm) for stepped aisles having seating on each side.

Exception: Thirty-six inches (914 mm) where the stepped aisle serves fewer than 50 seats.
2. Thirty-six inches (914 mm) for stepped aisles having seating on only one side.

Exceptions:

1. Thirty inches (760 mm) for catchment areas serving not more than 60 seats.

2. Twenty-three inches (584 mm) between a stepped aisle handrail and seating where a stepped aisle does not serve more than five rows on one side.

3. Twenty inches (508 mm) between a stepped aisle handrail or guard and seating where the aisle is subdivided by a mid-aisle handrail.
4. Forty-two inches (1067 mm) for level or ramped aisles having seating on both sides.

Exceptions:

1. Thirty-six inches (914 mm) where the aisle serves fewer than 50 seats.
2. Thirty inches (760 mm) where the aisle serves fewer than 15 seats and does not serve as part of an accessible route.
5. Thirty-six inches (914 mm) for level or ramped aisles having seating on only one side.

Exception: Thirty inches (760 mm) for catchment areas serving not more than 60 seats and not serving as part of an accessible route.
6. In Group I-2, where aisles are used for movement of patients in beds, aisles shall comply with Section 1105.6.8.

1104.24 Stairway floor number signs. Existing stairways shall be marked in accordance with Section 1023.9.

1104.25 Egress path markings. Existing high-rise buildings of Group A, B, E, I, M and R-1 occupancies shall be provided with luminous egress path markings in accordance with Section 1025.

Exception: Open, unenclosed stairwells in historic buildings designated as historic under a state or local historic preservation program.

SECTION 1105 CONSTRUCTION REQUIREMENTS FOR EXISTING GROUP I-2

1105.1 General. Existing Group I-2 shall meet all of the following requirements:

1. The minimum fire safety requirements in Section 1103.
2. The minimum means of egress requirements in Section 1104.
3. The additional egress and construction requirements in Section 1105.

Where the provisions of this chapter conflict with the construction requirements that applied at the time of construction, the most restrictive provision shall apply.

1105.2 Applicability. The provisions of Sections 1105.3 through 1105.8, 1105.10 and 1105.11 shall apply to the existing Group I-2 fire area.

1105.3 Construction. Group I-2, Condition 2 shall not be located on a floor level higher than the floor level limitation in Table 1105.3 based on the type of construction.

**TABLE 1105.3
FLOOR LEVEL LIMITATIONS FOR GROUP I-2, CONDITION 2**

CONSTRUCTION TYPE	AUTOMATIC SPRINKLER SYSTEM	ALLOWABLE FLOOR LEVEL ^a			
		1	2	3	4 or more
IA	Note b	P	P	P	P
	Note c	P	P	P	P
IB	Note b	P	P	P	P
	Note c	P	P	P	P
IIA	Note b	P	P	P	NP
	Note c	P	NP	NP	NP
IIB	Note b	P	P	NP	NP
	Note c	NP	NP	NP	NP
IIIA	Note b	P	P	NP	NP
	Note c	P	NP	NP	NP
IIIB	Note b	P	NP	NP	NP
	Note c	NP	NP	NP	NP
IV	Note b	P	P	NP	NP
	Note c	NP	NP	NP	NP
VA	Note b	P	P	NP	NP
	Note c	NP	NP	NP	NP
VB	Note b	P	NP	NP	NP
	Note c	NP	NP	NP	NP

P = Permitted; NP = Not Permitted.

- a. Floor level shall be counted based on the number of stories above grade.
- b. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- c. The building is equipped with an automatic sprinkler system in accordance with Section 1105.8.

1105.4 Incidental uses in existing Group I-2. Incidental uses associated with and located within existing single-occupancy or mixed-occupancy Group I-2 buildings and that generally pose a greater level of risk to such occupancies shall comply with the provisions of Sections 1105.4.1 through 1105.4.3.2.1. Incidental uses in Group I-2 occupancies are limited to those listed in Table 1105.4.

1105.4.1 Occupancy classification. Incidental uses shall not be individually classified in accordance with Section 302.1 of the *California Building Code*. Incidental uses shall be included in the building occupancies within which they are located.

1105.4.2 Area limitations. Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.

1105.4.3 Separation and protection. The incidental uses listed in Table 1105.4 shall be separated from the remainder of the building or equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table.

1105.4.3.1 Separation. Where Table 1105.4 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building in accordance with Section 509.4.1 of the *California Building Code*.

1105.4.3.2 Protection. Where Table 1105.4 permits an automatic sprinkler system without a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke in accordance with Section 509.4.2 of the *California Building Code*.

1105.4.3.2.1 Protection limitation. Except as otherwise specified in Table 1105.4 for certain incidental uses, where an automatic sprinkler system is provided in accordance with Table 1105.4, only the space occupied by the incidental use need be equipped with such a system.

1105.5 Corridor construction. In Group I-2, in areas housing patient sleeping or care rooms, corridor walls and the opening protectives therein shall provide a barrier designed to resist the passage of smoke in accordance with Sections 1105.5.1 through 1105.5.7.

1105.5.1 Materials. The walls shall be of materials permitted by the building type of construction.

1105.5.2 Fire-resistance rating. Unless required elsewhere in this code, corridor walls are not required to have a fire-resistance rating. Corridor walls that were installed as fire-resistance-rated assemblies in accordance with the applicable codes under which the building was constructed, remodeled or altered shall be maintained unless modified in accordance with the *California Existing Building Code*.

1105.5.3 Corridor wall continuity. Corridor walls shall extend from the top of the foundation or floor below to one of the following:

1. The underside of the floor or roof sheathing, deck or slab above.
2. The underside of a ceiling above where the ceiling membrane is constructed to limit the passage of smoke.
3. The underside of a lay-in ceiling system where the ceiling system is constructed to limit the passage of smoke and where the ceiling tiles weigh not less than 1 pound per square foot (4.88 kg/m²) of tile.

1105.5.4 Openings in corridor walls. Openings in corridor walls shall provide protection in accordance with Sections 1105.5.4.1 through 1105.5.4.3.

1105.5.4.1 Windows. Windows in corridor walls shall be sealed to limit the passage of smoke, or the window shall be automatic-closing upon detection of smoke, or the window opening shall be protected by an automatic closing device that closes upon detection of smoke.

Exception: In smoke compartments not containing patient sleeping rooms, pass-through windows or similar openings shall be permitted in accordance with Section 1105.5.4.3.

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**TABLE 1105.4
INCIDENTAL USES IN EXISTING GROUP I-2 OCCUPANCIES**

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	2 hours
Incinerator rooms	2 hours and provide automatic sprinkler system
Paint shops not classified as Group H	2 hours; or 1 hour and provide automatic sprinkler system
Laboratories and vocational shops, not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
Patient rooms equipped with padded surfaces	1 hour or provide automatic sprinkler system
Physical plant maintenance shops	1 hour or provide automatic sprinkler system
Waste and linen collection rooms with containers with total volume of 10 cubic feet or greater	1 hour or provide automatic sprinkler system
Storage rooms greater than 100 square feet	1 hour or provide automatic sprinkler system
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptable power supplies	2 hours

For SI: 1 square foot = 0.0929 m², 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L.

1105.5.4.2 Doors. Doors in corridor walls shall comply with Sections 1105.5.4.2.1 through 1105.5.4.2.3.

1105.5.4.2.1 Louvers. Doors in corridor walls shall not include louvers, transfer grills or similar openings.

Exception: Doors shall be permitted to have louvers, transfer grills or similar openings at toilet rooms or bathrooms; storage rooms that do not contain storage of flammable or combustible material; and storage rooms that are not required to be separated as incidental uses.

1105.5.4.2.2 Corridor doors. Doors in corridor walls shall limit the transfer of smoke by complying with the following:

1. Doors shall be constructed of not less than 1³/₄ inch-thick (44 mm) solid bonded-core wood or capable of resisting fire not less than 1¹/₃ hour.

Exception: Corridor doors in buildings equipped throughout with an automatic sprinkler system.

2. Frames for side-hinged swinging doors shall have stops on the sides and top to limit transfer of smoke.
3. Where provided, vision panels in doors shall be a fixed glass window assembly installed to limit the passage of smoke. Existing wired

glass panels with steel frames shall be permitted to remain in place.

4. The clearance between the bottom of the door and floor shall not exceed 1 inch (25 mm).
5. Doors shall be positive latching with devices that resist not less than 5 pounds (22.2 N). Roller latches are prohibited.
6. Mail slots or similar openings shall be permitted in accordance with Section 1105.5.4.3.

1105.5.4.2.3 Dutch doors. Where provided, Dutch doors shall comply with Section 1105.5.4.2.2. In addition, Dutch doors shall be equipped with latching devices on either the top or bottom leaf to allow leaves to latch together. The space between the leaves shall be protected with devices such as astragals to limit the passage of smoke.

1105.5.4.2.4 Self- or automatic-closing doors. Where self- or automatic-closing doors are required, closers shall be maintained in operational condition. Hold-open devices on doors shall be capable of manual release.

1105.5.4.2.5 Protective plates. Protective plates installed on corridor doors shall not be limited in size.

1105.5.4.3 Openings in corridor walls and doors. In other than smoke compartments containing patient sleeping rooms, mail slots, pass-through windows or similar openings shall not be required to be protected where the

aggregate area of the openings between the corridor and a room are not greater than 80 square inches (51 613 mm²) and are located with the top edge of any opening not higher than 48 inches above the floor.

1105.5.5 Penetrations. The space around penetrating items shall be filled with an approved material to limit the passage of smoke.

1105.5.6 Joints. Joints shall be filled with an approved material to limit the passage of smoke.

1105.5.7 Ducts and air transfer openings. The space around a duct penetrating a smoke partition shall be filled with an approved material to limit the passage of smoke. Air transfer openings in smoke partitions shall be provided with a smoke damper complying with Section 717.3.2.2 of the *California Building Code*.

Exception: Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 909, approved alternative protection shall be utilized.

1105.6 Means of egress. In addition to the means of egress requirements in Section 1104, Group I-2 facilities shall meet the means of egress requirements in Sections 1105.6.1 through 1105.6.8.

1105.6.1 Two means of egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which the means of egress originated. Smoke compartments that do not contain an exit shall be provided with direct access to not less than two adjacent smoke compartments.

1105.6.2 Size of door. Means of egress doors used for the movement of patients in beds shall provide a minimum clear width of 41½ inches (1054 mm). The height of the door opening shall be not less than 80 inches (2032 mm).

Exceptions:

1. Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the floor.
2. In Group I-2, Condition 1, existing means of egress doors used for the movement of patients in beds that provide a minimum clear width of 32 inches (813 mm) shall be permitted to remain.

1105.6.3 Group I-2 occupancies. In Group I-2, where a door serves as an opening protective in a fire barrier, smoke barrier or fire wall and where the door is equipped with a hold-open device, such door shall automatically close upon any of the following conditions:

1. Actuation of smoke detectors initiating the hold-open device.
2. Activation of the fire alarm system within the zone.
3. Activation of an automatic sprinkler system within the zone.

1105.6.4 Ramps. In areas where ramps are used for movement of patients in beds, the clear width of the ramp shall be not less than 48 inches (1219 mm).

1105.6.5 Corridor width. In areas where corridors are used for movement of patients in beds, the clear width of the corridor shall be not less than 48 inches (1219 mm).

1105.6.6 Dead-end corridors. In smoke compartments containing patient sleeping rooms and treatment rooms, dead-end corridors shall not exceed 30 feet (9144 mm) unless approved by the fire code official.

1105.6.7 Separation of exit access doors. Patient sleeping rooms, or any suite that includes patient sleeping rooms, of more than 1,000 square feet (92.9 m²) shall have not less than two exit access doors placed a distance apart equal to not less than one-third of the length of the maximum overall diagonal dimension of the patient sleeping room or suite to be served, measured in a straight line between exit access doors.

1105.6.8 Aisles. In areas where aisles are used for movement of patients in beds, the clear width of the aisle shall be not less than 48 inches (1219 mm).

1105.7 Smoke compartments. Smoke compartments shall be provided in existing Group I-2, Condition 2, in accordance with Sections 1105.7.1 through 1105.7.6.

1105.7.1 Design. Smoke barriers shall be provided to subdivide each story used for patients sleeping with an occupant load of more than 30 patients into not fewer than two smoke compartments.

1105.7.1.1 Refuge areas. Refuge areas shall be provided within each smoke compartment. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining smoke compartment. Where a smoke compartment is adjoined by two or more smoke compartments, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments.

The size of the refuge area shall provide the following:

1. Not less than 30 net square feet (2.8 m²) for each care recipient confined to a bed or stretcher.
2. Not less than 15 square feet (1.4 m²) for each resident in a Group I-2 using mobility assistance devices.
3. Not less than 6 square feet (0.56 m²) for each occupant not addressed in Items 1 and 2.

Areas of spaces permitted to be included in the calculation of the refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

1105.7.2 Smoke barriers. Smoke barriers shall be constructed in accordance with Section 709 of the *California Building Code*.

Exceptions:

1. Existing smoke barriers are permitted to remain where the existing smoke barrier has a minimum fire-resistance rating of ½ hour.

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2. Smoke barriers shall be permitted to terminate at an atrium enclosure in accordance with Section 404.6 of the *California Building Code*.

1105.7.3 Opening protectives. Openings in smoke barriers shall be protected in accordance with Section 716 of the *California Building Code*. Opening protectives shall have a minimum fire protection rating of $\frac{1}{3}$ hour.

Exceptions:

1. Existing wired glass vision panels in doors shall be permitted to remain.
2. Existing nonlabeled protection plates shall be permitted to remain.

1105.7.4 Penetrations. Penetrations of smoke barriers shall comply with the *California Building Code*.

Exception: Approved existing materials and methods of construction.

1105.7.5 Joints. Joints made in or between smoke barriers shall comply with the *California Building Code*.

Exception: Approved existing materials and methods of construction.

1105.7.6 Duct and air transfer openings. Penetrations in a smoke barrier by duct and air transfer openings shall comply with Section 717 of the *California Building Code*.

Exception: Where existing duct and air transfer openings in smoke barriers exist without smoke dampers, they shall be permitted to remain. Any changes to existing smoke dampers shall be submitted for review and approved in accordance with Section 717 of the *California Building Code*.

1105.8 Group I-2 care suites. Care suites in existing Group I-2, Condition 2 occupancies shall comply with Sections 407.4.4 through 407.4.4.6.2 of the *California Building Code*.

1105.9 Group I-2 automatic sprinkler system. An automatic sprinkler system installed in accordance with Section 903.3.1.1 shall be provided throughout the floor containing the Group I-2 fire area. The sprinkler system shall be provided throughout the floor where the Group I-2 occupancy is located, on all floors between the Group I-2 occupancy fire area and the level of exit discharge, the level of exit discharge, and all floors below the level of exit discharge.

Exception: Floors classified as an open parking garage are not required to be sprinklered.

1105.10 Group I-2 automatic fire alarm system. An automatic fire alarm system shall be installed in existing Group I-2 occupancies in accordance with Section 907.2.6.2.

Exception: Manual fire alarm boxes in patient sleeping areas shall not be required at exits if located at all nurses' control stations or other constantly attended staff locations, provided such that manual fire alarm boxes are visible, are provided with ready access, and travel distances required in Section 907.4.2.1 are not exceeded.

1105.11 Essential electrical systems. Essential electrical systems in Group I-2, Condition 2 occupancies shall be in accordance with Sections 1105.11.1 and 1105.11.2.

1105.11.1 Where required. Where required by NFPA 99, Group I-2, Condition 2 occupancies shall be provided with an essential electrical system in accordance with NFPA 99.

1105.11.2 Installation and duration. In Group I-2, Condition 2 occupancies, the installation and duration of operation of existing essential electrical systems shall be based on a hazard vulnerability analysis conducted in accordance with NFPA 99.

SECTION 1106 REQUIREMENTS FOR OUTDOOR OPERATIONS

1106.1 Tire storage yards. Existing tire storage yards shall be provided with fire apparatus access roads in accordance with Sections 1106.1.1 and 1106.1.2.

1106.1.1 Access to piles. Access roadways shall be within 150 feet (45 720 mm) of any point in the storage yard where storage piles are located not less than 20 feet (6096 mm) from any storage pile.

1106.1.2 Location within piles. Fire apparatus access roads shall be located within all pile clearances identified in Section 3405.4 and within all fire breaks required in Section 3405.5.

SECTION 1107 GROUP A PUBLIC ADDRESS SYSTEM

1107.1 Group A occupancy public address system. Existing buildings or structures intended for public assemblies of 10,000 or more persons, which, on or after January 1, 1991, have or subsequently have installed a public address system, shall have an emergency backup power system for the public address system.

SECTIONS 1108 THROUGH 1112 RESERVED

SECTION 1113 EXISTING GROUP R-1 AND GROUP R-2 OCCUPANCIES [SFM]

1113.1 Scope. The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings classified as Group R Occupancies.

1113.1.1 Application. In accordance with Health and Safety Code Section 13143.2, the provisions of Sections 1113.2 through 1113.12 shall only apply to multiple-story structures existing on January 1, 1975, let for human habitation, including, and limited to, apartment houses, hotels and motels wherein rooms used for sleeping are let above the ground floor.

1113.2 Number of exits. Every apartment and every other sleeping room shall have access to not less than two exits when the occupant load is 10 or more (exits need not be

directly from the apartment or sleeping room). A fire escape as specified herein may be used as one required exit.

Subject to approval of the authority having jurisdiction, a ladder device as specified herein may be used in lieu of a fire escape when the construction feature or the location of the building on the property cause the installation of a fire escape to be impractical.

1113.3 Stair construction. All stairs shall have a minimum run of 9 inches (229 mm) and a maximum rise of 8 inches (203 mm) and a minimum width exclusive of handrails of 30 inches (762 mm). Every stairway shall have at least one handrail. A landing having a minimum horizontal dimension of 30 inches (762 mm) shall be provided at each point of access to the stairway.

1113.4 Interior stairways. Every interior stairway shall be enclosed with walls of not less than one-hour fire-resistive construction. Where existing partitions form part of a stairwell enclosure, wood lath and plaster in good condition will be acceptable in lieu of one-hour fire-resistive construction. Doors to such enclosures shall be protected by a self-closing door equivalent to a solid wood door with a thickness of not less than $1\frac{3}{4}$ inches (44.5 mm).

Enclosures shall include all landings between flights and any corridors, passageways or public rooms necessary for continuous exit to the exterior of the buildings. The stairway need not be enclosed in a continuous shaft if cut off at each story by the fire-resistive construction required by this subsection for stairwell enclosures. Enclosures shall not be required if an automatic sprinkler system is provided for all portions of the building except bedrooms, apartments and rooms accessory thereto. Interior stairs and vertical openings need not be enclosed in two-story buildings.

1113.5 Exterior stairways. Exterior stairways shall be non-combustible or of wood of not less than 2-inch (51 mm) nominal thickness with solid treads and risers.

1113.6 Fire escapes, exit ladder devices. Fire escapes may be used as one means of egress if the pitch does not exceed 60 degrees, the width is not less than 18 inches (457 mm), the treads are not less than 4 inches (102 mm) wide, and they extend to the ground or are provided with counterbalanced stairs reaching to the ground. Access shall be by an opening having a minimum dimension of 29 inches (737 mm) when open. The sill shall not be more than 30 inches (762 mm) above the floor and landing.

A ladder device, when used in lieu of a fire escape, shall conform to Section 1113.6.1 and the following:

Serves an occupant load of nine people or less or a single dwelling unit or hotel room.

The building does not exceed three stories in height.

The access is adjacent to an opening as specified for emergency egress or rescue or from a balcony.

The device does not pass in front of any building opening below the unit being served.

The availability of activating the ladder device is accessible only to the opening or balcony served.

The device as installed will not cause a person using it to be within 12 feet (3658 mm) of exposed energized high-voltage conductors.

1113.6.1 Exit ladder devices.

1113.6.1.1 Scope. This standard for exit ladder devices is applicable where such devices are permitted by the building official for installation on existing apartment houses and hotels in conformance with the California Building Code.

1113.6.1.2 Instructions. Installation shall be in accordance with the manufacturer's instructions. Instructions shall be illustrated and shall include directions and information adequate for attaining proper and safe installation of the product. Where exit ladder devices are intended for mounting on different support surfaces, specific installation instructions shall be provided for each surface.

1113.6.1.3 General design. All load-bearing surfaces and supporting hardware shall be of noncombustible materials. Exit ladder devices shall have a minimum width of 12 inches (305 mm) when in the position intended for use. The design load shall not be less than 400 pounds (1780 N) for 16-foot (4877 mm) length and 600 pounds (2699 N) for 25-foot (7620 mm) length.

1113.6.1.4 Performance.

1113.6.1.4.1 Exit ladder devices shall be capable of withstanding an applied load of four times the design load when installed in the manner intended for use. Test loads shall be applied for a period of one hour.

1113.6.1.4.2 Exit ladder devices of the retractable type shall, in addition to the static load requirements of Section 413.6.1.4.1 of the California Building Code, be capable of withstanding the following tests:

1. Rung strength
2. Rung-to-side-rail shear strength
3. Release mechanism
4. Low temperature

1113.6.1.5 Rung-strength test. Rungs of retractable exit ladder devices shall be capable of withstanding a load of 1,000 pounds (4448 N) when applied to a $3\frac{1}{2}$ -inch-wide (89 mm) block resting at the center of the rung. The test load shall be applied for a period of one hour. The ladder shall remain operational following this test.

1113.6.1.6 Rung-to-side-rail shear test. Rungs of retractable exit ladder devices shall be capable of withstanding 1,000 (4448 N) when applied to a $3\frac{1}{2}$ -inch-wide (89 mm) block resting on the center rung as near the side rail as possible. The test load shall be applied for a period of one hour. Upon removal of the test load the fasteners attaching the rung to the side rail shall show no evidence of failure. The ladder shall remain operational following the test.

1113.6.1.7 Release mechanism test. The release mechanism of retractable exit ladder devices shall operate with an average applied force of not more than 5 pounds (22.2 N) for hand-operated releasing mechanisms and an average applied force of not more than 25 pounds (111 N) for foot-pedal types of releasing mechanisms. For these tests, a force gauge shall be applied to the release mechanism, and the average of three consecutive readings shall be computed.

1113.6.1.8 Low temperature operation test. Representative samples of the exit ladder devices shall be subjected to a temperature of -40°C in an environmental chamber for a period of 24 hours. The release mechanism shall be operated immediately upon removal from the chamber. The ladder device shall function as intended without any restriction of operation.

1113.7 Doors and openings. Exit doors and openings shall meet the requirements of Sections 1008.1.2, 1008.8.1.8, 1008.1.9 and 708.6 of the California Building Code. Doors shall not reduce the required width of stairway more than 6 inches (152 mm) when open. Transoms and openings other than doors from corridors to rooms shall be fixed closed and shall be covered with a minimum of $\frac{3}{4}$ -inch (19 mm) plywood or $\frac{1}{2}$ -inch (13 mm) gypsum wallboard or equivalent material.

Exceptions:

1. Existing solid-bonded wood-core doors $1\frac{3}{8}$ inches thick (34.9 mm), or their equivalent may be continued in use.
2. Where the existing frame will not accommodate a door complying with Section 708.6 of the California Building Code, a $1\frac{3}{8}$ -inch-thick (35 mm) solid-bonded wood-core door may be used.

1113.8 Exit signs. Every exit doorway or change of direction of a corridor shall be marked with a well-lighted exit sign having letters at least 5 inches (127 mm) high.

1113.9 Enclosure of vertical openings. Elevators, shafts, ducts and other vertical openings shall be enclosed as required for stairways in Section 1113.5 or by wired glass set in metal frames. Doors shall be noncombustible or as regulated in Section 1113.5.

1113.10 Separation of occupancies. Occupancy separations shall be provided as specified in Section 508 of the California Building Code. Lobbies and public dining rooms, not including cocktail lounges, shall not require a separation if the kitchen is so separated from the dining room. Every room containing a boiler or central heating plant shall be separated from the rest of the building by not less than a one-hour fire-resistive occupancy separation.

Exception: A separation shall not be required for such rooms with equipment serving only one dwelling unit.

1113.11 Equivalent protection. In lieu of the separation of occupancies required by Section 1113.10, equivalent protection may be permitted when approved by the enforcement agency.

Exception: The provisions of Sections 1113.3 through 1113.11 above shall not apply to any existing apartment

house, hotel or motel having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access which is subject to the provisions of Section 1114 and the California Existing Building Code, relating to existing high-rise buildings.

Note: In accordance with Health and Safety Code Section 17920.7, the provisions of Sections 1113.3 through 1113.11 above shall apply only to multiple-story structures existing on January 1, 1975, let for human habitation including, and limited to, apartments, houses, hotels and motels wherein rooms used for sleeping are let above the ground floor.

1113.12 Fire alarms.

1113.12.1 General. Every apartment house three or more stories in height or containing more than 15 apartments, every hotel three or more stories in height or containing 20 or more guest rooms, shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously and shall be in accordance with the California Fire Code. See Section 1114.14 for special requirements in buildings over 75 feet (22 860 mm) in height.

Exception: A fire alarm system need not be installed provided such apartment house or hotel is separated by an unpierced wall of not less than four-hour fire resistance in buildings of Type IA, Type IIB, Type III or Type IV construction and two-hour fire resistance in buildings of all other types of construction provided:

1. Areas do not exceed the number of apartments or guest rooms stipulated.
2. The fire-resistive wall conforms to the requirements of Section 706.6 of the California Building Code.
3. The wall complies with all other applicable provisions of the California Building Code.
4. The wall extends to all outer edges of horizontal projecting elements, such as balconies, roof overhangs, canopies, marquees or architectural projections.
5. No openings are permitted for air ducts or similar penetrations, except that openings for pipes, conduits and electrical outlets of copper, sheet steel or ferrous material shall be permitted through such wall and need not be protected, provided they do not unduly impair the required fire resistance of the assembly.
6. Tolerances around such penetrations shall be filled with approved noncombustible materials.

1113.12.2 Installation. The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

1113.13 Existing Group R Occupancy high-rise buildings.

1113.13.1 General. Regardless of other provisions of these regulations relating to existing high-rise buildings,

requirements relative to existing Group R-1 or Group R-2 Occupancies shall not be less restrictive than those established pursuant to Health and Safety Code Section 13143.2.

1113.13.2 Corridor openings. Openings in corridor walls and ceilings shall be protected by not less than 1³/₄-inch (44.5 mm) solid-bonded wood-core doors, 1/4-inch-thick (6 mm) wired glass conforming to Section 715.1 of the California Building Code, by approved fire dampers or by equivalent protection in lieu of any of these items. Transoms shall be fixed closed with material having a fire-resistive rating equal to 1/2-inch (12.7 mm) Type X gypsum wallboard or equivalent material installed on both sides of the opening.

1113.13.3 Fire alarm systems. Notwithstanding the provisions of Section 403 of the California Building Code, every existing high-rise building used for the housing of a Group R-1 or Group R-2 Occupancies shall have installed therein a fire alarm system conforming to this subsection.

1113.13.3.1 General. Every apartment house and every hotel shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously.

1113.13.3.2 Installation. The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

1113.13.3.3 Fire-extinguishing systems. Automatic fire-extinguishing systems installed in any structure subject to these regulations shall have an approved flow indicator electrically interconnected to the required fire alarm system.

SECTION 1114 EXISTING HIGH-RISE BUILDINGS [SFM]

1114.1 Scope and definition. The provisions of Sections 1114.1 through 1114.27 shall apply to every existing high-rise building of any type of construction or occupancy having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access.

Exceptions:

1. Hospitals, as defined in Section 1250 of the Health and Safety Code.
2. The following structures, while classified as high-rise buildings, shall not be subject to the provisions of Sections 1114.1 through 1114.27, but shall conform to all applicable provisions of these regulations.
 - 2.1. Building used exclusively as open parking garages.
 - 2.2. Buildings where all floors above the 75 foot (22 860 mm) level are used exclusively as open parking garages.

2.3. Floors of buildings used exclusively as open parking garages and located above all other floors used for human occupancy.

2.4. Buildings such as power plants, look-out towers, steeples, grain houses and similar structures, when so determined by the enforcing agency.

2.5. Buildings used exclusively for jails and prisons. For the purposes of this section, "building access" shall mean an exterior door opening conforming to all of the following:

1. Suitable and available for fire department use.
2. Located not more than 2 feet (610 mm) above the adjacent ground level.
3. Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.
4. Designed to permit penetration through the use of fire department forcible-entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.

"Existing high-rise structure" means a high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.

For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Actual construction of such buildings shall commence on or before January 1, 1976, unless all provisions for new buildings have been met.

Note: It is the intent of this section that, in determining the level from which the highest occupied floor is to be measured, the enforcing agency should exercise reasonable judgment, including consideration of overall accessibility to the building by fire department personnel and vehicular equipment. When a building is situated on sloping terrain and there is building access on more than one level, the enforcing agency may select the level which provides the most logical and adequate fire department access.

1114.2 Compliance data. Except as may be otherwise specified, existing high-rise building shall conform to the applicable requirements of these regulations by April 26, 1979.

Exception: The period of compliance may be extended upon showing of good cause for such extension if a systematic and progressive plan of correction is submitted to, and approved by, the enforcing agency. Such extension shall not exceed two years from the date of approval of such plan. Any plan of correction submitted pursuant to this exception shall be submitted and approved on or before April 26, 1979.

CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

1114.3 Continued use. Existing high-rise building may have their use continued if they conform, or are made to conform, to the intent of the provisions of Sections 1114.5 through 1114.27 to provide for the safety of the occupants of the high-rise buildings and person involved in fire-suppression activities.

1114.4 Alternate protection. Alternate means of egress, fire walls or fire barriers, smoke barriers, automatic fire detection or fire-extinguishing systems, or other fire-protection devices, equipment or installations may be approved by the enforcing agency to provide reasonable and adequate life safety as intended by Sections 1114.5 through 1114.27 for existing high-rise buildings.

1114.5 Basic provisions. The provisions outlined in Sections 1114.1 through 1114.27 are applicable to every existing highrise building.

1114.6 Minimum construction. Existing wood lath and plaster, existing 1/2-inch (12.7 mm) gypsum wallboard, existing installations of 1/2-inch thick (12.7 mm) wired glass which are or are rendered inoperative and fixed in a closed position, or other existing materials having similar fire-resistive capabilities shall be acceptable. All such assemblies shall be in good repair, free of any condition which would diminish their original fire-resistive characteristics.

Where 1³/₄-inch (44.5 mm) solid-bonded wood-core doors are specified in these regulations for existing high-rise buildings, new or existing 1³/₈-inch (34.9 mm) doors shall be acceptable where existing framing will not accommodate a 1³/₄-inch (44.5 mm) door.

Note: It is the intent of this provisions that existing wood frames may have their use continued.

1114.7 New construction. All new construction shall be composed of materials and assemblies of materials conforming to the fire-resistive provisions of these regulations. In no case shall enclosure walls be required to be of more than one-hour fire-resistive construction.

Exception: When approved by the enforcing agency, materials specified in Section 1114.6 may be used for new construction when necessary to maintain continuity of design and measurement of existing construction.

1114.8 Exits. Every floor from an existing high-rise building shall have access to two separate means of egress, one of which, when approved by the enforcing agency, may be an existing exterior fire escape. New installations of smoke-proof enclosures shall not be required.

Note: In determining the adequacy of exits and their design, Chapter 10 of the California Building Code may be used as a guide. It is the intent of this section that every existing high-rise building need not mandatorily conform or be made to conform with the requirements for new high-rise buildings. Reasonable judgment in the application of requirements must be exercised by the enforcing agency.

1114.9 Fire escapes. An existing fire escape in good structural condition may be acceptable as one of the required means of egress from each floor. Access to such fire escapes may be by any one of the following:

Through a room between the corridor and the fire escape if the door to the room is operable from the corridor side without the use of any key, special knowledge or effort.

By a door operable to a fire escape from the interior without the use of any key, special knowledge or effort.

By a window operable from the interior. Such window shall have a minimum dimension of 29 inches (737 mm) when open.

The sill shall not be more than 30 inches (762 mm) above the floor and landing.

1114.10 Protection of exterior openings. When an existing fire escape is accepted as one of the require means of egress, openings onto the fire escape landing and openings within 5 feet (1524 mm) horizontally of the landings shall be protected in a manner acceptable to the enforcing agency.

1114.11 Locking of stairway doors. When exit doors from corridors to exit stairways are locked to prohibit access from the stairway side, the locking mechanisms shall be retracted to the unlocked position upon failure of electrical power and a telephone or other two-way communication system connected to an approved emergency service that operates continuously shall be provided at not less than every fifth floor in each required stairway. In lieu thereof, master keys which will unlock all such doors from the stairway side shall be provided in such numbers and locations as approved by the enforcing agency.

1114.12 Enclosures. Interior vertical shafts, including but not limited to, elevators, stairway and utility, shall be enclosed with construction as set forth in Section 1114.6.

1114.13 Opening protection. Doors in other than elevators, which shall be of a type acceptable to the enforcing agency, shall be approved one-hour, fire-rated, tight-fitting or gasketed doors or equivalent protection, and shall be of the normally closed type, self-closing or a type which will close automatically in accordance with Section 715 of the California Building Code.

Exception: In lieu of stairway enclosures, smoke barriers may be provided in such a manner that fire and smoke will not spread to other floors or otherwise impair exit facilities. In these instances, smoke barriers shall not be less than one-hour fire resistive with openings protected by not less than approved one-third-hour, fire-rated, tight-fitting or gasketed doors. Such doors shall be of the self-closing type or of a type which will close automatically in the manner specified in Section 715 of the California Building Code.

Doors crossing corridors shall be provided with wired-glass vision panels set in approved steel frames. Doors for elevators shall not be of the open-grille type.

1114.14 Fire alarm system. Every existing high-rise building shall be provided with an approved fire alarm system. In department stores, retail sales stores and similar occupancies where the general public is admitted, such systems shall be of a type capable of alerting staff and employees. In office buildings and all other high-rise buildings, such sys-

tems shall be of a type capable of alerting all occupants simultaneously.

Exceptions:

1. In areas of public assemblage, the type and location of audible appliances shall be as determined by the enforcing agency.
2. When acceptable to the enforcing agency, the occupant voice notification system required by Section 1114.20 may be used in lieu of the fire alarm system required by Section 1114.14.

1114.15 Existing systems. Existing fire systems, when acceptable to the enforcing agency, shall be deemed as conforming to the provisions of these regulations. For requirements for existing Group R-1 Occupancies, see Section 312.13 of the California Building Code.

1114.16 Annunciation. When a new fire alarm system is installed, it shall be connected to an annunciator panel installed in a location approved by the enforcing agency. For purposes of annunciation, zoning shall be in accordance with Section 907.6.3 of the California Building Code.

1114.17 Monitoring. Shall be in accordance with Section 907.6.5 of the California Building Code.

1114.18 Systems interconnection. When an automatic fire detection system or automatic extinguishing system is installed, activation of such system shall cause the sounding of the fire alarm notification appliances at locations designated by the enforcing agency.

1114.19 Manual fire alarm boxes. A manual fire alarm box shall be provided in the locations designated by the enforcing agency. Such locations shall be where boxes are readily accessible and visible and in normal paths of daily travel by occupants of the building.

1114.20 Emergency voice/alarm communication system. An approved emergency voice/alarm system shall be provided in every existing high-rise building which exceeds 150 feet (45 720 mm) in height measured in the manner set forth in Section 312.1 of the California Building Code. Such system shall provide communication from a location available to and designated by the enforcing agency to not less than all public areas. The emergency voice/alarm system may be combined with a fire alarm system provide the combined system has been approved and listed by the State Fire Marshal. The sounding of a fire alarm signal in any given area or floor shall not prohibit voice communication to other areas of floors. Combination systems shall be designed to permit voice transmission to override the fire alarm signal, but the fire alarm signal shall not terminate in less than three minutes.

1114.21 Fire department system. When it is determined by test that portable fire department communication equipment is ineffective, a communication system acceptable to the enforcing agency shall be installed within the building to permit emergency communication between fire-suppression personnel.

1114.22 Interior wall and ceiling finish. Interior wall and ceiling finish of exitways shall conform to the provisions of Chapter 8 of the California Building Code. Where the materi-

als used in such finishes do not conform to the provisions of Chapter 8 of the California Building Code, such finishes may be surfaced with an approved fire-retardant coating.

1114.23 Ventilation. Natural or mechanical ventilation for the removal of products of combustion shall be provided in every story of an existing high-rise building. Such ventilation shall be any one or combination of the following: Panels or windows in the exterior wall which can be opened. Such venting facilities shall be provided at the rate of at least 20 square feet (1.86 m²) of opening per 50 lineal feet (15 240 lineal mm) of exterior wall in each story, distributed around the perimeter at not more than 50-foot (15 240 mm) intervals on at least two sides of the building. Approved fixed tempered glass may be used in lieu of openable panels or windows. When only selected panels or windows are of tempered glass, they shall be clearly identified as required by the enforcing agency. Any other design which will produce equivalent results.

1114.24 Smoke control systems. Existing air-circulation systems shall be provided with an override switch in a location approved by the enforcing agency which will allow for the manual control of shutdown of the systems.

Exception: Systems which serve only a single floor, or portion thereof, without any penetration by ducts or other means into adjacent floors.

1114.25 Elevator recall smoke detection. Smoke detectors for emergency operation of elevators shall be provided as required by Section 3003 of the California Building Code.

1114.26 Exit signs and illumination. Exits and stairways shall be provided with exit signs and illumination as required by Sections 1011.1 and 1011.2 of the California Building Code.

1114.27 Automatic sprinkler system—Existing high-rise buildings. Regardless of any other provisions of these regulations, every existing high-rise building of Type II-B, Type III-B or Type V-B construction shall be provided with an approved automatic sprinkler system conforming to NFPA 13.

SECTION 1115 EXISTING GROUP I OCCUPANCIES [SFM]

1115.1 General. Existing buildings housing existing protective social-care homes or facilities established prior to March 4, 1972 may have their use continued if they conform, or are made to conform, to the following provisions:

1115.2 Use of floors. The use of floor levels in buildings of Type III, IV or V nonfire-rated construction may be as follows: Nonambulatory—first floor only; Ambulatory—not higher than the third-floor level, provided walls and partitions are constructed of materials equal in fire-resistive quality to that of wood lath and plaster in good repair and all walls are firestopped at each floor level.

1115.3 Enclosure of exits and vertical openings. Except for two-story structures housing ambulatory guests, all interior stairs shall be enclosed in accordance with Chapter 10 of the California Building Code. In lieu of stairway enclosures,

floor separations or smoke barriers may be provided in such a manner that fire and smoke will not spread rapidly to floors above or otherwise impair exit facilities. In these instances, floor separations or smoke barriers shall have a fire resistance equal to not less than 1/2-inch (13 mm) gypsum wall board on each side of wood studs with openings protected by not less than a 1 3/4-inch (44.5 mm) solid bonded wood-core door of the self-closing type. All other vertical openings shall be enclosed in accordance with the provisions of Sections 1114.6 and 1114.13.

1115.4 Exit access. Each floor or portion thereof of buildings used for the housing of existing protective social-care homes or facilities shall have access to not less than two exits in such a manner as to furnish egress from the building or structure in the event of an emergency substantially equivalent to the provisions of Chapter 10 of the California Building Code.

1115.5 Corridor openings. Openings from rooms to interior corridors shall be protected by not less than 1 3/4-inch (44.5 mm) solid-bonded wood-core doors. Transoms and other similar openings shall be sealed with materials equivalent to existing corridor wall construction.

1115.6 Interior finishes. Interior wall and ceiling finishes shall conform to the requirements for a Group R-1 Occupancy as specified in Chapter 8 of the California Building Code.

1115.7 Automatic fire sprinklers. Automatic sprinkler systems shall be installed in existing protective social-care occupancies in accordance with the provisions of Section 903.2.6 of the California Building Code.

1115.8 Fire alarm systems. Automatic fire alarm systems shall be installed in existing protective social-care homes or facilities in accordance with the provisions of Section 907.2.6 of the California Building Code.

Exception: When an approved automatic sprinkler system conforming to Section 903.2.6 of the California Building Code is installed, a separate fire alarm system as specified in this section need not be provided.

SECTION 1116 EXISTING GROUP L AND GROUP H-8 OCCUPANCIES [SFM]

1116.1 Repairs general. Additions, alterations or repairs may be made to any building or structure without requiring the existing building or structure to comply with all the requirements of this code section, provided the addition, alteration or repair conforms to the requirements of this section.

1116.2 Unsafe condition. Additions, repairs or alterations shall not be made to an existing building or structure that will cause the existing building or structure to be in violation of any of the provisions of this code, nor shall such additions or alterations cause the existing building or structure to become unsafe, or to be in violation of any of the provisions of this code. An unsafe condition shall be deemed to have been created if an addition or alteration will cause the existing build-

ing or structure to become structurally unsafe or overloaded; will not provide adequate egress in compliance with the provisions of this code or will obstruct existing exits; will create a fire hazard; will reduce required fire resistance or will otherwise create conditions dangerous to human life.

1116.3 Changes in use or occupancy. Any buildings that have alternations or additions, which involves a change in use or occupancy, shall not exceed the height, number of stories and area permitted for new buildings.

1116.4 Buildings not in compliance with code. Additions or alterations shall not be made to an existing building or structure when such existing building or structure is not in full compliance with the provisions of this code except when such addition or alteration will result in the existing building or structure being no more hazardous, based on life safety, fire safety and sanitation, than before such additions or alterations are undertaken.

1116.5 Maintenance of structural and fire resistive integrity. Alterations or repairs to an existing building or structure that are nonstructural and do not adversely affect any structural member of any part of the building or structure having required fire resistance may be made with the same materials of which the building or structure is constructed. The installation or replacement of glass shall be as required for new installations.

1116.6 Continuation of existing use. Buildings in existence at the time of the adoption of this code may have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this code, provided such continued use is not dangerous to life.

1116.7 Maximum allowable quantities. Existing Group H-8 laboratory suites approved prior to January 1, 2008 shall not exceed the maximum allowable quantities listed in Tables 1116.7(1) and 1116.7(2).

TABLE 1116.7(1)
EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS
PRESENTING A PHYSICAL HAZARD BASIC QUANTITIES PER LABORATORY SUITE¹
When two units are given, values within parentheses are in cubic feet (cu. ft) or pounds (lb)

CONDITION		STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS		
MATERIAL	CLASS	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)
1.1 Combustible liquid	II	—	120 ²	—	—	120	—	—	30	—
	III-A	—	330 ²	—	—	330	—	—	80	—
	III-B	—	13,200 ²	—	—	13,200	—	—	3,300	—
1.2 Combustible dust lbs./1000 cu. ft.		1	—	—	1	—	—	1	—	—
1.3 Combustible fiber (loose) (baled)		(100) (1,000)	— —	— —	(100) (1,000)	— —	— —	(20) (200)	— —	— —
	1.4 Cryogenic, flammable or oxidizing	—	45	—	—	45	—	—	10	—
2.1 Explosives		12	(1) ²	—	1/4	(1/4)	—	1/4	(1/4)	—
3.1 Flammable solid		125 ²	—	—	25	—	—	25	—	—
3.2 Flammable gas (gaseous) (liquefied)		—	—	750 ²	—	—	750 ²	—	—	—
		—	15 ²	—	—	15 ²	—	—	—	—
3.3 Flammable liquid combination I-A, I-B, I-C	I-A	—	30 ²	—	—	30	—	—	10	—
	I-B	—	60 ²	—	—	60	—	—	15	—
	I-C	—	90 ²	—	—	90	—	—	20	—
		—	120 ²	—	—	120	—	—	30	—
4.1 Organic peroxide, unclassified detonatable		1 ²	(1) ²	—	1/4	(1/4)	—	1/4	(1/4)	—
4.2 Organic peroxide	I	5 ²	(5) ²	—	(1)	(1)	—	1	1	—
	II	50 ²	(50) ²	—	50	(50)	—	10	(10)	—
	III	125 ²	(125) ²	—	125	(125)	—	25	(25)	—
	IV	500	(500)	—	500	(500)	—	100	(100)	—
	V	N.L.	N.L.	—	N.L.	N.L.	—	N.L.	N.L.	—
4.3 Oxidizer	4	1 ²	(1) ²	—	1/4 ²	(1/4)	—	1/4	(1/4)	—
	3	10 ²	(10) ²	—	2	(2)	—	2	(2)	—
	2	250 ²	(250) ²	—	50	(250)	—	50	(50)	—
	1	1,000 ²	(1,000) ²	—	1,000	(1,000)	—	200	(200)	—
4.4 Oxidizer, Gas (gaseous) (liquefied)		—	—	1,500 ²	—	—	1,500 ²	—	—	—
		—	15 ²	—	—	15 ²	—	—	—	—
5.1 Pyrophoric		4 ²	(4) ²	50 ²	1	(1)	10 ²	0	0	0
6.1 Unstable (reactive)	4	1 ²	(1) ²	10 ²	1/4	(1/4)	2 ²	1/4	(1/4)	0
	3	5 ²	(5) ²	50 ²	1	(1)	10 ²	1	(1)	0
	2	50 ²	(50) ²	250 ²	50	(50)	250 ²	10	(10)	0
	1	125 ²	125 ²	750 ²	125	(125)	750 ²	25	(25)	0
7.1 Water (reactive)	3	5 ²	(5) ²	—	5	(5)	—	1	(1)	—
	2	50 ²	(50) ²	—	50	(50)	—	10	(10)	—
	1	125 ²	(125) ²	—	125	(125) ²	—	25	(25)	—

1. A laboratory suite is a space up to 10,000 square feet (929 m²) bounded by not less than a one-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.

2. Quantities may be increased 100 percent when stored in approved exhausted gas cabinets, exhausted enclosures or fume hoods.

CONSTRUCTION REQUIREMENTS FOR EXISTING BUILDINGS

**TABLE 1116.7(2)
EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS
PRESENTING A HEALTH HAZARD MAXIMUM QUANTITIES PER LABORATORY SUITE'
When two units are given, values within parentheses are in pounds (lbs.)**

MATERIAL	STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS	
	Solid lb	Liquid Gallons (lb)	Gas (cu. ft)	Solid lb	Liquid Gallons (lb)	Gas (cu. ft)	Solid lb	Liquid Gallons (lb)
1. Corrosives	5,000	500	650 ²	5,000	500	650	1,000	100
2a. Highly toxics ²	40	10	65	5	1	65	2	1/4
2b. Toxics	500	50	650 ²	500	50	650	5	1/2
3. Irritants	5,000	500	650	5,000	500	650	1,000	100
4. Sensitizers	5,000	500	650	5,000	500	650	1,000	100
5. Other health hazards	5,000	500	650	5,000	500	650	1,000	100

1. A laboratory suite is a space up to 10,000 square feet (929 m²) bounded by not less than a one-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.

2. Permitted only when stored or used in approved exhausted gas cabinets, exhausted enclosures or fume hoods. Quantities of high toxics in use in open systems need not be reduced above the third floor or below the first basement floor level. Individual container size shall be limited to 2 pounds (0.91 kg) for solids and 1/4 gallon (0.95 L) for liquids.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 12 – ENERGY SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							
1201.1			X																				
1201.3			X																				
1203.1			X																				
1203.1.5.1			X																				
1203.2.5			X																				
1203.2.6			X																				
1203.2.10			X																				
1206.1			X																				
1206.5			X																				
1206.14			X																				
1207			X																				

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 12

ENERGY SYSTEMS

User note:

About this chapter: Chapter 12 was added to address the current energy systems found in this code, and is provided for the introduction of a wide range of systems to generate and store energy in, on and adjacent to buildings and facilities. The expansion of such energy systems is related to meeting today's energy, environmental and economic challenges. Ensuring appropriate criteria to address the safety of such systems in building and fire codes is an important part of protecting the public at large, building occupants and emergency responders. More specifically, this chapter addresses standby and emergency power, portable generators, photovoltaic systems, fuel cell energy systems, and energy storage systems.

SECTION 1201 GENERAL

1201.1 Scope. The provisions of this chapter shall apply to the installation, operation, maintenance, repair, retrofitting, testing, commissioning and decommissioning of energy systems used for generating or storing energy. It shall not apply to equipment associated with the generation, control, transformation, transmission, or distribution of energy installations that is under the exclusive control of an electric utility or lawfully designated agency.

1201.2 Electrical wiring and equipment. Electrical wiring and equipment used in connection with energy systems shall be installed and maintained in accordance with this chapter, Section 603 and *the California Electrical Code*.

1201.3 Mixed system installation. Where approved, the aggregate nameplate kWh energy of all energy storage systems in a fire area shall not exceed the maximum quantity specified for any of the energy systems in this chapter. Where required by the fire code official, a hazard mitigation analysis shall be provided and approved in accordance with Section 104.8.2 to evaluate any potential adverse interaction between the various energy systems and technologies.

SECTION 1202 DEFINITIONS

1202.1 Definitions. The following terms are defined in Chapter 2:

BATTERY SYSTEM, STATIONARY STORAGE.

BATTERY TYPES.

CAPACITOR ENERGY STORAGE SYSTEM.

CRITICAL CIRCUIT.

EMERGENCY POWER SYSTEM.

ENERGY STORAGE MANAGEMENT SYSTEMS.

ENERGY STORAGE SYSTEM (ESS).

ENERGY STORAGE SYSTEM, ELECTROCHEMICAL.

ENERGY STORAGE SYSTEM, MOBILE.

ENERGY STORAGE SYSTEM, WALK-IN UNIT.

ENERGY STORAGE SYSTEM CABINET.

ENERGY STORAGE SYSTEM COMMISSIONING.

ENERGY STORAGE SYSTEM DECOMMISSIONING.

FUEL CELL POWER SYSTEM, STATIONARY.

PORTABLE GENERATOR.

STANDBY POWER SYSTEM.

SECTION 1203

EMERGENCY AND STANDBY POWER SYSTEMS

1203.1 General. Emergency power systems and standby power systems required by this code or the *California Building Code* shall comply with Sections 1203.1.1 through 1203.1.9.

1203.1.1 Stationary generators. Stationary emergency and standby power generators required by this code shall be listed in accordance with UL 2200.

1203.1.2 Fuel line piping protection. Fuel lines supplying a generator set inside a high-rise building or new Group I-2 occupancy having occupied floors located more than 75 feet above the lowest level of fire department vehicle access shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.
2. An assembly that has a fire-resistance rating of not less than 2 hours. Where the building is protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1, the required fire-resistance rating shall be reduced to 1 hour.
3. Other approved methods.

1203.1.3 Installation. Emergency power systems and standby power systems shall be installed in accordance with the *California Building Code, the California Electrical Code, NFPA 110 and NFPA 111.*

1203.1.4 Load transfer. Emergency power systems shall automatically provide secondary power within 10 seconds after primary power is lost, unless specified otherwise in this code. Standby power systems shall automatically provide secondary power within 60 seconds after primary power is lost, unless specified otherwise in this code.

1203.1.5 Load duration. Emergency power systems and standby power systems shall be designed to provide the required power for a minimum duration of 2 hours without being refueled or recharged, unless specified otherwise in this code.

1203.1.5.1 High-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest floor level having building access. *Emergency power systems and standby power systems shall be designed to provide the required power for a minimum duration of 6 hours without being refueled or recharged. The minimum required fuel supply shall be maintained at all times.*

1203.1.6 Uninterruptable power source. An uninterrupted source of power shall be provided for equipment where required by the manufacturer's instructions, the listing, this code or applicable referenced standards.

1203.1.7 Interchangeability. Emergency power systems shall be an acceptable alternative for installations that require standby power systems.

1203.1.8 Group I-2 occupancies. In Group I-2 occupancies located in flood hazard areas established in Section 1612.3 of the *California Building Code* where new essential electrical systems are installed, and where new essential electrical system generators are installed, the systems and generators shall be located and installed in accordance with ASCE 24. Where connections for hook up of temporary generators are provided, the connections shall be located at or above the elevation required in ASCE 24.

1203.1.9 Maintenance. Existing installations shall be maintained in accordance with the original approval and Section 1203.4.

1203.2 Where required. Emergency and standby power systems shall be provided where required by Sections 1203.2.1 through 1203.2.19.

1203.2.1 Ambulatory care facilities. Essential electrical systems for ambulatory care facilities shall be in accordance with Section 422.6 of the *California Building Code.*

1203.2.2 Elevators and platform lifts. Standby power shall be provided for elevators and platform lifts as required in Sections 604.3, 1009.4.1 and 1009.5.

1203.2.3 Emergency responder communication coverage systems. Standby power shall be provided for in-building, two-way emergency responder communication

coverage systems as required in Section 510.4.2.3. The standby power supply shall be capable of operating the in-building, two-way emergency responder communication coverage system at 100-percent system operation capacity for a duration of not less than 12 hours.

1203.2.4 Emergency voice/alarm communication systems. Standby power shall be provided for emergency voice/alarm communication systems in accordance with NFPA 72.

1203.2.5 Exhaust ventilation. Standby power shall be provided for mechanical exhaust ventilation systems as required in Section 1207.6.1.2.1. The system shall be capable of powering the required load for a duration of not less than 2 hours.

1203.2.6 Exit signs. Emergency power shall be provided for exit signs as required in Section 1013.6.3. The system shall be capable of powering the required load for a duration of not less than 90 minutes.

1203.2.7 Gas detection systems. Emergency power shall be provided for gas detection systems where required by Sections 1203.2.10 and 1203.2.17. Standby power shall be provided for gas detection systems where required by Sections 916.5 and 1207.6.1.2.4.

1203.2.8 Group I-2 occupancies. Essential electrical systems for Group I-2 occupancies shall be in accordance with Section 407.11 of the *California Building Code.*

1203.2.9 Group I-3 occupancies. Power-operated sliding doors or power-operated locks for swinging doors in Group I-3 occupancies shall be operable by a manual release mechanism at the door. Emergency power shall be provided for the doors and locks.

Exceptions:

1. Emergency power is not required in facilities where provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are not required as set forth in the *California Building Code.*
2. Emergency power is not required where remote mechanical operating releases are provided.

1203.2.10 Hazardous materials. Emergency and standby power shall be provided in occupancies with hazardous materials as required in the following sections:

1. Sections 5004.7 and 5005.1.5 for hazardous materials.
2. Sections 6004.2.2.8 and 6004.3.4.2 for highly toxic and toxic gases.
3. Section 6204.1.11 for organic peroxides.

1203.2.10 High-rise buildings and Group I-2 occupancies having occupied floors more than 75 feet above the lowest level of fire department vehicle access. Standby power and emergency power shall be provided for high-rise buildings and Group I-2 occupancies having occupied floors located more than 75 feet above the lowest level of fire department vehicle access as required in Sec-

tion 403 of the *California Building Code*, and shall be in accordance with Section 1203.

1203.2.12 Special purpose horizontal sliding doors. Standby power shall be provided for horizontal sliding doors as required in Section 1010.3.3. The standby power supply shall have a capacity to operate not fewer than 50 closing cycles of the door.

1203.2.13 Hydrogen fuel gas rooms. Standby power shall be provided for hydrogen fuel gas rooms as required by Section 5808.7.

1203.2.14 Laboratory suites. Standby or emergency power shall be provided in accordance with Section 5004.7 where laboratory suites are located above the sixth story above grade plane or located in a story below grade plane.

1203.2.15 Means of egress illumination. Emergency power shall be provided for means of egress illumination in accordance with Sections 1008.3 and 1104.5.1.

1203.2.16 Membrane structures. Standby power shall be provided for auxiliary inflation systems in permanent membrane structures in accordance with Section 2702 of the *California Building Code*. Auxiliary inflation systems shall be provided in temporary air-supported and air-inflated membrane structures in accordance with Section 3103.10.4.

1203.2.17 Semiconductor fabrication facilities. Emergency power shall be provided for semiconductor fabrication facilities as required in Section 2703.15.

1203.2.18 Smoke control systems. Standby power shall be provided for smoke control systems as required in Section 909.11.

1203.2.19 Underground buildings. Emergency and standby power shall be provided in underground buildings as required in Section 405 of the *California Building Code* and shall be in accordance with Section 1203.

1203.3 Critical circuits. Required critical circuits shall be protected using one of the following methods:

1. Cables used for survivability of required critical circuits shall be listed in accordance with UL 2196 and shall have a fire-resistance rating of not less than 1 hour.
2. Electrical circuit protective systems shall have a fire-resistance rating of not less than 1 hour. Electrical circuit protective systems shall be installed in accordance with their listing requirements.
3. Construction having a fire-resistance rating of not less than 1 hour.

1203.4 Maintenance. Emergency and standby power systems shall be maintained in accordance with NFPA 110 and NFPA 111 such that the system is capable of supplying service within the time specified for the type and duration required.

1203.4.1 Group I-2 and ambulatory care facilities. In Group I-2 occupancies and ambulatory care facilities,

emergency and standby power systems shall be maintained in accordance with NFPA 99.

1203.4.2 Schedule. Inspection, testing and maintenance of emergency and standby power systems shall be in accordance with an approved schedule established upon completion and approval of the system installation.

1203.4.3 Records. Records of the inspection, testing and maintenance of emergency and standby power systems shall include the date of service, name of the servicing technician, a summary of conditions noted and a detailed description of any conditions requiring correction and what corrective action was taken. Such records shall be maintained.

1203.4.4 Switch maintenance. Emergency and standby power system transfer switches shall be included in the inspection, testing and maintenance schedule required by Section 1203.4.2. Transfer switches shall be maintained free from accumulated dust and dirt. Inspection shall include examination of the transfer switch contacts for evidence of deterioration. When evidence of contact deterioration is detected, the contacts shall be replaced in accordance with the transfer switch manufacturer's instructions.

1203.5 Operational inspection and testing. Emergency power systems, including all appurtenant components, shall be inspected and tested under load in accordance with NFPA 110 and NFPA 111.

Exception: Where the emergency power system is used for standby power or peak load shaving, such use shall be recorded and shall be allowed to be substituted for scheduled testing of the generator set, provided that appropriate records are maintained.

1203.5.1 Group I-2 and ambulatory care facilities. In Group I-2 occupancies and ambulatory care facilities, emergency and standby power systems shall be inspected and tested under load in accordance with NFPA 99.

1203.5.2 Transfer switch test. The test of the transfer switch shall consist of electrically operating the transfer switch from the normal position to the alternate position and then return to the normal position.

1203.6 Supervision of maintenance and testing. Routine maintenance, inspection and operational testing shall be overseen by a properly instructed individual.

SECTION 1204 PORTABLE GENERATORS

1204.1 Portable generators. The use, operation and maintenance of portable generators shall comply with this section.

1204.2 Listing. Portable generators manufactured after January 1, 2021, shall be listed and labeled in accordance with UL 2201.

1204.3 Operation and maintenance. Portable generators shall be operated and maintained in accordance with the manufacturer's instructions.

1204.4 Grounding. Portable generators shall be grounded in accordance with the *California Electrical Code*.

1204.5 Operating locations. Portable generators shall be operated only outdoors a minimum of 5 feet (1524 mm) from any building openings such as windows and doors or air intakes. Portable generators shall not be operated within buildings or enclosed areas. Additional separation shall be provided for tents, membrane structures and outdoor assembly events as specified in Chapter 31.

1204.6 Cords and wiring. Extension cords and temporary wiring used to connect portable generators shall be in accordance with Section 603 and shall be provided with GFCI protection.

1204.7 Connections to premise wiring. Connections to a premise wiring system shall comply with all of the following:

1. Power shall not be provided in a manner that “back-feeds” receptacles or the premise wiring system.
2. Connection to a premise served by commercial power shall be made through a listed transfer switch installed, used and maintained in accordance with the *California Electrical Code*.
3. Connection to buildings not served by commercial power shall comply with the *California Electrical Code*.

1204.8 Refueling. Portable generators shall not be refueled while operating.

1204.9 Storage and repair. Storage and repair of fuel-fired portable generators shall comply with Section 313.

1204.10 Fire extinguisher. A listed portable fire extinguisher complying with Section 906 with a minimum rating of 2-A:20-B:C shall be provided not more than 50 feet (15 240 mm) from the portable generator.

SECTION 1205

SOLAR PHOTOVOLTAIC POWER SYSTEMS

1205.1 General. Solar photovoltaic (PV) systems shall be installed in accordance with the *California Building Code* or *California Residential Code*. The electrical portion of solar PV systems shall be installed in accordance with the *California Electrical Code*. Rooftop-mounted solar photovoltaic systems shall be installed in accordance with Sections 1205.2 through 1205.4.3. Ground-mounted solar photovoltaic systems shall comply with Section 1205.5.

1205.2 Access and pathways. Roof access, pathways and spacing requirements shall be provided in accordance with Sections 1205.2.1 through 1205.3.3. Pathways shall be over areas capable of supporting fire fighters accessing the roof. Pathways shall be located in areas with minimal obstructions, such as vent pipes, conduit or mechanical equipment.

Exceptions:

1. Detached, nonhabitable Group U structures including, but not limited to, detached garages serving Group R-3 buildings, parking shade structures, carports, solar trellises and similar structures.

2. Roof access, pathways and spacing requirements need not be provided where the fire code official has determined that rooftop operations will not be employed.

3. Building-integrated photovoltaic (BIPV) systems where the BIPV systems are approved, integrated into the finished roof surface and are listed in accordance with a national test standard developed to address Section 690.12(B)(2) of the *California Electrical Code*. The removal or cutting away of portions of the BIPV system during fire-fighting operations shall not expose a fire fighter to electrical shock hazards.

1205.2.1 Solar photovoltaic (PV) systems for Group R-3 buildings. Solar photovoltaic (PV) systems for Group R-3 buildings shall comply with Sections 1205.2.1.1 through 1205.2.3.

Exceptions:

1. These requirements shall not apply to structures designed and constructed in accordance with the *California Residential Code*.
2. These requirements shall not apply to roofs with slopes of 2 units vertical in 12 units horizontal (16.7-percent slope) or less.

1205.2.1.1 Pathways to ridge. Not fewer than two 36-inch-wide (914 mm) pathways on separate roof planes, from lowest roof edge to ridge, shall be provided on all buildings. Not fewer than one pathway shall be provided on the street or driveway side of the roof. For each roof plane with a photovoltaic array, not fewer than one 36-inch-wide (914 mm) pathway from lowest roof edge to ridge shall be provided on the same roof plane as the photovoltaic array, on an adjacent roof plane or straddling the same and adjacent roof planes.

1205.2.1.2 Setbacks at ridge. For photovoltaic arrays occupying 33 percent or less of the plan view total roof area, a setback of not less than 18 inches (457 mm) wide is required on both sides of a horizontal ridge. For photovoltaic arrays occupying more than 33 percent of the plan view total roof area, a setback of not less than 36 inches (457 mm) wide is required on both sides of a horizontal ridge.

1205.2.1.3 Alternative setbacks at ridge. Where an automatic sprinkler system is installed within the dwelling in accordance with Section 903.3.1.3, setbacks at the ridge shall conform to one of the following:

1. For photovoltaic arrays occupying 66 percent or less of the plan view total roof area, a setback of not less than 18 inches (457 mm) wide is required on both sides of a horizontal ridge.
2. For photovoltaic arrays occupying more than 66 percent of the plan view total roof area, a setback of not less than 36 inches (914 mm) wide is required on both sides of a horizontal ridge.

1205.2.2 Emergency escape and rescue openings. Panels and modules installed on Group R-3 buildings shall

not be placed on the portion of a roof that is below an emergency escape and rescue opening. A pathway of not less than 36 inches (914 mm) wide shall be provided to the emergency escape and rescue opening.

1205.2.3 Building-integrated photovoltaic (BIPV) systems. Where building-integrated photovoltaic (BIPV) systems are installed in a manner that creates areas with electrical hazards to be hidden from view, markings shall be provided to identify the hazardous areas to avoid. The markings shall be reflective and be visible from grade.

Exception: BIPV systems listed in accordance with Section 690.12(B)(2) of the *California Electrical Code*, where the removal or cutting away of portions of the BIPV system during fire-fighting operations have been determined to not expose a fire fighter to electrical shock hazards.

1205.2.4 Locations of DC conductors. Conduit, wiring systems and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays. DC wiring shall be installed in metallic conduit or raceways when located within enclosed spaces in a building. Conduit shall run along the bottom of load bearing members.

1205.3 Other than Group R-3 buildings. Access to systems for buildings, other than those containing Group R-3 occupancies, shall be provided in accordance with Sections 1205.3.1 through 1205.3.3.

Exception: Where it is determined by the fire code official that the roof configuration is similar to that of a Group R-3 occupancy, the residential access and ventilation requirements in Sections 1205.2.1.1 through 1205.2.1.3 are a suitable alternative.

1205.3.1 Perimeter pathways. There shall be a minimum 6-foot-wide (1829 mm) clear perimeter around the edges of the roof.

Exception: Where either axis of the building is 250 feet (76 200 mm) or less, the clear perimeter around the edges of the roof shall be permitted to be reduced to a minimum width of 4 feet (1219 mm).

1205.3.2 Interior pathways. Interior pathways shall be provided between array sections to meet the following requirements:

1. Pathways shall be provided at intervals not greater than 150 feet (45 720 mm) throughout the length and width of the roof.
2. A pathway not less than 4 feet (1219 mm) wide in a straight line to roof standpipes or ventilation hatches.

3. A pathway not less than 4 feet (1219 mm) wide around roof access hatches, with not fewer than one such pathway to a parapet or roof edge.

1205.3.3 Smoke ventilation. The solar installation shall be designed to meet the following requirements:

1. Where nongravity-operated smoke and heat vents occur, a pathway not less than 4 feet (1219 mm) wide shall be provided bordering all sides.
2. Where gravity-operated dropout smoke and heat vents occur, a pathway not less than 4 feet (1219 mm) wide on not fewer than one side.
3. Smoke ventilation options between array sections shall be one of the following:
 - 3.1. A pathway not less than 8 feet (2438 mm) wide.
 - 3.2. A pathway not less than 4 feet (1219 mm) wide bordering 4-foot by 8-foot (1219 mm by 2438 mm) venting cutouts every 20 feet (6096 mm) on alternating sides of the pathway.

1205.3.4 Locations of DC conductors in occupancies other than R-3. Conduit, wiring systems and raceways for photovoltaic circuits shall be located as close as possible to the ridge or hip or valley and from the hip or valley as directly as possible to an outside wall to reduce trip hazards and maximize ventilation opportunities. Conduit runs between sub arrays and to DC combiner boxes shall be installed in a manner that minimizes the total amount of conduit on the roof by taking the shortest path from the array to the DC combiner box. The DC combiner boxes shall be located such that conduit runs are minimized in the pathways between arrays. DC wiring shall be installed in metallic conduit or raceways when located within enclosed spaces in a building. Conduit shall run along the bottom of load bearing members.

1205.4 Buildings with rapid shutdown. Buildings with rapid shutdown solar photovoltaic systems shall have permanent labels in accordance with Sections 1205.4.1 through 1205.4.3.

1205.4.1 Rapid shutdown type. The type of solar photovoltaic system rapid shutdown shall be labeled with one of the following:

1. For solar photovoltaic systems that shut down the array and the conductors leaving the array, a label shall be provided. The first two lines of the label shall be uppercase characters with a minimum height of $\frac{3}{8}$ inch (10 mm) in black on a yellow background. The remaining characters shall be uppercase with a minimum height of $\frac{3}{16}$ inch (5 mm) in black on a white background. The label shall be in accordance with Figure 1205.4.1(1) and state the following:

SOLAR PV SYSTEM EQUIPPED WITH
RAPID SHUTDOWN. TURN RAPID
SHUTDOWN SWITCH TO THE "OFF"
POSITION TO SHUT DOWN PV SYSTEM
AND REDUCE SHOCK HAZARD IN ARRAY.

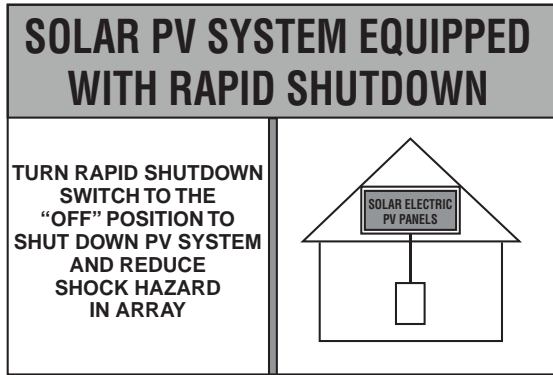


FIGURE 1205.4.1(1)
LABEL FOR SOLAR PV SYSTEMS THAT REDUCE SHOCK HAZARD WITHIN ARRAY AND SHUT DOWN CONDUCTORS LEAVING ARRAY

- For photovoltaic systems that only shut down conductors leaving the array, a label shall be provided. The first two lines of the label shall be uppercase characters with a minimum height of $\frac{3}{8}$ inch (10 mm) in white on a red background and the remaining characters shall be capitalized with a minimum height of $\frac{3}{16}$ inch (5 mm) in black on a white background. The label shall be in accordance with Figure 1205.4.1(2) and state the following:

THIS SOLAR PV SYSTEM EQUIPPED WITH RAPID SHUTDOWN. TURN RAPID SHUTDOWN SWITCH TO THE “OFF” POSITION TO SHUT DOWN CONDUCTORS OUTSIDE THE ARRAY. CONDUCTORS WITHIN ARRAY REMAIN ENERGIZED IN SUNLIGHT.

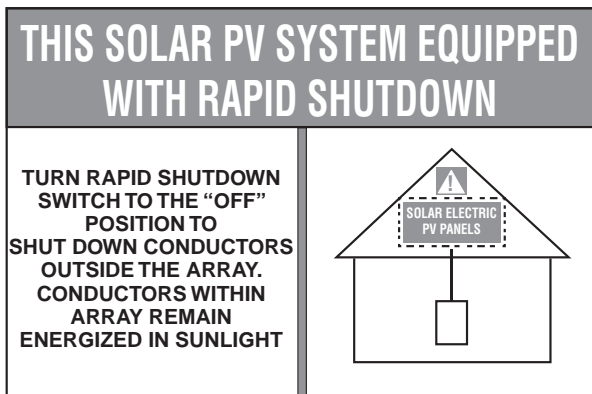


FIGURE 1205.4.1(2)
LABEL FOR SOLAR PV SYSTEMS THAT ONLY SHUT DOWN CONDUCTORS LEAVING THE ARRAY

1205.4.1.1 Diagram. The labels in Section 1205.4.1 shall include a simple diagram of a building with a roof. Diagram sections in red signify sections of the solar photovoltaic system that are not shut down when the rapid shutdown switch is turned off.

1205.4.1.2 Location. The rapid shutdown label in Section 1205.4.1 shall be located not greater than 3 feet (914 mm) from the service disconnecting means to which the photovoltaic systems are connected, and shall indicate the location of all identified rapid shutdown switches if not at the same location.

1205.4.2 Buildings with more than one rapid shutdown type. Solar photovoltaic systems that contain rapid shutdown in accordance with both Items 1 and 2 of Section 1205.4.1 or solar photovoltaic systems where only portions of the systems on the building contain rapid shutdown, shall provide a detailed plan view diagram of the roof showing each different photovoltaic system and a dotted line around areas that remain energized after the rapid shutdown switch is operated.

1205.4.3 Rapid shutdown switch. A rapid shutdown switch shall have a label located not greater than 3 feet (914 mm) from the switch that states the following:

RAPID SHUTDOWN SWITCH
 FOR SOLAR PV SYSTEM

1205.5 Ground-mounted photovoltaic panel systems. Ground-mounted photovoltaic panel systems shall be installed in accordance with this section. Setback requirements shall not apply to ground-mounted, free-standing photovoltaic arrays.

1205.5.1 Vegetation control. A clear, brush-free area of 10 feet (3048 mm) shall be required around the perimeter of the ground-mounted photovoltaic arrays. A noncombustible base of gravel or a maintained vegetative surface or a noncombustible base, approved by the fire code official, shall be installed and maintained under the photovoltaic arrays and associated electrical equipment installations.

SECTION 1206

STATIONARY FUEL CELL POWER SYSTEMS

1206.1 General. Stationary fuel cell power systems in new and existing occupancies shall comply with this section.

Exception: The temporary use of a fuel cell-powered electric vehicle to power a Group R-3 or R-4 building while parked shall comply with Section 1206.14.

1206.2 Permits. Permits shall be obtained for stationary fuel cell power systems as set forth in Section 105.6.9.

1206.3 Equipment. Stationary fuel cell power systems shall comply with the following:

- Prepackaged fuel cell power systems shall be listed and labeled in accordance with CSA FC 1.
- The modules and components in a preengineered fuel cell power system shall be listed and labeled in accordance with CSA FC 1 and interconnected to complete the assembly of the system at the job site in accordance with the manufacturer’s instructions and the module and component listings.

3. Field-fabricated fuel cell power systems shall be approved based on a review of the technical report provided in accordance with Section 104.8.2. The report shall be prepared by and bear the stamp of a registered design professional and shall include:

- 3.1. A fire risk evaluation.
- 3.2. An evaluation demonstrating that modules and components in the fuel cell power system comply with applicable requirements in CSA FC 1.
- 3.3. Documentation of the fuel cell power system's compliance with applicable NFPA 2 and NFPA 853 construction requirements.

1206.4 Installation. Stationary fuel cell power systems shall be installed and maintained in accordance with *the California Electrical Code* and NFPA 853, the manufacturer's installation instructions, and the listing. Stationary fuel cell power systems fueled by hydrogen shall be installed and maintained in accordance with NFPA 2 and *the California Electrical Code*, the manufacturer's installation instructions and the listing.

1206.5 Residential use. Stationary fuel cell power systems shall not be installed in Group R-3 and R-4 buildings, or dwelling units associated with Group R-2 buildings unless they are specifically listed for residential use.

Exception: The temporary use of a fuel cell-powered electric vehicle to power a Group R-3 or R-4 building while parked shall comply with Section 1206.14.

1206.6 Indoor installations. Stationary fuel cell power systems installed in indoor locations shall comply with Sections 1206.6 through 1206.6.2. For purposes of this section, an indoor location includes a roof and 50 percent or greater enclosing walls.

1206.6.1 Listed. Stationary fuel cell power systems installed indoors shall be specifically listed and labeled for indoor use.

1206.6.2 Separation. Rooms containing stationary fuel cell power systems shall be separated from the following occupancies by fire barriers or horizontal assemblies, or both, constructed in accordance with the *California Building Code*.

1. Group B, F, M, S and U occupancies by 1-hour fire-resistance-rated construction.
2. Group A, E, I and R occupancies by 2-hour fire-resistance-rated construction.

Exception: Stationary fuel cell power systems with an aggregate rating less than 50 kW shall not be required to be separated from other occupancies provided that the systems comply with Section 9.3 of NFPA 853.

1206.7 Vehicle impact protection. Where stationary fuel cell power systems are subject to impact by a motor vehicle, vehicle impact protection shall be provided in accordance with Section 312.

1206.8 Outdoor installation. Stationary fuel cell power systems located outdoors shall be separated by not less than 5 feet (1524 mm) from the following:

1. Lot lines.
2. Public ways.
3. Buildings.
4. Stored combustible materials.
5. Hazardous materials.
6. High-piled stock.
7. Any portion of a designated means of egress system.
8. Other exposure hazards.

1206.9 Fuel supply. The design, location and installation of the fuel supply for stationary fuel cell power systems shall comply with Chapter 53, Chapter 58 and the *International Fuel Gas Code*, based on the particular fuel being supplied to the system.

1206.10 Manual shutoff. Access to a manual shutoff valve shall be provided for the fuel piping within 6 feet (1829 mm) of any fuel storage tank serving the fuel cell and within 6 feet (1829 mm) of the power system. If the fuel tank and the stationary fuel cell power system are less than 12 feet (3658 mm) apart, a single shutoff valve shall be permitted. If the stationary fuel cell power system is located indoors, the shutoff valve shall be located outside of the room in which the system is installed, unless otherwise approved by the fire code official.

1206.11 Ventilation and exhaust. Ventilation and exhaust for stationary fuel cell power systems shall be provided in accordance with NFPA 853.

1206.12 Fire protection. Fire protection systems for stationary fuel cell power system installations shall be provided in accordance with NFPA 853.

1206.13 Gas detection systems. Stationary fuel cell power systems shall be provided with a gas detection system. Detection shall be provided in approved locations in the fuel cell power system enclosure, the exhaust system or the room that encloses the fuel cell power system. The system shall be designed to activate at a flammable gas concentration of not more than 25 percent of the lower flammable limit (LFL).

1206.13.1 System activation. The activation of the gas detection system shall automatically:

1. Close valves between the gas supply and the fuel cell power system.
2. Shut down the fuel cell power system.
3. Initiate local audible and visible alarms in approved locations.

1206.14 Group R-3 and R-4 fuel cell vehicle energy storage system use. The temporary use of the dwelling unit owner or occupant's fuel cell-powered electric vehicle to power a Group R-3 or R-4 dwelling while parked in an attached or detached garage or outside shall comply with the vehicle manufacturer's instructions and *the California Electrical Code*.

SECTION 1207 ELECTRICAL ENERGY STORAGE SYSTEMS (ESS)

1207.1 General. The provisions in this section are applicable to stationary and mobile electrical energy storage systems (ESS).

Exception: ESS in Group R-3 and R-4 occupancies shall comply with Section 1207.11.

1207.1.1 Scope. ESS having capacities exceeding the values shown in Table 1207.1.1 shall comply with this section.

**TABLE 1207.1.1
ENERGY STORAGE SYSTEM (ESS) THRESHOLD QUANTITIES**

TECHNOLOGY	ENERGY CAPACITY ^a
Capacitor ESS	3 kWh
Flow batteries ^b	20 kWh
Lead-acid batteries, all types	70 kWh ^c
Lithium-ion batteries	20 kWh
Nickel metal hydride (Ni-MH)	70 kWh
Nickel-cadmium batteries (Ni-Cd)	70 kWh
Other battery technologies	10 kWh
Other electrochemical ESS technologies	3 kWh

For SI: 1 kilowatt hour = 3.6 megajoules.

- Energy capacity is the total energy capable of being stored (nameplate rating), not the usable energy rating. For units rated in amp-hours, kWh shall equal rated voltage times amp-hour rating divided by 1,000.
- Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.
- Fifty gallons of lead-acid battery electrolyte shall be considered equivalent to 70 kWh.

1207.1.2 Permits. Permits shall be obtained for ESS as follows:

- Construction permits shall be obtained for stationary ESS installations and for mobile ESS charging and storage installations covered by Section 1207.10.1. Permits shall be obtained in accordance with Section 105.6.5.
- Operational permits shall be obtained for stationary ESS installations and for mobile ESS deployment operations covered by Section 1207.10.3. Permits shall be obtained in accordance with Section 105.5.14.

1207.1.2.1 Communication utilities. Operational permits shall not be required for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 voltage alternating current (VAC) and 60 voltage direct current (VDC).

1207.1.3 Construction documents. The following information shall be provided with the permit application:

- Location and layout diagram of the room or area in which the ESS is to be installed.
- Details on the hourly fire-resistance ratings of assemblies enclosing the ESS.

- The quantities and types of ESS to be installed.
- Manufacturer's specifications, ratings and listings of each ESS.
- Description of energy (battery) management systems and their operation.
- Location and content of required signage.
- Details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and deflagration venting systems, if provided.
- Support arrangement associated with the installation, including any required seismic restraint.
- A commissioning plan complying with Section 1207.2.1.
- A decommissioning plan complying with Section 1207.2.3.

1207.1.4 Hazard mitigation analysis. A failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis shall be provided in accordance with Section 104.8.2 under any of the following conditions:

- Where ESS technologies not specifically identified in Table 1207.1 are provided.
- More than one ESS technology is provided in a room or enclosed area where there is a potential for adverse interaction between technologies.
- Where allowed as a basis for increasing maximum allowable quantities. See Section 1207.5.2.

1207.1.4.1 Fault condition. The hazard mitigation analysis shall evaluate the consequences of the following failure modes. Only single failure modes shall be considered.

- A thermal runaway condition in a single ESS rack, module or unit.
- Failure of any battery (energy) management system.
- Failure of any required ventilation or exhaust system.
- Voltage surges on the primary electric supply.
- Short circuits on the load side of the ESS.
- Failure of the smoke detection, fire detection, fire suppression or gas detection system.
- Required spill neutralization not being provided or failure of a required secondary containment system.

1207.1.4.2 Analysis approval. The fire code official is authorized to approve the hazardous mitigation analysis provided that the consequences of the hazard mitigation analysis demonstrate:

- Fires will be contained within unoccupied ESS rooms or areas for the minimum duration of the fire-resistance-rated separations identified in Section 1207.7.4.

2. Fires in occupied work centers will be detected in time to allow occupants within the room or area to safely evacuate.
3. Toxic and highly toxic gases released during fires will not reach concentrations in excess of the IDLH level in the building or adjacent means of egress routes during the time deemed necessary to evacuate occupants from any affected area.
4. Flammable gases released from ESS during charging, discharging and normal operation will not exceed 25 percent of their lower flammability limit (LFL).
5. Flammable gases released from ESS during fire, overcharging and other abnormal conditions will be controlled through the use of ventilation of the gases, preventing accumulation, or by deflagration venting.

1207.1.4.3 Additional protection measures.

Construction, equipment and systems that are required for the ESS to comply with the hazardous mitigation analysis, including but not limited to those specifically described in Section 1207, shall be installed, maintained and tested in accordance with nationally recognized standards and specified design parameters.

1207.1.5 Large-scale fire test. Where required elsewhere in Section 1207, large-scale fire testing shall be conducted on a representative ESS in accordance with UL 9540A. The testing shall be conducted or witnessed and reported by an approved testing laboratory and show that a fire involving one ESS will not propagate to an adjacent ESS, and where installed within buildings, enclosed areas and walk-in units will be contained within the room, enclosed area or walk-in unit for a duration equal to the fire-resistance rating of the room separation specified in Section 1207.7.4. The test report shall be provided to the fire code official for review and approval in accordance with Section 104.8.2.

1207.1.6 Fire remediation. Where a fire or other event has damaged the ESS and ignition or re-ignition of the ESS is possible, the system owner, agent or lessee shall take the following actions, at their expense, to mitigate the hazard or remove damaged equipment from the premises to a safe location.

1207.1.6.1 Fire mitigation personnel. Where, in the opinion of the fire code official, it is essential for public safety that trained personnel be on-site to respond to possible ignition or re-ignition of a damaged ESS, the system owner, agent or lessee shall immediately dispatch one or more fire mitigation personnel to the premise, as required and approved, at their expense. These personnel shall remain on duty continuously after the fire department leaves the premise until the damaged energy storage equipment is removed from the premises, or earlier if the fire code official indicates the public safety hazard has been abated.

1207.1.6.2 Duties. On-duty fire mitigation personnel shall have the following responsibilities:

1. Keep a diligent watch for fires, obstructions to means of egress and other hazards.
2. Immediately contact the fire department if their assistance is needed to mitigate any hazards or extinguish fires.
3. Take prompt measures for remediation of hazards in accordance with the decommissioning plan per Section 1207.2.3.
4. Take prompt measures to assist in the evacuation of the public from the structures.

1207.2 Commissioning, decommissioning, operation and maintenance. Commissioning, decommissioning, operation and maintenance shall be conducted in accordance with this section.

1207.2.1 Commissioning. Commissioning of newly installed ESS and existing ESS that have been retrofitted, replaced or previously decommissioned and are returning to service shall be conducted prior to the ESS being placed in service in accordance with a commissioning plan that has been approved prior to initiating commissioning. The commissioning plan shall include the following:

1. A narrative description of the activities that will be accomplished during each phase of commissioning, including the personnel intended to accomplish each of the activities.
2. A listing of the specific ESS and associated components, controls and safety-related devices to be tested, a description of the tests to be performed and the functions to be tested.
3. Conditions under which all testing will be performed, which are representative of the conditions during normal operation of the system.
4. Documentation of the owner's project requirements and the basis of design necessary to understand the installation and operation of the ESS.
5. Verification that required equipment and systems are installed in accordance with the approved plans and specifications.
6. Integrated testing for all fire and safety systems.
7. Testing for any required thermal management, ventilation or exhaust systems associated with the ESS installation.
8. Preparation and delivery of operation and maintenance documentation.
9. Training of facility operating and maintenance staff.
10. Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.
11. Identification and documentation of personnel who are qualified to service, maintain and decommission

the ESS, and respond to incidents involving the ESS, including documentation that such service has been contracted for.

12. A decommissioning plan for removing the ESS from service, and from the facility in which it is located. The plan shall include details on providing a safe, orderly shutdown of energy storage and safety systems with notification to the code officials prior to the actual decommissioning of the system. The decommissioning plan shall include contingencies for removing an intact operational ESS from service, and for removing an ESS from service that has been damaged by a fire or other event.

Exception: Commissioning shall not be required for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC. A decommissioning plan shall be provided and maintained where required by the fire code official.

1207.2.1.1 Initial acceptance testing. During the commissioning process an ESS shall be evaluated for proper operation in accordance with the manufacturer's instructions and the commissioning plan prior to final approval.

1207.2.1.2 Commissioning report. A report describing the results of the system commissioning, including the results of the initial acceptance testing required in Section 1207.2.1.1, shall be provided to the fire code official prior to final inspection and approval and maintained at an approved on-site location.

1207.2.2 Operation and maintenance. An operation and maintenance manual shall be provided to both the ESS owner or their authorized agent and the ESS operator before the ESS is put into operation and shall include the following:

1. Manufacturer's operation manuals and maintenance manuals for the entire ESS, or for each component of the system requiring maintenance, that clearly identify the required routine maintenance actions.
2. Name, address and phone number of a service agency that has been contracted to service the ESS and its associated safety systems.
3. Maintenance and calibration information, including wiring diagrams, control drawings, schematics, system programming instructions and control sequence descriptions, for all energy storage control systems.
4. Desired or field-determined control set points that are permanently recorded on control drawings at control devices or, for digital control systems, in system programming instructions.
5. A schedule for inspecting and recalibrating all ESS controls.
6. A service record log form that lists the schedule for all required servicing and maintenance actions and

space for logging such actions that are completed over time and retained on-site.

The ESS shall be operated and maintained in accordance with the manual and a copy of the manual shall be retained at an approved on-site location.

1207.2.2.1 Ongoing inspection and testing. Systems that monitor and protect the ESS installation shall be inspected and tested in accordance with the manufacturer's instructions and the operation and maintenance manual. Inspection and testing records shall be maintained in the operation and maintenance manual.

1207.2.3 Decommissioning. The code official shall be notified prior to the decommissioning of an ESS. Decommissioning shall be performed in accordance with the decommissioning plan that includes the following:

1. A narrative description of the activities to be accomplished for removing the ESS from service, and from the facility in which it is located.
2. A listing of any contingencies for removing an intact operational ESS from service, and for removing an ESS from service that has been damaged by a fire or other event.

1207.3 Equipment. ESS equipment shall be in accordance with Sections 1207.3.1 through 1207.3.9.

1207.3.1 Energy storage system listings. ESS shall be listed in accordance with UL 9540.

Exception: Lead-acid and nickel-cadmium battery systems installed in facilities under the exclusive control of communications utilities, and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76, are not required to be listed.

1207.3.2 Equipment listing. Chargers, inverters and energy storage management systems shall be covered as part of the UL 9540 listing or shall be listed separately.

1207.3.3 Utility interactive systems. Inverters shall be listed and labeled in accordance with UL 1741. Only inverters listed and labeled for utility interactive system use and identified as interactive shall be allowed to operate in parallel with the electric utility power system to supply power to common loads.

1207.3.4 Energy storage management system. Where required by the ESS listing, an approved energy storage management system that monitors and balances cell voltages, currents and temperatures within the manufacturer's specifications shall be provided. The system shall disconnect electrical connections to the ESS or otherwise place it in a safe condition if potentially hazardous temperatures or other conditions such as short circuits, over voltage or under voltage are detected.

1207.3.5 Enclosures. Enclosures of ESS shall be of noncombustible construction.

1207.3.6 Repairs. Repairs of ESS shall only be done by qualified personnel. Repairs with other than identical parts shall be considered retrofitting and comply with Section

1207.3.7. Repairs shall be documented in the service records log.

1207.3.7 Retrofits. Retrofitting of an existing ESS shall comply with the following:

1. A construction permit shall be obtained in accordance with Section 105.6.5.
2. New batteries, battery modules, capacitors and similar ESS components shall be listed.
3. Battery management and other monitoring systems shall be connected and installed in accordance with the manufacturer's instructions.
4. The overall installation shall continue to comply with UL 9540 listing requirements, where applicable.
5. Systems that have been retrofitted shall be commissioned in accordance with Section 1207.2.1.
6. Retrofits shall be documented in the service records log.

1207.3.7.1 Retrofitting lead acid and nickel cadmium. Section 1207.3.7 shall not apply to retrofitting of lead-acid and nickel-cadmium batteries with other lead-acid and nickel-cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.

1207.3.8 Replacements. Replacements of ESS shall be considered new ESS installations and shall comply with the provisions of Section 1207 as applicable to new ESS. The ESS being replaced shall be decommissioned in accordance with Section 1207.2.3.

1207.3.9 Reused and repurposed equipment. Equipment and materials shall only be reused or reinstalled as permitted in Section 104.8.1. Storage batteries previously used in other applications, such as electric vehicle propulsion, shall not be reused in applications regulated by Chapter 12 unless approved by the fire code official and unless the equipment is refurbished by a battery refurbishing company approved in accordance with UL 1974.

1207.4 General installations requirements. Stationary and mobile ESS shall comply with the requirements of Sections 1207.4.1 through 1207.4.12.

1207.4.1 Electrical disconnects. Where the ESS disconnecting means is not within sight of the main electrical service disconnecting means, placards or directories shall be installed at the location of the main electrical service disconnecting means indicating the location of stationary storage battery system disconnecting means in accordance with *the California Electrical Code*.

Exception: Electrical disconnects for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC shall be permitted to have electrical disconnects signage in accordance with NFPA 76.

1207.4.2 Working clearances. Access and working space shall be provided and maintained about all electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with *the California Electrical Code* and the manufacturer's instructions.

1207.4.3 Fire-resistance-rated separations. Rooms and other indoor areas containing ESS shall be separated from other areas of the building in accordance with Section 1207.7.4. ESS shall be permitted to be in the same room with the equipment they support.

1207.4.4 Seismic and structural design. Stationary ESS shall comply with the seismic design requirements in Chapter 16 of the *California Building Code*, and shall not exceed the floor loading limitation of the building.

1207.4.5 Vehicle impact protection. Where ESS are subject to impact by a motor vehicle, including fork lifts, vehicle impact protection shall be provided in accordance with Section 312.

1207.4.6 Combustible storage. Combustible materials shall not be stored in ESS rooms, areas or walk-in units. Combustible materials in occupied work centers covered by Section 1207.4.10 shall be stored at least 3 feet (914 mm) from ESS cabinets.

1207.4.7 Toxic and highly toxic gases. ESS that have the potential to release toxic and highly toxic gas during charging, discharging and normal use conditions shall be provided with a hazardous exhaust system in accordance with *Chapter 5 of the California Mechanical Code*.

1207.4.8 Signage. Approved signs shall be provided on or adjacent to all entry doors for ESS rooms or areas and on enclosures of ESS cabinets and walk-in units located outdoors, on rooftops or in open parking garages. Signs designed to meet both the requirements of this section and *the California Electrical Code* shall be permitted. The signage shall include the following or equivalent:

1. "ENERGY STORAGE SYSTEM," "BATTERY STORAGE SYSTEM," "CAPACITOR ENERGY STORAGE SYSTEM" or the equivalent.
2. The identification of the electrochemical ESS technology present.
3. "ENERGIZED ELECTRICAL CIRCUITS."
4. Where water-reactive electrochemical ESS are present, the signage shall include "APPLY NO WATER."
5. Current contact information, including phone number, for personnel authorized to service the equipment and for fire mitigation personnel required by Section 1207.1.6.1.

Exception: Existing electrochemical ESS shall be permitted to include the signage required at the time they were installed.

1207.4.9 Security of installations. Rooms, areas and walk-in units in which electrochemical ESS are located shall be secured against unauthorized entry and safe-

guarded in an approved manner. Security barriers, fences, landscaping and other enclosures shall not inhibit the required air flow to or exhaust from the electrochemical ESS and its components.

1207.4.10 Occupied work centers. Electrochemical ESS located in rooms or areas occupied by personnel not directly involved with maintenance, service and testing of the systems shall comply with the following:

1. Electrochemical ESS located in occupied work centers shall be housed in locked noncombustible cabinets or other enclosures to prevent access by unauthorized personnel.
2. Where electrochemical ESS are contained in cabinets in occupied work centers, the cabinets shall be located within 10 feet (3048 mm) of the equipment that they support.
3. Cabinets shall include signage complying with Section 1207.4.8.

1207.4.11 Open rack installations. Where electrochemical ESS are installed in a separate equipment room and only authorized personnel have access to the room, they shall be permitted to be installed on an open rack for ease of maintenance.

1207.4.12 Walk-in units. Walk-in units shall be entered only for inspection, maintenance and repair of ESS units and ancillary equipment, and shall not be occupied for other purposes.

1207.5 Electrochemical ESS protection. The protection of electrochemical ESS shall be in accordance with Sections 1207.5.1 through 1207.5.8 where required by Sections 1207.7 through 1207.10.

1207.5.1 Size and separation. Electrochemical ESS shall be segregated into groups not exceeding 50 kWh (180 megajoules). Each group shall be separated a minimum of 3 feet (914 mm) from other groups and from walls in the storage room or area. The storage arrangements shall comply with Chapter 10.

1. Lead-acid and nickel-cadmium battery systems in facilities under the exclusive control of communications utilities and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76.
2. The fire code official is authorized to approve larger capacities or smaller separation distances based on large-scale fire testing complying with Section 1207.1.5.

1207.5.2 Maximum allowable quantities. Fire areas within rooms, areas and walk-in units containing electrochemical ESS shall not exceed the maximum allowable quantities in Table 1207.5.

Exceptions:

1. Where approved by the fire code official, rooms, areas and walk-in units containing electrochemical ESS that exceed the amounts in Table 1207.5 shall be permitted based on a hazardous mitigation analysis in accordance with Section 1207.1.4

and large-scale fire testing complying with Section 1207.1.5.

2. Lead-acid and nickel-cadmium battery systems installed in facilities under the exclusive control of communications utilities, and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76.
3. Dedicated-use buildings in compliance with Section 1207.7.1.

**TABLE 1207.5
MAXIMUM ALLOWABLE QUANTITIES OF
ELECTROCHEMICAL ESS**

TECHNOLOGY	MAXIMUM ALLOWABLE QUANTITIES ^a
STORAGE BATTERIES	
Flow batteries ^b	600 kWh
Lead-acid, all types	Unlimited
Lithium-ion	600 kWh
Nickel metal hydride (Ni-MH)	Unlimited
Nickel-cadmium (Ni-Cd)	Unlimited
Other battery technologies	200 kWh
CAPACITORS	
All types	20 kWh
OTHER ELECTROCHEMICAL ESS	
All types	20 kWh

- a. For electrochemical ESS units rated in amp-hours, kWh shall equal rated voltage times the amp-hour rating divided by 1,000.
- b. Shall include vanadium, zinc-bromine, polysulfide-bromide and other flowing electrolyte-type technologies.

1207.5.2.1 Mixed electrochemical energy systems. Where rooms, areas and walk-in units contain different types of electrochemical energy technologies, the total aggregate quantities of the systems shall be determined based on the sum of percentages of each technology-type quantity divided by the maximum allowable quantity of each technology type. The sum of the percentages shall not exceed 100 percent of the maximum allowable quantity.

1207.5.3 Elevation. Electrochemical ESS shall not be located in the following areas:

1. Where the floor is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.
2. Where the floor is located below the lowest level of exit discharge.

Exceptions:

1. Lead-acid and nickel-cadmium battery systems less than 50 VAC and 60 VDC installed in facilities under the exclusive control of communications utilities in accordance with NFPA 76.
2. Where approved, installations shall be permitted in underground vaults complying with *the California Electrical Code*, Article 450, Part III.

3. Where approved by the fire code official, installations shall be permitted on higher and lower floors.

1207.5.4 Fire detection. An approved automatic smoke detection system or radiant energy-sensing fire detection system complying with Section 907.2 shall be installed in rooms, indoor areas and walk-in units containing electrochemical ESS. An approved radiant energy-sensing fire detection system shall be installed to protect open parking garage and rooftop installations. Alarm signals from detection systems shall be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or where approved to a constantly attended location.

1207.5.4.1 System status. Where required by the fire code official, visible annunciation shall be provided on cabinet exteriors or in other approved locations to indicate that potentially hazardous conditions associated with the ESS exist.

1207.5.5 Fire suppression systems. Rooms and areas within buildings and walk-in units containing electrochemical ESS shall be protected by an automatic fire suppression system designed and installed in accordance with one of the following:

1. An automatic sprinkler system designed and installed in accordance with Section 903.3.1.1 with a minimum density of 0.3 gpm/ft² (1.14 L/min) based on the fire area or 2,500 square-foot (232 m²) design area, whichever is smaller.
2. Where approved, an automatic sprinkler system designed and installed in accordance with Section 903.3.1.1 with a sprinkler hazard classification based on large-scale fire testing complying with Section 1207.1.5.
3. The following alternative automatic fire-extinguishing systems designed and installed in accordance with Section 904, provided that the installation is approved by the fire code official based on large-scale fire testing complying with Section 1207.1.5:
 - 3.1. NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*.
 - 3.2. NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.
 - 3.3. NFPA 750, *Standard on Water Mist Fire Protection Systems*.
 - 3.4. NFPA 2001, *Standard on Clean Agent Fire-Extinguishing Systems*.
 - 3.5. NFPA 2010, *Standard for Fixed Aerosol Fire-Extinguishing Systems*.

Exception: Fire suppression systems for lead-acid and nickel-cadmium battery systems at facilities under the exclusive control of communications utilities that operate at less than 50 VAC and 60 VDC shall be provided where required by NFPA 76.

1207.5.5.1 Water-reactive systems. Electrochemical ESS that utilize water-reactive materials shall be protected by an approved alternative automatic fire-extinguishing system in accordance with Section 904, where the installation is approved by the fire code official based on large-scale fire testing complying with Section 1207.1.5.

1207.5.6 Maximum enclosure size. Outdoor walk-in units housing ESS shall not exceed 53 feet by 8 feet by 9.5 feet high (16 154 mm × 2438 mm × 2896 mm), not including bolt-on HVAC and related equipment, as approved. Outdoor walk-in units exceeding these limitations shall be considered indoor installations and comply with the requirements in Section 1207.7.

1207.5.7 Vegetation control. Areas within 10 feet (3048 mm) on each side of outdoor ESS shall be cleared of combustible vegetation and other combustible growth. Single specimens of trees, shrubbery or cultivated ground cover such as green grass, ivy, succulents or similar plants used as ground cover shall be permitted to be exempt provided that they do not form a means of readily transmitting fire.

1207.5.8 Means of egress separation. ESS located outdoors and in open parking garages shall be separated from any means of egress as required by the fire code official to ensure safe egress under fire conditions, but in no case less than 10 feet (3048 mm).

Exception: The fire code official is authorized to approve a reduced separation distance if large-scale fire testing complying with Section 1207.1.5 is provided that shows that a fire involving the ESS will not adversely impact occupant egress.

1207.6 Electrochemical ESS technology-specific protection. Electrochemical ESS installations shall comply with the requirements of this section in accordance with the applicable requirements of Table 1207.6.

1207.6.1 Exhaust ventilation. Where required by Table 1207.6 or elsewhere in this code, exhaust ventilation of rooms, areas and walk-in units containing electrochemical ESS shall be provided in accordance with the *California Mechanical Code* and Section 1207.6.1.1 or 1207.6.1.2.

1207.6.1.1 Ventilation based on LFL. The exhaust ventilation system shall be designed to limit the maximum concentration of flammable gas to 25 percent of the lower flammable limit (LFL) of the total volume of the room, area or walk-in unit during the worst-case event of simultaneous charging of batteries at the maximum charge rate, in accordance with nationally recognized standards.

1207.6.1.2 Ventilation based on exhaust rate. Mechanical exhaust ventilation shall be provided at a rate of not less than 1 ft³/min/ft² (5.1 L/sec/m²) of floor area of the room, area or walk-in unit. The ventilation shall be either continuous or shall be activated by a gas detection system in accordance with Section 1207.6.1.2.4.

1207.6.1.2.1 Standby power. Mechanical exhaust ventilation shall be provided with a minimum of 2 hours of standby power in accordance with Section 1203.2.5.

1207.6.1.2.2 Installation instructions. Required mechanical exhaust ventilation systems shall be installed in accordance with the manufacturer’s installation instructions and the *California Mechanical Code*.

1207.6.1.2.3 Supervision. Required mechanical exhaust ventilation systems shall be supervised by an approved central station, proprietary or remote station service in accordance with NFPA 72, or shall initiate an audible and visible signal at an approved constantly attended on-site location.

1207.6.1.2.4 Gas detection system. Where required by Section 1207.6.1.2, rooms, areas and walk-in units containing ESS shall be protected by an approved continuous gas detection system that complies with Section 916 and with the following:

1. The gas detection system shall be designed to activate the mechanical ventilation system when the level of flammable gas in the room, area or walk-in unit exceeds 25 percent of the LFL.
2. The mechanical ventilation system shall remain on until the flammable gas detected is less than 25 percent of the LFL.
3. The gas detection system shall be provided with a minimum of 2 hours of standby power in accordance with Section 1203.2.5.
4. Failure of the gas detection system shall annunciate a trouble signal at an approved central station, proprietary or remote station service in accordance with NFPA 72, or shall initiate an audible and visible trouble signal at an approved constantly attended on-site location.

1207.6.2 Spill control and neutralization. Where required by Table 1207.6 or elsewhere in this code, areas containing free-flowing liquid electrolyte or hazardous materials shall be provided with spill control and neutralization in accordance with this section.

1207.6.2.1 Spill control. Spill control shall be provided to prevent the flow of liquid electrolyte or hazardous materials to adjoining rooms or areas. The method shall be capable of containing a spill from the single largest battery or vessel.

1207.6.2.2 Neutralization. An approved method that is capable of neutralizing spilled liquid electrolyte from the largest battery or vessel to a pH between 5.0 and 9.0 shall be provided.

1207.6.2.3 Communications utilities. The requirements of Section 1207.6.2 shall apply only when the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L) for lead-acid and nickel-cadmium battery systems operating at less than 50 VAC and 60 VDC that are located at facilities under the exclusive control of communications utilities, and those facilities comply with NFPA 76 in addition to applicable requirements of this code.

1207.6.3 Explosion control. Where required by Table 1207.6 or elsewhere in this code, explosion control complying with Section 911 shall be provided for rooms, areas or walk-in units containing electrochemical ESS technologies.

Exceptions:

1. Where approved, explosion control is permitted to be waived by the fire code official based on large-scale fire testing complying with Section 1207.1.5 that demonstrates that flammable gases are not liberated from electrochemical ESS cells or modules where tested in accordance with UL 9540A.
2. Where approved, explosion control is permitted to be waived by the fire code official based on

**TABLE 1207.6
ELECTROCHEMICAL ESS TECHNOLOGY-SPECIFIC REQUIREMENTS**

COMPLIANCE REQUIRED ^b		BATTERY TECHNOLOGY				OTHER ESS AND BATTERY TECHNOLOGIES ^b	CAPACITOR ESS ^b
Feature	Section	Lead-acid	Ni-Cd and Ni-MH	Lithium-ion	Flow		
Exhaust ventilation	1207.6.1	Yes	Yes	No	Yes	Yes	Yes
Explosion control	1207.6.3	Yes ^a	Yes ^a	Yes	No	Yes	Yes
Safety caps	1207.6.4	Yes	Yes	No	No	Yes	Yes
Spill control and neutralization	1207.6.2	Yes ^c	Yes ^c	No	Yes	Yes	Yes
Thermal runaway	1207.6.5	Yes ^d	Yes	Yes ^e	No	Yes ^e	Yes

- a. Not required for lead-acid and nickel-cadmium batteries at facilities under the exclusive control of communications utilities that comply with NFPA 76 and operate at less than 50 VAC and 60 VDC.
- b. Protection shall be provided unless documentation acceptable to the fire code official is provided in accordance with Section 104.8.2 that provides justification why the protection is not necessary based on the technology used.
- c. Applicable to vented-type (i.e., flooded) nickel-cadmium and lead-acid batteries.
- d. Not required for vented-type (i.e., flooded) lead-acid batteries.
- e. The thermal runaway protection is permitted to be part of a battery management system that has been evaluated with the battery as part of the evaluation to UL 1973.

documentation provided in accordance with Section 104.7 that demonstrates that the electrochemical ESS technology to be used does not have the potential to release flammable gas concentrations in excess of 25 percent of the LFL anywhere in the room, area, walk-in unit or structure under thermal runaway or other fault conditions.

1207.6.4 Safety caps. Where required by Table 1207.6 or elsewhere in this code, vented batteries and other ESS shall be provided with flame-arresting safety caps.

1207.6.5 Thermal runaway. Where required by Table 1207.6 or elsewhere in this code, batteries and other ESS shall be provided with a listed device or other approved method to prevent, detect and minimize the impact of thermal runaway.

1207.7 Indoor installations. Indoor ESS installations shall be in accordance with Sections 1207.7.1 through 1207.7.4.

1207.7.1 Dedicated-use buildings. For the purpose of Table 1207.7, dedicated-use ESS buildings shall be classified as Group F-1 occupancies and comply with all the following:

1. The building shall only be used for ESS, electrical energy generation and other electrical grid-related operations.
2. Occupants in the rooms and areas containing ESS are limited to personnel that operate, maintain, service, test and repair the ESS and other energy systems.
3. No other occupancy types shall be permitted in the building.
4. Administrative and support personnel shall be permitted in areas within the buildings that do not contain ESS, provided that:

4.1. The areas do not occupy more than 10 percent of the building area of the story in which they are located.

4.2. A means of egress is provided from the incidental use areas to the public way that does not require occupants to traverse through areas containing ESS or other energy system equipment.

1207.7.2 Nondedicated-use buildings. For the purpose of Table 1207.7, nondedicated-use buildings include all buildings that contain ESS and do not comply with Section 1207.7.1 dedicated-use building requirements.

1207.7.3 Dwelling units and sleeping units. ESS shall not be installed in sleeping units or in habitable spaces of dwelling units.

1207.7.4 Fire-resistance-rated separations. Rooms and areas containing ESS shall include fire-resistance-rated separations as follows:

1. In dedicated-use buildings, rooms and areas containing ESS shall be separated from areas in which administrative and support personnel are located.
2. In nondedicated-use buildings, rooms and areas containing ESS shall be separated from other areas in the building.

Separation shall be provided by 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* and 2-hour horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, as appropriate.

1207.8 Outdoor installations. Outdoor installations shall be in accordance with Sections 1207.8.1 through 1207.8.3. Exterior wall installations for individual ESS units not exceeding 20 kWh shall be in accordance with Section 1207.8.4.

**TABLE 1207.7
INDOOR ESS INSTALLATIONS**

COMPLIANCE REQUIRED		DEDICATED-USE BUILDINGS ^a	NONDEDICATED-USE BUILDINGS ^b
Feature	Section		
Dwelling units and sleeping units	1207.7.3	NA	Yes
Elevation	1207.5.3	Yes	Yes
Fire suppression systems	1207.5.5	Yes ^c	Yes
Fire-resistance-rated separations	1207.7.4	Yes	Yes
General installation requirements	1207.4	Yes	Yes
Maximum allowable quantities	1207.5.2	No	Yes
Size and separation	1207.5.1	Yes	Yes
Smoke and automatic fire detection ^e	1207.5.4	Yes ^d	Yes
Technology specific protection	1207.6	Yes	Yes

NA = Not Allowed.

a. See Section 1207.7.1.

b. See Section 1207.7.2.

c. Where approved by the fire code official, fire suppression systems are permitted to be omitted in dedicated-use buildings located more than 100 feet (30.5 m) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high-piled stock and other exposure hazards.

d. Where approved by the fire code official, alarm signals are not required to be transmitted to a central station, proprietary or remote station service in accordance with NFPA 72, or a constantly attended location where local fire alarm annunciation is provided and trained personnel are always present.

e. Lead-acid and nickel-cadmium battery systems installed in Group U buildings and structures less than 1,500 square feet (139 m²) under the exclusive control of communications utilities, and operating at less than 50 VAC and 60 VDC in accordance with NFPA 76, are not required to have an approved automatic smoke or fire detection system.

**TABLE 1207.8
OUTDOOR ESS INSTALLATIONS^a**

COMPLIANCE REQUIRED		REMOTE INSTALLATIONS ^a	INSTALLATIONS NEAR EXPOSURES ^b
Feature	Section		
All ESS installations	1207.4	Yes	Yes
Clearance to exposures	1207.8.3	Yes	Yes
Fire suppression systems	1207.5.5	Yes ^c	Yes
Maximum allowable quantities	1207.5.2	No	Yes
Maximum enclosure size	1207.5.6	Yes	Yes
Means of egress separation	1207.5.8	Yes	Yes
Size and separation	1207.5.1	No	Yes ^d
Smoke and automatic fire detection	1207.5.4	Yes	Yes
Technology-specific protection	1207.6	Yes	Yes
Vegetation control	1207.5.7	Yes	Yes

a. See Section 1207.8.1.

b. See Section 1207.8.2.

c. Where approved by the fire code official, fire suppression systems are permitted to be omitted.

d. In outdoor walk-in units, spacing is not required between ESS units and the walls of the enclosure.

1207.8.1 Remote outdoor installations. For the purpose of Table 1207.8, remote outdoor installations include ESS located more than 100 feet (30 480 mm) from buildings, lot lines, public ways, stored combustible materials, hazardous materials, high-piled stock and other exposure hazards.

1207.8.2 Installations near exposures. For the purpose of Table 1207.8, installations near exposures include all outdoor ESS installations that do not comply with Section 1207.8.1 remote outdoor location requirements.

1207.8.3 Clearance to exposures. ESS located outdoors shall be separated by a minimum of 10 feet (3048 mm) from the following exposures:

1. Lot lines.
2. Public ways.
3. Buildings.
4. Stored combustible materials.
5. Hazardous materials.
6. High-piled stock.
7. Other exposure hazards.

Exceptions:

1. Clearances are permitted to be reduced to 3 feet (914 mm) where a 1-hour free-standing fire barrier suitable for exterior use and extending 5 feet (1524 mm) above and 5 feet (1524 mm) beyond the physical boundary of the ESS installation is provided to protect the exposure.
2. Clearances to buildings are permitted to be reduced to 3 feet (914 mm) where noncombustible exterior walls with no openings or combustible overhangs are provided on the wall adjacent to the ESS and the fire-resistance rating of the exterior wall is a minimum of 2 hours.

3. Clearances to buildings are permitted to be reduced to 3 feet (914 mm) where a weatherproof enclosure constructed of noncombustible materials is provided over the ESS, and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large-scale fire testing complying with Section 1207.1.5.

1207.8.4 Exterior wall installations. ESS shall be permitted to be installed outdoors on exterior walls of buildings when all of the following conditions are met:

1. The maximum energy capacity of individual ESS units shall not exceed 20 kWh.
2. The ESS shall comply with applicable requirements in Section 1207.
3. The ESS shall be installed in accordance with the manufacturer's instructions and their listing.
4. Individual ESS units shall be separated from each other by at least 3 feet (914 mm).
5. The ESS shall be separated from doors, windows, operable openings into buildings or HVAC inlets by at least 5 feet (1524 mm).

Exception: Where approved, smaller separation distances in Items 4 and 5 shall be permitted based on large-scale fire testing complying with Section 1207.1.5.

1207.9 Special installations. Rooftop and open parking garage ESS installations shall comply with Sections 1207.9.1 through 1207.9.6.

1207.9.1 Rooftop installations. For the purpose of Table 1207.9, rooftop ESS installations are those located on the roofs of buildings.

1207.9.2 Open parking garage installations. For the purpose of Table 1207.9, open parking garage ESS installations are those located in a structure or portion of a

TABLE 1207.9
SPECIAL ESS INSTALLATIONS

COMPLIANCE REQUIRED		ROOFTOPS ^a	OPEN PARKING GARAGES ^b
Feature	Section		
All ESS installations	1207.4	Yes	Yes
Clearance to exposures	1207.9.3	Yes	Yes
Fire suppression systems	1207.9.4	Yes	Yes
Maximum allowable quantities	1207.5.2	Yes	Yes
Maximum enclosure size	1207.5.6	Yes	Yes
Means of egress separation	1207.5.8	Yes	Yes
Open parking garage installations	1207.9.6	No	Yes
Rooftop installations	1207.9.5	Yes	No
Size and separation	1207.5.1	Yes	Yes
Smoke and automatic fire detection	1207.5.4	Yes	Yes
Technology-specific protection	1207.6	Yes	Yes

a. See Section 1207.9.1.

b. See Section 1207.9.2.

structure that complies with Section 406.5 of the *California Building Code*.

1207.9.3 Clearance to exposures. ESS located on rooftops and in open parking garages shall be separated by a minimum of 10 feet (3048 mm) from the following exposures:

1. Buildings, except the building on which rooftop ESS is mounted.
2. Any portion of the building on which a rooftop system is mounted that is elevated above the rooftop on which the system is installed.
3. Lot lines.
4. Public ways.
5. Stored combustible materials.
6. Locations where motor vehicles can be parked.
7. Hazardous materials.
8. Other exposure hazards.

Exceptions:

1. Clearances are permitted to be reduced to 3 feet (914 mm) where a 1-hour free-standing fire barrier suitable for exterior use and extending 5 feet (1524 mm) above and 5 feet (1524 mm) beyond the physical boundary of the ESS installation is provided to protect the exposure.
2. Clearances are permitted to be reduced to 3 feet (914 mm) where a weatherproof enclosure constructed of noncombustible materials is provided over the ESS, and it has been demonstrated that a fire within the enclosure will not ignite combustible materials outside the enclosure based on large-scale fire testing complying with Section 1207.1.5.

1207.9.4 Fire suppression systems. ESS located in walk-in units on rooftops or in walk-in units in open parking garages shall be provided with automatic fire suppression systems within the ESS enclosure in accordance with Section 1207.5.5. Areas containing ESS other than walk-in units in open parking structures on levels not open above to the sky shall be provided with an automatic fire suppression system complying with Section 1207.5.5.

Exception: A fire suppression system is not required in open parking garages if large-scale fire testing complying with Section 1207.1.5 is provided that shows that a fire will not impact the exposures in Section 1207.9.3.

1207.9.5 Rooftop installations. ESS and associated equipment that are located on rooftops and not enclosed by building construction shall comply with the following:

1. Stairway access to the roof for emergency response and fire department personnel shall be provided either through a bulkhead from the interior of the building or a stairway on the exterior of the building.
2. Service walkways at least 5 feet (1524 mm) in width shall be provided for service and emergency personnel from the point of access to the roof to the system.
3. ESS and associated equipment shall be located from the edge of the roof a distance equal to at least the height of the system, equipment or component but not less than 5 feet (1524 mm).
4. The roofing materials under and within 5 feet (1524 mm) horizontally from an ESS or associated equipment shall be noncombustible or shall have a Class A rating when tested in accordance with ASTM E108 or UL 790.
5. A Class I standpipe outlet shall be installed at an approved location on the roof level of the building or in the stairway bulkhead at the top level.

6. The ESS shall be the minimum of 10 feet (3048 mm) from the fire service access point on the roof-top.

1207.9.6 Open parking garages. ESS and associated equipment that are located in open parking garages shall comply with all of the following:

1. ESS shall not be located within 50 feet (15 240 mm) of air inlets for building HVAC systems.

Exception: This distance shall be permitted to be reduced to 25 feet (7620 mm) if the automatic fire alarm system monitoring the radiant-energy sensing detectors de-energizes the ventilation system connected to the air intakes upon detection of fire.

2. ESS shall not be located within 25 feet (7620 mm) of exits leading from the attached building where located on a covered level of the parking structure not directly open to the sky above.
3. An approved fence with a locked gate or other approved barrier shall be provided to keep the general public at least 5 feet (1524 mm) from the outer enclosure of the ESS.

1207.10 Mobile ESS equipment and operations. Mobile ESS equipment and operations shall comply with Sections 1207.10.1 through 1207.10.7.7.

**TABLE 1207.10
MOBILE ENERGY STORAGE SYSTEMS (ESS)**

COMPLIANCE REQUIRED		DEPLOYMENT ^a
Feature	Section	
All ESS installations	1207.4	Yes ^b
Fire suppression systems	1207.5.5	Yes ^c
Maximum allowable quantities	1207.5.2	Yes
Maximum enclosure size	1207.5.6	Yes
Means of egress separation	1207.5.8	Yes
Size and separation	1207.5.1	Yes ^d
Smoke and automatic fire detection	1207.5.4	Yes ^e
Technology-specific protection	1207.6	Yes
Vegetation control	1207.5.7	Yes

- a. See Section 1207.10.2.
- b. Mobile operations on wheeled vehicles and trailers shall not be required to comply with Section 1207.4.4 seismic and structural load requirements.
- c. Fire suppression system connections to the water supply shall be permitted to use approved temporary connections.
- d. In walk-in units, spacing is not required between ESS units and the walls of the enclosure.
- e. Alarm signals are not required to be transmitted to an approved location for mobile ESS deployed 30 days or less.

1207.10.1 Charging and storage. For the purpose of Section 1207.10, charging and storage covers the operation where mobile ESS are charged and stored so they are ready for deployment to another site, and where they are charged and stored after a deployment.

1207.10.2 Deployment. For the purpose of Section 1207.10, deployment covers operations where mobile ESS

are located at a site other than the charging and storage site and are being used to provide power.

1207.10.3 Permits. Construction and operational permits shall be provided for charging and storage of mobile ESS and operational permits shall be provided for deployment of mobile ESS as required by Section 1207.1.2.

1207.10.4 Construction documents. Construction documents complying with Section 1207.1.3 shall be provided with the construction permit application for mobile ESS charging and storage locations.

1207.10.4.1 Deployment documents. The following information shall be provided with the operation permit applications for mobile ESS deployments:

1. Relevant information for the mobile ESS equipment and protection measures in the construction documents required by Section 1207.1.3.
2. Location and layout diagram of the area in which the mobile ESS is to be deployed, including a scale diagram of all nearby exposures.
3. Location and content of signage, including no smoking signs.
4. Description of fencing to be provided around the ESS, including locking methods.
5. Details on fire suppression, smoke and automatic fire detection, system monitoring, thermal management, exhaust ventilation and explosion control, if provided.
6. For deployment, the intended duration of operation, including anticipated connection and disconnection times and dates.
7. Location and description of local staging stops during transit to the deployment site. See Section 1207.10.7.5.
8. Description of the temporary wiring, including connection methods, conductor type and size, and circuit overcurrent protection to be provided.
9. Description of how fire suppression system connections to water supplies or extinguishing agents are to be provided.
10. Contact information for personnel who are responsible for maintaining and servicing the equipment, and responding to emergencies as required by Section 1207.1.6.1.

1207.10.5 Approved locations. Locations where mobile ESS are charged, stored and deployed shall be restricted to the locations established on the construction and operational permits.

1207.10.6 Charging and storage. Installations where mobile ESS are charged and stored shall be treated as permanent ESS indoor or outdoor installations, and shall comply with the following sections, as applicable:

1. Indoor charging and storage shall comply with Section 1207.7.

2. Outdoor charging and storage shall comply with Section 1207.8.
3. Charging and storage on rooftops and in open parking garages shall comply with Section 1207.9.

Exceptions:

1. Electrical connections shall be permitted to be made using temporary wiring complying with the manufacturer's instructions, the UL 9540 listing and *the California Electrical Code*.
2. Fire suppression system connections to the water supply shall be permitted to use approved temporary connections.

1207.10.7 Deployed mobile ESS requirements. Deployed mobile ESS equipment and operations shall comply with this section and Table 1207.10.

1207.10.7.1 Duration. The duration of mobile ESS deployment shall not exceed 30 days.

Exceptions:

1. Mobile ESS deployments that provide power for durations longer than 30 days shall comply with Section 1207.10.6.
2. Mobile ESS deployments shall not exceed 180 days unless additional operational permits are obtained.

1207.10.7.2 Restricted locations. Deployed mobile ESS operations shall not be located indoors, in covered parking garages, on rooftops, below grade or under building overhangs.

1207.10.7.3 Clearance to exposures. Deployed mobile ESS shall be separated by a minimum of 10 feet (3048 mm) from the following exposures:

1. Public ways.
2. Buildings.
3. Stored combustible materials.
4. Hazardous materials.
5. High-piled storage.
6. Other exposure hazards.

Deployed mobile ESS shall be separated by a minimum of 50 feet (15 240 mm) from public seating areas and from tents, canopies and membrane structures with an occupant load of 30 or more.

1207.10.7.4 Electrical connections. Electrical connections shall be made in accordance with the manufacturer's instructions and the UL 9540 listing. Temporary wiring for electrical power connections shall comply with *the California Electrical Code*. Fixed electrical wiring shall not be provided.

1207.10.7.5 Local staging. Mobile ESS in transit from the charging and storage location to the deployment location and back shall not be parked within 100 feet (30 480 mm) of an occupied building for more than 1 hour during transit, unless specifically approved by the fire code official when the permit is issued.

1207.10.7.6 Fencing. An approved fence with a locked gate or other approved barrier shall be provided to keep the general public at least 5 feet (1524 mm) from the outer enclosure of a deployed mobile ESS.

1207.10.7.7 Smoking. Smoking shall be prohibited within 10 feet (3048 mm) of mobile ESS. Signs shall be posted in accordance with Section 310.

1207.11 ESS in Group R-3 and R-4 occupancies. ESS in Group R-3 and R-4 occupancies shall be installed and maintained in accordance with Sections 1207.11.1 through 1207.11.9. The temporary use of an owner or occupant's electric-powered vehicle as an ESS shall be in accordance with Section 1207.11.10.

1207.11.1 Equipment listings. ESS shall be listed and labeled in accordance with UL 9540. ESS listed and labeled solely for utility or commercial use shall not be used for residential applications.

Exception: Where approved, repurposed unlisted battery systems from electric vehicles are allowed to be installed outdoors or in detached dedicated cabinets located not less than 5 feet (1524 mm) from exterior walls, property lines and public ways.

1207.11.2 Installation. ESS shall be installed in accordance with the manufacturer's instructions and their listing.

1207.11.2.1 Spacing. Individual units shall be separated from each other by at least 3 feet (914 mm) of spacing unless smaller separation distances are documented to be adequate based on large-scale fire testing complying with Section 1207.1.5.

1207.11.3 Location. ESS shall be installed only in the following locations:

1. Detached garages and detached accessory structures.
2. Attached garages separated from the dwelling unit living space and sleeping units in accordance with Section R302.6.
3. Outdoors *or* on the exterior side of the exterior walls located *not less than* 3 feet (914 mm) from doors and windows *directly entering the dwelling unit*.
4. *Enclosed utility closets, basements, storage or utility spaces within dwelling units with finished or non-combustible walls and ceilings. Walls and ceilings of unfinished wood-framed construction shall be provided with not less than 5/8-inch (15.9 mm) Type X gypsum wallboard.*

ESS shall not be installed in sleeping rooms, closets, spaces opening directly into sleeping rooms or in habitable spaces of dwelling units.

1207.11.4 Energy ratings. Individual ESS units shall have a maximum rating of 20 kWh. The aggregate rating structure shall not exceed:

1. 40 kWh within utility closets and storage or utility spaces.
2. 80 kWh in attached or detached garages and detached accessory structures.

3. 80 kWh on exterior walls.
4. 80 kWh outdoors on the ground.

ESS installations exceeding the permitted individual or aggregate ratings shall be installed in accordance with Sections 1207.1 through 1207.9 of the California Fire Code.

1207.11.5 Electrical installation. ESS shall be installed in accordance with *the California Electrical Code*. Inverters shall be listed and labeled in accordance with UL 1741 or provided as part of the UL 9540 listing. Systems connected to the utility grid shall use inverters listed for utility interaction.

1207.11.6 Fire detection. ESS installed in Group R-3 and R-4 occupancies shall comply with the following:

1. Rooms and areas within dwellings units, sleeping units, *basements* and attached garages in which ESS are installed shall be protected by smoke alarms in accordance with Section 907.2.11.
2. A *listed heat alarm* interconnected to the smoke alarms shall be installed in locations within dwelling units, sleeping units and attached garages where smoke alarms cannot be installed based on their listing.

1207.11.7 Protection from impact. ESS installed in a location subject to vehicle damage *in accordance with Section 1207.11.7.1 or 1207.11.7.2 shall be provided with impact protection in accordance with Section 1207.11.7.3.*

1207.11.7.1 Garages. *Where an ESS is installed in the normal driving path of vehicle travel within a garage, impact protection complying with Section 1207.11.7.3 shall be provided. The normal driving path is a space between the garage vehicle opening and the interior face of the back wall to a height of 48 inches (1219 mm) above the finished floor. The width of the normal driving path shall be equal to the width of the garage door opening. Impact protection shall also be provided for ESS installed at either of the following locations (See Figure 1207.11.7.1):*

1. *On the interior face of the back wall and located within 36 inches (914 mm) to the left or to the right of the normal driving path.*
2. *On the interior face of a side wall and located within 24 inches (609 mm) (from the back wall and within 36 inches (914 mm) of the normal driving path.*

Exception: *Where the clear height of the vehicle garage opening is 7 feet 6 inches (2286 mm) or less, ESS installed not less than 36 inches (914 mm) above finished floor are not subject to vehicle impact protection requirements.*

1207.11.7.2 Other locations subject to vehicle impact. *Where an ESS is installed in a location other than as defined in Section 1207.11.7.1, and is subject to vehicle damage, impact protection shall be provided in accordance with Section 1207.11.7.3.*

1207.11.7.3 Impact protection options. *Where ESS is required to be protected from impact in accordance with Section 1207.11.7.1 or 1207.11.7.2, such protection shall comply with one of the following:*

1. *Bollards constructed in accordance with one of the following:*
 - 1.1. *Minimum 48 inches (1219 mm) in length by 3 inches (76 mm) in diameter Schedule 80 steel pipe embedded in a concrete pier not less than 12 inches (304 mm) deep and 6 inches (152 mm) in diameter, with at least 36 inches (914 mm) of pipe exposed, filled with concrete and spaced at a maximum interval of 5 feet (1524 mm). Each bollard shall be located not less than 6 inches (152 mm) from an ESS.*
 - 1.2. *Minimum 36 inches (914 mm) in height by 3 inches (76 mm) in diameter Schedule 80 steel pipe fully welded to a minimum 8-inch (203 mm) by 1/4-inch (6.4 mm) thick steel plate and bolted to a concrete floor by means of 4 1/2-inch (113 mm) concrete anchors with 3-inch (76 mm) minimum embedment. Spacing shall not be greater than 60 inches (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.*
 - 1.3. *Pre-manufactured steel pipe bollards shall be filled with concrete and anchored in accordance with the manufacturer's installation instructions, with spacing not greater than 60 inches (1524 mm), and each bollard shall be located not less than 6 inches (152 mm) from the ESS.*
2. *Wheel barriers constructed in accordance with one of the following:*
 - 2.1. *Four inches (102 mm) in height by 5 inches (127 mm) in width by 70 inches (1778 mm) in length wheel barrier made of concrete or polymer, anchored to the concrete floor not less than every 36 inches (914 mm) and located not less than 54 inches (1372 mm) from the ESS. Minimum 3 1/2-inch (89 mm) diameter concrete anchors with a 3-inch (76 mm) embedment per barrier shall be used. Spacing between barriers shall be no greater than 36 inches (914 mm).*
 - 2.2. *Pre-manufactured wheel barriers shall be anchored in accordance with the manufacturer's installation instructions.*
 3. *Approved method designed to resist a 2,000-pound (8899 Newtons) impact in the direction of travel at 24 inches (608 mm) above grade.*

1207.11.8 Ventilation. Indoor installations of ESS that include batteries that produce hydrogen or other flammable gases during charging shall be provided with exhaust ventilation in accordance with Section 1207.6.1.

1207.11.9 Toxic and highly toxic gas. ESS that have the potential to release toxic or highly toxic gas during charging, discharging and normal use conditions shall not be installed within Group R-3 or R-4 occupancies.

1207.11.10 Electric vehicle use. The temporary use of an owner or occupant’s electric-powered vehicle to power a dwelling unit or sleeping unit while parked in an attached

or detached garage or outside shall comply with the vehicle manufacturer’s instructions and *the California Electrical Code*.

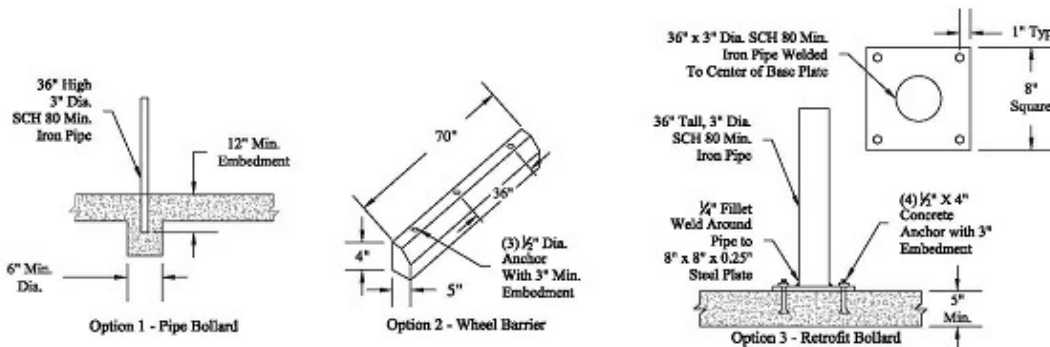
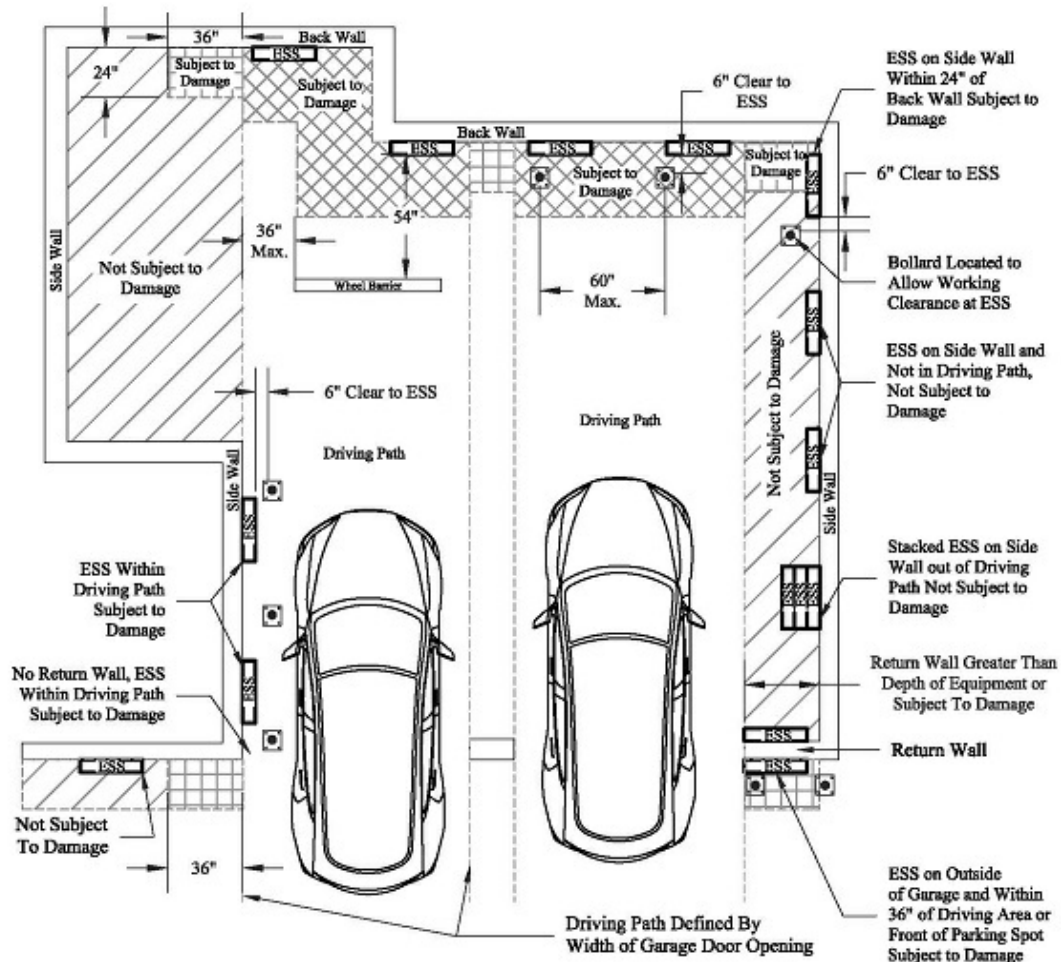


FIGURE 1207.11.7.1
ESS VEHICLE IMPACT PROTECTION

**CHAPTERS 13 through 19
RESERVED**

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 20 – AVIATION FACILITIES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

Part IV—Special Occupancies and Operations

CHAPTER 20

AVIATION FACILITIES

User note:

***About this chapter:** Chapter 20 specifies minimum requirements for the fire-safe operation of airports, heliports and helistops. The principal nonflight operational hazards associated with aviation involve fuel, facilities and operations. Therefore, safe use of flammable and combustible liquids during fueling and maintenance operations is emphasized. Availability of portable Class B:C-rated fire extinguishers for prompt control or suppression of incipient fires is required.*

SECTION 2001 GENERAL

2001.1 Scope. Airports, heliports, helistops and aircraft hangars shall be in accordance with this chapter.

2001.2 Regulations not covered. Regulations not specifically contained herein pertaining to airports, aircraft maintenance, aircraft hangars and appurtenant operations shall be in accordance with nationally recognized standards.

2001.3 Permits. For permits to operate aircraft-refueling vehicles, application of flammable or combustible finishes and hot work, see Section 105.5.

SECTION 2002 DEFINITIONS

2002.1 Definitions. The following terms are defined in Chapter 2:

AIRCRAFT OPERATION AREA (AOA).

AIRPORT.

HELIPORT.

HELISTOP.

SECTION 2003 GENERAL PRECAUTIONS

2003.1 Sources of ignition. Open flames, flame-producing devices and other sources of ignition shall not be permitted in a hangar, except in approved locations or in any location within 50 feet (15 240 mm) of an aircraft-fueling operation.

2003.2 Smoking. Smoking shall be prohibited in aircraft-refueling vehicles, aircraft hangars and aircraft operation areas used for cleaning, paint removal, painting operations or fueling. “No Smoking” signs shall be provided in accordance with Section 310.

Exception: Designated and approved smoking areas.

2003.3 Housekeeping. The aircraft operation area (AOA) and related areas shall be kept free from combustible debris at all times.

2003.4 Fire department access. Fire apparatus access roads shall be provided and maintained in accordance with Chapter 5. Fire apparatus access roads and aircraft parking positions shall be designed in a manner so as to preclude the possibility of fire vehicles traveling under any portion of a parked aircraft.

2003.5 Dispensing of flammable and combustible liquids. The dispensing, transferring and storage of flammable and combustible liquids shall be in accordance with this chapter and Chapter 57. Aircraft motor vehicle fuel-dispensing facilities shall be in accordance with Chapter 23.

2003.6 Combustible storage. Combustible materials stored in aircraft hangars shall be stored in approved locations and containers.

2003.7 Hazardous material storage. Hazardous materials shall be stored in accordance with Chapter 50.

SECTION 2004 AIRCRAFT MAINTENANCE

2004.1 Transferring flammable and combustible liquids. Flammable and combustible liquids shall not be dispensed into or removed from a container, tank, vehicle or aircraft except in approved locations.

2004.2 Application of flammable and combustible liquid finishes. The application of flammable or Class II combustible liquid finishes is prohibited unless both of the following conditions are met:

1. The application of the liquid finish is accomplished in an approved location.
2. The application methods and procedures are in accordance with Chapter 24.

2004.3 Cleaning parts. Class IA flammable liquids shall not be used to clean aircraft, aircraft parts or aircraft engines. Cleaning with other flammable and combustible liquids shall be in accordance with Section 5705.3.6.

2004.4 Spills. Sections 2004.4.1 through 2004.4.3 shall apply to spills of flammable and combustible liquids and

AVIATION FACILITIES

other hazardous materials. Fuel spill control shall also comply with Section 2006.11.

2004.4.1 Cessation of work. Activities in the affected area not related to the mitigation of the spill shall cease until the spilled material has been removed or the hazard has been mitigated.

2004.4.2 Vehicle movement. Aircraft or other vehicles shall not be moved through the spill area until the spilled material has been removed or the hazard has been mitigated.

2004.4.3 Mitigation. Spills shall be reported, documented and mitigated in accordance with the provisions of this chapter and Section 5003.3.

2004.5 Running engines. Aircraft engines shall not be run in aircraft hangars except in approved engine test areas.

2004.6 Open flame. Repairing of aircraft requiring the use of open flames, spark-producing devices or the heating of parts above 500°F (260°C) shall only be done outdoors or in an area complying with the provisions of the *California Building Code* for a Group F-1 occupancy.

2004.7 Other aircraft maintenance. Maintenance, repairs, modifications, or construction performed on aircraft not addressed elsewhere in this code shall be conducted in accordance with NFPA 410.

SECTION 2005 PORTABLE FIRE EXTINGUISHERS

2005.1 General. Portable fire extinguishers suitable for flammable or combustible liquid and electrical-type fires shall be provided as specified in Sections 2005.2 through 2005.6 and Section 906. Extinguishers required by this section shall be inspected and maintained in accordance with Section 906.

2005.2 On towing vehicles. Vehicles used for towing aircraft shall be equipped with not less than one listed portable fire extinguisher complying with Section 906 and having a minimum rating of 20-B:C.

2005.3 On welding apparatus. Welding apparatus shall be equipped with not less than one listed portable fire extinguisher complying with Section 906 and having a minimum rating of 2-A:20-B:C.

2005.4 On aircraft fuel-servicing tank vehicles. Aircraft fuel-servicing tank vehicles shall be equipped with not less than two listed portable fire extinguishers complying with Section 906, each having a minimum rating of 20-B:C. A portable fire extinguisher shall be provided with ready access from either side of the vehicle.

2005.5 On hydrant fuel-servicing vehicles. Hydrant fuel-servicing vehicles shall be equipped with not less than one listed portable fire extinguisher complying with Section 906 and having a minimum rating of 20-B:C.

2005.6 At fuel-dispensing stations. Portable fire extinguishers at fuel-dispensing stations shall be located such that pumps or dispensers are not more than 75 feet (22 860 mm) from one such extinguisher. Fire extinguishers shall be provided as follows:

1. Where the open-hose discharge capacity of the fueling system is not more than 200 gallons per minute (13 L/s), not less than two listed portable fire extinguishers complying with Section 906 and having a minimum rating of 20-B:C shall be provided.
2. Where the open-hose discharge capacity of the fueling system is more than 200 gallons per minute (13 L/s) but not more than 350 gallons per minute (22 L/s), not less than one listed wheeled extinguisher complying with Section 906 and having a minimum extinguishing rating of 80-B:C, and a minimum agent capacity of 125 pounds (57 kg), shall be provided.
3. Where the open-hose discharge capacity of the fueling system is more than 350 gallons per minute (22 L/s), not less than two listed wheeled extinguishers complying with Section 906 and having a minimum rating of 80-B:C each, and a minimum capacity agent of 125 pounds (57 kg) each, shall be provided.

2005.7 Fire extinguisher access. Access to portable fire extinguishers required by this chapter shall be maintained at all times. Where necessary, provisions shall be made to clear accumulations of snow, ice and other forms of weather-induced obstructions.

2005.7.1 Cabinets. Cabinets and enclosed compartments used to house portable fire extinguishers shall be clearly marked with the words “FIRE EXTINGUISHER” in letters not less than 2 inches (51 mm) high. Cabinets and compartments shall be provided with ready access at all times.

2005.8 Reporting use. Use of a fire extinguisher under any circumstances shall be immediately reported to the manager of the airport and the fire code official.

SECTION 2006 AIRCRAFT FUELING

2006.1 Aircraft motor vehicle fuel-dispensing facilities. Aircraft motor vehicle fuel-dispensing facilities shall be in accordance with Chapter 23.

2006.2 Airport fuel systems. Airport fuel systems shall be designed and constructed in accordance with NFPA 407.

2006.3 Construction of aircraft-fueling vehicles and accessories. Aircraft-fueling vehicles shall comply with this section and shall be designed and constructed in accordance with NFPA 407.

2006.3.1 Transfer apparatus. Aircraft-fueling vehicles shall be equipped and maintained with an approved transfer apparatus.

2006.3.1.1 Internal combustion type. Where such transfer apparatus is operated by an individual unit of the internal-combustion-motor type, such power unit shall be located as remotely as practicable from pumps, piping, meters, air eliminators, water separators, hose reels and similar equipment, and shall be housed in a separate compartment from any of the aforementioned items. The fuel tank in connection therewith shall be suitably designed and installed, and the maximum fuel

capacity shall not exceed 5 gallons (19 L) where the tank is installed on the engine. The exhaust pipe, muffler and tail pipe shall be shielded.

2006.3.1.2 Gear operated. Where operated by gears or chains, the gears, chains, shafts, bearings, housing and all parts thereof shall be of an approved design and shall be installed and maintained in an approved manner.

2006.3.1.3 Vibration isolation. Flexible connections for the purpose of eliminating vibration are allowed if the material used therein is designed, installed and maintained in an approved manner, provided that such connections do not exceed 24 inches (610 mm) in length.

2006.3.2 Pumps. Pumps of a positive-displacement type shall be provided with a bypass relief valve set at a pressure of not more than 35 percent in excess of the normal working pressure of such unit. Such units shall be equipped and maintained with a pressure gauge on the discharge side of the pump.

2006.3.3 Dispensing hoses and nozzles. Hoses shall be designed for the transferring of hydrocarbon liquids and shall not be any longer than necessary to provide efficient fuel-transfer operations. Hoses shall be equipped with an approved shutoff nozzle. Fuel-transfer nozzles shall be self-closing and designed to be actuated by hand pressure only. Notches and other devices shall not be used for holding a nozzle valve handle in the open position. Nozzles shall be equipped with a bonding cable complete with proper attachment for aircraft to be serviced.

2006.3.4 Protection of electrical equipment. Electric wiring, switches, lights and other sources of ignition, where located in a compartment housing piping, pumps, air eliminators, water separators, hose reels or similar equipment, shall be enclosed in a vapor-tight housing. Electrical motors located in such a compartment shall be of a type approved for use as specified in the *California Electrical Code*.

2006.3.5 Venting of equipment compartments. Compartments housing piping, pumps, air eliminators, water separators, hose reels and similar equipment shall be adequately ventilated at floor level or within the floor itself.

2006.3.6 Accessory equipment. Ladders, hose reels and similar accessory equipment shall be of an approved type and constructed substantially as follows:

1. Ladders constructed of noncombustible material are allowed to be used with or attached to aircraft-fueling vehicles, provided that the manner of attachment or use of such ladders is approved and does not constitute an additional fire or accident hazard in the operation of such fueling vehicles.
2. Hose reels used in connection with fueling vehicles shall be constructed of noncombustible materials and shall be provided with a packing gland or other device that will preclude fuel leakage between reels and fuel manifolds.

2006.3.7 Electrical bonding provisions. Transfer apparatus shall be metallically interconnected with tanks, chassis, axles and springs of aircraft-fueling vehicles.

2006.3.7.1 Bonding cables. Aircraft-fueling vehicles shall be provided and maintained with a substantial heavy-duty electrical cable of sufficient length to be bonded to the aircraft to be serviced. Such cable shall be metallically connected to the transfer apparatus or chassis of the aircraft-fueling vehicle on one end and shall be provided with a suitable metal clamp on the other end, to be fixed to the aircraft.

2006.3.7.2 Bonding cable protection. The bonding cable shall be bare or have a transparent protective sleeve and be stored on a reel or in a compartment provided for no other purpose. It shall be carried in such a manner that it will not be subjected to sharp kinks or accidental breakage under conditions of general use.

2006.3.8 Smoking. Smoking in aircraft-fueling vehicles is prohibited. Signs to this effect shall be conspicuously posted in the driver's compartment of all fueling vehicles.

2006.3.9 Smoking equipment. Smoking equipment such as cigarette lighters and ash trays shall not be provided in aircraft-fueling vehicles.

2006.4 Operation, maintenance and use of aircraft-fueling vehicles. The operation, maintenance and use of aircraft-fueling vehicles shall be in accordance with Sections 2006.4.1 through 2006.4.4 and other applicable provisions of this chapter.

2006.4.1 Proper maintenance. Aircraft-fueling vehicles and all related equipment shall be properly maintained and kept in good repair. Accumulations of oil, grease, fuel and other flammable or combustible materials is prohibited. Maintenance and servicing of such equipment shall be accomplished in approved areas.

2006.4.2 Vehicle integrity. Tanks, pipes, hoses, valves and other fuel delivery equipment shall be maintained leak free at all times.

2006.4.3 Removal from service. Aircraft-fueling vehicles and related equipment that are in violation of Section 2006.4.1 or 2006.4.2 shall be immediately defueled and removed from service and shall not be returned to service until proper repairs have been made.

2006.4.4 Operators. Aircraft-fueling vehicles that are operated by a person, firm or corporation other than the permittee or the permittee's authorized employee shall be provided with a legible sign visible from outside the vehicle showing the name of the person, firm or corporation operating such unit.

2006.5 Fueling and defueling. Aircraft-fueling and defueling operations shall be in accordance with Sections 2006.5.1 through 2006.5.5.

2006.5.1 Positioning of aircraft-fueling vehicles. Aircraft-fueling vehicles shall not be located, parked or permitted to stand in a position where such unit would obstruct egress from an aircraft should a fire occur during

fuel-transfer operations. Aircraft-fueling vehicles shall not be located, parked or permitted to stand under any portion of an aircraft.

Exception: Aircraft-fueling vehicles shall be allowed to be located under aircraft wings during underwing fueling of turbine-engine powered aircraft.

2006.5.1.1 Fueling vehicle egress. A clear path shall be maintained for aircraft-fueling vehicles to provide for prompt and timely egress from the fueling area.

2006.5.1.2 Aircraft vent openings. A clear space of not less than 10 feet (3048 mm) shall be maintained between aircraft fuel-system vent openings and any part or portion of an aircraft-fueling vehicle.

2006.5.1.3 Parking. Prior to leaving the cab, the aircraft-fueling vehicle operator shall ensure that the parking brake has been set. Not less than two chock blocks not less than 5 inches by 5 inches by 12 inches (127 mm by 127 mm by 305 mm) in size and dished to fit the contour of the tires shall be utilized and positioned in such a manner as to preclude movement of the vehicle in any direction.

2006.5.2 Electrical bonding. Aircraft-fueling vehicles shall be electrically bonded to the aircraft being fueled or defueled. Bonding connections shall be made prior to making fueling connections and shall not be disconnected until the fuel-transfer operations are completed and the fueling connections have been removed.

Where a hydrant service vehicle or cart is used for fueling, the hydrant coupler shall be connected to the hydrant system prior to bonding the fueling equipment to the aircraft.

2006.5.2.1 Conductive hose. In addition to the bonding cable required by Section 2006.5.2, conductive hose shall be used for all fueling operations.

2006.5.2.2 Bonding conductors on transfer nozzles. Transfer nozzles shall be equipped with approved bonding conductors that shall be clipped or otherwise positively engaged with the bonding attachment provided on the aircraft adjacent to the fuel tank cap prior to removal of the cap.

Exception: In the case of overwing fueling where an appropriate bonding attachment adjacent to the fuel fill port has not been provided on the aircraft, the fueling operator shall touch the fuel tank cap with the nozzle spout prior to removal of the cap. The nozzle shall be kept in contact with the fill port until fueling is completed.

2006.5.2.3 Funnels. Where required, metal funnels are allowed to be used during fueling operations. Direct contact between the fueling receptacle, the funnel and the fueling nozzle shall be maintained during the fueling operation.

2006.5.3 Training. Aircraft-fueling vehicles shall be attended and operated only by persons instructed in methods of proper use and operation and who are qualified to

use such fueling vehicles in accordance with minimum safety requirements.

2006.5.3.1 Fueling hazards. Fuel-servicing personnel shall know and understand the hazards associated with each type of fuel dispensed by the airport fueling-system operator.

2006.5.3.2 Fire safety training. Employees of fuel agents who fuel aircraft, accept fuel shipments or otherwise handle fuel shall receive approved fire safety training.

2006.5.3.2.1 Fire extinguisher training. Fuel-servicing personnel shall receive approved training in the operation of fire-extinguishing equipment.

2006.5.3.2.2 Records. The airport fueling-system operator shall maintain records of all training administered to its employees.

2006.5.4 Transfer personnel. During fuel-transfer operations, a qualified person shall be in control of each transfer nozzle and another qualified person shall be in immediate control of the fuel-pumping equipment to shut off or otherwise control the flow of fuel from the time fueling operations are begun until they are completed.

Exceptions:

1. For underwing refueling, the person stationed at the point of fuel intake is not required.
2. For overwing refueling, the person stationed at the fuel-pumping equipment shall not be required where the person at the fuel-dispensing device is within 75 feet (22 800 mm) of the emergency shutoff device; is not on the wing of the aircraft and has a clear and unencumbered path to the fuel-pumping equipment; and the fuel-dispensing line does not exceed 50 feet (15 240 mm) in length.

The fueling operator shall monitor the panel of the fueling equipment and the aircraft control panel during pressure fueling or shall monitor the fill port during overwing fueling.

2006.5.5 Fuel flow control. Fuel flow-control valves shall be operable only by the direct hand pressure of the operator. Removal of the operator's hand pressure shall cause an immediate cessation of the flow of fuel.

2006.6 Emergency fuel shutoff. Emergency fuel shutoff controls and procedures shall comply with Sections 2006.6.1 through 2006.6.4.

2006.6.1 Controls. Emergency fuel shutoff controls shall be provided with ready access at all times when the fueling system is being operated.

2006.6.2 Notification of the fire department. The fueling-system operator shall establish a procedure by which the fire department will be notified in the event of an activation of an emergency fuel shutoff control.

2006.6.3 Determining cause. Prior to reestablishment of normal fuel flow, the cause of fuel shutoff conditions shall be determined and corrected.

2006.6.4 Testing. Emergency fuel shutoff devices shall be operationally tested at intervals not exceeding three months. The fueling-system operator shall maintain testing records.

2006.7 Protection of hoses. Before an aircraft-fueling vehicle is moved, fuel-transfer hoses shall be properly placed on the approved reel or in the compartment provided, or stored on the top decking of the fueling vehicle if proper height rail is provided for security and protection of such equipment. Fuel-transfer hose shall not be looped or draped over any part of the fueling vehicle, except as herein provided. Fuel-transfer hose shall not be dragged when such fueling vehicle is moved from one fueling position to another.

2006.8 Loading and unloading. Aircraft-fueling vehicles shall be loaded only at an approved loading rack. Such loading racks shall be in accordance with Section 5706.5.1.12.

Exceptions:

1. Aircraft-refueling units are allowed to be loaded from the fuel tanks of an aircraft during defueling operations.
2. Fuel transfer between tank vehicles is allowed to be performed in accordance with Section 5706.6 where the operation is not less than 200 feet (60 960 mm) from an aircraft.

The fuel cargo of such units shall be unloaded only by approved transfer apparatus into the fuel tanks of aircraft, underground storage tanks or approved gravity storage tanks.

2006.9 Passengers. Passenger traffic is allowed during the time fuel-transfer operations are in progress, provided that the following provisions are strictly enforced by the owner of the aircraft or the owner's authorized employee:

1. Smoking and producing an open flame in the cabin of the aircraft or the outside thereof within 50 feet (15 240 mm) of such aircraft shall be prohibited.
A qualified employee of the aircraft owner shall be responsible for seeing that the passengers are not allowed to smoke when remaining aboard the aircraft or while going across the ramp from the gate to such aircraft, or vice versa.
2. Passengers shall not be permitted to linger about the plane, but shall proceed directly between the loading gate and the aircraft.
3. Passenger loading stands or walkways shall be left in loading position until all fuel-transfer operations are completed.
4. Fuel-transfer operations shall not be performed on the main exit side of any aircraft containing passengers except when the owner of such aircraft or a capable and qualified employee of such owner remains inside the aircraft to direct and assist the escape of such passengers through regular and emergency exits in the event fire should occur during fuel-transfer operations.

2006.10 Sources of ignition. Smoking and producing open flames within 50 feet (15 240 mm) of a point where fuel is

being transferred shall be prohibited. Electrical and motor-driven devices shall not be connected to or disconnected from an aircraft at any time fueling operations are in progress on such aircraft.

2006.11 Fuel spill prevention and procedures. Fuel spill prevention and the procedures for handling spills shall comply with Sections 2006.11.1 through 2006.11.7.

2006.11.1 Fuel-servicing equipment maintenance. Aircraft fuel-servicing equipment shall be maintained and kept free from leaks. Fuel-servicing equipment that malfunctions or leaks shall not be continued in service.

2006.11.2 Transporting fuel nozzles. Fuel nozzles shall be carried utilizing appropriate handles. Dragging fuel nozzles along the ground shall be prohibited.

2006.11.3 Drum fueling. Fueling from drums or other containers having a capacity greater than 5 gallons (19 L) shall be accomplished with the use of an approved pump.

2006.11.4 Fuel spill procedures. The fueling-system operator shall establish procedures to follow in the event of a fuel spill. These procedures shall be comprehensive and shall provide for all of the following:

1. Upon observation of a fuel spill, the aircraft-fueling operator shall immediately stop the delivery of fuel by releasing hand pressure from the fuel flow-control valve.
2. Failure of the fuel control valve to stop the continued spillage of fuel shall be cause for the activation of the appropriate emergency fuel shutoff device.
3. A supervisor for the fueling-system operator shall respond to the fuel spill area immediately.

2006.11.5 Notification of the fire department. The fire department shall be notified of any fuel spill that is considered a hazard to people or property or which meets one or more of the following criteria:

1. Any dimension of the spill is greater than 10 feet (3048 mm).
2. The spill area is greater than 50 square feet (4.65 m²).
3. The fuel flow is continuous in nature.

2006.11.6 Investigation required. An investigation shall be conducted by the fueling-system operator of all spills requiring notification of the fire department. The investigation shall provide conclusive proof of the cause and verification of the appropriate use of emergency procedures. Where it is determined that corrective measures are necessary to prevent future incidents of the same nature, they shall be implemented immediately.

2006.11.7 Multiple fuel delivery vehicles. Simultaneous delivery of fuel from more than one aircraft-fueling vehicle to a single aircraft-fueling manifold is prohibited unless proper backflow prevention devices are installed to prevent fuel flow into the tank vehicles.

2006.12 Aircraft engines and heaters. Operation of aircraft onboard engines and combustion heaters shall be terminated prior to commencing fuel-servicing operations and shall remain off until the fuel-servicing operation is completed.

Exception: In an emergency, a single jet engine is allowed to be operated during fuel servicing where all of the following conditions are met:

1. The emergency shall have resulted from an onboard failure of the aircraft's auxiliary power unit.
2. Restoration of auxiliary power to the aircraft by ground support services is not available.
3. The engine to be operated is either at the rear of the aircraft or on the opposite side of the aircraft from the fuel-servicing operation.
4. The emergency operation is in accordance with a written procedure approved by the fire code official.

2006.13 Vehicle and equipment restrictions. During aircraft-fueling operations, only the equipment actively involved in the fueling operation is allowed within 50 feet (15 240 mm) of the aircraft being fueled. Other equipment shall be prohibited in this area until the fueling operation is complete.

A clear space of not less than 10 feet (3048 mm) shall be maintained between aircraft fuel-system vent openings and any part or portion of aircraft-servicing vehicles or equipment.

Exception: Aircraft-fueling operations utilizing single-point refueling with a sealed, mechanically locked fuel line connection and the fuel is not a Class I flammable liquid.

2006.13.1 Overwing fueling. Vehicles or equipment shall not be allowed beneath the trailing edge of the wing when aircraft fueling takes place over the wing and the aircraft fuel-system vents are located on the upper surface of the wing.

2006.14 Electrical equipment. Electrical equipment, including but not limited to, battery chargers, ground or auxiliary power units, fans, compressors or tools, shall not be operated, nor shall they be connected or disconnected from their power source, during fuel-servicing operations.

2006.14.1 Other equipment. Electrical or other spark-producing equipment shall not be used within 10 feet (3048 mm) of fueling equipment, aircraft fill or vent points, or spill areas unless that equipment is intrinsically safe and approved for use in an explosive atmosphere.

2006.15 Open flames. Open flames and open-flame devices are prohibited within 50 feet (15 240 mm) of any aircraft fuel-servicing operation or fueling equipment.

2006.15.1 Other areas. The fire code official is authorized to establish other locations where open flames and open-flame devices are prohibited.

2006.15.2 Matches and lighters. Personnel assigned to and engaged in fuel-servicing operations shall not carry matches or lighters on or about their person. Matches or

lighters shall be prohibited in, on or about aircraft-fueling equipment.

2006.16 Lightning procedures. The fire code official is authorized to require the airport authority and the fueling-system operator to establish written procedures to follow when lightning flashes are detected on or near the airport. These procedures shall establish criteria for the suspension and resumption of aircraft-fueling operations.

2006.17 Fuel-transfer locations. Aircraft fuel-transfer operations shall be prohibited indoors.

Exception: In aircraft hangars built in accordance with the provisions of the *California Building Code* for Group F-1 occupancies, aircraft fuel-transfer operations are allowed where either of the following conditions exist:

1. Necessary to accomplish aircraft fuel-system maintenance operations. Such operations shall be performed in accordance with nationally recognized standards.
2. The fuel being used has a flash point greater than 100°F (37.8°C).

2006.17.1 Position of aircraft. Aircraft being fueled shall be positioned such that any fuel system vents and other fuel tank openings are not less than:

1. Twenty-five feet (7620 mm) from buildings or structures other than jet bridges.
2. Fifty feet (15 240 mm) from air intake vents for boiler, heater or incinerator rooms.

2006.17.2 Fire equipment access. Access for fire service equipment to aircraft shall be maintained during fuel-servicing operations.

2006.18 Defueling operations. The requirements for fueling operations contained in this section shall also apply to aircraft defueling operations. Additional procedures shall be established by the fueling-system operator to prevent overfilling of the tank vehicle used in the defueling operation.

2006.19 Maintenance of aircraft-fueling hose. Aircraft-fueling hoses shall be maintained in accordance with Sections 2006.19.1 through 2006.19.4.

2006.19.1 Inspections. Hoses used to fuel or defuel aircraft shall be inspected periodically to ensure their serviceability and suitability for continued service. The fuel service operator shall maintain records of all tests and inspections performed on fueling hoses. Hoses found to be defective or otherwise damaged shall be immediately removed from service.

2006.19.1.1 Daily inspection. Each hose shall be inspected daily. This inspection shall include a complete visual scan of the exterior for evidence of damage, blistering or leakage. Each coupling shall be inspected for evidence of leaks, slippage or misalignment.

2006.19.1.2 Monthly inspection. A more thorough inspection, including pressure testing, shall be accomplished for each hose on a monthly basis. This inspection shall include examination of the fuel deliv-

ery inlet screen for rubber particles, which indicates problems with the hose lining.

2006.19.2 Damaged hose. Hose that has been subjected to severe abuse shall be immediately removed from service. Such hoses shall be hydrostatically tested prior to being returned to service.

2006.19.3 Repairing hose. Hoses are allowed to be repaired by removing the damaged portion and recoupling the undamaged end. When recoupling hoses, only couplings designed and approved for the size and type of hose in question shall be used. Hoses repaired in this manner shall be visually inspected and hydrostatically tested prior to being placed back in service.

2006.19.4 New hose. New hose shall be visually inspected prior to being placed into service.

2006.20 Aircraft fuel-servicing vehicles parking. Unattended aircraft fuel-servicing vehicles shall be parked in areas that provide for both the unencumbered dispersal of vehicles in the event of an emergency and the control of leakage such that adjacent buildings and storm drains are not contaminated by leaking fuel.

2006.20.1 Parking area design. Parking areas for tank vehicles shall be designed and utilized such that a clearance of 10 feet (3048 mm) is maintained between each parked vehicle for fire department access. In addition, a minimum clearance of 50 feet (15 240 mm) shall be maintained between tank vehicles and parked aircraft and structures other than those used for the maintenance or garaging of aircraft fuel-servicing vehicles.

2006.21 Radar equipment. Aircraft fuel-servicing operations shall be prohibited while the weather-mapping radar of that aircraft is operating.

Aircraft fuel-servicing or other operations in which flammable liquids, vapors or mists could be present shall not be conducted within 300 feet (91 440 mm) of an operating aircraft surveillance radar.

Aircraft fuel-servicing operations shall not be conducted within 300 feet (91 440 mm) of airport flight traffic surveillance radar equipment.

Aircraft fuel-servicing or other operations in which flammable liquids, vapors or mists could be present shall not be conducted within 100 feet (30 480 mm) of airport ground traffic surveillance radar equipment.

2006.21.1 Direction of radar beams. The beam from ground radar equipment shall not be directed toward fuel storage or loading racks.

Exceptions:

1. Fuel storage and loading racks in excess of 300 feet (91 440 mm) from airport flight traffic surveillance equipment.
2. Fuel storage and loading racks in excess of 100 feet (30 480 mm) from airport ground traffic surveillance equipment.

**SECTION 2007
HELISTOPS AND HELIPORTS**

2007.1 General. Helistops and heliports shall be maintained in accordance with Sections 2007.2 through 2007.8. Helistops and heliports on buildings shall be constructed in accordance with the *California Building Code*.

2007.2 Clearances. The touchdown area shall be surrounded on all sides by a clear area having minimum average width at roof level of 15 feet (4572 mm) and not less than 5 feet (1524 mm) at any point. The clear area shall be maintained.

2007.3 Flammable and Class II combustible liquid spillage. Landing areas on structures shall be maintained so as to confine flammable or Class II combustible liquid spillage to the landing area itself, and provisions shall be made to drain such spillage away from exits or stairways serving the helicopter landing area or from a structure housing such exit or stairway.

2007.4 Exits. Exits and stairways shall be maintained in accordance with Section 412.7 of the *California Building Code*.

2007.5 Standpipe systems. A building with a rooftop helistop or heliport shall be provided with a Class I or III standpipe system extended to the roof level on which the helistop or heliport is located. All portions of the helistop and heliport area shall be within 150 feet (45 720 mm) of a 2¹/₂-inch (63.5 mm) outlet on the standpipe system.

2007.6 Foam protection. Foam fire-protection capabilities shall be provided for rooftop heliports. Such systems shall be designed, installed and maintained in accordance with the applicable provisions of Sections 903, 904 and 905.

2007.7 Fire extinguishers. Not less than one portable fire extinguisher having a minimum 80-B:C rating shall be provided for each permanent takeoff and landing area and for the aircraft parking areas. Installation, inspection and maintenance of these extinguishers shall be in accordance with Section 906.

2007.8 Federal approval. Before operating helicopters from helistops and heliports, approval shall be obtained from the Federal Aviation Administration.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 21 – DRY CLEANING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
2101.1.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 21

DRY CLEANING

User note:

About this chapter: Chapter 21 provides provisions that are intended to reduce hazards associated with use of flammable and combustible dry cleaning solvents. These materials, like all volatile organic chemicals, generate significant quantities of static electricity and are thus readily ignitable. Many flammable and nonflammable dry cleaning solvents also possess health hazards when involved in a fire.

SECTION 2101 GENERAL

2101.1 Scope. Dry cleaning plants and their operations shall comply with the requirements of this chapter.

2101.1.1 Compliance alternate for dry cleaning plants. Dry cleaning plants shall be permitted to comply with the provisions of NFPA 32 in its entirety as an acceptable alternative to the requirements of this chapter.

2101.2 Permit required. Permits shall be required as set forth in Section 105.5.

SECTION 2102 DEFINITIONS

2102.1 Definitions. The following terms are defined in Chapter 2:

DRY CLEANING.

DRY CLEANING PLANT.

DRY CLEANING ROOM.

DRY CLEANING SYSTEM.

SOLVENT OR LIQUID CLASSIFICATIONS.

Class I solvents.

Class II solvents.

Class IIIA solvents.

Class IIIB solvents.

Class IV solvents.

SECTION 2103 CLASSIFICATIONS

2103.1 Solvent classification. Dry cleaning solvents shall be classified according to their flash points as follows:

1. Class I solvents are liquids having a flash point below 100°F (38°C).
2. Class II solvents are liquids having a flash point at or above 100°F (38°C) and below 140°F (60°C).
3. Class IIIA solvents are liquids having a flash point at or above 140°F (60°C) and below 200°F (93°C).

4. Class IIIB solvents are liquids having a flash point at or above 200°F (93°C).

5. Class IV solvents are liquids classified as nonflammable.

2103.2 Classification of dry cleaning plants and systems. Dry cleaning plants and systems shall be classified based on the solvents used as follows:

1. Type I—systems using Class I solvents.
2. Type II—systems using Class II solvents.
3. Type III-A—systems using Class IIIA solvents.
4. Type III-B—systems using Class IIIB solvents.
5. Type IV—systems using Class IV solvents in which dry cleaning is not conducted by the public.
6. Type V—systems using Class IV solvents in which dry cleaning is conducted by the public.

Spotting and pretreating operations conducted in accordance with Section 2106 shall not change the type of the dry cleaning plant.

2103.2.1 Multiple solvents. Dry cleaning plants using more than one class of solvent for dry cleaning shall be classified based on the numerically lowest solvent class.

2103.3 Design. The occupancy classification, design and construction of dry cleaning plants shall comply with the applicable requirements of the *California Building Code*.

SECTION 2104 GENERAL REQUIREMENTS

2104.1 Prohibited use. Type I dry cleaning plants shall be prohibited. Limited quantities of Class I solvents stored and used in accordance with this section shall not be prohibited in dry cleaning plants.

2104.2 Building services. Building services and systems shall be designed, installed and maintained in accordance with this section and Chapter 6.

2104.2.1 Ventilation. Ventilation shall be provided in accordance with Section 502 of the *California Mechanical Code* and DOL 29 CFR Part 1910.1000, where applicable.

DRY CLEANING

2104.2.2 Heating. In Type II dry cleaning plants, heating shall be by indirect means using steam, hot water or hot oil only.

2104.2.3 Electrical wiring and equipment. Electrical wiring and equipment in dry cleaning rooms or other locations subject to flammable vapors shall be installed in accordance with *the California Electrical Code*.

2104.2.4 Bonding and grounding. Storage tanks, treatment tanks, filters, pumps, piping, ducts, dry cleaning units, stills, tumblers, drying cabinets and other such equipment, where not inherently electrically conductive, shall be bonded together and grounded. Isolated equipment shall be grounded.

SECTION 2105 OPERATING REQUIREMENTS

2105.1 General. The operation of dry cleaning systems shall comply with the requirements of Sections 2105.1.1 through 2105.3.

2105.1.1 Written instructions. Written instructions covering the proper installation and safe operation and use of equipment and solvent shall be given to the buyer.

2105.1.1.1 Type II, III-A, III-B and IV systems. In Type II, III-A, III-B and IV dry cleaning systems, machines shall be operated in accordance with the operating instructions furnished by the machinery manufacturer. Employees shall be instructed as to the hazards involved in their departments and in the work they perform.

2105.1.1.2 Type V systems. Operating instructions for customer use of Type V dry cleaning systems shall be conspicuously posted in a location near the dry cleaning unit. A telephone number shall be provided for emergency assistance.

2105.1.2 Equipment identification. The manufacturer shall provide nameplates on dry cleaning machines indicating the class of solvent for which each machine is designed.

2105.1.3 Open systems prohibited. Dry cleaning by immersion and agitation in open vessels shall be prohibited.

2105.1.4 Prohibited use of solvent. The use of solvents with a flash point below that for which a machine is designed or listed shall be prohibited.

2105.1.5 Equipment maintenance and housekeeping. Proper maintenance and operating practices shall be observed in order to prevent the leakage of solvent or the accumulation of lint. The handling of waste material generated by dry cleaning operations and the maintenance of facilities shall comply with the provisions of this section.

2105.1.5.1 Floors. Class I and II liquids shall not be used for cleaning floors.

2105.1.5.2 Filters. Filter residue and other residues containing solvent shall be handled and disposed of in covered metal containers.

2105.1.5.3 Lint. Lint and refuse shall be removed from traps daily, deposited in approved waste cans, removed from the premises, and disposed of safely. At all other times, traps shall be held securely in place.

2105.1.5.4 Customer areas. In Type V dry cleaning systems, customer areas shall be kept clean.

2105.2 Type II systems. Special operating requirements for Type II dry cleaning systems shall comply with the provisions of Sections 2105.2.1 through 2105.2.3.

2105.2.1 Inspection of materials. Materials to be dry cleaned shall be searched thoroughly and foreign materials, including matches and metallic substances, shall be removed.

2105.2.2 Material transfer. In removing materials from the washer, provisions shall be made for minimizing the dripping of solvent on the floor. Where materials are transferred from a washer to a drain tub, a nonferrous metal drip apron shall be placed so that the apron rests on the drain tub and the cylinder of the washer.

2105.2.3 Ventilation. A mechanical ventilation system that is designed to exhaust 1 cubic foot of air per minute for each square foot of floor area [$0.0058 \text{ m}^3/(\text{s} \times \text{m}^2)$] shall be installed in dry cleaning rooms and in drying rooms. The ventilation system shall operate automatically when the dry cleaning equipment is in operation and shall have manual controls at an approved location.

2105.3 Type IV and V systems. Type IV and V dry cleaning systems shall be provided with an automatically activated exhaust ventilation system to maintain an air velocity of not less than 100 feet per minute (0.51 m/s) through the loading door when the door is opened. Such systems for dry cleaning equipment shall comply with the *California Mechanical Code*.

Exception: Dry cleaning units are not required to be provided with exhaust ventilation where an exhaust hood is installed immediately outside of and above the loading door and operates at an airflow rate as follows:

$$Q = 100 \times A_{LD} \quad \text{(Equation 21-1)}$$

where:

Q = flow rate exhausted through the hood, cubic feet per minute (m^3/s).

A_{LD} = area of the loading door, square feet (m^2).

SECTION 2106 SPOTTING AND PRETREATING

2106.1 General. Spotting and pretreating operations and equipment shall comply with the provisions of Sections 2106.2 through 2106.5.

2106.2 Class I solvents. The maximum quantity of Class I solvents permitted at any work station shall be 1 gallon (4 L). Spotting or prespotting shall be permitted to be conducted

with Class I solvents where they are stored in and dispensed from approved safety cans or in sealed DOT-approved metal shipping containers of not more than 1-gallon (4 L) capacity.

2106.2.1 Spotting and prespotting. Spotting and prespotting shall be permitted to be conducted with Class I solvents where dispensed from plastic containers of not more than 1 pint (0.5 L) capacity.

2106.3 Class II and III solvents. Scouring, brushing, and spotting and pretreating shall be permitted to be conducted with Class II or III solvents. The maximum quantity of Class II or III solvents permitted at any work station shall be 1 gallon (4 L). In other than Group H-2 occupancy, the aggregate quantities of solvents shall not exceed the maximum allowable quantity per control area for use-open system.

2106.3.1 Spotting tables. Scouring, brushing or spotting tables on which articles are soaked in solvent shall have a liquid-tight top with a curb on all sides not less than 1 inch (25 mm) high. The top of the table shall be pitched to ensure thorough draining to a 1½-inch (38 mm) drain connected to an approved container.

2106.3.2 Special handling. Where approved, articles that cannot be washed in the usual washing machines are allowed to be cleaned in scrubbing tubs. Scrubbing tubs shall comply with the following:

1. Only Class II or III liquids shall be used.
2. The total amount of solvent used in such open containers shall not exceed 3 gallons (11 L).
3. Scrubbing tubs shall be secured to the floor.
4. Scrubbing tubs shall be provided with permanent 1½-inch (38 mm) drains. Such drain shall be provided with a trap and shall be connected to an approved container.

2106.3.3 Ventilation. Scrubbing tubs, scouring, brushing or spotting operations shall be located such that solvent vapors are captured and exhausted by the ventilating system.

2106.3.4 Bonding and grounding. Metal scouring, brushing and spotting tables and scrubbing tubs shall be permanently and effectively bonded and grounded.

2106.4 Type IV systems. Flammable and combustible liquids used for spotting operations shall be stored in approved safety cans or in sealed DOTn-approved shipping containers of not more than 1 gallon (4 L) in capacity. Aggregate amounts shall not exceed 10 gallons (38 L).

2106.5 Type V systems. Spotting operations using flammable or combustible liquids are prohibited in Type V dry cleaning systems.

SECTION 2107 DRY CLEANING SYSTEMS

2107.1 General equipment requirements. Dry cleaning systems, including dry cleaning units, washing machines, stills, drying cabinets, tumblers and their appurtenances, including pumps, piping, valves, filters and solvent coolers,

shall be installed and maintained in accordance with NFPA 32. The construction of buildings in which such systems are located shall comply with the requirements of this section and the *California Building Code*.

2107.2 Type II systems. Type II dry cleaning and solvent tank storage rooms shall not be located below grade or above the lowest floor level of the building and shall comply with Sections 2107.2.1 through 2107.2.3.

Exception: Solvent storage tanks installed underground, in vaults or in special enclosures in accordance with Chapter 57.

2107.2.1 Fire-fighting access. Type II dry cleaning plants shall be located so that access is provided and maintained from one side for fire-fighting and fire control purposes in accordance with Section 503.

2107.2.2 Number of means of egress. Type II dry cleaning rooms shall have not less than two means of egress doors located at opposite ends of the room, not less than one of which shall lead directly to the outside.

2107.2.3 Spill control and secondary containment. Curbs, drains or other provisions for spill control and secondary containment shall be provided in accordance with Section 5004.2 to collect solvent leakage and fire protection water and direct it to a safe location.

2107.3 Solvent storage tanks. Solvent storage tanks for Class II, IIIA and IIIB liquids shall conform to the requirements of Chapter 57 and be located underground or outside, above ground.

Exception: As provided in NFPA 32 for inside storage or treatment tanks.

SECTION 2108 FIRE PROTECTION

2108.1 General. Where required by this section, fire protection systems, devices and equipment shall be installed, inspected, tested and maintained in accordance with Chapter 9.

2108.2 Automatic sprinkler system. An automatic sprinkler system shall be installed in accordance with Section 903.3.1.1 throughout dry cleaning plants containing Type II, Type III-A or Type III-B dry cleaning systems.

Exceptions:

1. An automatic sprinkler system shall not be required in Type III-A dry cleaning plants where the aggregate quantity of Class III-A solvent in dry cleaning machines and storage does not exceed 330 gallons (1250 L) and dry cleaning machines are equipped with a feature that will accomplish any one of the following:
 - 1.1. Prevent oxygen concentrations from reaching 8 percent or more by volume.
 - 1.2. Keep the temperature of the solvent not less than 30°F (16.7°C) below the flash point.

DRY CLEANING

- 1.3. Maintain the solvent vapor concentration at a level lower than 25 percent of the lower explosive limit (LEL).
 - 1.4. Utilize equipment approved for use in Class I, Division 2, hazardous locations in accordance with *the California Electrical Code*.
 - 1.5. Utilize an integrated dry-chemical, clean agent or water-mist automatic fire-extinguishing system designed in accordance with Chapter 9.
2. An automatic sprinkler system shall not be required in Type III-B dry cleaning plants where the aggregate quantity of Class III-B solvent in dry cleaning machines and storage does not exceed 3,300 gallons (12 490 L).

2108.3 Automatic fire-extinguishing systems. Type II dry cleaning units, washer-extractors, and drying tumblers in Type II dry cleaning plants shall be provided with an approved automatic fire-extinguishing system installed and maintained in accordance with Chapter 9.

Exception: Where approved, a manual steam jet not less than $\frac{3}{4}$ inch (19 mm) with a continuously available steam supply at a pressure not less than 15 pounds per square inch gauge (psig) (103 kPa) is allowed to be substituted for the automatic fire-extinguishing system.

2108.4 Portable fire extinguishers. Portable fire extinguishers shall be selected, installed and maintained in accordance with this section and Section 906. Not fewer than two 2-A:10-B:C portable fire extinguishers shall be provided near the doors inside dry cleaning rooms containing Type II, Type III-A and Type III-B dry cleaning systems.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 22 – COMBUSTIBLE DUST-PRODUCING OPERATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
Table 2204.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 22

COMBUSTIBLE DUST-PRODUCING OPERATIONS

User note:

About this chapter: Chapter 22 provides requirements that seek to reduce the likelihood of dust explosions by managing the hazards of ignitable suspensions of combustible dusts associated with a variety of operations including woodworking, mining, food processing, agricultural commodity storage and handling and pharmaceutical manufacturing, among others. This chapter provides various requirements to control ignition sources, use properly listed and designed dust collection systems, maintain good housekeeping practices and provide proper training to those involved in these processes. Appropriate standards are referenced to deal with the specific dust hazards.

SECTION 2201 GENERAL

2201.1 Scope. The equipment, processes and operations involving dust explosion hazards and use or handling of combustible dust shall comply with the provisions of this chapter.

Exceptions:

1. Storage and use of consumer materials in Group B or R occupancies.
2. Storage and use of commercially packaged materials in Group M occupancies.
3. Materials displayed in original packaging in Group M occupancies and intended as building materials or for personal or household use.
4. Storage of sealed containers of combustible dust at facilities not associated with an operation that uses, handles or generates combustible dust.
5. Materials stored or used in farm buildings or similar occupancies intended for on-premises agricultural purposes.

2201.2 Permits. Permits shall be required for combustible dust-producing operations as set forth in Section 105.5.

SECTION 2202 DEFINITIONS

2202.1 Definition. The following terms are defined in Chapter 2:

COMBUSTIBLE DUST.

DUST COLLECTION SYSTEM.

SECTION 2203 DUST EXPLOSION PREVENTION

2203.1 Critical depth layer. The maximum dust layer on all surfaces, including but not limited to walls, ceilings, beams, equipment, furniture, pipes and ducts, shall not exceed the

critical depth layer specified in Table 2203.1. The critical depth layer is permitted to be adjusted for explosion hazard where further evaluated in accordance with one of the following:

1. Section 7.2.1.3 of NFPA 654.
2. Section 4.1.3.3 of NFPA 664 for wood flour.

Accumulated combustible dust shall be collected by one of the methods listed in Section 2203.5.

**TABLE 2203.1
CRITICAL DEPTH LAYER**

TYPE OF DUST	CRITICAL DEPTH LAYER (INCHES)
Wood flour	$\frac{1}{8}$
All other dusts	$\frac{1}{32}$

For SI: 1 inch = 25.4 mm.

2203.2 Dust-producing and dust-handling equipment. Dust-producing equipment and dust-handling equipment, including but not limited to vacuums, dust collection systems, dryers, mixers, blenders, separators, conveyors, storage containers, silos or other similar devices, shall be listed and shall be maintained in accordance with the manufacturer's recommended standards.

2203.2.1 Signages and markings. Signages and markings shall be provided in accordance with Sections 2203.2.1.1 through 2203.2.1.3.

2203.2.1.1 Deflagration vent discharge area markings. Where dust collection systems and other equipment, systems or system components are provided with deflagration vents, the area within the deflagration vent's discharge area shall be marked in an approved manner.

2203.2.1.2 Caution signs. Signs that read as follows shall be posted near the dust-containing equipment with deflagration vents:

CAUTION: THIS EQUIPMENT CAN
CONTAIN EXPLOSIVE DUST.
KEEP OUTSIDE THE MARKED AREA
WHILE EQUIPMENT IS OPERATING.

2203.2.1.3 Warning signs. Where dust collection systems and other equipment, systems or system components are provided with deflagration vents, vent closures shall be clearly marked as follows:

WARNING: EXPLOSION RELIEF
DEVICE. STAY CLEAR.

2203.3 Dust-collection and dust-conveying systems. Dust-collection and dust-conveying systems shall be in accordance with Sections 2203.3.1 through 2203.3.3.

2203.3.1 Dust-collection systems. Dust-collection systems shall be designed to collect dust emissions from dust-producing equipment at the point of generation. Dust-collection systems shall be in accordance with Section 511 of the *California Mechanical Code*.

Exception: Closed systems using listed equipment and designed in accordance with manufacturer’s recommendations and specifications, where cleanouts are provided in accordance with Section 2203.3.3.

Heating, ventilation, and air conditioning (HVAC) systems shall not be used as the means to collect dusts from localized sources.

2203.3.1.1 Location. Dust collectors shall be located outside of buildings.

Exceptions:

1. Dust collectors inside buildings complying with Section 511 of the *California Mechanical Code*.
2. Wet-type dust collectors specifically listed for the type of dust conveyed shall be permitted inside buildings where in accordance with the manufacturer’s instructions and specifications.
3. Dust collectors designed to specific NFPA standards listed in Table 2205.1 for the specific type of dust conveyed.

2203.3.1.2 Minimum conveying velocities. The minimum velocities within ducts used as part of the dust collection system shall be in accordance with Table 2203.3.1.2.

**TABLE 2203.3.1.2
MINIMUM CONVEYING VELOCITIES**

TYPE OF PRODUCT	FEET PER MINUTE
Fine light dust such as cotton, lint and wood flour (100 mesh and under)	2,000
Dry dust such as fine rubber molding powder	2,500
Average dust such as sawdust, grinding dust and coal dust	3,500
Heavy dust such as metal turnings, including aluminum and magnesium powder	4,000

For SI: 1 foot per minute = 0.00508 m/s.

2203.3.2 Plastic ducts and conveying systems. Plastic, fiberglass, other nonconductive ducts, duct liners or pipes shall not be used as part of ducts and conveying systems. Ductwork utilizing a combustible lining shall be permitted

only in high-impact areas and where approved. Flexible hose shall be permitted if designed and installed in accordance with the following requirements:

1. Manufactured of static dissipative construction.
2. Used only for connections and isolation purposes.
3. Limited to 18 inches (457 mm) in length.
4. Properly grounded.

2203.3.3 Cleanouts. Openings in enclosed equipment and conveyors shall be provided to allow access to all parts of the equipment and conveyors to permit inspection, cleaning, maintenance and the effective use of portable fire extinguishers or hose streams. Cleanouts for ducts used as part of the dust-collection system shall be in accordance with the *California Mechanical Code*.

2203.4 Sources of ignition. Sources of ignition shall be controlled in accordance with Sections 2203.4.1 through 2203.4.9.5.

2203.4.1 Classified electrical. Classified electrical shall be in accordance with the *California Electrical Code*. Electrical motors and electrical components of the equipment shall not be installed in the dust-laden airstream unless listed for Class II, Division 1, locations.

2203.4.2 Static electricity. Bonding and grounding is required to minimize accumulation of static electric charge in the following locations:

1. Dust-producing equipment.
2. Dust-collection system.
3. Pneumatic dust-conveying systems conveying combustible dust from one location to another, combustible dust conveyors, piping and conductive components. Conveying systems include transport modes such as railcars, hopper cars, boxcars, tank cars and trucks into which or from which commodities or products are pneumatically conveyed.
4. Conveying systems using metallic piping.

2203.4.3 Hot works. Hot work and similar spark-producing operations shall not be conducted in or adjacent to combustible dust-producing areas unless precautions have been taken to provide safety. Hot work shall be permitted only in safe, designated areas in accordance with Chapter 35. Hot work is prohibited on equipment that is operating.

2203.4.3.1 Signs. Conspicuous signs with the following warning shall be posted in the vicinity of combustible dust-producing areas or in the vicinity of combustible dust use:

NO WELDING. THE USE OF WELDING
OR CUTTING EQUIPMENT IN OR NEAR
THIS AREA IS DANGEROUS BECAUSE
OF FIRE AND EXPLOSION HAZARDS.

WELDING AND CUTTING SHALL BE
DONE ONLY UNDER THE SUPERVISION
OF THE PERSON IN CHARGE.

2203.4.4 Hot surfaces and hot equipment. In areas where a dust explosion hazard or dust flash fire hazard exists, the temperature (in degrees Celsius) of external surfaces shall be maintained below 80 percent of the lower of the dust-surface ignition temperature or the dust-cloud ignition temperature for worst-case dusts. External surfaces shall include but are not limited to:

1. Compressors.
2. Steam, water or process piping.
3. Ducts.
4. Conveyors.
5. Process equipment.

Where steam pipes or hot surfaces occur in dust-producing or dust-handling areas, accumulation of dust on the surfaces shall be minimized by an approved method.

Exception: Drying apparatus listed for the intended use and installed in accordance with the manufacturer's instructions.

2203.4.5 Powered industrial trucks. Powered industrial trucks used in electrically classified areas shall be listed for such use.

2203.4.6 Smoking prohibited. Smoking shall be prohibited in or adjacent to dust-producing or dust-handling areas. "No Smoking" signs complying with Section 310 shall be conspicuously posted in such areas. Smoking shall be permitted only in designated areas.

2203.4.7 Spark-producing devices. Spark-producing devices shall not be located within 20 feet (6096 mm) of areas requiring classified electrical unless separated by a permanent partition.

2203.4.8 Self-heating materials. Materials in silos and other large storage piles of particulates prone to self-heating shall be in accordance with Section 9.4.11 of NFPA 652.

2203.4.9 Open flames and fuel-fired equipment. Open flames and fuel-fired equipment shall be in accordance with Sections 2203.4.9.1 through 2203.4.9.5.

2203.4.9.1 Release of airborne combustible dust. Production, maintenance or repair activities that have the potential to release or force combustible dust to become airborne shall not be conducted within 35 feet (11 m) of an open flame or pilot flame.

2203.4.9.2 Space heaters. Fuel-fired space heaters drawing local ambient air shall not be located within electrically classified areas. Space-heating appliances in dust-producing or dust-handling areas shall be located where not subject to the accumulation of deposits of combustible dust.

2203.4.9.3 Equipment listing. Fuel-fired process equipment shall be listed for its intended use and shall be operated and maintained in accordance with the manufacturer's instructions.

2203.4.9.4 Inspection and preventive maintenance. Inspection and maintenance of fuel-fired process equip-

ment shall include verification that significant combustible dust accumulations do not exist within or around the equipment.

2203.4.9.5 Sources of combustion air. In Class II electrically classified locations, heating units shall be provided with a source of combustion air ducted directly from the building exterior or from an unclassified location.

2203.5 Housekeeping. Accumulation of combustible dust on surfaces inside buildings shall be maintained below the critical depth layer in Section 2203.1. Pressurized air or similar methods shall not be used to remove dust from surfaces. Accumulated combustible dust shall be collected by one of the following methods:

1. Portable vacuum cleaners listed for use in Class II, Group G, Division 1, atmospheres as defined in *the California Electrical Code*.
2. Dust collection systems.
3. Other approved means that will not place combustible dust into suspension in air.

Exception: Forced-air or similar methods shall be permitted to remove dust in accordance with NFPA 652, NFPA 654 or NFPA 664.

2203.6 Standard operational procedures. Dust-producing equipment and all associated equipment, including dust-collection equipment, shall be maintained in accordance with the manufacturer's instructions and specifications and applicable codes. The inspection, testing and maintenance program shall include the following, as applicable:

1. Fire and explosion protection and prevention equipment, as applicable, in accordance with the appropriate NFPA standards.
2. Dust-control equipment.
3. Control of potential ignition sources.
4. Electrical, process and mechanical equipment, including applicable process interlocks.
5. Lubrication of bearings for dust-collection, dust-handling and dust-producing equipment.
6. Additional maintenance in accordance with the manufacturer's instructions and specifications for dust-collection, dust-handling and dust-producing equipment.

Records shall be kept of maintenance and repairs performed. The standard operating procedures shall be submitted to the fire code official for review and approval. The written standard operating procedures shall be signed by the person responsible for facility operations.

2203.7 Emergency response plan. A written emergency response plan shall be developed for preventing, preparing for and responding to work-related emergencies, including but not limited to fire and explosion. The following information shall be developed into the plan:

1. Identification of dust hazards.
2. Identification and location of all utilities to affected areas.

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3. Site plans or floor plans locating utility shutoff controls, including water, gas and power.
4. The potential for explosion.
5. Locations of fire-extinguishing equipment compatible with the hazards present.
6. Any additional information required by the fire code official.

2203.8 Training. The plans and procedures required in Sections 2203.5, 2203.6 and 2203.7 shall be approved by the fire code official. The plans and procedures shall be reviewed annually and updated as required by process changes. Initial and annual refresher training shall be provided to employees who are involved in operating, maintaining and supervising facilities that handle combustible dust. Initial and annual refresher training shall include:

1. Workplace hazards.
2. General orientation, plant diagrams and plant safety rules.
3. Process description or flowchart.
4. Equipment operation, safe startup and shutdown, and response to hazard conditions or an incident.
5. The location and use of all related fire and explosion protection and prevention systems.
6. Equipment maintenance requirements and practices, including visual inspections of conveyors and ducts.
7. Housekeeping requirements, including the maintenance of the critical depth layer in Section 2203.1.
8. Emergency response plans as required in Section 2203.7.

The employer shall maintain records of initial and annual training and review.

SECTION 2204 DUST EXPLOSION SCREENING TESTS

2204.1 Combustibility and explosivity tests. Where combustibility or explosivity screening tests are required to analyze the combustible dust as part of compliance with Section 104.8 and Section 414.1.3 of the *California Building Code*, they shall be in accordance with Section 5.4 of NFPA 652.

2204.2 Samples. Representative samples for the screening test shall be obtained in accordance with Section 5.5 of NFPA 652.

SECTION 2205 STANDARDS

2205.1 Specific hazards standards. The fire code official is authorized to enforce additional industry- or material-specific provisions of the codes and standards listed in Table 2205.1 to prevent and control dust explosions, as applicable.

**TABLE 2205.1
EXPLOSION PROTECTION STANDARDS**

STANDARD	SUBJECT
NFPA 61	Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Processing Facilities
NFPA 68	Standard on Explosion Protection by Deflagration Venting
NFPA 69	Standard on Explosion Prevention Systems
NFPA 70	National Electrical Code
NFPA 77	Recommended Practice on Static Electricity
NFPA 85	Boiler and Combustion System Hazards Code
NFPA 120	Standard for Fire Prevention and Control in Coal Mines
NFPA 484	Standard for Combustible Metals
NFPA 654	Standard for Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids
NFPA 655	Standard for the Prevention of Sulfur Fires and Explosions
NFPA 664	Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities

2205.1.1 Dust hazard analysis. If a dust hazard analysis (DHA) is required by the fire code official for new or existing facilities and operations, it shall be in accordance with NFPA 652. The DHA for existing facilities shall be in accordance with Section 7.1.1 of NFPA 652.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 23 – MOTOR FUEL-DISPENSING FACILITIES AND REPAIR GARAGES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
2303.1.1			X																			
2306.6.2.7			X																			
2306.7.6			X																			

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CHAPTER 23

MOTOR FUEL-DISPENSING FACILITIES AND REPAIR GARAGES

User note:

About this chapter: Chapter 23 sets forth regulations for motor fuel-dispensing stations and repair garages. It addresses both liquid and gaseous motor fuels associated with automotive, marine, aircraft and fleet vehicle motor fuel-dispensing facilities. The repair garage provisions specifically address hazards associated with the different types of fuel used, including flammable and combustible liquids, hydrogen, LPG, LNG and CNG.

SECTION 2301 GENERAL

2301.1 Scope. Automotive motor fuel-dispensing facilities, marine motor fuel-dispensing facilities, fleet vehicle motor fuel-dispensing facilities, aircraft motor-vehicle fuel-dispensing facilities and repair garages shall be in accordance with this chapter and the *California Building Code*, *International Fuel Gas Code* and *California Mechanical Code*. Such operations shall include both those that are open to the public and private operations.

2301.2 Permits. Permits shall be required as set forth in Section 105.5.

2301.3 Construction documents. Construction documents shall be submitted for review and approval prior to the installation or construction of automotive, marine or fleet vehicle motor fuel-dispensing facilities and repair garages in accordance with Section 106.1.

2301.4 Indoor motor fuel-dispensing facilities. Motor fuel-dispensing facilities located inside buildings shall comply with the *California Building Code* and NFPA 30A.

2301.4.1 Protection of floor openings in indoor motor fuel-dispensing facilities. Where motor fuel-dispensing facilities are located inside buildings and the dispensers are located above spaces within the building, openings beneath dispensers shall be sealed to prevent the flow of leaked fuel to lower building spaces.

2301.5 Electrical. Electrical wiring and equipment shall be suitable for the locations in which they are installed and shall comply with Section 603, NFPA 30A and the *California Electrical Code*.

2301.6 Heat-producing appliances. Heat-producing appliances shall be suitable for the locations in which they are installed and shall comply with NFPA 30A and the *International Fuel Gas Code* or the *California Mechanical Code*.

SECTION 2302 DEFINITIONS

2302.1 Definitions. The following terms are defined in Chapter 2:

AIRCRAFT MOTOR-VEHICLE FUEL-DISPENSING FACILITY.

ALCOHOL-BLENDED FUELS.

AUTOMOTIVE MOTOR FUEL-DISPENSING FACILITY.

DISPENSING DEVICE, OVERHEAD TYPE.

FLEET VEHICLE MOTOR FUEL-DISPENSING FACILITY.

LIQUEFIED NATURAL GAS (LNG).

MARINE MOTOR FUEL-DISPENSING FACILITY.

REPAIR GARAGE.

SELF-SERVICE MOTOR FUEL-DISPENSING FACILITY.

TANK IN AN UNDERGROUND AREA.

SECTION 2303 LOCATION OF DISPENSING DEVICES

2303.1 Location of dispensing devices. Dispensing devices shall be located as follows:

1. Ten feet (3048 mm) or more from lot lines.
2. Ten feet (3048 mm) or more from buildings having combustible exterior wall surfaces or buildings having noncombustible exterior wall surfaces that are not part of a 1-hour fire-resistance-rated assembly or buildings having combustible overhangs.

Exception: Canopies constructed in accordance with the *California Building Code* providing weather protection for the fuel islands.

3. Such that all portions of the vehicle being fueled will be on the premises of the motor fuel-dispensing facility.
4. Such that the nozzle, where the hose is fully extended, will not reach within 5 feet (1524 mm) of building openings.
5. Twenty feet (6096 mm) or more from fixed sources of ignition.
6. Such that fuel dispensing is in view of the attendant at attended self-service motor fuel-dispensing facilities, as required by Section 2304.2.4.

2303.1.1 Protection of dispensing devices. Where dispensing devices are mounted at grade, they shall be protected at each end with a minimum of two concrete

filled steel posts, 6 inches (152 mm) in diameter, having a minimum 3-foot-deep (914 mm) footing not less than 15 inches (38 mm) in diameter and projecting above grade at a minimum of 3 feet (914 mm) and be located not less than 4 feet (1219 mm) nor more than 5 feet (1524 mm) from fuel dispensers or point-of-sale devices, or equivalent means approved by the fire chief.

2303.2 Emergency disconnect switches. An approved emergency disconnect switch shall be provided at an approved location to stop the transfer of fuel to the fuel dispensers in the event of a fuel spill or other emergency. The emergency disconnect switch for exterior fuel dispensers shall be provided with ready access and shall be located within 100 feet (30 480 mm) of, but not less than 20 feet (6096 mm) from, the fuel dispensers. For interior fuel-dispensing operations, the emergency disconnect switch shall be provided with ready access and be installed at an approved location. Such devices shall be distinctly labeled as: “EMERGENCY FUEL SHUTOFF.” Signs shall be provided in approved locations.

2303.2.1 Height. The height of the emergency disconnect switch shall be not less than 42 inches (1067 mm) and not more than 48 inches (1219 mm) measured vertically, from the floor level to the activating button.

**SECTION 2304
DISPENSING OPERATIONS**

2304.1 Supervision of dispensing. The dispensing of fuel at motor fuel-dispensing facilities shall be conducted by a qualified attendant or shall be under the supervision of a qualified attendant at all times or shall be in accordance with Section 2304.3.

2304.2 Attended self-service motor fuel-dispensing facilities. Attended self-service motor fuel-dispensing facilities shall comply with Sections 2304.2.1 through 2304.2.5. Attended self-service motor fuel-dispensing facilities shall have not less than one qualified attendant on duty while the facility is open for business. The attendant’s primary function shall be to supervise, observe and control the dispensing of fuel. The attendant shall prevent the dispensing of fuel into containers that do not comply with Section 2304.4.1, control sources of ignition, give immediate attention to accidental spills or releases, and be prepared to use fire extinguishers.

2304.2.1 Special-type dispensers. Approved special-dispensing devices and systems such as, but not limited to, card- or coin-operated and remote-preset types, are allowed at motor fuel-dispensing facilities provided that there is not less than one qualified attendant on duty while the facility is open to the public. Remote preset-type devices shall be set in the “off” position while not in use so that the dispenser cannot be activated without the knowledge of the attendant.

2304.2.2 Emergency controls. Approved emergency controls shall be provided in accordance with Section 2303.2.

2304.2.3 Operating instructions. Dispenser operating instructions shall be conspicuously posted in approved locations on every dispenser.

2304.2.4 Obstructions to view. The attendant shall have a direct line of sight to observe fuel-dispensing operations at all times. Obstructions shall not be placed between the dispensing area and the attendant.

Exception: Video monitoring systems shall be permitted to supplement direct line of sight supervision where approved by the fire code official.

2304.2.5 Communications. The attendant shall be able to communicate with persons in the dispensing area at all times. An approved method of communicating with the fire department shall be provided for the attendant.

2304.3 Unattended self-service motor fuel-dispensing facilities. Unattended self-service motor fuel-dispensing facilities shall comply with Sections 2304.3.1 through 2304.3.7.

2304.3.1 General. Where approved, unattended self-service motor fuel-dispensing facilities are allowed. As a condition of approval, the owner or operator shall provide, and be accountable for, daily site visits, regular equipment inspection and maintenance.

2304.3.2 Dispensers. Dispensing devices shall comply with Section 2306.7. Dispensing devices operated by the insertion of coins or currency shall not be used unless approved.

2304.3.3 Emergency controls. Approved emergency controls shall be provided in accordance with Section 2303.2. Emergency controls shall be of a type that is only manually resettable.

2304.3.4 Operating instructions. Dispenser operating instructions shall be conspicuously posted in approved locations on every dispenser and shall indicate the location of the emergency controls required by Section 2304.3.3.

2304.3.5 Emergency procedures. An approved emergency procedures sign, in addition to the signs required by Section 2305.6, shall be posted in a conspicuous location and shall read:

IN CASE OF FIRE, SPILL OR RELEASE

1. USE EMERGENCY PUMP SHUTOFF
2. REPORT THE ACCIDENT!

FIRE DEPARTMENT TELEPHONE NO. _____

FACILITY ADDRESS _____

2304.3.6 Communications. A telephone not requiring a coin to operate or other approved, clearly identified means to notify the fire department shall be provided on the site in a location approved by the fire code official.

2304.3.7 Quantity limits. Dispensing equipment used at unsupervised locations shall comply with one of the following:

1. Dispensing devices shall be programmed or set to limit uninterrupted fuel delivery to 25 gallons (95 L) and require a manual action to resume delivery.

2. The amount of fuel being dispensed shall be limited in quantity by a preprogrammed card as approved.

2304.4 Dispensing into portable containers. The dispensing of flammable or combustible liquids into portable approved containers shall comply with Sections 2304.4.1 through 2304.4.3.

2304.4.1 Approved containers required. Class I, II and IIIA liquids shall not be dispensed into a portable container unless such container does not exceed a 6-gallon (22.7 L) capacity, is listed or of approved material and construction, and has a tight closure with a screwed or spring-loaded cover so designed that the contents can be dispensed without spilling. Liquids shall not be dispensed into portable or cargo tanks.

2304.4.2 Nozzle operation. A hose nozzle valve used for dispensing Class I liquids into a portable container shall be in compliance with Section 2306.7.6 and be manually held open during the dispensing operation.

2304.4.3 Location of containers being filled. Portable containers shall not be filled while located inside the trunk, passenger compartment or truck bed of a vehicle.

SECTION 2305 OPERATIONAL REQUIREMENTS

2305.1 Tank filling operations for Class I, II or III liquids. Delivery operations to tanks for Class I, II or III liquids shall comply with Sections 2305.1.1 through 2305.1.3 and the applicable requirements of Chapter 57.

2305.1.1 Delivery vehicle location. Where liquid delivery to above-ground storage tanks is accomplished by positive-pressure operation, tank vehicles shall be positioned not less than 25 feet (7620 mm) from tanks receiving Class I liquids and 15 feet (4572 mm) from tanks receiving Class II and IIIA liquids, measured from the tank to the nearest unloading valve on the tank vehicle.

2305.1.2 Tank capacity calculation. The driver, operator or attendant of a tank vehicle shall, before making delivery to a tank, determine the unfilled, available capacity of such tank by an approved gauging device.

2305.1.3 Tank fill connections. Delivery of flammable liquids to tanks more than 1,000 gallons (3785 L) in capacity shall be made by means of approved liquid- and vapor-tight connections between the delivery hose and tank fill pipe. Where tanks are equipped with any type of vapor recovery system, all connections required to be made for the safe and proper functioning of the particular vapor recovery process shall be made. Such connections shall be made liquid and vapor tight and remain connected throughout the unloading process. Vapors shall not be discharged at grade level during delivery.

2305.2 Equipment maintenance and inspection. Motor fuel-dispensing facility equipment shall be maintained in proper working order at all times in accordance with Sections 2305.2.1 through 2305.2.5.

2305.2.1 Inspections. Flammable and combustible liquid fuel-dispensing and containment equipment shall be periodically inspected where required by the fire code official to verify that the equipment is in proper working order and not subject to leakage. Records of inspections shall be maintained.

2305.2.2 Repairs and service. The fire code official is authorized to require damaged or unsafe containment and dispensing equipment to be repaired or serviced in an approved manner.

2305.2.3 Dispensing devices. Where maintenance to Class I liquid dispensing devices becomes necessary and such maintenance could allow the accidental release or ignition of liquid, the following precautions shall be taken before such maintenance is begun:

1. Only persons knowledgeable in performing the required maintenance shall perform the work.
2. Electrical power to the dispensing device and pump serving the dispenser shall be shut off at the main electrical disconnect panel.
3. The emergency shutoff valve at the dispenser, where installed, shall be closed.
4. Vehicle traffic and unauthorized persons shall be prevented from coming within 12 feet (3658 mm) of the dispensing device.

2305.2.4 Emergency shutoff valves. Automatic emergency shutoff valves required by Section 2306.7.4 shall be checked not less than once per year by manually tripping the hold-open linkage.

2305.2.5 Leak detectors. Leak detection devices required by Section 2306.7.7.1 shall be checked and tested not less than annually in accordance with the manufacturer's specifications to ensure proper installation and operation.

2305.3 Spill control. Provisions shall be made to prevent liquids spilled during dispensing operations from flowing into buildings. Acceptable methods include, but shall not be limited to, grading driveways, raising doorsills or other approved means.

2305.4 Sources of ignition. Smoking and open flames shall be prohibited in areas where fuel is dispensed. The engines of vehicles being fueled shall be shut off during fueling. Electrical equipment shall be in accordance with *the California Electrical Code*.

2305.5 Fire extinguishers. Approved portable fire extinguishers complying with Section 906 with a minimum rating of 2-A:20-B:C shall be provided and located such that an extinguisher is not more than 75 feet (22 860 mm) from pumps, dispensers or storage tank fill-pipe openings.

2305.6 Warning signs. Warning signs shall be conspicuously posted within sight of each dispenser in the fuel-dispensing area and shall state the following:

1. No smoking.
2. Shut off motor.
3. Discharge your static electricity before fueling by touching a metal surface away from the nozzle.

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4. To prevent static charge, do not reenter your vehicle while gasoline is pumping.
5. If a fire starts, do not remove nozzle—back away immediately.
6. It is unlawful and dangerous to dispense gasoline into unapproved containers.
7. No filling of portable containers in or on a motor vehicle. Place container on ground before filling.

2305.7 Control of brush and debris. Fenced and diked areas surrounding above-ground tanks shall be kept free from vegetation, debris and other material that is not necessary to the proper operation of the tank and piping system.

Weeds, grass, brush, trash and other combustible materials shall be kept not less than 10 feet (3048 mm) from fuel-handling equipment.

SECTION 2306 FLAMMABLE AND COMBUSTIBLE LIQUID MOTOR FUEL-DISPENSING FACILITIES

2306.1 General. Storage of flammable and combustible liquids shall be in accordance with Chapter 57 and Sections 2306.2 through 2306.6.3.

2306.2 Method of storage. Approved methods of storage for Class I, II and III liquid fuels at motor fuel-dispensing facilities shall be in accordance with Sections 2306.2.1 through 2306.2.6.

2306.2.1 Underground tanks. Underground tanks for the storage of Class I, II and IIIA liquid fuels shall comply with Chapter 57.

2306.2.1.1 Inventory control for underground tanks. Accurate daily inventory records shall be maintained and reconciled on underground fuel storage tanks for indication of possible leakage from tanks and piping. The records shall include records for each product showing daily reconciliation between sales, use,

receipts and inventory on hand. Where there is more than one system consisting of tanks serving separate pumps or dispensers for a product, the reconciliation shall be ascertained separately for each tank system. A consistent or accidental loss of product shall be immediately reported to the fire code official.

2306.2.2 Above-ground tanks located inside buildings. Above-ground tanks for the storage of Class I, II and IIIA liquid fuels are allowed to be located in buildings. Such tanks shall be located in special enclosures complying with Section 2306.2.6, in a liquid storage room or a liquid storage warehouse complying with Chapter 57, or shall be listed and labeled as protected above-ground tanks in accordance with UL 2085.

2306.2.3 Above-ground tanks located outdoors, above grade. Above-ground tanks shall not be used for the storage of Class I, II or III liquid motor fuels, except as provided by this section.

1. Above-ground tanks used for outdoor, above-grade storage of Class I liquids shall be listed and labeled as protected above-ground tanks in accordance with UL 2085 and shall be in accordance with Chapter 57. Such tanks shall be located in accordance with Table 2306.2.3.
2. Above-ground tanks used for outdoor, above-grade storage of Class II or IIIA liquids shall be listed and labeled as protected above-ground tanks in accordance with UL 2085 and shall be installed in accordance with Chapter 57. Tank locations shall be in accordance with Table 2306.2.3.

Exception: Other above-ground tanks that comply with Chapter 57 where approved by the fire code official.
3. Tanks containing fuels shall not exceed 12,000 gallons (45 420 L) in individual capacity or 48,000 gallons (181 680 L) in aggregate capacity. Installations with the maximum allowable aggregate capacity

**TABLE 2306.2.3
MINIMUM SEPARATION REQUIREMENTS FOR ABOVE-GROUND TANKS**

TANK TYPE	INDIVIDUAL TANK CAPACITY (gallons)	MINIMUM DISTANCE FROM NEAREST IMPORTANT BUILDING ON SAME PROPERTY (feet)	MINIMUM DISTANCE FROM NEAREST FUEL DISPENSER (feet)	MINIMUM DISTANCE FROM LOT LINE THAT IS OR CAN BE BUILT ON, INCLUDING THE OPPOSITE SIDE OF A PUBLIC WAY (feet)	MINIMUM DISTANCE FROM NEAREST SIDE OF ANY PUBLIC WAY (feet)	MINIMUM DISTANCE BETWEEN TANKS (feet)
Protected above-ground tanks	Less than or equal to 6,000	5	25 ^{a, c}	15	5	3
	Greater than 6,000	15	25 ^{a, c}	25	15	3
Tanks in vaults	0–20,000	0 ^b	0	0 ^b	0	Separate compartment required for each tank
Other tanks	All	50	50	100	50	3

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

- a. At fleet vehicle motor fuel-dispensing facilities, a minimum separation distance is not required.
- b. Underground vaults shall be located such that they will not be subject to loading from nearby structures, or they shall be designed to accommodate applied loads from existing or future structures that can be built nearby.
- c. For Class IIIB liquids in protected above-ground tanks, a minimum separation distance is not required.

shall be separated from other such installations by not less than 100 feet (30 480 mm).

4. Tanks located at farms, construction projects or rural areas shall comply with Section 5706.2.
5. Above-ground tanks used for outdoor, above-grade storage of Class IIIB liquid motor fuel shall be listed and labeled in accordance with UL 142 or listed and labeled as protected above-ground tanks in accordance with UL 2085 and shall be installed in accordance with Chapter 57. Tank locations shall be in accordance with Table 2306.2.3.

2306.2.4 Above-ground tanks located in above-grade vaults or below-grade vaults. Above-ground tanks used for storage of Class I, II or IIIA liquid motor fuels are allowed to be installed in vaults located above grade or below grade in accordance with Section 5704.2.8 and shall comply with Sections 2306.2.4.1 and 2306.2.4.2. Tanks in above-grade vaults shall also comply with Table 2306.2.3.

2306.2.4.1 Tank capacity limits. Tanks storing Class I and Class II liquids at an individual site shall be limited to a maximum individual capacity of 15,000 gallons (56 775 L) and an aggregate capacity of 48,000 gallons (181 680 L).

2306.2.4.2 Fleet vehicle motor fuel-dispensing facilities. Tanks storing Class II and Class IIIA liquids at a fleet vehicle motor fuel-dispensing facility shall be limited to a maximum individual capacity of 20,000 gallons (75 700 L) and an aggregate capacity of 80,000 gallons (302 800 L).

2306.2.5 Portable tanks. Where approved by the fire code official, portable tanks are allowed to be temporarily used in conjunction with the dispensing of Class I, II or III liquids into the fuel tanks of motor vehicles or motorized equipment on premises not normally open to the public. The approval shall include a definite time limit.

2306.2.6 Special enclosures. Where installation of tanks in accordance with Section 5704.2.11 is impractical, or because of property or building limitations, tanks for liquid motor fuels are allowed to be installed in buildings in special enclosures in accordance with all of the following:

1. The special enclosure shall be liquid tight and vapor tight.
2. The special enclosure shall not contain backfill.
3. Sides, top and bottom of the special enclosure shall be of reinforced concrete not less than 6 inches (152 mm) thick, with openings for inspection through the top only.
4. Tank connections shall be piped or closed such that neither vapors nor liquid can escape into the enclosed space between the special enclosure and any tanks inside the special enclosure.
5. Means shall be provided whereby portable equipment can be employed to discharge to the outside any vapors that might accumulate inside the special enclosure should leakage occur.

6. Tanks containing Class I, II or IIIA liquids inside a special enclosure shall not exceed 6,000 gallons (22 710 L) in individual capacity or 18,000 gallons (68 130 L) in aggregate capacity.

7. Each tank within special enclosures shall be surrounded by a clear space of not less than 3 feet (910 mm) to allow for maintenance and inspection.

2306.3 Security. Above-ground tanks for the storage of liquid motor fuels shall be safeguarded from public access or unauthorized entry in an approved manner.

2306.4 Physical protection. Guard posts complying with Section 312 or other approved means shall be provided to protect above-ground tanks against impact by a motor vehicle unless the tank is listed as a protected above-ground tank with vehicle impact protection.

2306.5 Secondary containment. Above-ground tanks shall be provided with drainage control or diking in accordance with Chapter 57. Drainage control and diking is not required for listed secondary containment tanks. Secondary containment systems shall be monitored either visually or automatically. Enclosed secondary containment systems shall be provided with emergency venting in accordance with Section 2306.6.2.5.

2306.6 Piping, valves, fittings and ancillary equipment for use with flammable or combustible liquids. The design, fabrication, assembly, testing and inspection of piping, valves, fittings and ancillary equipment for use with flammable or combustible liquids shall be in accordance with Chapter 57 and Sections 2306.6.1 through 2306.6.3.

2306.6.1 Protection from damage. Piping shall be located such that it is protected from physical damage.

2306.6.2 Piping, valves, fittings and ancillary equipment for above-ground tanks for Class I, II and III liquids. Piping, valves, fittings and ancillary equipment for above-ground tanks storing Class I, II and III liquids shall comply with Sections 2306.6.2.1 through 2306.6.2.6.

2306.6.2.1 Tank openings. Tank openings for above-ground tanks shall be through the top only.

2306.6.2.2 Fill-pipe connections. The fill pipe for above-ground tanks shall be provided with a means for making a direct connection to the tank vehicle's fuel-delivery hose so that the delivery of fuel is not exposed to the open air during the filling operation. Where any portion of the fill pipe exterior to the tank extends below the level of the top of the tank, a check valve shall be installed in the fill pipe not more than 12 inches (305 mm) from the fill-hose connection.

2306.6.2.3 Overfill protection. Overfill protection shall be provided for above-ground flammable and combustible liquid storage tanks in accordance with Sections 5704.2.7.5.8 and 5704.2.9.7.5.

2306.6.2.4 Siphon prevention. An approved anti-siphon method shall be provided in the piping system to prevent flow of liquid by siphon action.

2306.6.2.5 Emergency relief venting. Above-ground storage tanks, tank compartments and enclosed second-

ary containment spaces shall be provided with emergency relief venting in accordance with Chapter 57.

2306.6.2.6 Spill containers. A spill container having a capacity of not less than 5 gallons (19 L) shall be provided for each fill connection. For tanks with a top fill connection, spill containers shall be noncombustible and shall be fixed to the tank and equipped with a manual drain valve that drains into the primary tank. For tanks with a remote fill connection, a portable spill container is allowed.

2306.6.2.7 Piping for tanks in underground areas. *Piping systems connected to a tank in an underground area shall also comply with Section 5703.6.2.2.*

2306.6.3 Piping, valves, fittings and ancillary equipment for underground tanks. Piping, valves, fittings and ancillary equipment for underground tanks shall comply with Chapter 57 and NFPA 30A.

2306.7 Fuel-dispensing systems for flammable or combustible liquids. The design, fabrication and installation of fuel-dispensing systems for flammable or combustible liquid fuels shall be in accordance with Sections 2306.7.1 through 2306.7.9.2.4. Alcohol-blended fuel-dispensing systems shall also comply with Section 2306.8.

2306.7.1 Listed equipment. Electrical equipment, dispensers, hose, nozzles and submersible or subsurface pumps used in fuel-dispensing systems shall be listed.

2306.7.2 Fixed pumps required. Class I and II liquids shall be transferred from tanks by means of fixed pumps designed and equipped to allow control of the flow and prevent leakage or accidental discharge.

2306.7.3 Mounting of dispensers. Dispensing devices, except those installed on top of a protected above-ground tank that qualifies as vehicle-impact resistant, shall be protected against physical damage by mounting on a concrete island 6 inches (152 mm) or more in height, or shall be protected in accordance with Section 312. Dispensing devices shall be installed and securely fastened to their mounting surface in accordance with the dispenser manufacturer's instructions. Dispensing devices installed indoors shall be located in an approved position where they cannot be struck by an out-of-control vehicle descending a ramp or other slope.

2306.7.3.1 Additional impact protection. The fire code official is authorized to require additional impact protection in accordance with Section 312 where dispensing devices are located in areas near parking areas, multiple dispensing devices, highway on- and off-ramps, and other areas where there is a higher potential for vehicle impacts.

2306.7.4 Dispenser emergency shutoff valve. An approved automatic emergency shutoff valve designed to close in the event of a fire or impact shall be properly installed in the liquid supply line at the base of each dispenser supplied by a remote pump. The valve shall be installed so that the shear groove is flush with or within $\frac{1}{2}$ inch (12.7 mm) of the top of the concrete dispenser island

and there is clearance provided for maintenance purposes around the valve body and operating parts. The valve shall be installed at the liquid supply line inlet of each overhead-type dispenser. Where installed, a vapor return line located inside the dispenser housing shall have a shear section or approved flexible connector for the liquid supply line emergency shutoff valve to function. Emergency shutoff valves shall be installed and maintained in accordance with the manufacturer's instructions, tested at the time of initial installation and not less than yearly thereafter in accordance with Section 2305.2.4.

2306.7.5 Dispenser hose. Dispenser hoses shall be not more than 18 feet (5486 mm) in length unless otherwise approved. Dispenser hoses shall be listed and approved. When not in use, hoses shall be reeled, racked or otherwise protected from damage.

2306.7.5.1 Emergency breakaway devices. Dispenser hoses for Class I and II liquids shall be equipped with a listed emergency breakaway device designed to retain liquid on both sides of a breakaway point. Such devices shall be installed and maintained in accordance with the manufacturer's instructions. Where hoses are attached to hose-retrieving mechanisms, the emergency breakaway device shall be located between the hose nozzle and the point of attachment of the hose-retrieval mechanism to the hose.

2306.7.6 Fuel delivery nozzles. A listed automatic-closing-type hose nozzle valve with or without a latch-open device shall be provided on island-type dispensers used for dispensing Class I, II or III liquids.

Overhead-type dispensing units shall be provided with a listed automatic-closing-type hose nozzle valve without a latch-open device. *The design of the system shall be such that the hose nozzle valve will close automatically in the event the valve is released from a fill opening or upon impact with a driveway.*

Any latch-open device determined to be inoperative by the fire code official shall be repaired or replaced within 48 hours after notification.

Exception: A listed automatic-closing-type hose nozzle valve with latch-open device is allowed to be used on overhead-type dispensing units where the design of the system is such that the hose nozzle valve will close automatically in the event the valve is released from a fill opening or upon impact with a driveway.

2306.7.6.1 Special requirements for nozzles. Where dispensing of Class I, II or III liquids is performed, a listed automatic-closing-type hose nozzle valve shall be used incorporating all of the following features:

1. The hose nozzle valve shall be equipped with an integral latch-open device.
2. Where the flow of product is normally controlled by devices or equipment other than the hose nozzle valve, the hose nozzle valve shall not be capable of being opened unless the delivery hose is

pressurized. If pressure to the hose is lost, the nozzle shall close automatically.

Exception: Vapor recovery nozzles incorporating insertion interlock devices designed to achieve shutoff on disconnect from the vehicle fill pipe.

3. The hose nozzle shall be designed such that the nozzle is retained in the fill pipe during the filling operation.
4. The system shall include listed equipment with a feature that causes or requires the closing of the hose nozzle valve before the product flow can be resumed or before the hose nozzle valve can be replaced in its normal position in the dispenser.

2306.7.7 Remote pumping systems. Remote pumping systems for liquid fuels shall comply with Sections 2306.7.7.1 and 2306.7.7.2.

2306.7.7.1 Leak detection. Where remote pumps are used to supply fuel dispensers, each pump shall have installed on the discharge side a listed leak detection device that will detect a leak in the piping and dispensers and provide an indication. A leak detection device is not required if the piping from the pump discharge to under the dispenser is above ground and visible.

2306.7.7.2 Location. Remote pumps installed above grade, outside of buildings, shall be located not less than 10 feet (3048 mm) from lines of adjoining property that can be built on and not less than 5 feet (1524 mm) from any building opening. Where an outside pump location is impractical, pumps are permitted to be installed inside buildings as provided for dispensers in Section 2301.4 and Chapter 57. Pumps shall be substantially anchored and protected against physical damage.

2306.7.8 Gravity and pressure dispensing. Flammable liquids shall not be dispensed by gravity from tanks, drums, barrels or similar containers. Flammable or combustible liquids shall not be dispensed by a device operating through pressure within a storage tank, drum or container.

2306.7.9 Vapor-recovery and vapor-processing systems. Vapor-recovery and vapor-processing systems shall be in accordance with Sections 2306.7.9.1 through 2306.7.9.2.4.

2306.7.9.1 Vapor-balance systems. Vapor-balance systems shall comply with Sections 2306.7.9.1.1 through 2306.7.9.1.5.

2306.7.9.1.1 Dispensing devices. Dispensing devices incorporating provisions for vapor recovery shall be listed and labeled. Where existing listed or labeled dispensing devices are modified for vapor recovery, such modifications shall be listed by report by a nationally recognized testing laboratory. The listing by report shall contain a description of the component parts used in the modification and recommended method of installation on specific

dispensers. Such report shall be made available on request of the fire code official.

Means shall be provided to shut down fuel dispensing in the event the vapor return line becomes blocked.

2306.7.9.1.2 Vapor-return line closeoff. An acceptable method shall be provided to close off the vapor return line from dispensers when the product is not being dispensed.

2306.7.9.1.3 Piping. Piping in vapor-balance systems shall be in accordance with Sections 5703.6, 5704.2.9 and 5704.2.11. Nonmetallic piping shall be installed in accordance with the manufacturer's instructions.

Existing and new vent piping shall be in accordance with Sections 5703.6 and 5704.2. Vapor return piping shall be installed in a manner that drains back to the tank, without sags or traps in which liquid can become trapped. If necessary, because of grade, condensate tanks are allowed in vapor return piping. Condensate tanks shall be designed and installed so that they can be drained without opening.

2306.7.9.1.4 Flexible joints and shear joints. Flexible joints shall be installed in accordance with Section 5703.6.9.

An approved shear joint shall be rigidly mounted and connected by a union in the vapor return piping at the base of each dispensing device. The shear joint shall be mounted flush with the top of the surface on which the dispenser is mounted.

2306.7.9.1.5 Testing. Vapor return lines and vent piping shall be tested in accordance with Section 5703.6.3.

2306.7.9.2 Vapor-processing systems. Vapor-processing systems shall comply with Sections 2306.7.9.2.1 through 2306.7.9.2.4.

2306.7.9.2.1 Equipment. Equipment in vapor-processing systems, including hose nozzle valves, vapor pumps, flame arresters, fire checks or systems for prevention of flame propagation, controls and vapor-processing equipment, shall be individually listed for the intended use in a specified manner.

Vapor-processing systems that introduce air into the underground piping or storage tanks shall be provided with equipment for prevention of flame propagation that has been tested and listed as suitable for the intended use.

2306.7.9.2.2 Location. Vapor-processing equipment shall be located at or above grade. Sources of ignition shall be located not less than 50 feet (15 240 mm) from fuel-transfer areas and not less than 18 inches (457 mm) above tank fill openings and tops of dispenser islands. Vapor-processing units shall be located not less than 10 feet (3048 mm) from the

nearest building or lot line of a property that can be built on.

Exception: Where the required distances to buildings, lot lines or fuel-transfer areas cannot be obtained, means shall be provided to protect equipment against fire exposure. Acceptable means shall include but not be limited to either of the following:

1. Approved protective enclosures, which extend not less than 18 inches (457 mm) above the equipment, constructed of fire-resistant or noncombustible materials.
2. Fire protection using an approved water-spray system.

2306.7.9.2.2.1 Distance from dispensing devices. Vapor-processing equipment shall be located not less than 20 feet (6096 mm) from dispensing devices.

2306.7.9.2.2.2 Physical protection. Vapor-processing equipment shall be protected against physical damage by guardrails, curbs, protective enclosures or fencing. Where approved protective enclosures are used, approved means shall be provided to ventilate the volume within the enclosure to prevent pocketing of flammable vapors.

2306.7.9.2.2.3 Downslopes. Where a downslope exists toward the location of the vapor-processing unit from a fuel-transfer area, the fire code official is authorized to require additional separation by distance and height.

2306.7.9.2.3 Installation. Vapor-processing units shall be securely mounted on concrete, masonry or structural steel supports on concrete or other noncombustible foundations. Vapor-recovery and vapor-processing equipment is allowed to be installed on roofs where approved.

2306.7.9.2.4 Piping. Piping in a mechanical-assist system shall be in accordance with Section 5703.6.

2306.8 Alcohol-blended fuel-dispensing operations. The design, fabrication and installation of alcohol-blended fuel-dispensing systems shall be in accordance with Section 2306.7 and Sections 2306.8.1 through 2306.8.6.

2306.8.1 Listed equipment. Dispensers shall be listed in accordance with UL 87A. Hoses, nozzles, breakaway fittings, swivels, flexible connectors or dispenser emergency shutoff valves, vapor recovery systems, leak detection devices and pumps used in alcohol-blended fuel-dispensing systems shall be listed for the specific purpose.

2306.8.2 Compatibility. Dispensers shall be used only with the fuels for which they have been listed and that are marked on the product. Field-installed components including hose assemblies, breakaway fittings, swivel connectors and hose nozzle valves shall be provided in accordance with the listing and the marking on the unit.

2306.8.3 Change of system contents. Fuel-dispensing systems subject to change in contents from gasoline to alcohol-blended fuels shall be subject to fire code official review and approval prior to commencing dispensing operations.

2306.8.4 Facility identification. Facilities dispensing alcohol-blended fuels shall be identified by an approved means.

2306.8.5 Marking. Dispensers shall be marked in an approved manner to identify the types of alcohol-blended fuels to be dispensed.

2306.8.6 Maintenance and inspection. Equipment shall be maintained and inspected in accordance with Section 2305.2.

SECTION 2307 LIQUEFIED PETROLEUM GAS MOTOR FUEL-DISPENSING FACILITIES

2307.1 General. Motor fuel-dispensing facilities for liquefied petroleum gas (LP-gas) fuel shall be in accordance with this section and Chapter 61.

2307.2 Approvals. Storage vessels and equipment used for the storage or dispensing of LP-gas shall be approved or listed in accordance with Sections 2307.2.1 and 2307.2.2.

2307.2.1 Approved equipment. Containers, pressure relief devices (including pressure relief valves), pressure regulators and piping for LP-gas shall be approved.

2307.2.2 Listed equipment. Hoses, hose connections, vehicle fuel connections, dispensers, LP-gas pumps and electrical equipment used for LP-gas shall be listed.

2307.3 Attendants. Motor fuel-dispensing operations for LP-gas shall be conducted by qualified attendants or in accordance with Section 2307.7 by persons trained in the proper handling of LP-gas.

2307.4 Location of dispensing operations and equipment. The point of transfer for LP-gas dispensing operations shall be separated from buildings and other exposures in accordance with the following:

1. Not less than 25 feet (7620 mm) from buildings where the exterior wall is not part of a fire-resistance-rated assembly having a rating of 1 hour or greater.
2. Not less than 25 feet (7620 mm) from combustible overhangs on buildings, measured from a vertical line dropped from the face of the overhang at a point nearest the point of transfer.
3. Not less than 25 feet (7620 mm) from the lot line of property that can be built on.
4. Not less than 25 feet (7620 mm) from the centerline of the nearest mainline railroad track.
5. Not less than 10 feet (3048 mm) from public streets, highways, thoroughfares, sidewalks and driveways.

6. Not less than 10 feet (3048 mm) from buildings where the exterior wall is part of a fire-resistance-rated assembly having a rating of 1 hour or greater.

Exception: The point of transfer for LP-gas dispensing operations need not be separated from canopies that are constructed in accordance with the *California Building Code* and that provide weather protection for the dispensing equipment.

LP-gas containers shall be located in accordance with Chapter 61. LP-gas storage and dispensing equipment shall be located outdoors.

2307.5 Additional requirements for LP-gas dispensers and equipment. LP-gas dispensers and related equipment shall comply with the following provisions:

1. Pumps shall be fixed in place and shall be designed to allow control of the flow and to prevent leakage and accidental discharge.
2. Dispensing devices installed within 10 feet (3048 mm) of where vehicle traffic occurs shall be protected against physical damage by mounting on a concrete island 6 inches (152 mm) or more in height, or shall be protected in accordance with Section 312.
3. Dispensing devices shall be securely fastened to their mounting surface in accordance with the dispenser manufacturer's instructions.

2307.6 Installation of LP-gas dispensing devices and equipment. The installation and operation of LP-gas dispensing systems shall be in accordance with Sections 2307.6.1 through 2307.6.4 and Chapter 61. LP-gas dispensers and dispensing stations shall be installed in accordance with the manufacturer's specifications and their listing.

2307.6.1 Product control valves. The dispenser system piping shall be protected from uncontrolled discharge in accordance with the following:

1. Where mounted on a concrete base, a means shall be provided and installed within $\frac{1}{2}$ inch (12.7 mm) of the top of the concrete base that will prevent flow from the supply piping in the event that the dispenser is displaced from its mounting.
2. A manual shutoff valve and an excess flow-control check valve shall be located in the liquid line between the pump and the dispenser inlet where the dispensing device is installed at a remote location and is not part of a complete storage and dispensing unit mounted on a common base.
3. An excess flow-control check valve or an emergency shutoff valve shall be installed in or on the dispenser at the point at which the dispenser hose is connected to the liquid piping.
4. A listed automatic-closing type hose nozzle valve with or without a latch-open device shall be provided on island-type dispensers.

2307.6.2 Hoses. Hoses and piping for the dispensing of LP-gas shall be provided with hydrostatic relief valves. The hose length shall not exceed 18 feet (5486 mm). An

approved method shall be provided to protect the hose against mechanical damage.

2307.6.3 Emergency breakaway devices. Dispenser hoses shall be equipped with a listed emergency breakaway device designed to retain liquid on both sides of the breakaway point. Where hoses are attached to hose-retrieving mechanisms, the emergency breakaway device shall be located such that the breakaway device activates to protect the dispenser from being displaced.

2307.6.4 Vehicle impact protection. Where installed within 10 feet of vehicle traffic, LP-gas storage containers, pumps and dispensers shall be protected in accordance with Section 2307.5, Item 2.

2307.7 Public fueling of motor vehicles. Self-service LP-gas dispensing systems, including key, code and card lock dispensing systems, shall be limited to the filling of permanently mounted containers providing fuel to the LP-gas powered vehicle.

The requirements for self-service LP-gas dispensing systems shall be in accordance with the following:

1. The arrangement and operation of the transfer of product into a vehicle shall be in accordance with this section and Chapter 61.
2. The system shall be provided with an emergency shutoff switch located within 100 feet (30 480 mm) of, but not less than 20 feet (6096 mm) from, dispensers.
3. The owner of the LP-gas motor fuel-dispensing facility or the owner's designee shall provide for the safe operation of the system and the training of users.
4. The dispenser and hose-end valve shall release not more than $\frac{1}{8}$ fluid ounce (4 cc) of liquid to the atmosphere upon breaking the connection with the fill valve on the vehicle.
5. Portable fire extinguishers shall be provided in accordance with Section 2305.5.
6. Warning signs shall be provided in accordance with Section 2305.6.
7. The area around the dispenser shall be maintained in accordance with Section 2305.7.

2307.8 Overfilling. LP-gas containers shall not be filled with LP-gas in excess of the volume determined using the fixed maximum liquid level gauge installed on the container, the volume determined by the overfilling prevention device installed on the container or the weight determined by the required percentage of the water capacity marked on the container.

SECTION 2308 COMPRESSED NATURAL GAS MOTOR FUEL-DISPENSING FACILITIES

2308.1 General. Motor fuel-dispensing facilities for compressed natural gas (CNG) fuel shall be in accordance

with this section, Chapter 53 and Section 413 of the *International Fuel Gas Code*.

2308.2 Approvals. Storage vessels and equipment used for the storage, compression or dispensing of CNG shall be approved or listed in accordance with Sections 2308.2.1 through 2308.2.4.

2308.2.1 Approved equipment. Containers, compressors, pressure relief devices (including pressure relief valves), and pressure regulators and piping used for CNG shall be approved.

2308.2.2 Listed equipment. Hoses, hose connections, dispensers and electrical equipment used for CNG shall be listed. Vehicle-fueling connections shall be listed and labeled.

2308.2.3 Residential fueling appliance (RFA). Residential fueling appliances shall be listed and installed in accordance with the installation requirements of CSA/ANSI NGV 5.1, manufacturer's installation instructions and Section 413 of the *International Fuel Gas Code*. The capacity of an RFA shall not exceed 5 cubic feet per minute (0.14 m³/min) of natural gas.

2308.2.4 Vehicle fueling appliance (VFA). Nonresidential fueling appliances shall be listed and installed in accordance with the installation requirements of CSA/ANSI NGV 5.2, manufacturer's installation instructions and the requirements of Section 413 of the *International Fuel Gas Code* for VFAs. The capacity of the VFA shall not exceed 10 cubic feet per minute (0.28 m³/min) of natural gas.

2308.3 Location of dispensing operations and equipment. Compression, storage and dispensing equipment shall be located above ground, outdoors.

Exceptions:

1. Compression, storage or dispensing equipment shall be allowed in buildings of noncombustible construction, as set forth in the *California Building Code*, that are unenclosed for three-quarters or more of the perimeter.
2. Compression, storage and dispensing equipment shall be allowed indoors or in vaults in accordance with Chapter 53.

2308.3.1 Location on property. In addition to the requirements of Section 2303.1, compression, storage and dispensing equipment not located in vaults complying with Chapter 53 shall be installed as follows:

1. Not beneath power lines.
2. Ten feet (3048 mm) or more from the nearest building or lot line that could be built on, public street, sidewalk or source of ignition.

Exception: Dispensing equipment need not be separated from canopies that are constructed in accordance with the *California Building Code* and that provide weather protection for the dispensing equipment.

3. Twenty-five feet (7620 mm) or more from the nearest rail of any railroad track and 50 feet (15 240 mm) or more from the nearest rail of any railroad main track or any railroad or transit line where power for train propulsion is provided by an outside electrical source, such as third rail or overhead catenary.

4. Fifty feet (15 240 mm) or more from the vertical plane below the nearest overhead wire of a trolley bus line.

2308.4 Private fueling of motor vehicles. Self-service CNG-dispensing systems, including key, code and card lock dispensing systems, shall be limited to the filling of permanently mounted fuel containers on CNG-powered vehicles.

In addition to the requirements in Section 2305, the owner of a self-service CNG motor fuel-dispensing facility shall ensure the safe operation of the system and the training of users.

2308.5 Pressure regulators. Pressure regulators shall be designed and installed or protected so that their operation will not be affected by the elements (freezing rain, sleet, snow or ice), mud or debris. The protection is allowed to be an integral part of the regulator.

2308.6 Valves. Gas piping to equipment shall be provided with a remote, manual shutoff valve that is provided with *ready access*.

2308.7 Emergency shutdown control. An emergency shutdown control shall be located within 75 feet (22 860 mm) of, but not less than 25 feet (7620 mm) from, dispensers and shall be provided in the compressor area. Upon activation, the emergency shutdown system shall automatically shut off the power supply to the compressor and close valves between the main gas supply and the compressor and between the storage containers and dispensers.

2308.8 Discharge of CNG from motor vehicle fuel storage containers. The discharge of CNG from motor vehicle fuel cylinders for the purposes of maintenance, cylinder certification, calibration of dispensers or other activities shall be in accordance with Sections 2308.8.1 through 2308.8.1.2.6.

2308.8.1 Methods of discharge. The discharge of CNG from motor vehicle fuel cylinders shall be accomplished through a closed transfer system in accordance with Section 2308.8.1.1 or an approved method of atmospheric venting in accordance with Section 2308.8.1.2.

2308.8.1.1 Closed transfer system. A documented procedure that explains the logical sequence for discharging the cylinder shall be provided to the fire code official for review and approval. The procedure shall include what actions the operator will take in the event of a low-pressure or high-pressure natural gas release during the discharging activity. A drawing illustrating the arrangement of piping, regulators and equipment settings shall be provided to the fire code official for review and approval. The drawing shall illustrate the piping and regulator arrangement and shall be shown in spatial relation to the location of the compressor, storage vessels and emergency shutdown devices.

2308.8.1.2 Atmospheric venting. Atmospheric venting of CNG shall comply with Sections 2308.8.1.2.1 through 2308.8.1.2.6.

2308.8.1.2.1 Plans and specifications. A drawing illustrating the location of the vessel support, piping, the method of grounding and bonding, and other requirements specified herein shall be provided to the fire code official for review and approval.

2308.8.1.2.2 Cylinder stability. A method of rigidly supporting the vessel during the venting of CNG shall be provided. The selected method shall provide not less than two points of support and shall prevent the horizontal and lateral movement of the vessel. The system shall be designed to prevent the movement of the vessel based on the highest gas-release velocity through valve orifices at the vessel’s rated pressure and volume. The structure or appurtenance shall be constructed of noncombustible materials.

2308.8.1.2.3 Separation. The structure or appurtenance used for stabilizing the cylinder shall be separated from the site equipment, features and exposures and shall be located in accordance with Table 2308.8.1.2.3.

**TABLE 2308.8.1.2.3
SEPARATION DISTANCE FOR ATMOSPHERIC VENTING OF CNG**

EQUIPMENT OR FEATURE	MINIMUM SEPARATION (feet)
Buildings	25
Building openings	25
CNG compressor and storage vessels	25
CNG dispensers	25
Lot lines	15
Public ways	15
Vehicles	25

For SI: 1 foot = 304.8 mm.

2308.8.1.2.4 Grounding and bonding. The structure or appurtenance used for supporting the cylinder shall be grounded in accordance with *the California Electrical Code*. The cylinder valve shall be bonded prior to the commencement of venting operations.

2308.8.1.2.5 Vent tube. A vent tube that will divert the gas flow to the atmosphere shall be installed on the cylinder prior to commencement of the venting and purging operation. The vent tube shall be constructed of pipe or tubing materials approved for use with CNG in accordance with Chapter 53.

The vent tube shall be capable of dispersing the gas not less than 10 feet (3048 mm) above grade level. The vent tube shall not be provided with a rain cap or other feature that would limit or obstruct the gas flow.

At the connection fitting of the vent tube and the CNG cylinder, a listed bidirectional detonation flame arrester shall be provided.

2308.8.1.2.6 Signage. Approved “No Smoking” signs complying with Section 310 shall be posted within 10 feet (3048 mm) of the cylinder support structure or appurtenance. Approved “Cylinder Shall Be Bonded” signs shall be posted on the cylinder support structure or appurtenance.

**SECTION 2309
HYDROGEN MOTOR FUEL-DISPENSING
AND GENERATION FACILITIES**

2309.1 General. Hydrogen motor fuel-dispensing and generation facilities shall be in accordance with this section, Chapter 58 and NFPA 2. Where a fuel-dispensing facility includes a repair garage, the repair operation shall comply with Section 2311.

2309.2 Equipment. Equipment used for the generation, compression, storage or dispensing of hydrogen shall be designed for the specific application in accordance with Sections 2309.2.1 through 2309.2.3.

2309.2.1 Approved equipment. Cylinders, containers and tanks; pressure relief devices, including pressure valves; hydrogen vaporizers; pressure regulators; and piping used for gaseous hydrogen systems shall be designed and constructed in accordance with Chapters 53, 55 and 58.

2309.2.2 Listed or approved equipment. Hoses, hose connections, compressors, hydrogen generators, dispensers, motor-fueling connections and electrical equipment used for hydrogen shall be listed or approved for use with hydrogen.

2309.2.3 Electrical equipment. Electrical installations shall be in accordance with *the California Electrical Code*.

2309.3 Location on property. In addition to the requirements of Section 2303.1, dispensing equipment shall be located in accordance with Sections 2309.3.1 through Section 2309.3.2.

2309.3.1 Location of operations and equipment. Generation, compression, storage and dispensing equipment shall be located in accordance with Sections 2309.3.1.1 through 2309.3.1.5.5.

2309.3.1.1 Outdoors. Generation, compression or storage equipment shall be allowed outdoors in accordance with Chapter 58 and NFPA 2.

2309.3.1.2 Indoors. Generation, compression, storage and dispensing equipment shall be located in indoor rooms or areas constructed in accordance with the requirements of *the California Building Code*, the *International Fuel Gas Code*, the *California Mechanical Code* and NFPA 2.

2309.3.1.2.1 Maintenance. Gaseous hydrogen systems and detection devices shall be maintained in accordance with the manufacturer’s instructions.

2309.3.1.2.2 Smoking. Smoking shall be prohibited in hydrogen cutoff rooms. “No Smoking” signs shall be provided at all entrances to hydrogen fuel gas rooms.

2309.3.1.2.3 Ignition source control. Open flames, flame-producing devices and other sources of ignition shall be controlled in accordance with Chapter 58.

2309.3.1.2.4 Housekeeping. Hydrogen fuel gas rooms shall be kept free from combustible debris and storage.

2309.3.1.3 Gaseous hydrogen storage. Storage of gaseous hydrogen shall be in accordance with Chapters 53 and 58.

2309.3.1.4 Liquefied hydrogen storage. Storage of liquefied hydrogen shall be in accordance with Chapters 55 and 58.

2309.3.1.5 Canopy tops. Gaseous hydrogen compression and storage equipment located on top of motor fuel-dispensing facility canopies shall be in accordance with Sections 2309.3.1.5.1 through 2309.3.1.5.5, Chapters 53 and 58, and the *International Fuel Gas Code*.

2309.3.1.5.1 Construction. Canopies shall be constructed in accordance with the motor fuel-dispensing facility canopy requirements of Section 406.7 of the *California Building Code*.

2309.3.1.5.2 Fire-extinguishing systems. Fuel-dispensing areas under canopies shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. The design of the sprinkler system shall be not less than that required for Extra Hazard Group 2 occupancies. Operation of the sprinkler system shall activate the emergency functions of Sections 2309.3.1.5.3 and 2309.3.1.5.4.

2309.3.1.5.3 Emergency discharge. Operation of the automatic sprinkler system shall activate an automatic emergency discharge system, which will discharge the hydrogen gas from the equipment on the canopy top through the vent pipe system.

2309.3.1.5.4 Emergency shutdown control. Operation of the automatic sprinkler system shall activate the emergency shutdown control required by Section 2309.5.3.

2309.3.1.5.5 Signage. Approved signage having 2-inch (51 mm) block letters shall be affixed at approved locations on the exterior of the canopy structure stating: "CANOPY TOP HYDROGEN STORAGE."

2309.3.2 Canopies. Dispensing equipment need not be separated from canopies of Type I or II construction that are constructed in a manner that prevents the accumulation of hydrogen gas and in accordance with Section 406.7 of the *California Building Code*.

2309.4 Dispensing into motor vehicles at hydrogen motor fuel-dispensing facilities. Hydrogen motor fuel-dispensing systems, including key, code and card lock dispensing systems, shall be limited to the filling of permanently mounted motor vehicle fuel tanks on hydrogen-powered vehicles.

In addition to the requirements in Section 2311, the owner of a hydrogen motor fuel-dispensing facility shall provide for the safe operation of the system by complying with this code and the fueling protocols in NFPA 2 and through the institution of a fire safety plan submitted in accordance with Section 404, the training of employees and operators who use and maintain the system in accordance with Section 406, and provisions for hazard communication in accordance with Section 407.

Exception: Filling of nonpermanently mounted storage containers or tanks for motor fuel-dispensing system testing purposes is permitted.

2309.4.1 Dispensing systems. Dispensing systems shall be equipped with an overpressure protection device set at not greater than 140 percent of the service pressure of the fueling nozzle it supplies.

2309.5 Safety precautions. Safety precautions at hydrogen motor fuel-dispensing and generation facilities shall be in accordance with Sections 2309.5.1 through 2309.5.3.1.

2309.5.1 Protection from vehicles. Guard posts or other approved means shall be provided to protect hydrogen storage systems and use areas subject to vehicular damage in accordance with Section 312.

2309.5.1.1 Vehicle fueling pad. The vehicle shall be fueled on noncoated concrete or other approved paving material having a resistance not exceeding 1 megohm as determined by the methodology specified in EN 1081.

2309.5.2 Emergency shutoff valves. A manual emergency shutoff valve shall be provided to shut down the flow of gas from the hydrogen supply to the piping system.

2309.5.2.1 Identification. Manual emergency shutoff valves shall be identified and the location shall be clearly visible, accessible and indicated by means of a sign.

2309.5.3 Emergency shutdown controls. In addition to the manual emergency shutoff valve required by Section 2309.5.2, a remotely located, manually activated emergency shutdown control shall be provided. An emergency shutdown control shall be located within 75 feet (22 860 mm) of, but not less than 25 feet (7620 mm) from, dispensers and hydrogen generators.

2309.5.3.1 System requirements. Activation of the emergency shutdown control shall automatically shut off the power supply to all hydrogen storage, compression and dispensing equipment; shut off natural gas or other fuel supply to the hydrogen generator; and close valves between the main supply and the compressor and between the storage containers and dispensing equipment.

2309.6 Repairs, purging, defueling and discharge. The repair, purging, defueling or discharge activities associated with hydrogen motor fuel-dispensing and generation systems, storage tanks and the installation of the systems shall be in accordance with Chapters 53 and 58 and NFPA 2.

Exception: The motor vehicle fuel tank and the fuel supply piping from the motor vehicle fuel tank to the

engine compartment on a motor vehicle or forklift unless the fuel tank is required to be defueled in accordance with Section 2311.8.11.

2309.6.1 Documented procedure. A documented procedure that explains the logic sequence for defueling or discharging operations shall be maintained on-site and shall be provided to the fire code official upon request. The procedure shall include what actions the operator is required to take in the event of a low-pressure or high-pressure hydrogen release during discharging activity. Schematic design documents shall be maintained on-site, illustrating the arrangement of piping, regulators and equipment settings. The schematic shall illustrate the piping and regulator arrangement and shall be shown in spatial relation to the location of the vehicle being defueled and, if applicable, to the compressor, storage vessels and emergency shutdown devices.

SECTION 2310

MARINE MOTOR FUEL-DISPENSING FACILITIES

2310.1 General. The construction of marine motor fuel-dispensing facilities shall be in accordance with the *California Building Code* and NFPA 30A. The storage of Class I, II or IIIA liquids at marine motor fuel-dispensing facilities shall be in accordance with this chapter and Chapter 57.

2310.2 Storage and handling. The storage and handling of Class I, II or IIIA liquids at marine motor fuel-dispensing facilities shall be in accordance with Sections 2310.2.1 through 2310.2.3.

2310.2.1 Class I, II or IIIA liquid storage. Class I, II or IIIA liquids stored inside buildings used for marine motor fuel-dispensing facilities shall be stored in approved containers or portable tanks. Storage of Class I liquids shall not exceed 10 gallons (38 L).

Exception: Storage in liquid storage rooms in accordance with Section 5704.3.7.

2310.2.2 Class II or IIIA liquid storage and dispensing. Class II or IIIA liquids stored or dispensed inside buildings used for marine motor fuel-dispensing facilities shall be stored in and dispensed from approved containers or portable tanks. Storage of Class II and IIIA liquids shall not exceed 120 gallons (454 L).

2310.2.3 Heating equipment. Heating equipment installed in Class I, II or IIIA liquid storage or dispensing areas shall comply with Section 2301.6.

2310.3 Dispensing. The dispensing of liquid fuels at marine motor fuel-dispensing facilities shall comply with Sections 2310.3.1 through 2310.3.5.

2310.3.1 General. Wharves, piers or floats at marine motor fuel-dispensing facilities shall be used exclusively for the dispensing or transfer of petroleum products to or from marine craft, except that transfer of essential ship stores is allowed.

2310.3.2 Supervision. Marine motor fuel-dispensing facilities shall have an attendant or supervisor who is fully aware of the operation, mechanics and hazards inherent to

fueling of boats on duty whenever the facility is open for business. The attendant's primary function shall be to supervise, observe and control the dispensing of Class I, II or IIIA liquids or flammable gases.

2310.3.3 Hoses and nozzles. Dispensing of Class I, II or IIIA liquids into the fuel tanks of marine craft shall be by means of an approved-type hose equipped with a listed automatic-closing nozzle without a latch-open device.

Hoses used for dispensing or transferring Class I, II or IIIA liquids, when not in use, shall be reeled, racked or otherwise protected from mechanical damage.

2310.3.4 Portable containers. Dispensing of Class I, II or IIIA liquids into containers, other than fuel tanks, shall be in accordance with Section 2304.4.1.

2310.3.5 Liquefied petroleum gas. Liquefied petroleum gas cylinders shall not be filled at marine motor fuel-dispensing facilities unless approved. Approved storage facilities for LP-gas cylinders shall be provided. See also Section 2307.

2310.4 Fueling of marine vehicles at other than approved marine motor fuel-dispensing facilities. Fueling of floating marine craft at other than a marine motor fuel-dispensing facility shall comply with Sections 2310.4.1 and 2310.4.2.

2310.4.1 Class I liquid fuels. Fueling of floating marine craft with Class I fuels at other than a marine motor fuel-dispensing facility is prohibited.

2310.4.2 Class II or III liquid fuels. Fueling of floating marine craft with Class II or III fuels at other than a marine motor fuel-dispensing facility shall be in accordance with all of the following:

1. The premises and operations shall be approved by the fire code official.
2. Tank vehicles and fueling operations shall comply with Section 5706.6.
3. The dispensing nozzle shall be of the listed automatic-closing type without a latch-open device.
4. Nighttime deliveries shall be made only in lighted areas.
5. The tank vehicle flasher lights shall be in operation while dispensing.
6. Fuel expansion space shall be left in each fuel tank to prevent overflow in the event of temperature increase.

2310.5 Fire prevention regulations. General fire safety regulations for marine motor fuel-dispensing facilities shall comply with Sections 2310.5.1 through 2310.5.7.

2310.5.1 Housekeeping. Marine motor fuel-dispensing facilities shall be maintained in a neat and orderly manner. Accumulations of rubbish or waste oils in excessive amounts shall be prohibited.

2310.5.2 Spills. Spills of Class I, II or IIIA liquids at or on the water shall be reported immediately to the fire department and jurisdictional authorities.

2310.5.3 Rubbish containers. Containers with tight-fitting or self-closing lids shall be provided for temporary storage of combustible debris, rubbish and waste material. The rubbish containers shall be constructed entirely of materials that comply with any one of the following:

1. Noncombustible materials.
2. Materials that meet a peak rate of heat release not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation.

2310.5.4 Marine vessels and craft. Vessels or craft shall not be made fast to fuel docks serving other vessels or craft occupying a berth at a marine motor fuel-dispensing facility.

2310.5.5 Sources of ignition. Construction, maintenance, repair and reconditioning work involving the use of open flames, arcs or spark-producing devices shall not be performed at marine motor fuel-dispensing facilities or within 50 feet (15 240 mm) of the dispensing facilities, including piers, wharves or floats, except for emergency repair work approved in writing by the fire code official. Fueling shall not be conducted at the pier, wharf or float during the course of such emergency repairs.

2310.5.5.1 Smoking. Smoking or open flames shall be prohibited within 50 feet (15 240 mm) of fueling operations. “No Smoking” signs complying with Section 310 shall be posted conspicuously about the premises. Such signs shall have letters not less than 4 inches (102 mm) in height on a background of contrasting color.

2310.5.6 Preparation of tanks for fueling. Boat owners and operators shall not offer their craft for fueling unless the tanks being filled are properly vented to dissipate fumes to the outside atmosphere.

2310.5.7 Warning signs. Warning signs shall be prominently displayed at the face of each wharf, pier or float at such elevation as to be clearly visible from the decks of marine craft being fueled. Such signs shall have letters not less than 3 inches (76 mm) in height on a background of contrasting color bearing the following or approved equivalent wording:

WARNING

NO SMOKING—STOP ENGINE WHILE FUELING,
SHUT OFF ELECTRICITY

DO NOT START ENGINE UNTIL AFTER BELOW
DECK SPACES ARE VENTILATED.

2310.6 Fire protection. Fire protection features for marine motor fuel-dispensing facilities shall comply with Sections 2310.6.1 through 2310.6.4.

2310.6.1 Standpipe hose stations. Fire hose, where provided, shall be enclosed within a cabinet, and hose stations shall be labeled: “FIRE HOSE—EMERGENCY USE ONLY.”

2310.6.2 Obstruction of fire protection equipment. Materials shall not be placed on a pier in such a manner as to obstruct access to fire-fighting equipment or piping system control valves.

2310.6.3 Access. Where the pier is designed for vehicular traffic, an unobstructed roadway to the shore end of the wharf shall be maintained for access by fire apparatus.

2310.6.4 Portable fire extinguishers. Portable fire extinguishers in accordance with Section 906, each having a minimum rating of 20-B:C, shall be provided as follows:

1. One on each float.
2. One on the pier or wharf within 25 feet (7620 mm) of the head of the gangway to the float, unless the office is within 25 feet (7620 mm) of the gangway or is on the float and an extinguisher is provided thereon.

**SECTION 2311
REPAIR GARAGES**

2311.1 General. Repair garages shall comply with this section and the *California Building Code*. Repair garages for vehicles that use more than one type of fuel shall comply with the applicable provisions of this section for each type of fuel used.

Where a repair garage includes a motor fuel-dispensing facility, the fuel-dispensing operation shall comply with the requirements of this chapter for motor fuel-dispensing facilities.

2311.2 Storage and use of flammable and combustible liquids. The storage and use of flammable and combustible liquids in repair garages shall comply with Chapter 57 and Sections 2311.2.1 through 2311.2.4.

2311.2.1 Cleaning of parts. Cleaning of parts shall be conducted in listed and approved parts-cleaning machines in accordance with Chapter 57.

2311.2.2 Waste oil, motor oil and other Class IIIB liquids. Waste oil, motor oil and other Class IIIB liquids shall be stored in approved tanks or containers, which are allowed to be stored and dispensed from inside repair garages.

2311.2.2.1 Tank location. Tanks storing Class IIIB liquids in repair garages are allowed to be located at, below or above grade, provided that adequate drainage or containment is provided.

2311.2.2.2 Liquid classification. Crankcase drainings shall be classified as Class IIIB liquids unless otherwise determined by testing.

2311.2.3 Drainage and disposal of liquids and oil-soaked waste. Garage floor drains, where provided, shall drain to approved oil separators or traps discharging to a sewer in accordance with the *California Plumbing Code*. Contents of oil separators, traps and floor drainage systems shall be collected at sufficiently frequent intervals and removed from the premises to prevent oil from being carried into the sewers.

2311.2.3.1 Disposal of liquids. Crankcase drainings and liquids shall not be dumped into sewers, streams or on the ground, but shall be stored in approved tanks or

containers in accordance with Chapter 57 until removed from the premises.

2311.2.3.2 Disposal of oily waste. Self-closing metal cans shall be used for oily waste.

2311.2.4 Spray finishing. Spray finishing with flammable or combustible liquids shall comply with Chapter 24.

2311.3 Sources of ignition. Sources of ignition shall not be located within 18 inches (457 mm) of the floor and shall comply with Chapters 3 and 35.

2311.3.1 Equipment. Appliances and equipment installed in a repair garage shall comply with the provisions of the *California Building Code*, the *California Mechanical Code* and the *California Electrical Code*.

2311.3.2 Smoking. Smoking shall not be allowed in repair garages except in approved locations.

2311.4 Below-grade areas. Pits and below-grade work areas in repair garages shall comply with Sections 2311.4.1 through 2311.4.3.

2311.4.1 Construction. Pits and below-grade work areas shall be constructed in accordance with the *California Building Code*.

2311.4.2 Means of egress. Pits and below-grade work areas shall be provided with means of egress in accordance with Chapter 10.

2311.4.3 Ventilation. Where Class I liquids or LP-gas are stored or used within a building having a basement or pit wherein flammable vapors could accumulate, the basement or pit shall be provided with mechanical ventilation in accordance with the *California Mechanical Code*, at a minimum rate of 1½ cubic feet per minute per square foot (cfm/ft²) [0.008 m³/(s × m²)] to prevent the accumulation of flammable vapors.

2311.5 Vehicles powered by liquefied petroleum gas (LP-gas). Vehicles powered by LP-gas and the servicing of vehicles powered by LP-gas shall be in compliance with this chapter, Chapter 61 of this code and NFPA 58.

2311.6 Vehicles powered by liquefied natural gas (LNG) and compressed natural gas (CNG). LNG vehicles and CNG vehicles shall comply with Sections 2311.6.1 and 2311.6.2, as applicable.

2311.6.1 Liquefied natural gas (LNG). LNG vehicle fuel system pressure shall be measured and recorded prior to entering the repair facility. The maximum allowable system pressure shall be not more than 170 psig (1172 kPa). Pressure greater than 170 psig (1172 kPa) shall be reduced by operating the vehicle or limited venting outdoors, as required.

2311.6.2 Compressed natural gas (CNG). CNG vehicle fuel system pressure and the ambient temperature shall be measured and recorded prior to entering the repair facility. Pressure greater than the indicated maximum pressure in accordance with Table 2311.6.2 shall be reduced by defueling the vehicle.

**TABLE 2311.6.2
TEMPERATURE COMPENSATED CYLINDER
PRESSURE TABLE^a**

GAS TEMPERATURE °F	PRESSURE IN FULL 3,600 PSI CNG CONTAINER, psig
123.6	4,500
120	4,455
110	4,272
100	4,105
90	3,936
80	3,768
70	3,600
60	3,432
50	3,263
40	3,094
30	2,926
20	2,757
10	2,589
0	2,421
-10	2,253
-20	2,086
-30	1,919
-40	1,753

For SI: °C = (°F - 32)/1.8, 1 psig = 6.895 kPa.

a. 3,600 psi service pressure calculated from the standard gas composition used to create the gasoline gallon equivalent (GGE).

2311.7 Fire extinguishers. Fire extinguishers shall be provided in accordance with Section 906.

2311.8 Repair garages for vehicles fueled by lighter-than-air fuels. The room, motor vehicle repair booth or motor vehicle repair space containing repair garage activities for the conversion or repair of vehicles that use CNG, LNG, hydrogen or other lighter-than-air motor fuels shall be in accordance with Sections 2311.8 through 2311.8.11 in addition to the other requirements of Section 2311. Repair garages for the repair of vehicles that use hydrogen fuel shall be in accordance with this code and NFPA 2.

Exceptions:

1. Repair garages where work is conducted only on vehicles where the motor vehicle fuel tank and system have been defueled and the motor vehicle fuel tank has been purged with nitrogen gas, and where standard operating procedures to document and maintain the fueling status throughout repair operations are approved.
2. Repair garages where work is not performed on the fuel system and is limited to exchange of parts and maintenance not requiring open flame or welding on the CNG-, LNG-, hydrogen- or other lighter-than-air-fueled motor vehicle. Movement of a subassembly on which the motor vehicle fuel tank remains mounted to allow access to other parts of the vehicle that are not a portion of the fuel system shall be permitted.

3. Repair garages for hydrogen-fueled vehicles where work is not performed on the motor vehicle fuel tank and is limited to the exchange of parts and maintenance not requiring open flame or welding on the hydrogen-fueled vehicle. During the work, the entire hydrogen fuel system shall contain less than 400 cubic feet (11.3 m³) of hydrogen.
4. Repair garages for natural-gas-fueled vehicles where work is not being performed on the motor vehicle fuel tank, and is limited to the exchange of parts and maintenance not requiring open flame or welding on the natural-gas-fueled vehicle. During the work, the natural gas in the motor vehicle fuel tank shall contain a pressure of not more than 250 psi at 70°F (1724 kPa at 21°C).

2311.8.1 Preparation of vehicles for repair. For vehicles powered by gaseous fuels, the fuel shutoff valves shall be closed prior to repairing any portion of the vehicle fuel system.

Vehicles powered by gaseous fuels in which the fuel system has been damaged shall be inspected and evaluated for fuel system integrity prior to being brought into the repair garage. The inspection shall include testing of the entire fuel delivery system for leakage.

2311.8.2 Repair garages used for the repair of hydrogen-fueled vehicles. Repair garages used for the repair of hydrogen-fueled vehicles shall be provided with an approved exhaust ventilation system in accordance with the *California Mechanical Code* and Chapter 6 of NFPA 2.

2311.8.3 Motor vehicle repair rooms. Motor vehicle repair rooms shall be enclosed with not less than 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code*, or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with 1-hour-rated opening protectives.

2311.8.4 Motor vehicle repair booths. The design and construction of motor vehicle repair booths shall be in accordance with Sections 2311.8.4.1 through 2311.8.4.4.

2311.8.4.1 Construction. Motor vehicle repair booths shall be constructed of approved noncombustible materials. Where walls or ceiling assemblies are constructed of sheet metal, single-skin assemblies shall be not thinner than 0.0478 inch (18 gage) (1.2 mm) and each sheet of double-skin assemblies shall be not thinner than 0.0359 inch (20 gage) (0.9 mm). Structural sections of motor vehicle repair booths shall be sealed in an approved manner.

2311.8.4.2 Surfaces. The interior surfaces of motor vehicle repair booths shall be constructed to permit the free passage of exhaust air from all parts of the interior.

2311.8.4.3 Means of egress. Means of egress shall be provided in accordance with Chapter 10.

Exception: Means of egress doors from premanufactured motor vehicle repair booths shall be not less than 30 inches (762 mm) in width by 80 inches (2032 mm) in height.

2311.8.4.4 Clear space. Motor vehicle repair booths shall be installed so that all parts of the booth be provided with ready access for cleaning. A clear area of not less than 3 feet (914 mm) wide shall be maintained on all sides of the motor vehicle repair booth. This clear area shall be kept free of any storage or combustible construction.

Exceptions:

1. This requirement shall not prohibit locating a motor vehicle repair booth closer than 3 feet (914 mm) to or directly against an interior partition, wall or floor/ceiling assembly that has a fire-resistance rating of not less than 1 hour, provided that the motor vehicle repair booth can be adequately maintained and cleaned.
2. This requirement shall not prohibit locating a motor vehicle repair booth closer than 3 feet (914 mm) to an exterior wall or a roof assembly, provided that the wall or roof is constructed of noncombustible material and the motor vehicle repair booth can be adequately maintained and cleaned.

2311.8.5 Motor vehicle repair spaces. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable gases.

2311.8.6 Fire protection. Motor vehicle repair booths or spaces installed in a room or area protected by an automatic sprinkler system shall have the protection extended to include the inside of the motor vehicle repair booth or space.

2311.8.7 Fire extinguishers. Portable fire extinguishers complying with Section 906 shall be provided for motor vehicle repair rooms, motor vehicle repair booths or motor vehicle repair spaces.

2311.8.8 Exhaust ventilation system. Repair garages used for the repair of CNG, LNG, or other lighter-than-air motor fuels other than hydrogen shall be provided with an approved mechanical ventilation system. The mechanical exhaust ventilation system shall be in accordance with the *California Mechanical Code* and Sections 2311.8.8.1 and 2311.8.8.2.

Exception: Where approved by the fire code official, natural ventilation shall be permitted in lieu of mechanical exhaust ventilation.

2311.8.8.1 Design. For indoor locations, air supply inlets and exhaust outlets for mechanical ventilation shall be arranged to provide uniformly distributed air movement with inlets uniformly arranged on walls near floor level and outlets at the high point of the room in walls or the roof.

Failure of the ventilation system shall cause the fueling system to shut down.

The exhaust ventilation rate shall be not less than 1 cubic foot per minute (0.03 m³/minute) per 12 cubic feet (34 m³) of room volume.

2311.8.8.2 Operation. The mechanical exhaust ventilation system shall operate continuously.

Exceptions:

1. Mechanical exhaust ventilation systems that are interlocked with a gas detection system designed in accordance with Sections 2311.8.9 through 2311.8.9.2.
2. Mechanical exhaust ventilation systems in repair garages that are used only for repair of vehicles fueled by liquid fuels or odorized gases, such as CNG, where the ventilation system is electrically interlocked with the lighting circuit.

2311.8.9 Gas detection system. Repair garages used for repair of vehicles fueled by nonodorized gases, including, but not limited to, hydrogen and nonodorized LNG, shall be provided with a gas detection system that complies with Section 916. The gas detection system shall be designed to detect leakage of nonodorized gaseous fuel. Where lubrication or chassis service pits are provided in garages used for repairing nonodorized LNG-fueled vehicles, gas sensors shall be provided in such pits.

2311.8.9.1 System activation. Activation of the gas detection alarm shall result in all of the following:

1. Initiation of local audible and visual alarms in approved locations.
2. Deactivation of heating systems located in the repair garage.
3. Activation of the mechanical exhaust ventilation system, where the ventilation system is interlocked with gas detection.

2311.8.9.2 Failure of the gas detection system. Failure of the gas detection system shall automatically deactivate the heating system, activate the mechanical exhaust ventilation system where the system is interlocked with the gas detection system and cause a trouble signal to sound in an approved location.

2311.8.10 Classified electrical area. Areas within 18 inches (450 mm) of a ceiling within a motor vehicle repair room or motor vehicle repair booth shall be designed and installed in accordance with the requirements for Class I, Division 2, classified locations, as set forth in *the California Electrical Code*.

Exceptions:

1. Rooms with exhaust ventilation of not less than 1 cubic foot per minute per square foot (0.3 m³/min/m²) of floor area, with suction taken from a point within 18 inches (450 mm) of the highest

point in the ceiling in repair garages for vehicles that use CNG, liquefied natural gas (LNG) or other lighter-than-air motor fuels.

2. Rooms used for the repair of hydrogen-fueled vehicles that have an approved exhaust ventilation system in accordance with the *California Mechanical Code* and NFPA 2.

2311.8.11 Defueling equipment required at vehicle maintenance and repair facilities. Facilities for repairing or replacing hydrogen fuel tanks on hydrogen-fueled vehicles shall have equipment to defuel vehicle storage tanks. Where work must be performed on a motor vehicle's fuel tank for the purpose of maintenance, repair or cylinder certification, defueling and purging shall be conducted in accordance with Section 2309.6 and NFPA 2.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 24 – FLAMMABLE FINISHES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
2407.2			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 24

FLAMMABLE FINISHES

User note:

About this chapter: Chapter 24 provides requirements that govern operations where flammable or combustible finishes are applied by spraying, dipping, powder coating or flow-coating processes. As with all operations involving flammable or combustible liquids and combustible dusts or vapors, controlling ignition sources and methods of reducing or controlling flammable vapors or combustible dusts at or near these operations are emphasized.

SECTION 2401 GENERAL

2401.1 Scope. This chapter shall apply to locations or areas where any of the following activities are conducted:

1. The application of flammable finishes to articles or materials by means of spray apparatus.
2. The application of flammable finishes by dipping or immersing articles or materials into the contents of tanks, vats or containers of flammable or combustible liquids for coating, finishing, treatment or similar processes.
3. The application of flammable finishes by applying combustible powders to articles or materials utilizing powder spray guns, electrostatic powder spray guns, fluidized beds or electrostatic fluidized beds.
4. Floor surfacing or finishing operations using Class I or II liquids in areas exceeding 350 square feet (32.5 m²).
5. The application of flammable finishes consisting of dual-component coatings or Class I or II liquids where applied by brush or roller in quantities exceeding 1 gallon (4 L).

2401.2 Nonapplicability. This chapter shall not apply to spray finishing utilizing flammable or combustible liquids that do not sustain combustion, including:

1. Liquids that do not have a fire point when tested in accordance with ASTM D92.
2. Liquids with a flashpoint greater than 95°F (35°C) in a water-miscible solution or dispersion with a water and inert (noncombustible) solids content of more than 80 percent by weight.

2401.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

SECTION 2402 DEFINITIONS

2402.1 Definitions. The following terms are defined in Chapter 2:

DETEARING.

DIP TANK.

**ELECTROSTATIC FLUIDIZED BED.
FLAMMABLE FINISHES.**

**FLAMMABLE VAPOR AREA.
FLUIDIZED BED.**

LIMITED SPRAYING SPACE.

RESIN APPLICATION AREA.

ROLL COATING.

SPRAY BOOTH.

SPRAY ROOM.

SPRAYING SPACE.

SECTION 2403 PROTECTION OF OPERATIONS

2403.1 General. Operations covered by this chapter shall be protected as required by Sections 2403.2 through 2403.4.4.

2403.2 Sources of ignition. Protection against sources of ignition shall be provided in accordance with Sections 2403.2.1 through 2403.2.8.

2403.2.1 Electrical wiring and equipment. Electrical wiring and equipment shall comply with this chapter and *the California Electrical Code*.

2403.2.1.1 Flammable vapor areas. Electrical wiring and equipment in flammable vapor areas shall be of an explosionproof type approved for use in such hazardous locations. Such areas shall be considered to be Class I, Division 1, or Class II, Division 1, hazardous locations in accordance with *the California Electrical Code*.

2403.2.1.2 Areas subject to deposits of residues. Electrical equipment, flammable vapor areas or drying operations that are subject to splashing or dripping of liquids shall be specifically approved for locations containing deposits of readily ignitable residue and explosive vapors.

Exceptions:

1. This provision shall not apply to wiring in rigid conduit, threaded boxes or fittings not containing taps, splices or terminal connections.

2. This provision shall not apply to electrostatic equipment allowed by Section 2407.

In resin application areas, electrical wiring and equipment that is subject to deposits of combustible residues shall be listed for such exposure and shall be installed as required for hazardous (classified) locations. Electrical wiring and equipment not subject to deposits of combustible residues shall be installed as required for ordinary hazard locations.

2403.2.1.3 Areas adjacent to spray booths. Electrical wiring and equipment located outside of, but within 3 feet (914 mm) of openings in a spray booth or a spray room, shall be approved for Class I, Division 2, or Class II, Division 2, hazardous locations, whichever is applicable.

2403.2.1.4 Areas subject to overspray deposits. Electrical equipment in flammable vapor areas located such that deposits of combustible residues could readily accumulate thereon shall be specifically approved for locations containing deposits of readily ignitable residue and explosive vapors in accordance with *the California Electrical Code*.

Exceptions:

1. Wiring in rigid conduit.
2. Boxes or fittings not containing taps, splices or terminal connections.
3. Equipment allowed by Sections 2404 and 2407 and Chapter 30.

2403.2.2 Open flames and sparks. Open flames and spark-producing devices shall not be located in flammable vapor areas and shall not be located within 20 feet (6096 mm) of such areas unless separated by a permanent partition.

Exception: Drying and baking apparatus complying with Section 2404.6.1.2.

2403.2.3 Hot surfaces. Heated surfaces having a temperature sufficient to ignite vapors shall not be located in flammable vapor areas. Space-heating appliances, steam pipes or hot surfaces in a flammable vapor area shall be located such that they are not subject to accumulation of deposits of combustible residues.

Exception: Drying apparatus complying with Section 2404.6.1.2.

2403.2.4 Equipment enclosures. Equipment or apparatus that is capable of producing sparks or particles of hot metal that would fall into a flammable vapor area shall be totally enclosed.

2403.2.5 Grounding. Metal parts of spray booths, exhaust ducts and piping systems conveying Class I or II liquids shall be electrically grounded in accordance with *the California Electrical Code*. Metallic parts located in resin application areas, including but not limited to exhaust ducts, ventilation fans, spray application equipment, workpieces and piping, shall be electrically grounded.

2403.2.6 Smoking prohibited. Smoking shall be prohibited in flammable vapor areas and hazardous materials storage rooms associated with flammable finish processes. “No Smoking” signs complying with Section 310 shall be conspicuously posted in such areas.

2403.2.7 Welding warning signs. Welding, cutting and similar spark-producing operations shall not be conducted in or adjacent to flammable vapor areas or dipping or coating operations unless precautions have been taken to provide safety. Conspicuous signs with the following warning shall be posted in the vicinity of flammable vapor areas, dipping operations and paint storage rooms:

NO WELDING
THE USE OF WELDING OR CUTTING
EQUIPMENT IN OR NEAR THIS AREA
IS DANGEROUS BECAUSE OF FIRE
AND EXPLOSION HAZARDS. WELDING
AND CUTTING SHALL BE DONE ONLY
UNDER THE SUPERVISION OF THE
PERSON IN CHARGE.

2403.2.8 Powered industrial trucks. Powered industrial trucks used in electrically classified areas shall be listed for such use.

2403.3 Storage, use and handling of flammable and combustible liquids. The storage, use and handling of flammable and combustible liquids shall be in accordance with this section and Chapter 57.

2403.3.1 Use. Containers supplying spray nozzles shall be of a closed type or provided with metal covers that are kept closed. Containers not resting on floors shall be on noncombustible supports or suspended by wire cables. Containers supplying spray nozzles by gravity flow shall not exceed 10 gallons (37.9 L) in capacity.

2403.3.2 Valves. Containers and piping to which a hose or flexible connection is attached shall be provided with a shutoff valve at the connection. Such valves shall be kept shut when hoses are not in use.

2403.3.3 Pumped liquid supplies. Where flammable or combustible liquids are supplied to spray nozzles by positive displacement pumps, pump discharge lines shall be provided with an approved relief valve discharging to pump suction or a safe detached location.

2403.3.4 Liquid transfer. Where a flammable mixture is transferred from one portable container to another, a bond shall be provided between the two containers. Not less than one container shall be grounded. Piping systems for Class I and II liquids shall be permanently grounded.

2403.3.5 Class I liquids as solvents. Class I liquids used as solvents shall be used in spray gun and equipment cleaning machines that have been listed and approved for such purpose or shall be used in spray booths or spray rooms in accordance with Sections 2403.3.5.1 and 2403.3.5.2.

2403.3.5.1 Listed devices. Cleaning machines for spray guns and equipment shall not be located in areas open to the public and shall be separated from ignition sources in accordance with their listings or by a distance of 3 feet (914 mm), whichever is greater. The

quantity of solvent used in a machine shall not exceed the design capacity of the machine.

2403.3.5.2 Within spray booths and spray rooms.

Where solvents are used for cleaning spray nozzles and auxiliary equipment within spray booths and spray rooms, the ventilating equipment shall be operated during cleaning.

2403.3.6 Class II and III liquids. Solvents used outside of spray booths, spray rooms or listed and approved spray gun and equipment cleaning machines shall be restricted to Class II and III liquids.

2403.4 Operations and maintenance. Flammable vapor areas, exhaust fan blades and exhaust ducts shall be kept free from the accumulation of deposits of combustible residues. Where excessive residue accumulates in such areas, spraying operations shall be discontinued until conditions are corrected.

2403.4.1 Tools. Scrapers, spuds and other tools used for cleaning purposes shall be constructed of nonsparking materials.

2403.4.2 Residue. Residues removed during cleaning and debris contaminated with residue shall be immediately removed from the premises and properly disposed.

2403.4.3 Waste cans. Approved metal waste cans equipped with self-closing lids shall be provided wherever rags or waste are impregnated with finishing material. Such rags and waste shall be deposited therein immediately after being utilized. The contents of waste cans shall be properly disposed of not less than once daily and at the end of each shift.

2403.4.4 Solvent recycling. Solvent distillation equipment used to recycle and clean dirty solvents shall comply with Section 5705.4.

SECTION 2404 SPRAY FINISHING

2404.1 General. The application of flammable or combustible liquids by means of spray apparatus in continuous or intermittent processes shall be in accordance with the requirements of Sections 2403 and 2404.2 through 2404.9.4.

2404.2 Location of spray-finishing operations. Spray-finishing operations conducted in buildings used for Group A, E, I or R occupancies shall be located in a spray room protected with an approved automatic sprinkler system installed in accordance with Section 903.3.1.1 and separated vertically and horizontally from the remainder of the building by fire barrier walls and horizontal assemblies with not less than a 1-hour fire-resistance rating in accordance with the *California Building Code*. In other occupancies, spray-finishing operations shall be conducted in a spray room, spray booth or limited spraying space approved for such use.

Exceptions:

1. Automobile undercoating spray operations and spray-on automotive lining operations conducted in areas with approved natural or mechanical ventila-

tion shall be exempt from the provisions of Section 2404 when approved and where utilizing Class IIIA or IIIB combustible liquids.

2. In buildings other than Group A, E, I or R occupancies, approved limited spraying space in accordance with Section 2404.9.
3. Resin application areas used for manufacturing of reinforced plastics complying with Section 2409 shall not be required to be located in a spray room, spray booth or spraying space.

2404.3 Design and construction. Design and construction of spray rooms, spray booths and spray spaces shall be in accordance with Sections 2404.3.1 through 2404.3.3.1.

2404.3.1 Spray rooms. Spray rooms shall be constructed and designed in accordance with Section 416 of the *California Building Code* and Section 2404.3.2 of this code, and shall comply with Sections 2404.4 through 2404.8 of this code.

2404.3.2 Floor. Combustible floor construction in spray rooms shall be covered by approved, noncombustible, nonsparking material, except where combustible coverings, including but not limited to thin paper or plastic and strippable coatings, are utilized over noncombustible materials to facilitate cleaning operations in spray rooms.

2404.3.3 Spray booths. The design and construction of spray booths shall be in accordance with Sections 2404.3.3.1 through 2404.3.3.6, Sections 2404.4 through 2404.8 and NFPA 33.

2404.3.3.1 Construction. Spray booths shall be constructed of approved noncombustible materials. Aluminum shall not be used. Where walls or ceiling assemblies are constructed of sheet metal, single-skin assemblies shall be not thinner than 0.0478 inch (18 gage) (1.2 mm) and each sheet of double-skin assemblies shall be not thinner than 0.0359 inch (20 gage) (0.9 mm). Structural sections of spray booths are allowed to be sealed with latex-based or similar caulks and sealants.

2404.3.3.2 Surfaces. The interior surfaces of spray booths shall be smooth; shall be constructed so as to permit the free passage of exhaust air from all parts of the interior, and to facilitate washing and cleaning; and shall be designed to confine residues within the booth. Aluminum shall not be used.

2404.3.3.3 Floor. Combustible floor construction in spray booths shall be covered by approved, noncombustible, nonsparking material, except where combustible coverings, including but not limited to thin paper or plastic and strippable coatings, are utilized over noncombustible materials to facilitate cleaning operations in spray booths.

2404.3.3.4 Means of egress. Means of egress shall be provided in accordance with Chapter 10.

Exception: Means of egress doors from premanufactured spray booths shall be not less than 30 inches (762 mm) in width by 80 inches (2032 mm) in height.

2404.3.3.5 Clear space. Spray booths shall be installed so that all parts of the booth are able to be accessed for cleaning. A clear space of not less than 3 feet (914 mm) shall be maintained on all sides of the spray booth. This clear space shall be kept free of any storage or combustible construction.

Exceptions:

1. This requirement shall not prohibit locating a spray booth closer than 3 feet (914 mm) to or directly against an interior partition, wall or floor/ceiling assembly that has a fire-resistance rating of not less than 1 hour, provided that the spray booth can be adequately maintained and cleaned.
2. This requirement shall not prohibit locating a spray booth closer than 3 feet (914 mm) to an exterior wall or a roof assembly, provided that the wall or roof is constructed of noncombustible material and the spray booth can be adequately maintained and cleaned.

2404.3.3.6 Size. The aggregate area of spray booths in a building shall not exceed the lesser of 10 percent of the area of any floor of a building or the basic area allowed for a Group H-2 occupancy without area increases, as set forth in the *California Building Code*.

Exception: One individual booth not exceeding 500 square feet (46 m²).

2404.3.4 Spraying spaces. Spraying spaces shall be designed and constructed in accordance with the *California Building Code*, and Section 2404.3.4.1 and Sections 2404.4 through 2404.8 of this code.

2404.3.4.1 Floor. Combustible floor construction in spraying spaces shall be covered by approved, noncombustible, nonsparking material, except where combustible coverings, such as thin paper or plastic and strippable coatings, are utilized over noncombustible materials to facilitate cleaning operations in spraying spaces.

2404.4 Fire protection. Spray booths and spray rooms shall be protected by an approved automatic fire-extinguishing system complying with Chapter 9. Protection shall extend to exhaust plenums, exhaust ducts and both sides of dry filters where such filters are used.

2404.4.1 Fire extinguishers. Portable fire extinguishers complying with Section 906 shall be provided for spraying areas in accordance with the requirements for an extra (high) hazard occupancy.

2404.5 Housekeeping, maintenance and storage of hazardous materials. Housekeeping, maintenance, storage and use of hazardous materials shall be in accordance with Sections 2403.3, 2403.4, 2404.5.1 and 2404.5.2.

2404.5.1 Different coatings. Spray booths, spray rooms and spraying spaces shall not be alternately utilized for different types of coating materials where the combination of materials is conducive to spontaneous ignition, unless

all deposits of one material are removed from the booth, room or space and exhaust ducts prior to spraying with a different material.

2404.5.2 Protection of sprinklers. Automatic sprinklers installed in flammable vapor areas shall be protected from the accumulation of residue from spraying operations in an approved manner. Bags used as a protective covering shall be 0.003-inch-thick (0.076 mm) polyethylene or cellophane or shall be thin paper. Automatic sprinklers contaminated by overspray particles shall be replaced with new automatic sprinklers.

2404.6 Sources of ignition. Control of sources of ignition shall be in accordance with Section 2403.2 and Sections 2404.6.1 through 2404.6.2.4.

2404.6.1 Drying operations. Spray booths and spray rooms shall not be alternately used for the purpose of drying by arrangements or methods that could cause an increase in the surface temperature of the spray booth or spray room except in accordance with Sections 2404.6.1.1 and 2404.6.1.2. Except as specifically provided in this section, drying or baking units utilizing a heating system having open flames or that are capable of producing sparks shall not be installed in a flammable vapor areas.

2404.6.1.1 Spraying procedure. The spraying procedure shall use low-volume spray application.

2404.6.1.2 Drying apparatus. Fixed drying apparatus shall comply with this chapter and the applicable provisions of Chapter 30. Where recirculation ventilation is provided in accordance with Section 2404.7.2, the heating system shall not be within the recirculation air path.

2404.6.1.2.1 Interlocks. The spraying apparatus, drying apparatus and ventilating system for the spray booth or spray room shall be equipped with interlocks arranged to accomplish all of the following:

1. Prevent operation of the spraying apparatus while drying operations are in progress.
2. Where the drying apparatus is located in the spray booth or spray room, prevent operation of the drying apparatus until a timed purge of spray vapors from the spray booth or spray room is complete. This purge time shall be based on completing not fewer than four air changes of spray booth or spray room volume or for a period of not less than 3 minutes, whichever is greater.
3. Have the ventilating system maintain a safe atmosphere within the spray booth or spray room during the drying process and automatically shut off drying apparatus in the event of a failure of the ventilating system.
4. Shut off the drying apparatus automatically if the air temperature within the booth exceeds 200°F (93°C).

2404.6.1.2.2 Portable infrared apparatus. Where a portable infrared drying apparatus is used, electrical

wiring and portable infrared drying equipment shall comply with *the California Electrical Code*. Electrical equipment located within 18 inches (457 mm) of floor level shall be approved for Class I, Division 2, hazardous locations. Metallic parts of drying apparatus shall be electrically bonded and grounded. During spraying operations, portable drying apparatus and electrical connections and wiring thereto shall not be located within spray booths, spray rooms or other areas where spray residue would be deposited thereon.

2404.6.2 Illumination. Where spraying spaces, spray rooms or spray booths are illuminated through glass panels or other transparent materials, only fixed luminaires shall be utilized as a source of illumination.

2404.6.2.1 Glass panels. Panels for luminaires or for observation shall be of heat-treated glass, wired glass or hammered wire glass and shall be sealed to confine vapors, mists, residues, dusts and deposits to the flammable vapor area. Panels for luminaires shall be separated from the luminaire to prevent the surface temperature of the panel from exceeding 200°F (93°C).

2404.6.2.2 Exterior luminaires. Luminaires attached to the walls or ceilings of a flammable vapor area, but outside of any classified area and separated from the flammable vapor areas by vapor-tight glass panels, shall be suitable for use in ordinary hazard locations. Such luminaires shall be serviced from outside the flammable vapor areas.

2404.6.2.3 Integral luminaires. Luminaires that are an integral part of the walls or ceiling of a flammable vapor area are allowed to be separated from the flammable vapor area by glass panels that are an integral part of the luminaire. Such luminaires shall be listed for use in Class I, Division 2, or Class II, Division 2, locations, whichever is applicable, and shall be suitable for accumulations of deposits of combustible residues. Such luminaires are allowed to be serviced from inside the flammable vapor area.

2404.6.2.4 Portable electric lamps. Portable electric lamps shall not be used in flammable vapor areas during spraying operations. Portable electric lamps used during cleaning or repairing operations shall be of a type approved for hazardous locations.

2404.7 Ventilation. Mechanical ventilation of flammable vapor areas shall be provided in accordance with Section 502.7 of the *California Mechanical Code*.

2404.7.1 Operation. Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying equipment shall be interlocked with the ventilation of the flammable vapor areas such that spraying operations cannot be conducted unless the ventilation system is in operation.

2404.7.2 Recirculation. Air exhausted from spraying operations shall not be recirculated.

Exceptions:

1. Air exhausted from spraying operations is allowed to be recirculated as makeup air for unmanned spray operations, provided that all of the following conditions exist:

1.1. The solid particulate has been removed.
1.2. The vapor concentration is less than 25 percent of the LFL.

1.3. Approved equipment is used to monitor the vapor concentration.

1.4. When the vapor concentration exceeds 25 percent of the LFL, both of the following shall occur:

1.4.1. An alarm shall sound.

1.4.2. Spray operations shall automatically shut down.

1.5. In the event of shutdown of the vapor concentration monitor, 100 percent of the air volume specified in the *California Mechanical Code* is automatically exhausted.

2. Air exhausted from spraying operations is allowed to be recirculated as makeup air to manned spraying operations where all of the conditions provided in Exception 1 are included in the installation and documents have been prepared to show that the installation does not pose a life safety hazard to personnel inside the spray booth, spraying space or spray room.

2404.7.3 Air velocity. The ventilation system shall be designed, installed and maintained so that the flammable contaminants are diluted in noncontaminated air to maintain concentrations in the exhaust airflow below 25 percent of the contaminant's lower flammable limit (LFL). In addition, the spray booth shall be provided with mechanical ventilation so that the average air velocity through openings is in accordance with Sections 2404.7.3.1 and 2404.7.3.2.

2404.7.3.1 Open-face or open-front spray booth. For spray application operations conducted in an open-face or open-front spray booth, the ventilation system shall be designed, installed and maintained so that the average air velocity into the spray booth through all openings is not less than 100 feet per minute (0.51 m/s).

Exception: For fixed or automated electrostatic spray application equipment, the average air velocity into the spray booth through all openings shall be not less than 50 feet per minute (0.25 m/s).

2404.7.3.2 Enclosed spray booth or spray room with openings for product conveyance. For spray application operations conducted in an enclosed spray booth or

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spray room with openings for product conveyance, the ventilation system shall be designed, installed and maintained so that the average air velocity into the spray booth through openings is not less than 100 feet per minute (0.51 m/s).

Exceptions:

1. For fixed or automated electrostatic spray application equipment, the average air velocity into the spray booth through all openings shall be not less than 50 feet per minute (0.25 m/s).
2. Where methods are used to reduce cross drafts that can draw vapors and overspray through openings from the spray booth or spray room, the average air velocity into the spray booth or spray room shall be that necessary to capture and confine vapors and overspray to the spray booth or spray room.

2404.7.4 Ventilation obstruction. Articles being sprayed shall be positioned in a manner that does not obstruct collection of overspray.

2404.7.5 Independent ducts. Each spray booth and spray room shall have an independent exhaust duct system discharging to the outside.

Exceptions:

1. Multiple spray booths having a combined frontal area of 18 square feet (1.67 m²) or less are allowed to have a common exhaust where identical spray finishing material is used in each booth. If more than one fan serves one booth, fans shall be interconnected such that all fans will operate simultaneously.
2. Where treatment of exhaust is necessary for air pollution control or for energy conservation, ducts shall be allowed to be manifolded if all of the following conditions are met:
 - 2.1. The sprayed materials used are compatible and will not react or cause ignition of the residue in the ducts.
 - 2.2. Nitrocellulose-based finishing material shall not be used.
 - 2.3. A filtering system shall be provided to reduce the amount of overspray carried into the duct manifold.
 - 2.4. Automatic sprinkler protection shall be provided at the junction of each booth exhaust with the manifold, in addition to the protection required by this chapter.

2404.7.6 Termination point. The termination point for exhaust ducts discharging to the atmosphere shall be not less than the following distances:

1. Ducts conveying explosive or flammable vapors, fumes or dusts: 30 feet (9144 mm) from the lot line; 10 feet (3048 mm) from openings into the building;

6 feet (1829 mm) from exterior walls and roofs; 30 feet (9144 mm) from combustible walls or openings into the building that are in the direction of the exhaust discharge; 10 feet (3048 mm) above adjoining grade.

2. Other product-conveying outlets: 10 feet (3048 mm) from the lot line; 3 feet (914 mm) from exterior walls and roofs; 10 feet (3048 mm) from openings into the building; 10 feet (3048 mm) above adjoining grade.

2404.7.7 Fan motors and belts. Electric motors driving exhaust fans shall not be placed inside booths or ducts. Fan rotating elements shall be nonferrous or nonsparking or the casing shall consist of, or be lined with, such material. Belts shall not enter the duct or booth unless the belt and pulley within the duct are tightly enclosed.

2404.7.8 Filters. Air intake filters that are part of a wall or ceiling assembly shall be listed as Class I or II in accordance with UL 900. Exhaust filters shall be required.

2404.7.8.1 Supports. Supports and holders for filters shall be constructed of noncombustible materials.

2404.7.8.2 Attachment. Overspray collection filters shall be readily removable and able to be accessed for cleaning or replacement.

2404.7.8.3 Maintaining air velocity. Visible gauges, audible alarms or pressure-activated devices shall be installed to indicate or ensure that the required air velocity is maintained.

2404.7.8.4 Filter rolls. Spray booths equipped with a filter roll that is automatically advanced when the air velocity is reduced to less than 100 feet per minute (0.51 m/s) shall be arranged to shut down the spraying operation if the filter roll fails to advance automatically.

2404.7.8.5 Filter disposal. Discarded filter pads shall be immediately removed to a safe, detached location or placed in a noncombustible container with a tight-fitting lid and disposed of properly.

2404.7.8.6 Spontaneous ignition. Spray booths using dry filters shall not be used for spraying materials that are highly susceptible to spontaneous heating and ignition. Filters shall be changed prior to spraying materials that could react with other materials previously collected. An example of a potentially reactive combination includes lacquer when combined with varnishes, stains or primers.

2404.7.8.7 Waterwash spray booths. Waterwash spray booths shall be of an approved design so as to prevent excessive accumulation of deposits in ducts and residue at duct outlets. Such booths shall be arranged so that air and overspray are drawn through a continuously flowing water curtain before entering an exhaust duct to the building exterior.

2404.8 Interlocks. Interlocks for spray application finishes shall be in accordance with Sections 2404.8.1 through 2404.8.2.

2404.8.1 Automated spray application operations.

Where protecting automated spray application operations, automatic fire-extinguishing systems shall be equipped with an approved interlock feature that will, upon discharge of the system, automatically stop the spraying operations and workpiece conveyors into and out of the flammable vapor areas. Where the building is equipped with a fire alarm system, discharge of the automatic fire-extinguishing system shall also activate the building alarm notification appliances.

2404.8.1.1 Alarm station. A manual fire alarm and emergency system shutdown station shall be installed to serve each flammable vapor area. When activated, the station shall accomplish the functions indicated in Section 2404.8.1.

2404.8.1.2 Alarm station location. Not less than one manual fire alarm and emergency system shutdown station shall be provided with ready access for operating personnel. Where access to this station is likely to involve exposure to danger, an additional station shall be located adjacent to an exit from the area.

2404.8.2 Ventilation interlock prohibited. Air makeup and flammable vapor area exhaust systems shall not be interlocked with the fire alarm system and shall remain in operation during a fire alarm condition.

Exception: Where the type of fire-extinguishing system used requires such ventilation to be discontinued, air makeup and exhaust systems shall shut down and dampers shall close.

2404.9 Limited spraying spaces. Limited spraying spaces shall comply with Sections 2404.9.1 through 2404.9.4.

2404.9.1 Job size. The aggregate surface area to be sprayed shall not exceed 9 square feet (0.84 m²).

2404.9.2 Frequency. Spraying operations shall not be of a continuous nature.

2404.9.3 Ventilation. Positive mechanical ventilation providing not fewer than six complete air changes per hour shall be installed. Such system shall meet the requirements of this code for handling flammable vapor areas. Explosion venting is not required.

2404.9.4 Electrical wiring. Electrical wiring within 10 feet (3048 mm) of the floor and 20 feet (6096 mm) horizontally of the limited spraying space shall be designed for Class I, Division 2 locations in accordance with *the California Electrical Code*.

SECTION 2405 DIPPING OPERATIONS

2405.1 General. Dip-tank operations shall comply with the requirements of Section 2403 and Sections 2405.2 through 2405.11.

2405.2 Location of dip-tank operations. Dip-tank operations conducted in buildings used for Group A, I or R occupancies shall be located in a room designed for that purpose, equipped with an approved automatic sprinkler

system and separated vertically and horizontally from other areas in accordance with the *California Building Code*.

2405.3 Construction of dip tanks. Dip tanks shall be constructed in accordance with Sections 2405.3.1 through 2405.3.4.3 and NFPA 34. Dip tanks, including drain boards, shall be constructed of noncombustible material and their supports shall be of heavy metal, reinforced concrete or masonry.

2405.3.1 Overflow. Dip tanks greater than 150 gallons (568 L) in capacity or 10 square feet (0.93 m²) in liquid surface area shall be equipped with a trapped overflow pipe leading to an approved location outside the building. The bottom of the overflow connection shall be not less than 6 inches (152 mm) below the top of the tank.

2405.3.2 Bottom drains. Dip tanks greater than 500 gallons (1893 L) in liquid capacity shall be equipped with bottom drains that are arranged to automatically and manually drain the tank quickly in the event of a fire unless the viscosity of the liquid at normal atmospheric temperature makes this impractical. Access to the manual operation shall be from a safe location. Where gravity flow is not practicable, automatic pumps shall be provided. Such drains shall be trapped and discharged to a closed, vented salvage tank or to an approved outside location.

Exception: Dip tanks containing Class IIIB combustible liquids where the liquids are not heated above room temperature and the process area is protected by automatic sprinklers.

2405.3.3 Dipping liquid temperature control. Protection against the accumulation of vapors, self-ignition and excessively high temperatures shall be provided for dipping liquids that are heated directly or heated by the surfaces of the object being dipped.

2405.3.4 Dip-tank covers. Dip-tank covers allowed by Section 2405.4.1 shall be capable of manual operation and shall be automatic closing by approved automatic-closing devices designed to operate in the event of a fire.

2405.3.4.1 Construction. Covers shall be constructed of noncombustible material or be of a tin-clad type with enclosing metal applied with locked joints.

2405.3.4.2 Supports. Chain or wire rope shall be utilized for cover supports or operating mechanisms.

2405.3.4.3 Closed covers. Covers shall be kept closed when tanks are not in use.

2405.4 Fire protection. Dip-tank operations shall be protected in accordance with Sections 2405.4.1 through 2405.4.2.

2405.4.1 Fixed fire-extinguishing equipment. An approved automatic fire-extinguishing system or dip-tank cover in accordance with Section 2405.3.4 shall be provided for the following dip tanks:

1. Dip tanks less than 150 gallons (568 L) in capacity or 10 square feet (0.93 m²) in liquid surface area.

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2. Dip tanks containing a liquid with a flash point below 110°F (43°C) used in such manner that the liquid temperature could equal or be greater than its flash point from artificial or natural causes, and having both a capacity of more than 10 gallons (37.9 L) and a liquid surface area of more than 4 square feet (0.37 m²).

2405.4.1.1 Fire-extinguishing system. An approved automatic fire-extinguishing system shall be provided for dip tanks with a 150-gallon (568 L) or more capacity or 10 square feet (0.93 m²) or larger in a liquid surface area. Fire-extinguishing system design shall be in accordance with NFPA 34.

2405.4.2 Portable fire extinguishers. Areas in the vicinity of dip tanks shall be provided with portable fire extinguishers complying with Section 906 and suitable for flammable and combustible liquid fires as specified for extra (high) hazard occupancies.

2405.5 Housekeeping, maintenance and storage of hazardous materials. Housekeeping, maintenance, storage and use of hazardous materials shall be in accordance with Sections 2403.3 and 2403.4.

2405.6 Sources of ignition. Control of sources of ignition shall be in accordance with Section 2403.2.

2405.7 Ventilation of flammable vapor areas. Flammable vapor areas shall be provided with mechanical ventilation adequate to prevent the dangerous accumulation of vapors. Required ventilation systems shall be arranged such that the failure of any ventilating fan shall automatically stop the dipping conveyor system.

2405.8 Conveyor interlock. Dip tanks utilizing a conveyor system shall be arranged such that in the event of a fire, the conveyor system shall automatically cease motion and the required tank bottom drains shall open.

2405.9 Hardening and tempering tanks. Hardening and tempering tanks shall comply with Sections 2405.3 through 2405.3.3, 2405.9.4 and 2405.8, but shall be exempt from other provisions of Section 2405.

2405.9.1 Location. Tanks shall be located as far as practical from furnaces and shall not be located on or near combustible floors.

2405.9.2 Hoods. Tanks shall be provided with a noncombustible hood and vent or other approved venting means, terminating outside of the structure to serve as a vent in case of a fire. Such vent ducts shall be treated as flues and proper clearances shall be maintained from combustible materials.

2405.9.3 Alarms. Tanks shall be equipped with a high-temperature limit switch arranged to sound an alarm when the temperature of the quenching medium reaches 50°F (10°C) below the flash point.

2405.9.4 Fire protection. Hardening and tempering tanks greater than 500 gallons (1893 L) in capacity or 25 square feet (2.3 m²) in liquid surface area shall be protected by an approved automatic fire-extinguishing system complying with Chapter 9.

2405.9.5 Use of air pressure. Air under pressure shall not be used to fill or agitate oil in tanks.

2405.10 Flow-coating operations. Flow-coating operations shall comply with the requirements for dip tanks. The area of the sump and any areas on which paint flows shall be considered to be the area of a dip tank.

2405.10.1 Paint supply. Paint shall be supplied by a gravity tank not exceeding 10 gallons (38 L) in capacity or by direct low-pressure pumps arranged to shut down automatically in case of a fire by means of approved heat-actuated devices.

2405.11 Roll-coating operations. Roll-coating operations shall comply with Section 2405.10. In roll-coating operations utilizing flammable or combustible liquids, sparks from static electricity shall be prevented by electrically bonding and grounding all metallic rotating and other parts of machinery and equipment and by the installation of static collectors, or by maintaining a conductive atmosphere such as a high relative humidity.

SECTION 2406 POWDER COATING

2406.1 General. Operations using finely ground particles of protective finishing material applied in dry powder form by a fluidized bed, an electrostatic fluidized bed, powder spray guns or electrostatic powder spray guns shall comply with Sections 2406.2 through 2406.7. In addition, Section 2407 shall apply to fixed electrostatic equipment used in powder coating operations.

2406.2 Location. Powder coating operations shall be conducted in enclosed powder coating rooms, enclosed powder coating facilities that are ventilated or ventilated spray booths.

2406.3 Construction of powder coating rooms and booths. Powder coating rooms shall be constructed of noncombustible materials. Spray booths shall be constructed in accordance with Section 2404.3.3.

Exception: Listed spray-booth assemblies that are constructed of other materials shall be allowed.

2406.4 Fire protection. Areas used for powder coating shall be protected by an approved automatic fire-extinguishing system complying with Chapter 9.

2406.4.1 Additional protection for fixed systems. Automated powder application equipment shall be protected by the installation of an approved, supervised flame detection apparatus that shall react to the presence of flame within 0.5 second and shall accomplish all of the following:

1. Shutting down of energy supplies (electrical and compressed air) to conveyor, ventilation, application, transfer and powder collection equipment.
2. Closing of segregation dampers in associated ductwork to interrupt airflow from application equipment to powder collectors.
3. Activation of an alarm that is audible throughout the powder coating room or booth.

2406.4.2 Fire extinguishers. Portable fire extinguishers complying with Section 906 shall be provided for areas used for powder coating in accordance with the requirements for an extra-hazard occupancy.

2406.5 Operation and maintenance. Powder coating areas shall be kept free from the accumulation of powder coating dusts, including horizontal surfaces such as ledges, beams, pipes, hoods, booths and floors.

2406.5.1 Cleaning. Surfaces shall be cleaned in such a manner so as to avoid scattering dusts to other places or creating dust clouds. Vacuum sweeping equipment shall be of a type approved for use in hazardous locations.

2406.6 Sources of ignition. Control of sources of ignition shall be in accordance with Section 2403.2 and Sections 2406.6.1 through 2406.6.4.

2406.6.1 Drying, curing and fusion equipment. Drying, curing and fusion equipment shall comply with Chapter 30.

2406.6.2 Spark-producing metals. Iron or spark-producing metals shall be prevented from being introduced into the powders being applied by magnetic separators, filter-type separators or by other approved means.

2406.6.3 Preheated parts. When parts are heated prior to coating, the temperature of the parts shall not exceed the ignition temperature of the powder to be used.

2406.6.4 Grounding and bonding. Precautions shall be taken to minimize the possibility of ignition by static electrical sparks through static bonding and grounding, where possible, of powder transport, application and recovery equipment.

2406.7 Ventilation. Exhaust ventilation shall be sufficient to maintain the atmosphere below one-half the minimum explosive concentration for the material being applied. Nondeposited, air-suspended powders shall be removed through exhaust ducts to the powder recovery system.

SECTION 2407 ELECTROSTATIC APPARATUS

2407.1 General. Electrostatic apparatus and devices used in connection with paint-spraying and paint-detearing operations shall be of an approved type.

2407.2 Location and clear space. A space of not less than twice the sparking distance shall be maintained between goods being painted or deteared and electrodes, electrostatic atomizing heads or conductors. *The equipment manufacturer's operating instructions shall be consulted to determine the sparking distance of the equipment involved.* A sign stating the sparking distance shall be conspicuously posted near the assembly.

Exception: Portable electrostatic paint-spraying apparatus listed for use in Class I, Division 1, locations.

2407.3 Construction of equipment. Electrodes and electrostatic atomizing heads shall be of approved construction, rigidly supported in permanent locations and effectively insu-

lated from ground. Insulators shall be nonporous and noncombustible.

Exception: Portable electrostatic paint-spraying apparatus listed for use in Class I, Division 1, locations.

2407.3.1 Barriers. Booths, fencing, railings or guards shall be placed about the equipment such that either by their location or character, or both, isolation of the process is maintained from plant storage and personnel. Railings, fencing and guards shall be of conductive material, adequately grounded, and not less than 5 feet (1524 mm) from processing equipment.

Exception: Portable electrostatic paint-spraying apparatus listed for use in Class I, Division 1, locations.

2407.4 Fire protection. Areas used for electrostatic spray finishing with fixed equipment shall be protected with an approved automatic fire-extinguishing system complying with Chapter 9 and Section 2407.4.1.

2407.4.1 Protection for automated liquid electrostatic spray application equipment. Automated liquid electrostatic spray application equipment shall be protected by the installation of an approved, supervised flame detection apparatus that shall, in the event of ignition, react to the presence of flame within 0.5 second and shall accomplish all of the following:

1. Activation of a local alarm in the vicinity of the spraying operation and activation of the building alarm system, if such a system is provided.
2. Shutting down of the coating material delivery system.
3. Termination of all spray application operations.
4. Stopping of conveyors into and out of the flammable vapor areas.
5. Disconnection of power to the high-voltage elements in the flammable vapor areas and disconnection of power to the system.

2407.5 Housekeeping, maintenance and storage of hazardous materials. Housekeeping, maintenance, storage and use of hazardous materials shall be in accordance with Sections 2403.3, 2403.4 and Sections 2407.5.1 and 2407.5.2.

2407.5.1 Maintenance. Insulators shall be kept clean and dry. Drip plates and screens subject to paint deposits shall be removable and taken to a safe place for cleaning. Grounds and bonding means for the paint-spraying apparatus and all associated equipment shall be periodically cleaned and maintained free of overspray.

2407.5.2 Signs. Signs shall be posted to provide the following information:

1. Designate the process zone as dangerous with respect to fire and accident.
2. Identify the grounding requirements for all electrically conductive objects in the flammable vapor area, including persons.
3. Restrict access to qualified personnel only.

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2407.6 Sources of ignition. Transformers, power packs, control apparatus and all other electrical portions of the equipment, except high-voltage grids and electrostatic atomizing heads and connections, shall be located outside of the flammable vapor areas or shall comply with Section 2403.2.

2407.7 Ventilation. The flammable vapor area shall be ventilated in accordance with Section 2404.7.

2407.8 Emergency shutdown. Electrostatic apparatus shall be equipped with automatic controls operating without time delay to disconnect the power supply to the high-voltage transformer and signal the operator under any of the following conditions:

1. Stoppage of ventilating fans or failure of ventilating equipment from any cause.
2. Stoppage of the conveyor carrying articles past the high-voltage grid.
3. Occurrence of a ground or an imminent ground at any point of the high-voltage system.
4. Reduction of clearance below that required in Section 2407.2.

2407.9 Ventilation interlock. Hand electrostatic equipment shall be interlocked with the ventilation system for the spraying area so that the equipment cannot be operated unless the ventilating system is in operation.

SECTION 2408 ORGANIC PEROXIDES AND DUAL-COMPONENT COATINGS

2408.1 General. Spraying operations involving the use of organic peroxides and other dual-component coatings shall be in accordance with the requirements of Section 2403 and Sections 2408.2 through 2408.5.

2408.2 Use of organic peroxide coatings. Spraying operations involving the use of organic peroxides and other dual-component coatings shall be conducted in approved sprinklered spray booths complying with Section 2404.3.3.

2408.3 Equipment. Spray guns and related handling equipment used with organic peroxides shall be of a type manufactured for such use.

2408.3.1 Pressure tanks. Separate pressure vessels and inserts specifically for the application shall be used for the resin and for the organic peroxide, and shall not be interchanged. Organic peroxide pressure tank inserts shall be constructed of stainless steel or polyethylene.

2408.4 Housekeeping, maintenance, storage and use of hazardous materials. Housekeeping, maintenance, storage and use of hazardous materials shall be in accordance with Sections 2403.3 and 2403.4 and Sections 2408.4.1 through 2408.4.7.

2408.4.1 Contamination prevention. Organic peroxide initiators shall not be contaminated with foreign substances.

2408.4.2 Spilled material. Spilled organic peroxides shall be promptly removed and any residue thereof promptly

eliminated. Spilled material absorbed by using a noncombustible absorbent shall be promptly disposed of in accordance with the manufacturer's recommendation.

2408.4.3 Residue control. Materials shall not be contaminated by dusts and overspray residues resulting from the sanding or spraying of finishing materials containing organic peroxides.

2408.4.4 Handling. Handling of organic peroxides shall be conducted in a manner that avoids shock and friction that produces decomposition and violent reaction hazards.

2408.4.5 Mixing. Organic peroxides shall not be mixed directly with accelerators or promoters.

2408.4.6 Personnel qualifications. Personnel working with organic peroxides and dual-component coatings shall be specifically trained to work with these materials.

2408.4.7 Storage. The storage of organic peroxides shall comply with Chapter 62.

2408.5 Sources of ignition. Only nonsparking tools shall be used in areas where organic peroxides are stored, mixed or applied.

SECTION 2409 INDOOR MANUFACTURING OF REINFORCED PLASTICS

2409.1 General. Indoor manufacturing processes involving spray or hand application of reinforced plastics and using more than 5 gallons (19 L) of resin in a 24-hour period shall be in accordance with Sections 2409.2 through 2409.6.1.

2409.2 Resin application equipment. Equipment used for spray application of resin shall be installed and used in accordance with Section 2408 and Sections 2409.3 through 2409.6.1.

2409.3 Fire protection. Resin application areas shall be protected by an automatic sprinkler system. The sprinkler system design shall be not less than that required for Ordinary Hazard, Group 2, with a minimum design area of 3,000 square feet (279 m²). Where the materials or storage arrangements are required by other regulations to be provided with a higher level of sprinkler system protection, the higher level of sprinkler system protection shall be provided.

2409.4 Housekeeping, maintenance, storage and use of hazardous materials. Housekeeping, maintenance, storage and use of hazardous materials shall be in accordance with Sections 2403.3 and 2403.4 and Sections 2409.4.1 through 2409.4.3.

2409.4.1 Handling of excess catalyzed resin. A noncombustible, open-top container shall be provided for disposal of excess catalyzed resin. Excess catalyzed resin shall be drained into the container while still in the liquid state. Enough water shall be provided in the container to maintain a minimum 2-inch (51 mm) water layer over the contained resin.

2409.4.2 Control of overchop. In areas where chopper guns are used, exposed wall and floor surfaces shall be covered with paper, polyethylene film or other approved

material to allow for removal of overchop. Overchop shall be allowed to cure for not less than 4 hours prior to removal.

2409.4.2.1 Disposal. Following removal, used wall and floor covering materials required by Section 2409.4.2 shall be placed in a noncombustible container and removed from the facility.

2409.4.3 Storage and use of hazardous materials. Storage and use of organic peroxides shall be in accordance with Section 2408 and Chapter 62. Storage and use of flammable and combustible liquids shall be in accordance with Chapter 57. Storage and use of unstable (reactive) materials shall be in accordance with Chapter 66.

2409.5 Sources of ignition in resin application areas. Sources of ignition in resin application areas shall comply with Section 2403.2.

2409.6 Ventilation. Mechanical ventilation shall be provided throughout resin application areas in accordance with Section 2404.7. The ventilation rate shall be adequate to maintain the concentration of flammable vapors in the resin application area at or below 25 percent of the LFL.

Exception: Mechanical ventilation is not required for buildings that have 75 percent of the perimeter unenclosed.

2409.6.1 Local ventilation. Local ventilation shall be provided inside of workpieces where personnel will be under or inside of the workpiece.

SECTION 2410

FLOOR SURFACING AND FINISHING OPERATIONS

2410.1 Scope. Floor surfacing and finishing operations exceeding 350 square feet (33 m²) and using Class I or II liquids shall comply with Sections 2410.2 through 2410.5.

2410.2 Mechanical system operation. Heating, ventilation and air-conditioning systems shall not be operated during resurfacing or refinishing operations or within 4 hours of the application of flammable or combustible liquids.

2410.3 Business operation. Floor surfacing and finishing operations shall not be conducted while an establishment is open to the public.

2410.4 Ignition sources. The power shall be shut down to all electrical sources of ignition within the flammable vapor area, unless those devices are classified for use in Class I, Division 1, hazardous locations.

2410.5 Ventilation. To prevent the accumulation of flammable vapors, mechanical ventilation at a minimum rate of 1 cubic foot per minute per square foot [0.00508 m³ / (s × m²)] of area being finished shall be provided. Such exhaust shall be by approved temporary or portable means. Vapors shall be exhausted to the exterior of the building.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 25 – FRUIT AND CROP RIPENING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 25

FRUIT AND CROP RIPENING

User note:

About this chapter: Chapter 25 provides guidance that is intended to reduce the likelihood of explosions resulting from improper use or handling of ethylene gas used for crop ripening and coloring processes. This is accomplished by regulating ethylene gas generation, regulating storage and distribution systems and controlling ignition sources. Design and construction of facilities for fruit and crop ripening are regulated by the California Building Code to reduce the impact of potential accidents to people and buildings.

SECTION 2501 GENERAL

2501.1 Scope. Ripening processes where ethylene gas is introduced into a room to promote the ripening of fruits, vegetables and other crops shall comply with this chapter.

Exception: Mixtures of ethylene and one or more inert gases in concentrations that prevent the gas from reaching greater than 25 percent of the lower explosive limit (LEL) when released to the atmosphere.

2501.2 Permits. Permits shall be required as set forth in Section 105.5.

2501.3 Ethylene generators. Approved ethylene generators shall be operated and maintained in accordance with Section 2506.

SECTION 2502 DEFINITIONS

2502.1 Terms defined in Chapter 2. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

SECTION 2503 ETHYLENE GAS

2503.1 Location. Ethylene gas shall be discharged only into approved rooms or enclosures designed and constructed for this purpose.

2503.2 Dispensing. Valves controlling discharge of ethylene shall provide positive and fail-closed control of flow and shall be set to limit the concentration of gas in air below 1,000 parts per million (ppm).

SECTION 2504 SOURCES OF IGNITION

2504.1 Ignition prevention. Sources of ignition shall be controlled or protected in accordance with this section and Chapter 3.

2504.2 Electrical wiring and equipment. Electrical wiring and equipment, including luminaires, shall be approved for use in Class I, Division 2, Group C hazardous (classified) locations.

2504.3 Static electricity. Containers, piping and equipment used to dispense ethylene shall be bonded and grounded to prevent the discharge of static sparks or arcs.

2504.4 Lighting. Lighting shall be by approved electric lamps or luminaires only.

2504.5 Heating. Heating shall be by indirect means utilizing low-pressure steam, hot water or warm air.

Exception: Electric or fuel-fired heaters approved for use in hazardous (classified) locations and that are installed and operated in accordance with the applicable provisions of the *California Electrical Code*, the *California Mechanical Code* or the *California Plumbing Code*.

SECTION 2505 COMBUSTIBLE WASTE

2505.1 Housekeeping. Empty boxes, cartons, pallets and other combustible waste shall be removed from ripening rooms or enclosures and disposed of at regular intervals in accordance with Chapter 3.

SECTION 2506 ETHYLENE GENERATORS

2506.1 Ethylene generators. Ethylene generators shall be listed and labeled by an approved testing laboratory, approved by the fire code official and used only in approved rooms in accordance with the ethylene generator manufacturer's instructions. The listing evaluation shall include documentation that the concentration of ethylene gas does not exceed 25 percent of the lower explosive limit (LEL).

2506.2 Ethylene generator rooms. Ethylene generators shall be used in rooms having a volume of not less than 1,000 cubic feet (28 m³). Rooms shall have air circulation to ensure even distribution of ethylene gas and shall be free from sparks, open flames or other ignition sources.

SECTION 2507 WARNING SIGNS

2507.1 Where required. Approved warning signs indicating the danger involved and necessary precautions shall be posted on all doors and entrances to the premises.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 26 – FUMIGATION AND INSECTICIDAL FOGGING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 26

FUMIGATION AND INSECTICIDAL FOGGING

User note:

About this chapter: Chapter 26 regulates fumigation and insecticidal fogging operations that use toxic pesticide chemicals to kill insects, rodents and other vermin. Fumigants and insecticidal fogging agents pose little hazard if properly applied; however, the inherent toxicity of all these agents and the potential flammability of some make special precautions necessary when they are used. Requirements of this chapter are intended to protect both the public and fire fighters from hazards associated with these products.

SECTION 2601 GENERAL

2601.1 Scope. Fumigation and insecticidal fogging operations within buildings, structures and spaces shall comply with this chapter.

2601.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 2602 DEFINITIONS

2602.1 Definitions. The following terms are defined in Chapter 2:

FUMIGANT.

FUMIGATION.

INSECTICIDAL FOGGING.

SECTION 2603 FIRE SAFETY REQUIREMENTS

2603.1 General. Buildings, structures and spaces in which fumigation and insecticidal fogging operations are conducted shall comply with the fire protection and safety requirements of Sections 2603.2 through 2603.7.

2603.2 Sources of ignition. Fires, open flames and similar sources of ignition shall be eliminated from the space under fumigation or insecticidal fogging. Heating, where needed, shall be of an *approved* type.

2603.2.1 Electricity. Electricity in any part of the building, structure or space where operation of switches or electrical devices, equipment or systems could serve as a source of ignition shall be shut off.

Exception: Circulating fans that have been specifically designed for utilization in hazardous atmospheres and installed in accordance with *the California Electrical Code*.

2603.2.2 Electronic devices. Electronic devices, including portable equipment and cellular phones, shall be shut off. Telephone lines shall be disconnected from telephones.

2603.2.3 Duration. Sources of ignition shall be shut off during the fumigation activity and remain shut off until the ventilation required in Section 2603.6 is completed.

2603.3 Notification. The fire code official and fire chief shall be notified in writing not less than 48 hours before the building, structure or space is to be closed in connection with the utilization of any toxic or flammable fumigant. Notification shall give the location of the enclosed space to be fumigated or fogged, the occupancy, the fumigants or insecticides to be utilized, the person or persons responsible for the operation, and the date and time at which the operation will begin. Written notice of any fumigation or insecticidal fogging operation shall be given to all affected occupants of the building, structure or space in which such operations are to be conducted with sufficient advance notice to allow the occupants to evacuate the building, structure or space. Such notice shall inform the occupants as to the purposes, anticipated duration and hazards associated with the fumigation or insecticidal fogging operation.

2603.3.1 Warning signs. Approved warning signs indicating the danger, type of chemical involved and necessary precautions shall be posted on all doors and entrances to the affected building, structure or space and on all gangplanks and ladders from the deck, pier or land to a ship. Such notices shall be printed in red ink on a white background. Letters in the headlines shall be not less than 2 inches (51 mm) in height and shall state the date and time of the operation, the name and address of the person, the name of the operator in charge, and a warning stating that the affected building, structure or space shall be vacated not less than 1 hour before the operation begins and shall not be reentered until the danger signs have been removed by the proper authorities.

2603.3.2 Breathing apparatus. Persons engaged in the business of fumigation or insecticidal fogging shall maintain and have available approved protective breathing apparatus.

2603.3.3 Watch personnel. During the period fumigation is in progress, except where fumigation is conducted in a gastight vault or tank, a responsible watchperson shall remain on duty at the entrance or entrances to the enclosed fumigated space until after the fumigation is completed

FUMIGATION AND INSECTICIDAL FOGGING

and the building, structure or space is properly ventilated and safe for occupancy. Sufficient watchers shall be provided to prevent persons from entering the enclosed space under fumigation without being observed.

2603.3.4 Evacuation during fumigation. Occupants of the building, structure or space to be fumigated, except the personnel conducting the fumigation, shall be evacuated from such building, structure or space prior to commencing fumigation operations.

2603.3.5 Evacuation during insecticidal fogging operations. Occupants in the building, structure or space to be fogged, except the personnel conducting the insecticidal fogging operations, shall be evacuated from such building, structure or space prior to commencing fogging operations.

2603.4 Insecticidal fogging liquids. Insecticidal fogging liquids with a flash point below 100°F (38°C) shall not be utilized.

2603.5 Sealing of buildings, structures and spaces. Paper and other similar materials that do not meet the flame propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701 shall not be used to wrap or cover a building, structure or space in excess of that required for the sealing of cracks, casements and similar openings.

2603.5.1 Maintenance of openings. All openings to the building, structure or space to be fumigated or fogged shall be kept securely closed during such operation.

2603.6 Venting and cleanup. At the end of the exposure period, fumigators shall safely and properly ventilate the premises and contents; properly dispose of fumigant containers, residues, debris and other materials used for such fumigation; and clear obstructions from gas-fired appliance vents.

2603.7 Flammable fumigants restricted. The use of carbon disulfide and hydrogen cyanide shall be restricted to agricultural fumigation.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 27 – SEMICONDUCTOR FABRICATION FACILITIES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 27

SEMICONDUCTOR FABRICATION FACILITIES

User note:

***About this chapter:** Chapter 27 provides requirements that are intended to control hazards associated with the manufacture of electrical circuit boards or microchips, commonly called semiconductors. Though the finished product possesses no unusual hazards, materials commonly associated with semiconductor manufacturing are often quite hazardous and include flammable liquids, pyrophoric and flammable gases, toxic substances and corrosives. The requirements of this chapter are concerned with both life safety and property protection. However, the fire code official should recognize that the risk of extraordinary property damages is far more common than the risk of personal injuries from fire. Section 415.11 of the California Building Code also addresses these facilities that are classified as Group H-5 occupancies.*

SECTION 2701 GENERAL

2701.1 Scope. Semiconductor fabrication facilities and comparable research and development areas classified as Group H-5 shall comply with this chapter and the *California Building Code*. The use, storage and handling of hazardous materials in Group H-5 shall comply with this chapter, other applicable provisions of this code and the *California Building Code*.

2701.2 Application. The requirements set forth in this chapter are requirements specific only to Group H-5 and shall be applied as exceptions or additions to applicable requirements set forth elsewhere in this code.

2701.3 Multiple hazards. Where a material poses multiple hazards, all hazards shall be addressed in accordance with Section 5001.1.

2701.4 Existing buildings and existing fabrication areas. Existing buildings and existing fabrication areas shall comply with this chapter, except that transportation and handling of HPM in corridors and enclosures for stairways and ramps shall be allowed where in compliance with Section 2705.3.2 and the *California Building Code*.

2701.5 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 2702 DEFINITIONS

2702.1 Definitions. The following terms are defined in Chapter 2:

EMERGENCY CONTROL STATION.

FABRICATION AREA.

GAS DETECTION SYSTEM.

HAZARDOUS PRODUCTION MATERIAL (HPM).

HPM.

HPM ROOM.

PASS-THROUGH.

SEMICONDUCTOR FABRICATION FACILITY.

SERVICE CORRIDOR.

TOOL. WORKSTATION.

SECTION 2703 GENERAL SAFETY PROVISIONS

2703.1 Emergency control station. An emergency control station shall be provided in accordance with Sections 2703.1.1 through 2703.1.3.

2703.1.1 Location. The emergency control station shall be located on the premises at an approved location outside the fabrication area.

2703.1.2 Staffing. Trained personnel shall continuously staff the emergency control station.

2703.1.3 Signals. The emergency control station shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. Automatic sprinkler system alarm and monitoring systems.
2. Manual fire alarm systems.
3. Emergency alarm systems.
4. Gas detection systems.
5. Smoke detection systems.
6. Emergency power systems.
7. Automatic detection and alarm systems for pyrophoric liquids and Class 3 water-reactive liquids required by Section 2705.2.3.4.
8. Exhaust ventilation flow alarm devices for pyrophoric liquids and Class 3 water-reactive liquids and cabinet exhaust ventilation systems required by Section 2705.2.3.4.

2703.2 Systems, equipment and processes. Systems, equipment and processes shall be in accordance with Sections 2703.2.1 through 2703.2.3.2.

2703.2.1 Application. Systems, equipment and processes shall include, but not be limited to, containers, cylinders, tanks, piping, tubing, valves and fittings.

2703.2.2 General requirements. In addition to the requirements in Section 2703.2, systems, equipment and processes shall comply with Section 5003.2, other applicable provisions of this code, the *California Building Code* and the *California Mechanical Code*.

2703.2.3 Additional requirements for HPM supply piping. In addition to the requirements in Section 2703.2, HPM supply piping and tubing for HPM gases and liquids shall comply with this section.

2703.2.3.1 General requirements. The requirements set forth in Section 5003.2.2.2 shall apply to supply piping and tubing for HPM gases and liquids.

2703.2.3.2 Health-hazard ranking 3 or 4 HPM. Supply piping and tubing for HPM gases and liquids having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections located within a ventilation enclosure if the material is a gas, or an approved method of drainage or containment provided for connections if the material is a liquid.

2703.3 Construction requirements. Construction of semiconductor fabrication facilities shall be in accordance with Sections 2703.3.1 through 2703.3.9.

2703.3.1 Fabrication areas. Construction and location of fabrication areas shall comply with the *California Building Code*.

2703.3.2 Pass-throughs in exit access corridors. Pass-throughs in exit access corridors shall be constructed in accordance with the *California Building Code*.

2703.3.3 Liquid storage rooms. Liquid storage rooms shall comply with Chapter 57 and the *California Building Code*.

2703.3.4 HPM rooms. HPM rooms shall comply with the *California Building Code*.

2703.3.5 Gas cabinets. Gas cabinets shall comply with Section 5003.8.6.

2703.3.6 Exhausted enclosures. Exhausted enclosures shall comply with Section 5003.8.5.

2703.3.7 Gas rooms. Gas rooms shall comply with Section 5003.8.4.

2703.3.8 Service corridors. Service corridors shall comply with Section 2705.3 and the *California Building Code*.

2703.3.9 Cabinets containing pyrophoric liquids or water-reactive Class 3 liquids. Cabinets in fabrication areas containing pyrophoric liquids or Class 3 water-reactive liquids in containers or in amounts greater than $\frac{1}{2}$ gallon (2 L) shall comply with Section 2705.2.3.4.

2703.4 Emergency plan. An emergency plan shall be established as set forth in Section 403.6.1.

2703.5 Maintenance of equipment, machinery and processes. Maintenance of equipment, machinery and processes shall comply with Section 5003.2.6.

2703.6 Security of areas. Areas shall be secured in accordance with Section 5003.9.2.

2703.7 Electrical wiring and equipment. Electrical wiring and equipment in HPM facilities shall comply with Sections 2703.7.1 through 2703.7.3.

2703.7.1 Fabrication areas. Electrical wiring and equipment in fabrication areas shall comply with the *California Electrical Code*.

2703.7.2 Workstations. Electrical equipment and devices within 5 feet (1524 mm) of workstations in which flammable or pyrophoric gases or flammable liquids are used shall comply with the *California Electrical Code* for Class I, Division 2 hazardous locations. Workstations shall not be energized without adequate exhaust ventilation in accordance with Section 2703.14.

Exception: Class I, Division 2 hazardous electrical equipment is not required where the air removal from the workstation or dilution will prevent the accumulation of flammable vapors and fumes on a continuous basis.

2703.7.3 Hazardous production material (HPM) rooms, gas rooms and liquid storage rooms. Electrical wiring and equipment in HPM rooms, gas rooms and liquid storage rooms shall comply with the *California Electrical Code*.

2703.8 Corridors and enclosures for stairways and ramps. Hazardous materials shall not be used or stored in corridors or enclosures for stairways and ramps.

2703.9 Service corridors. Hazardous materials shall not be used in an open-system use condition in service corridors.

2703.10 Automatic sprinkler system. An approved automatic sprinkler system shall be provided in accordance with Sections 2703.10.1 through 2703.10.5 and Chapter 9.

2703.10.1 Workstations and tools. The design of the sprinkler system in the area shall take into consideration the spray pattern and the effect on the equipment.

2703.10.1.1 Combustible workstations. A sprinkler head shall be installed within each branch exhaust connection or individual plenums of workstations of combustible construction. The sprinkler head in the exhaust connection or plenum shall be located not more than 2 feet (610 mm) from the point of the duct connection or the connection to the plenum. Where necessary to prevent corrosion, the sprinkler head and connecting piping in the duct shall be coated with approved or listed corrosion-resistant materials. Access to the sprinkler head shall be provided for periodic inspection.

Exceptions:

1. Approved alternative automatic fire-extinguishing systems are allowed. Activation of

such systems shall deactivate the related processing equipment.

2. Process equipment that operates at temperatures exceeding 932°F (500°C) and is provided with automatic shutdown capabilities for hazardous materials.
3. Exhaust ducts 10 inches (254 mm) or less in diameter from flammable gas storage cabinets that are part of a workstation.
4. Ducts listed or approved for use without internal automatic sprinkler protection.

2703.10.1.2 Combustible tools. Where the horizontal surface of a combustible tool is obstructed from ceiling sprinkler discharge, automatic sprinkler protection that covers the horizontal surface of the tool shall be provided.

Exceptions:

1. An automatic gaseous fire-extinguishing local surface application system shall be allowed as an alternative to sprinklers. Gaseous-extinguishing systems shall be actuated by infrared (IR) or ultraviolet/infrared (UV/IR) optical detectors.
2. Tools constructed of materials that are listed as Class 1 or Class 2 in accordance with UL 2360 or approved for use without internal fire-extinguishing system protection.

2703.10.2 Gas cabinets and exhausted enclosures. An approved automatic sprinkler system shall be provided in gas cabinets and exhausted enclosures containing HPM compressed gases.

Exception: Gas cabinets located in an HPM room other than those cabinets containing pyrophoric gases.

2703.10.3 Pass-throughs in existing exit access corridors. Pass-throughs in existing exit access corridors shall be protected by an approved automatic sprinkler system.

2703.10.4 Exhaust ducts for HPM. An approved automatic sprinkler system shall be provided in exhaust ducts conveying gases, vapors, fumes, mists or dusts generated from HPM in accordance with this section and the *California Mechanical Code*.

2703.10.4.1 Metallic and noncombustible nonmetallic exhaust ducts. An approved automatic sprinkler system shall be provided in metallic and noncombustible nonmetallic exhaust ducts where all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable gases, vapors or fumes.

2703.10.4.2 Combustible nonmetallic exhaust ducts. An approved automatic sprinkler system shall be provided in combustible nonmetallic exhaust ducts

where the largest cross-sectional diameter of the duct is equal to or greater than 10 inches (254 mm).

Exceptions:

1. Ducts listed or approved for applications without automatic sprinkler system protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

2703.10.4.3 Exhaust connections and plenums of combustible workstations. Automatic fire-extinguishing system protection for exhaust connections and plenums of combustible workstations shall comply with Section 2703.10.1.1.

2703.10.4.4 Exhaust duct sprinkler system requirements. Automatic sprinklers installed in exhaust duct systems shall be hydraulically designed to provide 0.5 gallon per minute (gpm) (1.9 L/min) over an area derived by multiplying the distance between the sprinklers in a horizontal duct by the width of the duct. Minimum discharge shall be 20 gpm (76 L/min) per sprinkler from the five hydraulically most remote sprinklers.

2703.10.4.4.1 Sprinkler head locations. Automatic sprinklers shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical runs, automatic sprinklers shall be installed at the top and at alternate floor levels.

2703.10.4.4.2 Control valve. A separate indicating control valve shall be provided for sprinklers installed in exhaust ducts.

2703.10.4.4.3 Drainage. Drainage shall be provided to remove sprinkler water discharged in exhaust ducts.

2703.10.4.4.4 Corrosive atmospheres. Where corrosive atmospheres exist, exhaust duct sprinklers and pipe fittings shall be manufactured of corrosion-resistant materials or coated with approved materials.

2703.10.4.4.5 Maintenance and inspection. Access to sprinklers in exhaust ducts shall be provided for periodic inspection and maintenance.

2703.10.5 Sprinkler alarms and supervision. Automatic sprinkler systems shall be electrically supervised and provided with alarms in accordance with Chapter 9. Automatic sprinkler system alarm and supervisory signals shall be transmitted to the emergency control station.

2703.11 Manual fire alarm system. A manual fire alarm system shall be installed throughout buildings containing a Group H-5 occupancy. Activation of the alarm system shall initiate a local alarm and transmit a signal to the emergency control station. Manual fire alarm systems shall be designed and installed in accordance with Section 907.

2703.12 Emergency alarm system. Emergency alarm systems shall be provided in accordance with Sections 2703.12.1 through 2703.12.3, Section 5004.9 and Section 5005.4.4. The maximum allowable quantity per control area

provisions of Section 5004.1 shall not apply to emergency alarm systems required for HPM.

2703.12.1 Where required. Emergency alarm systems shall be provided in the areas indicated in Sections 2703.12.1.1 through 2703.12.1.3.

2703.12.1.1 Service corridors. An approved emergency alarm system shall be provided in service corridors, with not less than one alarm device in the service corridor.

2703.12.1.2 Corridors and interior exit stairways and ramps. Emergency alarms for corridors, interior exit stairways and ramps and exit passageways shall comply with Section 5005.4.4.

2703.12.1.3 Liquid storage rooms, HPM rooms and gas rooms. Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with Section 5004.9.

2703.12.2 Alarm-initiating devices. An approved emergency telephone system, local alarm manual pull stations, or other approved alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

2703.12.3 Alarm signals. Activation of the emergency alarm system shall sound a local alarm and transmit a signal to the emergency control station.

2703.13 Gas detection systems. A gas detection system complying with Section 916 shall be provided for HPM gases where the physiological warning threshold level of the gas is at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases in accordance with Sections 2703.13.1 through 2703.13.2.2.

2703.13.1 Where required. A gas detection system shall be provided in the areas identified in Sections 2703.13.1.1 through 2703.13.1.4.

2703.13.1.1 Fabrication areas. A gas detection system shall be provided in fabrication areas where HPM gas is used in the fabrication area.

2703.13.1.2 HPM rooms. A gas detection system shall be provided in HPM rooms where HPM gas is used in the room.

2703.13.1.3 Gas cabinets, exhausted enclosures and gas rooms. A gas detection system shall be provided in gas cabinets and exhausted enclosures for HPM gas. A gas detection system shall be provided in gas rooms where HPM gases are not located in gas cabinets or exhausted enclosures.

2703.13.1.4 Corridors. Where HPM gases are transported in piping placed within the space defined by the walls of a corridor and the floor or roof above the corridor, a gas detection system shall be provided where piping is located and in the corridor.

Exception: A gas detection system is not required for occasional transverse crossings of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

2703.13.2 Gas detection system operation. The gas detection system shall be capable of monitoring the room, area or equipment in which the HPM gas is located at or below all the following gas concentrations:

1. Immediately dangerous to life and health (IDLH) values where the monitoring point is within an exhausted enclosure, ventilated enclosure or gas cabinet.
2. Permissible exposure limit (PEL) levels where the monitoring point is in an area outside an exhausted enclosure, ventilated enclosure or gas cabinet.
3. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 25 percent of the lower flammable limit (LFL) where the monitoring is within or outside an exhausted enclosure, ventilated enclosure or gas cabinet.
4. Except as noted in this section, monitoring for highly toxic and toxic gases shall also comply with Chapter 60.

2703.13.2.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to the emergency control station when a short-term hazard condition is detected. The alarm shall be both visible and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

2703.13.2.2 Shut off of gas supply. The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or exhausted enclosure, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception: Where the gas-detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

2703.14 Exhaust ventilation systems for HPM. Exhaust ventilation systems and materials for exhaust ducts utilized for the exhaust of HPM shall comply with Sections 2703.14.1 through 2703.14.3, other applicable provisions of this code, the *California Building Code* and the *California Mechanical Code*.

2703.14.1 Where required. Exhaust ventilation systems shall be provided in the following locations in accordance with the requirements of this section and the *California Building Code*:

1. Fabrication areas: Exhaust ventilation for fabrication areas shall comply with the *California Building Code*. The fire code official is authorized to require additional manual control switches.
2. Workstations: A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.
3. Liquid storage rooms: Exhaust ventilation for liquid storage rooms shall comply with Section 5004.3.1 and the *California Building Code*.
4. HPM rooms: Exhaust ventilation for HPM rooms shall comply with Section 5004.3.1 and the *California Building Code*.
5. Gas cabinets: Exhaust ventilation for gas cabinets shall comply with Section 5003.8.6.2. The gas cabinet ventilation system is allowed to connect to a workstation ventilation system. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Chapter 60.
6. Exhausted enclosures: Exhaust ventilation for exhausted enclosures shall comply with Section 5003.8.5.2. Exhaust ventilation for exhausted enclosures containing highly toxic or toxic gases shall also comply with Chapter 60.
7. Gas rooms: Exhaust ventilation for gas rooms shall comply with Section 5003.8.4.2. Exhaust ventilation for gas rooms containing highly toxic or toxic gases shall also comply with Chapter 60.
8. Cabinets containing pyrophoric liquids or Class 3 water-reactive liquids: Exhaust ventilation for cabinets in fabrication areas containing pyrophoric liquids or Class 3 water-reactive liquids shall be as required in Section 2705.2.3.4.

2703.14.2 Penetrations. Exhaust ducts penetrating fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code* shall be contained in a shaft of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate fire walls. Fire dampers shall not be installed in exhaust ducts.

2703.14.3 Treatment systems. Treatment systems for highly toxic and toxic gases shall comply with Chapter 60.

2703.15 Emergency power system. An emergency power system shall be provided in Group H-5 occupancies in accordance with Section 1203. The emergency power system shall supply power automatically to the electrical systems specified in Section 2703.15.1 when the normal supply system is interrupted.

2703.15.1 Required electrical systems. Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust ventilation systems.
2. HPM gas cabinet ventilation systems.
3. HPM exhausted enclosure ventilation systems.
4. HPM gas room ventilation systems.
5. HPM gas detection systems.
6. Emergency alarm systems.
7. Manual fire alarm systems.
8. Automatic sprinkler system monitoring and alarm systems.
9. Automatic alarm and detection systems for pyrophoric liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4.
10. Flow alarm switches for pyrophoric liquids and Class 3 water-reactive liquids cabinet exhaust ventilation systems required in Section 2705.2.3.4.
11. Electrically operated systems required elsewhere in this code or in the *California Building Code* applicable to the use, storage or handling of HPM.

2703.15.2 Exhaust ventilation systems. Exhaust ventilation systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

2703.16 Sub-atmospheric pressure gas systems. Sub-atmospheric pressure gas systems (SAGS) shall be in accordance with NFPA 318.

SECTION 2704 STORAGE

2704.1 General. Storage of hazardous materials shall comply with Section 2703 and this section and other applicable provisions of this code.

2704.2 Fabrication areas. Hazardous materials storage and the maximum quantities of hazardous materials in use and storage allowed in fabrication areas shall be in accordance with Sections 2704.2.1 through 2704.2.2.1.

2704.2.1 Location of HPM storage in fabrication areas. Storage of HPM in fabrication areas shall be within

approved or listed storage cabinets, gas cabinets, exhausted enclosures or within a workstation as follows:

1. Flammable and combustible liquid storage cabinets shall comply with Section 5704.3.2.
2. Hazardous materials storage cabinets shall comply with Section 5003.8.7.
3. Gas cabinets shall comply with Section 5003.8.6. Gas cabinets for highly toxic or toxic gases shall also comply with Section 6004.1.2.
4. Exhausted enclosures shall comply with Section 5003.8.5. Exhausted enclosures for highly toxic or toxic gases shall also comply with Section 6004.1.3.
5. Workstations shall comply with Section 2705.2.3.

2704.2.2 Maximum aggregate quantities in fabrication areas. The aggregate quantities of hazardous materials stored or used in a single fabrication area shall be limited as specified in this section.

Exception: Fabrication areas containing quantities of hazardous materials not exceeding the maximum allowable quantities per control area established by Sections 5003.1.1, 5704.3.4 and 5704.3.5.

2704.2.2.1 Storage and use in fabrication areas. The maximum quantities of hazardous materials stored or used in a single fabrication area shall not exceed the quantities set forth in Table 2704.2.2.1.

2704.3 Indoor storage outside of fabrication areas. The indoor storage of hazardous materials outside of fabrication areas shall be in accordance with Sections 2704.3.1 through 2704.3.3.

2704.3.1 HPM storage. The indoor storage of HPM in quantities greater than those listed in Sections 5003.1.1 and 5704.3.4 shall be in a room complying with the requirements of the *California Building Code* and this code for a liquid storage room, HPM room or gas room as appropriate for the materials stored.

2704.3.2 Other hazardous materials storage. The indoor storage of other hazardous materials shall comply with Sections 5001, 5003 and 5004 and other applicable provisions of this code.

2704.3.3 Separation of incompatible hazardous materials. Incompatible hazardous materials in storage shall be separated from each other in accordance with Section 5003.9.8.

SECTION 2705 USE AND HANDLING

2705.1 General. The use and handling of hazardous materials shall comply with this section, Section 2703 and other applicable provisions of this code.

2705.2 Fabrication areas. The use of hazardous materials in fabrication areas shall be in accordance with Sections 2705.2.1 through 2705.2.3.4.

2705.2.1 Location of HPM in use in fabrication areas. Hazardous production materials in use in fabrication areas shall be within approved or listed gas cabinets, exhausted enclosures or a workstation.

2705.2.2 Maximum aggregate quantities in fabrication areas. The aggregate quantities of hazardous materials in a single fabrication area shall comply with Section 2704.2.2 and Table 2704.2.2.1. The quantity of HPM in use at a workstation shall not exceed the quantities listed in Table 2705.2.2.

2705.2.3 Workstations. Workstations in fabrication areas shall be in accordance with Sections 2705.2.3.1 through 2705.2.3.4.

2705.2.3.1 Construction. Workstations in fabrication areas shall be constructed of materials compatible with the materials used and stored at the workstation. The portion of the workstation that serves as a cabinet for HPM gases, Class I flammable liquids or Class II or Class IIIA combustible liquids shall be noncombustible and, if of metal, shall be not less than 0.0478-inch (18 gage) (1.2 mm) steel.

2705.2.3.2 Protection of vessels. Vessels containing hazardous materials located in or connected to a workstation shall be protected as follows:

1. HPM: Vessels containing HPM shall be protected from physical damage and shall not project from the workstation.
2. Hazardous cryogenic fluids, gases and liquids: Hazardous cryogenic fluid, gas and liquid vessels located within a workstation shall be protected from seismic forces in an approved manner in accordance with the *California Building Code*.
3. Compressed gases: Protection for compressed gas vessels shall also comply with Section 5303.5.
4. Cryogenic fluids: Protection for cryogenic fluid vessels shall also comply with Section 5503.5.

2705.2.3.3 Drainage and containment for HPM liquids. Each workstation utilizing HPM liquids shall have all of the following:

1. Drainage piping systems connected to a compatible system for disposition of such liquids.
2. The work surface provided with a slope or other means for directing spilled materials to the containment or drainage system.
3. An approved means of containing or directing spilled or leaked liquids to the drainage system.

**TABLE 2704.2.2.1
QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5^a**

HAZARD CATEGORY	SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ NTP per square foot)
Physical-Hazard Materials			
Combustible dust	Note b	Not Applicable	Not Applicable
Combustible fiber Loose Baled	Note b Notes b and c	Not Applicable	Not Applicable
Combustible liquid Class II Class IIIA Class IIIB Combination Class I, II and IIIA	Not Applicable	0.01 0.02 Not Limited 0.04	Not Applicable
Cryogenic gas Flammable Oxidizing	Not Applicable	Not Applicable	Note d 1.25
Explosives	Note b	Note b	Note b
Flammable gas Gaseous Liquefied	Not Applicable	Not Applicable	Note d Note d
Flammable liquid Class IA Class IB Class IC Combination Class IA, IB and IC Combination Class I, II and IIIA	Not Applicable	0.0025 0.025 0.025 0.025 0.04	Not Applicable
Flammable solid	0.001	Not Applicable	Not Applicable
Organic peroxide Unclassified detonable Class I Class II Class III Class IV Class V	Note b Note b 0.025 0.1 Not Limited Not Limited	Not Applicable	Not Applicable
Oxidizing gas Gaseous Liquefied Combination of gaseous and liquefied	Not Applicable	Not Applicable	1.25 1.25 1.25
Oxidizer Class 4 Class 3 Class 2 Class 1 Combination Class 1, 2, 3	Note b 0.003 0.003 0.003 0.003	Note b 0.03 0.03 0.03 0.03	Not Applicable
Pyrophoric materials	0.01	0.00125	Notes d and e
Unstable (reactive) Class 4 Class 3 Class 2 Class 1	Note b 0.025 0.1 Not Limited	Note b 0.0025 0.01 Not Limited	Note b Note b Note b Not Limited
Water reactive Class 3 Class 2 Class 1	0.01 ^f 0.25 Not Limited	0.00125 0.025 Not Limited	Not Applicable

(continued)

TABLE 2704.2.2.1—continued
QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5^a

HAZARD CATEGORY	SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ NTP per square foot)
Health-Hazard Materials			
Corrosives	Not Limited	Not Limited	Not Limited
Highly toxic	Not Limited	Not Limited	Note d
Toxics	Not Limited	Not Limited	Note d

For SI: 1 pound = 0.454 kg, 1 pound per square foot = 4.882 kg/m², 1 gallon per square foot = 40.7 L/m², 1 cubic foot @ NTP/square foot = 0.305 m³ @ NTP/m², 1 cubic foot = 0.02832 m³.

- a. Hazardous materials within piping shall not be included in the calculated quantities.
- b. Quantity of hazardous materials in a single fabrication area shall not exceed the maximum allowable quantities per control area in Tables 5003.1.1(1) and 5003.1.1(2).
- c. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- d. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed the greater of 0.2 cubic feet at NTP/square foot or 9,000 cubic feet at NTP.
- e. The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 5003.8.2.
- f. Quantity of Class 3 water-reactive solids in a single tool shall not exceed 1 pound.

2705.2.3.4 Pyrophoric solids, liquids and Class 3 water-reactive liquids. Pyrophoric liquids and Class 3 water-reactive liquids in containers greater than 0.5-gallon (2 L) but not exceeding 5.3-gallon (20 L) capacity and pyrophoric solids in containers greater than 4.4 pounds (2 kg) but not exceeding 44 pounds (20 kg) shall be allowed at workstations where located inside cabinets and the following conditions are met:

1. Maximum amount per cabinet: The maximum amount per cabinet shall be limited to 5.3 gallons (20 L) of liquids and 44 pounds (20 kg) of total liquids and solids.
2. Cabinet construction: Cabinets shall be constructed in accordance with the following:
 - 2.1. Cabinets shall be constructed of not less than 0.097-inch (2.5 mm) (12 gage) steel.
 - 2.2. Cabinets shall be permitted to have self-closing limited access ports or noncombustible windows that provide access to equipment controls.
 - 2.3. Cabinets shall be provided with self- or manual-closing doors. Manual-closing doors shall be equipped with a door switch that will initiate local audible and visual alarms when the door is in the open position.
3. Cabinet exhaust ventilation system: An exhaust ventilation system shall be provided for cabinets and shall comply with the following:
 - 3.1. The system shall be designed to operate at a negative pressure in relation to the surrounding area.
 - 3.2. The system shall be equipped with monitoring equipment to ensure that required exhaust flow or static pressure is provided.

- 3.3. Low-flow or static pressure conditions shall send an alarm to the on-site emergency control station. The alarm shall be both visual and audible.
4. Cabinet spill containment: Spill containment shall be provided in each cabinet, with the spill containment capable of holding the contents of the aggregate amount of liquids in containers in each cabinet.
5. Valves: Valves in supply piping between the product containers in the cabinet and the workstation served by the containers shall fail in the closed position upon power failure, loss of exhaust ventilation and upon actuation of the fire control system.
6. Fire detection system: Each cabinet shall be equipped with an automatic fire detection system complying with the following conditions:
 - 6.1. Automatic detection system: UV/IR, high-sensitivity smoke detection (HSSD) or other approved detection systems shall be provided inside each cabinet.
 - 6.2. Automatic shutoff: Activation of the detection system shall automatically close the shutoff valves at the source on the liquid supply.
 - 6.3. Alarms and signals: Activation of the detection system shall initiate a local alarm within the fabrication area and transmit a signal to the emergency control station. The alarms and signals shall be both visual and audible.

2705.3 Transportation and handling. The transportation and handling of hazardous materials shall comply with Sections 2705.3.1 through 2705.3.4.1 and other applicable provisions of this code.

**TABLE 2705.2.2
MAXIMUM QUANTITIES OF HPM AT A WORKSTATION^d**

HPM CLASSIFICATION	STATE	MAXIMUM QUANTITY
Flammable, highly toxic, pyrophoric and toxic combined	Gas	Combined aggregate volume of all cylinders at a workstation shall not exceed an internal cylinder volume of 39.6 gallons or 5.29 cubic feet
Flammable	Liquid	15 gallons ^{a, b}
	Solid	5 pounds ^{a, b}
Corrosive	Gas	Combined aggregate volume of all cylinders at a workstation shall not exceed an internal cylinder volume of 39.6 gallons or 5.29 cubic feet
	Liquid	Use-open system: 25 gallons ^b Use-closed system: 150 gallons ^{b, e}
	Solid	20 pounds ^{a, b}
Highly toxic	Liquid	15 gallons ^{a, b}
	Solid	5 pounds ^{a, b}
Oxidizer	Gas	Combined aggregate volume of all cylinders at a workstation shall not exceed an internal cylinder volume of 39.6 gallons or 5.29 cubic feet
	Liquid	Use-open system: 12 gallons ^b Use-closed system: 60 gallons ^b
	Solid	20 pounds ^{a, b}
Pyrophoric	Liquid	0.5 gallon ^{c, f}
	Solid	4.4 pounds ^{c, f}
Toxic	Liquid	Use-open system: 15 gallons ^b Use-closed system: 60 gallons ^b
	Solid	5 pounds ^{a, b}
Unstable reactive Class 3	Liquid	0.5 gallon ^{a, b}
	Solid	5 pounds ^{a, b}
Water-reactive Class 3	Liquid	0.5 gallon ^{c, f}
	Solid	See Table 2704.2.2.1

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- Maximum allowable quantities shall be increased 100 percent for closed system operations. Where Note b applies, the increase for both notes shall be allowed.
- Quantities shall be allowed to be increased 100 percent where workstations are internally protected with an approved automatic fire-extinguishing or suppression system complying with Chapter 9. Where Note a applies, the increase for both notes shall be allowed. Where Note e applies, the maximum increase allowed for both Notes b and e shall not exceed 100 percent.
- Allowed only in workstations that are internally protected with an approved automatic fire-extinguishing or fire protection system complying with Chapter 9 and compatible with the reactivity of materials in use at the workstation.
- The quantity limits apply only to materials classified as HPM.
- Quantities shall be allowed to be increased 100 percent for nonflammable, noncombustible corrosive liquids where the materials of construction for workstations are listed or approved for use without internal fire-extinguishing or suppression system protection. Where Note b applies, the maximum increase allowed for both Notes b and e shall not exceed 100 percent.
- A maximum quantity of 5.3 gallons of liquids and 44 pounds of total liquids and solids shall be allowed at a workstation where conditions are in accordance with Section 2705.2.3.4.

2705.3.1 Corridors and enclosures for stairways and ramps. Corridors and enclosures for exit stairways and ramps in new buildings or serving new fabrication areas shall not contain HPM, except as permitted in corridors by Section 415.11.7.4 of the *California Building Code* and Section 2705.3.2 of this code.

2705.3.2 Transport in corridors and enclosures for stairways and ramps. Transport in corridors and enclosures for stairways and ramps shall be in accordance with Sections 2705.3.2.1 through 2705.3.3.

2705.3.2.1 Fabrication area alterations. Where existing fabrication areas are altered or modified in existing

buildings, HPM is allowed to be transported in existing corridors where such corridors comply with Section 5003.10 of this code and Section 415.11.2 of the *California Building Code*.

2705.3.2.2 HPM transport in corridors and enclosures for stairways and ramps. Nonproduction HPM is allowed to be transported in corridors and enclosures for stairways and ramps where utilized for maintenance, lab work and testing when the transportation is in accordance with Section 5003.10.

2705.3.3 Service corridors. Where a new fabrication area is constructed, a service corridor shall be provided where

SEMICONDUCTOR FABRICATION FACILITIES

it is necessary to transport HPM from a liquid storage room, HPM room, gas room or from the outside of a building to the perimeter wall of a fabrication area. Service corridors shall be designed and constructed in accordance with the *California Building Code*.

2705.3.4 Carts and trucks. Carts and trucks used to transport HPM in corridors and enclosures for stairways and ramps shall comply with Section 5003.10.3.

2705.3.4.1 Identification. Carts and trucks shall be marked to indicate the contents.

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
CHAPTER 28 – LUMBER YARDS AND AGRO-INDUSTRIAL,
SOLID BIOMASS AND WOODWORKING FACILITIES**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 28

LUMBER YARDS AND AGRO-INDUSTRIAL, SOLID BIOMASS AND WOODWORKING FACILITIES

User note:

About this chapter: Chapter 28 provides requirements that are intended to prevent fires and explosions, facilitate fire control and reduce exposures to and from facilities storing, selling or processing wood and forest products, including sawdust, wood chips, shavings, bark mulch, shorts, finished planks, sheets, posts, poles, timber and raw logs and the hazard they represent once ignited. Also included are solid biomass feedstock and raw products associated with agro-industrial facilities and the outdoor storage of pallets at pallet manufacturing and recycling facilities. This chapter requires active and passive fire protection features to reduce on- and off-site exposures, limit fire size and development and facilitate fire fighting by employees and the fire service.

SECTION 2801 GENERAL

2801.1 Scope. The storage, manufacturing and processing of solid biomass feedstock, timber, lumber, plywood, veneers and agro-industrial byproducts shall be in accordance with this chapter.

2801.2 Permit. Permits shall be required as set forth in Section 105.5.

SECTION 2802 DEFINITIONS

2802.1 Definitions. The following terms are defined in Chapter 2:

AGRO-INDUSTRIAL.

BIOMASS.

COLD DECK.

FINES.

HOGGED MATERIALS.

PLYWOOD AND VENEER MILLS.

RAW PRODUCT.

SOLID BIOFUEL.

SOLID BIOMASS FEEDSTOCK.

STATIC PILES.

TIMBER AND LUMBER PRODUCTION FACILITIES.

SECTION 2803 GENERAL REQUIREMENTS

2803.1 Open yards. Open yards required by the *California Building Code* shall be maintained around structures.

2803.2 Dust control. Equipment or machinery located inside buildings that generates or emits combustible dust shall be provided with an approved dust collection and exhaust system installed in accordance with Chapter 22 and the *California Mechanical Code*. Equipment or systems that are used

to collect, process or convey combustible dusts shall be provided with an approved explosion control system.

2803.2.1 Explosion venting. Where a dust explosion hazard exists in equipment rooms, buildings or other enclosures, such areas shall be provided with explosion (deflagration) venting or an approved explosion suppression system complying with Section 911.

2803.3 Waste removal. Sawmills, planning mills and other woodworking plants shall be equipped with a waste removal system that will collect and remove sawdust and shavings. Such systems shall be installed in accordance with Chapter 22 and the *California Mechanical Code*.

Exception: Manual waste removal where approved.

2803.3.1 Housekeeping. Provisions shall be made for a systematic and thorough cleaning of the entire plant at sufficient intervals to prevent the accumulations of combustible dust and spilled combustible or flammable liquids.

2803.3.2 Metal scrap. Provision shall be made for separately collecting and disposing of any metal scrap so that such scrap will not enter the wood handling or processing equipment.

2803.4 Electrical equipment. Electrical wiring and equipment shall comply with the *California Electrical Code*.

2803.5 Control of ignition sources. Protection from ignition sources shall be provided in accordance with Sections 2803.5.1 through 2803.5.3.

2803.5.1 Cutting and welding. Cutting and welding shall comply with Chapter 35.

2803.5.2 Static electricity. Static electricity shall be prevented from accumulating on machines and equipment subject to static electricity buildup by permanent grounding and bonding wires or other approved means.

2803.5.3 Smoking. Where smoking constitutes a fire hazard, the fire code official is authorized to order the owner or occupant to post approved “No Smoking” signs complying with Section 310. The fire code official is authorized to designate specific locations where smoking is allowed.

2803.6 Fire apparatus access roads. Fire apparatus access roads shall be provided for buildings and facilities in accordance with Section 503.

2803.7 Access plan. Where storage pile configurations could change because of changes in product operations and processing, the access plan shall be submitted for approval where required by the fire code official.

SECTION 2804 FIRE PROTECTION

2804.1 General. Fire protection in timber and lumber production mills, plywood and veneer mills and agro-industrial facilities shall comply with Sections 2804.2 through 2804.4.

2804.2 Fire alarms. An approved means for transmitting alarms to the fire department shall be provided in timber and lumber production mills and plywood and veneer mills.

2804.2.1 Manual fire alarms. A manual fire alarm system complying with Section 907.2 shall be installed in areas of timber and lumber production mills and for plywood and veneer mills that contain product dryers.

Exception: Where dryers or other sources of ignition are protected by a supervised automatic sprinkler system complying with Section 903.

2804.3 Portable fire extinguishers or standpipes and hose. Portable fire extinguishers or standpipes and hose supplied from an approved water system shall be provided within a 50-foot (15 240 mm) distance of travel from any machine producing shavings or sawdust. Portable fire extinguishers shall be provided in accordance with Section 906 for extra-high hazards.

2804.4 Automatic sprinkler systems. Automatic sprinkler systems shall be installed in accordance with Section 903.3.1.1.

SECTION 2805 PLYWOOD, VENEER AND COMPOSITE BOARD MILLS

2805.1 General. Plant operations of plywood, veneer and composite board mills shall comply with Sections 2805.2 and 2805.3.

2805.2 Dryer protection. Dryers shall be protected throughout by an approved, automatic deluge water-spray suppression system complying with Chapter 9. Deluge heads shall be inspected quarterly for pitch buildup. Deluge heads shall be flushed during regular maintenance for functional operation. Manual activation valves shall be located within 75 feet (22 860 mm) of the drying equipment.

2805.3 Thermal oil-heating systems. Facilities that use heat transfer fluids to provide process equipment heat through piped, indirect heating systems shall comply with this code and NFPA 664.

SECTION 2806 LOG STORAGE AREAS

2806.1 General. Log storage areas shall comply with Sections 2806.2 and 2806.3.

2806.2 Cold decks. Cold decks shall not exceed 500 feet (152.4 m) in length, 300 feet (91 440 mm) in width and 20 feet (6096 mm) in height. Cold decks shall be separated from adjacent cold decks or other exposures by not less than 100 feet (30 480 mm).

Exception: The size of cold decks shall be determined by the fire code official where the decks are protected by special fire protection including, but not limited to, additional fire flow, portable turrets and deluge sets, and hydrant hose houses equipped with approved fire-fighting equipment capable of reaching the entire storage area in accordance with Chapter 9.

2806.3 Pile stability. Log and pole piles shall be stabilized by approved means.

SECTION 2807 STORAGE OF WOOD CHIPS AND HOGGED MATERIALS ASSOCIATED WITH TIMBER AND LUMBER PRODUCTION FACILITIES

2807.1 General. The storage of wood chips and hogged materials associated with timber and lumber production facilities shall comply with Sections 2807.2 through 2807.5.

2807.2 Size of piles. Piles shall not exceed 60 feet (18 288 mm) in height, 300 feet (91 440 mm) in width and 500 feet (152 m) in length. Piles shall be separated from adjacent piles or other exposures by approved fire apparatus access roads.

Exception: The fire code official is authorized to allow the pile size to be increased where additional fire protection is provided in accordance with Chapter 9. The increase shall be based on the capabilities of the system installed.

2807.3 Pile fire protection. Automatic sprinkler protection shall be provided in conveyor tunnels and combustible enclosures that pass under a pile. Combustible or enclosed conveyor systems shall be equipped with an approved automatic sprinkler system.

2807.4 Material-handling equipment. Approved material-handling equipment shall be readily available for moving wood chips and hogged material.

2807.5 Emergency plan. The owner or operator shall develop a plan for monitoring, controlling and extinguishing spot fires. The plan shall be submitted to the fire code official for review and approval.

**SECTION 2808
STORAGE AND PROCESSING OF WOOD CHIPS,
HOGGED MATERIALS, FINES, COMPOST, SOLID
BIOMASS FEEDSTOCK AND RAW PRODUCT
ASSOCIATED WITH YARD WASTE, AGRO-
INDUSTRIAL AND RECYCLING FACILITIES**

2808.1 General. The storage and processing of wood chips, hogged materials, fines, compost, solid biomass feedstock and raw product produced from yard waste, debris and agro-industrial and recycling facilities shall comply with Sections 2808.2 through 2808.10.

2808.2 Storage site. Storage sites shall be level and on solid ground, elevated soil lifts or other all-weather surface. Sites shall be thoroughly cleaned before transferring wood products to the site.

2808.3 Size of piles. Piles shall not exceed 25 feet (7620 mm) in height, 150 feet (45 720 mm) in width and 250 feet (76 200 mm) in length. Stackable products shall not be stacked in excess of 25 feet (7620 mm) in height, 80 feet (24 384 mm) in width and 250 feet (76 200 mm) in length.

2808.3.1 Increase in pile or stack size. Piles or stackable products are permitted to be increased beyond the dimensions in Section 2808.3 provided that a written fire protection plan is approved by the fire code official. The fire protection plan shall include, but not be limited to, the following:

1. Contact information for after-hours response by facility personnel.
2. Storage yard areas and material-handling equipment selection, pile design and arrangement shall be based on sound safety and fire protection principles.
3. Fire apparatus access roads around the piles or stacks and access roads to the top of piles, if applicable, shall be established, identified and maintained.
4. The potential for spontaneous heating shall be evaluated and provisions made to control the temperature of the piles. Methods for monitoring the internal temperature of the pile shall be provided.
5. Routine yard inspections shall be conducted by trained personnel.
6. A means for early fire detection and reporting to the public fire department shall be provided.
7. Facilities and equipment needed by the fire department for fire extinguishment shall be provided, including a water supply in compliance with Section 507 and heavy equipment necessary to move material.
8. A de-inventory plan shall be utilized to remove alternating piles or stacked products in a manner to increase the separation distances between the remaining piles or stacks.

9. The increased pile size shall be based on the capabilities of the installed fire protection systems and features.

10. A controlled burn area shall be provided on-site for smoldering or damaged product.

2808.4 Pile separation. Piles or stacked product shall be separated from buildings, property lines and adjacent piles or stacks by a distance of not less than one and one-half times the height of the pile or stack. The distance between rows shall be a minimum of 30 feet (9144 mm). Approved fire apparatus access roads shall be provided within the separation space in accordance with Section 503.

2808.5 Combustible waste. The storage, accumulation and handling of combustible materials and control of vegetation shall comply with Chapter 3.

2808.6 Static pile protection. Static piles shall be monitored by an approved means to measure temperatures within the static piles. Internal pile temperatures shall be monitored and recorded weekly. Such records shall be maintained. An operational plan indicating procedures and schedules for the inspection, monitoring and restricting of excessive internal temperatures in static piles shall be submitted to the fire code official for review and approval.

2808.7 Pile fire protection. Automatic sprinkler protection shall be provided in conveyor tunnels and combustible enclosures that pass under a pile. Combustible conveyor systems and enclosed conveyor systems shall be equipped with an approved automatic sprinkler system.

2808.8 Fire extinguishers. Portable fire extinguishers complying with Section 906 and with a minimum rating of 4-A:60-B:C shall be provided on all vehicles and equipment operating on piles and at all processing equipment.

2808.9 Material-handling equipment. Approved material-handling equipment shall be available for moving wood chips, hogged material, wood fines and raw product during fire-fighting operations.

2808.10 Emergency plan. The owner or operator shall develop a plan for monitoring, controlling and extinguishing spot fires and submit the plan to the fire code official for review and approval.

**SECTION 2809
EXTERIOR STORAGE OF FINISHED LUMBER
AND SOLID BIOFUEL PRODUCTS**

2809.1 General. Exterior storage of finished lumber and solid biofuel products shall comply with Sections 2809.2 through 2809.5.

2809.2 Size of piles. Exterior storage shall be arranged to form stable piles with a maximum height of 20 feet (6096 mm). Piles shall not exceed 150,000 cubic feet (4248 m³) in volume.

2809.3 Fire apparatus access roads. Fire apparatus access roads in accordance with Section 503 shall be located so that a maximum grid system unit of 50 feet by 150 feet (15 240 mm by 45 720 mm) is established.

2809.4 Security. Permanent storage areas shall be surrounded with an approved fence. Fences shall be not less than 6 feet (1829 mm) in height.

Exceptions:

1. Lumber piles inside of buildings and production mills for lumber, plywood and veneer.
2. Solid biofuel piles inside of buildings and agro-industrial processing facilities for solid biomass feedstock.

2809.5 Fire protection. An approved hydrant and hose system or portable fire-extinguishing equipment suitable for the fire hazard involved shall be provided for open storage yards. Hydrant and hose systems shall be installed in accordance with NFPA 24. Portable fire extinguishers complying with Section 906 shall be located so that the distance of travel from the nearest unit does not exceed 75 feet (22 860 mm).

**SECTION 2810
OUTDOOR STORAGE OF PALLETS AT PALLET
MANUFACTURING AND RECYCLING FACILITIES**

2810.1 General. The outside storage of wood pallets and wood composite pallets on the same site as a pallet manufacturing or pallet recycling facility shall comply with Sections 2810.2 through 2810.11.

2810.2 Site plan. Each site shall maintain a current site plan. The site plan shall be submitted to the fire code official for approval and contain all of the following:

1. Lot lines.
2. Utilities.
3. Size, location and type of construction of the buildings on the property.
4. Presence of the fire protection systems.
5. Water supply sources for fire-fighting purposes.
6. Location of hazardous material storage areas.
7. Location of pallet storage.
8. Equipment protected with a dust collection system.
9. Fire apparatus access roads.
10. Designated smoking areas.
11. Location of fire alarm control panels.

2810.3 Fire prevention plan. The owner or owner's authorized representative shall submit a fire prevention plan for review and approval by the fire code official that includes all of the following:

1. Frequency of walk-through inspections to verify compliance with the plan.
2. Hot work permit program in accordance with Chapter 35.
3. Preventative maintenance program for equipment associated with pallet activities.
4. Inspection, testing and maintenance of fire protection systems in accordance with Chapter 9.

2810.4 Fire safety and evacuation plan. The owner or owner's authorized representative shall prepare and train employees in an approved fire safety and evacuation plan in accordance with Chapter 4.

2810.5 Security management plan. The owner or owner's authorized representative shall prepare a security management plan based on a security risk assessment and shall make the plan and assessment available to the fire code official upon request.

2810.6 Clearance to property line. Stacks of pallets shall not be stored within 0.75 times the stack height or 8 feet (2438 mm) of the property line, whichever is greater, or shall comply with Section 2810.11.

2810.7 Clearance to important buildings. Stacks of pallets shall not be stored within 0.75 times the stack height of any important building on site, or shall comply with Section 2810.11.

2810.8 Height. Pallet stacks shall not exceed 20 feet (6096 mm) in height.

2810.9 Fire flow. Fire-flow requirements for the site shall be determined by the fire code official.

2810.10 Portable fire extinguishers. Portable fire extinguishers shall be selected, installed and maintained in accordance with Section 906.

2810.11 Alternative approach. Where approved by the fire code official, pallet stacks are permitted to be located closer to a property line or structure than as required by Sections 2810.6 and 2810.7 where additional fire protection is provided, including, but not limited to, the following:

1. The storage yard areas and materials-handling equipment selection, design, and arrangement are based on an approved risk assessment.
2. Automatic fire detection that transmits an alarm to a supervising station in accordance with NFPA 72.
3. Fire apparatus access roads around all storage areas.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 29 – MANUFACTURE OF ORGANIC COATINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 29

MANUFACTURE OF ORGANIC COATINGS

User note:

About this chapter: Chapter 29 regulates materials and processes associated with the manufacture of paints as well as bituminous, asphaltic and other diverse compounds formulated to protect buildings, machines and objects from the effects of weather, corrosion and hostile environmental exposures. Paint for decorative, architectural and industrial uses comprises the bulk of organic coating production. Painting and processes related to the manufacture of nonflammable and noncombustible or water-based products are exempt from the provisions of this chapter. The application of organic coatings is covered by Chapter 24. Elimination of ignition sources, maintenance of fire protection equipment and isolation or segregation of hazardous operations are emphasized.

SECTION 2901 GENERAL

2901.1 Scope. Organic coating manufacturing processes shall comply with this chapter, except that this chapter shall not apply to processes manufacturing nonflammable or water-thinned coatings or to operations applying coating materials.

2901.2 Permits. Permits shall be required as set forth in Section 105.5.

2901.3 Maintenance. Structures and their service equipment shall be maintained in accordance with this code and NFPA 35.

SECTION 2902 DEFINITION

2902.1 Definition. The following term is defined in Chapter 2:

ORGANIC COATING.

SECTION 2903 GENERAL PRECAUTIONS

2903.1 Building features. Manufacturing of organic coatings shall be done only in buildings that do not have pits or basements.

2903.2 Location. Organic coating manufacturing operations and operations incidental to or connected with organic coating manufacturing shall not be located in buildings having other occupancies.

2903.3 Fire-fighting access. The fire department shall be able to access the organic coating manufacturing operations from not less than one side for the purpose of fire control. Approved aisles shall be maintained for the unobstructed movement of personnel and fire suppression equipment.

2903.4 Fire protection systems. Fire protection systems shall be installed, maintained, periodically inspected and tested in accordance with Chapter 9.

2903.5 Portable fire extinguishers. Not less than one portable fire extinguisher complying with Section 906 for extra hazard shall be provided in organic coating areas.

2903.6 Open flames. Open flames and direct-fired heating devices shall be prohibited in areas where flammable vapor-air mixtures exist.

2903.7 Smoking. Smoking shall be prohibited in accordance with Section 310.

2903.8 Power equipment. Power-operated equipment and industrial trucks shall be of a type approved for the location.

2903.9 Tank maintenance. The cleaning of tanks and vessels that have contained flammable or combustible liquids shall be performed under the supervision of persons knowledgeable of the fire and explosion potential.

2903.9.1 Repairs. Where necessary to make repairs involving hot work, the work shall be authorized by the responsible individual before the work begins.

2903.9.2 Empty containers. Empty flammable or combustible liquid containers shall be removed to a detached, outside location and, if not cleaned on the premises, the empty containers shall be removed from the plant as soon as practical.

2903.10 Drainage. Drainage facilities shall be provided to direct flammable and combustible liquid leakage and fire protection water to an approved location away from the building, any other structure, storage area or adjoining premises.

2903.11 Alarm system. An approved fire alarm system shall be provided in accordance with Section 907.

SECTION 2904 ELECTRICAL EQUIPMENT AND PROTECTION

2904.1 Wiring and equipment. Electrical wiring and equipment shall comply with this chapter and shall be installed in accordance with *the California Electrical Code*.

2904.2 Hazardous locations. Where Class I liquids are exposed to the air, the design of equipment and ventilation of structures shall be such as to limit the Class I, Division 1, locations to the following:

1. Piping trenches.
2. The interior of equipment.

3. The immediate vicinity of pumps or equipment locations, such as dispensing stations, open centrifuges, plate and frame filters, opened vacuum filters, change cans and the surfaces of open equipment. The immediate vicinity shall include a zone extending from the vapor liberation point 5 feet (1524 mm) horizontally in all directions and vertically from the floor to a level 3 feet (914 mm) above the highest point of vapor liberation.

2904.2.1 Other locations. Locations within the confines of the manufacturing room where Class I liquids are handled shall be Class I, Division 2, except locations indicated in Section 2904.2.

2904.2.2 Ordinary equipment. Ordinary electrical equipment, including switchgear, shall be prohibited, except where installed in a room maintained under positive pressure with respect to the hazardous area. The air or other media utilized for pressurization shall be obtained from a source that will not cause any amount or type of flammable vapor to be introduced into the room.

2904.3 Bonding. Equipment including, but not limited to, tanks, machinery and piping shall be bonded and connected to a ground where an ignitable mixture is capable of being present.

2904.3.1 Piping. Electrically isolated sections of metallic piping or equipment shall be grounded or bonded to the other grounded portions of the system.

2904.3.2 Vehicles. Tank vehicles loaded or unloaded through open connections shall be grounded and bonded to the receiving system.

2904.3.3 Containers. Where a flammable mixture is transferred from one portable container to another, a bond shall be provided between the two containers, and one shall be grounded.

2904.4 Ground. Metal framing of buildings shall be grounded with resistance of not more than 5 ohms.

SECTION 2905 PROCESS STRUCTURES

2905.1 Design. Process structures shall be designed and constructed in accordance with the *California Building Code*.

2905.2 Fire apparatus access. Fire apparatus access complying with Section 503 shall be provided for the purpose of fire control to not less than one side of organic coating manufacturing operations.

2905.3 Drainage. Drainage facilities shall be provided in accordance with Section 2903.10 where topographical conditions are such that flammable and combustible liquids are capable of flowing from the organic coating manufacturing operation so as to constitute a fire hazard to other premises.

2905.4 Explosion control. Explosion control shall be provided in areas subject to potential deflagration hazards as indicated in NFPA 35. Explosion control shall be provided in accordance with Section 911.

2905.5 Ventilation. Enclosed structures in which Class I liquids are processed or handled shall be ventilated at a rate of not less than 1 cubic foot per minute per square foot [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$] of solid floor area. Ventilation shall be accomplished by exhaust fans that take suction at floor levels and discharge to a safe location outside the structure. Noncontaminated intake air shall be introduced in such a manner that all portions of solid floor areas are provided with continuous uniformly distributed air movement.

2905.6 Heating. Heating provided in hazardous areas shall be by indirect means. Ignition sources such as open flames or electrical heating elements, except as provided for in Section 2904, shall not be permitted within the structure.

SECTION 2906 PROCESS MILLS AND KETTLES

2906.1 Mills. Mills, operating with close clearances, which process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a detached building or in a noncombustible structure without other occupancies. The amount of nitrocellulose or other flammable material brought into the area shall not be more than the amount required for a batch.

2906.2 Mixers. Mixers shall be of the enclosed type or, where of the open type, shall be provided with properly fitted covers. Where flow is by gravity, a shutoff valve shall be installed as close as practical to the mixer, and a control valve shall be provided near the end of the fill pipe.

2906.3 Open kettles. Open kettles shall be located in an outside area provided with a protective roof; in a separate structure of noncombustible construction; or separated from other areas by a noncombustible wall having a fire-resistance rating of not less than 2 hours.

2906.4 Closed kettles. Contact-heated kettles containing solvents shall be equipped with safety devices that, in case of a fire, will turn off the process heat, turn on the cooling medium and inject inert gas into the kettle.

2906.4.1 Vaporizer location. The vaporizer section of heat-transfer systems that heat closed kettles containing solvents shall be remotely located.

2906.5 Kettle controls. The kettle and thin-down tank shall be instrumented, controlled and interlocked so that any failure of the controls will result in a safe condition. The kettle shall be provided with a pressure-rupture disc in addition to the primary vent. The vent piping from the rupture disc shall be of minimum length and shall discharge to an approved location. The thin-down tank shall be adequately vented. Thinning operations shall be provided with an adequate vapor removal system.

SECTION 2907 PROCESS PIPING

2907.1 Design. Piping, valves and fittings shall be designed for the working pressures and structural stresses to which the

piping, valves and fittings will be subjected, and shall be of steel or other material approved for the service intended.

2907.2 Valves. Valves shall be of an indicating type. Terminal valves on remote pumping systems shall be of the dead-man type, shutting off both the pump and the flow of solvent.

2907.3 Support. Piping systems shall be supported adequately and protected against physical damage. Piping shall be pitched to avoid unintentional trapping of liquids, or approved drains shall be provided.

2907.4 Connectors. Approved flexible connectors shall be installed where vibration exists or frequent movement is necessary. Hose at dispensing stations shall be of an approved type.

2907.5 Tests. Before being placed in service, all piping shall be free of leaks when tested for not less than 30 minutes at not less than 1.5 times the working pressure or not less than 5 pounds per square inch gauge (psig) (35 kPa) at the highest point in the system.

SECTION 2908 RAW MATERIALS IN PROCESS AREAS

2908.1 Nitrocellulose quantity. The amount of nitrocellulose brought into the operating area shall not exceed the amount required for a work shift. Nitrocellulose spillage shall be promptly swept up and disposed of properly.

2908.2 Organic peroxides quantity. Organic peroxides brought into the operating area shall be in the original shipping container. When in the operating area, the organic peroxide shall not be placed in locations exposed to ignition sources, heat or mechanical shocks.

SECTION 2909 RAW MATERIALS AND FINISHED PRODUCTS

2909.1 General. The storage, handling and use of flammable and combustible liquids in process areas shall be in accordance with Chapter 57.

2909.2 Tank storage. Tank storage for flammable and combustible liquids located inside of structures shall be limited to storage areas at or above grade that are separated from the processing area in accordance with the *California Building Code*. Processing equipment containing flammable and combustible liquids and storage in quantities essential to the continuity of the operations shall not be prohibited in the processing area.

2909.3 Tank vehicle. Tank car and tank vehicle loading and unloading stations for Class I liquids shall be separated from the processing area, other plant structures, nearest lot line of property that can be built on or public thoroughfare by a minimum clear distance of 25 feet (7620 mm).

2909.3.1 Loading. Loading and unloading structures and platforms for flammable and combustible liquids shall be designed and installed in accordance with Chapter 57.

2909.3.2 Safety. Tank cars for flammable liquids shall be unloaded such that the safety to persons and property is

ensured. Tank vehicles for flammable and combustible liquids shall be loaded and unloaded in accordance with Chapter 57.

2909.4 Nitrocellulose storage. Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed in accordance with the *California Building Code*. The nitrocellulose storage area shall not be utilized for any other purpose. Electrical wiring and equipment installed in storage areas adjacent to process areas shall comply with Section 2904.2.

2909.4.1 Containers. Nitrocellulose shall be stored in closed containers. Barrels shall be stored on end and not more than two tiers high. Barrels or other containers of nitrocellulose shall not be opened in the main storage structure but at the point of use or other location intended for that purpose.

2909.4.2 Spills. Spilled nitrocellulose shall be promptly wetted with water and disposed of by use or burning in the open at an approved detached location.

2909.5 Organic peroxide storage. The storage of organic peroxides shall be in accordance with Chapter 62.

2909.5.1 Size. The size of the package containing organic peroxide shall be selected so that, as nearly as practical, full packages are utilized at one time. Spilled peroxide shall be promptly cleaned up and disposed of as specified by the supplier.

2909.6 Finished products. Finished products that are flammable or combustible liquids shall be stored outside of structures, in a separate structure, or in a room separated from the processing area in accordance with the *California Building Code*. The storage of finished products shall be in tanks or closed containers in accordance with Chapter 57.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 30 – INDUSTRIAL OVENS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 30

INDUSTRIAL OVENS

User note:

About this chapter: Chapter 30 addresses the fuel supply, ventilation, emergency shutdown equipment, fire protection and the operation and maintenance of industrial ovens, which are sometimes referred to as industrial heat enclosures or industrial furnaces. Compliance with this chapter is intended to reduce the likelihood of fires involving industrial ovens, which are usually the result of the fuel in use or volatile vapors given off by the materials being heated, or to manage the impact if a fire should occur.

SECTION 3001 GENERAL

3001.1 Scope. This chapter shall apply to the installation and operation of industrial ovens and furnaces. Industrial ovens and furnaces shall comply with the applicable provisions of the *International Fuel Gas Code*, the *California Mechanical Code*, NFPA 86 and this chapter. The terms “ovens” and “furnaces” are used interchangeably in this chapter.

3001.2 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

SECTION 3002 DEFINITIONS

3002.1 Definitions. The following terms are defined in Chapter 2:

FURNACE CLASS A.

FURNACE CLASS B.

FURNACE CLASS C.

FURNACE CLASS D.

SECTION 3003 LOCATION

3003.1 Ventilation. Enclosed rooms or basements containing industrial ovens or furnaces shall be provided with combustion air in accordance with the *International Fuel Gas Code* and the *California Mechanical Code*, and with ventilation air in accordance with the *California Mechanical Code*.

3003.2 Exposure. When locating ovens, oven heaters and related equipment, the possibility of fire resulting from overheating or from the escape of fuel gas or fuel oil and the possibility of damage to the building and injury to persons resulting from explosion shall be considered.

3003.3 Ignition source. Industrial ovens and furnaces shall be located so as not to pose an ignition hazard to flammable vapors or mists or combustible dusts.

3003.4 Temperatures. Roofs and floors of ovens shall be insulated and ventilated to prevent temperatures at combustible ceilings and floors from exceeding 160°F (71°C).

SECTION 3004 FUEL PIPING

3004.1 Fuel-gas piping. Fuel-gas piping serving industrial ovens shall comply with the *International Fuel Gas Code*. Piping for other fuel sources shall comply with this section.

3004.2 Shutoff valves. Each industrial oven or furnace shall be provided with an approved manual fuel shutoff valve in accordance with the *International Fuel Gas Code* or the *California Mechanical Code*.

3004.2.1 Fuel supply lines. Valves for fuel supply lines shall be located within 6 feet (1829 mm) of the appliance served.

Exception: Where approved and the valve is located in the same general area as the appliance served.

3004.3 Valve position. The design of manual fuel shutoff valves shall incorporate a permanent feature that visually indicates the open or closed position of the valve. Manual fuel shutoff valves shall not be equipped with removable handles or wrenches unless the handle or wrench can only be installed parallel with the fuel line when the valve is in the open position.

SECTION 3005 INTERLOCKS

3005.1 Shut down. Interlocks shall be provided for Class A ovens so that conveyors or sources of flammable or combustible materials shall shut down if either the exhaust or recirculation air supply fails.

SECTION 3006 FIRE PROTECTION

3006.1 Required protection. Class A and B ovens that contain, or are utilized for the processing of, combustible materials shall be protected by an approved automatic fire-extinguishing system complying with Chapter 9.

Exceptions:

1. Small tabletop ovens used in laboratory facilities.
2. Nonwalk-in ovens that are less than 4 feet (1219 mm) in length and width.

INDUSTRIAL OVENS

3006.2 Fixed fire-extinguishing systems. Fixed fire-extinguishing systems shall be provided for Class C or D ovens to protect against such hazards as overheating, spillage of molten salts or metals, quench tanks, ignition of hydraulic oil and escape of fuel. It shall be the user's responsibility to consult with the fire code official concerning the necessary requirements for such protection.

3006.3 Fire extinguishers. Portable fire extinguishers complying with Section 906 shall be provided not closer than 15 feet (4572 mm) or not more than 50 feet (15 240 mm) or in accordance with NFPA 10. This shall apply to the oven and related equipment.

SECTION 3007 OPERATION AND MAINTENANCE

3007.1 Furnace system information. An approved, clearly worded, and prominently displayed safety design data form or manufacturer's nameplate shall be provided stating the safe operating condition for which the furnace system was designed, built, altered or extended.

3007.2 Oven nameplate. Safety data for Class A solvent atmosphere ovens shall be furnished on the manufacturer's nameplate. The nameplate shall provide the following design data:

1. The solvent used.
2. The number of gallons (L) used per batch or per hour of solvent entering the oven.
3. The required purge time.
4. The oven operating temperature.
5. The exhaust blower rating for the number of gallons (L) of solvent per hour or batch at the maximum operating temperature.

Exception: For low-oxygen ovens, the maximum allowable oxygen concentration shall be included in place of the exhaust blower ratings.

3007.3 Training. Operating, maintenance and supervisory personnel shall be thoroughly instructed and trained in the operation of ovens or furnaces.

3007.4 Equipment maintenance. Equipment shall be maintained in accordance with the manufacturer's instructions.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 31 – TENTS, TEMPORARY SPECIAL EVENT STRUCTURES AND OTHER MEMBRANE STRUCTURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
3101.1			X																			
[T-19 §303 (a)(b)]				X																		
3101.2			X																			
3101.3			X																			
3103.3.1			X																			
3103.8.2			X																			
3103.9.4			X																			
[T-19 §340]				X																		
[T-19 §341]				X																		
[T-19 §321]				X																		
[T-19 §315 (a)]				X																		
[T-19 §332 (a)]				X																		
[T-19 §334]				X																		
[T-19 §335 (a)(b)]				X																		
[T-19 §315 (d)]				X																		
3108			X																			
[T-19 §315 (b)]				X																		
[T-19 §326 (b)]				X																		
[T-19 §316]				X																		
[T-19 §317]				X																		
[T-19 §319 (a-c)]				X																		
[T-19 §319 (d)(e)]				X																		
[T-19 §325]				X																		
[T-19 §324 (a)(b)]				X																		
[T-19 §320]				X																		
[T-19 §326 (a)]				X																		
[T-19 §326 (c)]				X																		
3107.20			X																			

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CHAPTER 31

TENTS, TEMPORARY SPECIAL EVENT STRUCTURES AND OTHER MEMBRANE STRUCTURES

User note:

About this chapter: Chapter 31 provides requirements that are intended to protect temporary as well as permanent tents and air-supported and other membrane structures and temporary stage special event structures from fire and similar hazards. The provisions regulate structure location and access, anchorage, egress, heat-producing equipment, hazardous materials and operations, combustible vegetation, ignition sources, and waste accumulation. This is accomplished through requiring regular inspections and certifying continued compliance with fire safety regulations. This chapter also addresses outdoor assembly events, which are not limited to those events with tents or other membrane structures, but are regulated due to the number of people, density of those people and hazards associated with large outdoor events related to egress, fire hazards from cooking and other related concerns.

SECTION 3101 GENERAL

3101.1 Scope. Tents, temporary special event structures and membrane structures shall comply with this chapter. The provisions of Section 3103 are applicable only to temporary tents and membrane structures. The provisions of Sections 3104 and 3106 are applicable to temporary and permanent tents and membrane structures. The provisions of Section 3105 are applicable to temporary special event structures. *The provisions of Section 3106 are applicable to inflatable amusement devices.* The provisions of Section 3107 are applicable to outdoor assembly events. Other temporary structures shall comply with the *California Building Code*.

These building standards govern the use of tents, awnings or other fabric enclosures, including membrane (air-supported and air-inflated) structures and places of assemblage, in or under which 10 or more persons may gather for any lawful purpose.

Exceptions:

1. *Tents, awnings or other fabric enclosures used to cover or enclose private swimming pools and similar facilities on the premises of private one- and two-family dwellings.*
2. *Tents used to conduct committal services on the ground of a cemetery.*
3. *Tents, awnings or other fabric enclosures erected and used within a sound stage, or other similar structural enclosure which is equipped with an overhead automatic sprinkler system.*
4. *Tensioned membrane roof materials supported by rigid frames or installed on a mast and cable system provided such structures conform to the requirements of one of the types of construction as described in these regulations.*
5. *Fabric structures which are part of mobile homes, recreational vehicles or commercial coaches governed by the provisions of Division 13, Part 2, Health and Safety Code (Department of Housing and Community Development).*

[California Code of Regulations, Title 19, Division 1, §303.(a) and (b)] Scope.

(a) The provisions of California Code of Regulations, Title 19, Division 1, Chapter 2 apply to the sale, offering for sale, manufacture for sale, rental and use of tents within this state.

(b) For building standards relating to tents and membrane structures, see California Code of Regulations, Title 24, Part 9.

3101.2 Alternate means of protection. *When approved by the enforcing agency, exceptions to the provisions of these building standards may be permitted, provided alternate means of protection which are at least equal to these regulations in quality, strength, effectiveness, fire resistance, durability and safety are provided.*

3101.3 Labor camps. *Tents used in labor camps for the housing of employees shall have tight wooden floors raised at least 4 inches (102 mm) above ground level having baseboards on all sides to a height of at least 6 inches (152 mm) or shall have concrete slabs with finished surface at least 4 inches (102 mm) above grade having baseboards on all sides to a height of at least 6 inches (152 mm).*

Electrical installations serving and installed within tents shall comply with the applicable requirements of the California Electrical Code.

Tents shall not be considered suitable sleeping places when it is found necessary to provide heating facilities in order to maintain a minimum temperature of 60°F (33.3°C) within such tent during the period of occupancy.

Note: *See Section 17008 of the Health and Safety Code for definition of labor camp.*

SECTION 3102 DEFINITIONS

3102.1 Definitions. The following terms are defined in Chapter 2:

AIR-INFLATED STRUCTURE.

**AIR-SUPPORTED STRUCTURE.
MEMBRANE STRUCTURE.
TEMPORARY SPECIAL EVENT STRUCTURE.
TENT.**

**SECTION 3103
TEMPORARY TENTS AND
MEMBRANE STRUCTURES**

3103.1 General. Tents and membrane structures used for temporary periods shall comply with this section and Section 3106. Other temporary structures erected for a period of 180 days or less shall comply with the *California Building Code*.

3103.2 Approval required. Tents and membrane structures having an area in excess of 400 square feet (37 m²) shall not be erected, operated or maintained for any purpose without first obtaining a permit and approval from the fire code official.

Exceptions:

1. Tents used exclusively for recreational camping purposes.
2. Tents open on all sides that comply with all of the following:
 - 2.1. Individual tents having a maximum size of 700 square feet (65 m²).
 - 2.2. The aggregate area of multiple tents placed side by side without a fire break clearance of 12 feet (3658 mm), not exceeding 700 square feet (65 m²) total.
 - 2.3. A minimum clearance of 12 feet (3658 mm) to all structures and other tents.

3103.3 Outdoor assembly event. For the purposes of this chapter, an outdoor assembly event shall include a circus, carnival, tent show, theater, skating rink, dance hall or other place of assembly in or under which persons gather for any purpose.

3103.3.1 Special amusement area. Tents and other membrane structures erected as a special amusement area shall be equipped with an automatic sprinkler system in accordance with Section 914.7.1.

3103.4 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

3103.5 Use period. Temporary tents, air-supported, air-inflated or tensioned membrane structures shall not be erected for a period of more than 180 days within a 12-month period on a single premises.

3103.6 Construction documents. A detailed site and floor plan for tents or membrane structures with an occupant load of 50 or more shall be provided with each application for approval. The tent or membrane structure floor plan shall indicate details of the means of egress facilities, seating capacity, arrangement of the seating and location and type of heating and electrical equipment. The construction documents shall include an analysis of structural stability.

3103.7 Inspections. The entire tent, air-supported, air-inflated or tensioned membrane structure system shall be inspected at regular intervals, but not less than two times per permit use period, by the permittee, owner or agent to determine that the installation is maintained in accordance with this chapter.

Exception: Permit use periods of less than 30 days.

3103.7.1 Inspection report. Where required by the fire code official, an inspection report shall be provided and shall consist of maintenance, anchors and fabric inspections.

3103.8 Access, location and parking. Access, location and parking for temporary tents and membrane structures shall be in accordance with this section.

3103.8.1 Access. Fire apparatus access roads shall be provided in accordance with Section 503.

3103.8.2 Location. Tents or membrane structures shall not be located within 20 feet (6096 mm) of lot lines, buildings, other tents or membrane structures, parked vehicles or internal combustion engines. For the purpose of determining required distances, support ropes and guy wires shall be considered as part of the temporary membrane structure or tent.

Exceptions:

1. Separation distance between membrane structures and tents not used for cooking is not required where the aggregate floor area does not exceed 15,000 square feet (1394 m²).
2. Membrane structures or tents need not be separated from buildings where all of the following conditions are met:
 - 2.1. The aggregate floor area of the membrane structure or tent shall not exceed 10,000 square feet (929 m²).
 - 2.2. The aggregate floor area of the building and membrane structure or tent shall not exceed the allowable floor area including increases as indicated in the *California Building Code*.
 - 2.3. Required means of egress are provided for both the building and the membrane structure or tent including travel distances.
 - 2.4. Fire apparatus access roads are provided in accordance with Section 503.
3. *When approved by the enforcing agency, tents may be located in or on permanent buildings provided such use does not constitute an undue hazard.*

3103.8.3 Location of structures in excess of 15,000 square feet in area. Membrane structures having an area of 15,000 square feet (1394 m²) or more shall be located not less than 50 feet (15 240 mm) from any other tent or structure as measured from the sidewall of the tent or membrane structure unless joined together by a corridor.

3103.8.4 Membrane structures on buildings. Membrane structures that are erected on buildings, balconies, decks or other structures shall be regulated as permanent membrane structures in accordance with Section 3102 of the *California Building Code*.

3103.8.5 Connecting corridors. Tents or membrane structures are allowed to be joined together by means of corridors. Exit doors shall be provided at each end of such corridor. On each side of such corridor and approximately opposite each other, there shall be provided openings not less than 12 feet (3658 mm) wide.

3103.8.6 Fire break. An unobstructed fire break passageway or fire road not less than 12 feet (3658 mm) wide and free from guy ropes or other obstructions shall be maintained on all sides of all tents and membrane structures unless otherwise approved by the fire code official.

3103.9 Structural stability and anchorage required. Tents or membrane structures and their appurtenances shall be designed and installed to withstand the elements of weather and prevent collapsing. Documentation of structural stability shall be furnished to the fire code official.

3103.9.1 Tents and membrane structures greater than one story. Tents and membrane structures exceeding one story shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.2 Tents and membrane structures greater than 7,500 square feet. Tents and membrane structures greater than 7,500 square feet (697 m²) shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.3 Tents and membrane structures with an occupant load greater than 1,000. Tents and membrane structures with an occupant capacity greater than 1,000 persons shall be designed and constructed to comply with Sections 1606 through 1609 of the *California Building Code*.

3103.9.4 Water-filled vessels. *Water-filled vessels shall not be used to anchor a tent or membrane structure unless approved and in accordance with the tent or membrane structure manufacturer's instructions.*

3103.10 Temporary air-supported and air-inflated membrane structures. Temporary air-supported and air-inflated membrane structures shall be in accordance with Sections 3103.10.1 through 3103.10.4.

3103.10.1 Door operation. During high winds exceeding 50 miles per hour (22 m/s) or in snow conditions, the use of doors in air-supported structures shall be controlled to avoid excessive air loss. Doors shall not be left open.

3103.10.2 Fabric envelope design and construction. Air-supported and air-inflated structures shall have the design and construction of the fabric envelope and the method of anchoring in accordance with Architectural Fabric Structures Institute FSAAS.

3103.10.3 Blowers. An air-supported structure used as a place of assembly shall be furnished with not less than

two blowers, each of which has adequate capacity to maintain full inflation pressure with normal leakage. The design of the blower shall be so as to provide integral limiting pressure at the design pressure specified by the manufacturer.

3103.10.4 Auxiliary inflation systems. Places of public assembly for more than 200 persons shall be furnished with an auxiliary inflation system capable of powering a blower with the capacity to maintain full inflation pressure with normal leakage in accordance with Section 3103.10.3 for a minimum duration of 4 hours. The auxiliary inflation system shall be either a fully automatic auxiliary engine-generator set or a supplementary blower powered by an internal combustion engine that shall be automatic in operation. The system shall be capable of automatically operating the required blowers at full power within 60 seconds of a commercial power failure.

3103.11 Seating arrangements. Seating in tents or membrane structures shall be in accordance with Chapter 10.

3103.12 Means of egress. Means of egress for temporary tents and membrane structures shall be in accordance with Sections 3103.12.1 through 3103.12.8.

3103.12.1 Distribution. Exits shall be spaced at approximately equal intervals around the perimeter of the tent or membrane structure, and shall be located such that all points are 100 feet (30 480 mm) or less from an exit.

3103.12.2 Number. Tents or membrane structures or a usable portion thereof shall have not less than one exit and not less than the number of exits required by Table 3103.12.2. The total width of means of egress in inches (mm) shall be not less than the total occupant load served by a means of egress multiplied by 0.2 inches (5 mm) per person.

3103.12.3 Exit openings from tents. Exit openings from tents shall remain open unless covered by a flame-resistant curtain. The curtain shall comply with the following requirements:

1. Curtains shall be free sliding on a metal support. The support shall be not less than 80 inches (2032 mm) above the floor level at the exit. The curtains shall be so arranged that, when open, no part of the curtains obstructs the exit.
2. Curtains shall be of a color, or colors, that contrasts with the color of the tent.

3103.12.4 Doors. Exit doors shall swing in the direction of exit travel. To avoid hazardous air and pressure loss in air-supported membrane structures, such doors shall be automatic closing against operating pressures. Opening force at the door edge shall not exceed 15 pounds (66 N).

3103.12.5 Aisle. The width of aisles without fixed seating shall be in accordance with the following:

1. In areas serving employees only, the minimum aisle width shall be 24 inches (610 mm) but not less than the width required by the number of employees served.

TABLE 3103.12.2
MINIMUM NUMBER OF MEANS OF EGRESS AND MEANS OF EGRESS WIDTHS
FROM TEMPORARY MEMBRANE STRUCTURES AND TENTS

OCCUPANT LOAD	MINIMUM NUMBER OF MEANS OF EGRESS	MINIMUM WIDTH OF EACH MEANS OF EGRESS (inches)	
		Tent	Membrane Structure
10 to 199	2	72	36
200 to 499	3	72	72
500 to 999	4	96	72
1,000 to 1,999	5	120	96
2,000 to 2,999	6	120	96
Over 3,000 ^a	7	120	96

For SI: 1 inch = 25.4 mm.

a. When the occupant load exceeds 3,000, the total width of means of egress (in inches) shall be not less than the total occupant load multiplied by 0.2 inch per person.

2. In public areas, smooth-surfaced, unobstructed aisles having a minimum width of not less than 44 inches (1118 mm) shall be provided from seating areas, and aisles shall be progressively increased in width to provide, at all points, not less than 1 foot (305 mm) of aisle width for each 50 persons served by such aisle at that point.

3103.12.5.1 Arrangement and maintenance. The arrangement of aisles shall be subject to approval by the fire code official and shall be maintained clear at all times during occupancy.

3103.12.6 Exit signs. Exits shall be clearly marked. Exit signs shall be installed at required exit doorways and where otherwise necessary to indicate clearly the direction of egress where the exit serves an occupant load of 50 or more.

3103.12.6.1 Exit sign illumination. Exit signs shall be either listed and labeled in accordance with UL 924 as the internally illuminated type and used in accordance with the listing or shall be externally illuminated by luminaires supplied in either of the following manners:

1. Two separate circuits, one of which shall be separate from all other circuits, for occupant loads of 300 or less.
2. Two separate sources of power, one of which shall be an approved emergency system, shall be provided where the occupant load exceeds 300. Emergency systems shall be supplied from storage batteries or from the on-site generator set, and the system shall be installed in accordance with *the California Electrical Code*. The emergency system provided shall have a minimum duration of 90 minutes when operated at full design demand.

3103.12.7 Means of egress illumination. Means of egress shall be illuminated with light having an intensity of not less than 1 foot-candle (11 lux) at floor level while the structure is occupied. Fixtures required for means of egress illumination shall be supplied from a separate circuit or source of power.

3103.12.8 Maintenance of means of egress. The required width of exits, aisles and passageways shall be maintained at all times to a public way. Guy wires, guy ropes and other support members shall not cross a means of egress at a height of less than 8 feet (2438 mm). The surface of means of egress shall be maintained in an approved manner.

SECTION 3104 TEMPORARY AND PERMANENT TENTS AND MEMBRANE STRUCTURES

3104.1 General. Tents and membrane structures, both temporary and permanent, shall be in accordance with this section and Sections 3106 and 3107. Permanent tents and membrane structures shall also comply with the *California Building Code*.

[California Code of Regulations, Title 19, Division 1, §340] Existing Small Tents.

Existing small tents are exempt from California Code of Regulations, Title 19, Division 1, Chapter 2.

[California Code of Regulations, Title 19, Division 1, §341] Existing Membrane Structures and Other (Large) Existing Tents.

Existing membranes of membrane structures and large (10 or more capacity) existing tents may continue to be used provided evidence of satisfactory flame resistance is available to the enforcing authority. Such evidence may be in the form of certification that the fabric passes the standard small scale flame resistance test as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8 regulations or through passage of effective field tests.

[California Code of Regulations, Title 19, Division 1, §321] Abatement of Fire or Panic Hazards.

Any condition that presents a fire hazard, would contribute to the rapid spread of fire, interfere with the rapid exit of persons from the tents, or interfere with or delay the extinguishment of a fire, shall be immediately corrected as ordered by the enforcing authority.

[California Code of Regulations, Title 19, Division 1, §315.(a)] Flame Resistance Standards.

(a) All tent fabrics and all interior decorative fabrics or materials shall be flame resistant in accordance with appropriate standards set forth in California Code of Regulations, Title 19, Division 1, Chapter 8.

Tent tops and sidewalls shall be made either from fabric which has been flame resistant treated with an approved exterior chemical process by an approved application concern, or from inherently flame-resistant fabric approved and listed by the State Fire Marshal.

[California Code of Regulations, Title 19, Division 1, §332.(a)] Flame Resistance.

(a) All tents manufactured for sale, sold, rented, offered for sale or used in California shall be made from non-flammable material or one of the following flame-resistant fabrics or material approved by the State Fire Marshal:

(1) Fabrics complying with the State Fire Marshal's requirements for flame resistance for exterior use, as set forth in California Code of Regulations, Title 19, Division 1, Chapter 8, or

(2) Fabrics complying with the flame-resistance requirements set forth in "A Specification for Flame-Resistance Materials Used in Camping Tentage" published in 1975 by Canvas Products Association International, hereinafter referred to as CPAI-84.

Exceptions:

(1) Tents used for committal services at cemeteries.

(2) Tents or similar fabric enclosures used within a sound stage or equivalent enclosure equipped with an overhead automatic fire extinguishing system.

3104.2 Flame propagation performance testing and certification. Before a permit is granted, the owner or agent shall file with the fire code official a certificate provided by the product manufacturer to verify that the materials have been tested and certified by an approved testing laboratory. The certificate shall indicate that the floor coverings, tents, membrane structures and their appurtenances, which include sidewalls, drops and tarpaulins, are composed of materials meeting the flame propagation performance of Test Method 2 of NFPA 701. Additionally, it shall indicate that the bunting and combustible decorative materials and effects are composed of material meeting the flame propagation performance criteria of Test Method 1 or Test Method 2 of NFPA 701, as applicable. Alternatively, the materials shall be treated with a flame retardant in an approved manner and meet the flame propagation performance criteria of the applicable test method of NFPA 701. The certificate shall indicate compliance with the testing requirements of NFPA 701, Chapter 16. The flame propagation performance criteria shall be effective for the period specified by the permit.

3104.3 Label. Membrane structures or tents shall have a permanently affixed label bearing the following information:

1. The identification of size and fabric or material.
2. The names and addresses of the manufacturers of the tent or air-supported structure.
3. A statement that the fabric or material meets the requirements of Section 3104.2.
4. If treated, the date the fabric or material was last treated with flame-retardant solution, the trade name or kind of chemical used in treatment, name of person or firm treating the fabric or material, and name of testing agency and test standard by which the fabric or material was tested.
5. If untreated, a statement that no treatment was applied when the fabric or material met the requirements of Section 3104.2.

[California Code of Regulations, Title 19, Division 1, §334.] Requirements Pertaining to All Tents.

All tents manufactured for sale in California shall be labeled in accordance with the appropriate provisions of California Code of Regulations, Title 19, Division 1, Section 335.

[California Code of Regulations, Title 19, Division 1, §335.(a) and (b)] Labeling of Tents.

(a) Each section of top and sidewall in large tents shall have a durable label, permanently affixed, bearing the following information:

(1) *The Seal of Registration.*

(2) *If treated fabric, the name and registration number of the approved application concern and approved chemical used, and the date of treatment.*

(3) *If registered fabric, the trade name and registration number of the approved fabric, and the date of production.*

In lieu of attached labels, the required information may be applied directly to the fabric by print, stamp or stencil.

(b) *Small tents shall have a permanently affixed label bearing the information in California Code of Regulations, Title 19, Division 1, Section 335, subsection (a), or shall comply with the provisions specified in CPAI-84 (1975) which reads as follows:*

(1) *Certification. A statement that the materials used in the manufacture of the item meet the flame resistance requirements of CPAI-84.*

(2) *Manufacturer Identification. An identification of the manufacturer of the item. If the item bears a private label, it shall identify the private labeler and shall also contain a code mark which will permit the seller of the item to identify the manufacturer to the purchaser upon request.*

(3) *Code Number.* A number enabling the manufacturer to identify from his records the suppliers and suppliers' lot numbers of the certified materials used in the item. The manufacturer shall also maintain records identifying the parties to whom he sold camping tentage. Further, he shall maintain records identifying items manufactured from lots of certified material. Records shall be maintained for four (4) years.

(4) *Warning label.*

24 pt. type

WARNING

16 pt. type

KEEP ALL FLAME AND HEAT SOURCES AWAY FROM THIS TENT FABRIC

12 pt. type

This tent is made with flame-resistant fabric which meets CPAI-84 specifications. It is not fire proof. The fabric will burn if left in continuous contact with any flame source.

The application of any foreign substance to the tent fabric may render the flame resistant properties ineffective.

This warning label or its equivalent must be permanently affixed to the tent at one conspicuous location, and must block letters on a white background. The first paragraph of the body of the label must be placed in a conspicuous location on each carton containing the tent.

3104.4 Affidavit. The affidavit required by Section 3104.2 shall contain all of the information specified in Section 3104.3.

[California Code of Regulations, Title 19, Division 1, §315.(d)] Flame Resistance Standards.

(d) Certificates of Flame Resistance or other documentation affirming the requirements of California Code of Regulations, Title 19, Division 1, Section 315, subsection (a) shall be made available upon request of the enforcement authority.

SECTION 3105 TEMPORARY SPECIAL EVENT STRUCTURES

3105.1 General. Temporary special event structures shall comply with Section 3104, Sections 3105.2 through 3105.9 and ANSI E1.21.

3105.2 Approval. Temporary special event structures in excess of 400 square feet (37 m²) shall not be erected, operated or maintained for any purpose without first obtaining approval and a permit from the fire code official and the building official.

3105.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

3105.4 Use period. Temporary special event structures erected in accordance with ANSI E1.21 shall not be erected for a period of more than six consecutive weeks.

3105.5 Required documents. The following documents shall be submitted to the fire code official and the building official for review before a permit is approved:

1. Construction documents: Construction documents shall be prepared by a registered design professional in accordance with the *California Building Code* and ANSI E1.21 where applicable. Construction documents shall include:
 - 1.1. A summary sheet showing the building code used, design criteria, loads and support reactions.
 - 1.2. Detailed construction and installation drawings.
 - 1.3. Design calculations.
 - 1.4. Operating limits of the structure explicitly outlined by the registered design professional including environmental conditions and physical forces.
 - 1.5. Effects of additive elements such as video walls, supported scenery, audio equipment, vertical and horizontal coverings.
 - 1.6. Means for adequate stability including specific requirements for guying and cross-bracing, ground anchors or ballast for different ground conditions.
2. Designation of responsible party: The owner of the temporary special event structure shall designate in writing a person to have responsibility for the temporary special event structure on the site. The designated person shall have sufficient knowledge of the construction documents, manufacturer's recommendations and operations plan to make judgments regarding the structure's safety and to coordinate with the fire code official.
3. Operations plan: The operations plan shall reflect manufacturer's operational guidelines, procedures for environmental monitoring and actions to be taken under specified conditions consistent with the construction documents.

3105.6 Inspections. Inspections shall comply with Section 107 and Sections 3105.6.1 and 3105.6.2.

3105.6.1 Independent inspector. The owner of a temporary special event structure shall employ a qualified, independent approved agency or individual to inspect the installation of a temporary special event structure.

3105.6.2 Inspection report. The inspecting agency or individual shall furnish an inspection report to the fire code official. The inspection report shall indicate that the temporary special event structure was inspected and was or was not installed in accordance with the approved construction documents. Discrepancies shall be brought to the immediate attention of the installer for correction. Where any discrepancy is not corrected, it shall be brought to the attention of the fire code official and the designated responsible party.

3105.7 Means of egress. The means of egress for temporary special event structures shall comply with Chapter 10.

3105.8 Location. Temporary special event structure shall be located a distance from property lines and buildings to accommodate distances indicated in the construction drawings for guy wires, cross-bracing, ground anchors or ballast. Location shall not interfere with egress from a building or encroach on fire apparatus access roads.

3105.9 Portable fire extinguishers. Portable fire extinguishers shall be provided as required by Section 906.

SECTION 3106 OUTDOOR ASSEMBLY EVENTS

3106.1 Scope. Outdoor assembly events shall comply with this section.

3106.2 General. Outdoor assembly events shall be in accordance with this section and Section 403.11. Temporary structures erected for outdoor assembly events shall comply with this chapter.

3106.2.1 Approval required. Outdoor assembly events shall be approved by the fire code official.

3106.2.2 Permits. An operational permit shall be required as set forth in Section 105.5.

3106.2.3 Access. An approved means of fire apparatus access shall be provided.

3106.2.3.1 Fire service features. Unobstructed access to fire hydrants, drafting sources and other fire protection features shall be maintained at all times.

3106.3 Occupancy and means of egress. The number and location of emergency egress and escape routes shall be approved by the fire code official.

3106.3.1 Occupant load. The fire code official shall establish an occupant load for the event site.

3106.3.2 Maintenance of emergency egress and escape routes. Emergency egress and escape routes shall be maintained at all times.

3106.4 Public safety for events. Outdoor assembly events shall comply with Sections 3106.4.1 through 3106.4.7.

3106.4.1 Public safety plan for gatherings. A public safety plan shall be prepared where required by Section 403.11.2. The public safety plan shall be submitted to the fire code official with the application for an operational permit as required by Section 3106.2.2.

3106.4.2 Weather monitoring person. Where required by the fire code official, the event operator or agent shall designate one qualified individual to continuously monitor local weather reports, forecasts and conditions. Said person shall be responsible for initiating weather-related event mitigation activities, ordering the suspension or cancellation of the outdoor assembly event and issuing the evacuation signal in accordance with the approved public safety plan.

3106.4.3 Crowd managers. Where events involve a gathering of more than 1,000 people, trained crowd managers shall be provided in accordance with Section 403.11.3.

3106.4.4 Portable fire extinguishers. Approved portable fire extinguishers complying with Section 906 shall be provided and placed in locations approved by the fire code official.

3106.4.5 Smoking. Smoking shall be permitted only in designated areas. Other areas shall have approved “No Smoking” signs conspicuously posted and maintained in accordance with Section 310.

[California Code of Regulations, Title 19, Division 1, §316] Smoking Prohibited.

Smoking is not permitted in any tent and in any adjacent areas where hay or other highly flammable materials are kept. “No Smoking” signs shall be conspicuously posted in all tents open to the public and wherever otherwise specified by the enforcing authority.

3106.4.6 Combustible vegetation. Combustible vegetation that could create a fire hazard shall be removed from the outdoor assembly event area.

3106.4.7 Combustible refuse. Combustible refuse shall be kept in noncombustible containers with tight-fitting or self-closing lids. Combustible refuse shall be removed from the event site at regular intervals to prevent an unsafe accumulation within the event site.

3106.5 Cooking appliances or devices. Outdoor assembly events with concession stands or booths using cooking appliances or devices shall comply with Sections 3106.5.1 through 3106.5.3.

3106.5.1 Separation from tents or structures. Cooking appliances or devices that produce sparks or grease-laden vapors or flying embers (firebrands) shall not be used within 20 feet (6096 mm) of a tent or temporary structure.

Exceptions:

1. Designated cooking tents not occupied by the public when approved by the fire code official.
2. Tents or structures where cooking appliances are protected with an automatic fire-extinguishing system in accordance with Section 904.13.

3106.5.2 Protection. Cooking equipment using combustible oils or solids shall meet the following:

1. A noncombustible lid shall be immediately available. The lid shall be of sufficient size to cover the cooking well completely.

2. The equipment shall be placed on a noncombustible surface.
3. An approved portable fire extinguisher for protection from cooking grease fires shall be provided at a location approved by the fire code official.

3106.5.3 Liquefied petroleum gas (LP-gas). The use of liquefied petroleum gas (LP-gas) shall be in accordance with Chapter 61.

3106.6 Electrical equipment and wiring. Outdoor assembly events with concession stands or booths using electrical equipment and temporary wiring for electrical power or lighting shall comply with the applicable provisions of the *California Electrical Code* and Sections 3106.6.1 through 3106.6.3.

3106.6.1 Outdoor use. Electrical equipment and wiring shall be listed and labeled for outdoor use.

3106.6.2 Generators. Generators shall be installed not less than 10 feet (3048 mm) from combustible materials, and shall be isolated from the public by physical guard, fence or enclosure installed not less than 3 feet (914 mm) away from the internal combustion power source.

3106.6.3 Portable fire extinguishers. Each generator shall be provided with an approved portable fire extinguisher complying with Section 906.

SECTION 3107 OPERATIONAL REQUIREMENTS

3107.1 General. Temporary and permanent tents and membrane structures shall comply with this section.

3107.2 Combustible materials. Hay, straw, shavings or similar combustible materials shall not be located within any tent or membrane structure containing an assembly occupancy, except the materials necessary for the daily feeding and care of animals. Sawdust and shavings utilized for a public performance or exhibit shall not be prohibited provided that the sawdust and shavings are kept damp. Combustible materials shall not be permitted under stands or seats at any time.

[California Code of Regulations, Title 19, Division 1, §315.(b)] Flame Resistance Standards.

(b) Sawdust, shavings or other combustible material used on the floor or ground shall be made flame resistant or when approved by the enforcing authority shall be kept adequately damp when tent is occupied.

[California Code of Regulations, Title 19, Division 1, §326.(b)] Hazard Abatement.

(b) Hay, straw, trash and other similar flammable material shall be stored more than 50 feet from any tent except upon approval of the enforcing authority.

Exception: Tents to which the public is not admitted.

3107.3 Smoking. Smoking shall not be permitted in tents or membrane structures. Approved “No Smoking” signs shall be conspicuously posted in accordance with Section 310.

[California Code of Regulations, Title 19, Division 1, §316] Smoking Prohibited.

Smoking is not permitted in any tent and in any adjacent areas where hay or other highly flammable materials are kept. “No Smoking” signs shall be conspicuously posted in all tents open to the public and wherever otherwise specified by the enforcing authority.

3107.4 Open or exposed flame. Open flame or other devices emitting flame, fire or heat or any flammable or combustible liquids, gas, charcoal or other cooking device or any other unapproved devices shall not be permitted inside or located within 20 feet (6096 mm) of the tent or membrane structures while open to the public unless approved by the fire code official.

[California Code of Regulations, Title 19, Division 1, §317] Fireworks and Open Flames.

Fireworks, open flame or any device emitting flame or spark shall not be used in or immediately adjacent to any tent while open to the public, except when approved in writing by the enforcing authority.

3107.5 Fireworks. Fireworks shall not be used within 100 feet (30 480 mm) of tents or membrane structures.

3107.6 Spot lighting. Spot or effect lighting shall only be by electricity, and all combustible construction located within 6 feet (1829 mm) of such equipment shall be protected with approved noncombustible insulation not less than 9¼ inches (235 mm) thick.

3107.7 Safety film. Motion pictures shall not be displayed in tents or membrane structures unless the motion picture film is safety film.

3107.8 Clearance. There shall be a clearance of not less than 3 feet (914 mm) between the fabric envelope and all contents located inside membrane structures.

3107.9 Portable fire extinguishers. Approved portable fire extinguishers complying with Section 906 shall be provided and placed in locations as required by the *California Code of Regulations, Title 19, Division 1, Chapter 2, Article 3, Section 319.*

[California Code of Regulations, Title 19, Division 1, §319.(a) through (c)] Fire Extinguishers and Other Fire Protection Equipment.

(a) One Class 2-A fire extinguisher shall be provided in every tent having a floor area between 500 square feet and 1,000 square feet plus one 2-A fire extinguisher in each auxiliary adjacent tent. One additional extinguisher shall be provided for each additional 2000 square feet or fraction thereof.

(b) At least one Class 10 B-C fire extinguisher shall be provided with each generator or transformer.

(c) At least one Class 10 B-C fire extinguisher shall be provided in kitchen, dining areas and at locations where flammable or combustible liquids or flammable gases are used, stored or dispensed.

3107.10 Fire protection equipment. Fire hose lines, water supplies and other auxiliary fire equipment shall be maintained at the site in such numbers and sizes as required by the fire code official.

[California Code of Regulations, Title 19, Division 1, §319.(d) and (e)] Fire Extinguishers and Other Fire Protection Equipment.

(d) Tents having a capacity of 1,000 or more persons shall be protected on each of the long sides with fire hose lines of at least 1½-inch internal diameter and of sufficient length to reach either end of the tent. The water supply shall be either from the public water mains or from tanks having a capacity of not less than 500 gallons. There shall be at least 65 pounds of flowing pressure at the nozzle of the hose line when a ½-inch tip is used.

(e) The enforcing authority may modify or waive any of the requirements of this section [Title 19, Division 1, Section 319] and may accept other types of fire extinguishing equipment in lieu of that required by Title 19, Division 1 regulations if, in the authorities' opinion, reasonable and adequate protection will be afforded.

3107.11 Occupant load factors. The occupant load allowed in an assembly structure, or portion thereof, shall be determined in accordance with Chapter 10.

3107.12 Heating and cooking equipment. Heating and cooking equipment shall be in accordance with Sections 3107.12.1 through 3107.12.7.

3107.12.1 Installation. Heating or cooking equipment, tanks, piping, hoses, fittings, valves, tubing and other related components shall be installed as specified in the *International Fuel Gas Code* and the *California Mechanical Code*, and shall be approved by the fire code official.

3107.12.2 Venting. Gas, liquid and solid fuel-burning equipment designed to be vented shall be vented to the outside air as specified in the *International Fuel Gas Code* and the *California Mechanical Code*. Such vents shall be equipped with *approved* spark arresters where required. Where vents or flues are used, all portions of the tent or membrane structure shall be not less than 12 inches (305 mm) from the flue or vent.

3107.12.3 Location. Cooking and heating equipment shall not be located within 10 feet (3048 mm) of *exits* or combustible materials.

3107.12.4 Operations. Operations such as warming of foods, cooking demonstrations and similar operations that use solid flammables, butane or other similar devices that do not pose an ignition hazard, shall be approved.

3107.12.5 Cooking tents. Tents with sidewalls or drops where cooking is performed shall be separated from other tents or membrane structures by not less than 20 feet (6096 mm).

3107.12.6 Outdoor cooking. Outdoor cooking that produces sparks or grease-laden vapors shall not be performed within 20 feet (6096 mm) of a tent or membrane structure.

3107.12.7 Electrical heating and cooking equipment. Electrical cooking and heating equipment shall comply with the *California Electrical Code*.

3107.13 LP-gas. The storage, handling and use of LP-gas and LP-gas equipment shall be in accordance with Sections 3107.13.1 through 3107.13.3.

3107.13.1 General. LP-gas equipment such as containers, tanks, piping, hoses, fittings, valves, tubing and other related components shall be approved and in accordance with Chapter 61 and with the *International Fuel Gas Code*.

[California Code of Regulations, Title 19, Division 1, §325] Liquefied Petroleum Gas.

Liquefied petroleum gas shall not be stored or used in connection with any tent unless the storage containers, equipment, fittings, appliances, placement, use and operation complies with the provisions of California Code of Regulations, Title 8, Article 5, Subchapter 1, Chapter 4.

3107.13.2 Location of containers. LP-gas containers and tanks shall be located outside in accordance with Table 6104.3. Pressure relief devices shall be pointed away from the tent or membrane structure.

3107.13.3 Protection and security. Portable LP-gas containers, tanks, piping, valves and fittings that are located outside and are being used to fuel equipment inside a tent or membrane structure shall be adequately protected to prevent tampering, damage by vehicles or other hazards and shall be located in an approved location. Portable LP-gas containers shall be secured to prevent unauthorized movement.

3107.14 Flammable and combustible liquids. The storage of flammable and combustible liquids and the use of flammable-liquid-fueled equipment shall be in accordance with Sections 3107.14.1 through 3107.14.3.

3107.14.1 Use. Flammable-liquid-fueled equipment shall not be used in tents or membrane structures.

3107.14.2 Flammable and combustible liquid storage. Flammable and combustible liquids shall be stored outside in an approved manner not less than 50 feet (15 240 mm) from tents or membrane structures. Storage shall be in accordance with Chapter 57.

[California Code of Regulations, Title 19, Division 1, §324.(a) and (b)] Flammable and Combustible Liquids.

(a) Liquids having a flash point below 200°F shall not be stored in any tent nor less than 50 feet from any tent.

(b) Flammable or combustible liquids shall be stored and dispensed in accordance with the provisions of the California Fire Code. The enforcing authority may permit limited quantities of flammable or combustible liquids required for display and normal merchandising.

3107.14.3 Refueling. Refueling shall be performed in an approved location not less than 20 feet (6096 mm) from tents or membrane structures.

3107.15 Display of motor vehicles. Liquid- and gas-fueled vehicles and equipment used for display within tents or

membrane structures shall be in accordance with Sections 3107.15.1 through 3107.15.5.3.

3107.15.1 Batteries. Batteries shall be disconnected except where the fire code official requires that the batteries remain connected to maintain safety features.

3107.15.2 Fuel. Vehicles or equipment shall not be fueled or defueled within the tent or membrane structure.

3107.15.2.1 Quantity limit. Fuel in the fuel tank shall not exceed one-quarter of the tank capacity or 5 gallons (19 L), whichever is less.

3107.15.2.2 Inspection. Fuel systems shall be inspected for leaks.

3107.15.2.3 Closure. Fuel tank openings shall be locked and sealed to prevent the escape of vapors.

3107.15.3 Location. The location of vehicles or equipment shall not obstruct means of egress.

3107.15.4 Places of assembly. When a compressed natural gas (CNG) or liquefied petroleum gas (LP-gas) powered vehicle is parked inside a place of assembly, all of the following conditions shall be met:

1. The quarter-turn shutoff valve or other shutoff valve on the outlet of the CNG or LP-gas container shall be closed and the engine shall be operated until it stops. Valves shall remain closed while the vehicle is indoors.
2. The hot lead of the battery shall be disconnected.
3. Dual-fuel vehicles equipped to operate on gasoline and CNG or LP-gas shall comply with this section and Sections 3107.15.1 through 3107.15.3 for gasoline-powered vehicles.

3107.15.5 Competitions and demonstrations. Liquid- and gas-fueled vehicles and equipment used for competition or demonstration within a tent or membrane structure shall comply with Sections 3107.15.5.1 through 3107.15.5.3.

3107.15.5.1 Fuel storage. Fuel for vehicles or equipment shall be stored in approved containers in an approved location outside of the structure in accordance with Section 3107.14.2.

3107.15.5.2 Fueling. Refueling shall be performed outside of the structure in accordance with Section 3107.14.3.

3107.15.5.3 Spills. Fuel spills shall be cleaned up immediately.

3107.16 Separation of generators. Generators and other internal combustion power sources shall be separated from tents or membrane structures by not less than 20 feet (6096 mm) and shall be isolated from contact with the public by fencing, enclosure or other approved means.

3107.17 Standby personnel. Where, in the opinion of the fire code official, it is essential for public safety in a tent or membrane structure used as a place of assembly or any other use where people congregate, because of the number of persons, or the nature of the performance, exhibition, display,

contest or activity, the owner, agent or lessee shall employ one or more qualified persons, as required and approved, to remain on duty during the times such places are open to the public, or when such activity is being conducted.

[California Code of Regulations, Title 19, Division 1, §320] Fire Safety Personnel.

The owners or operators of any tent used as a place of assemblage shall provide at least one qualified fire safety person in every tent having a capacity of 500 persons and one additional qualified person for each 1,000 additional persons or fraction thereof. Such persons shall be on duty in the tent at all times when the tent is open to the public. They shall be proficient in the handling of fire extinguishers and equipment and shall be familiar with the fire and panic safety regulations. The individual designated under this section shall meet the approval of the fire authority having jurisdiction.

Exception: *The enforcing authority may waive or modify the provisions of this section if, in his opinion, public safety will not be jeopardized.*

3107.17.1 Duties. Before each performance or the start of such activity, standby personnel shall keep diligent watch for fires during the time such place is open to the public or such activity is being conducted and take prompt measures for extinguishment of fires that occur and assist in the evacuation of the public from the structure.

3107.17.2 Crowd managers. There shall be trained crowd managers or trained crowd supervisors at a ratio of one crowd manager or supervisor for every 250 occupants, as approved.

3107.18 Combustible vegetation. Combustible vegetation that could create a fire hazard shall be removed from the area occupied by a tent or membrane structure, and from areas within 30 feet (9144 mm) of such structures.

[California Code of Regulations, Title 19, Division 1, §326.(a)] Hazard Abatement.

(a) All flammable vegetation within 50 feet of any tent shall be removed.

3107.19 Combustible waste material. The floor surface inside tents or membrane structures and the grounds outside and within a 30-foot (9144 mm) perimeter shall be kept free from combustible waste and other combustible materials that could create a fire hazard. Such waste shall be stored in approved containers and removed from the premises not less than once a day during the period the structure is occupied by the public.

[California Code of Regulations, Title 19, Division 1, §326.(c)] Hazard Abatement.

(c) Combustible waste shall not be permitted to accumulate on the grounds either inside or outside of tents. Such waste shall be stored in approved containers until removed from the premises.

3107.20 Obstructions. Exits, aisles and passageways shall not be blocked or have their minimum clear width obstructed in any manner by ticket offices, turnstiles, concessions, chairs, equipment, animal chutes, poles or guy ropes, or any-

thing whatsoever, nor shall they be blocked by persons for whom no seats are available.

In occupancies having fixed seating, and on request of the owner or manager, the enforcing agency may permit modifications from the provisions of this code to accommodate seating for handicapped persons using mechanical aids such as, but not limited to, walkers and wheelchairs.

SECTION 3108 INFLATABLE AMUSEMENT DEVICES

3108.1 Scope. *All inflatable amusement devices shall comply with this section.*

3108.2 General. *Inflatable amusement devices shall be designed, anchored, operated and maintained in accordance with the manufacturer's instructions and the requirements of ASTM F2374.*

3108.3 Combustible materials. *The fabrics, textiles, containment netting and combustible small mesh materials used in the construction of the inflatable amusement device shall meet the flame propagation criteria of Test Method 2 of NFPA 701. Additionally, a label and affidavit containing the information required in Sections 3104.3 and 3104.4 of this code shall be permanently affixed to the device.*

3108.4 Electrical equipment and wiring. *All electrical equipment, blower motors and temporary wiring for electrical power or lighting shall comply with Section 603 of this code.*

3108.5 Portable generators. *Portable generators shall comply with the applicable provisions of NFPA 70 and with the portable generator requirements of this code.*

3108.6 Portable fire extinguishers. *Each generator shall be provided with an approved portable fire extinguisher complying with Section 906 and placed in an approved location.*

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 32 – HIGH-PILED COMBUSTIBLE STORAGE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
Table 3206.2			X																			
3203.8			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 32

HIGH-PILED COMBUSTIBLE STORAGE

User note:

***About this chapter:** Chapter 32 provides guidance for reasonable protection of life from hazards associated with the storage of combustible materials in closely packed piles or on pallets, in racks or on shelves where the top of storage is greater than 12 feet in height, or 6 feet for high-hazard commodities. It provides requirements for identifying various classes of commodities; and general fire and life safety features including storage arrangements, smoke and heat venting, fire department access and housekeeping and maintenance. This chapter attempts to define the potential fire severity and, in turn, determine fire and life safety protection measures needed to control and in some cases suppress a potential fire. This chapter does not cover miscellaneous combustible material storage as regulated in Section 315.*

SECTION 3201 GENERAL

3201.1 Scope. High-piled combustible storage shall be in accordance with this chapter. In addition to the requirements of this chapter, the following material-specific requirements shall apply:

1. Aerosols shall be in accordance with Chapter 51.
2. Flammable and combustible liquids shall be in accordance with Chapter 57.
3. Hazardous materials shall be in accordance with Chapter 50.
4. Storage of combustible paper records shall be in accordance with NFPA 13.
5. Storage of combustible fibers shall be in accordance with Chapter 37.
6. General storage of combustible material shall be in accordance with Chapter 3.

3201.2 Permits. A permit shall be required as set forth in Sections 105.5 and 105.6.

3201.3 Construction documents. At the time of building permit application for new structures designed to accommodate high-piled storage or for requesting a change of occupancy/use, and at the time of application for a storage permit, plans and specifications shall be submitted for review and approval. In addition to the information required by the *California Building Code*, the storage permit submittal shall include the information specified in this section. The construction documents shall include all of the following:

1. Floor plan of the building showing locations and dimensions of high-piled storage areas.
2. Usable storage height for each storage area.
3. Number of tiers within each rack, if applicable.
4. Commodity clearance between top of storage and the sprinkler deflector for each storage arrangement.
5. Aisle dimensions between each storage array.
6. Maximum pile volume for each storage array.
7. Location and classification of commodities in accordance with Section 3203.

8. Location of commodities that are banded or encapsulated.
9. Location of required fire department access doors.
10. Type of fire protection systems.
11. Location of valves controlling the water supply of ceiling and in-rack sprinklers.
12. Type, location and specifications of smoke removal and curtain board systems.
13. Dimension and location of transverse and longitudinal flue spaces.
14. Additional information regarding required design features, commodities, storage arrangement and fire protection features within the high-piled storage area shall be provided at the time of permit, where required by the fire code official.

3201.3.1 Approved construction documents. Following approval of the construction documents, a copy of the approved plans shall be maintained on the premises in an approved location.

3201.3.2 Approved storage layout. A floor plan, of legible size, shall be provided, mounted on a wall and protected from damage. The floor plan shall be mounted in an approved location and show the following:

1. Locations, dimensions and rack layout of high-piled storage areas.
2. Design storage height for each storage area.
3. Types of commodities.
4. Commodity clearance between top of storage and the sprinkler deflector for each storage arrangement.
5. Aisle dimensions between each storage array.
6. For palletized and solid-piled storage, the maximum pile volume for each storage array.
7. Location and classification of commodities in accordance with Section 3203.
8. Location of required fire department access doors.
9. Location of valves controlling the water supply of ceiling and in-rack sprinklers.

HIGH-PILED COMBUSTIBLE STORAGE

3201.4 Fire safety and evacuation plan. Where required by the Section 403, a fire safety and evacuation plan shall be submitted at the time of permit application for review and approval. A copy of the approved fire safety and evacuation plan shall be maintained on the premises in an approved location.

SECTION 3202 DEFINITIONS

3202.1 Definitions. The following terms are defined in Chapter 2:

ARRAY.

ARRAY, CLOSED.

AUTOMATED RACK STORAGE.

BIN BOX.

COMMODITY.

EARLY SUPPRESSION FAST-RESPONSE (ESFR) SPRINKLER.

EXPANDED PLASTIC.

EXTRA-HIGH-RACK COMBUSTIBLE STORAGE.

HIGH-PILED COMBUSTIBLE STORAGE.

HIGH-PILED STORAGE AREA.

LONGITUDINAL FLUE SPACE.

MANUAL STOCKING METHODS.

MECHANICAL STOCKING METHODS.

SHELF STORAGE.

SOLID SHELVING.

TRANSVERSE FLUE SPACE.

SECTION 3203 COMMODITY CLASSIFICATION

3203.1 Classification of commodities. Commodities shall be classified as Class I, II, III, IV or high hazard in accordance with Sections 3203.2 through 3203.10.3. Materials listed within each commodity classification are assumed to be unmodified for improved combustibility characteristics. Use of flame-retarding modifiers or the physical form of the material could change the classification.

3203.2 Class I commodities. Class I commodities are noncombustible products in ordinary corrugated cartons with or without single-thickness dividers, or in ordinary paper wrappings with or without wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

3203.3 Class II commodities. Class II commodities are Class I products in slatted wooden crates, solid wooden boxes, multiple-thickness paperboard cartons or equivalent combustible packaging material with or without wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

3203.4 Class III commodities. Class III commodities are products of wood, paper, natural fiber cloth, or Group C plastics or products thereof, with or without wood pallets. The amount of Group A plastics shall be limited in accordance with Section 3203.9.

3203.5 Class IV commodities. Class IV commodities are Class I, II or III products containing Group A plastics in ordinary corrugated cartons; Class I, II and III products with Group A plastic packaging; Group B plastics; and free-flowing Group A plastics with or without wood pallets. The total amount of nonfree-flowing Group A plastics shall be limited in accordance with Section 3203.9.

3203.6 High-hazard commodities. High-hazard commodities are products presenting special fire hazards beyond those of Class I, II, III or IV. Group A plastics not otherwise classified are included in this class.

3203.7 Classification of plastics. Plastics shall be designated as Group A, B or C in accordance with Sections 3203.7.1 through 3203.7.3.

3203.7.1 Group A plastics. Group A plastics are plastic materials having a heat of combustion that is much higher than that of ordinary combustibles, and a burning rate higher than that of Group B plastics.

3203.7.2 Group B plastics. Group B plastics are plastic materials having a heat of combustion and a burning rate higher than that of ordinary combustibles, but not as high as those of Group A plastics.

3203.7.3 Group C plastics. Group C plastics are plastic materials having a heat of combustion and a burning rate similar to those of ordinary combustibles.

3203.8 Examples of commodity classification. Table 3203.8 shall be used to determine the commodity classification for various products and materials. Products not found in the list shall be classified based on the classification descriptions in Sections 3203.2 through 3203.6 and the products they most nearly represent in Table 3203.8. Table 3203.8 considers the product and the packaging if listed with the item. Products with additional packaging consisting of Group A plastics shall be classified in accordance with Section 3203.9.

The commodity classifications are based on products with, or without, wood pallets. Where plastic pallets are used, the commodity classification shall be modified in accordance with Section 3203.10.

3203.9 Limited quantities of Group A plastics in mixed commodities. Figures 3203.9(1) and 3203.9(2) shall be used to determine the commodity classification based on the quantity of Group A plastics in the following situations:

1. The product is not listed in Table 3203.8 and contains Group A plastics.
2. The commodity contains Group A plastics and is not classified as high hazard in Table 3203.8.
3. The product listing in Table 3203.8 does not specifically include packaging, and the packaging material includes Group A plastics.

**TABLE 3203.8
EXAMPLES OF COMMODITY CLASSIFICATION**

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Aerosols	Level 1	Class III (See Chapter 51)
	Level 2	Class IV (See Chapter 51)
	Level 3	High-hazard (See Chapter 51)
Batteries	Dry cells (excludes lithium, lithium-ion and other similar exotic metals or combustible electrolyte); without blister packing (if blister packed, refer to the commodity classification definitions)	Class I
	Dry cells (nonlithium or similar exotic metals); in blister packing; cartoned	Class II
	Vehicle; any size (for example, automobile or truck); empty plastic casing	High-hazard (Group A unexpanded)
	Vehicle; large (in other words, truck or larger); dry or wet cells (excludes lithium-ion and other cells containing combustible electrolytes)	High-hazard (Group A unexpanded)
	Vehicle; small (for example, automobile); wet cells (excludes lithium-ion and other cells containing combustible electrolytes)	Class I
	Lithium-ion (<i>excludes lithium-ion installed in the equipment or appliance it powers</i>)	High-hazard
Biomass	Circular baled corn stover	Class IV
	Rectangular baled corn stover	Class III
	Rectangular baled switchgrass	High-hazard
Empty containers	Noncombustible	Class I
	PET	Class IV
	Rigid plastic (not including PET)	High-hazard (Group A unexpanded)
	Wood; solid sided (such as crates, boxes)	Class II
Film rolls, including photographic	Polypropylene, polyester, polyethylene; rolled on any reel type	High-hazard (Group A unexpanded)
	35 mm metal film cartridges in polyethylene cans; cartoned	Class III
	Motion picture or bulk rolls in polycarbonate, polyethylene or in metal cans; polyethylene bagged; cartoned	Class II
	Rolls in polycarbonate plastic cassettes; cartoned	Class IV
	Photographic paper; sheets; bagged in polyethylene; cartoned	Class III
Flammable and combustible liquids	Glycol in combustible containers (50 percent or greater)	High-hazard
	Lacquers, which dry by solvent evaporation, in metal cans or cartons	High-hazard
	Lighters; butane; blister-packed; cartoned	High-hazard (Group A unexpanded)
	Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon glass bottles or jars; in racks; cartoned	Class III
	Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon glass bottles or jars; palletized; cartoned	Class IV
	Over 20- and up to 50-percent alcohol (such as alcoholic beverages, hair spray); up to 1-gallon plastic bottles or jars; cartoned	Class IV
	Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); greater than 5-gallon plastic containers with wall thickness greater than 0.25 inch	High-hazard (Group A unexpanded)
	Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); metal, glass or ceramic containers	Class I
	Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); plastic containers greater than 5 gallons and wall thickness up to 1/4 inch	Class II

(continued)

HIGH-PILED COMBUSTIBLE STORAGE

**TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION**

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Flammable and combustible liquids (continued)	Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); up to 5-gallon plastic bottles or jars	Class I
	Up to 20-percent alcohol (such as alcoholic beverages, flavoring extracts); wood containers	Class II
	Lubricating or hydraulic fluid in plastic containers	High-hazard
	Nail polish; up to 2-ounce glass bottles or jars; cartoned	Class IV
	Nail polish; up to 2-ounce plastic bottles or jars; cartoned	High-hazard (Group A unexpanded)
Flammable solids	Except solid combustible metals	High-hazard
Food products, frozen	In nonwaxed or nonplastic packaging	Class I
	In plastic trays	Class III
	In waxed or plastic-coated paper packaging	Class II
Food products, nonfrozen	Butter (stick or whipped spread) or margarine (up to 50-percent oil)	Class III
	Butter; whipped spread	Class III
	Dry foods (such as baked goods, candy, cereals, cheese, chocolate, cocoa, coffee, grains, granular sugar, nuts); bagged or cartoned	Class III
	Foods (such as coffee, fish products, fruit, meat products, nuts, poultry); metal cans	Class I
	Fruits and vegetables (noncombustible semiliquid); crushed; plastic containers up to 5 gallons	Class I
	Fruits and vegetables; fresh; wood spacers, nonplastic trays or containers	Class I
	Margarine; over 50- and up to 80-percent oil	High-hazard (Group A unexpanded)
	Meat; fresh; no plastic packaging; uncartoned	Class I
	Meat; fresh; no plastic packaging; cartoned	Class II
	Meat; fresh; plastic tray	Class III
	Milk; any container; stored in solid plastic crates	High-hazard (Group A unexpanded)
	Milk; paper containers, or plastic bottles or jars up to 5 gallons	Class I
	Salt; bagged	Class I
	Salt; cartoned	Class II
	Snack foods (such as potato chips); plasticized aluminum bags; cartoned	High-hazard (Group A unexpanded)
Syrup; wooden container	Class II	
Furniture and bedding	Box spring; standard (minimal plastic materials)	Class III
	Box spring; wrapped in plastic cover	Class IV
	Furniture and bedding; with foam cushioning	High-hazard (Group A expanded)
	Furniture; metal (such as file cabinets or desks with minimal plastic trim); cartoned	Class I
	Furniture; wood (such as doors, windows, cabinets); no plastic coverings or foam cushioning	Class III
	Furniture; wood; plastic coverings; nonexpanded plastic trim	Class IV
	Mattress; foam (in finished form)	High-hazard (Group A expanded)
	Pillows, foam rubber and foam plastics	High-hazard (Group A expanded)

(continued)

**TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION**

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Housing materials and appliances	Appliances; major (for example, stoves, refrigerators); no appreciable plastic interior or exterior trim; cartoned	Class II
	Appliances; major (for example, stoves, refrigerators); no appreciable plastic interior or exterior trim; uncartoned	Class I
	Appliances; no appreciable plastic exterior trim (interior of unit can have appreciable plastic)	Class III
	Carpet tiles; cartoned	High-hazard (Group A unexpanded)
	Fiberglass insulation; paper-backed rolls; bagged or unbagged	Class IV
	Floor coverings; vinyl, stacked tiles	Class IV
	Floor coverings; vinyl; rolled	High-hazard (Group A unexpanded)
	Gypsum board	Class I
	Housing materials (such as sinks, countertops); noncombustible, cartoned or crated	Class II
	Light fixtures; nonplastic; cartoned	Class II
	Paint; oil-based; friction-top metal containers; cartoned	Class IV
	Paint; water-based (latex); friction-top metal containers; cartoned	Class I
	Paper; asphalt; rolled, horizontal or vertical storage	High-hazard
	Roofing shingles; asphalt-coated fiberglass	Class III
	Roofing shingles; asphalt-impregnated felt	Class IV
Miscellaneous	Ammunition; small arms and shotgun; cartoned	Class IV
	Charcoal; mineral-spirit impregnated; bagged	High-hazard (Group A expanded)
	Charcoal; standard (nonmineral-spirit impregnated); bagged	Class III
	Fertilizers; nitrates; bagged	Class II
	Fertilizers; phosphates; bagged	Class I
	Leather hides; baled	Class II
	Leather; finished products (such as shoes, jackets, gloves, bags, luggage, belts)	Class III
	Motors; electric	Class I
	Pallets and flats that are idle; combustible	High-hazard
	Shock absorbers; metal dust cover	Class II
	Shock absorbers; plastic dust cover	Class III
	Skis; wood	Class III
	Skis; composite materials (such as plastic, fiberglass, foam)	Class IV
	Tobacco products; cartoned	Class III
Toys; stuffed; foam or synthetic	High-hazard (Group A expanded)	
Transformer; dry or empty (in other words, void of oil)	Class I	
Noncombustible liquids	Liquids or semiliquids; PET containers greater than 5 gallons having a nominal wall thickness greater than 1/4 inch	Class IV
	Liquids or semiliquids; PET containers up to 5 gallons having a nominal wall thickness less than 1/4 inch	Class I
	Liquids or semiliquids (such as crushed fruits and vegetables); plastic containers up to 5-gallon capacity	Class I
	Liquids or semiliquids; plastic (except PET) containers greater than 5-gallon capacity having a nominal wall thickness greater than 1/4 inch	High-hazard (Group A unexpanded)

(continued)

HIGH-PILED COMBUSTIBLE STORAGE

**TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION**

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Noncombustible liquids (continued)	Liquids or semiliquids; plastic (except PET) containers greater than 5-gallon capacity having a nominal wall thickness up to 1/4 inch	Class II
	Liquids; cardboard drink boxes, plastic coated, wax coated, and/or aluminum lined; uncartoned or on corrugated carton trays with plastic sheeting	Class I
	Liquids; cardboard drink boxes, plastic coated, wax coated, and/or aluminum lined; stored in plastic containers	High-hazard (Group A unexpanded)
	Liquids; glass bottles or jars; cartoned	Class I
	Liquids; less than 5-gallon plastic containers	Class I
	Liquids; pharmaceuticals (nonflammable); glass bottles or jars; cartoned	Class II
	Liquids; plastic bottles or jars; stored in open or solid plastic crates	High-hazard (Group A unexpanded)
Paper products	Book signatures (paper part of book without hard cover)	Class II
	Cartons (such as cardboard flats); corrugated; partially assembled	Class IV
	Cartons (such as cardboard flats); corrugated; unassembled in neat piles	Class III
	Cartons; wax coated, single-walled corrugated	High-hazard (Group A unexpanded)
	Cellulosic paper products; nonwax coated (such as books, cardboard games, cartoned tissue products, magazines, newspapers, paper cups, paper plates, paper towels, plastic-coated paper food containers, stationary)	Class III
	Cellulosic paper products; wax coated (such as paper plates, cups); loosely packed; cartoned	High-hazard (Group A unexpanded)
	Cellulosic paper products; wax coated (such as paper plates, cups); nested; cartoned	Class IV
	Matches; paper-type; cartoned	Class IV
	Matches; wooden; cartoned	High-hazard (Group A unexpanded)
	Rolled; lightweight; in storage racks	Class IV
	Rolled; medium or heavyweight; in storage racks or onsite	Class III
	Rolled; in horizontal storage or vertical storage that is banded or protected with an approved wrap	Class III
	Rolled; in vertical storage that is unbanded or not protected with an approved wrap	High-hazard
Tissue products; plastic wrapped; cartoned	Class III	
Tissue products; plastic wrapped; uncartoned	High-hazard (Group A unexpanded)	
Plastic, rubber	ABS (Acrylonitrile-butadiene-styrene copolymer)	High-hazard (Group A unexpanded)
	Acetal (polyformaldehyde)	High-hazard (Group A unexpanded)
	Acrylic (polymethyl methacrylate)	High-hazard (Group A unexpanded)
	Automobile bumpers and dashboards	High-hazard (Group A expanded)
	Butyl rubber	High-hazard (Group A unexpanded)
	Cellulose acetate	Class IV (Group B plastic)
	Cellulose acetate butyrate	High-hazard (Group A unexpanded)

(continued)

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Plastic, rubber (continued)	Chloroprene rubber	Class IV (Group B plastic)
	Containers; Nonexpanded plastic gridded or solid; collapsed or nested with no air spaces	High-hazard (Group A unexpanded)
	ECTFE (ethylene-chlorotrifluoro-ethylene copolymer)	Class IV (Group B plastic)
	EPDM (ethylene-propylene rubber)	High-hazard (Group A unexpanded)
	ETFE (ethylene-tetrafluoroethylene copolymer)	Class IV (Group B plastic)
	Ethyl cellulose	High-hazard (Group A unexpanded)
	FEP (fluorinated ethylene-propylene copolymer)	Class IV (Group B plastic)
	FRP (fiberglass-reinforced polyester)	High-hazard (Group A unexpanded)
	Melamine (melamine formaldehyde)	Class III (Group C plastic)
	Nitrile rubber (acrylonitrile-butadiene rubber)	High-hazard (Group A unexpanded)
	Nylon (nylon 6, nylon 6/6)	High-hazard (Group A unexpanded)
	PCTFE (polychlorotrifluoroethylene)	Class III (Group C plastic)
	PET (Polyethylene terephthalate-thermoplastic polyester)	High-hazard (Group A unexpanded)
	Phenolic	Class III (Group C plastic)
	Plastics; stored in fully closed and solid (no openings) metal containers	Class I
	Polybutadiene	High-hazard (Group A unexpanded)
	Polycarbonate	High-hazard (Group A unexpanded)
	Polyester elastomer	High-hazard (Group A unexpanded)
	Polyethylene	High-hazard (Group A unexpanded)
	Polypropylene	High-hazard (Group A unexpanded)
	Polystyrene; foam products (such as plates, cups)	High-hazard (Group A expanded)
	Polystyrene; rigid products	High-hazard (Group A unexpanded)
	Polyurethane	High-hazard (Group A expanded)
	PTFE (polytetrafluoroethylene)	Class III (Group C plastic)
PVC (polyvinyl chloride) products; plasticizer content 20 percent or less	Class III (Group C plastic)	

(continued)

HIGH-PILED COMBUSTIBLE STORAGE

**TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION**

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Plastic, rubber (continued)	PVC (polyvinyl chloride) products; plasticizer content greater than 20 percent	High-hazard (Group A unexpanded)
	PVC resins; bagged	Class III (Group C plastic)
	PVDC (polyvinylidene chloride)	Class III (Group C plastic)
	PVDF (polyvinylidene fluoride)	Class III (Group C plastic)
	PVF (polyvinyl fluoride)	High-hazard (Group A unexpanded)
	Pyroxylin	High-hazard
	Rubber; natural in blocks; cartoned	High-hazard (Group A unexpanded)
	Rubber; natural; expanded	High-hazard (Group A expanded)
	Rubber; natural; Nonexpanded	High-hazard (Group A unexpanded)
	Rubber; synthetic (santoprene)	High-hazard (Group A unexpanded)
	Rubber tires	High-hazard
	SAN (styrene acrylonitrile)	High-hazard (Group A unexpanded)
	SBR (styrene-butadiene rubber)	High-hazard (Group A unexpanded)
	Silicone rubber	Class IV (Group B plastic)
	Urea (urea formaldehyde)	Class III (Group C plastic)
Plastic containers	Bottles or jars greater than 1 gallon containing noncombustible solids	High-hazard (Group A unexpanded)
	Bottles or jars up to 1 gallon containing noncombustible solids	High-hazard (Group A unexpanded)
Powders, pills	Pharmaceutical pills; glass bottles or jars; cartoned	Class II
	Pharmaceuticals pills; plastic bottles or jars; cartoned	Class IV
	Polyvinyl alcohol (PVA) resins; bagged	Class IV
	Powders; combustible (ordinary—such as sugar or flour); free-flowing; bagged	Class II
	Powders; noncombustible free-flowing powdered or granular materials (such as cement, calcium chloride, clay, iron oxide, sodium chloride, sodium silicate); bagged	Class I
	Powders; noncombustible; glass bottles or jars; cartoned	Class I
	Powders; noncombustible; PET bottles or jars	Class II
	Powders; noncombustible; plastic (other than PET) bottles or jars; uncartoned	High-hazard (Group A unexpanded)
	Powders; noncombustible; plastic bottles or jars greater than 1-gallon capacity	High-hazard (Group A unexpanded)
	Powders; noncombustible; plastic bottles or jars up to 1-gallon capacity; cartoned	Class IV

(continued)

TABLE 3203.8—continued
EXAMPLES OF COMMODITY CLASSIFICATION

PRODUCT CATEGORY	PRODUCT	CLASSIFICATION
Textile materials and products	Cloth; natural fibers; baled	Class III
	Cloth; synthetic cloth	Class IV
	Clothing; natural fibers (such as wool, cotton) and viscose	Class III
	Cotton; cartoned	Class III
	Diapers; cotton or linen	Class III
	Diapers; plastic or nonwoven fabric; cartoned	Class IV
	Diapers; plastic or nonwoven fabric; plastic-wrapped; uncartoned	High-hazard (Group A unexpanded)
	Fabric; rayon and nylon	Class IV
	Fabric; synthetic (except rayon and nylon); greater than 50/50 blend	High-hazard (Group A unexpanded)
	Fabric; synthetic (except rayon and nylon); up to 50/50 blend	Class III
	Fabric; vinyl-coated (such as tablecloth); cartoned	High-hazard (Group A unexpanded)
	Fibers; rayon and nylon; baled	Class IV
	Fibers; synthetic (except rayon and nylon); baled	High-hazard (Group A unexpanded)
	Thread or yarn; rayon and nylon; wood or paper spools	Class IV
	Thread or yarn; rayon or nylon; plastic spools	High-hazard (Group A unexpanded)
	Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; paper or wood spools	Class IV
	Thread or yarn; synthetic (except rayon and nylon); greater than 50/50 blend; plastic spools	High-hazard (Group A unexpanded)
Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; plastic spools	High-hazard (Group A unexpanded)	
Thread or yarn; synthetic (except rayon and nylon); up to 50/50 blend; wood or paper spools	Class III	
Wax products	Candles	High-hazard (Group A expanded)
	Paraffin or petroleum wax; blocks	High-hazard (Group A expanded)
Wire, cable, spools	Spools; plastic; empty	High-hazard (Group A unexpanded)
	Spools; wood; empty	Class III
	Wire or cable; PVC insulated; metal or wood spools	Class II
	Wire or cable; PVC insulated; plastic spools	Class IV
	Wire; bare; metal spools; uncartoned	Class I
	Wire; bare; metal spools; cartoned	Class II
	Wire; bare; plastic spools; cartoned	Class IV
	Wire; bare; plastic spools; uncartoned	High-hazard (Group A unexpanded)
	Wire; bare; wood or cardboard spools	Class II
Wood products	Wood patterns	Class IV
	Wood products (such as fiberboard, lumber, particle board, plywood, pressboard with smooth ends and edges); bundled solid blocks	Class II
	Wood products (such as fiberboard, lumber, particle board, plywood, pressboard with smooth ends and edges); unbundled or nonsolid blocks	Class III
	Wood products (such as toothpicks, clothespins and hangers)	Class III

For SI: 1 inch = 25.4 mm, 1 gallon = 3.8 L, 1 ounce = 29.57 ml.

HIGH-PILED COMBUSTIBLE STORAGE

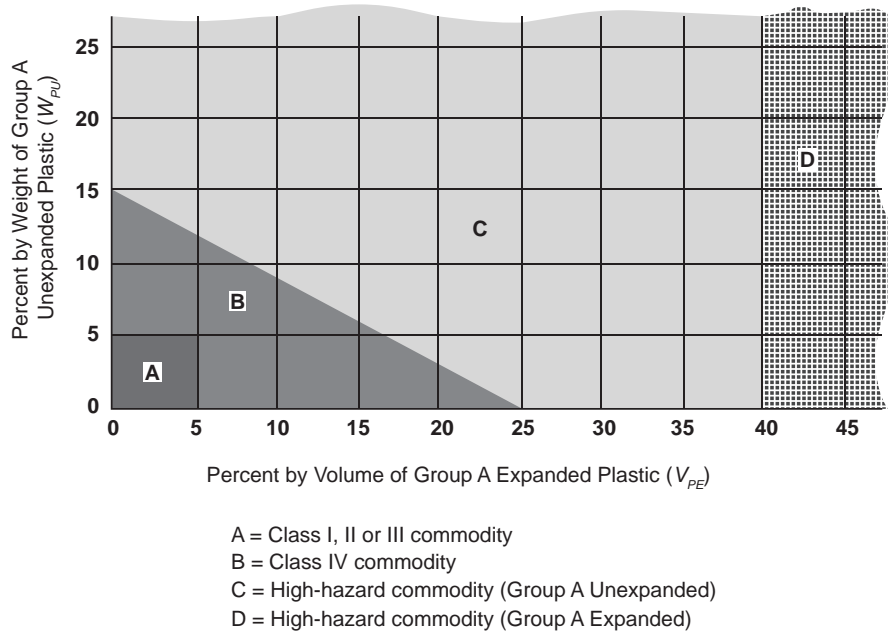


FIGURE 3203.9(1)
EVALUATION BY VOLUME OF GROUP A EXPANDED PLASTICS IN MIXED COMMODITIES^{a, b}

- a. This figure is used to determine the commodity classification of a mixed commodity with Group A plastics in a package or carton, or on a pallet.
- b. The following is an example of how to apply Figure 3203.9(1): A pallet load consists of a Class III commodity with components of unexpanded Group A plastic and packing material of expanded Group A plastic. Using Equation 32-1, the weight of unexpanded Group A plastic is 5 percent. Using Equation 32-2, the volume of expanded Group A plastic is 15 percent. This commodity is classified as a Class IV commodity. If the volume of the expanded Group A plastic is increased to 20 percent, the classification changes to a high-hazard commodity. Compare this result with the result from Figure 3203.9(2), and the highest classification will apply. Where the load is stored on a plastic pallet, the requirements in Section 3203.10 apply.

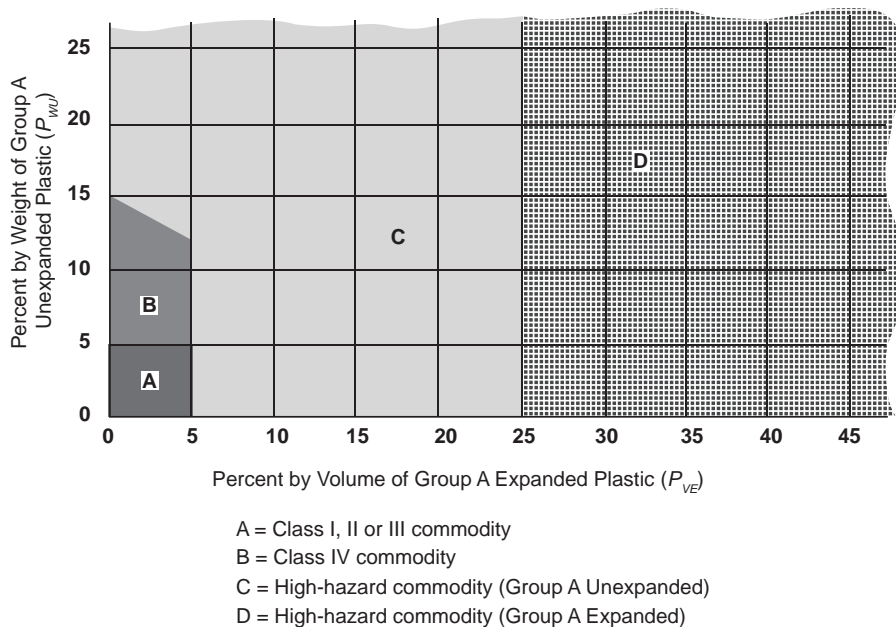


FIGURE 3203.9(2)
EVALUATION BY WEIGHT OF GROUP A EXPANDED PLASTICS IN MIXED COMMODITIES^{a, b, c}

- a. This figure is used to determine the commodity classification of a mixed commodity with Group A plastics in a package or carton, or on a pallet.
- b. The results from this figure must be compared to the results from Figure 3203.9(1). The highest classification will apply.
- c. The following is an example of how to apply Figure 3203.9(2): A pallet load consists of a Class III commodity with components of unexpanded Group A plastic and packing material of expanded Group A plastic. Using Equation 32-1, the weight of unexpanded Group A plastic is 5 percent. Using Equation 32-3, the weight of expanded Group A plastic is 6 percent. This commodity is classified as a high-hazard commodity. Where the load is stored on a plastic pallet, the requirements in Section 3203.10 apply.

3203.9.1 Classifying mixed commodities with limited Group A plastics. The percentage of Group A plastics determined in accordance with Section 3203.9.2 shall be used in Figures 3203.9(1) and 3203.9(2). Results from Figure 3203.9(1) must be compared to results from Figure 3203.9(2) and the commodity will be classified with the highest commodity classification.

Figures 3203.9(1) and 3203.9(2) shall not be used to reduce the commodity classification shown in Table 3203.8.

3203.9.2 Percentage of Group A plastics. The pallet, if any, shall not be included when measuring the weight of the commodity (W_{PU} or W_{PE}) or the volume of the commodity (V_{PE}). The pallet, if any, shall be included when measuring the weight of the entire load (W_L) or the volume of the entire load (V_L).

Exception: Where noncombustible pallets are used, the pallets shall not be included in the volume and weight calculations.

The percentage by weight of Group A unexpanded plastics in the load shall be calculated in accordance with Equation 32-1.

The percentage by volume of Group A expanded plastics in the load shall be calculated in accordance with Equation 32-2.

The percentage by weight of Group A expanded plastics in the load shall be calculated in accordance with Equation 32-3.

$$P_{WU} = W_{PU} / W_L \quad \text{(Equation 32-1)}$$

where:

P_{WU} = Percentage by weight of Group A unexpanded plastic.

W_{PU} = Weight of Group A unexpanded plastic in the commodity, not including the weight of the pallet, if any.

W_L = Weight of the entire load, including the weight of the pallet, if any.

$$P_{VE} = V_{PE} / V_L \quad \text{(Equation 32-2)}$$

where:

P_{VE} = Percentage by volume of Group A expanded plastic.

V_{PE} = Volume of Group A expanded plastic in the commodity, not including the volume of the pallet, if any.

V_L = Volume of the entire load, including the volume of the pallet, if any.

$$P_{WE} = W_{PE} / W_L \quad \text{(Equation 32-3)}$$

where:

P_{WE} = Percentage by weight of Group A expanded plastic.

W_{PE} = Weight of Group A expanded plastic in the commodity, not including the weight of the pallet, if any.

W_L = Weight of the entire load, including the weight of the pallet, if any.

3203.10 Plastic pallets. The commodity classification determined in Section 3203.8 or 3203.9 shall be modified in accordance with Sections 3203.10.1 through 3203.10.3 where plastic pallets are used.

Exception: The commodity classification is not modified where any of the following conditions occur:

1. Group A plastic commodities are stored on plastic pallets.
2. Sprinkler protection consists of sprinklers at the ceiling only, using sprinklers with a minimum K-factor of K-16.8 (240).
3. The plastic pallets are listed and labeled in accordance with Section 3206.4.1.1.

3203.10.1 Unreinforced plastic pallets. For Class I through IV commodities, where unreinforced polypropylene or unreinforced high-density polyethylene plastic pallets are used, the commodity classification shall be increased one class. To be considered unreinforced plastic pallets, the pallets shall be marked with a permanent symbol indicating the pallet is unreinforced.

3203.10.2 Reinforced plastic pallets. For Class I through IV commodities, where reinforced polypropylene or reinforced high-density polyethylene plastic pallets are used, the commodity classification shall be increased two classes except for Class IV commodities, which shall be increased to a high-hazard (Group A plastic, cartoned, unexpanded) commodity.

3203.10.3 Other pallets. For Class I through IV commodities stored on plastic pallets other than polypropylene or high-density polyethylene plastic pallets, the commodity classification shall be increased two classes unless specific testing is conducted by a testing laboratory.

SECTION 3204

DESIGNATION OF HIGH-PILED STORAGE AREAS

3204.1 General. High-piled storage areas, and portions of high-piled storage areas intended for storage of a different commodity class than adjacent areas, shall be designed and specifically designated to contain Class I, Class II, Class III, Class IV or high-hazard commodities. The designation of a high-piled storage area, or portion thereof intended for storage of a different commodity class, shall be based on the highest hazard commodity class stored except as provided in Section 3204.2.

3204.2 Designation based on engineering analysis. The designation of a high-piled combustible storage area, or portion thereof, is allowed to be based on a lower hazard class than that of the highest class of commodity stored where a limited quantity of the higher hazard commodity has been demonstrated by engineering analysis to be

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adequately protected by the automatic sprinkler system provided. The engineering analysis shall consider the ability of the sprinkler system to deliver the higher density required by the higher hazard commodity. The higher density shall be based on the actual storage height of the pile or rack and the minimum allowable design area for sprinkler operation as set forth in the density/area figures provided in NFPA 13. The contiguous area occupied by the higher hazard commodity shall not exceed 120 square feet (11 m²) and additional areas of higher hazard commodity shall be separated from other such areas by 25 feet (7620 mm) or more. The sprinkler system shall be capable of delivering the higher density over a minimum area of 900 square feet (84 m²) for wet pipe systems and 1,200 square feet (111 m²) for dry pipe systems. The shape of the design area shall be in accordance with Section 903.

SECTION 3205 HOUSEKEEPING AND MAINTENANCE

3205.1 Storage layout plan maintenance. The approved storage layout shall be verified and evaluated annually in accordance with Section 3201.3.2. Modifications or changes to the provisions of the approved storage layout shall not be made without the prior approval of the fire code official.

3205.2 Rack structures. The structural integrity of racks shall be maintained.

3205.3 Ignition sources. Clearance from ignition sources shall be provided in accordance with Section 305.

3205.4 Smoking. Smoking shall be prohibited. Approved “No Smoking” signs shall be conspicuously posted in accordance with Section 310.

3205.5 Aisle maintenance. When restocking is not being conducted, aisles shall be kept clear of storage, waste material and debris. Fire department access doors, aisles and exit doors shall not be obstructed. During restocking operations using manual stocking methods, a minimum unobstructed aisle width of 24 inches (610 mm) shall be maintained in 48-inch (1219 mm) or smaller aisles, and a minimum unobstructed aisle width of one-half of the required aisle width shall be maintained in aisles greater than 48 inches (1219 mm). During mechanical stocking operations, a minimum unobstructed aisle width of 44 inches (1118 mm) shall be maintained in accordance with Section 3206.10.

Exception: In high-piled single- and double-row rack storage of combustible materials protected by automatic sprinkler systems designed and installed in accordance with the requirements of NFPA 13 governing the use of K-25.2 (360) sprinklers, displays and wing stacks not exceeding 48 inches (1219 mm) in height provided that they do not obstruct or reduce the clear width of the aisle to less than 48 inches (1219 mm).

3205.6 Pile dimension and height limitations. Pile dimensions and height limitations shall comply with Section 3207.3.

3205.7 Designation of storage heights. Where required by the fire code official, a visual method of indicating the maximum allowable storage height shall be provided.

3205.8 Arrays. Arrays shall comply with Section 3207.4.

3205.9 Flue spaces. Flue spaces shall comply with Section 3208.3.

SECTION 3206 GENERAL FIRE PROTECTION AND LIFE SAFETY FEATURES

3206.1 General. Fire protection and life safety features for high-piled storage areas shall be in accordance with Sections 3206.2 through 3206.11.

3206.2 Type of protection. Where required by Table 3206.2, fire detection systems, smoke and heat removal and automatic sprinkler design densities shall be provided to protect the high-piled storage area.

3206.2.1 Extent of protection. The fire safety features required in Table 3206.2 shall extend to the lesser of 15 feet (4572 mm) beyond the high-piled storage area or a full height wall. Where portions of high-piled storage areas have different fire protection requirements because of commodity, method of storage or storage height, the fire protection features required by Table 3206.2 within this area shall be based on the most restrictive design requirements.

3206.3 High-piled storage areas. For the application of Table 3206.2, the size of the high-piled storage areas shall be determined in accordance with Sections 3206.3.1 through 3206.3.2.1.

3206.3.1 Size of high-piled storage area. The size of each high-piled storage area shall include the footprint of the actual high-piled storage racks, shelves or piles and the following aisles:

1. Interior aisles within the footprint of the storage area.
2. An aisle around the perimeter of the footprint with a minimum width as required in Section 3206.10.1 or the dimension to a full height wall, whichever is less.

3206.3.2 Multiple high-piled storage areas. Where a building contains multiple high-piled storage areas, the aggregate of all high-piled storage areas shall be used for the application of Table 3206.2 unless the high-piled storage areas are separated in accordance with one of the following:

1. High-piled storage areas separated by fire barriers with a minimum fire-resistance-rating of 1 hour constructed in accordance with Section 707 of the *California Building Code*.
2. In buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, high-piled storage areas separated by 100 feet (30 480 mm) or more. The area providing the separation shall not contain high-piled combustible storage.

**TABLE 3206.2
GENERAL FIRE PROTECTION AND LIFE SAFETY REQUIREMENTS**

COMMODITY CLASS	SIZE OF HIGH-PILED STORAGE AREA ^a (square feet) (see Sections 3206.2 and 3206.3)	ALL STORAGE AREAS (see Sections 3206, 3207 and 3208) ^b				SOLID-PILED STORAGE, SHELF STORAGE AND PALLETIZED STORAGE (see Section 3207.3)		
		Automatic fire-extinguishing system (see Section 3206.4)	Fire detection system (see Section 3206.5)	Fire department access doors (see Section 3206.7)	Smoke and heat removal (see Section 3206.8)	Maximum pile dimension ^c (feet)	Maximum permissible storage height ^d (feet)	Maximum pile volume (cubic feet)
I-IV	0-500	Not Required ^a	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required
	501-2,500	Not Required ^a	Yes ^e	Not Required	Not Required	120	40	100,000
	2,501-12,000 Open to the public	Yes	Not Required	Not Required	Not Required	120	40	400,000
	2,501-12,000 Not open to the public (Option 1)	Yes	Not Required	Not Required	Not Required	120	40	400,000
	2,501-12,000 Not open to the public (Option 2)	Not Required ^a	Yes	Yes	Yes ^{h,i}	120	30 ^c	200,000
	12,001-500,000	Yes	Not Required	Yes	Yes ^{h,i}	120	40	400,000
	Greater than 500,000 ^f	Yes	Not Required	Yes	Yes ^{h,i}	120	40	400,000
High hazard	0-500	Not Required ^a	Not Required	Not Required	Not Required	60	Not Required	Not Required
	501-2,500 Open to the public	Yes	Not Required	Not Required	Not Required	60	30	75,000
	501-2,500 Not open to the public (Option 1)	Yes	Not Required	Not Required	Not Required	60	30	75,000
	501-2,500 Not open to the public (Option 2)	Not Required ^a	Yes ^e	Yes	Yes ^{h,i}	60	20	50,000
	2,501-300,000	Yes	Not Required	Yes	Yes ^{h,i}	60	30	75,000
	Greater than 300,000 ^f	Yes	Not Required	Yes	Yes ^{h,i}	60	30	75,000

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m³, 1 square foot = 0.0929 m².

- a. Where automatic sprinklers are required for reasons other than those in Chapter 32, the portion of the sprinkler system protecting the high-piled storage area shall be designed and installed in accordance with Sections 3207 and 3208.
- b. For aisles, see Section 3206.10.
- c. Piles shall be separated by aisles complying with Section 3206.10.
- d. For storage in excess of the height indicated, special fire protection shall be provided in accordance with Note f where required by the fire code official. See Chapters 51 and 57 for special limitations for aerosols and flammable and combustible liquids, respectively.
- e. For storage exceeding 30 feet in height, Option 1 shall be used.
- f. Special fire protection provisions including, but not limited to, fire protection of exposed steel columns; increased sprinkler density; additional in-rack sprinklers, without associated reductions in ceiling sprinkler density; or fire department hose connections shall be provided where required by the fire code official.
- g. Not required where an automatic fire-extinguishing system is designed and installed to protect the high-piled storage area in accordance with Sections 3207 and 3208.
- h. Not required where storage areas *with an exit access travel distance of 250 feet (76 200 mm) or less* are protected by either early suppression fast response (ESFR) sprinkler systems or control mode special application sprinklers with a response time index of 50 (m • s)^{1/2} or less that are listed to control a fire in the stored commodities with 12 or fewer sprinklers, installed in accordance with *Section 903.3.1.1*.
- i. Not required in frozen food warehouses used solely for storage of Class I and II commodities where protected by an approved automatic sprinkler system.

3206.3.2.1 Multiple class high-piled storage areas.

High-piled storage areas classified as Class I through IV not separated from high-piled storage areas classified as high hazard shall utilize the aggregate of all high-piled storage areas as high hazard for the purposes of the application of Table 3206.2. Multiple class high-piled storage areas meeting the separation requirements in Section 3206.3.2 shall be considered as separated. The fire safety features in Table 3206.2 shall be extended beyond the higher-hazard storage area in accordance with Section 3206.2.1.

Exception: Multiple class high-piled storage areas do not need to be separated where in accordance with Section 3204.2.

3206.4 Automatic sprinklers. Automatic sprinkler systems shall be provided in accordance with Sections 3207, 3208 and 3209.

3206.4.1 Pallets. Automatic sprinkler system requirements based on the presence of pallets shall be in accordance with NFPA 13.

3206.4.1.1 Plastic pallets. Plastic pallets listed and labeled in accordance with FM 4996 or UL 2335 shall be treated as wood pallets for determining required sprinkler protection.

3206.5 Fire detection. Where fire detection is required by Table 3206.2, an approved automatic fire detection system shall be installed throughout the high-piled storage area. The system shall be monitored and be in accordance with Section 907.

3206.6 Building access. Fire apparatus access roads in accordance with Section 503 shall be provided within 150 feet (45 720 mm) of all portions of the exterior walls of buildings used for high-piled storage.

Exception: Where fire apparatus access roads cannot be installed because of topography, railways, waterways, nonnegotiable grades or other similar conditions, the fire code official is authorized to require additional fire protection.

3206.7 Fire department access doors. Where fire department access doors are required by Table 3206.2, fire department access doors shall be provided in accordance Sections 3206.7.1 through 3206.7.8.

3206.7.1 Exterior walls without fire department access doors. Fire department access doors are not required in an exterior wall that does not face a fire apparatus access road provided that all of the following conditions occur:

1. The opposite exterior wall faces a fire apparatus access road.
2. The opposite exterior wall is provided with fire department access doors.
3. The entire interior surface of the exterior wall is less than 150 feet (45 720 mm) away from a fire department access door.

4. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

3206.7.2 Where located. Where exterior walls surrounding high-piled storage areas face fire apparatus access roads, such walls shall be provided with fire department access doors.

3206.7.3 Access to doors. Fire department access doors shall be able to be accessed without the use of a ladder.

3206.7.4 Marking on fire department access doors. Fire department access doors shall be labeled on the exterior side with the following sign or other approved sign:

FIRE DEPARTMENT ACCESS DOOR
DO NOT BLOCK

The lettering shall be in a contrasting color to the background. Letters shall have a minimum height of 2 inches (51 mm) with a minimum stroke of $\frac{3}{8}$ inch (10 mm).

3206.7.5 Number of doors required. The required fire department access doors shall be distributed such that the lineal distance between adjacent fire department access doors does not exceed 125 feet (38 100 mm) measured center to center.

Exception: The linear distance between adjacent access doors shall not exceed 200 feet (60 960 mm) in existing buildings where change in occupancy is not proposed.

3206.7.6 Door size and type. Fire department access doors shall be not less than 3 feet (914 mm) in width and 6 feet 8 inches (2032 mm) in height. Roll-up doors shall not be considered fire department access doors unless approved.

3206.7.7 Locking devices. Locking devices on fire department access doors shall be approved.

3206.7.8 Key box. Where fire department access doors are required, a key box shall be installed in accordance with Section 506.1. The key box shall contain keys or devices to allow for entry through the fire department access doors.

3206.8 Smoke and heat removal. Where smoke and heat removal is required by Table 3206.2 it shall be provided in accordance with Section 910.

3206.9 Fire department hose connections. Where exit passageways are required by the *California Building Code* for egress, a Class I standpipe system shall be provided in accordance with Section 905.

3206.10 Aisles. Aisles providing access to exits and fire department access doors shall be provided in high-piled storage areas exceeding 500 square feet (46 m²), in accordance with Sections 3206.10.1 through 3206.10.3. Aisles separating storage piles or racks shall comply with NFPA 13. Aisles shall comply with Chapter 10.

Exception: Where aisles are precluded by rack storage systems, alternate methods of access and protection are allowed where approved.

3206.10.1 Width. Aisle width shall be in accordance with Sections 3206.10.1.1 and 3206.10.1.2.

Exceptions:

1. Aisles crossing rack structures or storage piles, that are used only for employee access, shall be not less than 24 inches (610 mm) wide.
2. Aisles separating shelves classified as shelf storage shall be not less than 30 inches (762 mm) wide.

3206.10.1.1 Sprinklered buildings. Aisles in sprinklered buildings shall be not less than 44 inches (1118 mm) wide. Aisles shall be not less than 96 inches (2438 mm) wide in high-piled storage areas exceeding 2,500 square feet (232 m²) in area, that are accessible to the public and designated to contain high-hazard commodities.

Aisles shall be not less than 96 inches (2438 mm) wide in areas open to the public where mechanical stocking methods are used.

Exceptions:

1. Aisles in high-piled storage areas exceeding 2,500 square feet (232 m²) in area, that are open to the public and designated to contain high-hazard commodities, and that are protected by a sprinkler system designed for multiple-row racks of high-hazard commodities, shall be not less than 44 inches (1118 mm) wide.
2. Aisles that are in high-piled storage areas exceeding 2,500 square feet (232 m²) in area, not open to the public and protected by a sprinkler system designed for multiple-row racks, shall be not less than 24 inches (610 mm) wide.

3206.10.1.2 Nonsprinklered buildings. Aisles in nonsprinklered buildings shall be not less than 96 inches (2438 mm) wide.

3206.10.2 Clear height. The required aisle width shall extend from floor to ceiling. Rack structural supports and catwalks are allowed to cross aisles at a minimum height of 6 feet 8 inches (2032 mm) above the finished floor level, provided that such supports do not interfere with fire department hose stream trajectory.

3206.10.3 Dead-end aisles. Dead-end aisles shall not exceed 20 feet (6096 mm) in length in Group M occupancies. Dead-end aisles shall not exceed 50 feet (15 240 mm) in length in all other occupancies.

Exception: Dead-end aisles are not limited where the length of the dead-end aisle is less than 2.5 times the least width of the dead-end aisle.

3206.11 Portable fire extinguishers. Portable fire extinguishers shall be provided in accordance with Section 906.

SECTION 3207 SOLID-PILED AND SHELF STORAGE

3207.1 General. Shelf storage and storage in solid piles, solid piles on pallets and bin box storage in bin boxes not exceeding 5 feet (1524 mm) in any dimension, shall be in accordance with Section 3206 and this section.

3207.2 Fire protection. Where automatic sprinklers are required by Table 3206.2, an approved automatic sprinkler system shall be installed throughout the building or to 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code*. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection rating. The design and installation of the automatic sprinkler system and other applicable fire protection shall be in accordance with the *California Building Code* and NFPA 13.

3207.2.1 Shelf storage. Shelf storage greater than 12 feet (3658 mm) but less than 15 feet (4572 mm) in height shall be in accordance with the fire protection requirements set forth in NFPA 13. Shelf storage 15 feet (4572 mm) or more in height shall be protected in an approved manner with special fire protection, such as in-rack sprinklers.

3207.3 Pile dimension and height limitations. Pile dimensions, the maximum permissible storage height and pile volume shall be in accordance with Table 3206.2.

3207.4 Arrays. Where an automatic sprinkler system design utilizes protection based on a closed array, array clearances shall be provided and maintained as specified by the standard used.

SECTION 3208 RACK STORAGE

3208.1 General. Rack storage shall be in accordance with Section 3206 and this section. Bin boxes exceeding 5 feet (1524 mm) in any dimension shall be regulated as rack storage.

3208.1.1 Storage racks. The design and installation of storage racks shall be in accordance with the *California Building Code*.

3208.2 Fire protection. Where automatic sprinklers are required by Table 3206.2, an approved automatic sprinkler system shall be installed throughout the building or to 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code*. Openings in such fire barriers shall be protected by opening protectives having a 1-hour fire protection rating. The design and installation of the automatic sprinkler system and other applicable fire protection shall be in accordance with Section 903.3.1.1 and the *California Building Code*.

3208.2.1 Plastic shelves. Storage on plastic shelves shall be protected by approved specially engineered fire protection systems.

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3208.2.2 Racks with solid shelving. Racks with solid shelving having an area greater than 20 square feet (1.9 m²), measured between approved flue spaces at all four edges of the shelf, shall be in accordance with this section.

Exceptions:

1. Racks with mesh, grated, slatted or similar shelves having uniform openings not more than 6 inches (152 mm) apart, comprising not less than 50 percent of the overall shelf area, and with approved flue spaces are allowed to be treated as racks without solid shelves.
2. Racks used for the storage of combustible paper records, with solid shelving, shall be in accordance with NFPA 13.

3208.2.2.1 Fire protection. Fire protection for racks with solid shelving shall be in accordance with NFPA 13.

3208.3 Flue spaces. Rack storage areas protected with an automatic sprinkler system shall be provided with flue spaces in accordance with Table 3208.3. Required flue spaces shall be maintained.

3208.3.1 Flue space protection. Flue spaces required by Table 3208.3 above the first tier of storage in single-, double- or multiple-row rack storage installations shall, where required by the fire code official, be equipped with approved protection devices. Such devices shall not be removed or modified.

3208.4 Column protection. Steel building columns shall be protected in accordance with NFPA 13.

3208.5 Extra-high-rack storage systems. Approval of the fire code official shall be obtained prior to installing extra-high-rack combustible storage.

3208.5.1 Fire protection. Buildings with extra-high-rack combustible storage shall be protected with a specially engineered automatic sprinkler system. Extra-high-rack combustible storage shall be provided with additional special fire protection, such as separation from other buildings and additional built-in fire protection features and fire department access, where required by the fire code official.

SECTION 3209 AUTOMATED STORAGE

3209.1 General. Automated storage shall be in accordance with this section.

3209.2 Automatic sprinklers. Where automatic sprinklers are required by Table 3206.2, the building shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

3209.3 Carousel storage. High-piled storage areas having greater than 500 square feet (46 m²) of carousel storage shall be provided with automatic shutdown in accordance with one of the following:

1. An automatic smoke detection system installed in accordance with Section 907, with coverage extending 15 feet (4575 mm) in all directions beyond unenclosed carousel storage systems and that sounds a local alarm at the operator's station and stops the carousel storage system upon the activation of a single detector.

**TABLE 3208.3
REQUIRED FLUE SPACES FOR RACK STORAGE**

RACK CONFIGURATION	FLUE DESIGN		AUTOMATIC SPRINKLER PROTECTION		
			Sprinklers at the ceiling with or without minimum in-rack sprinklers		In-rack sprinklers at every tier
			Storage height ≤ 25 feet	Storage height > 25 feet	Any height
Single-row rack	Transverse flue space	Size ^b	3 inches	3 inches	Not required
		Vertically aligned	Not required	Yes	Not required
	Longitudinal flue space		Not required	Not required	Not required
Double-row rack (Option 1)	Transverse flue space	Size ^b	6 inches ^a	3 inches	Not required
		Vertically aligned	Not required	Yes	Not required
	Longitudinal flue space		Not required	6 inches	Not required
Double-row rack (Option 2)	Transverse flue space	Size ^b	3 inches	6 inches	Not required
		Vertically aligned	Not required	Yes	Not required
	Longitudinal flue space		6 inches	Not required	Not required
Multiple-row rack	Transverse flue space	Size ^b	6 inches	6 inches	Not required
		Vertically aligned	Not required	Yes	Not required
	Longitudinal flue space		Not required	Not required	Not required

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a. Three-inch transverse flue spaces shall be provided not less than every 10 feet where ESFR sprinkler protection is provided.

b. Random variations are allowed, provided that the configuration does not obstruct water penetration.

2. An automatic smoke detection system installed in accordance with Section 907 and within enclosed carousel storage systems, that sounds a local alarm at the operator's station and stops the carousel storage system upon the activation of a single detector.
3. A single dead-man-type control switch that allows the operation of the carousel storage system only when the operator is present. The switch shall be in the same room as the carousel storage system and located to provide for observation of the carousel system.

3209.4 Automated rack storage. High-piled storage areas with automated rack storage shall be provided with a manually activated emergency shutdown switch and automatic shutdown in accordance with Sections 3209.4.1 and 3209.4.2.

3209.4.1 Manual activated shutdown. A manually activated switch shall be provided to initiate the approved automatic shutdown process. The switch shall be clearly identified and shall be in a location approved by the fire code official.

3209.4.2 Automatic shutdown. Automatic shutdown shall be required for high-piled combustible storage areas greater than 500 square feet (46 m²). The approved automatic shutdown process shall commence upon any of the following events:

1. Water flow is detected in the automatic sprinkler system, if present.
2. Activation of the fire detection system, if present.

SECTION 3210 SPECIALTY STORAGE

3210.1 General. Records storage facilities used for the rack or shelf storage of combustible paper records greater than 12 feet (3658 mm) in height shall be in accordance with Sections 3206 and 3208. Palletized storage of records shall be in accordance with Section 3207.

3210.1.1 Alternative fire protection. The design and installation of automatic fire-extinguishing systems in archives, vaults and record storage rooms shall be in accordance with NFPA 232.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 33 – FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
3303.5			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 33

FIRE SAFETY DURING CONSTRUCTION AND DEMOLITION

User note:

About this chapter: Chapter 33 outlines general fire safety precautions for all structures and all occupancies during construction and demolition operations. In general, these requirements seek to maintain required levels of fire protection, limit fire spread, establish the appropriate operation of equipment and promote prompt response to fire emergencies. There is an emphasis on owner responsibility and the need to create and implement a site safety plan. Features regulated include fire protection systems, fire fighter access to the site and building, water supply, means of egress, hazardous materials storage and use, and temporary heating equipment and other ignition sources. Fire watches are an important component of this chapter. This chapter correlates with Chapter 33 of the California Building Code.

SECTION 3301 GENERAL

3301.1 Scope. This chapter shall apply to structures in the course of construction, alteration or demolition, including those in underground locations. Compliance with NFPA 241 is required for items not specifically addressed herein.

3301.2 Purpose. This chapter prescribes minimum safeguards for construction, alteration and demolition operations to provide reasonable safety to life and property from fire during such operations.

SECTION 3302 DEFINITIONS

3302.1 Terms defined in Chapter 2. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

**

SECTION 3303 OWNER'S RESPONSIBILITY FOR FIRE PROTECTION

3303.1 Program development and maintenance. The owner or owner's authorized agent shall be responsible for the development, implementation and maintenance of an approved, written site safety plan establishing a fire prevention program at the project site applicable throughout all phases of the construction, repair, alteration or demolition work. The plan shall address the requirements of this chapter and other applicable portions of this code, the duties of staff and staff training requirements. The plan shall be submitted and approved before a building permit is issued. Any changes to the plan shall be submitted for approval.

3303.1.1 Components of site safety plans. Site safety plans shall include the following as applicable:

1. Name and contact information of site safety director.
2. Documentation of the training of the site safety director and fire watch personnel.
3. Procedures for reporting emergencies.
4. Fire department vehicle access routes.

5. Location of fire protection equipment, including portable fire extinguishers, standpipes, fire department connections and fire hydrants.
6. Smoking and cooking policies, designated areas to be used where approved, and signage locations in accordance with Section 3305.8.
7. Location and safety considerations for temporary heating equipment.
8. Hot work permit plan.
9. Plans for control of combustible waste material.
10. Locations and methods for storage and use of flammable and combustible liquids and other hazardous materials.
11. Provisions for site security.
12. Changes that affect this plan.
13. Other site-specific information required by the fire code official.

3303.2 Site safety director. The owner shall designate a person to be the site safety director. The site safety director shall be responsible for ensuring compliance with the site safety plan. The site safety director shall have the authority to enforce the provisions of this chapter and other provisions as necessary to secure the intent of this chapter. Where guard service is provided in accordance with NFPA 241, the site safety director shall be responsible for the guard service.

3303.3 Daily fire safety inspection. The site safety director shall be responsible for completion of a daily fire safety inspection at the project site. Each day, all building and outdoor areas shall be inspected to ensure compliance with the inspection list in this section. The results of each inspection shall be documented and maintained on-site until a certificate of occupancy has been issued. Documentation shall be immediately available on-site for presentation to the fire code official upon request.

1. Any contractors entering the site to perform hot work each day have been instructed in the hot work safety requirements in Chapter 35, and hot work is performed only in areas approved by the site safety director.

2. Temporary heating equipment is maintained away from combustible materials in accordance with the equipment manufacturer's instructions.
3. Combustible debris, rubbish and waste material is removed from the building in areas where work is not being performed.
4. Temporary wiring does not have exposed conductors.
5. Flammable liquids and other hazardous materials are stored in locations that have been approved by the site safety director when not involved in work that is being performed.
6. Fire apparatus access roads required by Section 3311 are maintained clear of obstructions that reduce the width of the usable roadway to less than 20 feet (6096 mm).
7. Fire hydrants are clearly visible from access roads and are not obstructed.
8. The location of fire department connections to standpipe and in-service sprinkler systems are clearly identifiable from the access road and such connections are not obstructed.
9. Standpipe systems are in service and continuous to the highest work floor, as specified in Section 3313.1.
10. Portable fire extinguishers are available in locations required by Sections 3316 and 3318.3.

3303.3.1 Violations. Failure to properly conduct, document and maintain documentation required by this section shall constitute an unlawful act in accordance with Section 112.1 and shall result in the issuance of a notice of violation to the site safety director in accordance with Section 112.3. Upon the third offense, the fire code official is authorized to issue a stop work order in accordance with Section 113, and work shall not resume until satisfactory assurances of future compliance have been presented to and approved by the fire code official.

3303.4 Qualifications. Site safety directors shall acquire training specific to their roles and responsibilities. Upon request, the training and qualifications of the site safety director shall be submitted to the fire code official for approval.

3303.5 Fire safety requirements for buildings of Types IV-A, IV-B and IV-C construction. Buildings of Types IV-A, IV-B and IV-C construction designed to be greater than six stories above grade plane shall comply with the following requirements during construction unless otherwise approved by the fire code official:

1. Standpipes shall be provided in accordance with Section 3313.
2. A water supply for fire department operations, as approved by the fire code official and the fire chief.
3. Where building construction exceeds six stories above grade plane and noncombustible protection is required by Section 602.4 of the *California Building Code*, at least one layer of noncombustible protection shall be installed on all building elements on floor levels,

including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

4. Where building construction exceeds six stories above grade plane, required exterior wall coverings shall be installed on floor levels, including mezzanines, more than four levels below active mass timber construction before additional floor levels can be erected.

Exception: Shafts and vertical exit enclosures shall not be considered part of the active mass timber construction.

3303.6 Training. Training of fire watch and other responsible personnel in the use of fire protection equipment shall be the responsibility of the site safety director. Records of training shall be kept and made a part of the written plan for the site safety plan.

3303.7 Fire protection devices. The site safety director shall ensure that all fire protection equipment is maintained and serviced in accordance with this code. Fire protection equipment shall be inspected in accordance with the fire protection program.

3303.8 Hot work operations. The site safety director shall ensure hot work operations and permit procedures are in accordance with Chapter 35.

3303.9 Impairment of fire protection systems. The site safety director shall ensure impairments to any fire protection system are in accordance with Section 901.

3303.9.1 Smoke detectors and smoke alarms. Smoke detectors and smoke alarms located in an area where airborne construction dust is expected shall be covered to prevent exposure to dust or shall be temporarily removed. Smoke detectors and alarms that were removed shall be replaced upon conclusion of dust-producing work. Smoke detectors and smoke alarms that were covered shall be inspected and cleaned, as necessary, upon conclusion of dust-producing work.

3303.10 Temporary covering of fire protection devices. Coverings placed on or over fire protection devices to protect them from damage during construction processes shall be immediately removed upon the completion of the construction processes in the room or area in which the devices are installed.

SECTION 3304 TEMPORARY HEATING EQUIPMENT

3304.1 Listed. Temporary heating devices shall be listed and labeled. The installation, maintenance and use of temporary heating devices shall be in accordance with the listing and the manufacturer's instructions.

3304.2 Oil-fired heaters. Oil-fired heaters shall comply with Section 605.

3304.3 LP-gas heaters. Fuel supplies for liquefied-petroleum gas-fired heaters shall comply with Chapter 61 and the *California Mechanical Code*.

3304.4 Refueling. Refueling operations for liquid-fueled equipment or appliances shall be conducted in accordance with Section 5705. The equipment or appliance shall be allowed to cool prior to refueling.

3304.5 Installation. Clearance to combustibles from temporary heating devices shall be maintained in accordance with the labeled equipment. When in operation, temporary heating devices shall be fixed in place and protected from damage, dislodgement or overturning in accordance with the manufacturer's instructions.

3304.6 Supervision. The use of temporary heating devices shall be supervised and maintained only by competent personnel.

**SECTION 3305
PRECAUTIONS AGAINST FIRE**

3305.1 Smoking. Smoking shall be prohibited except in approved areas. Signs shall be posted in accordance with Section 310. In approved areas where smoking is permitted, approved ashtrays shall be provided in accordance with Section 310.

3305.2 Combustible debris, rubbish and waste. Combustible debris, rubbish and waste material shall comply with the requirements of Sections 3305.2.1 through 3305.2.4.

3305.2.1 Combustible waste material accumulation. Combustible debris, rubbish and waste material shall not be accumulated within buildings.

3305.2.2 Combustible waste material removal. Combustible debris, rubbish and waste material shall be removed from buildings at the end of each shift of work.

3305.2.3 Rubbish containers. Where rubbish containers with a capacity exceeding 5.33 cubic feet (40 gallons) (0.15 m³) are used for temporary storage of combustible debris, rubbish and waste material, they shall have tight-fitting or self-closing lids. Such rubbish containers shall be constructed entirely of materials that comply with either of the following:

1. Noncombustible materials.
2. Materials that meet a peak rate of heat release not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation.

3305.2.4 Spontaneous ignition. Materials susceptible to spontaneous ignition, such as oily rags, shall be stored in a listed disposal container.

3305.3 Burning of combustible debris, rubbish and waste. Combustible debris, rubbish and waste material shall not be disposed of by burning on the site unless approved.

3305.4 Open burning. Open burning shall comply with Section 307.

3305.5 Fire watch. Where required by the fire code official or the site safety plan established in accordance with Section 3303.1, a fire watch shall be provided for building demolition and for building construction.

3305.5.1 Fire watch during construction. A fire watch shall be provided during nonworking hours for new construction that exceeds 40 feet (12 192 mm) in height above the lowest adjacent grade at any point along the building perimeter, for new multistory construction with an aggregate area exceeding 50,000 square feet (4645 m²) per story or as required by the fire code official.

3305.5.2 Fire watch personnel. Fire watch personnel shall be provided in accordance with this section.

3305.5.2.1 Duties. The primary duty of fire watch personnel shall be to perform constant patrols and watch for the occurrence of fire. The combination of fire watch duties and site security duties is acceptable.

3305.5.2.2 Training. Personnel shall be trained to serve as an on-site fire watch. Training shall include the use of portable fire extinguishers. Fire extinguishers and fire reporting shall be in accordance with Section 3310.

3305.5.2.3 Means of notification. Fire watch personnel shall be provided with not fewer than one approved means for notifying the fire department.

3305.5.3 Fire watch location and records. The fire watch shall include areas specified by the site safety plan established in accordance with Section 3303.

3305.5.4 Fire watch records. Fire watch personnel shall keep a record of all time periods of duty, including the log entry for each time the site was patrolled and each time a structure was entered and inspected. Records shall be made available for review by the fire code official upon request.

3305.6 Cutting and welding. Welding, cutting, open torches and other hot work operations and equipment shall comply with Chapter 35.

3305.7 Electrical. Temporary wiring for electrical power and lighting installations used in connection with the construction, alteration or demolition of buildings, structures, equipment or similar activities shall comply with the *California Electrical Code*.

3305.8 Cooking. Cooking shall be prohibited except in approved designated cooking areas separated from combustible materials by a minimum of 10 feet (3048 mm). Signs with a minimum letter height of 3 inches (76 mm) and a minimum brush stroke of 1/2 inch (13 mm) shall be posted in conspicuous locations in designated cooking areas and state:

DESIGNATED COOKING AREA
COOKING OUTSIDE OF A DESIGNATED
COOKING AREA IS PROHIBITED

3305.9 Separations between construction areas. Separations used in Type I and Type II construction to separate construction areas from occupied portions of the building

shall be constructed of materials that comply with one of the following:

1. Noncombustible materials.
2. Materials that exhibit a flame spread index not exceeding 25 when tested in accordance with ASTM E84 or UL 723.
3. Materials exhibiting a peak heat release rate not exceeding 300 kW/m² when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation on specimens at the thickness intended for use.

SECTION 3306 FLAMMABLE AND COMBUSTIBLE LIQUIDS

3306.1 Storage of flammable and combustible liquids. Storage of flammable and combustible liquids shall be in accordance with Section 5704.

3306.2 Class I and Class II liquids. The storage, use and handling of flammable and combustible liquids at construction sites shall be in accordance with Section 5706.2. Ventilation shall be provided for operations involving the application of materials containing flammable solvents.

3306.3 Housekeeping. Flammable and combustible liquid storage areas shall be maintained clear of combustible vegetation and waste materials. Such storage areas shall not be used for the storage of combustible materials.

3306.4 Precautions against fire. Sources of ignition and smoking shall be prohibited in flammable and combustible liquid storage areas. Signs shall be posted in accordance with Section 310.

3306.5 Handling at point of final use. Class I and II liquids shall be kept in approved safety containers.

3306.6 Leakage and spills. Leaking vessels shall be immediately repaired or taken out of service and spills shall be cleaned up and disposed of properly.

SECTION 3307 FLAMMABLE GASES

3307.1 Storage and handling. The storage, use and handling of flammable gases shall comply with Chapter 58.

3307.2 Cleaning with flammable gas. Flammable gases shall not be used to clean or remove debris from piping open to the atmosphere.

3307.2.1 Pipe cleaning and purging. The cleaning and purging of flammable gas piping systems, including cleaning new or existing piping systems, purging piping systems into service and purging piping systems out of service, shall comply with NFPA 56.

Exceptions:

1. Compressed gas piping systems other than fuel gas piping systems where in accordance with Chapter 53.

2. Piping systems regulated by the *International Fuel Gas Code*.
3. Liquefied petroleum gas systems in accordance with Chapter 61.

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SECTION 3308 EXPLOSIVE MATERIALS

3308.1 Storage and handling. Explosive materials shall be stored, used and handled in accordance with Chapter 56.

3308.2 Supervision. Blasting operations shall be conducted in accordance with Chapter 56.

3308.3 Demolition using explosives. Approved fire hoses for use by demolition personnel shall be maintained at the demolition site wherever explosives are used for demolition. Such fire hoses shall be connected to an approved water supply and shall be capable of being brought to bear on post-detonation fires anywhere on the site of the demolition operation.

SECTION 3309 PORTABLE GENERATORS

3309.1 General. Portable generators used at construction and demolition sites shall comply with Section 1204.

SECTION 3310 FIRE REPORTING

3310.1 Emergency telephone. Emergency telephone facilities with ready access shall be provided in an approved location at the construction site, or an approved equivalent means of communication shall be provided. The street address of the construction site and the emergency telephone number of the fire department shall be posted adjacent to the telephone. Alternatively, where an equivalent means of communication has been approved, the site address and fire department emergency telephone number shall be posted at the main entrance to the site, in guard shacks and in the construction site office.

SECTION 3311 ACCESS FOR FIRE FIGHTING

3311.1 Required access. Approved vehicle access for fire fighting shall be provided to all construction or demolition sites. Vehicle access shall be provided to within 100 feet (30 480 mm) of temporary or permanent fire department connections. Vehicle access shall be provided by either temporary or permanent roads, capable of supporting vehicle loading under all weather conditions. Vehicle access shall be maintained until permanent fire apparatus access roads are available.

3311.2 Key boxes. Key boxes shall be provided as required by Chapter 5.

**SECTION 3312
MEANS OF EGRESS**

[BE] 3312.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

3312.2 Maintenance. Required means of egress and required accessible means of egress shall be maintained during construction and demolition, remodeling or alterations and additions to any building.

Exception: Approved temporary means of egress and accessible means of egress systems and facilities.

3312.3 Storage. Combustible materials associated with construction, demolition, remodeling or alterations to an occupied structure shall not be stored in exits, enclosures for stairways and ramps, or exit access corridors serving an occupant load of 30 or more.

Exceptions:

1. Where the only occupants are construction workers.
2. Combustible materials that are temporarily accumulated to support work being performed when workers are present.

**SECTION 3313
WATER SUPPLY FOR FIRE PROTECTION**

3313.1 When required. An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building materials arrive on the site, on commencement of vertical combustible construction and on installation of a standpipe system in buildings under construction, in accordance with Sections 3313.2 through 3313.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

3313.2 Combustible building materials. When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire-flow supply shall be within 500 feet (152 m) of the combustible building materials, as measured along an approved fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

3313.3 Vertical construction of Types III, IV and V construction. Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 3313.3.1 through 3313.3.3 shall be provided,

accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

3313.3.1 Fire separation up to 30 feet. Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m) or the entire fire flow required for the building when constructed, whichever is greater.

3313.3.2 Fire separation of 30 feet up to 60 feet. Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m) or 50 percent of the fire flow required for the building when constructed, whichever is greater.

3313.3.3 Fire separation of 60 feet or greater. Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

3313.4 Vertical construction, Type I and II construction. If combustible building materials are delivered to the construction site, water supply in accordance with Section 3313.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

3313.5 Standpipe supply. Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 3314, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

**SECTION 3314
STANDPIPES**

3314.1 Where required. In buildings required to have standpipes by Section 905.3.1, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to stairways complying with Section 3312.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

3314.2 Buildings being demolished. Where a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but

shall not be demolished more than one floor below the floor being demolished.

3314.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Section 905.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes comply with the requirements of Section 905 as to capacity, outlets and materials.

SECTION 3315 AUTOMATIC SPRINKLER SYSTEM

3315.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code or the *California Building Code*, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved, except as provided in Section 105.3.4.

3315.2 Operation of valves. Operation of sprinkler control valves shall be allowed only by properly authorized personnel and shall be accompanied by notification of duly designated parties. Where the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 3316 PORTABLE FIRE EXTINGUISHERS

3316.1 Where required. Structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher in accordance with Section 906 and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist including, but not limited to, the storage and use of flammable and combustible liquids.

SECTION 3317 MOTORIZED CONSTRUCTION EQUIPMENT

3317.1 Conditions of use. Internal-combustion-powered construction equipment shall be used in accordance with all of the following conditions:

1. Equipment shall be located so that exhausts do not discharge against combustible material.
2. Exhausts shall be piped to the outside of the building.
3. Equipment shall not be refueled while in operation.
4. Fuel for equipment shall be stored in an approved area outside of the building.

SECTION 3318 SAFEGUARDING ROOFING OPERATIONS

3318.1 General. Roofing operations utilizing heat-producing systems or other ignition sources shall be conducted in accordance with Sections 3318.2 and 3318.3 and Chapter 35.

3318.2 Asphalt and tar kettles. Asphalt and tar kettles shall be operated in accordance with Section 303.

3318.3 Fire extinguishers for roofing operations. Fire extinguishers shall comply with Section 906. There shall be not less than one multiple-purpose portable fire extinguisher with a minimum 3-A 40-B:C rating on the roof being covered or repaired.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 34 – TIRE REBUILDING AND TIRE STORAGE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
3401.1			X																			
3404.2			X																			
3405.1			X																			
3405.4			X																			
3405.7			X																			
3405.8			X																			
3405.9			X																			
3406.1			X																			
3408.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 34

TIRE REBUILDING AND TIRE STORAGE

User note:

About this chapter: Chapter 34 provides requirements that are intended to prevent or control fires and explosions associated with the remanufacture and storage of tires and tire byproducts. Additionally, the requirements are intended to minimize the impact of indoor and outdoor tire storage fires by regulating pile volume and location, segregating the various operations, providing for fire department access and a water supply, and controlling ignition sources.

SECTION 3401 GENERAL

3401.1 Scope. Tire rebuilding plants, tire storage [including tire derived products as defined in *Public Resources Code, Section 42805.7(a)*] and tire byproduct facilities shall comply with this chapter, other applicable requirements of this code and NFPA 13. Tire storage in buildings shall also comply with Chapter 32.

3401.2 Permit required. Permits shall be required as set forth in Section 105.5.

SECTION 3402 DEFINITIONS

3402.1 Terms defined in Chapter 2. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

SECTION 3403 TIRE REBUILDING

3403.1 Construction. Tire rebuilding plants shall comply with the requirements of the *California Building Code*, as to construction, separation from other buildings or other portions of the same building, and protection.

3403.2 Location. Buffing operations shall be located in a room separated from the remainder of the building housing the tire rebuilding or tire recapping operations by a 1-hour fire barrier.

Exception: Buffing operations are not required to be separated where all of the following conditions are met:

1. Buffing operations are equipped with an approved continuous automatic water-spray system directed at the point of cutting action.
2. Buffing machines are connected to particle-collecting systems providing a minimum air movement of 1,500 cubic feet per minute (cfm) (0.71 m³/s) in volume and 4,500 feet per minute (fpm) (23 m/s) in-line velocity.
3. The collecting system shall discharge the rubber particles to an approved outdoor noncombustible or fire-resistant container that is emptied at frequent intervals to prevent overflow.

3403.3 Cleaning. The buffing area shall be cleaned at frequent intervals to prevent the accumulation of rubber particles.

3403.4 Spray rooms and booths. Each spray room or spray booth where flammable or combustible solvents are applied, shall comply with Chapter 24.

SECTION 3404 PRECAUTIONS AGAINST FIRE

3404.1 Open burning. Open burning is prohibited in tire storage yards.

3404.2 Sources of heat. *Open flame*, cutting, welding or heating devices *blow torches* or *highly flammable materials including, but not limited to, inner tubes* are prohibited *within 40 feet of a waste tire pile*.

3404.3 Smoking prohibited. Smoking is prohibited in tire storage yards, except in designated areas.

3404.4 Power lines. Tire storage piles shall not be located beneath electrical power lines having a voltage in excess of 750 volts or that supply power to fire emergency systems.

3404.5 Fire safety plan. The owner or individual in charge of the tire storage yard shall be required to prepare and submit to the fire code official a fire safety plan for review and approval. The fire safety plan shall include provisions for fire department vehicle access. Not less than one copy of the fire safety plan shall be prominently posted and maintained at the storage yard.

3404.6 Telephone number. The telephone number of the fire department and location of the nearest telephone shall be posted conspicuously in attended locations.

SECTION 3405 OUTDOOR STORAGE

3405.1 Individual piles. Tire storage shall be restricted to individual piles not exceeding 5,000 square feet (464.5 m²) of continuous area. *Pile width shall not exceed 50 feet*. Piles shall not exceed 50,000 cubic feet (1416 m³) in volume or 10 feet (3048 mm) in height.

3405.2 Separation of piles. Individual tire storage piles shall be separated from other piles by a clear space of not less than 40 feet (12 192 mm).

TIRE REBUILDING AND TIRE STORAGE

3405.3 Distance between piles of other stored products.

Tire storage piles shall be separated by a clear space of not less than 40 feet (12 192 mm) from piles of other stored product.

3405.4 Distance from lot lines and buildings. Tire storage piles shall be located not less than 50 feet (15 240 mm) from lot lines and buildings.

Exceptions:

1. *Tire storage piles containing less than 500 tires shall be permitted to be located no closer than 10 feet (3048 mm) from lot lines or from buildings. Tire storage piles shall not exceed 6 feet (1829 mm) in height when within 20 feet of any property line, building or perimeter fencing. Side slopes shall not exceed 60 degrees. When approved by the fire code official in accordance with Section 1.11.2.4, distances of less than 10 feet (3048 mm) from lot lines or from buildings may be approved.*
2. *When approved by the fire code official in accordance with Section 1.11.2.4, exempted facilities defined in Public Resources Code, Sections 42808(c) and 42831 and used tires as defined in Section 42806.5, tire storage piles shall be permitted to be located no closer than 10 feet (3048 mm) from lot lines or from buildings. Tire storage piles shall not exceed 6 feet (1829 mm) in height when within 20 feet of any property line or perimeter fencing. Side slopes shall not exceed 60 degrees.*
3. *When approved by the fire code official in accordance with Section 1.11.2.4, "minor waste tire facilities" as defined in Public Resources Code, Section 42808, tire storage piles shall be permitted to be located no closer than 10 feet (3048 mm) from lot lines or 50 feet (15 240 mm) from buildings. Tire storage piles shall not exceed 6 feet (1829 mm) in height when within 20 feet of any property line or perimeter fencing. Side slopes shall not exceed 60 degrees.*
4. *Existing "minor waste tire storage facilities" as defined in Public Resources Code, Section 42808, legally permitted prior to January 1, 2011, shall be permitted to maintain tire storage piles located no closer than 10 feet (3048 mm) from lot lines or 50 feet (15 240 mm) from buildings. Tire storage piles shall not exceed 6 feet (1829 mm) in height when within 20 feet (6096 mm) of any property line or perimeter fencing. Side slopes shall not exceed 60 degrees.*

3405.5 Fire breaks. Storage yards shall be maintained free from combustible ground vegetation for a distance of 40 feet (12 192 mm) from the stored material to grass and weeds; and for a distance of 100 feet (30 480 mm) from the stored product to brush and forested areas.

3405.6 Volume more than 150,000 cubic feet. Where the bulk volume of stored product is more than 150,000 cubic feet (4248 m³), storage arrangement shall be in accordance with the following:

1. Individual storage piles shall comply with size and separation requirements in Sections 3405.1 through 3405.5.

2. Adjacent storage piles shall be considered to be a group, and the aggregate volume of storage piles in a group shall not exceed 150,000 cubic feet (4248 m³).

Separation between groups shall be not less than 75 feet (22 860 mm) wide.

3405.7 Location of storage. Outdoor waste tire storage shall not be located in any of the following:

1. Under bridges, elevated trestles, elevated roadways or elevated railroads.
2. *In any area where they may be subjected to immersion in water during a 100-year storm, unless the operator demonstrates that the facility will be designed and operated so as to prevent waste tires from migrating off-site.*
3. *On surfaces with grades or other physical features that will interfere with fire-fighting equipment or personnel unless mitigating measures have been approved in writing by the local fire authority or a fire safety engineer registered by the State of California. Measures established by a fire safety engineer shall be subject to approval by the local fire authority.*

3405.8 Rim removal. Waste tires stored on rims shall be stored separate from other waste tires.

3405.9 Pyrolytic oil runoff. The facility shall be designed and constructed to provide protection to bodies of water from runoff of pyrolytic oil resulting from a potential tire fire.

SECTION 3406 FIRE DEPARTMENT ACCESS

3406.1 Required access. New and existing tire storage yards shall be provided with fire apparatus access roads in accordance with Section 503 and Section 3406.2. Existing tire storage yards shall be provided with fire apparatus access roads where required in Chapter 11.

3406.2 Location. Fire apparatus access roads shall be located within all pile clearances identified in Section 3405.4 and within all fire breaks required in Section 3405.5. Access roadways shall be within 150 feet (45 720 mm) of any point in the storage yard where storage piles are located, not less than 20 feet (6096 mm) from any storage pile.

SECTION 3407 FENCING

3407.1 Where required. Where the bulk volume of stored material is more than 20,000 cubic feet (566 m³), a firmly anchored fence or other approved method of security that controls unauthorized access to the storage yard shall surround the storage yard.

3407.2 Construction. The fence shall be constructed of approved materials and shall be not less than 6 feet (1829 mm) high and provided with gates not less than 20 feet (6096 mm) wide.

3407.3 Locking. Gates to the storage yard shall be locked when the storage yard is not staffed.

3407.4 Unobstructed. Gateways shall be kept clear of obstructions and be fully openable at all times.

SECTION 3408 FIRE PROTECTION

3408.1 Water supply. A public or private fire protection water supply shall be provided in accordance with Section 507 and shall be capable of delivering at least 1,000 gallons per minute (gpm) for a duration of at least three hours and at least 2,000 gpm for a duration of at least three hours if the sum of altered plus whole waste tires exceeds 10,000. The water supply shall be arranged such that any part of the storage yard can be reached by using not more than 500 feet (152 m) of hose.

3408.2 Fire extinguishers. Buildings or structures shall be provided with portable fire extinguishers in accordance with Section 906. Fuel-fired vehicles operating in the storage yard shall be equipped with a minimum 2-A:20-B:C-rated portable fire extinguisher.

SECTION 3409 INDOOR STORAGE ARRANGEMENT

3409.1 Pile dimensions. Where tires are stored on-tread, the dimension of the pile in the direction of the wheel hole shall be not more than 50 feet (15 240 mm). Tires stored adjacent to or along one wall shall not extend more than 25 feet (7620 mm) from that wall. Other piles shall be not more than 50 feet (15 240 mm) in width.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 35 – WELDING AND OTHER HOT WORK

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 35

WELDING AND OTHER HOT WORK

User note:

About this chapter: Chapter 35 covers requirements for safety in welding and other types of hot work by reducing the potential for fire ignitions that usually result in large losses. Several different types of hot work would fall under the requirements found in Chapter 35, including both gas and electric arc methods and any open-torch operations. Many of the activities of this chapter focus on the actions of the occupants.

SECTION 3501 GENERAL

3501.1 Scope. Welding, cutting, open torches and other hot work operations and equipment shall comply with this chapter.

3501.2 Permits. Permits shall be required as set forth in Section 105.5.

3501.3 Restricted areas. Hot work shall only be conducted in areas designed or authorized for that purpose by the personnel responsible for a hot work program. Hot work shall not be conducted in the following areas unless approval has been obtained from the fire code official:

1. Areas where the sprinkler system is impaired.
2. Areas where there exists the potential of an explosive atmosphere, such as locations where flammable gases, liquids or vapors are present.
3. Areas with readily ignitable materials, such as storage of large quantities of bulk sulfur, baled paper, cotton, lint, dust or loose combustible materials.
4. On board ships at dock or ships under construction or repair.
5. At other locations as specified by the fire code official.

3501.4 Cylinders and containers. Compressed gas cylinders and fuel containers shall comply with this chapter and Chapter 53.

3501.5 Design and installation of oxygen-fuel gas systems. An oxygen-fuel gas system with two or more manifolded cylinders of oxygen shall be in accordance with NFPA 51.

SECTION 3502 DEFINITIONS

3502.1 Definitions. The following terms are defined in Chapter 2:

HOT WORK.

HOT WORK AREA.

HOT WORK EQUIPMENT.

HOT WORK PERMITS.

HOT WORK PROGRAM.

RESPONSIBLE PERSON.

SECTION 3503 GENERAL REQUIREMENTS

3503.1 General. Hot work conditions and operations shall comply with this chapter.

3503.2 Temporary and fixed hot work areas. Temporary and fixed hot work areas shall comply with this section.

3503.3 Hot work program permit. Hot work permits, issued by an approved responsible person under a hot work program, shall be available for review by the fire code official at the time the work is conducted and for 48 hours after work is complete.

3503.4 Qualifications of operators. A permit for hot work operations shall not be issued unless the individuals in charge of performing such operations are capable of performing such operations safely. Demonstration of a working knowledge of the provisions of this chapter shall constitute acceptable evidence of compliance with this requirement.

3503.5 Records. The individual responsible for the hot work area shall maintain "prework check" reports in accordance with Section 3504.3.1. Such reports shall be maintained on the premises for not less than 48 hours after work is complete.

3503.6 Signage. Visible hazard identification signs shall be provided where required by Chapter 50. Where the hot work area is open to persons other than the operator of the hot work equipment, conspicuous signs shall be posted to warn others before they enter the hot work area. Such signs shall display the following warning:

CAUTION
HOT WORK IN PROGRESS
STAY CLEAR

SECTION 3504 FIRE SAFETY REQUIREMENTS

3504.1 Protection of combustibles. Protection of combustibles shall be in accordance with Sections 3504.1.1 through 3504.1.9.

3504.1.1 Combustibles. Hot work areas shall not contain combustibles or shall be provided with appropriate shielding to prevent sparks, slag or heat from igniting exposed combustibles.

3504.1.2 Openings. Openings or cracks in walls, floors, ducts or shafts within the hot work area shall be tightly

covered to prevent the passage of sparks to adjacent combustible areas, or shielded by metal fire-resistant guards, or curtains shall be provided to prevent passage of sparks or slag.

3504.1.3 Housekeeping. Floors shall be kept clean within the hot work area.

3504.1.4 Conveyor systems. Conveyor systems that are capable of carrying sparks to distant combustibles shall be shielded or shut down.

3504.1.5 Partitions. Partitions segregating hot work areas from other areas of the building shall be noncombustible. In fixed hot work areas, the partitions shall be securely connected to the floor such that gaps do not exist between the floor and the partition. Partitions shall prevent the passage of sparks, slag, and heat from the hot work area.

3504.1.6 Floors. Fixed hot work areas shall have floors with noncombustible surfaces.

3504.1.7 Precautions in hot work. Hot work shall not be performed on containers or equipment that contain or have contained flammable liquids, gases or solids until the containers and equipment have been thoroughly cleaned, inerted or purged; except that “hot tapping” shall be allowed on tanks and pipe lines where such work is to be conducted by approved personnel. Hot work on flammable and combustible liquid storage tanks shall be conducted in accordance with Section 3510.

3504.1.8 Sprinkler protection. Automatic sprinkler protection shall not be shut off while hot work is performed. Where hot work is performed close to automatic sprinklers, noncombustible barriers or damp cloth guards shall shield the individual sprinkler heads and shall be removed when the work is completed. If the work extends over several days, the shields shall be removed at the end of each workday. The fire code official shall approve hot work where sprinkler protection is impaired.

3504.1.9 Fire detection systems. Approved special precautions shall be taken to avoid accidental operation of automatic fire detection systems.

3504.2 Fire watch. Fire watches shall be established and conducted in accordance with Sections 3504.2.1 through 3504.2.6.

3504.2.1 When required. A fire watch shall be provided during hot work activities and shall continue for not less than 30 minutes after the conclusion of the work. The fire code official, or the responsible manager under a hot work program, is authorized to extend the fire watch based on the hazards or work being performed.

Exception: Where the hot work area has no fire hazards or combustible exposures.

3504.2.2 Location. The fire watch shall include the entire hot work area. Hot work conducted in areas with vertical or horizontal fire exposures that are not observable by a single individual shall have additional personnel assigned to fire watches to ensure that exposed areas are monitored.

3504.2.3 Duties. Individuals designated to fire watch duty shall have fire-extinguishing equipment readily available

and shall be trained in the use of such equipment. Individuals assigned to fire watch duty shall be responsible for extinguishing spot fires and communicating an alarm.

3504.2.4 Fire training. The individuals responsible for performing the hot work and individuals responsible for providing the fire watch shall be trained in the use of portable fire extinguishers.

3504.2.5 Fire hoses. Where hoselines are required, they shall be connected, charged and ready for operation.

3504.2.6 Fire extinguisher. Not less than one portable fire extinguisher complying with Section 906 and with a minimum 2-A:20-B:C rating shall be provided with ready access within 30 feet (9144 mm) of the location where hot work is performed.

3504.3 Area reviews. Before hot work is permitted and not less than once per day while the permit is in effect, the area shall be inspected by the individual responsible for authorizing hot work operations to ensure that it is a fire safe area. Information shown on the permit shall be verified prior to signing the permit in accordance with Section 105.5.

3504.3.1 Pre-hot-work check. A pre-hot-work check shall be conducted prior to work to ensure that all equipment is safe and hazards are recognized and protected. A report of the check shall be kept at the work site during the work and available upon request. The pre-hot-work check shall determine all of the following:

1. Hot work equipment to be used shall be in satisfactory operating condition and in good repair.
2. Hot work site is clear of combustibles or combustibles are protected.
3. Exposed construction is of noncombustible materials or, if combustible, then protected.
4. Openings are protected.
5. Floors are kept clean.
6. Exposed combustibles are not located on the opposite side of partitions, walls, ceilings or floors.
7. Fire watches, where required, are assigned.
8. Approved actions have been taken to prevent accidental activation of fire protection system equipment in accordance with Sections 3504.1.8 and 3504.1.9.
9. Fire extinguishers and fire hoses (where provided) are operable and available.

SECTION 3505 GAS WELDING AND CUTTING

3505.1 General. Devices or attachments mixing air or oxygen with combustible gases prior to consumption, except at the burner or in a standard torch or blow pipe, shall not be allowed unless approved.

3505.2 Cylinder and container storage, handling and use. Storage, handling and use of compressed gas cylinders,

containers and tanks shall be in accordance with this section and Chapter 53.

3505.2.1 Cylinders connected for use. The storage or use of a single cylinder of oxygen and a single cylinder of fuel gas located on a cart shall be allowed without requiring the cylinders to be separated in accordance with Section 5003.9.8 or 5003.10.3.6 when the cylinders are connected to regulators, ready for service, equipped with apparatus designed for cutting or welding and all of the following:

1. Carts shall be kept away from the cutting or welding operation in accordance with Section 3505.5 or fire-resistant shields shall be provided.
2. Cylinders shall be secured to the cart to resist movement.
3. Carts shall be in accordance with Section 5003.10.3.
4. Cylinder valves not having fixed hand wheels shall have keys, handles or nonadjustable wrenches on valve stems while the cylinders are in service.
5. Cylinder valve outlet connections shall conform to the requirements of CGA V-1.
6. Cylinder valves shall be closed when work is finished.
7. Cylinder valves shall be closed before moving the cart.

3505.2.1.1 Individual cart separation. Individual carts shall be separated from each other in accordance with Section 5003.9.8.

3505.3 Precautions. Cylinders, valves, regulators, hose and other apparatus and fittings for oxygen shall be kept free from oil or grease. Oxygen cylinders, apparatus and fittings shall not be handled with oily hands, oily gloves, or greasy tools or equipment.

3505.4 Acetylene gas. Acetylene gas shall not be piped except in approved cylinder manifolds and cylinder manifold connections, or utilized at a pressure exceeding 15 pounds per square inch gauge (psig) (103 kPa) unless dissolved in a suitable solvent in cylinders manufactured in accordance with DOTn 49 CFR Part 178. Acetylene gas shall not be brought in contact with unalloyed copper, except in a blowpipe or torch.

3505.5 Remote locations. Oxygen and fuel-gas cylinders and acetylene generators shall be located away from the hot work area to prevent such cylinders or generators from being heated by radiation from heated materials, sparks or slag, or misdirection of the torch flame.

3505.6 Cylinders shutoff. The torch valve shall be closed and the gas supply to the torch completely shut off when gas welding or cutting operations are discontinued for a period of 1 hour or more.

3505.7 Prohibited operation. Welding or cutting work shall not be held or supported on compressed gas cylinders or containers.

3505.8 Tests. Tests for leaks in piping systems and equipment shall be made with soapy water. The use of flames shall be prohibited for leak testing.

SECTION 3506 ELECTRIC ARC HOT WORK

3506.1 General. The frame or case of electric hot work machines, except internal-combustion-engine-driven machines, shall be grounded. Ground connections shall be mechanically strong and electrically adequate for the required current.

3506.2 Return circuits. Welding current return circuits from the work to the machine shall have proper electrical contact at joints. The electrical contact shall be periodically inspected.

3506.3 Disconnecting. Electrodes shall be removed from the holders when electric arc welding or cutting is discontinued for any period of 1 hour or more. The holders shall be located to prevent accidental contact and the machines shall be disconnected from the power source.

3506.4 Emergency disconnect. A switch or circuit breaker shall be provided so that fixed electric welders and control equipment can be disconnected from the supply circuit. The disconnect shall be installed in accordance with *the California Electrical Code*.

3506.5 Damaged cable. Damaged cable shall be removed from service until properly repaired or replaced.

SECTION 3507 CALCIUM CARBIDE SYSTEMS

3507.1 Calcium carbide storage. Storage and handling of calcium carbide shall comply with Chapter 50 of this code and Chapter 9 of NFPA 51.

SECTION 3508 ACETYLENE GENERATORS

3508.1 Use of acetylene generators. The use of acetylene generators shall comply with this section and Chapter 15 of NFPA 55.

3508.2 Portable generators. The minimum volume of rooms containing portable generators shall be 35 times the total gas-generating capacity per charge of all generators in the room. The gas-generating capacity in cubic feet per charge shall be assumed to be 4.5 times the weight of carbide per charge in pounds. The minimum ceiling height of rooms containing generators shall be 10 feet (3048 mm). An acetylene generator shall not be moved by derrick, crane or hoist while charged.

3508.3 Protection against freezing. Generators shall be located where water will not freeze. Common salt such as sodium chloride or other corrosive chemicals shall not be utilized for protection against freezing.

SECTION 3509 PIPING MANIFOLDS AND HOSE SYSTEMS FOR FUEL GASES AND OXYGEN

3509.1 General. The use of piping manifolds and hose systems shall be in accordance with Sections 3509.2 through 3509.7, Chapter 53 and Chapter 5 of NFPA 51.

3509.2 Protection. Piping shall be protected against physical damage.

3509.3 Signage. Signage shall be provided for piping and hose systems as follows:

1. Above-ground piping systems shall be marked in accordance with ASME A13.1.
2. Station outlets shall be marked to indicate their intended usage.
3. Signs shall be posted, indicating clearly the location and identity of section shutoff valves.

3509.4 Manifolding of cylinders. Oxygen manifolds shall not be located in an acetylene generator room. Oxygen manifolds shall be located not less than 20 feet (6096 mm) away from combustible material such as oil or grease, and gas cylinders containing flammable gases, unless the gas cylinders are separated by a fire partition.

3509.5 Identification of manifolds. Signs shall be posted for oxygen manifolds with service pressures not exceeding 200 psig (1379 kPa). Such signs shall include the words:

LOW-PRESSURE MANIFOLD
DO NOT CONNECT HIGH-PRESSURE CYLINDERS
MAXIMUM PRESSURE 250 PSIG

3509.6 Clamps. Hose connections shall be clamped or otherwise securely fastened.

3509.7 Inspection. Hoses shall be inspected frequently for leaks, burns, wear, loose connections or other defects rendering the hose unfit for service.

SECTION 3510 HOT WORK ON FLAMMABLE AND COMBUSTIBLE LIQUID STORAGE TANKS

3510.1 General. Hot work performed on the interior or exterior of tanks that hold or have held flammable or combustible liquids shall be in accordance with Section 3510.2 and Chapters 4, 5, 6, 7 and 10 of NFPA 326.

3510.2 Prevention. The following steps shall be taken to minimize hazards where hot work must be performed on a flammable or combustible liquid storage container:

1. Use alternative methods to avoid hot work where possible.
2. Analyze the hazards prior to performing hot work, identify the potential hazards and the methods of hazard control.
3. Hot work shall conform to the requirements of the code or standard to which the container was originally fabricated.
4. Test the immediate and surrounding work area with a combustible gas detector and provide for a means of continuing monitoring while conducting the hot work.
5. Qualified employees and contractors performing hot work shall use an industry-approved hot work permit system to control the work.
6. Personnel shall be properly trained on hot work policies and procedures regarding equipment, safety, hazard controls and job-specific requirements.
7. On-site safety supervision shall be present where hot work is in progress to protect the personnel conducting the hot work and provide additional overview of site-specific hazards.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 36 – MARINAS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 36

MARINAS

User note:

***About this chapter:** Chapter 36 addresses the fire protection and prevention requirements for marinas. It was developed in response to the complications encountered by a number of fire departments responsible for the protection of marinas as well as fire loss history in marinas that lacked fire protection. Compliance with this chapter intends to establish safe practices in marina areas, provide an identification method for mooring spaces in the marina, and provide fire fighters with safe operational areas and fire protection methods to extend hose lines in a safe manner.*

SECTION 3601 SCOPE

3601.1 Scope. Marina facilities shall be in accordance with this chapter.

3601.2 Plans and approvals. Plans for marina fire protection facilities shall be approved prior to installation. The work shall be subject to final inspection and approval after installation.

SECTION 3602 DEFINITIONS

3602.1 Definitions. The following terms are defined in Chapter 2:

FLOAT.

MARINA.

PIER.

VESSEL.

WHARF.

SECTION 3603 GENERAL PRECAUTIONS

3603.1 Combustible debris. Combustible debris and rubbish shall not be deposited or accumulated on land beneath marina structures, piers or wharves.

3603.2 Sources of ignition. Open-flame devices used for lighting or decoration on the exterior of a vessel, float, pier or wharf shall be approved.

3603.3 Flammable or combustible liquid spills. Spills of flammable or combustible liquids at or on the water shall be reported immediately to the fire department or jurisdictional authorities.

3603.4 Rubbish containers. Containers with tight-fitting or self-closing lids shall be provided for temporary storage of combustible debris, rubbish and waste material. The rubbish containers shall be constructed entirely of materials that comply with any one of the following:

1. Noncombustible materials.

2. Materials that meet a peak rate of heat release not exceeding 300 kW/m² where tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m² in the horizontal orientation.

3603.5 Electrical equipment. Electrical equipment shall be installed and used in accordance with its listing, Section 608 of this code and Chapter 5 of NFPA 303 as required for wet, damp and hazardous locations.

3603.6 Berthing and storage. Berthing and storage shall be in accordance with Chapter 7 of NFPA 303.

3603.7 Slip identification. Slips and mooring spaces shall be individually identified by an approved numeric or alphabetic designator. Space designators shall be posted at the space. Signs indicating the space designators located on finger piers and floats shall be posted at the base of all piers, finger piers, floats and finger floats.

SECTION 3604 FIRE PROTECTION EQUIPMENT

3604.1 General. Piers, marinas and wharves with facilities for mooring or servicing five or more vessels, and marine motor fuel-dispensing facilities shall be equipped with fire protection equipment in accordance with Sections 3604.2 through 3604.6.

3604.2 Standpipes. Marinas and boatyards shall be equipped throughout with standpipe systems in accordance with NFPA 303. Systems shall be provided with hose connections located such that no point on the marina pier or float system exceeds 150 feet (15 240 mm) from a standpipe hose connection.

3604.2.1 Identification of standpipe outlets. Standpipe hose connection locations shall be clearly identified by a flag or other approved means designed to be readily visible from the pier accessing the float system.

3604.3 Access and water supply. Piers and wharves shall be provided with fire apparatus access roads and water-supply systems with on-site fire hydrants where required by the fire code official. Such roads and water systems shall be provided and maintained in accordance with Sections 503 and 507.

3604.4 Portable fire extinguishers. One portable fire extinguisher of the ordinary (moderate) hazard type shall be provided at each required standpipe hose connection. Addi-

MARINAS

tional portable fire extinguishers, suitable for the hazards involved, shall be provided and maintained in accordance with Section 906.

3604.5 Communications. A telephone not requiring a coin to operate or other approved, clearly identified means to notify the fire department shall be provided on the site in a location approved by the fire code official.

3604.6 Emergency operations staging areas. Space shall be provided on all float systems for the staging of emergency equipment. Emergency operation staging areas shall provide a minimum of 4 feet wide by 10 feet long (1219 mm by 3048 mm) clear area exclusive of walkways and shall be located at each standpipe hose connection. Emergency operation staging areas shall be provided with a curb or barrier having a minimum height of 4 inches (102 mm) and maximum space between the bottom edge and the surface of the staging area of 2 inches (51 mm) on the outboard sides of the staging area.

An approved sign reading "FIRE EQUIPMENT STAGING AREA—KEEP CLEAR" shall be provided at each staging area.

SECTION 3605

MARINE MOTOR FUEL-DISPENSING FACILITIES

3605.1 Fuel dispensing. Marine motor fuel-dispensing facilities shall be in accordance with Chapter 23.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 37 – COMBUSTIBLE FIBERS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 37

COMBUSTIBLE FIBERS

User note:

About this chapter: Chapter 37 establishes the requirements for storage and handling of combustible fibers, including animal, vegetable and synthetic fibers, whether woven into textiles, baled, packaged or loose. Operations involving combustible fibers are typically associated with salvage, paper milling, recycling, cloth manufacturing, carpet and textile mills and agricultural operations, among others. The primary hazard associated with these operations is the abundance of materials and their ready ignitability.

SECTION 3701 GENERAL

3701.1 Scope. The equipment, processes and operations involving combustible fibers shall comply with this chapter.

3701.2 Applicability. Storage of combustible fibers in any quantity shall comply with this section.

3701.3 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 3702 DEFINITIONS

3702.1 Definitions. The following terms are defined in Chapter 2:

BALED COTTON.

BALED COTTON, DENSELY PACKED.

COMBUSTIBLE FIBERS.

COTTON.

SEED COTTON.

SECTION 3703 GENERAL PRECAUTIONS

3703.1 Use of combustible receptacles. Ashes, waste, rubbish or sweepings shall not be placed in wood or other combustible receptacles and shall be removed daily from the structure.

3703.2 Vegetation. Grass or weeds shall not be allowed to accumulate at any point on the premises.

3703.3 Clearances. A minimum clearance of 3 feet (914 mm) shall be maintained between automatic sprinklers and the top of piles.

3703.4 Agricultural products. Hay, straw, seed cotton or similar agricultural products shall not be stored adjacent to structures or combustible materials unless a clear horizontal distance equal to the height of a pile is maintained between such storage and structures or combustible materials. Storage shall be limited to stacks of 100 tons (91 metric tons) each. Stacks shall be separated by not less than 20 feet (6096 mm) of clear space. Quantities of hay, straw, seed cotton and other agricultural products shall not be limited where stored in or

near farm structures located outside closely built areas. A permit shall not be required for agricultural storage.

3703.5 Dust collection. Where located within a building, equipment or machinery that generates or emits combustible fibers shall be provided with an approved dust-collecting and exhaust system. Such systems shall comply with Chapter 22 of this code and Section 511 of the *California Mechanical Code*.

3703.6 Portable fire extinguishers. Portable fire extinguishers shall be provided in accordance with Section 906 as required for extra-hazard occupancy protection as indicated in Table 906.1.

3703.7 Sources of ignition. Sources of ignition shall comply with Sections 3703.7.1 and 3703.7.2.

3703.7.1 Smoking. Smoking shall be prohibited and “No Smoking” signs provided as follows:

1. In rooms or areas where materials are stored or dispensed or used in open systems.
2. Within 25 feet (7620 mm) of outdoor storage or open use areas.
3. Facilities or areas within facilities that have been designated as totally “no smoking” shall have “No Smoking” signs placed at all entrances to the facility or area. Designated areas within such facilities where smoking is permitted either permanently or temporarily shall be identified with signs designating that smoking is permitted in these areas only.

Signs required by this section shall be in English as a primary language or in symbols allowed by this code and shall comply with Section 310.

3703.7.2 Open flames. Open flames and high-temperature devices shall not be used in a manner that creates a hazardous condition. High-temperature devices and those devices utilizing an open flame shall be listed for use with the materials stored or used.

SECTION 3704 LOOSE FIBER STORAGE

3704.1 General. Loose combustible fibers, not in suitable bales or packages and stored outdoors in the open, shall comply with Section 2808 of this code. Occupancies involv-

COMBUSTIBLE FIBERS

ing the indoor storage of loose combustible fibers in amounts exceeding the maximum allowable quantity per control area as set forth in Section 5003.1 shall comply with Sections 3704.2 through 3704.6.

3704.2 Storage of 100 cubic feet or less. Loose combustible fibers in quantities of not more than 100 cubic feet (3 m³) located in a structure shall be stored in a metal or metal-lined bin equipped with a self-closing cover.

3704.3 Storage of more than 100 cubic feet to 500 cubic feet. Loose combustible fibers in quantities exceeding 100 cubic feet (3 m³) but not exceeding 500 cubic feet (14 m³) shall be stored in rooms enclosed with 1-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with openings protected by an approved opening protective assembly having a fire protection rating of $\frac{3}{4}$ hour in accordance with the *California Building Code*.

3704.4 Storage of more than 500 cubic feet to 1,000 cubic feet. Loose combustible fibers in quantities exceeding 500 cubic feet (14 m³) but not exceeding 1,000 cubic feet (28 m³) shall be stored in rooms enclosed with 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with openings protected by an approved opening protective assembly having a fire protection rating of 1 $\frac{1}{2}$ hours in accordance with the *California Building Code*.

3704.5 Storage of more than 1,000 cubic feet. Loose combustible fibers in quantities exceeding 1,000 cubic feet (28 m³) shall be stored in rooms enclosed with 2-hour fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with openings protected by an approved opening protective assembly having a fire protection rating of 1 $\frac{1}{2}$ hours in accordance with the *California Building Code*. The storage room shall be protected by an automatic sprinkler system installed in accordance with Section 903.3.1.1.

3704.6 Detached storage structure. Not more than 2,500 cubic feet (70 m³) of loose combustible fibers shall be stored in a detached structure suitably located, with openings protected against entrance of sparks. The structure shall not be occupied for any other purpose.

SECTION 3705 BALED STORAGE

3705.1 Bale size and separation. Baled combustible fibers shall be limited to single blocks or piles not more than 25,000 cubic feet (700 m³) in volume, not including aisles or clearances. Blocks or piles of baled fiber shall be separated from adjacent storage by aisles not less than 5 feet (1524 mm) wide, or by flash-fire barriers constructed of continuous sheets of noncombustible material extending from the floor to

a minimum height of 1 foot (305 mm) above the highest point of the piles and projecting not less than 1 foot (305 mm) beyond the sides of the piles.

3705.2 Special baling conditions. Sisal and other fibers in bales bound with combustible tie ropes, jute and other fibers that swell when wet, shall be stored to allow for expansion in any direction without affecting building walls, ceilings or columns. A minimum clearance of 3 feet (914 mm) shall be required between walls and sides of piles, except that where the storage compartment is not more than 30 feet (9144 mm) wide, the minimum clearance at side walls shall be 1 foot (305 mm), provided that a center aisle not less than 5 feet (1524 mm) wide is maintained.

CHAPTER 38
RESERVED

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 39 – PROCESSING AND EXTRACTION FACILITIES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 39

PROCESSING AND EXTRACTION FACILITIES

User note:

About this chapter: Chapter 39 focuses on the processing and extraction of oils and fats from various plants. This process includes extraction by use of a solvent, desolventizing the raw material, production of the miscella, distillation of the solvent from the miscella and solvent recovery. The processes used are not necessarily typical hazardous material processes, and often the systems and equipment associated with such processes may not be listed. This chapter provides the tools to appropriately address the hazards while also meeting the unique needs of industry. This chapter has provisions for a technical report prepared by a registered design professional and requires site inspections to make sure equipment and systems are installed as designed and approved.

SECTION 3901 GENERAL

3901.1 Scope. Plant processing or extraction facilities shall comply with this chapter and the *California Building Code*. The extraction process includes the act of extraction of the oils and fats by use of a solvent, desolventizing of the raw material, production of the miscella, distillation of the solvent from the miscella and solvent recovery. The use, storage, transfilling and handling of hazardous materials in these facilities shall comply with this chapter, other applicable provisions of this code and the *California Building Code*.

3901.2 Existing buildings or facilities. Existing buildings or facilities used for the processing of plants shall comply with this chapter. Existing extraction processes where the medium of extraction or solvent is changed shall comply with this chapter.

3901.3 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

SECTION 3902 DEFINITIONS

3902.1 Definitions. The following terms are defined in Chapter 2:

DESOLVENTIZING.

MISCELLA.

SECTION 3903 PROCESSING AND EXTRACTION

3903.1 Construction. Processing shall be located in a building complying with the *California Building Code*.

3903.2 Prohibited occupancies. Extraction processes utilizing flammable gases or flammable cryogenic fluids shall not be located in any building containing a Group A, E, I or R occupancy.

3903.3 Location. The extraction equipment and extraction processes utilizing hydrocarbon solvents shall be located in a room or area dedicated to extraction.

3903.4 Post-process purification and winterization. Post-processing and winterization involving the heating or pressurizing of the miscella to other than normal pressure or

temperature shall be approved and performed in an appliance listed for such use. Domestic or commercial cooking appliances shall not be used.

3903.4.1 Industrial ovens. The use of industrial ovens shall comply with Chapter 30.

3903.5 Use of flammable and combustible liquids. The use of flammable and combustible liquids for liquid extraction processes where the liquid is boiled, distilled or evaporated shall be located within a hazardous exhaust fume hood, rated for exhausting flammable vapors. Electrical equipment used within the hazardous exhaust fume hood shall be rated for use in flammable atmospheres. Heating of flammable or combustible liquids over an open flame is prohibited.

Exception: The use of a heating element not rated for flammable atmospheres, where documentation from the manufacture, or approved testing laboratory indicates the element is rated for heating of flammable liquids.

3903.6 Liquefied petroleum gas. Liquefied petroleum gases shall not be released to the atmosphere except where released in accordance with Section 7.3 of NFPA 58.

SECTION 3904 SYSTEMS AND EQUIPMENT

3904.1 General requirements. Systems and equipment used with the processing and extraction of oils and products from plants shall comply with Sections 3904.2 through 3904.2.2.3 and Section 5003.2, and other applicable provisions of this code, the *California Building Code* and the *California Mechanical Code*.

3904.2 Systems and equipment. Systems or equipment used for the extraction of oils from plant material shall comply with Section 3904.2.1 or 3904.2.2.

3904.2.1 Listings. Systems or equipment used for the extraction of oils from plant material shall be listed and labeled in accordance with UL 1389 and installed in accordance with the listing and the manufacturer's installation instructions.

3904.2.2 Approvals. Systems or equipment used for the extraction of oils from plant material shall be approved for the specific use. The system shall be reviewed by a registered design professional. The registered design

professional shall review and consider any information provided by the system’s designer or manufacturer. A technical report in accordance with Section 3904.2.2.1 shall be prepared and submitted to the fire code official for review and approval. The firm or individual preparing the technical report shall be approved by the fire code official prior to performing the analysis.

3904.2.2.1 Technical report. A technical report, reviewed and approved by the fire code official as required by Section 3904.2, is required prior to the equipment being located or installed at the facility. The report shall be prepared by a registered design professional or other professional approved by the fire code official.

3904.2.2.2 Report content. The technical report shall contain all of the following:

1. Manufacturer information.
2. Preparer of record of the technical report.
3. Date of review and report revision history.
4. Signature page, including all of the following:
 - 4.1. Author of the report.
 - 4.2. Date of report.
 - 4.3. Date and signature of registered design professional of record performing the design or peer review.
5. Model number of the item evaluated. If the equipment is provided with a serial number, the serial number shall be included for verification at the time of site inspection.
6. Methodology of the design or peer review process used to determine minimum safety requirements. Methodology shall consider the basis of design, and shall include a code analysis and code path to demonstrate whether specific codes or standards are applicable.
7. Equipment description. A list of every component and subassembly, such as fittings, hose, quick disconnects, gauges, site glass, gaskets, valves, pumps, vessels, containers and switches, of the system or equipment, indicating the manufacturer, model number, material and solvent compatibility. Manufacturer’s data sheets shall be provided.
8. A general flow schematic or general process flow diagram of the process. Post-processing or winterization shall be included in this diagram. Primary components of the process equipment shall be identified and match the equipment list required in Item 7. Operating temperatures, pressures and solvent state of matter shall be identified in each primary step or component. A piping and instrumentation diagram (PID or P&ID) shall be provided.
9. Analysis of the vessel(s) if pressurized beyond standard atmospheric pressure. Analysis shall include purchased and fabricated components.

10. Structural analysis for the frame system supporting the equipment.
11. Process safety analysis of the extraction system, from the introduction of raw product to the end of the extraction process.
12. Comprehensive process hazard analysis considering failure modes and points of failure throughout the process. The process hazard analysis shall include a review of emergency procedure information provided by the manufacturer of the equipment or process and not that of the facility, building or room.
13. Review of the assembly instructions, operational and maintenance manuals provided by the manufacturer.
14. List of references used in the analysis.

3904.2.2.3 Site inspection. Prior to operation of the extraction equipment, where required by the fire code official, the engineer of record or approved professional, as approved in Section 3904.2, shall inspect the site of the extraction process once equipment has been installed for compliance with the technical report and the building analysis. The engineer of record or approved professional shall provide a report of findings and observations of the site inspection to the fire code official prior to the approval of the extraction process. The field inspection report authored by the engineer of record shall include the serial number of the equipment used in the process and shall confirm that the equipment installed is the same model and type of equipment identified in the technical report.

**SECTION 3905
SAFETY SYSTEMS**

3905.1 Gas detection. For extraction processes utilizing flammable gases as solvents, a gas detection system complying with Section 916 shall be provided.

3905.1.1 Operation. Activation of the gas detection system shall result in all the following:

1. Initiation of distinct audible and visual alarm signals in the extraction room.
2. Deactivation of all heating systems located in the extraction room.
3. Activation of the mechanical ventilation system, where the system is interlocked with gas detection.
4. De-energize all light switches and electrical outlets.

3905.1.2 Failure of the gas detection system. Failure of the gas detection system shall result in the deactivation of the heating system; activation of the mechanical ventilation system where the system is interlocked with the gas detection system; and initiation of a trouble signal to sound in an approved location.

3905.2 Emergency shutoff. Extraction processes utilizing gaseous hydrocarbon-based solvents shall be provided with emergency shutoff systems in accordance with Section 5803.1.3.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 40 – STORAGE OF DISTILLED SPIRITS AND WINES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 40

STORAGE OF DISTILLED SPIRITS AND WINES

User note:

About this chapter: Chapter 40 provides specific requirements for the storage of distilled spirits and wines. In accordance with Section 307.1.1 of the California Building Code, these occupancies are not classified as a Group H occupancy. Instead, as listed in Sections 311.2 and 311.3 of the California Building Code, the storage of beverages that contain up to and including 16-percent alcohol are classified as a Group S-2 occupancy, and those that contain over 16-percent alcohol content are classified as a Group S-1 occupancy. Note that those that are classified as a Group S-1 occupancy are required to be provided with an automatic sprinkler system throughout the Group S-1 fire area, regardless of size, in accordance with Section 903.

SECTION 4001 GENERAL

4001.1 General. The storage of distilled spirits and wines in barrels and casks shall comply with this chapter in addition to other applicable requirements of this code.

4001.1.1 Nonapplicability. Chapter 50 and Chapter 57 are not applicable to the storage of distilled spirits and wines in barrels and casks as identified in Section 5001.1, Exception 10, and Section 5701.2, Item 10.

SECTION 4002 DEFINITIONS

4002.1 Definitions. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

SECTION 4003 PRECAUTIONS AGAINST FIRE

4003.1 Spill control. Drainage or containment systems shall be provided by means of curbs, scuppers, special drains or other suitable means to prevent the flow of spills throughout the building.

4003.2 Ventilation. For rooms and spaces where distilled spirits and wines in barrels and casks are stored, ventilation shall be provided in accordance with the *California Mechanical Code* and one of the following:

1. The rooms and spaces shall be ventilated at a rate sufficient to maintain the concentration of vapors within the area at or below 25 percent of the lower flammable limit (LFL). This shall be confirmed by sampling the actual vapor concentration under normal operating conditions. The sampling shall be conducted throughout the enclosed storage area, extending to or toward the bottom and the top of the enclosed storage area. The vapor concentration used to determine the required ventilation rate shall be the highest measured concentration during the sampling procedure. The sampling shall be conducted manually or by installation of a con-

tinuously monitoring flammable vapor detection system.

2. The rooms and spaces shall be provided exhaust ventilation at a rate of not less than 1 cfm per square foot [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$] of solid floor area. The exhaust ventilation shall be accomplished by natural or mechanical means, with discharge of the exhaust to a safe location outside the building.

4003.3 Sources of ignition. Sources of ignition shall be controlled in accordance with Sections 4003.3.1 through 4003.4.

4003.3.1 Smoking. Smoking shall be prohibited and “No Smoking” signs provided as follows:

1. In rooms or areas where hazardous materials are stored or dispensed or used in open systems in amounts requiring a permit in accordance with Sections 105.5 and 105.6.
2. Within 25 feet (7620 mm) of outdoor storage, dispensing or open-use areas.
3. Facilities or areas within facilities that have been designated as totally “no smoking” shall have “No Smoking” signs placed at all entrances to the facility or area. Designated areas within such facilities where smoking is permitted either permanently or temporarily shall be identified with signs designating that smoking is permitted in these areas only.
4. In rooms or areas where flammable or combustible hazardous materials are stored, dispensed or used.

Signs required by this section shall be in English as a primary language or in symbols allowed by this code and shall comply with Section 310.

4003.3.2 Open flame. Open flames and high-temperature devices shall not be used in a manner that creates a hazardous condition and shall be listed for use with the hazardous materials stored or used.

4003.3.3 Industrial trucks. Powered industrial trucks used in areas designated as hazardous (classified) locations in accordance with the *California Electrical Code* shall be listed and labeled for use in the environment intended in accordance with NFPA 505.

4003.3.4 Electrical. Electrical wiring and equipment shall be installed and maintained in accordance with Section 608 and *the California Electrical Code*.

4003.4 Lightning. Structures containing barrel storage should be protected from lightning. The lightning protection equipment shall be installed in accordance with *the California Electrical Code* and NFPA 780.

SECTION 4004 STORAGE

4004.1 Storage. Storage shall be in accordance with this section and Section 315.

4004.2 Empty containers. The storage of empty containers previously used for the storage of flammable or combustible liquids, unless free from explosive vapors, shall be stored as required for filled containers.

4004.3 Basement storage. Class I liquids shall be allowed to be stored in basements in amounts not exceeding the maximum allowable quantity per control area for use-open systems in Table 5003.1.1(1), provided that automatic suppression and other fire protection are provided in accordance with Chapter 9. Class II and IIIA liquids shall also be allowed to be stored in basements, provided that automatic suppression and other fire protection are provided in accordance with Chapter 9.

4004.4 Bulk beverage storage areas. There shall be no storage of combustible materials in the bulk beverage storage areas not related to the beverage storage activities.

SECTION 4005 FIRE PROTECTION

4005.1 Automatic sprinkler system. The storage of distilled spirits and wines shall be protected by an approved automatic sprinkler system as required by Chapter 9.

4005.2 Portable fire extinguishers. Approved portable fire extinguishers shall be provided in accordance with Section 906.

SECTION 4006 SIGNAGE

4006.1 Hazard identification signs. Unless otherwise exempted by the fire code official, visible hazard identification signs, as specified in NFPA 704 for the specific material contained, shall be placed on stationary containers and above-ground tanks; at entrances to locations where hazardous materials are stored, dispensed, used or handled in quantities requiring a permit; and at specific entrances and locations designated by the fire code official.

4006.1.1 Maintenance and style. Signs and markings required by Section 4006.1 shall not be obscured or removed; shall be in English as a primary language or in symbols allowed by this code; shall be durable; and the size, color and lettering shall be approved.

**CHAPTERS 41 through 47
RESERVED**

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CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
CHAPTER 48 – MOTION PICTURE AND TELEVISION PRODUCTION STUDIO
SOUND STAGES, APPROVED PRODUCTION FACILITIES AND PRODUCTION LOCATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter			X																				
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							

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CHAPTER 48

MOTION PICTURE AND TELEVISION PRODUCTION STUDIO SOUND STAGES, APPROVED PRODUCTION FACILITIES AND PRODUCTION LOCATIONS

SECTION 4801 GENERAL

4801.1 Scope. Production studios, sound stages, approved production facilities and production locations used by the entertainment industry for the purpose of motion picture, television and commercial production shall be in accordance with the provisions of this article.

4801.2 Purpose. The purpose of this article is to establish minimum requirements that will provide a reasonable degree of safety from fire, panic and explosion. Buildings and structures defined herein shall be in accordance with this article.

4801.3 DEFINITIONS.

APPROVED FIRE WATCH. Individuals provided with at least one approved means for notification of the fire department and their only duty shall be to perform constant patrols of the protected premises and keep watch for fires.

APPROVED PRODUCTION FACILITY. An existing building, or portion of a building, or a group of buildings altered for use by the entertainment industry for the purpose of motion picture, television and commercial production.

PLATFORM. Part of a set, which is a floor or horizontal surface raised above stage floor level.

PRODUCTION LOCATION. Any area or facility outside a production studio, approved production facility or sound stage used by the entertainment industry for the purpose of motion picture, television and commercial production.

PRODUCTION STUDIO. A building, portion of a building, or a group of buildings designed and constructed for use by the entertainment industry for the purpose of motion picture, television and commercial production.

SET. A structure built or assembled for the purpose of motion picture, television and commercial production.

SOUND STAGE. A building or portion of a building usually insulated from outside noise and natural light for use by the entertainment industry for the purpose of motion picture, television and commercial production.

SECTION 4802 OCCUPANCY CLASSIFICATION

4802.1 Live audience stages. Production facilities, sound stages and approved production studios with live audience stages shall be classified as Group A-1 occupancy in accordance with the California Building Code.

4802.2 All other stages. Production studios, sound stages and approved production facilities without live audience

stages shall be classified as Group F-1 occupancy in accordance with the California Building Code.

Note: Sections 4803 through 4810 apply only to studio sound stages and approved production facilities.

SECTION 4803 REQUIRED PERMITS

4803.1 Change in use. A permit from the fire code official shall be obtained any time a change in use or occupancy is intended by the owner (e.g., for live audience shows, wrap parties).

4803.2 Additional permits. A permit shall be required for:

- a) Use of pyrotechnic special effects.
- b) Open flames.
- c) Flammable or combustible liquids, gases and dust.
- d) Hot work.
- e) Presence of motor vehicles within a building.
- f) Any additional permits as required by the fire code official.

4803.3 Live audiences. A permit shall be required for seating arrangements of all live audience stages.

SECTION 4804 GENERAL REQUIREMENTS

4804.1 Housekeeping. Provisions of this part shall maintain proper housekeeping in accordance with Chapter 3.

4804.2 Aisles. Perimeter aisles within the sound stage and approved production facility shall be provided. Aisles required by this section shall have a minimum width of 4 feet (1219 mm). See Chapter 10 for maintenance requirements. Aisles required by this section shall have a minimum clear unobstructed height of 7 feet (2134 mm).

4804.3 Travel distance. The maximum travel distance to any exit within the sound stage and approved production facility shall be 150 feet (45 720 mm).

4804.4 Exit doors. Exit doors shall be equipped with panic hardware and swing in the direction of exit travel.

4804.5 Exit signs. Illuminated exit signs shall be installed in accordance with the California Building Code.

4804.6 Exit illumination. Exit illumination shall be provided in accordance with the California Building Code. In the event of power failure, exit path illumination shall be automatically provided by an approved emergency back-up system.

MOTION PICTURE AND TELEVISION PRODUCTION STUDIO SOUND STAGES, APPROVED PRODUCTION FACILITIES AND PRODUCTION LOCATIONS

4804.7 Exit obstructions. All means of egress shall be maintained in accordance with the provisions of Chapter 10, Section 1005.1.

4804.8 Foam plastics. All foam plastics shall meet the requirements of Chapter 8, Sections 807.5.1.5 and 807.5.7.

4804.9 Decorative materials. Drapes, drops, cut greens, etc., shall meet the flame retardant requirements of California Code of Regulations, Title 19, Division 1, Chapters 5 and 8, Sections 807.5.1.5 and 807.5.7.

**SECTION 4805
FIRE-EXTINGUISHING SYSTEMS**

4805.1 Existing sound stages and approved production facilities. All existing sound stages and approved production facilities equipped with an automatic fire sprinkler system shall be maintained in accordance with the provisions in Chapter 9.

4805.2 New sound stages. All new sound stages shall be equipped with an approved automatic fire sprinkler system. The system shall be installed in accordance with the provisions in Chapter 9 and shall meet the minimum design requirements of an Extra Hazard, Group 2 system.

4805.3 Solid-ceiling sets and platforms. All interior solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms (when provided) over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height shall be protected by one of the following:

1. An approved and listed heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. Detectors shall be connected to an approved and listed central, proprietary or remote station service or a local alarm, which will give an audible signal at a constantly attended location. Such system shall be installed in accordance with Chapter 9.
2. The ceiling shall be positioned to allow for the operation of the building's automatic fire sprinkler system after rehearsal, videotaping, filming or broadcasting of programs has been completed for the day.
3. An approved fire watch.
4. Special hazards shall be reviewed by the fire code official (see Additional Fire Protection Systems, Section 901.4.3).

**SECTION 4806
FIRE DETECTION EQUIPMENT**

4806.1 Fire alarm control units. Fire alarm control units shall be California State Fire Marshal listed and shall be utilized in accordance with their listing. Control units may be temporarily supported by sets, platforms or pedestals.

4806.2 Heat detectors. Heat detection required by this article shall be defined as a portable system as it is intended to be reinstalled when platforms or sets are changed.

Heat detectors may be secured to standard outlet boxes which may be temporarily supported by sets, platforms or pedestals.

Heat detectors shall be provided for solid-ceiling sets and platforms where required by Sections 4805.3 and 4811.14.

**SECTION 4807
FIRE SAFETY OFFICERS**

4807.1 Where permits are required by the Fire Code, a requirement for standby fire safety officers shall be determined by the fire code official on a case-by-case basis. Standby fire safety officers shall not be required when the provisions of this article are met.

**SECTION 4808
ELECTRICAL REQUIREMENTS**

4808.1 General. All electrical equipment including lighting, cabling and temporary power, such as portable generators, shall be maintained in good working order and shall comply with the provisions of the California Electrical Code.

4808.2 Lighting and power requirements. A studio sound stage and approved production facility shall be provided with a minimum of 35 watts per square foot of permanently installed power dedicated for the distribution of production lighting and power. Mobile generators may be utilized for auxiliary power.

4808.3 Distribution. Distribution equipment shall be designed for sound stage use. The wiring to such equipment shall be considered permanent and shall comply with applicable provisions of the California Electrical Code. Temporary feeders shall not be tapped from panelboards and switchboards where deadfront covers have to be removed.

4808.4 Installations. Permanent or temporary electrical installations shall be installed in accordance with the California Electrical Code and this code. Such equipment shall not obstruct exits, means of egress or fire department access, unless approved by the fire code official.

4808.5 Generators. Portable, mobile or stationary power-generating equipment may be used to supplement building electrical power for temporary use. Equipment shall be located at a pre-designated location, as approved by the fire code official.

Temporary auxiliary power cables supplied from mobile generators or adjacent buildings may pass through exterior walls and interior fire-resistive assemblies provided an approved through-penetration fire-stop system is utilized for protection of the opening.

SECTION 4809 MECHANICAL EQUIPMENT

4809.1 Existing equipment. All mechanical equipment used as part of the building ventilation system shall be maintained in good working order and shall comply with the provisions of the California Mechanical Code.

4809.2 Auxiliary equipment. All auxiliary heating, ventilation and air-conditioning equipment shall be approved and listed for the intended use. Flexible duct, if utilized, shall be noncombustible. Such auxiliary equipment shall not obstruct exits, means of egress or fire department access.

SECTION 4810 DESIGN REQUIREMENTS

4810.1 General. The fire code official shall be provided with certification that approved production facilities and studio sound stages will sustain the anticipated loads of sets, props or other temporary modifications.

Where the anticipated loads exceed the design criteria for an approved production facility and studio sound stage, the building or portions thereof shall be modified for the additional loads.

SECTION 4811 PRODUCTION LOCATIONS

4811.1 General. This chapter shall apply to production locations.

4811.2 Permits. A permit shall be obtained, unless waived by the fire code official for any of the activities that follow:

- a) Use of pyrotechnic special effects, see Section 3307.1 and California Code of Regulations, Title 19, Division 1, Chapter 6.
- b) Open flames.
- c) Flammable or combustible liquids, gases and dust.
- d) Hot work.
- e) Presence of motor vehicles within a building.
- f) Tents and canopies, see Chapter 31.
- g) Any additional permits as required by the agency having jurisdiction (AHJ).

4811.3 Pyrotechnic special effects and open flames. The use of pyrotechnic special effects and open flames shall be subject to the approval of the fire code official.

4811.4 Standby fire personnel. A requirement for standby fire safety officers shall be determined by the fire code official on a case-by-case basis.

4811.5 Foamed plastic materials. All foam plastics shall meet the requirements of Chapter 8, Sections 807.5.1.5 and 807.5.7.

4811.6 Smoking. When the fire code official determines that hazardous conditions necessitate controlled use of smoking materials, smoking may be prohibited or limited to designated smoking areas.

4811.7 Structural loads. Sets, scenery and other equipment shall not impact the structural integrity of a building or structure. Consultation with a building official or structural engineer may be required.

4811.8 Electrical requirements.

4811.8.1 General. All electrical equipment including lighting, cabling and temporary power, such as portable generators, shall be maintained in good working order and shall comply with the provisions of the California Electrical Code.

4811.8.2 Distribution. Temporary feeders shall not be tapped from panelboards and switchboards where dead-front covers have to be removed.

4811.8.3 Installations. Electrical installations shall be installed in accordance with the California Electrical Code. Such equipment shall not obstruct exits, means of egress or fire department access, unless approved by the fire code official.

4811.8.4 Generators. Portable, mobile or stationary power-generating equipment may be used to supplement building electrical power for temporary use. Equipment shall be placed in a location acceptable to the fire code official.

4811.9 Fire department access. Required emergency vehicle access shall be maintained. Any deviations are subject to approval by the fire code official.

4811.10 Means of egress. The production location shall be provided with means of egress appropriate for the intended use as approved by the fire code official.

4811.11 Fire protection systems and equipment. Functional fire protection systems and equipment shall be maintained in an operable condition, unless approved by the fire code official. Disconnecting or altering of fire protection systems and/or equipment shall be prohibited, unless otherwise approved by the fire code official with alternate means of protection provided.

4811.12 Fire hydrants and fire appliances. Hydrants, standpipes and fire department connections (FDC) shall not be obstructed, blocked or rendered inoperable in accordance with Chapter 9, unless approved by the fire code official.

4811.13 Fire extinguishers. Approved fire extinguishers shall be provided as required by the fire code official.

4811.14 Solid-ceiling sets and platforms. In buildings with existing fire protection systems and where production intends to construct solid-ceiling sets over 600 square feet (55.7 m²) in area, and platforms over 600 square feet (55.7 m²) in area and which exceed 3 feet (914 mm) in height, such buildings shall be protected by one of the following:

1. An approved and listed heat detector system. Heat detectors shall be spaced 30 feet (9144 mm) on center or as required by the manufacturer's installation instructions. Detectors shall be connected to an approved and listed central, proprietary or remote station service or a local alarm, which will give an audible signal at a constantly attended location. Such system shall be installed in accordance with Chapter 9.

**MOTION PICTURE AND TELEVISION PRODUCTION STUDIO SOUND STAGES, APPROVED PRODUCTION FACILITIES
AND PRODUCTION LOCATIONS**

2. *The ceiling shall be positioned to allow for the operation of the building's automatic fire sprinkler system after rehearsal, videotaping, filming or broadcasting of programs has been completed for the day.*
3. *An approved fire watch.*
4. *Special hazards shall be reviewed by the enforcing agency (see additional fire protection systems, Section 901.4.3).*

4811.15 Buildings without fire protection systems. *Special hazards shall be reviewed by the fire code official (see special hazards Section 901.4.4).*

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE

CHAPTER 49 – REQUIREMENTS FOR WILDLAND-URBAN INTERFACE FIRE AREAS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter			X																				
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							

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CHAPTER 49

REQUIREMENTS FOR WILDLAND-URBAN INTERFACE FIRE AREAS

User note:

About this chapter:

In addition to the building construction requirements in the California Building Code and California Residential Code, this chapter contains requirements for development and construction in Local Responsibility Areas (LRA) designated as Very High Fire Hazard Severity Zones and areas designated by the Board of Forestry and Fire Protection as State Responsibility Areas (SRA). While many of these provisions are found in Title 14 and Title 19 of the California Code of Regulations, they are replicated here for the code user. The local jurisdiction has the authority to apply the same regulations to LRA when the regulations are adopted by local ordinance.

The requirements in this chapter reference the process for adoption of Very High Fire Hazard Severity Zones in the LRA; criteria for evaluating existing subdivisions that are at significant fire risk and are without an adequate secondary egress; and criteria for fire safety provisions required in the Safety Element of a city or county General Plan.

The chapter includes mitigation strategies to reduce the hazards of fire originating within a structure spreading to wildland and fire originating in wildland spreading to structures. These strategies are included in the following requirements:

1. Development of fire protection plans.
2. Development of landscape plans and long-term vegetation management.
3. Creation and maintenance of defensible space to protect structures and subdivisions.

SECTION 4901 GENERAL

> **4901.1 Scope.** This chapter contains minimum requirements to mitigate conditions that might cause a fire originating in a structure to ignite vegetation in the Wildland-Urban Interface Fire Area, and conversely, a wildfire burning in vegetative fuels to transmit fire to buildings and threaten to destroy life, overwhelm fire suppression capabilities or result in large property losses.

> **4901.2 Purpose.** The purpose of this chapter is to provide minimum standards to reduce the likelihood of life and property loss due to a wildfire through the use of performance and prescriptive requirements for construction and development in State Responsibility Areas (SRA) and Local Responsibility Areas (LRA) designated as a Moderate, High or Very High Fire Hazard Severity Zone.

SECTION 4902 DEFINITIONS

4902.1 General. For the purpose of this chapter, certain terms are defined as follows:

> **DIRECTOR.** Director of the California Department of Forestry and Fire Protection (CAL FIRE).

> **FIRE PROTECTION PLAN.** A document prepared for a specific project or development proposed for a Wildland-Urban Interface (WUI) Fire Area. It describes ways to minimize and mitigate potential for loss from wildfire exposure.

> **FIRE HAZARD SEVERITY ZONES.** Geographical areas designated pursuant to California Public Resources Codes, Sections 4201 through 4204 and classified as Very High, High or Moderate in State Responsibility Areas or as Local Agency

Very High Fire Hazard Severity Zones designated pursuant to California Government Code, Sections 51175 through 51189.

The California Code of Regulations, Title 14, Section 1280 entitles the maps of these geographical areas as “Maps of the Fire Hazard Severity Zones in the State Responsibility Area of California.”

FIRE-RESISTANT VEGETATION. Plants, shrubs, trees and other vegetation that exhibit properties, such as high moisture content, little accumulation of dead vegetation, and low sap or resin content, that make them less likely to ignite or contribute heat or spread flame in a fire than native vegetation typically found in the region.

[Note: The following sources contain examples of types of vegetation that can be considered fire-resistant vegetation. (Fire-resistant Plants for Home Landscapes, A Pacific Northwest Extension publication; Home Landscaping for Fire, University of California Division of Agriculture and Natural Resources; Sunset Western Garden Book)]

IGNITION-RESISTANT MATERIAL. A type of building material that complies with the requirements in Section 704A.2 in the California Building Code.

LOCAL RESPONSIBILITY AREAS (LRA). Areas of the state in which the financial responsibility of preventing and suppressing fires is the primary responsibility of a city, county, city and county, or district.

STATE RESPONSIBILITY AREAS (SRA). Lands that are classified by the Board of Forestry pursuant to Public Resources Code Section 4125 where the financial responsibility of preventing and suppressing wildfires is primarily the responsibility of the state.

WILDFIRE. Any uncontrolled fire spreading through vegetative fuels that threatens to destroy life, property or resources as defined in Public Resources Code, Sections 4103 and 4104.

WILDFIRE EXPOSURE. One or a combination of radiant heat, convective heat, direct flame contact and burning embers being projected by vegetation fire to a structure and its immediate environment.

WILDLAND-URBAN INTERFACE (WUI). A geographical area identified by the state as a “Fire Hazard Severity Zone” in accordance with the Public Resources Code, Sections 4201 through 4204, and Government Code, Sections 51175 through 51189, or other areas designated by the enforcing agency to be at a significant risk from wildfires.

**SECTION 4903
PLANS**

4903.1 General. The fire code official is authorized to require the owner or owner’s authorized agent to provide a fire protection plan. The fire protection plan shall be prepared to determine the acceptability of fire protection and life safety measures designed to mitigate wildfire hazards presented for the property under consideration.

The fire protection plan shall be prepared by a registered design professional, qualified landscape architect, qualified fire safety specialist or similar specialist acceptable to the fire code official and shall analyze the wildfire risk of the building, project, premises or region to recommend necessary changes.

The fire code official is authorized to require a preliminary fire protection plan prior to the submission of a final fire protection plan.

4903.2 Contents. The fire protection plan shall be based on a project-specific wildfire hazard assessment that includes considerations of location, topography, aspect, and climatic and fire history.

The plan shall identify conformance with all applicable state wildfire protection regulations, statutes and applicable local ordinances, whichever are more restrictive.

The plan shall address fire department access, egress, road and address signage, water supply in addition to fuel reduction in accordance with Public Resources Code (PRC) 4290; the defensible space requirements in accordance with PRC 4291 or Government Code 51182; and the applicable building codes and standards for wildfire safety. The plan shall identify mitigation measures to address the project’s specific wildfire risk and shall include the information required in Section 4903.2.1.

4903.2.1 Project information. The final fire protection plan shall be reviewed and approved prior to start of construction.

4903.2.1.1 Preliminary fire protection plan. When a preliminary fire protection plan is submitted, it shall include, at a minimum, the following:

1. Total size of the project.

2. Information on the adjoining properties on all sides, including current land uses, and if known, existing structures and densities, planned construction, natural vegetation, environmental restoration plans, roads and parks.
3. A map with all project boundary lines, property lines, slope contour lines, proposed structure foundation footprints, and proposed roads and driveways. The map shall identify project fuel modification zones and method of identifying the fuel modification zone boundaries.

4903.2.1.2 Final fire protection plan. The final fire protection plan shall include items listed in Section 4903.2.1.1 and the following:

1. A map identifying all proposed plants in the fuel modification zones with a legend that includes a symbol for each proposed plant species. The plan shall include specific information on each species proposed, including but not limited to:
 - a. The plant life-form;
 - b. The scientific and common name; and
 - c. The expected height and width for mature growth.
2. Identification of irrigated and non-irrigated zones.
3. Requirements for vegetation reduction around emergency access and evacuation routes.
4. Identification of points of access for equipment and personnel to maintain vegetation in common areas.
5. Legally binding statements regarding community responsibility for maintenance of fuel modification zones.
6. Legally binding statements to be included in covenants, conditions and restrictions regarding property owner responsibilities for vegetation maintenance.

**SECTION 4904
FIRE HAZARD SEVERITY ZONES**

4904.1 General. Lands in the state are classified by the Director in accordance with the severity of wildfire hazard expected to prevail in those areas and the responsibility for fire protection, so that measures may be identified which will reduce the potential for losses to life, property and resources from wildfire.

4904.2 Classifications. The Director classifies lands into fire hazard severity zones in accordance with California Public Resources Code, Sections 4201 through 4204 for State Responsibility Areas and accordance with Government Code, Sections 51175 through 51189 for areas where a local agency is responsible for fire protection.

4904.3 Local agency requirements. Within 30 days after receiving a transmittal from the director that identifies Very High Fire Hazard Severity Zones, a local agency shall make

the information available for public review. The information shall be presented in a format that is understandable and accessible to the general public, including, but not limited to, maps. A local agency shall post a notice at the office of the county recorder, county assessor and county planning agency identifying the location of the map provided by the director pursuant to Government Code, Section 51178. If the agency amends the map, pursuant to subdivision (b) or (c) of Section 51179, the notice shall instead identify the location of the amended map.

4904.3.1 Local agency ordinances. A local agency shall designate, by ordinance, Very High Fire Hazard Severity Zones in its jurisdiction within 120 days of receiving recommendations from the director pursuant to Section 51178. The local agency shall transmit a copy of an ordinance adopted pursuant to Section 51179 (a) to the State Board of Forestry and Fire Protection within 30 days of adoption, as specified in Title 14, Division 1.5, Chapter 7, Subchapter 3, Article 1.

4904.3.2 Local agency discretion. A local agency may, at its discretion, include areas within the jurisdiction of the local agency, not identified as Very High Fire Hazard Severity Zones by the director, as Very High Fire Hazard Severity Zones following a finding supported by substantial evidence in the record that the requirements of Government Code Section 51182 are necessary for effective fire protection within the area.

**SECTION 4905
WILDFIRE PROTECTION
BUILDING CONSTRUCTION**

4905.1 General. Materials and construction methods for exterior wildfire exposure protection shall be applied within geographical areas where a wildfire burning in vegetative fuels may readily transmit fire to buildings and threaten to destroy life, overwhelm fire suppression capabilities or result in large property losses.

4905.2 Construction methods and requirements within established limits. Within the limits established by law, construction methods intended to mitigate wildfire exposure shall comply with the wildfire protection building construction requirements contained in the California Building Standards Code, including the following:

1. California Building Code, Chapter 7A,
2. California Residential Code, Section R337,
3. California Referenced Standards Code, Chapter 12-7A.

4905.3 Establishment of limits. The establishment of limits for the Wildland-Urban Interface (WUI) Fire Area's required construction methods shall be designated pursuant to the California Public Resources Code for State Responsibility Areas and California Government Code for Local Responsibility Areas (LRA) in Very High Severity Zones or by a local agency following a finding supported by substantial evidence in the record that the requirements of this section are necessary for effective fire protection within the area.

**SECTION 4906
VEGETATION MANAGEMENT**

4906.1 General. Planting of vegetation for new landscaping shall be selected to reduce non-fire-resistant vegetation in proximity to a structure and to maintain vegetation as it matures.

4906.2 Application. All new plantings of vegetation in State Responsibility Areas (SRA) and Local Responsibility Areas (LRA) designated as a Very High Fire Hazard Severity Zone shall comply with Sections 4906.3 through 4906.5.3.

4906.3 Landscape plans. Landscape plans shall be provided when required by the enforcing agency. The landscape plan shall include development and maintenance requirements for the vegetation management zone adjacent to structures and roadways, and to provide significant fire hazard reduction benefits for public and firefighting safety.

4906.3.1 Contents. Landscape plans shall contain the following:

1. Delineation of the 30-foot (9144 mm) and 100-foot (30.5 m) fuel management zones from all structures.
2. Identification of existing vegetation to remain and proposed new vegetation.
3. Identification of irrigated areas.
4. A plant legend with both botanical and common names, and identification of all plant material symbols.
5. Identification of ground coverings within the 30-foot (9144 mm) zone.

4906.4 Vegetation. All new vegetation shall be fire-resistant vegetation in accordance with this section.

Exception: Trees classified as non-fire-resistant vegetation complying with Section 4906.4.2.1.

To be considered fire-resistant vegetation, it must meet at least one of the following:

1. Be identified as fire-resistant vegetation in an approved book, journal or listing from an approved organization.
2. Be identified as fire-resistant vegetation by a licensed landscape architect with supporting justification.
3. Plants considered fire-resistant vegetation and approved by the local enforcing agency.

4906.4.1 Shrubs. All new plantings of shrubs shall comply with the following:

1. Shrubs shall not exceed 6 feet (1829 mm) in height.
2. Groupings of shrubs are limited to a maximum aggregate diameter of 10 feet (3048 mm).
3. Shrub groupings shall be separated from other groupings a minimum of 15 feet (4572 mm).
4. Shrub groupings shall be separated from structures a minimum of 30 feet (9144 mm).
5. Where shrubs are located below or within a tree's drip line, the lowest tree branch shall be a minimum of three times the height of the understory shrubs or 10 feet (3048 mm), whichever is greater.

4906.4.2 Trees. Trees shall be managed as follows within the 30-foot (9144 mm) zone of a structure:

1. New trees shall be planted and maintained so that the tree's drip line at maturity is a minimum of 10 feet (3048 mm) from any combustible structure.
2. The horizontal distance between crowns of new trees and crowns of adjacent trees shall not be less than 10 feet (3048 mm).
3. Existing trees shall be trimmed to provide a minimum separation of 10 feet (3048 mm) away from chimney and stovepipe outlets per Title 14, Section 1299.03.

4906.4.2.1 Non-fire-resistant vegetation. New trees not classified as fire-resistant vegetation, such as conifers, palms, pepper trees and eucalyptus species, shall be permitted provided the tree is planted and maintained so that the tree's drip line at maturity is a minimum 30 feet (9144 mm) from any combustible structure.

**SECTION 4907
DEFENSIBLE SPACE**

4907.1 General. Hazardous vegetation and fuels shall be managed to reduce the severity of potential exterior wildfire exposure to buildings and to reduce the risk of fire spreading to buildings as required by applicable laws and regulations.

Defensible space will be managed around all buildings and structures in State Responsibility Areas (SRA) as required in Public Resources Code 4291.

4907.2 Application. Buildings and structures located in the following areas shall maintain the required hazardous vegetation and fuel management:

1. All unincorporated lands designated by the State Board of Forestry and Fire Protection as a State Responsibility Area (SRA).
2. Land designated as a Very High Fire Hazard Severity Zone by the Director.
3. Land designated in ordinance by local agencies as a Very High Fire Hazard Severity Zone pursuant to Government Code Section 51179.

4907.3 Requirements. Hazardous vegetation and fuels around all buildings and structures shall be maintained in accordance with the following laws and regulations:

1. Public Resources Code, Section 4291.
2. California Code of Regulations, Title 14, Division 1.5, Chapter 7, Subchapter 3, Article 3, Section 1299.03.
3. California Government Code, Section 51182.
4. California Code of Regulations, Title 19, Division 1, Chapter 7, Subchapter 1, Section 3.07.

**SECTION 4908
FIRE SAFE DEVELOPMENT REGULATIONS**

4908.1 General. Pursuant to PRC 4290 all residential, commercial and industrial building construction within state

responsibility areas approved after January 1, 1991, and within lands classified and designated as an LRA Very High Fire Hazard Severity Zone, as defined in subdivision (i) of Section 51177 of the Government Code after July 1, 2021, shall comply with the SRA Fire Safe Development Regulations as specified in Title 14, Division 1.5, Chapter 7, Subchapter 2.

4908.2 Subdivision map findings. Pursuant to Government Code (GC), Section 66474.02, before approving a tentative map, or a parcel map for which a tentative map was not required, for an area located in an SRA or an LRA Very High Fire Hazard Severity Zone, as both are defined in GC Section 51177, a legislative body of a county, except as provided in GC Subsection 66474.02(c), shall make findings regarding compliance with the SRA Fire Safe Regulations and the availability of structural fire protection and suppression services. These findings and accompanying map shall be transmitted to the Board of Forestry and Fire Protection and comply with the requirements in Title 14, Division 1.5, Chapter 7, Subchapter 1, Article 1.

**SECTION 4909
SUBDIVISION REVIEW SURVEY**

4909.1 Subdivision identification. Pursuant to Public Resources Code Section 4290.5 and Title 14, Division 1.5, Chapter 7, Subchapter 1, Article 2, the Board, in consultation with the Office of the State Fire Marshal, shall survey local governments to identify existing subdivisions, as defined in Article 2, located in an SRA area or an LRA Very High Fire Hazard Severity Zone without a secondary egress route that is at significant fire risk.

4909.2 Fire safety recommendations. The Board, in consultation with the Office of the State Fire Marshal and the local government that identified the subdivision, shall develop recommendations to improve the subdivision's fire safety. The Board shall provide the final recommendations to the local government that identified the subdivision and to the residents of the subdivision.

4909.3 Implementation. The Board shall maintain a list of the subdivisions identified and the status of the implementation of the recommendations provided.

4909.4 Re-survey. Beginning July 1, 2021, the Board shall conduct this survey every 5 years.

**SECTION 4910
GENERAL PLAN SAFETY ELEMENT**

4910.1 General. Pursuant to Government Code Section 65302(g)(3), the safety element of a city or county's General Plan shall be reviewed and updated as necessary to address the risk of fire for land classified as SRA, as defined in Section 4102 of the Public Resources Code, and land classified as an LRA Very High Fire Hazard Severity Zone, as defined in Section 51177.

4910.2 Submission to the Board of Forestry and Fire Protection and local fire agencies. Pursuant to Government Code Section 65302.5(b)(1), the draft element of, or draft

amendment to, the safety element of a county or a city's general plan shall be submitted to the State Board of Forestry and Fire Protection and to every local agency that provides fire protection to territory in the city or county at least 90 days prior to either of the following: the adoption or amendment to the safety element of its general plan for each county that contains state responsibility areas; or the adoption or amendment to the safety element of its general plan for each city or county that contains a Very High Fire Hazard Severity Zone as defined pursuant to subdivision (i) of Section 51177.

4910.3 Review by the Board of Forestry and Fire Protection and local fire agencies. *The State Board of Forestry and Fire Protection shall, and a local agency may, review the draft or an existing safety element and recommend changes to the planning agency within 60 days of its receipt regarding the requirements in Government Code Section 65302.5(b)(2). The review by the Board of Forestry and Fire Protection is governed by Title 14, Division 1.5, Chapter 7, Article 6.*

4910.4 Adoption of the safety element. *Prior to the adoption of its draft element or draft amendment, the board of supervisors of the county or the council of a city shall consider the recommendations, if any, made by the State Board of Forestry and Fire Protection and any local agency that provides fire protection to territory in the city or county. The board of supervisors or city council shall respond to the Board of Forestry and Fire Protection and any local agency providing fire protection in compliance with Government Code Section 65302.5(b)(3) and (b)(4) and Title 14, Division 1.5, Chapter 7, Article 6.*

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 50 – HAZARDOUS MATERIALS—GENERAL PROVISIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
5001.5.1			X																			
5001.5.2			X																			
Table 5003.1.1(1)			X																			
Table 5003.1.1(2)			X																			
5003.10.2			X																			
5003.10.2.1			X																			
5003.10.2.2			X																			
5003.10.4			X																			
5003.10.4.1			X																			
5003.10.4.2			X																			
5003.10.4.3			X																			
5003.10.4.4			X																			
5003.10.5 – 5003.10.6.2			X																			
5004.3.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

Part V—Hazardous Materials

CHAPTER 50

HAZARDOUS MATERIALS—GENERAL PROVISIONS

User note:

About this chapter: Chapter 50 contains the general requirements for all hazardous materials in all occupancies. Hazardous materials are defined as those that pose an unreasonable risk to the health and safety of operating or emergency personnel, the public and the environment if not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal or transportation. The general provisions of this chapter are intended to be companion provisions with the specific requirements of Chapters 51 through 67 regarding a given hazardous material. Also, Sections 414 and 415 of the California Building Code contain construction requirements related to the storage and use of such materials.

SECTION 5001 GENERAL

5001.1 Scope. Prevention, control and mitigation of dangerous conditions related to storage, dispensing, use and handling of hazardous materials shall be in accordance with this chapter.

This chapter shall apply to all hazardous materials, including those materials regulated elsewhere in this code, except that where specific requirements are provided in other chapters, those specific requirements shall apply in accordance with the applicable chapter. Where a material has multiple hazards, all hazards shall be addressed.

Exceptions:

1. In retail or wholesale sales occupancies, medicines, foodstuff, cosmetics and commercial or institutional products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, provided that such materials are packaged in individual containers not exceeding 1.3 gallons (5 L).
2. Alcoholic beverages in retail or wholesale sales occupancies, provided that the liquids are packaged in individual containers not exceeding 1.3 gallons (5 L).
3. Application and release of pesticide and agricultural products and materials intended for use in weed abatement, erosion control, soil amendment or similar applications where applied in accordance with the manufacturer's instructions and label directions.
4. The off-site transportation of hazardous materials where in accordance with Department of Transportation (DOTn) regulations.
5. Building materials not otherwise regulated by this code.
6. Refrigeration systems (see Section 608).
7. Stationary storage battery systems regulated by Section 1207.

8. The display, storage, sale or use of fireworks and explosives in accordance with Chapter 56.
9. Corrosives utilized in personal and household products in the manufacturer's original consumer packaging in Group M occupancies.
10. The storage of beer, distilled spirits and wines in barrels and casks.
11. The use of wall-mounted dispensers containing alcohol-based hand rubs classified as Class I or II liquids where in accordance with Section 5705.5.
12. Specific provisions for flammable liquids in motor fuel-dispensing facilities, repair garages, airports and marinas in Chapter 23.
13. Storage and use of fuel oil in tanks and containers connected to oil-burning equipment. Such storage and use shall be in accordance with Section 605. For abandonment of fuel oil tanks, Chapter 57 applies.
14. Storage and display of aerosol products complying with Chapter 51.
15. Storage and use of flammable or combustible liquids that do not have a fire point when tested in accordance with ASTM D92, not otherwise regulated by this code.
16. Flammable or combustible liquids with a flash point greater than 95°F (35°C) in a water-miscible solution or dispersion with a water and inert (non-combustible) solids content of more than 80 percent by weight, which do not sustain combustion, not otherwise regulated by this code.
17. Commercial cooking oil storage tank systems located within a building and designed and installed in accordance with Section 607 and NFPA 30.

5001.1.1 Waiver. The provisions of this chapter are waived where the fire code official determines that such enforcement is preempted by other codes, statutes or ordinances. The details of any action granting such a waiver

shall be recorded and entered in the files of the code enforcement agency.

5001.2 Material classification. Hazardous materials are those chemicals or substances defined as such in this code. Definitions of hazardous materials shall apply to all hazardous materials, including those materials regulated elsewhere in this code.

5001.2.1 Mixtures. Mixtures shall be classified in accordance with hazards of the mixture as a whole. Mixtures of hazardous materials shall be classified in accordance with nationally recognized reference standards; by an approved qualified organization, individual, or Safety Data Sheet (SDS); or by other approved methods.

5001.2.2 Hazard categories. Hazardous materials shall be classified according to hazard categories. The categories include materials regulated by this chapter and materials regulated elsewhere in this code.

5001.2.2.1 Physical hazards. The material categories listed in this section are classified as physical hazards. A material with a primary classification as a physical hazard can also pose a health hazard.

1. Explosives and blasting agents.
2. Combustible liquids.
3. Flammable solids, liquids and gases.
4. Organic peroxide solids or liquids.
5. Oxidizer, solids or liquids.
6. Oxidizing gases.
7. Pyrophoric solids, liquids or gases.
8. Unstable (reactive) solids, liquids or gases.
9. Water-reactive materials solids or liquids.
10. Cryogenic fluids.

5001.2.2.2 Health hazards. The material categories listed in this section are classified as health hazards. A material with a primary classification as a health hazard can also pose a physical hazard.

1. Highly toxic and toxic materials.
2. Corrosive materials.

5001.3 Performance-based design alternative. Where approved by the fire code official, buildings and facilities where hazardous materials are stored, used or handled shall be permitted to comply with this section as an alternative to compliance with the other requirements set forth in this chapter and Chapters 51 through 67.

5001.3.1 Objective. The objective of Section 5001.3 is to protect people and property from the consequences of unauthorized discharge, fires or explosions involving hazardous materials.

5001.3.2 Functional statements. Performance-based design alternatives are based on the following functional statements:

1. Provide safeguards to minimize the risk of unwanted releases, fires or explosions involving hazardous materials.

2. Provide safeguards to minimize the consequences of an unsafe condition involving hazardous materials during normal operations and in the event of an abnormal condition.

5001.3.3 Performance requirements. Where safeguards, systems, documentation, written plans or procedures, audits, process hazards analysis, mitigation measures, engineering controls or construction features are required by Sections 5001.3.3.1 through 5001.3.3.18, the details of the design alternative shall be subject to approval by the fire code official. The details of actions granting the use of the design alternatives shall be recorded and entered in the files of the jurisdiction.

5001.3.3.1 Properties of hazardous materials. The physical- and health-hazard properties of hazardous materials on-site shall be known and shall be made readily available to employees, neighbors and the fire code official.

5001.3.3.2 Reliability of equipment and operations. Equipment and operations involving hazardous materials shall be designed, installed and maintained to ensure that they reliably operate as intended.

5001.3.3.3 Prevention of unintentional reaction or release. Safeguards shall be provided to minimize the risk of an unintentional reaction or release that could endanger people or property.

5001.3.3.4 Spill mitigation. Spill containment systems or means to render a spill harmless to people or property shall be provided where a spill is determined to be a plausible event and where such an event would endanger people or property.

5001.3.3.5 Ignition hazards. Safeguards shall be provided to minimize the risk of exposing combustible hazardous materials to unintended sources of ignition.

5001.3.3.6 Protection of hazardous materials. Safeguards shall be provided to minimize the risk of exposing hazardous materials to a fire or physical damage whereby such exposure could endanger or lead to the endangerment of people or property.

5001.3.3.7 Exposure hazards. Safeguards shall be provided to minimize the risk of and limit damage from a fire or explosion involving explosive hazardous materials whereby such fire or explosion could endanger or lead to the endangerment of people or property.

5001.3.3.8 Detection of gas or vapor release. Where a release of hazardous materials gas or vapor would cause immediate harm to persons or property, means of mitigating the dangerous effects of a release shall be provided.

5001.3.3.9 Reliable power source. Where a power supply is relied on to prevent or control an emergency condition that could endanger people or property, the power supply shall be from a reliable source.

5001.3.3.10 Ventilation. Where ventilation is necessary to limit the risk of creating an emergency

condition resulting from normal or abnormal operations, means of ventilation shall be provided.

5001.3.3.11 Process hazard analyses. Process hazard analyses shall be conducted to ensure reasonably the protection of people and property from dangerous conditions involving hazardous materials.

5001.3.3.12 Prestartup safety review. Written documentation of prestartup safety review procedures shall be developed and enforced to ensure that operations are initiated in a safe manner. The process of developing and updating such procedures shall involve the participation of affected employees.

5001.3.3.13 Operating and emergency procedures. Written documentation of operating procedures and procedures for emergency shutdown shall be developed and enforced to ensure that operations are conducted in a safe manner. The process of developing and updating such procedures shall involve the participation of affected employees.

5001.3.3.14 Management of change. A written plan for management of change shall be developed and enforced. The process of developing and updating the plan shall involve the participation of affected employees.

5001.3.3.15 Emergency plan. A written emergency plan shall be developed to ensure that proper actions are taken in the event of an emergency, and the plan shall be followed if an emergency condition occurs. The process of developing and updating the plan shall involve the participation of affected employees.

5001.3.3.16 Accident procedures. Written procedures for investigation and documentation of accidents shall be developed, and accidents shall be investigated and documented in accordance with these procedures.

5001.3.3.17 Consequence analysis. Where an accidental release of hazardous materials could endanger people or property, either on- or off-site, an analysis of the expected consequences of a plausible release shall be performed and utilized in the analysis and selection of active and passive hazard mitigation controls.

5001.3.3.18 Safety audits. Safety audits shall be conducted on a periodic basis to verify compliance with the requirements of this section.

5001.4 Retail and wholesale storage and display. For retail and wholesale storage and display of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in Group M occupancies and storage in Group S occupancies, see Section 5003.11.

5001.5 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

Where required by the fire code official, permittees shall apply for approval to permanently close a storage, use or handling facility. Such application shall be submitted not less than 30 days prior to the termination of the storage, use or handling of hazardous materials. The fire code official is authorized to require that the application be accompanied by an approved facility closure plan in accordance with Section 5001.6.3.

5001.5.1 Hazardous Materials Management Plan (HMMP). Where required by the fire code official, an application for a permit shall include a Hazardous Materials Management Plan (HMMP). The HMMP shall include a facility site plan designating the following:

1. Access to each storage and use area.
2. Location of emergency equipment.
3. Location where liaison will meet emergency responders.
4. Facility evacuation meeting point locations.
5. The general purpose of other areas within the building.
6. Location of all above-ground and underground tanks and their appurtenances including, but not limited to, sumps, vaults, below-grade treatment systems and piping.
7. The hazard classes in each area.
8. Locations of all control areas and Group H occupancies.
9. Emergency exits.

[For SFM] The HMMP shall comply with Health and Safety Code, Chapter 6.95, Sections 25500 through 25545, and Title 19, Division 2, Chapter 4.

5001.5.2 Hazardous Materials Inventory Statement (HMIS). Where required by the fire code official, an application for a permit shall include an HMIS, such as Superfund Amendments and Reauthorization Act of 1986 (SARA) Title III, Tier II Report or other approved statement. The HMIS shall include the following information:

1. Product name.
2. Component.
3. Chemical Abstract Service (CAS) number.
4. Location where stored or used.
5. Container size.
6. Hazard classification.
7. Amount in storage.
8. Amount in use-closed systems.
9. Amount in use-open systems.

[For SFM] The HMIS shall comply with Health and Safety Code, Chapter 6.95, Sections 25500 through 25545, and Title 19, Division 2, Chapter 4.

5001.6 Facility closure. Facilities shall be placed out of service in accordance with Sections 5001.6.1 through 5001.6.3.

5001.6.1 Temporarily out-of-service facilities. Facilities that are temporarily out of service shall continue to maintain a permit and be monitored and inspected.

5001.6.2 Permanently out-of-service facilities. Facilities for which a permit is not kept current or is not monitored and inspected on a regular basis shall be deemed to be permanently out of service and shall be

closed in an approved manner. Where required by the fire code official, permittees shall apply for approval to close permanently storage, use or handling facilities. The fire code official is authorized to require that such application be accompanied by an approved facility closure plan in accordance with Section 5001.6.3.

5001.6.3 Facility closure plan. Where a facility closure plan is required in accordance with Section 5001.5 to terminate storage, dispensing, handling or use of hazardous materials, it shall be submitted to the fire code official not less than 30 days prior to facility closure. The plan shall demonstrate that hazardous materials that are stored, dispensed, handled or used in the facility will be transported, disposed of or reused in a manner that eliminates the need for further maintenance and any threat to public health and safety.

SECTION 5002 DEFINITIONS

5002.1 Definitions. The following terms are defined in Chapter 2:

BOILING POINT.
CEILING LIMIT.
CHEMICAL.
CHEMICAL NAME.
CLOSED CONTAINER.
CONTAINER.
CONTROL AREA.
CYLINDER.
DAY BOX.
DEFLAGRATION.
DESIGN PRESSURE.
DETACHED BUILDING.
DISPENSING.
EXCESS FLOW CONTROL.
EXHAUSTED ENCLOSURE.
EXPLOSION.
FLAMMABLE VAPORS OR FUMES.
GAS CABINET.
GAS ROOM.
HANDLING.
HAZARDOUS MATERIALS.
HEALTH HAZARD.
IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH).
INCOMPATIBLE MATERIALS.
LIQUID.
LOWER EXPLOSIVE LIMIT (LEL).
LOWER FLAMMABLE LIMIT (LFL).

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA.
NORMAL TEMPERATURE AND PRESSURE (NTP).
OUTDOOR CONTROL AREA.
PERMISSIBLE EXPOSURE LIMIT (PEL).
PESTICIDE.
PHYSICAL HAZARD.
PRESSURE VESSEL.
SAFETY CAN.
SAFETY DATA SHEET (SDS).
SECONDARY CONTAINMENT.
SEGREGATED.
SOLID.
STORAGE, HAZARDOUS MATERIALS. SYSTEM.
TANK, ATMOSPHERIC.
TANK, PORTABLE.
TANK, STATIONARY.
TANK VEHICLE.
UNAUTHORIZED DISCHARGE.
USE (MATERIAL).
VAPOR PRESSURE.

SECTION 5003 GENERAL REQUIREMENTS

5003.1 Scope. The storage, use and handling of all hazardous materials shall be in accordance with this section.

5003.1.1 Maximum allowable quantity per control area. The maximum allowable quantity per control area shall be as specified in Tables 5003.1.1(1) through 5003.1.1(4).

For retail and wholesale storage and display in Group M occupancies and Group S storage, see Section 5003.11.

5003.1.2 Conversion. Where quantities are indicated in pounds and where the weight per gallon of the liquid is not provided to the fire code official, a conversion factor of 10 pounds per gallon (1.2 kg/L) shall be used.

5003.1.3 Quantities not exceeding the maximum allowable quantity per control area. The storage, use and handling of hazardous materials in quantities not exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(1) through 5003.1.1(4) shall be in accordance with Sections 5001 and 5003.

5003.1.4 Quantities exceeding the maximum allowable quantity per control area. The storage and use of hazardous materials in quantities exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(1) through 5003.1.1(4) shall be in accordance with this chapter.

TABLE 5003.1.1(1) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b					
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)			
Combustible dust	NA	H-2	See Note q	NA	NA	NA	See Note q	NA	NA	NA	See Note q	NA	NA	NA
Combustible fibers ⁴	Loose	H-3	(100)	NA	NA	(100)	(20)	NA	NA	NA	(20)	NA	NA	NA
	Baled ^o		(1,000)	NA	NA	(1,000)	(200)	NA	NA	NA	(200)	NA	NA	NA
Combustible liquid ^{c, i}	II	H-2 or H-3	NA	120 ^{d, e}	NA	120 ^d	NA	NA	NA	NA	30 ^d	NA	NA	NA
	IIIA	H-2 or H-3	NA	330 ^{d, e}	NA	330 ^d	NA	NA	NA	NA	80 ^d	NA	NA	NA
	IIIB	NA	NA	13,200 ^{e, f}	NA	13,200 ^f	NA	NA	NA	NA	3,300 ^f	NA	NA	NA
Cryogenic Flammable	NA	H-2	NA	45 ^d	NA	45 ^d	NA	NA	NA	NA	10 ^d	NA	NA	NA
Cryogenic Inert	NA	NA	NA	NA	NL	NA	NA	NL	NA	NA	NA	NA	NA	NA
Cryogenic Oxidizing	NA	H-3	NA	45 ^d	NA	45 ^d	NA	NA	NA	NA	10 ^d	NA	NA	NA
	Division 1.1	H-1	1 ^{e, g}	(1) ^{e, g}	NA	(0.25) ^g	0.25 ^g	NA	NA	0.25 ^g	(0.25) ^g	NA	NA	NA
Explosives	Division 1.2	H-1	1 ^{e, g}	(1) ^{e, g}	NA	(0.25) ^g	0.25 ^g	NA	NA	0.25 ^g	(0.25) ^g	NA	NA	NA
	Division 1.3	H-1 or H-2	10 ^{e, g}	(10) ^{e, g}	NA	(1) ^g	1 ^g	NA	NA	1 ^g	(1) ^g	NA	NA	NA
	Division 1.4	H-3	50 ^{e, g}	(50) ^{e, g}	NA	50 ^g	50 ^g	NA	NA	50 ^g	NA	NA	NA	NA
	Division 1.4G	H-3	125 ^{e, l}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Division 1.5	H-1	1 ^{e, g}	(1) ^{e, g}	NA	(0.25) ^g	0.25 ^g	NA	NA	0.25 ^g	(0.25) ^g	NA	NA	NA
	Division 1.6	H-1	1 ^{e, g}	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Flammable gas	Gaseous	H-2	NA	NA	1,000 ^{d, e}	NA	NA	1,000 ^{d, e}	NA	NA	NA	NA	NA	NA
	Liquefied		NA	(150) ^{d, e}	NA	(150) ^{d, e}	NA	NA	NA	NA	NA	NA	NA	NA
Flammable liquid ^c	IA	H-2	NA	30 ^{d, e}	NA	30 ^d	NA	NA	NA	NA	10d	NA	NA	NA
	IB and IC	or H-3	NA	120 ^{d, e}	NA	120 ^d	NA	NA	NA	NA	30d	NA	NA	NA
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ^{d, e, h}	NA	120 ^{d, h}	NA	NA	NA	NA	30 ^{d, h}	NA	NA	NA
	NA	H-3	125 ^{d, e}	NA	NA	125 ^d	NA	NA	NA	NA	25 ^d	NA	NA	NA

(continued)

TABLE 5003.1.1(1)—continued
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b			
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas (cubic feet at NTP)	
Inert gas	Gaseous	NA	NA	NA	NL	NA	NA	NA	NA	NL	NA	NA
	Liquefied	NA	NA	NA	NL	NA	NA	NA	NA	NL	NA	NA
Organic peroxide	UD	H-1	1 ^{c, g}	(1) ^{c, g}	NA	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	NA	0.25 ^g	(0.25) ^g
	I	H-2	5 ^{d, e}	(5) ^{d, e}	NA	1 ^d	(1) ^d	1 ^d	(1) ^d	NA	1 ^d	(1) ^d
	II	H-3	50 ^{d, e}	(50) ^{d, e}	NA	50 ^d	(50) ^d	10 ^d	(10) ^d	NA	10 ^d	(10) ^d
	III	H-3	125 ^{d, e}	(125) ^{d, e}	NA	125 ^d	(125) ^d	25 ^d	(25) ^d	NA	25 ^d	(25) ^d
	IV	NA	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Oxidizer	V	NA	NL	NL	NA	NL	NL	NL	NL	NA	NL	NL
	4	H-1	1 ^g	(1) ^{c, g}	NA	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	NA	0.25 ^g	(0.25) ^g
	3 ^k	H-2 or H-3	10 ^{d, e}	(10) ^{d, e}	NA	2 ^d	(2) ^d	2 ^d	(2) ^d	NA	2 ^d	(2) ^d
	2	H-3	250 ^{d, e}	(250) ^{d, e}	NA	250 ^d	(250) ^d	50 ^d	(50) ^d	NA	50 ^d	(50) ^d
Oxidizing gas	1	NA	4,000 ^{e, f}	(4,000) ^{e, f}	NA	4,000 ^f	(4,000) ^f	1,000 ^f	(1,000) ^f	NA	1,000 ^f	(1,000) ^f
	Gaseous	H-3	NA	NA	1,500 ^{d, e}	NA	NA	NA	NA	1,500 ^{d, e}	NA	NA
	Liquefied	H-3	(150) ^{d, e}	(150) ^{d, e}	NA	(150) ^{d, e}	(150) ^{d, e}	(150) ^{d, e}	(150) ^{d, e}	NA	(150) ^{d, e}	(150) ^{d, e}
Pyrophoric	NA	H-2	4 ^{c, g}	(4) ^{c, g}	50 ^{c, g}	1 ^g	(1) ^g	0	0	10 ^{c, g}	0	0
	4	H-1	1 ^{c, g}	(1) ^{c, g}	10 ^{c, g}	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	2 ^{c, g}	0.25 ^g	(0.25) ^g
Unstable (reactive)	3	H-1 or H-2	5 ^{d, e}	(5) ^{d, e}	50 ^{d, e}	1 ^d	(1) ^d	1 ^d	(1) ^d	10 ^{d, e}	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}	750 ^{d, e}	50 ^d	(50) ^d	10 ^d	(10) ^d	750 ^{d, e}	10 ^d	(10) ^d
	1	NA	NL	NL	NL	NL	NL	NL	NL	NL	NL	NL
Water reactive	3	H-2	5 ^{d, e}	(5) ^{d, e}	NA	5 ^d	(5) ^d	1 ^d	(1) ^d	NA	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}	NA	50 ^d	(50) ^d	10 ^d	(10) ^d	NA	10 ^d	(10) ^d
	1	NA	NL	NL	NA	NL	NL	NL	NL	NA	NL	NL

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NA = Not Applicable, NL = Not Limited, UD = Unclassified Detonable.

a. For use of control areas, see Section 5003.8.3.

b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.

c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuff or consumer products and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.

d. **[SEFM]** In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively. For Group L occupancies, refer to California Building Code Table 453.7.2.1 for approved cabinets.

e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, day boxes, gas cabinets, gas rooms, exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10. Where Note d applies, the increase for both notes shall be applied accumulatively.

(footnotes continued)

TABLE 5003.1.1(1)—continued
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, i, m, n, p}

- f. Quantities shall not be limited in a building equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.1.
- g. Allowed only in buildings equipped throughout with an approved automatic sprinkler system.
- h. Containing not more than the maximum allowable quantity per control area of Class IA, Class IB or Class IC flammable liquids.
- i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 605.4.2.
- j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.
- k. A maximum quantity of 220 pounds of solid or 22 gallons of liquid Class 3 oxidizers is allowed where such materials are necessary for maintenance purposes, operation or sanitation of equipment where the storage containers and the manner of storage are approved.
- l. Net weight of pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks including packaging shall be used.
- m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
- n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 5003.1.1, see Table 5003.1.1.1.
- o. Densely-packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- p. The following shall not be included in determining the maximum allowable quantities:
1. Liquid or gaseous fuel in fuel tanks on vehicles.
 2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with this code.
 3. Gaseous fuels in piping systems and fixed appliances regulated by the *International Fuel Gas Code*.
 4. Liquid fuels in piping systems and fixed appliances regulated by the *California Mechanical Code*.
 5. Alcohol-based hand rubs classified as Class I or II liquids in dispensers that are installed in accordance with Sections 5705.5 and 5705.5.1. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the construction documents.
- q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.8.2.

TABLE 5003.1.1(2) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD^{a, c, f, h, i}

MATERIAL	STORAGE ^b		USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b		
	Solid pounds ^{d, e}	Liquid gallons (pounds) ^{d, e}	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d
Corrosives	5,000	500	Gaseous 810 ^e Liquefied (150)	5,000	500	Gaseous 810 ^e Liquefied (150)	1,000	100
Highly toxics	10	(10)	Gaseous 20 ^g Liquefied (4) ^g	10	(10)	Gaseous 20 ^g Liquefied (4) ^g	3	(3)
Toxics	500	(500)	Gaseous 810 ^e Liquefied (150) ^e	500	(500)	Gaseous 810 ^e Liquefied (150) ^e	125	(125)

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- a. For use of control areas, see Section 5003.8.3.
- b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
- c. In retail and wholesale sales occupancies, the quantities of medicines, foodstuff or consumer products and cosmetics, containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- d. *[SFM] In other than Group L occupancies, maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively. For Group L occupancies, refer to California Building Code Table 453.7.2.1 for approved cabinets.*
- e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, gas cabinets or exhausted enclosures. Where Note d applies, the increase for both notes shall be applied accumulatively.
- f. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 5003.11, see Table 5003.11.1.
- g. Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures.
- h. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
- i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.

TABLE 5003.1.1(3) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD IN AN OUTDOOR CONTROL AREA^{a,b,c,d}

MATERIAL	CLASS	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b		
		Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	
Flammable gas	Gaseous Liquefied	Not Applicable	Not Applicable (300)	3,000 Not Applicable	Not Applicable	Not Applicable (150)	1,500 Not Applicable	Not Applicable	Not Applicable	
Flammable solid	Not Applicable	500	Not Applicable	Not Applicable	250	Not Applicable	Not Applicable	50	Not Applicable	
Inert Gas	Gaseous Liquefied	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	
Cryogenic inert	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	
Organic peroxide	Unclassified Detonable	1	(1)	Not Applicable	0.25	(0.25)	Not Applicable	0.25	(0.25)	
Organic peroxide	I	20	(20)	10	10	(10)	2	2	(2)	
	II	200	(200)	Not Applicable	100	(100)	20	20	(20)	
	III	500	(500)	Not Applicable	250	(250)	50	50	(50)	
	IV	Not Limited	Not Limited	Not Applicable	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	
	V	Not Limited	Not Limited	Not Applicable	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	
Oxidizer	4	2	(2)	1	1	(1)	0.25	0.25	(0.25)	
	3	40	(40)	20	20	(20)	4	4	(4)	
	2	1,000	(1,000)	Not Applicable	500	(500)	Not Applicable	100	(100)	
	1	Not Limited	Not Limited	Not Applicable	Not Limited	Not Limited	Not Applicable	Not Limited	Not Limited	
Oxidizing gas	Gaseous Liquefied	Not Applicable	Not Applicable (600)	6,000 Not Applicable	Not Applicable	Not Applicable (300)	1,500 Not Applicable	Not Applicable	Not Applicable	
	Not Applicable	8	(8)	100	4	(4)	10	0	0	
Unstable (reactive)	4	2	(2)	20	1	(1)	2	0.25	(0.25)	
	3	20	(20)	200	10	(10)	10	1	(1)	
	2	200	(200)	1,000	100	(100)	250	10	(10)	
Water reactive	1	Not Limited	Not Limited	1,500	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	
	3	20	(20)	Not Applicable	10	(10)	1	1	(1)	
	2	200	(200)	Not Applicable	100	(100)	Not Applicable	10	(10)	
1	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited		

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³.
 a. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
 b. The aggregate quantities in storage and use shall not exceed the quantity listed for storage.
 c. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed in outdoor storage per single property under the same ownership or control used for retail or wholesale sales is allowed to exceed the maximum allowable quantity per control area where such storage is in accordance with Section 5003.1.1.
 d. Quantities in parentheses indicate quantity units in parentheses at the head of each column.

TABLE 5003.1.1(4) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD IN AN OUTDOOR CONTROL AREA^{a, b, c, f}

MATERIAL	STORAGE		USE-CLOSED SYSTEMS			USE-OPEN SYSTEMS		
	Solid pounds	Liquid gallons (pounds)	Gas cubic feet at NTP (pounds)	Solid pounds	Liquid gallons (pounds)	Gas cubic feet at NTP (pounds)	Solid pounds	Liquid gallons (pounds)
Corrosives	20,000	2,000	Gaseous 1,620 Liquefied (300)	10,000	1,000	Gaseous 810 Liquefied (150)	1,000	100
Highly toxics	20	(20)	Gaseous 40 ^d Liquefied (8) ^d	10	(10)	Gaseous 20 ^d Liquefied (4) ^d	3	(3)
Toxics	1,000	(1,000) ^e	Gaseous 1,620 Liquefied (300)	500	50 ^e	Gaseous 810 Liquefied (150)	125	(125) ^e

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 pound per square inch absolute = 6.895 kPa, °C = (°F - 32)/1.8.

- a. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
- b. The aggregate quantities in storage and use shall not exceed the quantity listed for storage.
- c. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed in outdoor storage per single property under the same ownership or control used for retail or wholesale sales is allowed to exceed the maximum allowable quantity per control area where such storage is in accordance with Section 5003.11.
- d. Allowed only where used in approved exhausted gas cabinets, exhausted enclosures or under fume hoods.
- e. The maximum allowable quantity per control area for toxic liquids with vapor pressures in excess of 1 psia at 77°F shall be the maximum allowable quantity per control area listed for highly toxic liquids.
- f. Quantities in parentheses indicate quantity units in parentheses at the head of each column.

5003.2 Systems, equipment and processes. Systems, equipment and processes utilized for storage, dispensing, use or handling of hazardous materials shall be in accordance with Sections 5003.2.1 through 5003.2.9.

5003.2.1 Design and construction of containers, cylinders and tanks. Containers, cylinders and tanks shall be designed and constructed in accordance with approved standards. Containers, cylinders, tanks and other means used for containment of hazardous materials shall be of an approved type. Pressure vessels not meeting DOTn requirements for transportation shall comply with the *ASME Boiler and Pressure Vessel Code*.

5003.2.2 Piping, tubing, valves and fittings. Piping, tubing, valves, and fittings conveying hazardous materials shall be designed and installed in accordance with ASME B31.1 or other approved standards, and shall be in accordance with Sections 5003.2.2.1 and 5003.2.2.2.

5003.2.2.1 Design and construction. Piping, tubing, valves, fittings and related components used for hazardous materials shall be in accordance with the following:

1. Piping, tubing, valves, fittings and related components shall be designed and fabricated from materials that are compatible with the material to be contained and shall be of adequate strength and durability to withstand the pressure, structural and seismic stress and exposure to which they are subject.
2. Piping and tubing shall be identified in accordance with ASME A13.1 to indicate the material conveyed.
3. Manual valves or automatic remotely activated fail-safe emergency shutoff valves shall be installed on supply piping and tubing and provided with ready access at the following locations:
 - 3.1. The point of use.
 - 3.2. The tank, cylinder or bulk source.
4. Manual emergency shutoff valves and controls for remotely activated emergency shutoff valves shall be clearly visible, provided with ready access and identified in an approved manner.
5. Backflow prevention or check valves shall be provided where the backflow of hazardous materials could create a hazardous condition or cause the unauthorized discharge of hazardous materials.

Exceptions:

1. Piping for inlet connections designed to prevent backflow.
2. Piping for pressure relief devices.

5003.2.2.2 Additional regulations for supply piping for health-hazard materials. Supply piping and tubing for gases and liquids having a health-hazard ranking of 3 or 4 in accordance with NFPA 704 shall be in accordance with ASME B31.3 and the following:

1. Piping and tubing utilized for the transmission of highly toxic, toxic or highly volatile corrosive liquids and gases shall have welded, threaded or flanged connections throughout except for connections located within a ventilated enclosure if the material is a gas, or an approved method of drainage or containment is provided for connections if the material is a liquid.
2. Piping and tubing shall not be located within corridors, within any portion of a means of egress required to be enclosed in fire-resistance-rated construction or in concealed spaces in areas not classified as Group H occupancies.

Exception: Piping and tubing within the space defined by the walls of corridors and the floor or roof above or in concealed spaces above other occupancies where installed in accordance with Section 415.11.7.4 of the *California Building Code* for Group H-5 occupancies.

5003.2.3 Equipment, machinery and alarms. Equipment, machinery and required detection and alarm systems associated with the use, storage or handling of hazardous materials shall be listed or approved.

5003.2.4 Installation of tanks. Installation of tanks shall be in accordance with Sections 5003.2.4.1 through 5003.2.4.2.1.

5003.2.4.1 Underground tanks. Underground tanks used for the storage of liquid hazardous materials shall be provided with secondary containment. In lieu of providing secondary containment for an underground tank, an above-ground tank in an underground vault complying with Section 5704.2.8 shall be permitted.

5003.2.4.2 Above-ground tanks. Above-ground stationary tanks used for the storage of hazardous materials shall be located and protected in accordance with the requirements for outdoor storage of the particular material involved.

Exception: Above-ground tanks that are installed in vaults complying with Section 5303.16 or 5704.2.8 shall not be required to comply with location and protection requirements for outdoor storage.

5003.2.4.2.1 Marking. Above-ground stationary tanks shall be marked as required by Section 5003.5.

5003.2.5 Empty containers and tanks. Empty containers and tanks previously used for the storage of hazardous materials shall be free from residual material and vapor as defined by DOTn, the Resource Conservation and Recovery Act (RCRA) or other regulating authority or maintained as specified for the storage of hazardous material.

5003.2.6 Maintenance. In addition to the requirements of Section 5003.2.3, equipment, machinery and required detection and alarm systems associated with hazardous materials shall be maintained in an operable condition. Defective containers, cylinders and tanks shall be removed from service, repaired or disposed of in an approved manner. Defective equipment or machinery shall be

removed from service and repaired or replaced. Required detection and alarm systems shall be replaced or repaired where defective.

5003.2.6.1 Tanks out of service for 90 days. Stationary tanks not used for a period of 90 days shall be properly safeguarded or removed in an approved manner. Such tanks shall have the fill line, gauge opening and pump connection secured against tampering. Vent lines shall be properly maintained.

5003.2.6.1.1 Return to service. Tanks that are to be placed back in service shall be tested in an approved manner.

5003.2.6.2 Defective containers and tanks. Defective containers and tanks shall be removed from service, repaired in accordance with approved standards or disposed of in an approved manner.

5003.2.7 Liquid-level limit control. Atmospheric tanks having a capacity greater than 500 gallons (1893 L) and that contain hazardous material liquids shall be equipped with a liquid-level limit control or other approved means to prevent overfilling of the tank.

5003.2.8 Seismic protection. Machinery and equipment utilizing hazardous materials shall be braced and anchored in accordance with the seismic design requirements of the *California Building Code* for the seismic design category in which the machinery or equipment is classified.

5003.2.9 Testing. The equipment, devices and systems listed in Section 5003.2.9.1 shall be tested at the time of installation and at one of the intervals listed in Section 5003.2.9.2. Records of the tests conducted or maintenance performed shall be maintained in accordance with the provisions of Section 109.3.

Exceptions:

1. Periodic testing shall not be required where approved written documentation is provided stating that testing will damage the equipment, device or system and the equipment, device or system is maintained as specified by the manufacturer.
2. Periodic testing shall not be required for equipment, devices and systems that fail in a fail-safe manner.
3. Periodic testing shall not be required for equipment, devices and systems that self-diagnose and report trouble. Records of the self-diagnosis and trouble reporting shall be made available to the fire code official.
4. Periodic testing shall not be required if system activation occurs during the required test cycle for the components activated during the test cycle.
5. Approved maintenance in accordance with Section 5003.2.6 that is performed not less than annually or in accordance with an approved schedule shall be allowed to meet the testing

requirements set forth in Sections 5003.2.9.1 and 5003.2.9.2.

5003.2.9.1 Equipment, devices and systems requiring testing. The following equipment, systems and devices shall be tested in accordance with Sections 5003.2.9 and 5003.2.9.2.

1. Gas detection systems, alarms and automatic emergency shutoff valves required by Section 6004.2.2.10 for highly toxic and toxic gases.
2. Limit control systems for liquid level, temperature and pressure required by Sections 5003.2.7, 5004.8 and 5005.1.4.
3. Emergency alarm systems and supervision required by Sections 5004.9 and 5005.4.4.
4. Monitoring and supervisory systems required by Sections 5004.10 and 5005.1.6.
5. Manually activated shutdown controls required by Section 6403.1.1.1 for compressed gas systems conveying pyrophoric gases.

5003.2.9.2 Testing frequency. The equipment, systems and devices listed in Section 5003.2.9.1 shall be tested at one of the following frequencies:

1. Not less than annually.
2. In accordance with the approved manufacturer's requirements.
3. In accordance with approved recognized industry standards.
4. In accordance with an approved schedule.

5003.3 Release of hazardous materials. Hazardous materials in any quantity shall not be released into a sewer, storm drain, ditch, drainage canal, creek, stream, river, lake or tidal waterway or on the ground, sidewalk, street, highway or into the atmosphere.

Exceptions:

1. The release or emission of hazardous materials is allowed where in compliance with federal, state or local governmental agencies, regulations or permits.
2. The release of pesticides is allowed where used in accordance with registered label directions.
3. The release of fertilizer and soil amendments is allowed where used in accordance with manufacturer's specifications.

5003.3.1 Unauthorized discharges. In the event hazardous materials are released in quantities reportable under state, federal or local regulations, the fire code official shall be notified and the following procedures required in accordance with Sections 5003.3.1.1 through 5003.3.1.4.

5003.3.1.1 Records. Records of the unauthorized discharge of hazardous materials by the permittee shall be maintained.

5003.3.1.2 Preparation. Provisions shall be made for controlling and mitigating unauthorized discharges.

5003.3.1.3 Control. Where an unauthorized discharge caused by primary container failure is discovered, the involved primary container shall be repaired or removed from service.

5003.3.1.4 Responsibility for cleanup. The person, firm or corporation responsible for an unauthorized discharge shall institute and complete all actions necessary to remedy the effects of such unauthorized discharge, whether sudden or gradual, without cost to the jurisdiction. Where deemed necessary by the fire code official, cleanup can be initiated by the fire department or by an authorized individual or firm. Costs associated with such cleanup shall be borne by the owner, operator or other person responsible for the unauthorized discharge.

5003.4 Safety Data Sheets. Safety Data Sheets (SDS) shall be readily available on the premises for hazardous materials regulated by this chapter. Where a hazardous substance is developed in a laboratory, available information shall be documented.

Exception: Designated hazardous waste.

5003.5 Hazard identification signs. Unless otherwise exempted by the fire code official, visible hazard identification signs as specified in NFPA 704 for the specific material contained shall be placed on stationary containers and above-ground tanks and at entrances to locations where hazardous materials are stored, dispensed, used or handled in quantities requiring a permit and at specific entrances and locations designated by the fire code official.

5003.5.1 Markings. Individual containers, cartons or packages shall be conspicuously marked or labeled in an approved manner. Rooms or cabinets containing compressed gases shall be conspicuously labeled: “COMPRESSED GAS.”

5003.6 Signs. Signs and markings required by Sections 5003.5 and 5003.5.1 shall not be obscured or removed, shall be in English as a primary language or in symbols allowed by this code, shall be durable, and the size, color and lettering shall be approved.

5003.7 Sources of ignition. Sources of ignition shall comply with Sections 5003.7.1 through 5003.7.3.

5003.7.1 Smoking. Smoking shall be prohibited and “No Smoking” signs provided as follows:

1. In rooms or areas where hazardous materials are stored or dispensed or used in open systems in amounts requiring a permit in accordance with Section 5001.5.
2. Within 25 feet (7620 mm) of outdoor storage, dispensing or open use areas.
3. Facilities or areas within facilities that have been designated as totally “no smoking” shall have “No Smoking” signs placed at all entrances to the facility or area. Designated areas within such facilities

where smoking is permitted either permanently or temporarily, shall be identified with signs designating that smoking is permitted in these areas only.

4. In rooms or areas where flammable or combustible hazardous materials are stored, dispensed or used.

Signs required by this section shall be in English as a primary language or in symbols allowed by this code and shall comply with Section 310.

5003.7.2 Open flames. Open flames and high-temperature devices shall not be used in a manner that creates a hazardous condition and shall be listed for use with the hazardous materials stored or used.

5003.7.3 Industrial trucks. Powered industrial trucks used in areas designated as hazardous (classified) locations shall be in accordance with Section 309.2.

5003.7.4 Respiratory therapy. In Group I-2 and ambulatory care facilities, within areas with respiratory therapy services, sources of ignition shall be regulated in accordance with NFPA 99.

5003.8 Construction requirements. Buildings, control areas, enclosures and cabinets for hazardous materials shall be in accordance with Sections 5003.8.1 through 5003.8.7.2.

5003.8.1 Buildings. Buildings, or portions thereof, in which hazardous materials are stored, handled or used shall be constructed in accordance with the *California Building Code*.

5003.8.2 Required detached buildings. Group H occupancies containing quantities of hazardous materials in excess of those set forth in Table 5003.8.2 shall be in detached buildings.

5003.8.3 Control areas. Control areas shall comply with Sections 5003.8.3.1 through 5003.8.3.5.3.

5003.8.3.1 Construction requirements. Control areas shall be separated from each other by fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both.

5003.8.3.2 Percentage of maximum allowable quantities. The percentage of maximum allowable quantities of hazardous materials per control area allowed at each story within a building shall be in accordance with Table 5003.8.3.2.

5003.8.3.3 Number. The maximum number of control areas per floor within a building shall be in accordance with Table 5003.8.3.2. For the purposes of determining the number of control areas within a building, each portion of a building separated by one or more fire walls complying with Section 706 of the *California Building Code* shall be considered a separate building.

**TABLE 5003.8.2
DETACHED BUILDING REQUIRED**

A DETACHED BUILDING IS REQUIRED WHERE THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN			
Material	Class	Solids and liquids (tons) ^{a, b}	Gases (cubic feet) ^{a, b}
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4 ^c	1	
	Division 1.5	Maximum Allowable Quantity	
	Division 1.6	Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	
	Class II	25	
	Class III	50	
Unstable (reactives) nondetonable	Class 3	125	2,000
	Class 2		10,000
Water reactives	Class 3	125	Not Applicable
	Class 2		
Pyrophoric gases ^d	Not Applicable	Not Applicable	2,000

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.02832 m³, 1 ton = 2000 lb = 907.2 kg.

- a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Section 415.6 of the *California Building Code* or Chapter 56 based on the trinitrotoluene (TNT) equivalence of the material, whichever is greater.
- b. “Maximum Allowable Quantity” means the maximum allowable quantity per control area set forth in Table 5003.1.1(1).
- c. Limited to Division 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, providing the net explosive weight of individual articles does not exceed 1 pound.
- d. Detached buildings are not required for gases in gas rooms that support H-5 fabrication facilities where the gas room is separated from other areas by a fire barrier with a fire-resistance rating of not less than 2 hours and the gas is located in a gas cabinet that is internally sprinklered, equipped with continuous leak detection, automatic shutdown, and is not manifolded upstream of pressure controls. The gas supply is limited to cylinders that do not exceed 125 pounds water capacity in accordance with DOTn 49 CFR 173.192 for Hazard Zone A toxic gases.

**TABLE 5003.8.3.2
DESIGN AND NUMBER OF CONTROL AREAS**

STORY		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	1	2
	7–9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

- a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 5003.1.1(1) and 5003.1.1(2), with all increases allowed in the footnotes to those tables.
- b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

5003.8.3.4 Fire-resistance-rating requirements. The required fire-resistance rating for fire barriers shall be in accordance with Table 5003.8.3.2. The floor assembly of the control area and the construction supporting the floor of the control area shall have a fire-resistance rating of not less than 2 hours.

Exception: The floor assembly of the control area and the construction supporting the floor of the control area is allowed to be 1-hour fire-resistance rated in buildings of Types IIA, IIIA, IV and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
2. The building is three stories or less above grade plane.

5003.8.3.5 Hazardous materials in Group M display and storage areas and in Group S storage areas. Hazardous materials located in Group M and Group S occupancies shall be in accordance with Sections 5003.8.3.5.1 through 5003.8.3.5.3.

5003.8.3.5.1 Nonflammable solids and nonflammable and noncombustible liquids. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed within a single control area of a Group M display and storage area or a Group S storage area is allowed to exceed the maximum allowable quantities per control area specified in Tables 5003.1.1(1) and 5003.1.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with Section 5003.11.

5003.8.3.5.2 Flammable and combustible liquids. In Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area as indicated in Table 5704.3.4.1, provided that the materials are displayed and stored in accordance with Chapter 57.

5003.8.3.5.3 Aerosols. The maximum quantity of aerosol products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with Chapter 51.

5003.8.4 Gas rooms. Where a gas room is used to increase the maximum allowable quantity per control area or provided to comply with the provisions of Chapter 60, the gas room shall be in accordance with Sections 5003.8.4.1 and 5003.8.4.2.

5003.8.4.1 Construction. Gas rooms shall be protected with an automatic sprinkler system. Gas rooms shall be separated from the remainder of the building in accordance with the requirements of the *California Building Code* based on the occupancy group into which it has been classified.

5003.8.4.2 Ventilation system. The ventilation system for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding area. Highly toxic and toxic gases shall also comply with Section 6004.2.2.6. The ventilation system shall be installed in accordance with the *California Mechanical Code*.

5003.8.5 Exhausted enclosures. Where an exhausted enclosure is used to increase maximum allowable quantity per control area or where the location of hazardous materials in exhausted enclosures is provided to comply with the provisions of Chapter 60, the exhausted enclosure shall be in accordance with Sections 5003.8.5.1 through 5003.8.5.3.

5003.8.5.1 Construction. Exhausted enclosures shall be of noncombustible construction.

5003.8.5.2 Ventilation. Exhausted enclosures shall be provided with an exhaust ventilation system. The ventilation system for exhausted enclosures shall be designed to operate at a negative pressure in relation to the surrounding area. Ventilation systems used for highly toxic and toxic gases shall also comply with Items 1, 2 and 3 of Section 6004.1.3. The ventilation system shall be installed in accordance with the *California Mechanical Code*.

5003.8.5.3 Fire-extinguishing system. Exhausted enclosures where flammable materials are used shall be protected by an approved automatic fire-extinguishing system in accordance with Chapter 9.

5003.8.6 Gas cabinets. Where a gas cabinet is used to increase the maximum allowable quantity per control area or where the location of compressed gases in gas cabinets is provided to comply with the provisions of Chapter 60, the gas cabinet shall be in accordance with Sections 5003.8.6.1 through 5003.8.6.3.

5003.8.6.1 Construction. Gas cabinets shall be constructed with the following:

1. Not less than 0.097-inch (2.5 mm) (No. 12 gage) steel.
2. Self-closing limited access ports or noncombustible windows to give access to equipment controls.
3. Self-closing doors.
4. Interiors treated, coated or constructed of materials that are compatible with the hazardous materials stored. Such treatment, coating or construction shall include the entire interior of the cabinet.

5003.8.6.2 Ventilation. Gas cabinets shall be provided with an exhaust ventilation system. The ventilation system for gas cabinets shall be designed to operate at a negative pressure in relation to the surrounding area. Ventilation systems used for highly toxic and toxic gases shall also comply with Items 1, 2 and 3 of Section 6004.1.2. The ventilation system shall be installed in accordance with the *California Mechanical Code*.

5003.8.6.3 Maximum number of cylinders per gas cabinet. The number of cylinders contained in a single gas cabinet shall not exceed three.

5003.8.7 Hazardous materials storage cabinets. Where storage cabinets are used to increase maximum allowable quantity per control area or to comply with this chapter, such cabinets shall be in accordance with Sections 5003.8.7.1 and 5003.8.7.2.

5003.8.7.1 Construction. The interior of cabinets shall be treated, coated or constructed of materials that are nonreactive with the hazardous material stored. Such treatment, coating or construction shall include the entire interior of the cabinet. Cabinets shall either be listed in accordance with UL 1275 as suitable for the intended storage or constructed in accordance with the following:

1. Cabinets shall be of steel having a thickness of not less than 0.0478 inch (1.2 mm) (No. 18 gage). The cabinet, including the door, shall be double walled with a 1½-inch (38 mm) airspace between the walls. Joints shall be riveted or welded and shall be tight fitting. Doors shall be well fitted, self-closing and equipped with a self-latching device.
2. The bottoms of cabinets utilized for the storage of liquids shall be liquid tight to a minimum height of 2 inches (51 mm).

Electrical equipment and devices within cabinets used for the storage of hazardous gases or liquids shall be in accordance with the *California Electrical Code*.

5003.8.7.2 Warning markings. Cabinets shall be clearly identified in an approved manner with red letters on a contrasting background to read:

HAZARDOUS—KEEP FIRE AWAY

5003.9 General safety precautions. General precautions for the safe storage, handling or care of hazardous materials shall be in accordance with Sections 5003.9.1 through 5003.9.10.

5003.9.1 Personnel training and written procedures. Persons responsible for the operation of areas in which hazardous materials are stored, dispensed, handled or used shall be familiar with the chemical nature of the materials and the appropriate mitigating actions necessary in the event of fire, leak or spill.

5003.9.1.1 Fire department liaison. Responsible persons shall be designated and trained to be liaison personnel to the fire department. These persons shall aid the fire department in preplanning emergency responses and identifying the locations where hazardous materials are located, and shall have access to Safety Data Sheets and be knowledgeable in the site's emergency response procedures.

5003.9.2 Security. Storage, dispensing, use and handling areas shall be secured against unauthorized entry and safeguarded in a manner approved by the fire code official.

5003.9.3 Protection from vehicles. Guard posts or other approved means shall be provided to protect storage tanks and connected piping, valves and fittings; dispensing areas; and use areas subject to vehicular damage in accordance with Section 312.

5003.9.4 Electrical wiring and equipment. Electrical wiring and equipment shall be installed and maintained in accordance with the *California Electrical Code*.

5003.9.5 Static accumulation. Where processes or conditions exist where a flammable mixture could be ignited by static electricity, means shall be provided to prevent the accumulation of a static charge.

5003.9.6 Protection from light. Materials that are sensitive to light shall be stored in containers designed to protect them from such exposure.

5003.9.7 Shock padding. Materials that are shock sensitive shall be padded, suspended or otherwise protected against accidental dislodgement and dislodgement during seismic activity.

5003.9.8 Separation of incompatible materials. Incompatible materials in storage and storage of materials that are incompatible with materials in use shall be separated where the stored materials are in containers having a capacity of more than 5 pounds (2 kg), 0.5 gallon (2 L) or any amount of compressed gases. Separation shall be accomplished by:

1. Segregating incompatible materials in storage by a distance of not less than 20 feet (6096 mm).
2. Isolating incompatible materials in storage by a non-combustible partition extending not less than 18 inches (457 mm) above and to the sides of the stored material.
3. Storing liquid and solid materials in hazardous material storage cabinets.
4. Storing compressed gases in gas cabinets or exhausted enclosures in accordance with Sections 5003.8.5 and 5003.8.6.

Materials that are incompatible shall not be stored within the same cabinet or exhausted enclosure.

5003.9.9 Shelf storage. Shelving shall be of substantial construction, and shall be braced and anchored in accordance with the seismic design requirements of the *California Building Code* for the seismic zone in which the material is located. Shelving shall be treated, coated or constructed of materials that are compatible with the hazardous materials stored. Shelves shall be provided with a lip or guard where used for the storage of individual containers.

Shelf storage of hazardous materials shall be maintained in an orderly manner.

Exceptions:

1. Storage in hazardous material storage cabinets or laboratory furniture specifically designed for such use.
2. Storage of hazardous materials in amounts not requiring a permit in accordance with Section 5001.5.

5003.9.10 Safety cans. Safety cans shall be listed in accordance with UL 30 where used to increase the maximum allowable quantities per control area of flammable or combustible liquids in accordance with Table 5003.1.1(1). Safety cans listed in accordance with UL 1313 are allowed for flammable and combustible liquids where not used to increase the maximum allowable quantities per control

area and for other hazardous material liquids in accordance with the listing.

5003.10 Handling and transportation. In addition to the requirements of Section 5003.2, the handling and transportation of hazardous materials in corridors or enclosures for stairways and ramps shall be in accordance with Sections 5003.10.1 through 5003.10.3.6.

5003.10.1 Valve protection. Hazardous material gas containers, cylinders and tanks in transit shall have their protective caps in place. Containers, cylinders and tanks of highly toxic or toxic compressed gases shall have their valve outlets capped or plugged with an approved closure device in accordance with Chapter 53.

5003.10.2 Carts and trucks required. Liquids in containers exceeding 5.28 gallons (20 L) in an elevator, a corridor or enclosure for a stairway or ramp shall be transported on a cart or truck. Containers of hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 and transported within an elevator, corridors or interior exit stairways and ramps, shall be on a cart or truck. Where carts and trucks are required for transporting hazardous materials, they shall be in accordance with Section 5003.10.3. *Exceptions 1 through 4 shall not apply where elevators are utilized.*

Exceptions:

1. Two hazardous material liquid containers that are hand carried in acceptable safety carriers.
2. Not more than four drums not exceeding 55 gallons (208 L) each that are transported by suitable drum trucks.
3. Containers and cylinders of compressed gases that are transported by approved hand trucks, and containers and cylinders not exceeding 25 pounds (11 kg) that are hand carried.
4. Solid hazardous materials not exceeding 100 pounds (45 kg) that are transported by approved hand trucks, and a single container not exceeding 50 pounds (23 kg) that is hand carried.

5003.10.2.1 On the 11th story and above. *On the 11th story and above of any occupancy, all vertical handling and transportation of hazardous materials in the building shall be in approved carts.*

5003.10.2.2 Transportation of hazardous materials on the 11th story and above. *The handling and transportation of hazardous materials on the 11th story and above shall be limited to 5 percent of the maximum allowable quantities of Tables 5003.1(1) and (2). Quantities are permitted to be increased by 100 percent in buildings with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Materials where footnote g applies shall not be increased.*

5003.10.3 Carts and trucks. Carts and trucks required by Section 5003.10.2 to be used to transport hazardous materials shall be in accordance with Sections 5003.10.3.1 through 5003.10.3.6.

5003.10.3.1 Design. Carts and trucks used to transport hazardous materials shall be designed to provide a stable base for the commodities to be transported and shall have a means of restraining containers to prevent accidental dislodgement. Compressed gas cylinders placed on carts and trucks shall be individually restrained.

5003.10.3.2 Speed-control devices. Carts and trucks shall be provided with a device that will enable the operator to control safely movement by providing stops or speed-reduction devices.

5003.10.3.3 Construction. Construction materials for hazardous material carts or trucks shall be compatible with the material transported. The cart or truck shall be of substantial construction.

5003.10.3.4 Spill control. Carts and trucks transporting liquids shall be capable of containing a spill from the largest single container transported.

5003.10.3.5 Attendance. Carts and trucks used to transport materials shall not obstruct or be left unattended within any part of a means of egress.

5003.10.3.6 Incompatible materials. Incompatible materials shall not be transported on the same cart or truck.

5003.10.4 Elevators utilized to transport hazardous materials.

5003.10.4.1 *When transporting hazardous materials, elevators shall have no other passengers other than the individual(s) handling the chemical transport cart.*

5003.10.4.1.1 *When transporting cryogenic or liquefied compressed gases, there shall be no occupants in the elevator.*

5003.10.4.2 *Hazardous materials liquid containers shall have a maximum capacity of 20 liters (5.28 gal).*

5003.10.4.3 *Toxic and highly-toxic gases shall be limited to a container of a maximum water capacity of 1 pound.*

5003.10.4.4 *When transporting cryogenic or liquefied compressed gases, means shall be provided to prevent the elevator from being summoned to other floors.*

5003.10.5 Elevators or conveyance systems utilized to transport hazardous materials in excess of the quantities listed in Section 5003.10.4 shall comply with Sections 5003.10.5.1 through 5003.10.5.6.

5003.10.5.1 *Elevators or conveyance hoist-way enclosures shall be located in a shaft constructed in accordance with Section 713 of the California Building Code.*

5003.10.5.2 *Elevators shall have no passengers other than the individual handling the chemical transport and shall comply with the requirements of Section 5003.10.4.*

5003.10.5.2.1 *When transporting cryogenic or liquefied compressed gases, there shall be no occupants in the elevator.*

5003.10.5.3 Spill containment shall be provided for all transported liquids.

5003.10.5.4 Ventilation shall be provided in the elevator shaft in accordance with Section 5004.3.1.

5003.10.5.5 Signage shall be provided on all floors adjacent to each elevator call station to indicate the elevator is designated for hazardous materials transportation.

5003.10.5.6 Use of an elevator or conveyance system described in this section shall be restricted to personnel that have been properly trained.

5003.10.5.7 Means shall be provided to prevent the elevator from being summoned to other floors.

5003.10.6 Posted sequence of operation. A documented sequence of operation shall be submitted to the authority having jurisdiction for review and approval prior to the transportation of hazardous materials in elevators or conveyance systems described in Section 5003.10.5.

5003.10.6.1 The approved sequence of operations shall be posted in the elevator car or conveyance system.

5003.10.6.2 The approved sequence of operation shall be maintained and tested upon the request of the authority having jurisdiction.

5003.11 Group M storage and display and Group S storage. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored and displayed within a single control area of a Group M occupancy, or an outdoor control area, or stored in a single control area of a Group S occupancy, is allowed to exceed the maximum allowable quantity per control area indicated in Section 5003.1 where in accordance with Sections 5003.11.1 through 5003.11.3.11.

5003.11.1 Maximum allowable quantity per control area in Group M or S occupancies. The aggregate amount of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored and displayed within a single control area of a Group M occupancy or stored in a single control area of a Group S occupancy shall not exceed the amounts set forth in Table 5003.11.1.

5003.11.2 Maximum allowable quantity per outdoor control area in Group M or S occupancies. The aggregate amount of nonflammable solid and nonflammable or noncombustible liquid hazardous materials stored and displayed within a single outdoor control area of a Group M occupancy shall not exceed the amounts set forth in Table 5003.11.1.

5003.11.3 Storage and display. Storage and display shall be in accordance with Sections 5003.11.3.1 through 5003.11.3.11.

5003.11.3.1 Density. Storage and display of solids shall not exceed 200 pounds per square foot (976 kg/m²) of floor area actually occupied by solid merchandise. Storage and display of liquids shall not exceed 20 gallons per square foot (0.50 L/m²) of floor area actually occupied by liquid merchandise.

5003.11.3.2 Storage and display height. Display height shall not exceed 6 feet (1829 mm) above the finished floor in display areas of Group M occupancies. Storage height shall not exceed 8 feet (2438 mm) above the finished floor in storage areas of Group M and Group S occupancies.

5003.11.3.3 Container location. Individual containers less than 5 gallons (19 L) or less than 25 pounds (11 kg) shall be stored or displayed on pallets, racks or shelves.

5003.11.3.4 Racks and shelves. Racks and shelves used for storage or display shall be in accordance with Section 5003.9.9.

5003.11.3.5 Container type. Containers shall be approved for the intended use and identified as to their content.

5003.11.3.6 Container size. Individual containers shall not exceed 100 pounds (45 kg) for solids or 10 gallons (38 L) for liquids in storage and display areas.

5003.11.3.7 Incompatible materials. Incompatible materials shall be separated in accordance with Section 5003.9.8.

5003.11.3.8 Floors. Floors shall be in accordance with Section 5004.12.

5003.11.3.9 Aisles. Aisles 4 feet (1219 mm) in width shall be maintained on three sides of the storage or display area.

5003.11.3.10 Signs. Hazard identification signs shall be provided in accordance with Section 5003.5.

5003.11.3.11 Storage plan. A storage plan illustrating the intended storage arrangement, including the location and dimensions of aisles, and storage racks shall be provided.

5003.12 Outdoor control areas. Outdoor control areas for hazardous materials shall be in accordance with the following general requirements:

1. Outdoor control areas shall be kept free from weeds, debris and common combustible materials not necessary to the storage. The area surrounding an outdoor control area shall be kept clear of such materials for not less than 15 feet (4572 mm).
2. Outdoor control areas shall be located not closer than 20 feet (6096 mm) from a public street, public alley, public way or lot line that can be built on.

Exceptions:

1. For solid and liquid hazardous materials, a 2-hour fire-resistance-rated wall without openings extending not less than 30 inches (762 mm) above and to the sides of the storage area shall be allowed in lieu of such distance.
2. For compressed gas hazardous materials, unless otherwise specified, the minimum required distances shall not apply where fire barriers without openings or penetrations having a minimum fire-resistance rating of 2 hours interrupt the line of sight between the

**TABLE 5003.11.1
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M
AND S OCCUPANCIES—NONFLAMMABLE SOLIDS, NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS^{d, e, f}**

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material ^a	Class	Solids (pounds)	Liquids (gallons)
A. Health-Hazard Materials—Nonflammable and Noncombustible Solids and Liquids			
1. Corrosives ^{b, c}	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20 ^{b, c}	2 ^{b, c}
3. Toxics ^{b, c}	Not Applicable	1,000 ^k	100
B. Physical-Hazard Materials—Nonflammable and Noncombustible Solids and Liquids			
1. Oxidizers ^{b, c}	4	Not Allowed	Not Allowed
	3	1,350 ^g	135
	2	2,250 ^h	225
	1	18,000 ^{i, j}	1,800 ^{i, j}
2. Unstable (reactives) ^{b, c}	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3 ^{b, c}	550	55
	2 ^{b, c}	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³.

- a. Hazard categories are as specified in Section 5001.2.2.
- b. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note c applies, the increase for both notes shall be applied accumulatively.
- c. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets in accordance with Section 5003.8. Where Note b applies, the increase for both notes shall be applied accumulatively.
- d. See Table 5003.8.3.2 for design and number of control areas.
- e. Maximum allowable quantities for other hazardous material categories shall be in accordance with Section 5003.1.
- f. Maximum allowable quantities shall be increased 100 percent in outdoor control areas.
- g. Maximum allowable quantities shall be increased to 2,250 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- h. Maximum allowable quantities shall be increased to 4,500 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.
- i. Quantities are unlimited where protected by an automatic sprinkler system.
- j. Quantities are unlimited in an outdoor control area.
- k. Maximum allowable quantity of consumer products shall be increased to 10,000 pounds where individual packages are in the original sealed containers from the manufacturer and the toxic classification is exclusively based on the LC₅₀ threshold and no other hazardous materials classifications apply.

storage and the exposure. The configuration of the fire barrier shall be designed to allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

- 3. Where a property exceeds 10,000 square feet (929 m²), a group of two outdoor control areas is allowed where approved and where each control area is separated by a minimum distance of 50 feet (15 240 mm).
- 4. Where a property exceeds 35,000 square feet (3252 m²), additional groups of outdoor control areas are allowed where approved and where each group is separated by a minimum distance of 300 feet (91 440 mm).

**SECTION 5004
STORAGE**

5004.1 Scope. Storage of hazardous materials in amounts exceeding the maximum allowable quantity per control area

as set forth in Section 5003.1 shall be in accordance with Sections 5001, 5003 and 5004. Storage of hazardous materials in amounts not exceeding the maximum allowable quantity per control area as set forth in Section 5003.1 shall be in accordance with Sections 5001 and 5003. Retail and wholesale storage and display of nonflammable solid and nonflammable and noncombustible liquid hazardous materials in Group M occupancies and Group S storage shall be in accordance with Section 5003.11.

5004.2 Spill control and secondary containment for liquid and solid hazardous materials. Rooms, buildings or areas used for the storage of liquid or solid hazardous materials shall be provided with spill control and secondary containment in accordance with Sections 5004.2.1 through 5004.2.3.

Exception: Outdoor storage of containers on approved containment pallets in accordance with Section 5004.2.3.

5004.2.1 Spill control for hazardous material liquids.

Rooms, buildings or areas used for the storage of hazardous material liquids in individual vessels having a capacity of more than 55 gallons (208 L), or in which the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L), shall be provided with spill control to prevent the flow of liquids to adjoining areas. Floors in indoor locations and similar surfaces in outdoor locations shall be constructed to contain a spill from the largest single vessel by one of the following methods:

1. Liquid-tight sloped or recessed floors in indoor locations or similar areas in outdoor locations.
2. Liquid-tight floors in indoor locations or similar areas in outdoor locations provided with liquid-tight raised or recessed sills or dikes.
3. Sumps and collection systems.
4. Other approved engineered systems.

Except for surfacing, the floors, sills, dikes, sumps and collection systems shall be constructed of noncombustible material, and the liquid-tight seal shall be compatible with the material stored. Where liquid-tight sills or dikes are provided, they are not required at perimeter openings having an open-grate trench across the opening that connects to an approved collection system.

5004.2.2 Secondary containment for hazardous material liquids and solids. Where required by Table 5004.2.2, buildings, rooms or areas used for the storage of hazardous materials liquids or solids shall be provided with secondary containment in accordance with this section where the capacity of an individual vessel or the aggregate capacity of multiple vessels exceeds both of the following:

1. Liquids: Capacity of an individual vessel exceeds 55 gallons (208 L) or the aggregate capacity of multiple vessels exceeds 1,000 gallons (3785 L).
2. Solids: Capacity of an individual vessel exceeds 550 pounds (250 kg) or the aggregate capacity of multiple vessels exceeds 10,000 pounds (4540 kg).

5004.2.2.1 Containment and drainage methods. The building, room or area shall contain or drain the hazardous materials and fire protection water through the use of one of the following methods:

1. Liquid-tight sloped or recessed floors in indoor locations or similar areas in outdoor locations.
2. Liquid-tight floors in indoor locations or similar areas in outdoor locations provided with liquid-tight raised or recessed sills or dikes.
3. Sumps and collection systems.
4. Drainage systems leading to an approved location.
5. Other approved engineered systems.

5004.2.2.2 Incompatible materials. Incompatible materials used in open systems shall be separated from each other in the secondary containment system.

5004.2.2.3 Indoor design. Secondary containment for indoor storage areas shall be designed to contain a spill from the largest vessel plus the design flow volume of fire protection water calculated to discharge from the fire-extinguishing system over the minimum required system design area or area of the room or area in which the storage is located, whichever is smaller. The containment capacity shall be designed to contain the flow for a period of 20 minutes.

5004.2.2.4 Outdoor design. Secondary containment for outdoor storage areas shall be designed to contain a spill from the largest individual vessel. If the area is open to rainfall, secondary containment shall be designed to include the volume of a 24-hour rainfall as determined by a 25-year storm and provisions shall be made to drain accumulations of groundwater and rainwater.

5004.2.2.5 Monitoring. An approved monitoring method shall be provided to detect hazardous materials in the secondary containment system. The monitoring method is allowed to be visual inspection of the primary or secondary containment, or other approved means. Where secondary containment is subject to the intrusion of water, a monitoring method for detecting water shall be provided. Where monitoring devices are provided, they shall be connected to approved visual or audible alarms.

5004.2.2.6 Drainage system design. Drainage systems shall be in accordance with the *California Plumbing Code* and all of the following:

1. The slope of floors to drains in indoor locations, or similar areas in outdoor locations shall be not less than 1 percent.
2. Drains from indoor storage areas shall be sized to carry the volume of the fire protection water as determined by the design density discharged from the automatic fire-extinguishing system over the minimum required system design area or area of the room or area in which the storage is located, whichever is smaller.
3. Drains from outdoor storage areas shall be sized to carry the volume of the fire flow and the volume of a 24-hour rainfall as determined by a 25-year storm.
4. Materials of construction for drainage systems shall be compatible with the materials stored.
5. Incompatible materials used in open systems shall be separated from each other in the drainage system.
6. Drains shall terminate in an approved location away from buildings, valves, means of egress, fire access roadways, adjoining property and storm drains.

**TABLE 5004.2.2
REQUIRED SECONDARY CONTAINMENT—HAZARDOUS MATERIAL SOLIDS AND LIQUIDS STORAGE**

MATERIAL		INDOOR STORAGE		OUTDOOR STORAGE	
		Solids	Liquids	Solids	Liquids
1. Physical-hazard materials					
Combustible liquids	Class II	Not Applicable	See Chapter 57	Not Applicable	See Chapter 57
	Class IIIA		See Chapter 57		See Chapter 57
	Class IIIB		See Chapter 57		See Chapter 57
Cryogenic fluids			See Chapter 55		See Chapter 55
Explosives		See Chapter 56		See Chapter 56	
Flammable liquids	Class IA	Not Applicable	See Chapter 57	Not Applicable	See Chapter 57
	Class IB		See Chapter 57		See Chapter 57
	Class IC		See Chapter 57		See Chapter 57
Flammable solids		Not Required	Not Applicable	Not Required	Not Applicable
Organic peroxides	Unclassified Detonable	Required	Required	Not Required	Not Required
	Class I				
	Class II				
	Class III				
	Class IV				
	Class V	Not Required	Not Required	Not Required	Not Required
Oxidizers	Class 4	Required	Required	Not Required	Not Required
	Class 3				
	Class 2	Not Required	Not Required	Not Required	Not Required
	Class 1				
Pyrophorics		Not Required	Required	Not Required	Required
Unstable (reactives)	Class 4	Required	Required	Required	Required
	Class 3				
	Class 2				
	Class 1	Not Required	Not Required	Not Required	Not Required
Water reactives	Class 3	Required	Required	Required	Required
	Class 2				
	Class 1	Not Required	Not Required	Not Required	Not Required
2. Health-hazard materials					
Corrosives		Not Required	Required	Not Required	Required
Highly toxics		Required	Required	Required	Required
Toxics					

5004.2.3 Containment pallets. Where used as an alternative to spill control and secondary containment for outdoor storage in accordance with the exception in Section 5004.2, containment pallets shall comply with all of the following:

1. A liquid-tight sump with access for visual inspection shall be provided.
2. The sump shall be designed to contain not less than 66 gallons (250 L).
3. Exposed surfaces shall be compatible with material stored.

4. Containment pallets shall be protected to prevent collection of rainwater within the sump.

5004.3 Ventilation. Indoor storage areas and storage buildings shall be provided with mechanical exhaust ventilation or natural ventilation where natural ventilation can be shown to be acceptable for the materials as stored.

Exceptions:

1. Storage areas for flammable solids complying with Chapter 59.
2. Storage areas for medical gases complying with Chapter 53.

5004.3.1 System requirements. Exhaust ventilation systems shall comply with all of the following:

1. Installation shall be in accordance with the *California Mechanical Code*.
2. Mechanical ventilation shall be at a rate of not less than 1 cubic foot per minute per square foot [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$] of floor area over the storage area.
3. Systems shall operate continuously unless alternative designs are approved.
4. A manual shutoff control shall be provided outside of the room in a position adjacent to the access door to the room or in an approved location. The switch shall be a break-glass or other approved type and shall be labeled: “VENTILATION SYSTEM EMERGENCY SHUTOFF.”

Exception: [For SFM] When exhaust systems containing explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are 100 percent exhausted to the outside, an emergency ventilation system shutoff is not required.

5. Exhaust ventilation shall be designed to consider the density of the potential fumes or vapors released. For fumes or vapors that are heavier than air, exhaust shall be taken from a point within 12 inches (305 mm) of the floor. For fumes or vapors that are lighter than air, exhaust shall be taken from a point within 12 inches (305 mm) of the highest point of the room.
6. The location of both the exhaust and inlet air openings shall be designed to provide air movement across all portions of the floor or room to prevent the accumulation of vapors.
7. Exhaust air shall not be recirculated to occupied areas if the materials stored are capable of emitting hazardous vapors and contaminants have not been removed. Air contaminated with explosive or flammable vapors, fumes or dusts; flammable, highly toxic or toxic gases; or radioactive materials shall not be recirculated.

5004.4 Separation of incompatible hazardous materials. Incompatible materials shall be separated in accordance with Section 5003.9.8.

5004.5 Automatic sprinkler systems. Indoor storage areas and storage buildings shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. The design of the sprinkler system shall be not less than that required for Ordinary Hazard Group 2 with a minimum design area of 3,000 square feet (279 m²). Where the materials or storage arrangement are required by other regulations to be provided with a higher level of sprinkler system protection, the higher level of sprinkler system protection shall be provided.

5004.6 Explosion control. Indoor storage rooms, areas and buildings shall be provided with explosion control in accordance with Section 911.

5004.7 Standby or emergency power. Where mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems are required, such systems shall be provided with an emergency or standby power in accordance with Section 1203.

For storage areas for highly toxic or toxic materials, see Sections 6004.2.2.8 and 6004.3.4.2.

5004.7.1 Exempt applications. Standby or emergency power is not required for mechanical ventilation systems for any of the following:

1. Storage of Class IB and IC flammable liquids and Class II and III combustible liquids in closed containers not exceeding a capacity of 6½ gallons (25 L).
2. Storage of Class 1 and 2 oxidizers.
3. Storage of Class II, III, IV and V organic peroxides.
4. Storage of asphyxiant, irritant and radioactive gases.

5004.7.2 Fail-safe engineered systems. Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

5004.8 Limit controls. Limit controls shall be provided in accordance with Sections 5004.8.1 and 5004.8.2.

5004.8.1 Temperature control. Materials that must be kept at temperatures other than normal ambient temperatures to prevent a hazardous reaction shall be provided with an approved means to maintain the temperature within a safe range. Redundant temperature control equipment that will operate on failure of the primary temperature control system shall be provided. Where approved, alternative means that prevent a hazardous reaction are allowed.

5004.8.2 Pressure control. Stationary tanks and equipment containing hazardous material liquids that can generate pressures exceeding design limits because of exposure fires or internal reaction shall have some form of construction or other approved means that will relieve excessive internal pressure. The means of pressure relief shall vent to an approved location or to an exhaust scrubber or treatment system where required by Chapter 60.

5004.9 Emergency alarm. An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

5004.10 Supervision and monitoring. Emergency alarm, detection and automatic fire-extinguishing systems required by Section 5004 shall be electrically supervised and monitored by an approved supervising station or, where approved, shall initiate an audible and visual signal at a constantly attended on-site location.

5004.11 Clearance from combustibles. The area surrounding an outdoor storage area or tank shall be kept clear of combustible materials and vegetation for a minimum distance of 25 feet (7620 mm).

5004.12 Noncombustible floor. Except for surfacing, floors of storage areas shall be of noncombustible construction.

5004.13 Weather protection. Where overhead noncombustible construction is provided for sheltering outdoor hazardous material storage areas, such storage shall not be considered indoor storage where the area is constructed in accordance with the requirements for weather protection as required by the *California Building Code*.

Exception: Storage of explosive materials shall be considered as indoor storage.

5004.14 Outdoor storage location. Outdoor storage areas for hazardous materials shall be located as required by Section 5003.12 except where material-specific requirements, including requirements in referenced standards, are provided in other chapters of this code.

SECTION 5005 USE, DISPENSING AND HANDLING

5005.1 General. Use, dispensing and handling of hazardous materials in amounts exceeding the maximum allowable quantity per control area set forth in Section 5003.1 shall be in accordance with Sections 5001, 5003 and 5005. Use, dispensing and handling of hazardous materials in amounts not exceeding the maximum allowable quantity per control area set forth in Section 5003.1 shall be in accordance with Sections 5001 and 5003.

5005.1.1 Separation of incompatible materials. Separation of incompatible materials shall be in accordance with Section 5003.9.8.

5005.1.2 Noncombustible floor. Except for surfacing, floors of areas where liquid or solid hazardous materials are dispensed or used in open systems shall be of noncombustible, liquid-tight construction.

5005.1.3 Spill control and secondary containment for hazardous material liquids. Where required by other provisions of Section 5005, spill control and secondary containment shall be provided for hazardous material liquids in accordance with Section 5004.2.

5005.1.4 Limit controls. Limit controls shall be provided in accordance with Sections 5005.1.4.1 through 5005.1.4.4.

5005.1.4.1 High-liquid-level control. Open tanks in which liquid hazardous materials are used shall be equipped with a liquid-level limit control or other means to prevent overfilling of the tank.

5005.1.4.2 Low-liquid-level control. Approved safeguards shall be provided to prevent a low-liquid level in a tank from creating a hazardous condition, including but not limited to, overheating of a tank or its contents.

5005.1.4.3 Temperature control. Temperature control shall be provided in accordance with Section 5004.8.1.

5005.1.4.4 Pressure control. Pressure control shall be provided in accordance with Section 5004.8.2.

5005.1.5 Standby or emergency power. Where mechanical ventilation, treatment systems, temperature control, manual alarm, detection or other electrically operated systems are required by this code, such systems shall be provided with emergency or standby power in accordance with Section 1203.

5005.1.5.1 Exempt applications. Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

5005.1.6 Supervision and monitoring. Manual alarm, detection and automatic fire-extinguishing systems required by other provisions of Section 5005 shall be electrically supervised and monitored by an approved supervisory service or, where approved, shall initiate an audible and visual signal at a constantly attended on-site location.

5005.1.7 Lighting. Adequate lighting by natural or artificial means shall be provided.

5005.1.8 Fire protection systems. Indoor rooms or areas in which hazardous materials are dispensed or used shall be protected by an automatic sprinkler system or automatic fire-extinguishing system in accordance with Chapter 9. Sprinkler system design shall be not less than that required for Ordinary Hazard, Group 2, with a minimum design area of 3,000 square feet (279 m²). Where the materials or storage arrangement are required by other regulations to be provided with a higher level of sprinkler system protection, the higher level of sprinkler system protection shall be provided.

5005.1.9 Ventilation. Indoor dispensing and use areas shall be provided with exhaust ventilation in accordance with Section 5004.3.

Exception: Ventilation is not required for dispensing and use of flammable solids other than finely divided particles.

5005.1.10 Liquid transfer. Liquids having a hazard ranking of 3 or 4 in accordance with NFPA 704 shall be transferred by one of the following methods:

1. From safety cans complying with UL 30.
2. Through an approved closed piping system.
3. From containers or tanks by an approved pump taking suction through an opening in the top of the container or tank.
4. From containers or tanks by gravity through an approved self-closing or automatic-closing valve where the container or tank and dispensing operations are provided with spill control and secondary containment in accordance with Section 5004.2.

Highly toxic liquids shall not be dispensed by gravity from tanks.

5. Approved engineered liquid transfer systems.

Exceptions:

1. Liquids having a hazard ranking of 4 where dispensed from approved containers not exceeding 1.3 gallons (5 L).
2. Liquids having a hazard ranking of 3 where dispensed from approved containers not exceeding 5.3 gallons (20 L).

5005.1.11 Design. Systems shall be suitable for the use intended and shall be designed by persons competent in such design. Controls shall be designed to prevent materials from entering or leaving the process or reaction system at other than the intended time, rate or path. Where failure of an automatic control could result in a dangerous condition or reaction, the automatic control shall be fail-safe.

5005.1.12 Emergency isolation. Where gases or liquids having a hazard ranking of Health Class 3 or 4, Flammability Class 4 or Instability Class 3 or 4 in accordance with NFPA 704 are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103 kPa), an approved means of leak detection and emergency shutoff or excess flow control shall be provided. Where the piping originates from within a hazardous material storage room or area, the excess flow control shall be located within the storage room or area. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

Exceptions:

1. Piping for inlet connections designed to prevent backflow.
2. Piping for pressure relief devices.

5005.2 Indoor dispensing and use. Indoor dispensing and use of hazardous materials shall be in buildings complying with the *California Building Code* and in accordance with Section 5005.1 and Sections 5005.2.1 through 5005.2.2.4.

5005.2.1 Open systems. Dispensing and use of hazardous materials in open containers or systems shall be in accordance with Sections 5005.2.1.1 through 5005.2.1.4.

5005.2.1.1 Ventilation. Where gases, liquids or solids having a hazard ranking of 3 or 4 in accordance with NFPA 704 are dispensed or used, mechanical exhaust ventilation shall be provided to capture gases, fumes, mists or vapors at the point of generation.

Exception: Gases, liquids or solids that can be demonstrated not to create harmful gases, fumes, mists or vapors.

5005.2.1.2 Explosion control. Explosion control shall be provided in accordance with Section 5004.6 where an explosive environment can occur because of the characteristics or nature of the hazardous materials dispensed or used, or as a result of the dispensing or use process.

5005.2.1.3 Spill control for hazardous material liquids. Buildings, rooms or areas where hazardous material liquids are dispensed into vessels exceeding a 1.3-gallon (5 L) capacity or used in open systems exceeding a 5.3-gallon (20 L) capacity shall be provided with spill control in accordance with Section 5004.2.1.

5005.2.1.4 Secondary containment for hazardous material liquids. Where required by Table 5005.2.1.4, buildings, rooms or areas where hazardous material liquids are dispensed or used in open systems shall be provided with secondary containment in accordance with Section 5004.2.2 where the capacity of an individual vessel or system or the capacity of multiple vessels or systems exceeds the following:

1. Individual vessel or system: greater than 1.3 gallons (5 L).
2. Multiple vessels or systems: greater than 5.3 gallons (20 L).

5005.2.2 Closed systems. Use of hazardous materials in closed containers or systems shall be in accordance with Sections 5005.2.2.1 through 5005.2.2.4.

5005.2.2.1 Ventilation. Where closed systems are designed to be opened as part of normal operations, ventilation shall be provided in accordance with Section 5005.2.1.1.

5005.2.2.2 Explosion control. Explosion control shall be provided in accordance with Section 5004.6 where an explosive environment exists because of the hazardous materials dispensed or used, or as a result of the dispensing or use process.

Exception: Where process vessels are designed to contain fully the worst-case explosion anticipated within the vessel under process conditions based on the most likely failure.

5005.2.2.3 Spill control for hazardous material liquids. Buildings, rooms or areas where hazardous material liquids are used in individual vessels exceeding a 55-gallon (208 L) capacity shall be provided with spill control in accordance with Section 5004.2.1.

5005.2.2.4 Secondary containment for hazardous material liquids. Where required by Table 5005.2.1.4, buildings, rooms or areas where hazardous material liquids are used in vessels or systems shall be provided with secondary containment in accordance with Section 5004.2.2 where the capacity of an individual vessel or system or the capacity of multiple vessels or systems exceeds the following:

1. Individual vessel or system: greater than 55 gallons (208 L).
2. Multiple vessels or systems: greater than 1,000 gallons (3785 L).

5005.3 Outdoor dispensing and use. Dispensing and use of hazardous materials outdoors shall be in accordance with Sections 5005.3.1 through 5005.3.9.

**TABLE 5005.2.1.4
REQUIRED SECONDARY CONTAINMENT—HAZARDOUS MATERIAL LIQUIDS USE**

MATERIAL	INDOOR LIQUIDS USE	OUTDOOR LIQUIDS USE	
1. Physical-hazard materials			
Combustible liquids	Class II	See Chapter 57	See Chapter 57
	Class IIIA	See Chapter 57	See Chapter 57
	Class IIIB	See Chapter 57	See Chapter 57
Cryogenic fluids		See Chapter 55	See Chapter 55
Explosives		See Chapter 56	See Chapter 56
Flammable liquids	Class IA	See Chapter 57	See Chapter 57
	Class IB	See Chapter 57	See Chapter 57
	Class IC	See Chapter 57	See Chapter 57
Flammable solids		Not Applicable	Not Applicable
Organic peroxides	Unclassified Detonable	Required	Required
	Class I	Required	Required
	Class II		
	Class III		
	Class IV	Not Required	Not Required
Class V			
Oxidizers	Class 4	Required	Required
	Class 3		
	Class 2		
	Class 1		
Pyrophorics		Required	Required
Unstable (reactives)	Class 4	Required	Required
	Class 3		
	Class 2		
	Class 1	Not Required	Required
Water reactives	Class 3	Required	Required
	Class 2	Not Required	Required
	Class 1		
2. Health-hazard materials			
Corrosives		Required	Required
Highly toxics			
Toxics			

5005.3.1 Quantities exceeding the maximum allowable quantity per control area. Outdoor dispensing or use of hazardous materials, in either closed or open containers or systems, in amounts exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(3) and 5003.1.1(4) shall be in accordance with Sections 5001, 5003, 5005.1 and 5005.3.

5005.3.2 Quantities not exceeding the maximum allowable quantity per control area. Outdoor dispensing or use of hazardous materials, in either closed or open containers or systems, in amounts not exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(3) and 5003.1.1(4) shall be in accordance with Sections 5001 and 5003.

5005.3.3 Outdoor location. Outdoor dispensing and use areas for hazardous materials shall be located as required by Section 5003.12 except where material-specific requirements, including requirements in referenced standards, are provided in other chapters of this code.

5005.3.4 Spill control for hazardous material liquids in open systems. Outdoor areas where hazardous material liquids are dispensed in vessels exceeding a 1.3-gallon (5 L) capacity or used in open systems exceeding a 5.3-gallon (20 L) capacity shall be provided with spill control in accordance with Section 5004.2.1.

5005.3.5 Secondary containment for hazardous material liquids in open systems. Where required by Table 5005.2.1.4, outdoor areas where hazardous material

liquids are dispensed or used in open systems shall be provided with secondary containment in accordance with Section 5004.2.2 where the capacity of an individual vessel or system or the capacity of multiple vessels or systems exceeds the following:

1. Individual vessel or system: greater than 1.3 gallons (5 L).
2. Multiple vessels or systems: greater than 5.3 gallons (20 L).

5005.3.6 Spill control for hazardous material liquids in closed systems. Outdoor areas where hazardous material liquids are used in closed systems exceeding 55 gallons (208 L) shall be provided with spill control in accordance with Section 5004.2.1.

5005.3.7 Secondary containment for hazardous material liquids in closed systems. Where required by Table 5005.2.1.4, outdoor areas where hazardous material liquids are dispensed or used in closed systems shall be provided with secondary containment in accordance with Section 5004.2.2 where the capacity of an individual vessel or system or the capacity of multiple vessels or systems exceeds the following:

1. Individual vessel or system: greater than 55 gallons (208 L).
2. Multiple vessels or systems: greater than 1,000 gallons (3785 L).

5005.3.8 Clearance from combustibles. The area surrounding an outdoor dispensing or use area shall be kept clear of combustible materials and vegetation for a minimum distance of 30 feet (9144 mm).

5005.3.9 Weather protection. Where overhead noncombustible construction is provided for sheltering outdoor hazardous material use areas, such use shall not be considered indoor use where the area is constructed in accordance with the requirements for weather protection as required in the *California Building Code*.

Exception: Use of explosive materials shall be considered as indoor use.

5005.4 Handling. Handling of hazardous materials shall be in accordance with Sections 5005.4.1 through 5005.4.4.

5005.4.1 Quantities exceeding the maximum allowable quantity per control area. Handling of hazardous materials in indoor and outdoor locations in amounts exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(1) through 5003.1.1(4) shall be in accordance with Sections 5001, 5003, 5005.1 and 5005.4.

5005.4.2 Quantities not exceeding the maximum allowable quantity per control area. Handling of hazardous materials in indoor locations in amounts not exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(1) and 5003.1.1(2) shall be in accordance with Sections 5001, 5003 and 5005.1. Handling of hazardous materials in outdoor locations in amounts not exceeding the maximum allowable quantity per control area indicated in Tables 5003.1.1(3) and 5003.1.1(4) shall be in accordance with Sections 5001 and 5003.

5005.4.3 Outdoor location. Outdoor handling areas for hazardous materials shall be located as required by Section 5003.12 except where material-specific requirements, including requirements in referenced standards, are provided in other chapters of this code.

5005.4.4 Dispensing, use and handling. Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors, interior exit stairways or ramps or exit passageways, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and exit access doorway throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall initiate a local audible alarm.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 51 – AEROSOLS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 51

AEROSOLS

User note:

About this chapter: Chapter 51 provides requirements for the prevention, control and extinguishment of fires and explosions in facilities where retail aerosol products are displayed or stored. It is concerned with both life safety and property protection from a fire; however, historically, aerosol product fires have caused property loss more frequently than loss of life. Requirements for storing aerosol products are dependent on the level of aerosol product, level of sprinkler protection, type of storage condition and quantity of aerosol products.

SECTION 5101 GENERAL

5101.1 Scope. The provisions of this chapter, the *California Building Code* and NFPA 30B shall apply to the manufacturing, storage and display of aerosol products, aerosol cooking spray products and plastic aerosol 3 products. Manufacturing of aerosol products, aerosol cooking spray products and plastic aerosol 3 products using hazardous materials shall also comply with Chapter 50.

5101.2 Permit required. Permits shall be required as set forth in Section 105.5.

5101.3 Safety Data Sheets. Safety Data Sheet (SDS) information for aerosol products displayed shall be kept on the premises at an approved location.

5101.4 Containers. Metal aerosol containers shall be limited to a maximum size of 33.8 fluid ounces (1000 ml). Plastic aerosol containers shall be limited to a maximum of 4 fluid ounces (118 ml) except as provided in Sections 5104.1.1 and 5104.1.2. Glass aerosol containers shall be limited to a maximum of 4 fluid ounces (118 ml).

SECTION 5102 DEFINITIONS

5102.1 Definitions. The following terms are defined in Chapter 2:

AEROSOL CONTAINER.

AEROSOL PRODUCT.

Level 1 aerosol products.

Level 2 aerosol products.

Level 3 aerosol products.

AEROSOL PRODUCT WAREHOUSE.

PROPELLANT.

RETAIL DISPLAY AREA.

SECTION 5103 CLASSIFICATION OF AEROSOL PRODUCTS

5103.1 Classification levels. Aerosol products shall be classified as Level 1, 2 or 3 in accordance with Table 5103.1 and

NFPA 30B. Aerosol products in cartons that are not identified in accordance with this section shall be classified as Level 3.

**TABLE 5103.1
CLASSIFICATION OF AEROSOL PRODUCTS**

CHEMICAL HEAT OF COMBUSTION		AEROSOL CLASSIFICATION
Greater than (Btu/lb)	Less than or equal to (Btu/lb)	
0	8,600	1
8,600	13,000	2
13,000	—	3

For SI: 1 British thermal unit per pound = 0.002326 kJ/g.

5103.2 Identification. Cartons or outer packaging shall be identified on not fewer than one exterior side with the classification level of the aerosol products contained within the carton.

5103.2.1 Aerosol products. Cartons or outer packaging containing aerosol products in metal containers or glass and plastic containers 4 fluid ounces (118 ml) or less shall be clearly marked as follows:

LEVEL _____ AEROSOLS

5103.2.2 Aerosol cooking spray products. Cartons or outer packaging containing aerosol cooking spray products in metal containers shall be clearly marked as follows:

AEROSOL COOKING SPRAY

5103.2.3 Plastic aerosol products. Cartons or outer packaging containing aerosol products in plastic containers greater than 4 fluid ounces (118 ml) shall be clearly marked as follows:

PLASTIC AEROSOL 1, 3 or X

SECTION 5104 INSIDE STORAGE OF AEROSOL PRODUCTS

5104.1 General. The inside storage of Level 2 and 3 aerosol products shall comply with Sections 5104.2 through 5104.8 and NFPA 30B. Level 1 aerosol products and those aerosol products covered by Section 5104.1.1 shall be considered to be equivalent to a Class III commodity and shall comply with the requirements for palletized or rack storage in NFPA 13.

5104.1.1 Plastic aerosol products. Aerosol products in plastic containers larger than 4 fluid ounces (118 ml), but not to exceed 33.8 fluid ounces (1000 ml), shall be allowed only where in accordance with this section. The commodity classification shall be Class III commodities, as defined in NFPA 13 where any of the following conditions are met:

1. Base product does not have a fire point where tested in accordance with ASTM D92, and nonflammable propellant.
2. Base product does not sustain combustion as tested in accordance with DOTn 49 CFR Part 173, Appendix H, and nonflammable propellant.
3. Base product contains up to 20 percent by volume (15.8 percent by weight) of ethanol, isopropyl alcohol or a combination thereof in an aqueous mix, and nonflammable propellant.
4. Base product contains 4 percent by weight or less of an emulsified flammable liquefied gas propellant within an aqueous base. The propellant shall remain emulsified for the life of the product. Where such propellant is not permanently emulsified, the propellant shall be nonflammable.

5104.1.2 Plastic aerosol 3 products. Plastic aerosol 3 products shall be defined as those that meet one of the following criteria:

1. Base product does not have a fire point where tested in accordance with ASTM D92, and there is not more than 10 percent by weight flammable propellant.
2. Base product does not sustain combustion as tested in accordance with DOTn 49 CFR 173, Appendix H, and there is not more than 10 percent by weight flammable propellant.
3. Base product contains 50 percent by volume or less of flammable or combustible water-miscible alcohols in an aqueous mix, and there is not more than 10 percent by weight of flammable propellant.

5104.1.3 Plastic aerosol X products. Plastic aerosol X products are those products, in containers larger than 4 fluid ounces (118 ml), that do not meet the criteria provided in Section 5104.1.1 or 5104.1.2.

5104.1.3.1 Storage, use or handling. The storage, use or handling of plastic aerosol X products shall be prohibited.

5104.2 Storage in Groups A, B, E, F, I and R. Storage of Level 2 and 3 aerosol products in occupancies in Groups A, B, E, F, I and R shall be limited to the following maximum quantities:

1. A net weight of 1,000 pounds (454 kg) of Level 2 aerosol products.
2. A net weight of 500 pounds (227 kg) of Level 3 aerosol products.

3. A combined net weight of 1,000 pounds (454 kg) of Level 2 and 3 aerosol products.

The maximum quantity shall be increased 100 percent where the excess quantity is stored in storage cabinets in accordance with Section 5704.3.2.

5104.2.1 Excess storage. Storage of quantities exceeding the maximum quantities indicated in Section 5104.2 shall be stored in separate inside flammable liquid storage rooms in accordance with Section 5104.5.

5104.2.2 Aerosol cooking spray products. Storage of aerosol cooking spray products in Group A, B, E, F, I and R occupancies shall not be more than 1,000 pounds (454 kg) net weight.

5104.3 Storage in general purpose warehouses. Aerosol product storage in general purpose warehouses utilized only for warehousing-type operations involving mixed commodities shall comply with Section 5104.3.1, 5104.3.2. or 5104.3.3.

5104.3.1 Nonsegregated storage. Storage consisting of solid pile, palletized or rack storage of Level 2 and 3 aerosol products not segregated into areas utilized exclusively for the storage of aerosol products shall comply with Table 5104.3.1.

**TABLE 5104.3.1
NONSEGREGATED STORAGE OF LEVEL 2 AND 3 AEROSOL
PRODUCTS IN GENERAL PURPOSE WAREHOUSES^b**

AEROSOL LEVEL	MAXIMUM NET WEIGHT PER FLOOR (pounds) ^b			
	Palletized or solid-pile storage		Rack storage	
	Unprotected	Protected ^a	Unprotected	Protected ^a
2	2,500	12,000	2,500	24,000
3	1,000	12,000	1,000	24,000
Combination 2 and 3	2,500	12,000	2,500	24,000

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 square foot = 0.0929 m².
 a. Approved automatic sprinkler system protection and storage arrangements shall comply with NFPA 30B. Sprinkler system protection shall extend 20 feet beyond the storage area containing the aerosol products.
 b. Storage quantities indicated are the maximum permitted in any 50,000-square-foot area.

5104.3.2 Segregated storage. Storage of Level 2 and 3 aerosol products segregated into areas utilized exclusively for the storage of aerosol products shall comply with Table 5104.3.2 and Sections 5104.3.2.1 and 5104.3.2.2.

5104.3.2.1 Chain-link fence enclosures. Chain-link fence enclosures required by Table 5104.3.2 shall comply with the following:

1. The fence shall be not less than No. 9 gage steel wire, woven into a maximum 2-inch (51 mm) diamond mesh.
2. The fence shall be installed from the floor to the underside of the roof or ceiling above.

3. Class IV and high-hazard commodities shall be stored outside of the aerosol storage area and not less than 8 feet (2438 mm) from the fence.
4. Access openings in the fence shall be provided with either self- or automatic-closing devices or a labyrinth opening arrangement preventing aerosol containers from rocketing through the access openings.
5. Not less than two means of egress shall be provided from the fenced enclosure.

**TABLE 5104.3.2
SEGREGATED STORAGE OF LEVEL 2 AND 3 AEROSOL PRODUCTS AND PLASTIC AEROSOL 3 PRODUCTS IN GENERAL PURPOSE WAREHOUSES**

STORAGE SEPARATION	MAXIMUM SEGREGATED STORAGE AREA ^a		SPRINKLER REQUIREMENTS
	Percentage of building area (percent)	Area limitation (square feet)	
Separation area ^{e, f}	15	20,000	Notes b, c
Chain-link fence enclosure ^d	20	20,000	Notes b, c
1-hour fire-resistance-rated interior walls	20	30,000	Note b
2-hour fire-resistance-rated interior walls	25	40,000	Note b
3-hour fire-resistance-rated interior walls	30	50,000	Note b

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m².

- a. The maximum segregated storage area shall be limited to the smaller of the two areas resulting from the percentage of building area limitation and the area limitation.
- b. Automatic sprinkler system protection in aerosol product storage areas shall comply with NFPA 30B and be approved. Building areas not containing aerosol product storage shall be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
- c. Automatic sprinkler system protection in aerosol product storage areas shall comply with NFPA 30B and be approved. Sprinkler system protection shall extend a minimum 20 feet beyond the aerosol storage area.
- d. Chain-link fence enclosures shall comply with Section 5104.3.2.1.
- e. A separation area shall be defined as an area extending outward from the periphery of the segregated aerosol product storage area as follows:
 1. The limits of the aerosol product storage shall be clearly marked on the floor.
 2. The separation distance shall be not less than 25 feet and maintained clear of all materials with a commodity classification greater than Class III in accordance with Section 903.3.1.1.
- f. Separation areas shall only be permitted where approved.

5104.3.2.2 Aisles. The minimum aisle requirements for segregated storage in general purpose warehouses shall comply with Table 5104.3.2.2.

5104.3.3 Aerosol cooking spray products. Solid pile, palletized or rack storage of aerosol cooking spray products in a general purpose warehouse shall not be more than 2,500 pounds (1135 kg) net weight, unless protected in accordance with NFPA 30B.

**TABLE 5104.3.2.2
SEGREGATED STORAGE AISLE WIDTHS AND DISTANCE TO AISLES IN GENERAL PURPOSE WAREHOUSES**

STORAGE CONDITION	MINIMUM AISLE WIDTH (feet)	MAXIMUM DISTANCE FROM STORAGE TO AISLE (feet)
Solid pile or palletized ^a	4 feet between piles	25
Racks with ESFR sprinklers ^a	4 feet between racks and adjacent Level 2 and 3 aerosol product storage	25
Racks without ESFR sprinklers ^a	8 feet between racks and adjacent Level 2 and 3 aerosol product storage	25

For SI: 1 foot = 304.8 mm.

a. Sprinklers shall comply with NFPA 30B.

5104.4 Storage in aerosol product warehouses. The total quantity of Level 2 and 3 aerosol products in a warehouse utilized for the storage, shipping and receiving of aerosol products shall not be restricted in structures complying with Sections 5104.4.1 through 5104.4.4.

5104.4.1 Automatic sprinkler system. Aerosol product warehouses shall be protected by an approved wet-pipe automatic sprinkler system in accordance with NFPA 30B. Sprinkler protection shall be designed based on the highest classification level of aerosol product present.

5104.4.2 Pile and palletized storage aisles. Solid pile and palletized storage shall be arranged so the maximum travel distance to an aisle is 25 feet (7620 mm). Aisles shall have a minimum width of 4 feet (1219 mm).

5104.4.3 Rack storage aisles. Rack storage shall be arranged with a minimum aisle width of 8 feet (2438 mm) between rows of racks and 8 feet (2438 mm) between racks and adjacent solid pile or palletized storage. Where early suppression fast-response (ESFR) sprinklers provide automatic sprinkler protection, the minimum aisle width shall be 4 feet (1219 mm).

5104.4.4 Combustible commodities. Combustible commodities other than flammable and combustible liquids shall be permitted to be stored in an aerosol product warehouse.

Exception: Flammable and combustible liquids in 1-quart (946 ml) metal containers and smaller shall be permitted to be stored in an aerosol product warehouse.

5104.5 Storage in inside flammable liquid storage rooms. Inside flammable liquid storage rooms shall comply with Section 5704.3.7. The maximum quantities of aerosol products shall comply with Section 5104.5.1 or 5104.5.2.

5104.5.1 Storage rooms of 500 square feet or less. The storage of aerosol products in flammable liquid storage rooms less than or equal to 500 square feet (46 m²) in area shall not exceed the following quantities:

1. A net weight of 1,000 pounds (454 kg) of Level 2 aerosol products.
2. A net weight of 500 pounds (227 kg) of Level 3 aerosol products.

3. A combined net weight of 1,000 pounds (454 kg) of Level 2 and 3 aerosol products.

5104.5.2 Storage rooms greater than 500 square feet.

The storage of aerosol products in flammable liquid storage rooms greater than 500 square feet (46 m²) in area shall not exceed the following quantities:

1. A net weight of 2,500 pounds (1135 kg) of Level 2 aerosol products.
2. A net weight of 1,000 pounds (454 kg) of Level 3 aerosol products.
3. A combined net weight of 2,500 pounds (1135 kg) of Level 2 and 3 aerosol products.

The maximum aggregate storage quantity of Level 2 and 3 aerosol products permitted in separate inside storage rooms protected by an approved automatic sprinkler system in accordance with NFPA 30B shall be 5,000 pounds (2270 kg).

5104.6 Storage in liquid warehouses. The storage of Level 2 and 3 aerosol products in liquid warehouses shall comply with NFPA 30B. The storage shall be located within segregated storage areas in accordance with Section 5104.3.2 and Sections 5104.6.1 through 5104.6.3.

5104.6.1 Containment. Spill control or drainage shall be provided to prevent the flow of liquid to within 8 feet (2438 mm) of the segregated storage area.

5104.6.2 Sprinkler design. Sprinkler protection shall be designed based on the highest level of aerosol product present.

5104.6.3 Opening protection into segregated storage areas. Fire doors or gates opening into the segregated storage area shall either be self-closing or provided with automatic-closing devices activated by sprinkler water flow or an approved fire detection system.

5104.7 Storage in Group M occupancies. Storage of Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 products in occupancies in Group M shall comply with Table 5104.7. Retail display shall comply with Section 5106.

**TABLE 5104.7
MAXIMUM QUANTITIES OF LEVEL 2 AND 3 AEROSOL PRODUCTS, AEROSOL COOKING SPRAY PRODUCTS AND PLASTIC AEROSOL 3 PRODUCTS IN RETAIL STORAGE AREAS**

MAXIMUM NET WEIGHT PER FLOOR (pounds)			
Floor	Nonsegregated storage ^{a, b}	Segregated storage	
		Storage cabinets ^b	Separated from retail area ^c
Basement	Not Permitted	Not Permitted	Not Permitted
Ground	2,500	5,000	Note d
Upper	500	1,000	Note d

- For SI: 1 pound = 0.454 kg, 1 square foot = 0.0929 m².
- The total aggregate quantity on display and in storage shall not exceed the maximum retail display quantity indicated in Section 5106.3.
 - Storage quantities indicated are the maximum permitted in any 50,000-square-foot area.
 - The storage area shall be separated from the retail area with a 1-hour fire-resistance-rated assembly.
 - See Table 5104.3.2.

5104.8 Storage of aerosol cooking spray products. Aerosol cooking spray products shall be permitted to be stored in a general purpose warehouse.

5104.8.1 Mixed storage. Where aerosol cooking spray products are mixed with other higher-hazard aerosol products, the provided isolation, storage height restrictions and protection shall be based on the highest-hazard aerosol product present.

5104.8.2 Storage conditions. The storage and handling of aerosol cooking spray products shall comply with this chapter and NFPA 30B.

**SECTION 5105
OUTSIDE STORAGE**

5105.1 General. The outside storage of Level 2 and 3 aerosol products and plastic aerosol 3 products, including storage in temporary storage trailers, shall be separated from exposures in accordance with Table 5105.1.

**TABLE 5105.1
DISTANCE TO EXPOSURES FOR OUTSIDE STORAGE OF LEVEL 2 AND 3 AEROSOL PRODUCTS AND PLASTIC AEROSOL 3 PRODUCTS**

EXPOSURE	MINIMUM DISTANCE FROM AEROSOL STORAGE (feet) ^a
Buildings	50
Exit discharge to a public way	50
Lot lines	20
Other outside storage	50
Public alleys, public ways, public streets	20

- For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.
- The minimum separation distance indicated is not required where exterior walls having a 2-hour fire-resistance rating without penetrations separate the storage from the exposure. The walls shall extend not less than 30 inches above and to the sides of Level 2 and 3 aerosol products and plastic aerosol 3 products.

**SECTION 5106
RETAIL DISPLAY**

5106.1 General. This section shall apply to the retail display of 500 pounds (227 kg) or more of Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 products.

5106.2 Aerosol display and normal merchandising not exceeding 8 feet in height. Aerosol display and normal merchandising not exceeding 8 feet (2438 mm) in height shall be in accordance with Sections 5106.2.1 through 5106.2.5.

5106.2.1 Maximum quantities in retail display areas. Aerosol products, aerosol cooking spray products and plastic aerosol 3 products in retail display areas shall not exceed quantities needed for display and normal merchandising and shall not exceed the quantities in Table 5106.2.1.

**TABLE 5106.2.1
MAXIMUM QUANTITIES OF LEVEL 2 AND 3 AEROSOL
PRODUCTS, AEROSOL COOKING SPRAY PRODUCTS AND
PLASTIC AEROSOL 3 PRODUCTS IN RETAIL DISPLAY AREAS**

MAXIMUM NET WEIGHT PER FLOOR (pounds) ^b			
Floor	Unprotected ^a	Protected in accordance with Section 5106.2 ^{a, c}	Protected in accordance with Section 5106.3 ^c
Basement	Not Allowed	500	500
Ground	2,500	10,000	10,000
Upper	500	2,000	Not Allowed

For SI: 1 pound = 0.454 kg, 1 square foot = 0.0929 m².

- The total quantity shall not exceed 1,000 pounds net weight in any one 100-square-foot retail display area.
- Per 25,000-square-foot retail display area.
- Minimum Ordinary Hazard Group 2 wet-pipe automatic sprinkler system throughout the retail sales occupancy.

5106.2.2 Aerosol cooking spray product and plastic aerosol 3 product storage and fire protection. The storage and handling of aerosol cooking spray products and plastic aerosol 3 products shall comply with this chapter and NFPA 30B.

5106.2.3 Display of aerosol products. Level 2 and 3 aerosol products shall not be stacked more than 6 feet (1829 mm) high from the base of the aerosol product array to the top of the aerosol product array unless the aerosol products are placed on fixed shelving or otherwise secured in an approved manner. Where storage or retail display is on shelves, the height of such storage or retail display to the top of aerosol products shall not exceed 8 feet (2438 mm).

5106.2.4 Combustible cartons. Aerosol products located in retail display areas shall be removed from combustible cartons.

Exceptions:

- Display areas that use a portion of combustible cartons that consist of only the bottom panel and not more than 2 inches (51 mm) of the side panel are allowed.
- Where the display area is protected in accordance with Tables 6.4.2.7(a) through 6.4.2.7(l) of NFPA 30B, storage of aerosol products in combustible cartons is allowed.

5106.2.5 Retail display automatic sprinkler system. Where an automatic sprinkler system is required for the protected retail display of aerosol products, the wet-pipe automatic sprinkler system shall be in accordance with Section 903.3.1.1. The minimum system design shall be for an Ordinary Hazard Group 2 occupancy. The system shall be provided throughout the retail display area.

5106.3 Aerosol product display and normal merchandising exceeding 8 feet in height. Aerosol product display and merchandising exceeding 8 feet (2438 mm) in height shall be in accordance with Sections 5106.3.1 through 5106.3.3.

5106.3.1 Maximum quantities in retail display areas. Aerosol products in retail display areas shall not exceed

quantities needed for display and normal merchandising and shall not exceed the quantities in Table 5106.2.1, with fire protection in accordance with Section 5106.3.2.

5106.3.2 Automatic sprinkler protection. Aerosol product and plastic aerosol 3 product display and merchandising areas shall be protected by an automatic sprinkler system based on the requirements set forth in Tables 6.4.2.7(a) through 6.4.2.7(l) of NFPA 30B and the following:

- Protection shall be based on the highest level of aerosol product in the array and the packaging method of the storage located more than 6 feet (1829 mm) above the finished floor.
- Where using the cartoned aerosol products tables of NFPA 30B, uncartoned or display-cut Level 2 and 3 aerosol products and plastic aerosol 3 products shall not be permitted more than 6 feet (1829 mm) above the finished floor.
- The design area for Level 2 and 3 aerosol products and plastic aerosol 3 products shall extend not less than 20 feet (6096 mm) beyond the Level 2 and 3 aerosol product and plastic aerosol 3 product display and merchandising areas.
- Where ordinary and high-temperature ceiling sprinkler systems are adjacent to each other, noncombustible draft curtains shall be installed at the interface.

5106.3.3 Separation of Level 2 and 3 aerosol product and plastic aerosol 3 product areas. Separation of Level 2 and 3 aerosol product areas or plastic aerosol 3 product areas shall comply with the following:

- Level 2 and 3 aerosol product or plastic aerosol 3 product display and merchandising areas shall be separated from each other by not less than 25 feet (7620 mm). See Table 5106.2.1.
- Level 2 and 3 aerosol product or plastic aerosol 3 product display and merchandising areas shall be separated from flammable and combustible liquids storage and display areas by one or a combination of the following:
 - Segregating areas from each other by horizontal distance of not less than 25 feet (7620 mm).
 - Isolating areas from each other by a noncombustible partition extending not less than 18 inches (457 mm) above the merchandise.
 - In accordance with Section 5106.5.
- Where Item 2.2 is used to separate Level 2 or 3 aerosol products or plastic aerosol 3 products from flammable or combustible liquids, and the aerosol products are located within 25 feet (7620 mm) of flammable or combustible liquids, the area below the noncombustible partition shall be liquid tight at the floor to prevent spilled liquids from flowing beneath the aerosol products.

AEROSOLS

5106.4 Maximum quantities in storage areas. Aerosol products in storage areas adjacent to retail display areas shall not exceed the quantities in Table 5106.4.

5106.5 Special protection design for Level 2 and 3 aerosol products adjacent to flammable and combustible liquids in double-row racks. The display and merchandising of Level 2 and 3 aerosol products adjacent to flammable and combustible liquids in double-row racks shall be in accordance with Section 5106.3.3 or Sections 5106.5.1 through 5106.5.8.

5106.5.1 Fire protection. Fire protection for the display and merchandising of Level 2 and 3 aerosols in double-row racks shall be in accordance with Table 7.5.1 and Figure 7.5.1 of NFPA 30B.

5106.5.2 Cartoned aerosol products. Level 2 and 3 aerosol products displayed or merchandised more than 8 feet (2438 mm) above the finished floor shall be in cartons.

5106.5.3 Shelving. Shelving in racks shall be limited to wire mesh shelving having uniform openings not more than 6 inches (152 mm) apart, with the openings comprising not less than 50 percent of the overall shelf area.

5106.5.4 Aisles. Racks shall be arranged so that aisles not less than 7½ feet (2286 mm) wide are maintained between rows of racks and adjacent solid-piled or palletized merchandise.

5106.5.5 Flue spaces. Flue spaces in racks shall comply with the following:

1. Transverse flue spaces—Nominal 3-inch (76 mm) transverse flue spaces shall be maintained between merchandise and rack uprights.
2. Longitudinal flue spaces—Nominal 6-inch (152 mm) longitudinal flue spaces shall be maintained.

5106.5.6 Horizontal barriers. Horizontal barriers constructed of minimum ¾-inch-thick (10 mm) plywood or minimum 0.034-inch (0.086 mm) (No. 22 gage) sheet metal shall be provided and located in accordance with Table 7.5.1 and Figure 7.5.1 of NFPA 30B where in-rack sprinklers are installed.

5106.5.7 Class I, II, III, IV and plastic commodities. Class I, II, III, IV and plastic commodities located adjacent to Level 2 and 3 aerosol products and plastic aerosol 3 products shall be protected in accordance with NFPA 13.

5106.5.8 Flammable and combustible liquids. Class I, II, III A and III B liquids shall be allowed to be located adjacent to Level 2 and 3 aerosol products where both of the following conditions are met:

1. Class I, II, IIIA and IIIB liquid containers: Containers for Class I, II, IIIA and IIIB liquids shall be limited to 1.06-gallon (4 L) metal-relieving and nonrelieving style containers and 5.3-gallon (20 L) metal-relieving style containers.
2. Fire protection for Class I, II, IIIA and IIIB Liquids: Automatic sprinkler protection for Class I, II, IIIA and IIIB liquids shall be in accordance with Chapter 57.

**SECTION 5107
MANUFACTURING FACILITIES**

5107.1 General. Manufacturing facilities shall be in accordance with NFPA 30B.

**TABLE 5106.4
MAXIMUM STORAGE QUANTITIES FOR STORAGE AREAS ADJACENT TO RETAIL DISPLAY
OF LEVEL 2 AND 3 AEROSOL PRODUCTS AND PLASTIC AEROSOL 3 PRODUCTS**

MAXIMUM NET WEIGHT PER FLOOR (pounds)			
Floor	Unseparated ^{a, b}	Separated	
		Storage cabinets ^b	1-hour occupancy separation
Basement	Not Allowed	Not Allowed	Not Allowed
Ground	2,500	5,000	In accordance with Sections 6.4.4.3 and 6.4.4.4 of NFPA 30B
Upper	500	1,000	In accordance with Sections 6.4.4.3 and 6.4.4.4 of NFPA 30B

For SI: 1 pound = 0.454 kg, 1 square foot = 0.0929 m².

a. The aggregate quantity in storage and retail display shall not exceed the quantity limits for retail display.

b. In any 50,000-square-foot area.

CHAPTER 52
RESERVED

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 53 – COMPRESSED GASES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
[T-19 §3.18 (a)(b)]				X																		

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 53

COMPRESSED GASES

User note:

About this chapter: Chapter 53 regulates the storage, use and handling of all flammable and nonflammable compressed gases, such as those that are used in medical facilities, air separation plants, industrial plants, agricultural equipment and similar occupancies. Also, this chapter regulates inert gases, such as CO₂ used for enrichment and beverage dispensing, that although inert are considered asphyxiants and in larger amounts pose a life safety hazard. Standards for the design, construction and marking of compressed gas cylinders and pressure vessels are referenced. Compressed gases used in welding and cutting, cryogenic liquids and liquefied petroleum gases are also regulated under Chapters 35, 55 and 61, respectively. Compressed gases that are classified as hazardous materials are also regulated in Chapter 50, which includes general requirements.

SECTION 5301 GENERAL

5301.1 Scope. Storage, use and handling of compressed gases in compressed gas containers, cylinders, tanks and systems shall comply with this chapter and NFPA 55, including those gases regulated elsewhere in this code. Partially full compressed gas containers, cylinders or tanks containing residual gases shall be considered as full for the purposes of the controls required.

Liquefied natural gas for use as a vehicular fuel shall also comply with NFPA 52 and NFPA 59A.

Compressed gases classified as hazardous materials shall also comply with Chapter 50 for general requirements and chapters addressing specific hazards, including Chapters 58 (Flammable Gases and Flammable Cryogenic Fluids), 60 (Highly Toxic and Toxic Materials), 63 (Oxidizers, Oxidizing Gases and Oxidizing Cryogenic Fluids) and 64 (Pyrophoric Materials).

Compressed hydrogen (CH₂) shall also comply with the applicable portions of Chapters 23 and 58 of this code, the *International Fuel Gas Code* and NFPA 2.

Cutting and welding gases shall also comply with Chapter 35.

Exceptions:

1. Gases used as refrigerants in refrigeration systems (see Section 605).
2. Compressed natural gas (CNG) for use as a vehicular fuel shall comply with Chapter 23, the *International Fuel Gas Code* and NFPA 52.
3. Cryogenic fluids shall comply with Chapter 55.
4. LP-gas shall comply with Chapter 61 and the *International Fuel Gas Code*.

[California Code of Regulations, Title 19, Division 1, §3.18(a) and (b)] Hazardous Areas.

(a) *General. Occupancies or portions thereof used or intended to be used as operating rooms, surgeries, delivery rooms, storage rooms and similar hazardous locations in which flammable or nonflammable mixtures of gases are used or stored shall be maintained in accordance with the provisions of NFPA 99-2005 Inhalation*

Anesthetics, NFPA 99-2005 Laboratories, NFPA 99-2005 Hyperbaric Facilities, NFPA 55-2010 Bulk Oxygen Systems at Consumer Sites, and this section.

(b) *Containers. Cylinders and fittings for compressed gases shall conform to the regulations of the Federal Department of Transportation.*

Compressed gas cylinders shall be clearly marked with the name of the gas contained therein. Cylinders shall bear color markings and labels conforming to the following:

Gas	Color
(1) Oxygen.....	Green
(2) Carbon Dioxide	Gray
(3) Nitrous Oxide	Light Blue
(4) Cyclopropan	Orange
(5) Helium	Brown
(6) Ethlene.....	Red
(7) Carbon Dioxide and Oxygen.....	Gray and Green
(8) Helium and Oxygen.....	Brown and Green

Note: Polished metal or chrome-plated cylinders shall have color tags in addition to color labels.

When deemed necessary by the enforcing agency, compressed gas cylinders shall be secured by chains, metal straps or other approved materials to prevent overturning.

5301.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 5302 DEFINITIONS

5302.1 Definitions. The following terms are defined in Chapter 2:

COMPRESSED GAS.

COMPRESSED GAS CONTAINER.

COMPRESSED GAS SYSTEM.

NESTING.

TUBE TRAILER.

SECTION 5303 GENERAL REQUIREMENTS

5303.1 Containers, cylinders and tanks. Compressed gas containers, cylinders and tanks shall comply with this section. Compressed gas containers, cylinders or tanks that are not designed for refillable use shall not be refilled after use of the original contents.

5303.2 Design and construction. Compressed gas containers, cylinders and tanks shall be designed, fabricated, tested, marked with the specifications of manufacture and maintained in accordance with the regulations of DOTn 49 CFR Parts 100–185 or the *ASME Boiler and Pressure Vessel Code*, Section VIII.

5303.3 Pressure relief devices. Pressure relief devices shall be in accordance with Sections 5303.3.1 through 5303.3.5.

5303.3.1 Where required. Pressure relief devices shall be provided to protect containers, cylinders and tanks containing compressed gases from rupture in the event of overpressure.

Exception: Cylinders, containers and tanks where exempt from the requirements for pressure relief devices specified by the standards of design listed in Section 5303.3.2.

5303.3.2 Design. Pressure relief devices to protect containers shall be designed and provided in accordance with CGA S-1.1, CGA S-1.2, CGA S-1.3 or the *ASME Boiler and Pressure Vessel Code*, Section VIII, as applicable.

5303.3.3 Sizing. Pressure relief devices shall be sized in accordance with the specifications to which the container was fabricated and to material-specific requirements as applicable.

5303.3.4 Arrangement. Pressure relief devices shall be arranged to discharge upward and unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container, adjacent structures or personnel.

Exception: DOTn specification containers having an internal volume of 30 cubic feet (0.855 m³) or less.

5303.3.5 Freeze protection. Pressure relief devices or vent piping shall be designed or located so that moisture cannot collect and freeze in a manner that would interfere with the operation of the device.

5303.4 Marking. Stationary and portable compressed gas containers, cylinders, tanks and systems shall be marked in accordance with Sections 5303.4.1 through 5303.4.3.

5303.4.1 Stationary compressed gas containers, cylinders and tanks. Stationary compressed gas containers, cylinders and tanks shall be marked with the name of the gas and in accordance with Sections 5003.5 and 5003.6. Markings shall be visible from any direction of approach.

5303.4.2 Portable containers, cylinders and tanks. Portable compressed gas containers, cylinders and tanks shall be marked in accordance with CGA C-7.

5303.4.3 Piping systems. Piping systems shall be marked in accordance with ASME A13.1. Markings used for piping systems shall consist of the content's name and include a direction-of-flow arrow. Markings shall be provided at each valve; at wall, floor or ceiling penetrations; at each change of direction; and at not less than every 20 feet (6096 mm) or fraction thereof throughout the piping run.

Exceptions:

1. Piping that is designed or intended to carry more than one gas at various times shall have appropriate signs or markings posted at the manifold, along the piping and at each point of use to provide clear identification and warning.
2. Piping within gas manufacturing plants, gas processing plants, refineries and similar occupancies shall be marked in an approved manner.

5303.5 Security. Compressed gas containers, cylinders, tanks and systems shall be secured against accidental dislodgement and against access by unauthorized personnel in accordance with Sections 5303.5.1 through 5303.5.3.

5303.5.1 Security of areas. Areas used for the storage, use and handling of compressed gas containers, cylinders, tanks and systems shall be secured against unauthorized entry and safeguarded in an approved manner.

5303.5.2 Physical protection. Compressed gas containers, cylinders, tanks and systems that could be exposed to physical damage shall be protected. Guard posts or other approved means shall be provided to protect compressed gas containers, cylinders, tanks and systems indoors and outdoors from vehicular damage and shall comply with Section 312.

5303.5.3 Securing compressed gas containers, cylinders and tanks. Compressed gas containers, cylinders and tanks shall be secured to prevent falling caused by contact, vibration or seismic activity. Securing of compressed gas containers, cylinders and tanks shall be by one of the following methods:

1. Securing containers, cylinders and tanks to a fixed object with one or more restraints.
2. Securing containers, cylinders and tanks on a cart or other mobile device designed for the movement of compressed gas containers, cylinders or tanks.
3. Nesting of compressed gas containers, cylinders and tanks at container filling or servicing facilities or in sellers' warehouses not open to the public. Nesting shall be allowed provided that the nested containers, cylinders or tanks, if dislodged, do not obstruct the required means of egress.
4. Securing of compressed gas containers, cylinders and tanks to or within a rack, framework, cabinet or similar assembly designed for such use.

Exception: Compressed gas containers, cylinders and tanks in the process of examination, filling, transport or servicing.

5303.6 Valve protection. Compressed gas container, cylinder and tank valves shall be protected from physical damage by means of protective caps, collars or similar devices in accordance with Sections 5303.6.1 and 5303.6.2.

5303.6.1 Compressed gas container, cylinder or tank protective caps or collars. Compressed gas containers, cylinders and tanks designed for protective caps, collars or other protective devices shall have the caps or devices in place except when the containers, cylinders or tanks are in use or are being serviced or filled.

5303.6.2 Caps and plugs. Compressed gas containers, cylinders and tanks designed for valve protection caps or other protective devices shall have the caps or devices in place. When outlet caps or plugs are installed, they shall be in place.

Exception: Compressed gas containers, cylinders or tanks in use, being serviced or being filled.

5303.7 Separation from hazardous conditions. Compressed gas containers, cylinders and tanks and systems in storage or use shall be separated from materials and conditions that pose exposure hazards to or from each other. Compressed gas containers, cylinders, tanks and systems in storage or use shall be separated in accordance with Sections 5303.7.1 through 5303.7.11.2.

5303.7.1 Incompatible materials. Compressed gas containers, cylinders and tanks shall be separated from each other based on the hazard class of their contents. Compressed gas containers, cylinders and tanks shall be separated from incompatible materials in accordance with Section 5003.9.8.

5303.7.2 Combustible waste, vegetation and similar materials. Combustible waste, vegetation and similar materials shall be kept not less than 10 feet (3048 mm) from compressed gas containers, cylinders, tanks and systems. A noncombustible partition, without openings or penetrations and extending not less than 18 inches (457 mm) above and to the sides of the storage area is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

5303.7.3 Ledges, platforms and elevators. Compressed gas containers, cylinders and tanks shall not be placed near elevators, unprotected platform ledges or other areas where falling would result in compressed gas containers, cylinders or tanks being allowed to drop distances exceeding one-half the height of the container, cylinder or tank.

5303.7.4 Temperature extremes. Compressed gas containers, cylinders and tanks, whether full or partially full, shall not be exposed to artificially created high temperatures exceeding 125°F (52°C) or subambient (low) temperatures unless designed for use under the exposed conditions.

5303.7.5 Falling objects. Compressed gas containers, cylinders, tanks and systems shall not be placed in areas where they are capable of being damaged by falling objects.

5303.7.6 Heating. Compressed gas containers, cylinders and tanks, whether full or partially full, shall not be heated by devices that could raise the surface temperature of the container, cylinder or tank to above 125°F (52°C). Heating devices shall comply with the *California Mechanical Code* and the *California Electrical Code*. Approved heating methods involving temperatures of less than 125°F (52°C) are allowed to be used by trained personnel. Devices designed to maintain individual compressed gas containers, cylinders or tanks at constant temperature shall be approved and shall be designed to be fail-safe.

5303.7.7 Sources of ignition. Open flames and high-temperature devices shall not be used in a manner that creates a hazardous condition.

5303.7.8 Exposure to chemicals. Compressed gas containers, cylinders, tanks and systems shall not be exposed to corrosive chemicals or fumes that could damage containers, cylinders, tanks, valves or valve-protective caps.

5303.7.9 Exhausted enclosures. Where exhausted enclosures are provided as a means to segregate compressed gas containers, cylinders and tanks from exposure hazards, such enclosures shall comply with the requirements of Section 5003.8.5.

5303.7.10 Gas cabinets. Where gas cabinets are provided as a means to separate compressed gas containers, cylinders and tanks from exposure hazards, such gas cabinets shall comply with the requirements of Section 5003.8.6.

5303.7.11 Tube trailers. Tube trailers, including those containing compatible compressed gases, shall be surrounded by a clear space of not less than 3 feet (914 mm) to allow for maintenance, access and inspection.

5303.7.11.1 Individual tube trailers containing incompatible materials. Increased separation distances between individual tube trailers containing incompatible gases shall be provided where required by Section 5303.7.1.

5303.7.11.2 Connections. Piping systems used to connect tube trailers to a user piping system shall not be viewed as an encroachment into the 3-foot (914 mm) clear space.

5303.8 Wiring and equipment. Electrical wiring and equipment shall comply with the *California Electrical Code*. Compressed gas containers, cylinders, tanks and systems shall not be located where they could become part of an electrical circuit. Compressed gas containers, cylinders, tanks and systems shall not be used for electrical grounding.

5303.9 Service and repair. Service, repair, modification or removal of valves, pressure-relief devices or other compressed gas container, cylinder or tank appurtenances shall be performed by trained personnel.

5303.10 Unauthorized use. Compressed gas containers, cylinders, tanks and systems shall not be used for any purpose other than to serve as a vessel for containing the product that it is designed to contain.

5303.11 Exposure to fire. Compressed gas containers, cylinders and tanks that have been exposed to fire shall be removed from service. Containers, cylinders and tanks so removed shall be handled by approved, qualified persons.

5303.12 Leaks, damage or corrosion. Leaking, damaged or corroded compressed gas containers, cylinders and tanks shall be removed from service. Leaking, damaged or corroded compressed gas systems shall be replaced or repaired in accordance with the following:

1. Compressed gas containers, cylinders and tanks that have been removed from service shall be handled in an approved manner.
2. Compressed gas systems that are determined to be leaking, damaged or corroded shall be repaired to a serviceable condition or removed from service.

5303.13 Surface of unprotected storage or use areas. Unless otherwise specified in Section 5303.14, compressed gas containers, cylinders and tanks are allowed to be stored or used without being placed under overhead cover. To prevent bottom corrosion, containers, cylinders and tanks shall be protected from direct contact with soil or unimproved surfaces. The surface of the area on which the containers are placed shall be graded to prevent accumulation of water.

5303.14 Overhead cover. Compressed gas containers, cylinders and tanks are allowed to be stored or used in the sun except in locations where extreme temperatures prevail. Where extreme temperatures prevail, overhead covers shall be provided.

5303.15 Lighting. Approved lighting by natural or artificial means shall be provided.

5303.16 Vaults. Generation, compression, storage and dispensing equipment for compressed gases shall be allowed to be located in either above- or below-grade vaults complying with Sections 5303.16.1 through 5303.16.14.

5303.16.1 Listing required. Vaults shall be listed by a nationally recognized testing laboratory.

Exception: Where approved by the fire code official, below-grade vaults are allowed to be constructed on site, provided that the design is in accordance with the *California Building Code* and that special inspections are conducted to verify structural strength and compliance of the installation with the approved design in accordance with Section 1707 of the *California Building Code*. Installation plans for below-grade vaults that are constructed on site shall be prepared by, and the design shall bear the stamp of, a professional engineer. Consideration shall be given to soil and hydrostatic loading on the floors, walls and lid; anticipated seismic forces; uplifting by ground water or flooding; and to loads imposed from above, such as traffic and equipment loading on the vault lid.

5303.16.2 Design and construction. The vault shall completely enclose generation, compression, storage or dispensing equipment located in the vault. There shall not be openings in the vault enclosure except those necessary for vault ventilation and access, inspection, filling, emptying or venting of equipment in the vault. The walls and

floor of the vault shall be constructed of reinforced concrete not less than 6 inches (152 mm) thick. The top of an above-grade vault shall be constructed of noncombustible material and shall be designed to be weaker than the walls of the vault to ensure that the thrust of any explosion occurring inside the vault is directed upward.

The top of an at- or below-grade vault shall be designed to relieve safely or contain the force of an explosion occurring inside the vault. The top and floor of the vault and the tank foundation shall be designed to withstand the anticipated loading, including loading from vehicular traffic, where applicable. The walls and floor of a vault installed below grade shall be designed to withstand anticipated soil and hydrostatic loading. Vaults shall be designed to be wind and earthquake resistant, in accordance with the *California Building Code*.

5303.16.3 Secondary containment. Vaults shall be substantially liquid-tight and there shall not be backfill within the vault. The vault floor shall drain to a sump. For premanufactured vaults, liquid tightness shall be certified as part of the listing provided by a nationally recognized testing laboratory. For field-erected vaults, liquid tightness shall be certified in an approved manner.

5303.16.4 Internal clearance. There shall be sufficient clearance within the vault to allow for visual inspection and maintenance of equipment in the vault.

5303.16.5 Anchoring. Vaults and equipment contained therein shall be suitably anchored to withstand uplifting by groundwater or flooding. The design shall verify that uplifting is prevented even where equipment within the vault is empty.

5303.16.6 Vehicle impact protection. Vaults shall be resistant to damage from the impact of a motor vehicle, or vehicle impact protection shall be provided in accordance with Section 312.

5303.16.7 Arrangement. Equipment in vaults shall be listed or approved for above-ground use. Where multiple vaults are provided, adjacent vaults shall be allowed to share a common wall. The common wall shall be liquid and vapor tight and shall be designed to withstand the load imposed when the vault on either side of the wall is filled with water.

5303.16.8 Connections. Connections shall be provided to permit the venting of each vault to dilute, disperse and remove vapors prior to personnel entering the vault.

5303.16.9 Ventilation. Vaults shall be provided with an exhaust ventilation system installed in accordance with Section 5004.3. The ventilation system shall operate continuously or be designed to operate upon activation of the vapor or liquid detection system. The system shall provide ventilation at a rate of not less than 1 cubic foot per minute (cfm) per square foot [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$] of floor area, but not less than 150 cfm (4 m^3/min). The exhaust system shall be designed to provide air movement across all parts of the vault floor for gases having a density greater than air and across all parts of the vault ceiling for gases having a density less than air. Supply ducts shall

extend to within 3 inches (76 mm), but not more than 12 inches (305 mm), of the floor. Exhaust ducts shall extend to within 3 inches (76 mm), but not more than 12 inches (305 mm) of the floor or ceiling, for heavier-than-air or lighter-than-air gases, respectively. The exhaust system shall be installed in accordance with the *California Mechanical Code*.

5303.16.10 Monitoring and detection. Vaults shall be provided with approved vapor and liquid detection systems and equipped with on-site audible and visual warning devices with battery backup. Vapor detection systems shall sound an alarm when the system detects vapors that reach or exceed 25 percent of the lower explosive limit (LEL) or one-half the immediately dangerous to life and health (IDLH) concentration for the gas in the vault. Vapor detectors shall be located not higher than 12 inches (305 mm) above the lowest point in the vault for heavier-than-air gases and not lower than 12 inches (305 mm) below the highest point in the vault for lighter-than-air gases. Liquid detection systems shall sound an alarm upon detection of any liquid, including water. Liquid detectors shall be located in accordance with the manufacturer's instructions. Activation of either vapor or liquid detection systems shall cause a signal to be sounded at an approved, constantly attended location within the facility served by the tanks or at an approved location. Activation of vapor detection systems shall shut off gas-handling equipment in the vault and dispensers.

5303.16.11 Liquid removal. Means shall be provided to recover liquid from the vault. Where a pump is used to meet this requirement, it shall not be permanently installed in the vault. Electric-powered portable pumps shall be suitable for use in Class I, Division 1, locations, as defined in the *California Electrical Code*.

5303.16.12 Relief vents. Vent pipes for equipment in the vault shall terminate not less than 12 feet (3658 mm) above ground level.

5303.16.13 Accessway. Vaults shall be provided with an approved personnel accessway with a minimum dimension of 30 inches (762 mm) and with a permanently affixed, nonferrous ladder. Accessways shall be designed to be nonsparking. Travel distance from any point inside a vault to an accessway shall not exceed 20 feet (6096 mm). At each entry point, a warning sign indicating the need for procedures for safe entry into confined spaces shall be posted. Entry points shall be secured against unauthorized entry and vandalism.

5303.16.14 Classified area. The interior of a vault containing a flammable gas shall be designated a Class I, Division 1, location, as defined in the *California Electrical Code*.

SECTION 5304 STORAGE OF COMPRESSED GASES

5304.1 Upright storage. Compressed gas containers, cylinders and tanks, except those designed for use in a horizontal position, and all compressed gas containers, cylinders and

tanks containing nonliquefied gases, shall be stored in an upright position with the valve end up. An upright position shall include conditions where the container, cylinder or tank axis is inclined as much as 45 degrees (0.80 rad) from the vertical.

Exceptions:

1. Compressed gas containers with a water volume less than 1.3 gallons (5 L) are allowed to be stored in a horizontal position.
2. Cylinders, containers and tanks containing nonflammable gases, or cylinders, containers and tanks containing nonliquefied flammable gases that have been secured to a pallet for transportation purposes.

5304.2 Material-specific regulations. In addition to the requirements of this section, indoor and outdoor storage of compressed gases shall comply with the material-specific provisions of Chapters 54, 58 and 60 through 67.

SECTION 5305 USE AND HANDLING OF COMPRESSED GASES

5305.1 Compressed gas systems. Compressed gas systems shall be suitable for the use intended and shall be designed by persons competent in such design. Compressed gas equipment, machinery and processes shall be listed or approved.

5305.2 Controls. Compressed gas system controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. Automatic controls shall be designed to be fail-safe.

5305.3 Piping systems. Piping, including tubing, valves, fittings and pressure regulators, shall comply with this section and Chapter 50. Piping, tubing, pressure regulators, valves and other apparatus shall be kept gas tight to prevent leakage.

5305.4 Valves. Valves utilized on compressed gas systems shall be suitable for the use intended. Access to such valves shall be provided and maintained. Valve handles or operators for required shutoff valves shall not be removed or otherwise altered to prevent access.

5305.5 Venting. Venting of gases shall be directed to an approved location. Venting shall comply with the *California Mechanical Code*.

5305.6 Upright use. Compressed gas containers, cylinders and tanks, except those designed for use in a horizontal position, and all compressed gas containers, cylinders and tanks containing nonliquefied gases, shall be used in an upright position with the valve end up. An upright position shall include conditions where the container, cylinder or tank axis is inclined as much as 45 degrees (0.80 rad) from the vertical. Use of nonflammable liquefied gases in the inverted position where the liquid phase is used shall not be prohibited provided that the container, cylinder or tank is properly secured and the dispensing apparatus is designed for liquefied gas use.

COMPRESSED GASES

Exception: Compressed gas containers, cylinders and tanks with a water volume less than 1.3 gallons (5 L) are allowed to be used in a horizontal position.

5305.7 Transfer. Transfer of gases between containers, cylinders and tanks shall be performed by qualified personnel using equipment and operating procedures in accordance with CGA P-1.

Exception: The fueling of vehicles with CNG or CH₂, conducted in accordance with Chapter 23.

5305.8 Use of compressed gas for inflation. Inflatable equipment, devices or balloons shall only be pressurized or filled with compressed air or inert gases.

5305.9 Material-specific regulations. In addition to the requirements of this section, indoor and outdoor use of compressed gases shall comply with the material-specific provisions of Chapters 54, 58 and 60 through 67.

5305.10 Handling. The handling of compressed gas containers, cylinders and tanks shall comply with Sections 5305.10.1 and 5305.10.2.

5305.10.1 Carts and trucks. Containers, cylinders and tanks shall be moved using an approved method. Where containers, cylinders or tanks are moved by hand cart, hand truck or other mobile device, such carts, trucks or devices shall be designed for the secure movement of containers, cylinders or tanks. Carts and trucks utilized for transport of compressed gas containers, cylinders and tanks within buildings shall comply with Section 5003.10. Carts and trucks utilized for transport of compressed gas containers, cylinders and tanks exterior to buildings shall be designed so that the containers, cylinders and tanks will be secured against dropping or otherwise striking against each other or other surfaces.

5305.10.2 Lifting devices. Ropes, chains or slings shall not be used to suspend compressed gas containers, cylinders and tanks unless provisions at time of manufacture have been made on the container, cylinder or tank for appropriate lifting attachments, such as lugs.

SECTION 5306 MEDICAL GASES

5306.1 General. Medical gases at health care-related facilities intended for patient or veterinary care shall comply with Sections 5306.2 through 5306.5 in addition to other requirements of this chapter and Section 427 of the *California Building Code*.

5306.1.1 Training. Personnel who handle medical gases and associated equipment and cylinders shall be trained on the use, safe handling and associated hazards.

5306.2 Interior supply location. Medical gases shall be located in areas dedicated to the storage of such gases without other storage or uses. Where containers of medical gases in quantities greater than the permit amount are located inside buildings, they shall be in a 1-hour exterior room, a 1-hour interior room or a gas cabinet in accordance with Section 5306.2.1, 5306.2.2 or 5306.2.3, respectively. Rooms or areas where medical gases are stored or used in quantities exceed-

ing the maximum allowable quantity per control area as set forth in Section 5003.1 shall be in accordance with the *California Building Code* for high-hazard Group H occupancies.

5306.2.1 One-hour exterior rooms. A 1-hour exterior room shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with a fire-resistance rating of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be self-closing smoke- and draft-control assemblies having a fire protection rating of not less than 1 hour. Rooms shall have not less than one exterior wall that is provided with not less than two vents. Each vent shall have a minimum free opening area of 36 square inches (232 cm²) for each 1,000 cubic feet (28 m³) at normal temperature and pressure (NTP) of gas stored in the room and shall be not less than 72 square inches (465 cm²) in aggregate free opening area. One vent shall be within 6 inches (152 mm) of the floor and one shall be within 6 inches (152 mm) of the ceiling. Rooms shall be provided with not less than one automatic sprinkler to provide container cooling in case of fire.

5306.2.2 One-hour interior room. Where an exterior wall cannot be provided for the room, a 1-hour interior room shall be provided and shall be a room or enclosure separated from the remainder of the building by fire barriers constructed in accordance with Section 707 of the *California Building Code* or horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, with a fire-resistance rating of not less than 1 hour. Openings between the room or enclosure and interior spaces shall be provided with self-closing, smoke- and draft-control assemblies having a fire protection rating of not less than 1 hour. An automatic sprinkler system shall be installed within the room. The room shall be exhausted through a duct to the exterior. Supply and exhaust ducts shall be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior. Approved mechanical ventilation shall comply with the *California Mechanical Code* and be provided at a minimum rate of 1 cfm per square foot [0.00508 m³/(s × m²)] of the area of the room.

5306.2.3 Gas cabinets. Gas cabinets shall be constructed in accordance with Section 5003.8.6 and shall comply with the following:

1. Exhausted to the exterior through dedicated exhaust duct system installed in accordance with Chapter 5 of the *California Mechanical Code*.
2. Supply and exhaust ducts shall be enclosed in a 1-hour fire-resistance-rated shaft enclosure from the cabinet to the exterior. The average velocity of ventilation at the face of access ports or windows shall be not less than 200 feet per minute (1.02 m/s) with not less than 150 feet per minute (0.76 m/s) at any point of the access port or window.

3. Provided with an automatic sprinkler system internal to the cabinet.

5306.3 Exterior supply locations. Oxidizer medical gas systems located on the exterior of a building with quantities greater than the permit amount shall be located in accordance with Section 6304.2.1.

5306.4 Transfilling. Transfilling areas and operations including, but not limited to, ventilation and separation, shall comply with NFPA 99.

5306.5 Medical gas systems and equipment. Medical gas systems and equipment shall be installed, tested and labeled in accordance with NFPA 99 and the general provisions of this chapter. Existing medical gas systems and equipment shall be used and maintained in accordance with the use, maintenance, inspection and testing provisions of NFPA 99 for medical gas systems and equipment.

SECTION 5307 COMPRESSED GASES NOT OTHERWISE REGULATED

5307.1 General. Compressed gases in storage or use not regulated by the material-specific provisions of Chapters 6, 54, 55, and 60 through 67, including asphyxiant, irritant and radioactive gases, shall comply with this section in addition to other requirements of this chapter.

5307.2 Ventilation. Indoor storage and use areas and storage buildings shall be provided with ventilation in accordance with Section 5004.3. Where mechanical ventilation is provided, the systems shall be operational during such time as the building or space is occupied.

Exceptions:

1. A gas detection system complying with Section 5307.2.1 shall be permitted in lieu of mechanical ventilation.
2. Areas containing insulated liquid carbon dioxide systems used in beverage dispensing applications shall comply with Section 5307.3.

5307.2.1 Gas detection system. In rooms or areas not provided with ventilation in accordance with Section 5307.2, a gas detection system complying with Section 916 or, where approved, an oxygen depletion alarm system, either of which initiates audible and visible alarm signals in the room or area where sensors are installed, shall be provided.

5307.3 Insulated liquid carbon dioxide systems used in beverage dispensing applications. Insulated liquid carbon dioxide systems with more than 100 pounds (45.4 kg) of carbon dioxide used in beverage dispensing applications shall comply with Section 5307.3.1.

5307.3.1 Ventilation. Where insulated liquid carbon dioxide storage tanks, cylinders, piping and equipment are located indoors, rooms or areas containing storage tanks, cylinders, piping and equipment, and other areas where a leak of carbon dioxide is expected to accumulate, shall be provided with mechanical ventilation in accordance with

Section 5004.3 and designed to maintain the room containing carbon dioxide at a negative pressure in relation to the surrounding area.

Exception: A gas detection system complying with Section 5307.3.2 shall be permitted in lieu of mechanical ventilation.

5307.3.2 Gas detection system. Where ventilation is not provided in accordance with Section 5307.3.1, a gas detection system shall be provided in rooms or indoor areas and in below-grade outdoor locations with insulated carbon dioxide systems. Carbon dioxide sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is expected to accumulate or other approved locations. The system shall be designed as follows:

1. Activates an audible and visible supervisory alarm at a normally attended location upon detection of a carbon dioxide concentration of 5,000 ppm (9000 mg/m³).
2. Activates an audible and visible alarm within the room or immediate area where the system is installed upon detection of a carbon dioxide concentration of 30,000 ppm (54 000 mg/m³).

5307.4 Carbon dioxide enrichment systems. The design, installation and maintenance of carbon dioxide enrichment systems with more than 100 pounds (45.4 kg) of carbon dioxide, and carbon dioxide enrichment systems with any quantity of carbon dioxide having a remote fill connection, shall comply with Sections 5307.4.1 through 5307.4.7.

5307.4.1 Documentation. The following information shall be provided with the application for permit:

1. Total aggregate quantity of liquid carbon dioxide in pounds or cubic feet at normal temperature and pressure.
2. Location and total volume of the room where the carbon dioxide enrichment operation will be conducted. Identify whether the room is at grade or below grade.
3. Location of containers relative to equipment, building openings and means of egress.
4. Manufacturer's specifications and pressure rating, including cut sheets, of all piping and tubing to be used.
5. A piping and instrumentation diagram that shows piping support and remote fill connections.
6. Details of container venting, including but not limited to vent line size, material and termination location.
7. Alarm and detection system and equipment, if applicable.
8. Seismic support for containers.

5307.4.2 Equipment. Pressure relief, vent piping, fill indicators, fill connections, vent terminations, piping systems and the storage, use and handling of the carbon dioxide shall be in accordance with Chapter 53 and NFPA 55.

5307.4.3 Gas detection system. A gas detection system complying with Section 916 shall be provided in rooms or indoor areas in which the carbon dioxide enrichment process is located, in rooms or indoor areas in which container systems are located, and in other areas where carbon dioxide is expected to accumulate. Carbon dioxide sensors shall be provided within 12 inches (305 mm) of the floor in the area where the gas is expected to accumulate or leaks are most likely to occur. The system shall be designed as follows:

1. Activates a low-level alarm upon detection of a carbon dioxide concentration of 5,000 ppm (9000 mg/m³).
2. Activates a high-level alarm upon detection of a carbon dioxide concentration of 30,000 ppm (54 000 mg/m³).

5307.4.3.1 System activation. Activation of the low-level gas detection system alarm shall automatically:

1. Stop the flow of carbon dioxide to the piping system.
2. Activate the mechanical exhaust ventilation system.
3. Activate an audible and visible supervisory alarm signal at an approved location within the building.

Activation of the high-level gas detection system alarm shall automatically:

1. Stop the flow of carbon dioxide to the piping system.
2. Activate the mechanical exhaust ventilation system.
3. Activate an audible and visible evacuation alarm both inside and outside of the carbon dioxide enrichment area, and the area in which the carbon dioxide containers are located.

5307.4.4 Pressurization and ventilation. Rooms or indoor areas in which carbon dioxide enrichment is provided shall be maintained at a negative pressure in relation to the surrounding areas in the building. A mechanical ventilation system shall be provided in accordance with the *California Mechanical Code* that complies with all of the following:

1. Mechanical ventilation in the room or area shall be at a rate of not less than 1 cfm per square foot [0.00508 m³/(s × m²)].
2. When activated by the gas detection system, the mechanical ventilation system shall remain on until manually reset.
3. The exhaust system intakes shall be taken from points within 12 inches (305 mm) of the floor.
4. The ventilation system shall discharge to the outdoors in an approved location.

5307.4.5 Signage. Hazard identification signs shall be posted at the entrance to the room and indoor areas where the carbon dioxide enrichment process is located, and at the entrance to the room or indoor area where the carbon dioxide containers are located. The sign shall be not less than 8 inches (200 mm) in width and 6 inches (150 mm) in height and indicate:

CAUTION—CARBON DIOXIDE GAS
VENTILATE THE AREA BEFORE ENTERING.
A HIGH CARBON DIOXIDE (CO₂)
GAS CONCENTRATION
IN THIS AREA
CAN CAUSE ASPHYXIATION.

5307.4.6 Seismic and structural design. Carbon dioxide system containers and piping shall comply with the seismic design requirements in Chapter 16 of the *California Building Code* and shall not exceed the floor loading limitation of the building.

5307.4.7 Container refilling. Carbon dioxide containers located indoors shall not be refilled unless filled from a remote connection located outdoors.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 54 – CORROSIVE MATERIALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
5404.2.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 54

CORROSIVE MATERIALS

User note:

About this chapter: Chapter 54 addresses the hazards of corrosive materials that have a destructive effect on living tissues. Though corrosive gases exist, most corrosive materials are solid or liquid and classified as either acids or bases (alkalis). These materials may pose a wide range of hazards other than corrosivity, such as combustibility, reactivity or oxidizing hazards, and must conform to the requirements of this code with respect to all of their known hazards. The focus of this chapter is on materials whose primary hazard is corrosivity; that is, the ability to destroy or irreparably damage living tissue on contact.

SECTION 5401 GENERAL

5401.1 Scope. The storage and use of corrosive materials shall be in accordance with this chapter. Compressed gases shall also comply with Chapter 53.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 5003.11.
2. Stationary storage battery systems in accordance with Section 1207.
3. This chapter shall not apply to R-717 (ammonia) where used as a refrigerant in a refrigeration system (see Section 608).

5401.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 5402 DEFINITION

5402.1 Definition. The following term is defined in Chapter 2:

CORROSIVE.

SECTION 5403 GENERAL REQUIREMENTS

5403.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of corrosive materials in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003 and 5401.

5403.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with this chapter and Chapter 50.

SECTION 5404 STORAGE

5404.1 Indoor storage. Indoor storage of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(2), shall be in accordance with Sections 5001, 5003 and 5004 and this chapter.

5404.1.1 Liquid-tight floor. In addition to the provisions of Section 5004.12, floors in storage areas for corrosive liquids shall be of liquid-tight construction.

5404.2 Outdoor storage. Outdoor storage of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(4) shall be in accordance with Sections 5001, 5003 and 5004 and this chapter.

5404.2.1 Above-ground outside storage tanks. *When required by Section 5004.2.2,* above-ground outside storage tanks exceeding an aggregate quantity of 1,000 gallons (3785 L) of corrosive liquids shall be provided with secondary containment in accordance with Section 5004.2.2.

5404.2.2 Distance from storage to exposures. Outdoor storage of corrosive materials shall not be within 20 feet (6096 mm) of buildings not associated with the manufacturing or distribution of such materials, lot lines, public streets, public alleys, public ways or means of egress. A 2-hour fire barrier without openings or penetrations, and extending not less than 30 inches (762 mm) above and to the sides of the storage area, is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

SECTION 5405 USE

5405.1 Indoor use. The indoor use of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(2) shall be in accordance with Sections 5001, 5003 and 5005 and this chapter.

CORROSIVE MATERIALS

5405.1.1 Liquid transfer. Corrosive liquids shall be transferred in accordance with Section 5005.1.10.

5405.1.2 Ventilation. Where corrosive materials are dispensed or used, mechanical exhaust ventilation in accordance with Section 5005.2.1.1 shall be provided.

5405.2 Outdoor use. The outdoor use of corrosive materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(4) shall be in accordance with Sections 5001, 5003 and 5005 and this chapter.

5405.2.1 Distance from use to exposures. Outdoor use of corrosive materials shall be located in accordance with Section 5404.2.2.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 55 – CRYOGENIC FLUIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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CHAPTER 55

CRYOGENIC FLUIDS

User note:

About this chapter: Chapter 55 regulates the hazards associated with the storage, use and handling of cryogenic fluids through regulation of such things as pressure relief mechanisms and proper container storage. These hazards are in addition to the code requirements that address the other hazards of cryogenic fluids such as flammability and toxicity. These other characteristics are dealt with in Chapter 50 and other chapters, such as Chapter 58 and its content about flammable gases. Cryogenics are hazardous because they are held at extremely low temperatures and high pressures. Many cryogenic fluids, however, are actually inert gases and would not be regulated elsewhere in this code. Cryogenics are used for many applications but specifically have had widespread use in the biomedical field and in space programs.

SECTION 5501 GENERAL

5501.1 Scope. Storage, use and handling of cryogenic fluids shall comply with this chapter and NFPA 55. Cryogenic fluids classified as hazardous materials shall also comply with the general requirements of Chapter 50. Partially full containers containing residual cryogenic fluids shall be considered as full for the purposes of the controls required.

Exceptions:

1. Fluids used as refrigerants in refrigeration systems (see Section 608).
2. Liquefied natural gas (LNG), which shall comply with NFPA 59A.

Oxidizing cryogenic fluids, including oxygen, shall comply with Chapter 63, as applicable.

Flammable cryogenic fluids, including hydrogen, methane and carbon monoxide, shall comply with Chapters 23 and 58, as applicable.

Inert cryogenic fluids, including argon, helium and nitrogen, shall comply with ANSI/CGA P-18.

5501.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 5502 DEFINITIONS

5502.1 Definitions. The following terms are defined in Chapter 2.

CRYOGENIC CONTAINER.

CRYOGENIC FLUID.

CRYOGENIC VESSEL.

FLAMMABLE CRYOGENIC FLUID.

LOW-PRESSURE TANK.

SECTION 5503 GENERAL REQUIREMENTS

5503.1 Containers. Containers employed for storage or use of cryogenic fluids shall comply with Sections 5503.1.1 through 5503.1.3.2 and Chapter 50.

5503.1.1 Nonstandard containers. Containers, equipment and devices that are not in compliance with recognized standards for design and construction shall be approved upon presentation of satisfactory evidence that they are designed and constructed for safe operation.

5503.1.1.1 Data submitted for approval. The following data shall be submitted to the fire code official with reference to the deviation from the recognized standard with the application for approval.

1. Type and use of container, equipment or device.
2. Material to be stored, used or transported.
3. Description showing dimensions and materials used in construction.
4. Design pressure, maximum operating pressure and test pressure.
5. Type, size and setting of pressure relief devices.
6. Other data requested by the fire code official.

5503.1.2 Concrete containers. Concrete containers shall be built in accordance with the *California Building Code*. Barrier materials and membranes used in connection with concrete, but not functioning structurally, shall be compatible with the materials contained.

5503.1.3 Foundations and supports. Containers shall be provided with substantial concrete or masonry foundations, or structural steel supports on firm concrete or masonry foundations. Containers shall be supported to prevent the concentration of excessive loads on the supporting portion of the shell. Foundations for horizontal containers shall be constructed to accommodate expansion and contraction of the container. Foundations shall be provided to support the weight of vaporizers or heat exchangers.

5503.1.3.1 Temperature effects. Where container foundations or supports are subject to exposure to temperatures below -130°F (-90°C), the foundations or supports shall be constructed of materials to withstand the low-temperature effects of cryogenic fluid spillage.

5503.1.3.2 Corrosion protection. Portions of containers in contact with foundations or saddles shall be painted to protect against corrosion.

5503.2 Pressure relief devices. Pressure relief devices shall be provided in accordance with Sections 5503.2.1 through 5503.2.7 to protect containers and systems containing cryogenic fluids from rupture in the event of overpressure. Pressure relief devices shall be designed in accordance with CGA S-1.1, CGA S-1.2 and CGA S-1.3.

5503.2.1 Containers. Containers shall be provided with pressure relief devices.

5503.2.2 Vessels or equipment other than containers. Heat exchangers, vaporizers, insulation casings surrounding containers, vessels and coaxial piping systems in which liquefied cryogenic fluids could be trapped because of leakage from the primary container shall be provided with a pressure relief device.

5503.2.3 Sizing. Pressure relief devices shall be sized in accordance with the specifications to which the container was fabricated. The relief device shall have sufficient capacity to prevent the maximum design pressure of the container or system from being exceeded.

5503.2.4 Accessibility. Pressure relief devices shall be located such that they are provided with ready access for inspection and repair.

5503.2.5 Arrangement. Pressure relief devices shall be arranged to discharge unobstructed to the open air in such a manner as to prevent impingement of escaping gas on personnel, containers, equipment and adjacent structures or to enter enclosed spaces.

Exception: DOTn-specified containers with an internal volume of 2 cubic feet (0.057 m³) or less.

5503.2.6 Shutoffs between pressure relief devices and containers. Shutoff valves shall not be installed between pressure relief devices and containers.

Exceptions:

1. A shutoff valve is allowed on containers equipped with multiple pressure relief device installations where the arrangement of the valves provides the full required flow through the minimum number of required relief devices at all times.
2. A locking-type shutoff valve is allowed to be used upstream of the pressure relief device for service-related work performed by the supplier when in accordance with the requirements of the *ASME Boiler and Pressure Vessel Code*.

5503.2.7 Temperature limits. Pressure relief devices shall not be subjected to cryogenic fluid temperatures except when operating.

5503.3 Pressure relief vent piping. Pressure relief vent-piping systems shall be constructed and arranged so as to remain functional and direct the flow of gas to a safe location in accordance with Sections 5503.3.1 and 5503.3.2.

5503.3.1 Sizing. Pressure relief device vent piping shall have a cross-sectional area not less than that of the pressure relief device vent opening and shall be arranged so as not to restrict the flow of escaping gas.

5503.3.2 Arrangement. Pressure relief device vent piping and drains in vent lines shall be arranged so that escaping gas will discharge unobstructed to the open air and not impinge on personnel, containers, equipment and adjacent structures or enter enclosed spaces. Pressure relief device vent lines shall be installed in such a manner to exclude or remove moisture and condensation and prevent malfunction of the pressure relief device because of freezing or ice accumulation.

5503.4 Marking. Cryogenic containers and systems shall be marked in accordance with Sections 5503.4.1 through 5503.4.6.

5503.4.1 Identification signs. Visible hazard identification signs in accordance with NFPA 704 shall be provided at entrances to buildings or areas in which cryogenic fluids are stored, handled or used.

5503.4.2 Identification of contents. Stationary and portable containers shall be marked with the name of the gas contained. Stationary above-ground containers shall be placarded in accordance with Sections 5003.5 and 5003.6. Portable containers shall be identified in accordance with CGA C-7.

5503.4.3 Identification of containers. Stationary containers shall be identified with the manufacturing specification and maximum allowable working pressure with a permanent nameplate. The nameplate shall be installed on the container in a location provided with ready access. The nameplate shall be marked in accordance with the *ASME Boiler and Pressure Vessel Code* or DOTn 49 CFR Parts 100–185.

5503.4.4 Identification of container connections. Container inlet and outlet connections, liquid-level limit controls, valves and pressure gauges shall be identified with one of the following:

1. A permanent tag or label identifying the function.
2. A schematic drawing that portrays the function and designates whether the connection is to the vapor or liquid space of the container.

Where a schematic drawing is provided, it shall be attached to the container and maintained in a legible condition.

5503.4.5 Identification of piping systems. Piping systems shall be identified in accordance with ASME A13.1.

5503.4.6 Identification of emergency shutoff valves. Emergency shutoff valves shall be identified and the location shall be clearly visible and indicated by means of a sign.

5503.5 Security. Cryogenic containers and systems shall be secured against accidental dislodgement and against access by unauthorized personnel in accordance with Sections 5503.5.1 through 5503.5.4.

5503.5.1 Security of areas. Containers and systems shall be secured against unauthorized entry and safeguarded in an approved manner.

5503.5.2 Securing of containers. Stationary containers shall be secured to foundations in accordance with the *California Building Code*. Portable containers subject to shifting or upset shall be secured. Nesting shall be an acceptable means of securing containers.

5503.5.3 Securing of vaporizers. Vaporizers, heat exchangers and similar equipment shall be anchored to a suitable foundation and its connecting piping shall be sufficiently flexible to provide for the effects of expansion and contraction due to temperature changes.

5503.5.4 Physical protection. Containers, piping, valves, pressure relief devices, regulating equipment and other appurtenances shall be protected against physical damage and tampering.

5503.6 Electrical wiring and equipment. Electrical wiring and equipment shall comply with the *California Electrical Code* and Sections 5503.6.1 and 5503.6.2.

5503.6.1 Location. Containers and systems shall not be located where they could become part of an electrical circuit.

5503.6.2 Electrical grounding and bonding. Containers and systems shall not be used for electrical grounding. Where electrical grounding and bonding is required, the system shall comply with the *California Electrical Code*. The grounding system shall be protected against corrosion, including corrosion caused by stray electric currents.

5503.7 Service and repair. Service, repair, modification or removal of valves, pressure relief devices or other container appurtenances shall comply with Sections 5503.7.1 and 5503.7.2 and the *ASME Boiler and Pressure Vessel Code*, Section VIII or DOTn 49 CFR Parts 100–185.

5503.7.1 Containers. Containers that have been removed from service shall be handled in an approved manner.

5503.7.2 Systems. Service and repair of systems shall be performed by trained personnel.

5503.8 Unauthorized use. Containers shall not be used for any purpose other than to serve as a vessel for containing the product that it is designed to contain.

5503.9 Leaks, damage and corrosion. Leaking, damaged or corroded containers shall be removed from service. Leaking, damaged or corroded systems shall be replaced, repaired or removed in accordance with Section 5503.7.

5503.10 Lighting. Where required, lighting, including emergency lighting, shall be provided for fire appliances and operating facilities such as walkways, control valves and gates ancillary to stationary containers.

SECTION 5504 STORAGE

5504.1 General. Storage of containers shall comply with this section.

5504.2 Indoor storage. Indoor storage of containers shall be in accordance with Sections 5504.2.1 through 5504.2.2.3.

5504.2.1 Stationary containers. Stationary containers shall be installed in accordance with the provisions applicable to the type of fluid stored and this section.

5504.2.1.1 Containers. Stationary containers shall comply with Section 5503.1.

5504.2.1.2 Construction of indoor areas. Cryogenic fluids in stationary containers stored indoors shall be located in buildings, rooms or areas constructed in accordance with the *California Building Code*.

5504.2.1.3 Ventilation. Storage areas for stationary containers shall be ventilated in accordance with the *California Mechanical Code*.

5504.2.2 Portable containers. Indoor storage of portable containers shall comply with the provisions applicable to the type of fluid stored and Sections 5504.2.2.1 through 5504.2.2.3.

5504.2.2.1 Containers. Portable containers shall comply with Section 5503.1.

5504.2.2.2 Construction of indoor areas. Cryogenic fluids in portable containers stored indoors shall be stored in buildings, rooms or areas constructed in accordance with the *California Building Code*.

5504.2.2.3 Ventilation. Storage areas shall be ventilated in accordance with the *California Mechanical Code*.

5504.3 Outdoor storage. Outdoor storage of containers shall be in accordance with Sections 5504.3.1 through 5504.3.1.2.3.

5504.3.1 Separation from hazardous conditions. Cryogenic containers and systems in outdoor storage shall be separated from materials and conditions that pose exposure hazards to or from each other in accordance with Sections 5504.3.1.1 through 5504.3.1.1.5.

5504.3.1.1 Stationary containers. Stationary containers shall be separated from exposure hazards in accordance with the provisions applicable to the type of fluid contained and the minimum separation distances indicated in Table 5504.3.1.1.

5504.3.1.1.1 Point-of-fill connections. Remote transfer points and fill connection points shall not be positioned closer to exposures than the minimum distances required for stationary containers.

**TABLE 5504.3.1.1
SEPARATION OF STATIONARY CONTAINERS
FROM EXPOSURE HAZARDS**

EXPOSURE	MINIMUM DISTANCE (feet)
Air intakes	10
Building exits	10
Buildings, regardless of construction type	1
Combustible materials such as paper, leaves, weeds, dry grass or debris	15
Lot lines	5
Nonambulatory patient areas	50
Other hazardous materials	In accordance with Chapter 50
Places of public assembly	50
Wall openings	1

For SI: 1 foot = 304.8 mm.

5504.3.1.1.2 Surfaces beneath containers. Containers shall be placed on surfaces that are compatible with the fluid in the container.

5504.3.1.1.3 Location. Containers of cryogenic fluids shall not be located within diked areas containing other hazardous materials.

5504.3.1.1.4 Areas subject to flooding. Stationary containers located in areas subject to flooding shall be securely anchored or elevated to prevent the containers from separating from foundations or supports.

5504.3.1.1.5 Drainage. The area surrounding stationary containers shall be provided with a means to prevent accidental discharge of fluids from endangering personnel, containers, equipment and adjacent structures or to enter enclosed spaces. The stationary container shall not be placed where spilled or discharged fluids will be retained around the container.

Exception: These provisions shall not apply where it is determined by the fire code official that the container does not constitute a hazard, after consideration of special features such as crushed rock utilized as a heat sink, topographical conditions, nature of occupancy, proximity to structures on the same or adjacent property, and the capacity and construction of containers and character of fluids to be stored.

5504.3.1.2 Outdoor storage of portable containers. Outdoor storage of portable containers shall comply with Section 5503 and Sections 5504.3.1.2.1 through 5504.3.1.2.3.

5504.3.1.2.1 Exposure hazard separation. Portable containers in outdoor storage shall be separated from exposure hazards in accordance with Table 5504.3.1.2.1.

**TABLE 5504.3.1.2.1
SEPARATION OF PORTABLE CONTAINERS
FROM EXPOSURE HAZARDS**

EXPOSURE	MINIMUM DISTANCE (feet)
Air intakes	10
Building exits	10
Combustible materials such as paper, leaves, weeds, dry grass or debris	15
Lot lines	5
Other hazardous materials	In accordance with Chapter 50
Wall openings	1

For SI: 1 foot = 304.8 mm.

5504.3.1.2.2 Surfaces beneath containers. The surface of the area on which stationary containers are placed, including the surface of the area located below the point where connections are made for the purpose of filling such containers, shall be compatible with the fluid in the container.

5504.3.1.2.3 Drainage. The area surrounding portable containers shall be provided with a means to prevent accidental discharge of fluids from endangering adjacent containers, buildings, equipment or adjoining property.

Exception: These provisions shall not apply where it is determined by the fire code official that the container does not constitute a hazard.

**SECTION 5505
USE AND HANDLING**

5505.1 General. Use and handling of cryogenic fluid containers and systems shall comply with Sections 5505.1.1 through 5505.5.2.

5505.1.1 Cryogenic fluid systems. Cryogenic fluid systems shall be suitable for the use intended and designed by persons competent in such design. Equipment, machinery and processes shall be listed or approved.

5505.1.2 Piping systems. Piping, tubing, valves and joints and fittings conveying cryogenic fluids shall be installed in accordance with the material-specific provisions of Section 5501.1 and Sections 5505.1.2.1 through 5505.1.2.6.

5505.1.2.1 Design and construction. Piping systems shall be suitable for the use intended through the full range of pressure and temperature to which they will be subjected. Piping systems shall be designed and constructed to provide adequate allowance for expansion, contraction, vibration, settlement and fire exposure.

5505.1.2.2 Joints. Joints on container piping and tubing shall be threaded, welded, silver brazed or flanged.

5505.1.2.3 Valves and accessory equipment. Valves and accessory equipment shall be suitable for the intended use at the temperatures of the application and shall be designed and constructed to withstand the maximum pressure at the minimum temperature to which they will be subjected.

5505.1.2.3.1 Shutoff valves on containers. Shutoff valves shall be provided on all container connections except for pressure relief devices. Shutoff valves shall be provided with access thereto and located as close as practical to the container.

5505.1.2.3.2 Shutoff valves on piping. Shutoff valves shall be installed in piping containing cryogenic fluids where needed to limit the volume of liquid discharged in the event of piping or equipment failure. Pressure relief valves shall be installed where liquid is capable of being trapped between shutoff valves in the piping system (see Section 5503.2).

5505.1.2.4 Physical protection and support. Piping systems shall be supported and protected from physical damage. Piping passing through walls shall be protected from mechanical damage.

5505.1.2.5 Corrosion protection. Above-ground piping that is subject to corrosion because of exposure to corrosive atmospheres, shall be constructed of materials to resist the corrosive environment or otherwise protected against corrosion. Below-ground piping shall be protected against corrosion.

5505.1.2.6 Testing. Piping systems shall be tested and proven free of leaks after installation as required by the standards to which they were designed and constructed. Test pressures shall be not less than 150 percent of the maximum allowable working pressure where hydraulic testing is conducted or 110 percent where testing is conducted pneumatically.

5505.2 Indoor use. Indoor use of cryogenic fluids shall comply with the material-specific provisions of Section 5501.1.

5505.3 Outdoor use. Outdoor use of cryogenic fluids shall comply with the material specific provisions of Sections 5501.1, 5505.3.1 and 5505.3.2.

5505.3.1 Separation. Distances from lot lines, buildings and exposure hazards shall comply with Section 5504.3 and the material-specific provisions of Section 5501.1.

5505.3.2 Emergency shutoff valves. Manual or automatic emergency shutoff valves shall be provided to shut off the cryogenic fluid supply in case of emergency. An emergency shutoff valve shall be located at the source of supply and at the point where the system enters the building.

5505.4 Filling and dispensing. Filling and dispensing of cryogenic fluids shall comply with Sections 5505.4.1 through 5505.4.3.

5505.4.1 Dispensing areas. Dispensing of cryogenic fluids with physical or health hazards shall be conducted

in approved locations. Dispensing indoors shall be conducted in areas constructed in accordance with the *California Building Code*.

5505.4.1.1 Ventilation. Indoor areas where cryogenic fluids are dispensed shall be ventilated in accordance with the requirements of the *California Mechanical Code* in a manner that captures any vapor at the point of generation.

Exception: Cryogenic fluids that can be demonstrated not to create harmful vapors.

5505.4.1.2 Piping systems. Piping systems utilized for filling or dispensing of cryogenic fluids shall be designed and constructed in accordance with Section 5505.1.2.

5505.4.2 Vehicle loading and unloading areas. Loading or unloading areas shall be conducted in an approved manner in accordance with the standards referenced in Section 5501.1.

5505.4.3 Limit controls. Limit controls shall be provided to prevent overfilling of stationary containers during filling operations.

5505.5 Handling. Handling of cryogenic containers shall comply with Sections 5505.5.1 and 5505.5.2.

5505.5.1 Carts and trucks. Cryogenic containers shall be moved using an approved method. Where cryogenic containers are moved by hand cart, hand truck or other mobile device, such carts, trucks or devices shall be designed for the secure movement of the container.

Carts and trucks used to transport cryogenic containers shall be designed to provide a stable base for the commodities to be transported and shall have a means of restraining containers to prevent accidental dislodgement.

5505.5.2 Closed containers. Pressurized containers shall be transported in a closed condition. Containers designed for use at atmospheric conditions shall be transported with appropriate loose-fitting covers in place to prevent spillage.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 56 – EXPLOSIVES AND FIREWORKS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
5601.1			X																			
5601.1.3			X																			
5601.1.4			X																			
5601.2.2			X																			
5601.2.3			X																			
5601.2.4			X																			
5601.3.1			X																			
5602.1			X																			
[T-19 §1559.3]				X																		
[T-19 §1559.9]				X																		
[T-19 §1559.16]				X																		
[T-19 §1559.18]				X																		
[T-19 §1559.20]				X																		
[T-19 §1559.21]				X																		
5603.2			X																			
Table 5604.3			X																			
Table 5604.5.2(1)			X																			
5604.7.5.4			X																			
5604.7.8			X																			
5604.7.10			X																			
5604.8.4			X																			
5604.10.3			X																			
5604.11			X																			
[T-19 §1571]				X																		
[T-19 §1571.1]				X																		
[T-19 §1571.2]				X																		
[T-19 §1571.3]				X																		
[T-19 §1571.4]				X																		
[T-19 §1571.5]				X																		
[T-19 §1571.6]				X																		
[T-19 §1571.7]				X																		
5606.6			X																			
[T-19 §1574.1]				X																		
[T-19 §1574.2]				X																		
[T-19 §1574.3]				X																		
[T-19 §1574.4]				X																		

(continued)

CHAPTER 56 – EXPLOSIVES AND FIREWORKS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
[T-19 §1574.5]				X																		
[T-19 §1575]				X																		
[T-19 §1575.1]				X																		
[T-19 §1575.2]				X																		
5607.1			X																			
5607.9.1			X																			
5607.9.2			X																			
5608.1			X																			
5608.1.1			X																			
[T-19 §980 - §1006]				X																		
5610			X																			
[T-19 §1010 - §1015]				X																		
5611			X																			
[T-19 §1020 - §1028]				X																		
5612			X																			
[T-19 §1030 - §1039]				X																		
5613			X																			
[T-19 §1045 - §1046]				X																		

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CHAPTER 56

EXPLOSIVES AND FIREWORKS

User note:

About this chapter: Chapter 56 prescribes minimum requirements for the safe manufacture, storage, handling and use of explosives, ammunition and blasting agents for commercial and industrial occupancies. These provisions are intended to protect the general public, emergency responders and individuals who handle explosives. It also regulates the manufacturing, retail sale, display and wholesale distribution of fireworks; establishes the requirements for obtaining approval to manufacture, store, sell, discharge or conduct a public display; and references national standards for regulations governing manufacture, storage and public displays.

SECTION 5601 GENERAL

5601.1 Scope. The provisions of this chapter shall govern the possession, manufacture, storage, handling, sale and use of explosives, explosive materials, fireworks *rockets*, *emergency signaling devices* and small arms ammunition.

Exceptions:

1. The Armed Forces of the United States, Coast Guard or National Guard.
2. Explosives in forms prescribed by the official United States Pharmacopoeia.
3. The possession, storage and use of small arms ammunition where packaged in accordance with DOTn packaging requirements.
4. The possession, storage and use of not more than 1 pound (0.454 kg) of commercially manufactured sporting black powder, 20 pounds (9 kg) of smokeless powder and 10,000 small arms primers for hand loading of small arms ammunition for personal consumption.
5. The use of explosive materials by federal, state and local regulatory, law enforcement and fire agencies acting in their official capacities.
6. Special industrial explosive devices that in the aggregate contain less than 50 pounds (23 kg) of explosive materials.
7. The possession, storage and use of blank industrial-power load cartridges where packaged in accordance with DOTn packaging regulations.
8. Transportation in accordance with DOTn 49 CFR Parts 100–185.
9. Items preempted by federal regulations.
10. *Items preempted by state law and/or regulations.*

For additional provisions regarding the possession, manufacture, storage, handling, sale and use of explosives, see California Code of Regulations, Title 19, Division 1, Chapter 10.

5601.1.1 Explosive material standard. In addition to the requirements of this chapter, NFPA 495 shall govern the manufacture, transportation, storage, sale, handling and use of explosive materials.

5601.1.2 Explosive material terminals. In addition to the requirements of this chapter, the operation of explosive material terminals shall conform to the provisions of NFPA 498.

5601.1.3 Fireworks. The possession, manufacture, storage, sale, handling and use of fireworks are prohibited.

Exceptions:

1. Storage and handling of fireworks as allowed in Section 5604.
2. Manufacture, assembly and testing of fireworks as allowed in Section 5605 and *Health and Safety Code Division 11*.
3. The use of fireworks for fireworks displays *pyrotechnics before a proximate audience and pyrotechnic special effects in motion pictures, television, theatrical or group entertainment productions* as allowed in *Title 19, Division 1, Chapter 6 Fireworks* reprinted in Section 5608 and *Health and Safety Code Division 11*.
4. The possession, storage, sale, handling and use of specific types of Division 1.4G fireworks where allowed by applicable laws, ordinances and regulations, provided that such fireworks and facilities comply with the 2006 edition of NFPA 1124, CPSC 16 CFR Parts 1500 and 1507, and DOTn 49 CFR Parts 100–185, as applicable for consumer fireworks and *Health and Safety Code Division 11*.

5601.1.4 Rocketry. *For rocketry requirements see California Code of Regulations, Title 19, Division 1, Chapter 6, reprinted in Sections 5610, 5611 and 5612.*

5601.1.5 Ammonium nitrate. The storage and handling of ammonium nitrate shall comply with the requirements of NFPA 400 and Chapter 63.

Exception: Storage of ammonium nitrate in magazines with blasting agents shall comply with the requirements of NFPA 495.

5601.2 Permit required. Permits shall be required as set forth in Section 105.5 and regulated in accordance with this section.

5601.2.1 Residential uses. Persons shall not keep or store, nor shall any permit be issued to keep or store, any *explosives* at any place of habitation, or within 100 feet (30 480 mm) thereof.

Exception: Storage of smokeless propellant, black powder and small arms primers for personal use and not for resale in accordance with Section 5606.

5601.2.2 Sale and retail display. Persons shall not construct a retail display nor offer for sale explosives, explosive materials or fireworks on highways, sidewalks, public property or in Group A or E occupancies.

Exception: *Fireworks in accordance with California Code of Regulations, Title 19, Division 1, Chapter 6, see Section 5608.*

5601.2.3 Permit restrictions. The fire code official is authorized to limit the quantity of explosives, explosive materials or fireworks permitted at a given location. Persons possessing a permit for storage of explosives at any place, shall not keep or store an amount greater than authorized in such permit. Only the kind of explosive specified in such a permit shall be kept or stored.

Exception: *Fireworks in accordance with California Code of Regulations, Title 19, Division 1, Chapter 6, see Section 5608.*

5601.2.4 Financial responsibility. Before a permit is issued, as required by Section 5601.2, the applicant shall file with the jurisdiction a corporate surety bond in the principal sum of \$100,000 or a public liability insurance policy for the same amount, for the purpose of the payment of all damages to persons or property that arise from, or are caused by, the conduct of any act authorized by the permit upon which any judicial judgment results. The fire code official is authorized to specify a greater or lesser amount when, in his or her opinion, conditions at the location of use indicate a greater or lesser amount is required. Government entities shall be exempt from this bond requirement.

Exception: *Fireworks in accordance with California Code of Regulations, Title 19, Division 1, Chapter 6, see Section 5608.*

5601.2.4.1 Blasting. Before approval to do blasting is issued, the applicant for approval shall file a bond or submit a certificate of insurance in such form, amount and coverage as determined by the legal department of the jurisdiction to be adequate in each case to indemnify the jurisdiction against any and all damages arising from permitted blasting.

5601.2.4.2 Fireworks display. The permit holder shall furnish a bond or certificate of insurance in an amount deemed adequate by the fire code official for the payment of all potential damages to a person or persons or to property by reason of the permitted display, and arising from any acts of the permit holder, the agent, employees or subcontractors.

5601.3 Prohibited explosives. Permits shall not be issued or renewed for possession, manufacture, storage, handling, sale

or use of the following materials and such materials currently in storage or use shall be disposed of in an approved manner.

1. Liquid nitroglycerin.
2. Dynamite containing more than 60-percent liquid explosive ingredient.
3. Dynamite having an unsatisfactory absorbent or one that permits leakage of a liquid explosive ingredient under any conditions liable to exist during storage.
4. Nitrocellulose in a dry and uncompressed condition in a quantity greater than 10 pounds (4.54 kg) of net weight in one package.
5. Fulminate of mercury in a dry condition and fulminate of all other metals in any condition except as a component of manufactured articles not hereinafter forbidden.
6. Explosive compositions that ignite spontaneously or undergo marked decomposition, rendering the products of their use more hazardous, when subjected for 48 consecutive hours or less to a temperature of 167°F (75°C).
7. New explosive materials until approved by DOTn, except that permits are allowed to be issued to educational, governmental or industrial laboratories for instructional or research purposes.
8. Explosive materials forbidden for transport by DOTn.
9. Explosive materials containing an ammonium salt and a chlorate.
10. Explosives not packed or marked as required by DOTn 49 CFR Parts 100–185.

Exception: Gelatin dynamite.

5601.3.1 Abandonment prohibited. *No explosives shall be abandoned, but shall be returned to proper storage.*

5601.4 Qualifications. Persons in charge of magazines, blasting, fireworks display or pyrotechnic special effect operations shall not be under the influence of alcohol or drugs that impair sensory or motor skills, shall be not less than 21 years of age and shall demonstrate knowledge of all safety precautions related to the storage, handling or use of explosives, explosive materials or fireworks.

5601.5 Supervision. The fire code official is authorized to require operations permitted under the provisions of Section 5601.2 to be supervised at any time by the fire code official in order to determine compliance with all safety and fire regulations.

5601.6 Notification. Whenever a new explosive material storage or manufacturing site is established, including a temporary job site, the local law enforcement agency, fire department and local emergency planning committee shall be notified 48 hours in advance, not including Saturdays, Sundays and holidays, of the type, quantity and location of explosive materials at the site.

5601.7 Seizure. The fire code official is authorized to remove or cause to be removed or disposed of in an approved manner, at the expense of the owner, explosives, explosive materials or fireworks offered or exposed for sale, stored, possessed or used in violation of this chapter.

TABLE 5601.8.1(1)
APPLICATION OF QUANTITY-DISTANCE (Q-D) TABLES—DIVISION 1.1, 1.2 AND 1.5 EXPLOSIVES^{a, b, c}

ITEM	MAGAZINE	OPERATING BUILDING	INHABITED BUILDING	PUBLIC TRAFFIC ROUTE
Inhabited building	IBD in Table 5604.5.2(1)	IBD in Table 5604.5.2(1)	Not Applicable	Not Applicable
Magazine	IMD in Table 5604.5.2(1)	ILD or IPD in Table 5605.3	IBD in Table 5604.5.2(1)	PTR in Table 5604.5.2(1)
Operating building	ILD or IPD in Table 5604.5.2(1)	ILD or IPD in Table 5605.3	IBD in Table 5604.5.2(1)	PTR in Table 5604.5.2(1)
Public traffic route	PTR in Table 5604.5.2(1)	PTR in Table 5604.5.2(1)	Not Applicable	Not Applicable

For SI: 1 foot = 304.8 mm.

- The minimum separation distance shall be 60 feet. Where a building or magazine containing explosives is barricaded, the minimum distance shall be 30 feet.
- Linear interpolation between tabular values in the referenced Q-D tables shall not be allowed. Nonlinear interpolation of the values shall be allowed subject to an approved technical opinion and report prepared in accordance with Section 104.8.2.
- For definitions of quantity-distance abbreviations IBD, ILD, IMD, IPD and PTR, see Chapter 2.

TABLE 5601.8.1(2)
APPLICATION OF QUANTITY-DISTANCE (Q-D) TABLES—DIVISION 1.3 EXPLOSIVES^{a, b, c}

ITEM	MAGAZINE	OPERATING BUILDING	INHABITED BUILDING	PUBLIC TRAFFIC ROUTE
Inhabited building	IBD in Table 5604.5.2(2)	IBD in Table 5604.5.2(2)	Not Applicable	Not Applicable
Magazine	IMD in Table 5604.5.2(2)	ILD or IPD in Table 5604.5.2(2)	IBD in Table 5604.5.2(2)	PTR in Table 5604.5.2(2)
Operating building	ILD or IPD in Table 5604.5.2(2)	ILD or IPD in Table 5604.5.2(2)	IBD in Table 5604.5.2(2)	PTR in Table 5604.5.2(2)
Public traffic route	PTR in Table 5604.5.2(2)	PTR in Table 5604.5.2(2)	Not Applicable	Not Applicable

For SI: 1 foot = 304.8 mm.

- The minimum separation distance shall be not less than 50 feet.
- Linear interpolation between tabular values in the referenced Q-D table shall be allowed.
- For definitions of quantity-distance abbreviations IBD, ILD, IMD, IPD and PTR, see Chapter 2.

TABLE 5601.8.1(3)
APPLICATION OF QUANTITY-DISTANCE (Q-D) TABLES—DIVISION 1.4 EXPLOSIVES^{a, b, c}

ITEM	MAGAZINE	OPERATING BUILDING	INHABITED BUILDING	PUBLIC TRAFFIC ROUTE
Inhabited building	IBD in Table 5604.5.2(3)	IBD in Table 5604.5.2(3)	Not Applicable	Not Applicable
Magazine	IMD in Table 5604.5.2(3)	ILD or IPD in Table 5604.5.2(3)	IBD in Table 5604.5.2(3)	PTR in Table 5604.5.2(3)
Operating building	ILD or IPD in Table 5604.5.2(3)	ILD or IPD in Table 5604.5.2(3)	IBD in Table 5604.5.2(3)	PTR in Table 5604.5.2(3)
Public traffic route	PTR in Table 5604.5.2(3)	PTR in Table 5604.5.2(3)	Not Applicable	Not Applicable

For SI: 1 foot = 304.8 mm.

- The minimum separation distance shall be not less than 50 feet.
- Linear interpolation between tabular values in the referenced Q-D table shall not be allowed.
- For definitions of quantity-distance abbreviations IBD, ILD, IMD, IPD and PTR, see Chapter 2.

5601.8 Establishment of quantity of explosives and distances. The quantity of explosives and distances shall be in accordance with Sections 5601.8.1 through 5601.8.1.4.

5601.8.1 Quantity of explosives. The quantity-distance (Q-D) tables in Sections 5604.5 and 5605.3 shall be used to provide the minimum separation distances from potential explosion sites as set forth in Tables 5601.8.1(1) through 5601.8.1(3). The classification and the weight of the explosives are primary characteristics governing the use of these tables. The net explosive weight shall be

determined in accordance with Sections 5601.8.1.1 through 5601.8.1.4.

5601.8.1.1 Mass-detonating explosives (Division 1.1, 1.2 or 1.5). The total net explosive weight of mass-detonating explosives (Division 1.1, 1.2 or 1.5) shall be used. See Table 5604.5.2(1) or Table 5605.3, as appropriate.

Exception: Where the TNT equivalence of the explosive material has been determined, the equivalence is allowed to be used to establish the net explosive weight.

5601.8.1.2 Nonmass-detonating explosives (excluding Division 1.4). Nonmass-detonating explosives (excluding Division 1.4) shall be as follows:

1. Division 1.3 propellants. The total weight of the propellants alone shall be the net explosive weight. The net weight of propellant shall be used. See Table 5604.5.2(2).
2. Combinations of bulk metal powder and pyrotechnic compositions. The sum of the net weights of metal powders and pyrotechnic compositions in the containers shall be the net explosive weight. See Table 5604.5.2(2).

5601.8.1.3 Combinations of mass-detonating and nonmass-detonating explosives (excluding Division 1.4). Combination of mass-detonating and nonmass-detonating explosives (excluding Division 1.4) shall be as follows:

1. Where Division 1.1 and 1.2 explosives are located in the same site, determine the distance for the total quantity considered first as 1.1 and then as 1.2. The required distance is the greater of the two. Where the Division 1.1 requirements are controlling and the TNT equivalence of the 1.2 is known, the TNT equivalent weight of the 1.2 items shall be allowed to be added to the total explosive weight of Division 1.1 items to determine the net explosive weight for Division 1.1 distance determination. See Table 5604.5.2(2) or Table 5605.3, as appropriate.
2. Where Division 1.1 and 1.3 explosives are located in the same site, determine the distances for the total quantity considered first as 1.1 and then as 1.3. The required distance is the greater of the two. Where the Division 1.1 requirements are controlling and the TNT equivalence of the 1.3 is known, the TNT equivalent weight of the 1.3 items shall be allowed to be added to the total explosive weight of Division 1.1 items to determine the net explosive weight for Division 1.1 distance determination. See Table 5604.5.2(1), 5604.5.2(2) or 5605.3, as appropriate.
3. Where Division 1.1, 1.2 and 1.3 explosives are located in the same site, determine the distances for the total quantity considered first as 1.1, next as 1.2 and finally as 1.3. The required distance is the greatest of the three. As allowed by Items 1 and 2, TNT equivalent weights for 1.2 and 1.3 items are allowed to be used to determine the net weight of explosives for Division 1.1 distance determination. Table 5604.5.2(1) or Table 5605.3 shall be used where TNT equivalency is used to establish the net explosive weight.
4. For composite pyrotechnic items Division 1.1 and Division 1.3, the sum of the net weights of the pyrotechnic composition and the explosives involved shall be used. See Tables 5604.5.2(1) and 5604.5.2(2).

5601.8.1.4 Moderate fire—no blast hazards (Division 1.4). For Division 1.4 explosives, the total weight of the explosive material alone is the net weight. The net weight of the explosive material shall be used.

**SECTION 5602
DEFINITIONS**

5602.1 Definitions. The following terms are defined in Chapter 2:

AMMONIUM NITRATE.

BARRICADE.

Artificial barricade.

Natural barricade.

BARRICADED.

BLAST AREA.

BLAST SITE.

BLASTER.

BLASTING AGENT.

BULLET RESISTANT.

DETONATING CORD.

DETONATION.

DETONATOR.

EXPLOSIVE.

High explosive.

Low explosive.

Mass-detonating explosives.

UN/DOTn Class 1 explosives.

Division 1.1.

Division 1.2.

Division 1.3.

Division 1.4.

Division 1.5.

Division 1.6.

EXPLOSIVE MATERIAL.

FIREWORKS.

Fireworks, 1.3G.

Fireworks, 1.4G.

FIREWORKS DISPLAY.

HIGHWAY.

INHABITED BUILDING.

MAGAZINE.

Indoor.

Type 1.

Type 2.

Type 3.

Type 4.

Type 5.

MORTAR.

NET EXPLOSIVE WEIGHT (net weight).
 OPERATING BUILDING.
 OPERATING LINE.
 PHOSPHORIC MATERIAL.
 PROXIMATE AUDIENCE.
 PUBLIC TRAFFIC ROUTE (PTR).
 PYROTECHNIC ARTICLE.
 PYROTECHNIC COMPOSITION.
 PYROTECHNIC SPECIAL EFFECT.
 PYROTECHNIC SPECIAL-EFFECT MATERIAL.
 PYROTECHNICS.
 QUANTITY-DISTANCE (Q-D).

Inhabited building distance (IBD).

Intermagazine distance (IMD).

Intraline distance (ILD) or Intraplant distance (IPD).

RAILWAY.

READY BOX.

SMALL ARMS AMMUNITION.

SMALL ARMS PRIMERS.

SMOKELESS PROPELLANTS.

SPECIAL INDUSTRIAL EXPLOSIVE DEVICE.

THEFT RESISTANT.

[California Code of Regulations, Title 19, Division 1, §1559.3. Chief]

§1559.3. Chief shall mean the issuing authority (as used in this chapter).

[California Code of Regulations, Title 19, Division 1, §1559.9 Issuing authority]

§1559.9 Issuing authority shall mean either the sheriff of a county, or the chief or other head of a municipal police department of any city or city and county, or the chief of a fire department or fire protection agency and their authorized representatives, provided that, in the event the designated issuing authority is the chief of a fire department or fire protection agency, such fire department or fire protection agency is organized with regularly paid, full-time personnel. The governing body of any county, city or city and county shall designate one of the above as the issuing authority within its jurisdiction and shall notify the State Fire Marshal of the person so designated.

[California Code of Regulations, Title 19, Division 1, §1559.16 Public conveyance]

§1559.16 Public conveyance shall mean any railway car, street car, ferry, cab, bus, airplane or other vehicle which is carrying passengers for hire.

[California Code of Regulations, Title 19, Division 1, §1559.16 Person]

§1559.16 Person shall mean any person, organization, firm, corporation, association, city, county, city and county and state, and shall include any of their employees and authorized representatives.

[California Code of Regulations, Title 19, Division 1, §1559.16 Propellant-actuated power devices]

§1559.16 Propellant-actuated power devices shall mean any tool or special mechanized device or gas generator system which is actuated by a propellant or which releases and directs work through a propellant charge.

[California Code of Regulations, Title 19, Division 1, §1559.16 Propellants]

§1559.16 Propellants shall mean solid propellants, commonly called smokeless powders, used in small arms ammunition, cannon, rockets, propellant-actuated power devices and similar devices.

[California Code of Regulations, Title 19, Division 1, §1559.18 Railway]

§1559.18 Railway shall mean any tramway, steam, electric, diesel electric or other railway or railroad which carries passengers for hire on the particular line or branch in the vicinity where explosives are stored or where explosives manufacturing buildings are situated.

[California Code of Regulations, Title 19, Division 1, §1559.20 Tramway]

§1559.20 Tramway shall mean an aerial passenger tramway used to transport passengers by the use of overhead steel cables or by ropes, supported in one (1) or more spans.

[California Code of Regulations, Title 19, Division 1, §1559.21. US DOTn]

§1559.21. US DOTn shall mean the United States Department of Transportation.

SECTION 5603

RECORD KEEPING AND REPORTING

5603.1 General. Records of the receipt, handling, use or disposal of explosive materials, and reports of any accidents, thefts or unauthorized activities involving explosive materials shall conform to the requirements of this section.

5603.2 Transaction record. The permittee shall maintain a record of all transactions involving receipt, removal, sale, use or disposal of explosive materials. Such records shall be maintained for a period of 5 years.

Exception: Where only Division 1.4G (consumer fireworks) are handled, records need only be maintained for a period of 3 years.

5603.3 Loss, theft or unauthorized removal. The loss, theft or unauthorized removal of explosive materials from a magazine or permitted facility shall be reported to the fire code official, local law enforcement authorities and the US Department of Treasury, Bureau of Alcohol, Tobacco, Firearms and Explosives within 24 hours.

Exception: Loss of Division 1.4G (consumer fireworks) need not be reported to the Bureau of Alcohol, Tobacco, Firearms and Explosives.

5603.4 Accidents. Accidents involving the use of explosives, explosive materials and fireworks that result in injuries or

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property damage shall be reported to the fire code official immediately.

5603.5 Misfires. The pyrotechnic display operator or blaster in charge shall keep a record of all aerial shells that fail to fire or charges that fail to detonate.

5603.6 Hazard communication. Manufacturers of explosive materials and fireworks shall maintain records of chemicals, chemical compounds and mixtures required by DOL 29 CFR Part 1910.1200 and Section 407.

5603.7 Safety rules. Current safety rules covering the operation of magazines, as described in Section 5604.7, shall be posted on the interior of the magazine in a visible location.

SECTION 5604 EXPLOSIVE MATERIALS STORAGE AND HANDLING

5604.1 General. Storage of explosives and explosive materials, small arms ammunition, small arms primers, propellant-actuated cartridges and smokeless propellants in magazines shall comply with the provisions of this section.

5604.2 Magazine required. Explosives and explosive materials, and Division 1.3G fireworks shall be stored in magazines constructed, located, operated and maintained in accordance with the provisions of Section 5604 and NFPA 495 or NFPA 1124.

Exceptions:

- Storage of fireworks at display sites in accordance with Section 5608.5.
- Portable or mobile magazines not exceeding 120 square feet (11 m²) in area shall not be required to comply with the requirements of the *California Building Code*.

5604.3 Magazines. The storage of explosives and explosive materials in magazines shall comply with Table 5604.3.

5604.3.1 High explosives. Explosive materials classified as Division 1.1 or 1.2 or formerly classified as Class A by

the US Department of Transportation shall be stored in Type 1, 2 or 3 magazines.

Exceptions:

- Black powder shall be stored in a Type 1, 2, 3 or 4 magazine.
- Cap-sensitive explosive material that is demonstrated not to be bullet sensitive shall be stored in a Type 1, 2, 3, 4 or 5 magazine.

5604.3.2 Low explosives. Explosive materials that are not cap sensitive shall be stored in a Type 1, 2, 3, 4 or 5 magazine.

5604.3.3 Detonating cord. For quantity and distance purposes, detonating cord of 50 grains per foot shall be calculated as equivalent to 8 pounds (4 kg) of high explosives per 1,000 feet (305 m). Heavier or lighter core loads shall be rated proportionally.

5604.4 Prohibited storage. Detonators shall be stored in a separate magazine for blasting supplies and shall not be stored in a magazine with other explosive materials.

5604.5 Location. The use of magazines for storage of explosives and explosive materials shall comply with Sections 5604.5.1 through 5604.5.3.3.

5604.5.1 Indoor magazines. The use of indoor magazines for storage of explosives and explosive materials shall comply with the requirements of Sections 5604.5.1.1 through 5604.5.1.7.

5604.5.1.1 Use. The use of indoor magazines for storage of explosives and explosive materials shall be limited to occupancies of Group F, H, M or S, and research and development laboratories.

5604.5.1.2 Construction. Indoor magazines shall comply with the following construction requirements:

- Construction shall be fire resistant and theft resistant.
- Exterior shall be painted red.

TABLE 5604.3
STORAGE AMOUNTS AND MAGAZINE REQUIREMENTS FOR EXPLOSIVES, EXPLOSIVE MATERIALS
AND FIREWORKS, 1.3G MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA

NEW UN/DOTn DIVISION	OLD DOTn CLASS	ATF/OSHA CLASS	INDOOR ^a (pounds)				OUTDOOR (pounds)	MAGAZINE TYPE REQUIRED				
			Unprotected	Cabinet	Sprinklers	Sprinklers & cabinet		1	2	3	4	5
1.1 ^b	A	High	0	0	1	2	1	X	X	X	—	—
1.2	A	High	0	0	1	2	1	X	X	X	—	—
1.2	B	Low	0	0	1	1	1	X	X	X	X	—
1.3	B	Low	0	0	10	20	1	X	X	X	X	—
1.4	B	Low	0	0	50	100	1	X	X	X	X	—
1.5	C	Low	0	0	1	2	1	X	X	X	X	—
1.5	Blasting Agent	Blasting Agent	0	0	1	2	1	X	X	X	X	X
1.6	Not Applicable	Not Applicable	0	0	1	2	1	X	X	X	X	X

For SI: 1 pound = 0.454 kg, 1 pound per gallon = 0.12 kg per liter, 1 ounce = 28.35 g.

a. A factor of 10 pounds per gallon shall be used for converting pounds (solid) to gallons (liquid) in accordance with Section 5003.1.2.

b. Black powder shall be stored in a Type 1, 2, 3 or 4 magazine as provided for in Section 5604.3.1.

3. Base shall be fitted with wheels, casters or rollers to facilitate removal from the building in an emergency.
4. Lid or door shall be marked with conspicuous white lettering not less than 3 inches (76 mm) high and minimum $\frac{1}{2}$ inch (12.7 mm) stroke, reading “EXPLOSIVES—KEEP FIRE AWAY.”
5. The least horizontal dimension shall not exceed the clear width of the entrance door.

5604.5.1.3 Quantity limit. Not more than 50 pounds (23 kg) of explosives or explosive materials shall be stored within an indoor magazine.

Exception: Day boxes used for the storage of in-process material in accordance with Section 5605.6.4.1.

5604.5.1.4 Prohibited use. Indoor magazines shall not be used within buildings containing Group R occupancies.

5604.5.1.5 Location. Indoor magazines shall be located within 10 feet (3048 mm) of an entrance and only on floors at or having ramp access to the exterior grade level.

5604.5.1.6 Number. Not more than two indoor magazines shall be located in the same building. Where two such magazines are located in the same building, one magazine shall be used solely for the storage of not more than 5,000 detonators.

5604.5.1.7 Separation distance. Where two magazines are located in the same building, they shall be separated by a distance of not less than 10 feet (3048 mm).

5604.5.2 Outdoor magazines. Outdoor magazines other than Type 3 shall be located so as to comply with Table 5604.5.2(2) or 5604.5.2(3) as set forth in Tables 5601.8.1(1) through 5601.8.1(3). Where a magazine or group of magazines, as described in Section 5604.5.2.2, contains different classes of explosive materials, and Division 1.1 materials are present, the required separations for the magazine or magazine group as a whole shall comply with Table 5604.5.2(2).

5604.5.2.1 Separation. Where two or more storage magazines are located on the same property, each magazine shall comply with the minimum distances specified from inhabited buildings, public transportation routes and operating buildings. Magazines shall be separated from each other by not less than the intermagazine distances (IMD) shown for the separation of magazines.

5604.5.2.2 Grouped magazines. Where two or more magazines are separated from each other by less than the intermagazine distances (IMD), such magazines as a group shall be considered as one magazine and the total quantity of explosive materials stored in the group shall be treated as if stored in a single magazine. The location of the group of magazines shall comply with the intermagazine distances (IMD) specified from other magazines or magazine groups, inhabited buildings

(IBD), public transportation routes (PTR) and operating buildings (ILD or IPD) as required.

5604.5.3 Special requirements for Type 3 magazines. Type 3 magazines shall comply with Sections 5604.5.3.1 through 5604.5.3.3.

5604.5.3.1 Location. Wherever practicable, Type 3 magazines shall be located away from neighboring inhabited buildings, railways, highways and other magazines in accordance with Table 5604.5.2(2) or 5604.5.2(3), as applicable.

5604.5.3.2 Supervision. Type 3 magazines shall be attended when explosive materials are stored within. Explosive materials shall be removed to appropriate storage magazines for unattended storage at the end of the workday.

5604.5.3.3 Use. Not more than two Type 3 magazines shall be located at the same blasting site. Where two Type 3 magazines are located at the same blasting site, one magazine shall be used solely for the storage of detonators.

5604.6 Construction. Magazines shall be constructed in accordance with Sections 5604.6.1 through 5604.6.5.2.

5604.6.1 Drainage. The ground around a magazine shall be graded so that water drains away from the magazine.

5604.6.2 Heating. Magazines requiring heat shall be heated as prescribed in NFPA 495 by either hot water radiating heating within the magazine or by indirect warm air heating.

5604.6.3 Lighting. Where lighting is necessary within a magazine, electric safety flashlights or electric safety lanterns shall be used, except as provided in NFPA 495.

5604.6.4 Nonsparking materials. In other than Type 5 magazines, there shall not be exposed ferrous metal on the interior of a magazine containing packages of explosives.

5604.6.5 Signs and placards. Property on which Type 1 magazines and outdoor magazines of Types 2, 4 and 5 are located shall be posted with signs stating: “NO SMOKING” and “EXPLOSIVES—KEEP OFF.” These signs shall be of contrasting colors with a minimum letter height of 3 inches (76 mm) with a minimum brush stroke of $\frac{1}{2}$ inch (12.7 mm). The signs shall be located to minimize the possibility of a bullet shot at the sign hitting the magazine.

5604.6.5.1 Access road signs. At the entrance to explosive material manufacturing and storage sites, all access roads shall be posted with the following warning sign or other approved sign:

DANGER!
NEVER FIGHT EXPLOSIVE FIRES.
EXPLOSIVES ARE STORED ON THIS SITE
CALL _____

The sign shall be weather resistant with a reflective surface and have lettering not less than 2 inches (51 mm) high.

5604.6.5.2 Placards. Type 5 magazines containing Division 1.5 blasting agents shall be prominently plac-

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**TABLE 5604.5.2(1)
AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES AS
APPROVED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES AND REVISED JUNE 1991^a**

QUANTITY OF EXPLOSIVE MATERIALS ^c		DISTANCES IN FEET							
		Inhabited buildings		Public highways with traffic volume less than 3,000 vehicles per day		Public highways with traffic volume greater than 3,000 vehicles per day and passenger railways		Separation of magazines ^d	
Pounds over	Pounds not over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
0	5	70	140	30	60	51	102	6	12
5	10	90	180	35	70	64	128	8	16
10	20	110	220	45	90	81	162	10	20
20	30	125	250	50	100	93	186	11	22
30	40	140	280	55	110	103	206	12	24
40	50	150	300	60	120	110	220	14	28
50	75	170	340	70	140	127	254	15	30
75	100	190	380	75	150	139	278	16	32
100	125	200	400	80	160	150	300	18	36
125	150	215	430	85	170	159	318	19	38
150	200	235	470	95	190	175	350	21	42
200	250	255	510	105	210	189	378	23	46
250	300	270	540	110	220	201	402	24	48
300	400	295	590	120	240	221	442	27	54
400	500	320	640	130	260	238	476	29	58
500	600	340	680	135	270	253	506	31	62
600	700	355	710	145	290	266	532	32	64
700	800	375	750	150	300	278	556	33	66
800	900	390	780	155	310	289	578	35	70
900	1,000	400	800	160	320	300	600	36	72
1,000	1,200	425	850	165	330	318	636	39	78
1,200	1,400	450	900	170	340	336	672	41	82
1,400	1,600	470	940	175	350	351	702	43	86
1,600	1,800	490	980	180	360	366	732	44	88
1,800	2,000	505	1,010	185	370	378	756	45	90
2,000	2,500	545	1,090	190	380	408	816	49	98
2,500	3,000	580	1,160	195	390	432	864	52	104
3,000	4,000	635	1,270	210	420	474	948	58	116
4,000	5,000	685	1,370	225	450	513	1,026	61	122
5,000	6,000	730	1,460	235	470	546	1,092	65	130
6,000	7,000	770	1,540	245	490	573	1,146	68	136
7,000	8,000	800	1,600	250	500	600	1,200	72	144
8,000	9,000	835	1,670	255	510	624	1,248	75	150
9,000	10,000	865	1,730	260	520	645	1,290	78	156
10,000	12,000	875	1,750	270	540	687	1,374	82	164
12,000	14,000	885	1,770	275	550	723	1,446	87	174
14,000	16,000	900	1,800	280	560	756	1,512	90	180
16,000	18,000	940	1,880	285	570	786	1,572	94	188

(continued)

TABLE 5604.5.2(1)—continued
AMERICAN TABLE OF DISTANCES FOR STORAGE OF EXPLOSIVES AS
APPROVED BY THE INSTITUTE OF MAKERS OF EXPLOSIVES AND REVISED JUNE 1991^a

QUANTITY OF EXPLOSIVE MATERIALS ^c		DISTANCES IN FEET							
		Inhabited buildings		Public highways with traffic volume less than 3,000 vehicles per day		Public highways with traffic volume greater than 3,000 vehicles per day and passenger railways		Separation of magazines ^d	
Pounds over	Pounds not over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
18,000	20,000	975	1,950	290	580	813	1,626	98	196
20,000	25,000	1,055	2,000	315	630	876	1,752	105	210
25,000	30,000	1,130	2,000	340	680	933	1,866	112	224
30,000	35,000	1,205	2,000	360	720	981	1,962	119	238
35,000	40,000	1,275	2,000	380	760	1,026	2,000	124	248
40,000	45,000	1,340	2,000	400	800	1,068	2,000	129	258
45,000	50,000	1,400	2,000	420	840	1,104	2,000	135	270
50,000	55,000	1,460	2,000	440	880	1,140	2,000	140	280
55,000	60,000	1,515	2,000	455	910	1,173	2,000	145	290
60,000	65,000	1,565	2,000	470	940	1,206	2,000	150	300
65,000	70,000	1,610	2,000	485	970	1,236	2,000	155	310
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000	160	320
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000	165	330
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000	170	340
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000	175	350
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000	180	360
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000	185	370
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000	195	390
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000	205	410
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000	215	430
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000	225	450
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000	235	470
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000	245	490
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000	255	510
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000	265	530
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000	275	550
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000	285	570
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000	295	590
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000	315	630
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000	335	670
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000	360	720
275,000	300,000 ^b	2,275	2,275	690	1,380	2,000	2,000	385	770

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

- This table applies only to the manufacture and permanent storage of commercial explosive materials. It is not applicable to transportation of explosives or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles or other heavily encased explosives.
- Storage in excess of 300,000 pounds of explosive materials in one magazine is not allowed.
- Where a manufacturing building on an explosive materials plant site is designed to contain explosive materials, such building shall be located with respect to its proximity to inhabited buildings, public highways and passenger railways based on the maximum quantity of explosive materials permitted to be in the building at one time.
- Where two or more storage magazines are located on the same property, each magazine shall comply with the minimum distances specified from inhabited buildings, railways and highways, and, in addition, they should be separated from each other by not less than the distances shown for separation of magazines, except that the quantity of explosives in detonator magazines shall govern in regard to the spacing of said detonator magazines from magazines containing other explosive materials. Where any two or more magazines are separated from each other by less than the specified separation of magazines distances, then two or more such magazines, as a group, shall be considered as one magazine, and the total quantity of explosive materials stored in such group shall be treated as if stored in a single magazine located on the site of any magazine in the group and shall comply with the minimum distances specified from other magazines, inhabited buildings, railways and highways.
- All types of blasting caps in strengths through No. 8 cap shall be rated at 1½ pounds of explosives per 1,000 caps. For strengths higher than No. 8 cap, consult the chief having jurisdiction.
- For quantity and distance purposes, detonating fuse up to 60 grains per foot, shall be calculated as equivalent to nine (9) pounds of high explosives per 1000 feet. Heavier cord loads shall be rated proportionally.

EXPLOSIVES AND FIREWORKS

TABLE 5604.5.2(2)
TABLE OF DISTANCES (Q-D) FOR BUILDINGS AND MAGAZINES CONTAINING EXPLOSIVES—DIVISION 1.3 MASS-FIRE HAZARD^{a, b, c}

QUANTITY OF DIVISION 1.3 EXPLOSIVES (NET EXPLOSIVES WEIGHT)		DISTANCES IN FEET			
Pounds Over	Pounds Not Over	Inhabited Building Distance (IBD)	Distance to Public Traffic Route (PTR)	Intermagazine Distance (IMD)	Intraline Distance (ILD) or Intraplant Distance (IPD)
0	1,000	75	75	50	50
1,000	5,000	115	115	75	75
5,000	10,000	150	150	100	100
10,000	20,000	190	190	125	125
20,000	30,000	215	215	145	145
30,000	40,000	235	235	155	155
40,000	50,000	250	250	165	165
50,000	60,000	260	260	175	175
60,000	70,000	270	270	185	185
70,000	80,000	280	280	190	190
80,000	90,000	295	295	195	195
90,000	100,000	300	300	200	200
100,000	200,000	375	375	250	250
200,000	300,000	450	450	300	300

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

- a. Black powder, where stored in magazines, is defined as low explosive by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF).
- b. For quantities less than 1,000 pounds, the required distances are those specified for 1,000 pounds. The use of lesser distances is allowed where supported by approved test data or analysis.
- c. Linear interpolation of explosive quantities between table entries is allowed.

TABLE 5604.5.2(3)
TABLE OF DISTANCES (Q-D) FOR BUILDINGS AND MAGAZINES CONTAINING EXPLOSIVES—DIVISION 1.4^c

QUANTITY OF DIVISION 1.4 EXPLOSIVES (NET EXPLOSIVES WEIGHT)		DISTANCES IN FEET			
Pounds Over	Pounds Not Over	Inhabited Building Distance (IBD)	Distance to Public Traffic Route (PTR)	Intermagazine Distance ^{a, b} (IMD)	Intraline Distance (ILD) or Intraplant Distance ^a (IPD)
50	Not Limited	100	100	50	50

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

- a. A separation distance of 100 feet is required for buildings of other than Type I or Type II construction as defined in the *California Building Code*.
- b. For earth-covered magazines, specific separation is not required.
 - 1. Earth cover material used for magazines shall be relatively cohesive. Solid or wet clay and similar types of soil are too cohesive and shall not be used. Soil shall be free from unsanitary organic matter, trash, debris and stones heavier than 10 pounds or larger than 6 inches in diameter. Compaction and surface preparation shall be provided, as necessary, to maintain structural integrity and avoid erosion. Where cohesive material cannot be used, as in sandy soil, the earth cover over magazines shall be finished with a suitable material to ensure structural integrity.
 - 2. The earth fill or earth cover between earth-covered magazines shall be either solid or sloped, in accordance with the requirements of other construction features, but not less than 2 feet of earth cover shall be maintained over the top of each magazines. To reduce erosion and facilitate maintenance operations, the cover shall have a slope of 1 unit vertical to 2 units horizontal (50-percent slope).
- c. Restricted to articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives regulations, or unpacked articles used in process operations that do not propagate a detonation or deflagration between articles.

arded as required during transportation by DOTn 49 CFR Part 172 and DOTy 27 CFR Part 555.

5604.7 Operation. Magazines shall be operated in accordance with Sections 5604.7.1 through 5604.7.9.

5604.7.1 Security. Magazines shall be kept locked in the manner prescribed in NFPA 495 at all times except during placement or removal of explosives or inspection.

5604.7.2 Open flames and lights. Smoking, matches, flame-producing devices, open flames, firearms and fire-

arms cartridges shall not be allowed inside of or within 50 feet (15 240 mm) of magazines.

5604.7.3 Brush. The area located around a magazine shall be kept clear of brush, dried grass, leaves, trash, debris and similar combustible materials for a distance of 25 feet (7620 mm).

5604.7.4 Combustible storage. Combustible materials shall not be stored within 50 feet (15 240 mm) of magazines.

5604.7.5 Unpacking and repacking explosive materials.

Containers of explosive materials, except fiberboard containers, and packages of damaged or deteriorated explosive materials or fireworks shall not be unpacked or repacked inside or within 50 feet (15 240 mm) of a magazine or in close proximity to other explosive materials.

5604.7.5.1 Storage of opened packages. Packages of explosive materials that have been opened shall be closed before being placed in a magazine.

5604.7.5.2 Nonsparking tools. Tools used for the opening and closing of packages of explosive materials, other than metal slitters for opening paper, plastic or fiberboard containers, shall be made of nonsparking materials.

5604.7.5.3 Disposal of packaging. Empty containers and paper and fiber packaging materials that previously contained explosive materials shall be disposed of or reused in an approved manner.

5604.7.5.4 Packaging of Phosphoric Compounds. *No provisions of these regulations nor the standards referenced herein shall allow any person to repackage any compound from the original manufacturer's packaging unit. The manufacturer of phosphoric compounds shall package and ship only in units which have been determined to meet the standards for shipping of hazardous materials.*

5604.7.6 Tools and equipment. Metal tools, other than nonferrous transfer conveyors and ferrous metal conveyor stands protected by a coat of paint, shall not be stored in a magazine containing explosive materials or detonators.

5604.7.7 Contents. Magazines shall be used exclusively for the storage of explosive materials, blasting materials and blasting accessories.

5604.7.8 Methods of storage. *Packages of explosives shall be laid flat with top side up. Black powder, when stored in magazines with other explosives, shall be stored in separate piles. Corresponding grades and brands shall be stored together in such a manner so that brands and grade marks are visible. All stocks shall be stored so as to be easily counted and checked. Packages of explosives shall be piled in a stable manner. When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first. The use of storage pallets is mandatory. Packages of explosive materials shall be stacked in a stable manner not exceeding 8 feet (2438 mm) in height.*

5604.7.9 Stock rotation. When explosive material is removed from a magazine for use, the oldest usable stocks shall be removed first.

5604.7.10 Flooding. *Magazine contents shall be protected from flooding.*

5604.8 Maintenance. Maintenance of magazines shall comply with Sections 5604.8.1 through 5604.8.3.

5604.8.1 Housekeeping. Magazine floors shall be regularly swept and be kept clean, dry and free of grit, paper, empty packages and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from magazine floors shall be disposed of in accordance with the manufacturer's approved instructions.

5604.8.2 Repairs. Explosive materials shall be removed from the magazine before making repairs to the interior of a magazine. Explosive materials shall be removed from the magazine before making repairs to the exterior of the magazine where there is a possibility of causing a fire. Explosive materials removed from a magazine under repair shall either be placed in another magazine or placed a safe distance from the magazine, where they shall be properly guarded and protected until repairs have been completed. Upon completion of repairs, the explosive materials shall be promptly returned to the magazine. Floors shall be cleaned before and after repairs.

5604.8.3 Floors. Magazine floors stained with liquid shall be dealt with in accordance with instructions obtained from the manufacturer of the explosive material stored in the magazine.

5604.8.4 Piling of stocks. *Provisions shall be made to prevent the piling of stocks of explosives directly against the walls of Class I magazines. Such protection, however, shall not in any way interfere with proper ventilation or the required ventilation openings.*

5604.9 Inspection. Magazines containing explosive materials shall be opened and inspected at maximum seven-day intervals. The inspection shall determine whether there has been an unauthorized or attempted entry into a magazine or an unauthorized removal of a magazine or its contents.

5604.10 Disposal of explosive materials. Explosive materials shall be disposed of in accordance with Sections 5604.10.1 through 5604.10.7.

5604.10.1 Notification. The fire code official shall be notified immediately where deteriorated or leaking explosive materials are determined to be dangerous or unstable and in need of disposal.

5604.10.2 Deteriorated materials. Where an explosive material has deteriorated to an extent that it is in an unstable or dangerous condition, or when a liquid has leaked from an explosive material, the person in possession of such material shall immediately contact the material's manufacturer to obtain disposal and handling instructions.

5604.10.3 Qualified person. The work of destroying explosive materials shall be directed by persons experienced in the destruction of explosive materials. *Only competent experienced persons, at least 21 years of age, shall do the work of destroying explosives.*

5604.10.4 Storage of misfires. Explosive materials and fireworks recovered from blasting or display misfires shall be placed in a magazine until an experienced person has determined the proper method for disposal.

5604.10.5 Disposal sites. Sites for the destruction of explosive materials and fireworks shall be approved and located at the maximum practicable safe distance from inhabited buildings, public highways, operating buildings and all other exposures to ensure keeping air blast and ground vibration to a minimum. The location of disposal sites shall not be closer to magazines, inhabited buildings, railways, highways and other rights-of-way than is allowed by Tables 5604.5.2(1), 5604.5.2(2) and 5604.5.2(3). Where possible, barricades shall be utilized between the destruction site and inhabited buildings. Areas where explosives are detonated or burned shall be posted with adequate warning signs.

5604.10.6 Reuse of site. Unless an approved burning site has been thoroughly saturated with water and has passed a safety inspection, 48 hours shall elapse between the completion of a burn and the placement of scrap explosive materials for a subsequent burn.

5604.10.7 Personnel safeguards. Once an explosive burn operation has been started, personnel shall relocate to a safe location where adequate protection from air blast and flying debris is provided. Personnel shall not return to the burn area until the person in charge has inspected the burn site and determined that it is safe for personnel to return.

5604.11 Explosives at Piers, Railway Stations and Cars or Vessels Not Otherwise Specified in These Rules and Regulations.

[California Code of Regulations, Title 19, Division 1, §1571. General]

§1571. General. Except in an emergency and with permission of the “Chief” having jurisdiction, no person shall have or keep explosives in a railway car unless said car and contents and methods of loading are in accordance with the US DOT Regulations for the Transportation of Explosives.

[California Code of Regulations, Title 19, Division 1, §1571.1 Cargo Delivery].

§1571.1 Cargo Delivery. No person shall deliver any explosive to any person who does not possess and present a valid permit, or copy thereof, to receive and transport from the “Chief” having jurisdiction and/or the California Highway Patrol. In addition to the permit requirements, rail or truck terminal personnel shall not deliver any explosive to any person unless such explosive conforms in all respects, including marking and packing, to the Regulations for the Transportation of Explosives.

[California Code of Regulations, Title 19, Division 1, §1571.2 Placarding at Destination]

§1571.2 Placarding at Destination. Every railway car containing explosives which has reached its destination, or is stopped in transit so as no longer to be in interstate commerce, shall remain placarded as required until completely unloaded. After unloading, such placards shall be removed.

[California Code of Regulations, Title 19, Division 1, §1571.3 Explosives Location]

§1571.3 Explosives Location. Any explosives at a railway facility, truck terminal, pier, wharf, harbor facility or airport

terminal, within any city, city and county, county, fire protection district or the state, whether for delivery to a consignee, or forwarded to some other destination, shall be kept in a safe place which has been approved by the “Chief” having jurisdiction. In approving such location it is the intent that the explosives shall be isolated as far as practicable and in such manner that they can be easily and quickly removed.

[California Code of Regulations, Title 19, Division 1, §1571.4 Cargo Delivery Times]

§1571.4 Cargo Delivery Times. Explosives shall not be delivered to or received from any railway station, truck terminal, pier, wharf, harbor facility or airport terminal within a city, city and county, county, fire protection district, or the state between the hours of sunset and sunrise, except by special permit from the “Chief” having jurisdiction.

[California Code of Regulations, Title 19, Division 1, §1571.5 Fire Department Notification]

§1571.5 Fire Department Notification. When explosives are brought into any city, city and county, county, fire protection district or the state, by any means of transportation, for delivery to an intermediate receiver, consignee’s agent or consignee, or to be forwarded to some other destination, the carrier performing the shipment shall immediately notify the consignee and when required, the “Chief” having jurisdiction of the arrival of the explosives, and if said consignee does not receive and remove the said explosives from the possession of the carrier within 48-hours (Sundays and holidays excluded), after such notification, then the railway, trucking firm, vessel agent or airline shall remove the said explosives from the city, city and county, county, fire protection district, or state or to a permitted magazine or make a report to the “Chief” having jurisdiction, who shall see that the said explosives are moved to a place of safety.

[California Code of Regulations, Title 19, Division 1, §1571.6 Cargo Removal]

§1571.6 Cargo Removal. Any person having been notified, as consignee, of a shipment of explosives being in the hands of any carrier, within any city, city and county, county, fire protection district, or the state, shall remove the said explosives within 48-hours (Sundays and holidays excluded), after receiving such notification to a place meeting the requirements of these rules and regulations.

[California Code of Regulations, Title 19, Division 1, §1571.7 Facility Designation]

§1571.7 Facility Designation. The “Chief” having jurisdiction has the authority to and may designate the location for, and limit the quantity of, explosives which may be loaded, unloaded or temporarily retained at any facility within his jurisdiction.

**SECTION 5605
MANUFACTURE, ASSEMBLY AND
TESTING OF EXPLOSIVES, EXPLOSIVE
MATERIALS AND FIREWORKS**

5605.1 General. The manufacture, assembly and testing of explosives, ammunition, blasting agents and fireworks shall

comply with the requirements of this section and NFPA 495 or NFPA 1124.

Exceptions:

1. The hand loading of small arms ammunition prepared for personal use and not offered for resale.
2. The mixing and loading of blasting agents at blasting sites in accordance with NFPA 495.
3. The use of binary explosives or phosphoric materials in blasting or pyrotechnic special effects applications in accordance with NFPA 495 or NFPA 1126.

5605.2 Emergency planning and preparedness. Emergency plans, emergency drills, employee training and hazard communication shall conform to the provisions of this section and Sections 404, 405, 406 and 407.

5605.2.1 Hazardous Materials Management Plans and Inventory Statements required. Detailed Hazardous Materials Management Plans (HMMP) and Hazardous Materials Inventory Statements (HMIS) complying with the requirements of Section 407 shall be prepared and submitted to the local emergency planning committee, the fire code official and the local fire department.

5605.2.2 Maintenance of plans. A copy of the required HMMP and HMIS shall be maintained on site and furnished to the fire code official on request.

5605.2.3 Employee training. Workers who handle explosives or explosive charges or dispose of explosives shall be trained in the hazards of the materials and processes in which they are to be engaged and with the safety rules governing such materials and processes.

5605.2.4 Emergency procedures. Approved emergency procedures shall be formulated for each plant and shall include personal instruction in any anticipated emergency. Personnel shall be made aware of an emergency warning signal.

5605.3 Intraplant separation of operating buildings. Explosives manufacturing buildings and fireworks manufacturing buildings, including those where explosive charges are assembled, manufactured, prepared or loaded utilizing Division 1.1, 1.2, 1.3, 1.4 or 1.5 explosives, shall be separated from all other buildings, including magazines, within the confines of the manufacturing plant, at a distance not less than those shown in Table 5604.5.2(3) or Table 5605.3, as appropriate.

The quantity of explosives in an operating building shall be the net weight of all explosives contained therein. Distances shall be based on the hazard division requiring the greatest separation, unless the aggregate explosive weight is divided by approved walls or shields designed for that purpose. Where dividing a quantity of explosives into smaller stacks, a suitable barrier or adequate separation distance shall be provided to prevent propagation from one stack to another.

Where distance is used as the sole means of separation within a building, such distance shall be established by testing. Testing shall demonstrate that propagation between

stacks will not result. Barriers provided to protect against explosive effects shall be designed and installed in accordance with approved standards.

Exception: Fireworks manufacturing buildings separated in accordance with NFPA 1124.

**TABLE 5605.3
MINIMUM INTRALINE (INTRAPLANT) SEPARATION DISTANCES
(ILD OR IPD) BETWEEN BARRICADED OPERATING BUILDINGS
CONTAINING EXPLOSIVES—DIVISION 1.1, 1.2 OR 1.5
MASS-EXPLOSION HAZARD^a**

NET EXPLOSIVE WEIGHT		
Pounds Over	Pounds Not Over	Intraline Distance (ILD) or Intraplant Distance (IPD) (feet)
0	50	30
50	100	40
100	200	50
200	300	60
300	400	65
400	500	70
500	600	75
600	700	80
700	800	85
800	900	90
900	1,000	95
1,000	1,500	105
1,500	2,000	115
2,000	3,000	130
3,000	4,000	140
4,000	5,000	150
5,000	6,000	160
6,000	7,000	170
7,000	8,000	180
8,000	9,000	190
9,000	10,000	200
10,000	15,000	225
15,000	20,000	245
20,000	25,000	265
25,000	30,000	280
30,000	35,000	295
35,000	40,000	310
40,000	45,000	320
45,000	50,000	330
50,000	55,000	340
55,000	60,000	350
60,000	65,000	360
65,000	70,000	370

(continued)

TABLE 5605.3—continued
MINIMUM INTRALINE (INTRAPLANT) SEPARATION DISTANCES
(ILD OR IPD) BETWEEN BARRICADED OPERATING BUILDINGS
CONTAINING EXPLOSIVES—DIVISION 1.1, 1.2 OR 1.5
MASS-EXPLOSION HAZARD^a

NET EXPLOSIVE WEIGHT		
Pounds Over	Pounds Not Over	Intraline Distance (ILD) or Intraplant Distance (IPD) (feet)
70,000	75,000	385
75,000	80,000	390
80,000	85,000	395
85,000	90,000	400
90,000	95,000	410
95,000	100,000	415
100,000	125,000	450
125,000	150,000	475
150,000	175,000	500
175,000	200,000	525
200,000	225,000	550
225,000	250,000	575
250,000	275,000	600
275,000	300,000	635

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

a. Where a building or magazine containing explosives is not barricaded, the intraline distances shown in this table shall be doubled.

5605.4 Separation of manufacturing operating buildings from inhabited buildings, public traffic routes and magazines. Where an operating building on an explosive materials plant site is designed to contain explosive materials, such a building shall be located away from inhabited buildings, public traffic routes and magazines in accordance with Table 5604.5.2(2) or 5604.5.2(3) as appropriate, based on the maximum quantity of explosive materials permitted to be in the building at one time (see Section 5601.8).

Exception: Fireworks manufacturing buildings constructed and operated in accordance with NFPA 1124.

5605.4.1 Determination of net explosive weight for operating buildings. In addition to the requirements of Section 5601.8 to determine the net explosive weight for materials stored or used in operating buildings, quantities of explosive materials stored in magazines located at distances less than intraline distances from the operating building shall be added to the contents of the operating building to determine the net explosive weight for the operating building.

5605.4.1.1 Indoor magazines. The storage of explosive materials located in indoor magazines in operating buildings shall be limited to a net explosive weight not to exceed 50 pounds (23 kg).

5605.4.1.2 Outdoor magazines with a net explosive weight less than 50 pounds. The storage of explosive materials in outdoor magazines located at less than intraline distances from operating buildings shall be

limited to a net explosive weight not to exceed 50 pounds (23 kg).

5605.4.1.3 Outdoor magazines with a net explosive weight greater than 50 pounds. The storage of explosive materials in outdoor magazines in quantities exceeding 50 pounds (23 kg) net explosive weight shall be limited to storage in outdoor magazines located not less than intraline distances from the operating building in accordance with Section 5604.5.2.

5605.4.1.4 Net explosive weight of materials stored in combination indoor and outdoor magazines. The aggregate quantity of explosive materials stored in any combination of indoor magazines or outdoor magazines located at less than the intraline distances from an operating building shall not exceed 50 pounds (23 kg).

5605.5 Buildings and equipment. Buildings or rooms that exceed the maximum allowable quantity per control area of explosive materials shall be operated in accordance with this section and constructed in accordance with the requirements of the *California Building Code* for Group H occupancies.

Exception: Fireworks manufacturing buildings constructed and operated in accordance with NFPA 1124.

5605.5.1 Explosives dust. Explosives dust shall not be exhausted to the atmosphere.

5605.5.1.1 Wet collector. When collecting explosives dust, a wet collector system shall be used. Wetting agents shall be compatible with the explosives. Collector systems shall be interlocked with process power supplies so that the process cannot continue without the collector systems operating.

5605.5.1.2 Waste disposal and maintenance. Explosives dust shall be removed from the collection chamber as often as necessary to prevent overloading. The entire system shall be cleaned at a frequency that will eliminate hazardous concentrations of explosives dust in pipes, tubing and ducts.

5605.5.2 Exhaust fans. Squirrel cage blowers shall not be used for exhausting hazardous fumes, vapors or gases. Only nonferrous fan blades shall be used for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

5605.5.3 Work stations. Work stations shall be separated by distance, barrier or other approved alternatives so that fire in one station will not ignite material in another work station. Where necessary, the operator shall be protected by a personnel shield located between the operator and the explosive device or explosive material being processed. This shield and its support shall be capable of withstanding a blast from the maximum amount of explosives allowed behind it.

5605.6 Operations. Operations involving explosives shall comply with Sections 5605.6.1 through 5605.6.10.

5605.6.1 Isolation of operations. Where the type of material and processing warrants, mechanical operations involving explosives in excess of 1 pound (0.454 kg) shall be carried on at isolated stations or at intraplant distances,

and machinery shall be controlled from remote locations behind barricades or at separations so that workers will be at a safe distance while machinery is operating.

5605.6.2 Static controls. The work area where the screening, grinding, blending and other processing of static-sensitive explosives or pyrotechnic materials is done shall be provided with approved static controls.

5605.6.3 Approved containers. Bulk explosives shall be kept in approved, nonsparking containers when not being used or processed. Explosives shall not be stored or transported in open containers.

5605.6.4 Quantity limits. The quantity of explosives at any particular work station shall be limited to that posted on the load limit signs for the individual work station. The total quantity of explosives for multiple work stations shall not exceed that established by the intraplant distances in Table 5604.5.2(3) or Table 5605.3, as appropriate.

5605.6.4.1 Magazines. Magazines used for storage in processing areas shall be in accordance with the requirements of Section 5604.5.1. Explosive materials shall be removed to appropriate storage magazines for unattended storage at the end of the workday. The contents of indoor magazines shall be added to the quantity of explosives contained at individual work stations and the total quantity of material stored, processed or used shall be utilized to establish the intraplant separation distances indicated by Table 5604.5.2(3) or Table 5605.3, as appropriate.

5605.6.5 Waste disposal. Approved receptacles with covers shall be provided for each location for disposing of waste material and debris. These waste receptacles shall be emptied and cleaned as often as necessary but not less than once each day or at the end of each shift.

5605.6.6 Safety rules. General safety rules and operating instructions governing the particular operation or process conducted at that location shall be available at each location.

5605.6.7 Personnel limits. The number of occupants in each process building and in each magazine shall not exceed the number necessary for proper conduct of production operations.

5605.6.8 Pyrotechnic and explosive composition quantity limits. Not more than 500 pounds (227 kg) of pyrotechnic or explosive composition, including not more than 10 pounds (5 kg) of salute powder shall be allowed at one time in any process building or area. Compositions not in current use shall be kept in covered nonferrous containers.

Exception: Composition that has been loaded or pressed into tubes or other containers as consumer fireworks.

5605.6.9 Posting limits. The maximum number of occupants and maximum weight of pyrotechnic and explosive composition permitted in each process building shall be posted in a conspicuous location in each process building or magazine.

5605.6.10 Heat sources. Fireworks, explosives or explosive charges in explosive materials manufacturing, assembly or testing shall not be stored near any source of heat.

Exception: Approved drying or curing operations.

5605.7 Maintenance. Maintenance and repair of explosives-manufacturing facilities and areas shall comply with Section 5604.8.

5605.8 Explosive materials testing sites. Detonation of explosive materials or ignition of fireworks for testing purposes shall be done only in isolated areas at sites where distance, protection from missiles, shrapnel or flyrock, and other safeguards provides protection against injury to personnel or damage to property.

5605.8.1 Protective clothing and equipment. Protective clothing and equipment shall be provided to protect persons engaged in the testing, ignition or detonation of explosive materials.

5605.8.2 Site security. Where tests are being conducted or explosives are being detonated, only authorized persons shall be present. Areas where explosives are regularly or frequently detonated or burned shall be approved and posted with adequate warning signs. Warning devices shall be activated before burning or detonating explosives to alert persons approaching from any direction that they are approaching a danger zone.

5605.9 Waste disposal. Disposal of explosive materials waste from manufacturing, assembly or testing operations shall be in accordance with Section 5604.10.

SECTION 5606

SMALL ARMS AMMUNITION AND SMALL ARMS AMMUNITION COMPONENTS

5606.1 General. Indoor storage and display of black powder, smokeless propellants, small arms primers, small arms ammunition and commercial reloading shall comply with this section and NFPA 495.

5606.2 Prohibited storage. Small arms ammunition shall not be stored together with Division 1.1, Division 1.2 or Division 1.3 explosives unless the storage facility is suitable for the storage of explosive materials.

5606.3 Packages. Smokeless propellants shall be stored in approved shipping containers conforming to DOTn 49 CFR Part 173.

5606.3.1 Repackaging. The bulk repackaging of smokeless propellants, black powder and small arms primers shall not be performed in retail establishments.

5606.3.2 Damaged packages. Damaged containers shall not be repackaged.

Exception: Approved repackaging of damaged containers of smokeless propellant into containers of the same type and size as the original container.

5606.4 Storage in Group R occupancies. The storage of small arms ammunition components in Group R occupancies shall comply with Sections 5606.4.1 through 5606.4.3.

5606.4.1 Black powder. Black powder for personal use in quantities not exceeding 20 pounds (9 kg) shall be stored in original containers in occupancies limited to Group R-3. Quantities exceeding 20 pounds (9 kg) shall not be stored in any Group R occupancy.

5606.4.2 Smokeless propellants. Smokeless propellants for personal use in quantities not exceeding 20 pounds (9 kg) shall be stored in original containers in occupancies limited to Group R-3. Smokeless propellants in quantities exceeding 20 pounds (9 kg) but not exceeding 50 pounds (23 kg) and kept in a wooden box or cabinet having walls of not less than 1 inch (25 mm) nominal thickness shall be allowed to be stored in occupancies limited to Group R-3. Quantities exceeding these amounts shall not be stored in any Group R occupancy.

5606.4.3 Small arms primers. Not more than 10,000 small arms primers shall be stored in occupancies limited to Group R-3.

5606.5 Display and storage in Group M occupancies. The display and storage of small arms ammunition components in Group M occupancies shall comply with Sections 5606.5.1 through 5606.5.2.3.

5606.5.1 Display. Display of small arms ammunition components in Group M occupancies shall comply with Sections 5606.5.1.1 through 5606.5.1.3.

5606.5.1.1 Smokeless propellant. Not more than 20 pounds (9 kg) of smokeless propellants, in containers of 1 pound (0.454 kg) or less capacity each, shall be displayed in Group M occupancies.

5606.5.1.2 Black powder. Not more than 1 pound (0.454 kg) of black powder shall be displayed in Group M occupancies.

5606.5.1.3 Small arms primers. Not more than 10,000 small arms primers shall be displayed in Group M occupancies.

5606.5.2 Storage. Storage of small arms ammunition components shall comply with Sections 5606.5.2.1 through 5606.5.2.3.

5606.5.2.1 Smokeless propellant. Commercial stocks of smokeless propellants shall be stored as follows:

1. Quantities exceeding 20 pounds (9 kg), but not exceeding 100 pounds (45 kg) shall be stored in portable wooden boxes having walls of not less than 1 inch (25 mm) nominal thickness.
2. Quantities exceeding 100 pounds (45 kg), but not exceeding 800 pounds (363 kg), shall be stored in nonportable storage cabinets having walls not less than 1 inch (25 mm) nominal thickness. Not more than 400 pounds (182 kg) shall be stored in any one cabinet, and cabinets shall be separated by a distance of not less than 25 feet (7620 mm) or by a fire partition having a fire-resistance rating of not less than 1 hour.
3. Storage of quantities exceeding 800 pounds (363 kg), but not exceeding 5,000 pounds (2270 kg) in a building shall comply with all of the following:

- 3.1. The warehouse or storage room is not open to unauthorized personnel.
 - 3.2. Smokeless propellant shall be stored in nonportable storage cabinets having wood walls not less than 1 inch (25 mm) nominal thickness and having shelves with not more than 3 feet (914 mm) of separation between shelves.
 - 3.3. Not more than 400 pounds (182 kg) is stored in any one cabinet.
 - 3.4. Cabinets shall be located against walls of the storage room or warehouse with not less than 40 feet (12 192 mm) between cabinets.
 - 3.5. The minimum required separation between cabinets shall be 20 feet (6096 mm) provided that barricades twice the height of the cabinets are attached to the wall, midway between each cabinet. The barricades must extend not less than 10 feet (3048 mm) outward, be firmly attached to the wall and be constructed of steel not less than $\frac{1}{4}$ inch thick (6.4 mm), 2-inch (51 mm) nominal thickness wood, brick or concrete block.
 - 3.6. Smokeless propellant shall be separated from materials classified as combustible liquids, flammable liquids, flammable solids or oxidizing materials by a distance of 25 feet (7620 mm) or by a fire partition having a fire-resistance rating of 1 hour.
 - 3.7. The building shall be equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.
4. Smokeless propellants not stored in accordance with Item 1, 2, or 3 shall be stored in a Type 2 or 4 magazine in accordance with Section 5604 and NFPA 495.

5606.5.2.2 Black powder. Commercial stocks of black powder in quantities less than 50 pounds (23 kg) shall be allowed to be stored in Type 2 or 4 indoor or outdoor magazines. Quantities greater than 50 pounds (23 kg) shall be stored in outdoor Type 2 or 4 magazines. Where black powder and smokeless propellants are stored together in the same magazine, the total quantity shall not exceed that permitted for black powder.

5606.5.2.3 Small arms primers. Commercial stocks of small arms primers shall be stored as follows:

1. Quantities not to exceed 750,000 small arms primers stored in a building shall be arranged such that not more than 100,000 small arms primers are stored in any one pile and piles are not less than 15 feet (4572 mm) apart.

2. Quantities exceeding 750,000 small arms primers stored in a building shall comply with all of the following:

- 2.1. The warehouse or storage building is not open to unauthorized personnel.
- 2.2. Small arms primers shall be stored in cabinets. Not more than 200,000 small arms primers shall be stored in any one cabinet.
- 2.3. Shelves in cabinets shall have vertical separation of not less than 2 feet (610 mm).
- 2.4. Cabinets shall be located against walls of the warehouse or storage room with not less than 40 feet (12 192 mm) between cabinets. The minimum required separation between cabinets shall be allowed to be reduced to 20 feet (6096 mm) provided that barricades twice the height of the cabinets are attached to the wall, midway between each cabinet. The barricades shall be firmly attached to the wall and shall be constructed of steel not less than $\frac{1}{4}$ inch thick (6.4 mm), 2-inch (51 mm) nominal thickness wood, brick or concrete block.
- 2.5. Small arms primers shall be separated from materials classified as combustible liquids, flammable liquids, flammable solids or oxidizing materials by a distance of 25 feet (7620 mm) by a fire partition having a fire-resistance rating of 1 hour.
- 2.6. The building shall be protected throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

3. Small arms primers not stored in accordance with Item 1 or 2 of this section shall be stored in a magazine meeting the requirements of Section 5604 and NFPA 495.

5606.6 Commercial reloading. Commercial reloading of small arms ammunition shall comply with Sections 5606.6.1 through 5606.6.8.

5606.6.1 Electrical. Areas within 3 feet (914 mm) of reloading equipment shall be Class I, Division 2, Group A type.

5606.6.2 Exhaust fans. Squirrel cage blowers shall not be used for exhausting hazardous fumes, vapors or gases. Only nonferrous fan blades shall be used for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

5606.6.3 Work stations. Work stations shall be separated by distance, barrier or other approved alternatives so that

fire in one station will not ignite material in another work station.

5606.6.4 Personnel limits. The number of occupants in each process building and in each magazine shall not exceed the number necessary for proper conduct of production operations.

5606.6.5 Approved containers. Smokeless powder shall be kept in its original container.

5606.6.6 Static controls. The work area shall be provided with approved static controls.

5606.6.7 Waste disposal. Approved receptacles with covers shall be provided for each location for disposing of waste material and debris. These waste receptacles shall be emptied and cleaned as often as necessary but not less than once each day or at the end of each shift.

5606.6.8 Safety rules. General safety rules and operating instructions governing the particular operation or process conducted at that location shall be available at each location.

5606.6 Transportation of Small Arms Ammunition, Small Arms Primers, Smokeless Powder and Black Sporting Powder.

[California Code of Regulations, Title 19, Division 1, §1574.1. Transportation]

§1574.1. Transportation. Quantities, in shipping containers approved by the US DOTn, of not more than twenty (20) pounds of smokeless powder or not more than five (5) pounds of black sporting powder (or any combination thereof) may be transported in a private passenger vehicle without a permit.

[California Code of Regulations, Title 19, Division 1, §1574.2. Magazine]

§1574.2. Magazine—When Required. Quantities in excess of twenty (20) pounds (but not exceeding fifty (50) pounds) of smokeless powder, or not more than five (5) pounds of black sporting powder (or any combination thereof) may be transported in a private passenger vehicle when approved by the “Chief” having jurisdiction, provided however, that such powder shall be transported in separate portable magazines having wooden walls of at least one (1) inch nominal thickness.

[California Code of Regulations, Title 19, Division 1, §1574.3. Transportation Prohibitions]

§1574.3. Transportation Prohibitions. Transportation of quantities in excess of fifty (50) pounds of smokeless powder or five (5) pounds of black sporting powder is prohibited in a private passenger vehicle.

[California Code of Regulations, Title 19, Division 1, §1574.4. Transportation—US Department of Transportation]

§1574.4. Transportation—US Department of Transportation. Transportation of quantities in excess of fifty (50) pounds of smokeless powder or five (5) pounds of black sporting powder in other than a private passenger vehicle shall be in accordance with the US DOTn regulations.

[California Code of Regulations, Title 19, Division 1, §1574.5. Storage Containers]

§1574.5. Storage Containers. All smokeless powder and black sporting powder shall be stored in US DOTn approved shipping containers, or in a container approved by the “Chief” having jurisdiction.

[California Code of Regulations, Title 19, Division 1, §1575. Primer Containers]

§1575. Primer Containers. Small arms ammunition primers shall not be transported or stored except in the original shipping container approved by the US DOTn.

[California Code of Regulations, Title 19, Division 1, §1575.1. Transportation]

§1575.1. Transportation. Truck or rail transportation of small arms ammunition primers shall be in accordance with US DOTn regulations.

[California Code of Regulations, Title 19, Division 1, §1575.2 Transportation Prohibitions]

§1575.2 Transportation Prohibitions. Not more than 250,000 small arms ammunition primers shall be transported in a private passenger vehicle.

SECTION 5607 BLASTING

5607.1 General. Blasting operations shall be conducted only by approved, competent operators familiar with the required safety precautions and the hazards involved and in accordance with *this section* and the provisions of NFPA 495.

5607.2 Manufacturer’s instructions. Blasting operations shall be performed in accordance with the instructions of the manufacturer of the explosive materials being used.

5607.3 Blasting in congested areas. Where blasting is done in a congested area or in close proximity to a structure, railway or highway, or any other installation, precautions shall be taken to minimize earth vibrations and air blast effects. Blasting mats or other protective means shall be used to prevent fragments from being thrown.

5607.4 Restricted hours. Surface-blasting operations shall only be conducted during daylight hours between sunrise and sunset. Other blasting shall be performed during daylight hours unless otherwise approved by the fire code official.

5607.5 Utility notification. Where blasting is being conducted in the vicinity of utility lines or rights-of-way, the blaster shall notify the appropriate representatives of the utilities not less than 24 hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notices shall be confirmed with written notice.

Exception: In an emergency situation, the time limit shall not apply where approved.

5607.6 Electric detonator precautions. Precautions shall be taken to prevent accidental discharge of electric detonators from currents induced by radar and radio transmitters, lightning, adjacent power lines, dust and snowstorms, or other sources of extraneous electricity.

5607.7 Nonelectric detonator precautions. Precautions shall be taken to prevent accidental initiation of nonelectric detonators from stray currents induced by lightning or static electricity.

5607.8 Blasting area security. During the time that holes are being loaded or are loaded with explosive materials, blasting agents or detonators, only authorized persons engaged in drilling and loading operations or otherwise authorized to enter the site shall be allowed at the blast site. The blast site shall be guarded or barricaded and posted. Blast site security shall be maintained until after the post-blast inspection has been completed.

5607.9 Drill holes. Holes drilled for the loading of explosive charges shall be made and loaded in accordance with NFPA 495.

5607.9.1 Drill hole loading. No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives shall be immediately returned to proper storage.

5607.9.2 Drill hole deepening. Drill holes which have contained explosives shall not be re-drilled.

5607.10 Removal of excess explosive materials. After loading for a blast is completed and before firing, excess explosive materials shall be removed from the area and returned to the proper storage facilities.

5607.11 Initiation means. The initiation of blasts shall be by means conforming to the provisions of NFPA 495.

5607.12 Connections. The blaster shall supervise the connecting of the blastholes and the connection of the loadline to the power source or initiation point. Connections shall be made progressively from the blasthole back to the initiation point.

Blasting lead lines shall remain shunted (shorted) and shall not be connected to the blasting machine or other source of current until the blast is to be fired.

5607.13 Firing control. A blast shall not be fired until the blaster has made certain that all surplus explosive materials are in a safe place in accordance with Section 5607.10, all persons and equipment are at a safe distance or under sufficient cover and that an adequate warning signal has been given.

5607.14 Post-blast procedures. After the blast, the following procedures shall be observed.

1. Persons shall not return to the blast area until allowed to do so by the blaster in charge.
2. The blaster shall allow sufficient time for smoke and fumes to dissipate and for dust to settle before returning to or approaching the blast area.
3. The blaster shall inspect the entire blast site for misfires before allowing other personnel to return to the blast area.

5607.15 Misfires. Where a misfire is suspected, all initiating circuits shall be traced and a search made for unexploded charges. Where a misfire is found, the blaster shall provide proper safeguards for excluding all personnel from the blast area. Misfires shall be reported to the blasting supervisor

immediately. Misfires shall be handled under the direction of the person in charge of the blasting operation in accordance with NFPA 495.

SECTION 5608 FIREWORKS DISPLAY

5608.1 General. Outdoor fireworks displays, use of pyrotechnics before a proximate audience and pyrotechnic special effects in motion picture, television, theatrical and group entertainment productions shall comply with *California Code of Regulations, Title 19, Division 1, Chapter 6 Fireworks and this section.*

5608.1.1 Scope. *Fireworks and temporary storage, use and handling of pyrotechnic special effects material used in motion pictures, television and theatrical and group entertainment productions shall be in accordance with California Code of Regulations, Title 19, Division 1, Chapter 6 Fireworks.*

[California Code of Regulations, Title 19, Division 1, §980-1006]

Article 2. Definitions

§980. Definitions.

Aerial Shell. *A cylinder or spherical cartridge containing a burst charge and pyrotechnic or non-pyrotechnic effects, a fuse, a black powder lift charge and is fired from a mortar.*

ASTM. *The American Society of Testing and Materials, a national organization publishing standards for all types of materials and products.*

Barrage. *A rapidly fired sequence of effects.*

Batten. *A strip of wood to which pyrotechnic devices are attached for support.*

Binary Low Explosive Compounds. *Special effects materials in which fuel and an oxidizer are mixed together to produce a pyrotechnic composition.*

Blank Cartridge. *A cartridge constructed from either metal or plastic casing, with a center or rim fire primer filled with various amounts of pyrotechnic compositions measured by loads.*

Blasting Galvanometer. *An electrical resistance measuring device designed specifically and approved for testing of electric firing circuits.*

Bottle Rocket. *A pyrotechnic device containing a maximum of 20 grams of pyrotechnic composition, which rises into the air upon ignition. A stick is used for guidance and stability, and a burst of color or noise, or both, is produced at height of flight.*

Break. *An individual burst from an aerial shell, producing either a visible or audible effect or both, and may consist of a single burst or multiple effects.*

Bullet Effect. *The discharge of the pyrotechnic or explosive bullet hit.*

Bullet Hit. *A device containing various levels and amounts of pyrotechnic composition, whose purpose is to create the illusion of a bullet impact.*

California Candle. *Hand held heavy paper or cardboard tube emitting showers of sparks.*

Comet. *A pyrotechnic device launched from a mortar that produces an ascending burning effect, is self-consuming, and may or may not contain a burst charge or stars.*

Darts. *To move suddenly and swiftly from one place to another.*

Detonator. *Any device containing a detonating charge that is used for initiating detonation in an explosive. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps.*

DOTn means US Department of Transportation.

Dud. *A pyrotechnic item which leaves the mortar and returns to earth without producing the intended burst or effect. See also Misfire.*

Electric Firing. *A technique used to discharge fireworks in which an electric match or squib and a source of electric current are used to ignite fuses or lift charges.*

Electric Match. *An electric device containing a pyrotechnic compound which ignites when sufficient current flows through the leads.*

Firecracker. *A device containing explosive pyrotechnic composition in an amount not to exceed 50 milligrams (.772 grains) in total pyrotechnic weight, in a fused container whose primary function is to produce an audible effect. Note: All firecrackers are classified as “dangerous fireworks”, and pyrotechnic devices similar in construction to a “firecracker” which exceed the specified weight shall be designated explosives in accordance with Health and Safety Code Section 12000.*

Flash Paper. *Treated paper which is extremely sensitive to heat and creates a brief flash of fire upon ignition.*

Flash Powder. *Pyrotechnic composition intended for use in firecrackers and salutes, and often used for “flash”-type effects on stage and in productions involving special effects. Flash powder produces an audible report and a flash of light when ignited. Typical flash powder compositions contain potassium chlorate or potassium perchlorate, sulfur or antimony sulfide and powdered aluminum.*

Flower Pot. *A shell (not the lifting charge) that explodes at or near the bottom of a mortar blowing a shower of stars and burning material into the air.*

Fountain. *See Gerb.*

Gerb. (also known as a Fountain). *A device that, when ignited, emits a shower of sparks into the air at various altitudes.*

Ground Spinning Device. *Also known as a Ground Spinner. A pyrotechnic device that discharges sparks as it spins across the surface upon which it is placed.*

HDPE Mortar. *Also known as a High Density Polyethylene Mortar, is a mortar constructed of high density polyethylene which is certified and labeled as meeting one or more of the following ASTM standards, which are hereby incorporated by reference: ASTM D3350 or ASTM F714.*

Ignitor. An electric, chemical or mechanical device used to initiate burning or pyrotechnic or propellant materials.

Lance. A thin cardboard tube packed with a color-producing pyrotechnic composition.

License. “License” means any nontransferable authorization granted by the State Fire Marshal to engage in any activity regulated by this part.

Licensee. “Licensee” means any person 21 years of age or older holding a fireworks license issued pursuant to Chapter 5 (commencing with Section 12570), of the Health and Safety Code.

Loader. A person who places shells into mortars.

Low Burst or Low Break. The result of a shell exploding below its prescribed height.

Magazine Tender. Person who distributes pyrotechnic items to the loader during the show.

Match. A fuse made of string or thread impregnated with black powder.

Meteor Shower. A self-contained cardboard tube mounted on a plastic base emitting a shower of stars into the air.

Mines or Mine Bags. A device contained within a reusable or disposable tube, where upon ignition stars, firecrackers, salutes, whistles or other devices are propelled into the air, with the tube remaining on the ground.

Misfire. A pyrotechnic item which fails to function as designed after initiation. See also Dud.

Monitor. Person responsible for watching for pyrotechnic items which do not perform properly.

Mortar. A cylinder that is used to hold and fire public display or special effects pyrotechnic items or compositions as defined in Section 999 of this subchapter.

Mortar Box. Also known as a Trough. A portable wooden structure used for the placement of mortars.

Mortar Rack. A wooden rack holding closely spaced HDPE or paper mortars. Mortar racks are limited to 10 tubes per individual rack.

Multiple Break Shell. Aerial shell which has two or more breaks.

Muzzle Burst. The process of an aerial shell breaking or bursting just as it leaves the mortar, scattering stars and burning material.

N.F.P.A. The National Fire Protection Association.

Non-metallic Mortar. See HDPE and Paper Mortar definition.

Pan Type Mortar. A shallow metal container that is used to hold and fire special effect pyrotechnic compositions.

Paper Mortar. A mortar constructed of spiral or convolute wound paper or chipboard.

Party Popper. “Party Popper” also known by other names such as Champagne Party Poppers, Party Surprise Popper and Hot Shot Poppers, is a pyrotechnic device which contains less than 0.25 grain of pyrotechnic composition per unit load,

designed to be held in the hand and when fired propels soft paper, cloth inserts or other similar fill material into the air.

Pigeons. Also known as line rockets. Pyrotechnic items using mechanical devices to control the effect of flight movement.

Public Display of Fireworks. “Public display of fireworks” means an entertainment feature where the public or a private group is admitted or permitted to view the display or discharge of dangerous fireworks, as defined in Section 12505 of Health and Safety Code.

Report. A detailed written account of all events involving pyrotechnic materials, devices and operations in which a fire, injury or death occurs, or in which any violation of the laws or regulations takes place.

Retailer. Any person who, at a fixed place of business, sells, transfers or gives fireworks to a consumer or user.

Roman Candle. A heavy paper or cardboard tube containing pellets of pyrotechnic composition which, when ignited, are expelled into the air at several-second intervals.

Salute. An aerial shell as well as other pyrotechnic items whose primary effects are detonation and flash of light.

Set Piece. Also known as ground display piece, mechanical piece. A pyrotechnic device or series of devices that while on the ground or elevated produces a visual and/or audible effect. These devices may employ fountains, roman candles, wheels and lances.

Shunt. A deliberate short-circuit of an electrically fired pyrotechnic device or a means contained within its firing system to protect it from accidental ignition by extraneous electricity.

Single Break Shell. Aerial shell having one or more effects within a cylindrical or spherical casing.

Snap Cap. Also known by other names such as, but not limited to, Snappers, Pop Pop Snappers, Fun Snaps and Bang Snaps. It is a pyrotechnic device that typically contains less than .20 grams, but shall not contain more than .25 grams, of gravel impregnated with not more than one milligram of pyrotechnic composition. Each unit consists of a small, roughly spherical paper parcel, approximately one-quarter (1/4) inch in diameter with a twisted paper tail. Each unit, when dropped against a hard surface, produces a small, toy cap-like report.

Note: Studies are conducted annually by the Office of State Fire Marshal which will determine whether or not there are adverse consequences from the regulation of snap caps.

Soft Detonator. A detonator in which the explosive or pyrotechnic material is encased in a non-metallic container.

Sparkler. A stick or wire coated with a pyrotechnic composition that produces a shower of sparks upon ignition.

Squib. See Electric Match. See also Detonator and Soft Detonator.

Travel. To move from point of ignition either vertically or horizontally.

Trough. Also known as a Mortar Box. A portable wooden structure used for the placement of mortars.

Wheel Driver. A heavy paper or cardboard tube emitting a shower of sparks from a very small orifice, similar to a propellant motor.

Within This State. “Within this state” means all territory within the boundaries of this state.

Article 3. Licenses

§981. General.

(a) No person shall engage in any type of fireworks activities without having submitted an application for and having obtained a license from the State Fire Marshal in accordance with the provisions of this chapter. Licenses shall be processed in accordance with Title 19, California Code of Regulations, Section 3.33.

Exceptions:

- (1) Licensed Pyrotechnic Operators Basic Commercial, Restricted Commercial and Rockets, First Class may employ unlicensed assistants. Unlicensed assistants shall perform only when under the direct, immediate and constant supervision of the licensee when handling fireworks and pyrotechnic compositions.
- (2) Licensed special effects and theatrical pyrotechnicians may employ unlicensed assistants. Unlicensed assistants shall perform only when under the direct, immediate and constant supervision of the licensee when handling fireworks and pyrotechnic compositions.
- (3) A license shall not be required for the use or discharge of safe and sane fireworks.

§981.1. Cause for Denial.

The use of any false or misleading statement or misrepresentation offered or used to secure any fireworks license, permit, classification, registration or any other official fireworks document is a violation of these regulations, and shall be cause for denial of the license, permit, classification, registration or other official fireworks document.

§981.2. Misuse or Alteration of License.

All fireworks licensees as set forth in this chapter shall be prohibited from giving or permitting any other person to use such license for any purpose whatsoever.

Any license issued under this chapter found to be altered shall be confiscated by the authority examining the license. The authority confiscating the license shall notify the State Fire Marshal immediately, and shall cooperate with the State Fire Marshal in all matters relating to an investigation of the incident.

§981.5. License Scope.

(a) **Model Rockets.** A Model Rocket License authorizes the manufacture, import, export or wholesale or any combination thereof.

(b) **Pyrotechnic Operator.** A Pyrotechnic Operator's License authorizes and places the responsibility for the handling, supervision and discharge of any fireworks item or pyrotechnic device and establishes that the operator is responsible for the training of his or her assistants in the safe handling,

supervision, and discharge of these items and devices, in accordance with the following:

- (1) **Pyrotechnic Operator—Unrestricted** may conduct and take charge of all fireworks activities in connection with every kind of public fireworks display, whether commercial entertainment, experimental and other types of rockets, special effects in motion picture, theatrical and television production.
- (2) **Pyrotechnic Operator—Basic Commercial** may conduct and is restricted to all fireworks activities in connection with a commercial fireworks public display, including the determination that all mortars, set pieces, rocket launchers and rockets are properly installed and that the proper safety precautions have been taken to ensure the safety of persons and property. Such operator shall have charge of all activities directly related to handling, preparing and firing all fireworks at the public display, including the fixing of lifting charges and quick match as needed for aerial shells.
- (3) **Pyrotechnic Operator—Restricted Commercial** may conduct and is restricted exclusively to the use and discharge of firecrackers and the use of other exempt fireworks in religious ceremonies.
- (4) **Pyrotechnic Operator—Rockets First Class** may conduct and is restricted to all activities in connection with research experiments, production, transportation, fuel loading and launching of all types of experimental rockets. Such operator shall also be responsible for the actions and conduct of all assistants. Operators licensed under subsection (b) are also required to obtain a local permit from the authority having jurisdiction prior to all launches.
- (5) **Pyrotechnic Operator—Rockets Second Class** may conduct and is restricted to all activities in connection with research experiments, production, transportation, fuel loading and launching of all types of solid fuel experimental rockets only. Such operator shall also be responsible for the actions and conduct of all assistants. Operators licensed under subsection (b) are also required to obtain a local permit from the authority having jurisdiction prior to all launches.
- (6) **Pyrotechnic Operator—Rockets Third Class** may purchase, transport, store and launch high power rockets. Experimental high power rocket motors may only be imported, exported and wholesaled by individuals or companies holding valid import, export or wholesale licenses. Pyrotechnic Operators—Third Class may only purchase high powered rocket motors from licensed wholesalers. Operators licensed under subsection (b) are also required to obtain a local permit from the authority having jurisdiction prior to all launches.
- (7) **Pyrotechnic Operator—Special Effects First Class** may conduct and is restricted to the use, preparation for transportation and the preparation and use of all types of fireworks and special effects pyrotechnics, for the sole purpose of producing a visible or audible

effect where and when such use is a necessary part of motion picture, television, theatrical or operatic production, as permitted by the fire authority having jurisdiction.

(8) *Pyrotechnic Operator—Special Effects Second Class* may conduct and is restricted to the use of special effects, the loading of blank cartridges, colored fire, flash paper, smoke composition, the preparation and use of binary A and B Flash composition and such other fireworks of whatever kind and class as may be permitted by the authority having jurisdiction, under a special permit in connection with television and motion picture production.

(9) *Pyrotechnic Operator—Special Effects Third Class* authorizes the loading of blank cartridge shells, and use of special effects when under the direct supervision and control of a *Pyrotechnic Operator--Special Effects First or Second Class*.

(10) *Pyrotechnic Operator—Theatrical* authorizes the use of special effects, blank cartridges, colored fire, flash paper, flash, smoke composition, and the preparation and use of binary A and B Flash composition in stage or theatrical productions only.

(11) *Pyrotechnic Operator—Theatrical Trainee* authorizes the conducting of procedures permitted a *Pyrotechnic Operator--Theatrical* when under the direct supervision and control of a licensed *Pyrotechnic Operator--Theatrical*.

(12) *Pyrotechnic Operator—Performer* is restricted to persons who perform before an audience, directly or indirectly, and may include magicians, comedians, still photographers and others whose primary interest is in other than pyrotechnics. Such license is restricted to the use of blank cartridges, colored fire, flash paper, sparklers and smoke composition in connection with the production of theatricals and operas before live audiences in theaters, opera houses, television studios, night clubs and similar occupancies, or by the use of a still photographer.

(c) *Separate License Not Required.* A separate license shall not be required of licensed manufacturers, wholesalers or importer-exporter to manufacture, wholesale, import or export agricultural and wildlife fireworks or model rocket engines.

(d) *Explosive Materials Not Included in Scope of License.* The license scope as defined in this section is restricted to the use of materials defined as “fireworks” (as defined in Health and Safety Code Section 12511) and in no way confers authority for the use or discharge of explosive materials defined in Health and Safety Code Sections 12000, et seq.

Article 4. Permits

§982. Local Permit, Application For.

(a) When applying for a permit under Health and Safety Code section 12640(e), an applicant shall submit the following information and evidence to the authority having jurisdiction:

- (1) The name of the organization sponsoring the display, together with the names and license numbers of persons actually in charge of the display.
- (2) The date and time of day the display is to be held.
- (3) The exact location planned for the display.
- (4) The size and number of all fireworks to be discharged including the number of set pieces, shells and other items. Shells shall be designated by diameter specifying single, multiple break or salute.
- (5) The manner and place of storage of all fireworks prior to, during and after the display.
- (6) Diagram of the grounds on which the display is to be held showing the point at which the fireworks are to be discharged, the location of all buildings, roads and other means of transportation, the lines behind which the audience will be restrained, the location of all nearby trees, telegraph or telephone lines or other overhead obstruction.
- (7) Proof that satisfactory workers' compensation insurance is carried for all employees in compliance with Labor Code Section 3700.
- (8) If the permit is for a public display or special effects, documentary proof of conformance with sections 12610 and 12611, Health and Safety Code.
- (9) A State Fire Marshal's license for the public display of fireworks, under Health and Safety Code Sections 12575, 12576 or 12577. No permit for a public display of any type shall be granted unless a public display license general, special or limited has been first obtained from the State Fire Marshal.
- (10) The name and license number of the wholesaler who supplied all items used in the display.

(b) Permittee shall be responsible for compliance with the provisions under which a public display permit has been granted.

Article 6. Classification of Fireworks

§986. Classification.

(a) Fireworks or pyrotechnic devices that are to be used or sold for use in this state and found by the State Fire Marshal to come within the definition of “party poppers”, “snap caps”, “safe and sane”, “agricultural and wildlife”, “model rocket motors”, “high power rocket motors”, “emergency signaling device” or “exempt” fireworks shall be classified as such by the State Fire Marshal.

Exception: Special Effects items developed and compounded on location for single time usage.

(b) The classification of an item shall not be construed as conferring classification to any similar item without the approval of the State Fire Marshal. The trade name of an item shall not be changed without notifying the State Fire Marshal 30 days prior to such change.

§986.1. Sparklers.

Sparklers, which are defined as a stick or wire coated with a pyrotechnic composition that produces a shower of sparks

upon ignition, are classified as dangerous fireworks under the authority of Health and Safety Code section 12505(k).

Article 8. Storage

§989. General.

All magazines shall meet the requirements as set forth in the Code of Federal Regulations, Title 27, Part 55, Subpart K (Storage).

§989.1. Storage, General Provisions.

(a) All fireworks, pyrotechnic compositions and pyrotechnic devices shall be kept in a locked magazine and in a manner approved by the authority having jurisdiction unless they are:

- (1) In the process of being manufactured;
- (2) In the process of being used; or
- (3) Being transported to a place of storage or use by a licensee, in accordance with the Code of Federal Regulations, Title 49, Part 173, Subpart C, and Title 13, Chapter 6, Article 3 of the California Code of Regulations.

(b) Class C Common Fireworks and those devices designated as “safe and sane” fireworks shall be stored in a manner consistent with the Code of Federal Regulations, Title 49, Section 173.88.

§989.2. Access Roads and Signs.

All magazine storage sites shall have access roads suitable for use by fire apparatus posted with the following warning sign or other sign approved by the authority having jurisdiction:

DANGER
NEVER FIGHT EXPLOSIVES FIRES
EXPLOSIVES ARE STORED ON THIS SITE
CALL: _____

The sign shall be weather-resistant with a reflective surface and lettering at least two (2) inches high.

§989.3. Activities and Devices Prohibited.

Smoking, matches, flame-producing devices, open flames and firearms shall not be permitted inside or within fifty (50) feet of magazines.

§989.4. Magazines in Dwelling Prohibited.

No loaded indoor storage magazine shall be located in a residence or dwelling.

Article 13. General Safety Requirements

§991. Safety Inspection.

Retail fireworks stands and sales areas are subject to inspection by the authority having jurisdiction. All areas where fireworks, pyrotechnic compositions or devices are used, stored or discharged shall be free from any condition which increases, or may cause an increase of, the hazard or menace of fire or explosion to a greater degree than customarily recognized as normal by persons in the public service of preventing, suppressing or extinguishing fire, or which may become the cause of any obstruction, delay or hindrance to the prevention, suppression or extinguishment of fire.

§991.1. Disposition Unsold Stock.

All retail fireworks licensees shall return unsold fireworks stocks to the wholesaler from whom they were purchased. The retail licensee may store unsold stock in a place and manner approved by the fire authority having jurisdiction until stock is returned to the wholesaler. Such return of stock shall be accomplished no later than the thirty-first of July of each year.

§991.2. Personnel.

The employer or permittee shall be responsible for instructing his or her personnel who handle fireworks, pyrotechnic compositions or devices in any capacity, in the hazards of and safety procedures relating to fireworks, pyrotechnic compositions or devices as contained in this chapter.

§991.3. Smoking, Storage and Handling Facilities.

Smoking shall be prohibited and “No Smoking” signs posted in all portions of the premises or locations where fireworks, pyrotechnic compositions or devices are stored or handled.

§991.4. Smoking, Sales Facilities.

Smoking shall be prohibited and signs bearing the words “No Smoking” shall be posted on and in every building, mobile facility or structure used for the sale of fireworks. Signs shall be positioned at the entrance to and inside such buildings, mobile facilities or structures, and at such other locations as designated by the authority having jurisdiction. Lettering shall be red in color on a white background. Letters shall be at least 3 inches in height with a stroke of at least 1/2 inch.

§991.5. Prohibited Substances.

Intoxicating liquids, narcotics and controlled substances are prohibited within the area of the firing site as determined by the authority having jurisdiction, and shall not be used by any person handling fireworks or special effects at any time during transportation, set-up, firing or removal.

Exception: Prescription drugs not impairing the motor functions and/or judgment of the persons affected by this section. Drugs must be taken as directed and specifically prescribed for the individual to be covered by this exception.

§991.6. Alcohol and Narcotics.

Article 13.5. Electrical Firing Circuits

§992. Electric Firing Circuits, General.

Connecting any electric firing circuit to any power supply, is prohibited until all special effects devices, fireworks and pyrotechnics in the sequence are connected to firing leads and the firing area is clear of all unauthorized personnel.

Exception: Circuit testing as described in section 992.3.

§992.1. Power Sources.

§992.2. Firing Systems Safeguards.

Power sources for firing special effects devices, fireworks and pyrotechnics shall be restricted to batteries or individually isolated, ungrounded generators used for firing purposes only.

Commercial or house power may be used provided the firing system is electrically isolated from the commercial or house power through the use of such items as isolation trans-

formers. Under no condition may commercial or house power be used directly for firing purposes.

All firing systems, including battery and power circuit types, shall be designed to ensure against accidental firing by providing, a shunt or other control method in which no firing power may be applied to any firing circuits unless the operator intentionally enables or arms the firing system before applying firing power.

§992.3. Circuit Tests.

All electrically fired pyrotechnic circuits shall be tested with a galvanometer or other test device in which the test current is not capable of firing the pyrotechnic device being tested.

§992.4. Sight Firing.

Special effects devices and pyrotechnics shall not be fired unless the area involved with the firing is in the continuously unobstructed full view of the pyrotechnic operator or his/her assistant at the time of firing.

Article 14. Special Effects

§992.5. Scope.

This article shall govern all “Special Effects Devices/ Materials” including those materials which have been classified and described by the regulations of the Department of Transportation, Title 49, parts 172, 173 and 177 as Special Fireworks Class B Explosives and Common Fireworks Class C Explosives and such additional items as listed in Table 14A.

§992.6. Responsibility.

The company representative shall provide to the authority having jurisdiction the name and license number of the special effects operator who shall have the authority, responsibility and be in charge of handling all Special Effects Materials. The company representative shall also allocate sufficient time to the Special Effects Pyrotechnic Operator to prepare for the transportation, packing, storing, securing daily, discharging, disposing of, or otherwise handling of fireworks, pyrotechnic devices or materials in a safe manner. Upon completion of firing, no unauthorized person shall be permitted access to the firing area until the licensed pyrotechnic operator has determined the area to be safe and secure.

§992.7. Orientation Meeting.

The company representative shall provide to the authority having jurisdiction the name and license number of the special effects operator who shall have the authority, responsibility and be in charge of handling all Special Effects Materials. The company representative shall also allocate sufficient time to the Special Effects Pyrotechnic Operator to prepare for the transportation, packing, storing, securing daily, discharging, disposing of or otherwise handling of fireworks, pyrotechnic devices or materials in a safe manner. Upon completion of firing, no unauthorized person shall be permitted access to the firing area until the licensed pyrotechnic operator has determined the area to be safe and secure.

Prior to the activity, a discussion of the events planned and all aspects and ramifications concerning safety issues as they relate to the safe use of fireworks, pyrotechnic devices

and materials shall be held among all appropriate parties, as determined by the authority having jurisdiction.

§992.8. Special Effects Materials.

(a) Materials described in this chapter as Special Effect Materials can be used as Special Effects. Other hazardous materials may be used when so authorized by the authority having jurisdiction.

§992.9. Storage and Working Supplies.

(a) Special Effects Materials storage facilities shall be used exclusively for the storage of Special Effects Materials. Storage facilities shall not be used for the assembling, compounding or manufacture of Special Effects Materials or any other item of fireworks. Magazines shall be kept locked at all times except when supplies are being withdrawn or replenished. Special Effects Materials shall be stored in accordance with the Code of Federal Regulations, Title 27, Part 55, Subpart K.

§992.10. Quantities.

(a) The quantities of special effects materials removed from magazines shall be limited to the amount necessary for immediate use. Under no condition shall any surplus or excess be permitted to remain outside a magazine, unless under the direct supervision of a licensed pyrotechnic operator.

§992.11. Equipment.

All tools, scoops and devices used in loading and handling Special Effects Materials shall be made of non-sparking materials.

§992.12. Mixing.

No persons shall mix any Special Effects Material except a licensed manufacturer or a licensed Special Effects Pyrotechnic Operator—First Class. All mixing, assembling or compounding when done by other than a licensed manufacturer shall be conducted in accordance with the applicable provisions of this chapter and with approval of the authority having jurisdiction.

Exception: Binary A & B Flash composition pre-packaged by a licensed manufacturer may be mixed and utilized according to manufacturer's instructions by a Pyrotechnic Operator, Special Effects—Second Class or Pyrotechnic Operator, Theatrical.

§992.13. Special Effects Water Locations.

All special effects devices and explosive charges set in or on the surface of water, either salt or fresh or any other liquid, shall be fired by a separate, individual, ungrounded and uncommon two-wire circuit.

§992.14. Special Effects Not Allowed To Be Carried in Wearing Apparel.

No Special Effects Materials other than blank cartridges may be carried within the wearing apparel of a person. This shall not apply to actors portraying a scene in a theatrical, television or film production.

§992.15. Special Effect Packaging.

All Special Effects Materials shall be packaged in accordance with Department of Transportation standards as con-

tained in Title 49 of the Code of Federal Regulations, parts 172, 173 and 177 and shall remain in the prescribed containers until used or placed in a magazine.

§992.16. Special Effects Mortars.

Mortars and other items used to hold special effects, pyrotechnic or explosive materials during discharge shall be made of a material having a thickness proportional to the strength of the explosive or pyrotechnic material being used, and in every case sufficient to prevent distortion in service. Tubular mortars for firing aerial pyrotechnic and fireworks shells shall conform to the requirements of article 15 of this chapter.

§992.17. Flash Powder Mortars.

The use of special effects flash powder mortars consisting of converted switch boxes, sockets or similar components is prohibited.

§992.18. Special Effects Reports.

(a) Verbal reports shall be made to the State Fire Marshal within 24 hours after a firing under this article when either of the following events occur:

- (1) Injury or death to the public or the crew as a result of the firing.
- (2) Fires requiring emergency action or response.

(b) Within ten (10) working days following an incident giving rise to a verbal report, the licensed pyrotechnician in charge of the activity shall submit a complete, accurate and factual report directly to the State Fire Marshal on the episode.

§992.19. Shunts.

§992.20. Firing Safeguards

§992.22. Water Locations.

§992.21. Circuit Tests.

§992.23. Sight Firing.

Table 14A Special Effects Materials

The following materials, when used in the motion picture/television/theatrical industry by licensed special effects pyrotechnicians and when permitted by the authority having jurisdiction, are to be regulated under this chapter as fireworks, pyrotechnic materials and devices and not as explosives under Health and Safety Code Section 12000.

BULK POWDER COMPOSITIONS AND DEVICES

Black Powder Smokeless Powder
Smoke Flash Compositions
Common Photo Flash Compositions
Illuminating Compositions
Atomized Flash Compositions
Two Component Flash Powder
Flash Paper
Flash Cotton
Flash Powder
Simulated Phosphorus
Sparking Granules
Lifters

SMOKE POWDER COMPOSITION AND DEVICES

All Colors
Smoke Compositions
Smoke Pellets
Smoke Granules
Smoke Candles
Smoke Cookies
Smoke Grenade
Smoke Pots
Smoke Signals

MATCHES AND FUSES

Quick Match
Black Match
Arcing Match
Silver Match
Cannon Fuse
Safety Fuse
Thermalite
Instantaneous Fuse
Igniter Cord

SQUIBS AND DETONATORS

Bullet Hits
Electric Match
Soft Detonators
Squibs
Detonators
Igniters

FIREWORKS

Common Class C Safe and Sane Fireworks
Common Class C Dangerous Fireworks
Special Class B Fireworks

OTHER MATERIALS

Primacord or Detonating Cord
Exploding Bolts and Cable Cutters
Non Electric Fuse
Shape Charges
Trick Noise Makers

Article 15. Public Display

§993. Insurance.

(a) Any person, firm or corporation applying for a public display license shall furnish to the State Fire Marshal a policy of public liability and property damage insurance. The policy may have a deductible not to exceed fifteen thousand dollars (\$15,000). The policy shall provide limits of bodily injury and property damage liability of not less than one million dollars (\$1,000,000.00) combined single limits for each occurrence annually as payment for damages to persons or property which may result from or be caused by such public display of fireworks, or any negligence on the part of the licensee or his or its agents, servants, employees or subcontractors presenting such public display.

Exception: A deductible in excess of fifteen thousand dollars (\$15,000) may be permitted provided a security deposit, such as, but not limited to a surety bond, pledge of

assets or bank letter of credit covering the value of the excess, is approved by the State Fire Marshal.

(b) The certificate of insurance shall provide all of the following:

- (1) That the insurer will not cancel the insured's coverage without 15 days prior written notice to the State Fire Marshal.
- (2) That the duly licensed pyrotechnic operator required by law to supervise and discharge the public display, acting either as an employee of the insured or as an independent contractor and the State of California, its officers, agents, employees and servants are included as additional insurers, but only insofar as any operations under this chapter are concerned.
- (3) That the State shall not be responsible for any premium or assessments on the policy.

§993.1. Reports. General public display and special public display licensees shall report to the State Fire Marshal prior to date of each display all public displays of fireworks contemplated under their license. Licensee must report to the State Fire Marshal at least 72 hours prior to each display on state-owned or state-occupied property. Applicants for limited public display licenses shall report at the time of applying for their license. The report shall contain the information set forth in Section 982.

Exception: A general public display licensee conducting special effects activities for motion picture, television and theatrical productions need not comply with any of the above reporting requirements.

§997. Pyrotechnic Operators, Basic Commercial, Responsibilities.

(a) No basic commercial public display permit shall be granted unless there is a licensed basic commercial pyrotechnic operator and at least one additional experienced person present. Pyrotechnic Operators, Basic Commercial, shall:

- (1) Be responsible for and have control over on-site unloading, storing and security of all fireworks;
- (2) Be responsible for placement of mortars, set pieces and all other fireworks on-site as approved by the authority having jurisdiction. No fireworks shall be discharged over areas occupied by spectators;
- (3) Ensure that no person under the age of 18 is in the firing or fireworks storage sites;
- (4) Be in possession of a current basic commercial license at the time of display; and
- (5) Be responsible for and have control over the safe return of all unfired fireworks, misfires and duds.

§999. Mortars, Aerial Shells

(a) General.

- (1) Electric firing shall be required for all mortars eight inches (8") or greater in diameter.
- (2) Multiple-break shells that include a salute as one of the breaks shall be fired in HDPE mortars only.

(b) Steel Mortars.

- (1) Steel Mortars shall be constructed of commercially manufactured, first quality electric resistance weld (ERW) or drawn over mandrel (DOM) steel tubing conforming to ASTM Standard A135-83, which is incorporated by reference. Mortars constructed of cast iron, other fragmenting types of steel and all other types of metal are prohibited. Salutes shall not be fired from metallic mortars.
- (2) Steel mortars shall have a base plate the same thickness of the mortar wall, welded continuously around its perimeter.
- (3) The inside length of steel mortars shall meet the minimum specifications set forth below:

Shell Size	Inside Length
1.99 inches or less	8 inches
2 inches	13 inches
2½ inches	13 inches
3 inches	15 inches
4 inches	20 inches
5 inches	25 inches
6 inches	30 inches
7 inches	32 inches
8 inches	32 inches
10 inches	40 inches
12 inches	40 inches
16 inches	64 inches
24 inches	96 inches

(4) Mortars shall not have any visible cracks in the body of the tube, nor any cracks or voids in the weld around the base plug. Mortars shall not be dented or distorted beyond the point that such distortion interferes with the smooth and unimpeded travel of the shell throughout the entire length of the mortar.

(c) Paper Mortars.

(1) Reusable paper mortars shall be of spiral or convolute wound kraft paper or chipboard, and shall meet the minimum specifications set forth below:

Shell Size	Wall Thickness	Inside Length	Base Plug*
Less than 2 inches	1/8 inch	8 inches	1 inch
2 inches	1/4 inch	13 inches	2 inches
2½ inches	3/8 inch	13 inches	3 inches
3 inches	3/8 inch	15 inches	3 inches
4 inches	1/2 inch	20 inches	3 inches
5 inches	1/2 inch	25 inches	4 inches
6 inches	1/2 inch	30 inches	4 inches
7 inches	3/4 inch	32 inches	4 inches
8 inches	3/4 inch	32 inches	4 inches

*Sizes for base plugs are nominal.

(2) Base plugs for paper mortars shall be wooden and securely glued, as well as nailed, screwed or bolted to the base of the mortar. Base plugs shall be discarded and replaced when damaged. Minor cracks and checks are acceptable.

(3) Multiple-break shells shall not be fired from paper mortars.

(d) HDPE Mortars. High Density Polyethylene (HDPE) mortars shall meet the minimum specifications set forth below:

Shell Size	Wall Thickness	Inside Length	Base Plug*
Less than 2"	$\frac{1}{8}$ inch	10 inches	1 inch
2 inches	$\frac{1}{4}$ inch	13 inches	2 inches
2½ inches	$\frac{1}{4}$ inch	13 inches	3 inches
3 inches	$\frac{1}{4}$ inch	15 inches	3 inches
4 inches	$\frac{1}{4}$ inch	20 inches	3 inches
5 inches	$\frac{1}{4}$ inch	25 inches	4 inches
6 inches	$\frac{3}{8}$ inch	30 inches	4 inches
7 inches	$\frac{3}{8}$ inch	32 inches	4 inches
8 inches	$\frac{3}{8}$ inch	32 inches	6 inches

*Base plug sizes are nominal.

HDPE Mortars shall not be reloaded for a period of at least one (1) hour after use. All base plugs for HDPE mortars shall be wooden and securely glued, as well as nailed, screwed or bolted to the base of the mortar. Base plugs shall be discarded and replaced when damaged. Minor cracks and checks are acceptable.

(e) Other Materials. Recognizing that new materials for the construction of mortars may be developed, such materials may be used when specifically approved by the State Fire Marshal. Persons wishing to use material not specifically covered in this section shall submit the material in an amount sufficient for testing to the State Fire Marshal for determination of its safety and its inclusion in this section.

For illustrations of typical mortar racks, troughs and drums, see Diagrams A, B and C following Section 1002.

§1001. Setting Mortars.

(a) Metallic, re-usable paper and HDPE mortars shall be securely buried to a minimum of $\frac{2}{3}$ of their minimal legal length in earth or in drums or troughs filled with moist earth or sand essentially free of debris.

(b) Mortars other than metallic mortars may be placed in wooden finale racks.

(c) Planking below mortars shall be required when the base of the mortar, trough or drum is not on a stable and level surface.

(d) Mortars in non-electrically-fired shows shall meet all of the following requirements:

- (1) Mortars up to five inches in diameter and buried in earth or placed in troughs or drums shall be spaced a minimum of 3 inches apart or from the sides of the drum or trough.
- (2) Mortars six inches or larger in diameter and buried in earth or placed in troughs or drums shall be spaced a minimum of 5 inches apart or from the sides of the drum or trough. When a mortar requiring 5 inches of

space is placed adjacent to a mortar requiring only 3 inches of spacing, the larger spacing shall apply.

(e) Mortars in electrically-fired shows shall meet all of the following requirements:

(1) All mortars buried in earth or placed in drums and troughs shall be nominally spaced 2 inches apart or from the sides of the drum or trough.

(2) All technicians shall be positioned a minimum of 100 feet from any mortar and positioned so as to be protected from the direct line of fire.

(3) No one shall be allowed to enter the firing area during the firing of the display.

(f) Mortars shall be set in a stable and secure manner so that accidental impact and shell discharge will not change the trajectory of adjacent unfired shells.

For illustrations of typical mortar racks, troughs and drums, see Diagrams A, B and C following Section 1002.

§1002. Design Specifications for Mortar Racks, Troughs, Drums and Ready Boxes.

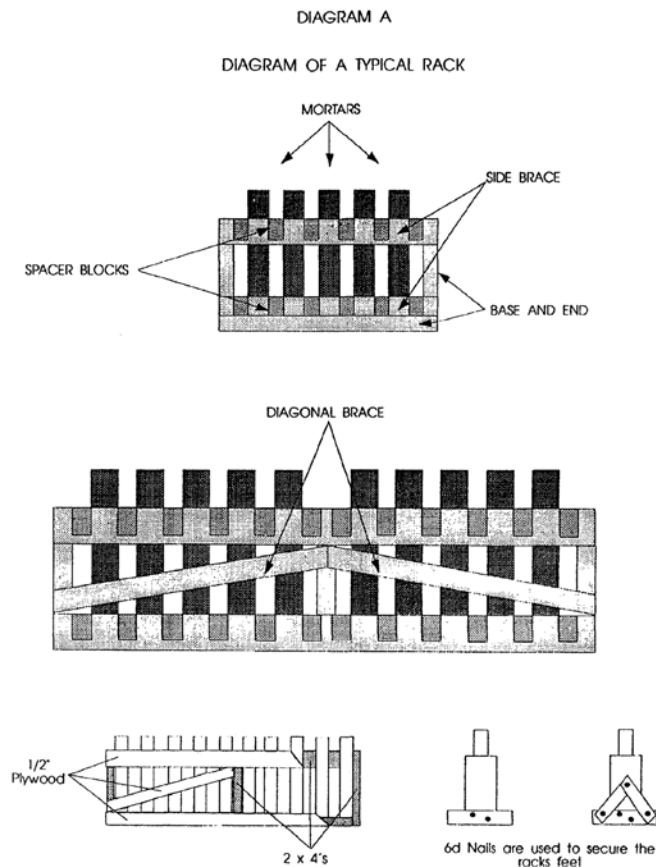
(a) Mortar racks shall be limited to a maximum of 10 tubes per unit. The base and ends of the rack shall be nominal 2 inch thick lumber. The inside width shall be equal to the outside diameter of the mortar tube. Each mortar tube shall be separated by horizontal or vertical blocks nominally 2 inches thick and 4 inches wide. Side braces for mortar racks of 3 inch size mortars and up shall be 1 inch x 6 inch nominal lumber or $\frac{1}{2}$ inch x 4 inch plywood securely fastened by nails, screws or attached with construction grade staples along the top and bottom of the rack. A diagonal side brace must be employed on all mortar racks with more than 5 mortar tubes. Mortar racks shall not incorporate steel brackets or other metallic parts in their construction with the exception of nails, screws or construction-grade staples. Metallic braces shall not be fastened to mortar racks at the firing site.

(b) Troughs shall not be more than 8 feet in length. Troughs may be placed in a continuous row provided they are stable and secure. The sides, bottom and ends of troughs shall be minimum $\frac{3}{4}$ inch plywood or nominal 2 inch lumber, except in cases where the surface at the bottom of the trough is sufficiently stable to support the firing of the mortar, no bottom shall be required. Troughs shall be secured by minimum $\frac{3}{8}$ inch through bolts, rods or angle iron "U" brackets at each end and center to prevent bulging.

(c) Drums shall be constructed of steel, aluminum or plastic.

(d) Ready boxes shall be constructed of wood not less than $\frac{1}{2}$ inch thickness or $\frac{3}{8}$ inch plywood, chipboard or presswood. Ready boxes shall not be equipped with any type of hold open device.

Note: For illustrations of typical mortar racks, troughs and drums, see Diagrams A, B and C immediately following this section.



§1003. Operation of Display.

(a) General.

- (1) All fireworks at a display site shall be stored in a place and manner secure from fire, accidental discharge and theft. All storage shall be approved by the authority having jurisdiction.
- (2) Shells shall be sized for proper fit and for damaged lift charge bags, lead fuse tears, tears in the piping of the quick match leaders and missing safety caps.
- (3) Safety caps protecting the fuse shall not be removed until firing or electric hookup.

(b) Ready Boxes.

- (1) Shells used for reloading shall be placed in ready boxes prior to the start of the display.
- (2) Ready boxes shall not be located less than 25 feet upwind from the nearest mortar prior to any firings.
- (3) Ready boxes shall be divided into separate compartments for each shell size.
- (4) When containing shells, ready boxes shall be set with the bottom facing the mortars with the front elevated,

or set on the bottom with the hinges towards the mortar, providing the lid cannot be opened fully.

- (5) Once in place, the ready box shall be covered with a flame-resistive water-repellant canvas cover.

(c) Loading Mortars.

- (1) At no time shall any person place any part of their body over the mortar muzzle during loading or firing.
- (2) Mortars shall be cleaned of debris or burning material prior to loading, and prior to reloading, as necessary.
- (3) Mortar racks may be reloaded with non-chained single-break shells when there is no longer any burning material in the racks.
- (4) Finale racks shall have tape placed over the mortar muzzles when loaded with finale chained shells.
- (5) Salutes and detonating shells shall not be fired from steel mortars.
- (6) Multiple-break shells that include a salute as one of the breaks shall be fired from HDPE mortars only.

(d) Firing.

- (1) All firing shall be done upon order or signal of the licensed pyrotechnic operator controlling the display.
- (2) Electric firing, if utilized, shall comply with all of the requirements of Article 13.5 of this chapter.
- (3) Upon conclusion of firing, no unauthorized person shall be permitted access to the firing area until the licensed pyrotechnic operator has determined the area to be safe and secure.
- (4) Electric firing shall be required for all mortars eight inches (8") or greater in diameter.

(e) Ground Effects.

- (1) Set pieces, wheels and mechanical devices shall be braced, guyed and securely attached or set as required to prevent displacement.
- (2) Low level Roman Candles, multiple batteries and projectiles shall be securely set to prevent accidental displacement.

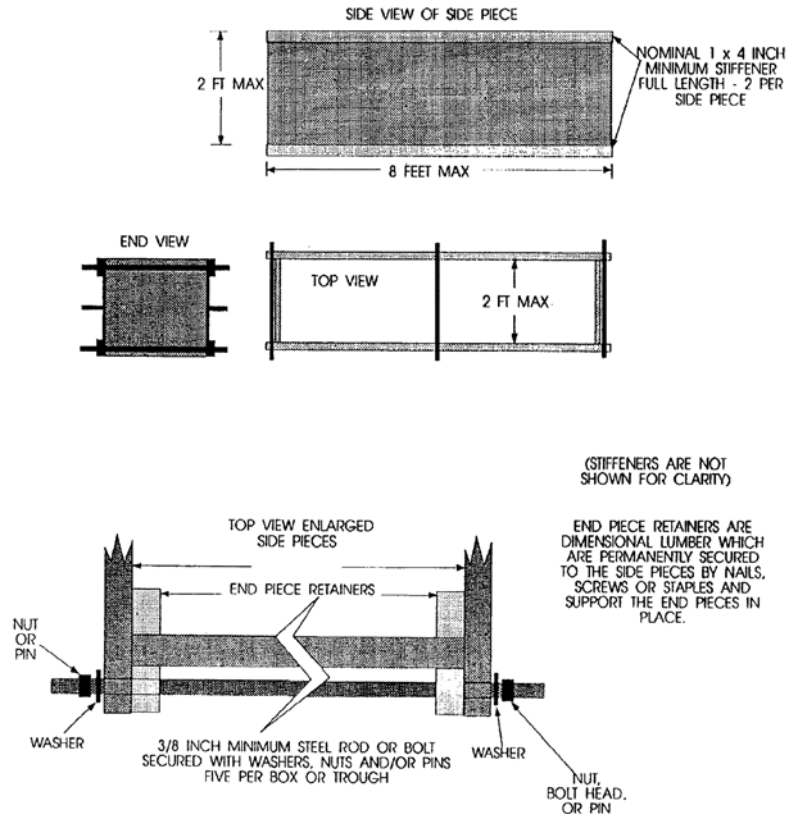
(f) Duds.

- (1) The licensed pyrotechnic operator shall account for and retrieve all duds immediately following the display.
- (2) The entire firing range shall be inspected immediately following the display to locate any duds. Any shells found shall be immediately doused with water before handling. The shell shall then be placed in a separate container filled halfway with water.

(g) Misfires.

- (1) When a shell misfires, and the fuse has burned, but the lift charge has not functioned, the mortar shall be identified and marked, and left undisturbed for a minimum of 5 minutes, then filled halfway with water.

DIAGRAM B
DIAGRAM OF A TYPICAL TROUGH SETTING



(2) When the shell misfires due to electric malfunction, and the fuse has not yet burned, the shell shall be removed and stored pursuant to the permit.

(3) When the display is concluded, the misfired shell shall be placed in a safe area pursuant to the permit.

(h) Unfired shells, including duds and misfires, must be removed immediately following the display and returned directly to the wholesaler/manufacturer unless provision has been made for storage and/or destruction with the authority having jurisdiction.

§1004. Safety Tools and Equipment.

(a) Tools required at the display site shall be, at a minimum, a shovel, a serviceable pressurized water fire extinguisher, a bucket or other container to soak duds, and any other equipment as required by the authority having jurisdiction.

(b) Any person manually discharging aerial shells shall wear at a minimum a hard hat, eye protection, long sleeved shirt, gloves, long pants and shoes or boots, and have available ear protection, as required by the authority having jurisdiction.

§1005. Post Display.

(a) Reports.

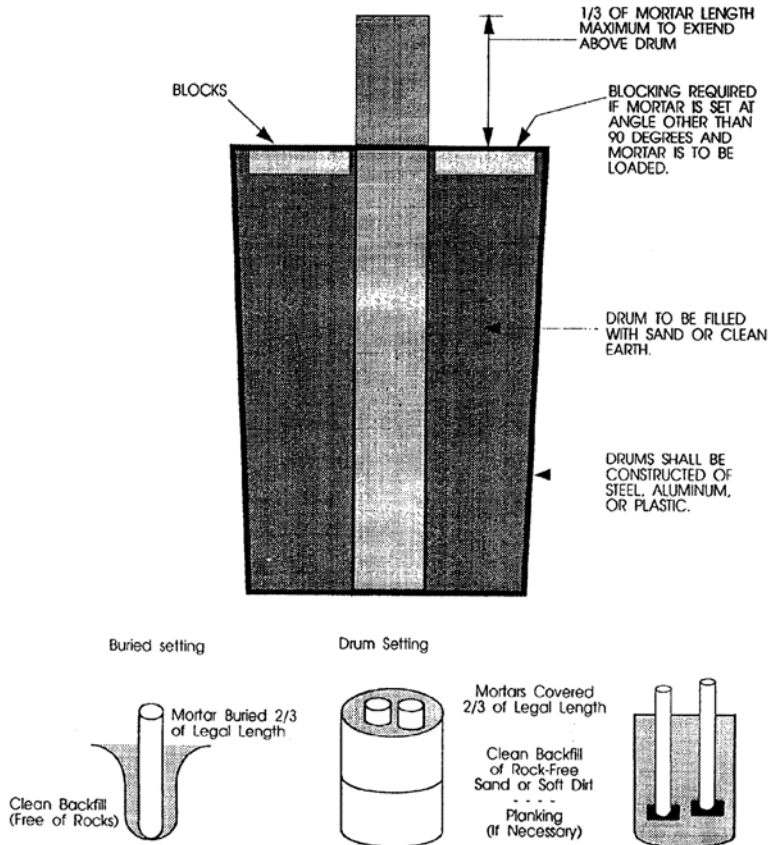
(1) Within ten (10) working days following any public display, the licensed pyrotechnician in charge of the display shall submit a complete, accurate and factual written report directly to the State Fire Marshal, covering:

- (A) A brief report of any duds or misfires including manufacturer's name, type and size;
- (B) A brief account of the cause of injury to any person from fireworks and such person's name and address;
- (C) A brief account of any fires caused by fireworks;
- (D) Any violations of the Health and Safety Code or of these regulations relating to public display fireworks; and
- (E) The names of all licensed and unlicensed assistants.

Exception: A general public display licensee conducting special effects activities for motion picture, television and theatrical productions need not comply with the requirements of subsections (A) and (E).

DIAGRAM C

DIAGRAM OF A TYPICAL DRUM SETTING



(b) Notification. Verbal reports are required within 24 hours to the State Fire Marshal when any of the following occur:

- (1) Fire requiring emergency action or response as a result of the firing; or
- (2) Injury or death to the public or crew. Within ten (10) working days following an incident giving rise to a verbal report, the licensed pyrotechnician in charge of the activity shall submit a complete, accurate and factual report directly to the State Fire Marshal on the event.

(c) Unfired Shells. Unfired shells shall either be removed following the display and returned directly to the wholesaler or supplier or stored in a manner approved by the authority having jurisdiction until such time as the shells can be transported directly to the wholesaler or supplier.

§1006. Smoking. No person shall smoke in any area where fireworks are handled or stored.

**SECTION 5609
TEMPORARY STORAGE OF
CONSUMER FIREWORKS**

5609.1 General. Where the display or temporary storage of fireworks 1.4G (consumer fireworks) is allowed by Section 5601.1.3, Exception 4, such display or storage shall comply with the applicable requirements of NFPA 1124.

**SECTION 5610
EXPERIMENTAL ROCKETS/UNLIMITED**

[California Code of Regulations, Title 19, Division 1, §1010-1015]

Article 16. Experimental Rockets/Unlimited

§1010. General. This article applies to all rockets except approved model rockets as defined in Article 14 and experimental high power rockets and experimental high power rocket motors as defined in Article 2.

§1011. Test Areas.

(a) *Experimental rockets unlimited shall not be launched within this State from any site other than test areas approved for such purpose by the fire authority having jurisdiction.*

(b) *These test areas shall meet the following minimum requirements:*

(1) *Test areas shall consist of a launching site and an impact range.*

(2) *The launching site is that area immediately surrounding the launching devices, including positions to protect all personnel.*

(3) *The impact range is that area over which rockets may travel by design or accident and upon which they fall. Its length should be not less than the maximum calculated ideal ballistic range of any rocket to be fired from its launching site and extends as the radius of a circular sector 90 from the launching site apex into the prevailing wind.*

(c) *Test areas should include no dwellings or structures other than those provided for operating and nonoperating personnel protection and loading rockets.*

(d) *Operating personnel protection shall consist of a bunker, blockhouse or similar protection designed to withstand shrapnel and mass impact equal to the potential created by the heaviest rocket intended to be fired, and falling from its zenith or exploding at any point. This bunker when located not less than 50 feet distant from the launching device shall afford minimum protection equal to a 2-foot wide slit trench not less than 5 feet deep and parapet observation ports with protection equal to a double thickness of sand bags. Overhead protection should consist of substantial structural materials, and these materials shall be covered to afford protection equivalent to that of a double layer of filled sand bags. Non-operating personnel minimum protection when located not less than 250 feet distant from the launching device shall consist of construction at least equal to the slit trench shelter described above.*

(e) *Rocket loading facilities shall be housed in a lightly constructed and covered structure located not less than 100 feet distant from any other structure including any launching device. Within this State, all fuel or propellant compounding or loading of experimental rockets unlimited shall be performed by licensed pyrotechnic operators or by experienced persons directly supervised by these pyrotechnic operators.*

§1012. Rocket Launchers. *Rocket launchers shall have a length sufficient to ensure stabilization to any rocket fired from them and shall be constructed of appropriate material such as metal or rigid flame-resistant plastic and designed for the specific intended purpose and use. Special protection shall be provided for persons setting and arming all rockets. The use of any two rail, "V" or "U" trough launcher, which depends solely on gravity to control the rocket during launching is prohibited.*

§1013. Setting Rocket Launchers. *All adjustments and alignments of the rocket launcher and connections shall be completed before the rocket is armed. Final rocket launcher*

adjustments shall be checked by the licensed pyrotechnic operator in charge.

§1014. Firing Procedure. *A definite ordered firing procedure shall be established by the licensed pyrotechnic operator in charge. Both visible and audible signals shall be used to alert all persons in the test area. Any launch or firing code used shall be reduced to writing and posted conspicuously in the test area.*

§1015. Launching Rockets.

(a) *Rockets may not be armed or launched except by an experienced pyrotechnic operator, who, if he or she is not licensed, shall be directly responsible to the licensed pyrotechnic operator in charge. The actual arming operation shall be accomplished by a competent person. During all arming operations all personnel shall take shelter when launching, excepting only the individual arming the rocket and his or her necessary assistants.*

All internal self-contained firing circuits (within the rocket) including, but not by way of limitation, multiple stage ignition, parachute releases, bursting charges, etc., shall be provided with an arming and disarming device operable remotely from without the assembled rocket in the launching position.

(b) *The firing circuit shall be shunted at both the control center and the launching site by the pyrotechnic operator assigned to arm the rocket. Both shunts shall be in place and he or she shall test them to ensure that the firing circuit is effectively short circuited, before the rocket is set in the launching position.*

(c) *The single special key, which removes the launching site shunt from the firing circuit, shall be the sole means for completing the firing circuit at the control center. The arming operator shall retain the shunt key in his or her personal possession from the time the circuit is initially shunted until the arming operations are completed and he or she removes the last shunt in the control center and establishes a ready firing circuit.*

(d) *No other means or device than a remotely controlled electric circuit of an approved design may be used to launch single stage rockets or the first stage of multistage rockets.*

SECTION 5611 MODEL ROCKETS

[California Code of Regulations, Title 19, Division 1, §1020-1028]

§980 Definitions:

Model Rocket Motor. *The same as a model rocket engine, as defined in Health and Safety Code Section 12520. Model rocket motors shall not produce more than 160 Newton-seconds of total impulse power.*

Article 17. Model Rockets

§1020. General Rocket Launchers. *Nothing in this article is intended to regulate the sale or the construction of model rockets, provided that such model rockets are not equipped with a model rocket motor.*

§1021. Classification and Labeling. All types of model rocket motors shall be submitted to the State Fire Marshal by a licensed model rocket motor manufacturer, importer/exporter or wholesaler for classification. A copy of a certificate of classification indicating the item has been classified as a model rocket motor by a laboratory approved by the Department of Transportation shall accompany the request for classification by the State Fire Marshal. Three samples of each motor type shall be submitted to the State Fire Marshal for classification.

Standards for the classification of model rocket motors shall conform to the National Fire Protection Association (N.F.P.A.) 1122 (1987), Code for Unmanned Rockets, Sections 3-1.1, 3-1.2, 3-1.3, 3-1.4, 3-1.5, 3-1.6, 3-1.7, 3-1.8, 3-1.9, 3-1.10.

(b) Individual engines shall bear the California State Fire Marshal seal and the registration number of the licensee.

§1022. Model Rocket Standards and Use.

(a) Model rocket standards and use shall comply with: N.F.P.A. 1122, the Code for Unmanned Rockets, Chapter 3, Sections 3-1.1 through 3-1.10, Chapter 4, Chapter 5, Chapter 6 and Appendix A-2-(1987), which is incorporated by reference herein except for Appendices A-2.3 and A-2.4.

§1023. Storage and Sale. No model rocket motors shall be stored, sold or offered for sale at retail unless such model rocket motors have been classified by the California State Fire Marshal.

§1024. Restrictions. The provisions of this article shall not be used to establish the authority to possess, launch or use experimental unlimited or experimental/high powered rocket motors.

§1025. Authorization.

(a) No model rocket user shall launch any model rocket motor from any site without first securing authorization from the authority having jurisdiction. The authority having jurisdiction may require notification each time that model rockets are to be launched.

(b) It shall be the responsibility of the model rocket user to secure permission of the owner of private lands when such land is intended to be used to launch model rockets.

§1026. Revocation of Permits and Authorized Use of Launching Area. The authority having jurisdiction may immediately revoke a permit to sell model rocket motors at retail if it is found that those persons granted a permit have violated these regulations. The authority having jurisdiction may immediately revoke its authorization to use a firing area if it is found that an undue hazard exists, including, but not limited to, fire safety hazards or life safety hazards.

§1027. Minimum Age.

(a) No model rocket motors shall be sold, given or delivered to any person under 18 years of age.

Exceptions:

(1) Model rocket motors bearing the standardized coding 1/4A, 1/2A, A, B, C and D may be sold, given or delivered to any person 14 years of age or older.

(2) Persons who are 12 years of age or older and who are taking part in a model rocket education program may receive model rocket motors and launch approved model rockets when under the direct supervision and control of a person 18 years of age or older. Model rocket motors must be obtained only from the adult in charge of the launching. Approved model rocket motors for this exception shall bear the motor coding 1/4A, 1/2A, A, B, C or D.

§1028. Supervision. The permittee shall be responsible for the safety of all spectators and other persons connected with the launching of model rockets.

SECTION 5612 EXPERIMENTAL HIGH POWER ROCKETS AND MOTORS

[California Code of Regulations, Title 19, Division 1, §1030-1039]

§980 Definitions:

Experimental High Power Rocket. Non-professional rockets which are propelled by commercially manufactured high-power solid propellant rocket motors.

Experimental High Power Rocket Motor. A State Fire Marshal approved, commercially manufactured rocket propulsion device containing a solid propellant charge wherein all the ingredients are pre-mixed and which produces more than 160 Newton-seconds (36 lb.-seconds) but shall not exceed 10,240 Newton-seconds (2302.2 lb.-seconds) of total impulse.

Article 18. Experimental High Power Rockets and Motors

§1030. General. This article is intended to regulate the sale, storage, construction and use of experimental high power rocket motors and experimental high power rockets.

§1031. Classification and Labeling.

(a) All types of experimental high power rocket motors shall be submitted by a licensed experimental high power rocket motor manufacturer, importer/exporter or wholesaler to the State Fire Marshal for classification.

(b) All motors shall bear the State Fire Marshal seal and the registration number of the licensee. Classified motors contained within packages may have the State Fire Marshal seal and registration number on the package, provided that such packages are sealed.

§1032. Experimental High Power Rocket Motor Standards and Use.

(a) Experimental high power rocket motor design and construction standards shall comply with all of the following:

(1) The maximum total impulse per rocket motor shall not exceed 10,240 Newton-seconds (2302.2 lb.-seconds).

(2) When more than one rocket motor is utilized, the combined total impulse shall not exceed 20,480 Newton-seconds (4604.4 lb.-seconds).

(b) If an experimental high power rocket is equipped with an experimental high power rocket motor, then the rocket shall:

- (1) be constructed of paper, plastic, rubber, aluminum or wood except that minor components such as screw eyes or motor mounts may be of other light-gauge metals; and
- (2) include an effective means or device for returning the rocket safely to the ground without causing personal injury or property damage; and
- (3) The rocket shall not contain any type of explosive or pyrotechnic warhead of any type.

(c) An experimental high power rocket shall not be used as a weapon.

§1033. License Required. No person shall possess, receive, transport, store or launch any experimental high power rocket motor without first securing a valid license as a Pyrotechnic Operator—Rockets First, Second or Third Class from the State Fire Marshal. No person shall sell an experimental high power rocket motor to any person unless the seller possesses a valid license as a wholesaler or retailer under this chapter.

§1034. Local Permit Required—Seller. No person shall sell an experimental high power rocket motor without first securing a permit from the authority having jurisdiction. This permit shall be in addition to, not in lieu of, a valid license issued by the State Fire Marshal for the sale of these motors. This permit shall be deemed separate from a local permit allowing the launching of rockets utilizing such motors.

§1035. Local Permit Required—Launch.

(a) No experimental high power rocket motor user shall launch any experimental high power rocket motor from any site without first securing a permit from the authority having jurisdiction.

(b) The authority having jurisdiction may require notification by the permittee each time an experimental high power rocket motor is to be launched. It shall be the responsibility of the experimental high power rocket motor user to also secure the permission of the owner of private land when such land is intended to be used as a launch site.

§1036. Launching Facilities.

(a) Experimental high power rocket motors shall be launched from platforms meeting the following specifications:

- (1) A launch guide (tube, rod, tower or other suitable device) shall be used to restrict the horizontal motion of the rocket until flight velocity sufficient to maintain stability during flight is achieved.
- (2) A launch angle of not more than twenty degrees (20°) from the vertical shall be used.

(b) Rocket motor launching shall be by remote electrical means only, and under the supervision and control of an individual properly licensed in accordance with this chapter.

(c) Surface wind at the launch site shall not exceed twenty miles per hour (20 m.p.h.), and visibility above the launching area shall be at least five thousand feet (5,000 ft.).

(d) The recovery device wadding ejected from the rocket during the launch flight sequence, if used, shall be of flame retardant material meeting the standards of Title 19, California Code of Regulations, Chapter 8, Sections 1171 through 1355.

(e) Experimental high power rocket motors shall be launched only during daylight hours unless specifically approved by the authority having jurisdiction.

(f) All personnel, including those conducting the actual launching of the experimental high power rocket motor(s), shall maintain a clear radial distance from the launch platform during the countdown and launch, pursuant to the guidelines in Table 18A.

**TABLE 18A
REQUIRED LAUNCH DISTANCES**

Total Impulse of Rocket	Radial Distance From launcher
0-320 Newton-Seconds*	30 feet
320.01-1280 Newton-Seconds*	150 feet
1280.01-2560 Newton-Seconds*	200 feet
2560.01-5120 Newton-Seconds*	300 feet
5120.01-10240 Newton-Seconds*	500 feet
10241-20480 Newton-Seconds*	1000 feet

*Rockets propelled by clusters of motors shall use the distance specified for the next higher impulse category.

§1037. Launch Site Standards.

(a) The launch site shall consist of a launching area and a recovery area. The launching area shall consist of an area surrounding the launching devices a radial distance from the launching device as specified in Table 18A above. The recovery area shall consist of the launching area and the minimum area necessary to retrieve the rocket, based on the estimated altitude likely to be achieved by the rocket. These calculations shall take into account the weight of the rocket and the specific type of motor used (or combined total impulse). Table 18B shall be used to determine the minimum launch site dimensions for the various classes of experimental high power rockets.

(b) The launch site shall not be located in any grain field, dry grass, brush- or forest-covered lands.

(c) The launch site shall not contain any buildings or structures, unless specifically approved in advance by the authority having jurisdiction, and under no circumstances shall such buildings or structures be less than one thousand five hundred feet (1,500 ft.) from the launch site.

(d) The launch site shall not contain any high voltage electrical lines or major highways.

(e) The launch site shall not contain any natural or artificially constructed obstacle deemed by the authority having jurisdiction to pose a hazard during launching.

(f) The launching area shall be located as near as possible to the center of the launch site but in no case less than seven hundred fifty feet (750 ft.) from the boundary of the launch site.

(g) The launching area shall have appropriate barriers around it such that spectators will be restrained from encroaching upon it. These barriers may be of any type approved by the authority having jurisdiction.

**TABLE 18B
MINIMUM EXPERIMENTAL HIGH POWER
ROCKET MOTOR LAUNCH SITE STANDARDS**

Maximum Combined Equivalent Motor Type	Minimum Launch Total Impulse	Site Dimensions (feet)
H	320	1,500
I	640	2,500
J	1,280	3,500
K	2,560	5,000
L	5,120	7,000
M	10,240	10,000
N	20,480	15,000

§1038. Testing. At locations approved by the authority having jurisdiction, experimental high power rocket motors may be ignited on the ground for the purpose of determining their performance. All of the following procedures shall be followed during the firing of these motors:

- (a) The experimental high power rocket motor shall be affixed to a testing device or to an immovable structure in such a manner that the motor will not work itself free during the testing or the experimentation process.
- (b) The experimental high power rocket motor shall be ignited only by remotely operated electrical means fully under the control and supervision of the licensed pyrotechnic operator conducting the testing or experimentation.
- (c) The exhaust path of the motor shall be cleared of all flammable objects prior to its firing.
- (d) All persons, whether they are conducting, participating in or observing the testing or experiment, shall stand away from the motor, and particularly its exhaust path, at all times during the test or experiment.
- (e) Under no circumstances shall testing or experimentation of experimental high power rocket motors be conducted indoors.

§1039. Supervision and Responsibility. The licensed pyrotechnic operator in charge of the launch site or test sites shall supervise the arming of every experimental high power rocket motor, the launching of all motors, and the disposal of all unwanted or defective motors. The licensed pyrotechnic operator shall also be responsible for the safety of all spectators or observers and all other persons connected with the launching of experimental high power rocket motors.

**SECTION 5613
EMERGENCY SIGNALING DEVICES**

[California Code of Regulations, Title 19, Division 1, §1045-1046]

Article 19. Emergency Signaling Devices

§1045. Fire Hazard. Whenever the authority having jurisdiction declares that the use of an emergency signaling device would create a fire hazard, no emergency signaling device shall be used regardless of its indicated registration and labeling. This prohibition shall continue as long as the fire hazard condition exists in the specific area, as determined by the authority having jurisdiction.

§1046. License Required. Manufacturers of emergency signaling devices whose manufacturing operations take place in California must possess a valid fireworks manufacturing license from the State Fire Marshal to manufacture emergency signaling devices.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 57 – FLAMMABLE AND COMBUSTIBLE LIQUIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]				X																			
Chapter / Section																							
[T-19 §3.15]				X																			
5702			X																				
5703.4.1			X																				
5703.6.2			X																				
5703.6.2.2			X																				
5704.2.1			X																				
5704.2.7.4			X																				
5706.5.1.11			X																				
5707			†																				

The state agency does not adopt sections identified with the following symbol: †

* The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 57

FLAMMABLE AND COMBUSTIBLE LIQUIDS

User note:

About this chapter: Chapter 57 provides requirements that are intended to reduce the likelihood of fires involving the storage, handling, use or transportation of flammable and combustible liquids. Adherence to these practices may also limit damage in the event of an accidental fire involving these materials. These liquids are used for fuel, lubricants, cleaners, solvents, medicine and even drinking. The danger associated with flammable and combustible liquids is that the vapors from these liquids, when combined with air in their flammable range, will burn or explode at temperatures near normal living and working environments. The regulations herein are intended to prevent the flammable and combustible liquids from being ignited and provide mitigating requirements for when a fire does occur.

SECTION 5701 GENERAL

5701.1 Scope and application. Prevention, control and mitigation of dangerous conditions related to storage, use, dispensing, mixing and handling of flammable and combustible liquids shall be in accordance with Chapter 50 and this chapter.

*[California Code of Regulations, Title 19, Division 1, §3.15]
Flammable and Combustible Liquids.*

Flammable and combustible liquids shall not be placed, stored or handled in any occupancy within the scope of California Code of Regulations, Title 19, Division 1 regulations, except as provided in the California Fire Code.

5701.2 Nonapplicability. This chapter shall not apply to liquids as otherwise provided in other laws or regulations or chapters of this code, including:

1. Specific provisions for flammable liquids in motor fuel-dispensing facilities, repair garages, airports and marinas in Chapter 23.
2. Medicines, foodstuffs, cosmetics and commercial or institutional products containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solution not being flammable, provided that such materials are packaged in individual containers not exceeding 1.3 gallons (5 L).
3. Quantities of alcoholic beverages in retail or wholesale sales or storage occupancies, provided that the liquids are packaged in individual containers not exceeding 1.3 gallons (5 L).
4. Storage and use of fuel oil in tanks and containers connected to oil-burning equipment. Such storage and use shall be in accordance with Section 605. For abandonment of fuel oil tanks, this chapter applies.
5. Refrigeration systems (see Section 608).
6. Storage and display of aerosol products complying with Chapter 51.
7. Storage and use of liquids that do not have a fire point when tested in accordance with ASTM D92.

8. Liquids with a flash point greater than 95°F (35°C) in a water-miscible solution or dispersion with a water and inert (noncombustible) solids content of more than 80 percent by weight, which do not sustain combustion.
9. Liquids without flash points that can be flammable under some conditions, such as certain halogenated hydrocarbons and mixtures containing halogenated hydrocarbons.
10. The storage of beer, distilled spirits and wines in barrels and casks.
11. Commercial cooking oil storage tank systems located within a building and designed and installed in accordance with Section 607 and NFPA 30.
12. Application and release of pesticide and agricultural products and materials intended for use in weed abatement, erosion control, soil amendment or similar applications where applied in accordance with the manufacturer's instructions and label directions.
13. The off-site transportation of flammable or combustible liquids where in accordance with Department of Transportation (DOTn) regulation.

5701.3 Referenced documents. The applicable requirements of Chapter 50, other chapters of this code, the *California Building Code* and the *California Mechanical Code* pertaining to flammable liquids shall apply.

5701.4 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

5701.5 Material classification. Flammable and combustible liquids shall be classified in accordance with the definitions in Chapter 2.

When mixed with lower flash-point liquids, Class II or III liquids are capable of assuming the characteristics of the lower flash-point liquids. Under such conditions, the appropriate provisions of this chapter for the actual flash point of the mixed liquid shall apply.

When heated above their flash points, Class II and III liquids assume the characteristics of Class I liquids. Under such conditions, the appropriate provisions of this chapter for flammable liquids shall apply.

**SECTION 5702
DEFINITIONS**

5702.1 Definitions. The following terms are defined in Chapter 2:

ALCOHOL-BASED HAND RUB.

BULK PLANT OR TERMINAL.

BULK TRANSFER.

COMBUSTIBLE LIQUID.

Class II.

Class IIIA.

Class IIIB.

FIRE POINT.

FLAMMABLE LIQUID.

Class IA.

Class IB.

Class IC.

FLASH POINT.

FUEL LIMIT SWITCH.

LIQUID STORAGE ROOM.

LIQUID STORAGE WAREHOUSE.

MOBILE FUELING.

PROCESS TRANSFER.

REFINERY.

REMOTE EMERGENCY SHUTOFF DEVICE.

REMOTE SOLVENT RESERVOIR.

SOLVENT DISTILLATION UNIT.

TANK, PRIMARY.

TANK IN AN UNDERGROUND AREA.

**SECTION 5703
GENERAL REQUIREMENTS**

5703.1 Electrical. Electrical wiring and equipment shall be installed and maintained in accordance with Section 603 and the *California Electrical Code*.

5703.1.1 Classified locations for flammable liquids.

Areas where flammable liquids are stored, handled, dispensed or mixed shall be in accordance with Table 5703.1.1. A classified area shall not extend beyond an unpierced floor, roof or other solid partition.

The extent of the classified area is allowed to be reduced, or eliminated, where sufficient technical justification is provided to the fire code official that a concentration in the area in excess of 25 percent of the lower flammable limit (LFL) cannot be generated.

5703.1.2 Classified locations for combustible liquids.

Areas where Class II or III liquids are heated above their flash points shall have electrical installations in accordance with Section 5703.1.1.

Exception: Solvent distillation units in accordance with Section 5705.4.

5703.1.3 Other applications. The fire code official is authorized to determine the extent of the Class I electrical equipment and wiring location where a condition is not specifically covered by these requirements or the *California Electrical Code*.

5703.2 Fire protection. Fire protection for the storage, use, dispensing, mixing, handling and on-site transportation of flammable and combustible liquids shall be in accordance with this chapter and applicable sections of Chapter 9.

5703.2.1 Portable fire extinguishers and hose lines.

Portable fire extinguishers shall be provided in accordance with Section 906. Hose lines shall be provided in accordance with Section 905.

5703.3 Site assessment. In the event of a spill, leak or discharge from a tank system, a site assessment shall be completed by the owner or operator of such tank system if the fire code official determines that a potential fire or explosion hazard exists. Such site assessments shall be conducted to ascertain potential fire hazards and shall be completed and submitted to the fire department within a time period established by the fire code official, not to exceed 60 days.

5703.4 Spill control and secondary containment. Where the maximum allowable quantity per control area is exceeded, and where required by Section 5004.2, rooms, buildings or areas used for storage, dispensing, use, mixing or handling of Class I, II and IIIA liquids shall be provided with spill control and secondary containment in accordance with Section 5004.2.

5703.4.1 Spill control and secondary containment for tanks in underground areas. Tanks in underground areas and associated piping systems shall be provided with spill control and secondary containment that are designed and constructed as outlined in Section 5004.2, except as modified by Section 5703.6.2.2.

5703.5 Labeling and signage. The fire code official is authorized to require warning signs for the purpose of identifying the hazards of storing or using flammable liquids. Signage for identification and warning such as for the inherent hazard of flammable liquids or smoking shall be provided in accordance with this chapter and Sections 5003.5 and 5003.6.

5703.5.1 Style. Warning signs shall be of a durable material. Signs warning of the hazard of flammable liquids shall have white lettering on a red background and shall read: "DANGER—FLAMMABLE LIQUIDS." Letters shall be not less than 3 inches (76 mm) in height and 1/2 inch (12.7 mm) in stroke.

5703.5.2 Location. Signs shall be posted in locations as required by the fire code official. Piping containing flammable liquids shall be identified in accordance with ASME A13.1.

5703.5.3 Warning labels. Individual containers, packages and cartons shall be identified, marked, labeled and placarded in accordance with federal regulations and applicable state laws.

**TABLE 5703.1.1
CLASS I ELECTRICAL EQUIPMENT LOCATIONS^a**

LOCATION	GROUP D DIVISION	EXTENT OF CLASSIFIED AREA
Underground tank fill opening	1	Pits, boxes or spaces below grade level, any part of which is within the Division 1 or 2 classified area.
	2	Up to 18 inches above grade level within a horizontal radius of 10 feet from a loose-fill connection and within a horizontal radius of 5 feet from a tight-fill connection.
Vent—Discharging upward	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet of open end of vent, extending in all directions.
Drum and container filling		
Outdoor or indoor with adequate ventilation	1	Within 3 feet of vent and fill opening, extending in all directions.
	2	Area between 3 feet and 5 feet from vent of fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.
Pumps, bleeders, withdrawal fittings, meters and similar devices		
Indoor	2	Within 5 feet of any edge of such devices, extending in all directions, and up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.
Outdoor	2	Within 3 feet of any edge of such devices, extending in all directions, and up to 18 inches above floor or grade level within 10 feet horizontally from an edge of such devices.
Pits		
Without mechanical ventilation	1	Entire area within pit if any part is within a Division 1 or 2 classified area.
With mechanical ventilation	2	Entire area within pit if any part is within a Division 1 or 2 classified area.
Containing valves, fittings or piping, and not within a Division 1 or 2 classified area	2	Entire pit.
Drainage ditches, separators, impounding basins		
Indoor	1 or 2	Same as pits.
Outdoor	2	Area up to 18 inches above ditch, separator or basin, and up to 18 inches above grade within 15 feet horizontal from any edge.
Tank vehicle and tank car^b		
Loading through open dome	1	Within 3 feet of edge of dome, extending in all directions.
	2	Area between 3 feet and 15 feet from edge of dome, extending in all directions.
Loading through bottom connections with atmospheric venting	1	Within 3 feet of point of venting to atmosphere, extending in all directions.
	2	Area between 3 feet and 15 feet from point of venting to atmosphere, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of loading connection.
Loading through closed dome with atmospheric venting	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 15 feet from open end of vent, extending in all directions, and within 3 feet of edge of dome, extending in all directions.
Loading through closed dome with vapor control	2	Within 3 feet of point of connection of both fill and vapor lines, extending in all directions.
Bottom loading with vapor control or any bottom unloading	2	Within 3 feet of point of connection, extending in all directions, and up to 18 inches above grade within a horizontal radius of 10 feet from point of connection.

(continued)

TABLE 5703.1.1—continued
CLASS I ELECTRICAL EQUIPMENT LOCATIONS^a

LOCATION	GROUP D DIVISION	EXTENT OF CLASSIFIED AREA
Storage and repair garage for tank vehicles	1	Pits or spaces below floor level.
	2	Area up to 18 inches above floor or grade level for entire storage or repair garage.
Garages for other than tank vehicles	Ordinary	Where there is an opening to these rooms within the extent of an outdoor classified area, the entire room shall be classified the same as the area classification at the point of the opening.
Outdoor drum storage	Ordinary	—
Indoor warehousing where there is no flammable liquid transfer	Ordinary	Where there is an opening to these rooms within the extent of an indoor classified area, the room shall be classified the same as if the wall, curb or partition did not exist.
Indoor equipment where flammable vapor/air mixtures could exist under normal operations	1	Area within 5 feet of any edge of such equipment, extending in all directions.
	2	Area within 5 feet of any edge of such equipment, extending in all directions. Area between 5 feet and 8 feet of any edge of such equipment, extending in all directions, and the area up to 3 feet above floor or grade level within 5 feet to 25 feet horizontally from any edge of such equipment. ^c
Outdoor equipment where flammable vapor/air mixtures could exist under normal operations	1	Area within 3 feet of any edge of such equipment, extending in all directions.
	2	Area between 3 feet and 8 feet of any edge of such equipment extending in all directions, and the area up to 3 feet above floor or grade level within 3 feet to 10 feet horizontally from any edge of such equipment.
Tank—Above ground		
Shell, ends or roof and dike area	1	Area inside dike where dike height is greater than the distance from the tank to the dike for more than 50 percent of the tank circumference.
	2	Area within 10 feet from shell, ends or roof of tank. Area inside dikes to level of top of dike.
Vent	1	Area within 5 feet of open end of vent, extending in all directions.
	2	Area between 5 feet and 10 feet from open end of vent, extending in all directions.
Floating roof	1	Area above the roof and within the shell.
Office and restrooms	Ordinary	Where there is an opening to these rooms within the extent of an indoor classified location, the room shall be classified the same as if the wall, curb or partition did not exist.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

- a. Locations as classified in *the California Electrical Code*.
- b. When classifying extent of area, consideration shall be given to the fact that tank cars or tank vehicles can be spotted at varying points. Therefore, the extremities of the loading or unloading positions shall be used.
- c. The release of Class I liquids can generate vapors to the extent that the entire building, and possibly a zone surrounding it, are considered a Class I, Division 2, location.

5703.5.4 Identification. Color coding or other approved identification means shall be provided on each loading and unloading riser for flammable or combustible liquids to identify the contents of the tank served by the riser.

5703.6 Piping systems. Piping systems, and their component parts, for flammable and combustible liquids shall be in accordance with Sections 5703.6.1 through 5703.6.11.

5703.6.1 Nonapplicability. The provisions of Section 5703.6 shall not apply to gas or oil well installations; piping that is integral to stationary or portable engines, including aircraft, watercraft and motor vehicles; and

piping in connection with boilers and pressure vessels regulated by the *California Mechanical Code*.

5703.6.2 Design and fabrication of piping systems and components. Piping system components shall be designed and fabricated in accordance with the applicable standard listed in Table 5703.6.2 and Chapter 27 of NFPA 30, except as modified by Sections 5703.6.2.1 and 5703.6.2.2.

5703.6.2.1 Special materials. Low-melting-point materials (such as aluminum, copper or brass), materials that soften on fire exposure (such as nonmetallic materials) and nonductile material (such as cast iron) shall be acceptable for use underground in accordance

with the applicable standard listed in Table 5703.6.2. Where such materials are used outdoors in above-ground piping systems or within buildings, they shall be in accordance with the applicable standard listed in Table 5703.6.2 and one of the following:

1. Suitably protected against fire exposure.
2. Located where leakage from failure would not unduly expose people or structures.
3. Located where leakage can be readily controlled by operation of remotely located valves in a location provided with ready access.

In all cases, nonmetallic piping shall be used in accordance with Section 27.4.6 of NFPA 30.

**TABLE 5703.6.2
PIPING STANDARDS**

PIPING USE	STANDARD
Power piping	ASME B31.1
Process piping	ASME B31.3
Pipeline transportation systems for liquid hydrocarbons and other liquids	ASME B31.4
Building services piping	ASME B31.9
Double containment piping	UL 971A, UL 1369

5703.6.2.2 Below-grade or underground piping systems connected to a tank in an underground area. *Below-grade or underground piping systems that are connected to a tank in an underground area shall have secondary containment. The building, room or area in which the flammable or combustible liquid is stored or located may be used as secondary containment if it meets the containment and drainage methods as described in Section 5004.2.2.1.*

All portions of below-grade and underground piping systems shall be monitored for leaks by one of the following methods:

1. *A listed or approved leak detection system that either activates an audible and visual alarm or stops the flow of product when a leak is detected.*
2. *Direct visual inspection conducted monthly by designated personnel.*
3. *Indirect visual inspection conducted monthly through the use of, but not limited to, mirrors, cameras or video equipment.*
4. *If the above methods cannot be met, an alternative means shall be provided in accordance with Section 1.11.2.4.*

Exceptions:

1. *Piping systems connected to a tank in an underground area that is used solely in connection with a fire pump or emergency system, legally required standby system or optional standby system as specified in Health and Safety Code Section 25270.2(o)(1)(C)(iii).*

2. *Piping systems connected to a tank in an underground area that contains petroleum to be used or previously used as a lubricant or coolant in a motor engine or transmission or oil-filled operational equipment or oil-filled manufacturing equipment, as described in Health and Safety Code Section 25270.2(o)(1)(C)(i).*
3. *Piping systems connected to a petroleum hazardous waste tank in an underground area that complies with the hazardous waste tank standards pursuant to the California Code of Regulations, Title 22, Chapter 15, Article 10 (commencing with Section 66265.190), and the facility has been issued a unified program facility permit pursuant to Health and Safety Code Section 25404.2 for generation, treatment, accumulation or storage of hazardous waste, as described in Health and Safety Code Section 25270.2(o)(1)(C)(ii).*

5703.6.3 Testing. Unless tested in accordance with the applicable section of ASME B31.9, piping, before being covered, enclosed or placed in use, shall be hydrostatically tested to 150 percent of the maximum anticipated pressure of the system, or pneumatically tested to 110 percent of the maximum anticipated pressure of the system, but not less than 5 pounds per square inch gauge (psig) (34.47 kPa) at the highest point of the system. This test shall be maintained for a sufficient time period to complete visual inspection of joints and connections. For not less than 10 minutes, there shall be no leakage or permanent distortion. Care shall be exercised to ensure that these pressures are not applied to vented storage tanks. Such storage tanks shall be tested independently from the piping.

5703.6.3.1 Existing piping. Existing piping shall be tested in accordance with this section where the fire code official has reasonable cause to believe that a leak exists. Piping that could contain flammable or combustible liquids shall not be tested pneumatically. Such tests shall be at the expense of the owner or operator.

Exception: Vapor-recovery piping is allowed to be tested using an inert gas.

5703.6.4 Protection from vehicles. Guard posts or other approved means shall be provided to protect piping, valves or fittings subject to vehicular damage in accordance with Section 312.

5703.6.5 Protection from external corrosion and galvanic action. Where subject to external corrosion, piping, related fluid-handling components and supports for both underground and above-ground applications shall be fabricated from noncorrosive materials, and coated or provided with corrosion protection. Dissimilar metallic parts that promote galvanic action shall not be joined.

5703.6.6 Valves. Piping systems shall contain a sufficient number of manual control valves and check valves to operate the system properly and to protect the plant under both normal and emergency conditions. Piping systems in connection with pumps shall contain a sufficient number of such valves to control properly the flow of liquids in normal operation and in the event of physical damage or fire exposure.

5703.6.6.1 Backflow protections. Connections to pipelines or piping by which equipment (such as tank cars, tank vehicles or marine vessels) discharges liquids into storage tanks shall be provided with check valves or block valves for automatic protection against backflow where the piping arrangement is such that backflow from the system is possible. Where loading and unloading is done through a common pipe system, a check valve is not required. However, a block valve, located in an area where it is provided with ready access or remotely operable, shall be provided.

5703.6.6.2 Manual drainage. Manual drainage-control valves shall be located at approved locations remote from the tanks, diked area, drainage system and impounding basin to ensure their operation in a fire condition.

5703.6.7 Connections. Above-ground tanks with connections located below normal liquid level shall be provided with internal or external isolation valves located as close as practical to the shell of the tank. Except for liquids whose chemical characteristics are incompatible with steel, such valves, where external, and their connections to the tank shall be of steel.

5703.6.8 Piping supports. Piping systems shall be substantially supported and protected against physical damage and excessive stresses arising from settlement, vibration, expansion, contraction or exposure to fire. The supports shall be protected against exposure to fire by one of the following:

1. Draining liquid away from the piping system at a minimum slope of not less than 1 percent.
2. Providing protection with a fire-resistance rating of not less than 2 hours.
3. Other approved methods.

5703.6.9 Flexible joints. Flexible joints shall be listed and approved and shall be installed on underground liquid, vapor and vent piping at all of the following locations:

1. Where piping connects to underground tanks.
2. Where piping ends at pump islands and vent risers.
3. At points where differential movement in the piping can occur.

5703.6.9.1 Fiberglass-reinforced plastic piping. Fiberglass-reinforced plastic (FRP) piping is not required to be provided with flexible joints in locations where both of the following conditions are present:

1. Piping does not exceed 4 inches (102 mm) in diameter.

2. Piping has a straight run of not less than 4 feet (1219 mm) on one side of the connection where such connections result in a change of direction.

In lieu of the minimum 4-foot (1219 mm) straight run length, approved and listed flexible joints are allowed to be used under dispensers and suction pumps, at submerged pumps and tanks, and where vents extend above ground.

5703.6.10 Pipe joints. Joints shall be liquid tight and shall be welded, flanged or threaded except that listed flexible connectors are allowed in accordance with Section 5703.6.9. Threaded or flanged joints shall fit tightly by using approved methods and materials for the type of joint. Joints in piping systems used for Class I liquids shall be welded where located in concealed spaces within buildings.

Nonmetallic joints shall be approved and shall be installed in accordance with the manufacturer's instructions.

Pipe joints that are dependent on the friction characteristics or resiliency of combustible materials for liquid tightness of piping shall not be used in buildings. Piping shall be secured to prevent disengagement at the fitting.

5703.6.11 Bends. Pipe and tubing shall be bent in accordance with ASME B31.9.

SECTION 5704 STORAGE

5704.1 General. The storage of flammable and combustible liquids in containers and tanks shall be in accordance with this section and the applicable sections of Chapter 50.

5704.2 Tank storage. The provisions of this section shall apply to:

1. The storage of flammable and combustible liquids in fixed above-ground and underground tanks.
2. The storage of flammable and combustible liquids in fixed above-ground tanks inside of buildings.
3. The storage of flammable and combustible liquids in portable tanks whose capacity exceeds 660 gallons (2498 L).
4. The installation of such tanks and portable tanks.

5704.2.1 Change of tank contents. Tanks subject to change in contents shall be in accordance with Section 5704.2.7. Prior to a change in contents, the fire code official is authorized to require testing of a tank.

Tanks that have previously contained Class I liquids shall not be loaded with Class II or Class III liquids until such tanks and all piping, pumps, hoses and meters connected thereto have been completely drained and flushed.

Exception: When approved by the Enforcing Agency, the procedures prescribed in API (API-RP-2003) Recommended Practices 2003, entitled: "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents," may be used for changing tank contents.

5704.2.2 Use of tank vehicles and tank cars as storage tanks. Tank cars and tank vehicles shall not be used as storage tanks.

5704.2.3 Labeling and signs. Labeling and signs for storage tanks and storage tank areas shall comply with Sections 5704.2.3.1 and 5704.2.3.2.

5704.2.3.1 Smoking and open flame. Signs shall be posted in storage areas prohibiting open flames and smoking. Signs shall comply with Section 5703.5.

5704.2.3.2 Label or placard. Tanks more than 100 gallons (379 L) in capacity, which are permanently installed or mounted and used for the storage of Class I, II or III liquids, shall bear a label and placard identifying the material therein. Placards shall be in accordance with NFPA 704.

Exceptions:

1. Tanks of 300-gallon (1136 L) capacity or less located on private property and used for heating and cooking fuels in single-family dwellings.
2. Tanks located underground.

5704.2.4 Sources of ignition. Smoking and open flames are prohibited in storage areas in accordance with Section 5003.7.

Exception: Areas designated as smoking and hot work areas, and areas where hot work permits have been issued in accordance with this code.

5704.2.5 Explosion control. Explosion control shall be provided in accordance with Section 911 for indoor tanks.

5704.2.6 Separation from incompatible materials. Storage of flammable and combustible liquids shall be separated from incompatible materials in accordance with Section 5003.9.8.

Grass, weeds, combustible materials and waste Class I, II or IIIA liquids shall not be accumulated in an unsafe manner at a storage site.

5704.2.7 Design, fabrication and construction requirements for tanks. The design, fabrication and construction of tanks shall comply with NFPA 30. Each tank shall bear a permanent nameplate or marking indicating the standard used as the basis of design.

5704.2.7.1 Materials used in tank construction. The materials used in tank construction shall be in accordance with NFPA 30. The materials of construction for tanks and their appurtenances shall be compatible with the liquids to be stored.

5704.2.7.2 Pressure limitations for tanks. Tanks shall be designed for the pressures to which they will be subjected in accordance with NFPA 30.

5704.2.7.3 Tank vents for normal venting. Tank vents for normal venting shall be installed and maintained in accordance with Sections 5704.2.7.3.1 through 5704.2.7.3.5.3.

5704.2.7.3.1 Vent lines. Vent lines from tanks shall not be used for purposes other than venting unless approved.

5704.2.7.3.2 Vent-line flame arresters and pressure-vacuum vents. Listed or approved flame arresters or pressure-vacuum (PV) vents that remain closed unless venting under pressure or vacuum conditions shall be installed in normal vents of tanks containing Class IB and IC liquids.

Vent-line flame arresters shall be installed in accordance with their listing or API 2000 and maintained in accordance with Section 21.8.6 of NFPA 30 or API 2000. In-line flame arresters in piping systems shall be installed and maintained in accordance with their listing or API 2028. Pressure-vacuum vents shall be installed in accordance with Section 21.4.3 of NFPA 30 or API 2000 and maintained in accordance with Section 21.8.6 of NFPA 30 or API 2000.

Exception: Where determined by the fire code official that the use of these devices can result in damage to the tank.

5704.2.7.3.3 Vent pipe outlets. Vent pipe outlets for tanks storing Class I, II or IIIA liquids shall be located such that the vapors are released at a safe point outside of buildings and not less than 12 feet (3658 mm) above the finished ground level. Vapors shall be discharged upward or horizontally away from adjacent walls to assist in vapor dispersion. Vent outlets shall be located such that flammable vapors will not be trapped by eaves or other obstructions and shall be not less than 5 feet (1524 mm) from building openings or lot lines of properties that can be built on. Vent outlets on atmospheric tanks storing Class IIIB liquids are allowed to discharge inside a building where the vent is a normally closed vent.

Exception: Vent pipe outlets on tanks storing Class IIIB liquid inside buildings and connected to fuel-burning equipment shall be located such that the vapors are released to a safe location outside of buildings.

5704.2.7.3.4 Installation of vent piping. Vent piping shall be designed, sized, constructed and installed in accordance with Section 5703.6. Vent pipes shall be installed such that they will drain toward the tank without sags or traps in which liquid can collect. Vent pipes shall be installed in such a manner so as not to be subject to physical damage or vibration.

5704.2.7.3.5 Manifolding. Tank vent piping shall not be manifolded unless required for special purposes such as vapor recovery, vapor conservation or air pollution control.

5704.2.7.3.5.1 Above-ground tanks. For above-ground tanks, manifolded vent pipes shall be adequately sized to prevent system pressure

limits from being exceeded where manifolded tanks are subject to the same fire exposure.

5704.2.7.3.5.2 Underground tanks. For underground tanks, manifolded vent pipes shall be sized to prevent system pressure limits from being exceeded when manifolded tanks are filled simultaneously.

5704.2.7.3.5.3 Tanks storing Class I liquids. Vent piping for tanks storing Class I liquids shall not be manifolded with vent piping for tanks storing Class II and III liquids unless positive means are provided to prevent the vapors from Class I liquids from entering tanks storing Class II and III liquids, to prevent contamination and possible change in classification of less volatile liquid.

5704.2.7.4 Emergency venting. Stationary, above-ground tanks shall be equipped with additional venting that will relieve excessive internal pressure caused by exposure to fires. Emergency vents for Class I, II and IIIA liquids shall not discharge inside buildings. The venting shall be installed and maintained in accordance with Section 22.7 of NFPA 30 *except as modified by Section 5703.6.2.2.*

Exceptions:

1. Tanks larger than 12,000 gallons (45 420 L) in capacity storing Class IIIB liquids that are not within the diked area or the drainage path of Class I or II liquids do not require emergency relief venting.
2. Emergency vents on protected above-ground tanks complying with UL 2085 containing Class II or IIIA liquids are allowed to discharge inside the building.

5704.2.7.5 Tank openings other than vents. Tank openings for other than vents shall comply with Sections 5704.2.7.5.1 through 5704.2.7.5.8.

5704.2.7.5.1 Connections below liquid level. Connections for tank openings below the liquid level shall be liquid tight.

5704.2.7.5.2 Filling, emptying and vapor recovery connections. Filling, emptying and vapor recovery connections to tanks containing Class I, II or IIIA liquids shall be located outside of buildings in accordance with Section 5704.2.7.5.6 at a location free from sources of ignition and not less than 5 feet (1524 mm) away from building openings or *lot lines* of property that can be built on. Such openings shall be properly identified and provided with a liquid-tight cap that shall be closed when not in use.

Filling and emptying connections to indoor tanks containing Class IIIB liquids and connected to fuel-burning equipment shall be located at a finished ground level location outside of buildings. Such openings shall be provided with a liquid-tight cap that shall be closed when not in use. A sign in accordance with Section 5003.6 that displays the follow-

ing warning shall be permanently attached at the filling location:

TRANSFERRING FUEL OTHER THAN
CLASS IIIB COMBUSTIBLE LIQUID TO
THIS TANK CONNECTION IS A VIOLATION
OF THE FIRE CODE AND IS STRICTLY
PROHIBITED

5704.2.7.5.3 Piping, connections and fittings. Piping, connections, fittings and other appurtenances shall be installed in accordance with Section 5703.6.

5704.2.7.5.4 Manual gauging. Openings for manual gauging, if independent of the fill pipe, shall be provided with a liquid-tight cap or cover. Covers shall be kept closed when not gauging. If inside a building, such openings shall be protected against liquid overflow and possible vapor release by means of a spring-loaded check valve or other approved device.

5704.2.7.5.5 Fill pipes and discharge lines. For top-loaded tanks, a metallic fill pipe shall be designed and installed to minimize the generation of static electricity by terminating the pipe within 6 inches (152 mm) of the bottom of the tank, and it shall be installed in a manner that avoids excessive vibration.

5704.2.7.5.5.1 Class I liquids. For Class I liquids other than crude oil, gasoline and asphalt, the fill pipe shall be designed and installed in a manner that will minimize the possibility of generating static electricity by terminating within 6 inches (152 mm) of the bottom of the tank.

5704.2.7.5.5.2 Underground tanks. For underground tanks, fill pipe and discharge lines shall enter only through the top. Fill lines shall be sloped toward the tank. Underground tanks for Class I liquids having a capacity greater than 1,000 gallons (3785 L) shall be equipped with a tight fill device for connecting the fill hose to the tank.

5704.2.7.5.6 Location of connections that are made or broken. Filling, withdrawal and vapor-recovery connections for Class I, II and IIIA liquids that are made and broken shall be located outside of buildings, not more than 5 feet (1524 mm) above the finished ground level, in an approved location in close proximity to the parked delivery vehicle. Such location shall be away from sources of ignition and not less than 5 feet (1524 mm) away from building openings. Such connections shall be closed and liquid tight when not in use and shall be properly identified.

5704.2.7.5.7 Protection against vapor release. Tank openings provided for purposes of vapor recovery shall be protected against possible vapor release by means of a spring-loaded check valve or dry-break connections, or other approved device, unless the opening is a pipe connected to a vapor processing system. Openings designed for combined fill and

vapor recovery shall be protected against vapor release unless connection of the liquid delivery line to the fill pipe simultaneously connects the vapor recovery line. Connections shall be vapor tight.

5704.2.7.5.8 Overfill prevention. An approved means or method in accordance with Section 5704.2.9.7.5 shall be provided to prevent the overfill of all Class I, II and IIIA liquid storage tanks. Storage tanks in refineries, bulk plants or terminals regulated by Section 5706.4 or 5706.7 shall have overfill protection in accordance with API 2350.

An approved means or method in accordance with Section 5704.2.9.7.5 shall be provided to prevent the overfilling of Class IIIB liquid storage tanks connected to fuel-burning equipment inside buildings.

Exception: Outside above-ground tanks with a capacity of 1,320 gallons (5000 L) or less.

5704.2.7.6 Repair, alteration or reconstruction of tanks and piping. The repair, alteration or reconstruction, including welding, cutting and hot tapping of storage tanks and piping that have been placed in service, shall be in accordance with NFPA 30. Hot work, as defined in Section 202, on such tanks shall be conducted in accordance with Section 3510.

5704.2.7.7 Design of supports. The design of the supporting structure for tanks shall be in accordance with the *California Building Code* and NFPA 30.

5704.2.7.8 Locations subject to flooding. Where a tank is located in an area where it is subject to buoyancy because of a rise in the water table, flooding or accumulation of water from fire suppression operations, uplift protection shall be provided in accordance with Sections 22.14 and 23.14 of NFPA 30.

5704.2.7.9 Corrosion protection. Where subject to external corrosion, tanks shall be fabricated from corrosion-resistant materials, coated or provided with corrosion protection in accordance with Section 23.3.5 of NFPA 30.

5704.2.7.10 Leak reporting. A consistent or accidental loss of liquid, or other indication of a leak from a tank system, shall be reported immediately to the fire department, the fire code official and other authorities having jurisdiction.

5704.2.7.10.1 Leaking tank disposition. Leaking tanks shall be promptly emptied, repaired and returned to service, abandoned or removed in accordance with Section 5704.2.13 or 5704.2.14.

5704.2.7.11 Tank lining. Steel tanks are allowed to be lined only for the purpose of protecting the interior from corrosion or providing compatibility with a material to be stored. Only those liquids tested for compatibility with the lining material are allowed to be stored in lined tanks.

5704.2.8 Vaults. Vaults shall be allowed to be either above or below grade and shall comply with Sections 5704.2.8.1 through 5704.2.8.18.

5704.2.8.1 Listing required. Vaults shall be listed in accordance with UL 2245.

Exception: Where approved by the fire code official, below-grade vaults are allowed to be constructed on site, provided that the design is in accordance with the *California Building Code* and that special inspections are conducted to verify structural strength and compliance of the installation with the approved design in accordance with Section 1707 of the *California Building Code*. Installation plans for below-grade vaults that are constructed on site shall be prepared by, and the design shall bear the stamp of, a professional engineer. Consideration shall be given to soil and hydrostatic loading on the floors, walls and lid; anticipated seismic forces; uplifting by groundwater or flooding; and to loads imposed from above such as traffic and equipment loading on the vault lid.

5704.2.8.2 Design and construction. The vault shall completely enclose each tank. There shall not be openings in the vault enclosure except those necessary for access to, inspection of, and filling, emptying and venting of the tank. The walls and floor of the vault shall be constructed of reinforced concrete not less than 6 inches (152 mm) thick. The top of an above-grade vault shall be constructed of noncombustible material and shall be designed to be weaker than the walls of the vault, to ensure that the thrust of an explosion occurring inside the vault is directed upward before significantly high pressure can develop within the vault.

The top of an at-grade or below-grade vault shall be designed to relieve safely or contain the force of an explosion occurring inside the vault. The top and floor of the vault and the tank foundation shall be designed to withstand the anticipated loading, including loading from vehicular traffic, where applicable. The walls and floor of a vault installed below grade shall be designed to withstand anticipated soil and hydrostatic loading.

Vaults shall be designed to be wind and earthquake resistant, in accordance with the *California Building Code*.

5704.2.8.3 Secondary containment. Vaults shall be substantially liquid tight and there shall not be backfill around the tank or within the vault. The vault floor shall drain to a sump. For premanufactured vaults, liquid tightness shall be certified as part of the listing provided by a nationally recognized testing laboratory. For field-erected vaults, liquid tightness shall be certified in an approved manner.

5704.2.8.4 Internal clearance. There shall be sufficient clearance between the tank and the vault to allow for visual inspection and maintenance of the tank and its appurtenances. Dispensing devices are allowed to be installed on tops of vaults.

5704.2.8.5 Anchoring. Vaults and their tanks shall be suitably anchored to withstand uplifting by ground water or flooding, including when the tank is empty.

5704.2.8.6 Vehicle impact protection. Vaults shall be resistant to damage from the impact of a motor vehicle, or vehicle impact protection shall be provided in accordance with Section 312.

5704.2.8.7 Arrangement. Tanks shall be listed for above-ground use, and each tank shall be in its own vault. Compartmentalized tanks shall be allowed and shall be considered as a single tank. Adjacent vaults shall be allowed to share a common wall. The common wall shall be liquid and vapor tight and shall be designed to withstand the load imposed when the vault on either side of the wall is filled with water.

5704.2.8.8 Connections. Connections shall be provided to permit venting of each vault to dilute, disperse and remove vapors prior to personnel entering the vault.

5704.2.8.9 Ventilation. Vaults that contain tanks of Class I liquids shall be provided with an exhaust ventilation system installed in accordance with Section 5004.3. The ventilation system shall operate continuously or be designed to operate upon activation of the vapor or liquid detection system. The system shall provide ventilation at a rate of not less than 1 cubic foot per minute (cfm) per square foot of floor area [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$], but not less than 150 cfm ($4 \text{ m}^3/\text{min}$). The exhaust system shall be designed to provide air movement across all parts of the vault floor. Supply and exhaust ducts shall extend to within 3 inches (76 mm), but not more than 12 inches (305 mm), of the floor. The exhaust system shall be installed in accordance with the *California Mechanical Code*.

5704.2.8.10 Liquid detection. Vaults shall be equipped with a detection system capable of detecting liquids, including water, and activating an alarm.

5704.2.8.11 Monitoring and detection. Vaults shall be provided with approved vapor and liquid detection systems and equipped with on-site audible and visual warning devices with battery backup. Vapor detection systems shall sound an alarm when the system detects vapors that reach or exceed 25 percent of the lower explosive limit (LEL) of the liquid stored. Vapor detectors shall be located not higher than 12 inches (305 mm) above the lowest point in the vault. Liquid detection systems shall sound an alarm upon detection of any liquid, including water. Liquid detectors shall be located in accordance with the manufacturer's instructions. Activation of either vapor or liquid detection systems shall cause a signal to be sounded at an approved, constantly attended location within the facility serving the tanks or at an approved location. Activation of vapor detection systems shall shut off dispenser pumps.

5704.2.8.12 Liquid removal. Means shall be provided to recover liquid from the vault. Where a pump is used

to meet this requirement, the pump shall not be permanently installed in the vault. Electric-powered portable pumps shall be suitable for use in Class I, Division 1, or Zone 0 locations, as defined in the *California Electrical Code*.

5704.2.8.13 Normal vents. Vent pipes that are provided for normal tank venting shall terminate not less than 12 feet (3658 mm) above ground level.

5704.2.8.14 Emergency vents. Emergency vents shall be vapor tight and shall be allowed to discharge inside the vault. Long-bolt manhole covers shall not be allowed for this purpose.

5704.2.8.15 Accessway. Vaults shall be provided with an approved personnel accessway with a minimum dimension of 30 inches (762 mm) and with a permanently affixed, nonferrous ladder. Accessways shall be designed to be nonsparking. Travel distance from any point inside a vault to an accessway shall not exceed 20 feet (6096 mm). At each entry point, a warning sign indicating the need for procedures for safe entry into confined spaces shall be posted. Entry points shall be secured against unauthorized entry and vandalism.

5704.2.8.16 Fire protection. Vaults shall be provided with a suitable means to admit a fire suppression agent.

5704.2.8.17 Classified area. The interior of a vault containing a tank that stores a Class I liquid shall be designated a Class I, Division 1, or Zone 0 location, as defined in the *California Electrical Code*.

5704.2.8.18 Overfill protection. Overfill protection shall be provided in accordance with Section 5704.2.9.7.5. The use of a float vent valve shall be prohibited.

5704.2.9 Above-ground tanks. Above-ground storage of flammable and combustible liquids in tanks shall comply with Section 5704.2 and Sections 5704.2.9.1 through 5704.2.9.7.9.

5704.2.9.1 Existing noncompliant installations. Existing above-ground tanks shall be maintained in accordance with the code requirements that were applicable at the time of installation. Above-ground tanks that were installed in violation of code requirements applicable at the time of installation shall be made code compliant or shall be removed in accordance with Section 5704.2.14, regardless of whether such tank has been previously inspected (see Section 108.4).

5704.2.9.2 Fire protection. Fire protection for above-ground tanks shall comply with Sections 5704.2.9.2.1 through 5704.2.9.2.4.

5704.2.9.2.1 Required foam fire protection systems. Where required by the fire code official, foam fire protection shall be provided for above-ground tanks, other than pressure tanks operating at or above 1 pound per square inch gauge (psig) (6.89 kPa) where such tank, or group of tanks spaced less than 50 feet (15 240 mm) apart measured shell to shell, has a liquid surface area in excess of 1,500

square feet (139 m²), and is in accordance with one of the following:

1. Used for the storage of Class I or II liquids.
2. Used for the storage of crude oil.
3. Used for in-process products and is located within 100 feet (30 480 mm) of a fired still, heater, related fractioning or processing apparatus or similar device at a processing plant or petroleum refinery as herein defined.
4. Considered by the fire code official as posing an unusual exposure hazard because of topographical conditions; nature of occupancy, proximity on the same or adjoining property, and height and character of liquids to be stored; degree of private fire protection to be provided; and facilities of the fire department to cope with flammable liquid fires.

5704.2.9.2.2 Foam fire protection system installation. Where foam fire protection is required, it shall be installed in accordance with NFPA 11.

5704.2.9.2.2.1 Foam storage. Where foam fire protection is required, foam-producing materials shall be stored on the premises.

Exception: Storage of foam-producing materials off the premises is allowed as follows:

1. Such materials stored off the premises shall be of the proper type suitable for use with the equipment at the installation where required.
2. Such materials shall be readily available at the storage location at all times.
3. Adequate loading and transportation facilities shall be provided.
4. The time required to deliver such materials to the required location in the event of fire shall be consistent with the hazards and fire scenarios for which the foam supply is intended.
5. At the time of a fire, these off-premises supplies shall be accumulated in sufficient quantities before placing the equipment in operation to ensure foam production at an adequate rate without interruption until extinguishment is accomplished.

5704.2.9.2.3 Fire protection of supports. Supports or pilings for above-ground tanks storing Class I, II or IIIA liquids elevated more than 12 inches (305 mm) above grade shall have a fire-resistance rating of not less than 2 hours in accordance with the fire exposure criteria specified in ASTM E1529.

Exceptions:

1. Structural supports tested as part of a protected above-ground tank in accordance with UL 2085.

2. Stationary tanks located outside of buildings where protected by an approved water-spray system designed in accordance with Chapter 9 and NFPA 15.
3. Stationary tanks located inside of buildings equipped throughout with an approved automatic sprinkler system designed in accordance with Section 903.3.1.1.

5704.2.9.2.4 Inerting of tanks storing boilover liquids. Liquids with boilover characteristics shall not be stored in fixed roof tanks larger than 150 feet (45 720 mm) in diameter unless an approved gas enrichment or inerting system is provided on the tank.

Exception: Crude oil storage tanks in production fields with no other exposures adjacent to the storage tank.

5704.2.9.3 Supports, foundations and anchorage. Supports, foundations and anchorages for above-ground tanks shall be designed and constructed in accordance with NFPA 30 and the *California Building Code*.

5704.2.9.4 Stairways, platforms and walkways. Stairways, platforms and walkways shall be of noncombustible construction and shall be designed and constructed in accordance with NFPA 30 and the *California Building Code*.

5704.2.9.5 Above-ground tanks inside of buildings. Above-ground tanks inside of buildings shall comply with Sections 5704.2.9.5.1 and 5704.2.9.5.2.

5704.2.9.5.1 Overfill prevention. Above-ground tanks storing Class I, II and IIIA liquids inside buildings shall be equipped with a device or other means to prevent overflow into the building including, but not limited to: a float valve; a preset meter on the fill line; a valve actuated by the weight of the tank's contents; a low-head pump that is incapable of producing overflow; or a liquid-tight overflow pipe not less than one pipe size larger than the fill pipe and discharging by gravity back to the outside source of liquid or to an approved location. Tanks containing Class IIIB liquids and connected to fuel-burning equipment shall be provided with a means to prevent overflow into buildings in accordance with Section 5704.2.7.5.8.

5704.2.9.5.2 Fill pipe connections. Fill pipe connections for tanks storing Class I, II and IIIA liquids and Class IIIB liquids connected to fuel-burning equipment shall be in accordance with Section 5704.2.9.7.6.

5704.2.9.6 Above-ground tanks outside of buildings. Above-ground tanks outside of buildings shall comply with Sections 5704.2.9.6.1 through 5704.2.9.6.3.

5704.2.9.6.1 Locations where above-ground tanks are prohibited. Storage of Class I and II liquids in above-ground tanks outside of buildings is prohibited within the limits established by law as the limits

of districts in which such storage is prohibited [JURISDICTION TO SPECIFY].

5704.2.9.6.1.1 Location of tanks with pressures 2.5 psig or less. Above-ground tanks operating at pressures not exceeding 2.5 psig (17.2 kPa) for storage of Class I, II or IIIA liquids, which are designed with a floating roof, a weak roof-to-shell seam or equipped with emergency venting devices limiting pressure to 2.5 psig (17.2 kPa), shall be located in accordance with Table 22.4.1.1(a) of NFPA 30.

Exceptions:

1. Vertical tanks having a weak roof-to-shell seam and storing Class IIIA liquids are allowed to be located at one-half the distances specified in Table 22.4.1.1(a) of NFPA 30, provided that the tanks are not within a diked area or drainage path for a tank storing Class I or II liquids.
2. Liquids with boilover characteristics and unstable liquids in accordance with Sections 5704.2.9.6.1.3 and 5704.2.9.6.1.4.
3. For protected above-ground tanks in accordance with Section 5704.2.9.7 and tanks in at-grade or above-grade vaults in accordance with Section 5704.2.8, the distances in Table 22.4.1.1(b) of NFPA 30 shall apply and shall be reduced by one-half, but not to less than 5 feet (1524 mm).

5704.2.9.6.1.2 Location of tanks with pressures exceeding 2.5 psig. Above-ground tanks for the storage of Class I, II or IIIA liquids operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting allowing pressures to exceed 2.5 psig (17.2 kPa) shall be located in accordance with Table 22.4.1.3 of NFPA 30.

Exception: Liquids with boilover characteristics and unstable liquids in accordance with Sections 5704.2.9.6.1.3 and 5704.2.9.6.1.4.

5704.2.9.6.1.3 Location of tanks storing boilover liquids. Above-ground tanks for storage of liquids with boilover characteristics shall be located in accordance with Table 22.4.1.4 of NFPA 30.

5704.2.9.6.1.4 Location of tanks storing unstable liquids. Above-ground tanks for the storage of unstable liquids shall be located in accordance with Table 22.4.1.5 of NFPA 30.

5704.2.9.6.1.5 Location of tanks storing Class IIIB liquids. Above-ground tanks for the storage of Class IIIB liquids, excluding unstable liquids, shall be located in accordance with Table 22.4.1.6 of NFPA 30, except where located within a diked area or drainage path for a tank or

tanks storing Class I or II liquids. Where a Class IIIB liquid storage tank is within the diked area or drainage path for a Class I or II liquid, distances required by Section 5704.2.9.6.1.1 shall apply.

5704.2.9.6.1.6 Reduction of separation distances to adjacent property. Where two tank properties of diverse ownership have a common boundary, the fire code official is authorized to, with the written consent of the owners of the two properties, apply the distances in Sections 5704.2.9.6.1.2 through 5704.2.9.6.1.5 assuming a single property.

5704.2.9.6.2 Separation between adjacent stable or unstable liquid tanks. The separation between tanks containing stable liquids shall be in accordance with Table 22.4.2.1 of NFPA 30. Where tanks are in a diked area containing Class I or II liquids, or in the drainage path of Class I or II liquids, and are compacted in three or more rows or in an irregular pattern, the fire code official is authorized to require greater separation than specified in Table 22.4.2.1 of NFPA 30 or other means to make tanks in the interior of the pattern open for fire-fighting purposes.

The separation between tanks containing unstable liquids shall be not less than one-half the sum of their diameters.

Exception: Tanks used for storing Class IIIB liquids are allowed to be spaced 3 feet (914 mm) apart unless within a diked area or drainage path for a tank storing Class I or II liquids.

5704.2.9.6.3 Separation between adjacent tanks containing flammable or combustible liquids and LP-gas. The minimum horizontal separation between an LP-gas container and a Class I, II or IIIA liquid storage tank shall be 20 feet (6096 mm) except in the case of Class I, II or IIIA liquid tanks operating at pressures exceeding 2.5 psig (17.2 kPa) or equipped with emergency venting allowing pressures to exceed 2.5 psig (17.2 kPa), in which case the provisions of Section 5704.2.9.6.2 shall apply.

An approved means shall be provided to prevent the accumulation of Class I, II or IIIA liquids under adjacent LP-gas containers such as by dikes, diversion curbs or grading. Where flammable or combustible liquid storage tanks are within a diked area, the LP-gas containers shall be outside the diked area and not less than 10 feet (3048 mm) away from the centerline of the wall of the diked area.

Exceptions:

1. Liquefied petroleum gas containers of 125 gallons (473 L) or less in capacity installed adjacent to fuel-oil supply tanks of 660 gallons (2498 L) or less in capacity.
2. Horizontal separation is not required between above-ground LP-gas containers and underground flammable and combustible liquid tanks.

5704.2.9.7 Additional requirements for protected above-ground tanks. In addition to the requirements of this chapter for above-ground tanks, the installation of protected above-ground tanks shall be in accordance with Sections 5704.2.9.7.1 through 5704.2.9.7.9.

5704.2.9.7.1 Tank construction. The construction of a protected above-ground tank and its primary tank shall be in accordance with Section 5704.2.7.

5704.2.9.7.2 Normal and emergency venting. Normal and emergency venting for protected above-ground tanks shall be provided in accordance with Sections 5704.2.7.3 and 5704.2.7.4. The vent capacity reduction factor shall not be allowed.

5704.2.9.7.3 Secondary containment. Protected above-ground tanks shall be provided with secondary containment, drainage control or diking in accordance with Section 5004.2. A means shall be provided to establish the integrity of the secondary containment in accordance with NFPA 30.

5704.2.9.7.4 Vehicle impact protection. Where protected above-ground tanks, piping, electrical conduit or dispensers are subject to vehicular impact, they shall be protected therefrom, either by having the impact protection incorporated into the system design in compliance with the impact test protocol of UL 2085, or by meeting the provisions of Section 312, or where necessary, a combination of both. Where guard posts or other approved barriers are provided, they shall be independent of each above-ground tank.

5704.2.9.7.5 Overfill prevention. Protected above-ground tanks shall not be filled in excess of 95 percent of their capacity. An overfill prevention system shall be provided for each tank. During tank-filling operations, the system shall comply with one of the following:

1. The overfill prevention system shall include the following:
 - 1.1. An independent means of notifying the person filling the tank that the fluid level has reached 90 percent of tank capacity by providing an audible or visual alarm signal, providing a tank level gauge marked at 90 percent of tank capacity, or other approved means.
 - 1.2. Automatic shut off of the flow of fuel to the tank when the quantity of liquid in the tank reaches 95 percent of tank capacity. For rigid hose fuel-delivery systems, an approved means shall be provided to empty the fill hose into the tank after the automatic shutoff device is activated.
2. The system shall reduce the flow rate to not more than 15 gallons per minute (0.95 L/s) so that at the reduced flow rate, the tank will not

overflow for 30 minutes, and automatically shut off flow into the tank so that none of the fittings on the top of the tank are exposed to product because of overfilling.

5704.2.9.7.5.1 Information signs. A permanent sign shall be provided at the fill point for the tank, documenting the filling procedure and the tank calibration chart.

Exception: Where climatic conditions are such that the sign may be obscured by ice or snow, or weathered beyond readability or otherwise impaired, said procedures and chart shall be located in the office window, lock box or other area available to the person filling the tank.

5704.2.9.7.5.2 Determination of available tank capacity. The filling procedure shall require the person filling the tank to determine the gallonage (literage) required to fill it to 90 percent of capacity before commencing the fill operation.

5704.2.9.7.6 Fill pipe connections. The fill pipe shall be provided with a means for making a direct connection to the tank vehicle’s fuel delivery hose so that the delivery of fuel is not exposed to the open air during the filling operation. Where any portion of the fill pipe exterior to the tank extends below the level of the top of the tank, a check valve shall be installed in the fill pipe not more than 12 inches (305 mm) from the fill hose connection.

5704.2.9.7.7 Spill containers. A spill container having a capacity of not less than 5 gallons (19 L) shall be provided for each fill connection. For tanks with a top fill connection, spill containers shall be noncombustible and shall be fixed to the tank and equipped with a manual drain valve that drains into the primary tank. For tanks with a remote fill connection, a portable spill container shall be allowed.

5704.2.9.7.8 Tank openings. Tank openings in protected above-ground tanks shall be through the top only.

5704.2.9.7.9 Antisiphon devices. Approved antisiphon devices shall be installed in each external pipe connected to the protected above-ground tank where the pipe extends below the level of the top of the tank.

5704.2.10 Drainage and diking. The area surrounding a tank or group of tanks shall be provided with drainage control or shall be diked to prevent accidental discharge of liquid from endangering adjacent tanks, adjoining property or reaching waterways.

Exceptions:

1. The fire code official is authorized to alter or waive these requirements based on a technical report that demonstrates that such tank or group of tanks does not constitute a hazard to other tanks, waterways or adjoining property, after consideration of special features such as topo-

graphical conditions, nature of occupancy and proximity to buildings on the same or adjacent property, capacity, and construction of proposed tanks and character of liquids to be stored, and nature and quantity of private and public fire protection provided.

2. Drainage control and diking is not required for listed secondary containment tanks.

5704.2.10.1 Volumetric capacity. The volumetric capacity of the diked area shall be not less than the greatest amount of liquid that can be released from the largest tank within the diked area. The capacity of the diked area enclosing more than one tank shall be calculated by deducting the volume of the tanks other than the largest tank below the height of the dike.

5704.2.10.2 Diked areas containing two or more tanks. Diked areas containing two or more tanks shall be subdivided in accordance with NFPA 30.

5704.2.10.3 Protection of piping from exposure fires. Piping shall not pass through adjacent diked areas or impounding basins, unless provided with a sealed sleeve or otherwise protected from exposure to fire.

5704.2.10.4 Combustible materials in diked areas. Diked areas shall be kept free from combustible materials, drums and barrels.

5704.2.10.5 Equipment, controls and piping in diked areas. Pumps, manifolds and fire protection equipment or controls shall not be located within diked areas or drainage basins or in a location where such equipment and controls would be endangered by fire in the diked area or drainage basin. Piping above ground shall be minimized and located as close as practical to the shell of the tank in diked areas or drainage basins.

Exceptions:

1. Pumps, manifolds and piping integral to the tanks or equipment being served, which is protected by intermediate diking, berms, drainage or fire protection such as water spray, monitors or resistive coating.
2. Fire protection equipment or controls that are appurtenances to the tanks or equipment being protected, such as foam chambers or foam piping and water or foam monitors and hydrants, or hand and wheeled extinguishers.

5704.2.11 Underground tanks. Underground storage of flammable and combustible liquids in tanks shall comply with Section 5704.2 and Sections 5704.2.11.1 through 5704.2.11.4.2.1.

5704.2.11.1 Location. Flammable and combustible liquid storage tanks located underground, either outside or under buildings, shall be in accordance with all of the following:

1. Tanks shall be located with respect to existing foundations and supports such that the loads carried by the latter cannot be transmitted to the tank.

2. The distance from any part of a tank storing liquids to the nearest wall of a basement, pit, cellar or lot line shall be not less than 3 feet (914 mm).
3. A minimum distance of 1 foot (305 mm), shell to shell, shall be maintained between underground tanks.

5704.2.11.2 Depth and cover. Excavation for underground storage tanks shall be made with due care to avoid undermining of foundations of existing structures. Underground tanks shall be set on firm foundations and surrounded with not less than 6 inches (152 mm) of noncorrosive inert material, such as clean sand.

5704.2.11.3 Overfill protection and prevention systems. Fill pipes shall be equipped with a spill container and an overfill prevention system in accordance with NFPA 30.

5704.2.11.4 Leak prevention. Leak prevention for underground tanks shall comply with Sections 5704.2.11.4.1 and 5704.2.11.4.2.

5704.2.11.4.1 Inventory control. Daily inventory records for underground storage tank systems shall be maintained.

5704.2.11.4.2 Leak detection. Underground storage tank systems shall be provided with an approved method of leak detection from any component of the system that is designed and installed in accordance with NFPA 30.

5704.2.11.4.2.1 Location. The leak detection panel status shall be annunciated at an approved on-site location.

5704.2.12 Testing. Tank testing shall comply with Sections 5704.2.12.1 and 5704.2.12.2.

5704.2.12.1 Acceptance testing. Prior to being placed into service, tanks shall be tested in accordance with Section 21.5 of NFPA 30.

5704.2.12.2 Testing of underground tanks. Before being covered or placed in use, tanks and piping connected to underground tanks shall be tested for tightness in the presence of the fire code official. Piping shall be tested in accordance with Section 5703.6.3. The system shall not be covered until it has been approved.

5704.2.13 Abandonment and status of tanks. Tanks taken out of service shall be removed in accordance with Section 5704.2.14, or safeguarded in accordance with Sections 5704.2.13.1 through 5704.2.13.2.3 and API 1604.

5704.2.13.1 Underground tanks. Underground tanks taken out of service shall comply with Sections 5704.2.13.1.1 through 5704.2.13.1.5.

5704.2.13.1.1 Temporarily out of service. Underground tanks temporarily out of service shall have the fill line, gauge opening, vapor return and pump connection secure against tampering. Vent lines shall

remain open and be maintained in accordance with Sections 5704.2.7.3 and 5704.2.7.4.

5704.2.13.1.2 Out of service for 90 days. Underground tanks not used for a period of 90 days shall be safeguarded in accordance with all the following or be removed in accordance with Section 5704.2.14:

1. Flammable or combustible liquids shall be removed from the tank.
2. All piping, including fill line, gauge opening, vapor return and pump connection, shall be capped or plugged and secured from tampering.
3. Vent lines shall remain open and be maintained in accordance with Sections 5704.2.7.3 and 5704.2.7.4.

5704.2.13.1.3 Out of service for one year. Underground tanks that have been out of service for a period of one year shall be removed from the ground in accordance with Section 5704.2.14 or abandoned in place in accordance with Section 5704.2.13.1.4.

5704.2.13.1.4 Tanks abandoned in place. Tanks abandoned in place shall be as follows:

1. Flammable and combustible liquids shall be removed from the tank and connected piping.
2. The suction, inlet, gauge, vapor return and vapor lines shall be disconnected.
3. The tank shall be filled completely with an approved inert solid material.
4. Remaining underground piping shall be capped or plugged.
5. A record of tank size, location and date of abandonment shall be retained.
6. All exterior above-grade fill piping shall be permanently removed when tanks are abandoned or removed.

5704.2.13.1.5 Reinstallation of underground tanks. Tanks that are to be reinstalled for flammable or combustible liquid service shall be in accordance with this chapter, *ASME Boiler and Pressure Vessel Code* (Section VIII), API 1615, UL 58 and UL 1316.

5704.2.13.2 Above-ground tanks. Above-ground tanks taken out of service shall comply with Sections 5704.2.13.2.1 through 5704.2.13.2.3.

5704.2.13.2.1 Temporarily out of service. Above-ground tanks temporarily out of service shall have all connecting lines isolated from the tank and be secured against tampering.

Exception: In-place fire protection (foam) system lines.

5704.2.13.2.2 Out of service for 90 days. Above-ground tanks not used for a period of 90 days shall be safeguarded in accordance with Section 5704.2.13.1.2 or removed in accordance with Section 5704.2.14.

Exceptions:

1. Tanks and containers connected to oil burners that are not in use during the warm season of the year or are used as a backup heating system to gas.
2. In-place, active fire protection (foam) system lines.

5704.2.13.2.3 Out of service for one year. Above-ground tanks that have been out of service for a period of one year shall be removed in accordance with Section 5704.2.14.

Exception: Tanks within operating facilities.

5704.2.14 Removal and disposal of tanks. Removal and disposal of tanks shall comply with Sections 5704.2.14.1 and 5704.2.14.2.

5704.2.14.1 Removal. Removal of above-ground and underground tanks shall be in accordance with all of the following:

1. Flammable and combustible liquids shall be removed from the tank and connected piping.
2. Piping at tank openings that is not to be used further shall be disconnected.
3. Piping shall be removed from the ground.

Exception: Piping is allowed to be abandoned in place where the fire code official determines that removal is not practical. Abandoned piping shall be capped and safeguarded as required by the fire code official.

4. Tank openings shall be capped or plugged, leaving a 1/8-inch to 1/4-inch-diameter (3.2 mm to 6.4 mm) opening for pressure equalization.
5. Tanks shall be purged of vapor and inerted prior to removal.
6. All exterior above-grade fill and vent piping shall be permanently removed.

Exception: Piping associated with bulk plants, terminal facilities and refineries.

5704.2.14.2 Disposal. Tanks shall be disposed of in accordance with federal, state and local regulations.

5704.2.15 Maintenance. Above-ground tanks, connected piping and ancillary equipment shall be maintained in a safe operating condition. Tanks shall be maintained in accordance with their listings. Damage to above-ground tanks, connected piping or ancillary equipment shall be repaired using materials having equal or greater strength and fire resistance or the equipment shall be replaced or taken out of service.

5704.3 Container and portable tank storage. Storage of flammable and combustible liquids in closed containers that do not exceed 60 gallons (227 L) in individual capacity and portable tanks that do not exceed 660 gallons (2498 L) in individual capacity, and limited transfers incidental thereto, shall comply with Sections 5704.3.1 through 5704.3.8.5.

5704.3.1 Design, construction and capacity of containers and portable tanks. The design, construction and capacity of containers for the storage of Class I, II and IIIA liquids shall be in accordance with this section and Section 9.4 of NFPA 30.

5704.3.1.1 Approved containers. Only approved containers and portable tanks shall be used.

5704.3.2 Liquid storage cabinets. Where other sections of this code require that liquid containers be stored in storage cabinets, such cabinets and storage shall be in accordance with Sections 5704.3.2.1 through 5704.3.2.2.

5704.3.2.1 Design and construction of storage cabinets. Design and construction of liquid storage cabinets shall be in accordance with Sections 5704.3.2.1.1 through 5704.3.2.1.4.

5704.3.2.1.1 Materials. Cabinets shall be listed in accordance with UL 1275, or constructed of approved wood or metal in accordance with the following:

1. Unlisted metal cabinets shall be constructed of steel having a thickness of not less than 0.044 inch (1.12 mm) (18 gage). The cabinet, including the door, shall be double walled with 1½-inch (38 mm) airspace between the walls. Joints shall be riveted or welded and shall be tight fitting.
2. Unlisted wooden cabinets, including doors, shall be constructed of not less than 1-inch (25 mm) exterior grade plywood. Joints shall be rabbeted and shall be fastened in two directions with wood screws. Door hinges shall be of steel or brass. Cabinets shall be painted with an intumescent-type paint.

5704.3.2.1.2 Labeling. Cabinets shall be provided with a conspicuous label in red letters on contrasting background that reads: “FLAMMABLE—KEEP FIRE AWAY.”

5704.3.2.1.3 Doors. Doors shall be well fitted, self-closing and equipped with a three-point latch.

5704.3.2.1.4 Bottom. The bottom of the cabinet shall be liquid tight to a height of not less than 2 inches (51 mm).

5704.3.2.2 Capacity. The combined total quantity of liquids in a cabinet shall not exceed 120 gallons (454 L).

5704.3.3 Indoor storage. Storage of flammable and combustible liquids inside buildings in containers and portable tanks shall be in accordance with Sections 5704.3.3.1 through 5704.3.3.10.

Exceptions:

1. Liquids in the fuel tanks of motor vehicles, aircraft, boats or portable or stationary engines.
2. The storage of distilled spirits and wines in wooden barrels or casks.

5704.3.3.1 Portable fire extinguishers. Approved portable fire extinguishers shall be provided in accordance with specific sections of this chapter and Section 906.

5704.3.3.2 Incompatible materials. Materials that will react with water or other liquids to produce a hazard shall not be stored in the same room with flammable and combustible liquids except where stored in accordance with Section 5003.9.8.

5704.3.3.3 Clear means of egress. Storage of any liquids, including stock for sale, shall not be stored near or be allowed to obstruct physically the route of egress.

5704.3.3.4 Empty containers or portable tank storage. The storage of empty tanks and containers previously used for the storage of flammable or combustible liquids, unless free from explosive vapors, shall be stored as required for filled containers and portable tanks. Portable tanks and containers, when emptied, shall have the covers or plugs immediately replaced in openings.

5704.3.3.5 Shelf storage. Shelving shall be of approved construction, adequately braced and anchored. Seismic requirements shall be in accordance with the *California Building Code*.

5704.3.3.5.1 Use of wood. Wood of not less than 1 inch (25 mm) nominal thickness is allowed to be used as shelving, racks, dunnage, scuffboards, floor overlay and similar installations.

5704.3.3.5.2 Displacement protection. Shelves shall be of sufficient depth and provided with a lip or guard to prevent individual containers from being displaced.

Exception: Shelves in storage cabinets or on laboratory furniture specifically designed for such use.

5704.3.3.5.3 Orderly storage. Shelf storage of flammable and combustible liquids shall be maintained in an orderly manner.

5704.3.3.6 Rack storage. Where storage on racks is allowed elsewhere in this code, a minimum 4-foot-wide (1219 mm) aisle shall be provided between adjacent rack sections and any adjacent storage of liquids. Main aisles shall be not less than 8 feet (2438 mm) wide.

5704.3.3.7 Pile or palletized storage. Solid pile and palletized storage in liquid warehouses shall be arranged so that piles are separated from each other by not less than 4 feet (1219 mm). Aisles shall be provided and arranged so that containers or portable tanks are not more than 20 feet (6096 mm) from an aisle. Main aisles shall be not less than 8 feet (2438 mm) wide.

5704.3.3.8 Limited combustible storage. Limited quantities of combustible commodities are allowed to be stored in liquid storage areas where the ordinary combustibles, other than those used for packaging the liquids, are separated from the liquids in storage by not less than 8 feet (2438 mm) horizontally, either by open

aisles or by open racks, and where protection is provided in accordance with Chapter 9.

5704.3.3.9 Idle combustible pallets. Storage of empty or idle combustible pallets inside an unprotected liquid storage area shall be limited to a maximum pile size of 2,500 square feet (232 m²) and to a maximum storage height of 6 feet (1829 mm). Storage of empty or idle combustible pallets inside a protected liquid storage area shall comply with NFPA 13. Pallet storage shall be separated from liquid storage by aisles that are not less than 8 feet (2438 mm) wide.

5704.3.3.10 Containers in piles. Containers in piles shall be stacked in such a manner as to provide stability and to prevent excessive stress on container walls. Portable tanks stored more than one tier high shall be designed to nest securely, without dunnage. Material-handling equipment shall be suitable to handle containers and tanks safely at the upper tier level.

5704.3.4 Quantity limits for storage. Liquid storage quantity limitations shall comply with Sections 5704.3.4.1 through 5704.3.4.4.

5704.3.4.1 Maximum allowable quantity per control area. For occupancies other than Group M wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area indicated in Table 5003.1.1(1) and shall not exceed the additional limitations set forth in this section.

For Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area indicated in Table 5704.3.4.1.

Storage of hazardous production material flammable and combustible liquids in Group H-5 occupancies shall be in accordance with Chapter 27.

5704.3.4.2 Occupancy quantity limits. The following limits for quantities of stored flammable or combustible liquids shall not be exceeded:

1. Group A occupancies: Quantities in Group A occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
2. Group B occupancies: Quantities in drinking, dining, office and school uses within Group B occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
3. Group E occupancies: Quantities in Group E occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
4. Group F occupancies: Quantities in dining, office, and school uses within Group F occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
5. Group I occupancies: Quantities in Group I occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
6. Group M occupancies: Quantities in dining, office, and school uses within Group M occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).

**TABLE 5704.3.4.1
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF
FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES^a**

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered ^b in accordance with footnote densities and arrangements	Sprinklered in accordance with Tables 5704.3.6.3(4) through 5704.3.6.3(8) and Table 5704.3.7.5.1	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 ^c	15,000 ^c	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m².

a. Control areas shall be separated from each other by not less than a 1-hour fire barrier.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:

1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those allowed with a minimum sprinkler design density of Ordinary Hazard Group 2.
2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those allowed with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to not more than 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

cies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1). The maximum allowable quantities for storage in wholesale and retail sales areas shall be in accordance with Section 5704.3.4.1.

7. Group R occupancies: Quantities in Group R occupancies shall not exceed that necessary for maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
8. Group S occupancies: Quantities in dining and office uses within Group S occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).

5704.3.4.3 Quantities exceeding limits for control areas. Quantities exceeding those allowed in *control areas* set forth in Section 5704.3.4.1 shall be in liquid storage rooms or liquid storage warehouses in accordance with Sections 5704.3.7 and 5704.3.8.

5704.3.4.4 Liquids for maintenance and operation of equipment. In all occupancies, quantities of flammable and combustible liquids in excess of 10 gallons (38 L) used for maintenance purposes and the operation of equipment shall be stored in liquid storage cabinets in accordance with Section 5704.3.2. Quantities not exceeding 10 gallons (38 L) are allowed to be stored outside of a cabinet where in approved containers located in private garages or other approved locations.

5704.3.5 Storage in control areas. Storage of flammable and combustible liquids in control areas shall be in accordance with Sections 5704.3.5.1 through 5704.3.5.4.

5704.3.5.1 Basement storage. Class I liquids shall be allowed to be stored in basements in amounts not exceeding the maximum allowable quantity per control area for use-open systems in Table 5003.1.1(1), provided that fire protection systems are provided in accordance with Chapter 9. Class II and IIIA liquids shall be allowed to be stored in basements, provided that automatic suppression and other fire protection are provided in accordance with Chapter 9.

5704.3.5.2 Storage pile heights. Containers having less than a 30-gallon (114 L) capacity that contain Class I or II liquids shall not be stacked more than 3 feet (914.4 mm) or two containers high, whichever is greater, unless stacked on fixed shelving or otherwise satisfactorily secured. Containers of Class I or II liquids having a capacity of 30 gallons (114 L) or more shall not be stored more than one container high. Containers shall be stored in an upright position.

5704.3.5.3 Storage distance from ceilings and roofs. Piles of containers or portable tanks shall not be stored closer than 3 feet (914 mm) to the nearest beam, chord, girder or other obstruction, and shall be 3 feet (914

mm) below sprinkler deflectors or discharge orifices of water spray or other overhead fire protection system.

5704.3.5.4 Combustible materials. In areas that are not open to the public, Class I, II and IIIA liquids shall not be stored in the same pile or rack section as ordinary combustible commodities unless such materials are packaged together as kits.

5704.3.6 Wholesale and retail sales uses. Flammable and combustible liquids in Group M occupancy wholesale and retail sales uses shall be in accordance with Sections 5704.3.6.1 through 5704.3.6.5, or Sections 10.10.2, 12.3.6, 16.4.1 through 16.4.3, 16.5.1 through 16.5.2.12, Figures 16.4.1(a) through 16.4.1(c) and Tables 16.5.2.1 through 16.5.2.12, of NFPA 30.

5704.3.6.1 Container type. Containers for Class I liquids shall be metal.

Exception: In sprinklered buildings, an aggregate quantity of 120 gallons (454 L) of water-miscible Class IB and Class IC liquids is allowed in non-metallic containers, each having a capacity of 16 ounces (0.473 L) or less.

5704.3.6.2 Container capacity. Containers for Class I liquids shall not exceed a capacity of 5 gallons (19 L).

Exception: Metal containers not exceeding 55 gallons (208 L) are allowed to store up to 240 gallons (908 L) of the maximum allowable quantity per control area of Class IB and IC liquids in a control area. The building shall be equipped throughout with an approved automatic sprinkler system in accordance with Table 5704.3.4.1. The containers shall be provided with plastic caps without cap seals and shall be stored upright. Containers shall not be stacked or stored in racks and shall not be located in areas open to the public.

5704.3.6.3 Fire protection and storage arrangements. Fire protection and container storage arrangements shall be in accordance with Table 5704.3.6.3(1) or the following:

1. Storage on shelves shall not exceed 6 feet (1829 mm) in height, and shelving shall be metal.
2. Storage on pallets or in piles greater than 4 feet 6 inches (1372 mm) in height, or where the ceiling exceeds 18 feet (5486 mm) in height, shall be protected in accordance with Table 5704.3.6.3(4), and the storage heights and arrangements shall be limited to those specified in Table 5704.3.6.3(2).
3. Storage on racks greater than 4 feet 6 inches (1372 mm) in height, or where the ceiling exceeds 18 feet (5486 mm) in height shall be protected in accordance with Tables 5704.3.6.3(5), 5704.3.6.3(6), and 5704.3.6.3(7) as appropriate, and the storage heights and arrangements shall be limited to those specified in Table 5704.3.6.3(3).

Combustible commodities shall not be stored above flammable and combustible liquids.

**TABLE 5704.3.6.3(1)
MAXIMUM STORAGE HEIGHT IN CONTROL AREA**

TYPE OF LIQUID	NONSPRINKLERED AREA (feet)	SPRINKLERED AREA ^a (feet)	SPRINKLERED WITH IN-RACK PROTECTION ^{a, b} (feet)
Flammable liquids:			
Class IA	4	4	4
Class IB	4	8	12
Class IC	4	8	12
Combustible liquids:			
Class II	6	8	12
Class IIIA	8	12	16
Class IIIB	8	12	20

For SI: 1 foot = 304.8 mm.

- a. In buildings protected by an automatic sprinkler system, the storage height for containers and portable tanks shall not exceed the maximum storage height permitted for the fire protection scheme set forth in NFPA 30 or the maximum storage height demonstrated in a full-scale fire test, whichever is greater. NFPA 30 criteria and fire test results for metallic containers and portable tanks shall not be applied to nonmetallic containers and portable tanks.
- b. In-rack protection shall be in accordance with Table 5704.3.6.3(5), 5704.3.6.3(6) or 5704.3.6.3(7).

**TABLE 5704.3.6.3(2)
STORAGE ARRANGEMENTS FOR PALLETIZED OR SOLID-PILE STORAGE IN LIQUID STORAGE ROOMS AND WAREHOUSES**

CLASS	STORAGE LEVEL	MAXIMUM STORAGE HEIGHT			MAXIMUM QUANTITY PER PILE (gallons)		MAXIMUM QUANTITY PER ROOM ^a (gallons)	
		Drums	Containers ^b (feet)	Portable tanks ^b (feet)	Containers	Portable tanks	Containers	Portable tanks
IA	Ground floor	1	5	Not Allowed	3,000	Not Allowed	12,000	Not Allowed
	Upper floors	1	5	Not Allowed	2,000	Not Allowed	8,000	Not Allowed
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
IB	Ground floor	1	6.5	7	5,000	20,000	15,000	40,000
	Upper floors	1	6.5	7	3,000	10,000	12,000	20,000
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
IC	Ground floor ^d	1	6.5 ^c	7	5,000	20,000	15,000	40,000
	Upper floors	1	6.5 ^c	7	3,000	10,000	12,000	20,000
	Basements	0	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed	Not Allowed
II	Ground floor ^d	3	10	14	10,000	40,000	25,000	80,000
	Upper floors	3	10	14	10,000	40,000	25,000	80,000
	Basements	1	5	7	7,500	20,000	7,500	20,000
III	Ground floor	5	20	14	15,000	60,000	50,000	100,000
	Upper floors	5	20	14	15,000	60,000	50,000	100,000
	Basements	3	10	7	10,000	20,000	25,000	40,000

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

- a. See Section 5704.3.8.1 for unlimited quantities in liquid storage warehouses.
- b. In buildings protected by an automatic sprinkler system, the storage height for containers and portable tanks shall not exceed the maximum storage height permitted for the fire protection scheme set forth in NFPA 30 or the maximum storage height demonstrated in a full-scale fire test, whichever is greater. NFPA 30 criteria and fire test results for metallic containers and portable tanks shall not be applied to nonmetallic containers and portable tanks.
- c. These height limitations are allowed to be increased to 10 feet for containers having a capacity of 5 gallons or less.
- d. For palletized storage of unsaturated polyester resins (UPR) in relieving-style metal containers with 50 percent or less by weight Class IC or II liquid and no Class IA or IB liquid, height and pile quantity limits shall be permitted to be 10 feet and 15,000 gallons, respectively, provided that such storage is protected by sprinklers in accordance with NFPA 30 and that the UPR storage area is not located in the same containment area or drainage path for other Class I or II liquids.

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**TABLE 5704.3.6.3(3)
STORAGE ARRANGEMENTS FOR RACK STORAGE IN LIQUID STORAGE ROOMS AND WAREHOUSES**

CLASS	TYPE RACK	STORAGE LEVEL	MAXIMUM STORAGE HEIGHT ^b (feet)	MAXIMUM QUANTITY PER ROOM ^a (gallons)
			Containers	Containers
IA	Double row or Single row	Ground floor	25	7,500
		Upper floors	15	4,500
		Basements	Not Allowed	Not Allowed
IB	Double row or Single row	Ground floor	25	15,000
		Upper floors	15	9,000
IC		Basements	Not Allowed	Not Allowed
II	Double row or Single row	Ground floor	25	24,000
		Upper floors	25	24,000
		Basements	15	9,000
III	Multirow	Ground floor	40	48,000
	Double row	Upper floors	20	48,000
	Single row	Basements	20	24,000

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

a. See Section 5704.3.8.1 for unlimited quantities in liquid storage warehouses.

b. In buildings protected by an automatic sprinkler system, the storage height for containers and portable tanks shall not exceed the maximum storage height permitted for the fire protection scheme set forth in NFPA 30 or the maximum storage height demonstrated in a full-scale fire test, whichever is greater. NFPA 30 criteria and fire test results for metallic containers and portable tanks shall not be applied to nonmetallic containers and portable tanks.

**TABLE 5704.3.6.3(4)
AUTOMATIC SPRINKLER PROTECTION FOR SOLID-PILE AND PALLETIZED STORAGE
OF LIQUIDS IN METAL CONTAINERS AND PORTABLE TANKS^a**

STORAGE CONDITIONS		CEILING SPRINKLER DESIGN AND DEMAND				MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLERS AND HOSE STREAMS (hours)
Class liquid	Container size and arrangement	Density (gpm/ft ²)	Area (square feet)		Maximum spacing (square feet)		
			High-temperature sprinklers	Ordinary temperature sprinklers			
IA	5 gallons or less, with or without cartons, palletized or solid pile ^b	0.30	3,000	5,000	100	750	2
	Containers greater than 5 gallons, on end or side, palletized or solid pile	0.60	5,000	8,000	80		
IB, IC and II	5 gallons or less, with or without cartons, palletized or solid pile ^b	0.30	3,000	5,000	100	500	2
	Containers greater than 5 gallons on pallets or solid pile, one high	0.25	5,000	8,000	100		
II	Containers greater than 5 gallons on pallets or solid pile, more than one high, on end or side	0.60	5,000	8,000	80	750	2
IB, IC and II	Portable tanks, one high	0.30	3,000	5,000	100	500	2
II	Portable tanks, two high	0.60	5,000	8,000	80	750	2
III	5 gallons or less, with or without cartons, palletized or solid pile	0.25	3,000	5,000	120	500	1
	Containers greater than 5 gallons on pallets or solid pile, on end or sides, up to three high	0.25	3,000	5,000	120	500	1
	Containers greater than 5 gallons, on pallets or solid pile, on end or sides, up to 18 feet high	0.35	3,000	5,000	100	750	2
	Portable tanks, one high	0.25	3,000	5,000	120	500	1
	Portable tanks, two high	0.50	3,000	5,000	80	750	2

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L, 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².

a. The design area contemplates the use of Class II standpipe systems. Where Class I standpipe systems are used, the area of application shall be increased by 30 percent without revising density.

b. For storage heights above 4 feet or ceiling heights greater than 18 feet, an approved engineering design shall be provided in accordance with Section 104.8.2.

5704.3.6.4 Warning for containers. Cans, containers and vessels containing flammable liquids or flammable liquid compounds or mixtures offered for sale shall be provided with a warning indicator, painted or printed on the container and stating that the liquid is flammable, and shall be kept away from heat and an open flame.

5704.3.6.5 Storage plan. Where required by fire the code official, aisle and storage plans shall be submitted in accordance with Chapter 50.

5704.3.7 Liquid storage rooms. Liquid storage rooms shall comply with Sections 5704.3.7.1 through 5704.3.7.5.2.

5704.3.7.1 General. Quantities of liquids exceeding those set forth in Section 5704.3.4.1 for storage in control areas shall be stored in a liquid storage room complying with this section and constructed and separated as required by the *California Building Code*.

5704.3.7.2 Quantities and arrangement of storage. The quantity limits and storage arrangements in liquid storage rooms shall be in accordance with Tables 5704.3.6.3(2) and 5704.3.6.3(3) and Sections 5704.3.7.2.1 through 5704.3.7.2.3.

5704.3.7.2.1 Mixed storage. Where two or more classes of liquids are stored in a pile or rack section, both of the following shall apply:

1. The quantity in that pile or rack shall not exceed the smallest of the maximum quantities for the classes of liquids stored in accordance with Table 5704.3.6.3(2) or 5704.3.6.3(3).
2. The height of storage in that pile or rack shall not exceed the smallest of the maximum heights for the classes of liquids stored in accordance with Table 5704.3.6.3(2) or 5704.3.6.3(3).

5704.3.7.2.2 Separation and aisles. Piles shall be separated from each other by not less than 4-foot (1219 mm) aisles. Aisles shall be provided so that all containers are 20 feet (6096 mm) or less from an aisle. Where the storage of liquids is on racks, a minimum 4-foot-wide (1219 mm) aisle shall be provided between adjacent rows of racks and adjacent storage of liquids. Main aisles shall be not less than 8 feet (2438 mm) wide.

Additional aisles shall be provided for access to doors, required windows and ventilation openings, standpipe connections, mechanical equipment and switches. Such aisles shall be not less than 3 feet (914 mm) in width, unless greater widths are required for separation of piles or racks, in which case the greater width shall be provided.

5704.3.7.2.3 Stabilizing and supports. Containers and piles shall be separated by pallets or dunnage to provide stability and to prevent excessive stress to container walls. Portable tanks stored over one tier shall be designed to nest securely without dunnage.

Requirements for portable tank design shall be in accordance with Chapters 9 and 12 of NFPA 30. Shelving, racks, dunnage, scuffboards, floor overlay and similar installations shall be of noncombustible construction or of wood not less than a 1-inch (25 mm) nominal thickness. Adequate material-handling equipment shall be available to handle tanks safely at upper tier levels.

5704.3.7.3 Spill control and secondary containment. Liquid storage rooms shall be provided with spill control and secondary containment in accordance with Section 5004.2.

5704.3.7.4 Ventilation. Liquid storage rooms shall be ventilated in accordance with Section 5004.3.

5704.3.7.5 Fire protection. Fire protection for liquid storage rooms shall comply with Sections 5704.3.7.5.1 and 5704.3.7.5.2.

5704.3.7.5.1 Fire-protection systems. Liquid storage rooms shall be protected by automatic sprinkler systems installed in accordance with Chapter 9 and Tables 5704.3.6.3(4) through 5704.3.6.3(7) and Table 5704.3.7.5.1. In-rack sprinklers shall also comply with NFPA 13.

Automatic foam-water systems and automatic aqueous film-forming foam (AFFF) water sprinkler systems shall not be used except where approved.

Protection criteria developed from fire modeling or full-scale fire testing conducted at an approved testing laboratory are allowed in lieu of the protection as shown in Tables 5704.3.6.3(2) through 5704.3.6.3(7) and Table 5704.3.7.5.1 where approved.

5704.3.7.5.2 Portable fire extinguishers. Not less than one approved portable fire extinguisher complying with Section 906 and having a rating of not less than 20-B shall be located not less than 10 feet (3048 mm) or more than 50 feet (15 240 mm) from any Class I or II liquid storage area located outside of a liquid storage room.

Not less than one portable fire extinguisher having a rating of not less than 20-B shall be located outside of, but not more than 10 feet (3048 mm) from, the door opening into a liquid storage room.

5704.3.8 Liquid storage warehouses. Buildings used for storage of flammable or combustible liquids in quantities exceeding those set forth in Section 5704.3.4 for control areas and Section 5704.3.7 for liquid storage rooms shall comply with Sections 5704.3.8.1 through 5704.3.8.5 and shall be constructed and separated as required by the *California Building Code*.

5704.3.8.1 Quantities and storage arrangement. The total quantities of liquids in a liquid storage warehouse shall not be limited. The arrangement of storage shall be in accordance with Table 5704.3.6.3(2) or 5704.3.6.3(4).

TABLE 5704.3.6.3(5)
AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN METAL CONTAINERS OF 5-GALLON CAPACITY OR LESS WITH OR WITHOUT CARTONS ON CONVENTIONAL WOOD PALLETS^a

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND				MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLER AND HOSE STREAM (hours)
	Density (gpm/ft ²)	Area (square feet)		Racks up to 9 feet deep	Racks more than 9 feet to 12 feet deep	30 psi (standard orifice)	14 psi (large orifice)		
		High-temperature sprinklers	Ordinary temperature sprinklers						
I (maximum 25-foot height) Option 1	0.40	3,000	5,000	<ol style="list-style-type: none"> Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing One line sprinklers above each level of storage Locate in longitudinal flue space, staggered vertical Shields required where multiple-level 	<ol style="list-style-type: none"> Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing One line sprinklers above each level of storage Locate in transverse flue spaces, staggered vertical and within 20 inches of aisle Shields required where multiple-level 	30 psi (0.5-inch orifice)	<ol style="list-style-type: none"> Eight sprinklers if only one level Six sprinklers each on two levels if only two levels Six sprinklers each on top three levels, if three or more levels Hydraulically most remote 	750	2
I (maximum 25-foot height) Option 2	0.55	2,000 ^b	Not Applicable	<ol style="list-style-type: none"> Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing See 2 above See 3 above See 4 above 	<ol style="list-style-type: none"> Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing See 2 above See 3 above See 4 above 	14 psi (0.53-inch orifice)	See 1 through 4 above	500	2
I and II (maximum 14-foot storage height) (maximum three tiers)	0.55 ^c	2,000 ^d	Not Applicable	<p>Not Applicable</p> <p>None for maximum 6-foot-deep racks</p>	Not Applicable	Not Applicable	Not Applicable	500	2
II (maximum 25-foot height)	0.30	3,000	5,000	<ol style="list-style-type: none"> Ordinary temperature sprinklers 8 feet apart horizontally One line sprinklers between levels at nearest 10-foot vertical intervals Locate in longitudinal flue space, staggered vertical Shields required where multiple-level 	<ol style="list-style-type: none"> Ordinary temperature sprinklers 8 feet apart horizontally Two lines between levels at nearest 10-foot vertical intervals Locate in transverse flue spaces, staggered vertical and within 20 inches of aisle Shields required where multiple-level 	30 psi	Hydraulically most remote—six sprinklers at each level, up to a maximum of three levels	750	2
III (40-foot height)	0.25	3,000	5,000	Same as for Class II liquids	Same as for Class II liquids	30 psi	Same as for Class II liquids	500	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².

- The design area contemplates the use of Class II standpipe systems. Where Class I standpipe systems are used, the area of application shall be increased by 30 percent without revising density.
- Using listed or approved extra-large orifices, high-temperature quick-response or standard element sprinklers under a maximum 30-foot ceiling with minimum 7.5-foot aisles.
- For friction lid cans and other metal containers equipped with plastic nozzles or caps, the density shall be increased to 0.65 gpm per square foot using listed or approved extra-large orifice, high-temperature quick-response sprinklers.
- Using listed or approved extra-large orifice, high-temperature quick-response or standard element sprinklers under a maximum 18-foot ceiling with minimum 7.5-foot aisles and metal containers.

TABLE 5704.3.6.3(6) AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN METAL CONTAINERS GREATER THAN 5-GALLON CAPACITY^a

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND					MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLER AND HOSE STREAM (hours)
	Density (gpm/ft ²)	Area (square feet)		Maximum spacing	On-side storage racks up to 9-foot-deep racks	On-end storage (on pallets) up to 9-foot-deep racks	Minimum nozzle pressure	Number of sprinklers operating		
		High-temperature sprinklers	Ordinary temperature sprinklers							
IA (maximum 25-foot height)	0.60	3,000	5,000	80 ft ² /head	<ol style="list-style-type: none"> Ordinary temperature sprinklers 8 feet apart horizontally One line sprinklers above each tier of storage Locate in longitudinal flue space, staggered vertical Shields required where multiple-level 	<ol style="list-style-type: none"> Ordinary temperature sprinklers 8 feet apart horizontally One line sprinklers above each tier of storage Locate in longitudinal flue space, staggered vertical Shields required where multiple-level 	30 psi	Hydraulically most remote—six sprinklers at each level	1,000	2
IB, IC and II (maximum 25-foot height)	0.60	3,000	5,000	100 ft ² /head	<ol style="list-style-type: none"> See 1 above One line sprinklers every three tiers of storage See 3 above See 4 above 	<ol style="list-style-type: none"> See 1 above See 2 above See 3 above See 4 above 	30 psi	Hydraulically most remote—six sprinklers at each level	750	2
III (maximum 40-foot height)	0.25	3,000	5,000	120 ft ² /head	<ol style="list-style-type: none"> See 1 above One line sprinklers every sixth level (maximum) See 3 above See 4 above 	<ol style="list-style-type: none"> See 1 above One line sprinklers every third level (maximum) See 3 above See 4 above 	15 psi	Hydraulically most remote—six sprinklers at each level	500	1

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².
 a. The design assumes the use of Class II standpipe systems. Where a Class I standpipe system is used, the area of application shall be increased by 30 percent without revising density.

TABLE 5704.3.6.3(7) AUTOMATIC AFF WATER PROTECTION REQUIREMENTS FOR RACK STORAGE OF LIQUIDS IN METAL CONTAINERS GREATER THAN 5-GALLON CAPACITY^{a, b}

CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND ^c				DURATION AFF SUPPLY (minimum)	DURATION WATER SUPPLY (hours)
	Density (gpm/ft ²)	Area (square feet)		On-end storage of drumson pallets, up to 25 feet	Minimum nozzle pressure (psi)	Number of sprinklers operating	Hose stream demand ^d (gpm)		
		High-temperature sprinklers	Ordinary temperature sprinklers						
IA, IB, IC and II	0.30	1,500	2,500	1. Ordinary temperature sprinkler up to 10 feet apart horizontally 2. One line sprinklers above each level of storage 3. Locate in longitudinal flue space, staggered vertically 4. Shields required for multiple-level	30	Three sprinklers per level	500	15	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².

- a. System shall be a closed-head wet system with approved devices for proportioning aqueous film-forming foam.
- b. Except as modified herein, in-rack sprinklers shall be installed in accordance with NFPA 13.
- c. The height of storage shall not exceed 25 feet.
- d. Hose stream demand includes 1/2-inch inside hose connections, where required.

TABLE 5704.3.6.3(8) AUTOMATIC SPRINKLER PROTECTION REQUIREMENTS FOR CLASS I LIQUID STORAGE IN METAL CONTAINERS OF 1-GALLON CAPACITY OR LESS WITH UNCARTONED OR CASE-CUT SHELF DISPLAY UP TO 6.5 FEET, AND PALLETIZED STORAGE ABOVE IN A DOUBLE-ROW RACK ARRAY^a

STORAGE HEIGHT	CEILING SPRINKLER DESIGN AND DEMAND			IN-RACK SPRINKLER ARRANGEMENT AND DEMAND				MINIMUM HOSE STREAM DEMAND (gpm)	MINIMUM DURATION SPRINKLERS AND HOSE STREAM (hours)		
	Density (gpm/ft ²)	Area (square feet)		Maximum spacing	Racks 9 to 12 feet	Racks up to 9 feet deep	Racks 9 to 12 feet			Minimum nozzle pressure	Number of sprinklers operating
		High temperature	Ordinary temperature								
Maximum 20-foot storage height	0.60	2,000 ^b	Not Applicable	100 ft ² /head	1. Ordinary temperature, quick-response sprinklers, maximum 8 feet 3 inches horizontal spacing 2. One line of sprinklers at the 6-foot level and the 11.5-foot level of storage 3. Locate in longitudinal flue space, staggered vertical 4. Shields required where multiple-level	1. Six sprinklers each on two levels 2. Hydraulically most remote 12 sprinklers	30 psi (standard orifice) or 14 psi (large orifice)	500	2		

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 pound per square inch = 6.895 kPa, 1 gallon = 3.785 L, 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m².

- a. This table shall not apply to racks with solid shelves.
- b. Using extra-large orifice sprinklers under a ceiling 30 feet or less in height. Minimum aisle width is 7.5 feet.

**TABLE 5704.3.7.5.1
AUTOMATIC AFFF-WATER PROTECTION REQUIREMENTS FOR SOLID-PILE AND
PALLETIZED STORAGE OF LIQUIDS IN METAL CONTAINERS OF 5-GALLON CAPACITY OR LESS^{a, b}**

PACKAGE TYPE	CLASS LIQUID	CEILING SPRINKLER DESIGN AND DEMAND					STORAGE HEIGHT (feet)	HOSE DEMAND (gpm) ^c	DURATION AFFF SUPPLY (minimum)	DURATION WATER SUPPLY (hours)
		Density (gpm/ft ²)	Area (square feet)	Temperature rating	Maximum spacing	Orifice size (inch)				
Cartoned	IB, IC, II and III	0.40	2,000	286°F	100 ft ² /head	0.531	11	500	15	2
Uncartoned	IB, IC, II and III	0.30	2,000	286°F	100 ft ² /head	0.5 or 0.531	12	500	15	2

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 gallon per minute per square foot = 40.75 L/min/m², °C = [(°F) - 32]/1.8.

- a. System shall be a closed-head wet system with approved devices for proportioning aqueous film-forming foam.
- b. Maximum ceiling height of 30 feet.
- c. Hose stream demand includes 1½-inch inside hose connections, where required.

5704.3.8.1.1 Mixed storage. Mixed storage shall be in accordance with Section 5704.3.7.2.1.

5704.3.8.1.2 Separation and aisles. Separation and aisles shall be in accordance with Section 5704.3.7.2.2.

5704.3.8.2 Spill control and secondary containment. Liquid storage warehouses shall be provided with spill control and secondary containment as set forth in Section 5004.2.

5704.3.8.3 Ventilation. Liquid storage warehouses storing containers greater than 5 gallons (19 L) in capacity shall be ventilated at a rate of not less than 0.25 cfm per square foot (0.00127 m³/s × m²) of floor area over the storage area.

5704.3.8.4 Automatic sprinkler systems. Liquid storage warehouses shall be protected by automatic sprinkler systems installed in accordance with Chapter 9 and Tables 5704.3.6.3(4) through 5704.3.6.3(7) and Table 5704.3.7.5.1, or Sections 16.4.1 through 16.4.3, 16.5.1 through 16.5.2.12, and Figures 16.4.1(a) through 16.4.1(c) and Tables 16.5.2.1 through 16.5.2.12 of NFPA 30. In-rack sprinklers shall also comply with NFPA 13.

Automatic foam-water systems and automatic AFFF water sprinkler systems shall not be used except where approved.

Protection criteria developed from fire modeling or full-scale fire testing conducted at an approved testing laboratory are allowed in lieu of the protection as shown in Tables 5704.3.6.3(2) through 5704.3.6.3(7) and Table 5704.3.7.5.1 where approved.

5704.3.8.5 Warehouse hose lines. In liquid storage warehouses, either 1½-inch (38 mm) lined or 1-inch (25 mm) hard rubber hose lines shall be provided in sufficient number to reach all liquid storage areas and shall be in accordance with Section 903 or 905.

5704.4 Outdoor storage of containers and portable tanks. Storage of flammable and combustible liquids in closed containers and portable tanks outside of buildings shall be in accordance with Section 5703 and Sections 5704.4.1 through

5704.4.8. Capacity limits for containers and portable tanks shall be in accordance with Section 5704.3.

5704.4.1 Plans. Storage shall be in accordance with approved plans.

5704.4.2 Location on property. Outdoor storage of liquids in containers and portable tanks shall be in accordance with Table 5704.4.2. Storage of liquids near buildings located on the same lot shall be in accordance with this section.

5704.4.2.1 Mixed liquid piles. Where two or more classes of liquids are stored in a single pile, the quantity in the pile shall not exceed the smallest of maximum quantities for the classes of material stored.

5704.4.2.2 Access. Storage of containers or portable tanks shall be provided with fire apparatus access roads in accordance with Chapter 5.

5704.4.2.3 Security. The storage area shall be protected against tampering or trespassers where necessary and shall be kept free from weeds, debris and other combustible materials not necessary to the storage.

5704.4.2.4 Storage adjacent to buildings. Not more than 1,100 gallons (4163 L) of liquids stored in closed containers and portable tanks is allowed adjacent to a building located on the same premises and under the same management, provided that one of the following requirements is met:

1. The building does not exceed one story in height. Such building shall be of fire-resistance-rated construction with noncombustible exterior surfaces or noncombustible construction and shall be used principally for the storage of liquids.
2. The exterior building wall adjacent to the storage area shall have a fire-resistance rating of not less than 2 hours, having no openings to above-grade areas within 10 feet (3048 mm) horizontally of such storage and no openings to below-grade areas within 50 feet (15 240 mm) horizontally of such storage.

The quantity of liquids stored adjacent to a building protected in accordance with Item 2 is allowed to

TABLE 5704.4.2
OUTDOOR LIQUID STORAGE IN CONTAINERS AND PORTABLE TANKS

CLASS OF LIQUID	CONTAINER STORAGE— MAXIMUM PER PILE		PORTABLE TANK STORAGE— MAXIMUM PER PILE		MINIMUM DISTANCE BETWEEN PILES OR RACKS (feet)	MINIMUM DISTANCE TO LOT LINE OF PROPERTY THAT CAN BE BUILT ON ^{c,d} (feet)	MINIMUM DISTANCE TO PUBLIC STREET, PUBLIC ALLEY OR PUBLIC WAY ^d (feet)
	Quantity ^{a,b} (gallons)	Height (feet)	Quantity ^{a,b} (gallons)	Height (feet)			
IA	1,100	10	2,200	7	5	50	10
IB	2,200	12	4,400	14	5	50	10
IC	4,400	12	8,800	14	5	50	10
II	8,800	12	17,600	14	5	25	5
III	22,000	18	44,000	14	5	10	5

For SI: 1 foot = 304.8 mm, 1 gallon 3.785 L.

a. For mixed class storage, see Section 5704.4.2.

b. For storage in racks, the quantity limits per pile do not apply, but the rack arrangement shall be limited to not more than 50 feet in length and two rows or 9 feet in depth.

c. If protection by a public fire department or private fire brigade capable of providing cooling water streams is not available, the distance shall be doubled.

d. Where the total quantity stored does not exceed 50 percent of the maximum allowed per pile, the distances are allowed to be reduced 50 percent, but not less than 3 feet.

exceed 1,100 gallons (4163 L), provided that the maximum quantity per pile does not exceed 1,100 gallons (4163 L) and each pile is separated by a 10-foot-minimum (3048 mm) clear space along the common wall.

Where the quantity stored exceeds 1,100 gallons (4163 L) adjacent to a building complying with Item 1, or the provisions of Item 1 cannot be met, a minimum distance in accordance with Table 5704.4.2, column 7 (“Minimum Distance to Lot Line of Property That Can Be Built On”) shall be maintained between buildings and the nearest container or portable tank.

5704.4.3 Spill control and secondary containment. Storage areas shall be provided with spill control and secondary containment in accordance with Section 5703.4.

Exception: Containers stored on approved containment pallets in accordance with Section 5004.2.3 and containers stored in cabinets and lockers with integral spill containment.

5704.4.4 Security. Storage areas shall be protected against tampering or trespassers by fencing or other approved control measures.

5704.4.5 Protection from vehicles. Guard posts or other means shall be provided to protect exterior storage tanks from vehicular damage. Where guard posts are installed, the posts shall be installed in accordance with Section 312.

5704.4.6 Clearance from combustibles. The storage area shall be kept free from weeds, debris and combustible materials not necessary to the storage. The area surrounding an exterior storage area shall be kept clear of such materials for a minimum distance of 15 feet (4572 mm).

5704.4.7 Weather protection. Weather protection for outdoor storage shall be in accordance with Section 5004.13.

5704.4.8 Empty containers and tank storage. The storage of empty tanks and containers previously used for the storage of flammable or combustible liquids, unless free from explosive vapors, shall be stored as required for

filled containers and tanks. Tanks and containers when emptied shall have the covers or plugs immediately replaced in openings.

**SECTION 5705
DISPENSING, USE, MIXING AND HANDLING**

5705.1 Scope. Dispensing, use, mixing and handling of flammable liquids shall be in accordance with Section 5703 and this section. Tank vehicle and tank car loading and unloading and other special operations shall be in accordance with Section 5706.

Exception: Containers of organic coatings having no fire point and which are opened for pigmentation are not required to comply with this section.

5705.2 Liquid transfer. Liquid transfer equipment and methods for transfer of Class I, II and IIIA liquids shall be approved and be in accordance with Sections 5705.2.1 through 5705.2.6.

5705.2.1 Pumps. Where positive-displacement pumps are used, they shall be provided with pressure relief discharging back to the tank, pump suction or other approved location, or shall be provided with interlocks to prevent over-pressure.

5705.2.2 Pressured systems. Where gases are introduced to provide for transfer of Class I liquids, or Class II and III liquids transferred at temperatures at or above their flash points by pressure, only inert gases shall be used. Controls, including pressure relief devices, shall be provided to limit the pressure so that the maximum working pressure of tanks, containers and piping systems cannot be exceeded. Where devices operating through pressure within a tank or container are used, the tank or container shall be a pressure vessel approved for the intended use. Air or oxygen shall not be used for pressurization.

Exception: Air transfer of Class II and III liquids at temperatures below their flash points.

5705.2.3 Piping, hoses and valves. Piping, hoses and valves used in liquid transfer operations shall be approved or listed for the intended use.

5705.2.4 Class I, II and III liquids. Class I liquids or, when heated to or above their flash points, Class II and Class III liquids, shall be transferred by one of the following methods:

1. From safety cans complying with UL 30.
2. Through an approved closed piping system.
3. From containers or tanks by an approved pump taking suction through an opening in the top of the container or tank.
4. For Class IB, IC, II and III liquids, from containers or tanks by gravity through an approved self-closing or automatic-closing valve where the container or tank and dispensing operations are provided with spill control and secondary containment in accordance with Section 5703.4. Class IA liquids shall not be dispensed by gravity from tanks.
5. Approved engineered liquid transfer systems.

Exception: Liquids in original shipping containers not exceeding a 5.3-gallon (20 L) capacity.

5705.2.5 Manual container filling operations. Class I liquids or Class II and Class III liquids that are heated up to or above their flash points shall not be transferred into containers unless the nozzle and containers are electrically interconnected. Acceptable methods of electrical interconnection include either of the following:

1. Metallic floor plates on which containers stand while filling, where such floor plates are electrically connected to the fill stem.
2. Where the fill stem is bonded to the container during filling by means of a bond wire.

5705.2.6 Automatic container-filling operations for Class I liquids. Container-filling operations for Class I liquids involving conveyor belts or other automatic-feeding operations shall be designed to prevent static accumulations.

5705.3 Use, dispensing and mixing inside of buildings. Indoor use, dispensing and mixing of flammable and combustible liquids shall be in accordance with Section 5705.2 and Sections 5705.3.1 through 5705.3.5.3.

5705.3.1 Closure of mixing or blending vessels. Vessels used for mixing or blending of Class I liquids and Class II

or III liquids heated up to or above their flash points shall be provided with self-closing, tight-fitting, noncombustible lids that will control a fire within such vessel.

Exception: Where such devices are impractical, approved automatic or manually controlled fire-extinguishing devices shall be provided.

5705.3.2 Bonding of vessels. Where differences of potential could be created, vessels containing Class I liquids or liquids handled at or above their flash points shall be electrically connected by bond wires, ground cables, piping or similar means to a static grounding system to maintain equipment at the same electrical potential to prevent sparking.

5705.3.3 Heating, lighting and cooking appliances. Heating, lighting and cooking appliances that utilize Class I liquids shall not be operated within a building or structure.

Exception: Operation in single-family dwellings.

5705.3.4 Location of processing vessels. Processing vessels shall be located with respect to distances to lot lines of adjoining property that can be built on, in accordance with Tables 5705.3.4(1) and 5705.3.4(2).

Exception: Where the exterior wall facing the adjoining lot line is a blank wall having a fire-resistance rating of not less than 4 hours, the fire code official is authorized to modify the distances. The distance shall be not less than that set forth in the *California Building Code*, and where Class IA or unstable liquids are involved, explosion control shall be provided in accordance with Section 911.

5705.3.5 Quantity limits for use. Liquid use quantity limitations shall comply with Sections 5705.3.5.1 through 5705.3.5.3.

5705.3.5.1 Maximum allowable quantity per control area. Indoor use, dispensing and mixing of flammable and combustible liquids shall not exceed the maximum allowable quantity per control area indicated in Table 5003.1.1(1) and shall not exceed the additional limitations set forth in Section 5705.3.5.

Use of hazardous production material flammable and combustible liquids in Group H-5 occupancies shall be in accordance with Chapter 27.

Exception: Cleaning with Class I, II and IIIA liquids shall be in accordance with Section 5705.3.6.

**TABLE 5705.3.4(1)
SEPARATION OF PROCESSING VESSELS FROM LOT LINES**

PROCESSING VESSELS WITH EMERGENCY RELIEF VENTING	LOCATION ^a	
	Stable liquids	Unstable liquids
Not in excess of 2.5 psig	Table 5705.3.4(2)	2.5 times Table 5705.3.4(2)
Over 2.5 psig	1.5 times Table 5705.3.4(2)	4 times Table 5705.3.4(2)

For SI: 1 pound per square inch gauge = 6.895 kPa.

a. Where protection of exposures by a public fire department or private fire brigade capable of providing cooling water streams on structures is not provided, distances shall be doubled.

TABLE 5705.3.4(2)
REFERENCE TABLE FOR USE WITH TABLE 5705.3.4(1)

TANK CAPACITY (gallons)	MINIMUM DISTANCE FROM LOT LINE OF A LOT THAT IS OR CAN BE BUILT ON, INCLUDING THE OPPOSITE SIDE OF A PUBLIC WAY (feet)	MINIMUM DISTANCE FROM NEAREST SIDE OF ANY PUBLIC WAY OR FROM NEAREST IMPORTANT BUILDING ON THE SAME PROPERTY (feet)
275 or less	5	5
276 to 750	10	5
751 to 12,000	15	5
12,001 to 30,000	20	5
30,001 to 50,000	30	10
50,001 to 100,000	50	15
100,001 to 500,000	80	25
500,001 to 1,000,000	100	35
1,000,001 to 2,000,000	135	45
2,000,001 to 3,000,000	165	55
3,000,001 or more	175	60

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

5705.3.5.2 Occupancy quantity limits. The following limits for quantities of flammable and combustible liquids used, dispensed or mixed based on occupancy classification shall not be exceeded:

1. Group A occupancies: Quantities in Group A occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
2. Group B occupancies: Quantities in drinking, dining, office and school uses within Group B occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
3. Group E occupancies: Quantities in Group E occupancies shall not exceed that necessary for demonstration, treatment, laboratory work, maintenance purposes and operation of equipment and shall not exceed quantities set forth in Table 5003.1.1(1).
4. Group F occupancies: Quantities in dining, office and school uses within Group F occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
5. Group I occupancies: Quantities in Group I occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).

6. Group M occupancies: Quantities in dining, office and school uses within Group M occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
7. Group R occupancies: Quantities in Group R occupancies shall not exceed that necessary for maintenance purposes and operation of equipment, and shall not exceed quantities set forth in Table 5003.1.1(1).
8. Group S occupancies: Quantities in dining and office uses within Group S occupancies shall not exceed that necessary for demonstration, laboratory work, maintenance purposes and operation of equipment and shall not exceed quantities set forth in Table 5003.1.1(1).

Exception: Cleaning with Class I, II, or IIIA liquids shall be in accordance with Section 5705.3.6.

5705.3.5.3 Quantities exceeding limits for control areas. Quantities exceeding the maximum allowable quantity per control area indicated in Sections 5705.3.5.1 and 5705.3.5.2 shall be in accordance with the following:

1. For open systems, indoor use, dispensing and mixing of flammable and combustible liquids shall be within a room or building complying with the *California Building Code* and Sections 5705.3.7.1 through 5705.3.7.5.3.
2. For closed systems, indoor use, dispensing and mixing of flammable and combustible liquids shall be within a room or building complying with the *California Building Code* and Sections 5705.3.7 through 5705.3.7.4 and Section 5705.3.7.6.

5705.3.6 Cleaning with flammable and combustible liquids. Cleaning with Class I, II and IIIA liquids shall be in accordance with Sections 5705.3.6.1 through 5705.3.6.2.7.

Exceptions:

1. Dry cleaning shall be in accordance with Chapter 21.
2. Spray-nozzle cleaning shall be in accordance with Section 2403.3.5.

5705.3.6.1 Cleaning operations. Class IA liquids shall not be used for cleaning. Cleaning with Class IB, IC or II liquids shall be conducted as follows:

1. In a room or building, Section 5705.3.7; or
2. In a parts cleaner listed, labeled and approved for the purpose, Section 5705.3.6.2.

Exception: Materials used in commercial and industrial process-related cleaning operations in accordance with other provisions of this code and not involving facilities maintenance cleaning operations.

5705.3.6.2 Listed and approved machines. Parts cleaning and degreasing conducted in listed and approved machines in accordance with Section 5705.3.6.1 shall be in accordance with Sections 5705.3.6.2.1 through 5705.3.6.2.7.

5705.3.6.2.1 Solvents. Solvents shall be classified and shall be compatible with the machines within which they are used.

5705.3.6.2.2 Machine capacities. The quantity of solvent shall not exceed the listed design capacity of the machine for the solvent being used with the machine.

5705.3.6.2.3 Solvent quantity limits. Solvent quantities shall be limited as follows:

1. Machines without remote solvent reservoirs shall be limited to quantities set forth in Section 5705.3.5.
2. Machines with remote solvent reservoirs using Class I liquids shall be limited to quantities set forth in Section 5705.3.5.
3. Machines with remote solvent reservoirs using Class II liquids shall be limited to 35 gallons (132 L) per machine. The total quantities shall not exceed an aggregate of 240 gallons (908 L) per control area in buildings not equipped throughout with an approved automatic sprinkler system and an aggregate of 480 gallons (1817 L) per control area in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
4. Machines with remote solvent reservoirs using Class IIIA liquids shall be limited to 80 gallons (303 L) per machine.

5705.3.6.2.4 Immersion soaking of parts. Work areas of machines with remote solvent reservoirs shall not be used for immersion soaking of parts.

5705.3.6.2.5 Separation. Multiple machines shall be separated from each other by a distance of not less than 30 feet (9144 mm) or by a fire barrier with a minimum 1-hour fire-resistance rating.

5705.3.6.2.6 Ventilation. Machines shall be located in areas adequately ventilated to prevent accumulation of vapors.

5705.3.6.2.7 Installation. Machines shall be installed in accordance with their listings.

5705.3.7 Rooms or buildings for quantities exceeding the maximum allowable quantity per control area. Where required by Section 5705.3.5.3 or 5705.3.6.1, rooms or buildings used for the use, dispensing or mixing of flammable and combustible liquids in quantities exceeding the maximum allowable quantity per control area shall be in accordance with Sections 5705.3.7.1 through 5705.3.7.6.3.

5705.3.7.1 Construction, location and fire protection. Rooms or buildings classified in accordance with the *California Building Code* as Group H-2 or H-3 occupancies based on use, dispensing or mixing of flammable or combustible liquids shall be constructed in accordance with the *California Building Code*.

5705.3.7.2 Basements. In rooms or buildings classified in accordance with the *California Building Code* as Group H-2 or H-3, dispensing or mixing of flammable or combustible liquids shall not be conducted in basements.

5705.3.7.3 Fire protection. Rooms or buildings classified in accordance with the *California Building Code* as Group H-2 or H-3 occupancies shall be equipped with an approved automatic fire-extinguishing system in accordance with Chapter 9.

5705.3.7.4 Doors. Interior doors to rooms or portions of such buildings shall be self-closing fire doors in accordance with the *California Building Code*.

5705.3.7.5 Open systems. Use, dispensing and mixing of flammable and combustible liquids in open systems shall be in accordance with Sections 5705.3.7.5.1 through 5705.3.7.5.3.

5705.3.7.5.1 Ventilation. Continuous mechanical ventilation shall be provided at a rate of not less than 1 cfm per square foot [$0.00508 \text{ m}^3/(\text{s} \times \text{m}^2)$] of floor area over the design area. Provisions shall be made for introduction of makeup air in such a manner to include all floor areas or pits where vapors can collect. Local or spot ventilation shall be provided where needed to prevent the accumulation of hazardous vapors. Ventilation system design shall comply with the *California Building Code* and *California Mechanical Code*.

Exception: Where natural ventilation can be shown to be effective for the materials used, dispensed or mixed.

5705.3.7.5.2 Explosion control. Explosion control shall be provided in accordance with Section 911.

5705.3.7.5.3 Spill control and secondary containment. Spill control shall be provided in accordance with Section 5703.4 where Class I, II or IIIA liquids are dispensed into containers exceeding a 1.3-gallon (5 L) capacity or mixed or used in open containers or systems exceeding a 5.3-gallon (20 L) capacity. Spill control and secondary containment shall be provided in accordance with Section 5703.4 where the capacity of an individual container exceeds 55 gallons (208 L) or the aggregate capacity of multiple containers or tanks exceeds 100 gallons (378.5 L).

5705.3.7.6 Closed systems. Use or mixing of flammable or combustible liquids in closed systems shall be in accordance with Sections 5705.3.7.6.1 through 5705.3.7.6.3.

5705.3.7.6.1 Ventilation. Closed systems designed to be opened as part of normal operations shall be provided with ventilation in accordance with Section 5705.3.7.5.1.

5705.3.7.6.2 Explosion control. Explosion control shall be provided where an explosive environment can occur as a result of the mixing or use process. Explosion control shall be designed in accordance with Section 911.

Exception: Where process vessels are designed to contain fully the worst-case explosion anticipated within the vessel under process conditions considering the most likely failure.

5705.3.7.6.3 Spill control and secondary containment. Spill control shall be provided in accordance with Section 5703.4 where flammable or combustible liquids are dispensed into containers exceeding a 1.3-gallon (5 L) capacity or mixed or used in open containers or systems exceeding a 5.3-gallon (20 L) capacity. Spill control and secondary containment shall be provided in accordance with Section 5703.4 where the capacity of an individual container exceeds 55 gallons (208 L) or the aggregate capacity of multiple containers or tanks exceeds 1,000 gallons (3785 L).

5705.3.8 Use, dispensing and handling outside of buildings. Outside use, dispensing and handling shall be in accordance with Sections 5705.3.8.1 through 5705.3.8.4.

Dispensing of liquids into motor vehicle fuel tanks at motor fuel-dispensing facilities shall be in accordance with Chapter 23.

5705.3.8.1 Spill control. Outside use, dispensing and handling areas shall be provided with spill control as set forth in Section 5703.4.

5705.3.8.2 Location on property. Dispensing activities that exceed the quantities set forth in Table 5705.3.8.2 shall not be conducted within 15 feet (4572 mm) of buildings or combustible materials or within 25 feet (7620 mm) of building openings, lot lines, public streets, public alleys or public ways. Dispensing activities that exceed the quantities set forth in Table 5705.3.8.2 shall not be conducted within 15 feet (4572 mm) of storage of Class I, II or III liquids unless such

liquids are stored in tanks that are listed and labeled as 2-hour protected tank assemblies in accordance with UL 2085.

Exceptions:

1. The requirements shall not apply to areas where only the following are dispensed: Class III liquids; liquids that are heavier than water; water-miscible liquids; and liquids with viscosities greater than 10,000 centipoise (cp) (10 Pa × s).
2. Flammable and combustible liquid dispensing in refineries, chemical plants, process facilities, gas and crude oil production facilities and oil-blending and packaging facilities, terminals and bulk plants.

**TABLE 5705.3.8.2
MAXIMUM ALLOWABLE QUANTITIES FOR
DISPENSING FLAMMABLE AND COMBUSTIBLE
LIQUIDS IN OUTDOOR CONTROL AREAS^{a, b}**

CLASS OF LIQUID	QUANTITY (gallons)
Flammable	
Class IA	10
Class IB	15
Class IC	20
Combination Class IA, IB and IC	30 ^c
Combustible	
Class II	30
Class IIIA	80
Class IIIB	3,300

For SI: 1 gallon = 3.785 L.

- a. For definition of "Outdoor Control Area," see Section 202.
- b. The fire code official is authorized to impose special conditions regarding locations, types of containers, dispensing units, fire control measures and other factors involving fire safety.
- c. Containing not more than the maximum allowable quantity per control area of each individual class.

5705.3.8.3 Location of processing vessels. Processing vessels shall be located with respect to distances to lot lines that can be built on in accordance with Table 5705.3.4(1).

Exception: In refineries and distilleries.

5705.3.8.4 Weather protection. Weather protection for outdoor use shall be in accordance with Section 5005.3.9.

5705.4 Solvent distillation units. Solvent distillation units shall comply with Sections 5705.4.1 through 5705.4.9.

5705.4.1 Unit with a capacity of 60 gallons or less. Solvent distillation units used to recycle Class I, II or IIIA liquids having a distillation chamber capacity of 60 gallons (227 L) or less shall be listed, labeled and installed in accordance with Section 5705.4 and UL 2208.

Exceptions:

1. Solvent distillation units used in continuous through-put industrial processes where the source

of heat is remotely supplied using steam, hot water, oil or other heat transfer fluids, the temperature of which is below the auto-ignition point of the solvent.

2. Approved research, testing and experimental processes.

5705.4.2 Units with a capacity exceeding 60 gallons.

Solvent distillation units used to recycle Class I, II or IIIA liquids, having a distillation chamber capacity exceeding 60 gallons (227 L) shall be used in locations that comply with the use and mixing requirements of Section 5705 and other applicable provisions in this chapter.

5705.4.3 Prohibited processing. Class I, II and IIIA liquids that are classified as unstable (reactive) shall not be processed in solvent distillation units.

Exception: Appliances listed for the distillation of unstable (reactive) solvents.

5705.4.4 Labeling. A permanent label shall be affixed to the unit by the manufacturer. The label shall indicate the capacity of the distillation chamber, and the distance the unit shall be placed away from sources of ignition. The label shall indicate the products for which the unit has been listed for use or refer to the instruction manual for a list of the products.

5705.4.5 Manufacturer’s instruction manual. An instruction manual shall be provided. The manual shall be readily available for the user and the fire code official. The manual shall include installation, use and servicing instructions. It shall identify the liquids for which the unit has been listed for distillation purposes along with each liquid’s flash point and auto-ignition temperature. For units with adjustable controls, the manual shall include directions for setting the heater temperature for each liquid to be instilled.

5705.4.6 Location. Solvent distillation units shall be used in locations in accordance with the listing. Solvent distillation units shall not be used in basements.

5705.4.7 Storage of liquids. Distilled liquids and liquids awaiting distillation shall be stored in accordance with Section 5704.

5705.4.8 Storage of residues. Hazardous residue from the distillation process shall be stored in accordance with Section 5704 and Chapter 50.

5705.4.9 Portable fire extinguishers. Approved portable fire extinguishers shall be provided in accordance with Section 906. Not less than one portable fire extinguisher having a rating of not less than 40-B shall be located not less than 10 feet (3048 mm) or more than 30 feet (9144 mm) from any solvent distillation unit.

5705.5 Alcohol-based hand rubs classified as Class I or II liquids. The use of wall-mounted dispensers containing alcohol-based hand rubs classified as Class I or II liquids shall be in accordance with all of the following:

1. The maximum capacity of each dispenser shall be 68 ounces (2 L).

2. The minimum separation between dispensers shall be 48 inches (1219 mm).
3. The dispensers shall not be installed above, below, or closer than 1 inch (25 mm) to an electrical receptacle, switch, appliance, device or other ignition source. The wall space between the dispenser and the floor or intervening counter top shall be free of electrical receptacles, switches, appliances, devices or other ignition sources.
4. Dispensers shall be mounted so that the bottom of the dispenser is not less than 42 inches (1067 mm) and not more than 48 inches (1219 mm) above the finished floor.
5. Dispensers shall not release their contents except when the dispenser is manually activated. Facilities shall be permitted to install and use automatically activated “touch free” alcohol-based hand-rub dispensing devices with the following requirements:

- 5.1. The facility or persons responsible for the dispensers shall test the dispensers each time a new refill is installed in accordance with the manufacturer’s care and use instructions.
- 5.2. Dispensers shall be designed and must operate in a manner that ensures accidental or malicious activations of the dispensing device are minimized. At a minimum, all devices subject to or used in accordance with this section shall have the following safety features:

- 5.2.1. Any activations of the dispenser shall only occur when an object is placed within 4 inches (98 mm) of the sensing device.
- 5.2.2. The dispenser shall not dispense more than the amount required for hand hygiene consistent with label instructions as regulated by the United States Food and Drug Administration (USFDA).
- 5.2.3. An object placed within the activation zone and left in place will cause only one activation.

6. Storage and use of alcohol-based hand rubs shall be in accordance with the applicable provisions of Sections 5704 and 5705.
7. Dispensers installed in occupancies with carpeted floors shall only be allowed in smoke compartments or fire areas equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2.

5705.5.1 Corridor installations. In addition to the provisions of Section 5705.5, where wall-mounted dispensers containing alcohol-based hand rubs are installed in corridors or rooms and areas open to the corridor, they shall be in accordance with all of the following:

1. Level 2 and 3 aerosol containers shall not be allowed in corridors.

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2. The maximum capacity of each Class I or II liquid dispenser shall be 41 ounces (1.21 L) and the maximum capacity of each Level 1 aerosol dispenser shall be 18 ounces (0.51 kg).
3. The maximum quantity allowed in a corridor within a control area shall be 10 gallons (37.85 L) of Class I or II liquids or 1135 ounces (32.2 kg) of Level 1 aerosols, or a combination of Class I or II liquids and Level 1 aerosols not to exceed, in total, the equivalent of 10 gallons (37.85 L) or 1,135 ounces (32.2 kg) such that the sum of the ratios of the liquid and aerosol quantities divided by the allowable quantity of liquids and aerosols, respectively, shall not exceed one.
4. The minimum corridor width shall be 72 inches (1829 mm).
5. Projections into a corridor shall be in accordance with Section 1003.3.3.

SECTION 5706 SPECIAL OPERATIONS

5706.1 General. This section shall cover the provisions for special operations that include, but are not limited to, storage, use, dispensing, mixing or handling of flammable and combustible liquids. The following special operations shall be in accordance with Sections 5701, 5703, 5704 and 5705, except as provided in Section 5706.

1. Storage and dispensing of flammable and combustible liquids on farms and construction sites.
2. Well drilling and operating.
3. Bulk plants or terminals.
4. Bulk transfer and process transfer operations utilizing tank vehicles and tank cars.
5. Tank vehicles and tank vehicle operation.
6. Refineries.
7. Vapor recovery and vapor-processing systems.

5706.2 Storage and dispensing of flammable and combustible liquids on farms and construction sites. Permanent and temporary storage and dispensing of Class I and II liquids for private use on farms and rural areas and at construction sites, earth-moving projects, gravel pits or borrow pits shall be in accordance with Sections 5706.2.1 through 5706.2.8.1.

Exception: Storage and use of fuel oil and containers connected with oil-burning equipment regulated by Section 605 and the *California Mechanical Code*.

5706.2.1 Combustibles and open flames near tanks. Storage areas shall be kept free from weeds and extraneous combustible material. Open flames and smoking are prohibited in flammable or combustible liquid storage areas.

5706.2.2 Marking of tanks and containers. Tanks and containers for the storage of liquids above ground shall be conspicuously marked with the name of the product that they contain and the words: “FLAMMABLE—KEEP

FIRE AND FLAME AWAY.” Tanks shall bear the additional marking: “KEEP 50 FEET FROM BUILDINGS.”

5706.2.3 Containers for storage and use. Metal containers used for storage of Class I or II liquids shall be in accordance with DOTn requirements or shall be of an approved design.

Discharge devices shall be of a type that do not develop an internal pressure on the container. Pumping devices or approved self-closing faucets used for dispensing liquids shall not leak and shall be well-maintained. Individual containers shall not be interconnected and shall be kept closed when not in use.

Containers stored outside of buildings shall be in accordance with Section 5704 and the *California Building Code*.

5706.2.4 Permanent and temporary tanks. The capacity of permanent above-ground tanks containing Class I or II liquids shall not exceed 1,100 gallons (4164 L). The capacity of temporary above-ground tanks containing Class I or II liquids shall not exceed 10,000 gallons (37 854 L). Tanks shall be of the single-compartment design.

Exception: Permanent above-ground tanks of greater capacity that meet the requirements of Section 5704.2.

5706.2.4.1 Fill-opening security. Fill openings shall be equipped with a locking closure device. Fill openings shall be separate from vent openings.

5706.2.4.2 Vents. Tanks shall be provided with a method of normal and emergency venting. Normal vents shall be in accordance with Section 5704.2.7.3.

Emergency vents shall be in accordance with Section 5704.2.7.4. Emergency vents shall be arranged to discharge in a manner that prevents localized overheating or flame impingement on any part of the tank in the event that vapors from such vents are ignited.

5706.2.4.3 Location. Tanks containing Class I or II liquids shall be kept outside and not less than 50 feet (15 240 mm) from buildings and combustible storage. Additional distance shall be provided where necessary to ensure that vehicles, equipment and containers being filled directly from such tanks will not be less than 50 feet (15 240 mm) from structures, haystacks or other combustible storage.

5706.2.4.4 Locations where above-ground tanks are prohibited. The storage of Class I and II liquids in above-ground tanks is prohibited within the limits established by law as the limits of districts in which such storage is prohibited [JURISDICTION TO SPECIFY].

5706.2.5 Type of tank. Tanks shall be provided with top openings only or shall be elevated for gravity discharge.

5706.2.5.1 Tanks with top openings only. Tanks with top openings shall be mounted in accordance with either of the following:

1. On well-constructed metal legs connected to shoes or runners designed so that the tank is stabilized and the entire tank and its supports can be moved as a unit.

2. For stationary tanks, on a stable base of timbers or blocks approximately 6 inches (152 mm) in height that prevents the tank from contacting the ground.

5706.2.5.1.1 Pumps and fittings. Tanks with top openings only shall be equipped with a tightly and permanently attached, approved pumping device having an approved hose of sufficient length for filling vehicles, equipment or containers to be served from the tank. Either the pump or the hose shall be equipped with a padlock to its hanger to prevent tampering. An effective antisiphoning device shall be included in the pump discharge unless a self-closing nozzle is provided. Siphons or internal pressure discharge devices shall not be used.

5706.2.5.2 Tanks for gravity discharge. Tanks with a connection in the bottom or the end for gravity-dispensing liquids shall be mounted and equipped as follows:

1. Supports to elevate the tank for gravity discharge shall be designed to carry all required loads and provide stability.
2. Bottom or end openings for gravity discharge shall be equipped with a valve located adjacent to the tank shell that will close automatically in the event of fire through the operation of an effective heat-activated releasing device. Where this valve cannot be operated manually, it shall be supplemented by a second, manually operated valve.

The gravity discharge outlet shall be provided with an approved hose equipped with a self-closing valve at the discharge end of a type that can be padlocked to its hanger.

5706.2.6 Spill control drainage control and diking. Indoor storage and dispensing areas shall be provided with spill control and drainage control as set forth in Section 5703.4. Outdoor storage areas shall be provided with drainage control or diking as set forth in Section 5704.2.10.

5706.2.7 Portable fire extinguishers. Portable fire extinguishers with a minimum rating of 20-B:C and complying with Section 906 shall be provided where required by the fire code official.

5706.2.8 Dispensing from tank vehicles. Where approved, liquids used as fuels are allowed to be transferred from tank vehicles into the tanks of motor vehicles or special equipment, provided that:

1. The tank vehicle's specific function is that of supplying fuel to motor vehicle fuel tanks.
2. The dispensing hose does not exceed 100 feet (30 480 mm) in length.
3. The dispensing nozzle is an approved type.
4. The dispensing hose is properly placed on an approved reel or in a compartment provided before the tank vehicle is moved.

5. Signs prohibiting smoking or open flames within 25 feet (7620 mm) of the vehicle or the point of refueling are prominently posted on the tank vehicle.
6. Electrical devices and wiring in areas where fuel dispensing is conducted are in accordance with *the California Electrical Code*.
7. Tank vehicle-dispensing equipment is operated only by designated personnel who are trained to handle and dispense motor fuels.
8. Provisions are made for controlling and mitigating unauthorized discharges.

5706.2.8.1 Location. Dispensing from tank vehicles shall be conducted not less than 50 feet (15 240 mm) from structures or combustible storage.

5706.3 Well drilling and operating. Wells for oil and natural gas shall be drilled and operated in accordance with Sections 5706.3.1 through 5706.3.8.

5706.3.1 Location. The location of wells shall comply with Sections 5706.3.1.1 through 5706.3.1.3.2.

5706.3.1.1 Storage tanks and sources of ignition. Storage tanks or boilers, fired heaters, open-flame devices or other sources of ignition shall not be located within 25 feet (7620 mm) of well heads. Smoking is prohibited at wells or tank locations except as designated and in approved posted areas.

Exception: Engines used in the drilling, production and serving of wells.

5706.3.1.2 Streets and railways. Wells shall not be drilled within 75 feet (22 860 mm) of any dedicated public street, highway or nearest rail of an operating railway.

5706.3.1.3 Buildings. Wells shall not be drilled within 100 feet (30 480 mm) of buildings not necessary to the operation of the well.

5706.3.1.3.1 Group A, E or I buildings. Wells shall not be drilled within 300 feet (91 440 mm) of buildings with an occupancy in Group A, E or I.

5706.3.1.3.2 Existing wells. Where wells are existing, buildings shall not be constructed within the distances set forth in Section 5706.3.1 for separation of wells or buildings.

5706.3.2 Waste control. Control of waste materials associated with wells shall comply with Sections 5706.3.2.1 and 5706.3.2.2.

5706.3.2.1 Discharge on a street or water channel. Liquids containing crude petroleum or its products shall not be discharged into or on streets, highways, drainage canals or ditches, storm drains or flood control channels.

5706.3.2.2 Discharge and combustible materials on ground. The surface of the ground under, around or near wells, pumps, boilers, oil storage tanks or buildings shall be kept free from oil, waste oil, refuse or waste material.

5706.3.3 Sumps. Sumps associated with wells shall comply with Sections 5706.3.3.1 through 5706.3.3.3.

5706.3.3.1 Maximum width. Sumps or other basins for the retention of oil or petroleum products shall not exceed 12 feet (3658 mm) in width.

5706.3.3.2 Backfilling. Sumps or other basins for the retention of oil or petroleum products larger than 6 feet by 6 feet (1829 mm by 1829 mm by 1829 mm) shall not be maintained longer than 60 days after the cessation of drilling operations.

5706.3.3.3 Security. Sumps, diversion ditches and depressions used as sumps shall be securely fenced or covered.

5706.3.4 Prevention of blowouts. Protection shall be provided to control and prevent the blowout of a well. Protection equipment shall meet federal, state and other applicable jurisdiction requirements.

5706.3.5 Storage tanks. Storage of flammable or combustible liquids in tanks shall be in accordance with Section 5704. Oil storage tanks or groups of tanks shall have posted in a conspicuous place, on or near such tank or tanks, an approved sign with the name of the owner or operator, or the lease number and the telephone number where a responsible person can be reached at any time.

5706.3.6 Soundproofing. Where soundproofing material is required during oil field operations, such material shall be noncombustible.

5706.3.7 Signs. Well locations shall have posted in a conspicuous place on or near such tank or tanks an approved sign with the name of the owner or operator, name of the leasee or the lease number, the well number and the telephone number where a responsible person can be reached at any time. Such signs shall be maintained on the premises from the time materials are delivered for drilling purposes until the well is abandoned.

5706.3.8 Field-loading racks. Field-loading racks shall be in accordance with Section 5706.5.

5706.4 Bulk plants or terminals. Portions of properties where flammable and combustible liquids are received by tank vessels, pipelines, tank cars or tank vehicles and stored or blended in bulk for the purpose of distribution by tank vessels, pipelines, tanks cars, tank vehicles or containers shall be in accordance with Sections 5706.4.1 through 5706.4.10.4.

5706.4.1 Building construction. Buildings shall be constructed in accordance with the *California Building Code*.

5706.4.2 Means of egress. Rooms in which liquids are stored, used or transferred by pumps shall have *means of egress* arranged to prevent occupants from being trapped in the event of fire.

5706.4.3 Heating. Rooms in which Class I liquids are stored or used shall be heated only by means not constituting a source of ignition, such as steam or hot water. Rooms containing heating appliances involving sources of ignition shall be located and arranged to prevent entry of flammable vapors.

5706.4.4 Ventilation. Ventilation shall be provided for rooms, buildings and enclosures in which Class I liquids are pumped, used or transferred. Design of ventilation systems shall consider the relatively high specific gravity of the vapors. Where natural ventilation is used, adequate openings in outside walls at floor level, unobstructed except by louvers or coarse screens, shall be provided. Where natural ventilation is inadequate, mechanical ventilation shall be provided in accordance with the *California Mechanical Code*.

5706.4.4.1 Basements and pits. Class I liquids shall not be stored or used within a building having a basement or pit into which flammable vapors can travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

5706.4.4.2 Dispensing of Class I liquids. Containers of Class I liquids shall not be drawn from or filled within buildings unless a provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, it shall be kept in operation while flammable vapors could be present.

5706.4.5 Storage. Storage of Class I, II and IIIA liquids in bulk plants shall be in accordance with the applicable provisions of Section 5704.

5706.4.6 Overfill protection of Class I and II liquids. Manual and automatic systems shall be provided to prevent overfill during the transfer of Class I and II liquids from mainline pipelines and marine vessels in accordance with API 2350.

5706.4.7 Wharves. This section shall apply to all wharves, piers, bulkheads and other structures over or contiguous to navigable water having a primary function of transferring liquid cargo in bulk between shore installations and tank vessels, ships, barges, lighter boats or other mobile floating craft.

Exception: Marine motor fuel-dispensing facilities in accordance with Chapter 23.

5706.4.7.1 Transferring approvals. Handling packaged cargo of liquids, including full and empty drums, bulk fuel and stores, over a wharf during cargo transfer shall be subject to the approval of the wharf supervisor and the senior deck officer on duty.

5706.4.7.2 Transferring location. Wharves at which liquid cargoes are to be transferred in bulk quantities to or from tank vessels shall be not less than 100 feet (30 480 mm) from any bridge over a navigable waterway; or from an entrance to, or superstructure of, any vehicular or railroad tunnel under a waterway. The termination of the fixed piping used for loading or unloading at a wharf shall be not less than 200 feet (60 960 mm) from a bridge or from an entrance to, or superstructures of, a tunnel.

5706.4.7.3 Superstructure and decking material. Superstructure and decking shall be designed for the intended use. Decking shall be constructed of materials

that will afford the desired combination of flexibility, resistance to shock, durability, strength and fire resistance.

5706.4.7.4 Tanks allowed. Tanks used exclusively for ballast water or Class II or III liquids are allowed to be installed on suitably designed wharves.

5706.4.7.5 Transferring equipment. Loading pumps capable of building up pressures in excess of the safe working pressure of cargo hose or loading arms shall be provided with bypasses, relief valves or other arrangements to protect the loading facilities against excessive pressure. Relief devices shall be tested not less than annually to determine that they function satisfactorily at their set pressure.

5706.4.7.6 Piping, valves and fittings. Piping valves and fittings shall be in accordance with Section 5703.6 except as modified by the following:

1. Flexibility of piping shall be ensured by appropriate layout and arrangement of piping supports so that motion of the wharf structure resulting from wave action, currents, tides or the mooring of vessels will not subject the pipe to repeated excessive strain.
2. Pipe joints that depend on the friction characteristics of combustible materials or on the grooving of pipe ends for mechanical continuity of piping shall not be used.
3. Swivel joints are allowed in piping to which hoses are connected and for articulated, swivel-joint transfer systems, provided that the design is such that the mechanical strength of the joint will not be impaired if the packing materials fail such as by exposure to fire.
4. Each line conveying Class I or II liquids leading to a wharf shall be provided with a block valve that has ready access and that is on shore, near the approach to the wharf and outside of any diked area. Where more than one line is involved, the valves shall be grouped in one location.
5. Means shall be provided for easy access to cargo line valves located below the wharf deck.
6. Piping systems shall contain a sufficient number of valves to operate the system properly and to control the flow of liquid in normal operation and in the event of physical damage.
7. Piping on wharves shall be bonded and grounded where Class I and II liquids are transported. Where excessive stray currents are encountered, insulating joints shall be installed. Bonding and grounding connections on piping shall be located on the wharf side of hose riser insulating flanges, where used, and shall be in a location provided with ready access for inspection.
8. Hose or articulated swivel-joint pipe connections used for cargo transfer shall be capable of accommodating the combined effects of change in draft

and maximum tidal range, and mooring lines shall be kept adjusted to prevent surge of the vessel from placing stress on the cargo transfer system.

9. Hoses shall be supported to avoid kinking and damage from chafing.

5706.4.7.7 Loading and unloading. Loading or discharging shall not commence until the wharf superintendent and officer in charge of the tank vessel agree that the tank vessel is properly moored and connections are properly made.

5706.4.7.8 Mechanical work. Mechanical work shall not be performed on the wharf during cargo transfer, except under special authorization by the fire code official based on a review of the area involved, methods to be employed and precautions necessary.

5706.4.8 Sources of ignition. Class I, II or IIIA liquids shall not be used, drawn or dispensed where flammable vapors can reach a source of ignition. Smoking shall be prohibited except in designated locations. "No Smoking" signs complying with Section 310 shall be conspicuously posted where a hazard from flammable vapors is normally present.

5706.4.9 Drainage control. Loading and unloading areas shall be provided with drainage control in accordance with Section 5704.2.10.

5706.4.10 Fire protection. Fire protection shall be in accordance with Chapter 9 and Sections 5706.4.10.1 through 5706.4.10.4.

5706.4.10.1 Portable fire extinguishers. Portable fire extinguishers with a rating of not less than 20-B and complying with Section 906 shall be located within 75 feet (22 860 mm) of hose connections, pumps and separator tanks.

5706.4.10.2 Fire hoses. Where piped water is available, ready-connected fire hose in a size appropriate for the water supply shall be provided in accordance with Section 905 so that manifolds where connections are made and broken can be reached by not less than one hose stream.

5706.4.10.3 Obstruction of equipment. Material shall not be placed on wharves in such a manner that would obstruct access to fire-fighting equipment or important pipeline control valves.

5706.4.10.4 Fire apparatus access. Where the wharf is designed for vehicular traffic, an unobstructed fire apparatus access road to the shore end of the wharf shall be maintained in accordance with Chapter 5.

5706.5 Bulk transfer and process transfer operations. Bulk transfer and process transfer operations shall be approved and be in accordance with Sections 5706.5.1 through 5706.5.4.5. Motor fuel-dispensing facilities shall comply with Chapter 23.

5706.5.1 General. The provisions of Sections 5706.5.1.1 through 5706.5.1.18 shall apply to bulk transfer and process transfer operations; Sections 5706.5.2 and

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5706.5.2.1 shall apply to bulk transfer operations; Sections 5706.5.3 through 5706.5.3.3 shall apply to process transfer operations and Sections 5706.5.4 through 5706.5.4.5 shall apply to dispensing from tank vehicles and tank cars.

5706.5.1.1 Location. Bulk transfer and process transfer operations shall be conducted in approved locations. Tank cars shall be unloaded only on private sidings or railroad-siding facilities equipped for transferring flammable or combustible liquids. Tank vehicles and tank cars engaged in bulk transfer or process transfer operations shall be separated from buildings, above-ground tanks, combustible materials, lot lines, public streets, public alleys or public ways by a distance of 25 feet (7620 mm) for Class I liquids and 15 feet (4572 mm) for Class II and IIIA liquids measured from the nearest loading or unloading valve on the tank vehicle or tank car.

Exception: Buildings for pumps and shelters for personnel supporting transfer operations shall not be required to be separated from tank vehicles and tank cars engaged in bulk transfer or process transfer operations.

5706.5.1.2 Weather protection canopies. Where weather protection canopies are provided, they shall be constructed in accordance with Section 5004.13. Weather protection canopies shall not be located within 15 feet (4572 mm) of a building or combustible material or within 25 feet (7620 mm) of building openings, lot lines, public streets, public alleys or public ways.

5706.5.1.3 Ventilation. Ventilation shall be provided to prevent accumulation of vapors in accordance with Section 5705.3.7.5.1.

5706.5.1.4 Sources of ignition. Sources of ignition shall be controlled or eliminated in accordance with Section 5003.7.

5706.5.1.5 Spill control and secondary containment. Areas where transfer operations are located shall be provided with spill control and secondary containment in accordance with Section 5703.4. The spill control and secondary containment system shall have a design capacity capable of containing the capacity of the largest tank compartment located in the area where transfer operations are conducted. Containment of the rainfall volume specified in Section 5004.2.2.6 is not required.

5706.5.1.6 Fire protection. Fire protection shall be in accordance with Section 5703.2.

5706.5.1.7 Static protection. Static protection shall be provided to prevent the accumulation of static charges during transfer operations. Bonding facilities shall be provided during the transfer through open domes where Class I liquids are transferred, or where Class II and III liquids are transferred into tank vehicles or tank cars that could contain vapors from previous cargoes of Class I liquids.

Protection shall consist of a metallic bond wire permanently electrically connected to the fill stem. The fill pipe assembly shall form a continuous electrically con-

ductive path downstream from the point of bonding. The free end of such bond wire shall be provided with a clamp or equivalent device for convenient attachment to a metallic part in electrical contact with the cargo tank of the tank vehicle or tank car. For tank vehicles, protection shall consist of a flexible bond wire of adequate strength for the intended service and the electrical resistance shall not exceed 1 megohm. For tank cars, bonding shall be provided where the resistance of a tank car to ground through the rails is 25 ohms or greater.

Such bonding connection shall be fastened to the vehicle, car or tank before dome covers are raised and shall remain in place until filling is complete and all dome covers have been closed and secured.

Exceptions:

1. Where vehicles and cars are loaded exclusively with products not having a static-accumulating tendency, such as asphalt, cutback asphalt, most crude oils, residual oils and water-miscible liquids.
2. Where Class I liquids are not handled at the transfer facility and the tank vehicles are used exclusively for Class II and III liquids.
3. Where vehicles and cars are loaded or unloaded through closed top or bottom connections whether the hose is conductive or nonconductive.

Filling through open domes into the tanks of tank vehicles or tank cars that contain vapor-air mixtures within the flammable range, or where the liquid being filled can form such a mixture, shall be by means of a downspout that extends to near the bottom of the tank.

5706.5.1.8 Stray current protection. Tank car loading facilities where Class I, II or IIIA liquids are transferred through open domes shall be protected against stray currents by permanently bonding the pipe to not less than one rail and to the transfer apparatus. Multiple pipes entering the transfer areas shall be permanently electrically bonded together. In areas where excessive stray currents are known to exist, all pipes entering the transfer area shall be provided with insulating sections to isolate electrically the transfer apparatus from the pipelines.

5706.5.1.9 Top loading. When top loading a tank vehicle with Class I and II liquids without vapor control, valves used for the final control of flow shall be of the self-closing type and shall be manually held open except where automatic means are provided for shutting off the flow when the tank is full. Where used, automatic shutoff systems shall be provided with a manual shutoff valve located at a safe distance from the loading nozzle to stop the flow if the automatic system fails.

When top loading a tank vehicle with vapor control, flow control shall be in accordance with Section

5706.5.1.10. Self-closing valves shall not be tied or locked in the open position.

5706.5.1.10 Bottom loading. When bottom loading a tank vehicle or tank car with or without vapor control, a positive means shall be provided for loading a pre-determined quantity of liquid, together with an automatic secondary shutoff control to prevent overflow. The connecting components between the transfer equipment and the tank vehicle or tank car required to operate the secondary control shall be functionally compatible.

5706.5.1.10.1 Dry disconnect coupling. When bottom loading a tank vehicle, the coupling between the liquid loading hose or pipe and the truck piping shall be a dry disconnect coupling.

5706.5.1.10.2 Venting. When bottom loading a tank vehicle or tank car that is equipped for vapor control and vapor control is not used, the tank shall be vented to the atmosphere to prevent pressurization of the tank. Such venting shall be at a height equal to or greater than the top of the cargo tank.

5706.5.1.10.3 Vapor-tight connection. Connections to the plant vapor control system shall be designed to prevent the escape of vapor to the atmosphere when not connected to a tank vehicle or tank car.

5706.5.1.10.4 Vapor-processing equipment. Vapor-processing equipment shall be separated from above-ground tanks, warehouses, other plant buildings, transfer facilities or nearest lot line of adjoining property that can be built on by a distance of not less than 25 feet (7620 mm). Vapor-processing equipment shall be protected from physical damage by remote location, guard rails, curbs or fencing.

5706.5.1.11 Switch loading. Tank vehicles or tank cars that have previously contained Class I liquids shall not be loaded with Class II or III liquids until such vehicles and all piping, pumps, hoses and meters connected thereto have been completely drained and flushed.

Exception: When approved by the Enforcing Agency, the procedures prescribed in API (API-RP-2003) Recommended Practices 2003 entitled "Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents" may be used for changing tank contents.

5706.5.1.12 Loading racks. Where provided, loading racks, stairways or platforms shall be constructed of noncombustible materials. Buildings for pumps or for shelter of loading personnel are allowed to be part of the loading rack. Wiring and electrical equipment located within 25 feet (7620 mm) of any portion of the loading rack shall be in accordance with Section 5703.1.1.

5706.5.1.13 Transfer apparatus. Bulk and process transfer apparatus shall be of an approved type.

5706.5.1.14 Inside buildings. Tank vehicles and tank cars shall not be located inside a building while transferring Class I, II or IIIA liquids, unless approved by the fire code official.

Exception: Tank vehicles are allowed under weather protection canopies and canopies of automobile motor vehicle fuel-dispensing stations.

5706.5.1.15 Tank vehicle and tank car certification. Certification shall be maintained for tank vehicles and tank cars in accordance with DOTn 49 CFR Parts 100–185.

5706.5.1.16 Tank vehicle and tank car stability. Tank vehicles and tank cars shall be stabilized against movement during loading and unloading in accordance with Sections 5706.5.1.16.1 through 5706.5.1.16.3.

5706.5.1.16.1 Tank vehicles. When the vehicle is parked for loading or unloading, the cargo trailer portion of the tank vehicle shall be secured in a manner that will prevent unintentional movement.

5706.5.1.16.2 Chock blocks. Not less than two chock blocks not less than 5 inches by 5 inches by 12 inches (127 mm by 127 mm by 305 mm) in size and dished to fit the contour of the tires shall be used during transfer operations of tank vehicles.

5706.5.1.16.3 Tank cars. Brakes shall be set and the wheels shall be blocked to prevent rolling.

5706.5.1.17 Monitoring. Transfer operations shall be monitored by an approved monitoring system or by an attendant. Where monitoring is by an attendant, the operator or other competent person shall be present at all times.

5706.5.1.18 Security. Transfer operations shall be surrounded by a noncombustible fence not less than 5 feet (1524 mm) in height. Tank vehicles and tank cars shall not be loaded or unloaded unless such vehicles are entirely within the fenced area.

Exceptions:

1. Motor fuel-dispensing facilities complying with Chapter 23.
2. Installations where adequate public safety exists because of isolation, natural barriers or other factors as determined appropriate by the fire code official.
3. Facilities or properties that are entirely enclosed or protected from entry.

5706.5.2 Bulk transfer. Bulk transfer shall be in accordance with Sections 5706.5.1 and 5706.5.2.1.

5706.5.2.1 Vehicle motor. Motors of tank vehicles or tank cars shall be shut off during the making and breaking of hose connections and during the unloading operation.

Exception: Where unloading is performed with a pump deriving its power from the tank vehicle motor.

5706.5.3 Process transfer. Process transfer shall be in accordance with Section 5706.5.1 and Sections 5706.5.3.1 through 5706.5.3.3.

5706.5.3.1 Piping, valves, hoses and fittings. Piping, valves, hoses and fittings that are not a part of the tank

vehicle or tank car shall be in accordance with Section 5703.6. Caps or plugs that prevent leakage or spillage shall be provided at all points of connection to transfer piping.

5706.5.3.1.1 Shutoff valves. Approved automatically or manually activated shutoff valves shall be provided where the transfer hose connects to the process piping, and on both sides of any exterior fire-resistance-rated wall through which the piping passes. Manual shutoff valves shall be arranged so that they are able to be accessed from grade. Valves shall not be locked in the open position.

5706.5.3.1.2 Hydrostatic relief. Hydrostatic pressure-limiting or relief devices shall be provided where pressure buildup in trapped sections of the system could exceed the design pressure of the components of the system.

Devices shall relieve to other portions of the system or to another approved location.

5706.5.3.1.3 Antisiphon valves. Antisiphon valves shall be provided where the system design would allow siphonage.

5706.5.3.2 Vents. Normal and emergency vents shall be maintained operable at all times.

5706.5.3.3 Motive power. Motors of tank vehicles or tank cars shall be shut off during the making and breaking of hose connections and during the unloading operation.

Exception: When unloading is performed with a pump deriving its power from the tank vehicle motor.

5706.5.4 Dispensing from tank vehicles and tank cars. Dispensing from tank vehicles and tank cars into the fuel tanks of motor vehicles shall be prohibited unless allowed by and conducted in accordance with Sections 5706.5.4.1 through 5706.5.4.5.

5706.5.4.1 Marine craft and special equipment. Liquids intended for use as motor fuels are allowed to be transferred from tank vehicles into the fuel tanks of marine craft and special equipment where approved by the fire code official, and where:

1. The tank vehicle's specific function is that of supplying fuel to fuel tanks.
2. The operation is not performed where the public has access or where there is unusual exposure to life and property.
3. The dispensing line does not exceed 50 feet (15 240 mm) in length.
4. The dispensing nozzle is approved.

5706.5.4.2 Emergency refueling. Where approved by the fire code official, dispensing of motor vehicle fuel from tank vehicles into the fuel tanks of motor vehicles is allowed during emergencies. Dispensing from tank vehicles shall be in accordance with Sections 5706.2.8 and 5706.6.

5706.5.4.3 Aircraft fueling. Transfer of liquids from tank vehicles to the fuel tanks of aircraft shall be in accordance with Chapter 20.

5706.5.4.4 Fueling of vehicles at farms, construction sites and similar areas. Transfer of liquid from tank vehicles to motor vehicles for private use on farms and rural areas and at construction sites, earth-moving projects, gravel pits and borrow pits is allowed in accordance with Section 5706.2.8.

5706.5.4.5 Commercial, industrial, governmental or manufacturing. Dispensing of Class II and III motor vehicle fuel from tank vehicles into the fuel tanks of motor vehicles located at commercial, industrial, governmental or manufacturing establishments is allowed where permitted, provided that such dispensing operations are conducted in accordance with the following:

1. Dispensing shall occur only at sites that have been issued a permit to conduct mobile fueling.
2. The owner of a mobile fueling operation shall provide to the jurisdiction a written response plan that demonstrates readiness to respond to a fuel spill and carry out appropriate mitigation measures, and describes the process to dispose properly of contaminated materials.
3. A detailed site plan shall be submitted with each application for a permit. The site plan shall indicate: all buildings, structures and appurtenances on site and their use or function; all uses adjacent to the lot lines of the site; the locations of all storm drain openings, adjacent waterways or wetlands; information regarding slope, natural drainage, curbing, impounding and how a spill will be retained on the site property; and the scale of the site plan.

Provisions shall be made to prevent liquids spilled during dispensing operations from flowing into buildings or off-site. Acceptable methods include, but shall not be limited to, grading driveways, raising doorsills or other approved means.

4. The fire code official is allowed to impose limits on the times and days during which mobile fueling operations is allowed to take place, and specific locations on a site where fueling is permitted.
5. Mobile fueling operations shall be conducted in areas not open to the public or shall be limited to times when the public is not present.
6. Mobile fueling shall not take place within 15 feet (4572 mm) of buildings, property lines, combustible storage or storm drains.

Exceptions:

1. The distance to storm drains shall not apply where an approved storm drain cover or an approved equivalent that will prevent any fuel from reaching

the drain is in place prior to fueling or a fueling hose being placed within 15 feet (4572 mm) of the drain. Where placement of a storm drain cover will cause the accumulation of excessive water or difficulty in conducting the fueling, such cover shall not be used and the fueling shall not take place within 15 feet (4572 mm) of a drain.

2. The distance to storm drains shall not apply for drains that direct influent to approved oil interceptors.
7. The tank vehicle shall comply with the requirements of NFPA 385 and local, state and federal requirements. The tank vehicle's specific functions shall include that of supplying fuel to motor vehicle fuel tanks. The vehicle and all its equipment shall be maintained in good repair.
8. Signs prohibiting smoking or open flames within 25 feet (7620 mm) of the tank vehicle or the point of fueling shall be prominently posted on three sides of the vehicle including the back and both sides.
9. A portable fire extinguisher with a minimum rating of 40:BC shall be provided on the vehicle with signage clearly indicating its location.
10. The dispensing nozzles and hoses shall be of an approved and listed type.
11. The dispensing hose shall not be extended from the reel more than 100 feet (30 480 mm) in length.
12. Absorbent materials, nonwater-absorbent pads, a 10-foot-long (3048 mm) containment boom, an approved container with lid and a nonmetallic shovel shall be provided to mitigate a minimum 5-gallon (19 L) fuel spill.
13. Tank vehicles shall be equipped with a "fuel limit" switch such as a count-back switch, to limit the amount of a single fueling operation to not more than 500 gallons (1893 L) before resetting the limit switch.

Exception: Tank vehicles where the operator carries and can utilize a remote emergency shutoff device that, when activated, immediately causes flow of fuel from the tank vehicle to cease.

14. Persons responsible for dispensing operations shall be trained in the appropriate mitigating actions in the event of a fire, leak or spill. Training records shall be maintained by the dispensing company.
15. Operators of tank vehicles used for mobile fueling operations shall have in their possession at all times an emergency communications device to notify the proper authorities in the event of an emergency.

16. The tank vehicle dispensing equipment shall be constantly attended and operated only by designated personnel who are trained to handle and dispense motor fuels.
17. Fuel dispensing shall be prohibited within 25 feet (7620 mm) of any source of ignition.
18. The engines of vehicles being fueled shall be shut off during dispensing operations.
19. Nighttime fueling operations shall only take place in adequately lighted areas.
20. The tank vehicle shall be positioned with respect to vehicles being fueled to prevent traffic from driving over the delivery hose.
21. During fueling operations, tank vehicle brakes shall be set, chock blocks shall be in place and warning lights shall be in operation.
22. Motor vehicle fuel tanks shall not be topped off.
23. The dispensing hose shall be properly placed on an approved reel or in an approved compartment prior to moving the tank vehicle.
24. The fire code official and other appropriate authorities shall be notified when a reportable spill or unauthorized discharge occurs.
25. Operators shall place a drip pan or an absorbent pillow under each fuel fill opening prior to and during dispensing operations. Drip pans shall be liquid-tight. The pan or absorbent pillow shall have a capacity of not less than 3 gallons (11.36 L). Spills retained in the drip pan or absorbent pillow need not be reported. Operators, when fueling, shall have on their person an absorbent pad capable of capturing diesel fuel overfills. Except during fueling, the nozzle shall face upward and an absorbent pad shall be kept under the nozzle to catch drips. Contaminated absorbent pads or pillows shall be disposed of regularly in accordance with local, state and federal requirements.

5706.6 Tank vehicles and vehicle operation. Tank vehicles shall be designed, constructed, equipped and maintained in accordance with NFPA 385 and Sections 5706.6.1 through 5706.6.4.

5706.6.1 Operation of tank vehicles. Tank vehicles shall be utilized and operated in accordance with NFPA 385 and Sections 5706.6.1.1 through 5706.6.1.11.

5706.6.1.1 Vehicle maintenance. Tank vehicles shall not be operated unless they are in proper state of repair and free from accumulation of grease, oil or other flammable substance, and leaks.

5706.6.1.2 Leaving vehicle unattended. The driver, operator or attendant of a tank vehicle shall not remain in the vehicle cab and shall not leave the vehicle while it is being filled or discharged. The delivery hose, when attached to a tank vehicle, shall be considered to be a part of the tank vehicle.

5706.6.1.3 Vehicle motor shutdown. Motors of tank vehicles or tractors shall be shut down during the making or breaking of hose connections. If loading or unloading is performed without the use of a power pump, the tank vehicle or tractor motor shall be shut down throughout such operations.

5706.6.1.4 Outage. A cargo tank or compartment thereof used for the transportation of flammable or combustible liquids shall not be loaded to absolute capacity. The vacant space in a cargo tank or compartment thereof used in the transportation of flammable or combustible liquids shall be not less than 1 percent. Sufficient space shall be left vacant to prevent leakage from or distortion of such tank or compartment by expansion of the contents caused by rise in temperature in transit.

5706.6.1.5 Overfill protection. The driver, operator or attendant of a tank vehicle shall, before making delivery to a tank, determine the unfilled capacity of such tank by a suitable gauging device. To prevent overfilling, the driver, operator or attendant shall not deliver in excess of that amount.

5706.6.1.6 Securing hatches. During loading, hatch covers shall be secured on all but the receiving compartment.

5706.6.1.7 Liquid temperature. Materials shall not be loaded into or transported in a tank vehicle at a temperature above the material's ignition temperature unless safeguarded in an approved manner.

5706.6.1.8 Bonding to underground tanks. An external bond-wire connection or bond-wire integral with a hose shall be provided for the transferring of flammable liquids through open connections into underground tanks.

5706.6.1.9 Smoking. Smoking by tank vehicle drivers, helpers or other personnel is prohibited while they are driving, making deliveries, filling or making repairs to tank vehicles.

5706.6.1.10 Hose connections. Delivery of flammable liquids to underground tanks with a capacity of more than 1,000 gallons (3785 L) shall be made by means of approved liquid and vapor-tight connections between the delivery hose and tank fill pipe. Where underground tanks are equipped with any type of vapor recovery system, all connections required to be made for the safe and proper functioning of the particular vapor recovery process shall be made. Such connections shall be made liquid and vapor tight and remain connected throughout the unloading process. Vapors shall not be discharged at grade level during delivery.

5706.6.1.10.1 Simultaneous delivery. Simultaneous delivery to underground tanks of any capacity from two or more discharge hoses shall be made by means of mechanically tight connections between the hose and fill pipe.

5706.6.1.11 Hose protection. Upon arrival at a point of delivery and prior to discharging any flammable or

combustible liquids into underground tanks, the driver, operator or attendant of the tank vehicle shall ensure that all hoses utilized for liquid delivery and vapor recovery, where required, will be protected from physical damage by motor vehicles. Such protection shall be provided by positioning the tank vehicle to prevent motor vehicles from passing through the area or areas occupied by hoses, or by other approved equivalent means.

5706.6.2 Parking. Parking of tank vehicles shall be in accordance with Sections 5706.6.2.1 through 5706.6.2.3.

Exception: In cases of accident, breakdown or other emergencies, tank vehicles are allowed to be parked and left unattended at any location while the operator is obtaining assistance.

5706.6.2.1 Parking near residential, educational and institutional occupancies and other high-risk areas.

Tank vehicles shall not be left unattended at any time on residential streets, or within 500 feet (152 m) of a residential area, apartment or hotel complex, educational facility, hospital or care facility. Tank vehicles shall not be left unattended at any other place that would, in the opinion of the fire chief, pose an extreme life hazard.

5706.6.2.2 Parking on thoroughfares. Tank vehicles shall not be left unattended on a public street, highway, public avenue or public alley.

Exceptions:

1. The necessary absence in connection with loading or unloading the vehicle. During actual fuel transfer, Section 5706.6.1.2 shall apply. The vehicle location shall be in accordance with Section 5706.6.2.1.
2. Stops for meals during the day or night, where the street is well lighted at the point of parking. The vehicle location shall be in accordance with Section 5706.6.2.1.

5706.6.2.3 Duration exceeding 1 hour. Tank vehicles parked at one point for longer than 1 hour shall be located off of public streets, highways, public avenues or alleys, and in accordance with either of the following:

1. Inside of a bulk plant and either 25 feet (7620 mm) or more from the nearest lot line or within a building approved for such use.
2. At other approved locations not less than 50 feet (15 240 mm) from the buildings other than those approved for the storage or servicing of such vehicles.

5706.6.3 Garaging. Tank vehicles shall not be parked or garaged in buildings other than those specifically approved for such use by the fire code official.

5706.6.4 Portable fire extinguisher. Tank vehicles shall be equipped with a portable fire extinguisher complying with Section 906 and having a minimum rating of 2-A:20-B:C.

During unloading of the tank vehicle, the portable fire extinguisher shall be out of the carrying device on the vehicle and shall be 15 feet (4572 mm) or more from the unloading valves.

5706.7 Refineries. Plants and portions of plants in which flammable liquids are produced on a scale from crude petroleum, natural gasoline or other hydrocarbon sources shall be in accordance with Sections 5706.7.1 through 5706.7.3. Petroleum-processing plants and facilities or portions of plants or facilities in which flammable or combustible liquids are handled, treated or produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources shall also be in accordance with API 651, API 653, API 752, API 1615, API 2001, API 2003, API 2009, API 2015, API 2023, API 2201 and API 2350.

5706.7.1 Corrosion protection. Above-ground tanks and piping systems shall be protected against corrosion in accordance with API 651.

5706.7.2 Cleaning of tanks. The safe entry and cleaning of petroleum storage tanks shall be conducted in accordance with API 2015.

5706.7.3 Storage of heated petroleum products. Where petroleum-derived asphalts and residues are stored in heated tanks at refineries and bulk storage facilities or in tank vehicles, such products shall be in accordance with API 2023.

5706.8 Vapor recovery and vapor-processing systems. Vapor-processing systems in which the vapor source operates at pressures from vacuum, up to and including 1 psig (6.9 kPa) or in which a potential exists for vapor mixtures in the flammable range, shall comply with Sections 5706.8.1 through 5706.8.5.

Exceptions:

1. Marine systems complying with federal transportation waterway regulations such as DOTn 33 CFR Parts 154 through 156, and CGR 46 CFR Parts 30, 32, 35 and 39.
2. Motor fuel-dispensing facility systems complying with Chapter 23.

5706.8.1 Over-pressure/vacuum protection. Tanks and equipment shall have independent venting for over-pressure or vacuum conditions that might occur from malfunction of the vapor recovery or processing system.

Exception: For tanks, venting shall comply with Section 5704.2.7.3.

5706.8.2 Vent location. Vents on vapor-processing equipment shall be not less than 12 feet (3658 mm) from adjacent ground level, with outlets located and directed so that flammable vapors will disperse to below the lower flammable limit (LFL) before reaching locations containing potential ignition sources.

5706.8.3 Vapor collection systems and overfill protection. The design and operation of the vapor collection system and overfill protection shall be in accordance with this section and Section 19.5 of NFPA 30.

5706.8.4 Liquid-level monitoring. A liquid knock-out vessel used in the vapor collection system shall have means to verify the liquid level and a high-liquid-level sensor that activates an alarm. For unpopulated facilities, the high-liquid-level sensor shall initiate the shutdown of liquid transfer into the vessel and shutdown of vapor recovery or vapor-processing systems.

5706.8.5 Overfill protection. Storage tanks served by vapor recovery or processing systems shall be equipped with overfill protection in accordance with Section 5704.2.7.5.8.

SECTION 5707

ON-DEMAND MOBILE FUELING OPERATIONS

5707.1 General. On-demand mobile fueling operations that dispense Class I, II and III liquids into the fuel tanks of motor vehicles shall comply with Sections 5707.1 through 5707.6.6.

Exception: Fueling from an approved portable container in cases of an emergency or for personal use.

5707.1.1 Approval required. Mobile fueling operations shall not be conducted without first obtaining a permit and approval from the fire code official. Mobile fueling operations shall occur only at approved locations. The fire code official is authorized to approve individual locations or geographic areas where mobile fueling is allowed.

5707.2 Mobile fueling vehicle. An on-demand mobile fueling vehicle shall be that which is utilized in on-demand fueling operations for the dispensing of Class I, II or III liquids into the fuel tanks of motor vehicles.

5707.2.1 Mobile fueling vehicle classifications. An on-demand mobile fueling vehicle shall be characterized as one of the following:

1. Tier 1 mobile fueling vehicle. A tank vehicle that complies with NFPA 385 and that has chassis-mounted tanks where the aggregate capacity does not exceed 1,600 gallons (6057 L).
2. Tier 2 mobile fueling vehicle. A vehicle with one or more chassis-mounted tanks or containers that do not exceed 110 gallons (416 L) in capacity with an aggregate capacity that does not exceed 800 gallons (3028 L) or the weight capacity of the vehicle in accordance with DOTn.
3. Tier 3 mobile fueling vehicle. A vehicle that carries a maximum aggregate capacity of 60 gallons (227 L) of motor fuel in metal safety cans listed in accordance with UL 30 or other approved metal containers, each not to exceed 5 gallons (19 L) in capacity.

5707.2.2 Mobile fueling vehicle requirements. Each mobile fueling vehicle shall comply with all local, state and federal requirements, as well as the following:

1. Mobile fueling vehicles with a chassis-mounted tank in excess of 110 gallons (416 L) shall also comply with the requirements of Section 5706.6 and NFPA 385.

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2. The mobile fueling vehicle and its equipment shall be maintained in good repair.
3. Safety cans and approved metal containers shall be secured to the mobile fueling vehicle except when in use.
4. Fueling a motor vehicle from tanks or containers mounted in a trailer connected to a mobile fueling vehicle shall be prohibited.

5707.3 Required documents. Documents developed to comply with Sections 5707.3.1 through 5707.3.3 shall be updated as necessary by the owner of the mobile fueling operation and shall be maintained in compliance with Section 109.3.

5707.3.1 Safety and emergency response plan. Mobile fueling operators shall have an approved written safety and emergency response plan that establishes policies and procedures for fire safety, spill prevention and control, personnel training and compliance with other applicable requirements of this code.

5707.3.2 Training records. Mobile fueling vehicles shall be operated only by designated personnel who are trained on proper fueling procedures and the safety and emergency response plan. Training records of operators shall be maintained.

5707.3.3 Site plan. Where required by the fire code official, a site plan shall be developed for each location or area at which mobile fueling occurs. The site plan shall be in sufficient detail to indicate the following:

1. All buildings and structures.
2. Lot lines or property lines.
3. Electric car chargers.
4. Solar photovoltaic parking lot canopies.
5. Appurtenances on-site and their use or function.
6. All uses adjacent to the lot lines of the site.
7. Fueling locations.
8. Locations of all storm drain openings and adjacent waterways or wetlands.
9. Information regarding slope, natural drainage, curbing and impounding.
10. How a spill will be kept on the site property.
11. Scale of the site plan.

5707.4 Mobile fueling areas. During fueling, the mobile fueling vehicle and point of connection to the vehicle shall not be located on public streets, public ways or inside buildings. Fueling on the roof level of parking structures or other buildings is prohibited.

5707.4.1 Separation. During fueling, the point of connection to the vehicle being fueled shall not take place within 25 feet (7620 mm) of buildings, lot lines, property lines or combustible storage. Mobile fueling vehicles shall not

park within 10 feet (3048 mm) of buildings, lot lines, property lines or combustible storage.

Exceptions:

1. The fire code official shall be authorized to decrease the separation distance for dispensing from metal safety cans or other approved metal containers in accordance with Section 5707.2.
2. The point of fueling shall not take place within 10 feet (3048 mm) of buildings, lot lines, property lines or combustible storage where the mobile fueling vehicle has an approved vapor recovery system or is servicing vehicles with onboard refueling vapor recovery.

Where dispensing operations occur within 15 feet (4572 mm) of a storm drain, an approved storm drain cover or an approved equivalent method that will prevent any fuel from reaching the drain shall be used.

5707.4.2 Sources of ignition. Smoking, open flames and other sources of ignition shall be prohibited within 25 feet (7620 mm) of fuel dispensing activities. Signs prohibiting smoking or open flames within 25 feet (7620 mm) of the vehicle or the point of fueling shall be prominently posted on the mobile fueling vehicle. The engines of vehicles being fueled shall be shut off during fueling.

5707.4.3 Electrical equipment. Mobile fueling shall not occur within 20 feet (6096 mm) of electrical equipment located within 18 inches (457 mm) of the ground unless such electrical equipment is rated for Class I, Division 2, hazardous locations in accordance with *the California Electrical Code*.

5707.5 Equipment. Mobile fueling equipment shall comply with Sections 5707.5.1 through 5707.5.5.

5707.5.1 Dispensing hoses and nozzles. Where equipped, the dispensing hose shall not exceed 50 feet (15 240 mm) in length. The dispensing nozzles and hoses shall be of an approved and listed type. Where metal-to-metal contact cannot be made between the nozzle and the fuel fill opening, a means for bonding the mobile fueling vehicle to the motor vehicle shall be provided and employed during fueling operations.

5707.5.2 Breakaway device. A listed breakaway device shall be provided at the nozzle.

Exception: Mobile fueling vehicles equipped with an approved brake interlock tied to the nozzle holder that prohibits movement of the mobile fueling vehicle when the nozzle is removed from its holder or tied to the delivery of fuel that prevents activation of the pumping system.

5707.5.3 Shutoff valve and fuel limit. Mobile fueling vehicles shall be equipped with a listed shutoff valve assembly and a fuel limit switch set to a maximum of 30 gallons (116 L).

5707.5.4 Fire extinguisher. An approved portable fire extinguisher complying with Section 906 with a minimum rating of 4-A:80-B:C shall be provided on the mobile fueling vehicle with signage clearly indicating its location.

5707.5.5 Spill kit. Mobile fueling vehicles shall contain a minimum 5-gallon (19 L) spill kit of an approved type.

5707.6 Operations. Mobile fueling vehicles shall be constantly attended during fueling operations with brakes set and warning lights in operation. Mobile fueling vehicles shall not obstruct emergency vehicle access roads.

5707.6.1 Dispensing hose. Where equipped, mobile fueling vehicles shall be positioned in a manner to preclude traffic from driving over the dispensing hose. The dispensing hose shall be properly placed on an approved reel or in an approved compartment prior to moving the mobile fueling vehicle.

5707.6.2 Drip control. Operators shall place a drip pan or an absorbent pillow under the nozzle and each fuel fill opening prior to and during dispensing operations to catch drips.

5707.6.3 Safety cones. Safety cones or other visual barriers shall be employed as warning devices to highlight the vehicle fueling area.

5707.6.4 Vehicle lights. The mobile fueling vehicle flasher lights shall be in operation while dispensing operations are in progress.

5707.6.5 Nighttime deliveries. Nighttime deliveries shall be made only in areas deemed adequately lighted by the fire code official.

5707.6.6 Spill reporting. Spills shall be reported in accordance with Section 5003.3.1.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 58 – FLAMMABLE GASES AND FLAMMABLE CRYOGENIC FLUIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
5801			X																			
5809			X																			

The state agency does not adopt sections identified with the following symbol: †

* The California Code of Regulations (CCR), Title 19, Division 1 provisions that are found in the California Fire Code are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 58

FLAMMABLE GASES AND FLAMMABLE CRYOGENIC FLUIDS

User note:

About this chapter: Chapter 58 sets requirements for the storage and use of flammable gases. For safety purposes, there is a limit on the quantities of flammable gas allowed per control area. Exceeding these limitations increases the possibility of damage to both property and individuals. The principal hazard posed by flammable gas is its ready ignitability, or even explosivity, when mixed with air in the proper proportions. Consequently, occupancies storing or handling large quantities of flammable gas are classified as Group H-2 (high hazard) by the California Building Code.

SECTION 5801 GENERAL

5801.1 Scope. The storage and use of flammable gases and flammable cryogenic fluids shall be in accordance with this chapter, NFPA 2 and NFPA 55. Compressed gases shall also comply with Chapter 53 and cryogenic fluids shall also comply with Chapter 55. Flammable cryogenic fluids shall comply with Section 5806. Hydrogen motor fuel-dispensing stations and repair garages and their associated above-ground hydrogen storage systems shall also be designed, constructed and maintained in accordance with Chapter 23. *Mobile fueling of hydrogen-fueled vehicles shall comply with Section 5809.*

Exceptions:

1. Gases used as refrigerants in refrigeration systems (see Section 608).
2. Liquefied petroleum gases and natural gases regulated by Chapter 61.
3. Fuel-gas systems and appliances regulated under the *California Mechanical Code and the California Plumbing Code* other than gaseous hydrogen systems and appliances.
4. Pyrophoric gases in accordance with Chapter 64.

5801.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 5802 DEFINITIONS

5802.1 Definitions. The following terms are defined in Chapter 2:

FLAMMABLE GAS.

FLAMMABLE LIQUEFIED GAS.

GAS DETECTION SYSTEM.

GASEOUS HYDROGEN SYSTEM.

HYDROGEN FUEL GAS ROOM.

METAL HYDRIDE.

METAL HYDRIDE STORAGE SYSTEM.

SECTION 5803 GENERAL REQUIREMENTS

5803.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of flammable gases in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 5801 and 5803.

5803.1.1 Special limitations for indoor storage and use.

Flammable gases shall not be stored or used in Group A, E, I or R occupancies or in offices in Group B occupancies.

Exceptions:

1. Cylinders of nonliquefied compressed gases not exceeding a capacity of 250 cubic feet (7.08 m³) or liquefied gases not exceeding a capacity of 40 pounds (18 kg) each at normal temperature and pressure (NTP) used for maintenance purposes, patient care or operation of equipment.
2. Food service operations in accordance with Section 6103.2.1.7.
3. Hydrogen gas systems located in a hydrogen fuel gas room constructed in accordance with Section 421 of the *California Building Code*.

5803.1.1.1 Medical gases. Medical gas system supply cylinders shall be located in medical gas storage rooms or gas cabinets as set forth in Section 5306.

5803.1.1.2 Aggregate quantity. The aggregate quantities of flammable gases used for maintenance purposes and operation of equipment shall not exceed the maximum allowable quantity per control area indicated in Table 5003.1.1(1).

5803.1.2 Storage containers. Cylinders and pressure vessels for flammable gases shall be designed, constructed, installed, tested and maintained in accordance with Chapter 53.

5803.1.3 Emergency shutoff. Compressed gas systems conveying flammable gases shall be provided with approved manual or automatic emergency shutoff valves that can be activated at each point of use and at each source.

5803.1.3.1 Shutoff at source. A manual or automatic fail-safe emergency shutoff valve shall be installed on supply piping at the cylinder or bulk source. Manual or automatic cylinder valves are allowed to be used as the required emergency shutoff valve where the source of supply is limited to unmanifolded cylinder sources.

5803.1.3.2 Shutoff at point of use. A manual or automatic emergency shutoff valve shall be installed on the supply piping at the point of use or at a point where the equipment using the gas is connected to the supply system.

5803.1.4 Ignition source control. Ignition sources in areas containing flammable gases in storage or in use shall be controlled in accordance with Section 5003.7.

Exception: Fuel gas systems connected to building service utilities in accordance with the *International Fuel Gas Code*.

5803.1.4.1 Static-producing equipment. Static-producing equipment located in flammable gas storage areas shall be grounded.

5803.1.4.2 Signs. “No Smoking” signs shall be posted at entrances to rooms and in areas containing flammable gases in accordance with Section 5003.7.1.

5803.1.5 Electrical. Electrical wiring and equipment shall be installed and maintained in accordance with Section 603 and the *California Electrical Code*.

5803.1.5.1 Bonding of electrically conductive materials and equipment. Exposed noncurrent-carrying metal parts, including metal gas piping systems, that are part of flammable gas supply systems located in a hazardous (electrically classified) location shall be bonded to a grounded conductor in accordance with the provisions of the *California Electrical Code*.

5803.1.5.2 Static-producing equipment. Static-producing equipment located in flammable gas storage or use areas shall be grounded.

5803.1.6 Liquefied flammable gases and flammable gases in solution. Containers of liquefied flammable gases and flammable gases in solution shall be positioned in the upright position or positioned so that the pressure relief valve is in direct contact with the vapor space of the container.

Exceptions:

1. Containers of flammable gases in solution with a capacity of 1.3 gallons (5 L) or less.
2. Containers of flammable liquefied gases, with a capacity not exceeding 1.3 gallons (5 L), designed to preclude the discharge of liquid from safety relief devices.

5803.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of flammable gases in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

**SECTION 5804
STORAGE**

5804.1 Indoor storage. Indoor storage of flammable gases in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1), shall be in accordance with Sections 5001, 5003 and 5004, and this chapter.

5804.1.1 Explosion control. Buildings or portions thereof containing flammable gases shall be provided with explosion control in accordance with Section 911.

5804.2 Outdoor storage. Outdoor storage of flammable gases in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003 and 5004, and this chapter.

**SECTION 5805
USE**

5805.1 General. The use of flammable gases in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003 and 5005, and this chapter.

**SECTION 5806
FLAMMABLE CRYOGENIC FLUIDS**

5806.1 General. The storage and use of flammable cryogenic fluids shall be in accordance with Sections 5806.2 through 5806.4.8.3 and Chapter 55.

5806.2 Limitations. Storage of flammable cryogenic fluids in stationary containers outside of buildings is prohibited within the limits established by law as the limits of districts in which such storage is prohibited [JURISDICTION TO SPECIFY].

5806.3 Above-ground tanks for liquid hydrogen. Above-ground tanks for the storage of liquid hydrogen shall be in accordance with Sections 5806.3.1 through 5806.3.2.1.

5806.3.1 Construction of the inner vessel. The inner vessel of storage tanks in liquid hydrogen service shall be designed and constructed in accordance with Section VIII, Division 1, of the *ASME Boiler and Pressure Vessel Code* and shall be vacuum jacketed in accordance with Section 5806.3.2.

5806.3.2 Construction of the vacuum jacket (outer vessel). The vacuum jacket used as an outer vessel for storage tanks in liquid hydrogen service shall be of welded steel construction designed to withstand the maximum internal and external pressure to which it will be subjected under operating conditions to include conditions of emergency pressure relief of the annular space between the inner and outer vessel. The jacket shall be designed to withstand a minimum collapsing pressure differential of 30 psi (207 kPa).

5806.3.2.1 Vacuum-level monitoring. A connection shall be provided on the exterior of the vacuum jacket to allow measurement of the pressure within the annular space between the inner and outer vessel. The

connection shall be fitted with a bellows-sealed or diaphragm-type valve equipped with a vacuum gauge tube that is shielded to protect against damage from impact.

5806.4 Underground tanks for liquid hydrogen. Underground tanks for the storage of liquid hydrogen shall be in accordance with Sections 5806.4.1 through 5806.4.8.3.

5806.4.1 Construction. Storage tanks for liquid hydrogen shall be designed and constructed in accordance with *ASME Boiler and Pressure Vessel Code* (Section VIII, Division 1) and shall be vacuum jacketed in accordance with Section 5806.4.8.

5806.4.2 Location. Storage tanks shall be located outside in accordance with the following:

1. Tanks and associated equipment shall be located with respect to foundations and supports of other structures such that the loads carried by the latter cannot be transmitted to the tank.
2. The distance from any part of the tank to the nearest wall of a basement, pit, cellar or lot line shall be not less than 3 feet (914 mm).
3. A minimum distance of 1 foot (305 mm), shell to shell, shall be maintained between underground tanks.

5806.4.3 Depth, cover and fill. The tank shall be buried such that the top of the vacuum jacket is covered with not less than 1 foot (305 mm) of earth and with concrete not less than 4 inches (102 mm) thick placed over the earthen cover. The concrete shall extend not less than 1 foot (305 mm) horizontally beyond the footprint of the tank in all directions. Underground tanks shall be set on firm foundations constructed in accordance with the *California Building Code* and surrounded with not less than 6 inches (152 mm) of noncorrosive inert material, such as sand.

Exception: The vertical extension of the vacuum jacket as required for service connections.

5806.4.4 Anchorage and security. Tanks and systems shall be secured against accidental dislodgement in accordance with this chapter.

5806.4.5 Venting of underground tanks. Vent pipes for underground storage tanks shall be in accordance with Section 5503.3.

5806.4.6 Underground liquid hydrogen piping. Underground liquid hydrogen piping shall be vacuum jacketed or protected by approved means and designed in accordance with Chapter 55.

5806.4.7 Overfill protection and prevention systems. An approved means or method shall be provided to prevent the overfill of all storage tanks.

5806.4.8 Vacuum jacket construction. The vacuum jacket shall be designed and constructed in accordance with Section VIII of *ASME Boiler and Pressure Vessel Code* and shall be designed to withstand the anticipated loading, including loading from vehicular traffic, where

applicable. Portions of the vacuum jacket installed below grade shall be designed to withstand anticipated soil, seismic and hydrostatic loading.

5806.4.8.1 Material. The vacuum jacket shall be constructed of stainless steel or other approved corrosion-resistant material.

5806.4.8.2 Corrosion protection. The vacuum jacket shall be protected by approved or listed corrosion-resistant materials or an engineered cathodic protection system. Where cathodic protection is utilized, an approved maintenance schedule shall be established. Exposed components shall be inspected not less than twice a year. Records of maintenance and inspection events shall be maintained.

5806.4.8.3 Vacuum-level monitoring. An approved method shall be provided to indicate loss of vacuum within the vacuum jacket(s).

SECTION 5807 METAL HYDRIDE STORAGE SYSTEMS

5807.1 General requirements. The storage and use of metal hydride storage systems shall be in accordance with Sections 5801, 5803, 5804, 5805 and 5807. Those portions of the system that are used as a means to store or supply hydrogen shall also comply with Chapters 50 and 53 as applicable.

5807.1.1 Classification. The hazard classification of the metal hydride storage system, as required by Section 5001.2.2, shall be based on the hydrogen stored without regard to the metal hydride content.

5807.1.2 Listed or approved systems. Metal hydride storage systems shall be listed or approved for the application and designed in a manner that prevents the addition or removal of the metal hydride by other than the original equipment manufacturer.

5807.1.3 Containers, design and construction. Compressed gas containers, cylinders and tanks shall be designed and constructed in accordance with Section 5303.2.

5807.1.4 Service life and inspection of containers. Metal hydride storage system cylinders, containers or tanks shall be inspected, tested and requalified for service at not less than 5-year intervals.

5807.1.5 Marking and labeling. Marking and labeling of cylinders, containers, tanks and systems shall be in accordance with Section 5303.4 and Sections 5807.1.5.1 through 5807.1.5.4.

5807.1.5.1 System marking. Metal hydride storage systems shall be marked with all of the following:

1. Manufacturer's name.
2. Service life indicating the last date the system can be used.
3. A unique code or serial number specific to the unit.

4. System name or product code that identifies the system by the type of chemistry used in the system.
5. Emergency contact name, telephone number or other contact information.
6. Limitations on refilling of containers to include rated charging pressure and capacity.

5807.1.5.2 Valve marking. Metal hydride storage system valves shall be marked with all of the following:

1. Manufacturer's name.
2. Service life indicating the last date the valve can be used.
3. Metal hydride service in which the valve can be used, or a product code that is traceable to this information.

5807.1.5.3 Pressure relief device marking. Metal hydride storage system pressure relief devices shall be marked with all of the following:

1. Manufacturer's name.
2. Metal hydride service in which the device can be used, or a product code that is traceable to this information.
3. Activation parameters to include temperature, pressure or both.

5807.1.5.3.1 Pressure relief devices integral to container valves. The required markings for pressure relief devices that are integral components of valves used on cylinders, containers and tanks shall be allowed to be placed on the valve.

5807.1.5.4 Pressure vessel markings. Cylinders, containers and tanks used in metal hydride storage systems shall be marked with all of the following:

1. Manufacturer's name.
2. Design specification to which the vessel was manufactured.
3. Authorized body approving the design and initial inspection and test of the vessel.
4. Manufacturer's original test date.
5. Unique serial number for the vessel.
6. Service life identifying the last date the vessel can be used.
7. System name or product code that identifies the system by the type of chemistry used in the system.

5807.1.6 Temperature extremes. Metal hydride storage systems, whether full or partially full, shall not be exposed to artificially created high temperatures exceeding 125°F (52°C) or subambient (low) temperatures unless designed for use under the exposed conditions.

5807.1.7 Falling objects. Metal hydride storage systems shall not be placed in areas where they are capable of being damaged by falling objects.

5807.1.8 Piping systems. Piping, including tubing, valves, fittings and pressure regulators, serving metal hydride storage systems, shall be maintained gas tight to prevent leakage.

5807.1.8.1 Leaking systems. Leaking systems shall be removed from service.

5807.1.9 Refilling of containers. The refilling of listed or approved metal hydride storage systems shall be in accordance with the listing requirements and manufacturer's instructions.

5807.1.9.1 Industrial trucks. The refilling of metal hydride storage systems serving powered industrial trucks shall be in accordance with Section 309.

5807.1.9.2 Hydrogen purity. The purity of hydrogen used for the purpose of refilling containers shall be in accordance with the listing and the manufacturer's instructions.

5807.1.10 Electrical. Electrical components for metal hydride storage systems shall be designed, constructed and installed in accordance with the *California Electrical Code*.

5807.2 Portable containers or systems. Portable containers or systems shall comply with Sections 5807.2.1 through 5807.2.2.

5807.2.1 Securing containers. Containers, cylinders and tanks shall be secured in accordance with Section 5303.5.3.

5807.2.1.1 Use on mobile equipment. Where a metal hydride storage system is used on mobile equipment, the equipment shall be designed to restrain containers, cylinders or tanks from dislodgement, slipping or rotating when the equipment is in motion.

5807.2.1.2 Motorized equipment. Metal hydride storage systems used on motorized equipment, shall be installed in a manner that protects valves, pressure regulators, fittings and controls against accidental impact.

5807.2.1.2.1 Protection from damage. Metal hydride storage systems, including cylinders, containers, tanks and fittings, shall not extend beyond the platform of the mobile equipment.

5807.2.2 Valves. Valves on containers, cylinders and tanks shall remain closed except when containers are connected to closed systems and ready for use.

SECTION 5808 HYDROGEN FUEL GAS ROOMS

5808.1 General. Where required by this code, hydrogen fuel gas rooms shall be designed and constructed in accordance with Sections 5808.1 through 5808.7 and the *California Building Code*.

5808.2 Location. Hydrogen fuel gas rooms shall not be located below grade.

5808.3 Design and construction. Hydrogen fuel gas rooms not exceeding the maximum allowable quantity per control area in Table 5003.1.1(1) shall be separated from other areas of the building in accordance with Section 509.1 of the *California Building Code*.

5808.3.1 Pressure control. Hydrogen fuel gas rooms shall be provided with a ventilation system designed to maintain the room at a negative pressure in relation to surrounding rooms and spaces.

5808.3.2 Windows. Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted where in accordance with Section 716 of the *California Building Code*.

5808.4 Exhaust ventilation. Hydrogen fuel gas rooms shall be provided with mechanical exhaust ventilation in accordance with the applicable provisions of Section 2311.8.2.

5808.5 Gas detection system. Hydrogen fuel gas rooms shall be provided with a gas detection system that complies with Sections 916, 5808.5.1 and 5808.5.2.

5808.5.1 System activation. Activation of a gas detection system alarm shall result in both of the following:

1. Initiation of distinct audible and visible alarm signals both inside and outside of the hydrogen fuel gas room.
2. Automatic activation of the mechanical exhaust ventilation system.

5808.5.2 Failure of the gas detection system. Failure of the gas detection system shall automatically activate the mechanical exhaust ventilation system, stop hydrogen generation and cause a trouble signal to sound at an approved location.

5808.6 Explosion control. Explosion control shall be provided where required by Section 911.

5808.7 Standby power. Mechanical ventilation and gas detection systems shall be connected to a standby power system in accordance with Section 1203.

**SECTION 5809
MOBILE GASEOUS FUELING
OF HYDROGEN-FUELED VEHICLES**

5809.1 General. Mobile fueling of gaseous hydrogen into the fuel tanks of hydrogen-fueled vehicles shall comply with Sections 5809.1 through 5809.6. Mobile fueling of liquid hydrogen is prohibited.

5809.1.1 Approval required. Mobile hydrogen-fueling operations shall not be conducted without first obtaining a permit and approval from the fire code official. Mobile hydrogen-fueling operations shall occur only at approved locations within the jurisdiction.

5809.2 Roadside service vehicles. Roadside hydrogen service vehicles shall comply with the following:

1. Roadside hydrogen service vehicles and hydrogen supply tanks shall comply with US DOTn requirements for the transportation of hydrogen gas.

2. Individual hydrogen fuel supply tanks installed on roadside hydrogen service vehicles shall have a maximum individual fuel capacity of 1,270 cubic feet (3 kg) of hydrogen.

3. The maximum aggregate amount of all hydrogen fuel in the supply tanks of roadside hydrogen service vehicles shall not exceed 4,233 cubic feet (10 kg) of hydrogen.

4. The roadside hydrogen service vehicle shall comply with all local, state and federal requirements.

5. The vehicle and its equipment shall be maintained in good repair.

5809.3 Required documents. Documents developed to comply with Sections 5809.3.1 through 5809.3.4 shall be submitted to the fire code official prior to approval of the permit application to conduct mobile gaseous hydrogen fueling operations. The required documents shall be maintained and updated when necessary by the permittee. Any modifications to an approved plan shall be submitted as needed and made available to the fire code official for review and approval.

5809.3.1 Safety and emergency response plan. The owner of a mobile hydrogen-fueling operation shall develop a written safety and emergency response plan that:

1. Establishes policies and procedures for fire safety, hydrogen leak prevention and control, personnel training and compliance with other applicable requirements of this code; and
2. Demonstrates readiness to respond to a hydrogen leak and carry out appropriate mitigation measures.

5809.3.2 Standard operating procedures. The owner of a mobile hydrogen-fueling operation shall develop a written fueling standard operating procedure (SOP) that:

1. Clearly and unambiguously describes the sequence of steps that a roadside gaseous hydrogen service vehicle operator needs to take to ensure safety of gaseous hydrogen fueling and compliance with the fueling protocol requirements;
2. Establishes a fueling protocol that is consistent with applicable requirements of a recognized national standard such as SAE J2601. Compliance with these requirements shall be demonstrated by a valid test record from an independent third party such as a recognized hydrogen-fueled vehicle OEM (Original Equipment Manufacturer).

5809.3.3 Training records. Persons performing dispensing operations shall be qualified to deliver and dispense gaseous hydrogen fuels and shall be trained in these standards that are being created, the equipment manufacturer's training and the appropriate mitigating actions in the event of a fire or a hydrogen leak prior to beginning the dispensing operations. Re-training shall be performed periodically, but no less frequent than annually. Training records shall be maintained by the dispensing company and made available to the fire code official upon request.

5809.3.4 Site plan. Where required by the fire code official for other than emergency roadside service, a site plan shall be developed for each location at which mobile gaseous hydrogen fueling occurs. The site plan shall be in suf-

efficient detail to indicate: all buildings, structures, lot lines, property lines and appurtenances on site and their use and function, and the scale of the site plan.

5809.4 Mobile hydrogen-fueling areas. Areas where mobile hydrogen fueling is allowed shall comply with Sections 5809.4.1 through 5809.4.3.

5809.4.1 Prohibited locations. Mobile hydrogen fueling shall not occur on public streets, public ways or inside buildings. Fueling on the roof level of parking structures or other buildings is prohibited.

Exception: Fueling hydrogen-fueled vehicles on a public street during a roadside emergency.

5809.4.2 Separation. The point of connection between the roadside hydrogen service vehicle and the hydrogen-fuel vehicle shall not be less than 15 feet (4572 mm) from buildings, property lines or combustible storage.

5809.4.3 Sources of ignition. Smoking, open flames and other sources of ignition, including un-rated electrical equipment, shall be prohibited within 25 feet (7620 mm) of fuel-dispensing activities. Signs prohibiting smoking or open flames within 25 feet (7620 mm) of the vehicle or the point of fueling shall be prominently posted on the mobile fueling vehicle. The engines of vehicles being fueled shall be shut off during fueling.

5809.5 Equipment. Mobile hydrogen-fueling equipment shall comply with Sections 5809.5.1 through 5809.5.4.

5809.5.1 Listed equipment. Roadside hydrogen service vehicle fuel-dispensing equipment and appurtenances shall be listed or approved by a recognized third party for its intended use.

5809.5.2 Dispensing hose. The dispensing hose shall be equipped with a breakaway coupling installed within 3 feet (1 m) from the dispensing nozzle.

5809.5.3 Hose reel. The dispensing hose shall be properly placed on an approved reel or in an approved compartment before moving the roadside hydrogen service vehicle.

5809.5.4 Pressure limit. Only dispensing of compressed gaseous hydrogen at partial pressure into the fuel tanks of hydrogen-fueled vehicles from on-board hydrogen supply tanks is allowed.

5809.6 Operations. Mobile hydrogen-fueling operations shall comply with Sections 5809.6.1 through 5809.6.6.

5809.6.1 Attendance. Roadside hydrogen service vehicles shall be constantly attended during fueling operations.

5809.6.2 Bonding cable. A bonding cable shall be securely connected between the mobile fueling vehicle and the fueled vehicle prior to the start of the dispensing operation.

5809.6.3 Positioning of fueling vehicle. Roadside hydrogen service vehicles shall be positioned with respect to vehicles being fueled to prevent traffic from driving over the delivery hose and between the transport vehicle and motor vehicle being fueled.

5809.6.4 Brakes. During fueling operations, mobile fueling vehicle's brakes shall be set, chock blocks shall be in place and warning lights shall be in operation.

5809.6.5 Fire extinguisher. A portable fire extinguisher with a minimum rating of 40-B:C shall be provided on the mobile, roadside service hydrogen-fueling vehicle with signage clearly indicating its location.

5809.6.6 Emergency communication device. Operators of mobile, roadside service hydrogen fueling vehicles shall have in their possession at all times an emergency communication device to notify the proper authorities in the event of an emergency during fueling.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 59 – FLAMMABLE SOLIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter			X																				
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 59

FLAMMABLE SOLIDS

User note:

About this chapter: Chapter 59 addresses general requirements for storage and handling of flammable solids, especially magnesium; however, it is important to note that several other solid materials, including such metals as titanium, zirconium, hafnium, calcium, zinc, sodium, lithium, potassium, sodium/potassium alloys, uranium, thorium and plutonium, can be explosion hazards under the right conditions. Some of these metals are almost exclusively laboratory materials but because of where they are used, fire service personnel must be trained to handle emergency situations. Because uranium, thorium and plutonium are also radioactive materials, they pose more specialized problems for fire service personnel.

SECTION 5901 GENERAL

5901.1 Scope. The storage and use of flammable solids shall be in accordance with this chapter.

5901.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 5902 DEFINITIONS

5902.1 Definitions. The following terms are defined in Chapter 2:

FLAMMABLE SOLID.

MAGNESIUM.

SECTION 5903 GENERAL REQUIREMENTS

5903.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of flammable solids in amounts not exceeding the maximum allowable quantity per control area as indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003 and 5901.

5903.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of flammable solids exceeding the maximum allowable quantity per control area as indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

SECTION 5904 STORAGE

5904.1 Indoor storage. Indoor storage of flammable solids in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

5904.1.1 Pile size limits and location. Flammable solids stored in quantities greater than 1,000 cubic feet (28 m³) shall be separated into piles each not larger than 1,000 cubic feet (28 m³).

5904.1.2 Aisles. Aisle widths between piles shall be not less than the height of the piles or 4 feet (1219 mm), whichever is greater.

5904.1.3 Basement storage. Flammable solids shall not be stored in basements.

5904.2 Outdoor storage. Outdoor storage of flammable solids in amounts exceeding the maximum allowable quantities per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003, 5004 and this chapter. Outdoor storage of magnesium shall be in accordance with Section 5906.

5904.2.1 Distance from storage to exposures. Outdoor storage of flammable solids shall not be located within 20 feet (6096 mm) of a building, lot line, public street, public alley, public way or means of egress. A 2-hour fire barrier without openings or penetrations and extending 30 inches (762 mm) above and to the sides of the storage area is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

5904.2.2 Pile size limits. Outdoor storage of flammable solids shall be separated into piles not larger than 5,000 cubic feet (141 m³) each. Piles shall be separated by aisles with a minimum width of not less than one-half the pile height or 10 feet (3048 mm), whichever is greater.

SECTION 5905 USE

5905.1 General. The use of flammable solids in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter. The use of magnesium shall be in accordance with Section 5906.

SECTION 5906 MAGNESIUM

5906.1 General. Storage, use, handling and processing of magnesium, including the pure metal and alloys of which the

FLAMMABLE SOLIDS

major part is magnesium, shall be in accordance with Chapter 50 and Sections 5906.2 through 5906.5.8.

5906.2 Storage of magnesium articles. The storage of magnesium shall comply with Sections 5906.2.1 through 5906.4.3.

5906.2.1 Storage of greater than 50 cubic feet. Magnesium storage in quantities greater than 50 cubic feet (1.4 m³) shall be separated from storage of other materials that are either combustible or in combustible containers by aisles. Piles shall be separated by aisles with a minimum width of not less than the pile height.

5906.2.2 Storage of greater than 1,000 cubic feet. Magnesium storage in quantities greater than 1,000 cubic feet (28 m³) shall be separated into piles not larger than 1,000 cubic feet (28 m³) each. Piles shall be separated by aisles with a minimum width of not less than the pile height. Such storage shall not be located in nonsprinklered buildings of Type III, IV or V construction, as defined in the *California Building Code*.

5906.2.3 Storage in combustible containers or within 30 feet of other combustibles. Where in nonsprinklered buildings of Type III, IV or V construction, as defined in the *California Building Code*, magnesium shall not be stored in combustible containers or within 30 feet (9144 mm) of other combustibles.

5906.2.4 Storage in foundries and processing plants. The size of storage piles of magnesium articles in foundries and processing plants shall not exceed 1,250 cubic feet (25 m³). Piles shall be separated by aisles with a minimum width of not less than one-half the pile height.

5906.3 Storage of pigs, ingots and billets. The storage of magnesium pigs, ingots and billets shall comply with Sections 5906.3.1 and 5906.3.2.

5906.3.1 Indoor storage. Indoor storage of pigs, ingots and billets shall only be on floors of noncombustible construction. Piles shall not be larger than 500,000 pounds (226.8 metric tons) each. Piles shall be separated by aisles with a minimum width of not less than one-half the pile height.

5906.3.2 Outdoor storage. Outdoor storage of magnesium pigs, ingots and billets shall be in piles not exceeding 1,000,000 pounds (453.6 metric tons) each. Piles shall be separated by aisles with a minimum width of not less than one-half the pile height. Piles shall be separated from combustible materials or buildings on the same or adjoining property by a distance of not less than the height of the nearest pile.

5906.4 Storage of fine magnesium scrap. The storage of scrap magnesium shall comply with Sections 5906.4.1 through 5906.4.3.

5906.4.1 Separation. Magnesium fines shall be kept separate from other combustible materials.

5906.4.2 Storage of 50 to 1,000 cubic feet. Storage of fine magnesium scrap in quantities greater than 50 cubic feet (1.4 m³) [six 55-gallon (208 L) steel drums] shall be separated from other occupancies by an open space of not

less than 50 feet (15 240 mm) or by a fire barrier constructed in accordance with Section 707 of the *California Building Code*.

5906.4.3 Storage of greater than 1,000 cubic feet. Storage of fine magnesium scrap in quantities greater than 1,000 cubic feet (28 m³) shall be separated from all buildings other than those used for magnesium scrap recovery operations by a distance of not less than 100 feet (30 480 mm).

5906.5 Use of magnesium. The use of magnesium shall comply with Sections 5906.5.1 through 5906.5.8.

5906.5.1 Melting pots. Floors under and around melting pots shall be of noncombustible construction.

5906.5.2 Heat-treating ovens. Approved means shall be provided for control of magnesium fires in heat-treating ovens.

5906.5.3 Dust collection. Magnesium grinding, buffing and wire-brushing operations, other than rough finishing of castings, shall be provided with approved hoods or enclosures for dust collection that are connected to a liquid-precipitation type of separator that converts dust to sludge without contact (in a dry state) with any high-speed moving parts.

5906.5.3.1 Duct construction. Connecting ducts or suction tubes shall be completely grounded, as short as possible, and without bends. Ducts shall be fabricated and assembled with a smooth interior, with internal lap joints pointing in the direction of airflow and without unused capped side outlets, pockets or other dead-end spaces that allow an accumulation of dust.

5906.5.3.2 Independent dust separators. Each machine shall be equipped with an individual dust-separating unit.

Exceptions:

1. One separator is allowed to serve two dust-producing units on multiunit machines.
2. One separator is allowed to serve not more than four portable dust-producing units in a single enclosure or stand.

5906.5.4 Power supply interlock. Power supply to machines shall be interlocked with exhaust airflow, and liquid pressure level or flow. The interlock shall be designed to shut down the machine it serves when the dust removal or separator system is not operating properly.

5906.5.5 Electrical equipment. Electric wiring, fixtures and equipment in the immediate vicinity of and attached to dust-producing machines, including those used in connection with separator equipment, shall be of approved types and shall be approved for use in Class II, Division 1 hazardous locations in accordance with the *California Electrical Code*.

5906.5.6 Grounding. Equipment shall be securely grounded by permanent ground wires in accordance with the *California Electrical Code*.

5906.5.7 Fire-extinguishing materials. Fire-extinguishing materials shall be provided for every operator performing machining, grinding or other processing operation on magnesium in accordance with either of the following:

1. Within 30 feet (9144 mm), a supply of extinguishing materials in an approved container with a hand scoop or shovel for applying the material.
2. Within 75 feet (22 860 mm), a portable fire extinguisher complying with Section 906.

All extinguishing materials shall be approved for use on magnesium fires. Where extinguishing materials are stored in cabinets or other enclosed areas, the enclosures shall be openable without the use of a key or special knowledge.

5906.5.8 Collection of chips, turnings and fines. Chips, turnings and other fine magnesium scrap shall be collected from the pans or spaces under machines and from other places where they collect not less than once each working day. Such material shall be placed in a covered, vented steel container and removed to an approved location.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 60 – HIGHLY TOXIC AND TOXIC MATERIALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 60

HIGHLY TOXIC AND TOXIC MATERIALS

User note:

About this chapter: Chapter 60 provides requirements to protect occupants, emergency responders and those in the immediate area of the building and facility from short-term, acute hazards associated with a release of, or general exposure to, toxic and highly toxic materials. This chapter deals with all three states of toxic and highly toxic materials: solids, liquids and gases. This code does not address long-term exposure effects of these materials, which are addressed by agencies such as the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA).

SECTION 6001 GENERAL

6001.1 Scope. The storage and use of highly toxic and toxic materials shall comply with this chapter. Compressed gases shall also comply with Chapter 53.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 5003.11.
2. Conditions involving pesticides or agricultural products as follows:
 - 2.1. Application and release of pesticide, agricultural products and materials intended for use in weed abatement, erosion control, soil amendment or similar applications when applied in accordance with the manufacturer's instruction and label directions.
 - 2.2. Transportation of pesticides in compliance with the Federal Hazardous Materials Transportation Act and regulations thereunder.
 - 2.3. Storage in dwellings or private garages of pesticides registered by the US Environmental Protection Agency to be utilized in and around the home, garden, pool, spa and patio.

6001.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6002 DEFINITIONS

6002.1 Definitions. The following terms are defined in Chapter 2:

CONTAINMENT SYSTEM.

CONTAINMENT VESSEL.

EXCESS FLOW VALVE.

HIGHLY TOXIC.

OZONE-GAS GENERATOR.

PHYSIOLOGICAL WARNING THRESHOLD.

REDUCED FLOW VALVE.

TOXIC.

SECTION 6003 HIGHLY TOXIC AND TOXIC SOLIDS AND LIQUIDS

6003.1 Indoor storage and use. The indoor storage and use of highly toxic and toxic materials shall comply with Sections 6003.1.1 through 6003.1.5.3.

6003.1.1 Quantities not exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic solids or liquids in amounts not exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(2) shall be in accordance with Sections 5001, 5003 and 6001.

6003.1.2 Quantities exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic solids or liquids in amounts exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(2) shall be in accordance with Section 6001, Sections 6003.1.3 through 6003.1.5.3 and Chapter 50.

6003.1.3 Treatment system—highly toxic liquids. Exhaust scrubbers or other systems for processing vapors of highly toxic liquids shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at normal temperature and pressure (NTP). Treatment systems and other processing systems shall be installed in accordance with the *California Mechanical Code*.

6003.1.4 Indoor storage. Indoor storage of highly toxic and toxic solids and liquids shall comply with Sections 6003.1.4.1 and 6003.1.4.2.

6003.1.4.1 Floors. In addition to the requirements set forth in Section 5004.12, floors of storage areas where highly toxic and toxic liquids are stored shall be of liquid-tight construction.

6003.1.4.2 Separation—highly toxic solids and liquids. In addition to the requirements set forth in

HIGHLY TOXIC AND TOXIC MATERIALS

Section 5003.9.8, highly toxic solids and liquids in storage shall be located in approved hazardous material storage cabinets or isolated from other hazardous material storage by construction in accordance with the *California Building Code*.

6003.1.5 Indoor use. Indoor use of highly toxic and toxic solids and liquids shall comply with Sections 6003.1.5.1 through 6003.1.5.3.

6003.1.5.1 Liquid transfer. Highly toxic and toxic liquids shall be transferred in accordance with Section 5005.1.10.

6003.1.5.2 Exhaust ventilation for open systems. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in open systems in accordance with Section 5005.2.1.1.

Exception: Liquids that do not generate highly toxic or toxic fumes, mists or vapors.

6003.1.5.3 Exhaust ventilation for closed systems. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in closed systems in accordance with Section 5005.2.2.1.

Exception: Liquids that do not generate highly toxic or toxic fumes, mists or vapors.

6003.2 Outdoor storage and use. Outdoor storage and use of highly toxic and toxic materials shall comply with Sections 6003.2.1 through 6003.2.6.

6003.2.1 Quantities not exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic solids or liquids in amounts not exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(4) shall be in accordance with Sections 5001, 5003 and 6001.

6003.2.2 Quantities exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic solids or liquids in amounts exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(4) shall be in accordance with Sections 6001 and 6003.2 and Chapter 50.

6003.2.3 General outdoor requirements. The general requirements applicable to the outdoor storage of highly toxic or toxic solids and liquids shall be in accordance with Sections 6003.2.3.1 and 6003.2.3.2.

6003.2.3.1 Location. Outdoor storage or use of highly toxic or toxic solids and liquids shall not be located within 20 feet (6096 mm) of lot lines, public streets, public alleys, public ways, exit discharges or exterior wall openings. A 2-hour fire barrier without openings or penetrations extending not less than 30 inches (762 mm) above and to the sides of the storage is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

6003.2.3.2 Treatment system—highly toxic liquids. Exhaust scrubbers or other systems for processing vapors of highly toxic liquid shall be provided where a spill or accidental release of such liquids can be

expected to release highly toxic vapors at normal temperature and pressure (NTP). Treatment systems and other processing systems shall be installed in accordance with the *California Mechanical Code*.

6003.2.4 Outdoor storage piles. Outdoor storage piles of highly toxic and toxic solids and liquids shall be separated into piles not larger than 2,500 cubic feet (71 m³). Aisle widths between piles shall be not less than one-half the height of the pile or 10 feet (3048 mm), whichever is greater.

6003.2.5 Weather protection for highly toxic liquids and solids—outdoor storage or use. Where overhead weather protection is provided for outdoor storage or use of highly toxic liquids or solids, and the weather protection is attached to a building, the storage or use area shall either be equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1, or storage or use vessels shall be fire resistive. Weather protection shall be provided in accordance with Section 5004.13 for storage and Section 5005.3.9 for use.

6003.2.6 Outdoor liquid transfer. Highly toxic and toxic liquids shall be transferred in accordance with Section 5005.1.10.

SECTION 6004

HIGHLY TOXIC AND TOXIC COMPRESSED GASES

6004.1 General. The storage and use of highly toxic and toxic compressed gases shall comply with this section.

6004.1.1 Special limitations for indoor storage and use by occupancy. The indoor storage and use of highly toxic and toxic compressed gases in certain occupancies shall be subject to the limitations contained in Sections 6004.1.1.1 through 6004.1.1.3.

6004.1.1.1 Group A, E, I or U occupancies. Toxic and highly toxic compressed gases shall not be stored or used within Group A, E, I or U occupancies.

Exception: Cylinders not exceeding 20 cubic feet (0.566 m³) at normal temperature and pressure (NTP) are allowed within gas cabinets or fume hoods.

6004.1.1.2 Group R occupancies. Toxic and highly toxic compressed gases shall not be stored or used in Group R occupancies.

6004.1.1.3 Offices, retail sales and classrooms. Toxic and highly toxic compressed gases shall not be stored or used in offices, retail sales or classroom portions of Group B, F, M or S occupancies.

Exception: In classrooms of Group B occupancies, cylinders with a capacity not exceeding 20 cubic feet (0.566 m³) at NTP are allowed in gas cabinets or fume hoods.

6004.1.2 Gas cabinets. Gas cabinets containing highly toxic or toxic compressed gases shall comply with Section 5003.8.6 and the following requirements:

1. The average ventilation velocity at the face of gas cabinet access ports or windows shall be not less

than 200 feet per minute (1.02 m/s) with not less than 150 feet per minute (0.76 m/s) at any point of the access port or window.

2. Gas cabinets shall be connected to an exhaust system.
3. Gas cabinets shall not be used as the sole means of exhaust for any room or area.
4. The maximum number of cylinders located in a single gas cabinet shall not exceed three, except that cabinets containing cylinders not exceeding 1 pound (0.454 kg) net contents are allowed to contain up to 100 cylinders.
5. Gas cabinets required by Section 6004.2 or 6004.3 shall be equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Alternative fire-extinguishing systems shall not be used.

6004.1.3 Exhausted enclosures. Exhausted enclosures containing highly toxic or toxic compressed gases shall comply with Section 5003.8.5 and the following requirements:

1. The average ventilation velocity at the face of the enclosure shall be not less than 200 feet per minute (1.02 m/s) with not less than 150 feet per minute (0.76 m/s).
2. Exhausted enclosures shall be connected to an exhaust system.
3. Exhausted enclosures shall not be used as the sole means of exhaust for any room or area.
4. Exhausted enclosures required by Section 6004.2 or 6004.3 shall be equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Alternative fire-extinguishing systems shall not be used.

6004.2 Indoor storage and use. The indoor storage and use of highly toxic or toxic compressed gases shall be in accordance with Sections 6004.2.1 through 6004.2.2.10.3.

6004.2.1 Applicability. The applicability of regulations governing the indoor storage and use of highly toxic and toxic compressed gases shall be as set forth in Sections 6004.2.1.1 through 6004.2.1.3.

6004.2.1.1 Quantities not exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic gases in amounts not exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(2) shall be in accordance with Sections 5001, 5003, 6001 and 6004.1.

6004.2.1.2 Quantities exceeding the maximum allowable quantity per control area. The indoor storage or use of highly toxic and toxic gases in amounts exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(2) shall be in accordance with Sections 6001, 6004.1, 6004.2 and Chapter 50.

6004.2.1.3 Ozone gas generators. The indoor use of ozone gas-generating equipment shall be in accordance with Section 6005.

6004.2.2 General indoor requirements. The general requirements applicable to the indoor storage and use of highly toxic and toxic compressed gases shall be in accordance with Sections 6004.2.2.1 through 6004.2.2.10.3.

6004.2.2.1 Cylinder and tank location. Cylinders shall be located within gas cabinets, exhausted enclosures or gas rooms. Portable and stationary tanks shall be located within gas rooms or exhausted enclosures.

6004.2.2.2 Ventilated areas. The room or area in which gas cabinets or exhausted enclosures are located shall be provided with exhaust ventilation. Gas cabinets or exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

6004.2.2.3 Leaking cylinders and tanks. One or more gas cabinets or exhausted enclosures shall be provided to handle leaking cylinders, containers or tanks.

Exceptions:

1. Where cylinders, containers or tanks are located within gas cabinets or exhausted enclosures.
2. Where approved containment vessels or containment systems are provided in accordance with all of the following:
 - 2.1. Containment vessels or containment systems shall be capable of fully containing or terminating a release.
 - 2.2. Trained personnel shall be available at an approved location.
 - 2.3. Containment vessels or containment systems shall be capable of being transported to the leaking cylinder, container or tank.

6004.2.2.3.1 Location. Gas cabinets and exhausted enclosures shall be located in gas rooms and connected to an exhaust system.

6004.2.2.4 Local exhaust for portable tanks. A means of local exhaust shall be provided to capture leaks from portable tanks. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the tank. The local exhaust system shall be located in a gas room. Exhaust shall be directed to a treatment system in accordance with Section 6004.2.2.7.

6004.2.2.5 Piping and controls—stationary tanks. In addition to the requirements of Section 5003.2.2, piping and controls on stationary tanks shall comply with the following requirements:

1. Pressure relief devices shall be vented to a treatment system designed in accordance with Section 6004.2.2.7.

Exception: Pressure relief devices on outdoor tanks provided exclusively for

relieving pressure due to fire exposure are not required to be vented to a treatment system provided that:

1. The material in the tank is not flammable.
 2. The tank is not located in a diked area with other tanks containing combustible materials.
 3. The tank is located not less than 30 feet (9144 mm) from combustible materials or structures or is shielded by a fire barrier complying with Section 6004.3.2.1.1.
2. Filling or dispensing connections shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system in accordance with Section 6004.2.2.7.
 3. Stationary tanks shall be provided with a means of excess flow control on all tank inlet or outlet connections.

Exceptions:

1. Inlet connections designed to prevent backflow.
2. Pressure relief devices.

6004.2.2.6 Gas rooms. Gas rooms shall comply with Section 5003.8.4 and both of the following requirements:

1. The exhaust ventilation from gas rooms shall be directed to an exhaust system.
2. Gas rooms shall be equipped with an approved automatic sprinkler system. Alternative fire-extinguishing systems shall not be used.

6004.2.2.7 Treatment systems. The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems required in Sections 6004.2.2.4 and 6004.2.2.5 shall be directed to a treatment system. The treatment system shall be utilized to handle the accidental release of gas and to process exhaust ventilation. The treatment system shall be designed in accordance with Sections 6004.2.2.7.1 through 6004.2.2.7.5 and Section 510 of the *California Mechanical Code*.

Exceptions:

1. Highly toxic and toxic gases—storage. A treatment system is not required for cylinders, containers and tanks in storage where all of the following controls are provided:
 - 1.1. Valve outlets are equipped with gastight outlet plugs or caps.
 - 1.2. Handwheel-operated valves have handles secured to prevent movement.

1.3. Approved containment vessels or containment systems are provided in accordance with Section 6004.2.2.3.

2. Toxic gases—use. Treatment systems are not required for toxic gases supplied by cylinders or portable tanks not exceeding 1,700 pounds (772 kg) water capacity where a gas detection system complying with Section 6004.2.2.10 and listed or approved automatic-closing fail-safe valves are provided. The gas detection system shall have a sensing interval not exceeding 5 minutes. Automatic-closing fail-safe valves shall be located immediately adjacent to cylinder valves and shall close when gas is detected at the permissible exposure limit (PEL) by a gas sensor monitoring the exhaust system at the point of discharge from the gas cabinet, exhausted enclosure, ventilated enclosure or gas room.

6004.2.2.7.1 Design. Treatment systems shall be capable of diluting, adsorbing, absorbing, containing, neutralizing, burning or otherwise processing the contents of the largest single vessel of compressed gas. Where a total containment system is used, the system shall be designed to handle the maximum anticipated pressure of release to the system when it reaches equilibrium.

6004.2.2.7.2 Performance. Treatment systems shall be designed to reduce the maximum allowable discharge concentrations of the gas to one-half immediate by dangerous to life and health (IDLH) at the point of discharge to the atmosphere. Where more than one gas is emitted to the treatment system, the treatment system shall be designed to handle the worst-case release based on the release rate, the quantity and the IDLH for all compressed gases stored or used.

6004.2.2.7.3 Sizing. Treatment systems shall be sized to process the maximum worst-case release of gas based on the maximum flow rate of release from the largest vessel utilized. The entire contents of the largest compressed gas vessel shall be considered.

6004.2.2.7.4 Stationary tanks. Stationary tanks shall be labeled with the maximum rate of release for the compressed gas contained based on valves or fittings that are inserted directly into the tank. Where multiple valves or fittings are provided, the maximum flow rate of release for valves or fittings with the highest flow rate shall be indicated. Where liquefied compressed gases are in contact with valves or fittings, the liquid flow rate shall be utilized for computation purposes. Flow rates indicated on the label shall be converted to cubic feet per minute (cfm/min) (m³/s) of gas at normal temperature and pressure (NTP).

6004.2.2.7.5 Portable tanks and cylinders. The maximum flow rate of release for portable tanks and cylinders shall be calculated based on the total

release from the cylinder or tank within the time specified in Table 6004.2.2.7.5. Where portable tanks or cylinders are equipped with approved excess flow or reduced flow valves, the worst-case release shall be determined by the maximum achievable flow from the valve as determined by the valve manufacturer or compressed gas supplier. Reduced flow and excess flow valves shall be permanently marked by the valve manufacturer to indicate the maximum design flow rate. Such markings shall indicate the flow rate for air under normal temperature and pressure (NTP).

**TABLE 6004.2.2.7.5
RATE OF RELEASE FOR CYLINDERS AND PORTABLE TANKS**

VESSEL TYPE	NONLIQUEFIED (minutes)	LIQUEFIED (minutes)
Containers	5	30
Portable tanks	40	240

6004.2.2.8 Emergency power. Emergency power shall be provided for the following systems in accordance with Section 603:

1. Exhaust ventilation system.
2. Treatment system.
3. Gas detection system.
4. Smoke detection system.
5. Temperature control system.
6. Fire alarm system.
7. Emergency alarm system.

6004.2.2.8.1 Fail-safe engineered systems. Emergency power shall not be required for mechanical exhaust ventilation, treatment systems and temperature control systems where approved fail-safe engineered systems are installed.

6004.2.2.9 Automatic fire detection system—highly toxic compressed gases. An approved automatic fire detection system shall be installed in rooms or areas where highly toxic compressed gases are stored or used. Activation of the detection system shall sound a local alarm. The fire detection system shall comply with Section 907.

6004.2.2.10 Gas detection system. A gas detection system complying with Section 916 shall be provided to detect the presence of gas at or below the PEL or ceiling limit of the gas for which detection is provided. The system shall be capable of monitoring the discharge from the treatment system at or below one-half the IDLH limit and shall initiate a response in accordance with Sections 6004.2.2.10.1 through 6004.2.2.10.3 if the gas detection alarm is activated.

Exception: A gas detection system is not required for toxic gases when the physiological warning threshold level for the gas is at a level below the accepted PEL for the gas.

6004.2.2.10.1 Alarms. The gas detection system shall initiate a local alarm and transmit a signal to a constantly attended control station when a short-term hazard condition is detected. The alarm shall be both audible and visible and shall provide warning both inside and outside the area where gas is detected. The audible alarm shall be distinct from all other alarms.

Exception: Signal transmission to a constantly attended control station is not required where not more than one cylinder of highly toxic or toxic gas is stored.

6004.2.2.10.2 Shut off of gas supply. The gas-detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for whichever gas is detected.

Exception: Automatic shutdown is not required for reactors utilized for the production of highly toxic or toxic compressed gases where such reactors are:

1. Operated at pressures less than 15 pounds per square inch gauge (psig) (103.4 kPa).
2. Constantly attended.
3. Provided with emergency shutoff valves that have ready access.

6004.2.2.10.3 Valve closure. Automatic closure of shutoff valves shall be in accordance with the following:

1. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas cabinet or exhausted enclosure, the shutoff valve in the gas cabinet or exhausted enclosure for the specific gas detected shall automatically close.
2. Where the gas-detection sampling point initiating the gas detection system alarm is within a gas room and compressed gas containers are not in gas cabinets or exhausted enclosures, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas-detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve for the compressed container of specific gas detected supplying the manifold shall automatically close.

Exception: Where the gas-detection sampling point initiating the gas-detection system alarm is at a use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve in the gas valve enclosure for the branch line located in the piping distribution manifold enclosure shall automatically close.

6004.3 Outdoor storage and use. The outdoor storage and use of highly toxic and toxic compressed gases shall be in accordance with Sections 6004.3.1 through 6004.3.4.

6004.3.1 Applicability. The applicability of regulations governing the outdoor storage and use of highly toxic and toxic compressed gases shall be as set forth in Sections 6004.3.1.1 through 6004.3.1.3.

6004.3.1.1 Quantities not exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic gases in amounts not exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(4) shall be in accordance with Sections 5001, 5003 and 6001.

6004.3.1.2 Quantities exceeding the maximum allowable quantity per control area. The outdoor storage or use of highly toxic and toxic gases in amounts exceeding the maximum allowable quantity per control area set forth in Table 5003.1.1(4) shall be in accordance with Sections 6001 and 6004.3 and Chapter 50.

6004.3.1.3 Ozone gas generators. The outdoor use of ozone gas-generating equipment shall be in accordance with Section 6005.

6004.3.2 General outdoor requirements. The general requirements applicable to the outdoor storage and use of highly toxic and toxic compressed gases shall be in accordance with Sections 6004.3.2.1 through 6004.3.2.4.

6004.3.2.1 Location. Outdoor storage or use of highly toxic or toxic compressed gases shall be located in accordance with Sections 6004.3.2.1.1 through 6004.3.2.1.3.

Exception: Compressed gases located in gas cabinets complying with Sections 5003.8.6 and 6004.1.2 and located 5 feet (1524 mm) or more from buildings and 25 feet (7620 mm) or more from an exit discharge.

6004.3.2.1.1 Distance limitation to exposures. Outdoor storage or use of highly toxic or toxic compressed gases shall not be located within 75 feet (22 860 mm) of a lot line, public street, public alley, public way, exit discharge or building not associated with the manufacture or distribution of such gases, unless all of the following conditions are met:

1. Storage is shielded by a 2-hour fire barrier that interrupts the line of sight between the storage and the exposure.
2. The 2-hour fire barrier shall be located not less than 5 feet (1524 mm) from any exposure.
3. The 2-hour fire barrier shall not have more than two sides at approximately 90-degree (1.57 rad) directions, or three sides with connecting angles of approximately 135 degrees (2.36 rad).

6004.3.2.1.2 Openings in exposed buildings. Where the storage or use area is located closer than 75 feet (22 860 mm) to a building not associated with

the manufacture or distribution of highly toxic or toxic compressed gases, openings into a building other than for piping are not allowed above the height of the top of the 2-hour fire barrier or within 50 feet (15 240 mm) horizontally from the storage area whether or not shielded by a fire barrier.

6004.3.2.1.3 Air intakes. The storage or use area shall not be located within 75 feet (22 860 mm) of air intakes.

6004.3.2.2 Leaking cylinders and tanks. The requirements of Section 6004.2.2.3 shall apply to outdoor cylinders and tanks. Gas cabinets and exhausted enclosures shall be located within or immediately adjacent to outdoor storage or use areas.

6004.3.2.3 Local exhaust for portable tanks. Local exhaust for outdoor portable tanks shall be provided in accordance with the requirements set forth in Section 6004.2.2.4.

6004.3.2.4 Piping and controls—stationary tanks. Piping and controls for outdoor stationary tanks shall be in accordance with the requirements set forth in Section 6004.2.2.5.

6004.3.3 Outdoor storage weather protection for portable tanks and cylinders. Weather protection in accordance with Section 5004.13 shall be provided for portable tanks and cylinders located outdoors and not within gas cabinets or exhausted enclosures. The storage area shall be equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

Exception: An automatic sprinkler system is not required where:

1. All materials under the weather protection structure, including hazardous materials and the containers in which they are stored, are noncombustible.
2. The weather protection structure is located not less than 30 feet (9144 mm) from combustible materials or structures or is separated from such materials or structures using a fire barrier complying with Section 6004.3.2.1.1.

6004.3.4 Outdoor use of cylinders, containers and portable tanks. Cylinders, containers and portable tanks in outdoor use shall be located in gas cabinets or exhausted enclosures and shall comply with Sections 6004.3.4.1 through 6004.3.4.3.

6004.3.4.1 Treatment systems. The treatment system requirements set forth in Section 6004.2.2.7 shall apply to highly toxic or toxic gases located outdoors.

6004.3.4.2 Emergency power. The requirements for emergency power set forth in Section 6004.2.2.8 shall apply to highly toxic or toxic gases located outdoors.

6004.3.4.3 Gas detection system. The gas detection system requirements set forth in Section 6004.2.2.10 shall apply to highly toxic or toxic gases located outdoors.

SECTION 6005 OZONE GAS GENERATORS

6005.1 Scope. Ozone gas generators having a maximum ozone-generating capacity of 0.5 pound (0.23 kg) or more over a 24-hour period shall be in accordance with Sections 6005.2 through 6005.6.

Exceptions:

1. Ozone-generating equipment used in Group R-3 occupancies.
2. Ozone-generating equipment where used in Group H-5 occupancies where in compliance with Chapters 27 and 50 and the other provisions in this chapter for highly toxic gases.

6005.2 Design. Ozone gas generators shall be designed, fabricated and tested in accordance with NEMA 250.

6005.3 Location. Ozone generators shall be located in *approved* cabinets or ozone generator rooms in accordance with Section 6005.3.1 or 6005.3.2.

Exception: An ozone gas generator within an approved pressure vessel where located outside of buildings.

6005.3.1 Cabinets. Ozone cabinets shall be constructed of approved materials and compatible with ozone. Cabinets shall display an approved sign stating: "OZONE GAS GENERATOR—HIGHLY TOXIC—OXIDIZER."

Cabinets shall be braced for seismic activity in accordance with the *California Building Code*.

Cabinets shall be mechanically ventilated in accordance with the *California Mechanical Code* with not less than six air changes per hour.

The average velocity of ventilation at makeup air openings with cabinet doors closed shall be not less than 200 feet per minute (1.02 m/s).

6005.3.2 Ozone gas generator rooms. Ozone gas generator rooms shall be mechanically ventilated in accordance with the *California Mechanical Code* with not less than six air changes per hour. Ozone gas generator rooms shall be equipped with a gas detection system complying with Section 916 that will shut off the generator and sound a local alarm when concentrations above the permissible exposure limit (PEL) occur.

Ozone gas generator rooms shall not be normally occupied, and such rooms shall be kept free of combustible and hazardous material storage. Room access doors shall display an approved sign stating: "OZONE GAS GENERATOR—HIGHLY TOXIC—OXIDIZER."

6005.4 Piping, valves and fittings. Piping, valves, fittings and related components used to convey ozone shall be in accordance with Sections 6005.4.1 through 6005.4.3.

6005.4.1 Piping. Piping shall be welded stainless steel piping or tubing.

Exceptions:

1. Double-walled piping.
2. Piping, valves, fittings and related components located in exhausted enclosures.

6005.4.2 Materials. Materials shall be compatible with ozone and shall be rated for the design operating pressures.

6005.4.3 Identification. Piping shall be identified with the following: "OZONE GAS—HIGHLY TOXIC—OXIDIZER."

6005.5 Automatic shutdown. Ozone gas generators shall be designed to shut down automatically under the following conditions:

1. When the dissolved ozone concentration in the water being treated is above saturation when measured at the point where the water is exposed to the atmosphere.
2. When the process using generated ozone is shut down.
3. Failure of the ventilation system for the cabinet or ozone generator room.
4. Failure of the gas detection system in an ozone gas generator room.

6005.6 Manual shutdown. Manual shutdown controls shall be provided at the generator and, where in a room, within 10 feet (3048 mm) of the main exit or exit access door.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 61 – LIQUEFIED PETROLEUM GASES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter			X																				
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]				X																			
Chapter / Section																							
[T-19 §3.22 (a)(c)]				X																			
[T-19 §3.22 (b)]				X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 61

LIQUEFIED PETROLEUM GASES

User note:

About this chapter: Chapter 61 provides requirements for the safe handling, storing and use of LP-gas to reduce the possibility of damage to containers, accidental releases of LP-gas, and exposure of flammable concentrations of LP-gas to ignition sources. LP-gas (notably propane) is well-known as a camping fuel for cooking, lighting, heating and refrigerating and also remains a popular standby fuel supply for auxiliary generators, as well as being widely used as an alternative motor vehicle fuel. Its characteristic as a clean-burning fuel has resulted in the addition of propane dispensers to service stations throughout the country. Dispensing LP-gas into motor vehicles is addressed by Chapter 23.

SECTION 6101 GENERAL

6101.1 Scope. Storage, handling and transportation of liquefied petroleum gas (LP-gas) and the installation of LP-gas equipment pertinent to systems for such uses shall comply with this chapter and NFPA 58. Properties of LP-gases shall be determined in accordance with Appendix B of NFPA 58.

[California Code of Regulations, Title 19, Division 1, §3.22(a) and (c)] Liquefied Petroleum Gas.

(a) When liquefied petroleum gas is used, the storage and handling thereof shall conform to the appropriate provisions referenced in California Code of Regulations, Title 19, Division 1, Sections 3.02 and 3.03.

(c) California Code of Regulations, Title 8, Section 475 is hereby adopted as a part of Title 19, Division 1 regulations.

6101.2 Permits. Permits shall be required as set forth in Sections 105.5 and 105.6.

Distributors shall not fill an LP-gas container for which a permit is required unless a permit for installation has been issued for that location by the fire code official.

6101.3 Construction documents. Where a single LP-gas container is more than 2,000 gallons (7570 L) in water capacity or the aggregate water capacity of LP-gas containers is more than 4,000 gallons (15 140 L), the installer shall submit construction documents for such installation.

SECTION 6102 DEFINITIONS

6102.1 Definitions. The following terms are defined in Chapter 2:

LIQUEFIED PETROLEUM GAS (LP-gas).
LP-GAS CONTAINER.

SECTION 6103 INSTALLATION OF EQUIPMENT

6103.1 General. LP-gas equipment shall be installed in accordance with the *International Fuel Gas Code* and NFPA 58, except as otherwise provided in this chapter.

6103.2 Use of LP-gas containers in buildings. The use of LP-gas containers in buildings shall be in accordance with Sections 6103.2.1 through 6103.2.2.

6103.2.1 Portable containers. Portable LP-gas containers, as defined in NFPA 58, shall not be used in buildings except as specified in NFPA 58 and Sections 6103.2.1.1 through 6103.2.1.7.

6103.2.1.1 Use in basement, pit or similar location. LP-gas containers shall not be used in a *basement*, pit, above-grade underfloor space or similar location where heavier-than-air gas might collect unless such location is provided with an approved means of ventilation.

Exception: Use with self-contained torch assemblies in accordance with Section 6103.2.1.6.

6103.2.1.2 Construction and temporary heating. Portable LP-gas containers are allowed to be used in buildings or areas of buildings undergoing construction or for temporary heating as set forth in Sections 6.22.4, 6.22.5 and 6.22.8 of NFPA 58.

6103.2.1.3 Group F occupancies. In Group F occupancies, portable LP-gas containers are allowed to be used to supply quantities necessary for processing, research or experimentation. Where manifolded, the aggregate water capacity of such containers shall not exceed 735 pounds (334 kg) per manifold. Where multiple manifolds of such containers are present in the same room, each manifold shall be separated from other manifolds by a distance of not less than 20 feet (6096 mm).

6103.2.1.4 Research and experimentation. In Group I occupancies and laboratories for educational use in Group B and E occupancies, portable LP-gas containers are allowed to be used for research and experimentation. Such containers shall not be used in classrooms. Such containers shall not exceed a 50-pound (23 kg) water capacity in occupancies used for educational purposes and shall not exceed a 12-pound (5 kg) water capacity in occupancies used for institutional purposes. Where more than one such container is present in the same room, each container shall be separated from other containers by a distance of not less than 20 feet (6096 mm).

[California Code of Regulations, Title 19, Division 1, §3.22(b)] Liquefied Petroleum Gas.

(b) All liquefied petroleum gas tanks located in school yards shall be surrounded by a rugged steel fence or equivalent. Tanks in other occupancies shall also be so protected if in the opinion of the enforcement agency such protection is needed to prevent unauthorized tampering. The fence shall be at least 6 feet in height and, if it completely surrounds the tank, shall be located a minimum of 3 feet from the tanks. Fenced areas shall be locked when unattended.

6103.2.1.5 Demonstration uses. Portable LP-gas containers are allowed to be used temporarily for demonstrations and public exhibitions. Such containers shall not exceed a water capacity of 12 pounds (5 kg). Where more than one such container is present in the same room, each container shall be separated from other containers by a distance of not less than 20 feet (6096 mm).

6103.2.1.6 Use with self-contained torch assemblies. Portable LP-gas containers are allowed to be used to supply approved self-contained torch assemblies or similar appliances. Such containers shall not exceed a water capacity of 2.7 pounds (1.2 kg).

6103.2.1.7 Use for food preparation. Where approved, listed LP-gas commercial food service appliances are allowed to be used for food-preparation within restaurants and in attended commercial food-catering operations in accordance with the *International Fuel Gas Code*, the *California Mechanical Code* and NFPA 58.

6103.2.2 Industrial vehicles and floor maintenance machines. LP-gas containers on industrial vehicles and floor maintenance machines shall comply with Sections 11.11 and 11.12 of NFPA 58.

6103.3 Location of equipment and piping. Equipment and piping shall not be installed in locations where such equipment and piping is prohibited by the *International Fuel Gas Code*.

SECTION 6104 LOCATION OF LP-GAS CONTAINERS

6104.1 General. The storage and handling of LP-gas and the installation and maintenance of related equipment shall comply with NFPA 58 and be subject to the approval of the fire code official, except as provided in this chapter.

6104.2 Maximum capacity within established limits. Within the limits established by law restricting the storage of liquefied petroleum gas for the protection of heavily populated or congested areas, the aggregate capacity of any one installation shall not exceed a water capacity of 2,000 gallons (7570 L) [JURISDICTION TO SPECIFY].

Exception: In particular installations, this capacity limit shall be determined by the fire code official, after consideration of special features such as topographical conditions, nature of occupancy, and proximity to build-

ings, capacity of proposed LP-gas containers, degree of fire protection to be provided and capabilities of the local fire department.

6104.3 Container location. LP-gas containers shall be located with respect to buildings and lot lines of adjoining property that can be built on, in accordance with Table 6104.3.

6104.3.1 Installation on roof prohibited. LP-gas containers used in stationary installations shall not be located on the roofs of buildings.

6104.3.2 Special hazards. LP-gas containers shall be located with respect to special hazards including, but not limited to, above-ground flammable or combustible liquid tanks, oxygen or gaseous hydrogen containers, flooding or electric power lines as specified in Section 6.5.3 of NFPA 58.

6104.4 Multiple LP-gas container installations. Multiple LP-gas container installations with a total water storage capacity of more than 180,000 gallons (681.3 kL) [150,000-gallon (567.8 kL) LP-gas capacity] shall be subdivided into groups containing not more than 180,000 gallons (681.3 kL) in each group. Such groups shall be separated by a distance of not less than 50 feet (15 240 mm), unless the containers are protected in accordance with one of the following:

1. Mounded in an approved manner.
2. Protected with approved insulation on areas that are subject to impingement of ignited gas from pipelines or other leakage.
3. Protected by fire walls of approved construction.
4. Protected by an approved system for application of water as specified in Table 6.5.1.2 of NFPA 58.
5. Protected by other approved means.

Where one of these forms of protection is provided, the separation shall be not less than 25 feet (7620 mm) between LP-gas container groups.

SECTION 6105 PROHIBITED USE OF LP-GAS

6105.1 Nonapproved equipment. LP-gas shall not be used for the purpose of operating devices or equipment unless such device or equipment is approved for use with LP-gas.

6105.2 Release to the atmosphere. LP-gas shall not be released to the atmosphere, except in accordance with Section 7.3 of NFPA 58.

SECTION 6106 DISPENSING AND OVERFILLING

6106.1 Attendants. Dispensing of LP-gas shall be performed by a qualified attendant.

6106.2 Overfilling. LP-gas containers shall not be filled or maintained with LP-gas in excess of either the volume determined using the fixed liquid-level gauge installed in accordance with the manufacturer's specifications and in

accordance with Section 5.9.5 of NFPA 58 or the weight determined by the required percentage of the water capacity marked on the container. Portable LP-gas containers shall not be refilled unless equipped with an overfilling prevention device (OPD) where required by Section 5.9.3 of NFPA 58.

6106.3 Dispensing locations. The point of transfer of LP-gas from one LP-gas container to another shall be separated from exposures as specified in NFPA 58.

SECTION 6107 SAFETY PRECAUTIONS AND DEVICES

6107.1 Safety devices. Safety devices on LP-gas containers, equipment and systems shall not be tampered with or made ineffective.

6107.2 Smoking and other sources of ignition. “No Smoking” signs complying with Section 310 shall be posted where required by the fire code official. Smoking within 25 feet (7620 mm) of a point of transfer, while filling operations are in progress at LP-gas containers or vehicles, shall be prohibited.

**TABLE 6104.3
LOCATION OF LP-GAS CONTAINERS**

LP-GAS CONTAINER CAPACITY (water gallons)	MINIMUM SEPARATION BETWEEN LP-GAS CONTAINERS AND BUILDINGS, PUBLIC WAYS ⁹ OR LOT LINES OF ADJOINING PROPERTY THAT CAN BE BUILT ON		MINIMUM SEPARATION BETWEEN LP-GAS CONTAINERS ^{b, c} (feet)
	Mounded or underground LP-gas containers ^a (feet)	Above-ground LP-gas containers ^b (feet)	
Less than 125 ^{c, d}	10	5 ^e	None
125 to 250	10	10	None
251 to 500	10	10	3
501 to 2,000	10	25 ^{e, f}	3
2,001 to 30,000	50	50	5
30,001 to 70,000	50	75	(0.25 of sum of diameters of adjacent LP-gas containers)
70,001 to 90,000	50	100	
90,001 to 120,000	50	125	

For SI: 1 foot = 304.8 mm, 1 gallon = 3.785 L.

- Minimum distance for underground LP-gas containers shall be measured from the pressure relief device and the filling or liquid-level gauge vent connection at the container, except that all parts of an underground LP-gas container shall be not less than 10 feet from a building or lot line of adjoining property that can be built on.
- For other than installations in which the overhanging structure is 50 feet or more above the relief-valve discharge outlet. In applying the distance between buildings and ASME LP-gas containers with a water capacity of 125 gallons or more, not less than 50 percent of this horizontal distance shall also apply to all portions of the building that project more than 5 feet from the building wall and that are higher than the relief valve discharge outlet. This horizontal distance shall be measured from a point determined by projecting the outside edge of such overhanging structure vertically downward to grade or other level on which the LP-gas container is installed. Distances to the building wall shall be not less than those prescribed in this table.
- Where underground multicontainer installations are composed of individual LP-gas containers having a water capacity of 125 gallons or more, such containers shall be installed so as to provide access at their ends or sides to facilitate working with cranes or hoists.
- At a consumer site, if the aggregate water capacity of a multiple-container installation, comprised of individual LP-gas containers having a water capacity of less than 125 gallons, is 500 gallons or more, the minimum distance shall comply with the appropriate portion of this table, applying the aggregate capacity rather than the capacity per LP-gas container. If more than one such installation is made, each installation shall be separated from other installations by not less than 25 feet. Minimum distances between LP-gas containers need not be applied.
- The following shall apply to above-ground containers installed alongside buildings:
 - LP-gas containers of less than a 125-gallon water capacity are allowed without a separation distance where in compliance with Items 2, 3 and 4.
 - Department of Transportation (DOTn) specification LP-gas containers shall be located and installed so that the discharge from the container pressure relief device is not less than 3 feet horizontally from building openings below the level of such discharge and shall not be beneath buildings unless the space is well ventilated to the outside and is not enclosed for more than 50 percent of its perimeter. The discharge from LP-gas container pressure relief devices shall be located not less than 5 feet from exterior sources of ignition, openings into direct-vent (sealed combustion system) appliances or mechanical ventilation air intakes.
 - ASME LP-gas containers of less than a 125-gallon water capacity shall be located and installed such that the discharge from pressure relief devices shall not terminate in or beneath buildings and shall be located not less than 5 feet horizontally from building openings below the level of such discharge and not less than 5 feet from exterior sources of ignition, openings into direct vent (sealed combustion system) appliances, or mechanical ventilation air intakes.
 - The filling connection and the vent from liquid-level gauges on either DOTn or ASME LP-gas containers filled at the point of installation shall be not less than 10 feet from exterior sources of ignition, openings into direct vent (sealed combustion system) appliances or mechanical ventilation air intakes.
- This distance is allowed to be reduced to not less than 10 feet for a single LP-gas container of 1,200-gallon water capacity or less, provided that such container is not less than 25 feet from other LP-gas containers of more than 125-gallon water capacity.
- Above-ground LP-gas containers with a water capacity of 2,000 gallons or less shall be separated from public ways by a distance of not less than 5 feet. Containers with a water capacity greater than 2,000 gallons shall be separated from public ways in accordance with this table.

Control of other sources of ignition shall comply with Chapter 3 of this code and Section 6.25 of NFPA 58.

6107.3 Clearance to combustibles. Weeds, grass, brush, trash and other combustible materials shall be kept not less than 10 feet (3048 mm) from LP-gas tanks or containers.

6107.4 Protecting containers from vehicles. Where exposed to vehicular damage due to proximity to alleys, driveways or parking areas, LP-gas containers, regulators and piping shall be protected in accordance with NFPA 58.

SECTION 6108 FIRE PROTECTION

6108.1 General. Fire protection shall be provided for installations having LP-gas storage containers with a water capacity of more than 4,000 gallons (15 140 L), as required by Section 6.29 of NFPA 58.

6108.2 Portable fire extinguishers. Portable fire extinguishers complying with Section 906 shall be provided as specified in NFPA 58.

SECTION 6109 STORAGE OF PORTABLE LP-GAS CONTAINERS AWAITING USE OR RESALE

6109.1 General. Storage of portable LP-gas containers of 1,000 pounds (454 kg) or less, whether filled, partially filled or empty, at consumer sites or distribution points, and for resale by dealers or resellers shall comply with Sections 6109.2 through 6109.15.1.

Exceptions:

1. LP-gas containers that have not previously been in LP-gas service.
2. LP-gas containers at distribution plants.
3. LP-gas containers at consumer sites or distribution points, which are connected for use.

6109.2 Exposure hazards. LP-gas containers in storage shall be located in a manner that minimizes exposure to excessive temperature rise, physical damage or tampering.

6109.3 Position. LP-gas containers in storage having individual water capacity greater than 2.7 pounds (1.2 kg) [nominal 1-pound (0.454 kg) LP-gas capacity] shall be positioned with the pressure relief valve in direct communication with the vapor space of the container.

6109.4 Separation from means of egress. LP-gas containers stored in buildings in accordance with Sections 6109.9 and 6109.11 shall not be located near exit access doors, exits, stairways or in areas normally used, or intended to be used, as a means of egress.

6109.5 Quantity. Empty LP-gas containers that have been in LP-gas service shall be considered as full containers for the purpose of determining the maximum quantities of LP-gas allowed in Sections 6109.9 and 6109.11.

6109.6 Storage on roofs. LP-gas containers that are not connected for use shall not be stored on roofs.

6109.7 Storage in basement, pit or similar location. LP-gas containers shall not be stored in a basement, pit or similar location where heavier-than-air gas might collect. LP-gas containers shall not be stored in above-grade underfloor spaces or basements unless such location is provided with an approved means of ventilation.

Exception: Department of Transportation (DOTn) specification cylinders with a maximum water capacity of 2.7 pounds (1.2 kg) for use in completely self-contained hand torches and similar applications. The quantity of LP-gas shall not exceed 20 pounds (9 kg).

6109.8 Protection of valves on LP-gas containers in storage. LP-gas DOTn cylinder valves shall be protected by screw-on-type caps or collars that shall be securely in place on all containers stored regardless of whether they are full, partially full or empty. Container and tank outlet valves shall be closed or plugged.

6109.9 Storage within buildings open to the public. Department of Transportation (DOTn) specification cylinders with maximum water capacity of 2.7 pounds (1.2 kg) used in completely self-contained hand torches and similar applications are allowed to be stored or displayed in a building open to the public. The quantity of LP-gas shall not exceed 200 pounds (91 kg) except as provided in Section 6109.11.

6109.10 Storage within buildings not open to the public. The maximum quantity allowed in one storage location in buildings not open to the public, such as industrial buildings, shall not exceed a water capacity of 735 pounds (334 kg) [nominal 300 pounds (136 kg) of LP-gas]. Where additional storage locations are required on the same floor within the same building, they shall be separated by not less than 300 feet (91 440 mm). Storage beyond these limitations shall comply with Section 6109.11.

6109.10.1 Quantities on equipment and vehicles. LP-gas containers carried as part of service equipment on highway mobile vehicles need not be considered in the total storage capacity in Section 6109.10, provided that such vehicles are stored in private garages and do not carry more than three LP-gas containers with a total aggregate LP-gas capacity not exceeding 100 pounds (45.4 kg) per vehicle. LP-gas container valves shall be closed.

6109.11 Storage within rooms used for gas manufacturing. Storage within buildings or rooms used for gas manufacturing, gas storage, gas-air mixing and vaporization, and compressors not associated with liquid transfer shall comply with Sections 6109.11.1 and 6109.11.2.

6109.11.1 Quantity limits. The maximum quantity of LP-gas shall be 10,000 pounds (4540 kg).

6109.11.2 Construction. The construction of such buildings and rooms shall comply with requirements for Group H occupancies in the *California Building Code*, Chapter 10 of NFPA 58 and both of the following:

1. Adequate vents shall be provided to the outside at both top and bottom, located not less than 5 feet (1524 mm) from building openings.

**TABLE 6109.12
SEPARATION FROM EXPOSURES OF LP-GAS CONTAINERS AWAITING USE,
RESALE OR EXCHANGE STORED OUTSIDE OF BUILDINGS**

QUANTITY OF LP-GAS STORED (pounds)	MINIMUM SEPARATION DISTANCE FROM STORED LP-GAS CYLINDERS TO (feet):						
	Nearest important building or group of buildings or line of adjoining property that may be built on	Line of adjoining property occupied by schools, places of religious worship, hospitals, athletic fields or other points of public gathering; busy thoroughfares; or sidewalks	LP-gas dispensing station	Doorway or opening to a building with two or more means of egress	Doorway or opening to a building with one means of egress	Combustible materials	Motor vehicle fuel dispenser
720 or less	0	0	5	5	10	10	20
721–2,500	0	10	10	5	10	10	20
2,501–6,000	10	10	10	10	10	10	20
6,001–10,000	20	20	20	20	20	10	20
Over 10,000	25	25	25	25	25	10	20

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

- The entire area shall be classified for the purposes of ignition source control in accordance with Section 6.25 of NFPA 58.

6109.12 Location of storage outside of buildings. Storage outside of buildings of LP-gas containers awaiting use, resale or part of a cylinder exchange program shall be located in accordance with Table 6109.12.

6109.13 Protection of containers. LP-gas containers shall be stored within a suitable enclosure or otherwise protected against tampering. Vehicle impact protection shall be provided as required by Section 6107.4.

Exception: Vehicle impact protection shall not be required for protection of LP-gas containers where the containers are kept in lockable, ventilated cabinets of metal construction.

6109.14 Alternative location and protection of storage. Where the provisions of Sections 6109.12 and 6109.13 are impractical at construction sites, or at buildings or structures undergoing major renovation or repairs, the storage of containers shall be as required by the fire code official.

6109.15 LP-gas cylinder exchange for resale. In addition to other applicable requirements of this chapter, facilities operating LP-gas cylinder exchange stations that are open to the public shall comply with the following requirements.

- Cylinders shall be secured in a lockable, ventilated metal cabinet or other approved enclosure.
- Cylinders shall be available only by authorized personnel or by use of an automated exchange system in accordance with Section 6109.15.1.
- A sign shall be posted on the entry door of the business operating the cylinder exchange stating “DO NOT BRING LP-GAS CYLINDERS INTO THE BUILDING” or similar approved wording.
- An emergency contact information sign shall be posted within 10 feet (3048 mm) of the cylinder storage cabinet. The content, lettering, size, color and location of the required sign shall be as required by the fire code official.

6109.15.1 Automated cylinder exchange stations. Cylinder exchange stations that include an automated vending system for exchanging cylinders shall comply with the following additional requirements:

- The vending system shall only permit access to a single cylinder per individual transaction.
- Cabinets storing cylinders shall be designed such that cylinders can only be placed inside when they are oriented in the upright position.
- Devices operating door releases for access to stored cylinders shall be permitted to be pneumatic, mechanical or electrically powered.
- Electrical equipment inside of or within 5 feet (1524 mm) of a cabinet storing cylinders, including but not limited to electronics associated with vending operations, shall comply with the requirements for Class I, Division 2, equipment in accordance with the *California Electrical Code*.
- A manual override control shall be permitted for use by authorized personnel. On newly installed cylinder exchange stations, the vending system shall not be capable of returning to automatic operation after a manual override until the system has been inspected and reset by authorized personnel.
- Inspections shall be conducted by authorized personnel to verify that all cylinders are secured, access doors are closed and the station has no visible damage or obvious defects that necessitate placing the station out of service. The frequency of inspections shall be as specified by the fire code official.

SECTION 6110 LP-GAS CONTAINERS NOT IN SERVICE

6110.1 Removed from service. LP-gas containers whose use has been discontinued shall comply with all of the following:

- Be disconnected from appliance piping.
- Have LP-gas container outlets, except relief valves, closed or plugged.

3. Be positioned with the relief valve in direct communication with the LP-gas container vapor space.

6110.2 Removal from site. LP-gas containers discontinued from service shall be removed from the site.

SECTION 6111 PARKING AND GARAGING OF LP-GAS TANK VEHICLES

6111.1 General. Parking of LP-gas tank vehicles shall comply with Sections 6111.2 and 6111.3.

Exception: In cases of accident, breakdown or other emergencies, LP-gas tank vehicles are allowed to be parked and left unattended at any location while the operator is obtaining assistance.

6111.2 Unattended parking. The unattended parking of LP-gas tank vehicles shall be in accordance with Sections 6111.2.1 and 6111.2.2.

6111.2.1 Near residential, educational and institutional occupancies and other high-risk areas. LP-gas tank vehicles shall not be left unattended at any time on residential streets or within 500 feet (152 m) of a residential area, apartment or hotel complex, educational facility, hospital or care facility. Tank vehicles shall not be left unattended at any other place that would, in the opinion of the fire code official, pose an extreme life hazard.

6111.2.2 Durations exceeding 1 hour. LP-gas tank vehicles parked at any one point for longer than 1 hour shall be located as follows:

1. Off public streets, highways, public avenues or public alleys.
2. Inside of a bulk plant.
3. At other approved locations not less than 50 feet (15 240 mm) from buildings other than those approved for the storage or servicing of such vehicles.

6111.3 Garaging. Garaging of LP-gas tank vehicles shall be as specified in NFPA 58. Vehicles with LP-gas fuel systems are allowed to be stored or serviced in garages as specified in Section 11.14 of NFPA 58.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 62 – ORGANIC PEROXIDES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 62

ORGANIC PEROXIDES

User note:

***About this chapter:** Chapter 62 addresses the hazards associated with the storage, handling and use of organic peroxides and is intended to manage the fire and oxidation hazards of organic peroxides by preventing their uncontrolled release. These chemicals possess the characteristics of flammable or combustible liquids and are also strong oxidizers. This unusual combination of properties requires special storage and handling precautions to prevent uncontrolled release, contamination, hazardous chemical reactions, fires or explosions. The requirements of this chapter pertain to industrial applications in which significant quantities of organic peroxides are stored or used; however, smaller quantities of organic peroxides still pose a significant hazard and, therefore, must be stored and used in accordance with the applicable provisions of this chapter and Chapter 50.*

SECTION 6201 GENERAL

6201.1 Scope. The storage and use of organic peroxides shall be in accordance with this chapter and Chapter 50.

Unclassified detonable organic peroxides that are capable of detonation in their normal shipping containers under conditions of fire exposure shall be stored in accordance with Chapter 56.

6201.2 Permits. Permits shall be required for organic peroxides as set forth in Section 105.5.

SECTION 6202 DEFINITION

6202.1 Definition. The following term is defined in Chapter 2:

ORGANIC PEROXIDE.

Class I.

Class II.

Class III.

Class IV.

Class V.

Unclassified detonable.

SECTION 6203 GENERAL REQUIREMENTS

6203.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of organic peroxides in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 6201 and 6203.

6203.1.1 Special limitations for indoor storage and use by occupancy. The indoor storage and use of organic peroxides shall be in accordance with Sections 6203.1.1.1 through 6203.1.1.4.

6203.1.1.1 Group A, E, I or U occupancies. In Group A, E, I or U occupancies, any amount of unclassified

detonable and Class I organic peroxides shall be stored in accordance with the following:

1. Unclassified detonable and Class I organic peroxides shall be stored in hazardous materials storage cabinets complying with Section 5003.8.7.
2. The hazardous materials storage cabinets shall not contain other storage.

6203.1.1.2 Group R occupancies. Unclassified detonable and Class I organic peroxides shall not be stored or used within Group R occupancies.

6203.1.1.3 Group B, F, M or S occupancies. Unclassified detonable and Class I organic peroxides shall not be stored or used in offices, or retail sales areas of Group B, F, M or S occupancies.

6203.1.1.4 Classrooms. In classrooms in Group B, F or M occupancies, any amount of unclassified detonable and Class I organic peroxides shall be stored in accordance with the following:

1. Unclassified detonable and Class I organic peroxides shall be stored in hazardous materials storage cabinets complying with Section 5003.8.7.
2. The hazardous materials storage cabinets shall not contain other storage.

6203.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of organic peroxides in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

SECTION 6204 STORAGE

6204.1 Indoor storage. Indoor storage of organic peroxides in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

Indoor storage of unclassified detonable organic peroxides that are capable of detonation in their normal shipping con-

ORGANIC PEROXIDES

tainers under conditions of fire exposure shall be stored in accordance with Chapter 56.

6204.1.1 Detached storage. Storage of organic peroxides shall be in detached buildings where required by Section 5003.8.2.

6204.1.2 Distance from detached buildings to exposures. In addition to the requirements of the *California Building Code*, detached storage buildings for Class I, II, III, IV and V organic peroxides shall be located in accordance with Table 6204.1.2. Detached buildings containing quantities of unclassified detonable organic peroxides in excess of those set forth in Table 5003.8.2 shall be located in accordance with Table 5604.5.2(1).

6204.1.3 Liquid-tight floor. In addition to the requirements of Section 5004.12, floors of storage areas shall be of liquid-tight construction.

6204.1.4 Electrical wiring and equipment. In addition to the requirements of Section 5003.9.4, electrical wiring and equipment in storage areas for Class I or II organic peroxides shall comply with the requirements for electrical Class I, Division 2, locations.

6204.1.5 Smoke detection. An approved supervised smoke detection system in accordance with Section 907 shall be provided in rooms or areas where Class I, II or III

organic peroxides are stored. Activation of the smoke detection system shall sound a local alarm.

Exception: A smoke detection system shall not be required in detached storage buildings equipped throughout with an approved automatic fire-extinguishing system complying with Chapter 9.

6204.1.6 Maximum quantities. Maximum allowable quantities per building in a mixed occupancy building shall not exceed the amounts set forth in Table 5003.8.2. Maximum allowable quantities per building in a detached storage building shall not exceed the amounts specified in Table 6204.1.2.

6204.1.7 Storage arrangement. Storage arrangements for organic peroxides shall be in accordance with Table 6204.1.7 and shall comply with all of the following:

1. Containers and packages in storage areas shall be closed.
2. Bulk storage shall not be in piles or bins.
3. A minimum 2-foot (610 mm) clear space shall be maintained between storage and uninsulated metal walls.
4. Fifty-five-gallon (208 L) drums shall not be stored more than one drum high.

**TABLE 6204.1.2
ORGANIC PEROXIDES—DISTANCE TO EXPOSURES FROM DETACHED STORAGE BUILDINGS OR OUTDOOR STORAGE AREAS**

ORGANIC PEROXIDE CLASS	MAXIMUM STORAGE QUANTITY (POUNDS) AT MINIMUM SEPARATION DISTANCE					
	Distance to buildings, lot lines, public streets, public alleys, public ways or means of egress			Distance between individual detached storage buildings or individual outdoor storage areas		
	50 feet	100 feet	150 feet	20 feet	75 feet	100 feet
I	2,000	20,000	175,000	2,000	20,000	175,000
II	100,000	200,000	No Limit	100,000 ^a	No Limit	No Limit
III	200,000	No Limit	No Limit	200,000 ^a	No Limit	No Limit
IV	No Limit	No Limit	No Limit	No Limit	No Limit	No Limit
V	No Limit	No Limit	No Limit	No Limit	No Limit	No Limit

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg.

a. Where the amount of organic peroxide stored exceeds this amount, the minimum separation shall be 50 feet.

**TABLE 6204.1.7
STORAGE OF ORGANIC PEROXIDES**

ORGANIC PEROXIDE CLASS	PILE CONFIGURATION				MAXIMUM QUANTITY PER BUILDING
	Maximum width (feet)	Maximum height (feet)	Minimum distance to next pile (feet)	Minimum distance to walls (feet)	
I	6	8	4 ^a	4 ^b	Note c
II	10	8	4 ^a	4 ^b	Note c
III	10	8	4 ^a	4 ^b	Note c
IV	16	10	3 ^{a, d}	4 ^b	No Requirement
V	No Requirement	No Requirement	No Requirement	No Requirement	No Requirement

For SI: 1 foot = 304.8 mm.

- a. Not less than one main aisle with a minimum width of 8 feet shall divide the storage area.
- b. Distance to noncombustible walls is allowed to be reduced to 2 feet.
- c. See Table 6204.1.2 for maximum quantities.
- d. The distance shall be not less than one-half the pile height.

6204.1.8 Location in building. The storage of Class I or II organic peroxides shall be on the ground floor. Class III organic peroxides shall not be stored in basements.

6204.1.9 Contamination. Organic peroxides shall be stored in their original DOTn shipping containers. Organic peroxides shall be stored in a manner to prevent contamination.

6204.1.10 Explosion control. Indoor storage rooms, areas and buildings containing unclassified detonable and Class I organic peroxides shall be provided with explosion control in accordance with Section 911.

6204.1.11 Standby power. Standby power shall be provided in accordance with Section 1203 for the following systems used to protect Class I and unclassified detonable organic peroxides:

1. Exhaust ventilation system.
2. Treatment system.
3. Smoke detection system.
4. Temperature control system.
5. Fire alarm system.
6. Emergency alarm system.

6204.1.11.1 Fail-safe engineered systems. Standby power shall not be required for mechanical exhaust ventilation, treatment systems and temperature control systems where approved fail-safe engineered systems are installed.

6204.2 Outdoor storage. Outdoor storage of organic peroxides in amounts exceeding the maximum allowable quantities per control area indicated in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

6204.2.1 Distance from storage to exposures. Outdoor storage areas for organic peroxides shall be located in accordance with Table 6204.1.2.

6204.2.2 Electrical wiring and equipment. In addition to the requirements of Section 5003.9.4, electrical wiring and equipment in outdoor storage areas containing unclassified detonable, Class I or Class II organic peroxides shall comply with the requirements for electrical Class I, Division 2, locations.

6204.2.3 Maximum quantities. Maximum quantities of organic peroxides in outdoor storage shall be in accordance with Table 6204.1.2.

6204.2.4 Storage arrangement. Storage arrangements shall be in accordance with Table 6204.1.7.

6204.2.5 Separation. In addition to the requirements of Section 5003.9.8, outdoor storage areas for organic peroxides in amounts exceeding those specified in Table 5003.8.2 shall be located a minimum distance of 50 feet (15 240 mm) from other hazardous material storage.

SECTION 6205 USE

6205.1 General. The use of organic peroxides in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE

CHAPTER 63 – OXIDIZERS, OXIDIZING GASES AND OXIDIZING CRYOGENIC FLUIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 63

OXIDIZERS, OXIDIZING GASES AND OXIDIZING CRYOGENIC FLUIDS

User note:

About this chapter: Chapter 63 addresses the hazards associated with solid, liquid, gaseous and cryogenic fluid oxidizing materials, including oxygen in home use, and establishes criteria for their safe storage and protection in indoor and outdoor storage facilities, minimizing the potential for uncontrolled releases and contact with fuel sources. Although oxidizers themselves do not burn, they pose unique fire hazards because of their ability to support combustion by breaking down and giving off oxygen.

SECTION 6301 GENERAL

6301.1 Scope. The storage and use of oxidizing materials shall be in accordance with this chapter and Chapter 50. Oxidizing gases shall also comply with Chapter 53. Oxidizing cryogenic fluids shall also comply with Chapter 55.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 5003.11.
2. Bulk oxygen systems at industrial and institutional consumer sites shall be in accordance with NFPA 55.
3. Liquid oxygen stored or used in home health care in Group I-4 and R occupancies in accordance with Section 6306.

6301.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6302 DEFINITIONS

6302.1 Definitions. The following terms are defined in Chapter 2:

BULK OXYGEN SYSTEM.

LIQUID OXYGEN AMBULATORY CONTAINER.

LIQUID OXYGEN HOME CARE CONTAINER.

OXIDIZER.

- Class 4.
- Class 3.
- Class 2.
- Class 1.

OXIDIZING CRYOGENIC FLUID.

OXIDIZING GAS.

SECTION 6303 GENERAL REQUIREMENTS

6303.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of oxidizing

materials in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 6301 and 6303. Oxidizing gases shall also comply with Chapter 53.

6303.1.1 Special limitations for indoor storage and use by occupancy. The indoor storage and use of oxidizing materials shall be in accordance with Sections 6303.1.1.1 through 6303.1.1.2.

6303.1.1.1 Class 4 liquid and solid oxidizers. The storage and use of Class 4 liquid and solid oxidizers shall comply with Sections 6303.1.1.1.1 through 6303.1.1.1.4.

6303.1.1.1.1 Group A, E, I or U occupancies. In Group A, E, I or U occupancies, any amount of Class 4 liquid and solid oxidizers shall be stored in accordance with the following:

1. Class 4 liquid and solid oxidizers shall be stored in hazardous materials storage cabinets complying with Section 5003.8.7.
2. The hazardous materials storage cabinets shall not contain other storage.

6303.1.1.1.2 Group R occupancies. Class 4 liquid and solid oxidizers shall not be stored or used within Group R occupancies.

6303.1.1.1.3 Offices and retail sales areas. Class 4 liquid and solid oxidizers shall not be stored or used in offices or retail sales areas of Group B, F, M or S occupancies.

6303.1.1.1.4 Classrooms. In classrooms of Group B, F or M occupancies, any amount of Class 4 liquid and solid oxidizers shall be stored in accordance with the following:

1. Class 4 liquid and solid oxidizers shall be stored in hazardous materials storage cabinets complying with Section 5003.8.7.
2. Hazardous materials storage cabinets shall not contain other storage.

6303.1.1.2 Oxidizing gases. Except for cylinders of nonliquefied compressed gases not exceeding a capacity of 250 cubic feet (7 m³) or liquefied compressed

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gases not exceeding a capacity of 46 pounds (21 kg) each used for maintenance purposes, patient care or operation of equipment, oxidizing gases shall not be stored or used in Group A, E, I or R occupancies or in offices in Group B occupancies.

The aggregate quantities of gases used for maintenance purposes and operation of equipment shall not exceed the maximum allowable quantity per control area listed in Table 5003.1.1(1).

Medical gas systems and medical gas supply cylinders shall also be in accordance with Section 5306.

6303.1.2 Emergency shutoff. Compressed gas systems conveying oxidizing gases shall be provided with approved manual or automatic emergency shutoff valves that can be activated at each point of use and at each source.

6303.1.2.1 Shutoff at source. A manual or automatic fail-safe emergency shutoff valve shall be installed on supply piping at the cylinder or bulk source. Manual or automatic cylinder valves are allowed to be used as the required emergency shutoff valve where the source of supply is limited to unmanifolded cylinder sources.

6303.1.2.2 Shutoff at point of use. A manual or automatic emergency shutoff valve shall be installed on the supply piping at the point of use or at a point where the equipment using the gas is connected to the supply system.

6303.1.3 Ignition source control. Ignition sources in areas containing oxidizing gases shall be controlled in accordance with Section 5003.7.

6303.1.4 Class 1 oxidizer storage configuration. The storage configuration of Class 1, 2 and 3 liquid and solid oxidizers shall be as set forth in Table 6303.1.4.

** **6303.1.5 Class 3 liquid and solid oxidizers.** Not more than 220 pounds (99 kg) of solid or 22 gallons (83 L) of liquid Class 3 oxidizer is allowed in storage and use where such materials are necessary for maintenance purposes or operation of equipment. The oxidizers shall be stored in approved containers and in an approved manner.

**SECTION 6304
STORAGE**

6304.1 Indoor storage. Indoor storage of oxidizing materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003 and 5004 and this chapter.

6304.1.1 Explosion control. Indoor storage rooms, areas and buildings containing Class 4 liquid or solid oxidizers shall be provided with explosion control in accordance with Section 911.

6304.1.2 Automatic sprinkler system. The automatic sprinkler system for oxidizer storage shall be designed in accordance with NFPA 400.

**TABLE 6303.1.4
STORAGE OF CLASS 1, 2 AND 3
OXIDIZER LIQUIDS AND SOLIDS**

STORAGE CONFIGURATION	LIMITS (feet)		
	Class 1	Class 2	Class 3
Piles			
Maximum width	24	16	12
Maximum height	20	Note c	Note c
Maximum distance to aisle	12	8	8
Minimum distance to next pile	4 ^a	Note a	Note a
Minimum distance to walls	2 ^b	2	4
Maximum quantity per pile	200 tons	MAQ	NA
Maximum quantity per building	No Limit	Note d	Note d

For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 ton = 0.907185 metric ton. MAQ = Maximum Allowable Quantity.

NA = Not Applicable.

- a. The minimum aisle width shall be equal to the pile height, but not less than 4 feet and not greater than 8 feet.
- b. There shall not be a minimum distance from the pile to a wall for amounts less than 9,000 pounds.
- c. Maximum storage height in nonsprinklered buildings is limited to 6 feet. In sprinklered buildings, see NFPA 400 for storage heights based on ceiling sprinkler protection.
- d. Maximum quantity per building varies. See Chapter 50 for control areas and MAQs.

6304.1.3 Liquid-tight floor. In addition to Section 5004.12, floors of storage areas for liquid and solid oxidizers shall be of liquid-tight construction.

6304.1.4 Smoke detection. An approved supervised smoke detection system in accordance with Section 907 shall be installed in liquid and solid oxidizer storage areas. Activation of the smoke detection system shall sound a local alarm.

Exception: Detached storage buildings protected by an approved automatic fire-extinguishing system.

6304.1.5 Storage conditions. The maximum quantity of oxidizers per building in storage buildings shall not exceed those quantities set forth in Tables 6304.1.5(1) through 6304.1.5(3).

The storage configuration for liquid and solid oxidizers shall be as set forth in Table 6303.1.4 and Tables 6304.1.5(1) through 6304.1.5(3).

Class 2 oxidizers shall not be stored in basements except where such storage is in stationary tanks.

Class 3 and 4 oxidizers in amounts exceeding the maximum allowable quantity per control area set forth in Section 5003.1 shall be stored on the ground floor only.

TABLE 6304.1.5(1)
STORAGE OF CLASS 2 OXIDIZER LIQUIDS AND SOLIDS

STORAGE CONFIGURATION	LIMITS	
	Group H occupancy storage	Detached storage
Piles		
Maximum width	25 feet	25 feet
Maximum height	Note a	Note a
Maximum distance to aisle	12 feet	12 feet
Minimum distance to next pile	Note b	Note b
Minimum distance to walls	2 feet ^c	2 feet ^c
Maximum quantity per pile	100 tons	100 tons
Maximum quantity per building	2000 tons	No Limit

- For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 ton = 0.907185 metric ton.
- a. Maximum storage height in nonsprinklered buildings is limited to 6 feet. In sprinklered buildings see NFPA 400 for storage heights based on ceiling sprinkler protection.
 - b. The minimum aisle width shall be equal to the pile height, but not less than 4 feet and not greater than 8 feet.
 - c. For protection level and detached storage under 4,500 pounds, there shall not be a minimum separation distance between the pile and any wall.

TABLE 6304.1.5(2)
STORAGE OF CLASS 3 OXIDIZER LIQUIDS AND SOLIDS

STORAGE CONFIGURATION	LIMITS	
	Group H occupancy storage	Detached storage
Piles		
Maximum width	16 feet	20 feet
Maximum height	Note a	Note a
Maximum distance to aisle	10 feet	10 feet
Minimum distance to next pile	Note b	Note b
Minimum distance to walls	4 feet ^c	4 feet ^c
Maximum quantity per pile	30 tons	100 tons
Maximum quantity per building	1200 tons	No Limit

- For SI: 1 foot = 304.8 mm, 1 pound = 0.454 kg, 1 ton = 0.907185 metric ton.
- a. Maximum storage height in nonsprinklered buildings is limited to 6 feet. In sprinklered buildings see NFPA 400 for storage heights based on ceiling sprinkler protection.
 - b. The minimum aisle width shall be equal to the pile height, but not less than 4 feet and not greater than 8 feet.
 - c. For protection level and detached storage under 2,300 pounds, there shall not be a minimum separation distance between the pile and any wall.

TABLE 6304.1.5(3)
STORAGE OF CLASS 4 OXIDIZER LIQUIDS AND SOLIDS

STORAGE CONFIGURATION	LIMITS (feet)
Piles	
Maximum length	10
Maximum width	4
Maximum height	8
Minimum distance to next pile	8
Maximum quantity per building	No Limit

For SI: 1 foot = 304.8 mm.

6304.1.6 Separation of Class 4 oxidizers from other materials. In addition to the requirements in Section 5003.9.8, Class 4 oxidizer liquids and solids shall be separated from other hazardous materials by not less than a 1-hour fire barrier or stored in hazardous materials storage cabinets.

6304.1.7 Contamination. Liquid and solid oxidizers shall not be stored on or against combustible surfaces. Liquid and solid oxidizers shall be stored in a manner to prevent contamination.

6304.1.8 Detached storage. Storage of liquid and solid oxidizers shall be in detached buildings where required by Section 5003.8.2.

6304.1.8.1 Separation distance. Detached storage buildings for Class 4 oxidizer liquids and solids shall be located not less than 50 feet (15 240 mm) from other hazardous materials storage.

6304.2 Outdoor storage. Outdoor storage of oxidizing materials in amounts exceeding the maximum allowable quantities per control area set forth in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5004 and this chapter. Oxidizing gases shall also comply with Chapter 53.

6304.2.1 Distance from storage to exposures for oxidizing gases. Outdoor storage areas for oxidizing gases shall be located in accordance with Table 6304.2.1.

6304.2.1.1 Oxidizing cryogenic fluids. Outdoor storage areas for oxidizing cryogenic fluids shall be located in accordance with Chapter 55.

TABLE 6304.2.1
OXIDIZER GASES—DISTANCE FROM STORAGE TO EXPOSURES^a

QUANTITY OF GAS STORED (cubic feet at NTP)	DISTANCE TO A BUILDING NOT ASSOCIATED WITH THE MANUFACTURE OR DISTRIBUTION OF OXIDIZING GASES OR PUBLIC WAY OR LOT LINE THAT CAN BE BUILT ON (feet)	DISTANCE BETWEEN STORAGE AREAS (feet)
0–50,000	5	5
50,001–100,000	10	10
100,001 or greater	15	10

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m³.

- a. The minimum required distances shall not apply where fire barriers without openings or penetrations having a minimum fire-resistance rating of 2 hours interrupt the line of sight between the storage and the exposure. The configuration of the fire barrier shall be designed to allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

6304.2.2 Storage configuration for liquid and solid oxidizers. Storage configuration for liquid and solid oxidizers shall be in accordance with Table 6303.1.4 and Tables 6304.1.5(1) through 6304.1.5(3).

6304.2.3 Storage configuration for oxidizing gases. Storage configuration for oxidizing gases shall be in accordance with Table 6304.2.1.

**SECTION 6305
USE**

6305.1 Scope. The use of oxidizers in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter. Oxidizing gases shall also comply with Chapter 53.

**SECTION 6306
LIQUID OXYGEN IN HOME HEALTH CARE**

6306.1 General. The storage and use of liquid oxygen (LOX) in home health care in Group I-4 and R occupancies shall comply with Sections 6306.2 through 6306.6, or shall be stored and used in accordance with Chapter 50.

6306.2 Information and instructions to be provided. The seller of liquid oxygen shall provide the user with information in written form that includes, but is not limited to, the following:

1. Manufacturer's instructions and labeling for safe storage and use of the containers.
2. Locating containers away from ignition sources, exits, electrical hazards and high-temperature devices in accordance with Section 6306.3.3.
3. Restraint of containers to prevent falling in accordance with Section 6306.3.4.
4. Requirements for handling containers in accordance with Section 6306.3.5.
5. Safeguards for refilling containers in accordance with Section 6306.3.6.
6. Signage requirements in accordance with Section 6306.6.

6306.3 Liquid oxygen home care containers. Containers of liquid oxygen in home health care shall be in accordance with Sections 6306.3.1 through 6306.3.6.3.

6306.3.1 Maximum individual container capacity. Liquid oxygen home care containers shall not exceed an individual capacity of 15.8 gallons (60 L) in Group I-4 and R occupancies. Liquid oxygen ambulatory containers are allowed in Group I-4 and R occupancies. Containers of liquid oxygen in home health care shall also be stored, used and filled in accordance with Section 6306 and Sections 5503.1 and 5503.2.

6306.3.2 Manufacturer's instructions and labeling. Containers shall be stored, used and operated in accordance with the manufacturer's instructions and labeling.

6306.3.3 Locating containers. Containers shall not be located in areas where any of the following conditions exist:

1. They can be overturned due to operation of a door.
2. They are in the direct path of egress.
3. They are subject to falling objects.
4. They can become part of an electrical circuit.

5. Open flames and high-temperature devices can cause a hazard.

6306.3.4 Restraining containers. Liquid oxygen home care containers shall be restrained while in storage or use to prevent falling caused by contact, vibration or seismic activity. Containers shall be restrained by one of the following methods:

1. Restraining containers to a fixed object with one or more restraints.
2. Restraining containers within a framework, stand or assembly designed to secure the container.
3. Restraining containers by locating a container against two points of contact such as the walls of a corner of a room or a wall and a secure furnishing or object such as a desk.

6306.3.5 Container handling. Containers shall be handled by use of a cart or hand truck designed for such use.

Exceptions:

1. Liquid oxygen home care containers equipped with a roller base.
2. Liquid oxygen ambulatory containers are allowed to be hand carried.

6306.3.6 Filling of containers. The filling of containers shall be in accordance with Sections 6306.3.6.1 through 6306.3.6.3.

6306.3.6.1 Filling location. Liquid oxygen home care containers and ambulatory containers shall be filled outdoors.

Exception: Liquid oxygen ambulatory containers are allowed to be filled indoors where the supply container is specifically designed for filling such containers and written instructions are provided by the container manufacturer.

6306.3.6.2 Incompatible surfaces. A drip pan compatible with liquid oxygen shall be provided under home care container fill and vent connections during the filling process in order to protect against liquid oxygen spillage from coming into contact with combustible surfaces, including asphalt.

6306.3.6.3 Open flames and high-temperature devices. The use of open flames and high-temperature devices shall be in accordance with Section 5003.7.2.

6306.4 Maximum aggregate quantity. The maximum aggregate quantity of liquid oxygen allowed in storage and in use in each dwelling unit shall be 31.6 gallons (120 L).

Exceptions:

1. The maximum aggregate quantity of liquid oxygen allowed in Group I-4 occupancies shall be limited by the maximum allowable quantity set forth in Table 5003.1.1(1).
2. Where individual sleeping rooms are separated from the remainder of the dwelling unit by fire barriers constructed in accordance with Section 707 of the

California Building Code, and horizontal assemblies constructed in accordance with Section 711 of the *California Building Code*, or both, having a minimum fire-resistance rating of 1 hour, the maximum aggregate quantity per dwelling unit shall be increased to allow not more than 31.6 gallons (120 L) of liquid oxygen per sleeping room.

6306.5 Smoking prohibited. Smoking shall be prohibited in rooms or areas where liquid oxygen is in use.

6306.6 Signs. Warning signs for occupancies using home health care liquid oxygen shall be in accordance with Sections 6306.6.1 and 6306.6.2.

6306.6.1 No smoking sign. A sign stating “OXYGEN—NO SMOKING” shall be posted in each room or area where liquid oxygen containers are stored, used or filled.

6306.6.2 Premises signage. Where required by the fire code official, each dwelling unit or sleeping unit shall have an approved sign indicating that the unit contains liquid oxygen home care containers.

6306.7 Fire department notification. Where required by the fire code official, the liquid oxygen seller shall notify the fire department of the locations of liquid oxygen home care containers.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 64 – PYROPHORIC MATERIALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 64

PYROPHORIC MATERIALS

User note:

About this chapter: Chapter 64 regulates the hazards associated with pyrophoric materials, which are capable of spontaneously igniting in the air at or below a temperature of 130°F (54°C). Many pyrophoric materials also pose severe flammability or reactivity hazards. This chapter addresses only the hazards associated with pyrophoric materials. Materials that pose multiple hazards must conform to the requirements of this code with respect to all hazards.

SECTION 6401 GENERAL

6401.1 Scope. The storage and use of pyrophoric materials shall be in accordance with this chapter. Compressed gases shall also comply with Chapter 53.

6401.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6402 DEFINITION

6402.1 Definition. The following term is defined in Chapter 2:

PYROPHORIC.

SECTION 6403 GENERAL REQUIREMENTS

6403.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of pyrophoric materials in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 6401 and 6403.

6403.1.1 Emergency shutoff. Compressed gas systems conveying pyrophoric gases shall be provided with approved manual or automatic emergency shutoff valves that can be activated at each point of use and at each source.

6403.1.1.1 Shutoff at source. An automatic emergency shutoff valve shall be installed on supply piping at the cylinder or bulk source. The shutoff valve shall be operated by a remotely located manually activated shutdown control located not less than 15 feet (4572 mm) from the source of supply. Manual or automatic cylinder valves are allowed to be used as the required emergency shutoff valve where the source of supply is limited to unmanifolded cylinder sources.

6403.1.1.2 Shutoff at point of use. A manual or automatic emergency shutoff valve shall be installed on the supply piping at the point of use or at a point where the equipment using the gas is connected to the supply system.

6403.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of pyrophoric materials in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

SECTION 6404 STORAGE

6404.1 Indoor storage. Indoor storage of pyrophoric materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003 and 5004 and this chapter.

The storage of silane gas, and gas mixtures with a silane concentration of 1.37 percent or more by volume, shall be in accordance with ANSI/CGA G-13.

6404.1.1 Liquid-tight floor. In addition to the requirements of Section 5004.12, floors of storage areas containing pyrophoric liquids shall be of liquid-tight construction.

6404.1.2 Pyrophoric solids and liquids. Storage of pyrophoric solids and liquids shall be limited to a maximum area of 100 square feet (9.3 m²) per pile. Storage shall not exceed 5 feet (1524 mm) in height. Individual containers shall not be stacked.

Aisles between storage piles shall be not less than 10 feet (3048 mm) in width.

Individual tanks or containers shall not exceed 500 gallons (1893 L) in capacity.

6404.1.3 Pyrophoric gases. Storage of pyrophoric gases shall be in detached buildings where required by Section 5003.8.2.

6404.1.4 Separation from incompatible materials. In addition to the requirements of Section 5003.9.8, indoor storage of pyrophoric materials shall be isolated from incompatible hazardous materials by 1-hour fire barriers with openings protected in accordance with the *California Building Code*.

Exception: Storage in approved hazardous materials storage cabinets constructed in accordance with Section 5003.8.7.

6404.2 Outdoor storage. Outdoor storage of pyrophoric materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003 and 5004, and this chapter.

The storage of silane gas, and gas mixtures with a silane concentration of 1.37 percent or more by volume, shall be in accordance with ANSI/CGA G-13.

6404.2.1 Distance from storage to exposures. The separation of pyrophoric solids, liquids and gases from buildings, lot lines, public streets, public alleys, public ways or means of egress shall be in accordance with the following:

1. Solids and liquids. Two times the separation required by Chapter 57 for Class IB flammable liquids.
2. Gases. The location and maximum amount of pyrophoric gas per storage area shall be in accordance with Table 6404.2.1.

6404.2.2 Weather protection. Where overhead construction is provided for sheltering outdoor storage areas of pyrophoric materials, the storage areas shall be provided with approved automatic fire-extinguishing system protection.

**SECTION 6405
USE**

6405.1 General. The use of pyrophoric materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter.

6405.2 Weather protection. Where overhead construction is provided for sheltering of outdoor use areas of pyrophoric materials, the use areas shall be provided with approved automatic fire-extinguishing system protection.

6405.3 Silane gas. The use of silane gas, and gas mixtures with a silane concentration of 1.37 percent or more by volume, shall be in accordance with ANSI/CGA G-13.

**TABLE 6404.2.1
PYROPHORIC GASES—DISTANCE FROM STORAGE TO EXPOSURES^a**

MAXIMUM AMOUNT PER STORAGE AREA (cubic feet)	MINIMUM DISTANCE BETWEEN STORAGE AREAS (feet)	MINIMUM DISTANCE TO LOT LINES OF PROPERTY THAT CAN BE BUILT ON (feet)	MINIMUM DISTANCE TO PUBLIC STREETS, PUBLIC ALLEYS OR PUBLIC WAYS (feet)	MINIMUM DISTANCE TO BUILDINGS ON THE SAME PROPERTY		
				Nonrated construction or openings within 25 feet	Two-hour construction and no openings within 25 feet	Four-hour construction and no openings within 25 feet
250	5	25	5	5	0	0
2,500	10	50	10	10	5	0
7,500	20	100	20	20	10	0

For SI: 1 foot = 304.8 mm, 1 cubic foot = 0.02832 m³.

a. The minimum required distances shall be reduced to 5 feet where protective structures having a minimum fire resistance of 2 hours interrupt the line of sight between the container and the exposure. The protective structure shall be not less than 5 feet from the exposure. The configuration of the protective structure shall allow natural ventilation to prevent the accumulation of hazardous gas concentrations.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 65 – PYROXYLIN (CELLULOSE NITRATE) PLASTICS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 65

PYROXYLIN (CELLULOSE NITRATE) PLASTICS

User note:

About this chapter: Chapter 65 addresses the significant hazards associated with pyroxylin (cellulose nitrate) plastics, which are the most dangerous and unstable of all plastic compounds. The chemically bound oxygen in their structure permits them to burn vigorously in the absence of atmospheric oxygen at a rate 15 times greater than comparable common combustibles. Strict compliance with the provisions of this chapter, along with proper housekeeping and storage arrangements, helps to reduce the hazards associated with pyroxylin (cellulose nitrate) plastics in a fire or other emergencies.

SECTION 6501 GENERAL

6501.1 Scope. This chapter shall apply to the storage and handling of plastic substances, materials or compounds with cellulose nitrate (pyroxylin) as a base, by whatever name known, in the form of blocks, sheets, tubes or fabricated shapes.

Cellulose nitrate (pyroxylin) motion picture film shall comply with the requirements of Section 306.

6501.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6502 DEFINITIONS

6502.1 Terms defined in Chapter 2. Words and terms used in this chapter and defined in Chapter 2 shall have the meanings ascribed to them as defined therein.

SECTION 6503 GENERAL REQUIREMENTS

6503.1 Displays. Cellulose nitrate (pyroxylin) plastic articles are allowed to be placed on tables not more than 3 feet (914 mm) wide and 10 feet (3048 mm) long. Tables shall be spaced not less than 3 feet (914 mm) apart. Where articles are displayed on counters, they shall be arranged in a like manner.

6503.2 Space under tables. Spaces underneath tables shall be kept free from storage of any kind and accumulation of paper, refuse and other combustible material.

6503.3 Location. Sales or display tables shall be so located that in the event of a fire at the table, the table will not interfere with free means of egress from the room in not less than one direction.

6503.4 Lighting. Lighting shall not be located directly above cellulose nitrate (pyroxylin) plastic material, unless provided with a suitable guard to prevent heated particles from falling.

SECTION 6504 STORAGE AND HANDLING

6504.1 Raw material. Raw cellulose nitrate (pyroxylin) plastic material in a Group F building shall be stored and handled in accordance with Sections 6504.1.1 through 6504.1.7.

6504.1.1 Storage of incoming material. Where raw material in excess of 25 pounds (11 kg) is received in a building or fire area, an approved vented cabinet or approved vented vault equipped with an approved automatic sprinkler system shall be provided for the storage of material.

6504.1.2 Capacity limitations. Cabinets in any one workroom shall not contain more than 1,000 pounds (454 kg) of raw material. Each cabinet shall not contain more than 500 pounds (227 kg). Each compartment shall not contain more than 250 pounds (114 kg).

6504.1.3 Storage of additional material. Raw material in excess of that allowed by Section 6504.1.2 shall be kept in vented vaults not exceeding 1,500-cubic-foot capacity (43 m³) of total vault space, and with approved construction, venting and sprinkler protection.

6504.1.4 Heat sources. Cellulose nitrate (pyroxylin) plastic shall not be stored within 2 feet (610 mm) of heat-producing appliances, steam pipes, radiators or chimneys.

6504.1.5 Accumulation of material. In factories manufacturing articles of cellulose nitrate (pyroxylin) plastics, approved sprinklered and vented cabinets, vaults or storage rooms shall be provided to prevent the accumulation in workrooms of raw stock in process or finished articles.

6504.1.6 Operators. In workrooms of cellulose nitrate (pyroxylin) plastic factories, operators shall not be stationed closer together than 3 feet (914 mm), and the amount of material per operator shall not exceed one shift's supply and shall be limited to the capacity of three tote boxes, including material awaiting removal or use.

6504.1.7 Waste material. Waste cellulose nitrate (pyroxylin) plastic materials such as shavings, chips, turnings, sawdust, edgings and trimmings shall be kept under water in metal receptacles until removed from the premises.

PYROXYLIN (CELLULOSE NITRATE) PLASTICS

6504.2 Fire protection. The manufacture or storage of articles of cellulose nitrate (pyroxylin) plastic in quantities exceeding 100 pounds (45 kg) shall be located in a building or portion thereof equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1.

6504.3 Sources of ignition. Sources of ignition shall not be located in rooms in which cellulose nitrate (pyroxylin) plastic in excess of 25 pounds (11 kg) is handled or stored.

6504.4 Heating. Rooms in which cellulose nitrate (pyroxylin) plastic is handled or stored shall be heated by low-pressure steam or hot water radiators.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 66 – UNSTABLE (REACTIVE) MATERIALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 66

UNSTABLE (REACTIVE) MATERIALS

User note:

About this chapter: Chapter 66 addresses the hazards of unstable (reactive) liquid and solid materials as well as unstable (reactive) compressed gases. In addition to their unstable reactivity, these materials may pose other hazards, such as toxicity, corrosivity, explosivity, flammability or oxidizing potential. This chapter, however, is intended to address those materials whose primary hazard is unstable reactivity. Materials that pose multiple hazards must conform to the requirements of the code with respect to all hazards. Strict compliance with the provisions of this chapter, along with proper housekeeping and storage arrangements, helps to reduce the exposure hazards associated with unstable (reactive) materials in a fire or other emergency.

SECTION 6601 GENERAL

6601.1 Scope. The storage and use of unstable (reactive) materials shall be in accordance with this chapter. Compressed gases shall also comply with Chapter 53.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 5003.11.
2. Detonable unstable (reactive) materials shall be stored in accordance with Chapter 56.

6601.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6602 DEFINITION

6602.1 Definition. The following term is defined in Chapter 2:

UNSTABLE (REACTIVE) MATERIAL.

- Class 4.
- Class 3.
- Class 2.
- Class 1.

SECTION 6603 GENERAL REQUIREMENTS

6603.1 Quantities not exceeding the maximum allowable quantity per control area. Quantities of unstable (reactive) materials not exceeding the maximum allowable quantity per control area shall be in accordance with Sections 6603.1.1 through 6603.1.2.5.

6603.1.1 General. The storage and use of unstable (reactive) materials in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 6601 and 6603.

6603.1.2 Limitations for indoor storage and use by occupancy. The indoor storage of unstable (reactive) materials shall be in accordance with Sections 6603.1.2.1 through 6603.1.2.5.

6603.1.2.1 Group A, E, I or U occupancies. In Group A, E, I or U occupancies, any amount of Class 3 and 4 unstable (reactive) materials shall be stored in accordance with the following:

1. Class 3 and 4 unstable (reactive) materials shall be stored in hazardous material storage cabinets complying with Section 5003.8.7.
2. The hazardous material storage cabinets shall not contain other storage.

6603.1.2.2 Group R occupancies. Class 3 and 4 unstable (reactive) materials shall not be stored or used within Group R occupancies.

6603.1.2.3 Group M occupancies. Class 4 unstable (reactive) materials shall not be stored or used in retail sales portions of Group M occupancies.

6603.1.2.4 Offices. Class 3 and 4 unstable (reactive) materials shall not be stored or used in offices of Group B, F, M or S occupancies.

6603.1.2.5 Classrooms. In classrooms in Group B, F or M occupancies, any amount of Class 3 and 4 unstable (reactive) materials shall be stored in accordance with the following:

1. Class 3 and 4 unstable (reactive) materials shall be stored in hazardous material storage cabinets complying with Section 5003.8.7.
2. The hazardous material storage cabinets shall not contain other storage.

6603.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of unstable (reactive) materials in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

SECTION 6604 STORAGE

6604.1 Indoor storage. Indoor storage of unstable (reactive) materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

In addition, Class 3 and 4 unstable (reactive) detonable materials shall be stored in accordance with the *California Building Code* requirements for explosives.

6604.1.1 Detached storage. Storage of unstable (reactive) materials shall be in detached buildings where required in Section 5003.8.2.

6604.1.2 Explosion control. Indoor storage rooms, areas and buildings containing Class 3 or 4 unstable (reactive) materials shall be provided with explosion control in accordance with Section 911.

6604.1.3 Liquid-tight floor. In addition to Section 5004.12, floors of storage areas for liquids and solids shall be of liquid-tight construction.

6604.1.4 Storage configuration. Unstable (reactive) materials stored in quantities greater than 500 cubic feet (14 m³) shall be separated into piles, each not larger than 500 cubic feet (14 m³). Aisle width shall be not less than the height of the piles or 4 feet (1219 mm), whichever is greater.

Exception: Materials stored in tanks.

6604.1.5 Location in building. Unstable (reactive) materials shall not be stored in basements.

6604.2 Outdoor storage. Outdoor storage of unstable (reactive) materials in amounts exceeding the maximum allowable quantities per control area indicated in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

6604.2.1 Distance from storage to exposures Class 4 and 3 (detonable) materials. Outdoor storage of Class 4 or 3 (detonable) unstable (reactive) material shall be in accordance with Table 5604.5.2(2). The number of pounds of material listed in the table shall be the net weight of the material present. Alternatively, the number of pounds of material shall be based on a trinitrotoluene (TNT) equivalent weight.

6604.2.2 Distance from storage to exposures Class 3 (deflagratable) materials. Outdoor storage of deflagratable Class 3 unstable (reactive) materials shall be in accordance with Table 5604.5.2(3). The number of pounds of material listed shall be the net weight of the material present.

6604.2.3 Distance from storage to exposures Class 2 and 1 materials. Outdoor storage of Class 2 or 1 unstable (reactive) materials shall not be located within 20 feet (6096 mm) of buildings not associated with the manufacture or distribution of such materials, lot lines, public streets, public alleys, public ways or means of egress. The minimum required distance shall not apply where fire barriers without openings or penetrations having a minimum fire-resistance rating of 2 hours interrupt the line of sight between the storage and the exposure. The fire barrier shall either be an independent structure or the exterior wall of the building adjacent to the storage area.

6604.2.4 Storage configuration. Piles of unstable (reactive) materials shall not exceed 1,000 cubic feet (28 m³).

6604.2.5 Aisle widths. Aisle widths between piles shall be not less than one-half the height of the pile or 10 feet (3048 mm), whichever is greater.

SECTION 6605 USE

6605.1 General. The use of unstable (reactive) materials in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 67 – WATER-REACTIVE SOLIDS AND LIQUIDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

CHAPTER 67

WATER-REACTIVE SOLIDS AND LIQUIDS

User note:

About this chapter: Chapter 67 addresses the hazards associated with water-reactive materials that are solid or liquid at normal temperatures and pressures. In addition to their water reactivity, these materials may pose a wide range of other hazards, such as toxicity, flammability, corrosiveness or oxidizing potential. This chapter addresses only those materials whose primary hazard is water reactivity. Materials that pose multiple hazards must conform to the requirements of this code with respect to all hazards. Strict compliance with the requirements of this chapter, along with proper housekeeping and storage arrangements, helps to reduce the exposure to hazards associated with water-reactive materials in a fire or other emergency.

SECTION 6701 GENERAL

6701.1 Scope. The storage and use of water-reactive solids and liquids shall be in accordance with this chapter.

Exceptions:

1. Display and storage in Group M and storage in Group S occupancies complying with Section 5003.11.
2. Detonable water-reactive solids and liquids shall be stored in accordance with Chapter 56.

6701.2 Permits. Permits shall be required as set forth in Section 105.5.

SECTION 6702 DEFINITION

6702.1 Definition. The following term is defined in Chapter 2:

WATER-REACTIVE MATERIAL.

- Class 3.
- Class 2.
- Class 1.

SECTION 6703 GENERAL REQUIREMENTS

6703.1 Quantities not exceeding the maximum allowable quantity per control area. The storage and use of water-reactive solids and liquids in amounts not exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Sections 5001, 5003, 6701 and 6703.

6703.2 Quantities exceeding the maximum allowable quantity per control area. The storage and use of water-reactive solids and liquids in amounts exceeding the maximum allowable quantity per control area indicated in Section 5003.1 shall be in accordance with Chapter 50 and this chapter.

SECTION 6704 STORAGE

6704.1 Indoor storage. Indoor storage of water-reactive solids and liquids in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1), shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

6704.1.1 Detached storage. Storage of water-reactive solids and liquids shall be in detached buildings where required by Section 5003.8.2.

6704.1.2 Liquid-tight floor. In addition to the provisions of Section 5004.12, floors in storage areas for water-reactive solids and liquids shall be of liquid-tight construction.

6704.1.3 Waterproof room. Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic sprinkler systems shall not be within such rooms or areas.

6704.1.4 Watertight containers. Where Class 3 water-reactive solids and liquids are stored in areas equipped with an automatic sprinkler system, the materials shall be stored in closed watertight containers.

6704.1.5 Storage configuration. Water-reactive solids and liquids stored in quantities greater than 500 cubic feet (14 m³) shall be separated into piles, each not larger than 500 cubic feet (14 m³). Aisle widths between piles shall be not less than the height of the pile or 4 feet (1219 mm), whichever is greater.

Exception: Water-reactive solids and liquids stored in tanks.

Class 2 water-reactive solids and liquids shall not be stored in basements unless such materials are stored in closed watertight containers or tanks.

Class 3 water-reactive solids and liquids shall not be stored in basements.

Class 2 or 3 water-reactive solids and liquids shall not be stored with flammable liquids.

6704.1.6 Explosion control. Indoor storage rooms, areas and buildings containing Class 2 or 3 water-reactive solids

WATER-REACTIVE SOLIDS AND LIQUIDS

and liquids shall be provided with explosion control in accordance with Section 911.

6704.2 Outdoor storage. Outdoor storage of water-reactive solids and liquids in quantities exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5004 and this chapter.

6704.2.1 General. Outdoor storage of water-reactive solids and liquids shall be within tanks or closed water-tight containers and shall be in accordance with Sections 6704.2.2 through 6704.2.5.

6704.2.2 Class 3 distance to exposures. Outdoor storage of Class 3 water-reactive solids and liquids shall not be within 75 feet (22 860 mm) of buildings, lot lines, public streets, public alleys, public ways or means of egress.

6704.2.3 Class 2 distance to exposures. Outdoor storage of Class 2 water-reactive solids and liquids shall not be within 20 feet (6096 mm) of buildings, lot lines, public streets, public alleys, public ways or means of egress. A 2-hour fire barrier without openings or penetrations, and extending not less than 30 inches (762 mm) above and to the sides of the storage area, is allowed in lieu of such distance. The wall shall either be an independent structure, or the exterior wall of the building adjacent to the storage area.

6704.2.4 Storage conditions. Class 3 water-reactive solids and liquids shall be limited to piles not greater than 500 cubic feet (14 m³).

Class 2 water-reactive solids and liquids shall be limited to piles not greater than 1,000 cubic feet (28 m³).

Aisle widths between piles shall be not less than one-half the height of the pile or 10 feet (3048 mm), whichever is greater.

6704.2.5 Containment. Secondary containment shall be provided in accordance with the provisions of Section 5004.2.2.

SECTION 6705 USE

6705.1 General. The use of water-reactive solids and liquids in amounts exceeding the maximum allowable quantity per control area indicated in Table 5003.1.1(1) or 5003.1.1(3) shall be in accordance with Sections 5001, 5003, 5005 and this chapter.

**CHAPTERS 68 through 79
RESERVED**

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE CHAPTER 80 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
ANSI/APA PRG 320-18			X																			
ASME A17.1 CSA B44			X																			
ASME BPE-2009			X																			
ASTM F2374			X																			
D3498—11			X																			
FM3260—00			X																			
FM3011—99			X																			
FM4430—80			X																			
ICC ES AC 331			X																			
ICC ES AC 77			X																			
NFPA 2—20			X																			
NFPA 10—21			X																			
NFPA 13—22			X																			
NFPA 13D—22			X																			
NFPA 14—19			X																			
NFPA 24—19			X																			
NFPA 25—13 CA			X																			
NFPA 32—16			X																			
NFPA 37—15			X																			
NFPA 54—15			X																			
NFPA 68—13			X																			
NFPA 72—22			X																			
NFPA 76—16			X																			
NFPA 82—14			X																			
NFPA 111—16			X																			
NFPA 241—19			X																			
NFPA 260—19			X																			
NFPA 289—19			X																			
NFPA 502—14			X																			
NFPA 1124—17			X																			
NFPA 2001—18			X																			
SFM 12-3			X																			
SFM 12-7-3			X																			

(continued)

CHAPTER 80 – REFERENCED STANDARDS—continued

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)			X																				
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							
SFM 12-7A-1			X																				
SFM 12-7A-2			X																				
SFM 12-7A-3			X																				
SFM 12-7A-4			X																				
SFM 12-7A-4A			X																				
SFM 12-7A-5			X																				
SFM 12-8-100			X																				
SFM 12-10-1			X																				
SFM 12-10-2			X																				
SFM 12-10-3			X																				
UL 13—96			X																				
UL 38—99			X																				
UL 193—04			X																				
UL 199—95			X																				
UL 228—97			X																				
UL 260—04			X																				
UL 262—04			X																				
UL 268A—98			X																				
UL 312—04			X																				
UL 346—05			X																				
UL 464—03			X																				
UL 497B—04			X																				
UL 521—99			X																				
UL 539—00			X																				
UL 632—00			X																				
UL 753—04			X																				
UL 791—06			X																				
UL 813—96			X																				
UL 864—03			X																				
UL 1974—17			X																				
UL 9540 Edition 2—2020			X																				
UL 9540 Edition 4—2019			X																				

V V

Part VI—Referenced Standards

CHAPTER 80

REFERENCED STANDARDS

User note:

About this chapter: This code contains numerous references to standards promulgated by other organizations that are used to provide requirements for materials and methods of construction. This chapter contains a comprehensive list of all standards that are referenced in this code. These standards, in essence, are part of this code to the extent of the reference to the standard.

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.7.

AASHTO

American Association of State Highway and Transportation Officials
444 North Capitol Street, NW, Suite 249
Washington, DC 20001

HB-17—2002: Specification for Highway Bridges, 17th Edition 2002
503.2.6

AFSI

Architectural Fabric Structures Institute
c/o Industrial Fabric Association International
1801 County Road B West
Roseville, MN 55113

FSAAS—16: Fabric Structures Associated Air Structures 2016
3103.10.2

ANSI

American National Standards Institute
25 West 43rd Street, 4th Floor
New York, NY 10036

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APA

APA – The Engineered Wood Association
7011 S. 19th Street
Tacoma, WA 98466-5333

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API

American Petroleum Institute
1220 L Street, NW
Washington, DC 20005

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ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
Reston, VA 20191-4400

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ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329

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ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016-5990

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ASSP

American Society of Safety Professionals
520 N. Northwest Highway
Park Ridge, IL 60068

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ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

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909.13.1
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- B88—16: Specification for Seamless Copper Water Tube**
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BHMA

Builders Hardware Manufacturers' Association
355 Lexington Avenue, 15th Floor
New York, NY 10017

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1010.3.2

CA

State of California Department of Consumer Affairs
Bureau of Electronics and Appliance Repair, Home Furnishings and Thermal Insulation
4244 South Market Court, Suite D
Sacramento, CA 95834-1243

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CGA

Compressed Gas Association
14501 George Carter Way, Suite 103
Chantilly, VA 20151

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CGR

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c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

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CPSC

Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814

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CSA

CSA Group
8501 East Pleasant Valley Road
Cleveland, OH 44131

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U.S. Department of Commerce
1401 Constitution Avenue, NW
Washington, DC 20230

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DOL

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c/o Superintendent of Documents
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Washington, DC 20402-9325

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DOTn

U.S. Department of Transportation
Office of Hazardous Material Safety
1200 New Jersey Avenue SE
East Building 2nd Floor
Washington, DC 20590

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5706.8

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Washington, DC 20402-9325

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EN

European Committee for Standardization (EN)
Central Secretariat
Rue de Stassart 36
B-10 50 Brussels

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FCC

Federal Communications Commission
Wireless Telecommunications Bureau (WTB)
445 12th Street SW
Washington, DC 20554

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FM

FM Approvals
Headquarters Office
1151 Boston-Providence Turnpike
P.O. Box 9102
Norwood, MA 02062

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102.3, 1011.5.2, 1103.1, 1104.18, 1105.5.2

CMC—22: California Mechanical Code

201.3, 308.3, 605.1, 605.2.1.1, 605.2.1.2, 605.2.1.3, 605.2.1.4, 605.2.1.5, 605.3, 605.4, 605.4.2.3, 605.4.2.5, 605.6.2, 605.8, 606.1, 606.2, 608.1, 608.3, 608.4, 608.5, 608.8, 608.9.1, 608.10, 608.17, 610.1.1, 903.2.11.4, 904.13, 907.3.1, 909.1, 909.10.2, 909.13.1, 910.4.7, 915.6.1, 1006.2.2.3, 1011.16, 1020.6.1, 1207.4.7, 1207.6.1, 1207.6.1.2.2, 1207.11.7, 2104.2.1, 2105.3, 2301.1, 2301.6, 2309.3.1.2, 2311.3.1, 2311.4.3, 2311.8.2, 2311.8.8, 2311.8.10, 2404.7, 2404.7.2, 2504.5, 2703.2.2, 2703.10.4, 2703.14, 2803.2, 2803.3, 3001.1, 3003.1, 3004.2, 3107.12.1, 3107.12.2, 3703.5, 3804.1.1.7, 3904.1, Table 5003.1.1(1), 5003.8.4.2, 5003.8.5.2, 5003.8.6.2, 5004.3.1, 5303.7.6, 5303.16.9, 5305.5, 5306.2.2, 5306.2.3, 5307.4.4, 5504.2.1.3, 5504.2.2.3, 5505.4.1.1, 5701.3, 5703.6.1, 5704.2.8.9, 5705.3.7.5.1, 5706.2, 5706.4.4, 6003.1.3, 6003.2.3.2, 6004.2.2.7, 6005.3.1, 6005.3.2, 6103.2.1.7

ICC—continued

- CPC—22: California Plumbing Code**
201.3, 903.3.5, 904.11.1.3, 912.6, 2311.2.3, 5004.2.2.6
- CRC—22: California Residential Code**
102.5, 202, 913.1, 1001.1, 1205.1, 1205.2.1
- ICC 300—17: Standard on Bleachers, Folding and Telescopic Seating and Grandstands**
1030.1.1, 1030.17
- ICC ES AC 331: Acceptance Criteria for Smoke and Heat Vents**
910.3.1
- ICC ES AC 77: Acceptance Criteria for Smoke Containment Systems Used with Fire-resistance-rated Elevator Hoistway Doors and Frames**
707.14.1
- ICC 500—20: ICC/NSSA Standard on the Design and Construction of Storm Shelters**
1031.2
- ICC A117.1—17: Accessible and Usable Buildings and Facilities**
907.5.2.3.3, 1009.8.2, 1009.9, 1009.11, 1010.2.13.1, 1012.1, 1012.6.5, 1012.10, 1013.4, 1023.11

IIAR

International Institute of Ammonia Refrigeration
1001 N. Fairfax Street, Suite 503
Alexandria, VA 22314

- ANSI/IIAR 2—2014, including Addendum A: Safe Design of Closed-circuit Ammonia Refrigeration Systems**
608.1.2, 608.9
- ANSI/IIAR 6—2019: Standard for Inspection, Testing, and Maintenance of Closed-circuit Ammonia Refrigeration Systems**
608.1.2
- ANSI/IIAR 7—2019: Developing Operating Procedures for Closed-circuit Ammonia Refrigeration Systems**
608.1.2
- ANSI/IIAR 8—2020: Decommissioning of Closed-circuit Ammonia Refrigeration Systems**
608.1.2
- ANSI/IIAR 9—2020: Standard for Minimum System Safety Requirements for Existing Closed-circuit Ammonia Refrigeration Systems**
608.1.2

IKECA

International Kitchen Exhaust Cleaning Association
100 North 20th Street, Suite 400
Philadelphia, PA 19103

- ANSI/IKECA C10—2016: Standard for the Methodology for Cleaning of Commercial Kitchen Exhaust Systems**
606.3.3.2

ISO

International Organization for Standardization (ISO)
ISO Central Secretariat 1 ch, de la Voie-Creuse, Case postale 56
CH-1211 Geneva 20, Switzerland

- ISO 8115—86: Cotton Bales—Dimensions and Density**
Table 2704.2.2.1, Table 5003.1.1(1)

NEMA

National Electrical Manufacturer's Association
1300 North 17th Street Suite 900
Arlington, VA 22209

- 250—2018: Enclosures for Electrical Equipment (1,000 Volt Maximum)**
6005.2

- | | **02—20: Hydrogen Technologies Code**
1206.3, 1206.4, 2309.1, 2309.3.1.1, 2309.3.1.2, 2309.4, 2309.6, 2311.8, 2311.8.2, 2311.8.10, 2311.8.11, 5301.1, 5801.1
- 04—21: Standard for Integrated Fire Protection and Life Safety System Testing**
901.6.2.1, 901.6.2.2
- | | **10—21: Standard for Portable Fire Extinguishers**
Table 901.6.1, 906.2, Table 906.3(1), Table 906.3(2), 906.3.2, 906.3.4, 3006.3
- 11—16: Standard for Low-, Medium-, and High-expansion Foam**
904.7, 5704.2.9.2.2
- 12—18: Standard on Carbon Dioxide Extinguishing Systems**
Table 901.6.1, 904.8, 904.13, 1207.5.5
- 12A—18: Standard on Halon 1301 Fire Extinguishing Systems**
Table 901.6.1, 904.9
- | | **13—22: Standard for the Installation of Sprinkler Systems as amended***
903.2.6.2, 903.2.15, 903.2.16, 903.3.1.1, 903.3.2, 903.3.8.2, 903.3.8.5, 904.13, 905.3.4, 907.6.4, 914.3.2, 1019.3, 1019.3, 1031.2.1, 1103.4.8, 1114.27, 3201.1, 3204.2, 3205.5, Table 3206.2, 3206.4.1, 3206.10, 3207.2, 3207.2.1, 3208.2.2, 3208.2.2.1, 3208.4, 3210.1, 3401.1, 5104.1, 5104.1.1, 5106.5.7, 5704.3.3.9, Table 5704.3.6.3(7), 5704.3.7.5.1, 5704.3.8.4

**NFPA 13, Amended Sections as follows:*

Revise Section 2.2 and add publications as follows:
2.2 NFPA Publications.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.*

Revise Section 6.4.3.1.1 as follows:

6.4.3.1.1* Pipe joints shall not be located under foundation footings. *The pipe under the building or building foundation shall not contain mechanical joints.*

Exceptions:

1. *Where allowed in accordance with Section 6.4.3.1.*
2. *Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.*

Delete Sections 8.15.5.1 and 8.15.5.2

8.15.5.1* Reserved.

8.15.5.2* Reserved.

Revise Section 9.2.1.16 as follows:

9.2.1.16 *Exterior columns under 10 ft² (0.93m²) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.*

Revise Section 9.2.3.1* as follows:

9.2.3.1* *Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, portecocheres, balconies, decks or similar projections are constructed with materials that are noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials.*

Delete Section A.9.2.3.1 of Annex

Revise Section 9.2.3.2

9.2.3.2 *Sprinklers shall be permitted to be omitted from below the canopies, roofs, balconies, decks or similar projections are combustible construction, provided the exposed finish material on the roof or canopy is noncombustible, limited-combustible or fire retardant treated wood as defined in NFPA 703, Standard for Fire Retardant-Treated Wood and Fire-Retardant Coatings for Building Materials, and the roofs or canopies contains only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:*

- (1) *Combustible concealed spaces filled entirely with noncombustible insulation.*
- (2) *Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft³ (4.5 m³) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic [See 11.2.3.1.5.2(9)].*
- (3) *Concealed spaces over isolated small roofs or canopies not exceeding 55 ft² (5.1 m²).*

NFPA—continued

Delete language to section 9.2.3.3 and reserve section number.

9.2.3.3 Reserved.

Revise Section 9.3.6.1 as follows:

9.3.6.1 Automatic fire sprinklers shall not be required in elevator machine rooms, elevator machinery spaces, control spaces or hoistways of traction elevators installed in accordance with the applicable provisions in *the California Building Code*, where all of the following conditions are met:

- (1) *The elevator machine room, machinery space, control room, control space or hoistway of traction elevator is dedicated to elevator equipment only.*
- (2) *The elevator machinery space, control room, control space or hoistway of traction elevators is separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire resistance rating of not less than that specified by the applicable building code.*
- (3) *No materials unrelated to elevator equipment are permitted to be stored in elevator machine rooms, machinery spaces, control rooms, control spaces or hoistways of traction elevators.*
- (4) *The elevator machinery is not of the hydraulic type.*

Add new Section 9.3.6.1.1 as follows:

9.3.6.1.1 *The sprinkler required at the top and bottom of the elevator hoistway by 8.15.5.6 shall not be required where permitted by Chapter 30 of the California Building Code.*

Revise Section 9.3.19.1* as follows:

9.3.19.1* *Unless the requirements of 9.2.3.1 or 9.2.3.2 are met, sprinklers shall be installed under exterior roofs, canopies, porte-cochere, balconies, decks or similar projections exceeding 4 ft (1.2 m) in width.*

Revise Annex Section A9.3.19.2 as follows:

A9.3.19.2 *The presence of planters, newspaper machines and similar items, should not be considered storage.*

Add Section 9.3.19.3 as follows:

9.3.19.3 *Sprinklers may be omitted for following structures:*

- (1) *Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.*
- (2) *Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.*

Add new Sections 16.9.3.1.3.4 and 16.9.3.1.3.5 as follows:

16.9.3.1.3.4 *Where a system includes floor control valves, a hydraulic design information sign containing information for the floor shall be provided at each floor control valve. A hydraulic design information sign shall be provided for each area calculated. The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area.*

16.9.3.1.3.5 *Control valves, check valves, drain valves, antifreeze valves shall be readily accessible for inspection, testing and maintenance. Valves located more than 7 feet above the finished floor shall be provided with a means of opening and closing the valve from the floor level.*

Add new Sections 16.9.10.5, 16.9.10.5.1, 16.9.10.5.1.1, 16.9.10.5.1.2, 16.9.10.5.1.3, 16.9.10.5.1.4, 16.9.10.5.2 as follows:

16.9.10.5 Sectional Valves.

16.9.10.5.1 *Private fire service main systems shall have sectional control valves at appropriate points in order to permit sectionalizing the system in the event of a break or for the making of repairs or extensions.*

16.9.10.5.1.1 *Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.*

16.9.10.5.1.2 *Sectional control valves shall be indicating valves in accordance with Section 16.9.3.2.*

16.9.10.5.1.3 *Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.*

16.9.10.5.1.4 *The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.*

16.9.10.5.2 *A valve shall be provided on each bank where a main crosses a body of water or outside the building foundation(s) where the main or section of main runs under a building.*

Add new Section 17.2.2.9.1 as follows:

17.2.2.9.1 *Powder-driven studs used for attaching hangers to the building structure are prohibited in Seismic design Categories C, D, E and F.*

NFPA—continued

Revise Section 18.5.11.4 as follows:

18.5.11.4 Where threaded pipe is used for sway bracing, it shall have a wall thickness of not less than Schedule 40.

Replace Section 18.5.12.5 as follows:

18.5.12.5 Lag screws or power-driven fasteners shall not be used to attach braces to the building structure.

Replace Section 18.5.12.6 as follows:

18.5.12.6 Fastening methods other than those identified in 9.3.5.12 shall not apply to other fastening methods, which shall be acceptable for use if certified by a registered professional engineer to support the loads determined in accordance with the criteria in 18.5.9. Calculations shall be submitted to the authority having jurisdiction.

Revise Section 18.5.12.7.4 as follows:

18.5.12.7.4 Concrete anchors when identified in 18.5.11.11 shall be acceptable for use where designed in accordance with the requirements of the building code and certified by a registered professional engineer.

Revise Section 18.6.1(3) as follows:

18.6.1*(3) No. 12, 440 lb (200 Kg) wire installed at least 45 degrees from the vertical plane and anchored on both sides of the pipe. Powder-driven fasteners for attaching restraint is allowed to be used provided that the restraint component does not support the dead load.

Revise Section 19.2.3.1.5.2(9) as follows:

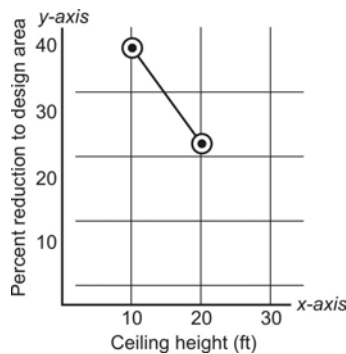
19.2.3.1.5.2(9) Exterior columns under 10 ft² (0.93m²) in total area, formed by studs or wood joist, with no sources of ignition within the column, supporting exterior canopies that are fully protected with a sprinkler system.

Revise Section 19.2.3.2.3.1 as follows:

19.2.3.2.3.1 Where listed quick-response sprinklers, excluding extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 19.2.3.2.3.1 when all of the following conditions are satisfied:

- (1) Wet pipe system
- (2) Light hazard occupancy
- (3) 20 ft (6.1 m) maximum ceiling height
- (4) There are no unprotected ceiling pockets as allowed by 10.2.9 and 11.2.7 exceeding 32 ft² (3 m²)

**FIGURE 19.2.3.2.3.1
DESIGN AREA REDUCTION FOR QUICK-RESPONSE SPRINKLERS**



Note: $y = \frac{-3x}{2} + 55$

For ceiling height ≥ 10 ft and ≤ 20 ft, $y = \frac{-3x}{2} + 55$

For ceiling height < 10 ft, $y = 40$

For ceiling height > 20 ft, $y = 0$

For SI units, 1 ft = 0.31 m.

Revise Section 19.2.3.2.3.2 as follows:

19.2.3.2.3.2 The number of sprinklers in the design area shall never be less than seven.

Revise Section 20.9.5.2 as follows:

20.9.5.2 Early suppression fast-response (ESFR) sprinklers shall not be used in buildings with automatic heat or smoke vents unless the vents use a standard-response operating mechanism with a minimum temperature rating of 360°F (182°C) or 100°F (56°C) above the operating temperature of the sprinklers, whichever is higher.

NFPA—continued

Add Section 28.1.3(18)(e)* as follows:

28.1.3(18)(e)* *Where a waterflow test is used for the purposes of system design, the test shall be conducted no more than 6 months prior to working plan submittal unless otherwise approved by the authority having jurisdiction.*

Revise Section 29.1 as follows:

29.1 Approval of Sprinkler Systems and Private Fire Service Mains. *The installing contractor shall do the following:*

- (1) *Notify the authority having jurisdiction and the property owner or property owner’s authorized representative of the time and date testing will be performed.*
- (2) *Perform all required testing (see Section 29.2).*
- (3) *Complete and sign the appropriate contractor’s material and test certificate(s) (see Figure A.29.1).*
- (4) *Remove all caps and straps prior to placing the sprinkler system in service.*
- (5) *Upon system acceptance by the authority having jurisdiction a label prescribed by Title 19 California Code of Regulations, Chapter 5 shall be affixed to each system riser.*

Revise Section 29.3 as follows:

29.3 Instructions. *The installing contractor shall provide the property owner or the property owner’s authorized representative with the following:*

- (1) *All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.*
- (2) *NFPA 25, Standard for the Inspection, testing, and maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*
- (3) *Title 19, California Code of Regulations, Chapter 5, “Fire Extinguishing Systems.”*

Revise Section 29.4.1 as follows:

29.4.1 *The installing contractor shall identify a hydraulically designed sprinkler system with a permanently marked weatherproof metal or rigid plastic sign secured with corrosion resistant wire, chain or other approved means. Such signs shall be placed at the alarm valve, dry pipe valve, preaction valve or deluge valve supplying the corresponding hydraulically designed area. Pipe schedule systems shall be provided with a sign indicating that the system was designed and installed as a pipe schedule system and the hazard classification(s) included in the design.*

Revise Section 29.4.3 as follows:

29.4.3 *The sign shall include the following information:*

- (1) *Location of the design area or areas*
- (2) *Discharge densities over the design area or areas*
- (3) *Required flow and pressure of the system at the base of the riser.*
- (4) *Occupancy classification or commodity classification and maximum permitted storage height and configuration*
- (5) *Hose stream allowance included in addition to the sprinkler demand*
- (6) *The name of the installing contractor*
- (7) *Required flow and pressure of the system at the water supply source.*
- (8) *Required flow and pressure of the system at the discharge side of the fire pump where a fire pump is installed.*
- (9) *Type or types and number of sprinklers or nozzles installed including the orifice size, temperature rating, orientation, K-Factor, sprinkler identification number (SIN) for sprinkler heads when applicable, and response type.*
- (10) *The minimum discharge flow rate and pressure required from the hydraulically most demanding sprinkler.*
- (11) *The required pressure settings for pressure reducing valves.*
- (12) *For deluge sprinkler systems, the required flow and pressure at the hydraulically most demanding sprinkler or nozzle.*
- (13) *The protection area per sprinkler based on the hydraulic calculations.*
- (14) *The edition of NFPA 13 to which the system was designed and installed.*

Revise Section 29.6.1 as follows:

29.6.1 *The installing contractor shall provide a general information sign used to determine system design basis and information relevant to the inspection, testing, and maintenance requirements required by NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California Edition.*

NFPA—continued

13D—22: Standard for the Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes as amended*

903.3.1.3, 903.3.5.1.1

**NFPA 13D, Amended Sections as follows:*

Revise Section 6.2.2 to read as follows:

6.2.2 Where a well, pump, tank or combination thereof is the source of supply for a fire sprinkler system, the configuration for the system shall be one of the following:

- (1) The water supply shall serve both domestic and fire sprinkler systems.
 - (a) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
 - (b) Any disconnecting means for the pump shall be approved.
 - (c) A method for refilling the tank shall be piped to the tank.
 - (d) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (e) The pump shall not be permitted to sit directly on the floor.
- (2) A stand-alone tank is permitted if the following conditions are met:
 - (a) The pump shall be connected to a 220-volt circuit breaker shared with a common household appliance (e.g., range, oven, dryer),
 - (b) The pump shall be a stainless steel 240-volt pump,
 - (c) A valve shall be provided to exercise the pump. The discharge of the exercise valve shall drain to the tank, and
 - (d) A sign shall be provided stating: “Valve must be opened monthly for 5 minutes.”
 - (e) A means for automatically refilling the tank level, so that the tank capacity will meet the required water supply duration in minutes, shall be provided.
 - (f) A test connection shall be provided downstream of the pump that creates a flow of water equal to the smallest sprinkler on the system. The connection shall return water to the tank.
 - (g) Any disconnecting means for the pump shall be approved.
 - (h) A method for refilling the tank shall be piped to the tank.
 - (i) A method of seeing the water level in the tank shall be provided without having to open the tank.
 - (j) The pump shall not be permitted to sit directly on the floor.

Add new Section 6.2.2.1 as follows:

6.2.2.1 Where a fire sprinkler system is supplied by a stored water source with an automatically operated means of pressurizing the system other than an electric pump, the water supply may serve the sprinkler system only.

Add new Section 6.2.4 as follows:

6.2.4 Where a water supply serves both domestic and fire sprinkler systems, 5 gpm (19 L/min) shall be added to the sprinkler system demand at the point where the systems are connected, to determine the size of common piping and the size of the total water supply requirements where no provision is made to prevent flow into the domestic water system upon operation of a sprinkler. For multipurpose piping systems, the 5 gpm (19 L/min) demand shall be added at the domestic connection nearest the design area. This demand may be split between two domestic connections at 2.5 gpm (10 L/min) each.

Revise Section 8.3.4 as follows:

8.3.4* Sprinklers shall not be required in detached garages, open attached porches, carports with no habitable space above, and similar structures.

Add new Sections 8.3.11 and 8.3.11.1 as follows:

8.3.11 Solar photovoltaic panel structures

8.3.11.1 Sprinklers shall be permitted to be omitted from the following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

NFPA—continued

13R—22: Standard for the Installation of Sprinkler Systems in Low-rise Residential Occupancies as amended*
903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.3.5.2, 903.4

**NFPA 13R, Amended Sections as follows:*

Revise Section 2.2 and add publications as follows:

2.2 NFPA Publications.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2013 California edition.

Add new Sections 6.6.10 and 6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures

6.6.10.1 *Sprinklers shall be permitted to be omitted from the following structures:*

- (1) *Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.*
- (2) *Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.*

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

- (1) *All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.*
- (2) *NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2013 California Edition and Title 19, California Code of Regulations, Chapter 5.*
- (3) *Once the system is accepted by the authority having jurisdiction a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.*

14—19: Standard for the Installation of Standpipe and Hose System, as amended*
905.2, 905.3.4, 905.4.2, 905.6.2, 905.8

**NFPA 14, Amended Sections as follows:*

Replace Section 6.3.7.1

6.3.7.1 *System water supply valves, isolation control valves, and other valves in fire mains shall be supervised in an approved manner in the open position by one of the following methods:*

- (1) *Where a building has a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:*
 - (a) *a central station, proprietary or remote supervising station, or*
 - (b) *a local signaling service that initiates an audible signal at a constantly attended location.*
- (2) *Where a building does not have a fire alarm system or a sprinkler monitoring system installed, the valve shall be supervised by:*
 - (a) *Locking the valves in the open position, or*
 - (b) *Sealing of valves and an approved weekly recorded inspection where valves are located within fenced enclosures under the control of the owner.*

16—19: Standard for the Installation of Foam-water Sprinkler and Foam-water Spray Systems
904.7, 904.13

17—21: Standard for Dry Chemical Extinguishing Systems
904.6, 904.13

17A—21: Standard for Wet Chemical Extinguishing Systems
904.5, 904.13

20—19: Standard for the Installation of Stationary Pumps for Fire Protection
412.2.4.1, 913.1, 913.2, 913.2.1, 913.5

24—19: Standard for Installation of Private Fire Service Mains and Their Appurtenances, as amended*
3109F

**NFPA 24, Amended Sections as follows:*

Amend Section 4.2.1 as follows:

Section 4.2.1. *Installation work shall be done by fully experienced and responsible contractors. Contractors shall be appropriately licensed in the State of California to install private fire service mains and their appurtenances.*

NFPA—continued

Revise Section 4.2.2 as follows:

4.2.2 Installation or modification of private fire service mains shall not begin until plans are approved and appropriate permits secured from the authority having jurisdiction.

Add Section 4.2.2.1 as follows:

4.2.2.1 As approved by the authority having jurisdiction, emergency repair of existing system may start immediately, with plans being submitted to the authority having jurisdiction within 96 hours from the start of the repair work.

Revise Section 5.9.5.1 as follows:

5.9.5.1 Fire department connections shall be on the street side of buildings and as approved by the authority having jurisdiction.

Add Sections 6.6.1.1, 6.6.1.2, 6.6.1.3 and 6.6.1.4 as follows:

6.6.1.1 Sectional control valves are not required when the fire service main system serves less than six fire appurtenances.

6.6.1.2 Sectional control valves shall be indicating valves in accordance with NFPA 13, Section 6.7.1.3.

6.6.1.3 Sectional control valves shall be located so that no more than five fire appurtenances are affected by shut-down of any single portion of the fire service main. Each fire hydrant, fire sprinkler system riser and standpipe riser shall be considered a separate fire appurtenance. In-rack sprinkler systems shall not be considered as a separate appurtenance.

6.6.1.4 The number of fire appurtenances between sectional control valves is allowed to be modified by the authority having jurisdiction.

Revise Section 10.4.3.1.1 as follows:

10.4.3.1.1 Pipe joints shall not be located under foundation footings. The pipe under the building or building foundation shall not contain mechanical joints.

Exceptions:

1. Where allowed in accordance with 10.4.3.2.
2. Alternate designs may be utilized where designed by a registered professional engineer and approved by the enforcing agency.

Revise Section 10.9.1 as follows:

10.9.1 Backfill shall be well tamped in layers or puddle under and around pipes to prevent settlement or lateral movement. Backfill shall consist of clean fill sand or pea gravel to a minimum 6" below and to a minimum of 12" above the pipe and shall contain no ashes, cinders, refuse, organic matter or other corrosive materials. Other backfill materials and methods are permitted where designed by a registered professional engineer and approved by the enforcing agency.

25—13CA: California NFPA 25 Edition (Based on the 2011 Edition) Inspection, Testing and Maintenance of Water-based Fire Protection Systems
Chapter 31F, 3108F

30—21: Flammable and Combustible Liquids Code

415.6.1, 415.6.2, 507.8.1.1.1, 507.8.1.1.2

30A—21: Code for Motor Fuel Dispensing Facilities and Repair Garages

406.2.9.2

31—20: Standard for the Installation of Oil-burning Equipment

2113.15

32—16: Standard for Dry Cleaning Facilities, as amended*

415.9.3, 2101.1.1

***NFPA 32, Amended Sections as follows:**

Delete the following publications from Section 2.2:

2.2 NFPA Publications.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2010 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2011 edition.

NFPA 70, *National Electrical Code*[®], 2011 edition.

NFPA 101[®], *Life Safety Code*[®], 2009 edition.

NFPA 5000[®], *Building Construction and Safety Code*[®], 2009 edition.

Revise Section 4.4.1.1 as follows:

4.4.1.1 General building and structure design and construction shall be in accordance with *California Building Code*.

Delete language to Sections 4.4.1.2 and 4.4.1.3 and reserve section numbers.

4.4.1.2 Reserved

4.4.1.3 Reserved

NFPA—continued

Revise Section 4.4.4 as follows:

4.4.4 Means of Egress. Means of egress shall conform with the provisions of *the California Building Code*.

Revise Section 4.6.2 as follows:

4.6.2 Automatic Sprinkler Systems. Where required by this standard, automatic sprinkler systems shall be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, and periodically inspected, tested and maintained in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 5*.

Revise Section 4.6.4 as follows:

4.6.4 Portable Fire Extinguishers. Suitable numbers and types of portable fire extinguishers shall be installed and maintained throughout the drycleaning plant in accordance with *California Code of Regulations, Title 19, Division 1, Chapter 3*.

Revise Section 7.3.2 as follows:

7.3.2 Electrical Installations. Electrical equipment and wiring in a Type II drycleaning room shall comply with the provisions of *California Electrical Code*, for use in Class I, Division 2 hazardous locations.

37—18: *Installation and Use of Stationary Combustion Engines and Gas Turbines* ||

40—19: *Standard for the Storage and Handling of Cellulose Nitrate Film*
409.1

51—18: *Design and Installation of Oxygen-fuel Gas Systems for Welding, Cutting and Allied Processes* ◀
3501.5, 3507.1, 3509.1

52—19: *Vehicular Gaseous Fuel System Code*
319.9.2, 5301.1

54—18: *National Fuel Gas Code* ||

55—19: *Compressed Gases and Cryogenic Fluids Code*
3508.1, 5301.1, 5307.4.2, 5501.1, 5801.1, 6301.1

56—20: *Standard for Fire and Explosion Prevention during Cleaning and Purging of Flammable Gas Piping Systems*
3307.2.1

58—20: *Liquefied Petroleum Gas Code*
415.9.2

61—20: *Standard for the Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities*
426.1

68—13: *Standard on Explosion Protection by Deflagration Venting*
Table 414.5.1, 911.1, 911.4, Table 2205.1

70—20: *National Electrical Code*
108.3, 406.2.7, 406.2.9, 412.5.7, 415.11.1.8, Table 509.1, 904.3.1, 907.6.1, 909.12.2, 909.16.3, 910.4.6, 1204.4.1, 2701.1, 2702.1.3, 3111.3

72—22: *National Fire Alarm and Signaling Code, as amended** ||
508.1.6, 604.6.3, Table 901.6.1, 903.4.1, 904.3.5, 907.1.2, 907.1.5, 907.2, 907.2.6, 907.2.6.3.3, 907.2.9.3, 907.2.11, 907.2.11.8, 907.2.13.2, 907.2.26.1, 907.2.26.4, 907.3, 907.3.3, 907.3.4, 907.5.2.1.2, 907.5.2.1.3, 907.5.2.1.3.1, 907.5.2.1.3.2, 907.5.2.2, 907.5.2.3.3, 907.5.2.3.4, 907.6, 907.6.1, 907.6.1.1, 907.6.2, 907.6.4.1, 907.6.6, 907.6.6.1, 907.6.6.4, 907.7, 907.7.1, 907.7.2, 907.8, 907.8.2, 907.8.2.4, 907.8.4, 917.1, 1009.12, 1103.3.2, 1203.2.4, 1207.5.4, 1207.6.1.2.3, 1207.6.1.2.4, Table 1207.7, 2810.11

*NFPA 72, *Amended Sections as follows:*

Revise Section 10.3.1 as follows:

10.3.1 Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. *Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

Revise Section 10.3.3 as follows:

10.3.3 All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be *California State Fire Marshal* listed for use with the control unit. <

Revise Section 12.3.8.1 as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure or raceway only under the following conditions:

- (1) For a distance not to exceed 10 ft (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance or control unit enclosures.

NFPA—continued

(2) Single drops installed in the raceway to individual devices or appliances.

(3)*In a single room not exceeding 1000 ft² (93 m²) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices.

(4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire-resistive rating.

Revise Section 14.4.6.1 as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in *accordance with the manufacturer's published instructions* according to the methods of Table 14.4.3.2.

Revise Section 17.15 as follows:

17.16 Fire Extinguisher Electronic Monitoring Device. A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by *California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2 (c) and California Fire Code to a fire alarm control unit.*

Delete the amendments to Section 21.3.6 and adopt the model text.

Revise Section 12.3.8 as follows:

12.3.8(5) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

23.8.1.2 Positive Alarm Sequence

23.8.1.2.1 *Systems that have positive alarm features complying with 23.8.1.2 shall be permitted if approved by the authority having jurisdiction. Operation of a patient room smoke detector in Group I-2 and R-2.1 occupancies shall not include a positive alarm sequence feature.*

Revise Section 23.8.5.1.2 as follows:

23.8.5.1.2* Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring *as permitted in section 17.15 of NFPA 72.*

Revise Section 23.8.5.4.1 as follows:

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

(1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.

(2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 by more than 30 seconds.

(3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1 or 21.2.1 without additional delay.

(4) The current status of the alarm verification feature is shown on the record of completion (*see Figure 7.8.2(a), Item 4.3*).

(5) *Operation of a patient room smoke detector in I-2 and R-2.1 occupancies shall not include an alarm verification feature.*

Revise Section 29.3.1 as follows:

29.3.1 All devices, combinations of devices, and equipment to be installed in conformity with this chapter shall be approved *and* listed by the California State Fire Marshal for the purposes for which they are intended.

Revise Section 29.8.2.1.1 as follows:

29.8.2.1.1* Smoke and Heat Alarms. *Where connected to a supervising station unless exempted by applicable laws, codes or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.*

Note: Exception to 29.8.2.1.1 not adopted by the SFM.

Add Section 29.10.2.1 as follows:

29.10.2.1 *The alarm verification feature shall not be used for household fire warning equipment.*

Add Section 29.10.6.8.1 as follows:

29.10.6.8.1 *The alarm verification feature shall not be used for household fire warning equipment.*

76—16: Standard for the Fire Protection of Telecommunications Facilities

1207.1.2.1, 1207.2.1, 1207.3.1, 1207.3.7.1, 1207.4.1, 1207.5.1, 1207.5.2, 1207.5.3, 1207.5.5, Table 1207.6, 1207.6.2.3, Table 1207.7

NFPA—continued

- 80—19: Standard for Fire Doors and Other Opening Protectives**
410.2.5, 509.4.2, 716.1, 716.2.5.1, 716.2.6.4, 716.2.9, 716.3.4.1, 716.3.5, 716.4.3, 1010.3.3
- 82—19: Standard on Incinerators and Waste and Linen Handling Systems and Equipment**
713.13
- 85—19: Boiler and Combustion System Hazards Code**
426.1
- 92—18: Standard for Smoke Control Systems**
909.7, 909.8
- 96—20: Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations**
606.2, 904.13
- 99—21: Health Care Facilities Code**
407.11, 422.6, 425.1
- 101—21: Life Safety Code**
1030.6.2
- 105—19: Standard for Smoke Door Assemblies and Other Opening Protectives**
405.4.2, 710.5.2.2, 716.2.10, 909.20.4.1
- 110—19: Standard for Emergency and Standby Power Systems**
2702.1.3, *3111F*
- 111—19: Standard on Stored Electrical Energy Emergency and Standby Power Systems**
2702.1.3, *3111F*
- 120—20: Standard for Fire Prevention and Control in Coal Mines**
426.1
- 170—18: Standard for Fire Safety and Emergency Symbols**
1025.2.6.1
- 211—19: Standard for Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances**
2112.5
- 221—21: Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls**
706.2, Table 716.1(2)
- 241—19: Standard for Safeguarding Construction, Alteration and Demolition Operations**
3301.1, 3303.2
- 252—17: Standard Methods of Fire Tests of Door Assemblies**
Table 716.1(1), 716.1.1, 716.1.2.2.1, 716.2.1.1, 716.2.1.2, 716.2.2.1, 716.2.2.2, 716.2.2.3.1, 716.2.5.1.1
- 253—19: Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source**
406.2.4, 424.2, 804.2, 804.3
- 257—17: Standard for Fire Test for Window and Glass Block Assemblies**
Table 716.1(1), 716.1.1, 716.1.2.2.2, 716.3.1.1, 716.3.1.2, 716.3.2.1.3, 716.3.4
- 259—18: Standard Test Method for Potential Heat of Building Materials**
2603.4.1.10, 2603.5.3
- 260—19 Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture**
805.1.1.1, 805.2.1.1, 805.3.1.1, 805.4.1.1
- 265—19: Standard Methods of Fire Tests for Evaluating Room Fire Growth Contribution of Textile or Expanded Vinyl Wall Coverings on Full Height Panels and Walls**
803.5.1, 803.5.1.1
- 268—19: Standard Test Method for Determining Ignitability of Exterior Wall Assemblies Using a Radiant Heat Energy Source**
1405.1.1.1, 1405.1.1.1.1, 1405.1.1.1.2, 2603.5.7
- 275—17: Standard Method of Fire Tests for the Evaluation of Thermal Barriers**
508.4.4.1, 509.4.1.1, 1406.10.2, 1408.10.2, 2603.4
- 276—19: Standard Method of Fire Tests for Determining the Heat Release Rate of Roofing Assemblies with Combustible Above-deck Roofing Components**
1508.1, 2603.3, 2603.4.1.5

REFERENCED STANDARDS

NFPA—continued

- 285—19: Standard Fire Test Method for the Evaluation of Fire Propagation Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components**
718.2.6, 1402.5, 1406.10.3, 1408.10.4, 1511.6.2, 2603.5.5
- 286—15: Standard Methods of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth**
402.6.4.4, 424.2, 803.1.1, 803.1.1.1, 803.11, 803.12, 803.13, 1406.10.2, 1408.10.3, 2603.7, 2603.9, 2604.2.4, 2614.4, 3105.3
- 288—17: Standard Methods of Fire Tests of Horizontal Fire Door Assemblies Installed in Horizontal in Fire-resistance-rated Floor Systems**
712.1.13.1
- 289—19: Standard Method of Fire Test for Individual Fuel Packages**
402.6.2, 402.6.4.5, 424.2, 806.4
- 409—16: Standard for Aircraft Hangars**
412.3.6, Table 412.3.6, 412.3.6.1, 412.5.5
- 418—16: Standard for Heliports**
412.7.4
- 484—19: Standard for Combustible Metals**
426.1
- 502—14: Standard for Road Tunnels, Bridges, and Other Limited Access Highways**
429
- 652—19: Standard on the Fundamentals of Combustible Dust**
426.1
- 654—20: Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids**
426.1
- 655—17: Standard for the Prevention of Sulfur Fires and Explosions**
426.1
- 664—20: Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities**
426.1
- 701—19: Standard Methods of Fire Tests for Flame Propagation of Textiles and Films**
410.2.6, 424.2, 806.4, 3102.3, 3102.3.1, 3102.6.1.1, 3105.3
- 704—17: Standard System for the Identification of the Hazards of Materials for Emergency Response**
202, 415.5.2
- 750—19: Standard on Water Mist Fire Protection Systems**
202, 904.11.1.1, 904.13
- 1124—17: Code for the Manufacture, Transportation and Storage and Retail Sales of Fireworks and Pyrotechnic Articles**
415.6.4.1
- 2001—18: Standard on Clean Agent Fire Extinguishing Systems, as amended***
904.10
- *NFPA 2001, Amended Sections as follows:*
- Add Sections 4.3.5.1.1 and 4.3.5.2.1 to read as follows:*
- 4.3.5.1.1 Alarms signals from the fire extinguishing system shall not interfere with the building fire alarm signal.*
- 4.3.5.2.1 The lens on visual appliances shall be “red” in color.*
- Exception: Other lens colors are permitted where approved by the enforcing agency.*
- 2010—20: Standard for Fixed Aerosol Fire-extinguishing Systems**
904.12
- 2245—2006: Below-grade Vaults for Flammable Liquid Storage Tanks**
5704.2.8.1
- 2335—2010: Fire Tests of Storage Pallets—with revisions through August 2017**
315.7.5, 3206.4.1.1
- 2360—2000: Test Methods for Determining the Combustibility Characteristics of Plastics Used in Semi-conductor Tool Construction—with revisions through October 2017**
2703.10.1.2

NFPA—continued

- 2524—2019: Standard for In-building 2-way Emergency Radio Communication Enhancement Systems
510.4
- 9540 *Edition 2—2020: Standard for Energy Storage Systems and Equipment* ||
1207.3.1, 1207.3.2, 1207.3.7, 1207.10.6, 1207.10.7.4, 1207.11.1, 1207.11.5
- 9540A *Edition 4—2019: Standard for Safety Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems* ||
1207.1.5, 1207.6.3
- 60601-1—2003: Medical Electrical Equipment, Part I: General Requirements for Safety
603.5.1.1
- 60950-1—2014: Information Technology Equipment—Safety Requirements
320.2.1
- 62368-1—2014: Audio/video, Information and Communication Technology Equipment—Safety Requirements
320.2.1

SFM

State of California
Department of Forestry and Fire Protection
Office of the State Fire Marshal
P.O. Box 944246
Sacramento, CA 94246-2460

SFM 12-3	Releasing Systems for Security Bars in Dwellings.....
SFM 12-7-3	Fire-testing Furnaces.....
SFM 12-7A-1	Exterior Wall Siding and Sheathing.....
SFM 12-7A-2	Exterior Window.....
SFM 12-7A-3	Under Eave.....
SFM 12-7A-4	Decking.....
SFM 12-7A-4A	Decking Alternate Method A.....
SFM 12-7A-5	Ignition Resistant Building Material.....
SFM 12-8-100	Room Fire Tests for Wall and Ceiling Materials.....
SFM 12-10-1	Power Operated Exit Doors.....
SFM 12-10-2	Single Point Latching or Locking Devices.....
SFM 12-10-3	Emergency Exit and Panic Hardware.....

(The Office of the State Fire Marshal standards referred to above are found in the California Code of Regulations, Title 24, Part 12.)

UL

Underwriters Laboratories LLC
333 Pfingsten Road
Northbrook, IL 60062

- 10C—2016: Positive Pressure Fire Tests of Door Assemblies
1010.2.9.3
- 13—96: *Power-limited Circuit Cables*
- 30—1995: *Metal Safety Cans—with revisions through June 2014*
5003.9.10, 5005.1.10, 5705.2.4, 5707.2
- 38—99: *Manually Actuated Signaling Boxes—with Revisions through February 2, 2005 as amended.**

**Amend Section 14.1.5 as follows:*

14.1.5 A signaling box having a glass panel, disc, rod or similar part that must be broken to operate it for a signal or for access to its actuating means shall satisfactorily complete five part-breaking operations using the means provided with the box, without jamming of the mechanism or other interference by broken particles. It shall be practicable to remove and replace the broken parts. A signaling box shall not have a glass panel, disc, rod or similar part requiring a striking action by grasping a tool to operate it for a signal. The force required to activate controls shall be no greater than 5 pounds (22 N) of force.

**Add Appendix B chapter to UL 38 (1999) as follows:*

Appendix B,

14.1.5 Operation. *Controls and operating mechanisms shall be operable with one hand and shall not require tight grasping, pinching or twisting of the wrist.*

REFERENCED STANDARDS

UL—continued

- 58—2018: Steel Underground Tanks for Flammable and Combustible Liquids**
5704.2.13.1.5
- 80—2007: Steel Tanks for Oil-burner Fuels and Other Combustible Liquids—with revisions through January 2014**
319.7.1, 605.4.2.1, 605.4.2.2, 607.2
- 87A—2015: Power-operated Dispensing Devices for Gasoline and Gasoline/Ethanol Blends with Nominal Ethanol Concentrations up to 85 Percent—with revisions through June 2017**
2306.8.1
- 142—2006: Steel Aboveground Tanks for Flammable and Combustible Liquids—with revisions through August 2014**
319.7.1, 605.4.1.1, 605.4.2.1, 605.4.2.2, 607.2, 2306.2.3
- 193—04: Alarm Valves for Fire-Protection Service*
- 199—95: Automatic Sprinklers for Fire Protection Service—with Revisions through August 19, 2005*
- 199E—2004: Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers**
904.13.4.1
- 217—2015: Single and Multiple Station Smoke Alarms—with revisions through November 2016**
907.2.11, 915.4.4
- 228—97: Door Closers/ HOLDERS, with or without Integral Smoke Detectors—with Revisions through January 26, 2006*
- 260—04: Dry Pipe and Deluge Valves for Fire Protection Service*
- 262—04: Gate Valves for Fire Protection Service*
- 268—2016: Smoke Detectors for Fire Alarm Systems—with revisions through July 2016**
907.2.6.2, 907.2.11.7, 915.5.3
- 268A—09: Smoke Detectors for Duct Application—with Revisions through October 22, 2003*
- 294—2018: Access Control System Units—with revisions through October 2018**
1010.2.11, 1010.2.12, 1010.2.13.1, 1010.2.14
- 300—2005: Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment—with revisions through December 2014**
904.13
- 300A—2006: Outline of Investigation for Extinguishing System Units for Residential Range Top Cooking Surfaces**
904.14.1.1
- 305—2012: Panic Hardware—with revisions through March 2017**
1010.2.9.3
- 312—04: Check Valves for Fire-Protection Service*
- 325—2017: Standard for Door, Drapery, Gate, Louver and Window Operators and Systems**
503.5, 503.6
- 498A—2008: Current Taps and Adaptors—with revisions through June 2016**
603.5.1
- 346—05: Waterflow Indicators for Fire Protective Signaling Systems*
- 464—03: Audible Signal Appliances—with Revisions through October 10, 2003*
- 497B—04: Protectors for Data Communication and Fire Alarm Circuits*
- 499—2014: Standard for Electrical Heating Appliances—with revisions through February 2017**
607.6
- 521—99: Heat Detectors for Fire Protective Signaling Systems—with Revisions through July 20, 2005*
- 539—00: Single- and Multiple-Station Heat Detectors—with Revisions through August 15, 2005*
- 632—00: Electrically Actuated Transmitters*
- 647—1993: Standard for Unvented Kerosene-fired Room Heaters and Portable Heaters—with revisions through April 2010**
605.5
- 710—2012: Exhaust Hoods for Commercial Cooking Equipment—with revisions through June 2018**
606.2
- 710B—2011: Recirculating Systems—with revisions through August 2014**
606.2, 904.13
- 723—2018: Standard for Test for Surface Burning Characteristics of Building Materials**
202, 803.1, 803.1.2, 803.3, 803.5.2, 803.10, 803.12, 803.13, 804.1.1, 804.1.2, 804.2.4, 3305.9

UL—continued

- 753—04: *Alarm Accessories for Automatic Water Supply Valves for Fire Protection Service*
- 790—2004: **Standard Test Methods for Fire Tests of Roof Coverings—with revisions through October 2018**
317.2, 317.3, 1207.9.5
- 791—2006: **Standard for Residential Incinerators—with revisions through November 2014**
605.8.1
- 791—06: *Standard for Residential Incinerators*
605.8
- 793—2008: **Automatically Operated Roof Vents for Smoke and Heat—with revisions through March 2017**
910.3.1
- 813—96: *Commercial Audio Equipment—with Revisions through December 7, 1999*
- 817—2015: **Standard for Cord Sets and Power-supply Cords—with revisions through August 2018**
603.6
- 864—2014: **Control Units and Accessories for Fire Alarm Systems—with revisions through March 2018**
909.12

**Amend No. 55.1 as follows:*

RETARD-RESET-RESTART PERIOD – MAXIMUM 30 SECONDS —*No alarm obtained from control unit. Maximum permissible time is 30 seconds.*

**Amend Section 55.2.2 as follows:*

Where an alarm verification feature is provided, the maximum retard-reset-restart period before an alarm signal can be confirmed and indicated at the control unit, including any control unit reset time and the power-up time for the detector to become operational for alarm, shall not exceed 30 seconds. (The balance of the section text is to remain unchanged).

**Add Section 55.2.9 as follows:*

Smoke detectors connected to an alarm verification feature shall not be used as releasing devices.

Exception: *Smoke detectors which operate their releasing function immediately upon alarm actuation independent of alarm verification feature.*

**Amend Section 89.1.10 as follows:*

The existing text of this section is to remain as printed with one editorial amendment as follows:

THE TOTAL DELAY (CONTROL UNIT PLUS SMOKE DETECTORS) SHALL NOT EXCEED 30 SECONDS.

(The balance of the section text is to remain unchanged).

- 900—2015: **Air Filter Units**
2404.7.8
- 924—2016: **Standard for Safety Emergency Lighting and Power Equipment—with revisions through May 2018**
1013.5, 3103.12.6.1
- 971A—2006: **Outline of Investigation for Metallic Underground Fuel Pipe**
Table 5703.6.2
- 1037—2016: **Antitheft Alarms and Devices—with revisions through September 2017**
506.1
- 1046—2010: **Grease Filters for Exhaust Ducts—with revisions through April 2017**
606.3.1
- 1275—2014: **Flammable Liquid Storage Cabinets—with revisions through February 2018**
5003.8.7.1, 5704.3.2.1.1
- 1313—2015: **Nonmetallic Safety Cans for Petroleum Products**
5003.9.10
- 1315—2017: **Safety for Metal Waste Paper Containers**
808.1, 808.2
- 1316—1994: **Glass Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols and Alcohol-gasoline Mixtures—with revisions through May 2006**
5704.2.13.1.5
- 1363—2018: **Relocatable Power Taps**
603.5.1

REFERENCED STANDARDS

UL—continued

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CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX CHAPTER 4 –
SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]				X																		
Chapter / Section																						
[T-19 §3.26]				X																		

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX CHAPTER 4

SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

SECTION 435 SPECIAL PROVISIONS FOR LICENSED 24-HOUR CARE FACILITIES IN A GROUP R-2.1, R-3.1, R-4 [SFM]

435.1 Scope. The provisions of this section shall apply to 24-hour care facilities in a Group R-2.1, R-3.1 or R-4 occupancy licensed by a governmental agency.

435.2 General. The provisions in this section shall apply in addition to general requirements in this code.

435.2.1 Restraint shall not be practiced in a Group R-2.1, R-3.1 or R-4 occupancies.

Exception: Occupancies which meet all the requirements for a Group I-3 occupancy.

435.2.2 Pursuant to Health and Safety Code, Section 13133, regulations of the state fire marshal pertaining to occupancies classified as Residential Facilities (RF) and Residential-care Facilities for the Elderly (RCFE) shall apply uniformly throughout the state and no city, county, city and county, including a charter city or charter county, or fire protection district shall adopt or enforce any ordinance or local rule or regulation relating to fire and panic safety which is inconsistent with these regulations. A city, county, city and county, including a charter city or charter county may, pursuant to Health and Safety Code, Section 13143.5, or a fire protection district may, pursuant to Health and Safety Code, Section 13869.7, adopt standards more stringent than those adopted by the state fire marshal that are reasonably necessary to accommodate local climate, geological or topographical conditions relating to roof coverings for Residential-care Facilities for the Elderly.

Exception: Local regulations relating to roof coverings in facilities licensed as a Residential Care Facility for the Elderly (RCFE) in accordance with Health and Safety Code Section 13133.

435.3 Building height and area provisions.

435.3.1 Group R-2.1, R-3.1 and R-4 shall be constructed in accordance with Table 504.3 of the California Building Code.

[California Code of Regulations, Title 19, Division 1, §3.26]
Operators Statement – Group I, R-2.1, R-3.1 and R-4 Occupancies. Every person, firm or corporation maintaining or operating any Group I or R-2.1, R-3.1 or R-4 occupancy shall provide an operators statement in accordance with Section 13132 of the Health and Safety Code which reads as follows:

“**13132.** Every person, firm or corporation maintaining or operating any facility for the care of the mentally handicapped shall file a statement with the fire authority having jurisdiction within five days of the admission or readmission of a patient stating that such patient is an ambulatory or a nonambulatory person and enumerating the reasons for such classification. Such a

statement shall also be filed for each existing patient within 30 days of the effective date of this section.

Any statement required to be filed pursuant to this section shall be certified as to its correctness by the person attending such patient.

It shall be unlawful for any person, firm or corporation required to file a statement pursuant to this section to include false statements therein. Any such act shall be in violation of this section and subject to the provisions of Section 13112.”

435.3.2 Limitations six or less clients. Group R-3.1 occupancies where nonambulatory clients are housed above the first story, having more than two stories in height or having more than 3,000 square feet (279 m²) of floor area above the first story shall not be of less than 1-hour fire-resistance-rated construction throughout.

In Group R-3.1 occupancies housing a bedridden client, the client sleeping room shall not be located above or below the first story.

Exception: Clients who become bedridden as a result of a temporary illness as defined in Health and Safety Code, Sections 1566.45, 1568.0832, and 1569.72. A temporary illness is an illness which persists for 14 days or less. A bedridden client may be retained in excess of the 14 days upon approval by the Department of Social Services and may continue to be housed on any story in a Group R-3.1 occupancy classified as a licensed residential facility.

Every licensee admitting or retaining a bedridden resident shall, within 48 hours of the resident’s admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

435.3.3 Limitations seven or more clients. Group R-4 occupancies, where nonambulatory clients are housed above the first story and there is more than 3,000 square feet (279 m²) of floor area above the first story or housing not more than 16 clients above the first story, shall be constructed of not less than 1-hour fire-resistance-rated construction throughout.

435.3.4 Ambulatory and nonambulatory elderly clients. Group R-4 occupancies housing nonambulatory elderly clients shall be of not less than 1-hour fire-resistance-rated construction throughout.

435.4 Type of construction provisions.

435.4.1 Group R-2.1, occupancies are not permitted in non-fire-resistance-rated construction, see Health and Safety Code, Section 13131.5.

435.5 Fire-resistance-rated construction provisions.

435.5.1 Smoke barriers required. Group R-2.1 and R-4 occupancies licensed as a Residential Care Facility (RCF)

with individual floor areas over 6000 square feet (557 m²) per floor, shall be provided with smoke barriers, constructed in accordance with Section 710 of the California Building Code.

Group R-2.1 occupancies housing bedridden clients shall be provided with smoke barriers constructed in accordance with Section 710 of the California Building Code regardless of the number of clients.

When smoke barriers are required, the area within a smoke compartment shall not exceed 22,500 square feet (2090 m²) nor shall its travel distance exceed 200 feet (60 960 mm). Such smoke barriers shall divide the floor as equally as possible.

435.5.2 Smoke partitions. Group R-2.1 occupancies where smoke partitions are required, framing shall be covered with noncombustible materials having an approved thermal barrier with an index of not less than 15 in accordance with FM 4880, UL 1040, NFPA 286 or UL 1715.

435.5.3 Independent egress. At least two means of egress shall be provided from each smoke compartment created by smoke barriers. Means of egress may pass through adjacent compartments provided it does not return through the smoke compartment from which means of egress originated.

435.6 Interior finish provisions.

435.6.1 Interior wall and ceiling finish. Group R-3.1 occupancies housing a bedridden client shall comply with Interior Wall and Ceiling Finish requirements specified for Group I-2 occupancies in Table 903.3 of the California Building Code.

435.6.2 Safety padding. Padding material used on walls, floors and ceilings in Group I and R-2.1 occupancies shall be of an approved type tested in accordance with the procedures established by State Fire Marshal Standard 12-8-100, Room Fire Test for Wall and Ceiling Materials, California Code of Regulations, Title 24, Part 12.

435.7 Fire Protection system provisions.

435.7.1 Automatic sprinkler systems in Group R-2.1, R-3.1 and R-4 occupancies. An automatic sprinkler system shall be installed where required in Section 903.

435.7.2 Fire alarm systems in Group R-2.1 and R-4 occupancies. An approved fire alarm system shall be installed where required in Section 907.

435.7.3 Smoke alarms in Groups R-2.1, R-3.1 and R-4 occupancies. Smoke alarms shall be installed where required in Section 907.2.11.2.

435.7.4 Hearing impaired. See Section 907.5.2.3.5.

435.8 Means of egress provisions.

435.8.1 General. In addition to the general means of egress requirements of Chapter 10, this section shall apply to Group R-2.1, R-3.1 and R-4 occupancies.

435.8.2 Number of exits.

435.8.2.1 Group R-2.1, R-3.1 and R-4 occupancies shall have a minimum of two exits.

Exception. Ancillary use areas or occupancies shall have egress as required by Section 1021.

435.8.3 Egress arrangements.

435.8.3.1 Egress through adjoining dwelling units shall not be permitted.

435.8.3.2 Group R-3.1 occupancies housing nonambulatory clients. In a Group R-3.1 occupancy, bedrooms used by nonambulatory clients shall have access to at least one of the required exits which shall conform to one of the following:

1. Egress through a hallway or area into a bedroom in the immediate area which has an exit directly to the exterior and the corridor/hallway is constructed consistent with the dwelling unit interior walls. The hallway shall be separated from common areas by a solid wood door not less than 1³/₈ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9 of the California Building Code.
2. Egress through a hallway which has an exit directly to the exterior. The hallway shall be separated from the rest of the house by a wall constructed consistent with the dwelling unit interior walls and opening protected by a solid wood door not less than 1³/₈ inch (35 mm) in thickness, maintained self-closing or shall be automatic closing by actuation of a smoke detector installed in accordance with Section 716.5.9 of the California Building Code.
3. Direct exit from the bedroom to the exterior, such doors shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed, doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).
4. Egress through an adjoining bedroom which exits to the exterior.

435.8.3.3 Group R-3.1 occupancies housing only one bedridden client. In Group R-3.1 occupancies housing a bedridden client and not provided with an approved automatic fire sprinkler system, all of the following shall apply:

1. In Group R-3.1 occupancies housing a bedridden client, a direct exit to the exterior of the residence shall be provided from the client sleeping room.
2. Doors to a bedridden client's sleeping room shall be of a self-closing, positive latching 1³/₈ inch

solid wood door. Such doors shall be provided with a gasket so installed as to provide a seal where the door meets the jam on both sides and across the top. Doors shall be maintained self-closing or shall be automatic closing by actuation of a smoke detector in accordance with California Building Code, Section 716.5.9.

3. Group R-3.1 occupancies housing a bedridden client shall not have a night latch, dead bolt, security chain or any similar locking device installed on any interior door leading from a bedridden client's sleeping room to any interior area such as a corridor, hallway and/or general use areas of the residence in accordance with Chapter 10.
4. The exterior exit door to a bedridden client's sleeping room shall be operable from both the interior and exterior of the residence.
5. Every required exit doorway from a bedridden client sleeping room shall be of a size as to permit the installation of a door not less than 3 feet (914 mm) in width and not less than 6 feet 8 inches (2032 mm) in height. When installed in exit doorways, exit doors shall be capable of opening at least 90 degrees and shall be so mounted that the clear width of the exit way is not less than 32 inches (813 mm).

Note: A sliding glass door can be used as an exterior exit doorway as long as it is operable from the inside and outside and the clear width of the exit way is not less than 32 inches (813 mm).

435.8.3.4 Intervening rooms. A means of exit shall not pass through more than one intervening room. A means of egress shall not pass through kitchens, storerooms, closets, garages or spaces used for similar purposes.

Exception: Kitchens which do not form separate rooms by construction.

435.8.4 Corridors.

435.8.4.1 Unless specified by Section 435.8.4, corridors serving Group R-2.1 and Group R-4 occupancies shall comply with Section 1018.1.

435.8.4.2 The minimum clear width of a corridor shall be as follows:

1. Group R-2.1 occupancies shall have 60 inches (1524 mm) on floors housing nonambulatory clients and 44 inches (1118 mm) on floors housing only ambulatory clients.
2. Group R-4 occupancies shall have 44 inches (1118 mm) on floors housing clients.

Exceptions:

1. Corridors serving an occupant load of 10 or less shall not be less than 36 inches (914 mm) in width.
2. Corridors serving ambulatory persons only and having an occupant load of 49 or less

shall not be less than 36 inches (914 mm) in width.

In Group R-2.1 occupancies provided with fire sprinklers throughout and which are required to have rated corridors, door closers need not be installed on doors to client sleeping rooms.

435.8.4.3 In a Group R-2.1 and Group R-4 occupancies having smoke barriers, cross-corridor doors in corridors 6 feet (1829 mm) or less in width shall have, as a minimum, a door 36 inches (914 mm) in width.

435.8.5 Changes in level. In Group R-3.1 occupancies housing nonambulatory clients, interior changes in level up to 0.25 inch (6 mm) may be vertical and without edge treatment. Changes in level between 0.25 inch (6 mm) and 0.5 inch (12.7 mm) shall be beveled with a slope no greater than 1 unit vertical in 2 units horizontal (50-percent slope). Changes in level greater than 0.5 inch (12.7 mm) shall be accomplished by means of a ramp.

435.8.6 Stairways.

435.8.6.1 Group R-2.1 and Group R-4 occupancies housing more than six nonambulatory clients above the first floor shall be provided with two vertical exit enclosures. Stairway enclosures shall be in compliance with Section 1022.

435.8.6.2 Group R-3.1 occupancies may continue to use existing stairways (except for winding and spiral stairways which are not permitted as a required means of egress) provided the stairs have a maximum rise of 8 inches (203 mm) with a minimum run of 9 inches (229 mm). The minimum stairway width may be 30 inches (762 mm).

435.8.7 Floor separation. Group R-3.1 occupancies shall be provided with a non-fire-resistance constructed floor separation at stairs which will prevent smoke migration between floors. Such floor separation shall have equivalent construction of 0.5 inch (12.7 mm) gypsum wallboard on one side of wall framing.

Exceptions:

1. Occupancies with at least one exterior exit from floors occupied by clients.
2. Occupancies provided with automatic fire sprinkler systems complying with Chapter 9.

435.8.7.1 Doors within floor separations. Doors within such floor separations shall be tight fitting solid wood at least 1³/₈ inches (35 mm) in thickness. Door glazing shall not exceed 1296 square inches (32 918 mm²) with no dimension greater than 54 inches (1372 mm). Such doors shall be positive latching, smoke gasketed and shall be automatic-closing by smoke detection.

435.8.8 Fences and gates. Grounds of a Residential Care for the Elderly facility serving Alzheimer clients may be fenced and gates therein equipped with locks, provided safe dispersal areas are located not less than 50 feet (15 240 mm) from the buildings. Dispersal areas shall be sized to provide an area of not less than 3 square feet (0.28 m²) per occupant. Gates shall not be installed

across corridors or passageways leading to such dispersal areas unless they comply with egress requirements.

435.8.9 Basement exits. One exit is required to grade level when the basement is accessible to clients.

435.8.10 Delayed egress locks. See Section 1010.2.13.

435.9 Request for alternate means of protection for facilities housing bedridden clients. Request for alternate means of protection shall apply to Sections 435 through 435.9. Request for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the local fire enforcing agency by the facility, client or the client’s authorized representative. Sufficient evidence shall be submitted to substantiate the need for an alternate means of protection.

The facility, client or the client’s representative or the local fire enforcing agency may request a written opinion from the State Fire Marshal concerning the interpretation of the regulations promulgated by the State Fire Marshal for a particular factual dispute. The State Fire Marshal shall issue the written opinion within 45 days following the request.

Approval of a request for use of an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to this section shall be limited to Group R-3.1 occupancies housing a bedridden client.

Approvals made by the local fire enforcing agency and the written opinion by the State Fire Marshal shall be applicable only to the requesting facility and shall not be construed as establishing any precedent for any future request by that facility or any other facility.

435.10 Temporarily bedridden clients. Clients who become temporarily bedridden as defined in Health and Safety Code, Section 1569.72, as enforced by the Department of Social Services, may continue to be housed on any story in Group R-2.1, R-3.1 or R-4 occupancies classified as Residential Care Facilities for the Elderly (RCFE). Every Residential Care Facility for the Elderly (RCFE) admitting or retaining a bedridden resident shall, within 48 hours of the resident’s admission or retention in the facility, notify the local fire authority with jurisdiction of the estimated length of time the resident will retain his or her bedridden status in the facility.

**SECTION 436
GROUP I-4 [SFM]**

436.1 Group I-4 special provisions. Rooms classified as Group I-4 shall not be located above or below the first story.

Exceptions:

1. Basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from adjacent ground level at the level of exit discharge, provided the basement or story has exterior exit doors at that level.

2. Group I-4 child-care center or adult day care may be located above the first story in buildings of Types I-A, I-B, II-A, III-A, IV-A, IV-B and IV-C construction, subject to the limitation of Section 503 when:

- 2.1. Group I-4 child-care center with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and

- 2.2. The entire story in which the Group I-4 child-care center or adult day care is located is equipped with an approved manual fire alarm and automatic smoke-detection system. (See the California Fire Code.) Actuation of an initiating device shall sound an audible alarm throughout the entire story. When a building fire alarm system is required by other provisions of this code or the Fire Code, the alarm system shall be connected to the building alarm system. An approved alarm signal shall sound at an approved location in the Group I-4 facility to indicate a fire alarm or sprinkler flow condition in other portions of the building; and

- 2.3. Group I-4 child-care center or adult day care, if more than 1,000 square feet (92.9 m²) in area, is divided into at least two compartments of approximately the same size by a smoke barrier with door openings protected by smoke- and draft-control assemblies having a fire-protection rating of not less than 20 minutes. Smoke barriers shall have a fire-resistive rating of not less than one hour. In addition to the requirements of Section 508.3.3 of the California Building Code, occupancy separations between Group I-4 child-care center or adult day care and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier shall be tightfitting, with gaskets installed as required by Section 710 of the California Building Code, and shall be automatic closing by actuation of the automatic sprinklers, fire alarm or smoke-detection system.

- 2.4. Each compartment formed by the smoke barrier has not less than two exits or exit access doors, one of which is permitted to pass through the adjoining compartment; and

- 2.5. Where two or more exits or exit access are required, at least one shall not share a common path of travel. The egress system shall comply with the requirements of Section 709 for smoke barriers.

- 2.6. The building is equipped with an automatic sprinkler system throughout.

436.1.1 Egress. Rooms used for Group I-4 child-care or adult day care on the first floor shall have one exit door directly to the exterior.

Exception: One-hour rated corridors with a minimum width of 60 inches (1524 mm).

SECTION 452

SCHOOL FACILITIES FOR KINDERGARTEN

THROUGH 12TH GRADE AND GROUP E CHILD-CARE

452.1 General provisions. School facilities for Kindergarten through 12th grade and Group E day care shall comply with the provisions of this section and other applicable provisions of this code including requirements for specific occupancies.

452.1.1 Location on property. All buildings housing Group E occupancies shall front directly on a public street or an exit discharge not less than 20 feet (6096 mm) in width. The exit discharge to the public street shall be a minimum 20-foot-wide (6096 mm) right-of-way, unobstructed and maintained only as access to the public street. At least one required exit shall be located on the public street or on the exit discharge.

452.1.2 Separate means of egress systems required. Every room with an occupant load of 300 or more shall have one of its exits or exit-access doorways lead directly into a separate means of egress system that consists of not less than two paths of exit travel which are separated by a smoke barrier in accordance with Section 709 of the California Building Code in such a manner to provide an atmospheric separation that precludes contamination of both paths of exit travel by the same fire. Not more than two required exits or exit-access doorways shall enter into the same means of egress system.

452.1.3 Fences and gates. School grounds may be fenced and gates therein may be equipped with locks, provided that safe dispersal areas based on 3 square feet (0.28 m²) per occupant are located between the school and the fence. Such required safe dispersal areas shall not be located less than 50 feet (15 240 mm) from school buildings.

Every public and private school shall conform with Section 32020 of the Education Code which states:

The governing board of every public school district, and the governing authority of every private school, which maintains any building used for the instruction or housing of school pupils on land entirely enclosed (except for building walls) by fences of walls, shall, through cooperation with the local law enforcement and fire-protection agencies having jurisdiction of the area, make provision for the erection of gates in such fences or walls. The gates shall be of sufficient size to permit the entrance of the ambulances, police equipment and fire-fighting apparatus used by the law enforcement and fire-protection agencies. There shall be no less than one such access gate and there shall be as many such gates as needed to assure access to all major buildings and ground areas. If such

gates are to be equipped with locks, the locking devices shall be designed to permit ready entrance by the use of the chain or bolt-cutting devices with which the local law enforcement and fire-protection agencies may be equipped.

452.1.4 Special provisions. Rooms used by kindergarten, first- or second-grade pupils, and Group E child-care, shall not be located above or below the first story.

Exceptions:

1. Kindergarten, first- or second-grade pupils, or Group E child-care may be located in basements or stories having floor levels located within 4 feet (1219 mm), measured vertically, from the adjacent ground level at the level of exit discharge, provided the basement or story has exterior exit doors at that level.
2. In buildings equipped with an automatic sprinkler system throughout, rooms used for kindergarten, first- and second-grade children or for Group E child-care purposes may be located on the second story, provided there are at least two exterior exit doors, or other egress systems complying with Section 1020 with two exits, for the exclusive use of such occupants. Egress systems for the exclusive use of such occupants shall be maintained until exit discharge at grade is attained.
3. Group E day-care facilities may be located above the first story in buildings of Type I-A, Type I-B, Type II-A, III-A, IV-A, IV-B and IV-C construction, subject to the limitation of Section 503 when:
 - 3.1. Facilities with children under the age of seven or containing more than 12 children per story shall not be located above the fourth floor; and
 - 3.2. The entire story in which the day-care facility is located is equipped with an approved manual fire alarm and automatic smoke-detection system. Actuation of an initiating device shall sound an audible alarm throughout the entire story.

When a building fire alarm system is required by other provisions of this code, the alarm system shall be interconnected and sound the day-care fire alarm system; and

- 3.3. The day-care facility, if more than 1,000 square feet (92.9 m²) in area, is divided into at least two compartments of approximately the same size by a smoke barrier in accordance with Section 709 of the California Building Code. In addition to the requirements of Section 508, occupancy separations between daycare and other occupancies shall be constructed as smoke barriers. Door openings in the smoke barrier shall be tight fitting, with gaskets installed as required by

Section 716.5.3.1 of the California Building Code and shall be automatic closing by actuation of the fire sprinklers, fire alarm or smoke detection system; and

3.4. Each compartment formed by the smoke barrier has not less than two exits or exit-access doors, one of which is permitted to pass through the adjoining compartment, and

3.5. At least one exit or exit-access door from the day-care facility shall be into a separate means of egress with not less than two paths of exit travel, which are separated in such a manner to provide an atmospheric separation. The egress system shall comply with the requirements of Section 709 for smoke barriers.

3.6. The building is equipped with an automatic sprinkler system throughout.

452.1.5 Special hazards. School classrooms constructed after January 1, 1990, not equipped with automatic sprinkler systems, which have metal grilles or bars on all their windows and do not have at least two exit doors within 3 feet (914 mm) of each end of the classroom opening to the exterior of the building or to a common hallway used for evacuation purposes, shall have an inside release for the grilles or bars on at least one window farthest from the exit doors. The window or windows with the inside release shall be clearly marked as emergency exits.

452.1.6 Class I, II or III-A flammable liquids. Class I, II or III-A flammable liquids shall not be placed, stored or used in Group E occupancies, except in approved quantities as necessary in laboratories and classrooms and for operation and maintenance as set forth in the California Fire Code.

**SECTION 455
LARGE FAMILY DAY-CARE HOMES [SFM]**

455.1 Large family day-care homes.

455.2 For purposes of clarification, Health and Safety Code Section 1597.45 and 1597.46 is repeated.

1597.45.

- (a) The use of a home as a small or large family day-care home shall be considered a residential use of property and a use by right for the purposes of all local ordinances, including, but not limited to, zoning ordinances.
- (b) A local jurisdiction shall not impose a business license, fee or tax for the privilege of operating a small or large family day-care home.
- (c) Use of a home as a small or large family day-care home shall not constitute a change of occupancy for purposes of Part 1.5 (commencing with Section 17910) of Division 13 (State Housing Law) or for purposes of local building codes.

(d) A small or large family daycare home shall not be subject to the provisions of Division 13 (commencing with Section 21000) of the Public Resources Code.

(e) The provisions of this chapter do not preclude a city, county or other local public entity from placing restrictions on building heights, setback or lot dimensions of a family day-care home, as long as those restrictions are identical to those applied to all other residences with the same zoning designation as the family day-care home. This chapter does not preclude a local ordinance that deals with health and safety, building standards, environmental impact standards or any other matter within the jurisdiction of a local public entity, as long as the local ordinance is identical to those applied to all other residences with the same zoning designation as the family daycare home. This chapter also does not prohibit or restrict the abatement of nuisances by a city, county, or city and county. However, the ordinance or nuisance abatement shall not distinguish family day-care homes from other homes with the same zoning designation, except as otherwise provided in this chapter.

(f) For purposes of this chapter, “small family day-care home or large family daycare home” includes a detached single-family dwelling, a townhouse, a dwelling unit within a dwelling or a dwelling unit within a covered multifamily dwelling in which the underlying zoning allows for residential uses. A small family daycare home or large family day-care home is where the family day-care provider resides and includes a dwelling or dwelling unit that is rented, leased or owned.

(Amended by Stats. 2019, Ch. 244, Sec. 9. (SB 234) Effective January 1, 2020.)

1597.46.

(a) A large family daycare home shall abide by all standards, in addition to the requirements of the State Uniform Building Standards Code, that are specifically designed to promote fire and life safety in large family day-care homes. The State Fire Marshal shall adopt separate building standards specifically relating to the subject of fire and life safety in family day-care homes, which shall be published in Title 24 of the California Code of Regulations. These standards shall apply uniformly throughout the state and shall include, but not be limited to, all of the following:

- (1) The requirement that a large family daycare home contain a fire extinguisher or smoke detector device, or both, that meets child-care standards established by the State Fire Marshal.
- (2) Specification as to the number of required exits from the home.
- (3) Specification as to the floor or floors on which child-care may be provided and the number of required exits on each floor.

(b) A large family day-care home for children shall have one or more carbon monoxide detectors in the facility that meet the standards established in Chapter 8 (commencing with Section 13260) of Part 2 of Division 12. The department shall account for the presence of these detectors during inspections.

(c) Enforcement of this section shall be in accordance with Sections 13145 and 13146. A city, county, city and county, or district shall not adopt or enforce a building ordinance or local rule or regulation relating to the subject of fire and life safety in large family day-care homes that is inconsistent with those standards adopted by the State Fire Marshal, except to the extent the building ordinance or local rule or regulation applies to all residences with the same zoning designation in which child-care is provided.

(Repealed and added by Stats. 2019, Ch. 244, Sec. 12. (SB 234) Effective January 1, 2020.)

455.3 Smoke alarms. Large family day-care homes shall be equipped with State Fire Marshal approved and listed single station residential type smoke alarms. The number and placement of smoke alarms shall be determined by the enforcement authority.

455.4 Fire extinguishers. Large and small family day-care homes shall be equipped with a portable fire extinguisher having a minimum 2A10BC rating.

455.5 Fire alarm devices. See Section 907.2.6.4.

> **455.6 Compliance.** Every large-family day-care home shall comply with the provisions for Group R-3 occupancies. For the purposes of Section 436.1 of the California Building Code, the first story shall be designated as the floor used for residential occupancy nearest to the street level which provides primary access to the building.

> **455.7 Special hazards.** Every unenclosed gas-fired water heater or furnace which is within the area used for child-care in a large family day-care home shall be protected in such a way as to prevent children from making contact with those appliances.

Exception: This does not apply to kitchen stoves or ovens.

455.8 Exiting. See Section 1006.2.2.7.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX A – BOARD OF APPEALS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)
(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

Part VII—Appendices

APPENDIX A

BOARD OF APPEALS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix A contains optional criteria that, when adopted, provide jurisdictions with detailed appeals, board member qualifications and administrative procedures to supplement the basic requirements found in Section 111 of this code.

SECTION A101 GENERAL

A101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 111. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the fire code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

A101.2 Application for appeal. Any person shall have the right to appeal a decision of the fire code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the fire code official within 20 days after the notice was served.

A101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

A101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

A101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The fire code official shall be an ex officio member of said board but shall not vote on any matter before the board.

A101.3.1 Qualifications. The board shall consist of members who are qualified by experience and training to pass on matters pertaining to hazards of fire, explosions, hazardous conditions or fire protection systems, and are not employees of the jurisdiction.

A101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifications required for board membership, and shall be appointed for the same term or until a successor has been appointed.

A101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

A101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

A101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

A101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

A101.3.7 Compensation of members. Compensation of members shall be determined by law.

A101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meetings of the board may be removed at the discretion of the chief appointing authority.

A101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

A101.5 Notice of meetings. The board shall meet upon notice from the chairperson within 10 days of the filing of an appeal or at stated periodic intervals.

A101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the fire code official and any person whose interests are affected shall be given an opportunity to be heard.

A101.5.2 Quorum. Three members of the board shall constitute a quorum.

A101.5.3 Postponed hearing. When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

A101.6 Legal counsel. The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

A101.7 Board decision. The board shall only modify or reverse the decision of the fire code official by a concurring vote of three or more members.

A101.7.1 Resolution. The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the fire code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the fire code official.

A101.7.2 Administration. The fire code official shall take immediate action in accordance with the decision of the board.

A101.8 Court review. Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX B – FIRE-FLOW REQUIREMENTS FOR BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
Table B105.1(1)			X																			
B105.2			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix B provides a tool for the use of jurisdictions in establishing a policy for determining fire-flow requirements in accordance with Section 507.3. The determination of required fire flow is not an exact science, but having some level of information provides a consistent way of choosing the appropriate fire flow for buildings throughout a jurisdiction. The primary tool used in this appendix is a table that presents fire flow based on construction type and building area based on the correlation of the Insurance Services Office (ISO) method and the construction types used in the International Building Code®.

SECTION B101 GENERAL

B101.1 Scope. The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m²), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases. The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases. The fire code official is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall be not more than twice that required for the building under consideration.

B103.3 Areas without water supply systems. For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the fire code official is authorized to utilize NFPA 1142.

SECTION B104 FIRE-FLOW CALCULATION AREA

B104.1 General. The fire-flow calculation area shall be the total floor area of all floor levels within the exterior walls,

and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation. Portions of buildings that are separated by fire walls without openings, constructed in accordance with the *California Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction. The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration requirements for one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(1) and B105.1(2).

B105.2 Buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses. The minimum fire-flow and flow duration for buildings other than one- and two-family dwellings, Group R-3 and R-4 buildings and townhouses shall be as specified in Tables B105.1(2) and B105.2.

Exception: [SFM] Group B, S-2 and U occupancies having a floor area not exceeding 1,000 square feet, primarily constructed of noncombustible exterior walls with wood or steel roof framing, having a Class A roof assembly, with uses limited to the following or similar uses:

1. California State Parks buildings of an accessory nature (restrooms).
2. Safety roadside rest areas, (SRRA), public restrooms.
3. Truck inspection facilities, (TIF), CHP office space and vehicle inspection bays.
4. Sand/salt storage buildings, storage of sand and salt.

APPENDIX B—FIRE-FLOW REQUIREMENTS FOR BUILDINGS

**TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES**

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the <i>California Fire Code</i> or Section 313.3 of the <i>California Residential Code</i>	500	1/2
3,601 and greater	Section 903.3.1.3 of the <i>California Fire Code</i> or Section 313.3 of the <i>California Residential Code</i>	1/2 value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m.

**TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2**

FIRE-FLOW CALCULATION AREA (square feet)					FIRE FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0–22,700	0–12,700	0–8,200	0–5,900	0–3,600	1,500	2
22,701–30,200	12,701–17,000	8,201–10,900	5,901–7,900	3,601–4,800	1,750	
30,201–38,700	17,001–21,800	10,901–12,900	7,901–9,800	4,801–6,200	2,000	
38,701–48,300	21,801–24,200	12,901–17,400	9,801–12,600	6,201–7,700	2,250	
48,301–59,000	24,201–33,200	17,401–21,300	12,601–15,400	7,701–9,400	2,500	
59,001–70,900	33,201–39,700	21,301–25,500	15,401–18,400	9,401–11,300	2,750	3
70,901–83,700	39,701–47,100	25,501–30,100	18,401–21,800	11,301–13,400	3,000	
83,701–97,700	47,101–54,900	30,101–35,200	21,801–25,900	13,401–15,600	3,250	
97,701–112,700	54,901–63,400	35,201–40,600	25,901–29,300	15,601–18,000	3,500	
112,701–128,700	63,401–72,400	40,601–46,400	29,301–33,500	18,001–20,600	3,750	
128,701–145,900	72,401–82,100	46,401–52,500	33,501–37,900	20,601–23,300	4,000	4
145,901–164,200	82,101–92,400	52,501–59,100	37,901–42,700	23,301–26,300	4,250	
164,201–183,400	92,401–103,100	59,101–66,000	42,701–47,700	26,301–29,300	4,500	
183,401–203,700	103,101–114,600	66,001–73,300	47,701–53,000	29,301–32,600	4,750	
203,701–225,200	114,601–126,700	73,301–81,100	53,001–58,600	32,601–36,000	5,000	
225,201–247,700	126,701–139,400	81,101–89,200	58,601–65,400	36,001–39,600	5,250	
247,701–271,200	139,401–152,600	89,201–97,700	65,401–70,600	39,601–43,400	5,500	
271,201–295,900	152,601–166,500	97,701–106,500	70,601–77,000	43,401–47,400	5,750	
295,901–Greater	166,501–Greater	106,501–115,800	77,001–83,700	47,401–51,500	6,000	
—	—	115,801–125,500	83,701–90,600	51,501–55,700	6,250	
—	—	125,501–135,500	90,601–97,900	55,701–60,200	6,500	
—	—	135,501–145,800	97,901–106,800	60,201–64,800	6,750	
—	—	145,801–156,700	106,801–113,200	64,801–69,600	7,000	
—	—	156,701–167,900	113,201–121,300	69,601–74,600	7,250	
—	—	167,901–179,400	121,301–129,600	74,601–79,800	7,500	
—	—	179,401–191,400	129,601–138,300	79,801–85,100	7,750	
—	—	191,401–Greater	138,301–Greater	85,101–Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *California Building Code*.

b. Measured at 20 psi residual pressure.

**TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND
TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES**

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the <i>California Fire Code</i>	25% of the value in Table B105.1(2) ^a	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the <i>California Fire Code</i>	25% of the value in Table B105.1(2) ^b	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

- a. The reduced fire flow shall be not less than 1,000 gallons per minute.
b. The reduced fire flow shall be not less than 1,500 gallons per minute.

B105.3 Water supply for buildings equipped with an automatic sprinkler system. For buildings equipped with an approved automatic sprinkler system, the water supply shall be capable of providing the greater of:

1. The automatic sprinkler system demand, including hose stream allowance.
2. The required fire flow.

SECTION B106 REFERENCED STANDARDS

B106.1 General. See Table B106.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE B106.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	<i>California Building Code</i>	B104.2
CRC—22	<i>California Residential Code</i>	Table B105.1(1)
NFPA 1142—17	<i>Standard on Water Supplies for Suburban and Rural Fire Fighting</i>	B103.3

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX BB – FIRE-FLOW REQUIREMENTS FOR BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX BB

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

SECTION BB101 SCOPE

BB101.1 *The procedures determining fire-flow requirements for any school buildings or portions of buildings hereafter constructed for which review and approval is required under Subdivision(a) of Section 17280 of the Government Code shall be in accordance with this appendix as amended by the state fire marshal. This appendix does not apply to structures other than buildings.*

SECTION BB102 DEFINITIONS

BB102.1 *For the purpose of Appendix III-A, certain terms are defined as follows:*

FIRE AREA. *The floor area, in square feet, used to determine the required fire flow.*

FIRE FLOW. *The flow rate of a water supply, measured at 20 psi (137.9 kPa) residual pressure, that is available for firefighting.*

SECTION BB103 MODIFICATIONS

BB103.1 *An alternative method of providing water for fire protection or any other alternative, in lieu of providing the water, may be enforced when deemed appropriate by the fire chief and the state fire marshal.*

SECTION BB104 FIRE AREA

BB104.1 General. *The fire area shall be the total floor area of all floor levels within the exterior walls, and under the horizontal projections of the roof of a building, except as modified in Section 4.*

BB104.2 Area separation. *Portions of buildings which are separated by one or more 4-hour area separation walls constructed in accordance with the building code, without openings and provided with a 30-inch (762 mm) parapet, are allowed to be considered as separate fire areas.*

BB104.3 Type I and Type IB construction. *The fire area of buildings constructed of Type I and Type IB construction shall be the area of the three largest successive floors.*

SECTION BB105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

BB105.1 *The minimum fire flow and flow duration for school buildings shall be as specified in Table BB105.1.*

Exception: *A reduction in required fire flow of up to 75 percent is allowed when the building is provided with an approved automatic sprinkler system. When a reduction in fire flow is used, fire flow shall not be less than 1500 GPM.*

APPENDIX BB—FIRE-FLOW REQUIREMENTS FOR BUILDINGS

**TABLE BB105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS**

FIRE AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB a	Type IIA and IIIA a	Type IV and V-A a	Type IIB and IIIB a	Type V-B a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895kPa.

a. Types of construction are based on the *California Building Code*.

b. Measured at 20 psi.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX C – FIRE HYDRANT LOCATIONS AND DISTRIBUTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)			X																			
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						
C101.1			X																			

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX C

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix C focuses on the location and spacing of fire hydrants, which is important to the success of fire-fighting operations. The difficulty with determining the spacing of fire hydrants is that every situation is unique and has unique challenges. Finding one methodology for determining hydrant spacing is difficult. This particular appendix gives one methodology based on the required fire flow that fire departments can work with to set a policy for hydrant distribution around new buildings and facilities in conjunction with Section 507.5.

SECTION C101 GENERAL

C101.1 Scope. In addition to the requirements of Section 507.5.1, fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed or moved into the jurisdiction.

Exception: [SFM] Group B, S-2 and U occupancies having a floor area not exceeding 1,000 square feet, primarily constructed of noncombustible exterior walls with wood or steel roof framing, having a Class A roof assembly, with uses limited to the following or similar uses:

1. California State Parks buildings of an accessory nature (restrooms).

2. Safety roadside rest areas, (SRRA), public restrooms.
3. Truck inspection facilities, (TIF), California Highway Patrol (CHP) office space and vehicle inspection bays.
4. Sand/salt storage buildings, storage of sand and salt.

SECTION C102 NUMBER OF FIRE HYDRANTS

C102.1 Minimum number of fire hydrants for a building. The number of fire hydrants available to a building shall be not less than the minimum specified in Table C102.1.

**TABLE C102.1
REQUIRED NUMBER AND SPACING OF FIRE HYDRANTS^a**

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS ^{a, b, c, f, g} (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT ^{d, f, g}
1,750 or less	1	500	250
1,751–2,250	2	450	225
2,251–2,750	3	450	225
2,751–3,250	3	400	225
3,251–4,000	4	350	210
4,001–5,000	5	300	180
5,001–5,500	6	300	180
5,501–6,000	6	250	150
6,001–7,000	7	250	150
7,001 or more	8 or more ^e	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

- a. Reduce by 100 feet for dead-end streets or roads.
- b. Where streets are provided with median dividers that cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis.
- c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.
- d. Reduce by 50 feet for dead-end streets or roads.
- e. One hydrant for each 1,000 gallons per minute or fraction thereof.
- f. A 50-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the *California Fire Code*.
- g. A 25-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the *California Fire Code* or Section 313 of the *California Residential Code*.
- h. The fire code official is authorized to modify the location, number and distribution of fire hydrants based on site-specific constraints and hazards.

**SECTION C103
FIRE HYDRANT SPACING**

C103.1 Hydrant spacing. Fire apparatus access roads and public streets providing required access to buildings in accordance with Section 503 shall be provided with one or more fire hydrants, as determined by Section C102.1. Where more than one fire hydrant is required, the distance between required fire hydrants shall be in accordance with Sections C103.2 and C103.3.

C103.2 Average spacing. The average spacing between fire hydrants shall be in accordance with Table C102.1.

Exception: The average spacing shall be permitted to be increased by 10 percent where existing fire hydrants provide all or a portion of the required number of fire hydrants.

C103.3 Maximum spacing. The maximum spacing between fire hydrants shall be in accordance with Table C102.1.

**SECTION C104
CONSIDERATION OF EXISTING FIRE HYDRANTS**

C104.1 Existing fire hydrants. Existing fire hydrants on public streets are allowed to be considered as available to meet the requirements of Sections C102 and C103. Existing fire hydrants on adjacent properties are allowed to be considered as available to meet the requirements of Sections C102 and C103 provided that a fire apparatus access road extends between properties and that an easement is established to prevent obstruction of such roads.

**SECTION C105
REFERENCED STANDARD**

C105.1 General. See Table C105.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE C105.1
REFERENCED STANDARD**

STANDARD ACRONYM	STANDARD NAME	SECTION HEREIN REFERENCED
CRC—22	<i>California Residential Code</i>	Table C102.1

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX CC – FIRE HYDRANT LOCATIONS AND DISTRIBUTION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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APPENDIX CC

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

SECTION CC101 SCOPE

CC101.1 Fire hydrants shall be provided in accordance with this appendix for the protection of any school buildings, or portions thereof hereafter constructed for which review and approval are required under Subdivision(a) of Section 17280 of the Government Code.

SECTION CC102 LOCATION

CC102.1 Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

SECTION CC103 NUMBER OF FIRE HYDRANTS

CC103.1 The minimum number of fire hydrants available to a building shall not be less than that listed in Table CC105.1. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table CC105.1 when applied to fire apparatus access roads and perimeter streets from which fire operations could be conducted.

SECTION CC104 CONSIDERATION OF EXISTING FIRE HYDRANTS

CC104.1 Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

SECTION CC105 DISTRIBUTION OF FIRE HYDRANTS

CC105.1 The average spacing between fire hydrants shall not exceed that listed in Table CC105.1.

Exception: A deficiency of up to 10 percent shall not be allowed when existing fire hydrants provide all, or a portion, of the required fire hydrant service.

Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table CC105.1.

CC105.2 When public or private water mains are not available to supply fire flow [not within 1,000 feet (304 800 mm) of the proposed building], the following alternatives shall be used:

1. Building(s) shall be protected by an automatic sprinkler system

Exception: Portable (relocatable) buildings, as defined in California Education Code Section 17742.5(e), which requires that portable buildings be designed and constructed to be relocatable over public streets, shall be designed and constructed for relocation without the separation of the roof or floor from the building and when measured at the most exterior walls, shall have a floor area not in excess of 2,000 square feet (186 m²). Such portable buildings shall be separated from other structures in groupings not to exceed 9,100 square feet (845 m²) in building area (pursuant to Table 503, California Building Code, for Type V-B buildings). Further area increases shall be as approved by the local fire authority having jurisdiction and the state fire marshal.

The water for sprinklers may be supplied by the domestic system, a pressure tank, a gravity tank or other means in accordance with NFPA 13. Water tanks shall be installed in accordance with NFPA 22. (See the California Building Code, Chapter 9.)

2. When the adequate fire flow is not available and the water for sprinklers is provided from a source other than a public water supply, the amount of water to supply the system shall be calculated using the area/density method or the room design method as delineated in NFPA 13. The calculated duration of water flow to sprinklers shall not be less than 15 minutes to 10 heads.
3. The sprinkler system shall have a water flow alarm monitored by an approved central, proprietary or remote station service or a local alarm which will give audible and visual signals at a constant attended location.
4. When this alternative is utilized and the calculated water duration to a sprinkler is less than NFPA 13 recommendations, the area increases and fire resistive substitutions allowed in Chapter 5 of the California Building Code shall not be permitted.

APPENDIX CC—FIRE HYDRANT LOCATIONS AND DISTRIBUTION

**TABLE CC105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS**

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS^{a, b, c} (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT^d
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more ^e	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

- a. Reduce by 100 feet for dead-end streets or roads.
- b. Where streets are provided with median dividers which can be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.
- c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.
- d. Reduce by 50 feet for dead-end streets or roads.
- e. One hydrant for each 1,000 gallons per minute or fraction thereof.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX D – FIRE APPARATUS ACCESS ROADS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
[California Code of Regulations, Title 19, Division 1]																							
Chapter / Section																							

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APPENDIX D

FIRE APPARATUS ACCESS ROADS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix D contains more detailed elements for use with the basic access requirements found in Section 503, which gives some minimum criteria, such as a maximum length of 150 feet and a minimum width of 20 feet, but in many cases does not state specific criteria. This appendix, like Appendices B and C, is a tool for jurisdictions looking for guidance in establishing access requirements and includes criteria for multiple-family residential developments, large one- and two-family subdivisions, specific examples for various types of turnarounds for fire department apparatus and parking regulatory signage.

SECTION D101 GENERAL

D101.1 Scope. Fire apparatus access roads shall be in accordance with this appendix and all other applicable requirements of the *California Fire Code*.

SECTION D102 REQUIRED ACCESS

D102.1 Access and loading. Facilities, buildings or portions of buildings hereafter constructed shall be accessible to fire department apparatus by way of an approved fire apparatus access road with an asphalt, concrete or other approved driving surface capable of supporting the imposed load of fire apparatus weighing up to 75,000 pounds (34 050 kg).

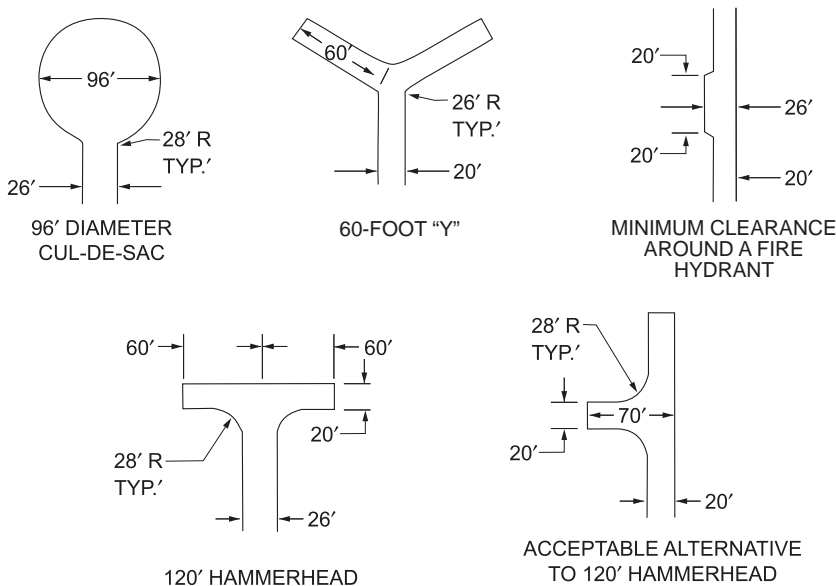
SECTION D103 MINIMUM SPECIFICATIONS

D103.1 Access road width with a hydrant. Where a fire hydrant is located on a fire apparatus access road, the minimum road width shall be 26 feet (7925 mm), exclusive of shoulders (see Figure D103.1).

D103.2 Grade. Fire apparatus access roads shall not exceed 10 percent in grade.

Exception: Grades steeper than 10 percent as approved by the fire code official.

D103.3 Turning radius. The minimum turning radius shall be determined by the fire code official.



For SI: 1 foot = 304.8 mm.

**FIGURE D103.1
DEAD-END FIRE APPARATUS ACCESS ROAD TURNAROUND**

D103.4 Dead ends. Dead-end fire apparatus access roads in excess of 150 feet (45 720 mm) shall be provided with width and turnaround provisions in accordance with Table D103.4.

**TABLE D103.4
REQUIREMENTS FOR DEAD-END
FIRE APPARATUS ACCESS ROADS**

LENGTH (feet)	WIDTH (feet)	TURNAROUNDS REQUIRED
0–150	20	None required
151–500	20	120-foot Hammerhead, 60-foot “Y” or 96-foot-diameter cul-de-sac in accordance with Figure D103.1
501–750	26	120-foot Hammerhead, 60-foot “Y” or 96-foot-diameter cul-de-sac in accordance with Figure D103.1
Over 750		Special approval required

For SI: 1 foot = 304.8 mm.

D103.5 Fire apparatus access road gates. Gates securing the fire apparatus access roads shall comply with all of the following criteria:

1. Where a single gate is provided, the gate width shall be not less than 20 feet (6096 mm). Where a fire apparatus road consists of a divided roadway, the gate width shall be not less than 12 feet (3658 mm).
2. Gates shall be of the horizontal swing, horizontal slide, vertical lift or vertical pivot type.
3. Construction of gates shall be of materials that allow manual operation by one person.
4. Gate components shall be maintained in an operative condition at all times and replaced or repaired when defective.
5. Electric gates shall be equipped with a means of opening the gate by fire department personnel for emergency access. Emergency opening devices shall be approved by the fire code official.
6. Methods of locking shall be submitted for approval by the fire code official.
7. Electric gate operators, where provided, shall be listed in accordance with UL 325.
8. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F2200.

D103.6 Signs. Where required by the fire code official, fire apparatus access roads shall be marked with permanent “NO PARKING—FIRE LANE” signs complying with Figure D103.6. Signs shall have a minimum dimension of 12 inches (305 mm) wide by 18 inches (457 mm) high and have red letters on a white reflective background. Signs shall be posted on one or both sides of the fire apparatus road as required by Section D103.6.1 or D103.6.2.

D103.6.1 Roads 20 to 26 feet in width. Fire lane signs as specified in Section D103.6 shall be posted on both sides of fire apparatus access roads that are 20 to 26 feet wide (6096 to 7925 mm).

D103.6.2 Roads more than 26 feet in width. Fire lane signs as specified in Section D103.6 shall be posted on one side of fire apparatus access roads more than 26 feet wide (7925 mm) and less than 32 feet wide (9754 mm).

**SECTION D104
COMMERCIAL AND INDUSTRIAL DEVELOPMENTS**

D104.1 Buildings exceeding three stories or 30 feet in height. Buildings or facilities exceeding 30 feet (9144 mm) or three stories in height shall have not fewer than two means of fire apparatus access for each structure.

D104.2 Buildings exceeding 62,000 square feet in area. Buildings or facilities having a gross building area of more than 62,000 square feet (5760 m²) shall be provided with two separate and approved fire apparatus access roads.

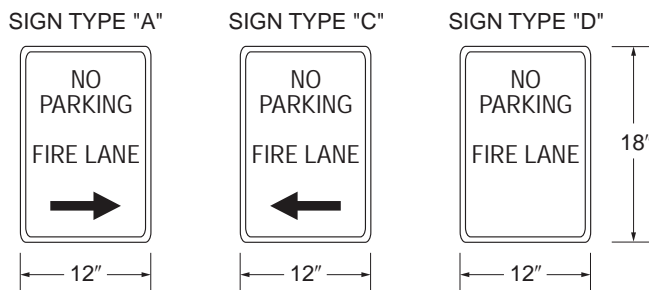
Exception: Projects having a gross building area of up to 124,000 square feet (11 520 m²) that have a single approved fire apparatus access road where all buildings are equipped throughout with approved automatic sprinkler systems.

D104.3 Remoteness. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the lot or area to be served, measured in a straight line between accesses.

**SECTION D105
AERIAL FIRE APPARATUS ACCESS ROADS**

D105.1 Where required. Where the vertical distance between the grade plane and the highest roof surface exceeds 30 feet (9144 mm), approved aerial fire apparatus access roads shall be provided. For purposes of this section, the highest roof surface shall be determined by measurement to the eave of a pitched roof, the intersection of the roof to the exterior wall, or the top of parapet walls, whichever is greater.

Exception: Where approved by the fire code official, buildings of Type IA, Type IB or Type IIA construction equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and having fire fighter access through an enclosed stairway with a Class I standpipe from the lowest level of fire department vehicle access to all roof surfaces.



**FIGURE D103.6
FIRE LANE SIGNS**

D105.2 Width. Aerial fire apparatus access roads shall have a minimum unobstructed width of 26 feet (7925 mm), exclusive of shoulders, in the immediate vicinity of the building or portion thereof.

D105.3 Proximity to building. One or more of the required access routes meeting this condition shall be located not less than 15 feet (4572 mm) and not greater than 30 feet (9144 mm) from the building, and shall be positioned parallel to one entire side of the building. The side of the building on which the aerial fire apparatus access road is positioned shall be approved by the fire code official.

D105.4 Obstructions. Overhead utility and power lines shall not be located over the aerial fire apparatus access road or between the aerial fire apparatus road and the building. Other obstructions shall be permitted to be placed with the approval of the fire code official.

**SECTION D106
MULTIPLE-FAMILY RESIDENTIAL DEVELOPMENTS**

D106.1 Projects having more than 100 dwelling units. Multiple-family residential projects having more than 100 dwelling units shall be equipped throughout with two separate and approved fire apparatus access roads.

Exception: Projects having up to 200 dwelling units shall have not fewer than one approved fire apparatus access road where all buildings, including nonresidential occupancies, are equipped throughout with approved automatic sprinkler systems installed in accordance with Section 903.3.1.1 or 903.3.1.2.

D106.2 Projects having more than 200 dwelling units. Multiple-family residential projects having more than 200 dwelling units shall be provided with two separate and approved fire apparatus access roads regardless of whether they are equipped with an approved automatic sprinkler system.

D106.3 Remoteness. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

**SECTION D107
ONE- OR TWO-FAMILY
RESIDENTIAL DEVELOPMENTS**

D107.1 One- or two-family dwelling residential developments. Developments of one- or two-family dwellings where the number of dwelling units exceeds 30 shall be provided with two separate and approved fire apparatus access roads.

Exceptions:

1. Where there are more than 30 dwelling units accessed from a single public or private fire apparatus access road and all dwelling units are equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1,

903.3.1.2 or 903.3.1.3, access from two directions shall not be required.

2. The number of dwelling units accessed from a single fire apparatus access road shall not be increased unless fire apparatus access roads will connect with future development, as determined by the fire code official.

D107.2 Remoteness. Where two fire apparatus access roads are required, they shall be placed a distance apart equal to not less than one-half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

**SECTION D108
REFERENCED STANDARDS**

D108.1 General. See Table D108.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE D108.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM F2200—14	<i>Standard Specification for Automated Vehicular Gate Construction</i>	D103.5
UL 325—02	<i>Door, Drapery, Gate, Louver, and Window Operators and Systems, with Revisions through May 2015</i>	D103.5

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX E – HAZARD CATEGORIES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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APPENDIX E

HAZARD CATEGORIES

This appendix is for information purposes and is not intended for adoption.

User note:

About this appendix: Appendix E contains guidance for designers, engineers, architects, code officials, plans reviewers and inspectors in the classifying of hazardous materials so that proposed designs can be evaluated intelligently and accurately. The descriptive materials and explanations of hazardous materials and how to report and evaluate them on a Safety Data Sheet (SDS) are intended to be instructional as well as informative. Note that Safety Data Sheets also include the concept known as Material Safety Data Sheets (MSDS).

SECTION E101 GENERAL

E101.1 Scope. This appendix provides information, explanations and examples to illustrate and clarify the hazard categories contained in Chapter 50 of the *California Fire Code*. The hazard categories are based on the DOL 29 CFR. Where numerical classifications are included, they are in accordance with nationally recognized standards.

This appendix should not be used as the sole means of hazardous materials classification.

SECTION E102 HAZARD CATEGORIES

E102.1 Physical hazards. Materials classified in this section pose a physical hazard.

E102.1.1 Explosives and blasting agents. The current UN/DOT classification system recognized by international authorities, the Department of Defense and others classifies all explosives as Class 1 materials. They are then divided into six separate divisions to indicate their relative hazard. There is not a direct correlation between the designations used by the old DOT system and those used by the current system nor is there correlation with the system (high and low) established by the Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF). Table 5604.3 provides some guidance with regard to the current categories and their relationship to the old categories. Some items appear in more than one division, depending on factors such as the degree of confinement or separation, type of packaging, storage configuration or state of assembly.

In order to determine the level of hazard presented by explosive materials, testing to establish quantitatively their explosive nature is required. There are numerous test methods that have been used to establish the character of an explosive material. Standardized tests, required for finished goods containing explosives or explosive materials in a packaged form suitable for shipment or storage, have been established by UN/DOT and BATF. However, these tests do not consider key elements that should be examined in a manufacturing situation. In manufacturing opera-

tions, the condition and/or the state of a material may vary within the process. Potentially, material classification and the requirements used to determine that classification during manufacturing will differ from the classification of the same material found in finished goods. A classification methodology must be used that recognizes the hazards commensurate with the application to the variable physical conditions as well as potential variations of physical character and type of explosive under consideration.

Test methods or guidelines for hazard classification of energetic materials used for in-process operations shall be approved by the fire code official. Test methods used shall be DOD, BATF, UN/DOT or other approved criteria. The results of such testing shall become a portion of the files of the jurisdiction and be included as an independent section of any Hazardous Materials Management Plan (HMMP) required by Section 5605.2.1. Also see Section 104.8.2.

Examples of materials in various Divisions are as follows:

1. Division 1.1 (High Explosives). Consists of explosives that have a mass explosion hazard. A mass explosion is one that affects almost the entire pile of material instantaneously. Includes substances that, where tested in accordance with approved methods, can be caused to detonate by means of a blasting cap where unconfined or will transition from deflagration to a detonation where confined or unconfined. Examples: dynamite, TNT, nitroglycerine, C-3, HMX, RDX, encased explosives, military ammunition.
2. Division 1.2 (Low Explosives). Consists of explosives that have a projection hazard, but not a mass explosion hazard. Examples: nondetonating encased explosives, military ammunition and the like.
3. Division 1.3 (Low Explosives). Consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard. The major hazard is radiant heat or violent burning, or both. Can be deflagrated where confined. Examples: smokeless powder, propellant explosives, display fireworks.

4. Division 1.4. Consists of explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is expected. An internal fire must not cause virtually instantaneous explosion of almost the entire contents of the package. Examples: squibs (nondetonating igniters), explosive actuators, explosive trains (low-level detonating cord).
5. Division 1.5 (Blasting Agents). Consists of very insensitive explosives. This division comprises substances that have a mass explosion hazard, but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport. Materials are not cap sensitive; however, they are mass detonating where provided with sufficient input. Examples: oxidizer and liquid fuel slurry mixtures and gels, ammonium nitrate combined with fuel oil.
6. Division 1.6. Consists of extremely insensitive articles that do not have a mass explosive hazard. This division comprises articles that contain only extremely insensitive detonating substances and that demonstrate a negligible probability of accidental initiation or propagation. Although this category of materials has been defined, the primary application is currently limited to military uses. Examples: Low vulnerability military weapons.

Explosives in each division are assigned a compatibility group letter by the Associate Administrator for Hazardous Materials Safety (DOT) based on criteria specified by DOTn 49 CFR. Compatibility group letters are used to specify the controls for the transportation and storage related to various materials to prevent an increase in hazard that might result if certain types of explosives were stored or transported together. Altogether, there are 35 possible classification codes for explosives, for example, 1.1A, 1.3C, 1.4S.

E102.1.2 Compressed gases. Examples include:

1. Flammable: acetylene, carbon monoxide, ethane, ethylene, hydrogen, methane. Ammonia will ignite and burn although its flammable range is too narrow for it to fit the definition of “Flammable gas.”
- For binary mixtures where the hazardous component is diluted with a nonflammable gas, the mixture shall be categorized in accordance with CGA P-23.
2. Oxidizing: oxygen, ozone, oxides of nitrogen, chlorine and fluorine. Chlorine and fluorine do not contain oxygen but reaction with flammables is similar to that of oxygen.
 3. Corrosive: ammonia, hydrogen chloride, fluorine.
 4. Highly toxic: arsine, cyanogen, fluorine, germane, hydrogen cyanide, nitric oxide, phosphine, hydrogen selenide, stibine.
 5. Toxic: chlorine, hydrogen fluoride, hydrogen sulfide, phosgene, silicon tetrafluoride.

6. Inert (chemically unreactive): argon, helium, krypton, neon, nitrogen, xenon.
7. Pyrophoric: diborane, dichloroborane, phosphine, silane.
8. Unstable (reactive): butadiene (unstabilized), ethylene oxide, vinyl chloride.

E102.1.3 Flammable and combustible liquids. Examples include:

1. Flammable liquids.

Class IA liquids shall include those having flash points below 73°F (23°C) and having a boiling point at or below 100°F (38°C).

Class IB liquids shall include those having flash points below 73°F (23°C) and having a boiling point at or above 100°F (38°C).

Class IC liquids shall include those having flash points at or above 73°F (23°C) and below 100°F (38°C).

2. Combustible liquids.

Class II liquids shall include those having flash points at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA liquids shall include those having flash points at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB liquids shall include those liquids having flash points at or above 200°F (93°C).

E102.1.4 Flammable solids. Examples include:

1. Organic solids: camphor, cellulose nitrate, naphthalene.
2. Inorganic solids: decaborane, lithium amide, phosphorous heptasulfide, phosphorous sesquisulfide, potassium sulfide, anhydrous sodium sulfide, sulfur.
3. Combustible metals (except dusts and powders): cesium, magnesium, zirconium.

E102.1.5 Combustible dusts and powders. Finely divided solids that could be dispersed in air as a dust cloud: wood sawdust, plastics, coal, flour, powdered metals (few exceptions).

E102.1.6 Combustible fibers. See the definition of combustible fibers in Section 202.

E102.1.7 Oxidizers. Examples include:

1. Gases: oxygen, ozone, oxides of nitrogen, fluorine and chlorine (reaction with flammables is similar to that of oxygen).
2. Liquids: bromine, hydrogen peroxide, nitric acid, perchloric acid, sulfuric acid.
3. Solids: chlorates, chromates, chromic acid, iodine, nitrates, nitrites, perchlorates, peroxides.

E102.1.7.1 Examples of liquid and solid oxidizers according to hazard. Examples include:

Class 4: ammonium perchlorate (particle size greater than 15 microns), ammonium permanganate, guanidine nitrate, hydrogen peroxide solutions more than 91 percent by weight, perchloric acid solutions more than 72.5 percent by weight, potassium superoxide, tetranitromethane.

Class 3: ammonium dichromate, calcium hypochlorite (over 50 percent by weight), chloric acid (10 percent maximum concentration), hydrogen peroxide solutions (greater than 52 percent up to 91 percent), mono-(trichloro)-tetra-(monopotassium dichloro)-penta-s-triazinetrione, nitric acid, (fuming—more than 86 percent concentration), perchloric acid solutions (60 percent to 72 percent by weight), potassium bromate, potassium chlorate, potassium dichloro-s-triazinetrione (potassium dichloro-isocyanurate), potassium perchlorate (99 percent), potassium permanganate (greater than 97.5 percent), sodium bromate, sodium chlorate and sodium chlorite (over 40 percent by weight).

Class 2: barium bromate, barium chlorate, barium hypochlorite, barium perchlorate, barium permanganate, 1-bromo-3-chloro-5, 5-dimethylhydantoin, calcium chlorate, calcium chlorite, calcium hypochlorite (50 percent or less by weight), calcium perchlorate, calcium permanganate, calcium peroxide (75 percent), chromium trioxide (chromic acid), copper chlorate, halane (1, 3-dichloro-5, 5-dimethylhydantoin), hydrogen peroxide (greater than 27.5 percent up to 52 percent), lead perchlorate, lithium chlorate, lithium hypochlorite (more than 39 percent available chlorine), lithium perchlorate, magnesium bromate, magnesium chlorate, magnesium perchlorate, mercurous chlorate, nitric acid (more than 40 percent but less than 86 percent), perchloric acid solutions (more than 50 percent but less than 60 percent), potassium peroxide, potassium superoxide, silver peroxide, sodium chlorite (40 percent or less by weight), sodium dichloro-s-triazinetrione anhydrous (sodium dichloroisocyanurate anhydrous), sodium perchlorate, sodium perchlorate monohydrate, sodium permanganate, sodium peroxide, sodium persulfate (99 percent), strontium chlorate, strontium perchlorate, thallium chlorate, urea hydrogen peroxide, zinc bromate, zinc chlorate and zinc permanganate.

Class 1: all inorganic nitrates (unless otherwise classified), all inorganic nitrites (unless otherwise classified), ammonium persulfate, barium peroxide, hydrogen peroxide solutions (greater than 8 percent up to 27.5 percent), lead dioxide, lithium hypochlorite (39 percent or less available chlorine), lithium peroxide, magnesium peroxide, manganese dioxide, nitric acid (40 percent concentration or less), perchloric acid solutions (less than 50 percent by weight), potassium dichromate, potassium monopersulfate (45 percent KHSO_5 or 90 percent triple salt), potassium percarbonate, potassium persulfate, sodium carbonate peroxide, sodium dichloro-s-

triazinetrione dihydrate, sodium dichromate, sodium perborate (anhydrous), sodium perborate monohydrate, sodium perborate tetra-hydrate, sodium percarbonate, strontium peroxide, trichloro-s-triazinetrione (trichloroisocyanuric acid) and zinc peroxide.

E102.1.8 Organic peroxides. Organic peroxides contain the double oxygen or peroxy (-o-o) group. Some are flammable compounds and subject to explosive decomposition. They are available as:

1. Liquids.
2. Pastes.
3. Solids (usually finely divided powders).

E102.1.8.1 Classification of organic peroxides according to hazard. Examples include:

Unclassified: Unclassified organic peroxides are capable of detonation and are regulated in accordance with Chapter 56.

Class I: acetyl cyclohexane sulfonyl 60-65 percent concentration by weight, fulfonyl peroxide, benzoyl peroxide over 98 percent concentration, t-butyl hydroperoxide 90 percent, t-butyl peroxyacetate 75 percent, t-butyl peroxyisopropylcarbonate 92 percent, diisopropyl peroxydicarbonate 100 percent, di-n-propyl peroxydicarbonate 98 percent, and di-n-propyl peroxydicarbonate 85 percent.

Class II: acetyl peroxide 25 percent, t-butyl hydroperoxide 70 percent (with DTBP and t-BuOH diluents), t-butyl peroxybenzoate 98 percent, t-butyl peroxy-2-ethylhexanoate 97 percent, t-butyl peroxyisobutyrate 75 percent, t-butyl peroxyisopropylcarbonate 75 percent, t-butyl peroxyisovalate 75 percent, dybenzoyl peroxydicarbonate 85 percent, di-sec-butyl peroxydicarbonate 98 percent, di-sec-butyl peroxydicarbonate 75 percent, 1,1-di-(t-butylperoxy)-3,5,5-trimethylcyclohexane 95 percent, di-(2-ethylhexyl) peroxydicarbonate 97 percent, 2,5-dimethyl-2,5-di (benzoylperoxy) hexane 92 percent, and peroxyacetic acid 43 percent.

Class III: acetyl cyclohexane sulfonal peroxide 29 percent, benzoyl peroxide 78 percent, benzoyl peroxide paste 55 percent, benzoyl peroxide paste 50 percent peroxide/50 percent butylbenzylphthalate diluent, cumene hydroperoxide 86 percent, di-(4-butylcyclohexyl) peroxydicarbonate 98 percent, t-butyl peroxy-2-ethylhexanoate 97 percent, t-butyl peroxyneodecanoate 75 percent, decanoyl peroxide 98.5 percent, di-t-butyl peroxide 99 percent, 1,1-di-(t-butylperoxy)3,5,5-trimethylcyclohexane 75 percent, 2,4-dichlorobenzoyl peroxide 50 percent, di-isopropyl peroxydicarbonate 30 percent, 2,5-dimethyl-2,5-di-(2-ethylhexanolyperoxy)-hexane 90 percent, 2,5-dimethyl-2,5-di-(t-butylperoxy) hexane 90 percent and methyl ethyl ketone peroxide 9 percent active oxygen diluted in dimethyl phthalate.

Class IV: benzoyl peroxide 70 percent, benzoyl peroxide paste 50 percent peroxide/15 percent water/35 percent butylphthalate diluent, benzoyl peroxide slurry

40 percent, benzoyl peroxide powder 35 percent, t-butyl hydroperoxide 70 percent, (with water diluent), t-butyl peroxy-2-ethylhexanoate 50 percent, decumyl peroxide 98 percent, di-(2-ethylhexal) peroxydicarbonate 40 percent, laurel peroxide 98 percent, p-methane hydroperoxide 52.5 percent, methyl ethyl ketone peroxide 5.5 percent active oxygen and methyl ethyl ketone peroxide 9 percent active oxygen diluted in water and glycols.

Class V: benzoyl peroxide 35 percent, 1,1-di-t-butyl peroxy 3,5,5-trimethylcyclohexane 40 percent, 2,5-di-(t-butyl peroxy) hexane 47 percent and 2,4-pentanedione peroxide 4 percent active oxygen.

E102.1.9 Pyrophoric materials. Examples include:

1. Gases: diborane, phosphine, silane.
2. Liquids: diethylaluminum chloride, di-ethylberyllium, diethylphosphine, diethylzinc, dimethylarsine, triethylaluminum etherate, tri-ethylbismuthine, triethylboron, trimethylaluminum, trimethylgallium.
3. Solids: cesium, hafnium, lithium, white or yellow phosphorous, plutonium, potassium, rubidium, sodium, thorium.

E102.1.10 Unstable (reactive) materials. Examples include:

Class 4: acetyl peroxide, dibutyl peroxide, dinitrobenzene, ethyl nitrate, peroxyacetic acid and picric acid (dry) trinitrobenzene.

Class 3: hydrogen peroxide (greater than 52 percent), hydroxylamine, nitromethane, paranitroaniline, perchloric acid and tetrafluoroethylene monomer.

Class 2: acrolein, acrylic acid, hydrazine, methacrylic acid, sodium perchlorate, styrene and vinyl acetate.

Class 1: acetic acid, hydrogen peroxide 35 percent to 52 percent, paraldehyde and tetrahydrofuran.

E102.1.11 Water-reactive materials. Examples include:

Class 3: aluminum alkyls such as triethylaluminum, isobutylaluminum and trimethylaluminum; bromine pentafluoride, bromine trifluoride, chlorodiethylaluminum and diethylzinc.

Class 2: calcium carbide, calcium metal, cyanogen bromide, lithium hydride, methylchlorosilane, potassium metal, potassium peroxide, sodium metal, sodium peroxide, sulfuric acid and trichlorosilane.

Class 1: acetic anhydride, sodium hydroxide, sulfur monochloride and titanium tetrachloride.

E102.1.12 Cryogenic fluids. The cryogenics listed will exist as compressed gases where they are stored at ambient temperatures.

1. Flammable: carbon monoxide, deuterium (heavy hydrogen), ethylene, hydrogen, methane.
2. Oxidizing: fluorine, nitric oxide, oxygen.
3. Corrosive: fluorine, nitric oxide.
4. Inert (chemically unreactive): argon, helium, krypton, neon, nitrogen, xenon.

5. Highly toxic: fluorine, nitric oxide.

E102.2 Health hazards. Materials classified in this section pose a health hazard.

E102.2.1 Highly toxic materials. Examples include:

1. Gases: arsine, cyanogen, diborane, fluorine, germane, hydrogen cyanide, nitric oxide, nitrogen dioxide, ozone, phosphine, hydrogen selenide, stibine.
2. Liquids: acrolein, acrylic acid, 2-chloroethanol (ethylene chlorohydrin), hydrazine, hydrocyanic acid, 2-methylaziridine (propylenimine), 2-methylacetone nitrile (acetone cyanohydrin), methyl ester isocyanic acid (methyl isocyanate), nicotine, tetranitromethane and tetraethylstannane (tetraethyltin).
3. Solids: (aceto) phenylmercury (phenyl mercuric acetate), 4-aminopyridine, arsenic pentoxide, arsenic trioxide, calcium cyanide, 2-chloroacetophenone, aflatoxin B, decaborane(14), mercury (II) bromide (mercuric bromide), mercury (II) chloride (*corrosive* mercury chloride), pentachlorophenol, methyl parathion, phosphorus (white) and sodium azide.

E102.2.2 Toxic materials. Examples include:

1. Gases: boron trichloride, boron trifluoride, chlorine, chlorine trifluoride, hydrogen fluoride, hydrogen sulfide, phosgene, silicon tetrafluoride.
2. Liquids: acrylonitrile, allyl alcohol, alpha-chlorotoluene, aniline, 1-chloro-2,3-epoxypropane, chloroformic acid (allyl ester), 3-chloropropene (allyl chloride), o-cresol, crotonaldehyde, dibromomethane, diisopropylamine, diethyl ester sulfuric acid, dimethyl ester sulfuric acid, 2-furaldehyde (furfural), furfural alcohol, phosphorus chloride, phosphoryl chloride (phosphorus oxychloride) and thionyl chloride.
3. Solids: acrylamide, barium chloride, barium (II) nitrate, benzidine, p-benzoquinone, beryllium chloride, cadmium chloride, cadmium oxide, chloroacetic acid, chlorophenylmercury (phenyl mercuric chloride), chromium (VI) oxide (chromic acid, solid), 2,4-dinitrotoluene, hydroquinone, mercury chloride (calomel), mercury (II) sulfate (mercuric sulfate), osmium tetroxide, oxalic acid, phenol, P-phenylenediamine, phenylhydrazine, 4-phenylmorpholine, phosphorus sulfide, potassium fluoride, potassium hydroxide, selenium (IV) disulfide and sodium fluoride.

E102.2.3 Corrosives. Examples include:

1. Acids: Examples: chromic, formic, hydrochloric (muriatic) greater than 15 percent, hydrofluoric, nitric (greater than 6 percent, perchloric, sulfuric (4 percent or more).
2. Bases (alkalis): hydroxides-ammonium (greater than 10 percent), calcium, potassium (greater than 1 percent), sodium (greater than 1 percent); certain carbonates-potassium.

3. Other corrosives: bromine, chlorine, fluorine, iodine, ammonia.

Note: Corrosives that are oxidizers (for example, nitric acid, chlorine, fluorine), compressed gases (for example, ammonia, chlorine, fluorine), or water-reactive (for example, concentrated sulfuric acid, sodium hydroxide) are physical hazards in addition to being health hazards.

SECTION E103 EVALUATION OF HAZARDS

E103.1 Degree of hazard. The degree of hazard present depends on many variables that should be considered individually and in combination. Some of these variables are as shown in Sections E103.1.1 through E103.1.5.

E103.1.1 Chemical properties of the material. Chemical properties of the material determine self reactions and reactions that could occur with other materials. Generally, materials within subdivisions of hazard categories will exhibit similar chemical properties. However, materials with similar chemical properties could pose very different hazards. Each individual material should be researched to determine its hazardous properties and then considered in relation to other materials that it might contact and the surrounding environment.

E103.1.2 Physical properties of the material. Physical properties, such as whether a material is a solid, liquid or gas at ordinary temperatures and pressures, considered along with chemical properties will determine requirements for containment of the material. Specific gravity (weight of a liquid compared to water) and vapor density (weight of a gas compared to air) are both physical properties that are important in evaluating the hazards of a material.

E103.1.3 Amount and concentration of the material. The amount of material present and its concentration must be considered along with physical and chemical properties to determine the magnitude of the hazard. Hydrogen peroxide, for example, is used as an antiseptic and a hair bleach in low concentrations (approximately 8 percent in water solution). Over 8 percent, hydrogen peroxide is classed as an oxidizer and is toxic. Above 90 percent, it is a Class 4 oxidizer “that can undergo an explosive reaction when catalyzed or exposed to heat, shock or friction,” a definition that, incidentally, places hydrogen peroxide over 90-percent concentration in the unstable (reactive) category. Small amounts at high concentrations could pose a greater hazard than large amounts at low concentrations.

E103.1.3.1 Mixtures. Gases—toxic and highly toxic gases include those gases that have an LC_{50} of 2,000 parts per million (ppm) or less when rats are exposed for a period of 1 hour or less. To maintain consistency with the definitions for these materials, exposure data for periods other than 1 hour must be normalized to 1 hour. To classify mixtures of compressed gases that contain one or more toxic or highly toxic components, the LC_{50} of the mixture must be determined. Mixtures that contain only two components are binary mixtures.

Those that contain more than two components are multicomponent mixtures. Where two or more hazardous substances (components) having an LC_{50} below 2,000 ppm are present in a mixture, their combined effect, rather than that of the individual substance components, must be considered. The effects of the hazards present must be considered as additive, except where there is a good reason to believe that the principal effects of the different harmful substances (components) are not additive.

For binary mixtures where the hazardous component is diluted with a nontoxic gas such as an inert gas, the LC_{50} of the mixture is estimated by use of the methodology contained in CGA P-20. The hazard zones specified in CGA P-20 are applicable for DOTn purposes and shall not be used for hazard classification.

E103.1.4 Actual use, activity or process involving the material. The definition of handling, storage and use in closed systems refers to materials in packages or containers. Dispensing and use in open containers or systems describes situations where a material is exposed to ambient conditions or vapors are liberated to the atmosphere. Dispensing and use in open systems, then, are generally more hazardous situations than handling, storage or use in closed systems. The actual use or process could include heating, electric or other sparks, catalytic or reactive materials and many other factors that could affect the hazard and must therefore be thoroughly analyzed.

E103.1.5 Surrounding conditions. Conditions such as other materials or processes in the area, type of construction of the structure, fire protection features (for example, fire walls, sprinkler systems, alarms), occupancy (use) of adjoining areas, normal temperatures, exposure to weather, etc., must be taken into account in evaluating the hazard.

E103.2 Evaluation questions. The following are sample evaluation questions:

1. What is the material? Correct identification is important; exact spelling is vital. Checking labels and SDS and asking responsible persons should be among the highest priorities.
2. What are the concentration and strength?
3. What is the physical form of the material? Liquids, gases and finely divided solids have differing requirements for spill and leak control and containment.
4. How much material is present? Consider in relation to permit amounts, maximum allowable quantity per control area (from Group H occupancy requirements), amounts that require detached storage and overall magnitude of the hazard.
5. What other materials (including furniture, equipment and building components) are close enough to interact with the material?
6. What are the likely reactions?
7. What is the activity involving the material?

APPENDIX E—HAZARD CATEGORIES

8. How does the activity impact the hazardous characteristics of the material? Consider vapors released or hazards otherwise exposed.
9. What must the material be protected from? (For example, other materials, temperature, shock, pressure.)
10. What effects of the material must people and the environment be protected from?
11. How can protection be accomplished? Consider:
 - 11.1. Proper containers and equipment.
 - 11.2. Separation by distance or construction.
 - 11.3. Enclosure in cabinets or rooms.
 - 11.4. Spill control, drainage and containment.
 - 11.5. Control system ventilation, special electrical, detection and alarm, extinguishment, explosion venting, limit controls, exhaust scrubbers and excess flow control.
 - 11.6. Administrative (operational) control signs, ignition source control, security, personnel training, established procedures, storage plans and emergency plans.

Evaluation of the hazard is a strongly subjective process; therefore, the person charged with this responsibility must gather as much relevant data as possible so that the decision will be objective and within the limits prescribed in laws, policies and standards.

It could be necessary to cause the responsible persons in charge to have tests made by qualified persons or testing laboratories to support contentions that a particular material or process is or is not hazardous. See Section 104.8.2.

SECTION E104 REFERENCED STANDARDS

E104.1 General. See Table E104.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE E104.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CGA P-20—2009	<i>Standard for Classification of Toxic Mixtures</i>	E103.1.3.1
CGA P-23—2008	<i>Standard for Categorizing Gas Mixtures Containing Flammable and Nonflammable Components</i>	E102.1.2

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX F – HAZARD RANKING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX F

HAZARD RANKING

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix F is intended to be a companion to the specific requirements of Chapters 51 through 67, which regulate the storage, handling and use of all hazardous materials classified as either physical or health hazards. These materials pose diverse hazards, including instability, reactivity, flammability, oxidizing potential or toxicity; therefore, identifying them by hazard ranking is essential. This appendix lists the various hazardous material categories that are defined in this code, along with the NFPA 704 hazard ranking for each.

SECTION F101 GENERAL

F101.1 Scope. Assignment of levels of hazards to be applied to specific hazard classes as required by NFPA 704 shall be in accordance with this appendix. The appendix is based on application of the degrees of hazard as defined in NFPA 704 arranged by hazard class as for specific categories defined in Chapter 2 of the *California Fire Code* and used throughout.

F101.2 General. The hazard rankings shown in Table F101.2 have been established by using guidelines found within NFPA 704. As noted in Section 4.2 of NFPA 704, there could be specific reasons to alter the degree of hazard assigned to a specific material; for example, ignition temperature, flammable range or susceptibility of a container to rupture by an internal combustion explosion or to metal failure while under pressure or because of heat from external fire. As a result, the degree of hazard assigned for the same material can vary when assessed by different people of equal competence.

The hazard rankings assigned to each class represent reasonable minimum hazard levels for a given class based on the use of criteria established by NFPA 704. Specific cases of use or storage may dictate the use of higher degrees of hazard in certain cases.

SECTION F102 REFERENCED STANDARDS

F102.1 General. See Table F102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE F102.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
NFPA 70—20	<i>National Electrical Code</i>	Table F101.2
NFPA 704—17	<i>Identification of the Hazards of Materials for Emergency Response</i>	F101.1, F101.2

APPENDIX F—HAZARD RANKING

TABLE F101.2
FIRE FIGHTER WARNING PLACARD DESIGNATIONS BASED ON HAZARD CLASSIFICATION CATEGORIES

HAZARD CATEGORY	DESIGNATION
Combustible liquid II	F2
Combustible liquid IIIA	F2
Combustible liquid IIIB	F1
Combustible dust	F3 or F2 ^a
Combustible fiber	F3
Cryogenic flammable	F4, H3
Cryogenic oxidizing	OX, H3
Explosive	R4
Flammable solid	F2
Flammable gas (gaseous)	F4
Flammable gas (liquefied)	F4
Flammable liquid IA	F4
Flammable liquid IB	F3
Flammable liquid IC	F3
Organic peroxide, UD	R4
Organic peroxide I	F4, R3
Organic peroxide II	F3, R3
Organic peroxide III	F2, R2
Organic peroxide IV	F1, R1
Organic peroxide V	None
Oxidizing gas (gaseous)	OX
Oxidizing gas (liquefied)	OX
Oxidizer 4	OX4
Oxidizer 3	OX3
Oxidizer 2	OX2
Oxidizer 1	OX1
Pyrophoric gases	F4
Pyrophoric solids, liquids	F3
Unstable reactive 4D	R4
Unstable reactive 3D	R4
Unstable reactive 3N	R2
Unstable reactive 2	R2
Unstable reactive 1	None
Water reactive 3	W3
Water reactive 2	W2
Corrosive	H3, COR
Toxic	H3
Highly toxic	H4

a. F3 = Finely divided solids, typically less than 75 micrometers (µm) (200 mesh), that pose an elevated risk of forming an ignitable dust cloud, such as finely divided sulfur, NFPA 70 Group E dusts (for example, aluminum, zirconium and titanium) and bisphenol A. F2 = Finely divided solids less than 420 µm (40 mesh) that pose an ordinary risk of forming an ignitable dust cloud.

F—Flammable category.

R—Reactive category.

H—Health category.

W—Special hazard: water reactive.

OX—Special hazard: oxidizing properties.

COR—Corrosive.

UD—Unclassified detonable material.

4D—Class 4 detonable material.

3D—Class 3 detonable material.

3N—Class 3 nondetonable material.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX G – CRYOGENIC FLUIDS—WEIGHT AND VOLUME EQUIVALENTS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX G

CRYOGENIC FLUIDS—WEIGHT AND VOLUME EQUIVALENTS

This appendix is for information purposes and is not intended for adoption.

User note:

About this appendix: Appendix G gives the fire code official and registered design professional a ready reference tool for the conversion of the liquid weight and volume of cryogenic fluid to their corresponding volume of gas and vice versa and is a companion to the provisions of Chapter 55 of this code.

SECTION G101 GENERAL

G101.1 Scope. This appendix is used to convert from liquid to gas for cryogenic fluids.

G101.2 Conversion. Table G101.2 shall be used to determine the equivalent amounts of cryogenic fluids in either the liquid or gas phase.

G101.2.1 Use of the table. To use Table G101.2, read horizontally across the line of interest. For example, to determine the number of cubic feet of gas contained in 1.0 gallon (3.785 L) of liquid argon, find 1.000 in the column entitled “Volume of Liquid at Normal *Boiling Point*.” Reading across the line under the column entitled “Volume of Gas at NTP” (70°F and 1 atmosphere/14.7 psia), the value of 112.45 cubic feet (3.184 m³) is found.

G101.2.2 Other quantities. If other quantities are of interest, the numbers can be multiplied or divided to obtain the quantity of interest. For example, to determine the number of cubic feet of argon gas contained in a volume of 1,000 gallons (3785 L) of liquid argon at its normal boiling point, multiply 112.45 by 1,000 to obtain 112,450 cubic feet (3184 m³).

APPENDIX G—CRYOGENIC FLUIDS—WEIGHT AND VOLUME EQUIVALENTS

TABLE G101.2
WEIGHT AND VOLUME EQUIVALENTS FOR COMMON CRYOGENIC FLUIDS

CRYOGENIC FLUID	WEIGHT OF LIQUID OR GAS		VOLUME OF LIQUID AT NORMAL BOILING POINT		VOLUME OF GAS AT NTP	
	Pounds	Kilograms	Liters	Gallons	Cubic feet	Cubic meters
Argon	1.000	0.454	0.326	0.086	9.67	0.274
	2.205	1.000	0.718	0.190	21.32	0.604
	3.072	1.393	1.000	0.264	29.71	0.841
	11.628	5.274	3.785	1.000	112.45	3.184
	10.340	4.690	3.366	0.889	100.00	2.832
	3.652	1.656	1.189	0.314	35.31	1.000
Helium	1.000	0.454	3.631	0.959	96.72	2.739
	2.205	1.000	8.006	2.115	213.23	6.038
	0.275	0.125	1.000	0.264	26.63	0.754
	1.042	0.473	3.785	1.000	100.82	2.855
	1.034	0.469	3.754	0.992	100.00	2.832
	0.365	0.166	1.326	0.350	35.31	1.000
Hydrogen	1.000	0.454	6.409	1.693	191.96	5.436
	2.205	1.000	14.130	3.733	423.20	11.984
	0.156	0.071	1.000	0.264	29.95	0.848
	0.591	0.268	3.785	1.000	113.37	3.210
	0.521	0.236	3.339	0.882	100.00	2.832
	0.184	0.083	1.179	0.311	35.31	1.000
Oxygen	1.000	0.454	0.397	0.105	12.00	0.342
	2.205	1.000	0.876	0.231	26.62	0.754
	2.517	1.142	1.000	0.264	30.39	0.861
	9.527	4.321	3.785	1.000	115.05	3.250
	8.281	3.756	3.290	0.869	100.00	2.832
	2.924	1.327	1.162	0.307	35.31	1.000
Nitrogen	1.000	0.454	0.561	0.148	13.80	0.391
	2.205	1.000	1.237	0.327	30.43	0.862
	1.782	0.808	1.000	0.264	24.60	0.697
	6.746	3.060	3.785	1.000	93.11	2.637
	7.245	3.286	4.065	1.074	100.00	2.832
	2.558	1.160	1.436	0.379	35.31	1.000
LNG ^a	1.000	0.454	1.052	0.278	22.968	0.650
	2.205	1.000	2.320	0.613	50.646	1.434
	0.951	0.431	1.000	0.264	21.812	0.618
	3.600	1.633	3.785	1.000	82.62	2.340
	4.356	1.976	4.580	1.210	100.00	2.832
	11.501	5.217	1.616	0.427	35.31	1.000

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³, °C = [(°F) – 32]/1.8, 1 pound per square inch atmosphere = 6.895 kPa.

a. The values listed for liquefied natural gas (LNG) are “typical” values. LNG is a mixture of hydrocarbon gases, and no two LNG streams have exactly the same composition.

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX H – HAZARDOUS MATERIALS MANAGEMENT PLAN
AND HAZARDOUS MATERIALS INVENTORY STATEMENTS**

(Matrix Adoption Tables are non-regulatory, intended only as an aid to the user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter			X																			
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX H

HAZARDOUS MATERIALS MANAGEMENT PLANS AND HAZARDOUS MATERIALS INVENTORY STATEMENTS (See Sections 5001.5.1 and 5001.5.2)

SECTION H1 SCOPE

H1.1 Scope. Hazardous materials inventory statements (HMIS) and hazardous materials management plans (HMMP) which are required by the fire chief, pursuant to Chapter 50, shall be provided for hazardous materials in accordance with Appendix H.

Exceptions:

1. Materials which have been satisfactorily demonstrated not to present a potential danger to public health, safety or welfare, based upon the quantity or condition of storage, when approved.
2. Chromium, copper, lead, nickel and silver need not be considered hazardous materials for the purposes of Appendix H unless they are stored in a friable, powdered or finely divided state.

Proprietary and trade secret information shall be protected under the laws of the state or jurisdiction having authority.

SECTION H2 HAZARDOUS MATERIALS INVENTORY STATEMENTS (HMIS)

H2.1 When Required. A separate HMIS shall be provided for each building, including its appurtenant structures, and each exterior facility in which hazardous materials are stored.

The hazardous materials inventory statement shall list, by hazard class, all hazardous materials stored. The hazardous materials inventory statement shall include the following information for each hazardous material listed:

1. Hazard class.
2. Common or trade name.
3. Chemical name, major constituents and concentrations if a mixture. If a waste, the waste category.
4. Chemical Abstract Service number (CAS number) found in 29 Code of Federal Regulations (C.F.R.).
5. Whether the material is pure or a mixture, and whether the material is a solid, liquid or gas.
6. Maximum aggregate quantity stored at any one time.
7. Storage conditions related to the storage type, temperature and pressure.

H2.2 Changes to HMIS. An amended HMIS shall be provided within 30 days of the storage of any hazardous materials which changes or adds a hazard class or which is

sufficient in quantity to cause an increase in the quantity which exceeds 5 percent for any hazard class.

SECTION H3 HAZARDOUS MATERIALS MANAGEMENT PLAN (HMMP)

H3.1 General. Applications for a permit to store hazardous materials shall include an HMMP standard form or short form in accordance with Section H3.3 and shall provide a narrative description of the operations and processes taking place at the facility. See Figure A-H-1.

H3.2 Information Required. The HMMP standard form shall include the information detailed in Section H3.2.

H3.2.1 General Information. General information, including business name and address, emergency contacts, business activity, business owner or operator, SIC code, number of employees and hours, Dunn and Bradstreet number, and signature of owner, operator or designated representative.

H3.2.2 General site plan. A general site plan drawn at a legible scale which shall include, but not be limited to, the location of buildings, exterior storage facilities, permanent access ways, evacuation routes, parking lots, internal roads, chemical loading areas, equipment cleaning areas, storm and sanitary sewer accesses, emergency equipment and adjacent property uses. The exterior storage areas shall be identified with the hazard class and the maximum quantities per hazard class of hazardous materials stored. When required by the chief, information regarding the location of wells, flood plains, earthquake faults, surface water bodies and general land uses within 1 mile (1.609 km) of the facility boundaries shall be included.

H3.2.3 Building floor plan. A building floor plan drawn to a legible scale which shall include, but not be limited to, hazardous materials storage areas within the building and shall indicate rooms, doorways, corridors, means of egress and evacuation routes. Each hazardous materials storage facility shall be identified by a map key which lists the individual hazardous materials, their hazard class and quantity present for each area.

H3.2.4 Hazardous materials handling. Information showing that activities involving the handling of hazardous materials between the storage areas and manufacturing processes on site are conducted in a manner to prevent the accidental release of such materials.

H3.2.5 Chemical capability and separation. Information showing procedures, controls, signs or other methods used to ensure separation and protection of stored materials

from factors which could cause accidental ignition or reaction of ignitable, reactive or incompatible materials in each area.

H3.2.6 Monitoring program. Information including, but not limited to, the location, type, manufacturer's specifications, if applicable, and suitability of monitoring methods for each storage facility when required.

H3.2.7 Inspection and recording keeping. Schedules and procedures for inspecting safety and monitoring and emergency equipment. The permittee shall develop and follow a written inspection procedure acceptable to the chief for inspecting the facility for events or practices which could lead to unauthorized discharges of hazardous materials. Inspections shall be conducted at a frequency appropriate to detect problems prior to a discharge. An inspection check sheet shall be developed to be used in conjunction with routine inspections. The check sheet shall provide for the date, time and location of inspection; note problems and dates and times of corrective actions taken; and include the name of the inspector and the countersignature of the designated safety manager for the facility.

H3.2.8 Employee training. A training program appropriate to the types and quantities of materials stored or used shall be conducted to prepare employees to safely handle hazardous materials on a daily basis and during emergencies. The training program shall include:

1. Instruction in safe storage and handling of hazardous materials, including maintenance of monitoring records;
2. Instruction in emergency procedures for leaks, spills, fires or explosions, including shutdown of operations and evacuation procedures; and
3. Record-keeping procedures for documenting training given to employees.

H3.2.9 Emergency response. A description of facility emergency procedures is to be provided.

H3.3 HMMP Short Form—(Minimal Storage Site). A facility shall qualify as a minimal storage site if the quantity of each hazardous material stored in one or more facilities in an aggregate quantity for the facility is 500 pounds (227 kg) or less for solids, 55 gallons (208.2 L) or less for liquids, or 200 cubic feet (5.7 m³) or less at NTP for compressed gases and does not exceed the threshold planning quantity as listed in 40 C.F.R., Part 355, Sections 302 and 304. The applicant for a permit for a facility which qualifies as a minimal storage site is allowed to file the short form HMMP. Such plan shall include the following components:

1. General facility information,
2. A simple line drawing of the facility showing the location of storage facilities and indicating the hazard class or classes and physical state of the hazardous materials being stored,
3. Information describing that the hazardous materials will be stored and handled in a safe manner and will be appropriately contained, separated and monitored, and
4. Assurance that security precautions have been taken, employees have been appropriately trained to handle the hazardous materials and react to emergency situations, adequate labeling and warning signs are posted, adequate emergency equipment is maintained, and the disposal of hazardous materials will be in an appropriate manner.

SECTION H4 MAINTENANCE OF RECORDS

H4.1 Hazardous materials inventory statements and hazardous materials management plans shall be maintained by the permittee for a period of not less than three years after submittal of updated or revised versions. Such records shall be made available to the fire chief upon request.

**FIGURE A-H-1
SAMPLE FORMAT
HAZARDOUS MATERIALS MANAGEMENT PLAN (HMMP) INSTRUCTIONS**

SECTION I—FACILITY DESCRIPTION

1.1 Part A

1. Fill out Items 1 through 11 and sign the declaration.
2. Only Part A of this section is required to be updated and submitted annually, or within 30 days of a change.

1.2 Part B—General Facility Description (Site Plan)

1. Provide a site plan on 8 1/2-by 11-inch (215 mm by 279 mm) paper, using letters on the top and bottom margins and numbers on the right and left side margins, showing the location of all buildings, structures, chemical loading areas, parking lots, internal roads, storm and sanitary sewers, wells, and adjacent property uses. Indicate the approximate scale, northern direction and date the drawing was completed.
2. List all special land uses within 1 mile (1.609 km).

1.3 Part C—Facility Storage Map (Confidential Information)

1. Provide a floor plan of each building on 8 1/2 by 11-inch (215 mm by 279 mm) paper, using letters on the top and bottom margins and numbers on the right and left side margins, with approximate scale and northern direction, showing the location of each storage area. Mark map clearly “Confidential—Do not disclose” for trade-secret information as specified by federal, state and local laws.
2. Identify each storage area with an identification number, letter, name or symbol.
3. Show the following:
 - 3.1. Accesses to each storage area.
 - 3.2. Location of emergency equipment.
 - 3.3. The general purpose of other areas within the facility.
 - 3.4. Location of all aboveground and underground tanks to include sumps, vaults, below-grade treatment systems, piping, etc.
4. Map key. Provide the following on the map or in a map key or legend for each storage area:
 - 4.1. A list of hazardous materials, including wastes.
 - 4.2. Hazard class of each hazardous waste.
 - 4.3. The maximum quantity for hazardous materials.
 - 4.4. Include the contents and capacity limit of all tanks at each area and indicate whether they are above or below ground.
 - 4.5. List separately any radioactives, cryogenes and compressed gases for each facility.
 - 4.6. Trade-secret information shall be listed as specified by federal, state and local laws.

SECTION II—HAZARDOUS MATERIALS INVENTORY STATEMENT (HMIS)

2.1 Part A—Declaration

Fill out all appropriate information.

2.2 Part B—Inventory Statement

1. You must complete a separate inventory statement for all waste and nonwaste hazardous materials. List all hazardous materials in alphabetical order by hazard class.

2. Inventory Statement Instructions:

Column	Information Required
---------------	-----------------------------

1. Provide hazard class for each material.
2. Nonwaste. Provide the common or trade name of the regulated material. Waste. In lieu of trade names, you may provide the waste category.
3. Provide the chemical name and major constituents and concentrations, if a mixture.
4. Enter the chemical abstract service number (CAS number) found in 29 C.F.R. For mixtures, enter the CAS number of the mixture as a whole if it has been assigned a number distinct from its constituents. For a mixture that has no CAS number, leave this item blank or report the CAS numbers of as many constituent chemicals as possible.

APPENDIX H—HAZARDOUS MATERIALS MANAGEMENT PLANS AND HAZARDOUS MATERIALS INVENTORY STATEMENTS

5. Enter the following descriptive codes as they apply to each material. You may list more than one code, if applicable.

- P = Pure*
- M = Mixture*
- S = Solid*
- L = Liquid*
- G = Gas*

6. Provide the maximum aggregate quantity of each material handled at any one time by the business. For underground tanks, list the maximum volume [in gallons (liters)] of the tank.

6.1. Enter the estimated average daily amount on site during the past year.

7. Enter the units used in Column 6 as:

- LB = Pounds*
- GA = Gallons*
- CF = Cubic Feet*

8. Enter the number of days that the material was present on site (during the last year).

9. Enter the storage codes below for type, temperature and pressure.

Type

- A = Aboveground Tank*
- B = Belowground Tank*
- C = Tank inside Building*
- D = Steel Drum*
- E = Plastic or Nonmetallic Drum*
- F = Can*
- G = Carbon*
- H = Silo*
- I = Fiber Drum*
- J = Bag*
- K = Box*
- L = Cylinder*
- M = Glass Bottle or Jug*
- N = Plastic Bottles or Jugs*
- O = Tote Bin*
- P = Tank Wagon*
- Q = Rail Car*
- R = Other*

Temperature

- 4 = Ambient*
- 5 = Greater than Ambient*
- 6 = Less than Ambient, but not Cryogenic [less than -150°F (-101.1°C)]*
- 7 = Cryogenic conditions [less than -150°F (-101.1°C)]*

Pressure

- 1 = Ambient (Atmospheric)*
- 2 = Greater than Ambient (Atmospheric)*
- 3 = Less than Ambient (Atmospheric)*

10. For each material listed, provide the Superfund Amendments and Reauthorization Act (SARA) hazard class as listed below. You may list more than one class. These categories are defined in 40 C.F.R. 370.3.

Physical Hazards

F = Fire

P = Sudden Release of Pressure

R = Reactivity

Health Hazards

I = Immediate (Acute)

D = Delayed (Chronic)

11. **Waste Only.** For each waste, provide the total estimated amount of hazardous waste handled throughout the course of the year.

SECTION III—SEPARATION AND MONITORING

3.1 Part A—Aboveground

Fill out Items 1 through 6, or provide similar information for each storage area shown on the facility map. Use additional sheets as necessary.

3.2 Part B—Underground

1. Complete a separate page for each underground tank, sump, vault, below-grade treatment system, etc.
2. Check the type of tank and method(s) that applies to your tank(s) and piping, and answer the appropriate questions. Provide any additional information in the space provided or on a separate sheet.

SECTION IV—WASTE DISPOSAL

Check all that apply and list the associated wastes for each method checked.

SECTION V—RECORDING KEEPING

Include a brief description of your inspection procedures. You are also required to keep an inspection log and recordable discharge log, which are designed to be used in conjunction with routine inspections for all storage facilities or areas. Place a check in each box that describes your forms. If you do not use the sample forms, provide copies of your forms for review and approval.

SECTION VI—EMERGENCY-RESPONSE PLAN

1. This plan should describe the personnel, procedures and equipment available for responding to a release or threatened release of hazardous materials that are stored, handled or used on site.
2. A check or a response under each item indicates that a specific procedure is followed at the facility, or that the equipment specified is maintained on site.
3. If the facility maintains a more detailed emergency-response plan on site, indicate this in Item 5. This plan shall be made available for review by the inspecting jurisdiction.

SECTION VII—EMERGENCY RESPONSE TRAINING PLAN

1. This plan should describe the basic training plan used at the facility.
2. A check in the appropriate box indicates the training is provided or the records are maintained.
3. If the facility maintains a more detailed emergency-response training plan, indicate this in Item 4. This plan shall be made available for review by the inspecting jurisdiction.

FIGURE A-H-1
HAZARDOUS MATERIALS MANAGEMENT PLAN
SECTION I: FACILITY DESCRIPTION

PART A—GENERAL INFORMATION

1. *Business Name:* _____ *Phone:* _____
Address: _____

2. *Person Responsible for the Business*
Name: _____ **Title:** _____ **Phone:** _____

3. *Emergency Contacts:*

Name:	Title:	Home Number:	Work Number:
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

4. *Person Responsible for the Application/Principal Contact:*
Name: _____ **Title:** _____ **Phone:** _____

5. *Property Owner:*
Name: _____ **Address:** _____ **Phone:** _____

6. *Principal Business Activity:* _____

7. *Number of Employees:* _____

8. *Number of Shifts:* _____

9. *Hours of Operation:* _____

10. *SIC Code:* _____

11. *Dunn and Bradstreet Number:* _____

12. *Declaration* _____

I certify that the information above and on the following parts is true and correct to the best of my knowledge.

Signature: _____ *Date:* _____

Print Name: _____ *Title:* _____

(Must be signed by owner/operator or designated representative)

PART B—GENERAL FACILITY DESCRIPTION/SITE PLAN

(Use grid format on next page.)

Special land uses within 1 mile (1.609 km): _____

PART C—FACILITY MAP

(Use grid format below.)

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	
1															1
2															2
3															3
4															4
5															5
6															6
7															7
8															8
9															9
10															10
11															11
12															12
13															13
14															14
15															15
16															16
17															17
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	

BUSINESS NAME	DATE
ADDRESS CITY	PAGE _____ OF _____

(Use grid format above)

SECTION II: HAZARDOUS MATERIALS INVENTORY STATEMENT

PART A—DECLARATION

1. Business Name: _____

2. Address: _____

3. Declaration:

Under penalty of perjury, I declare the above and subsequent information, provided as part of the hazardous materials inventory statement, is true and correct.

Signature: _____ Date: _____

Print Name: _____ Title: _____

(Must be signed by owner/operator or designated representative)

FIGURE A-II-E-1—(Continued)

PART B—HAZARDOUS MATERIALS INVENTORY STATEMENT

(1) HAZARD CLASS	(2) COMMON/ TRADE NAME	(3) CHEMICAL NAME, COMPONENTS AND CONCENTRATION	(4) CHEMICAL ABSTRACT SERVICE NO.	(5) PHYSICAL STATE	(6) MAXIMUM QUANTITY ON HAND AT ANY TIME	(7) UNITS	(8) DAYS ON SITE	(9) STORAGE CODE (TYPE, PRES., TEMP.)	(10) SARA CLASS	(11) ANNUAL WASTE THROUGHPUT
---------------------	---------------------------	--	--------------------------------------	-----------------------	---	--------------	---------------------	--	--------------------	---------------------------------

SECTION III: SEPARATION, SECONDARY CONTAINMENT AND MONITORING

PART A—ABOVEGROUND STORAGE AREAS

Storage Area Identification (as shown on facility map): _____

1. Storage Type:

_____ Original Containers	_____ Safety Cans
_____ Inside Machinery	_____ Bulk Tank
_____ 55-gallon (208.2 L)	_____ Outside Barrels
_____ Drums or Storage Shed	
_____ Pressurized Vessel	
_____ Other: _____	

2. Storage Location:

_____ Inside Building	_____ Outside Building
_____ Secured	

3. Separation:

_____ All Materials	_____ One-hour Separation
_____ Compatible Wall/Partition	
_____ Separated by 20 Feet (6096 mm)	_____ Approved Cabinets
_____ Other: _____	

4. Secondary Containment:

_____ Approved Cabinet	_____ Secondary Drums
_____ Tray	_____ Bermed, Coated Floor
_____ Vaulted Tank	_____ Double-wall Tank
_____ Other: _____	

5. Monitoring:

_____ Visual	_____ Continuous
_____ Other: _____	

Attach specifications if necessary

6. Monitoring Frequency:

_____ Daily	_____ Weekly
_____ Other: _____	

Attach specifications if necessary

APPENDIX H

FIGURE A-II-E-1—(Continued)

SECTION III: SEPARATION, CONTAINMENT AND MONITORING

PART B—UNDERGROUND

SINGLE-WALL TANKS AND PIPING

Tank Area Identification (as shown on facility map): _____

1. _____ Backfill Vapor Wells

Model and Manufacturer: _____

Continuous or Monthly Testing: _____

2. _____ Groundwater Monitoring Wells

3. _____ Monthly Precision Tank Test

4. _____ Piping—

Monitoring Method: _____

Frequency: _____

5. _____ Other: _____

DOUBLE-WALL TANKS AND PIPING

Tank Area Identification (as shown on facility map): _____

1. Method of monitoring the annular space: _____

2. Frequency:

_____ Continuous _____ Daily _____ Weekly

_____ Other: _____

3. List the type of secondary containment for piping: _____

4. List the method of monitoring the secondary containment for piping: _____

5. Are there incompatible materials within the same vault?

_____ Yes _____ No

If yes, how is separate secondary containment provided? _____

Note: If you have continuous monitoring equipment, you shall maintain copies of all service and maintenance work. Such reports shall be made available for review on site, and shall be submitted to the fire prevention bureau upon request. Attach additional sheets as necessary.

SECTION IV: WASTE DISPOSAL

_____ Discharge to the Sanitary _____ Pretreatment—

Sewer—Wastes: _____ Wastes: _____

Licensed Waste Hauler _____ Recycle _____

Wastes: _____ Wastes: _____

_____ Other—

Describe Method: _____

Wastes: _____

_____ No Waste

APPENDIX H

FIGURE A-II-E-1—(Continued)

SECTION IV: WASTE DISPOSAL—continued

B. Spill Containment:

_____ Absorbents _____ Other: _____

C. Spill Control and Treatment:

_____ Vapor Scrubber _____ Mechanical Ventilation

_____ Pumps/vacuums _____ Secondary Containment

_____ Neutralizer _____ Other: _____

4. Evacuation:

_____ Immediate area evacuation routes posted

_____ Entire building evacuation procedures developed

_____ Assembly areas preplanned

_____ Evacuation maps posted

_____ Other: _____

5. Supplemental hazardous materials emergency response plan on site.

Location: _____

Responsible Person: _____

Phone: _____

SECTION V: RECORD KEEPING

Description of our inspection program: _____

_____ We will use the attached sample forms in our inspection program.

_____ We will not use the sample forms. We have attached a copy of our own forms.

SECTION VI: EMERGENCY RESPONSE PLAN

1. In the event of an emergency, the following shall be notified:

A. On-site Responders:

Name:	Title:	Home Number:
_____	_____	_____
_____	_____	_____

B. Method of Notification to Responder:

_____ Automatic Alarm _____ Phone

_____ Manual Alarm _____ Verbal

_____ Other: _____

C. Agency: Phone Number:
Fire Department:
California Emergency Management Agency (Cal EMA):
Other:

2. Designated Local Emergency Medical Facility:

Name: Address: Phone (24 hours):

3. Mitigation Equipment:

A. Monitoring Devices:

- Toxic or flammable gas detection
Fluid detection
Other:

SECTION VII: EMERGENCY-RESPONSE TRAINING PLAN

1. Person responsible for the emergency-response training plan:

Name: Title: Phone:

2. Training Requirements:

A. All employees trained in the following as indicated:

- Procedures for internal alarm/notification
Procedures for notification of external emergency-response organization
Location and content of the emergency-response plan

B. Chemical handlers are trained in the following as indicated:

- Safe methods for handling and storage of hazardous materials
Proper use of personal protective equipment
Locations and proper use of fire- and spill-control equipment
Specific hazards of each chemical to which they may be exposed

C. Emergency-response team members are trained in the following:

- Procedures for shutdown of operations
Procedures for using, maintaining and replacing facility emergency and monitoring equipment

3. The following records are maintained for all employees:

- Verification that training was completed by the employee
Description of the type and amount of introductory and continuing training
Documentation on and description of emergency-response drills conducted at the facility

4. A more comprehensive and detailed emergency-response training plan is maintained on site.

Location:

Responsible Person:

Phone:

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX I – FIRE PROTECTION SYSTEMS—NONCOMPLIANT CONDITIONS**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX I

FIRE PROTECTION SYSTEMS—NONCOMPLIANT CONDITIONS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix I, which was developed by the ICC Hazard Abatement in Existing Buildings Committee, is intended to provide the fire code official with a list of conditions that are readily identifiable by the inspector during the course of an inspection utilizing this code. The specific conditions identified in this appendix are primarily derived from applicable NFPA standards and pose a hazard to the proper operation of the respective systems. While these do not represent all of the conditions that pose a hazard or otherwise may impair the proper operation of fire protection systems, their identification in this adoptable appendix will provide a more direct path for enforcement by the fire code official.

SECTION I101 NONCOMPLIANT CONDITIONS

I101.1 General. This appendix is intended to identify conditions that can occur where fire protection systems are not properly maintained or components have been damaged. This appendix is not intended to provide comprehensive inspection, testing and maintenance requirements, which are found in NFPA 10, 25 and 72. Rather, it is intended to identify problems that are readily observable during fire inspections.

I101.2 Noncompliant conditions requiring component replacement. The following conditions shall be deemed noncompliant and shall cause the related component(s) to be replaced to comply with the provisions of this code:

1. Sprinkler heads having any of the following conditions:
 - 1.1. Signs of leakage.
 - 1.2. Paint or other ornamentation that is not factory applied.
 - 1.3. Evidence of corrosion including, but not limited to, discoloration or rust.
 - 1.4. Deformation or damage of any part.
 - 1.5. Improper orientation of sprinkler head.
 - 1.6. Empty glass bulb.
 - 1.7. Sprinkler heads manufactured prior to 1920.
 - 1.8. Replacement sprinkler heads that do not match existing sprinkler heads in orifice size, K-factor temperature rating, coating or deflector type.
 - 1.9. Sprinkler heads for the protection of cooking equipment that have not been replaced within one year.
2. Water pressure and air pressure gauges that have been installed for more than 5 years and have not been tested to within 3 percent accuracy.

I101.3 Noncompliant conditions requiring component repair or replacement. The following shall be deemed noncompliant conditions and shall cause the related component(s) to be repaired or replaced to comply with the provisions of this code:

1. Sprinkler and standpipe system piping and fittings having any of the following conditions:
 - 1.1. Signs of leakage.
 - 1.2. Evidence of corrosion.
 - 1.3. Misalignment.
 - 1.4. Mechanical damage.
2. Sprinkler piping support having any of the following conditions:
 - 2.1. Materials resting on or hung from sprinkler piping.
 - 2.2. Damaged or loose hangers or braces.
3. Class II and Class III standpipe systems having any of the following conditions:
 - 3.1. No hose or nozzle, where required.
 - 3.2. Hose threads incompatible with fire department hose threads.
 - 3.3. Hose connection cap missing.
 - 3.4. Mildew, cuts, abrasions and deterioration evident.
 - 3.5. Coupling damaged.
 - 3.6. Gaskets missing or deteriorated.
 - 3.7. Nozzle missing or obstructed.
4. Hose racks and cabinets having any of the following conditions:
 - 4.1. Difficult to operate or damaged.
 - 4.2. Hose improperly racked or rolled.
 - 4.3. Inability of rack to swing 90 degrees (1.57 rad) out of the cabinet.
 - 4.4. Cabinet locked, except as permitted by this code.
 - 4.5. Cabinet door will not fully open.
 - 4.6. Door glazing cracked or broken.
5. Portable fire extinguishers having any of the following conditions:

- 5.1. Broken seal or tamper indicator.
 - 5.2. Expired maintenance tag.
 - 5.3. Pressure gauge indicator in “red.”
 - 5.4. Signs of leakage or corrosion.
 - 5.5. Mechanical damage, denting or abrasion of tank.
 - 5.6. Presence of repairs such as welding, soldering or brazing.
 - 5.7. Damaged threads.
 - 5.8. Damaged hose assembly, couplings or swivel joints.
6. Fire alarm and detection control equipment, initiating devices and notification appliances having any of the following conditions:
- 6.1. Corroded or leaking batteries or terminals.
 - 6.2. Smoke detectors having paint or other ornamentation that is not factory applied.
 - 6.3. Mechanical damage to heat or smoke detectors.
 - 6.4. Tripped fuses.
7. Fire department connections having any of the following conditions:
- 7.1. Fire department connections are not visible or able to be accessed from the fire apparatus access road.
 - 7.2. Couplings or swivels are damaged.
 - 7.3. Plugs and caps are missing or damaged.
 - 7.4. Gaskets are deteriorated.
 - 7.5. Check valve is leaking.
 - 7.6. Identification signs are missing.
8. Fire pumps having any of the following conditions:
- 8.1. Pump room temperature is less than 40°F (4.4°C).
 - 8.2. Ventilating louvers are not freely operable.
 - 8.3. Corroded or leaking system piping.
 - 8.4. Diesel fuel tank is less than two-thirds full.
 - 8.5. Battery readings, lubrication oil or cooling water levels are abnormal.

**TABLE I102.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
NFPA 10—21	<i>Portable Fire Extinguishers</i>	I101.1
NFPA 25—20	<i>Inspection, Testing and Maintenance of Water-based Fire Protection Systems</i>	I101.1
NFPA 72—19	<i>National Fire Alarm and Signaling Code</i>	I101.1

**SECTION I102
REFERENCED STANDARDS**

I102.1 General. See Table I102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX J – BUILDING INFORMATION SIGN**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX J

BUILDING INFORMATION SIGN

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix J provides design, installation and maintenance requirements for a Building Information Sign (BIS), a fire service tool to be utilized in the crucial, initial response of fire fighters to a structure fire. The BIS placard is designed to be utilized within the initial response time frame of an incident to assist fire fighters in their tactical sizing up of a situation as soon as possible after arrival on the scene of a fire emergency. The BIS design is in the shape of a fire service Maltese cross and includes five spaces (the four wings plus the centerpiece of the cross symbol) in which information is placed about the tactical considerations of construction type and hourly rating, fire protection systems, occupancy type, content hazards and special features that could affect tactical decisions and operations.

SECTION J101 GENERAL

J101.1 Scope. New buildings shall have a building information sign(s) that shall comply with Sections J101.1.1 through J101.7. Existing buildings shall be brought into compliance with Sections J101.1 through J101.9 when one of the following occurs:

1. The fire department conducts an annual inspection intended to verify compliance with this section, or any required inspection.
2. A change in use or occupancy has occurred.

Exceptions:

1. Group U occupancies.
2. One- and two-family dwellings.

J101.1.1 Sign location. The building information sign shall be placed at one of the following locations:

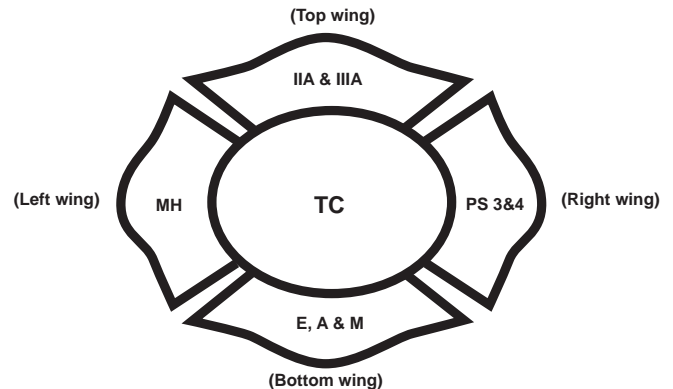
1. On the entry door or sidelight at a minimum height of 42 inches (1067 mm) above the walking surface on the address side of the building or structure.
2. On the exterior surface of the building or structure on either side of the entry door, not more than 3 feet (914 mm) from the entrance door, at a minimum height of 42 inches (1067 mm) above the walking surface on the address side of the building or structure.
3. Conspicuously placed inside an enclosed entrance lobby, on any vertical surface within 10 feet (3048 mm) of the entrance door at a minimum height of 42 inches (1067 mm) above the walking surface.
4. Inside the building's fire command center.
5. On the exterior of the fire alarm control unit or on the wall immediately adjacent to the fire alarm control unit door where the alarm panel is located in the enclosed main lobby.

J101.1.2 Sign features. The building information sign shall consist of all of the following:

1. White reflective background with red letters.

2. Durable material.
3. Numerals shall be Roman or Latin numerals, as required, or alphabet letters.
4. Permanently affixed to the building or structure in an approved manner.

J101.1.3 Sign shape. The building information sign shall be a Maltese cross as shown in Figure J101.1.3.



**FIGURE J101.1.3
EXAMPLE OF COMPLETED BUILDING INFORMATION SIGN**

J101.1.4 Sign size and lettering. The minimum size of the building information sign and lettering shall be in accordance with the following:

1. The width and height shall be 6 inches by 6 inches (152 mm by 152 mm).
2. The height or width of each Maltese cross wing area shall be $1\frac{1}{8}$ inches (29 mm) and have a stroke width of $\frac{1}{2}$ inch (12.7 mm).
3. The center of the Maltese cross, a circle or oval, shall be 3 inches (76 mm) in diameter and have a stroke width of $\frac{1}{2}$ inch (12.7 mm).
4. All Roman numerals and alphabetic designations, shall be $1\frac{1}{4}$ inch (32 mm) in height and have a stroke width of $\frac{1}{4}$ inch (6.4 mm).

J101.2 Sign designations. Designations shall be made based on the construction type, content, hazard, fire protection systems, life safety and occupancy. Where multiple designations occur within a classification category, the designation used shall be based on the greatest potential risk.

J101.3 Construction type (top wing). The construction types shall be designated by assigning the appropriate Roman numeral and letter, placed inside the top wing of the Maltese cross. The hourly rating provided is for the structural framing in accordance with Table 601 of the *California Building Code*,

CONSTRUCTION TYPE	FIRE-RESISTANCE RATING
IA—Noncombustible	3 hours
IB—Noncombustible	2 hours
IIA—Noncombustible	1 hour
IIB—Noncombustible	0 hours
IIIA—Noncombustible/combustible	1 hour
IIIB—Noncombustible/combustible	0 hours
IV—Heavy timber (HT)	HT
VA—Combustible	1 hour
VB—Combustible	0 hours

J101.4 Fire protection systems (right wing). The fire protection system shall be designated by determining its level of protection and assigning the appropriate designation to the right wing of the Maltese cross. Where multiple systems are provided, all shall be listed:

- AS Automatic sprinkler system installed throughout
- CES Chemical-extinguishing system and designated area
- CS Combination sprinkler and standpipe system
- DS Dry sprinkler system and designated areas
- FA Fire alarm system
- FP Fire pump
- FW Fire wall and designated areas
- PAS Pre-action sprinkler system and designated floor
- PS Partial automatic sprinkler system, and designated floor
- S Standpipe system
- NS No system installed

J101.5 Occupancy type (bottom wing). The occupancy of a building or structure shall be designated in accordance with the occupancy classification found in Section 302.1 of the *California Building Code* and the corresponding designation shall be placed in the bottom wing of the Maltese cross. Where a building or structure contains a mixture of uses and occupancies, all uses and occupancies shall be identified.

- A Assembly
- B Business
- E Educational
- F Factory or Industrial

- H High Hazard
- I Institutional
- M Mercantile
- R Residential

J101.6 Hazards of content (left wing). The hazards of building contents shall be designated by one of the following classifications as defined in NFPA 13 and the appropriate designation shall be placed inside the left wing of the Maltese cross:

- LH Light hazard
- MH Moderate hazard
- HH High hazard

J101.7 Tactical considerations (center circle). The center circle shall include the name of the local fire service and, where required, the letters “TC” for “tactical considerations.” Where fire fighters conduct preplan operations, a unique situation(s) for tactical considerations shall be identified and the information provided to the fire dispatch communications center to further assist fire fighters in identifying that there is special consideration(s) for this occupancy. Special consideration designations include, but are not limited to:

1. Impact-resistant drywall.
2. Impact-resistant glazing, such as blast or hurricane-type glass.
3. All types of roof and floor structural members including but not limited to post-tension concrete, bar joists, solid wood joists, rafters, trusses, cold-formed galvanized steel, I-joists and I-beams; green roof with vegetation, soil and plants.
4. Hazardous materials (such as explosives, chemicals, plastics).
5. Solar panels and DC electrical energy.
6. HVAC system; and smoke management system for pressurization and exhaust methods.
7. Other unique characteristic(s) within the building that are ranked according to a potential risk to occupants and fire fighters.

J101.8 Sign classification maintenance, building information. Sign maintenance shall comply with each of the following:

1. Fire departments in the jurisdiction shall define the designations to be placed within the sign.
2. Fire departments in the jurisdiction shall conduct annual inspections to verify compliance with this section of the code and shall notify the owner, or the owner’s agent, of any required updates to the sign in accordance with fire department designations and the owner, or the owner’s agent, shall comply within 30 days.
3. The owner of a building shall be responsible for the maintenance and updates to the sign in accordance with fire department designations.

J101.9 Training. Jurisdictions shall train fire department personnel on Sections J101.1 through J101.8.

**SECTION J102
REFERENCED STANDARDS**

J102.1 General. See Table J102.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE J102.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
IBC—21	International Building Code	J101.3, J101.5
NFPA 13—19	Installation of Sprinkler Systems	J101.6

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX K – CONSTRUCTION REQUIREMENTS FOR
EXISTING AMBULATORY CARE FACILITIES**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
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[California Code of Regulations, Title 19, Division 1]																						
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* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX K

CONSTRUCTION REQUIREMENTS FOR EXISTING AMBULATORY CARE FACILITIES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix K was created with the intent to provide jurisdictions with an option for assessing minimum fire and life safety requirements for buildings containing ambulatory care facilities. While this appendix is written with the intent to apply retroactive minimum standards, it is recognized that the ambulatory care requirements are relatively recent additions to the International Building Code®. For that reason, these requirements are presented as an appendix so that the adopting authority can exercise judgment in the adoption and application of this section. This appendix would also be useful for those local and state jurisdictions that are specifically focused on ensuring the safety of existing ambulatory care facilities by providing minimum criteria that could be used to bring older facilities into compliance with the current standards at the discretion of the adopting jurisdiction. The technical requirements are based on the current International Building Code language, which is consistent with the overall concept of the current federal requirements.

SECTION K101 GENERAL

K101.1 Scope. The provisions of this chapter shall apply to existing buildings containing ambulatory care facilities in addition to the requirements of Chapter 11. Where the provisions of this chapter conflict with either the construction requirements in Chapter 11 or the construction requirements that applied at the time of construction, the most restrictive provision shall apply.

K101.2 Intent. The intent of this appendix is to provide a minimum degree of fire and life safety to persons occupying existing buildings containing ambulatory care facilities where such buildings do not comply with the minimum requirements of the *California Building Code*.

SECTION K102 FIRE SAFETY REQUIREMENTS FOR EXISTING AMBULATORY CARE FACILITIES

K102.1 Separation. Ambulatory care facilities where the potential exists for four or more care recipients to be incapable of self-preservation at any time, whether rendered incapable by staff or staff has accepted responsibility for a care recipient already incapable, shall be separated from adjacent spaces, corridors or tenants with a fire partition installed in accordance with Section 708 of the *California Building Code*.

K102.2 Smoke compartments. Where the aggregate area of one or more ambulatory care facilities is greater than 10,000 square feet (929 m²) on one story, the story shall be provided with a smoke barrier to subdivide the story into not fewer than two smoke compartments. The area of any one such smoke compartment shall be not greater than 22,500 square feet (2092 m²). The travel distance from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet (60 960 mm). The smoke barrier shall be installed in accordance with Section 709 of the *California Building Code* with the exception that smoke barriers shall be continuous from an

outside wall to an outside wall, a floor to a floor, or from a smoke barrier to a smoke barrier or a combination thereof.

K102.2.1 Refuge area. Not less than 30 net square feet (2.8 m²) for each nonambulatory care recipient shall be provided within the aggregate area of corridors, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each smoke compartment. Each occupant of an ambulatory care facility shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

K102.2.2 Smoke barriers. Smoke barriers shall be constructed in accordance with Sections 422 and 709 of the *California Building Code*.

Exceptions:

1. Smoke barriers shall be permitted to terminate at an atrium enclosure in accordance with Section 404.6 of the *California Building Code*.
2. Smoke barriers shall be continuous from an outside wall to an outside wall, a floor to a floor, a smoke barrier to a smoke barrier or a combination thereof.

K102.2.3 Opening protectives. Openings in *smoke barriers* shall be protected in accordance with Section 716 of the *California Building Code*. Opening protectives shall have a minimum fire protection rating of 1/3 hour.

Exception: Existing wired glass vision panels in doors shall be permitted to remain.

K102.2.4 Penetrations. Penetrations of *smoke barriers* shall comply with the *California Building Code*.

Exception: Approved existing materials and methods of construction.

K102.2.5 Joints. Joints made in or between *smoke barriers* shall comply with the *California Building Code*.

Exception: Approved existing materials and methods of construction.

K102.2.6 Duct and air transfer openings. Penetrations in a smoke barrier by duct and air-transfer openings shall comply with Section 717 of the *California Building Code*.

Exception: Where existing duct and air-transfer openings in smoke barriers exist without smoke dampers, they shall be permitted to remain. Any changes to existing smoke dampers shall be submitted for review and approved in accordance with Section 717 of the *California Building Code*.

K102.2.7 Independent egress. A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.

K102.3 Automatic sprinkler system. An automatic sprinkler system shall be provided in ambulatory care facilities where required by Sections K102.3.1 and K102.3.2.

K102.3.1 Types IIB, IIIB and VB construction. An automatic sprinkler system shall be provided throughout the entire floor containing an ambulatory care facility in Types IIB, IIIB and VB construction where either of the following conditions exist at any time:

1. Four or more care recipients are rendered incapable of self-preservation.
2. One or more care recipients that are rendered incapable of self-preservation are located at other than the level of exit discharge serving such a facility.

In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor where such care is provided, all floors below and all floors between the level of ambulatory care and the nearest level of exit discharge, including the level of exit discharge.

K102.3.2 High-rise buildings. In high-rise buildings containing ambulatory care facilities, an automatic sprinkler system shall be provided throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:

1. Four or more care recipients are rendered incapable of self-preservation.
2. One or more care recipients that are rendered incapable of self-preservation are located at other than the level of exit discharge serving such a facility.

In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor where such care is provided, all floors below and all floors between the level of ambulatory care and the nearest level of exit discharge, including the level of exit discharge.

K102.4 Automatic fire alarm system. Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas

outside of tenant spaces, including public corridors and elevator lobbies.

Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, provided that the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.

K102.5 Waste and linen chutes. In ambulatory care facilities, existing waste and linen chutes shall comply with Sections K102.5.1 through K102.5.5.

K102.5.1 Enclosures. Chutes shall be enclosed with 1-hour fire-resistance-rated construction. Opening protectives shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

K102.5.2 Chute intakes. Chute intakes shall comply with Section K102.5.2.1 or K102.5.2.2.

K102.5.2.1 Chute intake direct from corridor. Where intake to chutes is direct from a corridor, the intake opening shall be equipped with a chute-intake door in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

K102.5.2.2 Chute intake via a chute-intake room. Where the intake to chutes is accessed through a chute-intake room, the room shall be enclosed with 1-hour fire-resistance-rated construction. Opening protectives for the intake room shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than $\frac{3}{4}$ hour. Opening protectives for the chute enclosure shall be in accordance with Section K102.5.1.

K102.5.3 Automatic sprinkler system. Chutes shall be equipped with an approved automatic sprinkler system in accordance with Section 903.2.11.2.

K102.5.4 Chute discharge rooms. Chutes shall terminate in a dedicated chute discharge room. Such rooms shall be separated from the remainder of the building by not less than 1-hour fire-resistance-rated construction. Opening protectives shall be in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

K102.5.5 Chute discharge protection. Chute discharges shall be equipped with a self-closing or automatic-closing opening protective in accordance with Section 716 of the *California Building Code* and have a fire protection rating of not less than 1 hour.

SECTION K103 INCIDENTAL USES IN EXISTING AMBULATORY CARE FACILITIES

K103.1 General. Incidental uses associated with and located within existing ambulatory care facilities required to be separated by Section 422 of the *California Building Code*, and that generally pose a greater level of risk to such occupancies, shall comply with the provisions of Sections K103.2 through

K103.4.2.1. Incidental uses in ambulatory care facilities required to be separated by Section 422 of the *California Building Code* are limited to those listed in Table K103.1.

K103.2 Occupancy classification. Incidental uses shall not be individually classified in accordance with Section 302.1 of the *California Building Code*. Incidental uses shall be included in the building occupancies in which they are located.

K103.3 Area limitations. Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.

K103.4 Separation and protection. The incidental uses listed in Table K103.1 shall be separated from the remainder of the building or be equipped with an automatic sprinkler system, or both, in accordance with the provisions of that table.

K103.4.1 Separation. Where Table K103.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building in accordance with Section 509.4.1 of the *California Building Code*.

K103.4.2 Protection. Where Table K103.1 permits an automatic sprinkler system without a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke in accordance with Section 509.4.2 of the *California Building Code*.

K103.4.2.1 Protection limitation. Except as otherwise specified in Table K103.1 for certain incidental uses, where an automatic sprinkler system is provided in accordance with Table K103.1, only the space occupied by the incidental use need be equipped with such a system.

**SECTION K104
MEANS OF EGRESS REQUIREMENTS FOR
EXISTING AMBULATORY CARE FACILITIES**

K104.1 Size of doors. The required capacity of each door opening shall be sufficient for the occupant load thereof and shall provide a minimum clear opening width of 28 inches (711 mm). Where this section requires a minimum clear opening width of 28 inches (711 mm) and a door opening includes two door leaves without a mullion, one leaf shall provide a minimum clear opening width of 28 inches (711 mm). In ambulatory care facilities, doors serving as means of egress from patient treatment rooms shall provide a minimum clear opening width of 32 inches (813 mm). The maximum width of a swinging door leaf shall be 48 inches (1219 mm) nominal. The minimum clear opening height of doors shall be 80 inches (2032 mm).

Exceptions:

1. Door openings to storage closets less than 10 square feet (0.93 m²) in area shall not be limited by the minimum clear opening width.
2. The width of door leaves in revolving doors that comply with Section 1010.3.1 shall not be limited.
3. The maximum width of door leaves in revolving doors that comply with Section 1010.3.2 shall not be limited.
4. Exit access doors serving a room not larger than 70 square feet (6.5 m²) shall have a door leaf width of not less than 24 inches (610 mm).
5. Door closers and door stops shall be permitted to be 78 inches (1981 mm) minimum above the floor.

K104.2 Corridor and aisle width. Corridor width shall be as determined in Section 1005.1 and this section. The minimum width of corridors and aisles that serve gurney traffic in areas where patients receive care that causes them to be incapable of self-preservation shall be not less than 72 inches (1829 mm).

**TABLE K103.1
INCIDENTAL USES IN EXISTING AMBULATORY CARE FACILITIES**

ROOM OR AREA	SEPARATION AND/OR PROTECTION
Furnace room where any piece of equipment is over 400,000 Btu per hour input	1 hour or provide automatic sprinkler system
Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower	1 hour or provide automatic sprinkler system
Refrigerant machinery room	1 hour or provide automatic sprinkler system
Hydrogen fuel gas rooms, not classified as Group H	1 hour
Incinerator rooms	2 hours and provide automatic sprinkler system
Laboratories not classified as Group H	1 hour or provide automatic sprinkler system
Laundry rooms over 100 square feet	1 hour or provide automatic sprinkler system
Waste and linen collection rooms with containers with total volume of 10 cubic feet or greater	1 hour or provide automatic sprinkler system
Storage rooms greater than 100 square feet	1 hour or provide automatic sprinkler system
Stationary storage battery systems having a liquid electrolyte capacity of more than 50 gallons for flooded lead-acid, nickel cadmium or VRLA, or more than 1,000 pounds for lithium-ion and lithium metal polymer used for facility standby power, emergency power or uninterruptible power supplies	1 hour

For SI: 1 square foot = 0.0929 m², 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L.

K104.3 Existing elevators. Existing elevators, escalators, dumbwaiters and moving walks shall comply with the requirements of Sections K104.3.1 and K104.3.2.

K104.3.1 Elevators, escalators, dumbwaiters and moving walks. Existing elevators, escalators, dumbwaiters and moving walks in ambulatory care facilities required to be separated by Section 422 of the *California Building Code* shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

K104.3.2 Elevator emergency operation. Existing elevators with a travel distance of 25 feet (7620 mm) or more above or below the main floor or other level of a building and intended to serve the needs of emergency personnel for fire-fighting or rescue purposes shall be provided with emergency operation in accordance with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*.

**SECTION K105
REFERENCED STANDARDS**

K105.1 General. See Table K105.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE K105.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	<i>California Building Code</i>	K101.2, K102.1, K102.2, K102.2.2, K102.2.3, K102.2.4, K102.2.5, K102.2.6, K102.5.1, K102.5.2.1, K102.5.2.2, K102.5.4, K102.5.5, K103.1, K103.2, K103.4.1, K103.4.2, K104.3.1
ASME A17.3—2020	<i>California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders</i>	K104.3.1, K104.3.2

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX L – REQUIREMENTS FOR FIRE FIGHTER AIR REPLENISHMENT SYSTEMS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
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APPENDIX L

REQUIREMENTS FOR FIRE FIGHTER AIR REPLENISHMENT SYSTEMS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix L provides for the design, installation and maintenance of permanently installed fire fighter breathing air systems in buildings designated by the jurisdiction. Breathing air is critical for fire-fighting operations. Historically, fire departments have supplied air bottles by means of a "bottle brigade," whereby fire fighters manually transport air bottles up stairways, which is an extraordinarily fire fighter-intensive process and takes fire fighters away from their primary mission of rescue and fire fighting. Technology now exists to address the issue using in-building air supply systems. Fire fighter breathing air systems were introduced in the late 1980s and are now required in a number of communities throughout the United States. The system has been called a "standpipe for air" and consists of stainless steel, high-pressure piping that is supplied by on-site air storage or fire department air supply units. Air-filling stations are then strategically located throughout the building, allowing fire fighters to refill breathing air cylinders inside the fire building, negating the required "bottle brigade," and making more fire fighters available for search, rescue and fire suppression operations.

SECTION L101 GENERAL

L101.1 Scope. Fire fighter air replenishment systems (FARS) shall be provided in accordance with this appendix. The adopting ordinance shall specify building characteristics or special hazards that establish thresholds triggering a requirement for the installation of a FARS. The requirement shall be based on the fire department's capability of replenishing fire fighter breathing air during sustained emergency operations. Considerations shall include:

1. Building characteristics, such as number of stories above or below grade plane, floor area, type of construction and fire resistance of the primary structural frame to allow sustained fire-fighting operations based on a rating of not less than 2 hours.
2. Special hazards, other than buildings, that require unique accommodations to allow the fire department to replenish fire fighter breathing air.
3. Fire department staffing level.
4. Availability of a fire department breathing air replenishment vehicle.

SECTION L102 DEFINITIONS

L102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

FIRE FIGHTER AIR REPLENISHMENT SYSTEM (FARS). A permanently installed arrangement of piping, valves, fittings and equipment to facilitate the replenishment of breathing air in self-contained breathing apparatus (SCBA) for fire fighters engaged in emergency operations.

SECTION L103 PERMITS

L103.1 Permits. Permits shall be required to install and maintain a FARS. Permits shall be in accordance with Sections L103.2 and L103.3.

L103.2 Construction permit. A construction permit is required for installation of or modification to a FARS. The construction permit application shall include documentation of an acceptance and testing plan as specified in Section L105.

L103.3 Operational permit. An operational permit is required to maintain a FARS.

SECTION L104 DESIGN AND INSTALLATION

L104.1 Design and installation. A FARS shall be designed and installed in accordance with Sections L104.2 through L104.15.3.

L104.2 Standards. Fire fighter air replenishment systems shall be in accordance with Sections L104.2.1 and L104.2.2.

L104.2.1 Pressurized system components. Pressurized system components shall be designed and installed in accordance with ASME B31.3.

L104.2.2 Air quality. The system shall be designed to convey breathing air complying with NFPA 1989.

L104.3 Design and operating pressure. The minimum design pressure shall be 110 percent of the fire department's normal SCBA fill pressure. The system design pressure shall be marked in an approved manner at the supply connections, and adjacent to pressure gauges on any fixed air supply components. Pressure shall be maintained in the system within 5 percent of the design pressure.

L104.4 Cylinder refill rate. The FARS shall be capable of refilling breathing air cylinders of a size and pressure used by the fire department at a rate of not less than two empty cylinders in 2 minutes.

L104.5 Breathing air supply. Where a fire department mobile air unit is available, the FARS shall be supplied by an external mobile air connection in accordance with Section L104.14. Where a fire department mobile air unit is not available, a stored pressure air supply shall be provided in accordance with Section L104.5.1. A stored pressure air supply shall be permitted to be added to a system supplied by an external mobile air connection provided that a means to bypass the stored pressure air supply is located at the external mobile air connection.

L104.5.1 Stored pressure air supply. A stored pressure air supply shall be designed based on Chapter 24 of NFPA 1901 except that provisions applicable only to mobile apparatus or not applicable to system design shall not apply. A stored pressure air supply shall be capable of refilling not less than 50 empty breathing air cylinders of a size and pressure used by the fire department.

L104.5.2 Retrofit of external mobile air connection. A FARS not initially provided with an external mobile air connection due to the lack of a mobile air unit shall be retrofitted with an external mobile air connection where a mobile air unit becomes available. Where an external mobile air connection is provided, a means to bypass the stored pressure air supply shall be located at the external mobile air connection. The retrofit shall be completed not more than 12 months after notification by the fire code official.

L104.6 Isolation valves. System isolation valves that are accessible to the fire department shall be installed on the system riser to allow piping beyond any air cylinder refill panel to be blocked.

L104.7 Pressure relief valve. Pressure relief valves shall be installed at each point of supply and at the top or end of every riser. The relief valve shall meet the requirements of CGA S-1.3 and shall not be field adjustable. Pressure relief valves shall discharge in a manner that does not endanger personnel who are in the area. Valves, plugs or caps shall not be installed in the discharge of a pressure relief valve. Where discharge piping is used the end shall not be threaded.

L104.8 Materials and equipment. Pressurized system components shall be listed or approved for their intended use and rated for the maximum allowable design pressure in the system. Piping and fittings shall be stainless steel.

L104.9 Welded connections. Piping connections that are concealed shall be welded.

L104.10 Protection of piping. System piping shall be protected from physical damage in an approved manner.

L104.11 Compatibility. Fittings and connections intended to be used by the fire department shall be compatible with the fire department's equipment.

L104.12 Security. Connections to a FARS shall be safeguarded from unauthorized access in an approved manner.

L104.13 Fill stations. Fire fighter air replenishment fill stations shall comply with Section L104.13.1 through L104.13.3.

L104.13.1 Location. Fill stations for refilling breathing air cylinders shall be located as follows:

1. Fill stations shall be provided at the fifth floor above and below the ground level floor and every third floor level thereafter.
2. On floor levels requiring fill stations, one fill station shall be provided adjacent to a required exit stair at a location designated by the fire code official. In buildings required to have three or more exit stairs, additional fill stations shall be provided at a ratio of one fill station for every three stairways.

L104.13.2 Design. Fill stations for breathing air cylinders shall be designed to meet the following requirements:

1. A pressure gauge and pressure-regulating devices and controls shall be provided to allow the operator to control the fill pressure and fill rate on each cylinder fill hose.
2. Valves controlling cylinder fill hoses shall be slow-operating valves.
3. A separate flow restriction device shall be provided on each fill hose.
4. A method shall be provided to bleed each cylinder fill hose.
5. The fill station shall be designed to provide a containment area that fully encloses any cylinder being filled and flexible cylinder fill hoses, and directs the energy from a failure away from personnel. Fill stations shall be designed to prohibit filling of cylinders that are not enclosed within the containment area.

Exception: Where required or approved by the fire chief, fill stations providing for the direct refilling of the fire fighters' breathing air cylinders using Rapid Intervention Crew/Company Universal Air Connection (RIC/UAC) fittings shall be used in lieu of cylinder fill stations that utilize containment areas.

L104.13.3 Cylinder refill rate. Fill stations shall be capable of simultaneously filling two or more empty breathing air cylinders equivalent to those used by the fire department to the cylinders' design pressure within 2 minutes.

L104.14 External mobile air connection. An external mobile air connection shall be provided for fire department mobile air apparatus where required by Section L104.5 to supply the system with breathing air.

L104.14.1 Location. The location of the external mobile air connection shall be accessible to mobile air apparatus and approved by the fire code official.

L104.14.2 Protection from vehicles. A means of vehicle impact protection in accordance with Section 312 shall be provided to protect mobile air connections that are subject to vehicular impact.

L104.14.3 Clear space around connections. A working space of not less than 36 inches (914 mm) in width, 36 inches (914 mm) in depth and 78 inches (1981 mm) in height shall be provided and maintained in front of and to the sides of external mobile air connections.

L104.15 Air-monitoring system. An approved air-monitoring system shall be provided. The system shall automatically monitor air quality, moisture and pressure on a continual basis. The air-monitoring system shall be equipped with not less than two content analyzers capable of detecting carbon monoxide, carbon dioxide, nitrogen, oxygen, moisture and hydrocarbons.

L104.15.1 Alarm conditions. The air-monitoring system shall transmit a supervisory signal when any of the following levels are detected:

1. Carbon monoxide exceeds 5 ppm.
2. Carbon dioxide exceeds 1,000 ppm.
3. An oxygen level below 19.5 percent or above 23.5 percent.
4. A nitrogen level below 75 percent or above 81 percent.
5. Hydrocarbon (condensed) content exceeds 5 milligrams per cubic meter of air.
6. The moisture concentration exceeds 24 ppm by volume.
7. The pressure falls below 90 percent of the maintenance pressure specified in Section L104.3.

L104.15.2 Alarm supervision, monitoring and notification. The air-monitoring system shall be electrically supervised and monitored by an approved supervising station, or where approved, shall initiate audible and visual supervisory signals at a constantly attended location.

L104.15.3 Air quality status display. Air quality status shall be visually displayed at the external mobile air connection required by Section L104.14.

**SECTION L105
ACCEPTANCE TESTS**

L105.1 Acceptance tests. Upon completion of the installation, a FARS shall be acceptance tested to verify compliance with equipment manufacturer’s instructions and design documents. Oversight of the acceptance tests shall be provided by a registered design professional. Acceptance testing shall include all of the following:

1. A pneumatic test in accordance with ASME B31.3 of the complete system at a minimum test pressure of 110 percent of the system design pressure using oil-free dry air, nitrogen or argon shall be conducted. Test pressure shall be maintained for not less than 24 hours. During this test, all fittings, joints and system components shall be inspected for leaks. Defects in the system or leaks detected shall be documented and repaired.
2. A cylinder-filling performance test shall be conducted to verify compliance with the required breathing air

cylinder refill rate from the exterior mobile air connection and, where provided, a stored air pressure supply system.

3. The air quality monitoring system shall be tested to verify both of the following conditions:
 - 3.1. Visual indicators required by Section L104.15.1 function properly.
 - 3.2. Supervisory signals are transmitted as required by Section L104.15.2 for each sensor based on a sensor function test.
4. Connections intended for fire department use shall be confirmed as compatible with the fire department’s mobile air unit, SCBA cylinders and, where provided, RIC/UAC connections.
5. Air samples shall be taken from not less than two fill stations and submitted to an approved gas analysis laboratory to verify compliance with NFPA 1989. The FARS shall not be placed into service until a written report verifying compliance with NFPA 1989 has been provided to the fire code official.

**SECTION L106
INSPECTION, TESTING AND MAINTENANCE**

L106.1 Periodic inspection, testing and maintenance. A FARS shall be continuously maintained in an operative condition and shall be inspected not less than annually. Not less than quarterly, an air sample shall be taken from the system and tested to verify compliance with NFPA 1989. The laboratory test results shall be maintained on site and readily available for review by the fire code official.

**SECTION L107
REFERENCED STANDARDS**

L107.1 General. See Table L107.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE L107.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASME B31.3—2020	<i>Process Piping</i>	L104.2.1, L105.1
CGA S-1.3—2008	<i>Pressure Relief Device Standards—Part 3 Stationary Storage Containers for Compressed Gases</i>	L104.7
NFPA 1901—16	<i>Standard for Automotive Fire Apparatus</i>	L104.5.1
NFPA 1989—13	<i>Breathing Air Quality for Fire Emergency Services Respiratory Protection</i>	L104.2.2, L105.1, L106.1

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX M – HIGH-RISE BUILDINGS—RETROACTIVE
AUTOMATIC SPRINKLER REQUIREMENT**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user’s convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX M

HIGH-RISE BUILDINGS—RETROACTIVE AUTOMATIC SPRINKLER REQUIREMENT

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix M was created with the intent to provide an option for adoption by jurisdictions that choose to require existing high-rise buildings to be retrofitted with automatic sprinklers. Modern fire and building codes require complete automatic fire sprinkler protection and a variety of other safety features in new high-rise construction. Many older high-rise buildings lack automatic sprinkler protection and other basic fire protection features necessary to protect the occupants, emergency responders and the structure itself. Without complete automatic sprinkler protection, fire departments cannot provide the level of protection that high-rise buildings demand. Existing high-rise buildings that are not protected with automatic sprinklers represent a significant hazard to occupants and fire fighters, and can significantly impact a community's infrastructure and economic viability in the event of a fire loss.

SECTION M101 SCOPE

M101.1 Scope. An automatic sprinkler system shall be installed in all existing high-rise buildings in accordance with the requirements and compliance schedule of this appendix.

SECTION M102 WHERE REQUIRED

M102.1 High-rise buildings. An automatic sprinkler system installed in accordance with Section 903.3.1.1 shall be provided throughout existing high-rise buildings.

Exceptions:

1. Airport traffic control towers.
2. Open parking structures.
3. Group U occupancies.
4. Occupancies in Group F-2.

SECTION M103 COMPLIANCE

M103.1 Compliance schedule. Building owners shall file a compliance schedule with the fire code official not later than 365 days after receipt of a written notice of violation. The compliance schedule shall not exceed 12 years for an automatic sprinkler system retrofit.

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE APPENDIX N – INDOOR TRADE SHOWS AND EXHIBITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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APPENDIX N

INDOOR TRADE SHOWS AND EXHIBITIONS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance or legislation of the jurisdiction.

User note:

About this appendix: Appendix N was created to address the hazards that are associated with larger, more complex trade shows and exhibitions. Although many of these requirements are already included in various locations in this code, some of the more important items, such as requirements for covered booths and multiple-level booths, are not. The intent is to have the requirements covering these events in a single location with pointers to other locations within this code, which makes it easier for those organizing exhibitions and individual exhibitors who are unfamiliar with the fire code to locate the requirements that are applicable to them.

SECTION N101 GENERAL

N101.1 Scope. Indoor trade shows and exhibitions with temporary vendor displays or booths within any indoor occupancy classification shall be in accordance with this appendix and all other applicable requirements of this code.

Compliance with this appendix is not required where Section N101.1.1 or N101.1.2 is applicable.

N101.1.1 Nonsprinklered buildings. In a building that is not equipped throughout with an automatic sprinkler system, the aggregate exhibit area must be less than 1,500 square feet (139 m²) of floor area and meet both of the following conditions:

1. The exhibit area does not include any covered or multiple-level exhibits or booths.
2. Not fewer than two remote exits or exit access doors in compliance with Chapter 10 are provided.

N101.1.2 Sprinklered buildings. In a building that is equipped throughout with an automatic sprinkler system with a minimum design density of ordinary hazard Group 1, the aggregate exhibit area must be less than 4,500 square feet (418 m²) of floor area and meet both of the following conditions:

1. The exhibit area does not include any covered or multiple-level exhibits or booths.
2. Not fewer than two remote exits or exit access doors in compliance with Chapter 10 are provided.

N101.2 Permit required. An operational permit for trade shows and exhibitions shall be required as set forth in Section 105.5.15.

N101.3 Application. A permit application for a trade show or exhibition shall be submitted to the fire code official prior to the start of the event in a time frame established by the jurisdiction. The application shall include documentation that identifies all of the following:

1. The means of egress.
2. The locations and widths of exits and aisles.
3. The locations of exit signs.
4. The total square footage (square meters) of spaces.

5. The location and arrangement of all booths and cooking equipment.
6. The location of all fire protection equipment.
7. The type and location of any heating and electrical equipment, where applicable.
8. The location of any covered or multiple-level booths.
9. Construction documents for any covered or multiple-level booths.
10. The storage locations and quantities of any highly combustible goods.
11. The location and type of any vehicle displays, where applicable.

SECTION N102 DEFINITIONS

N102.1 Definitions. For the purpose of this appendix, certain terms are defined as follows:

COOKING. Heating food products to a temperature of 145°F (63°C) or higher by baking, braising, boiling, frying or grilling.

COVERED BOOTH. An exhibit that has an obstruction placed over the exhibit above floor level that resembles a roof, canopy, tent or other obstruction, other than vertical signs or banners.

MULTIPLE-LEVEL BOOTH. An exhibit that has a second level or tier constructed on top of the exhibit or portion of the exhibit that is accessible to the public, or includes a live load above the exhibit area floor level.

SECTION N103 PUBLIC SAFETY FOR EVENTS

N103.1 Fire safety and evacuation plan. A fire safety and evacuation plan shall be provided in accordance with Section 404.2.

Exception: Where the fire code official determines that the nature of the exhibition, display or the activities therein does not pose an increased hazard to public safety.

N103.2 Fire watch personnel. Where, in the opinion of the fire code official, it is essential for public safety in a trade show or exhibition, either because of the number or persons present or because of the nature of the performance, exhibition, display or activity, the owner or owner's authorized agent shall provide one or more fire watch personnel in accordance with Section 403.11.1.

N103.3 Crowd managers. Where events involve a gathering of more than 1,000 people, trained crowd managers shall be provided in accordance with Section 403.11.3.

SECTION N104 INTERIOR FINISH AND DECORATIVE MATERIALS

N104.1 General. Interior finish, interior trim, furniture, furnishings and decorative materials, including decorative vegetation, used in exhibition areas shall comply with the requirements of this section and Chapter 8.

N104.2 Interior wall and ceiling finish. The materials used for interior wall and ceiling finish of exhibit booths and displays in exhibition areas shall comply with one of the following:

1. Where the building is not equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the wall and ceiling finish materials are required to be Class A in accordance with Section 803.
2. Where the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the wall and ceiling finish materials are required to be not less than Class B in accordance with Section 803.

SECTION N105 MULTIPLE-LEVEL BOOTHS

N105.1 Construction documents. Construction documents for all multiple-level booths shall be stamped by a registered design professional and shall be submitted with the permit application to the fire code official or the building code official, as appropriate.

N105.2 Structural design. Multiple-level booths shall be designed and constructed in accordance with Chapter 16 of the *California Building Code*.

N105.3 Means of egress. Upper levels of multiple-level booths with an occupant load greater than 10 persons shall have not fewer than two exits or exit access that are separated in accordance with Section 1007.1.1.

N105.4 Automatic sprinkler systems. An approved automatic sprinkler system in accordance with Section 903.3.1.1 shall be provided in multiple-level booths exceeding 400 square feet (37.2 m²) in floor area per level.

N105.5 Inspection. Inspection to verify that multiple-level booths are constructed in accordance with the construction documents and structural design details required by this section shall be approved by the building code official.

N105.6 Fire alarm and detection. Each multiple-level booth with a floor area exceeding 120 square feet (11.1 m²) on any level shall be provided with an approved fire alarm system in accordance with Section 907.2.

SECTION N106 COVERED BOOTHS

N106.1 Automatic sprinkler systems. An approved automatic sprinkler system in accordance with Section 903.3.1.1 of this code shall be provided in covered booths exceeding 100 square feet (9.3 m²) in floor area per level.

N106.2 Fire alarm and detection. Each covered booth with a floor area exceeding 120 square feet (11.1 m²) on any level shall be provided with an approved fire alarm system in accordance with Section 907.2.

SECTION N107 DISPLAY AND STORAGE OF HAZARDOUS AND COMBUSTIBLE MATERIALS

N107.1 Hazardous materials. The display of hazardous materials shall comply with Section 314 and Chapters 50 through 67. The storage of hazardous materials in indoor trade shows and exhibition areas shall be prohibited.

N107.1.1 Display near exit. The display of hazardous materials within 5 feet (1524 mm) of an exit shall be prohibited.

N107.2 Storage of combustible materials. Storage of combustible materials shall comply with Section 315.

N107.3 Vehicles. The display of liquid- or gas-fueled vehicles, boats or other motor craft in indoor trade shows and exhibition areas shall comply with Sections 314.4 and N107.3.1 through N107.3.3.

N107.3.1 Batteries in vehicles. Vehicle batteries shall be rendered inoperable. Batteries in liquid- and gas-fueled vehicles shall be disconnected. Batteries in electric vehicles shall be rendered inoperable by the removal of fuses or other approved methods but shall not be required to be disconnected.

N107.3.2 Vehicle fuel. Vehicle fuel shall comply with Sections N107.3.2.1 through N107.3.2.4.

N107.3.2.1 Fueling within the structure. Vehicles shall not be fueled or defueled within the structure.

N107.3.2.2 Vehicle fuel tanks. Vehicle fuel tanks shall contain not more than one quarter of the tank capacity or 5 gallons (18.93 L) of fuel, whichever is less.

N107.3.2.3 Vehicle fuel systems. Vehicle fuel systems shall be inspected for leaks prior to the vehicle being brought into the structure.

N107.3.2.4 Vehicle fuel tank openings. Vehicle fuel tank openings shall be locked and sealed to prevent the escape of vapors.

N107.3.3 Obstruction by vehicles. Vehicles shall not be located in such a manner that they obstruct a means of egress.

N107.3.4 Gas-powered vehicles. Compressed natural gas (CNG), liquefied petroleum gas (LPG) or hydrogen-powered vehicles present in indoor trade shows and exhibition areas shall comply with Sections N107.3.4.1 through N107.3.4.3.

N107.3.4.1 Shutoff valves. Shutoff valves shall be closed and the engine shall be operated until it stops. Valves shall remain closed until the vehicle is removed.

N107.3.4.2 Battery hot lead. The hot lead of the battery shall be disconnected.

N107.3.4.3 Dual-fuel vehicles equipped to operate on gasoline. Dual-fuel vehicles equipped to operate on gasoline as well as on CNG, LPG or hydrogen shall comply with Section 3107.15.

N107.3.5 Competitions or demonstrations. Competitions or demonstrations using any type of vehicle shall comply with Section 3107.15.5.

N107.4 Fueled equipment other than vehicles. Fueled equipment other than vehicles shall comply with Section 313.

N107.5 LP-gas containers. Liquefied petroleum (LP) gas containers shall comply with Sections N107.5.1 through N107.5.5 and Chapter 61.

N107.5.1 LP-gas containers exceeding 12 pounds (5 kg) of water capacity. The use of LP-gas containers exceeding 12 pounds (5 kg) of water capacity shall be prohibited.

N107.5.2 Where more than one LP-gas container is present in the same area. Where more than one LP-gas container is present in the same area, cylinders shall be separated from each other by a minimum of 20 feet (6096 mm).

N107.5.3 Equipment for LP-gas containers. Equipment for LP-gas containers, including tanks, piping, hoses, fittings, valves, tubing and other related components, shall be approved and shall comply with Chapter 61 and with the applicable requirements of the *International Fuel Gas Code*.

N107.5.4 Securing of LP-gas containers. Portable LP-gas containers shall be securely fastened in place to prevent unauthorized movement.

N107.5.5 Spare LP-gas containers. Spare LP-gas containers not connected to an approved appliance shall be stored in a location and manner approved by the fire code official.

N107.6 Cooking and open-flame devices. All cooking equipment and any open-flame devices shall comply with the requirements of Section 308 of this code and with Chapter 5 of the *California Mechanical Code*. Cooking equipment shall be separated from combustible material display or storage by a horizontal distance of not less than 5 feet (1524 mm).

**SECTION N108
MEANS OF EGRESS**

N108.1 Means of egress from the indoor trade show or exhibition area. Means of egress from the indoor trade show or exhibition area shall comply with Chapter 10 and with Sections N108.2 and N108.3.

N108.2 Design of means of egress. The design of means of egress shall take into consideration the exhibit layout and the anticipated crowd movement during the event.

N108.3 Aisles and corridors. Aisles and corridors within the exhibit area shall be kept free from obstructions when the public is present. Storage of any kind in aisles or corridors within the exhibit area is not permitted.

**SECTION N109
REFERENCED STANDARDS**

N109.1 General. See Table N109.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**TABLE N109.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
CBC—22	<i>California Building Code</i>	N105.2
IFGC—21	<i>International Fuel Gas Code</i>	N107.5.3
CMC—22	<i>California Mechanical Code</i>	N107.6

**CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX O – TEMPORARY HAUNTED HOUSES,
GHOST WALKS AND SIMILAR AMUSEMENT USES**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

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APPENDIX O

TEMPORARY HAUNTED HOUSES, GHOST WALKS AND SIMILAR AMUSEMENT USES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION O101 GENERAL

O101.1 Scope. *These regulations shall apply to temporary haunted houses, ghost walks or similar amusement uses, where decorative materials and confusing sounds and/or visual effects are present and shall be in accordance with this Appendix.*

O101.2 Permits. *An operational permit shall be required for haunted houses, ghost walks or similar amusement uses in accordance with Appendix O101.2.*

O101.2.1 Permit documents. *The permit application shall include a dimensioned site plan and floor plan.*

A site plan showing the following:

- 1. The proximity of the event building(s) to other structures or hazardous areas.*
- 2. The path of travel from the event building or area to the public way.*
- 3. The location of exterior evacuation assembly points.*

A floor plan showing the following:

- 1. Dimensions of the area being used (include total square footage, width and types of exits, aisles or interior exit pathways, etc.).*
- 2. The path of travel shall include the layout of any mazes, mirrors or other display items that may confuse the egress paths.*
- 3. A brief description of what will be depicted in each room or area along the walk or course, including the type of special effects to be utilized.*
- 4. Location of exits, exit signs and emergency lighting.*
- 5. Location of electrical panel(s) and light switches.*
- 6. Identification of what the normal or prior use of the structure(s) being used is (i.e., auditorium, school, church, etc.).*
- 7. Accessible egress routes.*
- 8. When required, areas of refuge.*
- 9. When required by Section 907.2.12, fire alarm panel location, manual fire alarm boxes and horn/strobe locations.*
- 10. Portable fire extinguisher locations.*
- 11. The location and fuel capacity of all generators.*

SECTION O102 DEFINITIONS

O102.1 DECORATIVE MATERIALS. *All materials used for decorative, acoustical or other effect (such as curtains, draperies, fabrics, streamers and surface coverings) and all other materials utilized for decorative effect (such as batting, cloth, cotton, hay stalks, straw, vines, leaves, trees, moss and similar items), including foam plastics and other materials containing foam plastics.*

O102.2 HAUNTED HOUSE. *A temporary building or structure, or portion thereof, which contains a system that transports passengers or provides a walkway through a course so arranged that the means of egresses are not apparent due to theatrical distractions, not visible due to low illumination, are disguised or are not readily available due to the method of transportation through the building or structure.*

O102.3 GHOST WALKS. *Similar to haunted houses and may include both indoor and outdoor areas where the means of egresses are similarly not readily identifiable.*

SECTION O103 GENERAL REQUIREMENTS

O103.1 Allowable structures. *Haunted houses, ghost walks and similar amusement uses shall only be located in structures that comply with the provisions for Special Amusement Areas in accordance with the California Building Code.*

O103.2 Tents or membrane structures. *Tents and membrane structures may be used when in compliance with all applicable requirements of this regulation and when the total floor area of the tent is less than 1,000 square feet and the travel distance to an exit from any location is less than 50 feet.*

O103.3 Fire evacuation plans. *A fire safety and evacuation plan that complies with Section 404 of this code shall be submitted.*

O103.4 Staffing. *The event shall be adequately staffed by qualified person(s) to control the occupant load and assist patrons in exiting should an evacuation become necessary. Staffing level shall be determined upon review of plans and may be increased at the discretion of the Fire Code Official.*

O103.5 Occupant load. *Maximum occupant load shall be in accordance with Chapter 10, Table 1004.1.1. A sign stating maximum occupancy shall be posted in a visible location near the entrance. The attendant(s) shall control the flow of patrons so as not to exceed this limit.*

O103.6 Exits. *Exiting shall be in accordance with Chapter 10 and this section.*

1. *Two exits shall be provided from each room with an occupant load of 50 or more. Required exit doors shall swing in the direction of egress.*
2. *Illuminated exit signs shall be provided at each exit serving an occupant load of 50 or more.*
3. *Exit doors serving an occupant load of 50 or more shall not be provided with a latch or lock unless it is panic hardware.*
4. *When tents or membrane structures are approved for use, curtains shall not be allowed to cover the exits.*
5. *Emergency lighting shall be provided in exit pathways.*
6. *Exhibits and decorative materials shall not obstruct, confuse or obscure exits, exit pathways, exit signs or emergency lights.*
7. *Additional exit pathway markings, such as low level exit signs and directional exit path markings, may be required.*

O103.7 Fire protection. *Haunted houses and ghost walks shall be provided with fire protection systems in accordance with Appendix O103.7.*

Exception: *When the total floor area of haunted houses or indoor portions of ghost walks are less than 1,000 square feet and the travel distance to an exit is less than 50 feet.*

O103.7.1 Fire sprinkler protection. *An automatic fire sprinkler system shall be required for haunted houses and indoor portions of ghost walks. Fire sprinkler systems shall be in accordance with Section 903.*

O103.7.2 Fire detection systems. *An approved automatic fire detection system shall be provided in accordance with Section 907.2.12, as required for amusement buildings.*

O103.7.3 Alarm. *Activation of any single smoke detector, the fire sprinkler system or other automatic fire detection device shall be in accordance with Section 907.2.12.1.*

O103.7.4 Emergency voice alarm. *Provide an emergency voice/alarm communication system in accordance with Section 907.2.12.3, as required for amusement buildings.*

O103.7.5 Portable fire extinguishers. *Fire extinguishers shall have a minimum 2A-10B:C rating. Fire extinguishers shall be properly mounted and shall be visible and accessible at all times. Clearly identify locations with signs or reflective tape. Fire extinguishers shall be located within 50 of feet travel distance from anywhere in the building.*

O103.8 Electrical. *When required, a permit shall be obtained from the local building official.*

O103.8.1 Extension cords. *Extension cords shall be UL listed and shall be appropriate for the intended use.*

O103.8.2 Power strips. *Only UL listed power strips with overcurrent protection shall be used when the number of outlets provided is inadequate. Power strips shall be*

plugged directly into the outlet, and shall not be plugged into one another in series.

O103.8.3 String lighting. *Manufacturer's installation guidelines shall be followed for the maximum allowable number of string lights that can be connected. When connecting string lights together, the total amperage of all string lights shall be calculated to ensure that they do not exceed the amperage for the extension cord and circuit.*

O103.8.4 Protection. *All extension cords and power strips shall be adequately protected from foot traffic.*

O103.8.5 Portable generators. *When portable generators are utilized, they shall be diesel fuel type and located a minimum of 20 feet away from all structures.*

O103.9 Decorative materials. *Interior wall, ceiling and floor finishes shall be Class A rated in accordance with the California Building Code.*

O103.9.1 Flame retardant. *All decorative materials shall be both inherently flame retardant and labeled as such, or shall be treated with a listed flame-retardant material. If the material is treated by the user, a container and receipt will serve as proof.*

O103.9.2 Flame test. *Testing shall be done in accordance with Section 803.5 of this code, as referenced from the California Code of Regulations, Title 19, Division 1, Article 3, Section 3.21(a) and (b). Proof of testing shall be provided.*

O103.9.3 Placement of decorative materials. *Decorative materials, props and/or performer platforms shall not obstruct, confuse or obscure exits, exit signs, exit pathways, emergency lighting or any component of fire protection systems and equipment (i.e. fire extinguishers, fire alarm systems, fire sprinklers, etc.) inside or outside the building.*

O103.10 Smoke generators. *Use of smoke-generating equipment may be restricted if determined to be incompatible with smoke alarm(s). Care and consideration shall be used with respect to smoke generator and smoke alarm locations. Smoke generator and smoke alarm locations shall be approved by the fire department.*

O103.11 Display of motor vehicles. *Display of motor vehicles shall be in accordance with Section 3104.18 of this code.*

O103.12 Inspections. *A fire and life safety inspection shall be conducted by the fire department prior to the start of the event.*

O103.13 Signs. *"NO SMOKING" signs shall be conspicuously posted at the main entrance and throughout the exhibit.*

O103.14 Prohibited areas. *Inside storage or use of flammable and/or combustible liquids, gases and solids shall be prohibited. Open flames shall be prohibited.*

O103.15 Maintenance. *Good housekeeping shall be maintained at all times throughout exhibit and exit pathways.*

CALIFORNIA FIRE CODE – MATRIX ADOPTION TABLE
APPENDIX P – COMMUNITY WILDLAND-URBAN INTERFACE (WUI)
FIRE HAZARD EVALUATION FRAMEWORK

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

(Not adopted by the State Fire Marshal)

Adopting Agency	BSC	BSC- CG	SFM		HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
			T-24	T-19*	1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
[California Code of Regulations, Title 19, Division 1]																						
Chapter / Section																						

* The *California Code of Regulations* (CCR), Title 19, Division 1 provisions that are found in the *California Fire Code* are a reprint from the current CCR, Title 19, Division 1 text for the code user's convenience only. The scope, applicability and appeals procedures of CCR, Title 19, Division I remain the same.

APPENDIX P

COMMUNITY WILDLAND-URBAN INTERFACE (WUI) FIRE HAZARD EVALUATION FRAMEWORK

Wildland-Urban Interface (WUI) fire spread has significant impact on communities well beyond the loss of structures, including community evacuation and incident response. Pre-fire planning and hazard mitigation impact how the fire develops, how the life safety of residents and first responders is impacted during evacuations, and the extent of structural and infrastructure losses. There is a need to document pre-fire hazard in a way that assesses the fire impact beyond potential structural losses.

This appendix contains a preliminary Community WUI Fire Hazard Evaluation Framework as a suggested methodology to begin to support communities at risk in the identification of their unique hazards and to provide common metrics for comparisons between communities. This preliminary framework includes information on community size, population and fuels; on notification and evacuation; and on the community infrastructure and firefighting response potential. Aspects of this framework may already be included in various community-level documents, such as Community Wildfire Protection Plans or evacuation plans. Development of a standard framework will (1) consolidate relevant WUI fire hazard and planning information in one place, and (2) allow for cross-community comparisons.

The evaluation required to implement this framework will support pre-fire hazard assessment and during-fire response operations. An increased understanding of fire-evacuation, fire-structural response and fire-defensive actions relationships is needed to assess the overall community WUI fire hazard. The quantification of these relationships will enable communities to optimize the community-level response to WUI fire hazards in a more integrated approach and result in increased life safety and reduced losses.

Definitions

The Community WUI Hazard Evaluation Framework presented here is intended for communities as small as a few hundred to tens of thousands of residents. The methodology is not intended for the documentation of single residences or large cities. It is intended to provide a community with an overview of the overall WUI fire-related hazards and to enable the authority having jurisdiction (AHJ) to compare the relative hazards and preparedness levels of different communities. The information collected can be used by first responders and community and county officials to prioritize hazard mitigation within and around the community and to develop “tabletop” responses to different WUI fire scenarios. In the event of an actual WUI fire, the information collected could be used by first responders and local officials to safely evacuate civilians, to reduce the risk of first responder injuries and to enhance fire containment. The following are definitions and uses of the different components of the

Community WUI Fire Hazard Evaluation Framework. This framework may be expanded to include additional characteristics that are not specifically listed in this preliminary version.

Community

In the sense of WUI fire hazard, the community should be viewed in the context of evacuation arteries rather than jurisdictional boundaries. As such, the community may have parts that are incorporated or unincorporated. Community size is reported in acres, and the community boundary selected for this hazard evaluation can be provided for use in a geographic information system (GIS) layer in a number of formats, including but not limited to shapefile, geodatabase or Geo-Package. A topographic overview of the area (community) is used to describe the general conditions using one or more of the following key words: flat terrain, rolling hills, moderate slopes, valleys, steep slopes and/or plateau.

Information about prevailing weather patterns, such as localized winds or significant wind events (strength and direction), should also be included in the community profile.

Fuels

The fuels section is intended to provide an overview of the structural, vegetative and other fuels present in the community. This is not a parcel-level assessment; however, if defensible space assessment data is available, it can be aggregated and utilized within this framework to provide higher resolution assessment of community fire hazard. Structure density is a simple metric to capture structure-to-structure spacing and provide insight on the potential structure-to-structure fire spread. For uniform communities, a representative structure separation distance (SSD) may be sufficient, whereas nonuniform communities will be better described using a histogram of SSD. The age of structures may also be a factor in structure vulnerability due to changes in building codes associated with structure hardening. Similarly, a community that was built over a short period of time can be represented by a single value representing the decade of construction, while a community that grew and expanded over long periods will be better represented by a histogram of structure ages.

A database such as LANDFIRE¹ can provide the vegetative fuel type and fuel loading throughout the community. This data will be limited by the age of the last LANDFIRE overflight and the 100 feet (30 meters) pixel spatial resolution.

Natural and artificial fuel breaks, including fuel treatments within and around the community, should be represented in a geospatial format and should include the year the vegetative fuel treatment was conducted. Fuel treatments should also include any logging activities in the area sur-

1. Landfire website: <https://www.landfire.gov/>

rounding the community. Fire history in and around the community will describe the last time the community experienced direct impacts from fire. Shapefiles of the fuel treatments and fire history will allow for spatial documentation of this data. Fuel treatments and fire history should be documented at least 10 miles (16 km) out from the edge of the community. Local conditions (e.g., fuel, topography, weather, evacuation routes) may require documentation well beyond 10 miles (16 km). The last large fire in the area of the community perimeter, together with the vegetative fuel loading, will provide information on the potential energy content of the vegetative fuels in the event of a short- or long-term drought.

The documentation of other community hazards, such as hazmat or high fuel load facilities (e.g., fixed propane tanks, hazardous material storage and use facilities, ammunition facilities, lumber yards, pallet storage, tire storage), is important as they can affect civilians and first responder safety during evacuations, fire containment and mop-up activities. The information should be provided in the form of a GIS layer and may then be used by first responders to develop “tabletop” responses for emergency preparedness, and to direct response actions during a WUI fire event.

Population

The population of the selected community will impact, among other factors, the minimum time required for evacuation. Population and population density, expressed as the number of residents per acre, are both important metrics that provide information that can be used for evacuation assessment. The permanent to transient population density ratio is intended to capture the fraction of the community that may be visiting for tourism and may not be aware of community evacuation and other fire related activities.

Notification

The notification section of the Community WUI Hazard Evaluation is designed to capture the presence and type of mass-notification tools available to emergency managers. It should be noted that reliance on individual notification methods may result in limited notifications. If a Reverse 911 system is in place, the percentage of the community that will potentially receive the notifications from this system will estimate the number of residents that may require different notification(s). Sirens or other fixed notification systems with power backup should also be listed in this section along with the fraction of the population covered by these systems. Additional notification systems that don't require phone or internet are also captured in this section, since WUI events frequently result in power outages or other service interruptions.

Evacuation

This section of the Community WUI Hazard Evaluation is not intended to replace a full community evacuation study or act as a community evacuation plan. The primary purpose of this section is to compute, given a number of assumptions, a Minimum Throughput Time (MTT), to provide an initial idealized

order of magnitude time to be considered in the early stages of evacuation pre-planning. This information can be of value to first responders and community emergency planning personnel, as it may potentially highlight critical evacuation bottlenecks inside or outside the community.

The MTT concept is a traffic engineering calculation of roadway capacity to provide an initial lower bound for planning community evacuation. The MTT is intended for isolated and partly isolated interface and intermix communities rather than a city setting with large populations and complex evacuation routes. A community should consider a detailed evacuation study to further enhance the community evacuation plan. There is a significant body of work associated with developing dynamic evacuation models.²

The MTT considers two significant factors: bottlenecks within and beyond town, and the total number of vehicles that must be accommodated. Bottlenecks slowing traffic throughput may be located within or outside of jurisdictional boundaries. Bottlenecks occurring well beyond the evacuating community may cause ripple effects significantly impacting community evacuation. In identifying the population for computing the MTT, consideration should be given to neighboring settlements/communities that may share the same evacuation route(s). The MTT should consider the minimum number of traffic lanes (i.e., 8 lanes merging into 2 lanes should be treated as 2 lanes) available for evacuation, the community population and the average speed limit of the egress routes. Contraflow, the implementation of reverse direction traffic flow, may be considered here, along with provisions for first responder access to the community. The computed Minimum Throughput Time (MTT) does not account for any of the numerous potential hindrances to evacuation traffic, such as road accidents, reduced speed due to smoke obscuration, merging of traffic in town to feed the primary arteries, large vehicles that occupy more space than cars and have reduced maneuverability, or fire activity impacts, such as burn overs, causing evacuation lane(s) closures and potential slowdowns associated with traffic redirections.

The evacuation section is also used to identify vulnerabilities of egress arteries including vegetative fuel setbacks as well as any hazardous material facilities which might affect evacuation. Fuel setback information, collected in 0.15 miles (0.25 km) increments along egress routes, presented in the form of a histogram and a GIS layer, could help identify vulnerable spots that may potentially impact evacuation and identify candidate locations for fuel treatments.

The presence of a Community Evacuation Plan, the presence and capacity of safety zones and other large crowd assembly areas, and whether evacuation drills are performed will contribute to the community evacuation preparedness overview. The number of hospitals and senior care facilities and their total capacity will provide further information to assess overall community evacuation needs.

2. An example of a framework which includes coupled fire and evacuation considerations, as well as background on the individual model components, is provided in Ronchi et al. (2019) “An open multi-physics framework for modelling WUI fire evacuations,” *Safety Science* 118:868-880.

COMMUNITY WUI FIRE HAZARD EVALUATION FRAMEWORK		
COMMUNITY	DATA TYPE	DATA LAYER IN MDS
Community shapefile, geodatabase or Geo-Package including topography and geographic attributes, and prevailing weather patterns (e.g., wind)	GIS layer	x
FUELS		
Structure Density (structure separation distances—SSD)	SSD histogram	
Age of structures	Histogram	
Vegetative Fuel Loading: - Fuel type - Fuel loading	Fuel type Tons/acre	
Natural and artificial fuel breaks (including fuel treatments within and around community and year built)	List, GIS layer	x
Community hazards (e.g., hazmat and high fuel load facilities)	Specify, GIS layer	x
Fire History	Frequency of, and most recent, fires in/around community	x
POPULATION		
Population - Density - Permanent/transient ratio	Number, age distribution Number/acre p/t ratio	
NOTIFICATION		
Reverse 911 - Opt-in or Opt-out - Percent of population enrolled in Reverse 911	Opt-in/Opt-out %	
Sirens or other notification with power backup - Percent of population within siren coverage range	List % population	
Notification dissemination w/out phone or internet	y/n	
EVACUATION		
Egress Route Capacity (Minimum Throughput Time)	Time (hours)	
Vulnerability of egress arteries: - Fuel setbacks - Hazmat/high fuel load facilities affecting evacuation - Other	Fuel setback data, GIS layer Specify, GIS layer	x x x
Hospitals and senior care facilities	Specify, number of persons	x
Community evacuation plan Safety zones and large crowd assembly areas, capacity Evacuation drills	y/n, specify, GIS layer y/n, number, GIS layer y/n	x x
Community in evacuation route of other communities, through-flow number	y/n, identify, number	
INFRASTRUCTURE / COOP / COG		
Location and needs of key facilities	List	x
Public water, dependence on power, generator backup, community owned water	y/n, y/n, y/n, y/n	
Power lines around primary arteries (above ground or below)	Above or below	x
Critical infrastructure that requires fuel to keep operating	Specify, GIS layer	x
FIRE FIGHTING RESPONSE		
Volunteer vs Career (availability of first responder resources at station)	Volunteer/career/combination	
Density of firefighting (ff) responder to number of structures (ff/structure ratio)	ff/structures	
Mutual aid response (engines-hours histogram) and agreements with mutual aid	Engines-hours histogram	

Infrastructure / COOP / COG

The locations and needs of key facilities for maintaining continuity of operations (COOP) and continuity of government (COG), such as police, fire, EMS, hospitals, government buildings, cell towers, water sources, water provider infrastructure, electrical utility key infrastructure and natural gas key infrastructure should be listed and incorporated in this part of the evaluation framework.

Infrastructure characteristics, particularly related to water supply and electric utilities, can impact response and potential pre-fire hazard reduction. The public water system dependence on power supply, including the availability of backup power sources (i.e., generator backup) will provide insight into the resilience of the water system. The location of power lines (i.e., above or below ground) can impact evacuation, as downed power lines can impact evacuation and mobility throughout the community.

Fire Fighting Response

The type of fire department, whether volunteer, career, or combined, may impact the likely availability and response time of first responder resources. The density of firefighting (ff) responders, as a ratio of the number of personnel on shift to the number of structures (number of ffs/number of structures) will provide information on the maximum possible coverage by the local resources.

In this section, mutual aid resources should be counted only if mutual aid agreements are in place and can ensure rapid deployment. Mutual aid response is captured through a histogram in 1-, 2-, 3- and 4-hour travel times. This may also be approximated using a geographic radius of distance from the community. The purpose of this information is to provide insight into the minimum response times by mutual aid.

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HISTORY NOTE APPENDIX

2022 California Fire Code California Code of Regulations, Title 24, Part 9

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Fire Code*, 2019 Triennial Edition, effective January 1, 2020.

1. (BSC 08/21, SFM 06/21) Adoption by reference of the 2021 *International Fire Code* with necessary amendments to become the 2022 *California Fire Code*, and repeal of the 2018 edition of the *International Fire Code*; effective on January 1, 2023.

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PREFACE

This document is Part 10 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Existing Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

Secretary Yolanda Richardson – Chair

Rajesh Patel – Vice-Chair

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Elley Klausbruckner

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Kent Sasaki

Laura Rambin

Mia Marvelli – Executive Director

Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page iv.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073

Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916

State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300

Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312

Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards (916) 900-5004

Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356

Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661

Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development

AKA: California Department of Health Care

Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800

Code Development and Analysis
Fire Safety Standards

How to Distinguish Between Model Code Language and California Amendments

To distinguish between model code language and the incorporated California amendments, including exclusive California standards, California amendments will appear in italics.

[BSC] This is an example of a state agency acronym used to identify an adoption or amendment by the agency. The acronyms will appear at California Amendments and in the Matrix Adoption Tables. Sections 1.2 through 1.14 in Chapter 1, Division 1 of this code, explain the used acronyms, the application of state agency adoptions to building occupancies or building features, the enforcement agency as designated by state law (may be the state adopting agency or local building or fire official), the authority in state law for the state agency to make the adoption and the specific state law being implemented by the agency's adoption. The following acronyms are used in Title 24 to identify the state adopting agency making an adoption.

Legend of Acronyms of Adopting State Agencies

BSC	California Building Standards Commission (see Section 1.2)
BSC-CG	California Building Standards Commission-CALGreen (see Section 1.2.2)
BSCC	Board of State and Community Corrections (see Section 1.3)
SFM	Office of the State Fire Marshal (see Section 1.11)
HCD 1	Department of Housing and Community Development (see Section 1.8.2.1.1)
HCD 2	Department of Housing and Community Development (see Section 1.8.2.1.3)
HCD 1/AC	Department of Housing and Community Development (see Section 1.8.2.1.2)
DSA-AC	Division of the State Architect-Access Compliance (see Section 1.9.1)
DSA-SS	Division of the State Architect-Structural Safety (see Section 1.9.2)
DSA-SS/CC	Division of the State Architect-Structural Safety/Community Colleges (see Section 1.9.2.2)
OSHPD 1	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 1R	Office of Statewide Health Planning and Development (see Section 1.10.1)
OSHPD 2	Office of Statewide Health Planning and Development (see Section 1.10.2)
OSHPD 3	Office of Statewide Health Planning and Development (see Section 1.10.3)
OSHPD 4	Office of Statewide Health Planning and Development (see Section 1.10.4)
OSHPD 5	Office of Statewide Health Planning and Development (see Section 1.10.5)
DPH	Department of Public Health (see Section 1.7)
AGR	Department of Food and Agriculture (see Section 1.6)
CEC	California Energy Commission (see Section 100 in Part 6, the California Energy Code)
CA	Department of Consumer Affairs (see Section 1.4): Board of Barbering and Cosmetology Board of Examiners in Veterinary Medicine Board of Pharmacy Acupuncture Board Bureau of Household Goods & Services Structural Pest Control Board (SPCB)
SL	State Library (see Section 1.12)
SLC	State Lands Commission (see Section 1.14)
DWR	Department of Water Resources (see Section 1.13 of Chapter 1 of the California Plumbing Code in Part 2 of Title 24)

The state agencies are available to answer questions about their adoptions. Contact information is provided on page iv of this code.

To learn more about the use of this code refer to pages vii and viii. Training materials on the application and use of this code are available at the website of the California Building Standards Commission www.dgs.ca.gov/bsc.

California Matrix Adoption Tables

Format of the California Matrix Adoption Tables

The matrix adoption tables, examples of which follow, are nonregulatory aids intended to show the user which state agencies have adopted and/or amended given sections of the model code. An agency’s statutory authority for certain occupancies or building applications determines which chapter or section may be adopted, repealed, amended or added. See Chapter 1, Division I, Sections 1.2 through 1.14 for agency authority, building applications and enforcement responsibilities.

The side headings identify the scope of state agencies’ adoption as follows:

Adopt the entire IEBC chapter without state amendments.

If there is an “X” under a particular state agency’s acronym on this row; this means that particular state agency has adopted the entire model code chapter without any state amendments.

Example:

CALIFORNIA EXISTING BUILDING CODE–MATRIX ADOPTION TABLE

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

CHAPTER 2 – DEFINITIONS

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter			X																		
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								S	A	M	P	L	E								
Chapter/Section																					

Adopt the entire IEBC chapter as amended, state-amended sections are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency has adopted the entire model code chapter; with state amendments.

Each state-amended section that the agency has added to that particular chapter is listed. There will be an “X” in the column, by that particular section, under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter																					
Adopt entire chapter as amended (amended sections listed below)			X																		
Adopt only those sections that are listed below								S	A	M	P	L	E								
Chapter 1																					
202			X																		

Adopt only those sections that are listed below:

If there is an “X” under a particular state agency’s acronym on this row, it means that particular state agency is adopting only specific model code or state-amended sections within this chapter. There will be an “X” in the column under the agency’s acronym, as well as an “X” by each section that the agency has adopted.

Example:

CHAPTER 2 – DEFINITIONS

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDP					BSCC	DPH	AGR	DWR	CA	SL	SLC
				1	2	1-AC	AC	SS	SS/CC	1	1R	2	3	4							
Adopt entire chapter																					
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below					X	X		S	A	M	P	L	E								
Chapter 1																					
202					X	X		S	A	M	P	L	E								
202					X	X			C	O	N	T.									
203					X	X															
203					X	X															

Marginal Markings

Solid vertical lines in the margins within the body of the code indicate a technical change from the requirements of the 2018 edition. Deletion indicators in the form of an arrow (➡) are provided in the margin where an entire section, paragraph, exception or table has been deleted or an item in a list of items or a table has been deleted.

A single asterisk [*] placed in the margin indicates that text or a table has been relocated within the code. A double asterisk [**] placed in the margin indicates that the text or table immediately following it has been relocated there from elsewhere in the code. The following table indicates such relocations in the 2020 edition of the *International Existing Building Code*.

2021 LOCATION	2018 LOCATION
303	1106
307	502.6, 503.14, 803.4.3, 1104
308	502.7, 503.15, 804, 1105
1009.1	809.1
1501.2.1	705.2

Symbols in the margin indicate the status of code changes as follows:

- || This symbol indicates that a change has been made to a California amendment.
- > This symbol indicates deletion of California amendment language.
- | This symbol indicates that a change has been made to International Code Council model language.
- ➡ This symbol indicates deletion of International Code Council model language.

Arrangement and Format of the 2021 IEBC

Before applying the requirements of the IEBC, it is beneficial to understand its arrangement and format. The IEBC, like other codes published by ICC, is arranged and organized to follow logical steps that generally occur during a plan review or inspection.

The following table shows how the IEBC is divided. The ensuing chapter-by-chapter synopsis details the scope and intent of the provisions of the IEBC.

CHAPTER TOPIC	
Chapter	Subjects
1–2	Administrative Requirements and Definitions
3	Provisions for all Compliance Methods
4	Repairs
5	Prescriptive Compliance Method for Existing Buildings
6–12	Work Area Compliance Method for Existing Buildings
13	Performance Compliance Method for Existing Buildings
14	Relocated Buildings
15	Construction Safeguards
16	Referenced Standards
Appendix A	Guidelines for Seismic Retrofit of Existing Buildings
Appendix B	Supplementary Accessibility Requirements for Existing Buildings
Appendix C	Guidelines for Wind Retrofit of Existing Buildings
Appendix D	Board of Appeals
Resource A	Guidelines on Fire Ratings of Archaic Materials and Assemblies

Maintenance

The IEBC is kept up to date through the review of proposed changes submitted by code enforcement officials, industry representatives, design professionals and other interested parties. Proposed changes are carefully considered through an open code development process in which all interested and affected parties may participate.

The ICC Code Development Process reflects principles of openness, transparency, balance, due process and consensus, the principles embodied in OMB Circular A-119, which governs the federal government's use of private-sector standards. The ICC process is open to anyone; there is no cost to participate, and people can participate without travel cost through the ICC's cloud-based app, *cdpAccess*[®]. A broad cross section of interests are represented in the ICC Code Development Process. The codes, which are updated regularly, include safeguards that allow for emergency action when required for health and safety reasons.

In order to ensure that organizations with a direct and material interest in the codes have a voice in the process, the ICC has developed partnerships with key industry segments that support the ICC's important public safety mission. Some code development committee members were nominated by the following industry partners and approved by the ICC Board:

- American Institute of Architects (AIA)
- National Association of Home Builders (NAHB)

The code development committees evaluate and make recommendations regarding proposed changes to the codes. Their recommendations are then subject to public comment and council-wide votes. The ICC's governmental members—public safety officials who have no financial or business interest in the outcome—cast the final votes on proposed changes.

The contents of this work are subject to change through the code development cycles and by any governmental entity that enacts the code into law. For more information regarding the code development process, contact the Codes and Standards Development Department of the ICC.

While the I-Code development procedure is thorough and comprehensive, the ICC, its members and those participating in the development of the codes disclaim any liability resulting from the publication or use of the I-Codes, or from compliance or noncompliance with their provisions. The ICC does not have the power or authority to police or enforce compliance with the contents of this code.

Code Development Committee Responsibilities (Letter Designations in Front of Section Numbers)

In each code development cycle, proposed changes to this code are considered at the Committee Action Hearings by the International Existing Building Code Development Committee. Proposed changes to a code section having a number beginning with a letter in brackets are considered by a different code development committee. For example, proposed changes to code sections that are preceded by the designation [F] (e.g., [F] 1504.2) are considered by the International Fire Code Development Committee at the Committee Action Hearings.

The content of sections in this code that begin with a letter designation is maintained by another code development committee in accordance with the following:

- [A] = Administrative Code Development Committee;
- [BE] = IBC – Means of Egress Code Development Committee;
- [BG] = IBC – General Code Development Committee;
- [BS] = IBC – Structural Code Development Committee;
- [E] = International Commercial Energy Conservation Code Development Committee or International Residential Energy Conservation Code Development Committee;
- [F] = International Fire Code Development Committee;
- [FG] = International Fuel Gas Code Development Committee;
- [M] = International Mechanical Code Development Committee; and
- [P] = International Plumbing Code Development Committee.

For the development of the 2024 edition of the I-Codes, there will be two groups of code development committees and they will meet in separate years, as shown in the following Code Development Hearings Table.

Code change proposals submitted for code sections that have a letter designation in front of them will be heard by the respective committee responsible for such code sections. Because different committees hold Committee Action Hearings in different years, it is possible that some proposals for this code will be heard by a committee in a different year than the year in which the primary committee for this code meets. In the case of the IEBC, the primary committees that maintain this code will meet in 2022.

For instance, Section 1501.3 is designated as the responsibility of the IBC—General Code Development Committee. This committee will conduct its code development hearings in 2021 to consider all code change proposals to the *International Building Code* and any portions of other codes that it is responsible for, including Section 1501.3 of the IEBC and other general provisions of the IEBC (designated with [BG] in front of those sections). Therefore, any proposals received for Section 1501.3 will be considered in 2021 by the IBC—General Code Development Committee.

It is very important that anyone submitting code change proposals understand which code development committee is responsible for the section of the code that is the subject of the code change proposal. For further information on the Code Development Committee responsibilities, please visit the ICC website at www.iccsafe.org/current-code-development-cycle.

CODE DEVELOPMENT HEARINGS

Group A Codes (Heard in 2021, Code Change Proposals Deadline: January 11, 2021)	Group B Codes (Heard in 2022, Code Change Proposals Deadline: January 10, 2022)
International Building Code – Egress (Chapters 10, 11, Appendix E) – Fire Safety (Chapters 7, 8, 9, 14, 26) – General (Chapters 2–6, 12, 27–33, Appendices A, B, C, D, K, N)	Administrative Provisions (Chapter 1 of all codes except IECC, IRC and IgCC, IBC Appendix O, the appendices titled “Board of Appeals” for all codes except IECC, IRC, IgCC, ICCPC and IZC, administrative updates to currently referenced standards, and designated definitions)
International Fire Code	International Building Code – Structural (Chapters 15–25, Appendices F, G, H, I, J, L, M)
International Fuel Gas Code	International Existing Building Code
International Mechanical Code	International Energy Conservation Code—Commercial
International Plumbing Code	International Energy Conservation Code—Residential – IECC—Residential – IRC—Energy (Chapter 11)
International Property Maintenance Code	International Green Construction Code (Chapter 1)
International Private Sewage Disposal Code	International Residential Code – IRC—Building (Chapters 1–10, Appendices AE, AF, AH, AJ, AK, AL, AM, AO, AQ, AR, AS, AT, AU, AV, AW)
International Residential Code – IRC—Mechanical (Chapters 12–23) – IRC—Plumbing (Chapters 25–33, Appendices AG, AI, AN, AP)	
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International Wildland-Urban Interface Code	
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Note: Proposed changes to the ICCPC will be heard by the code development committee noted in brackets [] in the text of the ICCPC.

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CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 1 – SCOPE AND ADMINISTRATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X	X	X		X	X	X	X	X	X	X	X	X							
Chapter / Section																						
<i>Division I – California Administration</i>																						
1.1	X		X	X	X		X	X	X													
1.2	X																					
1.3 (Reserved)																						
1.4 (Reserved)																						
1.5 (Reserved)																						
1.6 (Reserved)																						
1.7 (Reserved)																						
1.8				X	X																	
1.9.1							X															
1.9.1.1							X															
1.9.2								X	X													
1.9.2.1								X														
1.9.2.2									X													
1.10.1										X	X											
1.10.2												X										
1.10.3													X									
1.10.4														X								
1.10.5															X							
1.11			X																			
<i>Division II – Scope and Administration</i>																						
101.2				X	X																	
101.8	X			X	X																	
101.8.1							X	X														
102.1 – 102.5										X	X		X	X								
104.9 – 104.11										X	X		X	X								
105.1			X																			
105.2 Building: 1-6				X	X																	
105.2.1 – 105.2.2			X																			
105.3 – 105.3.1			X																			
105.4			X																			
105.5.1	X																					

(continued)

**CALIFORNIA BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 1 – SCOPE AND ADMINISTRATION—continued**

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below	X		X	X	X		X	X	X													
Chapter / Section																						
105.6 – 105.7			X																			
106.1				X	X																	
106.1 – 106.4			X																			
106.2.1				X	X																	
106.2.3				X	X																	
106.2.4				X	X																	
106.2.5	X			X	X			X	X													
106.2.6				X	X																	
106.4			X																			
106.5			X																			
107.1 – 107.4			X																			
109.1 – 109.2				†	†																	
109.3 – 109.3.11				X	X																	
109.3.6	X							X	X													
109.3.6.1				X	X																	
110			X																			
111			X																			
113.1 – 113.2			X																			
114			X																			
115			X																			

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 1
SCOPE AND ADMINISTRATION
DIVISION I
CALIFORNIA ADMINISTRATION

SECTION 1.1
GENERAL

1.1.1 Title. *These regulations shall be known as the California Existing Building Code, may be cited as such and will be referred to herein as “this code.” The California Existing Building Code is Part 10 of thirteen parts of the official compilation and publication of the adoption, amendment and repeal of building regulations to the California Code of Regulations, Title 24, also referred to as the California Building Standards Code. This part incorporates by adoption the 2021 International Existing Building Code of the International Code Council with necessary California amendments.*

1.1.2 Purpose. *The purpose of this code is to establish the minimum requirements to safeguard the public health, safety and general welfare through structural strength, means of egress facilities, stability, access to persons with disabilities, sanitation, adequate lighting and ventilation and energy conservation; safety to life and property from fire and other hazards attributed to the built environment; and to provide safety to fire fighters and emergency responders during emergency operations.*

1.1.3 Scope. *The provisions of this code shall apply to the construction, alteration, movement, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures throughout the State of California. [HCD 1 & 2] The provisions of this code shall apply to repair, alteration, change of occupancy, addition to and relocation of every existing building or structure or any appurtenances connected or attached to such buildings or structures throughout the State of California.*

1.1.3.1 Nonstate-regulated buildings, structures and applications. *Except as modified by local ordinance pursuant to Section 1.1.8, the following standards in the California Code of Regulations, Title 24, Parts 2, 2.5, 3, 4, 5, 6, 9, 10 and 11 shall apply to all occupancies and applications not regulated by a state agency.*

1.1.3.2 State-regulated buildings, structures and applications. *The model code, state amendments to the model code and/or state amendments where there are no relevant model code provisions shall apply to the following buildings, structures and applications regulated by state agencies as specified in Sections 1.2 through 1.14, except where modified by local ordinance pursuant to Section 1.1.8. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.*

Note: See “How to Distinguish Between Model Code Language and California Amendments” in the front of the code.

- 1. State-owned buildings, including buildings constructed by the Trustees of the California State University, and to the extent permitted by California laws, buildings designed and constructed by the Regents of the University of California, and regulated by the Building Standards Commission. See Section 1.2 for additional scope provisions.*
- 2. Section 1.3 is reserved for the Board of State Community Corrections.*
- 3. Section 1.4 is reserved for the Department of Consumer Affairs.*
- 4. Section 1.5 is reserved for the California Energy Commission.*
- 5. Section 1.6 is reserved for the Department of Food and Agriculture.*
- 6. Section 1.7 is reserved for the Department of Public Health.*
- 7. Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities. See Section 1.8.2.1.1 for additional scope provisions.*
- 8. Accommodations for persons with disabilities in buildings containing newly constructed covered multifamily dwellings, new common use areas serving existing covered multifamily dwellings, additions to existing buildings where the addition alone meets the definition of covered multifamily dwelling, and new common-use areas serving new covered multifamily dwellings, which are regulated by the Department of Housing and Community Development. See Section 1.8.2.1.2 for additional scope provisions.*
- 9. Permanent buildings and permanent accessory buildings or structures constructed within mobilehome parks and special occupancy parks regulated by the Department of Housing and Community Development. See Section 1.8.2.1.3 for additional scope provisions.*
- 10. Accommodations for persons with disabilities regulated by the Division of the State Architect. See Section 1.9.1 for additional scope provisions.*

11. *Public elementary and secondary schools, community college buildings and state-owned or state-leased essential service buildings regulated by the Division of the State Architect. See Section 1.9.2 for additional scope provisions.*
12. *Qualified historical buildings and structures and their associated sites regulated by the State Historical Building Safety Board with the Division of the State Architect.*
13. *General acute care hospitals, acute psychiatric hospitals, skilled nursing and/or intermediate care facilities, clinics licensed by the Department of Public Health and correctional treatment centers regulated by the Office of Statewide Health Planning and Development. See Section 1.10 for additional scope provisions.*
14. *Applications regulated by the Office of the State Fire Marshal include, but are not limited to, the following in accordance with Section 1.11:*
 - 14.1. *Buildings or structures used or intended for use as an:*
 1. *Asylum, jail, prison*
 2. *Mental hospital, hospital, home for the elderly, children's nursery, children's home or institution, school or any similar occupancy of any capacity*
 3. *Theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education*
 4. *Small family day-care homes, large family day-care homes, residential facilities and residential facilities for the elderly, residential care facilities*
 5. *State institutions or other state-owned or state-occupied buildings*
 6. *High-rise structures*
 7. *Motion picture production studios*
 8. *Organized camps*
 9. *Residential structures*
 - 14.2. *Tents, awnings or other fabric enclosures used in connection with any occupancy*
 - 14.3. *Fire alarm devices, equipment and systems in connection with any occupancy*
 - 14.4. *Hazardous materials, flammable and combustible liquids*
 - 14.5. *Public school automatic fire detection, alarm and sprinkler systems*

- 14.6. *Wildland-urban interface fire areas*
15. *Section 1.12 is reserved for the State Librarian.*
16. *Section 1.13 is reserved for the Department of Water Resources.*
17. *For applications listed in Section 1.9.1 regulated by the Division of the State Architect-Access Compliance, outdoor environments and uses shall be classified according to accessibility uses described in Chapter 11B contained in the California Building Code.*
18. *Section 1.14 is reserved for the California State Lands Commission.*

1.1.4 Appendices. *Provisions contained in the appendices of this code shall not apply unless specifically adopted by a state agency or adopted by a local enforcing agency in compliance with Health and Safety Code Section 18901 et seq. for Building Standards Law, Health and Safety Code Section 17950 for State Housing Law and Health and Safety Code Section 13869.7 for Fire Protection Districts. See Section 1.1.8 of this code.*

1.1.5 Referenced codes. *The codes, standards and publications adopted and set forth in this code, including other codes, standards and publications referred to therein are, by title and date of publication, hereby adopted as standard reference documents of this code. When this code does not specifically cover any subject related to building design and construction, recognized architectural or engineering practices shall be employed. The National Fire Codes, standards and the Fire Protection Handbook of the National Fire Protection Association are permitted to be used as authoritative guides in determining recognized fire prevention engineering practices.*

1.1.6 Nonbuilding standards, orders and regulations. *Requirements contained in the California Existing Building Code, or in any other referenced standard, code or document, which are not building standards as defined in Health and Safety Code Section 18909, shall not be construed as part of the provisions of this code. For nonbuilding standards, orders and regulations, see other titles of the California Code of Regulations.*

1.1.7 Order of precedence and use.

1.1.7.1 Differences. *In the event of any differences between these building standards and the standard reference documents, the text of these building standards shall govern.*

1.1.7.2 Specific provisions. *Where a specific provision varies from a general provision, the specific provision shall apply.*

1.1.7.3 Conflicts. *When the requirements of this code conflict with the requirements of any other part of the California Building Standards Code, Title 24 the most restrictive requirements shall prevail.*

1.1.7.3.1 Detached one- and two-family dwellings. *Detached one- and two-family dwellings, lodging houses, live/work units, townhouses not more than three stories above grade plane in height with a separate means of*

egress, and their accessory structures, may be designed and constructed in accordance with the California Residential Code or the California Building Code, but not both, unless the proposed structure(s) or element(s) exceed the design limitations established in the California Residential Code, and the code user is specifically directed by the California Residential Code to use the California Building Code.

1.1.8 City, county, or city and county amendments, additions or deletions. The provisions of this code do not limit the authority of city, county, or city and county governments to establish more restrictive and reasonably necessary differences to the provisions contained in this code pursuant to complying with Section 1.1.8.1. The effective date of amendments, additions or deletions to this code by a city, county, or city and county filed pursuant to Section 1.1.8.1 shall be the date filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with Health and Safety Code Section 18941.5 for Building Standards Law, Health and Safety Code Section 17958 for State Housing Law or Health and Safety Code Section 13869.7 for Fire Protection Districts.

1.1.8.1 Findings and filings.

1. The city, county, or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geological conditions.

Exception: Hazardous building ordinances and programs mitigating unreinforced masonry buildings.

2. The city, county, or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties, and fire departments shall file the amendments, additions or deletions, and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.
3. Findings prepared by fire protection districts shall be ratified by the local city, county, or city and county and filed with the California Department of Housing and Community Development, Division of Codes and Standards, P.O. Box 278180, Sacramento, CA 95827-8180 or 9342 Tech Center Drive, Suite 500, Sacramento, CA 95826-2581.

1.1.8.2 Locally adopted energy standards – California Energy Code, Part 6

In addition to the provisions of Section 1.1.8.1 of this Part, the provisions of this section shall apply to a city, county, and city and county adopting local energy standards applicable to buildings and structures subject to the California Energy Code, Part 6.

Applicable provisions of Public Resources Code Section 25402.1(h)(2) and applicable provisions of Section 10-106, Chapter 10 of the California Administrative Code, Part 1 apply to locally adopted energy standards amending the California Energy Code, Part 6.

1.1.9 Effective date of this code. Only those standards approved by the California Building Standards Commission that are effective at the time an application for building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the History Note page of this code.

Exceptions:

- (1) [HCD 1 & HCD 2] Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.
- (2) [HCD 1 & HCD 2] Plans approved by the Department of Housing and Community Development or a Department-approved design approval agency for factory-built housing as defined by Health and Safety Code Section 19971. Approved plans, pursuant to the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, Article 3, Section 3048 remain valid for a period of 36 months from the date of plan approval.

1.1.10 Availability of codes. At least one complete copy each of Titles 8, 19, 20, 24 and 25 with all revisions shall be maintained in the office of the building official responsible for the administration and enforcement of this code. Each state department concerned and each city, county, or city and county shall have an up-to-date copy of the code available for public inspection. See Health and Safety Code Section 18942(e)(1) and (2).

1.1.11 Format. This part fundamentally adopts the International Existing Building Code by reference on a chapter-by-chapter basis. When a specific chapter of the International Existing Building Code is not printed in the code and is marked “Reserved”, such chapter of the International Existing Building Code is not adopted as a portion of this code. When a specific chapter of the International Existing Building Code is marked “Not adopted by the State of California” but appears in the code, it may be available for adoption by local ordinance.

Those provisions of the model code used as the basis for this part of the California Building Standards Code in Title 24, California Code of Regulations, that are not printed herein and are marked “Not adopted by the State of California,” may be available for adoption by local ordinance, provided such ordinance and related model code provisions do not conflict with Title 24 provisions applicable to the subject occupancy or building feature. Such a local ordinance is not subject to the Express Finding and document filing requirements of Health and Safety Code Sections 13869.7, 17958 and 18941.5.

Note: Matrix Adoption Tables at the front of each chapter may aid the code user in determining which chapter or sections within a chapter are applicable to buildings under the authority of a specific state agency, but they are not to be considered regulatory.

1.1.12 Validity. If any chapter, section, subsection, sentence, clause or phrase of this code is for any reason held to be unconstitutional, contrary to statute, exceeding the authority of the state as stipulated by statutes or otherwise inoperative, such decision shall not affect the validity of the remaining portion of this code.

SECTION 1.2 BUILDING STANDARDS COMMISSION

1.2.1 BSC. *Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.*

1. State buildings for all occupancies.

Application—State buildings (all occupancies), including buildings constructed by the Trustees of the California State University (CSU) and the Regents of the University of California (UC) where no state agency has the authority to adopt building standards applicable to such buildings.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 18934.5.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

2. University of California, California State Universities and California Community Colleges.

Application—Standards for lighting for parking lots and primary campus walkways at the University of California, California State Universities and California Community Colleges.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Government Code Section 14617.

Reference—Government Code Section 14617.

3. Existing state-owned buildings, including those owned by the University of California and by the California State University.

Application—Building seismic retrofit standards including abating falling hazards of structural and nonstructural components and strengthening of building structures. See also Division of the State Architect.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Section 16600.

Reference—Health and Safety Code Sections 16600 through 16604.

4. Unreinforced masonry-bearing wall buildings.

Application—Minimum seismic strengthening standards for buildings specified in Appendix Chapter A1 of the California Existing Building Code, except for buildings subject to building standards pursuant to Health and Safety Code (commencing) with Section 17910.

Enforcing agency—State or local agency specified the applicable provisions of law.

Authority cited—Health and Safety Code Section 18934.7.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

1.2.1.1 State building. For purposes of this code, a “state building” is a structure for which a state agency or state entity has authority to construct, alter, enlarge, replace, repair or demolish.

1.2.1.2 Enforcement. [CSU, UC, Judicial Council and California Department of Corrections and Rehabilitation] State agencies or state entities authorized to construct state buildings may appoint a building official who is responsible to the agency for enforcement of the provisions of the California Building Standards Code.

Exception: State buildings regulated by other sections of this code remain the enforcement responsibility of the designated entities.

1.2.1.3 Enforcement. Reserved for DGS.

1.2.1.4 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym **BSC**.

1.2.2 BSC-CG. *Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.*

1. Green building standards for nonresidential occupancies.

Application—All occupancies where no state agency has the authority to adopt green building standards applicable to those occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health and Safety Code Sections 18930.5(a), 18938 and 18940.5.

Reference—Health and Safety Code, Division 13, Part 2.5, commencing with Section 18901.

2. Graywater systems for nonresidential occupancies.

Application—The construction, installation and alteration of graywater systems for indoor and outdoor uses in nonresidential occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—Health & Safety Code Section 18941.8.

Reference—Health & Safety Code Section 18941.8.

1.2.2.1 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym **BSC-CG**.

1.2.3 Alternative materials, design and methods of construction and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building

official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose intended, at least the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety.

1.2.3.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

1.2.3.2 Tests. Whenever there is insufficient evidence of compliance with the provisions of this code, or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the building official shall have the authority to require tests as evidence of compliance to be made at no expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the building official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the building official for the period required for retention of public records.

**SECTION 1.3
BOARD OF STATE AND COMMUNITY
CORRECTIONS
Reserved**

**SECTION 1.4
DEPARTMENT OF CONSUMER AFFAIRS
Reserved**

**SECTION 1.5
CALIFORNIA ENERGY COMMISSION
Reserved**

**SECTION 1.6
DEPARTMENT OF FOOD AND AGRICULTURE
Reserved**

**SECTION 1.7
DEPARTMENT OF PUBLIC HEALTH
Reserved**

**SECTION 1.8
DEPARTMENT OF HOUSING
AND COMMUNITY DEVELOPMENT**

1.8.1 Purpose. The purpose of this code is to establish the minimum requirements necessary to protect the health, safety and general welfare of the occupants and the public by governing accessibility, erection, construction, reconstruction, enlargement, conversion, alteration, repair, moving,

removal, demolition, occupancy, use, height, court, area, sanitation, ventilation, maintenance and safety to life and property from fire and other hazards attributed to the built environment.

**SECTION 1.8.2
AUTHORITY AND ABBREVIATIONS**

1.8.2.1 General. The Department of Housing and Community Development is authorized by law to promulgate and adopt building standards and regulations for several types of building applications. The applications under the authority of the Department of Housing and Community Development are listed in Sections 1.8.2.1.1 through 1.8.2.1.3.

Note: See the California Residential Code for detached one-and two-family dwellings and townhouses.

1.8.2.1.1 Housing construction.

Application—Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities including accessory buildings, facilities and uses thereto. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 1.”

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17922.15, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Business and Professions Code Division 5, Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; Civil Code Sections 832, 1101.4, 1101.5 and 1954.201, 1954.202 and 5551; Government Code Sections 8698.4, 12955.1 and 12955.1.1. California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.2 Housing accessibility.

Application—Covered multifamily dwellings as defined in Chapter 2 of the California Building Code, including but not limited to, lodging houses, dormitories, timeshares, condominiums, shelters for homeless persons, congregate residences, apartments, dwellings, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities.

Sections of this code identified by the abbreviation “HCD 1-AC” require specific accommodations for persons with disabilities as defined in Chapter 2 of the California Building Code. The application of such provisions shall be in conjunction with other requirements of the California Building Code, and apply only to

newly constructed covered multifamily dwellings as defined in Chapter 2 of the California Building Code. “HCD 1-AC” applications include, but are not limited to, the following:

1. All newly constructed covered multifamily dwellings as defined in Chapter 2 of the California Building Code.
2. New common use areas as defined in Chapter 2 of the California Building Code, serving existing covered multifamily dwellings.
3. Additions to existing buildings, where the addition alone meets the definition of covered multifamily dwellings as defined in Chapter 2 of the California Building Code.
4. New common use areas serving new covered multifamily dwellings.
5. Where any portion of a building’s exterior is preserved, but the interior of the building is removed, including all structural portions of floors and ceilings, the building is considered a new building for determining the application of Chapter 11A of the California Building Code.

“HCD 1-AC” building standards generally do not apply to public use areas or public accommodations such as hotels and motels, and public housing. Public use areas, public accommodations and public housing, as defined in Chapter 2 of the California Building Code, are subject to the Division of the State Architect (DSA-AC) in Chapter 11B of the California Building Code, and are referenced in Section 1.9.1.

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and Government Code Sections 12955.1 and 12955.1.1.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941 and Sections 19960 through 19997; Civil Code Sections 1101.4, 1101.5, 1954.201 and 1954.202; and Government Code Sections 12955.1 and 12955.1.1. California Code of Regulations, Title 20, Sections 1605.1, 1605.3 and 1607.

1.8.2.1.3 Permanent buildings in mobilehome parks and special occupancy parks.

Application—Permanent buildings, and permanent accessory buildings or structures, constructed within mobilehome parks and special occupancy parks that are under the control and ownership of the park operator. Sections of this code which pertain to applications listed in this section are identified using the abbreviation “HCD 2.”

Enforcing agency—The Department of Housing and Community Development, local building department or other local agency that has assumed responsibility for the enforcement of Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 for mobilehome parks and Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 for special occupancy parks.

Authority cited—Health and Safety Code Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17922.15, 17926, 17927, 17928, 17958.12, 18552, 18554, 18620, 18630, 18640, 18670, 18690, 18691, 18865, 18871.3, 18871.4, 18873, 18873.1 through 18873.5, 18938.3, 18944.11 and 19990; and Government Code Section 12955.1.

Reference—Health and Safety Code Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and Sections 19960 through 19997; Civil Code Sections 1101.4, 1101.5 and 1954.201; and Government Code Sections 12955.1 and 12955.1.1; and Title 25, Sections 1042 and 2042.

**SECTION 1.8.3
LOCAL ENFORCING AGENCY**

1.8.3.1 Duties and powers. The building department of every city, county, or city and county shall enforce all the provisions of law, this code, and the other rules and regulations promulgated by the Department of Housing and Community Development pertaining to the installation, erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

For additional information regarding the use and occupancy of existing buildings and appurtenant structures, see California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Article 1, Section 1.

1.8.3.2 Laws, rules and regulations. Other than the building standards contained in this code, and notwithstanding other provisions of law, the statutory authority and location of the laws, rules and regulations to be enforced by local enforcing agencies are listed by statute in Sections 1.8.3.2.1 through 1.8.3.2.5 below:

1.8.3.2.1 State Housing Law. Refer to the State Housing Law, California Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1, for the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses and dwellings, including accessory buildings, facilities and uses thereto.

1.8.3.2.2 Mobilehome Parks Act. Refer to the Mobilehome Parks Act, California Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000 for mobilehome park administrative and enforcement authority, permits, plans, fees, violations, inspections and penalties both within and outside mobilehome parks.

Exception: Mobilehome parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.3 Special Occupancy Parks Act. Refer to the Special Occupancy Parks Act, California Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000 for special occupancy park administrative and enforcement authority, permits, fees, violations, inspections and penalties both within and outside of special occupancy parks.

Exception: Special occupancy parks where the Department of Housing and Community Development is the enforcing agency.

1.8.3.2.4 Employee Housing Act. Refer to the Employee Housing Act, California Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600 for employee housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

1.8.3.2.5 Factory-Built Housing Law. Refer to the Factory-Built Housing Law, California Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000 for factory-built housing administrative and enforcement authority, permits, fees, violations, inspections and penalties.

SECTION 1.8.4

PERMITS, FEES, APPLICATIONS AND INSPECTIONS

1.8.4.1 Permits. A written construction permit shall be obtained from the enforcing agency prior to the erection, construction, reconstruction, installation, moving or alteration of any building or structure.

Exceptions:

1. Work exempt from permits as specified in Chapter 1, Division II, Scope and Administration, Section 105.2.
2. Changes, alterations or repairs of a minor nature not affecting structural features, egress, sanitation, safety or accessibility as determined by the enforcing agency.
3. Retroactive permits issued in accordance with Health and Safety Code Section 17958.12.

Exemptions from permit requirements shall not be deemed to grant authorization for any work to be done in any manner in violation of other provisions of law or this code.

1.8.4.2 Fees. Subject to other provisions of law, the governing body of any city, county, or city and county may prescribe fees to defray the cost of enforcement of rules and regulations promulgated by the Department of Housing and Community Development. The amount of the fees shall not exceed the amount reasonably necessary to administer or process permits, certificates, forms or other documents, or to defray the costs of enforcement. For additional information, see the State Housing Law, Health and Safety Code, Division 13, Part 1.5, Section 17951 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, Article 3, commencing with Section 6.

1.8.4.3 Plan review and time limitations. Subject to other provisions of law, provisions related to plan checking, prohibition of excessive delays and contracting with or employment of private parties to perform plan checking are set forth in the State Housing Law, Health and Safety Code Section 17960.1, and for employee housing, in Health and Safety Code Section 17021.

1.8.4.3.1 Retention of plans. The building department of every city, county, or city and county shall maintain an official copy, microfilm, electronic or other type of photographic copy of the plans of every building, during the life of the building, for which the department issued a building permit.

Exceptions:

1. Single or multiple dwellings not more than two stories and basement in height.
2. Garages and other structures appurtenant to buildings listed in Exception 1.
3. Farm or ranch buildings appurtenant to buildings listed in Exception 1.
4. Any one-story building where the span between bearing walls does not exceed 25 feet (7620 mm), except a steel frame or concrete building.

All plans for common interest developments as defined in Section 4100 of the California Civil Code shall be retained. For additional information regarding plan retention and reproduction of plans by an enforcing agency, see Health and Safety Code Sections 19850 through 19852.

1.8.4.4 Inspections. Construction or work for which a permit is required shall be subject to inspection by the building official, and such construction or work shall remain accessible and exposed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or other regulations of the Department of Housing and Community Development. Required inspections are listed in Chapter 1, Division II, Scope and Administration, Sections 109.3.1 through 109.3.11.

SECTION 1.8.5

RIGHT OF ENTRY FOR ENFORCEMENT

1.8.5.1 General. Subject to other provisions of law, officers and agents of the enforcing agency may enter and inspect public and private properties to secure compliance with the rules and regulations promulgated by the Department of Housing

and Community Development. For limitations and additional information regarding enforcement, see the following:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

**SECTION 1.8.6
LOCAL MODIFICATION BY
ORDINANCE OR REGULATION**

1.8.6.1 General. Subject to other provisions of law, a city, county, or city and county may make changes to the provisions adopted by the Department of Housing and Community Development. If any city, county, or city and county does not amend, add or repeal by local ordinances or regulations the provisions published in this code or other regulations promulgated by the Department of Housing and Community Development, those provisions shall be applicable and shall become effective 180 days after publication by the California Building Standards Commission. Amendments, additions and deletions to this code adopted by a city, county, or city and county pursuant to California Health and Safety Code Sections 17958.5, 17958.7 and 18941.5, together with all applicable portions of this code, shall also become effective 180 days after publication of the California Building Standards Code by the California Building Standards Commission.

1.8.6.2 Findings, filings and rejections of local modifications. Prior to making any modifications or establishing more restrictive building standards, the governing body shall make express findings and filings, as required by California Health and Safety Code Section 17958.7, showing that such modifi-

cations are reasonably necessary due to local climatic, geological or topographical conditions. No modification shall become effective or operative unless the following requirements are met:

1. The express findings shall be made available as a public record.
2. A copy of the modification and express finding, each document marked to cross-reference the other, shall be filed with the California Building Standards Commission for a city, county, or city and county and with the Department of Housing and Community Development for fire protection districts.
3. The California Building Standards Commission has not rejected the modification or change.

Nothing in this section shall limit the authority of fire protection districts pursuant to California Health and Safety Code Section 13869.7(a).

**SECTION 1.8.7
ALTERNATE MATERIALS, DESIGNS,
TESTS AND METHODS OF CONSTRUCTION**

1.8.7.1 General. The provisions of this code, as adopted by the Department of Housing and Community Development are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, design or method of construction not specifically prescribed by this code. Consideration and approval of alternates shall comply with Section 1.8.7.2 for local building departments and Section 1.8.7.3 for the Department of Housing and Community Development.

1.8.7.2 Local building departments. The building department of any city, county, or city and county may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal, demolition or arrangement of apartments, condominiums, hotels, motels, lodging houses, dwellings or accessory structures, except for the following:

1. Structures located in mobilehome parks as defined in California Health and Safety Code Section 18214.
2. Structures located in special occupancy parks as defined in California Health and Safety Code Section 18862.43.
3. Factory-built housing as defined in California Health and Safety Code Section 19971.

1.8.7.2.1 Approval of alternates. The consideration and approval of alternates by a local building department shall comply with the following procedures and limitations:

1. The approval shall be granted on a case-by-case basis.
2. Evidence shall be submitted to substantiate claims that the proposed alternate, in performance, safety and protection of life and health, conforms to, or is at least equivalent to, the standards contained in this code and other rules and regulations promulgated

by the Department of Housing and Community Development.

3. The local building department may require tests performed by an approved testing agency at the expense of the owner or owner’s agent as proof of compliance.
4. If the proposed alternate is related to accessibility in covered multifamily dwellings or in facilities serving covered multifamily dwellings as defined in Chapter 2 of the California Building Code, the proposed alternate must also meet the threshold set for equivalent facilitation as defined in Chapter 2 of the California Building Code.

For additional information regarding approval of alternates by a building department pursuant to the State Housing Law, see California Health and Safety Code Section 17951(e) and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

1.8.7.3 Department of Housing and Community Development. The Department of Housing and Community Development may approve alternates for use in the erection, construction, reconstruction, movement, enlargement, conversion, alteration, repair, removal or demolition of apartments, condominiums, hotels, motels, lodging houses, dwellings or accessory structures thereto and permanent buildings in mobilehome parks and special occupancy parks. The consideration and approval of alternates shall comply with the following:

1. The department may require tests at the expense of the owner or owner’s agent to substantiate compliance with the California Building Standards Code.
2. The approved alternate shall, for its intended purpose, be at least equivalent in performance and safety to the materials, designs, tests or methods of construction prescribed by this code.

**SECTION 1.8.8
APPEALS BOARD**

1.8.8.1 General. Every city, county, or city and county shall establish a process to hear and decide appeals of orders, decisions and determinations made by the enforcing agency relative to the application and interpretation of this code and other regulations governing construction, use, maintenance and change of occupancy. The governing body of any city, county, or city and county may establish a local appeals board and a housing appeals board to serve this purpose. Members of the appeals board(s) shall not be employees of the enforcing agency and shall be knowledgeable in the applicable building codes, regulations and ordinances as determined by the governing body of the city, county, or city and county.

Where no such appeals boards or agencies have been established, the governing body of the city, county, or city and county shall serve as the local appeals board or housing appeals board as specified in California Health and Safety Code Sections 17920.5 and 17920.6.

1.8.8.2 Definitions. The following terms shall for the purposes of this section have the meaning shown.

HOUSING APPEALS BOARD. The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the requirements of the city, county, or city and county relating to the use, maintenance and change of occupancy of buildings and structures, including requirements governing alteration, additions, repair, demolition and moving. In any area in which there is no such board or agency, “Housing appeals board” means the local appeals board having jurisdiction over the area.

LOCAL APPEALS BOARD. The board or agency of a city, county, or city and county which is authorized by the governing body of the city, county, or city and county to hear appeals regarding the building requirements of the city, county, or city and county. In any area in which there is no such board or agency, “Local appeals board” means the governing body of the city, county, or city and county having jurisdiction over the area.

1.8.8.3 Appeals. Except as otherwise provided in law, any person, firm or corporation adversely affected by a decision, order or determination by a city, county, or city and county relating to the application of building standards published in the California Building Standards Code, or any other applicable rule or regulation adopted by the Department of Housing and Community Development, or any lawfully enacted ordinance by a city, county, or city and county, may appeal the issue for resolution to the local appeals board or housing appeals board as appropriate.

The local appeals board shall hear appeals relating to new building construction and the housing appeals board shall hear appeals relating to existing buildings.

**SECTION 1.8.9
UNSAFE BUILDINGS OR STRUCTURES**

1.8.9.1 Authority to enforce. Subject to other provisions of law, the administration, enforcement, actions, proceedings, abatement, violations and penalties for unsafe buildings and structures are contained in the following statutes and regulations:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1. For enforcement related to accessory dwelling units, see Health and Safety Code Section 17980.12 operative until January 1, 2035.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this

code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.

4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

1.8.9.2 Actions and proceedings. Subject to other provisions of law, punishments, penalties and fines for violations of building standards are contained in the following statutes and regulations:

1. For applications subject to the State Housing Law as referenced in Section 1.8.3.2.1 of this code, refer to Health and Safety Code, Division 13, Part 1.5, commencing with Section 17910 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1, commencing with Section 1.
2. For applications subject to the Mobilehome Parks Act as referenced in Section 1.8.3.2.2 of this code, refer to Health and Safety Code, Division 13, Part 2.1, commencing with Section 18200 and California Code of Regulations, Title 25, Division 1, Chapter 2, commencing with Section 1000.
3. For applications subject to the Special Occupancy Parks Act as referenced in Section 1.8.3.2.3 of this code, refer to Health and Safety Code, Division 13, Part 2.3, commencing with Section 18860 and California Code of Regulations, Title 25, Division 1, Chapter 2.2, commencing with Section 2000.
4. For applications subject to the Employee Housing Act as referenced in Section 1.8.3.2.4 of this code, refer to Health and Safety Code, Division 13, Part 1, commencing with Section 17000 and California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 3, commencing with Section 600.
5. For applications subject to the Factory-Built Housing Law as referenced in Section 1.8.3.2.5 of this code, refer to Health and Safety Code, Division 13, Part 6, commencing with Section 19960 and California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 1, commencing with Section 3000.

SECTION 1.8.10 OTHER BUILDING REGULATIONS

1.8.10.1 Existing structures. Notwithstanding other provisions of law, the replacement, retention and extension of original materials and the use of original methods of con-

struction for any existing building or accessory structure, or portions thereof, shall be permitted in accordance with the provisions of this code as adopted by the Department of Housing and Community Development. For additional information, see California Health and Safety Code, Sections 17912, 17920.3, 17922 and 17958.8.

1.8.10.2 Moved structures. Subject to the requirements of California Health and Safety Code Sections 17922, 17922.3 and 17958.9, local ordinances or regulations relating to a moved residential building or accessory structure thereto, shall permit the replacement, retention and extension of original materials and the use of original methods of construction so long as the structure does not become or continue to be a substandard building.

SECTION 1.9 DIVISION OF THE STATE ARCHITECT

1.9.1 Division of the State Architect—Access Compliance - Reserved.

Buildings or facilities where accessibility is required for applications listed in California Code of Regulations, Title 24, Part 2 (California Building Code), Chapter 1, Section 1.9.1 regulated by the Division of the State Architect—Access Compliance shall comply with Title 24, Part 2, Chapter 11A or 11B, as applicable under authority cited by CA Government Code Section 4450 and in reference cited by CA Government Code Sections 4450 through 4461, 12955.1(c), and CA Health and Safety Code Sections 18949.1, 19952 through 19959.

1.9.1.1 Adopting agency identification. Division of the State Architect—Access Compliance amendments in this code appear preceded with the acronym [DSA-AC].

1.9.2 Division of the State Architect—Structural Safety.

1.9.2.1 DSA-SS Division of the State Architect—Structural Safety.

Application—Public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

Enforcing agency—The Division of the State Architect—Structural Safety [DSA-SS] has been delegated the responsibility and authority by the Department of General Services to review and approve the design and observe the construction of public elementary and secondary schools, community colleges and state-owned or state-leased essential services buildings.

Authority cited—Education Code Section 17310 and 81142 and Health and Safety Code Section 16022.

Reference—Education Code Sections 17280 through 17317, and 81130 through 81147 and Health and Safety Code Sections 16000 through 16023.

1.9.2.1.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations:

- 1.1. Sections 4-301 through 4-355, Group 1, and Sections 4-401 through 4-435, Group 2, Chapter 4, for public elementary and secondary schools and community colleges.

1.2. Sections 4-201 through 4-249, Chapter 4, for state-owned or state-leased essential services buildings.

2. **Title 24, Part 2, California Code of Regulations:** [applies to public elementary and secondary schools, community colleges and state-owned or state-leased essential services building(s)]:

2.1. Sections 1.1 and 1.9.2.1 of Chapter 1, Division I.

2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 106.1, 107.2.5 and 110.3.6 of Chapter 1, Division II.

3. **Title 24, Part 10, California Code of Regulations:** [applies to public elementary and secondary schools, community colleges and state-owned or state-leased essential services building(s)]:

3.1. Sections 1.1 and 1.9.2.1 of Chapter 1, Division I.

3.2. Sections 101.8.1, 106.2.5 and 109.3.6 of Chapter 1, Division II.

1.9.2.1.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, California Code of Regulations, for school buildings, community colleges and state-owned or state-leased essential service buildings.

The provisions of Title 24, Part 10, as adopted and amended by the Division of the State Architect—Structural Safety [DSA-SS], shall apply to the applications listed in Section 1.9.2.1.

The Division of the State Architect—Structural Safety [DSA-SS] adopts the following building standards in Title 24, Part 10:

Chapters 1, 3 and 5.

1.9.2.1.3 Amendments. Division of the State Architect—Structural Safety amendments in this code appear preceded with the acronym [DSA-SS].

> **Exception:** Chapter 3, Sections 317-323-DSA-SS adopts these sections without the use of the DSA-SS acronym.

1.9.2.1.4 Reference to other chapters. For public schools, where reference is made to sections in Chapters 16, 17, 18, 19, 21 or 22 of the California Building Code, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A of the California Building Code, respectively, shall apply instead.

1.9.2.2 DSA-SS/CC Division of the State Architect—Structural Safety/Community Colleges.

Application—Community Colleges. The Division of the State Architect has been delegated the authority by the Department of General Services to promulgate alternate building standards for application to community colleges, which a community college may elect to use in lieu of standards promulgated by DSA-SS in accordance with Section 1.9.2.1.

Enforcing agency—Division of the State Architect—Structural Safety/Community Colleges [DSA-SS/CC].

The Division of the State Architect has been delegated the authority by the Department of General Services to review and approve the design and oversee construction of community colleges electing to use the alternative building standards as provided in this section.

Authority cited—Education Code Section 81053.

Reference—Education Code Sections 81052, 81053 and 81130 through 81147.

1.9.2.2.1 Applicable administrative standards.

1. **Title 24, Part 1, California Code of Regulations:**

1.1. Sections 4-301 through 4-355, Group 1, and Sections 4-401 through 4-435, Group 2, Chapter 4.

2. **Title 24, Part 2, California Code of Regulations:**

2.1. Sections 1.1 and 1.9.2.2 of Chapter 1, Division I.

2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 106.1, 107.2.5 and 110.3.6 of Chapter 1, Division II.

3. **Title 24, Part 10, California Code of Regulations:** [applies to public elementary and secondary schools, community colleges and state-owned or state-leased essential services building(s)]:

3.1. Sections 1.1 and 1.9.2.1 of Chapter 1, Division I.

3.2. Sections 101.8.1, 106.2.5 and 109.3.6 of Chapter 1, Division II.

1.9.2.2.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10, 11 and 12, California Code of Regulations.

The provisions of Title 24, Part 10, as adopted and amended by the Division of the State Architect—Structural Safety/Community Colleges [DSA-SS/CC], shall apply to the applications listed in Section 1.9.2.2.

The Division of the State Architect—Structural Safety/Community Colleges [DSA-SS/CC] adopts the following building standards in Title 24, Part 10:

Chapters 1, 3 and 5.

1.9.2.2.3 Amendments. Division of the State Architect—Structural Safety/Community Colleges amendments in this code appear preceded with the acronym [DSA-SS/CC].

Exception: Chapter 3, Sections 317-323—DSA-SS/CC adopts these sections without the use of the DSA-SS/CC acronym. <

1.9.2.2.4 Reference to other chapters. For community colleges, where reference is made to sections in Chapters 17 or 18 of the California Building Code, the provisions in Chapters 17A and 18A of the California Building Code, respectively, shall apply instead.

**SECTION 1.10
OFFICE OF STATEWIDE HEALTH
PLANNING AND DEVELOPMENT**

1.10.1 OSHPD 1 and OSHPD 1R. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application [OSHPD 1] General acute care hospital buildings. [OSHPD 1R] Nonconforming hospital SPC or freestanding buildings that have been removed from acute care service.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

1.10.1.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapters 6 and 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.1.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 10, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.1.

OSHPD 1 adopts the following building standards in Title 24, Part 10: Chapters 2, 3A, 4A and 5A.

OSHPD 1R adopts the following building standards in Title 24, Part 10: Chapters 2, 3, 4 and 5.

1.10.1.3 Identification of amendments. For applications listed in Section 1.10.1, amendments in this code appear in this code preceded with the acronym [OSHPD 1], unless the entire chapter is applicable. For nonconforming hospital buildings removed from acute-care service, amendments are preceded with the acronym [OSHPD 1R].

1.10.1.4 Reference to other chapters. Where reference is made within this code to sections in Chapters 3, 4 and 5, the respective section in Chapters 3A, 4A and 5A, shall apply instead for hospital buildings under OSHPD 1.

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 19958, 127010, 127015, 129680, 1275 and 129675 through 130070.

1.10.2 OSHPD 2. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Skilled nursing facility and intermediate care facility buildings.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

1.10.2.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.2.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 10, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.2.

OSHPD 2 adopts the following building standards in Title 24, Part 10: Chapters 2, 3, 4 and 5.

1.10.2.3 Identification of amendments. For applications listed in Section 1.10.2, amendments in this code appear in this code preceded with the acronym [OSHPD 2], unless the entire chapter is applicable.

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 127010, 127015, 1275 and 129680.

1.10.3 OSHPD 3. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Licensed clinics and any freestanding building under a hospital license where outpatient clinical services are provided.

Enforcing agency—Local building department.

1.10.3.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.3.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 10, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.3.

OSHPD 3 adopts the following building standards in Title 24, Part 10: Chapters 2, 3, 4 and 5.

Authority—Health and Safety Code Sections 127010, 127015 and 1226.

References—Health and Safety Code Sections 127010, 127015, 129885 and 1226, Government Code Section 54350 and State Constitution Article 11, Section 7.

1.10.4 OSHPD 4. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Correctional treatment centers.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

1.10.4.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.4.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provisions of Title 24, Part 10, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.4.

OSHPD 4 adopts the following building standards in Title 24, Part 10: Chapters 2, 3, 4 and 5.

1.10.4.3 Identification of amendments. For applications listed in Section 1.10.4, amendments in this code appear in this code preceded with the acronym [OSHPD 4], unless the entire chapter is applicable.

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129790.

References—Health and Safety Code Sections 127010, 127015, 1275 and 129674 through 130070.

1.10.5 OSHPD 5. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Acute psychiatric hospital buildings.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility type.

1.10.5.1 Applicable administrative standards.

1. Title 24, Part 1, California Code of Regulations: Chapter 7.
2. Title 24, Part 2, California Code of Regulations: Sections 1.1 and 1.10, Chapter 1, Division I, and as indicated in the adoption matrix for Chapter 1, Division II.

1.10.5.2 Applicable building standards. California Building Standards Code, Title 24, Parts 2, 3, 4, 5, 6, 9, 10 and 11.

The provision of Title 24, Part 2, as adopted and amended by OSHPD, shall apply to the applications listed in Section 1.10.5.

OSHPD 5 adopts the following building standards in Title 24, Part 10: Chapters 2, 3, 4 and 5.

1.10.5.3 Identification of amendments. For applications listed in Section 1.10.5, amendments appear in this code preceded with the acronym [OSHPD 5].

Authority—Health and Safety Code Sections 127010, 127015, 1275 and 129850.

References—Health and Safety Code Sections 127010, 127015, 129680, 1275 and 129675 through 130070.

SECTION 1.11 OFFICE OF THE STATE FIRE MARSHAL

1.11.1 SFM—Office of the State Fire Marshal. Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application:

Institutional, educational or any similar occupancy. Any building or structure used or intended for use as an asylum, jail, prison, mental hospital, hospital, sanitarium, home for the elderly, children's nursery, children's home or institution, school or any similar occupancy of any capacity.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Assembly or similar place of assemblage. Any theater, dancehall, skating rink, auditorium, assembly hall, meeting hall, nightclub, fair building or similar place of assemblage where 50 or more persons may gather together in a building, room or structure for the purpose of amusement, entertainment, instruction, deliberation, worship, drinking or dining, awaiting transportation, or education.

Authority cited—Health and Safety Code Section 13143.

Reference—Health and Safety Code Section 13143.

Small family day-care homes.

Authority cited—Health and Safety Code Sections 1597.45, 1597.54, 13143 and 17921.

Reference—Health and Safety Code Section 13143.

Large family day-care homes.

Authority cited—Health and Safety Code Sections 1597.46, 1597.54 and 17921.

Reference—Health and Safety Code Section 13143.

Residential facilities and residential facilities for the elderly.

Authority cited—Health and Safety Code Section 13133.

Reference—Health and Safety Code Section 13143.

Any state institution or other state-owned or specified state-occupied building.

Specified state-occupied buildings. Any building, structure or area that meets any of the following criteria:

1. A building where the state has contracted into a build-to-suit lease.
2. A courthouse holding facility or trial court with a detention area.
3. A building used by the Department of Corrections and Rehabilitation as a community correctional reentry center.
4. 100 percent state occupied.
5. State-occupied areas in a state-leased building that is a high-rise and is 75 percent of the net area floor space or more occupied by state entities.
6. State-occupied areas that contain 5,000 square feet (465 m²) or more space of a state-leased Group H or Group L occupancy.
7. A state-leased building with facilities with the primary purpose of housing state records and/or state artifacts of historical significance.
8. Properties leased by California State University (CSU) or University of California (UC).
9. State institutions and their real property.
10. CAL FIRE occupied areas in leased building.
11. State-leased facilities where the governing body's fire protection services rely on an all-volunteer fire department.

Except as provided in Items 1 through 11, buildings shall become the responsibility of the local jurisdiction.

Authority cited—Health and Safety Code Sections 13108, 13145, 13146, 16022.5 and 17921.

Reference—Health and Safety Code Sections 13108, 13143, 13145, 13146, 16022.5 and 17921.

High-rise structures.

Authority cited—Health and Safety Code Section 13211.

Reference—Health and Safety Code Section 13143.

Motion picture production studios.

Authority cited—Health and Safety Code Section 13143.1.

Reference—Health and Safety Code Section 13143.

Organized camps.

Authority cited—Health and Safety Code Section 18897.3.

Reference—Health and Safety Code Section 13143.

Residential. All hotels, motels, lodging houses, apartment houses and dwellings, including congregate residences and buildings and structures accessory thereto. Multiple-story structures existing on January 1, 1975, let for human habita-

tion, including and limited to, hotels, motels and apartment houses, less than 75 feet (22 860 mm) above the lowest floor level having building access, wherein rooms used for sleeping are let above the ground floor.

Authority cited—Health and Safety Code Sections 13143.2 and 17921.

Reference—Health and Safety Code Section 13143.

Residential care facilities. Certified family care homes, out-of-home placement facilities, halfway houses, drug and/or alcohol rehabilitation facilities and any building or structure used or intended for use as a home or institution for the housing of any person of any age when such person is referred to or placed within such home or institution for protective social care and supervision services by any governmental agency.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Tents, awnings or other fabric enclosures used in connection with any occupancy.

Authority cited—Health and Safety Code Section 13116.

Reference—Health and Safety Code Section 13143.

Fire alarm devices, equipment and systems in connection with any occupancy.

Authority cited—Health and Safety Code Section 13114.

Reference—Health and Safety Code Section 13143.

Hazardous materials.

Authority cited—Health and Safety Code Section 13143.9.

Reference—Health and Safety Code Section 13143.

Flammable and combustible liquids.

Authority cited—Health and Safety Code Section 13143.6.

Reference—Health and Safety Code Section 13143.

Public school automatic fire detection, alarm and sprinkler systems.

Authority cited—Health and Safety Code Section 13143 and California Education Code Article 7.5, Sections 17074.50, 17074.52 and 17074.54.

Reference—Government Code Section 11152.5, Health and Safety Code Section 13143 and California Education Code Chapter 12.5, Leroy F. Greene School Facilities Act of 1998, Article 1.

Wildland-Urban interface fire area.

Authority cited—Health and Safety Code Sections 13143, 13108.5(a) and 18949.2(b) and (c) and Government Code Section 51189.

Reference—Health and Safety Code Sections 13143, Government Code Sections 51176, 51177, 51178 and 51179 and Public Resources Code Sections 4201 through 4204.

1.11.2 Duties and powers of the enforcing agency.**1.11.2.1 Enforcement.**

1.11.2.1.1 The responsibility for enforcement of building standards adopted by the State Fire Marshal and published in the California Building Standards Code relating to fire and panic safety and other regulations of the State Fire Marshal shall except as provided in Section 1.11.2.1.2 be as follows:

1. The city, county, or city and county with jurisdiction in the area affected by the standard or regulation shall delegate the enforcement of the building standards relating to fire and panic safety and other regulations of the State Fire Marshal as they relate to Group R-3 occupancies, as described in Section 1.1.3.1 or SFM Part 2 California Building Code, Section 310.1, to either of the following:
 - 1.1. The chief of the fire authority of the city, county or city and county, or an authorized representative.
 - 1.2. The chief building official of the city, county or city and county, or an authorized representative.
2. The chief of any city or county fire department or of any fire protection district, and authorized representatives, shall enforce within the jurisdiction the building standards and other regulations of the State Fire Marshal, except those described in Item 1 or 4.
3. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in areas outside of corporate cities and districts providing fire protection services.
4. The State Fire Marshal shall have authority to enforce the building standards and other regulations of the State Fire Marshal in corporate cities and districts providing fire protection services on request of the chief fire official or the governing body.
5. Any fee charged pursuant to the enforcement authority of this section shall not exceed the estimated reasonable cost of providing the service for which the fee is charged pursuant to Section 66014 of the Government Code.

1.11.2.1.2 Pursuant to Health and Safety Code Section 13108, and except as otherwise provided in this section, building standards adopted by the State Fire Marshal published in the California Building Standards Code relating to fire and panic safety shall be enforced by the State Fire Marshal in all state-owned buildings, state-occupied buildings and state institutions throughout the state. Upon the written request of the chief fire official of any city, county, or fire protection district, the State Fire Marshal may authorize such chief fire official and his or her authorized representatives, in their geographical area of responsibility, to make fire

prevention inspections of state-owned or state-occupied buildings, other than state institutions, for the purpose of enforcing the regulations relating to fire and panic safety adopted by the State Fire Marshal pursuant to this section and building standards relating to fire and panic safety published in the California Building Standards Code. Authorization from the State Fire Marshal shall be limited to those fire departments or fire districts which maintain a fire prevention bureau staffed by paid personnel.

Pursuant to Health and Safety Code Section 13108, any requirement or order made by any chief fire official who is authorized by the State Fire Marshal to make fire prevention inspections of state-owned or state-occupied buildings, other than state institutions, may be appealed to the State Fire Marshal. The State Fire Marshal shall, upon receiving an appeal and subject to the provisions of Chapter 5 (commencing with Section 18945) of Part 2.5 of Division 13 of the Health and Safety Code, determine if the requirement or order made is reasonably consistent with the fire and panic safety regulations adopted by the State Fire Marshal and building standards relating to fire and panic safety published in the California Existing Building Code.

Any person may request a code interpretation from the State Fire Marshal relative to the intent of any regulation or provision adopted by the State Fire Marshal. When the request relates to a specific project, occupancy or building, the State Fire Marshal shall review the issue with the appropriate local enforcing agency prior to rendering such code interpretation.

1.11.2.1.3 Pursuant to Health and Safety Code Section 13112, any person who violates any order, rule or regulation of the State Fire Marshal is guilty of a misdemeanor punishable by a fine of not less than \$100.00 or more than \$500.00, or by imprisonment for not less than six months, or by both. A person is guilty of a separate offense each day during which he or she commits, continues or permits a violation of any provision of, or any order, rule or regulation of, the State Fire Marshal as contained in this code.

Any inspection authority who, in the exercise of his or her authority as a deputy State Fire Marshal, causes any legal complaints to be filed or any arrest to be made shall notify the State Fire Marshal immediately following such action.

1.11.2.2 Right of entry. The fire chief of any city, county or fire protection district, or such person's authorized representative, may enter any state institution or any other state-owned or state-occupied building for the purpose of preparing a fire suppression preplanning program or for the purpose of investigating any fire in a state-occupied building.

The State Fire Marshal, his or her deputies or salaried assistants, the chief of any city or county fire department or fire protection district and his or her authorized representatives may enter any building or premises not used for dwelling purposes at any reasonable hour for the purpose

of enforcing this chapter. The owner, lessee, manager or operator of any such building or premises shall permit the State Fire Marshal, his or her deputies or salaried assistants and the chief of any city or county fire department or fire protection district and his or her authorized representatives to enter and inspect them at the time and for the purpose stated in this section.

1.11.2.3 More restrictive fire and panic safety building standards.

1.11.2.3.1 Any fire protection district organized pursuant to Health and Safety Code Part 2.7 (commencing with Section 13800) of Division 12 may adopt building standards relating to fire and panic safety that are more stringent than those building standards adopted by the State Fire Marshal and contained in the California Building Standards Code. For these purposes, the district board shall be deemed a legislative body and the district shall be deemed a local agency. Any changes or modifications that are more stringent than the requirements published in the California Building Standards Code relating to fire and panic safety shall be subject to Section 1.1.8.1.

1.11.2.3.2 Any fire protection district that proposes to adopt an ordinance pursuant to this section shall, not less than 30 days prior to noticing a proposed ordinance for public hearing, provide a copy of that ordinance, together with the adopted findings made pursuant to Section 1.11.2.3.1, to the city, county, or city and county where the ordinance will apply. The city, county, or city and county may provide the district with written comments, which shall become part of the fire protection district's public hearing record.

1.11.2.3.3 The fire protection district shall transmit the adopted ordinance to the city, county, or city and county where the ordinance will apply. The legislative body of the city, county, or city and county may ratify, modify or deny an adopted ordinance and transmit its determination to the district within 15 days of the determination. Any modification or denial of an adopted ordinance shall include a written statement describing the reasons for any modifications or denial. No ordinance adopted by the district shall be effective until ratification by the city, county, or city and county where the ordinance will apply. Upon ratification of an adopted ordinance, the city, county, or city and county shall file a copy of the findings of the district, and any findings of the city, county, or city and county, together with the adopted ordinance expressly marked and identified to which each finding refers, in accordance with Section 1.1.8.1(3).

1.11.2.4 Request for alternate means of protection. Requests for approval to use an alternative material, assembly or materials, equipment, method of construction, method of installation of equipment or means of protection shall be made in writing to the enforcing agency by the owner or the owner's authorized representative and shall be accompanied by a full statement of the conditions. Sufficient evidence or proof shall be submitted to substantiate any claim that may be made regarding its conformance.

The enforcing agency may require tests and the submission of a test report from an approved testing organization as set forth in Title 19, California Code of Regulation, to substantiate the equivalency of the proposed alternative means of protection.

When a request for alternate means of protection involves hazardous materials, the authority having jurisdiction may consider implementation of the findings and recommendations identified in a Risk Management Plan (RMP) developed in accordance with Title 19, Division 2, Chapter 4.5, Article 3.

Approval of a request for use of an alternative material, assembly of materials, equipment, method of construction, method of installation of equipment or means of protection made pursuant to these provisions shall be limited to the particular case covered by request and shall not be construed as establishing any precedent for any future request.

1.11.2.5 Appeals. When a request for an alternate means of protection has been denied by the enforcing agency, the applicant may file a written appeal to the State Fire Marshal for consideration of the applicant's proposal. In considering such appeal, the State Fire Marshal may seek the advice of the State Board of Fire Services. The State Fire Marshal shall, after considering all of the facts presented, including any recommendations of the State Board of Fire Services, determine if the proposal is for the purposes intended, at least equivalent to that specified in these regulations in quality, strength, effectiveness, fire resistance, durability and safety, and shall transmit such findings and any recommendations to the applicant and to the enforcing agency.

1.11.3 Construction documents.

1.11.3.1 Public schools. Plans and specifications for the construction, alteration or addition to any building owned, leased or rented by any public school district shall be submitted to the Division of the State Architect.

1.11.3.2 Movable walls and partitions. Plans or diagrams shall be submitted to the enforcing agency for approval before the installation of, or rearrangement of, any movable wall or partition in any occupancy. Approval shall be granted only if there is no increase in the fire hazard.

1.11.3.3 New construction high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required to comply with new construction high-rise buildings. Such plans and specifications shall be submitted to the enforcing agency having jurisdiction.
2. All plans and specifications shall be prepared under the responsible charge of an architect or a civil or structural engineer authorized by law to develop construction plans and specifications, or by both such architect and engineer. Plans and specifications shall be prepared by an engineer duly qualified in that branch of engineering necessary to perform such services. Administration of the work of construction shall be under the charge of the

responsible architect or engineer except that where plans and specifications involve alterations or repairs, such work of construction may be administered by an engineer duly qualified to perform such services and holding a valid certificate under Chapter 7 (commencing with Section 65700) of Division 3 of the Business and Professions Code for performance of services in that branch of engineering in which said plans, specifications and estimates and work of construction are applicable.

This section shall not be construed as preventing the design of fire-extinguishing systems by persons holding a C-16 license issued pursuant to Division 3, Chapter 9, Business and Professions Code. In such instances, however, the responsibility charge of this section shall prevail.

1.11.3.4 Existing high-rise buildings.

1. Complete plans or specifications, or both, shall be prepared covering all work required by California Building Code Section 312 for existing high-rise buildings. Such plans or specifications shall be submitted to the enforcing agency having jurisdiction.
2. When new construction is required to conform with the provisions of these regulations, complete plans or specifications, or both, shall be prepared in accordance with the provisions of this subsection. As used in this section, "new construction" is not intended to include repairs, replacements or minor alterations which do not disrupt or appreciably add to or affect the structural aspects of the building.

1.11.3.5 Retention of plans. Refer to Building Standards Law, Health and Safety Code Sections 19850 and 19851 for permanent retention of plans.

1.11.4 Fees.

1.11.4.1 Other fees. Pursuant to Health and Safety Code Section 13146.2, a city, county or district which inspects a hotel, motel, lodging house or apartment house may charge and collect a fee for the inspection from the owner of the structure in an amount, as determined by the city, county or district, sufficient to pay its costs of that inspection.

1.11.4.2 Large family day-care. Pursuant to Health and Safety Code Section 1597.46, Large Family Day-Care Homes, the local government shall process any required permit as economically as possible, and fees charged for review shall not exceed the costs of the review and permit process.

1.11.4.3 High-rise. Pursuant to Health and Safety Code Section 13217, High-rise Structure Inspection: Fees and costs, a local agency which inspects a high-rise structure pursuant to Health and Safety Code Section 13217 may charge and collect a fee for the inspection from the owner of the high-rise structure in an amount, as determined by the local agency, sufficient to pay its costs of that inspection.

1.11.4.4 Fire clearance preinspection. Pursuant to Health and Safety Code Section 13235, Fire Clearance Preinspection, fee, upon receipt of a request from a prospective licensee of a community care facility, as defined in Section 1502, of a residential care facility for the elderly, as defined in Section 1569.2, or of a child day-care facility,

as defined in Section 1596.750, the local fire enforcing agency, as defined in Section 13244, or State Fire Marshal, whichever has primary jurisdiction, shall conduct a preinspection of the facility prior to the final fire clearance approval. At the time of the preinspection, the primary fire enforcing agency shall price consultation and interpretation of the fire safety regulations and shall notify the prospective licensee of the facility in writing of the specific fire safety regulations which shall be enforced in order to obtain fire clearance approval. A fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility.

1.11.4.5 Care facilities. The primary fire enforcing agency shall complete the final fire clearance inspection for a community care facility, residential care facility for the elderly, or child day-care facility within 30 days of receipt of the request for the final inspection, or as of the date the prospective facility requests the final preclearance inspection by the State Department of Social Services, whichever is later.

Pursuant to Health and Safety Code Section 13235, a preinspection fee equal to, but not exceeding, the actual cost of the preinspection services may be charged for the preinspection of a facility.

Pursuant to Health and Safety Code Section 13131.5, a reasonable final inspection fee, not to exceed the actual cost of inspection services necessary to complete a final inspection may be charged for occupancies classified as residential care facilities for the elderly (RCFE).

Pursuant to Health and Safety Code Section 1569.84, neither the State Fire Marshal nor any local public entity shall charge any fee for enforcing fire inspection regulations pursuant to state law or regulation or local ordinance, with respect to residential care facilities for the elderly (RCFE) which service six or fewer persons.

1.11.4.6 Requests of the Office of the State Fire Marshal. Whenever a local authority having jurisdiction requests that the State Fire Marshal perform plan review and/or inspection services related to a building permit, the applicable fees for such shall be payable to the Office of the State Fire Marshal.

1.11.5 Inspections. Work performed subject to the provisions of this code shall comply with the inspection requirements of Sections 109.1, 109.3, 109.3.4, 109.3.5, 109.3.6, 109.3.7, 109.3.8, 109.3.9, 109.5 and 109.6 as adopted by the Office of the State Fire Marshal.

1.11.5.1 Existing Group I-1 or R occupancies. Licensed 24-hour care in a Group I-1 or R occupancy in existence and originally classified under previously adopted state codes shall be reinspected under the appropriate previous code, provided there is no change in the use or character which would place the facility in a different occupancy group.

1.11.6 Certificate of Occupancy. A Certificate of Occupancy shall be issued as specified in Title 24, Part 2, California Building Code, Section 111.

Exception: Certificates of occupancy are not required for work exempt from permits in accordance with Section 105.2 of the California Building Code.

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1.11.7 Temporary structures and uses. See Section 107.

1.11.8 Service utilities. See Section 111.

1.11.9 Stop work order. See Section 114.

1.11.10 Unsafe buildings, structures and equipment. See Section 115.

1.11.11 Adopting agency identification. The provisions of this code applicable to buildings identified in this Section 1.11 will be identified in the Matrix Adoption Tables under the acronym SFM.

SECTION 1.12 STATE LIBRARIAN Reserved

SECTION 1.13 DEPARTMENT OF WATER RESOURCES Reserved

SECTION 1.14 CALIFORNIA STATE LANDS COMMISSION Reserved

DIVISION II

SCOPE AND ADMINISTRATION

Note: Sections adopted or amended by state agencies are specifically indicated by an agency banner.

*Division II is not adopted by the Department of Housing and Community Development
except where specifically indicated.*

User note:

About this chapter: Chapter 1 establishes the limits of applicability of the code and describes how the code is to be applied and enforced. Chapter 1 is in two parts: Part 1—Scope and Administration (Sections 101–102) and Part 2—Administration and Enforcement (Sections 103–117). Section 101 identifies which buildings and structures come under its purview and references other I-Codes® as applicable.

This code is intended to be adopted as a legally enforceable document, and it cannot be effective without adequate provisions for its administration and enforcement. The provisions of Chapter 1 establish the authority and duties of the code official appointed by the authority having jurisdiction and also establish the rights and privileges of the registered design professional, contractor and property owner.

PART 1—SCOPE AND APPLICATION

SECTION 101 SCOPE AND GENERAL REQUIREMENTS

[A] 101.1 Title. These regulations shall be known as the *Existing Building Code* of [NAME OF JURISDICTION], hereinafter referred to as “this code.”

[A] 101.2 Scope. The provisions of this code shall apply to the repair, alteration, change of occupancy, addition to and relocation of existing buildings.

Exception: Detached one- and two-family dwellings and townhouses not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane in height, shall comply with this code or the *California Residential Code*.

101.2.1 Application of fire code. Where work regulated by this code is also regulated by the construction requirements for existing buildings in Chapter 11 of the *California Fire Code*, such work shall comply with applicable requirements in both codes.

[A] 101.3 Purpose. The intent of this code is to provide flexibility to permit the use of alternative approaches to achieve compliance with minimum requirements to provide a reasonable level of safety, health, property protection and general welfare insofar as they are affected by the repair, alteration, change of occupancy, addition and relocation of existing buildings.

[A] 101.4 Applicability. This code shall apply to the repair, alteration, change of occupancy, addition and relocation of existing buildings, regardless of occupancy, subject to the criteria of Sections 101.4.1 and 101.4.2.

[A] 101.4.1 Buildings not previously occupied. A building or portion of a building that has not been previously occupied or used for its intended purpose, in accordance with the laws in existence at the time of its completion, shall be permitted to comply with the provisions of the laws in existence at the time of its original permit unless

such permit has expired. Subsequent permits shall comply with the *California Building Code* or *California Residential Code*, as applicable, for new construction.

[A] 101.4.2 Buildings previously occupied. The legal occupancy of any building existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the *California Fire Code*, or the *International Property Maintenance Code*, or as is deemed necessary by the code official for the general safety and welfare of the occupants and the public.

[A] 101.5 Safeguards during construction. Construction work covered in this code, including any related demolition, shall comply with the requirements of Chapter 15.

[A] 101.6 Appendices. The code official is authorized to require retrofit of buildings, structures or individual structural members in accordance with the appendices of this code if such appendices have been individually adopted.

[A] 101.7 Correction of violations of other codes. Repairs or alterations mandated by any property, housing or fire safety maintenance code, or mandated by any licensing rule or ordinance adopted pursuant to law, shall conform only to the requirements of that code, rule or ordinance, and shall not be required to conform to this code unless the code requiring such repair or alteration so provides.

101.8 Maintenance. [BSC, HCD 1, HCD 2] *Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner’s designated agent shall be responsible for the maintenance of buildings and structures. To determine compliance with this subsection, the building official shall have the authority to require a building or structure to be re-inspected. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures.*

101.8.1 Maintenance. [DSA-SS, DSA-SS/CC] *Buildings and structures, and parts thereof, shall be maintained in a*

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safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protections and safety systems and devices in existing structures.

SECTION 102 APPLICABILITY

[A] **102.1 General.** Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall be applicable. Where, in any specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

[A] **102.2 Other laws.** The provisions of this code shall not be deemed to nullify any provisions of local, state or federal law.

[A] **102.3 Application of references.** References to chapter or section numbers or to provisions not specifically identified by number shall be construed to refer to such chapter, section or provision of this code.

[A] **102.4 Referenced codes and standards.** The codes and standards referenced in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 and 102.4.2.

Exception: Where enforcement of a code provision would violate the conditions of the listing of the equipment or appliance, the conditions of the listing shall govern.

[A] **102.4.1 Conflicts.** Where conflicts occur between provisions of this code and referenced codes and standards, the provisions of this code shall apply.

[A] **102.4.2 Conflicting provisions.** Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this code, the provisions of this code, as applicable, shall take precedence over the provisions in the referenced code or standard.

[A] **102.5 Partial invalidity.** In the event that any part or provision of this code is held to be illegal or void, this shall not have the effect of making void or illegal any of the other parts or provisions.

PART 2—ADMINISTRATION AND ENFORCEMENT

SECTION 103 CODE COMPLIANCE AGENCY

[A] **103.1 Creation of agency.** The [INSERT NAME OF DEPARTMENT] is hereby created, and the official in charge thereof shall be known as the code official. The function of

the agency shall be the implementation, administration and enforcement of the provisions of this code.

[A] **103.2 Appointment.** The code official shall be appointed by the chief appointing authority of the jurisdiction.

[A] **103.3 Deputies.** In accordance with the prescribed procedures of this jurisdiction and with the concurrence of the appointing authority, the code official shall have the authority to appoint a deputy code official, other related technical officers, inspectors and other employees. Such employees shall have powers as delegated by the code official.

SECTION 104 DUTIES AND POWERS OF CODE OFFICIAL

[A] **104.1 General.** The code official is hereby authorized and directed to enforce the provisions of this code. The code official shall have the authority to render interpretations of this code and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of this code. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in this code.

[A] **104.2 Applications and permits.** The code official shall receive applications, review construction documents and issue permits for the repair, alteration, addition, demolition, change of occupancy and relocation of buildings; inspect the premises for which such permits have been issued; and enforce compliance with the provisions of this code.

[A] **104.2.1 Determination of substantially improved or substantially damaged existing buildings and structures in flood hazard areas.** For applications for reconstruction, rehabilitation, repair, alteration, addition or other improvement of existing buildings or structures located in flood hazard areas, the building official shall determine where the proposed work constitutes substantial improvement or repair of substantial damage. Where the building official determines that the proposed work constitutes substantial improvement or repair of substantial damage, and where required by this code, the building official shall require the building to meet the requirements of Section 1612 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable.

[A] **104.2.2 Preliminary meeting.** When requested by the permit applicant or the code official, the code official shall meet with the permit applicant prior to the application for a construction permit to discuss plans for the proposed work or change of occupancy in order to establish the specific applicability of the provisions of this code.

Exception: Repairs and Level 1 alterations.

[A] **104.2.2.1 Building evaluation.** The code official is authorized to require an existing building to be investigated and evaluated by a registered design professional based on the circumstances agreed on at the preliminary meeting. The design professional shall notify the

code official if any potential noncompliance with the provisions of this code is identified.

[A] 104.3 Notices and orders. The code official shall issue necessary notices or orders to ensure compliance with this code.

[A] 104.4 Inspections. The code official shall make the required inspections, or the code official shall have the authority to accept reports of inspection by approved agencies or individuals. Reports of such inspections shall be in writing and be certified by a responsible officer of such approved agency or by the responsible individual. The code official is authorized to engage such expert opinion as deemed necessary to report on unusual technical issues that arise, subject to the approval of the appointing authority.

[A] 104.5 Identification. The code official shall carry proper identification when inspecting structures or premises in the performance of duties under this code.

[A] 104.6 Right of entry. Where it is necessary to make an inspection to enforce the provisions of this code, or where the code official has reasonable cause to believe that there exists in a structure or on a premises a condition that is contrary to or in violation of this code that makes the structure or premises unsafe, dangerous or hazardous, the code official is authorized to enter the structure or premises at reasonable times to inspect or to perform the duties imposed by this code, provided that if such structure or premises be occupied that credentials be presented to the occupant and entry requested. If such structure or premises be unoccupied, the code official shall first make a reasonable effort to locate the owner, the owner's authorized agent or other person having charge or control of the structure or premises and request entry. If entry is refused, the code official shall have recourse to the remedies provided by law to secure entry.

[A] 104.7 Department records. The code official shall keep official records of applications received, permits and certificates issued, fees collected, reports of inspections, and notices and orders issued. Such records shall be retained in the official records for the period required for retention of public records.

[A] 104.8 Liability. The code official, member of the Board of Appeals or employee charged with the enforcement of this code, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by this code or other pertinent law or ordinance, shall not thereby be rendered civilly or criminally liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

[A] 104.8.1 Legal defense. Any suit or criminal complaint instituted against an officer or employee because of an act performed by that officer or employee in the lawful discharge of duties and under the provisions of this code shall be defended by legal representatives of the jurisdiction until the final termination of the proceedings. The code official or any subordinate shall not be liable for cost in any action, suit or proceeding that is instituted in pursuance of the provisions of this code.

[A] 104.9 Approved materials and equipment. Materials, equipment and devices approved by the code official shall be constructed and installed in accordance with such approval.

[A] 104.9.1 Used materials and equipment. The use of used materials that meet the requirements of this code for new materials is permitted. Used equipment and devices shall be permitted to be reused subject to the approval of the code official.

[A] 104.10 Modifications. Wherever there are practical difficulties involved in carrying out the provisions of this code, the code official shall have the authority to grant modifications for individual cases on application of the owner or owner's authorized representative, provided that the code official shall first find that special individual reason makes the strict letter of this code impractical, the modification is in compliance with the intent and purpose of this code and such modification does not lessen health, accessibility, life and fire safety, or structural requirements. The details of action granting modifications shall be recorded and entered in the files of the Department of Building Safety.

[A] 104.10.1 Flood hazard areas. For existing buildings located in flood hazard areas for which repairs, alterations and additions constitute substantial improvement, the code official shall not grant modifications to provisions related to flood resistance unless a determination is made that:

1. The applicant has presented good and sufficient cause that the unique characteristics of the size, configuration or topography of the site render compliance with the flood-resistant construction provisions inappropriate.
2. Failure to grant the modification would result in exceptional hardship.
3. The granting of the modification will not result in increased flood heights, additional threats to public safety, extraordinary public expense nor create nuisances, cause fraud on or victimization of the public, or conflict with existing laws or ordinances.
4. The modification is the minimum necessary to afford relief, considering the flood hazard.
5. A written notice will be provided to the applicant specifying, if applicable, the difference between the design flood elevation and the elevation to which the building is to be built, stating that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced floor elevation and that construction below the design flood elevation increases risks to life and property.

[A] 104.11 Alternative materials, design and methods of construction, and equipment. The provisions of this code are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the code official finds that the proposed design is satisfactory and complies with the intent of the provisions of this code, and that the material, method or work offered is, for the purpose

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intended, not less than the equivalent of that prescribed in this code in quality, strength, effectiveness, fire resistance, durability and safety. Where the alternative material, design or method of construction is not approved, the code official shall respond in writing, stating the reasons why the alternative was not approved.

[A] 104.11.1 Research reports. Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in this code, shall consist of valid research reports from approved sources.

[A] 104.11.2 Tests. Where there is insufficient evidence of compliance with the provisions of this code or evidence that a material or method does not conform to the requirements of this code, or in order to substantiate claims for alternative materials or methods, the code official shall have the authority to require tests as evidence of compliance to be made without expense to the jurisdiction. Test methods shall be as specified in this code or by other recognized test standards. In the absence of recognized and accepted test methods, the code official shall approve the testing procedures. Tests shall be performed by an approved agency. Reports of such tests shall be retained by the code official for the period required for retention.

SECTION 105 PERMITS

[A] 105.1 Required. Any owner or owner's authorized agent who intends to repair, add to, alter, relocate, demolish or change the occupancy of a building or to repair, install, add, alter, remove, convert or replace any electrical, gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be performed, shall first make application to the code official and obtain the required permit.

[A] 105.1.1 Annual permit. Instead of an individual permit for each alteration to an already approved electrical, gas, mechanical, or plumbing installation, the code official is authorized to issue an annual permit on application therefor to any person, firm or corporation regularly employing one or more qualified trade persons in the building, structure, or on the premises owned or operated by the applicant for the permit.

[A] 105.1.2 Annual permit records. The person to whom an annual permit is issued shall keep a detailed record of alterations made under such annual permit. The code official shall have access to such records at all times, or such records shall be filed with the code official as designated.

[A] 105.2 Work exempt from permit. Exemptions from permit requirements of this code shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or ordinances of this jurisdiction. Permits shall not be required for the following:

Building:

1. Sidewalks and driveways not more than 30 inches (762 mm) above grade and not over any basement or

story below and that are not part of an accessible route.

2. Painting, papering, tiling, carpeting, cabinets, counter tops and similar finish work.
3. Temporary motion picture, television, and theater stage sets and scenery.
4. Shade cloth structures constructed for nursery or agricultural purposes, and not including service systems.
5. Window awnings supported by an exterior wall of Group R-3 or Group U occupancies.
6. Nonfixed and movable cases, counters and partitions not over 5 feet 9 inches (1753 mm) in height.

Electrical:

1. **Repairs and maintenance:** Minor repair work, including the replacement of lamps or the connection of approved portable electrical equipment to approved permanently installed receptacles.
2. **Radio and television transmitting stations:** The provisions of this code shall not apply to electrical equipment used for radio and television transmissions, but do apply to equipment and wiring for power supply, the installations of towers and antennas.
3. **Temporary testing systems:** A permit shall not be required for the installation of any temporary system required for the testing or servicing of electrical equipment or apparatus.

Gas:

1. Portable heating appliance.
2. Replacement of any minor part that does not alter approval of equipment or make such equipment unsafe.

Mechanical:

1. Portable heating appliance.
2. Portable ventilation equipment.
3. Portable cooling unit.
4. Steam, hot or chilled water piping within any heating or cooling equipment regulated by this code.
5. Replacement of any part that does not alter its approval or make it unsafe.
6. Portable evaporative cooler.
7. Self-contained refrigeration system containing 10 pounds (4.54 kg) or less of refrigerant and actuated by motors of 1 horsepower (746 W) or less.

Plumbing:

1. The stopping of leaks in drains, water, soil, waste or vent pipe; provided, however, that if any concealed trap, drainpipe, water, soil, waste or vent pipe becomes defective and it becomes necessary to remove and replace the same with new material, such work shall be considered as new work, and a

permit shall be obtained and inspection made as provided in this code.

2. The clearing of stoppages or the repairing of leaks in pipes, valves or fixtures, and the removal and reinstallation of water closets, provided that such repairs do not involve or require the replacement or rearrangement of valves, pipes or fixtures.

[A] 105.2.1 Emergency repairs. Where equipment replacements and repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day to the code official.

[A] 105.2.2 Repairs. Application or notice to the code official is not required for repairs to structures and items listed in Section 105.2 provided that such repairs do not include any of the following:

1. The cutting away of any wall, partition or portion thereof.
2. The removal or cutting of any structural beam or load-bearing support.
3. The removal or change of any required means of egress or rearrangement of parts of a structure affecting the egress requirements.
4. Any addition to, alteration of, replacement or relocation of any standpipe, water supply, sewer, drainage, drain leader, gas, soil, waste, vent or similar piping, or electric wiring.
5. Mechanical or other work affecting public health or general safety.

[A] 105.2.3 Public service agencies. A permit shall not be required for the installation, alteration or repair of generation, transmission, distribution or metering, or other related equipment that is under the ownership and control of public service agencies by established right.

[A] 105.3 Application for permit. To obtain a permit, the applicant shall first file an application therefor in writing on a form furnished by the Department of Building Safety for that purpose. Such application shall:

1. Identify and describe the work in accordance with Chapter 3 to be covered by the permit for which application is made.
2. Describe the land on which the proposed work is to be done by legal description, street address or similar description that will readily identify and definitely locate the proposed building or work.
3. Indicate the use and occupancy for which the proposed work is intended.
4. Be accompanied by construction documents and other information as required in Section 106.3.
5. State the valuation of the proposed work.
6. Be signed by the applicant or the applicant's authorized agent.
7. Give such other data and information as required by the code official.

[A] 105.3.1 Action on application. The code official shall examine or cause to be examined applications for permits and amendments thereto within a reasonable time after filing. If the application or the construction documents do not conform to the requirements of pertinent laws, the code official shall reject such application in writing, stating the reasons therefor. If the code official is satisfied that the proposed work conforms to the requirements of this code and laws and ordinances applicable thereto, the code official shall issue a permit therefor as soon as practicable.

[A] 105.3.2 Time limitation of application. An application for a permit for any proposed work shall be deemed to have been abandoned 180 days after the date of filing, unless such application has been pursued in good faith or a permit has been issued; except that the code official is authorized to grant one or more extensions of time for additional periods not exceeding 90 days each. The extension shall be requested in writing and justifiable cause demonstrated.

[A] 105.4 Validity of permit. The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other ordinance of the jurisdiction. Permits presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the code official from requiring the correction of errors in the construction documents and other data. The code official is authorized to prevent occupancy or use of a structure where in violation of this code or of any other ordinances of this jurisdiction.

[A] 105.5 Expiration. Every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 180 days after its issuance, or if the work authorized on the site by such permit is suspended or abandoned for a period of 180 days after the time the work is commenced. The code official is authorized to grant, in writing, one or more extensions of time for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated.

105.5.1 Expiration. [BSC] On or after January 1, 2019, every permit issued shall become invalid unless the work on the site authorized by such permit is commenced within 12 months after its issuance or if the work authorized on the site by such permit is suspended or abandoned for a period of 12 months after the time the work is commenced. The building official is authorized to grant, in writing, one or more extensions of time for periods not more than 180 days each. The extension shall be requested in writing and justifiable cause demonstrated. (See Health and Safety Code Section 18938.5 and 18938.6).

[A] 105.6 Suspension or revocation. The code official is authorized to suspend or revoke a permit issued under the provisions of this code wherever the permit is issued in error or on the basis of incorrect, inaccurate or incomplete information, or in violation of any ordinance or regulation or any of the provisions of this code.

[A] **105.7 Placement of permit.** The building permit or copy shall be kept on the site of the work until the completion of the project.

SECTION 106 CONSTRUCTION DOCUMENTS

[A] **106.1 General.** Submittal documents consisting of construction documents, special inspection and structural observation programs, investigation and evaluation reports, and other data shall be submitted in two or more sets, or in a digital format where allowed by the code official, with each application for a permit. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. Where special conditions exist, the code official is authorized to require additional construction documents to be prepared by a registered design professional.

Exception: The code official is authorized to waive the submission of construction documents and other data not required to be prepared by a registered design professional if it is found that the nature of the work applied for is such that reviewing of construction documents is not necessary to obtain compliance with this code.

[A] **106.2 Construction documents.** Construction documents shall be in accordance with Sections 106.2.1 through 106.2.6.

[A] **106.2.1 Construction documents.** Construction documents shall be dimensioned and drawn on suitable material. Electronic media documents are permitted to be submitted where approved by the code official. Construction documents shall be of sufficient clarity to indicate the location, nature and extent of the work proposed and show in detail that it will conform to the provisions of this code and relevant laws, ordinances, rules and regulations, as determined by the code official. The work areas shall be shown.

[A] **106.2.2 Fire protection system(s) shop drawings.** Shop drawings for the fire protection system(s) shall be submitted to indicate compliance with this code and the construction documents and shall be approved prior to the start of system installation. Shop drawings shall contain information as required by the referenced installation standards in Chapter 9 of the *California Building Code*.

[A] **106.2.3 Means of egress.** The construction documents for Alterations—Level 2, Alterations—Level 3, additions and changes of occupancy shall show in sufficient detail the location, construction, size and character of all portions of the means of egress in compliance with the provisions of this code. The construction documents shall designate the number of occupants to be accommodated in every work area of every floor and in all affected rooms and spaces.

[A] **106.2.4 Exterior wall envelope.** Construction documents for work affecting the exterior wall envelope shall describe the exterior wall envelope in sufficient detail to determine compliance with this code. The construction documents shall provide details of the exterior wall envelope

as required, including windows, doors, flashing, intersections with dissimilar materials, corners, end details, control joints, intersections at roof, eaves or parapets, means of drainage, water-resistive barriers and details around openings.

The construction documents shall include manufacturer's installation instructions that provide supporting documentation that the proposed penetration and opening details described in the construction documents maintain the wind and weather resistance of the exterior wall envelope. The supporting documentation shall fully describe the exterior wall system that was tested, where applicable, as well as the test procedure used.

[A] **106.2.5 Exterior balconies and elevated walking surfaces.** Where the scope of work involves balconies or other elevated walking surfaces have weather-exposed surfaces, and the structural framing is protected by an impervious moisture barrier, the construction documents shall include details for all elements of the impervious moisture barrier system. The construction documents shall include manufacturer's installation instructions.

[A] **106.2.6 Site plan.** The construction documents submitted with the application for permit shall be accompanied by a site plan showing to scale the size and location of new construction and existing structures on the site, distances from lot lines, the established street grades, and the proposed finished grades; and it shall be drawn in accordance with an accurate boundary line survey. In the case of demolition, the site plan shall show construction to be demolished and the location and size of existing structures and construction that are to remain on the site or plot. The code official is authorized to waive or modify the requirement for a site plan where the application for permit is for alteration, repair or change of occupancy.

[A] **106.3 Examination of documents.** The code official shall examine or cause to be examined the submittal documents and shall ascertain by such examinations whether the construction or occupancy indicated and described is in accordance with the requirements of this code and other pertinent laws or ordinances.

[A] **106.3.1 Approval of construction documents.** Where the code official issues a permit, the construction documents shall be approved in writing or by stamp as "Reviewed for Code Compliance." One set of construction documents so reviewed shall be retained by the code official. The other set shall be returned to the applicant, shall be kept at the site of work, and shall be open to inspection by the code official or a duly authorized representative.

[A] **106.3.2 Previous approval.** This code shall not require changes in the construction documents, construction or designated occupancy of a structure for which a lawful permit has been issued and the construction of which has been pursued in good faith within 180 days after the effective date of this code and has not been abandoned.

[A] **106.3.3 Phased approval.** The code official is authorized to issue a permit for the construction of foundations or any other part of a building before the construction

documents for the whole building or structure have been submitted, provided that adequate information and detailed statements have been filed complying with pertinent requirements of this code. The holder of such permit for the foundation or other parts of a building shall proceed at the holder's own risk with the building operation and without assurance that a permit for the entire structure will be granted.

[A] 106.3.4 Deferred submittals. Deferral of any submittal items shall have the prior approval of the code official. The registered design professional in responsible charge shall list the deferred submittals on the construction documents for review by the code official.

Submittal documents for deferred submittal items shall be submitted to the registered design professional in responsible charge who shall review them and forward them to the code official with a notation indicating that the deferred submittal documents have been reviewed and that they have been found to be in general conformance to the design of the building. The deferred submittal items shall not be installed until their deferred submittal documents have been approved by the code official.

[A] 106.4 Amended construction documents. Work shall be installed in accordance with the reviewed construction documents, and any changes made during construction that are not in compliance with the approved construction documents shall be resubmitted for approval as an amended set of construction documents.

[A] 106.5 Retention of construction documents. One set of approved construction documents shall be retained by the code official for a period of not less than the period required for retention of public records.

[A] 106.6 Design professional in responsible charge. Where it is required that documents be prepared by a registered design professional, the code official shall be authorized to require the owner or the owner's authorized agent to engage and designate on the building permit application a registered design professional who shall act as the registered design professional in responsible charge. If the circumstances require, the owner or the owner's authorized agent shall designate a substitute registered design professional in responsible charge who shall perform the duties required of the original registered design professional in responsible charge. The code official shall be notified in writing by the owner or the owner's authorized agent if the registered design professional in responsible charge is changed or is unable to continue to perform the duties. The registered design professional in responsible charge shall be responsible for reviewing and coordinating submittal documents prepared by others, including phased and deferred submittal items, for compatibility with the design of the building. Where structural observation is required, the inspection program shall name the individual or firms who are to perform structural observation and describe the stages of construction at which structural observation is to occur.

SECTION 107 TEMPORARY STRUCTURES AND USES

[A] 107.1 General. The code official is authorized to issue a permit for temporary uses. Such permits shall be limited as to time of service but shall not be permitted for more than 180 days. The code official is authorized to grant extensions for demonstrated cause.

[A] 107.2 Conformance. Temporary uses shall conform to the structural strength, fire safety, means of egress, accessibility, light, ventilation and sanitary requirements of this code as necessary to ensure the public health, safety and general welfare.

[A] 107.3 Temporary power. The code official is authorized to give permission to temporarily supply and use power in part of an electric installation before such installation has been fully completed and the final certificate of completion has been issued. The part covered by the temporary certificate shall comply with the requirements specified for temporary lighting, heat or power in the *California Electrical Code*.

[A] 107.4 Termination of approval. The code official is authorized to terminate such permit for a temporary use and to order the temporary use to be discontinued.

SECTION 108 FEES

[A] 108.1 Payment of fees. A permit shall not be valid until the fees prescribed by law have been paid, nor shall an amendment to a permit be released until the additional fee, if any, has been paid.

[A] 108.2 Schedule of permit fees. Where a permit is required, a fee for each permit shall be paid as required, in accordance with the schedule as established by the applicable governing authority.

[A] 108.3 Permit valuations. The applicant for a permit shall provide an estimated permit value at time of application. Permit valuations shall include total value of work, including materials and labor for which the permit is being issued, such as electrical, gas, mechanical, plumbing equipment and permanent systems. If, in the opinion of the code official, the valuation is underestimated on the application, the permit shall be denied unless the applicant can show detailed estimates to meet the approval of the code official. Final building permit valuation shall be set by the code official.

[A] 108.4 Work commencing before permit issuance. Any person who commences any work before obtaining the necessary permits shall be subject to a fee established by the code official that shall be in addition to the required permit fees.

[A] 108.5 Related fees. The payment of the fee for the construction, alteration, removal or demolition of work done in connection to or concurrently with the work authorized by a permit shall not relieve the applicant or holder of the permit from the payment of other fees that are prescribed by law.

[A] 108.6 Refunds. The code official is authorized to establish a refund policy.

SECTION 109 INSPECTIONS

[A] 109.1 General. Construction or work for which a permit is required shall be subject to inspection by the code official, and such construction or work shall remain visible and able to be accessed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Inspections presuming to give authority to violate or cancel the provisions of this code or of other ordinances of the jurisdiction shall not be valid. It shall be the duty of the permit applicant to cause the work to remain visible and able to be accessed for inspection purposes. Neither the code official nor the jurisdiction shall be liable for expense entailed in the removal or replacement of any material required to allow inspection.

[A] 109.2 Preliminary inspection. Before issuing a permit, the code official is authorized to examine or cause to be examined buildings and sites for which an application has been filed.

[A] 109.3 Required inspections. The code official, on notification, shall make the inspections set forth in Sections 109.3.1 through 109.3.11.

[A] 109.3.1 Footing or foundation inspection. Footing and foundation inspections shall be made after excavations for footings are complete and any required reinforcing steel is in place. For concrete foundations, any required forms shall be in place prior to inspection. Materials for the foundation shall be on the job, except where concrete is ready-mixed in accordance with ASTM C94, the concrete need not be on the job.

[A] 109.3.2 Concrete slab or under-floor inspection. Concrete slab and under-floor inspections shall be made after in-slab or under-floor reinforcing steel and building service equipment, conduit, piping accessories and other ancillary equipment items are in place but before any concrete is placed or floor sheathing installed, including the subfloor.

[A] 109.3.3 Lowest floor elevation. For additions and substantial improvements to existing buildings in flood hazard areas, on placement of the lowest floor, including basement, and prior to further vertical construction, the elevation documentation required in the *California Building Code*, or the *California Residential Code*, as applicable, shall be submitted to the code official.

[A] 109.3.4 Frame inspection. Framing inspections shall be made after the roof deck or sheathing, framing, fire blocking and bracing are in place and pipes, chimneys and vents to be concealed are complete and the rough electrical, plumbing, heating wires, pipes and ducts are approved.

109.3.4.1 Moisture content verification. *[HCD] Moisture content of framing members shall be verified in accordance with the California Green Building Standards Code (CALGreen), Chapter 4, Division 4.5.*

[A] 109.3.5 Lath or gypsum board inspection. Lath and gypsum board inspections shall be made after lathing and gypsum board, interior and exterior, is in place but before

any plastering is applied or before gypsum board joints and fasteners are taped and finished.

Exception: Gypsum board that is not part of a fire-resistance-rated assembly or a shear assembly.

[A] 109.3.6 Weather-exposed balcony and walking surface waterproofing. Where the scope of work involves balconies or other elevated walking surfaces that have weather-exposed surfaces and the structural framing is protected by an impervious moisture barrier, all elements of the impervious moisture barrier system shall not be concealed until inspected and approved.

Exception: *[DSA-SS, DSA-SS/CC, HCD 1, HCD 2]* Where special inspections are provided in accordance with *Section 1705A.1.1, Item 3* or *Section 1705.1.1, Item 3, as applicable*, of the *California Building Code*.

109.3.6.1 Weather-exposed balcony and walking surface (exterior elevated element) inspections for multifamily buildings with three or more dwelling units. *[HCD 1 & HCD 2] Weather-exposed balconies and walking surfaces extending beyond the exterior walls of a building, more than 6 feet (1828.8 mm) above ground level, and that rely on wood or wood-based products for structural support or stability shall be inspected. Inspections shall be conducted in accordance with Health and Safety Code Section 17973(a) through (f) and (m). Weather-exposed balconies and walking surfaces found to be in need of repair or replacement shall be corrected in accordance with Section 17973(g) through (i). Continued and ongoing maintenance of weather-exposed balconies and walking surfaces shall be the responsibility of the building owner in accordance with Section 17973(k). See definition of "exterior elevated element" in Health and Safety Code Section 17973(b)(2) for additional details. See Civil Code Section 5551 for inspections of condominium projects.*

[A] 109.3.7 Fire- and smoke-resistant penetrations. Protection of joints and penetrations in fire-resistance-rated assemblies, smoke barriers and smoke partitions shall not be concealed from view until inspected and approved.

[A] 109.3.8 Other inspections. In addition to the inspections specified in Sections 109.2 through 109.3.7, the code official is authorized to make or require other inspections of any construction work to ascertain compliance with the provisions of this code and other laws that are enforced by the Department of Building Safety.

Note: *All noncompliant plumbing fixtures in any residential real property shall be replaced with water-conserving plumbing fixtures. Plumbing fixture replacement is required prior to issuance of a certificate of final completion, certificate of occupancy or final permit approval by the local building department. See Civil Code Section 1101.1, et seq., for the definition of a noncompliant plumbing fixture, types of residential buildings affected and other important enactment dates.*

[A] **109.3.9 Special inspections.** Special inspections shall be required in accordance with the *California Building Code*.

[A] **109.3.10 Flood hazard documentation.** Where a building is located in a flood hazard area, documentation of the elevation of the lowest floor as required in the *California Building Code* or the *California Residential Code*, as applicable, shall be submitted to the code official prior to the final inspection.

[A] **109.3.11 Final inspection.** The final inspection shall be made after work required by the building permit is completed.

[A] **109.4 Inspection agencies.** The code official is authorized to accept reports of approved inspection agencies, provided that such agencies satisfy the requirements as to qualifications and reliability.

[A] **109.5 Inspection requests.** It shall be the duty of the holder of the building permit or their duly authorized agent to notify the code official when work is ready for inspection. It shall be the duty of the permit holder to provide access to and means for any inspections of such work that are required by this code.

[A] **109.6 Approval required.** Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the code official. The code official, on notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed or shall notify the permit holder or an agent of the permit holder wherein the same fails to comply with this code. Any portions that do not comply shall be corrected and such portion shall not be covered or concealed until authorized by the code official.

SECTION 110 CERTIFICATE OF OCCUPANCY

[A] **110.1 Change of occupancy.** A structure shall not be used or occupied in whole or in part, and a change of occupancy of a structure or portion thereof shall not be made until the code official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of this code or of other ordinances of the jurisdiction. Certificates presuming to give authority to violate or cancel the provisions of this code or other ordinances of the jurisdiction shall not be valid.

Exception: Certificates of occupancy are not required for work exempt from permits in accordance with Section 105.2.

[A] **110.2 Certificate issued.** After the code official inspects the structure and does not find violations of the provisions of this code or other laws that are enforced by the department, the code official shall issue a certificate of occupancy that contains the following:

1. The permit number.
2. The address of the structure.

3. The name and address of the owner or the owner's authorized agent.
4. A description of that portion of the structure for which the certificate is issued.
5. A statement that the described portion of the structure has been inspected for compliance with the requirements of this code for the occupancy and division of occupancy and the use for which the proposed occupancy is classified.
6. The name of the code official.
7. The edition of the code under which the permit was issued.
8. The use and occupancy in accordance with the provisions of the *California Building Code*.
9. The type of construction as defined in the *California Building Code*.
10. The design occupant load and any impact the alteration has on the design occupant load of the area not within the scope of the work.
11. Where an automatic sprinkler system is provided, and whether an automatic sprinkler system is required.
12. Any special stipulations and conditions of the building permit.

[A] **110.3 Temporary occupancy.** The code official is authorized to issue a temporary certificate of occupancy before the completion of the entire work covered by the permit, provided that such portion or portions shall be occupied safely. The code official shall set a time period during which the temporary certificate of occupancy is valid.

[A] **110.4 Revocation.** The code official is authorized to suspend or revoke a certificate of occupancy or completion issued under the provisions of this code, in writing, wherever the certificate is issued in error or on the basis of incorrect information supplied, or where it is determined that the building or structure or portion thereof is in violation of the provisions of this code or other ordinance of the jurisdiction.

SECTION 111 SERVICE UTILITIES

[A] **111.1 Connection of service utilities.** A person shall not make connections from a utility, source of energy, fuel, power, water system or sewer system to any building or system that is regulated by this code for which a permit is required, until approved by the code official.

[A] **111.2 Temporary connection.** The code official shall have the authority to authorize the temporary connection of the building or system to the utility, source of energy, fuel, power, water system or sewer system for the purpose of testing systems or for use under a temporary approval.

[A] **111.3 Authority to disconnect service utilities.** The code official shall have the authority to authorize disconnection of utility service to the building, structure or system regulated by this code and the referenced codes and standards in case of emergency where necessary to eliminate an imme-

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diate hazard to life or property or where such utility connection has been made without the approval required by Section 111.1 or 111.2. The code official shall notify the serving utility and, wherever possible, the owner or the owner's authorized agent and the occupant of the building, structure or service system of the decision to disconnect prior to taking such action. If not notified prior to disconnecting, the owner, the owner's authorized agent or occupant of the building, structure or service system shall be notified in writing, as soon as practical thereafter.

SECTION 112 MEANS OF APPEALS

[A] **112.1 General.** In order to hear and decide appeals of orders, decisions or determinations made by the code official relative to the application and interpretation of this code, there shall be and is hereby created a board of appeals. The board of appeals shall be appointed by the applicable governing authority and shall hold office at its pleasure. The board shall adopt rules of procedure for conducting its business and shall render all decisions and findings in writing to the appellant with a duplicate copy to the code official.

[A] **112.2 Limitations on authority.** An application for appeal shall be based on a claim that the true intent of this code or the rules legally adopted thereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equivalent or better form of construction is proposed. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] **112.3 Qualifications.** The board of appeals shall consist of members who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

[A] **112.4 Administration.** The code official shall take immediate action in accordance with the decision of the board.

SECTION 113 VIOLATIONS

[A] **113.1 Unlawful acts.** It shall be unlawful for any person, firm or corporation to repair, alter, extend, add, move, remove, demolish or change the occupancy of any building or equipment regulated by this code or cause same to be done in conflict with or in violation of any of the provisions of this code.

[A] **113.2 Notice of violation.** The code official is authorized to serve a notice of violation or order on the person responsible for the repair, alteration, extension, addition, moving, removal, demolition or change in the occupancy of a building in violation of the provisions of this code or in violation of a permit or certificate issued under the provisions of this code. Such order shall direct the discontinuance of the illegal action or condition and the abatement of the violation.

[A] **113.3 Prosecution of violation.** If the notice of violation is not complied with promptly, the code official is authorized to request the legal counsel of the jurisdiction to institute the appropriate proceeding at law or in equity to restrain, correct or abate such violation or to require the removal or termination of the unlawful occupancy of the building or structure in violation of the provisions of this code or of the order or direction made pursuant thereto.

[A] **113.4 Violation penalties.** Any person who violates a provision of this code or fails to comply with any of the requirements thereof or who repairs or alters or changes the occupancy of a building or structure in violation of the approved construction documents or directive of the code official or of a permit or certificate issued under the provisions of this code shall be subject to penalties as prescribed by law.

SECTION 114 STOP WORK ORDER

[A] **114.1 Authority.** Where the code official finds any work regulated by this code being performed in a manner contrary to the provisions of this code or in a dangerous or unsafe manner, the code official is authorized to issue a stop work order.

[A] **114.2 Issuance.** The stop work order shall be in writing and shall be given to the owner of the property, the owner's authorized agent or the person performing the work. Upon issuance of a stop work order, the cited work shall immediately cease. The stop work order shall state the reason for the order and the conditions under which the cited work is authorized to resume.

[A] **114.3 Emergencies.** Where an emergency exists, the code official shall not be required to give a written notice prior to stopping the work.

[A] **114.4 Failure to comply.** Any person who shall continue any work after having been served with a stop work order, except such work as that person is directed to perform to remove a violation or unsafe condition, shall be subject to fines established by the authority having jurisdiction.

SECTION 115 UNSAFE STRUCTURES AND EQUIPMENT

[A] **115.1 Unsafe conditions.** Structures or existing equipment that are or hereafter become unsafe, insanitary or deficient because of inadequate means of egress facilities, inadequate light and ventilation, or that constitute a fire hazard, or are otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance, shall be deemed an unsafe condition. Unsafe structures shall be taken down and removed or made safe as the code official deems necessary and as provided for in this code. A vacant structure that is not secured against unauthorized entry shall be deemed unsafe.

[A] 115.2 Record. The code official shall cause a report to be filed on an unsafe condition. The report shall state the occupancy of the structure and the nature of the unsafe condition.

[A] 115.3 Notice. If an unsafe condition is found, the code official shall serve on the owner of the structure or the owner's authorized agent a written notice that describes the condition deemed unsafe and specifies the required repairs or improvements to be made to abate the unsafe condition, or that requires the unsafe building to be demolished within a stipulated time. Such notice shall require the person thus notified to declare immediately to the code official acceptance or rejection of the terms of the order.

[A] 115.4 Method of service. Such notice shall be deemed properly served where a copy thereof is served in accordance with one of the following methods:

1. A copy is delivered to the owner or the owner's authorized agent personally.
2. A copy is sent by certified or registered mail addressed to the owner at the last known address with the return receipt requested.
3. A copy is delivered in any other manner as prescribed by local law.

If the certified or registered letter is returned showing that the letter was not delivered, a copy thereof shall be posted in a conspicuous place in or about the structure affected by such notice. Service of such notice in the foregoing manner on the owner's authorized agent shall constitute service of notice on the owner.

[A] 115.5 Restoration or abatement. The structure or equipment determined to be unsafe by the code official is permitted to be restored to a safe condition. The owner, the owner's authorized agent, operator or occupant of a structure, premises or equipment deemed unsafe by the code official shall abate or cause to be abated or corrected such unsafe conditions either by repair, rehabilitation, demolition or other approved corrective action. To the extent that repairs, alterations or additions are made, or a change of occupancy occurs during the restoration of the structure, such repairs, alterations, additions or change of occupancy shall comply with the requirements of this code.

SECTION 116 EMERGENCY MEASURES

[A] 116.1 Imminent danger. Where, in the opinion of the code official, there is imminent danger of failure or collapse of a building that endangers life, or where any building or part of a building has fallen and life is endangered by the occupation of the building, or where there is actual or potential danger to the building occupants or those in the proximity of any structure because of explosives, explosive fumes or vapors, or the presence of toxic fumes, gases, or materials, or operation of defective or dangerous equipment, the code official is hereby authorized and empowered to order and require the occupants to vacate the premises forthwith. The code official shall cause to be posted at each entrance to such structure a notice reading as follows: "This Structure Is Unsafe and Its

Occupancy Has Been Prohibited by the Code Official." It shall be unlawful for any person to enter such structure except for the purpose of securing the structure, making the required repairs, removing the hazardous condition, or of demolishing the same.

[A] 116.2 Temporary safeguards. Notwithstanding other provisions of this code, whenever, in the opinion of the code official, there is imminent danger due to an unsafe condition, the code official shall order the necessary work to be done, including the boarding up of openings, to render such structure temporarily safe whether or not the legal procedure herein described has been instituted; and shall cause such other action to be taken as the code official deems necessary to meet such emergency.

[A] 116.3 Closing streets. Where necessary for public safety, the code official shall temporarily close structures and close or order the authority having jurisdiction to close sidewalks, streets, public ways and places adjacent to unsafe structures, and prohibit the same from being utilized.

[A] 116.4 Emergency repairs. For the purposes of this section, the code official shall employ the necessary labor and materials to perform the required work as expeditiously as possible.

[A] 116.5 Costs of emergency repairs. Costs incurred in the performance of emergency work shall be paid by the jurisdiction. The legal counsel of the jurisdiction shall institute appropriate action against the owner of the premises or the owner's authorized agent where the unsafe structure is or was located for the recovery of such costs.

[A] 116.6 Hearing. Any person ordered to take emergency measures shall comply with such order forthwith. Any affected person shall thereafter, on petition directed to the appeals board, be afforded a hearing as described in this code.

SECTION 117 DEMOLITION

[A] 117.1 General. The code official shall order the owner or owner's authorized agent of any premises on which is located any structure that in the code official's judgment is so old or dilapidated, or has become so out of repair as to be dangerous, unsafe, insanitary or otherwise unfit for human habitation of occupancy, and such that it is unreasonable to repair the structure, to demolish and remove such structure; or if such structure is capable of being made safe by repairs, to repair and make safe and sanitary or to demolish and remove to the owner's or the owner's authorized agent's option; or where there has been a cessation of normal construction of any structure for a period of more than two years, to demolish and remove such structure.

[A] 117.2 Notices and orders. Notices and orders shall comply with Section 113.

[A] 117.3 Failure to comply. If the owner or the owner's authorized agent of a premises fails to comply with a demolition order within the time prescribed, the code official shall cause the structure to be demolished and removed, either through an available public agency or by contract or arrange-

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ment with private persons, and the cost of such demolition and removal shall be charged against the real estate on which the structure is located and shall be a lien on such real estate.

[A] 117.4 Salvage materials. Where any structure has been ordered demolished and removed, the governing body or other designated officer under said contract or arrangement aforesaid shall have the right to sell the salvage and valuable materials at the highest price obtainable. The net proceeds of such sale, after deducting the expenses of such demolition and removal, shall be promptly remitted with a report of such sale or transaction, including the items of expense and the amounts deducted, for the person who is entitled thereto, subject to any order of a court. If such a surplus does not remain to be turned over, the report shall so state.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHDPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)	X			X	X					X	X	X		X	X							
Adopt only those sections that are listed below			X					X	X													
Chapter / Section																						
201								X	X													
201.1										X	X	X		X	X							
ACCESSORY DWELLING UNIT				X	X																	
ADDITION			X																			
ALTERATION			X																			
APPROVED			X	X	X																	
BUILDING				X	X	X																
BUILDING OFFICIAL	X			X	X			X	X	X	X	X		X	X							
CHANGE OF OCCUPANCY			X																			
CODE OFFICIAL			X	X	X																	
CHANGE IN FUNCTION										X	X	X		X	X							
CRITICAL CARE AREA										X												
DANGEROUS			X																			
ENFORCEMENT AGENCY	X							X	X													
EQUIPMENT OR FIXTURE			X																			
EXISTING BUILDING			X																			
EXISTING STRUCTURE			X																			
EXISTING STRUCTURE										X	X	X		X	X							
EXTERIOR ELEVATED ELEMENT				X	X																	
FACILITY			X																			
GENERAL ACUTE CARE HOSPITAL										X												
INCIDENTAL STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS										X				X								
MAJOR STRUCTURAL ALTERATIONS										X				X								
MINOR STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS										X				X								
NONCOMBUSTIBLE MATERIAL			X																			
NONSTRUCTURAL ALTERATION										X				X								
PRIMARY FUNCTION			X																			

(continued)

**CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 2 – DEFINITIONS—continued**

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter														X									
Adopt Entire Chapter as amended (amended sections listed below)	X			X	X					X	X	X		X	X								
Adopt only those sections that are listed below			X					X	X														
Chapter / Section																							
REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE			X							X	X	X		X	X								
REHABILITATION			X																				
REPAIR			X																				
<i>REPAIR</i>										X													
REROOFING			X																				
ROOF COATING			X																				
ROOF RECOVER			X																				
ROOF REPAIR			X																				
ROOF REPLACEMENT			X																				
<i>SPC SEISMIC SEPARATION</i>										X	X												
<i>SUBSTANDARD BUILDING</i>				X	X																		
<i>SUBSTANTIAL STRUCTURAL DAMAGE</i>										X	X												
<i>UNREINFORCED CONCRETE</i>										X	X	X		X	X								
<i>UNREINFORCED MASONRY</i>										X				X									
UNSAFE			X	X	X																		
<i>VOLUNTARY STRUCTURAL IMPROVEMENTS</i>										X													
WORK AREA			X																				

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 2

DEFINITIONS

User note:

About this chapter: Codes, by their very nature, are technical documents. Every word, term and punctuation mark can add to or change the meaning of a technical requirement. It is necessary to maintain a consensus on the specific meaning of each term contained in the code. Chapter 2 performs this function by stating clearly what specific terms mean for the purpose of the code.

SECTION 201 GENERAL

201.1 Scope. Unless otherwise expressly stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter. [OSHPD 1, 1R, 2, 4 & 5] For terms not defined in this chapter, refer to Part 1, Chapters 6 and 7 of the California Administrative Code, and Part 2, Chapter 2 of the California Building Code.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other codes. Where terms are not defined in this code and are defined in the other California Codes, such terms shall have the meanings ascribed to them in those codes. [DSA-SS & DSA-SS/CC] Definitions of terms given in Section 4-208 or 4-314 of the California Administrative Code govern over those in Section 202.

201.4 Terms not defined. Where terms are not defined through the methods authorized by this chapter, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202 GENERAL DEFINITIONS

ACCESSORY DWELLING UNIT. [HCD 1 & HCD 2] An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. Accessory dwelling units shall include permanent provisions for living, sleeping, eating, cooking and sanitation on the same parcel as the single-family or multifamily dwelling is or will be situated. (See Government Code Section 65852.2.)

[A] ADDITION. An extension or increase in floor area, number of stories, or height of a building or structure.

[A] ALTERATION. Any construction or renovation to an existing structure other than a repair or addition.

[A] APPROVED. Acceptable to the code official.

Exception: [HCD 1 & HCD 2] “Approved” means meeting the approval of the Enforcing Agency, except as otherwise provided by law, when used in connection with any system, material, type of construction, fixture or appliance as the result of investigations and tests conducted by the agency, or by reason of accepted principles or tests by

national authorities, or technical, health, or scientific organizations or agencies.

Notes:

1. See Health and Safety Code Section 17920 for “Approved” as applied to residential construction and buildings or structures accessory thereto as referenced in Section 1.8.2.
2. See Health and Safety Code Section 17921.1 for “Approved” as applied to the use of hotplates in residential construction as referenced in Section 1.8.2.
3. See Health and Safety Code Section 19966 for “Approved” as applied to Factory-Built Housing as referenced in Section 1.8.3.2.5.
4. See Health and Safety Code Section 18201 for “Approved” as applied to Mobilehome Parks as referenced in Section 1.8.2.
5. See Health and Safety Code Section 18862.1 for “Approved” as applied to Special Occupancy Parks as referenced in Section 1.8.2.

[A] BUILDING. Any structure utilized or intended for supporting or sheltering any use or occupancy.

Exception: [HCD 1, HCD 2 & HCD 1-AC] For applications listed in Section 1.8.2 regulated by the Department of Housing and Community Development, “Building” shall not include the following:

1. Any mobilehome as defined in Health and Safety Code Section 18008.
2. Any manufactured home as defined in Health and Safety Code Section 18007.
3. Any commercial modular as defined in Health and Safety Code Section 18001.8 or any special purpose commercial modular as defined in Section 18012.5.
4. Any recreational vehicle as defined in Health and Safety Code, Section 18010.
5. Any multifamily manufactured home as defined in Health and Safety Code Section 18008.7.

For additional information, see Health and Safety Code Section 18908.

Note: Building shall have the same meaning as defined in Health and Safety Code Sections 17920 and 18908 for the applications specified in Section 1.11.

DEFINITIONS

BUILDING OFFICIAL. [BSC, DSA-SS, DSA-SS/CC] *The individual within the agency or organization charged with responsibility for compliance with the requirements of this code. For some agencies this person is termed the “enforcement agent.”*

BUILDING OFFICIAL. [HCD 1, HCD 2] [OSHPD 1, 1R, 2, 4 & 5] *The officer or other designated authority charged with the administration and enforcement of this code, or a duly authorized representative.*

CHANGE IN FUNCTION. [OSHPD 1, 1R, 2, 4 & 5] *See California Building Code Section 1224.3.*

[A] CHANGE OF OCCUPANCY. Any of the following shall be considered as a change of occupancy where the current *California Building Code* requires a greater degree of safety, accessibility, structural strength, fire protection, means of egress, ventilation or sanitation than is existing in the current building or structure:

1. Any change in the occupancy classification of a building or structure.
2. Any change in the purpose of, or a change in the level of activity within, a building or structure.
3. A change of use.

[A] CHANGE OF USE. A change in the use of a building or a portion of a building, within the same group classification, for which there is a change in application of the code requirements.

[A] CODE OFFICIAL. The officer or other designated authority charged with the administration and enforcement of this code.

[HCD 1 & HCD 2] [OSHPD 1, 1R, 2, 4 & 5] *“Code Official” shall mean “Building Official” as defined in this code.*

CRITICAL CARE AREA. [OSHPD 1] *See California Administrative Code Chapter 6.*

[BS] DANGEROUS. Any building, structure or portion thereof that meets any of the conditions described below shall be deemed dangerous:

1. The building or structure has collapsed, has partially collapsed, has moved off its foundation or lacks the necessary support of the ground.
2. There exists a significant risk of collapse, detachment or dislodgement of any portion, member, appurtenance or ornamentation of the building or structure under permanent, routine or frequent loads; under actual loads already in effect; or under snow, wind, rain, flood, earthquake or other environmental loads when such loads are imminent.

[A] DEFERRED SUBMITTAL. Those portions of the design that are not submitted at the time of the application and that are to be submitted to the code official within a specified period.

[BS] DISPROPORTIONATE EARTHQUAKE DAMAGE. A condition of earthquake-related damage where both of the following occur:

1. The 0.3-second spectral acceleration at the building site as estimated by the United States Geological Survey for

the earthquake in question is less than 40 percent of the mapped acceleration parameter SS.

2. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 10 percent from its predamage condition.

[BE] EMERGENCY ESCAPE AND RESCUE OPENING. An operable exterior window, door or other similar device that provides for a means of escape and access for rescue in the event of an emergency.

ENFORCEMENT AGENCY. [BSC, DSA-SS, DSA-SS/CC] *The agency or organization charged with responsibility for agency or organization compliance with the requirements of this code, also known as the Authority Having Jurisdiction in ASCE 41.*

EQUIPMENT OR FIXTURE. Any plumbing, heating, electrical, ventilating, air conditioning, refrigerating and fire protection equipment; and elevators, dumbwaiters, escalators, boilers, pressure vessels and other mechanical facilities; or installations that are related to building services. Equipment or fixture shall not include manufacturing, production or process equipment, but shall include connections from building service to process equipment.

[A] EXISTING BUILDING. A building erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

[A] EXISTING STRUCTURE. A structure erected prior to the date of adoption of the appropriate code, or one for which a legal building permit has been issued.

EXISTING STRUCTURE. [OSHPD 1, 1R, 2, 4 & 5] *A structure that has a valid certificate of occupancy issued by the building official.*

EXTERIOR ELEVATED ELEMENT. *See Government Code Section 17973(b)(2).*

[BF] EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments, such as cornices, soffits, facias, gutters and leaders.

[BF] EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space from the detrimental effects of the exterior environment.

[A] FACILITY. All or any portion of buildings, structures, site improvements, elements and pedestrian or vehicular routes located on a site.

[BS] FLOOD HAZARD AREA. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any year.

2. The area designated as a flood hazard area on a community's flood hazard map, or otherwise legally designated.

GENERAL ACUTE CARE HOSPITAL. [OSHPD 1] See California Building Code Section 1224.3.

[A] HISTORIC BUILDING. Any building or structure that is one or more of the following:

1. Listed, or certified as eligible for listing, by the State Historic Preservation Officer or the Keeper of the National Register of Historic Places, in the National Register of Historic Places.
2. Designated as historic under an applicable state or local law.
3. Certified as a contributing resource within a National Register, state designated or locally designated historic district.

INCIDENTAL STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS. [OSHPD 1 & 4] Alterations, additions or repairs which would not reduce the story lateral shear force-resisting capacity by more than 5 percent or increase the story shear by more than 5 percent in any existing story or a combination thereof with equivalent effect (not exceeding 5 percent total). The calculation of lateral shear force-resisting capacity and story shear shall account for the cumulative effects of additions and alterations since original construction.

MAJOR STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS. [OSHPD 1 & 4] Alterations, additions or repairs of greater extent than minor structural alterations, additions or repairs.

MINOR STRUCTURAL ALTERATIONS, ADDITIONS OR REPAIRS. [OSHPD 1 & 4] Alterations, additions or repairs of greater extent than incidental structural additions or alterations which would not reduce the story shear lateral-force-resisting capacity by more than 10 percent or increase the story shear by more than 10 percent in any existing story or a combination thereof with equivalent effect (not exceeding 10 percent total). The calculation of lateral shear force-resisting capacity and story shear shall account for the cumulative effects of additions and alterations since original construction.

[BF] NONCOMBUSTIBLE MATERIAL. A material that, under the conditions anticipated, will not ignite or burn when subjected to fire or heat. Materials that pass ASTM E136 are considered noncombustible materials.

NONSTRUCTURAL ALTERATION. [OSHPD 1 & 4] Non-structural alteration is any alteration which neither affects existing structural elements nor requires new structural elements for vertical or lateral support and which does not increase the lateral shear force in any story by more than 5 percent.

PRIMARY FUNCTION. A primary function is a major activity for which the facility is intended. Areas that contain a primary function include, but are not limited to, the customer services lobby of a bank, the dining area of a cafeteria, the

meeting rooms in a conference center, as well as offices and other work areas in which the activities of the public accommodation or other private entity using the facility are carried out. Mechanical rooms, boiler rooms, supply storage rooms, employee lounges or locker rooms, janitorial closets, entrances, corridors and restrooms are not areas containing a primary function.

[A] REGISTERED DESIGN PROFESSIONAL IN RESPONSIBLE CHARGE. A registered design professional engaged by the owner or the owner's authorized agent to review and coordinate certain aspects of the project, as determined by the code official, for compatibility with the design of the building or structure, including submittal documents prepared by others, deferred submittal documents and phased submittal documents.

REHABILITATION. Any work, as described by the categories of work defined herein, undertaken in an existing building.

[A] RELOCATABLE BUILDING. A partially or completely assembled building constructed and designed to be reused multiple times and transported to different building sites.

[A] REPAIR. The reconstruction, replacement or renewal of any part of an existing building for the purpose of its maintenance or to correct damage.

REPAIR. [OSHPD 1] as used in this Code means all the design and construction work affecting existing or requiring new structural elements undertaken to restore or enhance the structural and nonstructural load-resisting system participating in vertical or lateral response of a structure primarily intended to correct the effects of deterioration or impending or actual failure, regardless of cause.

[BS] REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover" and "Roof replacement."

[BS] RISK CATEGORY. A categorization of buildings and other structures for determination of flood, wind, snow, ice and earthquake loads based on the risk associated with unacceptable performance, as provided in Section 1604.5 of the California Building Code.

[BS] ROOF COATING. A fluid-applied adhered coating used for roof maintenance, roof repair or as a component of a roof covering system or roof assembly.

[BS] ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

[BS] ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purpose of correcting damage or restoring the predamage condition.

[BS] ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

DEFINITIONS

[BS] SEISMIC FORCES. The loads, forces and requirements prescribed herein, related to the response of the building to earthquake motions, to be used in the analysis and design of the structure and its components. Seismic forces are considered either full or reduced, as provided in Chapter 3.

SPC SEISMIC SEPARATION. [OSHPD 1 & IR] Means a building separation in accordance with the California Administrative Code, Chapter 6 Section 3.4.

SUBSTANDARD BUILDING. [HCD 1, HCD 2] See Health and Safety Code Section 17920.3.

[BS] SUBSTANTIAL DAMAGE. For the purpose of determining compliance with the flood provisions of this code, damage of any origin sustained by a structure whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

[BS] SUBSTANTIAL IMPROVEMENT. For the purpose of determining compliance with the flood provisions of this code, any repair, alteration, addition or improvement of a building or structure, the cost of which equals or exceeds 50 percent of the market value of the structure, before the improvement or repair is started. If the structure has sustained substantial damage, any repairs are considered substantial improvement regardless of the actual repair work performed. The term does not, however, include either of the following:

1. Any project for improvement of a building required to correct existing health, sanitary or safety code violations identified by the code official and that is the minimum necessary to ensure safe living conditions.
2. Any alteration of a historic structure, provided that the alteration will not preclude the structure's continued designation as a historic structure.

[BS] SUBSTANTIAL STRUCTURAL ALTERATION. An alteration in which the gravity load-carrying structural elements altered within a 5-year period support more than 30 percent of the total floor and roof area of the building or structure. The areas to be counted toward the 30 percent shall include mezzanines, penthouses, and in-filled courts and shafts tributary to the altered structural elements.

[BS] SUBSTANTIAL STRUCTURAL DAMAGE. A condition where any of the following apply:

1. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load-carrying capacity of any story in any horizontal direction has been reduced by more than 33 percent from its predamage condition.
2. The capacity of any vertical component carrying gravity load, or any group of such components, that has a tributary area more than 30 percent of the total area of the structure's floor(s) and roof(s) has been reduced more than 20 percent from its predamage condition, and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the *California Building Code* for new buildings of similar structure, purpose and location.

3. The capacity of any structural component carrying snow load, or any group of such components, that supports more than 30 percent of the roof area of similar construction has been reduced more than 20 percent from its predamage condition, and the remaining capacity with respect to dead, live and snow loads is less than 75 percent of that required by the *California Building Code* for new buildings of similar structure, purpose and location.

SUBSTANTIAL STRUCTURAL DAMAGE. [OSHPD 1 & IR] A condition where any of the following apply:

1. The vertical elements of the lateral force-resisting system have suffered damage such that the lateral load carrying capacity of any story in any horizontal direction has been reduced by more than 10 percent from its predamage condition.
2. The capacity of any vertical component carrying gravity load, or any group of such components, has a tributary area more than 15 percent of the total area of the structure's floor(s) and roof(s), has been reduced more than 10 percent from its predamage condition, and the remaining capacity of such affected elements, with respect to all dead and live loads, is less than 75 percent of that required by the *California Building Code* for new buildings of similar structure, purpose and location.
3. The capacity of any structural component carrying snow load, or any group of such components, that supports more than 15 percent of the roof area of similar construction, has been reduced more than 10 percent from its predamage condition, and the remaining capacity with respect to dead, live and snow loads is less than 75 percent of that required by the *California Building Code* for new buildings of similar structure, purpose and location.

TECHNICALLY INFEASIBLE. An alteration of a facility that has little likelihood of being accomplished because the existing structural conditions require the removal or alteration of a load-bearing member that is an essential part of the structural frame, or because other existing physical or site constraints prohibit modification or addition of elements, spaces or features which are in full and strict compliance with the minimum requirements for new construction and which are necessary to provide accessibility.

UNREINFORCED CONCRETE. [OSHPD 1, IR, 2, 4 & 5] Unreinforced concrete as used in this chapter means plain concrete as defined in *ACI 318 Section 2.3*.

UNREINFORCED MASONRY. [OSHPD 1 & 4] Unreinforced masonry as used in this chapter means masonry construction where reinforcements in any direction is less than minimum reinforcement specified in *TMS 402 Section 7.3.2.6*.

UNSAFE. Buildings, structures or equipment that are unsanitary, or that are deficient due to inadequate means of egress facilities, inadequate light and ventilation, or that constitute a fire hazard, or in which the structure or individual structural members meet the definition of "Dangerous," or that are

otherwise dangerous to human life or the public welfare, or that involve illegal or improper occupancy or inadequate maintenance shall be deemed unsafe. A vacant structure that is not secured against entry shall be deemed unsafe.

[HCD 1 & HCD 2] An unsafe building, as defined in this chapter, shall be considered substandard.

VOLUNTARY STRUCTURAL IMPROVEMENTS (VSIs).

[OSHPD 1] Voluntary structural improvements are any alterations of existing structural element(s) or addition of new structural elements which are not necessary for vertical or lateral support of other work and is initiated by the applicant primarily for the purpose of increasing the vertical or lateral load-carrying strength or stiffness of an existing building.

WORK AREA. That portion or portions of a building consisting of all reconfigured spaces as indicated on the construction documents. Work area excludes other portions of the building where incidental work entailed by the intended work must be performed and portions of the building where work not initially intended by the owner is specifically required by this code.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 3 – PROVISIONS FOR ALL COMPLIANCE METHODS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM	HCD				DSA				OSHDP					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC		
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4	5											
Adopt Entire Chapter														X												
Adopt Entire Chapter as amended (amended sections listed below)																										
Adopt only those sections that are listed below	X		X	X	X	X		X	X		X	X			X	X										
Chapter / Section																										
301.1 – 301.3.1			X								X	X			X	X										
301.1				X	X																					
301.1 Exception 1	X																									
301.1 Exception 2								X																		
301.1 Exception 3									X																	
301.1 Exception 4				X	X																					
301.1 Exception 5											X	X			X	X										
301.1.1	X																									
301.3				X	X	X					X	X			X	X										
301.3.1 Exception											X	X			X	X										
301.3.2				X	X																					
301.3.3				X	X																					
301.4				X	X																					
302			X								X	X			X	X										
302.1.1	X																									
302.2				X	X																					
302.4				X																						
302.5	X																									
304.1	X							X	X																	
304.2	X							X	X																	
304 – 305											X	X			X	X										
305.1	X							X	X																	
306														†												
306.1 Note						X																				
306.7.7			X																							
307 – 308			X																							
308.2				X	X																					
310 – 311											X	X			X											
312											X															
313 – 316			X																							
317 – 322	X							X	X																	
323								X	X																	



The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 3

PROVISIONS FOR ALL COMPLIANCE METHODS

User note:

About this chapter: Chapter 3 explains the three compliance options for alterations and additions available in the code. In addition, this chapter also lays out the methods to be used for seismic design and evaluation throughout this code. Finally, this chapter clarifies that provisions in other I-Codes® related to repairs, alterations, additions, relocation and changes of occupancy must also be addressed unless they conflict with this code. In that case, this code takes precedence.

SECTION 301 ADMINISTRATION

301.1 Applicability. The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with Section 301.2, 301.3 or 301.4. The provisions of Sections 302 through 309 shall apply to all alterations, repairs, additions, relocation of structures and changes of occupancy regardless of compliance method. **[OSHPD 1R, 2, 4 and 5]** Section 301.4 not adopted by OSHPD.

Exceptions:

1. Existing state-owned structures. [BSC] The repair, alteration, change of occupancy, addition or relocation of all existing buildings shall comply with the provisions of Sections 317 through 322 as the minimum standards for earthquake evaluation and design for retrofit of existing state-owned structures, including buildings owned by the University of California, the California State University or the Judicial Council.

The provisions of Sections 317 through 322 may be adopted by a local jurisdiction for earthquake evaluation and design for retrofit of existing buildings.

2. Public school buildings [DSA-SS] The provisions of Sections 317 through 323 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as public school buildings under the jurisdiction of the Division of the State Architect—Structural Safety (DSA-SS, refer to Section 1.9.2.1) where required by Sections 4-307 and 4-309(c) of the California Administrative Code.

The provisions of Sections 317 through 323 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing public school buildings currently under the jurisdiction of DSA-SS.

3. Community college buildings. [DSA-SS/CC] The provisions of Sections 317 through 323 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as community college buildings under the jurisdiction of the Division of the State Architect—

Structural Safety/Community Colleges (DSA-SS/CC, refer to Section 1.9.2.2) where required by Sections 4-307 and 4-309(c) of the California Administrative Code.

The provisions of Sections 317 through 323 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing community college buildings currently under the jurisdiction of DSA-SS/CC.

4. [HCD 1] In addition to the requirements in this chapter, maintenance, alteration, repair, addition or change of occupancy to existing buildings and accessory structures under the authority of the Department of Housing and Community Development, as provided in Section 1.8.2.1.1, shall comply with California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

Exceptions:

1. [HCD 2] For moved buildings and maintenance, alteration, repair, addition or change of occupancy to existing buildings and accessory structures in mobilehome parks or special occupancy parks as provided in Section 1.8.2.1.3, see California Code of Regulations, Title 25, Division 1, Chapters 2 and 2.2.

2. [HCD 1] Limited-density owner-built rural dwellings, as defined in Chapter 2 of the California Residential Code.

5. Hospital buildings removed from acute care service, skilled nursing facilities, intermediate-care facilities, correctional treatment centers and acute-psychiatric hospitals [OSHPD 1R, 2, 4 and 5]. The provisions of adopted sections in Chapters 3 through 5 shall control the alteration, repair and change of occupancy or function of existing structures for applications listed in Section 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). Functional service spaces shall comply with the requirements in the California Building Code, Sections 1224, 1225, 1226, 1227 and 1228.

301.1.1 Bleachers, grandstands and folding and telescopic seating. Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

301.2 Repairs. Repairs shall comply with the requirements of Chapter 4.

301.3 Alteration, addition or change of occupancy. The alteration, addition or change of occupancy of all existing buildings shall comply with one of the methods listed in Section 301.3.1, 301.3.2 or 301.3.3 as selected by the applicant. Sections 301.3.1 through 301.3.3 shall not be applied in combination with each other. *[OSHPD 1R, 2, 4 and 5] Sections 301.3.2 and 301.3.3, not adopted by OSHPD.*

Note: [HCD 1 & HCD 2] Sections 301.3.2 and 301.3.3 shall be permitted only if the performance compliance method and/or work area compliance method are adopted by a local ordinance.

Exception: Subject to the approval of the code official, alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code. New structural members added as part of the alteration shall comply with the *California Building Code*. This exception shall not apply to the following:

1. Alterations for accessibility required by the *California Building Code, Chapter 11A*.
2. Alterations that constitute substantial improvement in flood hazard areas, which shall comply with Sections 503.2, 701.3 or 1301.3.3.
3. Structural provisions of Section 304, Chapter 5 or to the structural provisions of Sections 706, 805 and 906.

301.3.1 Prescriptive compliance method. Alterations, additions and changes of occupancy complying with Chapter 5 of this code in buildings complying with the *California Fire Code* shall be considered in compliance with the provisions of this code.

Exception: Hospital buildings removed from acute care service, skilled nursing facilities, intermediate-care facilities, correctional treatment centers and acute psychiatric hospitals [OSHPD 1R, 2, 4 and 5]. The provisions of adopted sections in Chapters 3 through 5 shall control the alteration, repair and change of occupancy or function of existing structures for applications listed in Section 1.10.1, 1.10.2, 1.10.4 and 1.10.5 regulated by the Office of Statewide Health Planning and Development (OSHPD). Refer to Chapter 3A for services, systems and utilities that serve OSHPD 1 buildings.

301.3.2 Work area compliance method. Alterations, additions and changes of occupancy complying with the applicable requirements of Chapters 6 through 12 of this code shall be considered in compliance with the provisions of this code.

Note: [HCD 1 & HCD 2] The provisions contained in Chapters 6 through 12 are not adopted by HCD, but may be available for adoption by a local ordinance. (See Section 1.1.11.)

301.3.3 Performance compliance method. Alterations, additions and changes of occupancy complying with Chapter 13 of this code shall be considered in compliance with the provisions of this code.

Note: [HCD 1 & HCD 2] The provisions contained in Chapter 13 are not adopted by HCD, but may be available for adoption by a local ordinance. (See Section 1.1.11.)

301.4 Relocated or moved buildings. Relocated or moved buildings shall comply with the requirements of Chapter 14.

SECTION 302 GENERAL PROVISIONS

302.1 Dangerous conditions. The code official shall have the authority to require the elimination of conditions deemed dangerous.

302.1.1 Dangerous conditions. *[BSC] Regardless of the extent of structural or nonstructural damage, the code official shall have the authority to require the elimination of conditions deemed dangerous.*

302.2 Additional codes. Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in this code and the *California Energy Code, California Fire Code, California Mechanical Code, California Plumbing Code, California Residential Code* and *California Electrical Code*. Where provisions of the other codes conflict with provisions of this code, the provisions of this code shall take precedence.

302.2.1 Additional codes in health care. In existing Group I-2 occupancies, ambulatory health care facilities, outpatient clinics and hyperbaric facilities, alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall also comply with NFPA 99.

302.3 Existing materials. Materials already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the code official to be unsafe.

302.4 New and replacement materials. Except as otherwise required or permitted by this code, materials permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided that unsafe conditions are not created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location. *[HCD 1] Local ordinances or regulations shall permit the replacement, retention and extension of original materials, and the use of original methods of construction, for*

any building or accessory structure, provided such building or structure complied with the building code provisions in effect at the time of original construction and the building or accessory structure does not become or continue to be a substandard building. For additional information, see Health and Safety Code Sections 17912, 17920.3, 17922(d), 17922.3, 17958.8 and 17958.9.

Exception: No replacement residential garage door shall be installed to connect the replacement door to an existing residential automatic garage door opener that does not have a battery backup function designed to keep the garage door operational without interruption during an electrical outage. See Health and Safety Code Section 19892.

[BS] 302.4.1 New structural members and connections. New structural members and connections shall comply with the detailing provisions of the *California Building Code* for new buildings of similar structure, purpose and location.

Exception: Where alternative design criteria are specifically permitted.

302.5 Occupancy and use. Where determining the appropriate application of the referenced sections of this code, the occupancy and use of a building shall be determined in accordance with Chapter 3 of the *California Building Code*.

SECTION 303 STORM SHELTERS

303.1 Storm shelters. This section applies to the construction of storm shelters constructed as rooms or spaces within existing buildings for the purpose of providing protection during storms that produce high winds, such as tornados and hurricanes. Such structures shall be designated to be hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Such structures shall be constructed in accordance with this code and ICC 500.

** **303.2 Addition to a Group E occupancy.** Where an addition is added to an existing Group E occupancy located in an area where the shelter design wind speed for tornados is 250 mph (402.3 km/h) in accordance with Figure 304.2(1) of ICC 500 and the occupant load in the addition is 50 or more, the addition shall have a storm shelter constructed in accordance with ICC 500.

Exceptions:

1. Group E day care facilities.
2. Group E occupancies accessory to places of religious worship.
3. Additions meeting the requirements for shelter design in ICC 500.

303.2.1 Required occupant capacity. The required occupant capacity of the storm shelter shall include all buildings on the site, and shall be the total occupant load

of the classrooms, vocational rooms and offices in the Group E occupancy.

Exceptions:

1. Where an addition is being added on an existing Group E site, and where the addition is not of sufficient size to accommodate the required occupant capacity of the storm shelter for all of the buildings on-site, the storm shelter shall at a minimum accommodate the required capacity for the addition.
2. Where approved by the code official, the required occupant capacity of the shelter shall be permitted to be reduced by the occupant capacity of any existing storm shelters on the site.

303.2.2 Occupancy classification. The occupancy classification for storm shelters shall be determined in accordance with Section 423.3 of the *California Building Code*.

SECTION 304 STRUCTURAL DESIGN LOADS AND EVALUATION AND DESIGN PROCEDURES

[BS] 304.1 Live loads. Where an addition or alteration does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition or alteration. If the approved live load is less than that required by Section 1607 of the *California Building Code*, the area designated for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition or alteration results in increased design live load, the live load required by Section 1607 of the *California Building Code* shall be used.

[BS] 304.2 Snow loads on adjacent buildings. Where an alteration or addition changes the potential snow drift effects on an adjacent building, the code official is authorized to enforce Section 7.12 of ASCE 7.

[BS] 304.3 Seismic evaluation and design procedures. Where required, seismic evaluation or design shall be based on the procedures and criteria in this section, regardless of which compliance method is used.

[BS] 304.3.1 Compliance with full seismic forces. Where compliance requires the use of full seismic forces, the criteria shall be in accordance with one of the following:

1. One-hundred percent of the values in the *California Building Code*. Where the existing seismic force-resisting system is a type that can be designated as "Ordinary," values of R , Ω_0 and C_d used for analysis in accordance with Chapter 16 of the *California Building Code* shall be those specified for structural systems classified as "Ordinary" in accordance with Table 12.2-1 of ASCE 7, unless it can be demonstrated that

PROVISIONS FOR ALL COMPLIANCE METHODS

the structural system will provide performance equivalent to that of a “Detailed,” “Intermediate” or “Special” system.

2. ASCE 41, using a Tier 3 procedure and the two-level performance objective in Table 304.3.1 for the applicable risk category.

**[BS] TABLE 304.3.1
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41
FOR COMPLIANCE WITH FULL SEISMIC FORCES**

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1N EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2N EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3)	Collapse Prevention (S-5)
II	Life Safety (S-3)	Collapse Prevention (S-5)
III	Damage Control (S-2)	Limited Safety (S-4)
IV	Immediate Occupancy (S-1)	Life Safety (S-3)

[BS] 304.3.2 Compliance with reduced seismic forces. Where seismic evaluation and design is permitted to use reduced seismic forces, the criteria used shall be in accordance with one of the following:

1. The *California Building Code* using 75 percent of the prescribed forces. Values of R , Ω_0 and C_d used for analysis shall be as specified in Section 304.3.1 of this code.
2. Structures or portions of structures that comply with the requirements of the applicable chapter in Appendix A as specified in Items 2.1 through 2.4 and subject to the limitations of the respective Appendix A chapters shall be deemed to comply with this section.
 - 2.1. The seismic evaluation and design of unreinforced masonry bearing wall buildings in Risk Category I or II are permitted to be based on the procedures specified in Appendix Chapter A1.
 - 2.2. Seismic evaluation and design of the wall anchorage system in reinforced concrete and reinforced masonry wall buildings with flexible diaphragms in Risk Category I or II are permitted to be based on the procedures specified in Chapter A2.
 - 2.3. Seismic evaluation and design of cripple walls and sill plate anchorage in residential buildings of light-frame wood construction in Risk Category I or II are permitted to be based on the procedures specified in Chapter A3.
 - 2.4. Seismic evaluation and design of soft, weak or open-front wall conditions in multiple-unit residential buildings of wood construction in Risk Category I or II are permitted to be based on the procedures specified in Chapter A4.

3. ASCE 41, using the performance objective in Table 304.3.2 for the applicable risk category.

**[BS] TABLE 304.3.2
PERFORMANCE OBJECTIVES FOR USE IN ASCE 41
FOR COMPLIANCE WITH REDUCED SEISMIC FORCES**

RISK CATEGORY (Based on IBC Table 1604.5)	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-1E EARTHQUAKE HAZARD LEVEL	STRUCTURAL PERFORMANCE LEVEL FOR USE WITH BSE-2E EARTHQUAKE HAZARD LEVEL
I	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
II	Life Safety (S-3). See Note a	Collapse Prevention (S-5)
III	Damage Control (S-2). See Note a	Limited Safety (S-4). See Note b
IV	Immediate Occupancy (S-1)	Life Safety (S-3). See Note c

- a. For Risk Categories I, II and III, the Tier 1 and Tier 2 procedures need not be considered for the BSE-1E earthquake hazard level.
- b. For Risk Category III, the Tier 1 screening checklists shall be based on the Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on MS -factors that are the average of the values for Collapse Prevention and Life Safety.
- c. For Risk Category IV, the Tier 1 screening checklists shall be based on Collapse Prevention, except that checklist statements using the Quick Check provisions shall be based on MS -factors for Life Safety.

**SECTION 305
IN-SITU LOAD TESTS**

[BS] 305.1 General. Where used, in-situ load tests shall be conducted in accordance with Section 1708 of the *California Building Code*.

**SECTION 306
ACCESSIBILITY FOR EXISTING BUILDINGS
(Not adopted by HCD or OSHPD)**

[DSA-AC] Buildings or facilities where accessibility is required for applications listed in Title 24, Part 2, California Building Code, Chapter 1, Section 1.9.1 regulated by the Division of the State Architect-Access Compliance shall comply with Title 24, Part 2, California Building Code, Chapter 11A or Chapter 11B, as applicable.

306.1 Scope. The provisions of Sections 306.1 through 306.7.16 apply to maintenance and repair, change of occupancy, additions and alterations to existing buildings, including those identified as historic buildings.

Note: [HCD 1-AC] Accessibility requirements for covered multifamily dwellings, as defined in Chapter 2 of the California Building Code, are promulgated under HCD authority and are located in Chapter 11A of the California Building Code.

306.2 Design. Buildings and facilities shall be designed and constructed to be accessible in accordance with this code and the alteration and existing building provisions in ICC A117.1, as applicable.

306.3 Maintenance and repair. A facility that is constructed or altered to be accessible shall be maintained accessible during occupancy. Required accessible means of egress shall be maintained during construction, demolition, remodeling or alterations and additions to any occupied building.

Exception: Existing means of egress need not be maintained where approved temporary means of egress and accessible means of egress systems and facilities are provided.

306.3.1 Prohibited reduction in accessibility. An alteration that decreases or has the effect of decreasing accessibility of a building, facility or element, thereof, below the requirements for new construction at the time of the alteration is prohibited. The number of accessible elements need not exceed that required for new construction at the time of alteration.

306.4 Extent of application. An alteration of an existing facility shall not impose a requirement for greater accessibility than that which would be required for new construction.

306.5 Change of occupancy. Existing buildings that undergo a change of group or occupancy shall comply with Section 306.7.

Exception: Type B dwelling or sleeping units required by Section 1108 of the *International Building Code* are not required to be provided in existing buildings and facilities undergoing a change of occupancy in conjunction with alterations where the work area is 50 percent or less of the aggregate area of the building.

306.6 Additions. Provisions for new construction shall apply to additions. An addition that affects the accessibility to, or contains an area of, a primary function shall comply with the requirements in Section 306.7.1.

306.7 Alterations. A facility that is altered shall comply with the applicable provisions in Chapter 11 of the *International Building Code*, ICC A117.1 and the provisions of Sections 306.7.1 through 306.7.16, unless technically infeasible. Where compliance with this section is technically infeasible, the alteration shall provide access to the maximum extent technically feasible.

306.7.1 Alterations affecting an area containing a primary function. Where an alteration affects the accessibility to, or contains an area of primary function, the route to the primary function area shall be accessible. The accessible route to the primary function area shall include toilet facilities and drinking fountains serving the area of primary function.

Exceptions:

1. The costs of providing the accessible route are not required to exceed 20 percent of the costs of the alterations affecting the area of primary function.
2. This provision does not apply to alterations limited solely to windows, hardware, operating controls, electrical outlets and signs.
3. This provision does not apply to alterations limited solely to mechanical systems, electrical systems,

installation or alteration of fire protection systems and abatement of hazardous materials.

4. This provision does not apply to alterations undertaken for the primary purpose of increasing the accessibility of a facility.
5. This provision does not apply to altered areas limited to Type B dwelling and sleeping units.

306.7.2 Accessible means of egress. Accessible means of egress required by Chapter 10 of the *International Building Code* are not required to be added in existing facilities.

306.7.3 Alteration of Type A units. The alteration to Type A individually owned dwelling units within a Group R-2 occupancy shall be permitted to meet the provision for a Type B dwelling unit.

306.7.4 Type B units. Type B dwelling or sleeping units required by Section 1108 of the *International Building Code* are not required to be provided in existing buildings and facilities undergoing alterations where the work area is 50 percent or less of the aggregate area of the building.

306.7.5 Entrances. Where an alteration includes alterations to an entrance that is not accessible, and the facility has an accessible entrance, the altered entrance is not required to be accessible unless required by Section 306.7.1. Signs complying with Section 1112 of the *International Building Code* shall be provided.

306.7.6 Accessible route. Exterior accessible routes, including curb ramps, shall be not less than 36 inches (914 mm) minimum in width.

306.7.7 Elevators. Altered elements of existing elevators shall comply with *California Code of Regulations, Title 8, Division 1, Chapter 4, Subchapter 6, Elevator Safety Orders*. Such elements shall also be altered in elevators programmed to respond to the same hall call control as the altered elevator.

306.7.8 Platform lifts. Platform (wheelchair) lifts installed in accordance with ASME A18.1 shall be permitted as a component of an accessible route.

306.7.9 Stairways and escalators in existing buildings. Where an escalator or stairway is added where none existed previously and major structural modifications are necessary for installation, an accessible route complying with Section 1104.4 of the *International Building Code* is required between levels served by such escalator or stairway.

306.7.10 Determination of number of units. Where Chapter 11 of the *International Building Code* requires Accessible, Type A or Type B units and where such units are being altered or added, the number of Accessible, Type A and Type B units shall be determined in accordance with Sections 306.7.10.1 through 306.7.10.3.

306.7.10.1 Accessible dwelling or sleeping units. Where Group I-1, I-2, I-3, R-1, R-2 or R-4 dwelling or sleeping units are being altered or added, the requirements of Section 1108 of the *International Building Code* for Accessible units apply only to the quantity of spaces being altered or added.

306.7.10.2 Type A dwelling or sleeping units. Where more than 20 Group R-2 dwelling or sleeping units are being altered or added, the requirements of Section 1108 of the *International Building Code* for Type A units apply only to the quantity of the spaces being altered or added.

306.7.10.3 Type B dwelling or sleeping units. Where four or more Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being added, the requirements of Section 1108 of the *International Building Code* for Type B units apply only to the quantity of the spaces being added. Where Group I-1, I-2, R-1, R-2, R-3 or R-4 dwelling or sleeping units are being altered and where the work area is greater than 50 percent of the aggregate area of the building, the requirements of Section 1108 of the *International Building Code* for Type B units apply only to the quantity of the spaces being altered.

306.7.11 Toilet rooms. Where it is technically infeasible to alter existing toilet rooms to be accessible, one accessible single-user toilet room or one accessible family or assisted-use toilet room constructed in accordance with Section 1110.2.1 of the *International Building Code* is permitted. This toilet room shall be located on the same floor and in the same area as the existing toilet rooms. At the inaccessible toilet rooms, directional signs indicating the location of the nearest such toilet room shall be provided. These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.12 Bathing rooms. Where it is technically infeasible to alter existing bathing rooms to be accessible, one accessible single-user bathing room or one accessible family or assisted-use bathing room constructed in accordance with Section 1110.2.1 of the *International Building Code* is permitted. This accessible bathing room shall be located on the same floor and in the same area as the existing bathing rooms. At the inaccessible bathing rooms, directional signs indicating the location of the nearest such bathing room shall be provided. These directional signs shall include the International Symbol of Accessibility, and sign characters shall meet the visual character requirements in accordance with ICC A117.1.

306.7.13 Additional toilet and bathing facilities. In assembly and mercantile occupancies, where additional toilet fixtures are added, not fewer than one accessible family or assisted-use toilet room shall be provided where required by Section 1110.2.1 of the *International Building Code*. In recreational facilities, where additional bathing rooms are being added, not fewer than one family or assisted-use bathing room shall be provided where required by Section 1110.2.1 of the *International Building Code*.

306.7.14 Dressing, fitting and locker rooms. Where it is technically infeasible to provide accessible dressing, fitting or locker rooms at the same location as similar types of rooms, one accessible room on the same level

shall be provided. Where separate-sex facilities are provided, accessible rooms for each sex shall be provided. Separate-sex facilities are not required where only unisex rooms are provided.

306.7.15 Amusement rides. Where the structural or operational characteristics of an amusement ride are altered to the extent that the amusement ride's performance differs from that specified by the manufacturer or the original design, the amusement ride shall comply with requirements for new construction in Section 1111.4.8 of the *International Building Code*.

306.7.16 Historic structures. Where compliance with the requirements for accessible routes, entrances or toilet rooms would threaten or destroy the historic significance of the historic structure, as determined by the authority having jurisdiction, the alternative requirements of Sections 306.7.16.1 through 306.7.16.5 for that element shall be permitted.

Exceptions:

1. Accessible means of egress required by Chapter 10 of the *International Building Code* are not required to be provided in historic structures.
2. The altered element or space is not required to be on an accessible route, unless required by Sections 306.7.16.1 or 306.7.16.2.

306.7.16.1 Site arrival points. Not fewer than one exterior accessible route, including curb ramps from a site arrival point to an accessible entrance, shall be provided and shall not be less than 36 inches (914 mm) minimum in width.

306.7.16.2 Multiple-level buildings and facilities. An accessible route from an accessible entrance to public spaces on the level of the accessible entrance shall be provided.

306.7.16.3 Entrances. Where an entrance cannot be made accessible in accordance with Section 306.7.5, an accessible entrance that is unlocked while the building is occupied shall be provided; or, a locked accessible entrance with a notification system or remote monitoring shall be provided.

Signs complying with Section 1112 of the *International Building Code* shall be provided at the public entrances and the accessible entrance.

306.7.16.4 Toilet facilities. Where toilet rooms are provided, not fewer than one accessible single-user toilet room or one accessible family or assisted-use toilet room complying with Section 1110.2.1 of the *International Building Code* shall be provided.

306.7.16.5 Bathing facilities. Where bathing rooms are provided, not fewer than one accessible single-user bathing room or one accessible family or assisted-use bathing rooms complying with Section 1110.2.1 of the *International Building Code* shall be provided.

306.7.16.6 Type A units. The alteration to Type A individually owned dwelling units within a Group R-2

occupancy shall be permitted to meet the provision for a Type B dwelling unit.

306.7.16.7 Type B units. Type B dwelling or sleeping units required by Section 1108 of the *International Building Code* are not required to be provided in historic buildings.

**SECTION 309
ADDITIONS AND REPLACEMENTS
OF EXTERIOR WALL COVERINGS
AND EXTERIOR WALL ENVELOPES**

309.1 General. The provisions of Section 309 apply to all alterations, repairs, additions, relocations of structures and changes of occupancy regardless of compliance method.

309.2 Additions and replacements. Where an exterior wall covering or exterior wall envelope is added or replaced, the materials and methods used shall comply with the requirements for new construction in Chapter 14 and Chapter 26 of the *California Building Code* if the added or replaced exterior wall covering or exterior wall envelope involves two or more contiguous stories and comprises more than 15 percent of the total wall area on any side of the building.

**SECTION 310 [OSHPD 1R, 2 and 5]
SERVICES/SYSTEMS AND UTILITIES**

310.1 Services/systems and utilities. *Services/systems and utilities shall only originate in, pass through or under structures which are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).*

**SECTION 311 [OSHPD 1R, 2 and 5]
MEANS OF EGRESS**

311.1 General. *Means of egress through existing buildings shall be in accordance with the California Building Code, except as modified in this section.*

311.1.1 Jurisdiction. *Means of egress shall only pass through buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).*

**SECTION 312 [OSHPD 1R]
HOSPITAL SPC AND FREESTANDING
BUILDINGS REMOVED FROM GENERAL ACUTE
CARE SERVICE REMAINING UNDER THE
JURISDICTION OF OSHPD**

312.1 General. *The provisions of this section shall apply to hospital SPC and freestanding buildings that have been removed from Acute Care Service per California Existing Building Code Section 312A but remain under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD). These buildings may house various occupancies, uses and functions in accordance with this section. The requirements for those various occupancies, uses and functions shall be in accordance with the provisions of the California Building Standards Code, specific to each. The designation OSHPD 1R shall be limited to provisions applicable to the overall hospital SPC or freestanding building.*

312.1.1 Non-general acute care hospital (non-GACH) SPC buildings. *Non-GACH SPC buildings shall conform to the requirements of Section 1.10.1 [OSHPD 1R].*

312.1.2 Freestanding buildings. *Application and enforcement of freestanding buildings removed from general acute care services but remaining under OSHPD jurisdiction shall be in accordance with Section 1.10.1 [OSHPD 1R].*

**SECTION 307
SMOKE ALARMS**

307.1 Smoke alarms. Where an alteration, addition, change of occupancy or relocation of a building is made to an existing building or structure of a Group R occupancy, the existing building shall be provided with smoke alarms in accordance with the *California Fire Code* or Section R314 of the *California Residential Code*.

Exception: Work classified as Level 1 Alterations in accordance with Chapter 7.

**SECTION 308
CARBON MONOXIDE DETECTION**

308.1 Carbon monoxide detection. Where an addition, alteration, change of occupancy or relocation of a building is made to Group I-1, I-2, I-4 and R occupancies and classrooms of Group E occupancies, the existing building shall be provided with carbon monoxide detection in accordance with the *California Fire Code* or Section R315 of the *California Residential Code*.

Exceptions:

1. Work involving the exterior surfaces of buildings, such as the replacement of roofing or siding, the addition or replacement of windows or doors, or the addition of porches or decks.
2. Installation, alteration or repairs of plumbing or mechanical systems, other than fuel-burning appliances.
3. Work classified as Level 1 Alterations in accordance with Chapter 7.

308.2 Carbon monoxide alarms in existing portions of a building. *[HCD 1 & HCD 2] Pursuant to Health and Safety Code Section 17926, carbon monoxide detection shall be provided in all existing Group R buildings, as required in Section 915 of the California Building Code or Section R315 of the California Residential Code, as applicable.*

308.2.1 Carbon monoxide detection in existing Group E occupancy buildings. *Where the new addition includes any of the conditions identified in the California Fire Code Sections 915.1.2 through 915.1.6, carbon monoxide detection shall be installed in accordance with Section 915 of the California Fire Code. No person shall install, market, distribute, offer for sale, or sell any carbon monoxide device in the State of California unless the device and instructions have been approved and listed by the Office of the State Fire Marshal.*

Freestanding hospital-owned clinics shall be permitted to be under the jurisdiction of OSHPD in accordance with the California Administrative Code Sections 7-2104, 7-2105 and 7-2106.

312.1.3 Non-General Acute Care Building (non-GACH SPC building) access. All access points into hospital SPC buildings removed from general acute care service shall prominently display signage at each access point stating “NO GENERAL ACUTE CARE SERVICES BEYOND THIS POINT.”

312.2 Definitions.

FREESTANDING. Refer to Part 1, California Administrative Code, Chapter 7.

SPC BUILDING. Refer to Part 2, California Building Code, Chapter 2.

312.3 Buildings to remain under OSHPD jurisdiction.

312.3.1 Freestanding buildings containing qualifying nonacute care services. In order for a freestanding building, as defined in the California Administrative Code, Section 7-111, that is removed from general acute care service, to remain under OSHPD jurisdiction, it shall contain one or more qualifying nonacute care services. Qualifying nonacute care services include:

- a. Services considered “Outpatient Clinical Services” as defined in H&SC §129730(a):
 - i. Administrative space that directly supports hospital operations
 - ii. Central sterile supply
 - iii. Storage
 - iv. Morgue and autopsy facilities
 - v. Employee dressing rooms and lockers
 - vi. Janitorial and housekeeping facilities
 - vii. Laundry
- b. Outpatient portions of the following services (with no more than 25 percent in-patient use), including but not limited to:
 - i. Surgical
 - ii. Chronic dialysis
 - iii. Psychiatry
 - iv. Rehabilitation, occupational therapy or physical therapy
 - v. Maternity
 - vi. Dentistry
 - viii. Chemical dependency
- c. Services that duplicate Basic Services, as defined in H&SC §1250, or services that are provided as part of a Basic Service, but are not required for facility licensure (with no more than 25 percent in-patient use).

All hospital support services listed in Section 312.3.1 Item a that are located in an SPC building at the time general acute care services are removed may remain, provided the California Department of Public Health certifies to the Office that it has received and approved a plan that demonstrates how the health facility will continue to pro-

vide all basic services in the event of any emergency when the SPC building may no longer remain functional. This certification shall be submitted by the hospital to the Office prior to approval of the application to remove the SPC building from general acute care service.

312.3.2 SPC non-GACH buildings containing nonacute care services under existing license. The services listed in Section 312.3.1 shall be permitted as follows:

- a. Existing approved nonacute care services shall be permitted to remain. The enforcement agency may require evidence that the existing occupancies and services were in compliance at the time they were located in the SPC building. All hospital support services listed in Section 312.3.1, Item a that are remaining in the SPC building removed from general acute care service shall be in excess of the minimum requirements for licensure and operation of the general acute care hospital. Prior approval by the California Department of Public Health shall be obtained by the hospital to maintain these services in the SPC building removed from acute care service.
- b. New nonacute care services listed in Section 312.3.1, Item a shall be permitted, provided they are in excess of the minimum services required for licensure and operation of the general acute care hospital.
- c. New nonacute care services listed in Section 312.3.1, Item b shall be permitted. These services require compliance with the current functional requirements for that service as defined in Part 2, California Building Code, Section 1224.39, subject to the provisions of Section 506.1.
- d. New nonacute care services listed in Section 312.3.1, Item c shall be permitted provided they are in excess of the minimum services required for licensure and operation of the general acute care hospital. If patients are served by this service, it must meet the current functional requirements for that service as defined in Part 2, California Building Code, Section 1224.39, subject to the provisions of Section 506.1.

312.3.3 SPC non-GACH buildings containing a change of licensed nursing services under existing license. A change of service or function for all, or a portion, of the SPC building removed from general acute care service requires compliance with the current functional requirements for that service as defined in Part 2, California Building Code, Section 1224, subject to the provisions of Section 506.1.

312.3.3.1 Intermediate care and/or skilled nursing services. When general acute care services are removed from an SPC building which is intended to be used for separate and distinct intermediate care and/or skilled nursing services, and the new services will be licensed under the existing license of the general acute care hospital, these new services shall comply with current functional requirements as defined in Part 2, Section 1224.38 and/or 1224.40, and Section 310A.1.1.1.5 for a nonconforming hospital building.

312.3.3.2 Psychiatric nursing service. When general acute care services are removed from an SPC building

which is intended to be used for separate and distinct psychiatric nursing services, and the new services will be licensed under the existing license of the general acute care hospital, these new services shall comply with current functional requirements for that service as defined in Part 2, Section 1228, and Section 310A.1.1.1.5 for a nonconforming hospital building.

312.3.4 SPC non-GACH buildings containing other occupancies and/or uses. Other occupancies and/or uses shall comply with the occupancy/use requirements of the California Building Standards Code for that occupancy or use. Subject to the approval of the building official, the use or occupancy of existing buildings is allowed to be occupied for purposes in other groups, or within the same group, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

312.3.5 Vacant space. Spaces vacated through the removal of general acute care services that are intended to remain vacant must be in conformance with Part 2, California Building Code, Section 116.1. The hospital shall submit a project to the Office to demonstrate remediation of potential unsafe and insanitary conditions.

**SECTION 313 [SFM]
EXISTING GROUP R-1 AND
GROUP R-2 OCCUPANCIES**

313.1 Scope. The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings classified as Group R Occupancies.

313.1.1 Application. In accordance with Health and Safety Code Section 13143.2, the provisions of Sections 313.2 through 313.12 shall only apply to multiple-story structures existing on January 1, 1975, let for human habitation, including, and limited to, apartment houses, hotels and motels wherein rooms used for sleeping are let above the ground floor.

313.2 Number of exits. Every apartment and every other sleeping room shall have access to not less than two exits when the occupant load is 10 or more (exits need not be directly from the apartment or sleeping room). A fire escape as specified herein may be used as one required exit.

Subject to approval of the authority having jurisdiction, a ladder device as specified herein may be used in lieu of a fire escape when the construction feature or the location of the building on the property cause the installation of a fire escape to be impractical.

313.3 Stair construction. All stairs shall have a minimum run of 9 inches (229 mm) and a maximum rise of 8 inches (203 mm) and a minimum width exclusive of handrails of 30 inches (762 mm). Every stairway shall have at least one handrail. A landing having a minimum horizontal dimension of 30 inches (762 mm) shall be provided at each point of access to the stairway.

313.4 Interior stairways. Every interior stairway shall be enclosed with walls of not less than 1-hour fire-resistive construction. Where existing partitions form part of a stairwell

enclosure, wood lath and plaster in good condition will be acceptable in lieu of 1-hour fire-resistive construction. Doors to such enclosures shall be protected by a self-closing door equivalent to a solid wood door with a thickness of not less than 1³/₄ inches (44.5 mm).

Enclosures shall include all landings between flights and any corridors, passageways or public rooms necessary for continuous exit to the exterior of the buildings. The stairway need not be enclosed in a continuous shaft if cut off at each story by the fire-resistive construction required by this subsection for stairwell enclosures. Enclosures shall not be required if an automatic sprinkler system is provided for all portions of the building except bedrooms, apartments and rooms accessory thereto. Interior stairs and vertical openings need not be enclosed in two-story buildings.

313.5 Exterior stairways. Exterior stairways shall be non-combustible or of wood of not less than 2-inch (51 mm) nominal thickness with solid treads and risers.

313.6 Fire escapes, exit ladder devices. Fire escapes may be used as one means of egress if the pitch does not exceed 60 degrees, the width is not less than 18 inches (457 mm), the treads are not less than 4 inches (102 mm) wide, and they extend to the ground or are provided with counterbalanced stairs reaching to the ground. Access shall be by an opening having a minimum dimension of 29 inches (737 mm) when open. The sill shall not be more than 30 inches (762 mm) above the floor and landing.

A ladder device, when used in lieu of a fire escape, shall conform to Section 313.6.1 and the following:

1. Serves an occupant load of nine people or less or a single dwelling unit or hotel room.
2. The building does not exceed three stories in height.
3. The access is adjacent to an opening as specified for emergency egress or rescue or from a balcony.
4. The device does not pass in front of any building opening below the unit being served.
5. The availability of activating the ladder device is accessible only to the opening or balcony served.
6. The device as installed will not cause a person using it to be within 12 feet (3658 mm) of exposed energized high-voltage conductors.

313.6.1 Exit ladder devices.

313.6.1.1 Scope. This standard for exit ladder devices is applicable where such devices are permitted by the building official for installation on existing apartment houses and hotels in conformance with the California Building Code.

313.6.1.2 Instructions. Installation shall be in accordance with the manufacturer's instructions. Instructions shall be illustrated and shall include directions and information adequate for attaining proper and safe installation of the product. Where exit ladder devices are intended for mounting on different support surfaces, specific installation instructions shall be provided for each surface.

313.6.1.3 General design. All load-bearing surfaces and supporting hardware shall be of noncombustible materials. Exit ladder devices shall have a minimum width of 12 inches (305 mm) when in the position intended for use. The design load shall not be less than 400 pounds (1780N) for 16-foot (4877 mm) length and 600 pounds (2699N) for 25-foot (7620 mm) length.

313.6.1.4 Performance.

313.6.1.4.1 Exit ladder devices shall be capable of withstanding an applied load of four times the design load when installed in the manner intended for use. Test loads shall be applied for a period of one hour.

313.6.1.4.2 Exit ladder devices of the retractable type shall, in addition to the static load requirements of Section 413.6.1.4.1 of the California Building Code, be capable of withstanding the following tests:

1. Rung strength.
2. Rung-to-side-rail shear strength.
3. Release mechanism.
4. Low temperature.

313.6.1.5 Rung-strength test. Rungs of retractable exit ladder devices shall be capable of withstanding a load of 1,000 pounds (4448N) when applied to a 3¹/₂-inch-wide (89 mm) block resting at the center of the rung. The test load shall be applied for a period of 1 hour. The ladder shall remain operational following this test.

313.6.1.6 Rung-to-side-rail shear test. Rungs of retractable exit ladder devices shall be capable of withstanding 1,000 (4448N) when applied to a 3¹/₂-inch-wide (89 mm) block resting on the center rung as near the side rail as possible. The test load shall be applied for a period of 1 hour. Upon removal of the test load the fasteners attaching the rung to the side rail shall show no evidence of failure. The ladder shall remain operational following the test.

313.6.1.7 Release mechanism test. The release mechanism of retractable exit ladder devices shall operate with an average applied force of not more than 5 pounds (22.2N) for hand-operated releasing mechanisms and an average applied force of not more than 25 pounds (111N) for foot-pedal types of releasing mechanisms. For these tests, a force gauge shall be applied to the release mechanism, and the average of three consecutive readings shall be computed.

313.6.1.8 Low temperature operation test. Representative samples of the exit ladder devices shall be subjected to a temperature of -40°C in an environmental chamber for a period of 24 hours. The release mechanism shall be operated immediately upon removal from the chamber. The ladder device shall function as intended without any restriction of operation.

313.7 Doors and openings. Exit doors and openings shall meet the requirements of Sections 1008.1.2, 1008.8.1.8, 1008.1.9 and 708.6 of the California Building Code. Doors shall not reduce the required width of stairway more than 6 inches (152 mm) when open. Transoms and openings other

than doors from corridors to rooms shall be fixed closed and shall be covered with a minimum of 3/4-inch (19 mm) plywood or 1/2-inch (13 mm) gypsum wallboard or equivalent material.

Exceptions:

1. Existing solid-bonded wood-core doors 1³/₈ inches thick (34.9 mm), or their equivalent may be continued in use.
2. Where the existing frame will not accommodate a door complying with Section 708.6 of the California Building Code, a 1³/₈-inch-thick (35 mm) solid-bonded wood-core door may be used.

313.8 Exit signs. Every exit doorway or change of direction of a corridor shall be marked with a well-lighted exit sign having letters at least 5 inches (127 mm) high.

313.9 Enclosure of vertical openings. Elevators, shafts, ducts and other vertical openings shall be enclosed as required for stairways in Section 313.5 or by wired glass set in metal frames. Doors shall be noncombustible or as regulated in Section 313.5.

313.10 Separation of occupancies. Occupancy separations shall be provided as specified in Section 508 of the California Building Code. Lobbies and public dining rooms, not including cocktail lounges, shall not require a separation if the kitchen is so separated from the dining room. Every room containing a boiler or central heating plant shall be separated from the rest of the building by not less than a one-hour fire-resistive occupancy separation.

Exception: A separation shall not be required for such rooms with equipment serving only one dwelling unit.

313.11 Equivalent protection. In lieu of the separation of occupancies required by Section 313.10, equivalent protection may be permitted when approved by the enforcement agency.

Exception: The provisions of Sections 313.3 through 313.11 above shall not apply to any existing apartment house, hotel or motel having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access which is subject to the provisions of Section 314 and the California Fire Code, relating to existing high-rise buildings.

Note: In accordance with Health and Safety Code Section 17920.7, the provisions of Sections 313.3 through 313.11 above shall apply only to multiple-story structures existing on January 1, 1975, let for human habitation including, and limited to, apartments, houses, hotels and motels wherein rooms used for sleeping are let above the ground floor.

313.12 Fire alarms.

313.12.1 General. Every apartment house three or more stories in height or containing more than 15 apartments, every hotel three or more stories in height or containing 20 or more guest rooms, shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously and shall be in accordance with the California Fire Code. See Section

314.14 for special requirements in buildings over 75 feet (22 860 mm) in height.

Exception: A fire alarm system need not be installed provided such apartment house or hotel is separated by an unpierced wall of not less than 4-hour fire resistance in buildings of Type IA, Type IIB, Type III or Type IV construction and 2-hour fire resistance in buildings of all other types of construction provided:

1. Areas do not exceed the number of apartments or guest rooms stipulated.
2. The fire-resistive wall conforms to the requirements of Section 706.6 of the California Building Code.
3. The wall complies with all other applicable provisions of the California Building Code.
4. The wall extends to all outer edges of horizontal projecting elements, such as balconies, roof overhangs, canopies, marquees or architectural projections.
5. No openings are permitted for air ducts or similar penetrations, except that openings for pipes, conduits and electrical outlets of copper, sheet steel or ferrous material shall be permitted through such wall and need not be protected, provided they do not unduly impair the required fire resistance of the assembly.
6. Tolerances around such penetrations shall be filled with approved noncombustible materials.

313.12.2 Installation. The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

313.13 Existing Group R Occupancy high-rise buildings.

313.13.1 General. Regardless of other provisions of these regulations relating to existing high-rise buildings, requirements relative to existing Group R-1 or Group R-2 Occupancies shall not be less restrictive than those established pursuant to Health and Safety Code Section 13143.2.

313.13.2 Corridor openings. Openings in corridor walls and ceilings shall be protected by not less than 1³/₄-inch (44.5 mm) solid-bonded wood-core doors, 1/4-inch-thick (6 mm) wired glass conforming to Section 715.1 of the California Building Code, by approved fire dampers or by equivalent protection in lieu of any of these items. Transoms shall be fixed closed with material having a fire-resistive rating equal to 1/2-inch (12.7 mm) Type X gypsum wallboard or equivalent material installed on both sides of the opening.

313.13.3 Fire alarm systems. Notwithstanding the provisions of Section 403 of the California Building Code, every existing high-rise building used for the housing of a Group R-1 or Group R-2 Occupancies shall have installed therein a fire alarm system conforming to this subsection.

313.13.3.1 General. Every apartment house and every hotel shall have installed therein an automatic or manually operated fire alarm system. Such fire alarm systems shall be so designed that all occupants of the building may be warned simultaneously.

313.13.3.2 Installation. The installation of all fire alarm equipment shall be in accordance with the California Fire Code.

313.13.3.3 Fire-extinguishing systems. Automatic fire-extinguishing systems installed in any structure subject to these regulations shall have an approved flow indicator electrically interconnected to the required fire alarm system.

**SECTION 314 [SFM]
EXISTING HIGH-RISE BUILDINGS**

314.1 Scope and definition. The provisions of Sections 314.1 through 314.27 shall apply to every existing high-rise building of any type of construction or occupancy having floors (as measured from the top of the floor surface) used for human occupancy located more than 75 feet (22 860 mm) above the lowest floor level having building access.

Exceptions:

1. Hospitals, as defined in Section 1250 of the Health and Safety Code.
2. The following structures, while classified as high-rise buildings, shall not be subject to the provisions of Sections 314.1 through 314.27, but shall conform to all applicable provisions of these regulations.
 - 2.1. Building used exclusively as open parking garages.
 - 2.2. Buildings where all floors above the 75 foot (22 860 mm) level are used exclusively as open parking garages.
 - 2.3. Floors of buildings used exclusively as open parking garages and located above all other floors used for human occupancy.
 - 2.4. Buildings such as power plants, look-out towers, steeples, grain houses and similar structures, when so determined by the enforcing agency.
 - 2.5. Buildings used exclusively for jails and prisons. For the purposes of this section, "building access" shall mean an exterior door opening conforming to all of the following:
 - 2.5.1. Suitable and available for fire department use.
 - 2.5.2. Located not more than 2 feet (610 mm) above the adjacent ground level.
 - 2.5.3. Leading to a space, room or area having foot traffic communication capabilities with the remainder of the building.
 - 2.5.4. Designed to permit penetration through the use of fire department forcible-entry tools and equipment unless other approved arrangements have been made with the fire authority having jurisdiction.

“Existing high-rise structure” means a high-rise structure, the construction of which is commenced or completed prior to July 1, 1974.

For the purpose of this section, construction shall be deemed to have commenced when plans and specifications are more than 50 percent complete and have been presented to the local jurisdiction prior to July 1, 1974. Actual construction of such buildings shall commence on or before January 1, 1976, unless all provisions for new buildings have been met.

314.2 Compliance data. Except as may be otherwise specified, existing high-rise building shall conform to the applicable requirements of these regulations by April 26, 1979.

Exception: The period of compliance may be extended upon showing of good cause for such extension if a systematic and progressive plan of correction is submitted to, and approved by, the enforcing agency. Such extension shall not exceed two years from the date of approval of such plan. Any plan of correction submitted pursuant to this exception shall be submitted and approved on or before April 26, 1979.

314.3 Continued use. Existing high-rise building may have their use continued if they conform, or are made to conform, to the intent of the provisions of Sections 314.5 through 314.27 to provide for the safety of the occupants of the high-rise buildings and person involved in fire-suppression activities.

314.4 Alternate protection. Alternate means of egress, fire walls or fire barriers, smoke barriers, automatic fire detection or fire-extinguishing systems, or other fire-protection devices, equipment or installations may be approved by the enforcing agency to provide reasonable and adequate life safety as intended by Sections 314.5 through 314.27 for existing high-rise buildings.

314.5 Basic provisions. The provisions outlined in Sections 314.1 through 314.27 are applicable to every existing highrise building.

314.6 Minimum construction. Existing wood lath and plaster, existing 1/2-inch (12.7 mm) gypsum wallboard, existing installations of 1/2-inch thick (12.7 mm) wired glass which are or are rendered inoperative and fixed in a closed position, or other existing materials having similar fire-resistive capabilities shall be acceptable. All such assemblies shall be in good repair, free of any condition which would diminish their original fire-resistive characteristics.

Where 1 3/4-inch (44.5 mm) solid-bonded wood-core doors are specified in these regulations for existing high-rise buildings, new or existing 1 3/8-inch (34.9 mm) doors shall be acceptable where existing framing will not accommodate a 1 3/4-inch (44.5 mm) door.

Note: It is the intent of this provisions that existing wood frames may have their use continued.

314.7 New construction. All new construction shall be composed of materials and assemblies of materials conforming to the fire-resistive provisions of these regulations. In no case shall enclosure walls be required to be of more than one-hour fire-resistive construction.

Exception: When approved by the enforcing agency, materials specified in Section 314.6 may be used for new construction when necessary to maintain continuity of design and measurement of existing construction.

314.8 Exits. Every floor from an existing high-rise building shall have access to two separate means of egress, one of which, when approved by the enforcing agency, may be an existing exterior fire escape. New installations of smoke-proof enclosures shall not be required.

Note: In determining the adequacy of exits and their design, Chapter 10 of the California Building Code may be used as a guide. It is the intent of this section that every existing high-rise building need not mandatorily conform or be made to conform with the requirements for new high-rise buildings. Reasonable judgment in the application of requirements must be exercised by the enforcing agency.

314.9 Fire escapes. An existing fire escape in good structural condition may be acceptable as one of the required means of egress from each floor. Access to such fire escapes may be by any one of the following:

1. Through a room between the corridor and the fire escape if the door to the room is operable from the corridor side without the use of any key, special knowledge or effort.
2. By a door operable to a fire escape from the interior without the use of any key, special knowledge or effort.
3. By a window operable from the interior. Such window shall have a minimum dimension of 29 inches (737 mm) when open.
4. The sill shall not be more than 30 inches (762 mm) above the floor and landing.

314.10 Protection of exterior openings. When an existing fire escape is accepted as one of the require means of egress, openings onto the fire escape landing and openings within 5 feet (1524 mm) horizontally of the landings shall be protected in a manner acceptable to the enforcing agency.

314.11 Locking of stairway doors. When exit doors from corridors to exit stairways are locked to prohibit access from the stairway side, the locking mechanisms shall be retracted to the unlocked position upon failure of electrical power and a telephone or other two-way communication system connected to an approved emergency service that operates continuously shall be provided at not less than every fifth floor in each required stairway. In lieu thereof, master keys which will unlock all such doors from the stairway side shall be provided in such numbers and locations as approved by the enforcing agency.

314.12 Enclosures. Interior vertical shafts, including but not limited to, elevators, stairway and utility, shall be enclosed with construction as set forth in Section 314.6.

314.13 Opening protection. Doors in other than elevators, which shall be of a type acceptable to the enforcing agency, shall be approved one-hour, fire-rated, tight-fitting or gasketed doors or equivalent protection, and shall be of the normally closed type, self-closing or a type which will close

automatically in accordance with Section 715 of the California Building Code.

Exception: In lieu of stairway enclosures, smoke barriers may be provided in such a manner that fire and smoke will not spread to other floors or otherwise impair exit facilities. In these instances, smoke barriers shall not be less than one-hour fire resistive with openings protected by not less than approved one-third-hour, fire-rated, tight-fitting or gasketed doors. Such doors shall be of the self-closing type or of a type which will close automatically in the manner specified in Section 715 of the California Building Code.

Doors crossing corridors shall be provided with wired-glass vision panels set in approved steel frames. Doors for elevators shall not be of the open-grille type.

314.14 Fire alarm system. Every existing high-rise building shall be provided with an approved fire alarm system. In department stores, retail sales stores and similar occupancies where the general public is admitted, such systems shall be of a type capable of alerting staff and employees. In office buildings and all other high-rise buildings, such systems shall be of a type capable of alerting all occupants simultaneously.

Exceptions:

1. In areas of public assemblage, the type and location of audible appliances shall be as determined by the enforcing agency.
2. When acceptable to the enforcing agency, the occupant voice notification system required by Section 314.20 may be used in lieu of the fire alarm system required by Section 314.14.

314.15 Existing systems. Existing fire systems, when acceptable to the enforcing agency, shall be deemed as conforming to the provisions of these regulations. For requirements for existing Group R-1 Occupancies, see Section 312.13.

314.16 Annunciation. When a new fire alarm system is installed, it shall be connected to an annunciator panel installed in a location approved by the enforcing agency. For purposes of annunciation, zoning shall be in accordance with Section 907.6.3 of the California Building Code.

314.17 Monitoring. Shall be in accordance with Section 907.6.5 of the California Building Code.

314.18 Systems interconnection. When an automatic fire detection system or automatic extinguishing system is installed, activation of such system shall cause the sounding of the fire alarm notification appliances at locations designated by the enforcing agency.

314.19 Manual fire alarm boxes. A manual fire alarm box shall be provided in the locations designated by the enforcing agency. Such locations shall be where boxes are readily accessible and visible and in normal paths of daily travel by occupants of the building.

314.20 Emergency voice/alarm communication system. An approved emergency voice/alarm system shall be provided in every existing high-rise building which exceeds 150 feet (45 720 mm) in height measured in the manner set forth in Section 312.1. Such system shall provide communication from a location available to and designated by the enforcing agency to not

less than all public areas. The emergency voice/alarm system may be combined with a fire alarm system provide the combined system has been approved and listed by the State Fire Marshal. The sounding of a fire alarm signal in any given area or floor shall not prohibit voice communication to other areas of floors. Combination systems shall be designed to permit voice transmission to override the fire alarm signal, but the fire alarm signal shall not terminate in less than three minutes.

314.21 Fire department system. When it is determined by test that portable fire department communication equipment is ineffective, a communication system acceptable to the enforcing agency shall be installed within the building to permit emergency communication between fire-suppression personnel.

314.22 Interior wall and ceiling finish. Interior wall and ceiling finish of exitways shall conform to the provisions of Chapter 8 of the California Building Code. Where the materials used in such finishes do not conform to the provisions of Chapter 8 of the California Building Code, such finishes may be surfaced with an approved fire-retardant coating.

314.23 Ventilation. Natural or mechanical ventilation for the removal of products of combustion shall be provided in every story of an existing high-rise building. Such ventilation shall be any one or combination of the following: Panels or windows in the exterior wall which can be opened. Such venting facilities shall be provided at the rate of at least 20 square feet (1.86 m²) of opening per 50 lineal feet (15 240 lineal mm) of exterior wall in each story, distributed around the perimeter at not more than 50-foot (15 240 mm) intervals on at least two sides of the building. Approved fixed tempered glass may be used in lieu of openable panels or windows. When only selected panels or windows are of tempered glass, they shall be clearly identified as required by the enforcing agency. Any other design which will produce equivalent results.

314.24 Smoke control systems. Existing air-circulation systems shall be provided with an override switch in a location approved by the enforcing agency which will allow for the manual control of shutdown of the systems.

Exception: Systems which serve only a single floor, or portion thereof, without any penetration by ducts or other means into adjacent floors.

314.25 Elevator recall smoke detection. Smoke detectors for emergency operation of elevators shall be provided as required by Section 3003 of the California Building Code.

314.26 Exit signs and illumination. Exits and stairways shall be provided with exit signs and illumination as required by Sections 1011.1 and 1011.2 of the California Building Code.

314.27 Automatic sprinkler system—Existing high-rise buildings. Regardless of any other provisions of these regulations, every existing high-rise building of Type II-B, Type III-B or Type V-B construction shall be provided with an approved automatic sprinkler system conforming to NFPA 13.

**SECTION 315 [SFM]
EXISTING GROUP I OCCUPANCIES**

315.1 General. Existing buildings housing existing protective social-care homes or facilities established prior to March 4,

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1972 may have their use continued if they conform, or are made to conform, to the following provisions:

315.2 Use of floors. The use of floor levels in buildings of Type III, IV or V nonfire-rated construction may be as follows: Nonambulatory—first floor only; Ambulatory—not higher than the third-floor level, provided walls and partitions are constructed of materials equal in fire-resistive quality to that of wood lath and plaster in good repair and all walls are firestopped at each floor level.

315.3 Enclosure of exits and vertical openings. Except for two-story structures housing ambulatory guests, all interior stairs shall be enclosed in accordance with Chapter 10 of the California Building Code. In lieu of stairway enclosures, floor separations or smoke barriers may be provided in such a manner that fire and smoke will not spread rapidly to floors above or otherwise impair exit facilities. In these instances, floor separations or smoke barriers shall have a fire resistance equal to not less than $\frac{1}{2}$ -inch (13 mm) gypsum wall board on each side of wood studs with openings protected by not less than a $1\frac{3}{4}$ -inch (44.5 mm) solid bonded wood-core door of the self-closing type. All other vertical openings shall be enclosed in accordance with the provisions of Section 314.6 and 314.13.

315.4 Exit access. Each floor or portion thereof of buildings used for the housing of existing protective social-care homes or facilities shall have access to not less than two exits in such a manner as to furnish egress from the building or structure in the event of an emergency substantially equivalent to the provisions of Chapter 10 of the California Building Code.

315.5 Corridor openings. Openings from rooms to interior corridors shall be protected by not less than $1\frac{3}{4}$ -inch (44.5 mm) solid-bonded wood-core doors. Transoms and other similar openings shall be sealed with materials equivalent to existing corridor wall construction.

315.6 Interior finishes. Interior wall and ceiling finishes shall conform to the requirements for a Group R-1 Occupancy as specified in Chapter 8 of the California Building Code.

315.7 Automatic fire sprinklers. Automatic sprinkler systems shall be installed in existing protective social-care occupancies in accordance with the provisions of Section 903.2.6 of the California Building Code.

315.8 Fire alarm systems. Automatic fire alarm systems shall be installed in existing protective social-care homes or facilities in accordance with the provisions of Section 907.2.6 of the California Building Code.

Exception: When an approved automatic sprinkler system conforming to Section 903.2.6 of the California Building Code is installed, a separate fire alarm system as specified in this section need not be provided.

SECTION 316 [SFM] EXISTING GROUP L OCCUPANCIES

316.1 Repairs general. Additions, alterations or repairs may be made to any building or structure without requiring the existing building or structure to comply with all the requirements of this code section, provided the addition, alteration or repair conforms to the requirements of this section.

316.2 Unsafe condition. Additions, repairs or alterations shall not be made to an existing building or structure that will cause the existing building or structure to be in violation of any of the provisions of this code, nor shall such additions or alterations cause the existing building or structure to become unsafe, or to be in violation of any of the provisions of this code. An unsafe condition shall be deemed to have been created if an addition or alteration will cause the existing building or structure to become structurally unsafe or overloaded; will not provide adequate egress in compliance with the provisions of this code or will obstruct existing exits; will create a fire hazard; will reduce required fire resistance or will otherwise create conditions dangerous to human life.

316.3 Changes in use or occupancy. Any buildings that have alterations or additions, which involves a change in use or occupancy, shall not exceed the height, number of stories and area permitted for new buildings

316.4 Buildings not in compliance with code. Additions or alterations shall not be made to an existing building or structure when such existing building or structure is not in full compliance with the provisions of this code except when such addition or alteration will result in the existing building or structure being no more hazardous, based on life safety, fire safety and sanitation, than before such additions or alterations are undertaken.

316.5 Maintenance of structural and fire resistive integrity. Alterations or repairs to an existing building or structure that are nonstructural and do not adversely affect any structural member of any part of the building or structure having required fire resistance may be made with the same materials of which the building or structure is constructed. The installation or replacement of glass shall be as required for new installations.

316.6 Continuation of existing use. Buildings in existence at the time of the adoption of this code may have their existing use or occupancy continued if such use or occupancy was legal at the time of the adoption of this code, provided such continued use is not dangerous to life.

316.7 Maximum allowable quantities. Laboratory suites approved prior to January 1, 2008 shall not exceed the maximum allowable quantities listed in Tables 316.1 and 316.2.

SECTION 317 EARTHQUAKE EVALUATION AND DESIGN FOR RETROFIT OF EXISTING BUILDINGS

317.1 Purpose.

317.1.1 Existing state-owned structures. [BSC] The provisions of Sections 317 through 322 establish minimum standards for earthquake evaluation and design for retrofit of existing state-owned structures, including buildings owned by the University of California and the California State University.

The provisions of Sections 317 through 323 may be adopted by a local jurisdiction for earthquake evaluation and design for retrofit of existing buildings.

TABLE 316.7(1)
EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS
PRESENTING A PHYSICAL HAZARD BASIC QUANTITIES PER LABORATORY SUITE¹
When two units are given, values within parentheses are in cubic feet (cu. ft) or pounds (lb)

CONDITION		STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS		
MATERIAL	CLASS	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)	Solid Pounds (cu. ft)	Liquid Gallons (lb)	Gas (cu. ft)
1.1 Combustible liquid	II	—	120 ²	—	—	120	—	—	30	—
	II-A	—	330 ²	—	—	330	—	—	80	—
	III-B	—	13,200 ²	—	—	13,200	—	—	3,300	—
1.2 Combustible dust lbs./1000 cu. ft.		1	—	—	1	—	—	1	—	—
1.3 Combustible fiber (loose) (baled)		(100) (1,000)	— —	— —	(100) (1,000)	— —	— —	(20) (200)	— —	— —
	1.4 Cryogenic, flammable or oxidizing		45	—	—	45	—	—	10	—
2.1 Explosives		12	(1) ²	—	1/4	(1/4)	—	1/4	(1/4)	—
3.1 Flammable solid		125 ²	—	—	25	—	—	25	—	—
3.2 Flammable gas (gaseous) (liquefied)		— —	— 15 ²	750 ² —	— —	— 15 ²	750 ² —	— —	— —	— —
	3.3 Flammable liquid Combination I-A, I-B, I-C	I-A	—	30 ²	—	—	30	—	—	10
I-B		—	60 ²	—	—	60	—	—	15	—
I-C		—	90 ²	—	—	90	—	—	20	—
		—	120 ²	—	—	120	—	—	30	—
4.1 Organic peroxide, unclassified detonatable		1 ²	(1) ²	—	1/4	(1/4)	—	1/4	(1/4)	—
4.2 Organic peroxide	I	5 ²	(5) ²	—	(1)	(1)	—	1	1	—
	II	50 ²	(50) ²	—	50	(50)	—	10	(10)	—
	III	125 ²	(125) ²	—	125	(125)	—	25	(25)	—
	IV	500	(500)	—	500	(500)	—	100	(100)	—
	V	N.L.	N.L.	—	N.L.	N.L.	—	N.L.	N.L.	—
4.3 Oxidizer	4	1 ²	(1) ²	—	1/4 ²	(1/4)	—	1/4	(1/4)	—
	3	10 ²	(10) ²	—	2	(2)	—	2	(2)	—
	2	250 ²	(250) ²	—	50	(250)	—	50	(50)	—
	1	1,000 ²	(1,000) ²	—	1,000	(1,000)	—	200	(200)	—
4.4 Oxidizer Gas (gaseous) (liquefied)		— —	— 15 ²	1,500 ² —	— —	— 15 ²	1,500 ² —	— —	— —	— —
	5.1 Pyrophoric		4 ²	(4) ²	50 ²	1	(1)	10 ²	0	0
6.1 Unstable (reactive)	4	1 ²	(1) ²	10 ²	1/4	(1/4)	2 ²	1/4	(1/4)	0
	3	5 ²	(5) ²	50 ²	1	(1)	10 ²	1	(1)	0
	2	50 ²	(50) ²	250 ²	50	(50)	250 ²	10	(10)	0
	1	125 ²	(125) ²	750 ²	125	(125)	750 ²	25	(25)	0
7.1 Water (reactive)	3	5 ²	(5) ²	—	5	(5)	—	1	(1)	—
	2	50 ²	(50) ²	—	50	(50)	—	10	(10)	—
	1	125 ²	(125) ²	—	125	(125) ²	—	25	(25)	—

1. A laboratory suite is a space up to 10,000 square feet (929 m²) bounded by not less than a one-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.

2. Quantities may be increased 100 percent when stored in approved exhausted gas cabinets, exhausted enclosures or fume hoods.

TABLE 316.7(2)
EXEMPT AMOUNTS OF HAZARDOUS MATERIALS, LIQUIDS AND CHEMICALS
PRESENTING A PHYSICAL HAZARD BASIC QUANTITIES PER LABORATORY SUITE¹
When two units are given, values within parentheses are in pounds (lbs.)

MATERIAL	STORAGE			USE CLOSED SYSTEMS			USE OPEN SYSTEMS	
	Solid lb	Liquid Gallons (lb)	Gas cu. ft	Solid lb	Liquid Gallons (lb)	Gas (cu. ft)	Solid lb	Liquid Gallons (lb)
1. Corrosives	5,000	500	650 ²	5,000	500	650	1,000	100
2a. Highly toxics ²	40	10	65	5	1	65	2	1/4
2b. Toxics	500	50	650 ²	500	50	650	5	1/2
3. Irritants	5,000	500	650	5,000	500	650	1,000	100
4. Sensitizers	5,000	500	650	5,000	500	650	1,000	100
5. Other health hazards	5,000	500	650	5,000	500	650	1,000	100

1. A laboratory suite is a space up to 10,000 square feet (929 m²) bounded by not less than a 1-hour fire-resistive occupancy separation within which the exempt amounts of hazardous materials may be stored, dispensed, handled or used. Up through the third floor and down through the first basement floor, the quantity in this table shall apply. Fourth, fifth and sixth floors and the second and third basement floor level quantity shall be reduced to 75 percent of this table. The seventh through 10th floor and below the third basement floor level quantity shall be reduced to 50 percent of this table.
2. Permitted only when stored or used in approved exhausted gas cabinets, exhausted enclosures or fume hoods. Quantities of high toxics in use in open systems need not be reduced above the third floor or below the first basement floor level. Individual container size shall be limited to 2 pounds (0.91 kg) for solids and 1/4 gallon (0.95 L) for liquids.

317.1.2 Public school buildings. [DSA-SS] The provisions of Sections 317 through 323 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as public school buildings under the jurisdiction of the Division of the State Architect—Structural Safety [DSA-SS], refer to Section 1.9.2.1.

The provisions of Section 317 through 323 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing public buildings currently under the jurisdiction of DSA-SS.

317.1.2.1 Reference to other chapters. For public schools, where reference within this chapter is made to sections in Chapters 16, 17, 18, 19, 21 or 22 of the California Building Code, the provisions in Chapters 16A, 17A, 18A, 19A, 21A and 22A of the California Building Code, respectively, shall apply instead.

317.1.3 Community college buildings. [DSA-SS/CC] The provisions of Sections 317 through 323 establish minimum standards for earthquake evaluation and design for the rehabilitation of existing buildings for use as community college buildings under the jurisdiction of the Division of the State Architect—Structural Safety/Community Colleges [DSA-SS/CC], refer to Section 1.9.2.2.

The provisions of Section 317 through 323 also establish minimum standards for earthquake evaluation and design for rehabilitation of existing community college buildings currently under the jurisdiction of DSA-SS/CC.

317.1.3.1 Reference to other chapters. For community colleges, where reference within this chapter is made to sections in Chapters 17 or 18 of the California Building Code, the provisions in Chapters 17A and 18A of the California Building Code, respectively, shall apply instead.

> | **317.2 Scope.** All alterations, additions and/or repairs to existing structures or portions thereof shall, at a minimum, be

designed and constructed to resist the effects of seismic ground motions as provided in this section. The structural system shall be evaluated by a registered design professional and, if not meeting or exceeding the minimum seismic design performance requirements of this section, shall be retrofitted in compliance with these requirements.

Exception: Those structures for which Section 317.3 determines that assessment is not required, or for which Section 317.4 determines that retrofit is not needed, then only the requirements of Section 317.11 apply.

317.3 Applicability.

317.3.1 Existing state-owned buildings. [BSC] For existing state-owned structures including all buildings owned by the University of California and the California State University, the requirements of Section 317 apply whenever the structure is to be retrofitted, repaired or modified and any of the following apply:

1. Total construction cost, not including cost of furnishings, fixtures and equipment, or normal maintenance, for the building exceeds 25 percent of the construction cost for the replacement of the existing building. The changes are cumulative for past modifications to the building that occurred after adoption of the 1995 California Building Code and did not require seismic retrofit.
2. There are changes in risk category.
3. The modification to the structural components increases the seismic forces in or strength requirements of any structural component of the existing structure by more than 10 percent cumulative since the original construction, unless the component has the capacity to resist the increased forces determined in accordance with Section 319. If the building's seismic base shear capacity has been increased since the original construction, the per-

cent change in base shear may be calculated relative to the increased value.

4. Structural elements need repair where the damage has reduced the lateral-load-resisting capacity of the structural system by more than 10 percent.
5. Changes in live or dead load increase story shear by more than 10 percent.

317.3.2 Public school buildings. [DSA-SS] For public schools, the provisions of Section 317 apply when required in accordance with Sections 4-307 and 4-309(c) of the California Administrative Code.

317.3.3 Community college buildings. [DSA-SS/CC] For community colleges, the provisions of Section 317 apply when required in accordance with Sections 4-307 and 4-309(c) of the California Administrative Code.

317.4 Evaluation required. If the criteria in Section 317.3 apply to the project under consideration, the design professional of record shall provide an evaluation in accordance with Section 317 to determine the seismic performance of the building in its current configuration and condition. If the structure's seismic performance as required by Section 317.5 is evaluated as satisfactory and the peer reviewer(s), when Method B of Section 321 is used, concur, then no structural retrofit is required.

317.5 Minimum seismic design performance levels for structural and nonstructural components. Following the notations of ASCE 41, the seismic requirements for design and assessment are based upon a prescribed Seismic Hazard Level (BSE-1N, BSE-2N, BSE-1E, BSE-R or BSE-C), a specified structural performance level (S-1 through S-5) and a nonstructural performance level (N-A through N-E). The minimum seismic performance criteria are given in Table 317.5 according to the Building Regulatory Authority

and the Risk Category as determined in Chapter 16 of the California Building Code or by the regulatory authority. The building shall be evaluated in accordance with a Tier 3 Systematic Evaluation and Retrofit per ASCE 41 Chapter 6 for both the Level 1 and Level 2 performance levels, and the more restrictive requirements shall apply.

Exception: If the floor area of an addition is greater than the larger of 50 percent of the floor area of the original building or 1,000 square feet (93 m²), then the Table 317.5 entries for BSE-R (or BSE-1E) and BSE-C are replaced by BSE-1N and BSE-2N, respectively.

317.6 Retrofit required. Where the evaluation indicates the building does not meet the required performance objectives of this section, the owner shall take appropriate steps to ensure that the building's structural system is retrofitted in accordance with the provisions of Section 317. Appropriate steps are either: 1) undertake the seismic retrofit as part of the additions, alterations and/or repairs of the structure; or 2) provide a plan, acceptable to the building official, to complete the seismic retrofit in a timely manner. The relocation or moving of an existing building is considered to be an alteration requiring filing of the plans and specifications approved by the building official.

317.7 The additions, alteration or repair to any existing building are permitted to be prepared in accordance with the structural and nonstructural requirements for a new building as given in the California Building Code, applied to the entire building.

317.8 The requirements of ASCE 41 Chapters 14 and 15 are to apply to the use of seismic isolation and passive energy systems, respectively, for the repair, voluntary lateral-force-resisting system modification or retrofit of an existing structure. When seismic isolation or passive energy dissipation is

TABLE 317.5 SEISMIC PERFORMANCE REQUIREMENTS^{2,3} BY BUILDING REGULATORY AUTHORITY AND RISK CATEGORY

BUILDING REGULATORY AUTHORITY	RISK CATEGORY	PERFORMANCE CRITERIA ¹	
		Level 1	Level 2
State-Owned [BSC]	I, II, III	BSE-R, S-3, N-C	BSE-C, S-5, N-D
State-Owned [BSC]	IV	BSE-R, S-2, N-B	BSE-C, S-4, N-D
Division of the State Architect - [DSA-SS]	I	BSE-1N, S-3, N-B	BSE-2N, S-5, N-D
Division of the State Architect - [DSA-SS]	II, III	BSE-1N, S-2, N-B	BSE-2N, S-4, N-D
Division of the State Architect - [DSA-SS]	IV	BSE-1N, S-2, N-A	BSE-2N, S-4, N-D
Division of the State Architect - [DSA-SS/CC]	I, II	BSE-1E, S-3, N-C	BSE-2N, S-5, N-D
Division of the State Architect - [DSA-SS/CC]	III	BSE-1E, S-3, N-B	BSE-2N, S-5, N-D
Division of the State Architect - [DSA-SS/CC]	IV	BSE-1E, S-2, N-B	BSE-2N, S-4, N-D

1. ASCE 41 provides acceptance criteria (e.g., m, rotation) for Immediate Occupancy (S1), Life Safety (S3) and Collapse Prevention (S5), and specifies in Sections 2.3.1.2.1 and 2.3.1.4.1 the method to interpolate values for S-2 and S-4, respectively. For nonstructural components, N-A corresponds to the Operational level, N-B to the Position Retention, N-C to the Life Safety level, N-D to the Hazards Reduced, and N-E to the Not Considered. When evaluating for the Hazards Reduced Nonstructural Performance Level, the requirements need not be greater than what would be required by ASCE 7 nonstructural provisions for new construction.
2. Buildings evaluated and retrofitted to meet the structural and nonstructural requirements for a new building as given in the California Building Code as adopted by DSA or BSC, as applicable, are deemed to meet the seismic performance requirements of this section.
3. Buildings complying with the requirements of the exception in Section 319.1 are deemed to meet the seismic performance requirements of this section.

used, the project must have project peer review as prescribed in Section 322.

317.9 Any construction required by this chapter shall include structural observation by the registered design professional who is responsible for the structural design in accordance with Section 319.10.

317.10 Where Method B of Section 321 is used or is required by Section 319.7, the proposed method of building evaluation and design procedures must be accepted by the building official prior to the commencement of the work.

317.11 Voluntary lateral-force-resisting system modifications. Where the exception of Section 317.2 applies, modifications of existing structural components and additions of new structural components that are initiated for the purpose of improving the seismic performance of an existing structure and that are not required by other portions of this chapter are permitted under the requirements of Section 319.12.

SECTION 318 DEFINITIONS

318.1 In addition to the definitions given in Section 202, for the purposes of Sections 317 through 323, certain terms are defined as follows:

[DSA-SS & DSA-SS/CC] For the purposes of Section 317 through 323, definitions of terms given in Section 4-208 or 4-314 of the California Administrative Code govern over those in Section 202.

ADDITION [BSC] means any work that increases the floor or roof area or the volume of enclosed space of an existing building, and is structurally attached to the existing building by connections that are required for transmitting vertical or horizontal loads between the addition and the existing structure.

ALTERATION [BSC] means any change within or to an existing building, which does not increase and may decrease the floor or roof area or the volume of enclosed space.

BSE-C RESPONSE ACCELERATION PARAMETERS [BSC] are the parameters (S_{XS} and S_{XI}) taken from 5-percent/50-year maximum direction spectral response acceleration curves or by a Site Specific Response Spectrum developed in accordance with ASCE 41, Section 2.4.2.1.

BSE-R RESPONSE ACCELERATION PARAMETERS [BSC] are the parameters (S_{XS} and S_{XI}) taken from 20-percent/50-year maximum direction spectral response acceleration curves or by a Site Specific Response Spectrum developed in accordance with ASCE 41, Section 2.4.2.1.

REPAIR as used in this chapter means the design and construction work undertaken to restore or enhance the structural and nonstructural load-resisting system participating in the lateral response and stability of a structure that has experienced damage from earthquakes or other destructive events.

SECTION 319 SEISMIC CRITERIA SELECTION FOR EXISTING BUILDINGS

319.1 Basis for evaluation and design. This section determines what technical approach is to be used for the seismic evaluation and design for existing buildings. For those buildings or portions of buildings for which Section 317 requires action, the procedures and limitations for the evaluation of existing buildings and design of retrofit systems and/or repair thereof shall be implemented in accordance with this section.

One of the following approaches must be used:

1. Method A of Section 320;
2. Method B of Section 321, with independent review of a peer reviewer as required in Section 322; or
3. For state-owned buildings only, the use of one of the specific procedures listed in Section 319.1.1.

When Method B is chosen it must be approved by the building official, and, where applicable, by the peer reviewer. All referenced standards in ASCE 41 shall be replaced by referenced standards listed in Chapter 35 of the California Building Code.

Exceptions:

1. **[BSC]** For buildings constructed to the requirements of California Building Code, 2016 or later edition, as adopted by the governing jurisdiction, that code is permitted to be used in place of those specified in Section 319.1.
2. **[DSA-SS & DSA-SS/CC]** For the conversion of nonconforming buildings to conforming school buildings in accordance with Section 4-307 of the California Administrative Code, nonconforming buildings constructed to the requirements of California Building Code, 2016 or later edition, that code as it was adopted by the governing jurisdiction is permitted to be used in place of those specified in Section 319.1 provided the building complies with Seismic Design Category D or higher.

319.1.1 Specific procedures. **[BSC]** For state-owned buildings, the following specific procedures located in Appendix A may be used, without peer review, for their respective types of construction to comply with the seismic performance requirements for Risk Category I, II or III buildings:

1. Seismic Strengthening Provisions for Unreinforced Masonry Bearing Wall Buildings (Chapter A1).
2. Earthquake Hazard Reduction in Existing Reinforced Concrete and Reinforced Masonry Wall Buildings with Flexible Diaphragms (Chapter A2).

319.1.2 When a design project is begun under Method B the selection of the peer reviewer is subject to the approval of the building official. Following approval by the peer reviewer, the seismic criteria for the project and the planned evaluation provisions must be approved by the

building official. The approved seismic criteria and evaluation provisions shall apply. Upon approval of the building official these are permitted to be modified.

319.1.3 For state-owned and community college buildings, where unreinforced masonry is not bearing, it may be used only to resist applied lateral loads. Where unreinforced masonry walls are part of the structure they must be assessed for stability under the applicable nonstructural evaluation procedure.

319.1.4 Public schools. [DSA-SS] For public schools, unreinforced masonry shall not be used to resist in-plane or out-of-plane seismic forces or superimposed gravity loads.

319.1.5 Public schools. [DSA-SS] For public schools of light-frame construction, horizontal diaphragms and vertical shear walls shall consist of either diagonal lumber sheathing or structural panel sheathing. Braced horizontal diaphragms may be acceptable when approved by DSA. Straight lumber sheathing may be used in combination with diagonal or structural panel sheathing as diaphragms or shear walls. Let-in bracing, plaster (stucco), hollow clay tile, gypsum wallboard and particleboard sheathing shall not be assumed to resist seismic forces.

319.2 Existing conditions. The existing condition and properties of the entire structure must be determined and documented by thorough inspection of the structure and site, review of all available related construction documents, review of geotechnical and engineering geologic reports, and performance of necessary testing and investigation. Where samples from the existing structure are taken or in situ tests are performed, they shall be selected and interpreted in a statistically appropriate manner to ensure that the properties determined and used in the evaluation or design are representative of the conditions and structural circumstances likely to be encountered in the structure as a whole. Adjacent structures or site features that may affect the retrofit design shall be identified.

The entire load path of the seismic-force-resisting system shall be determined, documented and evaluated. The load path includes all the horizontal and vertical elements participating in the structural response: such as diaphragms, diaphragm chords, diaphragm collectors, vertical elements such as walls frames, braces; foundations and the connections between the components and elements of the load path. Repaired or retrofitted elements and the standards under which the work was constructed shall be identified.

Data collection in accordance with ASCE 41 Section 6.2 shall meet the following minimum levels:

1. **[BSC]** For state-owned buildings, the requirements shall be met following the data collection requirements of ASCE 41, Section 6.2.
2. **[DSA-SS, DSA-SS/CC]** For public schools and community college buildings constructed in conformance with the Field Act, the “Usual” level as defined in ASCE 41, Section 6.2.2.

3. **[DSA-SS, DSA-SS/CC]** For public schools and community college buildings not constructed in conformance with the Field Act, the “Comprehensive” level as defined in ASCE 41, Section 6.2.3.

Concrete material requirements and testing for public school and community college buildings shall also comply with Sections 1911A and 1909.5 of the California Building Code, respectively.

Qualified test data from the original construction may be accepted, in part or in whole, by the enforcement agency to fulfill the data collection requirements.

Exceptions:

1. The number of samples for data collection may be adjusted with approval of the enforcement agency when it has been determined that adequate information has been obtained or additional information is required.
2. Welded steel moment frame connections of buildings that may have experienced potentially damaging ground motions shall be inspected in accordance with Chapters 3 and 4, FEMA 352, Recommended Post Earthquake Evaluation and Repair Criteria for Welded Moment-Frame Construction for Seismic Applications (July 2000).

Where original building plans and specifications are not available, “as-built” plans shall be prepared that depict the existing vertical and lateral structural systems, exterior elements, foundations and nonstructural systems in sufficient detail to complete the design.

Data collection shall be directed and observed by the project structural engineer or design professional in charge of the design.

319.3 Site geology and soil characteristics. Soil profile shall be assigned in accordance with the requirements of Chapter 18 of the California Building Code.

319.4 Risk categories. Each structure shall be placed in one of the Risk Categories in accordance with the requirements of the California Building Code.

319.5 Configuration requirements. Each structure shall be designated structurally regular or irregular in accordance with the requirements of ASCE 41, Sections 7.3.1.1.1 to 7.3.1.1.4.

319.6 General selection of the design method. The requirements of Method B (Section 321) may be used for any existing building.

319.7 Prescriptive selection of the design method. The requirements of Method A (Section 320) or the specific procedures for applicable building types given in Section 319.1.1 are permitted to be used except under the following conditions, where the requirements of Method B (Section 321) must be used.

- 319.7.1** When the building contains prestressed or post-tensioned structural components (beams, columns, walls or slabs) or contains precast structural components (beams, columns, walls or flooring systems).

319.7.2 When the building is classified as irregular in vertical or horizontal plan. If the evaluation and retrofit is in accordance with Table 317.5 Footnote 2 or 3, the building shall be classified by application of ASCE 7, Section 12.3.2. If the evaluation and retrofit is in accordance with ASCE 41, the building shall be classified as irregular when an irregularity defined in ASCE 41, Sections 7.3.1.1.1 to 7.3.1.1.4 exists.

Exception: Section 319.7.2 does not apply in the following conditions:

1. The retrofit design removes the configurational attributes that caused the building to be classified as irregular.
2. The irregularity is demonstrated not to affect the seismic performance of the building.

319.7.3 For any building that is assigned to Risk Category IV.

319.7.4 For any building using undefined or hybrid structural systems.

319.7.5 When seismic isolation or energy dissipation systems are used in the retrofit or repair, either as part of the existing structure or as part of the modifications.

319.7.6 When the height of the structure exceeds 240 feet (73 152 mm).

319.7.7 When ASCE 41 is the evaluation standard and its application requires the use of nonlinear procedures.

319.8 Strength requirements. All components of the lateral-force-resisting system must have the strength to meet the acceptance criteria prescribed in ASCE 41, Chapter 7 or as prescribed in the applicable Appendix A chapter of this code if a specific procedure in Section 319.1.1 is used. Any component not having this strength shall have its capacity increased by modifying or supplementing its strength so that it exceeds the demand, or the demand is reduced to less than the existing strength by making other modifications to the structural system.

Exception: A component's strength is permitted to be less than that required by the specified seismic load combinations if it can be demonstrated that the associated reduction in seismic performance of the component or its removal due to the failure does not result in a structural system that does not comply with the required performance objectives of Section 317. If this exception is taken for a component, then it cannot be considered part of the primary lateral-load-resisting system.

319.9 Nonstructural component requirements. Where the nonstructural performance levels required by Section 317, Table 317.5 are N-D or higher, mechanical, electrical and plumbing components shall comply with the provisions of ASCE 41, Chapter 13, Section 13.2.

Exception: Modifications to the procedures and criteria may be made subject to approval by the building official, and concurrence of the peer reviewer if applicable. All reports and correspondence shall also be forwarded to the building official.

319.10 Structural observation, testing and inspection. Structural observation, testing and inspection as used in this section shall mean meeting the requirements of Chapter 17 of the California Building Code, with a minimum allowable level of investigation corresponding to seismic design category (SDC) D. Structural observation visits shall occur at significant construction stages and at the completion of the structural retrofit. Structural observation shall be provided for all structures.

Additional requirements: [DSA-SS, DSA-SS/CC] For public schools and community colleges, construction material testing, inspection and observation during construction shall also comply with the California Administrative Code.

319.10.1 The requirement for structural observation shall be noted and prominently displayed on the front sheet of the approved plans and incorporated into the general notes on the approved plans.

319.10.2 Preconstruction meeting. A preconstruction meeting is mandatory for all projects which require structural observation. The meeting shall include, but is not limited to, the registered design professional, structural observer, general constructor, affected subcontractors, the project inspector and a representative of the enforcement agency (designated alternates may attend if approved by the structural observer). The structural observer shall schedule and coordinate this meeting. The purpose of the meeting is to identify and clarify all essential structural components and connections that affect the lateral and vertical load systems and to review scheduling of the required observations for the project's structural system retrofit.

319.11 Temporary actions. When compatible with the building use, and the time phasing for both use and the retrofit program, temporary shoring or other structural support is permitted to be considered. Temporary bracing, shoring and prevention of falling hazards are permitted to be used to qualify for Item 1 in Section 319.12 that allows inadequate capability in some existing components, as long as the required performance levels given in Section 317 can be provided by the permanent structure. The consideration for such temporary actions shall be noted in the design documents.

319.12 Voluntary modifications to the lateral-force resisting system. Where modifications of existing structural components and additions of new structural components are initiated for the purpose of improving the lateral-force resisting strength or stiffness of an existing structure and they are not required by other sections of this code, then they are permitted to be designed to meet an approved seismic performance criteria provided that an engineering analysis is submitted that follows:

1. The capacity of existing structural components required to resist forces is not reduced, unless it can be demonstrated that reduced capacity meets the requirements of Section 319.8.
2. The lateral loading to or strength requirement of existing structural components is not increased beyond their capacity.

3. New structural components are detailed and connected to the existing structural components as required by the California Building Code.
4. New or relocated nonstructural components are detailed and connected to existing or new structural components as required by the California Building Code.
5. A dangerous condition is not created.

Use of ASCE 41 Tier 1 and Tier 2 deficiency only retrofit procedures are pre-approved for use where Section 317.3 does not require an assessment.

319.12.1 State-owned buildings. [BSC] Voluntary modifications to lateral force-resisting systems conducted in accordance with Appendix A of this code and the referenced standards of the California Building Code shall be permitted.

319.12.1.1 Design documents. [BSC] When Section 319.12 is the basis for structural modifications, the approved design documents must clearly state the scope of the seismic modifications and the accepted criteria for the design. The approved design documents must clearly have the phrase “The seismic requirements of the California Existing Building Code have not been checked to determine if these structural modifications meet the full seismic evaluation and strengthening requirements of Sections 317-322: the modifications proposed are to a different seismic performance standard than would be required in Section 319 if they were not voluntary as allowed in Section 319.12.”

319.12.2 Public schools and community colleges. [DSA-SS, DSA-SS/CC] When Section 319.12 is the basis for structural modifications, the approved design documents must clearly indicate the scope of modifications and the acceptance criteria for the design.

**SECTION 320
METHOD A**

320.1 General. The retrofit design shall employ the Linear Static or Linear Dynamic Procedures of ASCE 41, Section 7.4.1 or 7.4.2, and comply with the applicable general requirements of ASCE 41, Chapters 6 and 7. The earthquake hazard level and performance level given specified in Section 317.5 for the building’s risk category shall be used. Structures shall be designed for seismic forces coming from any horizontal direction.

**SECTION 321
METHOD B**

321.1 The existing or retrofitted structure shall be demonstrated to have the capability to sustain the deformation response due to the specified earthquake ground motions and meet the seismic performance requirements of Section 317. The registered design professional shall provide an evaluation of the response of the existing structure in its modified configuration and condition to the ground motions specified.

If the building’s seismic performance is evaluated as satisfactory and the peer reviewer(s) and the enforcement agency concurs, then no further structural retrofit and/or repair of the lateral load-resisting system is required.

When the evaluation indicates the building does not meet the required performance levels given in Table 317.5 for the risk category, then a retrofit and/or repair design shall be prepared that provides a structure that meets these performance objectives and reflects the appropriate consideration of existing conditions. Any approach to analysis and design is permitted to be used, provided that the approach shall be rational, shall be consistent with the established principals of mechanics and shall use the known performance characteristics of materials and assemblages under reversing loads typical of severe earthquake ground motions.

Exception: Further consideration of the structure’s seismic performance may be waived by the enforcement agency if both the registered design professional and peer reviewer(s) conclude that the structural system can be expected to perform at least as well as required by the provisions of this section without completing an analysis of the structure’s compliance with these requirements. A detailed report shall be submitted to the responsible building official that presents the reasons and basis for this conclusion. This report shall be prepared by the registered design professional. The peer reviewer(s) shall concur in this conclusion and affirm to it in writing. The building official shall either approve this decision or require completion of the indicated work specified in this section prior to approval.

321.2 The approach, models, analysis procedures, assumptions on material and system behavior and conclusions shall be peer reviewed in accordance with the requirements of Section 322 and accepted by the peer reviewer(s).

Exceptions:

1. The enforcement agency may perform the work of peer review when qualified staff is available within the jurisdiction.
2. The enforcement agency may modify or waive the requirements for peer review when appropriate.

321.2.1 The approach used in the development of the design shall be acceptable to the peer reviewer and the enforcement agency and shall be the same method as used in the evaluation of the building. Approaches that are specifically tailored to the type of building, construction materials and specific building characteristics may be used, if they are acceptable to the independent peer reviewer. The use of Method A allowed procedures may also be used under Method B.

321.2.2 Any method of analysis may be used, subject to acceptance by the peer reviewer(s) and the building official. The general requirements given in ASCE 41, Chapters 6 and 7, shall be complied with unless exceptions are accepted by the peer reviewer(s) and building official. Use of other than ASCE 41 procedures in Method B requires building official concurrence before implementation.

321.2.3 Prior to implementation, the procedures, methods, material assumptions and acceptance/rejection criteria proposed by the registered design professional will be peer reviewed as provided in Section 322. Where nonlinear procedures are used, prior to any analysis, the representation of the seismic ground motion shall be reviewed and approved by the peer reviewer(s) and the building official.

[DSA-SS, DSA-SS/CC] For public school and community college projects, the representation of the seismic ground motion shall be reviewed and approved by the California Geological Survey.

321.2.4 The conclusions and design decisions shall be reviewed and accepted by the peer reviewer(s) and the building official.

SECTION 322 PEER REVIEW REQUIREMENTS

322.1 General. Independent peer review is an objective, technical review by knowledgeable reviewer(s) experienced in the structural design, analysis and performance issues involved. The reviewer(s) shall examine the available information on the condition of the building, the basic engineering concepts employed and the recommendations for action.

322.2 Timing of independent review. The independent reviewer(s) shall be selected prior to initiation of substantial portions of the design and/or analysis work that is to be reviewed, and review shall start as soon as practical after Method B is adopted and sufficient information defining the project is available.

322.3 Qualifications and terms of employment. The reviewer(s) shall be independent from the design and construction team.

322.3.1 The reviewer(s) shall have no other involvement in the project before, during or after the review, except in a review capacity.

322.3.2 The reviewer(s) shall be selected and paid by the owner and shall have technical expertise in the evaluation and retrofit of buildings similar to the one being reviewed, as determined by the enforcement agency.

322.3.3 The reviewer (or in the case of review teams, the chair) shall be a California-licensed structural engineer who is familiar with the technical issues and regulations governing the work to be reviewed.

Exception: Other individuals with acceptable qualifications and experience may be a peer reviewer(s) with the approval of the building official.

322.3.4 The reviewer shall serve through completion of the project and shall not be terminated except for failure to perform the duties specified herein. Such termination shall be in writing with copies to the enforcement agency, owner and the registered design professional. When a reviewer is terminated or resigns, a qualified replacement shall be appointed within 10 working days, and the reviewer shall submit copies of all reports, notes and correspondence to the responsible building official, the owner

and the registered design professional within 10 working days of such termination.

322.3.5 The peer reviewer shall have access in a timely manner to all documents, materials and information deemed necessary by the peer reviewer to complete the peer review.

322.4 Scope of review. Review activities shall include, where appropriate, available construction documents, design criteria and representative observations of the condition of the structure, all inspection and testing reports, including methods of sampling, analytical models and analyses prepared by the registered design professional and consultants, and the retrofit or repair design. Review shall include consideration of the proposed design approach, methods, materials, details and constructability.

Changes observed during construction that affect the seismic-resisting system shall be reported to the reviewer in writing for review and recommendation.

322.5 Reports. The reviewer(s) shall prepare a written report to the owner and building official that covers all aspects of the review performed, including conclusions reached by the reviewer(s). Reports shall be issued after the schematic phase, during design development, and at the completion of construction documents but prior to submittal of the project plans to the enforcement agency for plan review. When acceptable to the building official, the requirement for a report during a specific phase of the project development may be waived.

Such reports should include, at the minimum, statements of the following:

1. Scope of engineering design peer review with limitations defined.
2. The status of the project documents at each review stage.
3. Ability of selected materials and framing systems to meet performance criteria with given loads and configuration.
4. Degree of structural system redundancy and the deformation compatibility among structural and nonstructural components.
5. Basic constructability of the retrofit or repair system.
6. Other recommendations that would be appropriate to the specific project.
7. Presentation of the conclusions of the reviewer identifying any areas that need further review, investigation and/or clarification.
8. Recommendations.

The last report prepared prior to submittal of permit documents to the enforcement agency shall include a statement indicating that the design is in conformance with the approved evaluation and design criteria.

322.6 Response and resolutions. The registered design professional shall review the report from the reviewer(s) and shall develop corrective actions and responses as appropriate. Changes observed during construction that affect the

seismic-resisting system shall be reported to the reviewer in writing for review and recommendations. All reports, responses and resolutions prepared pursuant to this section shall be submitted to the responsible enforcement agency and the owner along with other plans, specifications and calculations required. If the reviewer resigns or is terminated prior to completion of the project, then the reviewer shall submit copies of all reports, notes and correspondence to the responsible building official, the owner and the registered design professional within 10 working days of such termination.

322.7 Resolution of conflicts. When the conclusions and recommendations of the peer reviewer conflict with the registered design professional’s proposed design, the enforcement agency shall make the final determination of the requirement for the design.

school or community college portion, the entire structure shall be rehabilitated in accordance with this division.

2. Be retrofitted as necessary to protect the occupants from falling hazards of the unrehabilitated portion of the building, and;
3. Be retrofitted as necessary to protect required exitways being blocked by collapse or falling hazards of the unrehabilitated portion.

**SECTION 323 [DSA-SS, DSA-SS/CC]
ADDITIONAL REQUIREMENTS FOR PUBLIC
SCHOOLS AND COMMUNITY COLLEGES**

The requirements of Section 323 apply only to public schools under the jurisdiction of the Division of the State Architect-Structural Safety (DSA-SS, refer to Section 1.9.2.1) and community colleges under the jurisdiction of the Division of the State Architect—Structural Safety/Community Colleges (DSA-SS/CC, refer to Section 1.9.2.2).

323.1 Evaluation and design criteria report. During the schematic phase of the project, the owner or the registered design professional in charge of the design shall prepare and sign an Evaluation and Design Criteria Report in accordance with Sections 4-306 and 4-307(a) of the California Administrative Code. The report shall be submitted to the DSA for review and approval prior to proceeding with design development of the rehabilitation.

The Evaluation and Design Criteria Report shall:

1. Identify the building(s) structural and nonstructural systems, potential deficiencies in the elements or systems and the proposed method for retrofit.
2. Identify geological and site-related hazards.
3. Propose the methodology for evaluation and retrofit design.
4. Propose the complete program for data collection (Section 319.2).
5. Include existing or “as-built” building plans, reports and associated documents of the existing construction.

323.2 Rehabilitation involving only portions of structures. Where only a portion(s) of a structure is to be rehabilitated, the public school or community college portion of the structure shall:

1. Be seismically separated from the unrehabilitated portion in accordance with Chapter 16 of the California Building Code, or the entire structure shall be rehabilitated in accordance with this section. For structures in which the unrehabilitated portion is above or below the

**CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
CHAPTER 3A – PROVISIONS FOR ALL COMPLIANCE METHODS [OSHPD 1]**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter										X												
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 3A

PROVISIONS FOR ALL COMPLIANCE METHODS

User note:

About this chapter: Chapter 3 explains the three compliance options for alterations and additions available in the code. In addition, this chapter also lays out the methods to be used for seismic design and evaluation throughout this code. Finally, this chapter clarifies that provisions in other I-Codes[®] related to repairs, alterations, additions, relocation and changes of occupancy must also be addressed unless they conflict with this code. In that case, this code takes precedence.

SECTION 301A ADMINISTRATION

301A.1 Applicability. *The provisions of this chapter shall control the alteration, repair, addition and change of occupancy of existing structures for applications listed in Sections 1.10.1 [OSHPD 1] regulated by the Office of Statewide Health Planning and Development (OSHPD).*

California Energy Commission, State Fire Marshal and DSA-AC requirements for existing structures shall be enforced by the Office of Statewide Health Planning and Development (OSHPD).

301A.1.1 Bleachers, grandstands and folding and telescopic seating. Existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

301A.2 Repairs. Repairs shall comply with the requirements of Chapter 4A.

301A.3 Alteration, addition or change of occupancy. The alteration, addition or change of occupancy of all existing buildings or structures shall comply with one of the methods or categories listed in Section 301A.3.1, 301A.3.2 or 301A.3.3. Section 304A.3.2 applies to all methods or categories. Sections 301A.3.1 through 301A.3.3 shall not be applied in combination with each other, except when permitted by the enforcement agency.

Exception: Subject to the approval of the enforcement agency, alterations complying with the laws in existence at the time the building or the affected portion of the building was built shall be considered in compliance with the provisions of this code. New structural members added as part of the alteration shall comply with the California Building Code.

301A.3.1 Prescriptive compliance method. Alterations, additions and changes of occupancy complying with Chapter 5A of this code for existing buildings or structures shall be considered in compliance with the provisions of this code.

301A.3.2 Nonconforming buildings. Alterations, additions and changes of occupancy to existing buildings or structures designed in accordance with the Pre-1973 building code complying with Section 304A.3.1 and the applicable requirements herein shall be considered in compliance with the provisions of this code.

301A.3.3 Performance-based method. Alterations, additions and changes of occupancy to existing buildings or

structures complying with Sections 304A.3.4 and 304A.3.5 of this code shall be considered in compliance with the provisions of this code.

301A.4 Moved structures. Structures moved into or within the jurisdiction shall comply with the provisions of the California Building Code for new structures.

301A.5 Compliance with accessibility. Accessibility requirements for existing buildings shall comply with the California Building Code, Part 2 Volume 1 Chapter 11B, Section 201 "Existing Buildings and Facilities."

301A.6 Peer review requirements. Peer review requirements shall comply with California Building Code Section 1617A.1.41.

301A.7 Earthquake monitoring instruments for existing buildings. Earthquake monitoring instrumentation of existing buildings shall comply with Section 313A.

301A.8 Compliance alternatives for services/systems and utilities. Compliance alternatives for services/systems and utilities shall comply with Section 310A.

301A.9 Compliance alternatives for means of egress. Means of egress through existing buildings shall comply with Section 311A.

301A.10 Removal of hospital buildings from general acute care services. Removal of hospital buildings from General Acute Care Services shall comply with Section 312A.

301A.11 Hospital buildings removed from general acute care services. Hospital buildings removed from general acute care services shall comply with Section 312A.

SECTION 302A GENERAL PROVISIONS

302A.1 Dangerous conditions. The code official shall have the authority to require the elimination of conditions deemed dangerous.

302A.2 Additional codes. Alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall comply with the provisions for alterations, repairs, additions and changes of occupancy or relocation, respectively, in the California Fire Code, California Mechanical Code, California Plumbing Code and California Electrical Code. Where provisions of the other codes conflict with provisions of this chapter, the provisions of this chapter shall take precedence.

302A.2.1 Additional codes in health care. In existing Group I-2 occupancies, ambulatory health care facilities, outpatient clinics and hyperbaric facilities, alterations, repairs, additions and changes of occupancy to, or relocation of, existing buildings and structures shall also comply with NFPA 99.

302A.3 Existing materials and equipment. Materials and equipment already in use in a building in compliance with requirements or approvals in effect at the time of their erection or installation shall be permitted to remain in use unless determined by the code official to be unsafe in accordance with California Building Code Section 116.

302A.3.1 Existing seismic force-resisting systems. Where the existing seismic force-resisting system is a type that can be designated ordinary or is a welded steel moment frame constructed under a permit issued prior to October 25, 1994, values of R , Ω_0 and C_d for the existing seismic force-resisting system shall be those specified by this code for an ordinary system unless it is demonstrated that the existing system will provide performance equivalent to that of a detailed, intermediate or special system.

302A.4 New and replacement materials. Except as otherwise required or permitted by this code, materials and equipment permitted by the applicable code for new construction shall be used. Like materials shall be permitted for repairs and alterations, provided no hazard to life, health or property is created. Hazardous materials shall not be used where the code for new construction would not permit their use in buildings of similar occupancy, purpose and location.

[BS] 302A.4.1 New structural members and connections. New structural members and connections shall comply with the detailing provisions of the California Building Code for new buildings of similar structure, purpose and location.

Exception: Where alternative design criteria are specifically permitted.

302A.5 Occupancy and use. Where determining the appropriate application of the referenced sections of this code, the occupancy and use of a building shall be determined in accordance with Chapter 3 of the California Building Code.

302A.6 Maintenance. Buildings and structures, and parts thereof, shall be maintained in a safe and sanitary condition. Devices or safeguards which are required by this code shall be maintained in conformance with the code edition under which they were installed. The owner or the owner's designated agent shall be responsible for the maintenance of buildings and structures. To determine compliance with this subsection, the building official shall have the authority to require a building or structure to be re-inspected. The requirements of this chapter shall not provide the basis for removal or abrogation of fire protection and safety systems and devices in existing structures.

302A.7 Construction documents for retrofit or rehabilitation. The design loads and other information pertinent to the structural design required by California Building Code Section 1603A shall be included in the drawings. In addition to the information required by California Building Code Section 1603A.1.5, the drawings shall show the ground motion haz-

ard used for the retrofit or rehabilitation as either a percentage of the California Building Code prescribed ground motion for new hospital buildings, or ASCE 41 seismic hazard designation, or a probability of exceedance in a specified time period, or a return period for exceedance of the specified ground motion.

**SECTION 303A
RESERVED**

**SECTION 304A
STRUCTURAL DESIGN LOADS AND
EVALUATION AND DESIGN PROCEDURES**

[BS] 304A.1 Live loads. Where an addition or alteration does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition or alteration. If the approved live load is less than that required by Section 1607A of the California Building Code, the area designated for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition or alteration results in increased design live load, the live load required by Section 1607A of the California Building Code shall be used.

[BS] 304A.2 Snow loads on adjacent buildings. Where an alteration or addition changes the potential snow drift effects on an adjacent building, the code official is authorized to enforce Section 7.12 of ASCE 7.

[BS] 304A.3 Additions, alterations, repairs and seismic retrofit to existing buildings or structures.

[BS] 304A.3.1 Structures designed in accordance with pre-1973 building code. Provisions of this section shall apply to hospital buildings which were originally designed to pre-1973 building codes and not designated as SPC 3 or higher in accordance with Chapter 6 of the California Administrative Code.

304A.3.1.1 Incidental and minor structural alteration, additions or repairs. Incidental and minor structural additions shall be permitted, provided the additions meet the California Building Code for new construction using importance factor, I_e , equal to or greater than 1.0. Alterations or repair to existing gravity and lateral force-resisting systems shall be made to conform to the requirements of Section 503A or Chapter 4A, respectively, using importance factor, I_e , equal to or greater than 1.0.

1. **Nonstructural components.** Component importance factor, I_p , shall be permitted to be 1.0.

Exception: Components required for life-safety purposes after an earthquake, including emergency and standby power systems, mechanical smoke removal systems, fire protection sprinkler systems, fire alarm control panels and egress stairways shall have a component importance factor (I_p) of 1.5.

304A.3.1.2 Major structural alteration, additions or repairs. Major structural alterations, additions or

repairs shall be in accordance with Section 304A.3.4.1 or 304A.3.4.3 as applicable.

304A.3.2 Seismic evaluation and retrofit of general acute care hospitals for compliance with the California Administrative Code, Chapter 6. Notwithstanding any other requirements of this code, existing general acute care hospitals shall comply with the seismic evaluation requirements specified in Chapter 6, of the California Administrative Code, when applicable. Seismic retrofit to comply with requirements specified in Chapter 6 of the California Administrative Code shall be permitted to be in accordance with these provisions. When load combinations which do not include seismic forces are required, the new building provisions of this code shall be applicable.

304A.3.3 SPC-4D. Nonconforming hospital buildings satisfying the following requirements and one of Sections 501A.3.1, 501A.3.2 or 304A.3.4.5, but not a combination thereof, shall be considered to satisfy the requirements of SPC-4D.

1. Approval of construction documents based on building characterization in accordance with the California Administrative Code (CAC) Chapter 6 Section 2.1.2.1, material properties in accordance with the CAC Chapter 6 Section 2.1.2.2 and Section 304A.5.3 of this code, and a complete rational structural analysis shall be required.
2. Where the SPC-4D upgrade involves construction, a building permit prior to construction shall be required.
3. Where multiple building permits are used to upgrade a building to SPC-4D, a complete rational structural analysis to justify compliance with SPC-4D, for the building in its final configuration, shall be submitted as part of the construction documents submittal to the Office for the last project.
4. Where the SPC-4D upgrade involves construction, buildings shall be assigned to SPC-4D after all projects required for SPC-4D are closed in compliance.

304A.3.4 Performance objectives of performance-based methods. Except for the modifications as set forth in Sections 304A.3.4 and 304A.3.5, all additions, alterations, repairs and seismic retrofit to existing structures or portions thereof shall be permitted to be designed in accordance with the provisions of ASCE 41. When load combinations which do not include seismic forces are required, the new building code provisions of this code shall be applicable. Required building performance objectives under ASCE 41 shall be as follows:

304A.3.4.1 For general acute care hospital buildings along with all structures required for their continuous operation or access/egress:

1. Immediate Occupancy (IO) Structural Performance Level (S-1) as defined in Section 2.3.1.1 at Basic Safety Earthquake 1N (BSE-1N) Seismic Hazard Level; and

2. Life Safety (LS) Structural Performance Level (S-3) as defined in Section 2.3.1.3 at Basic Safety Earthquake 2N (BSE-2N) Seismic Hazard Level; and
3. The nonstructural components shall satisfy the requirements of this code for new construction.

Exception: Performance objectives for upgrading nonconforming hospital buildings to SPC-4D and for incidental or minor alterations or repairs of SPC-4D buildings shall be in accordance with Section 304A.3.4.5 of this code.

304A.3.4.2 For incidental and minor additions, alterations or repairs of pre-1973 hospital buildings which will not be used for general acute care services after January 1, 2030:

1. Life Safety Structural Performance (S-3) Level as defined in ASCE 41 Section 2.3.1.3 at the Basic Safety Earthquake 1E (BSE-1E) Seismic Hazard Level; and
2. Collapse Prevention (CP) Building Performance Level (5-D) in accordance with Section 2.3.3.4 at the Basic Safety Earthquake 2E (BSE-2E) Seismic Hazard Level; and
3. The nonstructural components shall satisfy the requirements of Position Retention Nonstructural Performance Level (N-B) in accordance with ASCE 41 Section 2.3.2.2 at BSE-1E Seismic Hazard Level.

304A.3.4.3 All other hospital buildings:

1. Operational Building Performance Level of (1-A) as defined in Section 2.3.3.1 at Basic Safety Earthquake 1N (BSE-1N) Seismic Hazard Level; and
2. Life Safety (LS) Building Performance Level (S-3) as defined in Section 2.3.1.3 at Basic Safety Earthquake 2N (BSE-2N) Seismic Hazard Level.

304A.3.4.4 SPC 2 using ASCE 41. Structures shall be considered to comply with SPC 2 requirements of Table 2.5.3, Chapter 6 of the California Administrative Code, when all of the following are satisfied:

1. Life Safety Structural Performance Level (S-3) in accordance with Section 2.3.1.3 of ASCE 41 at BSE-1E; and
2. Items identified in Chapter 6, Article 10 of the California Administrative Code satisfying the requirements of Position Retention nonstructural Performance Level (N-B) in accordance with Section 2.3.2.2 at BSE-1E.

304A.3.4.5 SPC-4D using ASCE 41. Structures shall be deemed to comply with the SPC-4D requirements of Table 2.5.3, Chapter 6 of the California Administrative Code, when all of the following are satisfied:

1. Damage control Structural Performance Level (S-2) in accordance with Section 2.3.1.2.1 of ASCE 41 at BSE-1E; and

2. Collapse Prevention Structural Performance Level (S-5) in accordance with Section 2.3.1.5 of ASCE 41 at BSE-2E; and
3. Items identified in Chapter 6, Article 10 of the California Administrative Code satisfy the requirements of Position Retention Nonstructural Performance Level (N-B) in accordance with Section 2.3.2.2 at BSE-1E.

304A.3.4.5.1 Replace ASCE 41-13 § 7.2.13.2 with the following:

- A. Where the adjacent building was constructed using the 1989 or later edition of the California Building Code and built under OSHPD jurisdiction, the minimum building separation distance specified in Section 7.2.13.1 need not be evaluated for Structural Performance Level Damage Control or lower.
- B. Where adjacent structure or building evaluated is not less than half as tall and adjacent structure has floors/levels that match those of the building being evaluated, the following exceptions apply:
 - 1) For Structural Performance Level of Life Safety or lower, the seismic separation between the adjacent structure and the building being evaluated need not be evaluated.
 - 2) For Structural Performance Level of Damage Control, buildings need not meet the minimum separation distance specified in Section 7.2.13.1 where either a) or b) applies:
 - a) Adjacent structure is more than 2 inches (50.8 mm) times the number of stories below that level away from the building being evaluated at all floor levels that align.
 - b) The adjacent building does not have any of the following structural deficiencies as defined in the California Administrative Code (CAC), Chapter 6, Article 3:
 - 1) Load path (3.1)
 - 2) Weak story (3.3.1)
 - 3) Soft story (3.3.2)
 - 4) Vertical discontinuity (3.3.5) or
 - 5) Torsion (3.3.6)

- C. Where an approved pounding analysis procedure that accounts for the change in dynamic response of the structures caused by impact is used, the evaluated and retrofitted buildings need not meet the minimum separation distance specified in Section 7.2.13.1. Such analysis shall demonstrate that:
 - 1) The structures are capable of transferring forces resulting from impact for

diaphragms located at the same elevation; or

- 2) The structures are capable of resisting all required vertical and lateral forces considering the loss of any elements or components damaged by impact of the structures.

304A.3.4.6 SPC 5 using ASCE 41. Structures shall be considered to comply with SPC 5 requirements of Table 2.5.3, Chapter 6 of the California Administrative Code where all of the following are satisfied:

1. Immediate Occupancy Structural Performance Level (S-1) in accordance with Section 2.3.1.1 of ASCE 41 at BSE-1N;
2. Life Safety Performance Level S-3 in accordance with Section 2.3.1.3 of ASCE 41 at BSE-2N; and
3. Items identified in Chapter 6, Article 10 of the California Administrative Code, satisfying the requirements of Operational Nonstructural Performance Level (N-A) in accordance with Section 2.3.2.1 of ASCE 41 at BSE-1N.

304A.3.4.7 NPC-2 and NPC-3 using ASCE 41: Operational Nonstructural Performance Level (N-A) and Position Retention Nonstructural Performance Level (N-B) of ASCE 41 at BSE-1N shall be considered equivalent to NPC 3/NPC 2 requirements, respectively, of Table 11.1, Chapter 6 of the California Administrative Code. For NPC 3/NPC 2, only components listed in Table 11.1, Chapter 6 of the California Administrative Code for NPC 3/NPC 2 need to satisfy the requirements specified above.

Exception: Evaluation procedure of Article 11, Chapter 6 of the California Administrative Code shall be used for seismic evaluation of NPC 2, NPC 3, NPC 4 or NPC 4D and NPC 5, where specific procedure is not outlined in ASCE 41. Administrative and permitting provisions outlined in Article 11, Chapter 6 of the California Administrative Code shall apply.

304A.3.4.8 NPC-4 or NPC 4D and NPC-5 using ASCE 41: Nonstructural components for Operational Nonstructural Performance Level (N-A) in Section 2.3.2.1 or NPC-4/NPC 4D shall satisfy the requirements of the California Building Code for new construction. Nonstructural components for NPC-5 shall satisfy Operational Performance Level N-A/NPC-4/NPC 4D and California Building Code Section 1617A.1.40 Items 1 & 2.

304A.3.5 Modifications to ASCE 41. The text of ASCE 41 shall be modified as indicated in Sections 304A.3.5.1 through 304A.3.5.16.

304A.3.5.1 ASCE 41 Section 1.1. Modify ASCE 41 Section 1.1 with the following:

Seismic evaluations shall be performed for performance objective specified in Section 304A.3.4 of this

code (CEBC) using procedure of this standard (ASCE 41) as follows:

1. Structural components shall be evaluated in accordance with Tier 3 systematic evaluations procedure in Chapter 6.
2. Nonstructural components shall be evaluated in accordance with Chapter 13.

Exception: For general acute care hospitals, seismic evaluation shall be permitted to be in accordance with Chapter 6 of the California Administrative Code (CAC) when required by provisions of that chapter.

304A.3.5.2 Reserved.

304A.3.5.3 ASCE 41 Section 6.2. Modify ASCE 41 Section 6.2 with the following:

Data Collection Requirements. The extent of data collection shall be at Comprehensive level for all structures, including structures upgraded to SPC-4D. A testing program for materials properties shall be approved by the enforcement agent prior to commencement of material testing work. Previously approved material test results shall be permitted to be used to satisfy part of the comprehensive data collection requirements.

Exception: Data collection at Usual level shall be permitted for structures with SPC-2 or lower target performance objective.

Tension testing of reinforcing bars shall be in accordance with ASTM A615. All test specimens shall be the full section of the bar as rolled (8-in. gage length) and shall not be reduced.

At test sample locations, structural members, slabs and walls shall be repaired to a state that is equivalent to their original condition.

For buildings built under an OSHPD permit based on the 1976 or later edition of the CBC, where materials properties are shown on design drawings and original materials test data are available, no materials testing shall be required when approved by the enforcement agent.

304A.3.5.4 ASCE 41 Section 7.3.2.1. Modify ASCE 41 Section 7.3.2.1 with the following:

Nonlinear Static Procedure. If higher mode effects are significant and building is taller than 75 feet above the base, the Nonlinear Dynamic Procedure shall be used.

304A.3.5.5 ASCE 41 Section 7.5.1. Modify ASCE 41 Section 7.5.1 with the following:

Acceptance Criteria – Drift Limitations. The inter-story drift ratio shall not exceed the drift limits for Risk Category IV buildings in ASCE 7 Table 12.12-1 due to forces corresponding to BSE-1E or BSE-1N, as applicable.

Exception: Larger interstory drift ratios shall be permitted where justified by rational analysis that both structural and nonstructural elements

can tolerate such drift and approved by the enforcement agent.

304A.3.5.6 ASCE 41 Section 7.5.1.4. Modify ASCE 41 Section 7.5.1.4 by the following:

Material Properties. Expected material properties are not permitted to be determined by multiplying lower bound values by the assumed factors specified in Chapters 8 through 12 and shall be based exclusively on materials tests.

304A.3.5.7 ASCE 41 Section 8.4. Modify ASCE 41 Section 8.4 with the following:

Foundation Strength and Stiffness. Foundation and soil strength shall be used to evaluate potential overturning, uplift and sliding for fixed base assumptions, and stiffness for flexible base assumptions, including deformations associated with those actions.

304A.3.5.8 ASCE 41 Section 8.4.1.1. Replace ASCE 41 Section 8.4.1.1 as follows:

Prescriptive Expected Capacities. Not permitted by OSHPD.

304A.3.5.9 ASCE 41 Section 8.4.2.3.2.1 Modify ASCE 41 Sections 8.4.2.3.2.1 and 8.4.2.3.2.2 as follows:

8.4.2.3.2.1 Alternatively, when seismic evaluation is performed for foundation after global analysis of the superstructure is complete, both overturning and axial seismic pseudo force demands are permitted to be divided by the *m*-factors above, provided the foundation is analyzed as a beam on Winkler springs (soil does not resist tension). The vertical spring stiffness values may be determined either from Figure 8-2 or Equation 8-11, or as provided by the geotechnical engineer. Acceptance criteria for soil bearing shall be considered met, based on one of the following methods, either A or B:

- A) Soil spring reactions are limited by the ultimate soil bearing capacity, and the foundation system is stable under the applied loads.
- B) The resisting soil pressure distribution under the footing is triangular such that the maximum soil bearing pressure at any point of the footing is less than the ultimate soil bearing capacity.

Subject to the approval of the authority having jurisdiction, higher soil pressures may be permitted when appropriately justified.

The evaluation of the foundation structural element shall be considered as force controlled in accordance with the material chapters using the bearing pressure distribution under the footing from the same method used for the soil bearing acceptance criteria.

8.4.2.3.2.2 Alternatively, superstructure pseudo force overturning demands to the foundation are permitted to be divided by the appropriate *m*-factors above and applied to the mathematical model representing the foundation system only, re-analyzed as a

beam on Winkler springs (soil does not resist tension). Acceptance criteria for soil bearing shall be considered met, based on one of the following methods, either A or B:

- A) Soil spring reactions are limited by the ultimate soil bearing capacity, and the foundation system is stable under the applied loads.
- B) The resisting soil pressure distribution under the footing is triangular, and the maximum soil bearing pressure at any point of the footing is less than the ultimate soil bearing capacity.

Subject to the approval of the authority having jurisdiction, higher soil pressures may be permitted when appropriately justified.

The evaluation of the foundation structural element shall be considered as force controlled in accordance with the material chapters using the bearing pressure distribution under the footing from the same method used for the soil bearing acceptance criteria.

304A.3.5.10 ASCE 41 Section 8.5.1. Modify ASCE 41 Section 8.5.1 with the following:

The product of $RRS_{bsa} \times RRS_e$ shall not be less than 0.7.

The combined effect of kinematic interaction and foundation damping shall meet the following:

1. The site specific response spectrum modified for soil-structure interaction effects shall not be taken as less than 80 percent of the spectral acceleration as determined from a site-specific response spectrum in accordance with ASCE 7 Section 21.3, or
2. The site specific response spectrum modified for soil-structure interaction effects shall not be taken as less than 70 percent of the spectral acceleration as determined from the design response spectrum and MCE_R response spectrum in accordance with ASCE 7 Sections 11.4.5 and 11.4.6, respectively.

Exception: For the seismic retrofit of existing nonconforming buildings, design ground motion shall be consistent with performance objectives in Section 304A.3.4.

304A.3.5.11 ASCE 41 Section 8.6. Modify ASCE 41 Section 8.6 with the following:

Seismic Earth Pressure. Where the grade difference from one side of the building to another exceeds one-half story height, the seismic increment of earth pressure shall be added to the gravity lateral earth pressure to evaluate the building overturning and sliding stability and the lateral force-resisting system below grade in combination with the building seismic forces.

304A.3.5.12 ASCE 41 Section 10.7.1.1. Modify ASCE 41 Section 10.7.1.1 with the following:

Monolithic Reinforced Concrete Shear Walls and Wall Segments. For nonlinear procedures, shear walls or wall segments with axial loads greater than $0.35 P_o$ shall be included in the model as primary elements with appropriate strength and stiffness degrading properties assigned to those components subject to the approval of the enforcement agent. For linear procedures, the effects of deformation compatibility shall be investigated using moment-curvature section analyses and cyclic testing results of similar components to determine whether strengthening is necessary to maintain the gravity load-carrying capacity of that component.

Horizontal wall segments or spandrels reinforced similar to vertical wall segments or piers shall be classified as wall segments, not shear wall coupling beams, in Tables 10-19 through 10-22.

304A.3.5.13 ASCE 41 Section 10.12.3 Modify ASCE 41 Section 10.12.3 as follows:

Exception: Component actions that are deformation controlled are permitted to use their expected strengths for the acceptance criteria.

304A.3.5.14 ASCE 41 Section 11.1. Modify ASCE 41 Section 11.1 by the following:

Scope: Unreinforced masonry walls (including unreinforced infill walls) and partitions are not permitted for General Acute Care (GAC) hospital buildings.

304A.3.5.15 ASCE 41 Section 14.1. Modify ASCE 41 Section 14.1 by the following:

Scope: For buildings located in Seismic Design Category F, verification of the interstory lateral displacements, the strength adequacy of the seismic force-resisting system and anchorage to the foundation shall be accomplished using the Nonlinear Dynamic Procedure.

304A.3.5.16 ASCE 41 Chapter 15 and 16. Not permitted by OSHPD.

**SECTION 305A
IN-SITU LOAD TESTS**

[BS] 305A.1 General. Where used, in-situ load tests shall be conducted in accordance with Section 1708A of the California Building Code.

**SECTION 306A
ACCESSIBILITY FOR EXISTING BUILDINGS**

306A.1 Scope. Accessibility requirements for existing buildings shall comply with the California Building Code, Part 2, Volume 1, Chapter 11B.

**SECTION 307A–309A
RESERVED**

**SECTION 310A
COMPLIANCE ALTERNATIVES
FOR SERVICES/SYSTEMS AND UTILITIES**

310A.1 General. *The provisions of this section are intended to maintain or increase the current degree of public safety, health and general welfare in existing buildings while permitting repair, alteration, addition and change of occupancy without requiring full compliance with California Building Code Chapters 2 through 33, or Sections 302A.3 and 502A through 506A, except where compliance with other provisions of this code is specifically required in this section.*

Services/systems and utilities that originate in and pass through or under buildings and are necessary to the operation of the hospital buildings shall meet the structural requirements of this section. Examples of services/systems and utilities include but are not limited to normal power; emergency power; nurse call; fire alarm; communication and data systems; space-heating systems; process load systems; cooling systems; domestic hot and cold water systems; means of egress systems; fire-suppression systems; building drain and sewer systems; and medical gas systems that support basic and supplemental services.

After January 1, 2030, services/systems and utilities for acute care hospital buildings shall not originate in or pass through or under a nonhospital or hospital building unless it has approved performance categories of SPC-3 or higher and NPC-5.

310A.1.1 Services/systems and utilities. *Services/systems and utilities that are necessary to the operation of the hospital buildings shall meet the structural requirements of this section, based upon the approved Structural Performance Category (SPC) of the building receiving the services/systems and utilities.*

Services from a conforming building shall be permitted to serve a nonconforming building with prior approval of the Office. The services/systems and utilities in the nonconforming building shall be equipped with fail safe valves, switches or other equivalent devices that allow the nonconforming building to be isolated from the conforming building.

Exception: *Remodel projects that use available existing services/systems and utilities are exempted from the requirements of this section. The enforcing agency shall be permitted to exempt minor addition, minor alteration and minor remodel projects and projects to upgrade existing services/systems and utilities from the requirements of this section.*

310A.1.1.1 Services/systems and utilities for hospital buildings.

310A.1.1.1.1 New hospital buildings, additions, alterations and remodels of conforming (SPC-3, -4, -4D or -5) hospital buildings. *Services/systems and utilities for new hospital buildings and addi-*

tions, alterations or remodels to existing conforming buildings shall originate in hospital buildings that are conforming or have approved performance categories of SPC-3 or higher, and NPC-4/NPC-4D or higher. The services/systems and utilities shall not pass through or under buildings that do not have approved performance categories of SPC-2 or higher and NPC-4/NPC-4D or higher.

Exceptions:

Services/systems and utilities shall be permitted to pass through or under buildings that have approved nonstructural performance categories of NPC-3 or higher or NPC-2, provided that the building has an approved extension to the NPC-3 deadline. The services/systems and utilities feeding the new building addition, alteration or remodel shall conform to the new building provisions of this code and shall be deemed by OSHPD to be free of adverse seismic interactions that could be caused by potential failure of overhead or adjacent components.

310A.1.1.1.2 Additions, alterations and remodels of SPC-2 hospital buildings. *Services/systems and utilities for additions, alterations or remodels of SPC-2 hospital buildings shall be permitted to originate in and pass through or under SPC-2 or higher buildings that have an approved nonstructural performance category of NPC-3 or higher.*

Exception: *Services/systems and utilities shall be permitted to pass through or under buildings that have approved nonstructural performance categories of NPC-2, provided that the building has an approved extension to the NPC-3 deadline. Services/systems and utilities feeding the addition, alteration or remodel shall conform to the nonstructural bracing requirements for new buildings.*

310A.1.1.1.3 Alterations and remodels of SPC-1 hospital buildings. *Services/systems and utilities for alterations or remodels of SPC-1 hospital buildings shall be permitted to originate in and pass through or under SPC-1 or higher buildings that have an approved nonstructural performance category of NPC-2 or higher.*

310A.1.1.1.4 Buildings without SPC/NPC ratings. *When services/systems and utilities for new buildings, additions, alterations or remodels pass through or under hospital buildings which would not otherwise require evaluation for an SPC rating, such buildings shall be evaluated in accordance with the requirements of Section 1.3, Chapter 6, of the California Administrative Code, to determine the appropriate ratings, or shall be shown to meet the structural requirements of these regulations for new hospital buildings. The services/systems and utilities feeding the new building addition, alteration or remodel shall conform with new building provisions of this code and shall be deemed by*

OSHPD to be free of adverse seismic interactions that could be caused by potential failure of overhead or adjacent components.

310A.1.1.1.5 Buildings removed from acute-care hospital service. Services/systems and utilities for conforming acute care hospital buildings shall be permitted to pass through or under a building that has been removed from acute care hospital service until January 1, 2030, if the building removed from service meets the performance requirements of Section 310A.1.1.1.1. Services/systems and utilities for nonconforming nonacute care hospital buildings shall be permitted to pass through or under a building that has been removed from acute care hospital service only if the building removed from service meets the performance requirements of Section 310A.1.1.1.2.

Exception: Service/system and utilities for acute care hospital buildings may pass through or under the buildings that have been removed from acute care service and which do not meet the performance requirements of Section 310A.1.1.1.1 or Section 310A.1.1.1.2, provided all the following are met:

1. The building removed from acute care service remains under the jurisdiction of OSHPD.
2. The service/system and utilities only support acute care services in SPC-1 or SPC-2 buildings, and where no critical care areas occur.
3. The SPC-1 or SPC-2 buildings supported by the service/system and utilities meet the nonstructural requirements of NPC-2, as defined in the CAC, Part 1, Article 11, Table 11.1 and are served with essential power from a conforming building or source which does not pass through or under a building removed from acute care services.
4. The SPC-2 buildings supported by the service/system and utilities are removed from acute care service no later than January 1, 2026.

310A.1.2 Jurisdiction. Services/systems and utilities shall originate in and only pass through or under buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

SECTION 311A COMPLIANCE ALTERNATIVES FOR MEANS OF EGRESS

311A.1 General. Means of egress through existing buildings shall be in accordance with the California Building Code, except as modified in this section.

311A.1.1 Means of egress. Means of egress shall comply with the requirements of Sections 311A.1.1.1 and 311A.1.1.2.

Exception: The enforcing agency shall be permitted to exempt minor additions, minor alterations and minor remodel projects from these requirements.

311A.1.1.1 Means of egress for hospital buildings. Means of egress for hospital buildings shall comply with the requirements of Sections 311A.1.1.1.1 through 311A.1.1.1.6.

311A.1.1.1.1 New and existing conforming hospital buildings. Means of egress for new hospital buildings and additions to existing conforming hospital buildings shall only pass through buildings that are conforming or comply with the requirements of SPC-3 or higher, and NPC-4/NPC-4D or higher.

Exception: Existing means of egress that pass through hospital buildings that have approved nonstructural performance categories NPC-3, or NPC-2 if the building has an approved extension to the NPC-3 deadline, shall be permitted to remain for the duration of extension. The non-structural components in the path of egress shall be braced in accordance with the new building provisions of this code.

311A.1.1.1.2 Existing SPC-2 hospital buildings. Means of egress for additions to existing SPC-2 hospital buildings shall only pass through hospital buildings that have approved performance categories of SPC-2 or higher and NPC-4/NPC-4D or higher.

Exception: The means of egress shall be permitted to pass through hospital buildings that have approved nonstructural performance categories of NPC-3, or NPC-2 if the building has an approved extension to the NPC-3 deadline. Non-structural components in the path of egress shall be braced in accordance with the new building provisions of this code.

311A.1.1.1.3 Existing SPC-3 or higher hospital buildings. Means of egress for remodels of existing SPC-3 or higher hospital buildings shall only pass through hospital buildings that have approved performance categories of SPC-2 or higher and NPC-4 /NPC-4D or higher.

Exception: The means of egress shall be permitted to pass through hospital buildings that have approved nonstructural performance categories of NPC-3, or NPC-2 if the building has an approved extension to the NPC-3 deadline. Non-structural components in the path of egress shall be braced in accordance with the new building provisions of this code.

311A.1.1.1.4 Existing SPC-1 hospital buildings. Means of egress for remodels of existing SPC-1 hospital buildings shall only pass through hospital

buildings that have approved performance categories of SPC-1 or higher and NPC-2 or higher.

Exception: Means of egress for acute care service spaces for hospitals licensed pursuant to subdivision (a) of Section 1250 of the Health and Safety Code shall comply with the requirements of Section 311A.1.1.1.2.

311A.1.1.1.5 Other hospital buildings. Hospital buildings that would not otherwise require evaluation for an SPC rating, which are used as a part of the means of egress for hospital buildings, shall be evaluated in accordance with the requirements of Section 1.3, Chapter 6, of the California Administrative Code to determine the appropriate rating, or shall meet the structural requirements of these regulations for conforming hospital buildings. Means of egress shall be in accordance with the requirements of Sections 311A.1.1.1.1 through 311A.1.1.1.4.

311A.1.1.1.6 Buildings removed from hospital service. The means of egress for acute care hospitals shall be permitted to pass through buildings that are removed from hospital service only if the buildings remain under the jurisdiction of OSHPD, and only until January 1, 2030, subject to the following:

1. Egress for conforming hospital buildings shall be permitted to pass through buildings that have been removed from acute care hospital service that comply with the requirements of Section 311A.1.1.1.1 or 311A.1.1.1.3.
2. Egress for nonconforming hospital buildings shall be permitted to pass through buildings that have been removed from acute care hospital service that comply with the requirements of Section 311A.1.1.1.2 or 311A.1.1.1.4.

After January 1, 2030, the means of egress for acute care hospital buildings shall only pass through hospital buildings that have approved performance categories of SPC-3 or higher and NPC-5.

311A.1.2 Jurisdiction. Means of egress shall only pass through buildings that are under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD).

**SECTION 312A
REMOVAL OF HOSPITAL
SPC AND FREESTANDING BUILDINGS FROM
GENERAL ACUTE CARE SERVICE**

312A.1 General. The provisions of this section shall apply when hospital SPC or freestanding buildings are being removed from general acute care service, including when freestanding buildings are removed from OSHPD jurisdiction. Removal of these buildings shall satisfy the requirements of this section and the California Building Standards Code. OSHPD approval of construction documents and a building permit are required for removal.

312A.1.1 Buildings without approved extensions. An SPC-1 hospital building without an approved delay in compli-

ance requirements in accordance with the California Administrative Code (CAC) Chapter 6 Section 1.5.2 or past the extension date granted in accordance with the CAC Chapter 6 Section 1.5.2 shall not be issued a building permit until a project to remove the subject SPC-1 building from general acute care services has been approved, permitted and closed in compliance by the Office.

Exception: Building permits for seismic compliance, maintenance and repair shall be permitted to be issued.

312A.2 Definitions. The following words and terms are applicable to this section only:

BUILDING. The area included within surrounding exterior walls or any combination of exterior walls and fire walls (as described in California Building Code Sections 202 and 706) exclusive of vent shafts and courts. Areas of the building not provided with surrounding walls shall be included in the building area if such areas are included within the horizontal projection of the roof or floor above. A building may consist of one or more adjacent SPC buildings.

GENERAL ACUTE CARE SERVICE. Means basic and supplemental services, as defined in California Building Code Section 1224.3, provided in a general acute care building, as defined in California Building Code Section 202 and the California Administrative Code, Chapter 6, Section 1.2.

STRUCTURAL SEPARATION. Means a building separation in accordance with the California Building Code.

312A.3 Establishing eligibility for removal from general acute care service. In order to establish that one or more SPC buildings are eligible for removal from general acute care service, the hospital owner shall submit construction documents showing that after the SPC buildings are removed from general acute care service:

1. All basic acute care services or supplemental services on the hospital's license are provided in SPC buildings satisfying the requirements for SPC-2, SPC-3, SPC-4, SPC-4D or SPC-5.

Exception: If the hospital includes SPC-1 buildings that are not being removed from general acute care service, and these SPC-1 buildings have an approved extension to the SPC-2 deadline, basic acute care services or supplemental services on the hospital's license are permitted to remain in these SPC buildings for the duration of their extension or until these SPC-1 buildings are removed from general acute care service, whichever comes first.

2. All basic acute care services or supplemental services on the hospital's license are provided in SPC buildings satisfying the requirements for NPC-3, NPC-4/NPC-4D or NPC-5.

Exception: Services shall be permitted to be located in SPC buildings satisfying the requirements of NPC-2 if the SPC buildings have an approved extension to NPC-3 deadline.

3. The hospital complies with all egress requirements, including occupant load, number of required exits and travel distance to exits, and provides evidence that no egress from any acute care hospital building passes

through the SPC buildings removed from general acute care service, SPC-1 buildings, or through buildings not under OSHPD jurisdiction.

Exceptions:

1. If the SPC building has an approved extension to the SPC-2 deadline, existing egress through the SPC-1 building shall be permitted for the duration of the extension or until the SPC-1 building is removed from general acute care service, whichever comes first.
2. When permitted by Section 311A.1.1.1.6.
4. No SPC building removed from general acute care service is used as a smoke compartment for any acute care hospital building. Buildings not under OSHPD jurisdiction shall not be used as a smoke compartment for any acute care hospital building.
5. Structural separation, fire barriers and fire walls shall satisfy the requirements of the California Building Standards Code.

Exception: An SPC seismic separation in accordance with the California Administrative Code Chapter 6 Section 3.4 shall be deemed to satisfy the building structural/seismic separation requirement in this section for SPC buildings that will remain under OSHPD jurisdiction.

6. If the SPC building removed from general acute care service shares a common fire alarm system with the acute care hospital, the main fire alarm control panel shall be located in an acute care hospital building. The SPC building removed from general acute care service shall be in a separate zone monitored by the main fire alarm control panel. Flexible connections shall be provided for conduits/conductors crossing structural or SPC seismic separation joints. If the intent is to place the SPC building under local jurisdiction, the building shall satisfy Section 312A.5.1.

Exception: Flexible connections for fire alarm conduits/conductors crossing seismic separation joints between an SPC building removed from general acute care service and adjacent SPC-1 or SPC-2 buildings may be omitted, provided the fire alarm in the adjacent SPC-1 and SPC-2 buildings have no connection to any SPC-3, SPC-4, SPC-4D and SPC-5 buildings providing general acute care service.

7. If the SPC building removed from general acute care service shares the fire sprinkler system with the acute care hospital, an isolation valve with a tamper switch shall be provided to isolate the portion of the system serving the SPC building removed from acute care service. Flexible connections shall be provided in piping that crosses structural or SPC seismic separation joints. The fire sprinkler system shall not originate in the SPC building removed from general acute care service. If the intent is to place the building under local jurisdiction, the building shall satisfy Section 312A.5.1.

Exception: Flexible connections for seismic separation joints and fail safe shutoff valves, and discon-

nects for utilities between an SPC building removed from general acute care service and adjacent SPC-1 or SPC-2 buildings may be omitted, provided utilities in the adjacent SPC-1 and SPC-2 buildings have no connection to any SPC-3, SPC-4, SPC-4D and SPC-5 buildings providing general acute care service.

8. Patient access as required by California Building Code Section 1224.4.7.5 does not pass through an SPC building removed from general acute care service or through buildings that are not under the jurisdiction of OSHPD.
9. The primary accessible entrance to the hospital is not through an SPC building removed from general acute care service or through buildings that are not under the jurisdiction of OSHPD.
10. No utilities servicing acute care hospital buildings originate in or pass through, over or under, an SPC building removed from general acute care service, except as permitted by Section 310A.1.1.1.5, or a building not under OSHPD jurisdiction.
11. If utilities originating in an acute care hospital building feed an SPC building removed from general acute care hospital service, fail safe shutoff valves and/or disconnects shall be provided that permit isolation of the SPC building removed from general acute care service from the hospital utilities. Flexible connections shall be provided for all utilities crossing structural or SPC seismic separation joints.

Exception: Flexible connections for seismic separation joints and fail safe shutoff valves, and disconnects for utilities between an SPC building removed from general acute care service and adjacent SPC-1 or SPC-2 buildings may be omitted, provided utilities in the adjacent SPC-1 and SPC-2 buildings have no connection to any SPC-3, SPC-4, SPC-4D and SPC-5 buildings providing general acute care service.

312A.4 Buildings remaining under OSHPD jurisdiction. SPC and freestanding buildings removed from acute care service while remaining under the jurisdiction of OSHPD shall be subject to the provisions of Section 312.3.

312A.5 Change in jurisdiction for buildings removed from general acute care service. Except as provided by Section 312A.5.3, at the hospital's discretion, a building removed from general acute care service shall be permitted to be placed under the jurisdiction of the local enforcement agency. To be eligible for a change in jurisdiction, the building removed from general acute care service shall satisfy the requirements of Section 312A.5.1.

312A.5.1 Eligibility for change in jurisdiction. For a building removed from general acute care service to be eligible for a change in jurisdiction to the local enforcing agency, all the following criteria shall be satisfied:

- a. The building removed from general acute care service shall be freestanding, as defined in the California Administrative Code, Section 7-111.

- b. Any hospital support services located in the building removed from general acute care service, including administrative services, central sterile supply, storage, morgue and autopsy, employee dressing rooms and lockers, janitorial and housekeeping service, and laundry, shall be in excess of the minimum requirements for licensure and operation. Prior approval by the California Department of Public Health shall be obtained by hospital to locate these services in the building removed from general acute care service.
- c. Services/systems and utilities (e.g., power, emergency power, communication/data/nurse-call systems, space-heating systems, fire alarm system, fire-sprinkler system, medical gas & plumbing systems) shall be separate and independent from those serving any buildings under OSHPD jurisdiction.
- d. If the building being transferred to the jurisdiction of the local enforcing agency is adjacent to a building under OSHPD jurisdiction and fire-resistive construction separations are required, they shall be located in the building under OSHPD jurisdiction.

312A.5.2 Modification of buildings removed from OSHPD jurisdiction. The owner of the building shall be responsible for bringing the building into compliance with all requirements of the new authority having jurisdiction. If a building requires modification to become eligible for removal from OSHPD jurisdiction, the construction project shall be closed with compliance by OSHPD prior to the change in jurisdiction. All occupancy separation, setback and allowable area requirements shall be enforced.

312A.5.3 Buildings not eligible for change in jurisdiction. The following freestanding buildings shall remain under OSHPD jurisdiction:

- a. Any building in which basic and/or supplementary services are provided for a general acute care hospital, acute psychiatric hospital and general acute care hospital providing only acute medical rehabilitation center services.
- b. Any building which provides required patient access, egress or smoke compartment for a Building under OSHPD's jurisdiction.
- c. Any building in which services under OSHPD jurisdiction are provided, including skilled nursing services, intermediate care services, acute psychiatric services and distinct part skilled nursing or intermediate care services.
- d. Any building providing central plant or utility services to a building under OSHPD jurisdiction.
- e. Any building through which utilities pass through, over or under, to serve a building under OSHPD jurisdiction.

312A.6 Vacated space. Vacated spaces intended to remain vacant while under the jurisdiction of OSHPD shall be subject to the provisions of Section 312.3.5.

312A.7 Demolition. Demolition of SPC buildings to be removed from general acute care services shall be permitted when buildings remaining under OSHPD's jurisdiction, after demolition, satisfy the requirements of the California Building Standards Code and demolition activity does not impair the operation and/or safety of any buildings that remain under the OSHPD's jurisdiction. Demolition shall be in accordance with California Building Code Section 3303.

**SECTION 313A
EARTHQUAKE MONITORING INSTRUMENTS
FOR EXISTING BUILDINGS**

313A.1 Earthquake recording instrumentation of existing buildings. All owners of existing structures, selected by the enforcement agency for the installation of earthquake-recording instruments, shall provide space for the installation and access to such instruments. Location of said instruments shall be determined by the enforcement agency. The enforcement agency shall make arrangements to provide, maintain and service the instruments. Data shall be the property of the enforcement agency, but copies of individual records shall be made available to the public on request and the payment of an appropriate fee.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 4 – REPAIRS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)				X	X						X	X		X	X							
Adopt only those sections that are listed below	X		X																			
Chapter / Section																						
401.1			X							X	X		X	X								
401.1.2	X																					
401.2			X																			
401.3	X																					
402			X																			
402.2				X	X																	
402.3				X	X																	
403			X																			
404			X																			
405.2.1 – 405.2.5				†	†																	
405.2.3.1			X																			
405.2.6	X																					
406										†	†		†	†								<
407.1				X	X																	
408.1				X	X																	
408.2				X	X																	
408.3				†	†																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 4

REPAIRS

User note:

About this chapter: Chapter 4 provides requirements for repairs of existing buildings. The provisions define conditions under which repairs may be made using materials and methods like those of the original construction or the extent to which repairs must comply with requirements for new buildings.

SECTION 401 GENERAL

401.1 Scope. Repairs shall comply with the requirements of this chapter. Repairs to historic buildings need only comply with Chapter 12. *[OSHPD 1R, 2, 4 & 5] Repairs to historic buildings not adopted by OSHPD shall comply with the requirements in the California Building Code, Sections 1224.2, 1225.2, 1226.2, 1227.2 and 1228.2 for functional requirements.*

401.1.1 Bleachers, grandstands and folding and telescopic seating. Repairs to existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

401.1.2 Scope. *[BSC] For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the requirements of Sections 405.2.1 and 405.2.3 are replaced by the requirements of Sections 317 through 322.*

401.2 Compliance. The work shall not make the building less complying than it was before the repair was undertaken.

[BS] 401.3 Flood hazard areas. In flood hazard areas, repairs that constitute substantial improvement shall require that the building comply with Section 1612 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable.

SECTION 402 BUILDING ELEMENTS AND MATERIALS

402.1 Glazing in hazardous locations. Replacement glazing in hazardous locations shall comply with the safety glazing requirements of the *California Building Code* or *California Residential Code* as applicable.

Exception: Glass block walls, louvered windows and jalousies repaired with like materials.

402.2 Existing materials. *[HCD] Existing materials shall comply with Section 302.3.*

402.3 New and replacement materials. *[HCD & HCD 2] New and replacement materials used for repairs shall comply with Section 302.4.*

SECTION 403 FIRE PROTECTION

403.1 General. Repairs shall be done in a manner that maintains the level of fire protection provided.

SECTION 404 MEANS OF EGRESS

404.1 General. Repairs shall be done in a manner that maintains the level of protection provided for the means of egress.

SECTION 405 STRUCTURAL

[BS] 405.1 General. Structural repairs shall be in compliance with this section and Section 401.2.

[BS] 405.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

[BS] 405.2.1 Repairs for less than substantial structural damage. Unless otherwise required by this section, for damage less than substantial structural damage, the damaged elements shall be permitted to be restored to their predamage condition.

[BS] 405.2.1.1 Snow damage. Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the *California Building Code*.

[BS] 405.2.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained disproportionate earthquake damage shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] 405.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system. A building that has sustained substantial structural damage to the vertical elements of its lateral force-resisting system shall be evaluated in accordance with Section 405.2.3.1, and either repaired in accordance with Section 405.2.3.2 or

repaired and retrofitted in accordance with Section 405.2.3.3, depending on the results of the evaluation.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose substantial structural damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.
2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] 405.2.3.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the code official. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of the *California Building Code* for load combinations that include wind or earthquake effects, except that the seismic forces shall be the reduced seismic forces.

[BS] 405.2.3.2 Extent of repair for compliant buildings. If the evaluation establishes that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.

[BS] 405.2.3.3 Extent of repair for noncompliant buildings. If the evaluation does not establish that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the building shall be retrofitted to comply with the provisions of this section. The wind loads for the repair and retrofit shall be those required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be in accordance with the *California Building Code*. The seismic loads for this retrofit design shall be those required by the building code in effect at the time of original construction, but not less than the reduced seismic forces.

[BS] 405.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions for dead, live and snow loads in the *California Building Code*. Undamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated if required to comply with the design loads of the rehabilitation design.

[BS] 405.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 405.2.3.1 and, if noncompliant, retrofitted in accordance with Section 405.2.3.3.

Exceptions:

1. Buildings assigned to Seismic Design Category A, B or C whose substantial structural

damage was not caused by earthquake need not be evaluated or retrofitted for load combinations that include earthquake effects.

2. One- and two-family dwellings need not be evaluated or retrofitted for load combinations that include earthquake effects.

[BS] 405.2.5 Substantial structural damage to snow load-carrying components. Where substantial structural damage to any snow load-carrying components is caused by or related to snow load effects, any components required to carry snow loads on roof framing of similar construction shall be repaired, replaced or retrofitted to satisfy the requirements of Section 1608 of the *California Building Code*.

[BS] 405.2.6 Flood hazard areas. In flood hazard areas, buildings that have sustained substantial damage shall be brought into compliance with Section 1612 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable.

**SECTION 406
ELECTRICAL**

[OSHPD 1R, 2, 4 & 5] Not adopted by OSHPD. Existing electrical wiring and equipment undergoing repair shall be in accordance with Title 24 Part 3 California Electrical Code (CEC).

406.1 Material. Existing electrical wiring and equipment undergoing repair shall be allowed to be repaired or replaced with like material.

406.1.1 Receptacles. Replacement of electrical receptacles shall comply with the applicable requirements of Section 406.4(D) of the *California Electrical Code*.

406.1.2 Plug fuses. Plug fuses of the Edison-base type shall be used for replacements only where there is no evidence of over fusing or tampering per applicable requirements of Section 240.51(B) of the *California Electrical Code*.

406.1.3 Nongrounding-type receptacles. For replacement of nongrounding-type receptacles with grounding-type receptacles and for branch circuits that do not have an equipment grounding conductor in the branch circuitry, the grounding conductor of a grounding-type receptacle outlet shall be permitted to be grounded to any accessible point on the grounding electrode system or to any accessible point on the grounding electrode conductor in accordance with Section 250.130(C) of the *California Electrical Code*.

406.1.4 Health care facilities. Portions of electrical systems being repaired in Group I-2, ambulatory care facilities and outpatient clinics shall comply with NFPA 99 requirements for repairs.

406.1.5 Grounding of appliances. Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers and outlet or junction boxes that are part of the existing branch circuit for these appliances shall be permitted to be grounded to the grounded circuit

conductor in accordance with Section 250.140 of the *California Electrical Code*.

SECTION 407 MECHANICAL

407.1 General. Existing mechanical systems undergoing repair shall not make the building less complying than it was before the damaged occurred. *[HCD 1 & HCD 2] Existing mechanical systems undergoing repair shall comply with the California Mechanical Code.*



SECTION 408 PLUMBING

408.1 Materials. Plumbing materials and supplies shall not be used for *repairs* that are prohibited in the *California Plumbing Code*. *[HCD 1 & HCD 2] Existing plumbing systems undergoing repair shall comply with the California Plumbing Code and Division 4.3 of the CALGreen Code, as applicable.*

408.2 Water closet replacement. The maximum water consumption flow rates and quantities for all replaced water closets shall be *1.28 gallons (4.8 L)* per flushing cycle.



408.3 Health care facilities. Portions of medical gas systems being repaired in Group I-2, ambulatory care facilities and outpatient clinics shall comply with NFPA 99 requirements for repairs.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 4A – REPAIRS [OSHPD 1]

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter										X												
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 4A

REPAIRS

User note:

About this chapter: Chapter 4 provides requirements for repairs of existing buildings. The provisions define conditions under which repairs may be made using materials and methods like those of the original construction or the extent to which repairs must comply with requirements for new buildings.

SECTION 401A GENERAL

401A.1 Scope. Repairs shall comply with the requirements of this chapter. *The provisions of this chapter shall apply to existing structures for applications listed in Section 1.10.1 [OSHPD 1] regulated by the Office of Statewide Health Planning and Development (OSHPD).*

401A.1.1 Bleachers, grandstands and folding and telescopic seating. Repairs to existing bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

401A.2 Compliance. The work shall not make the building less complying than it was before the repair was undertaken.

[BS] 401A.3 Flood hazard areas. *For buildings and structures in flood hazard areas established in California Building Code Section 1612A.3, any repair that constitutes substantial improvement of the existing structure, as defined in Chapter 2 shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.*

For buildings and structures in flood hazard areas established in California Building Code Section 1612A.3, any repairs that do not constitute substantial improvement or repair of substantial damage of the existing structure, as defined in Chapter 2, are not required to comply with the flood design requirements for new construction.

SECTION 402A BUILDING ELEMENTS AND MATERIALS

402A.1 Glass replacement. *The installation or replacement of glass shall be as required for new installations in accordance with the California Building Code.*

SECTION 403A FIRE PROTECTION

403A.1 General. *Fire protection shall comply with the California Building Standards Code.*

SECTION 404A MEANS OF EGRESS

404A.1 General. Repairs shall be done in a manner that maintains the level of protection provided for the means of egress.

SECTION 405A STRUCTURAL

[BS] 405A.1 General. *Buildings and structures, and parts thereof, shall be repaired in conformance with Section 405A.2. Work on nondamaged components that is necessary for the required repair of damaged components shall be considered part of the repair and shall not be subject to the requirements for alterations in Chapter 5A. Routine maintenance required by Chapter 3A, ordinary repairs exempt from permit in accordance with California Building Code Section 105.2, and abatement of wear due to normal service conditions shall not be subject to the requirements for repairs in this section.*

[BS] 405A.2 Repairs to damaged buildings. Repairs to damaged buildings shall comply with this section.

[BS] 405A.2.1 Repairs for less than substantial structural damage. *For damage less than substantial structural damage, repairs shall be allowed that restore the building to its predamage state. New structural members and connections used for this repair shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.*

[BS] 405A.2.1.1 Snow damage. Structural components whose damage was caused by or related to snow load effects shall be repaired, replaced or altered to satisfy the requirements of Section 1608 of the *California Building Code*.

[BS] 405A.2.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained disproportionate earthquake damage shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] 405A.2.3 Substantial structural damage to vertical elements of the lateral force-resisting system. A building that has sustained substantial structural damage to the vertical elements of its lateral force-resisting system shall be evaluated and repaired in accordance with the applicable provisions of Sections 405A.2.3.1 through 405A.2.3.3.

[BS] 405A.2.3.1 Evaluation. The building shall be evaluated by a registered design professional, and the evaluation findings shall be submitted to the building official. The evaluation shall establish whether the damaged building, if repaired to its predamage state, would comply with the provisions of this code for wind and earthquake loads. Wind loads for this evaluation shall be those prescribed in California Building Code Section 1609A. Earthquake loads for this evaluation, if required, shall be permitted to be 75 percent of those prescribed in California Building Code Section 1613A. Alternatively, where the earthquake damage has not resulted in disproportionate earthquake damage or did not result in collapse, the earthquake load evaluation shall be permitted to be performed in accordance with Section 304A.3.4.4 for SPC-2 buildings and Section 304A.3.4.5 for buildings rated SPC-3, SPC-4D and SPC-4. SPC-5 buildings shall be evaluated in accordance with Section 304A.3.4.6, except that the seismic hazard may be reduced to BSE-1E and BSE-2E.

[BS] 405A.2.3.2 Extent of repair for compliant buildings. If the evaluation establishes that the building in its predamage condition complies with the provisions of Section 405.2.3.1, then the damaged elements shall be permitted to be restored to their predamage condition.

[BS] 405A.2.3.3 Extent of repair for noncompliant buildings. If the evaluation does not establish compliance of the predamage building in accordance with Section 405A.2.3.1, then the building shall be rehabilitated to comply with applicable provisions of this code for load combinations, including wind or seismic loads. The wind loads for the repair shall be as required by the building code in effect at the time of original construction, unless the damage was caused by wind, in which case the wind loads shall be as required by this code. Earthquake loads for this rehabilitation design shall be those required for the design of the predamage building, but not less than 90 percent of those prescribed in California Building Code Section 1613A. Alternatively, where the earthquake damage has not resulted in disproportionate earthquake damage or did not result in collapse, the rehabilitation design shall be permitted to be performed in accordance with Section 304A.3.4.4 for SPC-2 buildings, Section 304A.3.4.5 for SPC-3, SPC-4D and SPC-4 buildings and Section 304A.3.4.6 for SPC-5 buildings. For SPC-5 buildings, the seismic hazard may be reduced to BSE-1E and BSE-2E. Use of Section 304A.3.4.5 to rehabilitate SPC-3, SPC-4D and SPC-4 buildings will result in re-classification of the building to SPC-4D. Noncompliant SPC-4 buildings may be rehabilitated to SPC-5 in accordance with Section 304A.3.4.6 using the reduced seismic hazard. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

dance with Section 304A.3.4.6 using the reduced seismic hazard. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

[BS] 405A.2.4 Substantial structural damage to gravity load-carrying components. Gravity load-carrying components that have sustained substantial structural damage shall be rehabilitated to comply with the applicable provisions of this code for dead and live loads. Snow loads shall be considered if the substantial structural damage was caused by or related to snow load effects. Existing gravity load-carrying structural elements shall be permitted to be designed for live loads approved prior to the damage. If the approved live load is less than that required by California Building Code Section 1607A, the area designed for the nonconforming live load shall be posted with placards of approved design, indicating the approved live load. Nondamaged gravity load-carrying components that receive dead, live or snow loads from rehabilitated components shall also be rehabilitated or shown to have the capacity to carry the design loads of the rehabilitation design. New structural members and connections required by this rehabilitation design shall comply with the detailing provisions of this code for new buildings of similar structure, purpose and location.

[BS] 405A.2.4.1 Lateral force-resisting elements. Regardless of the level of damage to vertical elements of the lateral force-resisting system, if substantial structural damage to gravity load-carrying components was caused primarily by wind or seismic effects, then the building shall be evaluated in accordance with Section 405A.2.3.1 and, if noncompliant, *rehabilitated* in accordance with Section 405A.2.3.3.

[BS] 405A.2.5 Substantial structural damage to snow load-carrying components. Where substantial structural damage to any snow load-carrying components is caused by or related to snow load effects, any components required to carry snow loads on roof framing of similar construction shall be repaired, replaced or retrofitted to satisfy the requirements of Section 1608 of the California Building Code.

[BS] 405A.2.6 Flood hazard areas. For buildings and structures in flood hazard areas established in Section 1612A.3, any repair that constitutes substantial improvement of the existing structure, as defined in Chapter 2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in California Building Code Section 1612A.3, any repairs that do not constitute substantial improvement or repair of substantial damage of the existing structure, as defined in Chapter 2, are not required to comply with the flood design requirements for new construction.

SECTION 406A ELECTRICAL

406A.1 General. Existing electrical wiring and equipment undergoing repair shall be in accordance with Title 24 Part 3 California Electrical Code (CEC).

SECTION 407A MECHANICAL

407A.1 General. Existing mechanical systems undergoing repair shall not make the building less complying than it was before the damaged occurred.



SECTION 408A PLUMBING

408A.1 Materials. Plumbing materials and supplies shall not be used for repairs that are prohibited in the Title 24 Part 5 California Plumbing Code (CPC).

408A.2 Water closet replacement. The maximum water consumption flow rates and quantities for all replaced water closets shall be 1.28 gallons (4.8 L) per flushing cycle.

Exception: Blowout-design water closets [3.5 gallons (13 L) per flushing cycle].

408A.3 Health care facilities. Portions of medical gas systems being repaired in Group I-2, ambulatory care facilities and outpatient clinics shall comply with NFPA 99 requirements for repairs.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 5 – PRESCRIPTIVE COMPLIANCE METHOD

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)				X	X	X																
Adopt only those sections that are listed below	X		X				X	X		X	X			X	X							
Chapter / Section																						
501										X	X			X	X							
501.1	X			X																		
501.1 Exception 1					X																	
501.1 Exception 2				X																		
501.1.1 – 501.5.1			X																			
501.1.2	X																					
501.3				†	†	†																
501.5			X	X																		
502										X	X			X	X							
502.1 Exception	X																					
502.3	X																					
502.4	X																					
502.6				†	†	†																
503										X	X			X	X							
503.1	X																					
503.2	X																					
503.3	X						X	X														
503.14			X	†	†	†																
503.15			X																			
503.16				†	†	†																
503.17			X	†	†	†																
504			X	†	†	†				X	X			X	X							
505			X							X	X			X	X							
505.2				X	X																	
506			X							X	X			X	X							
506.1	X																					
506.1.1	X																					
506.2	X																					
506.3	X																					
506.4 Exception	X																					
506.6				†	†	†																
507				†	†	†																

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 5

PRESCRIPTIVE COMPLIANCE METHOD

User note:

About this chapter: Chapter 5 provides details for the prescriptive compliance method—one of the three main options of compliance available in this code for buildings and structures undergoing alteration, addition or change of occupancy.

SECTION 501 GENERAL

501.1 Scope. The provisions of this chapter shall control the alteration, addition and change of occupancy of existing buildings and structures, *[BSC]* including state-regulated structures in accordance with Section 501.1.2. Historic buildings and structures shall comply with Part 8, Title 24, C.C.R.

Exceptions:

1. **[HCD 2]** For relocated or moved buildings and maintenance, alteration, repair, addition or change of occupancy to existing buildings and accessory structures in mobilehome parks or special occupancy parks as provided in Section 1.8.2.1.3. See California Code of Regulations, Title 25, Division 1, Chapters 2 and 2.2.
2. **[HCD 1]** Limited-density owner-built rural dwellings.

[HCD 1] In addition to the requirements in this chapter, maintenance, alteration, repair, addition or change of occupancy to existing buildings and accessory structures under the authority of the Department of Housing and Community Development, as provided in Section 1.8.2.1.1, shall comply with California Code of Regulations, Title 25, Division 1, Chapter 1, Subchapter 1.

501.1.1 Compliance with other methods. Alterations, additions and changes of occupancy to existing buildings and structures shall comply with the provisions of this chapter or with one of the methods provided in Section 301.3.

501.1.2 Existing state-owned structures. *[BSC]* The provisions of Sections 317 through 322 establish minimum standards for earthquake evaluation and design for retrofit of existing state-owned structures, including buildings owned by the University of California, the California State University and the Judicial Council.

The provisions of Sections 317 through 322 may be adopted by a local jurisdiction for earthquake evaluation and design for retrofit of existing buildings.

501.2 Fire-resistance ratings. Where approved by the code official, in buildings where an automatic sprinkler system installed in accordance with Section 903.3.1.1 or 903.3.1.2 of the California Building Code has been added, and the building is now sprinklered throughout, the required fire-resistance

ratings of building elements and materials shall be permitted to meet the requirements of the current building code. The building is required to meet the other applicable requirements of the California Building Code.

Plans, investigation and evaluation reports, and other data shall be submitted indicating which building elements and materials the applicant is requesting the code official to review and approve for determination of applying the current building code fire-resistance ratings. Any special construction features, including fire-resistance-rated assemblies and smoke-resistive assemblies, conditions of occupancy, means of egress conditions, fire code deficiencies, approved modifications or approved alternative materials, design and methods of construction, and equipment applying to the building that impact required fire-resistance ratings shall be identified in the evaluation reports submitted.

501.3 Health care facilities. In Group I-2 facilities, ambulatory care facilities and outpatient clinics, any altered or added portion of an existing electrical or medical gas systems shall be required to meet installation and equipment requirements in NFPA 99.

501.4 Existing Group R occupancies. *[SFM]* See the California Residential Code for existing Group R-3 occupancies or Chapter 11 of the California Fire Code for all other existing Group R occupancies.

501.5 Carbon monoxide alarms. *[HCD 1, SFM]* Pursuant to Health and Safety Code Section 17926, carbon monoxide detection shall be provided in all existing Group R buildings, as required in Section 915 of the California Building Code or Section R315 of the California Residential Code, as applicable.

501.5.1 Carbon monoxide detection in alterations to an existing Group E building. Where the alteration adds any of the conditions identified in the California Fire Code Sections 915.1.2 through 915.1.6 to an existing Group E building, not previously required to be provided with carbon monoxide detection, new carbon monoxide detection shall be installed in accordance with Section 915 of the California Fire Code.

Exceptions:

1. The alteration replaces an existing fossil-fuel burning appliance, fireplace or forced-air furnace, or any of the conditions identified in Sections 915.1.2 through 915.1.6 are already present.

2. *The Group E building was constructed before the adoption of the 2016 California Building Standards Code.*

**SECTION 502
ADDITIONS**

502.1 General. [BSC & HCD] Additions to any building or structure shall comply with the requirements of the *California Building Code* or *California Residential Code*, as applicable, for new construction. Alterations to the existing building or structure shall be made to ensure that the existing building or structure together with the addition are not less complying with the provisions of the *California Building Code* than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height and area provisions of Chapter 5 of the *California Building Code* or the height provisions of Chapter 3 of the *California Residential Code*, as applicable.

Exception: [BSC] For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the requirements of Section 502.5 are replaced by the requirements of Sections 317 through 322.

[BS] 502.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained disproportionate earthquake damage shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] 502.3 Flood hazard areas. For buildings and structures in flood hazard areas established in Section 1612.3 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable, any addition that constitutes substantial improvement of the existing structure shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612.3 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable, any additions that do not constitute substantial improvement of the existing structure are not required to comply with the flood design requirements for new construction.

[BS] 502.4 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *California Building Code* for new structures. Any existing gravity load-carrying structural element whose vertical load-carrying capacity is decreased as part of the addition and its related alterations shall be considered to be an altered element subject to the requirements of Section 503.3. Any

existing element that will form part of the lateral load path for any part of the addition shall be considered to be an existing lateral load-carrying structural element subject to the requirements of Section 502.5.

Exception: Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the existing building and the addition together comply with the conventional light-frame construction methods of the *California Building Code* or the provisions of the *California Residential Code*.

[BS] 502.5 Existing structural elements carrying lateral load. Where the addition is structurally independent of the existing structure, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the addition is not structurally independent of the existing structure, the existing structure and its addition acting together as a single structure shall be shown to meet the requirements of Sections 1609 and 1613 of the *California Building Code* using full seismic forces.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is not more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *California Building Code*. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the existing building and the addition together comply with the conventional light-frame construction methods of the *California Building Code* or the provisions of the *California Residential Code*.

502.6 Enhanced classroom acoustics. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the addition with a volume of 20,000 cubic feet (565 m³) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

**SECTION 503
ALTERATIONS**

503.1 General. Alterations to any building or structure shall comply with the requirements of the *California Building Code* or *California Residential Code*, as applicable, for new construction. Alterations shall be such that the existing building or structure is not less complying with the provisions of the *California Building Code* or *California Residential Code*,

as applicable, than the existing building or structure was prior to the alteration.

Exceptions:

1. An existing stairway shall not be required to comply with the requirements of Section 1011 of the *California Building Code* where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with Section 1011.11 of the *California Building Code* shall not be required to comply with the requirements of Section 1014.6 of the *California Building Code* regarding full extension of the handrails where such extensions would be hazardous because of plan configuration.
3. Where provided in below-grade transportation stations, existing and new escalators shall be permitted to have a clear width of less than 32 inches (815 mm).
4. **[BSC]** For state-owned buildings, including those owned by the University of California and the California State University and the judicial council, the requirements of Section 503.4 are replaced by the requirements of Sections 317 through 322.

[BS] 503.2 Flood hazard areas. For buildings and structures in flood hazard areas established in Section 1612.3 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable, any alteration that constitutes substantial improvement of the existing structure shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612.3 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable, any alterations that do not constitute substantial improvement of the existing structure are not required to comply with the flood design requirements for new construction.

[BS] 503.3 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an alteration causes an increase in design dead, live or snow load, including snow drift effects, of more than 5 percent shall be replaced or altered as needed to carry the gravity loads required by the *California Building Code* for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the alteration shall be shown to have the capacity to resist the applicable design dead, live and snow loads including snow drift effects required by the *California Building Code* for new structures.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes where the altered building complies with the conventional light-frame construction

methods of the *California Building Code* or the provisions of the *California Residential Code*.

2. Buildings in which the increased dead load is due entirely to the addition of a second layer of roof covering weighing 3 pounds per square foot (0.1437 kN/m²) or less over an existing single layer of roof covering **[DSA-SS, DSA-SS/CC]** Exception 2 is not permitted.

[BS] 503.4 Existing structural elements carrying lateral load. Except as permitted by Section 503.13, where the alteration increases design lateral loads, results in a prohibited structural irregularity as defined in ASCE 7, or decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted.

Exceptions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is not more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. Buildings in which the increase in the demand-capacity ratio is due entirely to the addition of rooftop-supported mechanical equipment individually having an operating weight less than 400 pounds (181.4 kg) and where the total additional weight of all rooftop equipment placed after initial construction of the building is less than 10 percent of the roof dead load. For purposes of this exception, “roof” shall mean the roof level above a particular story.

[BS] 503.5 Seismic Design Category F. Where the work area exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category F, the structure of the altered building shall meet the requirements of Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted.

[BS] 503.6 Bracing for unreinforced masonry parapets on reroofing. Where the intended alteration requires a permit for reroofing and involves removal of roofing materials from more than 25 percent of the roof area of a building assigned to Seismic Design Category D, E or F that has parapets constructed of unreinforced masonry, the work shall include installation of parapet bracing to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.

[BS] 503.7 Anchorage for concrete and reinforced masonry walls. Where the work area exceeds 50 percent of the building area, the building is assigned to Seismic Design Category C, D, E or F and the building’s structural system includes concrete or reinforced masonry walls with a flexible roof diaphragm, the alteration work shall include installation of wall anchors at the roof line, unless an evaluation demonstrates compliance of existing wall anchorage. Use of reduced seismic forces shall be permitted.

[BS] 503.8 Anchorage for unreinforced masonry walls in major alterations. Where the work area exceeds 50 percent of the building area, the building is assigned to Seismic Design Category C, D, E or F and the building’s structural system includes unreinforced masonry bearing walls, the alteration work shall include installation of wall anchors at the floor and roof lines, unless an evaluation demonstrates compliance of existing wall anchorage. Reduced seismic forces shall be permitted.

[BS] 503.9 Bracing for unreinforced masonry parapets in major alterations. Where the work area exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category C, D, E or F, parapets constructed of unreinforced masonry shall have bracing installed as needed to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Reduced seismic forces shall be permitted.

[BS] 503.10 Anchorage of unreinforced masonry partitions in major alterations. Where the work area exceeds 50 percent of the building area, and where the building is assigned to Seismic Design Category C, D, E or F, unreinforced masonry partitions and nonstructural walls within the work area and adjacent to egress paths from the work area shall be anchored, removed or altered to resist out-of-plane seismic forces, unless an evaluation demonstrates compliance of such items. Use of reduced seismic forces shall be permitted.

[BS] 503.11 Substantial structural alteration. Where the work area exceeds 50 percent of the building area and where work involves a substantial structural alteration, the lateral load-resisting system of the altered building shall satisfy the requirements of Sections 1609 and 1613 of the *California Building Code*. Reduced seismic forces shall be permitted.

Exceptions:

1. Buildings of Group R occupancy with not more than five dwelling or sleeping units used solely for residential purposes that are altered based on the conventional light-frame construction methods of the *California Building Code* or in compliance with the provisions of the *California Residential Code*.
2. Where the intended alteration involves only the lowest story of a building, only the lateral load-resisting components in and below that story need comply with this section.

[BS] 503.12 Roof diaphragms resisting wind loads in high-wind regions. Where the intended alteration requires a permit for reroofing and involves removal of roofing materials from more than 50 percent of the roof diaphragm of a

building or section of a building located where the ultimate design wind speed is greater than 130 mph (58 m/s) in accordance with Figure 1609.3(1) of the *California Building Code*, roof diaphragms, connections of the roof diaphragm to roof framing members, and roof-to-wall connections shall be evaluated for the wind loads specified in Section 1609 of the *California Building Code*, including wind uplift. If the diaphragms and connections in their current condition are not capable of resisting 75 percent of those wind loads, they shall be replaced or strengthened in *California* with the loads specified in Section 1609 of the *California Building Code*.

Exception: Buildings that have been demonstrated to comply with the wind load provisions in ASCE 7-88 or later editions.

[BS] 503.13 Voluntary lateral force-resisting system alterations. Structural alterations that are intended exclusively to improve the lateral force-resisting system and are not required by other sections of this code shall not be required to meet the requirements of Section 1609 or 1613 of the *California Building Code*, provided that all of the following apply:

1. The capacity of existing structural systems to resist forces is not reduced.
2. New structural elements are detailed and connected to existing or new structural elements as required by the *California Building Code* for new construction.
3. New or relocated nonstructural elements are detailed and connected to existing or new structural elements as required by the *California Building Code* for new construction.
4. The alterations do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

503.14 Smoke compartments. In Group I-2 occupancies where the alteration is on a story used for sleeping rooms for more than 30 care recipients, the story shall be divided into not less than two compartments by smoke barrier walls in accordance with Section 407.5 of the *California Building Code* as required for new construction.

503.15 Refuge areas. Where alterations affect the configuration of an area utilized as a refuge area, the capacity of the refuge area shall not be reduced below the required capacity of the refuge area for horizontal exits in accordance with Section 1026.4 of the *California Building Code*.

Where the horizontal exit also forms a smoke compartment, the capacity of the refuge area for Group I-1, I-2 and I-3 occupancies and Group B ambulatory care facilities shall not be reduced below that required in Sections 407.5.3, 408.6.2, 420.6.1 and 422.3.2 of the *California Building Code*, as applicable.

503.16 Enhanced classroom acoustics. In Group E occupancies, where the work area exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m³) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

503.17 Locking arrangements in educational occupancies.

In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the *California Building Code*.

503.18 Two-way communications systems. Where the work area for alterations exceeds 50 percent of the building area and the building has elevator service, a two-way communication systems shall be provided where required by Section 1009.8 of the *California Building Code*.

SECTION 504 FIRE ESCAPES (NOT ADOPTED BY HCD)

[BE] 504.1 Where permitted. Fire escapes shall be permitted only as provided for in Sections 504.1.1 through 504.1.4.

[BE] 504.1.1 New buildings. Fire escapes shall not constitute any part of the required means of egress in new buildings.

[BE] 504.1.2 Existing fire escapes. Existing fire escapes shall continue to be accepted as a component in the means of egress in existing buildings only.

[BE] 504.1.3 New fire escapes. New fire escapes for existing buildings shall be permitted only where exterior stairways cannot be utilized because of lot lines limiting stairway size or because of sidewalks, alleys or roads at grade level. New fire escapes shall not incorporate ladders or access by windows.

[BE] 504.1.4 Limitations. Fire escapes shall comply with this section and shall not constitute more than 50 percent of the required number of exits nor more than 50 percent of the required exit capacity.

[BE] 504.2 Location. Where located on the front of the building and where projecting beyond the building line, the lowest landing shall be not less than 7 feet (2134 mm) or more than 12 feet (3658 mm) above grade, and shall be equipped with a counterbalanced stairway to the street. In alleyways and thoroughfares less than 30 feet (9144 mm) wide, the clearance under the lowest landing shall be not less than 12 feet (3658 mm).

[BE] 504.3 Construction. The fire escape shall be designed to support a live load of 100 pounds per square foot (4788 Pa) and shall be constructed of steel or other approved noncombustible materials. Fire escapes constructed of wood not less than nominal 2 inches (51 mm) thick are permitted on buildings of Type V construction. Walkways and railings located over or supported by combustible roofs in buildings of Type III and IV construction are permitted to be of wood not less than nominal 2 inches (51 mm) thick.

[BE] 504.4 Dimensions. Stairways shall be not less than 22 inches (559 mm) wide with risers not more than, and treads not less than, 8 inches (203 mm) and landings at the foot of stairways not less than 40 inches (1016 mm) wide by 36 inches (914 mm) long, located not more than 8 inches (203 mm) below the door.

[BE] 504.5 Opening protectives. Doors and windows within 10 feet (3048 mm) of fire escape stairways shall be protected with $\frac{3}{4}$ -hour opening protectives.

Exception: Opening protection shall not be required in buildings equipped throughout with an approved automatic sprinkler system.

SECTION 505 WINDOWS AND EMERGENCY ESCAPE OPENINGS

505.1 Replacement windows. The installation or replacement of windows shall be as required for new installations.

505.2 Window opening control devices on replacement windows. In Group R-1, R-2 or R-3 buildings containing dwelling or sleeping units, and one- and two-family dwellings and townhouses regulated by the *California Residential Code*, window opening control devices or fall prevention devices complying with ASTM F2090 shall be installed where an existing window is replaced and where all of the following apply to the replacement window:

1. The window is operable.
2. One of the following applies:
 - 2.1. The window replacement includes replacement of the sash and frame.
 - 2.2. The window replacement includes the sash only where the existing frame remains.
3. One of the following applies:
 - 3.1. In Group R-2 or R-3 buildings containing dwelling or sleeping units, the bottom of the clear opening of the window opening is at a height less than 36 inches (915 mm) above the finished floor.
 - 3.2. In one- and two-family dwellings and townhouses regulated by the *California Residential Code*, the bottom of the clear opening of the window opening is at a height less than 24 inches (610 mm) above the finished floor.
4. The window will permit openings that will allow passage of a 4-inch-diameter (102 mm) sphere when the window is in its largest opened position.
5. The vertical distance from the bottom of the clear opening of the window opening to the finished grade or other surface below, on the exterior of the building, is greater than 72 inches (1829 mm).

Exception: Operable windows where the bottom of the clear opening of the window opening is located more than 75 feet (22 860 mm) above the finished grade or other surface below, on the exterior of the room, space or building, and that are provided with window fall prevention devices that comply with ASTM F2006.

505.3 Replacement window emergency escape and rescue openings. Where windows are required to provide emergency escape and rescue openings in Group R-2 and R-3 occupancies and one- and two-family dwellings and townhouses regulated by the *California Residential Code*, replacement windows shall be exempt from the requirements of Section 1031.3 of the *California Building Code* and

Section R310.2 of the *California Residential Code*, provided that the replacement window meets the following conditions:

1. The replacement window is the manufacturer’s largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.
2. Where the replacement of the window is part of a change of occupancy, it shall comply with Section 1011.5.6.

505.3.1 Control devices. Window opening control devices or fall prevention devices complying with ASTM F2090 shall be permitted for use on windows required to provide emergency escape and rescue openings. After operation to release the control device allowing the window to fully open, the control device shall not reduce the net clear opening area of the window unit. Emergency escape and rescue openings shall be operational from the inside of the room without the use of keys or tools.

505.4 Bars, grilles, covers or screens. Bars, grilles, covers, screens or similar devices are permitted to be placed over emergency escape and rescue openings, bulkhead enclosure or window wells that serve such openings, provided all of the following conditions are met:

1. The minimum net clear opening size complies with the code that was in effect at the time of construction.
2. Such devices shall be releasable or removable from the inside without the use of a key, tool or force greater than that which is required for normal operation of the escape and rescue opening.
3. Where such devices are installed, they shall not reduce the net clear opening of the emergency escape and rescue openings.
4. Smoke alarms shall be installed in accordance with Section 907.2.10 of the *California Building Code*.

SECTION 506 CHANGE OF OCCUPANCY

506.1 Compliance. A change of occupancy shall not be made in any building unless that building is made to comply with the requirements of the *California Building Code* for the use or occupancy. Changes of occupancy in a building or portion thereof shall be such that the existing building is not less complying with the provisions of this code than the existing building or structure was prior to the change. Subject to the approval of the code official, changes of occupancy shall be permitted without complying with all of the requirements of this code for the new occupancy, provided that the new occupancy is less hazardous, based on life and fire risk, than the existing occupancy.

Exception: The building need not be made to comply with Chapter 16 of the *California Building Code* unless required by Section 506.5.

506.1.1 Change in the character of use. A change of occupancy with no change of occupancy classification shall not be made to any structure that will subject the structure to any special provisions of the applicable *California Codes*, without approval of the code official. Compliance shall be only as necessary to meet the specific provisions and is not intended to require the entire building be brought into compliance.

506.1.2 Change in function. [OSHPD 1R, 2, 4 and 5] A change in function shall require compliance with all the functional requirements for new construction in the *California Building Code*, including requirements in Sections 1224, 1225, 1226, 1227 and 1228.

Exception [OSHPD 1R]: Hospital buildings removed from acute care service adapted for re-use as skilled nursing facilities, acute psychiatric hospitals or outpatient services of a hospital may be permitted to meet the minimum room clearances, areas and dimensions of the 2001 *California Building Code* for existing rooms re-used for a similar purpose, subject to the approval of OSHPD.

506.2 Certificate of occupancy. A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.

506.3 Stairways. An existing stairway shall not be required to comply with the requirements of Section 1011 of the *California Building Code* where the existing space and construction does not allow a reduction in pitch or slope.

506.4 Existing emergency escape and rescue openings. Where a change of occupancy would require an emergency escape and rescue opening in accordance with Section 1031.1 of the *California Building Code*, operable windows serving as the emergency escape and rescue opening shall comply with the following

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m²) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
 - 2.1. The replacement window meets the size requirements in Item 1.
 - 2.2. The replacement window is the manufacturer’s largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style that provides for an equal or greater window opening area than the existing window.

506.5 Structural. Any building undergoing a change of occupancy shall satisfy the requirements of this section.

Exception: [BSC] For state-owned buildings, including those owned by the University of California and the California State University and the Judicial Council, the performance level requirements of Section 506.5 are

replaced with the performance level requirements of Section 317.5.

506.5.1 Live loads. Structural elements carrying tributary live loads from an area with a change of occupancy shall satisfy the requirements of Section 1607 of the *California Building Code*. Design live loads for areas of new occupancy shall be based on Section 1607 of the *California Building Code*. Design live loads for other areas shall be permitted to use previously approved design live loads.

Exception: Structural elements whose demand-capacity ratio considering the change of occupancy is not more than 5 percent greater than the demand-capacity ratio based on previously approved live loads need not comply with this section.

506.5.2 Snow and wind loads. Where a change of occupancy results in a structure being assigned to a higher risk category, the structure shall satisfy the requirements of Sections 1608 and 1609 of the *California Building Code* for the new risk category.

Exception: Where the area of the new occupancy is less than 10 percent of the building area, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.

506.5.3 Seismic loads (seismic force-resisting system). Where a change of occupancy results in a building being assigned to a higher risk category, or where the change is from a Group S or Group U occupancy to any occupancy other than Group S or Group U, the building shall satisfy the requirements of Section 1613 of the *California Building Code* for the new risk category using full seismic forces.

Exceptions:

1. Where the area of the new occupancy is less than 10 percent of the building area, the occupancy is not changing from a Group S or Group U occupancy, and the new occupancy is not assigned to Risk Category IV, compliance with this section is not required. The cumulative effect of occupancy changes over time shall be considered.
2. Where a change of use results in a building being reclassified from Risk Category I or II to Risk Category III and the seismic coefficient, S_{DS} , is less than 0.33, compliance with this section is not required.
3. Unreinforced masonry bearing wall buildings assigned to Risk Category III and to Seismic Design Category A or B, shall be permitted to use Appendix Chapter A1 of this code.
4. Where the change is from a Group S or Group U occupancy and there is no change of risk category, use of reduced seismic forces shall be permitted.

506.5.4 Access to Risk Category IV. Any structure that provides operational access to an adjacent structure assigned to Risk Category IV as the result of a change of occupancy shall itself satisfy the requirements of Sections 1608, 1609 and 1613 of the *California Building Code*. For

compliance with Section 1613, *California Building Code*-level seismic forces shall be used. Where operational access to the Risk Category IV structure is less than 10 feet (3048 mm) from either an interior lot line or from another structure, access protection from potential falling debris shall be provided.

506.6 Enhanced classroom acoustics. In Group E occupancies, where the work area exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m³) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

**SECTION 507
HISTORIC BUILDINGS
(NOT ADOPTED BY HCD)**

507.1 Historic buildings. The provisions of this code that require improvements relative to a building's existing condition or, in the case of repairs, that require improvements relative to a building's predamage condition, shall not be mandatory for historic buildings unless specifically required by this section.

507.2 Life safety hazards. The provisions of this code shall apply to historic buildings judged by the code official to constitute a distinct life safety hazard.

[BS] 507.3 Flood hazard areas. Within flood hazard areas established in accordance with Section 1612.3 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable, where the work proposed constitutes substantial improvement, the building shall be brought into compliance with Section 1612 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable.

Exception: Historic buildings meeting any of the following criteria need not be brought into compliance:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

[BS] 507.4 Structural. Historic buildings shall comply with the applicable structural provisions in this chapter.

Exceptions:

1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. Repair of substantial structural damage is not required to comply with Sections 405.2.3, and 405.2.4. Substantial structural damage shall be repaired in accordance with Section 405.2.1.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 5A – PRESCRIPTIVE COMPLIANCE METHOD [OSHPD 1]

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter										X												
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 5A

PRESCRIPTIVE COMPLIANCE METHOD

User note:

About this chapter: Chapter 5 provides details for the prescriptive compliance method—one of the three main options of compliance available in this code for buildings and structures undergoing alteration, addition or change of occupancy.

SECTION 501A GENERAL

501A.1 Scope. The provisions of this chapter shall control the alteration, addition and change of occupancy of existing buildings and structures, including historic buildings and structures as referenced in Section 301A.3.1. *The provisions of this chapter shall apply to existing structures for applications listed in Section 1.10.1 [OSHPD 1] regulated by the Office of Statewide Health Planning and Development (OSHPD).*

501A.1.1 Compliance with other methods. Alterations, additions and changes of occupancy to existing buildings and structures shall comply with the provisions of this chapter or with one of the methods or procedures provided in Section 301.3.

501A.2 Fire-resistance ratings. *Fire-resistance ratings shall comply with the California Building Standards Code.*

501A.3 Prescriptive compliance provisions. *Alterations, additions and changes of occupancy to the following categories of existing buildings and structures shall comply with the provisions of this section.*

501A.3.1 Prescriptive compliance provisions for SPC-4D using the California Building Code, 1980 (CBC 1980). *Nonconforming buildings shall satisfy the following requirements:*

1. *The California Building Code, 1980 (CBC 1980), as used in this chapter, consists of the Uniform Building Code, 1979 (UBC 1979) along with requirements contained in:*
 - a) *California Code of Regulations, Title 24-Building Standards, dated February 2, 1980 (Revision record for Register 80, No. 5).*
 - b) *California Code of Regulations, Title 22 – Social Security, dated October 13, 1979 (Revision Record for Register 79, No 41).*
 - c) *California Code of Regulations, Title 17 – Public Health, dated October 13, 1979 (Revision Record for Register 79, No 41-B).*
2. *All existing structural elements of Seismic Force Resisting System (SFRS) shall satisfy the detailing requirements in the CBC 1980 or demonstrate that the level of seismic performance is equivalent to that given in the CBC 1980, as determined by the building official.*

3. *A continuous load path or paths with adequate strength and stiffness to transfer all the forces from the point of origin to final point of resistance shall be justified by analysis.*
4. *Site data report in accordance with the CBC 1980 shall establish that seismically induced differential settlement does not exceed 1" in 40'.*
5. *Adjacent buildings shall satisfy the SPC building separation requirements in accordance with the California Administrative Code, Chapter 6 Section 3.4.*
6. *The addition of new structural elements or strengthening of existing structural elements for retrofit of nonconforming buildings to SPC-4D shall comply with the following:*
 - a) *The seismic demand (forces or displacements) shall be in accordance with the CBC 1980;*
 - b) *Capacity, detailing and connections for new structural elements shall satisfy the requirements in the CBC 2019 for new construction; and*
 - c) *The strengthening of existing structural elements shall use capacities determined in accordance with the CBC 2019 for new construction consistent with the detailing and connections used in the strengthened member.*
7. *All construction, quality assurance and quality control shall be in accordance with the new construction provisions of CBC 2019.*
8. *Elements not part of the Seismic Force-Resisting System (SFRS), including those identified in the California Administrative Code Chapter 6, Article 10, shall be evaluated using seismic forces and the requirements of the CBC 1980.*
9. *Any column or wall that forms part of two or more intersecting SFRS and is subjected to axial load due to seismic forces acting along either principal plan axis equaling or exceeding 20 percent of the axial design strength of the column or wall shall be evaluated for the most critical load effect due to application of seismic force in any direction. The most critical load effect may be deemed to be satisfied if members and their foundations are evaluated for 100 percent of the forces for one direction plus 30*

percent of the forces for the perpendicular direction, whereby the combination produces the maximum effect.

Exceptions: The following buildings (with structural irregularities or unusual configuration/system) shall not be eligible for the SPC-4D upgrade using the prescriptive provisions in this section:

1. Buildings with prohibited irregularities in accordance with California Building Code Section 1617A.1.10.
2. Buildings taller than 5 stories or 65' height above the base having horizontal or vertical irregularities in accordance with ASCE 7 Tables 12.3-1 Items # 1a, 1b and 3 or 12.3-2 Items #1a, 1b, 5a and 5b.
3. Buildings with unusual configuration or structural system, as determined by the building official.

501A.3.2 Prescriptive compliance provisions for SPC-4D using the new building design requirements of this code.

Structures satisfying the requirements of the California Building Code for new general acute care hospital buildings design shall be deemed to satisfy the SPC-4D requirements of Table 2.5.3, Chapter 6 of the California Administrative Code.

All existing structural elements of a Seismic Force-Resisting System (SFRS) shall satisfy the detailing requirements of the California Building Code for new construction or demonstrate that the level of seismic performance is equivalent, as determined by the building official. A demonstration of equivalence shall consider the regularity, overstrength, redundancy and ductility of the structure.

Elements not part of the Seismic Force-Resisting System (SFRS), including those identified in the California Administrative Code Chapter 6, Article 10, shall be evaluated using seismic forces and the requirements of this code for new general acute care hospital buildings.

501A.3.3 Prescriptive compliance provisions for NPC 2, NPC 3, NPC 4 or NPC 4D and NPC 5.

501A.3.3.1 Supports and attachments of nonstructural components, except those listed in Section 501A.3.3.2 below, in buildings in seismic performance categories SPC 1 or SPC 2 with a performance level of NPC 3 or higher, and SPC 3, SPC 4 or SPC-4D, shall be permitted to comply with the provisions of Section 1630B of the 1998 California Building Code using an importance factor $I_p=1.5$. The capacity of welds, anchors and fasteners shall be determined in accordance with requirements of the California Building Code for new construction.

501A.3.3.2 Supports and attachments for systems listed under NPC-2 and NPC-5 (excluding those specifically listed for NPC-3 and NPC-4 or NPC-4D) in the California Administrative Code, Chapter 6, Table 11.1 shall satisfy the requirements of the California Building

Code for new construction and Section 501A.3.3.1 above shall not be applicable.

501A.3.3.3 For NPC 3 and NPC 4 or NPC 4D in SPC 2, SPC 3, SPC 4 or SPC-4D buildings, the adequacy and design of nonstructural component or equipment supports and attachments may extend only to the connection of the component or equipment to the support when the total reaction at the point of support (including the application of F_p) is less than or equal to the following limits:

1. 250 pounds for components or equipment attached to light frame walls. For the purposes of this requirement, the sum of the absolute value of all reactions due to component loads on a single stud shall not exceed 250 pounds.
2. 1,000 pounds for components or equipment attached to roofs or walls of reinforced concrete or masonry construction.
3. 2,000 pounds for components or equipment attached to floors or slabs-on-grade.

Exception: If the anchorage or bracing is configured in a manner that results in significant torsion on a supporting structural element, the effects of the nonstructural reaction force on the structural element shall be considered in the anchorage design.

501A.4 Health care facilities. In Group I-2 facilities, ambulatory care facilities and outpatient clinics, any altered or added portion of an existing electrical or medical gas systems shall be required to meet installation and equipment requirements in NFPA 99.

**SECTION 502A
ADDITIONS**

502A.1 General. Additions to any building or structure shall comply with the requirements of the California Building Code for new construction. Alterations to the existing building or structure shall be made to ensure that the existing building or structure together with the addition are not less complying with the provisions of the California Building Code than the existing building or structure was prior to the addition. An existing building together with its additions shall comply with the height and area provisions of Chapter 5 of the California Building Code.

[BS] 502A.2 Disproportionate earthquake damage. A building assigned to Seismic Design Category D, E or F that has sustained disproportionate earthquake damage shall be subject to the requirements for buildings with substantial structural damage to vertical elements of the lateral force-resisting system.

[BS] 502A.3 Flood hazard areas. For buildings and structures in flood hazard areas established in California Building Code Section 1612A.3, any addition that constitutes substantial improvement of the existing structure, as defined in Chapter 2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure

shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in California Building Code Section 1612A.3, any additions that do not constitute substantial improvement of the existing structure, as defined in Chapter 2, are not required to comply with the flood design requirements for new construction.

[BS] 502A.4 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an addition and its related alterations cause an increase in design gravity load of more than 5 percent shall be strengthened, supplemented, replaced or otherwise altered as needed to carry the increased gravity load required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased shall be considered an altered element subject to the requirements of Section 503A.3. Any existing element that will form part of the lateral load path for any part of the addition shall be considered an existing lateral load-carrying structural element subject to the requirements of Section 502A.5.

502A.4.1 Design live load. Where the addition does not result in increased design live load, existing gravity load-carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the addition. If the approved live load is less than that required by California Building Code Section 1607A, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the addition does result in increased design live load, the live load required by California Building Code Section 1607A shall be used.

[BS] 502A.5 Existing structural elements carrying lateral load. Where the addition is structurally independent of the existing structure, existing lateral load-carrying structural elements shall be permitted to remain unaltered. Where the addition is not structurally independent of the existing structure, the existing structure and its addition acting together as a single structure shall be shown to meet the requirements of Sections 1609A and 1613A of the California Building Code.

Exceptions: For incidental and minor additions:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the addition considered is no more than 10 percent greater than its demand-capacity ratio with the addition ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609A and 1613A of the California Building Code. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. Drift limits based on original design code shall be permitted to be used in lieu of the drift limits required by ASCE 7.

502A.6 Enhanced classroom acoustics. In Group E occupancies, enhanced classroom acoustics shall be provided in all classrooms in the addition with a volume of 20,000 cubic feet (565 m³) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

502A.7 Smoke alarms in existing portions of a building. Shall comply with California Building Standards Code.

502A.8 Carbon monoxide alarms in existing portions of a building. Shall comply with California Building Standards Code.

SECTION 503A ALTERATIONS

503A.1 General. Except as provided by this section, alterations to any building or structure shall comply with the requirements of the California Building Code for new construction. Alterations shall be such that the existing building or structure is no less conforming with the provisions of this code than the existing building or structure was prior to the alteration.

Exceptions:

1. An existing stairway shall not be required to comply with the requirements of California Building Code Section 1011 where the existing space and construction does not allow a reduction in pitch or slope.
2. Handrails otherwise required to comply with California Building Code Section 1011.11 shall not be required to comply with the requirements of California Building Code Section 1014.6 regarding full extension of the handrails where such extensions would be hazardous due to plan configuration.

[BS] 503A.2 Flood hazard areas. For buildings and structures in flood hazard areas established in Section 1612A.3 of the California Building Code, any alteration that constitutes substantial improvement of the existing structure, as defined in Chapter 2, shall comply with the flood design requirements for new construction, and all aspects of the existing structure shall be brought into compliance with the requirements for new construction for flood design.

For buildings and structures in flood hazard areas established in Section 1612A.3 of the California Building Code, any alterations that do not constitute substantial improvement of the existing structure, as defined in Chapter 2, are not required to comply with the flood design requirements for new construction.

[BS] 503A.3 Existing structural elements carrying gravity load. Any existing gravity load-carrying structural element for which an alteration causes an increase in design gravity load of more than 5 percent shall be replaced or otherwise altered as needed to carry the gravity loads required by this code for new structures. Any existing gravity load-carrying structural element whose gravity load-carrying capacity is decreased as part of the alteration shall be shown to have the capacity to resist the applicable design gravity load required by this code for new structures.

503A.3.1 Design live load. Where the alteration does not result in increased design live load, existing gravity load carrying structural elements shall be permitted to be evaluated and designed for live loads approved prior to the alteration. If the approved live load is less than that required by California Building Code Section 1607A, the area designed for the nonconforming live load shall be posted with placards of approved design indicating the approved live load. Where the alteration does result in increased design live load, the live load required by California Building Code Section 1607A shall be used.

[BS] 503A.4 Existing structural elements carrying lateral load. Except as permitted by Section 503A.13, where the alteration increases design lateral loads in accordance with California Building Code Section 1609A or 1613A, or where the alteration, results in a prohibited structural irregularity as defined in the California Building Code, or where the alteration decreases the capacity of any existing lateral load-carrying structural element, the structure of the altered building or structure shall meet the requirements of Sections 1609A and 1613A of the California Building Code.

Exceptions: For incidental and minor alterations:

1. Any existing lateral load-carrying structural element whose demand-capacity ratio with the alteration considered is not more than 10 percent greater than its demand-capacity ratio with the alteration ignored shall be permitted to remain unaltered. For purposes of calculating demand-capacity ratios, the demand shall consider applicable load combinations with design lateral loads or forces in accordance with Sections 1609A and 1613A of the California Building Code. Reduced seismic forces shall be permitted. For purposes of this exception, comparisons of demand-capacity ratios and calculation of design lateral loads, forces and capacities shall account for the cumulative effects of additions and alterations since original construction.
2. Drift limits based on original design code shall be permitted to be used in lieu of the drift limits required by ASCE 7.

[BS] 503A.5 Seismic Design Category F. Not permitted by OSHPD.

[BS] 503A.6 Bracing for unreinforced masonry parapets on reroofing. Not permitted by OSHPD.

[BS] 503A.7 Anchorage for concrete and reinforced masonry walls. Not permitted by OSHPD.

[BS] 503A.8 Anchorage for unreinforced masonry walls in major alterations. Not permitted by OSHPD.

[BS] 503A.9 Bracing for unreinforced masonry parapets in major alterations. Not permitted by OSHPD.

[BS] 503A.10 Anchorage of unreinforced masonry partitions in major alterations. Not permitted by OSHPD.

[BS] 503A.11 Substantial structural alteration. Not permitted by OSHPD.

[BS] 503A.12 Roof diaphragms resisting wind loads in high-wind regions. Not permitted by OSHPD.

[BS] 503A.13 Voluntary seismic improvements. Alterations to existing structural elements or additions of new structural elements that are not otherwise required by this chapter and are initiated for the purpose of improving the performance of the seismic force-resisting system of an existing structure or the performance of seismic bracing or anchorage of existing nonstructural elements shall be permitted, provided that an engineering analysis is submitted demonstrating the following:

1. The altered structure, and the altered structural and nonstructural elements are no less conforming with the provisions of this code with respect to earthquake design than they were prior to the alteration.
2. New structural elements are designed, detailed and connected to the existing structural elements as required by California Building Code Chapter 16A. Alterations of existing structural elements shall be based on design demand required by California Building Code Chapter 16A. Demands for new or altered existing structural elements need not exceed the maximum load effect that can be transferred to the elements by the system.
3. New, relocated or altered nonstructural elements are designed, detailed and connected to existing or new structural elements as required by California Building Code Chapter 16A.
4. The alterations do not create a structural irregularity as defined in ASCE 7 or make an existing structural irregularity more severe.

503A.14 Smoke compartments. Shall comply with California Building Standards Code.

503A.15 Refuge areas. Shall comply with California Building Standards Code.

503A.16 Enhanced classroom acoustics. In Group E occupancies, where the work area exceeds 50 percent of the building area, enhanced classroom acoustics shall be provided in all classrooms with a volume of 20,000 cubic feet (565 m³) or less. Enhanced classroom acoustics shall comply with the reverberation time in Section 808 of ICC A117.1.

503A.17 Locking arrangements in educational occupancies. In Group E occupancies, Group B educational occupancies and Group I-4 occupancies, egress doors with locking arrangements designed to keep intruders from entering the room shall comply with Section 1010.2.8 of the California Building Code.

503A.18 Two-way communications systems. Where the work area for alterations exceeds 50 percent of the building area and the building has elevator service, a two-way communication systems shall be provided where required by Section 1009.8 of the California Building Code.

503A.19 Smoke alarms. Shall comply with California Building Standards Code.

503A.20 Carbon monoxide alarms. Shall comply with California Building Standards Code.

**SECTION 504A
RESERVED**

**SECTION 505A
RESERVED**

**SECTION 506A
CHANGE OF OCCUPANCY**

506A.1 Conformance. No change shall be made in the use or occupancy of any building, that would place the building in a different division of the same group of occupancy or in a different group of occupancies, unless such building is made to comply with the requirements of the California Building Code for the use or occupancy. Subject to the approval of the building official, the use or occupancy of existing buildings shall be permitted to be changed and the building is allowed to be occupied for purposes in other groups without conforming to all the requirements of the California Building Code for those groups, provided the new or proposed use is less hazardous, based on life and fire risk, than the existing use.

506A.1.1 Change in function. A change in function shall require compliance with all the functional requirements for new construction in the California Building Code, including requirements in California Building Code Section 1224.

Exception: Minimum room clearances, areas and dimensions may meet the requirements of the 2001 California Building Code for existing rooms re-used for a similar purpose, subject to the approval of OSHPD.

506A.2 Certificate of occupancy. A certificate of occupancy shall be issued where it has been determined that the requirements for the new occupancy classification have been met.

506A.3 Stairways. Existing stairways in an existing structure shall not be required to comply with the requirements of a new stairway as outlined in California Building Code Section 1009 where the existing space and construction will not allow a reduction in pitch or slope.

506A.4 Existing emergency escape and rescue openings. Where a change of occupancy would require an emergency escape and rescue opening in accordance with Section 1031.1 of the California Building Code, operable windows serving as the emergency escape and rescue opening shall comply with the following

1. An existing operable window shall provide a minimum net clear opening of 4 square feet (0.38 m²) with a minimum net clear opening height of 22 inches (559 mm) and a minimum net clear opening width of 20 inches (508 mm).
2. A replacement window where such window complies with both of the following:
 - 2.1. The replacement window meets the size requirements in Item 1.
 - 2.2. The replacement window is the manufacturer's largest standard size window that will fit within the existing frame or existing rough opening. The replacement window shall be permitted to be of the same operating style as the existing window or a style

that provides for an equal or greater window opening area than the existing window.

506A.5 Structural. When a change of occupancy results in a structure being reclassified to a higher risk category, the structure shall conform to the seismic requirements for a new structure in the California Building Code of the higher risk category.

Exception: Specific seismic detailing requirements of California Building Code Section 1613A for a new structure shall not be required to be met where it can be shown that the level of performance is equivalent to that of a new structure. A demonstration of equivalence shall consider the regularity, over strength, redundancy and ductility of the structure.

**SECTION 507A
HISTORIC BUILDINGS**

507A.1 Historic buildings. The provisions of this code that require improvements relative to a building's existing condition or, in the case of repairs, that require improvements relative to a building's predamage condition, shall not be mandatory for historic buildings unless specifically required by this section.

507A.2 Life safety hazards. The provisions of this code shall apply to historic buildings judged by the code official to constitute a distinct life safety hazard.

[BS] 507A.3 Flood hazard areas. Within flood hazard areas established in accordance with Section 1612.3 of the California Building Code, or Section R322 of the California Residential Code, as applicable, where the work proposed constitutes substantial improvement, the building shall be brought into compliance with Section 1612 of the California Building Code, or Section R322 of the California Residential Code, as applicable.

Exception: Historic buildings meeting any of the following criteria need not be brought into compliance:

1. Listed or preliminarily determined to be eligible for listing in the National Register of Historic Places.
2. Determined by the Secretary of the US Department of Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined to qualify as an historic district.
3. Designated as historic under a state or local historic preservation program that is approved by the Department of Interior.

[BS] 507A.4 Structural. Historic buildings shall comply with the applicable structural provisions in this chapter.

Exceptions:

1. The code official shall be authorized to accept existing floors and existing live loads and to approve operational controls that limit the live load on any floor.
2. Repair of substantial structural damage is not required to comply with Sections 405A.2.3, and 405A.2.4. Substantial structural damage shall be repaired in accordance with Section 405A.2.1.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 6 – CLASSIFICATION OF WORK

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

*The state agency does not adopt sections identified with the following symbol: †
The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 7 – ALTERATIONS—LEVEL 1

Not adopted by the State of California

(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

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CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 8 – ALTERATIONS—LEVEL 2

Not adopted by the State of California

(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

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CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 9 – ALTERATIONS—LEVEL 3

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 10 – CHANGE OF OCCUPANCY

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

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CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 11 – ADDITIONS

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

*The state agency does not adopt sections identified with the following symbol: †
The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.*

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 12 – HISTORIC BUILDINGS

Not adopted by the State of California

(Historic buildings and structures shall comply with Part 8, Title 24, California Code of Regulations)

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Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE

CHAPTER 13 – PERFORMANCE COMPLIANCE METHODS

Not adopted by the State of California

(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 14 – RELOCATED OR MOVED BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)				X	X	X																
Adopt only those sections that are listed below																						
Chapter / Section																						
1401				X	X																	
1401.1				X	X																	
1401.2				X	X																	

CHAPTER 14

RELOCATED OR MOVED BUILDINGS

User note:

About this chapter: Chapter 14 is applicable to any building that is moved or relocated. The relocation of a building will automatically cause an inspection and evaluation process that enables the jurisdiction to determine the level of compliance with the California Fire Code and the California Existing Building Code. These two codes, by their scope, are applicable to existing buildings. This is the case regardless of any repair, remodeling, alteration work or change of occupancy occurring (see the California Fire Code and California Existing Building Code).

SECTION 1401 GENERAL

1401.1 Scope. This chapter provides requirements for relocated or moved structures, including relocatable buildings as defined in Chapter 2. *[HCD] The provisions of Chapter 14 are not applicable to commercial modulars, manufactured homes, mobilehomes, multi-unit manufactured housing and special purpose commercial modulars as defined in Health and Safety Code Sections 18001.8, 18007, 18008, 18008.7 and 18012.5, respectively. These structures are subject to installation/reinstallation requirements specified in the Mobilehome Parks Act (Health and Safety Code Section 18200 et seq.) and the California Code of Regulations, Title 25, Division 1, Chapter 2. Manufactured homes must meet unit identification (data plate) and certification label requirements as specified in the Code of Federal Regulations, Title 24, Subtitle B, Chapter XX, Part 3280 and Health and Safety Code Section 18032. Commercial modulars and special purpose commercial modulars must meet identification requirements in the California Code of Regulations, Title 25, Division 1, Chapter 3, Subchapter 2.*

1401.1.1 Bleachers, grandstands and folding and telescopic seating. Relocated or moved bleachers, grandstands and folding and telescopic seating shall comply with ICC 300.

1401.2 Conformance. The building shall be safe for human occupancy as determined by the *California Fire Code* and the *International Property Maintenance Code*. Any repair, alteration or change of occupancy undertaken within the moved structure shall comply with the requirements of this code applicable to the work being performed. Any field-fabricated elements shall comply with the requirements of the *California Building Code* or the *California Residential Code*, as applicable. *[HCD 1 & HCD 2] After July 1, 1978, local ordinances or regulations for relocated or moved apartment houses and dwellings shall permit the retention of existing materials and methods of construction, provided the apartment house or dwelling complies with the building standards for foundations applicable to new construction and does not become or continue to be a substandard building. For additional information, see Health and Safety Code Section 17958.9.*

SECTION 1402 REQUIREMENTS

1402.1 Location on the lot. The building shall be located on the lot in accordance with the requirements of the *California Building Code* or the *California Residential Code*, as applicable.

[BS] 1402.2 Foundation. The foundation system of relocated buildings shall comply with the *California Building Code* or the *California Residential Code*, as applicable.

[BS] 1402.2.1 Connection to the foundation. The connection of the relocated building to the foundation shall comply with the *California Building Code* or the *California Residential Code*, as applicable.

[BS] 1402.3 Wind loads. Buildings shall comply with *California Building Code* or *California Residential Code* wind provisions, as applicable.

Exceptions:

1. Detached one- and two-family dwellings and Group U occupancies where wind loads at the new location are not higher than those at the previous location.
2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1402.4 Seismic loads. Buildings shall comply with *California Building Code* or *California Residential Code* seismic provisions at the new location, as applicable.

Exceptions:

1. Structures in Seismic Design Categories A and B and detached one- and two-family dwellings in Seismic Design Categories A, B and C where the seismic loads at the new location are not higher than those at the previous location.
2. Structural elements whose stress is not increased by more than 10 percent.

[BS] 1402.5 Snow loads. Structures shall comply with *California Building Code* or *California Residential Code* snow loads, as applicable, where snow loads at the new location are higher than those at the previous location.

Exception: Structural elements whose stress is not increased by more than 5 percent.

RELOCATED OR MOVED BUILDINGS

[BS] 1402.6 Flood hazard areas. If relocated or moved into a flood hazard area, structures shall comply with Section 1612 of the *California Building Code*, or Section R322 of the *California Residential Code*, as applicable.

[BS] 1402.7 Required inspection and repairs. The code official shall be authorized to inspect, or to require approved professionals to inspect at the expense of the owner, the various structural parts of a relocated building to verify that structural components and connections have not sustained structural damage. Any repairs required by the code official as a result of such inspection shall be made prior to the final approval.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 15 – CONSTRUCTION SAFEGUARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter	X																					
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below				X	X																	
Chapter / Section																						
1501				X	X																	
1502				X	X																	
1503				X	X																	
1505				X	X																	
1508				X	X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 15

CONSTRUCTION SAFEGUARDS

User note:

About this chapter: Chapter 15 looks to the construction process. Parameters are provided for demolition and for protecting adjacent property during demolition and construction. Issues such as how to provide egress and adequate water supply while the building is growing, the timing of standpipe and sprinkler installation, and protection of pedestrians are addressed. Note that this chapter is consistent with Chapter 33 of the California Building Code and Chapter 33 of the California Fire Code.

SECTION 1501 GENERAL

[BG] 1501.1 Scope. The provisions of this chapter shall govern safety during construction and the protection of adjacent public and private properties.

[BG] 1501.2 Storage and placement. Construction equipment and materials shall be stored and placed so as not to endanger the public, the workers or adjoining property for the duration of the construction project.

** **[BS] 1501.2.1 Structural and construction loads.** Structural roof components shall be capable of supporting the roof-covering system and the material and equipment loads that will be encountered during installation of the system.

[BG] 1501.3 Alterations, repairs and additions. Required exits, existing structural elements, fire protection devices and sanitary safeguards shall be maintained at all times during alterations, repairs or additions to any building or structure.

Exceptions:

1. Where such required elements or devices are being altered or repaired, adequate substitute provisions shall be made.
2. Maintenance of such elements and devices is not required where the existing building is not occupied.

[BG] 1501.4 Manner of removal. Waste materials shall be removed in a manner that prevents injury or damage to persons, adjoining properties and public rights-of-way.

[BG] 1501.5 Fire safety during construction. Fire safety during construction shall comply with the applicable requirements of the *California Building Code* and the applicable provisions of Chapter 33 of the *California Fire Code*.

[BS] 1501.6 Protection of pedestrians. Pedestrians shall be protected during construction and demolition activities as required by Sections 1501.6.1 through 1501.6.7 and Table 1501.6. Signs shall be provided to direct pedestrian traffic.

[BS] 1501.6.1 Walkways. A walkway shall be provided for pedestrian travel in front of every construction and demolition site unless the applicable governing authority authorizes the sidewalk to be fenced or closed. A walkway shall be provided for pedestrian travel that leads from a building entrance or exit of an occupied structure to a public way. Walkways shall be of sufficient width to

accommodate the pedestrian traffic, but shall be not less than 4 feet (1219 mm) in width. Walkways shall be provided with a durable walking surface and shall be accessible in accordance with Chapter 11A of the *California Building Code*. Walkways shall be designed to support all imposed loads and the design live load shall be not less than 150 pounds per square foot (psf) (7.2 kN/m²).

**[BS] TABLE 1501.6
PROTECTION OF PEDESTRIANS**

HEIGHT OF CONSTRUCTION	DISTANCE OF CONSTRUCTION TO LOT LINE	TYPE OF PROTECTION REQUIRED
8 feet or less	Less than 5 feet	Construction railings
	5 feet or more	None
More than 8 feet	Less than 5 feet	Barrier and covered walkway
	5 feet or more, but not more than one-fourth the height of construction	Barrier and covered walkway
	5 feet or more, but between one-fourth and one-half the height of construction	Barrier
	5 feet or more, but exceeding one-half the height of construction	None

For SI: 1 foot = 304.8 mm.

[BS] 1501.6.2 Directional barricades. Pedestrian traffic shall be protected by a directional barricade where the walkway extends into the street. The directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

[BS] 1501.6.3 Construction railings. Construction railings shall be not less than 42 inches (1067 mm) in height and shall be sufficient to direct pedestrians around construction areas.

[BS] 1501.6.4 Barriers. Barriers shall be not less than 8 feet (2438 mm) in height and shall be placed on the side of the walkway nearest the construction. Barriers shall extend the entire length of the construction site. Openings in such barriers shall be protected by doors that are normally kept closed.

[BS] 1501.6.4.1 Barrier design. Barriers shall be designed to resist loads required in Chapter 16 of the *California Building Code* unless constructed as follows:

1. Barriers shall be provided with 2-inch by 4-inch (51 mm by 102 mm) top and bottom plates.
2. The barrier material shall be boards not less than $\frac{3}{4}$ inch (19.1 mm) in thickness or wood structural use panels not less than $\frac{1}{4}$ inch (6.4 mm) in thickness.
3. Wood structural use panels shall be bonded with an adhesive identical to that for exterior wood structural use panels.
4. Wood structural use panels $\frac{1}{4}$ inch (6.4 mm) or $\frac{15}{16}$ inch (23.8 mm) in thickness shall have studs spaced not more than 2 feet (610 mm) on center.
5. Wood structural use panels $\frac{3}{8}$ inch (9.5 mm) or $\frac{1}{2}$ inch (12.7 mm) in thickness shall have studs spaced not more than 4 feet (1219 mm) on center, provided that a 2-inch by 4-inch (51 mm by 102 mm) stiffener is placed horizontally at mid-height where the stud spacing is greater than 2 feet (610 mm) on center.
6. Wood structural use panels $\frac{5}{8}$ inch (15.9 mm) or thicker shall not span over 8 feet (2438 mm).

[BS] 1501.6.5 Covered walkways. Covered walkways shall have a clear height of not less than 8 feet (2438 mm) as measured from the floor surface to the canopy overhead. Adequate lighting shall be provided at all times. Covered walkways shall be designed to support all imposed loads. The design live load shall be not less than 150 psf (7.2 kN/m²) for the entire structure.

Exception: Roofs and supporting structures of covered walkways for new, light-frame construction not exceeding two stories above grade plane are permitted to be designed for a live load of 75 psf (3.6 kN/m²) or the loads imposed on them, whichever is greater. In lieu of such designs, the roof and supporting structure of a covered walkway are permitted to be constructed as follows:

1. Footings shall be continuous 2-inch by 6-inch (51 mm by 152 mm) members.
2. Posts not less than 4 inches by 6 inches (102 mm by 152 mm) shall be provided on both sides of the roof and spaced not more than 12 feet (3658 mm) on center.
3. Stringers not less than 4 inches by 12 inches (102 mm by 305 mm) shall be placed on edge on the posts.
4. Joists resting on the stringers shall be not less than 2 inches by 8 inches (51 mm by 203 mm) and shall be spaced not more than 2 feet (610 mm) on center.
5. The deck shall be planks not less than 2 inches (51 mm) thick or wood structural panels with an

exterior exposure durability classification not less than $\frac{23}{32}$ inch (18.3 mm) thick nailed to the joists.

6. Each post shall be knee-braced to joists and stringers by members not less than 2 inches by 4 inches (51 mm by 102 mm); 4 feet (1219 mm) in length.
7. A curb that is not less than 2 inches by 4 inches (51 mm by 102 mm) shall be set on edge along the outside edge of the deck.

[BS] 1501.6.6 Repair, maintenance and removal. Pedestrian protection required by Section 1501.6 shall be maintained in place and kept in good order for the entire length of time pedestrians are subject to being endangered. The owner or the owner's authorized agent, on completion of the construction activity, shall immediately remove walkways, debris and other obstructions and leave such public property in as good a condition as it was before such work was commenced.

[BS] 1501.6.7 Adjacent to excavations. Every excavation on a site located 5 feet (1524 mm) or less from the street lot line shall be enclosed with a barrier not less than 6 feet (1829 mm) in height. Where located more than 5 feet (1524 mm) from the street lot line, a barrier shall be erected where required by the code official. Barriers shall be of adequate strength to resist wind pressure as specified in Chapter 16 of the *California Building Code*.

[BG] 1501.7 Facilities required. Sanitary facilities shall be provided during construction or demolition activities in accordance with the *California Plumbing Code*.

SECTION 1502 PROTECTION OF ADJOINING PROPERTY

[BS] 1502.1 Protection required. Adjoining public and private property shall be protected from damage during construction and demolition work. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs. Provisions shall be made to control water runoff and erosion during construction or demolition activities. The person making or causing an excavation to be made shall provide written notice to the owners of adjoining buildings advising them that the excavation is to be made and that the adjoining buildings should be protected. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of the excavation.

[BS] 1502.2 Excavation retention systems. Where a retention system is used to provide support of an excavation for protection of adjacent structures, the system shall conform to the requirements in Section 1502.2.1 through 1502.2.3.

[BS] 1502.2.1 Excavation retention system design. Excavation retention systems shall be designed by a registered design professional to provide vertical and lateral support.

[BS] 1502.2.2 Excavation retention system monitoring. The retention system design shall include requirements for

monitoring of the system and adjacent structures for horizontal and vertical movement.

[BS] 1502.2.3 Retention system removal. Elements of the system shall only be removed or decommissioned where adequate replacement support is provided by back-fill or by the new structure. Removal or decommissioning shall be performed in such a manner that protects the adjacent property.

SECTION 1503 TEMPORARY USE OF STREETS, ALLEYS AND PUBLIC PROPERTY

[BG] 1503.1 Storage and handling of materials. The temporary use of streets or public property for the storage or handling of materials or equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the applicable governing authority and this chapter.

[BG] 1503.2 Obstructions. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 feet (6096 mm) of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

[BG] 1503.3 Utility fixtures. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in the gutter. Protection against damage shall be provided to such utility fixtures during the progress of the work, but sight of them shall not be obstructed.

SECTION 1504 FIRE EXTINGUISHERS

[F] 1504.1 Where required. Structures under construction, alteration or demolition shall be provided with not fewer than one approved portable fire extinguisher in accordance with Section 906 of the *California Fire Code* and sized for not less than ordinary hazard as follows:

1. At each stairway on all floor levels where combustible materials have accumulated.
2. In every storage and construction shed.
3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

[F] 1504.2 Fire hazards. The provisions of this code and of the *California Fire Code* shall be strictly observed to safeguard against all fire hazards attendant upon construction operations.

SECTION 1505 MEANS OF EGRESS

[BE] 1505.1 Stairways required. Where building construction exceeds 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access, a temporary or permanent stairway shall be provided. As construction progresses, such stairway shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1505.2 Maintenance of means of egress. Means of egress and required accessible means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

Exception: Existing means of egress need not be maintained where approved temporary means of egress and accessible means of egress systems and facilities are provided.

SECTION 1506 STANDPIPES

[F] 1506.1 Where required. In buildings required to have standpipes by Section 905.3.1 of the *California Building Code*, not less than one standpipe shall be provided for use during construction. Such standpipes shall be installed prior to construction exceeding 40 feet (12 192 mm) in height above the lowest level of fire department vehicle access. Such standpipes shall be provided with fire department hose connections at locations adjacent to *stairways*, complying with Section 1505.1. As construction progresses, such standpipes shall be extended to within one floor of the highest point of construction having secured decking or flooring.

[F] 1506.2 Buildings being demolished. Where a building or portion of a building is being demolished and a standpipe is existing within such a building, such standpipe shall be maintained in an operable condition so as to be available for use by the fire department. Such standpipe shall be demolished with the building but shall not be demolished more than one floor below the floor being demolished.

[F] 1506.3 Detailed requirements. Standpipes shall be installed in accordance with the provisions of Chapter 9 of the *California Building Code*.

Exception: Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of Section 905 of the *California Building Code* as to capacity, outlets and materials.

SECTION 1507 AUTOMATIC SPRINKLER SYSTEM

[F] 1507.1 Completion before occupancy. In buildings where an automatic sprinkler system is required by this code or the *California Building Code*, it shall be unlawful to occupy any portions of a building or structure until the automatic sprinkler system installation has been tested and *approved*, except as provided in Section 110.3.

[F] **1507.2 Operation of valves.** Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties. When the sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at the end of each work period to ascertain that protection is in service.

SECTION 1508 ACCESSIBILITY

[BE] **1508.1 Construction sites.** Structures, sites and equipment directly associated with the actual process of construction, including, but not limited to, scaffolding, bridging, material hoists, material storage or construction trailers, are not required to be accessible.

SECTION 1509 WATER SUPPLY FOR FIRE PROTECTION

[F] **1509.1 When required.** An approved water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible building material arrives on the site, on commencement of vertical combustible construction, and on installation of a standpipe system in buildings under construction, in accordance with Sections 1509.1 through 1509.5.

Exception: The fire code official is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

[F] **1509.2 Combustible building materials.** When combustible building materials of the building under construction are delivered to a site, a minimum fire flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used to provide this fire flow supply shall be within 500 feet (152 m) of the combustible building materials as measured along an *approved* fire apparatus access lane. Where the site configuration is such that one fire hydrant cannot be located within 500 feet (152 m) of all combustible building materials, additional fire hydrants shall be required to provide coverage in accordance with this section.

[F] **1509.3 Vertical construction of Types III, IV and V construction.** Prior to commencement of vertical construction of Type III, IV or V buildings that utilize any combustible building materials, the fire flow required by Sections 1509.3.1 through 1509.3.3 shall be provided, accompanied by fire hydrants in sufficient quantity to deliver the required fire flow and proper coverage.

[F] **1509.3.1 Fire separation up to 30 feet.** Where a building of Type III, IV or V construction has a fire separation distance of less than 30 feet (9144 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be built on, the water supply shall provide either a minimum of 500 gallons per minute (1893 L/m), or the entire fire flow required for the building when constructed, whichever is greater.

[F] **1509.3.2 Fire separation of 30 feet up to 60 feet.** Where a building of Type III, IV or V construction has a fire separation distance of 30 feet (9144 mm) up to 60 feet (18 288 mm) from property lot lines, and an adjacent property has an existing structure or otherwise can be constructed upon, the water supply shall provide a minimum of 500 gallons per minute (1893 L/m), or 50 percent of the fire flow required for the building when constructed, whichever is greater.

[F] **1509.3.3 Fire separation of 60 feet or greater.** Where a building of Type III, IV or V construction has a fire separation of 60 feet (18 288 mm) or greater from a property lot line, a water supply of 500 gallons per minute (1893 L/m) shall be provided.

[F] **1509.4 Vertical construction, Types I and II construction.** If combustible construction materials are delivered to the construction site, water supply in accordance with Section 1509.2 shall be provided. Additional water supply for fire flow is not required prior to commencing vertical construction of Type I and II buildings.

[F] **1509.5 Standpipe supply.** Regardless of the presence of combustible building materials, the construction type or the fire separation distance, where a standpipe is required in accordance with Section 1506, a water supply providing a minimum flow of 500 gallons per minute (1893 L/m) shall be provided. The fire hydrant used for this water supply shall be located within 100 feet (30 480 mm) of the fire department connection supplying the standpipe.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE CHAPTER 16 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter	X			X	X								X									
Adopt Entire Chapter as amended (amended sections listed below)			X					X	X	X	X	X		X	X							
Adopt only those sections that are listed below																						
Chapter / Section																						
ASCE/SEI 7—2016								X	X	X	X	X		X	X							
ASCE/SEI 41—2013										X												
ASCE/SEI 41—2017										X	X			X	X							
ASTM A615—15ae1										X												
ICC CBC—22										X												
NFPA 13R—22			X																			
NFPA 72—22			X																			

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The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER 16

REFERENCED STANDARDS

User note:

About this chapter: This code contains numerous references to standards that are used to regulate materials and methods of construction. Chapter 16 contains a comprehensive list of all standards that are referenced in the code, including the appendices. The standards are part of the code to the extent of the reference to the standard. Compliance with the referenced standard is necessary for compliance with this code. By providing specifically adopted standards, the construction and installation requirements necessary for compliance with the code can be readily determined. The basis for code compliance is, therefore, established and available on an equal basis to the building code official, contractor, designer and owner.

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4, or California Administration Division 1, as applicable. **[OSHPD 1] Reference to other chapters.** In addition to the code sections referenced, the standards listed in this chapter are applicable to the respective code sections in Chapters 2, 3A, 4A and 5A.

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

- 7—1988: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—1993: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—1995: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—1998: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—2002: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—2005: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—2010: Minimum Design Loads and Associated Criteria for Buildings and Other Structures**
503.12, 706.3.2
- 7—2016: Minimum Design Loads and Associated Criteria for Buildings and Other Structures with Supplement 1 [OSHPD 1, 1R, 2, 4 and 5, DSA-SS, DSA-SS/CC] and Supplement 3**
304.2, 304A.2, 304.3.1, 501A.3, 502A.5, 503.4, 503.12, 503.13, 503A.13, 706.3.2, 805.3, 805.4
- 41—2013: [OSHPD 1] Seismic Evaluation and Retrofit of Existing Buildings**
304A.2, 304A.3.4, 304A.3.5
- 41—2017: Seismic Evaluation and Retrofit of Existing Buildings [OSHPD 1R, 2, 4 and 5] with Supplement No. 1**
304.3.1, Table 304.3.1, 304.3.2, Table 304.3.2

ASHRAE

ASHRAE
1791 Tullie Circle NE
Atlanta, GA 30329

- 62.1—2019: Ventilation for Acceptable Indoor Air Quality**
807.2

ASME

American Society of Mechanical Engineers
Two Park Avenue
New York, NY 10016

- A17.1—2019/CSA B44—19: Safety Code for Elevators and Escalators**
306.7.7, 902.1.2

REFERENCED STANDARDS

ASME—continued

A17.3—2020: Safety Code for Existing Elevators and Escalators

902.1.2

A18.1—2020: Safety Standard for Platform Lifts and Stairway Chair Lifts

306.7.8

ASTM

ASTM International
100 Barr Harbor Drive, P.O. Box C700
West Conshohocken, PA 19428-2959

A615—15ae1: Specification for Deformed and Plain Carbon-steel Bars for Concrete Reinforcement:

303A.3.5.3

C94/C94M—17A: Specification for Ready-mixed Concrete

109.3.1

E108—17: Standard Test Methods for Fire Tests of Roof Coverings

1204.5

E136—16A: Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C

202

F2006—17: Standard Safety Specification for Window Fall Prevention Devices for Non-Emergency Escape (Egress) and Rescue (Ingress) Windows

505.2, 702.4

F2090—17: Standard Specification for Window Fall Prevention Devices with Emergency (Egress) Release Mechanisms

505.2, 505.3.1, 702.4, 702.5.1

ICC

International Code Council, Inc.
500 New Jersey Avenue NW 6th Floor
Washington, DC 20001

CBC—22: California Building Code

101.4.1, 104.2.1, 106.2.2, 109.3.3, 109.3.6, 109.3.9, 109.3.10, 110.2, 201A.3, 202, 202A, 301A.1, 301A.5, 301.3, 302A.4, 302.4.1, 302.5, 303.1, 303A.1, 303.2.2, 304.1, 304A.1, 304.3.1, 304.3.2, 305.1, 306.5, 306.7, 306.7.2, 306.7.4, 306.7.5, 306.7.9, 306.7.10, 306.7.10.1, 306.7.10.2, 306.7.10.3, 306.7.11, 306.7.12, 306.7.13, 306.7.15, 306.7.16, 306.7.16.3, 306.7.16.4, 306.7.16.5, 306.7.16.7, 309.2, 309A.2, 309A.3, 309A.6, 310A.2, 310A.3, 401.3, 401A.3, 402A, 402.1, 405A.1, 405A.2, 405.2.1.1, 405.2.3.1, 405.2.3.3, 405.2.4, 405.2.5, 405.2.6, 501.2, 501A.3, 502A.1, 502.1, 502.3, 502A.3, 502.4, 502A.4, 502.5, 502A.5, 503.1, 503A.1, 503.2, 503A.2, 503.3, 503A.3, 503.4, 503A.4, 503.5, 503.11, 503.12, 503.13, 503A.13, 503.14, 503.15, 503.17, 503.18, 505.3, 505.4, 506.1, 506A.1, 506.3, 506A.3, 506A.4, 506.4, 506.5.1, 506.5.2, 506.5.3, 506.5.4, 507.3, 701.2, 701.3, 702.1, 702.2, 702.3, 702.5, 702.6, 702.7, 704.1.1, 704.3, 705.1, 705.2, 706.2, 706.3.2, 802.2.1, 802.2.3, 802.3, 802.4, 802.5.2, 802.6, 802.6, 803.1.1, 803.2, 803.2.2, 803.2.3, 803.2.4, 803.2.5, 803.3, 804.1, 804.4.1, 804.4.1.1, Table 804.4.1.1(1), 804.4.1.2.1, 804.5.1.2, 804.5.3, 804.5.4, 804.5.5, 804.6, 804.7, 804.8.1, 804.9.1, 804.10.2, 804.11, 804.12.2, 805.2, 805.3, 805.4, 904.1.2, 904.1.3, 904.1.4, 904.1.6, 904.1.7, 904.2, 904.2.1, 904.2.2, 905.2, 905.3, 905.4, 906.2, 906.3, 906.6, 1001.2, 1001.3, 1002.1, 1002.2, 1002.3, 1002.4, 1004.1, 1006.1, 1006.2, 1006.3, 1006.4, 1010.1, 1011.1, 1011.2.1, 1011.2.2, 1011.3, 1011.5.1, 1011.5.2, 1011.5.3, 1011.5.6, 1011.6.1, 1011.6.1.1, 1011.6.3, 1011.7.1, 1011.7.2, 1011.7.3, 1011.8.1, 1011.8.2, 1011.8.3, 1102.1, 1102.2, 1102.3, 1103.1, 1103.2, 1103.3, 1201.4, 1202.2, 1203.12, 1204.2, 1204.9, 1206.1, 1301.2.2, 1301.2.3, 1301.2.4, 1301.3.3, 1301.4.1, 1301.6.1, 1301.6.1.1, 1301.6.2, 1301.6.2.1, 1301.6.3.2, 1301.6.3.3, 1301.6.4.1, 1301.6.5, 1301.6.5.1, 1301.6.6, 1301.6.7.1, 1301.6.8, 1301.6.9, 1301.6.9.1, 1301.6.10, 1301.6.10.1, 1301.6.11, 1301.6.11.1, 1301.6.12.1, 1301.6.13, Table 1301.6.15, 1301.6.15.1, 1301.6.16.1, 1301.6.17, 1301.6.17.1, 1301.6.18, 1301.6.18.1, 1301.6.19, Table 1301.6.19, 1301.6.20, 1301.6.20.1, 1301.9.1, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6, 1501.5, 1501.6.1, 1501.6.4.1, 1501.6.7, 1506.1, 1506.3, 1507.1

ICC 300—17: ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands

301.1.1

ICC 500—20: Standard for the Design and Construction of Storm Shelters

303.1, 303.2

ICC A117.1—17: Accessible and Usable Buildings and Facilities

306.3, 306.7, 306.7.11, 306.7.12

CEC—21: California Energy Code

302.2, 702.7, 708.1, 809.1, 907.1, 1104.1

ICC—continued

CFC—22: California Fire Code

101.2.1, 101.4.2, 301.3.1, 302.2, 307.1, 308.1, 802.2.1, 802.2.3, 803.2.3, 803.4.1.1, 803.4.1.2, 803.4.1.3, 803.4.1.4, 803.4.1.5, 803.4.1.6, 904.1.5, 1011.6.1.1, 1301.3.2, 1301.6.8.1, 1301.6.14, 1301.6.14.1, 1401.2, 1501.5, 1504.1, 1504.2

IFGC—21: International Fuel Gas Code®

302.2, 702.7.1

CMC—22: California Mechanical Code

302.2, 702.7, 807.1, 902.1.1, 1008.1, 1301.6.7.1, 1301.6.8, 1301.6.8.1

CPC—22: California Plumbing Code

302.2, 408.1, 702.7, 1009.1, 1009.2, 1009.3, 1009.5, 1501.7

IPMC—21: International Property Maintenance Code®

101.4.2, 302.2, 1301.3.2, 1401.2

CRC—22: California Residential Code

101.2, 101.4.1, 104.2.1, 109.3.3, 109.3.10, 302.2, 307.1, 308.1, 401.3, 402.1, 405.2.6, 502.3, 502.4, 502.5, 503.2, 503.3, 503.11, 505.2, 505.3, 507.3, 701.3, 702.4, 702.5, 706.2, 708.1, 805.2, 806.4, 809.1, 906.2, 907.1, 1011.2.1, 1103.1, 1103.2, 1103.3, 1104.1, 1201.4, 1301.2.2, 1301.2.3, 1301.3.3, 1401.2, 1402.1, 1402.2, 1402.2.1, 1402.3, 1402.4, 1402.5, 1402.6

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02169-7471

NFPA 13R—22: Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height

803.2.4

Add new Sections 6.6.10 and 6.6.10.1 as follows:

6.6.10 Solar photovoltaic panel structures.

6.6.10.1 Sprinklers shall be permitted to be omitted from the following structures:

- (1) Solar photovoltaic panel structures with no use underneath. Signs may be provided, as determined by the enforcing agency prohibiting any use underneath including storage.
- (2) Solar photovoltaic (PV) panels supported by framing that have sufficient uniformly distributed and unobstructed openings throughout the top of the array (horizontal plane) to allow heat and gases to escape, as determined by the enforcing agency.

Revise Section 11.4 as follows:

11.4 Instructions.

The installing contractor shall provide the property owner or the property owner's authorized representative with the following:

- (1) All literature and instructions provided by the manufacturer describing proper operation and maintenance of any equipment and devices installed.
- (2) NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems 2013 California Edition and Title 19, California Code of Regulations, Chapter 5.*
- (3) *Once the system is accepted by the authority having jurisdiction, a label as prescribed by Title 19, California Code of Regulations, Chapter 5, shall be affixed to each system riser.*

CEC—22: California Electrical Code

107.3, 302.2, 406.1.1, 406.1.2, 406.1.3, 406.1.5, 806.1, 806.4.4, 1007.1, 1007.2, 1007.3, 1007.4

NFPA 72—22: National Fire Alarm and Signaling Code

803.2.6, 803.4

Revise Section 10.3.1 as follows:

10.3.1 *Equipment constructed and installed in conformity with this Code shall be listed for the purpose for which it is used. Fire alarm systems and components shall be California State Fire Marshal approved and listed in accordance with California Code of Regulations, Title 19, Division 1.*

Revise Section 10.3.3 as follows:

10.3.3 *All devices and appliances that receive their power from the initiating device circuit or signaling line circuit of a control unit shall be California State Fire Marshal listed for use with the control unit.*

NFPA—continued

Revise Section 12.3.8.1 as follows:

12.3.8.1 The outgoing and return (redundant) circuit conductors shall be permitted in the same cable assembly (i.e., multiconductor cable), enclosure or raceway only under the following conditions:

- (1) For a distance not to exceed 10 feet (3.0 m) where the outgoing and return conductors enter or exit the initiating device, notification appliance, or control unit enclosures.
- (2) Single drops installed in the raceway to individual devices or appliances.
- (3) *In a single room not exceeding 1000 feet² (93 m²) in area, a drop installed in the raceway to multiple devices or appliances that does not include any emergency control function devices.
- (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire-resistive rating.

Revise Section 14.4.6.1 as follows:

14.4.6.1 Testing. Household fire alarm systems shall be tested in accordance with the manufacturer’s published instructions according to the methods of Table 14.4.3.2.

Revise Section 17.16 as follows:

17.16 Fire Extinguisher Electronic Monitoring Device. A fire extinguisher electronic monitoring device shall indicate those conditions for a specific fire extinguisher required by California Code of Regulations, Title 19, Division 1, Chapter 1, Section 574.2(c) and California Fire Code to a fire alarm control unit.

Revise Section 12.3.8 as follows:

12.3.8 (4) Where the vertically run conductors are contained in a 2-hour rated cable assembly, or enclosed (installed) in a 2-hour rated enclosure or a listed circuit integrity (C.I.) cable, which meets or exceeds a 2-hour fire resistive rating.

Revise Section 23.8.5.1.2 as follows:

23.8.5.1.2* Where connected to a supervising station, fire alarm systems employing automatic fire detectors or waterflow detection devices shall include a manual fire alarm box to initiate a signal to the supervising station.

Exception: Fire alarm systems dedicated to elevator recall control, supervisory service and fire sprinkler monitoring as permitted in Section 17.15 of NFPA 72.

Revise Section 23.8.5.4.1 as follows:

23.8.5.4.1 Systems equipped with alarm verification features shall be permitted under the following conditions:

- (1) The alarm verification feature is not initially enabled unless conditions or occupant activities that are expected to cause nuisance alarms are anticipated in the area that is protected by the smoke detectors. Enabling of the alarm verification feature shall be protected by password or limited access.
- (2) A smoke detector that is continuously subjected to a smoke concentration above alarm threshold does not delay the system functions of Sections 10.7 through 10.16, 23.8.1.1, or 21.2.1 by more than 30 seconds.
- (3) Actuation of an alarm-initiating device other than a smoke detector causes the system functions of Sections 10.7 through 10.16, 23.8.1.1, or 21.2.1 without additional delay.
- (4) The current status of the alarm verification feature is shown on the record of completion [see Figure 7.8.2(a), Item 4.3].
- (5) Operation of a patient room smoke detector in I-2 and R-2.1 occupancies shall not include an alarm verification feature.

Revise Section 29.3.1 as follows:

29.3.1 All devices, combinations of devices and equipment to be installed in conformity with this chapter shall be approved and listed by the California State Fire Marshal for the purposes for which they are intended.

Revise Section 29.5.2.1.1 as follows:

29.5.2.1.1* Smoke and Heat Alarms. Where connected to a supervising station unless exempted by applicable laws, codes or standards, smoke or heat alarms used to provide a fire-warning function, and when two or more alarms are installed within a dwelling unit, suite of rooms or similar area, shall be arranged so that the operation of any smoke or heat alarm causes all alarms within these locations to sound.

Note: Exception to 29.8.2.1.1 not adopted by the SFM.

Add Section 29.10.2.1 as follows:

29.10.2.1 The alarm verification feature shall not be used for household fire warning equipment.

Add Section 29.10.6.8.1 as follows:

29.10.6.8.1 The alarm verification feature shall not be used for household fire warning equipment.

NFPA 99—21: Health Care Facilities Code

302.2.1, 406.1.4, 408.3, 501.3, 707.1, 806.3, 808.1, 1007.1

NFPA 101—21: Life Safety Code

804.2

UL

UL LLC
333 Pfingsten Road
Northbrook, IL 60062

790—04: Standard Test Methods for Fire Tests of Roof Coverings—with Revisions through October 2018
1204.5

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A
CHAPTER A1 – SEISMIC STRENGTHENING PROVISIONS
FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)	X			X	X																	
Adopt only those sections that are listed below																						
Chapter / Section																						
A100.1	X			X	X																	
A103.1	X			X	X																	
A105.4				X	X																	

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

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Appendix A: GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

CHAPTER A1

SEISMIC STRENGTHENING PROVISIONS FOR UNREINFORCED MASONRY BEARING WALL BUILDINGS

User note:

About this appendix: Appendix A provides guidelines for upgrading the seismic-resistance capacity of different types of existing buildings. It is organized into separate chapters that deal with buildings of different types, including unreinforced masonry buildings, reinforced concrete and reinforced masonry wall buildings, and light-frame wood buildings.

SECTION A100 APPLICATION

[BS] A100.1 Vesting authority. When adopted by a state agency, the provisions of these regulations shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by the state legislature.

Following is a list of the state agencies that adopt building standards, the specific scope of application of the agency responsible for enforcement, and the specific statutory authority of each agency to adopt and enforce such provisions of building standards of this code, unless otherwise stated.

1. BSC—California Building Standards Commission.

Application—Existing buildings as specified in Section A102 having at least one unreinforced masonry bearing wall, with the exception of buildings subject to building standards pursuant to Health and Safety Code, commencing with Section 17910.

Enforcing Agency—State or local agency specified by the applicable provisions of the law.

Authority Cited—Health and Safety Code Section 18934.7.

Reference—Health and Safety Code Sections 18901 through 18949.

2. HCD 1—The Department of Housing and Community Development.

Application—Hotels, motels, lodging houses, apartments, dwellings, employee housing and factory-built housing.

Enforcing Agency—The local building department or the Department of Housing and Community Development.

Authority Cited—Health and Safety Code Sections 17040, 17921, 17922 and 19990.

Reference—Health and Safety Code Sections 17000 through 17060, 17910 through 17990, 19960 through 19997; and Government Code Section 12955.1.

3. HCD 2—The Department of Housing and Community Development.

Application—Permanent buildings and permanent accessory buildings or structures constructed within mobilehome parks and special occupancy parks.

Enforcing Agency—The local building department or the Department of Housing and Community Development.

Authority Cited—Health and Safety Code Sections 18300, 18620, 18640, 18865, 18873 and 18873.2.

Reference—Health and Safety Code Sections 18200 through 18700 and 18860 through 18874.

SECTION A101 PURPOSE

[BS] A101.1 Purpose. The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury from the effects of earthquakes on existing unreinforced masonry bearing wall buildings.

The provisions of this chapter are intended as minimum standards for structural seismic resistance, and are established primarily to reduce the risk of life loss or injury. Compliance with these provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to retrofitted buildings.

SECTION A102 SCOPE

[BS] A102.1 General. The provisions of this chapter shall apply to all existing buildings not more than six stories in height above the base of the structure and having not fewer than one unreinforced masonry bearing wall. The elements regulated by this chapter shall be determined in accordance with Table A102.1. Except as provided herein, other structural provisions of the building code shall apply. This chapter does not apply to the alteration of existing electrical, plumbing, mechanical or fire safety systems.

[BS] A102.2 Essential and hazardous facilities. The provisions of this chapter shall not apply to the strengthening of

[BS] TABLE A102.1
ELEMENTS REGULATED BY THIS CHAPTER

BUILDING ELEMENTS	S_{D1}			
	$\geq 0.067_g < 0.133_g$	$\geq 0.133_g < 0.20_g$	$\geq 0.20_g < 0.30_g$	$\geq 0.30_g$
Parapets	X	X	X	X
Walls, anchorage	X	X	X	X
Walls, h/t ratios		X	X	X
Walls, in-plane shear		X	X	X
Diaphragms ^a			X	X
Diaphragms, shear transfer ^b		X	X	X
Diaphragms, demand-capacity ratios ^b			X	X

a. Applies only to buildings designed according to the general procedures of Section A110.

b. Applies only to buildings designed according to the special procedures of Section A111.

buildings in Risk Category III or IV. Such buildings shall be strengthened to meet the requirements of the *California Building Code* for new buildings of the same risk category or other such criteria approved by the code official.

**SECTION A103
DEFINITIONS**

[BS] **A103.1 Definitions.** For the purpose of this chapter, the applicable definitions in the *California Building Code* as adopted by the *California Building Standards Commission (BSC)* shall also apply.

BUILDING CODE. [BSC, HCD 1 and HCD 2] “*Building Code*” shall mean the most current edition of the *California Building Code, Title 24, Part 2* as adopted by the *California Building Standards Commission (BSC)*.

[BS] **BED JOINT.** The horizontal layer of mortar on which a masonry unit is laid.

[BS] **COLLAR JOINT.** The vertical space between adjacent wythes. A collar joint may contain mortar or grout.

[BS] **CROSSWALL.** A new or existing wall that meets the requirements of Section A111.3. A crosswall is not a shear wall.

[BS] **CROSSWALL SHEAR CAPACITY.** The unit shear value times the length of the crosswall, $v_c L_c$.

[BS] **DETAILED BUILDING SYSTEM ELEMENTS.** The localized elements and the interconnections of these elements that define the design of the building.

[BS] **DIAPHRAGM EDGE.** The intersection of the horizontal diaphragm and a shear wall.

[BS] **DIAPHRAGM SHEAR CAPACITY.** The unit shear value times the depth of the diaphragm, $v_u D$.

[BS] **FLEXIBLE DIAPHRAGM.** A diaphragm of wood or untopped metal deck construction in which the horizontal deformation along its length is at least two times the average story drift.

HEAD JOINT. The vertical mortar joint placed between masonry units within the wythe.

[BS] **NORMAL WALL.** A wall perpendicular to the direction of seismic forces.

[BS] **OPEN FRONT.** An exterior building wall line on one side only without vertical elements of the seismic force-resisting system in one or more stories.

[BS] **POINTING.** The process of removal of deteriorated mortar from between masonry units and placement of new mortar. Also known as repointing or tuckpointing for purposes of this chapter.

[BS] **REPOINTING.** See “*Pointing*.”

[BS] **RIGID DIAPHRAGM.** A diaphragm of concrete construction or concrete-filled metal deck construction.

[BS] **TUCKPOINTING.** See “*Pointing*.”

[BS] **UNREINFORCED MASONRY (URM).** Includes burned clay, concrete or sand-lime brick; hollow clay or concrete block; plain concrete; and hollow clay tile. These materials shall comply with the requirements of Section A106 as applicable.

[BS] **UNREINFORCED MASONRY BEARING WALL.** A URM wall that provides the vertical support for the reaction of floor or roof-framing members for which the total superimposed vertical load exceeds 100 pounds per linear foot (1459 N/m) of wall length.

[BS] **UNREINFORCED MASONRY WALL.** A masonry wall that relies on the tensile strength of masonry units, mortar and grout in resisting design loads, and in which the area of reinforcement is less than the minimum amounts as defined for reinforced masonry walls.

[BS] **YIELD STORY DRIFT.** The lateral displacement of one level relative to the level above or below at which yield stress is first developed in a frame member.

**SECTION A104
SYMBOLS AND NOTATIONS**

[BS] **A104.1 Symbols and notations.** For the purpose of this chapter, the following notations supplement the applicable symbols and notations in the building code.

a_n = Diameter of core multiplied by its length or the area of the side of a square prism.

A = Cross-sectional area of unreinforced masonry pier or wall, square inches (10^{-6} m^2).

A_b	= Total area of the bed joints above and below the test specimen for each in-place shear test, square inches (10^{-6} m ²).	V_{cb}	= Total shear capacity of crosswalls in the direction of analysis immediately below the diaphragm level being investigated, $v_c L_c$, pounds (N).
A_n	= Area of net mortared or grouted section of a wall or wall pier.	V_p	= Shear force assigned to a pier on the basis of its relative shear rigidity, pounds (N).
D	= In-plane width dimension of pier, inches (10^{-3} m), or depth of diaphragm, feet (m).	V_r	= Pier rocking shear capacity of any URM wall or wall pier, pounds (N).
DCR	= Demand-capacity ratio specified in Section A111.4.2.	v_{test}	= Load at incipient cracking for each in-place shear test performed in accordance with Section A106.2.3.6, pounds (N).
f'_m	= Lower bound masonry compressive strength.	v_{tl}	= Lower bound mortar shear strength, pounds per square inch (kPa).
f_{sp}	= Tensile-splitting strength of masonry.	v_{to}	= Mortar shear test values as specified in Section A106.2.3.6, pounds per square inch (kPa).
F_{wx}	= Force applied to a wall at level x , pounds (N).	v_u	= Unit shear capacity value for a diaphragm sheathed with any of the materials given in Table A108.1(1) or A108.1(2), pounds per foot (N/m).
H	= Least clear height of opening on either side of a pier, inches (10^{-3} m).	V_{wx}	= Total shear force resisted by a shear wall at the level under consideration, pounds (N).
h/t	= Height-to-thickness ratio of URM wall. Height, h , is measured between wall anchorage levels and/or slab-on-grade.	W	= Total seismic dead load as defined in the building code, pounds (N).
L	= Span of diaphragm between shear walls, or span between shear wall and open front, feet (m).	W_d	= Total dead load tributary to a diaphragm level, pounds (N).
L_c	= Length of crosswall, feet (m).	W_w	= Total dead load of a URM wall above the level under consideration or above an open-front building, pounds (N).
L_i	= Effective diaphragm span for an open-front building specified in Section A111.8, feet (m).	W_{wx}	= Dead load of a URM wall assigned to level x halfway above and below the level under consideration, pounds (N).
P	= Applied force as determined by standard test method of ASTM C496 or ASTM E519, pounds (N).	$\Sigma v_u D$	= Sum of diaphragm shear capacities of both ends of the diaphragm, pounds (N).
P_D	= Superimposed dead load at the location under consideration, pounds (N). For determination of the rocking shear capacity, dead load at the top of the pier under consideration shall be used.	$\Sigma \Sigma v_u D$	= For diaphragms coupled with crosswalls, $v_u D$ includes the sum of shear capacities of both ends of diaphragms coupled at and above the level under consideration, pounds (N).
P_{D+L}	= Stress resulting from the dead plus actual live load in place at the time of testing, pounds per square inch (kPa).	ΣW_d	= Total dead load of all the diaphragms at and above the level under consideration, pounds (N).
P_{test}	= Splitting tensile test load determined by standard test method ASTM C496, pounds (N).		
P_w	= Weight of wall, pounds (N).		
R	= Response modification factor for Ordinary plain masonry shear walls in Bearing Wall System from Table 12.2-1 of ASCE 7, where $R = 1.5$.		
S_{DS}	= Design spectral acceleration at short period, in g units.		
S_{D1}	= Design spectral acceleration at 1-second period, in g units.		
v_a	= The shear strength of any URM pier, $v_m A/1.5$ pounds (N).		
v_c	= Unit shear strength for a crosswall sheathed with any of the materials given in Table A108.1(1) or Table A108.1(2), pounds per foot (N/m).		
v_{mL}	= Shear strength of unreinforced masonry, pounds per square inch (kPa).		
V_{aa}	= The shear strength of any URM pier or wall, pounds (N).		
V_{ca}	= Total shear capacity of crosswalls in the direction of analysis immediately above the diaphragm level being investigated, $v_c L_c$, pounds (N).		

SECTION A105 GENERAL REQUIREMENTS

[BS] A105.1 General. The seismic force-resisting system specified in this chapter shall comply with the *California Building Code* and referenced standards, except as modified herein.

[BS] A105.2 Alterations and repairs. Alterations and repairs required to meet the provisions of this chapter shall comply with applicable structural requirements of the building code unless specifically provided for in this chapter.

[BS] A105.3 Requirements for plans. The following construction information shall be included in the plans required by this chapter:

1. Dimensioned floor and roof plans showing existing walls and the size and spacing of floor and roof-framing members and sheathing materials. The plans shall

indicate all existing URM walls, and new crosswalls and shear walls, and their materials of construction. The location of these walls and their openings shall be fully dimensioned and drawn to scale on the plans.

2. Dimensioned URM wall elevations showing openings, piers, wall classes as defined in Section A106.2.3.9, thickness, heights, wall shear test locations, cracks or damaged portions requiring repairs, the general condition of the mortar joints, and if and where pointing is required. Where the exterior face is veneer, the type of veneer, its thickness and its bonding and/or ties to the structural wall masonry shall be noted.
3. The type of interior wall and ceiling materials, and framing.
4. The extent and type of existing wall anchorage to floors and roof where used in the design.
5. The extent and type of parapet corrections that were previously performed, if any.
6. Repair details, if any, of cracked or damaged unreinforced masonry walls required to resist forces specified in this chapter.
7. All other plans, sections and details necessary to delineate required retrofit construction.
8. The design procedure used shall be stated on both the plans and the permit application.
9. Details of the anchor prequalification program required by Section A107.5.3, if used, including location and results of all tests.
10. Quality assurance requirements of special inspection for all new construction materials and for retrofit construction including: anchor tests, pointing or repointing of mortar joints, installation of adhesive or mechanical anchors, and other elements as deemed necessary to ensure compliance with this chapter.

[BS] A105.4 Structural observation, testing and inspection. Structural observation, in accordance with Section 1704 of the *California Building Code*, shall be required for all structures in which seismic retrofit is being performed in accordance with this chapter. Structural observation shall include visual observation of work for compliance with the *approved* construction documents and confirmation of existing conditions assumed during design.

Structural testing and inspection for new and existing construction materials shall be in accordance with the building code, except as modified by this chapter.

Special inspection as described in Section A105.3, Item 10, shall be provided equivalent to Level 3 as prescribed in TMS 402, Table 3.1(2).

SECTION A106 MATERIALS REQUIREMENTS

[BS] A106.1 Condition of existing materials. Existing materials used as part of the required vertical load-carrying or

seismic force-resisting system shall be evaluated by on-site investigation and: determined to be in good condition (free of degraded mortar, degraded masonry units or significant cracking); or shall be repaired, enhanced, retrofitted or removed and replaced with new materials. Mortar joint deterioration shall be patched by pointing or repointing of the eroded joint in accordance with Section A106.2.3.10. Existing significant cracks in solid unit unreinforced and solid grouted hollow unit masonry shall be repaired.

[BS] A106.2 Existing unreinforced masonry.

[BS] A106.2.1 General. Unreinforced masonry walls used to support vertical loads or seismic forces parallel and perpendicular to the wall plane shall be tested as specified in this section. Masonry that does not meet the minimum requirements established by this chapter shall be repaired, enhanced, removed and replaced with new materials, or alternatively, shall have its structural functions replaced with new materials and shall be anchored to supporting elements.

[BS] A106.2.2 Lay-up of walls. Unreinforced masonry walls shall be laid in a running bond pattern.

[BS] A106.2.2.1 Header in multiple-wythe solid brick. The facing and backing wythes of multiple-wythe walls shall be bonded so that not less than 10 percent of the exposed face area is composed of solid headers extending not less than 4 inches (102 mm) into the backing wythes. The clear distance between adjacent header courses shall not exceed 24 inches (610 mm) vertically or horizontally. Where backing consists of two or more wythes, the headers shall extend not less than 4 inches (102 mm) into the most distant wythe, or the backing wythes shall be bonded together with separate headers for which the area and spacing conform to the foregoing. Wythes of walls not meeting these requirements shall be considered to be veneer, and shall not be included in the effective thickness used in calculating the height-to-thickness ratio and the shear capacity strength of the wall.

Exception: Where SD1 is 0.3 g or less, veneer wythes anchored and made composite with backup masonry are permitted to be used for calculation of the effective thickness.

[BS] A106.2.2.2 Lay-up patterns. Lay-up patterns other than those specified in Section A106.2.2.1 are allowed if their performance can be justified.

[BS] A106.2.3 Testing of masonry.

[BS] A106.2.3.1 Concrete masonry units and structural clay load-bearing tile. Grouted or ungrouted hollow concrete masonry units shall be tested in accordance with ASTM C140. Grouted or ungrouted structural clay load-bearing tile shall be tested in accordance with ASTM C67.

[BS] A106.2.3.2 In-place mortar joint shear tests. Mortar joint shear test values, v_{io} , shall be obtained by one of the following:

1. ASTM C1531.

- For masonry walls that have high shear strength mortar, or where in-place testing is not practical because of crushing or other failure mode of the masonry, alternative procedures for testing shall be used in accordance with Section A106.2.3.2.

[BS] A106.2.3.3 Alternative procedures for testing masonry. The splitting tensile strength of existing masonry, f_{sp} , or the prism strength of existing masonry, f'_m , is permitted to be determined in accordance with ASTM C496 and calculated by the following equation:

$$f_{sp} = \frac{0.494P}{a_n} \quad \text{(Equation A1-1)}$$

[BS] A106.2.3.4 Location of tests. The shear tests shall be taken at locations representative of the mortar conditions throughout the building. Test locations shall be determined at the building site by the registered design professional in charge. Results of all tests and their locations shall be recorded.

[BS] A106.2.3.5 Number of tests. The minimum number of tests per masonry class shall be determined as follows:

- At each of both the first and top stories, not less than two tests per wall or line of wall elements providing a common line of resistance to seismic forces.
- At each of all other stories, not less than one test per wall or line of wall elements providing a common line of resistance to seismic forces.
- In any case, not less than one test per 1,500 square feet (139.4 m²) of wall surface and not less than a total of eight tests.

[BS] A106.2.3.6 Minimum quality of mortar.

- Mortar shear test values, v_{to} , in pounds per square inch (kPa), shall be obtained for each in-place shear test in accordance with the following equation:

$$v_{to} = (V_{test}/A_b) - P_{D+L} \quad \text{(Equation A1-2)}$$

where:

V_{test} = Load at first observed movement.

A_b = Total area of the bed joints above and below the test specimen.

P_{D+L} = Stress resulting from actual dead plus live loads in place at the time of testing.

- Individual unreinforced masonry walls with more than 50 percent of mortar test values, v_{to} , less than 30 pounds per square inch (207 kPa) shall be pointed prior to and retested.
- The lower bound mortar shear strength, v_{il} , is defined as the mean minus one standard deviation of the mortar shear test values, v_{to} .
- Unreinforced masonry with mortar shear strength, v_{il} , less than 30 pounds per square inch (207 kPa)

shall be pointed and retested or shall have its structural function replaced, and shall be anchored to supporting elements in accordance with Sections A106.2.1 and A113.8. When existing mortar in any wythe is pointed to increase its shear strength and is retested, the condition of the mortar in the adjacent bed joints of the inner wythe or wythes and the opposite outer wythe shall be examined for extent of deterioration. The shear strength of any wall class shall be not greater than that of the weakest wythe of that class.

[BS] A106.2.3.7 Minimum quality of masonry. Where the alternative procedures of Section A106.2.3.2 are used to determine masonry quality, the following minimums apply:

- The minimum average value of splitting tensile strength, f_{sp} , as calculated by Equation A1-1 shall be 50 pounds per square inch (344.7 kPa).
- Individual unreinforced masonry walls with average splitting tensile strength of less than 50 pounds per square inch (344.7 kPa) shall be pointed and retested.
- The lower-bound mortar strength f_{spL} is defined as the mean minus one standard deviation P_{D+L} of the splitting tensile test values f_{sp} .

[BS] A106.2.3.8 Collar joints. The collar joints shall be inspected at the test locations during each in-place shear test, and estimates of the percentage of surfaces of the adjacent wythe that are covered with mortar shall be reported along with the results of the in-place shear tests.

[BS] A106.2.3.9 Unreinforced masonry classes. Existing unreinforced masonry shall be categorized into one or more classes based on shear strength, quality of construction, state of repair, deterioration and weathering. A class shall be characterized by the masonry shear strength determined in accordance with Section A108.2. Classes are defined for whole walls, not for small areas of masonry within a wall. Discretion in the definition of classes of masonry is permitted to avoid unnecessary testing.

[BS] A106.2.3.10 Pointing. Deteriorated mortar joints in unreinforced masonry walls shall be pointed in accordance with the following requirements:

- Joint preparation.** Deteriorated mortar shall be cut out by means of a toothing chisel or nonimpact power tool until sound mortar is reached, to a depth not less than $\frac{3}{4}$ inch (19.1 mm) or twice the thickness of the joint, whichever is less, but not greater than 2 inches (50 mm). Care shall be taken not to damage the masonry edges. After cutting is complete, all loose material shall be removed with a brush, or air or water stream.
- Mortar preparation.** The mortar mix shall be proportioned as required by the construction specifications and manufacturer's approved instructions.

3. **Packing.** The joint into which the mortar is to be packed shall be dampened but without free-standing water. The mortar shall be tightly packed into the joint in layers not exceeding $\frac{1}{4}$ inch (6.4 mm) deep until it is filled; then it shall be tooled to a smooth surface to match the original profile.

Nothing shall prevent pointing of any masonry wall joints before testing is performed in accordance with Section A106.2.3, except as required in Section A107.2.

SECTION A107 QUALITY CONTROL

[BS] A107.1 Pointing. Preparation and mortar pointing shall be performed with special inspection.

Exception: At the discretion of the code official, incidental pointing may be performed without special inspection.

[BS] A107.2 Masonry shear tests. In-place masonry shear tests shall comply with Section A106.2.3.1. Testing of masonry for determination of splitting tensile strength shall comply with Section A106.2.3.3.

[BS] A107.3 Existing wall anchors. Existing wall anchors used as all or part of the required tension anchors shall be tested in pullout according to Section A107.5.1. Not fewer than four anchors tested per floor shall be tested in pullout, with not fewer than two tests at walls with joists framing into the wall and two tests at walls with joists parallel to the wall, but not less than 10 percent of the total number of existing tension anchors at each level.

[BS] A107.4 New wall anchors. New wall anchors embedded in URM walls shall be subject to special inspection prior to placement of the anchor and grout or adhesive in the drilled hole. Five percent of all anchors that do not extend through the wall shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5.

New wall anchors embedded in URM walls resisting tension forces or a combination of tension and shear forces shall be subject to special inspection, prior to placement of the anchor and grout or adhesive in the drilled hole. Five percent of all anchors resisting tension forces shall be subject to a direct-tension test, and an additional 20 percent shall be tested using a calibrated torque wrench. Testing shall be performed in accordance with Section A107.5.

Exception: New bolts that extend through the wall with steel plates on the far side of the wall need not be tested.

[BS] A107.5 Tests of anchors in unreinforced masonry walls. Tests of anchors in unreinforced masonry walls shall be in accordance with Sections A107.5.1 through A107.5.3. Results of all tests shall be reported to the authority having jurisdiction. The report shall include the test results of maximum load for each test; pass-fail results; corresponding anchor size and type; orientation of loading; details of the anchor installation, testing apparatus and embedment; wall

thickness; and joist orientation and proximity to the tested anchor.

[BS] A107.5.1 Direct tension testing of existing anchors and new anchors. The test apparatus shall be supported by the masonry wall. The test procedure for prequalification of tension and shear anchors shall comply with ASTM E488. Existing wall anchors shall be given a preload of 300 pounds (1335 N) before establishing a datum for recording elongation. The tension test load reported shall be recorded at $\frac{1}{8}$ inch (3.2 mm) relative movement between the existing anchor and the adjacent masonry surface. New embedded tension anchors shall be subject to a direct tension load of not less than 2.5 times the design load but not less than 1,500 pounds (6672 N) for 5 minutes.

Exception: Where obstructions occur, the distance between the anchor and the test apparatus support shall be not less than one-half the wall thickness for existing anchors and 75 percent of the embedment length for new embedded anchors.

[BS] A107.5.2 Torque testing of new anchors. Anchors embedded in unreinforced masonry walls shall be tested using a torque-calibrated wrench to the following minimum torques:

- $\frac{1}{2}$ -inch-diameter (12.7 mm) bolts: 40 foot pounds (54.2 N-m).
- $\frac{5}{8}$ -inch-diameter (15.9 mm) bolts: 50 foot pounds (67.8 N-m).
- $\frac{3}{4}$ -inch-diameter (19.1 mm) bolts: 60 foot pounds (81.3 N-m).

[BS] A107.5.3 Prequalification test for bolts and other types of anchors. ASTM E488 or the test procedure in Section A107.5.1 is permitted to be used to determine tension or shear strength values for anchors greater than those permitted by Table A108.1(2). Anchors shall be installed in the same manner and using the same materials as will be used in the actual construction. Not fewer than five tests for each bolt size and type shall be performed for each class of masonry in which they are proposed to be used. The tension and shear strength values for such anchors shall be the lesser of the average ultimate load divided by 5.0 or the average load at which $\frac{1}{8}$ inch (3.2 mm) elongation occurs for each size and type of anchor and class of masonry.

SECTION A108 DESIGN STRENGTHS

[BS] A108.1 Strength values.

1. Strength values for existing materials are given in Table A108.1(1) and for new materials in Table A108.1(2).
2. The strength reduction factor, Φ , shall be taken equal to 1.0.
3. The use of materials not specified herein shall be based on substantiating research data or engineering judgment, as approved by the code official.

[BS] TABLE A108.1(1)
STRENGTH VALUES FOR EXISTING MATERIALS

EXISTING MATERIALS OR CONFIGURATION OF MATERIALS ^a		STRENGTH VALUES
		x 14.594 for N/m
Horizontal diaphragms	Roofs with straight sheathing and roofing applied directly to the sheathing.	300 lbs. per ft. for seismic shear
	Roofs with diagonal sheathing and roofing applied directly to the sheathing.	750 lbs. per ft. for seismic shear
	Floors with straight tongue-and-groove sheathing.	300 lbs. per ft. for seismic shear
	Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular.	1,500 lbs. per ft. for seismic shear
	Floors with diagonal sheathing and finished wood flooring.	1,800 lbs. per ft. for seismic shear
	Metal deck welded with minimal welding. ^c	1,800 lbs. per ft. for seismic shear
	Metal deck welded for seismic resistance. ^d	3,000 lbs. per ft. for seismic shear
Crosswalls ^b	Plaster on wood or metal lath.	600 lbs. per ft. for seismic shear
	Plaster on gypsum lath.	550 lbs. per ft. for seismic shear
	Gypsum wallboard, unblocked edges.	200 lbs. per ft. for seismic shear
	Gypsum wallboard, blocked edges.	400 lbs. per ft. for seismic shear
Existing footing, wood framing, structural steel, reinforcing steel	Plain concrete footings.	$f'_c = 1,500$ psi unless otherwise shown by tests
	Douglas fir wood.	Same as D.F. No. 1
	Reinforcing steel.	$F_y = 40,000$ psi maximum
	Structural steel.	$F_y = 33,000$ psi maximum

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 pound = 4.4 N, 1 pound per square inch = 6894.75 N/m², 1 pound per foot = 14.43 N/m.

a. Material must be sound and in good condition.

b. Shear values of these materials may be combined, except the total combined value should not exceed 900 pounds per foot.

c. Minimum 22-gage steel deck with welds to supports satisfying the standards of the Steel Deck Institute.

d. Minimum 22-gage steel deck with ³/₄-inch diameter plug welds at an average spacing not exceeding 8 inches and with sidelap welds appropriate for the deck span.

[BS] A108.2 **Masonry shear strength.** The unreinforced masonry shear strength, v_{mL} , shall be determined for each masonry class from one of the following equations:

- When testing is performed in accordance with Section A106.2.3.1, the unreinforced masonry shear strength, v_m , shall be determined by Equation A1-3.

$$v_{mL} = \frac{0.75 \left(0.75 v_{tL} \frac{P_D}{A_n} \right)}{1.5} \quad \text{(Equation A1-3)}$$

The mortar shear strength values, v_{tL} , shall be determined in accordance with Section A106.2.3.6.

- When alternate testing is performed in accordance with Section A106.2.3.3, unreinforced masonry shear, v_{mL} , shall be determined by Equation A1-4.

$$v_{mL} = \frac{0.75 \left(f_{sp} + \frac{P_D}{A_n} \right)}{1.5} \quad \text{(Equation A1-4)}$$

[BS] A108.3 **Masonry compression.** Where any increase in wall dead plus live load compression stress occurs, the maximum compression stress in unreinforced masonry, Q_c/A_n , shall not exceed 300 pounds per square inch (2070 kPa).

[BS] A108.4 **Masonry tension.** Unreinforced masonry shall be assumed to have no tensile capacity.

[BS] A108.5 **Wall tension anchors.** The tension strength of wall anchors shall be the average of the tension test values for anchors having the same wall thickness and framing orientation.

[BS] A108.6 **Foundations.** For existing foundations, new total dead loads are permitted to be increased over the existing dead load by 25 percent. New total dead load plus live load plus seismic forces may be increased over the existing dead load plus live load by 50 percent. Higher values may be justified only in conjunction with a geotechnical investigation.

SECTION A109 ANALYSIS AND DESIGN PROCEDURE

[BS] A109.1 **General.** The elements of buildings hereby required to be analyzed are specified in Table A102.1.

[BS] A109.2 **Selection of procedure.** Buildings with rigid diaphragms shall be analyzed by the general procedure of Section A110. Buildings with flexible diaphragms shall be analyzed by the general procedure or, where applicable, are permitted to be analyzed by the special procedure of Section A111.

[BS] TABLE A108.1(2)
STRENGTH VALUES OF NEW MATERIALS USED IN CONJUNCTION WITH EXISTING CONSTRUCTION

NEW MATERIALS OR CONFIGURATION OF MATERIALS		STRENGTH VALUES
Horizontal diaphragms	Plywood sheathing applied directly over existing straight sheathing with ends of plywood sheets bearing on joists or rafters and edges of plywood located on center of individual sheathing boards.	675 lbs. per ft.
Crosswalls	Plywood sheathing applied directly over wood studs; no value should be given to plywood applied over existing plaster or wood sheathing.	1.2 times the value specified in the current building code.
	Drywall or plaster applied directly over wood studs.	The value specified in the current building code.
	Drywall or plaster applied to sheathing over existing wood studs.	50 percent of the value specified in the current building code.
Tension anchors ^f	Anchors extending entirely through unreinforced masonry wall secured with bearing plates on far side of a wall 30 square inches of area. ^{b,c}	5,400 lbs. per anchor for three-wythe minimum walls. 2,700 lbs. for two-wythe walls.
Shear bolts ^{e,f}	Anchors embedded not less than 8 inches into unreinforced masonry walls; anchors should be centered in 2 1/2-inch-diameter holes with dry-pack or nonshrink grout around the circumference of the anchor.	The value for plain masonry specified for solid masonry TMS 402; and no value larger than those given for 3/4-inch bolts should be used.
Combined tension and shear anchors ^f	Through-anchors—anchors meeting the requirements for shear and for tension anchors. ^{b,c}	Tension—same as for tension anchors. Shear—same as for shear anchors.
	Embedded anchors—anchors extending to the exterior face of the wall with a 2 1/2-inch round plate under the head and drilled at an angle of 22 1/2 degrees to the horizontal; installed as specified for shear anchors. ^{a,b,c}	Tension—3,600 lbs. per anchor. Shear—same as for shear anchors.
Infilled walls	Reinforced masonry infilled openings in existing unreinforced masonry walls; provide keys or dowels to match reinforcing.	Same as values specified for unreinforced masonry walls.
Reinforced masonry ^d	Masonry piers and walls reinforced per the current building code.	The value specified in the current building code for strength design.
Reinforced concrete ^d	Concrete footings, walls and piers reinforced as specified in the current building code.	The value specified in the current building code for strength design.

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 pound = 4.4 N, 1 degree = 0.017 rad, 1 pound per foot = 14.43 N/m, 1 foot = 304.8 mm.

a. Embedded anchors to be tested as specified in Section A107.4.

b. Anchors shall be 1/2 inch minimum in diameter.

c. Drilling for anchors shall be done with an electric rotary drill; impact tools should not be used for drilling holes or tightening anchors and shear bolt nuts.

d. Load factors or capacity reduction factors shall not be used.

e. Other bolt sizes, values and installation methods may be used, provided that a testing program is conducted in accordance with Section A107.5.3. The strength value shall be determined by multiplying the calculated allowable value, determined in accordance with Section A107.5.3, by 3.0, and the usable value shall be limited to not greater than 1.5 times the value given in the table. Bolt spacing shall not exceed 6 feet on center and shall be not less than 12 inches on center.

f. An alternative adhesive anchor bolt system is permitted to be used providing: its properties and installation conform to an ICC Evaluation Service Report; and the report states that the system's use is in unreinforced masonry as an acceptable alternative to Sections A107.4 and A113.1 or TMS 402, Section 2.1.4. The report's allowable values shall be multiplied by a factor of three to obtain strength values and the strength reduction factor, Φ, shall be taken equal to 1.0.

**SECTION A110
GENERAL PROCEDURE**

[BS] A110.1 **Minimum design lateral forces.** Buildings shall be analyzed to resist minimum lateral forces assumed to act nonconcurrently in the direction of each of the main axes of the structure in accordance with the following:

$$V = \frac{0.75S_{DS}W}{R} \quad \text{(Equation A1-5)}$$

[BS] A110.2 **Seismic forces on elements of structures.** Parts and portions of a structure not covered in Section A110.3 shall be analyzed and designed per the current building code, using force levels defined in Section A110.1.

Exceptions:

1. Unreinforced masonry walls for which height-to-thickness ratios do not exceed ratios set forth in Table A110.2 need not be analyzed for out-of-plane loading. Unreinforced masonry walls that exceed the allowable *h/t* ratios of Table A110.2 shall be braced according to Section A113.5.
2. Parapets complying with Section A113.6 need not be analyzed for out-of-plane loading.
3. Where walls are to be anchored to flexible floor and roof diaphragms, the anchorage shall be in accordance with Section A113.1.

[BS] TABLE A110.2
ALLOWABLE VALUE OF HEIGHT-TO-THICKNESS RATIO OF UNREINFORCED MASONRY WALLS

WALL TYPES	$0.13_g \leq S_{D1} < 0.25_g$	$0.25_g \leq S_{D1} < 0.4_g$	$S_{D1} \geq 0.4_g$ BUILDINGS WITH CROSSWALLS ^a	$S_{D1} \geq 0.4_g$ ALL OTHER BUILDINGS
Walls of one-story buildings	20	16	16 ^{b,c}	13
First-story wall of multiple-story building	20	18	16	15
Walls in top story of multiple-story building	14	14	14 ^{b,c}	9
All other walls	20	16	16	13

For SI: 1 pound per square inch = 6894.75 N/m².

- Applies to the special procedures of Section A111 only. See Section A111.7 for other restrictions.
- This value of height-to-thickness ratio shall be used where mortar shear tests establish a tested mortar shear strength, v_p , of not less than 100 pounds per square inch. This value shall also be used where the tested mortar shear strength is not less than 60 pounds per square inch, and where a visual examination of the collar joint indicates not less than 50-percent mortar coverage.
- Where a visual examination of the collar joint indicates not less than 50-percent mortar coverage, and the tested mortar shear strength, v_p , is greater than 30 pounds per square inch but less than 60 pounds per square inch, the allowable height-to-thickness ratio may be determined by linear interpolation between the larger and smaller ratios in direct proportion to the tested mortar shear strength.

[BS] A110.3 In-plane loading of URM shear walls and frames. Vertical seismic force-resisting elements shall be analyzed in accordance with Section A112.

[BS] A110.4 Redundancy and overstrength factors. Any redundancy or overstrength factors contained in the building code may be taken as unity. The vertical component of seismic force (E_v) may be taken as zero.

SECTION A111 SPECIAL PROCEDURE

[BS] A111.1 Limits for the application of this procedure. The special procedures of this section shall be applied only to buildings having the following characteristics:

- Flexible diaphragms at all levels above the base of the structure.
- Vertical elements of the seismic force-resisting system consisting predominantly of masonry or a combination of masonry and concrete shear walls.
- Except for single-story buildings with an open front on one side only, not fewer than two lines of vertical elements of the seismic force-resisting system parallel to each axis of the building (see Section A111.8 for open front buildings).

[BS] A111.2 Seismic forces on elements of structures. With the exception of the provisions in Sections A111.4 through A111.7, elements of structures shall comply with Sections A110.2 through A110.4.

[BS] A111.3 Crosswalls. Crosswalls shall meet the requirements of this section.

[BS] A111.3.1 Crosswall definition. A crosswall is a wood-framed wall sheathed with any of the materials described in Table A108.1(1) or Table A108.1(2) or other system as defined in Section A111.3.5. Crosswalls shall be spaced not more than 40 feet (12 192 mm) on center measured perpendicular to the direction of consideration, and shall be placed in each story of the building. Crosswalls shall extend the full story height between diaphragms.

Exceptions:

- Crosswalls need not be provided at all levels where used in accordance with Section A111.4.2, Item 4.
- Existing crosswalls need not be continuous below a wood diaphragm at or within 4 feet (1219 mm) of grade, provided that:
 - Shear connections and anchorage requirements of Section A111.5 are satisfied at all edges of the diaphragm.
 - Crosswalls with total shear capacity of $0.5S_{D1}\Sigma W_d$ interconnect the diaphragm to the foundation.
 - The demand-capacity ratio of the diaphragm between the crosswalls that are continuous to their foundations does not exceed 2.5, calculated as follows:

$$DCR = \frac{(2.1S_{D1}W_d + V_{ca})}{2v_uD}$$

(Equation A1-6)

[BS] A111.3.2 Crosswall shear capacity. Within any 40 feet (12 192 mm) measured along the span of the diaphragm, the sum of the crosswall shear capacities shall be not less than 30 percent of the diaphragm shear capacity of the strongest diaphragm at or above the level under consideration.

[BS] A111.3.3 Existing crosswalls. Existing crosswalls shall have a maximum height-to-length ratio between openings of 1.5 to 1. Existing crosswall connections to diaphragms need not be investigated as long as the crosswall extends to the framing of the diaphragms above and below.

[BS] A111.3.4 New crosswalls. New crosswall connections to the diaphragm shall develop the crosswall shear capacity. New crosswalls shall have the capacity to resist an overturning moment equal to the crosswall shear capacity times the story height. Crosswall overturning moments need not be cumulative over more than two stories.

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] A111.3.5 **Other crosswall systems.** Other systems, such as moment-resisting frames, may be used as crosswalls provided that the yield story drift does not exceed 1 inch (25 mm) in any story.

[BS] A111.4 **Wood diaphragms.**

[BS] A111.4.1 **Acceptable diaphragm span.** A diaphragm is acceptable if the point (L, DCR) on Figure A111.4.1 falls within Region 1, 2 or 3.

[BS] A111.4.2 **Demand-capacity ratios.** Demand-capacity ratios shall be calculated for the diaphragm at any level according to the following formulas:

1. For a diaphragm without qualifying crosswalls at levels immediately above or below:

$$DCR = 2.1S_{DI}W_d/\Sigma v_u D \quad \text{(Equation A1-7)}$$

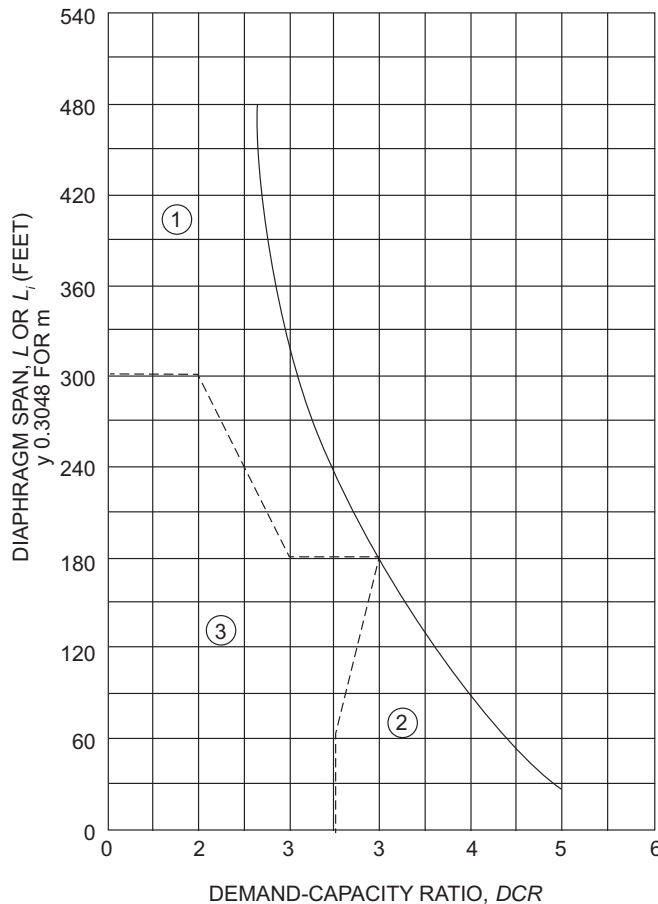
2. For a diaphragm in a single-story building with qualifying crosswalls, or for a roof diaphragm coupled by crosswalls to the diaphragm directly below:

$$DCR = 2.1S_{DI}W_d/\Sigma v_u D + V_{cb} \quad \text{(Equation A1-8)}$$

3. For diaphragms in a multiple-story building with qualifying crosswalls in all levels:

$$DCR = 2.1S_{DI}\Sigma W_d/(\Sigma \Sigma v_u D + V_{cb}) \quad \text{(Equation A1-9)}$$

DCR shall be calculated at each level for the set of diaphragms at and above the level under consideration. In addition, the roof diaphragm shall meet the requirements of Equation A1-10.



1. Region of demand-capacity ratios where crosswalls may be used to increase h/t ratios.
2. Region of demand-capacity ratios where h/t ratios of “buildings with crosswalls” may be used, whether or not crosswalls are present.
3. Region of demand-capacity ratios where h/t ratios of “all other buildings” shall be used, whether or not crosswalls are present.

For SI: 1 foot = 304.8 mm.

[BS] FIGURE A111.4.1
ACCEPTABLE DIAPHRAGM SPAN

4. For a roof diaphragm and the diaphragm directly below, if coupled by crosswalls:

$$DCR = 2.1S_{D1}\Sigma W_d/\Sigma v_u D \quad \text{(Equation A1-10)}$$

[BS] **A111.4.3 Chords.** An analysis for diaphragm flexure need not be made, and chords need not be provided.

[BS] **A111.4.4 Collectors.** An analysis of diaphragm collector forces shall be made for the transfer of diaphragm edge shears into vertical elements of the lateral force-resisting system. Collector forces may be resisted by new or existing elements.

[BS] **A111.4.5 Diaphragm openings.**

1. Diaphragm forces at corners of openings shall be investigated and shall be developed into the diaphragm by new or existing materials.
2. In addition to the demand-capacity ratios of Section A111.4.2, the demand-capacity ratio of the portion of the diaphragm adjacent to an opening shall be calculated using the opening dimension as the span.
3. Where an opening occurs in the end quarter of the diaphragm span, the calculation of $v_u D$ for the demand-capacity ratio shall be based on the net depth of the diaphragm.

[BS] **A111.5 Diaphragm shear transfer.** Diaphragms shall be connected to shear walls and new vertical seismic force-resisting elements with connections capable of developing the diaphragm-loading tributary to the shear wall or new seismic force-resisting elements given by the lesser of the following formulas:

$$V = 1.2S_{D1}C_pW_d \quad \text{(Equation A1-11)}$$

using the C_p values in Table A111.5, or

$$V = v_u D \quad \text{(Equation A1-12)}$$

[BS] **TABLE A111.5**
HORIZONTAL FORCE FACTOR, C_p

CONFIGURATION OF MATERIALS	C_p
Roofs with straight or diagonal sheathing and roofing applied directly to the sheathing, or floors with straight tongue-and-groove sheathing.	0.50
Diaphragms with double or multiple layers of boards with edges offset, and blocked plywood systems.	0.75
Diaphragms of metal deck without topping:	
Minimal welding or mechanical attachment.	0.6
Welded or mechanically attached for seismic resistance.	0.68

[BS] **A111.6 Shear walls (In-plane loading).**

[BS] **A111.6.1 Wall story force.** The wall story force distributed to a shear wall at any diaphragm level shall be the lesser value calculated as:

$$F_{wx} = 0.8S_{D1}(W_{wx} + W_d/2) \quad \text{(Equation A1-13)}$$

but need not exceed

$$F_{wx} = 0.8S_{D1}W_{wx} + v_u D \quad \text{(Equation A1-14)}$$

[BS] **A111.6.2 Wall story shear.** The wall story shear shall be the sum of the wall story forces at and above the level of consideration.

$$V_{wx} = \Sigma F_{wx} \quad \text{(Equation A1-15)}$$

[BS] **A111.6.3 Shear wall analysis.** Shear walls shall comply with Section A112.

[BS] **A111.6.4 New seismic force-resisting elements.** New seismic force-resisting elements such as moment frames, braced frames or shear walls shall be designed as required by the building code, except that the seismic forces shall be as specified in Section A111.6.1, and the story drift ratio shall be limited to 0.015, except as further limited by Section A112.4.2 for moment frames.

[BS] **A111.7 Out-of-plane forces—unreinforced masonry walls.**

[BS] **A111.7.1 Allowable unreinforced masonry wall height-to-thickness ratios.** The provisions of Section A110.2 are applicable, except the allowable height-to-thickness ratios given in Table A110.2 shall be determined from Figure A111.4.1 as follows:

1. In Region 1, height-to-thickness ratios for buildings with crosswalls may be used if qualifying crosswalls are present in all stories.
2. In Region 2, height-to-thickness ratios for buildings with crosswalls may be used whether or not qualifying crosswalls are present.
3. In Region 3, height-to-thickness ratios for “all other buildings” shall be used whether or not qualifying crosswalls are present.

[BS] **A111.7.2 Walls with diaphragms in different regions.** Where diaphragms above and below the wall under consideration have demand-capacity ratios in different regions of Figure A111.4.1, the lesser height-to-thickness ratio shall be used.

[BS] **A111.8 Open-front design procedure.** A single-story building with an open front on one side and crosswalls parallel to the open front may be designed by the following procedure:

1. Effective diaphragm span, L_i , for use in Figure A111.4.1 shall be determined in accordance with the following formula:

$$L_i = 2[(W_w/W_d)L + L] \quad \text{(Equation A1-16)}$$

2. Diaphragm demand-capacity ratio shall be calculated as:

$$DCR = 2.1S_{D1}(W_d + W_w)/[(v_u D) + V_{cb}] \quad \text{(Equation A1-17)}$$

SECTION A112
ANALYSIS AND DESIGN

[BS] **A112.1 General.** The following requirements are applicable to both the general procedure and the special procedure for analyzing vertical elements of the lateral force-resisting system.

[BS] A112.2 In-plane shear of unreinforced masonry walls.

[BS] A112.2.1 Flexural rigidity. Flexural components of deflection need not be considered in determining the rigidity of an unreinforced masonry wall.

[BS] A112.2.2 Shear walls with openings. Wall piers shall be analyzed according to the following procedure, which is diagrammed in Figure A112.2.2.

1. For any pier,
 - 1.1. The pier shear capacity shall be calculated as:

$$v_a = v_m A_n \quad \text{(Equation A1-18)}$$

where:

A_n = area of net mortared or grouted section of a wall or wall pier.

- 1.2. The pier rocking shear capacity shall be calculated as:

$$V_r = 0.9P_D D/H \quad \text{(Equation A1-19)}$$

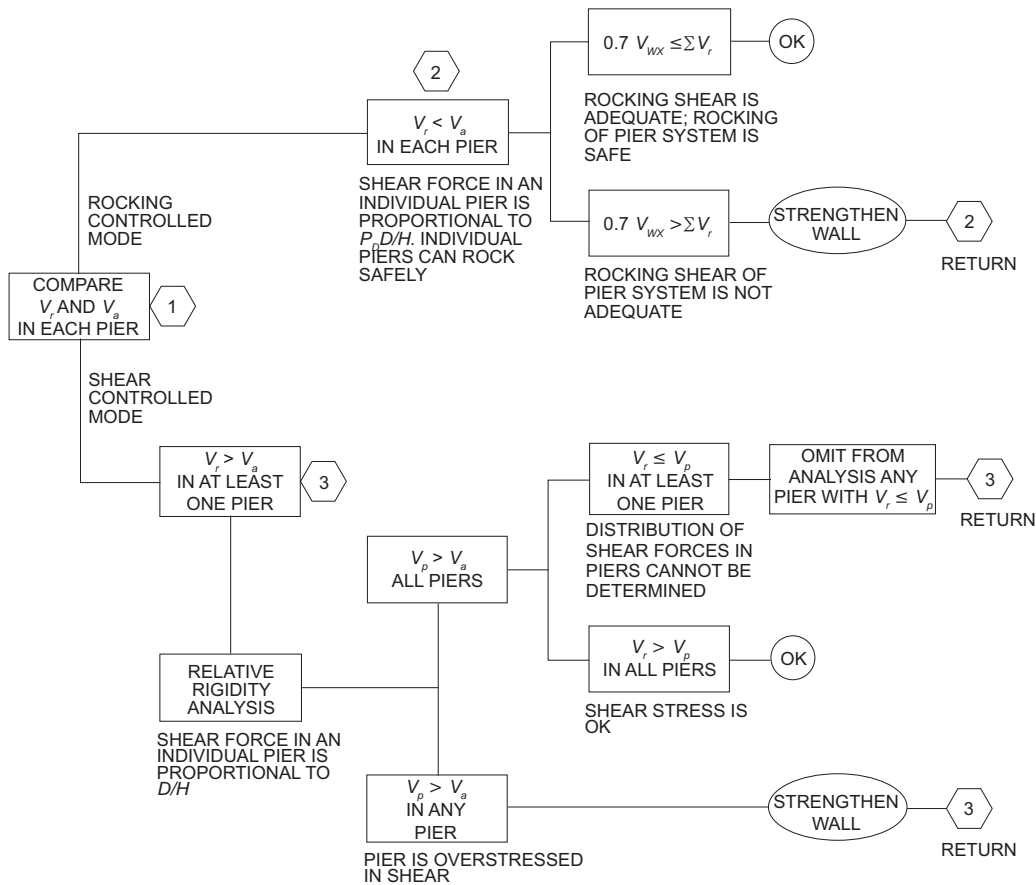
2. The wall piers at any level are acceptable if they comply with one of the following modes of behavior:

- 2.1. Rocking controlled mode. Where the pier rocking shear capacity is less than the pier shear capacity, in other words, $V_r < v_a$, for each pier in a level, forces in the wall at that level, V_{wx} , shall be distributed to each pier in proportion to $P_D D/H$.

For the wall at that level:

$$0.7V_{wx} < \Sigma V_r \quad \text{(Equation A1-20)}$$

- 2.2. Shear controlled mode. Where the pier shear capacity is less than the pier rocking capacity:



- V_a = Allowable shear strength of a pier.
- V_p = Shear force assigned to a pier on the basis of a relative shear rigidity analysis.
- V_r = Rocking shear capacity of pier.
- V_{wx} = Total shear force resisted by the wall.
- ΣV_r = Rocking shear capacity of all piers in the wall.

[BS] FIGURE A112.2.2 ANALYSIS OF URM WALL IN-PLANE SHEAR FORCES

ity, in other words, $v_a < V_r$ in one or more pier(s) in a level, forces in the wall at the level, V_{wall} , shall be distributed to each pier in proportion to D/H .

For each pier at that level:

$$V_p < v_a \quad \text{(Equation A1-21)}$$

and

$$V_p < V_r \quad \text{(Equation A1-22)}$$

If $V_p < v_a$ for each pier and $V_p > V_r$ for one or more piers, such piers shall be omitted from the analysis, and the procedure shall be repeated for the remaining piers, unless the wall is strengthened and reanalyzed.

- Masonry pier tension stress. Unreinforced masonry wall piers need not be analyzed for tension stress.

[BS] A112.2.3 Shear walls without openings. Shear walls without openings shall be analyzed the same as for walls with openings, except that V_r shall be calculated as follows:

$$V_r = 0.9(P_D + 0.5P_w)D/H \quad \text{(Equation A1-23)}$$

[BS] A112.3 Plywood-sheathed shear walls. Plywood-sheathed shear walls may be used to resist lateral forces for URM buildings with flexible diaphragms analyzed according to provisions of Section A111. Plywood-sheathed shear walls shall not be used to share lateral forces with other materials along the same line of resistance.

[BS] A112.4 Combinations of vertical elements.

[BS] A112.4.1 Seismic force distribution. Seismic forces shall be distributed among the vertical-resisting elements in proportion to their relative rigidities, except that moment-resisting frames shall comply with Section A112.4.2.

[BS] A112.4.2 Moment-resisting frames. Moment resisting frames shall not be used with an unreinforced masonry wall in a single line of resistance unless the wall has piers that have adequate shear capacity to sustain rocking in accordance with Section A112.2.2. The frames shall be designed in accordance with the building code to resist 100 percent of the seismic forces tributary to that line of resistance, as determined from Section A111.2. The story drift ratio shall be limited to 0.0075.

**SECTION A113
DETAILED BUILDING SYSTEM
DESIGN REQUIREMENTS**

[BS] A113.1 Wall anchorage.

[BS] A113.1.1 Anchor locations. Unreinforced masonry walls shall be anchored at the roof and floor levels as required in Section A110.2. Ceilings of plaster or similar materials, where not attached directly to roof or floor framing and where abutting masonry walls, shall either be anchored to the walls at a maximum spacing of 6 feet (1829 mm) or be removed.

[BS] A113.1.2 Anchor requirements. Anchors shall consist of bolts installed through the wall as specified in Table A108.1(2), or an *approved* equivalent at a maximum anchor spacing of 6 feet (1829 mm). Wall anchors shall be secured to the framing members parallel or perpendicular to the wall to develop the required forces.

[BS] A113.1.3 Minimum wall anchorage. Anchorage of masonry walls to each floor or roof shall resist a minimum force determined as $0.9S_{DS}$ times the tributary weight or 200 pounds per linear foot (2920 N/m), whichever is greater, acting normal to the wall at the level of the floor or roof. Existing wall anchors, if used, must be tested and meet the requirements of Section A107.5.1 or be upgraded.

[BS] A113.1.4 Anchors at corners. At the roof and floor levels, both shear and tension anchors shall be provided within 2 feet (610 mm) horizontally from the inside of the corners of the walls.

[BS] A113.2 Diaphragm shear transfer. Anchors transmitting shear forces shall have a maximum spacing of 6 feet (1829 mm) and shall have nuts installed over malleable iron or plate washers where bearing on wood, and heavy-cut washers where bearing on steel.

[BS] A113.3 Collectors. Collector elements shall be provided that are capable of transferring the seismic forces originating in other portions of the building to the element providing the resistance to those forces.

[BS] A113.4 Ties and continuity. Ties and continuity shall conform to the requirements of the building code.

[BS] A113.5 Wall bracing.

[BS] A113.5.1 General. Where a wall height-to-thickness ratio exceeds the specified limits, the wall may be laterally supported by vertical bracing members per Section A113.5.2 or by reducing the wall height by bracing per Section A113.5.3.

[BS] A113.5.2 Vertical bracing members. Vertical bracing members shall be attached to floor and roof construction for their design loads independently of required wall anchors. Horizontal spacing of vertical bracing members shall not exceed one-half of the unsupported height of the wall or 10 feet (3048 mm). Deflection of such bracing members at design loads shall not exceed one-tenth of the wall thickness.

[BS] A113.5.3 Intermediate wall bracing. The wall height may be reduced by bracing elements connected to the floor or roof. Horizontal spacing of the bracing elements and wall anchors shall be as required by design, but shall not exceed 6 feet (1829 mm) on center. Bracing elements shall be detailed to minimize the horizontal displacement of the wall by the vertical displacement of the floor or roof.

[BS] A113.6 Parapets. Parapets and exterior wall appendages not conforming to this chapter shall be removed, or stabilized or braced to ensure that the parapets and appendages remain in their original positions.

The maximum height of an unbraced unreinforced masonry parapet above the lower of either the level of tension anchors or the roof sheathing shall not exceed the height-to-thickness ratio shown in Table A113.6. If the required parapet height exceeds this maximum height, a bracing system designed for the forces determined in accordance with the building code shall support the top of the parapet. Parapet corrective work must be performed in conjunction with the installation of tension roof anchors.

The height of a URM parapet above any wall anchor shall be not less than 12 inches (305 mm).

Exception: If a reinforced concrete beam is provided at the top of the wall, the height above the wall anchor is permitted to be not less than 6 inches (152 mm).

[BS] A113.7 Veneer.

- Veneer shall be anchored with approved anchor ties conforming to the required design capacity specified in the building code and shall be placed at a maximum spacing of 24 inches (610 mm) with a maximum supported area of 4 square feet (0.372 m²).

Exception: Existing anchor ties for attaching brick veneer to brick backing shall be acceptable, provided that the ties are in good condition and conform to the following minimum size and material requirements.

Existing veneer anchor ties shall be considered adequate if they are of corrugated galvanized iron strips not less than 1 inch (25 mm) in width, 8 inches (203 mm) in length and 1/16 inch (1.6 mm) in thickness, or the equivalent.

- The location and condition of existing veneer anchor ties shall be verified as follows:
 - An approved testing laboratory shall verify the location and spacing of the ties and shall submit a report to the code official for approval as part of the structural analysis.
 - The veneer in a selected area shall be removed to expose a representative sample of ties (not less than four) for inspection by the code official.

[BS] A113.8 Nonstructural masonry walls. Unreinforced masonry walls that do not carry design vertical or lateral loads and that are not required by the design to be part of the lateral force-resisting system shall be adequately anchored to new or existing supporting elements. The anchors and elements shall be designed for the out-of-plane forces specified in the building code. The height- or length-to-thickness ratio between such supporting elements for such walls shall not exceed nine.

[BS] A113.9 Truss and beam supports. Where trusses and beams other than rafters or joists are supported on masonry, independent secondary columns shall be installed to support vertical loads of the roof or floor members.

Exception: Secondary supports are not required where S_{D1} is less than 0.3 g.

[BS] A113.10 Adjacent buildings. Where elements of adjacent buildings do not have a separation of 5 inches (127 mm) or greater, the allowable height-to-thickness ratios for “all other buildings” per Table A110.2 shall be used in the direction of consideration.

**SECTION A114
WALLS OF UNBURNED CLAY,
ADOBE OR STONE MASONRY**

[BS] A114.1 General. Walls of unburned clay, adobe or stone masonry construction shall conform to the following:

- Walls of unburned clay, adobe or stone masonry shall not exceed a height- or length-to-thickness ratio specified in Table A114.1.
- Adobe shall be allowed a maximum value of 9 pounds per square inch (62.1 kPa) for shear unless higher values are justified by test.
- Mortar for repointing may be of the same soil composition and stabilization as the brick, in lieu of cement mortar.

**[BS] TABLE A113.6
MAXIMUM ALLOWABLE HEIGHT-TO-THICKNESS RATIO FOR PARAPETS**

	S_{D1}		
	$0.13_g \leq S_{D1} \leq 0.25g$	$0.25_g \leq S_{D1} < 0.4g$	$S_{D1} \geq 0.4_g$
Maximum allowable height-to-thickness ratios	2.5	2.5	1.5

**[BS] TABLE A114.1
MAXIMUM HEIGHT-TO-THICKNESS RATIO FOR ADOBE OR STONE WALLS**

	S_{D1}		
	$0.13_g \leq S_{D1} < 0.25g$	$0.25_g \leq S_{D1} < 0.4_g$	$S_{D1} \geq 0.4_g$
One-story buildings	12	10	8
Two-story buildings			
First story	14	11	9
Second story	12	10	8

**CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A**

**CHAPTER A2 – EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE
AND REINFORCED MASONRY WALL BUILDINGS WITH FLEXIBLE DIAPHRAGMS**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)	X																						
Adopt only those sections that are listed below																							
Chapter / Section																							
A202.1	X																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER A2

EARTHQUAKE HAZARD REDUCTION IN EXISTING REINFORCED CONCRETE AND REINFORCED MASONRY WALL BUILDINGS WITH FLEXIBLE DIAPHRAGMS

SECTION A201 PURPOSE

[BS] **A201.1 Purpose.** The purpose of this chapter is to promote public safety and welfare by reducing the risk of death or injury as a result of the effects of earthquakes on reinforced concrete and reinforced masonry wall buildings with flexible diaphragms. Based on past earthquakes, these buildings have been categorized as being potentially hazardous and prone to significant damage, including possible collapse in a moderate to major earthquake. The provisions of this chapter are minimum standards for structural seismic resistance established primarily to reduce the risk of life loss or injury on both subject and adjacent properties. These provisions will not necessarily prevent loss of life or injury, or prevent earthquake damage to an existing building that complies with these standards.

SECTION A202 SCOPE

[BS] **A202.1 Scope.** The provisions of this chapter shall apply to wall anchorage systems that resist out-of-plane forces and to collectors in existing reinforced concrete or reinforced masonry buildings with flexible diaphragms. Wall anchorage systems that were designed and constructed in accordance with the 1997 *Uniform Building Code* or the 2001 or subsequent editions of the *California Building Code* shall be deemed to comply with these provisions.

SECTION A203 DEFINITIONS

[BS] **A203.1 Definitions.** For the purpose of this chapter, the applicable definitions in the *California Building Code* and the following shall apply:

[BS] **CONTINUITY CONNECTOR.** A component, typically a plate, rod, strap or hold-down, that ensures load path continuity along the full length of a crosstie or strut.

[BS] **CROSSTIE.** A member or group of members continuous across the main diaphragm that connects opposite wall lines and transfers out-of-plane wall anchorage forces into the diaphragm.

[BS] **FLEXIBLE DIAPHRAGM.** A roof or floor sheathed with plywood, wood decking (1-by or 2-by) or metal deck without a concrete topping slab.

[BS] **STRUT.** A member or group of members continuous across a subdiaphragm that transfers out-of-plane wall anchorage forces into the subdiaphragm.

[BS] **WALL ANCHORAGE SYSTEM.** The components comprising a complete load path for out-of-plane wall forces from the wall to the main diaphragm, typically including anchors embedded in or fastened to the wall; rods, straps, plates, hold-downs or other hardware; subdiaphragms and their chords; crossties; struts; and continuity connectors.

[BS] **WALL SEGMENT.** Any length of concrete wall with continuous horizontal reinforcing and not interrupted or intersected by a pilaster or vertical construction joint, or any length of reinforced masonry wall with continuous horizontal reinforcing and not interrupted or intersected by a pilaster or vertical control joint.

SECTION A204 SYMBOLS AND NOTATIONS

[BS] **A204.1 General.** For the purpose of this chapter, the applicable symbols and notations in the *California Building Code* shall apply.

SECTION A205 GENERAL REQUIREMENTS

[BS] **A205.1 General.** The seismic-resisting elements specified in this chapter shall comply with applicable provisions of Section 1613 of the *California Building Code* and Chapter 12 of ASCE 7, except as modified herein.

[BS] **A205.2 Requirements for plans.** The plans shall accurately reflect the results of the engineering investigation and design and shall show all pertinent dimensions and sizes for plan review and construction. The following shall be provided:

1. Floor plans and roof plans shall show existing framing construction, diaphragm construction, proposed wall anchors, crossties and collectors. Existing nailing, anchors, crossties and collectors shall be shown on the plans if they are considered part of the lateral force-resisting systems.
2. Typical wall panel details and sections with panel thickness, height, pilasters and location of anchors shall be provided.
3. Details shall include existing and new anchors and the method of developing anchor forces into the diaphragm framing, existing and new crossties, and existing and new or improved support of roof and floor girders at pilasters or walls.
4. The basis for design and the building code used for the design shall be stated on the plans.

[BS] A205.3 Structural observation. Structural observation, in accordance with Section 1704.6 of the *California Building Code* is required, regardless of seismic design category, height or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

A205.3.1 Additional special inspection. In addition to the requirements of Section 1705.13 of the *California Building Code*, special inspection shall be required for:

1. Installation of anchors into existing concrete or masonry walls to form part of a wall anchorage system.
2. Fastening of new or existing steel deck forming part of a wall anchorage system.
3. Installation of continuity connectors along the length of crossties, to ensure compliance with Section A206.2. This inspection may be periodic special inspection.

A205.3.2 Testing to establish adequacy of existing wall anchors. Testing shall show that the existing anchors can sustain a test load of 1.5 times the design tension load without noticeable deformation or damage to the anchor, to the masonry or concrete element, or to any part of the existing load path between the anchor and new retrofit components. Three anchors of each existing detail type shall be tested, and all three shall satisfy the requirement. Prior to testing, the design professional shall submit a test plan for code official approval identifying the expected locations of the existing anchors in question, the locations of the proposed tests, and the test procedure and criteria. After testing, the design professional shall submit a report of the satisfactory testing showing the test results, the design strengths derived from them, and the size and spacing as confirmed by investigation.

A205.4 Testing and Inspection. Structural testing and inspection for new construction materials, submittals, reports and certificates of compliance shall be in accordance with Sections 1704 and 1705 of the *California Building Code*. Work done to comply with this chapter shall not be eligible for Exception 1 to Section 1704.2 of the *California Building Code* or Exception 2 to Section 1705.13 of the *California Building Code*.

SECTION A206 ANALYSIS AND DESIGN

[BS] A206.1 Reinforced concrete and reinforced masonry wall anchorage. Concrete and masonry walls shall be anchored to all floors and roofs that provide lateral support for the wall in accordance with Section 12.11.2 of ASCE 7. The anchorage shall provide a direct connection capable of resisting 75 percent of the forces specified in Section 12.11.2.1 of ASCE 7.

Exceptions:

1. Existing walls need not be evaluated or retrofitted for bending between anchors.

2. Work required by this chapter need not consider shrinkage, thermal changes or differential settlement.

A206.1.1 Seismicity parameters, site class and geologic hazards. For any site designated as Site Class E, the value of F_a shall be taken as 1.2. Site-specific procedures are not required for compliance with this chapter. Mitigation of existing geologic site hazards such as liquefiable soil, fault rupture or landslide is not required for compliance with this chapter.

[BS] A206.2 Additional requirements for wall anchorage systems. The wall anchorage system shall comply with the requirements of this section and Section 12.11.2.2 of ASCE 7.

The maximum spacing between wall anchors shall be 8 feet (2438 mm), and each wall segment shall have at least two wall anchors.

The wall anchorage system, excluding subdiaphragms and existing roof or floor framing members, shall be designed and installed to limit the relative movement between the wall and the diaphragm to no more than $\frac{1}{8}$ inch before engagement of the anchors. Wall anchors shall be provided to resist out-of-plane forces, independent of existing shear anchors.

Where new members are added as crossties, they shall be spaced no more than 24 feet (7315 mm) apart. Where existing girders are used as crossties, their actual spacing shall be deemed adequate even where the spacing exceeds 24 feet (7315 mm), as long as the girders are provided with continuity connectors as required.

Wall anchorage shall not be provided by fastening the edge of plywood sheathing to steel ledgers. Wall anchorage shall not be provided solely by fastening the edge of steel decking to steel ledgers unless analysis demonstrates acceptable capacity. The existing connections shall be subject to field verification and the new connections shall be subject to special inspection.

New wall anchors shall be provided to resist the full wall anchorage design force independent of existing shear or tension anchors.

Exception: Existing cast-in-place anchors shall be permitted as part of the wall anchorage system if the tie element can be readily attached to the anchors, and if the anchors are capable of resisting the total vertical and lateral shear load (including dead load) while being acted on by the maximum wall anchorage tension force caused by an earthquake. Acceptable tension values for the existing anchors shall be established by testing in accordance with Section A205.4.

[BS] A206.3 Development of anchor forces into the diaphragm. Development of the required anchorage forces into roof and floor diaphragms shall comply with the requirements of this section and Section 12.11.2.2 of ASCE 7.

Lengths of development of anchor loads in wood diaphragms shall be based on existing field nailing of the sheathing unless existing edge nailing is positively identified on the original construction plans or at the site.

[BS] A206.4 Anchorage at pilasters. Where pilasters are present, the wall anchorage system shall comply with the

requirements of this section and Section 12.11.2.2.7 of ASCE 7. The pilasters or the walls immediately adjacent to the pilasters shall be anchored directly to the roof framing such that the existing vertical anchor bolts at the top of the pilasters are bypassed without permitting tension or shear failure at the top of the pilasters.

Exception: If existing vertical anchor bolts at the top of the pilasters are used for the anchorage, additional exterior confinement shall be provided as required to resist the total anchorage force.

➔ **[BS] A206.5 Combination of anchor types.** New anchors used in combination on a single framing member shall be of compatible behavior and stiffness.

[BS] A206.6 Anchorage at interior walls. Existing interior reinforced concrete or reinforced masonry walls that extend to the floor above or to the roof diaphragm shall be anchored for out-of-plane forces per Sections A206.1 and A206.3. Walls extending through the roof diaphragm shall be anchored for out-of-plane forces on both sides, and continuity ties shall be spliced across or continuous through the interior wall to provide diaphragm continuity.

[BS] A206.7 Collectors. Collectors designed in accordance with this section shall be provided at reentrant corners and at interior shear walls. Existing or new collectors shall have the capacity to develop into the diaphragm a force equal to the lesser of the rocking or shear capacity of the reentrant wall or the tributary shear based on 75 percent of the diaphragm design forces specified in Section 12.10 of ASCE 7. The capacity of the collector need not exceed the capacity of the diaphragm to deliver loads to the collector. A connection shall be provided from the collector to the reentrant wall to transfer the full collector internal force. If a truss or beam other than a rafter or purlin is supported by the reentrant wall or by a column integral with the reentrant wall, then an independent secondary column is required to support the roof or floor members whenever rocking or shear capacity of the reentrant wall is less than the tributary shear.

[BS] A206.8 Mezzanines. Existing mezzanines relying on reinforced concrete or reinforced masonry walls for vertical or lateral support shall be anchored to the walls for the tributary mezzanine load. Walls depending on the mezzanine for lateral support shall be anchored per Sections A206.1, A206.2 and A206.3.

Exception: Existing mezzanines that have independent lateral and vertical support need not be anchored to the walls.

SECTION A207 MATERIALS OF CONSTRUCTION

[BS] A207.1 Materials. Materials permitted by the building code, including their appropriate strength or allowable stresses, shall be used to meet the requirements of this chapter.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A
CHAPTER A3 – PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING
OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT,
WOOD-FRAME RESIDENTIAL BUILDINGS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)				X	X																		
Adopt only those sections that are listed below																							
Chapter / Section																							
A302.1 <i>CODE OFFICIAL</i>				X	X																		
A302.1 <i>ENFORCING AGENCY</i>				X	X																		
TABLE A304.3.1																							
TABLE A304.3.2																							
FIGURES A304.1.3 – A304.4.2				X	X																		
A304.3.1(1) <i>ANCHORING</i>																							
A304.4.1(3)																							
A304.4.2																							
A304.5				X	X																		
A304.6				X	X																		

CHAPTER A3

PRESCRIPTIVE PROVISIONS FOR SEISMIC STRENGTHENING OF CRIPPLE WALLS AND SILL PLATE ANCHORAGE OF LIGHT, WOOD-FRAME RESIDENTIAL BUILDINGS

SECTION A301 GENERAL

[BS] A301.1 Purpose. The provisions of this chapter are intended to promote public safety and welfare by reducing the risk of earthquake-induced damage to existing wood-frame residential buildings. The requirements contained in this chapter are prescriptive minimum standards intended to improve the seismic performance of residential buildings; however, they will not necessarily prevent earthquake damage.

This chapter sets standards for strengthening that may be approved by the code official without requiring plans or calculations prepared by a registered design professional. The provisions of this chapter are not intended to prevent the use of any material or method of construction not prescribed herein. The code official may require that construction documents for strengthening using alternative materials or methods be prepared by a registered design professional.

[BS] A301.2 Scope. The provisions of this chapter apply to residential buildings of light-frame wood construction containing one or more of the structural weaknesses specified in Section A303.

Exception: The provisions of this chapter do not apply to the buildings, or elements thereof, listed as follows. These buildings or elements require analysis by a registered design professional in accordance with Section A301.3 to determine appropriate strengthening:

1. Group R-1.
2. Group R with more than four dwelling units.
3. Buildings with a lateral force-resisting system using poles or columns embedded in the ground.
4. Cripple walls that exceed 4 feet (1219 mm) in height.
5. Buildings exceeding three stories in height and any three-story building with cripple wall studs exceeding 14 inches (356 mm) in height.
6. Buildings where the code official determines that conditions exist that are beyond the scope of the prescriptive requirements of this chapter.
7. Buildings or portions thereof constructed on concrete slabs on grade.

[BS] A301.3 Alternative design procedures. The details and prescriptive provisions herein are not intended to be the only acceptable strengthening methods permitted. Alternative details and methods shall be permitted to be used where approved by the code official. Approval of alternatives shall be based on a demonstration that the method or material used

is at least equivalent in terms of strength, deflection and capacity to that provided by the prescriptive methods and materials.

Where analysis by a registered design professional is required, such analysis shall be in accordance with all requirements of the building code, except that the seismic forces may be taken as 75 percent of those specified in the *California Building Code*.

SECTION A302 DEFINITIONS

[BS] A302.1 Definitions. For the purpose of this chapter, in addition to the applicable definitions in the building code, certain additional terms are defined as follows:

[BS] ADHESIVE ANCHOR. An assembly consisting of a threaded rod, washer, nut, and chemical adhesive approved by the code official for installation in existing concrete or masonry.

CODE OFFICIAL. “Code Official” shall have the same meaning as Enforcing Agency.

[BS] CRIPPLE WALL. A wood-frame stud wall extending from the top of the foundation to the underside of the lowest floor framing.

ENFORCING AGENCY. The designated department or agency as specified by statute or regulation.

[BS] EXPANSION ANCHOR. An approved post-installed anchor, inserted into a predrilled hole in existing concrete or masonry, that transfers loads to or from the concrete or masonry by direct bearing or friction or both.

[BS] PERIMETER FOUNDATION. A foundation system that is located under the exterior walls of a building.

[BS] SNUGTIGHT. As tight as an individual can torque a nut on a bolt by hand, using a wrench with a 10-inch-long (254 mm) handle, and the point at which the full surface of the plate washer is contacting the wood member and slightly indenting the wood surface.

[BS] WOOD STRUCTURAL PANEL. A panel manufactured from veneers, wood strands or wafers or a combination of veneer and wood strands or wafers bonded together with waterproof synthetic resins or other suitable bonding systems. Examples of wood structural panels are:

Composite panels. A wood structural panel that is comprised of wood veneer and reconstituted wood-based material and bonded together with waterproof adhesive.

Oriented strand board (OSB). A mat-formed wood structural panel comprised of thin rectangular wood

strands arranged in cross-aligned layers with surface layers normally arranged in the long panel direction and bonded with waterproof adhesive.

Plywood. A wood structural panel comprised of plies of wood veneer arranged in cross-aligned layers. The plies are bonded with waterproof adhesive that cures on application of heat and pressure.

SECTION A303 STRUCTURAL WEAKNESSES

[BS] A303.1 General. For the purposes of this chapter, any of the following conditions shall be deemed a structural weakness:

1. Sill plates or floor framing that are supported directly on the ground without a foundation system that conforms to the building code.
2. A perimeter foundation system that is constructed only of wood posts supported on isolated pad footings.
3. Perimeter foundation systems that are not continuous.

Exceptions:

1. Existing single-story exterior walls not exceeding 10 feet (3048 mm) in length, forming an extension of floor area beyond the line of an existing continuous perimeter foundation.
2. Porches, storage rooms and similar spaces not containing fuel-burning appliances.
4. A perimeter foundation system that is constructed of unreinforced masonry or stone.
5. Sill plates that are not connected to the foundation or that are connected with less than what is required by the building code.

Exception: Where approved by the code official, connections of a sill plate to the foundation made with other than sill bolts shall be accepted if the capacity of the connection is equivalent to that required by the building code.

6. Cripple walls that are not braced in accordance with the requirements of Section A304.4 and Table A304.3.1, or cripple walls not braced with diagonal sheathing or wood structural panels in accordance with the building code.

SECTION A304 STRENGTHENING REQUIREMENTS

[BS] A304.1 General.

[BS] A304.1.1 Scope. The structural weaknesses noted in Section A303 shall be strengthened in accordance with the requirements of this section. Strengthening work may include both new construction and alteration of existing construction. Except as provided herein, all strengthening work and materials shall comply with the applicable provisions of the *California Building Code*.

[BS] A304.1.2 Condition of existing wood materials.

Existing wood materials that will be a part of the strengthening work (such as sills, studs and sheathing) shall be in a sound condition and free from defects that substantially reduce the capacity of the member. Any wood material found to contain fungus infection shall be removed and replaced with new material. Any wood material found to be infested with insects or to have been infested with insects shall be strengthened or replaced with new materials to provide a net dimension of sound wood equal to or greater than its undamaged original dimension.

[BS] A304.1.3 Floor joists not parallel to foundations.

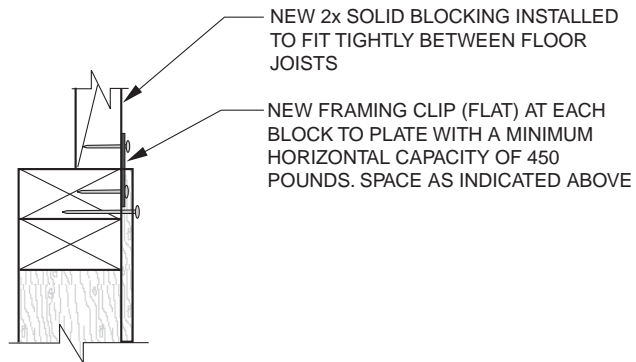
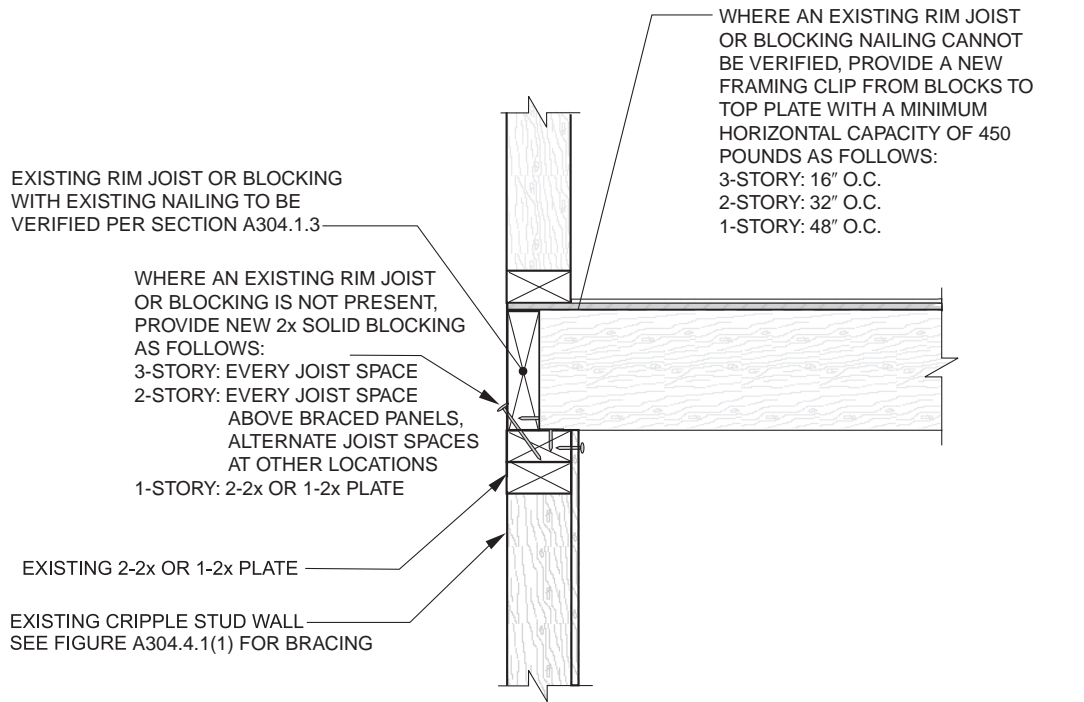
Floor joists framed perpendicular or at an angle to perimeter foundations shall be restrained either by an existing nominal 2-inch-wide (51 mm) continuous rim joist or by a nominal 2-inch-wide (51 mm) full-depth block between alternate joists in one- and two-story buildings, and between each joist in three-story buildings. Existing blocking for multiple-story buildings must occur at each joist space above a braced cripple wall panel.

Existing connections at the top and bottom edges of an existing rim joist or blocking need not be verified in one story buildings. In multiple-story buildings, the existing top edge connection need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum existing bottom edge connection shall consist of 8d toenails spaced 6 inches (152 mm) apart for a continuous rim joist, or three 8d toenails per block. Where this minimum bottom edge-connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.3 or A304.1.4(2) shall be provided.

Where an existing continuous rim joist or the minimum existing blocking does not occur, new $\frac{3}{4}$ -inch (19.1 mm) or $\frac{23}{32}$ -inch (18 mm) wood structural panel blocking installed tightly between floor joists and nailed as shown in Figure A304.1.4(3) shall be provided at the inside face of the cripple wall. In lieu of wood structural panel blocking, tight fitting, full-depth 2-inch (51 mm) blocking may be used. New blocking may be omitted where it will interfere with vents or plumbing that penetrates the wall.

[BS] A304.1.4 Floor joists parallel to foundations.

Where existing floor joists are parallel to the perimeter foundations, the end joist shall be located over the foundation and, except for required ventilation openings, shall be continuous and in continuous contact with the foundation sill plate or the top plate of the cripple wall. Existing connections at the top and bottom edges of the end joist need not be verified in one-story buildings. In multiple-story buildings, the existing top edge connection of the end joist need not be verified; however, the bottom edge connection to either the foundation sill plate or the top plate of a cripple wall shall be verified. The minimum bottom edge connection shall be 8d toenails spaced 6 inches (152 mm) apart. If this minimum bottom edge connection is not present or cannot be verified, a supplemental connection installed as shown in Figure A304.1.4(1), A304.1.4(2) or A304.1.4(3) shall be provided.



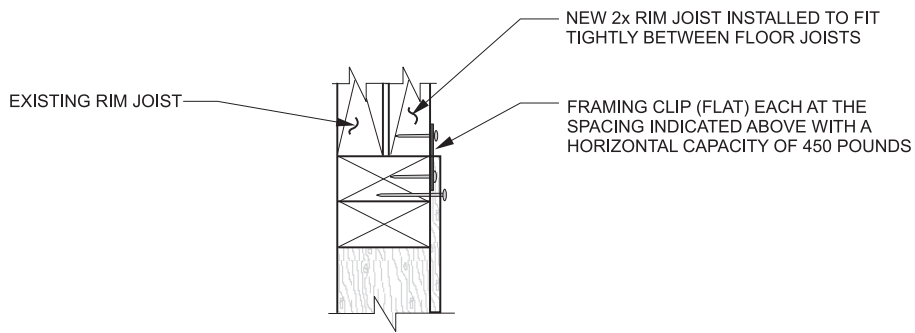
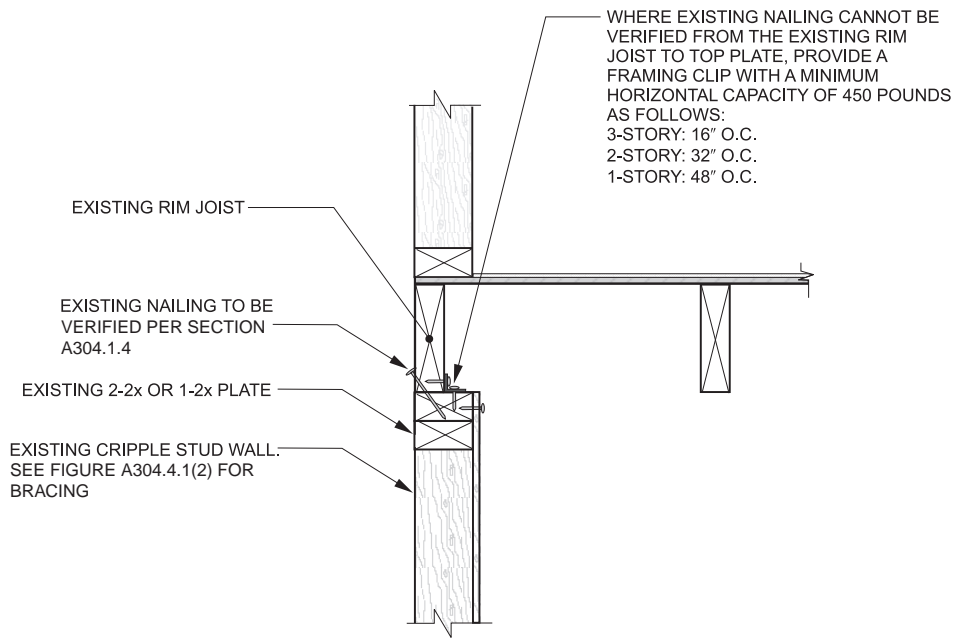
ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

**[BS] FIGURE A304.1.3
TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS)**

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS



ALTERNATE CONNECTION FOR FLUSH CONNECTION

For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

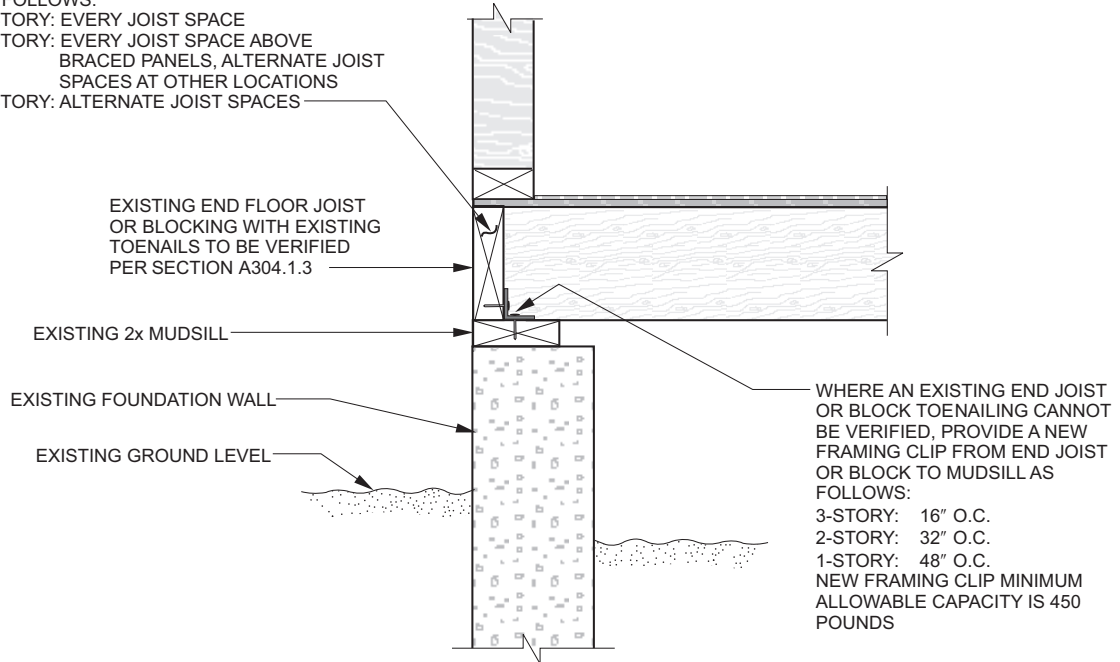
NOTE: See manufacturing instructions for nail sizes associated with metal framing clips.

**[BS] FIGURE A304.1.4(1)
TYPICAL FLOOR TO CRIPPLE WALL CONNECTION (FLOOR JOISTS PARALLEL TO FOUNDATIONS)**

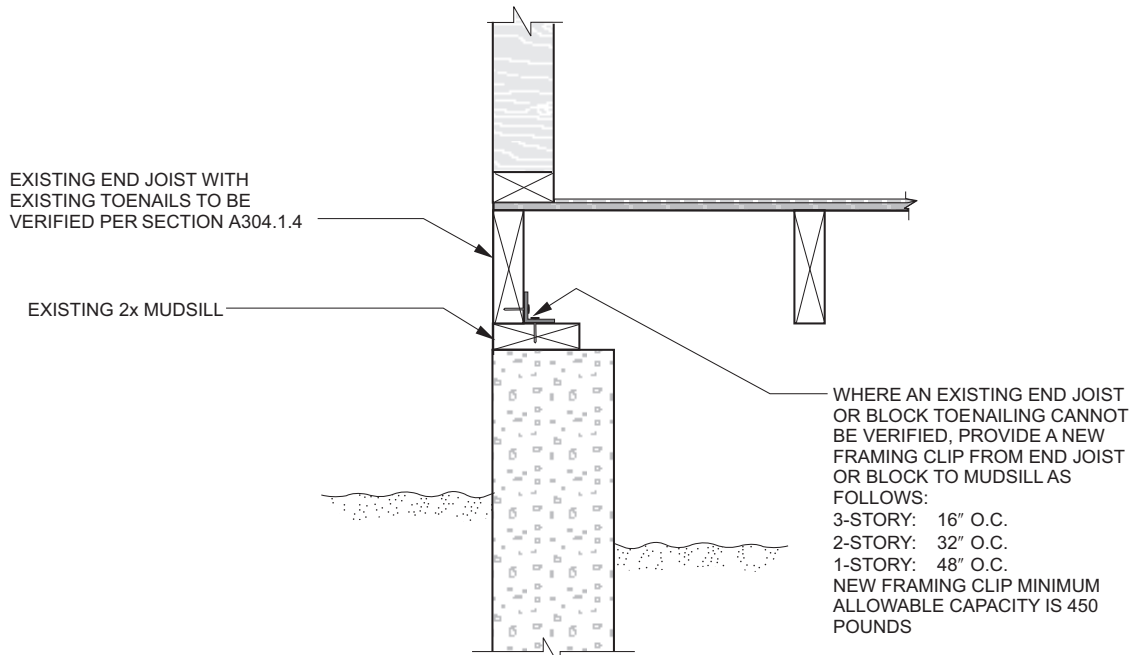
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

WHERE AN EXISTING RIM JOIST OR BLOCKING IS NOT PRESENT, PROVIDE NEW 2x SOLID BLOCKING AS FOLLOWS:

- 3-STORY: EVERY JOIST SPACE
- 2-STORY: EVERY JOIST SPACE ABOVE BRACED PANELS, ALTERNATE JOIST SPACES AT OTHER LOCATIONS
- 1-STORY: ALTERNATE JOIST SPACES



FLOOR JOISTS NOT PARALLEL TO FOUNDATIONS



FLOOR JOISTS PARALLEL TO FOUNDATIONS

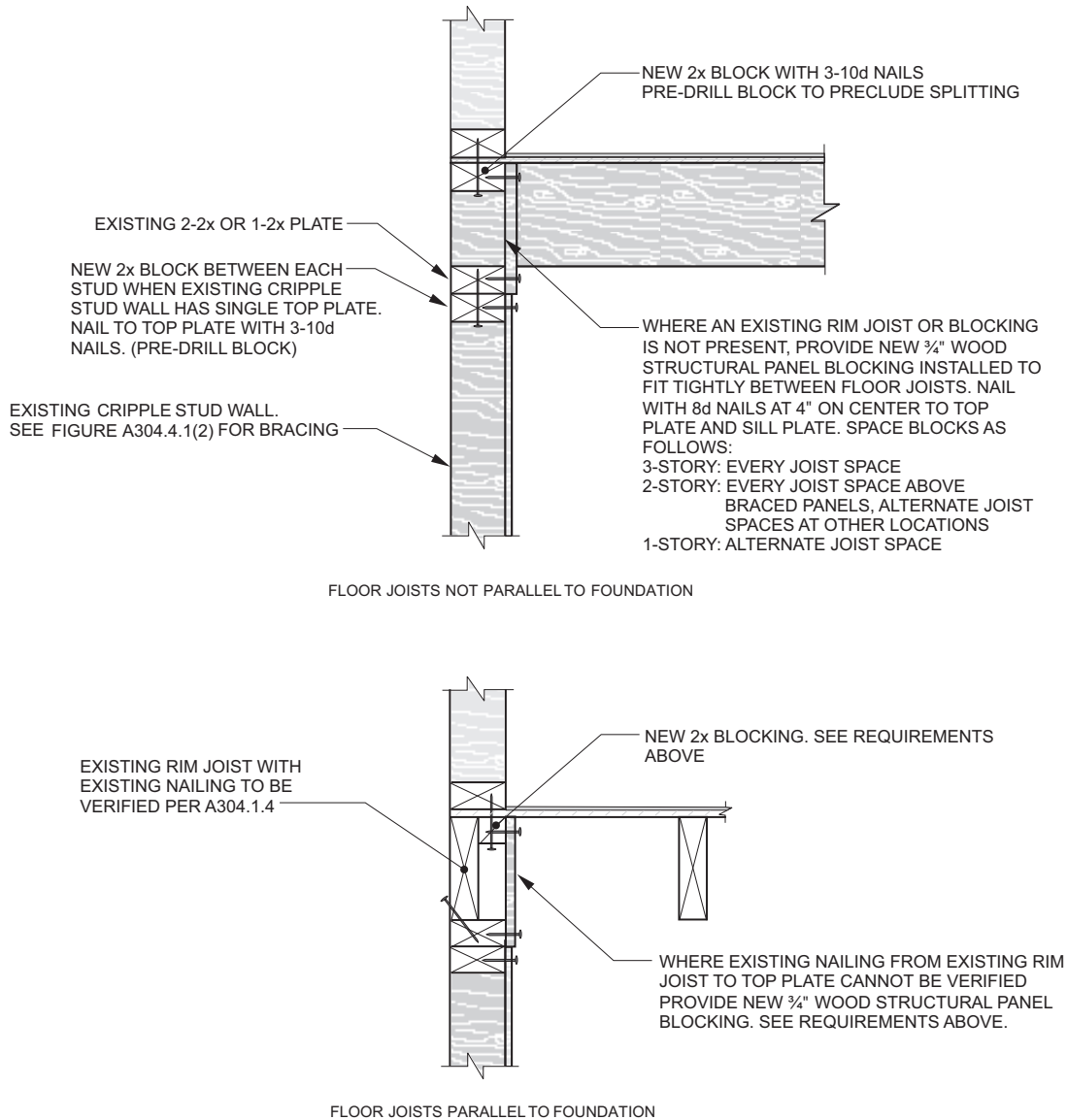
For SI: 1 inch = 25.4 mm.

NOTES:

1. See Section A304.3 for sill plate anchorage.
2. See manufacturing instructions for nail sizes associated with metal framing clips.

[BS] FIGURE A304.1.4(2)
TYPICAL FLOOR TO MUDSILL CONNECTIONS

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS



For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

NOTE: See Section A304.4 for cripple wall bracing.

[BS] FIGURE A304.1.4(3)
ALTERNATIVE FLOOR FRAMING TO CRIPPLE WALL CONNECTION

[BS] A304.2 Foundations.

[BS] A304.2.1 New perimeter foundations. New perimeter foundations shall be provided for structures with the structural weaknesses noted in Items 1 and 2 of Section A303. Soil investigations or geotechnical studies are not required for this work unless the building is located in a special study zone as designated by the code official or other authority having jurisdiction.

[BS] A304.2.2 Evaluation of existing foundations. Partial perimeter foundations or unreinforced masonry foundations shall be evaluated by a registered design professional for the force levels specified in Section A301.3. Test reports or other substantiating data to deter-

mine existing foundation material strengths shall be submitted to the code official. Where approved by the code official, these existing foundation systems shall be strengthened in accordance with the recommendations included with the evaluation in lieu of being replaced.

Exception: In lieu of testing existing foundations to determine material strengths, and where approved by the code official, a new nonperimeter foundation system designed for the forces specified in Section A301.3 shall be used to resist lateral forces from perimeter walls. A registered design professional shall confirm the ability of the existing diaphragm to transfer seismic forces to the new nonperimeter foundations.

[BS] A304.2.3 Details for new perimeter foundations. All new perimeter foundations shall be continuous and constructed according to Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2). New construction materials shall comply with the requirements of building code. Where approved by the code official, the existing clearance between existing floor joists or girders and existing grade below the floor need not comply with the building code.

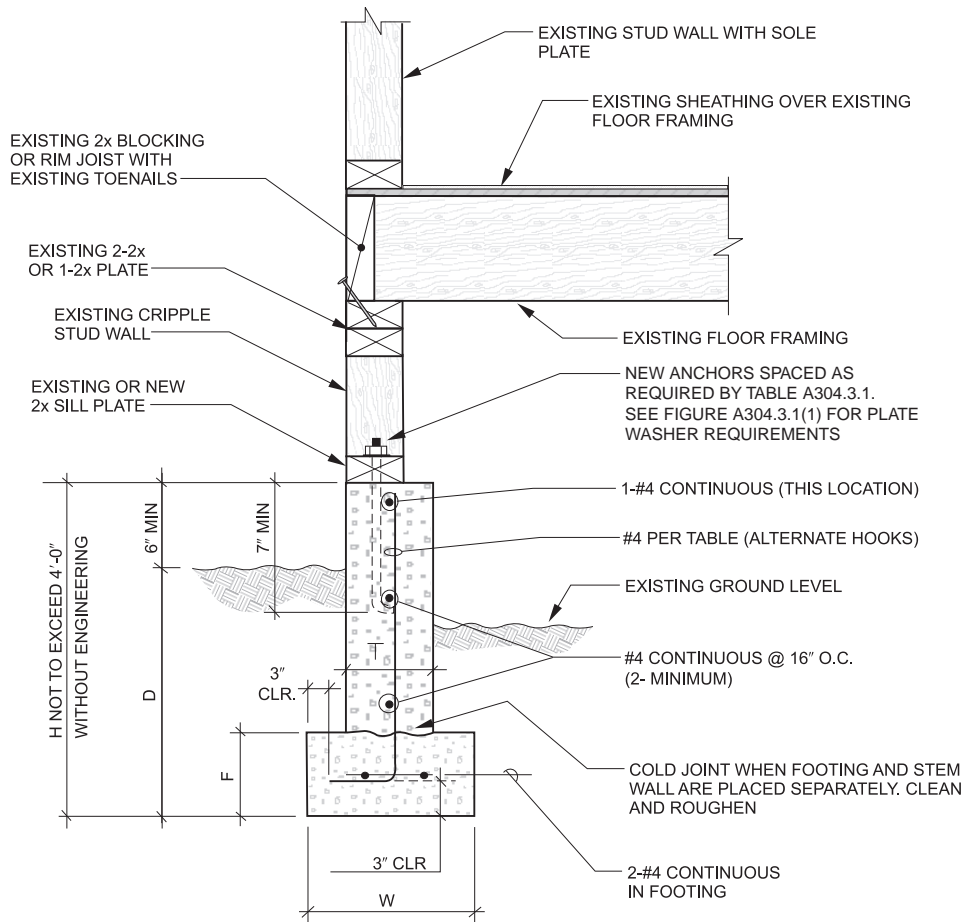
Exception: Where designed by a registered design professional and approved by the code official, partial perimeter foundations shall be used in lieu of a continuous perimeter foundation.

[BS] A304.2.4 New concrete foundations. New concrete foundations shall have a minimum compressive strength of 2,500 pounds per square inch (17.24 MPa) at 28 days.

[BS] A304.2.5 New hollow-unit masonry foundations. New hollow-unit masonry foundations shall be solidly

grouted. The grout shall have minimum compressive strength of 2,000 pounds per square inch (13.79 MPa). Mortar shall be Type M or S.

[BS] A304.2.6 New sill plates. Where new sill plates are used in conjunction with new foundations, they shall be minimum two times nominal thickness and shall be preservative-treated wood or naturally durable wood permitted by the building code for similar applications, and shall be marked or branded by an approved agency. Fasteners in contact with preservative-treated wood shall be hot-dip galvanized or other material permitted by the building code for similar applications. Anchors, that attach a preservative-treated sill plate to the foundation, shall be permitted to be of mechanically deposited zinc-coated steel with coating weights in accordance with ASTM B695, Class 55 minimum. Metal framing anchors in contact with preservative-treated wood shall be galvanized in accordance with ASTM A653 with a G185 coating.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BS] FIGURE A304.2.3(1)
NEW REINFORCED CONCRETE FOUNDATION SYSTEM**

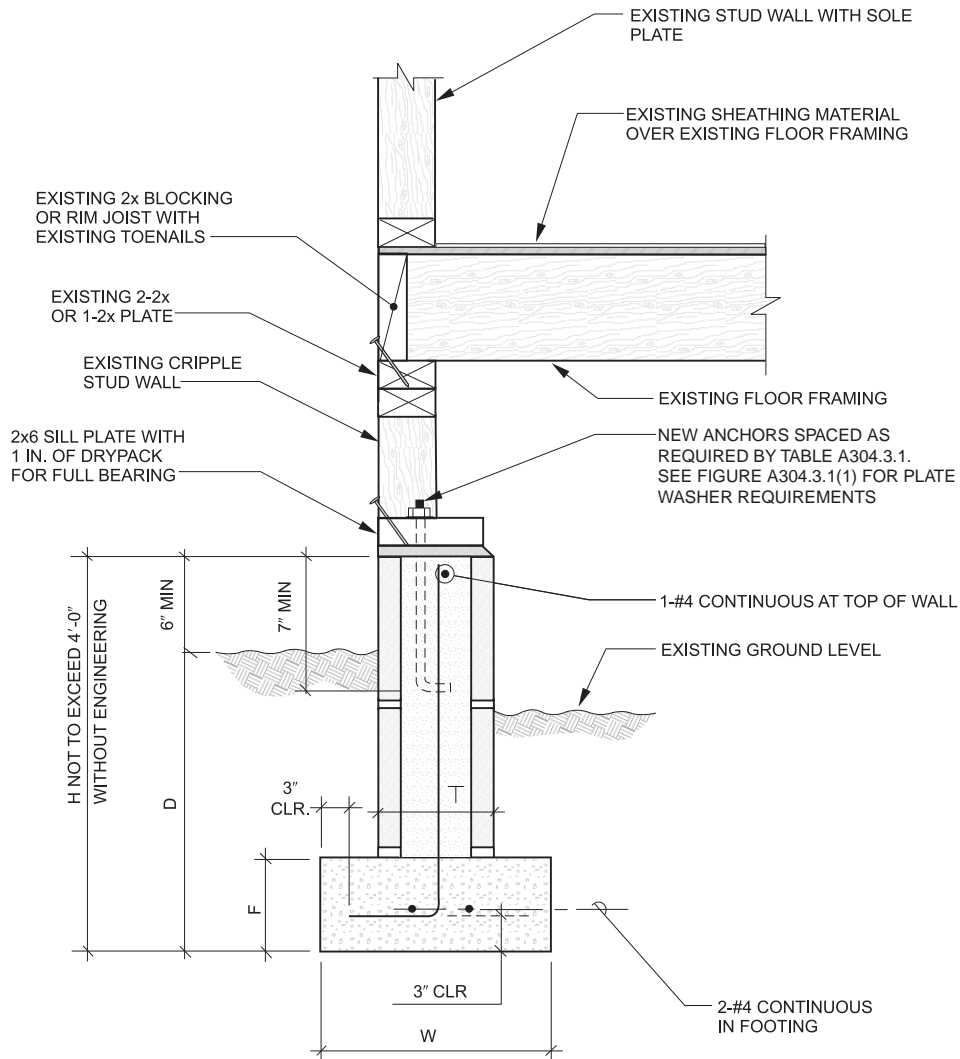
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

[BS] TABLE A304.2.3(1)
NEW REINFORCED CONCRETE FOUNDATION SYSTEM

NUMBER OF STORIES	MINIMUM FOUNDATION DIMENSIONS					MINIMUM FOUNDATION REINFORCING	
	W	F	D ^{a, b, c}	T	H	VERTICAL REINFORCING	
						Single-pour wall and footing	Footing placed separate from wall
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
2	15 inches	7 inches	18 inches	8 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 32 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 48 inches on center	#4 @ 18 inches on center

For SI: 1 inch = 25.4 mm.

- a. Where frost conditions occur, the minimum depth shall extend below the frost line.
- b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.
- c. Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] FIGURE A304.2.3(2)
NEW MASONRY CONCRETE FOUNDATION

[BS] TABLE A304.2.3(2)
NEW MASONRY CONCRETE FOUNDATION

MINIMUM FOUNDATION DIMENSIONS						MINIMUM FOUNDATION REINFORCING	
NUMBER OF STORIES	W	F	D ^{a, b, c}	T	H	VERTICAL REINFORCING	HORIZONTAL REINFORCING
1	12 inches	6 inches	12 inches	6 inches	≤ 24 inches	#4 @ 24 inches on center	#4 continuous at top of stem wall
2	15 inches	7 inches	18 inches	8 inches	≥ 24 inches	#4 @ 24 inches on center	#4 @ 16 inches on center
3	18 inches	8 inches	24 inches	10 inches	≥ 36 inches	#4 @ 24 inches on center	#4 @ 16 inches on center

For SI: 1 inch = 25.4 mm.

- a. Where frost conditions occur, the minimum depth shall extend below the frost line.
- b. The ground surface along the interior side of the foundation may be excavated to the elevation of the top of the footing.
- c. Where the soil is designated as expansive, the foundation depth and reinforcement shall be approved by the code official.

[BS] A304.3 Foundation sill plate anchorage.

[BS] A304.3.1 Existing perimeter foundations. Where the building has an existing continuous perimeter foundation, all perimeter wall sill plates shall be anchored to the foundation with adhesive anchors or expansion anchors in accordance with Table A304.3.1.

Anchors shall be installed in accordance with Figure A304.3.1(1), with the plate washer installed between the nut and the sill plate. The nut shall be tightened to a snug-tight condition after curing is complete for adhesive anchors and after expansion wedge engagement for expansion anchors. Anchors shall be installed in accordance with manufacturer’s recommendations. Expansion anchors shall not be used where the installation causes surface cracking of the foundation wall at the locations of the anchor.

Where existing conditions prevent anchor installations through the top of the sill plate, this connection shall be made in accordance with Figure A304.3.1(2), A304.3.1(3) or A304.3.1(4). Alternative anchorage methods having a

minimum shear capacity of 900 pounds (4003 N) per connection parallel to the wall shall be permitted. The spacing of these alternative connections shall comply with the maximum spacing requirements of Table A304.3.1 for 1/2-inch (12.7 mm) bolts.

[BS] A304.3.2 Placement of anchors. Anchors shall be placed within 12 inches (305 mm), but not less than 9 inches (229 mm), from the ends of sill plates and shall be placed in the center of the stud space closest to the required spacing. New sill plates may be installed in pieces where necessary because of existing conditions. For lengths of sill plates 12 feet (3658 mm) or greater, anchors shall be spaced along the sill plate as specified in Table A304.3.1. For other lengths of sill plate, anchor placement shall be in accordance with Table A304.3.2.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of an anchor, the anchor shall be placed as close to the obstruction as possible, but not less than 9

[BS] TABLE A304.3.1
SILL PLATE ANCHORAGE AND CRIPPLE WALL BRACING

NUMBER OF STORIES ABOVE CRIPPLE WALLS	MINIMUM SILL PLATE CONNECTION AND MAXIMUM SPACING ^{a, b, c}	AMOUNT OF BRACING FOR EACH WALL LINE ^{d, e, f}	
		A Combination of Exterior Walls Finished with Portland Cement Plaster and Roofing Using Clay Tile or Concrete Tile Weighing More than 6 psf (287 N/m ²)	All Other Conditions
One story	1/2 inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 50 percent of the wall length	Each end and not less than 40 percent of the wall length
Two stories	1/2 inch spaced 4 feet, 0 inch center-to-center with washer plate; or 5/8 inch spaced 6 feet, 0 inch center-to-center with washer plate	Each end and not less than 70 percent of the wall length	Each end and not less than 50 percent of the wall length
Three stories	5/8 inch spaced 4 feet, 0 inch center-to-center with washer plate	100 percent of the wall length ^g	Each end and not less than 80 percent of the wall length ^g

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 47.88 N/m².

- a. Sill plate anchors shall be adhesive anchors or expansion anchors in accordance with Section A304.3.1.
- b. All washer plates shall be 3 inches by 3 inches by 0.229 inch minimum. The hole in the plate washer is permitted to be diagonally slotted with a width of up to 3/16 inch larger than the bolt diameter and a slot length not to exceed 1 3/4 inches, provided that a standard cut washer is placed between the plate washer and the nut.
- c. This table shall also be permitted for the spacing of the alternative connections specified in Section A304.3.1.
- d. See Figure A304.4.2 for braced panel layout.
- e. Braced panels at ends of walls shall be located as near to the end as possible.
- f. All panels along a wall shall be nearly equal in length and shall be nearly equal in spacing along the length of the wall.
- g. The minimum required underfloor ventilation openings are permitted in accordance with Section A304.4.4.

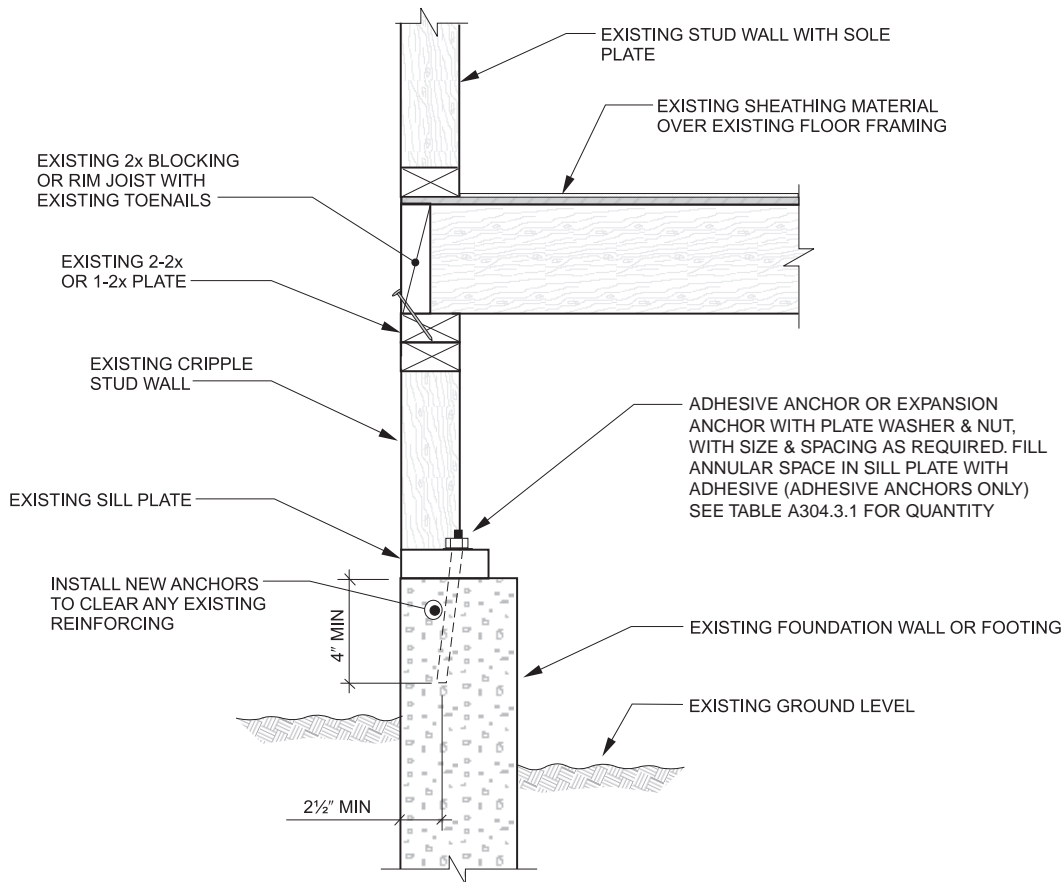
APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

inches (229 mm) from the end of the plate. Center-to-center spacing of the anchors shall be reduced as necessary to provide the minimum total number of anchors required based on the full length of the wall. Center-to-center spacing shall be not less than 12 inches (305 mm).

[BS] A304.3.3 New perimeter foundations. Sill plates for new perimeter foundations shall be anchored in accordance with Table A304.3.1 and Figure A304.2.3(1) and Table A304.2.3(1) or Figure A304.2.3(2) and Table A304.2.3(2).

[BS] A304.4 Cripple wall bracing.

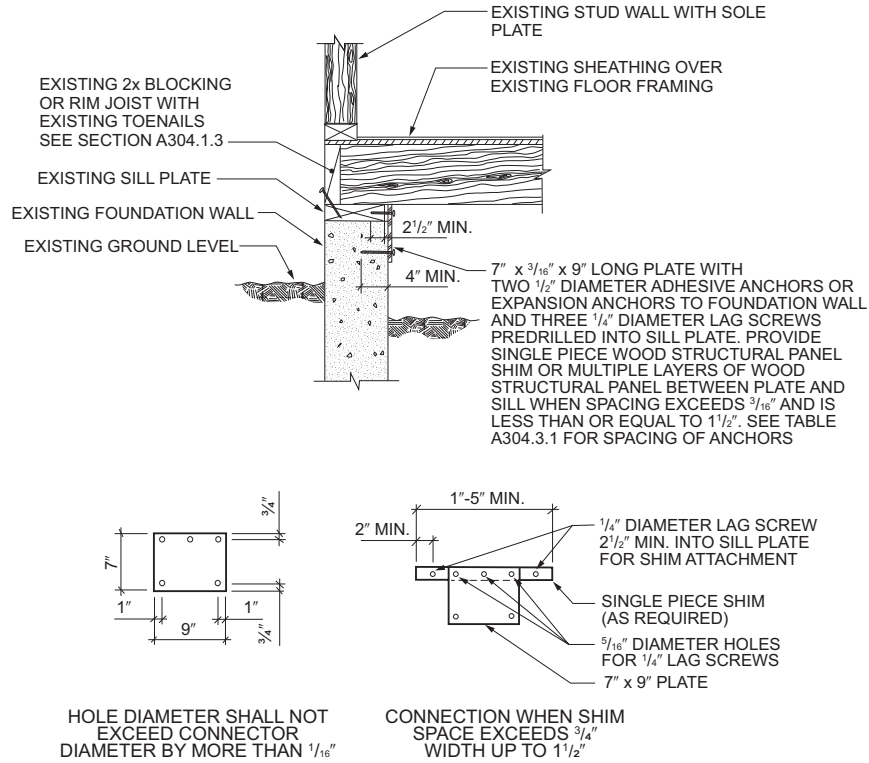
[BS] A304.4.1 General. Exterior cripple walls not exceeding 4 feet (1219 mm) in height shall be permitted to be specified by the prescriptive bracing method in Section A304.4. Cripple walls over 4 feet (1219 mm) in height require analysis by a registered design professional in accordance with Section A301.3.



For SI: 1 inch = 25.4 mm.

- a. Plate washers shall comply with the following:
 - $\frac{1}{2}$ -inch anchor or bolt—3 inches \times 3 inches \times 0.229 inch minimum.
 - $\frac{5}{8}$ -inch anchor or bolt—3 inches \times 3 inches \times 0.229 inch minimum.
- A diagonal slot in the plate washer is permitted in accordance with Table A304.3.1, Note b.
- b. See Figure A304.4.1(1) or A304.4.1(2) for cripple wall bracing.

[BS] FIGURE A304.3.1(1)
SILL PLATE ANCHORING TO EXISTING FOUNDATION^{a, b}

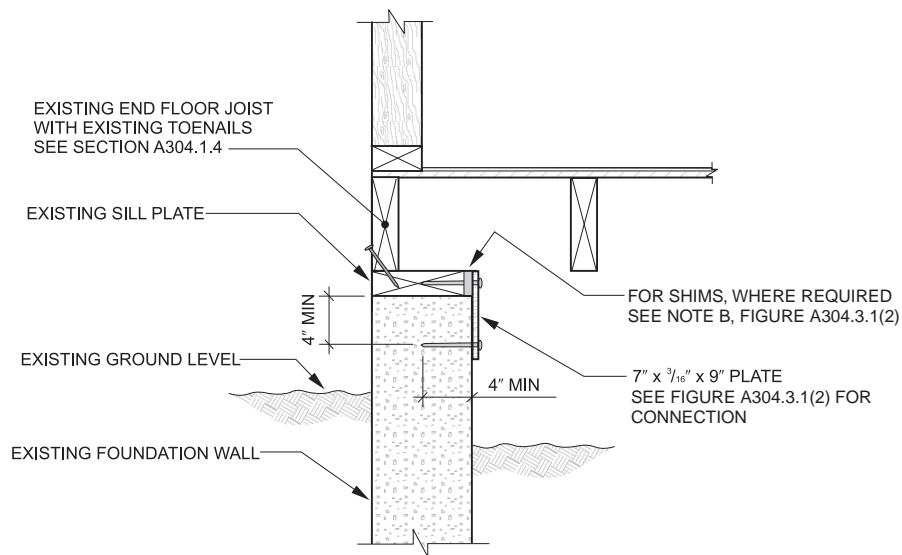


For SI: 1 inch = 25.4 mm.

NOTES:

- a. If shim space exceeds 1 1/2 inches, alternative details will be required.
- b. Where required, single piece shim shall be naturally durable wood or preservative-treated wood. If preservative-treated wood is used, it shall be isolated from the foundation system with a moisture barrier.

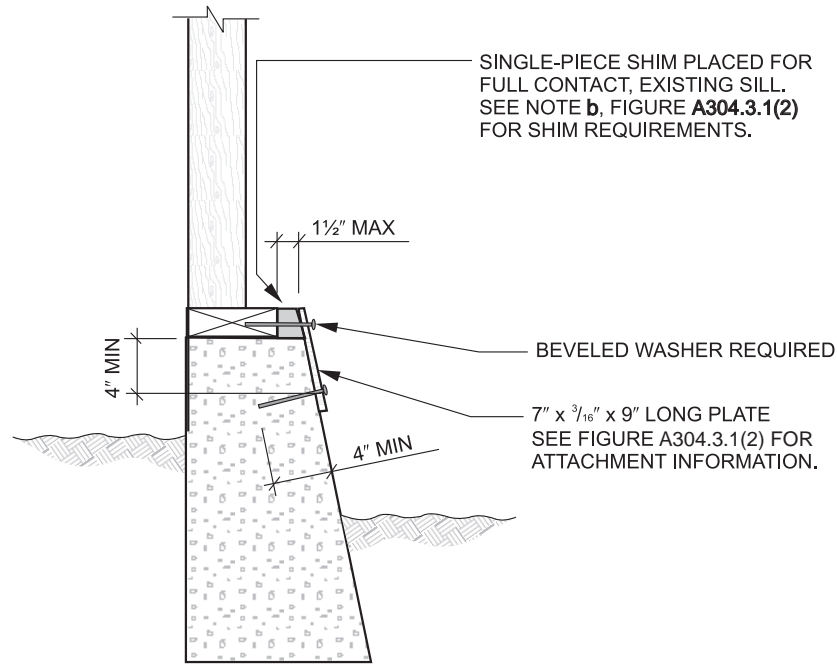
[BS] FIGURE A304.3.1(2)
ALTERNATIVE SILL PLATE ANCHORING IN EXISTING FOUNDATION—WITHOUT CRIPPLE WALLS AND FLOOR FRAMING NOT PARALLEL TO FOUNDATIONS^{a, b}



For SI: 1 inch = 25.4 mm.

[BS] FIGURE A304.3.1(3)
ALTERNATIVE SILL PLATE ANCHOR TO EXISTING FOUNDATION WITHOUT CRIPPLE WALL AND FLOOR FRAMING PARALLEL TO FOUNDATIONS

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE A304.3.1(4)
SILL PLATE ANCHORING TO EXISTING FOUNDATION—ALTERNATIVE CONNECTION FOR BATTERED FOOTING**

**[BS] TABLE A304.3.2
SILL PLATE ANCHORAGE FOR VARIOUS LENGTHS OF SILL PLATE^{a, b}**

NUMBER OF STORIES	LENGTHS OF SILL PLATE		
	Less than 12 feet to 6 feet	Less than 6 feet to 30 inches	Less than 30 inches ^c
One story	Three connections	Two connections	One connection
Two stories	Four connections for 1/2-inch anchors or bolts or three connections for 5/8-inch anchors or bolts	Two connections	One connection
Three stories	Four connections	Two connections	One connection

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

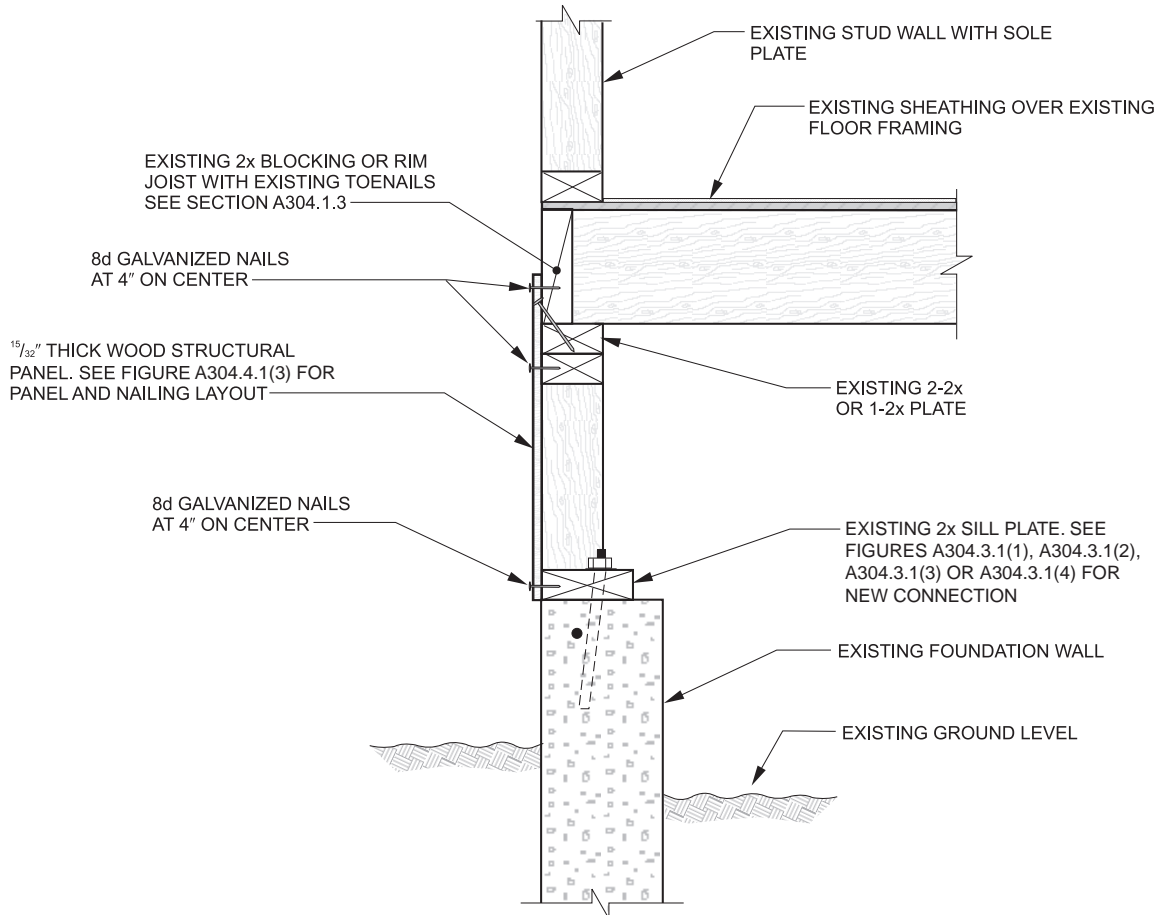
- a. Connections shall be either adhesive anchors or expansion anchors.
- b. See Section A304.3.2 for minimum end distances.
- c. Connections shall be placed as near to the center of the length of plate as possible.

[BS] A304.4.1.1 Sheathing installation requirements. Wood structural panel sheathing shall be not less than $1\frac{5}{32}$ -inch (12 mm) thick and shall be installed in accordance with Figure A304.4.1(1) or A304.4.1(2). Individual pieces of wood structural panels shall be nailed with 8d common nails spaced 4 inches (102 mm) on center at all edges and 12 inches (305 mm) on center at each intermediate support with not less than two nails for each stud. Nails shall be driven so that their heads are flush with the surface of the sheathing and shall penetrate the supporting member not less than $1\frac{1}{2}$ inches (38 mm). When a nail fractures the surface, it shall be left in place and not counted as part of the required nailing. A new 8d nail shall be located within 2 inches (51 mm) of the discounted nail and be hand-driven flush with the sheathing surface. Where the installation involves horizontal joints, those joints shall occur over nominal 2-inch by 4-inch (51 mm by 102 mm) blocking installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

Vertical joints at adjoining pieces of wood structural panels shall be centered on studs such that there is a minimum $\frac{1}{8}$ inch (3.2 mm) between the panels. Where required edge distances cannot be maintained because of the width of the existing stud, a new stud shall be added adjacent to the existing studs and connected in accordance with Figure A304.4.1(3).

[BS] A304.4.2 Distribution and amount of bracing. See Table A304.3.1 and Figure A304.4.2 for the distribution and amount of bracing required for each wall line. Each braced panel length must be not less than two times the height of the cripple stud. Where the minimum amount of bracing prescribed in Table A304.3.1 cannot be installed along any walls, the bracing must be designed in accordance with Section A301.3.

Exception: Where physical obstructions such as fireplaces, plumbing or heating ducts interfere with the placement of cripple wall bracing, the bracing shall then be placed as close to the obstruction as possible. The total amount of bracing required shall not be reduced because of obstructions.



For SI: 1 inch = 25.4 mm.
NOTE: See Figure A304.3.1(1) for sill plate anchoring.

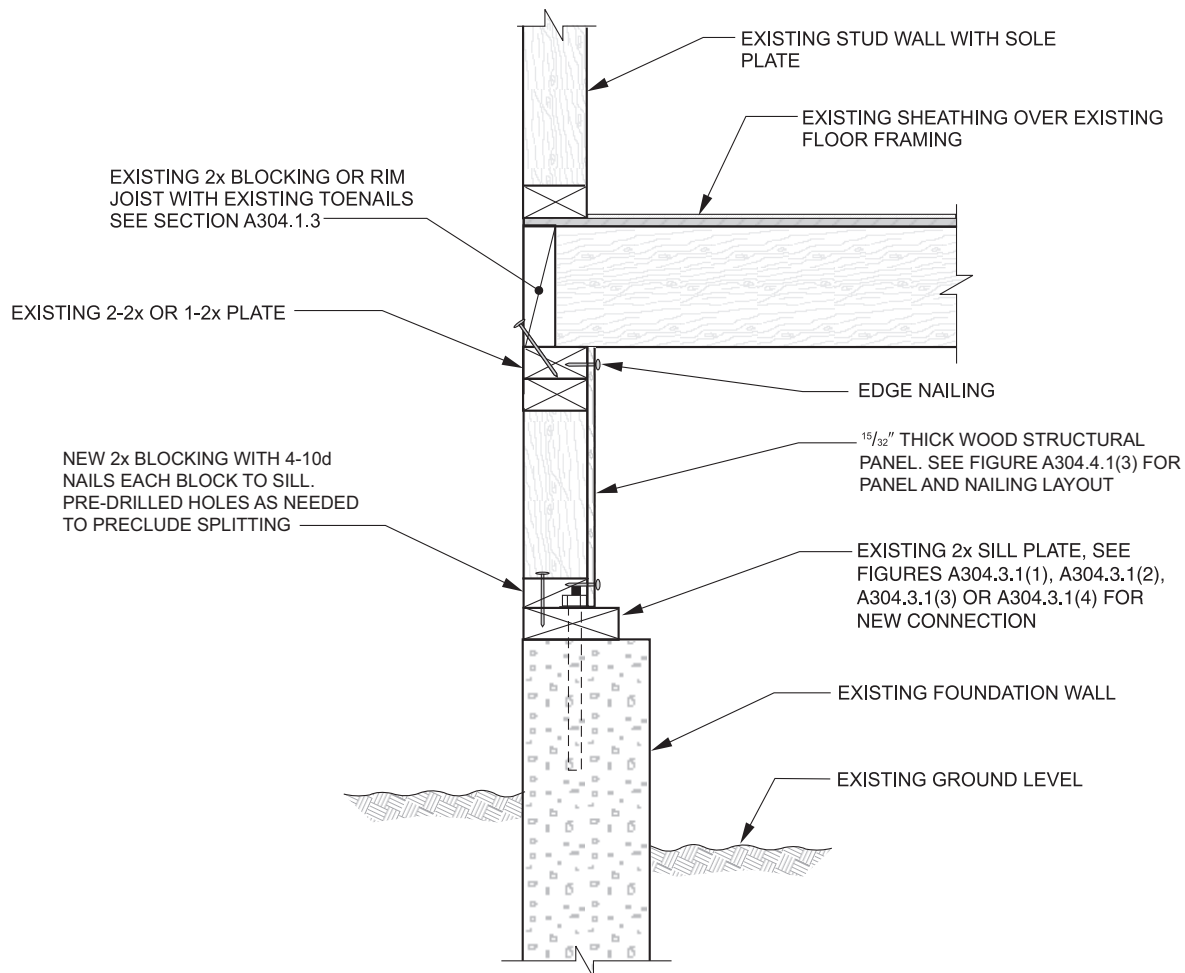
[BS] FIGURE A304.4.1(1)
CRIPPLE WALL BRACING WITH NEW WOOD STRUCTURAL PANEL ON EXTERIOR FACE OF CRIPPLE STUDS

[BS] A304.4.3 Stud space ventilation. Where bracing materials are installed on the interior face of studs forming an enclosed space between the new bracing and the existing exterior finish, each braced stud space must be ventilated. Adequate ventilation and access for future inspection shall be provided by drilling one 2-inch to 3-inch-diameter (51 mm to 76 mm) round hole through the sheathing, nearly centered between each stud at the top and bottom of the cripple wall. Such holes should be spaced not less than 1 inch (25 mm) clear from the sill or top plates. In stud spaces containing sill bolts, the hole shall be located on the centerline of the sill bolt but not closer than 1 inch (25 mm) clear from the nailing edge of the sheathing. Where existing blocking occurs within the stud space, additional ventilation holes shall be placed above and below the blocking, or the existing block shall be removed and a new nominal 2-inch by 4-inch (51 mm by 102 mm) block shall be installed with the nominal 4-inch (102 mm) dimension against the face of the plywood.

For stud heights less than 18 inches (457 mm), only one ventilation hole need be provided.

[BS] A304.4.4 Existing underfloor ventilation. Existing underfloor ventilation shall not be reduced without providing equivalent new ventilation as close to the existing ventilation as possible. Braced panels may include under-floor ventilation openings where the height of the opening, measured from the top of the foundation wall to the top of the opening, does not exceed 25 percent of the height of the cripple stud wall; however, the length of the panel shall be increased a distance equal to the length of the opening or one stud space minimum. Where an opening exceeds 25 percent of the cripple wall height, braced panels shall not be located where the opening occurs. See Figure A304.4.1(3).

Exception: For homes with a post and pier foundation system where a new continuous perimeter foundation system is being installed, new ventilation shall be provided in accordance with the building code.



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE A304.4.1(2)
CRIPPLE WALL BRACING WITH WOOD STRUCTURAL PANEL ON INTERIOR FACE OF CRIPPLE STUDS**

[BS] A304.5 Inspections. All work shall be subject to inspection by the code official including, but not limited to:

1. Placement and installation of new adhesive or expansion anchors installed in existing foundations. Special inspection *may be* required for adhesive anchors installed in existing foundations regulated by the prescriptive provisions of this chapter.
2. Installation and nailing of new cripple wall bracing.
3. Any work shall be subject to special inspection where required by the code official in accordance with the building code.

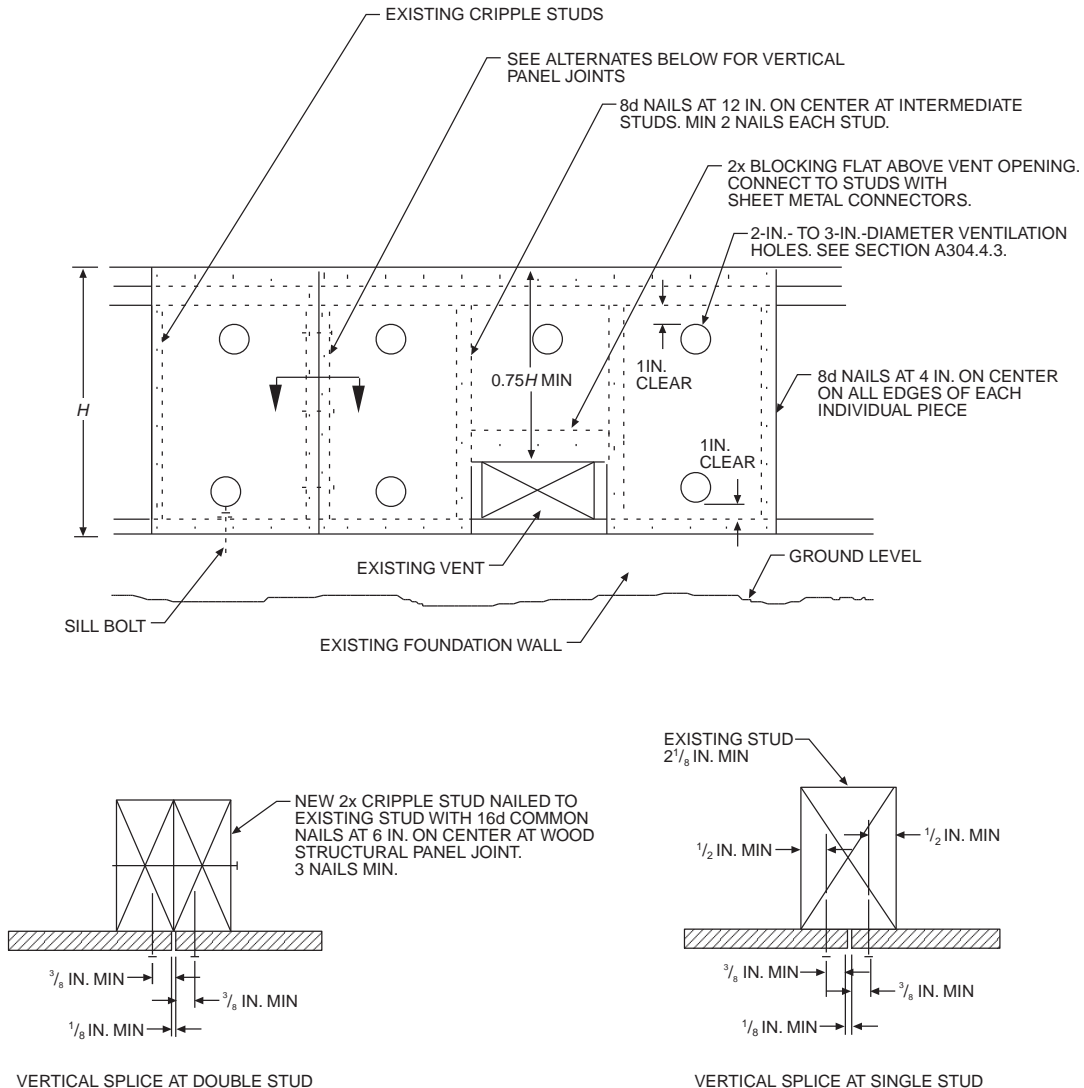
[BS] A304.5.1 Nails. All nails specified in this chapter shall be common wire nails of the following diameters and lengths:

1. 8d nails = 0.131 inch (3.3 mm) by 2½ inches (64 mm).

2. 10d nails = 0.148 inch (3.8 mm) by 3 inches (76 mm).
3. 12d nails = 0.148 inch (3.8 mm) by 3¼ inches (83 mm).
4. 16d nails = 0.162 inch (4.1 mm) by 3½ inches (89 mm).

Nails used to attach metal framing connectors directly to wood members shall be as specified by the connector manufacturer in an approved report.

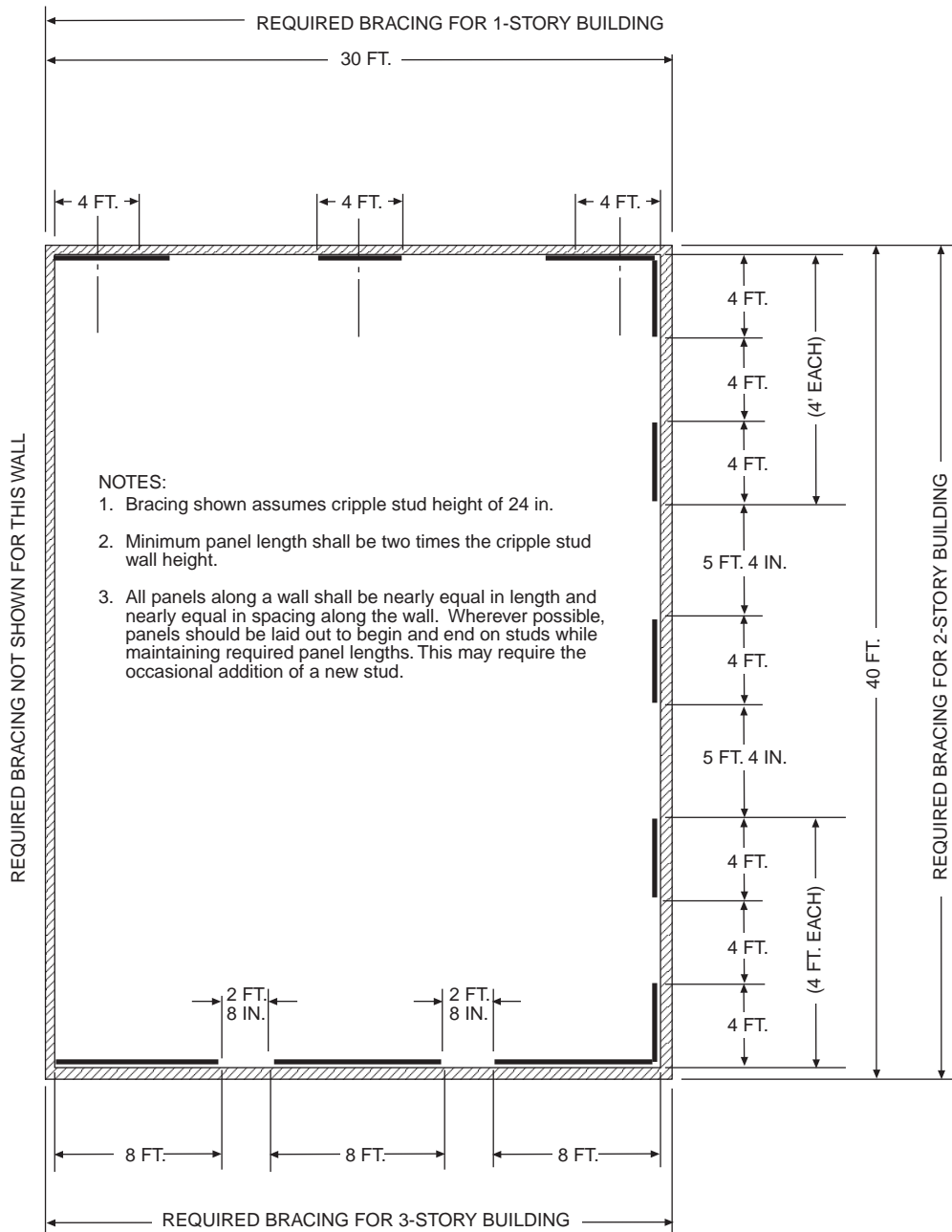
A304.6 Phasing of the strengthening work. When approved by the Enforcing Agency, the strengthening work contained in this chapter may be completed in phases.



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE A304.4.1(3)
PARTIAL CRIPPLE STUD WALL ELEVATION**

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS



Bracing determination:

- 1-story building—each end and not less than 40% of wall length.^a
 Transverse wall—30 ft. × 0.40 = 12 ft. minimum panel length = 4 ft. 0 in.
- 2-story building—each end and not less than 50% of wall length.^a
 Longitudinal wall—40 ft. × 0.50 = 20 ft. 0 in. minimum of bracing.
- 3-story building—each end and not less than 80% of wall length.^a
 Transverse wall—30 ft. × 0.80 = 24 ft. 0 in. minimum of bracing.

a. See Table 304.3.1 for buildings with both plaster walls and roofing exceeding 6 psf.

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 pound per square foot = 42.88 N/m².

**[BS] FIGURE A304.4.2
FLOOR PLAN-CRIPPLE WALL BRACING LAYOUT**

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A
CHAPTER A4 – EARTHQUAKE RISK REDUCTION
IN WOOD-FRAME RESIDENTIAL BUILDINGS WITH SOFT, WEAK OR OPEN FRONT WALLS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4									5
Adopt Entire Chapter																							
Adopt Entire Chapter as amended (amended sections listed below)																							
Adopt only those sections that are listed below																							
Chapter / Section																							

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER A4

EARTHQUAKE RISK REDUCTION IN WOOD-FRAME RESIDENTIAL BUILDINGS WITH SOFT, WEAK OR OPEN FRONT WALLS

SECTION A401 GENERAL

[BS] **A401.1 Purpose.** The purpose of this chapter is to promote public welfare and safety by reducing the risk of death or injury as a result of the effects of earthquakes on existing wood-frame, multiple-unit residential buildings. The ground motions of past earthquakes have caused the loss of human life, personal injury and property damage in these types of buildings. This chapter creates minimum standards to strengthen the more vulnerable portions of these structures. Where fully followed, these minimum standards will improve the performance of these buildings but will not necessarily prevent all earthquake-related damage.

[BS] **A401.2 Scope.** The provisions of this chapter apply to existing buildings of wood construction that contain residential occupancies and are assigned to Risk Category II, and where the structure has a soft, weak or open-front wall line, and there exists one or more stories above.

SECTION A402 DEFINITIONS

[BS] **A402.1 Definitions.** Notwithstanding the applicable definitions, symbols and notations in the building code, the following definitions shall apply for the purposes of this chapter:

[BS] **ASPECT RATIO.** The span-width ratio for horizontal diaphragms and the height-length ratio for shear walls.

[BS] **NONCONFORMING STRUCTURAL MATERIALS.** Wall bracing materials other than wood structural panels or diagonal sheathing.

[BS] **OPEN-FRONT WALL LINE.** An exterior wall line, without vertical elements of the lateral force-resisting system, that requires tributary seismic forces to be resisted by diaphragm rotation or excessive cantilever beyond parallel lines of shear walls. Diaphragms that cantilever more than 25 percent of the distance between lines of lateral force-resisting elements from which the diaphragm cantilevers shall be considered to be excessive. Exterior exit balconies of 6 feet (1829 mm) or less in width shall not be considered excessive cantilevers.

[BS] **RETROFIT.** An improvement of the lateral force-resisting system by alteration of existing structural elements or addition of new structural elements.

[BS] **SOFT WALL LINE.** A wall line whose lateral stiffness is less than that required by story drift limitations or deformation compatibility requirements of this chapter. In lieu of analysis, a soft wall line may be defined as a wall line in a story where the story stiffness is less than 70 percent of the story above for the direction under consideration.

[BS] **STORY.** A story as defined by the building code, including any basement or underfloor space of a building with cripple walls exceeding 4 feet (1219 mm) in height.

[BS] **WALL LINE.** Any length of wall along a principal axis of the building used to provide resistance to lateral loads. Parallel wall lines separated by less than 4 feet (1219 mm) shall be considered to be one wall line for the distribution of loads.

[BS] **WEAK WALL LINE.** A wall line in a story where the story strength is less than 80 percent of the story above in the direction under consideration.

SECTION A403 ANALYSIS AND DESIGN

[BS] **A403.1 General.** Modifications required by the provisions in this chapter shall be designed in accordance with the *California Building Code* provisions for new construction, except as modified by this chapter.

Exception: Buildings for which the prescriptive measures provided in Section A404 apply and are used.

Alteration of the existing lateral force-resisting system or vertical load-carrying system shall not reduce the strength or stiffness of the existing structure, unless the altered structure would remain in conformance to the building code and this chapter.

[BS] **A403.2 Scope of analysis.** This chapter requires the *alteration, repair, replacement* or addition of structural elements and their connections to meet the strength and stiffness requirements herein. The lateral load-path analysis shall include the resisting elements and connections from the wood diaphragm immediately above any soft, weak or open-front wall lines to the foundation soil interface or to the uppermost story of a podium structure comprised of steel, masonry, or concrete structural systems that supports the upper wood-framed structure. Stories above the uppermost story with a soft, weak or open-front wall line shall be considered in the analysis but need not be modified. The lateral load-path analysis for added structural elements shall include evaluation of the allowable soil-bearing and lateral pressures in accordance with the building code. Where any portion of a building within the scope of this chapter is constructed on or into a slope steeper than one unit vertical in three units horizontal (33-percent slope), the lateral force-resisting system at and below the base level diaphragm shall be analyzed for the effects of concentrated lateral forces at the base caused by this hillside condition.

[BS] **A403.3 Design base shear and design parameters.** The design base shear in a given direction shall be permitted to be 75 percent of the value required for similar new construction in accordance with the building code. The value

of R used in the design of the strengthening of any story shall not exceed the lowest value of R used in the same direction at any story above. The system overstrength factor, Ω_0 , and the deflection amplification factor, C_d , shall be not less than the largest respective value corresponding to the R factor being used in the direction under consideration.

Exceptions:

1. For structures assigned to Seismic Design Category B, values of R , Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening.
2. For structures assigned to Seismic Design Category C or D, values of R , Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening, provided that when the strengthening is complete, the strengthened structure will not have an extreme weak story irregularity defined as Type 5b in ASCE 7 Table 12.3-2.
3. For structures assigned to Seismic Design Category E, values of R , Ω_0 and C_d shall be permitted to be based on the seismic force-resisting system being used to achieve the required strengthening, provided that when the strengthening is complete, the strengthened structure will not have an extreme soft story, a weak story, or an extreme weak story irregularity defined, respectively, as Types 1b, 5a and 5b in ASCE 7 Table 12.3-2.
4. For retrofit systems involving different seismic force-resisting systems in the same direction within the same story, resisting elements are permitted to be designed using the least value of R for the different structural systems found in each independent line of resistance if all of the following conditions are met:
 - 4.1. The building is assigned to *Risk Category I* or II.
 - 4.2. The building height is no more than four stories above grade plane.
 - 4.3. The seismic force-resisting systems of the retrofitted building comprise only wood structural panel shear walls, steel moment-resisting frames, steel cantilever columns and steel-braced frames. Values for C and Ω_0 shall be consistent with the R value used.
5. With reference to ASCE 7 Table 12.2-1, ordinary, intermediate and special steel systems, and all light-frame systems shall be permitted without limitation where those systems are used only for retrofit with the requirements of this chapter.

[BS] A403.3.1 Expected story strength. Despite any other requirement of Section A403.3 or A403.4, the total expected strength of retrofit elements added to any story need not exceed 1.7 times the expected strength of the story immediately above in a two-story building, or 1.3 times the expected strength of the story immediately above in a three-story or taller building, as long as the retrofit

elements are located symmetrically about the center of mass of the story above, or so as to minimize torsion in the retrofitted story. Calculation of expected story strength and identification of irregularities in Section A403.3 shall be based on the expected strength of all wall lines, even if sheathed with nonconforming materials. The strength of a wall line above the retrofitted story shall be permitted to be reduced to account for inadequate load path or overturning resistance.

[BS] A403.3.2 Seismicity parameters, site class and geologic hazards. For any site designated as Site Class E, the value of F shall be taken as 1.2. Site-specific procedures are not required for compliance with this chapter. Mitigation of existing geologic site hazards such as liquefiable soil, fault rupture or landslide is not required for compliance with this chapter.

[BS] A403.4 Story drift limitations. The calculated story drift for each retrofitted story shall not exceed the allowable deformation compatible with all vertical load-resisting elements and 0.025 times the story height. The calculated story drift shall not be reduced by the effects of horizontal diaphragm stiffness but shall be increased where these effects produce rotation. Drift calculations shall be in accordance with the building code.

[BS] A403.4.1 Pole structures. The effects of rotation and soil stiffness shall be included in the calculated story drift where lateral loads are resisted by vertical elements whose required depth of embedment is determined by pole formulas. The coefficient of subgrade reaction used in deflection calculations shall be based on a geotechnical investigation conducted in accordance with the building code.

[BS] A403.5 Deformation compatibility and P Δ effects. The requirements of the building code shall apply, except as modified herein. Structural framing elements and their connections not required by design to be part of the lateral force-resisting system shall be designed and detailed to be adequate to maintain support of expected gravity loads when subjected to the expected deformations caused by seismic forces. Increased demand caused by P Δ effects and story sidesway stability shall be considered in retrofit stories that rely on the strength and stiffness of cantilever columns for lateral resistance.

[BS] A403.6 Ties and continuity. All parts of the structure included in the scope of Section A403.2 shall be interconnected as required by the building code.

[BS] A403.7 Collector elements. Collector elements shall be provided to transfer the seismic forces between the elements within the scope of Section A403.2.

[BS] A403.8 Floor diaphragms. Floor diaphragms within the scope of Section A403.2 shall be shown to have adequate strength at the following locations:

1. For straight lumber sheathed diaphragms without integral hardwood flooring throughout the diaphragm: The code official is authorized to waive the requirement where it is shown that the condition occurs in areas

small enough not to affect overall building performance.

- For all other diaphragms adequate strength shall be shown to be provided at locations where forces are transferred between the diaphragm and each new or strengthened vertical element of the seismic force-resisting system. Collector elements shall be provided where needed to distribute the transferred force over a greater length of diaphragm.

Exception: Where the existing vertical elements of the seismic force-resisting system are shown to comply with this chapter, diaphragms need not be evaluated.

[BS] A403.9 Wood-framed shear walls. Wood-framed shear walls shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section. Where new sheathing is applied to existing studs to create new wood-framed shear walls, the new wall elements shall be considered bearing wall systems for purposes of determining seismic design parameters.

[BS] A403.9.1 Gypsum or cement plaster products. Gypsum or cement plaster products shall not be used to provide the strength required by Section A403.3 or the stiffness required by Section A403.4.

[BS] A403.9.2 Wood structural panels.

[BS] A403.9.2.1 Drift limit. Wood structural panel shear walls shall meet the story drift limitation of Section A403.4. Conformance to the story drift limitation shall be determined by approved testing or calculation. Individual shear panels shall be permitted to exceed the maximum aspect ratio, provided that the allowable story drift and allowable shear capacities are not exceeded.

[BS] A403.9.2.2 Openings. Shear walls are permitted to be designed for continuity around openings in accordance with the building code. Blocking and steel strapping shall be provided at corners of the openings to transfer forces from discontinuous boundary elements into adjoining panel elements. Alternatively, perforated shear wall provisions of the building code are permitted to be used.

[BS] A403.9.3 Hold-down connectors.

[BS] A403.9.3.1 Expansion anchors in tension. Expansion anchors that provide tension strength by friction resistance shall not be used to connect hold-down devices to existing concrete or masonry elements.

[BS] A403.9.3.2 Required depth of embedment. The required depth of embedment or edge distance for the anchor used in the hold-down connector shall be provided in the concrete or masonry below any plain concrete slab unless satisfactory evidence is submitted to the code official that shows that the concrete slab and footings are of monolithic construction.

A403.10 Steel retrofit systems. Steel retrofit systems shall have strength and stiffness sufficient to resist the seismic loads and shall conform to the requirements of this section.

A403.10.1 Special moment frames. Steel special moment frames shall comply with all applicable provisions of AISC 341, except that Section E3.4a addressing strong-column/weak-beams of AISC 341, is not required for columns that carry no gravity load.

A403.10.2 Inverted moment frame systems. Cantilevered column systems shall be permitted to be designed as inverted special, intermediate or ordinary moment frames, with corresponding moment frame seismic design coefficients, where the system satisfies the following conditions:

- The columns carry no gravity load.
- The columns are configured in pairs or larger groups connected by a continuous reinforced concrete foundation or grade beam.
- The foundation or grade beam shall be designed to resist the expected plastic moment at the base of each column, computed as $R_y F_y Z$ in accordance with AISC 341.
- The flexibility of the foundation or grade beam, considering cracked section properties of the reinforced concrete, shall be included in computing the deformation of the steel frame system.
- The column height shall be taken as twice the actual height when checking lateral torsional buckling.

SECTION A404 PRESCRIPTIVE MEASURES FOR WEAK STORY

[BS] A404.1 Limitation. These prescriptive measures shall apply only to two-story buildings and only where deemed appropriate by the code official. These prescriptive measures rely on rotation of the second floor diaphragm to distribute the seismic load between the side and rear walls around a ground floor open area. In the absence of an existing floor diaphragm of wood structural panel or diagonal sheathing at the top of the first story, a new wood structural panel diaphragm of minimum thickness of $\frac{3}{4}$ inch (19.1 mm) and with 10d common nails at 6 inches (152 mm) on center shall be applied.

[BS] A404.1.1 Additional conditions. To qualify for these prescriptive measures, the following additional conditions need to be satisfied by the retrofitted structure:

- Diaphragm aspect ratio L/W is less than 0.67, where W is the diaphragm dimension parallel to the soft, weak or open-front wall line and L is the distance in the orthogonal direction between that wall line and the rear wall of the ground floor open area.
- Minimum length of side shear walls = 20 feet (6096 mm).
- Minimum length of rear shear wall = three-fourths of the total rear wall length.
- Plan or vertical irregularities shall not be other than a soft, weak or open-front wall line.
- Roofing weight less than or equal to 5 pounds per square foot (240 N/m²).

6. Aspect ratio of the full second floor diaphragm meets the requirements of the building code for new construction.

[BS] A404.2 Minimum required retrofit.

[BS] A404.2.1 Anchor size and spacing. The anchor size and spacing shall be not less than $\frac{3}{4}$ inch (19.1 mm) in diameter at 32 inches (813 mm) on center. Where existing anchors are inadequate, supplemental or alternative approved connectors (such as new steel plates bolted to the side of the foundation and nailed to the sill) shall be used.

[BS] A404.2.2 Connection to floor above. Shear wall top plates shall be connected to blocking or rim joist at upper floor with not less than 18-gage galvanized steel angle clips $4\frac{1}{2}$ inches (114 mm) long with 12-8d nails spaced not farther than 16 inches (406 mm) on center, or by equivalent shear transfer methods.

[BS] A404.2.3 Shear wall sheathing. The shear wall sheathing shall be not less than $\frac{15}{32}$ -inch (11.9 mm), 5-ply Structural I with 10d nails at 4 inches (102 mm) on center at edges and 12 inches (305 mm) on center at field; blocked all edges with 3 by 4 board or larger. Where existing sill plates are less than 3-by thick, place flat 2-by on top of sill between studs, with flat 18-gage galvanized steel clips $4\frac{1}{2}$ inches (114 mm) long with 12-8d nails or $\frac{3}{8}$ -inch-diameter (9.5 mm) lags through blocking for shear transfer to sill plate. Stagger nailing from wall sheathing between existing sill and new blocking. Anchor new blocking to foundation as specified in this section.

[BS] A404.2.4 Shear wall hold-downs. Shear walls shall be provided with hold-down anchors at each end. Two hold-down anchors are required at intersecting corners. Hold-downs shall be approved connectors with a minimum $\frac{5}{8}$ -inch-diameter (15.9 mm) threaded rod or other approved anchor with a minimum allowable load of 4,000 pounds (17.8 kN). Anchor embedment in concrete shall be not less than 5 inches (127 mm). Tie-rod systems shall be not less than $\frac{5}{8}$ inch (15.9 mm) in diameter unless using high-strength cable. High-strength cable elongation shall not exceed $\frac{5}{8}$ inch (15.9 mm) under a 4,000 pound (17.8 kN) axial load.

**SECTION A405
MATERIALS OF CONSTRUCTION**

[BS] A405.1 New materials. New materials shall meet the requirements of the *California Building Code*, except where allowed by this chapter.

[BS] A405.2 Allowable foundation and lateral pressures. The use of default values from the building code for continuous and isolated concrete spread footings shall be permitted. For soil that supports embedded vertical elements, Section A403.4.1 shall apply.

[BS] A405.3 Existing materials. The physical condition, strengths and stiffnesses of existing building materials shall be taken into account in any analysis required by this chapter. The verification of existing materials conditions and their conformance to these requirements shall be made by physical

observation, material testing or record drawings as determined by the registered design professional subject to the approval of the code official.

[BS] A405.3.1 Wood-structural-panel shear walls.

[BS] A405.3.1.1 Existing nails. Where the required calculations rely on design values for common nails or surfaced dry lumber, their use in construction shall be verified by exposure.

[BS] A405.3.1.2 Existing plywood. Where verification of the existing plywood is by use of record drawings alone, plywood shall be assumed to be of three plies.

[BS] A405.3.2 Existing wood framing. Wood framing is permitted to use the design stresses specified in the building code under which the building was constructed or other stress criteria approved by the code official.

[BS] A405.3.3 Existing structural steel. All existing structural steel shall be permitted to be assumed to comply with ASTM A36. Existing pipe or tube columns shall be assumed to be of minimum wall thickness unless verified by testing or exposure.

[BS] A405.3.4 Existing concrete. All existing concrete footings shall be permitted to be assumed to be plain concrete with a compressive strength of 2,000 pounds per square inch (13.8 MPa). Existing concrete compressive strength taken greater than 2,000 pounds per square inch (13.8 MPa) shall be verified by testing, record drawings or department records.

[BS] A405.3.5 Existing sill plate anchorage. The analysis of existing cast-in-place anchors shall be permitted to assume proper anchor embedment for purposes of evaluating shear resistance to lateral loads.

**SECTION A406
CONSTRUCTION DOCUMENTS**

[BS] A406.1 General. The plans shall show all information necessary for plan review and for construction and shall accurately reflect the design. The plans shall contain a note that states that this retrofit was designed in compliance with the criteria of this chapter.

[BS] A406.2 Existing construction. The plans shall show existing diaphragm and shear wall sheathing and framing materials; fastener type and spacing; diaphragm and shear wall connections; continuity ties; collector elements; and the portion of the existing materials that needs verification during construction. If the cap allowed by Section A403.3.1 is used to limit the scope of retrofit, the foregoing information shall be shown for each retrofitted story and at least one story above the uppermost retrofitted story. If the cap allowed by Section A403.3.1 is not used, the foregoing information need only be shown for each retrofitted story and for the floor at the top of that story.

[BS] A406.3 New construction.

[BS] A406.3.1 Foundation plan elements. The foundation plan shall include the size, type, location and spacing of all anchor bolts with the required depth of embedment,

edge and end distance; the location and size of all shear walls and all columns for braced frames or moment frames; referenced details for the connection of shear walls, braced frames or moment-resisting frames to their footing; and referenced sections for any grade beams and footings.

[BS] A406.3.2 Framing plan elements. The framing plan shall include the length, location and material of shear walls; the location and material of frames; references or details for the column-to-beam connectors, beam-to-wall connections and shear transfers at floor and roof diaphragms; and the required nailing and length for wall top plate splices.

[BS] A406.3.3 Shear wall schedule, notes and details. Shear walls shall have a referenced schedule on the plans that includes the correct shear wall capacity in pounds per foot (N/m); the required fastener type, length, gage and head size; and a complete specification for the sheathing material and its thickness. The schedule shall also show the required location of 3-inch (76 mm) nominal or two 2-inch (51 mm) nominal edge members; the spacing of shear transfer elements such as framing anchors or added sill plate nails; the required hold-down with its bolt, screw or nail sizes; and the dimensions, lumber grade and species of the attached framing member.

Notes shall show required edge distance for fasteners of structural wood panels and framing members; required flush nailing at the plywood surface; limits of mechanical penetrations; and the sill plate material assumed in the design. The limits of mechanical penetrations shall be detailed showing the maximum notching and drilled hole sizes.

[BS] A406.3.4 General notes. General notes shall show the requirements for material testing, special inspection and structural observation.

SECTION A407 QUALITY CONTROL

[BS] A407.1 Structural observation. Structural observation, in accordance with Section 1704.6 of the *California Building Code* is required, regardless of seismic design category, height or other conditions. Structural observation shall include visual observation of work for conformance to the *approved* construction documents and confirmation of existing conditions assumed during design.

A407.2 Contractor responsibility. Contractor responsibility shall be in accordance with Section 1704.4 of the *California Building Code*.

A407.3 Testing and inspection. Structural testing and inspection for new construction materials, submittals, reports and certificates of compliance shall be in accordance with Sections 1704 and 1705 of the *California Building Code*. Work done to comply with this chapter shall not be eligible for Exceptions 1, 2, or 3 of Section 1704.2 of the *California Building Code* or for the exception to Section 1705.13.2 of the *California Building Code*.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX A
CHAPTER A5 – REFERENCED STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
 See Chapter 1 for state agency authority and building applications.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter	X			X	X																	
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER A5
REFERENCED STANDARDS

SECTION A501
REFERENCED STANDARDS

A501.1 General. See Table A501.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that references the standard.

APPENDIX A—GUIDELINES FOR THE SEISMIC RETROFIT OF EXISTING BUILDINGS

**TABLE A501.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
AISC 341-16	<i>Seismic Provisions for Structural Steel Buildings</i>	A403.10.1, A403.10.2
ASCE/SEI 7 —16	<i>Minimum Design Loads for Buildings and Other Structures with Supplement No. 1</i>	A104.1, A205.1, A206.1, A206.2, A206.3, A206.4, A206.7, A403.3
ASTM A36/A36M— 14	<i>Specification for Carbon Structural Steel</i>	A405.3.3
ASTM A653/A653M —15	<i>Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process</i>	A304.2.6
ASTM B695 —04(2009)	<i>Standard Specification for Coating of Zinc Mechanically Deposited on Iron and Steel</i>	A304.2.6
ASTM C67- 14	<i>Test Methods of Sampling and Testing Brick and Structural Clay Tile</i>	A106.2.3.1
ASTM C140/C140M —15	<i>Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units</i>	A106.2.3.1
ASTM C496 —96/ C496M —11	<i>Standard Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens</i>	A104.1, A106.2.3.3
ASTM C1531—15	<i>Standard Test Methods for In Situ Measurement of Masonry Mortar Joint Shear Strength Index</i>	A106.2.3.2
ASTM E488/E488M —15	<i>Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements</i>	A107.5.1, A107.5.3
ASTM E519/ E519M —2010	<i>Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages</i>	A104.1
CBC—01	<i>California Building Code</i>	A202.1
CBC—07	<i>California Building Code</i>	A202.1
CBC—10	<i>California Building Code</i>	A202.1
CBC—13	<i>California Building Code</i>	A202.1
CBC—16	<i>California Building Code</i>	A202.1
CBC—19	<i>California Building Code</i>	A202.1
CBC—22	<i>California Building Code</i>	A102.2, A105.1, A105.4, A202.1, A203.1, A204.1, A205.1, A205.3, A205.3.1, A205.4, A301.3, A304.1.1, A403.1, A405.1, A407.1, A407.2, A407.3
UBC—97	<i>Uniform Building Code</i>	A202.1

**CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX B
SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS
FOR EXISTING BUILDINGS AND FACILITIES**

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

APPENDIX B

SUPPLEMENTARY ACCESSIBILITY REQUIREMENTS FOR EXISTING BUILDINGS AND FACILITIES

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: Chapter 11 of the International Building Code® contains provisions that set forth requirements for accessibility to buildings and their associated sites and facilities for people with physical disabilities. Sections 306 and 1508 in the code address accessibility provisions and alternatives permitted in existing buildings. Appendix B was added to address accessibility in construction for items that are not typically enforceable through the traditional building code enforcement process.

SECTION B101 QUALIFIED HISTORIC BUILDINGS AND FACILITIES

[BE] B101.1 General. Qualified historic buildings and facilities shall comply with Sections B101.2 through B101.5.

[BE] B101.2 Qualified historic buildings and facilities. These procedures shall apply to buildings and facilities designated as historic structures that undergo alterations or a change of occupancy.

[BE] B101.3 Qualified historic buildings and facilities subject to Section 106 of the National Historic Preservation Act. Where an alteration or change of occupancy is undertaken to a qualified historic building or facility that is subject to Section 106 of the National Historic Preservation Act, the federal agency with jurisdiction over the undertaking shall follow the Section 106 process. Where the state historic preservation officer or Advisory Council on Historic Preservation determines that compliance with the requirements for accessible routes, ramps, entrances, or toilet facilities would threaten or destroy the historic significance of the building or facility, the alternative requirements of Section 306.7.16 for that element are permitted.

[BE] B101.4 Qualified historic buildings and facilities not subject to Section 106 of the National Historic Preservation Act. Where an alteration or change of occupancy is undertaken to a qualified historic building or facility that is not subject to Section 106 of the National Historic Preservation Act, and the entity undertaking the alterations believes that compliance with the requirements for accessible routes, ramps, entrances or toilet facilities would threaten or destroy the historic significance of the building or facility, the entity shall consult with the state historic preservation officer. Where the state historic preservation officer determines that compliance with the accessibility requirements for accessible routes, ramps, entrances or toilet facilities would threaten or destroy the historical significance of the building or facility, the alternative requirements of Section 306.7.16 for that element are permitted.

[BE] B101.4.1 Consultation with interested persons. Interested persons shall be invited to participate in the consultation process, including state or local accessibility

officials, individuals with disabilities, and organizations representing individuals with disabilities.

[BE] B101.4.2 Certified local government historic preservation programs. Where the state historic preservation officer has delegated the consultation responsibility for purposes of this section to a local government historic preservation program that has been certified in accordance with Section 101 of the National Historic Preservation Act of 1966 [(16 U.S.C. 470a(c)] and implementing regulations (36 CFR 61.5), the responsibility shall be permitted to be carried out by the appropriate local government body or official.

[BE] B101.5 Displays. In qualified historic buildings and facilities where alternative requirements of Section 306.7.16 are permitted, displays and written information shall be located where they can be seen by a seated person. Exhibits and signs displayed horizontally shall be 44 inches (1120 mm) maximum above the floor.

SECTION B102 FIXED TRANSPORTATION FACILITIES AND STATIONS

[BE] B102.1 General. Existing fixed transportation facilities and stations shall comply with Section B102.2.

[BE] B102.2 Existing facilities—key stations. Rapid rail, light rail, commuter rail, intercity rail, high-speed rail and other fixed guideway systems, altered stations, and intercity rail and key stations, as defined under criteria established by the Department of Transportation in Subpart C of 49 CFR Part 37, shall comply with Sections B102.2.1 through B102.2.3.

[BE] B102.2.1 Accessible route. One accessible route, or more, from an accessible entrance to those areas necessary for use of the transportation system shall be provided. The accessible route shall include the features specified in Section E109.2 of the *California Building Code*, except that escalators shall comply with Section 3004.2.2 of the *California Building Code*. Where technical unfeasibility in existing stations requires the accessible route to lead from the public way to a paid area of the transit system, an

accessible fare collection machine complying with Section E109.2.3 of the *California Building Code* shall be provided along such accessible route.

[BE] B102.2.2 Platform and vehicle floor coordination. Station platforms shall be positioned to coordinate with vehicles in accordance with applicable provisions of 36 CFR Part 1192. Low-level platforms shall be 8 inches (250 mm) minimum above top of rail.

Exception: Where vehicles are boarded from sidewalks or street-level, low-level platforms shall be permitted to be less than 8 inches (250 mm).

[BE] B102.2.3 Direct connections. New direct connections to commercial, retail or residential facilities shall, to the maximum extent feasible, have an accessible route complying with Section 306.7.1 from the point of connection to boarding platforms and transportation system elements used by the public. Any elements provided to facilitate future direct connections shall be on an accessible route connecting boarding platforms and transportation system elements used by the public.

**SECTION B103
DWELLING UNITS AND SLEEPING UNITS**

[BE] B103.1 Communication features. Where dwelling units and sleeping units are altered or added, the requirements of Section E104.2 of the *California Building Code* shall apply only to the units being altered or added until the number of units with accessible communication features complies with the minimum number required for new construction.

**SECTION B104
REFERENCED STANDARDS**

[BE] B104.1 General. See Table B104.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**[BE] TABLE B104.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
Y3.H626 2P	<i>National Historic Preservation Act, 16 USC 4301.2, 43 USC 933 Act of 1966 as amended 16 USC 4301.3, 3rd Edition</i>	B101.3, B101.4, B101.4.2
CBC—21	<i>California Building Code</i>	B102.2.1, B103.1
36 CFR Part 1192	<i>Americans with Disabilities Act Guidelines for Transportation Vehicles—Rapid Rail Vehicles and Systems</i>	B102.2.2
49 CFR Part 37 Subpart C	<i>Alteration of Transportation Facilities by Public Entities Department of Transportation</i>	B102.2

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX C
CHAPTER C1 – GABLE END RETROFIT FOR HIGH-WIND AREAS

Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal's adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

APPENDIX C: GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS

CHAPTER C1

GABLE END RETROFIT FOR HIGH-WIND AREAS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User note:

About this appendix: Appendix C is intended to provide guidance for retrofitting existing structures to strengthen their resistance to wind forces. This appendix is similar in scope to Appendix A, which addresses seismic retrofits for existing buildings, except that the subject matter is related to wind retrofits. These retrofits are voluntary measures that serve to better protect the public and reduce damage from high-wind events for existing buildings.

The purpose of this appendix is to provide prescriptive alternatives for addressing retrofit of buildings in high-wind areas. Currently there are two chapters that deal with the retrofit of gable ends and the fastening of roof decks, Appendix Chapters C1 and C2, respectively.

SECTION C101 GENERAL

[BS] C101.1 Purpose. This chapter provides prescriptive methods for partial structural retrofit of an *existing building* to increase its resistance to out-of-plane wind loads. It is intended for voluntary use and for reference by mitigation programs. The provisions of this chapter do not necessarily satisfy requirements for new construction. Unless specifically cited, the provisions of this chapter do not necessarily satisfy requirements for structural improvements triggered by *addition, alteration, repair, change of occupancy*, building relocation or other circumstances.

[BS] C101.2 Eligible buildings and gable end walls. The provisions of this chapter are applicable only to buildings that meet the following eligibility requirements:

1. The building is not more than three stories tall, from adjacent grade to the bottom plate of each gable end wall being retrofitted with this chapter.
2. The building is classified as Occupancy Group R3 or is within the scope of the *California Residential Code*.
3. The structure includes one or more wood-framed gable end walls, either conventionally framed or metal-plate-connected.

In addition, the provisions of this chapter are applicable only to gable end walls that meet the following eligibility requirements:

4. Each gable end wall has or shall be provided with studs or vertical webs spaced 24 inches (610 mm) on center maximum.
5. Each gable end wall has a maximum height of 16 feet (4877 mm).

[BS] C101.3 Compliance Eligible gable end walls in eligible buildings may be retrofitted in accordance with this chapter. Other modifications required for compliance with this chapter shall be designed and constructed in accordance with the *California Building Code* or *California Residential Code* provisions for new construction, except as specifically provided for by this chapter.

SECTION C102 DEFINITIONS

[BS] C102.1 Definitions. The following words and terms shall, for the purposes of this chapter, have the meanings shown herein.

[BS] ANCHOR BLOCK. A piece of lumber secured to horizontal braces and filling the gap between existing framing members for the purpose of restraining horizontal braces from movement perpendicular to the framing members.

[BS] COMPRESSION BLOCK. A piece of lumber used to restrain in the compression mode (force directed toward the interior of the attic) an existing or retrofit stud. It is attached to a horizontal brace and bears directly against the existing or retrofit stud.

[BS] CONVENTIONALLY FRAMED GABLE END. A gable end framed with studs whose faces are perpendicular to the gable end wall.

[BS] GABLE END FRAME. A factory or site-fabricated frame, installed as a complete assembly that incorporates vertical webs with their faces parallel to the plane of the frame.

[BS] HORIZONTAL BRACE. A piece of lumber used to restrain both compression and tension loads applied by a retrofit stud. It is typically installed horizontally on the top of attic floor framing members (truss bottom chords or ceiling joists) or on the bottom of pitched roof framing members (truss top chord or rafters).

[BS] HURRICANE TIES. Manufactured metal connectors designed to provide uplift and lateral restraint for roof framing members.

[BS] NAIL PLATE. A manufactured metal plate made of galvanized steel with factory-punched holes for fasteners. A nail plate may have the geometry of a strap.

[BS] RETROFIT. The voluntary process of strengthening or improving buildings or structures, or individual components of buildings or structures for the purpose of making existing conditions better serve the purpose for which they were originally intended or the purpose that current building codes intend.

[BS] RETROFIT STUD. A lumber member used to structurally supplement an existing gable end wall stud or gable end frame web.

[BS] STUD-TO-PLATE CONNECTOR. A manufactured metal connector designed to connect studs to plates.

**SECTION C103
MATERIALS OF CONSTRUCTION**

[BS] C103.1 Existing materials. Existing wood materials that will be part of the retrofitting work (such as trusses, rafters, ceiling joists, top plates and wall studs) shall be in sound condition and free from defects or damage that substantially reduces the load-carrying capacity of the member. Any wood materials found to be damaged or deteriorated shall be strengthened or replaced with new materials to provide a net dimension of sound wood equivalent to its undamaged original dimensions.

[BS] C103.2 New materials. All new materials shall comply with the standards for those materials as specified in the *California Building Code* or the *California Residential Code*.

[BS] C103.3 Material specifications for retrofits. Materials for retrofitting gable end walls shall comply with Table C103.3.

[BS] C103.4 Twists in straps. Straps shall be permitted to be twisted or bent where they transition between framing

members or connection points. Straps shall be bent only once at a given location though it is permissible that they be bent or twisted at multiple locations along their length.

[BS] C103.5 Fasteners. Fasteners shall meet the requirements of Table C103.5, Sections C103.5.1 and C103.5.2, and shall be permitted to be screws or nails meeting the minimum length requirement shown in the figures and specified in the tables of this appendix. Fastener spacing shall meet the requirements of Section C103.5.3.

[BS] C103.5.1 Screws. Unless otherwise indicated in the appendix, screw sizes and lengths shall be in accordance with Table C103.5. Permissible screws include deck screws and wood screws. Screws shall have not less than 1 inch (25 mm) of thread. Fine threaded screws or drywall screws shall not be permitted. Select the largest possible diameter screw such that the shank adjacent to the head fits through the hole in the strap.

[BS] C103.5.2 Nails. Unless otherwise indicated in this appendix, nail sizes and lengths shall be in accordance with Table C103.5.

[BS] C103.5.3 General fastener spacing. Fastener spacing for shear connections of lumber-to-lumber shall meet the requirements shown in Figure C103.5.3 and the following conditions.

**[BS] TABLE C103.3
MATERIAL SPECIFICATIONS FOR RETROFITS^a**

COMPONENT	MINIMUM SIZE OR THICKNESS	MINIMUM MATERIAL GRADE	MINIMUM CAPACITY
Anchor blocks, compression blocks and horizontal braces	2 × 4 nominal lumber	#2 Spruce-Pine-Fir or better	NA
Nail plates	20 gage thickness 8d minimum nail holes	Galvanized sheet steel	NA
Retrofit studs	2 × 4 nominal lumber	#2 Spruce-Pine-Fir or better	NA
Gusset angle	14 gage thickness	Galvanized sheet steel	350 pounds uplift and lateral load
Stud-to-plate connector	20 gage thickness	Galvanized sheet steel	500 pounds uplift
Metal plate connectors, straps and anchors	20 gage thickness	Galvanized sheet steel	NA

For SI: 1 pound = 4.4 N.

NA = Not Applicable.

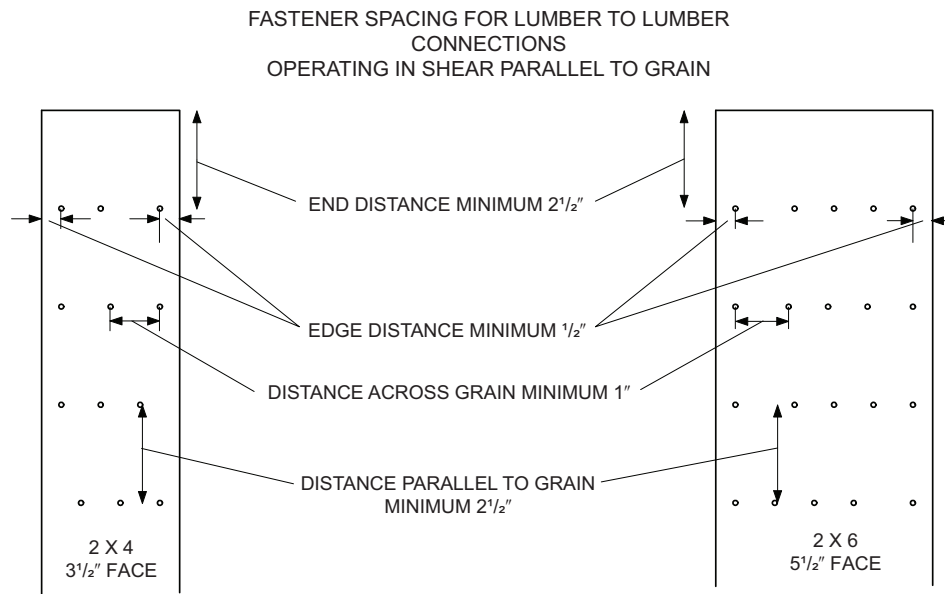
- a. Metal plate connectors, nail plates, stud-to-plate connectors, straps and anchors shall be products approved for connecting wood-to-wood or wood-to-concrete as appropriate.

**[BS] TABLE C103.5
NAIL AND SCREW REQUIREMENTS**

FASTENER TYPE	MINIMUM SHANK DIAMETER	MINIMUM HEAD DIAMETER	MINIMUM FASTENER LENGTH
#8 screws	NA	0.28 inches	1¼ inches
8d common nails	0.131 inches	0.28 inches	2½ inches
10d common nails	0.148 inches	0.28 inches	3 inches

For SI: 1 inch = 25.4 mm.

NA = Not Applicable.



For SI: 1 inch = 25.4 mm.

[BS] FIGURE C103.5.3
FASTENER SPACINGS FOR LUMBER-TO-LUMBER CONNECTIONS OPERATING IN SHEAR PARALLEL TO GRAIN

[BS] C103.5.3.1 General fastener spacing. Fastener spacing shall meet the following conditions except as provided for in Section C103.5.3.

The distance between fasteners and the edge of lumber that is less than $3\frac{1}{2}$ inches deep (89 mm) in the direction of the fastener length shall be not less than $\frac{3}{4}$ inch (19.1 mm).

1. The distance between fasteners and the edge of lumber that is more than 2 inches (51 mm) thick in the direction of the fastener length shall be not less than $\frac{1}{2}$ inch (12.7 mm).
2. The distance between a fastener and the end of lumber shall be not less than $2\frac{1}{2}$ inches (64 mm).
3. The distance between fasteners parallel to the grain (center-to-center) shall be not less than $2\frac{1}{2}$ inches (64 mm).
4. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is less than $3\frac{1}{2}$ inches (89 mm) deep in the direction of the fastener length shall be 1 inch (25 mm).
5. The distance between fasteners perpendicular to the grain (center-to-center) in lumber that is more than 2 inches (51 mm) thick in the direction of the fastener length shall be $\frac{1}{2}$ inch (12.7 mm).

[BS] C103.5.3.2 Wood-to-wood connections of two members each 2 inches or less in thickness. Wood-to-wood connections fastener spacing shall meet the following conditions.

1. The distance between fasteners parallel to grain (center-to-center) shall be not less than $2\frac{1}{2}$ inches (64 mm).

2. The distance between fasteners across grain (center-to-center) shall be not less than 1 inch (25 mm).
3. For wood-to-wood connections of lumber at right angles, fasteners shall be spaced not less than $2\frac{1}{2}$ inches (64 mm) parallel to the grain and 1 inch (25 mm) perpendicular to the grain in any direction.

[BS] C103.5.3.3 Metal connectors for wood-to-wood connections. Metal connectors for wood-to-wood connections shall meet the following conditions.

1. Fastener spacing to edge or ends of lumber shall be as dictated by the prefabricated holes in the connectors and the connectors shall be installed in a configuration that is similar to that shown by the connector manufacturer.
2. Fasteners in $1\frac{1}{4}$ -inch-wide (32 mm) metal straps that are installed on the narrow face of lumber shall be a minimum $\frac{1}{4}$ inch (6.4 mm) from either edge of the lumber. Consistent with Section C103.5.3.1, fasteners shall be permitted to be spaced according to the fastener holes fabricated into the strap.
3. Fasteners in metal nail plates shall be spaced not less than $\frac{1}{2}$ inch (12.7 mm) perpendicular to grain and not less than $1\frac{1}{2}$ inches (38 mm) parallel to grain.

**SECTION C104
RETROFITTING GABLE END WALLS
TO ENHANCE WIND RESISTANCE**

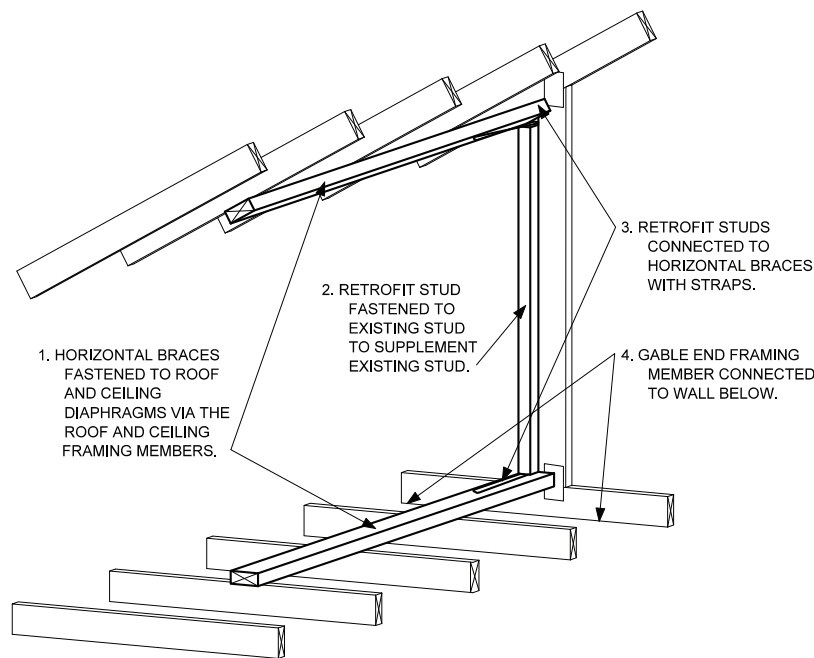
[BS] C104.1 General. These prescriptive methods of retrofitting are intended to increase the resistance of existing gable end construction for out-of-plane wind loads resulting from high-wind events. The ceiling diaphragm shall be comprised of minimum 1/2-inch-thick (12.7 mm) gypsum board, minimum nominal 3/8-inch-thick (9.5 mm) wood structural panels, or plaster. An overview isometric drawing of one type of gable end retrofit to improve wind resistance is shown in Figure C104.1.

[BS] C104.2 Horizontal braces. Horizontal braces shall be installed perpendicular to the roof and ceiling framing members at the location of each existing gable end stud greater than 3 feet (91 cm) in length. Unless it is adjacent to an omitted horizontal brace location, horizontal braces shall be minimum 2-inch by 4-inch (38 mm by 89 mm) dimensional lumber as defined in Section C103.3. A single horizontal brace is required at the top and bottom of each gable end stud for Retrofit Configuration A, B, or C. Two horizontal braces are required at the top and bottom of each gable end stud for Retrofit Configuration D. Maximum heights of gable end wall studs and associated retrofit studs for each Retrofit Configuration shall not exceed the values listed in Table C104.2. Horizontal braces shall be oriented with their wide faces across the roof or ceiling framing members, be fastened to not fewer than three framing members, and extend not less than 6 feet (183 cm) measured

perpendicularly from the gable end plus 2 1/2 inches (64 mm) beyond the last top chord or bottom chord member (rafter or ceiling joist) from the gable end as shown in Figures C104.2(1), C104.2(2), C104.2(3) and C104.2(4).

[BS] C104.2.1 Existing gable end studs. If the spacing of existing vertical gable end studs is greater than 24 inches (64 mm), a new stud and corresponding horizontal braces shall be installed such that the maximum spacing between existing and added studs shall be not greater than 24 inches (64 mm). Additional gable end wall studs shall not be required at locations where their length would be 3 feet (914 mm) or less. Each end of each required new stud shall be attached to the existing roofing framing members (truss top chord or rafter and truss bottom chord or ceiling joist) using not fewer than two 3-inch (76 mm) toenail fasteners (#8 wood screws or 10d nails) and a metal connector with minimum uplift capacity of 175 pounds (778 N), or nail plates with not fewer than four 1 1/4-inch-long (32 mm) fasteners (No. 8 wood screws or 8d nails).

[BS] C104.2.2 Main method of installation. Each horizontal brace shall be fastened to each existing roof or ceiling member that it crosses using three 3-inch-long (76 mm) fasteners (No. 8 wood screws or 10d nails) as indicated in Figure C104.2(1) and Figure C104.2(3) for trusses and Figure C104.2(2) and Figure C104.2(4) for conventionally framed gable end walls. Alternative methods for providing horizontal bracing of the gable end studs as provided in Sections C104.2.3 through C104.2.9 shall be permitted.



THIS FIGURE SHOWS A TRUSS GABLE END.
THE METHODOLOGY FOR A CONVENTIONALLY FRAMED GABLE END IS SIMILAR.
THE NUMBERS INDICATE A TYPICAL SEQUENCE OF INSTALLATION.
IN ORDER TO SHOW STRAPS COMPRESSION BLOCKS ARE NOT SHOWN.

**[BS] FIGURE C104.1
BASIC GABLE END RETROFIT METHODOLOGY**

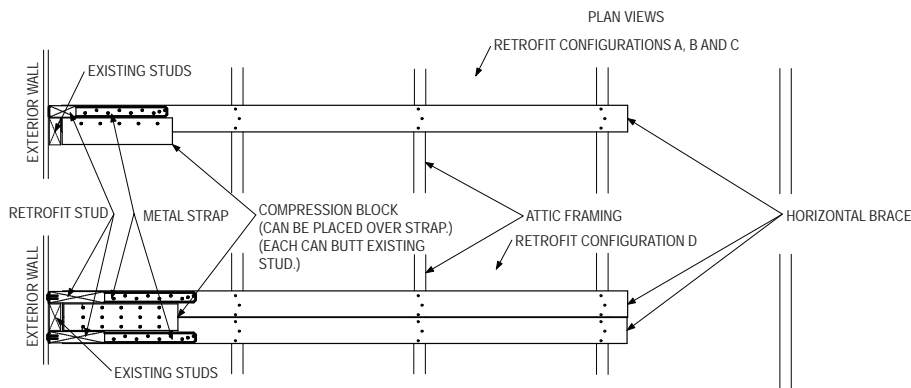
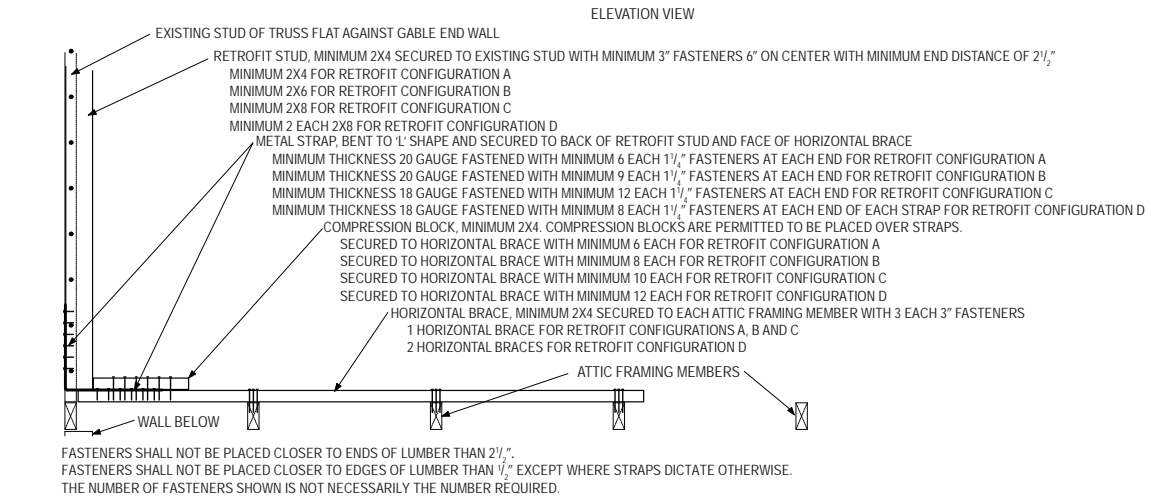
[BS] TABLE C104.2
STUD LENGTH LIMITATIONS BASED ON EXPOSURE AND DESIGN WIND SPEED

EXPOSURE CATEGORY	MAXIMUM 3-SEC GUST BASIC WIND SPEED ^a	MAXIMUM HEIGHT OF GABLE END RETROFIT STUD ^b			
		A	B	C	D
C	140	8'-0"	11'-3"	14'-9"	16'-0"
C	150	7'-6"	10'-6"	13'-6"	16'-0"
C	165	7'-0"	10'-0"	12'-3"	16'-0"
C	180	7'-0"	10'-0"	12'-3"	16'-0"
C	190	6'-6"	8'-9"	11'-0"	16'-0"
B	140	8'-0"	12'-3"	16'-0"	NR ^c
B	150	8'-0"	11'-3"	14'-9"	16'-0"
B	165	8'-0"	11'-3"	14'-9"	16'-0"
B	180	7'-6"	10'-6"	13'-6"	16'-0"
B	190	7'-0"	10'-0"	12'-3"	16'-0"
	Retrofit Configuration	A	B	C	D

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

NR = Not Required.

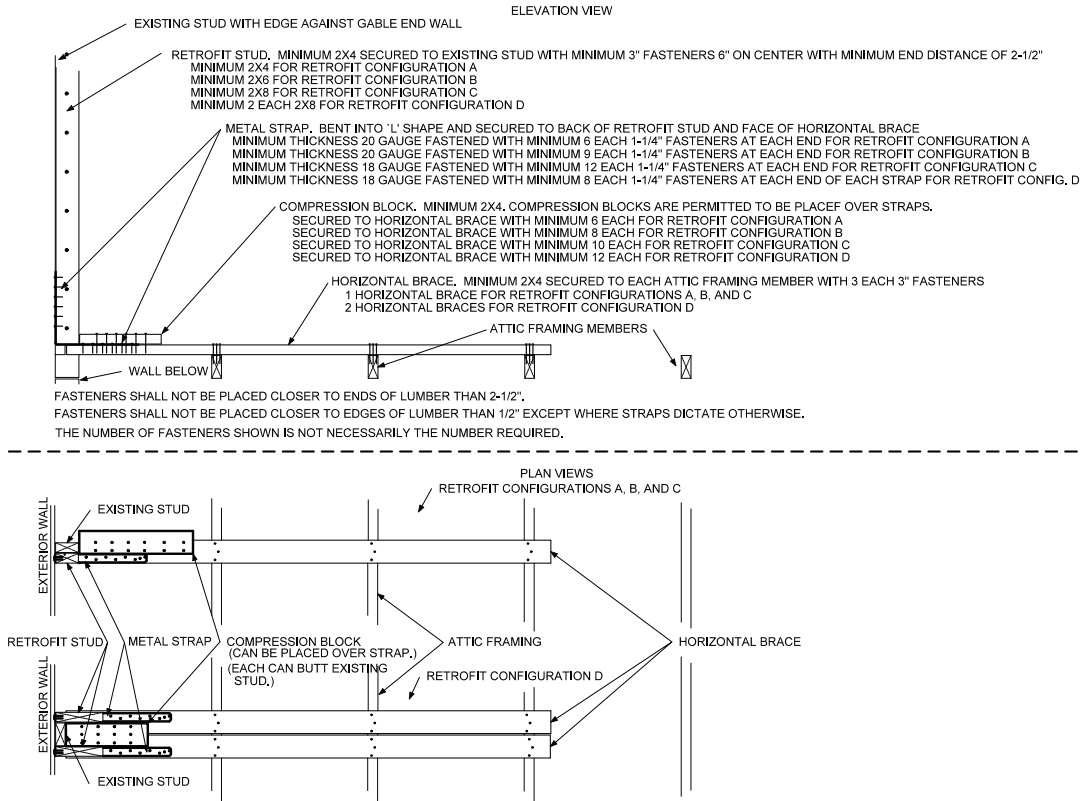
- a. Interpolation between given wind speeds is not permitted.
- b. Existing gable end studs less than or equal to 3 feet 0 inches in height shall not require retrofitting.
- c. Configuration C is acceptable to 16 feet 0 inches maximum height.



For SI: 1 inch = 25.4 mm.

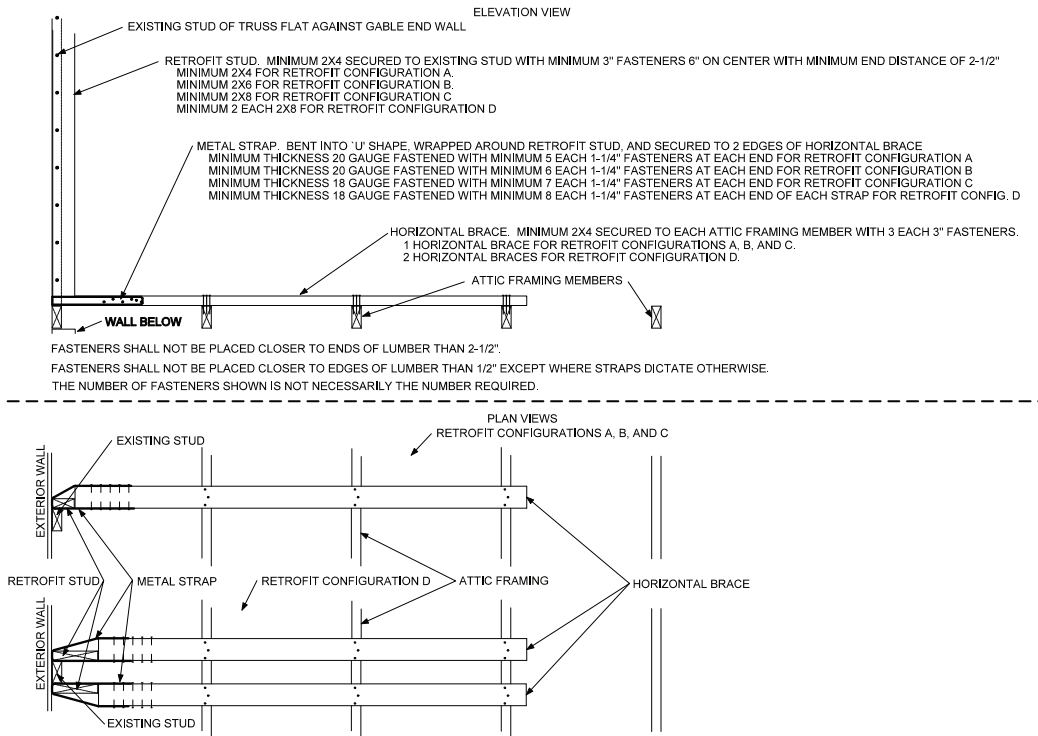
[BS] FIGURE C104.2(1)
TRUSS FRAMED GABLE END

APPENDIX C—GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS



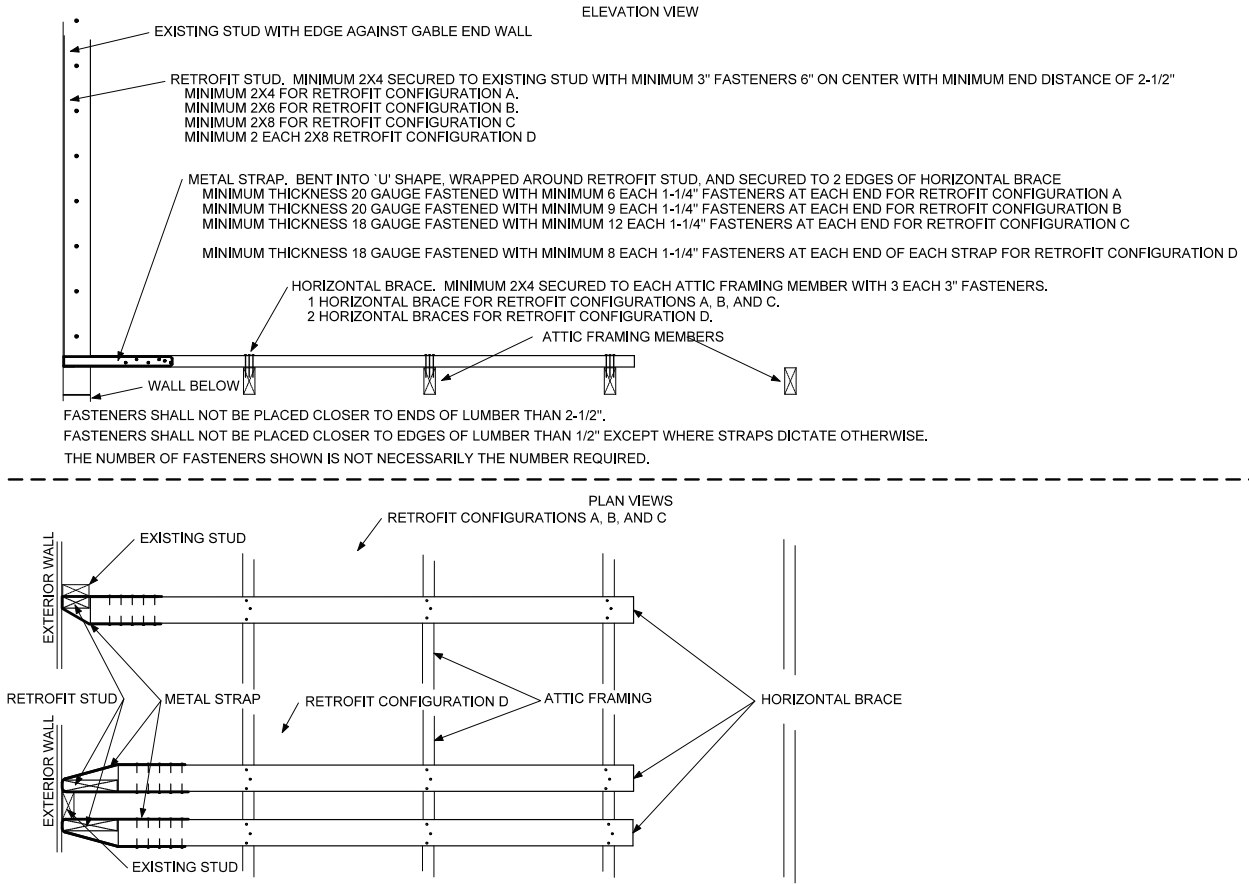
For SI: 1 inch = 25.4 mm.

**[BS] FIGURE C104.2(2)
 CONVENTIONALLY FRAMED GABLE END L-BENT STRAP**



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE C104.2(3)
 TRUSS FRAMED GABLE END U-BENT STRAP**



For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.2(4)
 CONVENTIONALLY FRAMED GABLE END U-BENT STRAP

[BS] C104.2.3 **Omitted horizontal brace.** Where conditions exist that prevent installation in accordance with Section C104.2.2, horizontal braces shall be permitted to be omitted for height limitations corresponding to Retrofit Configurations A and B as defined in Table C104.2 provided that installation is as indicated in Figure C104.2.3 and provided that all of the following conditions are met. This method is not permitted for Retrofit Configurations C or D.

1. There shall be not fewer than two horizontal braces on each side of an omitted horizontal brace or not fewer than one horizontal brace if it is the end horizontal brace. Omitted horizontal braces must be separated by not fewer than two horizontal braces even if that location is composed of two retrofit studs and two horizontal braces.
2. Horizontal braces adjacent to the omitted horizontal brace shall be 2-inch by 6-inch (38 mm by 140 mm) lumber, shall butt against the existing studs, and shall be fastened to each existing roof or ceiling member crossed using three 3-inch-long (76 mm) fasteners (No. 8 wood screws or 10d nails). For Retrofit Configuration B, four fasteners shall be required on not fewer than one of the connections between the horizontal brace and the existing roof

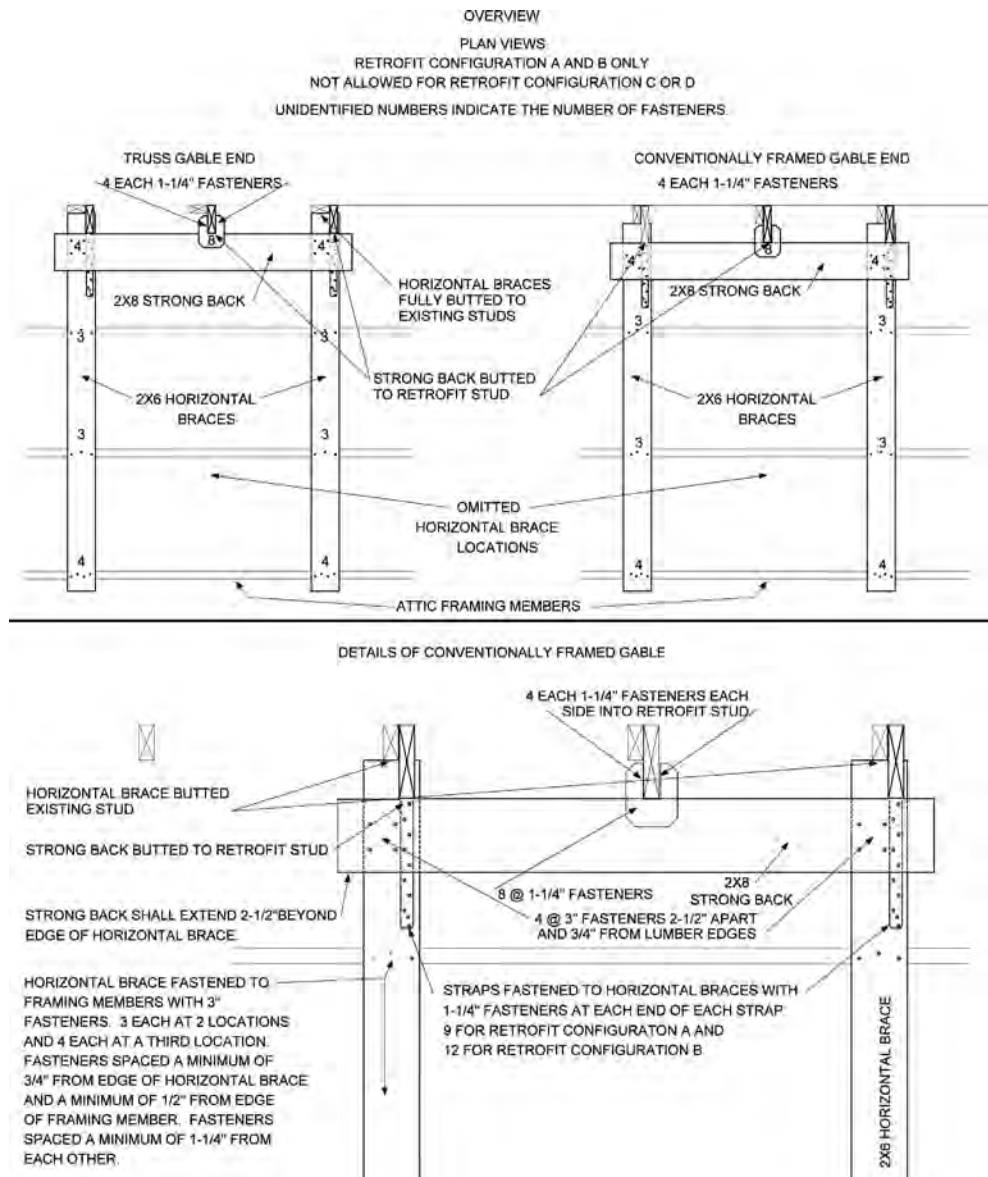
and ceiling framing members. Fasteners shall be spaced a not less than $\frac{3}{4}$ inch (19.1 mm) from the edges of the horizontal braces and not less than $1\frac{3}{4}$ inches (44 mm) from adjacent fasteners.

3. Where the existing studs on each side of an omitted horizontal brace have their wide face perpendicular to the gable end wall, the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall extend not less than $3\frac{3}{4}$ inches (95 mm) beyond the interior edge of the existing studs for both Retrofit Configurations A and B. The edges of the three retrofit studs facing towards the interior of the attic shall be aligned such that they are the same distance from the gable end wall.
4. Retrofit studs shall be fastened to existing studs in accordance with Section C104.3.
5. Retrofit studs adjacent to the omitted horizontal brace shall be fastened to the horizontal brace using straps in accordance with Table C104.4.1 consistent with the size of the retrofit stud. The method applicable to Table C104.4.2 is not permitted.
6. A strong back made of minimum of 2-inch by 8-inch (38 mm by 184 mm) nominal lumber shall be placed parallel to the gable end and shall be located on and

APPENDIX C—GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS

span between horizontal braces on the two sides of the omitted horizontal brace and shall extend beyond each horizontal brace by not less than 2½ inches (64 mm). The strong back shall be butted to the three retrofit studs. The strong back shall be attached to each of the horizontal braces on which it rests with five 3-inch-long (76 mm) fasteners (#8 screws or 8d nails). The fasteners shall have a minimum ¾-inch (19.1 mm) edge distance and a minimum 2½-inch (64 mm) spacing between fasteners. Additional compression blocks shall not be required at locations where a strong back butts against a retrofit stud.

7. The retrofit stud at the location of the omitted horizontal braces shall be fastened to the strong back using a connector with minimum uplift capacity of 800 pounds (3559 N) and installed such that this capacity is oriented in the direction perpendicular to the gable end wall.
8. The use of shortened horizontal braces using the alternative method of Section C104.2.5 is not permitted for horizontal braces adjacent to the omitted horizontal braces.
9. Horizontal braces shall be permitted to be interrupted in accordance with Section C104.2.8.



For SI: 1 inch = 25.4 mm.

**[BS] FIGURE C104.2.3
OMITTED HORIZONTAL BRACE**

[BS] C104.2.4 Omitted horizontal brace and retrofit stud. Where conditions exist that prevent installation in accordance with Section C104.2.2 or C104.2.3, then retrofit studs and horizontal braces shall be permitted to be omitted from those locations by installation of ladder assemblies for Retrofit Configurations A and B as defined in Table C104.2 provided that all of the following conditions are met. This method is not permitted for Retrofit Configurations C or D.

1. Not more than two ladder assemblies are permitted on a single gable end.
2. There shall be not fewer than two retrofit studs and horizontal brace assemblies on either side of the locations where the retrofit studs and horizontal bracing members are omitted (two ladder braces shall not bear on a single retrofit stud).
3. Where the existing studs on each side of an omitted horizontal brace have their wide face parallel to the gable end wall the retrofit studs at those locations and the retrofit stud at the omitted horizontal brace locations shall be 2-inch by 6-inch (38 mm by 180 mm) nominal lumber for Retrofit Configuration A and 2-inch by 8-inch (38 mm by 184 mm) lumber for Retrofit Configuration B.
4. Horizontal braces adjacent to the omitted horizontal brace shall be 2-inch by 6-inch (38 mm by 180 mm) nominal lumber and be fastened to each existing roof or ceiling member crossed using three 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails) as indicated in Figures C104.2(1) and C104.2(3) for gable end frames and Figures C104.2(2) and C104.2(4) for conventionally framed gable end walls. For Retrofit Configuration B, four fasteners shall be required on one of the connections between the horizontal brace and the existing roof and ceiling framing members.
5. Ladder rungs shall be provided across the location of the omitted retrofit studs as indicated in Figure C104.2.4(1) for gable end frames and Figure C104.2.4(2) for conventionally framed gable end walls.
6. Ladder rungs shall be minimum 2-inch by 4-inch (38 mm by 89 mm) lumber oriented with their wide face horizontal and spaced not greater than 16 inches (406 mm) on center vertically.
7. Where ladder rungs cross wall framing members they shall be connected to the wall framing members with a metal connector with a minimum capacity of 175 pounds (778 N) in the direction perpendicular to the gable end wall.
8. Notching of the ladder rungs shall not be permitted unless the net depth of the framing member is not less than 3¹/₂ inches (89 mm).

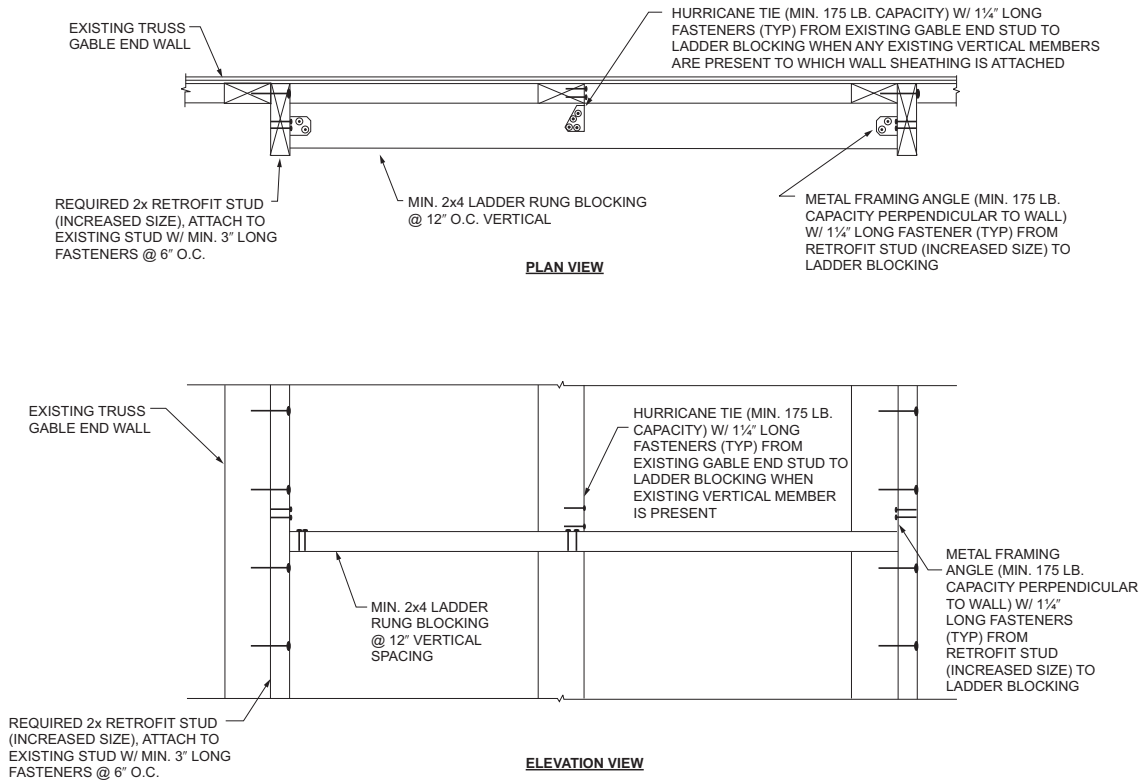
[BS] C104.2.5 Short horizontal brace. Where conditions exist that prevent installation in accordance with Section C104.2.2, C104.2.3 or C104.2.4, the horizontal braces shall be permitted to be shortened provided that installation is as indicated in Figure C104.2.5 and all of the following conditions are met.

1. The horizontal brace shall be installed across not fewer than two framing spaces, extend not less than 4 feet (1220 mm) from the gable end wall plus 2¹/₂ inches (64 mm) beyond the farthest roof or ceiling framing member from the gable end, and be fastened to each existing framing member with three 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails).
2. An anchor block shall be fastened to the side of the horizontal brace in the second framing space from the gable end wall as shown in Figure C104.2.5. The anchor block lumber shall have a minimum edge thickness of 1¹/₂ inches (38 mm) and the depth shall be at a minimum the depth of the existing roof or ceiling framing member. Six 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails) shall be used to fasten the anchor block to the side of the horizontal brace.
3. The anchor block shall extend into the space between the roof or ceiling framing members not less than one-half the depth of the existing-framing members at the location where the anchor block is installed. The anchor block shall be installed tightly between the existing framing members such that the gap at either end shall not exceed 1¹/₈ inch (3.2 mm).
4. The use of omitted horizontal braces using the method of Section C104.2.3 adjacent to a short horizontal brace as defined in this section is not permitted.

[BS] C104.2.6 Installation of horizontal braces onto webs of trusses. Where existing conditions preclude installation of horizontal braces on truss top or bottom chords they shall be permitted to be installed on truss webs provided that all of the following conditions are met.

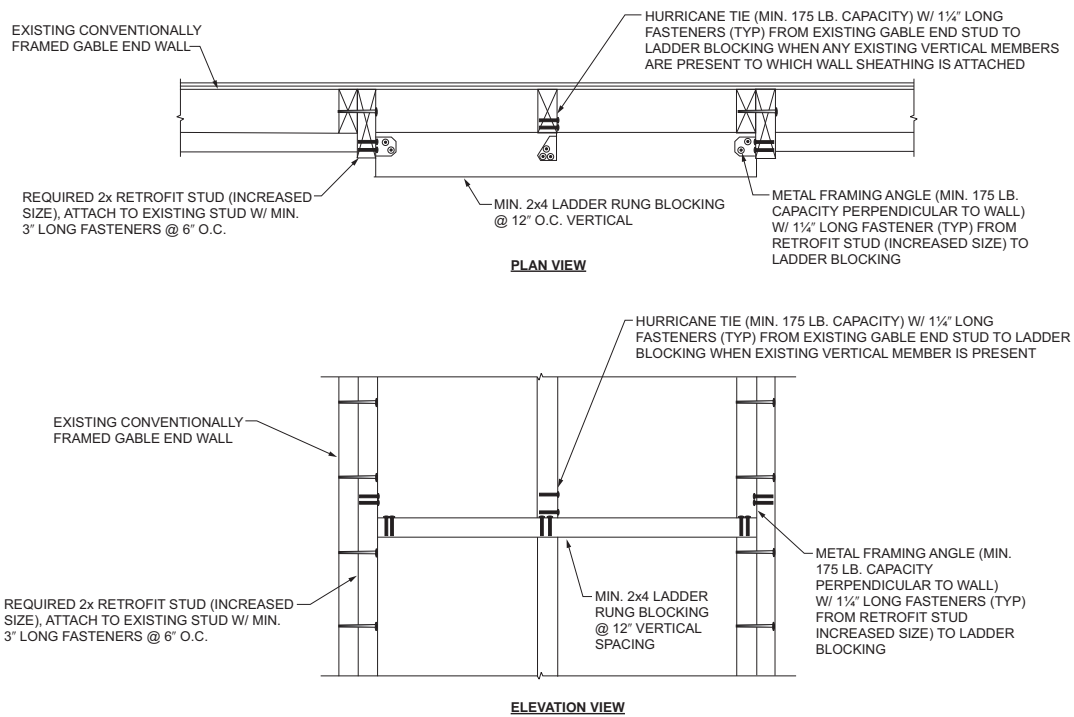
1. Horizontal braces shall be installed as close to the top or bottom chords as practical without altering the truss or any of its components and not more than three times the depth of the truss member to which it would ordinarily be attached.
2. A racking block, comprised of an anchor block meeting the definition of “Anchor block” in Section C102 or comprised of minimum 1⁵/₃₂-inch (12 mm) plywood or 7¹/₁₆-inch (11.1 mm) oriented strand board (OSB), shall be fastened to the horizontal brace in the second framing space from the gable end wall. The racking block shall extend toward the roof or ceiling diaphragm so that the edge of the racking block closest to the diaphragm is within one-half the depth of the existing framing member from the diaphragm surface. The racking block shall be attached to horizontal braces using six fasteners (No. 8 wood screws or 10d nails) of sufficient length to provide 1¹/₂ inches (38 mm) of penetration into the horizontal brace.
3. Racking blocks shall be permitted to be fastened to any face or edge of horizontal braces between each web or truss vertical posts to which a horizontal brace is attached. Racking blocks shall be permitted to be on alternate sides of horizontal braces. Racking blocks shall be installed tightly between the lumber of truss members or truss plates such that the gap at either end shall be not greater than 1¹/₈ inch (3.2 mm).

APPENDIX C—GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS



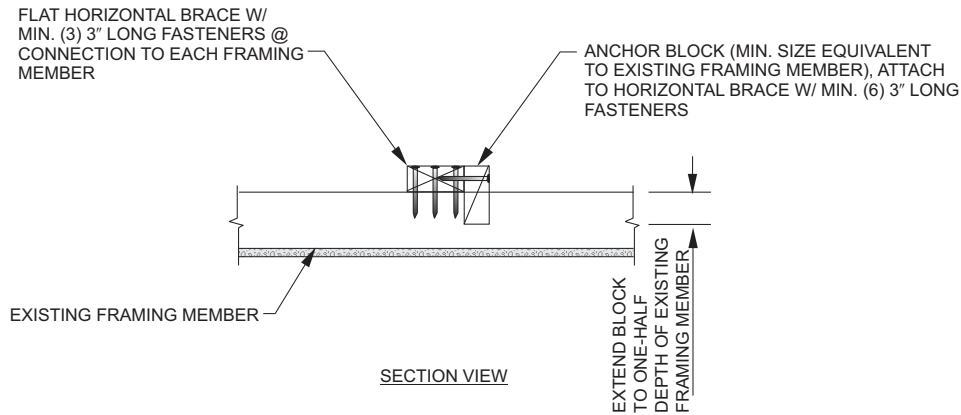
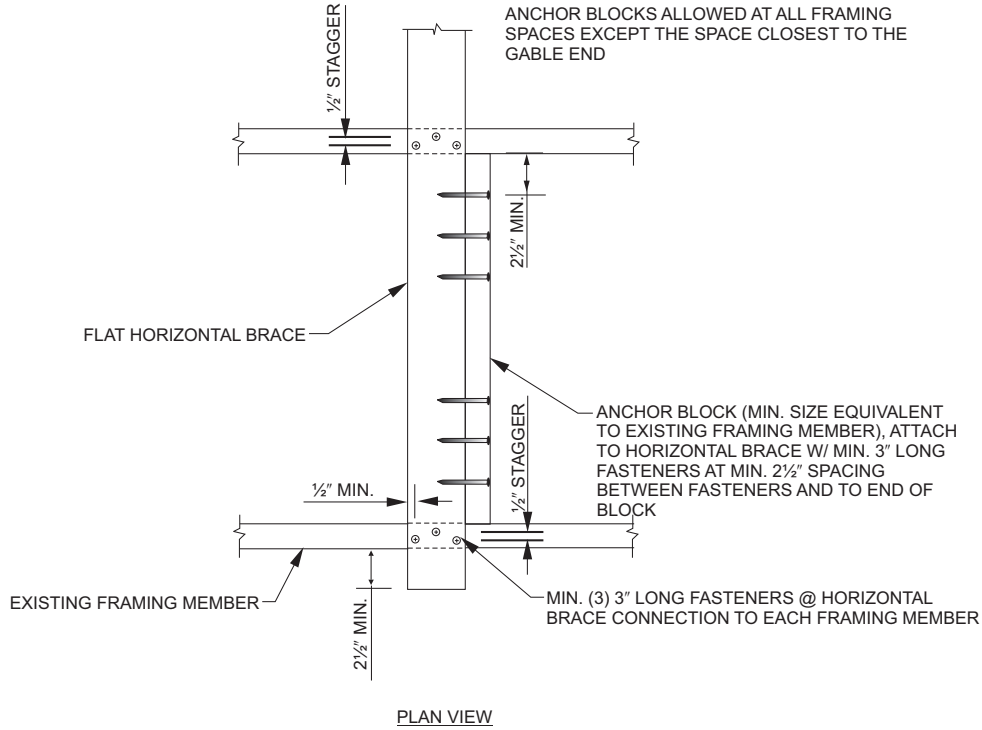
For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

**[BS] FIGURE C104.2.4(1)
LADDER BRACING FOR OMITTED RETROFIT STUD (GABLE END FRAME)**



For SI: 1 inch = 25.4 mm, 1 pound = 4.4 N.

**[BS] FIGURE C104.2.4(2)
LADDER BRACING FOR OMITTED RETROFIT STUD (CONVENTIONALLY FRAMED GABLE END)**



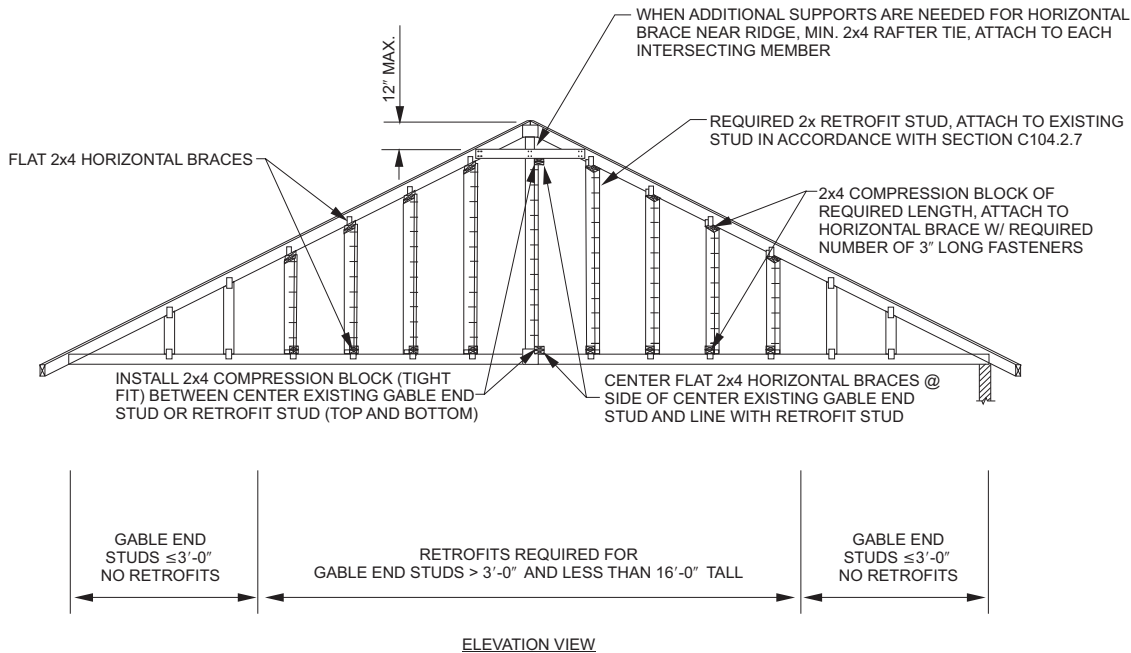
For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.2.5
ANCHOR BLOCK INSTALLATION

[BS] C104.2.7 Alternative method of installation of horizontal braces at truss ridges. Where conditions exist that limit or restrict installation of horizontal braces near the peak of the roof, ridge ties shall be added to provide support for the required horizontal brace. The top of additional ridge tie members shall be installed not greater than 16 inches (406 mm) below the existing ridge line or 4 inches (102 mm) below impediments. A minimum 2-inch by 4-inch (38 mm by 89 mm) nominal member shall be used for each ridge tie, and fastening shall consist of two 3-inch-long (76 mm) wood screws, four 3-inch-long (76 mm) 10d nails or two 3 1/2-inch-long (89 mm) 16d nails driven through and clinched at each top chord or web

member intersected by the ridge tie as illustrated in Figure C104.2.7.

[BS] C104.2.8 Interrupted horizontal braces. Where conditions exist that prevent the installation of a continuous horizontal brace then horizontal braces shall be permitted to be interrupted using the methods shown in Figures C104.2.8(1), C104.2.8(2), and C104.2.8(3). For interruptions that occur in the attic framing space closest to the gable end, nine 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted horizontal braces. For interruptions that occur in the second attic space from the gable end, six 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted



For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BS] FIGURE C104.2.7
DETAIL OF RETROFIT TIE INSTALLATION**

horizontal braces. For interruptions that occur in the attic framing space farthest from the gable end, three 3-inch (76 mm) fasteners shall be used to connect each section of the interrupted horizontal braces. Horizontal braces shall be continued far enough to allow connections to three existing roof framing members as shown in Figure C104.2.8(1), C104.2.8(2) or C104.2.8(3). Fasteners shall be spaced in accordance with Section C103.5.3. Horizontal braces shall be the same width and depth as required for an uninterrupted member.

[BS] C104.2.9 Piggyback gable end frames. Piggyback gable end frames (gable end frames built in two sections one above the other) shall be permitted to be retrofitted if either of the following cases is true:

1. The existing studs in both the upper gable end frames and the lower gable end frames to which wall sheathing, panel siding, or other wall covering are attached are sufficiently in line that retrofit studs can be installed and connections made between the two with retrofit stud(s).
2. Existing studs in the upper frame are not sufficiently in line with the studs in the frame below and the existing studs in the upper frame are 3 feet (91 cm) or shorter.

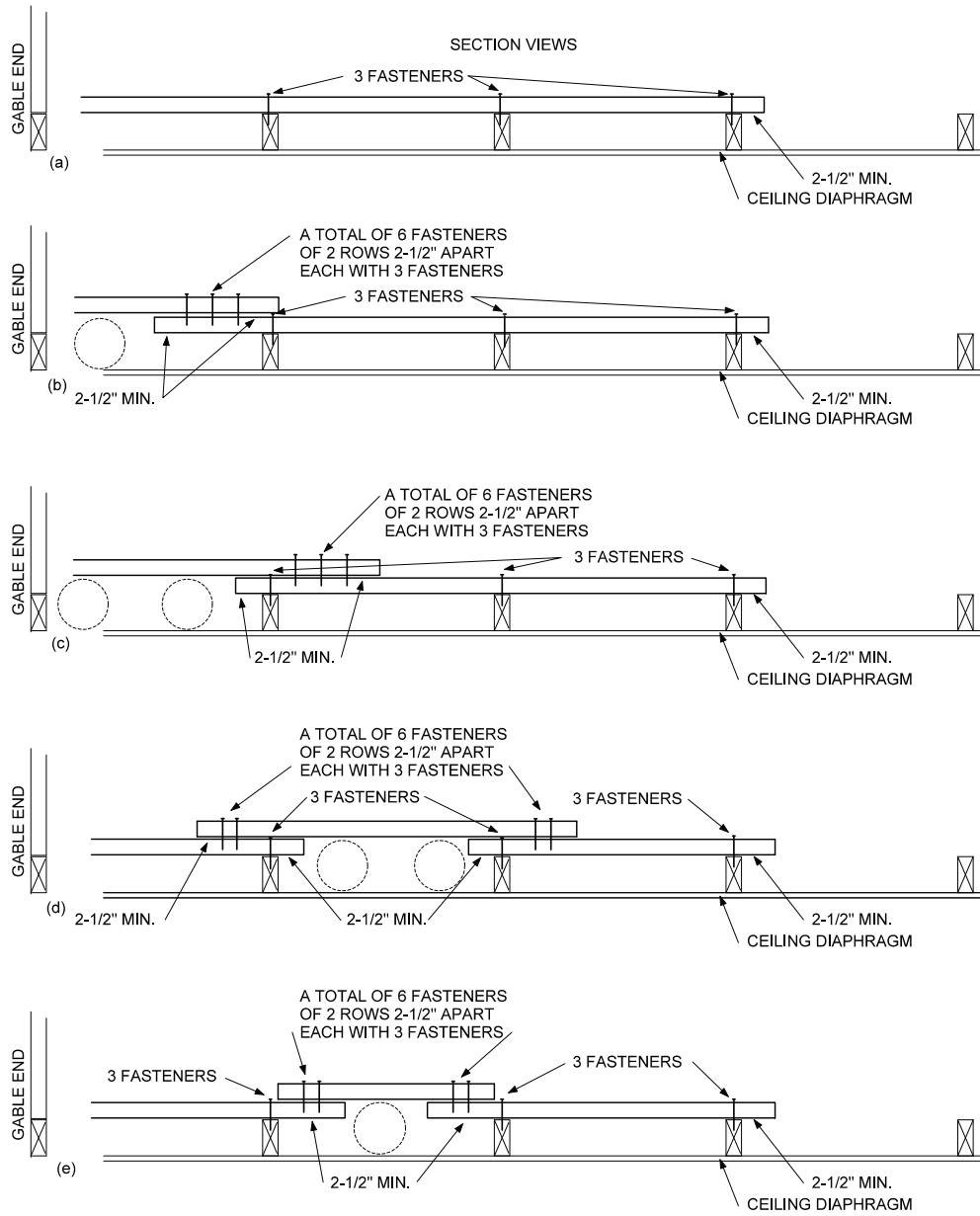
For Condition 1 both the lower stud and the upper stud shall be retrofitted using the methods of Section C104.2. For Condition 2 the retrofit stud shall be connected to the lower studs using the methods of Section C104.2 and be continuous from the bottom horizontal brace to the top horizontal brace. Connection is not required between the retrofit stud and the upper stud. In both conditions the bot-

tom chord of the piggyback truss section shall be fastened to each retrofit stud using a connector with minimum axial capacity of 175 pounds (778 N).

[BS] C104.3 Retrofit studs. Retrofit studs shall be installed in accordance with Section C104.3.1 using one of the five methods of Sections C104.3.2, C104.3.3, C104.3.4, C104.3.5 or C104.3.6. Figure C104.3 shows these methods of installation. For the Retrofit Configuration obtained from Table C104.2, the size of retrofit studs shall be as indicated in Table C104.4.1 or Table C104.4.2. Retrofit studs shall extend from the top of the lower horizontal brace to the bottom of the upper horizontal brace except that a maximum gap of $\frac{1}{8}$ inch (3.2 mm) is permitted at the bottom and $\frac{1}{2}$ inch (12.7 mm) at the top. Where wall sheathing, panel siding or other wall covering is fastened to a conventionally framed gable end, retrofit studs shall be applied in accordance with Section C104.2.1.

[BS] C104.3.1 Fastening. Where nail plates are not used, retrofit studs shall be attached to existing studs using 3-inch (76 mm) fasteners at not greater than 6 inches (152 mm) on center but not closer than $2\frac{1}{2}$ inches (64 mm) on center with fasteners not closer to ends of members than $2\frac{1}{2}$ inches (64 mm).

[BS] C104.3.2 Method #1: Face-to-edge or face-to-face method. Retrofit studs shall be installed immediately adjacent to existing gable end wall studs as indicated in Figure C104.3(a). The retrofit studs shall overlap the edge or side of the existing stud by not less than $1\frac{1}{4}$ inches (32 mm). Fasteners shall be installed as specified in Section C104.3.1.

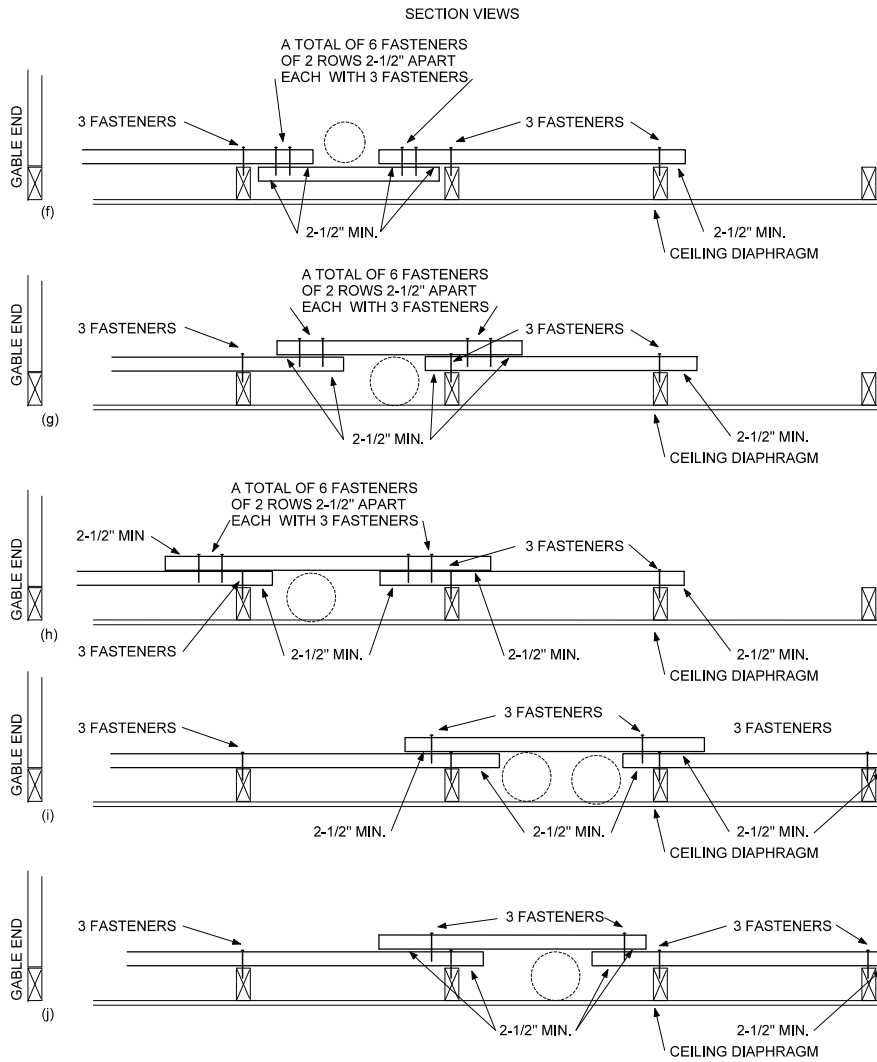


ALL FASTENERS 3"

For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.2.8(1)
SPLICED HORIZONTAL BRACES

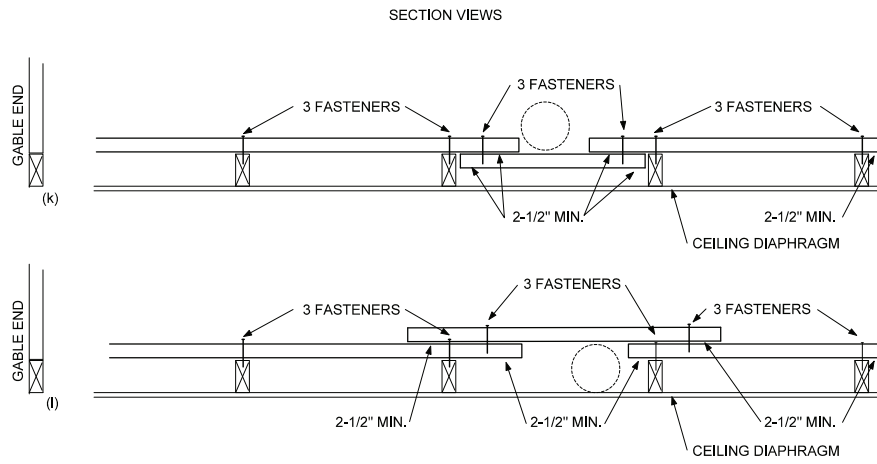
APPENDIX C—GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS



ALL FASTENERS 3"

For SI: 1 inch = 25.4 mm.

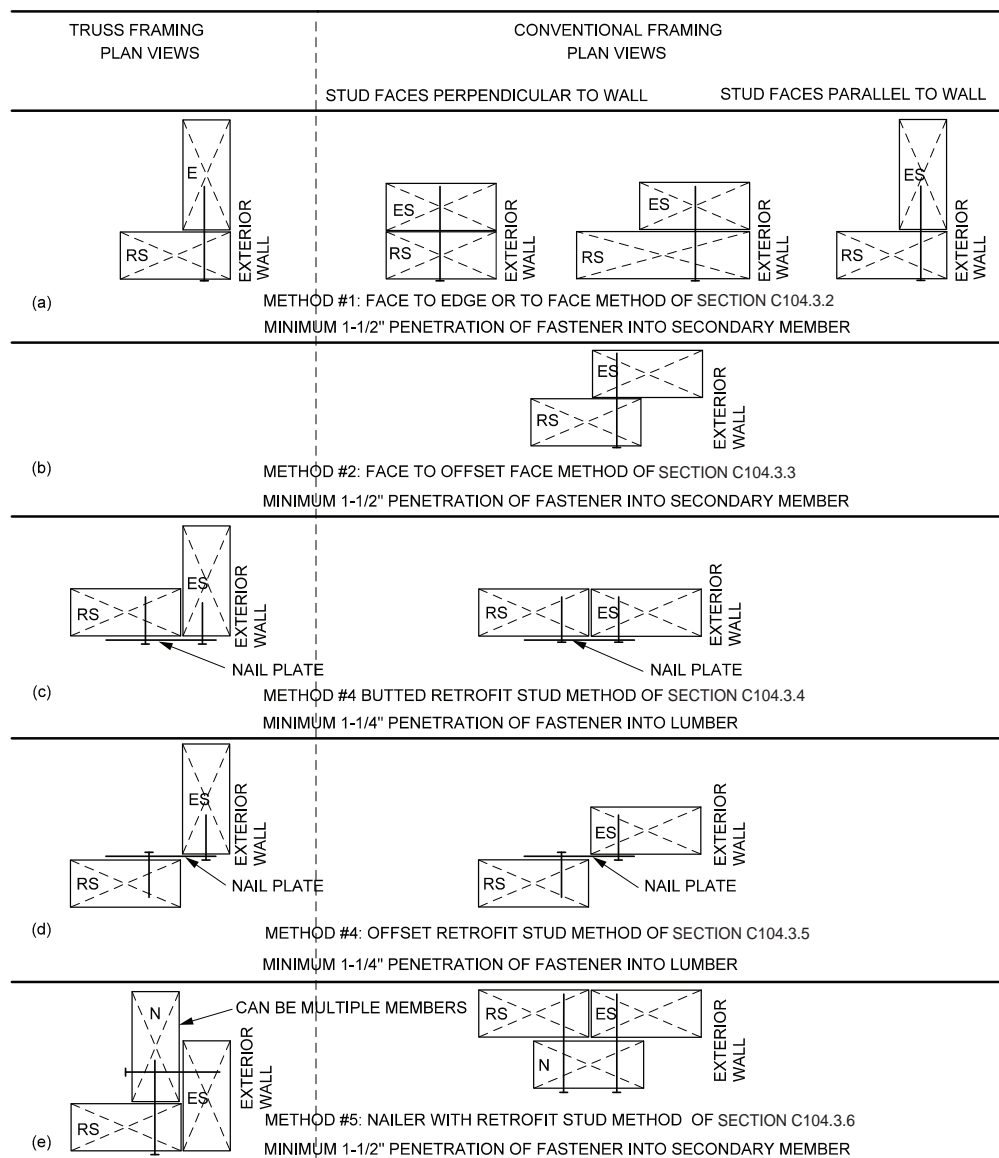
**[BS] FIGURE C104.2.8(2)
SPLICED HORIZONTAL BRACES**



ALL FASTENERS 3"

For SI: 1 inch = 25.4 mm.

**[BS] FIGURE C104.2.8(3)
SPLICED HORIZONTAL BRACES**



THE FIGURES DO NOT REFLECT THE NUMBER OF REQUIRED FASTENERS OR SHOW HORIZONTAL BRACES OR STRAPS. FASTENERS SHALL BE PLACED MAXIMUM 6" ON CENTER AND A MINIMUM OF 2-1/2" FROM ENDS. 3" FASTENERS CAN BE INSTALLED FROM EITHER SIDE OF LUMBER AS LONG AS THERE IS 1-1/2" FASTENER PENETRATION. ES INDICATES AN EXISTING STUD. RS INDICATES A RETROFIT STUD. N INDICATES A NAILER.

For SI: 1 inch = 25.4 mm.

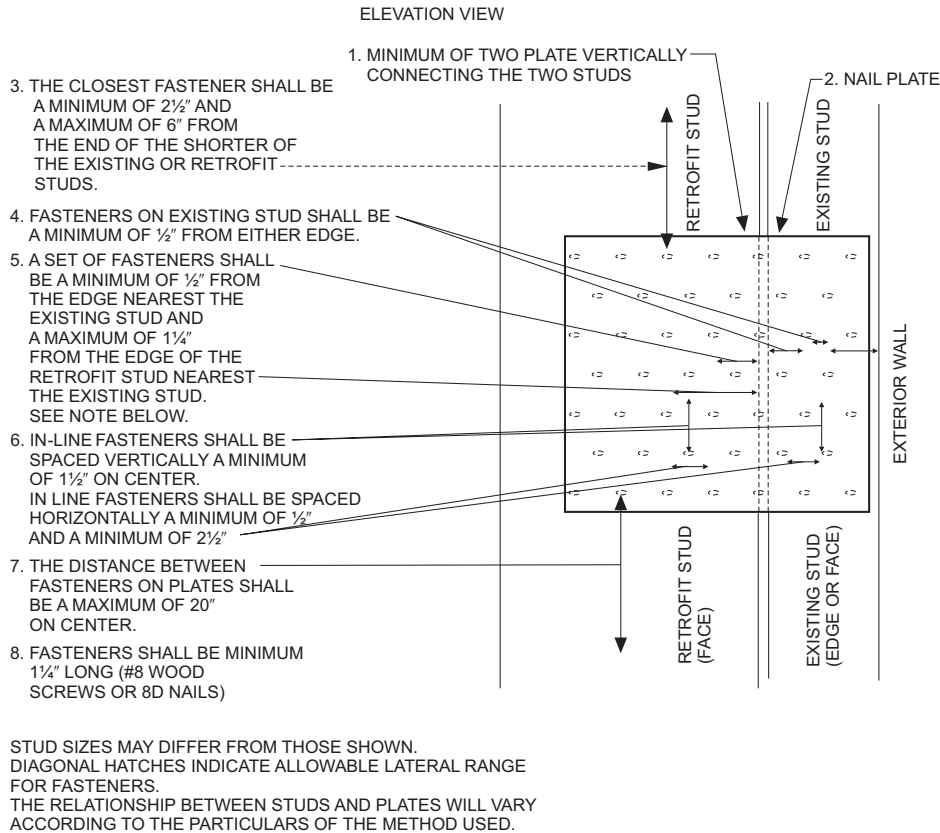
**[BS] FIGURE C104.3
METHOD OF INSTALLING RETROFIT STUDS**

[BS] C104.3.3 Method #2: Face-to-face offset method. Retrofit studs shall be installed against the face of existing studs as indicated in Figure C104.3(b) such that the faces overlap not less than 1½ inches (38 mm) and the edge distance to fasteners is not less than ¾ inch (19.1 mm). Fasteners shall be installed as specified in Section C104.3.1.

[BS] C104.3.4 Method #3: Butted retrofit stud method. Provided that all of the following fastening conditions are met, retrofit studs shall be permitted to be butted by their edge to existing studs with the addition of nail plates as indicated in Figure C104.3(c) and Figure C104.3.4.

1. The narrow edge of retrofit studs shall be installed against the narrow or the wide face of existing studs.
2. Not fewer than two nail plates shall be used.
3. Fasteners used to secure nail plates to studs shall be a minimum 1¼ inches (32 mm) long (#8 wood screws or 8d nails).
4. Fasteners placed in nail plates shall have a minimum end distance of 2½ inches (64 mm) for both studs and a maximum end distance of 6 inches (152 mm) from the ends of the shorter stud.

APPENDIX C—GUIDELINES FOR THE WIND RETROFIT OF EXISTING BUILDINGS



For SI: 1 inch = 25.4 mm.

[BS] FIGURE C104.3.4
NAIL PLATE FASTENING

5. Fasteners shall have a minimum ½-inch (12.7 mm) edge distance. Fasteners shall be placed not greater than 1½ inches (38 mm) from the abutting vertical edges of existing studs and retrofit studs.
6. There shall be at least three fasteners through nail plates into all existing and retrofit studs to which the nail plate is attached.
7. Nail plates with three fasteners onto a single existing or retrofit stud shall be spaced not greater than 15 inches (38 cm) on center.
8. Nail plates with more than three fasteners onto a single existing or retrofit stud shall be spaced not greater than 20 inches (51 cm) on center.
9. Fasteners used to secure nail plates shall be spaced vertically not less than 1½ inches (38 mm) on center. Staggered fasteners used to secure nail plates shall be spaced horizontally not less than ½ inch (12.7 mm).

[BS] C104.3.5 Method #4: Offset retrofit stud method. Retrofit studs may be offset from existing studs by use of nail plates as shown in Figure C104.3(d) such that the vertical corner of a retrofit stud shall align with the vertical corner of an existing stud as indicated in Figure C104.3(d) and Figure C104.3.4, and the fastening conditions of Section C104.3.4 are met.

[BS] C104.3.6 Method #5: Nailer with retrofit stud method. Retrofit studs and existing studs shall be permitted to be connected using noncontinuous 2-inch by 4-inch (38 mm by 89 mm) nailers as indicated in Figure C104.3(e) provided that the following conditions are met.

1. Both the existing stud and the retrofit stud shall be butted to nailers and both shall be fastened to the nailer with 3-inch-long (76 mm) fasteners (#8 wood screws or 8d nails). Fasteners connecting each stud to the nailer shall be spaced 6 inches (152 mm) o.c.
2. Fasteners into nailers from any direction shall be offset vertically by not less than 2½ inches (64 mm).
3. Fasteners into nailers shall be not less than 2½ inches (64 mm) but not more than 6 inches (152 mm) from the end of the shorter of the existing stud and retrofit stud to which they are fastened.

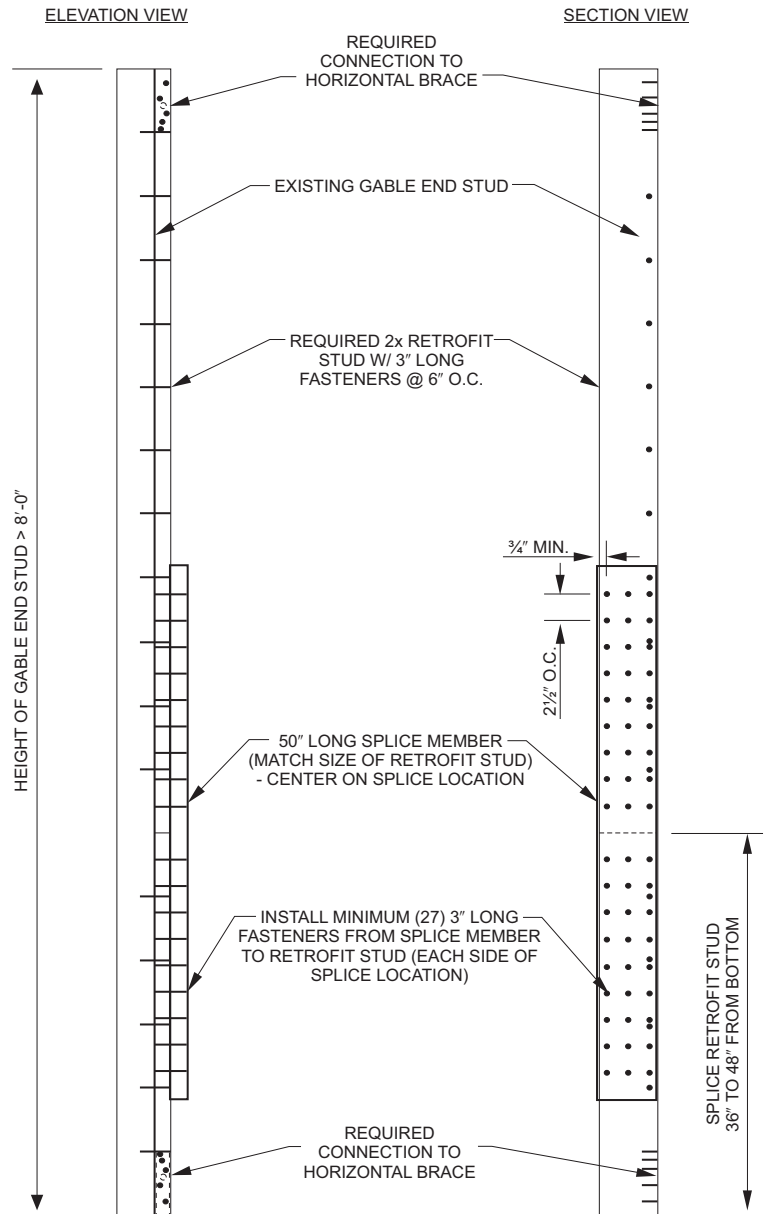
[BS] C104.3.7 Reduced depth of retrofit studs. Retrofit studs may be reduced in depth by notching, tapering or other methods at any number of locations along their length provided that all of the following conditions are met:

1. Retrofit studs to be reduced in depth shall be sized such that the remaining minimum depth of member at the location of the notch (including cross-cut

- kerfs) shall be not less than that required by Table C104.4.1 or Table C104.4.2.
2. Reduced in-depth retrofit stud shall not be spliced within 12 inches (30 cm) of the location of notches. Splice members shall not be notched.
 3. The vertical extent of notches shall not exceed 12 inches (30 cm) as measured at the depth of location of reduced depth.

4. A reduced in-depth retrofit stud member shall be fastened to the side of the existing gable end wall studs in accordance with Section C104.3.1. Two additional 3-inch (76 mm) fasteners (#8 wood screws or 10d nails) shall be installed on each side of notches in addition to those required by Section C104.3.1.

[BS] C104.3.8 Retrofit stud splices. Retrofit studs greater than 8 feet (244 cm) in height may be field spliced in accordance with Figure C104.3.8.



NOTE:
 SPLICE LOCATION MAY BE REQUIRED AT TOP OF GABLE END STUD IF HEIGHT > 11'-0" TO 12'-0"

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BS] FIGURE C104.3.8
 RETROFIT STUD SPLICES**

[BS] C104.4 Connection between horizontal braces and retrofit studs. Connections between horizontal braces and retrofit studs shall comply with Section C104.4.1 or C104.4.2. Each retrofit stud shall be connected to the top and bottom horizontal brace members with a minimum 20-gage 1¹/₄-inch-wide (32 mm) flat or coil metal strap with prepunched holes for fasteners. Straps shall be fastened with 1¹/₄-inch-long (32 mm) fasteners (#8 wood screws or 8d nails) with the number of fasteners as indicated in Table C104.4.1 and Table C104.4.2. Fasteners shall be not closer to the end of lumber than 2¹/₂ inches (64 mm).

[BS] C104.4.1 L-bent strap method. Retrofit studs shall be connected to horizontal braces or to strong backs in accordance with Figure C104.2(1), C104.2(2) or C104.2.3, and shall comply with the following conditions.

1. A strap shall be applied to the edges of a retrofit stud nearest the gable end wall and to the face of horizontal braces using at each end of the strap the number of fasteners specified in Table C104.4.1. Straps shall be long enough so that each strap extends sufficient distance onto the vertical face of the retrofit stud that the fastener closest to the ends of the studs is not less than 2¹/₂ inches (64 mm) from the end of the stud. Straps shall be permitted to be twisted to accommodate the transition between the tops of retrofit studs and horizontal bracings following roof pitches.
2. Compression blocks shall be installed on the horizontal braces directly against either the existing vertical gable end wall stud or the retrofit stud. Figure C104.2(1) (trusses) and Figure C104.2(2) (conventionally framed) show the installation of the compression block against the existing vertical gable end

wall stud with the strap from the retrofit stud running beside the compression block. Compression blocks shall be permitted to be placed over straps. Compression blocks shall be fastened to the horizontal braces with not fewer than the minimum number of 3-inch-long (76 mm) fasteners (#8 wood screws or 10d nails) specified in Table C104.4.1. End and edge distances for fasteners shall be in accordance with Section C103.5.3.

[BS] C104.4.2 U-bent strap method. Retrofit studs shall be connected to horizontal braces in accordance with Figure C104.2(3) or C104.2(4), shall be limited to Retrofit Configurations A and B as defined in Table C104.2, and shall comply with the following conditions.

1. Straps of sufficient length to meet the requirements for the number of fasteners in accordance with Table C104.4.2 and meet the end distance requirements of Section C103.5.3 shall be shaped around retrofit studs and fastened to the edges of horizontal braces. Straps shall wrap the back edge of the retrofit stud snugly with a maximum gap of 1/4 inch (6.4 mm). Rounded bends of straps shall be permitted. One fastener shall be installed that connects each strap to the side of the associated retrofit stud.
2. The horizontal brace shall butt snugly against the retrofit stud with a maximum gap of 1/4 inch (6.4 mm).
3. Straps shall be permitted to be twisted to accommodate the transition between the tops of retrofit studs and horizontal braces that follow the roof pitch.

**[BS] TABLE C104.4.1
ELEMENT SIZING AND SPACING FOR L-BENT RETROFIT METHOD**

RETROFIT ELEMENTS	RETROFIT CONFIGURATION			
	A	B	C	D
Minimum size and number of Horizontal Braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of Retrofit Studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting each end of straps to Retrofit Studs or to Horizontal Braces #8 screws or 10d nails 1 ¹ / ₄ " long	6	9	12	8 on each strap
Minimum number of fasteners to connect Compression Blocks to Horizontal Braces #8 screws or 10d nails 3" long	6	8	10	12

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**[BS] TABLE C104.4.2
ELEMENT SIZING AND SPACING FOR U-BENT RETROFIT METHOD**

RETROFIT ELEMENTS	RETROFIT CONFIGURATION			
	A	B	C	D
Minimum size and number of Horizontal Braces	2 × 4	2 × 4	2 × 4	2 each 2 × 4
Minimum size and number of Retrofit Studs	2 × 4	2 × 6	2 × 8	2 each 2 × 8
Minimum number of fasteners connecting Straps to each edge of Horizontal Braces #8 screws or 10d nails 1 ¹ / ₄ " long	6	7	7	6 on each side of strap

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

[BS] C104.5 Connection of gable end wall to wall below.

The bottom chords or bottom members of wood-framed gable end walls shall be attached to the wall below using one of the methods prescribed in Section C104.5.1 or C104.5.2. The particular method chosen shall correspond to the framing system and type of wall construction encountered.

[BS] C104.5.1 Gable end frame. The bottom chords of the gable end frame shall be attached to the wall below using gusset angles. Not fewer than two fasteners shall be installed into the bottom chord. The gusset angles shall be installed throughout the portion of the gable end where the gable end wall height is greater than 3 feet (91 cm) at the spacing specified in Table C104.5.1. Connection to the wall below shall be by one of the following methods:

1. For a wood-frame wall below, not fewer than two fasteners shall be installed. The fasteners shall be of the same diameter and style specified by the gusset angle manufacturer and sufficient length to extend through the double top plate of the wall below.
2. For a concrete or masonry wall below without a sill plate, the type and number of fasteners into the wall shall be consistent with the gusset angle manufacturer’s specifications for fasteners installed in concrete or masonry.
3. For a concrete or masonry wall below with a 2x sill plate, the fasteners into the wall below shall be of the diameter and style specified by the gusset angle manufacturer for concrete or masonry connections; but, long enough to pass through the wood sill plate and provide the required embedment into the concrete or masonry below. Alternatively, the gusset angle can be anchored to the sill plate using four each 1½-inch-long (38 mm) fasteners of the same type as specified by the gusset angle manufacturer for wood connections, provided that the sill plate is anchored to the wall on each side of the gusset angle by a ¼-inch-diameter (6.4 mm) masonry screw with 2¾ inches (70 mm) of embedment into the concrete or masonry wall. A ¼-inch (6.4 mm) washer shall be placed under the heads of the masonry screws.

**[BS] TABLE C104.5.1
SPACING OF GUSSET ANGLES**

EXPOSURE CATEGORY	BASIC WIND SPEED (mph)	SPACING OF GUSSET ANGLES (inches)
C	140	38
C	150	32
C	165	28
C	180	24
C	190	20
B	140	48
B	150	40
B	165	36
B	180	30
B	190	26

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

[BS] C104.5.2 Conventionally framed gable end wall.

Each stud in a conventionally framed gable end wall, throughout the length of the gable end wall where the wall height is greater than 3 feet (914 mm), shall be attached to the bottom or sill plate using a stud to plate connector with minimum uplift capacity of 175 pounds (778 N). The bottom or sill plate shall then be connected to the wall below using one of the following methods:

1. For a wood frame wall below, the sill or bottom plate shall be connected to the top plate of the wall below using ¼-inch-diameter (6.4 mm) lag bolt fasteners of sufficient length to penetrate the bottom plate of the upper gable end wall and extend through the bottom top plate of the wall below. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.
2. For a concrete or masonry wall below, the sill or bottom plate shall be connected to the concrete or masonry wall below using ¼-inch-diameter (6.4 mm) concrete or masonry screws of sufficient length to provide 2¾ inches (70 mm) of embedment into the top of the concrete or masonry wall. A washer sized for the diameter of the lag bolt shall be placed under the head of each lag bolt. The fasteners shall be installed at the spacing indicated in Table C104.5.2.

**[BS] TABLE C104.5.2
SPACING OF LAG OR MASONRY SCREWS
USED TO CONNECT SILL PLATE OF GABLE END WALL
TO TOP OF THE WALL BELOW**

EXPOSURE CATEGORY	BASIC WIND SPEED (mph)	SPACING OF LAG OR MASONRY SCREWS (inches)
C	140	19
C	150	16
C	165	14
C	180	14
C	190	10
B	140	24
B	150	20
B	165	18
B	180	15
B	190	13

For SI: 1 inch = 25.4 mm, 1 mile per hour = 0.447 m/s.

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX C
CHAPTER C2 – ROOF DECK FASTENING FOR HIGH-WIND AREAS

Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC-CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

The state agency does not adopt sections identified with the following symbol: †

The Office of the State Fire Marshal’s adoption of this chapter or individual sections is applicable to structures regulated by other state agencies pursuant to Section 1.11.

CHAPTER C2

ROOF DECK FASTENING FOR HIGH-WIND AREAS

SECTION C201 GENERAL

[BS] C201.1 Purpose. This chapter provides prescriptive methods for partial structural retrofit of an existing building to increase its resistance to wind loads. It is intended for voluntary use where the ultimate design wind speed, V_{ult} , determined in accordance with Figure 1609.3(1) of the *California Building Code* exceeds 130 mph (58 m/s) and for reference by mitigation programs. The provisions of this chapter do not necessarily satisfy requirements for new construction. Unless specifically cited, the provisions of this chapter do not necessarily satisfy requirements for structural improvements triggered by addition, alteration, repair, change of occupancy, building relocation or other circumstances.

[BS] C201.2 Eligible conditions. The provisions of this chapter are applicable only to buildings that meet either of the following eligibility requirements:

1. Buildings assigned to *Risk Category* I or II in accordance with Table 1604.5 of the *California Building Code*.
2. Buildings within the scope of the *California Residential Code*.

SECTION C202 ROOF DECK ATTACHMENT FOR WOOD ROOFS

[BS] C202.1 Roof decking attachment for one- and two-family dwellings. For one- and two-family dwellings, fastening shall be in accordance with Section C202.1.1 or C202.1.2 as appropriate for the existing construction. The diameter of 8d nails shall be not less than 0.131 inch (3 mm) and the length shall be not less than $2\frac{1}{4}$ inches (57 mm) to qualify for the provisions of this section for existing nails regardless of head shape or head diameter.

[BS] C202.1.1 Sawn lumber or wood plank roofs. Roof decking consisting of sawn lumber or wood planks up to 12 inches (30 cm) wide and secured with not fewer than two nails (minimum size 8d) to each roof framing member it crosses shall be deemed to be sufficiently connected. Sawn lumber or wood plank decking secured with smaller fasteners than 8d nails or with fewer than two nails (minimum size 8d) to each framing member it crosses shall be deemed sufficiently connected if fasteners are added such that two clipped head, round head or ring shank nails (minimum size 8d) are in place on each framing member the nail crosses.

[BS] C202.1.2 Wood structural panel roofs For roof decking consisting of wood structural panels, fasteners and spacings required in Table C202.1.2 shall be deemed to comply with the requirements of Section 706.3.

Supplemental fasteners as required by Table C202.1.2 shall be 8d ring shank nails with round heads and the following minimum dimensions:

1. 0.113-inch-nominal (3 mm) shank diameter.
2. Ring diameter not less than 0.012 inch (0.3 mm) greater than shank diameter.
3. 16 to 20 rings per inch.
4. A minimum 0.280-inch (7 mm) full round head diameter.
5. Ring shank to extend not less than $1\frac{1}{2}$ inches (38 mm) from the tip of the nail.
6. Minimum $2\frac{1}{4}$ -inch (57 mm) nail length.

[BS] TABLE C202.1.2
SUPPLEMENT FASTENERS AT PANEL EDGES AND INTERMEDIATE FRAMING

EXISTING FASTENERS	EXISTING FASTENER SPACING (EDGE OR INTERMEDIATE SUPPORTS)	MAXIMUM SUPPLEMENTAL FASTENER SPACING FOR 130 MPH < V_{ult} ≤ 140 MPH	MAXIMUM SUPPLEMENTAL FASTENER SPACING FOR INTERIOR ZONE ^c LOCATIONS FOR MPH V_{ult} > 140 MPH AND EDGE ZONES NOT COVERED BY THE COLUMN TO THE RIGHT	EDGE ZONE ^d FOR V_{ult} > 160 MPH AND EXPOSURE C, OR V_{ult} > 180 MPH AND EXPOSURE B
Staples or 6d	Any	6" o.c. ^b	6" o.c. ^b	4" o.c. ^b at panel edges and 4" o.c. ^b at intermediate supports
8d clipped head or round head smooth shank	6" o.c. or less	None necessary	None necessary along edges of panels but 6" o.c. ^b at intermediate supports of panel	4" o.c. ^a at panel edges and 4" o.c. ^a at intermediate supports
8d clipped head or round head ring shank	6" o.c. or less	None necessary	None necessary	4" o.c. ^a at panel edges and 4" o.c. ^a at intermediate supports
8d clipped head or round head smooth shank	Greater than 6" o.c.	6" o.c. ^a	6" o.c. ^a along panel edges and 6" o.c. ^b at intermediate supports of panel	4" o.c. ^a at panel edges and 4" o.c. ^a at intermediate supports
8d clipped head or round head ring shank	Greater than 6" o.c.	6" o.c. ^a	6" o.c. ^a	4" o.c. ^a at panel edges and 4" o.c. ^a at intermediate supports

For SI: 1 inch = 25.4 mm; 1 foot = 304.8 mm; 1 mile per hour = 0.447 m/s.

- a. Maximum spacing determined based on existing fasteners and supplemental fasteners.
- b. Maximum spacing determined based on supplemental fasteners only.
- c. Interior zone = sheathing that is not located within 4 feet of the perimeter edge of the roof or within 4 feet of each side of a ridge.
- d. Edge zone = sheathing that is located within 4 feet of the perimeter edge of the roof and within 4 feet of each side of a ridge.

CHAPTER C3

REFERENCED STANDARDS

SECTION C301 REFERENCED STANDARDS

[BS] C301.1 General. See Table C301.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, standard title, and the section or sections of this appendix that reference the standard.

**[BS] TABLE C301.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
<i>CBC—21</i>	<i>California Building Code</i>	C101.3, C103.2, C201.1, C201.2
<i>CRC—21</i>	<i>California Residential Code</i>	C101.2, C101.3, C103.2, C201.2

CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
APPENDIX D
BOARD OF APPEALS

Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

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APPENDIX D

BOARD OF APPEALS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

User notes:

About this appendix: Appendix D provides criteria for Board of Appeals members. Also provided are procedures by which the Board of Appeals should conduct its business.

Code development reminder: Code change proposals to this appendix will be considered by the Administrative Code Development Committee during the 2022 (Group B) Code Development Cycle.

SECTION D101 GENERAL

[A] D101.1 Scope. A board of appeals shall be established within the jurisdiction for the purpose of hearing applications for modification of the requirements of this code pursuant to the provisions of Section 112. The board shall be established and operated in accordance with this section, and shall be authorized to hear evidence from appellants and the code official pertaining to the application and intent of this code for the purpose of issuing orders pursuant to these provisions.

[A] D101.2 Application for appeal. Any person shall have the right to appeal a decision of the code official to the board. An application for appeal shall be based on a claim that the intent of this code or the rules legally adopted hereunder have been incorrectly interpreted, the provisions of this code do not fully apply or an equally good or better form of construction is proposed. The application shall be filed on a form obtained from the code official within 20 days after the notice was served.

[A] D101.2.1 Limitation of authority. The board shall not have authority to waive requirements of this code or interpret the administration of this code.

[A] D101.2.2 Stays of enforcement. Appeals of notice and orders, other than Imminent Danger notices, shall stay the enforcement of the notice and order until the appeal is heard by the board.

[A] D101.3 Membership of board. The board shall consist of five voting members appointed by the chief appointing authority of the jurisdiction. Each member shall serve for [INSERT NUMBER OF YEARS] years or until a successor has been appointed. The board member's terms shall be staggered at intervals, so as to provide continuity. The code official shall be an ex officio member of said board but shall not vote on any matter before the board.

[A] D101.3.1 Qualifications. The board shall consist of five individuals, who are qualified by experience and training to pass on matters pertaining to building construction and are not employees of the jurisdiction.

[A] D101.3.2 Alternate members. The chief appointing authority is authorized to appoint two alternate members who shall be called by the board chairperson to hear appeals during the absence or disqualification of a member. Alternate members shall possess the qualifica-

tions required for board membership, and shall be appointed for the same term or until a successor has been appointed.

[A] D101.3.3 Vacancies. Vacancies shall be filled for an unexpired term in the same manner in which original appointments are required to be made.

[A] D101.3.4 Chairperson. The board shall annually select one of its members to serve as chairperson.

[A] D101.3.5 Secretary. The chief appointing authority shall designate a qualified clerk to serve as secretary to the board. The secretary shall file a detailed record of all proceedings, which shall set forth the reasons for the board's decision, the vote of each member, the absence of a member and any failure of a member to vote.

[A] D101.3.6 Conflict of interest. A member with any personal, professional or financial interest in a matter before the board shall declare such interest and refrain from participating in discussions, deliberations and voting on such matters.

[A] D101.3.7 Compensation of members. Compensation of members shall be determined by law.

[A] D101.3.8 Removal from the board. A member shall be removed from the board prior to the end of their terms only for cause. Any member with continued absence from regular meeting of the board may be removed at the discretion of the chief appointing authority.

[A] D101.4 Rules and procedures. The board shall establish policies and procedures necessary to carry out its duties consistent with the provisions of this code and applicable state law. The procedures shall not require compliance with strict rules of evidence, but shall mandate that only relevant information be presented.

[A] D101.5 Notice of meeting. The board shall meet upon notice from the chairperson, within 10 days of the filing of an appeal or at stated periodic intervals.

[A] D101.5.1 Open hearing. All hearings before the board shall be open to the public. The appellant, the appellant's representative, the code official and any person whose interests are affected shall be given an opportunity to be heard.

[A] D101.5.2 Quorum. Three members of the board shall constitute a quorum.

[A] **D101.5.3 Postponed hearing.** When five members are not present to hear an appeal, either the appellant or the appellant's representative shall have the right to request a postponement of the hearing.

[A] **D101.6 Legal counsel.** The jurisdiction shall furnish legal counsel to the board to provide members with general legal advice concerning matters before them for consideration. Members shall be represented by legal counsel at the jurisdiction's expense in all matters arising from service within the scope of their duties.

[A] **D101.7 Board decision.** The board shall only modify or reverse the decision of the *code official* by a concurring vote of three or more members.

[A] **D101.7.1 Resolution.** The decision of the board shall be by resolution. Every decision shall be promptly filed in writing in the office of the code official within three days and shall be open to the public for inspection. A certified copy shall be furnished to the appellant or the appellant's representative and to the code official.

[A] **D101.7.2 Administration.** The code official shall take immediate action in accordance with the decision of the board.

[A] **D101.8 Court review.** Any person, whether or not a previous party of the appeal, shall have the right to apply to the appropriate court for a writ of certiorari to correct errors of law. Application for review shall be made in the manner and time required by law following the filing of the decision in the office of the chief administrative officer.

**CALIFORNIA EXISTING BUILDING CODE – MATRIX ADOPTION TABLE
RESOURCE A
GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES**

*Not adopted by the State of California
(May be available for adoption by local ordinance. See Section 1.1.11.)*

Adopting Agency	BSC	BSC- CG	SFM	HCD			DSA			OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	SS/CC	1	1R	2	3	4								
Adopt Entire Chapter																						
Adopt Entire Chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																						
Chapter / Section																						

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RESOURCE A

GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

User note:

About this resource: *In the process of repair and alteration of existing buildings, based on the nature and the extent of the work, this code might require certain upgrades in the fire-resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire-resistance rating of the existing building elements as part of the overall evaluation for the assessment of the need for improvements. This resource document provides a guideline for such an evaluation for fire-resistance rating of archaic materials that is not typically found in the modern model building codes.*

Introduction

The *International Existing Building Code*® (IEBC®) is a comprehensive code with the goal of addressing all aspects of work taking place in existing buildings and providing user-friendly methods and tools for regulation and improvement of such buildings. This resource document is included within the cover of the IEBC with that goal in mind and as a step towards accomplishing that goal.

In the process of repair and alteration of existing buildings, based on the nature and the extent of the work, the IEBC might require certain upgrades in the fire-resistance rating of building elements, at which time it becomes critical for the designers and the code officials to be able to determine the fire-resistance rating of the *existing building* elements as part of the overall evaluation for the assessment of the need for improvements. This resource document provides a guideline for such an evaluation for fire-resistance ratings of archaic materials that are not typically found in the modern model building codes.

Resource A is only a guideline and is not intended to be a document for specific adoption as it is not written in the format or language of ICC's International Codes and is not subject to the code development process.

PURPOSE

The *Guidelines on Fire Ratings of Archaic Materials and Assemblies* focuses upon the fire-related performance of archaic construction. "Archaic" encompasses construction typical of an earlier time, generally prior to 1950. "Fire-related performance" includes fire resistance, flame spread, smoke production and degree of combustibility.

The purpose of this guideline is to update the information which was available at the time of original construction, for use by architects, engineers and code officials when evaluating the fire safety of a rehabilitation project. In addition, information relevant to the evaluation of general classes of materials and types of construction is presented for those cases when documentation of the fire performance of a particular archaic material or assembly cannot be found.

It has been assumed that the building materials and their fastening, joining and incorporation into the building structure are sound mechanically. Therefore, some determination

must be made that the original manufacture, the original construction practice, and the rigors of aging and use have not weakened the building. This assessment can often be difficult because process and quality control was not good in many industries, and variations among locally available raw materials and manufacturing techniques often resulted in a product which varied widely in its strength and durability. The properties of iron and steel, for example, varied widely, depending on the mill and the process used.

There is nothing inherently inferior about archaic materials or construction techniques. The pressures that promote fundamental change are most often economic or technological matters not necessarily related to concerns for safety. The high cost of labor made wood lath and plaster uneconomical. The high cost of land and the congestion of the cities provided the impetus for high-rise construction. Improved technology made it possible. The difficulty with archaic materials is not a question of suitability, but familiarity.

Code requirements for the fire performance of key building elements (e.g., walls, floor/ceiling assemblies, doors, shaft enclosures) are stated in performance terms: hours of fire resistance. It matters not whether these elements were built in 1908 or 1980, only that they provide the required degree of fire resistance. The level of performance will be defined by the local community, primarily through the enactment of a building or rehabilitation code. This guideline is only a tool to help evaluate the various building elements, regardless of what the level of performance is required to be.

The problem with archaic materials is simply that documentation of their fire performance is not readily available. The application of engineering judgment is more difficult because building officials may not be familiar with the materials or construction method involved. As a result, either a full-scale fire test is required or the archaic construction in question removed and replaced. Both alternatives are time consuming and wasteful.

This guideline and the accompanying appendix are designed to help fill this information void. By providing the necessary documentation, there will be a firm basis for the continued acceptance of archaic materials and assemblies.

1 FIRE-RELATED PERFORMANCE OF ARCHAIC MATERIALS AND ASSEMBLIES

1.1 FIRE PERFORMANCE MEASURES

This guideline does not specify the level of performance required for the various building components. These requirements are controlled by the building occupancy and use and are set forth in the local building or rehabilitation code.

The fire resistance of a given building element is established by subjecting a sample of the assembly to a “standard” fire test which follows a “standard” time-temperature curve. This test method has changed little since the 1920s. The test results tabulated in the Appendix have been adjusted to reflect current test methods.

The current model building codes cite other fire-related properties not always tested for in earlier years: flame spread, smoke production, and degree of combustibility. However, they can generally be assumed to fall within well defined values because the principal combustible component of archaic materials is cellulose. Smoke production is more important today because of the increased use of plastics. However, the early flame spread tests, developed in the early 1940s, also included a test for smoke production.

“Plastics,” one of the most important classes of contemporary materials, were not found in the review of archaic materials. If plastics are to be used in a rehabilitated building, they should be evaluated by contemporary standards. Information and documentation of their fire-related properties and performance is widely available.

Flame spread, smoke production and degree of combustibility are discussed in detail below. Test results for eight common species of lumber, published in an Underwriter’s Laboratories’ report (104), are noted in the following table:

TUNNEL TEST RESULTS FOR EIGHT SPECIES OF LUMBER

SPECIES OF LUMBER	FLAME SPREAD	FUEL CONTRIBUTED	SMOKE DEVELOPED
Western White Pine	75	50-60	50
Northern White Pine	120-215	120-140	60-65
Ponderosa Pine	80-215	120-135	100-110
Yellow Pine	180-190	130-145	275-305
Red Gum	140-155	125-175	40-60
Yellow Birch	105-110	100-105	45-65
Douglas Fir	65-100	50-80	10-100

Flame Spread

The flame spread of interior finishes is most often measured by the ASTM E84 “tunnel test.” This test measures how far and how fast the flames spread across the surface of

the test sample. The resulting flame spread rating (FSR) is expressed as a number on a continuous scale where cement-asbestos board is 0 and red oak is 100. (Materials with a flame spread greater than red oak have an FSR greater than 100.) The scale is divided into distinct groups or classes. The most commonly used flame spread classifications are: Class I or A*, with a 0-25 FSR; Class II or B, with a 26-75 FSR; and Class III or C, with a 76-200 FSR. The *NFPA Life Safety Code* also has a Class D (201-500 FSR) and Class E (over 500 FSR) interior finish.

These classifications are typically used in modern building codes to restrict the rate of fire spread. Only the first three classifications are normally permitted, though not all classes of materials can be used in all places throughout a building. For example, the interior finish of building materials used in exits or in corridors leading to exits is more strictly regulated than materials used within private dwelling units.

In general, inorganic archaic materials (e.g., bricks or tile) can be expected to be in Class I. Materials of whole wood are mostly Class II. Whole wood is defined as wood used in the same form as sawn from the tree. This is in contrast to the contemporary reconstituted wood products such as plywood, fiberboard, hardboard, or particle board. If the organic archaic material is not whole wood, the flame spread classification could be well over 200 and thus would be particularly unsuited for use in exits and other critical locations in a building. Some plywoods and various wood fiberboards have flame spreads over 200. Although they can be treated with fire retardants to reduce their flame spread, it would be advisable to assume that all such products have a flame spread over 200 unless there is information to the contrary.

Smoke Production

The evaluation of smoke density is part of the ASTM E84 tunnel test. For the eight species of lumber shown in the table above, the highest levels are 275-305 for Yellow Pine, but most of the others are less smoky than red oak which has an index of 100. The advent of plastics caused substantial increases in the smoke density values measured by the tunnel test. The ensuing limitation of the smoke production for wall and ceiling materials by the model building codes has been a reaction to the introduction of plastic materials. In general, cellulosic materials fall in the 50-300 range of smoke density which is below the general limitation of 450 adopted by many codes.

Degree of Combustibility

The model building codes tend to define “noncombustibility” on the basis of having passed ASTM E136 or if the material is totally inorganic. The acceptance of gypsum wallboard as noncombustible is based on limiting paper thickness to not over 1/8 inch and a 0-50 flame spread rating by ASTM E84. At times there were provisions to define a Class I or A material (0-25 FSR) as noncombustible, but this is not currently recognized by most model building codes.

* Some codes are Roman numerals, others use letters.

If there is any doubt whether or not an archaic material is noncombustible, it would be appropriate to send out samples for evaluation. If an archaic material is determined to be noncombustible according to ASTM E136, it can be expected that it will not contribute fuel to the fire.

1.2 COMBUSTIBLE CONSTRUCTION TYPES

One of the earliest forms of timber construction used exterior load-bearing masonry walls with columns and/or wooden walls supporting wooden beams and floors in the interior of the building. This form of construction, often called “mill” or “heavy timber” construction, has approximately 1 hour fire resistance. The exterior walls will generally contain the fire within the building.

With the development of dimensional lumber, there was a switch from heavy timber to “balloon frame” construction. The balloon frame uses load-bearing exterior wooden walls which have long timbers often extending from foundation to roof. When longer lumber became scarce, another form of construction, “platform” framing, replaced the balloon framing. The difference between the two systems is significant because platform framing is automatically fire-blocked at every floor while balloon framing commonly has concealed spaces that extend unblocked from basement to attic. The architect, engineer, and *code official* must be alert to the details of construction and the ease with which fire can spread in concealed spaces.

2 BUILDING EVALUATION

A given rehabilitation project will most likely go through several stages. The preliminary evaluation process involves the designer in surveying the prospective building. The fire resistance of *existing building* materials and construction systems is identified; potential problems are noted for closer study. The final evaluation phase includes: developing design solutions to upgrade the fire resistance of building elements, if necessary; preparing working drawings and specifications; and the securing of the necessary code approvals.

2.1 PRELIMINARY EVALUATION

A preliminary evaluation should begin with a building survey to determine the existing materials, the general arrangement of the structure and the use of the occupied spaces, and the details of construction. The designer needs to know “what is there” before a decision can be reached about what to keep and what to remove during the rehabilitation process. This preliminary evaluation should be as detailed as necessary to make initial plans. The fire-related properties need to be determined from the applicable building or rehabilitation code, and the materials and assemblies existing in the building then need to be evaluated for these properties. Two work

sheets are shown below to facilitate the preliminary evaluation.

Two possible sources of information helpful in the preliminary evaluation are the original building plans and the building code in effect at the time of original construction. Plans may be on file with the local building department or in the offices of the original designers (e.g., architect, engineer) or their successors. If plans are available, the investigator should verify that the building was actually constructed as called for in the plans, as well as incorporate any later alterations or changes to the building. Earlier editions of the local building code should be on file with the building official. The code in effect at the time of construction will contain fire performance criteria. While this is no guarantee that the required performance was actually provided, it does give the investigator some guidance as to the level of performance which may be expected. Under some code administration and enforcement systems, the code in effect at the time of construction also defines the level of performance that must be provided at the time of rehabilitation.

Figure 1 illustrates one method for organizing preliminary field notes. Space is provided for the materials, dimensions, and condition of the principal building elements. Each floor of the structure should be visited and the appropriate information obtained. In practice, there will often be identical materials and construction on every floor, but the exception may be of vital importance. A schematic diagram should be prepared of each floor showing the layout of exits and hallways and indicating where each element described in the field notes fits into the structure as a whole. The exact arrangement of interior walls within apartments is of secondary importance from a fire safety point of view and need not be shown on the drawings unless these walls are required by code to have a fire-resistance rating.

The location of stairways and elevators should be clearly marked on the drawings. All exterior means of escape (e.g., fire escapes) should be identified.¹

The following notes explain the entries in Figure 1.

Exterior Bearing Walls: Many old buildings utilize heavily constructed walls to support the floor/ceiling assemblies at the exterior of the building. There may be columns and/or interior bearing walls within the structure, but the exterior walls are an important factor in assessing the fire safety of a building.

The field investigator should note how the floor/ceiling assemblies are supported at the exterior of the building. If columns are incorporated in the exterior walls, the walls may be considered nonbearing.

Interior Bearing Walls: It may be difficult to determine whether or not an interior wall is load bearing, but the field investigator should attempt to make this determination. At a later stage of the rehabilitation process, this question will need to be determined exactly. Therefore, the field notes should be as accurate as possible.

1. Problems providing adequate exiting are discussed at length in the *Egress Guideline for Residential Rehabilitation*.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

Exterior Nonbearing Walls: The fire resistance of the exterior walls is important for two reasons. These walls (both bearing and nonbearing) are depended upon to: a) contain a fire within the building of origin; or b) keep an exterior fire *outside* the building. It is therefore important to indicate on the drawings where any openings are located as well as the materials and construction of all doors or shutters. The drawings should indicate the presence of wired glass, its thickness and framing, and identify the materials used for windows and door frames. The protection of openings adjacent to exterior means of escape (e.g., exterior stairways, fire escapes) is particularly important. The ground floor drawing should locate the building on the property and indicate the precise distances to adjacent buildings.

Interior Nonbearing Walls (Partitions): A partition is a “wall that extends from floor to ceiling and subdivides space within any story of a building.” (48) Figure 1 has two categories (A & B) for Interior Nonbearing Walls (Partitions) which can be used for different walls, such as hallway walls as compared to inter-apartment walls. Under some circumstances there may be only one type of wall construction; in others, three or more types of wall construction may occur.

The field investigator should be alert for differences in function as well as in materials and construction details. In general, the details within apartments are not as important as the major exit paths and exit stairways. The preliminary field investigation should attempt to determine the thickness of all walls. A term introduced below called “thickness design” will depend on an accurate ($\pm \frac{1}{4}$ inch) determination. Even though this initial field survey is called “preliminary,” the data generated should be as accurate and complete as possible.

The field investigator should note the exact location from which observations are recorded. For instance, if a hole is found through a wall enclosing an exit stairway which allows a cataloging of the construction details, the field investigation notes should reflect the location of the “find.” At the preliminary stage it is not necessary to core every wall; the interior details of construction can usually be determined at some location.

Structural Frame: There may or may not be a complete skeletal frame, but usually there are columns, beams, trusses, or other like elements. The dimensions and spacing of the structural elements should be measured and indicated on the drawings. For instance, if there are 10-inch square columns located on a 30-foot square grid throughout the building, this should be noted. The structural material and cover or protective materials should be identified wherever possible. The thickness of the cover materials should be determined to an accuracy of $\pm \frac{1}{4}$ inch. As discussed above, the preliminary field survey usually relies on accidental openings in the cover materials rather than a systematic coring technique.

Floor/Ceiling Structural Systems: The span between supports should be measured. If possible, a sketch of the cross-section of the system should be made. If there is no location where accidental damage has opened the floor/ceiling construction to visual inspection, it is necessary to make such an opening. An evaluation of the fire resistance of a floor/ceiling assembly requires detailed knowledge of the materials and their arrangement. Special attention should be paid to the cover on structural steel elements and the condition of suspended ceilings and similar membranes.

Roofs: The preliminary field survey of the roof system is initially concerned with watertightness. However, once it is apparent that the roof is sound for ordinary use and can be

**FIGURE 1
PRELIMINARY EVALUATION FIELD NOTES**

BUILDING ELEMENT		MATERIALS	THICKNESS	CONDITION	NOTES
Exterior Bearing Walls					
Interior Bearing Walls					
Exterior Nonbearing Walls					
Interior Nonbearing Walls or Partitions:	A				
	B				
Structural Frame:					
Columns					
Beams					
Other					
Floor/Ceiling Structural System					
Spanning					
Roofs					
Doors (including frame and hardware):					
a) Enclosed vertical exitway					
b) Enclosed horizontal exitway					
c) Other					

retained in the rehabilitated building, it becomes necessary to evaluate the fire performance. The field investigator must measure the thickness and identify the types of materials which have been used. Be aware that there may be several layers of roof materials.

Doors: Doors to stairways and hallways represent some of the most important fire elements to be considered within a building. The uses of the spaces separated largely controls the level of fire performance necessary. Walls and doors enclosing stairways or elevator shafts would normally require a higher level of performance than between the bedroom and bath. The various uses are differentiated in Figure 1.

Careful measurements of the thickness of door panels must be made, and the type of core material within each door must be determined. It should be noted whether doors have self-closing devices; the general operation of the doors should be checked. The latch should engage and the door should fit tightly in the frame. The hinges should be in good condition. If glass is used in the doors, it should be identified as either plain glass or wired glass mounted in either a wood or steel frame.

Materials: The field investigator should be able to identify ordinary building materials. In situations where an unfamiliar material is found, a sample should be obtained. This sample should measure at least 10 cubic inches so that an ASTM

E136 fire test can be conducted to determine if it is combustible.

Thickness: The thickness of all materials should be measured accurately since, under certain circumstances, the level of fire resistance is very sensitive to the material thickness.

Condition: The method of attaching the various layers and facings to one another or to the supporting structural element should be noted under the appropriate building element. The “secureness” of the attachment and the general condition of the layers and facings should be noted here.

Notes: The “Notes” column can be used for many purposes, but it might be a good idea to make specific references to other field notes or drawings.

After the building survey is completed, the data collected must be analyzed. A suggested work sheet for organizing this information is given below as Figure 2.

The required fire resistance and flame spread for each building element are normally established by the local building or rehabilitation code. The fire performance of the existing materials and assemblies should then be estimated, using one of the techniques described below. If the fire performance of the *existing building* element(s) is equal to or greater than that required, the materials and assemblies may remain. If the fire performance is less than required, then corrective measures must be taken.

FIGURE 2
PRELIMINARY EVALUATION WORKSHEET

BUILDING ELEMENT	REQUIRED FIRE RESISTANCE	REQUIRED FLAME SPREAD	ESTIMATED FIRE RESISTANCE	ESTIMATED FLAME SPREAD	METHOD OF UPGRADING	ESTIMATED UPGRADED PROTECTION	NOTES
Exterior Bearing Walls							
Interior Bearing Walls							
Exterior Nonbearing Walls							
Interior Nonbearing Walls or Partitions:	A						
	B						
Structural Frame: Columns							
Beams							
Other							
Floor/Ceiling Structural System Spanning							
Roofs							
Doors (including frame and hardware):							
a) Enclosed vertical exitway							
b) Enclosed horizontal exitway							
c) Others							

The most common methods of upgrading the level of protection are to either remove and replace the existing building element(s) or to repair and upgrade the existing materials and assemblies. Other fire protection measures, such as automatic sprinklers or detection and alarm systems, also could be considered, though they are beyond the scope of this guideline. If the upgraded protection is still less than that required or deemed to be acceptable, additional corrective measures must be taken. This process must continue until an acceptable level of performance is obtained.

2.2 FIRE RESISTANCE OF EXISTING BUILDING ELEMENTS

The fire resistance of the existing building elements can be estimated from the tables and histograms contained in the Appendix. The Appendix is organized first by type of building element: walls, columns, floor/ceiling assemblies, beams, and doors. Within each building element, the tables are organized by type of construction (e.g., masonry, metal, wood frame), and then further divided by minimum dimensions or thickness of the building element.

A histogram precedes every table that has 10 or more entries. The X-axis measures fire resistance in hours; the Y-axis shows the number of entries in that table having a given level of fire resistance. The histograms also contain the location of each entry within that table for easy cross-referencing.

The histograms, because they are keyed to the tables, can speed the preliminary investigation. For example, Table 1.3.2, *Wood Frame Walls 4" to Less Than 6" Thick*, contains 96 entries. Rather than study each table entry, the histogram shows that every wall assembly listed in that table has a fire resistance of less than 2 hours. If the building code required the wall to have 2 hours fire resistance, the designer, with a minimum of effort, is made aware of a problem that requires closer study.

Suppose the code had only required a wall of 1 hour fire resistance. The histogram shows far fewer complying elements (19) than noncomplying ones (77). If the existing assembly is not one of the 19 complying entries, there is a strong possibility the existing assembly is deficient. The histograms can also be used in the converse situation. If the existing assembly is not one of the smaller number of entries with a lower than required fire resistance, there is a strong possibility the existing assembly will be acceptable.

At some point, the existing building component or assembly must be located within the tables. Otherwise, the fire resistance must be determined through one of the other techniques presented in the guideline. Locating the building component in the Appendix Tables not only guarantees the accuracy of the fire-resistance rating, but also provides a source of documentation for the building official.

2.3 EFFECTS OF PENETRATIONS IN FIRE-RESISTANT ASSEMBLIES

There are often many features in existing walls or floor/ceiling assemblies which were not included in the original certification or fire testing. The most common examples are pipes and utility wires passed through holes poked through an assembly. During the life of the building, many penetrations are added, and by the time a building is ready for rehabilitation it is not sufficient to just consider the fire resistance of the assembly as originally constructed. It is necessary to consider all penetrations and their relative impact upon fire performance. For instance, the fire resistance of the corridor wall may be less important than the effect of plain glass doors or transoms. In fact, doors are the most important single class of penetrations.

A fully developed fire generates substantial quantities of heat and excess gaseous fuel capable of penetrating any holes which might be present in the walls or ceiling of the fire compartment. In general, this leads to a severe degradation of the fire resistance of those building elements and to a greater potential for fire spread. This is particularly applicable to penetrations located high in a compartment where the positive pressure of the fire can force the unburned gases through the penetration.

Penetrations in a floor/ceiling assembly will generally completely negate the barrier qualities of the assembly and will lead to rapid spread of fire to the space above. It will not be a problem, however, if the penetrations are filled with non-combustible materials strongly fastened to the structure. The upper half of walls are similar to the floor/ceiling assembly in that a positive pressure can reasonably be expected in the top of the room, and this will push hot and/or burning gases through the penetration unless it is completely sealed.

Building codes require doors installed in fire resistive walls to resist the passage of fire for a specified period of time. If the door to a fully involved room is not closed, a large plume of fire will typically escape through the doorway, preventing anyone from using the space outside the door while allowing the fire to spread. This is why door closers are so important. Glass in doors and transoms can be expected to rapidly shatter unless constructed of listed or approved wire glass in a steel frame. As with other building elements, penetrations or nonrated portions of doors and transoms must be upgraded or otherwise protected.

Table 5.1 in Section V of the Appendix contains 41 entries of doors mounted in sound tight-fitting frames. Part 3.4 below outlines one procedure for evaluating and possibly upgrading existing doors.

3

FINAL EVALUATION AND DESIGN SOLUTION

The final evaluation begins after the rehabilitation project has reached the final design stage and the choice is made to keep certain archaic materials and assemblies in the rehabilitated building. The final evaluation process is essentially a more refined and detailed version of the preliminary evaluation. The specific fire resistance and flame spread require-

ments are determined for the project. This may involve local building and fire officials reviewing the preliminary evaluation as depicted in Figures 1 and 2 and the field drawings and notes. When necessary, provisions must be made to upgrade existing building elements to provide the required level of fire performance.

There are several approaches to design solutions that can make possible the continued use of archaic materials and assemblies in the rehabilitated structure. The simplest case occurs when the materials and assembly in question are found within the Appendix Tables and the fire performance properties satisfy code requirements. Other approaches must be used, though, if the assembly cannot be found within the Appendix or the fire performance needs to be upgraded. These approaches have been grouped into two classes: experimental and theoretical.

3.1 THE EXPERIMENTAL APPROACH

If a material or assembly found in a building is not listed in the Appendix Tables, there are several other ways to evaluate fire performance. One approach is to conduct the appropriate fire test(s) and thereby determine the fire-related properties directly. There are a number of laboratories in the United States which routinely conduct the various fire tests. A current list can be obtained by writing the Center for Fire Research, National Bureau of Standards, Washington, D.C. 20234.

The contract with any of these testing laboratories should require their observation of specimen preparation as well as the testing of the specimen. A complete description of where and how the specimen was obtained from the building, the transportation of the specimen, and its preparation for testing should be noted in detail so that the building official can be satisfied that the fire test is representative of the actual use.

The test report should describe the fire test procedure and the response of the material or assembly. The laboratory usually submits a cover letter with the report to describe the provisions of the fire test that were satisfied by the material or assembly under investigation. A building official will generally require this cover letter, but will also read the report to confirm that the material or assembly complies with the code requirements. Local code officials should be involved in all phases of the testing process.

The experimental approach can be costly and time consuming because specimens must be taken from the building and transported to the testing laboratory. When a load bearing assembly has continuous reinforcement, the test specimen must be removed from the building, transported, and tested in one piece. However, when the fire performance cannot be determined by other means, there may be no alternative to a full-scale test.

A “nonstandard” small-scale test can be used in special cases. Sample sizes need only be 10–25 square feet (0.93–2.3

m²), while full-scale tests require test samples of either 100 or 180 square feet (9.3 or 17 m²) in size. This small-scale test is best suited for testing nonload-bearing assemblies against thermal transmission only.

3.2 THE THEORETICAL APPROACH

There will be instances when materials and assemblies in a building undergoing rehabilitation cannot be found in the Appendix Tables. Even where test results are available for more or less similar construction, the proper classification may not be immediately apparent. Variations in dimensions, loading conditions, materials, or workmanship may markedly affect the performance of the individual building elements, and the extent of such a possible effect cannot be evaluated from the tables.

Theoretical methods being developed offer an alternative to the full-scale fire tests discussed above. For example, Section 4302(b) of the 1979 edition of the *Uniform Building Code* specifically allows an engineering design for fire resistance in lieu of conducting full-scale tests. These techniques draw upon computer simulation and mathematical modeling, thermodynamics, heat-flow analysis, and materials science to predict the fire performance of building materials and assemblies.

One theoretical method, known as the “Ten Rules of Fire Endurance Ratings,” was published by T. Z. Harmathy in the May, 1965 edition of *Fire Technology*. (35) Harmathy’s Rules provide a foundation for extending the data within the Appendix Tables to analyze or upgrade current as well as archaic building materials or assemblies.

HARMATHY’S TEN RULES

Rule 1: The “thermal”¹ fire endurance of a construction consisting of a number of parallel layers is greater than the sum of the “thermal” fire endurances characteristic of the individual layers when exposed separately to fire.

The minimum performance of an untested assembly can be estimated if the fire endurance of the individual components is known. Though the exact rating of the assembly cannot be stated, the endurance of the assembly is greater than the sum of the endurance of the components.

When a building assembly or component is found to be deficient, the fire endurance can be upgraded by providing a protective membrane. This membrane could be a new layer of brick, plaster, or drywall. The fire endurance of this membrane is called the “finish rating.” Appendix Tables 1.5.1 and 1.5.2 contain the finish ratings for the most commonly employed materials. (See also the notes to Rule 2).

The test criteria for the finish rating is the same as for the thermal fire endurance of the total assembly: average temperature increases of 250°F (121°C) above ambient or 325°F (163°C) above ambient at any one place with the membrane

1. The “thermal” fire endurance is the time at which the average temperature on the unexposed side of a construction exceeds its initial value by 250° when the other side is exposed to the “standard” fire specified by ASTM Test Method E-19.

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being exposed to the fire. The temperature is measured at the interface of the assembly and the protective membrane.

Rule 2: The fire endurance of a construction does not decrease with the addition of further layers.

Harmathy notes that this rule is a consequence of the previous rule. Its validity follows from the fact that the additional layers increase both the resistance to heat flow and the heat capacity of the construction. This, in turn, reduces the rate of temperature rise at the unexposed surface.

This rule is not just restricted to “thermal” performance but affects the other fire test criteria: direct flame passage, cotton waste ignition, and load bearing performance. This means that certain restrictions must be imposed on the materials to be added and on the loading conditions. One restriction is that a new layer, if applied to the exposed surface, must not produce additional thermal stresses in the construction, i.e., its thermal expansion characteristics must be similar to those of the adjacent layer. Each new layer must also be capable of contributing enough additional strength to the assembly to sustain the added dead load. If this requirement is not fulfilled, the allowable live load must be reduced by an amount equal to the weight of the new layer. Because of these limitations, this rule should not be applied without careful consideration.

Particular care must be taken if the material added is a good thermal insulator. Properly located, the added insulation could improve the “thermal” performance of the assembly. Improperly located, the insulation could block necessary thermal transmission through the assembly, thereby subjecting the structural elements to greater temperatures for longer periods of time, and could cause premature structural failure of the supporting members.

Rule 3: The fire endurance of constructions containing continuous air gaps or cavities is greater than the fire endurance of similar constructions of the same weight, but containing no air gaps or cavities.

By providing for voids in a construction, additional resistances are produced in the path of heat flow. Numerical heat flow analyses indicate that a 10 to 15 percent increase in fire endurance can be achieved by creating an air gap at the mid-plane of a brick wall. Since the gross volume is also increased by the presence of voids, the air gaps and cavities have a beneficial effect on stability as well. However, constructions containing combustible materials within an air gap may be regarded as exceptions to this rule because of the possible development of burning in the gap.

There are numerous examples of this rule in the tables. For instance:

Table 1.1.4; Item W-8-M-82: Cored concrete masonry, nominal 8 inch thick wall with one unit in wall thickness and with 62 percent minimum of solid material in each unit, load bearing (80 PSI). Fire endurance: 2½ hours.

Table 1.1.5; Item W-10-M-11: Cored concrete masonry, nominal 10 inch thick wall with two units in wall thickness and a 2-inch (51 mm) air space, load bearing (80 PSI). The units are essentially the same as item W-8-M-82. Fire endurance: 3½ hours.

These walls show 1 hour greater fire endurance by the addition of the 2-inch (51 mm) air space.

Rule 4: The farther an air gap or cavity is located from the exposed surface, the more beneficial is its effect on the fire endurance.

Radiation dominates the heat transfer across an air gap or cavity, and it is markedly higher where the temperature is higher.

The air gap or cavity is thus a poor insulator if it is located in a region which attains high temperatures during fire exposure.

Some of the clay tile designs take advantage of these factors. The double cell design, for instance, ensures that there is a cavity near the unexposed face. Some floor/ceiling assemblies have air gaps or cavities near the top surface and these enhance their thermal performance.

Rule 5: The fire endurance of a construction cannot be increased by increasing the thickness of a completely enclosed air layer.

Harmathy notes that there is evidence that if the thickness of the air layer is larger than about ½ inch (12.7 mm), the heat transfer through the air layer depends only on the temperature of the bounding surfaces, and is practically independent of the distance between them. This rule is not applicable if the air layer is not completely enclosed, i.e., if there is a possibility of fresh air entering the gap at an appreciable rate.

Rule 6: Layers of materials of low thermal conductivity are better utilized on that side of the construction on which fire is more likely to happen.

As in Rule 4, the reason lies in the heat transfer process, though the conductivity of the solid is much less dependent on the ambient temperature of the materials. The low thermal conductor creates a substantial temperature differential to be established across its thickness under transient heat flow conditions. This rule may not be applicable to materials undergoing physico-chemical changes accompanied by significant heat absorption or heat evolution.

Rule 7: The fire endurance of asymmetrical constructions depends on the direction of heat flow.

This rule is a consequence of Rules 4 and 6, as well as other factors. This rule is useful in determining the relative protection of corridors and walls enclosing an exit stairway from the surrounding spaces. In addition, there are often situations where a fire is more likely, or potentially more severe, from one side or the other.

Rule 8: The presence of moisture, if it does not result in explosive spalling, increases the fire endurance.

The flow of heat into an assembly is greatly hindered by the release and evaporation of the moisture found within cementitious materials such as gypsum, Portland cement, or magnesium oxychloride. Harmathy has shown that the gain in fire endurance may be as high as 8 percent for each percent (by volume) of moisture in the construction. It is the moisture chemically bound within the construction material at the time of manufacture or processing that leads to increased fire endurance. There is no direct relationship between the rela-

tive humidity of the air in the pores of the material and the increase in fire endurance.

Under certain conditions there may be explosive spalling of low permeability cementitious materials such as dense concrete. In general, one can assume that extremely old concrete has developed enough minor cracking that this factor should not be significant.

Rule 9: Load-supporting elements, such as beams, girders and joists, yield higher fire endurances when subjected to fire endurance tests as parts of floor, roof, or ceiling assemblies than they would when tested separately.

One of the fire endurance test criteria is the ability of a load-supporting element to carry its design load. The element will be deemed to have failed when the load can no longer be supported.

Failure usually results for two reasons. Some materials, particularly steel and other metals, lose much of their structural strength at elevated temperatures. Physical deflection of the supporting element, due to decreased strength or thermal expansion, causes a redistribution of the load forces and stresses throughout the element. Structural failure often results because the supporting element is not designed to carry the redistributed load.

Roof, floor, and ceiling assemblies have primary (e.g., beams) and secondary (e.g., floor joists) structural members. Since the primary load-supporting elements span the largest distances, their deflection becomes significant at a stage when the strength of the secondary members (including the roof or floor surface) is hardly affected by the heat. As the secondary members follow the deflection of the primary load-supporting element, an increasingly larger portion of the load is transferred to the secondary members.

When load-supporting elements are tested separately, the imposed load is constant and equal to the design load throughout the test. By definition, no distribution of the load is possible because the element is being tested by itself. Without any other structural members to which the load could be transferred, the individual elements cannot yield a higher fire endurance than they do when tested as parts of a floor, roof or ceiling assembly.

Rule 10: The load-supporting elements (beams, girders, joists, etc.) of a floor, roof, or ceiling assembly can be replaced by such other load-supporting elements which, when tested separately, yielded fire endurances not less than that of the assembly.

This rule depends on Rule 9 for its validity. A beam or girder, if capable of yielding a certain performance when tested separately, will yield an equally good or better performance when it forms a part of a floor, roof, or ceiling assembly. It must be emphasized that the supporting element of one assembly must not be replaced by the supporting element of another assembly if the performance of this latter element is not known from a separate (beam) test. Because of the load-reducing effect of the secondary elements that results from a test performed on an assembly, the performance of the sup-

porting element alone cannot be evaluated by simple arithmetic. This rule also indicates the advantage of performing separate fire tests on primary load-supporting elements.

ILLUSTRATION OF HARMATHY'S RULES

Harmathy provided one schematic figure which illustrated his Rules.¹ It should be useful as a quick reference to assist in applying his Rules.

EXAMPLE APPLICATION OF HARMATHY'S RULES

The following examples, based in whole or in part upon those presented in Harmathy's paper (35), show how the Rules can be applied to practical cases.

Example 1

Problem

A contractor would like to keep a partition which consists of a 3³/₄ inch (95 mm) thick layer of red clay brick, a 1¹/₄ inch (32 mm) thick layer of plywood, and a 3³/₈ inch (9.5 mm) thick layer of gypsum wallboard, at a location where 2-hour fire endurance is required. Is this assembly capable of providing a 2-hour protection?

Solution

- (1) This partition does not appear in the Appendix Tables.
- (2) Bricks of this thickness yield fire endurances of approximately 75 minutes (Table 1.1.2, Item W-4-M-2).
- (3) The 1¹/₄ inch (32 mm) thick plywood has a finish rating of 30 minutes.
- (4) The 3³/₈ inch (9.5 mm) gypsum wallboard has a finish rating of 10 minutes.
- (5) Using the recommended values from the tables and applying Rule 1, the fire endurance (FI) of the assembly is larger than the sum of the individual layers, or

$$FI > 75 + 30 + 10 = 115 \text{ minutes}$$

Discussion

This example illustrates how the Appendix Tables can be utilized to determine the fire resistance of assemblies not explicitly listed.

Example 2

Problem

- (1) A number of buildings to be rehabilitated have the same type of roof slab which is supported with different structural elements.
- (2) The designer and contractor would like to determine whether or not this roof slab is capable of yielding a 2-hour fire endurance. According to a rigorous interpretation of ASTM E119, however, only the roof assembly, including the roof slab as well as the cover and the supporting elements, can be subjected to a fire test.

1. Reproduced from the May 1065 *Fire Technology* (Vol. 1, No. 2). Copyright National Fire Protection Association, Boston. Reproduced by permission.

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Therefore, a fire endurance classification cannot be issued for the slabs separately.

- (3) The designer and contractor believe this slab will yield a 2-hour fire endurance even without the cover, and any beam of at least 2-hour fire endurance will provide satisfactory support. Is it possible to obtain a classification for the slab separately?

Solution

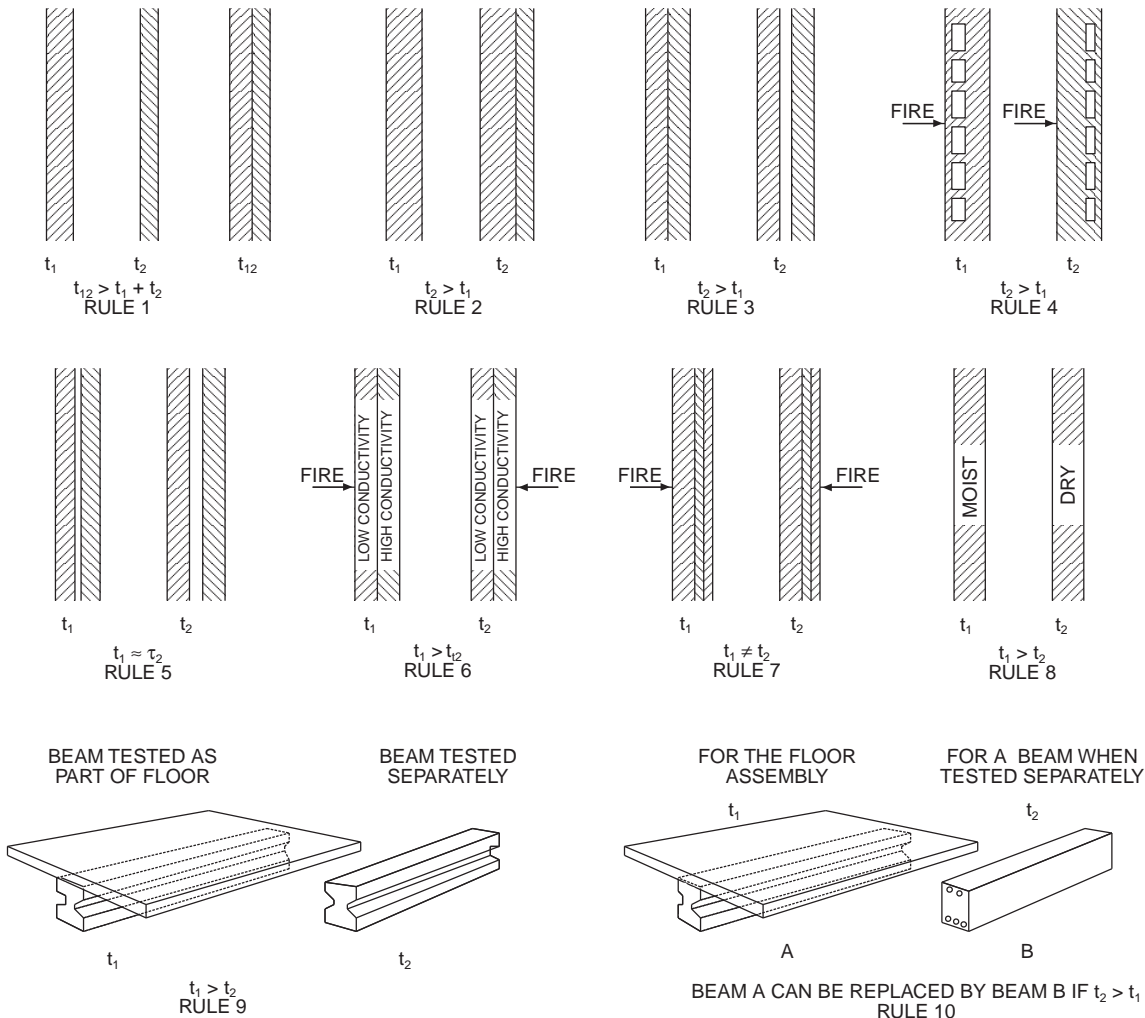
- (1) The answer to the question is yes.
- (2) According to Rule 10 it is not contrary to common sense to test and classify roofs and supporting elements separately. Furthermore, according to Rule 2, if the roof slabs actually yield a 2-hour fire endurance, the endurance of an assembly, including the slabs, cannot be less than 2 hours.
- (3) The recommended procedure would be to review the tables to see if the slab appears as part of any tested roof or floor/ceiling assembly. The supporting system

can be regarded as separate from the slab specimen, and the fire endurance of the assembly listed in the table is at least the fire endurance of the slab. There would have to be an adjustment for the weight of the roof cover in the allowable load if the test specimen did not contain a cover.

- (4) The supporting structure or element would have to have at least a 2-hour fire endurance when tested separately.

Discussion

If the tables did not include tests on assemblies which contained the slab, one procedure would be to assemble the roof slabs on any convenient supporting system (not regarded as part of the specimen) and to subject them to a load which, besides the usually required superimposed load, includes some allowances for the weight of the cover.



Diagrammatic illustration of 10 rules.
t = fire endurance

Example 3

Problem

A steel-joisted floor and ceiling assembly is known to have yielded a fire endurance of 1 hour and 35 minutes. At a certain location, a 2-hour endurance is required. What is the most economical way of increasing the fire endurance by at least 25 minutes?

Solution

- (1) The most effective technique would be to increase the ceiling plaster thickness. Existing coats of paint would have to be removed and the surface properly prepared before the new plaster could be applied. Other materials (e.g., gypsum wallboard) could also be considered.
- (2) There may be other techniques based on other principles, but an examination of the drawings would be necessary.

Discussion

- (1) The additional plaster has at least three effects:
 - a) The layer of plaster is increased and thus there is a gain of fire endurance (Rule 1).
 - b) There is a gain due to shifting the air gap farther from the exposed surface (Rule 4).
 - c) There is more moisture in the path of heat flow to the structural elements (Rules 7 and 8).
- (2) The increase in fire endurance would be at least as large as that of the finish rating for the added thickness of plaster. The combined effects in (1) above would further increase this by a factor of 2 or more, depending upon the geometry of the assembly.

Example 4

Problem

The fire endurance of item W-10-M-1 in Table 1.1.5 is 4 hours. This wall consists of two 3³/₄ inch (95 mm) thick layers of structural tiles separated by a 2-inch (51 mm) air gap and 3¹/₄ inch (19 mm) Portland cement plaster or stucco on both sides. If the actual wall in the building is identical to item W-10-M-1 except that it has a 4-inch (102 mm) air gap, can the fire endurance be estimated at 5 hours?

Solution

The answer to the question is no for the reasons contained in Rule 5.

Example 5

Problem

In order to increase the insulating value of its precast roof slabs, a company has decided to use two layers of different concretes. The lower layer of the slabs, where the strength of the concrete is immaterial (all the tensile load is carried by the steel reinforcement), would be made with a concrete of low strength but good insulating value. The upper layer, where the concrete is supposed to carry the compressive load, would remain the original high strength, high thermal con-

ductivity concrete. How will the fire endurance of the slabs be affected by the change?

Solution

The effect on the thermal fire endurance is beneficial:

- (1) The total resistance to heat flow of the new slabs has been increased due to the replacement of a layer of high thermal conductivity by one of low conductivity.
- (2) The layer of low conductivity is on the side more likely to be exposed to fire, where it is more effectively utilized according to Rule 6. The layer of low thermal conductivity also provides better protection for the steel reinforcement, thereby extending the time before reaching the temperature at which the creep of steel becomes significant.

3.3

“THICKNESS DESIGN” STRATEGY

The “thickness design” strategy is based upon Harmathy’s Rules 1 and 2. This design approach can be used when the construction materials have been identified and measured, but the specific assembly cannot be located within the tables. The tables should be surveyed again for thinner walls of like material and construction detail that have yielded the desired or greater fire endurance. If such an assembly can be found, then the thicker walls in the building have more than enough fire resistance. The thickness of the walls thus becomes the principal concern.

This approach can also be used for floor/ceiling assemblies, except that the thickness of the cover¹ and the slab become the central concern. The fire resistance of the untested assembly will be at least the fire resistance of an assembly listed in the table having a similar design but with less cover and/or thinner slabs. For other structural elements (e.g., beams and columns), the element listed in the table must also be of a similar design but with less cover thickness.

3.4

EVALUATION OF DOORS

A separate section on doors has been included because the process for evaluation presented below differs from those suggested previously for other building elements. The impact of unprotected openings or penetrations in fire resistant assemblies has been detailed in Part 2.3 above. It is sufficient to note here that openings left unprotected will likely lead to failure of the barrier under actual fire conditions.

For other types of building elements (e.g., beams, columns), the Appendix Tables can be used to establish a minimum level of fire performance. The benefit to rehabilitation is that the need for a full-scale fire test is then eliminated. For doors, however, this cannot be done. The data contained in Appendix Table 5.1, Resistance of Doors to Fire Exposure, can only provide guidance as to whether a successful fire test is even feasible.

1. Cover: the protective layer or membrane of material which slows the flow of heat to the structural elements.

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For example, a door required to have 1 hour fire resistance is noted in the tables as providing only 5 minutes. The likelihood of achieving the required 1 hour, even if the door is upgraded, is remote. The ultimate need for replacement of the doors is reasonably clear, and the expense and time needed for testing can be saved. However, if the performance documented in the table is near or in excess of what is being required, then a fire test should be conducted. The test documentation can then be used as evidence of compliance with the required level of performance.

The table entries cannot be used as the sole proof of performance of the door in question because there are too many unknown variables which could measurably affect fire performance. The wood may have dried over the years; coats of flammable varnish could have been added. Minor deviations in the internal construction of a door can result in significant differences in performance. Methods of securing inserts in panel doors can vary. The major non-destructive method of analysis, an x-ray, often cannot provide the necessary detail. It is for these, and similar reasons, that a fire test is still felt to be necessary.

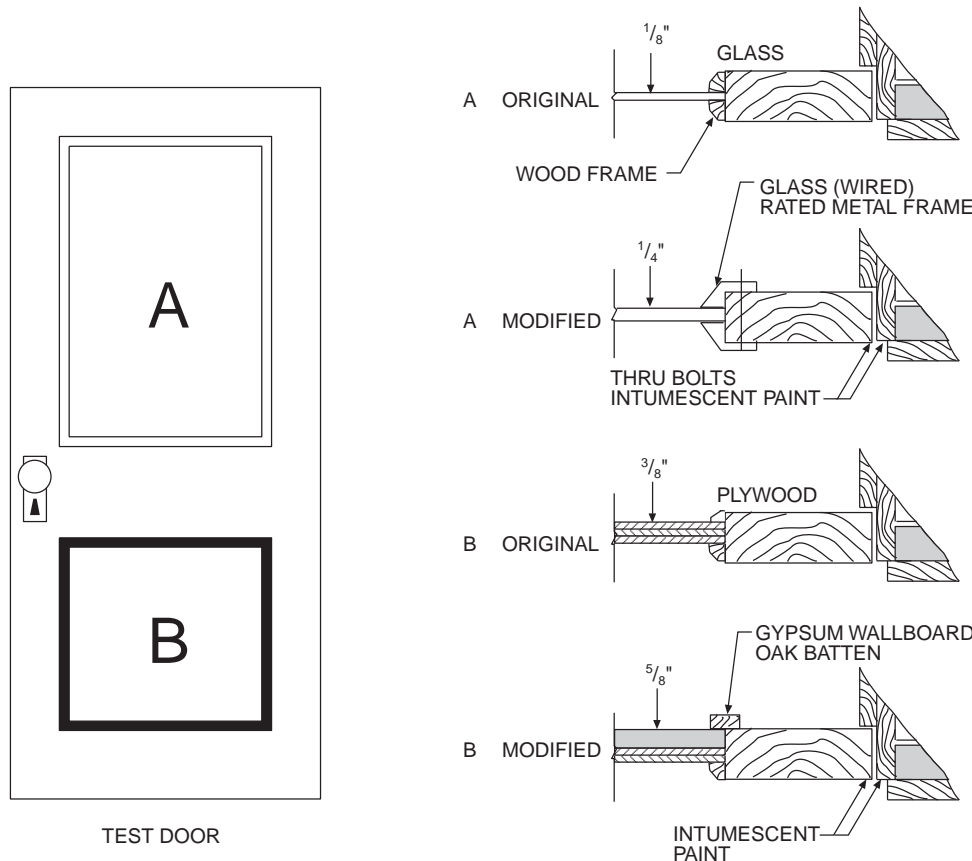
It is often possible to upgrade the fire performance of an existing door. Sometimes, “as is” and modified doors are evaluated in a single series of tests when failure of the unmodified door is expected. Because doors upgraded after

an initial failure must be tested again, there is a potential savings of time and money.

The most common problems encountered are plain glass, panel inserts of insufficient thickness, and improper fit of a door in its frame. The latter problem can be significant because a fire can develop a substantial positive pressure, and the fire will work its way through otherwise innocent-looking gaps between door and frame.

One approach to solving these problems is as follows. The plain glass is replaced with approved or listed wire glass in a steel frame. The panel inserts can be upgraded by adding an additional layer of material. Gypsum wallboard is often used for this purpose. Intumescent paint applied to the edges of the door and frame will expand when exposed to fire, forming an effective seal around the edges. This seal, coupled with the generally even thermal expansion of a wood door in a wood frame, can prevent the passage of flames and other fire gases. Figure 3 below illustrates these solutions.

Because the interior construction of a door cannot be determined by a visual inspection, there is no absolute guarantee that the remaining doors are identical to the one(s) removed from the building and tested. But the same is true for doors constructed today, and reason and judgment must be applied. Doors that appear identical upon visual inspection can be weighed. If the weights are reasonably close, the doors



For SI: 1 inch = 25.4 mm.

**FIGURE 3
MODIFICATION DETAILS**

can be assumed to be identical and therefore provide the same level of fire performance. Another approach is to fire test more than one door or to dismantle doors selected at random to see if they had been constructed in the same manner. Original building plans showing door details or other records showing that doors were purchased at one time or obtained from a single supplier can also be evidence of similar construction.

More often though, it is what is visible to the eye that is most significant. The investigator should carefully check the condition and fit of the door and frame, and for frames out of plumb or separating from the wall. Door closers, latches, and hinges must be examined to see that they function properly and are tightly secured. If these are in order and the door and frame have passed a full-scale test, there can be a reasonable basis for allowing the existing doors to remain.

4 SUMMARY

This section summarizes the various approaches and design solutions discussed in the preceding sections of the guideline. The term “structural system” includes: frames, beams, columns, and other structural elements. “Cover” is a protective layer(s) of materials or membrane which slows the flow of heat to the structural elements. It cannot be stressed too strongly that the fire endurance of actual building elements can be greatly reduced or totally negated by removing part of the cover to allow pipes, ducts, or conduits to pass through the element. This must be repaired in the rehabilitation process.

The following approaches shall be considered equivalent.

4.1 The fire resistance of a building element can be established from the Appendix Tables. This is subject to the following limitations:

The building element in the rehabilitated building shall be constructed of the same materials with the same nominal dimensions as stated in the tables.

All penetrations in the building element or its cover for services such as electricity, plumbing, and HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.

The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach essentially follows the approach taken by model building codes. The assembly must appear in a table either published in or accepted by the code for a given fire-resistance rating to be recognized and accepted.

4.2 The fire resistance of a building element which does not explicitly appear in the Appendix Tables can be established if one or more elements of same design but different dimensions have been listed in the tables. For walls, the existing element must be thicker than the one listed. For floor/ceiling

assemblies, the assembly listed in the table must have the same or less cover and the same or thinner slab constructed of the same material as the actual floor/ceiling assembly. For other structural elements, the element listed in the table must be of a similar design but with less cover thickness. The fire resistance in all instances shall be the fire resistance recommended in the table. This is subject to the following limitations:

The actual element in the rehabilitated building shall be constructed of the same materials as listed in the table. Only the following dimensions may vary from those specified: for walls, the overall thickness must exceed that specified in the table; for floor/ceiling assemblies, the thickness of the cover and the slab must be greater than, or equal to, that specified in the table; for other structural elements, the thickness of the cover must be greater than that specified in the table.

All penetrations in the building element or its cover for services such as electricity, plumbing, or HVAC shall be packed with noncombustible cementitious materials and so fixed that the packing material will not fall out when it loses its water of hydration.

The effects of age and wear and tear shall be repaired so that the building element is sound and the original thickness of all components, particularly covers and floor slabs, is maintained.

This approach is an application of the “thickness design” concept presented in Part 3.3 of the guideline. There should be many instances when a thicker building element was utilized than the one listed in the Appendix Tables. This guideline recognizes the inherent superiority of a thicker design. Note: “thickness design” for floor/ceiling assemblies and structural elements refers to cover and slab thickness rather than total thickness.

The “thickness design” concept is essentially a special case of Harmathy’s Rules (specifically Rules 1 and 2). It should be recognized that the only source of data is the Appendix Tables. If other data are used, it must be in connection with the approach below.

4.3 The fire resistance of building elements can be established by applying Harmathy’s Ten Rules of Fire Resistance Ratings as set forth in Part 3.2 of the guideline. This is subject to the following limitations:

The data from the tables can be utilized subject to the limitations in 4.2 above.

Test reports from recognized journals or published papers can be used to support data utilized in applying Harmathy’s Rules.

Calculations utilizing recognized and well established computational techniques can be used in applying Harmathy’s Rules. These include, but are not limited to, analysis of heat flow, mechanical properties, deflections, and load bearing capacity.

APPENDIX

INTRODUCTION

The fire-resistance tables that follow are a part of Resource A and provide a tabular form of assigning fire-resistance ratings to various archaic building elements and assemblies.

These tables for archaic materials and assemblies do for archaic materials what Tables 721.1(1) through 721.1(3) of the *California Building Code* do for more modern building elements and assemblies. The fire-resistance tables of Resource A should be used as described in the “Purpose and Procedure” that follows the table of contents for these tables.

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RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

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PURPOSE AND PROCEDURE

The tables and histograms which follow are to be used only within the analytical framework detailed in the main body of this guideline.

Histograms precede any table with 10 or more entries. The use and interpretation of these histograms is explained in Part 2 of the guideline. The tables are in a format similar to that found in the model building codes. The following example, taken from an entry in Table 1.1.2, best explains the table format.

1. Item Code: The item code consists of a four place series in the general form w-x-y-z in which each member of the series denotes the following:

- w = Type of building element (e.g., W=Walls; F=Floors, etc.)
- x = The building element thickness rounded down to the nearest 1-inch increment (e.g., 4⁵/₈ inches is rounded off to 4 inches)
- y = The general type of material from which the building element is constructed (e.g., M=Masonry; W=Wood, etc.)
- z = The item number of the particular building element in a given table

The item code shown in the example W-4-M-50 denotes the following:

- W = Wall, as the building element
- 4 = Wall thickness in the range of 4 inches (102 mm) to less than 5 inches (127 mm)
- M = Masonry construction
- 50 = The 50th entry in Table 1.1.2

2. The specific name or heading of this column identifies the dimensions which, if varied, has the greatest impact on fire resistance. The critical dimension for walls, the example here, is thickness. It is different for other building elements (e.g., depth for beams; membrane thickness for some floor/ceiling assemblies). The table entry is the named dimension of the building element measured at the time of actual testing to

within ±¹/₈ inch (3.2 mm) tolerance. The thickness tabulated includes facings where facings are a part of the wall construction.

3. Construction Details: The construction details provide a brief description of the manner in which the building element was constructed.
4. Performance: This heading is subdivided into two columns. The column labeled "Load" will either list the load that the building element was subjected to during the fire test or it will contain a note number which will list the load and any other significant details. If the building element was not subjected to a load during the test, this column will contain "n/a," which means "not applicable."

The second column under performance is labeled "Time" and denotes the actual fire endurance time observed in the fire test.

5. Reference Number: This heading is subdivided into three columns: Pre-BMS-92; BMS-92; and Post-BMS-92. The table entry under this column is the number in the Bibliography of the original source reference for the test data.
6. Notes: Notes are provided at the end of each table to allow a more detailed explanation of certain aspects of the test. In certain tables the notes given to this column have also been listed under the "Construction Details" and/or "Load" columns.
7. Rec Hours: This column lists the recommended fire endurance rating, in hours, of a building element. In some cases, the recommended fire endurance will be less than that listed under the "Time" column. In no case is the "Rec Hours" greater than given in the "Time" column.

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-50	4 ⁵ / ₈ "	Core: structural clay tile, See notes 12, 16, 21; Facings on unexposed side only, see note 18	N/A	25 min.		1		3, 4, 24	¹ / ₃

SECTION I - WALLS

FIGURE 1.1.1
MASONRY WALLS
0" TO LESS THAN 4" THICK

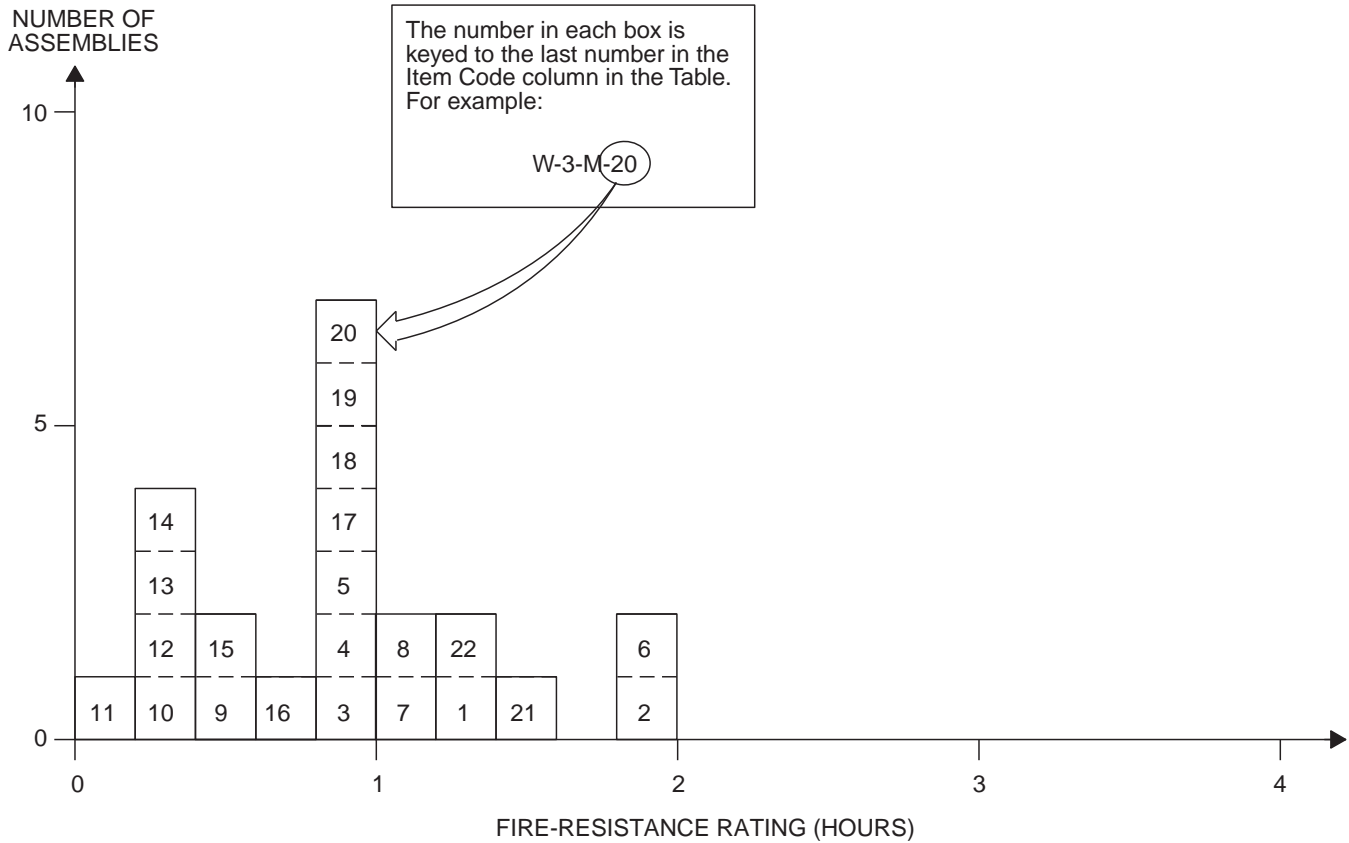


TABLE 1.1.1
MASONRY WALLS
0" TO LESS THAN 4" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-M-1	2 1/4"	Solid partition; 3/4" gypsum plank- 10' x 1'6"; 3/4" plus gypsum plaster each side.	N/A	1 hr. 22 min.			7	1	1 1/4
W-3-M-2	3"	Concrete block (18" x 9" x 3") of fuel ash, Portland cement and plasticizer; cement/sand mortar.	N/A	2 hrs.			7	2, 3	2
W-2-M-3	2"	Solid gypsum block wall; No facings	N/A	1 hr.		1		4	1
W-3-M-4	3"	Solid gypsum blocks, laid in 1:3 sanded gypsum mortar.	N/A	1 hr.		1		4	1
W-3-M-5	3"	Magnesium oxysulfate wood fiber blocks; 2" thick, laid in Portland cement-lime mortar; Facings: 1/2" of 1:3 sanded gypsum plaster on both sides.	N/A	1 hr.		1		4	1
W-3-M-6	3"	Magnesium oxysulfate bound wood fiber blocks; 3" thick; laid in Portland cement-lime mortar; Facings: 1/2" of 1:3 sanded gypsum plaster on both sides.	N/A	2 hrs.		1		4	2

(continued)

TABLE 1.1.1—continued
MASONRY WALLS
0" TO LESS THAN 4" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-M-7	3"	Clay tile; Ohio fire clay; single cell thick; Face plaster: 5/8" (both sides) 1:3 sanded gypsum; Design "E," Construction "A."	N/A	1 hr. 6 min.	0		2	5, 6, 7, 11, 12, 39	1
W-3-M-8	3"	Clay tile; Illinois surface clay; single cell thick; Face plaster: 5/8" (both sides) 1:3 sanded gypsum; Design "A," Construction "E."	N/A	1 hr. 1 min			2	5, 8, 9, 11, 12, 39	1
W-3-M-9	3"	Clay tile; Illinois surface clay; single cell thick; No face plaster; Design "A," Construction "C."	N/A	25 min.			2	5, 10, 11, 12, 39	1/3
W-3-M-10	3 7/8"	8" x 4 7/8" glass blocks; weight 4 lbs. each; Portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min.		1		4	1/4
W-3-M-11	3"	Core: structural clay tile; see Notes 14, 18, 13; No facings.	N/A	10 min.		1		5, 11, 26	1/6
W-3-M-12	3"	Core: structural clay tile; see Notes 14, 19, 23; No facings.	N/A	20 min.		1		5, 11, 26	1/3
W-3-M-13	3 5/8"	Core: structural clay tile; see Notes 14, 18, 23; Facings: unexposed side; see Note 20.	N/A	20 min.		1		5, 11, 26	1/3
W-3-M-14	3 5/8"	Core: structural clay tile; see Notes 14, 19, 23; Facings: unexposed side only; see Note 20.	N/A	20 min.		1		5, 11, 26	1/3
W-3-M-15	3 5/8"	Core: clay structural tile; see Notes 14, 18, 23; Facings: side exposed to fire; see Note 20.	N/A	30 min.		1		5, 11, 26	1/2
W-3-M-16	3 5/8"	Core: clay structural tile; see Notes 14, 19, 23; Facings: side exposed to fire; see Note 20.	N/A	45 min.		1		5, 11, 26	3/4
W-2-M-17	2"	2" thick solid gypsum blocks; see Note 27.	N/A	1 hr.		1		27	1
W-3-M-18	3"	Core: 3" thick gypsum blocks 70% solid; see Note 2; No facings.	N/A	1 hr.		1		27	1
W-3-M-19	3"	Core: hollow concrete units; see Notes 29, 35, 36, 38; No facings.	N/A	1 hr.		1		27	1
W-3-M-20	3"	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; No facings.	N/A	1 hr.		1			1
W-3-M-21	3 1/2"	Core: hollow concrete units; see Notes 28, 35, 36, 37, 38; Facings: one side; see Note 37.	N/A	1 1/2 hrs.		1			1 1/2
W-3-M-22	3 1/2"	Core: hollow concrete units; see Notes 29, 35, 36, 38; Facings: one side, see Note 37.	N/A	1 1/4 hrs.		1			1 1/4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, °C = [(°F) - 32]/1.8.

Notes:

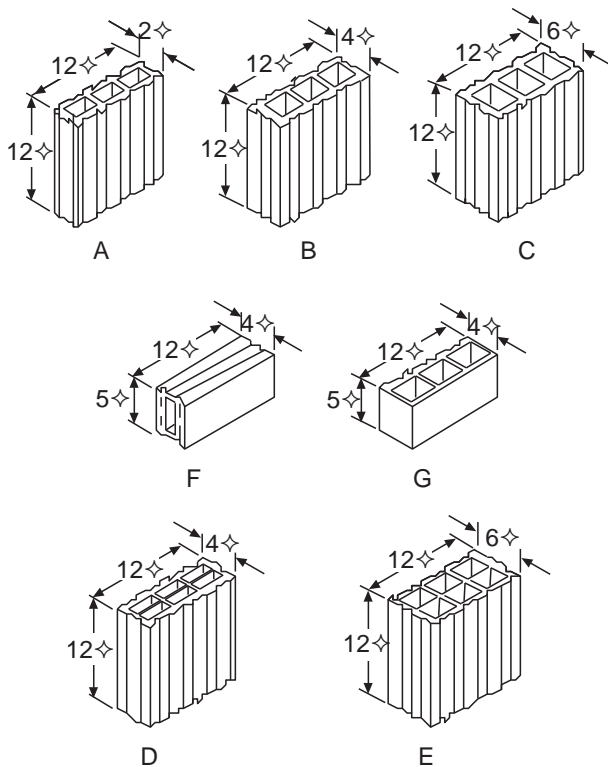
1. Failure mode—flame thru.
2. Passed 2-hour fire test (Grade "C" fire res. - British).
3. Passed hose stream test.
4. Tested at NBS under ASA Spec. No. A2-1934. As nonload bearing partitions.
5. Tested at NBS under ASA Spec. No. 42-1934 (ASTM C19-33) except that hose stream testing where carried was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
6. Failure by thermal criteria—maximum temperature rise 325°F.
7. Hose stream failure.
8. Hose stream—pass.
9. Specimen removed prior to any failure occurring.
10. Failure mode—collapse.
11. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.

(continued)

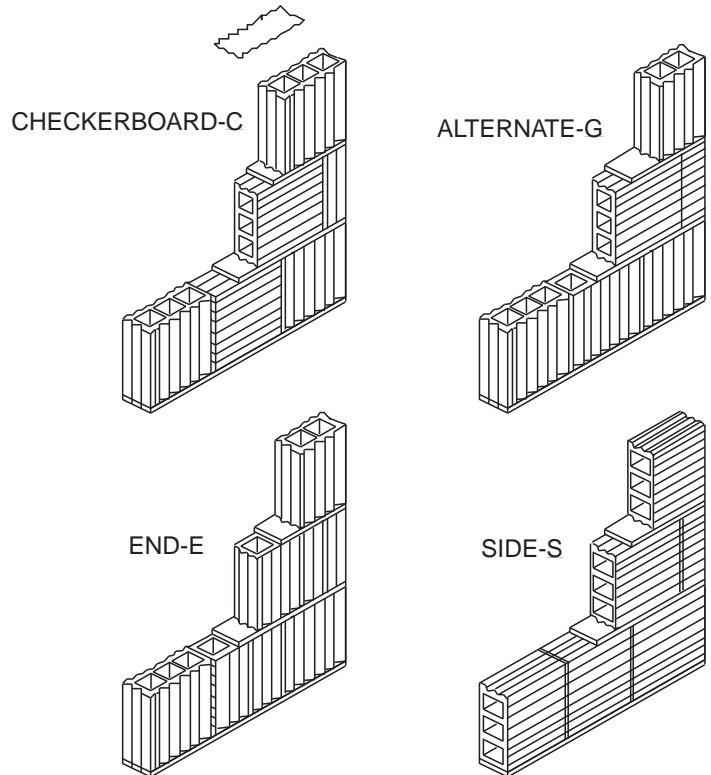
RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 1.1.1—continued
MASONRY WALLS
0" TO LESS THAN 4" THICK**

12. See appendix for construction and design details for clay tile walls.
13. Load: 80 psi for gross wall area.
14. One cell in wall thickness.
15. Two cells in wall thickness.
16. Double shells plus one cell in wall thickness.
17. One cell in wall thickness, cells filled with broken tile, crushed stone, slag cinders or sand mixed with mortar.
18. Dense hard-burned clay or shale tile.
19. Medium-burned clay tile.
20. Not less than $\frac{5}{8}$ inch thickness of 1:3 sanded gypsum plaster.
21. Units of not less than 30 percent solid material.
22. Units of not less than 40 percent solid material.
23. Units of not less than 50 percent solid material.
24. Units of not less than 45 percent solid material.
25. Units of not less than 60 percent solid material.
26. All tiles laid in Portland cement-lime mortar.
27. Blocks laid in 1:3 sanded gypsum mortar voids in blocks not to exceed 30 percent.
28. Units of expanded slag or pumice aggregate.
29. Units of crushed limestone, blast furnace, slag, cinders and expanded clay or shale.
30. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
31. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
32. Unit at least 49 percent solid.
33. Unit at least 62 percent solid.
34. Unit at least 65 percent solid.
35. Unit at least 73 percent solid.
36. Ratings based on one unit and one cell in wall thickness.
37. Minimum of $\frac{1}{2}$ inch—1:3 sanded gypsum plaster.
38. Nonload bearing.
39. See Clay Tile Partition Design Construction drawings below.

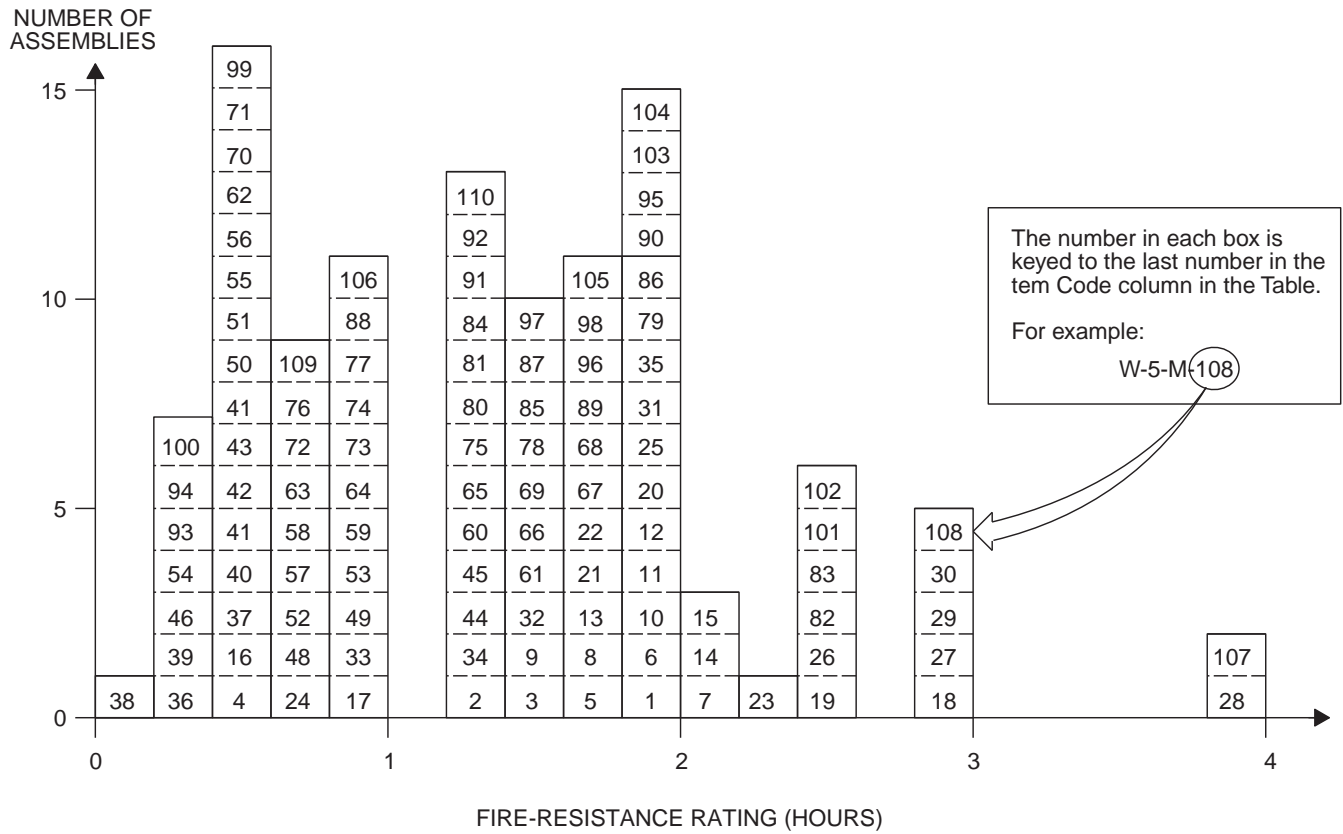


DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

**FIGURE 1.1.2
MASONRY WALLS
4" TO LESS THAN 6" THICK**



**TABLE 1.1.2
MASONRY WALLS
4" TO LESS THAN 6" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-1	4"	Solid 3" thick, gypsum blocks laid in 1:3 sanded gypsum mortar; Facings: 1/2" of 1:3 sanded gypsum plaster (both sides).	N/A	2 hrs.		1		1	2
W-4-M-2	4"	Solid clay or shale brick.	N/A	1 hr. 15 min		1		1, 2	1 1/4
W-4-M-3	4"	Concrete; No facings.	N/A	1 hr. 30 min.		1		1	1 1/2
W-4-M-4	4"	Clay tile; Illinois surface clay; single cell thick; No face plaster; Design "B," Construction "C."	N/A	25 min.			2	3-7, 36	1/3
W-4-M-5	4"	Solid sand-lime brick.	N/A	1 hr. 45 min.		1		1	3 3/4
W-4-M-6	4"	Solid wall; 3" thick block; 1/2" plaster each side; 17 3/4" x 8 3/4" x 4" "Breeze Blocks"; Portland cement/sand mortar.	N/A	1 hr. 52 min.			7	2	1 3/4
W-4-M-7	4"	Concrete (4020 psi); Reinforcement: vertical 3/8"; horizontal 1/4"; 6" x 6" grid.	N/A	2 hrs. 10 min.			7	2	2
W-4-M-8	4"	Concrete wall (4340 psi crush); reinforcement 1/4" diameter rebar on 8" centers (vertical and horizontal).	N/A	1 hr. 40 min.			7	2	1 2/3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-9	4 ³ / ₁₆ "	4 ³ / ₁₆ " × 2 ⁵ / ₈ " cellular fletton brick (1873 psi) with 1/2" sand mortar; bricks are U-shaped yielding hollow cover (approx. 2" × 4") in final cross-section configuration.	N/A	1 hr. 25 min.			7	2	1 ¹ / ₃
W-4-M-10	4 ¹ / ₄ "	4 ¹ / ₄ " × 2 ¹ / ₂ " fletton (1831 psi) brick in 1/2" sand mortar.	N/A	1 hr. 53 min			7	2	1 ³ / ₄
W-4-M-11	4 ¹ / ₄ "	4 ¹ / ₄ " × 2 ¹ / ₂ " London stock (683 psi) brick; 1/2" grout.	N/A	1 hr. 52 min.			7	2	1 ³ / ₄
W-4-M-12	4 ¹ / ₂ "	4 ¹ / ₄ " × 2 ¹ / ₂ " Leicester red, wire-cut brick (4465 psi) in 1/2" sand mortar.	N/A	1 hr. 56 min.			7	6	1 ³ / ₄
W-4-M-13	4 ¹ / ₄ "	4 ¹ / ₄ " × 2 ¹ / ₂ " stairfoot brick (7527 psi) 1/2" sand mortar.	N/A	1 hr. 37 min.			7	2	1 ¹ / ₂
W-4-M-14	4 ¹ / ₄ "	4 ¹ / ₄ " × 2 ¹ / ₂ " sand-lime brick (2603 psi) 1/2" sand mortar.	N/A	2 hrs. 6 min.			7	2	2
W-4-M-15	4 ¹ / ₄ "	4 ¹ / ₄ " × 2 ¹ / ₂ " concrete brick (2527 psi) 1/2" sand mortar.	N/A	2 hrs. 10 min.			7	2	2
W-4-M-16	4 ¹ / ₂ "	4" thick clay tile; Ohio fire clay; single cell thick; No plaster exposed face; 1/2" 1:2 gypsum back face; Design "F," Construction "S."	N/A	31 min.			2	3-6, 36	1/2
W-4-M-17	4 ¹ / ₂ "	4" thick clay tile; Ohio fire clay; single cell thick; Plaster exposed face; 1/2" 1:2 sanded gypsum; Back Face: none; Construction "S," Design "F."	80 psi	50 min.			2	3-5, 8, 36	3/4
W-4-M-18	4 ¹ / ₂ "	Core: solid sand-lime brick; 1/2" sanded gypsum plaster facings on both sides.	80 psi	3 hrs.		1		1, 11	3
W-4-M-19	4 ¹ / ₂ "	Core: solid sand-lime brick; 1/2" sanded gypsum plaster facings on both sides.	80 psi	2 hrs. 30 min.		1		1, 11	2 ¹ / ₂
W-4-M-20	4 ¹ / ₂ "	Core: concrete brick 1/2" of 1:3 sanded gypsum plaster facings on both sides.	80 psi	2 hrs.		1		1, 11	2
W-4-M-21	4 ¹ / ₂ "	Core: solid clay or shale brick; 1/2" thick, 1:3 sanded gypsum plaster facings on fire sides.	80 psi	1 hr. 45 min.		1		1, 2, 11	1 ³ / ₄
W-4-M-22	4 ³ / ₄ "	4" thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; Plaster on exposed face; none on unexposed face; 3/4" 1:3 sanded gypsum; Design "G," Construction "E."	N/A	1 hr. 48 min.			2	2, 3-5, 9, 36	1 ³ / ₄
W-4-M-23	4 ³ / ₄ "	4" thick clay tile; Ohio fire clay; single cell thick; cells filled with cement and broken tile concrete; No plaster exposed faced; 3/4" neat gypsum plaster on unexposed face; Design "G," Construction "E."	N/A	2 hrs. 14 min.			2	2, 3-5, 9, 36	2
W-5-M-24	5"	3" × 13" air space; 1" thick metal reinforced concrete facings on both sides; faces connected with wood splines.	2,250 lbs./ft.	45 min.		1		1	3/4
W-5-M-25	5"	Core: 3" thick void filled with "nondulated" mineral wool weighing 10 lbs./ft. ³ ; 1" thick metal reinforced concrete facings on both sides.	2,250 lbs./ft.	2 hrs.		1		1	2
W-5-M-26	5"	Core: solid clay or shale brick; 1/2" thick, 1:3 sanded gypsum plaster facings on both sides.	40 psi	2 hrs. 30 min.		1		1, 2, 11	2 ¹ / ₂
W-5-M-27	5"	Core: solid 4" thick gypsum blocks, laid in 1:3 sanded gypsum mortar; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	3 hrs.		1		1	3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-M-28	5"	Core: 4" thick hollow gypsum blocks with 30% voids; blocks laid in 1:3 sanded gypsum mortar; No facings.	N/A	4 hrs.		1		1	4
W-5-M-29	5"	Core: concrete brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	3 hrs.		1		1	3
W-5-M-30	5 1/4"	4" thick clay tile; Illinois surface clay; double cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "D," Construction "S."	N/A	2 hrs. 53 min.			2	2-5, 9, 36	2 3/4
W-5-M-31	5 1/4"	4" thick clay tile; New Jersey fire clay; double cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "D," Construction "S."	N/A	1 hr. 52 min.			2	2-5, 9, 36	1 3/4
W-5-M-32	5 1/4"	4" thick clay tile; New Jersey fire clay; single cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "D," Construction "S."	N/A	1 hr. 34 min.	2		2	2-5, 9, 36	1 1/2
W-5-M-33	5 1/4"	4" thick clay tile; New Jersey fire clay; single cell thick; Face plaster: 5/8" both sides; 1:3 sanded gypsum; Design "B," Construction "S."	N/A	50 min.			2	3-5, 8, 36	3/4
W-5-M-34	5 1/4"	4" thick clay tile; Ohio fire clay; single cell thick; Face plaster: 5/8" both sides; 1:3 sanded gypsum; Design "B," Construction "A."	N/A	1 hr. 19 min.			2	2-5, 9, 36	1 1/4
W-5-M-35	5 1/4"	4" thick clay tile; Illinois surface clay; single cell thick; Face plaster: 5/8" both sides; 1:3 sanded gypsum; Design "B," Construction "S."	N/A	1 hr. 59 min.			2	2-5, 10, 36	1 3/4
W-5-M-36	4"	Core: structural clay tile; see Notes 12, 16, 21; No facings.	N/A	15 min.		1		3, 4, 24	1/4
W-4-M-37	4"	Core: structural clay tile; see Notes 12, 17, 21; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-38	4"	Core: structural clay tile; see Notes 12, 16, 20; No facings.	N/A	10 min.		1		3, 4, 24	1/6
W-4-M-39	4"	Core: structural clay tile; see Notes 12, 17, 20; No facings.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-40	4"	Core: structural clay tile; see Notes 13, 16, 23; No facings.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-41	4"	Core: structural clay tile; see Notes 13, 17, 23; No facings.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-42	4"	Core: structural clay tile; see Notes 13, 16, 21; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-43	4"	Core: structural clay tile; see Notes 13, 17, 21; No facings.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-44	4"	Core: structural clay tile; see Notes 15, 16, 20; No facings	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-45	4"	Core: structural clay tile; see Notes 15, 17, 20; No facings.	N/A	1 hr. 15 min.		1		3, 4, 24	1 1/4
W-4-M-46	4"	Core: structural clay tile; see Notes 14, 16, 22; No facings.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-47	4"	Core: structural clay tile; see Notes 14, 17, 22; No facings.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-48	4 1/4"	Core: structural clay tile; see Notes 12, 16, 21; Facings: both sides; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-49	4 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 17, 21; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-50	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 16, 21; Facings: unexposed side only; see Note 18.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-51	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 17, 21; Facings: unexposed side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-52	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 16, 21; Facings: unexposed side only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-53	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 17, 21; Facings: fire side only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-54	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 16, 20; Facings: unexposed side; see Note 18.	N/A	20 min.		1		3, 4, 24	1/3
W-4-M-55	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 17, 20; Facings: exposed side; see Note 18.	N/A	25 min.		1		3, 4, 24	1/3
W-4-M-56	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 16, 20; Facings: fire side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2
W-4-M-57	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 12, 17, 20; Facings: fire side only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-58	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 16, 23; Facings: unexposed side only; see Note 18.	N/A	40 min.		1		3, 4, 24	2/3
W-4-M-59	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 17, 23; Facings: unexposed side only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-60	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 16, 23; Facings: fire side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 ¹ / ₄
W-4-M-61	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 17, 23; Facings: fire side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ¹ / ₂
W-4-M-62	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 16, 21; Facings: unexposed side only; see Note 18.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-63	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 17, 21; Facings: unexposed face only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-64	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 16, 23; Facings: exposed face only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-65	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 13, 17, 21; Facings: exposed side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 ¹ / ₄
W-4-M-66	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 17, 20; Facings: unexposed side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ¹ / ₂
W-4-M-67	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 16, 20; Facings: exposed side only; see Note 18.	N/A	1 hr. 45 min.		1		3, 4, 24	1 ³ / ₄
W-4-M-68	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 17, 20; Facings: exposed side only; see Note 18.	N/A	1 hr. 45 min.		1		3, 4, 24	1 ³ / ₄
W-4-M-69	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 16, 20; Facings: unexposed side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ³ / ₄
W-4-M-70	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 14, 16, 22; Facings: unexposed side only; see Note 18.	N/A	30 min.		1		3, 4, 24	1/2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-71	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 14, 17, 22; Facings: exposed side only; see Note 18.	N/A	35 min.		1		3, 4, 24	1/2
W-4-M-72	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 14, 16, 22; Facings: fire side of wall only; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-4-M-73	4 ⁵ / ₈ "	Core: structural clay tile; see Notes 14, 17, 22; Facings: fire side of wall only; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-4-M-74	5 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 16, 21; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-5-M-75	5 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 17, 21; Facings: both sides; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 ¹ / ₄
W-5-M-76	5 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 16, 20; Facings: both sides; see Note 18.	N/A	45 min.		1		3, 4, 24	3/4
W-5-M-77	5 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 17, 20; Facings: both sides; see Note 18.	N/A	1 hr.		1		3, 4, 24	1
W-5-M-78	5 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 16, 23; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ¹ / ₂
W-5-M-79	5 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 17, 23; Facings: both sides of wall; see Note 18.	N/A	2 hrs.		1		3, 4, 24	2
W-5-M-80	5 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 16, 21; Facings: both sides of wall; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 ¹ / ₄
W-5-M-81	5 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 16, 21; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ¹ / ₂
W-5-M-82	5 ¹ / ₄ "	Core: structural clay tile; see Notes 15, 16, 20; Facings: both sides; see Note 18.	N/A	2 hrs. 30 min.		1		3, 4, 24	2 ¹ / ₂
W-5-M-83	5 ¹ / ₄ "	Core: structural clay tile; see Notes 15, 17, 20; Facings: both sides; see Note 18.	N/A	2 hrs. 30 min.		1		3, 4, 24	2 ¹ / ₂
W-5-M-84	5 ¹ / ₄ "	Core: structural clay tile; see Notes 14, 16, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 15 min.		1		3, 4, 24	1 ¹ / ₄
W-5-M-85	5 ¹ / ₄ "	Core: structural clay tile; see Notes 14, 17, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 4, 24	1 ¹ / ₂
W-4-M-86	4"	Core: 3" thick gypsum blocks 70% solid; see Note 26; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-4-M-87	4"	Core: hollow concrete units; see Notes 27, 34, 35; No facings.	N/A	1 hr. 30 min.		1			1 ¹ / ₂
W-4-M-88	4"	Core: hollow concrete units; see Notes 28, 33, 35; No facings.	N/A	1 hr.		1			1
W-4-M-89	4"	Core: hollow concrete units; see Notes 28, 34, 35; Facings: both sides; see Note 25.	N/A	1 hr. 45 min.		1			1 ³ / ₄
W-4-M-90	4"	Core: hollow concrete units; see Notes 27, 34, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-4-M-91	4"	Core: hollow concrete units; see Notes 27, 32, 35; No facings.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-4-M-92	4"	Core: hollow concrete units; see Notes 28, 34, 35; No facings.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-4-M-93	4"	Core: hollow concrete units; see Notes 29, 32, 35; No facings.	N/A	20 min.		1			1/3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-M-94	4"	Core: hollow concrete units; see Notes 30, 34, 35; No facings.	N/A	15 min.		1			1/4
W-4-M-95	4 1/2"	Core: hollow concrete units; see Notes 27, 34, 35; Facings: one side only; see Note 25.	N/A	2 hrs.		1			2
W-4-M-96	4 1/2"	Core: hollow concrete units; see Notes 27, 32, 35; Facings: one side only; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-4-M-97	4 1/2"	Core: hollow concrete units; see Notes 28, 33, 35; Facings: one side; see Note 25.	N/A	1 hr. 30 min.		1			1 1/2
W-4-M-98	4 1/2"	Core: hollow concrete units; see Notes 28, 34, 35; Facings: one side only; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-4-M-99	4 1/2"	Core: hollow concrete units; see Notes 29, 32, 35; Facings: one side; see Note 25.	N/A	30 min.		1			1/2
W-4-M-100	4 1/2"	Core: hollow concrete units; see Notes 30, 34, 35; Facings: one side; see Note 25.	N/A	20 min.		1			1/3
W-5-M-101	5"	Core: hollow concrete units; see Notes 27, 34, 35; Facings: both sides; see Note 25.	N/A	2 hrs. 30 min.		1			2 1/2
W-5-M-102	5"	Core: hollow concrete units; see Notes 27, 32, 35; Facings: both sides; see Note 25.	N/A	2 hrs. 30 min.		1			2 1/2
W-5-M-103	5"	Core: hollow concrete units; see Notes 28, 33, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-5-M-104	5"	Core: hollow concrete units; see Notes 28, 31, 35; Facings: both sides; see Note 25.	N/A	2 hrs.		1			2
W-5-M-105	5"	Core: hollow concrete units; see Notes 29, 32, 35; Facings: both sides; see Note 25.	N/A	1 hr. 45 min.		1			1 3/4
W-5-M-106	5"	Core: hollow concrete units; see Notes 30, 34, 35; Facings: both sides; see Note 25.	N/A	1 hr.		1			1
W-5-M-107	5"	Core: 5" thick solid gypsum blocks; see Note 26; No facings.	N/A	4 hrs.		1			4
W-5-M-108	5"	Core: 4" thick hollow gypsum blocks; see Note 26; Facings: both sides; see Note 25.	N/A	3 hrs.		1			3
W-5-M-109	4"	Concrete with 4" x 4" No. 6 welded wire mesh at wall center.	100 psi	45 min.			43	2	3/4
W-4-M-110	4"	Concrete with 4" x 4" No. 6 welded wire mesh at wall center.	N/A	1 hr. 15 min.			43	2	1 1/4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

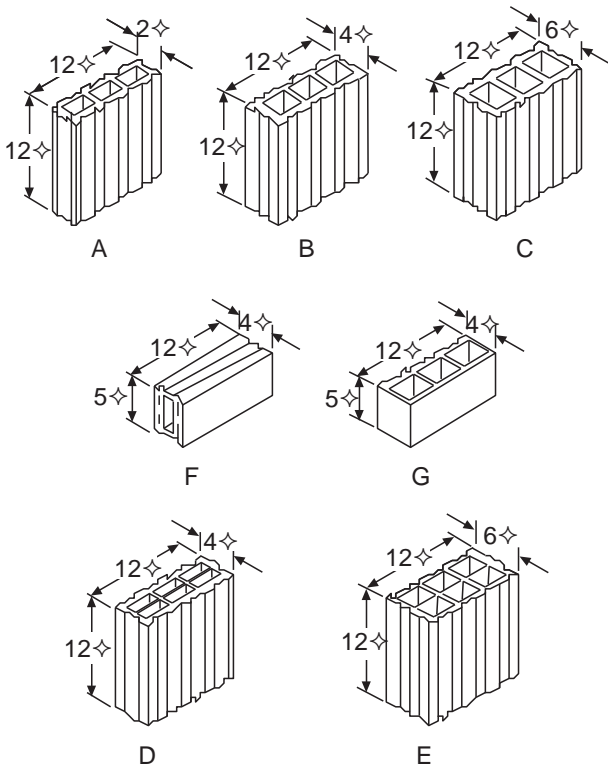
Notes:

1. Tested as NBS under ASA Spec. No. A 2-1934.
2. Failure mode—maximum temperature rise.
3. Treated at NBS under ASA Spec. No. 42-1934 (ASTM C19-53) except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for or reduced period as is contemporarily done.
4. For clay tile walls, unless the source the clay can be positively identified, it is suggested that the most pessimistic hour rating for the fire endurance of a clay tile partition of that thickness to be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
5. See appendix for construction and design details for clay tile walls.
6. Failure mode—flame thru or crack formation showing flames.
7. Hole formed at 25 minutes; partition collapsed at 42 minutes or removal from furnace.
8. Failure mode—collapse.
9. Hose stream pass.
10. Hose stream hole formed in specimen.
11. Load: 80 psi for gross wall cross sectional area.
12. One cell in wall thickness.
13. Two cells in wall thickness.

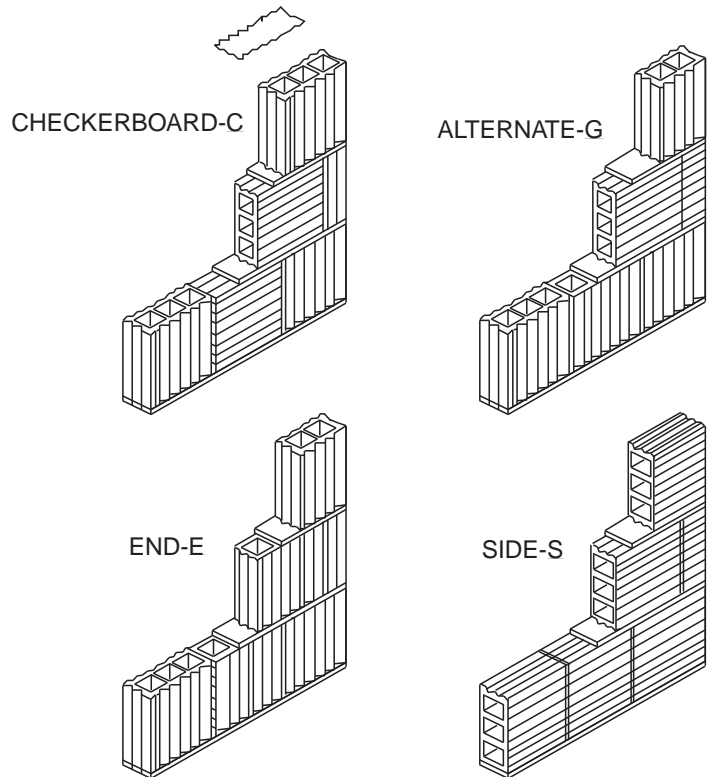
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TABLE 1.1.2—continued
MASONRY WALLS
4" TO LESS THAN 6" THICK

14. Double cells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than $\frac{5}{8}$ inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in Portland cement-lime mortar.
25. Minimum $\frac{1}{2}$ inch—1:3 sanded gypsum plaster.
26. Laid in 1:3 sanded gypsum mortar. Voids in hollow units not to exceed 30 percent.
27. Units of expanded slag or pumice aggregate.
28. Units of crushed limestone, blast furnace slag, cinders and expanded clay or shale.
29. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
30. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
31. Unit at least 49 percent solid.
32. Unit at least 62 percent solid.
33. Unit at least 65 percent solid.
34. Unit at least 73 percent solid.
35. Ratings based on one unit and one cell in wall thickness.
36. See Clay Tile Partition Design Construction drawings below.



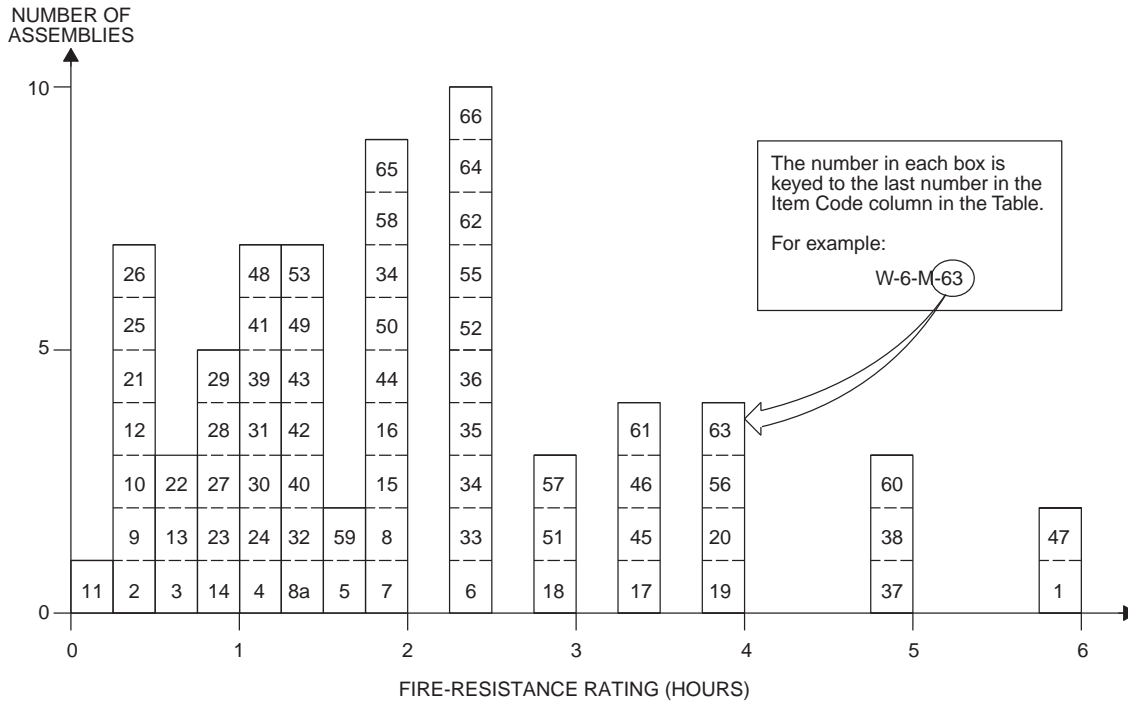
DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**FIGURE 1.1.3
MASONRY WALLS
6" TO LESS THAN 8" THICK**



**TABLE 1.1.3
MASONRY WALLS
6" TO LESS THAN 8" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-1	6"	Core: 5" thick, solid gypsum blocks laid in 1:3 sanded gypsum mortar; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	6 hrs.		1			6
W-6-M-2	6"	6" clay tile; Ohio fire clay; single cell thick; No plaster; Design "C," Construction "A."	N/A	17 min.			2	1, 3, 4, 6, 55	1/4
W-6-M-3	6"	6" clay tile; Illinois surface clay; double cell thick; No plaster; Design "E," Construction "C."	N/A	45 min.			2	1-4, 7, 55	3/4
W-6-M-4	6"	6" clay tile; New Jersey fire clay; double cell thick; No plaster; Design "E," Construction "S."	N/A	1 hr. 1 min.			2	1-4, 8, 55	1
W-7-M-5	7 1/4"	6" clay tile; Illinois surface clay; double cell thick; Plaster: 5/8"—1:3 sanded gypsum both faces; Design "E," Construction "A."	N/A	1 hr. 41 min.			2	1-4, 55	1 2/3
W-7-M-6	7 1/4"	6" clay tile; New Jersey fire clay; double cell thick; Plaster: 5/8"—1:3 sanded gypsum both faces; Design "E," Construction "S."	N/A	2 hrs. 23 min.			2	1-4, 9, 55	2 1/3
W-7-M-7	7 1/4"	6" clay tile; Ohio fire clay; single cell thick; Plaster: 5/8" sanded gypsum; 1:3 both faces; Design "C," Construction "A."	N/A	1 hr. 54 min.			2	1-4, 9, 55	2 3/4
W-7-M-8	7 1/4"	6" clay tile; Illinois surface clay; single cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "C," Construction "S."	N/A	2 hrs.			2	1, 3, 4, 9, 10, 55	2
W-7-M-8a	7 1/4"	6" clay tile; Illinois surface clay; single cell thick; Plaster: 5/8" sanded gypsum 1:3 both faces; Design "C," Construction "E."	N/A	1 hr. 23 min			2	1-4, 9, 10, 55	1 3/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.3—continued
MASONRY WALLS
6" TO LESS THAN 8" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-9	6"	Core: structural clay tile; see Notes 12, 16, 20; No facings.	N/A	20 min.		1		3, 5, 24	1/3
W-6-M-10	6"	Core: structural clay tile; see Notes 12, 17, 20; No facings.	N/A	25 min.		1		3, 5, 24	1/3
W-6-M-11	6"	Core: structural clay tile; see Notes 12, 16, 19; No facings.	N/A	15 min.		1		3, 5, 24	1/4
W-6-M-12	6"	Core: structural clay tile; see Notes 12, 17, 19; No facings.	N/A	20 min.		1		3, 5, 24	1/3
W-6-M-13	6"	Core: structural clay tile; see Notes 13, 16, 22; No facings.	N/A	45 min.		1		3, 5, 24	3/4
W-6-M-14	6"	Core: structural clay tile; see Notes 13, 17, 22; No facings.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-15	6"	Core: structural clay tile; see Notes 15, 17, 19; No facings.	N/A	2 hrs.		1		3, 5, 24	2
W-6-M-16	6"	Core: structural clay tile; see Notes 15, 16, 19; No facings.	N/A	2 hrs.		1		3, 5, 24	2
W-6-M-17	6"	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; No facings.	80 psi	3 hrs. 30 min.		1		5, 25	3 1/2
W-6-M-18	6"	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; No facings.	80 psi	3 hrs.		1		5, 25	3
W-6-M-19	6 1/2"	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; Facings: side 1; see Note 35.	80 psi	4 hrs.		1		5, 25	4
W-6-M-20	6 1/2"	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; Facings: side 1; see Note 35.	80 psi	4 hrs.		1		5, 25	4
W-6-M-21	6 5/8"	Core: structural clay tile; see Notes 12, 16, 20; Facings: unexposed face only; see Note 18.	N/A	30 min.		1		3, 5, 24	1/2
W-6-M-22	6 5/8"	Core: structural clay tile; see Notes 12, 17, 20; Facings: unexposed face only; see Note 18.	N/A	40 min.		1		3, 5, 24	2/3
W-6-M-23	6 5/8"	Core: structural clay tile; see Notes 12, 16, 20; Facings: exposed face only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-24	6 5/8"	Core: structural clay tile; see Notes 12, 17, 20; Facings: exposed face only; see Note 18.	N/A	1 hr. 5 min.		1		3, 5, 24	1
W-6-M-25	6 5/8"	Core: structural clay tile; see Notes 12, 16, 19; Facings: unexposed side only; see Note 18.	N/A	25 min.		1		3, 5, 24	1/3
W-6-M-26	6 5/8"	Core: structural clay tile; see Notes 12, 7, 19; Facings: unexposed face only; see Note 18.	N/A	30 min.		1		3, 5, 24	1/2
W-6-M-27	6 5/8"	Core: structural clay tile; see Notes 12, 16, 19; Facings: exposed side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-28	6 5/8"	Core: structural clay tile; see Notes 12, 17, 19; Facings: fire side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-29	6 5/8"	Core: structural clay tile; see Notes 13, 16, 22; Facings: unexposed side only; see Note 18.	N/A	1 hr.		1		3, 5, 24	1
W-6-M-30	6 5/8"	Core: structural clay tile; see Notes 13, 17, 22; Facings: unexposed side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	1 1/4
W-6-M-31	6 5/8"	Core: structural clay tile; see Notes 13, 16, 22; Facings: fire side only; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	1 1/4
W-6-M-32	6 5/8"	Core: structural clay tile; see Notes 13, 17, 22; Facings: fire side only; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	1 1/2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.3—continued
MASONRY WALLS
6" TO LESS THAN 8" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-33	6 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 16, 19; Facings: unexposed side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	2 ¹ / ₂
W-6-M-34	6 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 17, 19; Facings: unexposed side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	2 ¹ / ₂
W-6-M-35	6 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 16, 19; Facings: fire side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	2 ¹ / ₂
W-6-M-36	6 ⁵ / ₈ "	Core: structural clay tile; see Notes 15, 17, 19; Facings: fire side only; see Note 18.	N/A	2 hrs. 30 min.		1		3, 5, 24	2 ¹ / ₂
W-6-M-37	7"	Cored concrete masonry; see Notes 12, 34, 36, 38, 41; see Note 35 for facings on both sides.	80 psi	5 hrs.		1		5, 25	5
W-6-M-38	7"	Cored concrete masonry; see Notes 12, 33, 36, 38, 41; see Note 35 for facings.	80 psi	5 hrs.		1		5, 25	5
W-6-M-39	7 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 16, 20; Facings: both sides; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	1 ¹ / ₄
W-6-M-40	7 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 17, 20; Facings: both sides; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	1 ¹ / ₂
W-6-M-41	7 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 16, 19; Facings: both sides; see Note 18.	N/A	1 hr. 15 min.		1		3, 5, 24	1 ¹ / ₄
W-6-M-42	7 ¹ / ₄ "	Core: structural clay tile; see Notes 12, 17, 19; Facings: both sides; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	1 ¹ / ₂
W-7-M-43	7 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 16, 22; Facings: both sides of wall; see Note 18.	N/A	1 hr. 30 min.		1		3, 5, 24	1 ¹ / ₂
W-7-M-44	7 ¹ / ₄ "	Core: structural clay tile; see Notes 13, 17, 22; Facings: both sides of wall; see Note 18.	N/A	2 hrs.		1		3, 5, 24	1 ¹ / ₂
W-7-M-45	7 ¹ / ₄ "	Core: structural clay tile; see Notes 15, 16, 19; Facings: both sides; see Note 18.	N/A	3 hrs. 30 min.		1		3, 5, 24	3 ¹ / ₂
W-7-M-46	7 ¹ / ₄ "	Core: structural clay tile; see Notes 15, 17, 19; Facings: both sides; see Note 18.	N/A	3 hrs. 30 min.		1		3, 5, 24	3 ¹ / ₂
W-6-M-47	6"	Core: 5" thick solid gypsum blocks; see Note 45; Facings: both sides; see Note 45.	N/A	6 hrs.		1			6
W-6-M-48	6"	Core: hollow concrete units; see Notes 47, 50, 54; No facings.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-6-M-49	6"	Core: hollow concrete units; see Notes 46, 50, 54; No facings.	N/A	1 hr. 30 min.		1			1 ¹ / ₂
W-6-M-50	6"	Core: hollow concrete units; see Notes 46, 41, 54; No facings.	N/A	2 hrs.		1			2
W-6-M-51	6"	Core: hollow concrete units; see Notes 46, 53, 54; No facings.	N/A	3 hrs.		1			3
W-6-M-52	6"	Core: hollow concrete units; see Notes 47, 53, 54; No facings.	N/A	2 hrs. 30 min.		1			2 ¹ / ₂
W-6-M-53	6"	Core: hollow concrete units; see Notes 47, 51, 54; No facings.	N/A	1 hr. 30 min.		1			1 ¹ / ₂
W-6-M-54	6 ¹ / ₂ "	Core: hollow concrete units; see Notes 46, 50, 54; Facings: one side only; see Note 35.	N/A	2 hrs.		1			2
W-6-M-55	6 ¹ / ₂ "	Core: hollow concrete units; see Notes 4, 51, 54; Facings: one side; see Note 35.	N/A	2 hrs. 30 min.		1			2 ¹ / ₂
W-6-M-56	6 ¹ / ₂ "	Core: hollow concrete units; see Notes 46, 53, 54; Facings: one side; see Note 35.	N/A	4 hrs.		1			4

(continued)

TABLE 1.1.3—continued
MASONRY WALLS
6" TO LESS THAN 8" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-M-57	6½"	Core: hollow concrete units; see Notes 47, 53, 54; Facings: one side; see Note 35.	N/A	3 hrs.		1			3
W-6-M-58	6½"	Core: hollow concrete units; see Notes 47, 51, 54; Facings: one side; see Note 35.	N/A	2 hrs.		1			2
W-6-M-59	6½"	Core: hollow concrete units; see Notes 47, 50, 54; Facings: one side; see Note 35.	N/A	1 hr. 45 min.		1			1¾
W-7-M-60	7"	Core: hollow concrete units; see Notes 46, 53, 54; Facings: both sides; see Note 35.	N/A	5 hrs.		1			5
W-7-M-61	7"	Core: hollow concrete units; see Notes 46, 51, 54; Facings: both sides; see Note 35.	N/A	3 hrs. 30 min.		1			3½
W-7-M-62	7"	Core: hollow concrete units; see Notes 46, 50, 54; Facings: both sides; see Note 35.	N/A	2 hrs. 30 min.		1			2½
W-7-M-63	7"	Core: hollow concrete units; see Notes 47, 53, 54; Facings: both sides; see Note 35.	N/A	4 hrs.		1			4
W-7-M-64	7"	Core: hollow concrete units; see Notes 47, 51, 54; Facings: both sides; see Note 35.	N/A	2 hrs. 30 min.		1			2½
W-7-M-65	7"	Core: hollow concrete units; see Notes 47, 50, 54; Facings: both sides; see Note 35.	N/A	2 hrs.		1			2
W-6-M-66	6"	Concrete wall with 4" × 4" No. 6 wire fabric (welded) near wall center for reinforcement.	N/A	2 hrs. 30 min.			43	2	2½

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

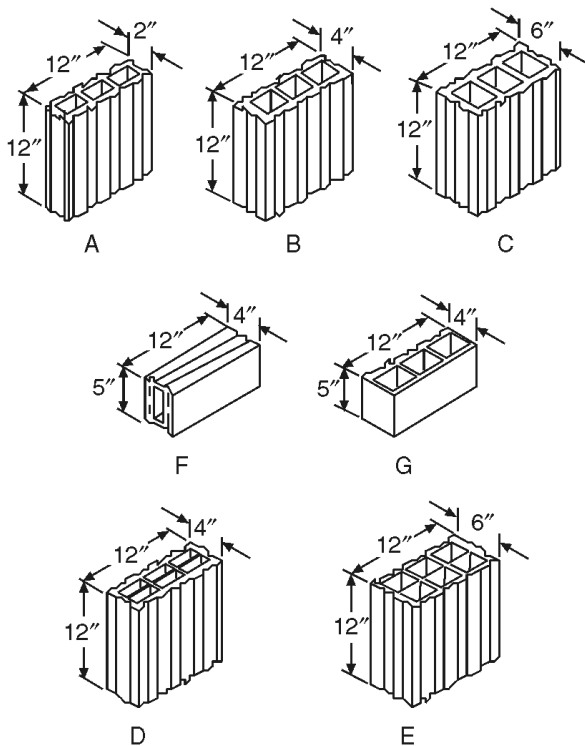
Notes:

1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C19-53) except that hose stream testing where carried out was run on test specimens exposed for full test duration, not for a reduced period as is contemporarily done.
2. Failure by thermal criteria—maximum temperature rise.
3. For clay tile walls, unless the source or density of the clay can be positively identified or determined, it is suggested that the lowest hourly rating for the fire endurance of a clay tile partition of that thickness be followed. Identified sources of clay showing longer fire endurance can lead to longer time recommendations.
4. See Note 55 for construction and design details for clay tile walls.
5. Tested at NBS under ASA Spec. No. A2-1934.
6. Failure mode—collapse.
7. Collapsed on removal from furnace at 1 hour 9 minutes.
8. Hose stream—failed.
9. Hose stream—passed.
10. No end point met in test.
11. Wall collapsed at 1 hour 28 minutes.
12. One cell in wall thickness.
13. Two cells in wall thickness.
14. Double shells plus one cell in wall thickness.
15. One cell in wall thickness, cells filled with broken tile, crushed stone, slag, cinders or sand mixed with mortar.
16. Dense hard-burned clay or shale tile.
17. Medium-burned clay tile.
18. Not less than 5/8 inch thickness of 1:3 sanded gypsum plaster.
19. Units of not less than 30 percent solid material.
20. Units of not less than 40 percent solid material.
21. Units of not less than 50 percent solid material.
22. Units of not less than 45 percent solid material.
23. Units of not less than 60 percent solid material.
24. All tiles laid in Portland cement-lime mortar.
25. Load: 80 psi for gross cross sectional area of wall.
26. Three cells in wall thickness.
27. Minimum percent of solid material in concrete units = 52.
28. Minimum percent of solid material in concrete units = 54.
29. Minimum percent of solid material in concrete units = 55.
30. Minimum percent of solid material in concrete units = 57.

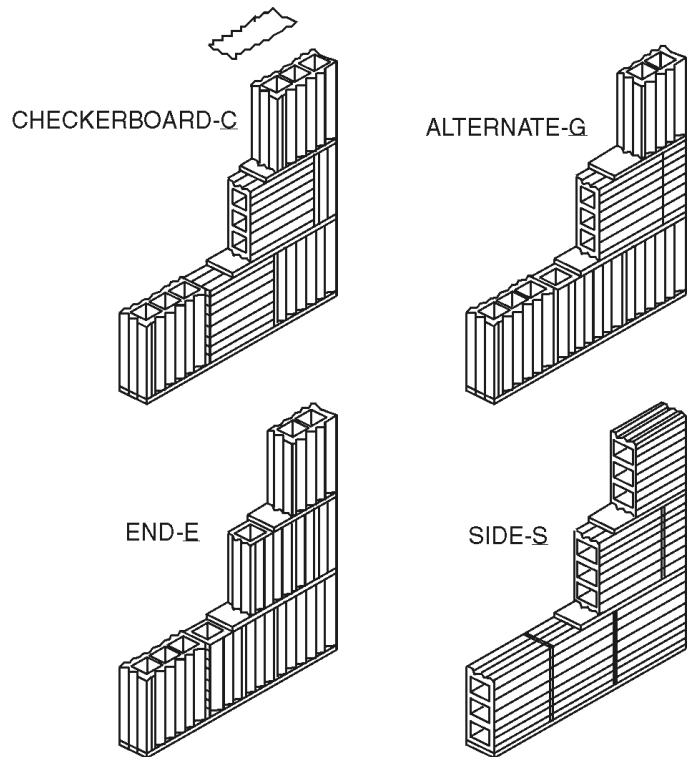
(continued)

TABLE 1.1.3—continued
MASONRY WALLS
6" TO LESS THAN 8" THICK

31. Minimum percent of solid material in concrete units = 62.
32. Minimum percent of solid material in concrete units = 65.
33. Minimum percent of solid material in concrete units = 70.
34. Minimum percent of solid material in concrete units = 76.
35. Not less than 1/2 inch of 1:3 sanded gypsum plaster.
36. Noncombustible or no members framed into wall.
37. Combustible members framed into wall.
38. One unit in wall thickness.
39. Two units in wall thickness.
40. Three units in wall thickness.
41. Concrete units made with expanded slag or pumice aggregates.
42. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
43. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
44. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
45. Laid in 1:3 sanded gypsum mortar.
46. Units of expanded slag or pumice aggregate.
47. Units of crushed limestone, blast furnace, slag, cinder and expanded clay or shale.
48. Units of calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
49. Units of siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
50. Unit minimum 49 percent solid.
51. Unit minimum 62 percent solid.
52. Unit minimum 65 percent solid.
53. Unit minimum 73 percent solid.
54. Ratings based on one unit and one cell in wall section.
55. See Clay Tile Partition Design Construction drawings below.

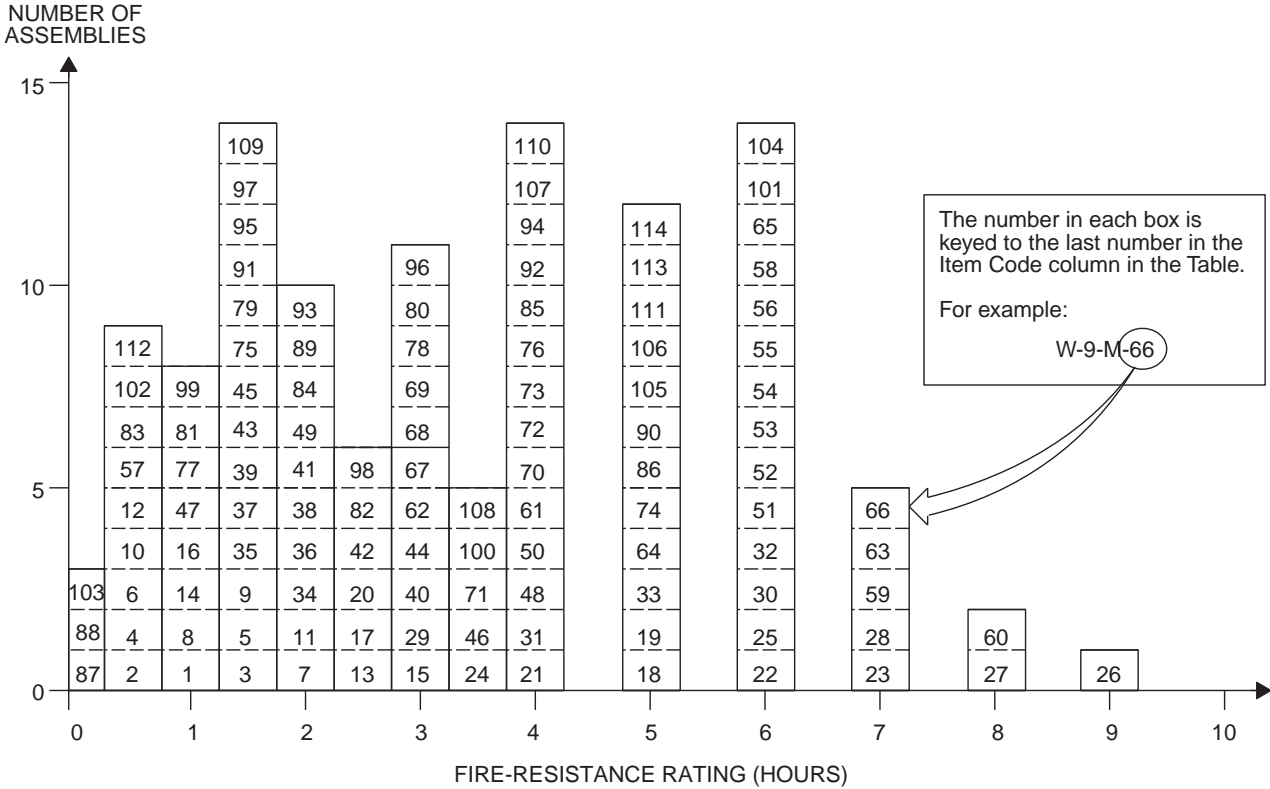


DESIGNS OF TILES USED IN FIRE-TEST PARTITIONS



THE FOUR TYPES OF CONSTRUCTION USED IN FIRE-TEST PARTITIONS

**FIGURE 1.1.4
MASONRY WALLS
8" TO LESS THAN 10" THICK**



**TABLE 1.1.4
MASONRY WALLS
8" TO LESS THAN 10" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-1	8"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40.	80 psi	1 hr. 15 min.		1		1, 20	1 ¹ / ₄
W-8-M-2	8"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; No facings; Result for wall with combustible members framed into interior.	80 psi	45 min.		1		1, 20	3/4
W-8-M-3	8"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43.	80 psi	1 hr. 30 min.		1		1, 20	1 ¹ / ₂
W-8-M-4	8"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; No facings; Combustible members framed into wall.	80 psi	45 min.		1		1, 20	3/4
W-8-M-5	8"	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 30 min.		1		1, 2, 5, 10, 18, 20, 21	1 ¹ / ₂
W-8-M-6	8"	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 5, 10, 19, 20, 21	3/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-7	8"	Core: clay or shale structural tile; No facings	See Notes	2 hrs.		1		1, 2, 5, 13, 18, 20, 21	2
W-8-M-8	8"	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 45 min.		1		1, 2, 5, 13, 19, 20, 21	1 ¹ / ₄
W-8-M-9	8"	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 15 min.		1		1, 2, 6, 9, 18, 20, 21	1 ³ / ₄
W-8-M-10	8"	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 6, 9, 19, 20, 21	³ / ₄
W-8-M-11	8"	Core: clay or shale structural tile; No facings.	See Notes	2 hrs.		1		1, 2, 6, 10, 18, 20, 21	2
W-8-M-12	8"	Core: clay or shale structural tile; No facings.	See Notes	45 min.		1		1, 2, 6, 10, 19, 20, 21	³ / ₄
W-8-M-13	8"	Core: clay or shale structural tile; No facings.	See Notes	2 hrs. 30 min.		1		1, 3, 6, 12, 18, 20, 21	2 ¹ / ₂
W-8-M-14	8"	Core: clay or shale structural tile; No facings.	See Notes	1 hr.		1		1, 2, 6, 12, 19, 20, 21	1
W-8-M-15	8"	Core: clay or shale structural tile; No facings.	See Notes	3 hrs.		1		1, 2, 6, 16, 18, 20, 21	3
W-8-M-16	8"	Core: clay or shale structural tile; No facings.	See Notes	1 hr. 15 min.		1		1, 2, 6, 16, 19, 20, 21	1 ¹ / ₄
W-8-M-17	8"	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; No facings.	See Notes	2 hrs. 30 min.		1		1, 44	2 ¹ / ₂
W-8-M-18	8"	Cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; No facings.	See Notes	5 hrs.		1		1, 45	5
W-8-M-19	8"	Core: solid clay or shale brick; No facings.	See Notes	5 hrs.		1		1, 22, 45	5
W-8-M-20	8"	Core: hollow rolok of clay or shale.	See Notes	2 hrs. 30 min.		1		1, 22, 45	2 ¹ / ₂
W-8-M-21	8"	Core: hollow rolok bak of clay or shale; No facings.	See Notes	4 hrs.		1		1, 45	4
W-8-M-22	8"	Core: concrete brick; No facings.	See Notes	6 hrs.		1		1, 45	6
W-8-M-23	8"	Core: sand-lime brick; No facings.	See Notes	7 hrs.		1		1, 45	7
W-8-M-24	8"	Core: 4", 40% solid clay or shale structural tile; 1 side 4" brick facing.	See Notes	3 hrs. 30 min.		1		1, 20	3 ¹ / ₂
W-8-M-25	8"	Concrete wall (3220 psi); Reinforcing vertical rods 1" from each face and 1" diameter; horizontal rods ⁵ / ₈ " diameter.	22,200 lbs./ft.	6 hrs.			7		6
W-8-M-26	8"	Core: sand-line brick; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	9 hrs.		1		1, 45	9
W-8-M-27	8 ¹ / ₂ "	Core: sand-line brick; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	8 hrs.		1		1, 45	8
W-8-M-28	8 ¹ / ₂ "	Core: concrete; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	7 hrs.		1		1, 45	7

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-29	8½"	Core: hollow rolok of clay or shale; ½" of 1:3 sanded gypsum plaster facings on one side.	See Notes	3 hrs.		1		1, 45	3
W-8-M-30	8½"	Core: solid clay or shale brick ½" thick, 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 22, 45,	6
W-8-M-31	8½"	Core: cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; ½" of 1:3 sanded gypsum plaster facings on both sides.	See Notes	4 hrs.		1		1, 44	4
W-8-M-32	8½"	Core: cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; ½" of 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 45	6
W-8-M-33	8½"	Core: hollow rolok bak of clay or shale; ½" of 1:3 sanded gypsum plaster facings on one side.	See Notes	5 hrs.		1		1, 45	5
W-8-M-34	8 ⁵ / ₈ "	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; ⁵ / ₈ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	2 hrs.		1		1, 20, 21	2
W-8-M-35	8 ⁵ / ₈ "	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; Exposed face: ⁵ / ₈ " of 1:3 sanded gypsum plaster.	See Notes	1 hr. 30 min.		1		1, 20, 21	1½
W-8-M-36	8 ⁵ / ₈ "	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; ⁵ / ₈ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	2 hrs.				1, 20, 21	2
W-8-M-37	8 ⁵ / ₈ "	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; ⁵ / ₈ " of 1:3 sanded gypsum plaster of the exposed face only.	See Notes	1 hr. 30 min.		1		1, 20, 21	1½
W-8-M-38	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: side 1; see Note 17.	See Notes	2 hrs.		1		1, 2, 5, 10, 18, 20, 21	2
W-8-M-39	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 5, 10, 19, 20, 21	1½
W-8-M-40	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	3 hrs.		1		1, 2, 5, 13, 18, 20, 21	3
W-8-M-41	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	2 hrs.		1		1, 2, 5, 13, 19, 20, 21	2
W-8-M-42	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: side 1; see Note 17.	See Notes	2 hrs. 30 min.		1		1, 2, 9, 18, 20, 21	2½
W-8-M-43	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 6, 9, 19, 20, 21	1½

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-44	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	3 hrs.		1		1, 2, 10, 18, 20, 21	3
W-8-M-45	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: fire side only; see Note 17.	See Notes	1 hr. 30 min.		1		1, 2, 6, 10, 19, 20, 21	1 ¹ / ₂
W-8-M-46	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	3 hrs. 30 min.		1		1, 2, 6, 12, 18, 20, 21	3 ¹ / ₂
W-8-M-47	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: exposed side only; see Note 17.	See Notes	1 hr. 45 min.		1		1, 2, 6, 12, 19, 20, 21	1 ³ / ₄
W-8-M-48	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: side 1, see Note 17; side 2, none.	See Notes	4 hrs.		1		1, 2, 6, 16, 18, 20, 21	4
W-8-M-49	8 ⁵ / ₈ "	Core: clay or shale structural tile; Facings: fire side only; see Note 17.	See Notes	2 hrs.		1		1, 2, 6, 16, 19, 20, 21	2
W-8-M-50	8 ⁵ / ₈ "	Core: 4", 40% solid clay or shale clay structural tile; 4" brick plus ⁵ / ₈ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	4 hrs.		1		1, 20	4
W-8-M-51	8 ³ / ₄ "	8 ³ / ₄ " × 2 ¹ / ₂ " and 4" × 2 ¹ / ₂ " cellular fletton (1873 psi) single and triple cell hollow brick set in ¹ / ₂ " sand mortar in alternate courses.	3.6 tons/ft.	6 hrs.			7	23, 29	6
W-8-M-52	8 ³ / ₄ "	8 ³ / ₄ " thick cement brick (2527 psi) with P.C. and sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-8-M-53	8 ³ / ₄ "	8 ³ / ₄ " × 2 ¹ / ₂ " fletton brick (1831 psi) in ¹ / ₂ " sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-8-M-54	8 ³ / ₄ "	8 ³ / ₄ " × 2 ¹ / ₂ " London stock brick (683 psi) in ¹ / ₂ " P.C. - sand mortar.	7.2 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-55	9"	9" × 2 ¹ / ₂ " Leicester red wire-cut brick (4465 psi) in ¹ / ₂ " P.C. - sand mortar.	6.0 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-56	9"	9" × 3" sand-lime brick (2603 psi) in ¹ / ₂ " P.C. - sand mortar.	3.6 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-57	9"	2 layers 2 ⁷ / ₈ " fletton brick (1910 psi) with 3 ¹ / ₄ " air space; Cement and sand mortar.	1.5 tons/ft.	32 min.			7	23, 25	1/3
W-9-M-58	9"	9" × 3" stairfoot brick (7527 psi) in ¹ / ₂ " sand-cement mortar.	7.2 tons/ft.	6 hrs.			7	23, 24	6
W-9-M-59	9"	Core: solid clay or shale brick; ¹ / ₂ " thick; 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 22, 45	7
W-9-M-60	9"	Core: concrete brick; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on both sides.	See Notes	8 hrs.		1		1, 45	8
W-9-M-61	9"	Core: hollow rolok of clay or shale; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on both sides.	See Notes	4 hrs.		1		1, 45	4
W-9-M-62	9"	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 1; Minimum % solids: 70; ¹ / ₂ " of 1:3 sanded gypsum plaster facings on one side.	See Notes	3 hrs.		1		1, 44	3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-M-63	9"	Cored clay or shale brick; Units in wall thickness: 2; Cells in wall thickness: 2; Minimum % solids: 87; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 45	7
W-9-M-64	9-10"	Core: cavity wall of clay or shale brick; No facings.	See Notes	5 hrs.		1		1, 45	5
W-9-M-65	9-10"	Core: cavity construction of clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on one side.	See Notes	6 hrs.		1		1, 45	6
W-9-M-66	9-10"	Core: cavity construction of clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	See Notes	7 hrs.		1		1, 45	7
W-9-M-67	9 1/4"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 40; 5/8" of 1:3 sanded gypsum plaster facings on both sides.	See Notes	3 hrs.		1		1, 20, 21	3
W-9-M-68	9 1/4"	Core: clay or shale structural tile; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids in units: 43; 5/8" of 1:3 sanded gypsum plaster facings on both sides.	See Notes	3 hrs.		1		1, 20, 21	3
W-9-M-69	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	3 hrs.		1		1, 2, 5, 10, 18, 20, 21	3
W-9-M-70	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 5, 13, 18, 20, 21	4
W-9-M-71	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	3 hrs. 30 min.		1		1, 2, 6, 9, 18, 20, 21	3 1/2
W-9-M-72	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 6, 10, 18, 20, 21	4
W-9-M-73	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	4 hrs.		1		1, 2, 6, 12, 18, 20, 21	4
W-9-M-74	9 1/4"	Core: clay or shale structural tile; Facings: sides 1 and 2; see Note 17.	See Notes	5 hrs.		1		1, 2, 6, 16, 18, 20, 21	5
W-9-M-75	8"	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1 1/2
W-8-M-76	8"	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; No facings	80 psi	4 hrs.		1		1, 20	4
W-8-M-77	8"	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 1/4
W-8-M-78	8"	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; No facings.	80 psi	3 hrs.		1		1, 20	3
W-8-M-79	8"	Cored concrete masonry; see Notes 2, 19, 26, 36, 42; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1 1/2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-80	8"	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; No facings.	80 psi	3 hrs.		1		1, 20	3
W-8-M-81	8"	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; No facings.	80 psi	1 hr.		1		1, 20	1
W-8-M-82	8"	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	2½
W-8-M-83	8"	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; No facings.	80 psi	45 min.		1		1, 20	¾
W-8-M-84	8"	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; No facings.	80 psi	2 hrs.		1		1, 20	2
W-8-M-85	8½"	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: 2¼" brick.	80 psi	4 hrs.		1		1, 20	4
W-8-M-86	8"	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: 3¾" brick face.	80 psi	5 hrs.		1		1, 20	5
W-8-M-87	8"	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; No facings.	80 psi	12 min.		1		1, 20	⅕
W-8-M-88	8"	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; No facings.	80 psi	12 min.		1		1, 20	⅕
W-8-M-89	8½"	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-8-M-90	8½"	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; Facings: side 1; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-91	8½"	Cored concrete masonry; see Notes 2, 19, 26, 31, 40; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	1¾
W-8-M-92	8½"	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; Facings: one side; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-93	8½"	Cored concrete masonry; see Notes 2, 19, 26, 36, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-8-M-94	8½"	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; Facings: fire side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-95	8½"	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; Facings: fire side only; see Note 38.	80 psi	1 hr. 30 min.		1		1, 20	1½
W-8-M-96	8½"	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: one side; see Note 38.	80 psi	3 hrs.				1, 20	3
W-8-M-97	8½"	Cored concrete masonry; see Notes 2, 19, 26, 29, 41; Facings: fire side only; see Note 38.	80 psi	1 hr. 30 min.		1		1, 20	1½
W-8-M-98	8½"	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; Facings: one side; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2½
W-8-M-99	8½"	Cored concrete masonry; see Notes 3, 19, 23, 27, 41; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1¼

(continued)

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-8-M-100	8½"	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3½
W-8-M-101	8½"	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; Facings: 3¾" brick face; one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-8-M-102	8½"	Cored concrete masonry; see Notes 2, 19, 26, 30, 43; Facings: fire side only; see Note 38.	80 psi	30 min.		1		1, 20	½
W-8-M-103	8½"	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; Facings: one side only; see Note 38.	80 psi	12 min.		1		1, 20	⅕
W-8-M-104	9"	Cored concrete masonry; see Notes 2, 18, 26, 34, 40; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-8-M-105	9"	Cored concrete masonry; see Notes 2, 18, 26, 31, 40; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-106	9"	Cored concrete masonry; see Notes 2, 18, 26, 36, 41; Facings: both sides of wall; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-107	9"	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: both sides; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-108	9"	Cored concrete masonry; see Notes 2, 18, 26, 29, 41; Facings: both sides; see Note 38.	80 psi	3 hrs. 30 min.		1		1, 20	3½
W-8-M-109	9"	Cored concrete masonry; see Notes 3, 19, 23, 27, 40; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	1¾
W-8-M-110	9"	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; Facings: one side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-8-M-111	9"	Cored concrete masonry; see Notes 3, 18, 26, 34, 41; 2¼" brick face on one side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-112	9"	Cored concrete masonry; see Notes 2, 18, 26, 30, 43; Facings: both sides; see Note 38.	80 psi	30 min.		1		1, 20	½
W-9-M-113	9½"	Cored concrete masonry; see Notes 3, 18, 23, 27, 41; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-8-M-114	8"		200 psi	5 hrs.			43	22	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

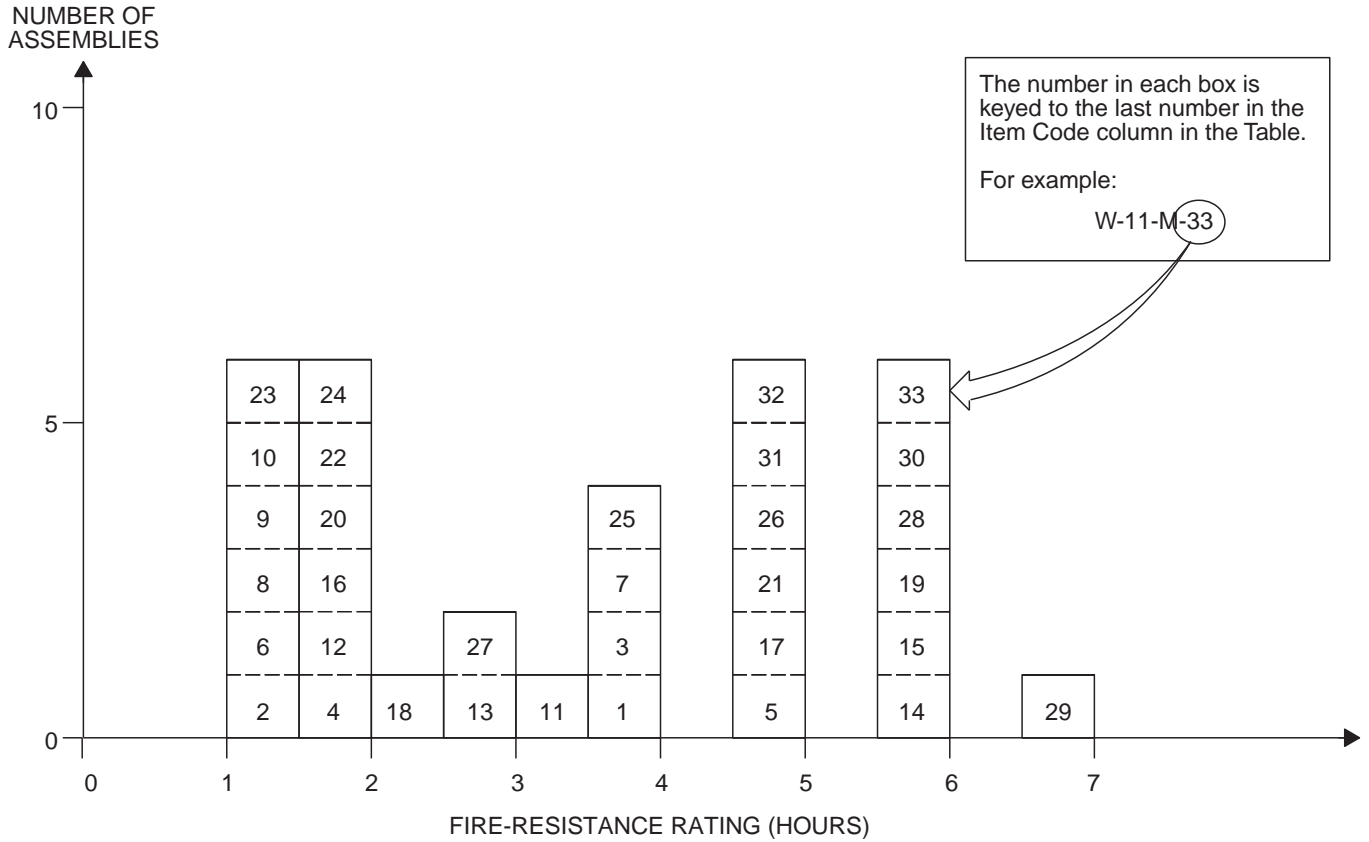
1. Tested at NBS under ASA Spec. No. 43-1934 (ASTM C19-53).
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than 5/8 inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.

(continued)

TABLE 1.1.4—continued
MASONRY WALLS
8" TO LESS THAN 10" THICK

19. Combustible members framed into wall.
20. Load: 80 psi for gross cross-sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52.
30. Minimum percent of solid material in concrete units = 54.
31. Minimum percent of solid material in concrete units = 55.
32. Minimum percent of solid material in concrete units = 57.
33. Minimum percent of solid material in concrete units = 60.
34. Minimum percent of solid material in concrete units = 62.
35. Minimum percent of solid material in concrete units = 65.
36. Minimum percent of solid material in concrete units = 70.
37. Minimum percent of solid material in concrete units = 76.
38. Not less than $\frac{1}{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert and dolomite.
44. Load: 120 psi for gross cross-sectional area of wall.
45. Load: 160 psi for gross cross-sectional area of wall.

**FIGURE 1.1.5
MASONRY WALLS
10" TO LESS THAN 12" THICK**



**TABLE 1.1.5
MASONRY WALLS
10" TO LESS THAN 12" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-1	10"	Core: two 3 ³ / ₄ ", 40% solid clay or shale structural tiles with 2" air space between; Facings: 3/4" Portland cement plaster on stucco on both sides.	80 psi	4 hrs.		1		1, 20	4
W-10-M-2	10"	Core: cored concrete masonry, 2" air cavity; see Notes 3, 19, 27, 34, 40; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1½
W-10-M-3	10"	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; No facings.	80 psi	4 hrs.		1		1, 20	4
W-10-M-4	10"	Cored concrete masonry; see Notes 2, 19, 26, 34, 40; No facings.	80 psi	2 hrs.		1		1, 20	2
W-10-M-5	10"	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; No facings.	80 psi	5 hrs.		1		1, 20	5
W-10-M-6	10"	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1½
W-10-M-7	10"	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; No facings.	80 psi	4 hrs.		1		1, 20	4
W-10-M-8	10"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 19, 27, 34, 42; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1¼

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.5—continued
MASONRY WALLS
10" TO LESS THAN 12" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-9	10"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 42; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 ¹ / ₄
W-10-M-10	10"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 19, 27, 34, 41; No facings.	80 psi	1 hr. 15 min.		1		1, 20	1 ¹ / ₄
W-10-M-11	10"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 41; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3 ¹ / ₂
W-10-M-12	10"	9" thick concrete block (11 ³ / ₄ " × 9" × 4 ¹ / ₄ ") with two 2" thick voids included; ³ / ₈ " P.C. plaster ¹ / ₈ " neat gypsum.	N/A	1 hr. 53 min.			7	23, 44	1 ³ / ₄
W-10-M-13	10"	Holly clay tile block wall - 8 ¹ / ₂ " block with two 3" voids in each 8 ¹ / ₂ " section; ³ / ₄ " gypsum plaster - each face.	N/A	2 hrs. 42 min.			7	23, 25	2 ¹ / ₂
W-10-M-14	10"	Two layers 4 ¹ / ₄ " brick with 1 ¹ / ₂ " air space; No ties sand cement mortar. (Fletton brick - 1910 psi).	N/A	6 hrs.			7	23, 24	6
W-10-M-15	10"	Two layers 4 ¹ / ₄ " thick Fletton brick (1910 psi); 1 ¹ / ₂ " air space; Ties: 18" o.c. vertical; 3' o.c. horizontal.	N/A	6 hrs.			7	23, 24	6
W-10-M-16	10 ¹ / ₂ "	Cored concrete masonry; 2" air cavity; see Notes 3, 19, 27, 34, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-17	10 ¹ / ₂ "	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; Facings: side 1 only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-10-M-18	10 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 19, 26, 33, 40; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 ¹ / ₂
W-10-M-19	10 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; Facings: one side; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-10-M-20	10 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 19, 26, 33, 41; Facings: fire side of wall only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-21	10 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; Facings: one side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-10-M-22	10 ¹ / ₂ "	Cored concrete masonry (cavity type 2" air space); see Notes 3, 19, 27, 34, 42; Facings: fire side only; see Note 38.	80 psi	1 hr. 45 min.		1		1, 20	1 ³ / ₄
W-10-M-23	10 ¹ / ₂ "	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 42; Facings: one side only; see Note 38.	80 psi	1 hr. 15 min.		1		1, 20	1 ¹ / ₄
W-10-M-24	10 ¹ / ₂ "	Cored concrete masonry (cavity type 2" air space); see Notes 3, 19, 27, 34, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-10-M-25	10 ¹ / ₂ "	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 41; Facings: one side only; see Note 38.	80 psi	4 hrs.		1		1, 20	4
W-10-M-26	10 ⁵ / ₈ "	Core: 8", 40% solid tile plus 2" furring tile; ⁵ / ₈ " sanded gypsum plaster between tile types; Facings: both sides ³ / ₄ " Portland cement plaster or stucco.	80 psi	5 hrs.		1		1, 20	5

(continued)

TABLE 1.1.5—continued
MASONRY WALLS
10" TO LESS THAN 12" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-10-M-27	10 ^{5/8} "	Core: 8", 40% solid tile plus 2" furring tile; 5/8" sanded gypsum plaster between tile types; Facings: one side 3/4" Portland cement plaster or stucco.	80 psi	3 hrs. 30 min.		1		1, 20	3 ^{1/2}
W-11-M-28	11"	Cored concrete masonry; see Notes 3, 18, 27, 34, 40; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-11-M-29	11"	Cored concrete masonry; see Notes 2, 18, 26, 33, 40; Facings: both sides; see Note 38.	80 psi	7 hrs.		1		1, 20	7
W-11-M-30	11"	Cored concrete masonry; see Notes 2, 18, 26, 33, 41; Facings: both sides of wall; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-11-M-31	11"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 42; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-11-M-32	11"	Cored concrete masonry (cavity type 2" air space); see Notes 3, 18, 27, 34, 41; Facings: both sides; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-11-M-33	11"	Two layers brick (4 ^{1/2} " Fletton, 2,428 psi) 2" air space; galvanized ties; 18" o.c. - horizontal; 3' o.c. - vertical.	3 tons/ft.	6 hrs.			7	23, 24	6

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

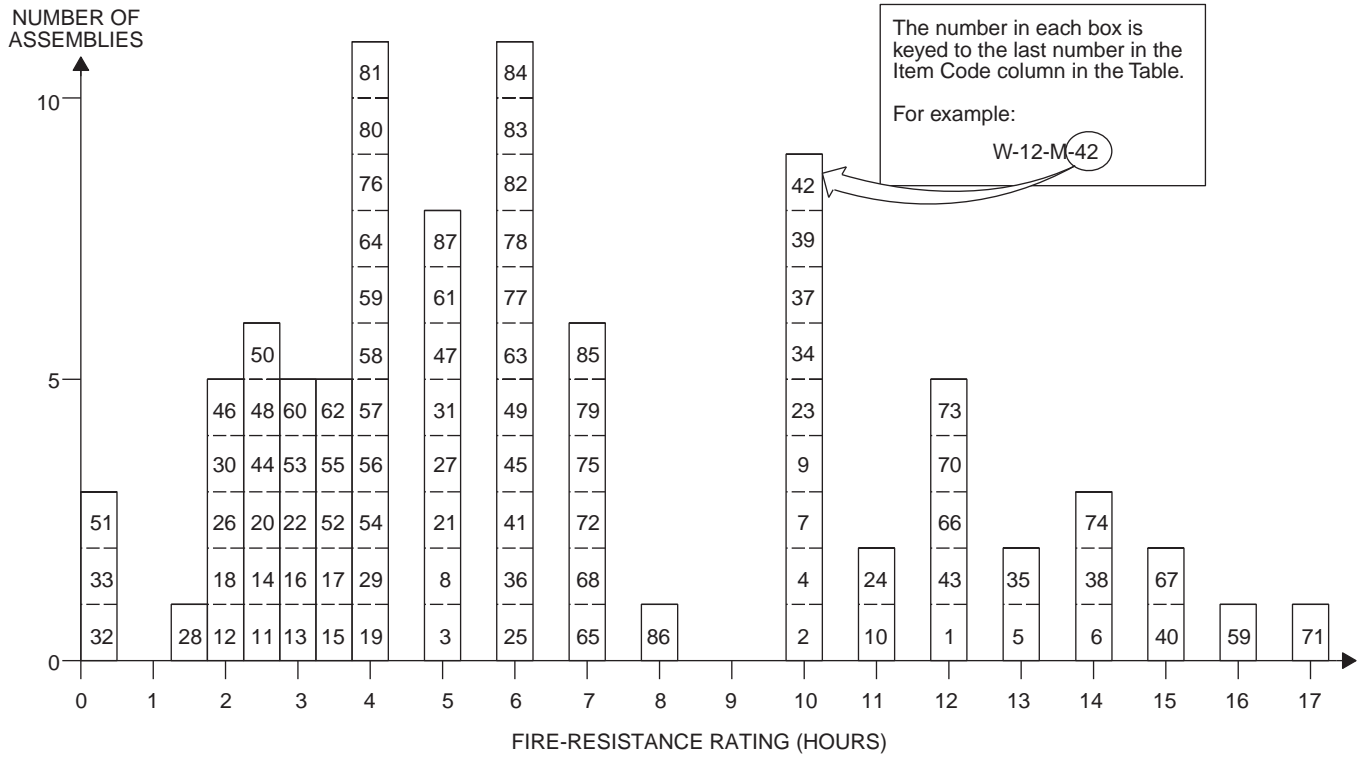
1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than 5/8 inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross cross sectional area of wall.
21. Portland cement-lime mortar.
22. Failure mode—thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.

(continued)

**TABLE 1.1.5—continued
MASONRY WALLS
10" TO LESS THAN 12" THICK**

36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than $\frac{1}{2}$ inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.

**FIGURE 1.1.6
MASONRY WALLS
12" TO LESS THAN 14" THICK**



**TABLE 1.1.6
MASONRY WALLS
12" TO LESS THAN 14" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-1	12"	Core: solid clay or shale brick; No facings.	N/A	12 hrs.		1		1	12
W-12-M-2	12"	Core: solid clay or shale brick; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-3	12"	Core: hollow rolok of clay or shale; No facings.	160 psi	5 hrs.		1		1, 44	5
W-12-M-4	12"	Core: hollow rolok bak of clay or shale; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-5	12"	Core: concrete brick; No facings.	160 psi	13 hrs.		1		1, 44	13
W-12-M-6	12"	Core: sand-lime brick; No facings.	N/A	14 hrs.		1		1	14
W-12-M-7	12"	Core: sand-lime brick; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-8	12"	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; No facings.	120 psi	5 hrs.		1		1, 45	5
W-12-M-9	12"	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; No facings.	160 psi	10 hrs.		1		1, 44	10
W-12-M-10	12"	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; No facings.	N/A	11 hrs.		1		1	11

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.6—continued
MASONRY WALLS
12" TO LESS THAN 14" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-11	12"	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; No facings.	80 psi	2 hrs.		1		1, 20	2½
W-12-M-12	12"	Core: clay or shale structural tile; see Notes 2, 4, 9, 19; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-13	12"	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-14	12"	Core: clay or shale structural tile; see Notes 2, 6, 14, 18; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	2½
W-12-M-15	12"	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3½
W-12-M-16	12"	Core: clay or shale structural tile; see Notes 2, 4, 13, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-17	12"	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; No facings.	80 psi	3 hrs. 30 min.		1		1, 20	3½
W-12-M-18	12"	Core: clay or shale structural tile; see Notes 3, 6, 9, 19; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-19	12"	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; No facings.	80 psi	4 hrs.		1		1, 20	4
W-12-M-20	12"	Core: clay or shale structural tile; see Notes 3, 6, 14, 19; No facings.	80 psi	2 hrs. 30 min.		1		1, 20	2½
W-12-M-21	12"	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-22	12"	Core: clay or shale structural tile; see Notes 3, 6, 16, 19; No facings.	80 psi	3 hrs.		1		1, 20	3
W-12-M-23	12"	Core: 8", 70% solid clay or shale structural tile; 4" brick facings on one side.	80 psi	10 hrs.		1		1, 20	10
W-12-M-24	12"	Core: 8", 70% solid clay or shale structural tile; 4" brick facings on one side.	N/A	11 hrs.		1		1	11
W-12-M-25	12"	Core: 8", 40% solid clay or shale structural tile; 4" brick facings on one side.	80 psi	6 hrs.		1		1, 20	6
W-12-M-26	12"	Cored concrete masonry; see Notes 1, 9, 15, 16, 20; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-27	12"	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-28	12"	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; No facings.	80 psi	1 hr. 30 min.		1		1, 20	1½
W-12-M-29	12"	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; No facings.	80 psi	4 hrs.		1		1, 20	4
W-12-M-30	12"	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; No facings.	80 psi	2 hrs.		1		1, 20	2
W-12-M-31	12"	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; No facings.	80 psi	5 hrs.		1		1, 20	5
W-12-M-32	12"	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; No facings.	80 psi	25 min.		1		1, 20	1/3
W-12-M-33	12"	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; No facings.	80 psi	25 min.		1		1, 20	1/3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.6—continued
MASONRY WALLS
12" TO LESS THAN 14" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-34	12 ¹ / ₂ "	Core: solid clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-35	12 ¹ / ₂ "	Core: solid clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on one side.	N/A	13 hrs.		1		1	13
W-12-M-36	12 ¹ / ₂ "	Core: hollow rolok of clay or shale; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	6 hrs.		1		1, 44	6
W-12-M-37	12 ¹ / ₂ "	Core: hollow rolok bak of clay or shale; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-38	12 ¹ / ₂ "	Core: concrete; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	14 hrs.		1		1, 44	14
W-12-M-39	12 ¹ / ₂ "	Core: sand-lime brick; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-40	12 ¹ / ₂ "	Core: sand-lime brick; 1/2" of 1:3 sanded gypsum plaster facings on one side.	N/A	15 hrs.		1		1	15
W-12-M-41	12 ¹ / ₂ "	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; 1/2" of 1:3 sanded gypsum plaster facings on one side.	120 psi	6 hrs.		1		1, 45	6
W-12-M-42	12 ¹ / ₂ "	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; 1/2" of 1:3 sanded gypsum plaster facings on one side.	160 psi	10 hrs.		1		1, 44	10
W-12-M-43	12 ¹ / ₂ "	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; 1/2" of 1:3 sanded gypsum plaster facings on one side.	N/A	12 hrs.		1		1	12
W-12-M-44	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 19, 26, 34, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 ¹ / ₂
W-12-M-45	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 18, 26, 34, 39, 41; Facings: one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-12-M-46	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 19, 26, 31, 41; Facings: fire side only; see Note 38.	80 psi	2 hrs.		1		1, 20	2
W-12-M-47	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; Facings: one side of wall only; see Note 38.	80 psi	5 hrs.		1		1, 20	5
W-12-M-48	12 ¹ / ₂ "	Cored concrete masonry; see Notes 3, 19, 27, 31, 43; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 ¹ / ₂
W-12-M-49	12 ¹ / ₂ "	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; Facings: one side only; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-12-M-50	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 19, 26, 32, 43; Facings: fire side only; see Note 38.	80 psi	2 hrs. 30 min.		1		1, 20	2 ¹ / ₂

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.6—continued
MASONRY WALLS
12" TO LESS THAN 14" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-12-M-51	12 ¹ / ₂ "	Cored concrete masonry; see Notes 2, 18, 26, 32, 43; Facings: one side only; see Note 38.	80 psi	25 min.		1		1, 20	1/3
W-12-M-52	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 2, 6, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	3 hrs. 30 min.		1		1, 20	3 ¹ / ₂
W-12-M-53	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 2, 6, 9, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs.		1		1, 20	3
W-12-M-54	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 2, 6, 14, 19; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-55	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 2, 6, 14, 18; Facings: exposed side only; see Note 17.	80 psi	3 hrs. 30 min.		1		1, 20	3 ¹ / ₂
W-12-M-56	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 2, 4, 13, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-57	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 1, 4, 13, 19; Facings: fire side only; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-12-M-58	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	4 hrs.		1		1, 20	4
W-12-M-59	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 9, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs.		1		1, 20	3
W-12-M-60	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 14, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	5 hrs.		1		1, 20	5
W-12-M-61	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 14, 19; Facings: fire side only; see Note 17.	80 psi	3 hrs. 30 min.		1		1, 20	3 ¹ / ₂
W-12-M-62	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 16, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs.		1		1, 20	6
W-12-M-63	12 ⁵ / ₈ "	Clay or shale structural tile; see Notes 3, 6, 16, 19; Facings: fire side only; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-12-M-64	12 ⁵ / ₈ "	Core: 8", 40% solid clay or shale structural tile; Facings: 4" brick plus 5/8" of 1:3 sanded gypsum plaster on one side.	80 psi	7 hrs.		1		1, 20	7
W-13-M-65	13"	Core: solid clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-66	13"	Core: solid clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs.		1		1, 20	15
W-13-M-67	13"	Core: solid clay or shale brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	15 hrs.		1		1	15
W-13-M-68	13"	Core: hollow rolok of clay or shale; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	80 psi	7 hrs.		1		1, 20	7
W-13-M-69	13"	Core: concrete brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	16 hrs.		1		1, 44	16

(continued)

TABLE 1.1.6—continued
MASONRY WALLS
12" TO LESS THAN 14" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-13-M-70	13"	Core: sand-lime brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-71	13"	Core: sand-lime brick; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	17 hrs.		1		1	17
W-13-M-72	13"	Cored clay or shale brick; Units in wall thickness: 1; Cells in wall thickness: 2; Minimum % solids: 70; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	120 psi	7 hrs.		1		1, 45	7
W-13-M-73	13"	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 3; Minimum % solids: 87; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	160 psi	12 hrs.		1		1, 44	12
W-13-M-74	13"	Cored clay or shale brick; Units in wall thickness: 3; Cells in wall thickness: 2; Minimum % solids: 87; 1/2" of 1:3 sanded gypsum plaster facings on both sides.	N/A	14 hrs.		1		1	14
W-13-M-75	13"	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; No facings.	80 psi	7 hrs.		1		1, 20	7
W-13-M-76	13"	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; No facings.	80 psi	4 hrs.		1		1, 20	4
W-13-M-77	13"	Cored concrete masonry; see Notes 3, 18, 27, 31, 43; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-13-M-78	13"	Cored concrete masonry; see Notes 2, 18, 26, 31, 41; Facings: both sides; see Note 38.	80 psi	6 hrs.		1		1, 20	6
W-13-M-79	13"	Cored concrete masonry; see Notes 2, 18, 26, 34, 41; Facings: both sides of wall; see Note 38.	80 psi	7 hrs.		1		1, 20	7
W-13-M-80	13 1/4"	Core: clay or shale structural tile; see Notes 2, 6, 9, 18; Facings: both sides; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-13-M-81	13 1/4"	Core: clay or shale structural tile; see Notes 2, 6, 14, 19; Facings: both sides; see Note 17.	80 psi	4 hrs.		1		1, 20	4
W-13-M-82	13 1/4"	Core: clay or shale structural tile; see Notes 2, 4, 13, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-83	13 1/4"	Core: clay or shale structural tile; see Notes 3, 6, 9, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-84	13 1/4"	Core: clay or shale structural tile; see Notes 3, 6, 14, 18; Facings: both sides; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-13-M-85	13 1/4"	Core: clay or shale structural tile; see Notes 3, 6, 16, 18; Facings: both sides; see Note 17.	80 psi	7 hrs.		1		1, 20	7

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.6—continued
MASONRY WALLS
12" TO LESS THAN 14" THICK

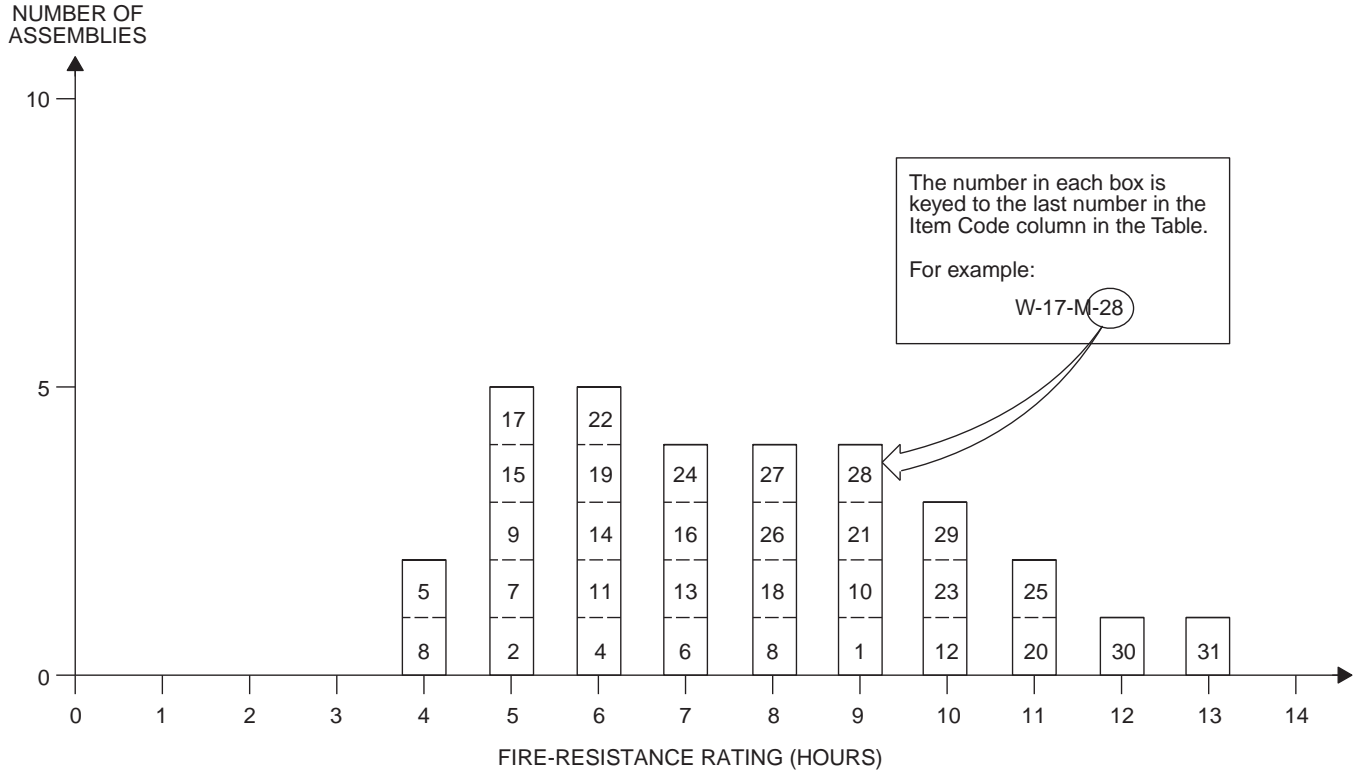
ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-13-M-86	13½"	Cored concrete masonry; see Notes 18, 23, 28, 39, 41; Facings: one side only; see Note 38.	80 psi	8 hrs.		1		1, 20	8
W-13-M-87	13½"	Cored concrete masonry; see Notes 19, 23, 28, 39, 41; Facings: fire side only; see Note 38.	80 psi	5 hrs.		1		1, 20	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than 5/8 inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode-thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than 1/2 inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.
44. Load: 160 psi of gross wall cross sectional area.
45. Load: 120 psi of gross wall cross sectional area.

**FIGURE 1.1.7
MASONRY WALLS
14" OR MORE THICK**



**TABLE 1.1.7
MASONRY WALLS
14" OR MORE THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-14-M-1	14"	Core: cored masonry; see Notes 18, 28, 33, 39, 41; Facings: both sides; see Note 38.	80 psi	9 hrs.		1		1, 20	9
W-16-M-2	16"	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; No facings.	80 psi	5 hrs.		1		1, 20	5
W-16-M-3	16"	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; No facings.	80 psi	4 hrs.		1		1, 20	4
W-16-M-4	16"	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; No facings.	80 psi	6 hrs.		1		1, 20	6
W-16-M-5	16"	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; No facings.	80 psi	4 hrs.		1		1, 20	4
W-16-M-6	16"	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; No facings.	80 psi	7 hrs.		1		1, 20	7
W-16-M-7	16"	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; No facings.	80 psi	5 hrs.		1		1, 20	5
W-16-M-8	16"	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; No facings.	80 psi	8 hrs.		1		1, 20	8
W-16-M-9	16"	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; No facings.	80 psi	5 hrs.		1		1, 20	5

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.1.7—continued
MASONRY WALLS
14" OR MORE THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-16-M-10	16"	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; No facings.	80 psi	9 hrs.		1		1, 20	9
W-16-M-11	16"	Core: clay or shale structural tile; see Notes 3, 7, 14, 18; No facings.	80 psi	6 hrs.		1		1, 20	6
W-16-M-12	16"	Core: clay or shale structural tile; see Notes 4, 8, 16, 18; No facings.	80 psi	10 hrs.		1		1, 20	10
W-16-M-13	16"	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; No facings.	80 psi	7 hrs.		1		1, 20	7
W-16-M-14	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	6 hrs.		1		1, 20	6
W-16-M-15	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 9, 19; Facings: fire side only; see Note 17.	80 psi	5 hrs.		1		1, 20	5
W-16-M-16	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	7 hrs.		1		1, 20	7
W-16-M-17	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 10, 19; Facings: fire side only; see Note 17.	80 psi	5 hrs.		1		1, 20	5
W-16-M-18	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	5 hrs.		1		1, 20	5
W-16-M-19	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 7, 11, 19; Facings: fire side only; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-16-M-20	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 8, 13, 18; Facings: sides 1 and 2; see Note 17.	80 psi	11 hrs.		1		1, 20	11
W-16-M-21	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 8, 13 18; Facings: side 1, see Note 17; side 2, none.	80 psi	9 hrs.		1		1, 20	9
W-16-M-22	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 8, 13, 19; Facings: fire side only; see Note 17.	80 psi	6 hrs.		1		1, 20	6
W-16-M-23	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	10 hrs.		1		1, 20	10
W-16-M-24	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 8, 15, 19; Facings: fire side only; see Note 17.	80 psi	7 hrs.		1		1, 20	7
W-16-M-25	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; Facings: side 1, see Note 17; side 2, none.	80 psi	11 hrs.		1		1, 20	11
W-16-M-26	16 ⁵ / ₈ "	Core: clay or shale structural tile; see Notes 4, 6, 16, 19; Facings: fire side only; see Note 17.	80 psi	8 hrs.		1		1, 20	8

(continued)

TABLE 1.1.7—continued
MASONRY WALLS
14" OR MORE THICK

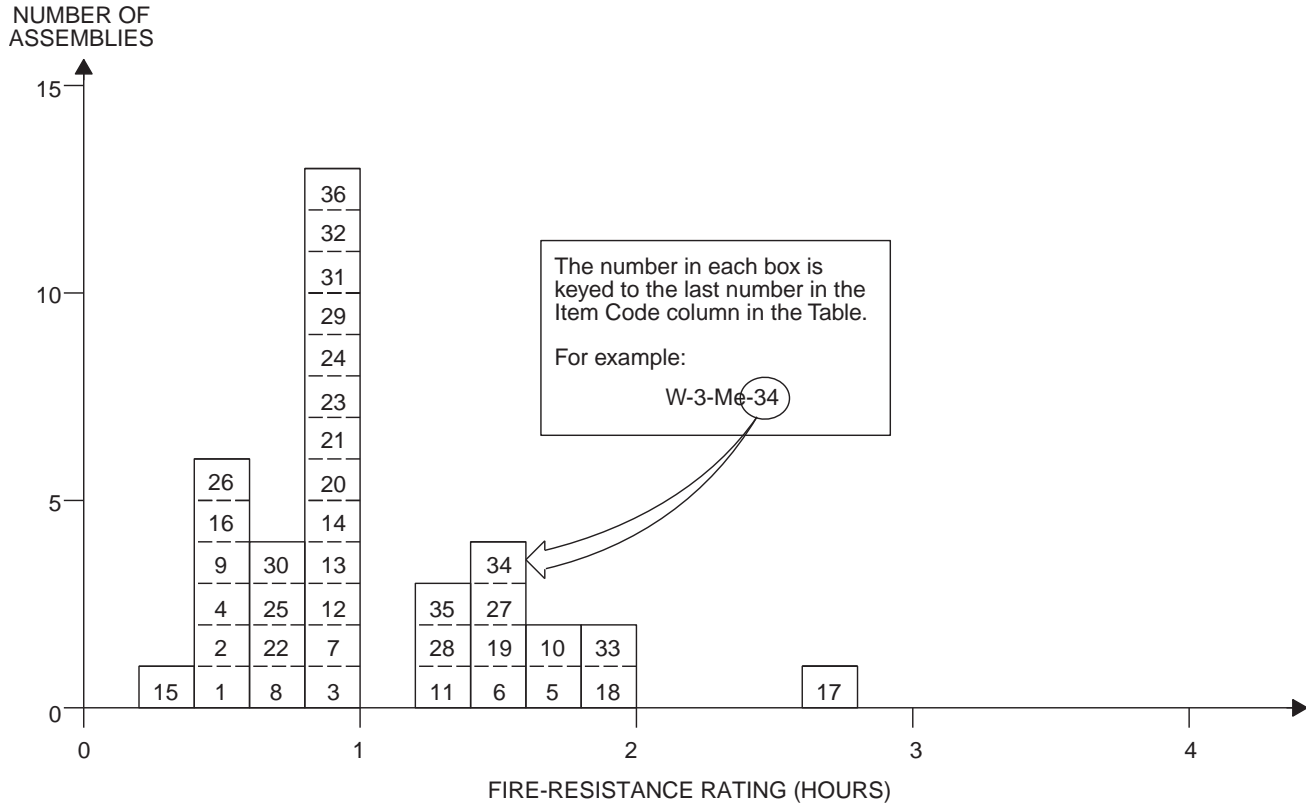
ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-17-M-27	17 ¹ / ₄ "	Core: clay or shale structural tile; see Notes 4, 7, 9, 18; Facings: sides 1 and 2; see Note 17.	80 psi	8 hrs.		1		1, 20	8
W-17-M-28	17 ¹ / ₄ "	Core: clay or shale structural tile; see Notes 4, 7, 10, 18; Facings: sides 1 and 2; see Note 17.	80 psi	9 hrs.		1		1, 20	9
W-17-M-29	17 ¹ / ₄ "	Core: clay or shale structural tile; see Notes 4, 7, 11, 18; Facings: sides 1 and 2; see Note 17.	80 psi	10 hrs.		1		1, 20	10
W-17-M-30	17 ¹ / ₄ "	Core: clay or shale structural tile; see Notes 4, 8, 15, 18; Facings: sides 1 and 2; see Note 17.	80 psi	12 hrs.		1		1, 20	12
W-17-M-31	17 ¹ / ₄ "	Core: clay or shale structural tile; see Notes 4, 6, 16, 18; Facings: sides 1 and 2; see Note 17.	80 psi	13 hrs.		1		1, 20	13

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Tested at NBS - ASA Spec. No. A2-1934.
2. One unit in wall thickness.
3. Two units in wall thickness.
4. Two or three units in wall thickness.
5. Two cells in wall thickness.
6. Three or four cells in wall thickness.
7. Four or five cells in wall thickness.
8. Five or six cells in wall thickness.
9. Minimum percent of solid materials in units = 40%.
10. Minimum percent of solid materials in units = 43%.
11. Minimum percent of solid materials in units = 46%.
12. Minimum percent of solid materials in units = 48%.
13. Minimum percent of solid materials in units = 49%.
14. Minimum percent of solid materials in units = 45%.
15. Minimum percent of solid materials in units = 51%.
16. Minimum percent of solid materials in units = 53%.
17. Not less than 5/8 inch thickness of 1:3 sanded gypsum plaster.
18. Noncombustible or no members framed into wall.
19. Combustible members framed into wall.
20. Load: 80 psi for gross area.
21. Portland cement-lime mortar.
22. Failure mode—thermal.
23. British test.
24. Passed all criteria.
25. Failed by sudden collapse with no preceding signs of impending failure.
26. One cell in wall thickness.
27. Two cells in wall thickness.
28. Three cells in wall thickness.
29. Minimum percent of solid material in concrete units = 52%.
30. Minimum percent of solid material in concrete units = 54%.
31. Minimum percent of solid material in concrete units = 55%.
32. Minimum percent of solid material in concrete units = 57%.
33. Minimum percent of solid material in concrete units = 60%.
34. Minimum percent of solid material in concrete units = 62%.
35. Minimum percent of solid material in concrete units = 65%.
36. Minimum percent of solid material in concrete units = 70%.
37. Minimum percent of solid material in concrete units = 76%.
38. Not less than 1/2 inch of 1:3 sanded gypsum plaster.
39. Three units in wall thickness.
40. Concrete units made with expanded slag or pumice aggregates.
41. Concrete units made with expanded burned clay or shale, crushed limestone, air cooled slag or cinders.
42. Concrete units made with calcareous sand and gravel. Coarse aggregate, 60 percent or more calcite and dolomite.
43. Concrete units made with siliceous sand and gravel. Ninety percent or more quartz, chert or flint.

**FIGURE 1.2.1
METAL FRAME WALLS
0" TO LESS THAN 4" THICK**



**TABLE 1.2.1
METAL FRAME WALLS
0" TO LESS THAN 4" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-1	3"	Core: steel channels having three rows of 4" x 1/8" staggered slots in web; core filled with heat expanded vermiculite weighing 1.5 lbs./ft. ² of wall area; Facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	25 min.		1			1/3
W-3-Me-2	3"	Core: steel channels having three rows of 4" x 1/8" staggered slots in web; core filled with heat expanded vermiculite weighing 2 lbs./ft. ² of wall area; Facings: sides 1 and 2, 18 gage steel, spot welded to core.	N/A	30 min.		1			1/2
W-3-Me-3	2 1/2"	Solid partition: 3/8" tension rods (vertical) 3' o.c. with metal lath; Scratch coat: cement/sand/lime plaster; Float coats: cement/sand/lime plaster; Finish coats: neat gypsum plaster.	N/A	1 hr.			7	1	1
W-2-Me-4	2"	Solid wall: steel channel per Note 1; 2" thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min.		1			1/2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.2.1—continued
METAL FRAME WALLS
0" TO LESS THAN 4" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-Me-5	2"	Solid wall: steel channel per Note 1; 2" thickness of neat gypsum plaster on metal lath.	N/A	1 hr. 45 min.		1			1 ³ / ₄
W-2-Me-6	2"	Solid wall: steel channel per Note 1; 2" thickness of 1:1 ¹ / ₂ ; 1:1 ¹ / ₂ gypsum plaster on metal lath.	N/A	1 hr. 30 min.		1			1 ¹ / ₂
W-2-Me-7	2"	Solid wall: steel channel per Note 2; 2" thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-2-Me-8	2"	Solid wall: steel channel per Note 1; 2" thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	45 min.		1			³ / ₄
W-2-Me-9	2 ¹ / ₄ "	Solid wall: steel channel per Note 2; 2 ¹ / ₄ " thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min.		1			¹ / ₂
W-2-Me-10	2 ¹ / ₄ "	Solid wall: steel channel per Note 2; 2 ¹ / ₄ " thickness of neat gypsum plaster on metal lath.	N/A	2 hrs.		1			2
W-2-Me-11	2 ¹ / ₄ "	Solid wall: steel channel per Note 2; 2 ¹ / ₄ " thickness of 1:1 ¹ / ₂ ; 1:1 ¹ / ₂ gypsum plaster on metal lath.	N/A	1 hr. 45 min.		1			1 ³ / ₄
W-2-Me-12	2 ¹ / ₄ "	Solid wall: steel channel per Note 2; 2 ¹ / ₄ " thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-2-Me-13	2 ¹ / ₄ "	Solid wall: steel channel per Note 2; 2 ¹ / ₄ " thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-2-Me-14	2 ¹ / ₂ "	Solid wall: steel channel per Note 1; 2 ¹ / ₂ " thickness of 4.5:1:7; 4.5:1:7 Portland cement, sawdust and sand sprayed on wire mesh; see Note 3.	N/A	1 hr.		1			1
W-2-Me-15	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:4; 1:4 Portland cement sprayed on wire mesh; see Note 3.	N/A	20 min.		1			¹ / ₃
W-2-Me-16	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:2; 1:3 Portland cement on metal lath.	N/A	30 min.		1			¹ / ₂
W-2-Me-17	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of neat gypsum plaster on metal lath.	N/A	2 hrs. 30 min.		1			2 ¹ / ₂
W-2-Me-18	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:1 ¹ / ₂ ; 1:1 ¹ / ₂ gypsum plaster on metal lath.	N/A	2 hrs.		1			2
W-2-Me-19	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:1; 1:1 gypsum plaster on metal lath.	N/A	1 hr. 30 min.		1			1 ¹ / ₂

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.2.1—continued
METAL FRAME WALLS
0" TO LESS THAN 4" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-2-Me-20	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:2; 1:2 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-2-Me-21	2 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:2; 1:3 gypsum plaster on metal lath.	N/A	1 hr.		1			1
W-3-Me-22	3"	Core: steel channel per Note 2; 1:2; 1:2 gypsum plaster on ³ / ₄ " soft asbestos lath; plaster thickness 2".	N/A	45 min.		1			³ / ₄
W-3-Me-23	3 ¹ / ₂ "	Solid wall: steel channel per Note 2; 2 ¹ / ₂ " thickness of 1:2; 1:2 gypsum plaster on ³ / ₄ " asbestos lath.	N/A	1 hr.		1			1
W-3-Me-24	3 ¹ / ₂ "	Solid wall: steel channel per Note 2; lath over and 1:2 ¹ / ₂ ; 1:2 ¹ / ₂ gypsum plaster on 1" magnesium oxysulfate wood fiberboard; plaster thickness 2 ¹ / ₂ ".	N/A	1 hr.		1			1
W-3-Me-25	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: ³ / ₄ " thickness of 1: ¹ / ₃₀ :2; 1: ¹ / ₃₀ : 3 Portland cement and asbestos fiber plaster.	N/A	45 min.		1			³ / ₄
W-3-Me-26	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: both sides ³ / ₄ " thickness of 1:2; 1:3 Portland cement.	N/A	30 min.		1			¹ / ₂
W-3-Me-27	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: both sides ³ / ₄ " thickness of neat gypsum plaster.	N/A	1 hr. 30 min.		1			1 ¹ / ₂
W-3-Me-28	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: both sides ³ / ₄ " thickness of 1: ¹ / ₂ ; 1: ¹ / ₂ gypsum plaster.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-3-Me-29	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: both sides ³ / ₄ " thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr.		1			1
W-3-Me-30	3 ¹ / ₂ "	Core: steel studs; see Note 4; Facings: both sides ³ / ₄ " thickness of 1:2; 1:3 gypsum plaster.	N/A	45 min.		1			³ / ₄
W-3-Me-31	3 ³ / ₄ "	Core: steel studs; see Note 4; Facings: both sides ⁷ / ₈ " thickness of 1: ¹ / ₃₀ : 2; 1: ¹ / ₃₀ : 3 Portland cement and asbestos fiber plaster.	N/A	1 hr.		1			1
W-3-Me-32	3 ³ / ₄ "	Core: steel studs; see Note 4; Facings: both sides ⁷ / ₈ " thickness of 1:2; 1:3 Portland cement.	N/A	45 min.		1			³ / ₄
W-3-Me-33	3 ³ / ₄ "	Core: steel studs; see Note 4; Facings: both sides ⁷ / ₈ " thickness of neat gypsum plaster.	N/A	2 hrs.		1			2
W-3-Me-34	3 ³ / ₄ "	Core: steel studs; see Note 4; Facings: both sides ⁷ / ₈ " thickness of 1: ¹ / ₂ ; 1: ¹ / ₂ gypsum plaster.	N/A	1 hr. 30 min.		1			1 ¹ / ₂

(continued)

**TABLE 1.2.1—continued
METAL FRAME WALLS
0" TO LESS THAN 4" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Me-35	3 ³ / ₄ "	Core: steel studs; see Note 4; Facings: both sides ⁷ / ₈ " thickness of 1:2; 1:2 gypsum plaster.	N/A	1 hr. 15 min.		1			1 ¹ / ₄
W-3-Me-36	3 ³ / ₄ "	Core: steel; see Note 4; Facings: ⁷ / ₈ " thickness of 1:2; 1:3 gypsum plaster on both sides.	N/A	1 hr.		1			1

For SI: 1 inch = 25.4 mm.

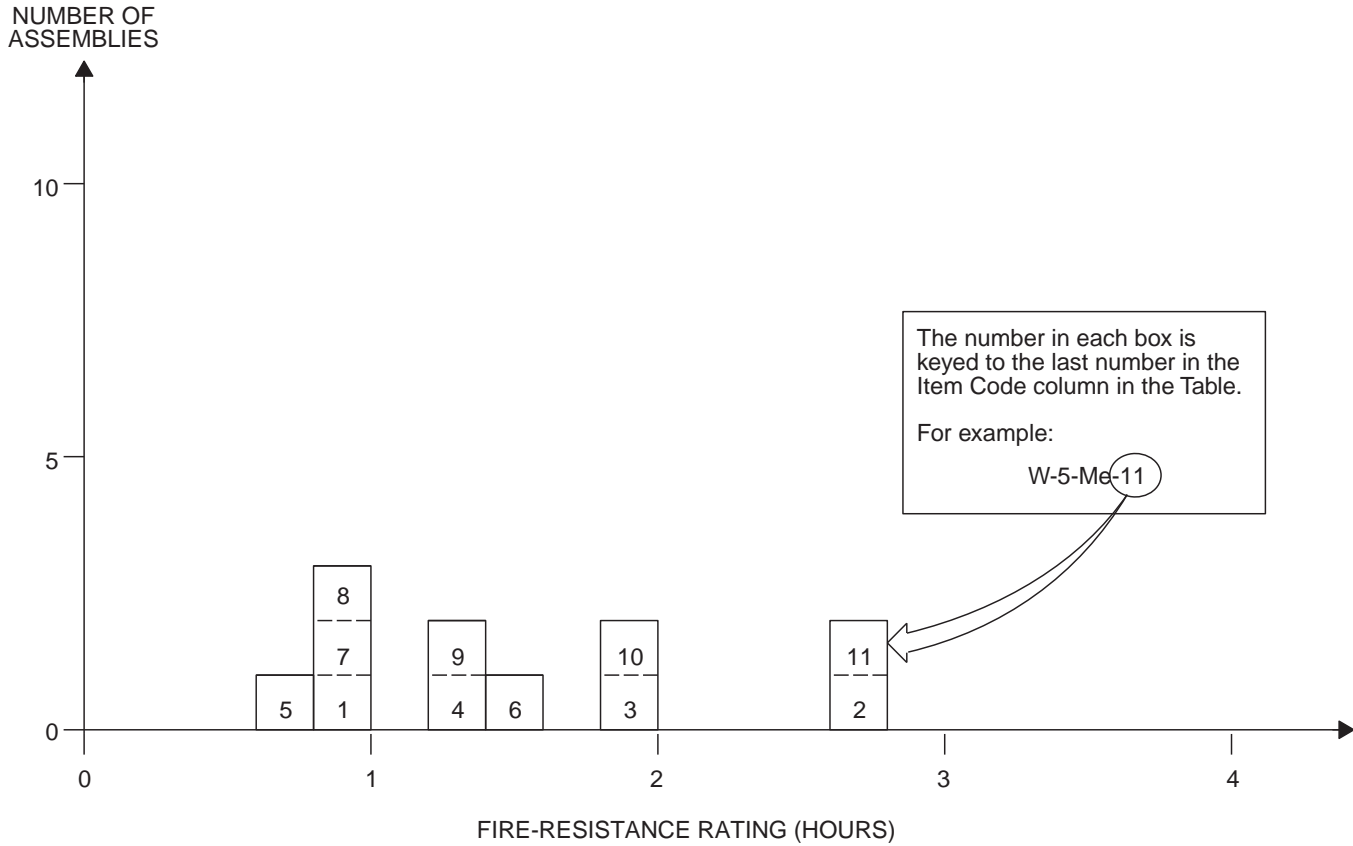
Notes:

1. Failure mode—local temperature rise—back face.
2. Three-fourths inch or 1 inch channel framing—hot-rolled or strip-steel channels.
3. Reinforcement is 4-inch square mesh of No. 6 wire welded at intersections (no channels).
4. Ratings are for any usual type of nonload-bearing metal framing providing 2 inches (or more) air space.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross-sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

**FIGURE 1.2.2
METAL FRAME WALLS
4" TO LESS THAN 6" THICK**



**TABLE 1.2.2
METAL FRAME WALLS
4" TO LESS THAN 6" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-Me-1	5 1/2"	3" cavity with 16 ga. channel studs (3 1/2" o.c.) of 1/2" x 1/2" channel and 3" spacer; Metal lath on ribs with plaster (three coats) 3/4" over face of lath; Plaster (each side): scratch coat, cement/lime/sand with hair; float coat, cement/lime/sand; finish coat, neat gypsum.	N/A	1 hr. 11 min.			7	1	1
W-4-Me-2	4"	Core: steel studs; see Note 2; Facings: both sides 1" thickness of neat gypsum plaster.	N/A	2 hrs. 30 min.		1			2 1/2
W-4-Me-3	4"	Core: steel studs; see Note 2; Facings: both sides 1" thickness of 1:1/2; 1:1/2 gypsum plaster.	N/A	2 hrs.		1			2
W-4-Me-4	4"	Core: steel; see Note 2; Facings: both sides 1" thickness of 1:2; 1:3 gypsum plaster.	N/A	1 hr. 15 min.		1			1 1/4
W-4-Me-5	4 1/2"	Core: lightweight steel studs 3" in depth; Facings: both sides 3/4" thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat applied on metal lath.	See Note 4	45 min.		1		5	3/4

(continued)

TABLE 1.2.2—continued
METAL FRAME WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-Me-6	4½"	Core: lightweight steel studs 3" in depth; Facings: both sides ¾" thick neat gypsum plaster on metal lath.	See Note 4	1 hr. 30 min.		1		5	1½
W-4-Me-7	4½"	Core: lightweight steel studs 3" in depth; Facings: both sides ¾" thick sanded gypsum plaster, 1:2 scratch and brown coats applied on metal lath.	See Note 4	1 hr.		1		5	1
W-4-Me-8	4¾"	Core: lightweight steel studs 3" in depth; Facings: both sides 7/8" thick sanded gypsum plaster, 1:2 scratch coat, 1:3 brown coat, applied on metal lath.	See Note 4	1 hr.		1		5	1
W-4-Me-9	4¾"	Core: lightweight steel studs 3" in depth; Facings: both sides 7/8" thick sanded gypsum plaster, 1:2 scratch and 1:3 brown coats applied on metal lath.	See Note 4	1 hr. 15 min.		1		5	1¼
W-5-Me-10	5"	Core: lightweight steel studs 3" in depth; Facings: both sides 1" thick neat gypsum plaster on metal lath.	See Note 4	2 hrs.		1		5	2
W-5-Me-11	5"	Core: lightweight steel studs 3" in depth; Facings: both sides 1" thick neat gypsum plaster on metal lath.	See Note 4	2 hrs. 30 min.		1		5, 6	2½

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Failure mode—local back face temperature rise.
2. Ratings are for any usual type of nonbearing metal framing providing a minimum 2 inches air space.
3. Facing materials secured to lightweight steel studs not less than 3 inches deep.
4. Rating based on loading to develop a maximum stress of 7270 psi for net area of each stud.
5. Spacing of steel studs must be sufficient to develop adequate rigidity in the metal-lath or gypsum-plaster base.
6. As per Note 4 but load/stud not to exceed 5120 psi.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

**TABLE 1.2.3
METAL FRAME WALLS
6" TO LESS THAN 8" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-Me-1	6 ⁵ / ₈ "	On one side of 1" magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1" air space, 3 ³ / ₄ " brick secured with metal ties to steel frame every fifth course; Inside facing of 7/8" 1:2 sanded gypsum plaster on metal lath secured directly to studs; Plaster side exposed to fire.	See Note 2	1 hr. 45 min.		1		1	1 ³ / ₄
W-6-Me-2	6 ⁵ / ₈ "	On one side of 1" magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1" air space, 3 ³ / ₄ " brick secured with metal ties to steel frame every fifth course; Inside facing of 7/8" 1:2 sanded gypsum plaster on metal lath secured directly to studs; Brick face exposed to fire.	See Note 2	4 hrs.		1		1	4
W-6-Me-3	6 ⁵ / ₈ "	On one side of 1" magnesium oxysulfate wood fiberboard sheathing attached to steel studs (see Notes 1 and 2), 1" air space, 3 ³ / ₄ " brick secured with metal ties to steel frame every fifth course; Inside facing of 7/8" vermiculite plaster on metal lath secured directly to studs; Plaster side exposed to fire.	See Note 2	2 hrs.		1		1	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs (minimum 3 inches deep) used. Stud spacing dependent on loading, but in each case, spacing is to be such that adequate rigidity is provided to the metal lath plaster base.
2. Load is such that stress developed in studs is not greater than 5120 psi calculated from net stud area.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

**TABLE 1.2.4
METAL FRAME WALLS
8" TO LESS THAN 10" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-9-Me-1	9 ¹ / ₁₆ "	On one side of 1/2" wood fiberboard sheathing next to studs, 3/4" air space formed with 3/4" x 1 ⁵ / ₈ " wood strips placed over the fiberboard and secured to the studs, paper backed wire lath nailed to strips 3 ³ / ₄ " brick veneer held in place by filling a 3/4" space between the brick and paper backed lath with mortar; Inside facing of 3/4" neat gypsum plaster on metal lath attached to 5/16" plywood strips secured to edges of steel studs; Rated as combustible because of the sheathing; See Notes 1 and 2; Plaster exposed.	See Note 2	1 hr. 45 min.		1		1	1 ³ / ₄
W-9-Me-2	9 ¹ / ₁₆ "	Same as above with brick exposed.	See Note 2	4 hrs.		1		1	4
W-8-Me-3	8 ¹ / ₂ "	On one side of paper backed wire lath attached to studs and 3 ³ / ₄ " brick veneer held in place by filling a 1" space between the brick and lath with mortar; Inside facing of 1" paper-enclosed mineral wool blanket weighing 0.6 lb./ft. ² attached to studs, metal lath or paper backed wire lath laid over the blanket and attached to the studs, 3/4" sanded gypsum plaster 1:2 for the scratch coat and 1:3 for the brown coat; See Notes 1 and 2; Plaster face exposed.	See Note 2	4 hrs.		1		1	4
W-8-Me-4	8 ¹ / ₂ "	Same as above with brick exposed.	See Note 2	5 hrs.		1		1	5

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Lightweight steel studs ≥ 3 inches in depth. Stud spacing dependent on loading, but in any case, the spacing is to be such that adequate rigidity is provided to the metal-lath plaster base.
2. Load is such that stress developed in studs is ≤ 5120 psi calculated from the net area of the stud.

General Note:

The construction details of the wall assemblies are as complete as the source documentation will permit. Data on the method of attachment of facings and the gauge of steel studs was provided when known. The cross sectional area of the steel stud can be computed, thereby permitting a reasoned estimate of actual loading conditions. For load-bearing assemblies, the maximum allowable stress for the steel studs has been provided in the table "Notes." More often, it is the thermal properties of the facing materials, rather than the specific gauge of the steel, that will determine the degree of fire resistance. This is particularly true for nonbearing wall assemblies.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 1.3.1
WOOD FRAME WALLS
0" TO LESS THAN 4" THICK**

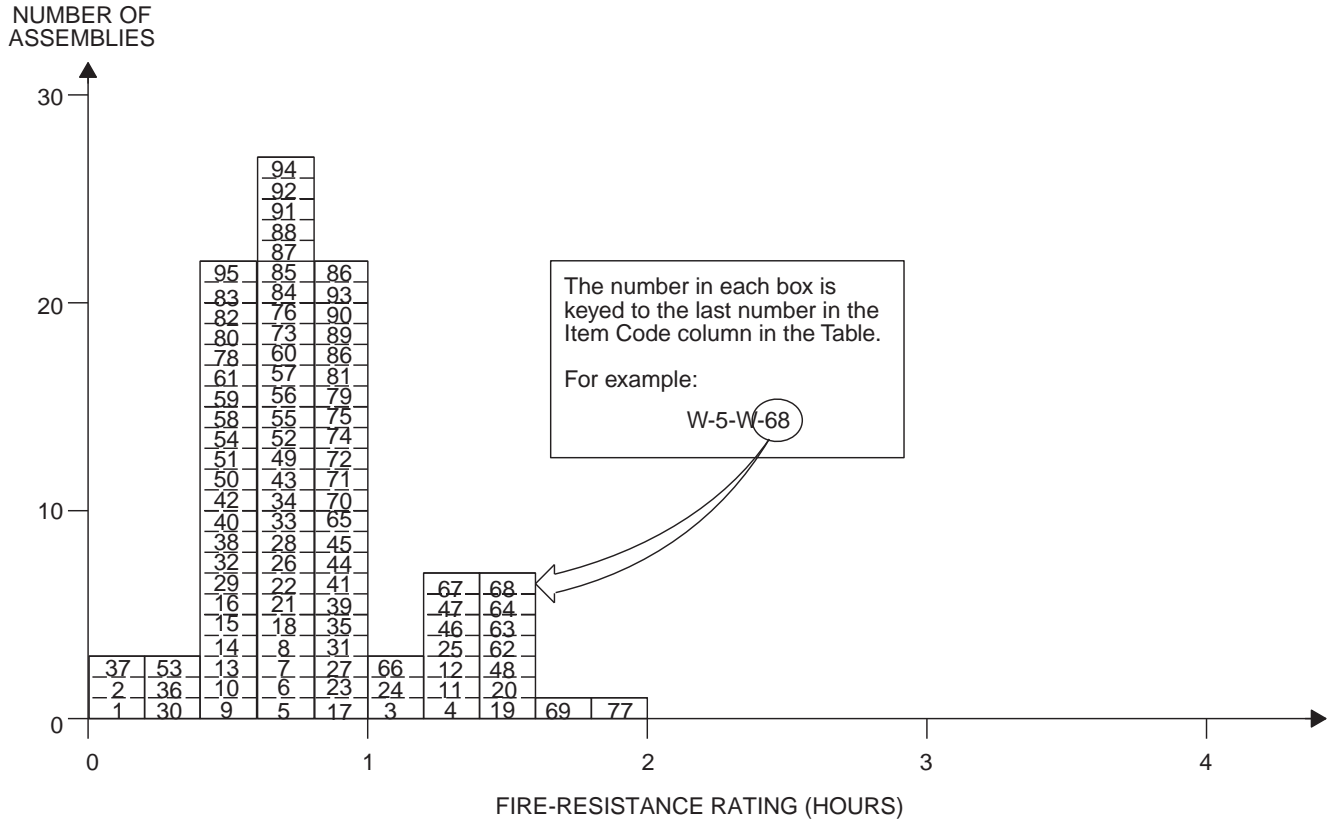
ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-W-1	3 ³ / ₄ "	Solid wall: 2 ¹ / ₄ " wood-wool slab core; 3 ³ / ₄ " gypsum plaster each side.	N/A	2 hrs.			7	1, 6	2
W-3-W-2	3 ⁷ / ₈ "	2 × 4 stud wall; 3 ¹ / ₁₆ " thick cement asbestos board on both sides of wall.	360 psi net area	10 min.		1		2-5	1 ¹ / ₆
W-3-W-3	3 ⁷ / ₈ "	Same as W-3-W-2 but stud cavities filled with 1 lb./ft. ² mineral wool batts.	360 psi net area	40 min.		1		2-5	2 ² / ₃

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa.

Notes:

1. Achieved "Grade C" fire resistance (British).
2. Nominal 2 × 4 wood studs of No. 1 common or better lumber set edgewise, 2 × 4 plates at top and bottom and blocking at mid height of wall.
3. All horizontal joints in facing material backed by 2 × 4 blocking in wall.
4. Load: 360 psi of net stud cross sectional area.
5. Facings secured with 6d casing nails. Nail holes predrilled and 0.02 inch to 0.03 inch smaller than nail diameter.
6. The wood-wool core is a pressed excelsior slab which possesses insulating properties similar to cellulosic insulation.

**FIGURE 1.3.2
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK**



**TABLE 1.3.2
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-1	4"	2" x 4" stud wall; 3/16" CAB; no insulation; Design A.	35 min.	10 min.			4	1-10	1/6
W-4-W-2	4 1/8"	2" x 4" stud wall; 3/16" CAB; no insulation; Design A.	38 min.	9 min.			4	1-10	1/6
W-4-W-3	4 3/4"	2" x 4" stud wall; 3/16" CAB and 3/8" gypsum board face (both sides); Design B.	62 min.	64 min.			4	1-10	1
W-5-W-4	5"	2" x 4" stud wall; 3/16" CAB and 1/2" gypsum board (both sides); Design B.	79 min.	Greater than 90 min.			4	1-10	1
W-4-W-5	4 3/4"	2" x 4" stud wall; 3/16" CAB and 3/8" gypsum board (both sides); Design B.	45 min.	45 min.			4	1-12	—
W-5-W-6	5"	2" x 4" stud wall; 3/16" CAB and 1/2" gypsum board face (both sides); Design B.	45 min.	45 min.			4	1-10, 12, 13	—
W-4-W-7	4"	2" x 4" stud wall; 3/16" CAB face; 3 1/2" mineral wool insulation; Design C.	40 min.	42 min.			4	1-10	2/3
W-4-W-8	4"	2" x 4" stud wall; 3/16" CAB face; 3 1/2" mineral wool insulation; Design C.	46 min.	46 min.			4	1-10, 43	2/3
W-4-W-9	4"	2" x 4" stud wall; 3/16" CAB face; 3 1/2" mineral wool insulation; Design C.	30 min.	30 min.			4	1-10, 12, 14	—

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-10	4 ^{1/8} "	2" × 4" stud wall; 3/16" CAB face; 3 ^{1/2} " mineral wool insulation; Design C.	—	30 min.			4	1-8, 12, 14	—
W-4-W-11	4 ^{3/4} "	2" × 4" stud wall; 3/16" CAB face; 3/8" gypsum strips over studs; 5 ^{1/2} " mineral wool insulation; Design D.	79 min.	79 min.			4	1-10	1
W-4-W-12	4 ^{3/4} "	2" × 4" stud wall; 3/16" CAB face; 3/8" gypsum strips at stud edges; 7 ^{1/2} " mineral wool insulation; Design D.	82 min.	82 min.			4	1-10	1
W-4-W-13	4 ^{3/4} "	2" × 4" stud wall; 3/16" CAB face; 3/8" gypsum board strips over studs; 5 ^{1/2} " mineral wool insulation; Design D.	30 min.	30 min.			4	1-12	—
W-4-W-14	4 ^{3/4} "	2" × 4" stud wall; 3/16" CAB face; 3/8" gypsum board strips over studs; 7" mineral wool insulation; Design D.	30 min.	30 min.			4	1-12	—
W-5-W-15	5 ^{1/2} "	2" × 4" stud wall; Exposed face: CAB shingles over 1" × 6"; Unexposed face: 1/8" CAB sheet; 7/16" fiberboard (wood); Design E.	34 min.	—			4	1-10	1/2
W-5-W-16	5 ^{1/2} "	2" × 4" stud wall; Exposed face: 1/8" CAB sheet; 7/16" fiberboard; Unexposed face: CAB shingles over 1" × 6"; Design E.	32 min.	33 min.			4	1-10	1/2
W-5-W-17	5 ^{1/2} "	2" × 4" stud wall; Exposed face: CAB shingles over 1" × 6"; Unexposed face: 1/8" CAB sheet; gypsum at stud edges; 3 ^{1/2} " mineral wool insulation; Design F.	51 min.	—			4	1-10	3/4
W-5-W-18	5 ^{1/2} "	2" × 4" stud wall; Exposed face: 1/8" CAB sheet; gypsum board at stud edges; Unexposed face: CAB shingles over 1" × 6"; 3 ^{1/2} " mineral wool insulation; Design F.	42 min.	—			4	1-10	2/3
W-5-W-19	5 ^{5/8} "	2" × 4" stud wall; Exposed face: CAB shingles over 1" × 6"; Unexposed face: 1/8" CAB sheet; gypsum board at stud edges; 5 ^{1/2} " mineral wool insulation; Design G.	74 min.	85 min.			4	1-10	1
W-5-W-20	5 ^{5/8} "	2" × 4" stud wall; Exposed face: 1/8" CAB sheet; gypsum board at 3/16" stud edges; 7/16" fiberboard; Unexposed face: CAB shingles over 1" × 6"; 5 ^{1/2} " mineral wool insulation; Design G.	79 min.	85 min.			4	1-10	1 ^{1/4}
W-5-W-21	5 ^{5/8} "	2" × 4" stud wall; Exposed face: CAB shingles 1" × 6" sheathing; Unexposed face: CAB sheet; gypsum board at stud edges; 5 ^{1/2} " mineral wool insulation; Design G.	38 min.	38 min.			4	1-10, 12, 14	—
W-5-W-22	5 ^{5/8} "	2" × 4" stud wall; Exposed face: CAB sheet; gypsum board at stud edges; Unexposed face: CAB shingles 1" × 6" sheathing; 5 ^{1/2} " mineral wool insulation; Design G.	38 min.	38 min.			4	1-12	—
W-6-W-23	6"	2" × 4" stud wall; 16" o.c.; 1/2" gypsum board each side; 1/2" gypsum plaster each side.	N/A	60 min.			7	15	1

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK.

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-W-24	6"	2" × 4" stud wall; 16" o.c.; 1/2" gypsum board each side; 1/2" gypsum plaster each side.	N/A	68 min.			7	16	1
W-6-W-25	6 7/8"	2" × 4" stud wall; 18" o.c.; 3/4" gypsum plank each side; 3/16" gypsum plaster each side.	N/A	80 min.			7	15	1 1/3
W-5-W-26	5 1/8"	2" × 4" stud wall; 16" o.c.; 3/8" gypsum board each side; 3/16" gypsum plaster each side.	N/A	37 min.			7	15	1/2
W-5-W-27	5 3/4"	2" × 4" stud wall; 16" o.c.; 3/8" gypsum lath each side; 1/2" gypsum plaster each side.	N/A	52 min.			7	15	3/4
W-5-W-28	5"	2" × 4" stud wall; 16" o.c.; 1/2" gypsum board each side.	N/A	37 min.			7	16	1/2
W-5-W-29	5"	2" × 4" stud wall; 1/2" fiberboard both sides 14% M.C. with F.R. paint at 35 gm./ft. ² .	N/A	28 min.			7	15	1/3
W-4-W-30	4 3/4"	2" × 4" stud wall; Fire side: 1/2" (wood) fiberboard; Back side: 1/4" CAB; 16" o.c.	N/A	17 min.			7	15, 16	1/4
W-5-W-31	5 1/8"	2" × 4" stud wall; 16" o.c.; 1/2" fiberboard insulation with 1/32" asbestos (both sides of each board).	N/A	50 min.			7	16	3/4
W-4-W-32	4 1/4"	2" × 4" stud wall; 3/8" thick gypsum wallboard on both faces; insulated cavities.	See Note 23	25 min.		1		17, 18, 23	1/3
W-4-W-33	4 1/2"	2" × 4" stud wall; 1/2" thick gypsum wallboard on both faces.	See Note 17	40 min.		1		17, 23	1/3
W-4-W-34	4 1/2"	2" × 4" stud wall; 1/2" thick gypsum wallboard on both faces; insulated cavities.	See Note 17	45 min.		1		17, 18, 23	3/4
W-4-W-35	4 1/2"	2" × 4" stud wall; 1/2" thick gypsum wallboard on both faces; insulated cavities.	N/A	1 hr.		1		17, 18, 24	1
W-4-W-36	4 1/2"	2" × 4" stud wall; 1/2" thick, 1.1 lbs./ft. ² wood fiberboard sheathing on both faces.	See Note 23	15 min.		1		17, 23	1/4
W-4-W-37	4 1/2"	2" × 4" stud wall; 1/2" thick, 0.7 lb./ft. ² wood fiberboard sheathing on both faces.	See Note 23	10 min.		1		17, 23	1/6
W-4-W-38	4 1/2"	2" × 4" stud wall; 1/2" thick, flameproofed 1.6 lbs./ft. ² wood fiberboard sheathing on both faces.	See Note 23	30 min.		1		17, 23	1/2
W-4-W-39	4 1/2"	2" × 4" stud wall; 1/2" thick gypsum wallboard on both faces; insulated cavities.	See Note 23	1 hr.		1		17, 18, 23	1
W-4-W-40	4 1/2"	2" × 4" stud wall; 1/2" thick, 1:2; 1:3 gypsum plaster on wood lath on both faces.	See Note 23	30 min.		1		17, 21, 23	1/2
W-4-W-41	4 1/2"	2" × 4" stud wall; 1/2", 1:2; 1:3 gypsum plaster on wood lath on both faces; insulated cavities.	See Note 23	1 hr.		1		17, 18, 21, 24	1

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-W-42	4 ¹ / ₂ "	2" × 4" stud wall; 1/2", 1:5; 1:7.5 lime plaster on wood lath on both wall faces.	See Note 23	30 min.		1		17, 21, 23	1/2
W-4-W-43	4 ¹ / ₂ "	2" × 4" stud wall; 1/2" thick 1:5; 1:7.5 lime plaster on wood lath on both faces; insulated cavities.	See Note 23	45 min.		1		17, 18, 21, 23	3/4
W-4-W-44	4 ⁵ / ₈ "	2" × 4" stud wall; 3/16" thick cement-asbestos over 3/8" thick gypsum board on both faces.	See Note 23	1 hr.		1		23, 25, 26, 27	1
W-4-W-45	4 ⁵ / ₈ "	2" × 4" stud wall; studs faced with 4" wide strips of 3/8" thick gypsum board; 3/16" thick gypsum cement-asbestos board on both faces; insulated cavities.	See Note 23	1 hr.		1		23, 25, 27, 28	1
W-4-W-46	4 ⁵ / ₈ "	Same as W-4-W-45 but nonload bearing.	N/A	1 hr. 15 min.		1		24, 28	1 ¹ / ₄
W-4-W-47	4 ⁷ / ₈ "	2" × 4" stud wall; 3/16" thick cement-asbestos board over 1/2" thick gypsum sheathing on both faces.	See Note 23	1 hr. 15 min.		1		23, 25, 26, 27	1 ¹ / ₄
W-4-W-48	4 ⁷ / ₈ "	Same as W-4-W-47 but nonload bearing.	N/A	1 hr. 30 min.		1		24, 27	1 ¹ / ₂
W-5-W-49	5"	2" × 4" stud wall; Exterior face: 3/4" wood sheathing; asbestos felt 14 lbs./100 ft. ² and 5/32" cement-asbestos shingles; Interior face: 4" wide strips of 3/8" gypsum board over studs; wall faced with 3/16" thick cement-asbestos board.	See Note 23	40 min.		1		18, 23, 25, 26, 29	2/3
W-5-W-50	5"	2" × 4" stud wall; Exterior face: as per W-5-W-49; Interior face: 9/16" composite board consisting of 7/16" thick wood fiber-board faced with 1/8" thick cement-asbestos board; Exterior side exposed to fire.	See Note 23	30 min.		1		23, 25, 26, 30	1/2
W-5-W-51	5"	Same as W-5-W-50 but interior side exposed to fire.	See Note 23	30 min.		1		23, 25, 26	1/2
W-5-W-52	5"	Same as W-5-W-49 but exterior side exposed to fire.	See Note 23	45 min.		1		18, 23, 25, 26	3/4
W-5-W-53	5"	2" × 4" stud wall; 3/4" thick T&G wood boards on both sides.	See Note 23	20 min.		1		17, 23	1/3
W-5-W-54	5"	Same as W-5-W-53 but with insulated cavities.	See Note 23	35 min.		1		17, 18, 23	1/2
W-5-W-55	5"	2" × 4" stud wall; 3/4" thick T&G wood boards on both sides with 30 lbs./100 ft. ² asbestos; paper, between studs and boards.	See Note 23	45 min.		1		17, 23	3/4
W-5-W-56	5"	2" × 4" stud wall; 1/2" thick, 1:2; 1:3 gypsum plaster on metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 34	3/4

(continued)

TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-57	5"	2" × 4" stud wall; 3/4" thick 2:1:8; 2:1:12 lime and Keene's cement plaster over metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	1/2
W-5-W-58	5"	2" × 4" stud wall; 3/4" thick 2:1:8; 2:1:10 lime Portland cement plaster over metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-59	5"	2" × 4" stud wall; 3/4" thick 1:5; 1:7.5 lime plaster on metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-60	5"	2" × 4" stud wall; 3/4" thick 1:1/30:2; 1:1/30:3 Portland cement, asbestos fiber plaster on metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	3/4
W-5-W-61	5"	2" × 4" stud wall; 3/4" thick 1:2; 1:3 Portland cement plaster on metal lath on both sides of wall.	See Note 23	30 min.		1		17, 21, 23	1/2
W-5-W-62	5"	2" × 4" stud wall; 3/4" thick neat gypsum plaster on metal lath on both sides of wall.	N/A	1 hr. 30 min.		1		17, 22, 24	1 1/2
W-5-W-63	5"	2" × 4" stud wall; 3/4" thick neat gypsum plaster on metal lath on both sides of wall.	See Note 23	1 hr. 30 min.		1		17, 21, 23	1 1/2
W-5-W-64	5"	2" × 4" stud wall; 3/4" thick 1:2; 1:2 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 30 min.		1		17, 18, 21, 23	1 1/2
W-5-W-65	5"	2" × 4" stud wall; same as W-5-W-64 but cavities not insulated.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-66	5"	2" × 4" stud wall; 3/4" thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 15 min.		1		17, 18, 21, 23	1 1/4
W-5-W-67	5 1/16"	Same as W-5-W-49 except cavity insulation of 1.75 lbs./ft. ² mineral wool bats; rating applies when either wall side exposed to fire.	See Note 23	1 hr. 15 min.		1		23, 26, 25	1 1/4
W-5-W-68	5 1/4"	2" × 4" stud wall, 7/8" thick 1:2; 1:3 gypsum plaster on metal lath on both sides of wall; insulated cavities.	See Note 23	1 hr. 30 min.		1		17, 18, 21, 23	1 1/2
W-5-W-69	5 1/4"	2" × 4" stud wall; 7/8" thick neat gypsum plaster applied on metal lath on both sides of wall.	N/A	1 hr. 45 min.		1		17, 22, 24	1 3/4
W-5-W-70	5 1/4"	2" × 4" stud wall; 1/2" thick neat gypsum plaster on 3/8" plain gypsum lath on both sides of wall.	See Note 23	1 hr.		1		17, 22, 23	1
W-5-W-71	5 1/4"	2" × 4" stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster on 3/8" thick plain gypsum lath with 1 3/4" × 1 3/4" metal lath pads nailed 8" o.c. vertically and 16" o.c. horizontally on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-72	5 1/4"	2" × 4" stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster on 3/8" perforated gypsum lath, one 3/4" diameter hole or larger per 16" square of lath surface, on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-73	5 1/4"	2" × 4" stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster on 3/8" gypsum lath (plain, indented or perforated) on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	3/4
W-5-W-74	5 1/4"	2" × 4" stud wall; 7/8" thick of 1:2; 1:3 gypsum plaster over metal lath on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-75	5 1/4"	2" × 4" stud wall; 7/8" thick of 1:1/30; 2:1:3 Portland cement, asbestos plaster applied over metal lath on both sides of wall.	See Note 23	1 hr.		1		17, 21, 23	1
W-5-W-76	5 1/4"	2" × 4" stud wall; 7/8" thick of 1:2; 1:3 Portland cement plaster over metal lath on both sides of wall.	See Note 23	45 min.		1		17, 21, 23	3/4
W-5-W-77	5 1/2"	2" × 4" stud wall; 1" thick neat gypsum plaster over metal lath on both sides of wall; nonload bearing.	N/A	2 hrs.		1		17, 22, 24	2
W-5-W-78	5 1/2"	2" × 4" stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster on 1/2" thick, 0.7 lb./ft. ² wood fiberboard on both sides of wall.	See Note 23	35 min.		1		17, 21, 23	1/2
W-4-W-79	4 3/4"	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 38	1
W-4-W-80	4 3/4"	Same as W-4-W-79 but uninsulated.	N/A	35 min.			43	21, 31, 35	1/2
W-4-W-81	4 3/4"	2" × 4" wood stud wall; 1/2" thick of 3:1:8; 3:1:12 lime, Keene's cement, sand plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 40	1
W-4-W-82	4 3/4"	2" × 4" wood stud wall; 1/2" thick of 1:6 1/4; 1:6 1/4 lime Keene's cement plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	30 min.			43	21, 31, 35, 40	1/2
W-4-W-83	4 3/4"	2" × 4" wood stud wall; 1/2" thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall.	N/A	30 min.			43	21, 31, 35	1/2
W-5-W-84	5 1/8"	2" × 4" wood stud wall; 11/16" thick of 1:5; 1:7.5 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	45 min.			43	21, 31, 35, 39	3/4
W-5-W-85	5 1/4"	2" × 4" wood stud wall; 3/4" thick of 1:5; 1:7 lime plaster over wood lath on both sides of wall; mineral wool insulation.	N/A	40 min.			43	21, 31, 35, 40	2/3
W-5-W-86	5 1/4"	2" × 4" wood stud wall; 1/2" thick of 2:1:12 lime, Keene's cement and sand scratch coat; 1/2" thick 2:1:18 lime, Keene's cement and sand brown coat over wood lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	21, 31, 35, 40	1
W-5-W-87	5 1/4"	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" plaster board on both sides of wall.	N/A	45 min.			43	21, 31	3/4

(continued)

**TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-5-W-88	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31	3/4
W-5-W-89	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 31, 33	1
W-5-W-90	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick neat plaster over 3/8" thick gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 22, 31	1
W-5-W-91	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" thick indented gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31	3/4
W-5-W-92	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" thick perforated gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31, 34	3/4
W-5-W-93	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" perforated gypsum lath on both sides of wall.	N/A	1 hr.			43	21, 31	1
W-5-W-94	5 ^{1/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 3/8" thick perforated gypsum lath on both sides of wall.	N/A	45 min.			43	21, 31, 34	3/4
W-5-W-95	5 ^{1/2} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 1/2" thick wood fiberboard plaster base on both sides of wall.	N/A	35 min.			43	21, 31, 36	1/2
W-5-W-96	5 ^{3/4} "	2" × 4" wood stud wall; 1/2" thick of 1:2; 1:2 gypsum plaster over 7/8" thick flameproofed wood fiberboard on both sides of wall.	N/A	1 hr.			43	21, 31, 37	1

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².

Notes:

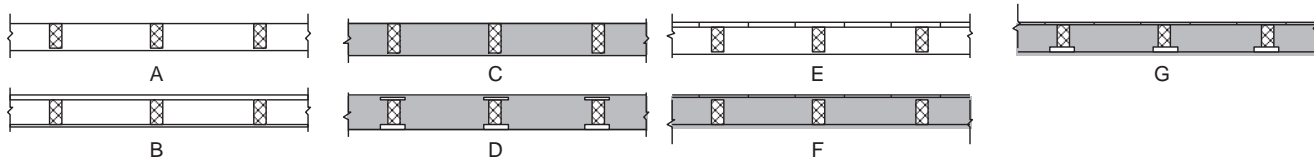
1. All specimens 8 feet or 8 feet 8 inches by 10 feet 4 inches, i.e. one-half of furnace size. See Note 42 for design cross section.
2. Specimens tested in tandem (two per exposure).
3. Test per ASA No. A2-1934 except where unloaded. Also, panels were of "half" size of furnace opening. Time value signifies a thermal failure time.
4. Two-inch by 4-inch studs: 16 inches on center.; where 10 feet 4 inches, blocking at 2-foot 4-inch height.
5. Facing 4 feet by 8 feet, cement-asbestos board sheets, 3/16 inch thick.
6. Sheathing (diagonal): 25/22 inch by 5 1/2 inch, 1 inch by 6 inches pine.
7. Facing shingles: 24 inches by 12 inches by 5/32 inch where used.
8. Asbestos felt: asphalt sat between sheathing and shingles.
9. Load: 30,500 pounds or 360 psi/stud where load was tested.
10. Walls were tested beyond achievement of first test end point. A load-bearing time in excess of performance time indicates that although thermal criteria were exceeded, load-bearing ability continued.
11. Wall was rated for one hour combustible use in original source.
12. Hose steam test specimen. See table entry of similar design above for recommended rating.
13. Rated one and one-fourth hour load bearing. Rated one and one-half hour nonload bearing.
14. Failed hose stream.
15. Test terminated due to flame penetration.
16. Test terminated—local back face temperature rise.
17. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by four-inch plates at top and bottom and blocking at mid height of wall.
18. Cavity insulation consists of rock wool bats 1.0 lb./ft.² of filled cavity area.
19. Cavity insulation consists of glass wool bats 0.6 lb./ft.² of filled cavity area.
20. Cavity insulation consists of blown-in rock wool 2.0 lbs./ft.² of filled cavity area
21. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster: dry sand; second ratio indicates brown coat mix.
22. "Neat" plaster is taken to mean unsanded wood-fiber gypsum plaster.
23. Load: 360 psi of net stud cross sectional area.
24. Rated as nonload bearing.

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 1.3.2—continued
WOOD FRAME WALLS
4" TO LESS THAN 6" THICK**

25. Nominal 2-inch by 4-inch studs per Note 17, spaced at 16 inches on center.
26. Horizontal joints in facing material supported by 2-inch by 4-inch blocking within wall.
27. Facings secured with 6d casing nails. Nail holes predrilled and were 0.02 to 0.03 inch smaller than nail diameter.
28. Cavity insulation consists of mineral wool bats weighing 2 lbs./ft.² of filled cavity area.
29. Interior wall face exposed to fire.
30. Exterior wall faced exposed to fire.
31. Nominal 2-inch by 4-inch studs of yellow pine or Douglas-fir spaced 16 inches on center in a single row.
32. Studs as in Note 31 except double row, with studs in rows staggered.
33. Six roofing nails with metal-lath pads around heads to each 16-inch by 48-inch lath.
34. Areas of holes less than 2³/₄ percent of area of lath.
35. Wood laths were nailed with either 3d or 4d nails, one nail to each bearing, and the end joining broken every seventh course.
36. One-half-inch thick fiberboard plaster base nailed with 3d or 4d common wire nails spaced 4 to 6 inches on center.
37. Seven-eighths-inch thick fiberboard plaster base nailed with 5d common wire nails spaced 4 to 6 inches on center.
38. Mineral wood bats 1.05 to 1.25 lbs./ft.² with waterproofed-paper backing.
39. Blown-in mineral wool insulation, 2.2 lbs./ft.².
40. Mineral wool bats, 1.4 lbs./ft.² with waterproofed-paper backing.
41. Mineral wood bats, 0.9 lb./ft.².
42. See wall design diagram below.



43. Duplicate specimen of W-4-W-7, tested simultaneously with W-4-W-7 in 18-foot test furnace.

**TABLE 1.3.3
WOOD FRAME WALLS
6" TO LESS THAN 8" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-6-W-1	6 ¹ / ₄ "	2 × 4 stud wall; 1/2" thick, 1:2; 1:2 gypsum plaster on 7/8" flameproofed wood fiberboard weighing 2.8 lbs./ft. ² on both sides of wall.	See Note 3	1 hr.		1		1-3	1
W-6-W-2	6 ¹ / ₂ "	2 × 4 stud wall; 1/2" thick, 1:3; 1:3 gypsum plaster on 1" thick magnesium oxysulfate wood fiberboard on both sides of wall.	See Note 3	45 min.		1		1-3	3/4
W-7-W-3	7 ¹ / ₄ "	Double row of 2 × 4 studs, 1/2" thick of 1:2; 1:2 gypsum plaster applied over 3/8" thick perforated gypsum lath on both sides of wall; mineral wool insulation.	N/A	1 hr.			43	2, 4, 5	1
W-7-W-4	7 ¹ / ₂ "	Double row of 2 × 4 studs, 5/8" thick of 1:2; 1:2 gypsum plaster applied over 3/8" thick perforated gypsum lath over laid with 2" × 2", 16 gage wire fabric, on both sides of wall.	N/A	1 hr. 15 min.			43	2, 4	1 ¹ / ₄

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².

Notes:

1. Nominal 2-inch by 4-inch wood studs of No. 1 common or better lumber set edgewise. Two-inch by 4-inch plates at top and bottom and blocking at mid height of wall.
2. Mix proportions for plastered walls as follows: first ratio indicates scratch coat mix, weight of dry plaster: dry sand; second ratio indicates brown coat mix.
3. Load: 360 psi of net stud cross sectional area.
4. Nominal 2-inch by 4-inch studs of yellow pine or Douglas-fir spaced 16 inches in a double row, with studs in rows staggered.
5. Mineral wool bats, 0.19 lb./ft.²

**TABLE 1.4.1
MISCELLANEOUS MATERIALS WALLS
0" TO LESS THAN 4" THICK**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-3-Mi-1	3 ⁷ / ₈ "	Glass brick wall: (bricks 5 ³ / ₄ " × 5 ³ / ₄ " × 3 ⁷ / ₈ ") 1/4" mortar bed, cement/lime/sand; mounted in brick (9") wall with mastic and 1/2" asbestos rope.	N/A	1 hr.			7	1, 2	1
W-3-Mi-2	3"	Core: 2" magnesium oxysulfate wood-fiber blocks; laid in Portland cement-lime mortar; Facings: on both sides; see Note 3.	N/A	1 hr.		1		3	1
W-3-Mi-3	3 ⁷ / ₈ "	Core: 8" × 4 ⁷ / ₈ " glass blocks 3 ⁷ / ₈ " thick weighing 4 lbs. each; laid in Portland cement-lime mortar; horizontal mortar joints reinforced with metal lath.	N/A	15 min.		1			1/4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN.

Notes:

1. No failure reached at 1 hour.
2. These glass blocks are assumed to be solid based on other test data available for similar but hollow units which show significantly reduced fire endurance.
3. Minimum of 1/2 inch of 1:3 sanded gypsum plaster required to develop this rating.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 1.4.2
MISCELLANEOUS MATERIALS WALLS
4" TO LESS THAN 6" THICK**

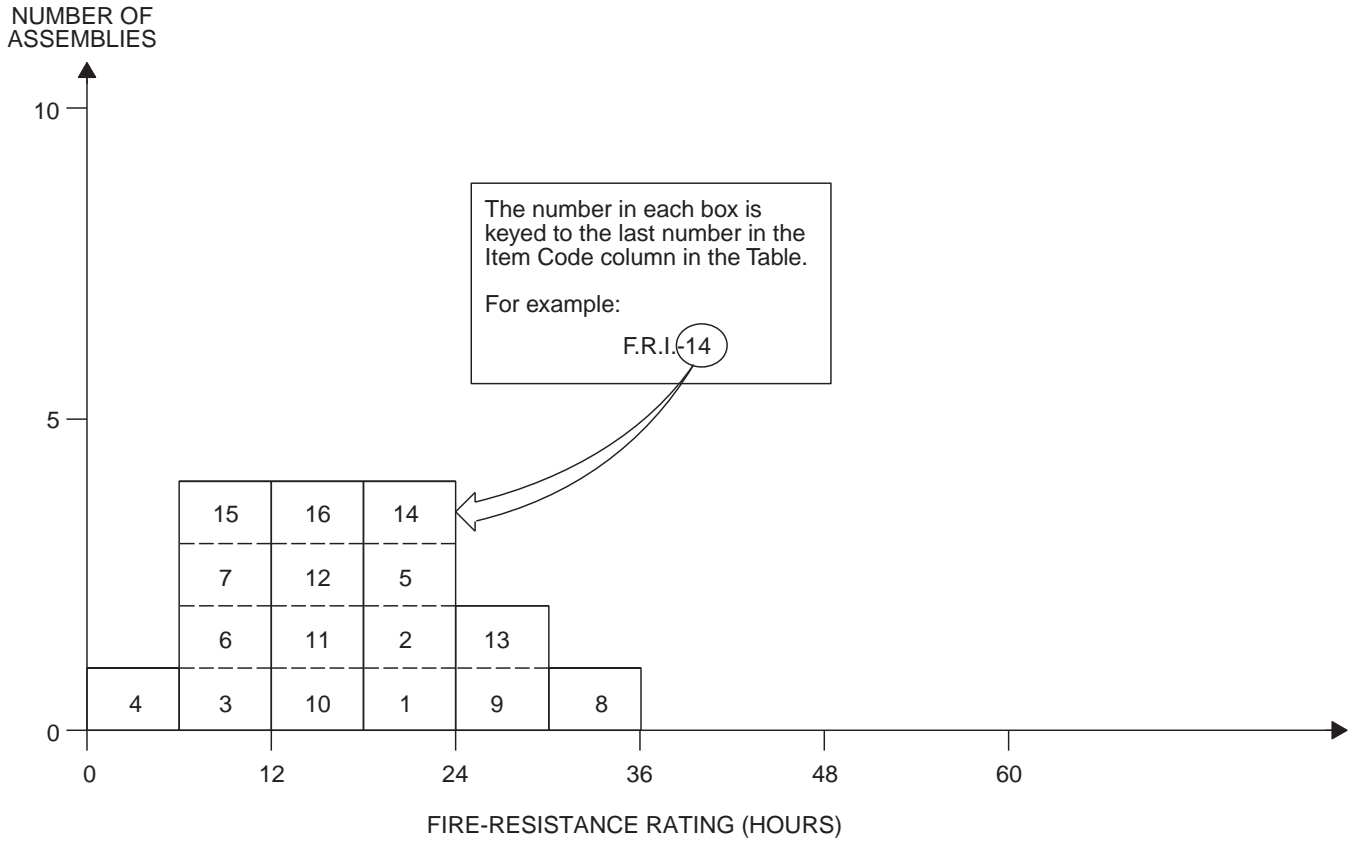
ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
W-4-Mi-1	4"	Core: 3" magnesium oxysulfate wood-fiber blocks; laid in Portland cement mortar; Facings: both sides; see Note 1.	N/A	2 hrs.		1			2

For SI: 1 inch = 25.4 mm.

Notes:

1. One-half inch sanded gypsum plaster. Voids in hollow blocks to be not more than 30 percent.

**FIGURE 1.5.1
FINISH RATINGS—INORGANIC MATERIALS**



**TABLE 1.5.1
FINISH RATINGS—INORGANIC MATERIALS**

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-I-1	9/16"	3/8" gypsum wallboard faced with 3/16" cement-asbestos board.	20 minutes		1		1, 2	15
F.R.-I-2	1 1/16"	1/2" gypsum sheathing faced with 3/16" cement-asbestos board.	20 minutes		1		1, 2	20
F.R.-I-3	3/16"	3/16" cement-asbestos board over uninsulated cavity.	10 minutes		1		1, 2	5
F.R.-I-4	3/16"	3/16" cement-asbestos board over insulated cavities.	5 minutes		1		1, 2	5
F.R.-I-5	3/4"	3/4" thick 1:2; 1:3 gypsum plaster over paper backed metal lath.	20 minutes		1		1, 2, 3	20
F.R.-I-6	3/4"	3/4" thick Portland cement plaster on metal lath.	10 minutes		1		1, 2	10
F.R.-I-7	3/4"	3/4" thick 1:5; 1:7.5 lime plaster on metal lath.	10 minutes		1		1, 2	10
F.R.-I-8	1"	1" thick neat gypsum plaster on metal lath.	35 minutes		1		1, 2, 4	35
F.R.-I-9	3/4"	3/4" thick neat gypsum plaster on metal lath.	30 minutes		1		1, 2, 4	30

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 1.5.1—continued
FINISH RATINGS—INORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-I-10	3/4"	3/4" thick 1:2; 1:2 gypsum plaster on metal lath.	15 minutes		1		1, 2, 3	15
F.R.-I-11	1/2"	Same as F.R.-I-7, except 1/2" thick on wood lath.	15 minutes		1		1, 2, 3	15
F.R.-I-12	1/2"	1/2" thick 1:2; 1:3 gypsum plaster on wood lath.	15 minutes		1		1, 2, 3	15
F.R.-I-13	7/8"	1/2" thick 1:2; 1:2 gypsum plaster on 3/8" perforated gypsum lath.	30 minutes		1		1, 2, 3	30
F.R.-I-14	7/8"	1/2" thick 1:2; 1:2 gypsum plaster on 3/8" thick plain or indented gypsum plaster.	20 minutes		1		1, 2, 3	20
F.R.-I-15	3/8"	3/8" gypsum wallboard.	10 minutes		1		1, 2	10
F.R.-I-16	1/2"	1/2" gypsum wallboard.	15 minutes		1		1, 2	15

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and the substrate being protected.
2. Tested in accordance with the Standard Specifications for Fire Tests of Building Construction and Materials, ASA No. A2-1932.
3. Mix proportions for plasters as follows: first ratio, dry weight of plaster: dry weight of sand for scratch coat; second ratio, plaster: sand for brown coat.
4. Neat plaster means unsanded wood-fiber gypsum plaster.

General Note:

The finish rating of modern building materials can be found in the current literature.

TABLE 1.5.2
FINISH RATINGS—ORGANIC MATERIALS

ITEM CODE	THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE	REFERENCE NUMBER			NOTES	REC. F.R. (MIN.)
			FINISH RATING	PRE-BMS-92	BMS-92	POST-BMS-92		
F.R.-O-1	9/16"	7/16" wood fiberboard faced with 1/8" cement-asbestos board.	15 minutes		1		1, 2	15
F.R.-O-2	29/32"	3/4" wood sheathing, asbestos felt weighing 14 lbs./100 ft. ² and 5/32" cement-asbestos shingles.	20 minutes		1		1, 2	20
F.R.-O-3	1 1/2"	1" thick magnesium oxysulfate wood fiberboard faced with 1:3; 1:3 gypsum plaster, 1/2" thick.	20 minutes		1		1, 2, 3	20
F.R.-O-4	1/2"	1/2" thick wood fiberboard.	5 minutes		1		1, 2	5
F.R.-O-5	1/2"	1/2" thick flameproofed wood fiberboard.	10 minutes		1		1, 2	10
F.R.-O-6	1"	1/2" thick wood fiberboard faced with 1/2" thick 1:2; 1:2 gypsum plaster.	15 minutes		1		1, 2, 3	30
F.R.-O-7	1 3/8"	7/8" thick flameproofed wood fiberboard faced with 1/2" thick 1:2; 1:2 gypsum plaster.	30 minutes		1		1, 2, 3	30
F.R.-O-8	1 1/4"	1 1/4" thick plywood.	30 minutes			35		30

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square foot = 47.9 N/m², °C = [(°F) - 32]/1.8.

Notes:

1. The finish rating is the time required to obtain an average temperature rise of 250°F, or a single point rise of 325°F, at the interface between the material being rated and the substrate being protected.
2. Tested in accordance with the Standard Specifications for Fire Tests of Building Construction and Materials, ASA No. A2-1932.
3. Plaster ratios as follows: first ratio is for scratch coat, weight of dry plaster: weight of dry sand; second ratio is for the brown coat.

General Note:

The finish rating of thinner materials, particularly thinner woods, have not been listed because the possible effects of shrinkage, warpage and aging cannot be predicted.

**SECTION II
COLUMNS**

**TABLE 2.1.1
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 0" TO LESS THAN 6"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-6-RC-1	6"	6" × 6" square columns; gravel aggregate concrete (4030 psi); Reinforcement: vertical, four 7/8" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	34.7 tons	62 min.			7	1, 2	1
C-6-RC-2	6"	6" × 6" square columns; gravel aggregate concrete (4200 psi); Reinforcement: vertical, four 1/2" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	21 tons	69 min.			7	1, 2	1

Notes:

1. Collapse.
2. British test.

FIGURE 2.1.2
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10" TO LESS THAN 12"

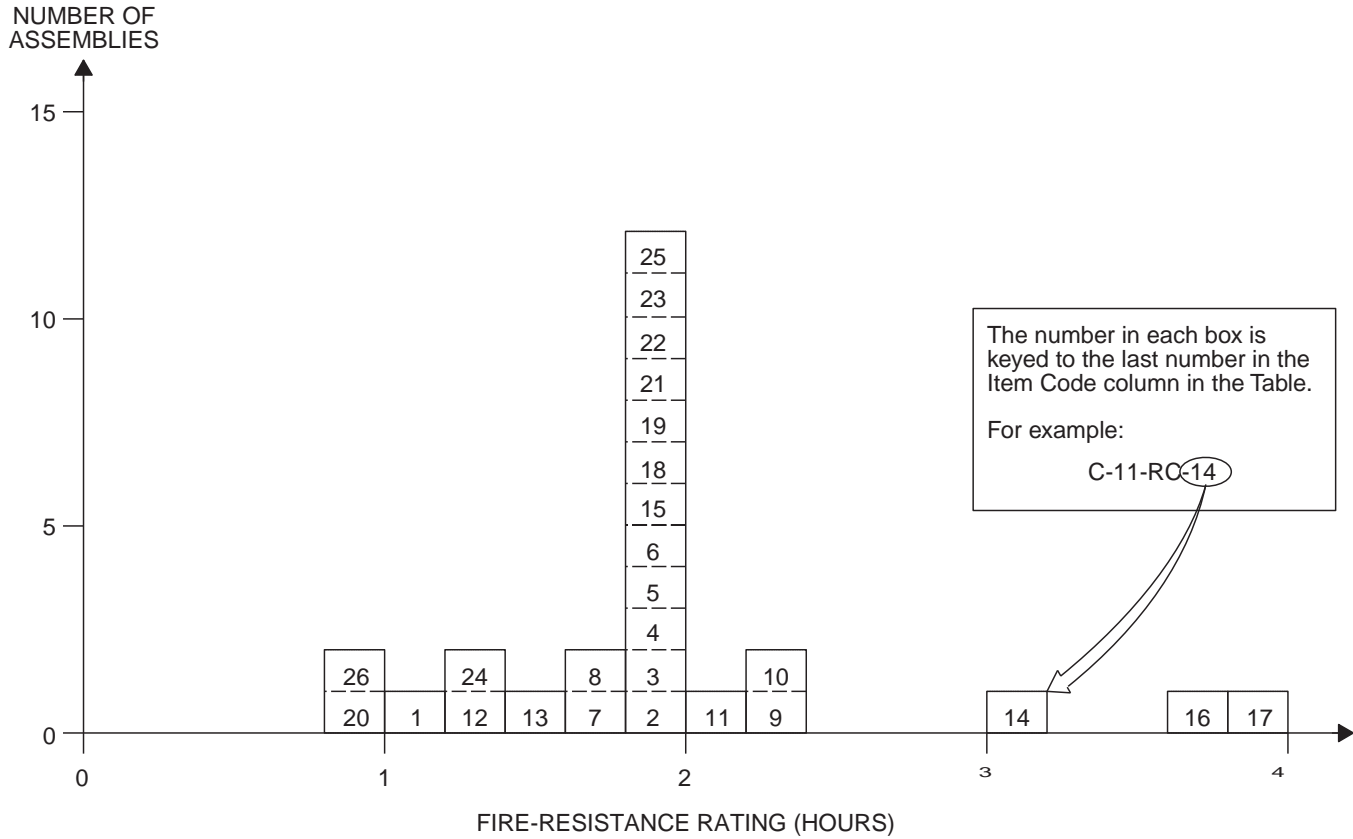


TABLE 2.1.2
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-RC-1	10"	10" square columns; aggregate concrete (4260 psi); Reinforcement: vertical, four 1 ¹ / ₄ " rebars; horizontal, 3 ³ / ₈ " ties at 6" pitch; Cover: 1 ¹ / ₄ ".	92.2 tons	1 hr. 2 min.			7	1	1
C-10-RC-2	10"	10" square columns; aggregate concrete (2325 psi); Reinforcement: vertical, four 1 ¹ / ₂ " rebars; horizontal, 5 ⁵ / ₁₆ " ties at 6" pitch; Cover: 1".	46.7 tons	1 hr. 52 min.			7	1	1 ³ / ₄
C-10-RC-3	10"	10" square columns; aggregate concrete (5370 psi); Reinforcement: vertical, four 1 ¹ / ₂ " rebars; horizontal, 5 ⁵ / ₁₆ " ties at 6" pitch; Cover: 1".	46.5 tons	2 hrs.			7	2, 3, 11	2
C-10-RC-4	10"	10" square columns; aggregate concrete (5206 psi); Reinforcement: vertical, four 1 ¹ / ₂ " rebars; horizontal, 5 ⁵ / ₁₆ " ties at 6" pitch; Cover: 1".	46.5 tons	2 hrs.			7	2, 7	2
C-10-RC-5	10"	10" square columns; aggregate concrete (5674 psi); Reinforcement: vertical, four 1 ¹ / ₂ " rebars; horizontal, 5 ⁵ / ₁₆ " ties at 6" pitch; Cover: 1".	46.7 tons	2 hrs.			7	1	2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.1.2—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST- BMS-92		
C-10-RC-6	10"	10" square columns; aggregate concrete (5150 psi); Reinforcement: vertical, four 1½" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	66 tons	1 hr. 43 min.			7	1	1¾
C-10-RC-7	10"	10" square columns; aggregate concrete (5580 psi); Reinforcement: vertical, four 1½" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1⅛".	62.5 tons	1 hr. 38 min.			7	1	1½
C-10-RC-8	10"	10" square columns; aggregate concrete (4080 psi); Reinforcement: vertical, four 1⅛" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1⅛".	72.8 tons	1 hr. 48 min.			7	1	1¾
C-10-RC-9	10"	10" square columns; aggregate concrete (2510 psi); Reinforcement: vertical, four 1½" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	51 tons	2 hrs. 16 min.			7	1	2¼
C-10-RC-10	10"	10" square columns; aggregate concrete (2170 psi); Reinforcement: vertical, four 1½" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1".	45 tons	2 hrs. 14 min.			7	12	2¼
C-10-RC-11	10"	10" square columns; gravel aggregate concrete (4015 psi); Reinforcement: vertical, four 1½" rebars; horizontal, 5/16" ties at 6" pitch; Cover: 1⅛".	46.5 tons	2 hrs. 6 min.			7	1	2
C-11-RC-12	11"	11" square columns; gravel aggregate concrete (4150 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; Cover: 1½".	61 tons	1 hr. 23 min.			7	1	1¼
C-11-RC-13	11"	11" square columns; gravel aggregate concrete (4380 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; Cover: 1½".	61 tons	1 hr. 26 min.			7	1	1¼
C-11-RC-14	11"	11" square columns; gravel aggregate concrete (4140 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; steel mesh around reinforcement; Cover: 1½".	61 tons	3 hrs. 9 min.			7	1	3
C-11-RC-15	11"	11" square columns; slag aggregate concrete (3690 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; Cover: 1½".	91 tons	2 hrs.			7	2, 3, 4, 5	2
C-11-RC-16	11"	11" square columns; limestone aggregate concrete (5230 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; Cover: 1½".	91.5 tons	3 hrs. 41 min.			7	1	3½
C-11-RC-17	11"	11" square columns; limestone aggregate concrete (5530 psi); Reinforcement: vertical, four 1¼" rebars; horizontal, 3/8" ties at 7½" pitch; Cover: 1½".	91.5 tons	3 hrs. 47 min.			7	1	3½

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.1.2—continued
 REINFORCED CONCRETE COLUMNS
 MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST- BMS-92		
C-11-RC-18	11"	11" square columns; limestone aggregate concrete (5280 psi); Reinforcement: vertical, four 1 ¹ / ₄ " rebars; horizontal, 3 ³ / ₈ " ties at 7 ¹ / ₂ " pitch; Cover: 1 ¹ / ₂ ".	91.5 tons	2 hrs.			7	2, 3, 4, 6	2
C-11-RC-19	11"	11" square columns; limestone aggregate concrete (4180 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	71.4 tons	2 hrs.			7	2, 7	2
C-11-RC-20	11"	11" square columns; gravel concrete (4530 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ " with 1 ¹ / ₂ " plaster.	58.8 tons	2 hrs.			7	2, 3, 9	1 ¹ / ₄
C-11-RC-21	11"	11" square columns; gravel concrete (3520 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	Variable	1 hr. 24 min.			7	1, 8	2
C-11-RC-22	11"	11" square columns; aggregate concrete (3710 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-23	11"	11" square columns; aggregate concrete (3190 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	58.8 tons	2 hrs.			7	2, 3, 10	2
C-11-RC-24	11"	11" square columns; aggregate concrete (4860 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	86.1 tons	1 hr. 20 min.			7	1	1 ¹ / ₃
C-11-RC-25	11"	11" square columns; aggregate concrete (4850 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 3 ³ / ₈ " ties at 7" pitch; Cover: 1 ¹ / ₂ ".	58.8 tons	1 hr. 59 min.			7	1	1 ³ / ₄
C-11-RC-26	11"	11" square columns; aggregate concrete (3834 psi); Reinforcement: vertical, four 5 ⁵ / ₈ " rebars; horizontal, 5 ⁵ / ₁₆ " ties at 4 ¹ / ₂ " pitch; Cover: 1 ¹ / ₂ ".	71.4 tons	53 min.			7	1	3 ³ / ₄

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Passed 2 hour fire exposure.
3. Passed hose stream test.
4. Reloaded effectively after 48 hours but collapsed at load in excess of original test load.
5. Failing load was 150 tons.
6. Failing load was 112 tons.
7. Failed during hose stream test.
8. Range of load 58.8 tons (initial) to 92 tons (92 minutes) to 60 tons (80 minutes).
9. Collapsed at 44 tons in reload after 96 hours.
10. Withstood reload after 72 hours.
11. Collapsed on reload after 48 hours.

**TABLE 2.1.3
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-RC-1	12"	12" square columns; gravel aggregate concrete (2647 psi); Reinforcement: vertical, four 5/8" rebars; horizontal, 5/16" ties at 4 1/2" pitch; Cover: 2".	78.2 tons	38 min.		1	7	1	1/2
C-12-RC-2	12"	Reinforced columns with 1 1/2" concrete outside of reinforced steel; Gross diameter or side of column: 12" ; Group I, Column A.	—	6 hrs.		1		2, 3	6
C-12-RC-3	12"	Description as per C-12-RC-2; Group I, Column B.	—	4 hrs.		1		2, 3	4
C-12-RC-4	12"	Description as per C-12-RC-2; Group II, Column A.	—	4 hrs.		1		2, 3	4
C-12-RC-5	12"	Description as per C-12-RC-2; Group II, Column B.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-12-RC-6	12"	Description as per C-12-RC-2; Group III, Column A.	—	3 hrs.		1		2, 3	3
C-12-RC-7	12"	Description as per C-12-RC-2; Group III, Column B.	—	2 hrs.		1		2, 3	2
C-12-RC-8	12"	Description as per C-12-RC-2; Group IV, Column A.	—	2 hrs.		1		2, 3	2
C-12-RC-9	12"	Description as per C-12-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	1 1/2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m².

Notes:

1. Failure mode—unspecified structural.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
3. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
 Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
 Column B: working loads are assumed as carried by the gross area of the column.

**TABLE 2.1.4
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 14" TO LESS THAN 16"**

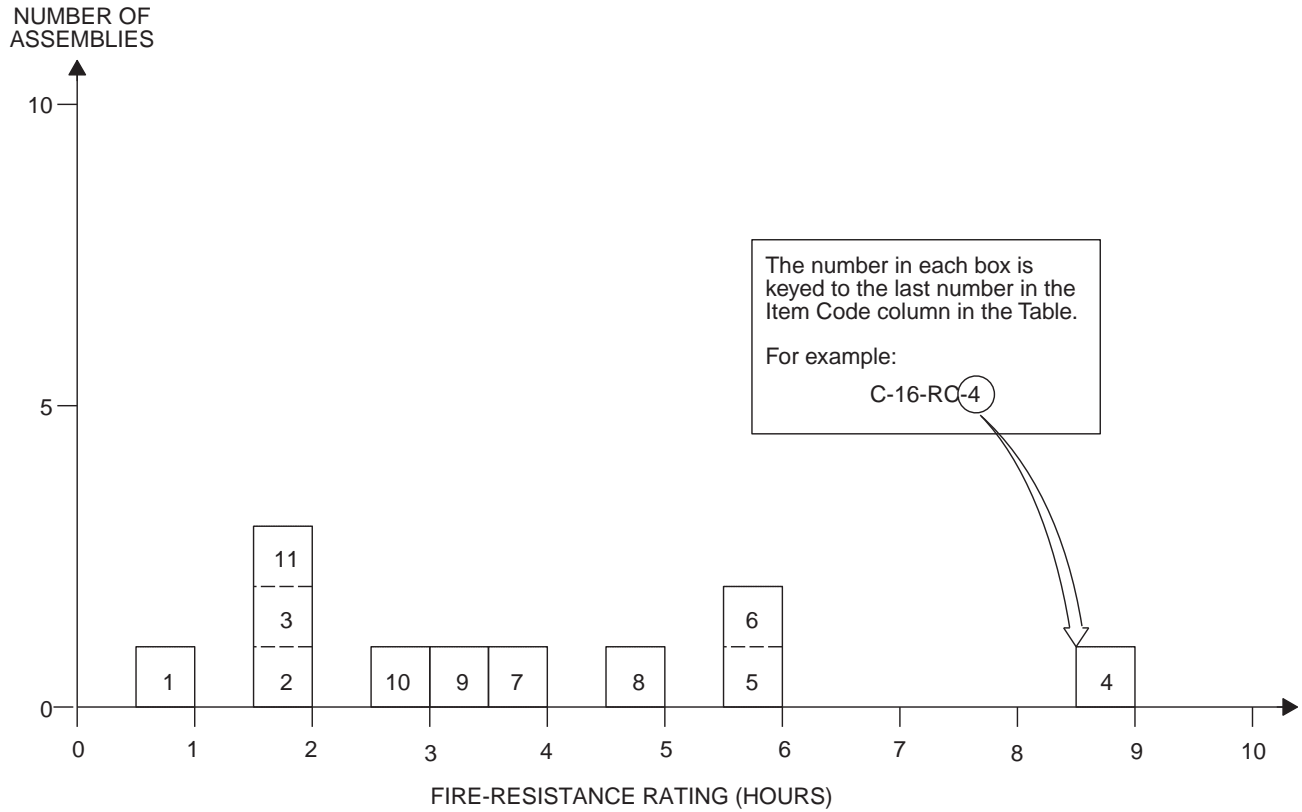
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
C-14-RC-1	14"	14" square columns; gravel aggregate concrete (4295 psi); Reinforcement: vertical four 3/4" rebars; horizontal: 1/4" ties at 9" pitch; Cover: 1 1/2"	86 tons	1 hr. 22 min.			7	1	1 1/4
C-14-RC-2	14"	Reinforced concrete columns with 1 1/2" concrete outside reinforcing steel; Gross diameter or side of column: 12" ; Group I, Column A.	—	7 hrs.		1		2, 3	7
C-14-RC-3	14"	Description as per C-14-RC-2; Group II, Column B.	—	5 hrs.		1		2, 3	5
C-14-RC-4	14"	Description as per C-14-RC-2; Group III, Column A.	—	5 hrs.		1		2, 3	5
C-14-RC-5	14"	Description as per C-14-RC-2; Group IV, Column B.	—	3 hrs. 30 min.		1		2, 3	3 1/2
C-14-RC-6	14"	Description as per C-14-RC-2; Group III, Column A.	—	4 hrs.		1		2, 3	4
C-14-RC-7	14"	Description as per C-14-RC-2; Group III, Column B.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-14-RC-8	14"	Description as per C-14-RC-2; Group IV, Column A.	—	2 hrs. 30 min.		1		2, 3	2 1/2
C-14-RC-9	14"	Description as per C-14-RC-2; Group IV, Column B.	—	1 hr. 30 min.		1		2, 3	1 1/2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m².

Notes:

- Failure mode—main rebars buckled between links at various points.
- Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
- Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.5
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16" TO LESS THAN 18"**



**TABLE 2.1.5
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-1	16"	16" square columns; gravel aggregate concrete (4550 psi); Reinforcement: vertical, eight 1 ³ / ₈ " rebar; horizontal, 5/16" ties at 6" pitch 1 ³ / ₈ " below column surface and 5/16" ties at 6" pitch linking center rebar of each face forming a smaller square in column cross section.	237 tons	1 hr			7	1, 2, 3	1
C-16-RC-2	16"	16" square columns; gravel aggregate concrete (3360 psi); Reinforcement: vertical, eight 1 ³ / ₈ " rebar; horizontal, 5/16" ties at 6" pitch; Cover: 1 ³ / ₈ ".	210 tons	2 hrs.			7	2, 4, 5, 6	2
C-16-RC-3	16"	16" square columns; gravel aggregate concrete (3980 psi); Reinforcement: vertical, four 7/8" rebar; horizontal, 3/8" ties at 6" pitch; Cover: 1".	123.5 tons	2 hrs.			7	2, 4, 7	2
C-16-RC-4	16"	Reinforced concrete columns with 1 ¹ / ₂ " concrete outside reinforcing steel; Gross diameter or side of column: 16" ; Group I, Column A.	—	9 hrs.		1		8, 9	9
C-16-RC-5	16"	Description as per C-16-RC-4; Group I, Column B.	—	6 hrs.		1		8, 9	6
C-16-RC-6	16"	Description as per C-16-RC-4; Group II, Column A.	—	6 hrs.		1		8, 9	6

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.1.5—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 16" TO LESS THAN 18"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-RC-7	16"	Description as per C-16-RC-4; Group II, Column B.	—	4 hrs.		1		8, 9	4
C-16-RC-8	16"	Description as per C-16-RC-4; Group III, Column A.	—	5 hrs.		1		8, 9	5
C-16-RC-9	16"	Description as per C-16-RC-4; Group III, Column B.	—	3 hrs. 30 min.		1		8, 9	3½
C-16-RC-10	16"	Description as per C-16-RC-4; Group IV, Column A.	—	3 hrs.		1		8, 9	3
C-16-RC-11	16"	Description as per C-16-RC-4; Group IV, Column B.	—	2 hrs.		1		8, 9	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m².

Notes:

1. Column passed 1-hour fire test.
2. Column passed hose stream test.
3. No reload specified.
4. Column passed 2-hour fire test.
5. Column reloaded successfully after 24 hours.
6. Reinforcing details same as C-16-RC-1.
7. Column passed reload after 72 hours.
8. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
9. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
Column B: working loads are assumed as carried by the gross area of the column.

**TABLE 2.1.6
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 18" TO LESS THAN 20"**

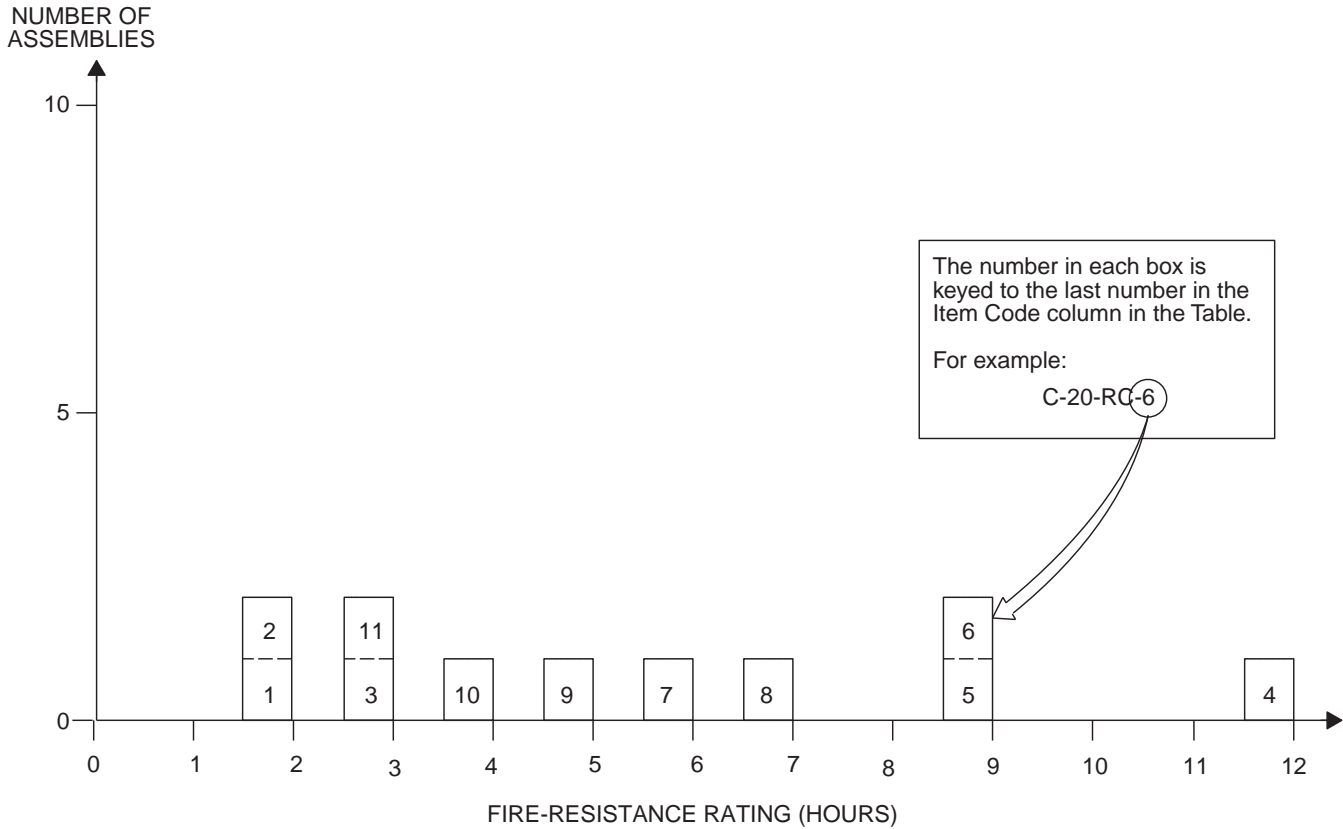
ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
C-18-RC-1	18"	Reinforced concrete columns with 1½" concrete outside reinforced steel; Gross diameter or side of column: 18" ; Group I, Column A.	—	11 hrs.		1		1, 2	11
C-18-RC-2	18"	Description as per C-18-RC-1; Group I, Column B.	—	8 hrs.		1		1, 2	8
C-18-RC-3	18"	Description as per C-18-RC-1; Group II, Column A.	—	7 hrs.		1		1, 2	7
C-18-RC-4	18"	Description as per C-18-RC-1; Group II, Column B.	—	5 hrs.		1		1, 2	5
C-18-RC-5	18"	Description as per C-18-RC-1; Group III, Column A.	—	6 hrs.		1		1, 2	6
C-18-RC-6	18"	Description as per C-18-RC-1; Group III, Column B.	—	4 hrs.		1		1, 2	4
C-18-RC-7	18"	Description as per C-18-RC-1; Group IV, Column A.	—	3 hrs. 30 min.		1		1, 2	3½
C-18-RC-8	18"	Description as per C-18-RC-1; Group IV, Column B.	—	2 hrs. 30 min.		1		1, 2	2½

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m².

Notes:

- Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint and, tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
- Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
Column B: working loads are assumed as carried by the gross area of the column.

**FIGURE 2.1.7
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20" TO LESS THAN 22"**



**TABLE 2.1.7
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20" TO LESS THAN 22"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-1	20"	20" square columns; gravel aggregate concrete (6690 psi); Reinforcement: vertical, four 1 ³ / ₄ " rebars; horizontal, ³ / ₈ " wire at 6" pitch; Cover 1 ³ / ₄ ".	367 tons	2 hrs.			7	1, 2, 3	2
C-20-RC-2	20"	20" square columns; gravel aggregate concrete (4330 psi); Reinforcement: vertical, four 1 ³ / ₄ " rebars; horizontal, ³ / ₈ " ties at 6" pitch; Cover 1 ³ / ₄ ".	327 tons	2 hrs.			7	1, 2, 4	2
C-20-RC-3	20 ¹ / ₄ "	20" square columns; gravel aggregate concrete (4230 psi); Reinforcement: vertical, four 1 ¹ / ₈ " rebars; horizontal, ³ / ₈ " wire at 5" pitch; Cover 1 ¹ / ₈ ".	199 tons	2 hrs. 56 min.			7	5	2 ³ / ₄
C-20-RC-4	20"	Reinforced concrete columns with 1 ¹ / ₂ " concrete outside of reinforcing steel; Gross diameter or side of column: 20" ; Group I, Column A.	—	12 hrs.		1		6, 7	12
C-20-RC-5	20"	Description as per C-20-RC-4; Group I, Column B.	—	9 hrs.		1		6, 7	9

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 2.1.7—continued
REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 20" TO LESS THAN 22"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-RC-6	20"	Description as per C-20-RC-4; Group II, Column A.	—	9 hrs.		1		6, 7	9
C-20-RC-7	20"	Description as per C-20-RC-4; Group II, Column B.	—	6 hrs.		1		6, 7	6
C-20-RC-8	20"	Description as per C-20-RC-4; Group III, Column A.	—	7 hrs.		1		6, 7	7
C-20-RC-9	20"	Description as per C-20-RC-4; Group III, Column B.	—	5 hrs.		1		6, 7	5
C-20-RC-10	20"	Description as per C-20-RC-4; Group IV, Column A.	—	4 hrs.		1		6, 7	4
C-20-RC-11	20"	Description as per C-20-RC-4; Group IV, Column B.	—	3 hrs.		1		6, 7	3

For SI: 1 inch = 25.4 mm, 1 pound per square yard = 5.3 N/m², 1 ton = 8.896 kN.

Notes:

1. Passed 2-hour fire test.
2. Passed hose stream test.
3. Failed during reload at 300 tons.
4. Passed reload after 72 hours.
5. Failure mode—collapse.
6. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.
7. Groupings of aggregates and ties are the same as for structural steel columns protected solidly with concrete, the ties to be placed over the vertical reinforcing bars and the mesh where required, to be placed within 1 inch from the surface of the column.
Column A: working loads are assumed as carried by the area of the column inside of the lines circumscribing the reinforcing steel.
Column B: working loads are assumed as carried by the gross area of the column.

**TABLE 2.1.8
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-HRC-1	12"	12" hexagonal columns; gravel aggregate concrete (4420 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding at 1 1/2" pitch; Cover: 1/2".	88 tons	58 min.			7	1	3/4
C-12-HRC-2	12"	12" hexagonal columns; gravel aggregate concrete (3460 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding at 1 1/2" pitch; Cover: 1/2".	78.7 tons	1 hr.			7	2	1

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Test stopped at 1 hour.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 2.1.9
HEXAGONAL REINFORCED CONCRETE COLUMNS
MINIMUM DIMENSION 14" TO LESS THAN 16"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-HRC-1	14"	14" hexagonal columns; gravel aggregate concrete (4970 psi); Reinforcement: vertical, eight 1/2" rebars; horizontal, 5/16" helical winding on 2" pitch; Cover: 1/2".	90 tons	2 hrs.			7	1, 2, 3	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Withstood 2-hour fire test.
2. Withstood hose stream test.
3. Withstood reload after 48 hours.

**TABLE 2.1.10
HEXAGONAL REINFORCED CONCRETE COLUMNS
DIAMETER—16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-HRC-1	16"	16" hexagonal columns; gravel concrete (6320 psi); Reinforcement: vertical, eight 5/8" rebars; horizontal, 5/16" helical winding on 3/4" pitch; Cover: 1/2".	140 tons	1 hr. 55 min.			7	1	1 3/4
C-16-HRC-2	16"	16" hexagonal columns; gravel aggregate concrete (5580 psi); Reinforcement: vertical, eight 5/8" rebars; horizontal, 5/16" helical winding on 1 3/4" pitch; Cover: 1/2".	124 tons	2 hrs.			7	2	2

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Failed on furnace removal.

**TABLE 2.1.11
HEXAGONAL REINFORCED CONCRETE COLUMNS
DIAMETER—20" TO LESS THAN 22"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-20-HRC-1	20"	20" hexagonal columns; gravel concrete (6080 psi); Reinforcement: vertical, 3/4" rebars; horizontal, 5/6" helical winding on 1 3/4" pitch; Cover: 1/2".	211 tons	2 hrs.			7	1	2
C-20-HRC-2	20"	20" hexagonal columns; gravel concrete (5080 psi); Reinforcement: vertical, 3/4" rebars; horizontal, 5/16" wire on 1 3/4" pitch; Cover: 1/2".	184 tons	2 hrs. 15 min.			7	2, 3, 4	2 1/4

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Column collapsed on furnace removal.
2. Passed 2 1/4-hour fire test.
3. Passed hose stream test.
4. Withstood reload after 48 hours.

TABLE 2.2
ROUND CAST IRON COLUMNS

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-CI-1	7" O.D.	Column: 0.6" minimum metal thickness; unprotected.	—	30 min.		1			1/2
C-7-CI-2	7" O.D.	Column: 0.6" minimum metal thickness concrete filled, outside unprotected.	—	45 min.		1			3/4
C-11-CI-3	11" O.D.	Column: 0.6" minimum metal thickness; Protection: 1 1/2" Portland cement plaster on high ribbed metal lath, 1/2" broken air space.	—	3 hrs.		1			3
C-11-CI-4	11" O.D.	Column: 0.6" minimum metal thickness; Protection: 2" concrete other than siliceous aggregate.	—	2 hrs. 30 min.		1			2 1/2
C-12-CI-5	12.5" O.D.	Column: 7" O.D. 0.6" minimum metal thickness; Protection: 2" porous hollow tile, 3/4" mortar between tile and column, outside wire ties.	—	3 hrs.		1			3
C-7-CI-6	7.6" O.D.	Column: 7" I.D., 3/10" minimum metal thickness, concrete filled unprotected.	—	30 min.		1			1/2
C-8-CI-7	8.6" O.D.	Column: 8" I.D., 3/10" minimum metal thickness; concrete filled reinforced with four 3 1/2" x 3/8" angles, in fill; unprotected outside.	—	1 hr.		1			1

For SI: 1 inch = 25.4 mm.

FIGURE 2.3
STEEL COLUMNS—GYPSUM ENCASEMENTS

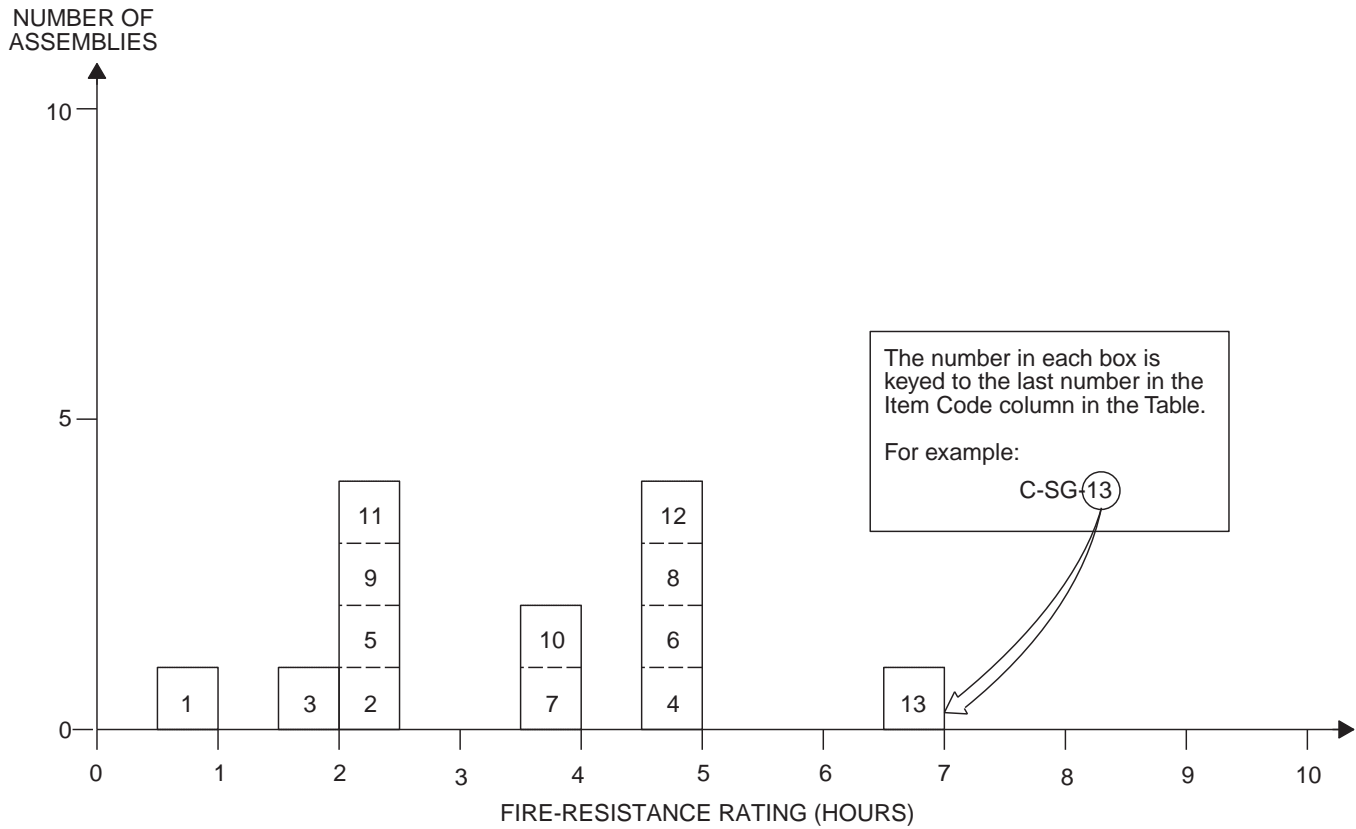


TABLE 2.3
STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-1	—	Steel protected with $\frac{3}{4}$ " 1:3 sanded gypsum or 1" 1:2½ Portland cement plaster on wire or lath; one layer.	—	1 hr.		1			1
C-SG-2	—	Same as C-SG-1; two layers.	—	2 hrs. 30 min.		1			2½
C-SG-3	130 in.²	2" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with block and mortar.	—	2 hrs.		1			2
C-SG-4	150 in.²	Same as C-130-SG-3 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-5	130 in.²	2" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with gypsum concrete.	—	2 hrs. 30 min.		1			2½
C-SG-6	150 in.²	Same as C-130-SG-5 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-7	300 in.²	4" solid blocks with wire mesh in horizontal joints; 1" mortar on flange; reentrant space filled with block and mortar.	—	4 hrs.		1			4

(continued)

TABLE 2.3—continued
STEEL COLUMNS—GYPSUM ENCASEMENTS

ITEM CODE	MINIMUM AREA OF SOLID MATERIAL	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-SG-8	300 in. ²	Same as C-300-SG-7 with reentrant space filled with gypsum concrete.	—	5 hrs.		1			5
C-SG-9	85 in. ²	2" solid blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			2½
C-SG-10	105 in. ²	Same as C-85-SG-9 with ½" sanded gypsum plaster.	—	4 hrs.		1			4
C-SG-11	95 in. ²	3" hollow blocks with cramps at horizontal joints; mortar on flange only at horizontal joints; reentrant space not filled.	—	2 hrs. 30 min.		1			2½
C-SG-12	120 in. ²	Same as C-95-SG-11 with ½" sanded gypsum plaster.	—	5 hrs.		1			5
C-SG-13	130 in. ²	2" neat fibered gypsum reentrant space filled poured solid and reinforced with 4" × 4" wire mesh ½" sanded gypsum plaster.	—	7 hrs.		1			7

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

TABLE 2.4
TIMBER COLUMNS MINIMUM DIMENSION

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-TC-1	11"	With unprotected steel plate cap.	—	30 min.		1		1, 2	½
C-11-TC-2	11"	With unprotected cast iron cap and pintle.	—	45 min.		1		1, 2	¾
C-11-TC-3	11"	With concrete or protected steel or cast iron cap.	—	1 hr. 15 min.		1		1, 2	1¼
C-11-TC-4	11"	With ¾" gypsum wallboard over column and over cast iron or steel cap.	—	1 hr. 15 min.		1		1, 2	1¼
C-11-TC-5	11"	With 1" Portland cement plaster on wire lath over column and over cast iron or steel cap; ¾" air space.	—	2 hrs.		1		1, 2	2

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

Notes:

1. Minimum area: 120 square inches.
2. Type of wood: long leaf pine or Douglas fir.

TABLE 2.5.1.1
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION LESS THAN 6"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-5-SC-1	5"	5" × 6" outer dimensions; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (4900 psi) 6" × 4" - 13 SWG mesh.	12 tons	1 hr. 29 min.			7	1	1¼

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.2
STEEL COLUMNS—CONCRETE ENCASEMENTS
6" TO LESS THAN 8" THICK

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SC-1	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: brick filled concrete (6220 psi); 6" × 4" mesh - 13 SWG; 1" below column surface.	12 tons	2 hrs. 46 min.			7	1	2 ³ / ₄
C-7-SC-2	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (5140 psi); 6" × 4" 13 SWG mesh 1" below surface.	12 tons	3 hrs. 1 min.			7	1	3
C-7-SC-3	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: concrete (4540 psi); 6" × 4" - 13 SWG mesh; 1" below column surface.	12 tons	3 hrs. 9 min.			7	1	3
C-7-SC-4	7"	7" × 8" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel concrete (5520 psi); 4" × 4" mesh; 16 SWG.	12 tons	2 hrs. 50 min.			7	1	2 ³ / ₄

For SI: 1 inch = 25.4 mm, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

FIGURE 2.5.1.3
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 8" TO LESS THAN 10"

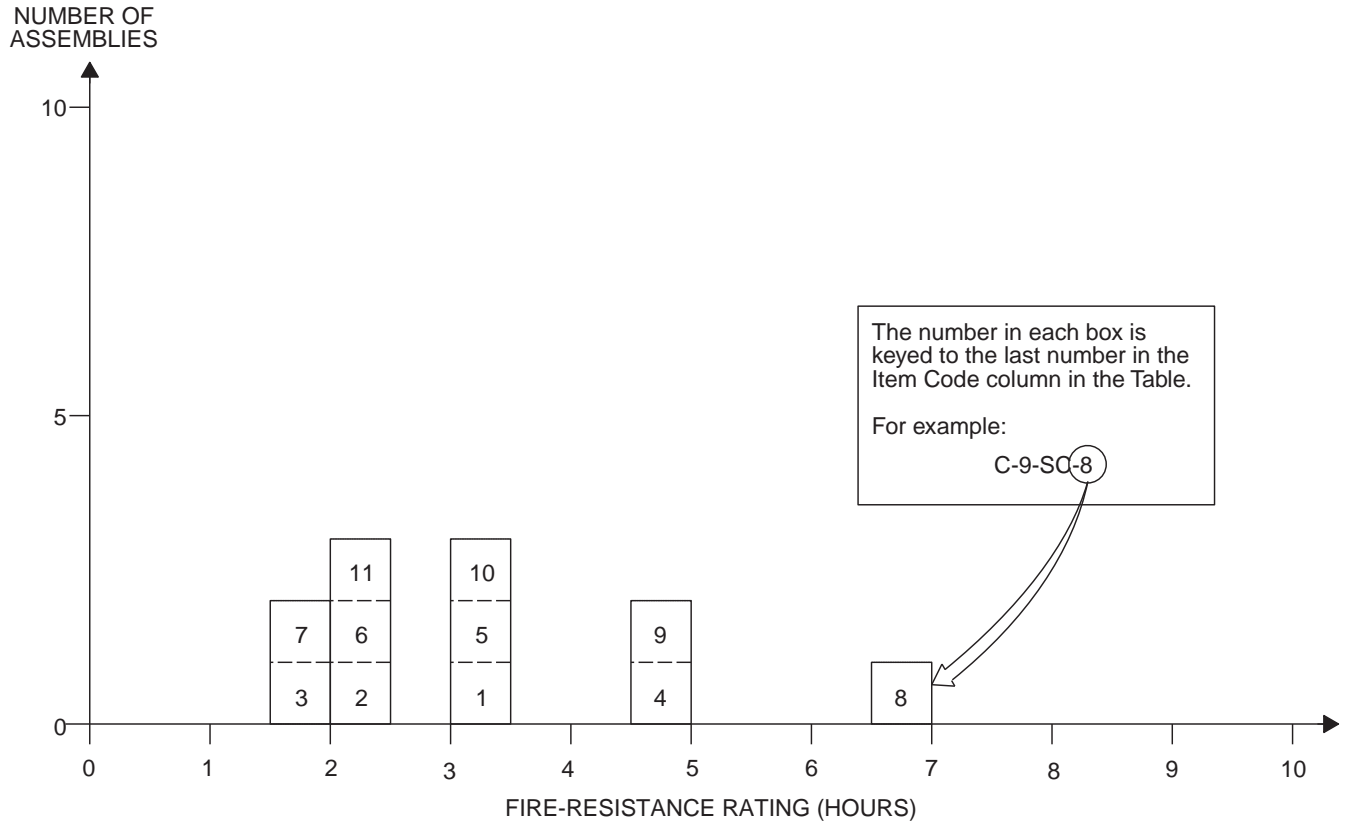


TABLE 2.5.1.3
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 8" TO LESS THAN 10"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-1	8½"	8½" × 10" column; 6" × 4½" × 20 lbs. "H" beam; Protection: gravel concrete (5140 psi); 6" × 4" - 13 SWG mesh.	39 tons	3 hrs. 8 min.			7	1	3
C-8-SC-2	8"	8" × 10" column; 8" × 6" × 35 lbs. "I" beam; Protection: gravel concrete (4240 psi); 6" × 4" - 13 SWG mesh; ½" cover.	90 tons	2 hrs. 1 min.			7	1	2
C-8-SC-3	8"	8" × 10" concrete encased column; 8" × 6" × 35 lbs. "H" beam; protection: aggregate concrete (3750 psi); 4" mesh - 16 SWG reinforcing ½" below column surface.	90 tons	1 hr. 58 min.			7	1	1¾
C-8-SC-4	8"	6" × 6" steel column; 2" outside protection; Group I.	—	5 hrs.		1		2	5
C-8-SC-5	8"	6" × 6" steel column; 2" outside protection; Group II.	—	3 hrs. 30 min.		1		2	3½
C-8-SC-6	8"	6" × 6" steel column; 2" outside protection; Group III.	—	2 hrs. 30 min.		1		2	2½

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.3—continued
 STEEL COLUMNS—CONCRETE ENCASEMENTS
 MINIMUM DIMENSION 8" TO LESS THAN 10"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SC-7	8"	6" × 6" steel column; 2" outside protection; Group IV.	—	1 hr. 45 min.		1		2	1 ³ / ₄
C-9-SC-8	9"	6" × 6" steel column; 3" outside protection; Group I.	—	7 hrs.		1		2	7
C-9-SC-9	9"	6" × 6" steel column; 3" outside protection; Group II.	—	5 hrs.		1		2	5
C-9-SC-10	9"	6" × 6" steel column; 3" outside protection; Group III.	—	3 hrs. 30 min.		1		2	3 ¹ / ₂
C-9-SC-11	9"	6" × 6" steel column; 3" outside protection; Group IV.	—	2 hrs. 30 min.		1		2	2 ¹ / ₂

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m², 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.4
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"

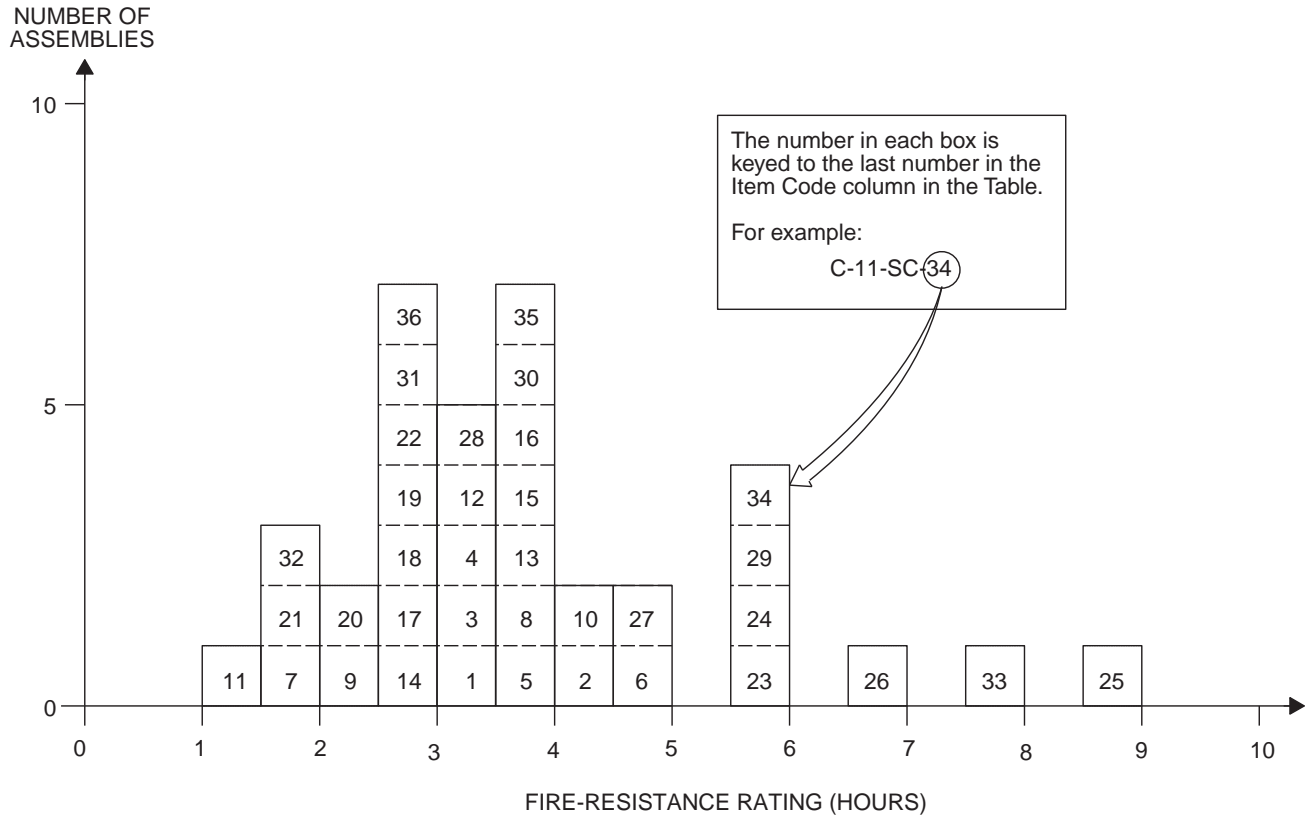


TABLE 2.5.1.4
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-1	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: gravel aggregate concrete (3640 psi); Mesh 6" × 4" 13 SWG, 1" below column surface.	90 tons	3 hrs. 7 min.			7	1,2	3
C-10-SC-2	10"	10" × 16" column; 8" × 6" × 35 lbs. "H" beam; Protection: clay brick concrete (3630 psi); 6" × 4" mesh; 13 SWG, 1" below column surface.	90 tons	4 hrs. 6 min.			7	2	4
C-10-SC-3	10"	10" × 12" column; 8" × 6" × 35 lbs. "H" beam; Protection: crushed stone and sand concrete (3930 psi); 6" × 4" - 13 SWG mesh; 1" below column surface.	90 tons	3 hrs. 17 min.			7	2	3¼
C-10-SC-4	10"	10" × 12" column; 8" × 6" × 35 lbs. "H" beam; Protection: crushed basalt and sand concrete (4350 psi); 6" × 4" - 13 SWG mesh; 1" below column surface.	90 tons	3 hrs. 22 min.			7	2	3⅓
C-10-SC-5	10"	10" × 12" column; 8" × 6" × 35 lbs. "H" beam; Protection: gravel aggregate concrete (5570 psi); 6" × 4" mesh; 13 SWG.	90 tons	3 hrs. 39 min.			7	2	3½
C-10-SC-6	10"	10" × 16" column; 8" × 6" × 35 lbs. "I" beam; Protection: gravel concrete (4950 psi); mesh; 6" × 4" 13 SWG 1" below column surface.	90 tons	4 hrs. 32 min.			7	2	4½

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.4—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-7	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (1370 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	2 hrs.			7	3, 4	2
C-10-SC-8	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: aggregate concrete (4000 psi); 13 SWG iron wire loosely around column at 6" pitch about 2" beneath column surface.	86 tons	3 hrs. 36 min.			7	2	3½
C-10-SC-9	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (3290 psi); 2" cover minimum.	86 tons	2 hrs. 8 min.			7	2	2
C-10-SC-10	10"	10" × 14" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: crushed brick filled concrete (5310 psi); 6" × 4" mesh; 13 SWG reinforcement 1" below column surface.	90 tons	4 hrs. 28 min.			7	2	4⅓
C-10-SC-11	10"	10" × 14" concrete encased column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (342 psi); 6" × 4" mesh; 13 SWG reinforcement 1" below surface.	90 tons	1 hr. 2 min.			7	2	1
C-10-SC-12	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4480 psi); four 3/8" vertical bars at "H" beam edges with 3/16" spacers at beam surface at 3' pitch and 3/16" binders at 10" pitch; 2" concrete cover.	90 tons	3 hrs. 2 min.			7	2	3
C-10-SC-13	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (5070 psi); 6" × 4" mesh; 13 SWG reinforcing at 6" beam sides wrapped and held by wire ties across (open) 8" beam face; reinforcements wrapped in 6" × 4" mesh; 13 SWG throughout; ½" cover to column surface.	90 tons	3 hrs. 59 min.			7	2	3¾
C-10-SC-14	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4410 psi); 6" × 4" mesh; 13 SWG reinforcement 1¼" below column surface; ½" limestone cement plaster with 3/8" gypsum plaster finish.	90 tons	2 hrs. 50 min.			7	2	2¾
C-10-SC-15	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: crushed clay brick filled concrete (4260 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 54 min.			7	2	3¾
C-10-SC-16	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (4350 psi); 6" × 4" mesh; 13 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 54 min.			7	2	3¾

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.4—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SC-17	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (5300 psi); 6" × 4"; 13 SWG wire mesh 1" below column surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-18	10"	10" × 12" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: limestone aggregate concrete (4800 psi) with 6" × 4"; 13 SWG mesh reinforcement 1" below surface.	90 tons	3 hrs.			7	4, 5	3
C-10-SC-19	10"	10" × 14" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: aggregate concrete (3900 psi); 4" mesh; 16 SWG reinforcing 1/2" below column surface.	118 tons	2 hrs. 42 min.			7	2	2
C-10-SC-20	10"	10" × 14" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: aggregate concrete (4930 psi); 4" mesh; 16 SWG reinforcing 1/2" below column surface.	177 tons	2 hrs. 8 min.			7	2	2
C-10-SC-21	10 ^{3/8} "	10 ^{3/8} " × 12 ^{3/8} " concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (835 psi) with 6" × 4" mesh; 13 SWG reinforcing 1 ^{3/16} " below column surface; 3/16" gypsum plaster finish.	90 tons	2 hrs.			7	3, 4	2
C-11-SC-22	11"	11" × 13" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: "open texture" brick filled concrete (890 psi) with 6" × 4" mesh; 13 SWG reinforcing 1 1/2" below column surface; 3/8" lime cement plaster; 1/8" gypsum plaster finish.	90 tons	3 hrs.			7	6, 7	3
C-11-SC-23	11"	11" × 12" column; 4" × 3" × 10 lbs. "H" beam; gravel concrete (4550 psi); 6" × 4" - 13 SWG mesh reinforcing; 1" below column surface.	12 tons	6 hrs.			7	7, 8	6
C-11-SC-24	11"	11" × 12" column; 4" × 3" × 10 lbs. "H" beam; Protection: gravel aggregate concrete (3830 psi); with 4" × 4" mesh; 16 SWG, 1" below column surface.	16 tons	5 hrs. 32 min.			7	2	5 1/2
C-10-SC-25	10"	6" × 6" steel column with 4" outside protection; Group I.	—	9 hrs.		1		9	9
C-10-SC-26	10"	Description as per C-SC-25; Group II.	—	7 hrs.		1		9	7
C-10-SC-27	10"	Description as per C-10-SC-25; Group III.	—	5 hrs.		1		9	5
C-10-SC-28	10"	Description as per C-10-SC-25; Group IV.	—	3 hrs. 30 min.		1		9	3 1/2
C-10-SC-29	10"	8" × 8" steel column with 2" outside protection; Group I.	—	6 hrs.		1		9	6
C-10-SC-30	10"	Description as per C-10-SC-29; Group II.	—	4 hrs.		1		9	4
C-10-SC-31	10"	Description as per C-10-SC-29; Group III.	—	3 hrs.		1		9	3
C-10-SC-32	10"	Description as per C-10-SC-29; Group IV.	—	2 hrs.		1		9	2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.4—continued
 STEEL COLUMNS—CONCRETE ENCASEMENTS
 MINIMUM DIMENSION 10" TO LESS THAN 12"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SC-33	11"	8" × 8" steel column with 3" outside protection; Group I.	—	8 hrs.		1		9	8
C-11-SC-34	11"	Description as per C-10-SC-33; Group II.	—	6 hrs.		1		9	6
C-11-SC-35	11"	Description as per C-10-SC-33; Group III.	—	4 hrs.		1		9	4
C-11-SC-36	11"	Description as per C-10-SC-33; Group IV.	—	3 hrs.		1		9	3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m², 1 ton = 8.896 kN.

Notes:

1. Tested under total restraint load to prevent expansion—minimum load 90 tons.
2. Failure mode—collapse.
3. Passed 2-hour fire test (Grade "C," British).
4. Passed hose stream test.
5. Column tested and passed 3-hour grade fire resistance (British).
6. Column passed 3-hour fire test.
7. Column collapsed during hose stream testing.
8. Column passed 6-hour fire test.
9. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.5
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12" TO LESS THAN 14"

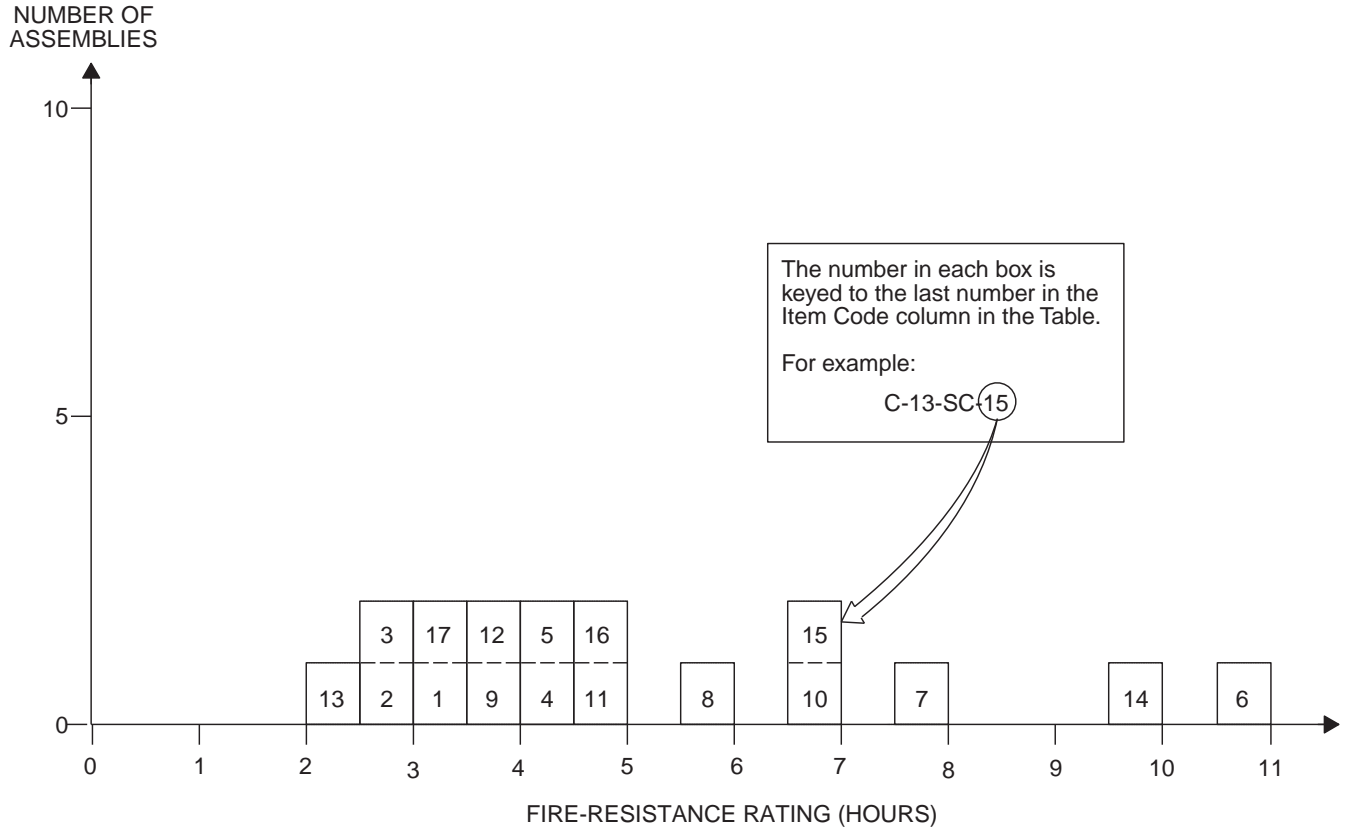


TABLE 2.5.1.5
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12" TO LESS THAN 14"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-1	12"	12" × 14" concrete encased steel column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4150 psi) with 4" mesh; 16 SWG reinforcing 1" below column surface.	120 tons	3 hrs. 24 min.			7	1	3 ¹ / ₃
C-12-SC-2	12"	12" × 16" concrete encased column; 8" × 6" × 35 lbs. "H" beam; Protection: aggregate concrete (4300 psi) with 4" mesh; 16 SWG reinforcing 1" below column surface.	90 tons	2 hrs. 52 min.			7	1	2 ³ / ₄
C-12-SC-3	12"	12" × 16" concrete encased steel column; 12" × 8" × 65 lbs. "H" column; Protection: gravel aggregate concrete (3550 psi) with 4" mesh; 16 SWG reinforcement 1" below column surface.	177 tons	2 hrs. 31 min.			7	1	2 ¹ / ₂
C-12-SC-4	12"	12" × 16" concrete encased column; 12" × 8" × 65 lbs. "H" beam; Protection: aggregate concrete (3450 psi) with 4" mesh; 16 SWG reinforcement 1" below column surface.	118 tons	4 hrs. 4 min.			7	1	4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.5—continued
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 12" TO LESS THAN 14"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SC-5	12 ¹ / ₂ "	12 ¹ / ₂ " × 14" column; 6" × 4 ¹ / ₂ " × 20 lbs. "H" beam; Protection: gravel aggregate concrete (3750 psi) with 4" × 4" mesh; 16 SWG reinforcing 1" below column surface.	52 tons	4 hrs. 29 min.			7	1	4 ¹ / ₃
C-12-SC-6	12"	8" × 8" steel column; 2" outside protection; Group I.	—	11 hrs.			1	2	11
C-12-SC-7	12"	Description as per C-12-SC-6; Group II.	—	8 hrs.		1		2	8
C-12-SC-8	12"	Description as per C-12-SC-6; Group III.	—	6 hrs.		1		2	6
C-12-SC-9	12"	Description as per C-12-SC-6; Group IV.	—	4 hrs.		1		2	4
C-12-SC-10	12"	10" × 10" steel column; 2" outside protection; Group I.	—	7 hrs.		1		2	7
C-12-SC-11	12"	Description as per C-12-SC-10; Group II.	—	5 hrs.		1		2	5
C-12-SC-12	12"	Description as per C-12-SC-10; Group III.	—	4 hrs.		1		2	4
C-12-SC-13	12"	Description as per C-12-SC-10; Group IV.	—	2 hrs. 30 min.		1		2	2 ¹ / ₂
C-13-SC-14	13"	10" × 10" steel column; 3" outside protection; Group I.	—	10 hrs.		1		2	10
C-13-SC-15	13"	Description as per C-12-SC-14; Group II.	—	7 hrs.		1		2	7
C-13-SC-16	13"	Description as per C-12-SC-14; Group III.	—	5 hrs.		1		2	5
C-13-SC-17	13"	Description as per C-12-SC-14; Group IV.	—	3 hrs. 30 min.		1		2	3 ¹ / ₂

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m², 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

FIGURE 2.5.1.6
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 14" TO LESS THAN 16"

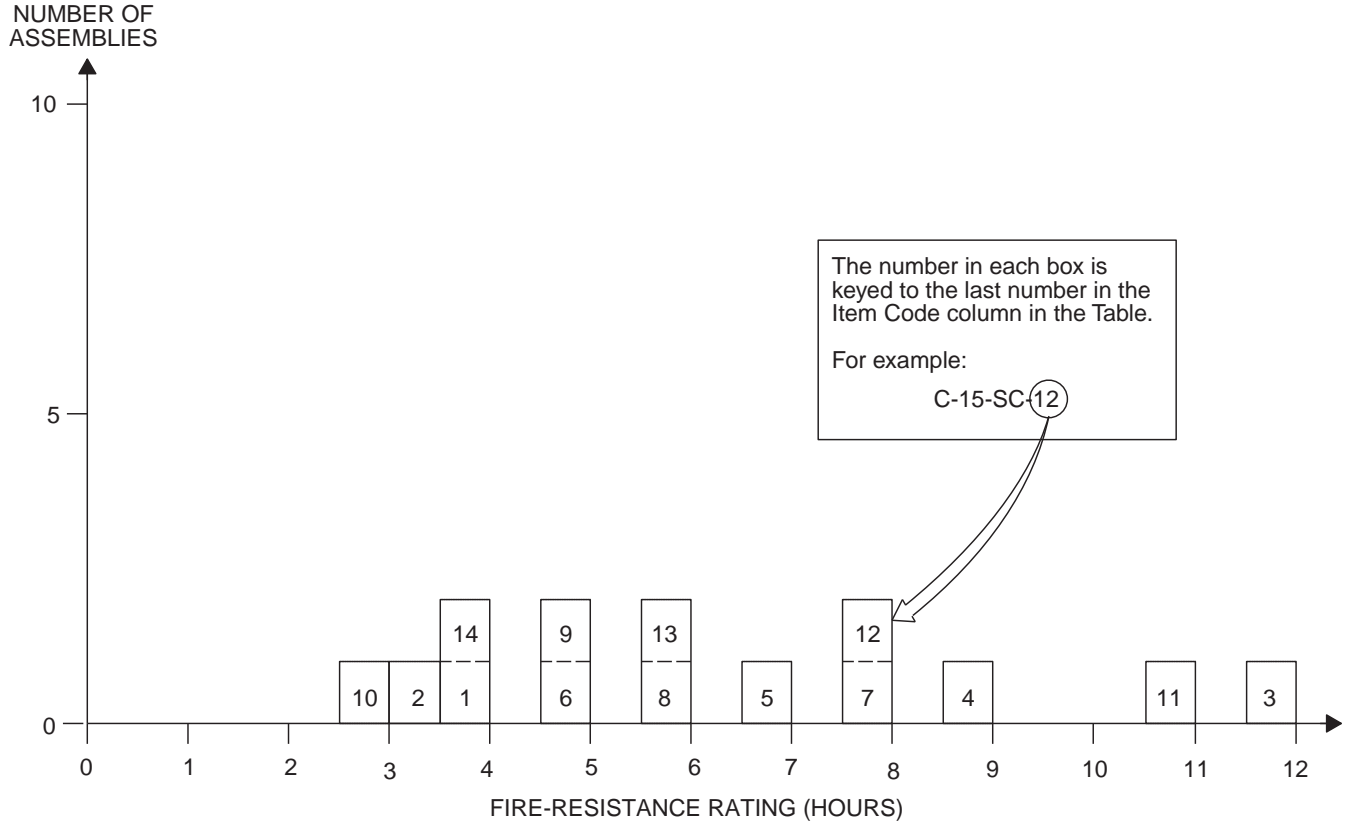


TABLE 2.5.1.6
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 14" TO LESS THAN 16"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-1	14"	24" × 16" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: aggregate concrete (4240 psi); 4" mesh - 16 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 40 min.			7	1	3
C-14-SC-2	14"	14" × 18" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: gravel aggregate concrete (4000 psi) with 4" - 16 SWG wire mesh reinforcement 1" below column surface.	177 tons	3 hrs. 20 min.			7	1	3
C-14-SC-3	14"	10" × 10" steel column; 4" outside protection; Group I.	—	12 hrs.		1		2	12
C-14-SC-4	14"	Description as per C-14-SC-3; Group II.	—	9 hrs.		1		2	9
C-14-SC-1	14"	24" × 16" concrete encased steel column; 8" × 6" × 35 lbs. "H" column; Protection: aggregate concrete (4240 psi); 4" mesh - 16 SWG reinforcing 1" below column surface.	90 tons	3 hrs. 40 min.			7	1	3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.1.6—continued
 STEEL COLUMNS—CONCRETE ENCASEMENTS
 MINIMUM DIMENSION 14" TO LESS THAN 16"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-14-SC-2	14"	14" × 18" concrete encased steel column; 12" × 8" × 65 lbs. "H" beam; Protection: gravel aggregate concrete (4000 psi) with 4"-16 SWG wire mesh reinforcement 1" below column surface.	177 tons	3 hrs. 20 min.			7	1	3
C-14-SC-3	14"	10" × 10" steel column; 4" outside protection; Group I.	—	12 hrs.		1		2	12
C-14-SC-4	14"	Description as per C-14-SC-3; Group II.	—	9 hrs.		1		2	9
C-14-SC-5	14"	Description as per C-14-SC-3; Group III.	—	7 hrs.		1		2	7
C-14-SC-6	14"	Description as per C-14-SC-3; Group IV.	—	5 hrs.		1		2	5
C-14-SC-7	14"	12" × 12" steel column; 2" outside protection; Group I.	—	8 hrs.		1		2	8
C-14-SC-8	14"	Description as per C-14-SC-7; Group II.	—	6 hrs.		1		2	6
C-14-SC-9	14"	Description as per C-14-SC-7; Group III.	—	5 hrs.		1		2	5
C-14-SC-10	14"	Description as per C-14-SC-7; Group IV	—	3 hrs.		1		2	3
C-15-SC-11	15"	12" × 12" steel column; 3" outside protection; Group I.	—	11 hrs.		1		2	11
C-15-SC-12	15"	Description as per C-15-SC-11; Group II.	—	8 hrs.		1		2	8
C-15-SC-13	15"	Description as per C-15-SC-11; Group III.	—	6 hrs.		1		2	6
C-15-SC-14	15"	Description as per C-15-SC-11; Group IV.	—	4 hrs.		1		2	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 pound per square yard = 5.3 N/m², 1 ton = 8.896 kN.

Notes:

1. Collapse.
2. Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
 Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
 Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**TABLE 2.5.1.7
STEEL COLUMNS—CONCRETE ENCASEMENTS
MINIMUM DIMENSION 16" TO LESS THAN 18"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-16-SC-13	16"	12" × 12" steel column; 4" outside protection; Group I.	—	14 hrs.		1		1	14
C-16-SC-2	16"	Description as per C-16-SC-1; Group II.	—	10 hrs.		1		1	10
C-16-SC-3	16"	Description as per C-16-SC-1; Group III.	—	8 hrs.		1		1	8
C-16-SC-4	16"	Description as per C-16-SC-1; Group IV.	—	5 hrs.		1		1	5

For SI: 1 inch = 25.4 mm.

Notes:

- Group I: includes concrete having calcareous aggregate containing a combined total of not more than 10 percent of quartz, chert and flint for the coarse aggregate.
Group II: includes concrete having trap-rock aggregate applied without metal ties and also concrete having cinder, sandstone or granite aggregate, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group III: includes concrete having cinder, sandstone or granite aggregate tied with No. 5 gage steel wire, wound spirally over the column section on a pitch of 8 inches, or equivalent ties, and concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, if held in place with wire mesh or expanded metal having not larger than 4-inch mesh, weighing not less than 1.7 lbs./yd.², placed not more than 1 inch from the surface of the concrete.
Group IV: includes concrete having siliceous aggregates containing a combined total of 60 percent or more of quartz, chert and flint, and tied with No. 5 gage steel wire wound spirally over the column section on a pitch of 8 inches, or equivalent ties.

**TABLE 2.5.2.1
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-10-SB-1	10½"	10½" × 13" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection. Fill of broken brick and mortar; 2" brick on edge; joints broken in alternate courses; cement-sand grout; 13 SWG wire reinforcement in every third horizontal joint.	90 tons	3 hrs. 6 min.			7	1	3
C-10-SB-2	10½"	10½" × 13" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" brick; joints broken in alternate courses; cement-sand grout; 13 SWG iron wire reinforcement in alternate horizontal joints.	90 tons	2 hrs.			7	2, 3, 4	2
C-10-SB-3	10"	10" × 12" block encased columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" foamed slag concrete blocks; 13 SWG wire at each horizontal joint; mortar at each joint.	90 tons	2 hrs.			7	5	2
C-10-SB-4	10½"	10½" × 12" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: gravel aggregate concrete fill (unconsolidated) 2" thick hollow clay tiles with mortar at edges.	86 tons	56 min.			7	1	¾
C-10-SB-5	10½"	10½" × 12" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2" hollow clay tiles with mortar at edges.	86 tons	22 min.			7	1	¼

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

- Failure mode—collapse.
- Passed 2-hour fire test (Grade "C" - British).
- Passed hose stream test.
- Passed reload test.
- Passed 2-hour fire exposure but collapsed immediately following hose stream test.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 2.5.2.2
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 12" TO LESS THAN 14"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SB-1	12"	12" × 15" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 2 ⁵ / ₈ " thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	90 tons	1 hr. 49 min.			7	1	1 ³ / ₄

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

TABLE 2.5.2.3
STEEL COLUMNS—BRICK AND BLOCK ENCASEMENTS
MINIMUM DIMENSION 14" TO LESS THAN 16"

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-15-SB-1	15"	15" × 17" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4 ¹ / ₂ " thick brick; joints broken in alternate courses; cement-sand grout; fill of broken brick and mortar.	45 tons	6 hrs.			7	1	6
C-15-SB-2	15"	15" × 17" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection. Fill of broken brick and mortar; 4 ¹ / ₂ " brick; joints broken in alternate courses; cement-sand grout.	86 tons	6 hrs.			7	2, 3, 4	6
C-15-SB-3	15"	15" × 18" brick encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4 ¹ / ₂ " brick work; joints alternating; cement-sand grout.	90 tons	4 hrs.			7	5, 6	4
C-15-SB-4	14"	14" × 16" block encased steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 4" thick foam slag concrete blocks; 13 SWG wire reinforcement in each horizontal joint; mortar in joints.	90 tons	5 hrs. 52 min.			7	7	4 ³ / ₄

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Only a nominal load was applied to specimen.
2. Passed 6-hour fire test (Grade "A" - British).
3. Passed (6 minute) hose stream test.
4. Reload not specified.
5. Passed 4-hour fire exposure.
6. Failed by collapse between first and second minute of hose stream exposure.
7. Mode of failure-collapse.

**TABLE 2.5.3.1
STEEL COLUMNS—PLASTER ENCASEMENTS
MINIMUM DIMENSION 6" TO LESS THAN 8"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SP-1	7 ¹ / ₂ "	7 ¹ / ₂ " × 9 ¹ / ₂ " plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG wire metal lath; 1 ¹ / ₄ " lime plaster.	90 tons	57 min.			7	1	3/4
C-7-SP-2	7 ⁷ / ₈ "	7 ⁷ / ₈ " × 10" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 3/8" gypsum board; wire wound with 16 SWG wire helically wound at 4" pitch; 1/2" gypsum plaster.	90 tons	1 hr. 13 min.			7	1	1
C-7-SP-3	7 ¹ / ₄ "	7 ¹ / ₄ " × 9 ³ / ₈ " plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 3/8" gypsum board; wire helically wound 16 SWG at 4" pitch; 1/4" gypsum plaster finish.	90 tons	1 hr. 14 min.			7	1	1

Notes:

1. Failure mode—collapse.

**TABLE 2.5.3.2
STEEL COLUMNS—PLASTER ENCASEMENTS
MINIMUM DIMENSION 8" TO LESS THAN 10"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-8-SP-1	8"	8" × 10" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG wire lath; 1" gypsum plaster.	86 tons	1 hr. 23 min.			7	1	1 ¹ / ₄
C-8-SP-2	8 ¹ / ₂ "	8 ¹ / ₂ " × 10 ¹ / ₂ " plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG metal lath wrap; 1 ¹ / ₄ " gypsum plaster.	90 tons	1 hr. 36 min.			7	1	1 ¹ / ₂
C-9-SP-3	9"	9" × 11" plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 24 SWG metal lath wrap; 1/8" M.S. ties at 12" pitch wire netting 1 ¹ / ₂ " × 22 SWG between first and second plaster coats; 1 ¹ / ₂ " gypsum plaster.	90 tons	1 hr. 33 min.			7	1	1 ¹ / ₂
C-8-SP-4	8 ³ / ₄ "	8 ³ / ₄ " × 10 ³ / ₄ " plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 3/4" gypsum board; wire wound spirally (#16 SWG) at 1 ¹ / ₂ " pitch; 1/2" gypsum plaster.	90 tons	2 hrs.			7	2, 3, 4	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.
2. Passed 2 hour fire exposure test (Grade "C" - British).
3. Passed hose stream test.

**TABLE 2.5.4.1
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 6" TO LESS THAN 8"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-7-SM-1	7 ⁵ / ₈ "	7 ⁵ / ₈ " × 9 ¹ / ₂ " (asbestos plaster) protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: 20 gage 1/2" metal lath; 9/16" asbestos plaster (minimum).	90 tons	1 hr. 52 min.			7	1	1 ³ / ₄

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Failure mode—collapse.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 2.5.4.2
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 8" TO LESS THAN 10"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-9-SM-1	9 ⁵ / ₈ "	9 ⁵ / ₈ " × 11 ³ / ₈ " asbestos slab and cement plaster protected columns; 8" × 6" × 35 lbs. "H" beam; Protection: 1" asbestos slab; wire wound; ⁵ / ₈ " plaster.	90 tons	2 hrs.			7	1, 2	2

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2 hour fire exposure test.
2. Collapsed during hose stream test.

**TABLE 2.5.4.3
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 10" TO LESS THAN 12"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-11-SM-1	11 ¹ / ₂ "	11 ¹ / ₂ " × 13 ¹ / ₂ " wood wool and plaster protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: wood-wool-cement paste as fill and to 2" cover over beam; ³ / ₄ " gypsum plaster finish.	90 tons	2 hrs.			7	1, 2, 3	2
C-10-SM-1	10"	10" × 12" asbestos protected steel columns; 8" × 6" × 35 lbs. "H" beam; Protection: sprayed on asbestos paste to 2" cover over column.	90 tons	4 hrs.			7	2, 3, 4	4

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 2 hour fire exposure (Grade "C" - British).
2. Passed hose stream test.
3. Passed reload test.
4. Passed 4 hour fire exposure test.

**TABLE 2.5.4.4
STEEL COLUMNS—MISCELLANEOUS ENCASEMENTS
MINIMUM DIMENSION 12" TO LESS THAN 14"**

ITEM CODE	MINIMUM DIMENSION	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
C-12-SM-1	12"	12" × 14 ¹ / ₄ " cement and asbestos protected columns; 8" × 6" × 35 lbs. "H" beam; Protection: fill of asbestos packing pieces 1" thick 1'3" o.c.; cover of 2" molded asbestos inner layer; 1" molded asbestos outer layer; held in position by 16 SWG nichrome wire ties; wash of refractory cement on outer surface.	86 tons	4 hrs. 43 min.			7	1, 2, 3	4 ² / ₃

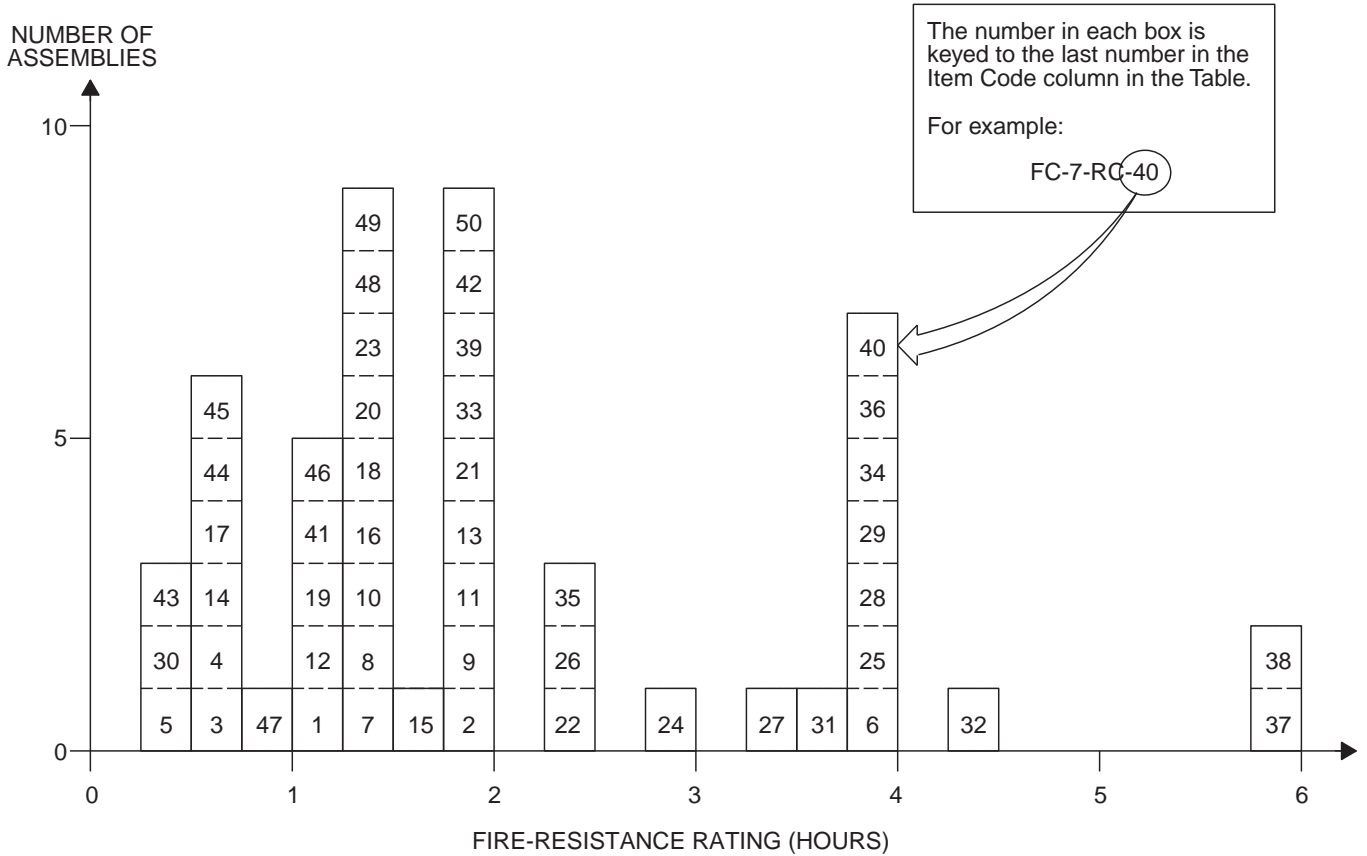
For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Passed 4 hour fire exposure (Grade "B" - British).
2. Passed hose stream test.
3. Passed reload test.

**SECTION III
FLOOR/CEILING ASSEMBLIES**

**FIGURE 3.1
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE**



**TABLE 3.1
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE**

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-1	3 ³ / ₄ "	3 ³ / ₄ " thick floor; 3 ¹ / ₄ " (5475 psi) concrete deck; 1/2" plaster under deck; 3/8" main reinforcement bars at 5 ¹ / ₂ " pitch with 7/8" concrete cover; 3/8" main reinforcement bars at 4 ¹ / ₂ " pitch perpendicular with 1/2" concrete cover; 13'1" span restrained.	195 psf	24 min.			7	1, 2	1/3
F/C-3-RC-2	3 ¹ / ₄ "	3 ¹ / ₄ " deep (3540 psi) concrete deck; 3/8" main reinforcement bars at 5 ¹ / ₂ " pitch with 7/8" cover; 3/8" main reinforcement bars at 4 ¹ / ₂ " pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	2 hrs.			7	1, 3, 4	2

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-3-RC-3	3 1/4"	3 1/4" deep (4175 psi) concrete deck; 3/8" main reinforcement bars at 5 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 4 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	31 min.			7	1, 5	1/2
F/C-3-RC-4	3 1/4"	3 1/4" deep (4355 psi) concrete deck; 3/8" main reinforcement bars at 5 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 4 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	41 min.			7	1, 5, 6	1/2
F/C-3-RC-5	3 1/4"	3 1/4" thick (3800 psi) concrete deck; 3/8" main reinforcement bars at 5 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 4 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	1 hr. 5 min.			7	1, 5	1
F/C-4-RC-6	4 1/4"	4 1/4" thick; 3 1/4" (4000 psi) concrete deck; 1" sprayed asbestos lower surface; 3/8" main reinforcement bars at 5 7/8" pitch with 7/8" concrete cover; 3/8" main reinforcement bars at 4 1/2" pitch perpendicular with 1/2" concrete cover; 13'1" span restrained.	195 psf	4 hrs.			7	1, 7	4
F/C-4-RC-7	4"	4" (5025 psi) concrete deck; 1/4" reinforcement bars at 7 1/2" pitch with 3/4" cover; 3/8" main reinforcement bars at 3 3/4" pitch perpendicular with 1/2" cover; 13'1" span restrained.	140 psf	1 hr. 16 min.			7	1, 2	1 1/4
F/C-4-RC-8	4"	4" thick (4905 psi) deck; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 3/4" pitch perpendicular with 1/2" cover; 13'1" span restrained.	100 psf	1 hr. 23 min.			7	1, 2	1 1/3
F/C-4-RC-9	4"	4" deep (4370 psi); 1/4" reinforcement bars at 6" pitch with 3/4" cover; 1/4" main reinforcement bars at 4" pitch perpendicular with 1/2" cover; 13'1" span restrained.	150 psf	2 hrs.			7	1, 3	2
F/C-4-RC-10	4"	4" thick (5140 psi) deck; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 3/4" pitch perpendicular with 1/2" cover; 13'1" span restrained.	140 psf	1 hr. 16 min.			7	1, 5	1 1/4
F/C-4-RC-11	4"	4" thick (4000 psi) concrete deck; 3" x 1 1/2" x 4 lbs. R.S.J.; 2'6" C.R.S.; flush with top surface; 4" x 6" x 13 SWG mesh reinforcement 1" from bottom of slab; 6'6" span restrained.	150 psf	2 hrs.			7	1, 3	2

(continued)

TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-4-RC-12	4"	4" deep (2380 psi) concrete deck; 3" × 1½" × 4 lbs. R.S.J.; 2'6" C.R.S.; flush with top surface; 4" × 6" x 13 SWG mesh reinforcement 1" from bottom surface; 6'6" span restrained.	150 psf	1 hr. 3 min.			7	1, 2	1
F/C-4-RC-13	4½"	4½" thick (5200 psi) deck; ¼" reinforcement bars at 7¼" pitch with ⅞" cover; ⅜" main reinforcement bars at 3¾" pitch perpendicular with ½" cover; 13'1" span restrained.	140 psf	2 hrs.			7	1, 3	2
F/C-4-RC-14	4½"	4½" deep (2525 psi) concrete deck; ¼" reinforcement bars at 7½" pitch with ⅞" cover; ⅜" main reinforcement bars at 3¾" pitch perpendicular with ½" cover; 13'1" span restrained.	150 psf	42 min.			7	1, 5	⅔
F/C-4-RC-15	4½"	4½" deep (4830 psi) concrete deck; 1½" × No. 15 gauge wire mesh; ⅜" reinforcement bars at 15" pitch with 1" cover; ½" main reinforcement bars at 6" pitch perpendicular with ½" cover; 12' span simply supported.	75 psf	1 hr. 32 min.			7	1, 8	1½
F/C-4-RC-16	4½"	4½" deep (4595 psi) concrete deck; ¼" reinforcement bars at 7½" pitch with ⅞" cover; ⅜" main reinforcement bars at 3½" pitch perpendicular with ½" cover; 12' span simply supported.	75 psf	1 hr. 20 min.			7	1, 8	1⅓
F/C-4-RC-17	4½"	4½" deep (3625 psi) concrete deck; ¼" reinforcement bars at 7½" pitch with ⅞" cover; ⅜" main reinforcement bars at 3½" pitch perpendicular with ½" cover; 12' span simply supported.	75 psf	35 min.			7	1, 8	½
F/C-4-RC-18	4½"	4½" deep (4410 psi) concrete deck; ¼" reinforcement bars at 7½" pitch with ⅞" cover; ⅜" main reinforcement bars at 3½" pitch perpendicular with ½" cover; 12' span simply supported.	85 psf	1 hr. 27 min.			7	1, 8	1⅓
F/C-4-RC-19	4½"	4½" deep (4850 psi) deck; ⅜" reinforcement bars at 15" pitch with 1" cover; ½" main reinforcement bars at 6" pitch perpendicular with ½" cover; 12' span simply supported.	75 psf	2 hrs. 15 min.			7	1, 9	1¼
F/C-4-RC-20	4½"	4½" deep (3610 psi) deck; ¼" reinforcement bars at 7½" pitch with ⅞" cover; ⅜" main reinforcement bars at 3½" pitch perpendicular with ½" cover; 12' span simply supported.	75 psf	1 hr. 22 min.			7	1, 8	1⅓

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-5-RC-21	5"	5" deep; 4 1/2" (5830 psi) concrete deck; 1/2" plaster finish bottom of slab; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 1/2" pitch perpendicular with 1/2" cover; 12' span simply supported.	69 psf	2 hrs.			7	1, 3	2
F/C-5-RC-22	5"	4 1/2" (5290 psi) concrete deck; 1/2" plaster finish bottom of slab; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 1/2" pitch perpendicular with 1/2" cover; 12' span simply supported.	No load	2 hrs. 28 min.			7	1, 10, 11	2 1/4
F/C-5-RC-23	5"	5" (3020 psi) concrete deck; 3" x 1 1/2" x 4 lbs. R.S.J.; 2' C.R.S. with 1" cover on bottom and top flanges; 8' span restrained.	172 psf	1 hr. 24 min.			7	1, 2, 12	1 1/2
F/C-5-RC-24	5 1/2"	5" (5180 psi) concrete deck; 1/2" retarded plaster underneath slab; 1/4" reinforcement bars at 7 1/2" pitch with 1 3/8" cover; 3/8" main reinforcement bars at 3 1/2" pitch perpendicular with 1" cover; 12' span simply supported.	60 psf	2 hrs. 48 min.			7	1, 10	2 3/4
F/C-6-RC-25	6"	6" deep (4800 psi) concrete deck; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 1/2" pitch perpendicular with 7/8" cover; 13'1" span restrained.	195 psf	4 hrs.			7	1, 7	4
F/C-6-RC-26	6"	6" (4650 psi) concrete deck; 1/4" reinforcement bars at 7 1/2" pitch with 7/8" cover; 3/8" main reinforcement bars at 3 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	2 hrs. 23 min.			7	1, 2	2 1/4
F/C-6-RC-27	6"	6" deep (6050 psi) concrete deck; 1/4" reinforcement bars at 7 1/2" pitch 7/8" cover; 3/8" reinforcement bars at 3 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	195 psf	3 hrs. 30 min.			7	1, 10	3 1/2
F/C-6-RC-28	6"	6" deep (5180 psi) concrete deck; 1/4" reinforcement bars at 8" pitch 3/4" cover; 1/4" reinforcement bars at 5 1/2" pitch perpendicular with 1/2" cover; 13'1" span restrained.	150 psf	4 hrs.			7	1, 7	4
F/C-6-RC-29	6"	6" thick (4180 psi) concrete deck; 4" x 3" x 10 lbs. R.S.J.; 2' 6" C.R.S. with 1" cover on both top and bottom flanges; 13'1" span restrained.	160 psf	3 hrs. 48 min.			7	1, 10	3 3/4
F/C-6-RC-30	6"	6" thick (3720 psi) concrete deck; 4" x 3" x 10 lbs. R.S.J.; 2' 6" C.R.S. with 1" cover on both top and bottom flanges; 12' span simply supported.	115 psf	29 min.			7	1, 5, 13	1/4

(continued)

TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-6-RC-31	6"	6" deep (3450 psi) concrete deck; 4" × 1 ³ / ₄ " × 5 lbs. R.S.J.; 2' 6" C.R.S. with 1" cover on both top and bottom flanges; 12' span simply supported.	25 psf	3 hrs. 35 min.			7	1, 2	3 ¹ / ₂
F/C-6-RC-32	6"	6" deep (4460 psi) concrete deck; 4" × 1 ³ / ₄ " × 5 lbs. R.S.J.; 2' C.R.S.; with 1" cover on both top and bottom flanges; 12' span simply supported.	60 psf	4 hrs. 30 min.			7	1, 10	4 ¹ / ₂
F/C-6-RC-33	6"	6" deep (4360 psi) concrete deck; 4" × 1 ³ / ₄ " × 5 lbs. R.S.J.; 2' C.R.S.; with 1" cover on both top and bottom flanges; 13'1" span restrained.	60 psf	2 hrs.			7	1, 3	2
F/C-6-RC-34	6 ¹ / ₄ "	6 ¹ / ₄ " thick; 4 ³ / ₄ " (5120 psi) concrete core; 1" T&G board flooring; 1/2" plaster undercoat; 4" × 3" × 10 lbs. R.S.J.; 3' C.R.S. flush with top surface concrete; 12' span simply supported; 2" × 1'3" clinker concrete insert.	100 psf	4 hrs.			7	1, 7	4
F/C-6-RC-35	6 ¹ / ₄ "	4 ³ / ₄ " (3600 psi) concrete core; 1" T&G board flooring; 1/2" plaster undercoat; 4" × 3" × 10 lbs. R.S.J.; 3' C.R.S.; flush with top surface concrete; 12' span simply supported; 2" × 1'3" clinker concrete insert.	100 psf	2 hrs. 30 min.			7	1, 5	2 ¹ / ₂
F/C-6-RC-36	6 ¹ / ₄ "	4 ³ / ₄ " (2800 psi) concrete core; 1" T&G board flooring; 1/2" plaster undercoat; 4" × 3" × 10 lbs. R.S.J.; 3' C.R.S.; flush with top surface concrete; 12" span simply supported; 2" × 1'3" clinker concrete insert.	80 psf	4 hrs.			7	1, 7	4
F/C-7-RC-37	7"	(3640 psi) concrete deck; 1/4" reinforcement bars at 6" pitch with 1 ¹ / ₂ " cover; 1/4" reinforcement bars at 5" pitch perpendicular with 1 ¹ / ₂ " cover; 13'1" span restrained.	169 psf	6 hrs.			7	1, 14	6
F/C-7-RC-38	7"	(4060 psi) concrete deck; 4" × 3" × 10 lbs. R.S.J.; 2' 6" C.R.S. with 1 ¹ / ₂ " cover on both top and bottom flanges; 4" × 6" × 13 SWG mesh reinforcement 1 ¹ / ₂ " from bottom of slab; 13'1" span restrained.	175 psf	6 hrs.			7	1, 14	6
F/C-7-RC-39	7 ¹ / ₄ "	5 ³ / ₄ " (4010 psi) concrete core; 1" T&G board flooring; 1/2" plaster undercoat; 4" × 3" × 10 lbs. R.S.J.; 2' 6" C.R.S.; 1" down from top surface of concrete; 12' simply supported span; 2" × 1' 3" clinker concrete insert.	95 psf	2 hrs.			7	1, 3	2
F/C-7-RC-40	7 ¹ / ₄ "	5 ³ / ₄ " (3220 psi) concrete core; 1" T&G flooring; 1/2" plaster undercoat; 4" × 3" × 10 lbs. R.S.J.; 2'6" C.R.S.; 1" down from top surface of concrete; 12' simply supported span; 2" × 1'3" clinker concrete insert.	95 psf	4 hrs.			7	1, 7	4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

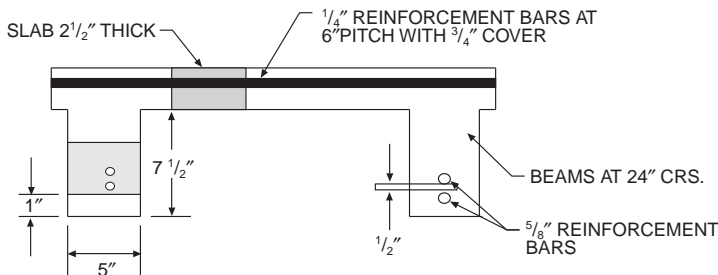
TABLE 3.1—continued
FLOOR/CEILING ASSEMBLIES—REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-7-RC-41	10" (2 1/4" Slab)	Ribbed floor, see Note 15 for details; slab 2 1/2" deep (3020 psi); 1/4" reinforcement bars at 6" pitch with 3/4" cover; beams 7 1/2" deep x 5" wide; 24" C.R.S.; 5/8" reinforcement bars two rows 1/2" vertically apart with 1" cover; 13'1" span restricted.	195 psf	1 hr. 4 min.			7	1, 2, 15	1
F/C-5-RC-42	5 1/2"	Composite ribbed concrete slab assembly; see Note 17 for details.	See Note 16	2 hrs.			43	16, 17	2
F/C-3-RC-43	3"	2500 psi concrete; 5/8" cover; fully restrained at test.	See Note 16	30 min.			43	16	1/2
F/C-3-RC-44	3"	2000 psi concrete; 5/8" cover; free or partial restraint at test.	See Note 16	45 min.			43	16	3/4
F/C-4-RC-45	4"	2500 psi concrete; 5/8" cover; fully restrained at test.	See Note 16	40 min.			43	16	2/3
F/C-4-RC-46	4"	2000 psi concrete; 3/4" cover; free or partial restraint at test.	See Note 16	1 hr. 15 min.			43	16	1 1/4
F/C-5-RC-47	5"	2500 psi concrete; 3/4" cover; fully restrained at test.	See Note 16	1 hr.			43	16	1
F/C-5-RC-48	5"	2000 psi concrete; 3/4" cover; free or partial restraint at test.	See Note 16	1 hr. 30 min.			43	16	1 1/2
F/C-6-RC-49	6"	2500 psi concrete; 1" cover; fully restrained at test.	See Note 16	1 hr. 30 min.			43	16	1 1/2
F/C-6-RC-50	6"	2000 psi concrete; 1" cover; free or partial restraint at test.	See Note 16	2 hrs.			43	16	2

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².

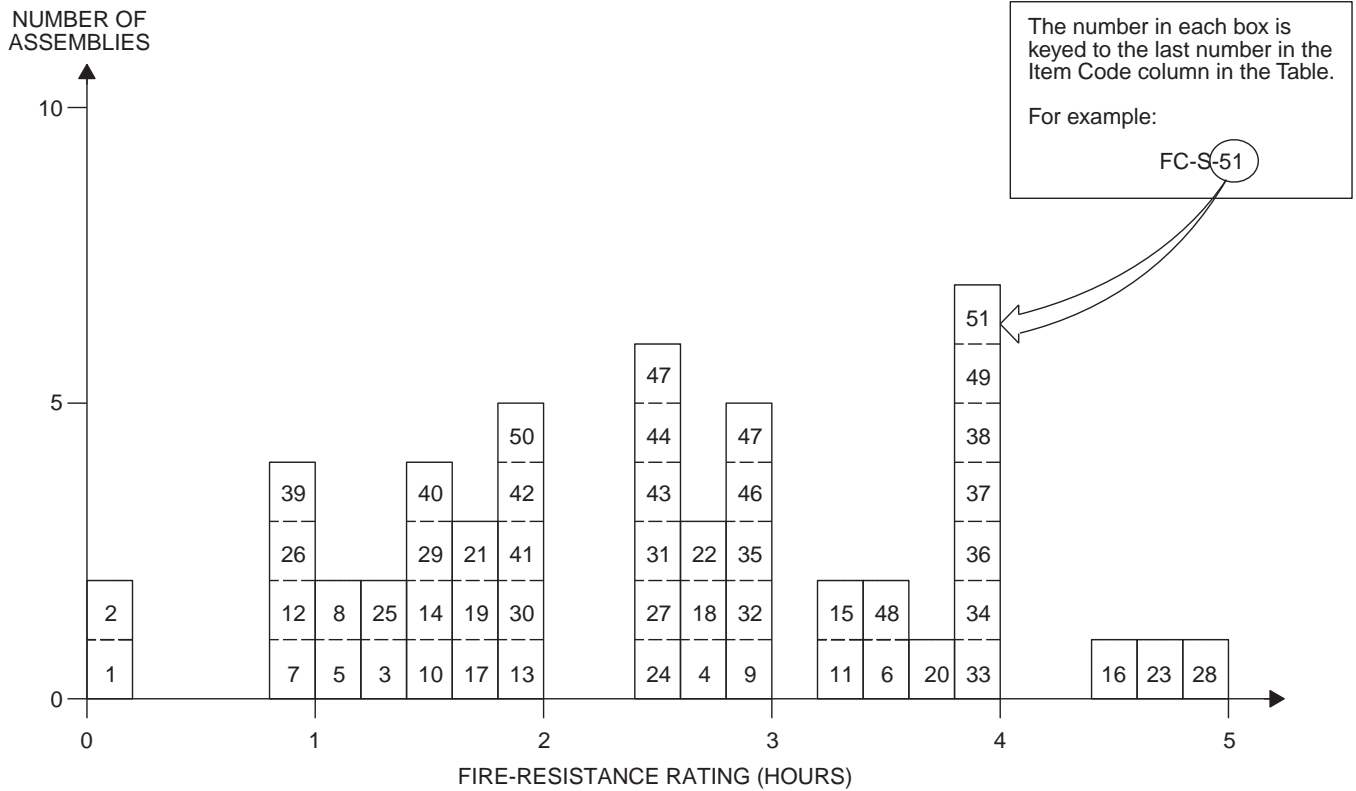
Notes :

1. British test.
2. Failure mode—local back face temperature rise.
3. Tested for Grade "C" (2 hour) fire resistance
4. Collapse imminent following hose stream.
5. Failure mode—flame thru.
6. Void formed with explosive force and report.
7. Achieved Grade "B" (4 hour) fire resistance (British).
8. Failure mode—collapse.
9. Test was run to 2 hours, but specimen was partially supported by the furnace at 1 1/4 hours.
10. Failure mode—average back face temperature.
11. Recommended endurance for nonload bearing performance only.
12. Floor maintained load bearing ability to 2 hours at which point test was terminated.
13. Test was run to 3 hours at which time failure mode 2 (above) was reached in spite of crack formation at 29 minutes.
14. Tested for Grade "A" (6 hour) fire resistance.
- 15.



16. Load unspecified.
17. Total assembly thickness 5 1/2 inches. Three-inch thick blocks of molded excelsior bonded with Portland cement used as inserts with 2 1/2-inch cover (concrete) above blocks and 3/4-inch gypsum plaster below. Nine-inch wide ribs containing reinforcing steel of unspecified size interrupted 20-inch wide segments of slab composite (i.e., plaster, excelsior blocks, concrete cover).

**FIGURE 3.2
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS**



**TABLE 3.2
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS**

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-1	0"	10' × 13'6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete; Membrane: none.	145 psf	7 min.			3	1, 2, 3, 8	0
F/C-S-2	0"	10' × 13'6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete; Membrane: none	145 psf	7 min.			3	1, 2, 3, 8	0
F/C-S-3	1/2"	10' × 13' 6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12" o.c.; Clips A, B, G; No extra reinforcement; 1/2" plaster - 1.5:2.5.	145 psf	1 hr. 15 min.			3	2, 3, 8	1 1/4
F/C-S-4	1/2"	10' × 13' 6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 16" o.c.; Clips D, E, F, G; Diagonal wire reinforcement; 1/2" plaster - 1.5:2.5.	145 psf	2 hrs. 46 min.			3	3, 8	2 3/4
F/C-S-5	1/2"	10' × 13'6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 16" o.c.; Clips A, B, G; No extra reinforcement; 1/2" plaster - 1.5:2.5.	145 psf	1 hr. 4 min.			3	2, 3, 8	1
F/C-S-6	1/2"	10' × 13'6" ; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 16" o.c.; Clips D, E, F, G; Hexagonal mesh reinforcement; 1/2" plaster.	145 psf	3 hrs. 28 min.			3	2, 3, 8	2 1/3

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-7	1/2"	10' × 13'6"; S.J. 103 - 24" o.c.; Deck: 4 lbs. rib lath; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck gravel concrete; Membrane: furring 16" o.c.; Clips C, E; Reinforcement: none; 1/2" plaster - 1.5:2.5 mill mix.	N/A	55 min.			3	5, 8	3/4
F/C-S-8	1/2"	Spec. 9' × 4'4"; S.J. 103 bar joists - 18" o.c.; Deck: 4 lbs. rib lath base; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck 1:2:4 gravel concrete; Membrane: furring, 3/4" C.R.S., 16" o.c.; Clips C, E; Reinforcement: none; 1/2" plaster - 1.5:2.5 mill mix.	300 psf	1 hr. 10 min.			3	2, 3, 8	1
F/C-S-9	5/8"	10' × 13'6"; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12" o.c.; Clips A, B, G; Extra "A" clips reinforcement; 5/8" plaster - 1.5:2; 1.5:3.	145 psf	3 hrs.			3	6, 8	3
F/C-S-10	5/8"	18' × 13'6"; Joists, S.J. 103 - 24" o.c.; Deck: 4 lbs. rib lath; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck 1:2:3.5 gravel concrete; Membrane: furring, spacing 16" o.c.; Clips C, E; Reinforcement: none; 5/8" plaster - 1.5:2.5 mill mix.	145 psf	1 hr. 25 min.			3	2, 3, 8	1 1/3
F/C-S-11	5/8"	10' × 13'6"; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12" o.c.; Clips D, E, F, G; Diagonal wire reinforcement; 5/8" plaster - 1.5:2; 0.5:3.	145 psf	3 hrs. 15 min.			3	2, 4, 8	3 1/4
F/C-S-12	5/8"	10' × 13'6"; Joists, S.J. 103 - 24" o.c.; Deck: 3.4 lbs. rib lath; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck 1:2:4 gravel concrete; Membrane: furring 16" o.c.; Clips D, E, F, G; Reinforcement: none; 5/8" plaster - 1.5:2.5.	145 psf	1 hr.			3	7, 8	1
F/C-S-13	3/4"	Spec. 9' × 4'4"; S.J. 103 - 18" o.c.; Deck: 4 lbs. rib lath; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck 1:2:4 gravel concrete; Membrane: furring, 3/4" C.R.S., 16" o.c.; Clips C, E; Reinforcement: none; 3/4" plaster - 1.5:2.5 mill mix.	300 psf	1 hr. 56 min.			3	3, 8	1 3/4
F/C-S-14	7/8"	Floor finish: 1" concrete; plate cont. weld; 4" - 7.7 lbs. "I" beams; Ceiling: 1/4" rods 12" o.c.; 7/8" gypsum sand plaster.	105 psf	1 hr. 35 min.			6	2, 4, 9, 10	1 1/2
F/C-S-15	1"	Floor finish: 1 1/2" L.W. concrete; 1/2" limestone cement; plate cont. weld; 5" - 10 lbs. "I" beams; Ceiling: 1/4" rods 12" o.c. tack welded to beams metal lath; 1" P. C. plaster.	165 psf	3 hrs. 20 min.			6	4, 9, 11	3 1/3
F/C-S-16	1"	10' × 13'6"; S.J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12" o.c.; Clips D, E, F, G; Hexagonal mesh reinforcement; 1" thick plaster - 1.5:2; 1.5:3.	145 psf	4 hrs. 26 min.			3	2, 4, 8	4 1/3
F/C-S-17	1"	10' × 13'6"; Joists - S.J. 103 - 24" o.c.; Deck: 3.4 lbs. rib lath; 6" × 6" - 10 × 10 ga. reinforcement; 2" deck 1:2:4 gravel concrete; Membrane: furring 16" o.c.; Clips D, E, F, G; 1" plaster.	145 psf	1 hr. 42 min.			3	2, 4, 8	1 2/3

(continued)

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-18	1 ¹ / ₈ "	10' × 13'6" ; S. J. 103 - 24" o.c.; Deck: 2" concrete 1:2:4; Membrane: furring 12" o.c.; Clips C, E, F, G; Diagonal wire reinforcement; 1 ¹ / ₈ " plaster.	145 psf	2 hrs. 44 min.			3	2, 4, 8	2 ² / ₃
F/C-S-19	1 ¹ / ₈ "	10' × 13'6" ; Joists - S.J. 103 - 24" o.c.; Deck: 1 ¹ / ₂ " gypsum concrete over; 1/2" gypsum board; Membrane: furring 12" o.c.; Clips D, E, F, G; 1 ¹ / ₈ " plaster - 1.5:2; 1.5:3.	145 psf	1 hr. 40 min.			3	2, 3, 8	1 ² / ₃
F/C-S-20	1 ¹ / ₈ "	2 ¹ / ₂ " cinder concrete; 1/2" topping; plate 6" welds 12" o.c.; 5" - 18.9 lbs. "H" center; 5" - 10 lbs. "I" ends; 1" channels 18" o.c.; 1 ¹ / ₈ " gypsum sand plaster.	150 psf	3 hrs. 43 min.			6	2, 4, 9, 11	3 ² / ₃
F/C-S-21	1 ¹ / ₄ "	10' × 13'6" ; Joists - S.J. 103 - 24" o.c.; Deck: 1 ¹ / ₂ " gypsum concrete over; 1/2" gypsum board base; Membrane: furring 12" o.c.; Clips D, E, F, G; 1 ¹ / ₄ " plaster - 1.5:2; 1.5:3.	145 psf	1 hr. 48 min.			3	2, 3, 8	1 ² / ₃
F/C-S-22	1 ¹ / ₄ "	Floor finish: 1 ¹ / ₂ " limestone concrete; 1/2" sand cement topping; plate to beams 3 ¹ / ₂ "; 12" o.c. welded; 5" - 10 lbs. "I" beams; 1" channels 18" o.c.; 1 ¹ / ₄ " wood fiber gypsum sand plaster on metal lath.	292 psf	2 hrs. 45 min.			6	2, 4, 9, 10	2 ³ / ₄
F/C-S-23	1 ¹ / ₂ "	2 ¹ / ₂ " L.W. (gas exp.) concrete; Deck: 1/2" topping; plate 6 ¹ / ₄ " welds 12" o.c.; Beams: 5" - 18.9 lbs. "H" center; 5" - 10 lbs. "I" ends; Membrane: 1" channels 18" o.c.; 1 ¹ / ₂ " gypsum sand plaster.	150 psf	4 hrs. 42 min.			6	2, 4, 9	4 ² / ₃
F/C-S-24	1 ¹ / ₂ "	Floor finish: 1 ¹ / ₂ " limestone concrete; 1/2" cement topping; plate 3 ¹ / ₂ " - 12" o.c. welded; 5" - 10 lbs. "I" beams; Ceiling: 1" channels 18" o.c.; 1 ¹ / ₂ " gypsum plaster.	292 psf	2 hrs. 34 min.			6	2, 4, 9, 10	2 ¹ / ₂
F/C-S-25	1 ¹ / ₂ "	Floor finish: 1 ¹ / ₂ " gravel concrete on exp. metal; plate cont. weld; 4" - 7.7 lbs. "I" beams; Ceiling: 1/4" rods 12" o.c. welded to beams; 1 ¹ / ₂ " fiber gypsum sand plaster.	70 psf	1 hr. 24 min.			6	2, 4, 9, 10	1 ¹ / ₃
F/C-S-26	2 ¹ / ₂ "	Floor finish: bare plate; 6 ¹ / ₄ " welding - 12" o.c.; 5" - 18.9 lbs. "H" girders (inner); 5" - 10 lbs "I" girders (two outer); 1" channels 18" o.c.; 2" reinforced gypsum tile; 1/2" gypsum sand plaster.	122 psf	1 hr.			6	7, 9, 11	1
F/C-S-27	2 ¹ / ₂ "	Floor finish: 2" gravel concrete; plate to beams 3 ¹ / ₂ " - 12" o.c. welded; 4" - 7.7 lbs. "I" beams; 2" gypsum ceiling tiles; 1/2" 1:3 gypsum sand plaster.	105 psf	2 hrs. 31 min.			6	2, 4, 9, 10	2 ¹ / ₂
F/C-S-28	2 ¹ / ₂ "	Floor finish: 1 ¹ / ₂ " gravel concrete; 1/2" gypsum asphalt; plate continuous weld; 4" - 7.7 lbs. "I" beams; 12" - 31.8 lbs. "I" beams - girder at 5' from one end; 1" channels 18" o.c.; 2" reinforcement gypsum tile; 1/2" 1:3 gypsum sand plaster.	200 psf	4 hrs. 55 min.			6	2, 4, 9, 11	4 ² / ₃

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-29	3/4"	Floor: 2" reinforced concrete or 2" precast reinforced gypsum tile; Ceiling: 3/4" Portland cement-sand plaster 1:2 for scratch coat and 1:3 for brown coat with 15 lbs. hydrated lime and 3 lbs. of short asbestos fiber bag per cement or 3/4" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	1 hr. 30 min.		1		12, 13, 14	1 1/2
F/C-S-30	3/4"	Floor: 2 1/4" reinforced concrete or 2" reinforced gypsum tile; the latter with 1/4" mortar finish; Ceiling: 3/4" sanded gypsum plaster; 1:2 for scratch coat and 1:3 for brown coat.	See Note 12	2 hrs.		1		12, 13, 14	2
F/C-S-31	3/4"	Floor: 2 1/2" reinforced concrete or 2" reinforced gypsum tile; the latter with 1/4" mortar finish; Ceiling: 1" neat gypsum plaster or 3/4" gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	2 hrs. 30 min.		1		12, 13, 14	2 1/2
F/C-S-32	3/4"	Floor: 2 1/2" reinforced concrete or 2" reinforced gypsum tile; the latter with 1/2" mortar finish; Ceiling: 1" neat gypsum plaster or 3/4" gypsum-vermiculite plaster, ratio of gypsum to fine vermiculite 2:1 to 3:1.	See Note 12	3 hrs.		1		12, 13, 14	3
F/C-S-33	1"	Floor: 2 1/2" reinforced concrete or 2" reinforced gypsum slabs; the latter with 1/2" mortar finish; Ceiling: 1" gypsum-vermiculite plaster applied on metal lath and ratio 2:1 to 3:1 gypsum to vermiculite by weight.	See Note 12	4 hrs.		1		12, 13, 14	4
F/C-S-34	2 1/2"	Floor: 2" reinforced concrete or 2" precast reinforced Portland cement concrete or gypsum slabs; precast slabs to be finished with 1/4" mortar top coat; Ceiling: 2" precast reinforced gypsum tile, anchored into beams with metal ties or clips and covered with 1/2" 1:3 sanded gypsum plaster.	See Note 12	4 hrs.		1		12, 13, 14	4
F/C-S-35	1"	Floor: 1:3:6 Portland cement, sand and gravel concrete applied directly to the top of steel units and 1 1/2" thick at top of cells, plus 1/2" 1:2 1/2" cement-sand finish, total thickness at top of cells, 2"; Ceiling: 1" neat gypsum plaster, back of lath 2" or more from underside of cellular steel.	See Note 15	3 hrs.		1		15, 16, 17, 18	3
F/C-S-36	1"	Floor: same as F/C-S-35; Ceiling: 1" gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath 2" or more from under-side of cellular steel.	See Note 15	4 hrs.		1		15, 16, 17, 18	4
F/C-S-37	1"	Floor: same as F/C-S-35; Ceiling: 1" neat gypsum plaster; back of lath 9" or more from underside of cellular steel.	See Note 15	4 hrs.		1		15, 16, 17, 18	4
F/C-S-38	1"	Floor: same as F/C-S-35; Ceiling: 1" gypsum-vermiculite plaster (ratio of gypsum to vermiculite 2:1 to 3:1), the back of lath being 9" or more from underside of cellular steel.	See Note 15	5 hrs.		1		15, 16, 17, 18	5

(continued)

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-S-39	3/4"	Floor: asbestos paper 14 lbs./100 ft. ² cemented to steel deck with waterproof linoleum cement, wood screeds and 7/8" wood floor; Ceiling: 3/4" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr.		1		19, 20, 21, 22	1
F/C-S-40	3/4"	Floor: 1 1/2", 1:2:4 Portland cement concrete; Ceiling: 3/4" sanded gypsum plaster 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	1 hr. 30 min.		1		19, 20, 21, 22	1 1/2
F/C-S-41	3/4"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 3/4" sanded gypsum plaster, 1:2 for scratch coat and 1:3 for brown coat.	See Note 19	2 hrs.		1		19, 20, 21, 22	2
F/C-S-42	1"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 1" Portland cement-sand plaster with 10 lbs. of hydrated lime for @ bag of cement 1:2 for scratch coat and 1:2 1/2" for brown coat.	See Note 19	2 hrs.		1		19, 20, 21, 22	2
F/C-S-43	1 1/2"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 1 1/2", 1:2 sanded gypsum plaster on ribbed metal lath.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-44	1 1/8"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 1 1/8", 1:1 sanded gypsum plaster.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-45	1"	Floor: 2 1/2", 1:2:4 Portland cement concrete; Ceiling: 1", 1:2 sanded gypsum plaster.	See Note 19	2 hrs. 30 min.		1		19, 20, 21, 22	2 1/2
F/C-S-46	3/4"	Floor: 2 1/2", 1:2:4 Portland cement concrete; Ceiling: 1" neat gypsum plaster or 3/4" gypsum-vermiculite plaster, ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	3 hrs.		1		19, 20, 21, 22	3
F/C-S-47	1 1/8"	Floor: 2 1/2", 1:2:4 Portland cement, sand and cinder concrete plus 1/2", 1:2 1/2" cement-sand finish; total thickness 3"; Ceiling: 1 1/8", 1:1 sanded gypsum plaster.	See Note 19	3 hrs.		1		19, 20, 21, 22	3
F/C-S-48	1 1/8"	Floor: 2 1/2", gas expanded Portland cement-sand concrete plus 1/2", 1:2.5 cement-sand finish; total thickness 3"; Ceiling: 1 1/8", 1:1 sanded gypsum plaster.	See Note 19	3 hrs. 30 min.		1		19, 20, 21, 22	3 1/2
F/C-S-49	1"	Floor: 2 1/2", 1:2:4 Portland cement concrete; Ceiling: 1" gypsum- vermiculite plaster; ratio of gypsum to vermiculite 2:1 to 3:1.	See Note 19	4 hrs.		1		19, 20, 21, 22	4
F/C-S-50	2 1/2"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 2" interlocking gypsum tile supported on upper face of lower flanges of beams, 1/2" 1:3 sanded gypsum plaster.	See Note 19	2 hrs.		1		19, 20, 21, 22	2
F/C-S-51	2 1/2"	Floor: 2", 1:2:4 Portland cement concrete; Ceiling: 2" precast metal reinforced gypsum tile, 1/2" 1:3 sanded gypsum plaster (tile clipped to channels which are clipped to lower flanges of beams).	See Note 19	4 hrs.		1		19, 20, 21, 22	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².

Notes:

1. No protective membrane over structural steel.
2. Performance time indicates first endpoint reached only several tests were continued to points where other failures occurred.
3. Load failure.

(continued)

TABLE 3.2—continued
FLOOR/CEILING ASSEMBLIES—STEEL STRUCTURAL ELEMENTS

4. Thermal failure.
5. This is an estimated time to load bearing failure. The same joist and deck specimen was used for a later test with different membrane protection.
6. Test stopped at 3 hours to reuse specimen; no endpoint reached.
7. Test stopped at 1 hour to reuse specimen; no endpoint reached.
8. All plaster used = gypsum.
9. Specimen size - 18 feet by 13 $\frac{1}{2}$ inches. Floor deck - base material - $\frac{1}{4}$ -inch by 18-foot steel plate welded to "I" beams.
10. "I" beams - 24 inches o.c.
11. "I" beams - 48 inches o.c.
12. Apply to open web joists, pressed steel joists or rolled steel beams, which are not stressed beyond 18,000 lbs./in.² in flexure for open-web pressed or light rolled joists, and 20,000 lbs./in.² for American standard or heavier rolled beams.
13. Ratio of weight of Portland cement to fine and coarse aggregates combined for floor slabs shall not be less than 1:6 $\frac{1}{2}$.
14. Plaster for ceiling shall be applied on metal lath which shall be tied to supports to give the equivalent of single No. 18 gage steel wires 5 inches o.c.
15. Load: maximum fiber stress in steel not to exceed 16,000 psi.
16. Prefabricated units 2 feet wide with length equal to the span, composed of two pieces of No. 18 gage formed steel welded together to give four longitudinal cells.
17. Depth not less than 3 inches and distance between cells no less than 2 inches.
18. Ceiling: metal lath tied to furring channels secured to runner channels hung from cellular steel.
19. Load: rolled steel supporting beams and steel plate base shall not be stressed beyond 20,000 psi in flexure. Formed steel (with wide upper flange) construction shall not be stressed beyond 16,000 psi.
20. Some type of expanded metal or woven wire shall be embedded to prevent cracking in concrete flooring.
21. Ceiling plaster shall be metal lath wired to rods or channels which are clipped or welded to steel construction. Lath shall be no smaller than 18 gage steel wire and not more than 7 inches o.c.
22. The securing rods or channels shall be at least as effective as single $\frac{3}{16}$ -inch rods with 1-inch of their length bent over the lower flanges of beams with the rods or channels tied to this clip with 14 gage iron wire.

FIGURE 3.3
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

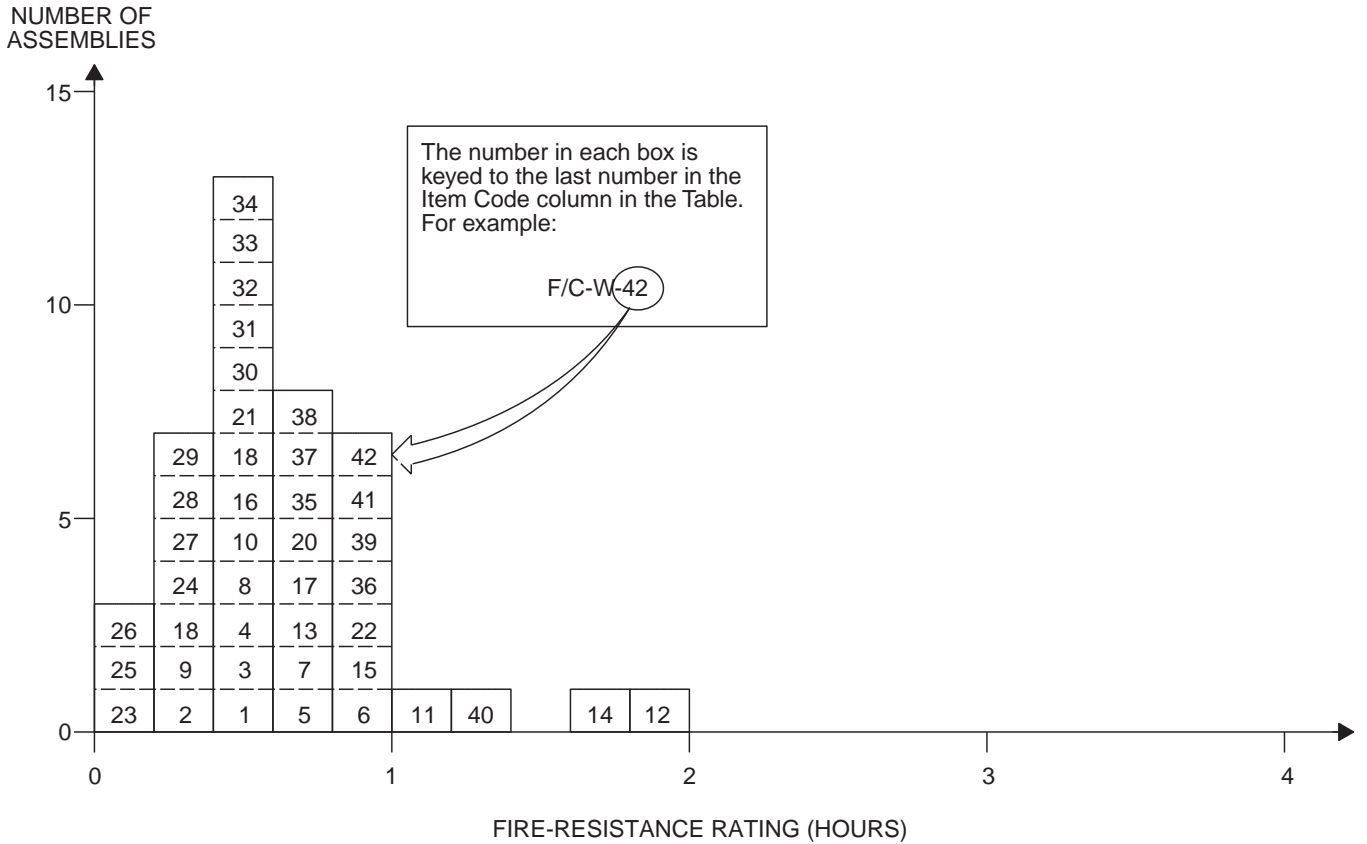


TABLE 3.3
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-1	3/8"	12' clear span - 2" × 9" wood joists; 18" o.c.; Deck: 1" T&G; Filler: 3" of ashes on 1/2" boards nailed to joist sides 2" from bottom; 2" air space; Membrane: 3/8" gypsum board.	60 psf	36 min.			7	1, 2	1/2
F/C-W-2	1/2"	12' clear span - 2" × 7" joists; 15" o.c.; Deck: 1" nominal lumber; Membrane: 1/2" fiber board.	60 psf	22 min.			7	1, 2, 3	1/4
F/C-W-3	1/2"	12' clear span - 2" × 7" wood joists; 16" o.c.; 2" × 1 1/2" bridging at center; Deck: 1" T&G; Membrane: 1/2" fiber board; 2 coats "distemper" paint.	30 psf	28 min.			7	1, 3, 15	1/3
F/C-W-4	3/16"	12' clear span - 2" × 7" wood joists; 16" o.c.; 2" × 1 1/2" bridging at center span; Deck: 1" nominal lumber; Membrane: 1/2" fiber board under 3/16" gypsum plaster.	30 psf	32 min.			7	1, 2	1/2
F/C-W-5	5/8"	As per previous F/C-W-4 except membrane is 5/8" lime plaster.	70 psf	48 min.			7	1, 2	3/4
F/C-W-6	5/8"	As per previous F/C-W-5 except membrane is 5/8" gypsum plaster on 22 gage 3/8" metal lath.	70 psf	49 min.			7	1, 2	3/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-7	1/2"	As per previous F/C-W-6 except membrane is 1/2" fiber board under 1/2" gypsum plaster.	60 psf	43 min.			7	1, 2, 3	2/3
F/C-W-8	1/2"	As per previous F/C-W-7 except membrane is 1/2" gypsum board.	60 psf	33 min.			7	1, 2, 3	1/2
F/C-W-9	9/16"	12' clear span - 2" x 7" wood joists; 15" o.c.; 2" x 1 1/2" bridging at center; Deck: 1" nominal lumber; Membrane: 3/8" gypsum board; 3/16" gypsum plaster.	60 psf	24 min.			7	1, 2, 3	1/3
F/C-W-10	5/8"	As per F/C-W-9 except membrane is 5/8" gypsum plaster on wood lath.	60 psf	27 min.			7	1, 2, 3	1/3
F/C-W-11	7/8"	12' clear span - 2" x 9" wood joists; 15" o.c.; 2" x 1 1/2" bridging at center span; Deck: 1" T&G; Membrane: original ceiling joists have 3/8" plaster on wood lath; 4" metal hangers attached below joists creating 15" chases filled with mineral wool and closed with 7/8" plaster (gypsum) on 3/8" S.W.M. metal lath to form new ceiling surface.	75 psf	1 hr. 10 min.			7	1, 2	1
F/C-W-12	7/8"	12' clear span - 2" x 9" wood joists; 15" o.c.; 2" x 1 1/2" bridging at center; Deck: 1" T&G; Membrane: 3" mineral wood below joists; 3" hangers to channel below joists; 7/8" gypsum plaster on metal lath attached to channels.	75 psf	2 hrs.			7	1, 4	2
F/C-W-13	7/8"	12' clear span - 2" x 9" wood joists; 16" o.c.; 2" x 1 1/2" bridging at center span; Deck: 1" T&G on 1" bottoms on 3/4" glass wool strips on 3/4" gypsum board nailed to joists; Membrane: 3/4" glass wool strips on joists; 3/8" perforated gypsum lath; 1/2" gypsum plaster.	60 psf	41 min.			7	1, 3	2/3
F/C-W-14	7/8"	12' clear span - 2" x 9" wood joists; 15" o.c.; Deck: 1" T&G; Membrane: 3" foam concrete in cavity on 1/2" boards nailed to joists; wood lath nailed to 1" x 1 1/4" straps 14 o.c. across joists; 7/8" gypsum plaster.	60 psf	1 hr. 40 min.			7	1, 5	1 2/3
F/C-W-15	7/8"	12' clear span - 2" x 9" wood joists; 18" o.c.; Deck: 1" T&G; Membrane: 2" foam concrete on 1/2" boards nailed to joist sides 2" from joist bottom; 2" air space; 1" x 1 1/4" wood straps 14" o.c. across joists; 7/8" lime plaster on wood lath.	60 psf	53 min.			7	1, 2	3/4
F/C-W-16	7/8"	12' clear span - 2" x 9" wood joists; Deck: 1" T&G; Membrane: 3" ashes on 1/2" boards nailed to joist sides 2" from joist bottom; 2" air space; 1" x 1 1/4" wood straps 14" o.c. ; 7/8" gypsum plaster on wood lath.	60 psf	28 min.			7	1, 2	1/3
F/C-W-17	7/8"	As per previous F/C-W-16 but with lime plaster mix.	60 psf	41 min.			7	1, 2	2/3
F/C-W-18	7/8"	12' clear span - 2" x 9" wood joists; 18" o.c.; 2" x 1 1/2" bridging at center; Deck: 1" T&G; Membrane: 7/8" gypsum plaster on wood lath.	60 psf	36 min.			7	1, 2	1/2
F/C-W-19	7/8"	As per previous F/C-W-18 except with lime plaster membrane and deck is 1" nominal boards (plain edge).	60 psf	19 min.			7	1, 2	1/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-20	7/8"	As per F/C-W-19, except deck is 1" T&G boards.	60 psf	43 min.			7	1, 2	2/3
F/C-W-21	1"	12' clear span - 2" × 9" wood joists; 16" o.c.; 2" × 1 1/2" bridging at center; Deck: 1" T&G; Membrane: 3/8" gypsum base board; 5/8" gypsum plaster.	70 psf	29 min.			7	1, 2	1/3
F/C-W-22	1 1/8"	12' clear span - 2" × 9" wood joists; 16" o.c.; 2" × 2" wood bridging at center; Deck: 1" T&G; Membrane: hangers, channel with 3/8" gypsum baseboard affixed under 3/4" gypsum plaster.	60 psf	1 hr.			7	1, 2, 3	1
F/C-W-23	3/8"	Deck: 1" nominal lumber; Joists: 2" × 7"; 15" o.c.; Membrane: 3/8" plasterboard with plaster skim coat.	60 psf	11 1/2 min.			12	2, 6	1/6
F/C-W-24	1/2"	Deck: 1" T&G lumber; Joists: 2" × 9"; 16" o.c.; Membrane: 1/2" plasterboard.	60 psf	18 min.			12	2, 7	1/4
F/C-W-25	1/2"	Deck: 1" T&G lumber; Joists: 2" × 7"; 16" o.c.; Membrane: 1/2" fiber insulation board.	30 psf	8 min.			12	2, 8	2/15
F/C-W-26	1/2"	Deck: 1" nominal lumber; Joists: 2" × 7"; 15" o.c.; Membrane: 1/2" fiber insulation board.	60 psf	8 min.			12	2, 9	2/15
F/C-W-27	5/8"	Deck: 1" nominal lumber; Joists: 2" × 7"; 15" o.c.; Membrane: 5/8" gypsum plaster on wood lath.	60 psf	17 min.			12	2, 10	1/4
F/C-W-28	5/8"	Deck: 1" T&G lumber; Joists: 2" × 9"; 16" o.c.; Membrane: 1/2" fiber insulation board; 1/2" plaster.	60 psf	20 min.			12	2, 11	1/3
F/C-W-29	No Membrane	Exposed wood joists.	See Note 13	15 min.		1		1, 12, 13, 14	1/4
F/C-W-30	3/8"	Gypsum wallboard: 3/8" or 1/2" with 1 1/2" No. 15 gage nails with 3/16" heads spaced 6" centers with asbestos paper applied with paperhangers' paste and finished with casein paint.	See Note 13	25 min.		1		1, 12, 13, 14	1/2
F/C-W-31	1/2"	Gypsum wallboard: 1/2" with 1 3/4" No. 12 gage nails with 1/2" heads, 6" o.c., and finished with casein paint.	See Note 13	25 min.		1		1, 12, 13, 14	1/2
F/C-W-32	1/2"	Gypsum wallboard: 1/2" with 1 1/2" No. 12 gage nails with 1/2" heads, 18" o.c., with asbestos paper applied with paperhangers' paste and secured with 1 1/2" No. 15 gage nails with 3/16" heads and finished with casein paint; combined nail spacing 6" o.c.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-33	3/8"	Gypsum wallboard: two layers 3/8" secured with 1 1/2" No. 15 gage nails with 3/8" heads, 6" o.c.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-34	1/2"	Perforated gypsum lath: 3/8", plastered with 1 1/8" No. 13 gage nails with 5/16" heads, 4" o.c.; 1/2" sanded gypsum plaster.	See Note 13	30 min.		1		1, 12, 13, 14	1/2
F/C-W-35	1/2"	Same as F/C-W-34, except with 1 1/8" No. 13 gage nails with 3/8" heads, 4" o.c.	See Note 13	45 min.		1		1, 12, 13, 14	3/4

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 3.3—continued
FLOOR/CEILING ASSEMBLIES—WOOD JOIST

ITEM CODE	MEMBRANE THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-W-36	1/2"	Perforated gypsum lath: 3/8", nailed with 1 1/8" No. 13 gage nails with 3/8" heads, 4" o.c.; joints covered with 3" strips of metal lath with 1 3/4" No. 12 nails with 1/2" heads, 5" o.c.; 1/2" sanded gypsum plaster.	See Note 13	1 hr.		1		1, 12, 13, 14	1
F/C-W-37	1/2"	Gypsum lath: 3/8" and lower layer of 3/8" perforated gypsum lath nailed with 1 3/4" No. 13 nails with 5/16" heads, 4" o.c.; 1/2" sanded gypsum plaster or 1/2" Portland cement plaster.	See Note 13	45 min.		1		1, 12, 13, 14	3/4
F/C-W-38	3/4"	Metal lath: nailed with 1 1/4" No. 11 nails with 3/8" heads or 6d common driven 1" and bent over, 6" o.c.; 3/4" sanded gypsum plaster.	See Note 13	45 min.		1		1, 12, 13, 14	3/4
F/C-W-39	3/4"	Same as F/C-W-38, except nailed with 1 1/2" No. 11 barbed roof nails with 7/16" heads, 6" o.c.	See Note 13	1 hr.		1		1, 12, 13, 14	1
F/C-W-40	3/4"	Same as F/C-W-38, except with lath nailed to joists with additional supports for lath 27" o.c.; attached to alternate joists and consisting of two nails driven 1 1/4", 2" above bottom on opposite sides of the joists, one loop of No. 18 wire slipped over each nail; the ends twisted together below lath.	See Note 13	1 hr. 15 min.		1		1, 12, 13, 14	1 1/4
F/C-W-41	3/4"	Metal lath: nailed with 1 1/2" No. 11 barbed roof nails with 7/16" heads, 6 o.c., with 3/4" Portland cement plaster for scratch coat and 1:3 for brown coat, 3 lbs. of asbestos fiber and 15 lbs. of hydrated lime/94 lbs. bag of cement.	See Note 13	1 hr.		1		1, 12, 13, 14	1
F/C-W-42	3/4"	Metal lath: nailed with 8d, No. 11 1/2 gage barbed box nails, 2 1/2" driven, 1 1/4" on slant and bent over, 6" o.c.; 3/4" sanded gypsum plaster, 1:2 for scratch coat and 1:3 for below coat.	See Note 13	1 hr.		1		1, 12, 13, 14	1

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².

Notes:

1. Thickness indicates thickness of first membrane protection on ceiling surface.
2. Failure mode—flame thru.
3. Failure mode—collapse.
4. No endpoint reached at termination of test.
5. Failure imminent—test terminated.
6. Joist failure—11.5 minutes; flame thru—13 minutes; collapse—24 minutes.
7. Joist failure—17 minutes; flame thru—18 minutes; collapse—33 minutes.
8. Joist failure—18 minutes; flame thru—8 minutes; collapse—30 minutes.
9. Joist failure—12 minutes; flame thru—8 minutes; collapse—22 minutes.
10. Joist failure—11 minutes; flame thru—17 minutes; collapse—27 minutes.
11. Joist failure—17 minutes; flame thru—20 minutes; collapse—43 minutes.
12. Joists: 2-inch by 10-inch southern pine or Douglas fir; No. 1 common or better. Subfloor: 3/4-inch wood sheathing diaphragm of asbestos paper, and finish of tongue-and-groove wood flooring.
13. Loadings: not more than 1,000 psi maximum fiber stress in joists.
14. Perforations in gypsum lath are to be not less than 3/4-inch diameter with one perforation for not more than 16/in.² diameter.
15. "Distemper" is a British term for a water-based paint such as white wash or calcimine.

FIGURE 3.4
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

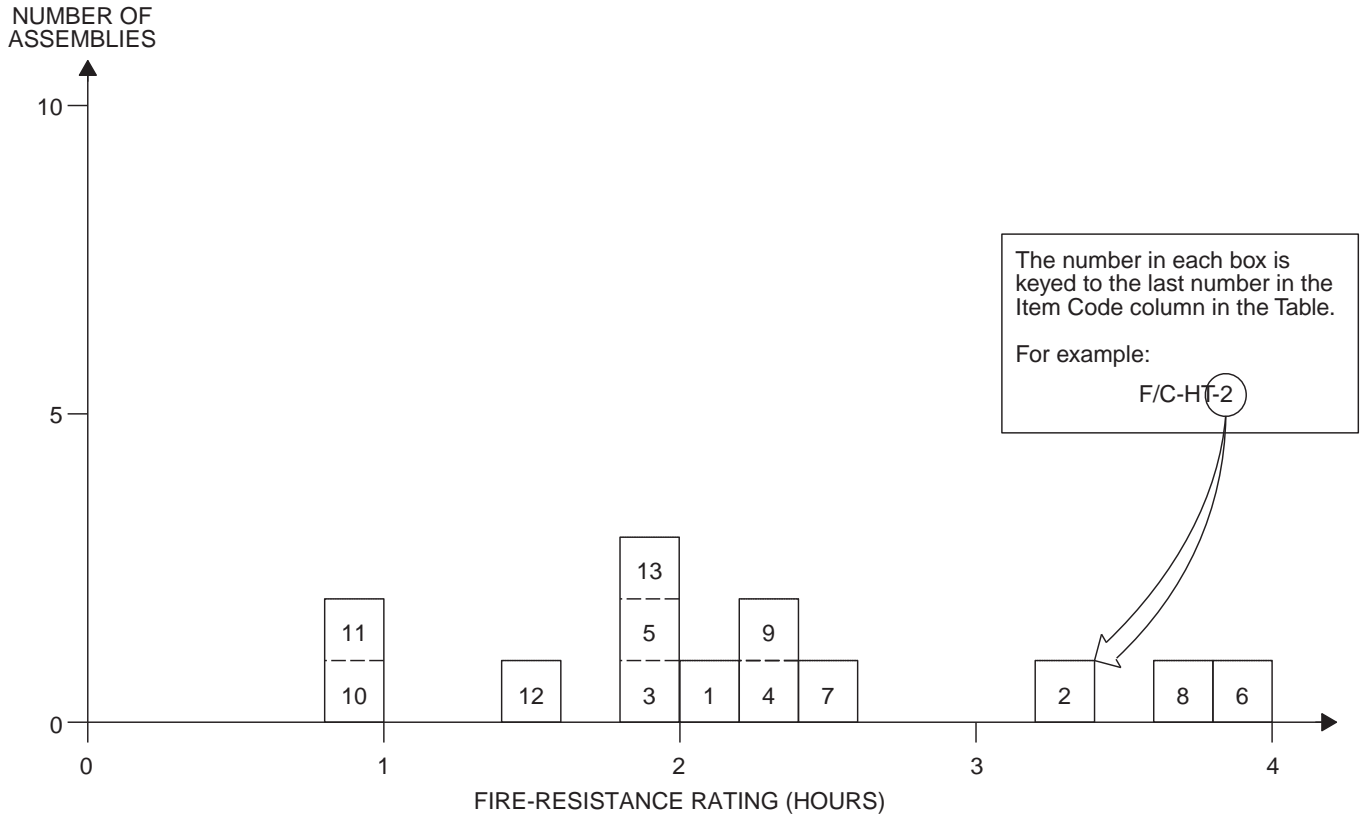


TABLE 3.4
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

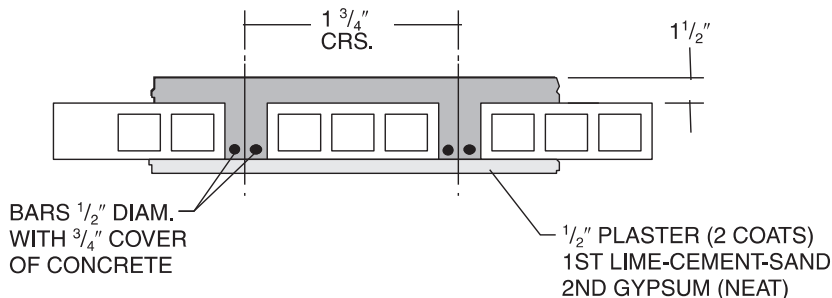
ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-HT-1	6"	Cover: 1½" concrete (6080 psi); three cell hollow clay tiles, 12" × 12" × 4"; ¾" concrete between tiles including two ½" rebars with ¾" concrete cover; ½" plaster cover, lower.	75 psf	2 hrs. 7 min.			7	1, 2, 3	2
F/C-HT-2	6"	Cover: 1½" concrete (5840 psi); three cell hollow clay tiles, 12" × 12" × 4"; ¾" concrete between tiles including two ½" rebars each with ½" concrete cover and ⅝" filler tiles between hollow tiles; ½" plaster cover, lower.	61 psf	3 hrs. 23 min.			7	3, 4, 6	3⅓
F/C-HT-3	6"	Cover: 1½" concrete (6280 psi); three cell hollow clay tiles, 12" × 12" × 4"; ¾" concrete between tiles including two ½" rebars with ½" cover; ½" plaster cover, lower.	122 psf	2 hrs.			7	1, 3, 5, 8	2
F/C-HT-4	6"	Cover: 1½" concrete (6280 psi); three cell hollow clay tiles, 12" × 12" × 4"; ¾" concrete between tiles including two ½" rebars with ¾" cover; ½" plaster cover, lower.	115 psf	2 hrs. 23 min.			7	1, 3, 7	2⅓
F/C-HT-5	6"	Cover: 1½" concrete (6470 psi); three cell hollow clay tiles, 12" × 12" × 4"; ¾" concrete between tiles including two ½" rebars with ½" cover; ½" plaster cover, lower.	122 psf	2 hrs.			7	1, 3, 5, 8	2

(continued)

TABLE 3.4—continued
FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

ITEM CODE	ASSEMBLY THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
F/C-HT-6	8"	Floor cover: 1½" gravel cement (4300 psi); three cell, 12" × 12" × 6"; 3½" space between tiles including two ½" rebars with 1" cover from concrete bottom; ½" plaster cover, lower.	165 psf	4 hrs.			7	1, 3, 9, 10	4
F/C-HT-7	9" (nom.)	Deck: 7/8" T&G on 2" × 1½" bottoms (18" o.c.) 1½" concrete cover (4600 psi); three cell hollow clay tiles, 12" × 12" × 4"; 3" concrete between tiles including one ¾" rebar ¾" from tile bottom; ¾" plaster cover.	95 psf	2 hrs. 26 min.			7	4, 11, 12, 13	2⅓
F/C-HT-8	9" (nom.)	Deck: 7/8" T&G on 2" × 1½" bottoms (18" o.c.) 1½" concrete cover (3850 psi); three cell hollow clay tiles, 12" × 12" × 4"; 3" concrete between tiles including one ¾" rebar ¾" from tile bottoms; ½" plaster cover.	95 psf	3 hrs. 28 min.			7	4, 11, 12, 13	
F/C-HT-9	9" (nom.)	Deck: 7/8" T&G on 2" × 1½" bottoms (18" o.c.) 1½" concrete cover (4200 psi); three cell hollow clay tiles, 12" × 12" × 4"; 3" concrete between tiles including one ¾" rebar ¾" from tile bottoms; ½" plaster cover.	95 psf	2 hrs. 14 min.			7	3, 5, 8, 11	
F/C-HT-10	5½"	Fire clay tile (4" thick); 1½" concrete cover; for general details, see Note 15.	See Note 14	1 hr.			43	15	1
F/C-HT-11	8"	Fire clay tile (6" thick); 2" cover.	See Note 14	1 hr.			43	15	1
F/C-HT-12	5½"	Fire clay tile (4" thick); 1½" cover; 5/8" gypsum plaster, lower.	See Note 14	1 hr. 30 min.			43	15	1½
F/C-HT-13	8"	Fire clay tile (6" thick); 2" cover; 5/8" gypsum plaster, lower.	See Note 14	2 hrs.			43	15	1½

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound per square inch = 0.00689 MPa, 1 pound per square foot = 47.9 N/m².



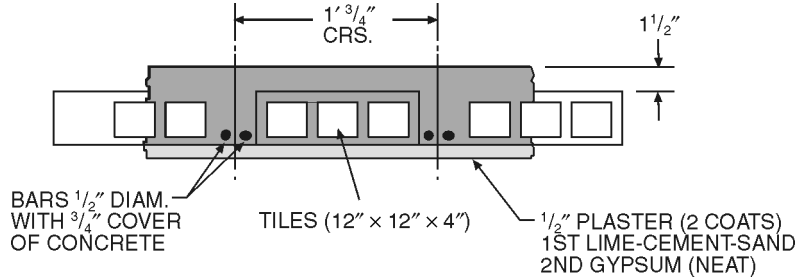
Notes:

1. A generalized cross section of this floor type follows:
2. Failure mode - structural.
3. Plaster: base coat—lime-cement-sand; top coat—gypsum (neat).

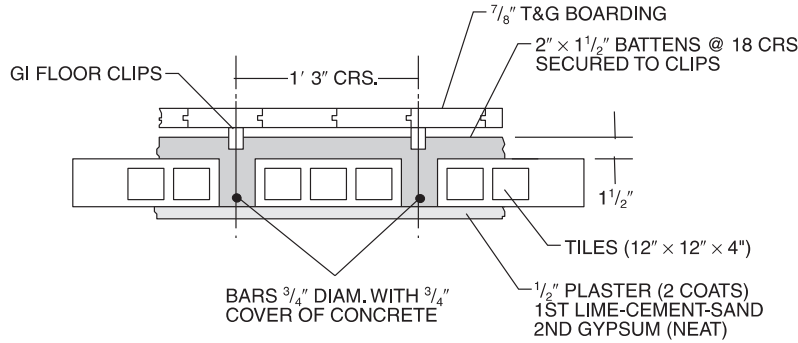
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TABLE 3.4—continued
 FLOOR/CEILING ASSEMBLIES—HOLLOW CLAY TILE WITH REINFORCED CONCRETE

4. Failure mode—collapse.
5. Test stopped before any endpoints were reached.
6. A generalized cross section of this floor type follows:



7. Failure mode—thermal—back face temperature rise.
8. Passed hose stream test.
9. Failed hose stream test.



10. Test stopped at 4 hours before any endpoints were reached.
11. A generalized cross section of this floor type follows:
12. Plaster: base coat—retarded hemihydrate gypsum-sand; second coat—neat gypsum.
13. Concrete in Item 7 is P.C. based but with crushed brick aggregates while in Item 8 river sand and river gravels are used with the P.C.
14. Load - unspecified.
15. The 12-inch by 12-inch fire-clay tiles were laid end to end in rows spaced 2 1/2 inches or 4 inches apart. The reinforcing steel was placed between these rows and the concrete cast around them and over the tile to form the structural floor.

**SECTION IV
BEAMS**

**TABLE 4.1.1
REINFORCED CONCRETE BEAMS
DEPTH 10" TO LESS THAN 12"**

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-11-RC-1	11"	24" wide × 11" deep reinforced concrete "T" beam (3290 psi); Details: see Note 5 figure.	8.8 tons	4 hrs. 2 min.			7	1, 2, 14	4
B-10-RC-2	10"	24" wide × 10" deep reinforced concrete "T" beam (4370 psi); Details: see Note 6 figure.	8.8 tons	1 hr. 53 min.			7	1, 3	1 ³ / ₄
B-10-RC-3	10 ¹ / ₂ "	24" wide × 10 ¹ / ₂ " deep reinforced concrete "T" beam (4450 psi); Details: see Note 7 figure.	8.8 tons	2 hrs. 40 min.			7	1, 3	2 ² / ₃
B-11-RC-4	11"	24" wide × 11" deep reinforced concrete "T" beam (2400 psi); Details: see Note 8 figure.	8.8 tons	3 hrs. 32 min.			7	1, 3, 14	3 ¹ / ₂
B-11-RC-5	11"	24" wide × 11" deep reinforced concrete "T" beam (4250 psi); Details: see Note 9 figure.	8.8 tons	3 hrs. 3 min.			7	1, 3, 14	3
B-11-RC-6	11"	Concrete flange: 4" deep × 2' wide (4895 psi) concrete; Concrete beam: 7" deep × 6 ¹ / ₂ " wide beam; "T" beam reinforcement; 10" × 4 ¹ / ₂ " × 25 lbs. R.S.J.; 1" cover on flanges; Flange reinforcement: ³ / ₈ " diameter bars at 6" pitch parallel to "T"; ¹ / ₄ " diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 11' restrained; Details: see Note 10 figure.	10 tons	6 hrs.			7	1, 4	6
B-11-RC-7	11"	Concrete flange: 6" deep × 1' 6 ¹ / ₂ " wide (3525 psi) concrete; Concrete beam: 5" deep × 8" wide precast concrete blocks 8 ³ / ₄ " long; "T" beam reinforcement; 7" × 4" × 16 lbs. R.S.J.; 2" cover on bottom; 1 ¹ / ₂ " cover on top; Flange reinforcement: two rows ¹ / ₂ " diameter rods parallel to "T"; Beam reinforcement: ¹ / ₈ " wire mesh perpendicular to 1" ; Span: 1' 3" simply supported; Details: see Note 11 figure.	3.9 tons	4 hrs.			7	1, 2	4
B-11-RC-8	11"	Concrete flange: 4" deep × 2' wide (3525 psi) concrete; Concrete beam 7" deep × 4 ¹ / ₂ " wide; (scaled from drawing); "T" beam reinforcement; 10" × 4 ¹ / ₂ " × 25 lbs. R.S.J.; no concrete cover on bottom; Flange reinforcement: ³ / ₈ " diameter bars at 6 pitch parallel to "T"; ¹ / ₄ " diameter bars perpendicular to "T"; Span: 11' restricted.	10 tons	4 hrs.			7	1, 2, 12	4
B-11-RC-9	11 ¹ / ₂ "	24" wide × 11 ¹ / ₂ " deep reinforced concrete "T" beam (4390 psi); Details: see Note 12 figure.	8.8 tons	3 hrs. 24 min.			7	1, 3	3 ¹ / ₃

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

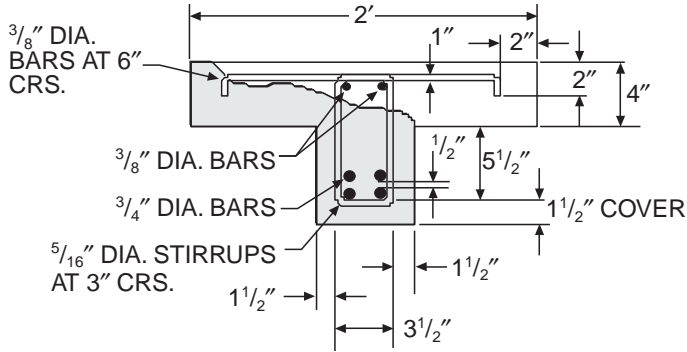
Notes:

1. Load concentrated at mid span.
2. Achieved 4 hour performance (Class "B," British).
3. Failure mode—collapse.
4. Achieved 6 hour performance (Class "A," British).

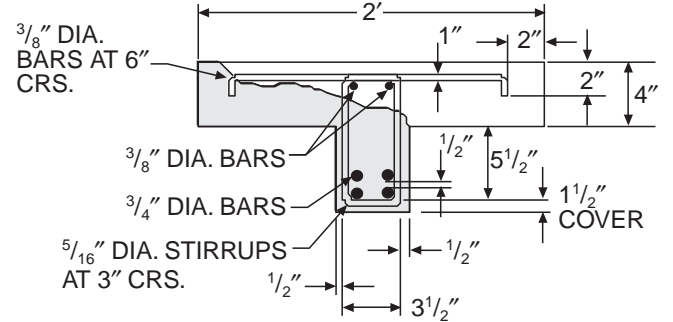
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TABLE 4.1.1—continued
REINFORCED CONCRETE BEAMS
DEPTH 10" TO LESS THAN 12"

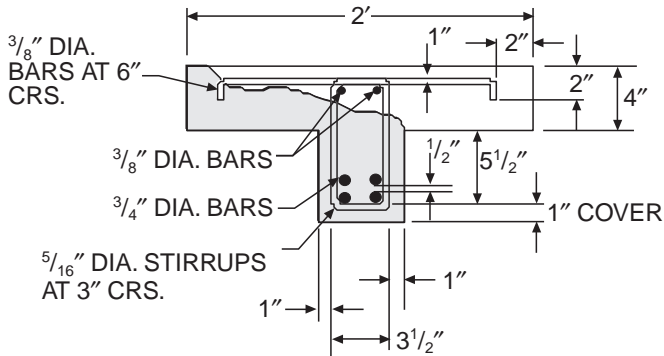
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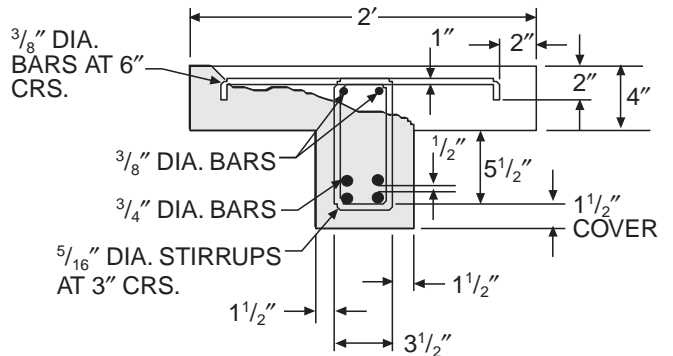
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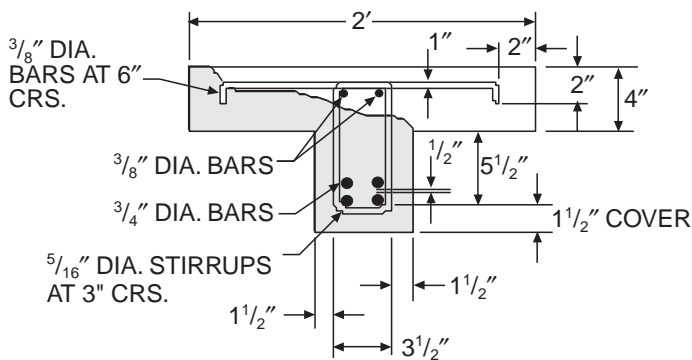
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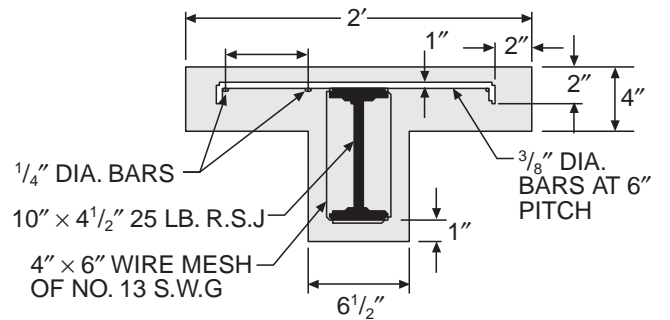
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9.



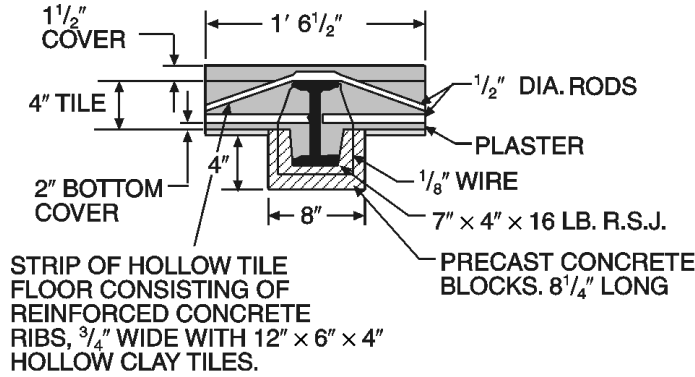
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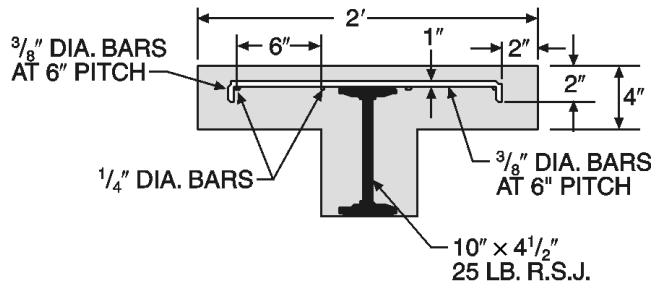
TABLE 4.1.1—continued
 REINFORCED CONCRETE BEAMS
 DEPTH 10" TO LESS THAN 12"

11.

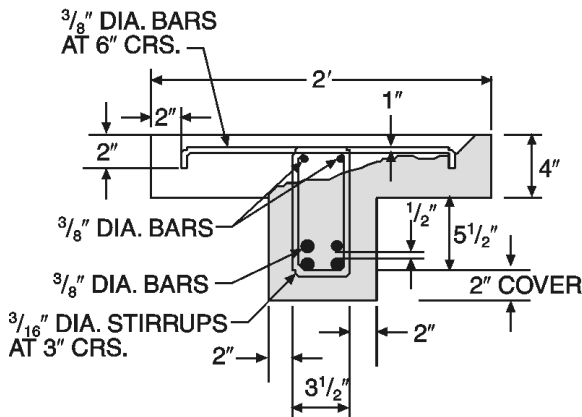


SPAN AND END CONDITIONS:-10'-3" (CLEAR).
 SIMPLY SUPPORTED.

12.



13.



14. The different performances achieved by B-11-RC-1, B-11-RC-4 and B-11-RC-5 are attributable to differences in concrete aggregate compositions reported in the source document but unreported in this table. This demonstrates the significance of material composition in addition to other details.

**TABLE 4.1.2
REINFORCED CONCRETE BEAMS
DEPTH 12" TO LESS THAN 14"**

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-12-RC-1	12"	12" × 8" section; 4160 psi aggregate concrete; Reinforcement: 4-7/8" rebars at corners; 1" below each surface; 1/4" stirrups 10" o.c.	5.5 tons	2 hrs.			7	1	2
B-12-RC-2	12"	Concrete flange: 4" deep × 2' wide (3045 psi) concrete at 35 days; Concrete beam: 8" deep; "T" beam reinforcement: 10" × 4 1/2" × 25 lbs. R.S.J.; 1" cover on flanges; Flange reinforcement: 3/8" diameter bars at 6" pitch parallel to "T"; 1/4" diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 10' 3" simply supported.	10 tons	4 hrs.			7	2, 3, 5	4
B-13-RC-3	13"	Concrete flange: 4" deep × 2' wide (3825 psi) concrete at 46 days; Concrete beam: 9" deep × 8 1/2" wide; (scaled from drawing); "T" beam reinforcement: 10" × 4 1/2" × 25 lbs. R.S.J.; 3" cover on bottom flange; 1" cover on top flange; Flange reinforcement: 3/8" diameter bars at 6" pitch parallel to "T"; 1/4" diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 11' restrained.	10 tons	6 hrs.			7	2, 3, 6, 8, 9	4
B-12-RC-4	12"	Concrete flange: 4" deep × 2' wide (3720 psi) concrete at 42 days; Concrete beam: 8" deep × 8 1/2" wide; (scaled from drawing); "T" beam reinforcement: 10" × 4 1/2" × 25 lbs. R.S.J.; 2" cover bottom flange; 1" cover top flange; Flange reinforcement: 3/8" diameter bars at 6" pitch parallel to "T"; 1/4" diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 11' restrained.	10 tons	6 hrs.			7	1, 3, 4, 7, 8, 9	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

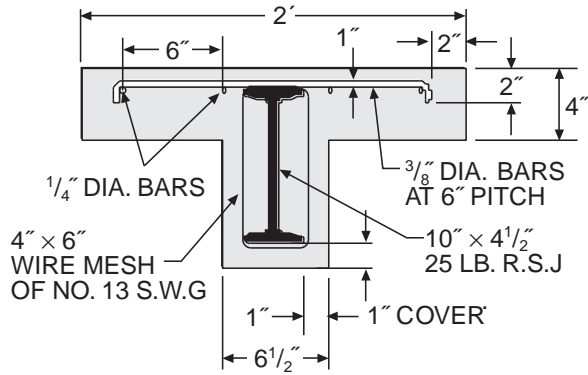
Notes:

1. Qualified for 2 hour use. (Grade "C," British) Test included hose stream and reload at 48 hours.
2. Load concentrated at mid span.
3. British test.
4. British test—qualified for 6 hour use (Grade "A").

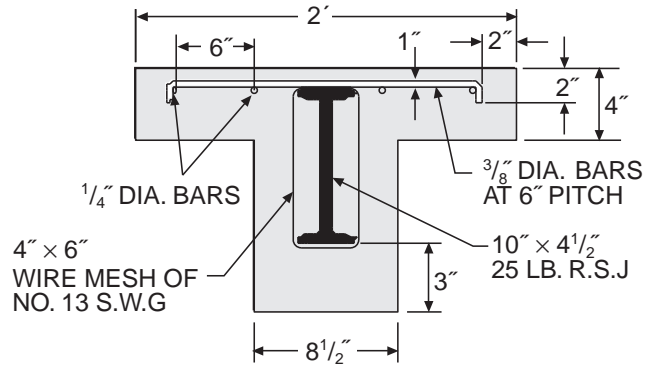
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TABLE 4.1.2—continued
REINFORCED CONCRETE BEAMS
DEPTH 12" TO LESS THAN 14"

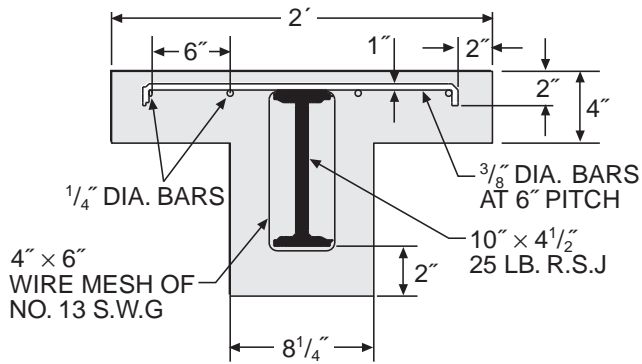
5.



6.



7.



8. See Table 4.1.3, Note 5.

9. Hourly rating based upon B-12-RC-2 above.

TABLE 4.1.3
REINFORCED CONCRETE BEAMS
DEPTH 14" TO LESS THAN 16"

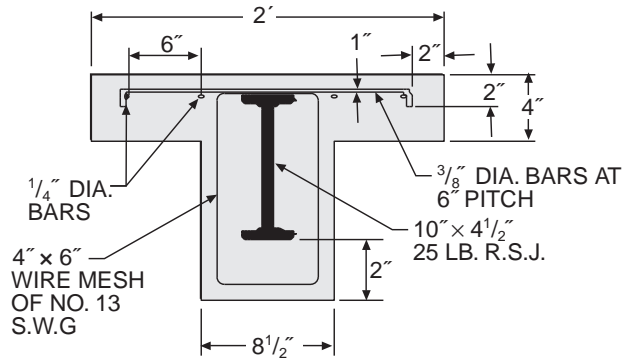
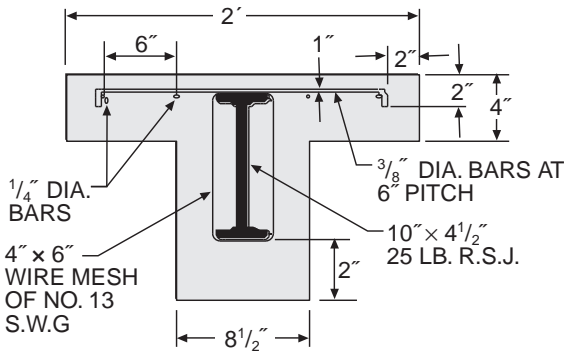
ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE-BMS-92	BMS-92	POST-BMS-92		
B-15-RC-1	15"	Concrete flange: 4" deep × 2' wide (3290 psi) concrete; Concrete beam: 10" deep × 8 1/2" wide; "I" beam reinforcement: 10" × 4 1/2" × 25 lbs. R.S.J.; 4" cover on bottom flange; 1" cover on top flange; Flange reinforcement: 3/8" diameter bars at 6" pitch parallel to "T"; 1/4" diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 11' restrained.	10 tons	6 hrs.			7	1, 2, 3 5, 6	4
B-15-RC-2	15"	Concrete flange: 4" deep × 2' wide (4820 psi) concrete; Concrete beam: 10" deep × 8 1/2" wide; "I" beam reinforcement: 10" × 4 1/2" × 25 lbs. R.S.J.; 1" cover over wire mesh on bottom flange; 1" cover on top flange; Flange reinforcement: 3/8" diameter bars at 6" pitch parallel to "T"; 1/4" diameter bars perpendicular to "T"; Beam reinforcement: 4" × 6" wire mesh No. 13 SWG; Span: 11' restrained.	10 tons	6 hrs.			7	1, 2, 4, 5, 6	4

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid span.
2. Achieved 6 hour fire rating (Grade "A," British).
- 3.

4.



5. Section 43.147 of the 1979 edition of the *Uniform Building Code Standards* provides:

"A restrained condition in fire tests, as used in this standard, is one in which expansion at the supports of a load-carrying element resulting from the effects of the fire is resisted by forces external to the element. An unrestrained condition is one in which the load-carrying element is free to expand and rotate at its support."

"Restraint in buildings is defined as follows: Floor and roof assemblies and individual beams in buildings shall be considered restrained when the surrounding or supporting structure is capable of resisting the thermal expansion throughout the range of anticipated elevated temperatures. Construction not complying . . . is assumed to be free to rotate and expand and shall be considered as unrestrained."

"Restraint may be provided by the lateral stiffness of supports for floor and roof assemblies and intermediate beams forming part of the assembly. In order to develop restraint, connections must adequately transfer thermal thrusts to such supports. The rigidity of adjoining panels or structures shall be considered in assessing the capability of a structure to resist therm expansion."

Because it is difficult to determine whether an existing building's structural system is capable of providing the required restraint, the lower hourly ratings of a similar but unrestrained assembly have been recommended.

6. Hourly rating based upon Table 4.2.1, Item B-12-RC-2.

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

**TABLE 4.2.1
REINFORCED CONCRETE BEAMS—UNPROTECTED DEPTH
10" TO LESS THAN 12"**

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST-BMS-92		
B-SU-1	10"	10" × 4½" × 25 lbs. "I" beam.	10 tons	39 min.			7	1	1/3

For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 ton = 8.896 kN.

Notes:

1. Concentrated at mid span.

**TABLE 4.2.2
STEEL BEAMS—CONCRETE PROTECTION DEPTH
10" TO LESS THAN 12"**

ITEM CODE	DEPTH	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. HOURS
			LOAD	TIME	PRE- BMS-92	BMS-92	POST- BMS-92		
B-SC-1	10"	10" × 8" rectangle; aggregate concrete (4170 psi) with 1" top cover and 2" bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6" pitch about 7" × 4" × 16 lbs. "I" beam.	3.9 tons	3 hrs. 46 min.			7	1, 2, 3	3¾
B-SC-1	10"	10" × 8" rectangle; aggregate concrete (3630 psi) with 1" top cover and 2" bottom cover; No. 13 SWG iron wire loosely wrapped at approximately 6" pitch about 7" × 4" × 16 lbs. "I" beam.	5.5 tons	5 hrs. 26 min.			7	1, 4, 5, 6, 7	3¾

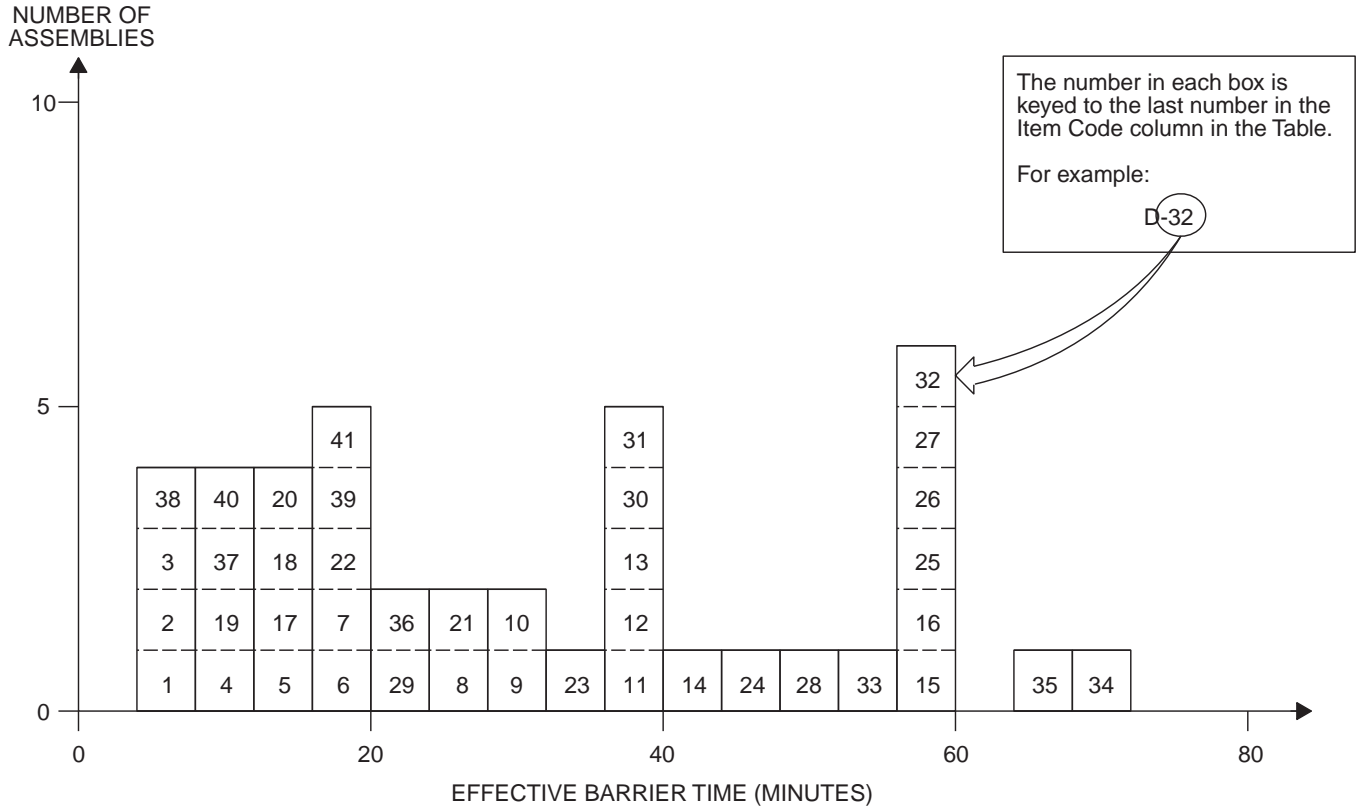
For SI: 1 inch = 25.4 mm, 1 pound = 0.004448 kN, 1 pound per square inch = 0.00689 MPa, 1 ton = 8.896 kN.

Notes:

1. Load concentrated at mid span.
2. Specimen 10-foot 3-inch clear span simply supported.
3. Passed Grade "C" fire resistance (British) including hose stream and reload.
4. Specimen 11-foot clear span—restrained.
5. Passed Grade "B" fire resistance (British) including hose stream and reload.
6. See Table 4.1.3, Note 5.
7. Hourly rating based upon B-SC-1 above.

**SECTION V
DOORS**

**FIGURE 5.1
RESISTANCE OF DOORS TO FIRE EXPOSURE**



**TABLE 5.1
RESISTANCE OF DOORS TO FIRE EXPOSURE**

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-1	3/8"	Panel door; pine perimeter (1 3/8"); painted (enamel).	5 min. 10 sec.	N/A			90	1, 2	5
D-2	3/8"	As above, with two coats U.L. listed intumescent coating.	5 min. 30 sec.	5 min.			90	1, 2, 7	5
D-3	3/8"	As D-1, with standard primer and flat interior paint.	5 min. 55 sec.	N/A			90	1, 3, 4	5
D-4	2 5/8"	As D-1, with panels covered each side with 1/2" plywood; edge grouted with sawdust filled plaster; door faced with 1/8" hardboard each side; paint see (5).	11 min. 15 sec.	3 min. 45 sec.			90	1, 2, 5, 7	10

(continued)

RESOURCE A—GUIDELINES ON FIRE RATINGS OF ARCHAIC MATERIALS AND ASSEMBLIES

TABLE 5.1—continued
RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-5	3/8"	As D-1, except surface protected with glass fiber reinforced intumescent fire retardant coating.	16 min.	N/A			90	1, 3, 4, 7	15
D-6	1 5/8"	Door detail: As D-4, except with 1/8" cement asbestos board facings with aluminum foil; door edges protected by sheet metal.	17 min.	10 min. 15 sec.			90	1, 3, 4	15
D-7	1 5/8"	Door detail with 1/8" hard-board cover each side as facings; glass fiber reinforced intumescent coating applied.	20 min.	N/A			90	1, 3, 4, 7	20
D-8	1 5/8"	Door detail same as D-4; paint was glass reinforced epoxy intumescent.	26 min.	24 min. 45 sec.			90	1, 3, 4, 6, 7	25
D-9	1 5/8"	Door detail same as D-4 with facings of 1/8" cement asbestos board.	29 min.	3 min. 15 sec.			90	1, 2	5
D-10	1 5/8"	As per D-9.	31 min. 30 sec.	7 min. 20 sec.			90	1, 3, 4	6
D-11	1 5/8"	As per D-7; painted with epoxy intumescent coating including glass fiber roving.	36 min. 25 sec.	N/A			90	1, 3, 4	35
D-12	1 5/8"	As per D-4 with intumescent fire retardant paint.	37 min. 30 sec.	24 min. 40 sec.			90	1, 3, 4	30
D-13	1 1/2" (nom.)	As per D-4, except with 24 ga. galvanized sheet metal facings.	39 min.	39 min.			90	1, 3, 4	39
D-14	1 5/8"	As per D-9.	41 min. 30 sec.	17 min. 20 sec.			90	1, 3, 4, 6	20
D-15	—	Class C steel fire door.	60 min.	58 min.			90	7, 8	60
D-16	—	Class B steel fire door.	60 min.	57 min.			90	7, 8	60
D-17	1 3/4"	Solid core flush door; core staves laminated to facings but not each other; Birch plywood facings 1/2" rebate in door frame for door; 3/32" clearance between door and wood frame.	15 min.	13 min.			37	11	13

(continued)

TABLE 5.1—continued
RESISTANCE OF DOORS TO FIRE EXPOSURE

ITEM CODE	DOOR MINIMUM THICKNESS	CONSTRUCTION DETAILS	PERFORMANCE		REFERENCE NUMBER			NOTES	REC. (MIN.)
			EFFECTIVE BARRIER	EDGE FLAMING	PRE- BMS-92	BMS-92	POST- BMS-92		
D-18	1 ³ / ₄ "	As per D-17.	14 min.	13 min.			37	11	13
D-19	1 ³ / ₄ "	Door same as D-17, except with 16 ga. steel; ³ / ₃₂ " door frame clearance.	12 min.	—			37	9, 11	10
D-20	1 ³ / ₄ "	As per D-19.	16 min.	—			37	10, 11	10
D-21	1 ³ / ₄ "	Doors as per D-17; intumescent paint applied to top and side edges.	26 min.	—			37	11	25
D-22	1 ³ / ₄ "	Door as per D-17, except with 1/2" × 1/8" steel strip set into edges of door at top and side facing stops; matching strip on stop.	18 min.	6 min.			37	11	18
D-23	1 ³ / ₄ "	Solid oak door.	36 min.	22 min.			15	13	25
D-24	1 ⁷ / ₈ "	Solid oak door.	45 min.	35 min.			15	13	35
D-25	1 ⁷ / ₈ "	Solid teak door.	58 min.	34 min.			15	13	35
D-26	1 ⁷ / ₈ "	Solid (pitch) pine door.	57 min.	36 min.			15	13	35
D-27	1 ⁷ / ₈ "	Solid deal (pine) door.	57 min.	30 min.			15	13	30
D-28	1 ⁷ / ₈ "	Solid mahogany door.	49 min.	40 min.			15	13	45
D-29	1 ⁷ / ₈ "	Solid poplar door.	24 min.	3 min.			15	13, 14	5
D-30	1 ⁷ / ₈ "	Solid oak door.	40 min.	33 min.			15	13	35
D-31	1 ⁷ / ₈ "	Solid walnut door.	40 min.	15 min.			15	13	20
D-32	2 ⁵ / ₈ "	Solid Quebec pine.	60 min.	60 min.			15	13	60
D-33	2 ⁵ / ₈ "	Solid pine door.	55 min.	39 min.			15	13	40
D-34	2 ⁵ / ₈ "	Solid oak door.	69 min.	60 min.			15	13	60
D-35	2 ⁵ / ₈ "	Solid teak door.	65 min.	17 min.			15	13	60
D-36	1 ¹ / ₂ "	Solid softwood door.	23 min.	8.5 min.			15	13	10
D-37	3/4"	Panel door.	8 min.	7.5 min.			15	13	5
D-38	5/16"	Panel door.	5 min.	5 min.			15	13	5
D-39	3/4"	Panel door, fire retardant treated.	17 ¹ / ₂ min.	3 min.			15	13	8
D-40	3/4"	Panel door, fire retardant treated.	8 ¹ / ₂ min.	8 ¹ / ₂ min.			15	13	8
D-41	3/4"	Panel door, fire retardant treated.	16 ³ / ₄ min.	11 ¹ / ₂ min.			15	13	8

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

Notes:

- All door frames were of standard lumber construction.
- Wood door stop protected by asbestos millboard.
- Wood door stop protected by sheet metal.
- Door frame protected with sheet metal and weather strip.
- Surface painted with intumescent coating.
- Door edge sheet metal protected.
- Door edge intumescent paint protected.
- Formal steel frame and door stop.
- Door opened into furnace at 12 feet.
- Similar door opened into furnace at 12 feet.
- The doors reported in these tests represent the type contemporaries used as 20-minute solid-core wood doors. The test results demonstrate the necessity of having wall anchored metal frames, minimum clearances possible between door, frame and stops. They also indicate the utility of long throw latches and the possible use of intumescent paints to seal doors to frames in event of a fire.
- Minimum working clearance and good latch closure are absolute necessities for effective containment for all such working door assemblies.
- Based on British tests.
- Failure at door-frame interface.

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HISTORY NOTE APPENDIX

2022 California Existing Building Code California Code of Regulations, Title 24, Part 10

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Existing Building Code*, 2019 Triennial Edition, effective January 1, 2020.

1. (BSC 09/21, DSA-SS 06/21, HCD 07/21, OSHPD 05/21, SFM 07/21) – Adoption by reference of the 2021 *International Existing Building Code* with necessary amendments to become the 2022 *California Existing Building Code*, and repeal of the 2018 edition of the *International Existing Building Code*; effective on January 1, 2023.

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2022 CALIFORNIA HISTORICAL BUILDING CODE

CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 8

California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is the Part 8 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Historical Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936

Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov

Web page: www.dgs.ca.gov/bsc

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The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

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For questions on California state agency amendments, please refer to the contact list on page v.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073

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www.dgs.ca.gov/bsc (916) 263-0916

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California Energy Commission

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Appliance Efficiency Standards
Compliance Manual/Forms

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Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards (916) 900-5004

Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356

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(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661

Organized Camps Standards

Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development AKA: California Department of Health Care Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

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Code Development and Analysis

Fire Safety Standards

HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

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PART 8 CONTAINS ALTERNATIVE REGULATIONS FOR QUALIFIED HISTORICAL BUILDINGS

The *California Historical Building Code* (CHBC) is unique among state regulations. The authoring of the original CHBC required state agencies promulgating regulations for building construction to work in harmony with representatives of other design and construction disciplines. The result was a totally new approach to building codes for historical structures, which maintains currently acceptable life–safety standards.

These regulations are also unique in that they are performance oriented rather than prescriptive. The provisions of the CHBC are to be applied by the enforcing authority of every city, county, city and county, or state agency in permitting repairs, alterations and additions necessary for the preservation, rehabilitation, relocation, related construction, change of use or continued use of a qualified historical building.

The authority for use of the CHBC is vested in Sections 18950 through 18961 of the Health and Safety Code. Section 18954 states, “The building department of every city or county shall apply the provisions of alternative building standards and building regulations adopted by the CHBC Board pursuant to Section 18959.5 in permitting repairs, alterations and additions necessary for the preservation, restoration, rehabilitation, moving or continued use of an historical building or structure. A state agency shall apply the alternative building regulations adopted by the CHBC Board pursuant to Section 18959.5 in permitting repairs, alterations and addi-

tions necessary for the preservation, restoration, rehabilitation, moving or continued use of an historical building or structure.”

However, be aware that in order to use the CHBC, the structure under consideration must be qualified by being designated as an historical building or structure. Section 18955 states, “For the purposes of this part, a qualified historical building or structure is any structure or collection of structures, and their associated sites deemed of importance to the history, architecture or culture of an area by an appropriate local or state governmental jurisdiction. This shall include structures on existing or future national, state or local historical registers or official inventories, such as the National Register of Historic Places, State Historical Landmarks, State Points of Historical Interest, and city or county registers or inventories of historical or architecturally significant sites, places, historic districts or landmarks.”

The regulations of the CHBC have the same authority as state law and are to be considered as such. Liability is the same as for prevailing law.

The intent of the CHBC is to save California’s architectural heritage by recognizing the unique construction problems inherent in historical buildings and by providing a code to deal with these problems.

HISTORICAL PREFACE

The background of the *California Historical Building Code* can be traced to December 1973, when the State Department of Parks and Recreation published the California History Plan, Volume I, in which Recommendation No. 11 was proposed by the then California Landmarks Advisory Committee (later to become The State Historical Resources Commission). This proposal expressed a need for a new building code to meet the intent of protecting the public health and safety and also retain “enough flexibility to allow restoration of a Historic feature while still retaining its Historic integrity.” No. 11 of this History Plan supported this need by stating that “. . . restoration . . . is frequently made difficult by unnecessarily rigid interpretation of building . . . codes.”

In March of 1974, the Landmarks Committee by resolution recommended that the Director of the State Department of Parks and Recreation and the State Architect initiate a study to develop this needed code. These two officials accepted this concept and jointly called a statewide meeting in Sacramento on May 14th of that year. Attending were representatives from both the public and private sectors, such as members of the building industry, design professions, local and state building officials, and others interested in this problem.

Out of this open conference, a steering committee was formed to explore in depth the ways and means of implementing the new historical building code concept. This ad hoc committee was chaired by a representative from the California Council, American Institute of Architects and composed of a comprehensive cross section of the professional organizations and government agencies concerned with design and code enforcement.

Meetings began late in 1974 and continued into early 1975. By April of that year, a legislative subcommittee of the ad hoc group drafted a sample bill for the proposed code and requested that it be carried by Senator James R. Mills, Presi-

dent Pro Tempore of the Senate. After further development and refinement, the enacting legislation to create the authority for the code and an advisory board to prepare regulations to implement it (SB 927, Mills) was supported by both the legislature and the public. It was signed by the governor in September 1975, and became effective January 1, 1976.

The members of the advisory board, which were required by law to include local and state building officials, individuals from the building industry and design professions, as well as representatives from city and county governments, were appointed and held their first session in Sacramento, February 24, 1976. This Board’s duties included the preparation of code regulations and the review of specific historic building cases, when officially requested by governing bodies.

Several of the Board’s members were a part of the original ad hoc steering committee and thus provided a continuity and smooth transition from the inception of the code’s philosophy to its pragmatic implementation in these performance-oriented regulations.

The first comprehensive regulations were codified in August and October 1979, after years of careful deliberation. Those regulations allowed all jurisdictions to utilize them at their discretion in replacing or modifying details of prevailing prescriptive codes.

Changes made in law in 1984 and 1991, and to the code, make the application of the *California Historical Building Code* statutes and regulations applicable for all agencies and at the discretion of the owner for local jurisdictions when dealing with qualified historical buildings.

These current performance regulations were adopted by the Board on June 23, 1998, and approved by the California Building Standards Commission on December 12, 2013.

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CHAPTER 8-1

ADMINISTRATION

Note: The *California Historical Building Code*, Part 8 of Title 24, governs for all qualified historical buildings or properties in the State of California.

SECTION 8-101 TITLE, PURPOSE AND INTENT

8-101.1 Title. These regulations shall be known as the *California Historical Building Code* and will be referred to herein as “the CHBC.”

8-101.2 Purpose. The purpose of the CHBC is to provide regulations for the preservation, restoration, rehabilitation, relocation or reconstruction of buildings or properties designated as qualified historical buildings or properties (Chapter 8-2). The CHBC is intended to provide solutions for the preservation of qualified historical buildings or properties, to promote sustainability, to provide access for persons with disabilities, to provide a cost-effective approach to preservation, and to provide for the reasonable safety of the occupants or users. The CHBC requires enforcing agencies to accept solutions that are reasonably equivalent to the regular code (as defined in Chapter 8-2) when dealing with qualified historical buildings or properties.

8-101.3 Intent. The intent of the CHBC is to facilitate the preservation and continuing use of qualified historical buildings or properties while providing reasonable safety for the building occupants and access for persons with disabilities.

SECTION 8-102 APPLICATION

8-102.1 Application. The CHBC is applicable to all issues regarding code compliance for qualified historical buildings or properties. The CHBC may be used in conjunction with the regular code to provide solutions to facilitate the preservation of qualified historical buildings or properties. The CHBC shall be used by any agency with jurisdiction and whenever compliance with the code is required for qualified historical buildings or properties.

1. The state or local enforcing agency shall apply the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, reconstruction, rehabilitation, relocation or continued use of a qualified historical building or property when so elected by the private property owner.
2. **State agencies.** All state agencies shall apply the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, rehabilitation, safety, relocation, reconstruction or continued use of qualified historical buildings or properties.

8-102.1.1 Additions, alterations and repairs. It is the intent of the CHBC to allow nonhistorical expansion or addition to a qualified historical building or property, pro-

vided nonhistorical additions shall conform to the requirements of the regular code. See Chapter 8-2.

8-102.1.2 Relocation. Relocated qualified historical buildings or properties shall be sited to comply with the regular code or with the solutions listed in the CHBC. Nonhistorical new construction related to relocation shall comply with the regular code. Reconstruction and restoration related to relocation is permitted to comply with the provisions in the CHBC.

8-102.1.3 Change of occupancy. For change of use or occupancy, see Chapter 8-3, Use and Occupancy.

8-102.1.4 Continued use. Qualified historical buildings or properties may have their existing use or occupancy continued if such use or occupancy conformed to the code or to the standards of construction in effect at the time of construction, and such use or occupancy does not constitute a distinct hazard to life safety as defined in the CHBC.

8-102.1.5 Unsafe buildings or properties. When a qualified historical building or property is determined to be unsafe as defined in the regular code, the requirements of the CHBC are applicable to the work necessary to correct the unsafe conditions. Work to remediate the buildings or properties need only address the correction of the unsafe conditions, and it shall not be required to bring the entire qualified historical building or property into compliance with regular code.

8-102.1.6 Additional work. Qualified historical buildings or properties shall not be subject to additional work required by the regular code, regulation or ordinance beyond that required to complete the work undertaken. Certain exceptions for accessibility and for distinct hazards exist by mandate and may require specific action, within the parameters of the CHBC.

SECTION 8-103 ORGANIZATION AND ENFORCEMENT

8-103.1 Authority. The state or local enforcing agency, pursuant to authority provided under Section 18954 of the Health and Safety Code, shall administer and enforce the provisions of the CHBC in permitting repairs, alterations and additions necessary for the preservation, restoration, reconstruction, rehabilitation, relocation or continued use of a qualified historical building or property.

8-103.2 State enforcement. All state agencies pursuant to authority provided under Section 18954 and Section 18961 of the Health and Safety Code shall administer and enforce the CHBC with respect to qualified historical buildings or properties under their respective jurisdiction.

8-103.3 Liability. Prevailing law regarding immunity of building officials is unaffected by the use and enforcement of the CHBC.

SECTION 8-104 REVIEW AND APPEALS

8-104.1 State Historical Building Safety Board (SHBSB). In order to provide for interpretation of the provisions of the CHBC and to hear appeals, the SHBSB shall act as an appeal and review body to state and local agencies or any affected party.

8-104.2 SHBSB review. When a proposed design, material or method of construction is being considered by the enforcing agency, the agency chief, the building official or the local board of appeals may file a written request for opinion to the SHBSB for its consideration, advice or findings. In considering such request, the SHBSB may seek the advice of other appropriate private or public boards, individuals, or state or local agencies. The SHBSB shall, after considering all of the facts presented, including any recommendation of other appropriate boards, agencies or other parties, determine if, for the purpose intended, the proposal is reasonably equivalent to that allowed by these regulations in proposed design, material or method of construction, and it shall transmit such findings and its decision to the enforcing agency for its application. The Board may recover the costs of such reviews and shall report the decision in printed form, copied to the California Building Standards Commission.

8-104.2.1 State agencies. All state agencies with ownership of, or that act on behalf of state agency owners of, qualified historical buildings or properties, shall consult and obtain SHBSB review prior to taking action or making decisions or appeals that affect qualified historical buildings or properties, per Section 18961 of the Health and Safety Code.

8-104.2.2 Imminent threat. Where an emergency is declared and a qualified historical building or property is declared an imminent threat to life and safety, the state agency assessing such a threat shall consult with the SHBSB before any demolition is undertaken, per Section 18961 of the Health and Safety Code.

8-104.3 SHBC appeals. If any local agency administering and enforcing the CHBC or any person adversely affected by any regulation, rule, omission, interpretation, decision or practice of the agency enforcing the CHBC wishes to appeal the issue for resolution to the SHBSB, either of these parties may appeal directly to the Board. The Board may accept the

appeal only if it determines that issues involved are of statewide significance. The Board may recover the costs of such reviews and shall make available copies of decisions in printed form at cost, copied to the California Building Standards Commission.

8-104.4 Local agency fees. Local agencies, when actively involved in the appeal, may also charge affected persons reasonable fees not to exceed the cost of obtaining reviews and appeals from the Board.

SECTION 8-105 CONSTRUCTION METHODS AND MATERIALS

8-105.1 Repairs. Repairs to any portion of a qualified historical building or property may be made in-kind with historical materials and the use of original or existing historical methods of construction, subject to conditions of the CHBC. (See Chapter 8-8.)

8-105.2 Solutions to the *California Historical Building Code*. Solutions provided in the CHBC, or any other acceptable regulation or methodology of design or construction and used in whole or in part, with the regular code, or with any combination of the regular code and the CHBC, shall be allowed. The CHBC does not preclude the use of any proposed alternative or method of design or construction not specifically prescribed or otherwise allowed by these regulations. Any alternative may be submitted for evaluation to the appropriate enforcing agency for review and acceptance. The enforcing agency may request that sufficient evidence or proof be submitted to substantiate any claims that may be made regarding such solutions. Any alternative offered in lieu of that prescribed or allowed in the CHBC shall be reasonably equivalent in quality, strength, effectiveness, durability and safety to that of the CHBC.

SECTION 8-106 SHBSB RULINGS

8-106.1 General. Rulings of the SHBSB (i.e., formal appeals, case decisions, code interpretations and administrative resolutions, etc.) that are issues of statewide application are required to be submitted to the California Building Standards Commission in printed form. These rulings may be used to provide guidance for similar cases or issues.

CHAPTER 8-2

DEFINITIONS

SECTION 8-201 DEFINITIONS

For the purpose of the CHBC, certain terms and phrases, words and their derivatives shall be construed as specified in this chapter. Additional definitions and/or terms may appear in the various other chapters relative to terms or phrases primarily applicable thereto. Any reference to “authority having jurisdiction” does not necessarily preclude the appellate process of Section 8-104.3.

ADDITION. A nonhistorical extension or increase in floor area or height of a building or property.

ALTERATION. A modification to a qualified historical building or property that affects the usability of the building or property, or part thereof. Alterations include, but are not limited to, remodeling, renovation, rehabilitation, reconstruction, historical restoration, changes or rearrangement of the structural parts or elements, and changes or rearrangements in the plan configuration of walls and full-height partitions.

BUILDING STANDARD. Any guideline, regulation or code that may be applied to a qualified historical building or property.

CHARACTER-DEFINING FEATURE. Those visual aspects and physical elements that comprise the appearance of a historical building or property, and that are significant to its historical, architectural and cultural values, including the overall shape of the historical building or property, its materials, craftsmanship, decorative details, interior spaces and features, as well as the various aspects of its site and environment.

CULTURAL RESOURCE. Building, site, property, object or district evaluated as having significance in prehistory or history.

DISTINCT HAZARD. Any clear and evident condition that exists as an immediate danger to the safety of the occupants or public right of way. Conditions that do not meet the requirements of current regular codes and ordinances do *not*, of themselves, constitute a distinct hazard. Section 8-104.3, SHBC appeals, remains applicable.

ENFORCING AGENCY, Authority Having Jurisdiction, Local Agency with Jurisdiction. An entity with the responsibility for regulating, enforcing, reviewing or otherwise that exerts control of or administration over the process of granting permits, approvals, decisions, variances, appeals for qualified historical buildings or properties.

EXIT LADDER DEVICE. An exit ladder device is a permanently installed, fixed, folding, retractable or hinged ladder intended for use as a means of emergency egress from areas of the second or third stories. Unless approved specifically for a longer length, the ladder shall be limited to 25 feet (7620 mm) in length. Exit ladders are permitted where the

area served by the ladder has an occupant load less than 10 persons.

FIRE HAZARD. Any condition which increases or may contribute to an increase in the hazard or menace of fire to a greater degree than customarily recognized by the authority having jurisdiction, or any condition or act which could obstruct, delay, hinder or interfere with the operations of fire-fighting personnel or the egress of occupants in the event of fire. Section 8-104.3, SHBC appeals, remains applicable.

HISTORICAL FABRIC OR MATERIALS. Original and later-added historically significant construction materials, architectural finishes or elements in a particular pattern or configuration which form a qualified historical property, as determined by the authority having jurisdiction.

HISTORICAL SIGNIFICANCE. Importance for which a property has been evaluated and found to be historical, as determined by the authority having jurisdiction.

IMMINENT THREAT. Any condition within or affecting a qualified historical building or property which, in the opinion of the authority having jurisdiction, would qualify a building or property as dangerous to the extent that the life, health, property or safety of the public, its occupants or those performing necessary repair, stabilization or shoring work are in immediate peril due to conditions affecting the building or property. Potential hazards to persons using, or improvements within, the right-of-way may not be construed to be “imminent threats” solely for that reason if the hazard can be mitigated by shoring, stabilization, barricades or temporary fences.

INTEGRITY. Authenticity of a building or property’s historical identity, evidenced by the survival of physical characteristics that existed during the property’s historical or prehistorical period of significance.

LIFE-SAFETY EVALUATION. An evaluation of the life-safety hazards of a qualified historical building or property based on procedures similar to those contained in NFPA 909, *Standard for the Protection of Cultural Resources, Appendix B, Fire Risk Assessment in Heritage Premises*.

LIFE SAFETY HAZARD. See Distinct Hazard.

PERIOD OF SIGNIFICANCE. The period of time when a qualified historical building or property was associated with important events, activities or persons, or attained the characteristics for its listing or registration.

PRESERVATION. The act or process of applying measures necessary to sustain the existing form, integrity and materials of a qualified historical building or property. Work, including preliminary measures to protect and stabilize the property, generally focuses upon the ongoing maintenance and repair of historic materials and features rather than extensive replacement and new construction. New exterior additions are not within the scope of this treatment; however, the lim-

DEFINITIONS

ited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-related work to make properties functional is appropriate within a preservation project.

QUALIFIED HISTORICAL BUILDING OR PROPERTY. As defined in Health and Safety Code Section 18955 as “Qualified Historical Building or Property.” Any building, site, object, place, location, district or collection of structures, and their associated sites, deemed of importance to the history, architecture or culture of an area by an appropriate local, state or federal governmental jurisdiction. This shall include historical buildings or properties on, or determined eligible for, national, state or local historical registers or inventories, such as the National Register of Historic Places, California Register of Historical Resources, State Historical Landmarks, State Points of Historical Interest, and city or county registers, inventories or surveys of historical or architecturally significant sites, places or landmarks.

RECONSTRUCTION. The act or process of depicting, by means of new construction, the form, features and detailing of a nonsurviving site, landscape, building, property or object for the purpose of replicating its appearance at a specific period of time.

REGULAR CODE. The adopted regulations that govern the design and construction or alteration of nonhistorical buildings and properties within the jurisdiction of the enforcing agency.

REHABILITATION. The act or process of making possible a compatible use for qualified historical building or property through repair, alterations and additions while preserving those portions or features which convey its qualified historical, cultural or architectural values.

RELOCATION. The act or process of moving any qualified historical building or property or a portion of a qualified historical building or property to a new site, or a different location on the same site.

REPAIR. Renewal, reconstruction or renovation of any portion of an existing property, site or building for the purpose of its continued use.

RESTORATION. The act or process of accurately depicting the form, features and character of a qualified building or property as it appeared at a particular period of time by the means of the removal of features from other periods in its history and reconstruction of missing features from the restoration period. The limited and sensitive upgrading of mechanical, electrical and plumbing systems and other code-required work to make properties functional is appropriate within a restoration project.

STRUCTURE. That which is built or constructed, an edifice or a building of any kind, or any piece of work artificially built up or composed of parts joined together in some definite manner.

TREATMENT. An act of work to carry out preservation, restoration, stabilization, rehabilitation or reconstruction.

CHAPTER 8-3

USE AND OCCUPANCY

SECTION 8-301 PURPOSE AND SCOPE

8-301.1 Purpose. The purpose of the CHBC is to provide regulations for the determination of occupancy classifications and conditions of use for qualified historical buildings or properties.

8-301.2 Scope. Every qualified historical building or property for which a permit or approval has been requested shall be classified prior to permit issuance according to its use or the character of its occupancy in accordance with the regular code and applicable provisions of this chapter.

SECTION 8-302 GENERAL

8-302.1 Existing use. The use or character of occupancy of a qualified historical building or property, or portion thereof, shall be permitted to continue in use regardless of any period of time in which it may have remained unoccupied or in other uses, provided such building or property otherwise conforms to all applicable requirements of the CHBC.

8-302.2 Change in occupancy. The use or character of the occupancy of a qualified historical building or property may be changed from or returned to its historical use or character, provided the qualified historical building or property conforms to the requirements applicable to the new use or character of occupancy as set forth in the CHBC. Such change in occupancy shall not mandate conformance with new construction requirements as set forth in regular code.

8-302.3 Occupancy separations. Required occupancy separations of more than one hour may be reduced to one-hour fire-resistive construction with all openings protected by not less than three-fourths-hour fire-resistive assemblies of the self-closing or automatic-closing type when the building is provided with an automatic sprinkler system throughout the entire building in accordance with Section 8-410.2. Doors equipped with automatic-closing devices shall be of a type which will function upon activation of a device which responds to products of combustion other than heat.

Required occupancy separations of one hour may be omitted when the building is provided with an automatic sprinkler system throughout.

8-302.4 Maximum floor area. Regardless of the use or character of occupancy, the area of a one-story qualified historical building or property may have, but shall not exceed, a floor area of 15,000 square feet (1393.5 m²) unless such an increase is otherwise permitted in regular code. Multistory qualified historical buildings (including basements and cellars) shall be in accordance with regular code requirements.

Exception: Historical buildings may be unlimited in floor area without fire-resistive area separation walls:

1. When provided with an automatic sprinkler, or
2. Residential occupancies of two stories or less when provided with a complete fire alarm and annunciation system and where the exiting system conforms to regular code.

8-302.5 Maximum height. The maximum height and number of stories of a qualified historical building or property shall not be limited because of construction type, provided such height or number of stories does not exceed that of its historical design.

8-302.5.1 High-rise buildings. Occupancies B, F-1, F-2 or S in high-rise buildings with floors located more than 75 feet above the lowest floor level having building access may be permitted with only the stories over 75 feet provided with an automatic fire sprinkler system if:

1. The building construction type and the exits conform to regular code, and
2. A complete building fire alarm and annunciation system is installed, and
3. A fire barrier is provided between the sprinklered and nonsprinklered floors.

8-302.6 Fire-resistive construction. See Chapter 8-4.

8-302.7 Light and ventilation. Existing provisions for light and ventilation which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain. See Section 8-303.6 for residential requirements. See Section 8-503 for Escape or Rescue Windows and Doors.

SECTION 8-303 RESIDENTIAL OCCUPANCIES

8-303.1 Purpose. The purpose of this section is to provide regulations for those buildings designated as qualified historical buildings or properties and classified as residential occupancies. The CHBC requires enforcing agencies to accept any reasonably equivalent alternative to the regular code when dealing with qualified historical buildings and properties.

8-303.2 Intent. The intent of the CHBC is to preserve the integrity of qualified historical buildings and properties while maintaining a reasonable degree of protection of life, health and safety for the occupants.

8-303.3 Application and scope. The provisions of this section shall apply to all qualified historical buildings used for human habitation. Those dwelling units intended only for display, or public use with no residential use involved, need not comply with the requirements of this section.

8-303.4 Fire escapes. See Chapter 8-5.

8-303.5 Room dimensions. Rooms used for sleeping purposes may contain a minimum of 50 square feet (4.6 m²) floor area, provided there is maintained an average ceiling height

USE AND OCCUPANCY

of 7 feet (2134 mm). Other habitable rooms need only be of adequate size to be functional for the purpose intended.

8-303.6 Light and ventilation. Windows in habitable rooms shall have an area of 6 percent of the floor area, or 6 square feet (0.56 m²), whichever is greater. Windows in sleeping rooms shall be openable (see Section 8-503). Residential occupancies need not be provided with electrical lighting.

8-303.7 Alteration and repair. The alteration and repair of qualified historical buildings or properties may permit the replacement, retention and extension of original materials and the continued use of original methods of construction, provided a life-safety hazard is not created or continued. Alterations and repairs shall be consistent with the CHBC.

The amount of alterations and repairs is not limited, provided there is no nonhistorical increase in floor area, volume or size of the building or property.

8-303.8 Exiting. See Chapter 8-5.

CHAPTER 8-4

FIRE PROTECTION

SECTION 8-401 PURPOSE, INTENT AND SCOPE

8-401.1 Purpose. The purpose of this chapter is to provide regulations for fire protection of qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonably equivalent alternatives to the regular code when dealing with qualified historical buildings or properties.

8-401.2 Intent. The intent of the CHBC is to preserve the integrity of qualified historical buildings or properties while maintaining a reasonable degree of fire protection based primarily on the life safety of the occupants and firefighting personnel.

8-401.3 Scope. This chapter shall apply when required by the provisions of Section 8-102.

SECTION 8-402 FIRE-RESISTIVE CONSTRUCTION

8-402.1 Exterior wall construction. The fire-resistance requirement for existing exterior walls and existing opening protection may be satisfied when an automatic sprinkler system designed for exposure protection is installed per the CHBC. The automatic sprinklers may be installed on the exterior with at least one sprinkler located over each opening required to be protected. Additional sprinklers shall also be distributed along combustible walls under the roof lines that do not meet the fire-resistive requirement due to relationship to property lines as required by regular code. Such sprinkler systems may be connected to the domestic water supply on the supply-main side of the building shut-off valve. A shut-off valve may be installed for the sprinkler system, provided it is locked in an open position.

8-402.2 One-hour construction. Upgrading an existing qualified historical building or property to one-hour fire-resistive construction and one-hour fire-resistive corridors shall not be required regardless of construction or occupancy when one of the following is provided:

1. An automatic sprinkler system throughout. See Section 8-410 for automatic sprinkler systems.
2. An approved life-safety evaluation.
3. Other alternative measures as approved by the enforcing agency.

8-402.3 Openings in fire-rated systems. Historical glazing materials and solid wood unrated doors in interior walls required to have one-hour fire rating may be approved when operable windows and doors are provided with appropriate smoke seals and when the area affected is provided with an automatic sprinkler system. See Section 8-410 for automatic sprinkler systems.

SECTION 8-403 INTERIOR FINISH MATERIALS

New non-historical interior wall and ceiling finishes shall conform to the provisions of the regular code. Existing non-conforming materials used in interior walls and finishes may be surfaced with an approved fire-retardant to increase the rating of the natural finish to within reasonable proximity of the required rating. For wood lath and plaster walls, see Section 8-404.

Exception: When an automatic sprinkler system is provided throughout the building, existing finishes shall be approved.

SECTION 8-404 WOOD LATH AND PLASTER

Wood lath and plaster walls may be considered in accordance with codes, standards and listings published prior to 1943 whereby a wood stud wall assembly with gypsum or lime plaster on hand split or sawn wooden lath obtains a one-half-hour fire-resistive rating. This rating may be increased for interior walls to as much as one hour by filling the wall with mineral fiber or glass fiber.

SECTION 8-405 OCCUPANCY SEPARATION

See Chapter 8-3.

SECTION 8-406 MAXIMUM FLOOR AREA

See Chapter 8-3.

SECTION 8-407 VERTICAL SHAFTS

Vertical shafts need not be enclosed when such shafts are blocked at every floor level by the installation of not less than 2 full inches (51 mm) of solid wood or equivalent construction to prevent the initial passage of smoke and flame. Automatic sprinkler systems or other solutions may be considered on a case-by-case basis, in lieu of enclosure of vertical shafts and stairwells.

SECTION 8-408 ROOF COVERING

Existing or original roofing materials may be repaired or reconstructed subject to the following requirements:

1. The original or historical roofing system shall be detailed or modified as necessary in order to be capable

FIRE PROTECTION

- of providing shelter while preserving the historical materials and appearance of the roof.
2. Wooden roof materials may be utilized where fire resistance is required, provided they are treated with fire-retardant treatments to achieve a Class “B” roof covering rating. Wood roofing in state designated Urban Wildland and High Fire Zones shall be permitted when installed in class “A” assemblies.
 3. Jurisdictions that prohibit wood roofing materials for application as roof coverings and roof assemblies shall submit documentation for the adoption. Express Terms, statement of reasons and minutes of the action by the adopting authority Health and Safety Code, Section 18959(f).

SECTION 8-409 FIRE ALARM SYSTEMS

Every qualified historical building or property shall be provided with fire alarm systems as required for the use or occupancy by the regular code or other approved alternative.

SECTION 8-410 AUTOMATIC SPRINKLER SYSTEMS

8-410.1 Every qualified historical building or property which cannot be made to conform to the construction requirements specified in the regular code for the occupancy or use, and which constitutes a distinct fire hazard (for definition of “distinct hazard,” see Chapter 8-2), shall be deemed to be in compliance if provided with an automatic sprinkler system or a life-safety system or other technologies as approved by the enforcing agency. (“Automatic” is defined in the regular code. Sprinkler System is defined in this section.)

8-410.2 When required by the CHBC, an automatic sprinkler system is defined by the following standards as adopted by the State Fire Marshal (for nonhazardous occupancies).

1. Buildings of four stories or less: NFPA 13R.
2. For floors above the fourth, NFPA 13.
3. Buildings with floors above 75 feet, NFPA 13.
4. When the building is free standing or with property line separation, two floors and 1500 sf per floor or less, NFPA 13D.
5. For exterior wall and opening protection. As required by this chapter.

Exception: When the automatic sprinkler systems are used to reach compliance using this code, in three or more occasions, NFPA 13D standard shall be increased to NFPA 13R standard, or NFPA 13R standard shall be increased to a NFPA 13 standard.

8-410.3 Automatic sprinkler systems shall not be used to substitute for or act as an alternate to the required number of exits from any facility. (See Chapter 8-5 for exiting requirements.)

8-410.4 An automatic sprinkler system shall be provided in all detention facilities.

SECTION 8-411 OTHER TECHNOLOGIES

Fire alarm systems, smoke and heat detection systems, occupant notification and annunciation systems, smoke control systems and fire modeling, timed egress analysis and modeling, as well as other engineering methods and technologies may be accepted by the enforcing agency to address areas of nonconformance.

SECTION 8-412 HIGH-RISE BUILDINGS

Qualified historical buildings having floors for human occupancy located more than 75 feet above the lowest floor level having building access shall conform to the provisions of the regular code for existing high-rise buildings as amended by the CHBC.

CHAPTER 8-5

MEANS OF EGRESS

SECTION 8-501 PURPOSE, INTENT AND SCOPE

8-501.1 Purpose. The purpose of this chapter is to establish minimum means of egress regulations for qualified historical buildings or properties. The CHBC requires enforcing agencies to accept reasonably equivalent alternatives to the means of egress requirements in the regular code.

8-501.2 Intent. The intent of these regulations is to provide an adequate means of egress.

8-501.3 Scope. Every qualified historical building or portion thereof shall be provided with exits as required by the CHBC when required by the provisions of Section 8-102.

SECTION 8-502 GENERAL

8-502.1 General. The enforcing agency shall grant reasonable exceptions to the specific provisions of applicable egress regulations where such exceptions will not adversely affect life safety.

8-502.2. Existing door openings and corridor widths of less than dimensions required by regular code shall be permitted where there is sufficient width and height for the occupants to pass through the opening or traverse the exit.

8-502.3 Stairs. Existing stairs having risers and treads or width at variance with the regular code are allowed if determined by the enforcing agency to not constitute a distinct hazard. Handrails with nonconforming grip size or extensions are allowed if determined by the enforcing agency to not constitute a distinct hazard.

8-502.4 Main entry doors. The front or main entry doors need not be rehung to swing in the direction of exit travel, provided other means or conditions of exiting, as necessary to serve the total occupant load, are provided.

8-502.5 Existing fire escapes. Existing previously approved fire escapes and fire escape ladders shall be acceptable as one of the required means of egress, provided they extend to the ground and are easily negotiated, adequately signed and in good working order. Access shall be by an opening having a minimum width of 29 inches (737 mm) when open with a sill no more than 30 inches (762 mm) above the adjacent floor, landing or approved step.

8-502.6 New fire escapes and fire escape ladders. New fire escapes and fire escape ladders which comply with this section shall be acceptable as one of the required means of egress. New fire escapes and new fire escape ladders shall comply with the following:

1. Access from a corridor shall not be through an intervening room.
2. All openings within 10 feet (3048 mm) shall be protected by three-fourths-hour fire assemblies. When

located within a recess or vestibule, adjacent enclosure walls shall be of not less than one-hour fire-resistive construction.

3. Egress from the building shall be by a clear opening having a minimum dimension of not less than 29 inches (737 mm). Such openings shall be openable from the inside without the use of a key or special knowledge or effort. The sill of an opening giving access shall not be more than 30 inches (737 mm) above the floor, step or landing of the building or balcony.
4. Fire escape stairways and balconies shall support the dead load plus a live load of not less than 100 pounds per square foot (4.79 kN/m²) and shall be provided with a top and intermediate handrail on each side. The pitch of the stairway shall not exceed 72 degrees with a minimum width of 18 inches (457 mm). Treads shall not be less than 4 inches (102 mm) in width, and the rise between treads shall not exceed 10 inches (254 mm). All stair and balcony railings shall support a horizontal force of not less than 50 pounds per lineal foot (729.5 N/m²) of railing.
5. Balconies shall not be less than 44 inches (1118 mm) in width with no floor opening other than the stairway opening greater than $\frac{5}{8}$ inch (15.9 mm) in width. Stairway openings in such balconies shall not be less than 22 inches by 44 inches (559 by 1118 mm). The balustrade of each balcony shall not be less than 36 inches (914 mm) high with not more than 9 inches (228 mm) between balusters.
6. Fire escapes shall extend to the roof or provide an approved gooseneck ladder between the top floor landing and the roof when serving buildings four or more stories in height having roofs with less than 4 units vertical in 12 units horizontal (33.3 percent slope). Fire escape ladders shall be designed and connected to the building to withstand a horizontal force of 100 pounds (445 N) placed anywhere on the rung. All ladders shall be at least 15 inches (381 mm) wide, located within 12 inches (305 mm) of the building. Ladder rungs shall be $\frac{3}{4}$ inch (19.1 mm) in diameter and shall be located 12 inches (305 mm) on center. Openings for roof access ladders through cornices and similar projections shall have minimum dimensions of 30 inches by 33 inches (762 by 838 mm).

The length of fire escapes and exit ladder devices shall be limited to that approved by the building official based on products listed by a recognized testing laboratory.

7. The lowest balcony shall not be more than 18 feet (5486 mm) from the ground. Fire escapes shall extend to the ground or be provided with counterbalanced stairs reaching to the ground.

MEANS OF EGRESS

8. Fire escapes shall not take the place of stairways required by the codes under which the building was constructed.
9. Fire escapes shall be kept clear and unobstructed at all times and maintained in good working order.

SECTION 8-503

ESCAPE OR RESCUE WINDOWS AND DOORS

Basements in dwelling units and every sleeping room below the fourth floor shall have at least one openable window or door approved for emergency escape which shall open directly into a public street, public way, yard or exit court. Escape or rescue windows or doors shall have a minimum clear area of 3.3 square feet (0.31 m²) and a minimum width or height dimension of 18 inches (457 mm) and be operable from the inside to provide a full, clear opening without the use of special tools.

SECTION 8-504

RAILINGS AND GUARDRAILS

The height of railings and guard railings and the spacing of balusters may continue in their historical height and spacing unless a distinct hazard has been identified or created by a change in use or occupancy.

CHAPTER 8-6

ACCESSIBILITY

SECTION 8-601 PURPOSE, INTENT AND SCOPE

8-601.1 Purpose. The purpose of the CHBC is to provide alternative regulations to facilitate access and use by persons with disabilities to and throughout facilities designated as qualified historical buildings or properties. These regulations require enforcing agencies to accept alternatives to regular code when dealing with qualified historical buildings or properties.

8-601.2 Intent. The intent of this chapter is to preserve the integrity of qualified historical buildings and properties while providing access to and use by persons with disabilities.

8-601.3 Scope. The CHBC shall apply to every qualified historical building or property that is required to provide access to persons with disabilities.

1. Provisions of this chapter do not apply to new construction or reconstruction/replicas of historical buildings.
2. Where provisions of this chapter apply to alteration of qualified historical buildings or properties, alteration is defined in *California Building Code (CBC)*, Chapter 2, Definitions and Abbreviations. 202 – A. Alter or Alteration.

8-601.4 General application. The provisions in the CHBC apply to local, state and federal governments (Title II entities); alteration of commercial facilities and places of public accommodation (Title III entities); and barrier removal in commercial facilities and places of public accommodation (Title III entities). Except as noted in this chapter.

SECTION 8-602 BASIC PROVISIONS

8-602.1 Regular code. The regular code for access for people with disabilities (Title 24, Part 2, Vol. 1, Chapter 11B) shall be applied to qualified historical buildings or properties unless strict compliance with the regular code will threaten or destroy the historical significance or character-defining features of the building or property.

8-602.2 Alternative provisions. If the historical significance or character-defining features are threatened, alternative provisions for access may be applied pursuant to this chapter, provided the following conditions are met:

1. These provisions shall be applied only on an item-by-item or a case-by-case basis.
2. Documentation is provided, including meeting minutes or letters, stating the reasons for the application of the alternative provisions. Such documentation shall be retained in the permanent file of the enforcing agency.

SECTION 8-603 ALTERNATIVES

8-603.1 Alternative minimum standards. The alternative minimum standards for alterations of qualified historical buildings or facilities are referenced in Section 202.5 of the 2010 ADA Standards for Accessible Design, as incorporated and set forth in federal regulation 28 CFR Pt. 36.

8-603.2 Entry. These alternatives do not allow exceptions for the requirement of level landings in front of doors, except as provided in Section 8-603.4.

1. Access to any entrance used by the general public and no further than 200 feet (60 960 mm) from the primary entrance.
2. Access at any entrance not used by the general public but open and unlocked with directional signs at the primary entrance and as close as possible to, but no further than 200 feet (60 960 mm) from, the primary entrance.
3. The accessible entrance shall have a notification system. Where security is a problem, remote monitoring may be used.

8-603.3 Doors. Alternatives listed in order of priority are:

1. Single-leaf door which provides a minimum 30 inches (762 mm) of clear opening.
2. Single-leaf door which provides a minimum 29½ inches (749 mm) clear opening
3. Double door, one leaf of which provides a minimum 29½ inches (749 mm) clear opening.
4. Double doors operable with a power-assist device to provide a minimum 29½ inches (749 mm) clear opening when both doors are in the open position.

8-603.4 Power-assisted doors. Power-assisted door or doors may be considered an equivalent alternative to level landings, strikeside clearance and door-opening forces required by the regular code.

8-603.5 Toilet rooms. In lieu of separate-gender toilet facilities as required in the regular code, an accessible unisex toilet facility may be designated.

8-603.6 Exterior and interior ramps and lifts. Alternatives listed in order of priority are:

1. A lift or a ramp of greater than standard slope but no greater than 1:10, for horizontal distances not to exceed 5 feet (1525 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.
2. Access by ramps of 1:6 slope for horizontal distance not to exceed 13 inches (330 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope.

**SECTION 8-604
EQUIVALENT FACILITATION**

Use of other designs and technologies, or deviation from particular technical and scoping requirements, are permitted if the application of the alternative provisions contained in Section 8-603 would threaten or destroy the historical significance or character-defining features of the historical building or property.

1. Such alternatives shall be applied only on an item-by-item or a case-by-case basis.
2. Access provided by experiences, services, functions, materials and resources through methods including, but not limited to, maps, plans, videos, virtual reality and related equipment, at accessible levels. The alternative design and/or technologies used will provide substantially equivalent or greater accessibility to, and usability of, the facility.
3. The official charged with the enforcement of the standards shall document the reasons for the application of the design and/or technologies and their effect on the historical significance or character-defining features. Such documentation shall be in accordance with Section 8-602.2, Item 2, and shall include the opinion and comments of state or local accessibility officials, and the opinion and comments of representative local groups of people with disabilities. Such documentation shall be retained in the permanent file of the enforcing agency. Copies of the required documentation should be available at the facility upon request.

Note: For commercial facilities and places of public accommodation (Title III entities).

Equivalent facilitation for an element of a building or property when applied as a waiver of an ADA accessibility requirement will not be entitled to the Federal Department of Justice certification of this code as rebuttable evidence of compliance for that element.

CHAPTER 8-7

STRUCTURAL REGULATIONS

SECTION 8-701 PURPOSE, INTENT AND SCOPE

8-701.1 Purpose. The purpose of the CHBC is to provide alternative regulations to the regular code for the structural safety of buildings designated as qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonably equivalent alternatives to the regular code when dealing with qualified historical buildings or properties.

8-701.2 Intent. The intent of this chapter is to encourage the preservation of qualified historical buildings or structures while providing standards for a minimum level of building performance with the objective of preventing partial or total structural collapse such that the overall risk of life-threatening injury as a result of structural collapse is low.

8-701.3 Application. The alternative structural regulations provided by Section 8-705 are to be applied in conjunction with the regular code whenever a structural upgrade or reconstruction is undertaken for qualified historical buildings or properties.

SECTION 8-702 GENERAL

8-702.1 The CHBC shall not be construed to allow the enforcing agency to approve or permit a lower level of safety of structural design and construction than that which is reasonably equivalent to the regular code provisions in occupancies which are critical to the safety and welfare of the public at large, including, but not limited to, public and private schools, hospitals, municipal police and fire stations and essential services facilities.

8-702.2 Nothing in these regulations shall prevent voluntary and partial seismic upgrades when it is demonstrated that such upgrades will improve life safety and when a full upgrade would not otherwise be required.

SECTION 8-703 STRUCTURAL SURVEY

8-703.1 Scope. When a structure or portion of a structure is to be evaluated for structural capacity under the CHBC, it shall be surveyed for structural conditions by an architect or engineer knowledgeable in historical structures. The survey shall evaluate deterioration or signs of distress. The survey shall determine the details of the structural framing and the system for resistance of gravity and lateral loads. Details, reinforcement and anchorage of structural systems and veneers shall be determined and documented where these members are relied on for seismic lateral resistance.

8-703.2 The results of the survey shall be utilized for evaluating the structural capacity and for designing modifications to the structural system to reach compliance with this code.

8-703.3 Historical records. Past historical records of the structure or similar structures may be used in the evaluation, including the effects of subsequent alterations.

SECTION 8-704 NONHISTORICAL ADDITIONS AND NONHISTORICAL ALTERATIONS

8-704.1 New nonhistorical additions and nonhistorical alterations which are structurally separated from an existing historical building or structure shall comply with regular code requirements.

8-704.2 New nonhistorical additions which impose vertical or lateral loads on an existing structure shall not be permitted unless the affected part of the supporting structure is evaluated and strengthened, if necessary, to meet regular code requirements.

Note: For use of archaic materials, see Chapter 8-8.

SECTION 8-705 STRUCTURAL REGULATIONS

8-705.1 Gravity loads. The capacity of the structure to resist gravity loads shall be evaluated and the structure strengthened as necessary. The evaluation shall include all parts of the load path. Where no distress is evident, and a complete load path is present, the structure may be assumed adequate by having withstood the test of time if anticipated dead and live loads will not exceed those historically present.

8-705.2 Wind and seismic loads. The ability of the structure to resist wind and seismic loads shall be evaluated. Wind loads shall be considered when appropriate, but need not exceed 75% of the wind loads prescribed by the regular code. The evaluation shall be based on the requirements of Section 8-706.

8.705.2.1 Any unsafe conditions in the lateral-load-resisting system shall be corrected, or alternative resistance shall be provided. When strengthening is required, additional resistance shall be provided to meet the minimum requirements of the CHBC. The strengthening measures shall be selected with the intent of meeting the performance objectives set forth in Section 8-701.2. The evaluation of structural members and structural systems for seismic loads shall consider the inelastic performance of structural members and their ability to maintain load-carrying capacity during the seismic loadings prescribed by the regular code.

8.705.2.2 The architect or engineer shall consider additional measures with minimal loss of, and impact to, his-

torical materials which will reduce damage and needed repairs in future earthquakes to better preserve the historical structure in perpetuity. These additional measures shall be presented to the owner for consideration as part of the rehabilitation or restoration.

SECTION 8-706 LATERAL LOAD REGULATIONS

8-706.1 Seismic forces. Strength-level seismic forces used to evaluate the structure for resistance to seismic loads shall be based on the *R*-values tabulated in the regular code for similar lateral-force-resisting systems including consideration of the structural detailing of the members where such *R*-values exist. Where such *R*-values do not exist, an appropriate *R*-value shall be rationally assigned considering the structural detailing of the members.

Exceptions:

1. The forces need not exceed 0.75 times the seismic forces prescribed by the regular code requirements.
2. For Risk Category I, II or III structures, near-fault increases in ground motion (maximum considered earthquake ground motion of 0.2 second spectral response greater than 150 percent at 5 percent damping) need not be considered when the fundamental period of the building is 0.5 seconds in the direction under consideration.
3. For Risk Category I or II structures, the seismic base shear need not exceed 0.30W.
4. For Risk Category III or IV structures, the seismic base shear need not exceed 0.40W.

8-706.1.1 When a building is to be strengthened with the addition of a new lateral force resisting system, the *R* value of the new system can be used when the new lateral force resisting system resists at least 75 percent of the building's base shear regardless of its relative rigidity.

8-706.1.2 Evaluation and seismic improvement of unreinforced masonry bearing wall buildings shall comply with the *California Existing Building Code* (CEBC), Appendix Chapter A1 2013 Edition, and as modified by the CHBC.

Exceptions:

1. Alternative standards may be used on a case-by-case basis when approved by the authority having jurisdiction. It shall be permitted to exceed the strength limitation of 100 psi in Section A108.2 of the CEBC when test data and building configuration supports higher values subject to the approval of the authority having jurisdiction.
2. CEBC Section A102.2 shall not apply to Qualified Historical Buildings in Risk Category III buildings and other structures whose primary occupancies are public assembly with an occupancy load greater than 300.

8-706.1.3 All deviations from the detailing provisions of the lateral-force-resisting systems shall be evaluated for stability and the ability to maintain load-carrying capacity at the expected inelastic deformations.

8-706.2 Existing building performance. The seismic resistance may be based upon the ultimate capacity of the structure to perform, giving due consideration to ductility and reserve strength of the lateral-force-resisting system and materials while maintaining a reasonable factor of safety. Broad judgment may be exercised regarding the strength and performance of materials not recognized by regular code requirements. (See Chapter 8-8, Archaic Materials and Methods of Construction.)

8-706.2.1 All structural materials or members that do not comply with detailing and proportioning requirements of the regular code shall be evaluated for potential seismic performance and the consequence of non-compliance. All members that would be reasonably expected to fail and lead to collapse or life threatening injury when subjected to seismic demands shall be judged unacceptable, and appropriate structural strengthening shall be developed.

8-706.3 Load path. A complete and continuous load path, including connections, from every part or portion of the structure to the ground shall be provided for the required forces. It shall be verified that the structure is adequately tied together to perform as a unit when subjected to earthquake forces.

8-706.4 Parapets. Parapets and exterior decoration shall be investigated for conformance with regular code requirements for anchorage and ability to resist prescribed seismic forces.

An exception to regular code requirements shall be permitted for those parapets and decorations which are judged not to be a hazard to life safety.

8-706.5 Nonstructural features. Nonstructural features of historical structure, such as exterior veneer, cornices and decorations, which might fall and create a life-safety hazard in an earthquake, shall be evaluated. Their ability to resist seismic forces shall be verified, or the feature shall be strengthened with improved anchorage when appropriate.

8-706.5.1 Partitions and ceilings of corridors and stairways serving an occupant load of 30 or more shall be investigated to determine their ability to remain in place when the building is subjected to earthquake forces.

8-706.5.2 Seismic forces used to evaluate and improve nonstructural components and their anchorage, where required, shall comply with ASCE 41 or need not exceed 0.75 times the seismic forces prescribed by the requirements of the regular code.

CHAPTER 8-8

ARCHAIC MATERIALS AND METHODS OF CONSTRUCTION

SECTION 8-801

PURPOSE, INTENT AND SCOPE

8-801.1 Purpose. The purpose of the CHBC is to provide regulations for the use of historical methods and materials of construction that are at variance with regular code requirements or are not otherwise codified, in buildings or structures designated as qualified historical buildings or properties. The CHBC require enforcing agencies to accept any reasonably equivalent alternatives to the regular code when dealing with qualified historical buildings or properties.

8-801.2 Intent. It is the intent of the CHBC to provide for the use of historical methods and materials of construction that are at variance with specific code requirements or are not otherwise codified.

8-801.3 Scope. Any construction type or material that is, or was, part of the historical fabric of a structure is covered by this chapter. Archaic materials and methods of construction present in a historical structure may remain or be reinstalled or be installed with new materials of the same class to match existing conditions.

SECTION 8-802

GENERAL ENGINEERING APPROACHES

Strength values for archaic materials shall be assigned based upon similar conventional codified materials, or on tests as hereinafter indicated. The archaic materials and methods of construction shall be thoroughly investigated for their details of construction in accordance with Section 8-703. Testing shall be performed when applicable to evaluate existing conditions. The architect or structural engineer in responsible charge of the project shall assign allowable stresses or strength levels to archaic materials. Such assigned strength values shall not be greater than those provided for in the following sections without adequate testing, and shall be subject to the concurrence of the enforcing agency.

SECTION 8-803

NONSTRUCTURAL ARCHAIC MATERIALS

Where nonstructural historical materials exist in uses which do not meet the requirements of the regular code, their continued use is allowed by this code, provided that any public health and life-safety hazards are mitigated subject to the concurrence of the enforcing agency.

SECTION 8-804

ALLOWABLE CONDITIONS FOR SPECIFIC MATERIALS

Archaic materials which exist and are to remain in qualified historical buildings or structures shall be evaluated for their condition and for loads required by this code. The structural

survey required in Section 8-703 of the CHBC shall document existing conditions, reinforcement, anchorage, deterioration and other factors pertinent to establishing allowable stresses, strength levels and adequacy of the archaic materials. The remaining portion of this chapter provides additional specific requirements for commonly encountered archaic materials.

SECTION 8-805 MASONRY

For adobe, see Section 8-806.

8-805.1 Existing solid masonry. Existing solid masonry walls of any type, except adobe, may be allowed, without testing, a maximum ultimate strength of nine pounds per square inch (62.1 kPa) in shear where there is a qualifying statement by the architect or engineer that an inspection has been made, that mortar joints are filled and that both brick and mortar are reasonably good. The shear stress above applies to unreinforced masonry, except adobe, where the maximum ratio of unsupported height or length to thickness does not exceed 13, and where minimum quality mortar is used or exists. Wall height or length is measured to supporting or resisting elements that are at least twice as stiff as the tributary wall. Stiffness is based on the gross section. Shear stress may be increased by the addition of 10 percent of the axial direct stress due to the weight of the wall directly above. Higher-quality mortar may provide a greater shear value and shall be tested in accordance with Appendix A, Chapter A1 of the *California Existing Building Code* (CEBC) 2010 edition, and as modified by the CHBC.

8-805.2 Stone masonry.

8-805.2.1 Solid-backed stone masonry. Stone masonry solidly backed with brick masonry shall be treated as solid brick masonry as described in Section 8-805.1 and in the 2009 IEBC, provided representative testing and inspection verifies solid collar joints between stone and brick and that a reasonable number of stones lap with the brick wythes as headers or that steel anchors are present. Solid stone masonry where the wythes of stone effectively overlap to provide the equivalent header courses may also be treated as solid brick masonry.

8-805.2.2 Independent wythe stone masonry. Stone masonry with independent face wythes may be treated as solid brick masonry as described in Section 8-805.1 and the CEBC, provided representative testing and inspection verify that the core is essentially solid in the masonry wall and that steel ties are epoxied in drilled holes between outer stone wythes at floors, roof and not to exceed 4 feet (1219 mm) on center in each direction, between floors and roof. A reinforcing element shall exist or be provided at or near the top of all stone masonry walls.

8-805.2.3 Testing of stone masonry. Testing of stone masonry shall be similar to the 2010 CEBC requirements for brick masonry, except that representative stones which are not interlocked shall be pulled outward from the wall and shear area appropriately calculated after the test.

8-805.3 Reconstructed walls. Totally reconstructed walls utilizing original brick or masonry, constructed similar to original, shall be constructed in accordance with the regular code. Repairs or infills may be constructed in a similar manner to the original walls without conforming to the regular code.

SECTION 8-806 ADOBE

8-806.1 General. Unburned clay masonry may be constructed, reconstructed, stabilized or rehabilitated subject to this chapter. Alternative approaches which provide an equivalent or greater level of safety may be used, subject to the concurrence of the enforcing agency.

8-806.2 Moisture protection. Provisions shall be in-place to protect adobe structures from deterioration due to moisture penetration. Adobe shall be maintained in reasonably good condition. Particular attention shall be given to moisture content of adobe walls. Unmaintained walls or ruins shall be evaluated for safety based on their condition and stability. Additional protection measures may be appropriate subject to the concurrence of the enforcing agency.

8-806.3 Height to thickness ratio. Unreinforced new or existing adobe walls meeting these criteria need not be evaluated for out of plane failure. Where existing dimensions do not meet these conditions, additional strengthening measures, such as a bond beam, may be appropriate. Existing sod or rammed earth walls shall be considered similar to the extent these provisions apply.

1. One-story adobe load-bearing walls shall not exceed a height-to-thickness ratio of 6.
2. Two-story adobe buildings or structures' height-to-thickness wall ratio shall not exceed 6 at the ground floor and 5 at the second floor, and shall be measured at floor-to-floor height when the second floor and attic ceiling/roof are connected to the wall as described below.

8-806.4 Nonload-bearing adobe. Nonload-bearing adobe partitions and gable end walls shall be evaluated for stability and anchored against out-of-plane failure if necessary.

8-806.5 Bond beam. Where provided, a bond beam or equivalent structural element shall be located at the top of all adobe walls, and at the second floor for two-story buildings or structures. The size and configuration of the structural element shall be sufficient to provide an effective brace for the wall, to tie the building together and to connect the wall to the floor or roof.

8-806.6 Repair or reconstruction. Repair or reconstruction of wall area may utilize unstabilized brick or adobe masonry designed to be compatible with the constituents of the existing adobe materials.

8-806.7 Shear values. Existing adobe may be allowed a maximum strength level of twelve pounds per square inch (82.7 kPa) for shear.

8-806.8 Mortar. Mortar may be of the same soil composition as that used in the existing wall, or in new walls as necessary to be compatible with the adobe brick.

SECTION 8-807 WOOD

8-807.1 Existing wood diaphragms or walls. Existing wood diaphragms or walls of straight or diagonal sheathing shall be assigned shear resistance values appropriate with the fasteners and materials functioning in conjunction with the sheathing. The structural survey shall determine fastener details and spacings and verify a load path through floor construction. Shear values of Tables 8-8-A and 8-8-B.

8-807.2 Wood lath and plaster. Wood lath and plaster walls and ceilings may be utilized using the shear values referenced in Section 8-807.1.

8-807.3 Existing wood framing. Existing wood framing members may be assigned allowable stresses consistent with codes in effect at the time of construction. Existing or new replacement wood framing may be of archaic types originally used if properly researched, such as balloon and single wall. Wood joints such as dovetail and mortise and tenon types may be used structurally, provided they are well made. Lumber selected for use and type need not bear grade marks, and greater or lesser species such as low-level pine and fir, boxwood and indigenous hardwoods and other variations may be used for specific conditions where they were or would have been used.

Wood fasteners such as square or cut nails may be used with a maximum increase of 50 percent over wire nails for shear.

SECTION 8-808 CONCRETE

8-808.1 Materials. Natural cement concrete, unreinforced rubble concrete and similar materials may be utilized wherever that material is used historically. Concrete of low strength and with less reinforcement than required by the regular code may remain in place. The architect or engineer shall assign appropriate values of strength based on testing of samples of the materials. Bond and development lengths shall be determined based on historical information or tests.

8-808.2 Detailing. The architect or engineer shall carefully evaluate all detailing provisions of the regular code which are not met and shall consider the implications of these variations on the ultimate performance of the structure, giving due consideration to ductility and reserve strength.

SECTION 8-809 STEEL AND IRON

The hand-built, untested use of wrought or black iron, the use of cast iron or grey iron, and the myriad of joining methods

that are not specifically allowed by code may be used wherever applicable and wherever they have proven their worth under the considerable span of years involved with most qualified historical buildings or structures. Uplift capacity should be evaluated and strengthened where necessary. Fixed conditions or midheight lateral loads on cast iron columns that could cause failure should be taken into account. Existing structural wrought, forged steel or grey iron may be assigned the maximum working stress prevalent at the time of original construction.

**SECTION 8-810
HOLLOW CLAY TILE**

The historical performance of hollow clay tile in past earthquakes shall be carefully considered in evaluating walls of hollow clay tile construction. Hollow clay tile bearing walls shall be evaluated and strengthened as appropriate for lateral loads and their ability to maintain support of gravity loads. Suitable protective measures shall be provided to prevent blockage of exit stairways, stairway enclosures, exit ways and public ways as a result of an earthquake.

**SECTION 8-811
VENEERS**

8-811.1 Terra cotta and stone. Terra cotta, cast stone and natural stone veneers shall be investigated for the presence of suitable anchorage. Steel anchors shall be investigated for

deterioration or corrosion. New or supplemental anchorage shall be provided as appropriate.

8-811.2 Anchorage. Brick veneer with mechanical anchorage at spacings greater than required by the regular code may remain, provided the anchorages have not corroded. Nail strength in withdrawal in wood sheathing may be utilized to its capacity in accordance with code values.

**SECTION 8-812
GLASS AND GLAZING**

8-812.1 Glazing subject to human impact. Historical glazing material located in areas subject to human impact may be approved subject to the concurrence of the enforcing agency when alternative protective measures are provided. These measures may include, but not be limited to, additional glazing panels, protective film, protective guards or systems, and devices or signs which would provide adequate public safety.

8-812.2 Glazing in fire-rated systems. See Section 8-402.3.

**TABLE 8-8A
STRENGTH VALUES FOR EXISTING MATERIALS**

EXISTING MATERIALS OR CONFIGURATIONS OF MATERIALS ¹	STRENGTH LEVEL CAPACITY x14.594 for N/m
1. Horizontal diaphragms ² 1.1 Roofs with straight sheathing and roofing applied directly to the sheathing 1.2 Roofs with diagonal sheathing and roofing applied directly to the sheathing 1.3 Floors with straight tongue-and-groove sheathing 1.4 Floors with straight sheathing and finished wood flooring with board edges offset or perpendicular 1.5 Floors with diagonal sheathing and finished	300 lbs per foot for seismic shear 750 lbs per foot for seismic shear 300 lbs per foot for seismic shear 1,500 lbs per foot for seismic shear 1,800 lbs per foot for seismic shear
2. Crosswalls ^{2,3} 2.1 Plaster on wood or metal lath 2.2 Plaster on gypsum lath 2.3 Gypsum wallboard, unblocked edges 2.4 Gypsum wallboard, blocked edges	Per side: 600 lbs per foot for seismic shear 550 lbs per foot for seismic shear 200 lbs per foot for seismic shear 400 lbs per foot for seismic shear
3. Existing footings, wood framing, structural steel and reinforcing steel 3.1 Plain concrete footings 3.2 Douglas fir wood 3.3 Reinforcing steel 3.4 Structural steel	$f'_c = 1,500$ psi (10.34 MPa) unless otherwise shown by tests ³ Allowable stress same as D.F. No. 1 ³ $f_t = 40,000$ lbs per square inch (124.1 N/mm ²) maximum $f_t = 33,000$ lbs per square inch (137.9 N/mm ²) maximum

¹ Material must be sound and in good condition.

² Shear values of these materials may be combined, except the total combined value shall not exceed 900 pounds per foot (13,140 N/m).

³ Stresses given may be increased for combinations of loads as specified in the regular code.

**TABLE 8-8B
STRENGTH VALUES OF NEW MATERIALS USED IN CONNECTION WITH EXISTING CONSTRUCTION**

NEW MATERIALS OR CONFIGURATIONS OF MATERIALS	STRENGTH LEVEL CAPACITY ¹
1. Horizontal diaphragms ² <ol style="list-style-type: none"> 1.1 ¹⁵/₃₂ inch minimum plywood sheathing fastened directly over existing straight sheathing with edges of plywood located on center of individual sheathing boards and fastened with minimum #8x 1¹/₄ inch wood screws or nails with helical threads 0.13 inch min. diameter and 1¹/₄ inch min. length at 4 inch centers all panel edges and 12 inch centers each way in field. 1.2 Same plywood and attachments as 1.1 fastened directly over existing diagonal sheathing. 1.3 ³/₈ inch plywood sheathing fastened directly over existing straight or diagonal sheathing with ends and edges on centers of individual sheathing boards and fastened with #6 wood screws or nails with helical threads 0.13 inch minimum diameter and 1¹/₄ inch min. length at 6 inch centers tall panel edges and 12 inch centers each way in field. 	1,500 lbs per foot 1,800 lbs per foot 900 lbs per foot
2. Shear walls: Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing	100 percent of the value specified in the regular code for shear walls
3. Crosswalls: (special procedure only) <ol style="list-style-type: none"> 3.1 Plywood sheathing applied directly over wood studs. No value shall be given to plywood applied over existing plaster or wood sheathing 3.2 Drywall or plaster applied directly over wood studs 3.3 Drywall or plaster applied to sheathing over existing wood studs 	133 percent of the value specified in the regular code for shear walls 100 percent of the values in the regular code 50 percent of the values specified in the regular code
4. Tension bolts <ol style="list-style-type: none"> a. Bolts extending entirely through unreinforced masonry walls secured with bearing plates on far side of a three-wythe- minimum wall with at least 30 square inches (19 350 mm²) of area^{4,5} b. All thread rod extending to the exterior face of the wall installed in adhesive⁹ 	5,400 lbs (24,010 N) per bolt ⁶ 2,700 lbs (12,009 N) per bolt for two-wythe walls ⁶ 3,600 lbs (16,014 N) per bolt
5. Shear bolts Bolts embedded a minimum of 8 inches (203 mm) into unreinforced masonry walls and centered in a 2 ¹ / ₂ -inch-diameter (63.5 mm) hole filled with dry-pack or nonshrink grout. Through bolts with first 8 inches (203 mm) as noted above and embedded all thread rod as noted in Item 4.b. ^{5,7,9}	¹ / ₂ inch (12.7 mm) diameter = 1050 lbs (4671 N) ⁶ ⁵ / ₈ inch (15.9 mm) diameter = 1500 lbs (6672 N) ⁶ ³ / ₄ inch (19 mm) diameter = 2250 lbs (10,008 N) ⁶
6. Infilled walls Reinforced masonry infilled openings in existing unreinforced masonry walls. Provide keys or dowels to match reinforcing.	Same as values specified for unreinforced masonry walls
7. Reinforced masonry Masonry piers and walls reinforced per the regular code	Same as values specified in the regular code ⁸
8. Reinforced concrete Concrete footings, walls and piers reinforced as specified in the regular code and designed for tributary loads	Same as values specified in the regular code ⁸

¹ Values are for strength level loads as defined in regular code standards.

² Values may be adjusted for other fasteners when approved by the enforcing authority.

³ In addition to existing sheathing value.

⁴ Bolts to be ¹/₂-inch (12.7 mm) minimum diameter.

⁵ Other bolt sizes, values and installation methods may be used provided a testing program is conducted in accordance with regular code standards. Bolt spacing shall not exceed 6 feet. (1830 mm) on center and shall not be less than 12 inches (305) mm on center.

⁶ Other masonry based on tests or other substantiated data.

⁷ Embedded bolts to be tested as specified in regular code standards.

⁸ Stresses given may be increased for combinations of loads as specified in the regular code.

⁹ Adhesives shall be approved by the enforcing agency and installed in accordance with the manufacturer's recommendations. All drilling dust shall be removed from drilled holes prior to installation.

CHAPTER 8-9

MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS

SECTION 8-901 PURPOSE, INTENT AND SCOPE

8-901.1 Purpose. The purpose of the CHBC is to provide regulations for the mechanical, plumbing and electrical systems of buildings designated as qualified historical buildings or properties. The CHBC requires enforcing agencies to accept any reasonable equivalent solutions to the regular code when dealing with qualified historical buildings or properties.

8-901.2 Intent. The intent of the CHBC is to preserve the integrity of qualified historical buildings or properties while providing a reasonable level of protection from fire, health and life-safety hazards (hereinafter referred to as safety hazards) for the building occupants.

8-901.3 Scope. The CHBC shall be applied in conjunction with the regular code whenever compliance with the regular code is required for qualified historical buildings or properties.

8-901.4 Safety hazard. No person shall permit any safety hazard to exist on premises under their control, or fail to take immediate action to abate such hazard. Existing systems which constitute a safety hazard when operational may remain in place, provided they are completely and permanently rendered inoperative. Safety hazards created by inoperative systems shall not be permitted to exist. Requirements of the regular code concerning general regulations shall be complied with, except that the enforcing agency shall accept solutions which do not cause a safety hazard.

8-901.5 Energy conservation. Qualified historical buildings or properties covered by this part are exempted from compliance with energy conservation standards. When new nonhistorical lighting and space conditioning system components, devices, appliances and equipment are installed, they shall comply with the requirements of Title 24, Part 6, *The California Energy Code*, except where the historical significance or character-defining features are threatened.

SECTION 8-902 MECHANICAL

8-902.1 General. Mechanical systems shall comply with the regular code unless otherwise modified by this chapter.

8-902.1.1 The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any heating, ventilating, air conditioning, domestic incinerators, kilns or miscellaneous heat-producing appliances or equipment within or attached to a historical building.

8-902.1.2 Existing systems which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

8-902.1.3 The enforcing agency may approve any alternative to the CHBC which would achieve equivalent life safety.

8-902.2 Heating facilities. All dwelling-type occupancies covered under this chapter shall be provided with heating facilities. Wood-burning or pellet stoves or fireplaces may be acceptable as heating facilities.

8-902.3 Fuel oil piping and tanks. Fuel oil piping and tanks shall comply with regular code requirements except that the enforcing agency may waive such requirements where the lack of compliance does not create a safety or environmental hazard.

8-902.4 Heat-producing and cooling equipment. Heat-producing and cooling equipment shall comply with the regular code requirements governing equipment safety, except that the enforcing agency may accept alternatives which do not create a safety hazard.

8-902.5 Combustion air.

8-902.5.1 All fuel-burning appliances and equipment shall be provided a sufficient supply of air for proper fuel combustion, ventilation and draft hood dilution.

8-902.5.2 The enforcing agency may require operational tests for combustion air systems which do not comply with applicable requirements of the regular code.

8-902.6 Venting of appliances.

8-902.6.1 Every appliance required to be vented shall be connected to an approved venting system. Venting systems shall develop a positive flow adequate to convey all combustion products to the outside atmosphere.

8-902.6.2 Masonry chimneys in structurally sound condition may remain in use for all fuel-burning appliances, provided the flue is evaluated and documentation provided that the masonry and grout are in good condition. Terra cotta chimneys and Type C metallic vents installed in concealed spaces shall not remain in use unless otherwise mitigated and approved on a case-by-case basis.

8-902.6.3 The enforcing agency may require operational tests for venting systems which do not comply with applicable requirements of the regular code.

8-902.7 Ducts.

8-902.7.1 New ducts shall be constructed and installed in accordance with applicable requirements of the regular code.

8-902.7.2 Existing duct systems which do not comply with applicable requirements of the regular code and do not, in the opinion of the enforcing agency, constitute a safety or health hazard may remain in use.

MECHANICAL, PLUMBING AND ELECTRICAL REQUIREMENTS

8-902.8 Ventilating systems.

8-902.8.1 Ventilating systems shall be installed so that no safety hazard is created.

8-902.8.2 Grease hoods and grease hood exhaust systems shall be furnished and installed in accordance with applicable requirements of the regular code. Existing systems which are altered shall comply with the regular code.

8-902.9 Miscellaneous equipment requirements.

8-902.9.1 The following appliances and equipment shall be installed so that no safety hazard is created: warm air furnaces, space heating equipment, vented decorative appliances, floor furnaces, vented wall furnaces, unit heaters, room heaters, absorption units, refrigeration equipment, duct furnaces, infrared radiant heaters, domestic incinerators, miscellaneous heat-producing appliances and water heaters.

8-902.9.2 Storage-type water heaters shall be equipped with a temperature- and pressure-relief valve in accordance with applicable requirements of the regular code.

SECTION 8-903 PLUMBING

8-903.1 General. Plumbing systems shall comply with the regular code unless otherwise noted.

8-903.1.1 The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any plumbing system or equipment within or attached to a historical building.

8-903.1.2 Existing systems which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

8-903.1.3 The enforcing agency may approve any alternative to these regulations which achieves reasonably equivalent life safety.

8-903.2 Residential occupancies.

8-903.2.1 Where toilet facilities are provided, alternative sewage disposal methods may be acceptable if approved by the local health department. In hotels, where private facilities are not provided, water closets at the ratio of one for each 15 rooms may be acceptable.

8-903.2.2 Toilet facilities are not required to be on the same floor or in the same building as sleeping rooms. Water-flush toilets may be located in a building immediately adjacent to the sleeping rooms. When alternative sewage disposal methods are utilized, they shall be located a minimum distance from the sleeping rooms or other locations as approved by the local health department.

8-903.2.3 Kitchen sinks shall be provided in all kitchens. The sink and countertop may be of any smooth nonabsorbent finish which can be maintained in a sanitary condition.

8-903.2.4 Hand washing facilities shall be provided for each dwelling unit and each hotel guest room. A basin and

pitcher may be acceptable as adequate hand washing facilities.

8-903.2.5 Hot or cold running water is not required for each plumbing fixture, provided a sufficient amount of water is supplied to permit the fixture's normal operation.

8-903.2.6 Bathtubs and lavatories with filler spouts less than 1 inch (25.4 mm) above the fixture rim may remain in use, provided there is an acceptable overflow below the rim.

8-903.2.7 Original or salvage water closets, urinals and flushometer valves shall be permitted in qualified historical buildings or properties. Historically accurate reproduction, nonlow-consumption water closets, urinals and flushometer valves shall be permitted except where historically accurate fixtures that comply with the regular code are available.

8-903.3 Materials. New nonhistorical materials shall comply with the regular code requirements. The enforcing agency shall accept alternative materials which do not create a safety hazard where their use is necessary to maintain the historical integrity of the building.

8-903.4 Drainage and vent systems. Plumbing fixtures shall be connected to an adequate drainage and vent system. The enforcing agency may require operational tests for drainage and vent systems which do not comply with applicable requirements of the regular code. Vent terminations may be installed in any location which, in the opinion of the enforcing agency, does not create a safety hazard.

8-903.5 Indirect and special wastes. Indirect and special waste systems shall be installed so that no safety hazard is created. Chemical or industrial liquid wastes which may detrimentally affect the sanitary sewer system shall be pretreated to render them safe prior to discharge.

8-903.6 Traps and interceptors. Traps and interceptors shall comply with the regular code requirements except that the enforcing agency shall accept solutions which do not increase the safety hazard. Properly maintained "S" and drum traps may remain in use.

8-903.7 Joints and connections.

8-903.7.1 Joints and connections in new plumbing systems shall comply with applicable requirements of the regular code.

8-903.7.2 Joints and connections in existing or restored systems may be of any type that does not create a safety hazard.

8-903.8 Water distribution. Plumbing fixtures shall be connected to an adequate water distribution system. The enforcing agency may require operational tests for water distribution systems which do not comply with applicable requirements of regular code. Prohibited (unlawful) connections and cross connections shall not be permitted.

8-903.9 Building sewers and private sewage disposal systems. New building sewers and new private sewage disposal systems shall comply with applicable requirements of the regular code.

8-903.10 Fuel-gas piping. Fuel-gas piping shall comply with the regular code requirements except that the enforcing agency shall accept solutions which do not increase the safety hazard.

SECTION 8-904 ELECTRICAL

8-904.1 General. Electrical systems shall comply with the regular code unless otherwise permitted by this code, or approved by the authority having jurisdiction.

8-904.1.1 The provisions of the CHBC shall apply to the acceptance, location, installation, alteration, repair, relocation, replacement or addition of any electrical system or portion thereof, the premise wiring, or equipment fixed in place as related to restoration within or attached to a qualified historical building or property.

8-904.1.2 Existing systems, wiring methods and electrical equipment which do not, in the opinion of the enforcing agency, constitute a safety hazard may remain in use.

8-904.1.3 The enforcing agency may approve any alternative to the CHBC which achieves equivalent safety.

8-904.1.4 Archaic methods that do not appear in present codes may remain and may be extended if, in the opinion of the enforcing agency, they constitute a safe installation.

8-904.2 Wiring methods.

8-904.2.1 Where existing branch circuits do not include an equipment grounding conductor and, in the opinion of the enforcing agency, it is impracticable to connect an equipment grounding conductor to the grounding electrode system, receptacle convenience outlets may remain the nongrounding type.

8-904.2.2 Ground fault circuit interrupter (GFCI) protected receptacles shall be installed where replacements are made at receptacle outlets that are required to be so protected by the regular code in effect at the time of replacement. Metallic face plates shall either be grounded to the grounded metal outlet box or be grounded to the grounding-type device when used with devices supplied by branch circuits without equipment grounding conductors.

8-904.2.3 Grounding-type receptacles shall not be used without a grounding means in an existing receptacle outlet unless GFCI protected. Existing nongrounding receptacles shall be permitted to be replaced with nongrounding or grounding-type receptacles where supplied through a ground fault circuit interrupter.

8-904.2.4 Extensions of existing branch circuits without equipment-grounding conductors shall be permitted to supply grounding-type devices only when the equipment grounding conductor of the new extension is grounded to any accessible point on the grounding electrode system.

8-904.2.5 Receptacle outlet spacing and other related distance requirements shall be waived or modified if determined to be impracticable by the enforcing agency.

8-904.2.6 For the replacement of lighting fixtures on an existing nongrounded lighting outlet, or when extending an existing nongrounding lighting outlet, the following shall apply:

1. The exposed conductive parts of lighting fixtures shall be connected to any acceptable point on the grounding electrode system, or
2. The lighting fixtures shall be made of insulating material and shall have no exposed conductive parts.

Exception: Lighting fixtures mounted on electrically nonconductive ceilings or walls where located not less than either 8 feet (2438 mm) vertically or 5 feet (1524 mm) horizontally from grounded surfaces.

8-904.2.7 Lighting load calculations for services and feeders may be based on actual loads as installed in lieu of the “watts per square foot” method.

8-904.2.8 Determination of existing loads may be based on maximum demand recordings in lieu of calculations, provided all of the following are met:

1. Recordings are provided by the serving agency.
2. The maximum demand data is available for a one-year period.

Exception: If maximum demand data for a one-year period is not available, the maximum demand data shall be permitted to be based on the actual amperes continuously recorded over a minimum 30-day period by a recording ammeter connected to the highest loaded phase of the feeder or service. The recording should reflect the maximum demand when the building or space is occupied and include the measured or calculated load at the peak time of the year, including the larger of the heating or cooling equipment load.

3. There has been no change in occupancy or character of load during the previous 12 months.
4. The anticipated load will not change, or the existing demand load at 125 percent plus the new load does not exceed the ampacity of the feeder or rating of the service.

CHAPTER 8-10

QUALIFIED HISTORICAL DISTRICTS, SITES AND OPEN SPACES

SECTION 8-1001 PURPOSE AND SCOPE

8-1001.1 Purpose. The purpose of this chapter is to provide regulations for the preservation, rehabilitation, restoration and reconstruction of associated historical features of qualified historical buildings, properties or districts (as defined in Chapter 8-2), and for which Chapters 8-3 through 8-9 of the CHBC may not apply.

8-1001.2 Scope. This chapter applies to the associated historical features of qualified historical buildings or properties such as historical districts that are beyond the buildings themselves which include, but are not limited to, natural features and designed site and landscape plans with natural and man-made landscape elements that support their function and aesthetics. This may include, but will not be limited to:

1. Site plan layout configurations and relationships (pedestrian, equestrian and vehicular site circulation, topographical grades and drainage, and use areas).
2. Landscape elements (plant materials, site structures other than the qualified historical building, bridges and their associated structures, lighting, water features, art ornamentation, and pedestrian, equestrian and vehicular surfaces).
3. Functional elements (utility placement, erosion control and environmental mitigation measures).

SECTION 8-1002 APPLICATION

8-1002.1 The CHBC shall apply to all sites and districts and their features associated with qualified historical buildings or qualified historical districts as outlined in 8-1001.2 Scope.

8-1002.2 Where the application of regular code may impact the associated features of qualified historical properties beyond their footprints, by work performed secondarily, those impacts shall also be covered by the CHBC.

8-1002.3 This chapter shall be applied for all issues regarding code compliance or other standard or regulation as they affect the purpose of this chapter.

8-1002.4 The application of any code or building standard shall not unduly restrict the use of a qualified historical building or property that is otherwise permitted pursuant to Chapter 8-3 and the intent of the *State Historical Building Code*, Section 18956.

SECTION 8-1003 SITE RELATIONS

The relationship between a building or property and its site, or the associated features of a district (including qualified historical landscape), site, objects and their features are critical components that may be one of the criteria for these buildings and properties to be qualified under the CHBC. The CHBC recognizes the importance of these relationships. This chapter shall be used to provide context sensitive solutions for treatment of qualified historical buildings, properties, district or their associated historical features, or when work to be performed secondarily impacts the associated historical features of a qualified historical building or property.

APPENDIX A

CHAPTER 8-6

TABLE 1—PROVISION APPLICABILITY

	Title II Public Entities	Title III Private Entities	Title III Barrier Removal
<p>SECTION 8-601 PURPOSE, INTENT, SCOPE</p> <p>8-601.1 Purpose. The purpose of the CHBC is to provide alternative regulations to facilitate access and use by persons with disabilities to and throughout facilities designated as qualified historical buildings or properties. These regulations require enforcing agencies to accept alternatives to regular code when dealing with qualified historical buildings or properties.</p> <p>8-601.2 Intent. The intent of this chapter is to preserve the integrity of qualified historical buildings and properties while providing access to and use by persons with disabilities.</p> <p>8-601.3 Scope. The CHBC shall apply to every qualified historical building or property that is required to provide access to persons with disabilities.</p> <ol style="list-style-type: none"> 1. Provisions of this chapter do not apply to new construction or reconstruction/replicas of historical buildings. 2. Where provisions of this chapter apply to alteration of qualified historical buildings or properties, alteration is defined in <i>California Building Code (CBC)</i>, Chapter 2, Definitions and Abbreviations. 202 – A. Alter or Alteration. <p>8-601.4 General application. The provisions in the CHBC apply to local, state and federal governments (Title II entities); alteration of commercial facilities and places of public accommodation (Title III entities); and barrier removal in commercial facilities and places of public accommodation (Title III entities). Except as noted in this chapter.</p>	Applies	Applies	Applies
<p>SECTION 8-602 — BASIC PROVISIONS</p> <p>8-602.1 Regular code. The regular code for access for people with disabilities (Title 24, Part 2, Vol.1, Chapter 11B) shall be applied to qualified historical buildings or properties unless strict compliance with the regular code will threaten or destroy the historical significance or character-defining features of the building or property.</p> <p>8-602.2 Alternative provisions. If the historical significance or character-defining features are threatened, alternative provisions for access may be applied pursuant to this chapter, provided the following conditions are met:</p> <ol style="list-style-type: none"> 1. These provisions shall be applied only on an item-by-item or case-by-case basis. 2. Documentation is provided, including meeting minutes or letters, stating the reasons for the application of the alternative provisions. Such documentation shall be retained in the permanent file of the enforcing agency. 	Applies	Applies	Applies
<p>Section 8-603 — ALTERNATIVES</p> <p>8-603.1 Alternative minimum standards. The alternative minimum standards for alterations of qualified historical buildings or facilities are referenced in Section 202.5 of the 2010 ADA Standards for Accessible Design, as incorporated and set forth in federal regulation 28 CFR Pt. 36.</p> <p>8-603.2 Entry. These alternatives do not allow exceptions for the requirement of level landings in front of doors, except as provided in Section 8-603.4.</p> <ol style="list-style-type: none"> 1. Access to any entrance used by the general public and no further than 200 feet (60 960 mm) from the primary entrance. 2. Access at any entrance not used by general public but open and unlocked with directional signs at the primary entrance and as close as possible to, but no further than 200 feet (60 960 mm) from, the primary entrance. 3. The accessible entrance shall have a notification system. Where security is a problem, remote monitoring may be used. 	Applies	Applies	Applies

(continued)

TABLE 1—PROVISION APPLICABILITY—continued

	Title II Public Entities	Title III Private Entities	Title III Barrier Removal
<p>8-603.3 Doors. Alternatives listed in order of priority are:</p> <ol style="list-style-type: none"> 1. Single-leaf door which provides a minimum 30 inches (762 mm) of clear opening. 2. Single-leaf door which provides a minimum 29½ inches (749 mm) clear opening. 3. Double door, one leaf of which provides a minimum 29½ inches (749 mm) clear opening. 4. Double doors operable with a power-assist device to provide a minimum 29½ inches (749 mm) clear opening when both doors are in the open position. <p>Exception: Alternatives in this section do not apply to alteration of commercial facilities and places of public accommodation (Title III entities).</p>	Does not apply	Does not apply	Applies
<p>8-603.4 Power-assisted doors. Power-assisted door or doors may be considered an equivalent alternative to level landings, strikeside clearance and door-opening forces required by regular code.</p> <p>8-603.5 Toilet rooms. In lieu of separate-gender toilet facilities as required in the regular code, an accessible unisex toilet may be designated.</p> <p>8-603.6 Exterior and interior ramps and lifts. Alternatives listed in order of priority are:</p> <ol style="list-style-type: none"> 1. A lift or a ramp of greater than standard slope but no greater than 1:10, for horizontal distances not to exceed 5 feet (1525 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope. 2. Access by ramps of 1:6 slope for horizontal distance not to exceed 13 inches (330 mm). Signs shall be posted at upper and lower levels to indicate steepness of the slope. 	Applies	Applies	Applies
<p>SECTION 8-604 — EQUIVALENT FACILITATION</p> <p>Use of other designs and technologies, or deviation from particular technical and scoping requirements, are permitted if the application of the alternative provisions contained in Section 8-603 would threaten or destroy the historical significance or character-defining features of the qualified historical building or property.</p> <ol style="list-style-type: none"> 1. Such alternatives shall be applied only on an item-by-item or case-by-case basis. 2. Access provided by experiences, services, functions, materials and resources through methods including, but not limited to, maps, plans, videos, virtual reality and related equipment, at accessible levels. The alternative design and/or technologies used will provide substantially equivalent or greater accessibility to, and usability of, the facility. 3. The official charged with the enforcement of the standards shall document the reasons for the application of the design and/or technologies and their effect on the historical significance or character-defining features. Such documentation shall be in accordance with Section 8-602.2, Item 2, and shall include the opinion and comments of state or local accessibility officials, and the opinion and comments of representative local groups of people with disabilities. Such documentation shall be retained in the permanent file of the enforcing agency. Copies of the required documentation should be available at the facility upon request. <p>Note: For commercial facilities and places of public accommodation (Title III entities).</p> <p>Equivalent facilitation for an element of a building or property when applied as a waiver of an ADA accessibility requirement will not be entitled to the Federal Department of Justice certification of this code as rebuttable evidence of compliance for that element.</p>	Applies	<p>Waivers</p> <p>If a builder applies for a waiver of an ADA accessibility requirement for an element of a building, he or she will not be entitled to certification’s rebuttable evidence of compliance for that element. This limitation on the certification determination should be noted in any publication of Chapter 8-6 if certification is granted.</p>	Applies

Notes: The regular code for Chapter 8-6 is contained in Title 24, Part 2, Vol.1, Chapter 11B, which contain standards for new construction. Provisions of this chapter may be used in conjunction with all other provisions of the regular code and ADA regulations.

HISTORY NOTE APPENDIX

2022 California Historical Building Code California Code of Regulations, Title 24, Part 8

11

HISTORY:

For prior history, see the History Note Appendix to the *California Historical Building Code*, 2019 Triennial Edition, effective January 1, 2020.

1. (SHBSB 01/21) Adoption of the 2022 *California Historical Building Code*, CCR Title 24, Part 8, carrying forward existing amendments from the 2019 edition, effective January 1, 2023.



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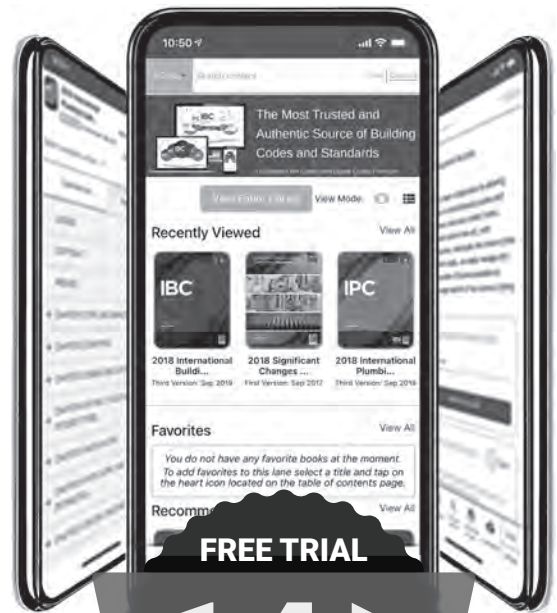
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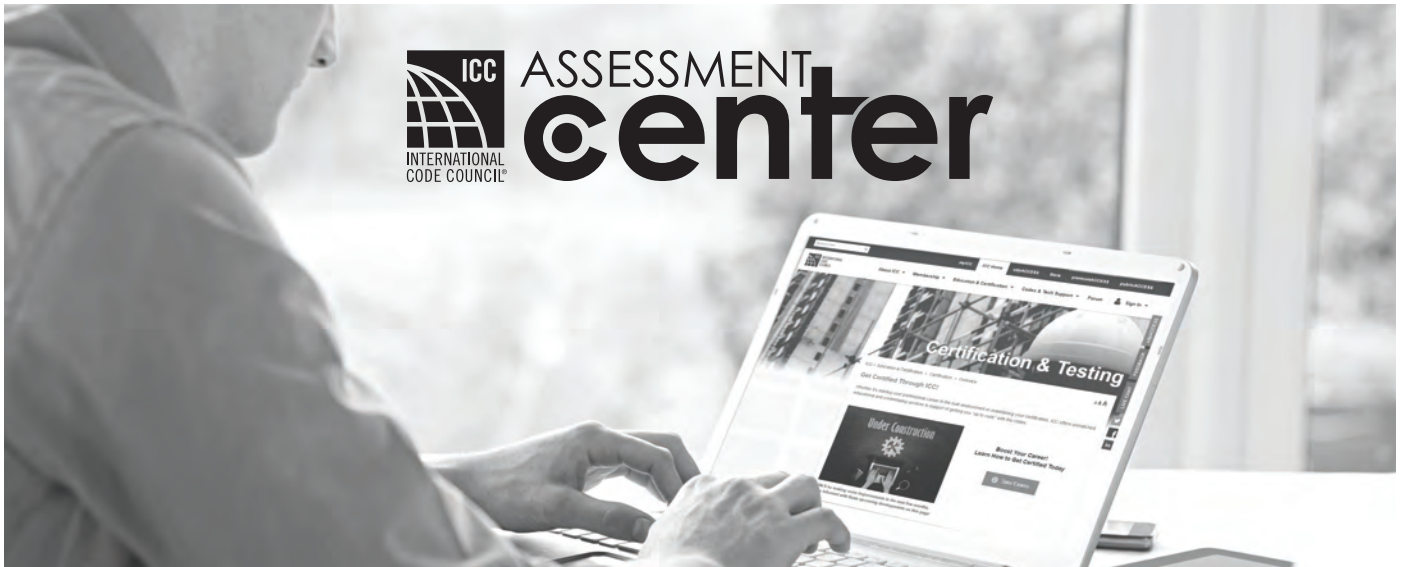


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2022 CALIFORNIA REFERENCED STANDARDS CODE

CALIFORNIA CODE OF REGULATIONS
TITLE 24, PART 12

California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is the Part 12 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Referenced Standards Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

The referenced standards contained in Part 12 are developed by the state agencies listed herein. The Part 12 Cross Reference Table herein identifies the state agency to which the standard applies, the subject of the standard, and the provisions in other parts of Title 24 where the application of the standard is required.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

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Sacramento, CA 95833-2936
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For questions on California state agency amendments, please refer to the contact list on page v.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073
Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916
State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300
Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312
Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200
Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100
Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210
Barber and Beauty Shop,
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Bureau of Household Goods and Services

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Insulation Testing Standards

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Structural Standards

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Department of Food and Agriculture

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Rendering & Collection Center Standards (916) 900-5004
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Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356
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Permanent Structures in Mobilehome &
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Factory-Built Housing, Manufactured Housing &
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Mobilehome—Permits & Inspections
Northern Region—(916) 255-2501
Southern Region—(951) 782-4431
(800) 952-8356
Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661
Organized Camps Standards
Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards
Essential Services Building Standards
Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development AKA: California Department of Health Care Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300
Hospital Standards
Skilled Nursing Facility Standards &
Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800
Code Development and Analysis
Fire Safety Standards

HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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PART 12 CROSS REFERENCE TABLE

(Cross reference table is nonregulatory, intended only as an aid to the code user.)

PART 12 STANDARD	SUBJECT	ADOPTING AGENCY	ASSOCIATED TITLE 24 BUILDING STANDARD
Chapter 12-3	Releasing systems for security bars in dwellings	SFM	Part 2, Sections 402.8.8, 425.1.5, 1010.1.4.4.1, 1030.1.1, 1030.5 Part 2.5, Sections R310.1.1, R310.4 Part 9, Sections 1010.1.4.5.1, 1030.1.1, 1030.5, 1031.7, Appendix 4 Section 452.1.5 and Title 19 provisions 4.1, 4.2, 4.3, 4.4, 4.5, 4.6 reprinted in Part 9 Part 10, Section 505.4
Chapter 12-4A	Laboratory animal quarter standards	DPH	Part 2, Section 1236
Chapter 12-4-1	Stage and Platforms	SFM	Part 2, Sections 410.2.7, 410.2.7.1, 410.2.7.2 Part 9, Sections 105.6.51, 4809
Chapter 12-7-1	Fire-resistive standards. Fire tests of building construction and materials	SFM	Part 2, Section 703
Chapter 12-7-2	Reserved		
Chapter 12-7-3	Fire-resistive standards. Fire testing furnaces	SFM	Part 9, Section 3001
Chapter 12-7-4	Fire-resistive standards. Fire door assembly tests.	SFM	Part 2, Section 716
Chapter 12-7-5	Fire-resistive standards. Interior finish of decorative material	SFM	Part 2, Chapter 8 Part 9, Chapter 8
Chapter 12-7A	Materials and construction methods for exterior wildfire exposure	SFM	Part 2, Chapter 7A Part 2.5, Section R337 Part 9, Chapter 49
Chapter 12-8-1	Fire-resistive standards for fire protection	SFM	Part 2, Sections 408.14 and 425.6.2, Chapter 35 Part 9, Section 425.6.2
Appendix 12-8-1A	Calculation of the total rate of heat and carbon monoxide or carbon dioxide production	SFM	
Appendix 12-8-1B	Guide to mounting techniques for wall and ceiling interior finish material	SFM	
Chapter 12-10-1	Exits. Power-operated exit doors.	SFM	Part 2, Sections 408.4.2, 1010.1.4.2, 1010.1.9.1
Chapter 12-10-2	Exits. Single point latching or locking devices.	SFM	Part 2, Sections 407.4.1.1, 1010.1.4.4, 1010.1.9.1, 1010.1.9.4 Part 9, Section 1010.4.2
Chapter 12-10-3	Exits. Emergency exit and panic hardware.	SFM	Part 9, Section 1009.12
Chapter 12-11A, 12-11B	Detectable warning products and directional surfaces	DSA	Part 2, Sections 1112A.9, 1116A.5, 11B-247, 11B-406.5.12, 11B-705, 11B-810.5.2
Chapter 12-12	Reserved		
Chapter 12-13	Standards for insulating material	CA/SFM	Part 2.5, Section R302.10.1 Part 6, Section 110.8 Part 9, Section 720, Table 721.1(1) Part 11, Section A5.504.4.8
Chapter 12-16-1	California standard for earthquake-actuated automatic gas shutoff systems	DSA	Part 2, Chapters 16 and 16A Part 5, Section 1211.7
Chapter 12-16-2	California standard for residential excess flow actuated automatic gas shutoff valves	DSA	Part 5, Section 1209.18
Chapter 12-31C	Radiation shielding	DPH	Part 2, Section 3102C
Chapter 12-71	Air filters	SFM	Part 4, Sections 401.2, 509.2.3, 509.2.3.4 Part 6, Section 120.1
Chapter 12-72-1	Protective signaling systems, standard test procedures	SFM	
Chapter 12-72-2	Protective signaling systems. Single- and multiple-station fire alarm devices mechanically operated type.	SFM	
Chapter 12-72-3	Protective signaling systems. Smoke detectors, combustion products type.	SFM	

CHAPTER 12-1
ADMINISTRATION
Reserved

CHAPTER 12-3

RELEASING SYSTEMS FOR SECURITY BARS IN DWELLINGS

(This standard includes provisions of Underwriters Laboratories Subject 2326, Appendix B, dated December 17, 1999, reprinted with their permission.)

INTRODUCTION

SECTION 12-3-1 SCOPE

12-3-1.1 These requirements cover releasing systems for bars, grilles, mesh, glazing or other items intended to provide security at doors and windows required for emergency escape from dwelling units. When actuated by the occupant, the system allows the obstructions over the door or window to be moved so occupants can escape in the event of an emergency.

12-3-1.2 These requirements only cover the ability of the releasing system to be manually activated from the interior of a dwelling unit by an occupant to affect an escape through the protected opening.

12-3-1.3 These requirements cover releasing systems intended for use on the interior side of doors or windows in all climatic locations.

12-3-1.4 These requirements do not evaluate the ability of the releasing system or obstructions to resist an external forced entry attack.

12-3-1.5 These requirements do not evaluate the ability of the releasing system or obstructions to be opened or removed from the exterior of the residential dwelling unit by emergency response personnel during rescue operations.

12-3-1.6 Products covered by these requirements are intended for installation in dwelling units to protect door and window openings that are designated by the *California Building Standards Code* to be used as the secondary means of escape from the living area.

12-3-1.7 Products covered by these requirements are not intended to be used to protect doors in means of egress path for nonresidential occupancies, the common egress path of multifamily residential dwelling units or the primary means of egress path in a single-family dwelling unit.

12-3-1.8 These requirements do not cover window guards or fall prevention devices that are intended to prevent falls from upper story windows.

12-3-1.9 These requirements do not apply to storm doors and windows or light duty screens used for insect control.

12-3-1.10 A product that contains features, characteristics, components or materials new or different from those covered by these requirements, and that involve a risk of fire, electric shock or injury to persons shall be evaluated using the appropriate additional component and end-product requirements as determined necessary to maintain an acceptable level of safety.

SECTION 12-3-2 GENERAL

12-3-2.1 Components.

12-3-2.1.1 Except as indicated in Section 12-3-2.1.2, a component of a product covered shall comply with the requirements for that component.

12-3-2.1.2 A component need not comply with a specific requirement that:

- (a) Involves a feature or characteristic not needed in the application of the component in the product covered by these requirements, or
- (b) Is superseded by these requirements.

12-3-2.1.3 A component shall be used in accordance with its recognized rating established for the intended conditions of use.

12-3-2.1.4 Specific components are recognized as being incomplete in construction features or restricted in performance capabilities. Such components are intended for use only under limited conditions, such as certain temperatures not exceeding specific limits, and shall be used only under those specific conditions for which they have been recognized.

12-3-2.2 Units of measurement.

12-3-2.2.1 When a value for measurement is followed by a value in other units in parentheses, the first stated value is the requirement.

12-3-2.3 Installation instructions.

12-3-2.3.1 A copy of the operating and installation instructions or equivalent information is to be furnished with the samples submitted for investigation for use as a guide in the examination and test of the mechanism. For this purpose, a printed edition is not required.

12-3-2.4 Definitions.

12-3-2.4.1 Dwelling unit. A single unit, providing complete, independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking and sanitation.

12-3-2.4.2 Escape. For the purposes of these requirements, escape refers to movement of occupants from the interior of a residential dwelling unit to a safe point outside of the dwelling unit during an emergency fire condition.

12-3-2.4.3 Emergency means of escape. A passage independent of and remote from the primary means of escape that provides a means of travel from living and sleeping spaces inside a dwelling unit to the outside.

12-3-2.4.4 Means of escape. A concept included in building codes that, in most cases, requires sleeping rooms and living areas in dwelling units to be provided with at least one primary means of escape and one secondary means of escape to the outside.

12-3-2.4.5 Primary means of escape. A door, stairway or ramp providing a means of unobstructed travel from living spaces inside a dwelling unit to the outside at street or ground level.

12-3-2.4.6 Security bars. For the purposes of these requirements, the term “security bars” includes “burglar bars” and refers to metal and other bars, grilles, grates and other barriers that are designed to provide security for doors and windows in dwelling units. The purpose of security bars, by their mere presence on a building, is to deter a potential forced entry into the dwelling.

CONSTRUCTION

SECTION 12-3-3 ASSEMBLY

12-3-3.1 Security bar releasing systems consist of the security bars, latches, manual actuators, cables, connectors, hinges and mounting hardware. The entire system shall be packaged in a single container. Standard mounting hardware including screws, bolts and washers are allowed to be provided separately.

Exception: The security bars shall be allowed to be provided separately if the instruction manual complies with Section 12-3-13.2.

12-3-3.2 The system shall be of a type capable of being readily maintained in proper operating condition.

12-3-3.3 The system shall be designed to immediately unlatch the security bars when actuated. It shall be able to be operated from the inside of a building by the occupants without the use of tools, keys, or special knowledge or effort.

12-3-3.4 The manual actuator used to release the security bars shall be designed to be mounted inside the dwelling unit for operation by the occupants. Covers or other barriers that can obstruct access to actuators shall not be provided if they inhibit the proper operation of the system.

12-3-3.5 The release mechanism shall not depend on springs to release the latch, although springs are allowed to be provided to assist in the operation.

12-3-3.6 The system shall be designed to prevent it from being locked in a closed position with a pad lock or similar device.

12-3-3.7 Systems provided with an automatic actuating mechanism shall also include a manual release system that complies with these requirements. The automatic actuation portion of the system, even in the event of its failure, shall not inhibit operation of the manual releasing system.

12-3-3.8 Manual actuation of the system shall release the security bars quickly and with simple, easily understood and

intuitive motions. The system shall be capable of being operated in all lighting conditions.

12-3-3.9 Manual actuation of the system shall not require two different forces to be applied at the same time, such as applying force to the actuator while also pushing on the bars.

12-3-3.10 When fully opened, the assembly shall provide a minimum clear opening of not less than 5.7 square feet (0.53 m²) with the width not less than 20 inches (508 mm) and the height not less than 24 inches (610 mm), measured parallel to the plane of the opening.

12-3-3.11 Security bars shall be constructed so that they do not swing up to open. They shall not include projections that can easily snag the clothing of those escaping through the opening.

12-3-3.12 Security bars shall have been constructed such that a sphere 4 inches (102 mm) in diameter shall not pass through any opening and shall not create other potential head entrapment hazards.

SECTION 12-3-4 MATERIALS

12-3-4.1 The materials employed shall have adequate mechanical strength to perform their expected function.

12-3-4.2 O-rings, gaskets and seals shall comply with UL Standard 157, 1996 Edition. Polymeric materials shall comply with UL Standard 746C, 1995 Edition, Section 25-27.

Exception: O-rings, gaskets, seals and polymeric materials that are used as decorative parts, or whose failure will not affect the ability of the system to comply with these requirements.

12-3-4.3 Components constructed of dissimilar metals shall not be used in applications where contact between them is likely to cause galvanic corrosion. The materials employed shall reduce the likelihood of the release mechanism becoming inoperative due to corrosion.

12-3-4.4 Ferrous metal parts shall be 300 series stainless steel or protected against corrosion using minimum G60 or A60 hot-dipped mil galvanization, 0.0104 mm thick zinc coating, 0.0127 mm thick cadmium coating or two coats of organic outdoor paint.

12-3-4.5 Manual actuators.

12-3-4.5.1 Security bar releasing assembly mechanisms shall include a manual actuation mechanism that is capable of unlatching the security bars so that they can be opened by the occupants. The actuating force shall be applied in one of the following manners:

Finger actuated: Pushing with the index finger or pulling a loop with the index finger in a curled position.

Hand actuated: Pulling, pushing, twisting, rotating or turning a lever, knob, handle, rod or similar actuator with the hand or multiple fingers.

Foot actuated: Kicking, depressing or stepping on an actuating pedal, lever, stirrup or similar actuator.

12-3-4.5.2 On foot-actuated systems, only a single foot motion shall be used to disengage the bar assembly from the latch. On finger- and hand-actuated systems, one or two distinct hand or finger motions shall be used to disengage the bar assembly from the latch.

12-3-4.5.3 Releasing the actuator after the latch has been disengaged from the bar assembly shall not reengage the bar assembly.

12-3-4.5.4 No features or methods shall be provided or referenced in the instruction manual to inhibit the operation of the releasing mechanism.

12-3-4.6 Cables and connectors.

12-3-4.6.1 Cables connecting actuators to latches and release mechanisms shall only be used in applications where the force transmitted by them during normal operation is less than $\frac{1}{10}$ the manufacturer's rated working tension or compression.

12-3-4.6.2 Cables and connectors shall not be damaged, or have wire strands frayed during normal installation or use, and shall not contact sharp objects when installed as intended.

12-3-4.6.3 The means used to secure cables or connectors to latches, release mechanisms and actuators shall provide a tight, reliable nonslip connection.

12-3-4.7 Hinges.

12-3-4.7.1 Hinges shall operate smoothly and reliably, and shall not be susceptible to rust or corrosion.

PERFORMANCE

**SECTION 12-3-5
TEST SETUP AND SAMPLE PREPARATION**

12-3-5.1 Sample selection.

12-3-5.1.1 Representative samples of the releasing system shall be assembled to a test fixture as described in the installation instructions, unless otherwise noted in specific tests. The assembly shall include the mounting, hardware, releasing mechanisms and fasteners recommended in the instructions.

12-3-5.1.2 Samples to be tested shall include each type and sizes of releasing system shown in the installation instructions. Each type of releasing mechanism shall be subjected to the complete test program, unless it can be shown that tests on one type of mechanism are representative of the worst case testing on another mechanism. The sample shall be tested with mounting hardware and security bars that represent the worst case conditions of use. This shall be considered to be the security bars with the heaviest weight, greatest dimensions, and systems that create the greatest torque, moment and frictional forces on the hinges and releasing mechanism.

12-3-5.1.3 The test report shall document the systems tested, along with the basis for sample selection.

12-3-5.2 Test fixture.

12-3-5.2.1 The test fixture in which the assembly is mounted shall consist of the wood stud construction described in Section 12-3-5.2.2. Systems that require a specific mounting arrangement not represented by these test fixtures, such as masonry or brick, shall be mounted in a fixture of equivalent dimensions and rigidity, as described in the installation instructions. If agreeable to the testing laboratory and manufacturer, the wood stud fixture shall be representative of all mounting structures, provided the system is securely held in place in the fixture during all tests.

12-3-5.2.2 The entire test fixture shall be constructed of commercially available two by four trade size vertical wood studs [nominal 1.5 inches by 3.5 inches (38.1 mm by 89 mm)], spaced on maximum 16 inch (406 mm) centers. The opening shall be framed with two by four plates and minimum two layers of two by four for headers. For window openings, a minimum of two layers of two by four shall be used for the sill and cripple studs shall be provided. The frame shall be secured in place so it does not move when the system is subjected to the test forces noted below. The frame shall extend a minimum of 12 inches (305 mm) above and on each side of the opening.

12-3-5.2.3 Actual doors and windows or their frames shall not be required to be mounted in the opening unless the presence of such doors, windows or frames affects the operation of the system, or unless part of the system is mounted on the door or window frame.

12-3-5.2.4 The exterior side of the assembly shall be covered by $\frac{3}{4}$ -inch (19 mm) thick trade size CDX plywood, secured with minimum $1\frac{1}{2}$ -inch (38 mm) nails or screws, secured at least every 12 inches (305 mm) to each stud, sill and header. The interior side of the assembly shall be covered with a layer of $\frac{1}{2}$ -inch (13 mm) gypsum wallboard, secured with minimum $1\frac{1}{4}$ -inch (32 mm) nails or screws at least every 12 inches (305 mm) to each stud, sill and header.

12-3-5.2.5 Openings in the test fixture shall be sized to accommodate the size of the assembly under test, as described in the installation instructions. Opening size shall be allowed to vary if the size used is judged to not affect the results of any test performed.

12-3-5.3 Sample assembly.

12-3-5.3.1 Samples of the releasing system shall arrive at the test site in the packaging anticipated for distribution and sale, and accompanied by the installation instructions. The samples are to be installed on the test fixture by a representative of the certification organization, using common hand and power tools as recommended by the instruction manual. Any specialty tools required for assembly shall be so identified in the instructions.

12-3-5.3.2 When multiple tests are required on an assembly, they are allowed to be performed on the same test fixture, provided that new hole or openings are used for mounting. Portions of the test fixture shall be allowed to

be replaced to accommodate new mounting holes or brackets.

12-3-5.3.3 Samples that include grease, graphite, silicon or other lubricants shall also be tested with the lubricant removed or not applied.

12-3-5.3.4 When assembled in accordance with the installation instructions the system shall be securely held in place in the test fixture and shall operate consistently in the intended fashion.

SECTION 12-3-6 SECURE ATTACHMENT TEST

12-3-6.1 Two samples of the system shall be subjected to the following test sequence.

12-3-6.2 The system, when in the closed position, shall resist 50-pound (22 N) force without opening, loosening in the test fixture or damaging the releasing assembly. The force shall be applied on the exterior side of the test fixture in a location that is most likely to move or damage the system. The force shall be gradually applied perpendicular to the opening and held for a period of 1 minute. A $\frac{3}{8}$ -inch (10 mm) diameter rope looped through the security bars, or similar arrangement, shall be used to apply the force.

SECTION 12-3-7 OPERATION TEST

12-3-7.1 Following the Secure Attachment Test, each of the two samples of the system shall unlatch immediately without intentional delay during each of 10 attempts to operate the system, and the security bars shall be fully opened to create the opening specified in Section 12-3-3.10. During each attempt, the actuating mechanism shall be operated as intended, using a finger, hand or foot movement as described in the operating instructions provided to unlatch the security bars. The security bars shall then be opened to the full open position, and the system shall then be reset to the closed position. An examination shall be performed to verify that the security bars are completely reset prior to the next attempt.

12-3-7.2 Springs provided in the latch or on the security bars that are intended to move the security bars from the latched position shall be removed or disabled prior to the test.

12-3-7.3 Prior to the test, the assembly shall be operated and reset a number of times to acquaint the operator with the system and its opening and reselling operation. On some systems, it may be necessary to slam, tap or otherwise carefully align the security bars in the latch to successfully reset the system into the closed position.

12-3-7.4 In the event that the actuating mechanism or assembly does not operate as intended during each of the 10 attempts, the test assembly, mounting method, actuating motion and system resetting procedure shall be reviewed to determine a potential cause of failure. After correcting any identified problems, the set of 10 operations shall be repeated with no unsuccessful attempts.

SECTION 12-3-8 MANUAL ACTUATION TEST

12-3-8.1 Following the Operation Test, each of the two sample assemblies shall be operated five times, and the forces required to unlatch the system shall be measured and recorded. These forces shall not exceed the values indicated in Sections 12-3-8.2 through 12-3-8.4.

12-3-8.2 A force gauge shall be used to apply the actuating force. The force shall be applied in the orientation anticipated by the design, using an appropriate force gauge and attachments, such as hooks, loops or probes. The gauge shall be capable of measuring the maximum force applied on each attempt. The force shall be applied in a location and fashion that is most likely to unlatch the actuator, and shall be allowed to range from a slow gradual application of force to a faster application of force of not less than 1 second in duration.

12-3-8.2.1 The average force required to unlatch finger-actuated systems shall not exceed 5 pounds (22 N) over the five attempts. The force required to unlatch the system during any of the attempts shall not exceed 10 pounds (44 N).

12-3-8.2.2 The average force required to unlatch hand-actuated systems shall not exceed 5 pounds (22 N) over the five attempts. The force required to unlatch the system during any of the attempts shall not exceed 10 pounds (44 N).

12-3-8.2.3 The average force required to unlatch foot-actuated systems shall not exceed 15 pounds (66 N) over the five attempts. The force required to unlatch the system during any of the attempts shall not exceed 30 pounds (132 N).

12-3-8.3 In lieu of complying with Section 12-3-8.2, foot-actuated systems designed to be operated by a kick shall successfully unlatch and disengage the latching mechanism each of five times when subjected to the following impact. The impact shall be applied by swinging a 25-pound (11.4 kg) weight on a 4-foot (1.2 m) pendulum from 10 inches (254 mm) away, measured horizontally. The point of impact on the foot actuator shall be at the bottom of the pendulum swing.

12-3-8.4 Once the system is unlatched, a maximum force required to set the security bars in motion shall not exceed 30 pounds (132 N), and the maximum force required to open the security bars to the minimum required width shall not exceed 15 pounds (66 N).

SECTION 12-3-9 ENDURANCE TEST

12-3-9.1 A sample of the security bar releasing system shall function as intended during 250 cycles of operation without failure or excessive wear of the parts, including serving or fraying of individual cable wires. Following the cycling, the system shall be subjected to the Operation Test.

12-3-9.2 The system shall be operated and reset as described in the manufacturer's operating instructions. As part of the cycling, it is only necessary to unlatch, disengage and reset

the system, and not open the security bars to the full open position. The cycling rate shall not exceed 30 cycles per minute.

**SECTION 12-3-10
ENVIRONMENTAL EXPOSURE TEST**

12-3-10.1 After each of the following exposures, test assemblies shall be subjected to the Manual Actuation Test. The test shall be performed while the test assemblies are in the test chambers, or immediately after their removal from the test chamber. Opening forces after these conditionings shall not exceed the values shown in Section 12-3-8.2 or 12-3-8.3. A single sample shall be subjected to each exposure. The same sample, or different sample, shall be allowed to be used for each exposure condition.

12-3-10.2 Elevated ambient. Samples shall be conditioned in a 120°F (49°C) environment for 24 hours.

12-3-10.3 Low ambient. Samples shall be conditioned in a 32°F (0°C) environment for 24 hours.

12-3-10.4 Humidity test. Samples shall be conditioned for 24 hours in moist air having a relative humidity of 85 +/- 5 percent at a temperature of 90°F +/- 5°F (32 +/- 2°C).

**SECTION 12-3-11
ABUSE TEST**

12-3-11.1 A sample shall comply with the Manual Actuation Test requirements in Sections 12-3-8.2 and 12-3-8.3 after being subjected to the simulated abuse provided in Section 12-3-11.2.

12-3-11.2 The sample shall be subject to six impacts of 5 feet-pounds (6.8 N · m) each applied with a 2-inch diameter (51 mm) steel ball on portions of the release system that are most likely to adversely affect the operation of the system.

MARKINGS AND INSTRUCTIONS

**SECTION 12-3-12
MARKINGS**

12-3-12.1 Security bars and the latching mechanism shall be permanently marked with the company name, model number and date of manufacture. When a manufacturer produces assemblies at more than one factory, each such assembly shall have a distinctive marking to identify it as the product of a particular factory.

12-3-12.2 Symbols or diagrams shall be marked on the manual actuator to identify how to manually release the security

bars. The diagram or symbols shall be readily visible to occupants when the assembly is mounted as intended.

12-3-12.3 Security bars and the latching mechanism shall be marked with the name or logo of the testing agency certifying to compliance of the products with this standard, and identification of the standard as SFM SB-2000.

12-3-12.4 Adhesive-backed labels used to provide required markings shall be suitable for the application and shall comply with UL Standard 969, 1995 Edition.

**SECTION 12-3-13
INSTRUCTION MANUAL**

12-3-13.1 Installation and operating instructions shall be provided with each system. Installation instructions shall describe how to install and initially test the system, and provide periodic testing and maintenance. Operating instructions shall be provided that include diagrams, drawing and symbols describing how to operate the system and escape in the event of a fire or other emergency.

12-3-13.2 When the releasing mechanism assembly is provided separately from the security bar assembly in accordance with Section 12-3-3.1, the instruction manual shall describe the compatible security bars that have been investigated and found suitable for use with the releasing assembly. Security bars shall be identified by the manufacturer's name and model number and maximum dimensions.

12-3-13.3 The installation instructions shall include directions on mounting the actuator inside the room at a height not exceeding 48 inches (1.2 m) from the finished floor.

CHAPTER 12-4A
LABORATORY ANIMAL QUARTERS STANDARDS

STANDARD 12-4A-1

Department of Health Services

Authority: Sections 102, 208 and 25811.

Reference: Sections 102, 208 and 436.5.

Laboratory Animal Quarters

Sec. 12-4A-101. Laboratory animal quarters shall comply with Chapter IV, “Guide for Care and Use of Laboratory Animals,” U.S. Department of Health, Education and Welfare, Publication Number 85-23, Revised 1985.

CHAPTER 12-4-1

STAGE AND PLATFORMS

SMOKE OR HEAT VENTILATORS STANDARD 12-4-1

STATE FIRE MARSHAL

SMOKE OR HEAT VENTILATORS

Sec. 12-4-100.

(a) **Application.** The minimum design, construction and performance standard set forth herein for stage and platform smoke or heat ventilators are those deemed necessary to establish conformance to the provisions of these regulations.

(b) **Scope.** This standard covers ventilators and shutters designed to open under conditions of excessive smoke or heat to provide openings for the release to the atmosphere of accumulated smoke or heat.

A smoke or heat ventilator covered by this standard consists of a prefabricated frame of metal or other noncombustible materials; a cover of noncombustible or plastic materials; an automatic releasing device; and the control rigging. The control rigging may include electrically operated units for normal opening and closing.

(c) **Tested and listed component parts.** Component parts, devices, combinations of devices and electrical equipment which have been tested and listed by an approved testing agency for the intended purpose need not be individually retested. Such individually tested and listed component parts, devices and equipment shall be subjected to the performance standard tests to determine their suitability for use in the smoke or heat ventilator.

(d) **Alternate constructions.** Ventilators having materials or forms of construction differing from this standard may be investigated and tested in accordance with these regulations, and if found to be substantially equivalent in performance may be given recognition for approval.

(e) **Marking.** Units shall be provided with a manufacturer's label or other permanent markings clearly identifying the manufacturer and model numbers. Plastics in dome-type ventilators shall be identified by brandmarkings, imprint or other markings acceptable to the State Fire Marshal.

(f) **Framing design.** The unit and cover shall be so formed and assembled that they will have the strength and rigidity necessary to resist the abuses to which they are liable to be subject without adversely affecting their performance, and without operational failure due to partial collapse with the resulting reduction of spacings, loosening or displacement of parts, or other serious defects.

(g) **Curb design.** The ventilator design shall include provisions for mounting on roof curbs or shall in themselves incorporate a design to provide the equivalent of roof curbs.

(h) **Corrosion resistant.** Ventilators shall be constructed of corrosion-resistant materials. Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating or other equivalent means. This includes all parts upon which proper mechanical operation may depend. Bearings and hinge points shall be corrosion resistant or of such material and design as to ensure against binding due to corrosion.

Ventilators designed and constructed in accordance with the above may be accepted without additional tests establishing the effects of frost, expansion by heat or warping of the framework.

(i) **Plastic covers.** Plastic covers shall be of the dome type having a continuous curvature with the center not less in height than 10 percent of the span having the least dimension but not less than 5 inches (127 mm).

(j) **Area.** The minimum dimension for an effective vent opening should not be less than 4 feet (1219 mm) in any direction. The effective venting area is the minimum cross-sectional area through which smoke and gases must pass in route to the atmosphere. The effective venting area of monitors shall be the cross-sectional area of the throat or the area of the side lights on one side of the monitor, whichever is the lesser.

Ventilators having plastic covers shall not exceed 100 square feet (9.3 m²) in area.

(k) **Fail-safe design.** The ventilator cover, lid, sidelight or shutter shall be designed to fail safe in the event of fire and shall not fall back over the opening. It shall require a manual operation to reclose the cover, lid, sidelight or shutter.

(l) **Opening counterforce.**

1. Gravity-type ventilators shall have securely attached weights to provide a continuous excess counterweight of not less than 30 pounds throughout the opening arc of the lid or sidelight.
2. Devices used to open ventilators shall be designed to exert a continuous opening force, at all times normal to the lid of not less than 30 pounds. When springs are used they shall not be stressed to more than 50 percent of their capacity when the lid is in a closed position.
3. Louvered-type shutters intended for installation in gables shall be of the gravity type. The excess counterweight shall be not less than 2 pounds per square foot of gross shutter area.

(m) Automatic heat or smoke detectors shall be placed in the underside of the ventilator at or above the roof line.

STAGE AND PLATFORMS

(n) **Test procedure.**

1. Ventilators and shutters shall be mounted for the tests in a manner simulating their intended use. The lid, cover or sidelight shall be held in a closed position by a fusible link, or an automatic heat or smoke actuated detector or combination thereof, and the fusible link or detector controls.
2. The opening counterforce shall be measured at the geometric center of the lid, cover or sidelight. The automatic detector shall be released and measurements of the counterforce taken at various points throughout the opening arc but at not less than at 30 inches (762 mm) and at 60 inches (1524 mm) from the plane of the lid when in a closed position, and at a point past 90 inches (2286 mm) from the horizontal.
3. The opening force of gable-type shutter ventilators shall be measured from the top of the operating bar.

(o) **Test report.** The test report shall include but is not limited to the following:

1. A detailed description of the unit and its intended operation.
2. Engineering data and shop drawings. Shop drawings shall bear the seal or stamp of a registered or licensed engineer or architect attesting to the structural integrity of the ventilator as it relates to the provisions of Section 12-4-100 (f).
3. Photographs [4 inches by 5 inches (101 mm by 127 mm) or larger] of the unit with markings identifying component parts of the unit.
4. Description and results of the tests performed.

CHAPTER 12-7-1

FIRE-RESISTIVE STANDARDS

FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS STANDARD 12-7-1

STATE FIRE MARSHAL SCOPE

Sec. 12-7-100.

(a) This standard for fire tests contains methods that are applicable to assemblies of masonry units and to composite assemblies of structural materials for buildings, including bearing and other walls and partitions, columns, girders, beams, slabs and composite slab and beam assemblies for floors and roofs. They are also applicable to other assemblies and structural units that constitute permanent integral parts of a finished building.

(b) It is the intent that classifications shall register performance during the period of exposure and shall not be construed as having determined suitability for use after exposure.

FIRE TESTING FURNACES AND CONTROL

Sec. 12-7-101. Fire testing furnaces and their control shall conform to SFM 12-7-1, Fire Testing Furnaces.

UNEXPOSED SURFACE TEMPERATURES

Sec. 12-7-102.

(a) **Thermocouples.** Temperatures of unexposed surfaces shall be measured with thermocouples placed under flexible, oven-dry, felted asbestos pads, 6 inches square (645 mm²), 0.4 inch (10 mm) in thickness, and weighing not less than 1.0 nor more than 1.4 pounds per square foot. The pads shall be sufficiently soft so that, without breaking, they may be shaped to contact over the whole surface against which they are placed. The wire leads of the thermocouple shall have an immersion under the pad and be in contact with the unexposed surface for not less than 3¹/₂ inches (89 mm). The hot junction of the thermocouple shall be placed approximately under the center of the pad. The outside diameter of protecting or insulating tubes shall not be more than 5/₁₆ inch (8 mm). The pad shall be held firmly against the surface and shall fit closely about the thermocouples. The wires for the thermocouple in the length covered by the pad shall be not heavier than No. 18 B.&S. gage [0.04 inch (1 mm)] and shall be electrically insulated and heat- and moisture-resistant coatings.

Note: In tests of assemblies with roof coverings, the thermocouples and pads shall be placed on top of the roof covering.

(b) **Ceiling-floor, ceiling-roof assemblies.** Temperature readings shall be taken in the center of the plenum, on the bottom side of the floor or roof deck, and on the structural members in fire-endurance tests of ceiling-floor and ceiling-

roof assemblies. Thermocouples shall be located on structural steel as specified in Section 12-7-110 (c). In combustible assemblies five or more thermocouples shall be located on the bottom of soffit of joists or beams. Thermocouples shall be placed in representative locations such as at midspan, over joints in the ceiling, over light fixtures, over air-outlet openings or similar locations.

(c) **Thermocouple locations on unexposed side.** Temperature readings shall be taken at not less than nine points on the surface of the unexposed side. Five of these shall be symmetrically disposed, one to be approximately at the center of the specimen and four at approximately the center of its quarter sections. The other four shall be located at the discretion of the testing authority to obtain representative information on the performance of the construction under test. None of the thermocouples shall be located nearer than 1¹/₂ times the thickness of the construction, or nearer than 12 inches (305 mm) to the edges. An exception shall be made in those cases where there is an element of the construction at the edges which is not otherwise represented in the remainder of the construction. Also, none of the thermocouples shall be located opposite or on top of beams, girders, pilasters or other structural members if temperatures at such points will obviously be lower than at other more representative locations.

(d) **Temperature intervals.** Temperature readings shall be taken at intervals not exceeding 15 minutes until a reading exceeding 212°F (100°C) has been obtained at any one point. Thereafter the readings may be taken more frequently at the discretion of the testing body, but the intervals need not be less than 5 minutes.

(e) **Maximum unexposed temperature rise.** Where the conditions of acceptance place a limitation on the rise of temperature of the unexposed surface, the temperature end point of the fire endurance period shall be determined by the average of the measurements taken at individual points; except that if a temperature rise 30 percent in excess of the specified limit occurs at any one of these points, the remainder shall be ignored and the fire endurance period judged as ended.

CLASSIFICATION AS DETERMINED BY TEST

Sec. 12-7-103.

(a) **Fire exposure report.** Results shall be reported in accordance with the performance tests prescribed in these methods. They shall be expressed in time periods of resistance, to the nearest integral minute. Reports shall include observations of significant details of behavior of the material or construction during the test and after the furnace fire is cut off, including information on deformation, spalling, cracking, burning of the specimen or its component parts, continuance

FIRE-RESISTIVE STANDARDS

of flaming and production of smoke. The form and contents of reports shall be in accordance with Section 12-7-115.

(b) **Structural fire report.** Reports of tests involving wall, ceiling-floor, ceiling-roof or beam constructions in which restraint is provided against expansion, contraction or rotation of the construction shall describe the method used to provide this restraint and include details of the restraining frame as well as information recorded during the test concerning the forces imposed on that structure by the test specimen.

TEST SPECIMEN

Sec. 12-7-104.

(a) **Representative specimen.** The test specimen shall be truly representative of the construction for which classification is desired, as to materials, workmanship and details such as dimensions of parts, and shall be built under conditions representative of those obtaining as practically applied in building construction and operations. The physical properties of the materials and ingredients used in the test specimen shall be determined and recorded. When necessary for evaluation of test reports, the sponsor shall furnish them to the enforcing agency.

(b) **Specimen size.** The size and dimensions of the test specimen specified herein are intended to apply for rating constructions of dimensions within the usual general range employed in buildings. If the conditions of use limit the construction to smaller dimensions, a proportionate reduction may be made in the dimensions of the specimens for a test qualifying them for such restricted use.

DURATION AND CONDUCT OF TESTS

Sec. 12-7-105.

(a) **Fire endurance.** The fire endurance test on the specimen with its applied load, if any, shall be continued until failure occurs, or until the specimen has withstood the test conditions for a period equal to that herein specified in the conditions of acceptance for the given type of construction.

(b) **Hose stream test.** Where required by the conditions of acceptance, a duplicate sample shall be subjected to a fire exposure test for a period equal to one-half of that indicated as the resistance period in the fire endurance test, but not for more than 1 hour, immediately after which the sample shall be subjected to the impact, erosion and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed face, changes in direction being made slowly.

(c) **Exemption.** The hose stream shall not be required in the case of constructions having a resistance period, indicated in the fire endurance test, of less than 1 hour.

(d) **Optional program.** The submitter may elect, with the advice and consent of the testing body, to have the hose stream test made on the sample subjected to the fire endurance test and immediately following the expiration of the fire endurance test.

(e) **Stream equipment and details.** The stream shall be delivered through $2\frac{1}{2}$ -inch (63.5 mm) hose, discharging through a National Standard Play Pipe of corresponding size

equipped with a $1\frac{1}{8}$ -inch (22 mm) discharge tip of the standard-taper, smooth-bore pattern without shoulder at the orifice. The water pressure and duration of application shall be as specified in Table SFM 12-7-1A.

(f) **Nozzle distance.** The nozzle orifice shall be 20 feet (6096 mm) from the center of the exposed surface of the test sample if the nozzle is so located that, when directed at the center, its axis is normal to the surface of the test sample. If otherwise located, its distance from the center shall be less than 20 feet (6096 mm) by an amount equal to 1 foot (305 mm) for each 10 degrees of deviation from the normal.

(g) **Protection and conditioning of test specimen.** The test specimen shall be protected during and after fabrication to ensure normality of its quality and condition at the time of test. It shall not be tested until a large portion of its final strength has been attained, and if it contains moisture, until the excess has been removed to achieve an air-dry condition in accordance with the requirements given in Items 1 through 3. The testing equipment and sample undergoing the fire test shall be protected from any condition of wind or weather that might lead to abnormal results. The ambient air temperature at the beginning of the test shall be within the range of 50 to 90°F (10 to 32°C). The velocity of air across the unexposed surface of the sample, measured just before the test begins, shall not exceed 4.4 feet per second, as determined by an anemometer placed at right angles to the unexposed surface. If mechanical ventilation is employed during the test, an air stream shall not be directed across the surface of the specimen.

1. Prior to the fire test, constructions shall be conditioned with the objective of providing, within a reasonable time, a moisture condition within the specimen approximately representative of that likely to exist in similar constructions in buildings. For purposes of standardization, this condition is to be considered as that which would be established at equilibrium resulting from drying in an ambient atmosphere of 50 percent relative humidity at 73°F (23°C). However, with some constructions, it may be difficult or impossible to achieve such uniformity within a reasonable period of time. Accordingly, where this is the case, specimens may be tested when the dampest portion of the structure, the portion at 6-inch (152 mm) depth below the surface of massive constructions, has achieved a moisture content corresponding to drying to equilibrium with air in the range of 50 to 75 percent relative humidity at $73 \pm 5^\circ\text{F}$. In the event that specimens dried in a heated building fail to meet these requirements after a 12-month conditioning period, or in the event that the nature of the construction is such that it is evident that drying of the specimen interior will be prevented by hermetic sealing, these requirements may be waived, except as to attainment of a large portion of final strength, and in the specimen tested in the condition in which it then exists.
2. Specimens shall be exposed to the controlled conditions outlined in Item 1 until the interior or dampest section of the assembly attains a relative humidity of 75 percent or less. If during the conditioning of the specimen it appears desirable or is necessary to use accelerated drying techniques, it is the responsibility of the

laboratory conducting the test to avoid procedures which will significantly alter the structural or fire endurance characteristics of the specimen or both from those produced as the result of drying in accordance with procedures given in Item 1.

3. Within 72 hours prior to the fire test, information on the actual moisture content and distribution within the specimen shall be obtained. This information shall be included in the test report.

TESTS OF BEARING WALLS AND PARTITIONS

Sec. 12-7-106.

(a) **Size of sample.** The area exposed to fire shall be not less than 100 square feet (9.3 m²) with neither dimension less than 9 feet (2743 mm). The test specimen shall not be restrained on its vertical edges. The fire testing furnace, its arrangement and control during fire tests shall conform to SFM 12-7-3, Section 12-7-301 (a), Vertical Large-scale Wall Furnace.

(b) **Loading.** During the fire endurance test, and fire and hose stream test, a superimposed lead shall be applied to the construction in a manner calculated to develop theoretically, as nearly as practicable, the working stresses contemplated by the design.

(c) **Conditions of acceptance.** The test shall be regarded as successful if the following conditions are met:

1. The wall or partition shall have sustained the applied load during the fire endurance test without passage of flame or gases hot enough to ignite conditioned cotton waste, for a period equal to that for which classification is desired.

Note: Cotton waste shall be conditioned by drying in an oven at a temperature of 120°F (49°C) for a period of not less than 1 hour prior to the test.

2. The wall or partition shall have sustained the applied load during the fire and hose stream test as specified in Section 12-7-105, without passage of flame, of gases hot enough to ignite cotton waste, or passage of the hose stream, and after cooling but within 72 hours after its completion shall sustain the dead load of the test construction plus twice the superimposed load specified above.
3. Transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250°F (139°C) above its initial temperature.
4. Deflection of the wall or partition during the fire endurance test shall not exceed 6 inches (152 mm). The deflection of specimens varying from the dimensions given in Section 12-7-106 (a) shall be determined proportionately.

TESTS OF NONBEARING WALLS AND PARTITIONS

Sec. 12-7-107.

(a) **Size of sample.** The area exposed to fire shall be not less than 100 square feet (9.3 m²), with neither dimension less

than 9 feet (2743 mm). The test specimen shall be restrained on all four edges. The fire testing furnace, its arrangement and control during fire tests shall conform to SFM 12-7-3, Section 12-7-301 (a), Vertical Large-scale Wall Furnace.

(b) **Conditions of acceptance.** The test shall be regarded as successful if the following conditions are met:

1. The wall or partition shall have withstood the fire endurance test without passage of flame or gases hot enough to ignite conditioned cotton waste, for a period equal to that for which classification is desired.

Note: Cotton waste shall be conditioned by drying in an oven at a temperature of 120°F (49°C) for a period of not less than 1 hour prior to the test.

2. The wall or partition shall have withstood the fire and hose stream test as specified in Section 12-7-105 without passage of flame, of gases hot enough to ignite cotton waste, or passage of the hose stream.
3. Transmission of heat through the wall or partition during the fire endurance test shall not have been such as to raise the temperature on its unexposed surface more than 250°F (139°C) above its initial temperature.
4. Deflection of the wall or partition during the fire endurance test shall not exceed 6 inches (152 mm). The deflection of specimens varying from the dimensions given in Section 12-7-107 (a) shall be determined proportionately.

TEST OF COLUMNS

Sec. 12-7-108.

(a) **Size of sample.** The length of the column exposed to fire shall, when practicable, approximate the maximum clear length contemplated by the design, and for building columns shall be not less than 9 feet (2743 mm). The contemplated details of connections and their protection, if any, shall be applied according to the methods of acceptable field practice.

(b) **Loading.**

1. During the fire endurance test, the column shall be exposed to fire on all sides and shall be loaded in a manner calculated to develop theoretically, as nearly as practicable, the working stresses contemplated by the design. Provision shall be made for transmitting the load to the exposed portion of the column without unduly increasing the effective column length.
2. If the submitter and the testing body jointly so decide, the column may be subjected to $1\frac{3}{4}$ times its designed working load before the fire endurance test is undertaken. The fact that such a test has been made shall not be construed as having had a deleterious effect on the fire endurance test performance.

(c) **Condition of acceptance.** The test shall be regarded as successful if the column sustains the applied load during the fire endurance test for a period equal to that for which classification is desired.

ALTERNATE TEST OF PROTECTION FOR STRUCTURAL STEEL COLUMNS

Sec. 12-7-109.

(a) **Application.** This test procedure does not require column loading at any time and may be used at the discretion of the testing laboratory to evaluate steel column protections that are not required by design to carry any of the column load.

(b) Size and character of sample.

1. The size of the steel column used shall be such as to provide a test specimen that is truly representative of the design, materials and workmanship for which classification is desired. The protection shall be applied according to the methods of acceptable field practice. The length of the protected column shall be at least 8 feet (2438 mm). The column shall be vertical during application of the protection and during the fire exposure. The rating of performance shall not be applicable to sizes of columns smaller than those tested.
2. The applied protection shall be restrained against longitudinal temperature expansion greater than that of the steel column by rigid steel plates or reinforced concrete attached to the ends of the steel column before the protection is applied. The size of the plates or amount of concrete shall be adequate to provide direct bearing for the entire transverse area of the protection.
3. The ends of the specimen, including the means for restraint, shall be given sufficient thermal insulation to prevent appreciable direct heat transfer from the furnace.

(c) **Temperature measurement.** The temperature of the steel in the column shall be measured by at least three thermocouples located at each of four levels. The upper and lower levels shall be 2 feet (609 mm) from the ends of the steel column, and the other two intermediate levels shall be equally spaced. The thermocouples at each level shall be so placed as to measure significant temperatures of the component elements of the steel section.

(d) **Exposure to fire.** During the fire endurance test, the specimen shall be exposed to fire on all sides for its full length.

(e) **Conditions of acceptance.** The test shall be regarded as successful if the transmission of heat through the protection during the period of fire exposure for which classification is desired does not raise the average (arithmetical) temperature of the thermocouples at any one of the four levels above 1000°F (537.8°C), or does not raise the temperature above 1200°F (648.8°C) at any one of the measured points.

TESTS OF FLOORS AND ROOFS

Sec. 12-7-110. (The following is applicable to floors and roofs with or without attached, furred or suspended ceilings, and requires application of fire exposure to the underside of the construction.)

(a) Size and construction of sample.

1. The area exposed to fire shall be not less than 180 square feet (16.7 m²), with neither dimension less than 12 feet (3657 mm). Structural members, if a part of the construction under test, shall lie within the combustion chamber and have a clearance of not less than 8 inches (203 mm) from its walls. No individual classification shall be made of structural members which have a clearance of less than 24 inches (609 mm) from its walls. The fire testing furnace, its arrangement and control during fire tests shall conform to the provisions of SFM 12-7-3, Section 12-7-301 (c), for Horizontal Large-scale Floor Furnace.
2. Structural members forming a part of the assembly shall be supported in accordance with the recommended fabrication procedures for the type of construction. Assemblies representing forms of construction that restrain structural elements and top deck shall be supported by a restraining frame, incorporated in or attachable to the furnace structure in such a manner that comparable restraint shall occur during the test.

(b) **Loading.** Throughout the fire endurance test, a superimposed load shall be applied to the test specimen. This load, together with the weight of the specimen, shall be as nearly as practicable the maximum theoretical dead and live loads permitted by nationally recognized design standards.

(c) **Temperature measurement.** The temperature of the steel in structural members shall be measured by thermocouples at three or more sections equally spaced along the length of the members with one section located at mid-span; alternately when thermocouples are placed at four sections, they may be at the quarter points provided no thermocouples shall be placed within 24 inches (609 mm) of the furnace walls; except that in cases where the cover thickness is not uniform along the specimen length, at least one of these sections shall include the point of minimum cover. For solid section steel beams, there shall be four thermocouples at each section: one at the center on the exposed face of the bottom flange, one on the edge of the bottom flange, one on the web at the center and one on the bottom at the edge of the top flange. For reinforced or prestressed concrete structural members, thermocouples shall be located on each of the tension reinforcing elements unless there are more than eight elements, in which case thermocouples shall be placed on eight elements of selected in such a manner as to obtain representative temperatures of all the elements. For designs employing trusses or open-web steel joists, four thermocouples shall preferably be placed at mid-span of each truss or joist, two on the bottom chord, one at the middle of the web element and one on the bottom of the top chord with locations selected in such a manner as to obtain representative temperatures of all the elements, provided, however, that no more than four joists need to be so instrumented. For designs employing combustible framing, three or more thermocouples shall be placed approximately at mid-span on three or more framing members and so located as to obtain representative temperatures on the soffits of the framing members.

(d) **Conditions of acceptance.** In obtaining an assembly classification, the following conditions shall be met:

1. The construction shall have sustained the applied load during the fire endurance test without passage of flame or gases hot enough to ignite conditioned cotton waste for a period at least equal to that for which classification is desired.

Note: Cotton waste shall be conditioned by drying in an oven at a temperature of 120°F (49°C) for a period of not less than 1 hour prior to the test.
2. The transmission of heat through the construction during the fire endurance test shall not have been such as to raise the average temperature of the thermocouples on its unexposed surface more than 150°F (139°C) above its initial temperature.
3. Structural failure, deflection or sagging of the structural elements of the test specimen or any portion of the structural elements in excess of 12 inches (305 mm) shall be judged as the end of the fire endurance period.
4. For assemblies employing steel structural members, including decks designed as structural diaphragms the transmission of heat through the protection during the period of fire endurance for which classification is desired does not raise the temperature at any location on the member above 1200°F (649°C), nor the average of the thermocouples at any section above 1000°F (538°C).
5. For assemblies employing multiple open web steel joists [spaced less than 48 inches (1219 mm) on center], the transmission of heat through the protection during the period of fire endurance for which classification is desired does not raise the average of all thermocouples in all joists above 1000°F (538°C).
6. For assemblies employing concrete structural members, the transmission of heat through the cover to the steel during the period for which classification is desired does not raise the average temperature of the thermocouples at any section on the steel above 800°F (426°C) for cold drawn prestressing steel or 1000°F (538°C) for reinforcing steel.

(e) **Reports of results.** The fire endurance shall be reported for the floor or roof assembly as tested, and a different fire endurance classification from that of the assembly for structural members shall not be recorded without reference to Section 12-7-110 (f) and (g).

(f) **Alternate classification procedure for loaded structural frame members.** Fire endurance classifications may be developed for structural frame members tested as part of a floor or roof assembly as described in Section 12-7-110 (a) through (c) using the conditions of acceptance described in Section 12-7-110 (g). The fire endurance classification so derived shall be applicable to the structural frame member when used with any floor or roof construction which has a comparable or greater thermal capacity for heat dissipation from the beam, and equal or greater compressive strength than the floor or roof with which it was tested. The fire-resistance classification developed by this method shall not be applicable to sizes of structural frame members smaller than those tested.

(g) **Structural frame members, conditions of acceptance.**

1. The construction shall have sustained the applied load during the fire endurance test for a period equal to that for which classification is desired.
2. For assemblies employing solid steel beams the transmission of heat through the protection during the period of fire endurance for which classification is desired does not raise the temperature at any location on the member above 1200°F (649°C), nor the average temperature recorded by four thermocouples at any section above 1000°F (538°C).
3. For assemblies employing open-web steel joists or steel trusses spaced 4 feet (1219 mm) or more on centers, the transmission of heat through the protection on the steel joists or trusses during the period of fire endurance for which classification is desired does not raise the average temperature of all joists or truss thermocouples above 1000°F (538°C).
4. For assemblies employing concrete structural members the transmission of heat through the cover to the steel during the period for which classification is desired does not raise the average temperature of the thermocouples at any section on the steel above 800°F (426°C) for cold drawn prestressing steel or 1000°F (538°C) for reinforcing steel.

TESTS OF LOADED RESTRAINED STRUCTURAL FRAME MEMBERS

Sec. 12-7-111.

(a) **Application.** An individual classification of a structural frame member (beams, girders, joists, etc.) may be developed by this test procedure. The structural frame member may be tested with a representative floor or roof section; and the fire endurance classification so derived shall be applicable to the structural frame member when used with any floor or roof construction which has a comparable or greater thermal capacity for heat dissipation from the beam than the floor or roof with which it was tested. The fire endurance classification developed by this method shall not be applicable to sizes of structural frame members smaller than those tested.

(b) **Size and construction of specimen.** The structural frame member shall be such as to provide a test specimen that is representative of the design, materials and workmanship for which classification is desired. Any protection shall be applied according to the methods of acceptable field practice. The length of the structural frame member exposed to the fire shall be not less than 12 feet (3657 mm), and the member shall be tested in a horizontal position. Specimens representing forms of construction in which restraint due to thermal expansion occurs shall be supported by a restraining frame in such a manner that comparable restraint shall occur during the test. A section of a representative floor or roof construction not less than 5 feet (1524 mm) wide, symmetrically located with reference to the structural frame member and extending its full length may be included in the test assembly and exposed to fire from below. The floor or roof construction shall not be supported or restrained along its span length or ends.

FIRE-RESISTIVE STANDARDS

(c) **Furnace.** The fire testing furnace, its arrangement and control during fire tests shall conform to SFM 12-7-3, Fire Testing Furnaces, Section 12-7-301, for the Horizontal Large-scale Floor Furnace, or the Horizontal Large-scale Beam Furnace.

(d) **Loading.** Throughout the fire endurance test, a superimposed load shall be applied to the test specimen. This load, together with the weight of the specimen, shall be as nearly as practicable the maximum theoretical dead and live loads permitted by nationally recognized design standards.

(e) **Temperature measurements.** The temperature of the steel in structural members shall be measured by thermocouples at three or more sections spaced along the length of the members with one section located at the mid-span, except that in cases where the cover thickness is not uniform along the structural frame member length at least one of these sections shall include the point of minimum cover. For solid steel beams there shall be four thermocouples at each section: one shall be located at the center on the exposed face of the bottom flange; one on the edge of the bottom flange, one on the web at the center and one on the bottom of the top flange. For open-web steel joists there shall be four thermocouples at each section: two on the bottom of the lower chord, one at the middle of the web and one on the bottom of the top chord. For trusses there shall be not less than four thermocouples at each section: one on the bottom of the top chord, one at the middle of the nearest diagonal or vertical member and two on the bottom of the lower chord. For reinforced or prestressed concrete structural members, thermocouples shall be located on each of the tension reinforcing elements, unless there are more than eight such elements, in which case thermocouples shall be placed on eight elements selected in such a manner as to obtain representative temperature on all the elements.

(f) **Conditions of acceptance.** In deriving a structural frame member classification, the following conditions shall be met:

1. The structural frame member shall have sustained the applied load during the fire endurance test for a period at least equal to that for which classification is desired.
2. For structural steel members, the transmission of heat through the protection during the period of fire endurance for which classification is desired does not raise the temperature of the thermocouple at any location on the structural steel member above 1200°F (649°C) nor the average of the thermocouples at any section above 1000°F (538°C).
3. For concrete beams, the transmission of heat through the cover to the steel during the period of fire endurance for which classification is desired does not raise the average temperature of the thermocouples at any section on the steel above 800°F (426°C) for cold drawn prestressing steel or 1000°F (538°C) for reinforcing steel.

Sec. 12-7-112.

(a) **Application.** Where the size and construction of the sample, or the loading specified in Sections 12-7-110 (a) and (b) is not feasible by design or dimensions, this alternate test procedure may be used to evaluate the protection for steel

beams, girders and trusses without application of design load, provided that the protection is not required by design to function structurally in resisting applied loads. The furnace and its control during fire tests shall conform to SFM 12-7-3, Fire Testing Furnaces, Section 12-7-301, for the Horizontal Small-scale Beam Furnace, the Horizontal Large-scale Beam Furnace or the Horizontal Large-scale Floor Furnace.

(b) Size and character of sample.

1. The size of the steel beam, girder or truss shall be such as to provide a test specimen that is representative of the design, materials and workmanship for which classification is desired. The protection shall be applied according to the methods of acceptable field practice, and the projection below the ceiling, if any, shall be representative of the conditions of intended use. The length of the beam, girder or truss exposed to the fire shall be not less than 7 feet (2133 mm), and the member shall be tested in a horizontal position. A section of a representative floor or roof construction not less than 5 feet (1524 mm) wide, symmetrically located with reference to the beam, girder or truss and extending its full length, may be included in the test assembly and exposed to fire from below.

The rating of performance shall not be applicable to sizes of solid structural members or elements of built-up structural members, such as trusses, smaller than those tested.

2. The applied protection shall be restrained against longitudinal expansion greater than that of the steel beam, girder or truss by rigid steel plates or reinforced concrete attached to the ends of the member before the protection is applied. The ends of the member, including the means for restraint, shall be given sufficient thermal insulation to prevent appreciable direct heat transfer from the furnace to the unexposed ends of the member or from the ends of the member to the outside of the furnace.

(c) **Temperature measurement.** The temperature of the steel in the beam, girder or truss shall be measured with not less than four thermocouples at each of not less than three sections equally spaced along the length of the beam, girder or truss, symmetrically disposed and not nearer than 2 feet (609 mm) from the inside face of the walls of the furnace. The thermocouples at each section shall be symmetrically placed so as to measure significant temperatures of all component elements of the steel section.

(d) **Conditions of acceptance.** The test shall be regarded as successful if the transmission of heat through the protection during the period of fire exposure for which classification is desired does not raise the average (arithmetical) temperature of the thermocouples at one of the sections above 100°F (38°C), or does not raise the temperature above 1200°F (649°C) at any one of the measured points. The fire-resistance classification so derived shall be applicable to the beam, girder or truss when used with any floor or roof construction which has an equal or greater thermal capacity for heat dissipation from the beam than the floor or roof with which it was tested.

TESTS OF CEILING CONSTRUCTIONS

Sec. 12-7-113.

(a) **Application.** This test procedure is to be used for classification of ceilings that are not an integral part of a floor construction and where 36 inches (914 mm) or more space is provided above the top of the joists or beams supporting and protected by the ceiling.

(b) **Size of sample.** The area exposed to fire shall be not less than 180 square feet (16.7 m²), with neither dimension less than 12 feet (3657 mm), and the ceiling surface at its edges shall be in contact with the test furnace structure.

(c) **Test construction and enclosure.** The test ceiling construction shall include all structural members and details including hangers, if any, but not walkways. Above the ceiling during the test, there shall be provided a tight flat-topped enclosure, the underside of the covering material of which shall be 36 inches (914 mm) above the top of the joists or beams supporting and protected by the ceiling. The top of the enclosure shall be made of cement-asbestos board $\frac{1}{4}$ inch (6 mm) in thickness under asbestos millboard $\frac{1}{2}$ inch (13 mm) in thickness, and the side walls of 8-inch (203 mm) common brick, or it shall be of a construction having equivalent heat conductivity and heat capacity. Where use of the ceiling under a combustible construction is contemplated, at least five 15-inch (381 mm) square panels of 1-inch (25 mm) pine boards shall be attached to the underside of the top of the enclosure. The temperatures on the bottom surface of these panels shall be measured.

(d) **Conditions of acceptance.** The test shall be regarded as successful if the following conditions are met:

1. The ceiling shall have withstood the fire endurance test without the passage of flame or ignition of combustible members or materials forming part of the construction above the ceilings as evidenced by glow or flame.
2. Transmission of heat through the ceiling during the fire endurance test shall not have been such as to raise the average temperature above the test ceiling more than indicated in Items A, B and C. The limiting temperatures shall be the average of those taken at not less than five points, one of which shall be approximately at the center, and four at approximately the centers of the quarter sections.
 - A. With combustible supports or other combustible material in contact with the ceiling, the temperature increase at the points of contact shall not exceed 250°F (121°C).
 - B. With combustible supports or other combustible material not in contact with the ceiling, the temperature increase on the surface of any combustible members, pine panels, or combustible material adjacent to the ceiling shall not exceed 250°F (121°C). The temperature on the exposed surface of combustible members not in contact with the ceiling shall be measured under a sheet of mica approximately 0.002 inch (0.05 mm) in thickness.
 - C. With no combustible material above the ceiling construction, the average temperature measured

on the lower surface of the main structural supporting members (beams or slabs) shall not exceed 1200°F (649°C) and the average temperature of the top and bottom of the beams, when used, shall not exceed 1000°F (538°C).

TESTS OF PROTECTION FOR COMBUSTIBLE FRAMING, OR FOR COMBUSTIBLE FACINGS ON THE UNEXPOSED SIDE OF WALLS, PARTITIONS AND FLOORS

Sec. 12-7-114.

(a) **Character of sample.** Test panels carrying wall, partition or floor protection shall be finished with the protections which are the subject of the test, except that where the finish on the unexposed side is not the subject of the test and is not specifically indicated, the testing laboratory shall apply a finish judged suitable for the purpose. In case a floor construction, as installed for actual use, is to have no finish on the unexposed side, it shall be so tested.

(b) **Size of sample.** The area exposed to fire shall be, for tests of wall and partition protection, not less than 100 square feet (9.3 m²) with neither dimension less than 9 feet (2743 mm); for tests of floor protection, not less than 180 square feet (16.7 m²) with neither dimension less than 12 feet (3657 mm).

(c) **Conditions of acceptance.** The test shall be regarded as successful if the following conditions are met:

1. The protection shall have withstood the fire endurance test, without ignition of the materials protected, for a period equal to that for which classification is desired.
2. Transmission of heat through the protection during the fire endurance test shall not have been such as to raise the temperatures at its contact with the protected structural members or facings of the test panel more than 250°F (130°C) above the initial temperatures at these points, except that for members closely embedded on three sides in masonry, concrete or similar noncombustible materials the permissible temperature rise may be 325°F (181°C).

STANDARD FIRE ENDURANCE TEST REPORT FORM

Sec. 12-7-115. Reports of fire endurance tests specified in Section 12-7-103 shall include all data and in the form prescribed in this section.

(a) **Cover page.** Cover page shall include: Laboratory, Laboratory Project Number, Sponsor and Date Tested.

(b) **Title page.** Title page shall include: Table of Contents, Summary of Construction and Fire Endurance Time. The signature of the fire-protection engineer responsible for the conduct of the test may be on the title page or at the conclusion of the report.

(c) **Test facility.** A complete description and details of the furnace and recording equipment shall be provided. This may be in an appendix to the report.

1. Describe details of end conditions (wedges, bearing, means to prevent rotation), describe details of the

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restraining frame, degree of restraint or reactive forces opposing expansion and the method used to provide this restraint.

2. If construction is tested under load, indicate how load is applied and controlled (include loading diagram).
3. If construction is tested as nonload bearing indicate whether frame is rigid or moves in test.

(d) **Description of materials.** Type, size, class, strength, densities, trade name and any additional data necessary to fully define and identify materials. The testing laboratory shall indicate whether materials meet ASTM standards by markings, or by statement of sponsor, or by physical or chemical test by the testing laboratory. The sponsor shall authorize the testing laboratory to provide all data to the enforcing agency as may be necessary for evaluation.

(e) **Description of test assembly.**

1. Give size of test specimen including dimensions of all parts.
2. Give details of structural design, including safety factor of all structural members in the test assembly.
3. Include plan, elevation, principal cross section, plus other sections as needed for clarity. Detailed drawing of complete assembly.
4. Give details of attachment of test panel in frame.
5. Give location of thermocouples, deflection points and other items for test.
6. Describe general ambient conditions at:
 - A. Time of construction;
 - B. During curing (time from construction to test); and
 - C. Time of test.
7. Record air movement across unexposed face of test specimen.
8. Report relative humidity in specimen.

(f) **Description of test.**

1. Except as provided in Section 12-7-102 (d), report temperatures at beginning and every 5 minutes. If charts are included in report, clearly indicate time and Fahrenheit temperature:
 - A. In furnace space.
 - B. On unexposed face for each thermocouple.
 - C. On protected framing members as stipulated in test method. In combustible assemblies indicate temperatures on framing back of protection, soft-fit of joists or other framing members.
 - D. On request of the enforcement agency, furnish the temperatures in the plenum at mid-depth of ceiling-floor assemblies and underside of floor.
2. Report deflections every 5 minutes for first 15 minutes and last hour of test. Every 10 minutes in between.
3. Report appearance of exposed face:
 - A. Every 15 minutes;
 - B. At any noticeable development, give details and time, i.e., cracks, buckling, twisting, expansion of

supports, flaming, smoke, loss of material, etc.; and

- C. At end of test include amount of drop out, condition of fasteners, sag, etc.
4. Report appearance of the unexposed face:
 - A. Every 15 minutes;
 - B. At any noticeable development including cracking, smoking, buckling, giving details and time; and
 - C. At end of test.
5. Report time of failure by:
 - A. Temperature rise;
 - B. Failure to carry load; and
 - C. Passage of flame-heat-smoke.
6. If hose stream is required, repeat necessary parts of Items 3 and 5. If failure occurs in hose stream test, describe.

(g) **Comments by testing engineer.**

1. Included shall be a statement concerning construction being representative of field construction. If construction does not represent typical field construction, all deviations shall be noted.
2. If construction is unsymmetrical, clearly indicate face exposed to fire.
3. Fire test.

(h) **Summary of results.** Shall include:

1. Endurance time.
2. Nature of failure.
3. Hose stream results.

(i) **Pictures.** Pictures shall be provided as necessary to clarify and show what cannot be covered in the report. Pictures shall include:

1. Assembly in construction with closeups of details supplementing the report.
2. Exposed face prior to test.
3. Unexposed face at start of endurance test.
4. Unexposed face at end of fire endurance test.
5. Exposed face at end of fire endurance test.
6. If hose stream test is required, repeat Items 1 through 5.

**TABLE SFM 12-7-1A
CONDITIONS FOR HOSE STREAM TEST**

	WATER PRESSURE AT BASE OF NOZZLE (POUNDS PER SQUARE INCH)	DURATION OF APPLICATION, MINUTES PER 100 SQUARE FEET OF EXPOSED AREA
4 hours and over	45	5
2 hours and over, if less than 4	30	2½
1½ hours and over, if less than 2	30	1½
1 hour and over, if less than 1½	30	1
Less than 1 hour, if desired	30	1

For SI: 1 square foot = 92 903 mm²

CHAPTER 12-7-2
FIRE-RESISTIVE STANDARDS

Reserved

CHAPTER 12-7-3

FIRE-RESISTIVE STANDARDS

FIRE TESTING FURNACES STANDARD 12-7-3

STATE FIRE MARSHAL SCOPE

Sec. 12-7-300. This standard sets forth the general requirements for the design and control of fire testing furnaces intended for fire exposure testing and assignment of fire endurance ratings of building materials, assemblies of building materials, equipment and devices.

Furnace design and dimensions

Sec. 12-7-301. Furnaces shall consist of a furnace chamber and an insulated specimen frame. The furnace chamber walls and floor shall consist of insulating fire brick or equivalent heat-reflective materials. Furnace dimensions shall be not less than shown in the following:

(a) **Vertical large-scale wall furnace.** The furnace exposure panel or door shall consist of an insulated steel restraining frame having an available opening for the test sample of not less than 200 square feet (18.6 m²) in area with neither dimension less than 9 feet (2743 mm).

(b) **Vertical half-scale wall furnace.** The furnace exposure panel or door shall consist of an insulated steel restraining frame having an available opening of not less than 50 square feet (4.6 m²) for the test sample. Neither dimension of the furnace opening shall be less than 7 feet (2133 mm).

(c) **Horizontal large-scale floor furnace.** The furnace exposure panel shall consist of an insulated steel restraining frame having an available opening of not less than 180 square feet (16.7 m²) for the test sample. Neither dimension of the furnace opening shall be less than 12 feet (3657 mm).

(d) **Horizontal small-scale furnace.** The furnace exposure panel shall consist of an insulated frame having an available opening of not less than 35 square feet (3 m²) for the test sample. Neither dimension of the furnace opening shall be less than 5 feet (1524 mm).

(e) **Horizontal large-scale beam furnace.** The furnace exposure panel shall consist of an insulated steel restraining frame having an available opening of not less than 180 square feet (16.7 m²) for the test sample. Neither dimension of the furnace opening shall be less than 5 feet (1524 mm).

(f) **Horizontal small-scale beam furnace.** The furnace exposure panel for the "Alternate Test of Protection for Structural Steel Beams, Girders and Trusses" shall consist of an insulated steel frame having an available opening of not less than 35 square feet (3 m²) for the test sample. Neither dimension of the furnace opening shall be less than 5 feet (1524 mm).

(g) **Column furnace.** The column furnace shall be of such dimensions as to provide an opening for column sections not less than 8 feet (2438 mm) in clear length.

(h) **Protection of equipment and test specimen.** The testing furnaces, equipment and test specimen undergoing the fire test shall be protected from any condition of wind or weather, that might lead to abnormal results. The ambient air temperature of the testing room at the beginning of the test shall be within the range of 50°F to 90°F (10°C to 32°C). Velocity of air across the unexposed face of the test specimen shall not exceed 4.4 feet per second, as determined by an anemometer placed at right angles to the unexposed surface, measured before or during the test. If mechanical ventilation is employed during the test, an airstream shall not be directed across the surface of the specimen.

BURNERS AND FUEL

Sec. 12-7-302.

(a) Burners.

1. In vertical furnaces, burners shall be placed in the back wall of the furnace. The location of the burners and provisions for combustion air shall be such as to provide an even flame exposure to the entire exposed face of the test specimen. Combustion air openings shall be provided in such a manner as to normally prevent induction of combustion air through any opening in the test specimen.
2. In horizontal furnaces, burners shall be placed in the floor or side walls. Burners and the provisions for combustion air shall be so arranged as to provide a uniform exposure to the entire exposed face of the test specimen.
3. In column furnaces, burners shall be placed in the four walls to provide an even luminous flame exposure to all sides of the test sample.

(b) **Fuel.** Furnaces shall be supplied with natural, manufactured or bottled gas.

TIME-TEMPERATURE CURVE

Sec. 12-7-303. The conduct of fire tests of materials, assemblies, methods of construction, equipment and devices shall be controlled to conform to the applicable portion of the standard time-temperature curve shown in Figure 12-7-3-1. The points on the curve that determine its character are:

1000°F (538°C)	at	5 minutes
1300°F (704°C)	at	10 minutes
1500°F (843°C)	at	30 minutes
1700°F (927°C)	at	1 hour

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1792°F (978°C) at	1½ hours
1850°F (1010°C) at	2 hours
1925°F (1052°C) at	3 hours
2000°F (1093°C) at	4 hours

For a closer definition of the time-temperature curve, see Table 12-7-3A.

FURNACE CONTROL

Sec. 12-7-304.

(a) Thermocouples.

1. Furnace thermocouples shall be protected by sealed porcelain tubes having $\frac{3}{4}$ -inch (19 mm) outside diameter and $\frac{1}{8}$ -inch (3 mm) wall thickness, or as an alternate, in the case of base-metal thermocouples, shall be protected by $\frac{1}{2}$ -inch (13 mm) wrought steel or wrought iron pipe of standard weight or equivalent protection of approved type. The exposed length of the pyrometer tube and thermocouple in the furnace chamber shall be not less than 12 inches (305 mm).
2. In the large-scale horizontal floor and vertical wall furnaces, the temperature of the fire test exposure shall be deemed to be the average temperature obtained from the readings of not less than nine thermocouples symmetrically disposed and distributed to show the temperature near all parts of the test specimen. In the vertical half scale and horizontal small-scale furnaces, the number of thermocouples shall be proportioned to those of the large-scale furnaces, but shall in no case be less than four thermocouples.
3. In the column furnace, the temperature of the fire test exposure shall be deemed to be the average temperature obtained from the readings of not less than eight thermocouples symmetrically disposed at two levels to show the temperature near all parts of the test specimen. The two levels shall be located approximately 2 feet (609 mm) from the top and bottom of an 8-foot (2438 mm) clear height furnace.
4. In the vertical wall furnaces, the junction of the thermocouples shall be placed 6 inches (152 mm) from the exposed face of the test specimen at the beginning of the test. The junction of the thermocouples shall, during the fire test and as a result of deflection, be maintained at 6 inches (152 mm) from the exposed face of the test specimen.
5. In horizontal beam, floor and roof furnaces having a furnace chamber not less than 180 square feet (16.7 m²) in area, the junction of the thermocouples shall be 12 inches (305 mm) from the exposed face of the test specimen at the beginning of the test, and shall not touch the test specimen during the test as a result of its deflection.
6. In horizontal beam, floor and roof furnaces having a furnace chamber less than 180 square feet (16.7 m²) in area, the junction of the thermocouples shall be placed 6 inches (152 mm) from the exposed face of the test specimen at the beginning of the test and, during the

test, shall not touch the test specimen as a result of its deflection.

(b) **Temperature recording.** The furnace temperatures shall be read at intervals not exceeding 5 minutes during the first 2 hours, and thereafter the intervals may be increased to not more than 10 minutes.

(c) **Furnace control accuracy.** The accuracy of the furnace control shall be such that the area under the time-temperature curve, obtained by averaging the results from the thermocouple readings, is within 10 percent of the corresponding area under the standard time-temperature curve for fire tests of 1 hour or less duration, within 7.5 percent for those over 1 hour and not more than 2 hours, and within 5 percent for tests exceeding 2 hours in duration. Individual thermocouple readings shall not exceed or fall below the standard time-temperature curve by more than 15 percent.

(d) **Furnace correction.** When the indicated resistance period is $\frac{1}{2}$ hour or over, determined by the average or maximum temperature rise on the unexposed surface or within the test sample, or by failure under load, a correction shall be applied for variation of the furnace exposure from that prescribed, where it will affect the classification, by multiplying the indicated period by two-thirds of the difference in area between the curve of average furnace temperature and the standard curve for the first three-fourths of the period and dividing the product by the area between the standard curve and a base line of 60°F (20°C) for the same part of the indicated period, the latter area increased by 54 Fahr-hour or 30 Cent-hour (3240 Fahr-minutes or 1800 Cent-minutes) to compensate for the thermal lag of the furnace thermocouples during the first part of the test. For fire exposure in the test higher than standard, the indicated resistance period shall be increased by the amount of the correction and be similarly decreased for fire exposure below standard.

Note: The correction can be expressed by the following formula:

$$C = \frac{21(A - AS)}{3(AS + L)}$$

where:

C = correction in the same units as l

l = indicated fire endurance period

A = area under the curve of indicated average furnace temperature for the first three-fourths of the indicated period

AS = area under the standard furnace curve for the same part of the indicated period

L = lag correction in the same units as A and AS (54 Fahr-hour or 30 Cent-hour (3240 Fahr-minutes or 1800 Cent-minutes))

(e) **Furnace pressure.** The pressure in the furnace chamber during the fire test shall be maintained as nearly equal to atmospheric pressure as possible. Horizontal furnaces may be operated at a slight negative pressure sufficient to reduce haze permitting visual observation. Furnace stacks shall be equipped with dampers to facilitate maintenance of furnace pressure.

CORRELATION

Sec. 12-7-305. Tests of specific assemblies of materials shall be conducted for correlation (or correlation factor) of furnace exposure by comparison with tests of identical assemblies and materials conducted in furnaces of “Approved Listing Agencies” which furnaces are deemed as conforming to the design and operating requirements of this standard.

Correlation tests of wall furnaces shall include tests of two assemblies, one combustible and one noncombustible.

Correlation tests of horizontal furnaces dependent on intended test specimens shall include at least one test for each type of assembly such as combustible ceiling-floor assembly, noncombustible assembly having a high thermal capacity

floor for heat dissipation, noncombustible assembly having an insulating concrete floor or other type of design.

Comparison of test results shall provide evidence of equivalent exposure based on transmitted temperatures on the unexposed side, on structural framing members, on the underside of floor or roof decks, and in the plenum space.

**TABLE 12-7-3A
STANDARD TIME-TEMPERATURE CURVE FOR CONTROL OF FIRE TESTS**

TIME	AREA ABOVE 68°F BASE						AREA ABOVE 20°C BASE					
	TEMPERATURE											
hr.: min.	°Fahr.		°Fahr. min.		°Fahr. hr.		°Cent.		°Cent. min.		°Cent. hr.	
0:00		68		00		0		20		00		0
0:05	1	000	2	330		39		538	1	290		22
0:10	1	300	7	740		129		704	4	300		72
0:15	1	399	14	150		236		760	7	860		131
0:20	1	462	20	970		350		795	11	650		194
0:25	1	510	28	050		468		821	15	590		260
0:30	1	550	35	360		589		843	19	650		328
0:35	1	584	42	860		714		862	23	810		397
0:40	1	613	50	510		842		878	28	060		468
0:45	1	638	58	300		971		892	32	390		540
0:50	1	661	66	200	1	103		905	36	780		613
0:55	1	681	74	220	1	237		916	41	230		687
1:00	1	700	82	330	1	372		927	45	740		762
1:05	1	718	90	540	1	509		937	50	300		838
1:10	1	735	98	830	1	647		946	54	910		915
1:15	1	750	107	200	1	787		955	59	560		993
1:20	1	765	115	650	1	928		963	64	250		071
1:25	1	779	124	180	2	070		971	68	990	1	150
1:30	1	792	132	760	2	213		978	73	760	1	229
1:35	1	804	141	420	2	357		985	78	560	1	309
1:40	1	815	150	120	2	502		991	83	400	1	390
1:45	1	826	158	890	2	648		996	88	280	1	471
1:50	1	835	167	700	2	795	1	001	93	170	1	553
1:55	1	843	176	550	2	942	1	006	98	080	1	635
2:00	1	850	185	440	2	091	1	010	103	020	1	717

(continued)

FIRE-RESISTIVE STANDARDS

**TABLE 12-7-3A—continued
STANDARD TIME-TEMPERATURE CURVE FOR CONTROL OF FIRE TESTS**

TIME	AREA ABOVE 68°F BASE						AREA ABOVE 20°C BASE					
	TEMPERATURE											
hr.: min.	°Fahr.		°Fahr. min.		°Fahr. hr.		°Cent.		°Cent. min.		°Cent. hr.	
2:10	1	862	203	330	3	389	1	017	112	960	1	882
2:20	1	875	221	330	3	689	1	024	122	960	2	049
2:30	1	888	239	400	3	991	1	031	133	040	2	217
2:40	1	900	257	720	4	295	1	038	143	180	2	386
2:50	1	912	276	110	4	602	1	045	153	390	2	556
3:00	1	925	294	610	4	910	1	052	163	670	2	728
3:10	1	938	313	250	5	221	1	059	174	030	2	900
3:20	1	950	332	000	5	533	1	066	184	450	3	074
3:30	1	962	350	890	5	848	1	072	194	940	3	249
3:40	1	975	369	890	6	165	1	079	205	500	3	425
3:50	1	988	389	030	6	484	1	086	216	130	3	602
4:00	2	000	408	280	6	805	1	093	226	820	3	780
4:10	2	012	427	670	7	128	1	100	237	590	3	960
4:20	2	025	447	180	7	453	1	107	248	430	4	140
4:30	2	038	466	810	7	780	1	114	259	340	4	322
4:40	2	050	486	560	8	110	1	121	270	310	4	505
4:50	2	062	506	450	8	441	1	128	281	360	4	689
5:00	2	075	526	450	8	774	1	135	292	470	4	874
5:10	2	088	546	580	9	110	1	142	303	660	5	061
5:20	2	100	566	840	9	447	1	149	315	910	5	248
5:30	2	112	587	220	9	787	1	156	326	240	5	437
5:40	2	125	607	730	10	129	1	163	337	630	5	627
5:50	2	138	628	360	10	473	1	170	349	930	5	818
6:00	2	150	649	120	10	819	1	177	360	620	6	010
6:10	2	162	670	000	11	167	1	184	372	230	6	204
6:20	2	175	691	010	11	517	1	191	383	900	6	398
6:30	2	188	712	140	11	869	1	198	395	640	6	594
6:40	2	200	733	400	12	223	1	204	407	450	6	791
6:50	2	212	754	780	12	580	1	211	419	330	6	989
7:00	2	225	776	290	12	938	1	218	431	270	7	188
7:10	2	238	797	920	13	299	1	225	443	290	7	388
7:20	2	250	819	680	13	661	1	232	455	380	7	590
7:30	2	262	841	560	14	026	1	239	467	540	7	792
7:40	2	275	863	570	14	393	1	246	479	760	7	996
7:50	2	288	885	700	14	762	1	253	492	060	8	201
8:00	2	300	907	960	15	133	1	260	504	420	8	407

For SI: °C = [(°F) - 32]/1.8.

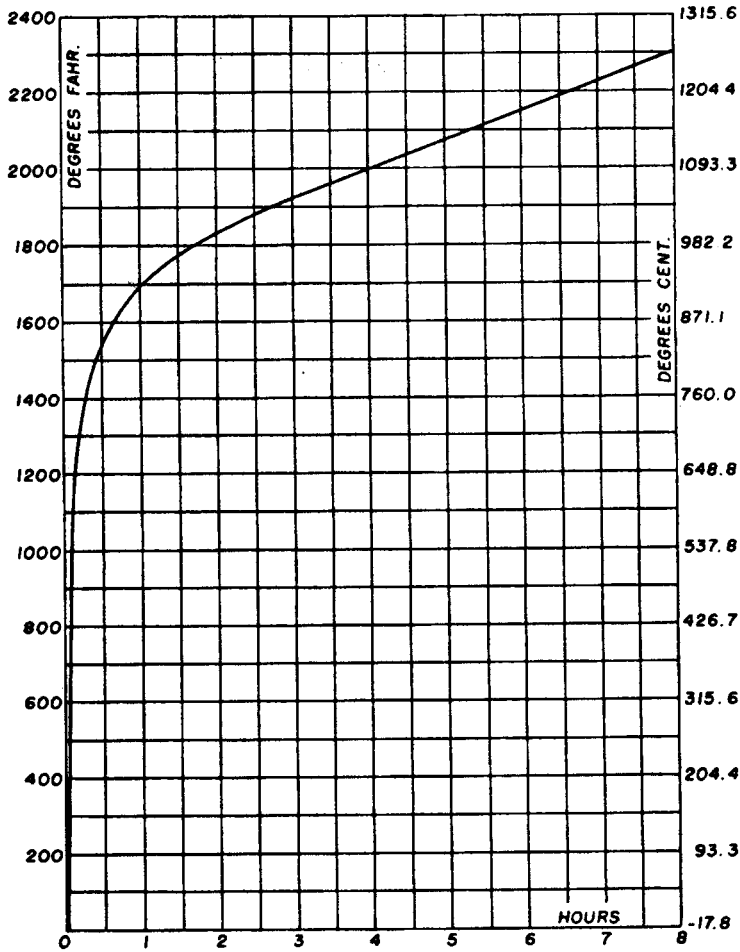


FIGURE 12-7-3-1—TIME-TEMPERATURE CURVE

CHAPTER 12-7-4

FIRE-RESISTIVE STANDARDS

FIRE DOOR ASSEMBLY TESTS STANDARD 12-7-4

STATE FIRE MARSHAL SCOPE

Sec. 12-7-400.

(a) **Application.** These methods of fire tests are applicable to door assemblies of various materials and types of construction for use in wall openings to retard the passage of fire (flame, heat and smoke).

(b) **Performance.** Tests made in conformity with these test methods will register performance during the test exposure, but such tests shall not be construed as determining suitability for use after exposure to fire.

(c) **Suitability of assemblies.** It is the intent that tests made in conformity with these test methods will develop data to enable enforcing agencies to determine the suitability of door assemblies for use in locations where fire resistance of a specified duration is required.

FIRE TESTING FURNACES AND CONTROL

Sec. 12-7-401.

(a) **Furnaces.** Fire testing furnaces and their control shall conform to SFM 12-7-3, Fire Testing Furnaces, Section 12-7-301 (a), Vertical Large-scale Wall Furnaces.

(b) **Half scale.** If the proposed conditions of use limit the construction to smaller dimensions, and for the evaluation of hardware intended for use on doors not exceeding 4 feet (1219 mm) in width by 7 feet 2 inches (2184 mm) in height, fire testing furnaces conforming to Section 12-7-301 (b), Vertical Half-scale Wall Furnace, may be utilized. Constructions and hardware for ceiling access doors intended for use in fire-endurance rated ceiling-floor assemblies shall be tested in furnaces conforming to SFM 12-7-3, Section 12-7-301 (b), (d) or (f).

UNEXPOSED SURFACE TEMPERATURES

Sec. 12-7-402.

(a) **Temperatures recorded.** The unexposed surface temperatures of all fire door assemblies shall be recorded. The unexposed surface temperature shall be determined in the manner specified in Sections 12-7-402 (b), (c) and (d).

(b) **Surface temperature locations.** Unexposed surface temperatures shall be taken at not less than three points, with at least one thermocouple in each 16 square foot (1.5 m²) area of the door(s). Thermocouples shall not be located over reinforcements extending through the door, over glass panels or nearer than 12 inches (305 mm) from the edge of the door.

(c) **Thermocouples.** Unexposed surface temperatures shall be measured with thermocouples placed under flexible, oven-dry, felted asbestos pads of the following approximate dimensions and weight: 6 inches square (3871 mm²), 0.40 inch (10 mm) in thickness, and weighing 0.026 pound. The pads shall be held firmly against the surface of the door(s) and shall fit closely about the thermocouples without breaking. The thermocouple leads shall be immersed under the pad for distance of not less than 3¹/₂ inches (88.9 mm), with the hot junction under the center of the pad. The thermocouple leads under the pads shall be not heavier than No. 18 B.&S. gage [0.04 inch (1 mm)] and shall be electrically insulated with heat-resistant and moisture-resistant coatings.

(d) **Recording interval.** Unexposed surface temperatures shall be read at the same intervals as used for the furnace temperatures, Section 12-7-304 (b).

TEST ASSEMBLIES

Sec. 12-7-403.

(a) Construction and size.

1. The construction and size of the test fire door assembly, consisting of single doors, doors in pairs, special purpose doors (such as Dutch doors, double egress doors, etc.) or multisection doors shall be representative of that for which classification or rating is desired. The materials and construction of the door and frame, and the details of the installation, hardware, hangers, guides, trim, finish and clearance or lap shall be recorded to ensure positive identification or duplication in all respects.
2. A floor structure shall be provided as part of the opening to be protected, except where such floor interferes with the operation of the door. The floor segment shall be of noncombustible material and shall project into the furnace approximately twice the thickness of the test door.

(b) Mounting of doors for test purposes.

1. Swinging doors shall be mounted so as to open into the furnace chamber, except doors in pairs swinging in opposite directions shall be mounted so as to have one door leaf open into and one door leaf open away from the furnace chamber.
2. Sliding and rolling doors, except passenger elevator shaft doors, shall be mounted on the exposed side of the opening in the wall closing the furnace chamber.

3. Passenger elevator shaft doors shall be mounted on the unexposed side of the opening in the wall closing the furnace chamber.
4. Access-type door and chute-type door and frame assemblies shall be mounted so as to have one assembly open into the furnace chamber and another assembly open away from the furnace chamber. Ceiling access doors and frame assemblies shall be mounted in a representative ceiling with the room side of the access door opening into the furnace chamber.
5. Dumbwaiter and service counter door and frame assemblies shall be mounted on the exposed side of the opening in the wall.
6. Door frames shall be evaluated when mounted so as to have the doors open either away from or into the furnace chamber at the discretion of the enforcing agency to obtain representative information on the performance of the construction under test.
7. Surface-mounted hardware (fire exit devices) for use on fire doors shall be evaluated by being installed on one door assembly swinging into the furnace chamber and another door assembly swinging away from the furnace chamber.
8. The mounting of all doors shall be such that they fit snugly within the frame, against the wall surfaces, or in guides, but such mounting shall not prevent free and easy operation of the test door.
9. Clearances for swinging doors shall be [with a minus $\frac{1}{16}$ -inch (1.6 mm) tolerance] as follows: $\frac{1}{8}$ inch (3.2 mm) along the meeting edge of doors in pairs, $\frac{3}{8}$ inch (9.5 mm) at the bottom edge of single swing doors and $\frac{1}{4}$ inch (6.35 mm) at the bottom edge of a pair of doors.
10. Clearances for horizontal sliding doors not mounted within guides [with a minus $\frac{1}{8}$ -inch (3.2 mm) tolerance] shall be as follows: $\frac{1}{2}$ inch (13 mm) between door and wall surfaces, $\frac{3}{8}$ inch (9.5 mm) between door and floor structure and $\frac{1}{4}$ inch (6.35 mm) between the meeting edges of center parting doors. A minimum lap of 4 inches (102 mm) of the door over the wall opening at sides and top shall be provided.
11. Clearances for vertical sliding doors moving within guides [with a minus $\frac{1}{8}$ -inch (3.2 mm) tolerance] shall be as follows: $\frac{1}{2}$ inch (13 mm) between door and wall surfaces along the top and/or bottom door edges with guides mounted directly to the wall surface, and $\frac{3}{16}$ inch (4.8 mm) between meeting edges of biparting doors or $\frac{3}{16}$ inch (4.8 mm) between door and floor structure or sill.
12. Clearances for passenger elevator sliding doors [with a minus $\frac{1}{8}$ -inch (3.2 mm) tolerance] shall be as follows: $\frac{3}{8}$ inch (9.5 mm) between door and wall surfaces and $\frac{3}{8}$ inch (9.5 mm) between multi-section door panels. Multisection door panels shall overlap $\frac{3}{4}$ inch (19 mm). Door panels shall lap the wall opening $\frac{3}{4}$ inch (19 mm) at the sides and top.

CONDUCT OF TESTS

Sec. 12-7-404.

(a) **Time of testing.** Masonry settings shall be allowed to dry at least 3 days before tests are made.

(b) **Fire endurance test.**

1. The pressure in the furnace chamber shall be maintained as nearly equal to the atmospheric pressure as possible.
2. The test shall be continued until the exposure period of the desired classification or rating is reached, unless the conditions of acceptance set forth in the appropriate paragraphs are exceeded in a shorter period.

(c) **Hose stream test.**

1. Immediately following the fire endurance test, the test assembly shall be subjected to the impact, erosion and cooling effects of a hose stream directed first at the middle and then at all parts of the exposed surface, changes in direction being made slowly.
2. The hose stream shall be delivered through a 2 $\frac{1}{2}$ -inch (63.5 mm) hose discharging through a national standard play-pipe of corresponding size equipped with a 1 $\frac{1}{8}$ -inch (22 mm) discharge tip of the standard-taper smooth-bore pattern without shoulder at the orifice. The water pressure at the base of the nozzle and duration of the application in seconds per square feet of exposed area shall be as given in Table 12-7-4A.
3. The tip of the nozzle shall be located 20 feet (6096 mm) from and on a line normal to the center of the test door. If impossible to be so located, the nozzle may be on a line deviating not more than 30 degrees from the line normal to the center of the test door. When so located the distance from the center shall be less than 20 feet (6096 mm) by an amount equal to 1 foot (305 mm) for each 10 degrees of deviation from the normal.

**TABLE 12-7-4A
HOSE STREAM TEST**

DESIRED RATING	WATER PRESSURE AT BASE OF NOZZLE, POUNDS PER SQUARE INCH	DURATION OF APPLICATION, SECONDS PER SQUARE FOOT EXPOSED AREA
3 hours	45	3
1 $\frac{1}{2}$ hours and over if less than 3 hours	30	1.5
1 hour and over if less than 1 $\frac{1}{2}$ hours	30	0.9
Less than 1 hour	30	0.6

REPORT

Sec. 12-7-405.

1. The report shall record the construction and mounting details of the door(s) as provided in Section 12-7-403. Drawings and photographs of construction and mounting details shall be provided.
2. The results shall be reported in accordance with the performance in tests prescribed in these test methods. The report shall show the performance under the desired exposure period chosen from the following: 20 minutes, 30 minutes, 45 minutes, 1 hour, 1½ hours or 3 hours. The report shall include the temperature measurements of the furnace, and if determined, of the unexposed side of the test assembly. It shall also contain a record of all observations having a bearing on the performance of the test assembly.

CONDITIONS OF ACCEPTANCE

Sec. 12-7-406.

(a) General.

1. A door assembly shall be considered as meeting the requirements for acceptable performance when it remains in the opening during the tests specified in this standard within the limitations contained in this section for the desired endurance rating.
2. The test assembly shall have withstood the fire endurance test and hose stream test without developing openings anywhere through the assembly, except that dislodging of small fragments from the central area of the glass light shall be disregarded. The edges of the individual glass light shall remain in place.

Exception: The hose stream test shall not be required for opposite swing double egress exit doors, and for doors of fire endurance rating of less than 45 minutes with or without approved wired glass lights.
3. Flaming on the unexposed surface of a door assembly shall not be permitted during the first 30 minutes of the classification periods. Some intermittent light flames [tongues of flame not exceeding approximately 6 inches (152 mm) in length] for periods not exceeding 5-minute intervals are permissible along the edges of door after 30 minutes. During the last 15 minutes of the classification period the unexposed surface area of the door covered by light flaming or charring shall be contained within a distance of 1½ inches (38 mm) from a vertical door edge and within 3 inches (76 mm) from the top edge of the door.

Exception: On doors not subjected to the hose stream test, finished with surface veneers or crossbands and veneers, surface flaming on the unexposed surface shall not burn or char crossbands or surface veneer along the hinge or latch jamb and shall not burn or char crossbands or surface veneer down more than ¼ inch (13 mm)

from the top edge, except that light browning without any flaming may occur at throughbolts and the latch rose.

(b) **Hardware.** When hardware is to be evaluated for use on fire doors, it shall hold the door closed under the conditions of acceptance for an exposure period of 3 hours, and the latch bolts shall remain projected and shall be intact after the test. Builders fire door hardware shall not be equipped with any dogging device, set screw or other arrangement which can be used to prevent projection and latching of the latch bolt, locking device or locking bolt upon closing of the door(s). The hardware need not be operable after the test. All parts essential to the latching or unlatching of fire exit hardware devices shall be constructed of materials having a solidus temperature of not less than 1000°F (358°C).

(c) Swing doors.

1. The movement of swing doors shall not permit any portion of the edges to move from the original position in a direction perpendicular to the plane of the door more than the thickness of the door during the first half of the classification period, nor more than 2⁷/₈ inches (73 mm) during the entire classification period and as a result of the hose stream.
2. The movement of swing doors mounted in pairs shall not permit any portion of the meeting edges to move more than the thickness of the door away from the adjacent door edge in a direction perpendicular to the plane of the doors during the entire classification period and as a result of the hose stream.
3. An assembly consisting of a pair of swinging doors, incorporating an astragal shall not separate in a direction parallel to the plane of the doors more than ¾ inch (19 mm) not equal to the throw of the latch bolt along the meeting edges.
4. An assembly consisting of a pair of swinging doors, without an overlapping astragal, for a fire and hose stream exposure of 1½ hours or less, shall not separate along the meeting edges more than 3³/₈ inch (9.5 mm), including the initial clearance between doors.
5. An assembly consisting of a single swinging door shall not separate more than ½ inch (13 mm) at the latch location.
6. Door frames to be evaluated with doors shall remain securely fastened to the wall on all sides and shall not cause through openings between frame and doors or between frame and adjacent wall.

(d) Sliding doors.

1. Doors mounted on the face of the wall shall not move from the wall sufficiently to develop a separation of more than 2¹/₈ inches (54 mm) at the point of separation during the entire classification period and as a result of the hose stream.
2. Doors mounted in guides shall not release from guides and guides shall not loosen from fastenings.
3. The bottom bar of rolling steel doors shall not separate from the floor structure more than ¾ inch

FIRE-RESISTIVE STANDARDS

- (19 mm) during the entire classification period and as a result of the hose stream.
4. The meeting edge of centerparting horizontal sliding doors and biparting vertical sliding doors shall not separate more than the door thickness in a direction perpendicular to the plane of the doors.
 5. The meeting edges of centerparting horizontal sliding doors and biparting vertical sliding doors without an overlapping astragal for a fire and hose stream exposure of $1\frac{1}{2}$ hours or less shall not separate along the meeting edges more than $\frac{3}{8}$ inch (9.5 mm), including the initial clearance between doors.
 6. The meeting edges of centerparting horizontal sliding doors incorporating an astragal shall not separate in a direction parallel to the plane of the doors more than $\frac{3}{4}$ inch (19 mm) nor equal to the throw of the latch bolt along the meeting edges.
 7. The bottom edge of service counter doors or single slide dumbwaiter doors shall not separate from the sill more than $\frac{3}{8}$ inch (9.5 mm).
 8. A resilient astragal when required for life-safety purposes shall not deteriorate sufficiently to cause through openings during the fire endurance part of the test, but small portions may be dislodged during the hose stream part of the test.
 9. The lap edges of passenger elevator doors, including the lap edges of multisection doors, shall not move from the wall or adjacent panel surfaces sufficiently to develop a separation of more than $2\frac{7}{8}$ inches (73 mm) at the point of separation during the entire classification period and as a result of the hose stream.
 10. The meeting edges of centerparting passenger elevator door assemblies, for a fire and hose stream exposure of $1\frac{1}{2}$ hours or less, shall not move apart more than $1\frac{1}{4}$ inches (32 mm) as measured in any horizontal plane during the entire classification period and as a result of the hose stream.
6. Temperature rise on the unexposed fact at the end of 30 minutes. Temperature rise classification shall be 250°F (121°C) max., 450°F (232°C) max., 650°F (343°C) max. or no reference on the label to temperature rise denoting a temperature rise on the unexposed surface in excess of 650°F (343°C) at the end of 30 minutes.
- (c) **Glass lights.** All doors with glass vision panels of 100 square inches (64 516 mm²) or less in area carry the same temperature rating as the door without glass lights. All doors with glass lights in excess of 100 square inches (64 516 mm²) are rated as having a surface temperature in excess of 650°F (343°C) max., at the end of 30 minutes.

MARKING

Sec. 12-7-407.

(a) **Label.** Fire assemblies shall bear a label issued by an approved listing agency or a label approved by the State Fire Marshal showing the fire-protection rating of the assembly.

(b) **Label markings.** The markings on the labels approved by the State Fire Marshal shall include the following:

1. Name and address of the listee.
2. Model number or identification of the assembly.
3. Serial number assigned by the listing agency or file number assigned by the State Fire Marshal.
4. Rating of 3, $1\frac{1}{3}$, 1, $\frac{3}{4}$, $\frac{1}{2}$ or $\frac{1}{3}$ hour indicating duration of exposure to fire.
5. Letter A, B, C, D or E following the hourly rating designating the location for which the assembly is designed.

CHAPTER 12-7-5

FIRE-RESISTIVE STANDARDS

Interior Finish of Decorative Material STANDARD 12-7-5

STATE FIRE MARSHAL SCOPE

Sec. 12-7-500. These requirements and methods of test apply to unframed and framed rigid construction.

TEST SETUP AND PERFORMANCE

Section 12-7-501

(a) **Unframed Rigid Combustible Decorative Material.** Rigid combustible decorative material and assemblies of materials not more than $\frac{1}{4}$ inch (6 mm) in thickness used for folding doors, room dividers, decorative screens and similar applications, which do not create concealed spaces and which are installed with exposed edges, shall be flame resistant in accordance with the following:

1. Test specimen shall be 12 inches (305 mm) wide and 24 inches (609 mm) long. Four specimens shall be tested, two in each direction of the material.
2. The specimen shall be suspended vertically with its lower edge 2 inches (51 mm) above the top of a $\frac{3}{8}$ inch (9.5 mm) diameter Bunsen Burner. The test shall be performed in a draft-free area.
3. The flames from the burner shall be 4 inches (101 mm) long and shall be adjusted with sufficient air supply to eliminate any yellow flame tips but without any distinct inner blue cone.
4. The specimen shall be exposed to the flame at each corner and at not less than one other point along the lower edge. Each exposure shall be of sufficient duration to determine if the material will ignite and continue to burn, but shall be not less than 20 seconds.
5. The criteria for acceptance shall be as follows:
 - (A) There shall be not more than intermittent flaming appreciably beyond the area exposed to the test flame.
 - (B) Flame shall not reach the top of the specimen.
 - (C) On removing the test flame there shall be not more than 1 second of after flaming except there may be nonprogressive flaming of short duration in areas of accumulated char which were directly exposed to the test flame.

Section 12-7-502

(a) **Framed Rigid Combustible Decorative Material.** Rigid combustible decorative material and assemblies of materials not more than $\frac{1}{4}$ inch (6 mm) in thickness used for folding doors, room dividers, decorative screens and similar applications, and which are installed with all edges protected, shall conform to the following:

1. All exposed edges shall be protected with frames of metal or other noncombustible material, or solid wood of minimum $\frac{1}{4}$ -inch (6 mm) dimension.
2. The total square foot area of the material shall not exceed ten percent of that of the floor area of the room in which the material is installed.
3. When tested as follows, flames shall not reach the top edge of the specimen.

The test shall be conducted in a draft free area, on a specimen of the material 12 inches by 12 inches (305 mm by 305 mm) suspended at a 45-degree angle from the horizontal with the upper and lower edges in a horizontal plane. The test flame shall be 3 inches (76 mm) long from a Bunsen burner of approximately $\frac{1}{2}$ -inch (13 mm) inside diameter with the air supply completely shut off. The burner shall be positioned so that its top is 1 inch (25 mm) vertically below a point on the lower surface of the test specimen, 1 inch (25 mm) up from its lower horizontal edge and midway between the inclined edges. The exposure to the test flame and the duration of test shall be for a period of 2 minutes.

CHAPTER 12-7A

MATERIALS AND CONSTRUCTION METHODS FOR EXTERIOR WILDFIRE EXPOSURE

EXTERIOR WALL SIDING AND SHEATHING SFM STANDARD 12-7A-1

12-7A-1.1 Application. The minimum design, construction and performance standards set forth herein for exterior wall siding and sheathing are those deemed necessary to establish conformance to the provisions of these regulations. Materials and assemblies that meet the performance criteria of this standard are acceptable for use as defined in *California Building Standards Code*.

12-7A-1.2 Scope. This standard evaluates the performance of exterior walls of structures when exposed to direct flames.

12-7A-1.3 Referenced documents.

1. ASTM E2257, Test Method for Room Fire Test of Wall and Ceiling Materials and Assemblies.
2. ASTM D4442, Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
3. ASTM D4444, Test Methods for Use and Calibration of Hand-Held Moisture Meters.
4. *California Building Code*, Chapter 7A.

12-7A-1.4 Definitions.

1. **Siding (cladding).** Any material that constitutes the exposed exterior covering of an exterior wall and is applied over sheathing or is directly attached to the wall structural system.
2. **Sheathing.** The material placed on an exterior wall beneath cladding or siding and is directly attached to the wall structural system.

12-7A-1.5 Summary of test method.

1. **Direct flame exposure.** This test method provides for the direct flame exposure of a wall specimen to a flame source centered at the base of a 4-foot by 8-foot (1220 mm by 2440 mm) test assembly.
2. **Gas burner.** The method employs a gas burner to produce a diffusion flame in contact with the test wall assembly.
3. **Heat output.** The gas burner produces a prescribed net rate of heat output of 8535 Btu/min (150 kW) for a period of 10 minutes, after which the flame exposure is terminated.
4. **Resistance to fire penetration.** The test method measures the ability of the wall system to resist fire penetration from the exterior to the unexposed side of the test assembly under the conditions of exposure. Observations are made for the appearance of sustained flaming or glow on the unexposed side and/or sustained glow-

ing on the unexposed side at the end of a 60-minute observation period.

12-7A-1.6 Equipment. Unless otherwise noted, dimensions in the following descriptions shall be followed with a tolerance of ± 0.5 inch (13 mm).

1. **Wall assembly holding fixture.** The test specimen support assembly shown in Figure 1 is designed to permit rapid installation and removal of wall assemblies, and to prevent edge penetration of fire at the margins of the wall assembly. It includes a sturdy frame assembly to hold the specimen and a simulated soffit that is non-combustible. The frame assembly permits a 4-foot by 8-foot (1220 mm by 2440 mm) prefabricated wall section to be inserted and to be sealed in such a way that protects the edges from fire. Side shields are situated near the vertical edges and to within 12 inches (304 mm) of the top of the test wall assembly as shown in Figure 1 to aid in minimizing extraneous drafts to the surface of the assembly.

2. Burner.

- 2.1. **Burner details.** The ignition source for the test shall be a gas diffusion burner with a nominal 4-inch-wide by 39-inch-long (100 mm wide by 1000 mm long) porous top surface of a refractory material, as shown in Figure 2. With the exception of top surface dimensions, the essential configuration of the burner is comparable to the burner design described in ASTM E2257. The burner enclosure shall be positioned so that it is centered relative to the width of the test wall. The distance from the bottom of the test specimen to the top surface of the burner shall be 12 inches \pm 2 inches (300 mm \pm 50 mm). The bottom of the test specimen shall be protected from burner fire exposure by the placement of a 4-foot-wide (1220-mm) thermal barrier consisting of nominal 0.75 inch (19 mm) cement board (or equivalent) between the burner enclosure and the test specimen. The burner enclosure shall be in contact with the protective barrier. The thermal barrier shall be positioned so that the top edge extends 3 inch \pm 1 inch (76 mm \pm 25 mm) above the top edge of the burner, and fastened to the base of the wall in such a manner to prevent obstruction of the burner flame caused by distortion away from the surface of the wall. Any gaps between the top edge of the thermal barrier and the test wall surface shall be filled with ceramic wool, or equivalent, prior to the test.

Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of 8535 ± 454 Btu/min (150 ± 8 kW) throughout the flame exposure.

The burner shall be ignited by a pilot burner or a remotely controlled spark igniter.

2.2. Burner output verification. The gas supply to the burner shall be the same as used for testing.

1. Without a test specimen in the apparatus, place the gas burner in the configuration to be

used for testing and obtain a heat release rate value of 150 kW.

2. Take measurements at least once every 6 seconds and start 1 minute prior to ignition of the burner. Determine the average heat output over a period of at least 1 minute by the oxygen consumption method, or calculate the heat output from the gas mass flow and the net heat of combustion.
3. Perform verification prior to each day of testing.

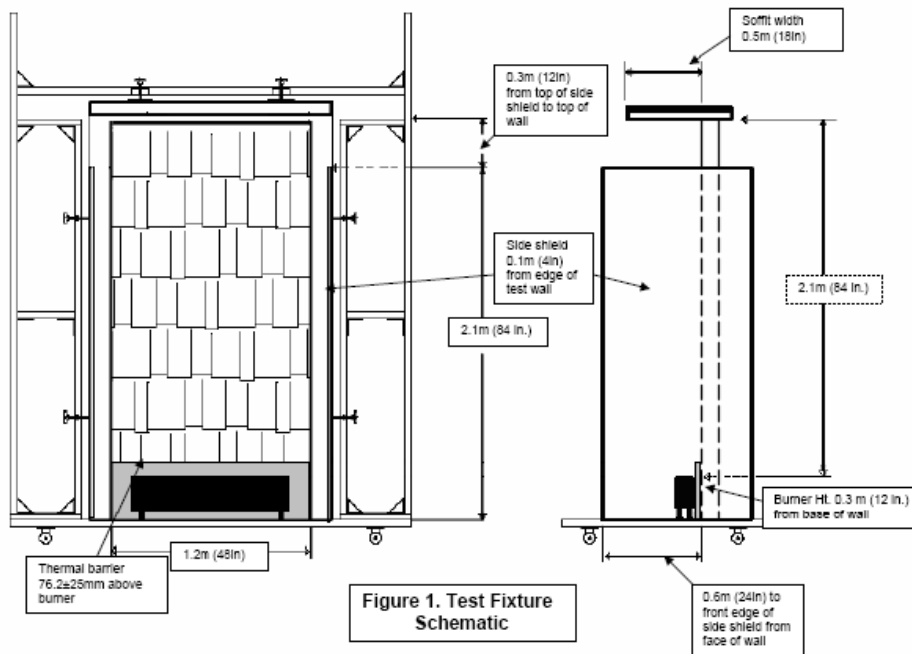


FIGURE 1. TEST FIGURE SCHEMATIC

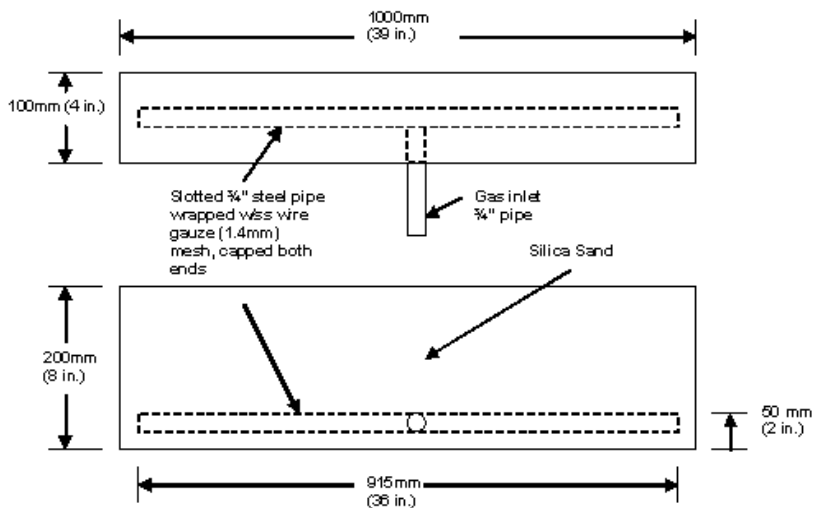


FIGURE 2. GAS BURNER IGNITION SOURCE

12-7A-1.7 Test assembly.

1. **Dimensions.** The test specimen's dimensions shall be 4 feet wide by 8 feet high (1220 mm by 2440 mm). The test specimen shall be representative of the end-use wall assembly except as specified in Items 3 and 4. The test specimen shall be mounted in the steel frame holding fixture assembly as shown in Figure 1.
2. **Joint details.** The test specimen shall incorporate joint detail(s) representative of actual installation.
3. **Wall assemblies without internal cavity spaces.** For wall assemblies without internal cavity spaces, the entire wall assembly shall constitute the test specimen to be tested. The wall assembly shall be constructed in accordance with manufacturer's specifications and/or building code requirements, where applicable. Other components of the wall assembly, such as building felt and sheathing, are employed to conform to the manufacturer's specifications and/or building codes.
4. **Wall assemblies with internal cavity spaces.** For wall assemblies with internal cavity spaces, the materials on what would be considered the interior (unexposed) side of the wall assembly shall be omitted from the test specimen. Materials such as insulation normally installed within the cavity space shall be omitted from the test specimen. The wall assembly used as the test specimen shall include the structural support elements and any sheathing, weather barrier and cladding attached to the exterior surface of the structural support elements.
5. **Layered materials.** For wall assemblies composed of layered materials, such as sheathing, siding (cladding) and underlayment, the installation of such layered materials shall be in accordance with the manufacturer's instructions, or in the absence of such instructions, applicable building code requirements. In the absence of manufacturer's specifications, the wall assembly shall include the following minimum components: nominal 2 x 4 studs spaced 16 inches (410 mm) on center, and the desired exterior siding material. If sheathing is used, tests shall be run on typical $\frac{7}{16}$ -inch (11 mm) oriented strandboard (OSB) of Exposure 1 rating. Where specified by the manufacturer, sheathing material and installation shall be in accordance with the manufacturer's instructions. The sheathing shall have one vertical seam on a selected stud with a 0.125 inch (3 mm) gap.
6. **Edge protection.** Protect the vertical and horizontal edges of the test specimen with 12-mm-thick ceramic wool blanket (or equivalent) to eliminate the gap between the holder and the test specimen and prevent unwanted edge effects caused by heat transfer to the edges of the test specimen through the sample holder.
7. **Replicates.** Three matched test specimen assemblies shall be tested.
8. **Pre-test conditioning of test specimens.** The completed test specimens are to be stored indoors at temperatures not lower than 60°F (16°C) nor higher than

90°F (32°C) for the period of time necessary to cure or condition the assembly components. Test specimens are to be stored so that each will be surrounded by freely circulating air. Pieces of any hygroscopic materials from the same stock from which the test specimen was constructed shall be tacked to the specimen during construction in such a manner that they are easily removed. These pieces shall be conditioned with the completed specimens. Prior to testing, the pieces of hygroscopic materials shall be tested for moisture content.

- 8.1. Make the moisture determination on two samples from each piece and report the average. For lumber and other wood-based materials, use Test Methods D 4442. Use of an appropriately calibrated moisture meter, as described in Test Methods D 4444, to determine the moisture content of wood or wood products is also permitted. For other hygroscopic materials, use test methods appropriate for those materials.
- 8.2. For lumber used in the construction of the supporting wall structure, the moisture content shall not be more than 12 percent. For wood sheathing, the moisture content shall not exceed 8 percent. For other hygroscopic materials, the moisture shall be within ranges specified by the manufacturer before the assembly is constructed. These specified ranges shall be typical for exposure at $77 \pm 9^\circ\text{F}$ [$25 \pm 5^\circ\text{C}$] and $55 \pm 10\%$ relative humidity.

12-7A-1.8 Weathering. Weathering of materials shall be in accordance with California Building Code Section 703A Standards of Quality.

12-7A-1.9 Conduct of tests.

1. **Test room environment.** The ambient temperature in the test room shall be above 60°F (15°C) and the relative humidity shall be less than 75 percent. The test room shall be draft-protected and equipped with an exhaust hood system for removal of products of combustion during testing.
2. **Airflow.** The horizontal airflow, measured at a horizontal distance of 20 inches (0.5 m) from the edge of the wall assembly, shall not exceed 1.64 ft/s (0.5 m/s).
3. **Placement of test frame.** Prior to testing, and without the test specimen in place, position the frame assembly under the exhaust hood and set the gas burner for the prescribed level of output.
4. **Placement of specimen.** Once the burner output is verified, position the specimen holder assembly at the desired test location under the collection hood.
5. **Test specimen.** Insert the test specimen into the frame assembly, sealing all edges with ceramic wool.
6. **Ignition.** Simultaneously ignite the gas burner and start the timer marking the beginning of the test. Control the burner to a constant 150 ± 8 kW output. Control the hood duct flow to collect all products of combustion.

7. **Flame exposure.** Continue the flame exposure until flame penetration of the test specimen and sustained flaming on the unexposed side occurs or for a period of 10 minutes, then extinguish the burner.
8. **Observation.** If sustained flaming on the unexposed side of the test specimen has not occurred, observe the unexposed side of the test specimen for an additional 60 minutes for evidence of sustained flaming or glowing combustion on the unexposed side. Terminate the observation prior to the completion of the 60-minute observation period if all evidence of flame, glow and smoke has disappeared.

Note: An infrared thermometer has been found to be useful to detect the increase of temperature on the unexposed side of the test assembly.

9. **Documentation.** Perform photographic and/or video documentation before, during and after each test.

12-7A-1.10 Report. The report shall include the following:

1. Name and address of the testing laboratory.
2. Name and address of test sponsor.
3. Description of the test specimen including construction details of the wall system, including details of individual components (such as type, thickness and installation method of any sheathing) and the manufacturer's installation details and limitations as applicable.
4. Number of specimens tested.
5. Description of weathering, as applicable.
6. Moisture content of hygroscopic elements of wall system construction at the time of testing.
7. Details of the burner verification, including heat supply rate.
8. Date of test, test identification number and date of report.
9. The test results shall include:
 - 9.1. A notation of the time and location of sustained flaming on the unexposed side of the test specimen during the test, along with the sequence number of the test specimen.
 - 9.2. A determination of the presence of glow on the unexposed side of the test specimen at the end of the 60-minute observation period.
 - 9.3. Observations of the burning characteristics of the exposed surface of the test wall during and after the flame exposure.

12-7A-1.11 Conditions of Acceptance. Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.

1. Absence of flame penetration through the wall assembly at any time.
2. Absence of evidence of glowing combustion on the interior surface of the assembly at the end of the 70-minute test.

EXTERIOR WINDOWS

SFM STANDARD 12-7A-2

12-7A-2.1 Application. Exterior window assemblies that meet the performance criteria of this standard are acceptable for use as defined in the *California Building Standards Code*.

12-7A-2.2 Scope. This standard evaluates the performance of exterior windows used in structures when exposed to direct flames.

12-7A-2.3 Referenced documents.

1. AAMA (for definitions) Training Manual, Residential & Light Commercial Window and Door Installation Training and Registration Program.
2. CAWM 400-95, Standard Practice for Installation of Windows with Integral Mounting Flange in Wood Frame Construction.

12-7A-2.4 Definitions.

1. **Frame (Jambs).** This usually consists of two vertical members (side jambs) and two horizontal members (head and sill) that hold the sash. Frames and sash are typically made of steel, aluminum, vinyl, fiberglass, wood or a combination of these materials.
2. **Glazing.** The glass in a window. It may include layers of plastic as well as glass.
3. **Sash.** The fixed or movable parts of the window in which the panes of glass are set.

12-7A-2.5 Test apparatus.

1. **Wall assembly test module.** The module is designed to permit rapid installation and removal of window/wall assemblies, and is designed to prevent edge penetration of fire at the margins. It includes two noncombustible side walls attached to a wall frame assembly, and a simulated soffit that is also noncombustible. The assembly permits a prefabricated 4 × 8 ft (1.2 × 2.4 m) wall section containing the test window to be inserted from the rear and sealed in such a way that the edges are protected from fire (see Figure 1).
2. **Burner.** A 4 × 39 inch (100 × 1000 mm) diffusion burner shall be used. Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of 150 ± 4 kW throughout the flame exposure. Burner output can be determined from HRR or calculated from the gas flow rate, temperature and pressure.
3. **Burner location.** The burner shall be positioned so that it is centered relative to the width of the wall assembly and against the wall. The distance from the floor to the top of the burner shall be 12 inches (300 mm).

12-7A-2.6 Test assembly.

1. **Window.** The window width cannot exceed 3 feet (900 mm) due to the limitations of the test fixture. The burner's flame shall cover the full width of the window sill. The distance from top of the burner to bottom of window will be 8 inches (200 mm).

Note: Larger windows may be tested by expanding the size of the rear wall of the Wall Assembly Test Module.

2. **Materials.** In the absence of the window manufacturer's specifications, the wall assembly shall include the following minimum components:
 - 2.1. 2 by 4 inch studs spaced 16 inches (410 mm) on center, framed out to incorporate a rough opening sized to receive the test window such that the window is centered relative to the width of the wall;
 - 2.2. Gypsum board for mounting around the window once it is installed;
 - 2.3. Pieces of gypsum cut into narrow strips for use as trim around the window;
 - 2.4. Caulk to be used as per the window manufacturer's instructions.
3. **Wall assembly.** A noncombustible wall shall be used with a manufacturer or code-specified opening for the particular window. Install window in framed rough opening following manufacturer guidelines. Apply manufacturer-recommended caulk to nailing flange prior to installation. Use narrow strips of gypsum board as trim around window, covering the nail flange of the window. Any type of framing material may be tested.
 - 3.1. Fit the window test assembly into the rear wall of the Wall Assembly Test Module, sealing all edges, including the soffit-to-wall joint. Ceramic wool or comparable material shall be used for sealing.

12-7A-2.7 Conduct of tests.

1. **Burner output verification.** Without the window in place, set the burner for 150 kW output. Conduct a verification run of 3 minutes to assure the heat release rate, and then turn off the burner.
2. **Test.** Place the burner against the wall assembly at the center. Ignite the burner at the 150 kW output and control during the test for constant and uniform output. Optional radiometers can be placed behind the Wall Assembly Test Module to measure heat flux through the window glass.
3. **Duration and observations.** The test shall be continued until flame-through occurs at the window. Flame-through can occur at the glass (glazing) and/or in the frame. At this point, the burner shall be extinguished and the assembly monitored for sustained combustion. Note the time elapsed and location of penetration if it occurs.
4. **Report.** Report a description of the window unit, including the types of frames, cladding and panes being tested and details of the installation. Record when and how the glass breaks or flame-through occurs in the framing materials or sash, and/or if the framing material deforms or otherwise suffers a loss of integrity such

that the glass cannot be held in place, and a record of the time at which any of these events occur.

12-7A-2.8 Conditions of Acceptance.

1. **Duration of direct flame exposure.** To pass this test standard, the window and window assembly shall withstand 8 minutes of direct flame exposure with the absence of flame penetration through the window frame or pane, or structural failure of the window frame or pane.
2. **Flame penetration or structural failure.** Flame penetration or structural failure of the frame or pane anytime during the test constitutes failure of this test standard.

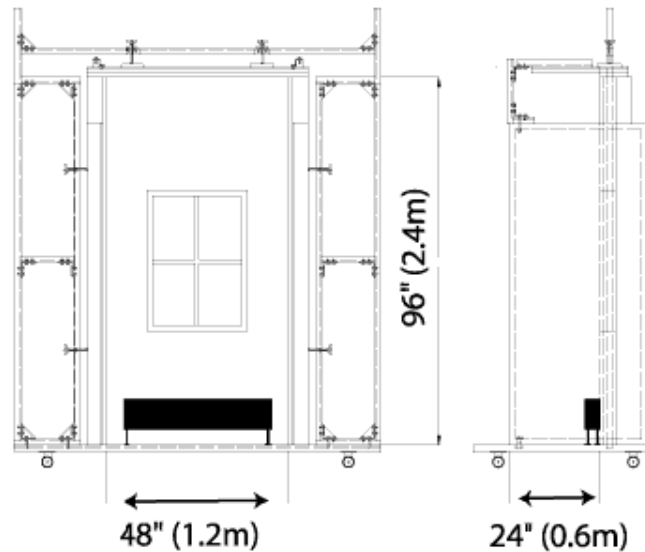


FIGURE 1. SCHEMATIC OF THE WALL ASSEMBLY Test Module used for evaluating the fire performance of a window.

HORIZONTAL PROJECTION UNDERSIDE SFM STANDARD 12-7A-3

12-7A-3.1 Application. The minimum design, construction and performance standards set forth herein for the exposed underside of horizontal projections such as the horizontal soffits of roof eaves, floor projections and exposed underfloor areas are those deemed necessary to establish conformance to the provisions of these regulations. Materials and assemblies that meet the performance criteria of this standard are acceptable for use as defined in the *California Building Standards Code*.

12-7A-3.2 Scope. This standard evaluates the fire-resistive performance of horizontal projection assemblies including the horizontal soffits of roof eaves, floor projections and exposed underfloor areas when subjected to direct flame exposure to the underside of a horizontal projection.

12-7A-3.3 Referenced documents.

1. ASTM D4442, Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
2. ASTM D4444, Test Methods for Use and Calibration of Hand-Held Moisture Meters.
3. *California Building Code*, Chapter 7A.

12-7A-3.4 Definitions.

1. **Eaves.** A projecting edge of a roof that extends beyond the supporting wall as in CBC 702A “Roof Eave” or similar horizontal projection assembly.
2. **Soffit.** The enclosed underside of any exterior overhanging section of a roof eave or similar horizontal projection assembly (see CBC 702A “Roof Eave Soffit”).

12-7A-3.5 Equipment.

1. **Burner.** A 12 by 12-inch (300 by 300 mm) diffusion burner shall be used. Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of 300 ± 15 kW throughout the flame exposure. Burner output can be determined from HRR or calculated from the gas flow rate, temperature and pressure.
2. **Infrared temperature analyzer** (optional). Intended for monitoring the temperature change of the inside of the eaves.
3. **Moisture content.** Prior to testing, all materials (lumber and soffit material) shall be conditioned to a constant weight or for a minimum of 30 days at $73 \pm 4^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity, whichever occurs first. Constant weight shall be defined as occurring when the change in test material weight is less than or equal to 2 percent in a 24-hour period. Lumber moisture content shall be between 8 and 12 percent (oven-dry basis) and sheathing shall not exceed 8 percent (oven-dry basis).

12-7A-3.6 Materials.

1. **Framing.** The materials used shall be representative of the grades that would be typical of eave construction and installed in the eave’s subassembly as per accepted construction practices.
2. **Soffit.** Material selected for the test.

12-7A-3.7 Test system preparation (Figure 1).

1. **Eaves fabrication.** The 4-foot-wide by 2-foot (1.2 m by 0.6 m) test specimen shall be constructed to fit into a 4-foot-wide (1.2 m) space at the top of the test assembly described in SFM 12-7A-1. Normal eave framing, joints in soffit material and other typical features present in the constructed assembly shall be present in the test specimen.
2. **Test Fixture.** The test fixture shall be as described in SFM 12-7A-1, with the exception that the top soffit projection of the wall assembly fixture is modified to facilitate installation and removal of eave assemblies. Gypsum board (or equivalent) is used to create a non-combustible wall surface in the 4 x 8 ft. opening in the wall test fixture.
3. **Eaves assembly.** Fit the eave assembly into the test module so that the horizontal surface of the assembly is 84 inches (2.1 m) from the top of the burner.
4. **Moisture content.** Measure the moisture content of the wooden members of the assembly using a moisture meter (ASTM D4444), and for sheathing products, by methods outlined in ASTM D4442.
5. **Sealing.** Seal the edges and ends with ceramic wool or comparable material to prevent flame penetration in these locations of the eave assembly.

12-7A-3.8 Conduct of Tests.

1. **Airflow.** The wall test shall be conducted under conditions of ambient airflow.
2. **Number of tests.** Conduct the tests on three replicate eaves assemblies.
3. **Burner output verification.** Without the eaves assembly in place, adjust the burner for 300 ± 15 kW output. Extinguish the burner.
4. **Burner positioning.** Center the burner with respect to the width of the eaves wall assembly and 0.75 inch (20 mm) from the wall. The distance from the floor to the top of the burner shall be 12 inches (300 mm).
5. **Procedure.**
 - 5.1 **Ignition.** Ignite the burner, controlling for a constant 300 ± 15 kW output.
 - 5.2 **Flame exposure.** Continue the exposure until flame penetration of the eaves occurs or for a 10-minute period.

5.3 **Continued combustion.** If penetration does not occur, continue observation for an additional 30 minutes or until all combustion has ceased.

Note: An infrared thermometer has been found to be useful to detect the increase of temperature on the back side of the eaves and as an aid to identify the areas of potential combustion.

6. **Observations.** Note the time, location and nature of flame penetration.

12-7A-3.9 Report. The report shall include a description of the eaves material, details of the construction of the eaves, moisture content of the framing and wood-based soffit elements as applicable, and point of flame penetration. Provide details on the time and reasons for early termination of the test.

12-7A-3.10 Conditions of Acceptance. Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.

1. Absence of flame penetration of the eaves or horizontal projection assembly at any time.
2. Absence of structural failure of the eaves or horizontal projection subassembly at any time.
3. Absence of sustained combustion of any kind at the conclusion of the 40-minute test.

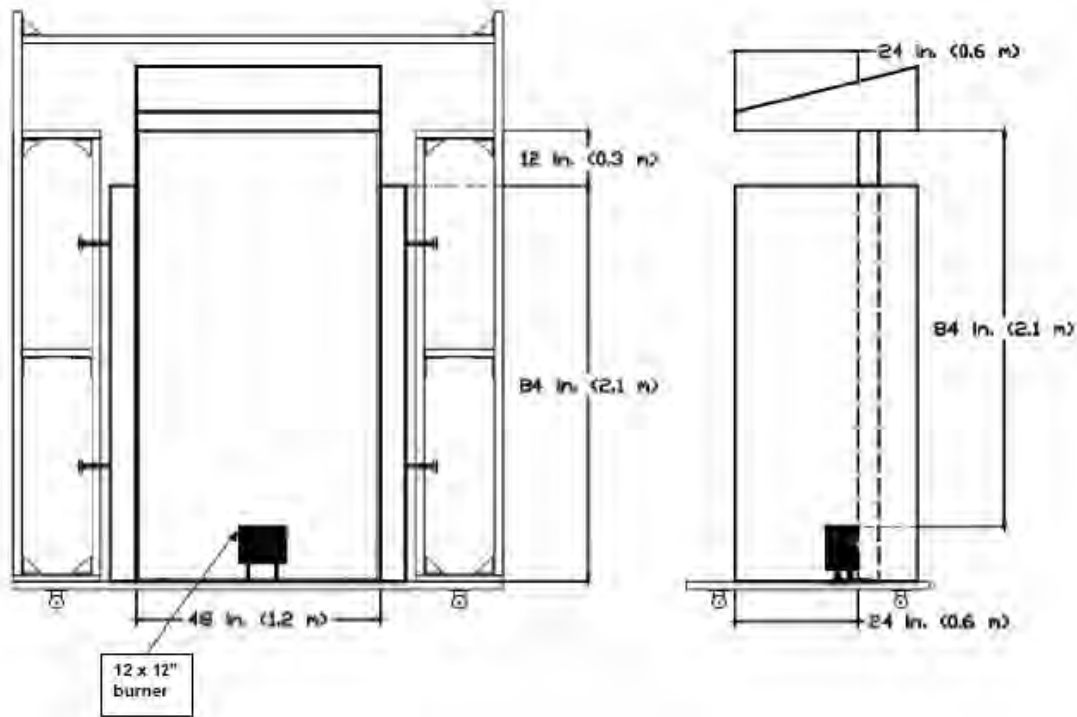


FIGURE 1. EAVES TEST ASSEMBLY

DECKING

SFM STANDARD 12-7A-4

12-7A-4.1 Application. The minimum design, construction and performance standards set forth herein for unloaded decks are those deemed necessary to establish conformance to the provisions of these regulations. Materials and assemblies that meet the performance criteria of this standard are acceptable for use as defined in *California Building Standards Code*.

12-7A-4.2 Scope. This standard evaluates the performance of decks (or other horizontal ancillary structures in close proximity to primary structures) when exposed to direct flames and brands. The under-deck flame exposure test is intended to determine the heat release rate (HRR) and degradation modes of deck or other horizontal boards when exposed to a burner flame simulating combustibles beneath a deck. The burning brand exposure test is intended to determine the degradation modes of deck or other horizontal boards when exposed to a burning brand on the upper surface.

12-7A-4.3 Referenced document.

1. ASTM D4444, Test Methods for Use and Calibration of Hand-Held Moisture Meters.
2. ASTM E108, Test Methods for Fire Tests of Roof Coverings.
3. *California Building Code*, Chapter 7A.
4. UL 790, Standard Test Methods for Fire Tests of Roof Coverings.

12-7A-4.4 Definitions.

1. **Deck boards.** Horizontal members that constitute the exposed surface of the ancillary structure.
2. **Deck surface area.** The test specimen area defined by the overall specimen length and width after assembly.
3. **Heat release rate.** The net rate of energy release as measured by oxygen depletion calorimetry.

12-7A-4.5 Test assembly.

1. **Size.** The overall size of the test deck shall be nominally 24 x 24 inches (610 x 610 mm) unless width variation of deck boards requires an increase in overall deck width (i.e., the direction of joists) in order to meet the overall dimensions. The length of individual deck boards shall be 24 inches (610 mm).
2. **Joists.** The deck is supported by two nominal 2 x 6 Douglas-fir joists running perpendicular to the deck boards, and constructed with a 16-inch (406 mm) center-to-center spacing. A comparable species that may be more commonly used for structural framing of decks in a given region can be substituted for Douglas-fir.
3. **Deck board spacing and fastening.** Edge-to-edge spacing and method of attachment shall conform to the manufacturer's installation recommendations. The front deck board shall be flush with the ends of the joists, and the rear deck board shall overhang the end of the joists by 1 inch (25 mm).

3.1. In the absence of recommended installation guidance, the edge-to-edge spacing shall be $\frac{3}{16}$ inch (5 mm) with boards mechanically attached to the joists using deck screws.

3.2. If nominal 6-inch-wide (152 mm) deck boards are used, a total of 5 boards shall be used for each deck. Changing the board width could change the number of deck boards.

12-7A-4.6 Materials.

1. **Cross-sectional dimension.** All deck board materials are to have cross-sectional dimensions equivalent to use in service.
2. **Description.** The material under test should be described as completely as possible (unit weight, thickness, width and general information regarding composition).
3. **Condition of test material.** Prior to testing, all materials (deck boards and joist material) shall be conditioned to a constant weight or for a minimum of 30 days at $73 \pm 4^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and $50 \pm 5\%$ relative humidity, whichever occurs first. Constant weight shall be defined as occurring when the change in test material weight is less than or equal to 2 percent in a 24-hour period.

12-7A-4.7 PART A. Under-deck flame test.

12-7A-4.7.1 Equipment.

1. **Burner.** A 12 x 12 inch (300 x 300 mm) sand diffusion burner shall be used. Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of 80 ± 4 kW throughout the flame exposure. Burner output can be determined from HRR or calculated from the gas flow rate, temperature and pressure.
2. **Oxygen depletion calorimeter.** The equipment shall include a hood, associated ducting and instrumentation to provide HRR data by oxygen depletion calorimetry.

12-7A-4.7.2 Test system preparation. See Figure No. 1.

1. **Deck support assembly.** The assembly that holds the test deck over the burner.
2. **Baffle panels and joist support.** Horizontal metal plates to support the deck joists along their full length, and also to confine burner flames to the underside of the deck boards located between the support joists.
3. **Back wall.** Ceramic fiber board or another noncombustible panel product for the back wall material. Total height of the back wall shall be 8 feet (2.4 m).
4. **Ledger board.** A 4-foot-long (1.2 m) simulated 2 x 6 ledger board shall be constructed of layers of ceramic fiber board (or other noncombustible panel product) and attached to the wall at a height slightly below the overhang of the rear deck board of the test deck.

12-7A-4.7.3 Conduct of tests.

1. **Airflow.** The test shall be conducted under conditions of ambient airflow.
2. **Number of tests.** Conduct the test on three replicate assemblies.
3. **Burner output verification.** Without a deck in the apparatus, set the output of the burner to 80 ± 4 kW. Conduct a verification run of 3 minutes to ensure the heat release rate, and then turn off the burner.
4. **Measurement of heat release rate.** HRR is measured during the tests with a properly calibrated oxygen depletion calorimeter. Since HRR is typically a post-test analysis, this criterion for Acceptance may be determined at the end of the test.
5. **Burner positioning.** Center the burner directly under the middle deck board, midway between the joists. The distance from the top of the burner to the bottom of the deck boards shall be 27 inches (690 mm).
6. **Moisture content.** Measure the moisture content of the wooden members of the assembly using a moisture meter (ASTM D4444).
7. **Procedure.**
 - 7.1. **Ignition.** Ignite the burner, controlling for a constant 80 ± 4 kW output.
 - 7.2. **Flame exposure.** Continue the exposure for a 3-minute period. Extinguish the burner.
 - 7.3. **Continued combustion.** Continue observation for an additional 40 minutes or until all combustion has ceased.
8. **Observations.** Note physical changes of the deck boards during the test, including structural failure of any deck board, location of flaming and glowing ignition, and loss of material (i.e., flaming drops of particles falling from the deck). It is desirable to capture the entire test with a video recorder to allow review of the details of performance.

12-7A-4.7.4 Report. The report shall include a description of the deck board material and the time of any degradation (effective net peak heat release rate, structural failure, flaming drops or particles falling from the deck) during the test.

1. **Calculated rate of heat release.** The effective net peak heat release rate (HRR) shall be calculated as follows:
 - 1.1. During the first 5 minutes of the test (the 3 minutes during which the ignition source burner is operating and the immediately following 2 minutes) the effective net peak HRR of the test assembly shall be reported as: effective net peak HRR = (peak heat release rate – 80 kW) / (deck surface area).
 - 1.2. During the remaining test duration the effective net peak heat release rate of the test assembly shall be reported as: effective net peak HRR = (peak heat release rate) / (deck surface area).

12-7A-4.7.5 Conditions of Acceptance. Should one of the three replicates fail to meet the Conditions of Acceptance,

three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance.

1. Effective net peak heat release rate of less than or equal to 25 kW/ft² (269 kW/m²).
2. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
3. Absence of falling particles that are still burning when reaching the burner or floor.

12-7A-4.8 PART B. Burning brand exposure.

12-7A-4.8.1 Equipment.

1. **Wind tunnel.** The wind tunnel shall have the capability of providing 12 mph (5.4 m/s) airflow over the deck assembly.
2. **Anemometer.** Device for measuring airflow across the deck.
3. **Burner.** Gas-fueled burner for brand ignition.

12-7A-4.8.2 Test system preparation. See Figure 2. The ASTM E108 “A” brand roof test apparatus is to be used, with the following modifications:

1. **Deck support.** The deck shall be supported horizontally with the center 60 inches (150 mm) from the front opening of the wind tunnel and the joists parallel to the airflow and resting on two transverse metal supports. The top surfaces of these supports, no more than 3 inches (75 mm) wide, are at the same height as the floor of the wind tunnel.
2. **Fragments.** Burning fragments shall be free to fall to the floor of the room.

12-7A-4.8.3 Conduct of tests.

1. **Number of tests.** Conduct the test on three replicate assemblies.
2. **Moisture content.** Measure the moisture content of the wooden members of the assembly using a moisture meter (ASTM D4444).
3. **Procedure.** Adhere to ASTM E108 “Standard Test Methods for Fire Tests of Roof Coverings” (burning brand test, “A” brand), with apparatus modified as described above in “Test system preparation” and the following procedure:
 - 3.1. The air velocity shall be calibrated using the 60-inch (1.5 m) framework spacing, with a smooth noncombustible calibration deck at a 5-inch (127 mm) per 12-inch (305 mm) horizontal incline positioned 60 inches (1.5 m) from the front opening of the wind tunnel. All other measurement details shall be followed as specified in Sections 4.4.2, 4.4.3 and 4.4.4 of ASTM E108. Although ASTM E108 specifies calibration to be conducted with the 33-inch (840-mm) framework spacing used for the intermittent flame test set up, tests have shown that at the nominal 12 mph setting, there was not difference in measured velocity between the 33- and 60-inch (838 mm and 1524 mm) framework spacing.

- 3.2. Mount the test specimen at a zero horizontal incline positioned 60 inches (1.5 m) from the front opening of the wind tunnel.
- 3.3. Ignite the “A” brands as specified in Section 9.4 of ASTM E108 as reprinted here:
 1. Each 12- x 12-inch (300 x 300 mm) face for 30 seconds.
 2. Each 2.25- x 12-inch (57 x 300 mm) edge for 45 seconds.
 3. Each 12- x 12-inch (300 x 300 mm) face again for 30 seconds.
- 3.4. Center the burning brand laterally on the deck with the front edge 2.5 inches (64 mm) from the entering air edge of the deck.
- 3.5. Continue the exposure for a 40-minute period or until all combustion of the deck boards ceases. The test shall be terminated immediately if flaming combustion accelerates uncontrollably (runaway combustion) or structural failure of any deck board occurs.

Heat Release Rate is not monitored because of the impracticability with the specified airflow.

4. **Observations.** Note physical changes of the deck boards during the test, including deformation from the horizontal plane, location of flaming and glowing combustion, and loss of material (i.e., flaming drops of particles falling from the deck). It is desirable to capture the entire test with a video recorder to allow review of the details of performance.

12-7A-4.8.4 Report. The report shall include description of the deck board material, and the time of any degradation (accelerated combustion, board collapse, flaming drops or particles falling from the deck).

12-7A-4.8.5 Conditions of Acceptance. Should one of the three replicates fail to meet the Conditions of Acceptance, three additional tests may be run. All of the additional tests must meet the Conditions of Acceptance:

1. Absence of sustained flaming or glowing combustion of any kind at the conclusion of the 40-minute observation period.
2. Absence of falling particles that are still burning when reaching the burner or floor.

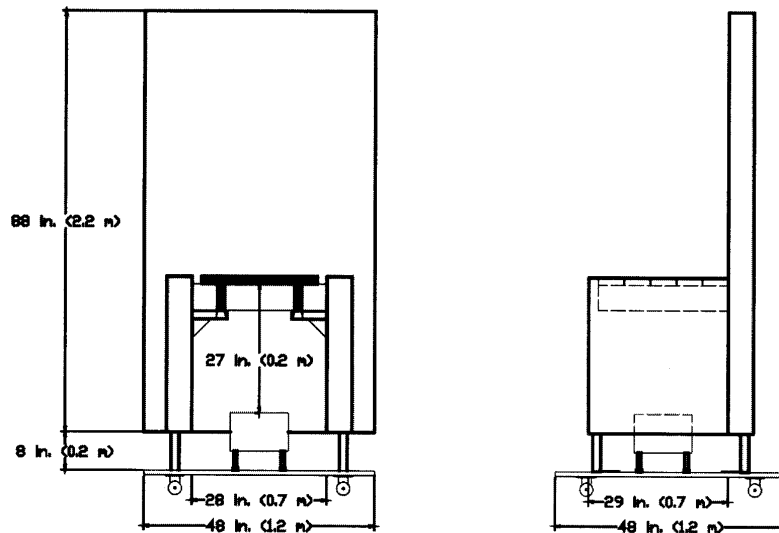


FIGURE 1. DECK TEST ASSEMBLY (UNDER DECK-FLAME)

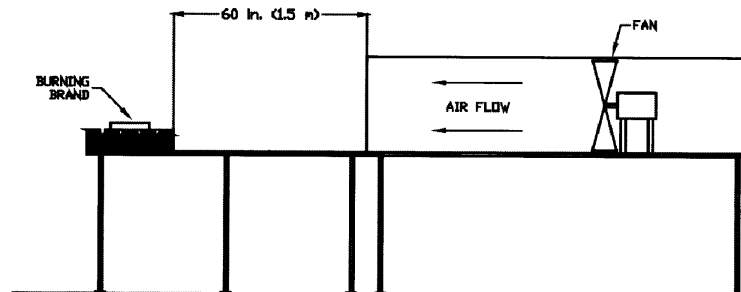


FIGURE 2. DECK TEST ASSEMBLY (BURNING-BRAND)

DECKING ALTERNATE METHOD A

SFM STANDARD 12-7A-4A

12-7A-4A.1 Application. The minimum design, construction and performance standards set forth herein for unloaded decks are those deemed necessary to establish conformance to the provisions of these regulations. Materials and assemblies that meet the performance criteria of this standard are acceptable for use as defined in the *California Building Standards Code*.

12-7A-4A.2 Scope. This standard evaluates the performance of decks (or other horizontal ancillary structures in close proximity to primary structures) when exposed to direct flames and brands. The under-deck flame exposure test is intended to determine the heat release rate (HRR) and degradation modes of deck or other horizontal boards when exposed to a burner flame simulating combustibles beneath a deck. The burning brand exposure test is intended to determine the degradation modes of deck or other horizontal boards when exposed to a burning brand on the upper surface.

12-7A-4A.3 Referenced document.

1. ASTM E108. Standard Test Methods for Fire Tests of Roof Coverings.
2. *California Building Code*, Chapter 7A.

12-7A-4A.4 Definitions.

1. **Deck boards.** Horizontal members that constitute the exposed surface of the ancillary structure.
2. **Heat release rate.** The net rate of energy release as measured by oxygen depletion calorimetry.

12-7A-4A.5 Test assembly.

1. **Size.** The overall size of the test deck shall be nominally 24 x 24 inches (610 x 610 mm) unless width variation of deck boards requires an increase in overall deck width (i.e., the direction of joists) in order to meet the overall dimensions. The length of individual deck boards shall be 24 inches (610 mm).
2. **Joists.** The deck is supported by two nominal 2 x 6 Douglas-fir joists running perpendicular to the deck boards, and constructed with a 16-inch (406 mm) center-to-center spacing. A comparable species that may be more commonly used for structural framing of decks in a given region can be substituted for Douglas-fir.
3. **Deck board spacing and fastening.** Edge-to-edge spacing and method of attachment shall conform to the manufacturer's installation recommendations. The front deck board shall be flush with the ends of the joists, and the rear deck board shall overhang the end of the joists by 1 inch (25 mm).
 - 3.1. In the absence of recommended installation guidance, the edge-to-edge spacing shall be $\frac{3}{16}$ inch (5 mm) with boards mechanically attached to the joists using deck screws.
 - 3.2. If nominal 6-inch-wide (152 mm) deck boards are used, a total of five boards shall be used for each

deck. Changing the board width could change the number of deck boards.

12-7A-4A.6 Materials.

1. **Cross-sectional dimension.** All deck board materials are to have cross-sectional dimensions equivalent to use in service.
2. **Description.** The material under test should be described as completely as possible (unit weight, thickness, width and general information regarding composition).
3. **Condition of test material.** Prior to testing, all materials (deck boards and joist material) shall be conditioned to a constant weight or for a minimum of 30 days at $73 \pm 4^\circ\text{F}$ ($23 \pm 2^\circ\text{C}$) and 50 ± 5 percent relative humidity, whichever occurs first. Constant weight shall be defined as occurring when the change in test material weight is less than or equal to 2 percent in a 24-hour period.

Note: The moisture content of joists shall be between 8- and 10-percent moisture content.

12-7A-4A.7 Under-deck flame test.

12-7A-4A.7.1 Equipment.

1. **Burner.** A 12- x 12-inch (300 x 300 mm) diffusion burner shall be used. Natural gas, methane or propane shall be supplied to the burner through a metered control system. The gas supply to the burner shall produce a net heat output of 80 ± 4 kW throughout the flame exposure. Burner output can be determined from HRR or calculated from the gas flow rate, temperature and pressure.
2. **Oxygen depletion calorimeter.** The equipment shall include a hood, associated ducting and instrumentation to provide HRR data by oxygen depletion calorimetry.

12-7A-4A.7.2 Test system preparation. See 12-7A-4 Figure No. 1.

1. **Deck support assembly.** Assembly that holds the test deck over the burner.
2. **Baffle panels and joist support.** Horizontal metal plates to support the deck joists along their full length, and also to confine burner flames to the underside of the deck boards located between the support joists.
3. **Back wall.** Ceramic fiber board or another noncombustible panel product for the back wall material. Total height of the back wall is 8 feet (2.4 m).
4. **Ledger board.** A 4-foot-long (1.2 m) simulated 2 x 6 ledger board shall be constructed of layers of ceramic fiber board (or other noncombustible panel product) and attached to the wall at a height slightly below the overhang of the rear deck board of the test deck.

12-7A-4A.7.3 Conduct of tests.

1. **Airflow.** The test is conducted under conditions of ambient airflow.
2. **Number of tests.** Conduct the test on three replicate assemblies.
3. **Burner output verification.** Without a deck in the apparatus, set the output of the burner to 80 ± 4 kW. Conduct a verification run of 3 minutes to ensure the heat release rate, and then turn off the burner.
4. **Measurement of heat release rate.** HRR is measured during the tests with a properly calibrated oxygen depletion calorimeter. Since HRR is typically a post-test analysis, this criterion for Acceptance may be determined at the end of the test.
5. **Burner positioning.** Center the burner directly under the middle deck board, midway between the joists. The distance from the top of the burner to the bottom of the deck boards shall be 27 inches (690 mm).
6. **Moisture content.** Measure the moisture content of the wooden members of the assembly using a moisture meter (ASTM D4444).
7. **Procedure.**
 - 7.1. **Ignition.** Ignite the burner, controlling for a constant 80 ± 4 kW output.
 - 7.2. **Flame exposure.** Continue the exposure for a 3-minute period. Extinguish the burner.
 - 7.3. **Continued combustion.** Continue observation for an additional 40 minutes or until all combustion has ceased. The test shall be terminated immediately if flaming combustion accelerates uncontrollably (runaway combustion) or structural failure of any deck board occurs.
8. **Observations.** Note physical changes of the deck boards during the test, including structural failure of any deck board, location of flaming and glowing ignition, and loss of material (i.e., flaming drops of particles falling from the deck). It is desirable to capture the entire test with a video recorder to allow review of the details of performance.

12-7A-4A.7.4 Report. The report shall include a description of the deck board material and the time of any degradation (effective net peak heat release rate) during the test.

12-7A-4A.7.5 Conditions of acceptance. Should one of the three replicates fail to meet the Condition of Acceptance, three additional tests may be run. All of the additional tests must meet the Condition of Acceptance with an effective peak heat release rate of less than or equal to 25 kW/ft^2 (269 kW/m^2).

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CHAPTER 12-8-1

FIRE-RESISTIVE STANDARDS FOR FIRE PROTECTION

STANDARD 12-8-100

ROOM FIRE TEST FOR WALL AND CEILING MATERIALS (See Chapter 35, California Building Code.)

STATE FIRE MARSHAL

Authority: Sections 13143, 13146.1, Health and Safety Code

Reference: Sections 13108, 13143, 13146.1, Health and Safety Code

FIRE AND SMOKE MEASUREMENTS AND PHOTOGRAPHIC RECORD

Sec. 12-8-102.

SCOPE

Sec. 12-8-101.

(a) **Basic.** This standard is intended to evaluate, under a specified fire exposure condition, the contribution to room fire growth provided by wall ceiling and/or floor materials or assemblies. This standard is not intended to evaluate the fire endurance or flamespread of material or assemblies.

Note: See State Fire Marshal (SFM) 7-1 and *Uniform Building Code* (UBC) Standard 8-1.

This standard can be used to evaluate the effectiveness of thermal barriers in restricting the contribution of combustible materials in the wall and floor assemblies to fire growth in a padded safety cell. This standard shall be used in conjunction with ASTM E603-77, "Standard Guide for Room Fire Experiments," which covers instrumentation, safety precautions and the general effect of various parameters.

(b) **Tests and listings by approved testing agency.** Test data for wall and/or ceiling materials or assemblies investigated and tested in accordance with the Standard for Safety established by Underwriters Laboratories, Inc., UL 723C, "Investigation for the Classification of Wall and Ceiling Interior Finish Materials and Assemblies Using a Room Fire Test," will be acceptable for evaluation against this standard, provided all instrumentation data required by this standard is incorporated in the test and report.

(c) **Test simulation.** The test simulates a fire in the corner of an 8-foot by 12-foot (2438 mm by 3657 mm) compartment containing a single open doorway; this can be used to evaluate the relative performance of specific wall, ceiling and floor materials or assemblies when they are used together in the same relationship within an enclosure, in addition to simulating the manner in which they will be used.

(d) **Materials considered.** The test may be used for evaluating wall, ceiling and flooring finish materials and assemblies, including panels, tiles, boards, sprayed or brushed coatings, etc.

(a) **Significance.** This fire test is applicable to a description of certain fire performance characteristics in appraising wall, ceiling and flooring materials, products or systems under specified fire exposure conditions in an enclosure. The test indicates the maximum extent of fire growth in an enclosure, the rate of heat release, and if they occur, the time to flashover and the time to flame extension beyond the doorway following flashover. Time to flashover is either the time when the radiant flux onto the floor reaches 20 kW/m² or the average temperature of the upper air reaches 1100°F (593°C). A crumpled up single sheet of newspaper may be placed on the floor 3 feet (914 mm) out from the center of the front wall.

The spontaneous ignition of this newspaper will provide a visual indication of flashover. It determines both the extent to which the wall and ceiling materials or assemblies may contribute to fire growth in a compartment and the potential for fire spread beyond the compartment under the particular conditions simulated. It does not measure the contribution of the furnishing materials.

(b) **Fire measurements.** The potential for the spread of fire to other objects in the enclosure interior, remote from the ignition source, is evaluated by measurements of:

1. The total heat flux incident at the center of the floor.
2. A characteristic upper level gas temperature in the test compartment.

(c) **Fire spread potential.** The potential for the spread of fire to objects outside the compartment of origin is evaluated by the measurement of the total rate of heat release of the fire.

(d) **Smoke measurements.** Measurements of the rate of production of carbon monoxide and visible smoke are taken.

(e) **Photographic record.** The overall performance of the test specimen is to be visually documented by full color photographic records. Videotaping of the complete fire test may be done as an alternate to the continuous photographic record. Such records may show when each area of the test specimen becomes involved in the fire.

(f) **Photographic Specification.** Photographic equipment shall be used to continuously record the fire spread in the room and the fire projection from the door of the room. The

location of the camera must avoid interference with the air inflow.

Note: A window, cut 2-0 above the floor wall facing the gas burner, fitted with heat-resistant, impact-resistant glazing provides useful photographic access. Flood lights should not raise the ambient temperature in the room above that specified in Section 12-8-110. The interior wall surfaces of the test room, adjacent to the corner in which the burner is located, shall be clearly marked with a 12-inch (305 mm) grid. A clock shall appear in all photographic records, giving the time to the nearest second (or 0.01 minute) from the start of the test. This clock shall be accurately synchronized with all other measurements, or other provisions shall be made to correlate the photographic record with time. Color slides shall also be taken at 15-second intervals for the first 3 minutes of the test and at a minimum of 30-second intervals thereafter for the duration of the test.

REPORT

Sec. 12-8-103. The report shall include the following items:

1. **Material description.** The name, thickness, density and size of the material shall be listed, along with other identifying characteristics or labels.
2. Materials mounting and conditioning.
3. Layout of specimens and attachments in test room.
4. Relative humidity and temperature of the room and the test building prior to and during the test.
5. The fuel gas flow to the ignition burner and its calculated rate of gross heat output.
6. The total incident heat flux at the center of the floor shall be reported for each heat flux gage as a function of time starting 1 minute prior to the test.
7. The temperature of gases in the room, the doorway, and in the exhaust duct shall be reported for each thermocouple as a function of time starting 1 minute prior to the test. The temperature recorded by the thermocouple in the duct will be used in the required calculation.
8. The volumetric flow rate of the gas in the duct shall be calculated from Equation 12 in Appendix 12-8-1A and reported as a function of time starting 1 minute prior to the test.
9. The oxygen concentration in the analyzer shall be reported as a function of time starting 1 minute prior to the test.
10. The carbon dioxide concentration, if measured in the analyzer, shall be reported as a function of time starting 1 minute prior to the test.

Note: Separate reporting of the volumetric flow rate, temperature, oxygen and carbon dioxide and/or carbon monoxide concentrations provide diagnostic information on the performance of the exhaust gas collection system and provide a check on the heat production calculations.

11. The total rate of heat production shall be calculated from the measured oxygen and carbon dioxide and/or carbon monoxide concentrations, and the temperature and volumetric flow rate of the gas in the duct.
12. The product of the volumetric flow rate of the gas in the duct and the carbon monoxide concentration at the specified location in the combustion hood system shall be reported as a function of time after the start of the test.
13. The product of the volumetric flow rate of the gas in the duct at the duct gas temperature and the optical density per foot at the specified smoke meter location in the duct shall be reported as a function of time after the start of the test.

Note: If this product is multiplied by 1.55×10^{-3} , for English units, it gives the smoke units produced per second, where a smoke unit is defined as the quantity of smoke which, when distributed uniformly over a cubic meter, would have an optical density of unity over a path length of 1 meter. (This is the definition used in the Proposed ASTM Test for Heat and Visible Smoke Release Rates for Materials and Products.)

14. A transcription of the visual, photographic, audio and written records of the fire test shall be provided. The records shall indicate the time of ignition of the wall and ceiling finishes, the approximate location of the flame front most distant from the ignition source, at intervals not exceeding 15 seconds during the fire test, the time of flashover, and the time at which flames extend outside the doorway. In addition, still photographs taken at intervals not exceeding 15 seconds for the first 3 minutes, beginning at the start of the test and at every 30 seconds for the remainder of the test shall be supplied. Photographs showing the extent of the damage of the materials after the test shall also be supplied. The camera settings, film speed and lighting used shall be described.
15. A report on the pretest calibration conducted in Section 12-8-113.
16. Report on the barometric pressure at time of test.
17. A complete discussion of the criteria. This shall include all calculations and references to other data used to satisfy the criteria presented in Section 12-8-115.

TEST SAMPLES

Sec. 12-8-104. Samples of the test material, both in its original (untested) and post-tested conditions, shall be retained by the testing agency. All samples shall be retained by the testing agency for a minimum period of three years from the date of the test. All samples shall measure 4 inches by 4 inches (101 mm by 101 mm) by the sample thickness. Two samples of the material in its original pretest condition shall be retained. These samples shall be taken from the same material lot used for the test samples. Post-test samples from the test shall include one each, from the geometric center of each wall panel and the ceiling panel, and one each from the following locations:

1. The top, mid-height and bottom of each wall along the vertical centerline of each wall panel.

2. The quarter points of the ceiling, in those cases in which the test material was applied to the ceiling.

All samples shall be clearly identified as to the material, test date and their location within the room.

SUMMARY OF METHOD AND HEAT SOURCE

Sec. 12-8-105.

(a) **Summary of method.** The test involves an ignition source exposure of the wall, ceiling and/or floor lining materials or assemblies as they would be incorporated in actual safety cell installation.

(b) **Heat source.** This method uses a gas burner to produce a diffusion flame in contact with the walls and ceiling in the corner of an 8-foot by 12-foot by 8-foot-high (2438 mm by 3657 mm by 2438 mm) compartment. The burner produces a prescribed gross rate of heat output as given in Table 12-8-1A and Figure 12-8-1.

The contribution of the wall, ceiling and flooring materials or assemblies to fire growth is measured in terms of the time history of the incident heat flux at the center of the floor, the time history of the temperature of the gases in the upper part of the compartment, the time to flashover and the rate of heat release. The test is conducted with natural ventilation to the test compartment provided through a single doorway 30 inches by 80 inches (762 mm by 2032 mm) in width and height. The combustion products are collected in a hood feeding into a plenum connected to an exhaust duct in which measurements are made of the gas velocity, temperature and concentrations.

IGNITION SOURCE AND LOCATION

Sec. 12-8-106.

(a) **Ignition source.** The ignition source for the test shall be a gas burner with a nominal 12 inches by 12 inches (305 mm by 305 mm) porous top surface of a refractory material.

Note: A burner may be constructed with a 1-inch (25 mm) porous ceramic-fiber board over a 6-inch (152 mm) plenum; or alternatively a minimum 4-inch (101 mm) layer of Ottawa sand can be used to provide the horizontal surface through which the gas is supplied. The sand burner may be preferable for dripping materials. This type of burner is shown in Figure 12-8-7.

(b) **Burner location.** The top surface of the burner through which the gas is supplied shall be located horizontally, 12 inches (305 mm) off the floor, and the burner enclosure shall be in contact with both walls in a corner of the room opposite from the door. The edge of the diffusion surface shall be within 1 inch (25 mm) of the wall.

(c) **Gas supply.** The gas supply to the burner shall be propane and shall produce a heat source as outlined in Section 12-8-105 (b). The flow rate shall be metered throughout the test. The burner shall be so designed that it can be set at the flow rates required to produce the gross rates of heat release as specified in Section 12-8-105 (b).

(d) **Ignition.** The burner may be ignited by a pilot burner or a remote controlled spark igniter.

COMPARTMENT DIMENSIONS AND CONSTRUCTION

Sec. 12-8-107.

(a) **Compartment geometry and construction.** The interior dimensions of the floor of the fire room when the specimens are in place, shall measure 8 feet (2438 mm) \pm 1 inch (25 mm) \times 12 feet (3657 mm) \pm 1 inch (25 mm). The finished ceiling shall be 8 feet (2438 mm) \pm 0.5 inch (13 mm) above the floor. There shall be four walls at right angles defining the compartment.

Note: The experimental choices for the sizes of compartment fire experiments are discussed in Section 5 of ASTM E603. The compartment size defined in this section has been chosen to make it convenient to utilize standard sized 4-foot by 8-foot (1219 mm by 2438 mm) building materials or panels.

(b) **Doorway.** There shall be a 30-inch (762 mm) \pm 0.25-inch (6 mm) \times 80-inch (2032 mm) \pm 0.25-inch (6 mm) doorway in the center of one of the 8-foot by 8-foot (2438 mm by 2438 mm) walls, and no other wall or ceiling openings that will allow ventilation.

(c) **Wall construction.** The wall containing the door shall be of calcium silicate board of 46 pcf density and 0.5 inch (13 mm) nominal thickness. As an alternative to the calcium silicate board, 0.5-inch (13 mm) thick gypsum wallboard may be used. The door frame shall be constructed to remain unchanged during the test period to a tolerance of \pm 1 percent in height and width.

(d) **Compartment construction.** The test compartment may be a framed structure or a concrete block structure. If self-supporting panels are tested, a separate exterior frame or block compartment may not be required.

(e) **Floor materials.** The floor of the test compartment shall be noncombustible as defined by ASTM E136.

SPECIMEN MOUNTING AND TEST MATERIAL SIZE

Sec. 12-8-108.

(a) **Specimen mounting.** The specimens (e.g., the ceiling and wall materials whose condition is being tested) shall be mounted on a framing or support system comparable to that intended for their field use, using backing materials, insulation or air gaps, as appropriate to the intended application and representing a typical value of thermal resistance for the wall system.

(b) **Test material size.** In the test, the ceiling material shall cover the entire ceiling if such an end use application is anticipated and the wall material shall cover three of the side walls, but not the wall containing the door. The wall and ceiling materials shall be mounted in the same wall-ceiling relationship in which they are intended for use, and it therefore may be necessary to actually construct a section of a prototype padded safety cell.

FIRE COMPARTMENT ENVIRONMENT

Sec. 12-8-109. The test building in which the fire compartment is located shall have vents for the discharge of combus-

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tion products and have provisions for fresh air intake, so that no oxygen deficient air shall be introduced into the fire compartment during the test. Prior to initiation of the test the ambient air at the mid-height entrance to the compartment shall have a velocity in any direction of less than 100 feet per minute. The building shall be of adequate size so that there shall be no smoke accumulation in the building below the level of the top of the fire compartment.

AMBIENT CONDITIONS IN TEST BUILDING AND FIRE COMPARTMENT

Sec. 12-8-110.

(a) **Ambient conditions in test building.** The ambient temperature in the test building at any location outside the fire compartment shall be above 40°F (4°C), and the relative humidity shall be less than 75 percent for the duration of the test.

(b) **Ambient conditions in fire compartment.** The ambient temperature in the fire compartment measured by one of the thermocouples specified in Section 12-8-112, Item 2., D., shall be within the range of 65°F to 75°F (18°C to 24°C) for at least 16 hours prior to the test.

(c) **Humidity.** The ambient relative humidity in the fire compartment for 16 hours prior to the test shall be within the range of 50 ± 5 percent. This may require the use of a humidifier or dehumidifier.

SPECIMEN CONDITIONING

Sec. 12-8-111. The specimens shall be conditioned prior to mounting at a temperature of 70°F ± 5°F, and at a relative humidity of 50 ± 5 percent until they reach a rate of weight change of less than 0.1 percent per day.

INSTRUMENTATION

Sec. 12-8-112. The following are the minimum requirements for instrumentation for this test:

Note: Added instrumentation may be desirable for further information.

1. Total heat flux gages.

A. **Location.** Two gages shall be mounted within 5 inches (127 mm) of each other and within a distance of 2 inches (51 mm) above the floor surface upward in the geometric center of the floor.

Note: See Figure 12-8-2.

One additional gage shall be mounted in the wall adjacent to the ignition burner during calibration tests only.

Note: See Section 12-8-113, Item 2.

It shall be 6 feet (1829 mm) above the floor, and 6 inches (152 mm) from the corner where the burner is located, along the wall opposite the doorway. The front surface of the calibration gage shall be flush with the wall surface, within 0.04 inch (1 mm).

B. **Specification.** The gages shall be of the Gardon type, with a flat black surface and a 180° view angle, and shall be maintained at a constant temperature, within ± 1.8°F above the dew point by water supplied at a temperature of 120°F to 150°F (49°C to 65°C). This will normally require a flow rate of at least 0.1 gpm. The full-scale output range shall be 5 Btu/ft.²/sec. for the floor gage and 10 Btu/ft.²/sec. for the wall gage.

Note: A suitable Gardon-type heat flux gage, manufactured by the Medtherm Corporation in Huntsville, Alabama, is listed under model 64-5-18 for the 5 Btu/ft.²/sec. range and under model 64-10-18 for the 10 Btu/ft.²/sec. range. See R. Gardon, "An Instrument for the Direct Measurement of Intense Thermal Radiation," Review of Scientific Instruments, Vol. 24, No. 5, May 1953, pp. 36-70, for further information.

2. Gas temperature thermocouples.

A. **Specification.** Twenty-mil-diameter bare chromel-alumel thermocouple wire within 0.5 inch (13 mm) of the bead should be run along expected isotherms to minimize conduction errors. The insulation between the chromel and alumel wires must be stable to at least 2000°F (1093°C) or the wires must be separated.

Note: Metal clad ceramic powder will work satisfactorily. The commonly used silicone-impregnated glass insulation will break down above 1500°F (815°C).

B. **Location for doorway.** A thermocouple shall be located in the interior plane of the door opening on the door centerline, 1 inch (25 mm) down from the top.

Note: See Figure 12-8-3.

C. **Locations for room.** Thermocouples shall be located 4 inches (101 mm) down from the center of the ceiling and from the center of each of the four ceiling quadrants, and one shall be directly over the center of the ignition burner, 4 inches (101 mm) below the ceiling. The thermocouples shall be mounted on supports, with their junctions at least 4 inches (101 mm) away from a solid surface. There shall be no attachments to the test specimens.

Note: See Figure 12-8-3.

D. **Location in canopy hood and duct systems.** One pair of thermocouples shall be placed 11 feet (3353 mm) downstream to the entrance to the horizontal duct. The pair of thermocouples shall straddle the center of the duct and be separated by 2 inches (51 mm) from each other.

Note: See Figure 12-8-4.

3. **Canopy hood and exhaust duct location and design.** A hood shall be installed immediately adjacent to the door of the fire room. The bottom of the

hood shall be level with the top surface of the room. The face dimensions of the hood shall be minimum 8 feet by 8 feet (2438 mm by 2438 mm) and the depth shall be 3.5 feet (1067 mm). The hood shall feed into a plenum having a 3-foot by 3-foot (914 mm by 914 mm) cross section.

Note: See Figure 12-8-4.

The plenum shall have a minimum height of 3 feet (914 mm). The height can be increased up to a maximum of 6 feet (1829 mm) to satisfy building constraints. The exhaust duct connected to the plenum shall be 16 inches (406 mm) in diameter, horizontal, and shall have a circular aperture of 12 inches (305 mm) at its entrance.

The hood shall have sufficient draft to collect all the combustion products leaving the room. This draft should be capable of moving up to 5,000 standard cubic feet per minute (scfm) during the test. Provisions shall be made to vary the draft so that it can operate at either 1,000 or 5,000 scfm. Mixing vanes may also be required in the duct if concentration gradients are found to exist.

An alternate exhaust system design may be used if it has been shown to produce equivalent results. Equivalency may be shown by meeting the requirements of Section 12-8-113, Item 5.

4. **Duct gas velocity specification.** A bidirectional probe or equivalent measuring system shall be used to measure gas velocity in the duct.

Note: See B. J. McCaffrey and G. Heskestad, *Combustion and Flame*, 26, 125-127 (1976).

The probe shown in Figure 12-8-6 consists of a short stainless steel cylinder 1.75-inch (44 mm) long and 0.975-inch (25 mm) inside diameter with a solid diaphragm in the center. The pressure taps on either side of the diaphragm support the probe. The axis of the probe shall be along the centerline of the duct 11 feet (3353 mm) downstream from the entrance. The taps shall be connected to a pressure transducer which shall be able to resolve pressure differences of 0.0001-inch (0.002 mm) of water.

Notes:

1. Capacitance-type transducers have been found to be the most stable for this application.
 2. The bidirectional probe is specified rather than the pilot-static tube in order to avoid problems of clogging with soot.
5. **Duct oxygen concentration specification.** A stainless steel gas sampling tube shall be located 13 feet (3962 mm) downstream from the entrance to the duct, to obtain a continuously flowing sample for determining the oxygen concentration of the exhaust gas as a function of time. A suitable filter and cold trap shall be placed in the line to remove particulates and water. The oxygen analyzer shall be of the paramagnetic or polarographic type and shall be capable of measuring the reduction in oxygen concentration

over the range of 0.21 down to 0.15 with an accuracy of ± 2 percent in this concentration range. The signal from the oxygen analyzer must be within 5 percent of its final value in 30 seconds after introducing a step change in composition of the gas stream flowing past the inlet to the sampling tube.

6. **Duct carbon dioxide concentration specification.** The gas sampling tube defined in Section 12-8-112, Item 5, or an alternate tube in the same location, shall provide a continuous sample for the measurement of the carbon dioxide concentration with an analyzer which has a range of 0 to 20 percent and a maximum error of 2 percent of full-scale. The total system response time between the sampling inlet and the meter shall be no greater than 30 seconds.
7. **Duct carbon monoxide concentration specification.** The gas sampling tube defined in Section 12-8-112, Item 5, or an alternate tube in the same location, shall provide a continuous sample for the measurement of the carbon monoxide concentration with an analyzer which has a range of 0 to 10 percent and a maximum error of 2 percent of full-scale.
8. **Optical density of smoke in duct specification (supplementary measurement).** A meter shall be installed to measure the optical density of the exhaust gases in a vertical path across the width of a horizontal duct, 1 foot (105 mm) downstream of the duct velocity probe. A horizontal path should be used with a vertical duct.

A suitable design for the meter is as follows:

Use as a light source a number 1810 lamp which is rated at 6.3 volts, 0.40 amps, and 1.5 candela and is operated at 5 volts d.c. The lamp is mounted at the focal point of a + 20 diopter and 50 mm diameter double convex collimating lens. At the other side of the duct the collimated beam is intercepted by a + 10 diopter 50 mm diameter plane convex lens and concentrated onto the cathode of a 1P39 phototube. A Corning CS3-132 type 3304 filter (available from the Swift Glass Company, Box 890, Elmira Heights, NY 14903) is used in front of the phototube to correct its spectral response to the standard photopic curve of the human eye.

The lens, filter and phototube are mounted inside of a light-tight housing which is blackened inside to minimize internal reflections. The phototube is connected to a linear operational power amplifier with an adjustable gain of 10^6 which in turn is connected to a commercially available log ratio amplifier to produce an output voltage proportional to the optical density. A smoke meter meeting the above requirements is described in a report by R. W. Bukowski, "Smoke Measurements in Large- and Small-scale Fire Testing," NBSIR 78-1502, October 1978. Alternate systems can be used, but the color temperature of the light source must match that of the 1810 lamp under the specified operating conditions, and the light receiver, including the photo detector, must match the standard photopic curve of the eye.

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The optical density shall be continuously recorded over the duration of the test. After completion of the test, the optical density reading must be less than 0.02 (transmission higher than 95 percent).

CALIBRATION AND DOCUMENTATION OF IGNITION SOURCE AND TEST EQUIPMENT

Sec. 12-8-113. A calibration test shall be performed prior to and within 30 days of any fire test. The calibration test, to last for 15 minutes, shall use the standard ignition source with inert wall and ceiling materials (calcium silicate board of 46 pcf density and 0.5-inch (13 mm) thickness. The following quantities shall be reported:

1. Once the burner is activated, the output of all instruments normally used in the test is to be measured and data recorded as a function of time.
2. The time history of the total heat flux at the wall location.
3. The maximum extension of the burner flame as recorded by still color photographs of 0.1 second exposure time taken at a minimum of 30-second intervals, or more often if it is changing rapidly. These shall be taken with a camera operating in the "operative mode" with the camera set to the standard ASA ratings of the film.
4. The temperature and velocity profiles across the duct cross-section at the location of the bidirectional probe if one is used. These profiles shall be used to determine the factor "k" in Equation 12, Appendix 12-8-1A.
5. The total rate of heat production is determined both by the oxygen consumption calculation and by the metered gas input. These must agree within 5 percent.

Note: The net heat of combustion is 2,283 Btu/ft³ for propane at 68°F (20°C) and 14.7 psi. This value should be used in this calculation.

TEST PROCEDURE

Sec. 12-8-114. The following paragraphs describe the steps in the test procedure:

1. Establish an initial volumetric flow rate of 1,000 cfm through the duct if a forced ventilation system is used. If a forced ventilation system is used, increase the volume flow rate through the duct to 5,000 cfm when the oxygen content falls below 18 percent.
2. Turn on all sampling and recording devices and establish steady state baseline readings for at least 1 minute.
3. Ignite the gas burner and start the clock simultaneously. Increase gas flow rate in steps as indicated in Section 12-8-106 (c).
4. Take 35 mm color slides at 15-second intervals during the first 3 minutes and at 30-second intervals thereafter to photographically document the growth of the fire.
5. Provide a continuous voice or written record of the fire, which will give times of all significant events such as

flame attachment to the wall, flames out of the doorway, flashover, etc.

6. The ignition burner shall be shut off at 15 minutes after initiation of the test and the test terminated at that time unless safety considerations dictate an earlier termination.
7. Photograph and verbally describe the damage after the test.

FLASHOVER AND SMOKE

Sec. 12-8-115.

(a) **Flashover.** The criterion for acceptable performance shall be that the compartment never reaches flashover at any time during the 15-minute period of ignition source burner operation. Flashover shall be considered to have occurred if one or more of the following conditions occur during the test:

1. The average ceiling gas temperature, as determined by averaging the temperature at the center and quarter point thermocouples, reaches or exceeds 1112°F (600°C).
2. The total heat flux at the floor, as determined by either of the total heat flux meters mounted in the geometric center of the floor, reaches or exceeds a value of 1.761 Btu/ft.²/sec.
3. Visible flaming extends from the doorway of the test compartment.

(b) **Smoke.** Materials meeting the acceptance criteria of this standard shall have a smoke density rating no greater than 75 when tested in the thickness intended for use by UBC Standard 26-5, or when tested in accordance with UBC Standard 8-1.

MARKINGS

Sec. 12-8-116. All materials shall be provided with a manufacturer's label or other permanent marking clearly identifying the manufacturer label or other permanent marking clearly identifying the manufacturer, the product and model numbers (or brand name). Materials approved and listed by the State Fire Marshal shall be marked as required by Section 1.58, Title 19, C.A.C.

TABLE 12-8-1A
IGNITION SOURCE RATE OF HEAT RELEASE
PROGRAM FOR TESTS OF SAFETY CELL PADDING MATERIALS

ELAPSED TEST TIME (Min)	BURNER GROSS RATE OF HEAT RELEASE (KW)
0	44
1	88
2	132
3	132
4	88
5-15	44

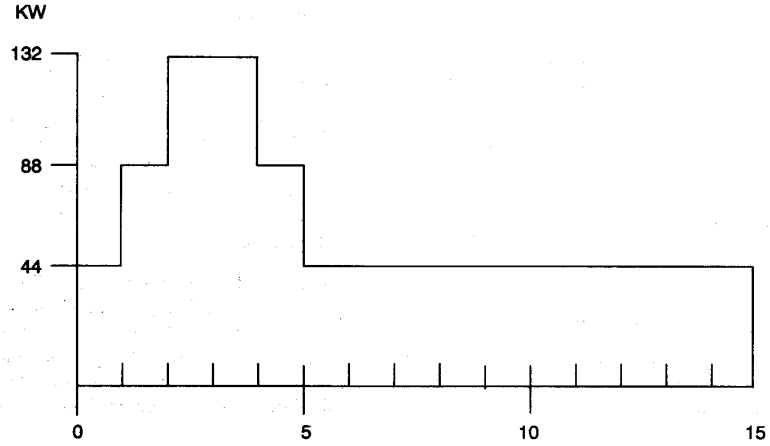


FIGURE 12-8-1—TIME—MINUTES

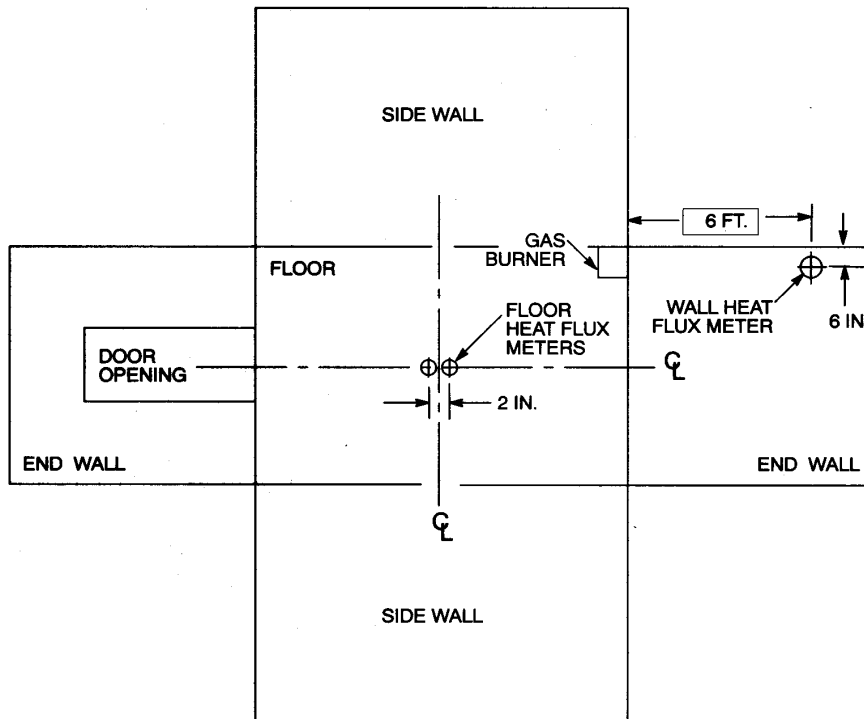


FIGURE 12-8-2—LOCATION OF HEAT FLUX METERS

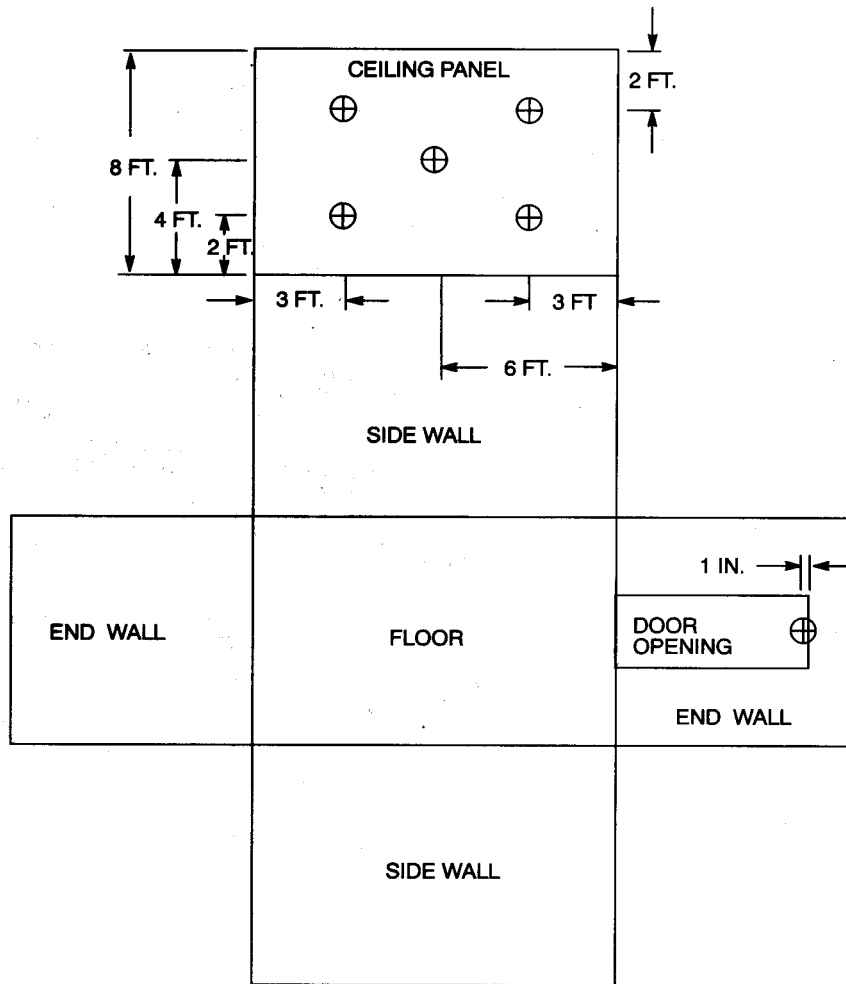
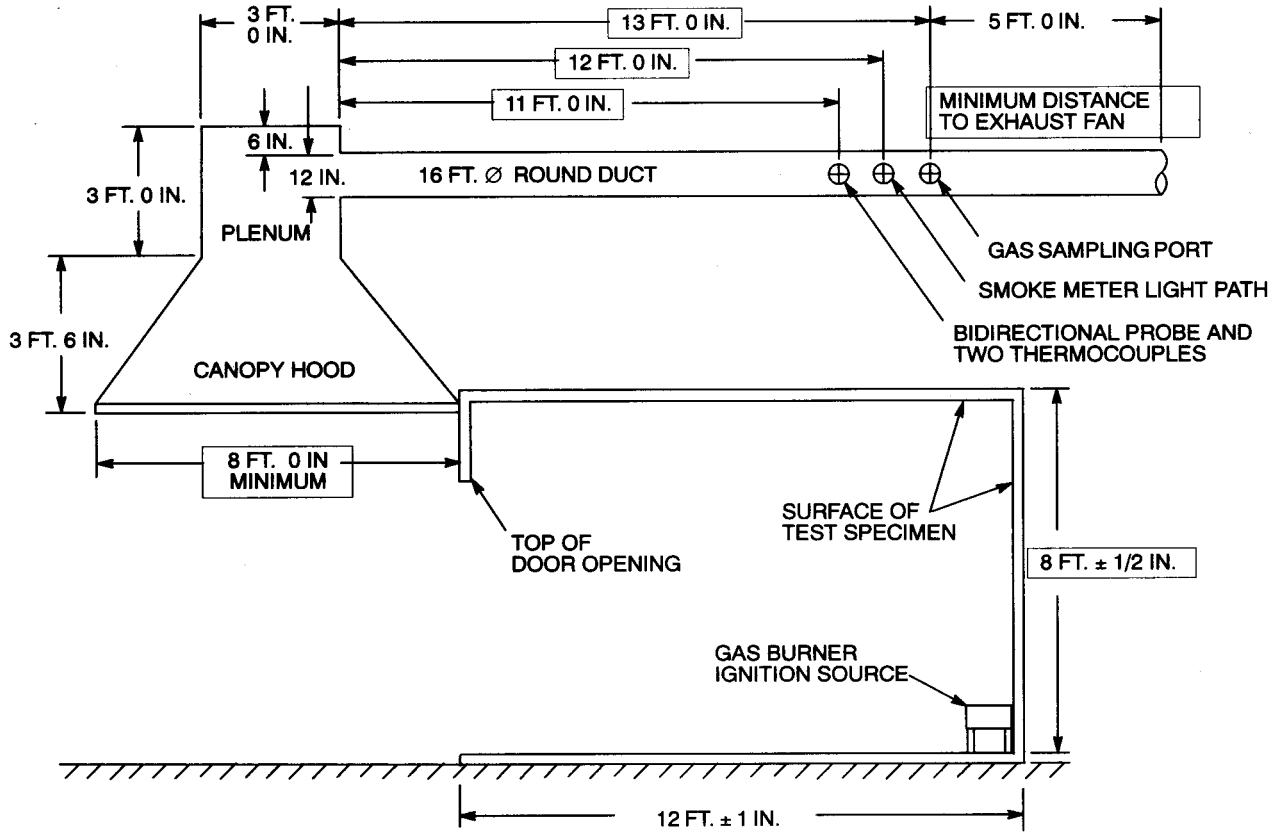


FIGURE 12-8-3—ROOM THERMOCOUPLE LOCATIONS

Note: Two 0.20 mil. Type K thermocouples at each location.



NOTES:

1. PLENUM HEIGHT MAY BE INCREASED UP TO 6 FT. TO ADJUST FOR BUILDING CONSTRAINTS.
2. SUPPORT FOR HOOD MUST NOT INTERFERE WITH AIR INFLOW TO ROOM.
3. THE EXHAUST SYSTEM MUST BE CAPABLE OF EXHAUSTING AT LEAST 5,000 SCFM. THIS MAY RESULT IN A FLOW OF UP TO 12,000 ACFM, DEPENDING ON DUCT GAS TEMPERATURE.

FIGURE 12-8-4—SECTION VIEW OF ROOM TEST APPARATUS

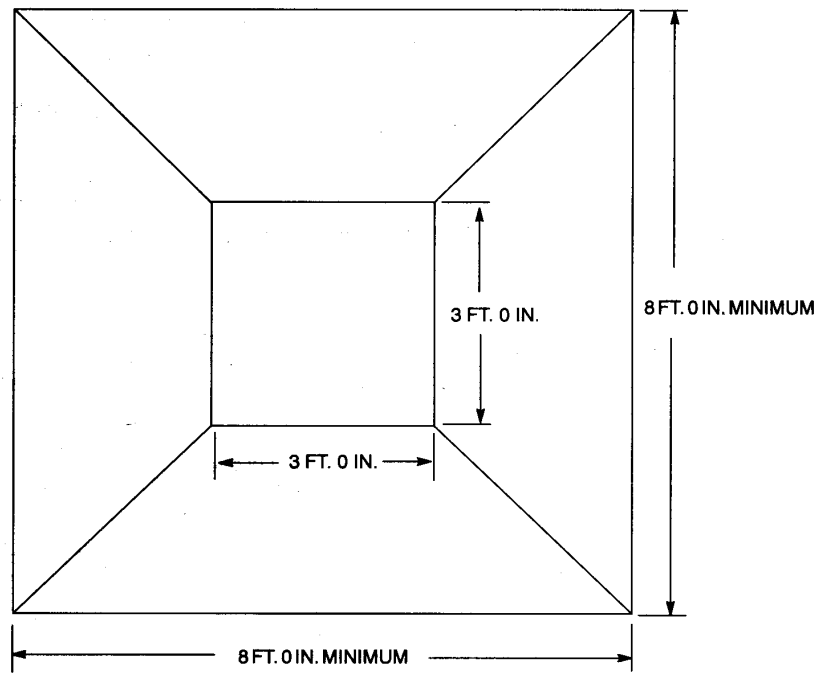


FIGURE 12-8-5—PLAN VIEW OF CANOPY HOOD

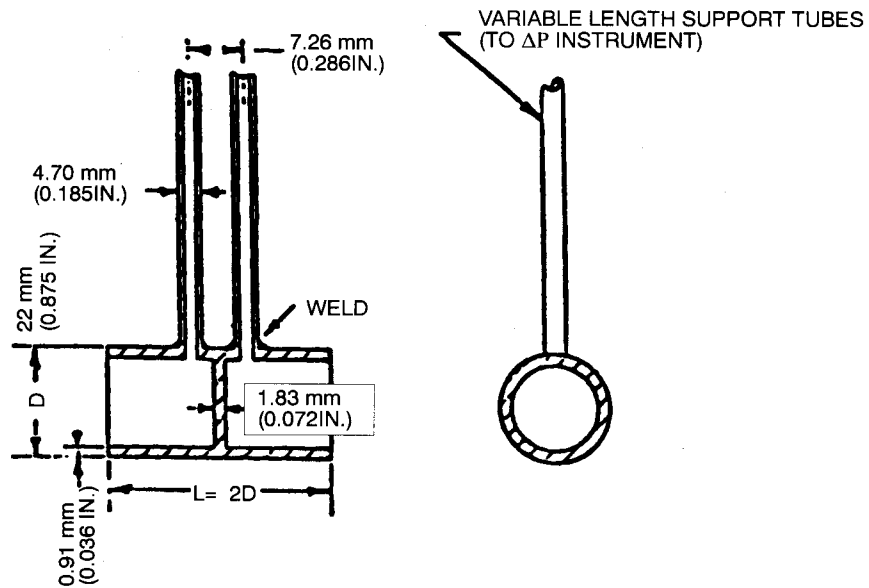


FIGURE 12-8-6—BIDIRECTIONAL PROBE

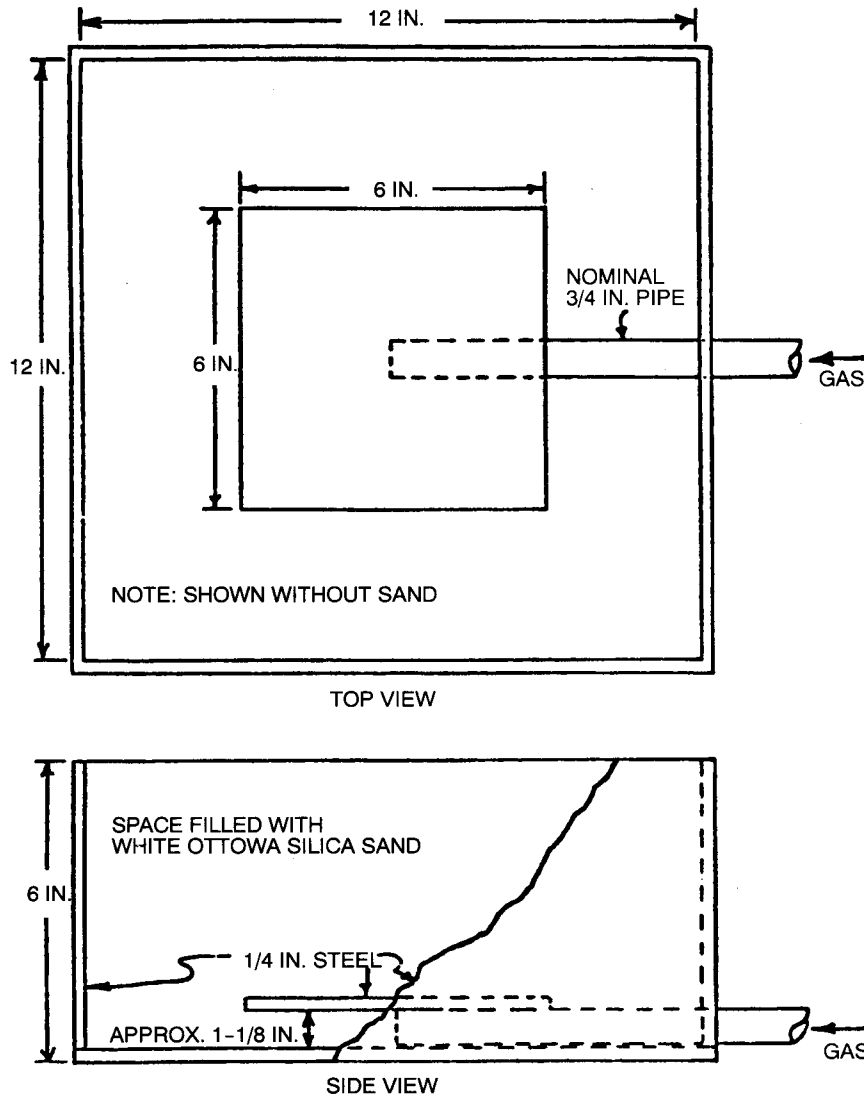


FIGURE 12-8-7—GAS BURNER

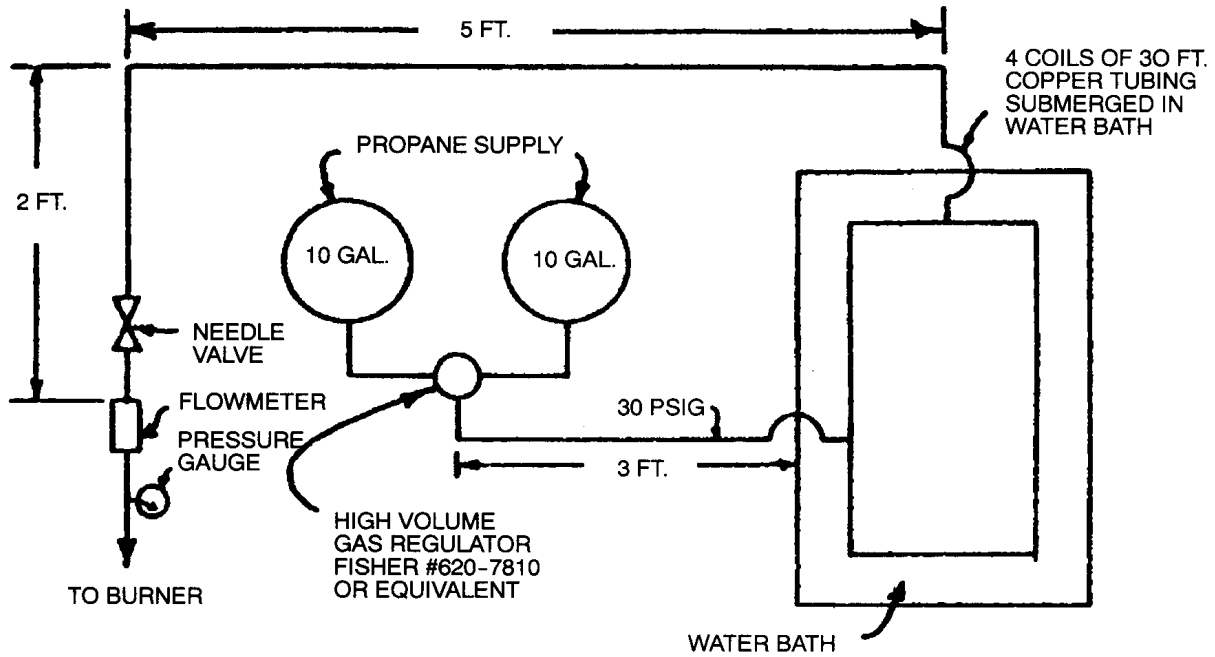


FIGURE 12-8-8—BURNER GAS FLOW CONTROL AND MEASUREMENT

APPENDIX 12-8-1A

CALCULATION OF THE TOTAL RATE OF HEAT AND CARBON MONOXIDE OR CARBON DIOXIDE PRODUCTION

The total rate of heat production is given by

$$\dot{Q} = E\phi X_{o_2}^0 V_A \quad (1)$$

where:

E = the heat release per volume of oxygen consumed, 467 Btu/ft.³

ϕ = the fraction of the oxygen consumed

$X_{o_2}^0$ = the ambient molar concentration of oxygen

V_A = the volume flow rate of air into the system corrected to 36°F (including that which enters the room and that which passes directly into the exhaust duct).

The oxygen depletion is given by

$$\phi = \frac{M_{o_2}^0 - M_{o_2}}{M_{o_2}^0} \quad (2)$$

where:

$M_{o_2}^0$ = the molar flow rate of oxygen into the system.

M_{o_2} = the molar flow rate of oxygen in the exhaust duct.

The concentrations of oxygen and carbon dioxide in the analyzers are given by

$$X_{o_2} = \frac{M_{o_2}}{M_{N_2}^0 + M_{o_2} + M_{co_2}} \quad (3)$$

$$X_{co_2} = \frac{M_{co_2}}{M_{N_2}^0 + M_{o_2} + M_{co_2}} \quad (4)$$

where:

$M_{N_2}^0$ = the molar flow rate of nitrogen into the system.

M_{co_2} = the molar flow rate of carbon dioxide in the exhaust duct.

It is assumed that all the water is trapped out and that the only gases passing through the analyzers are nitrogen, oxygen and carbon dioxide.

Combining Equations 3 and 4 to get

$$M_{co_2} = \frac{X_{co_2} M_{o_2}}{X_{o_2}}$$

and noting that

$$X_{o_2}^0 = \frac{M_{o_2}^0}{M_{N_2}^0 + M_{o_2}^0}$$

Equation 3 can be solved for M_{o_2} ,

$$M_{o_2} = \frac{M_{o_2}^0 [(X_{o_2}^0 / X_{o_2}^0) - X_{o_2}]}{1 - X_{o_2} - X_{co_2}} \quad (5)$$

which, when substituted into Equation 2, yields

$$\phi = \frac{X_{o_2}^0 - X_{o_2} / (1 - X_{co_2})}{X_{o_2}^0 [1 - X_{o_2} / (1 - X_{co_2})]} \quad (6)$$

The volumetric flow rate in the exhaust duct is given by

$$V_S = (1 - \phi) V_A + \phi V_A \quad (7)$$

where:

V_S = referred to standard conditions 68°F.

V_A = referred to standard conditions 68°F.

= the expansion factor, due to chemical reaction, of the air that is depleted of its oxygen.

$$= X_{N_2}^0 + bX_{o_2}^0 = 0.79 + 0.21b \quad (8)$$

where b is the ratio of the moles of combustion products formed to the moles of oxygen consumed. The value of ranges from 1.000 for carbon to 1.175 for cellulose with the plastics having values in between. In order to reduce the error incurred when unknown products are burning is taken to have an intermediate value of 1.084 which is exact for propane, the burner gas.

From Equation 7, the volumetric flow rate of air entering the system is

$$V_A = V_S / [1 + (-1)\phi] \quad (9)$$

Setting: = 1.084

E = 467 Btu/ft.³

$X_{o_2}^0$ = 0.21

Equation 1 becomes

$$\dot{Q} = \frac{E\phi X_{o_2}^0 V_S}{1 + (-1)\phi} = \frac{98.1\phi V_S}{1 + 0.084\phi} \text{ Btu/min.} \quad (10)$$

if V_S is in cfm referred to 68°F.

Setting $E = 17.4 \text{ MJ/m}^3$

$$\dot{Q} = \frac{3.65\phi V_S}{1 + 0.084\phi} \text{ MW} \quad (11)$$

where:

V_S = in m³/sec, and is determined from the flow measurement in the exhaust duct

ϕ = the oxygen depletion, which is obtained from Equation 6.

CALCULATION OF THE TOTAL RATE OF HEAT AND CARBON MONOXIDE OR CARBON DIOXIDE PRODUCTION

When the velocity is measured with a bidirectional probe and the Reynolds number correction is taken into account, the volumetric flow rate in m³/sec. in the duct under standard conditions is given by

$$V_s = 0.926kA [(2\rho/o) (T_o/T)]^{1/2} = 20.1kA \sqrt{\rho/T} \quad (12)$$

where:

0.926 = a suitable calibration factor for air velocities in excess of 3 ft./sec. in a 16-inch (406 mm) duct

k = the ratio of the average duct gas mass flow per unit area, as determined by measuring the velocity and temperature profiles across the stack, and the velocity and temperature at the center line where the bidirectional probe is located during the test

A = the cross-sectional area of the duct in m² at the location of the probe

ρ = the differential pressure measured with the probe in Pa

o = the density of air in kg/m³ at the reference temperature T_o in K

T = the duct gas temperature in K

The volumetric flow rate can be expressed in standard cubic feet per minute (scfm) at 60°F using common engineering units by

$$V_s = 8.38 \times 10^4 kA [\rho/(t + 459)]^{1/2} \text{ scfm} \quad (13)$$

where:

A = given in ft² and in. of water

ρ = given in ft² and in. of water

t = the duct gas temperature in °F.

The volume flow rate of CO in m³/sec. through the duct can be found from the formula

$$V_{co} = \frac{0.79V_s X_{co}}{(1 + 0.084\phi)(1 - X_{o_2} - X_{co_2} - X_{co})} \quad (14)$$

where:

X_{co} = the concentration of carbon monoxide measured in the analyzer.

This can be derived as follows

$$\frac{V_{co}}{V_A} = \frac{M_{co}}{M_{AIR}} = \frac{M_{co}}{M_{o_2}} = \frac{M_{o_2}}{M_A} \frac{M_{o_2}^0}{M_{o_2}^0} = \frac{X_{co} M_{o_2}}{X_{o_2} M_{o_2}^0} X_{o_2}^0 \quad (15)$$

where:

M_{CO} and M_A = the molar flow rates of carbon dioxide in the duct and of the air into the system including that flowing into the room and that entering the exhaust duct directly.

The ratio of the CO and O₂ concentration in the duct are the same as in the analyzer so that

$$\frac{M_{co}}{M_{o_2}} = \frac{X_{co}}{X_{o_2}} \quad (16)$$

When CO is present in the sampling line, Equation 5 becomes

$$M_{o_2} = M_{o_2}^0 \frac{(X_{o_2}/X_{o_2}^0) - X_{o_2}}{1 - X_{o_2} - X_{co_2} - X_{co}} \quad (17)$$

Equation 14 is obtained by combining equations 15, 16 and 17, letting

$$1 - X_{o_2}^0 = 0.79, \text{ and letting}$$

$$V_A = \frac{V_s}{1 - 0.084\phi}$$

When CO is not measured, but is removed from the sample line and CO is measured, ϕ and \dot{q} are calculated as follows

$$\phi = \frac{X_{o_2}^0 - (X_{o_2}/1 - X_{co})}{X_{o_2}^0(X_{o_2}1 - X_{co})} \quad (18)$$

$$\dot{q} = [\phi - ((E'' - E')/E')((1 - \phi)/2)(X_{co}X_{o_2})] E' X_{o_2} V_A (MW) \quad (19)$$

where:

$$E'' = 23.4 \text{ MJ/m}^3$$

$$E' = 17.4 \text{ MJ/m}^3$$

$$V_A = \text{m}^3/\text{sec.}$$

referred to a 68°F base. Thus, \dot{q} becomes

$$\dot{q} = [\phi - 0.345((1 - \phi)/2)(X_{co}/X_{o_2})] 17.4 X_{o_2}^0 V_A (MW) \quad (20)$$

When Equations 18 through 20 are used to calculate the rate of heat release, \dot{q} , the carbon dioxide must be removed from the sample streams flowing through the oxygen and carbon monoxide analyzers. The removal of carbon dioxide can be accomplished by passing the sample stream through a filter of either ascarite or an aqueous solution of sodium hydroxide.

APPENDIX 12-8-1B

GUIDE TO MOUNTING TECHNIQUES FOR WALL AND CEILING INTERIOR FINISH MATERIAL

GENERAL

Sec. 12-8-1B.1.

(a) **Basic.** This guide is intended as an aid in determining the method of mounting various building materials in the standard fire test room. These mountings are described for test method uniformity and good laboratory practice; they are not meant to imply restriction in the specific details of field installation. They are intended to be used for general material testing where the specific details of the field installation either have not been established or are so broad that any single installation method may not be representative of the full range of installation possibilities.

(b) **Mounting methods.** The suggested mounting methods are grouped according to building materials to be tested which are broadly described either by usage or by form of the material. For some building materials, none of the methods described may be applicable. In such cases, other means of attachment may have to be devised. Wherever possible, these specimens shall be mounted using the same method of attachment as that contemplated in the field installation.

(c) All backing materials, when used, shall be supported on a framed support system. A typical supporting framework is shown in Figure 12-8-1B-1.

(d) Whenever calcium silicate board or gypsum wallboard is specified as a backing substrate in subsequent paragraphs, the material shall be 0.5-inch-thick (13 mm) calcium silicate board supplied in 4 feet by 8 feet (1219 mm by 2438 mm) sheets with a density of 46 lb/ft³, or 0.625-inch-thick (16 mm) gypsum wallboard "Type X" supplied in 4 feet by 8 feet (1219 mm by 2438 mm) sheets with a density of 42.2 lb/ft³, and they shall be uncoated. Where metal screws in combination with washers and wing nuts are specified for fastening, they shall be standard 0.25-inch (6 mm) by 20 TPI round head steel machine screws, 0.25-inch (6 mm) by 20 TPI steel wing nuts and 2 inch (51 mm) O.D. by 0.044-inch-thick (1 mm) flat steel washers with a 0.281-inch (7 mm) I.D. hole. Fastening screws shall be installed as shown in Figure 12-8-1B-2. The fastening pattern is shown in Figure 12-8-1B-3 for rigid wall materials and Figure 12-8-1B-4 for flexible wall materials. The fastening pattern for all ceiling materials is shown in Figure 12-8-1B-5.

ACOUSTICAL MATERIALS AND OTHER BOARD MATERIALS

Sec. 12-8-1B.2.

(a) Depending on the type of field mounting required by the acoustical product, either wood furring strips or metal runners are to be used to support acoustical material.

(b) Wood furring strips for mounting acoustical materials and other board materials are to be nominal 1-inch by 2-inch (25 mm by 51 mm) wood furring strips and attached to a gypsum wall board substrate to approximately the field installation.

(c) Metal runners for mounting are to be attached to the 0.625-inch (16 mm) gypsum wallboard substrate to approximate the field suspension systems application.

BATT OR BLANKET-TYPE INSULATING AND OTHER FLEXIBLE MATERIALS

Sec. 12-8-1B.3. Batt or blanket and other flexible materials which do not have sufficient rigidity or strength to support themselves are to be supported by round head machine screws in combination with wing nuts and flat washers, as specified in Section 12-8-1B.1 (d), which are inserted through the material in such a way as to fasten the material to a substrate board.

BUILDING UNITS

Sec. 12-8-1B.4. Materials falling within this category include organic and/or inorganic materials formed or laminated into blocks, boards, planks, slabs or sheets of various sizes, thicknesses or shapes. If building units have sufficient structural integrity to support themselves, no additional mounting to a substrate board support is required. If the building units are of such construction as to require individual components and are not self-supporting, the component is to be fastened to the substrate board as specified in Section 12-8-1B.1 (d).

COATINGS OR SPRAY APPLIED MATERIALS

Sec. 12-8-1B.5.

(a) Coating materials, such as cementitious mixtures, mastic coatings, sprayed fibers, etc., are to be mixed and applied to the substrate board as specified in the manufacturer's instructions at the thickness, coverage rate or density recommended by the manufacturer.

(b) Materials intended for application to a wood surface are to be applied to a substrate made of 1 inch by 4 inches (25 mm by 101 mm) nominal "C" and better VG Douglas fir flooring (FSC 70 to 90) or to other species for which the surface burning characteristic is to be measured.

(c) Coating materials intended for application to particular combustible surfaces, but not wood, are to be applied to the specific surface for which they are intended. The coating material and combustible material are to be attached to the substrate board as specified in Section 12-8-1B.1 (d).

(d) Coating materials intended only for field applications to nonflammable surfaces are to be applied to 0.5 in calcium silicate board.

WALL COVERING MATERIAL

Sec. 12-8-1B.6. Wall coverings such as vinyl coatings, wall-paper, etc., of various types are to be mounted on 0.625-inch (16 mm) gypsum wallboard or on the actual substrate to which they are to be applied, using the adhesive and application technique specified by the manufacturer.

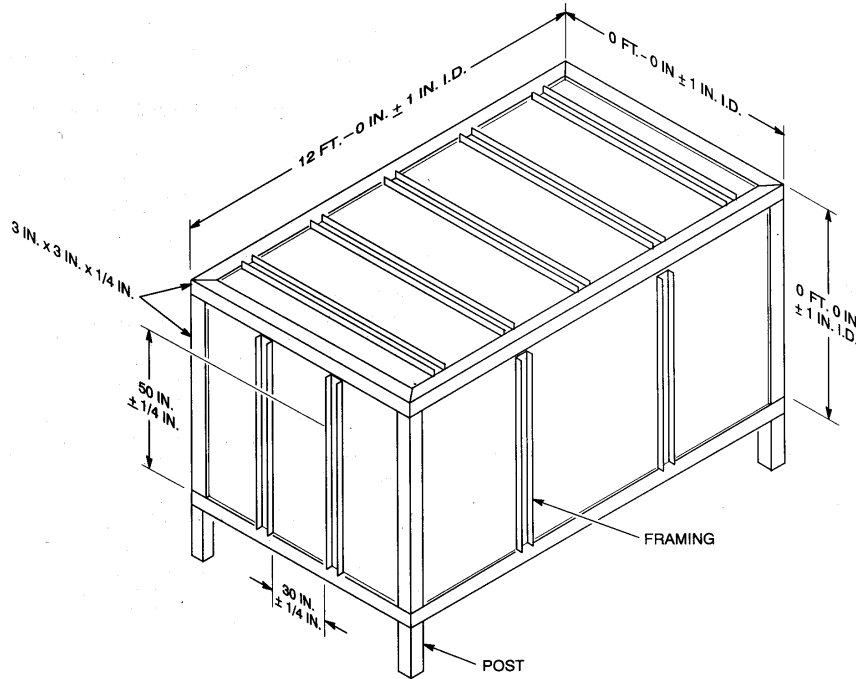


FIGURE 12-8-1B-1—TYPICAL STEEL FRAME SUPPORT SYSTEM

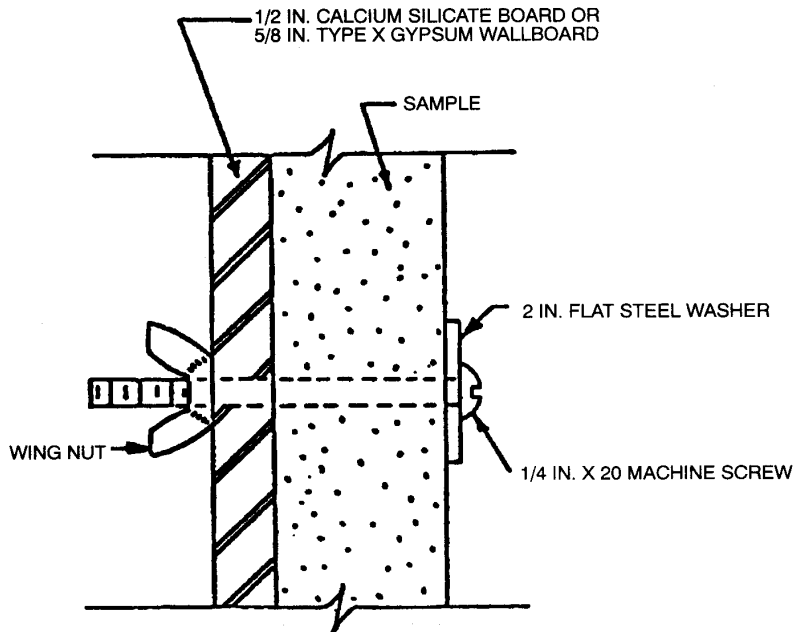


FIGURE 12-8-1B-2—MATERIAL FASTENING TECHNIQUE

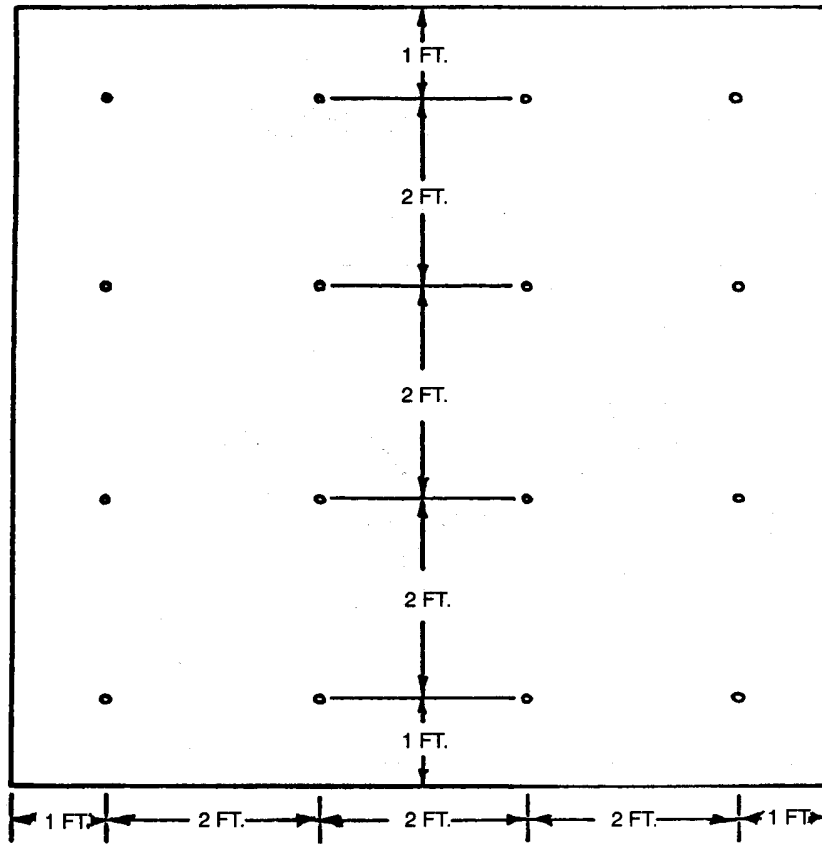


FIGURE 12-8-1B-3—TYPICAL MOUNTING TECHNIQUE FOR RIGID WALL MATERIALS

Note: When required, additional fasteners may be used to hold up the specimen flush to the wall.

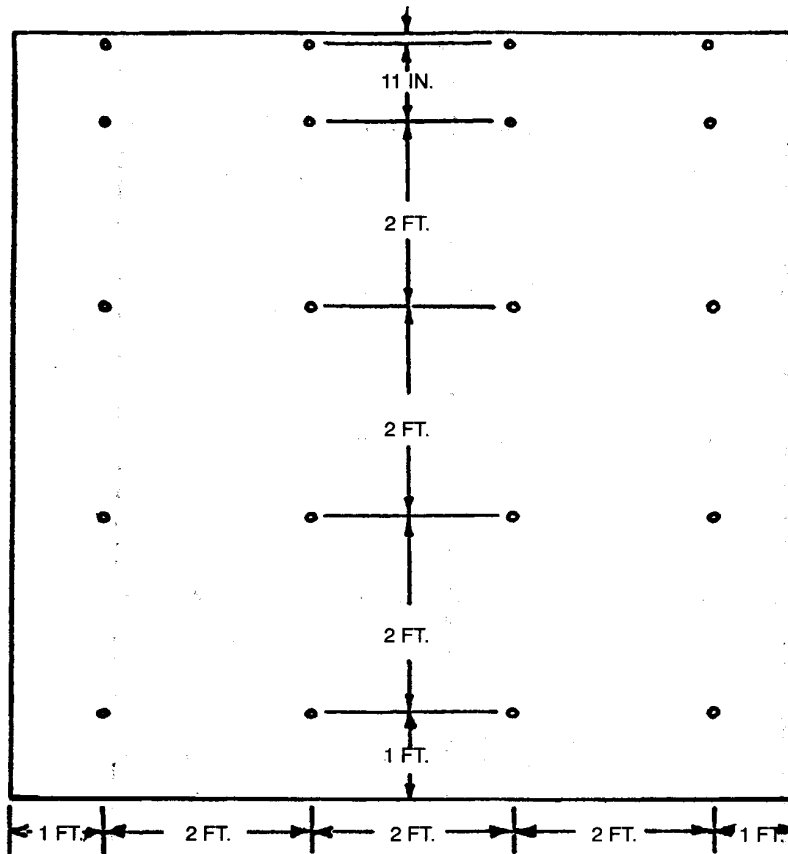


FIGURE 12-8-1B-4—TYPICAL MOUNTING
TECHNIQUE FOR FLEXIBLE WALL MATERIALS

Note: When required, additional fasteners may be used to hold up the specimen flush to the wall.

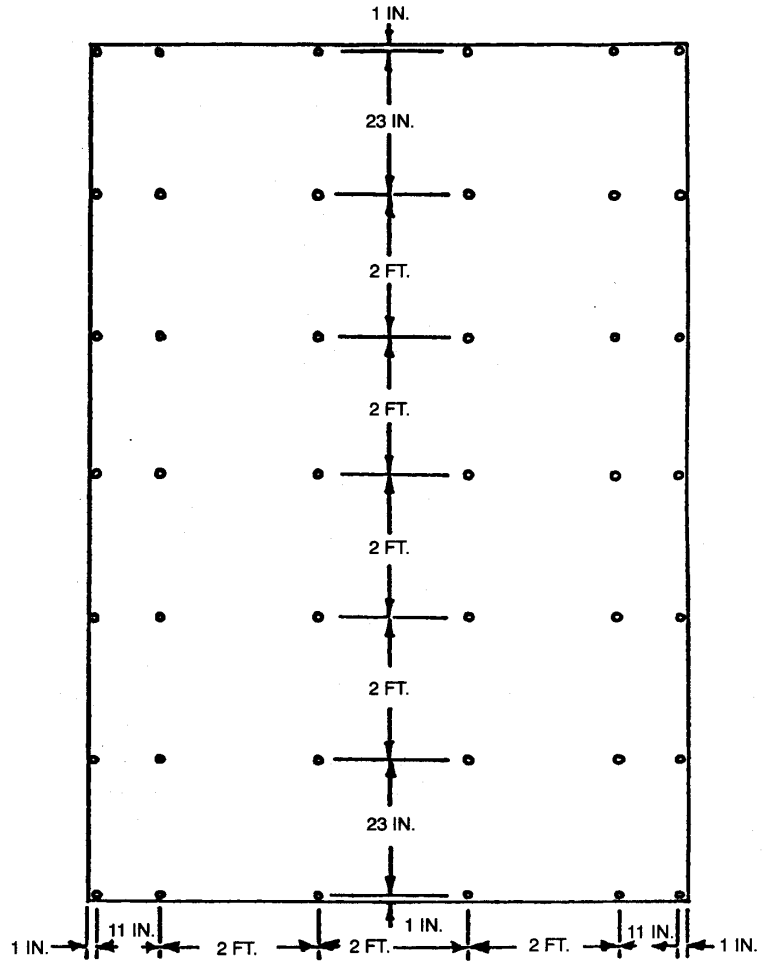


FIGURE 12-8-1B-5—TYPICAL MOUNTING TECHNIQUE FOR CEILING MATERIALS

CHAPTER 12-10-1

EXITS

POWER-OPERATED EXIT DOORS STANDARD 12-10-1

STATE FIRE MARSHAL SCOPE

Sec. 12-10-100.

(a) **General.** These requirements and methods of test apply to power operated: swinging doors, and combination sliding and swinging doors intended for installation in locations where conforming exits are required by Title 24, California Code of Regulations, Part 2, Chapter 10.

(b) Power-operated doors described in (a) may be provided with air, hydraulic or electric operators actuated from a floor, activating carpet, photoelectric device or other approved signaling device.

(c) **Alternates.** A product employing materials or having forms of construction differing from those described in this procedure may be examined and tested in accordance with the intent of these testing procedures and, if found to be substantially equivalent, may be recognized for listing.

(d) **Application.** The minimum design, construction and testing procedures set forth herein are those deemed as the minimum necessary to establish conformance to the regulations of the State Fire Marshal contained in Title 24, California Code of Regulations.

(e) **Fire door assemblies.** Power-operated doors intended for installation in openings where listed fire door assemblies are required, shall in addition to the requirements of this standard, be tested in accordance with the Fire Door Assembly Tests, SFM 12-7-4.

GENERAL

Sec. 12-10-101.

(a) **Panic hardware.** Power-operated doors intended for installation in openings where panic hardware is required shall be tested with listed panic hardware on the doors.

(b) **Glazed doors.** Glazing of doors shall conform to Title 24, California Code of Regulations, Part 2, Chapter 7.

(c) **Opening degree.** Where manually operated in the direction of egress, leaves of swinging doors or swing-out sections of sliding doors shall swing open to not less than 90 degrees from the closed position.

(d) **Locking mechanisms.** Locking mechanisms on doors intended for locations which do not require panic hardware shall be of a type readily identified as locked, and the doors shall be posted with durable, permanent signs reading "THESE DOORS TO REMAIN UNLOCKED WHENEVER THE PUBLIC IS PRESENT." Signs shall be 1-inch-high (25

mm) block letters on a contrasting background. Signs shall be located on the header framing.

(e) **Swinging and sliding doors.** Each swing-out leaf of swinging or sliding doors with swinging sections shall be provided with durable signs in not less than 1-inch (25 mm) block letters on contrasting background wording, "IN EMERGENCY, PUSH TO OPEN," or other approved wording. The sign shall be located at the closing edge of the door not less than 36 inches (914 mm) or more than 60 inches (1524 mm) above the floor. The sign shall read horizontally and be in two lines.

Illuminated exit signs when required by other provisions of the basic building regulations shall be installed above the header. Wiring and circuit arrangement shall conform to the provisions of the *California Electrical Code*.

(f) **Electrical wiring and devices.** Electrical wiring, electrical devices and controls shall be of a type tested and listed in conformance with the standards established by the *California Electrical Code*, or shall be tested for conformance with the testing procedures approved by the State Fire Marshal.

(g) **Testing.** Doors with power operators shall be examined and tested by a testing laboratory approved by the State Fire Marshal, or tests shall be conducted by a qualified independent fire protection engineer, acceptable to the State Fire Marshal.

(h) **Test report.** The test report shall contain engineering data and drawings; size and weight of door tested; wiring diagrams of electrical control systems; schematic drawings of mechanical controls; and operating manuals. The report shall describe the mechanical operation of the power operator in sequence as the door(s) open and close under normal and emergency conditions. The report shall set forth the tests performed in accordance with the provisions of this standard and the results thereof. The report shall additionally contain an analysis comparing each feature of the design against the performance test procedures contained herein.

(i) **Simulated installation and test equipment.** Doors with power operators shall be installed in a simulated wall and door framing assembly in accordance with the manufacturer's instructions. The test specimen shall be not less than 3 feet (914 mm) wide by 7 feet (2133 mm) high. A motor-driven or suitable mechanism shall be used to actuate the activating carpet. The rate of operation or number of cycles shall be 3 to 5 per minutes. On sliding doors with a swing-out section additional operating endurance tests shall be conducted. A motor-driven mechanism or other approved means shall be used to push the swinging door section open and pull the swinging section closed at a rate of 3 to 5 cycles per minute,

EXITS

so that the latching mechanism and disconnect switches operate as in service. During the test the door specimen shall have only the lubrication which is provided by the manufacturer at the factory, or as may be recommended by the manufacturer in his installation instructions.

(j) **Endurance tests.** The power operator shall function as intended to open and close the door(s) for 100,000 cycles of operation without failure or excessive wear of parts. The release mechanism and disconnect switches of the swinging section in sliding doors shall function as intended for 250 cycles of operation without failure or excessive wear of parts. The opening and closing forces, and the speed of opening and closing shall be recorded at the start of the endurance tests, and shall again be recorded at the end of the endurance tests. Opening and closing forces at the beginning and at the end of the endurance test shall not exceed the maximum forces prescribed in these procedures.

HISTORY:

1. Editorial correction (Register 71, No. 52 errata sheets).

SWINGING DOORS

Sec. 12-10-102.

(a) Each door opening when the door(s) is in the 90-degree open position, shall provide a clear opening width of not less than 28 inches (711 mm), with no single leaf less than 24 inches (609 mm) in width.

(b) **Doors in pairs.** Doors in pairs shall be equipped with a separate operator for each leaf unless tests with a tandem operator with one leaf jammed in a closed and in a partially open position indicates that the second leaf continues to operate or is free to swing into the open position without exceeding the maximum permitted manual opening pressures. On doors with mechanical controls, one mechanism shall be subjected to fault conditions; during the fault condition the second leaf shall be openable manually without exceeding the maximum permitted opening pressure.

(c) **Closing mechanism.** Normal closing of doors shall be by spring action, pressure-operated mechanism or electrically driven mechanism. The closing force measured at the closing stile shall not exceed 40 pounds at any point in the closing arc. The final 10 degrees of closing shall be not less than 1½ seconds.

(d) Each possible fault condition that affects the power supply shall be introduced into the door and power-operator assembly. Under each fault condition, single doors and each leaf of doors in pairs shall open to the 90-degree position with an applied pressure at the normal location at the push plate not exceeding 40 pounds.

(e) **In-swinging doors.** Power-operated in-swinging doors are not recognized in determining exit width opening required to swing in the direction of egress.

(f) **Activating carpets and safety mats.**

1. When carpets are used as the activating device, they shall have a width¹ not less than 10 inches (254 mm) less than the clear width of the door opening with the centerline of the carpet in the centerline of the door opening.
2. The length² of activating carpets shall be not less than 42 inches (1067 mm). The length of activating carpets for doors exceeding 42 inches (1067 mm) in width shall be not less than 56 inches (1422 mm).
3. Doors serving one-way traffic only shall be provided with a safety mat³ having a length not less than the width of the widest leaf.
4. Doors serving both egress and ingress shall have a series of joined carpets on the swing side of the door arranged as follows:
 - A. One safety carpet or mat nearest to the door at least as long as the width of the door leaf;
 - B. One or more activating carpets to provide a total carpet length on the swing side of not less than 2½ times the width of the widest door leaf.

HISTORY:

1. Editorial correction (Register 71, No. 52 errata sheets).

SLIDING DOORS

Sec. 12-10-103.

(a) **General.**

1. Sliding leaves of sliding doors shall be provided with swinging sections arranged to swing in the direction of egress when pressure is applied at the location of normal push plates or on the crossbar of panic hardware on doors where panic hardware is required.
2. Operation of the swinging section shall disconnect the sliding door power operator.
3. Permanent stops shall be provided to prevent double swing.
4. Location of the breakway tension adjustment, opening and closing speed adjustment, opening and closing snub speed adjustments, opening and closing power pressure adjustments, and similar controls shall be concealed and not readily accessible where they may be subject to tampering.
5. Doors shall be suspended from overhead track. Operators, control levers or mechanisms shall be guarded.

(b) **Closing mechanism.** The closing force of sliding doors at 24 inches (609 mm) of opening shall not exceed 30 pounds with a closing speed not in excess of 1.5 feet per second.

1 Width: Shall be measured between the exposed edges of the carpet tread surface excluding molded edge bevels or aluminum edge trim.

2 Length: Shall be measured from the centerline of the doors pivot to the exposed edge of the carpet tread surface excluding molded edge bevels or aluminum edge trim.

3 Safety Mat: A safety mat is one that will prevent the door from opening if there is pressure on the safety mat before pressure is applied to the activating mat, and one that will prevent the door from closing following normal door actuation until pressure on the safety mat is removed.

(c) **Opening width.** The minimum clear width of the door opening with the swinging section, or sections in the 90-degree open position shall be not less than 28 inches (711 mm) with no single leaf less than 24 inches (609 mm) in width.

(d) **Opening forces.** The swinging section in sliding doors shall swing open into the full open position when an opening force not exceeding 40 pounds is applied at the normal push plate location or on the crossbar of panic hardware.

(e) **Fault condition introduced.** Under each possible fault condition that affects the power supply with the sliding leaf or leaves retracted one-half the leaf width into its or their pocket(s) each swinging section shall open to the 90-degree position with an applied pressure at the normal location of the push plate not exceeding 40 pounds.

(f) **Sliding doors without swing-out section.** Power-operated sliding doors which are not provided with a swing-out section may be evaluated for conformance to the mechanical requirements and endurance tests provided in this standard. Power-operated sliding doors which are not provided with a swing-out section shall not be listed for use in locations where required exits are specified in Part 2, Title 24, California Code of Regulations.

(g) **Activating carpets, safety mats.** Activating carpets and safety mats shall conform to Section 12-10-102 (f).

MARKING

Sec. 12-10-104. The name of the manufacturer, or trademark by which the manufacturer can be readily identified, shall be legibly marked on the operating equipment where it can be seen after installation. The type, model number or letter designation identifying the product as a listed device shall be provided on a label attached in a location as indicated in its listing.

CHAPTER 12-10-2

EXITS

SINGLE-POINT LATCHING OR LOCKING DEVICES

STANDARD 12-10-2

STATE FIRE MARSHAL SCOPE

Sec. 12-10-200.

(a) **Builders hardware, exit doors.** These design requirements and testing procedures apply to builders hardware, single-point latches and locks, intended for use on required means of egress doors in other than Group R and M Occupancies with an occupant load of 10 or less. It is the intent that devices designed and tested in accordance with these procedures will develop data to enable the State Fire Marshal to determine the suitability of latches and locks on means of egress doors. Alternate designs and materials may be submitted with substantiating test data. If, after evaluation, devices are found to comply with the intent of these procedures, they may also be recognized for approval and listing by the State Fire Marshal.

(b) **Fire doors.** Builders hardware single-point latches and locks intended for use on doors bearing a fire-retardant classification shall also conform to the construction standards and performance tests specified in Fire Door Assembly Tests, SFM 12-7-4, Section 12-7-400.

(c) **Listing by approved listing agency.** Listing by an approved listing agency shall not be construed as necessarily indicating compliance in all respects with the requirements of these design requirements and test procedures for single-point latching or locking devices. The test report of the approved listing agency may be filed for review and after evaluation, if it is found to provide evidence of conformance, the single-point latching or locking device may be recognized for approval and listing.

(d) **Definitions.**

1. **Inside knob.** Inside knob means the knob, lever, bar or paddle on the side of the door which must be turned or depressed to unlatch or unlock the door to permit egress.
2. **Outside knob.** Outside knob means the knob on the corridor side of room to corridor doors, or the knob on the exterior side of a door leading to the exterior.

INSTRUCTIONS

Sec. 12-10-201. Approved installation instructions shall be provided by the manufacturer. Instructions shall be illustrated and shall include directions and information adequate to ensure proper and safe installation of the device.

DESIGN

Sec. 12-10-202.

(a) **Finish.** Builders hardware shall have a smooth finish with no sharp or burred edges. Knobs may be knurled or have an abrasive finish for ease of turning or identification as may be required. Strikes shall be plain with curved lip. Strike and lip extending beyond jamb have rounded corners.

(b) **Knob, lever or “T” handle actuated.** Single-point latch bolts and/or dead bolts shall be retracted from the strike to release the door by a knob, lever or “T” handle with not to exceed $\frac{1}{4}$ turn. A thumb piece or thumb turn is not acceptable for this purpose.

(c) **Tested design.** Builders hardware single-point latching or locking devices shall be designed to retract the latch bolt and/or dead bolt after application of the horizontal forces and the endurance tests without exceeding the releasing torque specified in 12-10-204 (h).

(d) **Knobs.** Knobs shall have a minimum diameter of 2 inches (51 mm) and a maximum diameter of $2\frac{3}{4}$ inches (70 mm).

(e) **“T” handle.** “T” handles shall be oval-shaped and have minimum dimensions of $1\frac{3}{4}$ inch by 1 inch (44 mm by 25 mm) at center portion with $1\frac{1}{4}$ inch (32 mm) projection.

(f) **Levers.** The lever of lever actuated latches or locks shall be curved with a return to within $\frac{1}{2}$ inch (13 mm) of the door to prevent catching on the clothing of persons during egress.

(g) **Self-releasing knob.** The inside knob shall be free at all times. Any locking, stopworks or shut-out mechanism shall not prevent retracting the latch bolt or dead bolt to release the door by turning of the inside knob, or “T” handle, or depressing the inside lever, bar or paddle.

(h) **Dead bolt operation.** Operation of the inside knob shall retract both latch bolt and dead bolt simultaneously. The opening in the strike shall be of such dimensions that when the flat of the latch bolt is forced against the edge of the latch hole there shall be no pressure against the side of the dead bolt.

(i) **Springs.** Retraction of the latch bolt and/or dead bolt shall not depend on springs.

(j) **Backset.** Backset shall be not less than $2\frac{3}{4}$ inches (70 mm) or more than 5 inches (127 mm).

(k) **Throw.** Latches shall have a minimum latch throw of $\frac{1}{2}$ inch (13 mm). Latches intended for use on fire endurance

EXITS

rated doors shall also conform to the requirements of SFM 12-7-4, Section 12-7-400, Fire Door Assembly Tests.

(l) **Roller latches.** Roller latches intended for use on room to corridor doors shall have a minimum projection of $\frac{3}{8}$ inch (9.5 mm) excluding any coating or sound deadening material. Stops or staking shall be provided to provide a minimum projection of $\frac{1}{8}$ inch (3 mm). Spring design shall be such as will require an opening force of 20 pounds when the roller projects $\frac{3}{16}$ inch (72 mm) in a door and frame with $\frac{1}{8}$ -inch (3 mm) jamb clearance. Adjustment of the roller projection shall not be possible from the front of face plate.

CONSTRUCTION MATERIALS

Sec. 12-10-203.

(a) **Cases, interior working parts.** Cases, latch or lock enclosures, and interior working parts shall be of brass, bronze, steel, monel, stainless steel or of materials equivalent in mechanical strength to brass or bronze. Cases of mortise locks may be of cast iron.

(b) **Latch bolts, strikes.** Latch bolts and strikes shall be of brass, bronze, monel, stainless steel or materials equivalent in mechanical strength having corrosion resistance equivalent to brass or bronze.

(c) **Corrosion resistance.** Cases, enclosures and internal working parts shall have corrosion resistance equivalent to cadmium plating not less than 0.00015 inch (0.004 mm) thick or zinc plating not less than 0.0004 inch (0.01 mm) thick, or processed to give equal corrosion resistance as determined by comparison in salt fog atmosphere per ASTM Method B-117.

(d) **Nonmetallic materials.** Nonmetallic materials may be used as coatings or for wearing surfaces, rollers and finishes, and antifriction inserts, or for similar purpose if the material otherwise conforms to these requirements.

(e) **Springs.** Component springs used in the assembly of a latch or lock shall be of material having spring properties equivalent to stainless steel conforming to ASTM A313.67.

ENDURANCE AND PERFORMANCE TEST PROCEDURES

Sec. 12-10-204.

(a) **Testing laboratory.** Tests shall be conducted at a testing laboratory approved by the State Fire Marshal, or tests shall be conducted by a qualified independent fire protection engineer, acceptable to the State Fire Marshal, in testing facilities acceptable to the State Fire Marshal.

(b) **Report.** The test report shall include a detailed description of the latch or lock and its intended function; engineering data, shop drawings and photographs; identification of materials as to source, composition, strength and corrosion resistance; the physical or chemical tests including dimensions of parts before and after the endurance tests establishing conformance of materials. The report shall include the manufacturer's installation instructions. The report shall be verified by the laboratory or fire protection engineer responsible for the conduct of the test. The test report and evidence of listing by an approved listing agency

may be provided for the applicable portions of these endurance and performance test procedures. Test reports prepared for other governmental agencies may be utilized to the extent that the test procedures contained herein have been duplicated.

(c) Test latches or locks.

1. **Samples.** Samples of the test latch or lock shall be selected by the testing agency or fire protection engineer at random from the manufacturer's current production runs. The types tested shall be considered to represent, for purposes of approval and listing, all lock types of a series, except that when there are variations of basic mechanical design and/or materials for mechanical parts, each variation shall be tested for compliance with the minimum performance test procedures.

2. **Modifications in design or test procedure.** Devices involving dead-locking bolts, lever handles, shear pins in the outside knob or other variations in design may require modifications in the test procedure in order to simulate the intended in-service conditions. Requests for modifications in the design and test procedures shall be filed for evaluation and approval by the State Fire Marshal before proceeding with the test.

(d) Test equipment.

1. **Static loading.** The static loading apparatus used for the torque loading, axial load, vertical load and releasing torque tests shall consist of frame, test door and test block as detailed in Figure 12-10-2-1. Except as shown, materials shall be of steel, welded or bolted. The test apparatus may be of alternate design and construction having equivalent or greater rigidity.

2. **Endurance test.** Apparatus for the endurance test shall consist of frame and test door as shown in Figure 12-10-2-2. An alternate design having equivalent or greater rigidity may be utilized. Alternate designs utilizing components of greater dimensions or greater rigidity may affect details of the approval and listing.

3. **Test equipment.** Torque wrenches, spring scales, hydraulic or pneumatic pressure scales, or other instruments shall be calibrated in an approved manner.

(e) **Torque loading test.** Each latch or lock shall be installed in a $\frac{1}{4}$ -inch (44 mm) thick test block in accordance with the manufacturer's installation instructions. The test block shall be installed in the static loading test fixture. The torque load shall be applied to the inside door knob or lever. The knob or lever shall be turned or depressed to fully retract the latch bolt or dead bolt before application of the torque load. The applied torque load shall be 300 inch-pounds. After removal of the torque load the latch shall automatically return to its latch position, the dead bolt shall be extended to its locked position.

Subsequent hand turning of the knob or depressing the lever shall retract the latch or dead bolt. Three representative

latches and/or locks shall be tested and there shall be no failures.

(f) **Axial load.** Each latch or lock shall be installed as described in Section 12-10-204 (e). A hydraulic loading device or load dynamometer shall be applied first to the outside knob and then to the inside knob or lever so that the force applied to the knob or lever is in line with the axis of the spindle. The axial load applied alternately to the outside knob and inside knob or lever shall be 500 pounds. Neither knob nor lever shall pull off under the axial load. Three representative latches and/or locks shall be tested and there shall be no failures.

(g) **Vertical load test.** Each latch or lock shall be installed as described in Section 12-10-204 (e). Each latch or lock shall be subjected to a vertical downward force applied perpendicular to the spindle axis through a sling which shall conform to the knob shape. A vertical downward force of 350 pounds shall be applied first to the outside knob and then to the inside knob or lever. Neither knob nor lever shall break off under the downward force. Three latches or locks shall be tested and there shall be no failures.

(h) **Releasing torque test.** A latch or lock set shall be installed as described in Section 12-10-204 (e). A hydraulic or pneumatic loading device shall be used to apply a horizontal force of 50 pounds against the latching edge of the test block 3 inches (76 mm) above and in the vertical center of the latch or lock spindle in such a direction that the flat of the latch bolt is forced against the edge of the latch hole in the strike. After not less than 25 unlatchings under the above-prescribed load not more than 30 inch-pounds of torque on the inside knob in either direction or 15 pounds of downward pressure on an inside lever shall be required to retract the latch bolt. After 100,000 cycles of the endurance test as described in Section 12-10-204 (i), the torque or downward pressure necessary to retract the latch bolt shall not exceed the above-prescribed limits.

(i) **Endurance test.** Five latches or locks shall be subjected to an accelerated endurance test as provided in this subsection. The locks shall be installed in the door of the endurance testing apparatus in accordance with the manufacturer's installation instructions. The latch or lock shall be operated to retract the latch, open the door, and close the door at a rate of approximately 10 cycles per minute. A cycle shall consist of the following:

1. Turn the inside knob to retract the latch bolt.
2. Open the door after the latch bolt is restricted to clear the strike.
3. Release the knob allowing the latch bolt to return to its extended position by action of its own spring.

After insertion of the latches or locks in the test door the torque in inch-pounds necessary to fully retract the latch bolts shall be recorded. The torque shall be the average recorded for the five latches or locks. Each sample shall be subjected to 800,000 operating cycles as described above. Each latch shall continue to extend itself per cycle 3 above throughout the test. At the end of the endurance test the torque to retract the latch bolts of any four latch bolts shall not exceed two times the initial average torque. If two latches fail to operate suc-

cessfully at the end of the test or the torque of any four latches exceeds two times the initial average torque, an additional five latches or locks shall be subjected to the endurance test and the torque of any seven latches shall not exceed two times the initial average torque.

(j) **Roller latches.**

1. **Fire test.** Roller latches shall be installed in a composite test fire door in accordance with the manufacturer's installation instructions and subjected to the fire test as described in SFM 12-7-4, for a period of 30 minutes. The latch shall be adjusted to an opening pressure of 20 pounds applied to the closing edge immediately above the latch. Throughout the test the latch shall require an applied pressure of 20 pounds to open the door.
2. **Endurance test.** Five samples of the roller latch shall be subjected to the endurance test as described in Section 12-10-204 (i). The latch shall continue to extend the roller throughout the test without any failure. The opening pressure at the end of the test shall not be less than 15 pounds.
3. **Installation.** Doors utilizing roller latches shall be installed in doors hung in steel frames only. Frame jambs shall be anchored to the floor to prevent spreading of the jambs. In other than concrete fill floors the jambs shall be anchored to a steel sill or steel floor plate extending between the jambs to prevent spreading of the frame. Horizontal bracing shall be provided in the wall in back of the strike.

THICKNESS OF COATINGS TESTS

Sec. 12-10-205. The thickness of cadmium, zinc or bronze plated coatings applied for corrosion resistance may be determined by either of the following methods:

1. Cross sections of coated samples cut at 90 degrees exposed edges polished and thickness measured with a suitable microscope and scale.
2. Dropping test of a suitable reagent at a definite rate until coating is penetrated. The thickness is calculated from the known characteristics of the reagent at the observed temperature and time required for the end point to appear.

Thickness testing shall not apply to other processes having equal corrosion resistance; acceptance shall be determined by comparison in salt fog atmosphere per ASTM Method B-117.

MARKING

Sec. 12-10-206. The name of the manufacturer, or trademark by which the manufacturer can be readily identified, shall be legibly marked on the latch or lock where it can be seen after installation. When the manufacturer produces similar devices, the type, model number or letter designation identifying the listed product shall be legibly marked on the latch or case. Such identification may be an approved marking or label on the case.

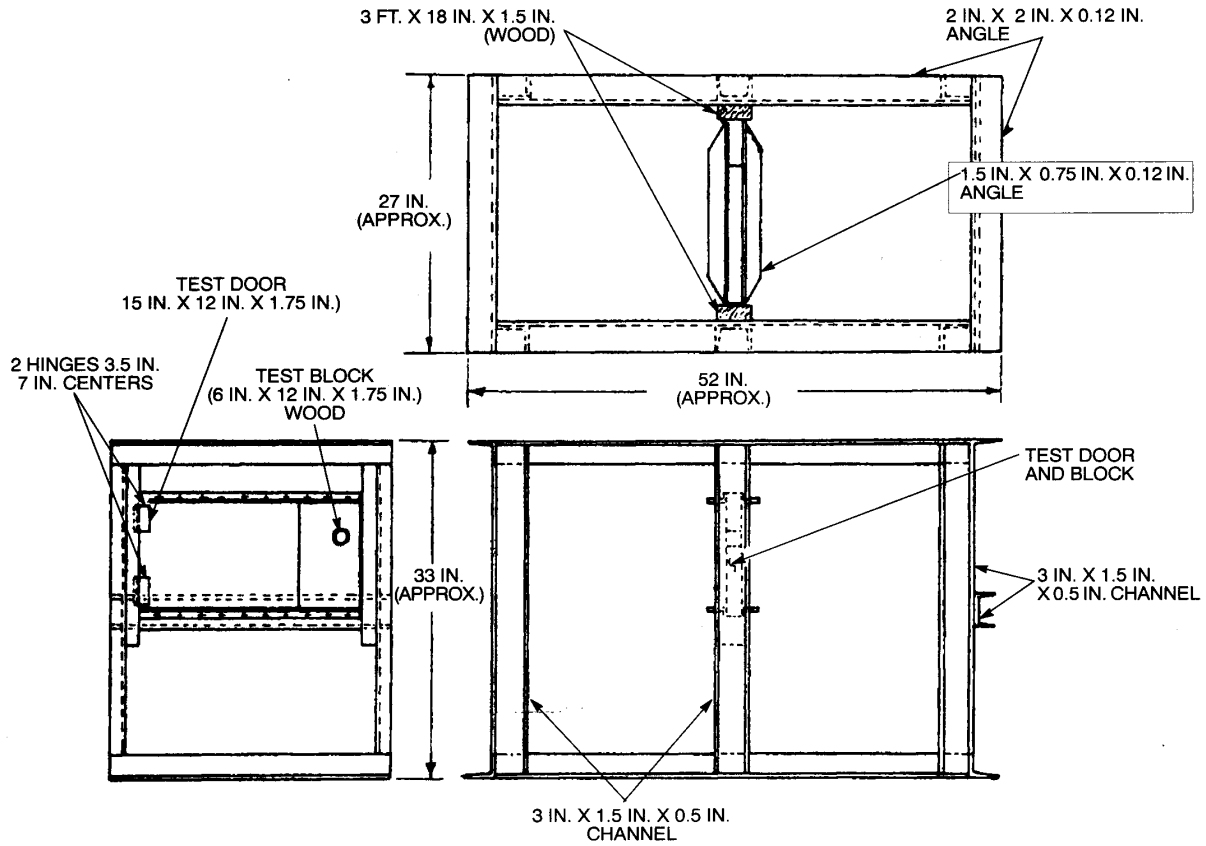


FIGURE 12-10-2-1—STATIC LOADING FIXTURE

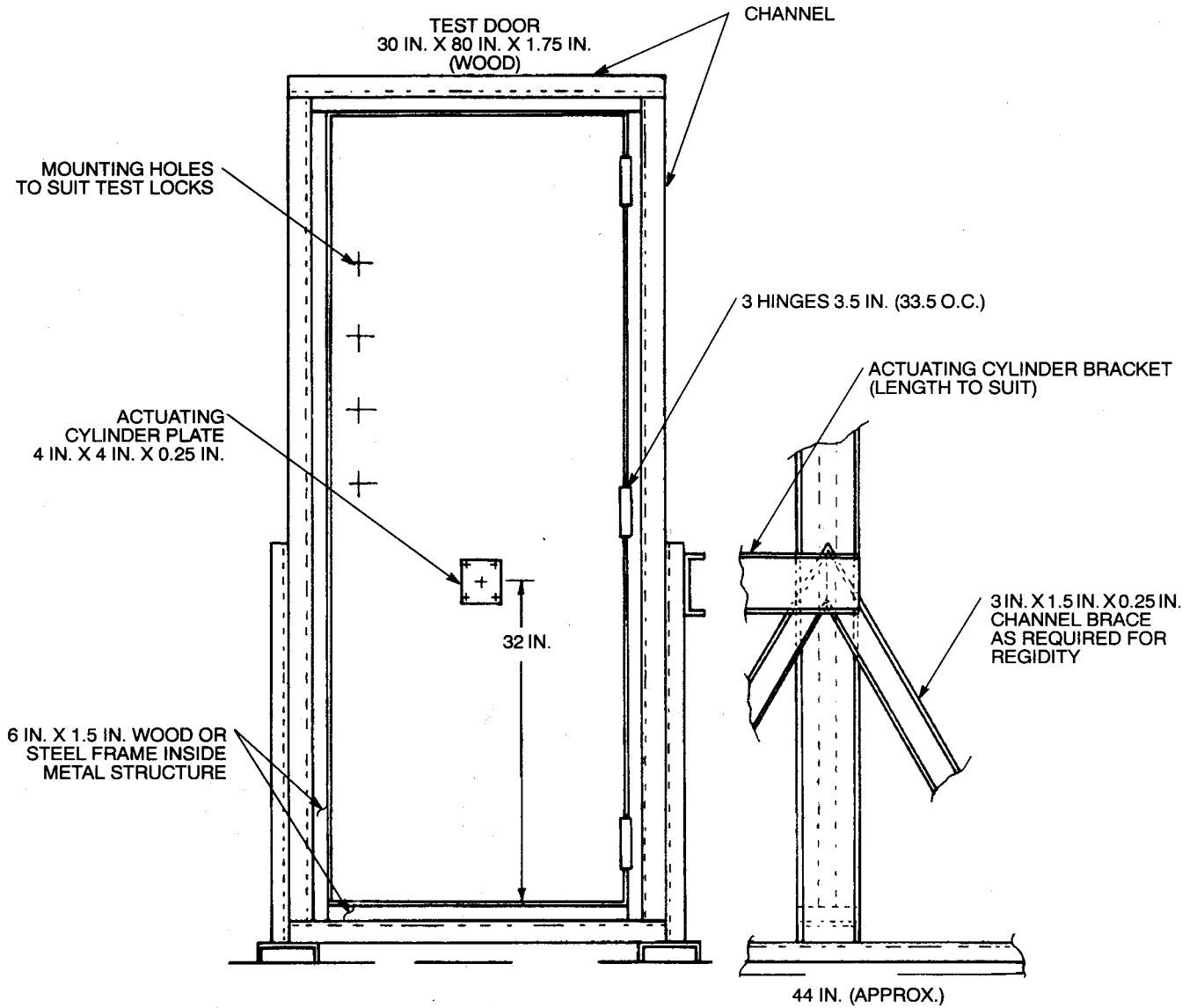


FIGURE 12-10-2-2—ENDURANCE LIFE TESTING APPARATUS

CHAPTER 12-10-3

EXITS

EMERGENCY EXIT AND PANIC HARDWARE STANDARD 12-10-3

STATE FIRE MARSHAL SCOPE

Sec. 12-10-300.

(a) **Exit door hardware.** These requirements and methods of test apply to releasing devices actuated by a crossbar for outward-opening doors intended for use on exit doors.

(b) **Fire-exit hardware.** Releasing devices intended for use on doors bearing a fire-retardant classification shall also conform to the construction standards and performance tests specified in Fire Door Assembly Tests, SFM 12-7-4, Section 12-7-400.

(c) **Listing by approved listing agency.** Listing by an approved listing agency shall not be construed as necessarily indicating compliance in all respects with the requirements of these Construction Standards and Performance Tests for Emergency Exit and Panic Hardware. The test report of the listing agency may be filed for review and after evaluation, if it is found to provide evidence of conformance, the releasing device assembly may be recognized for approval and listing.

INSTRUCTIONS

Sec. 12-10-301. Approved installation instructions shall be provided by the manufacturer. Instructions shall be illustrated and shall include directions and information adequate for obtaining proper and safe installation of the equipment.

DESIGN

Sec. 12-10-302.

(a) **Releasing pressure.** Exit panic hardware mechanisms shall be designed to release the door latch or latches when pressure not to exceed 15 pounds is applied at any point along the cross-bar perpendicular to the door in the direction of exit travel. The cross-bar shall extend across not less than one-half the width of the door.

(b) **Locking device.** A locking device employed as part of the mechanism shall not prevent release of the door latch or latches when pressure of not to exceed 15 pounds is applied to the cross-bar in the direction of exit travel.

(c) **Dead locking bolt.** A dead locking bolt shall not be provided as a part of the mechanism unless it is released and retracted, and does not prevent release of the door latch or latches, or release of the door to swing outward when pressure not to exceed 15 pounds is applied to the cross-bar in the direction of exit travel.

(d) **Cross bar.** The ends of the cross-bar shall be curved, guarded or otherwise designed to prevent catching on the clothing of persons during egress.

(e) **Springs.** The release mechanism shall not depend on springs to release or retract the door latch or latches, locking mechanism, dead bolt or vertical rods.

(f) **Dogging devices.** Exit panic hardware mechanisms shall not be equipped with any locking or dogging device, set screw or other arrangement which can be used to prevent release of the door latch or latches, locking device or dead locking bolt when pressure is applied to the cross-bar.

CONSTRUCTION MATERIALS

Sec. 12-10-303.

(a) **Strength.** The materials used in the assembly of a releasing mechanism shall have mechanical strength equivalent to brass or bronze to perform their intended function.

(b) **Springs.** Component springs used in the assembly of a releasing mechanism shall be of material having spring properties equivalent to stainless steel conforming to ASTM A313-67.

(c) **Corrosion resistance of moving parts.** Moving parts in the releasing mechanism assembly shall have corrosion resistance equivalent to 300 series stainless steel, or shall show no visual signs of corrosion after being subjected to a salt fog atmosphere per ASTM B117 for a period of 120 hours.

(d) **Nonmoving parts.** Nonmoving parts, cases and similar parts shall be of materials, or shall be coated to provide corrosion protection equivalent to 0.0005-inch-thick (0.01 mm) cadmium coated steel as determined by comparison in salt fog atmosphere per ASTM B117 for a period of not less than 16 hours.

(e) **Galvanic action.** Coated or uncoated metals used in the assembly of releasing mechanisms shall not be used in combination such as to cause detrimental galvanic action which may adversely affect the function of any part of the assembly.

(f) **Nonmetallic materials.** Nonmetallic materials may be used as coatings for wearing surfaces, rollers, finishes or for similar purposes if the materials otherwise conform to these requirements.

ENDURANCE AND PERFORMANCE TESTS**Sec. 12-10-304.**

(a) **Testing laboratory.** Tests shall be conducted at a testing laboratory approved by the State Fire Marshal, or tests shall be conducted by a qualified independent fire protection engineer, acceptable to the State Fire Marshal in test facilities acceptable to the State Fire Marshal.

(b) **Report.** The test report shall include a detailed description of the releasing mechanism and its intended function; engineering data, shop drawings and photographs; identification of materials as to source, composition, strength and corrosion resistance; the physical or chemical tests including dimension of parts before and after the endurance tests establishing conformance of materials. The report shall include copies of the manufacturer's installation instructions. The report shall be verified by the laboratory or fire protection engineer responsible for the conduct of the test. The test report and evidence of listing by an approved listing agency may be provided for the applicable portions of these endurance and performance tests.

(c) **Test equipment.** The releasing mechanism shall be applied on a suitable door hung on heavy duty ball bearing butts or pivots installed in a suitable metal frame in accordance with the manufacturer's instructions. A motor-driven mechanism shall be used to actuate the cross-bar so as to release the latches or dead-locking bolts, push the door open and jerk the door shut so that the latches or dead-locking bolts operate as in service. The rate of operation or number of cycles shall be approximately ten per minute. For the test the assembly is to have only the lubrication which is provided at the factory or as recommended by the manufacturer in his installation instructions.

Note: Mechanisms involving dead-locking bolts may require modification in the test procedure in order to simulate the intended in-service condition. Modifications in the test procedure shall be filed for evaluation and approval before proceeding with the test.

(d) **Releasing pressure.** The motor-driven mechanism shall be arranged to apply not to exceed 15 pounds pressure against the cross-bar to release the door latch(es) or dead-locking bolts before the door is pushed open.

(e) **Cycle test.** The release mechanism and latches or dead-locking bolts shall function as intended for 100,000 cycles of operation without failure or excessive wear of the parts.

EMERGENCY OPERATION TEST**Sec. 12-10-305.**

(a) **Releasing pressure.** The release mechanism shall be so designed that a horizontal force of 50 pounds or less will actuate the release bar and latches or dead-locking bolt when the latched or locked door is subjected to outward pressure as described in Sections 12-10-305 (c) and (d). The horizontal force shall be applied at any point along the cross-bar perpendicular to the door in the direction of swing.

(b) **Test specimen.** The test specimen for the emergency operation test shall be the sample which has been previously subjected to the cycle test specified in Section 12-10-304.

(c) **Testing instrument.** The horizontal force applied to the cross-bar shall be measured with a calibrated spring scale or other approved means.

(d) **Outward pressure, single door.** A hydraulic loading device or load dynamometer shall be used to apply a horizontal force of 250 pounds against the latching edge in the direction in which the door opens. The thrust load shall be applied to the stile immediately above the latching mechanism.

(e) **Outward pressure, double doors.** A hydraulic loading device or load dynamometer shall be used to apply a horizontal force of 250 pounds against the lock stile of each door of doors in pairs 2 inches (51 mm) in from the edge at midpoint between top and bottom of each door leaf in the direction of door swing.

(f) **Release bar deformation.** The cross-bar on a 36-inch (914 mm) wide door shall not be permanently set or deformed in excess of $\frac{1}{4}$ inch (6 mm), by the test; a spacing of at least 1 inch (25 mm) is to be provided and maintained between the cross-bar and the face of the door when the horizontal force is applied against the cross-bar.

MARKING

Sec. 12-10-306. The listee's name (or approved symbol), type or model designation shall be plainly marked on the releasing assembly. Devices and assemblies which are not listed by an approved listing agency for the intended purpose shall bear a label or other identifying markings as approved by the State Fire Marshal.

CHAPTERS 12-11A AND 12-11B

BUILDING AND FACILITY ACCESS SPECIFICATIONS

Detectable warning products and directional surfaces installed after January 1, 2001, shall be evaluated by an independent entity, selected by the Department of General Services, Division of the State Architect-Access Compliance, for all occupancies, including transportation and other outdoor environments, except that when products and surfaces are for use in residential housing evaluation shall be in consultation with the Department of Housing and Community Development. See Government Code Section 4460.

PRODUCT APPROVAL FOR DETECTABLE WARNING PRODUCTS AND DIRECTIONAL SURFACES

SCOPE

Sections 12-11A.202 and 12-11B.202. These requirements and test methods apply to detectable warning products and directional surfaces.

DETECTABLE WARNING PRODUCTS

Sections 12-11A.203 and 12-11B.203. Must comply with the California Code of Regulations, Title 24.

DIRECTIONAL SURFACES

Sections 12-11A.204 and 12-11B.204. Must comply with the California Code of Regulations, Title 24.

INDEPENDENT ENTITY

Sections 12-11A.205 and 12-11B.205. Evaluation by an independent entity to confirm the prescriptive and performance standard of detectable warning products or directional surfaces installed after January 1, 2001. An independent entity is a not-for-profit product safety testing and certification organization, dedicated to testing for public safety. An independent entity would operate for the testing, certification and quality assessment of products, systems and services.

TWO-YEAR APPROVAL

Sections 12-11A.206 and 12-11B.206. Detectable warning products and directional surfaces are to be recertified every two years without exception or waiver.

FEE

Sections 12-11A.207 and 12-11B.207. The Division of the State Architect-Access Compliance may impose a fee on

manufacturers of the specified products, to cover the cost of detectable warning products and directional surfaces.

DISABILITY ACCESS ACCOUNT

Sections 12-11A.208 and 12-11B.208. The fees received from manufacturers will be placed in the Disability Access Account.

DETECTABLE WARNING PRODUCTS AND DIRECTIONAL SURFACES

Sections 12-11A.209 and 12-11B.209. Detectable Warning Products and Directional Surfaces must ensure consistency and uniformity:

- (a) Shape,
- (b) Color fastness,
- (c) Conformation,
- (d) Sound-on-cane acoustic quality,
- (e) Resilience, and
- (f) Attachment will not degrade significantly for at least five years.

SIGNIFICANT DEGRADATION

Sections 12-11A.210 and 12-11B.210. Significant degradation means that the product maintains at least 90 percent of its approved design characteristics.

SELECTION OF INDEPENDENT ENTITY

Sections 12-11A.211 and 12-11B.211. The independent entity selected by the Division of the State Architect-Access Compliance shall be recognized as having appropriate expertise in determining whether products comply with the California Code of Regulations, Title 24.

Authority: Government Code Sections 4450, 4460 and Health & Safety Code Section 18949.1.

Reference: Government Code Section 4460.

CHAPTER 12-12
RESERVED

CHAPTER 12-13

STANDARDS FOR INSULATING MATERIAL

(See Part 6, Title 24, CCR)

DEPARTMENT OF CONSUMER AFFAIRS Bureau of Home Furnishings and Thermal Insulation

Article 3. Standards for Insulating Material

APPLICATION AND SCOPE

Sec. 12-13-1551.

(a) This article establishes standards governing the quality of insulation sold within the state after September 22, 1981, including those properties which affect the safety and thermal performance of insulation during application and in the use intended.

(b) The provisions of this article shall apply only to the following types of insulating material:

1. Aluminum foil (reflective foil);
2. Cellular glass (board form);
3. Cellulose fiber (loose fill and spray applied);
4. Mineral aggregate (board form);
5. Mineral fiber (blankets, board form, loose fill);
6. Perlite (loose fill);
7. Polystyrene (board form, molded and extruded);
8. Polyurethane (board form and field applied);
9. Polyisocyanurate (board form and field applied);
10. Urea formaldehyde foam (field applied);
11. Vermiculite (loose fill).

(c) The provisions of this article shall apply to the sale of insulating material within the state. The provisions of this article shall not apply to insulating material manufactured in California, but sold outside the state, nor to insulating material manufactured outside California and sold wholesale in California for final retail sale outside the state. For the purpose of this article, the sale of a building or an appliance which contains installed insulating material is not considered the sale of the insulating material.

(d) Any type of insulating material not listed in subsection (b) may be sold within California notwithstanding any other provision of this article.

Authority: Sections 25920 and 25922, Public Resources Code.

Reference: Sections 25910, 25920, 25921 and 25922, Public Resources Code.

HISTORY:

1. Repealer of Article 3 (Sections 1551-1561) filed 8-11-78; effective thirtieth day thereafter (Register 78, No. 32). For prior history, see Registers 76, No. 16; 78, Nos. 2 and 26.
2. New Article 3 (Sections 1551-1565) filed 1-16-79; effective thirtieth day thereafter (Register 79, No. 3).
3. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

DEFINITIONS

Sec. 12-13-1552. For purposes of this article, the following definitions shall apply:

(a) **“Approved laboratory”** means any testing facility including a facility owned or operated by a manufacturer which has been approved pursuant to Section 1554 of this article.

(b) **“ANSI”** means the American National Standards Institute.

(c) **“ASTM”** means ASTM International.

(d) **“Building materials”** means materials used in walls, ceilings, roofs and floors of buildings.

(e) **“Exposed application”** means any interior application of the product in which it is not used in a construction assembly imposing a material which meets the requirements of Chapter 8 of the *California Building Code* in substantial contact with the facing or membrane surface.

(f) **“Installed design density”** means the proven density for loose fill insulation other than cellulose which has been determined by the manufacturer to constitute the density whereby settlement of no more than 2 percent shall occur over the first three years, or no more than 4 percent over the first 15 years of installation.

(g) **“Insulating material” or “insulation”** means any material listed in Section 1551 (b) of this article and placed within or contiguous to a wall, ceiling, roof or floor of a room or building, or contiguous to the surface of any appliance or its intake or outtake mechanism, for the purpose of reducing heat transfer or reducing adverse temperature fluctuations of the building room or appliance.

(h) **“Manufacturer”** means any person who either:

1. Produces insulating material in the final composition either for use in the form sold or to be further dimensionally modified; or
2. In the case of polyurethane, polyisocyanurate and urea formaldehyde foam formed at the installation site, produces the primary components of the material.

“Manufacturer” shall not include any building contractor or any other person whose sole activity is to install insulation at the installation site.

(i) **“Quality assurance program.” (Reserved)**

(j) **“Recommended wall density”** means the density used for pressure fill retrofit wall applications to prevent settling.

(k) **“Representative sample”** means a sample of insulating material with the same characteristics (other than thickness) and using the same facing imposed on the insulating material manufactured for final use.

STANDARDS FOR INSULATING MATERIAL

(l) **“Representative thickness”** means a thickness of insulating material at which the change in thermal performance per inch will vary no more than plus or minus 2 percent with increases in thickness.

(m) **“TAPPI”** means Technical Association of Pulp and Paper Industry.

(n) **“Thermal performance”** means the tested thermal conductivity, thermal conductance or thermal resistance (*R*-value), as appropriate, of an insulating material.

(o) **“Urea formaldehyde foam”** means a cellular plastic insulation material generated in a continuous stream by mixing the components which are a urea formaldehyde resin, air and a foaming agent.

Authority: Sections 25920 and 25922, Public Resources Code.

Reference: Sections 25915 (a), 25920, 25921 and 25922, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

QUALITY STANDARDS

Sec. 12-13-1553. The manufacturer shall cause the testing of samples of insulating material for conformity with the quality standards described in this section.

(a) **General testing provisions.** In testing any material pursuant to this section, the following general procedures shall be used.

1. All tests with the exception of the ANSI/ASTM E84-79 test shall be conducted using representative samples at the representative thickness of the insulation, except that when the final use of an insulating material entails a thickness less than the representative thickness, then the insulating material will be tested at the lesser thickness.
2. Where uniformity of product ensures consistency of test results across a product grouping, test results for one may be used for certification of other products within that product group. The manufacturer shall provide sufficient documentation to establish a valid basis for applying a particular test result to other products within the group.

The Executive Director shall determine whether a valid basis exists for grouping products for testing pursuant to this subsection. If it is determined that a valid basis does not exist, individual tests shall be required. A manufacturer may appeal the Executive Director’s determination to the full Commission.

3. Thermal performance of building insulations shall be stated in *R* value. Other insulations shall use thermal conductivity, conductance or *R* value as appropriate.
4. All thermal performance tests shall be conducted on materials which have been conditioned at 73.4° ± 3.6°F and a relative humidity of 50 ± 5 percent for 24 hours immediately preceding the tests. The

average testing temperature shall be 75° ± 2°F with at least a 40°F (4°C) temperature difference.

5. Aluminum foil insulation shall be tested according to ANSI/ASTM C236-66 to determine the thermal performance in horizontal, upward and downward directions. The tested thermal performance in the heat-flow direction or directions of the intended application shall be labeled on the material. The manufacturer shall test once in each direction of intended application, except that for products labeled with only one heat-flow direction, the manufacturer shall test two samples in that direction.
6. Insulation (other than aluminum foil insulation materials) for which additional value is claimed for facings and air spaces shall be tested for thermal performance as a material without the air space pursuant to this article. The manufacturer may elect to report additional thermal performance values of a given construction tested according to ANSI/ASTM C236-66 for that construction as long as full details of that construction are also disclosed in the certification statement and pursuant to Section 1557 (c) of this article. If a manufacturer elects to report a thermal performance value for a material plus an air space (as supplemental information to the required material thermal performance), but not necessarily for a full construction, the manufacturer must also disclose the conditions of the test and the limitations to the attainment of that result.
7. Except as provided in Items 5 and 6, the thermal performance test results certified under Section 1555 of this article shall be the average of the values obtained from at least three tests.
8. The average measured thermal performance of the tests required by Items 5, 6 and 7 shall not be more than 5 percent below the value specified on the product. In addition, all insulation material sold within the state after September 22, 1981, shall have a measured thermal performance not more than 10 percent below the value specified on the product.
9. All numbered test descriptions shall be contained in the document “Test Descriptions for Insulating Material” dated February 27, 1981.
10. Facings on representative samples may be removed or modified by slitting for the ANSI/ASTM C177-76 and ANSI/ASTM C518-76 tests.
11. All thermal performance testing equipment used for testing insulating materials shall be calibrated with samples referenced to the United States National Bureau of Standards.
12. Manufacturers of loose fill insulations for which no settled density test is required by this section shall be required to include the installed design density in the identifying information described in Section 1557. The manufacturer shall provide suf-

ficient documentation to establish a valid basis for the determination of installed design density.

The Executive Director shall determine whether a valid basis exists for the installed design density claimed by the manufacturer. If it is determined that a valid basis does not exist, the director may assign an appropriate installed design density or may require an appropriate test to determine the installed design density. The manufacturer may appeal the Executive Director's determination to the full Commission.

- 13. Within 180 days after the availability of appropriate representative thickness calibration samples from the National Bureau of Standards, all insulating materials thicker than 1 inch (25 mm), which have not previously been tested at the representative thickness of a representative sample, shall be tested at representative thickness and recertified. Test results and a revised certification statement will be submitted to the Executive Director. The Executive Director shall determine if and when an appropriate representative thickness calibration sample is available from the National Bureau of Standards and shall publish a list of available representative thickness calibration samples. The manufacturer may appeal the Executive Director's determination to the full Commission.
- 14. All products which may be used for pressure fill retrofit wall application shall be separately tested for thermal performance using a sample prepared at the manufacturer's recommended wall density for such applications.
- 15. All water heater insulation kits and nonpreformed pipe insulation shall be tested for thermal performance at the installed compressed thickness of a typical application. Installed compressed thickness shall be determined according to Test Description Number 6. All nonpreformed duct insulation shall be labeled, in accordance with Section 1557(c), with an installed R-value equal to the R-value of the uncompressed insulation times 0.75.

(b) Aluminum foil.

- 1. **Composition.** The insulation shall have uniform flat surfaces and shall not be crumpled, torn or punctured. Aluminum foil shall contain not less than 99 percent aluminum. Kraft paper and flangeboard shall meet the requirements of ANSI/TAPPI T400 OS75. Flangeboard used for more than two insulation layers shall be of 28 point grade minimum, if single sheet flangeboard is used or 14 point grade minimum if double sheet flangeboard is used.

Adhesive used in bonding shall be waterproof and shall show no sign of bleeding when tested in accordance with the following test procedure. Bleeding at cut edges may be disregarded.

Specimens for tests shall consist of pieces of insulation cut to approximately 3 by 6 inches (76 mm by 152 mm), suspended in a vertical position and

heated to a temperature of 180°F ± 5°F for at least 5 hours. At the end of heating period, examine the reflective surfaces to determine whether the adhesive has bled or extruded through the surface, or delamination has occurred.

- 2. **Thermal performance.** Thermal performance shall be determined according to ANSI/ASTM C236-66. The test panel shall consist of a panel utilizing a wooden frame of 2 by 6 inches (51 mm by 152 mm) construction covered with 3/4-inch (19 mm) plywood on both sides. The resultant thermal performance shall be based on the insulation only.
- 3. **Size.** Layers of insulation composed of unsupported foil that is exposed shall have a minimum thickness of 0.0004 inch (0.01 mm). Unsupported foil that is sandwiched in a multilayer sheet shall have a minimum thickness of 0.00035 inch (0.009 mm). Foil bonded to kraft paper shall have a minimum thickness of 0.00025 inch (0.006 mm). Minimum space between layers of a multilayer sheet shall conform with the United States General Services Administration insulation standard HH-I-1252B dated August 18, 1976.
- 4. **Resistance to combustion.** Surface-burning characteristics shall be determined according to the ANSI/ASTM E84-79, and shall not exceed the following values:

Flame spread	25
Smoke developed	50
- 5. **Pliability.** Foil shall be folded and the folded edge smoothed using a light finger pressure. The finished insulation shall not crack when folded to 180° bend at a temperature of 70° ± 2°F and a relative humidity of 50 ± 5 percent.

(c) Cellular glass in board form.

- 1. **Composition.** The material shall consist of a glass composition which has been foamed or cellulated under molten conditions, annealed and set to form a rigid material with hermetically sealed cells.
- 2. **Thermal performance.** Determination of the thermal performance shall be based on a representative sample and shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
- 3. **Resistance to combustion.** Surface-burning characteristics shall be determined according to ANSI/ASTM E84-79, and shall not exceed the following values:

Flame spread	25
Smoke developed	50

(d) Cellulose fiber in loose fill form.

- 1. **Composition.** The basic material shall consist of virgin or recycled wood-based cellulosic fiber and may be made from related paper or paperboard stock, excluding contaminated materials and extraneous foreign materials such as metals and glass which may reasonably be expected to be retained in

the finished product. Suitable chemicals may be introduced to improve flame resistance, processing and handling characteristics. The particles shall not be so fine as to create a dust hazard, and the added chemicals shall not create a health hazard. The materials used must be capable of proper adhesion to the additive chemicals.

2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Density.** The density shall be determined according to the United States General Services Administration insulation standard HH-I-515D dated June 15, 1978, or as amended October 11, 1979, at the manufacturer's option. Cellulose insulation made from newsprint may use a 13 percent settling percentage along with the drop box procedure in place of the humidity cycling procedure described in HH-I-515D dated June 15, 1978. All other tests for loose fill cellulose fiber insulation prescribed by this section shall be conducted at the settled density as determined herein.
4. **Resistance to combustion.** Flammability characteristics shall comply with the standard for flammability and smoldering combustion in 44 Fed. Reg. pages 39966-39973.
5. **Resistance to fungi.** Resistance to fungi shall be determined according to Method 508 of the March 10, 1975, edition of the Military Standard for Environmental Test Methods known as MIL-STD-810C, except the spore suspensions shall be prepared using distilled water. The core of gypsum wall board shall be used as the control. After the test exposure, the test samples shall show no more fungal growth than the control material when examined at 40 times magnification.
6. **Corrosiveness.** The product shall comply with the standard for corrosiveness set forth in 44 Fed. Reg. pages 39966-39973.
7. **Odor emission.** Odor emission shall be determined according to Test Description Number 3. A detectable odor of objectionable nature observed by two or more of the panel members shall be cause for rejection.
8. **Identification.** Each insulation container shall be marked with the type (pouring or pneumatic), net weight and the manufacturer's recommendations for installation including minimum thickness, maximum coverage and settled density to provide the levels of thermal performance shown. Manufacturer's installation recommendations shall include precautions according to the *California Electrical Code* Section 410-66.

Insulation which may be used for pressure fill retrofit wall application shall be marked with the recommended wall den-

sity to prevent settling and separately marked with the tested thermal performance for such applications.

(e) **Cellulose fiber spray applied.**

1. **Composition.** The basic material shall consist of virgin or recycled wood-based cellulosic fiber and may be made from related paper or paperboard stock, excluding contaminated materials and extraneous foreign materials such as metals and glass which may reasonably be expected to be retained in the finished product. Suitable chemicals may be introduced to improve flame resistance, processing, adhesive and cohesive qualities, and handling characteristics. The added chemicals shall not create a health hazard.

The basic material shall be processed into a form suitable for installation by pneumatic conveying equipment and simultaneous mixing with water and/or adhesive at the spray nozzle.

2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Resistance to combustion.** Flammability characteristics shall comply with the standard for flammability and smoldering combustion in 44 Fed. Reg. pages 39966-39973.
4. **Corrosiveness.** The product shall comply with the standard for corrosiveness set forth in 44 Fed. Reg. pages 39966-39973.
5. **Bond strength.** The bond strength shall be determined by Test Description Number 3 and the bond shall support a force five times the weight of the sample for 1 minute.
6. **Bond deflection.** The bond deflection shall be determined by Test Description Number 4 and shall be greater than $\frac{1}{60}$ th of the length of the sample.
7. **Air erosion.** The air erosion shall be determined by Test Description Number 5 and shall withstand an air velocity of 800 ft/min.
8. **Odor emission.** Odor emissions shall be determined by Test Description Number 1. A detectable odor of objectionable nature observed by two or more panel members shall be cause for rejection.
9. **Fungi resistance.** Resistance to fungi shall be determined according to Method 508 of the March 10, 1975, edition of the Military Standard for Environmental Test Methods known as MIL-STD-810C, except the spore suspensions shall be prepared using distilled water, and observations shall be made at 7-day intervals during the 28-day cycle to determine the minimum length of time required for fungal growth to appear. Viability of the spore organisms shall be determined by injecting or inoculating a separate bottle of culture medium with

the spore preparation for each organism and observing for growth and individual viability. The back side of 1/2-inch (13 mm) standard commercial grade gypsum wall board grayback paper surface shall be used as the control. After the test exposure, the test samples shall be examined at 40 times magnification for evidence of fungal growth. The material shall show no more fungal growth than the control material.

- 10. Test procedures described in Items 5, 6 and 7 are not required of products which are installed in such a manner that physical restrictions imposed by the construction elements preclude any possibility of subsequent delamination, erosion or dusting and the product is identified only for such installations.

(f) Mineral aggregate in board form.

- 1. **Composition.** The basic material shall be mineral in nature, crushed, dried and graded to the proper particle size and expanded by the application of heat to form a spherical, cellular type of aggregate. It shall be composed of spherical cellular beads of expanded aggregate and fibers formed into rigid, flat, rectangular units and shall have an integral water proofing treatment. It shall be clean, dry and free of extraneous material. Fibers shall be evenly distributed and insulation and facings shall be sufficiently coherent to be unaffected by handling and installation.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Resistance to combustion.** Surface-burning characteristics of materials with facings and membranes intended for exposed applications shall be determined according to ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread. 25
Smoke developed 450

Facings and membranes of materials intended for exposed applications shall be exposed to the flame during the ANSI/ASTM E84-79 test.

Insulation boards exclusive of facings and membranes shall not exceed the following values:

Flame spread. 25
Smoke developed 50

(g) Mineral fiber in blanket form.

- 1. **Composition.** The basic material shall be fibers made from mineral substances such as rock, slag or glass processes from a molten state into fibrous form.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Size.** The thickness shall be determined according to ANSI/ASTM C167-64.

- 4. **Resistance to combustion.** Surface-burning characteristics of materials with facings and membranes intended for exposed applications shall be determined according to ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread 25
Smoke developed 450

Facings and membranes of materials intended for exposed applications shall be exposed to the flame during the ANSI/ASTM E84-79 test.

Insulation blankets not intended for exposed applications shall comply with the United States General Services Administration insulation standard HH-I-521F dated September 4, 1980, for flammability and smoldering combustion testing.

- 5. **Corrosiveness.** Corrosiveness shall be determined according to Test Description Number 2. The steel test plate in contact with the insulation shall show no greater corrosion than a steel plate in contact with sterile cotton.
6. **Resistance to fungi.** Resistance to fungi shall be determined according to Method 508 of the March 10, 1975, edition of the Military Standard for Environmental Test Methods known as MIL-STD-810C except the spore suspensions shall be prepared using distilled water. The core of gypsum wall board shall be used as the control. After the test exposure, the test samples shall show no more fungal growth than the control material when examined at 40 times magnification.
7. **Odor emission.** Odor emission shall be determined according to Test Description Number 1. A detectable odor of objectionable nature observed by two or more of the panel members shall be cause for rejection.

(h) Mineral fiber in board form.

- 1. **Composition.** The basic material shall be made from mineral substances such as rock, slag or glass processed from a molten state into a fibrous form. Insulation shall be composed of mineral fibers with water resistant binder added and formed into flat, rectangular units. Insulation boards shall be uniform in quality, free from defects, such as broken edges, splits or loose materials which would impair its intended use.

Roof insulation boards shall have either integral waterproofing treatment or a waterproof coating on one surface. The coating shall be flush with the edges of the sides and may be flush with or extend over both ends.

- 2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Resistance to combustion.** Surface-burning characteristics of materials with facings and membranes

intended for exposed applications shall be determined according to ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread.	25
Smoke developed	450

Facings and membranes of materials intended for exposed applications shall be exposed to the flame during the ANSI/ASTM E84-79 test.

Insulation boards exclusive of facings and membranes shall not exceed the following values:

Flame spread.	25
Smoke developed	50

(i) **Mineral fiber in loose fill form.**

1. **Composition.** Mineral fiber insulation shall be made from mineral substances such as rock, slag or glass processed from a molten state into fibrous form. The insulation shall be mechanically processed to produce a mineral fiber suitable for pneumatic or poured application.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Density.** The density shall be determined according to installed design density. All tests shall be conducted at the installed design density.
4. **Resistance to combustion.** Loose fill insulation shall comply with the United States General Services Administration insulation standard HH-I-1030B dated August 12, 1980, for flammability and smoldering combustion testing.
5. **Corrosiveness.** Corrosiveness shall be determined according to Test Description Number 2. The steel plate in contact with the insulation shall show no greater corrosion than a steel plate in contact with sterile cotton.
6. **Resistance to fungi.** Resistance to fungi shall be determined according to Method 508 of the March 10, 1975, edition of the Military Standard for Environmental Test Methods known as MIL-STD-810C, except the spore suspensions shall be prepared using distilled water. The core of gypsum wall board shall be used as the control. After the test exposure, the test samples shall show no more fungal growth than the control material when examined at 40 times magnification.
7. **Odor emission.** Odor emission shall be determined according to Test Description Number 1. A detectable odor of objectionable nature observed by two or more of the panel members shall be cause for rejection.
8. **Identification.** Each insulation container shall be marked with the type (pouring or pneumatic), the net weight and the manufacturer's recommendations for installation including minimum thickness, maximum coverage and installed design density to pro-

vide the levels of thermal performance shown. Manufacturer's installation recommendations shall include precautions according to the *California Electrical Code* Section 410-66.

Products which may be used for pressure fill retrofit wall application shall be marked with the recommended wall density to prevent settling and separately marked with the tested thermal performance for such applications.

(j) **Perlite in loose fill form.**

1. **Composition.** Expanded perlite loose fill insulation shall be produced by the expanding of natural perlite or by heating.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option.
3. **Density.** Density shall be determined according to installed design density. All tests except the ANSI/ASTM E84-79 test shall be conducted at the installed design density.
4. **Resistance to combustion.** Resistance to combustion shall be determined by the use of the Attic Floor Radiant Panel Test, as described in the United States General Services Administration insulation standard HH-I-515D Section 3.1.9 as amended October 11, 1979.
5. **Identification.** Each insulation container shall be marked with the type (pouring or pneumatic), the net weight and the manufacturer's recommendations for installation including minimum thickness, maximum coverage and installed design density to provide the levels of thermal performance shown. Manufacturer's installation recommendations shall include precautions according to the 1993 *National Electrical Code* Section 410-66.

Products which may be used for pressure fill retrofit wall application shall be marked with the recommended wall density to prevent settling and separately marked with the tested thermal performance for such applications.

(k) **Polystyrene in board form.**

1. **Composition.** Insulation board shall be formed by the expansion of polystyrene resin beads or granules in a mold or the insulation board shall be formed by the expansion of polystyrene base resin in an extrusion process. The insulation shall be uniformly fused, homogeneous and essentially unicellular. Insulation board shall be uniform in physical properties and reasonably free of voids or accumulations of unexpanded material, foreign inclusions, broken corners and broken edges.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer's option. All foam insulation materials using materials other than air or pentane as an expanding agent shall either sep-

arately condition samples at 73.4° ± 3.6°F and a relative humidity of 50 ± 5 percent, and at 140°F dry heat and test at 30-, 60- and 90-day intervals or shall test samples certified by an approved testing laboratory to have been aged while exposed to free air in a well ventilated room for at least two years at 70° ± 10°F, provided, however, that until 2½ years after the adoption of these quality standards by the Commission, test samples may be aged for six months for certification of the material.

Notwithstanding any other provision of this article, this thermal performance standard shall not take effect until 250 days after adoption. If the certification statement submitted pursuant to Section 1555 of this article does not include test results for thermal performance, the manufacturer shall submit a new certification statement which includes such test results prior to 250 days after adoption. If the latest certification statement is based on the six-month aging test, a new statement, based upon the two-year aging test or the accelerated aging test shall be submitted by 2½ years after the adoption date.

3. A. **Resistance to combustion.** The material shall be tested to meet the requirements of Sections 2603.2 and 2603.3 of the *California Building Code*, with the additional provision that the surface-burning characteristics shall be determined according to ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread	75
Smoke developed.	450

Exception: Polystyrene foam insulation boards with a maximum thickness of 2 inches (51 mm) when installed below a minimum 3.5-inch-thick (89 mm) concrete slab on grade.

B. This subsection shall not apply to any product recognized by the International Conference of Building Officials, as of the date of adoption of these regulations, as complying with Sections 2602.1-2602.6 of the 1994 *Uniform Building Code* based solely upon diversified testing. The manufacturer of any product which is recognized by the International Conference of Building Officials, subsequent to the date of approval of these regulations, as complying with Sections 2602.1-2602.6 of the 1994 *Uniform Building Code* based solely upon diversified testing, may petition the Commission for an exemption of that product from the provisions of this subsection.

4. **Dimensional stability.** All foamed polystyrene insulation materials which are factory formed shall be tested for dimensional stability in accordance with Procedures E and G of ASTM D2126-75 with the following exceptions: (a) sample size shall be 12 inches by 12 inches (305 mm by 305 mm) ± 1 inch (25 mm), and (b) samples shall be tested as manufactured with or without facers.

The average percent change in length or width shall not exceed ± 2 percent in 24 hours or ± 4 percent in 7

days. The average percent change in thickness shall not exceed ± 10 percent in 7 days. Samples shall be regarded as failing if: (1) delamination area of “faced” samples exceeds 25 percent or (2) warping or cupping exceeds ¼ inch (6 mm) when checked by a straight edge across raised diagonal corners.

(1) **Polyurethane and polyisocyanurate in board form and field applied.**

1. **Composition.** The manufacture of the insulation shall be based mainly on the reaction of an organic polyisocyanate with a polyol resin.

Board shall be of uniform texture, reasonably free from accumulation of unexpanded material and foreign inclusions, and reasonably free of broken edges and corners. It shall be reasonably free from holes, voids, depressions and objectionable odor. Laminated composite boards shall be included in this quality standard. The faces of laminated boards shall adhere firmly throughout to the foam, and shall show no excessive amounts of slits, voids or depressions.

2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C518-76 at the manufacturer’s option. All foam insulation materials using materials other than air or pentane as an expanding agent shall either separately condition samples at 73.4° ± 3.6°F and a relative humidity of 50 ± 5 percent, and at 140°F (60°C) dry heat and test at 30-, 60- and 90-day intervals or shall test samples certified by an approved testing laboratory to have been aged while exposed to free air in a well ventilated room for at least two years at 70° ± 10°F, provided, however, that until 2½ years after the adoption of these quality standards by the Commission, test samples may be aged for six months for certification of the material.

Notwithstanding any other provision of this article, this thermal performance standard shall not take effect until 250 days after adoption. If the certification statement submitted pursuant to Section 1555 of these regulations does not include test results for thermal performance, the manufacturer shall submit a new certification statement which includes such test results prior to 250 days after adoption. If the latest certification statement is based on the six-month aging test, a new statement, based upon the two-year aging test or the accelerated aging test shall be submitted by 2½ years after the adoption date.

3. **Dimensional stability.** All foamed polyurethane and polyisocyanurate insulation materials which are factory formed shall be tested for dimensional stability in accordance with Procedures E and G of ASTM D2126-75 with the following exceptions: (a) sample size shall be 12 inches by 12 inches (305 mm by 305 mm) ± 1 inch (25 mm) and (b) samples shall be tested as manufactured with or without facers.

The average percent change in length or width shall not exceed ± 2 percent in 24 hours or ± 4 percent in 7 days. The average percent change in thick-

ness shall not exceed ± 10 percent in 7 days. Samples shall be regarded as failing if: (1) delamination area of “faced” samples exceeds 25 percent or (2) warping or cupping exceeds $\frac{1}{4}$ inch (6 mm) when checked by a straight edge across raised diagonal corners.

4. **Resistance to combustion.**

A. The material shall be tested to meet the requirements of Sections 2602.1-2602.6 of the 1994 *Uniform Building Code*, with the additional provision that the surface-burning characteristics shall be determined according to ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread 75
Smoke developed 450

B. This subsection shall not apply to any product recognized by the International Conference of Building Officials, as of the date of adoption of this article, as complying with Sections 2602.1-2602.6 of the 1994 *Uniform Building Code* based solely upon diversified testing. The manufacturer of any product which is recognized by the International Conference of Building Officials, subsequent to the date of approval of these regulations, as complying with Sections 2602.1-2602.6 of the 1994 *Uniform Building Code* based solely upon diversified testing, may petition the Commission for an exemption of that product from the provisions of this subsection.

5. **Identification.** Foam containers shall state the conditions of proper storage.

(m) **Urea formaldehyde foam field applied.**

1. **Limitation on sale.** Urea formaldehyde foam is unsafe for use as insulation. Sale within the State of California of urea formaldehyde foam insulation is prohibited.

2. **Exemption.** Notwithstanding any other provision of this article, a manufacturer of the primary components of urea formaldehyde foam insulation may apply for certification as provided in Section 1555 of this article. Such certification statement shall indicate compliance with the following standards:

A. **Composition.** The material shall consist of cellular plastic generated in a continuous stream by mixing the components which are a urea formaldehyde resin, air and a foaming agent. The material shall be suitable for filling closed cavities through small holes and suitable also for filling open cavities by trowelling during foaming prior to enclosure.

B. **Thermal performance.** The effective thermal performance, incorporating a derating value, shall be determined according to the method described in 42 Fed. Reg. pages 55143-55148.

C. **Resistance to combustion.** Surface-burning characteristics shall be determined according to the ANSI/ASTM E84-79 and shall not exceed the following values:

Flame spread 25
Smoke developed 450

Test specimens shall be aged for 45 days at 70°F $\pm 5^\circ\text{F}$ and 35 to 40 percent relative humidity before testing.

D. **Free formaldehyde content of dry foam.** The free formaldehyde content of the dry foam shall be less than 0.01 percent formaldehyde by weight when tested as specified in paragraph (f) (8), published in 45 Fed. Reg. page 63801, except that the specimens to be tested shall also be aged for 56 days at $24 \pm 5^\circ\text{C}$ ($75 \pm 10^\circ\text{F}$) and 50 ± 10 percent relative humidity in an uncovered beaker.

E. **Corrosiveness.** The material shall be tested and shall meet the criteria for corrosiveness as specified in 45 Fed. Reg. pages 63786-63810.

F. **Density.** The material shall be tested and shall meet the criteria for density as specified in 45 Fed. Reg. pages 63786-63810.

G. **Shrinkage.** The material shall be tested and meet the criteria for shrinkage as specified in 45 Fed. Reg. pages 63786-63810, except that the material shall not shrink more than 2.0 percent in any direction.

H. **Volume resistivity.** The material shall be tested and meet the criteria for volume resistivity as specified in 45 Fed. Reg. pages 63786-63810.

I. **Identification.** Resin and foaming agent containers shall be marked with conditions of proper storage and the derated R-value and shrinkage of the prepared foam as certified by the manufacturer.

J. **Safety information.** Installers of urea formaldehyde foam insulation shall present the following safety notice to the purchasers of the foam prior to the signing of the contract for installation. The notice shall be printed in a minimum of 8-point type size. One copy of the notice signed by the purchaser shall be immediately given to the purchaser, one copy shall be retained by the installer and one copy shall be mailed by the installer to the Executive Director of the Energy Commission within 48 hours after installation of the insulation is completed.

Manufacturers shall make all sales of urea foam insulation components expressly subject to the application restrictions listed in the notice described below.

UREA FORMALDEHYDE FOAM INSULATION SAFETY NOTICE

The Federal Panel on Formaldehyde has concluded that formaldehyde should be presumed to pose a carcinogenic (cancer) risk for humans. Formaldehyde gas may also cause eye, nose,

and throat irritation, coughing, shortness of breath, skin irritation, nausea, headaches and dizziness. People with respiratory problems or allergies may suffer more serious reactions, especially people allergic to formaldehyde. Women who are pregnant or planning to become pregnant should not be exposed to this product.

The symptoms may appear immediately or not until months after installation.

This product may release formaldehyde gas into your home or building over a long period of time. In some

instances the formaldehyde gas cannot be controlled by ventilation or other means.

Application of this product is restricted to exterior side-walls in both residential and commercial/industrial buildings. A 4-mil thickness plastic polyethylene vapor barrier, or equivalent plastic sheeting vapor barrier, shall be installed between the urea formaldehyde foam insulation and the interior space of the home or building in all applications.

If you have health concerns, call your doctor. Also, call the installer or manufacturer of the material.

(PLEASE PRINT OR WRITE LEGIBLY)

PURCHASER NAME OR NAMES _____
PURCHASER ADDRESS _____ CITY _____ ZIP _____
PURCHASER PHONE NUMBER: Home () _____ Work () _____

LOCATION OF INSTALLATION IF DIFFERENT FROM ABOVE

LOCATION ADDRESS _____ CITY _____ ZIP _____
The Purchaser acknowledges he or she has read and understands this notice.
Signed X _____ Date _____
Signed X _____ Date _____

THE FOLLOWING INFORMATION IS TO BE COMPLETED BY THE INSTALLING CONTRACTOR

CONTRACTOR'S NAME _____
CONTRACTOR'S ADDRESS _____ CITY _____ ZIP _____
CONTRACTOR'S STATE LICENSE NUMBER _____
NAME OF MANUFACTURER _____
MANUFACTURER'S ADDRESS _____ CITY _____ ZIP _____
MANUFACTURER'S PHONE NUMBER () _____
TEMPERATURE OF OUTSIDE AIR AT START OF INSTALLATION _____ °F

Table with 3 columns: RESIN, FOAMING AGENT, BATCH NUMBER, EXPIRATION DATE, TEMPERATURE (START OF INSTALLATION) °F

STEPS THE INSTALLING CONTRACTOR MUST FOLLOW

- 1. The installing contractor is responsible for mailing this completed notice to the following address within 48 hours after completion of installation. Mail one copy to: Executive Director, Energy Resources, Conservation and Development Commission, 1516 9th Street, Sacramento, CA 95814.
2. Give one copy to the Purchaser.
3. The installing contractor shall keep one copy of this completed notice for a period of not less than three years.

3. **Severability of provisions.** If any provision of Section 1553 (m) (1) or (2), or the application thereof to any person or circumstances, is held invalid, the remaining provisions, or the application of such provisions to other persons or circumstances, shall not be affected thereby.

(n) **Vermiculite in loose fill form.**

1. **Composition.** Vermiculite loose fill insulation shall be produced by the expanding or exfoliating of natural vermiculate or by grading and heating.
2. **Thermal performance.** Determination of the thermal performance shall be in accordance with ANSI/ASTM C177-76, ANSI/ASTM C236-66 or ANSI/ASTM C615-76 at the manufacturer's option.
3. **Density.** Density shall be determined according to installed design density. All tests except the ANSI/ASTM E84-79 test shall be conducted at the installed design density.
4. **Resistance to combustion.** Resistance to combustion shall be determined by the use of the Attic Floor Radiant Panel Test, as described in the United States General Services Administration insulation standard HH-I-515D as amended October 11, 1979.
5. **Identification.** Containers of vermiculite shall be marked with the type (pouring or pneumatic), the net weight and the manufacturer's recommendations for installation including minimum thickness, maximum coverage and installed design density to provide the levels of thermal performance shown. Manufacturer's installation recommendations shall include precautions according to the *California Electric Code* Section 410-66.

Products which may be used for pressure fill retrofit wall application shall be marked with the recommended wall density to prevent settling and separately marked with the tested thermal performance for such applications.

Authority: Sections 25402(a) and 25920, Public Resources Code.

Reference: Sections 25920-25922, Public Resources Code.

HISTORY:

1. Amendment of subsection (a) (9) filed 4-2-79; effective thirtieth day thereafter (Register 79, No. 14).
2. Editorial correction of subsection designations with subsection (l) (4) (Register 79, No. 17).
3. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).
4. New subsection (m) (2) (J) filed 9-11-81; effective thirtieth day thereafter (Register 81, No. 37).
5. Editorial correction of subsection (k) (3) (B) filed 1-13-82 (Register 82, No. 3).
6. Amendment of subsections (a) (5) and (a) (8) filed 5-5-82; effective thirtieth day thereafter (Register 82, No. 19).
7. Editorial correction of subsection (m) printing error (Register 82, No. 44).

APPROVAL OF TESTING LABORATORIES

Sec. 12-13-1554.

(a) Except as provided in subsection (b), laboratories shall be approved using the procedures described in the Criteria for the Approval of Testing Laboratories, dated October 27, 1978. The Executive Director shall approve any laboratory that meets the standards described in the Criteria for the Approval of Testing Laboratories, dated October 27, 1978. A testing laboratory shall have the right to appeal to the full Commission any denial of approval by the Executive Director.

(b) Up to and including September 30, 1982, laboratories shall be approved either upon accreditation by the United States Department of Commerce National Voluntary Laboratory Accreditation Program or as stated in the preceding paragraph, at the manufacturer's option. After September 30, 1982, laboratories shall only be approved upon accreditation by the United States Department of Commerce National Voluntary Laboratory Accreditation Program.

Authority: Section 25218(e), Public Resources Code.

Reference: Sections 25915(a) and 25921, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81, designated effective 9-22-81 (Register 81, No. 33).

CERTIFICATION

Sec. 12-13-1555.

(a) No insulating material shall be sold or installed in California on or after September 22, 1981, unless the manufacturer has certified that the material complies with the provisions of this article.

(b) The manufacturer shall submit a certification statement to the Executive Director for each type of insulating material. Such statement shall contain the following information:

1. Name of the manufacturer.
2. A description of the type of insulating material being certified in sufficient detail to permit its identification. The description may include information sheets, brochures, a sample label for the product or similar information.
3. Test results from an approved laboratory.
4. A description of the basis for ensuring that all the insulating material of the type being certified complies with the requirements of this article. Such description shall include, but not be limited to a description of the frequency of testing of the material, the quality assurance program, and any third-party inspections or testing used by the manufacturer.
5. A declaration that the insulating material complies with the requirements of this article.
6. The wording of the certification seal, if such seal consists of a statement pursuant to Section 1557 (b) (2) of this article.

(c) Every certification statement shall be dated and signed by the manufacturer attesting to its truth and accuracy. Where

the manufacturer is either a corporation or a business association, the certification statement shall be dated, signed and attested to by a responsible official thereof.

(d) Within 45 days after receipt of a certification statement, the Executive Director shall forward, to the manufacturer, an acknowledgment that the statement has been received and that it is complete and accurate on its face.

(e) Certification of the insulation material shall be deemed to occur upon forwarding of the acknowledgement by the Executive Director. If acknowledgment is not forwarded in a timely manner, certification shall be deemed to occur on the 45th day after receipt of the certification statement.

(f) The statement of test results required in the certification may be based upon tests conducted prior to the adoptive date of this article if: (1) the same test was conducted within two years of the date of adoption, (2) the laboratory at which the tests were conducted has been approved for those tests as of the date of the certification statement, and (3) the laboratory certifies that the test and product are the same as the test and product referred to in the statement of test results.

Authority: Section 25218(e), Public Resources Code.

Reference: Sections 25921 and 25921.1, Public Resources Code.

HISTORY:

1. Amendment of subsections (a), (b) (4), (b) (6) and (f) filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

QUALITY ASSURANCE (Reserved)

Sec. 12-13-1556.

Authority: Section 25218 (e), Public Resources Code.

Reference: Section 25921.1, Public Resources Code.

HISTORY:

1. Repealer filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

IDENTIFICATION

Sec. 12-13-1557.

(a) Except as specified in subsection (b), Item 3, of this section, no insulation shall be sold in California on or after September 22, 1981, unless the insulating material, container, bundle or similar packaging material bears a visible Commission approved statement certifying that a representative sample of the insulation material has been tested and approved by an approved laboratory and complies with the requirements of this article.

(b) The Commission-approved statement shall consist of either:

1. A design or statement approved by the Executive Director, or
2. An identification of the manufacturer and any statement that the material meets the quality standards of the State of California.
3. A statement that the material meets the quality standards of the State of California included in the bill of lading shall meet the requirements of this section only if the product is being shipped in bulk, or the container or product is not otherwise labeled by the manufacturer and the product is being sold to its ultimate user.

(c) Any representation of thermal performance which appear on any label, literature, advertising or any other writing intended for the public shall be consistent with the certification testing results and derating required by this article.

(d) Any insulation with facings and membranes for which the flame spread exceeds 25 when tested with facings and membranes exposed to the flame during the ANSI/ASTM E84-79 test must be clearly labeled with a statement that the product may be highly combustible if used in an exposed application. This subsection shall not apply to any product meeting the requirements of Sections 2602.1-2602.6 of the 1994 *Uniform Building Code*.

Authority: Section 25218(e), Public Resources Code.

Reference: Section 25921, Public Resources Code.

HISTORY:

1. Amendment of subsections (a) and (c) filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

INSPECTIONS

Sec. 12-13-1558.

After September 22, 1981, the Commission may, upon the consent of the owner or lessee, or upon securing a search warrant, have access, during normal working hours, to the premises of manufacturers, distributors and retailers of insulating material sold for installation within the state for the purpose of determining compliance with the standards promulgated pursuant to Chapter 10.5 of the *California Public Resources Code*. Such access shall be for the purposes of obtaining representative samples of subject insulation and inspecting records and documents pertaining to tests by approved testing labs.

Authority: Section 25218 (e), Public Resources Code.

Reference: Section 25926, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

PERFORMANCE TESTS

Sec. 12-13-1559.

The Commission may conduct, or may contract with others to conduct, independent performance tests of representative samples of insulation sold in the state to determine compliance with standards adopted pursuant to Chapter 10.5 of the *California Public Resources Code*. Such tests shall form the basis for instituting enforcement proceedings.

Authority: Section 25218 (e), Public Resources Code.

Reference: Section 25926, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

COSTS OF INSPECTION AND TESTING (Reserved)

Sec. 12-13-1560.

Authority: Section 25218 (e), Public Resources Code.

Reference: Section 25926, Public Resources Code.

HISTORY:

1. Repealer filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

ENFORCEMENT (Reserved)

Sec. 12-13-1561.

Authority: Section 25218 (e), Public Resources Code.

Reference: Section 25931, Public Resources Code.

HISTORY:

1. Repealer filed 6-26-79; effective thirtieth day thereafter (Register 79, No. 26).

RELEASE OF INFORMATION

Sec. 12-13-1562.

Persons submitting information to the Commission who wish information to be kept confidential shall comply with the provisions of Sections 2501-2511 of the Public Resources Code.

Authority: Section 25218(e), Public Resources Code.

Reference: Sections 25223 and 25921.1, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

LIABILITY

Sec. 12-13-1563.

Nothing in this article shall be construed as imposing responsibility on manufacturers for misuse of properly labeled insulation.

Authority: Section 25218(e), Public Resources Code.

Reference: Sections 25926 and 25931, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

INSULATING EXISTING BUILDINGS

Sec. 12-13-1564.

(a) On or after March 25, 1982, if insulating material is installed in an existing building, in any of the applications specified in California Code of Regulations, Title 24, Part 6, Section 118, the installing contractor shall certify that the amount of insulation installed meets or exceeds the requirements of Part 6, Section 118 for that application. Such certification shall be made on completion of the installation by posting in a conspicuous location a certificate signed under penalty of perjury. The certificate shall state the manufacturer's name and material identification, the thermal resistance (*R*-value) of the newly installed insulation, the estimated *R*-value of the original insulation, the total *R*-value, and (in application of loose fill insulation) the minimum contractor installed weight per square foot. This installed weight per square foot shall conform with the manufacturer's installed design density per square foot at the manufacturer's labeled *R*-value.

(b) **Water heater insulation kits.** No water heater insulation kit shall be sold, on or after March 25, 1982, unless it has a thermal resistance of at least R-6 and is so identified.

Each water heater insulation kit sold shall include instructions which are equivalent to the Department of Energy standard practice for the installation of insulation on gas-fired,

oil-fired and electric resistance water heaters, 44 Fed. Reg. pages 64703-64705.

Authority: Section 25922, Public Resources Code.

Reference: Section 25922, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).
2. Editorial correction of subsection (a) filed 1-13-82 (Register 82, No. 2).

INTERPRETATION

Sec. 12-13-1565.

The General Counsel of the Commission shall make a determination as to the application or interpretation of any provision of this article to any person requesting such a determination. Any such request shall be submitted in writing to the Commission. The Commission shall make written replies to such inquiries and shall widely publish interpretations that have broad application or interest.

Authority: Section 25218 (e), Public Resources Code.

Reference: Sections 25920 and 25922, Public Resources Code.

HISTORY:

1. Amendment filed 8-10-81; designated effective 9-22-81 (Register 81, No. 33).

CHAPTER 12-16-1

ENGINEERING REGULATIONS—QUALITY AND DESIGN OF THE MATERIALS OF CONSTRUCTION

STANDARD 12-16-1

CALIFORNIA STANDARD FOR EARTHQUAKE-ACTUATED AUTOMATIC GAS SHUTOFF SYSTEMS (See CCR Title 24, Part 2, Chapters 16 and 16A, and CCR Title 24, Part 5, Chapter 12)

DIVISION OF THE STATE ARCHITECT

Authority: Sections 19180–19183, Health and Safety Code.

Reference: Section 19182, Health and Safety Code.

Division 1—CONSTRUCTION SCOPE

Sec. 12-16-101. The American Society of Civil Engineers (ASCE) requirements for “Earthquake-Actuated Automatic Gas Shutoff Devices,” ANSI/ASCE/SEI 25-16 (copyright 2016 by ASCE), shall be the applicable standard used by the Division of the State Architect for the certification of these devices.

Sec. 12-16-101.1. Each installation of a customer-owned device that satisfies this standard shall be in accordance with the *California Plumbing Code (CCR Title 24, Part 5)*.

CHAPTER 12-16-2

ENGINEERING REGULATIONS—QUALITY AND DESIGN OF THE MATERIALS OF CONSTRUCTION

STANDARD 12-16-2 CALIFORNIA STANDARD FOR RESIDENTIAL EXCESS FLOW ACTUATED AUTOMATIC GAS SHUTOFF VALVES (See CCR Title 24, Part 5, Chapter 12)

DIVISION OF THE STATE ARCHITECT

Authority: Sections 19200–19204, Health and Safety Code.

Reference: Sections 19201.5 and 19202, Health and Safety Code.

Division 1—CONSTRUCTION SCOPE

Sec. 12-16-201. The American Society for Testing and Materials (ASTM) F2138-12(2017) Standard Specification for Excess Flow Valves for Natural Gas Service, and the American National Standards Institute (ANSI) Z21.93-2017/CSA 6.30-2017 Excess Flow Valves for Natural and LP Gas with Pressure up to 5 psig, shall be the applicable standards used by the Division of the State Architect for certification of these devices.

Sec. 12-16-201.1. Each installation of a customer-owned device that satisfies this standard shall be in accordance with the *California Plumbing Code (CCR Title 24, Part 5)*.

CHAPTER 12-31C
RADIATION SHIELDING STANDARDS

STANDARD 12-31C-1

DEPARTMENT OF HEALTH SERVICES

Authority: Sections 102, 208 and 25811.

Reference: Sections 102, 208 and 436.5.

ALL HEALING ARTS X-RAY INSTALLATIONS

Sec. 12-31C-101. All radiation shielding barriers in rooms and enclosures housing radiation machines shall comply with the mandatory standards and appendices in Report No. 35, "DentalX-RAY Protection"; Report 49, "Structural Shielding Design and Evaluation for Medical use of X-rays and Gamma Rays of Energies up to 10 MeV"; and Report No. 51, "Radiation Protection Design Guidelines for 0.1-100 MeV Particle Accelerator Facilities." Published by the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, Maryland 20814.

CHAPTER 12-71

AIR FILTERS

AIR FILTERS STANDARD 12-71-1

STATE FIRE MARSHAL

DESCRIPTION OF TEST APPARATUS, METHOD AND CLASSIFICATION REQUIREMENTS FOR AIR FILTERS

Sec. 12-71-100.

(a) Test apparatus.

1. The test duct, made of M.S. gage galvanized sheet metal reinforced with angle irons, is 21 inches square (13 548 mm²) and 13¹/₂ feet (4114 mm) long.
2. One end of the duct is tapered to the discharge of a variable-speed blower and the other end is open to discharge. A metal filter frame is provided near the middle of the length of the duct to receive one 20 by 20 inches (508 mm by 508 mm) (nominal) filter unit. Two tightfitting doors, located to permit access to the filter frame, are each provided with a mica window to permit observation of both faces of the filter and conditions in the duct downstream from the filter.
3. Two 1-inch (25 mm) pipe elbows, about 18 inches (457 mm) from the base of the test filter, form gas burner outlets adjusted to provide yellow, wavering flames. The burners consume approximately 4 cubic feet (approximately 1,000 Btu/cubic feet) of gas per minute.
4. With the filter in place the air velocity is adjusted to approximately 200 linear feet per minute as measured at the discharge end of the duct by an Alnor Velometer Anemometer.

(b) Test method.

1. Filters are tested clean, that is, unused. The flames are applied for 3 minutes during which time observations are made of both faces of the filter as to the downstream travel of flame or sparks and the density, duration and character of the products of combustion.
2. Smoke density is measured as the drop in light intensity on a microammeter by means of photoelectric cell mounted a few inches below and about 12 inches (305 mm) inside the discharge end of the duct. The light source, stabilized for light intensity, is mounted 1 inch (25 mm) above the duct directly above the photoelectric cell. The microammeter readings are recorded every 5 seconds for the first minute and every 10 seconds for the next 2 minutes.

3. The differences between these readings and the readings taken before the test are plotted against time (the scale being 40 μ A and 40 seconds to the inch) with the resulting area under the curve being measured by use of a planimeter or calculated mathematically. This area is a measure of the smoke density produced during the test.

(c) **Classification.** As a result of the tests, air filter units are classified as Class 1 or 2 as indicated below:

1. Class 1 air filter units are those which, when clean, do not produce flames or sparks when attacked by flame and which develop areas under the smoke density curves that are less than 1.5 square inches (967 mm²).
2. Class 2 air filter units are those which, when clean, burn moderately when attacked by flame or emit moderate amounts of smoke or both. These units, although they may be consumed to some extent, do not project flames or extensive sparks that would ignite adjacent combustible materials beyond the discharge end of the duct during the test and do not develop areas under the smoke density curves that are more than 6.0 square inches (3871 mm²).

(d) **Adhesive coatings.** Liquid-adhesive coatings used on filters shall have a flash point of 325°F (163°C) Cleveland open cup tester, or higher.

CHAPTER 12-72-1

PROTECTIVE SIGNALING SYSTEMS

PROTECTIVE SIGNALING SYSTEMS, STANDARD TEST PROCEDURES STANDARD 12-72-1

STATE FIRE MARSHAL SCOPE

Sec. 12-72-100.

(a) **Basic.** This standard represents the minimum basic requirements for the construction and performance of the protective signaling systems to be listed under this classification. The minimum design, construction and performance standards set forth herein are those deemed as minimum necessary to establish conformance to the regulations of the State Fire Marshal as set forth in the *California Electrical Code*, and when applicable shall be reported on in their entirety by the approved testing laboratory.

(b) **Systems.** This standard covers electrically operated devices and control units designed to transmit and sound alarms, supervisory and trouble signals to be employed in ordinary indoor locations in accordance with the Standards of the National Fire Protection Association for the Installation, Maintenance and Use of Proprietary, Auxiliary and Local Protective Signaling Systems, Remote Station, Nos. 72A, 72B, 72C and 72D, and the *California Electrical Code*. This includes combination protective signaling systems employing nonsupervised sounding circuits; combination fire alarm-communication, -program and -clock systems (hereinafter referred to as combination signaling systems); and audible devices used for both alarm and program or communication purposes.

(c) **Control unit.** A control unit covered by this standard consists of a unit assembly of electrical parts having provisions for the connection of power-supply circuits routed through the control unit equipment by a prescribed scheme of circuitry; signal initiating circuits extended to separate devices by which the operating parts of the control unit are actuated for signals, and to incorporated or separate devices by which the signals are transmitted or indicated to form a coordinated combination system for definite signaling service.

TEST REPORTS

Sec. 12-72-101.

(a) **Test report contents.** The report shall include engineering data, and an analysis comparing the design against Section 12-72-102 (a) through (u); it shall include wiring, diagrams, operating manuals and photographs as set forth in Section 12-72-102 (a), Items 5 and 6; it shall set forth the tests performed in accordance with Sections 12-72-103 (a) through (g) and the results thereof; and shall verify the correctness of the electrical rating required by Section 12-72-107.

(b) **Listed devices.** Electrical wiring, material, devices, combination of devices, fittings, appliances and equipment which have been tested and listed by an approved listing agency for the intended purpose and use need not be individually retested.

The report shall include the catalog number or other readily identifiable marking, the name of the approved listing agency, the laboratory test report number and date. Such individually tested and listed component parts and devices when installed in combination with other devices in a control unit or in a circuit extended from such control unit shall be subjected to the performance standard tests to determine its suitability for use in combination with other component parts, devices, circuits or equipment.

(c) **Listed control units.** Control units which by their design are intended to fully comply with the Standard for the Installation, Maintenance and Use of Proprietary, Auxiliary, Remote Station and Local Protective Association may be investigated and tested in accordance with the Standards for Safety established by Underwriters' Laboratories, Inc., U.L. 864, provided such investigation, test and report incorporates the provisions of the *California Electrical Code*.

(d) **Rejection for cause.** Compliance with these standards will not necessarily mean approval and listing, if, when examined and tested, it is found to have other features which may impair the result intended by these regulations. Unusual constructions may require application of additional performance tests. The State Fire Marshal may refuse to approve any item for cause.

(e) **Systems only.** The standard applies to protective signaling systems as defined in the *California Electrical Code*, and systems or systems components for which application for approval and listing has been filed under the provisions of the *California Electrical Code*.

This standard does not cover manual stations, automatic detectors, automatic transmitters or other actuating devices; nor does it cover separately listed bells, registers or other indicating devices which are not provided as a part of the control unit or matched against the output of sound-reproducing equipment.

(f) **Differing constructions.** A control unit having materials or forms of construction differing from this standard may be investigated and tested according to the intent of this standard, and if found to be substantially equivalent may be given recognition for approval and listing. The office of the State Fire Marshal shall be consulted for general requirements and performance standards.

GENERAL

Sec. 12-72-102.

(a) Investigation—Report.

1. A control unit or combination signaling system shall be so designed and constructed as to be practical, reliable and sufficiently durable for its intended installation and use. It shall be suitable for use with acceptable actuating and indicating devices which have been found by investigation to be suitable for use with the control unit or combination signaling system. It shall permit its application in conformity with the regulations set forth in the *California Electrical Code*.
2. The scheme of electrical or electronic circuiting of a control unit or combination signaling system shall provide for the degree of electrical supervision required by the *California Electrical Code*, and when required, shall ensure emergency operation in the presence of a fault condition.
3. Attachment plugs, bells, circuit-breakers, cords, fuse-holders, fuses, lampholders, receptacles, transformers, switches, wires, etc., provided as a part of a control unit or combination signaling system shall be investigated and judged under the requirements established by the *California Electrical Code*, for such devices and also with respect to their suitability for the particular application.
4. Amplifiers used in the fire-protective signaling circuits of combination systems shall be tested in accordance with UL, Inc. Standard 813 (Second Edition 1954, amended 1966 and 1967), Sound Recording and Reproducing Equipment.

The exchange or replacement of amplifiers from those originally tested with a combination system shall be tested in accordance with UL, Inc. Standard 813 and evaluated in accordance with this standard to determine their suitability for use with the combination system.

5. The report of investigation shall include schematic wiring diagrams tracing the electrical or electronic circuits in their normally supervised and operating condition. Contacts of operating devices shall be shown in the normally supervised position with operating and supervisory power supplied to the equipment.
6. The report of investigation shall include photographs of the equipment with markings identifying the component parts. Operating and maintenance manuals shall be included with each control unit or combination signaling system and shall be attached to the test report and certification.
7. The report of investigation shall include an itemized list of optional equipment that has, by test, been determined as not required to provide a fire alarm signal transmission. The report of investigation shall include routing of circuits for any equipment or

devices which are not necessary for the transmission of a fire alarm signal.

(b) Marking.

1. Control units and combination signaling systems shall be plainly and permanently marked with a nameplate bearing the manufacturer's name, model number and electrical rating. Enclosures and castings shall have die stamped or cast identifying numbers or other readily identifiable markings. Component parts shall be fully described or identified by manufacturer's name and model number.
2. A wiring diagram of the control unit or combination signaling system shall be attached inside the control cabinet or metalware enclosure.
3. An audible alarm silencing switch when provided, shall be marked to indicate its normal position unless it is of the automatically restoring type. A permanently attached metal or equivalent sign shall bear the following words, "Do not operate the audible alarm silencing switch until the fire department has been notified." The trouble signal silencing switch, unless of the automatically restoring type, shall be marked to indicate its normal on position.
4. Terminal connections for the power supply shall be marked or identified as required by the *California Electrical Code*.
5. Installation wiring terminals or leads shall be marked or otherwise plainly evident.
6. A control unit designed for use with automatic detectors shall be marked for use with nonrestoring types of detectors only, unless the control unit provides signal lock-in performance required by Section 12-72-103 (b), Item 14.
7. A control unit designed for use with limited-energy circuits shall be marked to identify the particular circuits in which the energy is limited.
8. The maximum impedance of each actuating circuit shall be marked when the value for successful operation is less than 100 ohms.
9. A control unit designed to limit the duration of an alarm signal by means of a time-limit cutout shall be marked to indicate the time for which it is to be adjusted; nonadjustable time-limit cutouts shall be marked to indicate time at which it will operate. [See Sections 12-72-103 (1), Items 1 and 2.]
10. Equipment required to be mounted in a definite position in order to function properly shall be marked to indicate correct mounting position.

(c) Frame, enclosure and metalware.

1. Control units and combination signaling systems shall be installed in locked substantial cabinets or metalware enclosures and shall be of a type expressly designed for the service for which they are used. Control unit cabinets and combination signaling system metalware enclosures enclosing alarm

- signaling circuits shall be provided with integral key locks.
2. Control unit cabinets and combination signaling system metalware enclosures shall be so formed and assembled that they will have the strength and rigidity necessary to resist the abuses to which they are liable to be subjected, without adversely affecting their performance, and without increasing fire hazard due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts, or other serious defects.
 3. Electrical parts of a control unit or combination signaling system shall be so located or enclosed that suitable protection against accidental contact with uninsulated hazardous live parts will be provided.
 4. Operating parts, such as gear mechanisms, relays and similar devices, shall be protected against fouling by dust, insects or by other material which might impair their operation, by means of individual protection or dust-tight cabinets.
 5. The thickness of cast metal for an enclosure shall be as indicated in Table 12-72-1A; except that cast metal of lesser thickness may be used if upon investigation it is shown that it has the equivalent mechanical strength.
 6. Sheet metal enclosures for a control unit or combination signaling system shall be investigated and listed by a nationally recognized testing laboratory for its intended purpose or use, or shall be not less than indicated in Table 12-72-1B.
 7. An enclosure shall have suitable means for mounting, accessible without disassembling any operating part except removal of a completely assembled panel such as a relay panel.
 8. An enclosure cover shall be hinged if it gives access to fuses or any other overload-protective device, the normal functioning of which requires renewal, or if it is necessary to open the cover in connection with the normal operation of the control unit or combination signaling system.
 9. Enclosure covers accessible for service only may be unhinged if, upon investigation, they are found to be suitable for the purpose. Unhinged covers shall be securely held in place by screws or equivalent fastening devices requiring the use of a tool for its removal.
 10. Cabinets or compartments for housing of primary batteries shall be key locked with provisions for protection against moisture or movement. Metal cabinets shall be of approved design constructed of sheet iron or steel not less than No. 14 manufacturer's standard gage.
 11. Compartments for storage batteries shall have a total volume not less than twice the volume occupied by the batteries. Ventilating openings shall be provided, and so located to permit dispersion of gas while the battery is being charged at the highest rate permitted by the means incorporated in the unit.
 12. The interior of the storage battery compartment shall be protected against detrimental action by the electrolyte. The compartment shall be so located or enclosed that the equipment of the signaling system will not be adversely affected by battery gases.
 13. Ventilating openings shall be screened with wire screening having wires of not less than No. 16 AWG, expanded metal mesh or perforated metal of not less than 0.042 inch (1 mm) in thickness. No opening in wire screening, metal mesh or perforated metal shall exceed $\frac{1}{2}$ square inch (322 mm²) in area.
 14. A compartment enclosing electrical parts shall not be open to the floor or other support on which the equipment rests.
 - (d) **Protection against corrosion.** Iron and steel parts shall be protected against corrosion by enameling, galvanizing, plating or other equivalent means. This includes all parts upon which proper mechanical operation may depend. It does not apply to bolts, screws, washers or similar parts, if corrosion will not impair operation of the equipment. Stainless steel, polished or treated, does not require additional protection. Bearings shall be of such design and material to ensure against binding due to corrosion.
 - (e) **Insulating materials.**
 1. Base for support of live-metal parts shall be of non-combustible, moisture-resistant, insulating material commonly recognized as suitable for support of live-metal parts. A base shall withstand the most severe conditions liable to be met in service.
 2. Bases mounted on metal surfaces shall be provided with an insulating barrier from the mounting surfaces unless all live-metal parts are staked, upset, sealed or otherwise prevented from loosening to prevent parts and ends of terminal screws from coming in contact with the supporting surface.
 3. Countersunk, sealed parts of control units shall be covered to a depth of not less than $\frac{1}{8}$ inch (3 mm) with a waterproof insulating compound which will not melt at a temperature 15°C higher than the normal operating temperature of the assembly. In no case shall such insulating compound melt at less than 65°C.
 - (f) **Mounting parts.**
 1. All parts of control equipment shall be securely mounted in position to prevent loosening or turning if such motion may adversely affect normal operation of the control equipment. A switch, lampholder, attachment-plug receptacle or plug connector shall be mounted securely and, except as noted in Item 3, shall be prevented from turning. See Item 4.
 2. The requirement that a switch be prevented from turning may be waived if all four of the following conditions are met:
 - A. The switch is to be of a plunger or other type that does not tend to rotate when operated (a toggle switch is considered to be subject to forces that

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tend to turn the switch during normal operation of the switch).

- B. The means of mounting the switch is to make it unlikely that operation of the switch will loosen the switch.
 - C. The spacings are not to be reduced below the minimum acceptable values if the switch does rotate.
 - D. Normal operation of the switch is to be by mechanical means rather than by direct contact by persons.
3. A lampholder of a type in which the lamp cannot be replaced (such as a neon pilot or indicator light in which the lamp is sealed in by a nonremovable jewel) need not be prevented from turning if rotation cannot reduce spacings below the minimum acceptable values.
 4. The means for preventing the turning mentioned in Section 12-72-103 (f) is to consist of more than friction between surfaces—e.g., a suitable lockwasher, properly applied, is acceptable as the means for preventing a small stem-mounted switch or other device having a single-hole mounting means from turning.
 5. Uninsulated live-metal parts, including terminals, shall be secured by methods other than friction between surfaces, to prevent turning or shifting that may result in reduction of any required spacings. Contact assemblies shall be so secured that alignment of contacts will be ensured.

(g) **Grounding.** Cabinets, metalware enclosures and non-current carrying metal parts shall be grounded as required by the *California Electrical Code*. Equipment grounded by a multiple-conductor cord shall have a fixed contacting member in the attachment plug for connection of the grounding conductor. The grounding conductor shall be green-identified and shall not be used as a circuit conductor.

(h) Operating mechanisms.

1. Parts and motors shall be suitable for the particular applications and shall be of sufficient mechanical strength and capacity to withstand the stresses to which they will be subjected in operation without introducing any hazard.
2. Cams, signaling wheels and similar parts shall be fastened to prevent loosening or independent turning. Adjustable parts and adjusting screws shall have provisions to prevent loosening under conditions of use.
3. Electromagnetic devices shall be designed to provide positive electrical and mechanical performance under all conditions of use.

(i) Current-carrying parts.

1. Current-carrying parts shall be of nonferrous metal recognized as suitable and of sufficient mechanical strength for the particular application.

2. Except for grounded signaling wheels, bearings, hinges, etc., shall not be used for carrying current between interrelated fixed and moving parts.

(j) **Supply connections.** Control units and combination signaling systems shall be provided with wiring terminals for the connection of conductors of at least the size required by the *California Electrical Code*, for the electrical rating of the equipment.

(k) Terminal connections.

1. Wiring terminals shall ensure thorough connections under hard usage. Terminals shall be a suitable pressure wire connector, firmly bolted or held by a screw, except that for No. 8 AWG and smaller wires, a wire binding screw having upturned lugs or the equivalent may be used. Alternate: Binding screws without upturned lugs may be recognized when conductors are fitted with mechanically and electrical secure ring connectors.
2. Wire-binding screws not less than 8-32 may be used at terminal strips, except that a 6-32 screw may be used for No. 14 AWG and smaller wires. Terminal plates shall be not less than 0.050 inch (1 mm) in thickness to provide not less than two full threads in the metal. Terminal plates of less thickness may be recognized when the resistance to stripping of the threads is equal to or greater than two full threads in 0.050-inch-thick (1 mm) terminal plates.

(l) Raceways and power-supply cord.

1. Control units shall have provisions for connection of armored cable or conduit. Combination signaling systems may be provided with a flexible cord and attachment cap. The power-supply cord serving the fire alarm signal generator or tone oscillator shall be Type SJ or equivalent. Strain relief shall be provided so that mechanical stress on a flexible cord will not be transmitted to terminals, splices or interior wiring. Power-supply for the signal generator or tone oscillator provided by a cord shall have an attachment cap with a device to prevent its easy removal from the receptacle.
2. Power-supply for clock, communication or program systems shall not be supplied from the fire alarm control unit.

(m) Internal wiring.

1. Internal wiring of a control unit or combination signaling system shall consist of suitably insulated conductors for the voltage and temperature attained, and of adequate current-carrying capacity for the service.
2. All conductors in an enclosure or raceway shall be insulated for the maximum voltage of any conductor in the enclosure or raceway.
3. Wireways shall be smooth and free from sharp edges, burrs, fins and moving parts. Holes in sheet metal partitions shall be provided with smooth bushings or shall have smooth well-rounded surfaces.

4. All joints and connections shall be mechanically secure and shall provide a reliable electrical contact without strain on connections and terminals. Stranded conductors clamped under wiring-binding screws or similar parts shall have the individual strands soldered together or equivalent arrangement to ensure reliable connections.
5. Wire shall be neatly arranged and routed, and shall be held in place with clamps, string ties or equivalent unless of sufficient rigidity to retain a shaped form, placed in spaces affording protection against damage during servicing.

(n) Interconnection of units.

1. Control units and combination signaling systems shall be interconnected by metallic raceway enclosures or armored cable suitable for the purpose.
2. Cords and wires used to interconnect units within the overall enclosure shall be securely fastened to the enclosure walls by means of clamps or shall be cabled assemblies with strain relief.
3. In combination signaling systems, the control unit audible alarm circuit shall form the alarm signal interconnection. The audible alarm circuit shall be continuous to the terminals of the relay approved for alarm signaling service for the control unit, except that contacts of a combination signaling system power-supply supervisory relay may be included in the circuit.
4. The alarm signal relay shall be firmly attached to the enclosure and shall be a component part of the combination signaling system unit.
5. The interconnection between control units having nonsupervised audible alarm circuits and the combination signaling system shall be in duplicate, wired alternately to two or more signal relays wired in parallel to the oscillator or tone signal relays.
6. Portions of alarm circuits in combination signaling system control panels which are not supervised from the contacts of the audible alarm signal relay to the oscillator or tone signal alarm relays shall not exceed 24 inches (609 mm) in length. They shall be of 600V insulated wire held in place by clamps or equivalent and so located that they will not be subject to handling during use or servicing.

(o) Capacitors. Capacitors shall be of materials suitable for their intended use. A paper capacitor shall be impregnated or suitably enclosed to exclude moisture. It shall not be injuriously affected by the temperature attained under the most severe conditions of use. The removal of a capacitor of the plug-in type shall require the use of a tool.

(p) Coil windings—transformers.

1. The insulation of coil windings of relays, transformers, etc., shall be impregnated or otherwise designed to exclude moisture.

2. Transformers connected across a power-supply circuit shall be individually housed in noncombustible material.
3. Transformers shall be of the two-coil or insulated type except that an autotransformer may be employed provided the terminal common to both input and output circuits is connected to the grounded supply terminal.

(q) Overcurrent protection.

1. Storage batteries provided as part of a control unit, other than primary batteries, shall be protected by overcurrent devices having a rating of not less than 150 percent and not more than 200 percent of the maximum operating load on the battery.
2. System control units and combination signaling system control units shall be protected on the current supply side by overcurrent devices having a rating not more than 150 percent of the maximum normal operating current.
3. Transformers shall be protected on either the primary or secondary side by overcurrent devices having a rating not greater than the continuous duty rating of the transformer unless the current is limited to the same value by other acceptable means.

(r) Rectifiers.

1. Rectifiers used direct shall be approved for the purpose and of adequate capacity to maintain voltage regulation between 100 percent of rated voltage at maximum load and 130 percent of rated voltage at no load.
2. A control unit incorporating a battery-charging rectifier shall be provided with meters as part of the assembly or with readily accessible terminal connections for portable meters for determination of battery voltage and charging current.

(s) Storage batteries.

1. Storage batteries provided as part of a control unit shall have sealed cells with spray-trap vents. Normal charging shall be by a trickle-charge rectifier. The mounting arrangement shall prevent terminals from contacting terminals of adjacent cells or parts of the battery enclosure. The cells shall permit ready access for checking the specific gravity of the electrolyte.
2. The conditioning charge shall be so limited that with the maximum charge which can be obtained, the battery gases will not adversely affect the control unit.

(t) Spacings.

1. A control unit or combination signaling system shall provide reliably maintained spacings between uninsulated live-metal parts, and between uninsulated live-metal parts and dead-metal or noncurrent carrying metal parts not less than those indicated in Table 12-72-1C and Section 12-72-102 (t), Items 3 and 4.

2. The spaces within devices or assemblies which have been individually or as assemblies tested and listed by a nationally recognized testing agency for the intended use need not comply with the provisions of Table 12-72-1C and Section 12-72-102 (t), Items 3 and 4. The report shall note such devices and assemblies by reference to the test report.
3. If a short circuit between uninsulated live-metal parts of the same polarity would prevent the normal signaling operation of the control unit without simultaneously producing a trouble signal, the spacings between such parts shall be not less than those indicated for “other parts” in Table 12-72-1C except in the case of the special devices mentioned in Footnote 2 to the table, the spacing between uninsulated live-metal parts of the same polarity, for any potential of 0-300 volts, shall be not less than $\frac{1}{32}$ inch (0.8 mm) through air, and the spacing over surface shall be not less than $\frac{1}{16}$ inch (1.6 mm) unless the smaller over-surface spacings permitted in Footnotes 3 and 4 of Table 12-72-1C.
4. Spacings may be reduced provided a barrier or liner of suitable moisture-resistant insulating material of sufficient mechanical strength to withstand operation of equipment and arcing is used, and is reliably held in place.

(u) **Speakers—sound equipment.** Speakers shall be of an approved type and designed with current capabilities for the intended function and purposes.

PERFORMANCE

Sec. 12-72-103.

(a) General.

1. The performance of a control unit or combination signaling system shall be investigated by subjecting a representative sample in commercial form to tests described in Sections 12-72-103 (b) through (q). Insofar as possible tests are to be made in the order indicated by the following test headings.
2. A control unit shall be tested in the position in which it is designed to be installed for proper function.
3. A combination signaling system console or rack is to be placed in a position simulating an actual installation against a vertical wood wall unless by its design, it is obviously intended for installation in the open. If ventilation openings are provided on the rear surfaces, it is to be spaced out 1 inch (25 mm) from the wall.
4. Tests shall be made at rated frequency and voltage. The rated voltage for test purposes is considered to be 120 volts for units marked 110–125 volts, or 240 volts if marked 220–250 volts.
5. Control units intended to be energized by trickle-charged batteries shall be tested at the rated trickle-charge of the battery except for over-and under-voltage tests.

(b) Normal operation.

1. A control unit or combination signaling system shall operate reliably and uniformly for all conditions of its intended performance when employed in conjunction with actuating devices, indicating devices and power supplies to form a combination type indicated by the wiring diagram and supplementary information supplied with it.
2. To determine compliance, actuating devices, indicating devices optional equipment not necessary for transmission of a fire alarm signal, and power supplies are to be connected to the control unit to form a typical combination, and the control unit operated for each condition of its intended performance.
3. A combination signaling system shall be connected to the intended signal initiating control units and devices, optional equipment or devices not necessary for the transmission of a fire alarm signal, signal indicating devices (in sound-reproducing equipment the output impedance and matching load combination which produced the maximum input in the power- input test is to be used), and power supplies, and the equipment operated for each condition of its intended performance.
4. Actuating and indicating devices used for testing are to be those specified by the wiring diagram of the equipment, except that substitute devices may be used if the actuating switching contacts produce equivalent actuation, and if the indicating devices produce equivalent signal indication and circuit loading. Acceptable substitute load devices are those found by investigation to produce the same load conditions as the devices intended to be used with the equipment.
5. The control unit or combination signaling system shall be in the normal circuit supervisory condition prepared for normal signaling operation by being connected to the devices and circuits indicated in Sections 12-72-103 (b), Items 1 through 3.
6. The operation of any actuating device shall cause the equipment to operate the related indicating devices to produce a clearly defined signal of the type for which the combination is designed.
7. A coded fire alarm signal shall consist of not less than three complete rounds of the number transmitted.
8. Fire alarm signals in schools emitted by devices not distinctive in tone or used for other purposes shall be intermittent or continuous sounding signals. The signal, herein referred to as the *California Uniform Fire Code* Signal, shall be given for a period of 10 full seconds followed by a silence of 5 full seconds before the signal is repeated. The signal shall be given for a period of not less than 1 minute. Conformance requires signal duration in excess of 1 minute.

9. Control units or combination signaling systems shall have provisions to disconnect time and program signal circuits upon initiation of an alarm signal. Restoration of time, recall or program circuits shall require manual operation of a resetting device in the control unit or combination signaling system console. The resetting device shall be located inside the locked control panel or console, or shall be key-operated. A metal sign having the following words shall be attached adjacent to the switch "Reset switch shall not be operated until building has been determined safe from fire." The wiring diagram required by Section 12-72-103 (b), Item 2, shall include the circuit arrangement.
 10. Combination signaling systems designed for use with a coded fire alarm control unit (control unit of type other than continuous ringing) shall be provided with an audible alarm signal relay of the lock-in type. This may be a latching-type relay or an electrical holding circuit.
 11. Combination signaling systems designed for use with a continuous ringing fire alarm control unit shall be provided with a *California Fire Code* Signal coding device actuated by the audible alarm signal relay.
 12. Combination signaling system using sound-reproducing equipment designed to provide an alarm signal of distinctive tone used for no other purpose is not required to provide a coding device. To be considered as distinctive in tone, the frequency should be not less than 300 cycles higher or lower than any other signal (such as a classroom or program signal) and shall be an undulating tone swinging not less than approximately 100 cycles each side of the mean frequency with a pulse rate of not less than 30 per minute.
 13. Combination signaling systems which are so designed that they may have the power supply circuit disconnected or alarm signal output discontinued without a trouble signal shall have provisions to instantly and automatically restore power supply, signal generation and signal output upon actuation of a fire alarm initiating device.
 14. The signal indicating resulting from the operation of a noncode fire alarm control unit by automatic detectors having self-restoring contacts shall be maintained automatically by the control unit until a resetting device in the control unit is manually operated.
 15. Combination signaling systems designed to have the audible alarm circuit routed through a clock- cross-connect or pin board shall not, on removal or relocation of any pin, cause interruption of interference with the fire alarm signal. The circuit arrangement shall be shown on the wiring diagram required by Section 12-72-103 (b), Item 2.
 16. Normal operation of fire alarm signaling equipment shall not depend upon a ground connection.
 17. A switch and circuit provided for silencing alarm sounding devices shall conform to the following:
 - A. Switching to the off-normal position shall automatically transfer the alarm signal to visual warning signal lights which shall not be extinguished until the system is manually restored to normal.
 - B. With the system in normal supervisory condition, switching to the off-normal position shall result in an audible trouble signal.
 - C. Restoration of the alarm initiating circuit to normal supervisory condition shall result in a trouble signal, unless the silencing switch and its related control circuit is of the automatically restoring type.
 - D. The switch shall be located inside of the locked control unit enclosure.
 18. Circuits and all related devices of a combination system may have their output regulated providing the minimum setting will allow satisfactory compliance to the *California Electrical Code*, for the total number of sound reproducers that may be served by the system.
- (c) **Power input-sound reproducing equipment.**
1. The current or wattage consumption of a combination signaling system utilizing sound reproducing equipment shall not exceed the marked input rating by more than 5 percent when the equipment is operated under normal conditions while connected to a supply circuit of rated frequency and voltage corresponding to the mean of the marked primary voltage rating.
 2. For the test specified in Section 12-72-103 (c), Item 1, the audio-input connections of each amplifier of the system are to be connected to an oscillator adjusted to supply a 1,000-cycle signal. All volume and tone controls are to be at their maximum settings, and normal operating condition is considered to be operational with the audio-input-signal potential adjusted to produce audio-output rating of the amplifier. The tests are to be conducted throughout the range of impedance taps with load impedance of the amplifier.
- (d) **Fire alarm signal precedence.**
1. Control units designed to serve more than one type of alarm-initiating device or to utilize the audible alarm devices for more than one type of signaling service shall provide priority for manual box signals, and for fire alarm signals in combination signaling systems.
 2. A coded system control unit shall be actuated by one or more initiating devices other than a manual box and by a manual box simultaneously. The manual box signal shall take precedence over other signals.
 3. Combination signaling system shall be actuated to transmit a program or sound signal. A fire alarm initiating device shall be actuated while the program or

sound signal is being transmitted. The fire alarm signal shall take priority without any interference or garbling of the alarm signal. Each separate type of program, or sound signal, including all-call or individual room signals shall be actuated without interfering with the fire alarm signal.

4. Fault conditions shall be introduced in each piece of optional equipment or device and during such fault conditions a fire alarm initiating device shall be actuated. The fire alarm signal shall be transmitted without interference or garbling of the alarm signal.

(e) Electrical supervision.

1. Unless otherwise provided, the circuits formed by conductors extended from the terminals of the control unit or combination signaling system shall be so electrically supervised that a trouble signal will be promptly indicated upon the occurrence of a signal break or ground fault condition of its circuits which would prevent normal operation of the combination, control unit, actuating devices and indicating devices. Electrical supervision of the main operating power, power supply to the oscillator or tone generator shall be provided under the conditions set forth in Sections 12-72-103 (e), Items 2 through 4. The above requirements do not apply to the following type of circuits:
 - A. The audible alarm signaling circuits of combination signaling system of the clock-bell program or sound reproducing type, provided all portions of the circuits are used for normal program or signaling purposes not less than once each hour.
 - B. Local system circuits intended for use only with sprinkler waterflow alarm or sprinkler-supervisory circuits.
 - C. Current and circuits for trouble signals.
 - D. Current for alternate operation when source of main power supply is interrupted.
 - E. Current supply and circuits for supplementary signal devices, or optional equipment not necessary for the transmission of a fire alarm signal, provided that a break or ground fault will not affect operation of the system for required fire alarm signals.
 - F. Circuit for register or indicating device provided as a part of the control unit.
 - G. Audible alarm circuits, provided there are suitable terminal facilities for the connection of either multiple circuits, so that a break or ground fault prevents operation of only one of the circuits; or a return loop circuit so that a break or ground fault does not prevent operation of any alarm signal sounding device or appliance with means provided for testing the continuity of the circuit conductors.
 - H. Circuit for an alarm-indicating device in the same room as the control unit, provided the circuit con-

ductors are installed in a metallic raceway or equivalent to prevent mechanical injury or tampering.

2. Electrical supervision of the main source of operating power. Supervision of a control unit using a rectifier for battery charging shall include supervision of the power supply to the rectifier and the fuse in the load circuit of the battery.
3. Electrical supervision of the power supply to the oscillator or tone generator of a combination signaling system when the signal and its related amplifiers are used for normal room signaling service. The supervisory circuit may be so arranged as to sound the fire alarm control unit trouble signal.
4. Electrical supervision of the signal output of a combination signaling system when the alarm signal oscillator or tone generator and its related amplification devices and circuits are not used for normal signaling.
5. A single break or ground fault in an alarm initiating or indicating circuit, or failure and restoration of the power supply to the control unit, shall not cause transmission of an alarm signal.
6. To determine conformance of a control unit or combination signaling system with the performance and tests requirements of Items 1 through 5, the investigation is to start with the representative system combination in the normal supervisory condition indicated in Section 12-72-103 (b), Item 5; each type of fault to be detected shall be separately introduced in each circuit conductor.
7. If the off-normal position of any normally preset mechanism or any similar part of the control unit or control equipment requires manual restoration to normal position for proper signaling operation of the control equipment, such off-normal position shall be indicated by a trouble signal. Compliance is to be determined by observation during the normal operation test.
8. While the control unit or control equipment is in the supervisory condition, any operation of any manual-switching part that may interfere with normal operation of the equipment of transmission of an alarm signal shall be indicated by a trouble signal. The control unit or equipment shall be operated for transmission of signals in each position of the manual-switching parts.

(f) Trouble signals. Trouble signals shall be distinctive from alarm signals, or other communication or warning signals. They shall be indicated by the continuous sound of an audible trouble signaling device or appliance. The audible signal sounding device or appliance may be common to more than one supervised circuit. Trouble signal sounding circuits may be provided with time limit cut-off devices to provide for intermittent operation of the trouble signal device or appliance. The time limit device or appliance shall provide for the continuous sounding of the trouble signal sounding

device or appliance for a period of not less than 10 minutes followed by a period of silence not to exceed 5 minutes.

(g) **Trouble signal silencing switch.** A trouble signal silencing switch shall be provided. Upon operation of the trouble signal silencing switch, the trouble indication shall be transferred to a trouble lamp or other approved visual indicator located adjacent to the silencing switch. Operation of the trouble signal silencing switch shall also remove the time limit cutout from the circuit. The visual indicator shall remain in operation until the silencing switch is restored to its normal position unless the audible trouble signal will be obtained when a fault occurs without restoring the switch to normal position. The silencing switch and its related control circuit may be of the automatically restoring type.

(h) **Control unit input and output current and voltage.**

1. The input or output current of each circuit of a control unit shall not exceed the marked rating of the control unit by more than 10 percent when the unit is operated under conditions of normal use.
2. A limited-energy detector circuit shall conform to the following:
 - A. The open-circuit voltage between any two wiring terminals and between any terminal and a grounded circuit part or noncurrent carrying metal part shall not exceed 50 volts when the control unit is connected to a power supply source of rated voltage and frequency.
 - B. Overcurrent protection not in excess of 2 amperes shall be provided in such manner that each limited-energy circuit is protected. Current-limiting transformers may be substituted, provided that under condition of short circuit, current flow at the terminals will not exceed 2 amperes.

(i) **Jarring.** The control unit or control equipment installed or supported in the position of its normal use connected to a power supply and in supervisory condition shall withstand jarring from impact or vibration such as may be experienced in service by striking the enclosure. Striking the enclosure shall not cause signaling operation of any part nor adversely affect any subsequent normal operation.

(j) **Temperature.**

1. Materials employed in the construction of a control unit or combination signaling system which have not been investigated and reported on by a nationally recognized testing laboratory as an assembly in the form intended for use shall be investigated and tested to determine temperature rises that may adversely affect the materials of construction, normal signaling operation of the equipment and fire hazard to building materials.
2. A control unit shall be mounted on a wood panel representative of its manner of installation in service. It shall be connected to a power supply as indicated in Section 12-72-103 (a), Item 4, and operated under representative normal conditions liable to produce the highest temperatures.

3. A combination signaling system shall be set up representative of normal service conditions against a wood panel wall as specified in Section 12-72-103 (a), Item 3, connected to a supply circuit as indicated in Section 12-72-103 (c), Item 1, and operated under representative normal conditions liable to produce the highest temperatures.
4. In control units equipped with time-limit cutouts which are not intended to limit the time of alarm-signal operation, the time-limit cutout shall be shunted out of the circuit for the duration of the test.
5. A control unit or combination signaling system intended to provide impulse signals shall be operated by a testing device to provide one impulse per second, except that if the signal impulses are normally produced by a device which is a part of the control unit or equipment assembly, the test impulses are to be at the rate of normal operation of the device.
6. Circuits shall be loaded representative of maximum load under normal service conditions. Resistors shall be adjusted for maximum wattage dissipation possible under conditions of normal service.
7. Except for coils, temperature readings are to be preferably obtained by means of thermocouples. Temperatures are to be considered as constant when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 5 minute intervals, indicate no change. Temperature rise on coils may be determined by the resistance method or mercury thermometers.
8. Horizontal screened or ventilation openings subject to accumulation of dust and lint shall be covered with loose cotton.
9. Materials of construction and fire hazard to buildings shall be considered to be adversely affected if the temperature rise exceeds the limits shown in the following, based on an assumed ambient temperature of 25°C:
 - A. 65°C on wood panels or other combustible material or surfaces adjacent to or upon which a control unit may be mounted in service.
 - B. 35°C on rubber or thermoplastic insulation.
 - C. 60°C on varnished cloth insulation.
 - D. 65°C on surface of coil winding of impregnated organic insulation.
 - E. 125°C on phenolic insulation.
 - F. 65°C on a transformer enclosure.
 - G. 65°C on fiber insulation.
 - H. 30°C at any point on a copper-oxide rectifier.
 - I. 50°C at any point on a selenium rectifier.
 - J. 15°C less than melting point of a sealing compound.

- K. Rated temperature limit of a capacitor.
- L. 65°C on fuses.
- M. 350°C on embedded resistor.

10. The test-operating condition shall be continued for a period of not less than:

- A. Operation under a normal supervisory condition until constant temperatures are attained.
- B. Operation for 1 hour during normal signaling condition of local system control equipment designed for actuation by automatic devices. Includes control units producing a continuous signal until actuating device is restored to normal or until a circuit-resetting device is manually operated.
- C. Operation for 15 minutes during normal signaling condition of a local system control unit intended to be actuated by coded manual fire alarm boxes.
- D. Operation of a rectifier at its maximum rated output until constant temperatures are attained.

(k) Over- and under-voltage operation.

1. The design of a signaling system shall provide that the system will perform its intended function at 85 percent and at 110 percent of rated voltage. The operating parts of control equipment shall withstand 110 percent of its rated voltage continuously without injury during the normal supervisory condition.
2. To determine compliance with the higher voltage specified in Item 1, the signaling system is to be subjected to the increased voltage while in its normal supervisory condition until a constant temperature of all of its parts attained but in no case less than 3 hours and then tested for all signaling conditions. The unit shall not fail to transmit any required signal.
3. To determine compliance with the under-voltage specified in Item 1, the signaling system is to be operated in the normal supervisory condition until constant temperatures of all its parts are attained and then immediately tested for all signaling conditions at the reduced voltage. Reduced voltage is to be achieved by a means that maintains a stable potential of the required value under the most severe conditions of normal loading.
4. Circuits extended from the control unit in which the maximum impedance for successful operation is less than 100 ohms shall have the maximum impedance connected to its circuits during the under-voltage test.

(l) Time limit cutout.

1. A time limit cutout arranged to control the duration of a continuous alarm signal shall operate within the range of the time marked for the control unit when tested at an ambient temperature of 25°C ± 2°C. A common coded signal shall complete not less than three complete rounds and a system control unit

intended for schools not less than 1 full minute of signal transmission as specified in Section 12-72-103 (b), Item 8, before operation of the time limit cutout.

2. Except as specified in Item 1, a bell circuit time-limit-cutout shall operate in not less than 3 minutes nor more than 10 minutes when energized continuously at the maximum rated current value of the circuit to which it is connected, tested at an ambient temperature of 25°C ± 2°C.

(m) Overload.

1. Under the conditions specified in Items 2 through 4, a current-interrupting device provided as part of, or intended for use with, a signaling system control unit or equipment shall perform in an acceptable manner during an overload test consisting of not less than 50 make and break operations. There shall be no electrical or mechanical failure of the device, nor shall there be any undue arcing, burning, pitting or welding of contacts.
2. A control unit or equipment normally supplied from a grounded circuit shall be tested with all normally grounded parts and the enclosure connected through a 15 ampere fuse to the grounded conductor of the supply circuit.
3. Current-interrupting devices controlling devices on the load side of control equipment power supply terminals shall be tested at 115 percent of rated voltage with a test load equivalent to that which the device is intended to control.
4. Overcurrent devices in control equipment which includes motor-driven devices or intended to include motors on any of its circuits shall be tested under stalled rotor conditions of the motor.

(n) Endurance. An operating device included as part of a control unit or combination signaling system shall perform acceptably when tested at the rate and for the number of cycles specified in Table 12-72-1D. When the device controls an electrical load the contacts shall make and break the normal current the device is intended to control for the number of cycles specified. There shall not be any electrical or mechanical failure of the device, nor shall there be any undue arcing, burning, pitting or welding of the contacts. The device shall be tested in conjunction with its related components in the assembly by operating the primary actuating device to produce the signals.

(o) Dielectric tests.

1. Except for motors rated at 1/2 hp or less, and 250 volts or less, signaling system control units or equipment shall withstand, without breakdown, the application of a 60-cycle alternating potential of twice rated voltage plus 1,000 volts for a period of 1 full minute. The test potential shall be applied to the following parts:
 - A. Between all normally ungrounded current-carrying parts and the enclosure.

B. Between all metal current-carrying parts and exposed noncurrent-carrying parts.

C. Between all current-carrying metal parts of circuits, including transformer windings, operating at different frequencies of potentials.

2. Motors rated less than $\frac{1}{2}$ hp and 250 volts shall withstand for 1 minute without breakdown, the application of a 60-cycle a.c. potential of 900 volts between the frame and winding.

(p) **Abnormal operation.**

1. A control unit shall be capable of operating under abnormal conditions without emission of flame, molten metal or other manifestation of a fire hazard. Excessive temperatures or burnout is indicative of failure.
2. A control unit connected to a supply circuit of rated voltage shall have its alarm initiating and audible alarm circuits short-circuited until a constant temperature is attained, or burnout occurs, unless the fault results in operation of an overcurrent device which is an integral component part of the unit.

(q) **Burnout tests.**

1. A continuous-duty resistor shall not burn out or be adversely affected while carrying the maximum normal load continuously. An intermittent duty resistor shall carry its maximum rated current on any step for the maximum length of time permitted by limiting devices of the unit.
2. A transformer operated continuously, at the rated voltage and frequency specified by Section 12-72-103 (a), Item 4, with the enclosure grounded and having a load of three times maximum normal load current connected to its output terminals shall not be adversely affected by injury to the enclosure, nor shall any emission of flame or molten metal occur.
3. The testing circuit shall be protected by overcurrent devices having a rating of at least ten times the primary current rating of the transformer. Output terminals of the transformer shall be short-circuited, if such a condition results in less than three times the maximum normal load current being drawn from the secondary. Tests shall be continued until constant temperatures are attained or a burnout occurs. Blowing of the fuse on the primary side of the transformer is not considered to be a failure.
4. If the circuit designs of a control unit or combination signaling system incorporate a time limit cutout or a mercury tube switch wired into the system circuit in such a manner that a short circuit or a ground fault causes the device to carry current in excess of its maximum normal load, it shall withstand the test specified in Items 5 through 7, without introducing a fire hazard.
5. The device is to be tested in the control equipment as it is intended to be normally used and in series with a protective fuse of the marked maximum rat-

ing indicated by the markings on the control unit. All openings in the enclosure of the control equipment shall be covered with surgical cotton, and the enclosure is to be connected to ground through a fuse of the same rating as the protective fuse mentioned above.

6. The open circuit voltage of the test circuit is to be within 5 percent of the rated voltage; see Sections 12-72-103 (a), Item 4, and 12-72-103 (c), Item 1, of the control equipment circuit in which the device is installed, except that a higher voltage may be used if agreeable to those concerned. The source of current and the test circuit should have sufficient capacity to deliver 1,000 amperes when the system is short-circuited at the testing terminals.
7. Ignition of the cotton, or of insulation on circuit conductors, emission of flame or molten metal from the enclosure, blowing of the fuse in the grounding conductor, damage to other parts of the control equipment, or any evidence of a fire hazard is to be deemed as failure. Burnout of pigtail leads or a thermal element, or welding of contacts, is not to be considered as a failure.

PRINTED WIRING BOARDS

Sec. 12-72-104.

(a) **General.**

1. These requirements cover printed wiring boards that are intended for use in fire protective signaling equipment. The acceptability of the combination of the printed wiring board and the electric equipment is to be determined by the State Fire Marshal.
2. Printed wiring boards conforming to ASTM Grade FR-5 when tested in accordance with ASTM Designation D-1867, may be used in protective signaling equipment.
3. Throughout these requirements, the term "printed wiring" is used to designate a pattern of conductive material formed in a predetermined design on the surface or surfaces of a common insulating base, and intended primarily to provide point to point electrical connections, shielding or to form inductors. The term "printed wiring board" is used to designate the combination of a printed wiring pattern and the common insulating base completely processed as far as the printed portion is concerned. The term "printed wiring assembly" is used to designate a printed wiring board on which separate components have been added.
4. Printed wiring boards which do not conform to Item 3, shall be tested in accordance with the procedures set forth in Sections 12-72-104 (b) through (d).

(b) **Insulating material.** Insulating material on which printed wiring is applied shall be suitable for the sole support of uninsulated live parts and for the temperature involved, and shall have suitable mechanical strength.

(c) **Conductors.**

1. Current-carrying parts of printed wiring shall be of copper, copper-alloy, aluminum, silver or other material having similar corrosion-resisting properties.
2. Conductor surfaces shall be substantially free of wrinkles, pits, blisters, corrosion or other imperfections before and after being subjected to the conditions described in Item 6.
3. Printed wiring shall be so applied to the insulating material that the average strength of the bond between the printed wiring and the insulating base for each individual strip of conductor will not be less than 1 pound per inch of width of the printed wiring when samples are tested under the conditions described in Items 4 through 7.
4. The samples of printed wiring boards are to be without components (capacitors, resistors, etc.) and, except at points where connections are to be made, the conductors are to be free from solder. If the normal production soldering operation results in a coating of solder on the conductors, the samples are to be subjected to a simulated soldering operation, using a material other than solder, at the normal soldering temperature, or an equivalent arrangement, in order to obtain the same thermal effect on the conductors.
5. A uniform width of the printed wiring is to be peeled from the insulating material for a distance of $\frac{1}{4}$ inch (6 mm) at a uniform rate of approximately 12 inches (305 mm) per minute, with the angle between the printed conductor and the insulating material at not less than 85 degrees, and the force required to separate the conductor from the insulating material measured. Three determinations are to be made on each of six samples, and the average strength of the bond for each individual strip or conductor determined.
6. Following the test described in the preceding paragraph, three of the samples are to be placed in an air oven maintained at the temperature determined by the following expression for 1,344 consecutive hours:

$$T = 1.02 (R + 15 + 273) - 273, \text{ where}$$

T = oven temperature in °C.

R = temperature in °C for which the printed material is to be recognized (75°, 90°, 105° or 125°C).

The remaining three samples are to be placed first in the air oven for 168 hours and then in a moist air chamber having a relative humidity of 83.5–86.5 percent at a temperature of 30.5°–33.5°C, for 168 hours, and the cycle repeated for a total of 1,344 hours (four 168-hour periods in the air oven alternating with four 168-hour periods in the moist air).

7. After 1,344 hours under the conditions described in the preceding paragraph, the six samples are to be

allowed to cool to room temperature and then subjected to the test described in Item 5 and the average strength of the bond determined for each sample.

8. The use of coatings over printed wiring will be given special consideration with respect to their effect on the strength of the bond between the printed wiring and the insulating material.

(d) **Dielectric strength.**

1. The average dielectric breakdown potential for six samples of printed wiring boards that have been conditioned in an air oven for 1,344 hours at the temperature determined by the formula in Section 12-72-104 (c), Item 6, shall be not less than 80 percent of the average dielectric breakdown potential for six samples of printed wiring boards that have not been subjected to such conditioning.
2. The 12 samples may be provided without components (capacitors, sockets, resistors, etc.) but are to be samples that have been subjected to the complete production soldering process. The test potential is to be obtained from a suitable transformer, the output voltage of which can be regulated. The potential is to be increased gradually from zero, at the rate, of approximate 75 volts per second, until dielectric breakdown occurs. Three different locations on each sample, with different spacings between conductors, if possible, are to be tested. The locations selected are to be the same for all samples. The average dielectric breakdown potentials for each group of six samples for each location is to be determined. The average value for each location for the samples that have been conditioned is to be not less than 80 percent of the average value for the corresponding location for the samples that have not been conditioned.

RELAYS FOR PROTECTIVE SIGNALING SERVICE

Sec. 12-72-105.

(a) **Test conditions.** Relays which have not been qualified as approved for use with protective signaling systems by investigation and report from an approved listing agency shall have its suitability for use in a protective signaling system evidenced by an investigation and report by an approved testing laboratory which shall include certification that the relay conforms to the minimum requirements of the *California Electrical Code*. The test report shall include, but is not limited to:

1. Over- and under-voltage operation per the *California Electrical Code*.
2. The insulation of coil windings of relays shall be such as to resist the absorption of moisture.
3. Temperature readings on the coil and insulation under normal operation at a constant temperature (temperature may be considered constant when three succeeding readings at not less than 5 minute intervals indicate no change in temperature).

4. Overload test consisting of 50 operations at 115 percent of rated voltage with a test load being that which the relay is to handle.
5. Endurance test consisting of 40,000 cycles of coded or noncoded signal impulses at rated load and voltage.
6. Dielectric strength test without breakdown by application of 60 cycle a.c. at twice rated voltage plus 1,000 volts for a period not less than 1 minute.

(b) **Acceptance criteria.** There shall be no electrical or mechanical failure, nor any undue pitting, burning or welding of contact during any test.

SEMICONDUCTOR TESTS

Sec. 12-72-106.

(a) **General.** Semiconductors shall be investigated to determine their suitability for application under all the environmental conditions to which they will be exposed in service.

The performance tests of the complete device are intended to show the effects of these conditions. The prescribed tests may be supplemented where conditions exceeding those represented by the tests indicated herein may be encountered.

(b) **Test procedure.**

1. **Temperature.** The system combination is to be connected as in the normal operation test and operated in an oven at 85°C. It is then to be operated in a refrigerator at 0°C. After temperature equilibrium has been maintained in both cases, the unit shall operate as in the normal operation test.
2. **Humidity.** The system combination is to be connected as in the normal operation test, and placed in a humidity cabinet maintained at 85 percent humidity, 32°C, for a period of 48 hours. At the end of this time, the unit shall operate as in the normal operation test.
3. **Transient voltage.** The system combination shall be subjected to the transient voltages caused by the collapse of the field of a 2-kilovolt-ampere transformer switched on and off on a random basis for 500 cycles.

4. **Acceptance criteria.** There shall be no adverse effects on the system combination and the unit shall operate as intended.

(c) **Temperature.** A semiconductor shall be operated so as to obtain not more than 75 percent of its rated operating temperature during the normal supervisory condition indicated in Section 12-72-103 (b), Item 5. The rated operating temperature of a semiconductor shall not be exceeded under any condition of operation of the complete unit which produces the maximum temperature dissipation of its components, including the over-voltage test described in Section 12-72-103 (k), Items 1 and 2, and the variable ambient temperature test described in Section 12-72-106 (b), Item 1.

ELECTRICAL RATING

Sec. 12-72-107. The electrical rating of a control unit or combination signaling system shall be marked as provided in Section 12-72-102 (b). The following ratings shall be marked on the nameplate or may be marked on supplemental labels at the terminal strips:

(a) Each power supply circuit—the voltage, frequency and maximum input in amperes or watts.

(b) Each alarm initiating circuit—maximum current output and maximum open-circuit voltage if different than the power supply circuit.

(c) Each control unit audible alarm or indicating circuit—maximum current output and the maximum open-circuit voltage if different than the power supply circuit.

(d) Each combination signaling system sound reproducing control audible alarm circuit-output rating in watts.

(e) Supplementary—device circuit—maximum current load that may be connected, and the voltage and frequency of supply power other than that of the control unit.

(f) Fuses—maximum ampere rating of the fuse that may be installed in each fuseholder provided as part of the control unit or combination signaling system.

TABLE 12-72-1A—CAST-METAL ENCLOSURES

DIMENSION OF AREA	MINIMUM THICKNESS IN INCHES	
	Die-cast metal	Castings other than die-cast
24 square inches or less, no dimension greater than 6 inches	$\frac{5}{64}$ *	$\frac{1}{2}$
More than 24 square inches or any dimension exceeding 6 inches	$\frac{3}{32}$	$\frac{1}{2}$
Threaded conduit opening	$\frac{1}{4}$	$\frac{1}{4}$
Unthreaded conduit opening	$\frac{1}{8}$	$\frac{1}{9}$

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².
 * Suitable reinforcing ribs may subdivide larger areas.

TABLE 12-72-1B—SHEET-METAL ENCLOSURES

MAXIMUM DIMENSIONS		MINIMUM THICKNESS IN INCHES*		
		Steel		Copper, brass or aluminum
Linear dimension	Surface area in square inches	Zinc coated	Uncoated	
24	360	0.057 (16)	0.054 (16)	0.075 (12)
48	1,200	0.071 (14)	0.067 (14)	0.095 (10)
60	1,500	0.098 (12)	0.095 (12)	0.122 (8)
Over 60	Over 1,500	0.127 (10)	0.124 (10)	0.153 (6)

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

Note: Numbers in parentheses are the galvanized sheet gage for zinc-coated steel, manufacturer’s standard gage for uncoated steel, American wire gage for nonferrous metal.

* At areas where armored cable or conduit is to be attached, sheet metal shall be of such thickness or so formed or reinforced that it will have the stiffness equivalent to uncoated flat sheet steel 0.054 inch thickness; when a supporting frame or equivalent reinforcing by forming or flanging is provided, thicknesses may be reduced by two gage numbers.

TABLE 12-72-1C—MINIMUM ACCEPTABLE SPACINGS IN INCHES^{1,2}

POTENTIAL INVOLVED IN VOLTS	AT INSTALLATION-WIRING TERMINALS		AT OTHER PARTS	
	Through the air	Over the surface of insulating material	Through the air	Over the surface of insulating material
0-150	$\frac{1}{4}^3$	$\frac{1}{4}^3$	$\frac{1}{8}^4$	$\frac{1}{4}^4$
151-300	$\frac{1}{8}^{3,5}$	$\frac{1}{8}^3$	$\frac{1}{4}^4$	$\frac{3}{8}^4$
	$\frac{1}{4}^3$			

For SI: 1 inch = 25.4 mm.

- Measurements are to be made while wire with adequate capacity for the applied load is connected to each terminal as it would be in actual installation. In no case is the wire to be smaller than No. 14 AWG.
- At fixed parts of rigidly clamped special assemblies of live parts and insulating separators (such as contact springs on relays or cam switches) that are wired at the factory, the spacings may be less than those indicated, but not less than $\frac{1}{16}$ inch for 0-150 volts, and not less than $\frac{3}{32}$ inch for 151-300 volts, through air and over surface, except as noted in the following footnotes.
- Nor less than $\frac{3}{64}$ inch through air and over surface for 250 volts or less if the equipment which the component part controls does not consume more than 375 volt-amperes or more than 5 amperes.
- Not less than $\frac{1}{32}$ inch through air and over surface for a circuit involving a potential or not more than 30 volts and supplied by a primary battery or by a standard Class 2 transformer or by a suitable combination of transformer and fixed impedance having output characteristics in compliance with what is required for a Class 2 transformer.
- The spacing through air at installation-wiring terminals may be less than $\frac{1}{4}$ inch but not less than $\frac{1}{8}$ inch if the terminals are recessed in insulating material or have insulating barriers so as to confine loose strands of conductors sufficiently to make it unlikely that the terminals will be grounded or short-circuited.

TABLE 12-72-1D—ENDURANCE TEST

NORMAL SIGNALING PERFORMANCE OF DEVICE	TOTAL NUMBER OF CYCLES DEVICE TO BE TESTED	CYCLES PER MINUTE
Continuous noncode signal for each operation of alarm signal initiating device	6,000	6
A number of coded or noncode impulses for each operation of alarm signal initiating device	40,000	60
Preliminary coded or noncode signal impulses followed by continuous signal impulses after each operation of alarm signal initiating device	40,000 resetting of device after each group of 40 impulses	— 60
Relays	40,000	60

CHAPTER 12-72-2
PROTECTIVE SIGNALING SYSTEMS

SINGLE- AND MULTIPLE-STATION FIRE ALARM DEVICES MECHANICALLY OPERATED TYPE
STANDARD 12-72-2

STATE FIRE MARSHAL
SCOPE

Sec. 12-72-200.

(a) **Basic.** This standard represents the minimum basic requirements for the construction and performance of single- and multiple-station fire alarm devices intended for indoor installation, and to be listed under this classification. The minimum design, construction and performance standards set forth herein are those deemed as minimum necessary to establish conformance to the regulations of the State Fire Marshal.

(b) **Definitions.** For the purpose of this standard, the following definitions shall apply:

1. **Fire alarm device, multiple station.** Two or more gas-operated single station units interconnected by metal tubing to one or more remote alarm-sounding devices.
2. **Fire alarm device, single station.** A self-contained fire alarm system comprising a heat detector, an alarm-sounding device and a stored energy source incorporated in one integral package. The basic types are gas-operated units and spring-wound units.
3. **Gas-operated type.** A device having a temperature-sensitive eutectic element; compressed gas, usually in a liquid state in a cylinder; and a sounding means, such as a horn or whistle. When the eutectic element melts, the compressed gas is released in a gaseous state through the alarm-sounding device.
4. **Spring-wound type.** A device having a temperature-sensitive bimetal or eutectic element and a spring-wound type mechanism with clapper mounted within a bell housing. The snap action of the bimetal or melting of the eutectic element releases the spring mechanism resulting in a bell-type sound.

TEST REPORTS

Sec. 12-72-201.

(a) **Test Report contents.** The report shall include engineering data, and an analysis comparing the design against Sections 12-72-201(b) through 12-72-202(g); it shall include operating manuals and photographs. The report shall set forth the tests performed in accordance with this standard and the results thereof.

(b) **Instructions and drawings.** A copy of the operating and installation instructions and any related drawings is to be fur-

nished with the sample submitted for investigation to be used as a guide in the examination and test of the unit and for this purpose they need not be in final printed form.

The instructions and drawings shall include such directions and information as deemed by the manufacturer to be adequate for attaining proper and safe installation, operation and maintenance.

(c) **Rejection for cause.** Compliance with these standards will not necessarily mean approval and listing, if, when examined and tested, it is found to have other features which may impair the result intended by these regulations. Unusual constructions may require application of additional performance tests. The State Fire Marshal may refuse to approve any item for cause. (See the *California Electrical Code*.)

(d) **Devices covered.** This standard does not cover electrically operated single- or multiple-station fire alarm devices actuated by heat, smoke or combustion products.

(e) **Temperature classification.** The temperature sensitive elements of single- and multiple-station fire alarm devices are to be identified as to their temperature of operation as follows:

TEMPERATURE CLASSIFICATION	RATING RANGE, °F (°C)	MAXIMUM CEILING TEMPERATURE, °F (°C)
Ordinary	135-174 (57-79)	100 (38)
Intermediate	175-225 (79-107)	150 (66)

The maximum rating of a fire alarm device is to be not more than 225°F (107°C).

(f) **Differing constructions.** A control unit having materials or forms of construction differing from this standard may be investigated and tested according to the intent of this standard, and if found to be substantially equivalent may be given recognition for approval and listing. The office of the State Fire Marshal shall be consulted for general requirements and performance standards.

GENERAL

Sec. 12-72-202.

(a) **Construction.**

1. Unless otherwise indicated, the term “fire alarm device” as used in this standard refers to single- and multiple-station mechanically operated type fire alarm devices.

PROTECTIVE SIGNALING SYSTEMS

2. A fire alarm device shall be so constructed that it will be reliable and durable for the intended installation and use.
- (b) **Mounting.**
1. A fire alarm device shall be provided with a means for mounting either to a ceiling or wall.
 2. The means for mounting shall not result in any distortion of the fire alarm device so as to alter its operating characteristics.
- (c) **Calibration.**
1. Any means for calibration or adjustment shall be guarded or sealed to prevent manipulation by hand or ordinary tools. A thermal responsive element adjustment, if provided as part of a unit, shall not be capable of being readjusted after shipment from the factory.
 2. A calibration means considered to be not accessible or apparent is one not exposed to manipulation by tools, or one not readily replaceable. The complete concealment of tool-engagement means in a screw, such as a slot, recessed head, etc., by the use of solder or brazing material is considered adequate for the purpose of preventing manipulation or replacement.
- (d) **Materials.**
1. A part shall be constructed of materials that are acceptable for the intended application and shall be of adequate mechanical strength.
 2. Diaphragms and spring parts shall be made of non-ferrous material, such as phosphor bronze, nickel, silver, etc., or of ferrous materials. If ferrous materials are employed, they shall be hermetically sealed or plated so as not to be affected adversely by corrosion.
 3. A eutectic element, if used as the operating member of a fire alarm device, shall be constructed so as not to be affected adversely by conditions to which it is likely to be exposed in service, as represented by the tests described in Section 12-72-203.
 4. All exposed parts likely to be affected adversely by corrosion shall be protected by enameling, galvanizing, sherardizing, plating or equivalent means.
- (e) **Operating mechanisms.**
1. The moving parts of a fire alarm device shall have sufficient play at bearing surfaces to prevent binding.
 2. The manually operated parts of a fire alarm device shall have sufficient strength to withstand the stresses to which they will be subjected in service.
 3. A gear train driving spring shall be reliably anchored at each end. The spring winding means shall be provided with a positive stop to limit the winding or shall withstand the maximum force likely to be applied without affecting the operation of the mechanism adversely.

(f) **Mechanical assembly.**

1. Any servicing or restoration operations intended to be made by the user shall be simple and capable of being accomplished with ordinary tools.
2. A device shall be so constructed that parts will not become displaced during or after installation.
3. An obstruction means, such as a wire mesh screen, shall be provided to prevent the entry of foreign bodies or materials into sounding devices which could prevent their operation.

(g) **Power supervisory feature.** A means shall be provided on a unit to automatically indicate that operating power is not available. The indication may be in the form of a flag, target, sight glass, change in mounting position of the fire alarm device or equivalent. A fire alarm device shall be capable of producing an alarm signal for not less than 4 minutes at the point where the loss of operating power is indicated initially. See Section 12-72-203 (1).

(h) **Operating gas.**

1. The operating gas employed in a fire alarm device shall be noncombustible and shall be of a degree of toxicity that will not produce death or serious injury to guinea pigs during a 2-hour exposure to the gas at a concentration of 2 $\frac{1}{2}$ percent by volume of air.
2. Refrigerants 12 and 22 are commonly used gases which comply with this requirement.

PERFORMANCE

Sec. 12-72-203.

(a) **General.**

1. Representative samples of units in commercial form shall be subjected to the following applicable tests.
2. If a device(s) is required to be mounted in a definite position in order to function properly, it shall be tested in that position.
3. If a device is normally intended to be connected to tubing to function, it shall be connected to the maximum length of tubing specified by the manufacturer unless the length of tubing would not have a bearing on its operation.

(b) **Determination of spacings.**

1. The sensitivity of a fire alarm device is to be expressed in terms of spacing limitations. Spacing limitations refer to the maximum distance permitted between devices mounted on smooth ceilings.
2. Installation spacing limitations of a fire alarm device are developed by an oven test [15-foot (4572 mm) spacing only] or by a fire test. See Sections 12-72-203 (c) and (d).
3. Determination of spacings is obtained by the testing of ordinary degree ratings. Devices shall be sufficiently sensitive to qualify for at least a 15-foot (4572 mm) spacing limitation.

4. An ordinary-degree rating, with a spacing of 15 feet (4572 mm), may be tested for sensitivity by being subjected to the oven test. See Section 12-72-203 (c), Item 1. If the device does not operate within 2 minutes, a fire test shall be conducted.
5. A fire alarm device is not acceptable if it fails to qualify for at least a 15-foot (4572 mm) spacing, i.e., does not operate within 2 minutes in the oven test, and does not operate when subjected to the fire test.

(c) **Oven test.**

1. A fire alarm device shall operate in a normal and uniform manner when tested to the time-temperature curve illustrated in Figure 12-72-2-1. A sample shall be uniform in operation when mounted in the same position inside the oven. Operation is considered uniform if the device operates within a tolerance of 15°F (8.3°C) for an ordinary rated unit and 20°F (11°C) for an intermediate rated unit. A fire alarm device which operates within 2 minutes or less is suitable for a 15-foot (4572 mm) spacing allocation.
2. The test apparatus consists of a full draft circulating air oven capable of producing the time-temperature curve illustrated in Figure 12-72-2-1. Air is to be moved past the sample at a velocity of 230 to 245 feet per minute. The temperature in the oven is recorded by means of a thermocouple and calibrated potentiometer.
3. The device under test is to be installed in the test oven with its temperature-sensitive element located in the air streams and positioned so that there is no obstruction of the moving air to the sensing element.
4. After installation in the oven, the device is to be subjected to the time-temperature conditions illustrated by Figure 12-72-2-1. The time of actuation is to be recorded at the instant the unit goes into alarm.
5. To determine that the performance of a fire alarm device is uniform, five samples are to be tested, using a different sample for each test, but each of the five samples is to be installed inside the chamber in the same position.

(d) **Fire test.**

1. A fire alarm device, installed at the intended spacing, shall operate prior to the 160°F (71.1°C) rated sprinklers installed on a 10-foot (3048 mm) spacing schedule when both are simultaneously exposed to a control fire condition.
2. The test room is to be equipped with automatic sprinkler piping arranged to receive automatic sprinklers on a 10-by-10-foot (3048 mm by 3048 mm) spacing schedule. Sprinklers of the standard upright spray type are to be installed with the deflectors approximately 7 inches (178 mm) below the ceiling, which is normal for sprinkler piping installation. For each test, new automatic sprinklers of the same make and ratings are to be installed in the sprinkler piping. The devices under test are to be installed at their designated spacing, minimum 15 feet (4572

mm), in line with the sprinkler and fire test plan. See Figure 12-72-2-2 for layout.

3. This test is to be conducted in a room having a smooth ceiling with no physical obstructions between the fire source and devices under test and with minimum air movement. The room is to be provided for maintaining the room temperature ambient, if necessary. The heaters are to be shut off during a test trial.
4. The room shall be of sufficient cross-sectional area so that the devices under test are located in accordance with the spacing layout illustrated by Figure 12-72-2-2. The reflection of heated air is to be prevented from returning to the devices under test from adjacent wall surfaces during the course of the fire test. The room height shall be such that the vertical distance from the base of the fire to the ceiling is approximately 12 feet (3657 mm).
5. Fire tests are to be produced by burning denatured alcohol consisting of 190 proof ethanol to which 5 percent methanol has been added as a denaturant, in steel pans of a size necessary to produce a temperature rise sufficient to operate the automatic sprinklers in 2 minutes, ± 10 seconds, when installed on a 10-by-10-foot (3048 mm by 3048 mm) spacing schedule. Since temperature conditions in the test room may vary throughout the year, it is necessary to utilize different pan sizes in order to obtain the proper temperature-rise condition. This test condition develops a time-temperature curve similar to that shown in Figure 12-72-2-1.
6. The fire tests are to be conducted to compare the operating time of the fire alarm devices when installed at their recommended spacing schedule as compared with the operating time of automatic sprinklers installed on the standard 10-by-10-foot (3048 mm by 3048 mm) spacing schedule. Operation of the devices prior to the sprinkler will qualify the device for a spacing on which it is installed. Since automatic sprinklers vary in their sensitivity, the particular sprinkler utilized in these tests is to be one which has average operating response under uniform temperature-rise conditions.
7. Four units shall be subjected simultaneously to the fire test condition and all four units are required to respond prior to the sprinkler.
8. For units which may be mounted on a side wall, the device under test shall be mounted in a vertical position so that the distance between the top of the unit and the ceiling is 6 inches (152 mm). The front of the units shall face the fire source and any surfaces on which the units are mounted shall be of a configuration to prevent reflection of heat onto the detector element.
9. If a fire alarm device is intended to be mounted on the ceiling, the unit shall be so installed for this test.
10. If a device is intended to be employed with an enclosure, such as used in mounting, it shall be subjected

to the fire test using the enclosure representative of normal installation.

(e) High-temperature exposure test.

1. A fire alarm device shall not operate when subjected for 30 days to the test ambient temperature indicated in Table 12-72-2A. Following the exposure, the response of the units shall not show a variation of more than 10 percent from the value obtained in the Oven Test on as-received samples. There shall be no change in the sound intensity when tested following the exposure. There shall be no evidence of eutectic flow as a result of this test.
2. Devices capable of repeated operation are to be subjected to the Oven Test before and after exposure to the test temperature ambient. Where devices are not capable of repeated operation the response data after exposure is to be compared to the response of identical as-received samples.
3. A fire alarm device shall withstand the high-temperature exposure without false operation and there shall be no visible deformation or change in the temperature sensitive element or any other part of the unit as a result of the test.
4. Five samples of each temperature rating are to be tested for their normal operating temperature after which they are to be placed in a circulating air oven maintained at the test temperature.
5. The units are to be removed from the oven after the 30-day period, allowed to remain at room temperature for at least 24 hours and then subjected to the oven test.

(f) Corrosion tests.

1. The response of a fire alarm device, after being subjected to corrosive atmospheres, shall not show a variation of more than 50 percent from the value obtained in the oven test on as-received samples. No false alarms shall occur during the exposure and there shall be no change in the sound intensity when the units are subjected to the oven test.
2. Devices capable of repeated operations are to be subjected to the oven test before and after exposure to the corrosive atmospheres. Where devices are not capable of repeated operation, the response data obtained from the oven test is to be compared to the response of identical as-received samples.
3. Two samples are to be exposed for 10 days to an atmosphere containing approximately 1 percent hydrogen sulfide by volume in air saturated with water vapor at room temperature.
4. Two samples are to be exposed for 10 days to an atmosphere containing approximately 1 percent sulphur dioxide in 1 percent carbon dioxide by volume in air saturated with water vapor at room temperature.
5. After exposure to the corrosive atmospheres, the samples are to be removed from the test chamber, allowed to remain in a normal atmosphere at room

temperature for at least 24 hours and then subjected to the oven test.

6. This test is to be conducted only on devices of the ordinary degree rating unless there is reason to anticipate different behavior of other ratings.

(g) Operating temperature test.

1. A fire alarm device shall operate in a normal manner and within the operating temperature limits and tolerances included in Table 12-72-2B, when subjected to an operating temperature test in heated water, oil or air bath.
2. Five samples of each temperature rating are to be subjected to this test. Depending on their particular design, the devices are to be suspended in a circulating water, oil or air bath, and the temperature gradually increased at the rate of 1°F (0.6°C) per minute until operation takes place. The temperature of the bath at the instant of operation is to be recorded.

(h) Vibration test.

1. A fire alarm device shall be capable of withstanding vibration without false operation, without breakage or damage to parts or any leakage at fittings. Following the vibration test the response of a unit shall not show a variation of more than 50 percent from the value obtained in the oven test on as-received samples. There shall be no change in the sound intensity following the vibration.
2. Two samples are to be secured in the position of normal use on a mounting board and the board, in turn, securely fastened to a variable speed vibration machine having an amplitude of 0.01 inch (0.2 mm). The frequency of vibration is to be varied from 10 to 35 cycles per second (cps) in increments of 5 cps until a resonant frequency is obtained. The samples are then to be vibrated at the maximum resonant frequency for a period of 4 hours. If no resonant frequency is obtained, the samples are to be vibrated at 35 cycles per second for a period of 120 hours.
3. For these tests, amplitude is defined as the maximum displacement of sinusoidal motion from a position of rest or one-half of the total table displacement. Resonance is defined as the maximum magnification of the applied vibration.
4. Devices capable of repeated operation are to be subjected to the oven test before and after the vibration test. Where devices are not capable of repeated operation, the response data obtained from the oven test is to be compared to the response of identical as-received samples.
5. This test is generally to be conducted only on devices of the ordinary degree rating unless there is a reason to anticipate different behavior of other ratings. For multiple station fire alarm devices, the units shall be interconnected with a 10-foot (3048 mm) length of tubing between units and between the units and any sounding appliance with which it is intended to be employed.

(i) **Humidity test.**

1. A fire alarm device shall be capable of operating in a normal manner and comply with the requirements of the oven test following exposure for 24 hours to moist air having a relative humidity of 85 ± 5 percent at a temperature of $30 \pm 2^\circ\text{C}$ ($86 \pm 3.6^\circ\text{F}$). The units shall be tested within 5 minutes after removal from the humid environment.
2. Two samples are to be subjected to this test. This test is to be conducted on devices having an ordinary degree rating only, unless different behavior of other ratings is anticipated.

(j) **Low-temperature exposure test.**

1. A fire alarm device shall be capable of operating in a normal manner and comply with the requirements of the oven test following exposure for 24 hours to a temperature of $\text{minus } 30 \pm 2^\circ\text{C}$ ($\text{minus } 34.4 \pm 3.6^\circ\text{F}$). The units shall be tested within 5 minutes after removal from the low temperature chamber. There shall be no false operation, damage to parts or leakage at fittings.
2. Two samples are to be subjected to this test. This test is to be conducted on devices having an ordinary degree rating only, unless different behavior of other ratings is anticipated.
3. For a multiple station fire alarm device the maximum length of tubing specified by the manufacturer [see Section 12-72-203 (a), Item 2] is to be connected between the unit and any alarm sounding device with which it is intended to be used prior to conducting the test.

(k) **Endurance test.**

1. There shall be no mechanical failure of a spring wound-type fire alarm device and the unit shall be capable of operating in a normal manner and comply with the requirements of the oven test following 100 cycles of operation at a rate of not less than once per hour.
2. Two samples of any rating shall be subjected to this test. Each cycle shall consist of a complete rundown and rewinding operation. Following the 100 cycles, the units shall be subjected to the oven test.

(l) **Audibility test.**

1. The audible alarm generated by a fire alarm device shall be distinctive in sound from other customary sounds, continue for at least 4 full minutes at full intensity and be not less than 83 decibels when measured in an ambient temperature of $23 \pm 3^\circ\text{C}$ ($73 \pm 5.4^\circ\text{F}$) with a relative humidity of 60 ± 20 percent and a barometric pressure of approximately 700 mm mercury.
2. The measurement of sound level is to be made with a sound level meter employing the C weighting network and fast response characteristics. The measurement is to be made in a room having the approximate dimensions of 20- by 10- by 10-feet (6096 mm by 3048 mm by 3048 mm) high or larger

with sound absorbing panels on walls and ceiling having a Noise Reduction Coefficient (NRC) of 0.95 or higher for the walls and 0.64 or higher for the ceiling. The ambient noise level shall be not greater than 55 decibels. The device is to be mounted in a position of normal use, approximately 5 feet (1524 mm) above the floor in the center of the room. The microphone is to be located at a 10-foot (3048 mm) distance from the device and in a position to receive the maximum sound level produced by the device.

3. Alternately, the measurement may be made in a free field condition to minimize the effect of reflected sound energy. The ambient noise level is to be at least 10 decibels below the measured level produced by the signal device. Free field conditions may be simulated by mounting the device not less than 10 feet (3048 mm) from the ground and with the microphone located 10 feet (3048 mm) from the device and conducting the test outdoors on a clear day with a wind velocity of not more than 5 miles per hour and an ambient temperature of $15\text{--}25^\circ\text{C}$ ($50\text{--}77^\circ\text{F}$).
4. Alternatively, an anechoic chamber of not less than 1,000 cubic feet (28 m^3), with no dimension less than 7 feet (2133 mm), and with an absorption factor of 0.99 or greater from 100 Hertz (Hz) to 10 kilohertz (kHz) for all surfaces may be used for this measurement.

(m) **Hydrostatic strength test.**

1. The storage cylinder of a gas operated-type detector shall be capable of withstanding, without failure, an internal hydrostatic pressure of five times the pressure of the stored gas at the operating temperature of the device.
2. In conducting the hydrostatic strength test, the storage cylinder is to be tested to the specified pressure after the shell has been completely filled with water or oil. Care should be exercised to expel all air from the test specimen before the pressure is applied.
3. The apparatus for this test is to consist of a hand- or motor-operated hydraulic pump capable of producing the required test pressure, a substantial test cage capable of containing the shell and its parts in the event of failure, the necessary valves and fittings for attachment to the test sample, a calibrated pressure gage graduated in at least 20 pounds per square inch (psi) increments to at least 200 psi more than the test pressure, and the necessary valves, fittings, etc., for regulating and maintaining the specified test pressure.
4. The pressure should be increased at a rate of approximately 300 psi per minute until the test pressure is obtained. The ultimate test pressure is to be held for 1 minute.
5. Five cylinders are to be subjected to this test. None of the cylinders shall rupture or show evidence of leakage. Deformation of a cylinder is not considered a failure.

INSTRUCTIONS

Sec. 12-72-204.

(a) **General.** Each fire alarm device shall be provided with the following installation, operating and maintenance instructions:

1. Typical installation layout for the unit(s) indicating recommended locations.
2. Description of the operation, testing (if provided), and proper maintenance procedures of the unit(s).
3. Information on establishing a household emergency evacuation plan in the event of a fire.
4. An indication that the local fire authority shall be notified of the installation.

(b) The instructions may be incorporated on the outside of the unit, on a separate sheet, or as part of a manual. If not included directly on the device, the instructions or manual shall be referenced in the marking information on the unit.

MARKING

Sec. 12-72-205.

(a) **General.** A fire alarm device shall be clearly and permanently marked where it will be visible after installation with the following information. Removal of a unit from an installed position by removing not more than one screw to view the marking is considered as meeting the requirement regarding visibility after installation.

1. Name or identifying symbol of manufacturer or vendor.
2. Model number or equivalent.
3. Temperature rating of the fire alarm device.
4. Reference to the State Fire Marshal Regulations for Household Fire Warning Equipment.
5. The statement: "Do Not Paint" or equivalent to prevent painting of the temperature sensitive element and the markings. The letters shall be a minimum of 1/8 inch (3 mm) in height.
6. The following information is required on gas operated units. The letters shall be a minimum of 1/8 inch (3 mm) in height.

CAUTION—Pressurized Container—Do Not Puncture or Incinerate—Explosion Hazard May Result

7. The following or equivalent wording:

Operation—Responds To A Heat Producing Fire Only. Unit Will Actuate When The Temperature Of The Surrounding Air Reaches The Marked Temperature Rating (Plus Or Minus A Few Degrees) Provided The Air Temperature Increase Is 1°F (0.56°C) Per Minute Or Less. At Faster Rates Of Temperature Rise, The Surrounding Air Temperature At Which The Unit Will Actuate Will Be Above The Marked Rating, The Temperature Differential Depending On The Rate Of Rise Of Tem-

perature Produced By A Fire. This Temperature Differential Results From the Time Lag Before The Temperature Element Absorbs The Necessary Heat From the Surrounding Air to Actuate.

8. Instructions for setting or rewinding of a spring wound fire alarm device to be included on the device.
9. For gas-operated fire alarm devices information to return the unit to the factory for servicing shall be provided.
10. State Fire Marshal listing file number if required by Article 1.5.

(b) If a manufacturer has more than one temperature rating for an alarm device, where the thermally sensitive element is renewable and must be replaced after operation, the renewable element shall bear the manufacturer's name or equivalent identification and the temperature rating.

(c) If a manufacturer produces units at more than one factory, each unit shall have a distinctive marking to identify it as the product of a particular factory.

TESTING OVEN

Sec. 12-72-206.

(a) **General.** The testing oven shall be constructed and operated in accordance with this section and the following:

1. A typical test oven consists of an oval shaped stainless steel box approximately 31 by 10 by 16 inches (787 mm by 254 mm by 406 mm) high, made of No. 11 M.S.G. material. One of the curved end sections is hinged. See Figure 12-72-2-3.
2. A section 6 by 6 inches (152 mm by 152 mm) at the top is fitted with a removable wooden cover.
3. Two glass windows, 4 by 6 inches (101 mm by 152 mm) in size, are provided in the sides of the oven for observation of the samples under test.
4. The interior of the oven is divided horizontally by a baffle over the heater chamber located in the central lower section. One end of the horizontal baffle is joined to a guide vane extending upward at an angle of 72 degrees into the oven chamber. The vane directs the air currents to ensure greater uniformity of temperature in the oven.
5. Eight 1,000-watt heating elements, threaded into screw shell lampholders, furnish the heat. They are so connected that six of the heating elements are controlled by means of two manually adjusted auto-transformers. An auxiliary switch controls the other two heating elements for supplying additional heat when necessary.
6. An air current through the bank of heaters is created by means of a four blade 5-inch (127 mm) diameter fan located behind the heating elements and connected to a shaft which extends to the outside of the oven. A variable speed motor is mounted on a bracket inside the lower cabinet and operates the fan

through a pulley and belt arrangement. The speed of the motor is adjusted and the pitch of the fan blade is such that the velocity of the air current is 230 to 245 feet per minute over the sample under test.

7. Temperatures are measured by means of two No. 30 AWG wire thermocouples inserted through copper tubes extending to the inside of the test chamber and are located adjacent to the device under test and in the heating chamber. The air velocity is measured by a velometer installed in the oven.
8. A control board is mounted on the cabinet adjacent to the testing oven. The control board incorporates five toggle switches and four indicating lights for operating the heating elements, air flow fan and a cooling fan. A toggle switch is used for turning on the temperature recorder and another is used for checking the temperatures in either the upper or lower portion of the oven.
9. Two manually adjusted autotransformers are mounted on the control panel for controlling the heat developed by the heating coils. An air flow indicator gage is incorporated on the control board for continuous indication of the air flow during the test run. In the event that the air flow tends to change during a test run, the speed of the fan is adjusted to keep the air velocity within the specified range.

(b) **Test method.**

1. The preparation for test consists of mounting the device on the small removable screen base of 1/4-inch (6 mm) hardware cloth formed to a height where the temperature sensing element is midway between the top of the chamber and the guide vane. The sample under test is positioned in the air stream so that there is no obstruction between the guide vane and sensing element. A spring wound device is mounted with the sensing element in a horizontal position. The test sample shall remain in the oven at least 5 minutes prior to starting each test run.
2. The heating coils are permitted to preheat for 10 to 20 seconds prior to starting the test. The fan controlling the air flow is turned on and its speed adjusted to produce the required velocity. The temperatures are read every 10 seconds. The two autotransformers are adjusted as needed to obtain the desired rate of temperature rise. Normal oven temperatures at the start of the test are to be 85–90°F (29.4–32.2°C).
3. Upon operation of the device, the current applied to the bank of heaters is cut-off and the oven is cooled to normal room temperature by means of the cooling fan.

TABLE 12-72-2A—TEMPERATURE CLASSIFICATIONS

TEMPERATURE CLASSIFICATION	RATING RANGE °F (°C)	TEST TEMPERATURE °F (°C)
Ordinary	135-174 (57-74)	125 (51.7)
Intermediate	175-225 (79-107)	150 (66)

TABLE 12-72-2B—TEMPERATURE CLASSIFICATIONS

TEMPERATURE CLASSIFICATION	OPERATING TEMPERATURE LIMITS		OPERATION
	Minimum °F (°C)	Maximum °F (°C)	Tolerance, °F (°C)
Ordinary	128 (53.3)	165 (73.9)	10 (5.6)
Intermediate	166 (74.4)	225 (107)	15 (8.3)

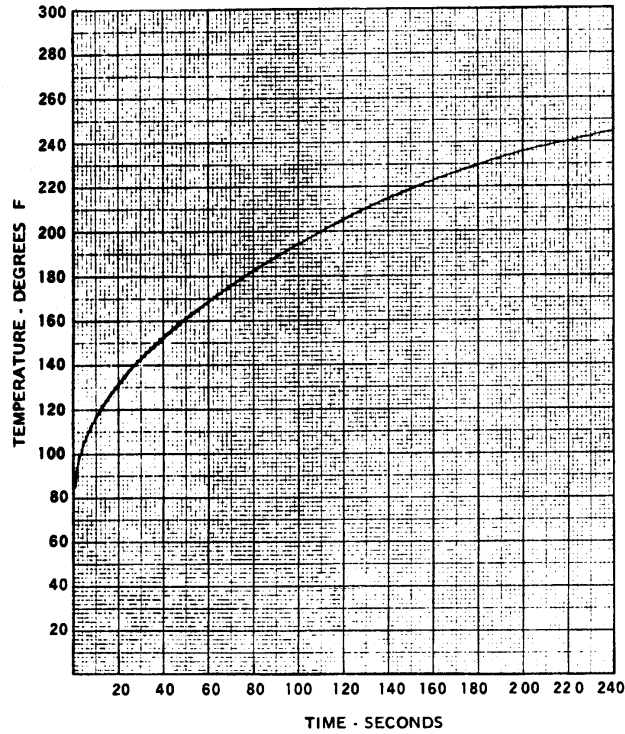
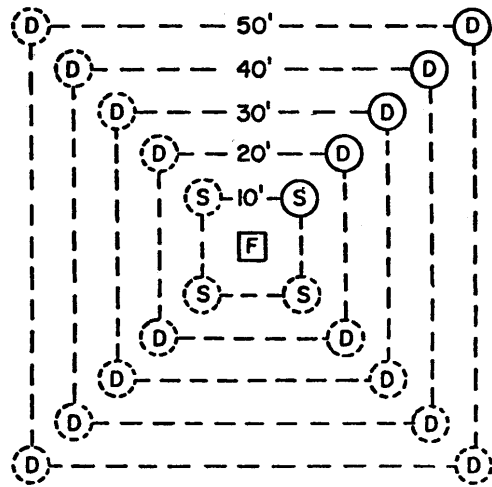


FIGURE 12-72-2-1—TIME-TEMPERATURE CURVE—15-FOOT SPACINGS



Legend:

- F** — TEST FIRE, DENATURED ALCOHOL, 190-PROOF. PAN LOCATED APPROXIMATELY 3 FEET ABOVE FLOOR.
- S** — INDICATES NORMAL SPRINKLER SPACINGS ON 10-FOOT SCHEDULES.
- S** — SPRINKLER INSTALLED DURING FIRE TEST. RATED 160° F (71.1° C), STANDARD UPRIGHT SPRAY TYPE. DEFLECTORS APPROXIMATELY 7 INCHES BELOW CEILING.
- D** — INDICATES NORMAL FIRE ALARM DEVICE SPACING ON VARIOUS SPACING SCHEDULES.
- D** — FIRE ALARM DEVICE UNDER TEST. EMPLOYED TO DETERMINE MAXIMUM ALLOWABLE SPACING.

FIGURE 12-72-2-2—FIRE-TEST LAYOUT

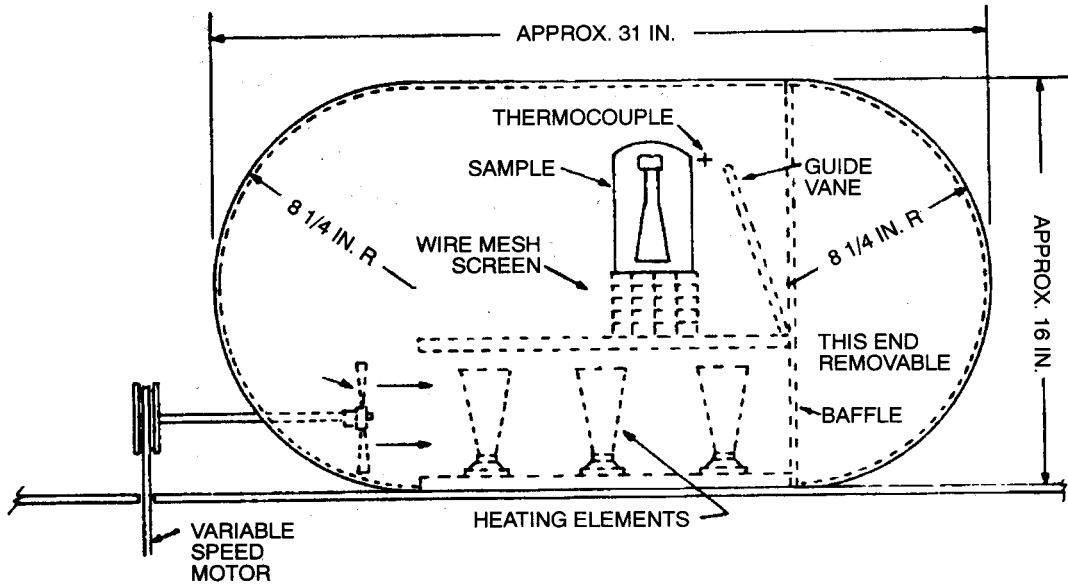


FIGURE 12-72-2-3—TEST OVEN

CHAPTER 12-72-3

PROTECTIVE SIGNALING SYSTEMS

SMOKE DETECTORS, COMBUSTION PRODUCTS TYPE STANDARD 12-72-3

STATE FIRE MARSHAL SCOPE

Sec. 12-72-300.

(a) **Basic.** This standard represents the minimum basic requirements for the construction and performance of combustion products detectors of other than the photoelectric type to be employed in ordinary indoor locations and to be listed under this classification. The minimum design, construction and performance standards set forth herein are those deemed as minimum necessary to establish conformance to the regulations of the State Fire Marshal.

(b) **Definitions.** For the purpose of this standard, the following definitions shall apply:

1. **Alarm signal.** A signal intended to indicate an emergency fire condition.
2. **Annunciator.** Integrally mounted or remotely connected visual indicating device intended to indicate an alarm or trouble condition.
3. **Ionization type detector.** A device in which the presence of small combustion practices, often invisible to the eye, interfere with the normal ionization current resulting from radiation produced by a radioactive source in the detection chamber. A second chamber, employing a similar ionization source, may also be used to compensate for normal environmental ambient changes.
4. **Ionization-resistance bridge type detector.** Employs both ionization and resistance bridge principles in one unit. Additive response from both detector elements is required for detector operation.
5. **Resistance-bridge type detector.** Responds to an abnormal rate of increase of combustion products which change the impedance of second similar plate may be employed to compensate for normal ambient changes.
6. **Sensitivity.** Relative degree of response of a detector. A high sensitivity denotes response to a lower concentration of combustion than a low sensitivity under identical fire test conditions.
7. **Trouble signal.** A visual or audible signal intended to indicate a fault or trouble condition, such as an open or ground fault, occurring in the device or connected wiring.
8. **Voltage classification.**
 - A. **Low voltage.** A circuit classified as low voltage is one involving a potential of not more than 30

volts alternating current (42.4 peak) or direct current, and supplied from a circuit whose power is limited to a maximum of 100 volt amperes.

B. **High voltage.** A circuit classified as high voltage is one having circuit characteristics in excess of those of a low-voltage circuit.

TEST REPORTS

Sec. 12-72-301.

(a) The report shall include engineering data, and an analysis comparing the design against Sections 12-72-302 (a) through 12-72-302 (t); it shall include wiring diagrams, operating manuals and photographs; it shall set forth the tests performed in accordance with this standard and the results thereof and shall verify the correctness of the electrical rating.

(b) **Listed components.** Electrical wiring, material, devices, combination of devices, fittings, appliances and equipment which have been tested and listed by an approved listing agency for the intended purpose and use need not be individually retested.

The report shall include the catalog number or other readily identifiable marking; the name of the approved listing agency, the laboratory test report number and date. Such individually tested and listed component parts and devices shall be subjected to the performance standard tests to determine its suitability for use in combination with other component parts, devices, circuits or equipment.

(c) **Listed detectors.** Detectors which have been tested to any other acceptable test standard may be evaluated provided such test incorporates all features of this standard.

(d) **Rejection for cause.** Compliance with these standards will not necessarily mean approval and listing, if when examined and tested, it is found to have other features which may impair the result intended by these regulations. Unusual constructions may require application of additional performance tests. The State Fire Marshal may refuse to approve any item for cause. (See the *California Electrical Code*.)

(e) **Smoke detectors only.**

1. A combustion products detector, as covered by these requirements consists of an assembly of electrical components arranged to detect one or more products of combustion. The products of combustion may consist of but are not necessarily limited to gaseous combustion products, water vapor and visible as well as invisible smoke particles. The detector includes provision for the connection to a source of

power, signaling and optional remote control circuits.

2. These requirements cover the following types of detectors:
 - A. Detectors intended for open area protection, intended for connection to a compatible power supply or control unit for operation as part of a fire alarm system.
 - B. Detectors intended solely for control of releasing devices such as electromagnetic door holders, fire dampers, etc.
 - C. Detectors suitable for Items A and B above.
3. This standard does not cover the following:
 - A. Detectors for monitoring the smoke density within flues or stacks.
 - B. Duct detectors.
 - C. Power supplies and control units to which the detectors are intended to be connected. These are covered under the Standard Test Procedures for Protective Signaling Systems, SFM 12-72-1.
 - D. Smoke detectors of the photoelectric type which are covered by the Standard for Smoke Detectors, Photoelectric Type, for Fire-Protective Signaling Systems, UL 168.
4. The manufacture, importation, distribution and disposal of smoke detectors containing radioactive material are subject to the safety requirements of state radiation control agencies and/or the U.S. Atomic Energy Commission.
5. Verification of an acceptable evaluation by the regulating agency involved is required prior to the investigation of the smoke detector to ensure compliance with this standard.

(f) **Differing constructions.** A detector having materials or forms of construction differing from this standard may be investigated and tested according to the intent of this standard, and if found to be substantially equivalent may be given recognition for approval and listing. The office of the State Fire Marshal shall be consulted for general requirements and performance standards.

(g) **Operating and installation instructions.**

1. A copy of the operating and installation instructions and related schematic wiring diagrams and installation drawings are to be furnished with the sample submitted for investigation to be used as a guide in the examination and test of the detector and for this purpose need not be in final printed form. The information may be included in a manual or technical bulletin.
2. The instructions and drawings should include such directions and information as deemed by the manufacturer to be adequate for attaining proper and safe installation, maintenance and operation of the detector. See Section 12-72-302 (b).

GENERAL

12-72-302.

(a) **Construction.**

1. A detector shall be so constructed that it will be reliable and sufficiently durable for its intended installation and use.
2. A component of a detector shall comply with the requirements for that component, except that such requirements may be modified if appropriate for the particular application.
3. Except where specifically indicated otherwise, the construction requirements specified for a detector shall also apply for any remote accessories with which it is to be employed.
4. Each detector is to be provided with a means for monitoring the relative sensitivity of the unit after it has been installed.
5. The monitoring means may be by means of a jack or terminals for connection of a meter, or by a visual means which would be visible with the unit installed, or equivalent.
6. The use of a plug-in type detector assembly, which may be removed readily for insertion of an adapter connected to metering equipment, would be acceptable.

(b) **Marking.**

1. A detector shall be permanently marked with the following information, except where it is indicated that the information may appear on an installation wiring diagram.
 - A. Name or identifying symbol of the manufacturer or vendor.
 - B. Model number or equivalent and serial number or equivalent.
 - C. Electrical rating, in volts, amperes or watts, and frequency for each circuit. May appear on the installation wiring diagram.
 - D. Sensitivity setting and reference to the region of sensitivity such as maximum, nominal or intermediate or minimum. If a detector is intended to be adjusted in the field, the range of sensitivity is to be indicated. The sensitivity shall be indicated as an instrument reading. A sensitivity indication other than an instrument reading may be employed if it provides an equivalent indication of the sensitivity of the detector. May appear on the installation wiring diagram.
 - E. Correct mounting position if a unit is intended to be mounted in a definite position. This information may appear on the installation wiring diagram.
 - F. Identification of lights, switches, meters, etc., regarding their function, unless their operation is obvious.

- G. Maximum rating of fuse in each fuseholder. Located adjacent to the fuseholder.
 - H. Reference to an installation wiring diagram, if not attached to the detector, by drawing number and issue number of date.
 - I. For a detector which employs a radioactive material, the following information shall be indicated directly on the unit: type, amount, radiation symbol (optional), safe disposal and a caution notice which shall read as follows:
 - CAUTION—Contains Radioactive Material, or its equivalent wording.
 - J. A reference to the Technical Bulletin. May appear on the installation wiring diagram.
 - K. Reference to a specific model number or description of the instrument to be used for checking the sensitivity of the detector. May appear on the installation wiring diagram.
 - L. A detector intended for permanent connection only to a wiring system other than metal-clad cable or conduit shall be marked to indicate the system or systems for which it is suitable. The marking shall be so located that it will be visible when power-supply connections to the detector are made or may appear on the installation wiring diagram.
 - M. The State Fire Marshal's listing label if required by Article 1.5.
 - N. A detector which is not intended to be painted in the field shall be marked on the outside "DO NOT PAINT."
2. An installation wiring diagram shall be provided with each detector illustrating the field connections to be made. The drawing may be attached to the unit or, if separate, shall be referenced in the marking attached to the unit with the drawing number and issue number and/or date.
 3. The drawing shall show a pictorial view of the installation terminals or leads to which field connections are made as they would appear when viewed during an installation and the minimum internal dimensions of a back box, if not provided with the detector, shall be specified. The terminal numbers on the detector shall agree with the numbers on the drawing. A drawing not attached to the detector unit shall be marked with the name or identifying symbol of the manufacturer's or vendor's drawing number, and an issue number and/or date.
 4. The following marking information is required to appear on the detector or the installation wiring diagram for the applicable circuits to which field connections are made. Where an electrical rating is indicated, it may be omitted if reference is made for connection to a specific control unit or equivalent.
 - A. **Supply circuit.** Voltage, current or watts, and frequency.
 - B. **Initiating device circuit connections.** For detectors intended to be connected only to the initiating device circuit of a fire alarm system control unit, at least two detectors shall be shown connected to a typical initiating device circuit. For a detector intended only for releasing device service, a typical connection shall be shown. For a detector suitable for both application, typical connections representing both types of connections shall be illustrated.
 - C. **Supplementary circuits.** Voltage, current or watts, and frequency rating.
5. **Technical bulletin.** A technical bulletin shall be provided by the manufacturer for each installation to be used as a reference by the installer. The bulletin shall include the manufacturer's recommendations regarding typical detector locations. The information shall include guidelines on detector location, spacings, maintenance, servicing tests, etc., under various environmental conditions and physical configurations. Some conditions for which guidelines are required are:
 - A. Temperature
 - B. Humidity
 - C. Corrosive atmospheres
 - D. Air movement (ventilating and air-conditioning systems)
 - E. High ceilings
 - F. Sloped ceilings
 - G. Girder ceiling construction
 - H. Small and large bays
 - I. Open joist construction
 - J. High stock piling
 - K. Conditions produced by manufacturing processes
 6. Detailed information shall be provided regarding the use of the facilities provided on the detector to monitor the sensitivity. Typical information that shall be provided includes:
 - A. Nominal reading under clear condition
 - B. Nominal reading when close to alarm
 - C. Nominal reading at alarm condition
 - D. Guidelines on instrument use for an engineering survey, installation and maintenance
 7. Information regarding locations where not to install detectors shall also be provided to minimize the possibility of false alarms.
 8. Reference to the bulletin number and date is required either on the detector nameplate marking or on the installation drawing. If the installation drawing is included as part of the technical bulletin, reference to the bulletin is required to be indicated on the detector.

(c) **Frame, enclosure and metalware.**

1. A detector enclosure shall be so formed and assembled that it has the strength and rigidity necessary to resist the abuses to which it is likely to be subjected in service without adversely affecting its performance and without introducing a fire, shock or accident hazard due to total or partial collapse with resulting reduction of spacings, loosening or displacement of parts or other defects.
2. Except as noted, all electrical parts of a detector shall be enclosed to provide protection against contact with uninsulated live parts. A separate enclosure for field wiring terminals that will be enclosed by a back box is not required.
3. A detector shall have a suitable means for mounting, which shall be accessible without disassembling any operating part of the unit. Removal of a completely assembled panel or equivalent to mount the detector is not considered to be disassembly of an operating part.
4. An assembled part intended to be removed during installation shall be protected against damage from handling.
5. An enclosure shall have provision for the connection of metal-clad cable or conduit. An enclosure without provision for the connection of metal-clad cable or conduit may be acceptable if there are furnished with it definite instructions indicating the sections of the unit which are intended to be drilled in the field for the connection of raceways, or if the unit is intended for mounting on an outlet box.
6. The thickness of cast metal for an enclosure shall be as indicated in Table 12-72-3A. Except that cast metal having a thickness $\frac{1}{32}$ inch (0.8 mm) less than that indicated in the table may be employed if the surface under consideration is curved, ribbed or otherwise reinforced, or if the shape and/or size of the surface is such that equivalent mechanical strength is provided.
7. If threads for the connection of conduit are tapped all the way through a hole in an enclosure wall, or if an equivalent construction is employed, there shall be not less than three and one-half nor more than five threads in the metal, and the construction shall be such that a standard conduit bushing can be properly attached.
8. If threads for the connection of conduit are tapped only part of the way through a hole in an enclosure wall, there shall be not less than three and one-half full threads in the metal, and there shall be a smooth, rounded inlet hole for the conductors which shall afford protection to the conductors equivalent to that provided by a standard conduit bushing.
9. **Sheet metal enclosures.** The thickness of sheet metal employed for the enclosure of a detector shall be not less than that indicated in Table 12-72-3B, except that sheet metal of two gauge sizes lesser

thickness may be employed if the surface under consideration is curved, ribbed or otherwise reinforced, or if the shape and/or size of the surface is such that equivalent mechanical strength is provided.

10. At any point where conduit or metal-clad cable is to be attached, sheet metal shall be of such thickness or shall be so formed or reinforced that it will have a stiffness at least equivalent to that of an uncoated flat sheet steel having a minimum thickness of 0.053 inch (1.3 mm) (No. 16 MSG).
11. A plate or plug closure for an unused conduit opening or other hole in the enclosure shall have a thickness not less than:
 - A. 0.014 inch (0.3 mm) for steel or 0.019 inch (0.5 mm) for nonferrous metal for a hole having a $\frac{1}{4}$ -inch (6 mm) maximum dimension.
 - B. 0.027-inch (0.7 mm) steel or 0.032-inch (0.8 mm) nonferrous metal for a hole having a $1\frac{3}{8}$ -inch (35 mm) maximum dimension.
12. A closure for a hole larger than $1\frac{3}{8}$ -inch (35 mm) diameter shall have a thickness equal to that required for the enclosure of the device or a standard knockout seal shall be used. Such plates or plugs shall be securely mounted.
13. A knockout in a sheet metal enclosure shall be reliably secured but shall be capable of being removed without undue deformation of the enclosure.
14. A knockout shall be provided with a surrounding surface adequate for proper seating of a conduit bushing, and shall be so located that installation of a bushing at any knockout likely to be used during installation will not result in spacings between uninsulated live parts and the bushing of less than those indicated under spacings.

The figures in parentheses are the galvanized sheet gage numbers (GSG) (for zinc-coated steel), the manufacturers' standard gage numbers (MSG) (for uncoated steel), and the American wire gage numbers (AWG) (for a nonferrous metal) which provide the required minimum thickness of metal.
15. An enclosure or parts of an enclosure of nonmetallic material shall have the mechanical strength and durability and be so formed that parts will be protected against damage. The mechanical strength of an enclosure shall be at least equivalent to a sheet metal enclosure of the minimum thickness specified in Table 12-72-3B. See Section 12-72-205 for performance tests on plastic materials and enclosures.
16. (No requirements.)
17. The continuity of the grounding system shall not rely on the dimensional integrity of the nonmetallic material.
18. Ventilating openings in an enclosure, including perforated holes, louvers and openings protected by means of wire screening, expanded metal or perforated covers, shall be of such size or shape that no

opening will permit passage of a rod having a diameter of $3\frac{3}{64}$ inch (77 mm). An enclosure for fuses or other overload protective device and provided with ventilating openings shall afford adequate protection against the emission of flame or molten metal. The opening shall be designed to permit cleaning without damage to functional enclosed parts.

19. Except as noted in the following paragraph, perforated sheet metal and sheet metal employed for expanded metal mesh shall be not less than 0.042 inch (1 mm) in average thickness, 0.046 inch (1.1 mm) if zinc coated.
20. If the indentation of a guard or enclosure will not alter the clearance between uninsulated live parts and dead metal parts so as to affect performance adversely or reduce spacings below the minimum values given under spacings, 0.021 inch (0.5 mm) expanded metal mesh [0.024 inch (0.6 mm) if zinc coated] may be employed, provided that (1) the exposed mesh on any one side or surface of the device so protected has an area of not more than 72 square inches (46 451 mm²) and has no dimension greater than 12 inches (305 mm), or (2) the width of an opening so protected is not greater than $3\frac{1}{2}$ inches (89 mm).
21. The wires forming a screen protecting current carrying parts shall be not smaller than No. 16 AWG and the screen openings shall be not greater than $\frac{1}{2}$ square inch (322 mm²) in area.
22. An enclosure cover shall be hinged, sliding, pivoted or similarly attached if (1) it provides ready access to fuses or any other overcurrent protective device the normal functioning of which requires renewal, or (2) it is necessary to open the cover in connection with the normal operation of the unit.
23. With reference to the requirement of Item 22, normal operation is considered to be operation of a switch for testing or for silencing an audible signal appliance or operation of any other component of a unit which requires such action in connection with its intended performance.
24. A hinged cover is not required where the only fuse(s) enclosed is intended to provide protection to portions of internal circuits, such as may be employed on a separate printed wiring board or circuit subassembly, to prevent excessive circuit damage resulting from a fault. The use of such a fuse(s) is acceptable if the following or equivalent marking is indicated on the cover of units employing high voltage circuits: Circuit Fuse(s) Inside—Disconnect Power Prior to Servicing.
25. A hinged cover shall be provided with a latch, screw or catch to hold it closed. An unhinged cover shall be securely held in place by screws or the equivalent.
26. Glass covering an observation opening shall be held securely in place so that it cannot be readily dis-

placed in service and shall provide adequate mechanical protection of the enclosed parts. The thickness of a glass cover shall be not less than that indicated in Table 12-72-3C.

27. A glass panel for an opening having an area of more than 144 square inches (92 903 mm²) or having any dimension greater than 12 inches (305 mm), shall be supported by a continuous groove not less than $\frac{3}{16}$ inch (4.7 mm) deep along all four edges of the panel.
28. A transparent material other than glass employed as a cover over an opening in an enclosure shall have mechanical strength equivalent to that of glass, not become a fire hazard or distort, or not become less transparent at the temperature to which it may be subjected under normal or abnormal service conditions.

(d) Protection against corrosion.

1. Except as indicated herein, iron and steel parts shall be suitably protected against corrosion by enameling, galvanizing, sheradizing, plating or other equivalent means.
2. These requirements apply to all enclosures whether of sheet steel or cast iron, and to all springs and other parts upon which proper mechanical operation may depend. It does not apply to minor parts such as washers, screws, bolts and the like, if the failure of such unprotected parts would not be liable to result in a hazardous condition or adversely affect the operation of the unit. Parts made of stainless steel (properly polished or treated if necessary) do not require additional protection against corrosion. Bearing surfaces should be of such materials and design as to ensure against binding due to corrosion.

(e) Insulating materials.

1. Material for the mounting of current-carrying parts shall be porcelain, phenolic composition, cold-molded composition or material which is suitable for the particular application.
2. Vulcanized fiber may be used for insulating bushings, washers, separators and barriers, but not as the sole support for uninsulated current-carrying parts of other than low-voltage circuits. Plastic materials may be used for the sole support of uninsulated live parts, if found to have adequate mechanical strength and rigidity, dielectric withstand, resistance to heat, flame propagation, arcing, creep and moisture, and other properties suitable for the application, without displaying a loss of these properties beyond the minimum acceptable level as a result of aging.
3. Metal parts as described below need not comply with the requirement of Section 12-72-302 (d), Item 2.
 - A. Adhesive attached metal foil markings, screws, handles, etc., which are located on the outside of the detector enclosure and isolated from electrical components or wiring by grounded metal parts so that they are not liable to become energized.

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4. A terminal block mounted on a metal surface which may be grounded shall be provided with an insulating barrier between the mounting surface and all live parts on the underside of the base which are not staked, upset, sealed or equivalently prevented from loosening so as to prevent such parts and the ends of replaceable terminal screws from coming in contact with the supporting surface.
5. A countersunk part shall be covered with a waterproof insulating compound which will not melt at a temperature 15°C (27°F) higher than the maximum normal operating temperature of the assembly, and at not less than 65°C (149°F) in any case. The depth or thickness of sealing compound shall be not less than $\frac{1}{8}$ inch (3 mm).

(f) Mounting parts.

1. All parts of a detector shall be securely mounted in position and prevented from loosening or turning if such motion may affect adversely the normal performance of the unit, or may affect the fire and accident hazard incident to the operation of the detector.
2. A switch, lampholder, attachment-plug receptacle, plug connector or similar electrical component, shall be mounted securely and, except as noted in Items 3 and 4, shall be prevented from turning.
3. The requirement that a switch be prevented from turning may be waived if all four of the following conditions are met:
 - A. The switch is to be of a plunger or other type that does not tend to rotate when operated. A toggle switch is considered to be subject to forces that tend to turn the switch during normal operation of the switch.
 - B. Isolated metal parts, such as small assembly screws, etc., which are positively separated from wiring and uninsulated live parts.
 - C. Panels and covers which do not enclose uninsulated live parts if wiring is positively separated from the panel or cover so that it is not liable to become energized.
 - D. Panels and covers which are insulated from electrical components and wiring by an insulating barrier of vulcanized fiber, varnished cloth, phenolic composition or similar material not less than $\frac{1}{32}$ -inch (0.8 mm) thick and reliably secured in place.
4. A bonding conductor shall be of material suitable for use as an electrical conductor. If of ferrous metal, it shall be protected against corrosion by painting, plating or the equivalent. The conductor shall be not smaller than the maximum size wire employed in the circuit wiring of the component or part. A separate bonding conductor or strap shall be installed in such a manner that it is protected from mechanical damage.
5. The bonding shall be by a positive means, such as by clamping, riveting, bolted or screwed connection, brazing or welding. The bonding connection shall reliably penetrate nonconductive coatings such as paint. Bonding around a resilient mount shall not depend on the clamping action of rubber or similar material.
6. A bolted or screwed connection that incorporates a star washer under the screw head, is considered acceptable for penetrating nonconductive coatings.
7. Where the bonding means depends upon screw threads, two or more screws or two full threads of a single screw engaging metal is considered acceptable.
8. Metal-to-metal hinge-bearing members for doors or covers may be considered as a means for bonding the door or cover for grounding providing a multiple-bearing, pin-type hinge is employed.
9. Splices shall not be employed in conductors used to bond electrical enclosures or components.

(g) Deleted.

(h) Motors.

1. All motors shall be protected by thermal or by over-current protective devices, or a combination thereof.
2. A motor employing thermal protection which complies with the Standard for Thermal Protectors for Motors, UL 547, is considered to comply with the requirement of Item 1.
3. Motors, such as direct-drive fan motors, which are not normally subjected to overloads, and which are determined to be adequately protected against overheating due to locked-rotor current by a thermal or overcurrent protective device may be accepted under this requirement, provided it is determined that the motor will not overheat under the performance requirements of this standard.
4. Impedance protection may be accepted for motors which are determined to be adequately protected against overheating due to locked-rotor current, provided it is determined that the motor will not overheat under the performance requirements of this standard.

(i) Current-carrying parts.

1. A current-carrying part shall have adequate mechanical strength and current carrying capacity for the service, and shall be a metal such as silver, copper or copper alloy, or other material which will provide equivalent performance.
2. Bearings, hinges, etc., are not acceptable for carrying current between interrelated fixed and moving parts.
3. The insulation of coil windings of relays, transformers, etc., shall be such as to resist the absorption of moisture.
4. Enameled wire is not required to be given additional treatment to prevent moisture absorption.

(j) **Supply connections.** A detector shall be provided with wiring terminals or leads for the connection of conductors of at least the size required by the *California Electrical Code*, corresponding to the rating of the unit.

(k) **Terminal connections and leads.**

1. The parts to which wiring connections are made are to consist of binding screws with terminal plates having upturned lugs or the equivalent to hold the wires in position. Other terminal connections may be provided if found to be equivalent.
2. If a wire binding screw is employed at a field wiring terminal, the screw shall be not smaller than No. 8, except that a No. 6 screw may be used for the connection of a No. 14 AWG or smaller conductor.
3. Except as noted in the following paragraph, a terminal plate tapped for a wire binding screw shall be of metal not less than 0.050 inch (1.27 mm) in thickness for a No. 8 or larger screw, and not less than 0.030 inch (0.7 mm) in thickness for a No. 8 screw, and shall have not less than two full threads in the metal.
4. A terminal plate may have the metal extruded at the tapped hole for the binding screw so as to provide two full threads. Other constructions may be employed if they provide equivalent security.
5. Leads provided for field connections shall be not less than 6 inches (152 mm) long, provided with strain relief, shall be not smaller than No. 18 AWG, and the insulation, if of rubber or thermoplastic, shall be not less than $\frac{1}{32}$ inch (0.8 mm) in thickness.
6. The leads specified in Item 5 may be less than 6 inches (152 mm) in length if it is evident that the use of a longer lead might result in a hazard.
7. In a detector intended for connection to a high-voltage source of supply by means of other than a metal-enclosed wiring system, such as nonmetallic sheathed cable:
 - A. An equipment-grounding terminal or lead shall be provided.
 - B. A marking shall be provided to indicate the system or systems for which it is suitable. (See Item 1, L of Section 12-72-302 (b)).
 - C. The grounding means shall be reliably connected to all exposed dead metal parts which are liable to become energized and all dead metal parts within the enclosure which are exposed to contact during servicing and maintenance.
8. The surface of an insulated lead intended solely for the connection of an equipment-grounding conductor shall be green, with or without one or more yellow stripes and no other leads visible to the installer, other than grounding conductors, shall be so identified.
9. A field-wiring terminal intended for connection of an equipment-grounding conductor shall be plainly identified, such as being marked G, GR, Ground, Grounding, or the equivalent, or by a suitable mark-

ing on a wiring diagram provided on the detector. The field-wiring diagram is provided on the detector. The field-wiring terminal shall be so located that it is unlikely to be removed during normal servicing of the detector.

10. A field-wiring terminal for the connection of a grounded supply conductor shall be identified by means of a metallic plated coating substantially white in color and shall be readily distinguishable from the other terminals, or proper identification of the terminal for the connection of the grounded conductor shall be clearly shown in some other manner, such as on an attached wiring diagram.
11. A field-wiring lead provided for connection of a grounded supply conductor shall be finished to show a white or natural gray color and shall be readily distinguishable from other leads and no other leads, other than grounded conductors, shall be so identified.
12. A terminal or lead identified for the connection of the grounded supply conductor shall not be electrically connected to a single-pole manual switching device which has an off position or to a single-pole overcurrent (not thermal) protective device.

(l) **Field-wiring compartment.**

1. The field-wiring compartment area of a detector to which connections are to be made is to be of sufficient size for completing all wiring connections as specified by the installation wiring diagram.
2. Protection for the internal components and wire insulation from sharp edges shall be provided by insulating or metal barriers having smoothly rounded edges or by the following or equivalent instructions located in the wiring area: "CAUTION—When making installation route field wiring away from sharp projections, corners and internal components."
3. The location of an outlet box or compartment in which field-wiring connections are to be made shall be such that these connections may be inspected after the detector is installed as intended. The removal of not more than two mounting screws, or an equivalent arrangement, to view the field connections, is considered as meeting the intent of this paragraph.

(m) **Internal wiring.**

1. The internal wiring of a unit shall consist of conductors of at least the size required by the Basic Electrical Regulations, corresponding to the current rating of the unit, and having insulation rated for the potential involved and the temperatures to which it may be subjected. The wiring shall be routed away from moving parts and sharp projections and held in place with clamps, string ties or equivalent, unless of sufficient rigidity to retain a shaped form.
2. Leads or a cable assembly connected to parts mounted on a hinged cover shall be of sufficient length to permit the full opening of the cover with-

out applying stress to the leads or their connections. The leads shall be secured or equivalently arranged to prevent abrasion of insulation and jamming between parts of the enclosure.

3. If the use of a short length of insulated conductor is not feasible, e.g., a short coil lead or the like, electrical insulating tubing may be employed. The tubing is not to be subjected to sharp bends, tension, compression or repeated flexing, and is not to contact sharp edges, projections or corners. The wall thickness of the tubing is to conform to the requirements for such tubing, except that the wall thickness at any point for polyvinyl chloride tubing of $\frac{3}{8}$ -inch (9.5 mm) diameter or less, is to be not less than 0.017 inch (0.4 mm). For insulating tubing of other types, the wall thickness is to be not less than required to at least equal the mechanical strength, dielectric properties, heat and moisture resistant characteristics, etc. of polyvinyl chloride tubing having a wall thickness of 0.017 inch (0.4 mm).
 4. Internal wiring of circuits which operate at different potentials shall be reliably separated by barriers or shall be segregated, unless the conductors of the circuits of lower voltage are provided with insulation equivalent to that required for the highest voltage involved. Segregation of insulated conductors may be accomplished by clamping, routing or equivalent means which ensures permanent separation. See Item 10.
 5. Stranded conductors clamped under wire-binding screws or similar parts shall have the individual strands soldered together or be equivalently arranged to ensure reliable connections.
 6. Wireways shall be smooth and free from sharp edges, burrs, fins, moving parts, etc., which may cause abrasion of the conductor insulation.
 7. All splices and connections shall be mechanically secured and bonded electrically.
 8. A splice shall be provided with insulation equivalent to that of the wires involved if permanence of electrical spacing between the splice and uninsulated metal parts is not assured.
 9. Splices shall be located, enclosed and supported so that they are not subject to damage from flexing, motion or vibration.
 10. A metal barrier shall have a thickness at least equal to that required by Table 12-72-3B, based on the size of the barrier. A barrier of insulation material shall be not less than 0.028 inch (0.7 mm) in thickness and shall be of greater thickness if its deformation may be readily accomplished so as to defeat its purpose. Any clearance between the edge of a barrier and a compartment wall shall be not more than $\frac{1}{16}$ inch (1.6 mm).
 11. Where a lead or wire harness passes through an opening in a wall, barrier or enclosing case, there shall be a metal or insulating type bushing, or the equivalent, which shall be substantial, reliably secured in place, and shall have a smooth rounded surface against which the wire may bear.
 12. If the opening is in a phenolic composition or other suitable nonconducting material or in metal of thickness greater than 0.042 inch (1 mm), a smooth surface having rounded edges is considered to be the equivalent of a bushing.
 13. Ceramic materials and some molded compositions are considered to be acceptable for insulating bushings, but separate buildings of wood and of hot-molded shellac are not acceptable.
 14. Fiber may be employed where it will not be subjected to a temperature higher than 90°C (194°F) under normal operating conditions, the bushing is not less than $\frac{1}{16}$ inch (1.6 mm) in thickness with a minus tolerance of $\frac{1}{64}$ inch (0.4 mm) for manufacturing variations, and it is so formed and secured in place that it will not be affected adversely by ordinary ambient conditions of humidity.
 15. If a soft-rubber bushing is employed in a hole in metal, the hole shall be free from sharp edges, burrs, projections, etc., which would be likely to cut into the rubber.
 16. An insulating metal grommet may be considered acceptable in lieu of an insulating bushing, provided that the insulating material used is not less than $\frac{1}{32}$ inch (0.8 mm) in thickness and fills completely the space between the grommet and the metal in which it is mounted.
 17. A strain relief means shall be provided for the field supply leads, and all internally connected wires or cords which are subject to movement in conjunction with the installation, operation or normal servicing of a detector to prevent any mechanical stress from being transmitted to terminals and internal connections. Inward movement of the cord or leads provided with a ring-type strain relief means shall not damage internal connections or components, or result in a reduction of electrical spacings.
 18. Each lead employed for field connections or an internal lead subjected to movement or handling during installation and normal servicing shall be capable of withstanding for 1 minute a pull of 10 pounds without any evidence of damage or of transmitting the stress to internal connections.
- (n) **Lampholders and lamps.**
1. Lampholders and lamps shall be rated for the circuit in which they are employed when the detector is operated under any condition of normal service.
 2. A lampholder employing a screw shell shall be so wired that the screw shell will be connected to an identified (grounded circuit) conductor.
 3. If more than one screw shell-type lampholder is provided, the screw shells of all such lampholders shall be connected to the same conductor unless there is

no shock hazard present (30 volts RMS or less) when replacing the lamps.

4. A lampholder shall be installed so that uninsulated live parts will not be exposed to contact by persons removing or replacing lamps in normal service.

(o) Operating components.

1. Operating components and assemblies, such as switches, relays and similar devices, shall be adequately protected by individual protection or dust-tight cabinets, against fouling by dust or by other material which may affect their normal operation.
2. Moving parts shall have sufficient play at bearing surfaces to prevent binding.
3. Provision shall be made to prevent adjusting screws and similar adjustable parts from loosening under the conditions of actual use.
4. Manually operated parts shall have sufficient strength to withstand the stresses to which they will be subjected in operation.
5. An electromagnetic device shall ensure reliable and positive electrical and mechanical performance under all conditions of normal operation.

(p) Switches.

1. A switch provided as part of a unit shall have a current and voltage rating not less than that of the circuit which it controls when the device is operated under any condition of normal service.
2. If a reset switch is provided, it shall be of a self-restoring type.

(q) Over-current protection. Fuseholders, fuses and circuit breakers provided on a detector unit shall be rated for the application.

(r) Printed wiring boards. Printed wiring boards shall be acceptable for the application. The securing of components to the board shall be made in a reliable manner and the spacings between circuits shall comply with the spacings requirements. The board shall be reliably mounted so that deflection of the board during servicing shall not result in damage to the board or in a fire or shock hazard. (See SFM 12-72-1.)

(s) Service and maintenance protection.

1. An uninsulated live part and hazardous moving parts within the enclosure shall be located, guarded or enclosed so as to minimize the likelihood of accidental contact by persons performing service functions which may have to be performed with the equipment energized.
2. Manual-switching devices may be located or oriented with respect to uninsulated live parts or hazardous moving parts so that manipulation of the mechanism can be accomplished in the normal direction of access if uninsulated live parts or hazardous moving parts are not located in front (in the direction of access) of the mechanism and are not located within 6 inches (152 mm) on any side or behind the mechanism, unless guarded.

3. In determining compliance with Item 2, only uninsulated live parts in high-voltage circuits are to be considered.

4. An electrical control component which may require examination, adjustment, servicing or maintenance while energized (excluding voltage measurements except for jacks or terminals specifically intended for that purpose) shall be located and mounted with respect to other components and with respect to grounded metal parts so that it is accessible for electrical service functions without subjecting persons to the likelihood of shock hazard from adjacent uninsulated live parts or to accident hazard from adjacent hazardous moving parts.

5. Other arrangements of location of components and/or guarding are also acceptable where electrical components are accessible for service as indicated by Item 4.

6. The following are not considered to be uninsulated live parts: (1) coils of controllers, relays and solenoids, and transformer windings, if the coils and windings are provided with suitable insulating overwraps, (2) enclosed motor windings, (3) terminals and (4) splices with suitable insulation and insulated wire.

(t) Spacings.

1. A detector shall provide reliably maintained spacings between uninsulated live parts and dead metal parts and between uninsulated live parts of opposite polarity. The spacings shall be not less than those indicated in Table 12-72-3E.

2. The spacing between an uninsulated live part and a wall or cover of a metal enclosure, a fitting for conduit or metal-clad cable, and any dead-metal part shall be not less than that indicated in Table 12-72-3E.

3. The through air and over surface spacings at an individual component part are to be judged on the basis of the volt-amperes used and controlled by the individual component. However, the spacing from one component to another, and from any component to the enclosure or to other uninsulated dead metal parts excluding the component mounting surface, shall be judged on the basis of the maximum voltage and total volt-ampere rating of all components in the enclosure.

4. The spacing requirements in Table 12-72-3E do not apply to the inherent spacings inside motors, except at wiring terminals, or to the inherent spacings of a component which is provided as part of the detector. Such spacings are judged on the basis of the requirements for the component. The electrical clearance resulting from the assembly of a component into the complete device, including clearances to dead metal or enclosures, shall be those indicated in Table 12-72-3E.

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- 5. The “to walls of enclosure” spacings are not to be applied to an individual enclosure of a component part within an outer enclosure.
- 6. An insulating liner or barrier of vulcanized fiber, varnished cloth, mica, phenolic composition or similar material employed where spacings would otherwise be insufficient, shall be not less than 0.028 inch (0.7 mm) in thickness, except that a liner or barrier not less than 0.013 inch (0.3 mm) in thickness may be used in conjunction with an air spacing of not less than one-half of the through air spacing required. The liner shall be located so that it will not be affected adversely by arcing.
- 7. Insulating material having a thickness less than that specified in Item 6 may be used, if upon investigation, it is found to be adequate for the particular application.
- 8. Enamel-insulated wire is considered to be a bare current-carrying part in determining compliance of a device with the spacing requirements, but enamel is acceptable as turn-to-turn insulation in coils.

PERFORMANCE

Sec. 12-72-303.

(a) General.

- 1. Unless otherwise specified, detectors representative of production are to be used for each of the following tests.
- 2. The devices employed for testing are to be those specified by the wiring diagram of the detector, except that substitute devices may be used if they produce functions and load conditions equivalent to those obtained with the devices intended to be used with the detector in service.
- 3. Data on detector components, e.g., capacitors, resistors (other than carbon or wire wound), solid state devices, etc., shall be provided by the manufacturer for evaluation of the reliability of the components for the intended application. If a Mil-Spec. is referenced, a copy of the specification is to be provided for review. A failure rate of 0.5 failure per million hours for nonsupervised components would be acceptable.
- 4. The data required in the preceding paragraph shall include the following:
 - A. **Component fault analysis.** Effect of failure, open and short, particularly of capacitors, on operation of a detector.
 - B. A description of any component screening and burn-in test, if available.
 - C. Amount of derating of components under normal standby and alarm conditions. A derating of 50 percent or more is acceptable for all components except for electrolytic capacitors. See also Table 12-72-3F.

- D. **Component failure rate data at rated values and derated values.** This may be in the form of a reference to a Mil-Spec. handbook or equivalent.
- E. Maximum ratings for components.
- F. Any other data, not included above, which will provide an equivalent reliability analysis.

DETECTOR RATED VOLTAGE, NAMEPLATE	TEST VOLTAGE
110 to 120	120
220 to 240	240
Other	Marked Rating

- 5. Unless specifically specified otherwise, the test voltage for each test of a detector shall be as follows at rated frequency:
- 6. The following samples are used to perform the tests of this standard:
 - A. At least 20 assembled detectors fully representative of production units.
 - B. One additional unassembled detector fully representative of production units.
 - C. Five additional samples of detectors employing a radioactive source. These may be partial assemblies illustrating the radioactive source installation.
 - D. Three control units and/or power supplies if the detectors are intended specifically to be employed with a specific unit or power supply.
 - E. The monitoring instrument or reference to a commonly available meter intended to monitor sensitivity of a detector.

(b) Normal operation.

- 1. A detector shall be capable of operating for all conditions of its intended performance at all sensitivity settings when employed in conjunction with any related power supply or control unit with which it is intended to be employed and indicating devices to form the system combination covered by the installation wiring diagram and any supplementary information provided.
- 2. The test voltage shall be in accordance with Section 12-72-303 (a), Item 5, and the combustion products detector shall be in the normal circuit supervisory standby condition and prepared for normal signaling operation when it is connected to related devices and circuits.
- 3. The introduction of combustion products into the detector chamber such as produced by a smoldering cotton lamp wick, rope or equivalent, shall result in the operation of the detector in its intended manner. Section 12-72-303 (p), Item 2.

(c) Power input and output. The input or output current of each circuit of a combustion products detector shall not exceed the marked rating by more than 10 percent when the

detector is operated under the conditions of normal use and with the detector connected to a source of supply in accordance with Section 12-72-303 (a), Item 5.

(d) Electrical supervision.

1. All nonreliable components such as electronic tube heaters, blower motors, capacitors, functional heating elements, etc., the failure of which may result in an open or shorted condition shall be electrically supervised. See Sections 12-72-302 (e); 12-72-303 (a), Item 3; 12-72-303 (e) and 12-72-303 (s).
2. All electrical circuits formed by conductors extending from the installation wiring connections for interconnecting to a power supply or system control units the failure of which may result in an open or ground fault shall be electrically supervised either at the detector or at the control unit to which a detector would be connected. See Section 12-72-302 (e).
3. The requirements of Sections 12-72-392 (d), Items 1 and 2, do not apply to the following:
 - A. Trouble indicating circuits.
 - B. The circuits of a detector employed only for releasing device service if the fault results in the same operation of the unit as that obtained by detection of combustion products.
 - C. A circuit for a supplementary signal annunciator, signal sounding appliance, motor controller or similar appliance provided that a break or a ground fault in no way affects the normal operation of the unit except for omission of the supplementary feature.

(e) Electrical supervision test.

1. The electrical circuits formed by conductors extending from the installation wiring connections of a detector for interconnection to a power supply source or system control unit initiating device circuit shall be electrically supervised so that the detector trouble signal or circuit is energized under any of the following fault conditions if the fault prevents normal operation of the detector for fire alarm signals.
 - A. Single open or single ground fault of the connecting field wiring.
 - B. Failure of a nonreliable component. See Sections 12-72-303 (d), Item 1; 12-72-303 (a), Item 3; and 12-72-303 (s).
2. A motor included in a detector, such as a blower motor which is required to operate continuously during normal operation, shall be supervised to indicate stalling or burnout.
3. The heaters of all electronic tubes or other functional heating elements employed in a detector shall be electrically supervised to indicate an open circuit fault by an audible trouble signal if the fault prevents normal operation of the unit.

4. Internal shorts between any two elements of an electronic tube shall be indicated by either a trouble signal or an alarm signal if such failure prevents normal operation of the unit. Such a failure shall not result in a fire hazard.
5. Interruption and restoration of any source of electrical power connected to a detector unit shall not cause an alarm signal.
6. The operation of any manual switching part of a detector unit to other than its normal position while the detector unit is in the normal standby condition shall be indicated by a trouble signal, if the off-normal position of the switch interferes with normal operation of the detector unit.
7. To determine if a detector unit complies with the requirements for electrical supervision, see Section 12-72-303 (d). The detector is to be tested with the representative system combination in its normal supervisory condition, and the type of fault to be detected is then to be introduced. Each fault shall be applied separately, the results noted and the fault removed. The system combination is then to be restored to its normal supervisory condition prior to establishing the next fault.

(f) Sensitivity test.

1. A combustion products detector shall operate within the limits specified below when subjected to a smoldering smoke condition using the combustion products and test equipment described in the following paragraphs. If the detector employs a variable sensitivity setting, test measurements are to be made at maximum, minimum and nominal settings.
 - A. Visible Smoke Obscuration Limits—
 - 0.0 percent per foot maximum (0.013)¹
 - 0.2 percent per foot minimum (0.001)¹
 - B. Relative Combustion Products Measurement Limits—
 - 9.0 volts maximum
 - 1.0 volt minimum
 - C. Monitoring Means—
 - Within 25 percent of the operating limits of the detector rating.
2. **Combustion products.** A mercerized cotton lamp wick, nominally $\frac{7}{8}$ inch (22 mm) wide by $\frac{1}{8}$ inch (3 mm) in cross section and secured by an alligator type clip 3 inches (76 mm) below a removable cover assembly is to be employed as the source of combustion products. The wick end is to be cut square and smoldering initiated by momentarily placing the wick end over a horizontally mounted resistive heater element energized to a dull red color. Smoldering may be promoted by passing a slow current of air over the wick end. The smoldering end is to be cut away

1. Figure in parentheses denotes optical density per foot.

2. A meter suitable for this purpose is Weston Instrument Model 622 in conjunction with a Model 594 RR Photronic Cell.

approximately 1/4 inch (6 mm) above the charred section prior to conducting a succeeding trial. The smoldering rate of the wick is to be such that the visible smoke obscuration increases at an approximate uniform rate of 1.5 ± 0.2 percent per foot (0.0329 0.001 optical density per foot).

(g) **Test equipment and methods.**

1. The visible smoke obscuration (optical density) in the test compartment is to be measured by means of a direct current (DC) type microammeter having a maximum internal resistance of 100 ohms used with a barrier type selenium photovoltaic cell, enclosed in a hermetically sealed case. The meter and cell are used in conjunction with the light produced by a tungsten filament automotive type lamp rated 6 volts and energized from a regulated supply to provide a light beam of uniform flux density. The photoelectric cell and lamp are to be spaced 5 feet (1524 mm) apart. The following equations are to be used:

- A. At any distance, the percent obscuration per foot will be:

$$O_u = [1 - (T_s/T_c)^{1/d}] 100$$

where:

- O_u = Percent obscuration per foot.
- T_s = Smoke density meter reading with smoke.
- T_c = Smoke density meter reading with clear air.
- d = Distance in feet ($m \times 3.33$).

- B. The percent obscuration of light for the full length beam at any distance will be:

$$O_d = [1 - (T_s/T_c)] 100$$

where:

- O_d = Percent obscuration at distance d .
- T_s = Smoke density meter reading with smoke.
- T_c = Smoke density meter reading with clean air.

- C. When the percent obscuration per foot is known, the percent obscuration for the full length of any longer beam can be determined by the following:

$$O_d = [1 - [1 - (O_u/100)]^d] 100$$

where:

- O_d = Percent obscuration at distance d .
- O_u = Percent obscuration per foot.
- d = Distance in feet ($m \times 3.33$).

- D. At any distance, the total optical density will be:

$$OD_t = \text{Log}_{10}(T_c/T_s)$$

where:

- OD_t = Optical density.
- T_c = Smoke density meter reading with clear air.

T_s = Smoke density meter reading with smoke.

- E. At any distance, the optical density per foot will be:

$$OD_f = [\text{Log}_{10}(T_c/T_s)]/d$$

where:

- OD_f = Optical density per foot.
- T_c = Smoke density meter reading with clear air.
- T_s = Smoke density meter reading with smoke.
- d = Distance in feet ($m \times 3.33$).

2. A meter³ calibrated in volts is to be used to measure the relative buildup of primarily invisible products of combustion. The meter, used with an ionization detecting monitoring head without an alarm indicating circuit, has Americium 241 as the radioactive element. The monitoring head is to be located in the test chamber adjacent to the sample under test

3. **Test chamber.** The following items refer to Figure 12-72-3-1.

A. **Cabinet.** Plywood, 3/4 inch (19 mm) thick, except for 1/4 inch (6 mm) thick clear plastic front panel. Overall dimensions approximately 69 1/2 inches (1765 mm) long, 18 inches (457 mm) high, 11 inches (279 mm) deep. A center divider forms two equal 8 inches (203 mm) high by 10 inches (254 mm) deep interior compartments. Inside of lower left side of plastic front panel, as well as all interior surfaces of the cabinet are to be painted flat black. Plastic front assembled with rubber gasket.

B. **Combustible.** Cotton wick. See Section 12-72-303 (f), Item 2. Secured by alligator type clip to removable cap which covers a 3 1/4-inch (82 mm) diameter hole in top of compartment. Cap measures approximately 4 inches square (2580 mm²). Center of hole located approximately 16 inches (406 mm) from left end.

C. **Air dispersing medium.** Three-fourths inch (19 mm) nominal diameter solid glass beads to fill to capacity an expanded metal container, approximately 4 inches (101 mm) wide, 8 inches (203 mm) high, 10 inches (254 mm) deep. Any space between top surface of beads and compartment ceiling to be filled with foam plastic. Provides uniform flow of air and combustion products. Center of unit approximately 22 inches (559 mm) from right-hand side of compartment.

D. **Air circulating fan.** Motor mounted on 1/4-inch (6 mm) plastic support which fits into slots of compartment and fills completely the upper chamber. Employs 5 inch (100 cfm) diameter fan.

E. **Opening.** Rectangular hole, approximately 6 by 4 inches (152 mm by 101 mm), center of opening 4 inches (101 mm) from end of cabinet.

1 Figure in parentheses denotes optical density per foot.

2 A meter suitable for this purpose is Weston Instrument Model 622 in conjunction with a Model 594 RR Photronic Cell.

3 A meter suitable for this purpose is a Pyrotronics, Inc., Type CPM-2 with monitoring head.

- F. **Exhaust fan.** Same as Item D. Mounted in end wall of compartment.
- G. **Exhaust fan cover.** Plastic, approximately $5\frac{3}{4}$ inches (146 mm) wide, 10 inches (254 mm) long, by $\frac{3}{16}$ inch (4.7 mm) thick. Fitted in slots.
- H. **Lamp.** Low voltage automobile-type lamp. See Section 12-72-303 (g), Item 1.
- I. **Monitoring head.** Ionization detector mounted on back wall in test area. See Section 12-72-303 (g), Item 2. Employed with Item M.
- J. **Photovoltaic cell.** See Section 12-72-303 (g), Item 1. Mounted on Item K. Has a linear response up to 800 microamperes at 200 footcandles.
- K. **Air dispersing medium.** Same as Item C, except 3 inches (76 mm) wide.
- L. **Opening.** Rectangular, approximately 6 by 2 inches (152 mm by 51 mm), center of opening 3 inches (76 mm) from left end. Covered with perforated metal having approximately 50 percent openings.
- M. **Combustion products meter.** See Section 12-72-303 (g), Item 2. Meter is to have a 0–10 volts scale. Employed with ionization head (Item I). Provides indication of relative build-up of combustion products in test chamber.
- N. **Control equipment.** Includes fan and switch controls, lamp voltage control and terminals for connection of microammeter.
- O. **Obscuration equipment meter.** See Section 12-72-303 (g), Item 1. Meter is to have 0–100 or 0–200 microamperes full scale.
- P. **Access door for test sample.** Plastic, approximately $11\frac{1}{2}$ by $7\frac{1}{2}$ by $\frac{1}{4}$ inch (292 mm by 190 mm by 6 mm) thick. Secured by hinges and spring catch to front section. Center of door approximately 30 inches (762 mm) from right-hand side of cabinet. Fitted with rubber gasket to prevent air loss.
4. **Test method.** The test is to be conducted in an ambient temperature of $23 \pm 3^\circ\text{C}$ ($73.4 \pm 5^\circ\text{F}$) at a relative humidity between 30–50 percent and a barometric pressure of not less than 700 millimeters of mercury. A minimum of 12 samples of the detector, previously energized for at least 16 hours or as recommended by the manufacturer from a source of supply in accordance with Section 12-72-303 (a), Item 5, are to be subjected to this test. The samples shall be momentarily disconnected from the source of supply, placed in the center of the lower section of the test chamber with the signaling contacts connected to an indicating circuit and re-energized from the specified source of supply.
5. With the air velocity in the test compartment maintained at 30 to 35 feet per minute (fpm), as measured in the sample area, the wick is to be inserted into the upper chamber with the smoldering end facing downward. The air flow is to be parallel to the $\frac{1}{8}$ -inch (3 mm) thick end of the wick and the wick end is to be approximately 3 inches (76 mm) below the compartment roof. See Section 12-72-303 (r), Item 2. Operation is to be continued until the detector is actuated in an alarm condition. Five test trials shall be conducted on each sample with at least a 5-minute interval between each trial. The following readings are to be recorded for each trial at the moment of actuation: (1) visible smoke obscuration, (2) combustion products meter reading, (3) elapsed time of test trial and (4) the monitoring means. If a detector has a variable sensitivity setting, five trials are to be made at the maximum, minimum and nominal sensitivity settings.
6. The detector shall be uniform in operation so that the average of the readings of the smoke density and combustion products meters of the mean three of five trials (highest and lowest not included) of one detector shall be within 50 percent of the mean average of all detectors. If a detector has a variable sensitivity setting, the requirement applies to each setting tested.
7. There shall be no false alarms or effect on operation of a detector set at the maximum sensitivity setting when two representative samples are subjected to the following test conditions:
- A. Operation for three months in an ambient room temperature of approximately $25 \pm 3^\circ\text{C}$ ($77 \pm 5^\circ\text{F}$) and relative humidity of 30–50 percent, having a relatively clean atmosphere with minimum air movement.
 - B. Operation for three months in a relatively clean atmosphere in laminal air stream having a velocity of 300 ± 25 fpm. in an ambient room temperature of approximately $25 \pm 3^\circ\text{C}$ ($77 \pm 5^\circ\text{F}$) and relative humidity of 30–50 percent.
 - C. Ten cycles of humidity variation between 20 and 90 ± 5 percent at room temperature.
 - D. Ten cycles of temperature variation between 17.8°C and 66°C (0°F and 150°F).
 - E. Ten cycles of rapid change of air velocity from 0 to 300 ± 25 fpm.
 - F. Ten cycles of a 2-inch (51 mm) drop of air pressure starting from $29\text{--}31 \pm 0.5$ inch (13 mm) of mercury.
 - G. Fifty cycles of momentary interruption of the detector power supply at a rate of not more than 6 cycles per minute.
8. Two detectors, employing a maximum sensitivity setting are to be mounted in a position of normal use, energized from a source of supply in accordance with Section 12-72-303 (a), Item 5, and subjected to each of the above test conditions.
9. For tests, C, D and F of Section 12-72-303 (g), Item 5, the time of cycling from one extreme to the other shall be a maximum of 1 hour and a minimum of 5 minutes. For test E the air velocity is to be turned on and off abruptly with a maximum of 1 hour between applications. For test F the time of change from one

pressure to the other is approximately one-half minute. The cycling is conducted at a rate not faster than once per 10 seconds. Each cycle is to start at one test condition, changing to the other extreme and returning to the original test condition.

10. The test samples subjected to tests A-G of Section 12-72-303 (g), Item 5, are to be tested for sensitivity, see Sections 12-72-303 (f) following the completion of the test. The response of the detectors, when tested in accordance with the sensitivity test, shall not vary more than 50 percent from the value obtained prior to the test.

(h) **Deleted.**

(i) **Fire test.**

1. At least two of the four detectors subjected to each of the following combustible tests shall operate for alarm when installed on 30-foot (9144 mm) spacings and exposed to the following four types of controlled test fires. The maximum response time shall be 2 minutes for tests A, B and C, and 4 minutes for test D.

A. Paper. Combustible is to be $\frac{1}{2}$ pound of shredded newsprint type paper, strips to be $\frac{1}{4}$ to $\frac{3}{8}$ inch (6 mm to 9 mm) wide, 6 to 24 inches (152 mm to 609 mm) long placed in a receptacle formed of $\frac{1}{4}$ -inch (6 mm) mesh hardware cloth. The receptacle is to be approximately 12 inches (305 mm) in diameter by 24 inches (609 mm) high with a hardware cloth bottom 6 inches (152 mm) above the base. The combustible is to be ignited at the bottom center. Paper is to be dried prior to test.

B. Polystyrene. Combustible is to be 2 ounces of typical foam polystyrene type packing material, with no flame inhibitor, each piece $\frac{1}{4}$ to $\frac{3}{8}$ inch (6 mm to 9 mm) diameter, 3 to 10 inches (76 mm to 254 mm) long placed in the same type of receptacle as used for test A. Alternate shape of combustible is cylindrical, $\frac{3}{4}$ inch (19 mm) diameter by $\frac{1}{2}$ inch (13 mm) high having a $\frac{3}{8}$ -inch (9 mm) diameter hole. The combustible is to be ignited at the bottom center.

C. Gasoline. Combustible is to be 200 cubic centimeters (cc) of regular leaded gasoline placed in a 9-inch (228 mm) diameter steel pan container $1\frac{1}{2}$ inches (38 mm) deep.

D. Wood brand (Class A). Combustible is to be three layers of kiln dried fir strips, each strip $\frac{3}{4}$ inch (19 mm) in cross section, 12 inches (305 mm) long with 12 strips in each layer. Strips are to be nailed or stapled together with adjacent layers at right angles to each other. Overall dimensions of wood brand is approximately 12 by 12 by $2\frac{1}{4}$ inches (305 mm by 305 mm by 57 mm) high. The brand is to be ignited by burning 100 cc of denatured alcohol consisting of 190 proof (95 percent) ethanol to which 5 percent methanol is added as a denaturant. The alcohol is placed in the same type of container as used for test C.

2. The fire tests are to be conducted in a room having a smooth ceiling with no physical obstructions between the fire source and detectors and with minimum air movement. The room is to be provided with means for the removal of combustion products, such as vents or exhaust fans. Heaters are to be provided for maintaining the room temperature ambient, if necessary. The heaters are to be shut off during a test trial. The room shall be of sufficient cross-sectional area so that the detectors can be located in accordance with the spacing layout illustrated by Figure 12-72-3-2 and any reflection of combustion products is prevented from returning to the detectors from adjacent walls during the course of the test. The room height shall be such that the vertical distance from the base of the combustible to the ceiling is approximately 12 feet (3657 mm).

3. The tests are to be conducted in an ambient temperature between 15.6°C and 26.7°C (60°F and 80°F) and a relative humidity of 50 ± 20 percent. The test samples are to be energized from a source of supply in accordance with Section 12-72-303 (a), Item 5.

4. Four samples, each adjusted to their minimum sensitivity setting, are to be installed on the ceiling at a 30-foot (9144 mm) spacing schedule with relation to the test fire [21.2-foot (6462 mm) linear distance measured along the ceiling to a point directly over the center of the test fire]. See Figure 12-72-3-2. The time starts at the moment of ignition. At least two trials shall be conducted for each combustible. Each detector shall respond at least once to each of the four combustibles employed.

5. Sensitivity monitoring instruments are to be employed to determine that the test room area is free of products of combustion prior to conducting a test.

(j) **Temperature test.**

1. The materials or components employed in a detector shall not be affected adversely by the temperatures attained under any condition of normal operation.
2. A material or component will be considered as being adversely affected if it is subject to a temperature rise greater than that indicated in Table 12-72-3F.
3. The classes of material used for electrical insulation referred to in Items 8 and 9 of Table 12-72-3F include the following:

Class A — Impregnated cotton, paper and similar (Class 105) organic materials when impregnated, and enamel as applied to coil windings.

Class B — Inorganic materials, such as mica and (Class 130) impregnated asbestos.

4. All values for temperature rises apply to equipment intended for use in ambient temperatures normally prevailing which usually are not higher than 25°C (77°F). If equipment is intended specifically for use with a prevailing ambient temperature constantly more than 25°C (77°F), the test of the equipment is made at the higher ambient temperature, and the allowable temperature rises specified in the table are

to be reduced by the amount of the difference between that higher ambient temperature and 25°C (77°F).

5. Temperature measurements on equipment intended for recessed mounting shall be made with the unit installed in an enclosure of nominal 3/4-inch (19 mm) wood having clearances of 2 inches (51 mm) on the top, sides and rear, and the front extended to be flush with the detector cover.
6. A temperature is considered to be constant when three successive readings, taken at not less than 5 minute intervals, indicate no change.
7. Temperatures are to be measured by means of thermocouples consisting of wires not larger than No. 24 AWG. The preferred method of measuring the temperature of a coil is the thermocouple method, but a temperature measurement by either the thermocouple or resistance method is acceptable, except that the thermocouple method is not to be employed for a temperature measurement at any point where supplementary thermal insulation is employed.
8. If thermocouples are used in the determination of temperatures, it is standard practice to employ thermocouples consisting of No. 24-30 AWG iron and constantan wires and a potentiometer type indicating instrument. Such equipment will be used whenever referee temperature measurements by thermocouples are necessary.
9. The thermocouple wire is to conform with the requirements for "special" thermocouples as listed in the Table of Limits of Error of Thermocouples in ANSI C96.1-1964 (R1969).
10. The temperature of a copper coil winding is determined by the resistance method by comparing the resistance of the winding at the temperature to be determined with the resistance at a known temperature by means of the equation:

$$TE (R/r) (234.5 + t) - 234.5$$

where:

- T = is the temperature to be determined in degrees C.
 - t = is the known temperature in degrees C.
 - R = is the resistance in ohms at the temperature to be determined.
 - r = is the resistance in ohms at the known temperature.
11. As it is generally necessary to de-energize the winding before measuring R , the value of R at shutdown may be determined by taking several resistance measurements at short intervals, beginning as quickly as possible after the instant of shutdown. A curve of the resistance values and the time may be plotted and extrapolated to give the value of R at shutdown.
 12. To determine compliance with this test, a detector is to be connected to a source of supply in accordance

with Section 12-72-303 (a), Item 5, and operated under the following conditions:

- A. **Normal standby**—(16 hours) constant temperatures.
- B. **Alarm**—(1 hour).
- C. **Alarm**— (7 hours) abnormal test.

13. For test condition C the temperature limits may be exceeded but there shall be no manifestation of a fire hazard or approaching failure and the detector shall operate in a normal manner following the test.
14. The detector is to be subjected to the Dielectric Withstand Test following the above test.

(k) **Over-and-under voltage operation.**

1. A detector shall withstand the continuous application of 110 percent of the test voltage specified by Section 12-72-303 (a), Item 5, in the normal standby condition at maximum and minimum sensitivity settings without being affected adversely and shall operate successfully for normal signaling performance at the specified increased voltage. Sensitivity measurements at the increased voltage shall be within 50 percent from the readings measured at rated voltage.
2. For operation at the higher voltage four new detectors are to be subjected to the specified increased voltage in the normal standby condition for at least 16 hours and then tested for normal signaling operation and sensitivity.
3. A detector shall operate for its normal signaling performance while energized from a supply of 85 percent of the test voltage specified by Section 12-72-303 (a), Item 5, for both maximum and minimum sensitivity settings. Sensitivity measurements at the reduced voltage shall be at 50 percent of the readings measured at rated voltage.
4. For operation at the reduced voltage four new detectors are to be energized from a source of supply in accordance with Section 12-72-303 (a), Item 5, following which the voltage is to be reduced to 85 percent of nameplate rating and then tested for normal signaling operation and sensitivity.

(l) **Variable ambient temperature.**

1. A detector shall be capable of operating in a normal manner when tested in an ambient temperature of 0°C and 49°C (32°F and 120°F), at a relative humidity between 30-50 percent.
2. Two detectors are to be maintained at each ambient temperature for a sufficient length of time to ensure that thermal equilibrium has been reached. The units are then to be tested for sensitivity while connected to a source of supply in accordance with Section 12-72-303 (a), Item 5.
3. Sensitivity measurements shall be recorded before and during exposure to each ambient temperature in accordance with the sensitivity test.

PROTECTIVE SIGNALING SYSTEMS

- Each unit shall operate normally in each ambient. The sensitivity readings measured with the units in each ambient temperature shall be within 50 percent of the value recorded in the normal ambient condition.

(m) Overload.

- A detector shall be capable of operating in a normal manner after being subjected to 50 cycles of alarm signal operation at a rate of not more than 6 cycles per minute with the supply circuit to the detector at 115 percent of rated nameplate voltage. Each cycle shall consist of starting with the detector energized in the normal standby condition, initiation of an alarm by smoke or electrical means, and restoration of the detector to normal standby condition.
- Rated test loads are to be connected to those output circuits of the detector which are energized from the detector power supply, such as remote indicators, relays, etc. The test loads shall be those devices, or the equivalent, normally intended for connection. If an equivalent load is employed for a device consisting of an inductive load, a power factor of 60 percent is to be employed. The rated loads are established initially with the detector connected to a source of supply in accordance with Section 12-72-303 (a), Item 5, following which the voltage is increased to 115 percent of rating.
- For direct current signaling circuits an equivalent inductive test load is to have the required direct current resistance for the test current and the inductance (calibrated) to obtain a power factor of 60 percent when connected to a 60 Hertz (Hz) alternating current potential equal to the rated direct current test voltage. When the inductive load has both the required direct current resistance and the required inductance, the current measured with the load connected to an alternating current circuit will be equal to 0.6 times the current measured with the load connected to a direct current circuit when the voltage of each circuit is the same.
- Separately energized circuits of a detector such as dry contacts shall be capable of operating in a normal manner after being subjected for 50 cycles of signal operation at a rate of not more than 6 cycles per minute while connected to a source of supply in accordance with Section 12-72-303 (a), Item 5, with 150 percent rated loads at 60 percent power factor applied to output circuits which do not receive energy from the detector. There shall be no electrical or mechanical failure of the switching circuit.
- The test loads shall be set at 150 percent of rated current while connected to a separate power source of supply in accordance with Section 12-72-303 (a), Item 5.

(n) Endurance.

- A detector shall be capable of operating in a normal manner after being subjected to 6,000 cycles of

alarm signal operation at a rate of not more than 10 cycles per minute with the detector connected to a source of supply in accordance with Section 12-72-303 (a), Item 5, and with related devices or equivalent loads connected to the output circuits. There shall be no electrical or mechanical failure or evidence of failure of the detector components. The same detector shall be tested that had been subjected previously to the overload test.

- Separately energized circuits of a detector shall be capable of performing acceptably when operated for 6,000 cycles at a rate of not more than 10 cycles per minute. When an electrical load is involved, the contacts of the device shall be caused to make and break the normal current at the voltage specified by Section 12-72-303 (a), Item 5. The load shall represent that which the device is intended to control. The endurance tests of the separately energized circuits may be conducted in conjunction with the endurance test of the detector. There shall be no electrical or mechanical failure of the detector nor undue pitting, burning or welding of any relay contacts.

(o) Dielectric tests.

- A detector shall be capable of withstanding, without breakdown for a period of 1 minute, the application of a 60 Hz alternating potential between high-voltage, live parts and dead-metal parts, and between live parts of high- and low-voltage circuits, except as noted in Item 2. The test potential shall be:
 - 1,000 volts RMS plus twice rated voltage for high-voltage circuits.
- A detector employing a low-voltage circuit shall be capable of withstanding, for 1 minute without breakdown, a 60 Hz alternating potential of 500 volts RMS applied between low-voltage live parts and dead-metal parts.
- Any reference grounds shall be disconnected prior to the test applications.
- A transformer, the output voltage of which is essentially sinusoidal, can be varied and can maintain the specified high potential voltage at the equipment during the duration of the test and is to be used to determine compliance with the foregoing. The applied potential is to be increased gradually from zero until the required test value is reached and is to be held at that value for 1 minute.

(p) Abnormal operation.

- A detector shall be capable of operating continuously under abnormal conditions without resulting in a fire hazard.
- To determine if a detector complies with the requirement of Item 1, it is to be operated under the most severe abnormal conditions liable to be encountered in service while connected to a source of supply in accordance with Section 12-72-303 (a), Item 5. Emission of flame or molten metal, or any other

manifestation of a fire hazard, is considered to be a failure.

3. In determining if a detector complies with the requirement with respect to circuit-fault conditions, the fault condition is to be maintained continuously until constant temperatures are attained, or until burnout occurs, if the fault does not result in the operation of an overload protective device. Shorting of electrolytic capacitors would represent a typical fault.

(q) Transient tests.

1. Two detectors shall be capable of operating in a normal manner after being subjected to 500 externally induced and 500 internally induced transients while energized from a source of supply in accordance with Section 12-72-303 (a), Item 5, and connected to the devices normally used with the unit.
2. The primary of a 120/240 volt, 60 Hz, 2 kilovolt-amperes (kVA) isolating power transformer, with the secondary open circuited, is to be connected to the same branch circuit as the detector. The input to the transformer is to be de-energized for approximately 1 second by an automatic switching device at a rate of not more than 6 cycles per minute for 500 cycles. During the test the detector is to be operated for normal signaling performance to determine whether transients, generated by the random collapse of the magnetic field of the transformer, resulted in a component failure or other adverse effect.
3. The electrical characteristics of the testing transformer are as follows:

	VOLTAGE	FREQUENCY	INDUCTANCE (L) MILLIHENRIES	QUALITY FACTOR Q	DC RESISTANCE (R) OHMS (23°C)
Primary winding	120	1,000	21.2	11.50	0.244
Secondary winding	240	1,000	109.3	4.65	0.371

4. Two detectors are to be energized in the normal standby condition while connected to a source of supply in accordance with Section 12-72-303 (a), Item 5, which is to be interrupted for approximately 1 second at a rate of not more than 6 cycles per minute for a total of 500 cycles. Following the test the detector is operated for normal signaling performance.

(r) Humidity test.

1. Two detectors shall be capable of operating in a normal manner while energized from a source of supply in accordance with Section 12-72-303 (a), Item 5, after having been exposed for 24 hours to moist air having a relative humidity of 85 + 5 percent at a temperature of 30 ± 2°C (86 ± 3°F). The sensitivity shall be determined with the detector connected to a source of supply in accordance with Section 12-72-303 (a), Item 5.

2. Sensitivity measurements shall be recorded before and during exposure to the humidity condition in accordance with the sensitivity test.
3. The sensitivity values measured with the unit in the humid atmosphere shall be within 50 percent of the value recorded in the normal ambient condition.

(s) Component failure.

1. Failure of electronic components of questionable reliability such as opening or shorting of electrolytic capacitors shall either have no adverse effect on normal operation or may be indicated by a trouble or an alarm signal.
2. If failure of a questionable component cannot be indicated by a trouble or alarm signal, a reliable component shall be employed. The reliability may be based on derating or on reliability data recorded for the particular component. See Section 12-72-303 (a).

(t) Dust test.

1. The sensitivity of a detector shall either not be affected adversely by an accumulation of dust or may result in a false alarm.
2. To determine compliance with Item 1 two samples in their normal mounting position, are to be placed, de-energized, in an air tight chamber having an internal volume of at least 3 cubic feet.
3. Approximately 2 ounces of cement dust, capable of passing through a 200 mesh screen, is to be circulated for 15 minutes by compressed air or a blower under controlled velocity conditions not exceeding 50 rpm so as to completely envelop the sample in the chamber.
4. Following the exposure to dust the detector is to be removed carefully, mounted in its intended position, energized from a source of supply in accordance with Section 12-72-303 (a), Item 5, and tested for sensitivity unless a false alarm is obtained. Sensitivity measurements after subsection to the dust test may be greater than 50 percent toward the more sensitive region but shall not be more than 50 percent toward the insensitive region.

(u) Static discharge test.

1. The components of a detector shall be shielded so that its operation is not affected adversely, or a false alarm obtained, when subjected to static electric discharges. Operation of the trouble circuit during this test is not considered a failure.
2. Each of two detectors is to be mounted in its intended mounting position and connected to a source of supply in accordance with Section 12-72-303 (a), Item 5. A 250 picofarad low leakage capacitor rated 10,000 volts direct current, is to be connected to two high-voltage insulated leads, 3 feet (914 mm) long, stripped 1 inch (25 mm) at each end. The end of each lead is to be attached to a metal test probe mounted on a plastic insulating rod to permit

manipulation and isolation from shock hazard. The test probes shall be metallic rods with a spherical end of $\frac{1}{4}$ -inch (6 mm) radius. The capacitors are to be charged by touching the ends of the test leads to a source of 10,000 volts direct current for at least 2 seconds for each discharge.

3. Ten discharges with at least a 5 minute interval between discharges are to be applied to different points on the exposed surface of the detector, recharging the capacitors for each discharge. Five discharges are to be made with one probe connected to earth ground and the other probed on the detector surface followed by five discharges with the polarity reversed.
4. Following the discharges, if a trouble or an alarm signal is not obtained, the detector is to be tested for sensitivity. Sensitivity measurements shall be within 25 percent of the average of the readings measured prior to the test.

(v) Vibration test.

1. A detector shall be capable of withstanding vibration without breakage or damage to parts. Following the vibration the detector shall be capable of operating in a normal manner.
2. To determine compliance with Item 1, sensitivity measurements following the vibration shall be conducted in accordance with the sensitivity test and shall be within 50 percent of the value recorded in the normal ambient condition.
3. Two samples, one at the maximum and one at the minimum sensitivity setting, are to be secured in their intended mounting position on a mounting board and the board, in turn, securely fastened to a variable speed vibration machine having an amplitude of 0.01 inch (0.2 mm). The frequency of vibration is to be varied from 10 to 35 cycles per second in increments of five cycles per second until a resonant frequency is obtained. The samples are then to be vibrated at the maximum resonant frequency for a period of one-fourth hour. If no resonant frequency is obtained, the samples are to be vibrated at 35 cycles per second for a period of 4 hours.
4. For these tests, amplitude is defined as the maximum displacement of sinusoidal motion from a position of rest or one-half of the total table displacement. Resonance is defined as the maximum magnification of the applied vibration.

(w) Jarring test.

1. A detector shall be capable of withstanding jarring resulting from impact and vibration such as might be experienced in service, without affecting adversely its subsequent normal operation. A trouble signal resulting from the jarring may be permitted if the normal operation is not affected.
2. The detector and associated equipment, if any, are to be mounted in a position of intended use to the center of a 6 by 4 foot (1829 mm by 1219 mm) nominal

$\frac{3}{4}$ -inch (19 mm) thick plywood board which is secured in place at four corners. A 3-foot (914 mm) board impact is to be applied to the center of the reverse side of this board by means of a 1.18 pound, 2 inch (51 mm) diameter steel sphere either (1) swung through a pendulum arc from a sufficient height, (*h*) of 2.54 feet (774 mm) or (2) dropped from a sufficient height (*h*) of 2.54 feet to apply 3 foot-pounds of energy depending upon the mounting of the equipment. See Figure 12-72-3-3.

3. Compliance with Item 1 is to be determined by supporting the detector in its intended mounting position and conducting the jarring while the unit is in the normal standby condition and connected to a rated source of supply in accordance with Section 12-72-303 (a), Item 5. Following the jarring the unit(s) shall be tested for sensitivity. Sensitivity measurements following the jarring shall be within 25 percent of the average of the readings measured prior to the test.

(x) Corrosion test.

1. A detector shall be capable of operating in a normal manner after being subjected to the corrosive atmosphere tests described in the following paragraphs.
2. Two samples, one at maximum and one at minimum sensitivity setting, are to be exposed to an atmosphere containing approximately 1 percent hydrogen sulphide by volume in air saturated with water vapor at room temperature for 10 days. The units are not energized during the exposure.
3. Two samples, one at maximum and one at minimum sensitivity settings are to be exposed to an atmosphere containing approximately 1 percent carbon dioxide and 0.5 percent sulfur dioxide by volume in air saturated with water vapor at room temperature for 10 days.
4. The detectors are to be tested for sensitivity prior to exposure to the corrosive atmospheres. Twenty-four hours or more after the required exposure the detectors are to be again tested for sensitivity. Sensitivity measurements following the exposure to the corrosive atmospheres shall be within 50 percent of the value recorded in the sensitivity test, except as indicated in Item 5.
5. The sensitivity following exposure to the corrosion atmospheres described in Item 3 may exceed 50 percent from the value measured prior to the corrosion exposure if the same units, set at their minimum sensitivity, are subjected to and comply with the fire test requirements described in Section 12-72-303 (i), Items 1-5.

(y) Radioactive element measurement test.

1. The total activity of the radioactive source(s) of a detector shall not exceed the maximum content specified in the marking on the detector by more than 10 percent.

2. The measurement shall be made on at least five samples of the detector in the as-received condition using appropriate instrumentation and techniques.

(z) **Paint loading test.**

1. A detector shall operate in a normal manner and shall comply with the requirements of the sensitivity test after painting, if the detector assembly, screens, openings, etc., are likely to be clogged by painting. If a detector is marked prominently so it will be visible after the unit is installed which prohibits painting, then this test need not be conducted. See Section 12-72-303 (a) and (b).
2. The exterior surfaces of two samples, including screened openings, etc., are to be coated with a lead-oil base paint which is spread at approximately two times the paint manufacturer's recommended spreading rate. The paint is to be allowed to dry, for 5 days at room temperature. Following this, the samples are to be given a second identical application of paint and again permitted to dry for 5 days. The detectors are to be tested for sensitivity, one at maximum and one at minimum sensitivity setting before and after the specified paint loading. Sensitivity measurements following the paint loading shall be within 25 percent of the average of the readings measured prior to the paint loading.

TESTS ON THERMOPLASTIC MATERIALS

Sec. 12-72-304.

(a) **General.** Thermoplastic materials included for the sole support of current carrying parts or as an enclosure of an appliance shall be subjected to the tests included in Sections 12-72-304(b) - (i) inclusive. Where possible, the complete appliance shall be used.

(b) **Temperature test.**

1. There shall be no excessive warping or exposure of high-voltage uninsulated current carrying parts so as to impair operation when representative samples of a plastic material are aged for 7 hours in an air circulating oven maintained at 90°C (194°F).
2. At least three representative samples shall be placed in the oven. At the end of the 7 hours, the samples shall be removed, permitted to cool and then examined for adverse distortion.

(c) **Flame test.** A plastic material employed as part of an appliance for the sole support of current carrying parts or as an enclosure shall not continue to burn for more than 1 minute after the fifth 5-second application of a test flame, with an interval of 5 seconds between applications of the flame. There shall be no dripping of particles, complete consumption of the sample during the test and the material shall not be destroyed in the area of the test flame to such an extent that the integrity of the enclosure is affected. Three samples of the material or three test specimens consisting of a part or section of the polymeric enclosure shall be subjected to this test.

Consideration may be given to leaving in place components and other parts which may influence the performance.

(d) Two of the three test samples shall show acceptable performance. If one sample fails, the test shall be repeated on a new sample with the flame applied under the same conditions as for the failing sample. If the new specimen fails to comply with the requirements, the material is not acceptable. The following test equipment is employed.

1. **Test chamber.** The test chamber consists of a sheet-metal cell 2 feet by 1 foot by 1 foot (609 mm by 305 mm by 305 mm), open at the top and on one long side. The chamber shall be located so that an ample supply of air is provided, but the sample is not subjected to drafts. The chamber may be placed in a hood, provided that the fan is turned off during the test and is allowed to run only between tests to remove fumes.
2. A ring stand with a suitable clamp is used for supporting the specimens.
3. **Burner and mounting block.** The test flame is to be obtained by means of a Tirrill Burner having a nominal bore of $\frac{3}{8}$ inch (9 mm). The tube length above the primary air inlets is to be approximately 4 inches (101 mm). The burner is to be adjusted so that, while the burner is in a vertical position, the overall height of the flame is 5 inches (127 mm) and the height of the inner blue cone is $1\frac{1}{2}$ inches (38 mm). A mounting block is to be provided so that the burner may be positioned at an angle of 20 degrees from the vertical.
4. A stopwatch or clock.
5. Circulating-air oven.

(e) **Conditioning and mounting.** The test samples are to be conditioned by placing them in a circulating-air oven maintained at a uniform temperature not less than 10°C higher than the maximum temperature of the material measured under normal operating conditions but not less than 70°C in any case. The samples are to remain in the oven for 7 days. Prior to test the samples are to be returned to room temperature. The test sample is to be mounted as intended in service in the test chamber. The test flame is to be applied at an angle of 20 degrees from the vertical to any portion of the interior of the enclosure judged as liable to be ignited by proximity to live or arcing parts, coils, wiring, etc. The test flame shall be applied to a different location on each of the three samples tested. The test flame is to be applied for 5 seconds and removed for 5 seconds. The operation is to be repeated until the specimen has been subjected to a total of five applications of the test flame.

(f) **Impact test.** An appliance employing a thermoplastic enclosure shall withstand three 5 foot-pound impacts without exposure of live parts, impairment of the operation of the appliance or result in a shock hazard.

Each of two units is to be mounted securely in a position of normal use on a surface representative of a typical installation. Three 5 foot-pound impacts are to be applied to each sample, each trial on a different section of the enclosure, by

PROTECTIVE SIGNALING SYSTEMS

means of a 1.18 pound, 2-inch (51 mm) diameter steel sphere swung through a pendulum arc from a sufficient height to apply 5 foot-pounds of energy.

Following the impacts, the unit is to be examined for damage and checked for normal operation by being energized from a source of rated voltage and frequency. Cracking of the enclosure is acceptable if it does not impair normal operation, but is not acceptable if a dust or moisture tight enclosure is required.

(g) **Infrared analysis of plastics.** The basic composition of a plastic material employed for the sole support of current carrying parts or an enclosure is to be by infrared analysis.

(h) **Sample preparation.** The general technique for preparing plastics for infrared analysis is to dissolve the sample in a suitable boiling hot solvent. The resulting solution is then to be placed on a sodium chloride plate from which the solvent is evaporated by gentle heating, thereby leaving a reasonably uniform thin film of the plastic on the sodium chloride plate. The salt plate is then mounted in a spectrometer and the infrared spectrum of the plastic is recorded.

A suitable solvent is one which will dissolve the plastic without reacting with it and which can be readily evaporated on gentle heating.

Examples of solvents suitable for certain polymer types are:
acetone—for polymers of high oxygen content, e.g., polyesters and phenolic resins.

o-dichlorobenzene—for simple vinyl type polymers e.g., polyvinylchlorides.

n,n-dimethylformamide—for polymers of nitrogen content, e.g., polyamides.

Some high molecular weight or highly cross-linked polymers which are insoluble in all volatile solvents are to be prepared by the pressed halide-disk technique. A few milligrams of the plastic are to be removed from the surface of a sample by a fine file. These filings are to be ground in a mechanical vibrating ball mill for three to 5 minutes. Care must be taken to reduce the particle size to a size (approximately 2 micrometers) smaller than that of the shortest wave length to be scanned so as to minimize scattering effects. The appropriately ground sample is to be intimately mixed with spectroscopic grade potassium bromide and a sufficient amount of this mixture to produce a 1 mm thick, 1/2-inch (13 mm) diameter disk is to be placed in an evacuable die. The die is to be placed under vacuum and a pressure of 10,000-15,000 psi is to be applied. The pressed disk is removed from the die and mounted in a spectrometer, and the infrared spectrum of the plastic is recorded.

(i) **Instrumentation.** The infrared spectrum from 2.0–15.0 micrometers (5000–667 cm⁻¹) of a given plastic is to be obtained on an optical double beam recording infrared spectrometer, having either a grating or sodium chloride prism dispersing element.

TABLE 12-72-3A—CAST-METAL ENCLOSURES

USE OR DIMENSIONS OF AREA INVOLVED	MINIMUM THICKNESS IN INCHES	
	Die-cast metal	Cast metal of other than the die-cast type
Area of 24 square inches or less and having no dimension greater than 6 inches	1/16	1/8
Area greater than 24 square inches or having any dimensions greater than 6 inches	3/32	1/8
At a threaded conduit hole	1/4	1/4
At an unthreaded conduit hole	1/8	1/8

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

TABLE 12-72-3B—SHEET METAL ENCLOSURES

MAXIMUM ENCLOSURE DIMENSIONS		MINIMUM THICKNESS OF SHEET METAL IN INCHES		COPPER, BRASS OR ALUMINUM
		Steel		
Any linear dimension in inches	Area of any surface in square inches	Coated	Uncoated	
12	90	0.035 (20)	0.031 (20)	0.045 (16)
24	360	0.046 (18)	0.042 (18)	0.058 (14)
48	1,200	0.057 (16)	0.053 (16)	0.075 (12)
60	1,500	0.070 (14)	0.067 (14)	0.095 (10)
Over 60	Over 1,500	0.097 (12)	0.093 (12)	0.122 (8)

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

TABLE 12-72-3C—THICKNESS OF GLASS COVERS

MAXIMUM SIZE OF OPENING		MINIMUM THICKNESS OF GLASS IN INCHES
Length or width in inches	Area in square inches	
4	16	$\frac{1}{16}$
12	144	$\frac{1}{8}$ ¹
Over 12	Over 144	1

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

1. One-eighth inch or more, depending upon the size, shape and mounting of the glass panel.

TABLE 12-72-3D—THICKNESS OF INSULATING MATERIAL

MAXIMUM DIMENSION IN INCHES	MAXIMUM AREA IN SQUARE INCHES	MINIMUM THICKNESS IN INCHES
24	360	$\frac{3}{8}$ ¹
48	1,152	$\frac{1}{2}$
48	1,728	$\frac{5}{8}$
Over 48	Over 1,728	$\frac{3}{4}$

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

1. Material less than $\frac{3}{8}$ inch but not less than $\frac{1}{8}$ inch in thickness may be employed for a panel if the panel is adequately supported or reinforced to provide rigidity not less than that of a $\frac{3}{8}$ -inch sheet. Material less than $\frac{1}{8}$ inch may be employed for subassemblies, such as supports for terminals for internal wiring, resistors and other components.

TABLE 12-72-3E—MINIMUM SPACINGS

POINT OF APPLICATION	MINIMUM SPACING—INCHES ¹		
	Voltage Range Volts	Through Air	Over Surface
To walls of enclosure Cast-metal enclosures Sheet metal enclosures	0–300	$\frac{1}{4}$	$\frac{1}{4}$
	0–300	$\frac{1}{2}$	$\frac{1}{2}$
Installation wiring terminals With barriers—see Section 12-72-302 (t), Item 6	0–30	$\frac{1}{8}$	$\frac{3}{16}$
	31–150	$\frac{1}{8}$	$\frac{1}{4}$
	151–300	$\frac{1}{4}$	$\frac{3}{8}$
Without barriers	0–30	$\frac{3}{16}$	$\frac{3}{16}$
	31–150	$\frac{1}{4}$	$\frac{1}{4}$
	151–300	$\frac{1}{4}$	$\frac{1}{8}$
Rigidly clamped assemblies ² 100 volt-amperes maximum Over 100 volt amperes	0–30	$\frac{1}{32}$ ³	$\frac{1}{32}$ ³
	0–30	$\frac{3}{64}$	$\frac{3}{64}$
	31–150	$\frac{1}{16}$	$\frac{1}{16}$
	151–300	$\frac{3}{32}$	$\frac{3}{32}$
Other parts	0–30	$\frac{1}{16}$	$\frac{1}{8}$
	31–150	$\frac{1}{8}$	$\frac{1}{4}$
	151–300	$\frac{1}{4}$	$\frac{3}{8}$

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

1. Measurements are to be made with solid wire of adequate ampacity for the applied load connected to each terminal. In no case is the wire to be smaller than No. 18 AWG.
2. Rigidly clamped assemblies include such parts as contact springs on relays or cam switches, printed wiring boards, etc.
3. Spacings less than those indicated, but in no case less than $\frac{1}{64}$ inch are acceptable for connection of integrated circuits and similar components where the spacing between the adjacent connecting wires on the component is less than $\frac{1}{32}$ inch.

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TABLE 12-72-3F—MAXIMUM TEMPERATURE RISES

DEVICE OR MATERIAL	DEGREES °C	DEGREES °F
1. Any point on rectifiers:		
A. Copper oxide	30	54
B. Germanium	50	90
C. Magnesium-copper sulphide	95	171
D. Selenium	50	90
E. Silicon	75	135
2. Rubber or thermoplastic insulation	35 ¹	63 ¹
3. Varnished cloth insulation	60	108
4. Fuses	65	117
5. Surfaces adjacent to or upon which the unit may be mounted in service	65	117
6. Wood or other combustible material	65	117
7. Fiber used as electrical insulation	65	117
8. Class A (Class 105) insulation	65 ³	117 ³
9. Class B (Class 130) insulation	85 ³	153 ³
10. Phenolic composition used as electrical insulation	125	225
11. Capacitors	40	72
12. Solid state devices (transistors, silicon-controlled rectifiers, etc.) integrated circuits	See ⁴	
13. Wirewound resistor	150 ²	302 ²
14. Carbon resistor	See ⁴	
15. Sealing compound	15	(27) less than the melting point ²

For SI: 1 inch = 25.4 mm, 1 square inch = 645 mm².

1. This limitation does not apply to an insulated conductor or a material which has been investigated and accepted for a higher temperature.
2. These are limiting temperatures, not temperature rises.
3. 10°C (18°F) higher on coil insulation if measured by the resistance method.
4. The temperature of a solid-state device shall not exceed 50 percent of its rating during the normal standby condition. The temperature of a solid-state device shall not exceed 75 percent of its rated temperature under any other condition of operation of the complete unit which produces the maximum temperature dissipation of its components. For reference purposes 0°C (32°F) shall be considered as 0 percent. For integrated circuits the loading factor shall not exceed 50 percent of its rating under the normal standby condition and 75 percent under any condition of operation. Both solid-state components and integrated circuits may be operated up to the maximum ratings, under any one of the following conditions:
 - 4.1. All components comply with the requirements Mil-Std. 883C.
 - 4.2. A quality control program is established by the manufacturer consisting of inspection and test of 100 percent of all components, either on an individual basis, as part of a subassembly, or equivalent.
 - 4.3. Each assembled production unit is subjected to a burn in test while in an alarm condition for 24 hours while connected to a source of rated nameplate voltage and frequency in an ambient of at least 49°C (120°F) followed by an operational test the maximum temperature on a carbon resistor shall be not greater than 50°C during the normal standby condition and not greater than 75°C during the alarm condition.

TABLE 12-72-3G—OBSCURATION—OPTICAL DENSITY CHART
(Based on a 5-foot light beam)

METER READING (Microamperes)	PERCENT PER FOOT OBSCURATION O_d	TOTAL OBSCURATION O_d	TOTAL OPTICAL DENSITY OD_t	OPTIC DENSITY PER FOOT OD_f
100.0	0.0000	0.0000	0.0000	0.0000
99.5	0.1002	0.5001	0.0022	0.0004
99.0	0.2008	1.0001	0.0044	0.0009
98.5	0.3019	1.5001	0.0066	0.0013
98.0	0.4033	2.0001	0.0088	0.0018
97.5	0.5051	2.5002	0.0110	0.0022
97.0	0.6074	3.0002	0.0132	0.0027
96.5	0.7101	3.5002	0.0155	0.0031
96.0	0.8132	4.0003	0.0177	0.0036
95.5	0.9167	4.5003	0.0200	0.0040
95.0	1.0227	5.0003	0.0223	0.0045
94.5	1.1251	5.5004	0.0246	0.0049
94.0	1.2300	6.0004	0.0296	0.0054
93.5	1.3353	6.5004	0.0292	0.0058
93.0	1.4410	7.0005	0.0315	0.0063
92.5	1.5473	7.5005	0.0339	0.0068
92.0	1.6539	8.0005	0.0362	0.0072
91.5	1.7611	8.5005	0.0386	0.0077
91.0	1.8687	9.0006	0.0410	0.0082
90.5	1.9768	9.5006	0.0434	0.0087
90.0	2.0853	10.0006	0.0458	0.0092
89.5	2.1944	10.5007	0.0482	0.0096
89.0	2.3039	11.0007	0.0506	0.0101
88.5	2.4139	11.5007	0.0531	0.0106
88.0	2.5244	12.0008	0.0555	0.0111
87.5	2.6355	12.5008	0.0580	0.0116
87.0	2.7470	13.0008	0.0605	0.0121
86.5	2.8590	13.5008	0.0630	0.0126
86.0	2.9716	14.0009	0.0655	0.0131
85.5	3.0847	14.5009	0.0680	0.0136
85.0	3.1984	15.0009	0.0706	0.0141
84.5	3.3125	15.5010	0.0732	0.0146
84.0	3.4272	16.0010	0.0757	0.0152
83.5	3.5425	16.5010	0.0783	0.0157
83.0	3.6583	17.0011	0.0809	0.0162
82.5	3.7746	17.5011	0.0836	0.0167
82.0	3.8916	18.0011	0.0862	0.0172
81.5	4.0091	18.5011	0.0889	0.0178
81.0	4.1271	19.0012	0.0915	0.0183
80.5	4.2458	19.5012	0.0942	0.0188
80.0	4.3651	20.0012	0.0969	0.0194

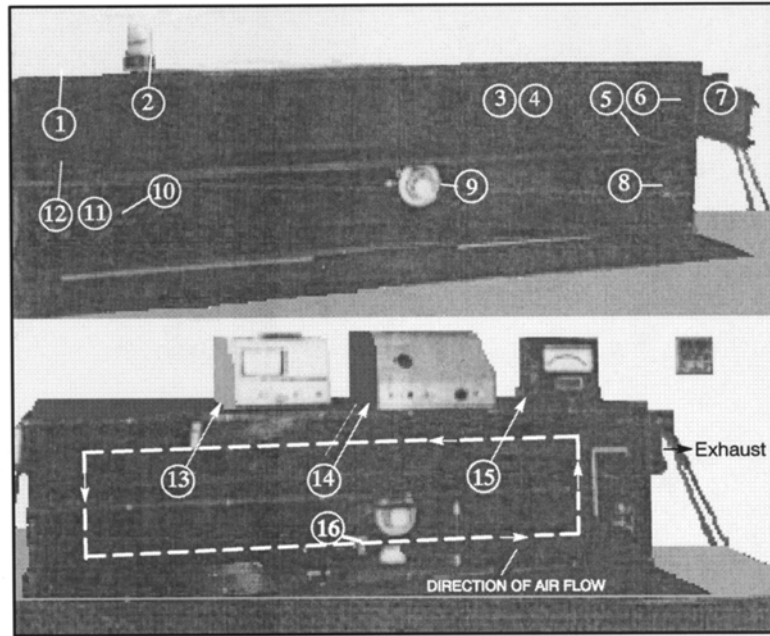


FIGURE 12-72-3-1—SMOKE DETECTOR TEST CHAMBER

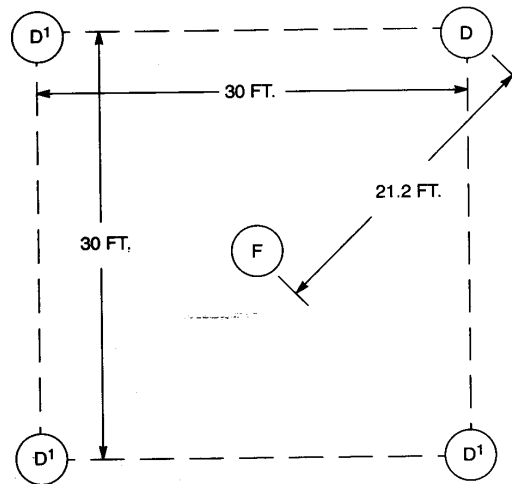


FIGURE 12-72-3-2—FIRE TEST DETECTOR INSTALLATION

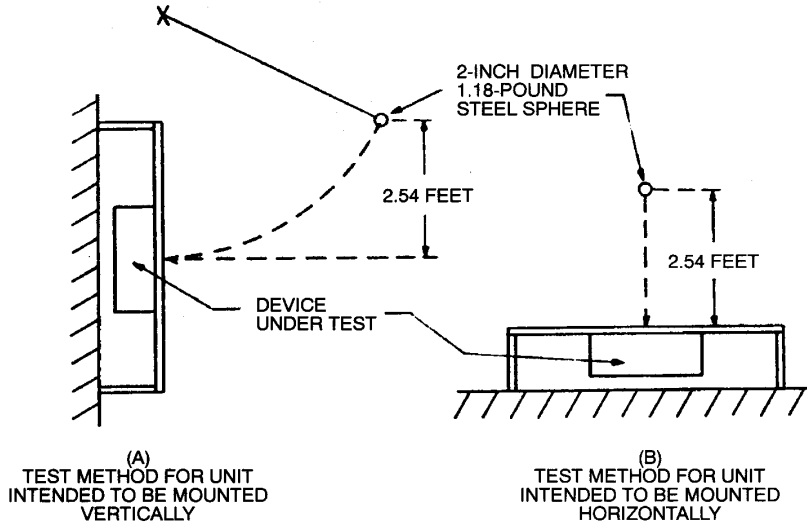


FIGURE 12-72-3-3—JARRING TEST

HISTORY NOTE APPENDIX

2022 California Referenced Standards Code California Code of Regulations, Title 24, Part 12

||

HISTORY:

For prior code history, see the History Note Appendix to the *California Referenced Standards Code*, 2019 Triennial Edition, effective January 1, 2020.

1. (BSC 07/21) – Amendments to the 2022 *California Referenced Standards Code*, CCR Title 24, Part 12. Approved by the California Building Standards Commission on January 18, 2022; filed with the Secretary of State on February 2, 2022; and effective on January 1, 2023.
2. (SFM 08/21) – Repeal the 2019 Adoption of the *California Referenced Standards Code*, CCR Title 24, Part 12 and adopt the 2022 *California Referenced Standards Code*. Approved by the California Building Standards Commission on January 19, 2022; filed with Secretary of State on February 2, 2022; and effective on January 1, 2023.



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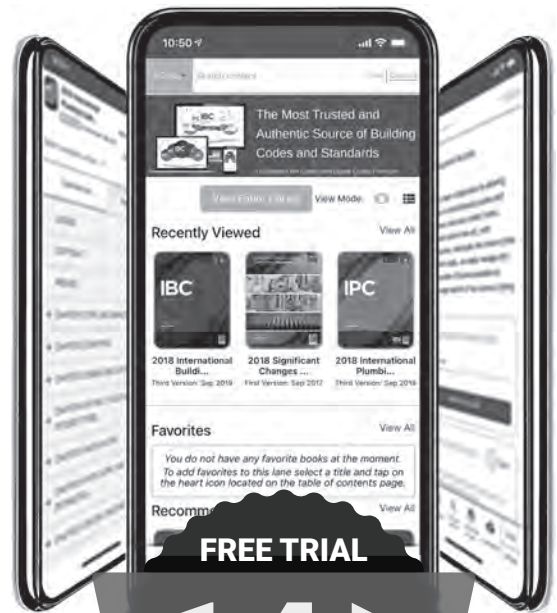
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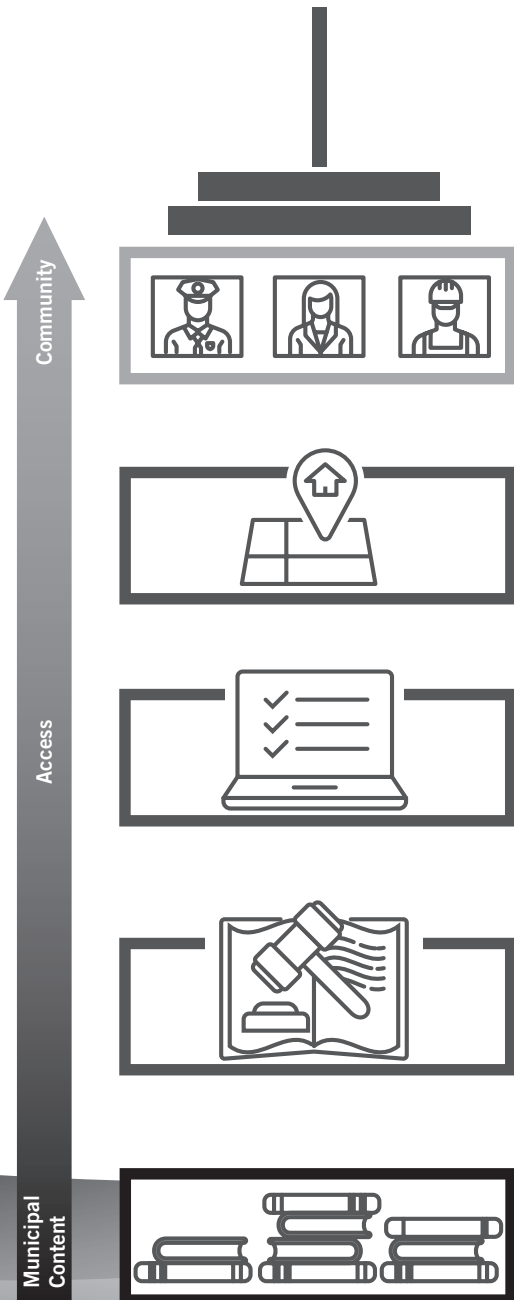


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California Building Standards Commission



Effective January 1, 2023

For Errata and Supplement effective dates see the History Note Appendix

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PREFACE

This document is Part 11 of thirteen parts of the official triennial compilation and publication of the adoptions, amendments and repeal of administrative regulations to *California Code of Regulations, Title 24*, also referred to as the *California Building Standards Code*. This part is known as the *California Existing Building Code*.

The *California Building Standards Code* is published in its entirety every three years by order of the California legislature, with supplements published in intervening years. The California legislature delegated authority to various state agencies, boards, commissions and departments to create building regulations to implement the State's statutes. These building regulations, or standards, have the same force of law, and take effect 180 days after their publication unless otherwise stipulated. The *California Building Standards Code* applies to occupancies in the State of California as annotated.

A city, county, or city and county may establish more restrictive building standards reasonably necessary because of local climatic, geological or topographical conditions. Findings of the local condition(s) and the adopted local building standard(s) must generally be filed with the California Building Standards Commission (or other filing if indicated) to become effective, and may not be effective sooner than the effective date of this edition of the *California Building Standards Code*. Local building standards that were adopted and applicable to previous editions of the *California Building Standards Code* do not apply to this edition without appropriate adoption and the required filing.

Should you find publication (e.g., typographical) errors or inconsistencies in this code or wish to offer comments toward improving its format, please address your comments to:

California Building Standards Commission
2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833-2936
Phone: (916) 263-0916
Email: cbsc@dgs.ca.gov
Web page: www.dgs.ca.gov/bsc

ACKNOWLEDGMENTS

The 2022 *California Building Standards Code* (Code) was developed through the outstanding collaborative efforts of the Department of Housing and Community Development, Division of State Architect, Office of the State Fire Marshal, Office of Statewide Health Planning and Development, California Energy Commission, California Department of Public Health, California State Lands Commission, Board of State and Community Corrections and the California Building Standards Commission (Commission).

This collaborative effort included the assistance of the Commission's Code Advisory Committees and many other volunteers who worked tirelessly to assist the Commission in the production of this Code.

Governor Gavin Newsom

Members of the California Building Standards Commission

Secretary Yolanda Richardson – Chair

Rajesh Patel – Vice-Chair

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Elley Klausbruckner

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Peter Santillan

Kent Sasaki

Laura Rambin

Mia Marvelli – Executive Director

Michael L. Nearman – Deputy Executive Director

For questions on California state agency amendments, please refer to the contact list on page v.

LEGEND FOR AGENCY ADOPTIONS

Unless otherwise noted, state agency adoptions are indicated by the following banners in the section leaders:

Department of Housing and Community Development: [HCD]

California Building Standards Commission, *CALGreen*: [BSC-CG]

Division of the State Architect, Structural Safety: [DSA-SS]

Office of Statewide Health Planning and Development: [OSHDP 1, 1R, 2, 4 & 5]

See Chapter 1, Sections 103–106 for applications regulated by the respective state agencies.

EFFECTIVE USE OF THIS CODE

The format of this code is common to other parts of the *California Building Standards Code* and contains building standards applicable to occupancies which fall under the authority of different state agencies. Occupancies and applications under the authority of a specific state agency are identified in Chapter 1, Sections 103 through 106. Sections of this code which are applicable and adopted by each state agency are identified in the Matrix Adoption Tables located at the beginning of each chapter. The following outline is provided as a guide to establish which provisions are applicable to a specific occupancy.

1. Establish the type of occupancy.
2. Verify which state agency has authority for the established occupancy by reviewing the authorities list in Sections 103 through 106.
3. Once the appropriate agency has been identified, find the chapter which covers the established occupancy.
4. The Matrix Adoption Tables at the beginning of Chapters 4 and 5 identify the required green building measures necessary to meet the minimum requirements of this code for the established occupancy.
5. Voluntary tier measures are contained in Appendix Chapters A4 and A5. A Checklist containing each green building measure, both required and voluntary is provided at the end of each appendix chapter. Each measure listed in the application checklist has a section number which correlates to a section where more information about the specific measure is available.
6. The Application Checklist identifies which measures are required by this code and allows users to check-off which voluntary items have been selected to meet voluntary tier levels if desired or mandated by a city, county, or city and county.

CALIFORNIA CODE OF REGULATIONS, TITLE 24

California Agency Information Contact List

The following state agencies may propose building standards for publication in Title 24. Request notice of such activity with each agency of interest. See Sections 1.2 through 1.14 of the California Building Code (Part 2 of Title 24) for more detailed information on the regulatory jurisdiction of each state agency.

Board of State and Community Corrections

www.bscc.ca.gov (916) 445-5073

Local Adult and Juvenile
Detention Facility Standards

California Building Standards Commission

www.dgs.ca.gov/bsc (916) 263-0916

State Buildings including UC and
CSU Buildings, Parking Lot and Walkway Lighting,
Green Building Standards for Non-residential Buildings

California Energy Commission

www.energy.ca.gov **Energy Hotline** (800) 772-3300

Building Efficiency Standards
Appliance Efficiency Standards
Compliance Manual/Forms

California State Lands Commission

www.slc.ca.gov (562) 499-6312

Marine Oil Terminal Standards

California State Library

www.library.ca.gov (916) 323-9843

Department of Consumer Affairs:

Acupuncture Board

www.acupuncture.ca.gov (916) 515-5200

Office Standards

Board of Pharmacy

www.pharmacy.ca.gov (916) 518-3100

Pharmacy Standards

Bureau of Barbering and Cosmetology

www.barbercosmo.ca.gov (800) 952-5210

Barber and Beauty Shop,
and College Standards

Bureau of Household Goods and Services

www.bhgs.dca.ca.gov (916) 999-2041

Insulation Testing Standards

Structural Pest Control Board

www.pestboard.ca.gov (800) 737-8188

Structural Standards

Veterinary Medical Board

www.vmb.ca.gov (916) 515-5220

Veterinary Hospital Standards

Department of Food and Agriculture

www.cdffa.ca.gov

Meat & Poultry Packing Plant Standards

Rendering & Collection Center Standards (916) 900-5004

Dairy Standards (916) 900-5008

Department of Housing and Community Development

www.hcd.ca.gov (800) 952-8356

Residential—Hotels, Motels, Apartments,
Single-Family Dwellings; and
Permanent Structures in Mobilehome &
Special Occupancy Parks

(916) 445-3338

Factory-Built Housing, Manufactured Housing &
Commercial Modular

Mobilehome—Permits & Inspections

Northern Region—(916) 255-2501

Southern Region—(951) 782-4431

(800) 952-8356

Employee Housing Standards

Department of Public Health

www.dph.ca.gov (916) 449-5661

Organized Camps Standards

Public Swimming Pools Standards

Division of the State Architect

www.dgs.ca.gov/dsa (916) 445-8100

Access Compliance

Fire and Life Safety

Structural Safety

Public Schools Standards

Essential Services Building Standards

Community College Standards

State Historical Building Safety Board

Historical Rehabilitation, Preservation,
Restoration or Relocation Standards

Office of Statewide Health Planning and Development AKA: California Department of Health Care Access and Information (HCAI)

www.hcai.ca.gov (916) 440-8300

Hospital Standards

Skilled Nursing Facility Standards &

Clinic Standards

Office of the State Fire Marshal

osfm.fire.ca.gov (916) 568-3800

Code Development and Analysis

Fire Safety Standards

HOW TO DETERMINE WHERE CHANGES HAVE BEEN MADE

Symbols in the margins indicate where changes have been made or language has been deleted.

|| This symbol indicates that a change has been made.

> This symbol indicates deletion of language.

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CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

CHAPTER 1 – ADMINISTRATION

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter																					
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below		X		X				X	X		X		X								
Chapter/Section																					
101		X		X				X	X		X		X								
102		X		X				X	X		X		X								
103		X																			
104				X																	
105								X													
106									X		X		X								

CHAPTER 1

ADMINISTRATION

SECTION 101 GENERAL

101.1 Title. These regulations shall be known as the *California Green Building Standards Code*, may be cited as such, and will be referred to herein as “this code.” It is intended that it shall also be known as the *CALGreen Code*. The *California Green Building Standards Code* is Part 11 of thirteen parts of the official compilation and publication of the adoption, amendment and repeal of building regulations to the *California Code of Regulations*, Title 24, also referred to as the *California Building Standards Code*.

101.2 Purpose. The purpose of this code is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a reduced negative impact or positive environmental impact and encouraging sustainable construction practices in the following categories:

1. Planning and design.
2. Energy efficiency.
3. Water efficiency and conservation.
4. Material conservation and resource efficiency.
5. Environmental quality.

101.3 Scope. The provisions of this code shall apply to the planning, design, operation, construction, use and occupancy of every newly constructed building or structure, unless otherwise indicated in this code, throughout the State of California.

It is not the intent that this code substitute or be identified as meeting the certification requirements of any green building program.

101.3.1 State-regulated buildings, structures and applications. Provisions of this code shall apply to the following buildings, structures and applications regulated by state agencies as specified in Sections 103 through 106, except where modified by local ordinance pursuant to Section 101.7. When adopted by a state agency, the provisions of this code shall be enforced by the appropriate enforcing agency, but only to the extent of authority granted to such agency by statute.

1. State-owned buildings, including buildings constructed by the Trustees of the California State University, and to the extent permitted by California law, buildings designed and constructed by the Regents of the University of California and regulated by the Building Standards Commission. See Section 103 for additional scoping provisions.
2. Energy efficiency standards regulated by the California Energy Commission.
3. All residential buildings constructed throughout the State of California, including but not limited to, hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilets or cooking facilities reg-

ulated by the Department of Housing and Community Development. See Section 104 for additional scoping provisions.

4. Public elementary and secondary schools, and community college buildings regulated by the Division of the State Architect. See Section 105 for additional scoping provisions.
5. Qualified historical buildings and structures and their associated sites regulated by the State Historical Building Safety Board within the Division of the State Architect.
6. General acute care hospitals, acute psychiatric hospitals, skilled nursing and/or intermediate care facilities, clinics licensed by the Department of Public Health and correctional treatment centers regulated by the Office of Statewide Health Planning and Development. See Section 106 for additional scoping provisions.
7. Graywater systems regulated by the Department of Water Resources and the Department of Housing and Community Development.
8. Green building standards for occupancies where no state agency has authority or expertise, adopted by the California Building Standards Commission. See Section 103 for additional scoping provisions.

101.4 Appendices. Provisions contained in the appendices of this code are not mandatory unless specifically adopted by a city, county, or city and county in compliance with *Health and Safety Code* Sections 18930 and 18941.5, respectively, for Building Standards Law; *Health and Safety Code* Section 17950 for State Housing Law; and *Health and Safety Code* Section 13869.7 for Fire Protection Districts. See Section 101.7 of this code.

101.5 Referenced codes and standards. The codes and standards referenced elsewhere in this code shall be considered part of the requirements of this code to the prescribed extent of each such reference.

101.5.1 Building. The provisions of the *California Building Code*, *California Residential Code* and *California Existing Building Code*, as applicable, shall apply to the construction, alteration, movement, enlargement, replacement, repair, use and occupancy, location, maintenance, removal and demolition of every structure or any appurtenances connected or attached to such buildings or structures.

101.5.2 Electrical. The provisions of the *California Electrical Code* shall apply to the installation of electrical systems, including but not limited to, alterations, repair, replacement, equipment, appliances, fixtures, fittings and appurtenances thereto.

101.5.3 Mechanical. The provisions of the *California Mechanical Code* shall apply to the installation, alterations, repair and replacement of mechanical systems, including equipment, appliances, fixtures, fittings and/or appurtenances, including ventilating, heating, cooling, air-conditioning and refrigeration systems, incinerators and other energy-related systems.

101.5.4 Plumbing. The provisions of the *California Plumbing Code* shall apply to the installation, alteration, repair and replacement of plumbing systems, including equipment, appliances, fixtures, fittings and appurtenances where connected to a water or sewage system.

101.5.5 Fire prevention. The provisions of CCR, Title 19, Division 1 and CCR, Title 24, Part 2 and Part 9 relating to fire and panic safety as adopted by the Office of the State Fire Marshal shall apply to all structures, processes and premises for protection from the hazard of fire, panic and explosion.

101.5.6 Energy. The provisions of the *California Energy Code* shall apply to the minimum design and construction of buildings for energy efficiency.

101.6 Order of precedence and use.

101.6.1 Differences. In the event of any differences between these building standards and the standard reference documents, the text of these building standards shall govern. In the event a local amendment to this code results in differences between these building standards and the amendment, the text of the amendment shall govern.

101.6.2 Specific provision. Where a specific provision varies from a general provision, the specific provision shall apply.

101.6.3 Conflicts. When the requirements of this code conflict with the requirements of any other part of the *California Building Standards Code*, Title 24, the most restrictive requirement shall prevail.

101.6.4 Explanatory notes. Explanatory material, such as references to websites or other sources where additional information may be found, is included in this code in the form of notes. Notes are informational only and are not enforceable requirements of this code.

101.7 City, county, or city and county amendments, additions or deletions. This code is intended to set mandatory minimum Green Building Standards and includes optional tiers that may, at the discretion of any city, county, or city and county, be applied.

This code does not limit the authority of city, county, or city and county governments to make necessary changes to the provisions contained in this code pursuant to Section 101.7.1. The effective date of amendments, additions or deletions to this code for cities, counties, or cities and counties filed pursuant to Section 101.7.1 shall be the date on which it is filed. However, in no case shall the amendments, additions or deletions to this code be effective any sooner than the effective date of this code.

Local modifications shall comply with *Health and Safety Code* Section 18941.5(b) for Building Standards Law, *Health and Safety Code* Section 17958.5 for State Housing Law or *Health and Safety Code* Section 13869.7 for Fire Protection Districts.

101.7.1 Findings and filings.

1. The city, county, or city and county shall make express findings for each amendment, addition or deletion based upon climatic, topographical or geo-

logical conditions. For the purpose of this section, climatic, topographical or geological conditions include local environmental conditions as established by the city, county, or city and county.

2. The city, county, or city and county shall file the amendments, additions or deletions expressly marked and identified as to the applicable findings. Cities, counties, cities and counties, and fire departments shall file the amendments, additions or deletions and the findings with the California Building Standards Commission at 2525 Natomas Park Drive, Suite 130, Sacramento, CA 95833.
3. Findings prepared by fire protection districts shall be ratified by the local city, county, or city and county and filed with the California Department of Housing and Community Development at 9342 Tech Center Drive, Suite 500, Sacramento, CA 95826.
4. The city, county, or city and county shall obtain California Energy Commission approval for any energy-related ordinances consistent with *Public Resources Code* Section 25402.1(h)(2) and Title 24, Part 1, Section 10-106. Local governmental agencies may adopt and enforce energy standards for newly constructed buildings, additions, alterations and repairs, provided the California Energy Commission finds that the standards will require buildings to be designed to consume no more energy than permitted by Part 6. Such local standards include, but are not limited to, adopting the requirements of Part 6 before their effective date, requiring additional energy conservation measures, or setting more stringent energy budgets.

101.8 Alternate materials, designs and methods of construction. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design or method of construction not specifically prescribed by this code, provided that any such alternative has been approved. An alternate shall be approved on a case-by-case basis where the enforcing agency finds that the proposed alternate is satisfactory and complies with the intent of the provisions of this code and is at least the equivalent of that prescribed in this code in planning and design, energy, water, material conservation and resource efficiency, environmental air quality, performance, safety and the protection of life and health. Consideration and compliance provisions for occupancies regulated by adopting state agencies are found in the sections listed below.

1. Section 1.2.3 in the *California Building Code* (CBC) for the California Building Standards Commission.
2. Section 104.11 of Chapter 1, Division II for the Division of the State Architect.
3. Section 1.8.7, Chapter 1, Division I, of the 2022 *California Building Code*; and Section 1.8.7, Chapter 1, Division I, of the 2022 *California Residential Code* for the Department of Housing and Community Development.
4. Section 7-104, 2022 *California Administrative Code* for the Office of the Statewide Health Planning and Development.

101.9 Effective date of this code. Only those standards approved by the California Building Standards Commission that are effective at the time an application for a building permit is submitted shall apply to the plans and specifications for, and to the construction performed under, that permit. For the effective dates of the provisions contained in this code, see the appropriate application checklist and the History Note page of this code.

101.10 Mandatory requirements. This code contains both mandatory and voluntary green building measures. Mandatory and voluntary measures are identified in the appropriate application checklist contained in this code.

101.11 Effective use of this code. The following steps shall be used to establish which provisions of this code are applicable to a specific occupancy:

1. Establish the type of occupancy.
2. Verify which state agency has authority for the established occupancy by reviewing the authorities list in Sections 103 through 106.
3. Once the appropriate agency has been identified, find the chapter which covers the established occupancy.
4. The Matrix Adoption Tables at the beginning of Chapters 4 and 5 identify the mandatory green building measures necessary to meet the minimum requirements of this code for the established occupancy.
5. Voluntary tier measures are contained in Appendix Chapters A4 and A5. A checklist containing each green building measure, both required and voluntary, is provided at the end of each appendix chapter. Each measure listed in the application checklist has a section number which correlates to a section where more information about the specific measure is available.
6. The application checklist identifies which measures are required by this code and allows users to check off which voluntary items have been selected to meet voluntary tier levels if desired or mandated by a city, county, or city and county.

SECTION 102 CONSTRUCTION DOCUMENTS AND INSTALLATION VERIFICATION

102.1 Submittal documents. Construction documents and other data shall be submitted in one or more sets with each application for a permit. Where special conditions exist, the enforcing agency is authorized to require additional construction documents to be prepared by a licensed design professional and may be submitted separately.

Exception: The enforcing agency is authorized to waive the submission of construction documents and other data not required to be prepared by a licensed design professional.

102.2 Information on construction documents. Construction documents shall be of sufficient clarity to indicate the location, nature and scope of the proposed green building feature and show that it will conform to the provisions of this code, the *California Building Standards Code* and other relevant laws, ordinances, rules and regulations as determined by the enforcing agency.

102.3 Verification. Documentation of conformance for applicable green building measures shall be provided to the enforcing agency. Alternate methods of documentation shall be acceptable when the enforcing agency finds that the proposed alternate documentation is satisfactory to demonstrate substantial conformance with the intent of the proposed green building measure.

(HCD) Documentation of conformance for applicable green building measures shall be provided to the enforcing agency. All projects shall submit a completed Residential Occupancies Application Checklist that includes Chapter 4 residential mandatory measures and Tier 1 or Tier 2, as applicable. References to the measure-specific documentation used to show compliance shall be included. Alternate methods of documentation shall be acceptable when the enforcing agency finds that the proposed alternate documentation is satisfactory to demonstrate substantial conformance with the intent of the proposed green building measure.

Note: HCD’s Residential Occupancies Application Checklist that includes the minimum criteria for documentation is available at: <http://www.hcd.ca.gov/building-standards/cal-green/cal-green-forms.shtml>.

**SECTION 103
BUILDING STANDARDS COMMISSION**

103.1 BSC-CG. Specific scope of application of the agency responsible for enforcement, the enforcement agency, and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

1. **Application**—All occupancies where no state agency has the authority to adopt green building standards applicable to those occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—*Health and Safety Code* Sections 18930.5(a), 18938 and 18940.5.

Reference—*Health and Safety Code*, Division 13, Part 2.5, commencing with Section 18901.

2. **Graywater systems.** The construction, installation and alteration of graywater systems for indoor and outdoor uses in nonresidential occupancies.

Application—All occupancies where no state agency has the authority to adopt green building standards applicable to those occupancies.

Enforcing agency—State or local agency specified by the applicable provisions of law.

Authority cited—*Health and Safety Code* Section 18941.8.

Reference—*Health and Safety Code* Section 18941.8.

103.1.1 Adopting agency identification. The provisions of this code applicable to buildings identified in this section will be identified in the Matrix Adoption Tables under the acronym **BSC-CG**.

**SECTION 104
DEPARTMENT OF HOUSING
AND COMMUNITY DEVELOPMENT**

104.1 Scope. Specific scope of application of the agency responsible for enforcement, the enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

1. **Housing construction.**

Application—Hotels, motels, lodging houses, apartments, dwellings, dormitories, condominiums, shelters for homeless persons, congregate residences, employee housing, factory-built housing and other types of dwellings containing sleeping accommodations with or without common toilet or cooking facilities including accessory buildings, facilities and uses thereto.

Enforcing agency—Local building department or the Department of Housing and Community Development.

Authority cited—*Health and Safety Code* Sections 17040, 17920.9, 17921, 17921.5, 17921.6, 17921.10, 17922, 17922.6, 17922.12, 17922.14, 17922.15, 17926, 17927, 17928, 17958.12, 18938.3, 18944.11 and 19990; and *Government Code* Section 12955.1.

Reference—*Business and Professions Code* Division 5; *Health and Safety Code* Sections 17000 through 17062.5, 17910 through 17995.5, 18200 through 18700, 18860 through 18874, 18938.6, 18941, 19890, 19891, 19892 and 19960 through 19997; *Civil Code* Sections 832, 1101.4, 1101.5, 1954.201, 1954.202 and 5551; *Government Code* Sections 8698.4, 12955.1 and 12955.1.1; and *California Code of Regulations*, Title 20, Sections 1605.1, 1605.3 and 1607.

**SECTION 105
DIVISION OF THE STATE ARCHITECT**

105.1 Specific scope of application of the agency responsible for enforcement, the enforcement agency, and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

105.1.1 Application—Public elementary and secondary schools and community colleges. New building construction and site work on a new or existing site.

Note: The Application of Standards outlined in Title 24, Part 6 supersedes the above application as it applies to the California Energy Code.

Enforcing agency—The Division of the State Architect-Structural Safety (DSA-SS) has been delegated the responsibility and authority by the Department of General Services to review and approve the design and observe the construction of public elementary and secondary schools, and community colleges.

Authority cited—*Education Code* Sections 17310 and 81142.

Reference—*Education Code* Sections 17280 through 17317, and 81130 through 81147.

105.1.2 Applicable administrative standards.**1. Title 24, Part 1, *California Code of Regulations*:**

Sections 4-301 through 4-355, Group 1, Chapter 4, for public elementary and secondary schools, and community colleges.

2. Title 24, Part 2, *California Code of Regulations*:

- 2.1. Sections 1.1 and 1.9.2 of Chapter 1, Division I.
- 2.2. Sections 102.1, 102.2, 102.3, 102.4, 102.5, 104.9, 104.10 and 104.11 of Chapter 1, Division II.

105.1.3 Applicable building standards. *California Building Standards Code*, Title 24, Parts 2, 3, 4, 5, 6, 9, 11 and 12, *California Code of Regulations*, for school buildings and community colleges.

**SECTION 106
OFFICE OF STATEWIDE HEALTH
PLANNING AND DEVELOPMENT**

106.1 OSHPD 1. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—General acute care hospitals and acute psychiatric hospitals, excluding distinct part units or distinct part freestanding buildings providing skilled nursing or intermediate care services. For structural regulations: Skilled nursing facilities and/or intermediate care facilities except those skilled nursing facilities and intermediate care facilities of single-story, Type V, wood or light steel-frame construction.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

106.1.1 Applicable administrative standards.

1. Title 24, Part 1, *California Code of Regulations*: Chapters 6 and 7.
2. Title 24, Part 2, *California Code of Regulations*: Sections 1.1 and 1.10 of Chapter 1, Division I and Chapter 1, Division II.

106.1.2 Applicable building standards. *California Building Standards Code*, Title 24, Parts 2, 3, 4, 5, 9, 11 and 12.

106.1.3 Identification of amendments. For applications listed in Section 106.1, amendments appear in this code preceded with the acronym [OSHPD 1].

Authority—*Health and Safety Code* Sections 127010, 127015, 1275 and 129850.

Reference—*Health and Safety Code* Sections 19958, 127010, 127015, 129680, 1275 and 129675 through 130070.

106.2 OSHPD 2. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Skilled nursing facilities and intermediate care facilities, including distinct part skilled nursing and intermediate care services on a general acute care or acute psychiatric hospital license, provided either are in a separate unit or a freestanding building. For structural regulations: Single-story, Type V skilled nursing facility and/or intermediate care facilities utilizing wood or light steel-frame construction.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility type.

106.2.1 Applicable administrative standards.

1. Title 24, Part 1, *California Code of Regulations*: Chapter 7.
2. Title 24, Part 2, *California Code of Regulations*: Sections 1.1 and 1.10 of Chapter 1, Division I and Chapter 1, Division II.

106.2.2 Applicable building standards. *California Building Standards Code*, Title 24, Parts 2, 3, 4, 5, 9, 11 and 12.

106.2.3 Identification of amendments. For applications listed in Section 106.2, amendments appear in this code preceded with the acronym [OSHPD 2].

Authority—*Health and Safety Code* Sections 127010, 127015, 1275 and 129850.

Reference—*Health and Safety Code* Sections 127010, 127015, 1275 and 129680.

106.3 OSHPD 4. Specific scope of application of the agency responsible for enforcement, enforcement agency and the specific authority to adopt and enforce such provisions of this code, unless otherwise stated.

Application—Correctional treatment centers.

Enforcing agency—Office of Statewide Health Planning and Development (OSHPD). The office shall also enforce the Division of the State Architect—Access Compliance regulations and the regulations of the Office of the State Fire Marshal for the above-stated facility types.

106.3.1 Applicable administrative standards.

1. Title 24, Part 1, *California Code of Regulations*: Chapter 7.
2. Title 24, Part 2, *California Code of Regulations*: Sections 1.1 and 1.10 of Chapter 1, Division I and Chapter 1, Division II.

106.3.2 Applicable building standards. *California Building Standards Code*, Title 24, Parts 2, 3, 4, 5, 9, 11 and 12.

ADMINISTRATION

106.3.3 Identification of amendments. For applications listed in Section 106.3, amendments appear in this code preceded with the acronym [OSHPD 4], unless the entire chapter is applicable.

Authority—*Health and Safety Code* Sections 127010, 127010, 127015 and 129790.

References—*Health and Safety Code* Sections 127010, 127015, 1275, and 129675 through 130070.

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

CHAPTER 2 – DEFINITIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X		X				X													
Adopt entire chapter as amendeded (amended sections listed below)									X		X		X								
Adopt only those sections that are listed below																					
Chapter/Section																					
201																					
CALIFORNIA RESIDENTIAL CODE									†		†		†								
LOW-RISE RESIDENTIAL BUILDING									†		†		†								
PLANTS									†		†		†								
RESIDENTIAL BUILDING									†		†		†								
RESILIENT FLOORING									†		†		†								

The state agency does not adopt sections identified by the following symbol: †.

CHAPTER 2

DEFINITIONS

SECTION 201 GENERAL

201.1 Scope. Unless otherwise stated, the following words and terms shall, for the purposes of this code, have the meanings shown in this chapter.

201.2 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

201.3 Terms defined in other documents. Where terms are not defined in this code and are defined in the *California Building Standards Code* or other referenced documents, such terms shall have the meanings ascribed to them as in those publications.

201.4 Terms not defined. Where terms are not defined as specified in this section, such terms shall have ordinarily accepted meanings such as the context implies.

SECTION 202 DEFINITIONS

ACCESSORY DWELLING UNIT. [HCD] An attached or detached residential dwelling unit that provides complete independent living facilities for one or more persons and is located on a lot with a proposed or existing primary residence. Accessory dwelling units shall include permanent pro-

visions for living, sleeping, eating, cooking and sanitation on the same parcel as the single-family or multifamily dwelling is or will be situated. (See Government Code Section 65852.2.)

ACCESSORY OCCUPANCIES. [HCD] Occupancies that are ancillary to the main occupancy of residential building(s) or portions thereof. Accessory occupancies shall include, but are not limited to, Group U occupancies. (See Section 312 of the *California Building Code*.)

ACCESSORY STRUCTURE. [HCD] A structure that is accessory to and incidental to that of the dwelling(s) and that is located on the same lot.

ADDITION. An extension or increase in floor area of an existing building or structure.

ADJUST. To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

AGRIFIBER PRODUCTS. Agrifiber products include wheatboard, strawboard, panel substrates and door cores, not including furniture, fixtures and equipment (FF&E) not considered base building elements.

ALBEDO. Synonymous with solar reflectance, which is a ratio of the energy reflected back into the atmosphere to the energy absorbed by the surface, with 100 percent being total reflectance.

DEFINITIONS

ALTERATION OR ALTER. Any construction or renovation to an existing structure other than repair for the purpose of maintenance or addition.

ARB (CARB). The California Air Resources Board.

ARTERIAL HIGHWAY. A general term denoting a highway primarily for through traffic usually on a continuous route.

ASSEMBLY (ASSEMBLY PRODUCT). An assembly (assembly product) includes or has been formulated using multiple materials.

AUTOMATIC. Automatic means capable of operating without human intervention.

AUTOMATIC LOAD MANAGEMENT SYSTEM (ALMS). A system designed to manage load across one or more electric vehicle supply equipment (EVSE) to share electrical capacity and/or automatically manage power at each connection point.

A-WEIGHTED SOUND LEVEL (dba). The sound pressure level in decibels as measured on a sound level meter using the internationally standardized A-weighting filter or as computed from sound spectral data to which A-weighting adjustments have been made.

BALANCE. To proportion flows within the distribution system, including submains, branches and terminals, according to design quantities.

BIORETENTION. A shallow depression that utilizes conditioned soil and vegetation for the storage, treatment or infiltration of storm water runoff.

BROWNFIELD SITE. Real property, the expansion, redevelopment or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant, with certain legal exclusions and additions.

Note: See the full text at the EPA's website.

1 BTU/HOUR. British thermal units per hour, also referred to as Btu. The amount of heat required to raise one pound of water one degree Fahrenheit per hour, a common measure of heat transfer rate. A ton of refrigeration is 12,000 Btu, the amount of heat required to melt a ton (2,000 pounds) of ice at 32° Fahrenheit.

BUILDING COMMISSIONING. A systematic quality assurance process that spans the entire design and construction process, including verifying and documenting that building systems and components are planned, designed, installed, tested, operated and maintained to meet the owner's project requirements.

BUILDING ENVELOPE. The ensemble of exterior and demising partitions of a building that enclose conditioned space.

CALIFORNIA BUILDING CODE. The current version of the *California Building Code*.

CALIFORNIA ELECTRICAL CODE. The current version of the *California Electrical Code*.

CALIFORNIA ENERGY CODE. The current version of the *California Energy Code*, unless otherwise specified.

CALIFORNIA MECHANICAL CODE. The current version of the *California Mechanical Code*.

CALIFORNIA PLUMBING CODE. The current version of the *California Plumbing Code*.

CALIFORNIA RESIDENTIAL CODE. The current version of the *California Residential Code*.

CHLOROFLUOROCARBON (CFC). A class of compounds primarily used as refrigerants, consisting of only chlorine, fluorine and carbon.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL) HIGHWAY. A metric similar to the day-night average sound level (Ldn), except that a 5 decibel (dB) adjustment is added to the equivalent continuous sound exposure level for evening hours (7 p.m. to 10 p.m.) in addition to the 10 dB nighttime adjustment used in the Ldn.

COMPACT DISHWASHER. A dishwasher that has a capacity of less than eight place settings plus six serving pieces as specified in ANSI/AHAM DW-1.

COMPOSITE WOOD PRODUCTS. Composite wood products include hardwood plywood, particleboard and medium density fiberboard. "Composite wood products" does not include hardboard, structural plywood, structural panels, structural composite lumber, oriented strand board, glued laminated timber, prefabricated wood I-joists or finger-jointed lumber, all as specified in California Code of Regulations (CCR), Title 17, Section 93120.1(a).

Note: See CCR, Title 17, Section 93120.1.

CONDITIONED FLOOR AREA. The floor area (in square feet) of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

CONDITIONED SPACE. A space in a building that is either directly conditioned or indirectly conditioned.

CONDITIONED SPACE, DIRECTLY. An enclosed space that is provided with wood heating, is provided with mechanical heating that has a capacity exceeding 10 Btu/hr-ft², or is provided with mechanical cooling that has a capacity exceeding 5 Btu/hr-ft², unless the space-conditioning system is designed for a process space. (See Process Space.)

CONDITIONED SPACE, INDIRECTLY. Enclosed space, including but not limited to, unconditioned volume in atria, that (1) is not directly conditioned space; and (2) either (a) has a thermal transmittance area product (UA) to directly conditioned space exceeding that to the outdoors or to unconditioned space and does not have fixed vents or openings to the outdoors or to unconditioned space, or (b) is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.

COOL PAVEMENT(S). Includes, but is not limited to, high albedo pavements and coatings, vegetative surfaces, porous or pervious pavements that allow water infiltration, and pavements shaded by trees and other sources of shade.

COOLING EQUIPMENT. Equipment used to provide mechanical cooling for a room or rooms in a building.

CUTOFF LUMINAIRES. Luminaires whose light distribution is such that the candela per 1000 lamp lumens does not numerically exceed 25 (2.5 percent) at an angle of 90 degrees above nadir, and 100 (10 percent) at a vertical angle of 80 degrees above nadir. This applies to all lateral angles around the luminaire.

DAY-NIGHT AVERAGE SOUND LEVEL (L_{dn}). The A-weighted equivalent continuous sound exposure level for a 24-hour period with a 10 dB adjustment added to sound levels occurring during nighttime hours (10 p.m. to 7 a.m.).

DECIBEL (dB). A measure on a logarithmic scale of the magnitude of a particular quantity (such as sound pressure, sound power, sound intensity) with respect to a reference quantity.

DEMAND HOT WATER RECIRCULATION SYSTEM. A hot water recirculation system requiring manual activation and equipped with a thermostat that will automatically shut off the recirculation pump when the water temperature reaches a preset level at the point of use.

DEVELOPMENT FOOTPRINT. The total area of the building footprint, hardscape, access roads and parking.

DEWATERING. Pumping of uncontaminated or treated groundwater for construction activities.

DIRECT-VENT APPLIANCE. A fuel-burning appliance with a sealed combustion system that draws all air for combustion from the outside atmosphere and discharges all flue gases to the outside atmosphere.

DISPOSAL. The management of solid waste through land-filling or transformation at permitted solid waste facilities.

DIVERSION. Activities which reduce or eliminate the amount of solid waste from solid waste disposal for purposes of this code.

ELECTRIC VEHICLE (EV). An automotive-type vehicle for on-road use, such as passenger automobiles, buses, trucks, vans, neighborhood electric vehicles, electric motorcycles and the like, primarily powered by an electric motor that draws current from a rechargeable storage battery, fuel cell, photovoltaic array or other source of electric current. Plug-in hybrid electric vehicles (PHEV) are considered electric vehicles. For purposes of the *California Electrical Code*, off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats and the like, are not included.

ELECTRIC VEHICLE (EV) CAPABLE SPACE. A vehicle space with electrical panel space and load capacity to support a branch circuit and necessary raceways, both underground and/or surface mounted, to support EV charging.

ELECTRIC VEHICLE (EV) CHARGER. Off-board charging equipment used to charge an electric vehicle.

ELECTRIC VEHICLE (EV) READY SPACE. [HCD] A vehicle space which is provided with a branch circuit; any necessary raceways, both underground and/or surface mounted; to accommodate EV charging, terminating in a receptacle or a charger.

ELECTRIC VEHICLE CHARGING SPACE (EV SPACE). A space intended for future installation of EV charging equipment and charging of electric vehicles.

ELECTRIC VEHICLE CHARGING STATION (EVCS). One or more electric vehicle charging spaces served by electric vehicle charger(s) or other charging equipment allowing charging of electric vehicles. Electric vehicle charging stations are not considered parking spaces.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). The conductors, including the ungrounded, grounded and equipment grounding conductors and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

EMBODIED ENERGY. The energy used for raw material extraction, transportation, manufacturing, assembly, installation and disposal during the life of a product, including the potential energy stored within the product.

ENERGY BUDGET. The sum of the annual TDV energy consumption for energy use components included in the performance compliance approach for the Standard Design Building, as established in the Alternative Calculation Method Reference Manual approved by the Energy Commission and calculated by Compliance Software certified by the Energy Commission.

ENERGY COMMISSION. The California State Energy Resources Conservation and Development Commission.

ENERGY DESIGN RATING. The sum of the annual TDV energy consumption for energy use components included in the performance compliance approach for the Standard Design Building (Energy Budget) and the annual time dependent valuation (TDV) energy consumption for lighting and components not regulated by Title 24, Part 6 (such as domestic appliances and consumer electronics) and accounting for the annual TDV energy offset by an on-site renewable energy system. The Design Rating is calculated by Compliance Software certified by the Energy Commission.

ENERGY EQUIVALENT (NOISE) LEVEL (L_{eq}). The level of a steady noise which would have the same energy as the fluctuating noise level integrated over the time period of interest.

ENFORCING AGENCY. The designated department or agency as specified by statute or regulation.

EUTROPHICATION. The excessive growth of aquatic plants, especially algae, producing bacteria which consume nearly all of the oxygen required to sustain fauna and other flora.

EVAPOTRANSPIRATION ADJUSTMENT FACTOR (ETAF). [DSA-SS] An adjustment factor when applied to reference evapotranspiration that adjusts for plant factors and irrigation efficiency, which are two major influences on the amount of water that needs to be applied to the landscape.

EXFILTRATION. The uncontrolled outward air leakage from inside a building, including leakage through cracks and interstices, around windows and doors, and through any other exterior partition or duct penetration.

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EXPRESSWAY. An arterial highway for through traffic which may have partial control of access, but which may or may not be divided or have grade separations at intersections.

FLOOR AREA RATIO. Gross square footage of all structures on a site divided by gross square footage of the site.

FOOTPRINT AREA. [DSA-SS] The total area of the furthest exterior wall of the structure projected to natural grade, not including exterior areas such as stairs, covered walkways, patios and decks.

FREEWAY. A divided arterial highway with full control of access and with grade separations at intersections.

FRENCH DRAIN. A trench, hole or other depressed area loosely filled with rock, gravel, fragments of brick or similar pervious material used to collect or channel drainage or runoff water.

GEOHERMAL. Renewable energy generated by deep-earth water or steam.

GLOBAL WARMING POTENTIAL (GWP). The radiative forcing impact of one mass-based unit of a given greenhouse gas relative to an equivalent unit of carbon dioxide over a given period of time. Carbon dioxide is the reference compound with a GWP of one.

GLOBAL WARMING POTENTIAL VALUE (GWP VALUE). The 100-year GWP value published by the Intergovernmental Panel on Climate Change (IPCC) in either its Second Assessment Report (SAR) (IPCC, 1995); or its Fourth Assessment A-3 Report (AR4) (IPCC, 2007). The SAR GWP values are found in column “SAR (100-yr)” of Table 2.14.; the AR4 GWP values are found in column “100 yr” of Table 2.14.

GRAYWATER. Pursuant to *Health and Safety Code* Section 17922.12, “graywater” means untreated wastewater that has not been contaminated by any toilet discharge, has not been affected by infectious, contaminated or unhealthy bodily wastes, and does not present a threat from contamination by unhealthful processing, manufacturing or operating wastes. “Graywater” includes, but is not limited to, wastewater from bathtubs, showers, bathroom washbasins, clothes washing machines and laundry tubs, but does not include wastewater from kitchen sinks or dishwashers.

Note: For the purpose of applying the standards contained in this code, “Graywater,” as defined above, has the same meaning as “gray water,” “grey water,” and “greywater.”

GREEN BUILDING. A holistic approach to design, construction and demolition that minimizes the building’s impact on the environment, the occupants and the community.

GREENFIELDS. Sites that are not previously developed or graded and remain in a natural state, able to support agriculture, open space or habitat.

Note: Previously developed sites are those that previously contained buildings, roadways or parking lots or were graded or altered by direct human activities.

GREYFIELD SITE. Any site previously developed with at least 50 percent of the surface area covered with impervious material.

HALON. Any of a class of chemical compounds derived from hydrocarbons by replacing one or more hydrogen atoms with bromine atoms, and other hydrogen atoms with other halogen atoms (chlorine, fluorine, iodine).

HAZARDOUS WASTE.

(a) A waste, defined as a “hazardous waste” in accordance with Section 25117 of the *Health and Safety Code*, or a combination of wastes, which because of its quantity, concentration or physical, chemical or infectious characteristics may do either of the following:

- (1) Cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness.
- (2) Pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of, or otherwise managed.

(b) Unless expressly provided otherwise, “hazardous waste” includes extremely hazardous waste and acutely hazardous waste.

HEAT ISLAND EFFECT. “Heat island effect” and “urban heat islands” refer to measurable elevated temperatures in developed areas as compared to more rural surroundings. Temperatures in developed areas are affected by absorption of heat by hardscapes and radiation of heat into surrounding areas resulting in local climate changes. Heat islands are influenced by geographic location and by local weather patterns, with effects changing on a daily or seasonal basis.

HIGH-GWP REFRIGERANT. A compound used as a heat transfer fluid or gas that is: (A) a chlorofluorocarbon, a hydrochlorofluorocarbon, a hydrofluorocarbon, a perfluorocarbon, or any compound or blend of compounds, with a GWP value equal to or greater than 150, or (B) any ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2009).

HIGH-RISE RESIDENTIAL BUILDING. For the purposes of *CALGreen*, any building that is of Occupancy Group R and is four stories or greater in height.

HOT WATER RECIRCULATION SYSTEM. A hot water distribution system that reduces the time needed to deliver hot water to fixtures that are distant from the water heater, boiler or other water heating equipment. The recirculation system is comprised of hot water supply and return piping with shutoff valves, balancing valves, circulating pumps and a method of controlling the circulating system.

HOTEL OR MOTEL. (HCD-1) Any building containing six or more guest rooms intended or designed to be used, or which are used, rented or hired out to be occupied or which are occupied for sleeping purposes by guests.

HYDROCHLOROFLUOROCARBON (HCFC). A class of compounds primarily used as refrigerants or foam expansion agents, consisting of only hydrogen, chlorine, fluorine and carbon.

HYDROFLUOROCARBON (HFC). A class of compounds primarily used as refrigerants or foam expansion agents, consisting of only hydrogen, fluorine and carbon.

IESNA. Illuminating Engineering Society of North America.

INERT SOLIDS OR INERT WASTE. A non-liquid solid waste including, but not limited to, soil and concrete, that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board pursuant to Division 7 (commencing with Section 13000) of the *California Water Code* and does not contain significant quantities of decomposable solid waste.

INFILL SITE. A site in an urbanized area that meets criteria defined in *Public Resources Code* Section 21061.3.

INFILTRATION. An uncontrolled inward air leakage from outside a building or unconditioned space, including leakage through cracks and interstices, around windows and doors and through any other exterior or demising partition or pipe or duct penetration.

INTERIOR BUILDING. The inside of the weatherproofing system.

JUNIOR ACCESSORY DWELLING UNIT. [HCD] A unit that is no more than 500 square feet in size and contained entirely within an existing single-family structure. A junior accessory dwelling unit may include separate sanitation facilities, or may share sanitation facilities with the existing structure. (See Government Code Section 65852.22.)

KITCHEN. That portion in a residential dwelling unit that is a room or area used for cooking, food storage and preparation and washing dishes, including associated counter tops and cabinets, refrigerator, stove, ovens and floor area.

LANDSCAPE WATER METER. [HCD] An inline device installed at the irrigation supply point that measures the flow of water into the irrigation system and is connected to a totalizer to record water use.

LEVEL 2 ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE). [HCD] The 208/240-volt 40-ampere branch circuit, and the electric vehicle charging connectors, attachment plugs and all other fittings, devices, power outlets or apparatus installed specifically for the purpose of transferring energy between the premises wiring and the electric vehicle.

LIFE CYCLE ASSESSMENT (LCA). A technique to evaluate the relevant energy and material consumed and environmental impacts associated with the entire life of a product, process, activity or service, including a whole building.

LIFE CYCLE INVENTORY (LCI). A process of quantifying energy and raw material requirements, atmospheric emissions, waterborne emissions, solid wastes and other releases for the entire life cycle of a product, process or activity, including a whole building.

LONG RADIUS ELBOW. Pipe fitting installed between two lengths of pipe or tubing to allow a change of direction, with a radius 1.5 times the pipe diameter.

LOW-GWP REFRIGERANT. A compound used as a heat transfer fluid or gas that: (A) has a GWP value less than 150, and (B) is not an ozone depleting substance as defined in Title 40 of the Code of Federal Regulations, Part 82, §82.3 (as amended March 10, 2009).

LOW IMPACT DEVELOPMENT (LID). Control of stormwater at its source to mimic drainage services provided by an undisturbed site.

LOW POWER LEVEL 2 ELECTRIC VEHICLE (EV) CHARGING RECEPTACLE. [HCD] A 208/240-volt 20-ampere minimum branch circuit and a receptacle for use by an EV driver to charge their electric vehicle or hybrid electric vehicle.

LOW-RISE RESIDENTIAL BUILDING. For the purpose of *CALGreen*, any building that is of Occupancy Group R and is three stories or less.

MAXIMUM INCREMENTAL REACTIVITY (MIR). The maximum change in weight of ozone formed by adding a compound to the “Base Reactive Organic Gas (ROG) Mixture” per weight of compound added, expressed to hundredths of a gram ($\text{g O}_3/\text{g ROG}$).

Note: MIR values for individual compounds and hydrocarbon solvents are specified in CCR, Title 17, Sections 94700 and 94701.

MERV Filter minimum efficiency reporting value.

METERING FAUCET. A self-closing faucet that dispenses a specific volume of water for each actuation cycle. The volume or cycle duration can be fixed or adjustable.

MODEL WATER EFFICIENT LANDSCAPE ORDINANCE (MWEL) [BSC-CG & DSA-SS] A California regulation commencing with Section 490 of Chapter 2.7, Division 2, Title 23, *California Code of Regulations*. The MWEL regulation establishes a structure for planning, designing, installing, maintaining and managing water efficient landscapes in new construction and rehabilitated projects.

MODEL WATER EFFICIENT LANDSCAPE ORDINANCE (MWEL). [HCD] The California model ordinance (California Code of Regulations, Title 23, Division 2, Chapter 2.7), regulating landscape design, installation and maintenance practices. Local agencies are required to adopt the updated MWEL, or adopt a local ordinance at least as effective as the MWEL.

MOISTURE CONTENT. The weight of the water in wood expressed in percentage of the weight of the oven-dry wood.

MOUNTING HEIGHT (MH). The height of the photometric center of a luminaire above grade level.

MULTI-OCCUPANT SPACES. Indoor spaces used for presentations and training, including classrooms and conference rooms.

NEIGHBORHOOD ELECTRIC VEHICLE (NEV). A motor vehicle that meets the definition of “low-speed vehicle” either in Section 385.5 of the Vehicle Code or in 49

DEFINITIONS

CFR571.500 (as it existed on July 1, 2000), and is certified to zero-emission vehicle standards.

NEWLY CONSTRUCTED (or NEW CONSTRUCTION). A newly constructed building (or new construction) does not include additions, alterations or repairs.

NO ADDED FORMALDEHYDE (NAF) BASED RESINS. Resin formulated with no added formaldehyde as part of the resin cross linking structure for making hardwood plywood, particle board or medium density fiberboard. “No added formaldehyde resins” include, but are not limited to, resins made from soy, polyvinyl acetate or methylene diisocyanate. [BSC] See CCR, Title 17, Section 93120.1(a).

NON-STORMWATER DISCHARGES. Discharges that do not originate from precipitation events. Including, but not limited to, dewatering activities, washout area discharge, vehicle and equipment cleaning, street cleaning and irrigation runoff.

NONWATER URINAL WITH DRAIN CLEANSING ACTION. A nonwater urinal that conveys waste into the drainage system without the use of water for flushing and automatically performs a drain-cleansing action after a predetermined amount of time.

OFF-STREET LOADING SPACES. [BSC-CG, DSA-SS] An area, other than a public street, public way or other property (and exclusive of off-street parking spaces), permanently reserved or set aside for the loading or unloading of motor vehicles, including ways of ingress and egress and maneuvering areas. Whenever the term “loading space” is used, it shall, unless the context clearly requires otherwise, be construed as meaning off-street loading space. This excludes designated passenger loading/unloading.

ORGANIC WASTE. Food waste, green waste, landscape and pruning waste, nonhazardous wood waste and food-soiled paper waste that is mixed in with food waste.

OUTDOOR AIR (Outside air). Air taken from outdoors and not previously circulated in the building.

OVE. [BSC-CG, DSA-SS] Optimal Value Engineering, another term for advanced wood framing techniques.

PERMEABLE PAVING. Permeable paving materials and techniques which allow the movement of water around the paving material and allow precipitation to percolate through the paving surface to the soil below.

PLANTS.

Adaptive plants. Adaptive plants are plants that grow well in a given habitat with minimal attention in the form of winter protection, pest protection, irrigation and fertilization once established.

Note: Adaptive plants are considered low in maintenance and are not invasive plants.

Invasive plants. Invasive plants are both indigenous and nonindigenous species with growth habits that are characteristically aggressive.

Note: Invasive plants typically have a high reproductive capacity and tendency to overrun the ecosystems they inhabit.

Native plants. Native plants are plants that have adapted to a given area and are not invasive.

POSTCONSUMER CONTENT. [BSC-CG, DSA-SS] Waste material generated by consumers after it is used and which would otherwise be discarded.

POSTCONSUMER CONTENT. [HCD] Any material which has been used by a consumer and then recycled for use in a new material or product.

POTABLE WATER. Water that is drinkable and meets the US Environmental Protection Agency (EPA) Drinking Water Standards. See definition in the *California Plumbing Code*, Part 5.

POTABLE WATER. [HCD] Water that is satisfactory for drinking, culinary and domestic purposes, and meets the US Environmental Protection Agency (EPA) Drinking Water Standards and the requirements of the Health Authority Having Jurisdiction.

PRECONSUMER (or POSTINDUSTRIAL) [BSC-CG, DSA-SS] Material diverted from the waste stream during one manufacturing process, including scraps, damaged goods and excess production, that is used in another manufacturing process.

PRECONSUMER (OR POSTINDUSTRIAL) CONTENT. [HCD] Material diverted from the waste stream during one manufacturing process, including scraps, damaged goods and excess production that is reclaimed and used in another manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated those wastes.

PROCESS. An activity or treatment that is not related to the space conditioning, lighting, service water heating or ventilating of a building as it relates to human occupancy.

PROCESS SPACE. A space that is thermostatically controlled to maintain a process environment temperature less than 55°F or to maintain a process environment temperature greater than 90°F for the whole space that the system serves, or that is a space with a space-conditioning system designed and controlled to be incapable of operating at temperatures above 55°F or incapable of operating at temperatures below 90°F at design conditions.

PRODUCT-WEIGHTED MIR (PWMIR). The sum of all weighted-MIR for all ingredients in a product subject to this article. The PWMIR is the total product reactivity expressed to hundredths of a gram of ozone formed per gram of product (excluding container and packaging).

Note: PWMIR is calculated according to equations found in CCR, Title 17, Section 94521(a).

PROPORTIONAL RECYCLED CONTENT (PRCM). The amount of recycled content of a material in an assembly as related to the percentage of the material in an assembly product. PRCM is derived by multiplying the percentage of each material in an assembly by the percentage of recycled content in the material.

PSIG. Pounds per square inch, gauge.

RAINWATER. Precipitation on any public or private parcel that has not entered an offsite storm drain system or channel, a flood control channel, or any other stream channel, and has not previously been put to beneficial use.

RAINWATER CATCHMENT SYSTEM. A facility designed to capture, retain and store rainwater flowing off a building, parking lot, or any other manmade impervious surface for subsequent onsite use. Rainwater catchment system is also known as “Rainwater Harvesting System” or “Rainwater Capture System.”

REACTIVE ORGANIC COMPOUND (ROC). Any compound that has the potential, once emitted, to contribute to ozone formation in the troposphere.

RECLAIMED (RECYCLED) WATER. Nonpotable water that meets California State Water Resources Control Board statewide uniform criteria for disinfected tertiary recycled water. Reclaimed (recycled) water is also known as “recycled water” or “reclaimed water.”

RECYCLE or RECYCLING. The process of collecting, sorting, cleansing, treating and reconstituting materials that would otherwise become solid waste, and returning them to the economic mainstream in the form of raw material for new, reused or reconstituted products which meet the quality standards necessary to be used in the marketplace. “Recycling” does not include transformation, as defined in *Public Resources Code* Section 40201.

RECYCLED CONTENT. [BSC-CG, DSA-SS] Refer to International Organization for Standardization ISO 14021—Environmental labels and declarations—Self-declared environmental claims (Type II environmental labeling).

RECYCLED CONTENT (RC). [HCD] The amount of recycled material in an assembly product or material. Refer to International Organization for Standardization ISO 14021—Environmental labels and declarations—Self-declared environmental claims (Type II environmental labeling).

RECYCLED CONTENT VALUE (RCV). [BSC-CG, DSA-SS] Material cost multiplied by postconsumer content plus $\frac{1}{2}$ the preconsumer content, or $RCV = \$ X (\text{postconsumer content} + \frac{1}{2} \text{preconsumer content})$.

RECYCLED CONTENT VALUE (RCV). [HCD]

Assembly products (RCVA). Assembly product cost multiplied by the recycled content of the assembly based on all of the postconsumer content and 50 percent of the preconsumer content.

Materials (RCVM). Material cost multiplied by recycled content of the material based on all of the postconsumer content and 50 percent of the preconsumer content.

RECYCLED WATER. Water which, as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur [Water Code Section 13050 (n)]. Simply put, recycled water is water treated to remove waste matter, attaining a quality that is suitable to use the water again.

RESIDENTIAL BUILDING. See “LOW-RISE RESIDENTIAL BUILDING” or “HIGH-RISE RESIDENTIAL BUILDING.”

RESILIENT FLOORING. Refers to nontextile flooring materials which have a relatively firm surface, yet characteristically have “give” and “bounce back” to their original surface profile from the weight of objects that compress its surface. Resilient flooring materials are made in various shapes and sizes including both tile and roll form. Common types of resilient flooring include but are not limited to:

1. Vinyl composition tile.
2. Vinyl tile and sheet flooring.
3. Linoleum tile and sheet.
4. Cork tile and sheet flooring.
5. Rubber tile and sheet flooring.
6. Polymeric poured seamless flooring.
7. Other types of non-textile synthetic flooring.

RE-USE. The use, in the same form as it was produced, of a material which might otherwise be discarded.

SCHRADER ACCESS VALVES. Access fittings with a valve core installed.

SHORT RADIUS ELBOW. Pipe fitting installed between two lengths of pipe or tubing to allow a change of direction, with a radius 1.0 times the pipe diameter.

SINGLE OCCUPANT SPACES. Private offices, workstations in open offices, reception workstations and ticket booths.

SOLAR ACCESS. The ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in determination of annual solar access.

SOLAR REFLECTANCE. A measure of the fraction of solar energy that is reflected by a surface (measured on a scale of zero to one).

SOLAR REFLECTANCE INDEX (SRI). A measure of a material surface’s ability to reflect solar heat, as shown by a small temperature rise. It includes both solar reflectance and thermal emittance and is quantified such that a standard black surface (solar reflectance 0.05, thermal emittance 0.90) is zero and a standard white surface (solar reflectance 0.80, thermal emittance 0.90) is 100.

SOLID WASTE.

- (a) All putrescible and nonputrescible solid, semisolid and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, dewatered, treated or chemically fixed sewage sludge which is not hazardous waste, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes.

DEFINITIONS

- (b) “Solid waste” does not include any of the following wastes:
- (1) Hazardous waste, as defined in *Public Resources Code* Section 40141.
 - (2) Radioactive waste regulated pursuant to the Radiation Control Law (Chapter 8, commencing with Section 114960, of Part 9 of Division 104 of the *Health and Safety Code*).
 - (3) Medical waste regulated pursuant to the Medical Waste Management Act (Part 14 commencing with Section 117600) of Division 104 of the *Health and Safety Code*. Untreated medical waste shall not be disposed of in a solid waste landfill, as defined in *Public Resources Code* Section 40195.1. Medical waste that has been treated and deemed to be solid waste shall be regulated pursuant to this division.

SPECIAL LANDSCAPE AREA (SLA). [DSA-SS] An area of the landscape dedicated solely to edible plants, planting areas used for educational purposes, recreational areas, areas irrigated with recycled water, water features using recycled water, and where turf provides a playing surface or gathering space.

STANDARD DISHWASHER. A dishwasher that has a capacity equal to or greater than eight place settings plus six serving pieces as specified in ANSI/AHAM DW-1.

SUBMETER. [HCD 1] A secondary device beyond a meter that measures water consumption of an individual rental unit within a multiunit residential structure or mixed-use residential and commercial structure. (See Civil Code Section 1954.202(g) and Water Code Section 517 for additional details.)

SUPERMARKET. For the purposes of Section 5.508.2, a supermarket is any retail food facility with 8,000 square feet or more conditioned area, and that utilizes either refrigerated display cases, or walk-in coolers or freezers connected to remote compressor units or condensing units.

TENANT-OCCUPANTS. Building occupants who inhabit a building during its normal hours of operation as permanent occupants, such as employees, as distinguished from customers and other transient visitors.

TEST. A procedure to determine quantitative performance of a system or equipment.

THERMAL EMITTANCE. The relative ability of a surface to radiate absorbed heat (measured on a scale of 0 to 1).

TIME DEPENDENT VALUATION (TDV) ENERGY. The time varying energy caused to be used by the building to provide space conditioning and water heating and for specified buildings lighting. TDV energy accounts for the energy used at the building site and consumed in producing and in delivering energy to a site, including, but not limited to, power generation, transmission and distribution losses.

ULTRA-LOW EMITTING FORMALDEHYDE (ULEF) RESINS. Resins formulated such that average formaldehyde emissions are consistently below the Phase 2 emission standards in Section 93120.2, as provided in Section 93120.3(d)

of Title 17, California Code of Regulations. [BSC] See CCR, Title 17, Section 93120.1(a).

UNIVERSAL WASTE. [BSC-CG, DSA-SS] The wastes listed below are subject to regulation pursuant to Chapter 23 of Title 22, *California Code of Regulations*, and shall be known as “universal wastes.”

- (1) Batteries, as described in Title 22 CCR, Section 66273.2, Subsection (a);
- (2) Electronic devices, as described in Title 22 CCR, Section 66273.3, Subsection (a);
- (3) Mercury-containing equipment, as described in Title 22 CCR, Section 66273.4, Subsection (a);
- (4) Lamps, as described in Title 22 CCR, Section 66273.5, Subsection (a);
- (5) Cathode ray tubes, as described in Title 22 CCR, Section 66273.6, Subsection (a);
- (6) Cathode ray tube glass, as described in Title 22 CCR, Section 66273.7, Subsection (a); and
- (7) Aerosol cans, as specified in Health and Safety Code, Section 25201.16.

VANPOOL VEHICLE. Eligible vehicles are limited to any motor vehicle, other than a motortruck or truck tractor, designed for carrying more than 10 but not more than 15 persons including the driver, which is maintained and used primarily for the nonprofit work-related transportation of adults for the purposes of ridesharing.

Note: Source: Vehicle Code, Division 1, Section 668.

VAPOR BARRIER. Material that has a permeance of one perm or less and that provides resistance to the transmission of water vapor.

VEGETATED SPACE. Vegetated spaces include, but are not limited to, native, undisturbed areas; rehabilitation of previously disturbed areas with landscaping; green belts; and recreation facilities that include landscaping, such as golf courses.

VOC. A volatile organic compound (VOC) broadly defined as a chemical compound based on carbon chains or rings with vapor pressures greater than 0.1 millimeters of mercury at room temperature. These compounds typically contain hydrogen and may contain oxygen, nitrogen and other elements. See CCR Title 17, Section 94508(a).

Note: Where specific regulations are cited from different agencies, such as South Coast Air Quality Management District (SCAQMD), California Air Resources Board (ARB or CARB), etc., the VOC definition included in that specific regulation is the one that prevails for the specific measure in question.

WATTLES. Wattles are used to reduce sediment in runoff. Wattles are often constructed of natural plant materials such as hay, straw or similar material shaped in the form of tubes and placed on a downflow slope. Wattles are also used for perimeter and inlet controls.

ZEV. Any vehicle certified to zero-emission standards.

- || **ZERO-EMITTING AND HIGH EFFICIENT VEHICLES. [BSC-CG]** Eligible vehicles are limited to the following:
- > || 1. Zero emission vehicle (ZEV), enhanced advanced technology PZEV (enhanced AT ZEV) or transitional zero emission vehicles (TZEV) regulated under CCR, Title 13, Section 1962.
 - > || 2. High-efficiency vehicles, regulated by US EPA, bearing a fuel economy and greenhouse gas rating of 9 or 10 as regulated under 40 CFR Section 600 Subpart D.

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

CHAPTER 3 – GREEN BUILDING

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	1	1R	2	3	4									5
Adopt entire CA chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below		X		X				X	X		X		X									
Chapter/Section																						
301		X		X					X					X								
301.1				X				X														
301.1.1				X																		
301.2				X																		
301.3		X																				
301.3.1		X																				
301.3.2		X																				
301.4								X														
301.5									X		X			X								
302		X		X				X	X		X			X								
303		X		X					X		X			X								
303.1		X																				
304		X		X					X		X			X								
305									X													
306								X														

CHAPTER 3

GREEN BUILDING

SECTION 301 GENERAL

301.1 Scope. Buildings shall be designed to include the green building measures specified as mandatory in the application checklists contained in this code. Voluntary green building measures are also included in the application checklists and may be included in the design and construction of structures covered by this code, but are not required unless adopted by a city, county, or city and county as specified in Section 101.7.

301.1.1 Additions and alterations. [HCD] The mandatory provisions of Chapter 4 shall be applied to additions or alterations of existing residential buildings where the addition or alteration increases the building’s conditioned area, volume or size. The requirements shall apply only to and/or within the specific area of the addition or alteration.

The mandatory provisions of Section 4.106.4.2 may apply to additions or alterations of existing parking facilities or the addition of new parking facilities serving exist-

ing multifamily buildings. See Section 4.106.4.3 for application.

NOTE: Repairs including, but not limited to, resurfacing, restriping, and repairing or maintaining existing lighting fixtures are not considered alterations for the purpose of this section.

301.2 Low-rise and high-rise residential buildings. [HCD] The provisions of individual sections of *CALGreen* may apply to either low-rise residential buildings, high-rise residential buildings, or both. Individual sections will be designated by banners to indicate where the section applies specifically to low-rise only (LR) or high-rise only (HR). When the section applies to both low-rise and high-rise buildings, no banner will be used.

301.3 Nonresidential additions and alterations. [BSC-CG] The provisions of individual sections of Chapter 5 apply to newly constructed buildings, building additions of 1,000 square feet or greater, and/or building alterations with a permit valuation of \$200,000 or above (for occupancies within

the authority of California Building Standards Commission). Code sections relevant to additions and alterations shall only apply to the portions of the building being added or altered within the scope of the permitted work.

A code section will be designated by a banner to indicate where the code section only applies to newly constructed buildings [N] or to additions and/or alterations [A]. When the code section applies to both, no banner will be used.

301.3.1 Nonresidential additions and alterations that cause updates to plumbing fixtures only:

Note: On and after January 1, 2014, certain commercial real property, as defined in Civil Code Section 1101.3, shall have its noncompliant plumbing fixtures replaced with appropriate water-conserving plumbing fixtures under specific circumstances. See Civil Code Section 1101.1 *et seq.* for definitions, types of commercial real property affected, effective dates, circumstances necessitating replacement of noncompliant plumbing fixtures, and duties and responsibilities for ensuring compliance.

301.3.2 Waste diversion. The requirements of Section 5.408 shall be required for additions and alterations whenever a permit is required for work.

301.4 Mandatory measures for public schools and community colleges. [DSA-SS] New building construction and site work on a new or existing site shall comply with Section 301.4.

301.4.1 Building and site construction on a new site shall comply with Chapter 5 as adopted by DSA-SS.

301.4.2 Work on an existing site shall comply with Section 301.4.2.

301.4.2.1 Newly constructed site work shall comply with Chapter 5 as adopted by DSA-SS.

301.4.2.2 Newly constructed buildings shall comply with Chapter 5 as adopted by DSA-SS and Section 301.4.3.

301.4.2.3 Additions to existing buildings shall comply with Section 301.4.3.

301.4.2.4 Rehabilitated landscape areas shall comply with Sections 5.304.6 and 5.106.12.

301.4.3 Minimum rehabilitated landscape area requirement. A minimum rehabilitated landscape area equal to 75 percent of the footprint area of the building shall comply with Section 5.304.6 and Section 5.106.12. New buildings or additions to existing buildings less than 1,600 square feet shall not be required to comply with Section 301.4.3.

301.5 Health Facilities. [OSHPD 1, 2 & 4] Health facilities under the jurisdiction of the Office of Statewide Health Planning and Development (OSHPD) are required to comply with the mandatory measures prescribed in Section 5.304, Outdoor Water Use. Compliance with Section 5.304, as adopted by the Building Standards Commission, is enforced by the local agency having jurisdiction. Evidence of local approval shall be submitted to OSHPD prior to issuance of plan approval or a building permit.

SECTION 302 MIXED OCCUPANCY BUILDINGS

302.1 Mixed occupancy buildings. In mixed occupancy buildings, each portion of a building shall comply with the specific green building measures applicable to each specific occupancy.

Exceptions:

1. [HCD] Accessory structures and accessory occupancies serving residential buildings shall comply with Chapter 4 and Appendix A4, as applicable.
2. [HCD] For the purposes of *CALGreen*, live/work units, complying with Section 419 of the *California Building Code*, shall not be considered mixed occupancies. Live/work units shall comply with Chapter 4 and Appendix A4, as applicable.

SECTION 303 PHASED PROJECTS

303.1 Phased projects. For shell buildings and others constructed for future tenant improvements, only those code measures relevant to the building components and systems considered to be new construction (or newly constructed) shall apply.

303.1.1 Initial tenant improvements. The provisions of this code shall apply only to the initial tenant improvements to a project. Subsequent tenant improvements shall comply with the scoping provisions in Section 301.3 non-residential additions and alterations.

SECTION 304 VOLUNTARY TIERS

304.1 Purpose. Voluntary tiers are intended to further encourage building practices that improve public health, safety and general welfare by promoting the use of building concepts which minimize the building's impact on the environment and promote a more sustainable design.

304.1.1 Tiers. The provisions of Divisions A4.6 and A5.6 outline means, in the form of voluntary tiers, for achieving enhanced construction levels by incorporating additional measures for residential and nonresidential new construction. Voluntary tiers may be adopted by local governments and, when adopted, enforced by local enforcing agencies. Buildings complying with tiers specified for each occupancy contain additional prerequisite and elective green building measures necessary to meet the threshold of each tier. See Section 101.7 of this code for procedures and requirements related to local amendments, additions or deletions, including changes to energy standards.

[BSC & HCD] Where there are practical difficulties involved in complying with the threshold levels of a tier, the enforcing agency may grant modifications for individual cases. The enforcing agency shall first find that a special individual reason makes the strict letter of the tier impractical and that modification is in conformance with the intent and purpose of the measure. The details of any action granting modification shall be recorded and entered in the files of the enforcing agency.

**SECTION 305 [OSHPD 1]
CALGreen TIER 1 AND CALGreen TIER 2**

305.1 *CALGreen Tier 1 and CALGreen Tier 2* buildings contain voluntary green building measures necessary to meet the threshold of each level.

305.1.1 *CALGreen Tier 1.* To achieve *CALGreen Tier 1*, buildings must comply with the latest edition of “Savings By Design, Healthcare Modeling Procedures” found online at http://www.energysoft.com/main/page_downloads_sbd_healthcare.html.

305.1.2 *CALGreen Tier 2.* To achieve *CALGreen Tier 2*, buildings must exceed the latest edition of “Savings By Design, Healthcare Modeling Procedures” by a minimum of 15 percent.

**SECTION 306 [DSA-SS]
VOLUNTARY MEASURES**

306.1 Purpose. For public schools and community colleges, voluntary measures further encourage building practices that improve public health, safety and general welfare by promoting the use of building concepts which minimize the building’s impact on the environment and promote a more sustainable design.

306.1.1 Appendix A5, Divisions A5.1 through A5.5, outline means of achieving enhanced sustainable design and construction by incorporating voluntary measures that exceed the mandatory measures.

306.1.2 Chapter 5 Nonresidential Mandatory Measures that are not adopted as mandatory measures by DSA-SS are voluntary measures recommended and encouraged for the design, construction, verification and maintenance of non-energy systems.

Note: The building commissioning requirements for energy efficiency specified in the *California Energy Code* are required.

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

CHAPTER 4 – RESIDENTIAL MANDATORY MEASURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter				X																	
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																			X		
Chapter/Section																					
Division 4.2				†															X		

The state agency does not adopt sections identified by the following symbol: †.

CHAPTER 4

RESIDENTIAL MANDATORY MEASURES

Division 4.1 – PLANNING AND DESIGN

SECTION 4.101 GENERAL

4.101.1 Scope. The provisions of this division outline planning, design and development methods that include environmentally responsible site selection, building design, building siting and development to protect, restore and enhance the environmental quality of the site and respect the integrity of adjacent properties.

SECTION 4.102 DEFINITIONS

4.102.1 Definitions. The following terms are defined in Chapter 2.

FRENCH DRAIN.
WATTLES.

SECTION 4.103 SITE SELECTION (Reserved)

SECTION 4.104 SITE PRESERVATION (Reserved)

SECTION 4.105 DECONSTRUCTION AND REUSE OF EXISTING STRUCTURES (Reserved)

SECTION 4.106 SITE DEVELOPMENT

4.106.1 General. Preservation and use of available natural resources shall be accomplished through evaluation and careful planning to minimize negative effects on the site and adjacent areas. Preservation of slopes, management of storm water drainage and erosion controls shall comply with this section.

4.106.2 Storm water drainage and retention during construction. Projects which disturb less than one acre of soil and are not part of a larger common plan of development which in total disturbs one acre or more, shall manage storm water drainage during construction. In order to manage storm water drainage during construction, one or more of the following measures shall be implemented to prevent flooding of adjacent property, prevent erosion and retain soil runoff on the site.

1. Retention basins of sufficient size shall be utilized to retain storm water on the site.
2. Where storm water is conveyed to a public drainage system, collection point, gutter or similar disposal method, water shall be filtered by use of a barrier system, wattle or other method approved by the enforcing agency.
3. Compliance with a lawfully enacted storm water management ordinance.

Note: Refer to the State Water Resources Control Board for projects which disturb one acre or more of soil, or are part of a larger common plan of development which in total disturbs one acre or more of soil.

(Website: https://www.waterboards.ca.gov/water_issues/programs/stormwater/construction.html)

4.106.3 Grading and paving. Construction plans shall indicate how the site grading or drainage system will manage all surface water flows to keep water from entering buildings. Examples of methods to manage surface water include, but are not limited to, the following:

1. Swales
2. Water collection and disposal systems
3. French drains
4. Water retention gardens
5. Other water measures which keep surface water away from buildings and aid in groundwater recharge.

Exception: Additions and alterations not altering the drainage path.

4.106.4 Electric vehicle (EV) charging for new construction. New construction shall comply with Section 4.106.4.1 or 4.106.4.2 to facilitate future installation and use of EV chargers. Electric vehicle supply equipment (EVSE) shall be installed in accordance with the *California Electrical Code*, Article 625.

Exceptions:

1. On a case-by-case basis, where the local enforcing agency has determined EV charging and infrastructure are not feasible based upon one or more of the following conditions:
 - 1.1. Where there is no local utility power supply or the local utility is unable to supply adequate power.
 - 1.2. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 4.106.4, may adversely impact the construction cost of the project.
2. Accessory Dwelling Units (ADU) and Junior Accessory Dwelling Units (JADU) without additional parking facilities.

4.106.4.1 New one- and two-family dwellings and townhouses with attached private garages. For each dwelling unit, install a listed raceway to accommodate a dedicated 208/240-volt branch circuit. The raceway shall not be less than trade size 1 (nominal 1-inch inside diameter). The raceway shall originate at the main service or subpanel and shall terminate into a listed cabinet, box or other enclosure in close proximity to the proposed location of an EV charger. Raceways are required to be continuous at enclosed, inaccessible or concealed areas and spaces. The service panel and/or subpanel shall provide capacity to install a 40-ampere 208/240-volt minimum dedicated branch circuit and space(s) reserved to permit installation of a branch circuit overcurrent protective device.

Exception: A raceway is not required if a minimum 40-ampere 208/240-volt dedicated EV branch circuit is installed in close proximity to the proposed location of an EV charger at the time of original construction in accordance with the *California Electrical Code*.

4.106.4.1.1 Identification. The service panel or sub-panel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging as “EV CAPABLE”. The raceway termination location shall be permanently and visibly marked as “EV CAPABLE”.

4.106.4.2 New multifamily dwellings, hotels and motels and new residential parking facilities. When parking is provided, parking spaces for new multifamily dwellings, hotels and motels shall meet the requirements of Sections 4.106.4.2.1 and 4.106.4.2.2. Calculations for spaces shall be rounded up to the nearest whole number. A parking space served by electric vehicle supply equipment or designed as a future EV charging space shall count as at least one standard automobile parking space only for the purpose of complying with any applicable minimum parking space requirements established by a local jurisdiction. See Vehicle Code Section 22511.2 for further details.

4.106.4.2.1 Multifamily development projects with less than 20 dwelling units; and hotels and motels with less than 20 sleeping units or guest rooms. The number of dwelling units, sleeping units or guest rooms shall be based on all buildings on a project site subject to this section.

1. **EV Capable.** Ten (10) percent of the total number of parking spaces on a building site, provided for all types of parking facilities, shall be electric vehicle charging spaces (EV spaces) capable of supporting future Level 2 EVSE. Electrical load calculations shall demonstrate that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV spaces at a minimum of 40 amperes.

The service panel or subpanel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging purposes as “EV CAPABLE” in accordance with the *California Electrical Code*.

Exceptions:

1. When EV chargers (Level 2 EVSE) are installed in a number equal to or greater than the required number of EV capable spaces.
2. When EV chargers (Level 2 EVSE) are installed in a number less than the required number of EV capable spaces, the number of EV capable spaces required may be reduced by a number equal to the number of EV chargers installed.

Notes:

- a. Construction documents are intended to demonstrate the project’s capability and capacity for facilitating future EV charging.

b. There is no requirement for EV spaces to be constructed or available until receptacles for EV charging or EV chargers are installed for use.

2. **EV Ready.** Twenty-five (25) percent of the total number of parking spaces shall be equipped with low power Level 2 EV charging receptacles. For multifamily parking facilities, no more than one receptacle is required per dwelling unit when more than one parking space is provided for use by a single dwelling unit.

Exception: Areas of parking facilities served by parking lifts.

4.106.4.2.2 Multifamily development projects with 20 or more dwelling units, hotels and motels with 20 or more sleeping units or guest rooms. The number of dwelling units, sleeping units or guest rooms shall be based on all buildings on a project site subject to this section.

1. **EV Capable.** Ten (10) percent of the total number of parking spaces on a building site, provided for all types of parking facilities, shall be electric vehicle charging spaces (EV spaces) capable of supporting future Level 2 EVSE. Electrical load calculations shall demonstrate that the electrical panel service capacity and electrical system, including any on-site distribution transformer(s), have sufficient capacity to simultaneously charge all EVs at all required EV spaces at a minimum of 40 amperes.

The service panel or subpanel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging purposes as “EV CAPABLE” in accordance with the *California Electrical Code*.

Exception: When EV chargers (Level 2 EVSE) are installed in a number greater than five (5) percent of parking spaces required by Section 4.106.4.2.2, Item 3, the number of EV capable spaces required may be reduced by a number equal to the number of EV chargers installed over the five (5) percent required.

Notes:

- Construction documents shall show locations of future EV spaces.
 - There is no requirement for EV spaces to be constructed or available until receptacles for EV charging or EV chargers are installed for use.
2. **EV Ready.** Twenty-five (25) percent of the total number of parking spaces shall be equipped with low power Level 2 EV charging receptacles. For multifamily parking facilities, no more than one receptacle is required per dwelling unit when

more than one parking space is provided for use by a single dwelling unit.

Exception: Areas of parking facilities served by parking lifts.

3. **EV Chargers.** Five (5) percent of the total number of parking spaces shall be equipped with Level 2 EVSE. Where common use parking is provided, at least one EV charger shall be located in the common use parking area and shall be available for use by all residents or guests.

When low power Level 2 EV charging receptacles or Level 2 EVSE are installed beyond the minimum required, an automatic load management system (ALMS) may be used to reduce the maximum required electrical capacity to each space served by the ALMS. The electrical system and any on-site distribution transformers shall have sufficient capacity to deliver at least 3.3 kW simultaneously to each EV charging station (EVCS) served by the ALMS. The branch circuit shall have a minimum capacity of 40 amperes, and installed EVSE shall have a capacity of not less than 30 amperes. ALMS shall not be used to reduce the minimum required electrical capacity to the required EV capable spaces.

4.106.4.2.2.1 Electric vehicle charging stations (EVCS). Electric vehicle charging stations required by Section 4.106.4.2.2, Item 3, shall comply with Section 4.106.4.2.2.1.

Exception: Electric vehicle charging stations serving public accommodations, public housing, motels and hotels shall not be required to comply with this section. See *California Building Code*, Chapter 11B, for applicable requirements.

4.106.4.2.2.1.1 Location. EVCS shall comply with at least one of the following options:

- The charging space shall be located adjacent to an accessible parking space meeting the requirements of the *California Building Code*, Chapter 11A, to allow use of the EV charger from the accessible parking space.
- The charging space shall be located on an accessible route, as defined in the *California Building Code*, Chapter 2, to the building.

Exception: Electric vehicle charging stations designed and constructed in compliance with the *California Building Code*, Chapter 11B, are not required to comply with Section 4.106.4.2.2.1.1 and Section 4.106.4.2.2.1.2, Item 3.

4.106.4.2.2.1.2 Electric vehicle charging stations (EVCS) dimensions. The charging spaces shall be designed to comply with the following:

- The minimum length of each EV space shall be 18 feet (5486 mm).

2. The minimum width of each EV space shall be 9 feet (2743 mm).
3. One in every 25 charging spaces, but not less than one, shall also have an 8-foot (2438 mm) wide minimum aisle. A 5-foot (1524 mm) wide minimum aisle shall be permitted provided the minimum width of the EV space is 12 feet (3658 mm).
 - a. Surface slope for this EV space and the aisle shall not exceed 1 unit vertical in 48 units horizontal (2.083 percent slope) in any direction.

4.106.4.2.2.1.3 Accessible EV spaces. In addition to the requirements in Sections 4.106.4.2.2.1.1 and 4.106.4.2.2.1.2, all EVSE, when installed, shall comply with the accessibility provisions for EV chargers in the *California Building Code*, Chapter 11B. EV ready spaces and EVCS in multifamily developments shall comply with *California Building Code*, Chapter 11A, Section 1109A.

4.106.4.2.3 EV space requirements.

1. **Single EV space required.** Install a listed raceway capable of accommodating a 208/240-volt dedicated branch circuit. The raceway shall not be less than trade size 1 (nominal 1-inch inside diameter). The raceway shall originate at the main service or subpanel and shall terminate into a listed cabinet, box or enclosure in close proximity to the location or the proposed location of the EV space. Construction documents shall identify the raceway termination point, receptacle or charger location, as applicable. The service panel and/or subpanel shall have a 40-ampere minimum dedicated branch circuit, including branch circuit overcurrent protective device installed, or space(s) reserved to permit installation of a branch circuit overcurrent protective device.

Exception: A raceway is not required if a minimum 40-ampere 208/240-volt dedicated EV branch circuit is installed in close proximity to the location or the proposed location of the EV space, at the time of original construction in accordance with the *California Electrical Code*.

2. **Multiple EV spaces required.** Construction documents shall indicate the raceway termination point and the location of installed or future EV spaces, receptacles or EV chargers. Construction documents shall also provide information on amperage of installed or future receptacles or EVSE, raceway method(s), wiring schematics and electrical load calculations. Plan design shall be based upon a 40-ampere minimum branch circuit. Required raceways and related components

that are planned to be installed underground, enclosed, inaccessible or in concealed areas and spaces shall be installed at the time of original construction.

Exception: A raceway is not required if a minimum 40-ampere 208/240-volt dedicated EV branch circuit is installed in close proximity to the location or the proposed location of the EV space at the time of original construction in accordance with the *California Electrical Code*.

4.106.4.2.4 Identification. The service panel or sub-panel circuit directory shall identify the overcurrent protective device space(s) reserved for future EV charging purposes as “EV CAPABLE” in accordance with the *California Electrical Code*.

4.106.4.2.5 Electric Vehicle Ready Space Signage. Electric vehicle ready spaces shall be identified by signage or pavement markings, in compliance with Caltrans Traffic Operations Policy Directive 13-01 (Zero Emission Vehicle Signs and Pavement Markings) or its successor(s).

4.106.4.3 Electric vehicle charging for additions and alterations of parking facilities serving existing multifamily buildings. When new parking facilities are added, or electrical systems or lighting of existing parking facilities are added or altered and the work requires a building permit, ten (10) percent of the total number of parking spaces added or altered shall be electric vehicle charging spaces (EV spaces) capable of supporting future Level 2 EVSE.

Notes:

1. Construction documents are intended to demonstrate the project’s capability and capacity for facilitating future EV charging.
2. There is no requirement for EV spaces to be constructed or available until EV chargers are installed for use.

CHAPTER 4

RESIDENTIAL MANDATORY MEASURES

Division 4.2 – ENERGY EFFICIENCY

SECTION 4.201 GENERAL

4.201.1 Scope. For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory standards.

CHAPTER 4

RESIDENTIAL MANDATORY MEASURES

Division 4.3 – WATER EFFICIENCY AND CONSERVATION

SECTION 4.301 GENERAL

4.301.1 Scope. The provisions of this chapter shall establish the means of conserving water used indoors, outdoors and in wastewater conveyance.

SECTION 4.302 DEFINITIONS

4.302.1 Definitions. Reserved.

SECTION 4.303 INDOOR WATER USE

4.303.1 Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with Sections 4.303.1.1, 4.303.1.2, 4.303.1.3 and 4.303.1.4.

Note: All noncompliant plumbing fixtures in any residential real property shall be replaced with water-conserving plumbing fixtures. Plumbing fixture replacement is required prior to issuance of a certificate of final completion, certificate of occupancy, or final permit approval by the local building department. See Civil Code Section 1101.1, et seq., for the definition of a noncompliant plumbing fixture, types of residential buildings affected and other important enactment dates.

4.303.1.1 Water closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush. Tank-type water closets shall be certified to the performance criteria of the US EPA WaterSense Specification for Tank-type Toilets.

Note: The effective flush volume of dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

4.303.1.2 Urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush. The effective flush volume of all other urinals shall not exceed 0.5 gallons per flush.

4.303.1.3 Showerheads.

4.303.1.3.1 Single showerhead. Showerheads shall have a maximum flow rate of not more than 1.8 gallons per minute at 80 psi. Showerheads shall be certified to the performance criteria of the US EPA WaterSense Specification for Showerheads.

4.303.1.3.2 Multiple showerheads serving one shower. When a shower is served by more than one showerhead, the combined flow rate of all shower-

heads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

Note: A hand-held shower shall be considered a showerhead.

4.303.1.4 Faucets.

4.303.1.4.1 Residential lavatory faucets. The maximum flow rate of residential lavatory faucets shall not exceed 1.2 gallons per minute at 60 psi. The minimum flow rate of residential lavatory faucets shall not be less than 0.8 gallons per minute at 20 psi.

4.303.1.4.2 Lavatory faucets in common and public use areas. The maximum flow rate of lavatory faucets installed in common and public use areas (outside of dwellings or sleeping units) in residential buildings shall not exceed 0.5 gallons per minute at 60 psi.

4.303.1.4.3 Metering faucets. Metering faucets when installed in residential buildings shall not deliver more than 0.2 gallons per cycle.

4.303.1.4.4 Kitchen faucets. The maximum flow rate of kitchen faucets shall not exceed 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.

Note: Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

4.303.1.4.5 Pre-rinse spray valves. When installed, shall meet the requirements in the *California Code of Regulations*, Title 20 (Appliance Efficiency Regulations), Sections 1605.1(h)(4) Table H-2, Section 1605.3(h)(4)(A), and Section 1607(d)(7), and shall be equipped with an integral automatic shutoff.

FOR REFERENCE ONLY: The following table and code section have been reprinted from the *California Code of Regulations, Title 20 (Appliance Efficiency Regulations)*, Section 1605.1(h)(4) and Section 1605.3(h)(4)(A).

**TABLE H-2
STANDARDS FOR COMMERCIAL PRE-RINSE SPRAY VALVES
MANUFACTURED ON OR AFTER JANUARY 28, 2019**

PRODUCT CLASS [spray force in ounce force (ozf)]	MAXIMUM FLOW RATE (gpm)
Product Class 1 (≤ 5.0 ozf)	1.00
Product Class 2 (> 5.0 ozf and ≤ 8.0 ozf)	1.20
Product Class 3 (> 8.0 ozf)	1.28

Title 20 Section 1605.3(h)(4)(A): Commercial pre-rinse spray valves manufactured on or after January 1,

RESIDENTIAL MANDATORY MEASURES

2006, shall have a minimum spray force of not less than 4.0 ounces-force (ozf) [113 grams-force (gf)].

4.303.2 Submeters for multifamily buildings and dwelling units in mixed-use residential/commercial buildings. Submeters shall be installed to measure water usage of individual rental dwelling units in accordance with the *California Plumbing Code*.

4.303.3 Standards for plumbing fixtures and fittings. Plumbing fixtures and fittings shall be installed in accordance with the *California Plumbing Code*, and shall meet the applicable standards referenced in Table 1701.1 of the *California Plumbing Code*.

SECTION 4.304 OUTDOOR WATER USE

4.304.1 Outdoor potable water use in landscape areas. Residential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent.

Notes:

1. The Model Water Efficient Landscape Ordinance (MWELO) is located in the *California Code of Regulations*, Title 23, Chapter 2.7, Division 2.

MWELO and supporting documents, including a water budget calculator, are available at: <https://www.water.ca.gov/>

SECTION 4.305 WATER REUSE SYSTEMS (Reserved)

CHAPTER 4

RESIDENTIAL MANDATORY MEASURES

Division 4.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

SECTION 4.401 GENERAL

4.401.1 Scope. The provisions of this chapter shall outline means of achieving material conservation and resource efficiency through protection of buildings from exterior moisture; construction waste diversion; employment of techniques to reduce pollution through recycling of materials; and building commissioning or testing, adjusting and balancing.

SECTION 4.402 DEFINITIONS

4.402.1 Definitions. Reserved.

SECTION 4.403 FOUNDATION SYSTEMS (Reserved)

SECTION 4.404 EFFICIENT FRAMING TECHNIQUES (Reserved)

SECTION 4.405 MATERIAL SOURCES (Reserved)

SECTION 4.406 ENHANCED DURABILITY AND REDUCED MAINTENANCE

4.406.1 Rodent proofing. Annular spaces around pipes, electric cables, conduits or other openings in sole/bottom plates at exterior walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or a similar method acceptable to the enforcing agency.

SECTION 4.407 WATER RESISTANCE AND MOISTURE MANAGEMENT (Reserved)

SECTION 4.408 CONSTRUCTION WASTE REDUCTION, DISPOSAL AND RECYCLING

4.408.1 Construction waste management. Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with

either Section 4.408.2, 4.408.3 or 4.408.4, or meet a more stringent local construction and demolition waste management ordinance.

Exceptions:

1. Excavated soil and land-clearing debris.
2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist or are not located reasonably close to the jobsite.
3. The enforcing agency may make exceptions to the requirements of this section when isolated jobsites are located in areas beyond the haul boundaries of the diversion facility.

4.408.2 Construction waste management plan. Submit a construction waste management plan in conformance with Items 1 through 5. The construction waste management plan shall be updated as necessary and shall be available during construction for examination by the enforcing agency.

1. Identify the construction and demolition waste materials to be diverted from disposal by recycling, reuse on the project or salvage for future use or sale.
2. Specify if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream).
3. Identify diversion facilities where the construction and demolition waste material will be taken.
4. Identify construction methods employed to reduce the amount of construction and demolition waste generated.
5. Specify that the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

4.408.3 Waste management company. Utilize a waste management company, approved by the enforcing agency, which can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with Section 4.408.1.

Note: The owner or contractor may make the determination if the construction and demolition waste materials will be diverted by a waste management company.

4.408.4 Waste stream reduction alternative [LR]. Projects that generate a total combined weight of construction and demolition waste disposed of in landfills, which do not exceed 3.4 pounds per square foot of the building area shall meet the minimum 65 percent construction waste reduction requirement in Section 4.408.1.

4.408.4.1 Waste stream reduction alternative. Projects that generate a total combined weight of construction and demolition waste disposed of in landfills, which do not

RESIDENTIAL MANDATORY MEASURES

exceed 2 pounds per square foot of the building area, shall meet the minimum 65 percent construction waste reduction requirement in Section 4.408.1.

4.408.5 Documentation. Documentation shall be provided to the enforcing agency which demonstrates compliance with Section 4.408.2, Items 1 through 5, Section 4.408.3 or Section 4.408.4.

Notes:

1. Sample forms found in “A Guide to the California Green Building Standards Code (Residential)” located at <http://www.hcd.ca.gov/building-standards/calgreen/cal-green-forms.html> may be used to assist in documenting compliance with this section.
2. Mixed construction and demolition debris (C&D) processors can be located at the California Department of Resources Recycling and Recovery (CalRecycle).

SECTION 4.409 LIFE CYCLE ASSESSMENT (Reserved)

SECTION 4.410 BUILDING MAINTENANCE AND OPERATION

4.410.1 Operation and maintenance manual. At the time of final inspection, a manual, compact disc, web-based reference or other media acceptable to the enforcing agency which includes all of the following shall be placed in the building:

1. Directions to the owner or occupant that the manual shall remain with the building throughout the life cycle of the structure.
2. Operation and maintenance instructions for the following:
 - a. Equipment and appliances, including water-saving devices and systems, HVAC systems, photovoltaic systems, electric vehicle chargers, water-heating systems and other major appliances and equipment.
 - b. Roof and yard drainage, including gutters and downspouts.
 - c. Space conditioning systems, including condensers and air filters.
 - d. Landscape irrigation systems.
 - e. Water reuse systems.
3. Information from local utility, water and waste recovery providers on methods to further reduce resource consumption, including recycle programs and locations.
4. Public transportation and/or carpool options available in the area.
5. Educational material on the positive impacts of an interior relative humidity between 30–60 percent and

what methods an occupant may use to maintain the relative humidity level in that range.

6. Information about water-conserving landscape and irrigation design and controllers which conserve water.
7. Instructions for maintaining gutters and downspouts and the importance of diverting water at least 5 feet away from the foundation.
8. Information on required routine maintenance measures, including, but not limited to, caulking, painting, grading around the building, etc.
9. Information about state solar energy and incentive programs available.
10. A copy of all special inspection verifications required by the enforcing agency or this code.
11. Information from the Department of Forestry and Fire Protection on maintenance of defensible space around residential structures.
12. Information and/or drawings identifying the location of grab bar reinforcements.

4.410.2 Recycling by occupants. Where 5 or more multifamily dwelling units are constructed on a building site, provide readily accessible area(s) that serves all buildings on the site and are identified for the depositing, storage and collection of nonhazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste and metals, or meet a lawfully enacted local recycling ordinance, if more restrictive.

Exception: Rural jurisdictions that meet and apply for the exemption in Public Resources Code Section 42649.82 (a)(2)(A) et seq. are not required to comply with the organic waste portion of this section.

CHAPTER 4

RESIDENTIAL MANDATORY MEASURES

Division 4.5 – ENVIRONMENTAL QUALITY

SECTION 4.501 GENERAL

4.501.1 Scope. The provisions of this chapter shall outline means of reducing the quantity of air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of a building's installers, occupants and neighbors.

SECTION 4.502 DEFINITIONS

4.502.1 Definitions. The following terms are defined in Chapter 2.

AGRIFIBER PRODUCTS.

COMPOSITE WOOD PRODUCTS.

DIRECT-VENT APPLIANCE.

MAXIMUM INCREMENTAL REACTIVITY (MIR).

MOISTURE CONTENT.

PRODUCT-WEIGHTED MIR (PWMIR).

REACTIVE ORGANIC COMPOUND (ROC).

VOC.

SECTION 4.503 FIREPLACES

4.503.1 General. Any installed gas fireplace shall be a direct-vent sealed-combustion type. Any installed woodstove or pellet stove shall comply with US EPA New Source Performance Standards (NSPS) emission limits as applicable, and shall have a permanent label indicating they are certified to meet the emission limits. Woodstoves, pellet stoves and fireplaces shall also comply with applicable local ordinances.

SECTION 4.504 POLLUTANT CONTROL

4.504.1 Covering of duct openings and protection of mechanical equipment during construction. At the time of rough installation, during storage on the construction site and until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheetmetal or other methods acceptable to the enforcing agency to reduce the amount of water, dust and debris, which may enter the system.

4.504.2 Finish material pollutant control. Finish materials shall comply with this section.

4.504.2.1 Adhesives, sealants and caulks. Adhesives, sealants and caulks used on the project shall meet the

requirements of the following standards unless more stringent local or regional air pollution or air quality management district rules apply:

1. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits, as shown in Table 4.504.1 or 4.504.2, as applicable. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene), except for aerosol products, as specified in Subsection 2 below.
2. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than 1 pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of *California Code of Regulations*, Title 17, commencing with Section 94507.

4.504.2.2 Paints and coatings. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Suggested Control Measure, as shown in Table 4.504.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 4.504.3 shall be determined by classifying the coating as a Flat, Nonflat or Nonflat-high Gloss coating, based on its gloss, as defined in subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-high Gloss VOC limit in Table 4.504.3 shall apply.

4.504.2.3 Aerosol paints and coatings. Aerosol paints and coatings shall meet the Product-weighted MIR Limits for ROC in Section 94522(a)(2) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(e)(1) and (f)(1) of *California Code of Regulations*, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8, Rule 49.

4.504.2.4 Verification. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:

1. Manufacturer's product specification.
2. Field verification of on-site product containers.

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**TABLE 4.504.1
ADHESIVE VOC LIMIT^{1,2}**

Less Water and Less Exempt Compounds in Grams per Liter

ARCHITECTURAL APPLICATIONS	VOC LIMIT
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesive	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250
Other adhesives not specifically listed	50
SPECIALTY APPLICATIONS	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Top and trim adhesive	250
SUBSTRATE SPECIFIC APPLICATIONS	
Metal to metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80

1. If an adhesive is used to bond dissimilar substrates together, the adhesive with the highest VOC content shall be allowed.
2. For additional information regarding methods to measure the VOC content specified in this table, see South Coast Air Quality Management District Rule 1168.

**TABLE 4.504.2
SEALANT VOC LIMIT**

Less Water and Less Exempt Compounds in Grams per Liter

SEALANTS	VOC LIMIT
Architectural	250
Marine deck	760
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
SEALANT PRIMERS	
Architectural	
Nonporous	250
Porous	775
Modified bituminous	500
Marine deck	760
Other	750

**TABLE 4.504.3
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS^{2,3}**
**Grams of VOC per Liter of Coating,
Less Water and Less Exempt Compounds**

COATING CATEGORY	VOC LIMIT
Flat coatings	50
Nonflat coatings	100
Nonflat-high gloss coatings	150
SPECIALTY COATINGS	
Aluminum roof coatings	400
Basement specialty coatings	400
Bituminous roof coatings	50
Bituminous roof primers	350
Bond breakers	350
Concrete curing compounds	350
Concrete/masonry sealers	100
Driveway sealers	50
Dry fog coatings	150
Faux finishing coatings	350
Fire resistive coatings	350
Floor coatings	100
Form-release compounds	250
Graphic arts coatings (sign paints)	500
High temperature coatings	420
Industrial maintenance coatings	250
Low solids coatings ¹	120
Magnesite cement coatings	450
Mastic texture coatings	100
Metallic pigmented coatings	500
Multicolor coatings	250
Pretreatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Rust preventative coatings	250
Shellacs	
Clear	730
Opaque	550
Specialty primers, sealers and undercoaters	100
Stains	250
Stone consolidants	450
Swimming pool coatings	340
Traffic marking coatings	100
Tub and tile refinish coatings	420
Waterproofing membranes	250
Wood coatings	275
Wood preservatives	350
Zinc-rich primers	340

1. Grams of VOC per liter of coating, including water and including exempt compounds.
2. The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.
3. Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008. More information is available from the Air Resources Board.

4.504.3 Carpet systems. All carpet installed in the building interior shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPPH/DEODC/EHLB/IAQ/Pages/VOC.aspx>

4.504.3.1 Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPPH/DEODC/EHLB/IAQ/Pages/VOC.aspx>

4.504.3.2 Carpet adhesive. All carpet adhesive shall meet the requirements of Table 4.504.1.

4.504.4 Resilient flooring systems. Where resilient flooring is installed, at least 80 percent of floor area receiving resilient flooring shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPPH/DEODC/EHLB/IAQ/Pages/VOC.aspx>

4.504.5 Composite wood products. Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB’s Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.) as shown in Table 4.504.5.

4.504.5.1 Documentation. Verification of compliance with this section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the following:

1. Product certifications and specifications.
2. Chain of custody certifications.
3. Product labeled and invoiced as meeting the Composite Wood Products regulation (see CCR, Title 17, Section 93120, *et seq.*).
4. Exterior grade products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association,

the Australian AS/NZS 2269, European 636 3S, and Canadian CSA O121, CSA O151, CSA O153 and CSA O325 standards.

5. Other methods acceptable to the enforcing agency.

**TABLE 4.504.5
FORMALDEHYDE LIMITS¹
Maximum Formaldehyde Emissions in Parts per Million**

PRODUCT	CURRENT LIMIT
Hardwood plywood veneer core	0.05
Hardwood plywood composite core	0.05
Particleboard	0.09
Medium density fiberboard	0.11
Thin medium density fiberboard ²	0.13

1. Values in this table are derived from those specified by the California Air Resources Board, Air Toxics Control Measure for Composite Wood as tested in accordance with ASTM E1333. For additional information, see *California Code of Regulations*, Title 17, Sections 93120 through 93120.12.
2. Thin medium density fiberboard has a maximum thickness of ⁵/₁₆ inch (8 mm).

**SECTION 4.505
INTERIOR MOISTURE CONTROL**

4.505.1 General. Buildings shall meet or exceed the provisions of the *California Building Standards Code*.

4.505.2 Concrete slab foundations. Concrete slab foundations required to have a vapor retarder by the *California Building Code*, Chapter 19 or concrete slab-on-ground floors required to have a vapor retarder by the *California Residential Code*, Chapter 5, shall also comply with this section.

4.505.2.1 Capillary break. A capillary break shall be installed in compliance with at least one of the following:

1. A 4-inch-thick (101.6 mm) base of 1/2 inch (12.7 mm) or larger clean aggregate shall be provided with a vapor retarder in direct contact with concrete and a concrete mix design, which will address bleeding, shrinkage and curling, shall be used. For additional information, see American Concrete Institute, ACI 302.2R-06.
2. Other equivalent methods approved by the enforcing agency.
3. A slab design specified by a licensed design professional.

4.505.3 Moisture content of building materials. Building materials with visible signs of water damage shall not be installed. Wall and floor framing shall not be enclosed when the framing members exceed 19 percent moisture content. Moisture content shall be verified in compliance with the following:

1. Moisture content shall be determined with either a probe-type or contact-type moisture meter. Equivalent moisture verification methods may be approved by the enforcing agency and shall satisfy requirements found in Section 101.8 of this code.

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- Moisture readings shall be taken at a point 2 feet (610 mm) to 4 feet (1219 mm) from the grade stamped end of each piece to be verified.
- At least three random moisture readings shall be performed on wall and floor framing with documentation acceptable to the enforcing agency provided at the time of approval to enclose the wall and floor framing.

Insulation products which are visibly wet or have a high moisture content shall be replaced or allowed to dry prior to enclosure in wall or floor cavities. Wet-applied insulation products shall follow the manufacturers' drying recommendations prior to enclosure.

SECTION 4.506 INDOOR AIR QUALITY AND EXHAUST

4.506.1 Bathroom exhaust fans. Each bathroom shall be mechanically ventilated and shall comply with the following:

- Fans shall be ENERGY STAR compliant and be ducted to terminate outside the building.
- Unless functioning as a component of a whole house ventilation system, fans must be controlled by a humidity control.
 - Humidity controls shall be capable of adjustment between a relative humidity range of ≤ 50 percent to a maximum of 80 percent. A humidity control may utilize manual or automatic means of adjustment.
 - A humidity control may be a separate component to the exhaust fan and is not required to be integral (i.e., built-in).

Notes:

- For the purposes of this section, a bathroom is a room which contains a bathtub, shower or tub/shower combination.
- Lighting integral to bathroom exhaust fans shall comply with the *California Energy Code*.

SECTION 4.507 ENVIRONMENTAL COMFORT

4.507.1 Reserved.

4.507.2 Heating and air-conditioning system design. Heating and air-conditioning systems shall be sized, designed and have their equipment selected using the following methods:

- The heat loss and heat gain is established according to ANSI/ACCA 2 Manual J—2016 (*Residential Load Calculation*), ASHRAE handbooks or other equivalent design software or methods.
- Duct systems are sized according to ANSI/ACCA 1 Manual D—2016 (*Residential Duct Systems*), ASHRAE handbooks or other equivalent design software or methods.
- Select heating and cooling equipment according to ANSI/ACCA 3 Manual S—2014 (*Residential Equip-*

ment Selection) or other equivalent design software or methods.

Exception: Use of alternate design temperatures necessary to ensure the systems function are acceptable.

SECTION 4.508 OUTDOOR AIR QUALITY (Reserved)

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES
DIVISION 5.1 – PLANNING AND DESIGN**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								X													
Chapter/Section																					
5.101								X													
5.102 Definitions								X													
5.106.4.2 and subsections		†						X													
5.106.5.3 and subsections								X													
5.106.5.4 and subsections								†													
5.106.8								X													
5.106.10								X													
5.106.12 and subsections		†						X													

The state agency does not adopt sections identified with the following symbol: †

**CHAPTER 5
NONRESIDENTIAL MANDATORY MEASURES**

Division 5.1 – PLANNING AND DESIGN

**SECTION 5.101
GENERAL**

5.101.1 Scope. The provisions of this chapter outline planning, design and development methods that include environmentally responsible site selection, building design, building siting and development to protect, restore and enhance the environmental quality of the site and respect the integrity of adjacent properties.

**SECTION 5.102
DEFINITIONS**

5.102.1 Definitions. The following terms are defined in Chapter 2.

CUTOFF LUMINAIRES.

LOW-EMITTING AND FUEL EFFICIENT VEHICLES.

NEIGHBORHOOD ELECTRIC VEHICLE (NEV).

TENANT-OCCUPANTS.

VANPOOL VEHICLE.

ZEV.

**SECTION 5.103
SITE SELECTION
(Reserved)**

**SECTION 5.104
SITE PRESERVATION
(Reserved)**

**SECTION 5.105
DECONSTRUCTION AND REUSE
OF EXISTING STRUCTURES
(Reserved)**

**SECTION 5.106
SITE DEVELOPMENT**

5.106.1 Stormwater pollution prevention for projects that disturb less than one acre of land. Newly constructed projects and additions which disturb less than one acre of land and are not part of a larger common plan of development or sale shall prevent the pollution of stormwater runoff from the construction activities through one or more of the following measures:

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5.106.1.1 Local ordinance. Comply with a lawfully enacted stormwater management and/or erosion control ordinance.

5.106.1.2 Best management practices (BMP's). Prevent the loss of soil through wind or water erosion by implementing an effective combination of erosion and sediment control and good housekeeping BMP's.

1. Soil loss BMP's that should be considered for implementation as appropriate for each project include, but are not limited to, the following:
 - a. Scheduling construction activity during dry weather, when possible.
 - b. Preservation of natural features, vegetation, soil and buffers around surface waters.
 - c. Drainage swales or lined ditches to control stormwater flow.
 - d. Mulching or hydroseeding to stabilize disturbed soils.
 - e. Erosion control to protect slopes.
 - f. Protection of storm drain inlets (gravel bags or catch basin inserts).
 - g. Perimeter sediment control (perimeter silt fence, fiber rolls).
 - h. Sediment trap or sediment basin to retain sediment on site.
 - i. Stabilized construction exits.
 - j. Wind erosion control.
 - k. Other soil loss BMP's acceptable to the enforcing agency.
2. Good housekeeping BMP's to manage construction equipment, materials, non-stormwater discharges and wastes that should be considered for implementation as appropriate for each project include, but are not limited to, the following:
 - a. Dewatering activities.
 - b. Material handling and waste management.
 - c. Building materials stockpile management.
 - d. Management of washout areas (concrete, paints, stucco, etc.).
 - e. Control of vehicle/equipment fueling to contractor's staging area.
 - f. Vehicle and equipment cleaning performed off site.
 - g. Spill prevention and control.
 - h. Other housekeeping BMP's acceptable to the enforcing agency.

5.106.2 Stormwater pollution prevention for projects that disturb one or more acres of land. Comply with all lawfully enacted stormwater discharge regulations for projects that (1) disturb one acre or more of land, or (2) disturb less than one acre of land but are part of a larger common plan of development or sale.

Note: Projects that (1) disturb one acre or more of land, or (2) disturb less than one acre of land but are part of a

larger common plan of development or sale must comply with the postconstruction requirements detailed in the applicable National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities issued by the State Water Resources Control Board or the Lahontan Regional Water Quality Control Board (for projects in the Lake Tahoe Hydrologic Unit).

The NPDES permits require postconstruction runoff (post-project hydrology) to match the preconstruction runoff (pre-project hydrology) with the installation of postconstruction stormwater management measures. The NPDES permits emphasize runoff reduction through on-site stormwater use, interception, evapotranspiration and infiltration through non-structural controls, such as Low Impact Development (LID) practices and conservation design measures. Stormwater volume that cannot be addressed using nonstructural practices is required to be captured in structural practices and be approved by the enforcing agency.

Refer to the current applicable permits on the State Water Resources Control Board website at: www.waterboards.ca.gov/constructionstormwater. Consideration to the stormwater runoff management measures should be given during the initial design process for appropriate integration into site development.

5.106.4 Bicycle parking. For buildings within the authority of California Building Standards Commission as specified in Section 103, comply with Section 5.106.4.1. For buildings within the authority of the Division of the State Architect pursuant to Section 105, comply with Section 5.106.4.2.

5.106.4.1 Bicycle parking. [BSC-CG] Comply with Sections 5.106.4.1.1 and 5.106.4.1.2; or meet the applicable local ordinance, whichever is stricter.

5.106.4.1.1 Short-term bicycle parking. If the new project or an addition or alteration is anticipated to generate visitor traffic, provide permanently anchored bicycle racks within 200 feet of the visitors' entrance, readily visible to passers-by, for 5 percent of new visitor motorized vehicle parking spaces being added, with a minimum of one two-bike capacity rack.

Exception: Additions or alterations which add nine or less visitor vehicular parking spaces.

5.106.4.1.2 Long-term bicycle parking. For new buildings with tenant spaces that have 10 or more tenant-occupants, provide secure bicycle parking for 5 percent of the tenant-occupant vehicular parking spaces with a minimum of one bicycle parking facility.

5.106.4.1.3. For additions or alterations that add 10 or more tenant-occupant vehicular parking spaces, provide secure bicycle parking for 5 percent of the tenant vehicular parking spaces being added, with a minimum of one bicycle parking facility.

5.106.4.1.4. For new shell buildings in phased projects provide secure bicycle parking for 5 percent of the anticipated tenant-occupant vehicular parking spaces with a minimum of one bicycle parking facility.

5.106.4.1.5. Acceptable bicycle parking facility for Sections 5.106.4.1.2, 5.106.4.1.3 and 5.106.4.1.4 shall

be convenient from the street and shall meet one of the following:

1. Covered, lockable enclosures with permanently anchored racks for bicycles;
2. Lockable bicycle rooms with permanently anchored racks; or
3. Lockable, permanently anchored bicycle lockers.

Note: Additional information on recommended bicycle accommodations may be obtained from Sacramento Area Bicycle Advocates.

5.106.4.2 Bicycle parking. [DSA-SS] For public schools and community colleges, comply with Sections 5.106.4.2.1 and 5.106.4.2.2.

5.106.4.2.1 Student bicycle parking. Provide permanently anchored bicycle racks conveniently accessed with a minimum of four two-bike capacity racks per new building.

5.106.4.2.2 Staff bicycle parking. Provide permanent, secure bicycle parking conveniently accessed with a minimum of two staff bicycle parking spaces per new building. Acceptable bicycle parking facilities shall be convenient from the street or staff parking area and shall meet one of the following:

1. Covered, lockable enclosures with permanently anchored racks for bicycles;
2. Lockable bicycle rooms with permanently anchored racks; or
3. Lockable, permanently anchored bicycle lockers.

5.106.5.3 Electric vehicle (EV) charging. [N] Construction to provide electric vehicle infrastructure and facilitate electric vehicle charging shall comply with Section 5.106.5.3.1 and shall be provided in accordance with regulations in the *California Building Code* and the *California Electrical Code*.

Exceptions:

1. On a case-by-case basis where the local enforcing agency has determined compliance with this section is not feasible based upon one of the following conditions:
 - a. Where there is no local utility power supply.
 - b. Where the local utility is unable to supply adequate power.
 - c. Where there is evidence suitable to the local enforcement agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.
2. Parking spaces accessible only by automated mechanical car parking systems are not required to comply with this code section.

5.106.5.3.1 EV capable spaces. [N] EV capable spaces shall be provided in accordance with Table 5.106.5.3.1 and the following requirements:

1. Raceways complying with the *California Electrical Code* and no less than 1-inch (25 mm) diameter shall be provided and shall originate at a service panel or a subpanel(s) serving the area, and shall terminate in close proximity to the proposed location of the EV capable space and into a suitable listed cabinet, box, enclosure or equivalent. A common raceway may be used to serve multiple EV capable spaces.
2. A service panel or subpanel(s) shall be provided with panel space and electrical load capacity for a dedicated 208/240 volt, 40-ampere minimum branch circuit for each EV capable space, with delivery of 30-ampere minimum to an installed EVSE at each EVCS.
3. The electrical system and any on-site distribution transformers shall have sufficient capacity to supply full rated amperage at each EV capable space.
4. The service panel or subpanel circuit directory shall identify the reserved overcurrent protective device space(s) as “EV CAPABLE”. The raceway termination location shall be permanently and visibly marked as “EV CAPABLE.”

Note: A parking space served by electric vehicle supply equipment or designed as a future EV charging space shall count as at least one standard automobile parking space only for the purpose of complying with any applicable minimum parking space requirements established by an enforcement agency. See Vehicle Code Section 22511.2 for further details.

TABLE 5.106.5.3.1

TOTAL NUMBER OF ACTUAL PARKING SPACES	NUMBER OF REQUIRED EV CAPABLE SPACES	NUMBER OF EVCS (EV CAPABLE SPACES PROVIDED WITH EVSE) ²
0–9	0	0
10–25	4	0
26–50	8	2
51–75	13	3
76–100	17	4
101–150	25	6
151–200	35	9
201 and over	20 percent of total ¹	25 percent of EV capable spaces ¹

1. Calculation for spaces shall be rounded up to the nearest whole number.
2. The number of required EVCS (EV capable spaces provided with EVSE) in column 3 count toward the total number of required EV capable spaces shown in column 2.

5.106.5.3.2 Electric vehicle charging stations (EVCS). EV capable spaces shall be provided with EVSE to create EVCS in the number indicated in Table 5.106.5.3.1. The EVCS required by Table 5.106.5.3.1 may be provided with EVSE in any combination of Level 2 and

Direct Current Fast Charging (DCFC), except that at least one Level 2 EVSE shall be provided.

One EV charger with multiple connectors capable of charging multiple EVs simultaneously shall be permitted if the electrical load capacity required by Section 5.106.5.3.1 for each EV capable space is accumulatively supplied to the EV charger.

The installation of each DCFC EVSE shall be permitted to reduce the minimum number of required EV capable spaces without EVSE by five and reduce proportionally the required electrical load capacity to the service panel or subpanel.

5.106.5.3.3 Use of automatic load management systems (ALMS). ALMS shall be permitted for EVCS. When ALMS is installed, the required electrical load capacity specified in Section 5.106.5.3.1 for each EVCS may be reduced when serviced by an EVSE controlled by an ALMS. Each EVSE controlled by an ALMS shall deliver a minimum 30 amperes to an EV when charging one vehicle and shall deliver a minimum 3.3 kW while simultaneously charging multiple EVs.

5.106.5.3.4 Accessible EVCS. When EVSE is installed, accessible EVCS shall be provided in accordance with the *California Building Code*, Chapter 11B, Section 11B-228.3.

Note: For EVCS signs, refer to Caltrans Traffic Operations Policy Directive 13-01 (Zero Emission Vehicle Signs and Pavement Markings) or its successor(s).

5.106.5.4 Electric vehicle (EV) charging: medium-duty and heavy-duty. [N]

Construction shall comply with Section 5.106.5.4.1 to facilitate future installation of electric vehicle supply equipment (EVSE). Construction for warehouses, grocery stores and retail stores with planned off-street loading spaces shall also comply with Section 5.106.5.4.1 for future installation of medium- and heavy-duty EVSE.

Exceptions:

1. On a case-by-case basis where the local enforcing agency has determined compliance with this section is not feasible based upon one of the following conditions:
 - a. Where there is no local utility power supply.
 - b. Where the local utility is unable to supply adequate power.
 - c. Where there is evidence suitable to the local enforcing agency substantiating that additional local utility infrastructure design requirements, directly related to the implementation of Section 5.106.5.3, may adversely impact the construction cost of the project.

When EVSE(s) is/are installed, it shall be in accordance with the *California Building Code*, the *California Electrical Code* and as follows:

5.106.5.4.1 Electric vehicle charging readiness requirements for warehouses, grocery stores and retail stores with planned off-street loading spaces. [N]

In order to avoid future demolition when adding EV supply and distribution equipment, spare raceway(s) or busway(s) and adequate capacity for transformer(s), service panel(s) or subpanel(s) shall be installed at the time of construction in accordance with the *California Electrical Code*. Construction plans and specifications shall include, but are not limited to, the following:

1. The transformer, main service equipment and subpanels shall meet the minimum power requirement in Table 5.106.5.4.1 to accommodate the dedicated branch circuits for the future installation of EVSE.
2. The construction documents shall indicate one or more location(s) convenient to the planned off-street loading space(s) reserved for medium- and heavy-duty ZEV charging cabinets and charging dispensers, and a pathway reserved for routing of conduit from the termination of the raceway(s) or busway(s) to the charging cabinet(s) and dispenser(s), as shown in Table 5.106.5.4.1.
3. Raceway(s) or busway(s) originating at a main service panel or a subpanel(s) serving the area where potential future medium- and heavy-duty EVSE will be located and shall terminate in close proximity to the potential future location of the charging equipment for medium- and heavy-duty vehicles.
4. The raceway(s) or busway(s) shall be of sufficient size to carry the minimum additional system load to the future location of the charging for medium- and heavy-duty ZEVs as shown in Table 5.106.5.4.1.

**TABLE 5.106.5.4.1
RACEWAY CONDUIT AND PANEL POWER
REQUIREMENTS FOR MEDIUM- AND HEAVY-DUTY EVSE [N]**

BUILDING TYPE	BUILDING SIZE (SQ. FT.)	NUMBER OF OFF-STREET LOADING SPACES	ADDITIONAL CAPACITY REQUIRED (KVA) FOR RACEWAY & BUSWAY AND TRANSFORMER & PANEL
Grocery	10,000 to 90,000	1 or 2	200
		3 or Greater	400
	Greater than 90,000	1 or Greater	400
Retail	10,000 to 135,000	1 or 2	200
		3 or Greater	400
	Greater than 135,000	1 or Greater	400
Warehouse	20,000 to 256,000	1 or 2	200
		3 or Greater	400
	Greater than 256,000	1 or Greater	400

5.106.8 Light pollution reduction. [N] Outdoor lighting systems shall be designed and installed to comply with the following:

1. The minimum requirements in the *California Energy Code* for Lighting Zones 0-4 as defined in Chapter 10, Section 10-114 of the *California Administrative Code*; and
2. Backlight (B) ratings as defined in IES TM-15-11 (shown in Table A-1 in Chapter 8);
3. Uplight and Glare ratings as defined in *California Energy Code* (shown in Tables 130.2-A and 130.2-B in Chapter 8) and
4. Allowable BUG ratings not exceeding those shown in Table 5.106.8 [N], or

Comply with a local ordinance lawfully enacted pursuant to Section 101.7, whichever is more stringent.

Exceptions:

1. Luminaires that qualify as exceptions in Sections 130.2(b) and 140.7 of the *California Energy Code*.
2. Emergency lighting.
3. Building facade meeting the requirements in Table 140.7-B of the *California Energy Code*, Part 6.
4. Custom lighting features as allowed by the local enforcing agency, as permitted by Section 101.8 Alternate materials, designs and methods of construction.
5. Luminaires with less than 6,200 initial luminaire lumens.

5.106.8.1 Facing – Backlight. Luminaires within 2MH of a property line shall be oriented so that the nearest property line is behind the fixture, and shall comply with the backlight rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point of that property line.

Exception: Corners. If two property lines (or two segments of the same property line) have equidistant points to the luminaire, then the luminaire may be oriented so that the intersection of the two lines (the corner) is directly behind the luminaire. The luminaire shall still use the distance to the nearest point(s) on the property lines to determine the required backlight rating.

5.106.8.2 Facing – Glare. For luminaires covered by 5.106.8.1, if a property line also exists within or extends into the front hemisphere within 2MH of the luminaire then the luminaire shall comply with the more stringent glare rating specified in Table 5.106.8 based on the lighting zone and distance to the nearest point on the nearest property line within the front hemisphere.

Notes:

1. See also *California Building Code*, Chapter 12, Section 1205.7 for college campus lighting requirements for parking facilities and walkways.
2. Refer to Chapter 8 (Compliance Forms, Worksheets and Reference Material) for IES TM-15-11 Table A-1, *California Energy Code* Tables 130.2-A and 130.2-B.
3. Refer to the *California Energy Code* for requirements for additions and alterations.

**TABLE 5.106.8 [N]
MAXIMUM ALLOWABLE BACKLIGHT, UPLIGHT AND GLARE (BUG) RATINGS^{1,2}**

ALLOWABLE RATING	LIGHTING ZONE LZ0	LIGHTING ZONE LZ1	LIGHTING ZONE LZ2	LIGHTING ZONE LZ3	LIGHTING ZONE LZ4
Maximum Allowable Backlight Rating (B)					
Luminaire greater than 2 mounting heights (MH) from property line	N/A	No Limit	No Limit	No Limit	No Limit
Luminaire back hemisphere is 1 – 2 MH from property line	N/A	B2	B3	B4	B4
Luminaire back hemisphere is 0.5 – 1 MH from property line	N/A	B1	B2	B3	B3
Luminaire back hemisphere is less than 0.5 MH from property line	N/A	B0	B0	B1	B2
Maximum Allowable Uplight Rating (U)					
For area lighting ³	N/A	U0	U0	U0	U0
For all other outdoor lighting, including decorative luminaires	N/A	U1	U2	U3	U4
Maximum Allowable Glare Rating (G)					
Luminaire greater than 2 MH from property line	N/A	G1	G2	G3	G4
Luminaire front hemisphere is 1 – 2 MH from property line	N/A	G0	G1	G1	G2
Luminaire front hemisphere is 0.5 – 1 MH from property line	N/A	G0	G0	G1	G1
Luminaire front hemisphere is less than 0.5 MH from property line	N/A	G0	G0	G0	G1

1. IESNA Lighting Zones 0 are not applicable; refer to Lighting Zones as defined in the *California Energy Code* and Chapter 10 of the *California Administrative Code*.
2. For property lines that abut public walkways, bikeways, plazas and parking lots, the property line may be considered to be 5 feet beyond the actual property line for purpose of determining compliance with this section. For property lines that abut public roadways and public transit corridors, the property line may be considered to be the centerline of the public roadway or public transit corridor for the purpose of determining compliance with this section.
3. General lighting luminaires in areas such as outdoor parking, sales or storage lots shall meet these reduced ratings. Decorative luminaires located in these areas shall meet U-value limits for “all other outdoor lighting.”

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5.106.10 Grading and paving. Construction plans shall indicate how site grading or a drainage system will manage all surface water flows to keep water from entering buildings. Examples of methods to manage surface water include, but are not limited to, the following:

1. Swales.
2. Water collection and disposal systems.
3. French drains.
4. Water retention gardens.
5. Other water measures which keep surface water away from buildings and aid in groundwater recharge.

Exception: Additions and alterations not altering the drainage path.

5.106.12 Shade trees. [DSA-SS] Shade trees shall be planted to comply with Sections 5.106.12.1, 5.106.12.2 and 5.106.12.3. Percentages shown shall be measured at noon on the summer solstice. Landscape irrigation necessary to establish and maintain tree health shall comply with Section 5.304.6.

5.106.12.1 Surface parking areas. Shade tree plantings, minimum No. 10 container size or equal, shall be installed to provide shade over 50 percent of the parking area within 15 years.

Exceptions: Surface parking area covered by solar photovoltaic shade structures or shade structures with roofing materials that comply with Table A5.106.11.2.2 in Appendix A5 shall be permitted in whole or in part in lieu of shade tree plantings.

5.106.12.2 Landscape areas. Shade tree plantings, minimum No. 10 container size or equal shall be installed to provide shade of 20% of the landscape area within 15 years.

Exception: Playfields for organized sport activity are not included in the total area calculation.

5.106.12.3 Hardscape areas. Shade tree plantings, minimum No. 10 container size or equal shall be installed to provide shade over 20 percent of the hardscape area within 15 years.

Exceptions:

1. Walks, hardscape areas covered by solar photovoltaic shade structures or shade structures with roofing materials that comply with Table A5.106.11.2.2 in Appendix A5 shall be permitted in whole or in part in lieu of shade tree plantings.
2. Designated and marked play areas of organized sport activity are not included in the total area calculation.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES
DIVISION 5.2 – ENERGY EFFICIENCY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	1	1R	2	3	4									5
Adopt entire CA chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																		X				
Chapter/Section																						
Division 5.2																		X				

**CHAPTER 5
NONRESIDENTIAL MANDATORY MEASURES**

Division 5.2 – ENERGY EFFICIENCY

**SECTION 5.201
GENERAL**

5.201.1 Scope. California Energy Code. For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory building standards.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES
DIVISION 5.3 – WATER EFFICIENCY AND CONSERVATION**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								X													
Chapter/Section																					
5.301.1								X													
5.302.1 Definitions								X													
5.303.3.1								X													
5.303.3.2								X													
5.303.3.3								X													
5.303.3.4								X													
5.303.6								X													
5.304.6 and subsections		†						X													

The state agency does not adopt sections identified by the following symbol: †.

**CHAPTER 5
NONRESIDENTIAL MANDATORY MEASURES**

Division 5.3 – WATER EFFICIENCY AND CONSERVATION

**SPECIAL LANDSCAPE AREA (SLA). [DSA-SS]
SUBMETER.**

**SECTION 5.301
GENERAL**

5.301.1 Scope. The provisions of this chapter shall establish the means of conserving water used indoors, outdoors and in wastewater conveyance.

**SECTION 5.302
DEFINITIONS**

5.302.1 Definitions. The following terms are defined in Chapter 2.

EVAPOTRANSPIRATION ADJUSTMENT FACTOR (ETAFA). [DSA-SS]

FOOTPRINT AREA [DSA-SS]

GRAYWATER.

METERING FAUCET.

MODEL WATER EFFICIENT LANDSCAPE ORDINANCE (MWELO).

POTABLE WATER.

RECLAIMED (RECYCLED) WATER.

RECYCLED WATER.

**SECTION 5.303
INDOOR WATER USE**

5.303.1 Meters. Separate submeters or metering devices shall be installed for the uses described in Sections 5.303.1.1 and 5.303.1.2.

5.303.1.1 New buildings or additions in excess of 50,000 square feet. Separate submeters shall be installed as follows:

1. For each individual leased, rented or other tenant space within the building projected to consume more than 100 gal/day (380 L/day), including, but not limited to, spaces used for laundry or cleaners, restaurant or food service, medical or dental office, laboratory, or beauty salon or barber shop.
2. Where separate submeters for individual building tenants are unfeasible, for water supplied to the following subsystems:
 - a. Makeup water for cooling towers where flow through is greater than 500 gpm (30 L/s).
 - b. Makeup water for evaporative coolers greater than 6 gpm (0.04 L/s).

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c. Steam and hot-water boilers with energy input more than 500,000 Btu/h (147 kW).

5.303.1.2 Excess consumption. A separate submeter or metering device shall be provided for any tenant within a new building or within an addition that is projected to consume more than 1,000 gal/day.

5.303.2 Reserved.

5.303.3 Water conserving plumbing fixtures and fittings. Plumbing fixtures (water closets and urinals) and fittings (faucets and showerheads) shall comply with the following:

5.303.3.1 Water closets. The effective flush volume of all water closets shall not exceed 1.28 gallons per flush. Tank-type water closets shall be certified to the performance criteria of the US EPA WaterSense Specification for Tank-Type Toilets.

Note: The effective flush volume of dual flush toilets is defined as the composite, average flush volume of two reduced flushes and one full flush.

5.303.3.2 Urinals.

5.303.3.2.1 Wall-mounted urinals. The effective flush volume of wall-mounted urinals shall not exceed 0.125 gallons per flush.

5.303.3.2.2 Floor-mounted urinals. The effective flush volume of floor-mounted or other urinals shall not exceed 0.5 gallons per flush.

5.303.3.3 Showerheads.

5.303.3.3.1 Single showerhead. Showerheads shall have a maximum flow rate of not more than 1.8 gallons per minute at 80 psi. Showerheads shall be certified to the performance criteria of the US EPA WaterSense Specification for Showerheads.

5.303.3.3.2 Multiple showerheads serving one shower. When a shower is served by more than one showerhead, the combined flow rate of all showerheads and/or other shower outlets controlled by a single valve shall not exceed 1.8 gallons per minute at 80 psi, or the shower shall be designed to allow only one shower outlet to be in operation at a time.

Note: A hand-held shower shall be considered a showerhead.

5.303.3.4 Faucets and fountains.

5.303.3.4.1 Nonresidential lavatory faucets. Lavatory faucets shall have a maximum flow rate of not more than 0.5 gallons per minute at 60 psi.

5.303.3.4.2 Kitchen faucets. Kitchen faucets shall have a maximum flow rate of not more than 1.8 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.8 gallons per minute at 60 psi.

5.303.3.4.3 Wash fountains. Wash fountains shall have a maximum flow rate of not more than 1.8 gallons per minute/20 [rim space (inches) at 60 psi].

5.303.3.4.4 Metering faucets. Metering faucets shall not deliver more than 0.20 gallons per cycle.

5.303.3.4.5 Metering faucets for wash fountains. Metering faucets for wash fountains shall have a maximum flow rate of not more than 0.20 gallons per cycle/20 [rim space (inches) at 60 psi].

Note: Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

5.303.3.4.6 Pre-rinse spray valve. When installed, shall meet the requirements in the *California Code of Regulations*, Title 20 (Appliance Efficiency Regulations), Section 1605.1(h)(4) Table H-2, Section 1605.3(h)(4)(A), and Section 1607(d)(7), and shall be equipped with an integral automatic shutoff.

FOR REFERENCE ONLY: The following table and code section have been reprinted from the *California Code of Regulations*, Title 20 (Appliance Efficiency Regulations), Section 1605.1(h)(4) and Section 1605.3(h)(4)(A).

**TABLE H-2
STANDARDS FOR COMMERCIAL PRE-RINSE SPRAY VALVES
MANUFACTURED ON OR AFTER JANUARY 28, 2019**

PRODUCT CLASS [spray force in ounce force (ozf)]	MAXIMUM FLOW RATE (gpm)
Product Class 1 (≤ 5.0 ozf)	1.00
Product Class 2 (> 5.0 ozf and ≤ 8.0 ozf)	1.20
Product Class 3 (> 8.0 ozf)	1.28

Title 20 Section 1605.3(h)(4)(A): Commercial pre-rinse spray valves manufactured on or after January 1, 2006, shall have a minimum spray force of not less than 4.0 ounces-force (ozf) [113 grams-force (gf)].

5.303.4 Commercial kitchen equipment.

5.303.4.1 Food waste disposers. Disposers shall either modulate the use of water to no more than 1 gpm when the disposer is not in use (not actively grinding food waste/no-load) or shall automatically shut off after no more than 10 minutes of inactivity. Disposers shall use no more than 8 gpm of water.

Note: This code section does not affect local jurisdiction authority to prohibit or require disposer installation.

5.303.5 Areas of addition or alteration. For those occupancies within the authority of the California Building Standards Commission as specified in Section 103, the provisions of Sections 5.303.3 and 5.303.4 shall apply to new fixtures in additions or areas of alteration to the building.

5.303.6 Standards for plumbing fixtures and fittings. Plumbing fixtures and fittings shall be installed in accordance with the *California Plumbing Code*, and shall meet the applicable standards referenced in Table 1701.1 of the *California Plumbing Code* and in Chapter 6 of this code.

SECTION 5.304 OUTDOOR WATER USE

5.304.1 Outdoor potable water use in landscape areas. Non-residential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent.

Notes:

1. The Model Water Efficient Landscape Ordinance (MWELO) is located in the *California Code of Regulations*, Title 23, Chapter 2.7, Division 2.
2. MWELO and supporting documents, including a water budget calculator, are available at: <https://www.water.ca.gov/>.

5.304.6 Outdoor potable water use in landscape areas. For public schools and community colleges, landscape projects as described in Sections 5.304.6.1 and 5.304.6.2 shall comply with the California Department of Water Resources Model Water Efficient Landscape Ordinance (MWELO) commencing with Section 490 of Chapter 2.7, Division 2, Title 23, *California Code of Regulations*, except that the evapotranspiration adjustment factor (ETAF) shall be 0.65 with an additional water allowance for special landscape areas (SLA) of 0.35.

Exception: Any project with an aggregate landscape area of 2,500 square feet or less may comply with the prescriptive measures contained in Appendix D of the MWELO.

5.304.6.1 Newly constructed landscapes. New construction projects with an aggregate landscape area equal to or greater than 500 square feet.

5.304.6.2 Rehabilitated landscapes. Rehabilitated landscape projects with an aggregate landscape area equal to or greater than 1,200 square feet.

SECTION 5.305 WATER REUSE SYSTEMS (Reserved)

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES
DIVISION 5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								X													
Chapter/Section																					
5.401.1								X													
5.402.1 Definitions								X													
5.407 and subsections								X													
5.408.1 and subsections								X													
5.410.1								X													
5.410.1.2								X													

**CHAPTER 5
NONRESIDENTIAL MANDATORY MEASURES**

Division 5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

**SECTION 5.401
GENERAL**

5.401.1 Scope. The provisions of this chapter shall outline means of achieving material conservation and resource efficiency through protection of buildings from exterior moisture, construction waste diversion, employment of techniques to reduce pollution through recycling of materials, and building commissioning or testing and adjusting.

**SECTION 5.402
DEFINITIONS**

5.402.1 Definitions. The following terms are defined in Chapter 2.

ADJUST.

BALANCE.

BUILDING COMMISSIONING.

ORGANIC WASTE.

TEST.

**SECTION 5.403
FOUNDATION SYSTEMS
(Reserved)**

**SECTION 5.404
EFFICIENT FRAMING TECHNIQUES
(Reserved)**

**SECTION 5.405
MATERIAL SOURCES
(Reserved)**

**SECTION 5.406
ENHANCED DURABILITY
AND REDUCED MAINTENANCE
(Reserved)**

**SECTION 5.407
WATER RESISTANCE AND
MOISTURE MANAGEMENT**

5.407.1 Weather protection. Provide a weather-resistant exterior wall and foundation envelope as required by *California Building Code* Section 1402.2 (Weather Protection), manufacturer’s installation instructions or local ordinance, whichever is more stringent.

5.407.2 Moisture control. Employ moisture control measures by the following methods.

5.407.2.1 Sprinklers. Design and maintain landscape irrigation systems to prevent spray on structures.

5.407.2.2 Entries and openings. Design exterior entries and/or openings subject to foot traffic or wind-driven rain to prevent water intrusion into buildings as follows:

5.407.2.2.1 Exterior door protection. Primary exterior entries shall be covered to prevent water intrusion by using nonabsorbent floor and wall finishes within at

NONRESIDENTIAL MANDATORY MEASURES

least 2 feet around and perpendicular to such openings plus at least one of the following:

1. An installed awning at least 4 feet in depth.
2. The door is protected by a roof overhang at least 4 feet in depth.
3. The door is recessed at least 4 feet.
4. Other methods which provide equivalent protection.

5.407.2.2.2 Flashing. Install flashings integrated with a drainage plane.

SECTION 5.408 CONSTRUCTION WASTE REDUCTION, DISPOSAL AND RECYCLING

5.408.1 Construction waste management. Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with Section 5.408.1.1, 5.408.1.2 or 5.408.1.3; or meet a local construction and demolition waste management ordinance, whichever is more stringent.

5.408.1.1 Construction waste management plan. Where a local jurisdiction does not have a construction and demolition waste management ordinance that is more stringent, submit a construction waste management plan that

1. Identifies the construction and demolition waste materials to be diverted from disposal by efficient usage, recycling, reuse on the project or salvage for future use or sale.
2. Determines if construction and demolition waste materials will be sorted on-site (source-separated) or bulk mixed (single stream).
3. Identifies diversion facilities where construction and demolition waste material collected will be taken.
4. Specifies that the amount of construction and demolition waste materials diverted shall be calculated by weight or volume, but not by both.

5.408.1.2 Waste management company. Utilize a waste management company that can provide verifiable documentation that the percentage of construction and demolition waste material diverted from the landfill complies with this section.

Note: The owner or contractor shall make the determination if the construction and demolition waste material will be diverted by a waste management company.

Exceptions to Sections 5.408.1.1 and 5.408.1.2:

1. Excavated soil and land-clearing debris.
2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
3. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

5.408.1.3 Waste stream reduction alternative. The combined weight of new construction disposal that does not exceed two pounds per square foot of building area may be deemed to meet the 65 percent minimum requirement as approved by the enforcing agency.

5.408.1.4 Documentation. Documentation shall be provided to the enforcing agency which demonstrates compliance with Sections 5.408.1.1 through 5.408.1.3. The waste management plan shall be updated as necessary and shall be accessible during construction for examination by the enforcing agency.

Notes:

1. Sample forms found in “A Guide to the California Green Building Standards Code (Nonresidential)” located at <https://www.dgs.ca.gov/BSC/Resources/Page-Content/Building-Standards-Commission-Resources-List-Folder/CALGreen> may be used to assist in documenting compliance with the waste management plan.
2. Mixed construction and demolition debris (C&D) processors can be located at the California Department of Resources Recycling and Recovery (CalRecycle).

5.408.2 Universal waste. [A] Additions and alterations to a building or tenant space that meet the scoping provisions in Section 301.3 for nonresidential additions and alterations, shall require verification that Universal Waste items such as fluorescent lamps and ballast and mercury containing thermostats as well as other California prohibited Universal Waste materials are disposed of properly and are diverted from landfills. A list of prohibited Universal Waste materials shall be included in the construction documents.

Note: Refer to the Universal Waste Rule link at: <https://dtsc.ca.gov/universalwaste/>

5.408.3 Excavated soil and land clearing debris. 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed.

Exception: Reuse, either on-or off-site, of vegetation or soil contaminated by disease or pest infestation.

Notes:

1. If contamination by disease or pest infestation is suspected, contact the County Agricultural Commissioner and follow its direction for recycling or disposal of the material. (www.cdffa.ca.gov/exec/county/county_contacts.html)
2. For a map of known pest and/or disease quarantine zones, consult with the California Department of Food and Agriculture. (www.cdffa.ca.gov)

SECTION 5.409 LIFE CYCLE ASSESSMENT (Reserved)

SECTION 5.410 BUILDING MAINTENANCE AND OPERATION

5.410.1 Recycling by occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste and metals, or meet a lawfully enacted local recycling ordinance, if more restrictive.

Exception: Rural jurisdictions that meet and apply for the exemption in Public Resources Code 42649.82 (a)(2)(A) et seq. shall also be exempt from the organic waste portion of this section.

5.410.1.1 Additions. All additions conducted within a 12-month period under single or multiple permits, resulting in an increase of 30 percent or more in floor area, shall provide recycling areas on site.

Exception: Additions within a tenant space resulting in less than a 30-percent increase in the tenant space floor area.

5.410.1.2 Sample ordinance. Space allocation for recycling areas shall comply with Chapter 18, Part 3, Division 30 of the *Public Resources Code*. Chapter 18 is known as the California Solid Waste Reuse and Recycling Access Act of 1991 (Act).

Note: A sample ordinance for use by local agencies may be found in Appendix A of the document at the CalRecycle's web site.

5.410.2 Commissioning. [N] New buildings 10,000 square feet and over. For new buildings 10,000 square feet and over, building commissioning shall be included in the design and construction processes of the building project to verify that the building systems and components meet the owner's or owner representative's project requirements. Commissioning shall be performed in accordance with this section by trained personnel with experience on projects of comparable size and complexity. For I-occupancies that are not regulated by OSHPD or for I-occupancies and L-occupancies that are not regulated by the *California Energy Code* Section 100.0 Scope, all requirements in Sections 5.410.2 through 5.410.2.6 shall apply.

Note: For energy-related systems under the scope (Section 100) of the *California Energy Code*, including heating, ventilation, air conditioning (HVAC) systems and controls, indoor lighting systems and controls, as well as water heating systems and controls, refer to *California Energy Code* Section 120.8 for commissioning requirements.

Commissioning requirements shall include:

1. Owner's or owner representative's project requirements.
2. Basis of design.
3. Commissioning measures shown in the construction documents.
4. Commissioning plan.

5. Functional performance testing.
6. Documentation and training.
7. Commissioning report.

Exceptions:

1. Unconditioned warehouses of any size.
2. Areas less than 10,000 square feet used for offices or other conditioned accessory spaces within unconditioned warehouses.
3. Tenant improvements less than 10,000 square feet as described in Section 303.1.1.
4. Open parking garages of any size, or open parking garage areas, of any size, within a structure.

Note: For the purposes of this section, unconditioned shall mean a building, area or room which does not provide heating and or air conditioning.

Informational Notes:

1. IAS AC 476 is an accreditation criteria for organizations providing training and/or certification of commissioning personnel. AC 476 is available to the Authority Having Jurisdiction as a reference for qualifications of commissioning personnel. AC 476 does not certify individuals to conduct functional performance tests or to adjust and balance systems.
2. Functional performance testing for heating, ventilation, air conditioning systems and lighting controls must be performed in compliance with the *California Energy Code*.

5.410.2.1 Owner's or Owner representative's Project Requirements (OPR). [N] The expectations and requirements of the building appropriate to its phase shall be documented before the design phase of the project begins. This documentation shall include the following:

1. Environmental and sustainability goals.
2. Building sustainable goals.
3. Indoor environmental quality requirements.
4. Project program, including facility functions and hours of operation, and need for after hours operation.
5. Equipment and systems expectations.
6. Building occupant and operation and maintenance (O&M) personnel expectations.

5.410.2.2 Basis of Design (BOD). [N] A written explanation of how the design of the building systems meets the OPR shall be completed at the design phase of the building project. The Basis of Design document shall cover the following systems:

1. Renewable energy systems.
2. Landscape irrigation systems.
3. Water reuse systems.

5.410.2.3 Commissioning plan. [N] Prior to permit issuance a commissioning plan shall be completed to docu-

NONRESIDENTIAL MANDATORY MEASURES

ment how the project will be commissioned. The commissioning plan shall include the following:

1. General project information.
2. Commissioning goals.
3. Systems to be commissioned. Plans to test systems and components shall include:
 - a. An explanation of the original design intent.
 - b. Equipment and systems to be tested, including the extent of tests.
 - c. Functions to be tested.
 - d. Conditions under which the test shall be performed.
 - e. Measurable criteria for acceptable performance.
4. Commissioning team information.
5. Commissioning process activities, schedules and responsibilities. Plans for the completion of commissioning shall be included.

5.410.2.4 Functional performance testing. [N] Functional performance tests shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the approved plans and specifications. Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized, and include any readings and adjustments made.

5.410.2.5 Documentation and training. [N] A systems manual and systems operations training are required, including Occupational Safety and Health Act (OSHA) requirements in *California Code of Regulations* (CCR), Title 8, Section 5142, and other related regulations.

5.410.2.5.1 Systems manual. [N] Documentation of the operational aspects of the building shall be completed within the systems manual and delivered to the building owner or representative. The systems manual shall include the following:

1. Site information, including facility description, history and current requirements.
2. Site contact information.
3. Basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, site events log.
4. Major systems.
5. Site equipment inventory and maintenance notes.
6. A copy of verifications required by the enforcing agency or this code.
7. Other resources and documentation, if applicable.

5.410.2.5.2 Systems operations training. [N] A program for training of the appropriate maintenance staff for each equipment type and/or system shall be developed and documented in the commissioning report and shall include the following:

1. System/equipment overview (what it is, what it does and with what other systems and/or equipment it interfaces).

2. Review and demonstration of servicing/preventive maintenance.
3. Review of the information in the systems manual.
4. Review of the record drawings on the system/equipment.

5.410.2.6 Commissioning report. [N] A report of commissioning process activities undertaken through the design and construction phases of the building project shall be completed and provided to the owner or representative.

5.410.4 Testing and adjusting. New buildings less than 10,000 square feet. Testing and adjusting of systems shall be required for new buildings less than 10,000 square feet or new systems to serve an addition or alteration subject to Section 303.1.

5.410.4.1 (Reserved)

Note: For energy-related systems under the scope (Section 100) of the *California Energy Code*, including heating, ventilation, air conditioning (HVAC) systems and controls, indoor lighting system and controls, as well as water heating systems and controls, refer to *California Energy Code* Section 120.8 for commissioning requirements and Sections 120.5, 120.6, 130.4 and 140.9(b)3 for additional testing requirements of specific systems.

5.410.4.2 Systems. Develop a written plan of procedures for testing and adjusting systems. Systems to be included for testing and adjusting shall include, as applicable to the project:

1. Renewable energy systems.
2. Landscape irrigation systems.
3. Water reuse systems.

5.410.4.3 Procedures. Perform testing and adjusting procedures in accordance with manufacturer's specifications and applicable standards on each system.

5.410.4.3.1 HVAC balancing. In addition to testing and adjusting, before a new space-conditioning system serving a building or space is operated for normal use, balance the system in accordance with the procedures defined by the Testing Adjusting and Balancing Bureau National Standards; the National Environmental Balancing Bureau Procedural Standards; Associated Air Balance Council National Standards or as approved by the enforcing agency.

5.410.4.4 Reporting. After completion of testing, adjusting and balancing, provide a final report of testing signed by the individual responsible for performing these services.

5.410.4.5 Operation and maintenance (O & M) manual. Provide the building owner or representative with detailed operating and maintenance instructions and copies of warranties/warranties for each system. O & M instructions shall be consistent with OSHA requirements in CCR, Title 8, Section 5142, and other related regulations.

5.410.4.5.1 Inspections and reports. Include a copy of all inspection verifications and reports required by the enforcing agency.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
CHAPTER 5 – NONRESIDENTIAL MANDATORY MEASURES
DIVISION 5.5 – ENVIRONMENTAL QUALITY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD						BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4	5								
Adopt entire CA chapter		X																				
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below								X														
Chapter/Section																						
5.501.1								X														
5.502.1 Definitions								X														
5.504.3								X														
5.504.4								X														
5.504.4.1								X														
Table 5.504.4.1								X														
Table 5.504.4.2								X														
5.504.4.3								X														
5.504.4.3.1								X														
Table 5.504.4.3								X														
5.504.4.3.2								X														
5.504.4.4 and subsections								X														
5.504.4.5								X														
Table 5.504.4.5								X														
5.504.4.6								X														
5.504.4.7 and subsections								X														
5.504.4.8 and subsections								X														
5.504.5.3								X														
5.505								X														
5.506.1								X														
5.506.3		†						X														
5.507.4 and subsections								X														
5.508.1 and subsections								X														

The state agency does not adopt sections identified by the following symbol: †.

CHAPTER 5

NONRESIDENTIAL MANDATORY MEASURES

Division 5.5 – ENVIRONMENTAL QUALITY

**SECTION 5.501
GENERAL**

5.501.1 Scope. The provisions of this chapter shall outline means of reducing the quantity of air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of a building’s installers, occupants and neighbors.

**SECTION 5.502
DEFINITIONS**

5.502.1 Definitions. The following terms are defined in Chapter 2.

ARTERIAL HIGHWAY.

A-WEIGHTED SOUND LEVEL (dBA).

1 BTU/HOUR.

COMMUNITY NOISE EQUIVALENT LEVEL (CNEL).

COMPOSITE WOOD PRODUCTS.

DAY-NIGHT AVERAGE SOUND LEVEL (Ldn).

DECIBEL (dB).

ENERGY EQUIVALENT (NOISE) LEVEL (L_{eq}).

EXPRESSWAY.

FREEWAY.

GLOBAL WARMING POTENTIAL (GWP).

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GLOBAL WARMING POTENTIAL VALUE (GWP VALUE).

HIGH-GWP REFRIGERANT.

LONG RADIUS ELBOW.

LOW-GWP REFRIGERANT.

MERV.

MAXIMUM INCREMENTAL REACTIVITY (MIR).

PRODUCT-WEIGHTED MIR (PWMIR).

PSIG.

REACTIVE ORGANIC COMPOUND (ROC).

SCHRADER ACCESS VALVES.

SHORT RADIUS ELBOW.

SUPERMARKET.

VOC.

**SECTION 5.503
FIREPLACES**

5.503.1 Fireplaces. Install only a direct-vent sealed-combustion gas or sealed wood-burning fireplace, or a sealed wood-stove or pellet stove, and refer to residential requirements in the *California Energy Code*, Title 24, Part 6, Subchapter 7, Section 150. Woodstoves, pellet stoves and fireplaces shall comply with applicable local ordinances.

5.503.1.1 Woodstoves. Woodstove and pellet stoves shall comply with US EPA New Source Performance Standards (NSPS) emission limits as applicable, and shall have a permanent label indicating they are certified to meet the emission limits.

**SECTION 5.504
POLLUTANT CONTROL**

5.504.1 Temporary ventilation. The permanent HVAC system shall only be used during construction if necessary to condition the building or areas of addition or alteration within the required temperature range for material and equipment installation. If the HVAC system is used during construction, use return air filters with a Minimum Efficiency Reporting Value (MERV) of 8, based on ASHRAE 52.2-1999, or an average efficiency of 30 percent based on ASHRAE 52.1-1992. Replace all filters immediately prior to occupancy, or, if the building is occupied during alteration, at the conclusion of construction.

5.504.3 Covering of duct openings and protection of mechanical equipment during construction. At the time of rough installation and during storage on the construction site until final startup of the heating, cooling and ventilating equipment, all duct and other related air distribution component openings shall be covered with tape, plastic, sheetmetal or other methods acceptable to the enforcing agency to reduce the amount of dust, water and debris which may enter the system.

5.504.4 Finish material pollutant control. Finish materials shall comply with Sections 5.504.4.1 through 5.504.4.6.

5.504.4.1 Adhesives, sealants and caulks. Adhesives, sealants and caulks used on the project shall meet the requirements of the following standards:

1. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable, or SCAQMD Rule 1168 VOC limits, as shown in Tables 5.504.4.1 and 5.504.4.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene), except for aerosol products as specified in subsection 2, below.
2. Aerosol adhesives, and smaller unit sizes of adhesives, and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of *California Code of Regulations*, Title 17, commencing with Section 94507.

**TABLE 5.504.4.1
ADHESIVE VOC LIMIT^{1,2}
Less Water and Less Exempt Compounds in Grams Per Liter**

ARCHITECTURAL APPLICATIONS	CURRENT VOC LIMIT
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesive	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250
Other adhesive not specifically listed	50
SPECIALTY APPLICATIONS	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Top and trim adhesive	250
SUBSTRATE SPECIFIC APPLICATIONS	
Metal to metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80

1. If an adhesive is used to bond dissimilar substrates together the adhesive with the highest VOC content shall be allowed.
2. For additional information regarding methods to measure the VOC content specified in this table, see South Coast Air Quality Management District Rule 1168, <http://www.arb.ca.gov/DRDB/SC/CURHTML/R1168.PDF>.

**TABLE 5.504.4.2
SEALANT VOC LIMIT
Less Water and Less Exempt Compounds in Grams per Liter**

SEALANTS	CURRENT VOC LIMIT
Architectural	250
Marine deck	760
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
SEALANT PRIMERS	
Architectural Nonporous	250
Porous	775
Modified bituminous	500
Marine deck	760
Other	750

Note: For additional information regarding methods to measure the VOC content specified in these tables, see South Coast Air Quality Management District Rule 1168.

5.504.4.3 Paints and coatings. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table 5.504.4.3, unless more stringent local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table 5.504.4.3 shall be determined by classifying the coating as a Flat, Nonflat or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board Suggested Control Measure, and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table 5.504.4.3 shall apply.

5.504.4.3.1 Aerosol paints and coatings. Aerosol paints and coatings shall meet the PWMIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of *California Code of Regulations*, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.

5.504.4.3.2 Verification. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:

1. Manufacturer’s product specification
2. Field verification of on-site product containers

**TABLE 5.504.4.3
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS^{2,3}
Grams of VOC per Liter of Coating,
Less Water and Less Exempt Compounds**

COATING CATEGORY	CURRENT LIMIT
Flat coatings	50
Nonflat coatings	100
Nonflat-high gloss coatings	150
SPECIALTY COATINGS	
Aluminum roof coatings	400
Basement specialty coatings	400
Bituminous roof coatings	50
Bituminous roof primers	350
Bond breakers	350
Concrete curing compounds	350
Concrete/masonry sealers	100
Driveway sealers	50
Dry fog coatings	150
Faux finishing coatings	350
Fire resistive coatings	350
Floor coatings	100
Form-release compounds	250
Graphic arts coatings (sign paints)	500
High temperature coatings	420
Industrial maintenance coatings	250
Low solids coatings ¹	120
Magnesite cement coatings	450
Mastic texture coatings	100
Metallic pigmented coatings	500
Multicolor coatings	250
Pretreatment wash primers	420
Primers, sealers and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Rust preventative coatings	250
Shellacs Clear	730
Opaque	550
Specialty primers, sealers and undercoaters	100
Stains	250
Stone consolidants	450
Swimming pool coatings	340
Traffic marking coatings	100
Tub and tile refinish coatings	420
Waterproofing membranes	250
Wood coatings	275
Wood preservatives	350
Zinc-rich primers	340

1. Grams of VOC per liter of coating, including water and including exempt compounds.
2. The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.
3. Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008. More information is available from the Air Resources Board.

5.504.4.4 Carpet systems. All carpet installed in the building interior shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

5.504.4.4.1 Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

5.504.4.4.2 Carpet adhesive. All carpet adhesive shall meet the requirements of Table 5.504.4.1.

5.504.4.5 Composite wood products. Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB’s Air Toxics Control Measure (ATCM) for Composite Wood (17 CCR 93120 et seq.) Those materials not exempted under the ATCM must meet the specified emission limits, as shown in Table 5.504.4.5.

**TABLE 5.504.4.5
FORMALDEHYDE LIMITS¹**

Maximum Formaldehyde Emissions in Parts per Million

PRODUCT	CURRENT LIMIT
Hardwood plywood veneer core	0.05
Hardwood plywood composite core	0.05
Particleboard	0.09
Medium density fiberboard	0.11
Thin medium density fiberboard ²	0.13

1. Values in this table are derived from those specified by the California Air Resources Board, Air Toxics Control Measure for Composite Wood as tested in accordance with ASTM E1333. For additional information, see *California Code of Regulations*, Title 17, Sections 93120 through 93120.12.

2. Thin medium density fiberboard has a maximum thickness of ⁵/₁₆ inch (8 mm).

5.504.4.5.1 Early compliance. Reserved.

5.504.4.5.3 Documentation. Verification of compliance with this section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the following:

1. Product certifications and specifications.

2. Chain of custody certifications.
3. Product labeled and invoiced as meeting the Composite Wood Products regulation (see CCR, Title 17, Section 93120, *et seq.*).
4. Exterior grade products marked as meeting the PS-1 or PS-2 standards of the Engineered Wood Association, the Australian AS/NZS 2269 or European 636 3S standards.
5. Other methods acceptable to the enforcing agency.

5.504.4.6 Resilient flooring systems. Where resilient flooring is installed, at least 80 percent of floor area receiving resilient flooring shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

5.504.4.6.1 Verification of compliance. Documentation shall be provided verifying that resilient flooring materials meet the pollutant emission limits.

5.504.4.7 Thermal insulation. Comply with the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

5.504.4.7.1 Verification of compliance. Documentation shall be provided verifying that thermal insulation materials meet the pollutant emission limits.

5.504.4.8 Acoustical ceilings and wall panels. Comply with the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

5.504.4.8.1 Verification of compliance. Documentation shall be provided verifying that acoustical finish materials meet the pollutant emission limits.

5.504.5.3 Filters. In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media for outside and return air that provides at least a Minimum Efficiency Reporting Value (MERV) of

13. MERV 13 filters shall be installed prior to occupancy, and recommendations for maintenance with filters of the same value shall be included in the operation and maintenance manual.

Exception: Existing mechanical equipment.

5.504.5.3.1 Labeling. Installed filters shall be clearly labeled by the manufacturer indicating the MERV rating.

5.504.7 Environmental tobacco smoke (ETS) control. Where outdoor areas are provided for smoking, prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows and within the building as already prohibited by other laws or regulations; or as enforced by ordinances, regulations or policies of any city, county, city and county, California Community College, campus of the California State University, or campus of the University of California, whichever are more stringent. When ordinances, regulations or policies are not in place, post signage to inform building occupants of the prohibitions.

SECTION 5.505 INDOOR MOISTURE CONTROL

5.505.1 Indoor moisture control. Buildings shall meet or exceed the provisions of *California Building Code*, CCR, Title 24, Part 2, Sections 1202 (Ventilation) and Chapter 14 (Exterior Walls). For additional measures, see Section 5.407.2 of this code.

SECTION 5.506 INDOOR AIR QUALITY

5.506.1 Outside air delivery. For mechanically or naturally ventilated spaces in buildings, meet the minimum requirements of Section 120.1 (Requirements For Ventilation) of the *California Energy Code*, or the applicable local code, whichever is more stringent, and Division 1, Chapter 4 of CCR, Title 8.

5.506.2 Carbon dioxide (CO₂) monitoring. For buildings or additions equipped with demand control ventilation, CO₂ sensors and ventilation controls shall be specified and installed in accordance with the requirements of the *California Energy Code*, Section 120.1(c)(4).

5.506.3 Carbon dioxide (CO₂) monitoring in classrooms. (DSA-SS) Each public K-12 school classroom, as listed in Table 120.1-A of the *California Energy Code*, shall be equipped with a carbon dioxide monitor or sensor that meets the following requirements:

1. The monitor or sensor shall be permanently affixed in a tamper-proof manner in each classroom between 3 and 6 feet (914 mm and 1829 mm) above the floor and at least 5 feet (1524 mm) away from doors and operable windows.
2. When the monitor or sensor is not integral to an Energy Management Control System (EMCS), the monitor or sensor shall display the carbon dioxide readings on the device. When the sensor is integral to an EMCS, the carbon dioxide readings shall be available to and regularly monitored by facility personnel.

3. A monitor shall provide notification through a visual indicator on the monitor when the carbon dioxide levels in the classroom have exceeded 1,100 ppm. A sensor integral to an EMCS shall provide notification to facility personnel through a visual and/or audible indicator when the carbon dioxide levels in the classroom have exceeded 1,100 ppm.
4. The monitor or sensor shall measure carbon dioxide levels at minimum 15-minute intervals and shall maintain a record of previous carbon dioxide measurements of not less than 30 days duration.
5. The monitor or sensor used to measure carbon dioxide levels shall have the capacity to measure carbon dioxide levels with a range of 400 ppm to 2000 ppm or greater.
6. The monitor or sensor shall be certified by the manufacturer to be accurate within 75 ppm at 1,000 ppm carbon dioxide concentration and shall be certified by the manufacturer to require calibration no more frequently than once every 5 years.

SECTION 5.507 ENVIRONMENTAL COMFORT

5.507.4 Acoustical control. Employ building assemblies and components with Sound Transmission Class (STC) values determined in accordance with ASTM E90 and ASTM E413 or Outdoor-Indoor Sound Transmission Class (OITC) determined in accordance with ASTM E1332, using either the prescriptive or performance method in Section 5.507.4.1 or 5.507.4.2.

Exception: Buildings with few or no occupants or where occupants are not likely to be affected by exterior noise, as determined by the enforcement authority, such as factories, stadiums, storage, enclosed parking structures and utility buildings.

Exception: [DSA-SS] For public schools and community colleges, the requirements of this section and all subsections apply only to new construction.

5.507.4.1 Exterior noise transmission, prescriptive method. Wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall meet a composite STC rating of at least 50 or a composite OITC rating of no less than 40, with exterior windows of a minimum STC of 40 or OITC of 30 in the following locations:

1. Within the 65 CNEL noise contour of an airport.

Exceptions:

1. L_{dn} or CNEL for military airports shall be determined by the facility Air Installation Compatible Land Use Zone (AICUZ) plan.
2. L_{dn} or CNEL for other airports and heliports for which a land use plan has not been developed shall be determined by the local general plan noise element.
2. Within the 65 CNEL or L_{dn} noise contour of a freeway or expressway, railroad, industrial source or

NONRESIDENTIAL MANDATORY MEASURES

fixed-guideway source as determined by the Noise Element of the General Plan.

5.507.4.1.1 Noise exposure where noise contours are not readily available. Buildings exposed to a noise level of 65 dB L_{eq} -1-hr during any hour of operation shall have building, addition or alteration exterior wall and roof-ceiling assemblies exposed to the noise source meeting a composite STC rating of at least 45 (or OITC 35), with exterior windows of a minimum STC of 40 (or OITC 30).

5.507.4.2 Performance method. For buildings located as defined in Section 5.507.4.1 or 5.507.4.1.1, wall and roof-ceiling assemblies exposed to the noise source making up the building or addition envelope or altered envelope shall be constructed to provide an interior noise environment attributable to exterior sources that does not exceed an hourly equivalent noise level (L_{eq} -1Hr) of 50 dBA in occupied areas during any hour of operation.

5.507.4.2.1 Site features. Exterior features such as sound walls or earth berms may be utilized as appropriate to the building, addition or alteration project to mitigate sound migration to the interior.

5.507.4.2.2 Documentation of compliance. An acoustical analysis documenting complying interior sound levels shall be prepared by personnel approved by the architect or engineer of record.

5.507.4.3 Interior sound transmission. Wall and floor-ceiling assemblies separating tenant spaces and tenant spaces and public places shall have an STC of at least 40.

Note: Examples of assemblies and their various STC ratings may be found at the California Office of Noise Control: http://www.toolbase.org/PDF/CaseStudies/stc_icc_ratings.pdf.

SECTION 5.508 OUTDOOR AIR QUALITY

5.508.1 Ozone depletion and greenhouse gas reductions. Installations of HVAC, refrigeration and fire suppression equipment shall comply with Sections 5.508.1.1 and 5.508.1.2.

5.508.1.1 Chlorofluorocarbons (CFCs). Install HVAC, refrigeration and fire suppression equipment that do not contain CFCs.

5.508.1.2 Halons. Install HVAC, refrigeration and fire suppression equipment that do not contain Halons.

5.508.2 Supermarket refrigerant leak reduction. New commercial refrigeration systems shall comply with the provisions of this section when installed in retail food stores 8,000 square feet or more conditioned area, and that utilize either refrigerated display cases, or walk-in coolers or freezers connected to remote compressor units or condensing units. The leak reduction measures apply to refrigeration systems containing high-global-warming potential (high-GWP) refrigerants with a GWP of 150 or greater. New refrigeration systems include both new facilities and the

replacement of existing refrigeration systems in existing facilities.

Exception: Refrigeration systems containing low-global warming potential (low-GWP) refrigerant with a GWP value less than 150 are not subject to this section. Low-GWP refrigerants are nonozone-depleting refrigerants that include ammonia, carbon dioxide (CO₂), and potentially other refrigerants.

5.508.2.1 Refrigerant piping. Piping compliant with the *California Mechanical Code* shall be installed to be accessible for leak protection and repairs. Piping runs using threaded pipe, copper tubing with an outside diameter (OD) less than 1/4 inch, flared tubing connections and short radius elbows shall not be used in refrigerant systems except as noted below.

5.508.2.1.1 Threaded pipe. Threaded connections are permitted at the compressor rack.

5.508.2.1.2 Copper pipe. Copper tubing with an OD less than 1/4 inch may be used in systems with a refrigerant charge of 5 pounds or less.

5.508.2.1.2.1 Anchorage. One-fourth-inch OD tubing shall be securely clamped to a rigid base to keep vibration levels below 8 mils.

5.508.2.1.3 Flared tubing connections. Double-flared tubing connections may be used for pressure controls, valve pilot lines and oil.

Exception: Single-flared tubing connections may be used with a multiring seal coated with industrial sealant suitable for use with refrigerants and tightened in accordance with manufacturer's recommendations.

5.508.2.1.4 Elbows. Short radius elbows are only permitted where space limitations prohibit use of long radius elbows.

5.508.2.2 Valves. Valves and fittings shall comply with the *California Mechanical Code* and as follows.

5.508.2.2.1 Pressure relief valves. For vessels containing high-GWP refrigerant, a rupture disc shall be installed between the outlet of the vessel and the inlet of the pressure relief valve.

5.508.2.2.1.1 Pressure detection. A pressure gauge, pressure transducer or other device shall be installed in the space between the rupture disc and the relief valve inlet to indicate a disc rupture or discharge of the relief valve.

5.508.2.2.2 Access valves. Only Schrader access valves with a brass or steel body are permitted for use.

5.508.2.2.2.1 Valve caps. For systems with a refrigerant charge of 5 pounds or more, valve caps shall be brass or steel and not plastic.

5.508.2.2.2.2 Seal caps. If designed for it, the cap shall have a neoprene O-ring in place.

5.508.2.2.2.1 Chain tethers. Chain tethers to fit over the stem are required for valves designed to have seal caps.

Exception: Valves with seal caps that are not removed from the valve during stem operation.

5.508.2.3 Refrigerated service cases. Refrigerated service cases holding food products containing vinegar and salt shall have evaporator coils of corrosion-resistant material, such as stainless steel; or be coated to prevent corrosion from these substances.

5.508.2.3.1 Coil coating. Consideration shall be given to the heat transfer efficiency of coil coating to maximize energy efficiency.

5.508.2.4 Refrigerant receivers. Refrigerant receivers with capacities greater than 200 pounds shall be fitted with a device that indicates the level of refrigerant in the receiver.

5.508.2.5 Pressure testing. The system shall be pressure tested during installation prior to evacuation and charging.

5.508.2.5.1 Minimum pressure. The system shall be charged with regulated dry nitrogen and appropriate tracer gas to bring system pressure up to 300 psig minimum.

5.508.2.5.2 Leaks. Check the system for leaks, repair any leaks and retest for pressure using the same gauge.

5.508.2.5.3 Allowable pressure change. The system shall stand, unaltered, for 24 hours with no more than a +/- one pound pressure change from 300 psig, measured with the same gauge.

5.508.2.6 Evacuation. The system shall be evacuated after pressure testing and prior to charging.

5.508.2.6.1 First vacuum. Pull a system vacuum down to at least 1000 microns (+/- 50 microns), and hold for 30 minutes.

5.508.2.6.2 Second vacuum. Pull a second system vacuum to a minimum of 500 microns and hold for 30 minutes.

5.508.2.6.3 Third vacuum. Pull a third vacuum down to a minimum of 300 microns, and hold for 24 hours with a maximum drift of 100 microns over a 24-hour period.

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

CHAPTER 6 – REFERENCED ORGANIZATIONS AND STANDARDS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X		X				X	X		X		X								
Adopt entire chapter as amendeded (amended sections listed below)																					
Adopt only those sections that are listed below																					
Chapter/Section																					

CHAPTER 6

REFERENCED ORGANIZATIONS AND STANDARDS

SECTION 601 GENERAL

601.1 This chapter lists the organizations and standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard.

ORGANIZATION	STANDARD	REFERENCED SECTION
AHAM Association of Home Appliance Manufacturers		
1119 19th Street NW, Suite 402 Washington, D.C. 20026-3627 http://www.aham.org	ANSI/AHAM DW-1-2010	202
AABC Associated Air Balance Council		
1518 K St NW Washington, DC 20005 www.aabc.com	National Standards, 1989	5.410.4.3.1 A5.410.5.3.1
ACCA Air Conditioning Contractors of America		
2800 Shirlington Road, Suite 300 Arlington, VA 22206 www.acca.org	ANSI/ACCA 2 Manual J–2016 ANSI/ACCA 1 Manual D–2016 ANSI/ACCA 3 Manual S–2014	4.507.2 4.507.2 4.507.2
ANSI American National Standards Institute		
Operations Office 25 West 43rd Street, Fourth Floor New York, NY 10036 www.ansi.org	ANSI/AHAM DW-1-2010 NSF/ANSI 140-2014 ANSI/ACCA 2 Manual J–2016 ANSI/ACCA 1 Manual D–2016 ANSI/ACCA 3 Manual S–2014	202 4.504.3 4.507.2 4.507.2 4.507.2
ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.		
1791 Tullie Circle, NE Atlanta, GA 30329 www.ashrae.org	52.1-92 52.2-2007 62.2 90.1	A5.504.1 202 A5.504.1 5.108.8

continued

REFERENCED ORGANIZATIONS AND STANDARDS

ASME American Society of Mechanical Engineers		
Three Park Avenue New York, NY 10016-5990 www.asme.org	ASME A112.18.1 ASME A112.19 ASME A112.19.2 ASME A112.19.14	5.303.6 5.303.6 5.303.2 5.303.6
ASTM ASTM International		
100 Barr Harbor Drive West Conshohocken, PA 19428-2859 www.astm.org	ASTM C33 ASTM C150 ASTM C595 ASTM C618 ASTM C989 ASTM C1157 ASTM C1240 ASTM C1371-98 ASTM C1549-09(2014) ASTM C1602 ASTM C1697 ASTM E90 ASTM E408-02 ASTM E413 ASTM E1332 ASTM E1333-14 ASTM E1903-11 ASTM E1918-06(2015) ASTM E1918-16 (2016) ASTM E1980-11	A5.405.5.3.2 A5.405.5.1 A5.405.5.1 A5.405.5.2.1 A5.405.5.2.1 A5.405.5.1 A5.405.5.2.1 A5.106.11.2.2 A4.106.7, A5.106.11.1 A5.405.5.3.2.3 A5.405.5.2.1 5.507.4 A5.10, 6.11.2.2 5.507.4 5.507.4 Tables 4.504.5, 5.504.4.5, 5.504.8.5 A5.103.2.1 A4.106.7 A5.106.11.1 A4.106.5.3, A5.106.11.2.3
CSA Canadian Standards Association		
5060 Spectrum Way, Suite 100 Mississauga, Ontario, Canada L4W 5N6 www.csa.ca	CSA B125.1, CSA O121, CSA O151, CSA O153, CSA O325	4.504.5.1
IAPMO International Association of Plumbing and Mechanical Officials		
4755 E. Philadelphia St. Ontario, CA 91761 iapmo@iapmo.org	IAPMO Z124.9	5.303.6
IESNA Illuminating Engineering Society of North America		
170 Wall St., Floor 17 New York, NY 10005-4001 http://www.ies.org	IES TM-15-11	5.10 6.6 A4.106.10
NEBB National Environmental Balancing Bureau		
8575 Grovemont Cir Gaithersburg, MD 20877 http://nebb.org/index.php	Procedural Standards, 1983	5.410.4.3.1 A5.410.5.3.1
NSF International		
789 Dixboro Rd. Ann Arbor, MI 48113-0140 http://www.nsf.org/	NSF/ANSI 140-2014	4.504.3
TABB Testing, Adjusting and Balancing Bureau		
601 N Fairfax St, Ste 250 Alexandria, VA 22314 http://www.tabbcertified.org/contact.html	National Standards, 2003	5.410.3.3.1 A5.410.5.3.1
US EPA United States Environmental Protection Agency		
Office of Wastewater Management (4204M) 1200 Pennsylvania Avenue Washington, D.C. 20460 http://www.epa.gov/watersense/	WaterSense	4.303.1

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE CHAPTER 7 – INSTALLER AND SPECIAL INSPECTOR QUALIFICATIONS

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter				X																	
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below		X																			
Chapter/Section																					
702.2		X																			
703.1		X																			

CHAPTER 7

INSTALLER AND SPECIAL INSPECTOR QUALIFICATIONS

SECTION 701 GENERAL (Reserved)

SECTION 702 QUALIFICATIONS

702.1 Installer training. HVAC system installers shall be trained and certified in the proper installation of HVAC systems including ducts and equipment by a nationally or regionally recognized training or certification program. Uncertified persons may perform HVAC installations when under the direct supervision and responsibility of a person trained and certified to install HVAC systems or contractor licensed to install HVAC systems. Examples of acceptable HVAC training and certification programs include but are not limited to the following:

1. State certified apprenticeship programs.
2. Public utility training programs.
3. Training programs sponsored by trade, labor or state-wide energy consulting or verification organizations.
4. Programs sponsored by manufacturing organizations.
5. Other programs acceptable to the enforcing agency.

702.2 Special inspection. [HCD] When required by the enforcing agency, the owner or the responsible entity acting as the owner’s agent shall employ one or more special inspectors to provide inspection or other duties necessary to substantiate compliance with this code. Special inspectors shall demonstrate competence to the satisfaction of the enforcing agency for the particular type of inspection or task to be per-

formed. In addition to other certifications or qualifications acceptable to the enforcing agency, the following certifications or education may be considered by the enforcing agency when evaluating the qualifications of a special inspector:

1. Certification by a national or regional green building program or standard publisher.
2. Certification by a statewide energy consulting or verification organization, such as HERS raters, building performance contractors and home energy auditors.
3. Successful completion of a third party apprentice training program in the appropriate trade.
4. Other programs acceptable to the enforcing agency.

Notes:

1. Special inspectors shall be independent entities with no financial interest in the materials or the project they are inspecting for compliance with this code.
2. HERS raters are special inspectors certified by the California Energy Commission (CEC) to rate homes in California according to the Home Energy Rating System (HERS).

[BSC-CG] When required by the enforcing agency, the owner or the responsible entity acting as the owner’s agent shall employ one or more special inspectors to provide inspection or other duties necessary to substantiate compliance with this code. Special inspectors shall demonstrate competence to the satisfaction of the enforcing agency for the particular type of inspection or task to be performed. In addition, the special inspector shall have a certification from a recognized state, national or international association, as determined by the local agency. The area of certification shall

INSTALLER AND SPECIAL INSPECTOR QUALIFICATIONS

be closely related to the primary job function, as determined by the local agency.

Note: Special inspectors shall be independent entities with no financial interest in the materials or the project they are inspecting for compliance with this code.

SECTION 703 VERIFICATIONS

703.1 Documentation. Documentation used to show compliance with this code shall include but is not limited to, construction documents, plans, specifications, builder or installer certification, inspection reports or other methods acceptable to the enforcing agency which demonstrate substantial conformance. When specific documentation or special inspection is necessary to verify compliance, that method of compliance will be specified in the appropriate section or identified in the application checklist.

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE CHAPTER 8 – COMPLIANCE FORMS, WORKSHEETS AND REFERENCE MATERIAL

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								X													
Chapter/Section																					
IES TM-15-11 Table A-1								X													
Table 130.2-A								X													
Table 1302.2-B								X													

CHAPTER 8

COMPLIANCE FORMS, WORKSHEETS AND REFERENCE MATERIAL

[BSC] Sample forms found in “A Guide to the California Green Building Standards Code (Nonresidential)” located at <https://www.dgs.ca.gov/BSC/Resources/Page-Content/Building-Standards-Commission-Resources-List-Folder/CALGreen> may be used to assist in documenting compliance with the waste management plan and other provisions of this code.

[HCD 1] Sample forms located at www.hcd.ca.gov/building-standards/calgreen/cal-green-forms.shtml may be used to assist in documenting compliance with *CALGreen*.

WORKSHEET (WS-1) BASELINE WATER USE

BASELINE WATER USE CALCULATION TABLE								
FIXTURE TYPE	FLOW RATE		DURATION		DAILY USES		OCCUPANTS ¹	GALLONS PER DAY
Showerheads	1.8 gpm @ 80 psi	×	5 min.	×	1	×	Note 1a	=
Lavatory faucets nonresidential	0.5 gpm @ 60 psi	×	.25 min.	×	3	×		=
Kitchen faucets	1.8 gpm @ 60 psi	×	4 min.	×	1	×	Note 1b	=
Replacement aerators	2.2 gpm	×		×		×		=
Wash fountains	1.8 gpm/20 [rim space(in.)@ 60 psi]	×		×		×		=
Metering faucets	0.20 gal/cycle	×		×	3	×		=
Metering faucets for wash fountains	0.20 gal/cycle/20 [rim space(in.)@ 60 psi]	×	.25 min.	×		×		=
Gravity tank-type water closets	1.28 gal/flush	×	1 flush	×	1 male ² 3 female	×		=
Flushometer tank water closets	1.28 gal/flush	×	1 flush	×	1 male ² 3 female	×		=
Flushometer valve water closets	1.28 gal/flush	×	1 flush	×	1 male ² 3 female	×		=
Electromechanical hydraulic water closets	1.28 gal/flush	×	1 flush	×	1 male ² 3 female	×		=
Urinals	0.5 or 0.125 ³ gal/flush	×	1 flush	×	2 male	×		=
Total daily baseline water use (BWU)								=

1. For nonresidential occupancies, refer to Table 4-1, Chapter 4, 2022 *California Plumbing Code*, for occupant load factors.
 - a. Shower use by occupants depends on the type of use of a building or portion of a building, e.g., total occupant load for a health club, but only a fraction of the occupants in an office building as determined by the anticipated number of users.
 - b. Kitchen faucet use is determined by the occupant load of the area served by the fixture.
2. The daily use number shall be increased to three if urinals are not installed in the room.
3. Floor-mounted urinals @ 0.5 GPF or wall-mounted urinals @ 0.125 GPF.

**WORKSHEET (WS-2)
WATER USE REDUCTION**

12-, 20- OR 25-PERCENT REDUCTION WATER USE CALCULATION TABLE									
FIXTURE TYPE	FLOW RATE		DURATION		DAILY USES		OCCUPANTS ¹		GALLONS PER DAY
Showerheads		×	5 min.	×	1	×	Note 1a	=	
Lavatory faucets nonresidential ⁴		×	.25 min.	×	3	×		=	
Kitchen faucets		×	4 min.	×	1	×	Note 1b	=	
Replacement aerators		×		×		×		=	
Wash fountains		×		×		×		=	
Metering faucets		×	.25 min.	×	3	×		=	
Metering faucets for wash fountains		×	.25 min.	×		×		=	
Gravity tank-type water closets		×	1 flush	×	1 male ³ 3 female	×		=	
Flushometer tank water closets		×	1 flush	×	1 male ³ 3 female	×		=	
Flushometer valve water closets		×	1 flush	×	1 male ³ 3 female	×		=	
Electromechanical hydraulic water closets		×	1 flush	×	1 male ³ 3 female	×		=	
Urinals		×	1 flush	×	2 male	×		=	
Urinals Nonwater supplied	0.0 gal/flush		1 flush		2 male	×			
Proposed water use								=	
12% Reduction _____ (BWU from WS-1) × .88 = _____ Allowable water use 20% Reduction _____ (BWU from WS-1) × .80 = _____ Allowable water use 25% Reduction _____ (BWU from WS-1) × .75 = _____ Allowable water use									

1. For occupancies, refer to Table 4-1, Chapter 4, 2022 *California Plumbing Code*, for occupant load factors.
 - a. Shower use by occupants depends on the type of use of a building or portion of a building, e.g., total occupant load for a health club, but only a fraction of the occupants in an office building as determined by the anticipated number of users.
 - b. Kitchen faucet use is determined by the occupant load of the area served by the fixture.
2. Includes single and dual flush water closets with an effective flush of 1.28 gallons or less.
 - Single flush toilets - The effective flush volume shall not exceed 1.28 gallons (4.8 liters). The effective flush volume is the average flush volume when tested in accordance with ASME A112.19.2.
 - Dual flush toilets - The effective flush volume shall not exceed 1.28 gallons (4.8 liters). The effective flush volume is defined as the composite, average flush volume of two reduced flushes and one full flush. Flush volumes will be tested in accordance with ASME A112.19.2 and ASME A112.19.14.
3. The daily use number shall be increased to three if urinals are not installed in the room.
4. Where complying faucets are unavailable, aerators rated at 35 gpm or other means may be used to achieve reduction.

Construction Waste Management (CWM) Plan

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____
 Job #: _____
 Project Manager: _____
 Waste Hauling Company: _____
 Contact Name: _____

All Subcontractors shall comply with the project’s Construction Waste Management Plan. All Subcontractor foremen shall sign the CWM Plan Acknowledgment Sheet.

Subcontractors who fail to comply with the Waste Management Plan will be subject to backcharges or withholding of payment, as deemed appropriate. For instance, Subcontractors who contaminate debris boxes that have been designated for a single material type will be subject to backcharge or withheld payment, as deemed appropriate.

1. The project’s overall rate of waste diversion will be ____ %.
2. This project shall generate the least amount of waste possible by planning and ordering carefully, following all proper storage and handling procedures to reduce broken and damaged materials and reusing materials whenever possible. The majority of the waste that is generated on this jobsite will be diverted from the landfill and recycled for other use.
3. Spreadsheet 1, enclosed, identifies the waste materials that will be generated on this project, the diversion strategy for each waste type and the anticipated diversion rate.
4. Waste prevention and recycling activities will be discussed at the beginning of weekly subcontractor meetings. As each new subcontractor comes on-site, the WMP Coordinator will present him/her with a copy of the CWM Plan and provide a tour of the jobsite to identify materials to be salvaged and the procedures for handling jobsite debris. All Subcontractor foremen will acknowledge in writing that they have read and will abide by the CWM Plan. Subcontractor Acknowledgment Sheet enclosed. The CWM Plan will be posted at the jobsite trailer.
5. Salvage: Excess materials that cannot be used in the project, nor returned to the vendor, will be offered to site workers, the owner or donated to charity if feasible.
6. [HAULING COMPANY] will provide a commingled drop box at the jobsite for most of the construction waste. These commingled drop boxes will be taken to [Sorting Facility Name and Location]. The average diversion rate for commingled waste will be ____%. As site conditions permit, additional drop boxes will be used for particular phases of construction (e.g., concrete and wood waste) to ensure the highest waste diversion rate possible.
7. In the event that the waste diversion rate achievable via the strategy described in (6) above, is projected to be lower than what is required, then a strategy of source-separated waste diversion and/or waste stream reduction will be implemented. Source separated waste refers to jobsite waste that is not commingled but is instead allocated to a debris box designated for a single material type, such as clean wood or metal.

Notes:

1. Waste stream reduction refers to efforts taken by the builder to reduce the amount of waste generated by the project to below four (4) pounds per square foot of building area.
2. When using waste stream reduction measures, the gross weight of the product is subtracted from a base weight of four (4) pounds per square foot of building area. This reduction is considered additional diversion and can be used in the waste reduction percentage calculations.
8. [HAULING COMPANY] will track and calculate the quantity (in tons) of all waste leaving the project and calculate the waste diversion rate for the project. [HAULING COMPANY] will provide Project Manager with an updated monthly report on gross weight hauled and the waste diversion rate being achieved on the project. [HAULING COMPANY’s] monthly report will track separately the gross weights and diversion rates for commingled debris and for each source-separated waste stream leaving the project. In the event that [HAULING COMPANY] does not service any or all of the debris boxes on the project, the [HAULING COMPANY] will work with the responsible parties to track the material type and weight (in tons) in such debris boxes in order to determine waste diversion rates for these materials.
9. In the event that Subcontractors furnish their own debris boxes as part of their scope of work, such Subcontractors shall not be excluded from complying with the CWM Plan and will provide [HAULING COMPANY] weight and waste diversion data for their debris boxes.
10. In the event that site use constraints (such as limited space) restrict the number of debris boxes that can be used for collection of designated waste the project Superintendent will, as deemed appropriate, allocate specific areas onsite where individual material types are to be consolidated. These collection points are not to be contaminated with non-designated waste types.
11. Debris from jobsite office and meeting rooms will be collected by [DISPOSAL SERVICE COMPANY]. [DISPOSAL SERVICE COMPANY] will, at a minimum, recycle office paper, plastic, metal and cardboard.

Construction Waste Management (CWM) Worksheet

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____			
Job Number: _____			
Project Manager: _____			
Waste Hauling Company: _____			
Construction Waste Management (CWM) Plan			
DIVERSION METHOD:			
WASTE MATERIAL TYPE	COMMINGLED AND SORTED OFF SITE	SOURCE SEPARATED ON SITE	PROJECTED DIVERSION RATE
Asphalt			
Concrete			
Shotcrete			
Metals			
Wood			
Rigid insulation			
Fiberglass insulation			
Acoustic ceiling tile			
Gypsum drywall			
Carpet/carpet pad			
Plastic pipe			
Plastic buckets			
Plastic			
Hardiplank siding and boards			
Glass			
Cardboard			
Pallets			
Job office trash, paper, glass & plastic bottles, cans, plastic			
Alkaline and rechargeable batteries, toner cartridges and electronic devices			
Other:			
Other:			
Other:			
Other:			

Construction Waste Management (CWM) Acknowledgment

Note: This sample form may be used to assist in documenting compliance with the waste management plan.

Project Name: _____

Job Number: _____

Project Manager: _____

Waste Hauling Company: _____

CWM Plan Acknowledgment

The Foreman for each new Subcontractor that comes on site is to receive a copy of the Construction Waste Management Plan and complete this Acknowledgment Form.

I have read the Waste Management Plan for the project; I understand the goals of this plan and agree to follow the procedures described in this plan.

DATE	SUBCONTRACTOR COMPANY NAME	FOREMAN NAME	SIGNATURE

Title 23, Waters, California Code of Regulations

MWELO and supporting documents, including a water budget calculator, are available at: <https://www.water.ca.gov/>.

Commissioning Referenced Standards for Non-Energy Systems

The following CALGreen Referenced Standards are included herein as a convenience for the users of the California Green Building Standards Code, but they are not considered to be part of the code unless they are officially adopted by a local jurisdiction.

Contents	Page
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Part 1

STANDARDS FOR COMPLIANCE WITH BUILDING COMMISSIONING

Reference: Section 5.410.2, Commissioning.

Introduction:

The purpose of this code is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of concepts that reduce negative and increase positive environmental impacts. Commissioning is a vital element in this effort.

Definitions used in the *CALGreen Cx* Reference standard:

Acronyms

BOD	Basis of Design
Cx	Commissioning
FPT	Functional Performance Test
HVAC	Heating, Ventilating and Air-Conditioning
O&M	Operations and Maintenance
OPR	Owner's Project Requirements

Glossary:

Acceptance Criteria—The conditions that must be met for systems or equipment to meet defined and expected outcomes.

Commissioning (Cx)—Building commissioning as required in this code involves a quality assurance process that begins during design and continues to occupancy. Commissioning verifies that the new building operates as the owner intended and that building staff are prepared to operate and maintain its systems and equipment. Exceptions are allowed for dry storage warehouses of any size and conditioned spaces under 10,000 square feet accessory to them; and for tenant improvements under 10,000 square feet within a larger space.

Owner—The individual or entity holding title to the property on which the building is constructed.

Commissioning Coordinator—The person who coordinates the commissioning process. This can be either a third-party commissioning provider or an experienced member of the design team or owner in-house staff member.

Commissioning Team—The key members of each party involved with the project designated to provide insight and carry out tasks necessary for a successful commissioning project. Team members may include the commissioning coordinator, owner or owner's representative, building staff, design professionals, contractors or manufacturer's representatives and testing specialists.

Independent Third-Party Commissioning Professional—A commissioning consultant contracted directly by the owner who is not responsible to, or affiliated with, any other member of the design and construction team.

Operation and Maintenance (O&M) Manuals—Documents that provide information necessary for operating and maintaining installed equipment and systems.

Owner Representative—An individual or entity assigned by the owner to act and sign on the owner's behalf.

Process Equipment—Energy-using equipment and components that are not used for HVAC, electrical, plumbing and irrigation operations. Such devices would include but are not limited to heat transfer, water purifying, air cleaning, air vacuum and air compressing.

Sequence of Operation—A written description of the intended performance and operation of each control element and feature of the equipment and systems.

Selecting Trained Personnel (for Commissioning)

This code requires that "Commissioning shall be performed in accordance with this section by trained personnel with experience on projects of comparable size and complexity." The trained personnel manage and facilitate the commissioning process. The trained personnel develop and implement the commissioning tasks and documentation identified in Sections 5.410.2.1 through 5.410.2.6. Trained personnel may include appropriate members of owner staff, contractor and design team as well as independent commissioning professionals.

It is essential that there is a single person designated to lead and manage the commissioning activities. In practice, this individual has been referenced by various identifiers such as commissioning authority, agent, provider, coordinator, lead, etc. In this guide the term “commissioning coordinator” is used.

The designated commissioning coordinator may be an independent, third-party commissioning professional, a project design team member (e.g., engineer or architect), an owner’s engineer or facility staff, contractor or specialty subcontractor. Methods of evaluating the designated commissioning coordinator and trained personnel include review of the following:

1. Technical knowledge;
2. Relevant experience;
3. Potential conflict of interest concerns;
4. Professional certifications and training;
5. Communication and organizational skills; and
6. Reference and sample work products.

Selection of “trained,” qualified personnel is required by this code. In order to meet this requirement, the commissioning provider should be evaluated via the methods discussed above. In addition, various organizations have training and certification programs that may be a source for identification of qualified commissioning providers.

For information about enforcement and compliance of each commissioning element see Sections 5.410.2.1 through 5.410.2.6. For compliance forms and templates see Part 2 following this standard.

Reference: 1 Owner’s Project Requirements

CALGreen Section 5.410.2.1, Owner’s or Owner representative’s Project Requirements (OPR).

1.1 Intent:

The Owner’s Project Requirements (OPR) documents the functional requirements of a project and expectations of the building use and operation as it relates to systems being commissioned. The document describes the physical and functional building characteristics desired by the owner and establishes performance and acceptance criteria. The OPR is most effective when developed during predesign and used to develop the Basis of Design (BOD) during the design process. The level of detail and complexity of the OPR will vary according to building use, type and systems.

1.2 Compliance Method:

Compliance is demonstrated by the owner or owner’s representative developing and/or approving the Owner’s Project Requirements (OPR) document and can be defined as follows:

1. Environmental and Sustainability Goals—Establish environmental project goals and objectives exceeding the code for the project’s sustainability, which may include:
 - a. CALGreen voluntary measures or Tiers sought, or other specific green building rating system or program credits and/or level of certification sought
 - b. Specific environmental or sustainability goals such as water efficiency, water reuse, CO₂ monitoring, xeriscaping, etc.
2. Building Sustainable Goals—Establish goals and targets affecting energy efficiency, which may include:
 - a. Measures affecting building sustainability desired by owner
 - i. Building orientation and siting
 - ii. Daylighting
 - iii. Facade, envelope and fenestration
 - iv. Roof
 - v. Natural ventilation
 - vi. Onsite renewable power generation and net-zero energy use
 - vii. Landscaping and shading
3. Indoor Environmental Quality Requirements—For each program space describe indoor environmental requirements including intended use and anticipated schedule, and the following:
 - a. Temperature and humidity
 - b. Acoustics
 - c. Air quality, ventilation and filtration

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- d. Desired adjustability of system controls
 - e. Accommodations for after-hours use
 - f. Other owner requirements including natural ventilation, operable windows, daylight, views, etc.
4. Project Program, including facility functions and hours of operation, and need for after-hours operation—Describe primary purpose, program and use of proposed project include the following:
- a. Building size, number of stories, construction type, occupancy type and number
 - b. Building program areas including intended use and anticipated occupancy schedules
 - c. Future expandability and flexibility of spaces
 - d. Quality and/or durability of materials and building lifespan desired
 - e. Budget or operational constraints
 - f. Applicable codes
5. Equipment and Systems Expectations—Describe the following for each system commissioned:
- a. Level of quality, reliability, equipment type, automation, flexibility, maintenance and complexity desired
 - b. Specific efficiency targets, desired technologies or preferred manufacturers for building systems, acoustics and vibration
 - c. Degree of system integration, automation and functionality for controls
6. Building Occupant and O&M Personnel Expectations—Describe the following:
- a. How building will be operated and by whom
 - b. Level of training and orientation required to understand, operate and use the building systems for building operation and maintenance staff, as well as occupants
 - c. Building operation and maintenance staff location and capabilities

1.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance at Plan Intake by:

- a) Receipt of a copy of the OPR document, or
- b) Receipt of a form signed by the owner or owner representative attesting that the OPR has been completed and approved by the owner.

Reference: 2 Basis of Design (BOD)

CALGreen Section 5.410.2.2, Basis of Design (BOD).

2.1 Intent:

The Basis of Design (BOD) describes the building systems to be commissioned and outlines design assumptions not indicated in the design documents. The design team develops the BOD to describe how the building systems' design meets the Owner's Project Requirements (OPR), and why the systems were selected. The BOD is most effective when developed early in the project design and updated as necessary throughout the design process.

2.2 Compliance Method:

Compliance requires the completion of the BOD document and should include the following where applicable:

1. Renewable Energy Systems
 - a. Provide narrative description of system—type, performance, control type, energy savings, payback period
 - b. Describe reason for system selection—why chosen system is better than alternatives, issues such as performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, utility company incentives, owner preference
 - c. Sequence of Operation—operating schedules, setpoints, storage capacity
 - d. Describe how system meets the OPR
2. Landscape Irrigation Systems
 - a. Provide narrative description of system—type, performance, water usage
 - b. Describe reason for system selection—why chosen system is better than alternatives, issues such as performance, efficiency, reliability, flexibility, expandability, cost, owner preference, simplicity

- c. Sequence of Operation—operating schedules, setpoints
 - d. Describe how system meets the OPR
3. Water Reuse Systems
- a. Provide narrative description of system—type, performance, capacity, reuse purpose
 - b. Describe reason for system selection—why chosen system is better than alternatives, issues such as performance, efficiency, reliability, flexibility, expandability, cost, owner preference, simplicity
 - c. Sequence of Operation—operating schedules, setpoints
 - d. Describe how system meets the OPR

2.3 Enforcement:

At their discretion, the building official confirms demonstrated compliance at Plan Intake by:

- a) Receipt of a copy of the BOD document, or
- b) Receipt of a form signed by the architect, engineer or designer of record, attesting that the BOD has been completed and meets the requirements of the OPR.

Reference: 3 Commissioning measures shown in the construction documents

CALGreen Section 5.410.2, Commissioning.

This section provides details for element 3: Commissioning measures shown in the construction documents.

3.1 Intent:

Include commissioning measures or requirements in the construction documents (plans and specifications). Commissioning measures or requirements should be clear, detailed and complete to clarify the commissioning process.

3.2 Compliance Method:

Compliance is achieved by including commissioning requirements in the project specifications. The commissioning specifications should include the following:

1. Primary (and optionally all) commissioning requirements are included in the general specification division (typically Division 1) and clear cross references of all commissioning requirements to and from the general division are included to ensure all subcontractors are held to them.
2. A list of the systems and assemblies covered by the commissioning requirements.
3. Roles and responsibilities of all parties, including:
 - i. General contractor and subcontractors, vendors, construction manager
 - ii. Commissioning provider lead
 - iii. Owner, facility staff
 - iv. Architect and design engineers
 - v. Include the noncontractor parties in the construction specifications (information used only to provide the contractor with context for their work).
 - vi. Include who writes checklists and tests, who reviews and approves test forms, who directs tests, who executes tests, who documents test results, and who approves completed tests. These roles may vary by system or assembly.
4. Meeting requirements
5. Commissioning schedule management procedures
6. Issue and noncompliance management procedures
7. Requirements for execution and documentation of installation, checkout and start up, including controls point-to-point checks and calibrations
8. Specific testing requirements by system, including:
 - i. Monitoring and trending
 - ii. Opposite season or deferred testing requirements, functions and modes to be tested
 - iii. Conditions of test
 - iv. Acceptance criteria, and any allowed sampling
 - v. Include details of the format and rigor of the test forms required to document test execution
 - vi. Include example forms is recommended

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9. Submittal review requirements and approval process.
10. Content, authority and approval process of the commissioning plan.
11. Commissioning documentation and reporting requirements.
12. Facility staff training requirements and verification procedures.
13. O&M manual review and approval procedures.
14. System's manual development and approval requirements and procedures.
15. Definitions section.

3.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance at Plan Intake by:

- a) Receipt of a copy of the commissioning specifications, or
- b) Receipt of a form signed by the owner or owner's representative or designer of record attesting that the owner-approved commissioning specifications are included in the construction documents.

Reference: 4 Commissioning plan

CALGreen Section 5.410.2.3, Commissioning plan.

4.1 Intent:

The Commissioning Plan (Cx Plan) establishes the commissioning process guideline for the project and commissioning team's level of effort by identifying the required Cx activities to ensure that the Owner's Project Requirements (OPR) and the Basis of Design (BOD) are met. The Cx Plan also includes a commissioning schedule from design to occupancy.

4.2 Compliance Method:

Compliance is demonstrated by preparation of a project-specific Cx Plan that includes the elements listed in the code section above. The following gives guidance for developing the components of the commissioning plan:

1. General project information - Provide project-identifying information including but not limited to the following:
 - i. Project name, owner, location.
 - ii. Building type, building area.
 - iii. Project schedule.
 - iv. Contact information of individual/company providing the commissioning services.
2. Commissioning goals – Document the commissioning goals, including but not limited to:
 - i. Meeting *CALGreen* code requirements for commissioning.
 - ii. Meeting OPR and BOD requirements.
 - iii. Carrying out requirements for commissioning activities as specified in plans and specifications.
3. Systems to be commissioned – See BOD
 - a. An explanation of the original design intent - Document the performance objectives and design intent for each system listed to be commissioned in a written narrative
 - Refer to the OPR and BOD documents
 - b. Equipment and systems to be tested, including the extent of tests
 - i. Provide a list of equipment and systems to be tested
 - ii. Describe the range and extent of tests to be performed for each system component, and interface between systems
 - c. Functions to be tested - Provide example functional test procedures to identify the level of testing detail required
 - See (Section 5.410.2.4) FPT guidance for more information
 - d. Conditions under which the test shall be performed - Identify the conditions under which the major operational system functions are to be tested, including:
 - i. Normal operations and part-load operations.
 - ii. Seasonal testing requirements.
 - iii. Restart of equipment and systems after power loss.

- iv. System alarm confirmations.
- e. Measurable criteria for acceptable performance - Include measurable criteria for acceptable performance of each system to be tested
- 4. Commissioning team information - Provide a contact list for all commissioning team members, including but not limited to:
 - i. Owner, owner's representative.
 - ii. Architect, engineers.
 - iii. Designated commissioning representative.
 - iv. General contractor, subcontractors and construction manager.
- 5. Commissioning process activities, schedules and responsibilities
 - i. Establish prescribed commissioning process steps and activities to be accomplished by the Cx team throughout the design to occupancy.
 - ii. For each phase of the work, define the roles and responsibilities for each member of the Cx team.
 - iii. List the required Cx deliverables, reports, forms and verifications expected at each stage of the commissioning effort.
 - iv. Include the confirmation process for the O&M manual, systems manual and the facility operator and maintenance staff training.

4.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance at Plan Intake by:

- a) Receipt of a copy of the commissioning plan, or
- b) Receipt of a form signed by the owner or owner's representative attesting that the Cx Plan has been completed.

Reference: 5 Functional performance testing

CALGreen Section 5.410.2.4, Functional performance testing.

5.1 Intent:

Develop and implement the functional performance tests to document, as set forth in the commissioning plan, that all components, equipment, systems and system-to-system interfaces were installed as specified, and operate according to the Owner's Project Requirements, Basis of Design, and plans and specifications.

The following systems to be functionally tested are listed in the Basis of Design (Section 5.410.2.2 of the code):

- 1. Renewable energy systems
- 2. Landscape irrigation systems
- 3. Water reuse systems

5.2 Compliance Method:

Compliance is demonstrated by developing and implementing test procedures for each piece of commissioned equipment and interfaces between equipment and systems according to the building-specific commissioning plan. Tests should include verification of proper operation of all equipment features, each part of the sequence of operation, overrides, lockouts, safeties, alarms, occupied and unoccupied modes, loss of normal power, exercising a shutdown, startup, low load through full load (as much as is possible) and back, staging and standby functions, scheduling, energy efficiency strategies and loop tuning.

Elements of acceptable test procedures include:

- 1. Date and party—Identification of the date of the test and the party conducting the test.
- 2. Signature block—Signature of the designated commissioning lead and the equipment installing contractor attesting that the recorded test results are accurate.
- 3. Prerequisites—Any conditions or related equipment checkout or testing that needs to be completed before conducting this test.
- 4. Precautions—Identification of the risks involved to the test team members and the equipment and how to mitigate them.
- 5. Instrumentation—Listing of the instrumentation and tools necessary to complete the test.
- 6. Reference—In each procedure item, identify the source for what is being confirmed (e.g., sequence of operation ID, operating feature, specification requirement, etc.).
- 7. Test instructions—Step-by-step instructions of how to complete the test, including functions to test and the conditions under which the tests should be performed.

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8. Acceptance criteria—Measurable pass / fail criteria for each step of the test, as applicable.
9. Results—Expected system response and space to document the actual response, readings, results and adjustments.
10. Return to normal—Instructions that all systems and equipment are to be returned to their as-found state at the conclusion of the tests.
11. Deficiencies—A list of deficiencies and how they were mitigated.

5.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance during onsite enforcement by:

- a) Receipt of a copy of completed and signed functional performance tests and corrected deficiencies, or
- b) Receipt of a form signed by the owner, owner's representative or commissioning coordinator attesting that the functional performance tests have been completed and any deficiencies corrected.

Reference: 6.1 Documentation and training

CALGreen Section 5.410.2.5, Documentation and training.

Section 5.410.2.5.1, Systems manual.

6.1.1 Intent:

The Systems Manual documents information focusing on the operation of the building systems. This document provides information needed to understand, operate and maintain the equipment and systems and informs those not involved in the design and construction of the building systems. This document is in addition to the record construction drawings, documents and the Operation & Maintenance (O&M) manuals supplied by the contractor. The Systems Manual is assembled during the construction phase and available during the contractors' training of the facility staff.

6.1.2 Compliance Method:

Compliance is demonstrated by providing the Systems Manual. The information in the Systems Manual includes the following:

1. Site information, including facility description, history and current requirements
 - a. Site information
 - i. Location of property - address
 - ii. Site acreage
 - iii. Local utility information
 - Water service provider
 - Natural/LPG gas service provider
 - Electrical service provider
 - Telecommunications service provider
 - Other service providers
 - b. Facility description
 - i. Use/function
 - ii. Square footage
 - iii. Occupancy type
 - iv. Construction type
 - v. Basis of Design
 - vi. Location of major systems and equipment
 - c. Project history
 - i. Project requirements
 - Owner's Project Requirements (OPR)
 - Basis of Design (BOD)
 - ii. Project undocumented events
 - iii. Record drawings and documents
 - iv. Final control drawings and schematics
 - v. Final control sequences

- vi. Construction documents - location or delivery information
 - Mechanical and electrical drawings
 - Specifications
 - Submittals
 - Project change orders and information
- d. Current requirements
 - i. Building operating schedules
 - ii. Space temperature, humidity and pressure, CO₂ setpoints
 - iii. Summer and winter setback schedules
 - iv. Chilled and hot water temperatures
 - v. As-built control setpoints and parameters
- 2. Site contact information
 - a. Owner information
 - b. Emergency contacts
 - c. Design team: architect, mechanical engineer, electrical engineer, etc.
 - d. Prime contractor contact information
 - e. Subcontractor information
 - f. Equipment supplier contact information
- 3. Basic operation and maintenance, including general site operating procedures, basic trouble shooting, recommended maintenance requirements site events log
 - a. Basic operation
 - i. Written narratives of basic equipment operation
 - ii. Interfaces, interlocks and interaction with other equipment and systems
 - iii. Initial maintenance provided by contractor
 - b. General site operating procedures
 - i. Instructions for changes in major system operating schedules
 - ii. Instructions for changes in major system holiday and weekend schedules
 - c. Basic troubleshooting
 - i. Cite any recommended troubleshooting procedures specific to the major systems and equipment installed in the building.
 - ii. Manual operation procedures
 - iii. Standby/backup operation procedures
 - iv. Bypass operation procedures
 - v. Major system power fail resets and restarts
 - vi. Trend log listing
 - d. Recommended maintenance events log
 - e. Operation & Maintenance manuals - location or delivery information
- 4. Major systems
 - a. Renewable energy systems
 - i. Photovoltaic panels and inverters
 - ii. Wind-powered electrical generators and inverters
 - b. Landscape irrigation systems
 - i. Water distribution diagrams
 - ii. Control system
 - c. Water reuse systems
 - i. Reclaimed water system for indoor use
 - ii. Reclaimed water for irrigation use

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5. Site equipment inventory and maintenance notes
 - a. Spare parts inventory
 - b. Frequently required parts and supplies
 - c. Special equipment required to operate or maintain systems
 - d. Special tools required to operate or maintain systems
6. A copy of all special inspection verifications required by the enforcing agency of this code
7. Other resources and documentation

6.1.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance during on-site enforcement by:

- a. Receipt of a copy of the Systems Manual, or
- b. Receipt of a form signed by the owner or owner's representative attesting that the systems manual has been completed.

Reference: 6.2 Documentation and training

CALGreen Section 5.410.2.5, Documentation and training.

Section 5.410.2.5.2, Systems operations training.

6.2.1 Intent:

The systems operation training verifies that a training program is developed to provide training to the appropriate maintenance staff for each equipment type and/or system and that this training program is documented in the commissioning report. The systems operations training program is specified in the project specifications for the major systems listed. The systems manual, Operation and Maintenance (O&M) documentation and record drawings are prepared and available to the maintenance staff prior to implementation of any training or the development of a written training program. The training program is to be administered when the appropriate maintenance staff is made available to receive training.

6.2.2 Compliance Method:

The written training program includes: (a) learning goals and objectives for each session, (b) training agenda, topics and length of instruction for each session, (c) instructor information and qualifications, (d) location of training sessions (on-site, off-site, manufacturer's or vendor's facility), (e) attendance forms, (f) training materials and (g) description on how the training will be archived for future use.

1. Systems/equipment overview
 - a. Review OPR and BOD related to the major systems and equipment
 - b. Describe system type and configuration
 - c. Explain operation of all major systems and equipment and how it interfaces with other systems and equipment
 - d. Describe operation of critical devices, controls and accessories
 - e. Review location of the major systems and equipment
 - f. Describe operation of control system for each system, location of critical control elements and procedures to properly operate control system
 - g. Review recommendations for implementation to reduce energy and water use
2. Review and demonstration of servicing/preventive maintenance
 - a. Explain location or delivery contact of the Operation & Maintenance manuals
 - b. Review of all manufacturer's recommended maintenance activities to maintain warranty
 - c. Review and demonstrate frequent maintenance activities and suggested schedule
 - d. Review and demonstrate typical servicing procedures and techniques (electrical current, pressure and flow readings, etc.; calibration procedures, point trending, power fail restart procedures, etc.)
 - e. Locate, observe and identify major equipment, systems, accessories and controls
 - f. Review emergency shut-offs and procedures
3. Review the information in the systems manual
 - a. Describe use of systems manual
 - b. Review elements of systems manual
 - c. Explain how to update and add revisions to systems manual

4. Review record drawings on the systems/equipment
 - a. Explain location or delivery contact of the record drawings
 - b. Review record drawings, revisions and changes to original design drawings.
 - c. Review equipment schedules and compare with actual installed systems

6.2.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance during on-site enforcement by:

1. In the event appropriate maintenance staff is made available to receive training for each equipment type and/or system installed in the building.
 - a. Receipt of a copy of the written training program and completed attendance forms, or
 - b. Receipt of a form signed by the owner or owner's representative attesting that the training program and delivery of training has been completed.
2. In the event appropriate maintenance staff are unavailable to receive training for each equipment type and/or system installed in the building.
 - a. Receipt of a copy of the training program provided to the owner or owner's representative, or
 - b. Receipt of a form signed by the owner or owner's representative attesting that the written training program has been provided.

Reference: 7 Commissioning report

CALGreen Section 5.410.2.6, Commissioning report.

7.1 Intent:

The commissioning report documents the commissioning process and test results. The report includes confirmation from the commissioning agent verifying that commissioned systems meet the conditions of the Owner's Project Requirements (OPR), Basis of Design (BOD) and contract documents.

7.2 Compliance Method:

The components of the commissioning report include the following and are defined as follows:

1. Executive summary of process and results of commissioning program, including observations, conclusions and any outstanding items.
2. History of any system deficiencies and how resolved
 - a. Include outstanding deficiencies and plans for resolution
 - b. Include plans for seasonal testing scheduled for a later date
3. System performance test results and evaluations
4. Summary of training process completed and scheduled
5. Attach commissioning process documents
 - a. Commissioning plan
 - b. Owner's Project Requirements (OPR)
 - c. Basis of Design (BOD)
 - d. Executed installation checklists
 - e. Executed Functional Performance Test (FPT) forms
 - f. Recommendations for end-of-warranty review activities

7.3 Enforcement:

At their discretion, the inspector confirms demonstrated compliance during on-site enforcement by:

- a) Receipt of a copy of the commissioning report, or
- b) Receipt of a form signed by the owner or owner's representative attesting that the Cx Report has been completed.

Part 2

SAMPLE FORMS AND TEMPLATES FOR COMMISSIONING

Note: Following are examples of templates and/or forms that may be used or adopted for verification compliance with commissioning. Code users may provide their own documents as permitted by the enforcing agency. For each subsection of commissioning, samples are provided; in a few cases with narrative templates, and in most cases with compliance forms. Simplified forms or more detailed forms, but not both, may be selected to submit for each project.

**CALGreen COMPLIANCE FORM
OWNER’S PROJECT REQUIREMENTS (OPR)**

The following form may be required to be printed on the permit set of construction drawings or submitted separately. Italicized text indicates direct or partial quotes from the *CALGreen Code*.

CALGreen Commissioning Requirement 5.410.2.1, Owner’s Project Requirements (OPR)

5.410.2.1 Owner’s or Owner representative’s Project Requirements (OPR). *[N] The expectations and requirements of the building appropriate to its phase shall be documented before the design phase of the project begins. This documentation shall include the following:*

1. *Environmental and sustainability goals.*
2. *Building sustainable goals.*
3. *Indoor environmental quality requirements.*
4. *Project program, including facility functions and hours of operation, and need for after hours operation.*
5. *Equipment and systems expectations.*
6. *Building occupant and operation and maintenance (O&M) personnel expectations.*

	OPR ELEMENTS	INCLUDED
1.	Environmental and sustainability goals.	<input type="checkbox"/>
2.	Building sustainable goals.	<input type="checkbox"/>
3.	Indoor environmental quality requirements.	<input type="checkbox"/>
4.	Project program, including facility functions and hours of operation, and need for after-hours operation.	<input type="checkbox"/>
5.	Equipment and systems expectations.	<input type="checkbox"/>
6.	Building occupant and O&M personnel expectations.	<input type="checkbox"/>

Owner/Owner’s Representative Signature

Date

**OWNER’S PROJECT REQUIREMENTS (OPR)
COMPLIANCE CHECKLIST**

INCORPORATE THIS FORM IN THE PLANS

Project Address: _____

Permit Number: _____

ITEM #	OPR ITEMS	PAGE NUMBER IN OPR DOCUMENT
	OWNER AND USER REQUIREMENTS—PROJECT PROGRAM	
1	General building information (size, stories, construction type, occupancy type and number)	
2	Intended uses and schedules	
3	Future expandability and flexibility of spaces	
4	Quality and/or durability of materials and desired building lifespan	
5	Budget or operation constraints	
	ENVIRONMENTAL AND SUSTAINABILITY GOALS	
6	Level of compliance with the <i>California Green Building Standards Code</i> : Mandatory, Tier 1 or Tier 2	
7	Specific environmental or sustainability goals (e.g., water efficiency, water reuse, CO ₂ monitoring, xeriscaping, etc.)	
	BUILDING SUSTAINABLE GOALS	
8	Measures affecting energy efficiency desired by owner (e.g., building orientation, shading, daylighting, natural ventilation, renewable power, etc.)	
	INDOOR ENVIRONMENTAL QUALITY REQUIREMENTS	
9	Lighting	
10	Temperature and humidity	
11	Acoustics	
12	Air quality, ventilation and filtration	
13	Desired adjustability of system controls	
14	Accommodations for after-hours use	
15	Other owner requirements (e.g., natural ventilation, daylight, views, etc.)	

(continued)

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ITEM #	OPR ITEMS	PAGE NUMBER IN OPR DOCUMENT
EQUIPMENT AND SYSTEMS EXPECTATIONS		
16	Level of quality, reliability, equipment type, flexibility, maintenance and complexity desired	
17	Specific efficiency targets, desired technologies or preferred manufacturers for building systems, acoustics and vibration	
18	Degree of system integration, automation and functionality for controls (i.e., load shedding, demand response, energy management)	
BUILDING OCCUPANT AND O&M PERSONNEL EXPECTATIONS		
19	Description of how the building will be operated and by whom	
20	Level of training and orientation required to understand, operate and use the building systems for building operation and maintenance staff, as well as occupants	
21	Building operation and maintenance staff location and capabilities	
COMMISSIONING AGENT INFORMATION		
22	Name of commissioning agency:	
23	Address of agency:	
24	Contact person(s) name(s):	

Owner/Owner's Representative Acknowledgement

Owner's Project Requirements (OPR). The expectations and requirements of the building appropriate to its phase shall be documented before the design phase of the project begins. The OPR includes the elements listed above and they have been approved by the Owner or Owner's Representative.

Name: _____ Owner Owner's Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

**BASIS OF DESIGN (BOD)
COMPLIANCE TEMPLATE**

Documentation of the Basis of Design (BOD) is a step required for compliance with CALGreen Code, Section 5.410.2.2, for newly constructed buildings greater than 10,000 square feet. This template is a guide for use by the design team.

1. Renewable Energy Systems

1.1. Narrative Description of System

- A. [System type(s), location, inverter type, control type, performance, efficiency, energy savings, payback period]
- B. [Describe how system meets any special requirements listed in the Owner's Project Requirements document.]

1.2. Reasons for System Selection

[Reasons that the selected renewable energy systems are a better choice than alternatives (e.g., performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, utility company incentives, owner preference, space constraints, cost, owner preferences, ease of maintenance, etc.)]

1.3. Renewable Energy System Generation Calculations

[Describe sizing calculation method, assumptions and results]

2. Landscape Irrigation Systems

2.1. Narrative Description of System

- A. [System type(s), location, control type, performance, efficiency, water savings]
- B. [Describe how system meets any special requirements listed in the Owner's Project Requirements document.]

2.2. Reasons for System Selection

[Reasons that the selected landscape irrigation systems are a better choice than alternatives (e.g., performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, utility company incentives, owner preference, cost, owner preferences, ease of maintenance, etc.)]

2.3. Landscape Irrigation System Calculations

[Describe sizing calculation method, assumptions and results]

3. Water Reuse Systems

3.1. Narrative Description of System

- A. [System type(s), location, space requirements, equipment requirements, control type, performance, efficiency, potable water savings, payback period]
- B. [Describe how system meets any special requirements listed in the Owner's Project Requirements document.]

3.2. Reasons for System Selection

[Reasons that the selected water reuse systems are a better choice than alternatives (e.g., performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, utility company incentives, owner preference, space constraints, cost, owner preferences, ease of maintenance, etc.)]

3.3. Water Reuse System Calculations

**BASIS OF DESIGN (BOD)
COMPLIANCE CHECKLIST**

[Describe sizing calculation method, assumptions and results]

INCORPORATE THIS FORM IN THE PLANS

Project Address: _____

Permit Number: _____

ITEM #	BOD ITEMS	PAGE NUMBER IN BOD DOCUMENT
	RENEWABLE ENERGY SYSTEMS (IF ANY)	
1	Narrative description of system (i.e., system type(s), location, inverter type, control type, performance, efficiency, energy savings, payback period, other)	
2	Description of how the system meets requirements listed in OPR	
3	Reasons for system selection, as opposed to alternatives (e.g., performance, efficiency, reliability, flexibility, simplicity, expandability, cost, payback period, etc.)	
4	Renewable energy system generation calculations: sizing calculation method, assumptions and results	
	LANDSCAPE IRRIGATION SYSTEMS	
5	Narrative description of system (i.e. system type(s), location, control type, performance, efficiency, water savings, other)	
6	Description of how the system meets requirements in OPR	
7	Reasons for system selection, as opposed to alternatives (e.g., performance, efficiency, reliability, flexibility, cost, utility company incentives, etc.)	
8	Landscape irrigation system calculations: sizing calculation method, assumptions and results	
	WATER REUSE SYSTEM (IF ANY)	
11	Narrative description of system (i.e., system type(s), location, space requirements, equipment requirements, control type, performance, efficiency, potable water savings, payback period, other)	
12	Description of how the system meets requirements in OPR	
13	Reasons for system selection, as opposed to alternatives (e.g., performance, efficiency, reliability, flexibility, simplicity, cost, payback period, etc.)	
14	Water reuse system calculations: sizing calculation method, assumptions and results	

Architect/Engineer/Designer Acknowledgement				
I hereby acknowledge the Basis of Design (BOD) document has been completed and meets the Owner's Project Requirements (OPR).				
	Name	License Number	Signature	Date
Architect of Record				
Landscape Architect				
Renewable Energy System Designer				
Other (specify):				

Commissioning Agent Acknowledgment

I have reviewed the Basis of Design (BOD) and verified that it meets the Owner's Project Requirements (OPR):

Name: _____

Company Name (if applicable): _____

Agent's Signature: _____ Date: _____

**Cx MEASURES IN CONSTRUCTION DOCUMENTS
COMPLIANCE FORM**

The following form may be required to be printed on the permit set of construction drawings or submitted separately.

CALGreen Commissioning Requirement 5.410.2, Commissioning Measures in the Construction Documents

5.410.2. *Commissioning measures shall be shown in the construction documents.*

The commissioning measures shown in the construction documents include the checked elements listed below and have been approved by the owner, owner’s representative or designer of record.

	COMMISSIONING MEASURE ELEMENTS¹	INCLUDED
1.	Measures shown in the specifications and cross referenced	<input type="checkbox"/>
2.	List of commissioned equipment and systems	<input type="checkbox"/>
3.	Cx roles and responsibilities of all parties	<input type="checkbox"/>
4.	Meeting requirements	<input type="checkbox"/>
5.	Commissioning schedule management procedures	<input type="checkbox"/>
6.	Procedures for addressing outstanding issues or noncompliance	<input type="checkbox"/>
7.	Requirements for execution and documentation of installation and equipment start-up	<input type="checkbox"/>
8.	Specific testing requirements for each system type ¹	<input type="checkbox"/>
9.	Submittal review and approval requirements	<input type="checkbox"/>
10.	Contents and approval process of the commissioning plan	<input type="checkbox"/>
11.	Cx documentation and reporting requirements	<input type="checkbox"/>
12.	Facility staff training requirements and verification procedures	<input type="checkbox"/>
13.	O&M manual review and approval procedures	<input type="checkbox"/>
14.	Systems manual development and approval procedures	<input type="checkbox"/>
15.	Definitions	<input type="checkbox"/>

¹ These are not the detailed step-by-step test procedures but are lists of features, elements, modes and conditions of tests for specific equipment.

Owner / Owner’s Representative
or Designer of Record Signature

Date

Cx MEASURES IN CONSTRUCTION DOCUMENTS

INCORPORATE THIS FORM IN THE PLANS

Project Address: _____

Permit Number: _____

ITEM #	COMMISSIONING MEASURES ITEMS
1	Measures shown in the specifications and cross referenced
2	List of commissioned equipment and systems
3	Cx roles and responsibilities of all parties
4	Meeting requirements
5	Commissioning schedule management procedures
6	Procedures for addressing outstanding issues or noncompliance
7	Requirements for execution and documentation of installation and equipment start-up
8	Specific testing requirements for each system type
9	Submittal review and approval requirements
10	Contents and approval process of the commissioning plan
11	Cx documentation and reporting requirements
12	Facility staff training requirements and verification procedures
13	O&M manual review and approval procedures
14	Systems manual development and approval procedures
15	Definitions

Commissioning Agent Acknowledgment

I have reviewed the construction documents listed above and verified their compliance with the Owner's Project Requirements (OPR), Basis of Design (BOD) and commissioning plan.

Name: _____

Company Name (if applicable): _____

Agent's Signature: _____ Date: _____

**COMMISSIONING PLAN
COMPLIANCE FORM**

The following form may be required to be printed on the permit set of construction drawings or submitted separately.

CALGreen Commissioning Requirement 5.410.2.3, Commissioning Plan

5.410.2.3 Commissioning plan. [N] *Prior to permit issuance a commissioning plan shall be completed to document how the project will be commissioned. The commissioning plan shall include the following:*

(See Cx plan elements checklist below.)

The commissioning plan should be started during the design phase of the building project. Include the checked elements listed below and approved by the owner or owner’s representative.

	COMMISSIONING PLAN ELEMENTS ¹	INCLUDED
1.	General project information	<input type="checkbox"/>
2.	Commissioning goals	<input type="checkbox"/>
3.	Systems to be commissioned—see BOD	
3a.	An explanation of original design intent	<input type="checkbox"/>
3b.	Equipment and systems to be commissioned and tested, including extent of tests	<input type="checkbox"/>
3c.	Functions to be tested and conditions of tests ¹	<input type="checkbox"/>
3d.	Conditions under which the test shall be performed	
3e.	Measurable criteria for acceptable performance	<input type="checkbox"/>
4.	Cx team information	<input type="checkbox"/>
5.	Cx process activities, schedules and responsibilities	<input type="checkbox"/>

1. These are not the detailed step-by-step test procedures but are lists of features, elements, modes and conditions of tests for specific equipment.

Owner / Owner’s Representative Signature

Date

**COMMISSIONING PLAN
COMPLIANCE CHECKLIST**

INCORPORATE THIS FORM IN THE PLANS

Project Address: _____

Permit Number: _____

ITEM #	COMMISSIONING PLAN ITEMS ¹	PAGE NUMBER IN COMMISSIONING PLAN DOCUMENT
GENERAL PROJECT INFORMATION		
1	Project name, owner, location	
2	Building type, building area	
3	Overall project commissioning schedule	
4	Contact information for individual/company providing commissioning services	
COMMISSIONING GOALS		
5	Meet <i>California Green Building Standards Code</i> requirements for commissioning	
6	Meeting OPR and BOD requirements	
7	Carrying out requirements for commissioning activities as specified in plans and specifications	
SYSTEMS TO BE COMMISSIONED		
8	Explanation of the original design intent (refer to OPR and BOD documents)	
9	Equipment and systems to be tested, functions to be tested, conditions under which the test shall be performed and measurable criteria for acceptable performance	
COMMISSIONING TEAM INFORMATION		
10	List of all team members and contact information (i.e., owner, owner’s representative, architect, engineers, designated commissioning representative and (if available): general contractor, subcontractors manager)	
COMMISSIONING PROCESS ACTIVITIES, SCHEDULES and RESPONSIBILITIES		
11	Prescribed commissioning process steps and activities to be accomplished by the Cx team throughout the design to occupancy	
12	Roles and responsibilities for each member of the Cx team for each phase of the work	
13	Required Cx deliverables, reports, forms and verifications expected at each stage of the commissioning effort	
14	Confirmation process for the O&M manual, systems manual and the facility operator and maintenance staff training	

1. The following systems shall be tested: renewable energy systems, landscape irrigation systems and water reuse systems.

Owner/Owner’s Representative Acknowledgment

The commissioning plan includes the items listed above and have been approved by the Owner or Owner’s Representative:

Name: _____ Owner Owner’s Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

**FUNCTIONAL PERFORMANCE TESTING
COMPLIANCE FORM**

CALGreen Commissioning Requirement 5.410.2.4, Functional Performance Testing

5.410.2.4 Functional performance testing. [N] *Functional performance tests shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the approved plans and specifications. Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized, and include any readings and adjustments made.*

Test forms have been developed for each piece of commissioned equipment and system and include the checked elements listed below. These tests have been executed with deficiencies corrected.

	FUNCTIONAL TEST ELEMENTS	INCLUDED
1.	Date and parties participating	<input type="checkbox"/>
2.	Signature block attesting test is complete and accurate	<input type="checkbox"/>
3.	Prerequisites	<input type="checkbox"/>
4.	Precautions	<input type="checkbox"/>
5.	Instrumentation required	<input type="checkbox"/>
6.	Reference to the source of what is being confirmed (sequences, packaged features, etc.)	<input type="checkbox"/>
7.	Detailed step-by-step test instructions	<input type="checkbox"/>
8.	Acceptance criteria	<input type="checkbox"/>
9.	Results	<input type="checkbox"/>
10.	Confirmation of returning to normal	<input type="checkbox"/>
11.	Deficiency list	<input type="checkbox"/>

Cx Coordinator Signature

Date

**FUNCTIONAL PERFORMANCE TESTING
COMPLIANCE FORM**

REPORT # (e.g., FPT-003)	SYSTEM/EQUIPMENT TEST REPORT (See minimum report requirements on page 2 of this form.)	PAGE/TAB # IN COMMISSIONING REPORT

THIS FORM IS TO BE COMPLETED FOR THE TIME OF INSPECTION

Project Address: _____

Permit Number: _____

List the functional test reports below for all systems to be tested (see Form 5.4-8.1, item #9).

Minimum Requirements for Test Report

1. Date and Party – Identification of the date of the test and the party conducting the test.
2. Signature Block – Signature of the designated commissioning lead and the equipment-installing contractor attesting that the recorded test results are accurate.
3. Prerequisites – Any conditions or related equipment checkout or testing that needs to be completed before conducting this test.
4. Precautions – Identification of the risks involved to the test team members and the equipment and how to mitigate them.
5. Instrumentation – Listing of the instrumentation and tools necessary to complete the test.
6. Reference – In each procedure item, identify the source for what is being confirmed (e.g., sequence of operation ID, operating feature, specification requirement, etc.)
7. Test Instructions – Step-by-step instructions of how to complete the test, including functions to test and the conditions under which the tests should be performed.
8. Acceptance Criteria – Measurable pass/fail criteria for each step of the test, as applicable.
9. Results – Expected system response and space to document the actual response, readings, results and adjustments.
10. Return to Normal – Instructions that all systems and equipment are to be returned to their as-found state at the conclusion of the tests.
11. Deficiencies – A list of deficiencies and how they were mitigated.

<p>Commissioning Agent Acknowledgment</p> <p>I have reviewed the test reports listed above and verified that they are complete; these tests have been executed with deficiencies corrected.</p> <p>Name: _____</p> <p>Company Name (if applicable): _____</p> <p>Agent's Signature: _____ Date: _____</p>
--

SYSTEMS MANUAL COMPLIANCE FORM	CALGreen Std. BSC-5.4-10 10-08-10
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CALGreen Commissioning Requirement 5.410.2.5.1, Documentation and Training—Systems Manual

5.410.2.5.1 Systems Manual. [N] Documentation of the operational aspects of the building shall be completed within the systems manual and delivered to the building owner or representative. The systems manual shall include the following:

(See elements checklist below.)

	SYSTEM MANUAL ELEMENTS	INCLUDED
1.	Site information including facility description, history and current requirements	<input type="checkbox"/>
2.	Site contact information	<input type="checkbox"/>
3.	Basic operations and maintenance and troubleshooting	<input type="checkbox"/>
4.	Systems covered include major systems listed under the BOD	<input type="checkbox"/>
5.	Site equipment inventory and maintenance notes	<input type="checkbox"/>
6.	Special inspection verifications	<input type="checkbox"/>
7.	Other resources and documentation	<input type="checkbox"/>

Owner or Owner's Representative Signature

Date

**SYSTEM OPERATIONS TRAINING
COMPLIANCE FORM**

CALGreen Commissioning Requirement 5.410.2.5.2, System Operations Training

5.410.2.5.2 Systems Operations Training. [N] A program for training of the appropriate maintenance staff for each equipment type and/or system shall be developed and documented in the commissioning report and shall include the following.

(See elements checklist below.)

The written training program includes the checked elements listed below.

	TRAINING PROGRAM ELEMENTS	INCLUDED
1.	System/equipment overview (what it is, what it does, and with what other systems and/or equipment it interfaces)	<input type="checkbox"/>
2.	Review and demonstration of servicing and preventive maintenance	<input type="checkbox"/>
3.	Review of the information in the systems manual	<input type="checkbox"/>
4.	Review of the record drawings on the system/equipment	<input type="checkbox"/>

The owner or owner’s representative attests that when the appropriate maintenance staff are made available prior to certificate of occupancy that the written training program was executed with these staff. Or, if appropriate maintenance staff are not available, that the written training program was submitted and approved by the owner or owner’s representative.

Owner or Owner's Representative Signature

Date

**SYSTEM OPERATIONS TRAINING
COMPLIANCE FORM**

THIS FORM IS TO BE COMPLETED PRIOR TO INSPECTION

Project Address: _____

Permit Number: _____

Part One: Systems Manual

ITEM #	SYSTEMS MANUAL ELEMENTS	PAGE NUMBER IN MANUAL
	SITE INFORMATION	
1	General (i.e., address, acreage, local utility information, other)	
2	Facility description (i.e., use/function, square footage, occupancy type, construction type, basis of design, location of major systems and equipment)	
3	Project history (i.e., project requirements (BOD/OPR), project undocumented events, record drawings and documents, final control drawings and schematics, final control sequences, construction documents)	
4	Current requirements (i.e., building operating schedules, space temperature, humidity, pressure, CO ₂ setpoints, summer and winter setback schedules, chilled and hot water temperatures, as-built control setpoints and parameters)	
	SITE CONTACT INFORMATION	
5	Owner information	
6	Emergency contacts	
7	Design team (i.e., architect, mechanical engineer, electrical engineer, other)	
8	Prime contractor contact information	
9	Subcontractor information	
10	Equipment supplier contact information	
	BASIC OPERATIONS AND MAINTENANCE	
11	Basic operation (i.e., narratives of basic equipment operation, interfaces, interlocks and interaction with other equipment and systems, initial maintenance provided by the contractor)	
12	General site-operating schedules (i.e., instructions for changes in major system operating schedules, instructions for changes in major system holiday and weekend schedules)	
13	Basic troubleshooting (i.e., cite recommended troubleshooting procedures specific to major systems and equipment, manual operation procedures, standby/backup/bypass operation procedures, major system power fail resets and restarts, trend log listing)	
14	Recommended maintenance events log (i.e., HVAC air filter replacement schedule and log, building control system sensor calibration schedule and log)	
15	Operation and maintenance manuals (location or delivery information)	
	MAJOR SYSTEMS	
19	Water heating systems	
20	Landscape irrigation systems (i.e., water distribution diagrams and control system)	
21	Water reuse systems (i.e., reclaimed water system for indoor use, reclaimed water for irrigation use)	
	SITE EQUIPMENT INVENTORY AND MAINTENANCE NOTES	
22	Spare parts inventory	
23	Frequently required parts and supplies	
24	Special equipment required to operate or maintain systems	
25	Special tools required to operate or maintain systems	
	SPECIAL INSPECTIONS	
26	Copies of all special inspection verifications required by the enforcing agency of this code	
	OTHER	
27	Other resources and documentation	

Part Two: Training

ITEM #	TRAINING PROGRAM ELEMENTS	PAGE NUMBER IN TRAINING DOCUMENT
1	System/equipment overview (i.e., what it is, what it does, and with what other systems and/or equipment it interfaces)	
2	Review and demonstration of servicing and preventative maintenance	
3	Review of the information in the systems manual	
4	Review of the record drawings on the system/equipment	

Owner/Owner's Representative Acknowledgment

Documentation of the operation aspects of the building shall be completed within the systems manual and delivered to the building owner or representative and facilities operator. The systems manual includes the elements listed in part one of this form; or

When the appropriate maintenance staff is made available prior to the certificate of occupancy, the written training program will be executed to these staff. The written training program includes the elements listed in part two of this form.

Name: _____ Owner Owner's Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

**COMMISSIONING REPORT
COMPLIANCE FORM**

CALGreen Commissioning Requirement 5.410.2.6, Commissioning Report

5.410.2.6 Commissioning Report. [N] *A report of commissioning process activities undertaken through the design and construction phases of the building project shall be completed and provided to the owner or representative.*

The commissioning report should include the checked elements listed below and should be approved by the owner or owner’s representative.

	COMMISSIONING REPORT ELEMENTS	INCLUDED
1.	Executive summary with conclusions and outstanding issues	<input type="checkbox"/>
2.	History of system deficiencies and resolution	<input type="checkbox"/>
3.	Summary of system functional test results	<input type="checkbox"/>
4.	Summary of training completion	<input type="checkbox"/>
5.	Attachments of commissioning plan, OPR, BOD, executed (filled in) installation checklists, executed functional tests, recommendations for end-of-warranty review	<input type="checkbox"/>

Owner / Owner’s Representative Signature

Date

**COMMISSIONING REPORT
COMPLIANCE FORM**

THIS FORM IS TO BE COMPLETED PRIOR TO INSPECTION

Project Address: _____

Permit Number: _____

ITEM #	COMMISSIONING REPORT ELEMENTS	PAGE NUMBER IN COMMISSIONING REPORT DOCUMENT
1	EXECUTIVE SUMMARY	
	Executive summary of process and results of commissioning program (include observations, conclusions and any outstanding items)	
2	HISTORY OF ANY SYSTEM DEFICIENCIES AND HOW RESOLVED	
	Outstanding deficiencies and plans for resolution	
	Plans for seasonal testing scheduled for a later date	
3	RESULTS	
	System performance test results and evaluations	
4	SUMMARY OF TRAINING	
	Summary of training process completed and scheduled	
5	ATTACH COMMISSIONING PROCESS DOCUMENTS	
	Commissioning plan	
	Owner's Project Requirements (OPR)	
	Basis of Design (BOD)	
	Executed installation checklists	
	Executed Functional Performance Test (FPT) forms	
	Recommendations for end-of-warranty review activities	

Owner and Commissioning Agent Acknowledgment

The commissioning report includes the items listed above and is approved by the owner/owner's representative and commissioning agent below.

1. Owner/Owner's Representative

The commissioning report includes the items listed above and have been approved by the owner or owner's representative.

Name: _____ Owner Owner's Representative

Company Name (if applicable): _____

Signature: _____ Date: _____

2. Commissioning Agent

Name: _____

Company Name (if applicable): _____

Signature: _____ Date: _____

COMPLIANCE FORMS, WORKSHEETS AND REFERENCE MATERIAL

FOR REFERENCE ONLY: The following table has been reprinted from the IES TM-15-11 Reference standard, see Section 5.106.8.

IES TM-15-11 TABLE A-1 Backlight Ratings (Maximum Zonal Lumens)

SECONDARY SOLID ANGLE	MAXIMUM ZONAL LUMENS PER OUTDOOR LIGHTING ZONE				
	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Backlight High (BH) 60 to 80 degrees	110	500	1,000	2,500	5,000
Backlight Medium (BM) 30 to < 60 degrees	220	1,000	2,500	5,000	8,500
Backlight Low (BL) 0 to < 30 degrees	110	500	1,000	2,500	5,000

FOR REFERENCE ONLY: The following table has been reprinted from the *California Energy Code, Part 6, Title 24*, see Section 5.106.8.

TABLE 130.2-A Uplight Ratings (Maximum Zonal Lumens)

SECONDARY SOLID ANGLE	MAXIMUM ZONAL LUMENS PER OUTDOOR LIGHTING ZONE				
	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Uplight High (UH) 100 to 180 degrees	0	10	50	500	1,000
Uplight Low (UL) 90 to < 100 degrees	0	10	50	500	1,000

FOR REFERENCE ONLY: The following table has been reprinted from the *California Energy Code, Part 6, Title 24*, see Section 5.106.8.

TABLE 130.2-B Glare Ratings (Maximum Zonal Lumens)

SECONDARY SOLID ANGLE	GLARE RATING FOR ASYMMETRICAL LUMINAIRE TYPES (Type I, Type II, Type III, Type IV)				
	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Forward Very High (FVH) 80 to 90 degrees	10	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	10	100	225	500	750
Forward High (FH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to < 80 degrees	110	500	1,000	2,500	5,000
SECONDARY SOLID ANGLE	GLARE RATING FOR QUADRILATERAL SYMMETRICAL LUMINAIRE TYPES (Type V, Type V Square)				
	Maximum Zonal Lumens per Outdoor Lighting Zone				
	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Forward Very High (FVH) 80 to 90 degrees	10	100	225	500	750
Backlight Very High (BVH) 80 to 90 degrees	10	100	225	500	750
Forward High (FH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000
Backlight High (BH) 60 to < 80 degrees	660	1,800	5,000	7,500	12,000

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

APPENDIX A4 – RESIDENTIAL VOLUNTARY MEASURES

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.

See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter				X																	
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																		X			
Chapter/Section																					
Appendix A4.2				†														X			

The state agency does not adopt sections identified by the following symbol: †.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Some of the measures contained in this appendix are not mandatory unless adopted by a city, county, or city and county as specified in Section 101.7 and provide additional measures that designers, builders and property owners may wish to consider during the planning, design and construction process.

Division A4.1 – PLANNING AND DESIGN

PREFACE

Given that land use and planning are largely regulated locally, cities, counties, and cities and counties should consider reducing greenhouse gas emissions associated with development through local land-use practices in conjunction with enforcing the provisions of this code. Specific land use strategies a city, county, or city and county may wish to consider include but are not limited to the following:

Site selection. Develop sites for buildings, hardscape, roads or parking areas consistent with the local general plan and regional transportation plan pursuant to SB 375 (Stats 2008, Ch. 728).

Regional sustainable communities strategy. Site selection and building design and use shall conform the project with the prevailing regional sustainable communities strategy or alternative planning strategy, whichever meets the greenhouse gas target established by the California Air Resources Board pursuant to SB 375 (Stats. 2008, Ch. 728), including the general location of uses, residential densities and building intensities.

Transit priority projects. To qualify as a transit priority project, the project shall meet three criteria:

- (1) (a) contain at least 50 percent residential use, based on total building square footage and, if the project contains

between 26 and 50 percent nonresidential uses, a floor area ratio of not less than 0.75; (b) provide a minimum net density of at least 20 dwelling units per acre; and (c) be within one-half mile of a major transit stop or high-quality transit corridor included in a regional transportation plan as described in Section 21155 of Stats. 2008, Ch. 728;

(2) be consistent with the prevailing sustainable communities strategy or alternative planning strategy, whichever meets the greenhouse gas target established by the California Air Resources Board, including the general location of uses, residential densities and building intensities; and

(3) have all necessary entitlements required by the applicable local government.

Note: For additional information, see *Government Code* Sections 65080, 65080.1, 65400 and 65470, and *Public Resources Code* Sections 21061.3 and 21155.

SECTION A4.101 GENERAL

A4.101.1 Scope. The provisions of this division outline planning, design and development methods that include environmentally responsible site selection, building design, building siting and development to protect, restore and enhance the environmental quality of the site and respect the integrity of adjacent properties.

SECTION A4.102 DEFINITIONS

A4.102.1 Definitions. The following terms are defined in Chapter 2.

BROWNFIELD SITE.

DEVELOPMENT FOOTPRINT.

GREENFIELDS.

GREYFIELD SITE.

INFILL SITE.

PERMEABLE PAVING.

SECTION A4.103 SITE SELECTION

A4.103.1 Selection. A site which complies with at least one of the following characteristics is selected:

1. An infill site is selected.
2. A greyfield site is selected.
3. An EPA-recognized and remediated Brownfield site is selected.

A4.103.2 Community connectivity. Facilitate community connectivity by one of the following methods:

1. Locate project within a $\frac{1}{4}$ -mile true walking distance of at least four basic services, readily accessible by pedestrians.
2. Locate project within a $\frac{1}{2}$ -mile true walking distance of at least seven basic services, readily accessible by pedestrians.
3. Other methods increasing access to additional resources.

Note: Examples of services include, but are not limited to, bank, place of worship, convenience grocery, day care, cleaners, fire station, barber shop, beauty shop, hardware store, laundry, library, medical clinic, dental clinic, senior care facility, park, pharmacy, post office, restaurant, school, supermarket, theater, community center, fitness center, museum or farmers market. Other services may be considered on a case-by-case basis.

SECTION A4.104 SITE PRESERVATION

A4.104.1 Supervision and education. Individuals with oversight authority on the project who have been trained in areas related to environmentally friendly development can teach green concepts to other members of the development staff and ensure that training is provided to all parties associated with the development of the project.

Prior to beginning the construction activities, all parties involved with the development process shall receive a written guideline and instruction specifying the green goals of the project.

Note: Lack of adequate supervision and dissemination of the project goals can result in negative effects on green building projects. If the theme of green building is not carried throughout the project, the overall benefit can be substantially reduced by the lack of knowledge and information provided to the various entities involved with the construction of the project.

SECTION A4.105 DECONSTRUCTION AND REUSE OF EXISTING MATERIALS

A4.105.1 General. Existing buildings on the site are deconstructed and the salvaged materials are reused. Reused materials or products must comply with current building standards requirements or be an accepted alternate method or material.

A4.105.2 Reuse of materials. Materials which can be easily reused include but are not limited to the following:

1. Light fixtures.
2. Plumbing fixtures.
3. Doors and trim.
4. Masonry.
5. Electrical devices.
6. Appliances.
7. Foundations or portions of foundations.

Note: Reused material must be in compliance with the appropriate Title 24 requirements.

SECTION A4.106 SITE DEVELOPMENT

A4.106.1 Reserved.

A4.106.2 Soil analysis and protection. The soils at the building site are analyzed and protected as specified in this section.

A4.106.2.1 Soil analysis. Soil analysis is performed by a licensed design professional and the findings utilized in the structural design of the building.

A4.106.2.2 Soil protection. The effect of development on building sites is evaluated and the soil is protected by one or more of the following:

1. Natural drainage patterns are evaluated and erosion controls are implemented to minimize erosion during construction and after occupancy.
2. Site access is accomplished by minimizing the amount of cut and fill needed to install access roads and driveways.
3. As allowed by other parts of the *California Building Standards Code* underground construction activities are coordinated to utilize the same trench, minimize the amount of time the disturbed soil is exposed and the soil is replaced using accepted compaction methods.

A4.106.2.3 Topsoil protection. Topsoil shall be protected or saved for reuse as specified in this section.

Tier 1. Displaced topsoil shall be stockpiled for reuse in a designated area and covered or protected from erosion.

Note: Protection from erosion includes covering with tarps, straw, mulch, chipped wood, vegetative cover or other means acceptable to the enforcing agency to protect the topsoil for later use.

Tier 2. The construction area shall be identified and delineated by fencing or flagging to limit construction activity to the construction area. Heavy equipment or vehicle traffic and material storage outside the construction area shall be limited to areas that are planned to be paved.

A4.106.3 Landscape design. Postconstruction landscape designs shall accomplish one or more of the following:

1. Areas disrupted during construction are restored to be consistent with native vegetation species and patterns.
2. Utilize at least 75 percent native California or drought tolerant plant and tree species appropriate for the climate zone region.

A4.106.4 Water permeable surfaces. Permeable paving is utilized for the parking, walking or patio surfaces in compliance with the following.

Tier 1. Not less than 20 percent of the total parking, walking or patio surfaces shall be permeable.

Tier 2. Not less than 30 percent of the total parking, walking or patio surfaces shall be permeable.

Exceptions:

1. The primary driveway, primary entry walkway and entry porch or landing shall not be included when calculating the area required to be a permeable surface.
2. Required accessible routes for persons with disabilities as required by *California Code of Regulations*, Title 24, Part 2, Chapter 11A and/or Chapter 11B as applicable.

A4.106.5 Cool roof for reduction of heat island effect. Roofing materials for Tier 1 and Tier 2 buildings shall comply with this section:

Exceptions:

1. Roof constructions that have a thermal mass over the roof membrane including areas of vegetated (green) roofs, weighing at least 25 pounds per square foot.
2. Roof areas covered by building integrated solar photovoltaic panels and building integrated solar thermal panels.

A4.106.5.1 Solar reflectance. Roofing materials shall have a minimum 3-year aged solar reflectance equal to or greater than the values specified in Tables A4.106.5.1(1)

and A4.106.5.1(3) for Tier 1 and Tables A4.106.5.1(2) and A4.105.5.1(4) for Tier 2.

If CRRC testing for aged solar reflectance is not available for any roofing products, the aged value shall be determined using the Cool Roof Rating Council (CRRC) certified initial value using the equation $\rho_{aged} = [0.2 + \beta[\rho_{initial}-0.2]]$, where $\rho_{initial}$ = the initial Solar Reflectance and soiling resistance, β , is listed by product type in Table A4.106.5.1.

Solar reflectance may also be certified by other supervisory entities approved by the Energy Commission pursuant to Title 24, Part 1, Section 10-113.

**TABLE A4.106.5.1
VALUES OF SOILING RESISTANCE (β) BY PRODUCT TYPE**

PRODUCT TYPE	CCRC PRODUCT CATEGORY	β
Field-applied coating	Field-applied coating	0.65
Other	Not a field-applied coating	0.70

A4.106.5.2 Thermal emittance. Roofing materials shall have a CRRC initial or aged thermal emittance equal to or greater than those specified in Tables A4.106.5.1(1) and A4.106.5.1(3) for Tier 1 and Tables A4.106.5.1(2) and A4.106.5.1(4) for Tier 2.

Thermal emittance may also be certified by other supervisory entities approved by the Energy Commission pursuant to Title 24, Part 1, *California Administrative Code*.

A4.106.5.3 Solar reflectance index alternative. Solar Reflectance Index (SRI) equal to or greater than the values specified in Tables A4.106.5.1(1) and A4.106.5.1(3) for Tier 1 and Tables A4.106.5.1(2) and A4.106.5.1(4) for Tier 2 may be used as an alternative to compliance with the 3-year aged solar reflectance values and thermal emittance.

SRI values used to comply with this section shall be calculated using the Solar Reflectance Index (SRI) Calculation Worksheet (SRI-WS) developed by the California Energy Commission or in compliance with ASTM E1980-01 as specified in the 2022 *California Energy Code*. Solar reflectance values used in the SRI-WS shall be based on the aged reflectance value of the roofing product or the equation in Section A4.106.5.1 if the CRRC certified aged solar reflectance are not available. Certified thermal emittance used in the SRI-WS may be either the initial value or the aged value listed by the CRRC.

Solar reflectance and thermal emittance may also be certified by other supervisory entities approved by the Commission pursuant to Title 24, Part 1, *California Administrative Code*.

Note: The Solar Reflectance Index Calculation Worksheet (SRI-WS) is available by contacting the Energy Standards Hotline at 1-800-772-3300, website at www.energy.ca.gov or by email at Title24@energy.ca.gov.

TABLE A4.106.5.1(1)
TIER 1 – LOW-RISE RESIDENTIAL

ROOF SLOPE	CLIMATE ZONE	MINIMUM 3-YEAR AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	13 & 15	0.63	0.75	75
> 2:12	10 – 15	0.20	0.75	16

TABLE A4.106.5.1(2)
TIER 2 – LOW-RISE RESIDENTIAL

ROOF SLOPE	CLIMATE ZONE	MINIMUM 3-YEAR AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	2, 4, 6 – 15	0.65	0.85	78
> 2:12	2, 4, 6 – 15	0.23	0.85	20

TABLE A4.106.5.1(3)
TIER 1 – HIGH-RISE RESIDENTIAL BUILDINGS, HOTELS AND MOTELS

ROOF SLOPE	CLIMATE ZONE	MINIMUM 3-YEAR AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	9, 10, 11, 13, 14, 15	0.55	0.75	64
> 2:12	2 – 15	0.20	0.75	16

TABLE A4.106.5.1(4)
TIER 2 – HIGH-RISE RESIDENTIAL BUILDINGS, HOTELS AND MOTELS

ROOF SLOPE	CLIMATE ZONE	MINIMUM 3-YEAR AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	2 – 15	0.65	0.75	78
> 2:12	2 – 15	0.23	0.75	20

A4.106.5.4 Verification. Inspection shall be conducted to ensure roofing materials meet cool roof aged solar reflectance and thermal emittance or SRI values.

A4.106.6 Vegetated roof. Install a vegetated roof for at least 50 percent of the roof area. Vegetated roofs shall comply with requirements for roof gardens and landscaped roofs in the *California Building Code*, Chapter 15 and Chapter 16.

A4.106.7 Reduction of heat island effect for nonroof areas. Reduce nonroof heat islands for 50 percent of sidewalks, patios, driveways or other paved areas by using one or more of the methods listed.

1. Trees or other plantings to provide shade and that mature within 15 years of planting. Trees should be native or adaptive to the region and climate zones and noninvasive; hardy and resistant to drought, insects and disease; easy to maintain (no frequent shedding of twigs, branches, unwanted fruit or seed pods); and suitable in mature size and environmental requirements for the site. Tree selection and placement should consider location and size of areas to be shaded, location of utilities, views from the structure, distance to sidewalks and foundations, overhangs onto adjacent properties and streets; other infrastructure and adjacent to landscaping. In addition, shading shall

not cast a shadow, as specified, on any neighboring solar collectors pursuant to *Public Resources Code* Section 25981, et seq. (Solar Shade Control Act).

2. Use high albedo materials with an initial solar reflectance value of at least 0.30 as determined in accordance with American Society for Testing and Materials (ASTM) Standards E1918 or C1549.
3. Use open grid pavement system or pervious or permeable pavement system.
4. Locate 50 percent of parking underground or use multi-level parking.
5. Other methods of reducing heat island effects acceptable to the enforcing agency.

Note: Local agencies may have ordinances requiring mitigation of heat island effects through building or parking lot shading, tree plantings, landscaping, use of pervious pavements and other approved methods.

A4.106.8 Electric vehicle (EV) charging for new construction. New construction shall comply with Sections A4.106.8.1, A4.106.8.2 or A4.106.8.3, to facilitate future installation and use of electric vehicle chargers. Electric vehicle supply equipment (EVSE) shall be installed in accordance with the *California Electrical Code*, Article 625.

A4.106.8.1 New one- and two-family dwellings and townhouses with attached private garages.

Tier 1 and Tier 2. For each dwelling unit, a dedicated 208/240-volt branch circuit shall be installed in the raceway required by Section 4.106.4.1. The branch circuit and associated overcurrent protective device shall be rated at 40 amperes minimum. Other electrical components, including a receptacle or blank cover, related to this section shall be installed in accordance with the *California Electrical Code*.

A4.106.8.1.1 Identification. The service panel or sub-panel circuit directory shall identify the overcurrent protective device designated for future EV charging purposes as “EV READY” in accordance with the *California Electrical Code*. The receptacle or blank cover shall be identified as “EV READY.”

A4.106.8.2 New multifamily development projects and hotels and motels. New multifamily development projects and hotels and motels shall meet the following requirements.

A4.106.8.2.1 Multifamily development projects and hotels and motels.

Tier 1.

EV Ready. Thirty-five (35) percent of the total number of parking spaces shall be equipped with low power Level 2 EV charging receptacles. For multifamily parking facilities, no more than one receptacle is required per dwelling unit when more than one parking space is provided for use by a single dwelling unit.

Exception: Areas of parking facilities served by parking lifts.

EV Chargers for projects with 20 or more dwelling units, sleeping units or guest rooms. Ten (10) percent of the total number of parking spaces shall be equipped with Level 2 EVSE. Where common use parking is provided, at least one EV charger shall be located in the common use parking area and shall be available for use by all residents or guests.

Tier 2.

EV Ready. Forty (40) percent of the total number of parking spaces shall be equipped with low power Level 2 EV charging receptacles. For multifamily parking facilities, no more than one receptacle is required per dwelling unit when more than one parking space is provided for use by a single dwelling unit.

Exception: Areas of parking facilities served by parking lifts.

EV Chargers for projects with 20 or more dwelling units, sleeping units or guest rooms. Fifteen (15) percent of the total number of parking spaces shall be equipped with Level 2 EVSE. Where common use parking is provided, at least one EV charger shall be located in the common use parking area and shall be available for use by all residents or guests.

A4.106.8.2.2 Technical requirements. The EV spaces required by Section A4.106.8.2 shall be designed and constructed in accordance with Sections 4.106.4.2, 4.106.4.2.1 (Notes), 4.106.4.2.2 (Notes), 4.106.4.2.2.1.1, 4.106.4.2.2.1.2, 4.106.4.2.2.1.3, 4.106.4.2.3, 4.106.4.2.4 and 4.106.4.2.5.

A4.106.9 Bicycle parking. Comply with Sections A4.106.9.1 through A4.106.9.3 or meet a local ordinance, whichever is more stringent.

Exception: Number of bicycle parking spaces shall be permitted to be reduced, as approved by the enforcing agency, due to building site characteristics, including but not limited to, isolation from other development.

A4.106.9.1 Short-term bicycle parking. Provide permanently anchored bicycle racks within 100 feet of the visitor’s entrance, readily visible to passers-by, for 5 percent of visitor motorized vehicle parking capacity with a minimum of one two-bike capacity rack.

A4.106.9.2 Long-term bicycle parking for multifamily buildings. Provide on-site bicycle parking for at least one bicycle per every two dwelling units. Acceptable parking facilities shall be conveniently reached from the street and may include, but not be limited to:

1. Covered, lockable enclosures with permanently anchored racks for bicycles.
2. Lockable bicycle rooms with permanently anchored racks.
3. Lockable, permanently anchored bicycle lockers.

A4.106.9.3 Long-term bicycle parking for hotel and motel buildings. Provide one on-site bicycle parking space for every 25,000 square feet, but not less than two. Acceptable parking facilities shall be conveniently reached from the street and may include, but not be limited to:

1. Covered, lockable enclosures with permanently anchored racks for bicycles.
2. Lockable bicycle rooms with permanently anchored racks.
3. Lockable, permanently anchored bicycle lockers.

**SECTION A4.107
(Reserved)**

**SECTION A4.108
INNOVATIVE CONCEPTS AND LOCAL
ENVIRONMENTAL CONDITIONS**

A4.108.1 Innovative concepts and local environmental conditions. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design or method of construction not specifically prescribed by this code. This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code pursuant to Section 101.7.1.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Division A4.2 – ENERGY EFFICIENCY

SECTION A4.201 GENERAL

A4.201.1 Scope. For the purposes of mandatory energy efficiency standards in the *California Building Standards Code* (Title 24), the California Energy Commission will continue to adopt mandatory standards in the *California Energy Code* (Title 24, Part 6). It is the intent of these voluntary provisions to encourage local jurisdictions through codification to achieve exemplary performance in the area of building energy efficiency. Local jurisdictions adopting these voluntary provisions as mandatory local energy efficiency standards shall submit the required application and receive the required approval of the California Energy Commission in compliance with Title 24, Part 1, Section 10-106 prior to enforcement. Once the required filing has been verified and finding has been made by the Energy Commission, local jurisdictions shall file an ordinance expressly marking the local modification along with findings and receive the required acceptance from the California Building Standards Commission in compliance with Section 101.7 of this code, prior to enforcement. (Title 24, Part 1, Section 10-106 is available at <http://www.energy.ca.gov/title24/2022standards/>)

SECTION A4.202 DEFINITIONS

A4.202.1 Definitions. The following terms are defined in Chapter 2.

ENERGY BUDGET.

ENERGY DESIGN RATING (EDR).

ENERGY DESIGN RATING, ENERGY EFFICIENCY.

ENERGY DESIGN RATING, SOLAR ELECTRIC GENERATION AND DEMAND FLEXIBILITY.

ENERGY DESIGN RATING, TOTAL

TIME DEPENDENT VALUATION (TDV) ENERGY.

SECTION A4.203 PERFORMANCE APPROACH FOR NEWLY CONSTRUCTED BUILDINGS

A4.203.1 Energy efficiency. Newly constructed low-rise residential buildings shall comply with Sections A4.203.1.1 through A4.203.1.3.

A4.203.1.1 Hourly Source Energy Design Rating (EDR1). EDR1 rating for the building's Proposed Design shall be computed by Compliance Software certified by the Energy Commission as specified in Title 24, Part 6, Section 100.1 and 150.1(b), and shall reduce the EDR1

required in the Compliance Software for minimum performance-based compliance with the *California Energy Code* by the compliance margin specified in Table A4.203.1.1. The rating shall be included in the Certificate of Compliance documentation.

**TABLE A4.203.1.1
RECOMMENDED EDR1 MARGINS BY CLIMATE ZONES**

CALIFORNIA ENERGY CODE CLIMATE ZONE	EDR1 COMPLIANCE MARGIN
1	4.3
2	4.4
3	6.0
4	5.8
5	5.8
6	3.5
7	2.9
8	2.1
9	3.6
10	6.5
11	4.3
12	4.4
13	4.9
14	5.8
15	1.8
16	4.3

Note: Community shared options complying with Title 24, Part 1, Section 10-115 may be used to achieve EDR1 targets.

A4.203.1.2 Prerequisite options. In addition, a minimum of TWO of the efficiency measures specified in Sections A4.203.1.2.1 through A4.203.1.2.8 will be required to be met.

A4.203.1.2.1 Roof deck insulation, or ducts in conditioned space. Meet one of the three options for the location of ducts and air handlers as well as insulation *R*-values and installation of a radiant barrier as specified in Title 24, Part 6, Section 150.1(c)9A or B:

1. Below roof deck insulation with a minimum *R*-value of 19; or,
2. Continuous above deck insulation with a minimum *R*-8 and with an air space present between the roofing and the roof deck; or,
3. All ducts and air handlers in conditioned space as specified in the Title 24, Part 6, Reference Appendix RA3.1.

A4.203.1.2.2 High performance walls. Meet the climate zone dependent *U*-factor or insulation *R*-value for either 2x6 or 2x4 framing as specified in Title 24, Part 6, Section 150.1(c)1B: maximum *U*-factor of 0.048.

> **A4.203.1.2.3 Compact hot water distribution system.** Meet the requirements for installation of Compact Hot Water Distribution Systems specified in the Title 24, Part 6, Reference Appendix RA3.6.5.

> **A4.203.1.2.4 Drain water heat recovery.** Meet the requirements for installation of Drain Water Heat Recovery specified in Title 24, Part 6, Reference Appendix RA4.4.21.

> **A4.203.1.2.5 High performance vertical fenestration.** Meet the climate zone dependent *U*-factor and Solar Heat Gain Co-efficient (SHGC) specified in Title 24, Part 6, Section 110.6, Maximum *U*-factor 0.21, SHGC 0.23.

> **A4.203.1.2.6 Heat pump water heater demand management.** For buildings with heat pump water heating, meet the requirements for installation of controls specified by Title 24, Part 6, Reference Appendix JA13.3.3.

> **A4.203.1.2.7 Battery storage system controls.** For buildings with battery storage systems, meet the requirements for installation of controls specified by Title 24, Part 6, Reference Appendix JA12 for either the Time-of-Use Control or Advanced Demand Flexibility Control option.

> **A4.203.1.2.8 Heat pump space and water heating.** Meet the space heating and water heating loads using heat pump equipment.

> **A4.203.1.3 Consultation with local electric service provider.** Local jurisdictions considering adoption of reduced EDR targets based on using solar photovoltaic (PV) systems larger than required by the *California Energy Code* shall consult with the local electric service provider to ensure that PV system sizing required to comply with the EDR targets will be acceptable to the local electric service provider. The local jurisdiction shall not require onsite PV systems that are larger than the local electric service provider will allow to be interconnected.

Note: Authority: Sections 25213, 25218, 25218.5, 25402 and 25402.1, Public Resources Code. Reference: Sections 25402, 25402.1, 25402.4 and 25402.8, Public Resources Code.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Division A4.3 – WATER EFFICIENCY AND CONSERVATION

SECTION A4.301 GENERAL (Reserved)

SECTION A4.302 DEFINITIONS (Reserved)

SECTION A4.303 INDOOR WATER USE

A4.303.1 Kitchen faucets. The maximum flow rate of kitchen faucets shall not exceed 1.5 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.5 gallons per minute at 60 psi.

Note: Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.

A4.303.2 Alternate water sources for nonpotable applications. Alternate nonpotable water sources are used for indoor potable water reduction. Alternate nonpotable water sources shall be installed in accordance with the *California Plumbing Code*.

A4.303.3 Appliances. Install at least one qualified ENERGY STAR dishwasher or clothes washer.

Note: See Section A5.303.3 for nonresidential dishwashers and clothes washers.

A4.303.4 Nonwater urinals and waterless toilets. Nonwater urinals or composting toilets are installed.

Where approved, nonwater urinals with drain cleansing action (formerly hybrid urinals), as defined in Chapter 2, shall be considered nonwater urinals.

A4.303.5 Hot water recirculation systems. One- and two-family dwellings shall be equipped with a demand hot water recirculation system, as defined in Chapter 2. The demand hot water recirculation system shall be installed in accordance with the *California Plumbing Code*, *California Energy Code* and the manufacturer's installation instructions.

SECTION A4.304 OUTDOOR WATER USE

A4.304.1 Rainwater catchment systems. An approved rainwater catchment system is designed and installed to use rainwater generated by at least 65 percent of the available

roof area. Rainwater catchment systems shall be designed and installed in accordance with the *California Plumbing Code*.

A4.304.2 Potable water elimination. When landscaping is provided and as allowed by local ordinance, a water efficient landscape irrigation design that eliminates the use of potable water beyond the initial requirements for plant installation and establishment shall be provided. Methods used to accomplish the requirements of this section shall comply with the requirements of the *California Building Standards Code* and shall include, but not be limited to, the following:

1. Use of captured rainwater.
2. Use of recycled water.
3. Water treated for irrigation purposes and conveyed by a water district or public entity.
4. Use of graywater.
5. Use of drought tolerant plants.

A4.304.3 Landscape water meters. For new water service connections, landscaped irrigated areas less than 5,000 square feet shall be provided with separate submeters or metering devices for outdoor potable water use.

SECTION A4.305 WATER REUSE SYSTEMS

A4.305.1 Graywater. Alternative plumbing piping is installed to permit the discharge from the clothes washer or other fixtures to be used for an irrigation system in compliance with the *California Plumbing Code*.

A4.305.2 Recycled water piping. Based on projected availability, dual water piping is installed for future use of recycled water at the following locations:

1. Interior piping for the use of recycled water is installed to serve all water closets, urinals and floor drains.
2. Exterior piping is installed to transport recycled water from the point of connection to the structure. Recycled water systems shall be designed and installed in accordance with the *California Plumbing Code*.

A4.305.3 Recycled water for landscape irrigation. Recycled water is used for landscape irrigation.

SECTION A4.306 INNOVATIVE CONCEPTS AND LOCAL ENVIRONMENTAL CONDITIONS

A4.306.1 Innovative concepts and local environmental conditions. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design or method of con-

APPENDIX A4—RESIDENTIAL VOLUNTARY MEASURES

struction not specifically prescribed by this code. This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code pursuant to Section 101.7.1.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Division A4.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

SECTION A4.401 GENERAL (Reserved)

SECTION A4.402 DEFINITIONS

A4.402.1 Definitions. The following terms are defined in Chapter 2.

ASSEMBLY (ASSEMBLY PRODUCT).

POSTCONSUMER CONTENT.

PRECONSUMER (OR POSTINDUSTRIAL) CONTENT.

PROPORTIONAL RECYCLED CONTENT (PRC_M).

RECYCLED CONTENT (RC).

RECYCLED CONTENT VALUE (RCV).

Assembly products (RCV_A).

Materials (RCV_M).

SECTION A4.403 FOUNDATION SYSTEMS

A4.403.1 Frost protected foundation systems. As allowed by local conditions, utilize a Frost-Protected Shallow Foundation (FPSF) in compliance with the *California Residential Code* (CRC). When an FPSF foundation system is installed, the manual required by Section 4.410.1 shall include instructions to the owner or occupant regarding the necessity for heating the structure as required in Section R403.3 of the *California Residential Code*.

A4.403.2 Reduction in cement use. As allowed by the enforcing agency, cement used in foundation mix design shall be reduced as follows:

Tier 1. Not less than a 20 percent reduction in cement use.

Tier 2. Not less than a 25 percent reduction in cement use.

Note: Products commonly used to replace cement in concrete mix designs include, but are not limited to:

1. Fly ash.
2. Slag.
3. Silica fume.
4. Rice hull ash.

SECTION A4.404 EFFICIENT FRAMING TECHNIQUES

A4.404.1 Lumber size. Beams, headers and trimmers are sized and installed as specified in Chapter 23 of the *Califor-*

nia Building Code, or Chapter 6 of the *California Residential Code*, as applicable. Other calculations acceptable to the enforcing agency which use the minimum size member for the tributary load shall be acceptable.

A4.404.2 Dimensions and layouts. Building dimensions and layouts are designed to minimize waste by one or more of the following measures in at least 80 percent of the structure:

1. Building design dimensions in 2-foot increments are used.
2. Windows and doors are located at regular 16" or 24" stud positions.
3. Other methods acceptable to the enforcing agency.

A4.404.3 Building systems. Use premanufactured building systems to eliminate solid sawn lumber whenever possible. One or more of the following premanufactured building systems is used:

1. Composite floor joist or premanufactured floor framing system.
2. Composite roof rafters or premanufactured roof framing system.
3. Panelized (SIPS, ICF or similar) framing systems.
4. Other methods approved by the enforcing agency.

A4.404.4 Pre-cut materials and details. Material lists are included in the plans which specify the material quantity and provide direction for on-site cuts to be made from the material provided. Material lists and direction shall be provided for the following systems:

1. Floor framing.
2. Wall framing.
3. Ceiling and roof framing.
4. Structural panels and roof sheathing.

SECTION A4.405 MATERIAL SOURCES

A4.405.1 Prefinished building materials. Utilize prefinished building materials which do not require additional painting or staining when possible. One or more of the following building materials that do not require additional resources for finishing are used:

1. Exterior trim not requiring paint or stain.
2. Windows not requiring paint or stain.
3. Siding or exterior wall coverings which do not require paint or stain.

A4.405.2 Concrete floors. Floors that do not require additional coverings are used including but not limited to stained, natural or stamped concrete floors.

A4.405.3 Recycled content. Comply with the requirements for recycled content in Section A4.405.3.1.

A4.405.3.1 Recycled content. Use materials, equivalent in performance to virgin materials with a total (combined) recycled content value (RCV) of:

Tier 1. The RCV shall not be less than 10 percent of the total material cost of the project.

$$\text{Required Total RCV (dollars)} = \text{Total Material Cost (dollars)} \times 10 \text{ percent} \quad \text{(Equation A4. 4-1)}$$

Tier 2. The RCV shall not be less than 15 percent of the total material cost of the project.

$$\text{Required Total RCV (dollars)} = \text{Total Material Cost (dollars)} \times 15 \text{ percent} \quad \text{(Equation A4. 4-2)}$$

For the purposes of this section, materials used as components of the structural frame shall not be used to calculate recycled content. The structural frame includes the load bearing structural elements, such as wall studs, plates, sills, columns, beams, girders, joists, rafters and trusses.

Notes:

1. Sample forms which allow user input and automatic calculation are located at <http://www.hcd.ca.gov/building-standards/calgreen/calgreen-forms.html> and may be used to simplify documenting compliance with this section and for calculating recycled content value of materials or assembly products.
2. Sources and recycled content of some recycled materials can be obtained from CalRecycle if not provided by the manufacturer.

A4.405.3.1.1 Total material cost. Total material cost is the total estimated or actual cost of materials and assembly products used in the project. The required total recycled content value for the project (in dollars) shall be determined by Equation A4.4-1 or Equation A4.4-2.

Total material cost shall be calculated by using one of the methods specified below:

1. **Simplified method.** To obtain the total cost of the project, multiply the square footage of the residential structure by the square foot valuation established pursuant to the ICC Building Valuation Data (BVD) or other valuation data approved and/or established by the enforcing agency. The total material cost is 45 percent of the total cost of the project. Use Equations A4.4-3A or A4.4-3B to determine total material costs using the simplified method.

$$\text{Total material costs} = \text{Project square footage} \times \text{square foot valuation} \times 45 \text{ percent} \quad \text{(Equation A4.4-3A)}$$

$$\text{Total estimated or actual cost of project} \times 45 \text{ percent} \quad \text{(Equation A4.4-3B)}$$

2. **Detailed method.** To obtain the total cost of the project, add the estimated and/or actual costs of materials used for the project, including the struc-

ture (steel, concrete, wood or masonry); the enclosure (roof, windows, doors and exterior walls); the interior walls, ceilings and finishes (gypsum board, ceiling tiles, etc.). The total estimated and/or actual costs shall not include fees, labor and installation costs, overhead, appliances, equipment, furniture or furnishings.

A4.405.3.1.2 Determination of total recycled content value (RCV). Total RCV may be determined either by dollars or percentage as noted below.

1. **Total recycled content value for the project (in dollars).** This is the sum of the recycled content value of the materials and/or assemblies considered and shall be determined by Equation A4.4-4. The result of this calculation may be directly compared to Equations A4.4-1 and A4.4-2 to determine compliance with Tier 1 or Tier 2 prerequisites.

$$\text{Total Recycled Content Value (dollars)} = (\text{RCV}_M + \text{RCV}_A) \quad \text{(Equation A4.4-4)}$$

2. **Total recycled content value for the project (by percentage).** This is expressed as a percentage of the total material cost and shall be determined by Equation A4.4-4 and Equation A4.4-5. The result of this calculation may be directly compared for compliance with Tier 1 (10 percent) or Tier 2 (15 percent) prerequisites.

$$\text{Total Recycled Content Value (percent)} = \frac{[\text{Total Recycled Content Value (dollars)} \div \text{Total Material Cost (dollars)}] \times 100}{\text{Total Material Cost (dollars)}} \quad \text{(Equation A4.4-5)}$$

A4.405.3.1.3 Determination of recycled content value of materials (RCV_M). The recycled content value of each material (RCV_M) is calculated by multiplying the cost of material, as defined by the recycled content. See Equations A4.4-6 and A4.4-7.

$$\text{RCV}_M \text{ (dollars)} = \text{Material cost (dollars)} \times \text{RC}_M \text{ (percent)} \quad \text{(Equation A4.4-6)}$$

$$\text{RC}_M \text{ (percent)} = \text{Postconsumer content percentage} + (\frac{1}{2}) \text{ Preconsumer content percentage} \quad \text{(Equation A4.4-7)}$$

Notes:

1. If the postconsumer and preconsumer recycled content is provided in pounds, Equation A4.4-7 may be used, but the final result (in pounds) must be multiplied by 100 to show RC_M as a percentage.
2. If the manufacturer reports total recycled content of a material as one percentage in lieu of separately reporting preconsumer and postconsumer values, the total shall be considered preconsumer recycled material.

A4.405.3.1.4 Determination of recycled content value of assemblies – (RCV_A). Recycled content value of assemblies is calculated by multiplying the total cost

of the assembly by the total recycled content of the assembly (RC_A), and shall be determined by Equation A4.4-8.

$$RCV_A \text{ (dollars)} = \text{Assembly cost (dollars)} \times \text{Total } RC_A \text{ (percent)} \quad \text{(Equation A4.4-8)}$$

If not provided by the manufacturer, Total RC_A (percent) is the sum (Σ) of the Proportional Recycled Content (PRC_M) of each material in the assembly. RC_A shall be determined by Equation A4.4-9.

$$RC_A = \Sigma PRC_M \quad \text{(Equation A4.4-9)}$$

PRC_M of each material may be calculated by one of two methods using the following formulas:

Method 1: Recycled content (postconsumer and preconsumer) of each material provided in percentages

$$PRC_M \text{ (percent)} = \text{Weight of material (percent)} \times RC_M \text{ (percent)} \quad \text{(Equation A4.4-10)}$$

$$\text{Weight of material (percent)} = \frac{\text{Weight of material (lbs)} \div \text{Weight of assembly (lbs)}}{\times 100} \quad \text{(Equation A4.4-11)}$$

$$RC_M \text{ (percent)} = \text{Postconsumer content percentage} + \left(\frac{1}{2}\right) \text{Preconsumer content percentage} \quad \text{(See Equation A4.4-7)}$$

Method 2: Recycled content (postconsumer and preconsumer) provided in pounds

$$PRC_M \text{ (percent)} = \frac{RC_M \text{ (lbs)}}{\text{Weight of material (lbs)}} \times 100 \quad \text{(Equation A4.4-12)}$$

$$RC_M \text{ (lbs)} = \text{Postconsumer content (lbs)} + \left(\frac{1}{2}\right) \text{Preconsumer content (lbs)} \quad \text{(Equation A4.4-13)}$$

Note: If the manufacturer reports total recycled content of a material as one percentage in lieu of separately reporting preconsumer and postconsumer values, the total shall be considered preconsumer recycled material.

A4.405.3.1.5 Alternate method for concrete. When Supplementary Cementitious Materials (SCMs), such as fly ash or ground blast furnace slag cement, are used in concrete, an alternate method of calculating and reporting recycled content in concrete products shall be permitted. When determining the recycled content value, the percent recycled content shall be multiplied by the cost of the cementitious materials only, not the total cost of the concrete.

A4.405.4 Use of building materials from rapidly renewable sources. One or more of the following materials manufactured from rapidly renewable sources or agricultural by-products is used:

1. Insulation.
2. Bamboo or cork.
3. Engineered products.
4. Agricultural based products.
5. Other products acceptable to the enforcing agency.

Note: The intent of this section is to utilize building materials and products which are typically harvested within a 10-year or shorter cycle.

**SECTION A4.406
ENHANCED DURABILITY
AND REDUCED MAINTENANCE
(Reserved)**

**SECTION A4.407
WATER RESISTANCE
AND MOISTURE MANAGEMENT**

A4.407.1 Drainage around foundations. Install foundation and landscape drains which discharge to a dry well, sump, bioswale or other approved on-site location.

A4.407.2 Roof drainage. Install gutter and downspout systems to route water at least 5 feet away from the foundation or connect to landscape drains which discharge to a dry well, sump, bioswale, rainwater capture system or other approved on-site location.

A4.407.3 Flashing details. Provide flashing details on the building plans which comply with accepted industry standards or manufacturer's instructions. Details are shown on house plans at all of the following locations:

1. Around windows and doors.
2. Roof valleys.
3. Deck connections to the structure.
4. Roof-to-wall intersections.
5. Chimneys to roof intersections.
6. Drip caps above windows and doors with architectural projections.

Note: Reference details may be found in the *Residential Sheet Metal Guidelines* published by the Sheet Metal and Air Conditioning Contractors' National Association Inc.

A4.407.4 Material protection. Protect building materials delivered to the construction site from rain and other sources of moisture.

A4.407.5 Ice and water barriers. In Climate Zone 16, an ice and water barrier is installed at valley, eaves and wall to roof intersections. The ice and water barrier shall extend at least 24 inches inside the exterior wall line or as specified by the manufacturer's installation instructions.

A4.407.6 Door protection. Exterior doors to the dwelling are covered to prevent water intrusion by one or more of the following:

1. An awning at least 4 feet in depth is installed.
2. The door is protected by a roof overhang at least 4 feet in depth.
3. The door is recessed at least 4 feet.
4. Other methods which provide equivalent protection.

A4.407.7 Roof overhangs. A permanent overhang or awning at least 2 feet in depth is provided at all exterior walls.

**SECTION A4.408
CONSTRUCTION WASTE REDUCTION,
DISPOSAL AND RECYCLING**

A4.408.1 Enhanced construction waste reduction. Non-hazardous construction and demolition debris generated at the site is diverted to recycle or salvage in compliance with one of the following:

Tier 1. At least a 65 percent reduction. Any mixed recyclables that are sent to mixed-waste recycling facilities shall include a qualified third party verified facility average diversion rate. Verification of diversion rates shall meet minimum certification eligibility guidelines, acceptable to the local enforcing agency.

Tier 2. At least a 75 percent reduction with a third-party verification as required for Tier 1.

Exceptions:

1. Equivalent or alternative waste reduction methods are developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
2. The enforcing agency may make exceptions to the requirements of this section when jobsites are located in areas beyond the haul boundaries of the diversion facility.

A4.408.1.1 Documentation. Documentation shall be provided to the enforcing agency which demonstrates compliance with this section. Documentation shall be in compliance with Section 4.408.5.

**SECTION A4.409
LIFE CYCLE ASSESSMENT
(Reserved)**

**SECTION A4.410
BUILDING MAINTENANCE AND OPERATION
(Reserved)**

**SECTION A4.411
INNOVATIVE CONCEPTS AND LOCAL
ENVIRONMENTAL CONDITIONS**

A4.411.1 Innovative concepts and local environmental conditions. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design or method of construction not specifically prescribed by this code. This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code pursuant to Section 101.7.1.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Division A4.5 – ENVIRONMENTAL QUALITY

SECTION A4.501 GENERAL (Reserved)

SECTION A4.502 DEFINITIONS

A4.502.1 Definitions. The following terms are defined in Chapter 2.

MERV.

NO ADDED FORMALDEHYDE (NAF) BASED RESINS.

ULTRA-LOW EMITTING FORMALDEHYDE (ULEF) RESINS.

SECTION A4.503 FIREPLACES (Reserved)

SECTION A4.504 POLLUTANT CONTROL

A4.504.1 Compliance with formaldehyde limits. Use composite wood products made with either California Air Resources Board approved no-added formaldehyde (NAF) resins or ultra-low emitting formaldehyde (ULEF) resins.

Note: Documentation must be provided that verifies that finish materials are certified to meet the pollutant emission limits.

A4.504.2 Resilient flooring systems. Resilient flooring systems installed in the building shall meet the percentages specified in this section and meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx>

Tier 1. At least 90 percent of the total area of resilient flooring installed shall comply.

Tier 2. 100 percent of the total area of resilient flooring installed shall comply.

Exception for Tier 2: An allowance for up to 5 percent specialty purpose flooring may be permitted.

Note: Documentation must be provided that verifies that finish materials are certified to meet the pollutant emission limits in this section.

A4.504.3 Thermal insulation. Thermal insulation installed in the building shall meet the following requirements:

Tier 1. Install thermal insulation that meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx>

Tier 2. Install insulation which complies with Tier 1 plus does not contain any added formaldehyde.

Note: Documentation must be provided that verifies the materials are certified to meet the pollutant emission limits in this section.

SECTION A4.505 INTERIOR MOISTURE CONTROL (Reserved)

SECTION A4.506 INDOOR AIR QUALITY AND EXHAUST

A4.506.1 Reserved.

A4.506.2 Construction filter. [HR] Provide filters on return air openings rated at MERV 8 or higher during construction.

A4.506.3 Direct-vent appliances. Direct-vent heating and cooling equipment shall be utilized if the equipment will be located in the conditioned space or install the space heating and water heating equipment in an isolated mechanical room.

SECTION A4.507 ENVIRONMENTAL COMFORT (Reserved)

**SECTION A4.508
OUTDOOR AIR QUALITY
(Reserved)**

**SECTION A4.509
INNOVATIVE CONCEPTS AND LOCAL
ENVIRONMENTAL CONDITIONS**

A4.509.1 Innovative concepts and local environmental conditions. The provisions of this code are not intended to prevent the use of any alternate material, appliance, installation, device, arrangement, method, design or method of construction not specifically prescribed by this code. This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code pursuant to Section 101.7.1.

APPENDIX A4

RESIDENTIAL VOLUNTARY MEASURES

Division A4.6 – TIER 1 AND TIER 2

SECTION A4.601 GENERAL

A4.601.1 Scope. The measures contained in this appendix are not mandatory unless adopted by a city, county, or city and county as specified in Section 101.7. The provisions of this section outline means of achieving enhanced construction or reach levels by incorporating additional green building measures. In order to meet one of the tier levels designers, builders or property owners are required to incorporate additional green building measures necessary to meet the threshold of each level.

A4.601.2 Prerequisite measures. Tier 1 and Tier 2 thresholds require compliance with the mandatory provisions of this code and incorporation of the required prerequisite measures listed in Section A4.601.4.2 for Tier 1 and A4.601.5.2 for Tier 2. Prerequisite measures are also identified in the Residential Occupancies Application Checklist in Section A4.602.

As specified in Section 101.7, additional prerequisite measures may be included by the enforcing agency to address specific local environmental conditions and may be listed in the Innovative Concepts and Local Environmental Conditions portions of the checklist.

A4.601.3 Elective measures. In addition to the required measures, Tier 1 and Tier 2 buildings must incorporate at least the number of elective measures specified in Sections A4.601.4.2 and A4.601.5.2.

A4.601.4 Tier 1. To achieve Tier 1 status a project must comply with the following:

A4.601.4.1 Mandatory measures for Tier 1. The project shall meet or exceed all of the mandatory measures in Chapter 4, Divisions 4.1 through 4.5 and Chapter 7 as applicable.

A4.601.4.2 Prerequisite and elective measures for Tier 1. In addition to the mandatory measures, compliance with the following prerequisite and elective measures from Appendix A4 is also required to achieve Tier 1 status:

1. From Division A4.1, Planning and Design.
 - 1.1. Comply with the topsoil protection requirements in Section A4.106.2.3.
 - 1.2. Comply with the 20 percent permeable paving requirements in Section A4.106.4.
 - 1.3. Comply with the cool roof requirements in Section A4.106.5.
 - 1.4. Comply with the Tier 1 electric vehicle (EV) charging requirements in Section A4.106.8.
 - 1.5. Comply with at least two elective measures selected from Division A4.1.

2. From Division A4.2, Energy Efficiency.

2.1. For newly constructed low-rise residential buildings, comply with the energy efficiency requirements in Sections A4.203.1, A4.203.1.1, Table A4.203.1.1, A4.203.1.2 and A4.203.1.3.

3. From Division A4.3, Water Efficiency and Conservation.

3.1. Comply with at least two elective measures selected from Division A4.3.

4. From Division A4.4, Material Conservation and Resource Efficiency.

4.1. Comply with the 20 percent cement reduction requirements in Section A4.403.2.

4.2. Comply with the 10 percent recycled content requirements in Section A4.405.3.1.

4.3. Comply with the 65 percent reduction in construction waste in Section A4.408.1.

4.4. Comply with at least two elective measures selected from Division A4.4.

5. From Division A4.5, Environmental Quality.

5.1. Comply with the 90 percent resilient flooring systems requirements in Section A4.504.2.

5.2. Comply with the thermal insulation requirements for Tier 1 in Section A4.504.3.

5.3. Comply with at least one elective measure selected from Division A4.5.

Note: The Residential Occupancies Application Checklist contained in Section A4.602 may be used to show which elective measures are selected.

A4.601.5 Tier 2. To achieve Tier 2 status a project must comply with the following.

Note: The measures necessary to achieve Tier 2 status are very stringent. Cities, counties, and cities and counties considering adoption of Tier 2 as mandatory should carefully consider the stringency of each measure and ensure that the measures are achievable in their location.

A4.601.5.1 Mandatory measures for Tier 2. The project shall meet or exceed all of the mandatory measures in Chapter 4, Divisions 4.1 through 4.5 and Chapter 7 as applicable.

A4.601.5.2 Prerequisite and elective measures for Tier 2. In addition to the mandatory measures, compliance with the following prerequisite and elective measures from Appendix A4 is also required to achieve Tier 2 status.

1. From Division A4.1, Planning and Design.

1.1. Comply with the topsoil protection requirements for Tier 1 and Tier 2 in Section A4.106.2.3.

APPENDIX A4—RESIDENTIAL VOLUNTARY MEASURES

- 1.2. Comply with the 30 percent permeable paving requirements in Section A4.106.4.
- 1.3. Comply with the cool roof requirements in Section A4.106.5.
- 1.4. Comply with the Tier 2 electric vehicle (EV) charging requirements in Section A4.106.8.
- 1.5. Comply with at least four elective measures selected from Division A4.1.
- 2. From Division A4.2, Energy Efficiency.
 - 2.1. For newly constructed low-rise residential buildings, comply with the energy efficiency requirements in Sections A4.203.1, A4.203.1.1, Table A4.203.1.1, A4.203.1.2 and A4.203.1.3.
- 3. From Division A4.3, Water Efficiency and Conservation.
 - 3.1. Comply with at least three elective measures selected from Division A4.3.
- 4. From Division A4.4, Material Conservation and Resource Efficiency.
 - 4.1. Comply with the 25 percent cement reduction requirements in Section A4.403.2.
 - 4.2. Comply with the 15 percent recycled content requirements in Section A4.405.3.1.
 - 4.3. Comply with the 75 percent reduction in construction waste in Section A4.408.1.
 - 4.4. Comply with at least four elective measures selected from Division A4.4.
- 5. From Division A4.5, Environmental Quality.
 - 5.1. Comply with the 100 percent resilient flooring systems requirements in Section A4.504.2.
 - 5.2. Comply with the thermal insulation requirements for Tier 1 and Tier 2 in Section A4.504.3.
 - 5.3. Comply with at least one elective measure selected from Division A4.5.

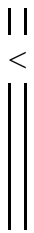
Note: The Residential Occupancies Application Checklist contained in Section A4.602 may be used to show which elective measures are selected.

DIVISION A4.6 – TIER 1 AND TIER 2—continued

SECTION A4.602 RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
PLANNING AND DESIGN						
Site Selection						
A4.103.1 A site which complies with at least one of the following characteristics is selected: 1. An infill site is selected. 2. A greyfield site is selected. 3. An EPA-recognized Brownfield site is selected.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
A4.103.2 Facilitate community connectivity by one of the following methods: 1. Locate project within a 1/4-mile true walking distance of at least 4 basic services; 2. Locate project within 1/2-mile true walking distance of at least 7 basic services; 3. Other methods increasing access to additional resources.	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>
Site Preservation						
A4.104.1 An individual with oversight responsibility for the project has participated in an educational program promoting environmentally friendly design or development and has provided training or instruction to appropriate entities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deconstruction and Reuse of Existing Materials						
A4.105.2 Existing buildings are disassembled for reuse or recycling of building materials. The proposed structure utilizes at least one of the following materials which can be easily reused: 1. Light fixtures 2. Plumbing fixtures 3. Doors and trim 4. Masonry 5. Electrical devices 6. Appliances 7. Foundations or portions of foundations	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Site Development						
4.106.2 A plan is developed and implemented to manage storm water drainage during construction.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.106.3 Construction plans shall indicate how site grading or a drainage system will manage all surface water flows to keep water from entering buildings.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.106.4.1 Provide capability for electric vehicle charging for one- and two-family dwellings; townhouses with attached private garages in accordance with Section 4.106.4.1.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.106.4.2 Provide capability for electric vehicle charging for multifamily dwellings and hotels/motels in accordance with Sections 4.106.4.2.1 or 4.106.4.2.2, as applicable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.106.4.3 Provide capability for electric vehicle charging for existing parking lots or new parking lots for existing residential buildings in accordance with Section 4.106.4.3, as applicable.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.1 Reserved		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued



SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
A4.106.2.1 Soil analysis is performed by a licensed design professional and the findings utilized in the structural design of the building.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.2.2 Soil disturbance and erosion are minimized by at least one of the following: 1. Natural drainage patterns are evaluated and erosion controls are implemented to minimize erosion during construction and after occupancy. 2. Site access is accomplished by minimizing the amount of cut and fill needed to install access roads and driveways. 3. Underground construction activities are coordinated to utilize the same trench, minimize the amount of time the disturbed soil is exposed and the soil is replaced using accepted compaction methods.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.2.3 Topsoil shall be protected or saved for reuse as specified in this section. Tier 1. Displaced topsoil shall be stockpiled for reuse in a designated area and covered or protected from erosion. Tier 2. The construction area shall be identified and delineated by fencing or flagging to limit construction activity to the construction area.	<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ³	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.3 Postconstruction landscape designs accomplish one or more of the following: 1. Areas disrupted during construction are restored to be consistent with native vegetation species and patterns. 2. Utilize at least 75 percent native California or drought tolerant plant and tree species appropriate for the climate zone region.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.4 Permeable paving is utilized for the parking, walking or patio surfaces in compliance with the following: Tier 1. Not less than 20 percent of the total parking, walking or patio surfaces shall be permeable. Tier 2. Not less than 30 percent of the total parking, walking or patio surfaces shall be permeable.	<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ³	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.5 Roofing materials shall have a minimum 3-year aged solar reflectance and thermal emittance or a minimum Solar Reflectance Index (SRI) equal to or greater than the values specified in the applicable tables. Low-rise Residential Tier 1 roof covering shall meet or exceed the values contained in Table A4.106.5.1(1). Tier 2 roof covering shall meet or exceed the values contained in Table A4.106.5.1(2). High-rise Residential, Hotels and Motels Tier 1 roof covering shall meet or exceed the values contained in Table A4.106.5.1(3). Tier 2 roof covering shall meet or exceed the values contained in Table A4.106.5.1(4).	<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ³	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency <input type="checkbox"/> All	Installer or Designer <input type="checkbox"/> All	Third party <input type="checkbox"/> All
		Tier 1	Tier 2			
A4.106.6 Install a vegetated roof for at least 50 percent of the roof area. Vegetated roofs shall comply with requirements for roof gardens and landscaped roofs in the <i>California Building Code</i> , Chapters 15 and 16.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.7 Reduce nonroof heat islands for 50 percent of sidewalks, patios, driveways or other paved areas by using one or more of the methods listed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.8.1 Tier 1 and Tier 2 for one- and two-family dwellings and townhouses with attached private garages. Install a dedicated 208/240-volt branch circuit, including an overcurrent protective device rated at 40 amperes minimum per dwelling unit.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.8.2 Provide capability for future electric vehicle charging in new multifamily dwellings, hotels and motels, as specified. Tier 1. 35 percent of the total number of parking spaces shall be electric vehicle (EV ready) with low power Level 2 EV charging receptacles. For projects with 20 or more dwelling units, sleeping units or guest rooms, 10 percent of the total number of parking spaces shall be equipped with Level 2 EVSE. Tier 2. 40 percent of the total number of parking spaces shall be electric vehicle (EV ready) with low power Level 2 EV charging receptacles. For projects with 20 or more dwelling units, sleeping units or guest rooms, 15 percent of the total number of parking spaces shall be equipped with Level 2 EVSE.		<input checked="" type="checkbox"/> ²		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
			<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.106.9 Provide bicycle parking facilities as noted below or meet a local ordinance, whichever is more stringent. Number of bicycle parking spaces may be reduced, as approved by the enforcing agency, due to building site characteristics, including but not limited to, isolation from other development. 1. Provide short-term bicycle parking, per Section A4.106.9.1. 2. Provide long-term bicycle parking for multifamily buildings, per Section A4.106.9.2. 3. Provide long-term bicycle parking for hotel and motel buildings, per Section A4.106.9.3.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



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**SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued**

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
Innovative Concepts and Local Environmental Conditions						
A4.108.1 Items in this section are necessary to address innovative concepts or local environmental conditions.						
Item 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ENERGY EFFICIENCY						
General						
4.201.1 Building meets or exceeds the requirements of the <i>California Building Energy Efficiency Standards</i> ³ .	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Performance Approach for Newly Constructed Buildings						
A4.203.1.1 Hourly Source Energy Rating (EDR1). EDR1 ratings for building design shall be computed by Energy Compliant software and shall reduce the EDR1 required by the software by the compliance margins specified in Table A4.203.1.1.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.203.1.2 Prerequisite options. In addition, a minimum of two of the efficiency measures specified in Sections A4.203.1.2.1 through A4.203.1.2.8 will be required to be met. <ul style="list-style-type: none"> • Roof Deck Insulation or Ducts in Conditioned Space. • High-performance Walls. • Compact Hot Water Distribution System. • Drain Water Heat Recovery. • High Performance Vertical Fenestration. • Heat Pump Water Heater Demand Management. • Battery Storage System Controls. • Heat Pump Space and Water Heating. 		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.203.1.3 Consultation with local electric service provider. Local jurisdictions considering adoption of reduced EDR targets based on using solar photovoltaic (PV) systems larger than required by the <i>California Energy Code</i> shall consult with the local electric service provider to ensure that that PV system sizing required to comply with the EDR targets will be acceptable to the local electric service provider.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency <input type="checkbox"/> All	Installer or Designer <input type="checkbox"/> All	Third party <input type="checkbox"/> All
		Tier 1	Tier 2			
WATER EFFICIENCY AND CONSERVATION						
Indoor Water Use						
4.303.1 Plumbing fixtures (water closets and urinals) and fittings (showerheads, faucets and pre-rinse spray valves) installed in residential buildings shall comply with the prescriptive requirements of Sections 4.303.1.1 through 4.303.1.4.5.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.303.2 Submeters for multifamily building and dwelling units in mixed-use residential/commercial buildings. Submeters shall be installed to measure water usage of individual rental dwelling units in accordance with the <i>California Plumbing Code</i> .	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.303.3 Plumbing fixtures and fittings required in Section 4.303.1 shall be installed in accordance with the <i>California Plumbing Code</i> , and shall meet the applicable referenced standards.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.303.1 The maximum flow rate of kitchen faucets shall not exceed 1.5 gallons per minute at 60 psi. Kitchen faucets may temporarily increase the flow above the maximum rate, but not to exceed 2.2 gallons per minute at 60 psi, and must default to a maximum flow rate of 1.5 gallons per minute at 60 psi. Note: Where complying faucets are unavailable, aerators or other means may be used to achieve reduction.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.303.1.4.3 Metering faucets in residential buildings shall not deliver more than 0.2 gallons per cycle.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.303.2 Alternate water source for nonpotable applications. Alternate nonpotable water sources are used for indoor potable water reduction. Alternate nonpotable water sources shall be installed in accordance with the <i>California Plumbing Code</i> .		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.303.3 Install at least one qualified ENERGY STAR dishwasher or clothes washer.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.303.4 Nonwater urinals or waterless toilets are installed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.303.5 One- and two-family dwellings shall be equipped with a demand hot water recirculation system.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outdoor Water Use						
4.304.1 Residential developments shall comply with a local water efficient landscape ordinance or the current California Department of Water Resources' Model Water Efficient Landscape Ordinance (MWELO), whichever is more stringent.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.304.1 A rainwater capture, storage and re-use system is designed and installed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.304.2 A landscape design is installed, which does not utilize potable water.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.304.3 For new water service connections, landscaped irrigated areas less than 5,000 square feet shall be provided with separate submeters or metering devices for outdoor potable water use.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

APPENDIX A4—RESIDENTIAL VOLUNTARY MEASURES

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
Water Reuse Systems						
A4.305.1 Piping is installed to permit future use of a graywater irrigation system served by the clothes washer or other fixtures.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.305.2 Recycled water piping is installed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.305.3 Recycled water is used for landscape irrigation.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Innovative Concepts and Local Environmental Conditions						
A4.306.1 Items in this section are necessary to address innovative concepts or local environmental conditions.						
Item 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MATERIAL CONSERVATION AND RESOURCE EFFICIENCY						
Foundation Systems						
A4.403.1 A Frost-protected Shallow Foundation (FPSF) is designed and constructed.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.403.2 Cement use in foundation mix design is reduced. Tier 1. Not less than a 20 percent reduction in cement use. Tier 2. Not less than a 25 percent reduction in cement use.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Efficient Framing Techniques						
A4.404.1 Beams and headers and trimmers are the minimum size to adequately support the load.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.404.2 Building dimensions and layouts are designed to minimize waste.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.404.3 Use premanufactured building systems to eliminate solid sawn lumber whenever possible.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.404.4 Material lists are included in the plans which specify material quantity and provide direction for on-site cuts.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency <input type="checkbox"/> All	Installer or Designer <input type="checkbox"/> All	Third party <input type="checkbox"/> All
		Tier 1	Tier 2			
Material Sources						
A4.405.1 One or more of the following building materials, that do not require additional resources for finishing are used: 1. Exterior trim not requiring paint or stain 2. Windows not requiring paint or stain 3. Siding or exterior wall coverings which do not require paint or stain		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.405.2 Floors that do not require additional coverings are used including but not limited to stained, natural or stamped concrete floors.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.405.3 Postconsumer or preconsumer recycled content value (RCV) materials are used on the project. Tier 1. Not less than a 10 percent recycled content value. Tier 2. Not less than a 15 percent recycled content value.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.405.4 Renewable source building products are used.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Enhanced Durability and Reduced Maintenance						
4.406.1 Annular spaces around pipes, electric cables, conduits or other openings in plates at exterior walls shall be protected against the passage of rodents by closing such openings with cement mortar, concrete masonry or similar method acceptable to the enforcing agency.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Water Resistance and Moisture Management						
A4.407.1 Install foundation and landscape drains.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.2 Install gutter and downspout systems to route water at least 5 feet away from the foundation or connect to landscape drains which discharge to a dry well, sump, bioswale, rainwater capture system or other approved on-site location.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.3 Provide flashing details on the building plans and comply with accepted industry standards or manufacturer’s instructions.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.4 Protect building materials delivered to the construction site from rain and other sources of moisture.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.5 In Climate Zone 16 an ice/water barrier is installed at roof valleys, eaves and wall to roof intersections.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.6 Exterior doors to the dwelling are protected to prevent water intrusion.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.407.7 A permanent overhang or awning at least 2 feet in depth is provided.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

APPENDIX A4—RESIDENTIAL VOLUNTARY MEASURES

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
Construction Waste Reduction, Disposal and Recycling						
4.408.1 Recycle and/or salvage for reuse a minimum of 65 percent of the nonhazardous construction and demolition waste in accordance with one of the following: 1. Comply with a more stringent local construction and demolition waste management ordinance; or 2. A construction waste management plan, per Section 4.408.2; or 3. A waste management company, per Section 4.408.3; or 4. The waste stream reduction alternative, per Section 4.408.4.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.408.1 Construction waste generated at the site is diverted to recycle or salvage in compliance with one of the following: 1. Tier 1 at least a 65 percent reduction with a third-party verification. 2. Tier 2 at least a 75 percent reduction with a third-party verification. Exception: Equivalent waste reduction methods are developed by working with local agencies.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/>
Building Maintenance and Operation						
4.410.1 An operation and maintenance manual shall be provided to the building occupant or owner.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.410.2 Where 5 or more multifamily dwelling units are constructed on a building site, provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics, organic waste, and metals or meet a lawfully enacted local recycling ordinance, if more restrictive. Exception: Rural jurisdictions that meet and apply for the exemption in Public Resources Code Section 42649.82 (a)(2)(A) et seq. will also be exempt from the organic waste portion of this section.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Innovative Concepts and Local Environmental Conditions						
A4.411.1 Items in this section are necessary to address innovative concepts or local environmental conditions.						
Item 1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 2	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ENVIRONMENTAL QUALITY						
Fireplaces						
4.503.1 Any installed gas fireplace shall be a direct-vent sealed-combustion type. Any installed woodstove or pellet stove shall comply with US EPA New Source Performance Standards (NSPS) emission limits as applicable, and shall have a permanent label indicating they are certified to meet the emission limits. Woodstoves, pellet stoves and fireplaces shall also comply with applicable local ordinances.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pollutant Control						
4.504.1 Duct openings and other related air distribution component openings shall be covered during construction.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.2.1 Adhesives, sealants and caulks shall be compliant with VOC and other toxic compound limits.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.2.2 Paints, stains and other coatings shall be compliant with VOC limits.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.2.3 Aerosol paints and coatings shall be compliant with product weighted MIR limits for ROC and other toxic compounds.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.2.4 Documentation shall be provided to verify that compliant VOC limit finish materials have been used.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency <input type="checkbox"/> All	Installer or Designer <input type="checkbox"/> All	Third party <input type="checkbox"/> All
		Tier 1	Tier 2			
4.504.3 Carpet and carpet systems shall be compliant with VOC limits.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.4 80 percent of floor area receiving resilient flooring shall comply with specified VOC criteria.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.504.5 Particleboard, medium density fiberboard (MDF) and hardwood plywood used in interior finish systems shall comply with low formaldehyde emission standards.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.504.1 Use composite wood products made with either California Air Resources Board approved no-added formaldehyde (NAF) resins or ultra-low emitting formaldehyde (ULEF) resins.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.504.2 Install VOC compliant resilient flooring systems. Tier 1. At least 90 percent of the resilient flooring installed shall comply. Tier 2. 100 percent of the resilient flooring installed shall comply.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.504.3 Thermal insulation installed in the building shall meet the following requirements: Tier 1. Install thermal insulation in compliance with VOC limits. Tier 2. Install insulation which contains no-added formaldehyde (NAF) and is in compliance with Tier 1.		<input checked="" type="checkbox"/> ²	<input checked="" type="checkbox"/> ²	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interior Moisture Control						
4.505.2 Vapor retarder and capillary break is installed at slab-on-grade foundations.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.505.3 Moisture content of building materials used in wall and floor framing is checked before enclosure.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Indoor Air Quality and Exhaust						
4.506.1 Each bathroom shall be provided with the following: 1. ENERGY STAR fans ducted to terminate outside the building. 2. Fans must be controlled by a humidity control (separate or built-in); OR functioning as a component of a whole-house ventilation system. 3. Humidity controls with manual or automatic means of adjustment, capable of adjustment between a relative humidity range of ≤ 50 percent to a maximum of 80 percent.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.506.1 Reserved.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.506.2 [HR] Provide filters on return air openings rated MERV 8 or higher during construction when it is necessary to use HVAC equipment.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
A4.506.3 Direct-vent appliances shall be used when equipment is located in conditioned space; or the equipment must be installed in an isolated mechanical room.		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

continued

APPENDIX A4—RESIDENTIAL VOLUNTARY MEASURES

SECTION A4.602
RESIDENTIAL OCCUPANCIES APPLICATION CHECKLIST—continued

FEATURE OR MEASURE	LEVELS APPLICANT TO SELECT ELECTIVE MEASURES			VERIFICATIONS ENFORCING AGENCY TO SPECIFY VERIFICATION METHOD		
	Mandatory	Prerequisites and electives ¹		Enforcing Agency	Installer or Designer	Third party
		Tier 1	Tier 2	<input type="checkbox"/> All	<input type="checkbox"/> All	<input type="checkbox"/> All
Environmental Comfort						
4.507.2 Duct systems are sized, designed and equipment is selected using the following methods: 1. Establish heat loss and heat gain values according to ANSI/ACCA 2 Manual J-2016 or equivalent. 2. Size duct systems according to ANSI/ACCA 1 Manual D-2016 or equivalent. 3. Select heating and cooling equipment according to ANSI/ACCA 3 Manual S-2014 or equivalent.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Outdoor Air Quality Reserved						
Innovative Concepts and Local Environmental Conditions						
A4.509.1 Items in this section are necessary to address innovative concepts or local environmental conditions.						
Item 1		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 2		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Item 3		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Installer and Special Inspector Qualifications						
Qualifications						
702.1 HVAC system installers are trained and certified in the proper installation of HVAC systems.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
702.2 Special inspectors employed by the enforcing agency must be qualified and able to demonstrate competence in the discipline they are inspecting.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Verifications						
703.1 Verification of compliance with this code may include construction documents, plans, specifications builder or installer certification, inspection reports or other methods acceptable to the enforcing agency which show substantial conformance.	<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

1. Green building measures listed in this table may be mandatory if adopted by a city, county, or city and county as specified in Section 101.7.
2. Required prerequisite for this Tier.
3. These measures are currently required elsewhere in statute or in regulation.

Division A4.7— RESIDENTIAL MODEL ORDINANCE

A4.701.1 General. The voluntary measures of this code are designed and promulgated to be adopted by reference and made mandatory by local ordinance pursuant to Section 101.7. Jurisdictions wishing to adopt the voluntary provisions of this code as an enforceable regulation governing structures and premises should ensure that certain factual information is included in the adopting ordinance and that the measures are appropriate and achievable and are considered to be suitable

as mandatory by the city, county, or city and county. The following sample adoption ordinance addresses several key elements of a code adoption ordinance, including the information required for insertion into the code text.

This code does not limit the authority of city, county, or city and county government to make necessary changes to the provisions contained in this code.

SAMPLE RESOLUTION FOR ADOPTION OF THE TIER 1 OR TIER 2 PROVISIONS OF THE CALIFORNIA GREEN BUILDING STANDARDS CODE WITH OR WITHOUT ADDITIONAL ITEMS NECESSARY TO ADDRESS INNOVATIVE CONCEPTS OR LOCAL ENVIRONMENTAL CONDITIONS.

ATTACHMENT ____.

SAMPLE RESOLUTION ADOPTING THE CALIFORNIA GREEN BUILDING STANDARDS CODE APPENDICES AS A MANDATORY REFERENCE STANDARD

CITY OF _____

RESOLUTION # _____

RESOLUTION ADOPTING ENHANCED GREEN BUILDING MEASURES FOR NEW AND EXISTING RESIDENTIAL CONSTRUCTION.

WHEREAS, the City/County of _____ 's (City or County) General Plan sets forth goals for preserving and improving the natural and built environment of the City/County, protecting the health of its residents and visitors, and fostering its economy; and

WHEREAS, green building is a holistic approach to design, construction and demolition that minimizes the building's impact on the environment, the occupants and the community; and

WHEREAS, green buildings benefit building industry professionals, residents and communities by improving construction quality; increasing building durability; reducing utility, maintenance, water and energy costs; creating healthier homes; and enhancing comfort and livability; and

WHEREAS, the *California Green Building Standards Code* appendices have included voluntary tiers to provide a city, county, or city and county, building professionals, and the general public with a range of voluntary green building measures for builders to choose from when constructing homes in California; and

WHEREAS, the *California Green Building Standards Code* appendices benefited from extensive input from a city, county, or city and county, building professionals, State agencies, and recognized green building professionals and the practices contained in these guidelines were selected for their viability in today's market and their ability to promote sustainable buildings and communities; and

WHEREAS, adoption of the *California Green Building Standards Code* appendices promotes statewide consistency and predictability for building professionals; and

NOW THEREFORE, BE IT RESOLVED, that the City/County hereby finds that green building design, construction and operation furthers the goals set forth in the City/County General Plan, including land use, conservation, open space and (include others, if applicable.)

NOW THEREFORE, BE IT RESOLVED, that newly constructed residential buildings, alterations or additions to residential buildings shall meet the _____ (Tier 1 or Tier 2) measures contained in the *California Green Building Standards Code* appendices and the green building design, construction and operation innovative concepts or additions or amendment thereto contained in Attachment _____ to address local environmental conditions; and;

NOW THEREFORE, BE IT FURTHER RESOLVED, that the City Council or County Board of Supervisors of the City/County of _____ adopts the *California Green Building Standards Code* appendices, as they may be amended from time to time, as a City/County mandatory reference document and directs City/County staff to enforce these green building measures as mandatory standards within the City/County.

ADOPTED BY THE FOLLOWING VOTE:

AYES:

NOES:

ABSENT:

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.1 – PLANNING AND DESIGN**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																					
Chapter/Section																					

**APPENDIX A5
NONRESIDENTIAL VOLUNTARY MEASURES**

The measures contained in this appendix are not mandatory unless adopted by a city, county, or city and county as specified in Section 101.7 and provide additional measures that designers, builders and property owners may wish to consider during the planning, design and construction process.

Division A5.1 – PLANNING AND DESIGN

PREFACE

Given that land use and planning are largely regulated locally, cities, counties and cities and counties should consider reducing greenhouse gas emissions associated with development through local land-use practices in conjunction with enforcing the provisions of this code. Specific land use strategies a city, county or city and county may wish to consider include but are not limited to the following:

Site selection. Develop sites for buildings, hardscape, roads or parking areas consistent with the local general plan and regional transportation plan pursuant to SB 375 (Stats. 2008, Ch. 728).

Regional sustainable communities strategy. Site selection and building design and use shall conform the project with the prevailing regional sustainable communities strategy or alternative planning strategy, whichever meets the greenhouse gas target established by the California Air Resources Board pursuant to SB375 (Stats. 2008, Ch. 728), including the general location of uses, residential densities and building intensities.

Transit priority projects. To qualify as a transit priority project, the project shall meet three criteria:

- (1) (a) contain at least 50 percent residential use, based on total building square footage and, if the project contains between 26 and 50 percent nonresidential uses, a floor area ratio of not less than 0.75; (b) provide a minimum net density of at least 20 dwelling units per acre; and (c) be within one-half mile of a major transit stop or high-quality

transit corridor included in a regional transportation plan as described in Section 21155 of Stats. 2008, Ch. 728;

(2) be consistent with the prevailing sustainable communities strategy or alternative planning strategy, whichever meets the greenhouse gas target established by the California Air Resources Board, including the general location of uses, residential densities and building intensities; and

(3) have all necessary entitlements required by the applicable local government.

Note: For additional information, see Government Code Sections 65080, 65080.1 and 65400 and Public Resources Code Sections 21061.3 and 21155.

**SECTION A5.101
GENERAL**

A5.101.1 Scope. The provisions of this chapter outline planning, design and development methods that include environmentally responsible site selection, building design, building siting and development to protect, restore and enhance the environmental quality of the site and respect the integrity of adjacent properties.

**SECTION A5.102
DEFINITIONS**

A5.102.1 Definitions. The following terms are defined in Chapter 2.

ALBEDO.

BIORETENTION.

BROWNFIELD SITE.

DEVELOPMENT FOOTPRINT.
 FLOOR AREA RATIO.
 GREENFIELDS.
 GREYFIELD SITE.
 INFILL SITE.
 LOW-EMITTING AND FUEL EFFICIENT VEHICLES.
 LOW IMPACT DEVELOPMENT (LID).
 NEIGHBORHOOD ELECTRIC VEHICLE (NEV).
 PERMEABLE PAVING.
 SOLAR REFLECTANCE.
 SOLAR REFLECTANCE INDEX (SRI).
 THERMAL EMITTANCE.
 VANPOOL VEHICLE.
 VEGETATED SPACE.
 ZEV.

**SECTION A5.103
 SITE SELECTION**

A5.103.1 Community connectivity. Where feasible, locate project on a previously developed site within a 1/2 mile radius of at least ten basic services, readily accessible by pedestrians, including, but not limited, to one each of bank, place of worship, convenience grocery, day care, cleaners, fire station, barber shop, beauty shop, hardware store, laundry, library, medical clinic, dental clinic, senior care facility, park, pharmacy, post office, restaurant (two may be counted), school, supermarket, theater, community center, fitness center, museum or farmers market. Other services may be considered on a case-by-case basis.

A5.103.2 Brownfield or greyfield site redevelopment or infill area development. If feasible, select for development a brownfield in accordance with Section A5.103.2.1 or on a greyfield or infill site as defined in Section A5.102.

A5.103.2.1 Brownfield redevelopment. Develop a site documented as contaminated by means of an ASTM E1903-11 Phase II Environmental Site Assessment or on a site defined as a brownfield by a local, state or federal government agency. The site must be fully remediated in accordance with EPA regulations to the level required of the anticipated land use.

**SECTION A5.104
 SITE PRESERVATION**

A5.104.1 Reduce development footprint and optimize open space. Optimize open space on the project site in accordance with Sections A5.104.1.1, A5.104.1.2 or A5.104.1.3.

A5.104.1.1 Local zoning requirement in place. Exceed the zoning’s open space requirement for vegetated open space on the site by 25 percent.

A5.104.1.2 No local zoning requirement in place. Provide vegetated open space area adjacent to the building equal to the building footprint area.

A5.104.1.3 No open space required in zoning ordinance. Provide vegetated open space equal to 20 percent of the total project site area.

**SECTION A5.105
 DECONSTRUCTION AND REUSE
 OF EXISTING STRUCTURES**

A5.105.1 If feasible, disassemble existing buildings instead of demolishing to allow reuse or recycling of building materials.

A5.105.1.1 Existing building structure. Maintain at least 75 percent of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing) based on surface area.

Exceptions:

1. Window assemblies and nonstructural roofing material.
2. Hazardous materials that are remediated as a part of the project.
3. A project with an addition of more than two times the square footage of the existing building.

A5.105.1.2 Existing nonstructural elements. Reuse existing interior nonstructural elements (interior walls, doors, floor coverings and ceiling systems) in at least 50 percent of the area of the completed building (including additions).

Exception: A project with an addition of more than two times the square footage of the existing building.

A5.105.1.3 Salvage. Salvage additional items in good condition such as light fixtures, plumbing fixtures and doors as follows. Document the weight or number of the items salvaged.

1. Salvage for reuse on the project items that conform to other provisions of Title 24 in an on-site storage area.
2. Nonconforming items may be salvaged in dedicated collection bins for exempt projects or other uses.

**SECTION A5.106
 SITE DEVELOPMENT**

A5.106.2 Storm water design. Design storm water runoff rate, quantity and quality in conformance with Section A5.106.3 Low Impact Development (LID) or by local requirements, whichever are stricter.

A5.106.3 Low Impact Development (LID). All newly constructed projects shall mitigate (infiltrate, filter or treat) stormwater runoff from the 85th percentile 24-hour runoff event (for volume-based BMPs) or the runoff produced by a rain event equal to two times the 85th percentile hourly intensity (for flow-based BMPs) through the application of LID strategies. Employ at least two of the following methods or other best management practices to allow rainwater to soak into the ground, evaporate into the air or collect in storage

receptacles for irrigation or other beneficial uses. LID strategies include, but are not limited to:

1. Bioretention (rain gardens)/filtration planters;
2. Precipitation capture (Cisterns and rain barrels);
3. Green roofs meeting the structural requirements of the building code;
4. Roof leader or impervious area disconnection;
5. Permeable and porous paving;
6. Vegetative swales and filter strips; tree preservation; and
7. Tree preservation and tree plantings;
8. Landscaping soil quality;
9. Stream buffer; and
10. Volume retention suitable for previously developed sites.

A5.106.3.1 Implementation. If applicable, coordinate LID projects with the local Regional Water Quality Control Board, which may issue a permit or otherwise require LID.

Note: Further information on design of specific control measures may be found on US EPA’s website, on SWRCB’s website and from local boards that require LID.

A5.106.3.2 Greyfield or infill site. Manage 40 percent of the average annual rainfall on the site’s impervious surfaces through infiltration, reuse or evapotranspiration.

A5.106.4 Reserved.

A5.106.4.1 Reserved.

A5.106.4.2 Reserved.

A5.106.4.3 Changing rooms. For buildings with over 10 tenant-occupants, provide changing/shower facilities for tenant-occupants only in accordance with Table A5.106.4.3 or document arrangements with nearby changing/shower facilities.

Note: Additional information on recommended bicycle accommodations may be obtained from Sacramento Area Bicycle Advocates at <https://sacbike.org>.

TABLE A5.106.4.3

NUMBER OF TENANT-OCCUPANTS	SHOWER/ CHANGING FACILITIES REQUIRED ²	2-TIER (12" X 15" X 72") PERSONAL EFFECTS LOCKERS ^{1, 2} REQUIRED
0-10	0	0
11-50	1 unisex shower	2
51-100	1 unisex shower	3
101-200	1 shower stall per gender	4
Over 200	1 shower stall per gender for each 200 additional tenant-occupants	One 2-tier locker for each 50 additional tenant-occupants

1. One 2-tier locker serves two people. Lockers shall be lockable with either padlock or combination lock.
2. Tenant spaces housing more than 10 tenant-occupants within buildings sharing common toilet facilities need not comply; however, such common shower facilities shall accommodate the total number of tenant-occupants served by the toilets and include a minimum of one unisex shower and two 2-tier lockers.

A5.106.5.1 Designated parking for clean air vehicles. In new projects or additions or alterations that add 10 or more vehicular parking spaces, provide designated parking for any combination of zero-emitting, fuel-efficient and carpool/van pool vehicles as listed in code Sections A5.106.5.1.1 or A5.106.5.1.2.

A5.106.5.1.1 Tier 1. Provide 35 percent designated parking spaces of the total number of parking spaces, for any combination of zero-emitting, fuel-efficient and carpool/van pool vehicles. Calculation for spaces shall be rounded up to the nearest whole number.

Note: Designated parking for clean air vehicles shall count toward the total parking spaces required by the local enforcing agencies.

A5.106.5.1.2 Tier 2. Provide 50 percent designated parking spaces of the total number of parking spaces, for any combination of zero-emitting, fuel-efficient and carpool/van pool vehicles. Calculation for spaces shall be rounded up to the nearest whole number.

Note: Designated parking for clean air vehicles shall count toward the total parking spaces required by the local enforcing agencies.

A5.106.5.1.3 Parking stall marking. Paint, in the paint used for stall striping, the following characters such that the lower edge of the last word aligns with the end of the stall striping and is visible beneath a parked vehicle:

CLEAN AIR/
VANPOOL/EV

Note: Vehicles bearing Clean Air Vehicle stickers from expired HOV lane programs may be considered eligible for designated parking spaces.

A5.106.5.1.4 Vehicle designations. Building managers may consult with local community Transit Management Associations (TMAs) for methods of designating qualifying vehicles, such as issuing parking stickers.

Notes:

1. Information on qualifying vehicles, car labeling regulations and DMV CAV decals may be obtained from the following sources:
 - a. California DriveClean.
 - b. California Air Resources Board.
 - c. US EPA fuel economy regulations and standards.
 - d. DMV Registration Operations.
2. Purchasing policy and refueling sites for zero-emitting vehicles for state employees use can be found at the Department of General Services.

A5.106.5.3 Electric vehicle (EV) charging. [N] Construction shall comply with Section A5.106.5.3.1 or A5.106.5.3.2, and in accordance with regulations in the *California Building Code* and the *California Electrical Code*.

A5.106.5.3.1 Tier 1. Table A5.106.5.3.1 shall be used to determine the number of EV capable spaces required. Refer to Section 5.106.5.3 for design space requirements.

When EV capable spaces are provided with EVSE to create EVCS per Table A5.106.5.3.1, refer to Section 5.106.5.3.2 for the allowed use of Level 2 or Direct Current Fast Charger (DCFC) and Section 5.106.5.3.3 for the allowed use of Automatic Load Management System (ALMS).

TABLE A5.106.5.3.1

TOTAL NUMBER OF ACTUAL PARKING SPACES	TIER 1 NUMBER OF REQUIRED EV CAPABLE SPACES	TIER 1 NUMBER OF EVCS (EV CAPABLE SPACES PROVIDED WITH EVSE) ²
0–9	2	0
10–25	5	2
26–50	11	4
51–75	19	5
76–100	26	9
101–150	38	13
151–200	53	18
201 and over	30 percent of total parking spaces ¹	33 percent of EV capable spaces ¹

1. Calculation for spaces shall be rounded up to the nearest whole number.
2. The number of required EVCS (EV capable spaces provided with EVSE) in column 3 count toward the total number of required EV capable spaces shown in column 2.

A5.106.5.3.2 Tier 2. Table A5.106.5.3.2 shall be used to determine the number of EV capable spaces required. Refer to Section 5.106.5.3 for design requirements.

When EV capable spaces are provided with EVSE to create EVCS per Table A5.106.5.3.1, refer to Section 5.106.5.3.2 for the allowed use of Level 2 or Direct Current Fast Charger (DCFC) and Section 5.106.5.3.3 for the allowed use of Automatic Load Management System (ALMS).

TABLE A5.106.5.3.2

TOTAL NUMBER OF ACTUAL PARKING SPACES	TIER 2 NUMBER OF REQUIRED EV CAPABLE SPACES	TIER 2 NUMBER OF EVCS (EV CAPABLE SPACES PROVIDED WITH EVSE) ²
0–9	3	0
10–25	8	3
26–50	17	6
51–75	28	9
76–100	40	13
101–150	57	19
151–200	79	26
201 and over	45 percent of total parking spaces ¹	33 percent of EV capable spaces ¹

1. Calculation for spaces shall be rounded up to the nearest whole number.
2. The number of required EVCS (EV capable spaces provided with EVSE) in column 3 count toward the total number of required EV capable spaces shown in column 2.

A5.106.6 Parking capacity. Design parking capacity to meet but not exceed minimum local zoning requirements.

A5.106.6.1 Reduce parking capacity. With the approval of the enforcement authority, employ strategies to reduce on-site parking area by

1. Use of on street parking or compact spaces, illustrated on the site plan or
2. Implementation and documentation of programs that encourage occupants to carpool, ride share or use alternate transportation.

Note: Strategies for programs may be obtained from local TMAs.

A5.106.7 Exterior wall shading. Meet requirements in the current edition of the *California Energy Code* and comply with either Section A5.106.7.1 or A5.106.7.2 for wall surfaces. If using vegetative shade, plant species documented to reach desired coverage within 5 years of building occupancy.

A5.106.7.1 Fenestration. Provide vegetative or man-made shading devices for all fenestration on east-, south- and west-facing walls.

A5.106.7.1.1 East and west walls. Shading devices shall have 30-percent coverage to a height of 20 feet or to the top of the exterior wall, whichever is less. Calculate shade coverage on the summer solstice at 10 AM for east-facing walls and at 3 PM for west-facing walls.

A5.106.7.1.2 South walls. Shading devices shall have 60-percent coverage to a height of 20 feet or to the top of the exterior wall, whichever is less.

A5.106.7.2 Opaque wall areas. Use wall surfacing with minimum SRI 25 (aged), for 75 percent of opaque wall areas.

Exception: Use of vegetated shade in Wildland-Urban Interface Areas as defined in Chapter 7A (Materials and Construction Methods for Exterior Wildfire Exposure) of the *California Building Code* shall meet the requirements of that chapter.

Note: If not available from the manufacturer, aged SRI value calculations may be found at the California Energy Commission’s web site at www.energy.ca.gov.

A5.106.11 Heat island effect. Reduce nonroof heat islands by Section A5.106.11.1 and roof heat islands by Section A5.106.11.2.

A5.106.11.1 Hardscape alternatives. Use one or a combination of strategies 1 and 2 for 50 percent of site hardscape or put 50 percent of parking underground.

1. Use light colored materials with an initial solar reflectance value of at least 30 as determined in accordance with American Society for Testing and Materials (ASTM) Standards E1918 or C1549.
2. Use open-grid pavement system or pervious or permeable pavement system.

A5.106.11.2 Cool roof for reduction of heat island effect. Use roofing materials having a minimum aged solar reflectance and thermal emittance complying with Sections A5.106.11.2.1 and A5.106.11.2.2 or a minimum

aged Solar Reflectance Index (SRI) complying with Section A5.106.11.2.3 and as shown in Table A5.106.11.2.2 for Tier 1 or Table A5.106.11.2.3 for Tier 2.

Exceptions:

1. Roof constructions that have a thermal mass over the roof membrane, including areas of vegetated (green) roofs, weighing at least 25 pounds per square foot.
2. Roof area covered by building integrated solar photovoltaic and building integrated solar thermal panels.

A5.106.11.2.1 Solar reflectance. Roofing materials shall have a minimum aged solar reflectance equal to or greater than the values specified in Table A5.106.11.2.2 for Tier 1 and Table A5.106.11.2.3 for Tier 2.

If Cool Roof Rating Council (CRRC) testing for aged reflectance is not available for any roofing products, the aged value shall be determined using the CRRC certified initial value using the equation $\rho_{aged} = [0.2 + \beta (\rho_{initial} - 0.2)]$, where $\rho_{initial}$ = the initial solar reflectance and soiling resistance, β , listed by product type in Table A5.106.11.2.1.

Solar reflectance may also be certified by other supervisory entities approved by the Energy Commission pursuant to Title 24, Part 1, *California Administrative Code*.

A5.106.11.2.2 Thermal emittance. Roofing materials shall have a CRRC initial or aged thermal emittance as determined in accordance with ASTM E408 or C1371 equal to or greater than those specified in Table A5.106.11.2.2 for Tier 1 and Table A5.106.11.2.3 for Tier 2.

Thermal emittance may also be certified by other supervisory entities approved by the Energy Commission pursuant to Title 24, Part 1, *California Administrative Code*.

A5.106.11.2.3 Solar reflectance index alternative. Solar Reflectance Index (SRI) equal to or greater than the values specified in Table A5.106.11.2.2 for Tier 1 and Table A5.106.11.2.3 for Tier 2 may be used as an alternative to compliance with the aged solar reflectance values and thermal emittance.

SRI values used to comply with this section shall be calculated using the Solar Reflectance Index (SRI) Calculation Worksheet (SRI-WS) developed by the California Energy Commission or in compliance with ASTM E1980-11 as specified in the *California Energy Code*, Section 110.8(i)3. Solar reflectance values used in the SRI-WS shall be based on the aged reflectance value of the roofing product or the equation in section A5.106.11.2.1 if the CRRC certified aged solar reflectance are not available. Certified Thermal emittance used in the SRI-WS may be either the initial value or the aged value listed by the CRRC.

Solar reflectance and thermal emittance may also be certified by other supervisory entities approved by the Commission pursuant to Title 24, Part 1, *California Administrative Code*.

Note: The Solar Reflectance Index Calculation Worksheet (SRI-WS) is available by contacting the Energy Standard Hotline at 1-800-772-3300, website at www.energy.ca.gov or by email at Title24@energy.state.ca.us.

A5.106.11.3 Verification of compliance. If no documentation is available, an inspection shall be conducted to ensure roofing materials meet cool roof aged solar reflectance and thermal emittance or SRI values.

**TABLE A5.106.11.2.1
VALUES OF SOILING RESISTANCE, β , BY PRODUCT TYPE**

PRODUCT TYPE	CRRC PRODUCT CATEGORY	β
Field-applied coating	Field-applied coating	0.65
Other	Not a field-applied coating	0.70

**TABLE A5.106.11.2.2 [BSC]
TIER 1**

ROOF SLOPE	CLIMATE ZONE	MINIMUM AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	1–16	0.63	0.75	75
> 2:12	1–16	0.20	0.75	16

**TABLE A5.106.11.2.3 [BSC]
TIER 2**

ROOF SLOPE	CLIMATE ZONE	MINIMUM AGED SOLAR REFLECTANCE	THERMAL EMITTANCE	SRI
≤ 2:12	1–16	0.68	0.85	82
> 2:12	1–16	0.28	0.85	27

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.2 – ENERGY EFFICIENCY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC	
				1	2	1/AC	AC	SS	1	1R	2	3	4									5
Adopt entire CA chapter																						
Adopt entire chapter as amended (amended sections listed below)																						
Adopt only those sections that are listed below																		X				
Chapter/Section																						
Appendix A5.2																		X				

**APPENDIX A5
NONRESIDENTIAL VOLUNTARY MEASURES**

Division A5.2 – ENERGY EFFICIENCY

**SECTION A5.201
GENERAL**

A5.201.1 Scope. For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory standards. It is the intent of these voluntary provisions to encourage local jurisdictions through codification to achieve exemplary performance in the area of building energy efficiency. Local jurisdictions adopting these voluntary provisions as mandatory local energy efficiency standards shall submit the required application and receive the required findings of the California Energy Commission in compliance with Title 24, Part 1, Section 10-106, prior to enforcement. Once the required filing has been verified and finding has been made by the Energy Commission, local jurisdictions shall file an ordinance expressly marking the local modifications along with findings and receive the required acceptance from the California Building Standards Commission in compliance with Section 101.7 of this code, prior to enforcement (Title 24, Part 1, Section 10-106 is available at <http://www.energy.ca.gov/title24/2022standards/>).

**SECTION A5.202
DEFINITIONS**

A5.202.1 Definitions. The following terms are defined in Chapter 2.

- ENERGY BUDGET.**
- GEOHERMAL.**
- PROCESS.**

SOLAR ACCESS.

TIME DEPENDENT VALUATION (TDV).

**SECTION A5.203
PERFORMANCE APPROACH**

A5.203.1 Energy efficiency. Nonresidential, high-rise residential and hotel/motel buildings that include lighting and/or mechanical systems shall comply with Sections A5.203.1.1 and A5.203.1.2. Newly constructed buildings and additions are included in the scope of these sections. Buildings permitted without lighting or mechanical systems shall comply with Section A5.203.1.1 but are not required to comply with Section A5.203.1.2.

A5.203.1.1 Tier 1 and Tier 2 prerequisites. To comply with Tier 1, ONE of the following efficiency measures is required for all applicable components of the building project. To comply with Tier 2, TWO of the following efficiency measures are required.

A5.203.1.1.1 Outdoor lighting. Newly installed outdoor lighting power shall be no greater than 90 percent of the Allowed Outdoor Lighting Power, and general hardscape lighting within the scope of Title 24, Part 6, Section 140.7(b)1 shall have a color temperature no higher than 3000K. The Allowed Outdoor Lighting Power calculation is specified in Title 24, Part 6, Section 140.7, Requirements For Outdoor Lighting.

Exception: The color temperature requirement is not applicable to the applications identified in the exceptions to Section 140.7(a) nor to the applications identified as “specific applications” in Section 140.7(b)2 and Table 140.7.

A5.203.1.1.2 Service water heating in restaurants.

Newly constructed restaurants 8,000 square feet or greater and with service water heaters rated 75,000 Btu/h or greater shall install a solar water-heating system with a minimum solar savings fraction of 0.15.

Exceptions:

1. Buildings with a natural gas service water heater with a minimum of 95-percent thermal efficiency.
2. Buildings where greater than 75 percent of the total roof area has annual solar access that is less than 70 percent. Solar access is the ratio of solar insolation, including shade, to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

A5.203.1.1.3 Warehouse dock seal doors. Exterior loading dock doors that are adjacent to conditioned or indirectly conditioned spaces shall have dock seals or dock shelters installed at the time of permitting. This requirement shall apply to newly constructed buildings and to loading dock doors added to existing buildings.

A5.203.1.1.4 Daylight Design Power Adjustments Factors (PAFs). Daylighting devices shall be installed as specified in Title 24, Part 6, Section 140.3(d).

A5.203.1.1.5 Exhaust air heat recovery. Heat recovery requirements based on ASHRAE 90.1, Section 6.5.6.1 are adapted and modified for California climate zones as described below.

1. Systems with minimum design outdoor air fraction of 80 percent or greater and supply air flow of 200 cfm or greater in climate zones 2, 9, 10, 11, 12, 13, 14, 15 shall have a heat recovery system.
2. Heat recovery systems required by this section shall result in a net sensible energy recovery ratio of at least 60 percent for both heating and cooling as tested using AHRI 1060-2014 or 1061-2014 and certified by AHRI. A 60 percent sensible energy recovery ratio shall mean a change in the dry-bulb of the outdoor air supply equal to 60 percent of the difference between the outdoor air and exhaust air dry-bulb at design conditions. Provisions shall be made to bypass or control the energy recovery system to permit air economizer operation as required by Title 24, Part 6, Section 140.4(e), Economizers.

Exceptions:

1. Systems serving spaces that are not cooled and that are heated to less than 60°F.
2. Where more than 60 percent of the outdoor air heating energy is provided from site-recovered energy.

3. Where the sum of the airflow rates exhausted and relieved within 20 feet of each other is less than 75 percent of the design outdoor airflow rate, excluding exhaust air that is:

1. Used for another energy recovery system;
 2. Not allowed by ASHRAE Standard 170 for use in energy recovery systems with leakage potential; or
 3. Of Class 4 as defined in ASHRAE Standard 62.1.
4. Systems expected to operate less than 20 hours per week.

A5.203.1.2 Performance standard. Comply with one of the advanced efficiency levels indicated below.

A5.203.1.2.1 Tier 1. Buildings complying with the first level of advanced energy efficiency shall have an Energy Budget that is no greater than indicated below, depending on building type and the type of energy systems included in the building project. If the newly constructed building or addition does not include indoor lighting or mechanical systems, then no additional performance requirements above Title 24, Part 6 are required.

1. For nonresidential building projects that include indoor lighting or mechanical systems, but not both: No greater than 95 percent of the Title 24, Part 6, Energy Budget for the Standard Design Building as calculated by compliance software certified by the Energy Commission.
2. For nonresidential building projects that include indoor lighting and mechanical systems: No greater than 90 percent of the Title 24, Part 6 Energy Budget for the Standard Design Building as calculated by compliance software certified by the Energy Commission.
3. For high-rise residential and hotel/motel building projects: No greater than 95 percent of the Title 24, Part 6, Energy Budget for the Standard Design Building as calculated by compliance software certified by the Energy Commission.

A5.203.1.2.2 Tier 2. Buildings complying with the second level of advanced energy efficiency shall have an Energy Budget that is no greater than indicated below, depending on building type and the type of energy systems included in the building project. If the newly constructed building or addition does not include indoor lighting or mechanical systems, then no additional performance requirements above Title 24, Part 6 are required.

1. For nonresidential building projects that include indoor lighting or mechanical systems, but not both: No greater than 90 percent of the Title 24, Part 6, Energy Budget for the Standard Design

Building as calculated by compliance software certified by the Energy Commission.

2. For nonresidential building projects that include indoor lighting and mechanical systems: No greater than 85 percent of the Title 24, Part 6, Energy Budget for the Standard Design Building as calculated by compliance software certified by the Energy Commission.
3. For high-rise residential and hotel/motel building projects: No greater than 95 percent of the Title 24, Part 6, Energy Budget for the Standard Design Building as calculated by compliance software certified by the Energy Commission.

Note: For Energy Budget calculations, high-rise residential and hotel/motel buildings are considered nonresidential buildings.

SECTION A5.211 RENEWABLE ENERGY

A5.211.1 On-site renewable energy. Use on-site renewable energy sources such as solar, wind, geothermal, low-impact hydro, biomass and bio-gas for at least 1 percent of the electric power calculated as the product of the building service voltage and the amperage specified by the electrical service overcurrent protection device rating or 1kW, (whichever is greater), in addition to the electrical demand required to meet 1 percent of the natural gas and propane use. The building project's electrical service overcurrent protection device rating shall be calculated in accordance with the *California Electrical Code*. Natural gas or propane use is calculated in accordance with the *California Plumbing Code*.

A5.211.1.1 Documentation. Using a calculation method approved by the California Energy Commission, calculate the renewable onsite energy system to meet the requirements of Section A5.211.1, expressed in kW. Factor in net-metering, if offered by local utility, on an annual basis.

A5.211.3 Green power. If offered by local utility provider, participate in a renewable energy portfolio program that provides a minimum of 50-percent electrical power from renewable sources. Maintain documentation through utility billings.

SECTION A5.212 ELEVATORS, ESCALATORS AND OTHER EQUIPMENT

A5.212.1 Elevators and escalators. In buildings with more than one elevator or two escalators, provide systems and controls to reduce the energy demand of elevators and escalators as follows. Document systems operation and controls in the project specifications and commissioning plan.

A5.212.1.1 Elevators. Traction elevators shall have a regenerative drive system that feeds electrical power back into the building grid when the elevator is in motion.

A5.212.1.1.1 Car lights and fan. A parked elevator shall turn off its car lights and fan automatically until the elevator is called for use.

A5.212.1.2 Escalators. An escalator shall have a VVVF motor drive system that is fully regenerative when the escalator is in motion.

A5.212.1.4 Controls. Controls that reduce energy demand shall meet requirements of CCR, Title 8, Chapter 4, Subchapter 6 and shall not interrupt emergency operations for elevators required in CCR, Title 24, Part 2, *California Building Code*.

SECTION A5.213 ENERGY EFFICIENT STEEL FRAMING

A5.213.1 Steel framing. Design steel framing for maximum energy efficiency. Techniques for avoiding thermal bridging in the envelope include:

1. Exterior rigid insulation;
2. Punching large holes in the stud web without affecting the structural integrity of the stud;
3. Spacing the studs as far as possible while maintaining the structural integrity of the structure; and
4. Detailed design of intersections of wall openings and building intersections of floors, walls and roofs.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.3 – WATER EFFICIENCY AND CONSERVATION**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																					
Chapter/Section																					

**APPENDIX A5
NONRESIDENTIAL VOLUNTARY MEASURES**

Division A5.3 – WATER EFFICIENCY AND CONSERVATION

**SECTION A5.301
GENERAL**

A5.301.1 Scope.

**SECTION A5.302
DEFINITIONS**

A5.302.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

COMPACT DISHWASHER.

MODEL WATER EFFICIENT LANDSCAPE ORDINANCE.

PLANTS.

POTABLE WATER.

RECYCLED WATER.

STANDARD DISHWASHER.

SUBMETER.

**SECTION A5.303
INDOOR WATER USE**

A5.303.2.3.1 Tier 1 – 12-percent savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 12 percent shall be provided. The reduction shall be based on the maximum allowable water use per plumbing

fixture and fitting as required by the *California Building Standards Code*. The 12-percent reduction in potable water use shall be demonstrated by one of the following methods:

1. Prescriptive method. Each plumbing fixture and fitting shall not exceed the maximum flow rate at greater than or equal to 12-percent reduction as specified in Table A5.303.2.3.1; or
2. Performance method. A calculation demonstrating a 12-percent reduction in the building “water use baseline” as established in Table A5.303.2.2 shall be provided.

A5.303.2.3.2 Tier 2 – 20-percent savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 20 percent shall be provided. A calculation demonstrating a 20-percent reduction in the building “water use baseline” as established in Table A5.303.2.2 shall be provided.

A5.303.2.3.3 25-percent savings. A schedule of plumbing fixtures and fixture fittings that will reduce the overall use of potable water within the building by 25 percent shall be provided. A calculation demonstrating a 25-percent reduction in the building “water use baseline” as established in Table A5.303.2.2 shall be provided.

A5.303.2.3.4 Nonpotable water systems for indoor use. Utilizing nonpotable water systems (such as captured rainwater, treated graywater and recycled water) intended to supply water closets, urinals and other allowed uses, may be used in the calculations demonstrating the 12-, 20- or 25-percent reduction. The non-potable water systems shall comply with the current edition of the *California Plumbing Code*.

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

**TABLE A5.303.2.2
WATER USE BASELINE (PERFORMANCE METHOD)³**

FIXTURE TYPE	BASELINE FLOW RATE	DURATION	DAILY USES	OCCUPANTS ²
Showerheads	1.8 gpm @ 80 psi	5 min.	1	X ^{2a}
Lavatory faucets nonresidential	0.5 gpm @ 60 psi	.25 min.	3	X
Kitchen faucets	1.8 gpm @ 60 psi	4 min.	1	X ^{2b}
Replacement aerators	2 gpm @ 60 psi			X
Wash fountains	1.8 gpm/20 [rim space (in.) @ 60 psi]			X
Metering faucets	0.20 gallons/cycle	.25 min.	3	X
Metering faucets for wash fountains	0.20 gallons/cycle/20 [rim space (in.) @ 60 psi]	.25 min.	1 male ¹ 3 female	X
Gravity tank type water closets	1.28 gallons/flush	1 flush	1 male ¹ 3 female	X
Flushometer tank water closets	1.28 gallons/flush	1 flush	1 male ¹ 3 female	X
Flushometer valve water closets	1.28 gallons/flush	1 flush	1 male ¹ 3 female	X
Electromechanical hydraulic water closets	1.28 gallons/flush	1 flush	1 male ¹ 3 female	X
Urinals	0.5 or 0.125 ⁴ gallons/flush	1 flush	2 male	X

1. The daily use number shall be increased to three if urinals are not installed in the room.
2. Refer to Table 4-1, Chapter 4, 2022 *California Plumbing Code*, for occupant load factors.
 - a. Shower use by occupants depends on the type of use of a building or portion of a building, e.g., total occupant load for a health club, but only a fraction of the occupants in an office building as determined by the anticipated number of users.
 - b. Kitchen faucet use is determined by the occupant load of the area served by the fixture.
3. Use worksheet WS-1 to calculate baseline water use.
4. Floor-mounted urinals @ 0.5 GPF or wall-mounted urinals @ 0.125 GPF.

**TABLE A5.303.2.3.1
FIXTURE FLOW RATES (PRESCRIPTIVE METHOD)**

FIXTURE TYPE	BASELINE FLOW RATE ²	MAXIMUM FLOW RATE AT ≥ 12 PERCENT REDUCTION
Showerheads	1.8 gpm @ 80 psi	1.6 gpm @ 80 psi
Lavatory faucets nonresidential ³	0.5 gpm @ 60 psi	0.35 gpm @ 60 psi
Kitchen faucets ³	1.8 gpm @ 60 psi	1.6 gpm @ 60 psi
Wash fountains	1.8 gallons/cycle/20 [rim space (in.) @ 60 psi]	1.6 gpm/20 [rim space (in.) @ 60 psi]
Metering faucets	0.20 gallons/cycle	0.18 gallons/cycle
Metering faucets for wash fountains	0.20 gallons/cycle/20 [rim space (in.) @ 60 psi]	0.18 gallons/cycle 20 [rim space (in.) @ 60 psi]
Gravity tank type water closets	1.28 gallons/flush	1.12 gallons/flush ¹
Flushometer tank water closets	1.28 gallons/flush	1.12 gallons/flush ¹
Flushometer valve water closets	1.28 gallons/flush	1.12 gallons/flush ¹
Electromechanical hydraulic water closets	1.28 gallons/flush	1.12 gallons/flush ¹
Urinals	0.5 or 0.125 ⁴ gallons/flush	0.44 or 0.11 gallons/flush

1. Includes water closets with an effective flush rate of 1.12 gallons or less when tested per ASME A 112.19.2 and ASME A 112.19.14.
2. See Table A5.503.2.2 for additional notes and references.
3. Where complying faucets are unavailable, aerators rated at 0.35 gpm or other means may be used to achieve reduction.
4. Floor-mounted urinals @ 0.5 GPF or wall-mounted urinals @ 0.125 GPF.

A5.303.3 Appliances and fixtures for commercial application. Appliances and fixtures shall meet the following:

1. Clothes washers shall have a maximum Water Factor (WF) that will reduce the use of water by 10 percent below the California Energy Commissions’ WF standards for commercial clothes washers located in Title 20 of the *California Code of Regulations*.
2. Dishwashers shall meet the following water use standards:
 - a. Residential—ENERGY STAR.
 - i. Standard Dishwashers – 4.25 gallons per cycle.
 - ii. Compact Dishwashers – 3.5 gallons per cycle.
 - b. Commercial—Shall be in accordance with ENERGY STAR requirements. Refer to Table A5.303.3.
3. Ice makers shall be air cooled.
4. Food steamers shall be connectionless or boilerless – and shall consume no more than 2 gallons of water per pan per hour, including condensate water, for batch type steamers, and no more than 5 gallons of water per pan per hour, including condensate water, for cook to order steamers.
5. The use and installation of water softeners that discharge to the community sewer system may be limited or prohibited by local agencies if certain conditions are met.
6. Combination ovens shall use a maximum of 1.5 gallons of water per hour per pan, including condensate water.
7. Food waste pulping systems shall use no more than 2 gpm of potable water.
 - 7.1. Note: potable water excludes on-site graywater use, such as dishwasher discharge water.

A5.303.4 Water conserving plumbing fixtures and fittings.

> || **A5.303.4.1 Nonwater urinals.** Nonwater urinals with drain cleansing action are installed in accordance with the *California Plumbing Code*.

|| Where approved, nonwater urinals with drain cleansing action (formerly urinal, hybrids) as defined in Chapter 2, shall be considered waterless urinals.

A5.303.5 Dual plumbing. New buildings and facilities shall be dual plumbed for potable and recycled water systems for toilet flushing when recycled water is available as determined by the enforcement authority.

**SECTION A5.304
OUTDOOR WATER USE**

A5.304.1 Reserved.

A5.304.2 Outdoor water use. For new water service not subject to the provisions of *Water Code* Section 535, separate meters or submeters shall be installed for indoor and outdoor potable water use for landscaped areas of at least 500 square feet but not more than 1,000 square feet.

A5.304.6 Restoration of areas disturbed by construction. Restore all landscape areas disturbed during construction by planting with local adaptive and/or noninvasive vegetation.

A5.304.7 Previously developed sites. On previously developed or graded sites, restore or protect at least 50 percent of the site area with adaptive and/or noninvasive vegetation. Projects complying with Section A5.106.3, Item 3 may apply vegetated roof surface to this calculation if the roof plants meet the definition of adaptive and noninvasive.

Exception: Area of the building footprint is excluded from the calculation.

A5.304.8 Graywater irrigation system. Install a graywater collection system for onsite subsurface irrigation using graywater collected from bathtubs, showers, bathroom wash basins and laundry water. See *California Plumbing Code*.

**TABLE A5.303.3
COMMERCIAL DISHWASHER WATER USE**

TYPE	HIGH-TEMPERATURE— MAXIMUM GALLONS PER RACK	LOW-TEMPERATURE— MAXIMUM GALLONS PER RACK
Single Tank Conveyor	0.70 (2.6 L)	≤ 0.79 (3 L)
Multiple Tank Conveyor	≤ 0.54 (2 L)	≤ 0.54 (2 L)
Stationary Single Tank Door	≤ 0.89 (3.4 L)	≤ 1.18 (4.5 L)
Under Counter	≤ 0.86 (3.3 L)	≤ 1.19 (4.5 L)
Pot, Pan and Utensil	≤ 0.58 GPSF	≤ 0.58 GPSF
Single Tank Flight Type	GPH ≤ 2.975x + 55.00	GPH ≤ 2.975x + 55.00
Multiple Tank Flight Type	GPH ≤ 4.96x + 17.00	GPH ≤ 4.96x + 17.00

Note: GPSF = gallons per square foot of rack; GPH = gallons per hour;
X = square feet of conveyor belt/minute (max conveyor speed sf/min as tested and certified to NSF/ANSI Standard 3)

**SECTION A5.305
WATER REUSE**

A5.305.1 Nonpotable water systems. Nonpotable water systems for indoor and outdoor use shall comply with the current edition of the *California Plumbing Code*.

A5.305.2 Irrigation systems. Irrigation systems regulated by a local water efficient landscape ordinance or by the California Department of Water Resources Model Water Efficient Landscape Ordinance (MWELo) shall use recycled water.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																					
Chapter/Section																					

**APPENDIX A5
NONRESIDENTIAL VOLUNTARY MEASURES**

Division A5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

**SECTION A5.403
FOUNDATION SYSTEMS
(Reserved)**

**SECTION A5.401
GENERAL**

A5.401.1 Scope. The provisions of this chapter shall outline means of achieving material conservation and resource efficiency through reuse of existing building stock and materials; use of recycled, regional, rapidly renewable and certified wood materials; and employment of techniques to reduce pollution through recycling of materials.

**SECTION A5.402
DEFINITIONS**

A5.402.1 Definitions. The following terms are defined in Chapter 2.

BUILDING COMMISSIONING.

EMBODIED ENERGY.

EUTROPHICATION.

LIFE CYCLE ASSESSMENT (LCA).

LIFE CYCLE INVENTORY (LCI).

OVE.

POSTCONSUMER CONTENT.

PRECONSUMER (or POSTINDUSTRIAL) CONTENT.

RECYCLED CONTENT.

RECYCLED CONTENT VALUE (RCV).

**SECTION A5.404
EFFICIENT FRAMING TECHNIQUES**

A5.404.1 Wood framing. Employ advanced wood framing techniques or OVE, as recommended by the US Department of Energy’s Office of Building Technology, State and Community Programs and as permitted by the enforcing agency.

A5.404.1.1 Structural or fire-resistance integrity. The OVE selected shall not conflict with structural framing methods or fire-rated assemblies required by the *California Building Code*.

A5.404.1.2 Framing specifications. Advanced framing techniques include the following:

1. Building design using 2-foot modules;
2. Spacing wall studs up to 24 inches on center;
3. Spacing floor and roof framing members up to 24 inches on center;
4. Using 2-stud corner framing and drywall clips or scrap lumber for drywall backing;
5. Eliminating solid headers in non-load-bearing walls;
6. Using in-line framing, aligning floor, wall and roof framing members vertically for direct transfer of loads; and
7. Using single lumber headers and top plates where appropriate.

Note: Additional information can be obtained from the US DOE Energy Efficiency and Renewable Energy (EERE) website.

**SECTION A5.405
MATERIAL SOURCES**

A5.405.1 Regional materials. Compared to other products in a given product category, select building materials or products for permanent installation on the project that have been harvested or manufactured in California or within 500 miles of the project site.

1. For those materials locally manufactured, select materials manufactured using low embodied energy or those that will result in net energy savings over their useful life.
2. Regional materials shall make up at least 10 percent, based on cost, of total materials value.
3. If regional materials make up only part of a product, their values are calculated as percentages based on weight.
4. Provide documentation of the origin, net projected energy savings and value of regional materials.

A5.405.2 Bio-based materials. Select bio-based building materials and products made from solid wood, engineered wood, bamboo, wool, cotton, cork, straw, natural fibers, products made from crops (soy-based, corn-based) and other bio-based materials with at least 50-percent bio-based content.

A5.405.2.1 Reserved.

A5.405.2.2 Rapidly renewable materials. Use materials made from plants harvested within a ten-year cycle for at least 2.5 percent of total materials value, based on estimated cost.

A5.405.3 Reused materials. Use salvaged, refurbished, refinished or reused materials for a minimum of 5 percent of the total value, based on estimated cost of materials on the project. Provide documentation as to the respective values.

Note: Sources of some reused materials can be found at CalRecycle’s <https://www.calrecycle.ca.gov/>. See also Appendix A5, Division A5.1, Section A5.105.1 for on-site materials reuse.

A5.405.4 Recycled content. Use materials, equivalent in performance to virgin materials with a total (combined) recycled content value (RCV) of:

Tier 1. The RCV shall not be less than 10 percent of the total material cost of the project, or use two products which meet the minimum recycled content levels in Table A5.405.4 for at least 75%, by cost, of all products in that category in the project.

$$\text{Required Total RCV (dollars)} = \text{Total Material Cost (dollars)} \times 10 \text{ percent} \quad \text{(Equation A5. 4-1)}$$

Tier 2. The RCV shall not be less than 15 percent of the total material cost of the project, or use three products which meet the minimum recycled content levels in Table A5.405.4 for at least 75%, by cost, of all products in that category in the project.

$$\text{Required Total RCV (dollars)} = \text{Total Material Cost (dollars)} \times 15 \text{ percent} \quad \text{(Equation A5. 4-2)}$$

For the purposes of this section, materials used as components of the structural frame shall not be used to calculate recycled content. The structural frame includes the load bearing structural elements such as wall studs, plates, sills, columns, beams, girders, joists, rafters and trusses.

Notes:

1. Sample forms which allow user input and automatic calculation are located at www.hcd.ca.gov/CALGreen.html and may be used to simplify documenting compliance with this section and for calculating recycled content value of materials or assembly products.
2. Sources and recycled content of some recycled materials can be obtained from CalRecycle if not provided by the manufacturer.

A5.405.4.1 Total material cost. Total material cost is the total estimated or actual cost of materials and assembly products used in the project. The required total recycled content value for the project (in dollars) shall be determined by Equation A5.4-1 or A5.4-2.

Total material cost shall be calculated by using one of the methods specified below:

1. **Simplified method.** To obtain the total cost of the project multiply the square footage of the structure by the square foot valuation established by the enforcing agency. The total material cost is 45 percent of the total cost of the project. Use Equations A5.4-3A or A5.4-3B to determine total material costs using the simplified method.

$$\text{Total material costs} = \text{Project square footage} \times \text{square foot valuation} \times 45 \text{ percent} \quad \text{(Equation A5.4-3A)}$$

$$\text{Total estimated or actual cost of project} \times 45 \text{ percent} \quad \text{(Equation A5.4-3B)}$$

2. **Detailed method.** To obtain the total cost of the project, add the estimated and/or actual costs of materials used for the project including the structure (steel, concrete, wood or masonry); the enclosure (roof, windows, doors and exterior walls); the interior walls, ceilings and finishes (gypsum board, ceiling tiles, etc.). The total estimated and/or actual costs shall not include fees, labor and installation costs, overhead, appliances, equipment, furniture or furnishings.

A5.405.4.2 Determination of total recycled content value (RCV). Total RCV may be determined either by dollars or percentage as noted below.

1. **Total recycled content value for the project (in dollars).** This is the sum of the recycled content value of the materials and/or assemblies considered and shall be determined by Equation A5.4-4. The result of this calculation may be directly compared to Equations A5.4-1 and A5.4-2 to determine compliance with Tier 1 or Tier 2 prerequisites.

$$\text{Total Recycled Content Value (dollars)} = (\text{RCV}_M + \text{RCV}_A) \quad \text{(Equation A5.4-4)}$$

2. **Total recycled content value for the project (by percentage).** This is expressed as a percentage of the total material cost and shall be determined by Equations A5.4-4 and A5.4-5. The result of this calculation may be directly compared for compliance with Tier 1 (10 percent) or Tier 2 (15 percent) prerequisites.

$$\text{Total Recycled Content Value (percent)} = \frac{[\text{Total Recycled Content Value (dollars)} \div \text{Total Material Cost (dollars)}] \times 100}{\text{(Equation A5.4-5)}}$$

A5.405.4.3 Determination of recycled content value of materials (RCV_M). The recycled content value of each material (RCV_M) is calculated by multiplying the cost of material, as defined by the recycled content. See Equations A5.4-6 and A5.4-7.

$$\text{RCV}_M \text{ (dollars)} = \text{Material cost (dollars)} \times \text{RC}_M \text{ (percent)} \quad \text{(Equation A5.4-6)}$$

$$\text{RC}_M \text{ (percent)} = \text{Postconsumer content percentage} + \left(\frac{1}{2}\right) \text{Preconsumer content percentage} \quad \text{(Equation A5.4-7)}$$

Notes:

1. If the postconsumer and preconsumer recycled content is provided in pounds, Equation A5.4-7 may be used, but the final result (in pounds) must be multiplied by 100 to show RC_M as a percentage.
2. If the manufacturer does not separately identify the pre-consumer and post-consumer recycled content of a material but reports it as a total single percentage, the total amount shall be considered preconsumer recycled material.

A5.405.4.4 Determination of recycled content value of assemblies – (RCV_A). Recycled content value of assemblies is calculated by multiplying the total cost of assembly by the total recycled content of the assembly (RC_A), and shall be determined by Equation A5.4-8.

$$\text{RCV}_A \text{ (dollars)} = \text{Assembly cost (dollars)} \times \text{Total RC}_A \text{ (percent)} \quad \text{(Equation A5.4-8)}$$

If not provided by the manufacturer, Total RC_A (percent) is the sum (Σ) of the Proportional Recycled Content (PRC_M) of each material in the assembly. RC_A shall be determined by Equation A4.4-9.

$$\text{RC}_A = \Sigma \text{PRC}_M \quad \text{(Equation A5.4-9)}$$

PRC_M of each material may be calculated by one of two methods using the following formulas:

Method 1: Recycled content (Postconsumer and Preconsumer) of each material provided in percentages

$$\text{PRC}_M \text{ (percent)} = \text{Weight of material (percent)} \times \text{RC}_M \text{ (percent)} \quad \text{(Equation A5.4-10)}$$

$$\text{Weight of material (percent)} = \frac{[\text{Weight of material (lbs)} \div \text{Weight of assembly (lbs)}] \times 100}{\text{(Equation A5.4-11)}}$$

$$\text{RC}_M \text{ (percent)} = \text{Postconsumer content percentage} + \left(\frac{1}{2}\right) \text{Preconsumer content percentage} \quad \text{(See Equation A5.4-7)}$$

Method 2: Recycled content (Postconsumer and Preconsumer) provided in pounds

$$\text{PRC}_M \text{ (percent)} = \frac{[\text{RC}_M \text{ (lbs)} \div \text{Weight of material (lbs)}] \times 100}{\text{(Equation A5.4-12)}}$$

$$\text{RC}_M \text{ (lbs)} = \text{Postconsumer content (lbs)} + \left(\frac{1}{2}\right) \text{Preconsumer content (lbs)} \quad \text{(Equation A5.4-13)}$$

Note: If the manufacturer does not separately identify the pre-consumer and post-consumer recycled content of a material but reports it as a total single percentage, the total amount shall be considered preconsumer recycled material.

A5.405.4.5 Alternate method for concrete. When Supplementary Cementitious Materials (SCMs), such as fly ash or ground blast furnace slag cement, are used in concrete, an alternate method of calculating and reporting recycled content in concrete products shall be permitted. When determining the recycled content value, the percent recycled content shall be multiplied by the cost of the cementitious materials only, not the total cost of the concrete.

**TABLE A5.405.4
MINIMUM RECYCLED CONTENT LEVELS**

MATERIAL/ PRODUCT TYPE	MINIMUM TOTAL RECYCLED CONTENT	MINIMUM POST-CONSUMER RECYCLED CONTENT
Insulation, fiberglass	30%	30%
Insulation, cellulose	75%	75%
Exterior Paint, latex	50%	50%
Carpet, nylon	10%	10%
Compost	80%	80%
Mulch	80%	80%
Acoustical ceiling panels	60%	—
Drywall, gypsum	4%	4%
Aggregate base	80%	80%

A5.405.5 Cement and concrete. Use cement and concrete made with recycled products and complying with the following sections.

A5.405.5.1 Cement. Cement shall comply with one of the following standards:

1. Portland cement shall meet ASTM C150, *Standard Specification for Portland Cement*.
2. Blended cement shall meet ASTM C595, *Standard Specification for Blended Hydraulic Cement* or ASTM C1157, *Standard Performance Specification for Hydraulic Cement*.
3. Other Hydraulic Cements shall meet ASTM C1157, *Standard Performance Specification for Hydraulic Cement*.

A5.405.5.2 Concrete. Unless otherwise directed by the Engineer of Record, use concrete manufactured with cementitious materials in accordance with Sections A5.405.5.2.1 and A5.405.5.2.1.1, as approved by the enforcing agency.

A5.405.5.2.1 Supplementary cementitious materials (SCM). Use concrete made with one or more supplementary cementitious materials (SCM) conforming to the following standards:

1. Fly ash conforming to ASTM C618, *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*.
2. Slag cement (GGBFS) conforming to ASTM C989, *Specification for Use in Concrete and Mortars*.
3. Silica fume conforming to ASTM C1240, *Specification for Silica Fume Used in Cementitious Mixtures*.
4. Natural pozzolan conforming to ASTM C618, *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*.
5. Blended supplementary cementitious materials conforming to ASTM C1697, Standard Specification for Blended Supplementary Cementitious Materials. The amount of each SCM in the blend will be used separately in calculating Equation A5.4-1. If Class C fly ash is used in the blend, it will be considered to be “SL” for the purposes of satisfying the equation.
6. Ultra-fine fly ash (UFFA) conforming to ASTM C618, *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete* and the following chemical and physical requirements:

Chemical Requirements	Percent
Sulfur Trioxide (SO ₃)	1.5 max.
Loss on ignition	1.2 max.
Available Alkalines (as Na ₂ O) equivalent	1.5 max.
Physical Requirements	Percent
Particle size distribution Less than 3.5 microns	50
Less than 9.0 microns	90
Strength Activity Index with portland cement 7 days	95 (minimum % of control)
28 days	110 (minimum % of control)
Expansion at 16 days when testing job materials in conformance with ASTM C1567*	0.10 max.

* In the test mix, cement shall be replaced with at least 12% UFFA by weight.

7. Metakaolin conforming to ASTM C618, *Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete*, the following chemical and physical requirements:

Chemical Requirements	Percent
Silicon Dioxide (SiO ₂) + Aluminum Oxide (Al ₂ O ₃)	92.0 min.
Calcium Oxide (CaO)	1.0 max.
Sulfur Trioxide (SO ₃)	1.0 max.
Loss on ignition	1.2 max.
Available Alkalies (as Na ₂ O) equivalent	1.0 max.
Physical Requirements	Percent
Particle size distribution Less than 45 microns	95
Strength Activity Index with portland cement 7 days	100 (minimum % of control)
28 days	100 (minimum % of control)

8. Other materials with comparable or superior environmental benefits, as approved by the Engineer of Record and enforcing authority.

A5.405.5.2.1.1 Mix design equation. Use any combination of one or more SCM, satisfying Equation A5.4-14. When ASTM C595 or ASTM C1157 cement is used, the amount of SCM in these cements shall be used in calculating Equation A5.4-14.

Exception: Minimums in mix designs approved by the Engineer of Record may be lower where high early strength is needed for concrete products or to meet an accelerated project schedule.

$$F/25 + SL/50 + UF/12 \geq 1 \quad \text{(Equation A5.4-14)}$$

where:

F = Fly ash, natural pozzolan or other approved SCM as a percent of total cementitious material for concrete on the project.

SL = GGBFS, as a percent of total cementitious material for concrete on the project.

UF = Silica fume, metakaolin or UFFA, as a percent of total cementitious material for concrete on the project.

A5.405.5.3 Additional means of compliance. Any of the following measures shall be permitted to be employed for the production of cement or concrete, depending on their availability and suitability, in conjunction with Section A5.405.5.2.

A5.405.5.3.1 Cement. The following measures shall be permitted to be used in the manufacture of cement.

A5.405.5.3.1.1 Alternative fuels. The use of alternative fuels where permitted by state or local air quality standards.

A5.405.5.3.1.2 Alternative power. Alternate electric power generated at the cement plant and/or green power purchased from the utility meeting the requirements of Section A5.211.

A5.405.5.3.2 Concrete. The following measures shall be permitted to be used in the manufacture of concrete.

A5.405.5.3.2.1 Alternative energy. Renewable or alternative energy meeting the requirements of Section A5.211.

A5.405.5.3.2.2 Recycled aggregates. Concrete made with one or more of the following materials:

1. Blast furnace slag as a lightweight aggregate in unreinforced concrete.
2. Recycled concrete that meets grading requirements of ASTM C33, *Standard Specification for Concrete Aggregates*.
3. Other materials with comparable or superior environmental benefits, as approved by the engineer and enforcing authority.

A5.405.5.3.2.3 Mixing water. Water recycled by the local water purveyor or water reclaimed from manufacturing processes and conforming to ASTM C1602, *Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete*.

A5.405.5.3.2.4 High strength concrete. Concrete elements designed to reduce their total size compared to standard 3,000 psi concrete, thereby reducing the total volume of cement, aggregate and water used on the project, as approved by the Engineer of Record.

**SECTION A5.406
ENHANCED DURABILITY AND
REDUCED MAINTENANCE**

A5.406.1 Choice of materials. Compared to other products in a given product category, choose materials proven to be characterized by one or more of the following.

A5.406.1.1 Service life. Select materials for longevity and minimal deterioration under conditions of use.

A5.406.1.2 Reduced maintenance. Select materials that require little, if any, finishing. For those with surface protection, choose materials that do not require frequent applications of toxic or malodorous finishes.

A5.406.1.3 Recyclability. Select materials that can be reused or recycled at the end of their service life in the project.

**SECTION A5.408
CONSTRUCTION WASTE REDUCTION,
DISPOSAL AND RECYCLING**

A5.408.3.1 Enhanced construction waste reduction – Tier 1. Divert to recycle or salvage at least 65 percent of nonhazardous construction and demolition waste gener-

ated at the site. Any mixed recyclables that are sent to mixed-waste recycling facilities shall include a qualified third party verified facility average diversion rate. Verification of diversion rates shall meet minimum certification eligibility guidelines, acceptable to the local enforcing agency.

A5.408.3.1.1 Enhanced construction waste reduction – Tier 2. Divert to recycle or salvage at least 80 percent of nonhazardous construction and demolition waste generated at the site.

A5.408.3.1.2 Verification of compliance. A copy of the completed waste management report or documentation of certification of the waste management company utilized shall be provided.

Exceptions:

1. Excavated soil and land-clearing debris.
2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.
3. Demolition waste meeting local ordinance or calculated in consideration of local recycling facilities and markets.

**SECTION A5.409
LIFE CYCLE ASSESSMENT**

A5.409.1 General. Life cycle assessment shall be ISO 14044 compliant. The service life of the building and materials assemblies shall not be less than 60 years unless designated in the construction documents as having a shorter service life as approved by the enforcing agency.

A5.409.2 Whole building life cycle assessment. Conduct a whole building life assessment, including operating energy, showing that the building project achieves at least a 10 percent improvement for at least three of the impacts listed in Section A5.409.2.2, one of which shall be climate change, compared to a reference building of similar size, function, complexity and operating energy performance, and meeting the 2016 *California Energy Code* at a minimum.

A5.409.2.1 Building components. The building envelope, structural elements, including footings and foundations, interior ceilings, walls and floors; and exterior finishes shall be considered in the assessment.

Exceptions:

1. Plumbing, mechanical and electrical systems and controls; fire and smoke detection and alarm systems and controls; and conveying systems.
2. Interior finishes are not required to be included.

Notes:

1. Software for calculating whole building life cycle assessments includes those found at the Athena Institute website (Impact Estimator software), the PE International website (GaBi software), and the PRe Consultants website (SimaPro software).

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

2. Interior finishes, if included, may be assessed using the NIST BEES tool.

A5.409.2.2 Impacts to be considered. Select from the following impacts in the assessment:

1. Climate change (greenhouse gases).
2. Fossil fuel depletion.
3. Stratospheric ozone depletion.
4. Acidification of land and water sources.
5. Eutrophication.
6. Photochemical oxidants (smog).

A5.409.3 Materials and system assemblies. If whole building analysis of the project is not elected, select a minimum of 50 percent of materials or assemblies based on life cycle assessment of at least three of the impacts listed in Section A5.409.2.2, one of which shall be climate change.

Note: Software for calculating life cycle assessments for assemblies and materials may be found at the Athena Institute web site and the NIST BEES web site.

A5.409.4 Substitution for prescriptive standards. Performance of a life cycle assessment completed in accordance with Section A5.409.2 may be substituted for other prescriptive Material Conservation and Resource Efficiency provisions of Division A5.4, including those made mandatory through local adoption of Tier 1 or Tier 2 in Division A5.6.

A5.409.5 Verification of compliance. Documentation of compliance shall be provided as follows:

1. The assessment is performed in accordance with ISO 14044.
2. The project meets the requirements of other parts of Title 24.
3. A copy of the analysis shall be made available to the enforcement authority.
4. A copy of the analysis and any maintenance or training recommendations shall be included in the operation and maintenance manual.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
 APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
 DIVISION A5.5 – ENVIRONMENTAL QUALITY**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the user.
 See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC- CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below								X													
Chapter/Section																					
A5.507.5		†						X													

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The state agency does not adopt sections identified by the following symbol: †.

APPENDIX A5

NONRESIDENTIAL VOLUNTARY MEASURES

Division A5.5 – ENVIRONMENTAL QUALITY

SECTION A5.501 GENERAL

A5.501.1 Scope. The provisions of this chapter shall outline means of reducing the quantity of air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of a building’s installers, occupants and neighbors.

SECTION A5.502 DEFINITIONS

A5.502.1 Definitions. The following terms are defined in Chapter 2.

INTERIOR, BUILDING.

MERV. [BSC]

MULTI-OCCUPANT SPACES.

NO ADDED FORMALDEHYDE (NAF) BASED RESINS.

SINGLE OCCUPANT SPACES.

ULTRA-LOW EMITTING FORMALDEHYDE (ULEF) RESINS.

SECTION A5.504 POLLUTANT CONTROL

A5.504.1 Indoor air quality (IAQ) during construction. Maintain IAQ as provided in Sections A5.504.1.1 and A5.504.1.2.

A5.504.1.1 Temporary ventilation. Provide temporary ventilation during construction in accordance with Section 120.1 (Requirements for Ventilation) of the *California Energy Code*, CCR, Title 24, Part 6 and Chapter 4 of CCR, Title 8 and as follows:

1. Ventilation during construction shall be achieved through openings in the building shell using fans to produce a minimum of three air changes per hour.
2. If the building is occupied during demolition or construction, meet or exceed the recommended Control Measures of the Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction, 1995, Chapter 3.

A5.504.1.2 Additional IAQ measures. Employ additional measures as follows:

1. When using generators to generate temporary power, use generators meeting the requirements of CCR, Title 13, Chapter 9 or local ordinance, whichever is more stringent.

2. Protect on-site absorbent materials from moisture. Remove and replace any materials with evidence of mold, mildew or moisture infiltration.
3. Store odorous and high VOC-emitting materials off-site, without packaging, for a sufficient period to allow odors and VOCs to disperse.
4. When possible, once materials are on the jobsite, install odorous and high VOC-emitting materials prior to those that are porous or fibrous.
5. Clean oil and dust from ducts prior to use.

A5.504.2 IAQ postconstruction. After all interior finishes have been installed, flush out the building by supplying continuous ventilation with all air handling units at their maximum outdoor air rate and all supply fans at their maximum position and rate for at least 14 days.

1. During this time, maintain an internal temperature of at least 60°F and relative humidity no higher than 60 percent. If extenuating circumstances make these temperature and humidity limits unachievable, the flush-out may be conducted under conditions as close as possible to these limits, provided that documentation of the extenuating circumstances is provided in writing.
2. Occupancy may start after 4 days, provided flush-out continues for the full 14 days. During occupied times, the thermal comfort conditions of Title 24 must be met.
3. For buildings that rely on natural ventilation, exhaust fans and floor fans must be used to improve air mixing and removal during the 14-day flush-out and windows should remain open.
4. Do not “bake out” the building by increasing the temperature of the space.
5. If continuous ventilation is not possible, flush-out air must total the equivalent of 14 days of maximum outdoor air. The equivalent of 14 days of maximum outdoor air (the target air volume) shall be calculated by multiplying the maximum feasible air flow rate (in ft³/m) by 14 days (20,160 minutes). The air volumes for each period of ventilation are then calculated and summed and the flush-out continues until the total equals the target air volume.

A5.504.2.1 IAQ testing. If the engineer determines that building flush-out pursuant to Section A5.504.2 is not feasible, a testing alternative may be employed after all interior finishes have been installed, using testing protocols recognized by the United States Environmental Protection Agency (US EPA).

A5.504.2.1.1 Maximum levels of contaminants. Allowable levels of contaminant concentrations measured by testing shall not exceed the following:

1. Carbon Monoxide (CO): 9 parts per million, not to exceed outdoor levels by 2 parts per million;
2. Formaldehyde: 27 parts per billion;
3. Particulates (PM10): 50 micrograms per cubic meter;
4. 4-Phenylcyclohexene (4-PCH), if fabrics and carpets with styrene butadiene rubber (SBR) latex backing, are installed: 6.5 micrograms per cubic meter; and
5. Total Volatile Organic Compounds (TVOC): 300 micrograms per cubic meter.

A5.504.2.1.2 Test protocols. Testing of indoor air quality should include the following elements:

1. The contaminant sampling and averaging times and the measurement methods should be sufficient to achieve a Limit of Detection that is below the maximum allowable concentrations.
2. Testing should be conducted with the HVAC system operated at the minimum design outdoor air ventilation rate.
3. Air samplers and monitors should be located near likely sources of formaldehyde and other volatile organic compounds, at a height of 3 to 6 feet from the floor and well away from walls and air diffusers.
4. The test protocols should be justified with documentation to show that appropriate sampling methods and times were used.

A5.504.2.1.3 Noncomplying building areas. For each sampling area of the building exceeding the maximum concentrations specified in Section A5.504.2.1.1, flush out with outside air and retest samples taken from the same area. Repeat the procedures until testing demonstrates compliance.

Note: US EPA-recognized testing protocols may be found on the Air Resources Board web site.

A5.504.4.5.1 No added formaldehyde Tier 1. Use composite wood products approved by the California Air Resources Board (ARB) as no-added formaldehyde (NAF) based resins or ultra-low emitting formaldehyde (ULEF) resins.

Notes:

1. See Title 17, Section 93120.3(c) and (d), respectively.
2. Documentation must be provided verifying that materials are certified to meet the pollutant emission limits. A list of manufacturers and their NAF and ULEF certified materials is provided at: http://www.arb.ca.gov/toxics/compwood/naf_ulef/listofnaf_ulef.htm.

A5.504.4.7 Resilient flooring systems, Tier 1. Where resilient flooring is installed, at least 90 percent of floor area receiving resilient flooring shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

A5.504.4.7.1 Resilient flooring systems, Tier 2. Where resilient flooring is installed, 100 percent of floor area receiving resilient flooring shall meet the requirements of the California Department of Public Health, “Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers,” Version 1.2, January 2017 (Emission testing method for California Specification 01350).

See California Department of Public Health’s website for certification programs and testing labs.

<https://www.cdph.ca.gov/Programs/CCDPHP/DEODC/EHLB/IAQ/Pages/VOC.aspx#material>

A5.504.4.7.2 Verification of compliance. Documentation shall be provided verifying that resilient flooring materials meet the pollutant emission limits.

A5.504.4.8 Thermal insulation, Tier 1. Thermal insulation, No-added Formaldehyde. Install thermal insulation which complies with Tier 1 plus does not contain any added formaldehyde.

A5.504.4.8.1 Verification of compliance. Documentation shall be provided verifying that thermal insulation materials meet the pollutant emission limits.

A5.504.5 Hazardous particulates and chemical pollutants. Minimize and control pollutant entry into buildings and cross-contamination of regularly occupied areas.

A5.504.5.1 Entryway systems. Install permanent entryway systems measuring at least six feet in the primary direction of travel to capture dirt and particulates at entryways directly connected to the outdoors.

1. Qualifying entryways are those that serve as regular entry points for building users.
2. Acceptable entryway systems include, but are not limited to, permanently installed grates, grilles or slotted systems that allow cleaning underneath.
3. Roll-out mats are acceptable only when maintained regularly by janitorial contractors as documented in service contract or by in-house staff as documented by written policies and procedures.

A5.504.5.2 Isolation of pollutant sources. In rooms where activities produce hazardous fumes or chemicals,

such as garages, janitorial or laundry rooms and copy or printing rooms, exhaust them and isolate them from their adjacent rooms.

1. Exhaust each space with no air recirculation in accordance with ASHRAE 62.1, Table 6-4 to create negative pressure with respect to adjacent spaces with the doors to the room closed.
2. For each space, provide self-closing doors and deck to deck partitions or a hard ceiling.
3. Install low-noise, vented range hoods for all cooking appliances and in laboratory or other chemical mixing areas.

SECTION A5.507 ENVIRONMENTAL COMFORT

A5.507.1 Lighting and thermal comfort controls. Provide controls in the workplace as described in Sections A5.507.1.1 and A5.507.1.2.

A5.507.1.1 Single-occupant spaces. Provide individual controls that meet energy use requirements in the *California Energy Code* in accordance with Sections A5.507.1.1.1 and A5.507.1.1.2.

A5.507.1.1.1 Lighting. Provide individual task lighting and/or daylighting controls for at least 90 percent of the building occupants.

A5.507.1.1.2 Thermal comfort. Provide individual thermal comfort controls for at least 50 percent of the building occupants.

1. Occupants shall have control over at least one of the factors of air temperature, radiant temperature, air speed and humidity as described in ASHRAE 55-2004.
2. Occupants inside 20 feet of the plane of and within 10 feet either side of operable windows can substitute windows to control thermal comfort. The areas of operable window must meet the requirements of Section 120.1 (Requirement for Ventilation) of the *California Energy Code*.

A5.507.1.2 Multi-occupant spaces. Provide lighting and thermal comfort system controls for all shared multi-occupant spaces, such as classrooms and conference rooms.

A5.507.2 Daylight. Provide daylit spaces as required for top-lighting and sidelighting in the *California Energy Code*. In constructing a design, consider the following:

1. Use of light shelves and reflective room surfaces to maximize daylight penetrating the rooms
2. Means to eliminate glare and direct sun light, including through skylights
3. Use of photosensors to turn off electric lighting when daylight is sufficient
4. Not using diffuse daylighting glazing where views are desired

A5.507.3 Views. Achieve direct line of sight to the outdoor environment via vision glazing between 2 feet 6 inches and 7 feet 6 inches above finish floor for building occupants in 90 percent of all regularly occupied areas as demonstrated by plan view and section cut diagrams.

A5.507.3.1 Interior office spaces. Entire areas of interior office spaces may be included in the calculation if at least 75 percent of each area has direct line of sight to perimeter vision glazing.

A5.507.3.2 Multi-occupant spaces. Include in the calculation the square footage with direct line of sight to perimeter vision glazing.

Exceptions to Sections A5.507.2 and A5.507.3. Copy/printing rooms, storage areas, mechanical spaces, restrooms, auditoria and other intermittently or infrequently occupied spaces or spaces where daylight would interfere with use of the space.

A5.507.5 Acoustical control [DSA-SS]. Public Schools and Community Colleges: Unoccupied, furnished classrooms must have a maximum background noise level of no more than 45 dBA LAeq and a maximum (unoccupied, furnished) reverberation of 0.6-second time for classrooms with less than 10,000 cubic feet and a maximum (unoccupied, furnished) reverberation of 0.7-second time for classroom volumes with between 10,000 cubic feet and 20,000 cubic feet.

SECTION A5.508 OUTDOOR AIR QUALITY

A5.508.1.3 Hydrochlorofluorocarbons (HCFCs). Install HVAC and refrigeration equipment that do not contain HCFCs.

A5.508.1.4 Hydrofluorocarbons (HFCs). Install HVAC complying with either of the following:

1. Install HVAC, refrigeration and fire suppression equipment that do not contain HFCs or that do not contain HFCs with a global warming potential greater than 150.
2. Install HVAC and refrigeration equipment that limit the use of HFC refrigerant through the use of a secondary heat transfer fluid with a global warming potential no greater than 1.

**CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE
APPENDIX A5 – NONRESIDENTIAL VOLUNTARY MEASURES
DIVISION A5.6 – VOLUNTARY TIERS**

(Matrix Adoption Tables are nonregulatory, intended only as an aid to the code user.
See Chapter 1 for state agency authority and building applications.)

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter		X																			
Adopt entire chapter as amended (amended sections listed below)																					
Adopt only those sections that are listed below																					
Chapter/Section																					

**APPENDIX A5
NONRESIDENTIAL VOLUNTARY MEASURES**

Division A5.6 – VOLUNTARY TIERS

**SECTION A5.601
CALGreen TIER 1 AND TIER 2**

A5.601.1 Scope. The measures contained in this appendix are not mandatory unless adopted by local government as specified in Section 101.7. The provisions of this section outline means of achieving enhanced construction or reach levels by incorporating additional green building measures for newly constructed nonresidential buildings as well as additions and alterations. In order to meet one of the tier levels designers, builders or property owners are required to incorporate additional green building measures necessary to meet the threshold of each level. Refer to the provisions in Section 301.3 for nonresidential additions and alterations scope and application.

A5.601.2 CALGreen Tier 1

A5.601.2.1 Prerequisites. To achieve CALGreen tier status, a project must meet all of the mandatory measures in Chapter 5 and, in addition, meet the provisions of this section.

A5.601.2.2 Energy performance. For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory standards.

A5.601.2.3 Tier 1. Comply with the energy efficiency requirements in Section A5.203.1.1 and Section A5.203.1.2.1.

A5.601.2.4 Voluntary measures for Tier 1. In addition to the provisions of Sections A5.601.2.1 and A5.601.2.3 above, compliance with the following voluntary measures from Appendix A5 is required for Tier 1:

1. From Division A5.1,
 - a. Comply with the designated parking requirements for fuel efficient vehicles for a minimum of 10 percent of parking capacity per Section A5.106.5.1 and Table A5.106.5.1.1.
 - b. Comply with thermal emittance, solar reflectance or SRI values for cool roofs in Section A5.106.11.2 and Table A5.106.11.2.1.¹
 - c. Comply with one elective measure selected from this division.
2. From Division A5.2 comply with TWO of the following:
 1. Outdoor lighting as described in A5.203.1.1.1.
 2. Service water heating in restaurants as described in A5.203.1.1.2.
 3. Warehouse Dock Seal Doors A5.203.1.1.3.
 4. Daylight Design Power Adjustments 5.203.1.1.4.
 5. Exhaust Air Heat Recovery A5.203.1.1.5.
3. From Division A5.3,
 - a. Comply with the 12-percent reduction for indoor potable water use in Section A5.303.2.3.1.
 - b. Comply with one elective measure selected from this division.
4. From Division A5.4,²
 - a. Comply with recycled content of 10 percent of materials based on estimated total cost, or use two products from Table A5.405.4 for at least 75 percent by cost in Section A5.405.4.
 - b. Comply with the 65-percent reduction in construction and demolition waste in Section A5.408.3.1.

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

- c. Comply with one elective measure selected from this division.
5. From Division A5.5,
 - a. Comply with resilient flooring systems for 90 percent of resilient flooring in Section A5.504.4.7.
 - b. Comply with thermal insulation meeting 2009 CHPS low-emitting materials list in Section A5.504.4.8.
 - c. Comply with one elective measure selected from this division.
6. Comply with one additional elective measure selected from any division.

¹ Cool roof is required for compliance with Tiers 1 and 2 and may be used to meet energy standards in Part 6, exceed energy standards and to mitigate heat island effect.

² Life cycle assessment compliant with Section A5.409.4 in this code may be substituted for prescriptive measures from Division A5.4.

A5.601.3 CALGreen Tier 2.

A5.601.3.2 Energy performance. For the purposes of mandatory energy efficiency standards in this code, the California Energy Commission will continue to adopt mandatory standards.

A5.601.3.3 Tier 2. Comply with the energy efficiency requirements in Section A5.203.1.1 and Section A5.203.1.2.2.

A5.601.3.4 Voluntary measures for Tier 2. In addition to the provisions of Sections A5.601.3.1 and A5.601.3.3 above, compliance with the following voluntary measures from Appendix A5 and additional elective measures shown in Table A5.601.3.4 is required for Tier 2:

1. From Division A5.1,
 - a. Comply with the designated parking requirements for fuel efficient vehicles for a minimum of 12 percent of parking capacity per Section A5.106.5.1 and Table A5.106.5.1.2.
 - b. Comply with thermal emittance, solar reflectance or SRI values for cool roofs in Section A5.106.11.2 and Table A5.106.11.2.2.¹
 - c. Comply with three elective measures selected from this division.
2. From Division A5.2 comply with ONE of the following:
 1. Outdoor lighting as described in A5.203.1.1.1.
 2. Service water heating in restaurants as described in A5.203.1.1.2.
 3. Warehouse Dock Seal Doors A5.203.1.1.3.
 4. Daylight Design Power Adjustments 5.203.1.1.4.
 5. Exhaust Air Heat Recovery A5.203.1.1.5.
3. From Division A5.3,
 - a. Comply with the 20-percent reduction for indoor potable water use in Section A5.303.2.3.2.

- b. Comply with three elective measures selected from this division.
4. From Division A5.4,²
 - a. Comply with recycled content of 15 percent of materials based on estimated total cost, or use two products from Table A5.405.4 for at least 75 percent by cost in Section A5.405.4.1.
 - b. Comply with the 80-percent reduction in construction and demolition waste in Section A5.408.3.1.
 - c. Comply with three elective measures selected from this division.
5. From Division A5.5,
 - a. Comply with resilient flooring systems for 100 percent of resilient flooring in Section A5.504.4.7.1.

Exception: Allowance may be permitted in Tier 2 for up to 5-percent specialty purpose flooring.
 - b. Comply with thermal insulation meeting 2009 CHPS low-emitting materials list and no added formaldehyde in Section A5.504.4.8.1.
 - c. Comply with three elective measures selected from this division.
6. Comply with three additional elective measures selected from any division.

¹ Cool roof is required for compliance with Tiers 1 and 2 and may be used to meet energy standards in Part 6, exceed energy standards and to mitigate heat island effect.

² Life cycle assessment compliant with Section A5.409.4 in this code may be substituted for prescriptive measures from Division A5.4.

A5.601.4 Compliance verification. Compliance with Section A5.601.2 or A5.601.3 shall be as required in Chapter 7 of this code. Compliance documentation shall be made part of the project record as required in Section 5.410.2 or 5.410.3.

**TABLE A5.601 NONRESIDENTIAL BUILDINGS:
Green Building Standards Code Proposed Performance Approach**

Note: This table is intended only as an aid in illustrating the nonresidential tier structure (Refer to Checklists A5.602, A5.602.1 and A5.602.2 for CALGreen verification guidelines for Mandatory Checklist, Tier 1 Checklist and Tier 2 Checklist.)

CATEGORY	ENVIRONMENTAL PERFORMANCE GOAL	TIER 1	TIER 2
All	Minimum Mandatory (See Mandatory Checklist)	Meet all of the provisions of Chapter 5 (See Tier 1 Checklist)	Meet all of the provisions of Chapter 5 (See Tier 2 Checklist)
DIVISION 5.1 Planning and Design	Designated Parking for Fuel Efficient Vehicles (Tier 1 and Tier 2 only)	Approx. 35% of total spaces	Approx. 50% of total spaces
	Electric Vehicle Charging	Approx. 30% of total spaces	Approx. 45% of total spaces
	Cool Roof to Reduce Heat Island Effect	Roof Slope < 2:12 SRI 75 Roof Slope > 2:12 SRI 16	Roof Slope < 2:12 SRI 82 Roof Slope > 2:12 SRI 27
		1 additional Elective from Division A5.1	3 additional Electives from Division A5.1
DIVISION 5.2 Energy Efficiency	Energy Performance ^{2a, 2b}	Outdoor lighting power 90% of Part 6 allowance	Outdoor lighting power 90% of Part 6 allowance
		If applicable, solar water-heating system with minimum solar savings fraction of 0.15	If applicable, solar water-heating system with minimum solar savings fraction of 0.15
		Warehouse door seals	Warehouse door seals
		Comply with day lighting requirements	Comply with day lighting requirements
		Exhaust heat recovery	Exhaust heat recovery
		Energy Budget 95% or 90% of Part 6 calculated value of allowance	Energy Budget 90% or 85% of Part 6 calculated value of allowance
DIVISION 5.3 Water Efficiency and Conservation	Indoor Water Use	12% Savings	20% Savings
		1 additional Elective from Division A5.3	3 additional Electives from Division A5.3
DIVISION 5.4 Material Conservation and Resource Efficiency³	Construction Waste Reduction	At least 65% reduction	At least 80% reduction
	Recycled Content	Utilize recycled content materials for 10% of total material cost	Utilize recycled content materials for 15% of total material cost
		1 additional Elective from Division A5.4	3 additional Electives from Division A5.4
DIVISION 5.5 Environmental Quality	Low-VOC Resilient Flooring	90% of flooring meets VOC limits	100% of flooring meets VOC limits ¹
	Low-VOC Thermal Insulation	Comply with VOC limits	Install no-added formaldehyde insulation and comply with VOC limits
		1 additional Elective from Division A5.5	3 additional Electives from Division A5.5
Additional Measures		1 additional Elective from any division	3 additional Electives from any division
Approximate Total Measures		15	25

1. Exception: Allowance may be permitted in Tier 2 for up to 5-percent specialty purpose flooring.

2. Solar water-heating system requirement for newly constructed restaurants as per A5.203.1.1.2.

Exceptions:

a. Buildings with a natural gas service water heater with a minimum of 95-percent thermal efficiency.

b. Buildings where greater than 75 percent of the total roof area has annual solar access that is less than 70 percent. Solar access is the ratio of solar insolation including shade to the solar insolation without shade. Shading from obstructions located on the roof or any other part of the building shall not be included in the determination of annual solar access.

3. Life cycle assessment compliant with Section A5.409.4 in this code may be substituted for prescriptive measures from Division A5.4.

**A5.602
CALGreen VERIFICATION GUIDELINES
MANDATORY MEASURES CHECKLIST**

Application: This checklist shall be used for nonresidential projects that meet one of the following: new construction, building additions of 1,000 square feet or greater, or building alterations with a permit valuation of \$200,000 or more pursuant to Section 301.3 AND do not trigger a Tier 1 or Tier 2 requirement:

Y = Yes (section has been selected and/or included)

N/A = Not Applicable (code section does not apply to the project—mainly used for additions and alterations)

O = Other (provide explanation)

[N] = New construction pursuant to Section 301.3

[A] = Additions and/or Alterations pursuant to Section 301.3

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N/A	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.1 Planning and Design	Mandatory	Storm water pollution prevention for projects that disturb less than 1 acre of land	5.106.1 through 5.106.2				
	Mandatory	Short-term bicycle parking (with exception)	5.106.4.1.1				
	Mandatory	Long-term bicycle parking	5.106.4.1.2 through 5.106.4.1.5				
	Mandatory	Electric vehicle (EV) charging [N] w/ exceptions	5.106.5.3				
	Mandatory	EV capable spaces [N]	5.106.5.3.1				
	Mandatory	Electric vehicle charging stations (EVCS)	5.106.5.3.2				
	Mandatory	Use of automatic load management systems (ALMS)	5.106.5.3.3				
	Mandatory	Accessible EVCS	5.106.5.3.4				
	Mandatory	Note for EVCS signs					
	Mandatory	Table 5.106.5.3.1 w/ footnotes	5.106.3.1, 5.106.3.2 and 5.106.3.3				
	Mandatory	Electric vehicle (EV) charging: medium-duty and heavy-duty [N]	5.106.5.4				
	Mandatory	Electric vehicle charging readiness requirements for warehouses, grocery stores and retail stores with planned off-street loading spaces [N]	5.106.5.4.1				
	Mandatory	Table 5.106.5.4.1	5.106.5.4 and 5.106.5.4.1				
	Mandatory	Light pollution reduction [N] (with exceptions, notes and table)	5.106.8 through 5.106.8.2				
Mandatory	Grading and paving (exception for additions and alterations not altering the drainage path)	5.106.10					
DIVISION 5.2 Energy Efficiency	Mandatory	Meet the minimum energy efficiency standard	5.201.1				
DIVISION 5.3 Water Efficiency and Conservation (continued)	Mandatory	Separate meters (new buildings or additions > 50,000 sf that consume more than 100 gal/day)	5.303.1.1				
	Mandatory	Separate meters (for tenants in new buildings or additions that consume more than 1,000 gal/day)	5.303.1.2				
	Mandatory	Water closets shall not exceed 1.28 gallons per flush (gpf)	5.303.3.1				

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N/A	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.3 Water Efficiency and Conservation	Mandatory	Wall-mounted urinals shall not exceed 0.125 gpf	5.303.3.2.1				
	Mandatory	Floor-mounted urinals shall not exceed 0.5 gpf	5.303.3.2.2				
	Mandatory	Single showerhead shall have maximum flow rate of 1.8 gpm (gallons per minute) at 80 psi	5.303.3.3.1				
	Mandatory	Multiple showerheads serving one shower shall have a combined flow rate of 1.8 gpm at 80 psi	5.303.3.3.2				
	Mandatory	Nonresidential lavatory faucets	5.303.3.4.1				
	Mandatory	Kitchen faucets	5.303.3.4.2				
	Mandatory	Wash fountains	5.303.3.4.3				
	Mandatory	Metering faucets	5.303.3.4.4				
	Mandatory	Metering faucets for wash fountains	5.303.3.4.5				
	Mandatory	Pre-rinse spray valve	5.303.3.4.6				
	Mandatory	Food waste disposers	5.303.4.1				
	Mandatory	Areas of additions or alterations	5.303.5				
	Mandatory	Standards for plumbing fixtures and fittings	5.303.6				
	Mandatory	Outdoor potable water use in landscape areas (with notes)	5.304.1				
DIVISION 5.4 Material Conservation and Resource Efficiency (continued)	Mandatory	Weather protection	5.407.1				
	Mandatory	Moisture control: sprinklers	5.407.2.1				
	Mandatory	Moisture control: exterior door protection	5.407.2.2.1				
	Mandatory	Moisture control: flashing	5.407.2.2.2				
	Mandatory	Construction waste management—comply with either: Sections 5.408.1.1, 5.408.1.2, 5.408.1.3 or more stringent local ordinance	5.408.1.1, 5.408.1.2, 5.408.1.3				
	Mandatory	Construction waste management: documentation	5.408.1.4				
	Mandatory	Universal waste [A]	5.408.2				
	Mandatory	Excavated soil and land clearing debris (100% reuse or recycle)	5.408.3				
	Mandatory	Recycling by occupants (with exception)	5.410.1				
	Mandatory	Recycling by occupants: additions (with exception)	5.410.1.1				
	Mandatory	Recycling by occupants: sample ordinance	5.410.1.2				
	Mandatory	Commissioning new buildings (≥ 10,000 sf) [N]	5.410.2				
	Mandatory	Owner’s or owner representative’s Project Requirements (OPR) [N]	5.410.2.1				
	Mandatory	Basis of Design (BOD) [N]	5.410.2.2				

(continued)

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N/A	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.4 Material Conservation and Resource Efficiency (continued)	Mandatory	Commissioning plan [N]	5.410.2.3				
	Mandatory	Functional performance testing [N]	5.410.2.4				
	Mandatory	Documentation and training [N]	5.410.2.5				
	Mandatory	Systems manual [N]	5.410.2.5.1				
	Mandatory	Systems operation training [N]	5.410.2.5.2				
	Mandatory	Commissioning report [N]	5.410.2.6				
	Mandatory	Testing and adjusting for new buildings < 10,000 sf or new systems that serve additions or alterations [A]	5.410.4				
	Mandatory	System testing plan for renewable energy, landscape irrigation and water reuse [A]	5.410.4.2				
	Mandatory	Procedures for testing and adjusting	5.410.4.3				
	Mandatory	Procedures for HVAC balancing	5.410.4.3.1				
	Mandatory	Reporting for testing and adjusting	5.410.4.4				
	Mandatory	Operation and maintenance (O&M) manual	5.410.4.5				
	Mandatory	Inspection and reports	5.410.4.5.1				
	DIVISION 5.5 Environmental Quality (continued)	Mandatory	Fireplaces	5.503.1			
Mandatory		Woodstoves	5.503.1.1				
Mandatory		Temporary ventilation	5.504.1				
Mandatory		Covering of ducts openings and protection of mechanical equipment during construction	5.504.3				
Mandatory		Adhesives, sealants and caulks	5.504.4.1				
Mandatory		Paints and coatings	5.504.4.3				
Mandatory		Aerosol paints and coatings	5.504.4.3.1				
Mandatory		Aerosol paints and coatings: verification	5.504.4.3.2				
Mandatory		Carpet systems	5.504.4.4				
Mandatory		Carpet cushion	5.504.4.4.1				
Mandatory		Carpet adhesives per Table 5.504.4.1	5.504.4.4.2				
Mandatory		Composite wood products	5.504.4.5				
Mandatory		Composite wood products: documentation	5.504.4.5.3				
Mandatory		Resilient flooring systems	5.504.4.6				
Mandatory		Resilient flooring: verification of compliance	5.504.4.6.1				
Mandatory		Thermal insulation	5.504.4.7				
Mandatory		Verification of compliance	5.504.4.7.1				
Mandatory		Acoustical ceilings and wall panels	5.504.4.8				
Mandatory	Verification of compliance	5.504.4.8.1					

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N/A	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.5 Environmental Quality	Mandatory	Filters (with exceptions)	5.504.5.3				
	Mandatory	Filters: labeling	5.504.5.3.1				
	Mandatory	Environmental tobacco smoke (ETS) control	5.504.7				
	Mandatory	Indoor moisture control	5.505.1				
	Mandatory	Outside air delivery	5.506.1				
	Mandatory	Carbon dioxide (CO ₂) monitoring	5.506.2				
	Mandatory	Acoustical control (with exception)	5.507.4				
	Mandatory	Exterior noise transmission, prescriptive method (with exceptions)	5.507.4.1				
	Mandatory	Noise exposure where noise contours are not readily available	5.507.4.1.1				
	Mandatory	Performance method	5.507.4.2				
	Mandatory	Site features	5.507.4.2.1				
	Mandatory	Documentation of compliance	5.507.4.2.2				
	Mandatory	Interior sound transmission (with note)	5.507.4.3				
	Mandatory	Ozone depletion and greenhouse gas reductions	5.508.1				
	Mandatory	Chlorofluorocarbons (CFCs)	5.508.1.1				
	Mandatory	Halons	5.508.1.2				
Mandatory	Supermarket refrigerant leak reduction for retail food stores 8,000 square feet or more Sections 5.508.2 through 5.508.2.6.3	5.508.2 through 5.508.2.6.3					
		END OF MANDATORY PROVISIONS					

Documentation Author's / Responsible Designer's Declaration Statement	
<input type="checkbox"/> Mandatory: I attest that this mandatory provisions checklist is accurate and complete.	
Signature:	
Company:	Date:
Address:	License:
City/State/Zip:	Phone:

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

**A5.602.1
CALGreen VERIFICATION GUIDELINES
TIER 1 CHECKLIST**

Application: This checklist shall be used for nonresidential projects that meet the following: new construction, or building additions of 1,000 square feet or greater, or building alterations with a permit valuation of \$200,000 or more pursuant to Section 301.3, AND are adopting Tier 1 voluntary measures.

Note: All applicable mandatory requirements in Chapter 5 shall be met prior to applying Tier 1 voluntary measures.

Instructions:

Comply with all Tier 1 prerequisite measures from the various categories shown on the table below.

Add a “Y” to all mandatory and Tier 1 prerequisite measures in the appropriate columns.

Select the required number of additional electives from those categories shown on the table below and add a “Y” on the selected elective and add an “N” on the rest.

Count the total number of Tier 1 prerequisite measures plus the additional electives and write down the total number at the end of the checklist. Determine if the required number of Tier 1 measures have been selected to achieve Tier 1 compliance.

Y = Yes (section has been selected and/or included)

N = No (section has not been selected and/or included)

O = Other (provide explanation)

[N] = New construction pursuant to Section 301.3

[A] = Additions and/or Alterations pursuant to Section 301.3

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.1 Planning and Design (continued)	Mandatory	Storm water pollution prevention for projects that disturb less than 1 acre of land	5.106.1 through 5.106.2				
	Mandatory	Short-term bicycle parking	5.106.4.1.1				
	Mandatory	Long-term bicycle parking	5.106.4.1.2 through 5.106.4.1.5				
	Tier 1	Designated parking—35% of parking capacity w/ parking stall markings and stall identification	A5.106.5.1, A5.106.5.1.1, A5.106.5.1.3, A5.106.5.1.4				
	Mandatory	Electric vehicle (EV) charging [N] w/ exceptions	5.106.5.3				
	Mandatory	EV capable spaces [N]	5.106.5.3.1				
	Mandatory	Electric vehicle charging stations (EVCS)	5.106.5.3.2				
	Mandatory	Use of automatic load management systems (ALMS)	5.106.5.3.3				
	Mandatory	Accessible EVCS	5.106.5.3.4				
	Mandatory	Note for EVCS signs					
	Mandatory	Table 5.106.5.3.1 w/ footnotes	5.106.3.1, 5.106.3.2 and 5.106.3.3				
	Tier 1 Prerequisite	Electric vehicle (EV) charging [N] and Table A5.106.5.3.1 w/ footnotes	A5.106.5.3, A5.106.5.3.1				
	Mandatory	Electric vehicle (EV) charging: medium-duty and heavy-duty [N]	5.106.5.4				
	Mandatory	Electric vehicle charging readiness requirements for warehouses, grocery stores and retail stores with planned off-street loading spaces [N]	5.106.5.4.1				
	Mandatory	Table 5.106.5.4.1	5.106.5.4 and 5.106.5.4.1				
	Mandatory	Light pollution reduction [N] (with exceptions, notes and table)	5.106.8 through 5.106.8.2				
	Mandatory	Grading and paving (exception for additions and alterations not altering the drainage path)	5.106.10				
	Tier 1 Prerequisite	Cool roof (A5.106.11.2.2): SRI 75 when ≤ 2:12, SRI 16 when > 2:12	A5.106.11.2				

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.1 Planning and Design	Select One Elective	<i>Elective</i>	<i>Community connectivity</i>	A5.103.1			
		<i>Elective</i>	<i>Brownfield or greyfield site redevelopment or infill area development</i>	A5.103.2 A5.103.2.1			
		<i>Elective</i>	<i>Reduce development footprint and optimize open space</i>	A5.104.1, A5.104.1.1, A5.104.1.2, A5.104.1.3			
		<i>Elective</i>	<i>Disassemble and reuse existing building structure (75%) with exceptions</i>	A5.105.1.1			
		<i>Elective</i>	<i>Disassemble and reuse existing nonstructural elements (50%) with exceptions</i>	A5.105.1.2			
		<i>Elective</i>	<i>Salvage</i>	A5.105.1.3			
		<i>Elective</i>	<i>Storm water design</i>	A5.106.2, A5.106.2.1, A5.106.2.2			
		<i>Elective</i>	<i>Low Impact Development (LID)</i>	A5.106.3, A5.106.3.1, A5.106.3.2			
		<i>Elective</i>	<i>Changing rooms w/ note</i>	A5.106.4.3			
		<i>Elective</i>	<i>Parking capacity w/ reduced parking capacity option</i>	A5.106.6, A5.106.6.1			
		<i>Elective</i>	<i>Exterior wall shading w/ fenestration and/or opaque wall area option</i>	A5.106.7, A5.106.7.1, A5.106.7.2			
		<i>Elective</i>	<i>Heat island effect</i>	A5.106.11			
DIVISION 5.2 Energy Efficiency	Mandatory	Meet the minimum energy efficiency standard	5.201.1				
	<i>Tier 1 Prerequisite</i>	<i>Energy performance—outdoor lighting power 90% of Part 6</i>	A5.203.1.1.1				
	<i>Tier 1 Prerequisite</i>	<i>If applicable, service for water heating in restaurants of 8,000 sf or greater</i>	A5.203.1.1.2				
	<i>Tier 1 Prerequisite</i>	<i>Energy budget 95% or 90% of Part 6 calculated value of allowance</i>	A5.203.1.2.1				
	<i>Elective</i>	<i>On-site renewable energy (with documentation)</i>	A5.211.1, A5.211.1.1				
	<i>Elective</i>	<i>Green power</i>	A5.211.3				
	<i>Elective</i>	<i>Elevators with car lights and fan</i>	A5.212.1.1, A5.212.1.1.1				
	<i>Elective</i>	<i>Escalators</i>	A5.212.1.2				
	<i>Elective</i>	<i>Controls that reduce energy</i>	A5.212.1.4				
	<i>Elective</i>	<i>Steel framing</i>	A5.213.1				
DIVISION 5.3 Water Efficiency and Conservation (continued)	Mandatory	Separate meters (new buildings or additions > 50,000 sf that consume more than 100 gal/day)	5.303.1.1				
	Mandatory	Separate meters (for tenants in new buildings or additions that consume more than 1,000 gal/day)	5.303.1.2				
	<i>Tier 1 Prerequisite</i>	<i>Water reduction Tier 1—12% savings over the “water use baseline” in Table A5.303.2.2 or meet Table A5.303.2.3.1</i>	A5.303.2.3.1				
	Mandatory	Water closets shall not exceed 1.28 gallons per flush (gpf)	5.303.3.1				
	Mandatory	Wall-mounted urinals shall not exceed 0.125 gpf	5.303.3.2.1				
	Mandatory	Floor-mounted urinals shall not exceed 0.5 gpf	5.303.3.2.2				
	Mandatory	Single showerhead shall have maximum flow rate of 1.8 gpm (gallons per minute) at 80 psi	5.303.3.3.1				
	Mandatory	Multiple showerheads serving one shower shall have a combined flow rate of 1.8 gpm at 80 psi	5.303.3.3.2				

(continued)

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.3 Water Efficiency and Conservation	Mandatory	Nonresidential lavatory faucets	5.303.3.4.1				
	Mandatory	Kitchen faucets	5.303.3.4.2				
	Mandatory	Wash fountains	5.303.3.4.3				
	Mandatory	Metering faucets	5.303.3.4.4				
	Mandatory	Metering faucets for wash fountains	5.303.3.4.5				
	Mandatory	Pre-rinse spray valve	5.303.3.4.6				
	Mandatory	Food waste disposers	5.303.4.1				
	Mandatory	Areas of additions or alterations	5.303.5				
	Mandatory	Standards for plumbing fixtures and fittings	5.303.6				
	Mandatory	Outdoor potable water use in landscape areas (with notes)	5.304.1				
Select One Elective	<i>Elective</i>	<i>Nonpotable water systems for indoor use</i>	<i>A5.303.2.3.4</i>				
	<i>Elective</i>	<i>Appliances and fixtures for commercial application</i>	<i>A5.303.3</i>				
	<i>Elective</i>	<i>Nonwater urinals</i>	<i>A5.303.4.1</i>				
	<i>Elective</i>	<i>Dual plumbing</i>	<i>A5.303.5</i>				
	<i>Elective</i>	<i>Outdoor potable water use</i>	<i>A5.304.2</i>				
	<i>Elective</i>	<i>Restoration of areas disturbed by construction</i>	<i>A5.304.6</i>				
	<i>Elective</i>	<i>Previously developed sites (with exception)</i>	<i>A5.304.7</i>				
	<i>Elective</i>	<i>Graywater irrigation system</i>	<i>A5.304.8</i>				
	<i>Elective</i>	<i>Nonpotable water systems</i>	<i>A5.305.1</i>				
	<i>Elective</i>	<i>Irrigation systems</i>	<i>A5.305.2</i>				
DIVISION 5.4 Material Conservation and Resource Efficiency (continued)	<i>Tier 1 Prerequisite</i>	<i>Recycled content for 10% of total material cost</i>	<i>A5.405.4, A5.405.4.1 through A5.405.4.5</i>				
	Mandatory	Weather protection	5.407.1				
	Mandatory	Moisture control: sprinklers	5.407.2.1				
	Mandatory	Moisture control: exterior door protection	5.407.2.2.1				
	Mandatory	Moisture control: flashing	5.407.2.2.2				
	Mandatory	Construction waste management—comply with either: Sections 5.408.1.1, 5.408.1.2, 5.408.1.3 or more stringent local ordinance	5.408.1.1, 5.408.1.2, 5.408.1.3				
	Mandatory	Construction waste management: documentation	5.408.1.4				
	Mandatory	Universal waste [A]	5.408.2				
	Mandatory	Excavated soil and land clearing debris (100% reuse or recycle)	5.408.3				
	<i>Tier 1 Prerequisite</i>	<i>Enhanced construction waste reduction (65%—Tier 1 with verification)</i>	<i>A5.408.3.1, A5.408.3.1.2</i>				
	Mandatory	Recycling by occupants (with exception)	5.410.1				
	Mandatory	Recycling by occupants: additions (with exception)	5.410.1.1				
	Mandatory	Recycling by occupants: sample ordinance	5.410.1.2				
	Mandatory	Commissioning new buildings (≥ 10,000 sf) [N]	5.410.2				

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.4 Material Conservation and Resource Efficiency	Mandatory	Owner’s or Owner representative’s Project Requirements (OPR) [N]	5.410.2.1				
	Mandatory	Basis of Design (BOD) [N]	5.410.2.2				
	Mandatory	Commissioning plan [N]	5.410.2.3				
	Mandatory	Functional performance testing [N]	5.410.2.4				
	Mandatory	Documentation and training [N]	5.410.2.5				
	Mandatory	Systems manual [N]	5.410.2.5.1				
	Mandatory	Systems operation training [N]	5.410.2.5.2				
	Mandatory	Commissioning report [N]	5.410.2.6				
	Mandatory	Testing and adjusting for new buildings < 10,000 sf or new systems that serve additions or alterations [A]	5.410.4				
	Mandatory	System Testing Plan for renewable energy, landscape irrigation and water reuse [A]	5.410.4.2				
	Mandatory	Procedures for testing and adjusting	5.410.4.3				
	Mandatory	Procedures for HVAC balancing	5.410.4.3.1				
	Mandatory	Reporting for testing and adjusting	5.410.4.4				
	Mandatory	Operation and maintenance (O&M) manual	5.410.4.5				
	Mandatory	Inspection and reports	5.410.4.5.1				
Select One Elective	<i>Elective</i>	<i>Wood framing or OVE w/ note</i>	<i>A5.404.1, A5.404.1.1, A5.404.1.2</i>				
	<i>Elective</i>	<i>Regional materials</i>	<i>A5.405.1</i>				
	<i>Elective</i>	<i>Bio-based materials</i>	<i>A5.405.2</i>				
	<i>Elective</i>	<i>Rapidly renewable materials</i>	<i>A5.405.2.2</i>				
	<i>Elective</i>	<i>Reused materials w/ note</i>	<i>A5.405.3</i>				
	<i>Elective</i>	<i>Cement and concrete: cement</i>	<i>A5.405.5.1</i>				
	<i>Elective</i>	<i>Cement and concrete: concrete with SCM & Mix design equation</i>	<i>A5.405.5.2, A5.405.5.2.1, A5.405.5.2.1.1</i>				
	<i>Elective</i>	<i>Cement and concrete: additional means of compliance</i>	<i>A5.405.5.3, A5.405.5.3.1, A5.405.5.3.1.1, A5.405.5.3.1.2, A5.405.5.3.2, A5.405.5.3.2.1, A5.405.5.3.2.2, A5.405.5.3.2.3, A5.405.5.3.2.4</i>				
	<i>Elective</i>	<i>Choice of materials</i>	<i>A5.406.1, A5.406.1.1, A5.406.1.2, A5.406.1.3</i>				
	<i>Elective</i>	<i>Life cycle assessment: general</i>	<i>A5.409.1</i>				
	<i>Elective</i>	<i>Whole building life cycle assessment</i>	<i>A5.409.2, A5.409.2.1, A5.409.2.2</i>				
	<i>Elective</i>	<i>Materials and system assemblies</i>	<i>A5.409.3</i>				
<i>Elective</i>	<i>Substitution for prescriptive standards</i>	<i>A5.409.4</i>					
<i>Elective</i>	<i>Verification of compliance</i>	<i>A5.409.5</i>					

(continued)

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.5 Environmental Quality (continued)	Mandatory	Fireplaces	5.503.1				
	Mandatory	Woodstoves	5.503.1.1				
	Mandatory	Temporary ventilation	5.504.1				
	Mandatory	Covering of ducts openings and protection of mechanical equipment during construction	5.504.3				
	Mandatory	Adhesives, sealants and caulks	5.504.4.1				
	Mandatory	Paints and coatings	5.504.4.3				
	Mandatory	Aerosol paints and coatings	5.504.4.3.1				
	Mandatory	Aerosol paints and coatings: verification	5.504.4.3.2				
	Mandatory	Carpet systems	5.504.4.4				
	Mandatory	Carpet cushion	5.504.4.4.1				
	Mandatory	Carpet adhesives per Table 5.504.4.1	5.504.4.4.2				
	Mandatory	Composite wood products	5.504.4.5				
	Mandatory	Composite wood products: documentation	5.504.4.5.3				
	Mandatory	Resilient flooring systems	5.504.4.6				
	Mandatory	Resilient flooring: verification of compliance	5.504.4.6.1				
	<i>Tier 1 Prerequisite</i>	<i>Resilient flooring systems, Tier 1 (with verification of compliance)</i>	<i>A5.504.4.7, A5.504.4.7.2</i>				
	Mandatory	Thermal insulation	5.504.4.7				
	Mandatory	Verification of compliance	5.504.4.7.1				
	<i>Tier 1 Prerequisite</i>	<i>Thermal insulation, Tier 1 (with verification of compliance)</i>	<i>A5.504.4.8.1, A5.504.4.8.1</i>				
	Mandatory	Acoustical ceilings and wall panels	5.504.4.8				
	Mandatory	Verification of compliance	5.504.4.8.1				
	Mandatory	Filters (with exceptions)	5.504.5.3				
	Mandatory	Filters: labeling	5.504.5.3.1				
	Mandatory	Environmental tobacco smoke (ETS) control	5.504.7				
	Mandatory	Indoor moisture control	5.505.1				
	Mandatory	Outside air delivery	5.506.1				
	Mandatory	Carbon dioxide (CO ₂) monitoring	5.506.2				
	Mandatory	Acoustical control (with exception)	5.507.4				
	Mandatory	Exterior noise transmission, prescriptive method (with exceptions)	5.507.4.1				
	Mandatory	Noise exposure where noise contours are not readily available	5.507.4.1.1				
	Mandatory	Performance method	5.507.4.2				
	Mandatory	Site features	5.507.4.2.1				
	Mandatory	Documentation of compliance	5.507.4.2.2				
	Mandatory	Interior sound transmission (with note)	5.507.4.3				
	Mandatory	Ozone depletion and greenhouse gas reductions	5.508.1				
	Mandatory	Chlorofluorocarbons (CFCs)	5.508.1.1				
Mandatory	Halons	5.508.1.2					
Mandatory	Supermarket refrigerant leak reduction for retail food stores 8,000 square feet or more Sections 5.508.2 through 5.508.2.6.3	5.508.2 through 5.508.2.6.3					

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.5 Environmental Quality	Select One Elective	<i>Elective</i>	<i>Indoor air quality (IAQ) during construction</i>	A5.504.1, A5.504.1.1, A5.504.1.2			
		<i>Elective</i>	<i>IAQ postconstruction</i>	A5.504.2			
		<i>Elective</i>	<i>IAQ testing</i>	A5.504.2.1, A5.504.2.1.1, A5.504.2.1.2, A5.504.2.1.3			
		<i>Elective</i>	<i>No added formaldehyde Tier 1 (with notes)</i>	A5.504.4.5.1			
		<i>Elective</i>	<i>Hazardous particulates and chemical pollutants</i>	A5.504.5			
		<i>Elective</i>	<i>Entryway systems</i>	A5.504.5.1			
		<i>Elective</i>	<i>Isolation of pollutant sources</i>	A5.504.5.2			
		<i>Elective</i>	<i>Lighting and thermal comfort controls</i>	A5.507.1, A5.507.1.1 through A5.507.1.2			
		<i>Elective</i>	<i>Daylight</i>	A5.507.2			
		<i>Elective</i>	<i>Views</i>	A5.507.3			
		<i>Elective</i>	<i>Interior office spaces</i>	A5.507.3.1			
		<i>Elective</i>	<i>Multi-occupant spaces (with exceptions)</i>	A5.507.3.2			
		<i>Elective</i>	<i>Hydrochlorofluorocarbons (HCFCs)</i>	A5.508.1.3			
		<i>Elective</i>	<i>Hydrofluorocarbons (HFCs)</i>	A5.508.1.4			
Additional Measures		<i>Select 1 additional measure from any division</i>	Add section #				
Total number of Measures required			15				
Total number of Measures selected							

Documentation Author's / Responsible Designer's Declaration Statement <i>Check the appropriate box(es) for the list below.</i>	
<input type="checkbox"/> Mandatory: I attest that the mandatory provisions checklist is accurate and complete.	
<input type="checkbox"/> Tier 1 compliant: I attest that the total number of voluntary measures selected meet or exceed the total number required to achieve Tier 1 compliance.	
<input type="checkbox"/> Partial Tier 1 compliant: I attest that the total number of voluntary measures selected do not meet the total number required to achieve Tier 1 compliance: however, partial Tier 1 compliance has been achieved.	
Signature:	
Company:	Date:
Address:	License:
City/State/Zip:	Phone:

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

A5.602.2
CALGreen VERIFICATION GUIDELINES
TIER 2 CHECKLIST

Application: This checklist shall be used for nonresidential projects that meet the following: new construction, or building additions of 1,000 square feet or greater, or building alterations with a permit valuation of \$200,000 or more pursuant to Section 301.3, AND are adopting Tier 2 voluntary measures.

Note: All applicable mandatory requirements in Chapter 5 shall be met prior to applying Tier 2 voluntary measures.

Instructions:

Comply with all Tier 2 prerequisite measures from the various categories shown on the table below.

Add a “Y” to all mandatory and Tier 2 prerequisite measures in the appropriate columns.

Select the required number of additional electives from those categories shown on the table below and add a “Y” on the selected elective and add an “N” on the rest.

Count the total number of Tier 2 prerequisite measures plus the additional electives and write down the total number at the end of the checklist. Determine if the required number of Tier 2 measures have been selected to achieve Tier 2 compliance.

Y = Yes (section has been selected and/or included)

N = No (section has not been selected and/or included)

O = Other (provide explanation)

[N] = New construction pursuant to Section 301.3

[A] = Additions and/or Alterations pursuant to Section 301.3

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.1 Planning and Design (continued)	Mandatory	Storm water pollution prevention for projects that disturb less than 1 acre of land	5.106.1 through 5.106.2				
	Mandatory	Short-term bicycle parking	5.106.4.1.1				
	Mandatory	Long-term bicycle parking	5.106.4.1.2 through 5.106.4.1.5				
	Tier 2	Designated parking—50% of parking capacity w/ parking stall markings and stall identification	A5.106.5.1, A5.106.5.1.2, A5.106.5.1.3, A5.106.5.1.4				
	Mandatory	Electric vehicle (EV) charging [N] w/ exceptions	5.106.5.3				
	Mandatory	EV capable spaces [N]	5.106.5.3.1				
	Mandatory	Electric vehicle charging stations (EVCS)	5.106.5.3.2				
	Mandatory	Use of automatic load management systems (ALMS)	5.106.5.3.3				
	Mandatory	Accessible EVCS	5.106.5.3.4				
	Mandatory	Note for EVCS signs					
	Mandatory	Table 5.106.5.3.1 w/ footnotes	5.106.3.1, 5.106.3.2 and 5.106.3.3				
	Tier 2 Prerequisite	Electric vehicle (EV) charging [N] and Table A5.106.5.3.2 w/ footnotes	A5.106.5.3, A5.106.5.3.2				
	Mandatory	Electric vehicle (EV) charging: medium-duty and heavy-duty [N]	5.106.5.4				
	Mandatory	Electric vehicle charging readiness requirements for warehouses, grocery stores and retail stores with planned off-street loading spaces [N]	5.106.5.4.1				
	Mandatory	Table 5.106.5.4.1	5.106.5.4 and 5.106.5.4.1				
	Mandatory	Light pollution reduction [N] (with exceptions, notes and table)	5.106.8 through 5.106.8.2				
	Mandatory	Grading and paving (exception for additions and alterations not altering the drainage path)	5.106.10				
	Tier 2 Prerequisite	Cool roof (A5.106.11.2.2): SRI 82 when ≤ 2:12, SRI 27 when > 2:12	A5.106.11.2				

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.1 Planning and Design	Select Three Electives	<i>Elective</i>	<i>Community connectivity</i>	A5.103.1			
		<i>Elective</i>	<i>Brownfield or greyfield site redevelopment or infill area development</i>	A5.103.2, A5.103.2.1			
		<i>Elective</i>	<i>Reduce development footprint and optimize open space</i>	A5.104.1, A5.104.1.1, A5.104.1.2, A5.104.1.3			
		<i>Elective</i>	<i>Disassemble and reuse existing building structure (75%) with exceptions</i>	A5.105.1.1			
		<i>Elective</i>	<i>Disassemble and reuse existing nonstructural elements (50%) with exceptions</i>	A5.105.1.2			
		<i>Elective</i>	<i>Salvage</i>	A5.105.1.3			
		<i>Elective</i>	<i>Storm water design</i>	A5.106.2, A5.106.2.1, A5.106.2.2,			
		<i>Elective</i>	<i>Low Impact Development (LID)</i>	A5.106.3, A5.106.3.1, A5.106.3.2			
		<i>Elective</i>	<i>Changing rooms w/ note</i>	A5.106.4.3			
		<i>Elective</i>	<i>Parking capacity w/ reduced parking capacity option</i>	A5.106.6, A5.106.6.1			
		<i>Elective</i>	<i>Exterior wall shading w/ fenestration and/or opaque wall area option</i>	A5.106.7, A5.106.7.1, A5.106.7.2			
		<i>Elective</i>	<i>Heat island effect</i>	A5.106.11			
DIVISION 5.2 Energy Efficiency	Mandatory	Meet the minimum energy efficiency standard	5.201.1				
	<i>Tier 2 Prerequisite</i>	<i>Energy Performance—outdoor lighting power 90% of Part 6</i>	A5.203.1.1.1				
	<i>Tier 2 Prerequisite</i>	<i>If applicable, service for water heating in restaurants of 8,000 sf or greater</i>	A5.203.1.1.2				
	<i>Tier 2 Prerequisite</i>	<i>Energy budget 90% or 85% of Part 6 calculated value of allowance</i>	A5.203.1.2.2				
	<i>Elective</i>	<i>On-site renewable energy (with documentation)</i>	A5.211.1, A5.211.1.1				
	<i>Elective</i>	<i>Green power</i>	A5.211.3				
	<i>Elective</i>	<i>Elevators with car lights and fan</i>	A5.212.1.1, A5.212.1.1.1				
	<i>Elective</i>	<i>Escalators</i>	A5.212.1.2				
	<i>Elective</i>	<i>Controls that reduce energy</i>	A5.212.1.4				
DIVISION 5.3 Water Efficiency and Conservation (continued)	Mandatory	Separate meters (new buildings or additions > 50,000 sf that consume more than 100 gal/day)	5.303.1.1				
	Mandatory	Separate meters (for tenants in new buildings or additions that consume more than 1,000 gal/day)	5.303.1.2				
	<i>Tier 2 Prerequisite</i>	<i>Water reduction Tier 2—20% or 25% savings over the “water use baseline” in Table A5.303.2.2</i>	A5.303.2.3.2 or A5.303.2.3.3				
	Mandatory	Water closets shall not exceed 1.28 gallons per flush (gpf)	5.303.3.1				
	Mandatory	Wall-mounted urinals shall not exceed 0.125 gpf	5.303.3.2.1				
	Mandatory	Floor-mounted urinals shall not exceed 0.5 gpf	5.303.3.2.2				
	Mandatory	Single showerhead shall have maximum flow rate of 1.8 gpm (gallons per minute) at 80 psi	5.303.3.3.1				
	Mandatory	Multiple showerheads serving one shower shall have a combined flow rate of 1.8 gpm at 80 psi	5.303.3.3.2				

(continued)

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
DIVISION 5.3 Water Efficiency and Conservation (continued)	Mandatory	Nonresidential lavatory faucets	5.303.3.4.1				
	Mandatory	Kitchen faucets	5.303.3.4.2				
	Mandatory	Wash fountains	5.303.3.4.3				
	Mandatory	Metering faucets	5.303.3.4.4				
	Mandatory	Metering faucets for wash fountains	5.303.3.4.5				
	Mandatory	Pre-rinse spray valve	5.303.3.4.6				
	Mandatory	Food waste disposers	5.303.4.1				
	Mandatory	Areas of additions or alterations	5.303.5				
	Mandatory	Standards for plumbing fixtures and fittings	5.303.6				
	Mandatory	Outdoor potable water use in landscape areas (with notes)	5.304.1				
	Select Three Electives	<i>Elective</i>	<i>Nonpotable water systems for indoor use</i>	<i>A5.303.2.3.4</i>			
<i>Elective</i>		<i>Appliances and fixtures for commercial application</i>	<i>A5.303.3</i>				
<i>Elective</i>		<i>Nonwater urinals</i>	<i>A5.303.4.1</i>				
<i>Elective</i>		<i>Dual plumbing</i>	<i>A5.303.5</i>				
<i>Elective</i>		<i>Outdoor potable water use</i>	<i>A5.304.2</i>				
<i>Elective</i>		<i>Restoration of areas disturbed by construction</i>	<i>A5.304.6</i>				
<i>Elective</i>		<i>Previously developed sites (with exception)</i>	<i>A5.304.7</i>				
<i>Elective</i>		<i>Graywater irrigation system</i>	<i>A5.304.8</i>				
<i>Elective</i>		<i>Nonpotable water systems</i>	<i>A5.305.1</i>				
<i>Elective</i>		<i>Irrigation systems</i>	<i>A5.305.2</i>				
DIVISION 5.4 Material Conservation and Resource Efficiency (continued)		<i>Tier 2 Prerequisite</i>	<i>Recycled content for 15% of total material cost</i>	<i>A5.405.4, A5.405.4.1 through A5.405.4.5</i>			
	Mandatory	Weather protection	5.407.1				
	Mandatory	Moisture control: sprinklers	5.407.2.1				
	Mandatory	Moisture control: exterior door protection	5.407.2.2.1				
	Mandatory	Moisture control: flashing	5.407.2.2.2				
	Mandatory	Construction waste management—comply with either: Sections 5.408.1.1, 5.408.1.2, 5.408.1.3 or more stringent local ordinance	5.408.1.1, 5.408.1.2, 5.408.1.3				
	Mandatory	Construction waste management: documentation	5.408.1.4				
	Mandatory	Universal waste [A]	5.408.2				
Mandatory	Excavated soil and land clearing debris (100% reuse or recycle)	5.408.3					

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.4 Material Conservation and Resource Efficiency	<i>Tier 2 Prerequisite</i>	<i>Enhanced construction waste reduction (80%—Tier 2 with verification)</i>	<i>A5.408.3.1.1, A5.408.3.1.2</i>				
	Mandatory	Recycling by occupants (with exception)	5.410.1				
	Mandatory	Recycling by occupants: additions (with exception)	5.410.1.1				
	Mandatory	Recycling by occupants: sample ordinance	5.410.1.2				
	Mandatory	Commissioning new buildings (≥ 10,000 sf) [N]	5.410.2				
	Mandatory	Owner’s or Owner representative’s Project Requirements (OPR) [N]	5.410.2.1				
	Mandatory	Basis of Design (BOD) [N]	5.410.2.2				
	Mandatory	Commissioning plan [N]	5.410.2.3				
	Mandatory	Functional performance testing [N]	5.410.2.4				
	Mandatory	Documentation and training [N]	5.410.2.5				
	Mandatory	Systems manual [N]	5.410.2.5.1				
	Mandatory	Systems operation training [N]	5.410.2.5.2				
	Mandatory	Commissioning report [N]	5.410.2.6				
	Mandatory	Testing and adjusting for new buildings < 10,000 sf or new systems that serve additions or alterations [A]	5.410.4				
	Mandatory	System Testing Plan for renewable energy, landscape irrigation and water reuse [A]	5.410.4.2				
	Mandatory	Procedures for testing and adjusting	5.410.4.3				
	Mandatory	Procedures for HVAC balancing	5.410.4.3.1				
	Mandatory	Reporting for testing and adjusting	5.410.4.4				
	Mandatory	Operation and maintenance (O&M) manual	5.410.4.5				
	Mandatory	Inspection and reports	5.410.4.5.1				
Select Three Electives	<i>Elective</i>	<i>Wood framing or OVE (with note)</i>	<i>A5.404.1, A5.404.1.1, A5.404.1.2</i>				
	<i>Elective</i>	<i>Regional materials</i>	<i>A5.405.1</i>				
	<i>Elective</i>	<i>Bio-based materials</i>	<i>A5.405.2</i>				
	<i>Elective</i>	<i>Rapidly renewable materials</i>	<i>A5.405.2.2</i>				
	<i>Elective</i>	<i>Reused materials (with note)</i>	<i>A5.405.3</i>				
	<i>Elective</i>	<i>Cement and concrete: cement</i>	<i>A5.405.5.1</i>				
	<i>Elective</i>	<i>Cement and concrete: concrete with SCM & Mix design equation</i>	<i>A5.405.5.2, A5.405.5.2.1, A5.405.5.2.1.1</i>				
	<i>Elective</i>	<i>Cement and concrete: additional means of compliance</i>	<i>A5.405.5.3, A5.405.5.3.1, A5.405.5.3.1.1, A5.405.5.3.1.2, A5.405.5.3.2, A5.405.5.3.2.1, A5.405.5.3.2.2, A5.405.5.3.2.3, A5.405.5.3.2.4</i>				
(cont’d)	<i>Elective</i>	<i>Choice of materials</i>	<i>A5.406.1, A5.406.1.1, A5.406.1.2, A5.406.1.3</i>				

(continued)

APPENDIX A5—NONRESIDENTIAL VOLUNTARY MEASURES

CHAPTER 5 DIVISIONS			SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.4 Material Conservation and Resource Efficiency	Select Three Electives (cont'd)	<i>Elective</i>	<i>Life cycle assessment: general</i>	<i>A5.409.1</i>				
		<i>Elective</i>	<i>Whole building life cycle assessment</i>	<i>A5.409.2, A5.409.2.1, A5.409.2.2</i>				
		<i>Elective</i>	<i>Materials and system assemblies</i>	<i>A5.409.3</i>				
		<i>Elective</i>	<i>Substitution for prescriptive standards</i>	<i>A5.409.4</i>				
		<i>Elective</i>	<i>Verification of compliance</i>	<i>A5.409.5</i>				
DIVISION 5.5 Environmental Quality (continued)	Mandatory	Fireplaces	5.503.1					
	Mandatory	Woodstoves	5.503.1.1					
	Mandatory	Temporary ventilation	5.504.1					
	Mandatory	Covering of ducts openings and protection of mechanical equipment during construction	5.504.3					
	Mandatory	Adhesives, sealants and caulks	5.504.4.1					
	Mandatory	Paints and coatings	5.504.4.3					
	Mandatory	Aerosol paints and coatings	5.504.4.3.1					
	Mandatory	Aerosol paints and coatings: verification	5.504.4.3.2					
	Mandatory	Carpet systems	5.504.4.4					
	Mandatory	Carpet cushion	5.504.4.4.1					
	Mandatory	Carpet adhesives per Table 5.504.4.1	5.504.4.4.2					
	Mandatory	Composite wood products	5.504.4.5					
	Mandatory	Composite wood products: documentation	5.504.4.5.3					
	Mandatory	Resilient flooring systems	5.504.4.6					
	Mandatory	Resilient flooring: verification of compliance	5.504.4.6.1					
	<i>Tier 2 Prerequisite</i>	<i>Resilient flooring systems, Tier 2 (with verification of compliance)</i>	<i>A5.504.4.7.1, A5.504.4.7.2</i>					
	Mandatory	Thermal insulation	5.504.4.7					
	Mandatory	Verification of compliance	5.504.4.7.1					
	Mandatory	Acoustical ceilings and wall panels	5.504.4.8					
	Mandatory	Verification of compliance	5.504.4.8.1					
	Mandatory	Filters (with exceptions)	5.504.5.3					
	Mandatory	Filters: labeling	5.504.5.3.1					
	Mandatory	Environmental tobacco smoke (ETS) control	5.504.7					
	Mandatory	Indoor moisture control	5.505.1					
	Mandatory	Outside air delivery	5.506.1					
	Mandatory	Carbon dioxide (CO ₂) monitoring	5.506.2					
	Mandatory	Acoustical control (with exception)	5.507.4					
	Mandatory	Exterior noise transmission, prescriptive method (with exceptions)	5.507.4.1					
Mandatory	Noise exposure where noise contours are not readily available	5.507.4.1.1						
Mandatory	Performance method	5.507.4.2						

(continued)

CHAPTER 5 DIVISIONS		SECTION TITLE	CODE SECTION	Y	N	O	PLAN SHEET, SPEC OR ATTACH REFERENCE
(continued) DIVISION 5.5 Environmental Quality	Mandatory	Site features	5.507.4.2.1				
	Mandatory	Documentation of compliance	5.507.4.2.2				
	Mandatory	Interior sound transmission (with note)	5.507.4.3				
	Mandatory	Ozone depletion and greenhouse gas reductions	5.508.1				
	Mandatory	Chlorofluorocarbons (CFCs)	5.508.1.1				
	Mandatory	Halons	5.508.1.2				
	Mandatory	Supermarket refrigerant leak reduction for retail food stores 8,000 square feet or more Sections 5.508.2 through 5.508.2.6.3	5.508.2 through 5.508.2.6.3				
Select Three Electives	<i>Elective</i>	<i>Indoor air quality (IAQ) during construction</i>	<i>A5.504.1, A5.504.1.1, A5.504.1.2</i>				
	<i>Elective</i>	<i>IAQ postconstruction</i>	<i>A5.504.2</i>				
	<i>Elective</i>	<i>IAQ testing</i>	<i>A5.504.2.1, A5.504.2.1.1, A5.504.2.1.2, A5.504.2.1.3</i>				
	<i>Elective</i>	<i>No added formaldehyde Tier 1 (with notes)</i>	<i>A5.504.4.5.1</i>				
	<i>Elective</i>	<i>Hazardous particulates and chemical pollutants</i>	<i>A5.504.5</i>				
	<i>Elective</i>	<i>Entryway systems</i>	<i>A5.504.5.1</i>				
	<i>Elective</i>	<i>Isolation of pollutant sources</i>	<i>A5.504.5.2</i>				
	<i>Elective</i>	<i>Lighting and thermal comfort controls</i>	<i>A5.507.1, A5.507.1.1 through A5.507.1.2</i>				
	<i>Elective</i>	<i>Daylight</i>	<i>A5.507.2</i>				
	<i>Elective</i>	<i>Views</i>	<i>A5.507.3</i>				
	<i>Elective</i>	<i>Interior office spaces</i>	<i>A5.507.3.1</i>				
	<i>Elective</i>	<i>Multi-occupant spaces (with exceptions)</i>	<i>A5.507.3.2</i>				
	<i>Elective</i>	<i>Hydrochlorofluorocarbons (HCFCs)</i>	<i>A5.508.1.3</i>				
<i>Elective</i>	<i>Hydrofluorocarbons (HFCs)</i>	<i>A5.508.1.4</i>					
Additional Measures		Select three additional measures from any division	Additional measures: 1. 2. 3.				
Total number of Measures required for Tier 2			25				
Total number of Measures selected							

<p>Documentation Author's / Responsible Designer's Declaration Statement <i>Check the appropriate box(es) for the list below.</i></p> <ul style="list-style-type: none"> <input type="checkbox"/> Mandatory: I attest that the mandatory provisions checklist is accurate and complete. <input type="checkbox"/> Tier 2 compliant: I attest that the total number of voluntary measures selected meet or exceed the total number required to achieve Tier 2 compliance. <input type="checkbox"/> Partial Tier 2 compliant: I attest that the total number of voluntary measures selected do not meet the total number required to achieve Tier 2 compliance; however, partial Tier 2 compliance has been achieved. 	
Signature:	
Company:	Date:
Address:	License:
City/State/Zip:	Phone:

CALIFORNIA GREEN BUILDING STANDARDS CODE – MATRIX ADOPTION TABLE

APPENDIX A6.1—VOLUNTARY STANDARDS FOR HEALTH FACILITIES [OSHPD 1, 2 & 4]

The following sections are relocated from the voluntary appendices into one appendix to assist code users in the planning, design and construction of environmentally sustainable medical facilities under the authority of the Office of Statewide Health Planning and Development specified in Chapter 1 of this code.

Adopting agency	BSC	BSC-CG	SFM	HCD			DSA		OSHPD					BSCC	DPH	AGR	DWR	CEC	CA	SL	SLC
				1	2	1/AC	AC	SS	1	1R	2	3	4								
Adopt entire CA chapter																					
Adopt entire chapter as amended (amended sections listed below)									X		X		X								
Adopt only those sections that are listed below																					
Chapter/Section																					
A5.106.9									X		X		X								
A5.203									X												
A5.505.4.5.1									X		X		X								

APPENDIX A6.1—VOLUNTARY STANDARDS FOR HEALTH FACILITIES [OSHPD 1, 2 & 4]

Division A5.1 – SITE PLANNING AND DESIGN

SECTION A5.106 SITE DEVELOPMENT

A5.106.9 Building orientation. Locate and orient the building as follows:

1. When site and location permit, orient the building with the long sides facing north and south.
2. Protect the building from thermal loss, drafts and degradation of the building envelope caused by wind and wind-driven materials such as dust, sand, snow and leaves, with building orientation and landscape features.

Note: For information on sun angles and shading, visit: <http://www2.aud.ucla.edu/energy-design-tools/>.

Calculations may be made using the Solar-2 tool.

Division A5.2 – ENERGY EFFICIENCY

SECTION A5.202 DEFINITIONS

A5.202.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ENERGY STAR. A joint program of the US Environmental Protection Agency and the US Department of Energy. ENERGY STAR is a voluntary program designed to identify and promote energy-efficient products and practices.

SECTION A5.203 PERFORMANCE APPROACH

A5.203.2 Energy performance. It is the intent of this code to encourage green buildings to achieve exemplary performance in the area of energy efficiency.

A5.203.2.1 CALGreen Tier 1. [OSHPD 1] To achieve CALGreen Tier 1, buildings must comply with the latest edition of “Savings By Design, Healthcare Modeling Procedures” found online at <http://www.energysoft.com/ep/2007SBDHPProcedures.pdf>.

A5.203.2.2 CALGreen Tier 2. [OSHPD 1] To achieve CALGreen Tier 2, buildings must exceed the latest edition of “Savings By Design, Healthcare Modeling Procedures” by a minimum of 15 percent.

SECTION A5.204 PRESCRIPTIVE APPROACH

A5.204.1 ENERGY STAR equipment and appliances. All equipment and appliances provided by the builder shall be ENERGY STAR labeled if ENERGY STAR is applicable to that equipment or appliance.

A5.204.4 Commissioning. [OSHPD 1 & 4] Building commissioning shall be included in the design and construction processes of the building project to verify that the building’s energy related systems are installed, calibrated and perform according to the owner’s project requirements, basis of design and construction documents.

The owner and designer shall designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities. The owner shall document the Owner’s Project Requirements (OPR). The design team shall develop the Basis of

Design (BOD). The CxA shall review these documents for clarity and completeness. The owner and design team shall be responsible for updates to their respective documents, develop and incorporate commissioning requirements into the construction documents and develop and implement a commissioning plan. The CxA shall verify the installation and performance of the systems to be commissioned, verify that training and operation and maintenance documentation have been provided to the owner’s operations staff and complete a commissioning report.

Commissioning process activities shall be completed for the following energy-related systems, at a minimum:

1. Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls.
2. Lighting and daylighting controls.
3. Domestic hot water systems.
4. Renewable energy systems (wind, solar, etc.).
5. Building envelope systems.

A5.204.4.1 Owner’s Project Requirements (OPR). The expectations and requirements of the building shall be documented by the owner and the designer before the design phase of the project begins. This shall be reviewed by the CxA. At a minimum, this documentation shall include the following:

1. Environmental and sustainability goals.
2. Energy efficiency goals.
3. Indoor environmental quality requirements.
4. Equipment and systems expectations.
5. Building occupant and O&M personnel expectations.

A5.204.4.2 Basis of Design (BOD). A written explanation of how the design of the building systems meets the Owner’s Project Requirements shall be completed at the design phase of the building project and updated as necessary during the design and construction phases. This shall be reviewed by the CxA. At a minimum, the Basis of Design document shall cover the following systems:

1. Heating, ventilation, air conditioning (hvac) systems and controls.
2. Indoor lighting system and controls.
3. Water heating system.
4. Renewable energy systems.

A5.204.4.3 Commissioning plan. A commissioning plan shall be completed to document the approach to how the project will be commissioned and shall be started during the design phase of the building project. This shall be reviewed by the CxA. The Commissioning Plan shall include the following at a minimum:

1. General project information.
2. Commissioning goals.
3. Systems to be commissioned. Plans to test systems and components shall include at a minimum:

- a. A detailed explanation of the original design intent;
 - b. Equipment and systems to be tested, including the extent of tests;
 - c. Functions to be tested;
 - d. Conditions under which the test shall be performed; and
 - e. Measurable criteria for acceptable performance.
4. Commissioning team information.
 5. Commissioning process activities, schedules and responsibilities – plans for the completion of commissioning requirements listed in Sections A5.204.4.4 through A5.204.4.6 shall be included.

A5.204.4.4 Functional performance testing. Functional performance tests shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the approved plans and specifications. Functional performance testing reports shall contain information addressing each of the building components tested, the testing methods utilized and include any readings and adjustments made. This shall be reviewed and verified by the CxA.

A5.204.4.5 Postconstruction documentation and training. A systems manual and systems operations training are required.

A5.204.4.5.1 Systems manual. Documentation of the operational aspects of the building shall be completed within the systems manual and delivered to the building owner and facilities operator. This shall be reviewed by the CxA. At a minimum, the systems manual shall include the following:

1. Site information, including facility description, history and current requirements.
2. Site contact information.
3. Basic operations and maintenance, including general site operating procedures, basic troubleshooting, recommended maintenance requirements, site events log.
4. Major systems.
5. Site equipment inventory and maintenance notes.
6. Other resources and documentation.

A5.204.4.5.2 Systems operations training. The CxA shall oversee the training of the appropriate maintenance staff for each equipment type and/or system. The training shall include, as a minimum, the following:

1. System/equipment overview (what it is, what it does and what other systems and/or equipment it interfaces with).
2. Review of the information in the systems manual.
3. Review of the record drawings on the system/equipment.

A5.204.4.6 Commissioning report. The CxA shall create a complete report of commissioning process activities under-

taken through the design, construction and postconstruction phases of the building project and provided to the owner.

A5.204.6 Building orientation and shading. Locate orient and shade the building as required in Section A5.106.9.

SECTION A5.205 [OSHPD 1 & 4] BUILDING ENVELOPE

A5.205.1 Fenestration products and exterior doors.

A5.205.1.1 Certification of fenestration products and exterior doors other than field-fabricated. Any fenestration product and exterior door, other than field-fabricated fenestration products and field-fabricated exterior doors, may be installed only if the manufacturer has certified to the California Energy Commission or if an independent certifying organization approved by the Commission has certified that the product complies with all of the applicable requirements of this subsection.

A5.205.1.1.1 Air leakage. Manufactured fenestration products and exterior doors shall have air infiltration rates not exceeding 0.3 cfm/ft² of window area, 0.3 cfm/ft² of door area for residential doors, 0.3 cfm/ft² of door area for nonresidential single doors (swinging and sliding) and 1.0 cfm/ft² for nonresidential double doors (swinging), when tested according to NFRC-400 or ASTM E283 at a pressure differential of 75 pascals (or 1.57 pounds/ft²), incorporated herein by reference.

A5.205.1.1.2 U-factor. A fenestration product's *U*-factor shall be rated in accordance with NFRC 100 or the applicable default *U*-factor set forth in Table A.5.205.1-A.

Exception: If the fenestration product is a skylight or is site-built fenestration in a building covered by the nonresidential standards with less than 10,000 square feet of site-built fenestration, the default *U*-factor may be calculated as set forth in Reference Nonresidential Appendix NA6 of the California Energy Commission 2008 *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*.

A5.205.1.1.3 SHGC. A fenestration product's SHGC shall be rated in accordance with NFRC 200 for site-built fenestration or use the applicable default SHGC set forth in Table A5.205.1-B.

Exception: If the fenestration product is a skylight or is site-built fenestration in a building covered by the nonresidential standards with less than 10,000 square feet of site-built fenestration, the default SHGC may be calculated as set forth in Reference Nonresidential Appendix NA6 of the California Energy Commission 2008 *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*.

A5.205.1.1.4 Labeling. Fenestration products shall:

1. Have a temporary label (or label certificate for site-built fenestration) meeting the requirements of Section 10-111(a)1 of Title 24, Part 1 not to be removed before inspection by the enforcement

agency, listing the certified *U*-factor and SHGC and certifying that the air leakage requirements of Section A5.205.1.1.1 are met for each product line; and

2. Have a permanent label (or label certificate for site-built fenestration) meeting the requirements of Section 10-111(a)2 of Title 24, Part 1 if the product is rated using NFRC procedures.

A5.205.1.1.5 Fenestration acceptance requirements.

Before an occupancy permit is granted, site-built fenestration products in other than low-rise residential buildings shall be certified as meeting the Acceptance Requirements for Code Compliance, as specified by the Reference Nonresidential Appendix NA7 of the California Energy Commission 2008 *Building Energy Efficiency Standards for Residential and Nonresidential Buildings* to ensure that site-built fenestration meet Standards requirements, including a matching label certificate for each product installed and be readily accessible at the project location. A Certificate of Acceptance shall be submitted to the enforcement agency that certifies that the fenestration product meets the acceptance requirements.

Exception: Fenestration products removed and reinstalled as part of a building alteration or addition.

A5.205.1.2 Installation of field-fabricated fenestration and exterior doors. Field-fabricated fenestration and field-fabricated exterior doors may be installed only if the compliance documentation has demonstrated compliance for the installation using *U*-factors from Table A5.205.1-A and SHGC values from Table A5.205.1-B. Field-fabricated fenestration and field-fabricated exterior doors shall be caulked between the fenestration products or exterior door and the building and shall be weatherstripped.

Exception: Unframed glass doors and fire doors need not be weatherstripped or caulked.

A5.205.2 Joints and other openings. Joints and other openings in the building envelope that are potential sources of air leakage shall be caulked, gasketed, weatherstripped or otherwise sealed to limit infiltration and exfiltration.

A5.205.3 Insulation and roofing products.

A5.205.3.1 Certification by manufacturers. Any insulation shall be certified by Department of Consumer Affairs, Bureau of Home Furnishing and Thermal Insulation that the insulation conductive thermal performance is approved pursuant to the *California Code of Regulations*, Title 24, Part 12, Chapters 12-13, Article 3, "Standards for Insulating Material."

A5.205.3.2 Installation of urea formaldehyde foam insulation. Urea formaldehyde foam insulation may be applied or installed only if:

1. It is installed in exterior side walls; and
2. A four-mil-thick plastic polyethylene vapor barrier or equivalent plastic sheathing vapor barrier is installed between the urea formaldehyde foam insulation and the interior space in all applications.

APPENDIX A6.1—VOLUNTARY STANDARDS FOR HEALTH FACILITIES [OSHPD 1, 2 & 4]

**TABLE A.5.205.1-A
DEFAULT FENESTRATION PRODUCT U-FACTORS**

FRAME	PRODUCT TYPE	TOTAL WINDOW SHGC		
		SINGLE PANE U-FACTOR	DOUBLE PANE ¹ U-FACTOR	GLASS BLOCK ² U-FACTOR
Metal	Operable	1.28	0.79	0.87
	Fixed	1.19	0.71	0.72
	Greenhouse/garden window	2.26	1.40	N.A.
	Doors	1.25	0.77	N.A.
	Skylight	1.98	1.30	N.A.
Metal, thermal break	Operable	N.A.	0.66	N.A.
	Fixed	N.A.	0.55	N.A.
	Greenhouse/garden window	N.A.	1.12	N.A.
	Doors	N.A.	0.59	N.A.
	Skylight	N.A.	1.11	N.A.
Nonmetal	Operable	0.99	0.58	0.60
	Fixed	1.04	0.55	0.57
	Greenhouse/garden window	0.99	0.53	N.A.
	Doors	1.94	1.06	N.A.
	Skylight	1.47	0.84	N.A.

N.A. = Not applicable.

1. For all dual-glazed fenestration products, adjust the listed *U*-factors as follows:
 - a. Add 0.05 for products with dividers between panes if spacer is less than $\frac{7}{16}$ inch wide.
 - b. Add 0.05 to any product with true divided lite (dividers through the panes).
2. Translucent or transparent panels shall use glass blocks.

**TABLE A.5.205.1-B
DEFAULT SOLAR HEAT GAIN COEFFICIENT (SHGC)**

FRAME	PRODUCT TYPE	GLAZING	TOTAL WINDOW SHGC		
			Single Pane	Double Pane	Glass Block ¹
Metal	Operable	Clear	0.80	0.70	0.70
	Fixed	Clear	0.83	0.73	0.73
	Operable	Tinted	0.67	0.59	N.A.
	Fixed	Tinted	0.68	0.60	N.A.
Metal, thermal break	Operable	Clear	N.A.	0.63	N.A.
	Fixed	Clear	N.A.	0.69	N.A.
	Operable	Tinted	N.A.	0.53	N.A.
	Fixed	Tinted	N.A.	0.57	N.A.
Nonmetal	Operable	Clear	0.74	0.65	0.70
	Fixed	Clear	0.76	0.67	0.67
	Operable	Tinted	0.60	0.53	N.A.
	Fixed	Tinted	0.63	0.55	N.A.

N.A. = Not applicable.

1. Translucent or transparent panels shall use glass block values.

A5.205.3.3 Flame spread rating. All insulating material shall be installed in compliance with the flame spread rating and smoke density requirements of the Title 24, Part 2, *California Building Code*.

A5.205.3.4 Installation of insulation in existing buildings. Insulation installed in an existing attic or on an existing duct or water heater, shall comply with the applicable requirements of Subsections A5.205.3.4.1, A5.205.3.4.2 and A5.205.3.4.3 below. If a contractor installs the insulation, the contractor shall certify to the customer, in writing, that the insulation meets the applicable requirements of Subsections A5.205.3.4.1, A5.205.3.4.2 and A5.205.3.4.3 below.

A5.205.3.4.1 Attics. If insulation is installed in the existing attic of a low-rise residential building, the R-value of the total amount of insulation (after addition of insulation to the amount, if any, already in the attic) shall be at least R-38 in climate zones 1 and 16; and R-30 in all other climate zones.

Exception: Where the accessible space in the attic is not large enough to accommodate the required R-value, the entire accessible space shall be filled with insulation provided such installation does not violate Section 1203.2 of Title 24, Part 2, *California Building Code*.

A5.205.3.4.2 Water heaters. If external insulation is installed on an existing unfired water storage tank or on an existing back-up tank for a solar water-heating system, it shall have an R-value of at least R-12 or the heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.

A5.205.3.4.3 Ducts. If insulation is installed on an existing space-conditioning duct, it shall comply with Section 605 of the *California Mechanical Code* (CMC).

A5.205.3.5 Placement of roof/ceiling insulation. Insulation installed to limit heat loss and gain through the top of conditioned spaces shall comply with the following:

A5.205.3.5.1 Insulation shall be installed in direct contact with a continuous roof or ceiling which is sealed to limit infiltration and exfiltration as specified in Section A5.205.2, including but not limited to placing insulation either above or below the roof deck or on top of a drywall ceiling; and

A5.205.3.5.2 When insulation is installed at the roof in nonresidential buildings, fixed vents or openings to the outdoors or to unconditioned spaces shall not be installed and the space between the ceiling and the roof is either directly or indirectly conditioned space and shall not be considered an attic for the purposes of complying with CBC attic ventilation requirements; and

A5.205.3.5.3 Insulation placed on top of a suspended ceiling with removable ceiling panels shall be deemed to have no affect on envelope heat loss; and

Exception: When there are conditioned spaces with a combined floor area no greater than 2,000 square feet in an otherwise unconditioned building and when the average height of the space between the ceiling and the roof over these spaces is greater than 12 feet, insulation placed in direct contact with a suspended ceiling with removable ceiling panels shall be an acceptable method of reducing heat loss from a conditioned space and shall be accounted for in heat loss calculations.

A5.205.3.5.4 Insulation shall be installed below the roofing membrane or layer used to seal the roof from water penetration unless the insulation has a maximum water absorption of 0.3 percent by volume when tested according to ASTM C272.

Note: Vents, which do not penetrate the roof deck, that are designed for wind resistance for roof membranes are not within the scope of Section A5.205.3.5.2.

A5.205.3.6 Demising walls in nonresidential buildings. The opaque portions of framed demising walls in nonresidential buildings shall be insulated with an installed R-value of no less than R-13 between framing members.

A5.205.3.7 Insulation requirements for heated slab floors. Heated slab-on-grade floors shall be insulated according to the requirements in Table A5.205.3-A.

A5.205.3.7.1 Insulation materials in ground contact must:

A5.205.3.7.1.1 Comply with the certification requirements of Section A5.205.3.1 and

A5.205.3.7.1.2 Have a water absorption rate for the insulation material alone without facings that is no greater than 0.3 percent when tested in accordance with Test Method A – 24 Hour-Immersion of ASTM C272.

A5.205.3.7.2 Insulation installation must:

A5.205.3.7.2.1 Cover the insulation with a solid guard that protects against damage from ultraviolet radiation, moisture, landscaping operation, equipment maintenance and wind; and

A5.205.3.7.2.2 Include a rigid plate, which penetrates the slab and blocks the insulation from acting as a conduit for insects from the ground to the structure above the foundation.

A5.205.3.8 Wet insulation systems. When insulation is installed on roofs above the roofing membrane or layer used to seal the roof from water penetration, the effective R-value of the insulation shall be as specified in Reference Joint Appendix JA4 of the California Energy Commission 2008 *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*.

A5.205.3.9 Roofing products solar reflectance and thermal emittance.

A5.205.3.9.1 In order to meet the requirements of Sections 141, 142, 143(a)1, 149(b)1B, 151(f)12, 152(b)1H or 152(b)2 of Title 24, Part 6, a roofing product's ther-

mal emittance and 3-year aged solar reflectance shall be certified and labeled according to the requirements of Section 10-113 of Title 24, Part 1.

Exception: Roofing products that are not certified according to Section 10-113 of Title 24, Part 1 shall assume the following default aged reflectance/emittance values:

A5.205.3.9.1.1 For asphalt shingles, 0.08/0.75

A5.205.3.9.1.2 For all other roofing products, 0.10/0.75

A5.205.3.9.2 If CRRC testing for 3-year aged reflectance is not available for any roofing products, the 3-year aged value shall be derived from the CRRC initial value using the equation $R_{aged} = [0.2 + 0.7(\rho_{initial}-0.2)]$, where $\rho_{initial}$ = the initial Solar Reflectance.

A5.205.3.9.3 Solar Reflectance Index (SRI), calculated as specified by ASTM E1980-01, may be used as an alternative to thermal emittance and 3-year aged solar reflectance when complying with the requirements of Sections 141, 142, 143(a)1, 149(b)1B, 151(f)12, 152(b)1H or 152(b)2 of Title 24, Part 6. SRI calculations

shall be based on moderate wind velocity of 2-6 meters per second. The SRI shall be calculated based on the 3-year aged reflectance value of the roofing products.

A5.205.3.9.4 Liquid applied roof coatings applied to low-sloped roofs in the field as the top surface of a roof covering shall:

A5.205.3.9.4.1 Be applied across the entire roof surface to meet the dry mil thickness or coverage recommended by the coating manufacturer, taking into consideration the substrate on which the coating is applied, and

A5.205.3.9.4.2 Meet the minimum performance requirements listed in Table A5.205.3-B or the minimum performance requirements of ASTM C836, D3468, D6083 or D6694, whichever are appropriate to the coating material.

Exceptions:

1. Aluminum-pigmented asphalt roof coatings shall meet the requirements of ASTM D2824 or ASTM D6848 and be installed as specified by ASTM D3805.

**TABLE A5.205.3-A
SLAB INSULATION REQUIREMENTS FOR HEATED SLAB-ON-GRADE**

INSULATION LOCATION	INSULATION ORIENTATION	INSTALLATION REQUIREMENTS	CLIMATE ZONE	INSULATION R-FACTOR
Outside edge of heated slab, either inside or outside the foundation wall	Vertical	From the level of the top of the slab, down 16 inches or to the frost line, whichever is greater. Insulation may stop at the top of the footing where this is less than the required depth. For below grade slabs, vertical insulation shall be extended from the top of the foundation wall to the bottom of the foundation (or the top of the footing) or to the frost line, whichever is greater.	1 – 15	5
			16	10
Between heated slab and outside foundation wall	Vertical and Horizontal	Vertical insulation from top of slab at inside edge of outside wall down to the top of the horizontal insulation. Horizontal insulation from the outside edge of the vertical insulation extending 4 feet toward the center of the slab in a direction normal to the outside of the building in plan view.	1 – 15	5
			16	10 vertical and 7 horizontal

**TABLE A5.205.3-B
MINIMUM PERFORMANCE REQUIREMENTS FOR LIQUID APPLIED ROOF COATINGS**

PHYSICAL PROPERTY	ASTM TEST PROCEDURE	REQUIREMENT
Initial percent elongation (break)	D2370	Minimum 200 percent 73°F (23°C)
Initial percent elongation (break) OR Initial flexibility	D2370 D522, Test B	Minimum 60 percent 0°F (-18°C) Minimum pass 1" mandrel 0°F (-18°C)
Initial tensile strength (maximum stress)	D2370	Minimum 100 psi (1.38 Mpa) 73°F (23°C)
Initial tensile strength (maximum stress) OR Initial flexibility	D2370 D522, Test B	Minimum 200 psi (2.76 Mpa) 0°F (-18°C) Minimum pass 1" mandrel 0°F (-18°C)
Final percent elongation (break) after accelerated weathering 1000 h	D2370	Minimum 100 percent 73°F (23°C)
Final percent elongation (break) after accelerated weathering 1000 h OR Flexibility after accelerated weathering 1000 h	D2370	Minimum 40 percent 0°F (-18°C) Minimum pass 1" mandrel 0°F (-18°C)
Permeance	D1653	Maximum 50 perms
Accelerated weathering 1000 h	D4798	No cracking or checking ¹

1. Any cracking or checking visible to the eye fails the test procedure.

2. Cement-based roof coatings shall contain a minimum of 20 percent cement and shall meet the requirements of ASTM C1583, ASTM D822 and ASTM D5870.

SECTION A5.207 [OSHPD 1, 2 & 4] HVAC DESIGN, EQUIPMENT AND INSTALLATION

A5.207.1 Space-conditioning equipment certification by manufacturers. Any space-conditioning equipment listed in this section may be installed only if the manufacturer has certified that the equipment complies with all the applicable requirements of this section.

A5.207.1.1 Efficiency. Equipment shall meet the applicable requirements in Tables A5.207.1-A through A5.207.1-M, subject to the following:

1. If more than one standard is listed for any equipment in Tables A5.207.1-A through A5.207.1-M, the equipment shall meet all the applicable standards that are listed; and
2. If more than one test method is listed in Tables A5.207.1-A through A5.207.1-M, the equipment shall comply with the applicable standard when tested with each test method; and
3. Where equipment can serve more than one function, such as both heating and cooling or both space heating and water heating, it shall comply with all the requirements applicable to each function; and
4. Where a requirement is for equipment rated at its “maximum rated capacity” or “minimum rated capacity,” the capacity shall be as provided for and allowed by the controls, during steady-state operation.

Exception: Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI Standard 550 test conditions of 44°F leaving chilled water temperature and 85°F entering condenser water temperature shall have a minimum full load COP rating as shown in Tables A5.207.1-H, A5.207.1-I and A5.207.1-J and a minimum NPLV rating as shown in Tables A5.207.1-K, A5.207.1-L and A5.207.1-M. The table values are only applicable over the following full load design ranges:

Leaving Chiller Water Temperature	40 to 48°F
Entering Condenser Water Temperature	75 to 85°F
Condensing Water Temperature Rise	5 to 15°F

A5.207.1.2 Controls for heat pumps with supplementary electric resistance heaters. Heat pumps with supplementary electric resistance heaters shall have controls:

A5.207.1.2.1 That prevent supplementary heater operation when the heating load can be met by the heat pump alone; and

A5.207.1.2.2 In which the cut-on temperature for compression heating is higher than the cut-on temperature for supplementary heating and the cut-off temperature for compression heating is higher than the cut-off temperature for supplementary heating.

Exceptions: The controls may allow supplementary heater operation during:

1. Defrost; and
2. Transient periods such as start-ups and following room thermostat setpoint advance, if the controls provide preferential rate control, intelligent recovery, staging, ramping or another control mechanism designed to preclude the unnecessary operation of supplementary heating.

A5.207.1.3 Thermostats. All unitary heating and/or cooling systems including heat pumps that are not controlled by a central energy management control system (EMCS) shall have a setback thermostat.

1. **Setback capabilities.** All thermostats shall have a clock mechanism that allows the building occupant to program the temperature set points for at least four periods within 24 hours. Thermostats for heat pumps shall meet the requirements of Section A5.207.1.2.

Exception: Gravity gas wall heaters, gravity floor heaters, gravity room heaters, noncentral electric heaters, fireplaces or decorative gas appliances, wood stoves, room air conditioners and room air-conditioner heat pumps need not comply with this requirement. Additionally, room air-conditioner heat pumps need not comply with Section A5.207.1.2 Under performance method of compliance, the resulting increase in energy use due to elimination of the setback thermostat shall be factored into the compliance analysis in accordance with a method prescribed by the Executive Director.

A5.207.1.4 Gas- and oil-fired furnace standby loss controls. Gas-fired and oil-fired forced air furnaces with input ratings \geq 225,000 Btu/h shall also have an intermittent ignition or interrupted device (IID) and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings \geq 225,000 Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input rating.

**TABLE A5.207.1-A
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	EFFICIENCY ¹		TEST PROCEDURE
		Before 1/1/2010	After 1/1/2010	
Air conditioners, Air cooled	≥ 65,000 Btu/h and < 135,000 Btu/h	10.3 EER ²	11.2 EER ²	ARI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h	9.7 EER ²	11.0 EER ²	ARI 340/360
	≥ 240,000 Btu/h and < 760,000 Btu/h	9.5 EER ² and 9.7 IPLV ²	10.0 EER ² and 9.7 IPLV ²	
	≥ 760,000 Btu/h	9.2 EER ² and 9.4 IPLV ²	9.7 EER ² and 9.4 IPLV ²	
Air conditioners, water and evaporatively cooled				ARI 210/240
	> 240,000 Btu/h	11.0 EER ² and 10.3 IPLV ²		ARI 340/360
Condensing units, air cooled	≥ 135,000 Btu/h	10.1 EER and 11.2 IPLV		ARI 365
Condensing units, water or evaporatively cooled	≥ 135,000 Btu/h	13.1 EER and 13.1 IPLV		

1. IPLVs are only applicable to equipment with capacity modulation.
2. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

**TABLE A5.207.1-B
UNITARY AND APPLIED HEAT PUMPS—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	EFFICIENCY ¹		TEST PROCEDURE
			Before 1/1/2010	After 1/1/2010	
Air cooled (cooling mode)	≥ 65,000 Btu/h and < 135,000 Btu/h	Split system and single package	10.1 EER ²	11.0	ARI 340/360
	≥ 135,000 Btu/h and < 240,000 Btu/h		9.3 EER ²	10.6	
	≥ 240,000 Btu/h		9.0 EER ² and 9.2 IPLV ²	9.5 EER ² and 9.2 IPLV ²	
Air cooled (heating mode)	≥ 65,000 Btu/h and < 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.2 COP	3.3 COP	ARI 210/240
	≥ 135,000 Btu/h (Cooling capacity)	47°F db/43°F wb outdoor air	3.1 COP	3.2 COP	ARI 340/360

1. IPLVs and Part load rating conditions are applicable only to equipment with capacity modulation.
2. Deduct 0.2 from the required EERs and IPLVs for units with a heating section other than electric resistance heat.

**TABLE A5.207.1-C
AIR-COOLED GAS-ENGINE HEAT PUMPS**

EQUIPMENT TYPE	SIZE CATEGORY	SUBCATEGORY OR RATING CONDITION	EFFICIENCY ¹	TEST PROCEDURE
Air-cooled gas engine heat pump (cooling mode)	All capacities	95°F db Outdoor air	0.60 COP	ANSI Z21.40.4
Air-cooled gas engine heat pump (heating mode)	All capacities	47°F db/43°F wb Outdoor air	0.72 COP	ANSI Z21.40.4

**TABLE A5.207.1-D
WATER CHILLING PACKAGES—MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY	EFFICIENCY	TEST PROCEDURE
Air cooled, with condenser	< 150 Tons	2.80 COP	ARI 550/590
Electrically operated	≥ 150 Tons	3.05 IPLV	
Air cooled, without condenser	All Capacities	3.10 COP	
Electrically operated		3.45 IPLV	
Water cooled, electrically operated, positive displacement (Reciprocating)	All Capacities	4.20 COP	ARI 550/590
		5.05 IPLV	
Water cooled,	< 150 Tons	4.45 COP	ARI 550/590
		5.20 IPLV	
Electrically operated,	≥ 150 Tons and	4.90 COP	
Positive displacement	< 300 Tons	5.60 IPLV	
	≥ 300 Tons	5.50 COP	
(Rotary screw and scroll)		6.15 IPLV	
Water cooled, electrically operated, centrifugal	< 150 Tons	5.00 COP	ARI 550/590
		5.25 IPLV	
	≥ 150 Tons and < 300 Tons	5.55 COP	
		5.90 IPLV	
	≥ 300 Tons	6.10 COP	
		6.40 IPLV	
Air cooled absorption, single effect	All Capacities	0.60 COP	ARI 560
Water cooled absorption, single effect	All Capacities	0.70 COP	
Absorption double effect, indirect-fired	All Capacities	1.00 COP	
		1.05 IPLV	
Absorption double effect, direct-fired	All Capacities	1.00 COP	
		1.00 IPLV	
Water cooled gas engine driven chiller	All Capacities	1.2 COP	ANSI Z21.40.4
		2.0 IPLV	

**TABLE A5.207.1-E
PACKAGED TERMINAL AIR CONDITIONERS AND PACKAGED TERMINAL HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS**

EQUIPMENT TYPE	SIZE CATEGORY (input)	SUBCATEGORY OR RATING CONDITION	EFFICIENCY ¹	TEST PROCEDURE
PTAC (cooling mode) new construction	All Capacities	95°F db outdoor air	$12.5 - (0.213 \times \text{Cap}/1000)^1$ EER	ARI 310/380
PTAC (cooling mode) replacements ²			$10.9 - (0.213 \times \text{Cap}/1000)^1$ EER	
PTHP (cooling mode) new construction			$12.3 - (0.213 \times \text{Cap}/1000)^1$ EER	
PTHP (cooling mode) replacements ²			$10.8 - (0.213 \times \text{Cap}/1000)^1$ EER	
PTHP (heating mode) new construction			$3.2 - (0.026 \times \text{Cap}/1000)^1$ COP	
PTHP (heating mode) replacements ²			$2.9 - (0.026 \times \text{Cap}/1000)^1$ COP	
SPVAC (cooling mode)	< 65,000 Btu/h	95°F db/75°F wb outdoor air	9.0 EER	ARI 390
	≥ 65,000 Btu/h and < 135,000 Btu/h		8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h		8.6 EER	
SPVHP (cooling mode)	< 65,000 Btu/h		9.0 EER	
	≥ 65,000 Btu/h and < 135,000 Btu/h		8.9 EER	
	≥ 135,000 Btu/h and < 240,000 Btu/h		8.6 EER	
SPVHP (heating mode)	< 65,000 Btu/h	47°F db/43°F wb outdoor air	3.0 COP	
	≥ 65,000 Btu/h and < 135,000 Btu/h		3.0 COP	
	≥ 135,000 Btu/h and < 240,000 Btu/h		2.9 COP	

1. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.
2. Replacement units must be factory labeled as follows: MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS. Replacement efficiencies apply only to units with existing sleeves less than 16 inches high and less than 42 inches wide.

**TABLE A5.207.1-G
PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT⁴**

EQUIPMENT TYPE	TOTAL SYSTEM HEAT REJECTION CAPACITY AT RATED CONDITIONS	SUBCATEGORY OR RATING CONDITION	PERFORMANCE REQUIRED ^{1,2}	TEST PROCEDURE ³
Propeller or axial fan open cooling towers	All	95°F entering water	≥ 38.2 gpm/hp	CTI ATC-105
		85°F leaving water		and
		75°F wb outdoor air		CTI STD-201
Centrifugal fan open cooling towers	All	95°F entering water	≥ 20.0 gpm/hp	CTI ATC-105
		85°F leaving water		and
		75°F wb outdoor air		CTI STD-201
Air cooled condensers	All	125°F condensing temperature	≥ 176,000 Btu/h·hp	ARI 460
		R22 test fluid		
		190°F entering gas temperature		
		15°F subcooling		
		95°F entering drybulb		

- For purposes of this table, open cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
- For purposes of this table air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.
- Open cooling towers shall be tested using the test procedures in CTI ATC-105. Performance of factory assembled open cooling towers shall be either certified as base models as specified in CTI STD-201 or verified by testing in the field by a CTI approved testing agency. Open factory assembled cooling towers with custom options added to a CTI certified base model for the purpose of safe maintenance or to reduce environmental or noise impact shall be rated at 90 percent of the CTI certified performance of the associated base model or at the manufacturer’s stated performance, whichever is less. Base models of open factory assembled cooling towers are open cooling towers configured in exact accordance with the Data of Record submitted to CTI as specified by CTI STD-201. There are no certification requirements for field erected cooling towers.
- The efficiencies for open cooling towers listed in Table A5.207.1-G are not applicable for closed-circuit cooling towers.

**TABLE A5.207.1-H
COPS FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS**

CENTRIFUGAL CHILLERS < 150 Tons COP _{std} = 5.0								
			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
46	75	29	5.58	5.83	6.03	6.32	6.54	6.70
45	75	30	5.50	5.74	5.92	6.19	6.38	6.53
44	75	31	5.42	5.65	5.82	6.07	6.24	6.37
43	75	32	5.35	5.57	5.72	5.95	6.11	6.23
42	75	33	5.27	5.49	5.64	5.85	6.00	6.11
41	75	34	5.19	5.41	5.56	5.75	5.89	5.99
46	80	34	5.19	5.41	5.56	5.75	5.89	5.99
40	75	35	5.11	5.33	5.48	5.67	5.79	5.88
45	80	35	5.11	5.33	5.48	5.67	5.79	5.88
44	80	36	5.03	5.26	5.40	5.58	5.70	5.79
43	80	37	4.94	5.18	5.32	5.50	5.62	5.70
42	80	38	4.84	5.10	5.25	5.43	5.53	5.61
41	80	39	4.73	5.01	5.17	5.35	5.46	5.53
46	85	39	4.73	5.01	5.17	5.35	5.46	5.53
40	80	40	4.62	4.92	5.09	5.27	5.38	5.45
45	85	40	4.62	4.92	5.09	5.27	5.38	5.45
44	85	41	4.49	4.82	5.00	5.20	5.30	5.38
43	85	42	4.35	4.71	4.91	5.12	5.23	5.30
42	85	43	4.19	4.59	4.81	5.03	5.15	5.22
41	85	44	4.02	4.46	4.70	4.94	5.06	5.14
40	85	45	3.84	4.32	4.58	4.84	4.98	5.06
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(\times) + 0.0062692(\times)^2 - 0.000045595(\times)^3$$
 where $\times = \text{Condenser DT} + \text{LIFT}$

$$\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$$

**TABLE A5.207.1-1
COPS FOR NONSTANDARD CENTRIFUGAL CHILLERS > 150 TONS, ≤ 300 TONS**

CENTRIFUGAL CHILLERS > 150 TONS, ≤ 300 TON COP _{std} = 5.55								
			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
46	75	29	6.17	6.44	6.66	6.99	7.23	7.40
45	75	30	6.08	6.34	6.54	6.84	7.06	7.22
44	75	31	6.00	6.24	6.43	6.71	6.90	7.05
43	75	32	5.91	6.15	6.33	6.58	6.76	6.89
42	75	33	5.83	6.07	6.23	6.47	6.63	6.75
41	75	34	5.74	5.98	6.14	6.36	6.51	6.62
46	80	34	5.74	5.98	6.14	6.36	6.51	6.62
40	75	35	5.65	5.90	6.05	6.26	6.40	6.51
45	80	35	5.65	5.90	6.05	6.26	6.40	6.51
44	80	36	5.56	5.81	5.97	6.17	6.30	6.40
43	80	37	5.46	5.73	5.89	6.08	6.21	6.30
42	80	38	5.35	5.64	5.80	6.00	6.12	6.20
41	80	39	5.23	5.54	5.71	5.91	6.03	6.11
46	85	39	5.23	5.54	5.71	5.91	6.03	6.11
40	80	40	5.10	5.44	5.62	5.83	5.95	6.03
45	85	40	5.10	5.44	5.62	5.83	5.95	6.03
44	85	41	4.96	5.33	5.55	5.74	5.86	5.94
43	85	42	4.81	5.21	5.42	5.66	5.78	5.86
42	85	43	4.63	5.08	5.31	5.56	5.69	5.77
41	85	44	4.45	4.93	5.19	5.46	5.60	5.69
40	85	45	4.24	4.77	5.06	5.35	5.50	5.59
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)^3$$
 where $x = \text{Condenser DT} + \text{LIFT}$

$$\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$$

**TABLE A5.207.1-J
COPS FOR NONSTANDARD CENTRIFUGAL CHILLERS > 300 TONS**

CENTRIFUGAL CHILLERS > 300 TONS COP _{std} = 6.1								
			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
46	75	29	6.80	7.11	7.35	7.71	7.97	8.16
45	75	30	6.71	6.99	7.21	7.55	7.78	7.96
44	75	31	6.61	6.89	7.09	7.40	7.61	7.77
43	75	32	6.52	6.79	6.98	7.26	7.45	7.60
42	75	33	6.43	6.69	6.87	7.13	7.31	7.44
41	75	34	6.33	6.60	6.77	7.02	7.18	7.30
46	80	34	6.33	6.60	6.77	7.02	7.18	7.30
40	75	35	6.23	6.50	6.68	6.91	7.06	7.17
45	80	35	6.23	6.50	6.68	6.91	7.06	7.17
44	80	36	6.13	6.41	6.58	6.81	6.95	7.05
43	80	37	6.02	6.31	6.49	6.71	6.85	6.94
42	80	38	5.90	6.21	6.40	6.61	6.75	6.84
41	80	39	5.77	6.11	6.30	6.52	6.65	6.74
46	85	39	5.77	6.11	6.30	6.52	6.65	6.74
40	80	40	5.63	6.00	6.20	6.43	6.56	6.65
45	85	40	5.63	6.00	6.20	6.43	6.56	6.65
44	85	41	5.47	5.87	6.10	6.33	6.47	6.55
43	85	42	5.30	5.74	5.98	6.24	6.37	6.46
42	85	43	5.11	5.60	5.86	6.13	6.28	6.37
41	85	44	4.90	5.44	5.72	6.02	6.17	6.27
40	85	45	4.68	5.26	5.58	5.90	6.07	6.17
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)^3$$
 where $x = \text{Condenser DT} + \text{LIFT}$

$$\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$$

**TABLE A5.207.1-K
COPS FOR NONSTANDARD CENTRIFUGAL CHILLERS < 150 TONS**
CENTRIFUGAL CHILLERS < 150 TONS
COP_{std} = 5.25

			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
			46	75	29	5.84	6.10	6.30
45	75	30	5.75	6.00	6.19	6.47	6.68	6.83
44	75	31	5.67	5.91	6.08	6.34	6.53	6.67
43	75	32	5.59	5.82	5.99	6.23	6.39	6.52
42	75	33	5.51	5.74	5.90	6.12	6.27	6.39
41	75	34	5.43	5.66	5.81	6.02	6.16	6.26
46	80	34	5.43	5.66	5.81	6.02	6.16	6.26
40	75	35	5.35	5.58	5.73	5.93	6.06	6.15
45	80	35	5.35	5.58	5.73	5.93	6.06	6.15
44	80	36	5.26	5.50	5.65	5.84	5.96	6.05
43	80	37	5.16	5.42	5.57	5.76	5.87	5.96
42	80	38	5.06	5.33	5.49	5.67	5.79	5.87
41	80	39	4.95	5.24	5.41	5.60	5.71	5.78
46	85	39	4.95	5.24	5.41	5.60	5.71	5.78
40	80	40	4.83	5.14	5.32	5.52	5.63	5.70
45	85	40	4.83	5.14	5.32	5.52	5.63	5.70
44	85	41	4.69	5.04	5.25 ³	5.43	5.55	5.62
43	85	42	4.55	4.93	5.13	5.35	5.47	5.54
42	85	43	4.38	4.80	5.03	5.26	5.38	5.46
41	85	44	4.21	4.67	4.91	5.17	5.30	5.38
40	85	45	4.01	4.52	4.79	5.06	5.20	5.29
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)^3$$
 where $x = \text{Condenser DT} + \text{LIFT}$

$$\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$$

**TABLE A5.207.1-L
IPLV/NPLV FOR NONSTANDARD CENTRIFUGAL CHILLERS > 150 TONS, < 300 TONS**
CENTRIFUGAL CHILLERS > 150 TONS, < 300 TONS
IPLV_{std} = 5.9

			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
			46	75	29	6.58	6.87	7.11
45	75	30	6.49	6.76	6.98	7.30	7.53	7.70
44	75	31	6.40	6.66	6.98	7.15	7.36	7.52
43	75	32	6.31	6.56	6.75	7.02	7.21	7.35
42	75	33	6.22	6.47	6.65	6.90	7.07	7.20
41	75	34	6.13	6.38	6.55	6.79	6.95	7.06
46	80	34	6.13	6.38	6.55	6.79	6.95	7.06
40	75	35	6.03	6.29	6.46	6.68	6.83	6.94
45	80	35	6.03	6.29	6.46	6.68	6.83	6.94
44	80	36	5.93	6.20	6.37	6.58	6.72	6.82
43	80	37	5.82	6.11	6.28	6.49	6.62	6.72
42	80	38	5.71	6.01	6.19	6.40	6.53	6.62
41	80	39	5.58	5.91	6.10	6.31	6.44	6.52
46	85	39	5.58	5.91	6.10	6.31	6.44	6.52
40	80	40	5.44	5.80	6.00	6.22	6.35	6.43
45	85	40	5.44	5.80	6.00	6.22	6.35	6.43
44	85	41	5.29	5.68	5.90 ³	6.13	6.26	6.34
43	85	42	5.13	5.55	5.79	6.03	6.16	6.25
42	85	43	4.94	5.41	5.67	5.93	6.07	6.16
41	85	44	4.74	5.26	5.54	5.82	5.97	6.07
40	85	45	4.52	5.09	5.40	5.71	5.87	5.97
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)

$$K_{adj} = 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)^3$$
 where $x = \text{Condenser DT} + \text{LIFT}$

$$\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$$

TABLE A5.207.1-M
COPS FOR NONSTANDARD CENTRIFUGAL CHILLERS > 300 TONS
 CENTRIFUGAL CHILLERS > 300 TONS
 IPLV_{std} = 6.4

			CONDENSER FLOW RATE					
			2 gpm/ton	2.5 gpm/ton	3 gpm/ton	4 gpm/ton	5 gpm/ton	6 gpm/ton
Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	LIFT ¹ (°F)	Required COP					
			46	75	29	7.15	7.47	7.72
45	75	30	7.05	7.35	7.58	7.93	8.18	8.36
44	75	31	6.95	7.23	7.45	7.77	8.00	8.16
43	75	32	6.85	7.13	7.33	7.63	7.83	7.98
42	75	33	6.75	7.03	7.22	7.49	7.68	7.82
41	75	34	6.65	6.93	7.12	7.37	7.55	7.67
46	80	34	6.65	6.93	7.12	7.37	7.55	7.67
40	75	35	6.55	6.83	7.01	7.26	7.42	7.54
45	80	35	6.55	6.83	7.01	7.26	7.42	7.54
44	80	36	6.44	6.73	6.92	7.15	7.30	7.41
43	80	37	6.32	6.63	6.82	7.05	7.19	7.30
42	80	38	6.20	6.53	6.72	6.95	7.09	7.19
41	80	39	6.06	6.42	6.62	6.85	6.99	7.08
46	85	39	6.06	6.42	6.62	6.85	6.99	7.08
40	80	40	5.91	6.30	6.52	6.76	6.89	6.98
45	85	40	5.91	6.30	6.52	6.76	6.89	6.98
44	85	41	5.75	6.17	6.40 ³	6.66	6.79	6.89
43	85	42	5.57	6.03	6.28	6.55	6.70	6.79
42	85	43	5.37	5.88	6.16	6.44	6.59	6.69
41	85	44	5.15	5.71	6.01	6.33	6.49	6.59
40	85	45	4.91	5.53	5.86	6.20	6.37	6.48
Condenser DT²			14.04	11.23	9.36	7.02	5.62	4.68

- LIFT = Entering Condenser Water Temperature (°F) – Leaving Chilled Water Temperature (°F)
- Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
 $K_{adj} = 6.1507 - 0.30244(x) + 0.0062692(x)^2 - 0.000045595(x)^3$
 where $x = \text{Condenser DT} + \text{LIFT}$
 $\text{COP}_{adj} = K_{adj} * \text{COP}_{std}$

A5.207.2 Space conditioning systems. A building complies with this section by being designed with and having constructed and installed a space-conditioning system that meets the requirements of Subsections A5.207.2.1 through A5.207.2.6.

A5.207.2.1 Supply-air temperature reset controls. Mechanical space-conditioning systems supplying heated or cooled air to multiple zones shall include controls that automatically reset supply-air temperatures:

1. In response to representative building loads or to outdoor air temperature; and
2. By at least 25 percent of the difference between the design supply-air temperature and the design room air temperature.

Air distribution systems serving zones that are likely to have constant loads, such as interior zones, shall be designed for the air flows resulting from the fully reset supply-air temperature.

Exceptions:

1. Systems that meet the requirements of Section 144(d) of Title 24, Part 6, without using Exception 1 or 2 to that section.
2. Where supply-air temperature reset would increase overall building energy use.
3. Zones in which specific humidity levels are required to satisfy process needs.

A5.207.2.2 Electric resistance heating. Electric resistance heating systems shall not be used for space heating.

Exceptions:

1. Where an electric-resistance heating system supplements a heating system in which at least 60 percent of the annual energy requirement is supplied by site-solar or recovered energy.
2. Where the total capacity of all electric-resistance heating systems serving the entire building is less than 10 percent of the total design output capacity of all heating equipment serving the entire building.
3. Where an electric resistance heating system serves an entire building that is not a high-rise residential or hotel/motel building; and has a conditioned floor area no greater than 5,000 square feet; and has no mechanical cooling; and is in an area where natural gas is not currently available and an extension of a natural gas system is impractical, as determined by the natural gas utility.

A5.207.2.3 Heat rejection systems.

A5.207.2.3.1 General. Subsection A5.207.2.3 applies to heat rejection equipment used in comfort cooling systems such as air-cooled condensers, open cooling towers, closed-circuit cooling towers and evaporative condensers.

A5.207.2.3.2 Fan speed control. Each fan powered by a motor of 7.5 hp (5.6 kW) or larger shall have the capability to operate that fan at $\frac{2}{3}$ of full speed or less

and shall have controls that automatically change the fan speed to control the leaving fluid temperature or condensing temperature/pressure of the heat rejection device.

Exceptions:

1. Heat rejection devices included as an integral part of the equipment listed in Tables A5.207.1-A through A5.207.1-E.
2. Condenser fans serving multiple refrigerant circuits.
3. Condenser fans serving flooded condensers.
4. Up to $\frac{1}{3}$ of the fans on a condenser or tower with multiple fans where the lead fans comply with the speed control requirement.

A5.207.2.3.3 Tower flow turndown. Open cooling towers configured with multiple condenser water pumps shall be designed so that all cells can be run in parallel with the larger of:

1. The flow that's produced by the smallest pump or
2. 33 percent of the design flow for the cell.

A5.207.2.3.4 Limitation on centrifugal fan cooling towers. Open cooling towers with a combined rated capacity of 900 gpm and greater at 95°F condenser water return, 85°F condenser water supply and 75°F outdoor wet-bulb temperature shall use propeller fans and shall not use centrifugal fans.

Exceptions:

1. Cooling towers that are ducted (inlet or discharge) or have an external sound trap that requires external static pressure capability.
2. Cooling towers that meet the energy efficiency requirement for propeller fan towers in Section A5.207.1, Table A5.207.1-G.

A5.207.2.4 Hydronic system measures.

A5.207.2.4.1 Hydronic variable flow systems. HVAC chilled and hot water pumping shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of: a) 50 percent or less of the design flow rate; or b) the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system.

Exceptions:

1. Systems that include no more than three control valves.
2. Systems having a total pump system power less than or equal to 1½ HP.

A5.207.2.4.2 Chiller isolation. When a chilled water plant includes more than one chiller, provisions shall be made so that flow through any chiller is automatically shut off when that chiller is shut off while still maintaining flow through other operating chiller(s). Chillers that are piped in series for the purpose of increased temperature differential shall be considered as one chiller.

A5.207.2.4.3 Boiler isolation. When a hot water plant includes more than one boiler, provisions shall be made so that flow through any boiler is automatically shut off when that boiler is shut off while still maintaining flow through other operating boiler(s).

A5.207.2.4.4 Chilled and hot water temperature reset controls. Chilled and hot water systems with a design capacity exceeding 500,000 Btu/hr supplying chilled or heated water (or both) shall include controls that automatically reset supply water temperatures as a function of representative building loads or outside air temperature.

Exception: Hydronic systems that use variable flow to reduce pumping energy in accordance with Section A5.207.2.4.1.

A5.207.2.4.5 Water-cooled air conditioner and hydronic heat pump systems. Water circulation systems serving water-cooled air conditioners, hydronic heat pumps or both that have total pump system power exceeding 5 hp shall have flow controls that meet the requirements of Section A5.207.2.4.6. Each air conditioner or heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.

A5.207.2.4.6 Variable flow controls.

A5.207.2.4.6.1 Variable speed drives. Individual pumps serving variable flow systems and having a motor horsepower exceeding 5 hp shall have controls and/or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The pumps shall be controlled as a function of required differential pressure.

A5.207.2.4.6.2 Pressure sensor location and set-point.

1. For systems without direct digital control of individual coils reporting to the central control panel, differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.
2. For systems with direct digital control of individual coils with central control panel, the static pressure set point shall be reset based on the valve requiring the most pressure and the set-point shall be no less than 80 percent open. The pressure sensor(s) may be mounted anywhere.

Exceptions:

1. Heating hot water systems.
2. Condenser water systems serving only water-cooled chillers.

A5.207.2.4.7 Hydronic heat pump (WLHP) controls. Hydronic heat pumps connected to a common heat pump water loop with central devices for heat rejection and heat addition shall have controls that are capable of

providing a heat pump water supply temperature dead band of at least 20°F between initiation of heat rejection and heat addition by the central devices.

Exception: Where a system loop temperature optimization controller is used to determine the most efficient operating temperature based on real-time conditions of demand and capacity, dead bands of less than 20°F shall be allowed.

A5.207.2.5 Air distribution system duct leakage sealing. All duct systems shall be sealed to a leakage rate not to exceed 6 percent of the fan flow if the duct system:

A5.207.2.5.1 Is connected to a constant volume, single zone, air conditioners, heat pumps or furnaces; and

A5.207.2.5.2 Serves less than 5,000 square feet of floor area; and

A5.207.2.5.3 Has more than 25 percent duct surface area located in one or more of the following spaces:

1. Outdoors; or
2. In a space directly under a roof where the *U*-factor of the roof is greater than the *U*-factor of the ceiling; or

Exception: Where the roof meets the requirements of Section 143(a)1C of Title 24, Part 6.

3. In a space directly under a roof with fixed vents or openings to the outside or unconditioned spaces; or

4. In an unconditioned crawlspace; or

5. In other unconditioned spaces.

The leakage rate shall be confirmed through field verification and diagnostic testing, in accordance with procedures set forth in the Reference Nonresidential Appendix NA1 of the California Energy Commission 2008 *Building Energy Efficiency Standards for Residential and Nonresidential Buildings*.

A5.207.2.6 Variable air volume control for single zone systems. Effective January 1, 2012, all unitary air conditioning equipment and air-handling units with mechanical cooling capacity at ARI conditions greater than or equal to 110,000 Btu/hr that serve single zones shall be designed for variable supply air volume with their supply fans controlled by two-speed motors, variable speed drives or equipment that has been demonstrated to the Executive Director to use no more energy. The supply fan controls shall modulate down to a minimum of $\frac{2}{3}$ of the full fan speed or lower at low cooling demand.

A5.207.3 Service water-heating systems and equipment.

A5.207.3.1 Certification by manufacturers. Any service water-heating system or equipment may be installed only if the manufacturer has certified that the system or equipment complies with all of the requirements of this subsection for that system or equipment.

A5.207.3.1.1 Temperature controls for service water-heating systems. Service water-heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest

acceptable temperature settings for the intended use as listed in Table 2, Chapter 9 of the ASHRAE Handbook, HVAC Applications Volume.

A5.207.3.2 Efficiency. Equipment shall meet the applicable requirements of the Appliance Efficiency Regulations as required by Section A5.210.1, subject to the following:

1. If more than one standard is listed in the Appliance Efficiency Regulations, the equipment shall meet all the standards listed; and
2. If more than one test method is listed in the Appliance Efficiency Regulations, the equipment shall comply with the applicable standard when tested with each test method; and
3. Where equipment can serve more than one function, such as both heating and cooling or both space heating and water heating, it shall comply with all the requirements applicable to each function; and
4. Where a requirement is for equipment rated at its “maximum rated capacity” or “minimum rated capacity,” the capacity shall be as provided for and allowed by the controls, during steady-state operation.

A5.207.3.3 Installation. Any service water-heating system or equipment may be installed only if the system or equipment complies with all of the applicable requirements of this subsection for the system or equipment.

A5.207.3.3.1 Outlet temperature controls. On systems that have a total capacity greater than 167,000 Btu/hr, outlets that require higher than service water temperatures as listed in the ASHRAE Handbook, Applications Volume, shall have separate remote heaters, heat exchangers or boosters to supply the outlet with the higher temperature.

A5.207.3.3.2 Temperature controls for public lavatories. The controls shall limit the outlet temperature to 110°F.

A5.207.3.3.3 Insulation. Unfired service water heater storage tanks and backup tanks for solar water-heating systems shall have:

1. External insulation with an installed *R*-value of at least *R*-12; or
2. Internal and external insulation with a combined *R*-value of at least *R*-16; or
3. The heat loss of the tank surface based on an 80°F water-air temperature difference shall be less than 6.5 Btu per hour per square foot.

A5.207.3.3.4 Service water heaters in state buildings. Any newly constructed building constructed by the State shall derive its service water heating from a system that provides at least 60 percent of the energy needed for service water heating from site solar energy or recovered energy.

Exception: Buildings for which the state architect determines that service water heating from site solar energy or recovered energy is economically or physically infeasible.

A5.207.4 Natural gas central furnaces, cooking equipment and pool and spa heaters: Pilot lights prohibited.

Any natural gas system or equipment listed below may be installed only if it does not have a continuously burning pilot light:

1. Fan-type central furnaces.
2. Household cooking appliances.

Exception: Household cooking appliances without an electrical supply voltage connection and in which each pilot consumes less than 150 Btu/hr.

3. Pool heaters.
4. Spa heaters.

A5.207.5 Controls for space-conditioning systems. Space-conditioning systems shall be installed with controls that comply with the applicable requirements of Subsections A5.207.5.1 through A5.207.5.5.

A5.207.5.1 Thermostatic controls for each zone. The supply of heating and cooling energy to each space-conditioning zone or dwelling unit shall be controlled by an individual thermostatic control that responds to temperature within the zone and that meets the applicable requirements of Section A5.207.5.2.

Exception: An independent perimeter heating or cooling system may serve more than one zone without individual thermostatic controls if:

1. All zones are also served by an interior cooling system;
2. The perimeter system is designed solely to offset envelope heat losses or gains;
3. The perimeter system has at least one thermostatic control for each building orientation of 50 feet or more; and
4. The perimeter system is controlled by at least one thermostat located in one of the zones served by the system.

A5.207.5.2 Criteria for zonal thermostatic controls. The individual thermostatic controls required by Section A5.207.5.1 shall meet the following requirements as applicable:

1. Where used to control comfort heating, the thermostatic controls shall be capable of being set, locally or remotely, down to 55°F or lower.
2. Where used to control comfort cooling, the thermostatic controls shall be capable of being set, locally or remotely, up to 85°F or higher.
3. Where used to control both comfort heating and comfort cooling, the thermostatic controls shall meet Items 1 and 2 and shall be capable of providing a temperature range or dead band of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exception: Systems with thermostats that require manual changeover between heating and cooling modes.

- Thermostatic controls for all unitary single zone, air conditioners, heat pumps and furnaces, shall comply with the setback thermostat requirements of Section A5.207.1.3 or, if equipped with DDC to the Zone level, with the Automatic Demand Shed Controls of Section A5.207.5.5.

Exception: Systems serving zones that must have constant temperatures to prevent degradation of materials, a process, plants or animals.

A5.207.5.3 Heat pump controls. All heat pumps with supplementary electric resistance heaters shall be installed with controls that comply with Section A5.207.1.2.

A5.207.5.4 Dampers for air supply and exhaust equipment. Outdoor air supply and exhaust equipment shall be installed with dampers that automatically close upon fan shutdown.

Exceptions:

- Where it can be demonstrated to the satisfaction of the enforcing agency that the equipment serves an area that must operate continuously.
- Gravity and other nonelectrical equipment that has readily accessible manual damper controls.
- At combustion air intakes and shaft vents.
- Where prohibited by other provisions of law.

A5.207.5.5 Automatic demand shed controls. HVAC systems with DDC to the Zone level shall be programmed to allow centralized demand shed for noncritical zones as follows:

- The controls shall have a capability to remotely setup the operating cooling temperature set points by 4 degrees or more in all noncritical zones on signal from a centralized contact or software point within an Energy Management Control System (EMCS).
- The controls shall remotely set down the operating heating temperature set points by 4 degrees or more in all noncritical zones on signal from a centralized contact or software point within an EMCS.
- The controls shall have capabilities to remotely reset the temperatures in all noncritical zones to original operating levels on signal from a centralized contact or software point within an EMCS.
- The controls shall be programmed to provide an adjustable rate of change for the temperature setup and reset.

A5.207.6 Pipe insulation. The piping for all space-conditioning and service water-heating systems with fluid temperatures listed in Table A5.207.6-A shall have the amount of insulation specified in Subsection A5.207.6.1 or A5.207.6.2. Insulation conductivity shall be determined in accordance with ASTM C335 at the mean temperature listed in Table A5.207.6-A and shall be rounded to the nearest $1/100$ Btu-inch per hour per square foot per °F.

Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance and wind, including but not limited to, the following:

Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.

Insulation covering chilled water piping and refrigerant suction piping located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which shall be sealed.

Exceptions:

- Factory-installed piping within space-conditioning equipment certified under Section A5.210.1 or A5.207.1.
- Piping that conveys fluids with a design operating temperature range between 60°F and 105°F.
- Piping that serves process loads, gas piping, cold domestic water piping, condensate drains, roof drains, vents or waste piping.
- Where the heat gain or heat loss to or from piping without insulation will not increase building source energy use.
- Piping that penetrates framing members shall not be required to have pipe insulation for the distance of the framing penetration. Metal piping that penetrates metal framing shall use grommets, plugs, wrapping or other insulating material to assure that no contact is made with the metal framing.

A5.207.6.1 For insulation with a conductivity in the range shown in Table A5.207.6-A for the applicable fluid temperature range, the insulation shall have the applicable thickness shown in Table A5.207.6-A.

A5.207.6.2 For insulation with a conductivity outside the range shown in Table A5.207.6-A for the applicable fluid temperature range, the insulation shall have a minimum thickness as calculated with Equation A5.207.6-A below.

**EQUATION A5.207.6-A
INSULATION THICKNESS EQUATION**

$$T = PR \left[\left(1 + \frac{t}{PR} \right)^{\frac{K}{k}} - 1 \right]$$

where:

- T = Minimum insulation thickness for material with conductivity K , inches.
- PR = Pipe actual outside radius, inches.
- t = Insulation thickness from Table A5.207.6-A, inches.
- K = Conductivity of alternate material at the mean rating temperature indicated in Table A5.207.6-A, for the applicable fluid temperature range, in Btu-inch per hour per square foot per °F.
- k = The lower value of the conductivity range listed in Table A5.207.6-A, for the applicable fluid temperature range, Btu-inch per hour per square foot per °F.

**TABLE A5.207.6-A
PIPE INSULATION THICKNESS**

FLUID TEMPERATURE RANGE (°F)	CONDUCTIVITY RANGE (in Btu-inch per hour per square foot per °F)	INSULATION MEAN RATING TEMPERATURE (°F)	NOMINAL PIPE DIAMETER (in inches)					
			Runouts up to 2	1 and less	1.25-2	2.50-4	5-6	8 and larger
			INSULATION THICKNESS REQUIRED (in inches)					
Space heating systems (steam, steam condensate and hot water)								
Above 350	0.32-0.34	250	1.5	2.5	2.5	3.0	3.5	3.5
251-350	0.29-0.31	200	1.5	2.0	2.5	2.5	3.5	3.5
201-250	0.27-0.30	150	1.0	1.5	1.5	2.0	2.0	3.5
141-200	0.25-0.29	125	0.5	1.5	1.5	1.5	1.5	1.5
105-140	0.24-0.28	100	0.5	1.0	1.0	1.0	1.5	1.5
Service water-heating systems (recirculating sections, all piping in electric trace tape systems and the first 8 feet of piping from the storage tank for nonrecirculating systems)								
Above 105	0.24-0.28	100	0.5	1.0	1.0	1.5	1.5	1.5
Space cooling systems (chilled water, refrigerant and brine)								
40-60	0.23-0.27	75	0.5	0.5	0.5	1.0	1.0	1.0
Below 40	0.23-0.27	75	1.0	1.0	1.5	1.5	1.5	1.5

**A5.208
Not used**

**A5.209 [OSHPD 1, 2 & 4]
LIGHTING**

A5.209.1 Lighting control devices, ballasts and luminaires. Any lighting control device, ballast or luminaire subject to the requirements of Section A5.209 shall be installed only if the manufacturer has certified to the Commission that the device complies with all of the applicable requirements of Section A5.209.

Lighting control devices may be individual devices or systems consisting of two or more components. For control systems consisting of two or more components, such as an Energy Management Control System (EMCS), the manufacturer of the control system shall certify each of the components required for the system to comply with Section A5.209.

A5.209.1.1 All devices: Instructions for installation and calibration. The manufacturer shall provide step-by-step instructions for installation and start-up calibration of the device.

A5.209.1.2 Indicator lights. Indicator lights integral to lighting control devices shall consume no more than one watt of power per indicator light.

A5.209.1.3 Automatic time switch control devices. Automatic time switch control devices or system shall:

1. Be capable of programming different schedules for weekdays and weekends; and
2. Have program backup capabilities that prevent the loss of the device’s schedules for at least 7 days and the device’s time and date setting for at least 72 hours if power is interrupted.

A5.209.1.4 Occupant sensors, motion sensors and vacancy sensors. Occupant sensors, motion sensors and vacancy sensors shall be capable of automatically turning

off all the lights in an area no more than 30 minutes after the area has been vacated and shall have a visible status signal that indicates that the device is operating properly or that it has failed or malfunctioned. The visible status signal may have an override switch that turns the signal off. In addition, ultrasonic and microwave devices shall have a built-in mechanism that allows calibration of the sensitivity of the device to room movement in order to reduce the false sensing of occupants and shall comply with either Subsection A5.209.1.4.1 or A5.209.1.4.2 below, as applicable:

A5.209.1.4.1 If the device emits ultrasonic radiation as a signal for sensing occupants within an area, the device shall:

1. Have had a Radiation Safety Abbreviated Report submitted to the Center for Devices and Radiological Health, Federal Food and Drug Administration, under 21 Code of Federal Regulations, Section 1002.12 (1996) and a copy of the report shall have been submitted to the California Energy Commission; and
2. Emit no audible sound; and
3. Not emit ultrasound in excess of the decibel (dB) values shown in Table A5.209.1-A, measured no more than 5 feet from the source, on axis.

A5.209.1.4.2 If the device emits microwave radiation as a signal for sensing occupants within the area, the device shall:

1. Comply with all applicable provisions in 47 *Code of Federal Regulations*, Parts 2 and 15 (1996) and have an approved Federal Communications Commission Identifier that appears on all units of the device and that has been submitted to the California Energy Commission; and
2. Not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5

centimeters from the emission surface of the device; and

3. Have permanently affixed to it installation instructions recommending that it be installed at least 12 inches from any area normally used by room occupants.

A5.209.1.5 Multilevel occupant sensor. Multilevel occupant sensors shall have an automatic OFF function that turns off all the lights and either an automatic or a manually controlled ON function capable of meeting all the multilevel and uniformity requirements of Section A5.209.2.2 for the controlled lighting. The first stage shall be capable of activating between 30–70 percent of the lighting power in a room either through an automatic or manual action and may be a switching or dimming system. After that event occurs the device shall be capable of all of the following actions when manually called to do so by the occupant:

1. Activating the alternate set of lights.
2. Activating 100 percent of the lighting power.
3. Deactivating all lights.

A5.209.1.6 Automatic daylighting control devices. Automatic daylighting control devices used to control lights in daylit zones shall:

1. Be capable of reducing the power consumption of the general lighting in the controlled area by at least two thirds in response to the availability of daylight; and
2. If the device is a dimmer controlling incandescent or fluorescent lamps, provide electrical outputs to lamps for reduced flicker operation through the dimming range, so that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz and without causing premature lamp failure; and
3. If the devices reduce lighting in control steps, incorporate time-delay circuits to prevent cycling of light level changes of less than 3 minutes and have a manual or automatic means of adjusting the deadband to provide separation of on and off points for each control step; and
4. If the device is placed in calibration mode, automatically restore its time delay settings to normal operation programmed time delays after no more than 60 minutes; and
5. Have a setpoint control that easily distinguishes settings to within 10 percent of full scale adjustment; and
6. Have a light sensor that has a linear response with 5 percent accuracy over the range of illuminance measured by the light sensor; and
7. Have a light sensor that is physically separated from where calibration adjustments are made or is capable of being calibrated in a manner that the person initiating calibration is remote from the sensor

during calibration to avoid influencing calibration accuracy.

A5.209.1.7 Interior photosensors. Interior photosensor shall not have a mechanical slide cover or other device that permits easy unauthorized disabling of the control and shall not be incorporated into a wall-mounted occupant-sensor.

A5.209.1.8 Multilevel astronomical time-switch controls. Multilevel astronomical time-switch controls used to control lighting in daylit zones shall:

1. Contain at least two separately programmable steps per zone that reduces illuminance in a relatively uniform manner as specified in Section A5.209.2.2; and
2. Have a separate offset control for each step of 1 to 240 minutes; and
3. Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within 5 minutes per year; and
4. Store astronomical time parameters (used to develop longitude, latitude, time zone) for at least 7 days if power is interrupted; and
5. Display date/time, sunrise and sunset and switching times for each step; and
6. Have an automatic daylight savings time adjustment; and
7. Have automatic time switch capabilities specified in Section A5.209.1.3.

A5.209.1.9 Outdoor astronomical time-switch controls. Outdoor astronomical time-switch controls used to control outdoor lighting as specified in Section A5.209.3.3 shall:

1. Contain at least two separately programmable steps per function area; and
2. Have the ability to independently offset the on and off times for each channel by 0 to 99 minutes before or after sunrise or sunset; and
3. Have sunrise and sunset prediction accuracy within +/- 15 minutes and timekeeping accuracy within 5 minutes per year; and
4. Store astronomical time parameters (used to develop longitude, latitude, time zone) for at least 7 days if power is interrupted; and
5. Display date/time, sunrise and sunset; and
6. Have an automatic daylight savings time adjustment; and
7. Have automatic time switch capabilities specified in Section A5.209.1.3.

A5.209.1.10 Dimmers. Dimmers used to control lighting shall:

1. Be capable of reducing power consumption by a minimum of 65 percent when the dimmer is at its lowest light level; and
2. If the device is a dimmer controlling incandescent or fluorescent lamps, provide electrical outputs to

lamps for reduced flicker operation through the dimming range, so that the light output has an amplitude modulation of less than 30 percent for frequencies less than 200 Hz and without causing premature lamp failure; and

3. Be listed by a rating lab recognized by the International Code Council (ICC) as being in compliance with Underwriters Laboratories Standards; and
4. If the device is a wall box dimmer designed to be used in a three- or more-way circuit with nondimmable switches, the level set by the dimmer, shall not be overridden by any of the switches in the circuit. The dimmer and all of the switches in the circuit shall have the capability of turning lighting OFF if it is ON and turning lighting ON to the level set by the dimmer if the lighting is OFF. Any wall box dimmer that is connected to a system with an emergency override function shall be controlled by the emergency override.
5. If the device is a stepped dimmer, it shall include an off position to turn lights completely off.

**TABLE A5.209.1-A
ULTRASOUND MAXIMUM DECIBEL VALUES**

MIDFREQUENCY OF SOUND PRESSURE THIRD-OCTAVE BAND (in kHz)	MAXIMUM dB LEVEL WITHIN THIRD-OCTAVE BAND (in dB reference 20 micropascals)
Less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

A5.209.2 Indoor lighting controls

A5.209.2.1 Area controls.

A5.209.2.1.1 Each area enclosed by ceiling-height partitions shall have an independent switching or control device. This switching or control device shall be:

1. Readily accessible; and
2. Located so that a person using the device can see the lights or area controlled by that switch or so that the area being lit is annunciated; and
3. Manually operated or automatically controlled by an occupant-sensor that meets the applicable requirements of Section A5.209.1.

A5.209.2.1.2 Other devices may be installed in conjunction with the switching or control device provided that they:

1. Permit the switching or control device to manually turn the lights off in each area enclosed by ceiling-height partitions; and
2. Reset the mode of any automatic system to normal operation without further action.

Exception 1 to Section A5.209.2.1: Up to 0.3 watts per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, if:

1. The area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Title 24, Part 1; and
2. The security or egress lighting is controlled by switches accessible only to authorized personnel.

Exception 2 to Section A5.209.2.1: Public areas with switches that are accessible only to authorized personnel.

A5.209.2.2 Multilevel lighting controls. The general lighting of any enclosed space 100 square feet or larger and has a connected lighting load that exceeds 0.8 watts per square foot, shall have multilevel lighting controls. Multilevel controls shall have at least one control step that is between 30 percent and 70 percent of design lighting power and allow the power of all lights to be manually turned off. A reasonably uniform level of illuminance shall be achieved by any of the following:

1. Continuous or stepped dimming of all lamps or luminaires; or
2. Switching alternate lamps in luminaires, alternate luminaires and alternate rows of luminaires.

Exceptions:

1. Lights in corridors.
2. A space that has only one luminaire with no more than two lamps.

A5.209.2.3 Daylight areas.

A5.209.2.3.1 Daylight areas shall be defined as follows:

A5.209.2.3.1.1 Daylight area. The total daylight area shall not double count overlapping areas with any primary sidelit daylight area, secondary sidelit daylight area or skylit daylight area.

A5.209.2.3.1.2 Daylight area, primary sidelit is the combined primary sidelit area without double counting overlapping areas. The floor area for each primary sidelit area is directly adjacent to vertical glazing below the ceiling with an area equal to the product of the sidelit width and the primary sidelit depth.

The primary sidelit width is the width of the window plus, on each side, the smallest of:

1. 2 feet; or
2. The distance to any 5 feet or higher permanent vertical obstruction.

The primary sidelit depth is the horizontal distance perpendicular to the glazing which is the smaller of:

1. One window head height; or
2. The distance to any 5 feet or higher permanent vertical obstruction.

A5.209.2.3.1.3 Daylight area, secondary sidelit is the combined secondary sidelit area without double counting overlapping areas. The floor area for each secondary sidelit area is directly adjacent to primary

sidelit area with an area equal to the product of the sidelit width and the secondary sidelit depth.

The secondary sidelit width is the width of the window plus, on each side, the smallest of:

1. 2 feet; or
2. The distance to any 5 feet or higher permanent vertical obstruction; or
3. The distance to any skylit daylight area.

The secondary sidelit depth is the horizontal distance perpendicular to the glazing which begins from one window head height and ends at the smaller of:

1. Two window head heights;
2. The distance to any 5 feet or higher permanent vertical obstruction; or
3. The distance to any skylit daylight area.

A5.209.2.3.1.4 Daylight area, skylit is the combined daylight area under each skylight without double counting overlapping areas. The daylight area under each skylight is bounded by the rough opening of the skylight, plus horizontally in each direction the smallest of:

1. 70 percent of the floor-to-ceiling height; or
2. The distance to any primary sidelit area or the daylight area under rooftop monitors; or
3. The distance to any permanent partition or permanent rack which is farther away than 70 percent of the distance between the top of the permanent partition or permanent rack and the ceiling.

A5.209.2.3.2 Luminaires providing general lighting that are in or are partially in the skylit daylight area and/or the primary sidelit daylight area shall be controlled as follows:

A5.209.2.3.2.1 Primary sidelit and skylit daylight areas shall have at least one lighting control that:

1. Controls at least 50 percent of the general lighting power in the primary sidelit and skylit daylight areas separately from other lighting in the enclosed space.
2. Controls luminaires in primary sidelit areas separately from skylit areas.

Exception: Primary sidelit and skylit daylight areas that have a combined area totaling less than or equal to 250 square feet within any enclosed space.

A5.209.2.3.2.2 For all skylit daylight areas:

1. The skylit daylight area shall be shown on the plans.
2. All of the general lighting in the skylit area shall be controlled independently by an automatic daylighting control device that meets the applicable requirements of Section A5.209.1.

3. The automatic daylighting control shall be installed in accordance with Section A5.209.2.3.2.4.

Exceptions:

1. Where the total skylit daylight area in any enclosed space is less than or equal to 2,500 square feet.
2. Skylit daylight areas where existing adjacent structures obstruct direct beam sunlight for at least 6 hours per day during the equinox as calculated using computer or graphical methods.
3. When the skylight effective aperture is greater than 4.0 percent and all general lighting in the skylit area is controlled by a multi-level astronomical time switch that meets the requirements of Section A5.209.1.8 and that has an override switch that meets the requirements of Section A5.209.2.4.2.
4. Skylit daylight areas where the effective aperture is less than 0.006. The effective aperture for skylit daylight areas is specified in Section 146(a)2E of Title 24, Part 6.

A5.209.2.3.2.3 The primary sidelit area(s) shall be shown on the plans and the general lighting in the primary sidelit areas shall be controlled independently by an automatic daylighting control device that meets the applicable requirements of Section A5.209.1 and is installed in accordance with Section A5.209.2.3.2.4.

Exceptions:

1. Where the total primary sidelit daylight area in any enclosed space has an area less than or equal to 2,500 square feet.
2. Primary sidelit daylight areas where the effective aperture is less than 0.1. The effective aperture for primary sidelit daylight areas is specified in Section 146(a)2E of Title 24, Part 6.
3. Primary sidelit daylight areas where existing adjacent structures are twice as tall as their distance away from the windows.
4. Parking garages.

A5.209.2.3.2.4 Automatic daylighting control device installation and operation. Automatic daylighting control devices shall be installed and configured to operate according to all of the following requirements:

1. Automatic daylighting control devices shall have photosensors that are located so that they are not readily accessible in accordance with the designer's or manufacturer's instructions.
2. The location where calibration adjustments are made to the automatic daylighting control device shall be readily accessible to autho-

rized personnel or located within 2 feet of a ceiling access panel that is no higher than 11 feet above floor level.

3. Automatic daylighting controls shall be multi-level, including continuous dimming and have at least one control step that is between 50 percent to 70 percent of rated power of the controlled lighting.

Exceptions:

1. Controlled lighting having a lighting power density less than 0.3 W/ft².
2. When skylights are replaced or added to on an existing building with an existing general lighting system.
4. Under all daylight conditions in all areas served by the controlled lighting, the combined illuminance from the controlled lighting and daylight is not less than the illuminance from controlled lighting when no daylight is available.
5. When all areas served by the controlled lighting are receiving daylight illuminance levels greater than 150 percent of the illuminance from controlled lighting when no daylight is available, the controlled lighting power consumption shall be no greater than 35 percent of the rated power of the controlled lighting.

A5.209.2.4 Shut-off controls.

A5.209.2.4.1 In addition to the manual controls installed to comply with Sections A5.209.2.1 and A5.209.2.2 for every floor, all indoor lighting systems shall be equipped with separate automatic controls to shut off the lighting. These automatic controls shall meet the requirements of Section A5.209.1 and may be an occupant sensor, automatic time switch or other device capable of automatically shutting off the lighting.

Exceptions:

1. Where the lighting system is serving an area that must be continuously lit, 24 hours per day/365 days per year.
2. Lighting in corridors, guestrooms, dwelling units of high-rise residential buildings and hotel/motels and parking garages.
3. Up to 0.3 watts per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, provided that the area is designated a security or emergency egress area on the plans and specifications submitted to the enforcement agency under Section 10-103(a)2 of Title 24, Part 1.

A5.209.2.4.2 If an automatic control device is installed to comply with Section A5.209.2.4.1, it shall incorporate an override switching device that:

1. Is readily accessible; and

2. Is located so that a person using the device can see the lights or the area controlled by that switch or so that the area being lit is annunciated; and

3. Is manually operated; and

4. Allows the lighting to remain on for no more than 2 hours when an override is initiated; and

Exception: In malls, auditoriums, single tenant retail spaces, industrial facilities and arenas, where captive-key override is utilized, override time may exceed 2 hours.

5. Controls an area enclosed by ceiling height partitions not exceeding 5,000 square feet.

Exception: In malls, auditoriums, single tenant retail spaces, industrial facilities, convention centers and arenas, the area controlled may not exceed 20,000 square feet.

A5.209.2.4.3 If an automatic time switch control device is installed to comply with Section A5.209.2.4.1, it shall incorporate an automatic holiday “shut-off” feature that turns off all loads for at least 24 hours and then resumes the normally scheduled operation.

Exception: Retail stores and associated malls, restaurants, grocery stores, churches and theaters.

A5.209.2.4.4 Offices 250 square feet or smaller; multi-purpose rooms of less than 1,000 square feet and classrooms and conference rooms of any size, shall be equipped with occupant sensor(s) to shut off the lighting. In addition, controls shall be provided that allow the lights to be manually shut off in accordance with Section A5.209.2.1 regardless of the sensor status.

A5.209.3 Outdoor lighting controls and equipment.

A5.209.3.1 Outdoor lighting. All permanently installed outdoor luminaires employing lamps rated over 100 watts shall either have a lamp efficacy of at least 60 lumens per watt or be controlled by a motion sensor.

Exceptions:

1. Lighting required by a health or life safety statute ordinance or regulation, including but not limited to, emergency lighting.
2. Lighting used in or around swimming pools, water features or other locations subject to Article 680 of Title 24, Part 3, *California Electrical Code*.
3. Searchlights.
4. Theme lighting for use in theme parks.
5. Lighting for film or live performances.
6. Temporary outdoor lighting.
7. Light emitting diode, light emitting capacitors, neon and cold cathode lighting.
8. Sign lighting.

A5.209.3.2 Luminaire cutoff requirements. All outdoor luminaires that use lamps rated greater than 175 watts in hardscape areas including parking lots, building entrances,

sales and nonsales canopies and all outdoor sales areas shall be designated Cutoff for light distribution. To comply with this requirement, the luminaire shall be rated Cutoff in a photometric test report that includes any tilt or other nonlevel mounting condition of the installed luminaire. Cutoff is a luminaire light distribution classification where the candela per 1000 lamp lumens does not numerically exceed 25 at or above a vertical angle of 90 degrees above nadir and 100 at or above a vertical angle of 80 degrees above nadir. Nadir is in the direction of straight down, as would be indicated by a plumb line. 90 degrees above nadir is horizontal. 80 degrees above nadir is 10 degrees below horizontal.

Exceptions:

1. Signs.
2. Lighting for building facades, public monuments, statues and vertical surfaces of bridges.
3. Lighting required by a health or life safety statute ordinance or regulation, including but not limited to, emergency lighting.
4. Temporary outdoor lighting.
5. Lighting used in or around swimming pools, water features or other locations subject to Article 680 of the *California Electrical Code*.
6. Replacement of existing pole mounted luminaires in hardscape areas meeting all of the following conditions:
 1. Where the existing luminaire does not meet the luminaire cutoff requirements in A5.209.3.2; and
 2. Spacing between existing poles is greater than 6 times the mounting height of the existing luminaires; and
 3. Where no additional poles are being added to the site; and
 4. Where new wiring to the luminaires is not being installed; and
 5. Provided that the connected lighting power wattage is not increased.

A5.209.3.3 Controls for outdoor lighting.

A5.209.3.3.1 All permanently installed outdoor lighting shall be controlled by a photocontrol or astronomical time switch that automatically turns off the outdoor lighting when daylight is available.

Exception: Lighting in tunnels and large covered areas that require illumination during daylight hours.

A5.209.3.3.2 For lighting of building facades, parking lots, sales and nonsales canopies, all outdoor sales areas and student pick-up/drop-off zones where two or more luminaires are used, an automatic time switch shall be installed that is capable of (1) turning off the lighting when not needed and (2) reducing the lighting power (in watts) by at least 50 percent but not exceeding 80 percent or providing continuous dimming through a range that includes 50 percent through 80 percent

reduction. This control shall meet the requirements of Section A5.209.1.3.

Exceptions:

1. Lighting required by a health or life safety statute ordinance or regulation, including but not limited to, emergency lighting.
2. Lighting for steps or stairs that require illumination during daylight hours.
3. Lighting that is controlled by a motion sensor and photocontrol.
4. Lighting for facilities that have equal lighting requirements at all hours and are designed to operate continuously.
5. Temporary outdoor lighting.
6. Signs.

A5.209.4 Outdoor lighting. This section applies to all outdoor lighting, whether attached to buildings, poles, structures or self-supporting, including but not limited to, hardscape areas including parking lots, lighting for building entrances, sales and nonsales canopies; lighting for all outdoor sales areas; and lighting for building facades.

Exceptions: When more than 50 percent of the light from a luminaire falls on one or more of the following applications, the lighting power for that luminaire shall be exempt from Section A5.209.4.2.

1. Temporary outdoor lighting.
2. Lighting required and regulated by the Federal Aviation Administration and the Coast Guard.
3. Lighting for public streets, roadways, highways and traffic signage lighting, including lighting for driveway entrances occurring in the public right-of-way.
4. Lighting for sports and athletic fields and children's playground.
5. Lighting for industrial sites, including but not limited to, rail yards, maritime shipyards and docks, piers and marinas, chemical and petroleum processing plants and aviation facilities.
6. Lighting specifically for automated teller machines as required by *California Financial Code* Section 13040 or required by law through a local ordinance.
7. Lighting of public monuments.
8. Signs shall meet the requirements of Section A5.209.5.
9. Lighting used in or around swimming pools, water features or other locations subject to Article 680 of Title 24, Part 3, *California Electrical Code*.
10. Lighting of tunnels, bridges, stairs, wheelchair elevator lifts for American with Disabilities Act (ADA) compliance and ramps that are other than parking garage ramps.
11. Landscape lighting.

12. In theme parks: outdoor lighting for themes and special effects.
13. Lighting for outdoor theatrical and other outdoor live performances, provided that these lighting systems are additions to area lighting systems and are controlled by a multiscene or theatrical cross-fade control station accessible only to authorized operators.
14. Outdoor lighting systems for qualified historic buildings, as defined in Title 24, Part 8, *California Historic Building Code*, if they consist solely of historic lighting components or replicas of historic lighting components. If lighting systems for qualified historic buildings contain some historic lighting components or replicas of historic components, combined with other lighting components, only those historic or historic replica components are exempt. All other outdoor lighting systems for qualified historic buildings shall comply with Section A5.209.4.

A.5.209.4.1 Outdoor lighting power trade-offs. Outdoor lighting power trade-offs shall be determined as follows:

1. Allowed lighting power determined according to Section A5.209.4.4.1 for general hardscape lighting allowance may be traded to specific applications in Section A5.209.4.4.2, provided the hardscape area from which the lighting power is traded continues to be illuminated in accordance with Section A5.209.4.4.1.1.
2. Allowed lighting power determined according to Section A5.209.4.4.2 for additional lighting power allowances for specific applications shall not be traded between specific applications or to hardscape lighting in Section A5.209.4.4.1.
3. Allowed lighting power determined according to Section A5.209.4.4.3 for additional lighting power allowances for local ordinance shall not be traded to specific applications in Section A5.209.4.4.2 or to hardscape areas not covered by the local ordinance.
4. Trading off lighting power allowances between outdoor and indoor areas shall not be permitted.

A5.209.4.2 Outdoor lighting power. An outdoor lighting installation complies with this section if the actual outdoor lighting power installed is no greater than the allowed outdoor lighting power calculated under Section A5.209.4.4. The allowed outdoor lighting shall be calculated by Lighting Zone as defined in Section 10-114 of Title 24, Part 1. Local governments may amend lighting zones in compliance with Section 10-114 of Title 24, Part 1.

A5.209.4.3 Calculation of actual lighting power. The wattage of outdoor luminaires shall be determined in accordance with Section 130(d) of Title 24, Part 6.

A5.209.4.4 Calculation of allowed lighting power. The allowed lighting power shall be the combined total of the sum of the general hardscape lighting allowance determined in accordance with Section A5.209.4.4.1, the sum of the additional lighting power allowance for specific

applications determined in accordance with Section A5.209.4.4.2 and the sum of the additional lighting power allowances for local ordinance determined in accordance with Section A5.209.4.4.3.

A5.209.4.4.1 General hardscape lighting allowance. Determine the general hardscape lighting power allowances as follows:

A5.209.4.4.1.1 The general hardscape area of a site shall include parking lot(s), roadway(s), driveway(s), sidewalk(s), walkway(s), bikeway(s), plaza(s) and other improved area(s) that are illuminated. In plan view of the site, determine the illuminated hardscape area, which is defined as any hardscape area that is within a square pattern around each luminaire or pole that is ten times the luminaire mounting height with the luminaire in the middle of the pattern, less any areas that are within a building, beyond the hardscape area, beyond property lines or obstructed by a structure. The illuminated hardscape area shall include portions of planters and landscaped areas that are within the lighting application and are less than or equal to 10 feet wide in the short dimensions and are enclosed by hardscape or other improvement on at least three sides. Multiply the illuminated hardscape area by the Area Wattage Allowance (AWA) from Table A5.209.4-A for the appropriate Lighting Zone.

A5.209.4.4.1.2 Determine the perimeter length of the general hardscape area. The total perimeter shall not include portions of hardscape that is not illuminated according to Section A5.209.4.4.1.1. Multiply the hardscape perimeter by the Linear Wattage Allowance (LWA) for hardscape from Table A5.209.4-A for the appropriate lighting zone. The perimeter length for hardscape around landscaped areas and permanent planters shall be determined as follows:

1. Landscaped areas completely enclosed within the hardscape area and which have width or length less than 10 feet wide, shall not be added to the hardscape perimeter length.
2. Landscaped areas completely enclosed within the hardscape area and which width or length are a minimum of 10 feet wide, the perimeter of the landscaped areas or permanent planter shall be added to the hardscape perimeter length.
3. Landscaped edges that are not abutting the hardscape shall not be added to the hardscape perimeter length.

A5.209.4.4.1.3 Determine the Initial Wattage Allowance (IWA) for general hardscape lighting from Table A.209.4-A for the appropriate lighting zone. The hardscape area shall be permitted one IWA per site.

A5.209.4.4.1.4 The general hardscape lighting allowance shall be the sum of the allowed watts determined

from Sections A5.209.4.4.1.1, A5.209.4.4.1.2 and A5.209.4.4.1.3 above.

A5.209.4.4.2 Additional lighting power allowance for specific applications. Additional lighting power for specific applications shall be the smaller of the additional lighting allowances for specific applications determined in accordance with Table A5.209.4-B for the appropriate lighting zone or the actual installed lighting power meeting the requirements for the allowance.

A5.209.4.4.3 Additional lighting power allowance for local ordinance requirements. For hardscape areas, including parking lots, site roadways, driveways, sidewalks, walkways or bikeways, when specific light levels are required by law through a local ordinance and provided the local ordinance meets Section 10-114 of Title 24, Part 1, additional lighting power for those hardscape areas covered by the local ordinance requirement shall be the smaller of the additional lighting allowances for local ordinance determined from Table A5.209.4-C for the appropriate lighting zone or the actual installed lighting power meeting the requirements for the allowance.

A5.209.5 Signs. This section applies to all internally illuminated and externally illuminated signs, unfiltered light emitting diodes (LEDs) and unfiltered neon, both indoor and outdoor. Each sign shall comply with either Subsection A5.209.5.1 or A5.209.5.2, as applicable.

A5.209.5.1 Maximum allowed lighting power.

A5.209.5.1.1 For internally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 12 watts per square foot. For double-faced signs, only the area of a single face shall be used to determine the allowed lighting power.

A5.209.5.1.2 For externally illuminated signs, the maximum allowed lighting power shall not exceed the product of the illuminated sign area and 2.3 watts per square foot. Only areas of an externally lighted sign that are illuminated without obstruction or interference, by one or more luminaires, shall be used.

**TABLE A5.209.4-A
GENERAL HARDSCAPE LIGHTING POWER ALLOWANCE**

TYPE OF POWER ALLOWANCE	LIGHTING ZONE 1	LIGHTING ZONE 2	LIGHTING ZONE 3	LIGHTING ZONE 4
Area wattage allowance (AWA)	0.036 W/ft ²	0.045 W/ft ²	0.092 W/ft ²	0.115 W/ft ²
Linear wattage allowance (LWA)	0.36 W/lf	0.45 W/lf	0.92 W/lf	1.15 W/lf
Initial wattage allowance (IWA)	340 W	510 W	770 W	1030 W

**TABLE A5.209.4-B
ADDITIONAL LIGHTING POWER ALLOWANCE FOR SPECIFIC APPLICATIONS
All area and distance measurements in plan view unless otherwise noted.**

	LIGHTING APPLICATION	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
WATTAGE ALLOWANCE PER APPLICATION. Use all that apply as appropriate.					
	Building entrances or exits. Allowance per door. Luminaires qualifying for this allowance shall be within 20 feet of the door.	30 watts	75 watts	100 watts	120 watts
	Primary entrances to senior care facilities, police stations, hospitals, fire stations and emergency vehicle facilities. Allowance per primary entrance(s) only. Primary entrances shall provide access for the general public and shall not be used exclusively for staff or service personnel. This allowance shall be in addition to the building entrance or exit allowance above. Luminaires qualifying for this allowance shall be within 100 feet of the primary entrance.	45 watts	80 watts	120 watts	130 watts
	Drive up windows. Allowance per customer service location. Luminaires qualifying for this allowance shall be within two mounting heights of the sill of the window.	40 watts	75 watts	125 watts	200 watts
	Vehicle service station uncovered fuel dispenser. Allowance per fueling dispenser. Luminaires qualifying for this allowance shall be within two mounting heights of the dispenser.	120 watts	175 watts	185 watts	330 watts
WATTAGE ALLOWANCE PER UNIT LENGTH (w/linear ft). May be used for one or two frontage side(s) per site.					
	Outdoor sales frontage. Allowance for frontage immediately adjacent to the principal viewing location(s) and unobstructed for its viewing length. A corner sales lot may include two adjacent sides provided that a different principal viewing location exists for each side. Luminaires qualifying for this allowance shall be located between the principal viewing location and the frontage outdoor sales area.	No allowance	22.5 w/linear ft	36 w/linear ft	45 w/linear ft
WATTAGE ALLOWANCE PER HARDSCAPE AREA (W/ft²). May be used for any illuminated hardscape area on the site.					
	Hardscape ornamental lighting. Allowance for the total site illuminated hardscape area. Luminaires qualifying for this allowance shall be rated for 100 watts or less as determined in accordance with Section 130(d) and shall be post-top luminaires, lanterns, pendant luminaires or chandeliers.	No allowance	0.02 w/ft ²	0.04 w/ft ²	0.06 w/ft ²
WATTAGE ALLOWANCE PER SPECIFIC AREA (W/ft²). Use as appropriate provided that none of the following specific applications shall be used for the same area.					
	Building facades. Only areas of building façade that are illuminated shall qualify for this allowance. Luminaires qualifying for this allowance shall be aimed at the façade and shall be capable of illuminating it without obstruction or interference by permanent building features or other objects.	No allowance	0.18 w/ft ²	0.35 w/ft ²	0.50 w/ft ²
	Outdoor sales lots. Allowance for uncovered sales lots used exclusively for the display of vehicles or other merchandise for sale. Driveways, parking lots or other nonsales areas shall be considered hardscape areas even if these areas are completely surrounded by sales lot on all sides. Luminaires qualifying for this allowance shall be within five mounting heights of the sales lot area.	0.164 w/ft ²	0.555 w/ft ²	0.758 w/ft ²	1.285 w/ft ²
	Vehicle service station hardscape. Allowance for the total illuminated hardscape area less area of buildings, under canopies, off property or obstructed by signs or structures. Luminaires qualifying for this allowance shall be illuminating the hardscape area and shall not be within a building, below a canopy, beyond property lines or obstructed by a sign or other structure.	0.014 w/ft ²	0.155 w/ft ²	0.308 w/ft ²	0.485 w/ft ²
	Vehicle service station canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.514 w/ft ²	1.005 w/ft ²	1.358 w/ft ²	2.285 w/ft ²
	Sales canopies allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	No allowance	0.655 w/ft ²	0.908 w/ft ²	1.135 w/ft ²
	Nonsales canopies. Allowance for the total area within the drip line of the canopy. Luminaires qualifying for this allowance shall be located under the canopy.	0.084 w/ft ²	0.205 w/ft ²	0.408 w/ft ²	0.585 w/ft ²
	Guard stations. Allowance up to 1,000 square feet per vehicle lane. Guard stations provide access to secure areas controlled by security personnel who stop and may inspect vehicles and vehicle occupants, including identification, documentation, vehicle license plates and vehicle contents. Qualifying luminaires shall be within two mounting heights of a vehicle lane or the guardhouse.	0.154 w/ft ²	0.355 w/ft ²	0.708 w/ft ²	0.985 w/ft ²
	Student pick-up/drop-off zone. Allowance for the area of the student pick-up/drop-off zone, with or without canopy, for preschool through 12th grade school campuses. A student pick-up/drop off zone is a curbside, controlled traffic area on a school campus where students are picked up and dropped off from vehicles. The allowed area shall be the smaller of the actual width or 25 feet, times the smaller of the actual length or 250 feet. Qualifying luminaires shall be within two mounting heights of the student pick-up/drop-off zone.	No allowance	0.12 w/ft ²	0.45 w/ft ²	No allowance
	Outdoor dining. Allowance for the total illuminated hardscape of outdoor dining. Outdoor dining areas are hardscape areas used to serve and consume food and beverages. Qualifying luminaires shall be within 2 mounting heights of the hardscape area of outdoor dining.	0.014 w/ft ²	0.135 w/ft ²	0.258 w/ft ²	0.435 w/ft ²
	Special security lighting for retail parking and pedestrian hardscape. This additional allowance is for illuminated retail parking and pedestrian hardscape identified as having special security needs. This allowance shall be in addition to the building entrance or exit allowance.	0.007 w/ft ²	0.009 w/ft ²	0.019 w/ft ²	No allowance

**TABLE A5.209.4-C
ADDITIONAL LIGHTING POWER ALLOWANCE FOR ORDINANCE REQUIREMENTS**

ADDITIONAL LIGHTING POWER ALLOWANCE (W/ft ²) WHEN AVERAGE LIGHT LEVELS ARE REQUIRED BY LOCAL ORDINANCE.				
Required (horizontal foot-candles, AVERAGE)	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
0.5	0	0	0	0
1.0	0.004	0	0	0
1.5	0.024	0.015	0	0
2.0	0.044	0.035	0	0
3.0	0.084	0.075	0.028	0.005
4.0 or greater	0.124	0.115	0.068	0.045
ADDITIONAL LIGHTING POWER ALLOWANCE (W/ft ²) WHEN MINIMUM LIGHT LEVELS ARE REQUIRED BY LOCAL ORDINANCE.				
Required (horizontal foot-candles, MINIMUM)	Lighting Zone 1	Lighting Zone 2	Lighting Zone 3	Lighting Zone 4
0.5	0.044	0	0	0
1.0	0.124	0.035	0	0
1.5	0.164	0.115	0.068	0.045
2.0	0.164	0.155	0.108	0.085
3.0	0.164	0.155	0.108	0.085
4.0 or greater	0.164	0.155	0.108	0.085

A5.209.5.2 Alternate lighting sources. The sign shall comply if it is equipped only with one or more of the following light sources:

A5.209.5.2.1 High pressure sodium lamps; or

A5.209.5.2.2 Metal halide lamps that are:

1. Pulse start or ceramic served by a ballast that has a minimum efficiency of 88 percent or greater or
2. Pulse start that are 320 watts or smaller, are not 250 watt or 175 watt lamps and are served by a ballast that has a minimum efficiency of 80 percent.

Where ballast efficiency is the measured output wattage to the lamp divided by the measured operating input wattage when tested according to ANSI C82.6-2005; or

A5.209.5.2.3 Neon or cold cathode lamps with transformer or power supply efficiency greater than or equal to the following:

1. A minimum efficiency of 75 percent when the transformer or power supply rated output current is less than 50 mA; or
2. A minimum efficiency of 68 percent when the transformer or power supply rated output current is 50 mA or greater.

Where the ratio of the output wattage to the input wattage is at 100-percent tubing load; or

A5.209.5.2.4 Fluorescent lamps with a minimum color rendering index (CRI) of 80; or

A5.209.5.2.5 Light emitting diodes (LEDs) with a power supply having an efficiency of 80 percent or greater; or

Exception: Single voltage external power supplies that are designed to convert 120 volt AC input into lower voltage DC or AC output and have a nameplate output power less than or equal to 250 watts, shall comply with the applicable requirements of the *Appliance Efficiency Regulations*, Title 20.

A5.209.5.2.6 Compact fluorescent lamps that do not contain medium screw base sockets (E24/E26); or

A5.209.5.2.7 Electronic ballasts with a fundamental output frequency not less than 20 kHz;

Exception 1 to Section A5.209.5: Unfiltered incandescent lamps that are not part of an electronic message center (EMC), an internally illuminated sign or an externally illuminated sign.

Exception 2 to Section A5.209.5: Exit signs. Exit signs shall meet the requirements of the *Appliance Efficiency Regulations*.

Exception 3 to Section A5.209.5: Traffic Signs. Traffic signs shall meet the requirements of the *Appliance Efficiency Regulations*.

A5.209.6 Sign lighting controls. All signs with permanently connected lighting shall meet the requirements below:

1. Automatic time switch control. All signs with permanently connected lighting shall be controlled with an automatic time switch control that complies with the applicable requirements of Section A5.209.1.
2. Photocontrol or outdoor astronomical time switch control. All outdoor signs shall be controlled with a photocontrol or outdoor astronomical time switch control.

Exception: Outdoor signs in tunnels and large covered areas that require illumination during daylight hours.

3. Dimming. All outdoor signs shall be controlled with a dimmer that provides the ability to automatically reduce sign power by a minimum of 65 percent during nighttime hours.

Exceptions:

1. Signs that are illuminated for less than 1 hour per day during daylight hours.
2. Outdoor signs in tunnels and large covered areas that require illumination during daylight hours.
3. Metal halide, high pressure sodium, cold cathode and neon lamps used to illuminate signs or parts of signs.
4. Demand Responsive Electronic Message Center Control. An Electronic Message Center (EMC) having a new connected lighting power load greater than 15 kW shall have a control installed that is capable of reducing the lighting power by a minimum of 30 percent when receiving a demand response signal that is sent out by the local utility.
5. EMCs required by a health or life safety statute ordinance or regulation, including but not limited to exit signs and traffic signs.

A5.209.7 Nonresidential lighting control acceptance. Before an occupancy permit is granted for a new building or space or a new lighting system serving a building, space or site is operated for normal use, all indoor and outdoor lighting controls serving the building, space or site shall be certified as meeting the Acceptance Requirements for Code Compliance. A Certificate of Acceptance shall be submitted to the enforcement agency under Section 10-103(a) of Title 24, Part 1, that:

1. Certifies that plans, specifications, installation certificates and operating and maintenance information meet the requirements of Title 24, Part 6.
2. Certifies that automatic daylighting controls meet the applicable requirements of Sections A5.209.1 and A5.209.2.3.2.4.
3. Certifies that when a multilevel astronomical time switch is used to meet Exception 3 to Section A5.209.2.3.2.2 all general lighting in the skylit area is controlled by a multilevel astronomical time switch that meets the applicable requirements of Section A5.209.1 and that has an override switch that meets the requirements of Section A209.2.4.2.
4. Certifies that lighting controls meet the requirements of Sections A5.209.2.1 through A5.209.2.3 and Title 24, Part 6, Sections 131(e) and (f) and 146(a)2, as applicable.
5. Certifies that automatic lighting controls meet the applicable requirements of Sections A5.209.1 and A5.209.2.4.
6. Certifies that occupant-sensors meet the applicable requirements of Sections A5.209.1 and A5.209.2.4.
7. Certified that outdoor lighting controls meet the applicable requirements of Sections A5.209.1 and A5.209.3.

**SECTION A5.210 [OSHPD 1, 2 & 4]
APPLIANCES**

A5.210.1 Appliances regulated by the *Appliance Efficiency Regulations*. Any appliance for which there is a California standard established in the *Appliance Efficiency Regulations* may be installed only if the manufacturer has certified to the Commission, as specified in those regulations, that the appliance complies with the applicable standard for that appliance.

Note: For certified appliances, go to www.energy.ca.gov/appliances/database/.

Division A5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY

**SECTION A5.401
GENERAL**

A5.401.1 Scope. The provisions of this chapter shall outline means of achieving material conservation and resource efficiency through reuse of existing building stock and materials; use of recycled, regional, rapidly renewable and certified wood materials; and employment of techniques to reduce pollution through recycling of materials.

**SECTION A5.407 [OSHPD 1, 2 & 4]
WATER RESISTANCE AND MOISTURE
MANAGEMENT**

A5.407.3 Weather protection. Provide a weather-resistant exterior wall and foundation envelope as required by *California Building Code* Section 1403.2 and *California Energy Code* Section 150, manufacturer’s installation instructions or local ordinance, whichever is more stringent.

A5.407.4 Moisture control. Employ moisture control measures by the following methods.

A5.407.4.1 Sprinklers. Design and maintain landscape irrigation systems to prevent spray on structures.

A5.407.4.2 Entries and openings. Design exterior entries and/or openings subject to foot traffic or wind-driven rain to prevent water intrusion into buildings.

Notes:

1. Use features such as overhangs and recesses and flashings integrated with a drainage plane.
2. Use nonabsorbent floor and wall finishes within at least two feet around and perpendicular to such openings.

**SECTION A5.408
CONSTRUCTION WASTE REDUCTION,
DISPOSAL AND RECYCLING**

A5.408.5 Construction waste diversion. [OSHPD 1, 2 & 4] Establish a construction waste management plan for the diverted materials or meet local construction and demolition waste management ordinance, whichever is more stringent.

A5.408.6 Construction waste reduction of at least 50 percent. [OSHPD 1, 2 & 4] Recycle and/or salvage for reuse a

minimum of 50 percent of the nonhazardous construction and demolition debris or meet a local construction and demolition waste management ordinance, whichever is more stringent. Calculate the amount of materials diverted by weight or volume, but not by both.

Exceptions:

1. Excavated soil and land-clearing debris.
2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.

A5.408.7 Excavated soil and land clearing debris. [OSHPD 1, 2 & 4] 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled. For a phased project, such material may be stockpiled on site until the storage site is developed.

SECTION A5.410

BUILDING MAINTENANCE AND OPERATION

A5.410.6 Recycling by occupants. [OSHPD 1, 2 & 4] Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of nonhazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals.

Division A5.5 – ENVIRONMENTAL QUALITY

SECTION A5.504 POLLUTANT CONTROL

A5.504.4.5.1 No-added formaldehyde. Use composite wood products approved by the California Air Resources Board (ARB) as no-added formaldehyde (NAF) based resins or ultra-low-emitting formaldehyde (ULEF) resins.

Notes:

1. See Title 17, Section 93120.3(c) and (d), respectively.
2. Documentation must be provided verifying that materials are certified to meet the pollutant emission limits. A list of manufacturers and their NAF and ULEF certified materials is provided at http://www.arb.ca.gov/toxics/comp-wood/naf_ulef/listofnaf_ulef.htm.

A5.504.4.9 Acoustical ceilings and wall panels. Comply with Chapter 8 in Title 24, Part 2, the *California Building Code* and with the VOC-emission limits defined in the 2009 CHPS criteria and listed on its High Performance Products Database.

A5.504.4.9.1 Verification of compliance. Documentation shall be provided verifying that acoustical finish materials meet the pollutant emission limits.

Note: Products compliant with CHPS criteria certified under the Greenguard Children & Schools program may also be used.

Note: [OSHPD 1, 2 & 4] Documentation shall be provided that verifies that finish materials are certified to meet the pollutant emission limits.

A5.504.5 Hazardous particulates and chemical pollutants. Minimize and control pollutant entry into buildings and cross-contamination of regularly occupied areas.

A5.504.5.1 Entryway systems. Install permanent entryway systems measuring at least six feet in the primary direction of travel to capture dirt and particulates at entryways directly connected to the outdoors.

1. Qualifying entryways are those that serve as regular entry points for building users.
2. Acceptable entryway systems include, but are not limited to, permanently installed grates, grilles or slotted systems that allow cleaning underneath.
3. Roll-out mats are acceptable only when maintained regularly by janitorial contractors as documented in service contract or by in-house staff as documented by written policies and procedures.

A5.504.8 Finish material pollutant control. [OSHPD 1, 2 & 4] Finish materials shall comply with Sections A5.504.4.1 through A5.504.4.5.

A5.504.8.1 Adhesives, sealants and caulks. Adhesives, sealants and caulks used on the project shall meet the requirements of the following standards:

1. Adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers and caulks shall comply with local or regional air pollution control or air quality management district rules where applicable or SCAQMD Rule 1168 VOC limits, as shown in Tables A5.504.8.1 and A5.504.8.2. Such products also shall comply with the Rule 1168 prohibition on the use of certain toxic compounds (chloroform, ethylene dichloride, methylene chloride, perchloroethylene and trichloroethylene), except for aerosol products as specified in Subsection 2, below.
2. Aerosol adhesives and smaller unit sizes of adhesives and sealant or caulking compounds (in units of product, less packaging, which do not weigh more than one pound and do not consist of more than 16 fluid ounces) shall comply with statewide VOC standards and other requirements, including prohibitions on use of certain toxic compounds, of California Code of Regulations, Title 17, commencing with Section 94507.

Note: Title 17 may be found at <http://ccr.oal.ca.gov/>.

**TABLE A5.504.8.1
ADHESIVE VOC LIMIT^{1,2}**

Less Water and Less Exempt Compounds in Grams per Liter

ARCHITECTURAL APPLICATIONS	CURRENT VOC LIMIT
Indoor carpet adhesives	50
Carpet pad adhesives	50
Outdoor carpet adhesives	150
Wood flooring adhesive	100
Rubber floor adhesives	60
Subfloor adhesives	50
Ceramic tile adhesives	65
VCT and asphalt tile adhesives	50
Drywall and panel adhesives	50
Cove base adhesives	50
Multipurpose construction adhesives	70
Structural glazing adhesives	100
Single-ply roof membrane adhesives	250
Other adhesive not specifically listed	50
SPECIALTY APPLICATIONS	
PVC welding	510
CPVC welding	490
ABS welding	325
Plastic cement welding	250
Adhesive primer for plastic	550
Contact adhesive	80
Special purpose contact adhesive	250
Structural wood member adhesive	140
Top and trim adhesive	250
SUBSTRATE SPECIFIC APPLICATIONS	
Metal to metal	30
Plastic foams	50
Porous material (except wood)	50
Wood	30
Fiberglass	80

1. If an adhesive is used to bond dissimilar substrates together the adhesive with the highest VOC content shall be allowed.
2. For additional information regarding methods to measure the VOC content specified in this table, see South Coast Air Quality Management District Rule 1168, <http://www.arb.ca.gov/DRDB/SC/CURHTML/R1168.PDF>.

A5.504.8.3 Paints and coatings. Architectural paints and coatings shall comply with VOC limits in Table 1 of the ARB Architectural Coatings Suggested Control Measure, as shown in Table A5.504.8.3, unless local limits apply. The VOC content limit for coatings that do not meet the definitions for the specialty coatings categories listed in Table A5.504.8.3, shall be determined by classifying the coating as a Flat, Nonflat or Nonflat-High Gloss coating, based on its gloss, as defined in Subsections 4.21, 4.36 and 4.37 of the 2007 California Air Resources Board, Suggested Control Measure and the corresponding Flat, Nonflat or Nonflat-High Gloss VOC limit in Table A5.504.8.3 shall apply.

**TABLE A5.504.8.2
SEALANT VOC LIMIT**

Less Water and Less Exempt Compounds in Grams per Liter

SEALANTS	CURRENT VOC LIMIT
Architectural	250
Marine deck	760
Nonmembrane roof	300
Roadway	250
Single-ply roof membrane	450
Other	420
SEALANT PRIMERS	
Architectural Nonporous	250
Porous	775
Modified bituminous	500
Marine deck	760
Other	750

Note: For additional information regarding methods to measure the VOC content specified in these tables, see South Coast Air Quality Management District Rule 1168: <http://www.arb.ca.gov/DRDB/SC/CURHTML/R1168.PDF>.

A5.504.8.3.1 Aerosol paints and coatings. Aerosol paints and coatings shall meet the Product-Weighted MIR Limits for ROC in Section 94522(a)(3) and other requirements, including prohibitions on use of certain toxic compounds and ozone depleting substances, in Sections 94522(c)(2) and (d)(2) of *California Code of Regulations*, Title 17, commencing with Section 94520; and in areas under the jurisdiction of the Bay Area Air Quality Management District additionally comply with the percent VOC by weight of product limits of Regulation 8 Rule 49.

A5.504.8.3.2 Verification. Verification of compliance with this section shall be provided at the request of the enforcing agency. Documentation may include, but is not limited to, the following:

1. Manufacturers product specification.
2. Field verification of on-site product containers.

A5.504.8.4 Carpet systems. All carpet installed in the building interior shall meet the testing and product requirements of one of the following:

1. Carpet and Rug Institute’s Green Label Plus Program.
2. California Department of Public Health Standard Practice for the testing of VOCs (Specification 01350).
3. NSF/ANSI 140 at the Gold level.
4. Scientific Certifications Systems Sustainable Choice.

TABLE A5.504.8.3
VOC CONTENT LIMITS FOR ARCHITECTURAL COATINGS^{2,3}
 Grams of VOC Per Liter of Coating,
 Less Water and Less Exempt Compounds

COATING CATEGORY	EFFECTIVE 1/1/2010	EFFECTIVE 1/1/2012
Flat coatings	50	
Nonflat coatings	100	
Nonflat-high gloss coatings	150	
Specialty coatings		
Aluminum roof coatings	400	
Basement specialty coatings	400	
Bituminous roof coatings	50	
Bituminous roof primers	350	
Bond breakers	350	
Concrete curing compounds	350	
Concrete/masonry sealers	100	
Driveway sealers	50	
Dry fog coatings	150	
Faux finishing coatings	350	
Fire-resistive coatings	350	
Floor coatings	100	
Form-release compounds	250	
Graphic arts coatings (sign paints)	500	
High-Temperature coatings	420	
Industrial maintenance coatings	250	
Low solids coatings ¹	120	
Magnesite cement coatings	450	
Mastic texture coatings	100	
Metallic pigmented coatings	500	
Multicolor coatings	250	
Pretreatment wash primers	420	
Primers, sealers and undercoaters	100	
Reactive penetrating sealers	350	
Recycled coatings	250	
Roof coatings	50	
Rust preventative coatings	400	250
Shellacs:		
Clear	730	
Opaque	550	
Specialty primers, sealers and undercoaters	350	100
Stains	250	
Stone consolidants	450	
Swimming pool coatings	340	
Traffic marking coatings	100	
Tub and tile refinish coatings	420	
Waterproofing membranes	250	
Wood coatings	275	
Wood preservatives	350	
Zinc-rich primers	340	

1. Grams of VOC Per liter of coating, including water and including exempt compounds.
2. The specified limits remain in effect unless revised limits are listed in subsequent columns in the table.
3. Values in this table are derived from those specified by the California Air Resources Board, Architectural Coatings Suggested Control Measure, February 1, 2008. More information is available at Air Resources Board.

A5.504.8.4.1 Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.

A5.504.8.4.2 Carpet adhesive. All carpet adhesive shall meet the requirements of Table A5.504.8.1.

A5.504.8.5 Composite wood products. Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in ARB’s Air Toxics Control Measure for Composite Wood (17 CCR 93120 et seq.), by or before the dates specified in those sections, as shown in Table A5.504.8.5

TABLE A5.504.8.5
FORMALDEHYDE LIMITS¹

Product	Current Limit	Jan 1, 2012	July 1, 2012
Hardwood plywood veneer core	0.05		
Hardwood plywood composite core	0.08		0.05
Particle board	0.09		
Medium density fiberboard	0.11		
Thin medium density fiberboard ²	0.21	.13	

1. Values in this table are derived from those specified by the California Air Resources Board, Air Toxics Control Measure for Composite Wood as tested in accordance with ASTM E1333-96 (2002). For additional information, see *California Code of Regulations*, Title 17, Sections 93120 through 93120.12.
2. Thin medium density fiberboard has a maximum thickness of eight millimeters.

A5.504.8.5.2 Documentation. Verification of compliance with this section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the following:

1. Product certifications and specifications.
2. Chain of custody certifications.
3. Other methods acceptable to the enforcing agency.

A5.504.9 Environmental tobacco smoke (ETS) control. [OSHPD 1, 2 & 4] Where outdoor areas are provided for smoking, prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows and within the building, if not already prohibited by other laws or regulations, or as enforced by ordinances, regulations or policies of any city, county, city and county, California Community College, campus of the California State University or campus of the University of California, whichever are more stringent. When ordinances, regulations or policies are not in place, post signage to inform building occupants of the prohibitions.

SECTION A5.505 [OSHPD 1, 2 & 4]
INDOOR MOISTURE CONTROL

A5.505.2 Indoor moisture control. Buildings shall meet or exceed the provisions of *California Building Code*, CCR, Title 24, Part 2, Sections 1203 and Chapter 14.

**NONRESIDENTIAL OCCUPANCIES
APPLICATION CHECKLIST [OSHPD 1, 2 and 4]**

FEATURE OR MEASURE	COMPLIANCE LEVELS			NOTES
	Mandatory CALGreen	VOLUNTARY CALGreen		
		Tier 1	Tier 2	
DIVISION A5.1 – PLANNING AND DESIGN				
SECTION Site Development				
A5.106.9 Building orientation. Locate and orient the building as follows: 1. When site and location permit, orient the building with the long sides facing north and south. 2. Protect the building from thermal loss, drafts and degradation of the building envelope caused by wind and wind-driven materials such as dust.		<input type="checkbox"/>	<input type="checkbox"/>	
DIVISION A5.2 – ENERGY EFFICIENCY				
SECTION A5.203 Performance Measures				
A5.203.1 Energy performance. [OSHPD 1] A5.203.1.1 CALGreen Tier 1. [OSHPD 1] Buildings must comply with the latest edition of “Savings By Design, Healthcare Modeling Procedures.” A5.203.1.2 CALGreen Tier 2. [OSHPD 1] Buildings must exceed the latest edition of “Savings By Design, Healthcare Modeling Procedures” by 15 percent.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.204 Prescriptive Measures				
A5.204.1 ENERGY STAR equipment and appliances. All equipment and appliances provided by the builder shall be ENERGY STAR labeled if ENERGY STAR is applicable to that equipment or appliance.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.204.4 Commissioning. Building commissioning for all building systems covered by T24, Part 6, process systems and renewable energy systems shall be included in the design and construction processes of the building project. Commissioning requirements shall include as a minimum items listed in Section A5.204.4. A5.204.4.1 Owner’s Project Requirements (OPR). Documented before the design phase of the project begins the OPR shall include items listed in Section A5.204.4. A5.204.4.2 Basis of Design (BOD). A written explanation of how the design of the building systems meets the OPR shall be completed at the design phase of the building project and updated periodically to cover the systems listed in Section A5.204.4.2. A5.204.4.3 Commissioning plan. A commissioning plan describing how the project will be commissioned shall be started during the design phase of the building project and shall include as a minimum items listed in Section A5.204.4.3. A5.204.4.4 Functional performance testing shall demonstrate the correct installation and operation of each component, system and system-to-system interface in accordance with the approved plans and specifications. A5.204.4.5 Post construction documentation and training. A systems manual and systems operations training are required. A5.204.4.5.1 Systems manual. The systems manual shall be delivered to the building owner and facilities operator and shall include the items listed in Section A5.204.4.5.1. A5.204.4.5.2 Systems operations training. The training of the appropriate maintenance staff for each equipment type and/or system shall include as a minimum items listed in Section A5.204.4.5.2. A5.204.4.6 Commissioning report. A complete report of commissioning process activities undertaken through the design, construction and postconstruction phases of the building project shall be completed and provided to the owner.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.204.6 Building orientation and shading. Locate orient and shade the building as required in Section A5.106.11.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.205 Building Envelope				
A5.205.1 Fenestration products and exterior doors. A5.205.1.1 Certification of fenestration products and exterior door other than field-fabricated.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.205.1.2 Installation of field-fabricated fenestration and exterior doors.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.205.2 Joints and other openings.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.205.3 Installation and roofing products.		<input type="checkbox"/>	<input type="checkbox"/>	

continued

NONRESIDENTIAL OCCUPANCIES
APPLICATION CHECKLIST [OSHPD 1, 2 and 4]

FEATURE OR MEASURE	COMPLIANCE LEVELS			NOTES
	Mandatory CALGreen	VOLUNTARY CALGreen		
		Tier 1	Tier 2	
SECTION A5.207 HVAC Design, Equipment and Installation				
A5.207.1 Space-conditioning equipment certification by manufacturers.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.1.1 Efficiency.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.1.2 Controls for heat pumps with supplementary electric resistance heaters.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.1.3 Thermostats.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.1.4 Gas-and oil-fired furnace standby loss controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2 Space conditioning systems.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.1 Supply air temperature reset controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.2 Electric resistance heating.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.3 Heat rejection systems.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.4 Hydronic system measures.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.5 Air distribution system duct leakage sealing.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.2.6 Variable air volume control for single zone systems.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.3 Service water-heating systems and equipment.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.3.1 Certification by manufacturers.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.3.2 Efficiency.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.3.3 Installation.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.4 Natural gas central furnaces, cooking equipment and pool and spa heaters. Pilot lights prohibited.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5 Controls for space-conditioning systems.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5.1 Thermostatic controls for each zone.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5.2 Criteria for zonal thermostatic controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5.3 Heat pump controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5.4 Dampers for air supply and exhaust equipment.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.5.5 Automatic demand shed controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.207.6 Pipe insulation.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.209 Lighting				
A5.209.1 Lighting control devices, ballasts and luminaires.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.1 All devices: Instructions and calibration.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.2 Indicator lights.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.3 Automatic time switch control devices.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.4 Occupant sensors, motion sensors and vacancy sensors.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.5 Multilevel occupant sensor.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.6 Automatic daylighting control devices.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.7 Interior Photosensors.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.8 Multilevel astronomical time-switch controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.9 Outdoor astronomical time-switch controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.1.10 Dimmers.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2 Indoor lighting controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.1 Area controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.2 Multilevel lighting controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3 Daylight areas.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3.1 Daylight area.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3.1.2 Daylight area, primary sidelit.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3.1.3 Daylight area, secondary sidelit.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3.1.4 Daylight area, skylit.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.3.2 Controls for luminaires providing general lighting that are in or are partially in the skylit daylight area and or the primary sidelit daylight area.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.2.4 Shut-off controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.3 Outdoor lighting controls and equipment.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.3.1 Outdoor lighting.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.3.2 Luminaire cutoff requirements.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.3.3 Controls for outdoor lighting.		<input type="checkbox"/>	<input type="checkbox"/>	

continued

**NONRESIDENTIAL OCCUPANCIES
APPLICATION CHECKLIST [OSHPD 1, 2 and 4]**

FEATURE OR MEASURE	COMPLIANCE LEVELS			NOTES
	Mandatory CALGreen	VOLUNTARY CALGreen		
		Tier 1	Tier 2	
A5.209.4 Outdoor lighting.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.1 Outdoor lighting power trade-offs.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.2 Outdoor lighting power.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.3 Calculation of actual lighting power.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.4 Calculation of allowed lighting power.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.4.1 General hardscape lighting allowance.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.4.2 Additional lighting power allowance for specific applications.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.4.4.3 Additional lighting power allowance for local ordinance requirements.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.5 Signs.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.5.1 Maximum allowed lighting power.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.5.2 Alternate lighting sources.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.6 Sign lighting controls.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.209.7 Nonresidential lighting control acceptance.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.210 Appliances				
A5.210.1 Appliances regulated by the appliance efficiency regulations.				
DIVISION A5.4 – MATERIAL CONSERVATION AND RESOURCE EFFICIENCY				
SECTION A5.407 Water Resistance and Moisture Management				
A5.407.3 Weather Protection.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.407.4.1 Moisture control.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.407.4.2 Sprinklers.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.407.4.3 Entries and openings.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.408 Construction Waste Reduction, Disposal and Recycling				
A5.408.5 Construction waste diversion. Establish a construction waste management plan or meet local ordinance, whichever is more stringent.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.408.6 Construction waste. Recycle and/or salvage for reuse a minimum of 50 percent of nonhazardous construction and demolition debris or meet local ordinance, whichever is more stringent. Exceptions: 1. Excavated soil and land-clearing debris. 2. Alternate waste reduction methods developed by working with local agencies if diversion or recycle facilities capable of compliance with this item do not exist.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.408.7 Excavated soil and land clearing debris. 100 percent of trees, stumps, rocks and associated vegetation and soils resulting primarily from land clearing shall be reused or recycled.		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.410 Building Maintenance and Operation				
A5.410.6 Recycling by occupants. Provide readily accessible areas that serve the entire building and are identified for the depositing, storage and collection of nonhazardous materials for recycling.		<input type="checkbox"/>	<input type="checkbox"/>	
DIVISION A5.5 – ENVIRONMENTAL QUALITY				
SECTION A5.504 Pollutant Control				
A5.504.4.5.1 No-added formaldehyde. Use composite wood products approved by the California Air Resources Board (ARB) as no-added formaldehyde (NAF) based resins or ultra-low-emitting formaldehyde (ULEF) resins. Notes: 1. See Title 17, Section 93120.3(c) and (d), respectively. 2. Documentation must be provided verifying that materials are certified to meet the pollutant emission limits. A list of manufacturers and their NAF and ULEF certified materials is provided at http://www.arb.ca.gov/toxics/compwood/naf_ulef/listofnaf_ulef.htm .		<input type="checkbox"/>	<input type="checkbox"/>	
A5.504.8 Finish material pollutant control. Finish materials shall comply with Sections A5.504.8.1 through A5.504.8.4.		<input type="checkbox"/>	<input type="checkbox"/>	
A5.504.8.1 Adhesives, sealants and caulks. Adhesives, sealants and caulks used on the project shall meet the requirements of the following standards. 1. Adhesives, adhesive bonding primers and adhesive primers, sealants and sealant primers shall comply with Table A5.504.8.1. 2. Aerosol adhesives shall meet the requirements of <i>California Code of Regulations</i> , Title 17, commencing with Section 94507, http://ccr.oal.ca.gov/ .		<input type="checkbox"/>	<input type="checkbox"/>	

continued

**NONRESIDENTIAL OCCUPANCIES
APPLICATION CHECKLIST [OSHPD 1, 2 and 4]**

FEATURE OR MEASURE	COMPLIANCE LEVELS			NOTES
	Mandatory CALGreen	VOLUNTARY CALGreen		
		Tier 1	Tier 2	
<p>A5.504.8.3 Paints and coatings. Architectural paints and coatings shall comply with Table A5.504.8.3.</p> <p>A5.504.8.3.2 Verification.</p> <p>A5.504.8.4 Carpet systems. All carpet installed in the building interior shall meet the testing and product requirements of one of the standards listed in Section A5.504.8.3.</p> <p>A5.504.8.4.1 Carpet cushion. All carpet cushion installed in the building interior shall meet the requirements of the Carpet and Rug Institute Green Label program.</p> <p>A5.504.8.4.2 Carpet adhesive. All carpet adhesive shall meet the requirements of Table A5.504.8.1.</p> <p>A5.504.8.5 Composite wood products. Hardwood plywood, particleboard and medium density fiberboard composite wood products used on the interior or exterior of the building shall meet the requirements for formaldehyde as specified in Table A5.504.8.</p> <p>A5.504.8.5.2 Documentation. Verification of compliance with this section shall be provided as requested by the enforcing agency. Documentation shall include at least one of the following.</p> <ol style="list-style-type: none"> 1. Product certifications and specifications 2. Chain of custody certifications 3. Other methods acceptable to the enforcing agency 		<input type="checkbox"/>	<input type="checkbox"/>	
<p>A5.504.4.9 Acoustical ceilings and wall panels. Comply with Chapter 8 in Title 24, Part 2 and with the VOC-emission limits defined in the CHPS Low-emitting Materials List.</p>		<input type="checkbox"/>	<input type="checkbox"/>	
<p>A5.504.5 Hazardous particulates and chemical pollutants. Minimize and control pollutant entry into buildings and cross-contamination of regularly occupied areas.</p> <p>A5.504.5.1 Entryway systems. Install permanent entryway systems measuring at least six feet in the primary direction of travel to capture dirt and particulates at entryways directly connected to the outdoors as listed in Items 1 through 3 in Section A5.504.5.1.</p>		<input type="checkbox"/>	<input type="checkbox"/>	
<p>A5.504.9 Environmental tobacco smoke (ETS) control. Prohibit smoking within 25 feet of building entries, outdoor air intakes and operable windows and in buildings; or as enforced by ordinances, regulations or policies of any city, county, city and county, California Community College, campus of the California State University or campus of the University of California, whichever are more stringent.</p>		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.505 Indoor Moisture Control				
<p>A5.505.2 Indoor moisture control. Buildings shall meet or exceed the provisions of <i>California Building Code</i>, CCR, Title 24, Part 2, Section 1203 and Chapter 14.</p>		<input type="checkbox"/>	<input type="checkbox"/>	
SECTION A5.507 Environmental Comfort				
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HISTORY NOTE APPENDIX

2022 California Green Building Standards Code California Code of Regulations, Title 24, Part 11

||

HISTORY:

For prior history, see the History Note Appendix to the *California Green Building Standards Code*, 2019 Edition, effective January 1, 2020.

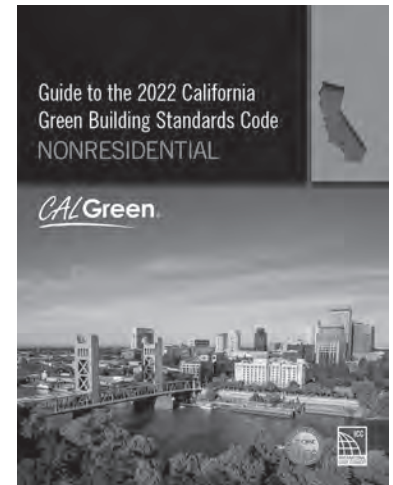
1. (BSC 03/21, HCD 03/21, DSA-SS 03/21, CEC 04/21)
Repeal, amend and add provisions in the 2022 *California Green Building Standards Code* for residential, nonresidential and public-school buildings. Effective on January 1, 2023.

Code Resources from ICC

GUIDE TO THE 2022 CALIFORNIA GREEN BUILDING STANDARDS CODE: NONRESIDENTIAL

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